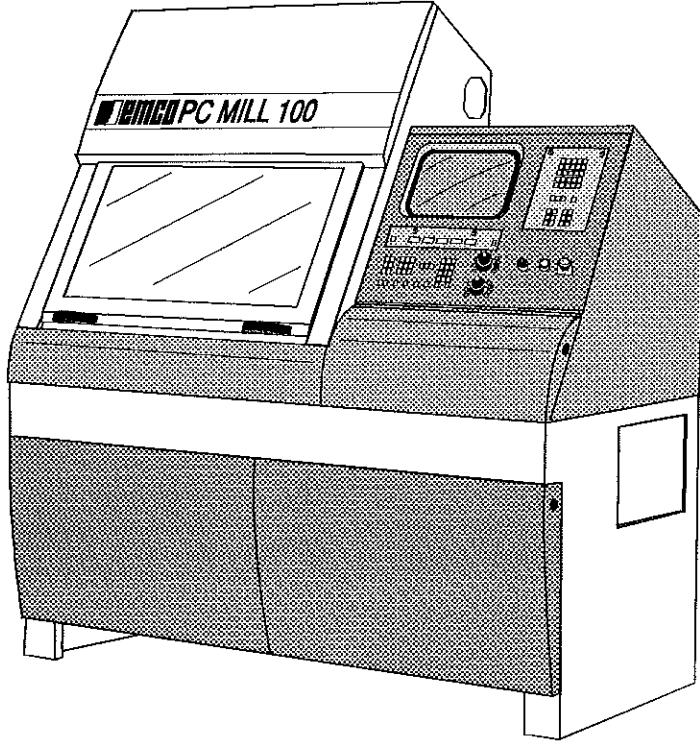


Machine description

EMCO PC MILL 100

Milling machine



Edition 1997

Ref. No. EN 4341

**Machine description
EMCO PC MILL 100
E97-11 EN 4341**



EMCO MAIER Gesellschaft m.b.H. • P.O. Box 131 • A-5400 Hallein/Austria • Tel. (06245) 891-0 • Fax (06245) 86965

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Introduction

For more than four decades EMCO has been developing wood and metal working machines and has also been successfully on the market since 1980 with computer controlled machine tools (CNC machines), particularly on the training sector.

This high degree of experience is a profit for the turning and milling machines of the PC TURN and PC MILL model series.

The newly designed compact machines meet entirely today's requirements in construction and set up as well as safety.

The PC machines are operated via a conventional personal computer (PC). This kind of operation permits an efficient training of the most different CNC controls (SIEMENS, FANUC, etc.) with one and the same machine. The CNC monitor of the installed CNC control is simulated on the PC screen, input of data is carried out via a control keyboard.

Due to the worldwide industrial use of our machines we dispose of a service network which covers all world areas.

Immediately available service engineers, telephone service as well as a 100% sparepart supply exceeding the 10-year obligatory provision is something natural for us.

One of our more than 100 general representatives worldwide will inform you on particular new developments (e.g. clamping options for work pieces or tools, new softwares, etc.) and their fitting possibilities.

In the present operating instructions you will find a complete description of safety hints, transport, set-up, operation and maintenance of the machine. Therefore read this instructions completely before machine start-up.

EC conformity



The CE sign certifies together with the EC declaration of conformity that the machine and the manual correspond to the EC guideline for machines 89/392/EEC and its modifications 91/368/EEC and 93/68/EEC.

**EMCO MAIER Gesellschaft m. b. H.
Abteilung Technische Dokumentation
A-5400 Hallein, Austria**

Contents

Adequate use	5	Shell end mill arbor	32
Warranty conditions for new EMCO machines	5	Clamping the tools in the shell end mill arbor	32
Safety recommendations	6	Working ranges of the tools	33
Technical data of the machine	7	Miller support	34
PC Configuration	9	Clamping the tools into the miller support	34
A Machine installation			
Machine acceptance	10	Working ranges of the tools	35
Scope of supply	10	Tap holder	36
Transport of machine	11	Clamping the tools in the tap holder	36
Installation criteria	12	Working ranges of the tools	37
Installation possibility, alignment	12	Clamping devices for workpieces	38
Dimensions of the machine	13	Clamping rails	38
Space required for operation and maintenance	13	The machine vice	38
Electrical Connection	14	Incremental straps	39
PC-Connection	15	Intermediate flange	39
Pneumatic connection	15	Three-jaw chuck ø85 mm	40
Initial start- up	16	Clamping ranges	40
Switching on machine	16	Pneumatic vice (option)	41
B Description of the machine			
Main elements	17	Adjusting the clamping position	41
Machine base	18	Setting the clamping device pressure	42
Slides	18	Standard values for the clamping pressure	42
Slide drives	18	Technological Data	43
Milling spindle	18	Determination of the speed n during milling and drilling	44
Central lubrication	18	Determination of cutting depth t during milling in aluminium ...	45
Pneumatic maintenance unit	19	Determination of feed speed F during milling in aluminium ..	45
Pneumatic scheme of the maintenance unit	19	Determination of the cutting depth t during milling in steel .	46
Automatic door mechanism (option)	20	Determination of the feed speed F during milling in steel ..	46
Safety Devices	20	Determination of the feed speed F during drilling.....	47
EMERGENCY-OFF-key	20	Speed- torque characteristic line	48
Door limit switches	20	Determination of the tool length Z with the gauge	49
Key switch	21	Exchange of the control keyboard	49
Consent key	22	Coolant device (accessory)	50
Robotics interface (option)	22	Mounting the coolant device	50
DNC-interface (option)	22	Electrical connection	51
Working area	23	Set-up of an FMS	52
Working area in X- and Y-axes	23	Operating module	52
Working area in Z-axis	23	Door safety module	52
Limitation of traversing paths	23	C Maintenance of the machine	
Coordinate system	23	Lubricating and oiling the machine	53
Points at the machine	24	Lubrication survey	53
Machine zero point M	24	Lubricant recommendations	53
Reference point R	24	Central lubrication	54
Workpiece zero point W	24	Deaerating the lubricant lines	54
Toolholding-fixture reference point N (T)	24	Z-spindle bearing	55
Tool system	25	Tool magazine slide	55
Releasing the tool turret	26	Pneumatic unit	56
Toolholder	27	Water separator	56
Order numbers	27	Cleaning the machine door	57
Mounting the toolholder into the tool drum	28	Pneumatic vice (option)	58
Dismounting the toolholder	28	D Readjustment work	
Collet holders	29	Slides	59
Maintenance of collets and collet holders	29	Reverse clearance	59
Mounting the collets	29	Slide clearance	60
Dismounting the collets	29	Positioning of the tool drum	62
Clamping the tools into the collet holder	30	Readjustment of the collet stroke	63
Clamping ranges	30	Supplement	
Working ranges of the tools	31	Declaration of conformity	
		Service addresses	

Adequate use

The machine is designed for milling and drilling of machinable metals and machinable synthetic materials.

Machining of other materials is not admitted and may be carried out in particular cases only after consultation with the machine manufacturer.

Adequate use also includes compliance with the operating and maintenance instructions indicated by the manufacturer.

The machine may exclusively be operated by persons familiar with operation, maintenance and repair and who know about the hazards.

All regulations for the prevention of accidents and safety instructions for work with machine tools have to be complied with at any time.

In case of inadequate use of the machine the manufacturer renounces any liability and the responsibility is transferred exclusively to the user.

Warranty conditions for new EMCO machines

1. The warranty period for new EMCO machines is, without limitation of operating hours, 12 months after initial shipment of the machine from EMCO or its authorized representative. Should the installation be completed by EMCO or its authorized representative, the warranty period begins with the completed installation of the machine.
If a delay of installation occurs which is not caused by EMCO or its representative, the warranty period becomes invalid 12 months after scheduled installation date.
2. The warranty extends to the elimination of all defects in material or workmanship which affect the regular function of the machine.
3. Occuring defects must be immediately reported to the EMCO representative or the next EMCO service department with detailed description of the defect in written or oral form, followed by a written verification.
4. Defects which are correctly reported and under warranty will be corrected by either repair or replacement delivery to the original buyer free-of-charge; defective parts are to be returned to EMCO or the EMCO authorized representative, freight prepaid, if requested.
5. Warranty for spare parts: Emco guarantees to the original buyer that, only those parts sold directly by Emco or through an authorized representative will be free from defects, which render part commercially unacceptable in material and workmanship, for a period according to applicable national law, at least three (3) months, but not to exceed six (6) months from the date of initial shipment or installation by Emco or its representative.
In the case of repeated claims for the same part: Warranty replacement does not extend the period of the original warranty.
6. There is no claim of warranty for defects which occurred by:
Negligence of operating instruction manuals, safety and handling regulations or other instructions regarding delivery, installation, set-up or usage of the machine, incorrect set-up resp. installation, as well as, unauthorized, not expressed regulated or allowed alterations or modifications of the machine by the original buyer or third parties, natural wear, improper or negligent handling, chemical, electro-chemical or electrical influences, inadequate energy supply or force majeure.
7. Any service performed by EMCO or its authorized representative beyond warranty will be charged at EMCO's or its authorized representative's regular rates.

Safety recommendations

Read documentation

Read this documentation completely before you start up the machine.

Electrical connection

The electrical connection of the machine must only be carried out by electrics experts.

Authorized operation

The machine may only be operated by authorized persons.

Protect the machine against unauthorized start-up (main switch which can be locked).

Start-up

Make sure that prior to each start-up the machine is in perfect maintenance state and that no safety features have been removed.

No modifications on machine

Modifications on your own on safety features, bridgings of control features as well as any interference with the electric/electronic part of the machine is prohibited.

In case of hazards EMERGENCY-OFF

In case of hazards immediately actuate EMERGENCY-OFF key to stop machine.

Safe tool-clamping

Prior to start of operation check if workpiece and tool are clamped safely.

Observe speed limits

Clamping devices are subject to speed limits. Thus observe the maximum speed of the clamping devices used by you.

Use chip hook

Remove chips only with machine switched off and by means of a chip hook.

Do not reach into running machine!

Tool change

Change machining tools only during standstill of machine.

Measurement work

Carry out measurement work only during standstill of the machine and with EMERGENCY-OFF key actuated.

Wear body protection

Mind that your hair does not get caught in the machine - hair protection to be worn.

Protect your eyes with safety-glasses.

Do not wear loose working clothes. Mind that the working clothes are tight around the wrists and hips.

Machine supervision

Never leave running machine unattended.

Before leaving the working place switch off machine.

Maintenance and readjustment work

All maintenance and readjustment work may be carried out only with machine switched off and EMERGENCY-OFF key actuated.

Claim

In the event of a collision or instance of damage, contact the representative or manufacturer.

In case of complaints, damage, confusions and spare parts orders always indicate the machine number.

For parts not supplied by EMCO, EMCO will not assume liability.

Technical data of the machine

Working area		
Slideway longitudinal (X-axis)	[mm]	185
Slideway cross (Y-axis)	[mm]	100
Slideway vertical (Z-axis)	[mm]	200
effective Z-stroke	[mm]	100
Distance spindle nose - table surface	[mm]	95-195
Milling table		
Clamping surface (LxD)	[mm]	420x125
maximum table load	[kg]	10
2 T-slots	[mm]	11
Distance of T-slots	[mm]	90
Milling spindle		
Spindle bearing	[mm]	ø40
Type of bearing		roller bearing
Clamping fixture similar to DIN 2079		SK 30
Tightening bolt		works standard
Tool clamping		automatic
Milling spindle drive		
A.C. motor		
Power with 100%/60% D.C.	[W]	640/700
Nominal motor speed	[rpm]	5000
Speed range (infinitely variable)	[rpm]	150-5000
maximum torque on milling spindle with 60% D.C.	[Nm]	3,5
maximum milling cutter diameter for milling work in steel	[mm]	ø25
Drilling capacity in aluminium (Torradur B)	[mm]	16
Thread-cutting capacity in aluminium (Torradur B)	[mm]	M8
Feed drives		
Step resolution/output accuracy	[mm]	25
Operating feed in X/Y/Z (infinitely variable)	[mm/min]	0-2000
Rapid motion in X/Y/Z	[mm/min]	3000
maximum feed force in X/Y/Z	[N]	2000/2000/2400

Subject to technical modifications!

TECHNICAL DATA

Tool system		
Tool drum with direction logic		
Number of tool stations		10
maximum tool diameter	[mm]	ø55
maximum tool weight	[kg]	7
Feed force	[N]	1100
Cut-to-cut time T1/T2/T3 acc. to VDI 2852	[s]	11/10/10
Tool change time T1/T2/T3 without traversing movement	[s]	9/7,5/7,5
Electrical connection		
Power supply, reversible	[V]	230/400~3/N/PE 230~3/PE
maximum voltage fluctuations	[%]	±10
Frequency	[Hz]	50/60
Connected load	[kVA]	28
Main fuse	[A-slow]	20
Lubrication system		
Guideways		Central lubrication
Tool magazine slides		Oil lubrication
Spindle support		Grease lubrication
Pneumatic unit		
Compressed air maintenance unit for integrated tool cone blow-out device		
Supply pressure	[bar]	6
Pneumatic connection	[mm]	ø10
Dimensions		
Total length x total depth x total height	[mm]	1730 x 875 x 1892
Total weight	[kg]	570
Machine acceptance		
Machine acceptance acc. to DIN		DIN 8615, Part 1
Sound pressure level		
mean sound pressure level	[dB(A)]	69
With the following conditions:		
- Measuring method: enveloping surface according to DIN 45 635		
- Operating mode: maximum speed during idle running		
Safety instructions/standards		
Conforming to EC standards according to		EN292 Part 1/2 EN60204 Part 1 EC-machine guideline Annex 1

Subject to technical modifications!

Accessories

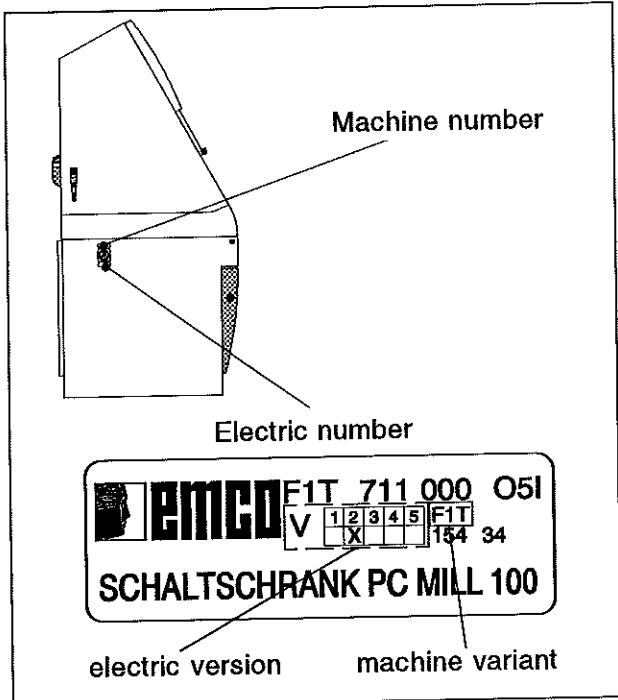
Accessories marked with ** are built up by order in the plant

Coolant device		
Tank capacity	[l]	35
maximum conveying capacity	[l/min]	15
maximum conveying pressure	[bar]	0.5
* Pneumatic unit		
Basic equipment for pneumatic vice and automatic door mechanism		
Supply pressure	[bar]	6
Pneumatic connection	[mm]	ø10
* Pneumatic vice		
pneumatic vice with stroke control		
maximum jaw distance	[mm]	70
maximum jaw stroke	[mm]	5
* Automatic door mechanism		

PC Configuration

Control set-up		
Separate set-up of machine operating board and control-specific keyboard		
control specific keyboard		exchangeable
integrated computer (PC)		PC 80486-SX
screen standard		14" monochrome
screen accessory		14" colour
PC configuration		
Siemens PC IBM compatible		80486-SX
cycle frequency	[MHz]	25
main storage RAM	[MB]	4
hard disk	[MB]	170
graphics card		VGA
keyboard		MPF-2
serial interface		2
parallel interface		1
disk drive		3½", 1.44MB
Software		
operating system		MS DOS 6.2
MS-Windows		version 3.1

A Machine installation



Side view of the machine

Machine acceptance

- Check the machine for any transport damage and completeness of the delivery.
If you find any defects, please contact the dealer or the insurance company.
- In case of complaints always specify the exact designation of the machine and the machine number and the electric number.
The self-adhesive plates indicating the machine number and the electric number are to be found laterally on the machine nearly the main switch.

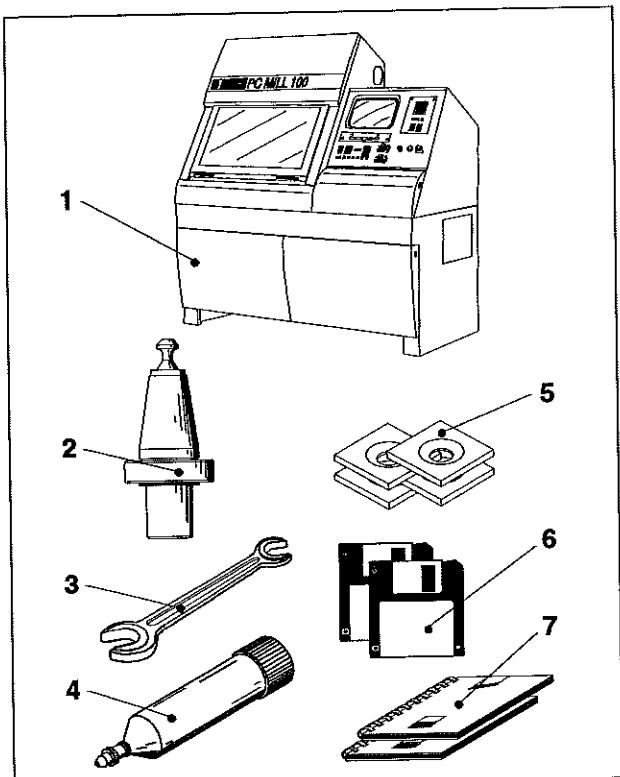
On the plate with the electric number you will find the variant of the machine (e.g. "F1T") and beside the letter "V" the electric version (e.g. "2"). The available circuit diagrams for this machine you will find in the Electrical Documentation, which is put into the electrical cabinet of machine. The Electrical Documentation may also be ordered from EMCO:

Electrical Documentation EMCO PC MILL 100

Ref. No. ZVP 674 340

Version F1T_V02 (= machine variant and electrical version)

- The rust protection agent must be removed by the customer.



Scope of supply

Scope of supply

- Milling machine EMCO PC MILL 100 with full shell, safety devices, milling head, milling table, machine lamp and central lubrication. Control part complete with PC and keyboard, key module for desired control.
- 1 reference tool (clamped in tool drum)
- 1 double-ended spanner SW10x13
- 1 grease gun
- 4 supports
- control software and control keyboard as desired, MSD floppy
- machine description and software description

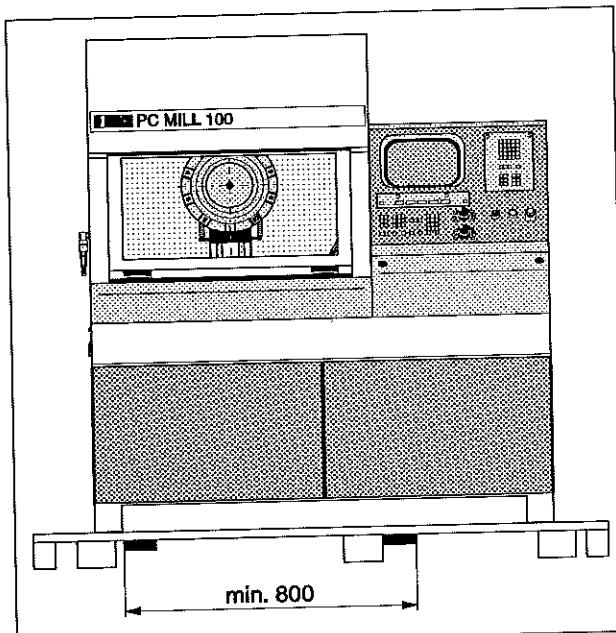
Transport of machine

The machine is delivered on a wooden pallet. It is fixed on the pallet with 4 square neck bolts.



Danger:

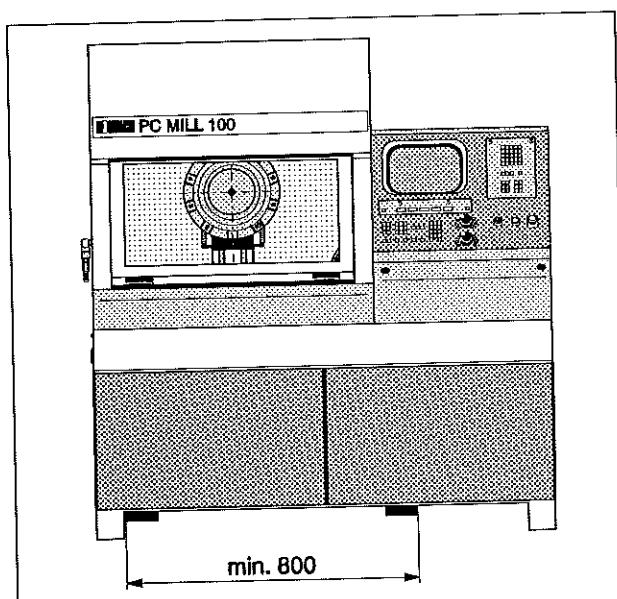
Mind the maximum permissible lifting capacity of the hoist when lifting the machine.



Transport with pallet

Transport with pallet

Fork width min. 800 mm
Lifting capacity 660 kg



Transport without pallet

Transport without pallet

Fork width min. 800 mm
Lifting capacity 570 kg

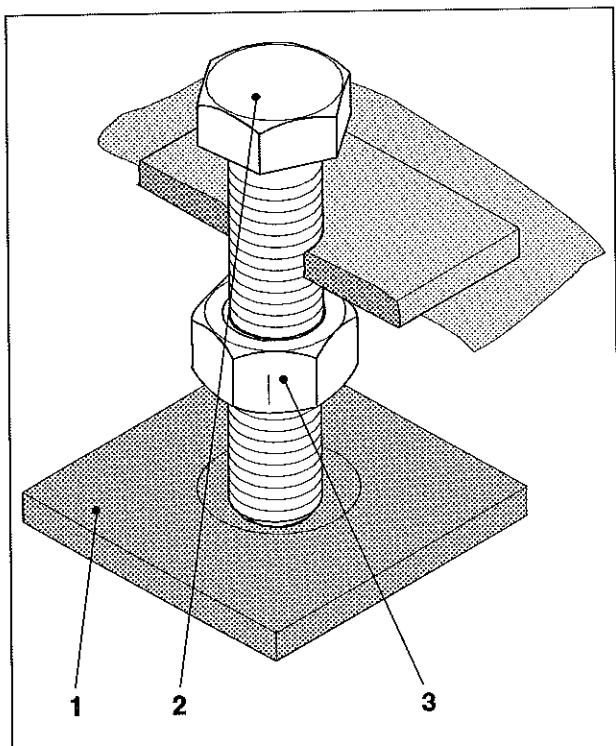
Installation criteria

Ground

The machine is to be set up on a ground as horizontal as possible with appropriate load-bearing capacity to assure a steady position and avoid vibrations which could have a negative influence on the finishing accuracy.

Ergonomic design

Due to its ergonomic design the machine provides optimum operation. However, when choosing the installation site pay attention to sufficient lighting. (A machine lamp is available in the working area of the machine.)



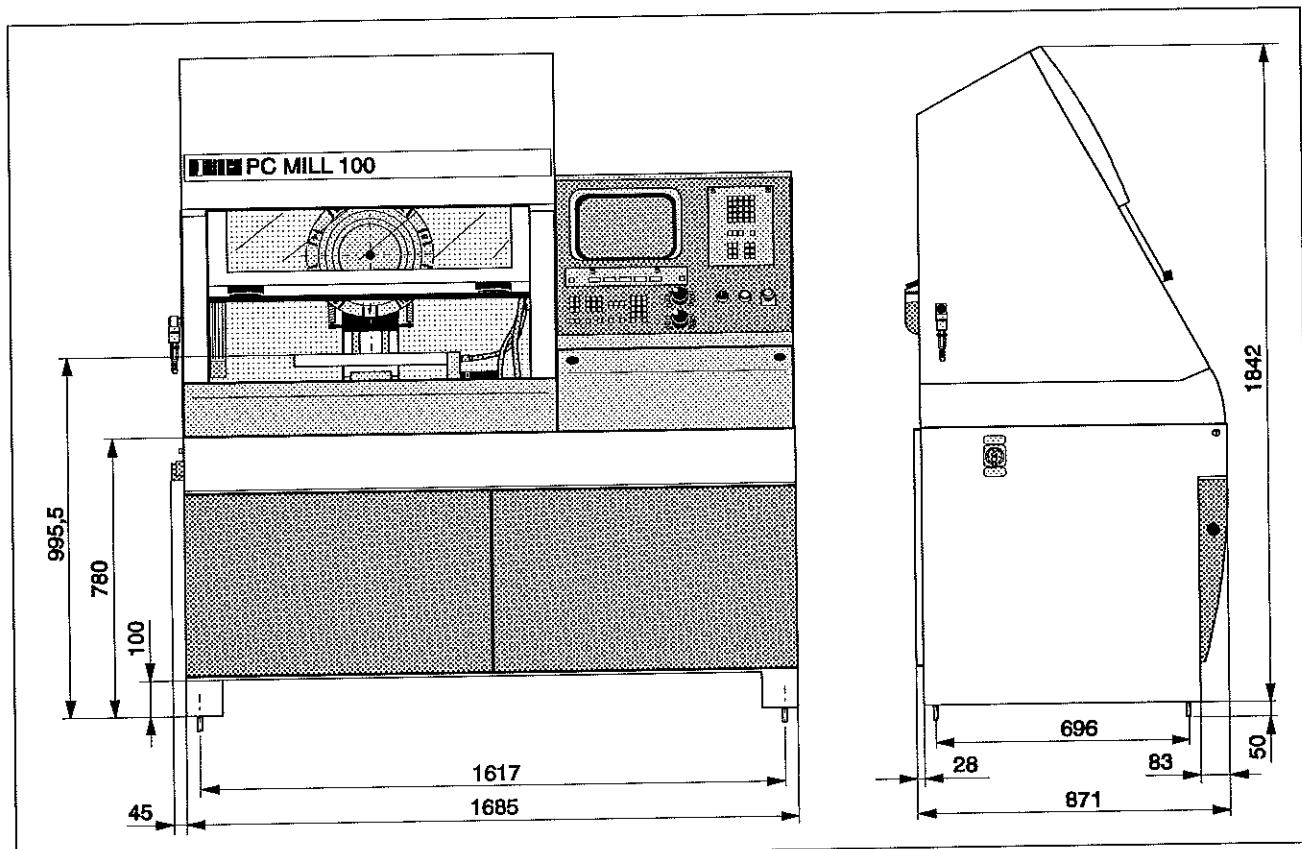
Setting screws for aligning the machine

Installation possibility, alignment

4 supports (1) are supplied with the machine. Instead of the 4 supports also levelling elements can be used. The **levelling elements** can be ordered under **order no. 780 150** (4 pieces required).

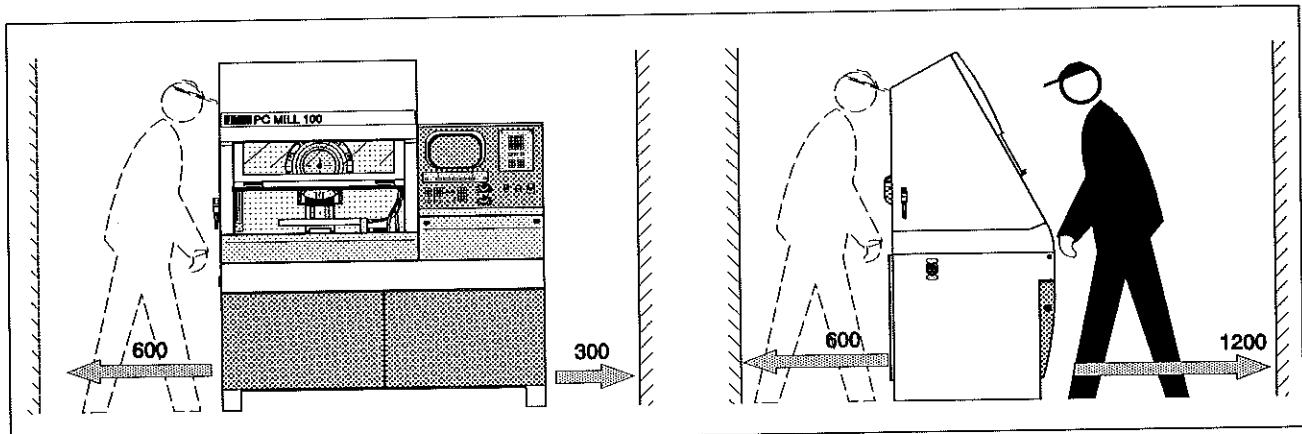
- Lift machine.
- Lay supports (1) under the setting screws already mounted M16x65, SW24 (2).
- Place machine onto the supports and align it with the setting screws (2) as horizontal as possible.
- Secure alignment with the counter nuts (3).

Dimensions of the machine

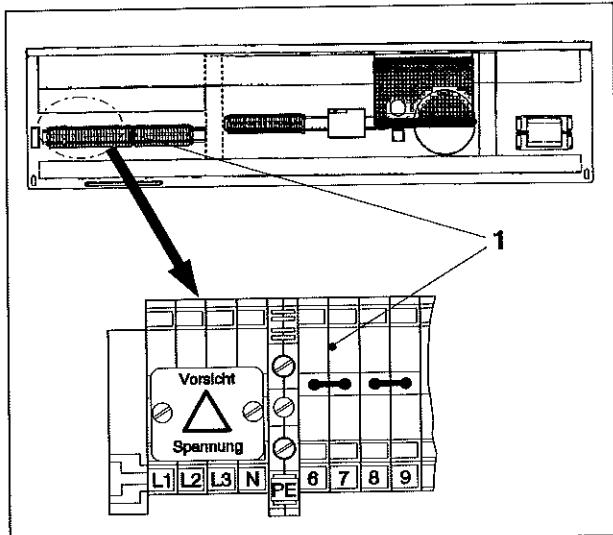


Total dimensions of the machine

Space required for operation and maintenance



Space required for operation and maintenance



Terminal strip for electr. connection in the electrical cabinet (seen from above)

Electrical Connection



Danger:

The electrical connection may only be established by an electrics expert.

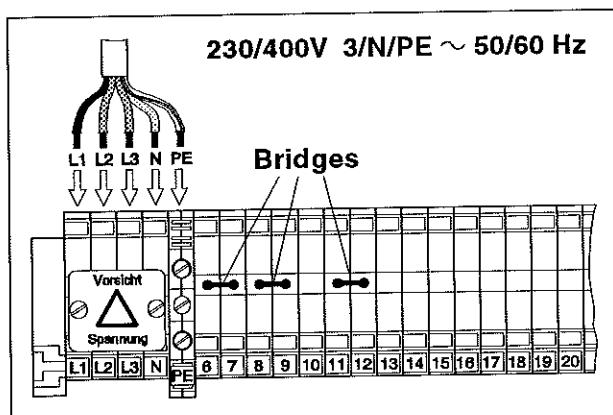
- Thread cable through the cable screwed joint at the electrical cabinet.
- Connect each of the cores at the terminal strip (1).



Caution:

Mind the positions of the bridges on the clamping elements 6 up to 14 at the terminal strip (1) in order to avoid damage in the electronics.

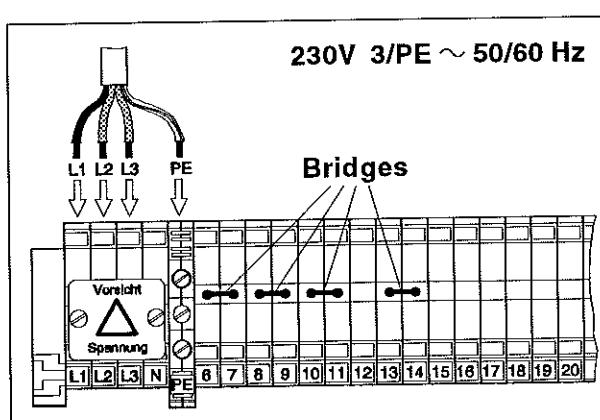
For further information see the electrical documentation.



Electrical connection with zero conductor

Electrical Connection 230/400V with zero conductor

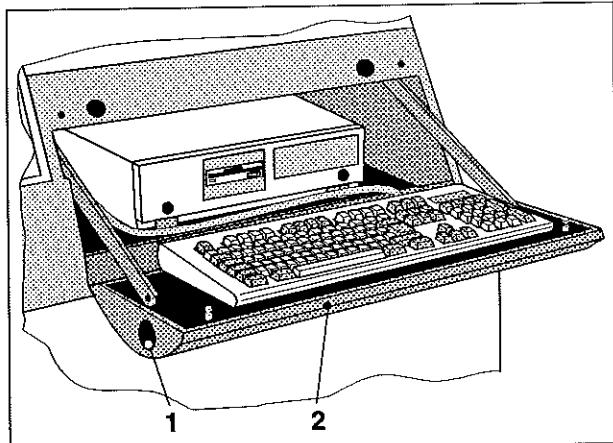
Voltage	230/400V 3/N/PE ~ 50/60 Hz
Preliminary fuse	20 A tr
Cross-section of cable	min. 5x4 mm ²
Max. voltage fluctuations	±10%



Electrical connection without zero conductor

Electrical Connection 230V without zero conductor

Voltage	230V 3/PE ~ 50/60 Hz
Preliminary fuse	20 A tr
Cross-section of cable	min. 4x4 mm ²
Max. voltage fluctuations	±10%



Installation of the PC into the machine

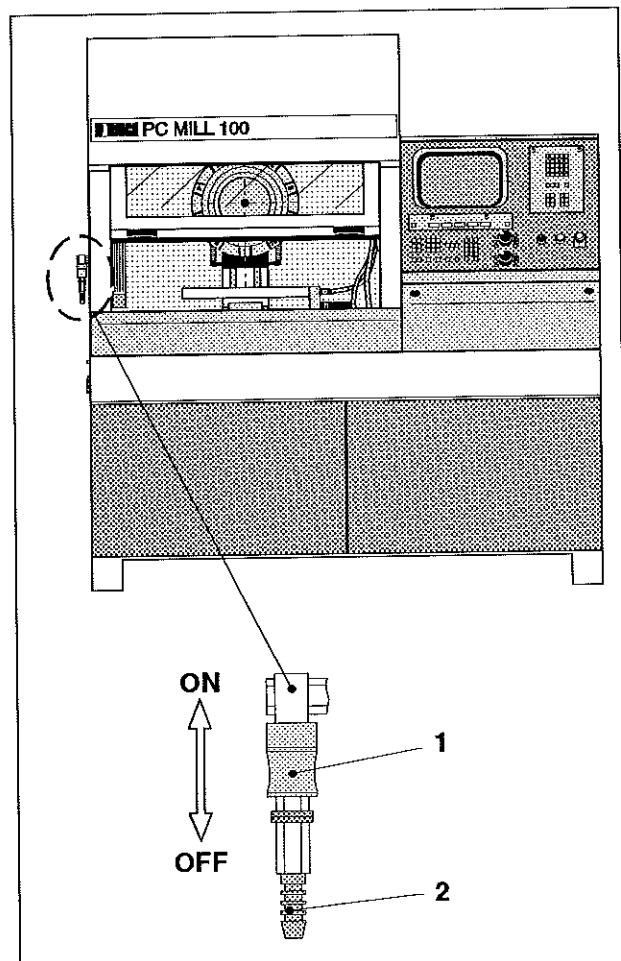
PC-Connection

The PC either the keyboard is delivered in the original packing with the machine.

All connection cables such as mains cables and interface cables are already available in the machine.

By turning down the cover (2) the case for the PC is accessible in which also all the cables are mounted.

The cover (2) can be opened by pulling in the bores (1).



Pneumatic connection of the machine

Pneumatic connection

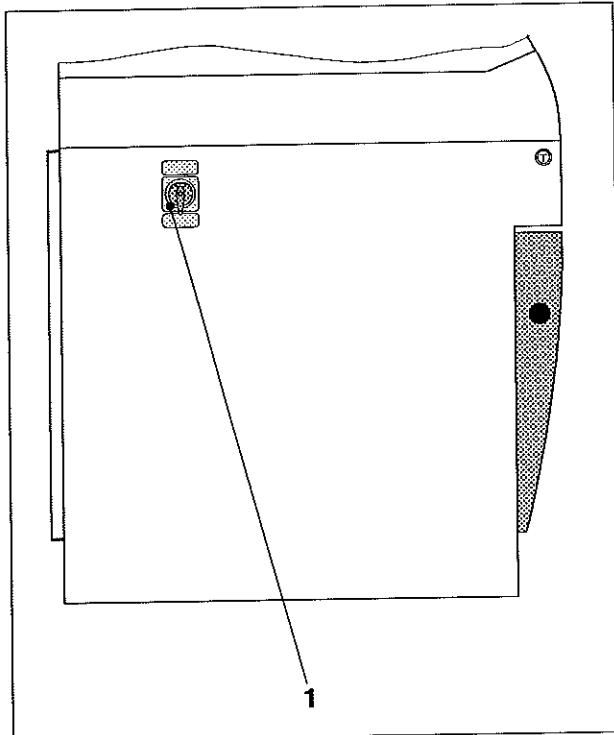
Maximum working pressure 6 bar



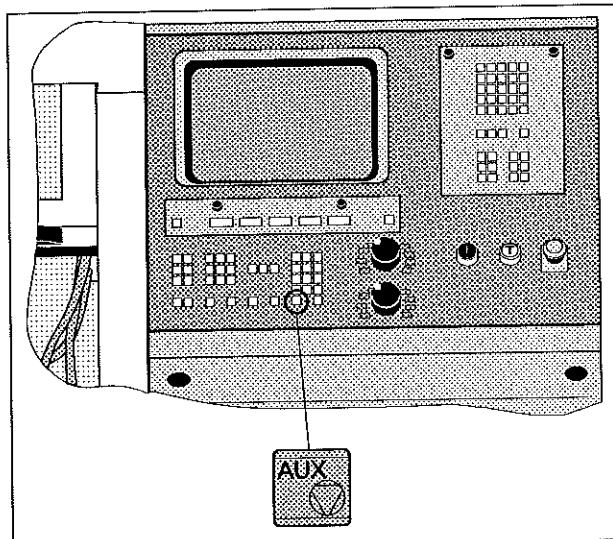
Caution:

To avoid malfunctions or damage at the accessories connected at the pneumatic unit it is not permitted to carry out modifications at the valves.

- Connect air supply at the connection piece (2) of the pneumatic unit laterally at the machine (compressed air hose ø10 mm).
- By pushing the manual slide (1) upwards the filter and the valves are supplied with compressed air.
- Lock air supply by pushing the manual slide (2) downwards.



Main switch at the machine



Activating the central lubrication with "AUX ON"

Initial start- up

- All blank parts are to be cleaned from rust preventive agent with a clean cloth.
- Prior to start-up grease the machine (see maintenance of the machine).
- Check oil level of central lubrication, if necessary refill oil (see maintenance of the machine).
- Tool and workpiece must be clamped tightly and safely.
- For further operation please see switch-on and switch-off procedure of the machine as well as software description.

Switching on machine

- Turn main switch (1) to position "1".
- Open air-supply.
- After a major standstill of the machine press "AUX ON" key for approx. 1 minute.
By pressing the "AUX ON" key all drives are supplied with current. With a steady pressure on the key also the central lubrication is activated approx. every 6 seconds in order to lubricate the slide guides.
- For further operation of the machine please see your "Software description" .

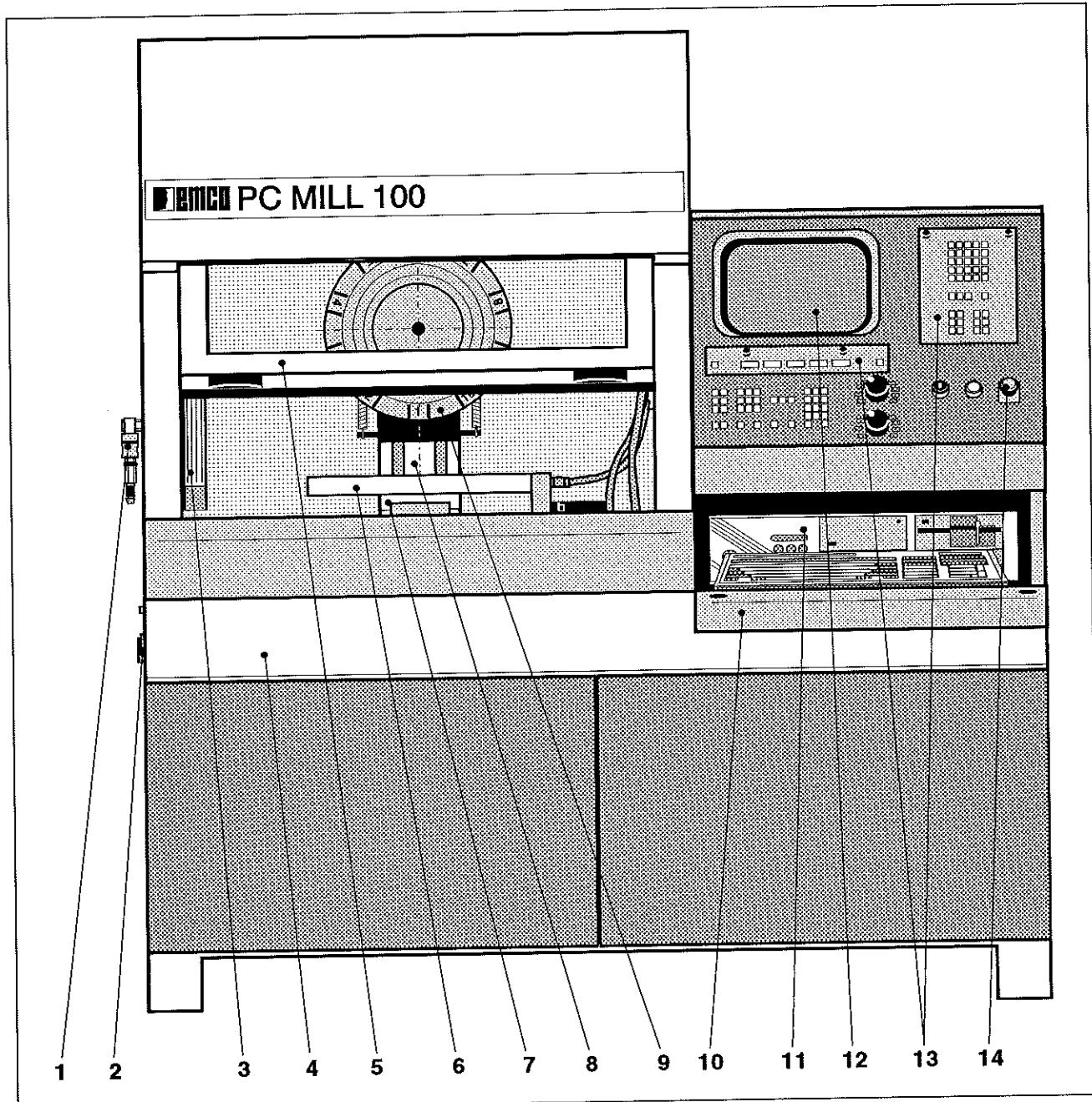
Note:

If the machine is not used for a major period:

- Clean machine carefully
- Slightly oil blank parts.
- Protect machine against unauthorized start-up (key switch at the operating panel, lockable main switch).
- Cover machine with dust protection (packing).

After a major standstill of the machine all operations as described under "Initial start-up" are to be carried out.

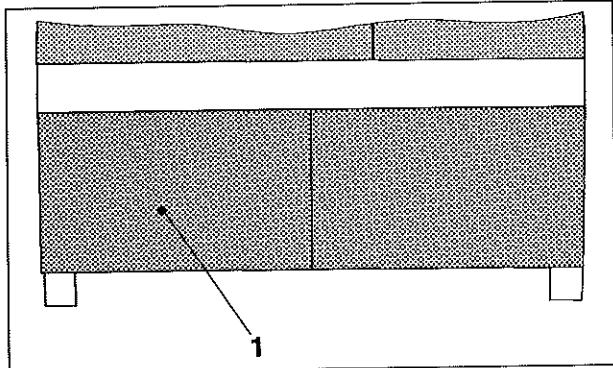
B Description of the machine



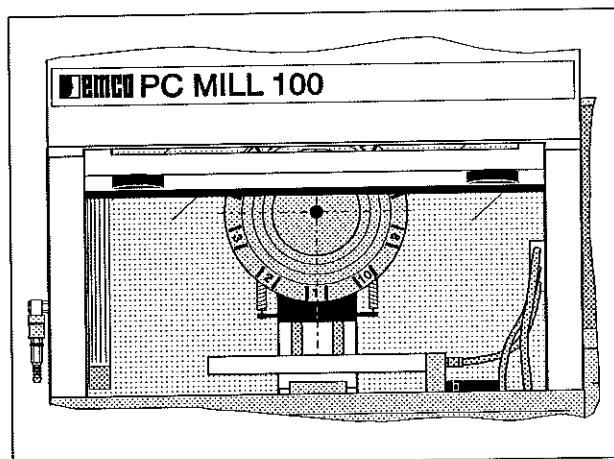
Main elements at the machine

Main elements

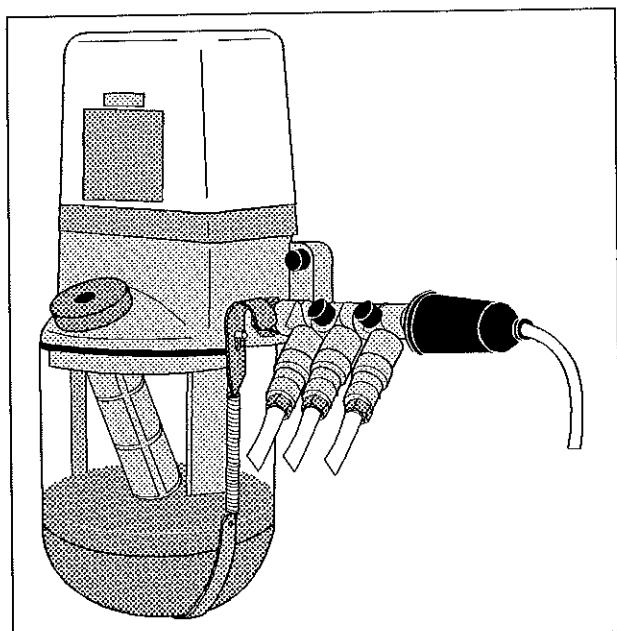
- | | |
|-----------------------------------|--|
| 1. Pneumatic connection | 8. Z-slide |
| 2. Machine main switch (lockable) | 9. Milling spindle with tool drum |
| 3. Machine lamp | 10. Flap for PC area (swivelling) |
| 4. Machine base | 11. Control PC |
| 5. Chip guard door | 12. Screen 14" |
| 6. Milling table (X-slide) | 13. Control-specific keyboard (exchangeable) |
| 7. Y-slide | 14. EMERGENCY-OFF key |



Machine base



Working area with slides and tool drum



Central lubrication

Machine base

The machine base is of solid welded design for supporting the machine bed, the control with the PC as well as the whole electrical equipment. Furthermore, there is a space provided for the coolant device (accessory) behind the removable cover (1).

Slides

The slides run in precisely ground dove-tail guides.

The clearance of the slides can be readjusted via tapered gibbs.

The slides are supplied with oil via the central oil lubrication so that all sliding surfaces are always dampened with oil.

Slide drives

The slides are traversed with step motors via recirculating ball screw spindles.

The amply dimensioned spindles, the rigid spindle nuts and the axial bearings without backlash provide high positioning and working accuracy.

Feed speed	0-2000 mm/min
Rapid motion speed	3000 mm/min
Traversing path X-slide	185 mm
Traversing path Y-slide	100 mm
Traversing path Z-slide	100 mm
Step resolution.....	0.0025 mm
max. feed force X/Y-slides	2000 N
max. feed force Z-slides	2400 N

Milling spindle

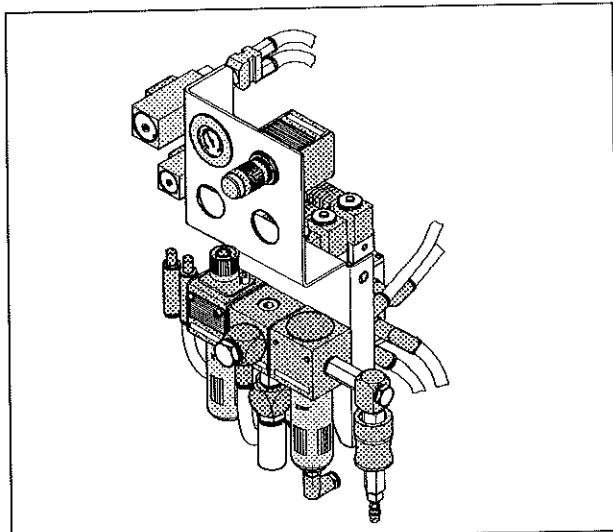
The milling spindle is mounted in rolling bearings in the milling head. The drive is carried out via a three-phase A.C. motor, the spindle speed is infinitely variable via the control.

Speed..... 150-5000 rpm
maximum torque 7 Nm

Central lubrication

The slides are supplied with guideway oil via the central lubrication.

The pump is automatically switched on after a slide traversing path of 16 m.



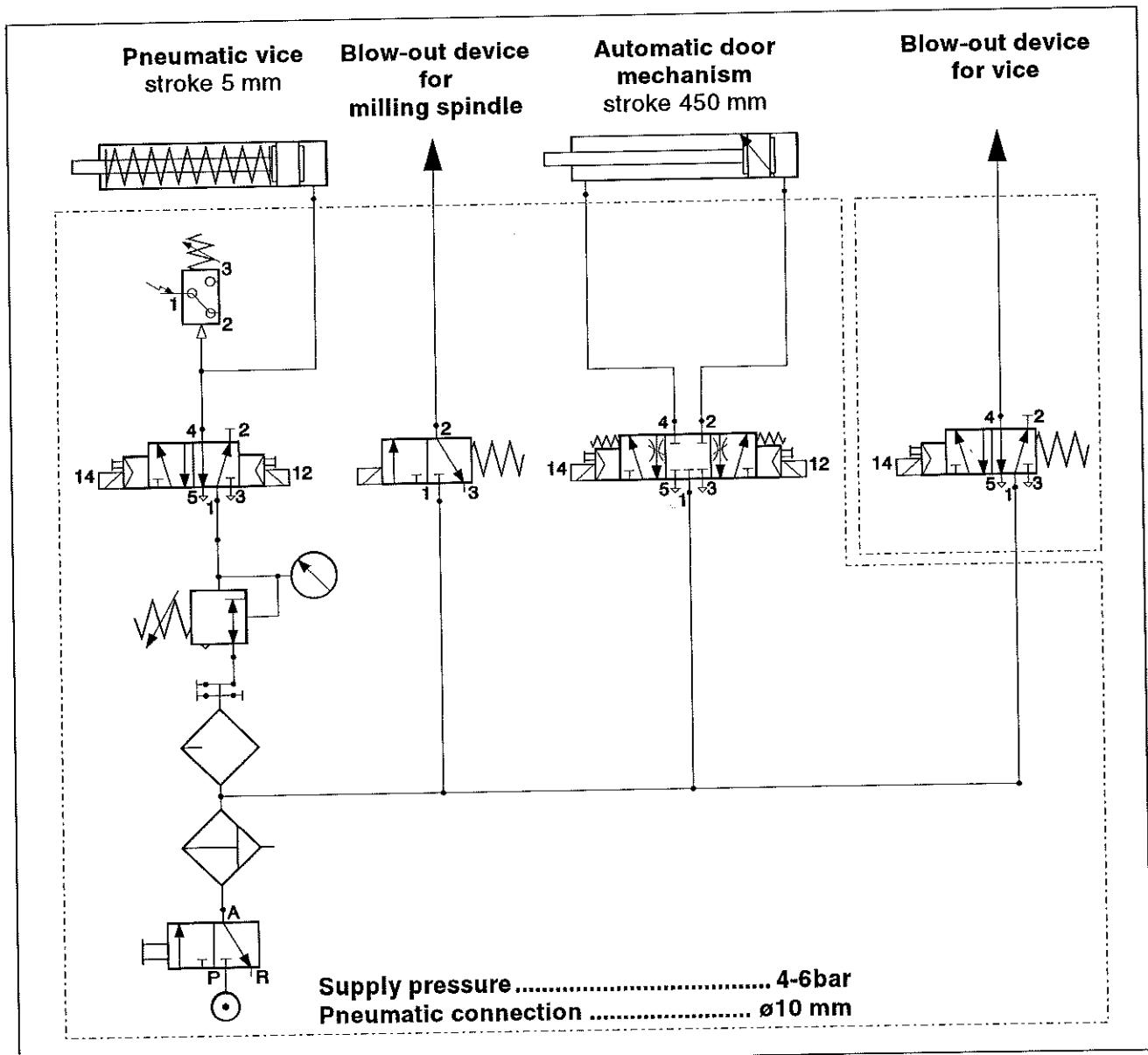
pneumatic maintenance unit

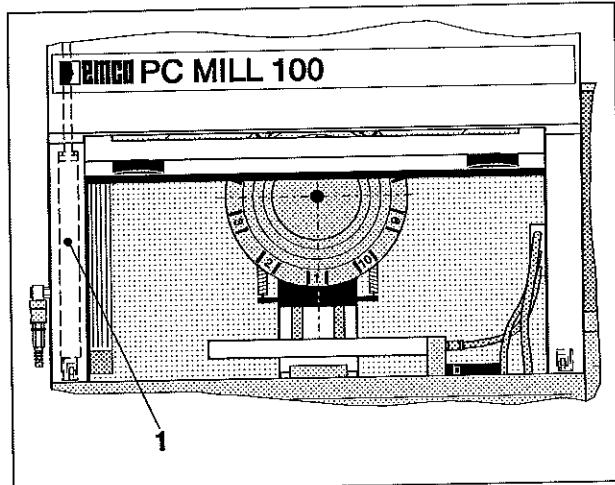
Pneumatic maintenance unit

The basic equipment of the pneumatic unit contains valve and switch for the blow-out device of the tool system.

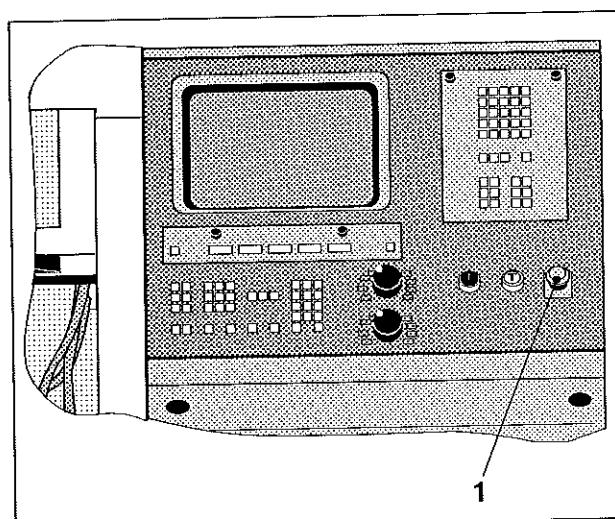
The maintenance unit available as option for the automatization of the machine contains additionally all connections, pressure switches, pressure controllers and valves for triggering the automatic door mechanism and the pneumatic vice with the blow-out device.

Pneumatic scheme of the maintenance unit

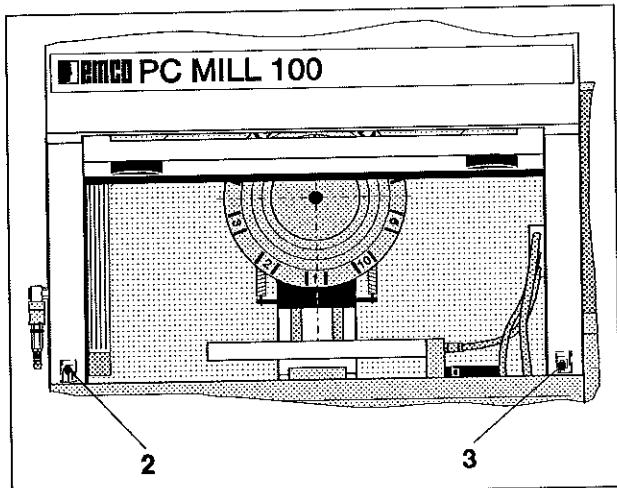




Pneumatic cylinder for automatic door mechanism



EMERGENCY-OFF-key at the machine



Door limit switches

Automatic door mechanism (option)

Upon order the automatic door mechanism can be mounted as option at the manufacturer.

The chip guard door can be opened and/or closed by the CNC program or by pressing a key via a pneumatic cylinder (1).

Monitoring of the door position is carried out via 3 limit switches.

Safety Devices

The safety devices are contained in the base machine and facilitate generally risk-free operation of the machine.



Danger:

The safety devices must never be removed from the machine.

Als mechanic or electric bridgings of the safety devices are prohibited.

EMERGENCY-OFF-key

In case of any hazard the EMERGENCY-OFF-key (1) is to be pressed immediately.

By pressing the key (1) the power supply to the main drive, the feed motors as well as the tool turret is interrupted immediately.

For unlocking the EMERGENCY-OFF-key turn knob in clockwise direction.



Note:

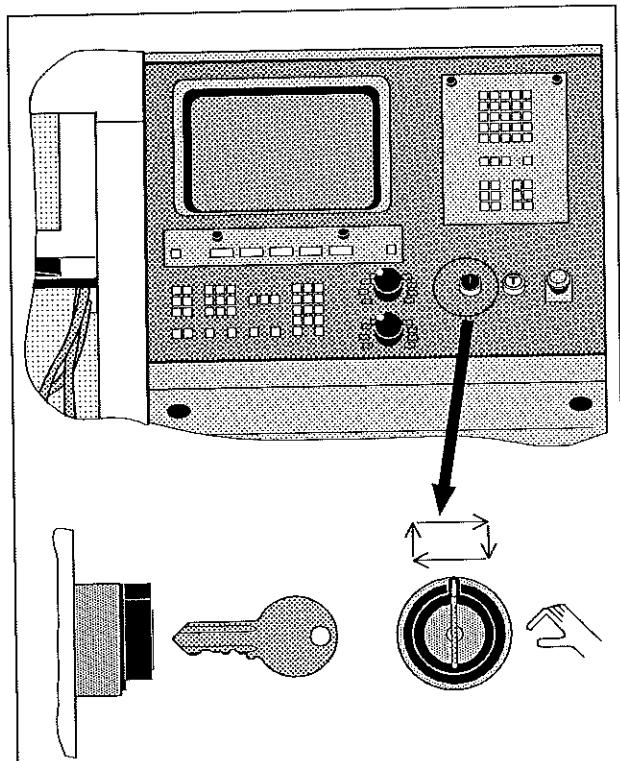
After pressing the EMERGENCY-OFF-key the reference point must be reapproached.

Door limit switches

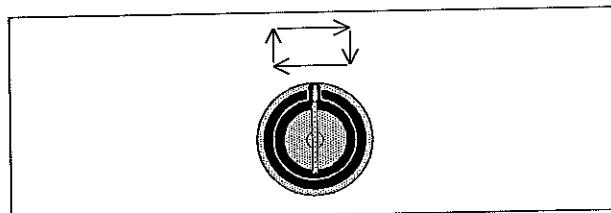
The position of the chip guard door is controlled by two limit switches (2 and 3).

Due to the control a program start is not possible with open door.

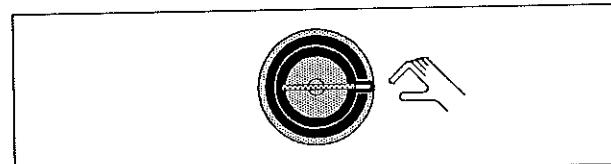
If the chip guard door is opened during a program all traversing movements of the slide as well as the milling spindle stop.



Position of the key switch



Key switch in position "automatic operation"



Key switch in position "setting operation"

Key switch

The key switch can be switched into 2 different positions:

Position "Automatic"

The switch position "automatic" is the working position of the machine in which all safety devices are active.

Thus, opening the chip guard door with running milling spindle is not possible without stopping the machining procedure.

Note:

Manual traversing of the slide is only possible with closed chip guard as soon as the reference point has been approached.

Position "Setting operation"

In this position the slides can be traversed manually in JOG operation also with the reference point not approached.

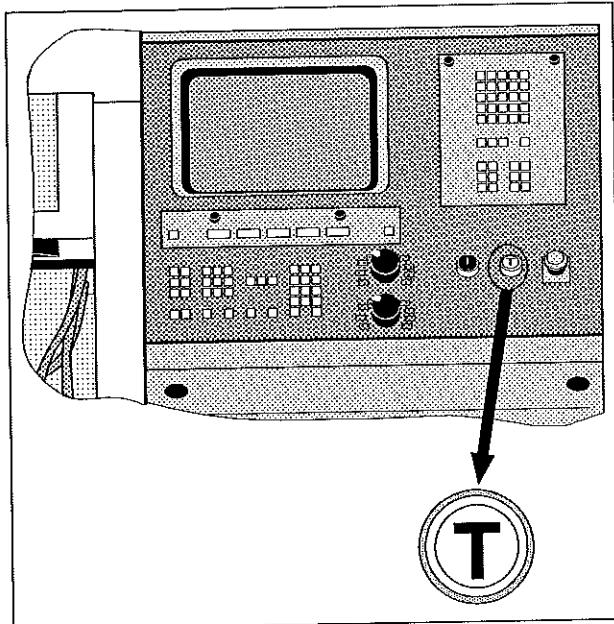
The chip guard door must be closed during this procedure.

Furthermore, in this key position it is possible to carry out various operations at the machine with open chip guard door (see consent key).

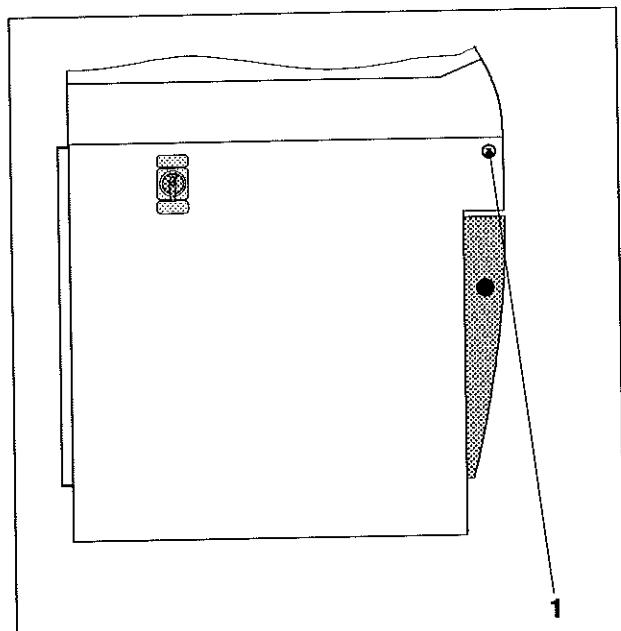


Danger:

- With switch position "setting operation" there is an increased danger of hazards.
- During setting operation keep the chip guard door closed as far as the working procedure permits.
- After termination of the setting work immediately switch the key switch to position "automatic" and take off the key.
- The key may be handed only to those persons who know about the hazards and take adequate precaution measures.



Position of the consent key at the operating panel



Second consent key at the machine

Consent key

The function of the consent key depends on the position of the key switch.

In addition to the consent key at the operating panel there is also a second consent key (1) laterally at the machine.

The second consent key (1) has the same functions as the consent key at the operating panel, it only serves for easier accessibility in setting operation (tool measuring).

Note:

If the consent key is pressed for more than 40 s the function of this key is interrupted, the consent key must be released and pressed again.



Functions of the consent key

Key switch position in "setting operation"

- Manual traversing of the slide with open chip guard door.
The reference point must be approached.
- Blockwise setting of a program in test run (dry run and single block).

Robotics interface (option)

With the robotics interface in addition to the general triggering of the periphery (such as automatic door mechanism, vice) the machine can also be connected with further machines or devices (e.g. loading and unloading robot).

DNC-interface (option)

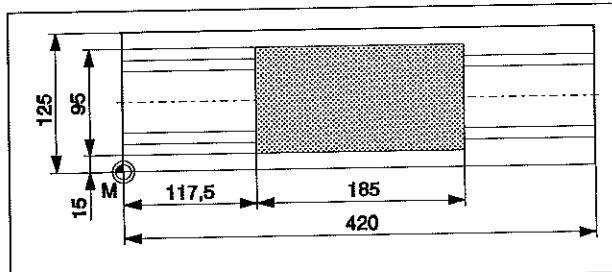
Via the DNC-interface the machine can be operated via a host. In contrast to the robotics interface, in addition to standard functions, e.g. programs can be transmitted or started from the host.

The DNC-interface is mainly used for the set-up of an FMS.

Working area

Working area in X- and Y-axes

Traversing path X-axis 185 mm
 Traversing path Y-axis 100 mm



Traversing paths of the X- and Y-slides

Note:

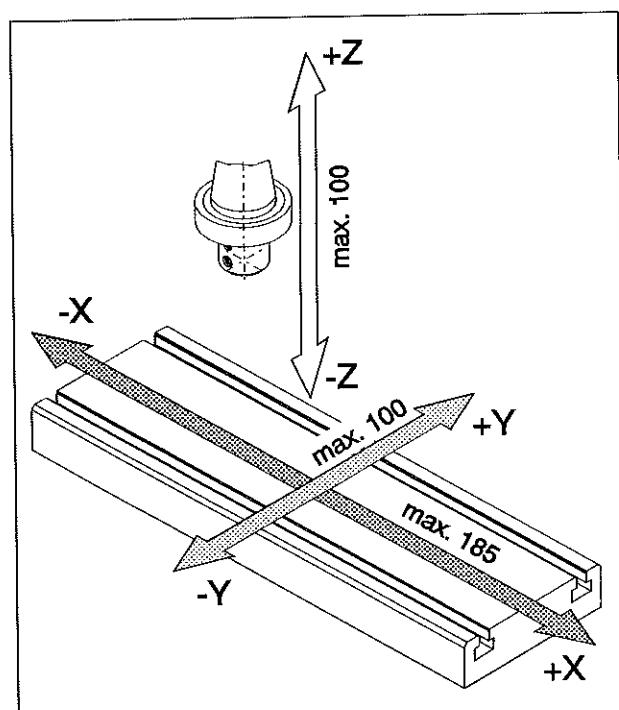
Mind that the clamped workpieces in the traversing area of the milling cutters are clamped at the milling table.



Working area in Z-axis

The working area in Z-direction depends on the length of the clamped workpiece.
 Further details are to be found at the respective clamping device.

effective Z-stroke 100 mm



Working area and coordinate system

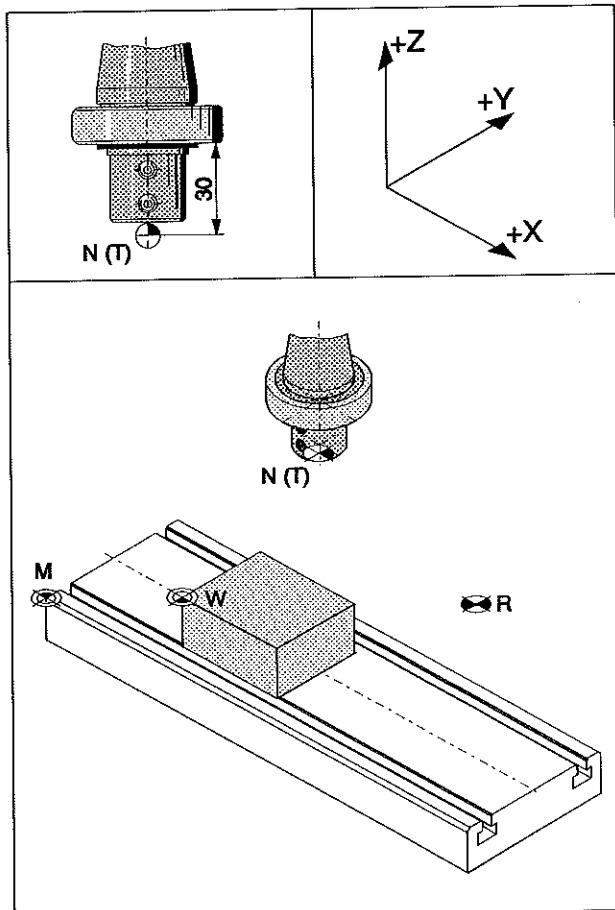
Limitation of traversing paths

The traversing paths of the slides are limited by software limit switches.
 When reaching a software limit switch the respective feed motor stops and a message is indicated at the monitor of the control.
 By means of the software limit switches a mechanical overload of the axis spindles due to fixed stops is avoided.

Coordinate system

The coordinate system is turning in clockwise direction. The origin lies in the machine zero point M or in the workpiece zero point W.

Points at the machine



Points at the machine

Machine zero point M

The machine zero point M lies on the surface of the milling table on the left front corner. The machine zero point M is the origin of the coordinate system.

Reference point R

The reference point R is a fixed point at the machine. It serves for the calibration of the measuring system. The reference point R must be approached after each switch-on of the machine to communicate the exact distance between the points M and N(T) to the control.

Workpiece zero point W

The workpiece zero point W can be freely programmed by the user. By programming a workpiece zero point the origin of the coordinate system is displaced from the machine zero point M into the workpiece zero point W.

Toolholding-fixture reference point N (T)

The toolholding-fixture reference point N (T) lies exactly in the rotary axis of the milling spindle, in a distance of 30 mm in Z-direction from the shoulder of the ball bearing of the toolholder. The tool lengths are described starting from this point.

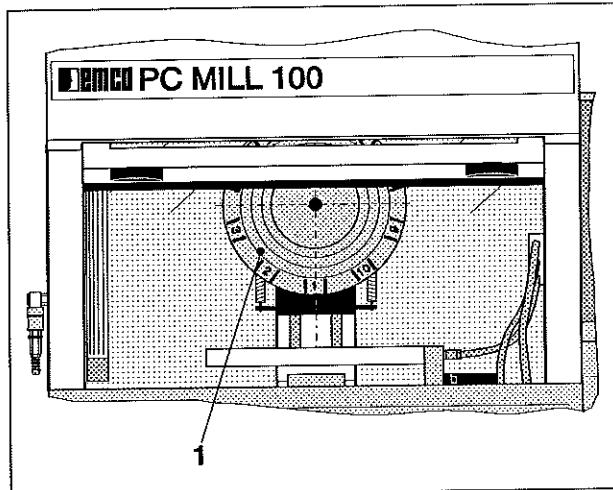
Tool system

All tools are mounted on the toolholders. The toolholders with the premounted drilling and milling tools are mounted on the tool drum (1).

The **tool change** is carried out manually or during a CNC-program **automatically**.

The tool drum (1) is provided with a **direction logic**, i.e. always the shortest way for swivelling the drum is selected. Thus the time for the tool change procedure is reduced to the minimum.

Number of tool supports 10



Tool drum for 10 tools

During tool change tool drum and milling head traverse upward.

The milling head continues to traverse when the tool drum has reached the end position. Thus, the toolholder in the milling head is released.

Now the tool drum is swivelled into the desired position (direction logic).

The milling head traverses downward again, thus, the toolholder with the new tool is released.

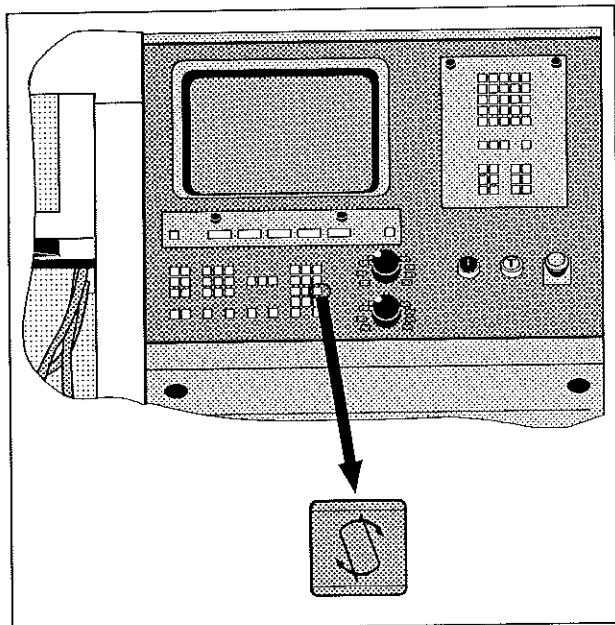
The whole tool change procedure is controlled via limit switches (proximity detectors).

Note:

Due to the safety devices of the machine a tool change procedure is only possible with closed chip guard door.

Releasing the tool turret

After the stop of a tool change procedure (power failure, EMERGENCY-OFF key, Escape key) the tool turret has to be released to adjust the control to the position of the tool turret.



Releasing the tool turret

Alarm message

"7021 Release tool turret"

- By pressing the tool turret key (1) the stopped tool change procedure is terminated.

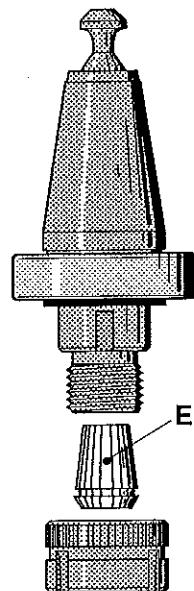
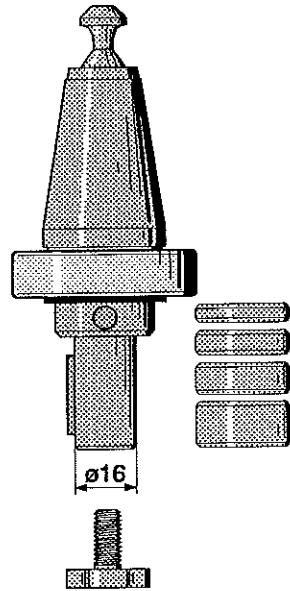
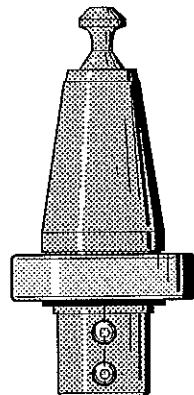
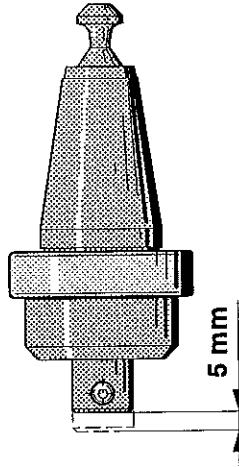
Alarm message

"6047 Error tool turret"

If this alarm message appears on your screen the tool turret is in a position not recognized by the control.

- Switch the key switch with closed chip guard door to "setting operation" and the operating mode selection switch to "JOG operation".
- Traverse Z-slide into +Z-direction until the alarm message changes to "7021 Release tool turret".
- The alarm message "6047 Error tool turret" does not extinguish:
Open the chip guard door and turn the tool drum manually until the message "7040 Machine door open" appears on the screen.
Close the chip guard door, on the screen the message "7021 Release tool turret" appears.
- Switch key switch to "Automatic" and take off key.
- Now release the tool turret as described above.

Toolholder

Collet holder**Shell end mill arbor****Miller support****Tap holder**

The machining tools are mounted on the toolholder.

Drills, end-milling cutters and profile cutters are clamped by means of collets into the collet holder, shell end mills and disk milling cutters are mounted on the shell end mill arbor.

Taps are clamped in special tap holders with longitudinal compensation.

All toolholders are available as accessory at EMCO.

A special miller support is available for the end-milling cutters Ø10, Ø12 and Ø16 mm.

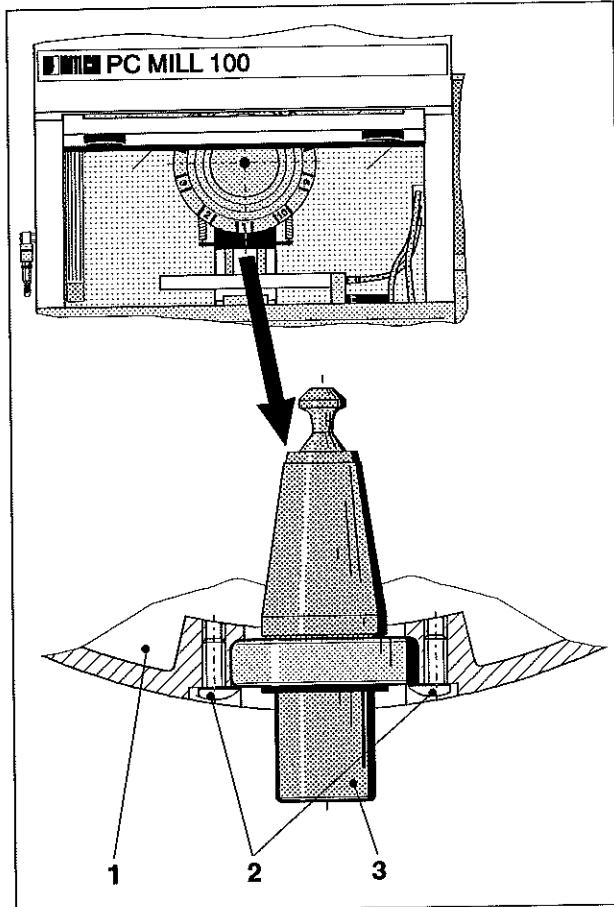
Tool support similar to DIN 2079 SK 30
Clamping bolt works standard

Order numbers

Toolholder	Ord. no.
Collet holder	ESX 16 770 910
Shell end mill arbor	Ø16 mm 770 860
	Ø10 mm 770 830
Miller support	Ø12 mm 770 840
	Ø16 mm 770 850
Tap holder	M3 770 870
	M4 770 880
	M5-M8 770 890

Toolholders

Mounting the toolholder into the tool drum



Mounting the toolholders

Danger:

- Mounting and dismounting the toolholder into the tool drum may only be carried out during machine standstill.
- Due to the modified DIN tool support only toolholders bought particularly for this machine from EMCO may be clamped.
- Wear protection gloves during mounting and dismounting the tools to avoid injuries at the hands.

- Turn clamping screws (2) at the tool support of the tool drum (1) in such a way that the toolholder (3) with mounted tool can be inserted.
- Insert toolholder (3) and turn clamping screws (2) in a way that the toolholder can be kept with a slight clearance in the tool drum.
- Swivel tool drum by one position and mount next tool.

Caution:

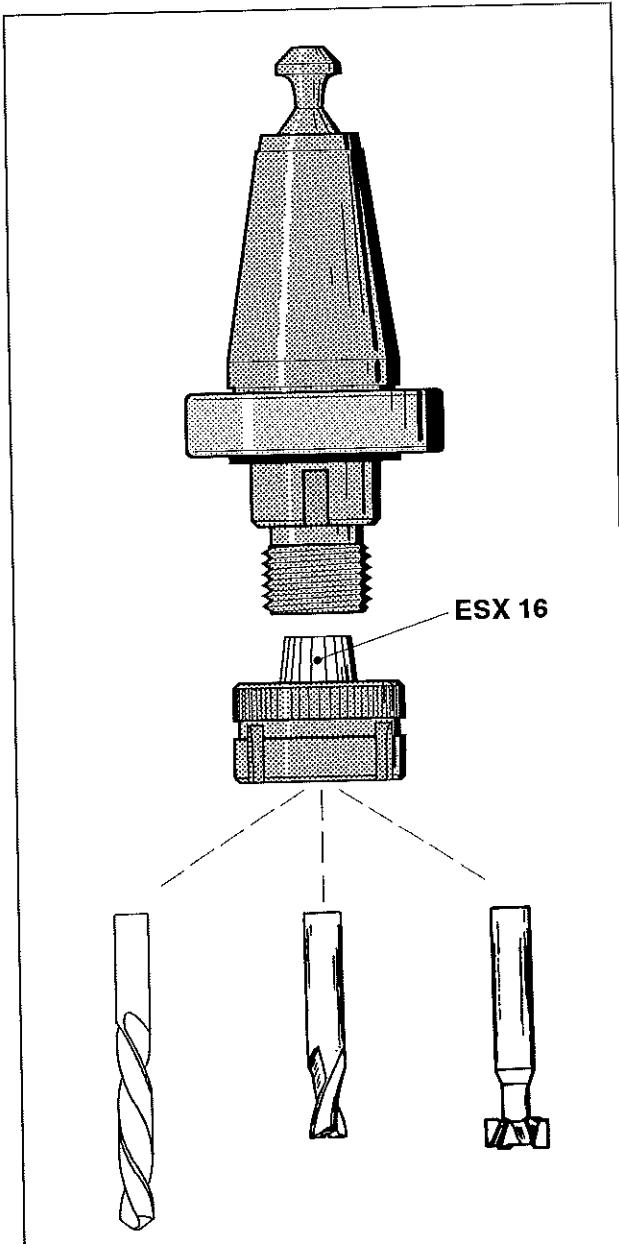
- To avoid a twisting of the toolholder in the milling spindle the toolholder must have a slight clearance in the tool drum.
- Remove dirt and grease from the toolholder before mounting it.

Dismounting the toolholder

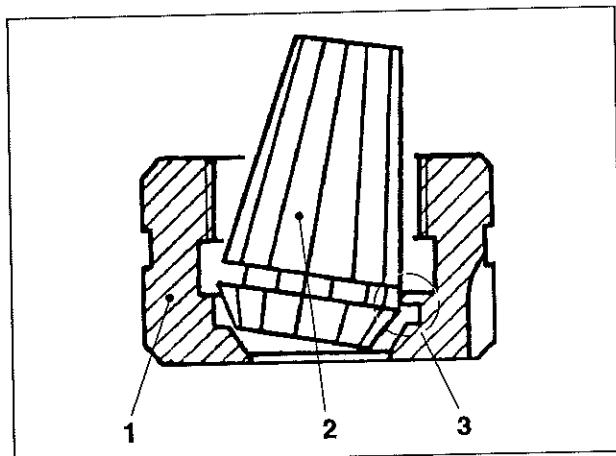
- Swivel in tool.
- Turn clamping screws (2) in such a way that the toolholder (3) can be removed.
Hold the toolholder fast so that it does not fall down and the tool is not damaged.

Note:

Clean the released tool from dirt and chips and oil the tool shaft slightly with oil.



Collet holder



Mounting the collets

Collet holders

Drills, end-milling cutters and profile cutters are clamped in the collet holder.

Order no. 770 910
Clamping range 0.5 up to 10 mm
Collet type ESX 16

Maintenance of collets and collet holders

Note:

In case of insufficient maintenance dirt and chips may damage the collet holders and the collets.

Thus, the round-run accuracy of the tool might be impaired.

The collet holders and the collets have to be cleaned carefully and oiled slightly before and after use.

Mounting the collets

- Unscrew clamping nuts (1).
- Insert collet (2) obliquely into the clamping nut (1) so that the eccentric ring (3) engages in the groove of the collet.
- Screw collet with clamping nut onto collet holder.

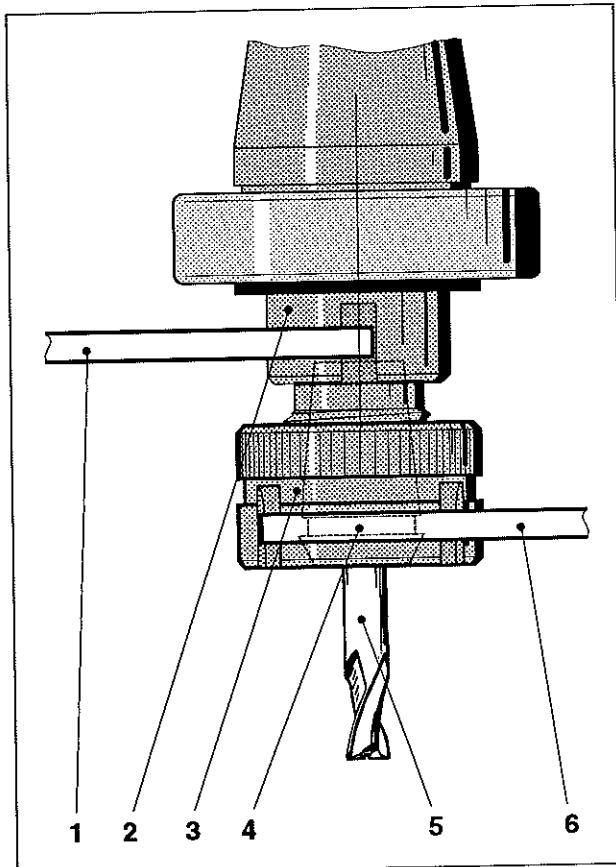
Danger:

When the collet holder is clamped in the tool drum of the machine, mounting and dismounting of the collet holders may only be carried out during machine standstill.

Dismounting the collets

- Loosen clamping nut (1).
- Via the eccentric ring (3) in the clamping nut the collet (2) is pressed out when screwing off the clamping nut.

Clamping the tools into the collet holder



Clamping the tools into the collet holder

- Mount adequate collet (4).
- Insert tool (5) into the collet (4). Mind that the tool is pushed in far enough into the collet. When clamping too short the tool may be ejected from the device.
- Tighten clamping nut (3) with supplied pin wrench (6). Countertighten the collet holder (2) with the second pin wrench (1).



Danger:

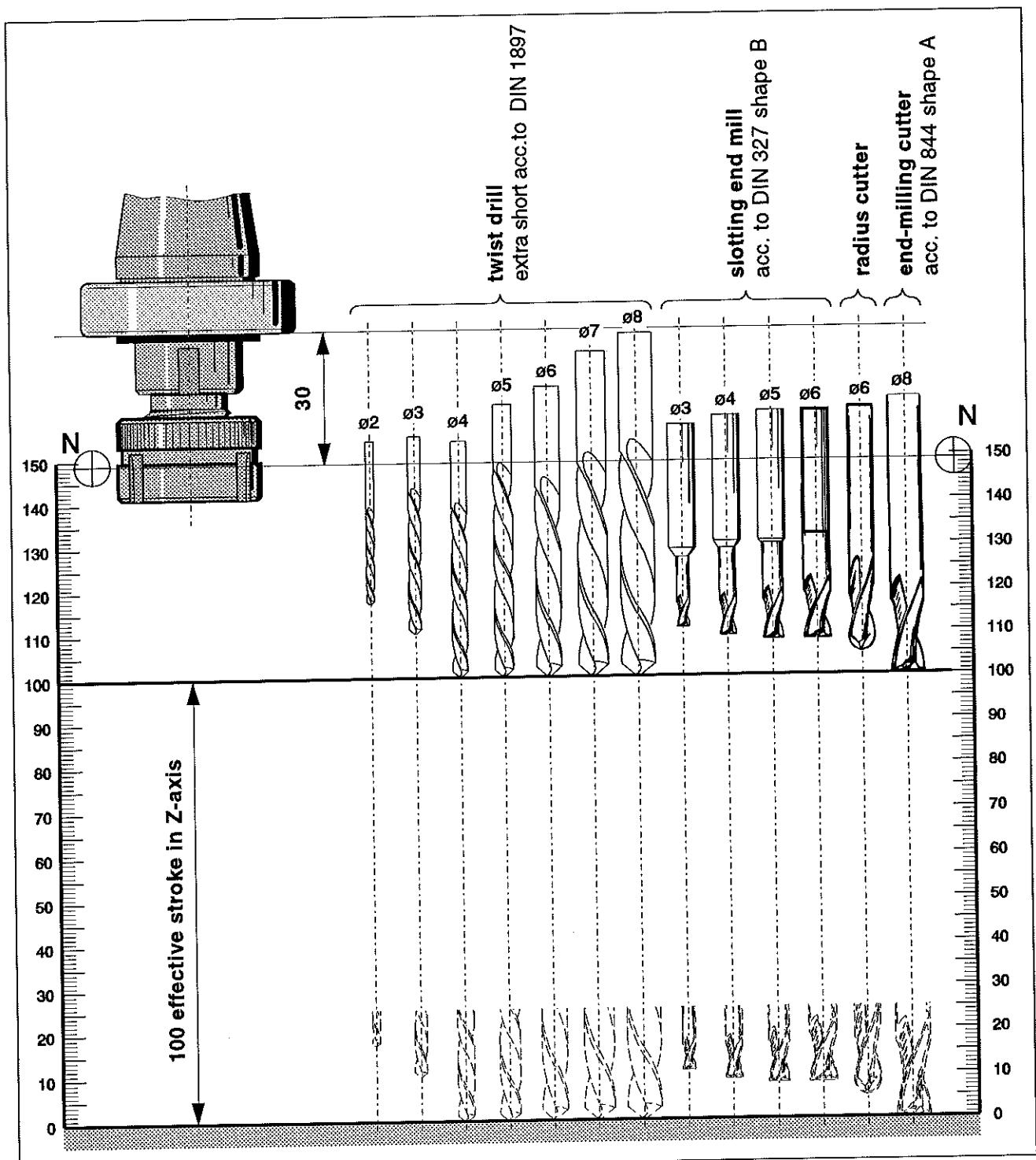
- With mounted collet holder, mounting and dismounting the tools may only be carried out during machine standstill.
- The values indicated in the table "clamping ranges" must always be complied with, otherwise the tools cannot be clamped safely.

Clamping ranges

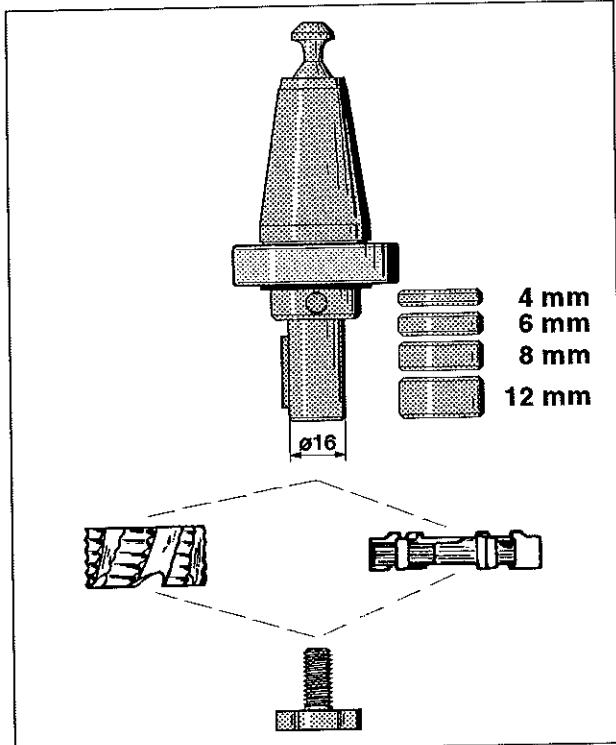
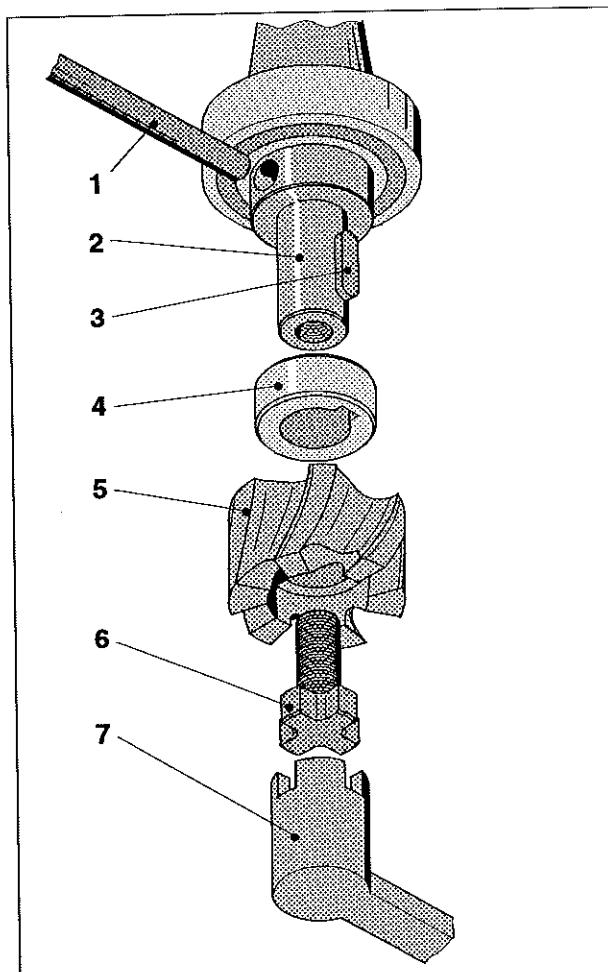
The clamping ranges are engraved in the collets.

Nominal diameter of the collet	Clamping range		Order no.
	[mm]	[inch]	
1.0	0.5-1.0	1/32	152 710
1.5	1.0-1.5	4/64	152 715
2.0	1.5-2.0	1/16-5/64	152 720
2.5	2.0-2.5	3/32	152 725
3.0	2.5-3.0	7/64	152 730
4.0	3.0-4.0	1/8-9/64-5/32	152 740
5.0	4.0-5.0	11/64-3/16	152 750
6.0	5.0-6.0	13/64-7/32-15/64	152 760
7.0	6.0-7.0	1/4-17/64	152 770
8.0	7.0-8.0	9/32-19/64-5/16	152 780
9.0	8.0-9.0	21/64-11/32	152 790
10.0	9.0-10.0	23/64-3/8-25/64	152 800
Set of collets (all 12 pcs.)			152 700

Working ranges of the tools



Working ranges with the collet holder

*Shell end mill arbor**Clamping the tools into the shell end mill arbor*

Shell end mill arbor

In the shell end mill arbor shell end mills and disk milling cutters are clamped.

Collars are supplied with the milling spindle for compensating the milling cutter width and a wrench for tightening the clamping screw.

Order no. 770 860
Tool support shaft Ø16 mm

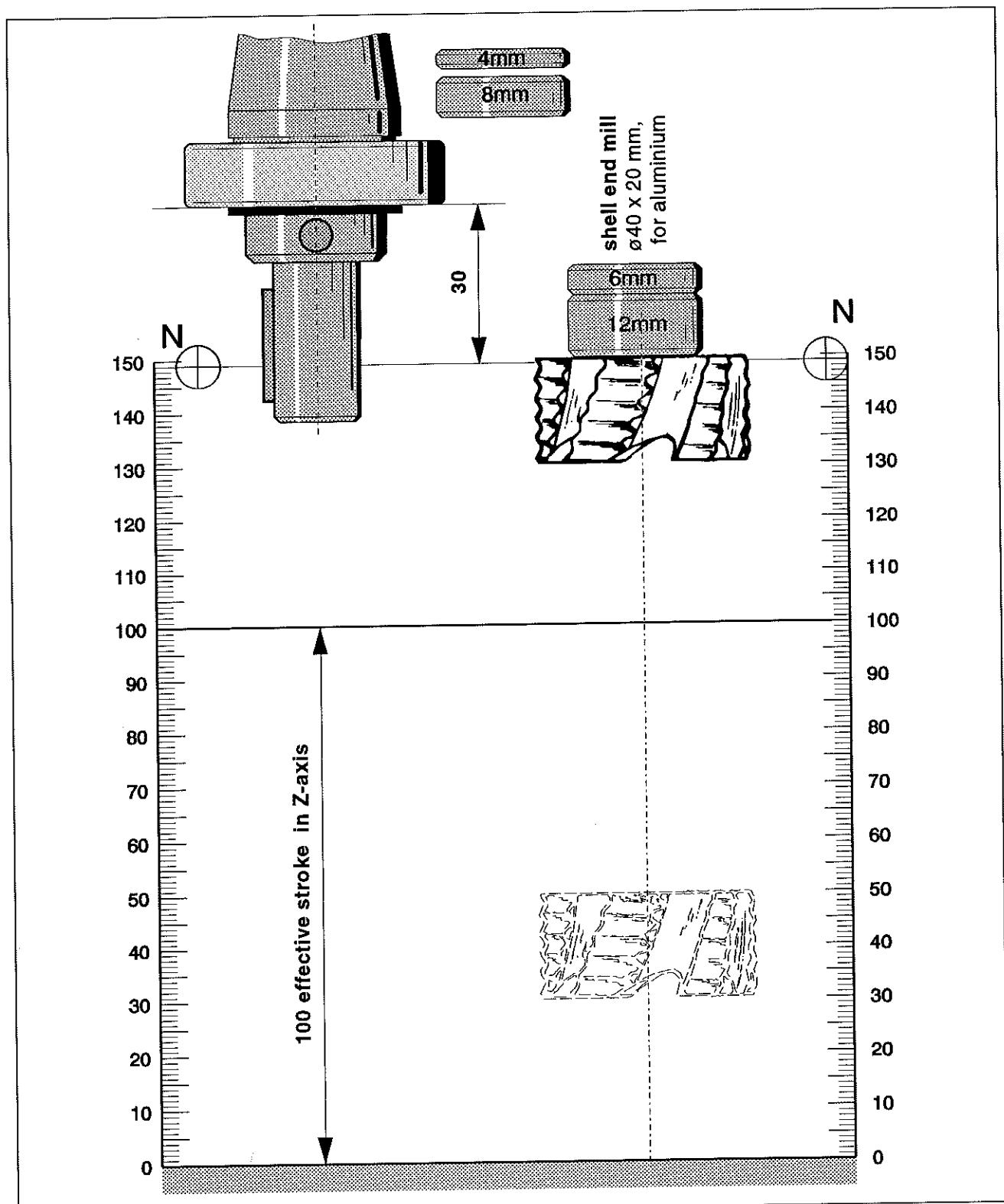
Clamping the tools in the shell end mill arbor



Danger:

- With clamped shell end mill arbor in the tool drum, clamping and unclamping the tool may only be carried out during machine standstill.
- Only tools with a bore of Ø16 mm and square key groove may be clamped.

- Unscrew clamping screw (6).
- If necessary, mount adequate collar (4) onto the collar shaft (2).
- Mount tool (5) onto the shaft (square key).
- Screw clamping screw (6) into the shaft and tighten with the wrench (7). Countertighten the shell end mill arbor (1). The clamping screw must lean on the tool (5) and not on the end face of the shell end mill arbor.

Working ranges of the tools

Working ranges with the shell end mill arbor

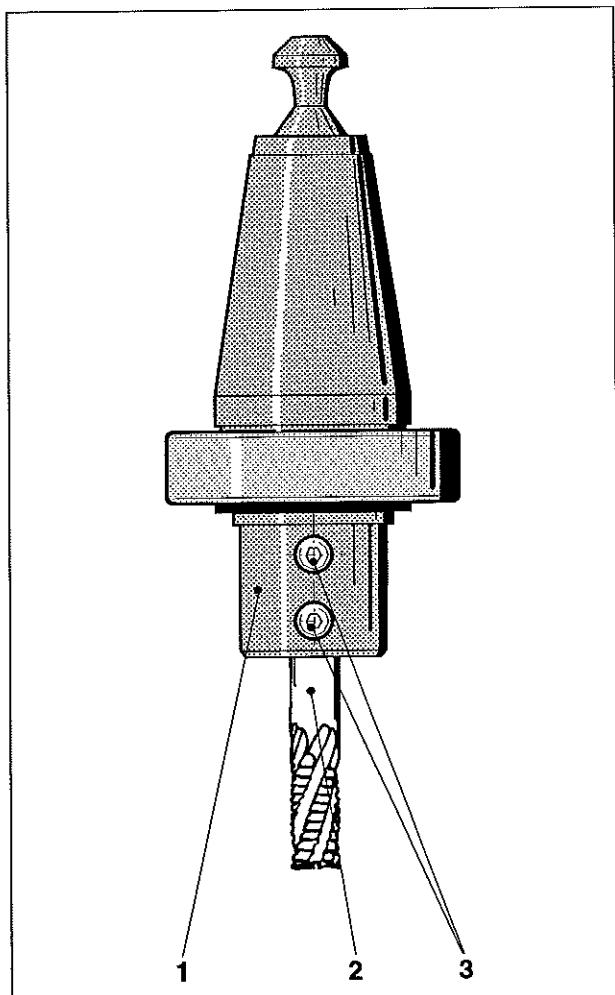
Miller support

The miller support serves for the support of end-milling cutters which cannot be clamped any more with the collet holder.

Due to the support diameter we distinguish between 3 miller supports.

Order number:

miller support ø10 mm	770 830
miller support ø12 mm	770 840
miller support ø16 mm	770 850



Clamping the tools into the miller support

Clamping the tools into the miller support

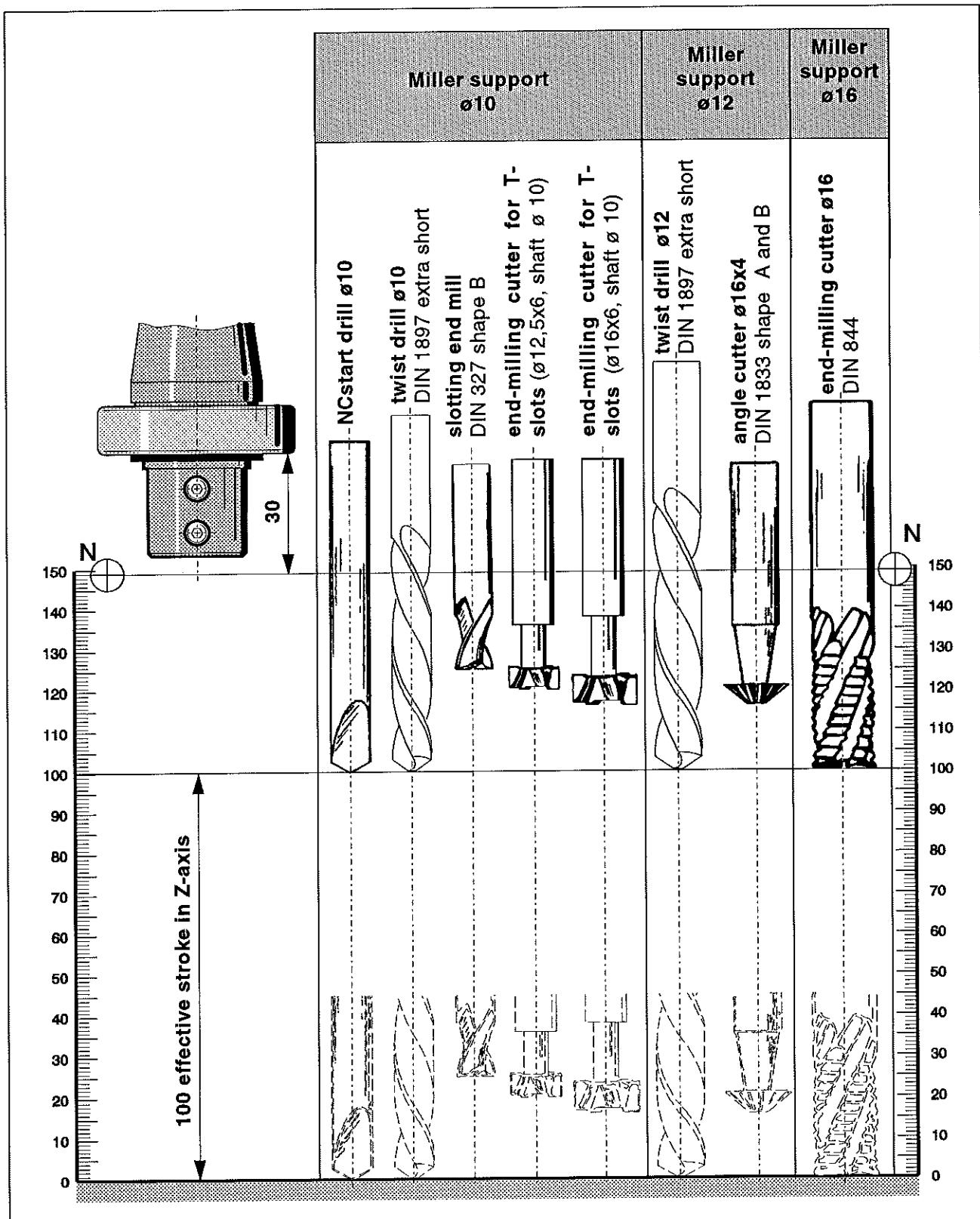


Danger:

- With clamped miller support in the tool drum of the machine, clamping and unclamping of the tools may only be carried out during machine standstill.
- Only tools with the nominal diameter fitting the miller support may be clamped.

- Insert tool (2) into support shaft of the miller support (1).
- Tighten both set screws (3) with an Allan key SW3.
Mind that the tool (2) is held by both set screws (3).

Working ranges of the tools



Working ranges with the miller supports

Tap holder

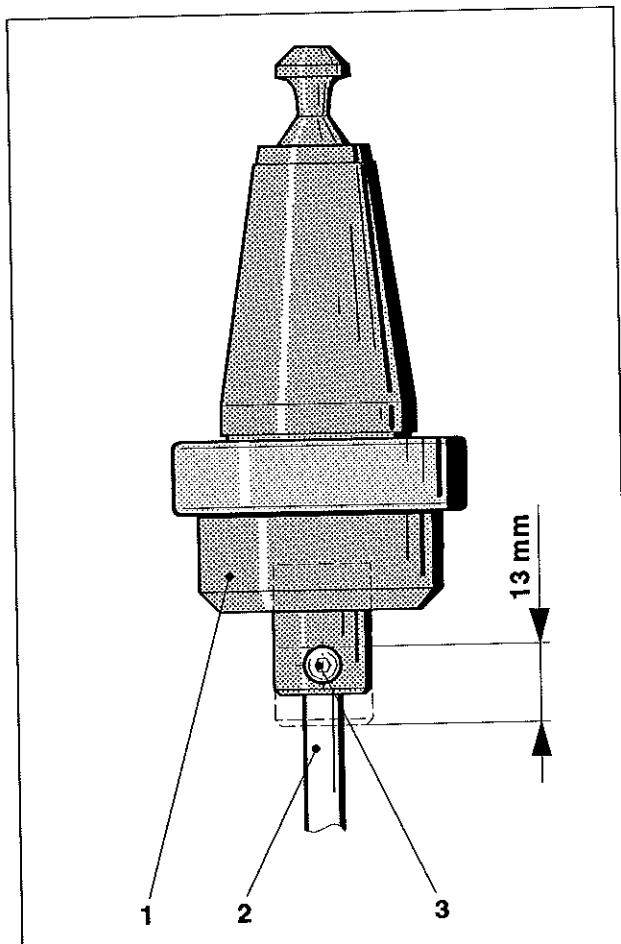
Taps are not clamped in the collet holder but in the tap holder.

The tap holder has a length compensation of 13 mm.

We distinguish between 3 tap holders according to the thread size.

Order numbers:

tap holder M3	770 870
tap holder M4	770 880
tap holder M5-M8	770 890



Clamping of tap holders

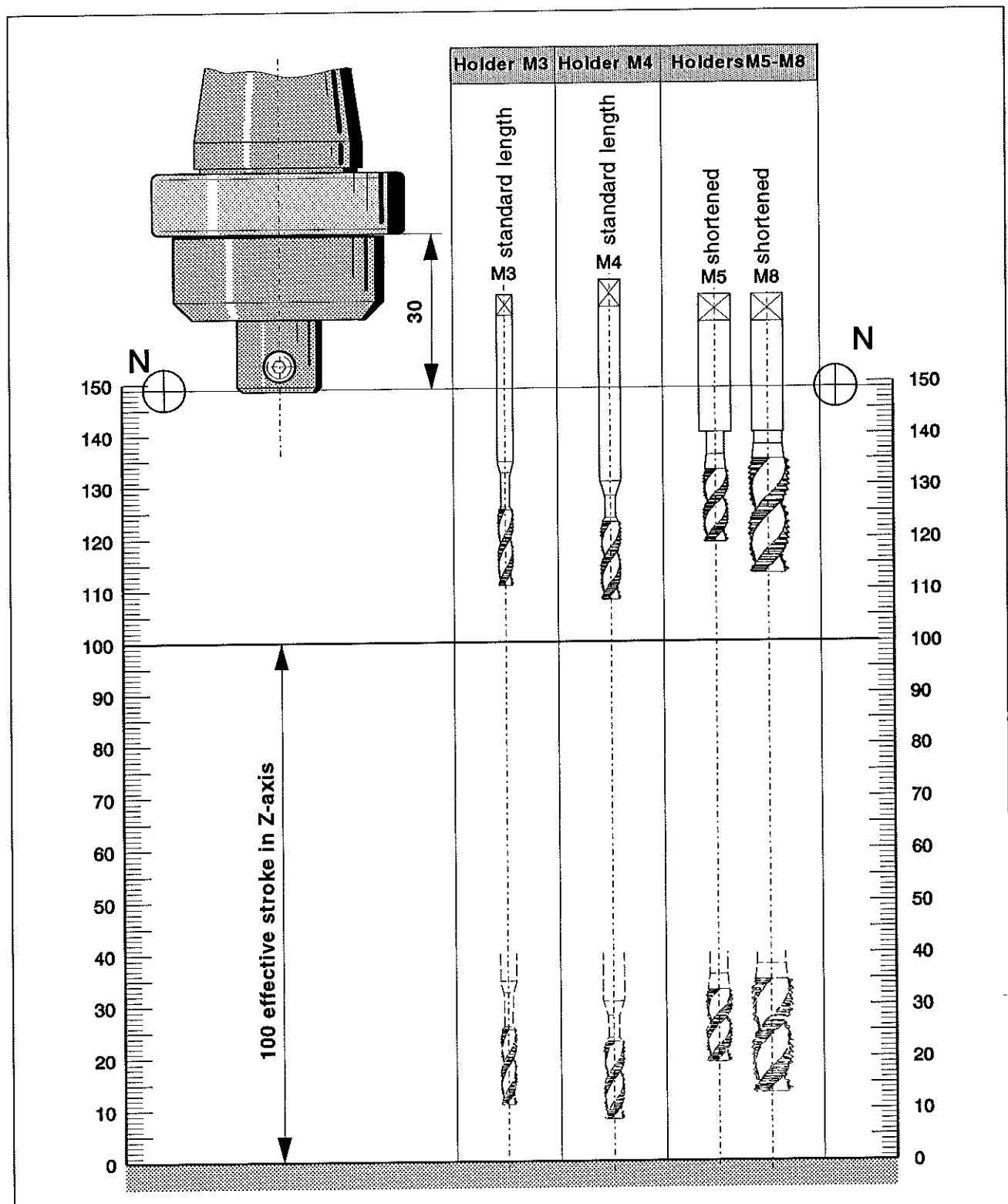
Clamping the tools in the tap holder



Danger:

- With clamped tap holder in the tool drum of the machine the tap may only be clamped and unclamped during machine standstill.
- Only the taps allocated to the tap holder may be clamped.

- Insert tap (2) into the support shaft of the tap holder (1).
- Tighten the set screw (3) with an Allan key SW2.5.

Working ranges of the tools*Working range with the tap holder*

Clamping devices for workpieces

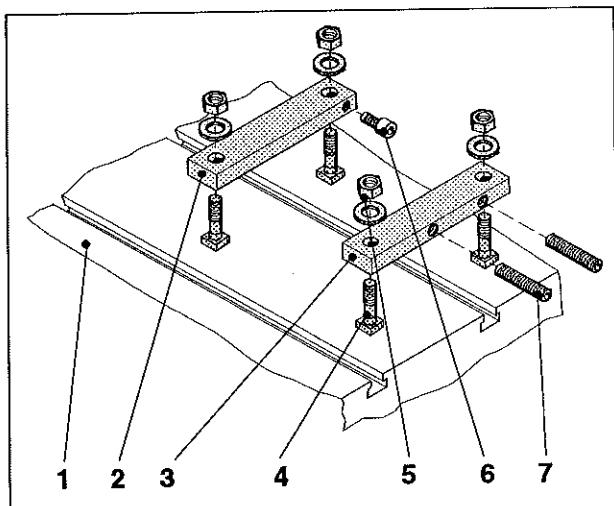
The clamping rails are included in the basic equipment of the machine.

All other clamping devices can be obtained from EMCO as accessories.

Clamping rails

Mounting the clamping rails

- Thread in slot screws (4) at the milling table (1) and screw down clamping rails (2) and (3) with the nuts SW13 (5).
- Before tightening align clamping rails by means of a stop square rectangular to the milling table.



Mounting the clamping rails

Clamping the workpieces

- Put workpiece between the clamping rails. The clamping rail (2) and the cheese head screw (6) serve as stop.
- Clamp workpiece with the two locking screws SW6 (7).



Danger:

- The clamping rails and the machine vice may only be mounted and dismounted during machine standstill.
- Workpieces may be clamped and released only during machine standstill.

The machine vice

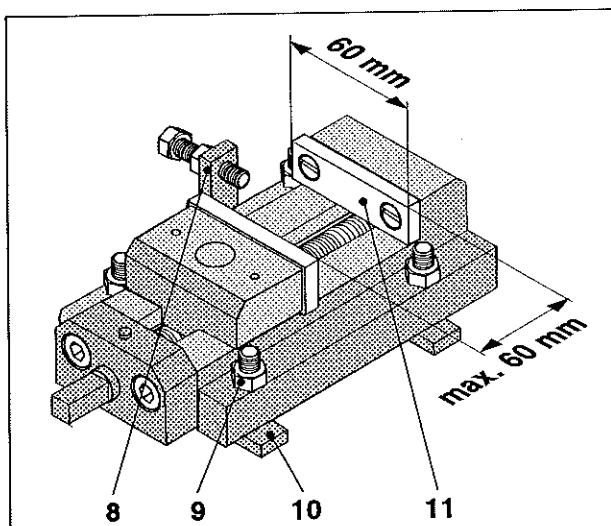
The machine vice is provided with exchangeable clamping jaws (11) and a stop (8).

The stop (8) is mounted laterally on the vice with a hexagon screw SW10.

Order No. 770 310

Jaw width 60 mm

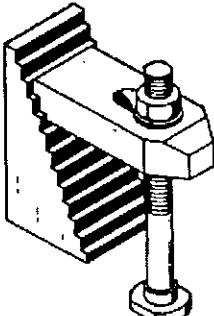
Clamping width max. 60 mm



Machine vice

Mounting the machine vice

- Thread in sliding blocks (10) into the T-slots on the milling table.
- Align vice by means of a stop square rectangular to the milling table.
- Clamp down vice tightly and safely by means of all 4 hexagon nuts SW13 (9).

*Incremental strap*

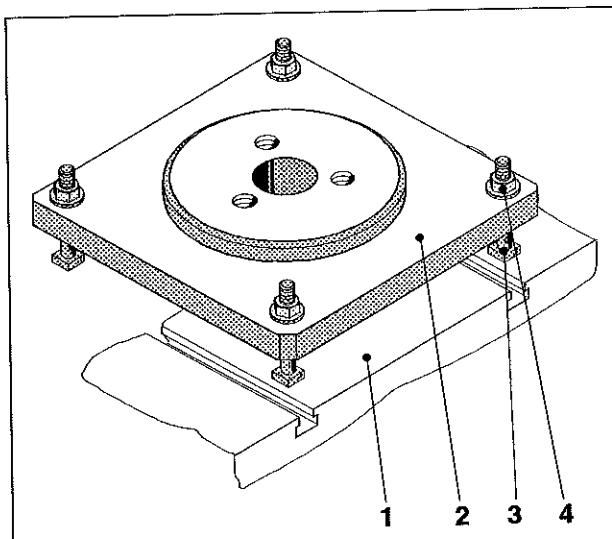
Incremental straps

Incremental straps are suitable for clamping irregular and high workpieces.
For clamping a workpiece at least 2 incremental straps are required.

Order no. 465 100
Clamping height 60 mm

**Danger:**

Clamping and releasing the workpieces with incremental straps may only be carried out during machine standstill.

*Mounting the intermediate flange*

Intermediate flange

The intermediate flange serves for the support of the three-jaw chuck.
It is mounted on the milling table.

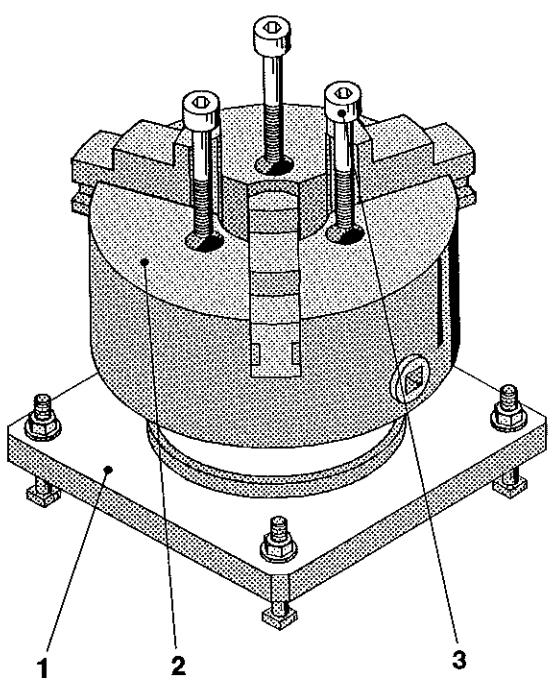
Order no. 770 800

Mounting the intermediate flange

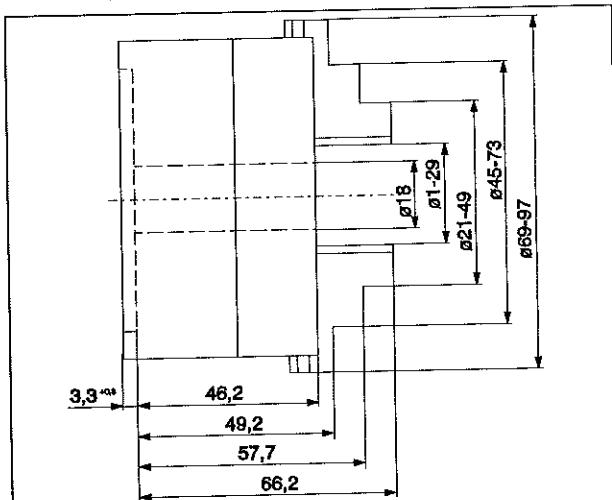
**Danger:**

- Mounting the intermediate flange may only be carried out during machine standstill.
- Always mount the intermediate flange with all 4 T-slot screws.

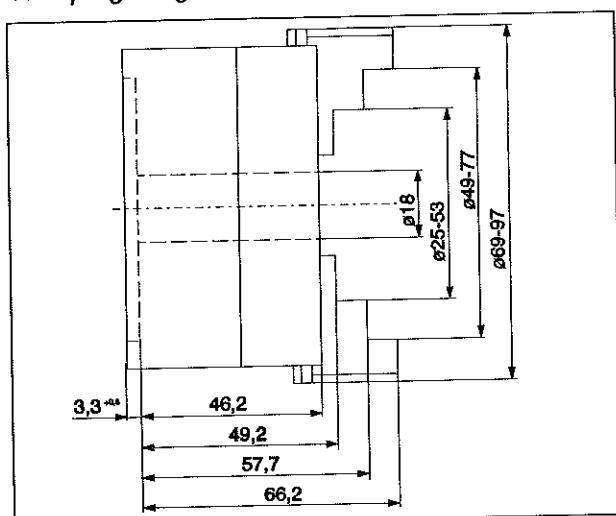
- Thread intermediate flange (2) with the 4 T-slot screws (3) at the milling table (1).
- Tighten hexagon nuts SW13 (4).



Mounting the chuck at the intermediate flange



Clamping range - externally graduated jaws



Clamping range - internally graduated jaws

Three-jaw chuck ø85 mm

The three-jaw chuck is clamped at the intermediate flange.

Order no. V4W 186



Note:

Also mind the instructions enclosed with the chuck.

Mounting the chuck



Danger:

- The chuck may be mounted only during machine standstill.
- For mounting the chuck only screws M5x40 according to DIN 912 may be used. With longer screws the chuck might not fit tightly at the intermediate flange, in case of too short screws these might tear out.

- Intermediate flange (1) and centering flange (2) have to be free from dirt.
- Screw the chuck (2) with the three cheese head screws M5x40 SW4(3) onto the intermediate flange and tighten the screws (3).

Clamping ranges



Danger:

- The maximum admissible clamping ranges must never be exceeded. Exceeding them may lead to jaw fracture.
- Jaw protection must never be more than 12 mm since otherwise there is the risk of jaw fracture.
- After clamping the workpieces take off the chuck key.

Pneumatic vice (option)

The pneumatic vice is mounted as option by the manufacturer.

A prerequisite is a pneumatic maintenance unit available as option.

The vice is supplied with an Allan key SW5 and a fork wrench SW 10/13.

In the scope of supply also a blow-out device is included.

To enable an efficient blow-out of the vice the mounted copper tube can be easily adjusted to the desired position by bending it with caution.

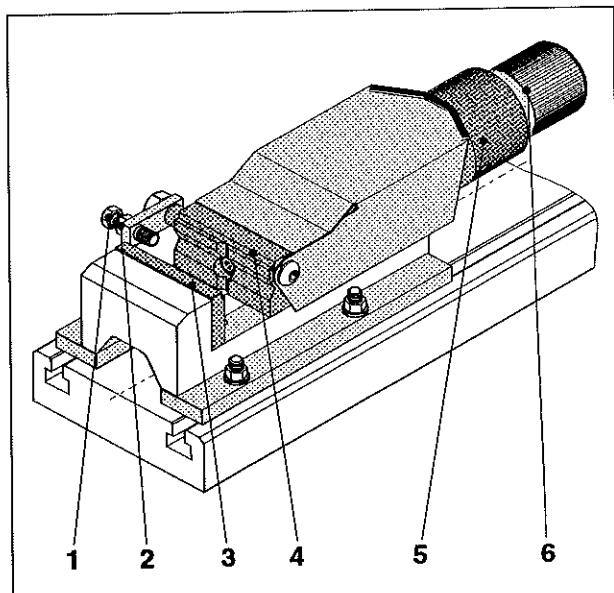
When adjusting the copper tube mind that the tools clamped in the tool drum can be swivelled through without collision.

Adjusting the clamping position

For easier clamping of cylindrical workpieces prisms are installed in the clamping jaws of the vice in horizontal and vertical direction.

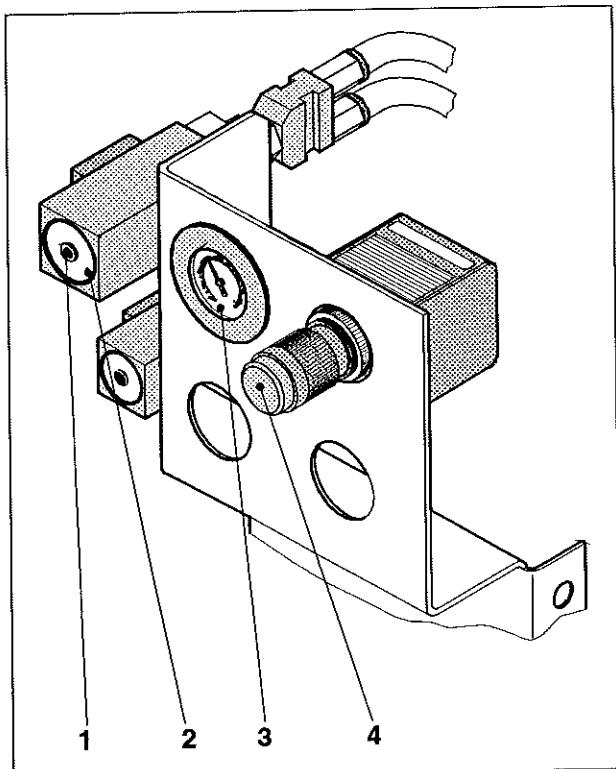
Jaw distance max. 70 mm
 Jaw stroke 5 mm

- Set clamping device state of the control on "Release" (message "7054 Vice open!" is displayed on the screen).
- Place workpiece on vice against the clamping jaw (3) of the vice.
- Approach clamping jaw (4) of the vice by turning the knurling wheel (5) up to a distance of approx. 2 mm from the workpiece (adjust jaw distance via the workpiece length to be clamped).
 When turning the knurling wheel mind that the sliding valve (6) does not turn with the wheel (counterhold).
- Laterally at the vice a stop is mounted on the clamping jaw (4) which has to be adjusted by twisting the hexagon screw M6x40, SW10 (1). The adjustment is fixed by means of the counter nut SW10 (2).
 A second setting screw (1) M6x20 is contained in the scope of supply of the vice. It should be used for wider workpieces to avoid a collision of the milling head with the setting screw.
- When closing the vice via the control the workpiece is clamped with the set pressure (the jaw stroke of the clamping jaw (4) is 5 mm).



pneumatic vice

Setting the clamping device pressure



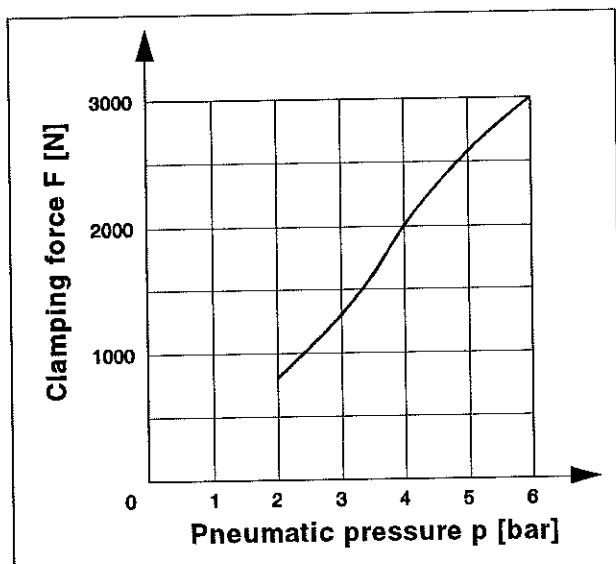
Setting the clamping device pressure

The clamping force of the vice can be regulated by changing the air pressure at the pneumatic maintenance unit.

Additionally a press switch is mounted which controls the pressure set at the manometer.

If the set pressure is not achieved an alarm message is displayed on the screen.

- Close clamping device.
- Set clamping device pressure – 0,5 bar.
Set pressure which lies about 0.5 bar below the desired clamping device pressure by means of the turning knob (4) at the pressure control unit.
The set pressure can be read at the manometer (3).
- Loosen fixation screw (2) at the press switch.
- Turn setting screw (1) at the press switch until the message "6072 Vice not ready" is displayed on the screen.
Increase pressure turn in clockwise direction
Reduce pressure turn in counter-clockwise direction
- Tighten fixation screw (2) with caution.
- Set desired clamping device pressure at the turning knob (4) of the pressure control unit.
- Acknowledge the alarm message on the screen.
If the workpiece is clamped again no alarm message must be displayed on the screen.



Clamping force diagram for vice

Standard values for the clamping pressure

Minimum clamping pressure 2 bar
Maximum clamping pressure 6 bar

The clamping forces with set clamping pressure are to be seen at the opposite diagram.

Technological Data

1. Cutting speed V

$$V \text{ [m/min]} = \frac{D \text{ [mm]} \cdot \pi \cdot n \text{ [rpm]}}{1000}$$

V [m/min] cutting speed
 D [mm] diameter of workpiece
 n [rpm] speed of main spindle

The maximal admissible cutting speed depends on:

- **Material of workpiece**

The higher the strength of the material, the lower the cutting speed.

- **Material of tool**

Hard metal tools allow for a higher cutting speed than HSS-tools.

- **Feed value**

The larger the feed, the lower the cutting speed.

- **Depth of cut**

The larger the depth of cut the lower the cutting speed.

Cutting speed for programming exercises on the EMCO PC MILL 100:

Aluminium (Torradur B) 44 m/min
 Steel (9S20),

tender synthetic material 35 m/min
 hard synthetic material 25 m/min

2. Speed n

$$n \text{ [rpm]} = \frac{V \text{ [m/min]} \cdot 1000}{D \text{ [mm]} \cdot \pi}$$

The cutting speed and the tool diameter enable you to calculate the speed of the main spindle.

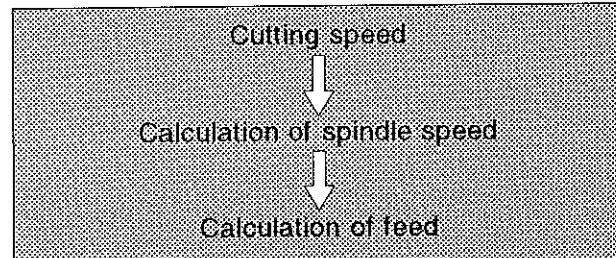
3. Feed F

On the EMCO PC MILL 100 the feed F is programmed in [mm/min].

$$F \text{ [mm/min]} = n \text{ [rpm]} \cdot F \text{ [mm/rev.]}$$

F [mm/min] feed in [mm/min]
 F [mm/rev.] feed in [mm/U]
 n [rpm] speed of main spindle

Summary



Determination of the speed n during milling and drilling

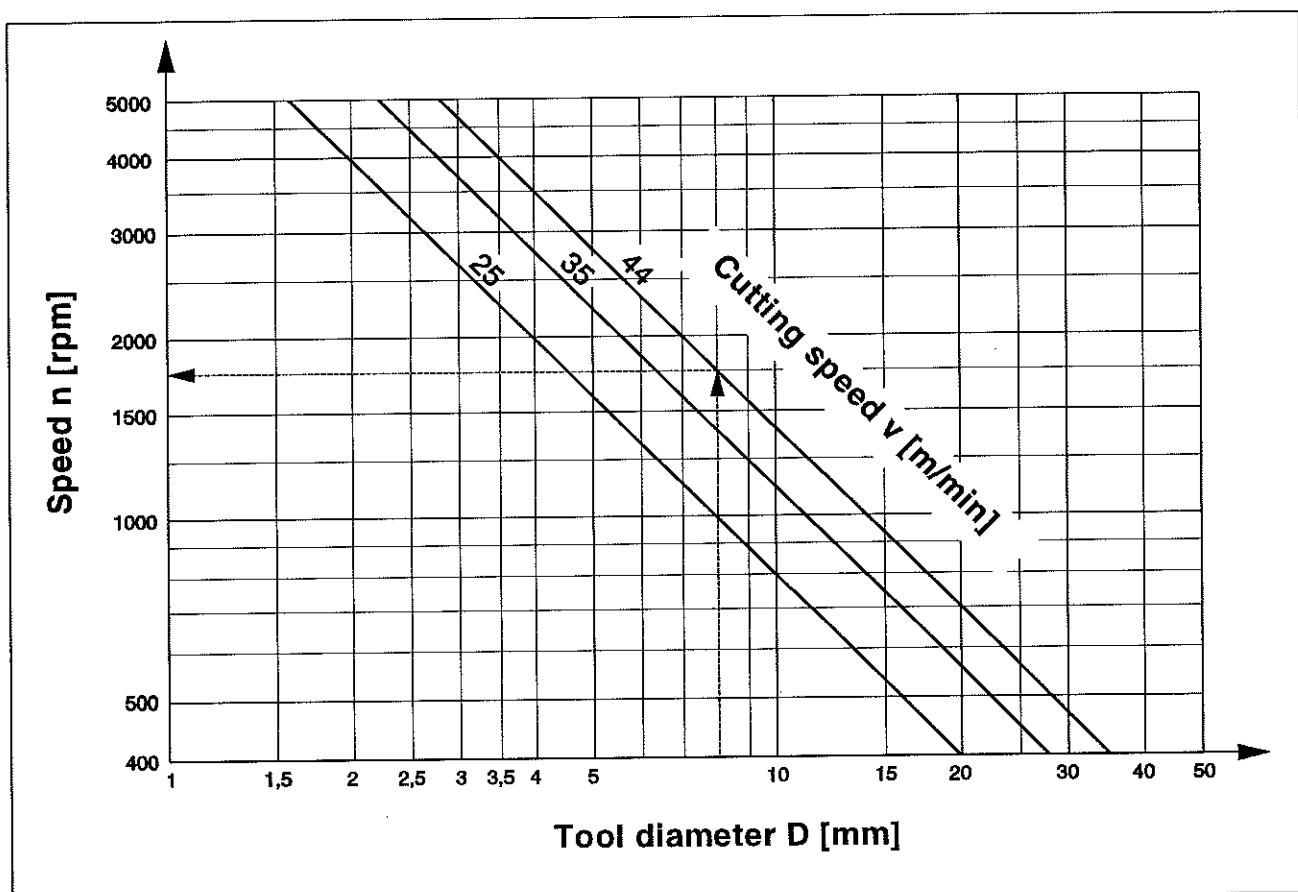
Example:

You know:

- tool diameter $D = \varnothing 8 \text{ mm}$
- cutting tool $v = 44 \text{ m/min}$

You want to know:

- speed n in [rpm]



Determination of the speed

Solution:

Speed $n = 1750 \text{ rpm}$

Determination of the cutting depth t during milling in aluminium

Example:

You know:

- workpiece material Torradur B
- diameter of milling cutter $D = \varnothing 16 \text{ mm}$
- feed speed $F = 150 \text{ mm/min}$

You want to know:

- cutting depth t in [mm]

Determination of the feed speed F during milling in aluminium

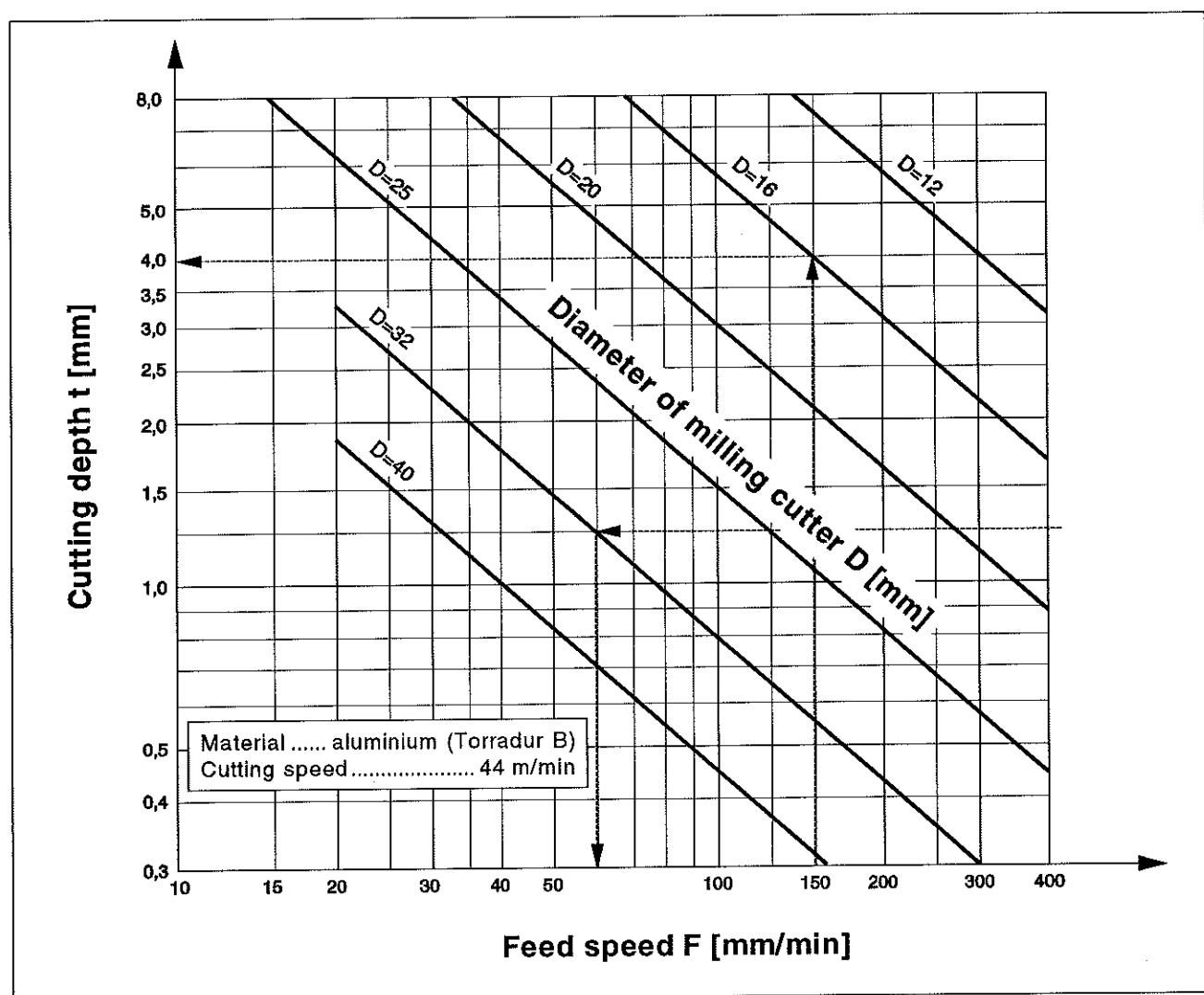
Example:

You know:

- workpiece material Torradur B
- diameter of milling cutter $D = \varnothing 32 \text{ mm}$
- cutting depth $t = 1.25 \text{ mm}$

You want to know:

- feed speed F in [mm/min]



Milling in aluminium

Solution:

cutting depth $t = 4 \text{ mm}$

Solution:

feed speed $F = 60 \text{ mm/min}$

Determination of the cutting depth t during milling in steel

Example:

You know:

- workpiece material steel (9S20)
- diameter of milling cutter $D = \varnothing 16 \text{ mm}$
- feed speed $F = 70 \text{ mm/min}$

You want to know:

- cutting depth t in [mm]

Determination of the feed speed F during milling in steel

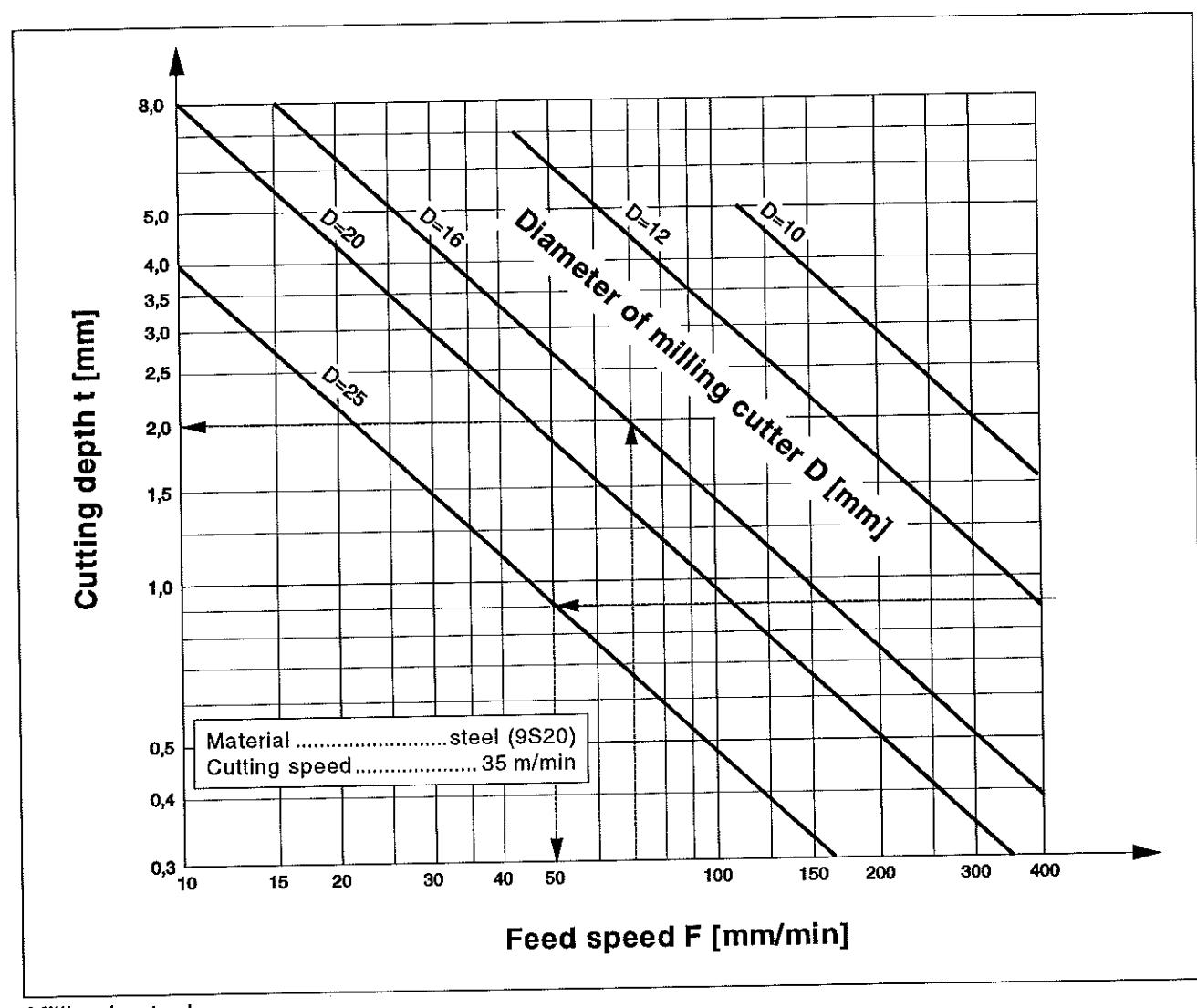
Example:

You know:

- workpiece material Stahl (9S20)
- diameter of milling cutter $D = \varnothing 25 \text{ mm}$
- cutting depth $t = 0.9 \text{ mm}$

You want to know:

- feed speed F in [mm/min]



Milling in steel

Solution:

cutting depth $t = 2 \text{ mm}$

Solution:

feed speed $F = 50 \text{ mm/min}$

Determination of the feed speed F during drilling

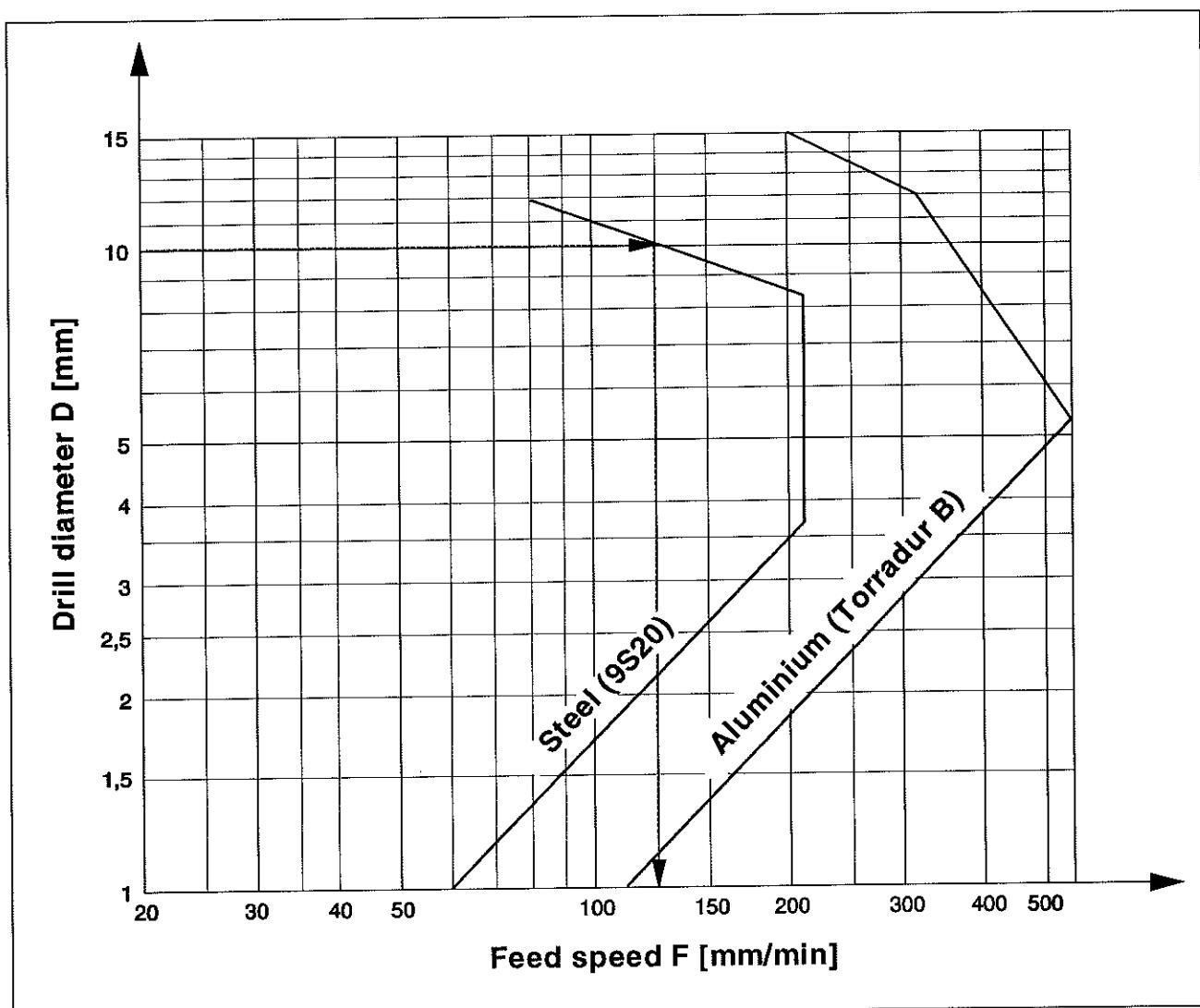
Example:

You know:

- workpiece material steel (9S20)
- Diameter of drill $D = \varnothing 10 \text{ mm}$

You want to know:

- Feed speed F in [mm/min]

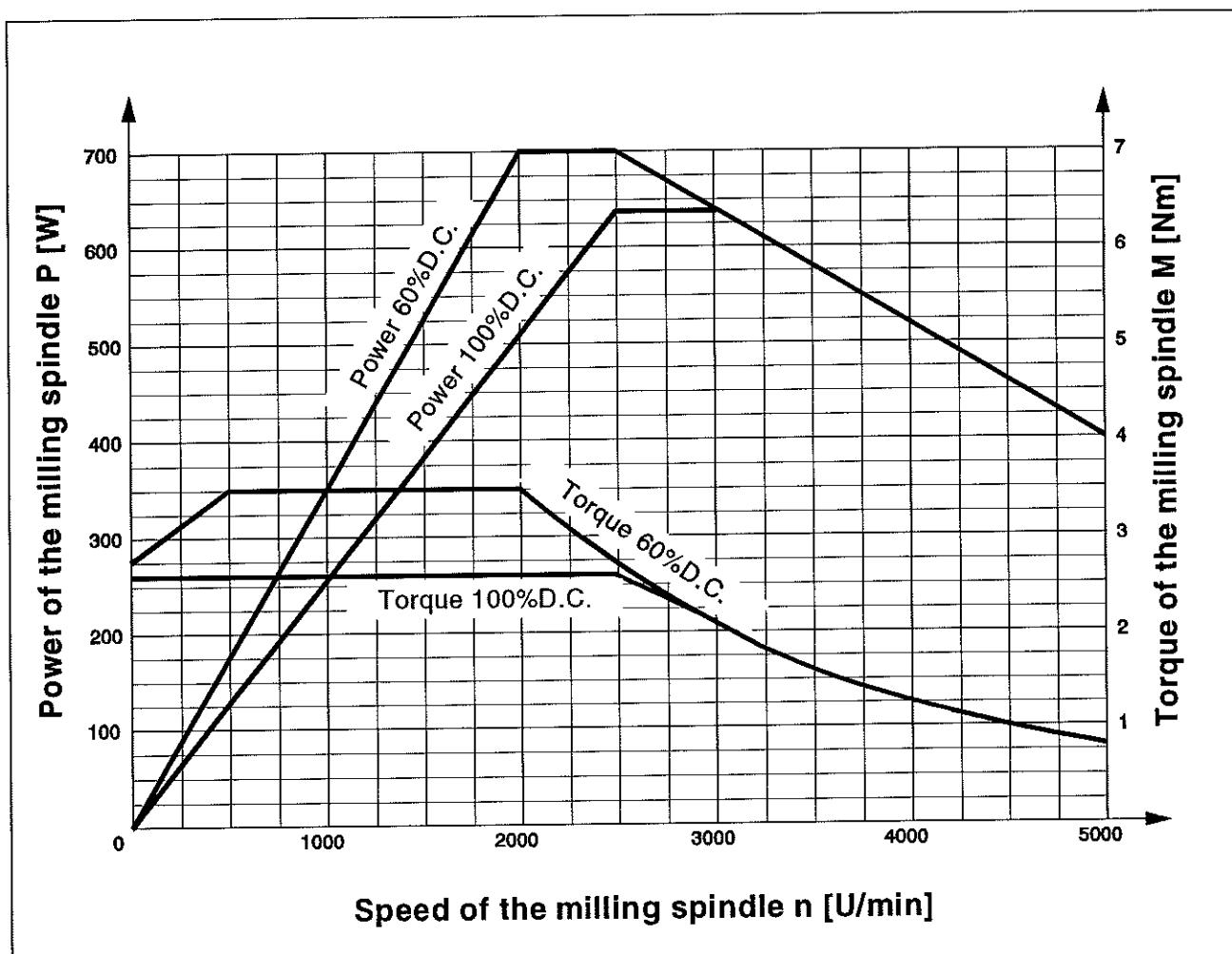


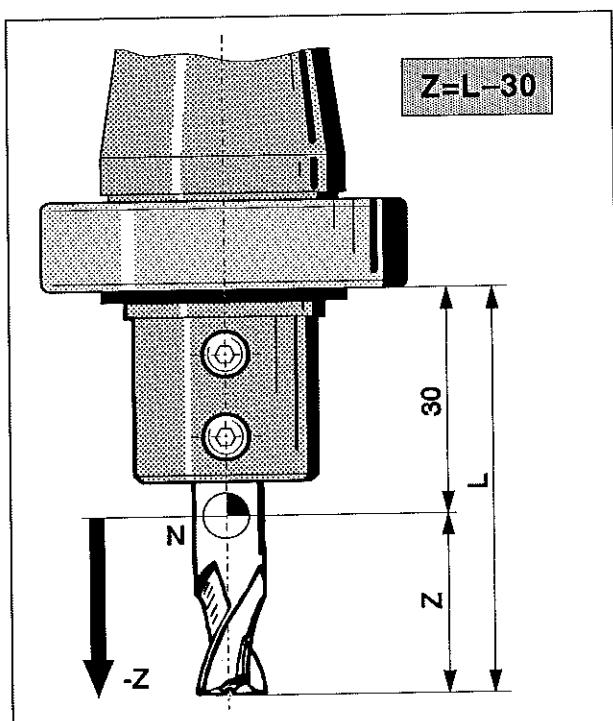
Drilling - Determination of the feed speed

Solution:

Feed speed $F = 125 \text{ mm/min}$

Speed-torque characteristic line





Determination of the tool length Z

Determination of the tool length Z with the gauge

The toolholding-fixture reference point N (T) is to be found in a distance of 30 mm from the shoulder of the ball bearing of the toolholder (see "Points at the machine").

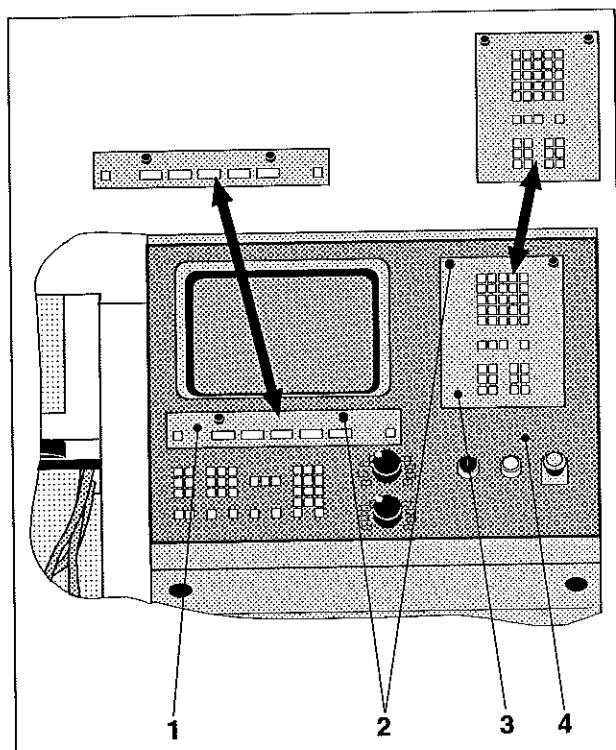
Measure the entire length from the ball bearing shoulder to the tool tip and deduct 30 mm from this value.

The calculated value is the $-Z$ -dimension which has to be entered into the tool register of your control.



Note:

- Mind the negative sign for the tool lengths.
- This is not a very exact method. You will have to carry out tool length corrections after the first sample workpiece.



Exchange of the key modules

Exchange of the control keyboard

By exchanging the control keyboard it is possible to operate the machine fast and without larger resetting effort with another control.

- Untwist knurled screws (2) at the key modules (1 and 3).
- Swivel up key modules (1 and 3) on the upper side approx. 1 cm from the operating panel and take them off upwards.
- Insert new key modules from above into the recesses at the operating panel (4) and then swivel them to the operating panel.
- Fasten the newly inserted key modules with the 4 knurled screws (2) at the operating panel (4).
- Now install the corresponding software for your new control at your PC (see software description).



Note:

Wrap up well the key modules not needed and keep them in a protected and clean place to avoid damage.

Coolant device (accessory)

Order no. 793 700
 Coolant capacity ca. 35 l
 Conv. capac. at nozzle approx. 3.5 l/min

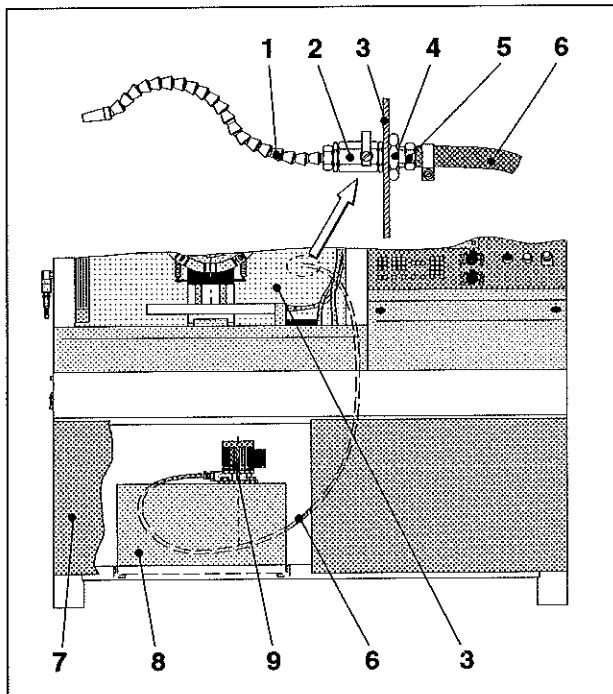
All bores, connections and chip sieves are already contained in the basic machine.

Mounting the coolant device

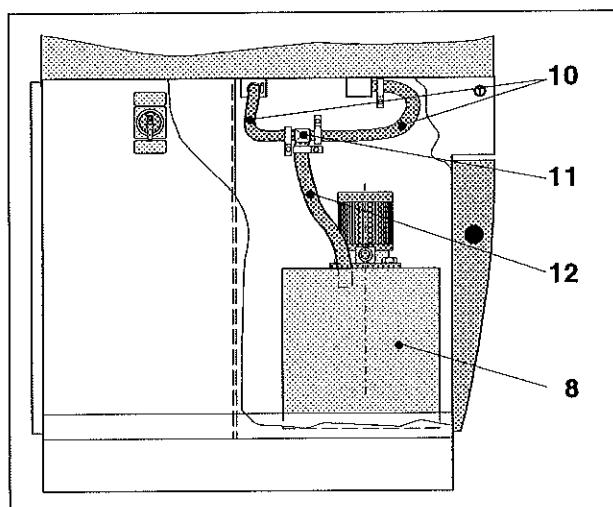


Danger:

Mounting the coolant device may only be carried out during standstill of the machine.
 (Switch off machine main switch!).

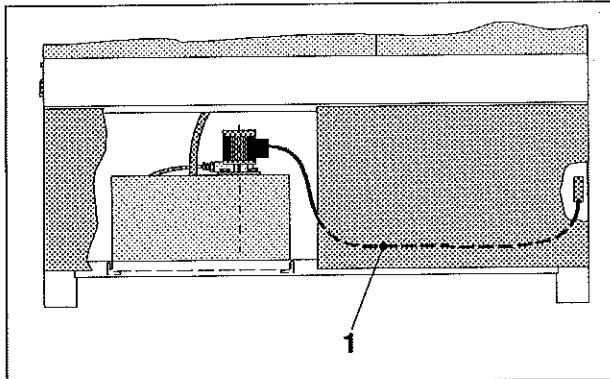


Placing the coolant hose

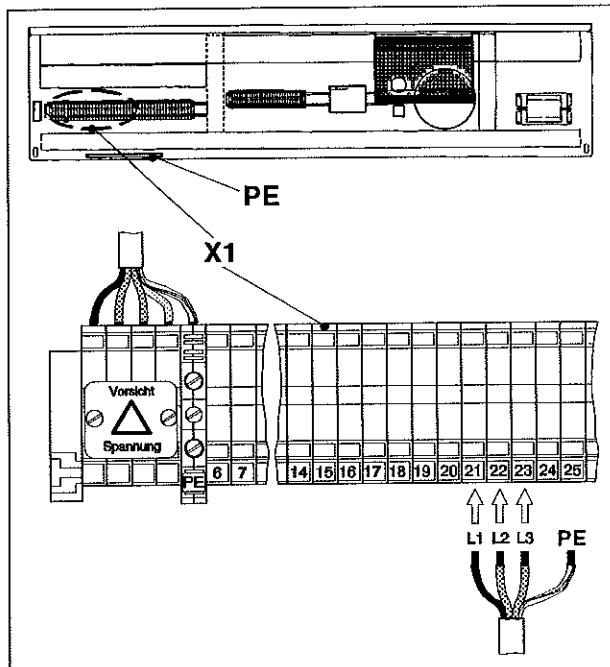


Placing the return flow hoses

- Unscrew rear panel of machine.
- Take off left front blind (7) by lifting it slightly.
- Mount coolant pump (9) by means of the 4 supplied hexagon head screws M6 x 20, the 4 serrated lock washers and hexagon nuts M6 (SW10) on the cover of the coolant tank (8).
- Thread premounted unit consisting of plug valve (2), screwed socket (5), adapter and flexible hose (1) through the bore at the right of the machine panel (3) and fix it at the rear side by means of the hexagon nut R $\frac{1}{2}$ " (4).
- Mount coolant hose ø10 x 3700 mm (6) at the pressure exit of the coolant pump (9) by means of a hose clip.
- Thread second end of the coolant hose (6) through the introduction hole and mount it with a hose clip on the screwed socket (5).
- Assemble return flow system consisting of the two hoses ø16 x 400 mm (10), the hose ø16 x 1100 mm (12) and the T-piece (11). Fix the hoses by means of the supplied hose clips on the T-piece.
- Mount each hose (10) by means of hose clips at one outlet connection piece of the machine.
- Place coolant tank (8) on the rails at the machine base.
- Remount rear panel of machine.



Laying the cables into the electrical cabinet



Terminal strip for electrical connection in the electrical cabinet (view from above)

Electrical connection



Danger:

The electrical connection of the coolant device may only be carried out by an electrics expert.
Prior to the connection the machine has to be separated from the mains supply.

- Lead cable (1) of the coolant pump along the cables already placed in the machine into the electrical cabinet.
- Connect cable cores at terminal strip X1 according to the picture on the opposite and the following list.
Earthing on terminal strip PE.
(For the connection see also electrical documentation)

E-connection of the coolant pump

Core ends (pump)	1	2	3	yellow/green
Terminal strip (E-cabinet)	X1			PE
Supply terminal	21	22	23	PE

- Close electrical cabinet again, mount front blind.

Switching on/switching off coolant device

The coolant pump is switched on and off by pressing the coolant key at the operating panel of the machine (see also software description). Additionally, there is a plug valve on the flexible coolant hose for regulating the flow quantity.



Set-up of an FMS

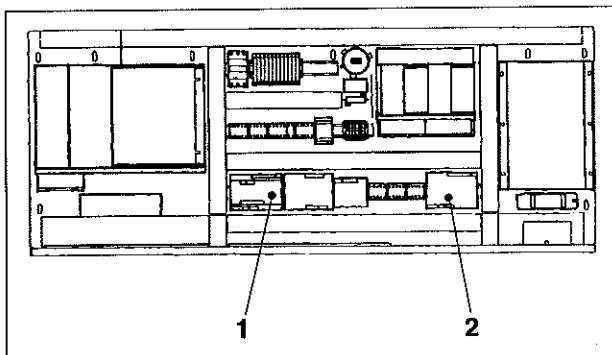
If this machine is to be a part of an FMS the following safety items according to CE standard have to be complied with.

Operating module

The operating module (1) is situated in the electric cabinet.

For shifting the machine from machine operation to FMS operation and vice versa a key switch has to be mounted by the customer.

The electrical connection for the key switch can be seen in the electric documentation of your machine on the sheet "operating module/safety circuit", position <11>.



Modules in the electric cabinet



Caution:

Check the jumper positions at the operating and door safety module to avoid damage of the modules.

Door safety module

After ordering a robotics or DNC interface a second door safety module (2) is mounted by the manufacturer in the electric cabinet of the machine. It controls the door of the protective fence of the FMS which has to be mounted.

The following components have to be connected:

- door limit switch / door open
- door limit switch / door closed
- interlocking magnet / protective fence door
- limit switch for interlocking magnet
- key "unlock protective fence"
- key "lock protective fence"

The electrical connections are to be seen in the electric documentation of your machine on the sheet "door safety module protective fence".



Danger:

The safety devices for safe operation of the FMS must not be bridged.

C Maintenance of the machine

Lubricating and oiling the machine



Danger:

All lubrication and maintenance work may only be carried out during machine standstill.

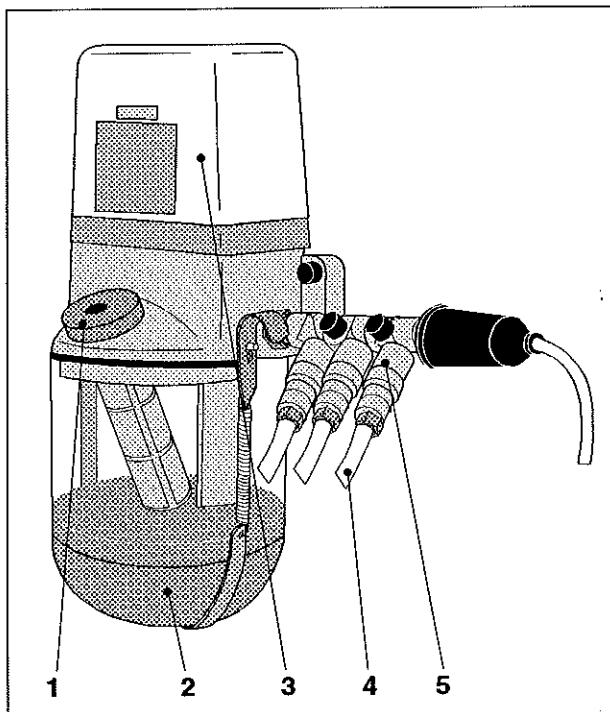
Lubrication survey

No.	Lubricating point	Lubricant	Interval [h]
1	Main spindle bearing	greased for lifetime	—
2	Z-spindle bearing	Grease (lubrication nipple)	40
3	Guideway X-slide	Central oil lubrication	preset by manufacturer
4	Guideway Y-slide		
5	Guideway Z-slide		
6	X-spindle nut	greased for lifetime	—
7	Y-spindle nut		
8	Z-spindle nut		
9	Tool magazine slide	Glideaway oil	40
10	pneumatic maintenance unit	pneumatic oil	when needed
11	pneumatic vice	slideway oil/grease	8 / 200

Lubricant recommendations

Use	Designation according to DIN	Examples	
Central oil lubrication (slide guides) tool magazine slide pneum. vice	slideway oil CGLP DIN 51502 ISO VG68	BP CASTROL ESSO KLÜBER MOBIL EMCO BP CASTROL KLÜBER MOBIL RÖHM	Maccurat 68 Magnaglide D68 Febis K68 Lamora Super Pollad 68 Vactra 2 Gliding paste L2 Greace MS3 Altemp Q NB 50 Mobilgrease Special F 80
Z-spindle bearing pneum. vice	grease DIN 51804/T1 NLGI 2 DIN 51807-1		
Compressed-air oiler	pneumatic oil DIN 51524 ISO VG32	CASTROL MOBIL	Magnaglide D32 HLP 32

Central lubrication



Central oil lubrication

The slide guides in X-, Y- and Z-direction are supplied with guideway oil via the central oil lubrication.

The distribution elements (5) distribute the guideway oil evenly to the lubricating points. As soon as a slide has passed a travel path of 16 m the pump (3) is switched on automatically.

The central lubrication can also be activated manually by means of the "AUX ON" key. If the key "AUX ON" is pressed for a major period the pump is switched on every 6 s (also see initial start-up in chapter "A Installation of the machine").

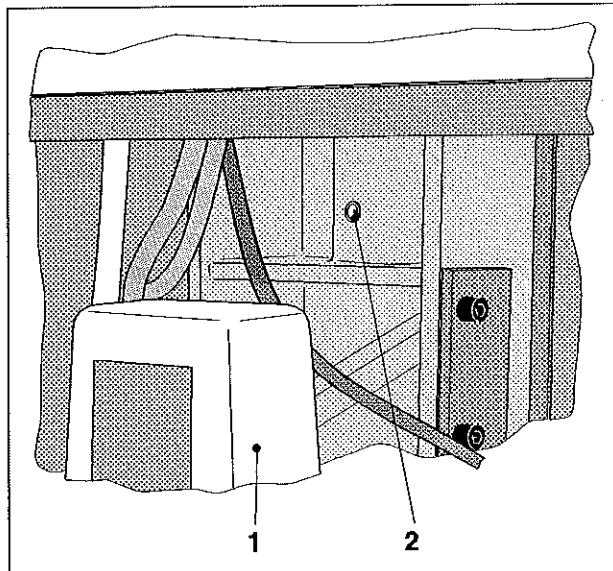
- Check the level of the lubricant tank (2) daily on the rear side of the machine.
Take care that the oil level does not drop below the minimum level.
- For refilling unscrew filling screw (1).
Tank capacity 0.7 l

Degaassing the lubricant lines

If a lubrication is started with too low oil level air enters the lubrication system. Air inclusions are visible in the lubricant lines behind the distribution elements (5).

- Unscrew lubricant lines (4).
- Carry out lubrication with "AUX ON" key until only oil is pressed out of the distribution elements (5).
- Retighten lubrication lines (4).

Z-spindle bearing



Lubrication nipple for Z-spindle bearing

Danger:

The lubrication of the Z-spindle bearing may only be carried out during machine standstill.
(Machine main switch in position "0").



The spindle bearing is extremely loaded by the milling head base.

Therefore take care that the spindle bearing is regularly supplied with lubrication grease to avoid damages of the bearing.

Lubrication interval every 40 h (weekly)

Lubrication via lubrication nipple (2)

Lubrication grease see lubricant recommendations

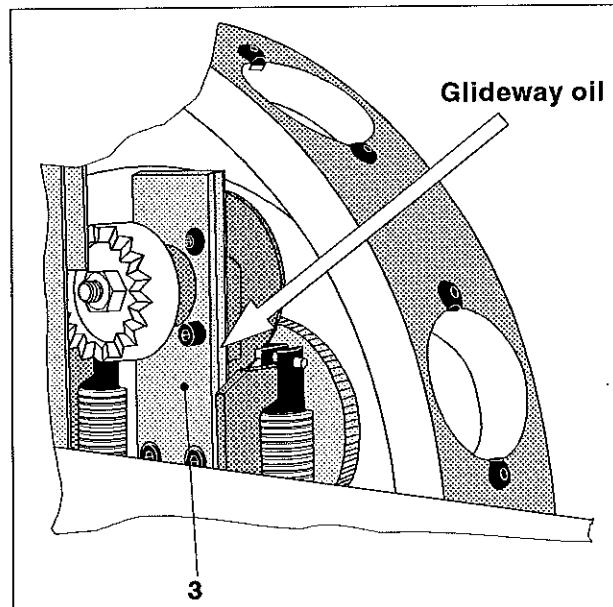
- Take off lower cover at the rear side of the machine.
- Lubrication of the spindle bearing by means of the supplied grease gun at the lubrication nipple (2).
The lubrication nipple (2) is to be found above the central lubrication (1) at the Z-slide.
- Remount lower cover.

Tool magazine slide

The tool magazine slide (3) is not supplied by the central lubrication

Thus, pay attention to a regular lubrication to avoid damages at the slide guides.

Lubrication interval every 40 hours (weekly)
Lubricant glideway oil



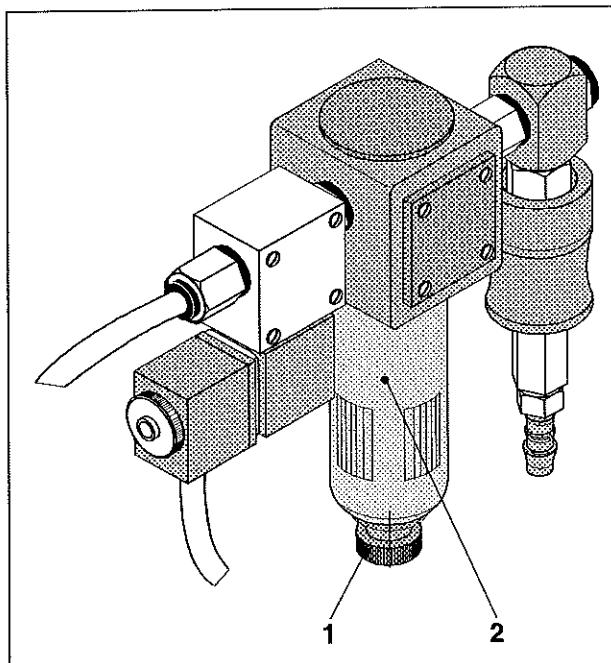
Oiling the tool magazine slide guide

Danger:

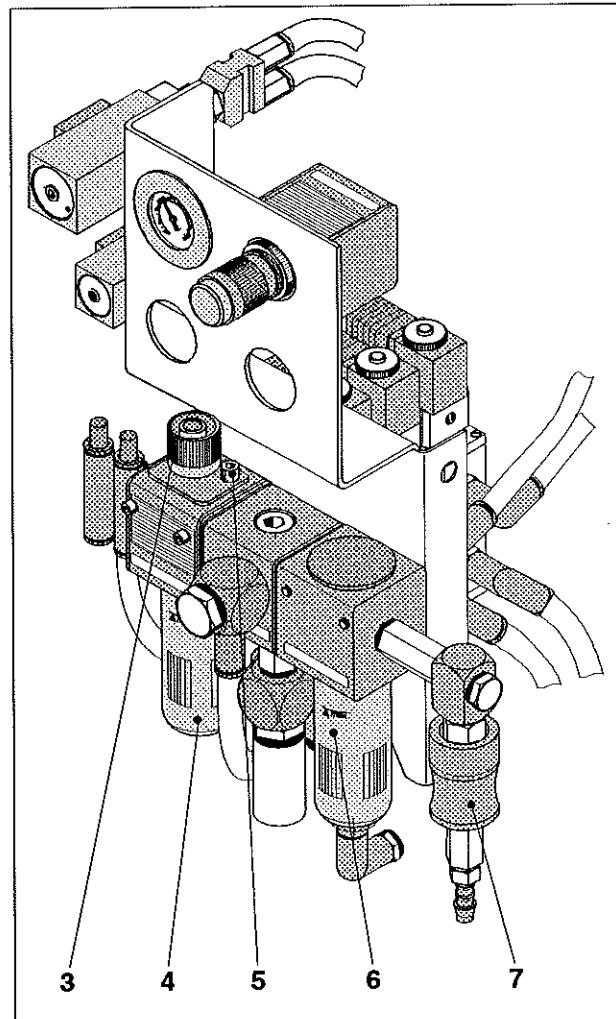
The lubrication of the tool magazine slide may only be carried out during machine standstill.
(Machine main switch in position "0".)



- Take off upper cover on the rear side of the machine.
- Lubricate slide guide with an oil can.
- Remount upper machine cover.



pneumatic maintenance unit (basic equipment)



Refilling the pneumatic oil

Pneumatic unit

Check the liquid level in the separator tank (2) in regular periods (at least monthly).

If the liquid level is near the maximum admissible filling level the tank has to be emptied.

- Dismount lower cover at the rear side of the machine.
- Loosen drain screw (1) at the tank (2) under working pressure.
The water flows out of the tank under pressure.
- Retighten drain screw (1).
- Remount lower machine cover.

Pneumatic unit (option)

The oil level of the compressed-air oiler has to be controlled daily at the tank (4) of the maintenance unit.

If necessary an adequate oil has to be refilled (see lubricant recommendations).

- Screw off filling screw (5) and fill in oil up to the "max" mark at the tank (4).
- The control knob (3) serves for setting the mixture ratio air/oil.
It is preset by the manufacturer and should not be changed.

Water separator

To keep the compressed air as free as possible from water a water separator is installed in the maintenance unit.

The separator tank (6) is automatically emptied after each closing and subsequent opening of the air supply at the manual slide (7).

Cleaning the machine door

The pane of the machine door has to be cleaned with a window cleanser, if necessary.

- Open the machine door approx. 150 mm and clean the pane.

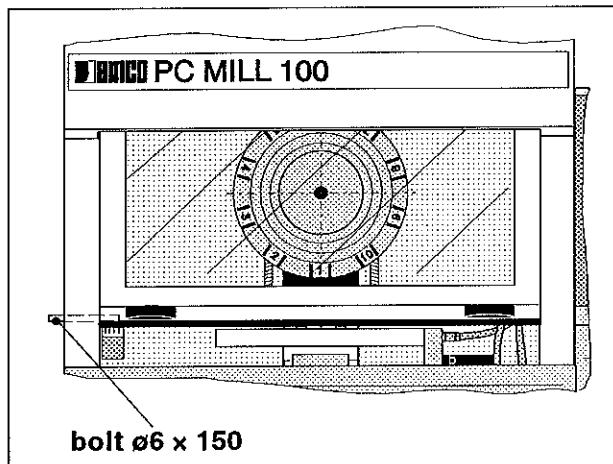


Danger:

To avoid injuries touching the clamped tools a pane wiper with stick (approx. 30 mm long) has to be used (sponge and stripping device) for cleaning the machine door .

Opening the machine door

According to the machine type the machine door can be opened in different ways.



Keep the machine door open (no automatic door mechanism)

Machine without automatic door mechanism

By inserting a retaining bolt the machine door can be kept in partly opened state.

The retaining bolt must be made by yourself ($\varnothing 6 \times 150$).

After opening the machine door by approx. 150 mm the retaining bolt is inserted laterally into the machine through the bore into the slot of the machine door.

Thus, the position of the machine is secured against dislocations in both directions.

Machine with automatic door mechanism

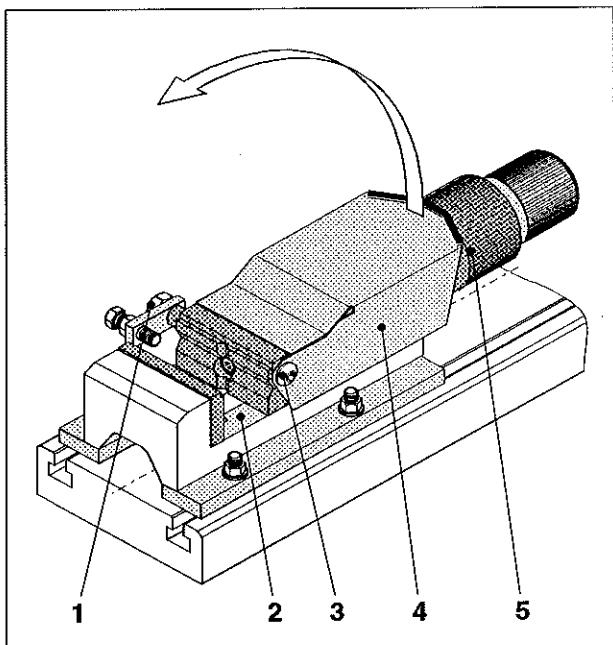
The machine door of a machine with automatic door mechanism (option) can be opened in touching operation by approx. 150 mm ..



Caution:

The door is held in opened state by the pneumatic cylinder and must not be secured, otherwise a damage of the machine door might be caused.

Pneumatic vice (option)



Lubricating the vice

Clean the vice daily (every 8 hours) from chips and other kinds of dirt to avoid damage at the jaw guides and to guarantee safe clamping.

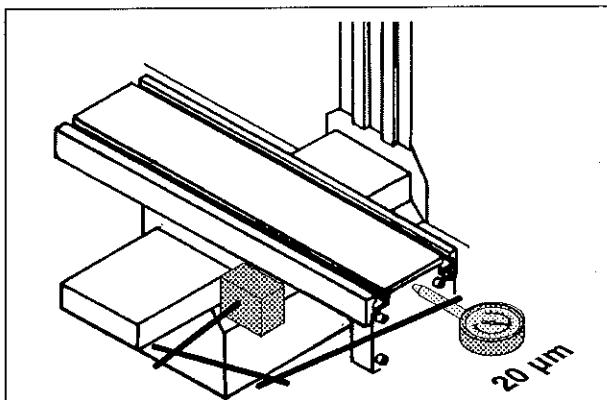
The jaw guides (2) have to be lubricated daily (every 8 hours) with slideway oil after cleaning (see lubricant recommendations).

The vice spindle has to be lubricated with grease approx. every 200 hours (once a year).

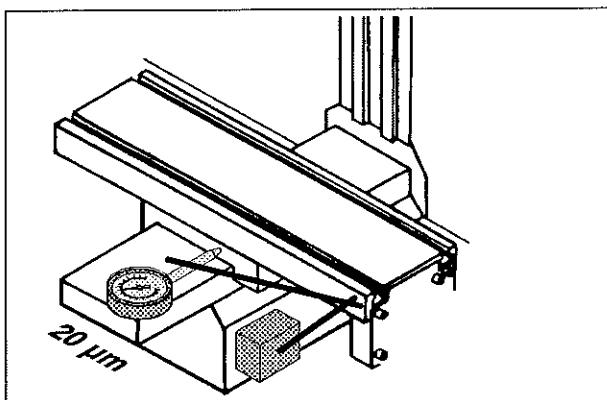
The spindle can be reached after closing the jaws at the knurled wheel (5) and opening the cover (4).

The cover (4) can be swivelled upwards by loosening the hexagon screw SW13 (1) and the fillister head screw SW5 (3).

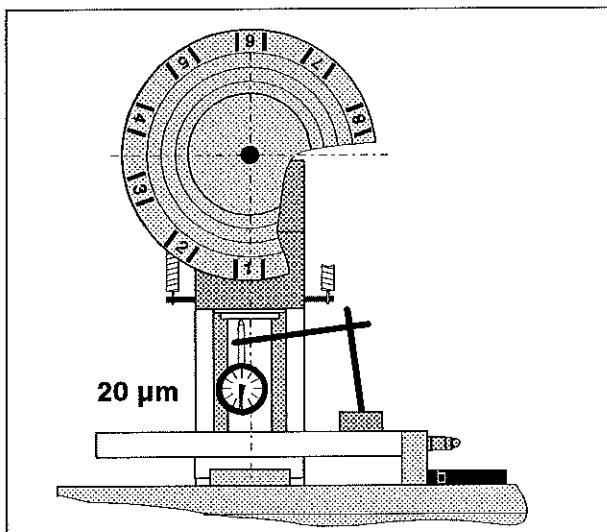
D Readjustment work



Reverse clearance X slide (set-up meas. gauge)



Reverse clearance Y slide (set-up meas. gauge)



Reverse clearance Z slide

Measuring gauge fixings:
(also see drawings)

Reverse clearance	Fixing (magnetic base of the measuring gauge)
X slide	Y slide
Y slide	machine base
Z slide	milling table

Slides

With the slides (X, Y and Z slides) the **slide clearance** and the **reverse clearance** are to be considered.

They are decisive for the working accuracy of the machine.

Since the slide guides of the slides "rub in" in the course of time also in case of careful lubrication, slide clearance and reverse clearance are to be checked after a major operation period (at least once a year).

Reverse clearance

The reverse clearance is the way by which the step motor spindle is shifted without any traversing movement of the slide.

This occurs in case of a change of direction (e.g. feed direction change from -X to +X) of the respective slide. Here the control indicates a travelled traversing path although the slide has not been traversed thereby.

The reverse clearance cannot be readjusted directly but only in relation with the slide clearance.

Relation slide clearance-reverse clearance

The smaller the slide clearance has been set the larger the reverse clearance becomes.

Measuring the reverse clearance

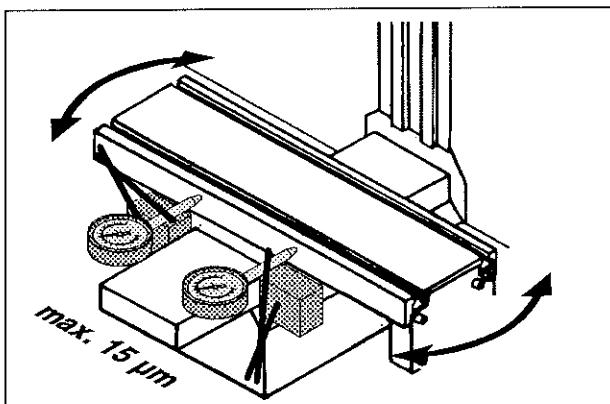
- Fix measuring gauge with magnetic base and support at the machine (see table and figures).
- The clearance is measured in the central position of the respective slide.
- Place measuring base of the measuring gauge with slight pressure onto the slide to be measured and set measuring gauge to "0".
- Set position display of the slides on the screen to "0".
- Traverse respective slide approx. 1-2 mm in direction measuring gauge (measuring gauge and position display indicate the same value).
- Traverse slide again to position "0" using the screen display.
- Read measuring value from the measuring gauge (=reverse clearance).

Max. admissible reverse clearance 20μm

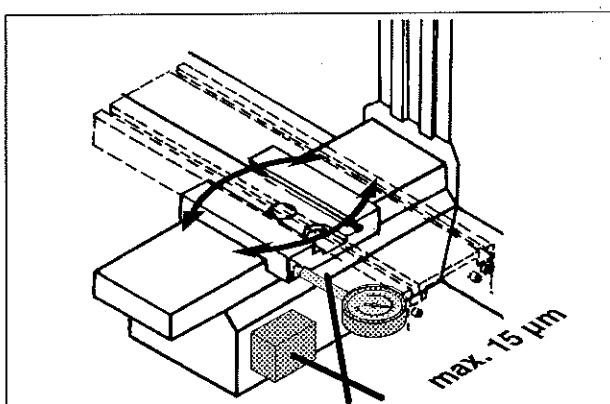
- If the measured reverse clearance lies in the admissible tolerance range the measured values have to be entered in the control software.
- If the measured reverse clearance exceeds the admissible one ($> 20 \mu\text{m}$), the clearance must be readjusted via the slide clearance.
After the readjustment of the slide clearance the reverse clearance is always to be re-measured.

Slide clearance

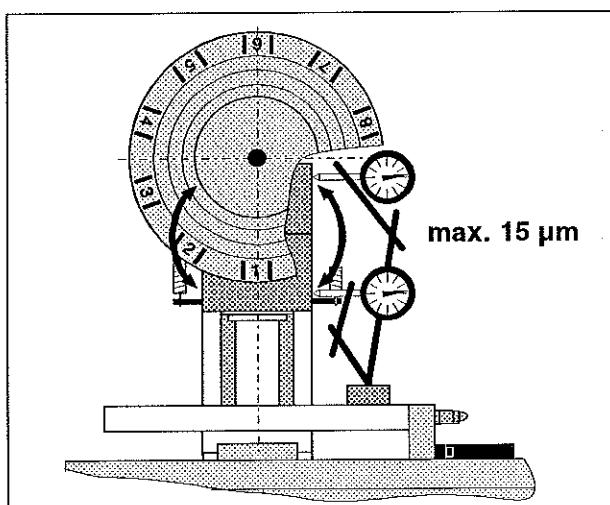
In addition to the reverse clearance the slide clearance is the measure for the working accuracy. Too large slide clearance can cause "chattering", too small slide clearance enlarges the reverse clearance and unnecessarily stresses step motors and slide guides.



Slide clearance X slide (set-up measuring gauge)



Slide clearance Y slide (set-up measuring gauge)



Slide clearance Z slide (set-up measuring gauge)

Check of the slide clearance

Tool

- Meas. gauge with magnetic base and support

Support

- Install meas. gauge with magnetic base and support according to the slide clearance to be measured and set meas. gauge with slight pressure against the slide (see opposite pictures).

X slide:

Place magnetic base on the Y slide.
When the magnetic base is placed on the machine base the clearance of the Y slide is measured.

Y slide :

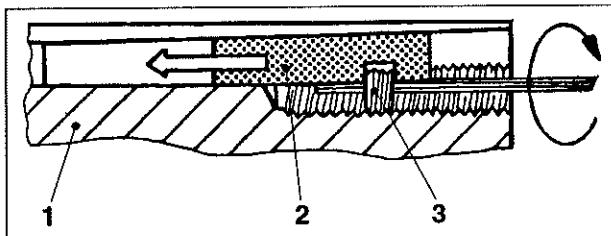
Place magnetic base on the machine base.

Z slide:

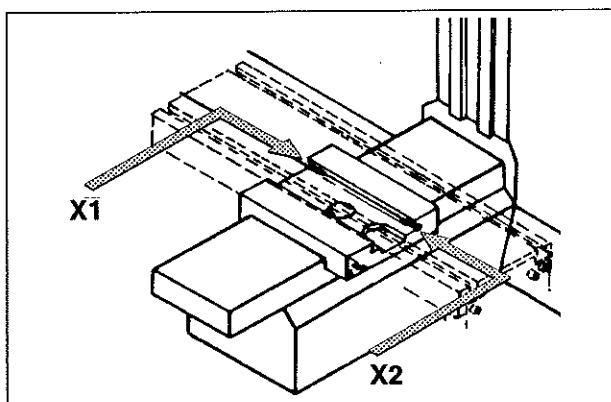
Place magnetic base on the milling table.

- Set measuring gauge to "0".
- Find out slide clearance by pressing the slide to and fro at right angles to the slide axis.
The test force should amount to approx. $F = 300 \text{ N} (\approx 30 \text{ kg})$.
- Repeat measurement on the second side of the slide.

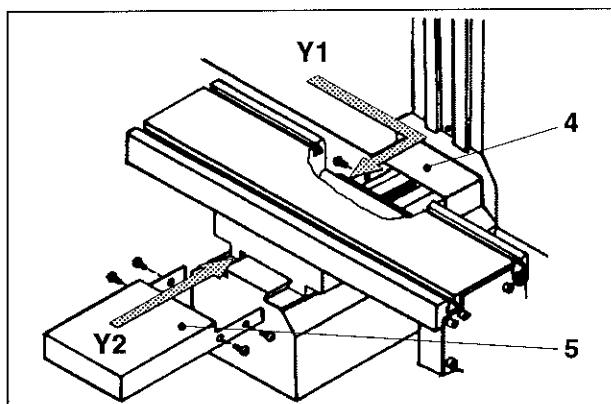
Maximum slide clearance 15 μm



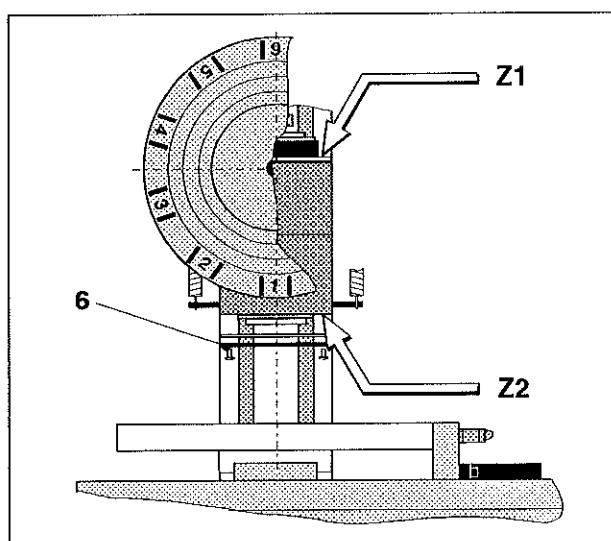
Principle of slide clearance (V-ledge)



Readjustment of the X slide



Readjustment of the Y slide



Readjustment of the Z slide

Readjustment of the slide clearance

Tool

- Allan key SW4, SW2,5
- measuring gauge with support and magnetic base

Principle of slide clearance readjustment

The slides (1) glide in dove-tail guides. Conical V-ledges (2) are applied likewise in conical guideways.

By turning the set screws (3) in clockwise direction the V-ledge is pressed in deeper, thus reducing the clearance of the slide.

Procedure

- Every slide is to be readjusted at two opposite V-ledges.

To be able to reach the set screws for the V-ledge adjustment some of the stripping sheets and stripping felts have to be unscrewed.

X slide

The set screws are freely accessible through the bore (X1) and (X2).

Y slide

Dismount protection sheets (4) and (5) by unscrewing the 4 fillister head screws SW4 of each sheet to be able to reach the set screws through the bores (Y1) and (Y2).

Z slide

The upper V-ledge is freely accessible via the bore (Z1) by means of an extended Allan key SW2.5.

The lower V-ledge can be reached via the bore (Z2) after unscrewing the stripping sheet (6) with the stripping felt (2 fillister head screws SW4).

- Turn set screws SW2.5 of the V-ledge according to the wrong setting of the slide (2 V-ledges for X, Y and Z slide each).
- Remount slide covers, stripping felts and stripping sheets.
- Measure reverse clearance.

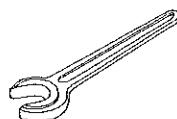


Danger:

The machine may be started up again only if all parts have been mounted carefully.

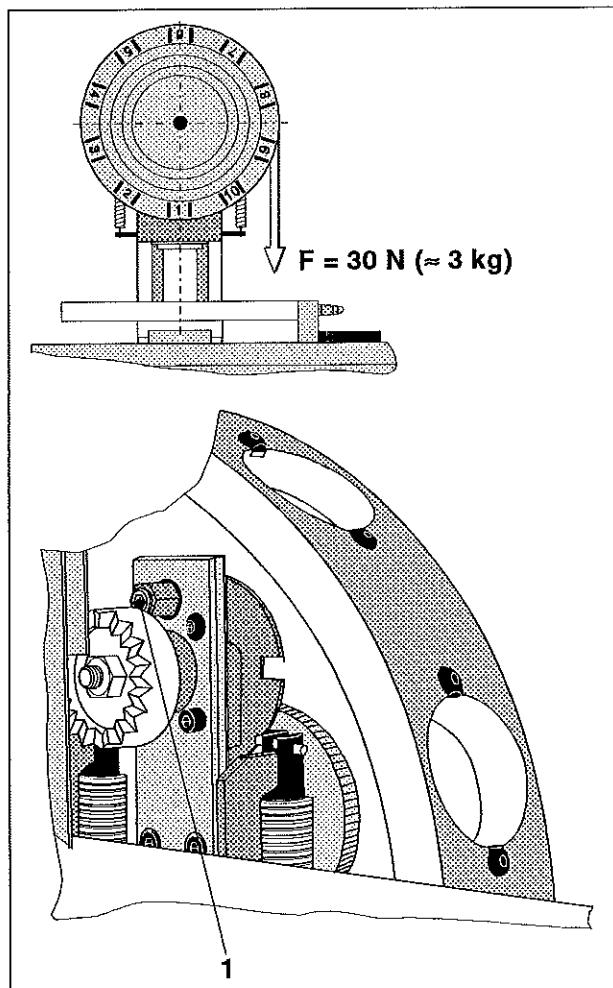
Positioning of the tool drum

If the tool drum does not snap in exactly any more the ball catch has to be readjusted.



Tools:

- Allan key SW5
- Test weight with suspension device $F=30\text{ N}$
($\approx 3\text{ kg}$)



Readjustment of the ball catch

Danger:

The readjustment of the ball catch of the tool drum may only be carried out during standstill of the machine.
(Switch off machine main switch!)



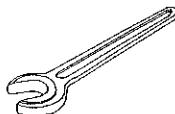
Procedure:

- Place the test weight with the suspension device on the outside on the tool drum.
- Readjust set screw (1) by means of the Allan key SW5 until the tool drum with the weight snaps in and just does not keep on turning on its own.

Readjustment of the collet stroke

If the tools are no longer kept tightly in the milling head and/or the support pivot of the toolholder cannot be entered any more into the collet of the milling head, the stroke of the collet has to be readjusted.

Tool:

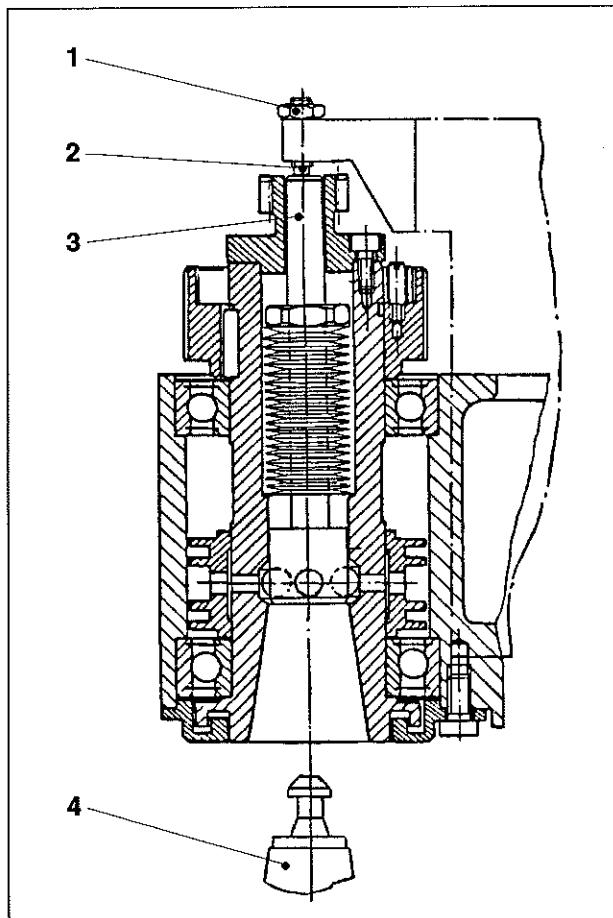


- Allan key SW3
- hexagon key SW10
- reference tool (included in the basic equipment)

Note:

The set screw for readjusting the collet stroke is accessible from the back by taking off the upper rear panel of the machine. It is also the best way to control the position of the milling head from the back.

For this reason you should have an assistant at hand during this readjustment work.



Adjustment of the collet stroke

Procedure:

- Take off upper rear panel of the machine.
- Set machine to setting operation (change key switch).
- Traverse milling head upwards until the clamping pin (2) presses completely onto the spring unit (3) of the milling head.
Keep milling head in this position.



Danger:

Take special care that the assistant is outside of the danger area during the traverse of the milling head.

- Loosen counter nut SW10 (1).
- Readjust clamping pin (2) by means of the Allan key SW3 until the reference tool (4) can just still be taken up in the taper shaft.
- Secure position of the set screw (2) in this position by tightening the counter nut (1).
- Remount rear panel of the machine.

Declaration of conformity

Product: PC-controlled vertical machining center

Machine data: *Model* *Type*
EMCO *PC MILL 100*

Address of manufacturer: Emco Maier Ges.m.b.H
Friedmann-Maier-Str. 9
A-5400 Hallein

Bases of standards: EN 292-1; EN 292-2; EN 294; EN 418; EN 60204-1 (6/93); prEN 1037;
prEN 1050; prEN 1088

Regulations: MSV (BGBI. Nr. 306/1994, 27.4.94)

Test certificates:

**Particular notes ,
enclosures:** Electrical documentation as applicable

We herewith declare that the above-mentioned product referring to the subject declaration is in conformity with the currently valid stipulations of the directive of the Council dated June 14th, 1989 for the alignment of the legal stipulations of the member states for machines (89/392/EEC) and its modifications dated June 20th, 1991 (91/368/EEC), June 14th, 1993 (93/44/EEC) and July 22nd, 1993 (93/68/EEC).

Furthermore, the conformity of the subject product with the above-mentioned standard bases and regulations is effective.

Place, date: Hallein, 05.01.95

Authorized person: Head of quality department Dr. Wilfried Brugger

