

Subtractive Manufacturing Lab

Introduction

In the subtractive manufacturing lab, you will learn the fundamentals of CNC machining. This includes gaining an overview of a 3-axis CNC machine (Emco Concept Mill 105) along with its components, understanding the standard procedure for turning on and setting up the machine, manually jogging the machine, specifying work coordinate systems, practicing the writing of basic CNC programs using the machine's interface (referred to as conversational programming), and finally, importing and executing a CAM toolpath generated through Fusion 360.



Fig. 1. Emco Concept Mill 105 3-axis CNC machine.

Learning Outcomes

- Explain the overall CNC machining workflow to set up and operate the machine.
- Explain the workplace and safety precautions associated with operating the Emco Concept Mill 105 CNC machine.
- Explain the general system components of the Emco Concept Mill 105 CNC machine.
- Explain the basic operating instructions of the Emco Concept Mill 105 CNC machine, including interface, manual control, conversational programming, and CAM programming.
- Operate the machine and run the toolpaths generated manually and using Fusion 360.

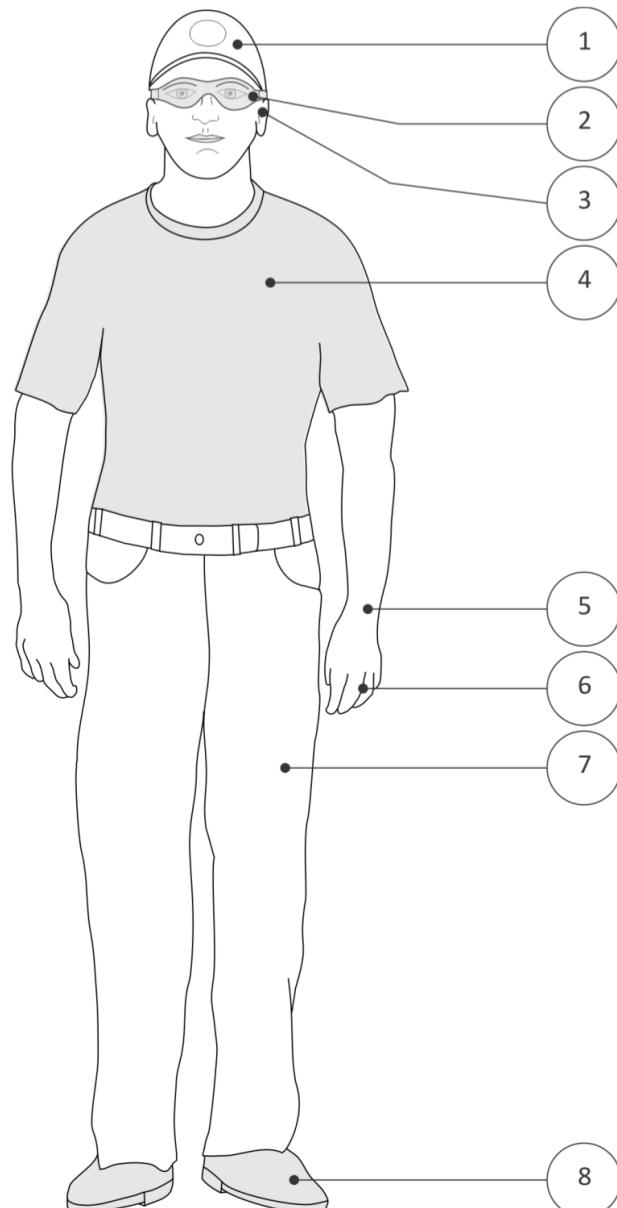
Prerequisites

Basic understanding of CAD/CAM processes and their application to generate toolpaths in a language understandable by computer-aided machines (i.e., G-code).

Lab Rules

The following are important rules that must be followed while you are in the lab:

- Do not** touch or operate any machine without the supervision of lab technicians or teaching assistants.
- Everyone must wear **safety glasses** in the lab environment.
- You must wear appropriate, **closed-toes shoes**.
- Check your clothes and hair before you walk into the shop.
- Do not** wear jewelry or loose clothing when operating the lab equipment.
- Cover and protect **long hair** from moving parts.
- Do not** approach any operator while their machine is in use.
- Do not** crowd machines or tables.
- Be aware of what is going on around you. Concentrate on what you are doing. Don't hurry. Listen to the machine.
- You will not be allowed to enter the lab without proper **machine shop attire**. See the following diagram for instructions about proper machine shop attire.
- Should you have any questions about the shop rules, please do not hesitate to ask the lab technicians or teaching assistants.
- Do not** forget to clean after yourself. Do not leave any trash or personal items in the lab.



- 1-Hat or Tie Long Hair
- 2-Safety Glasses (All Times)
- 3-Ear Plugs (As Needed)
- 4-Short Sleeve Shirt (Tuck In)

- 5-No Watch
- 6-No Rings / Jewelry
- 7-Long Pants
- 8-Leather Shoes

© CNC Area

Operating the Emco Concept Mill 105 CNC Machine

Follow the outlined steps to power on and configure the machine, and to create and execute CNC programs using the machine's Human Machine Interface (HMI) through conversational programming, as well as via CAM using toolpaths generated within Fusion 360.

- Power on the machine and follow the prompts to prepare it for operation.
- Once you've established the machine's reference, allow them to manually jog it, evaluating the coordinates (machine positions) at different speeds.
- Following this, re-reference the machine by utilizing the REF POINT button, then proceed to press the XYZ buttons.
- Demonstrate the process of changing the tool using the turret: Jog → Turret.
- After switching between MDA and Jog modes, remember to perform a RESET.
- Subsequently, compose a G-code command through MDA to position the machine at:
 - X00 Y25 Z80
- Introduce an additional command block to activate the spindle, setting the spindle speed to 500 RPM:
 - M4 S2000
- Execute movement with a specified feed rate to desired points:
 - G01 Z70 F200
 - G01 X05 Y20
- Conclude by deactivating the spindle.
- Finalize the program.
- Run the entire program both consecutively and in SINGLE BLOCK mode.
- Transition to practical CNC machining using Fusion 360.

The remainder of the document provides a comprehensive analysis of the machine's components and detailed operational instructions.

emco industrial
training

Designed for your profit

[E[M]CONOMY]
means:



**Small Volume. Great Performance.
CONCEPT MILL 105**

CNC training with industrial performance

Concept MILL 105

Slides and load-bearing elements are manufactured from gray cast iron for the Concept MILL 105 to ensure maximum precision. Equipped with infinitely variable main drive, 10-station tool changer, pneumatic vise and NC indexing device as optional fourth axis, this compact machine in table format is optimally suitable for teaching of sophisticated function and manufacturing technologies. The control for the Concept MILL 105 is connected via PC, on which the interchangeable WinNC control from EMCO can be installed.

[Tool magazine]

- Tool magazine with directional logic
- For 10 tools
- Engraving spindle attachment



[Machine covers]

- All-round protection against chips
- 100% coolant retention
- Optimum view of working area
- Large safety glass window in door

[Work area]

- Generous view of work area
- Best ergonomics

[Swivel table]

- Extensible drawer for PC keyboard
- Arranged ergonomically



[Main drive]

- Infinitely variable main drive
- Three-phase asynchronous motor

[Machine base]

- With extensible drawer
- Provides space for PC tower



Piston



Milled part



Milled part

Machine with optional equipment

[Engineering]



Highlights

- Stable, gray cast-iron construction, suitable for industrial use
- 10 station tool changer with directional logic
- Backlash-free bearings for working spindle in precision, lifetime-lubricated, angular ball bearings
- Infinitely variable main and feed drives
- Realistic execution of all essential milling operations



Options

- TFT display and control keyboard
- NC indexing device (fully functioning fourth axis) with tailstock, three-jaw chuck and live center
- Engraving spindle attachment
- Automatic clamping device
- Electronic handwheel
- Coolant system
- Minimum quantity lubrication
- Machine base with swivel table

[The interchangeable control]

The unique concept of the interchangeable control can be fitted in all Concept machines. In doing so, the user is trained on all CNC industry controls that are common on the market.

The result: All CNC technicians can be applied more flexibly. And this is a decisive plus: for the qualified employees as well as for the business.



The conversion to another control system is carried out within a minute by calling up the respective software and by simply replacing the control specific module



Simple to program using the EMCO WinNC control units



Simulation suitable for training using Win3D-View

[Technical data]

emco industrial training

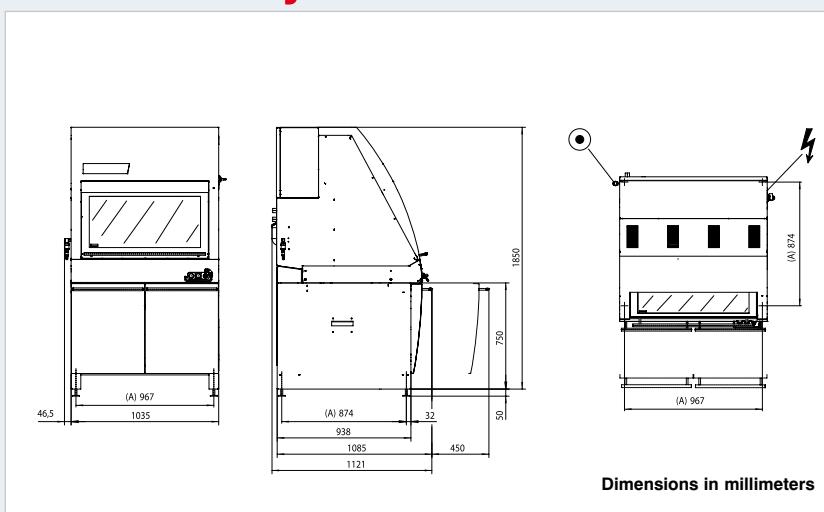
Designed for your profit

CONCEPT MILL 105

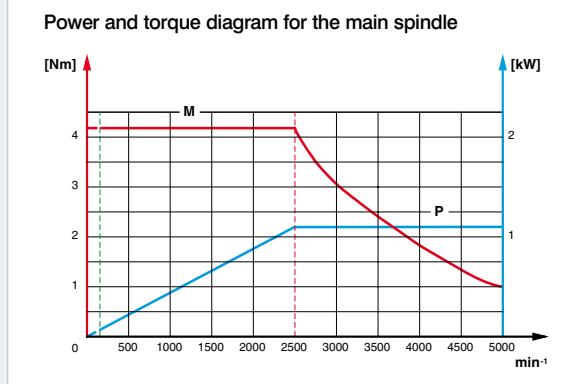
Work area	
Travel in X longitudinal	200 mm (7.9")
Travel in Y latitudinal	150 mm (5.91")
Travel in Z vertical	250 mm (9.84")
Min. distance spindle nose - table	95 mm (3.74")
Max. distance spindle nose - table	245 mm (9.65")
Table	
Clamping area (L x W)	420 x 125 mm (16.54x4.92")
T-slots: quantity, width, spacing	2 x 11 x 90 mm (2x0.43x3.54")
Max. table load	10 kg (22 lb)
Milling spindle	
Speed range	150 - 5000 rpm
Motor power 3 phase asynchronous motor	1.1 kW (1.48 hp)
Max. torque	4.2 Nm
Axis data	
Rapid motion speed X / Y / Z	5 m/min (196.85 ipm)
Max. feed rate X / Y / Z	0 - 5 m/min (0-196.85 ipm)
Feed power X / Y	2000 N
Feed power Z	2400 N
Accuracy	
Step resolution (X / Y / Z)	0.0015 – 0.001 mm
3 phase step motors	(0.00006 – 0.0004")
Average positioning variation in X / Y (VDI/DGQ 3441)	5 µm (0.0002")
Average positioning variation in Z (VDI/DGQ 3441)	5 µm (0.0002")

Tool change	
No. of tool stations	10
Tool selection	Directional logic
Max. tool diameter	55 mm (2.17")
Max. tool length	50 mm (1.97")
Max. tool weight	0.7 kg (1.54 lb)
Tool changing time T1 / T2 / T3	9/7.5/7.5 s
Power consumptions	
Power supply	1.4 kW (1.88 hp)
Dimensions	
Dimensions W x D x H	1135 x 1100 x 1100 mm (44.69x43.31x43.31)
Total weight	400 kg
Compressed air	6 bar

Machine layout



Power



Work area

Travel in X longitudinal	200 mm (7.9")
Travel in Y latitudinal	150 mm (5.91")
Travel in Z vertical	250 mm (9.84")
Min. distance spindle nose - table	95 mm (3.74")
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Milling spindle

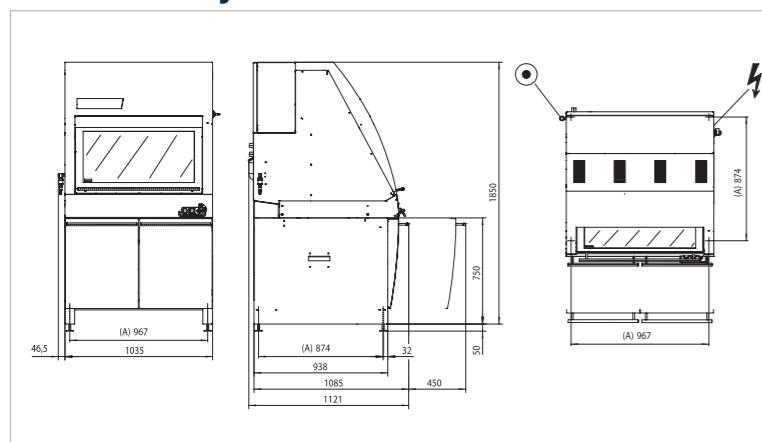
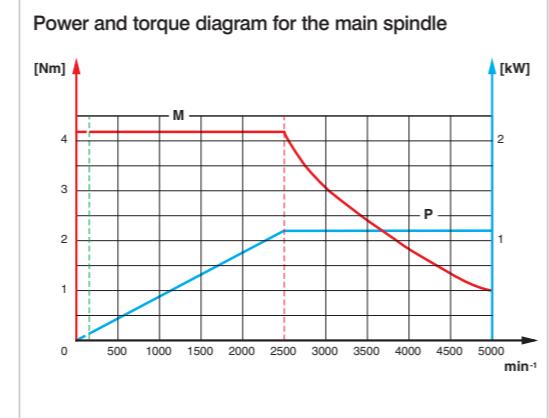
Speed range	150 - 5000 rpm
Motor power 3 phase asynchronous motor	1.1 kW (1.48 hp)
Max. torque	4.2 Nm

Axis data

Rapid motion speed X / Y / Z	5 m/min (196.85 ipm)
Max. feed rate X / Y / Z	0 - 5 m/min (0 - 196.85 ipm)
Feed power X / Y	2000 N
Feed power Z	2400 N

Accuracy

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3 phase step motors	(0.00006 - 0.0004")
Average positioning variation in X / Y	5 µm (0.0002")
(VDI/DGQ 3441)	
Average positioning variation in Z	5 µm (0.0002")
(VDI/DGQ 3441)	

Machine layout**Power**

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SMALL VOLUME. GREAT PERFORMANCE.
CONCEPT MILL 105



Concept MILL 105

Slides and load-bearing elements are manufactured from gray cast iron for the Concept MILL 105 to ensure maximum precision. Equipped with infinitely variable main drive, 10-station tool changer, pneumatic vise and NC indexing device as optional fourth axis, this compact machine in table format is optimally suitable for teaching of sophisticated function and manufacturing technologies. The control for the Concept MILL 105 is connected via PC, on which the interchangeable WinNC control from EMCO can be installed.

1 TOOL MAGAZINE

- Tool magazine with directional logic
- For 10 tools
- Engraving spindle attachment

2 WORK AREA

- Generous view of work area
- Best ergonomics

3 MACHINE BASE

- With extensible drawer
- Provides space for PC tower

4 MACHINE COVERS

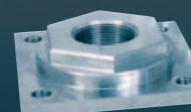
- All-round protection against chips
- 100% coolant retention
- Optimum view of working area
- Large safety glass window in door



Machine with optional equipment



Camshaft-housing



Milled part

Milled part

[Engineering]

Highlights

- Stable, gray cast-iron construction, suitable for industrial use
- 10 station tool changer with directional logic
- Backlash-free bearings for working spindle in precision, lifetime-lubricated, angular ball bearings
- Infinitely variable main and feed drives
- Realistic execution of all essential milling operations

Options

- NC indexing device (fully functioning fourth axis) with tailstock, three-jaw chuck and live center
- Engraving spindle attachment
- Automatic clamping device
- Electronic handwheel
- Coolant system
- Minimum quantity lubrication
- Machine base with swivel table
- Easy2operate

[The interchangeable control]

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The result: All CNC technicians can be applied more flexibly. And this is a decisive plus: for qualified employees as well as for the business.



The change to a different control system is carried out within a minute by calling up the respective software



Simple to program using the EMCO WinNC control units



Simulation suitable for training using Win3D-View

[Easy2control: New operating concept]

Optional it is possible to equip the machine with the latest software of the interchangeable control, with which control specific and machine keyboards of the WinNC can be displayed on a 16:9 Full-HD screen – Easy2control.

The different panels for machine, control and quick access can be switched via tabs.

The buttons and rotary knobs can either be operated by using the mouse or in case a Full HD touchscreen is used directly on the keys and switches on the monitor. To operate the software on the Concept machine a license dongle and a small machine control panel – „Easy2operate“ – is required.



Easy2control with Easy2operate

Emco Concept Mill 105

PC-controlled milling machine for training



Machine Description
Emco Concept Mill 105
Ref.-No. EN 2105 Edition A2003-02

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emco
Industrial training systems

Introduction

For more than five decades EMCO has been developing 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 **EMCO Concept Turn** and **EMCO Concept 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.

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

EC conformity



The CE mark certifies, together with the EC declaration of conformity, that the machine and the guidelines are in conformity with the regulations of the directives applicable to the products.

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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.

In case of installation of the machine in an overall plant and/or with other modifications in the machine, their conformity with the CE provisions as well as the directives and regulations have to be established with the start-up of the plant and/or the machine. Before that, a start-up is definitely prohibited.

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. Occurring 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 instructions

Read the instructions completely before you start up the machine.

Prior to start of work get familiar with all functions and operating elements. During the work it might be too late.

Electrical connection

Electrical connection of the machine must only be carried out by an authorized electrics expert. Local protection measures have always to be borne in mind.

Observe local regulations

Observe your country's regulations for work involving machine tools and CNC machine tools

Authorized operation

The machine may only be operated by authorized persons.

Authorized persons are exclusively persons familiar with operation, maintenance and repair and who are instructed on hazards.

Protect machine

Protect the machine (main switch can be locked) during adjustment, maintenance and repair work against unauthorized start-up.

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 are prohibited.

In case of hazards EMERGENCY-OFF

In case of hazards immediately stop machine with EMERGENCY-OFF.

Tool change

Change machining tools only during standstill of machine. Only use tools and sealing bolts with O ring on the shaft, always close all stations (otherwise danger of coolant and chip entry in the internal area of the tool turret!). In case of tool change always turn driven tool holder into locking position.

Personal protective equipment

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

Mind that your hair does not get caught in the machine (in such a case wear hair protection). Protect your eyes with safety-glasses.

When removing chips use a chip hook and gloves.

Setting, maintenance and adjusting work

All setting, maintenance and adjusting work must only be carried out during standstill of machine and EMERGENCY-OFF key actuated.

The inspection and maintenance instructions for machine and accessories are to be observed. This saves costs, excludes major standstills of the machine, reduces hazards and saves the environment.

Tools, operating materials and spare parts

Only use tools, operating materials and original spare parts recommended by EMCO.

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

Disposal of noxious materials

When handling auxiliary and operating materials (cooling lubricants, cleaning solutions, lubricating oils, etc.) observe the safety regulations for these materials.

Take adequate measures for the appropriate storage and disposal of noxious materials.

Claim

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

In case of complaints, damage, confusions and spare part orders always indicate the machine number, electric number and software version.

Machine supervision

Never leave running machine unattended.

Before leaving the working place switch off machine and protect against unauthorized start-up (lock main switch and remove key).

Danger, Attention, Note

Please always mind the regulations for prevention accidents and safety rules indicated in the individual chapters and the additional instructions. Important instructions concerning the technical safety and the staff protection are emphasized particularly:

**Danger**

refers to possible danger to persons during working and operating procedures.

**Attention**

is indicated in working and operating procedures which have to be observed exactly to avoid possible damage of the machine and slight danger of injury for operators.

**Note**

is indicated if something particular has to be observed when an activity is carried out.

**Environmental Protection Notes**

refer to the avoidance of special waste, responsible handling of environmentally noxious substances as well as possibilities for saving auxiliary and operating materials.

Technical Data of the Machine

Working area		
Slideway longitudinal (X axis)	[mm]	200
Slideway cross (Y axis)	[mm]	150
Slideway vertical (Z axis)	[mm]	250
effective Z-stroke	[mm]	150
Distance spindle nose - table surface	[mm]	95-245
Milling table		
Clamping surface (LxD)	[mm]	420x125
maximum table load	[kg]	10
2 T-slots according to DIN 650, width	[mm]	11
Distance of T-slots	[mm]	90
Milling spindle		
Spindle bearing	[mm]	ø40
Type of bearing		spindle bearing
Toolholding fixture similar to DIN7920 - SK30		works standard
Tensioning bolt		works standard
Tool clamping		automatic
Milling spindle drive		
Rotary current motor AC		
Max. power	[kW]	1,1
Speed range (infinitely variable)	[min ⁻¹]	150-5000
maximum torque at the milling spindle	[Nm]	4.2
Feed drives		
AC step motors in X/Y/Z axis		
Step resolution	[µm]	1,5
Max. feed force X/Y/Z	[N]	2000/2000/2400
Working feed in X/Y/Z (infinitely variable)	[m/min]	0 - 5
Rapid traverse speed X/Y/Z	[m/min]	5
Medium positioning variation X/Y/Z according to DIN VDI 3441	[µm]	3 / 3 / 4
Tool system		
Tool drum with direction logic		
Number of tool stations		10
maximum tool diameter	[mm]	ø55
maximum tool length	[mm]	50
maximum tool weight	[kg]	0.7
Feeding force	[N]	1100
Tool change time T1 / T2 / T3	[s]	9 / 7.5 / 7.5
chip to chip time acc. To VDI2852 T1 / T2 / T3	[s]	3 / 3 / 4
Lubrication system		
Guideways, feed spindle nuts		autom. central oil lubrication
Main spindle		life time lubrication

Subject to technical modifications!

Coolant device (Option)		
Tank capacity	[l]	35
Max. conveying capacity	[l/min]	15
Max. conveying pressure	[bar]	0.5
Pneumatics (standard design)		
Pneumatic maintenance unit for tool cone blow-out device (with filter)		
Supply pressure	[bar]	6
Hose connection	[mm]	ø10
Pneumatic unit (option)		
Pneumatic unit for the automatization accessories		
Supply pressure	[bar]	6
Hose connection	[mm]	ø10
Automatic clamping device (option)		
Pneumatic vice with blow-out device		
Opening capacity	[mm]	70
Jaw width	[mm]	72
Automatic door mechanism (option)		
pneumatically actuated, incl. final position control		
Electrical connection		
Power supply	[V]	1/N/PE 230~
Max. voltage fluctuations	[%]	±10
Frequency	[Hz]	50/60
Connected load of the machine	[kVA]	1.4
Max. preliminary fuse for the machine	[A-slow]	16
Dimensions, weight		
Total height	[mm]	1100
Installation surface WxD	[mm]	1135x1100
Total weight of the machine	[kg]	400
Sound pressure level		
Medium sound pressure level	[db(A)]	72
With the following conditions:		
Masuring method:	enveloping surface according to DIN 45635	
Operating mode:	maximum speed during idle running	

Subject to technical modifications!

PC-Configuration

Computer components	Minimum configuration
IBM or IBM compatible	Celeron 700 MHz
Hard disk	10 GB
Drives	3½" floppy drive CD-ROM drive
Operating system	Win 9x, NT, 4.0, 2000, XP
Main memory	128 MB
Graphics card	8 MB VGA colour graphics card
Screen	Colour screen 14"
Keyboard	MF-2
Network-card to connect the machine with PC	10/100MB LAN with RJ45-plug connection
USB-interface to connect external control keyboard to PC (Accessory)	up from USB 1.0

Subject to technical modifications!

Declaration of conformity

Product: PC-controlled milling machine for training

Machine data: **Model** **Type**
EMCO Concept Mill 105

Address of manufacturer: Emco Maier Ges.m.b.H.
Salzachtal Bundesstrasse Nord 58
A-5400 Hallein

Bases of standards: EN 292-1; EN 292-2; EN 294; EN 418; EN 60204-1; EN 954-1;
EN 1037; EN 1050; EN 1088

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

Test certificates:

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

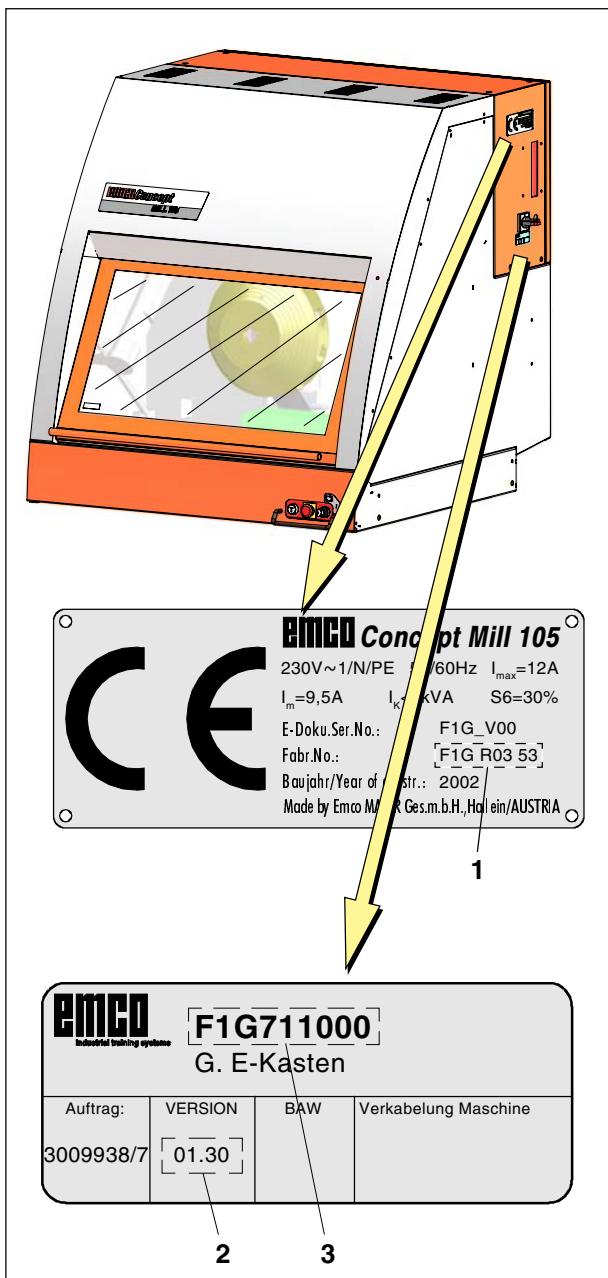
We herewith declare that the above-mentioned product referring to the subject declaration is in conformity with the currently valid stipulations of the directive of the Council dated June 22nd, 1998 for the alignment of the legal stipulations of the member states for machines (98/37/EEC), with the directive of the Council dated May 3rd, 1989 for the alignment of the legal stipulations for electromagnetic compatibility (89/336/EEC) and its modifications dated April 28th, 1992 (92/31/EEC) and July 22nd, 1993 (93/68/EEC), and with the directive of the Council dated February 19th, 1973 concerning low voltage equipment (73/23/EEC) and its modification dated 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, 27.01.03

Authorized person: Head of quality department

emco | Emco Maier Ges.m.b.H.
Salzachtal Bundesstr. Nord 58
Tel. 0 62 45 / 891-0 | P.O. Box 131
Fax 0 62 45 / 889 65 | A-5400 Hallein-Taxach

A Installation of the machine



Machine number and electrics number

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.

Machine number

The adhesive plate with the machine number (1) is to be found laterally on the machine above the lockable main switch.

The machine number is also stamped into the machine bed.

Electrics number

The adhesive plate with the electrics number is mounted on the right side of the machine below the main switch.

The electrics number consists of a 9-digit number (2) followed by the version number (3).

Example of a complete electrics number:

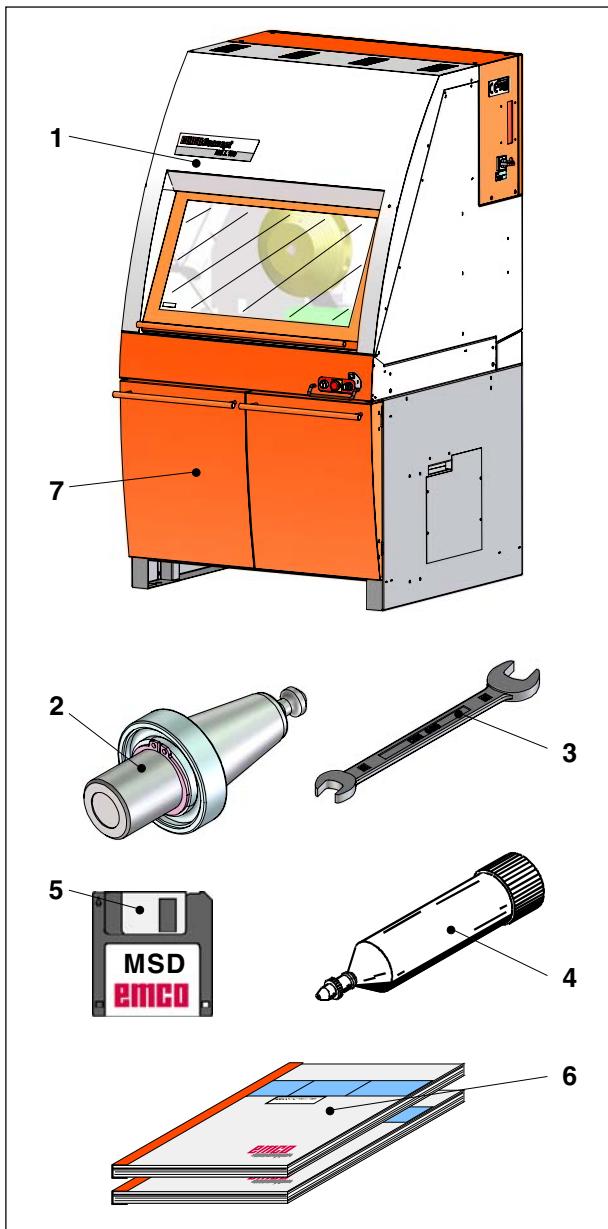
F1G 611 000 V1.30 (see illustration)

Note:

The wiring diagrams valid for your machine are to be found in the **electrical documentation** which is in the switch cabinet of the machine.

An electrical documentation can also be obtained under order number **ZVP 677 912** and indicating the version number (e.g. **V1.30**) from EMCO.

Scope of supply



Scope of supply

Basic machine

- (1) PC-controlled CNC-machining center Concept Mill 105 with:
 - full shell with chip tray
 - safety devices according to CE-standard
 - machine lamp
 - central lubrication
- (2) 1 reference tool (clamped in tool drum)
- (3) double-ended spanner SW8x10
- (4) oil press
- (5) disk with machine data (MSD)
- (6) machine description and electrical documentation

Further Options

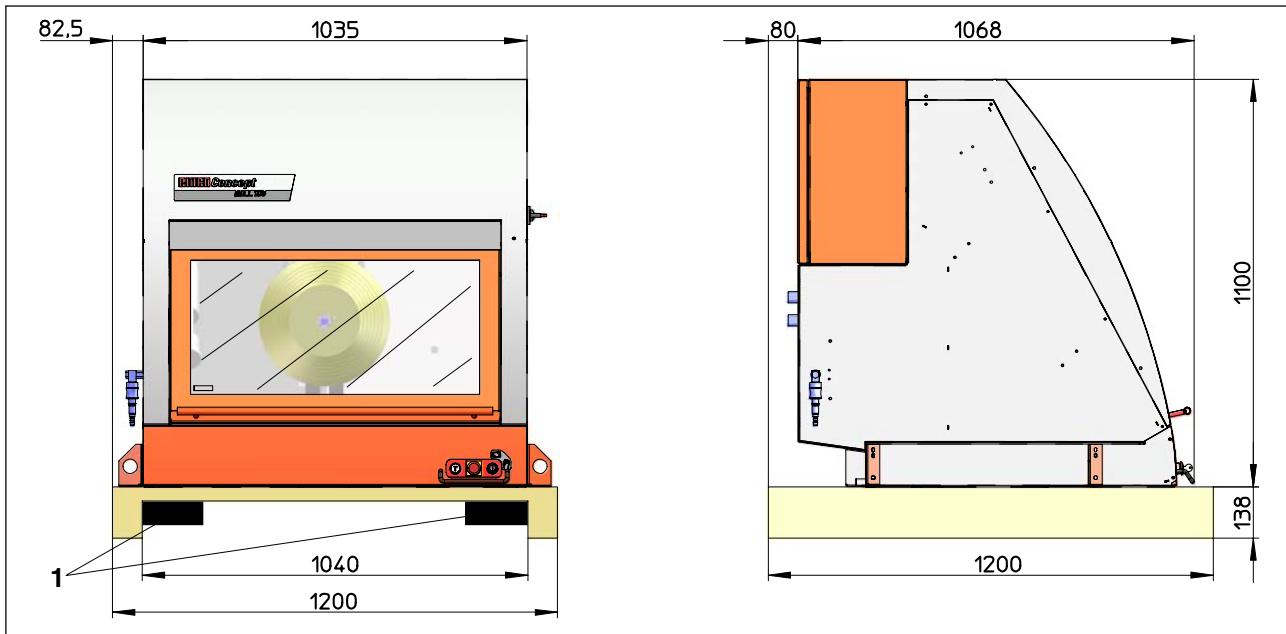
- Machine base (7)
- Coolant device
- automatic door
- automatic machine vice
- Robotic-Interface
- DNC-Interface

Control software - Option

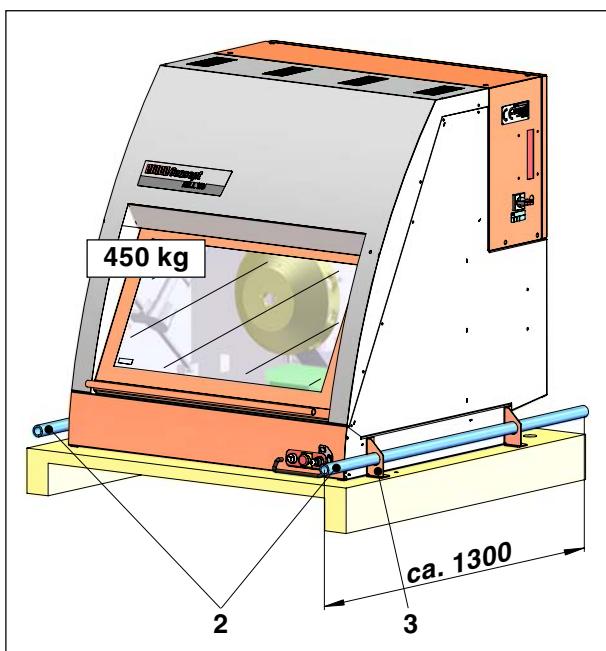
- Siemens 810/820
- Siemens 810D/840D
- GE Fanuc Series 0
- GE Fanuc Series 21
- Emcotronic TM02
- Heidenhain TNC 355
- Emco WinCam

Transport of machine

Transport without machine base



Position of stack forks (1) with the transport



Transport with lifting bars

Transport with pallet



Attention:

The machine may only be transported on the pallet if the machine is fixed on the pallet by means of anchor bolts.
Note the positions of the stack forks (1).

Lifting capacity min. 450 kg
Fork width 800 - 1 000 mm
Fork length min. 1 200 mm

Transport without pallet

The machine is transported with adequate lifting bars (2) which are passed through the lifting angles (3) on both sides of the machine.

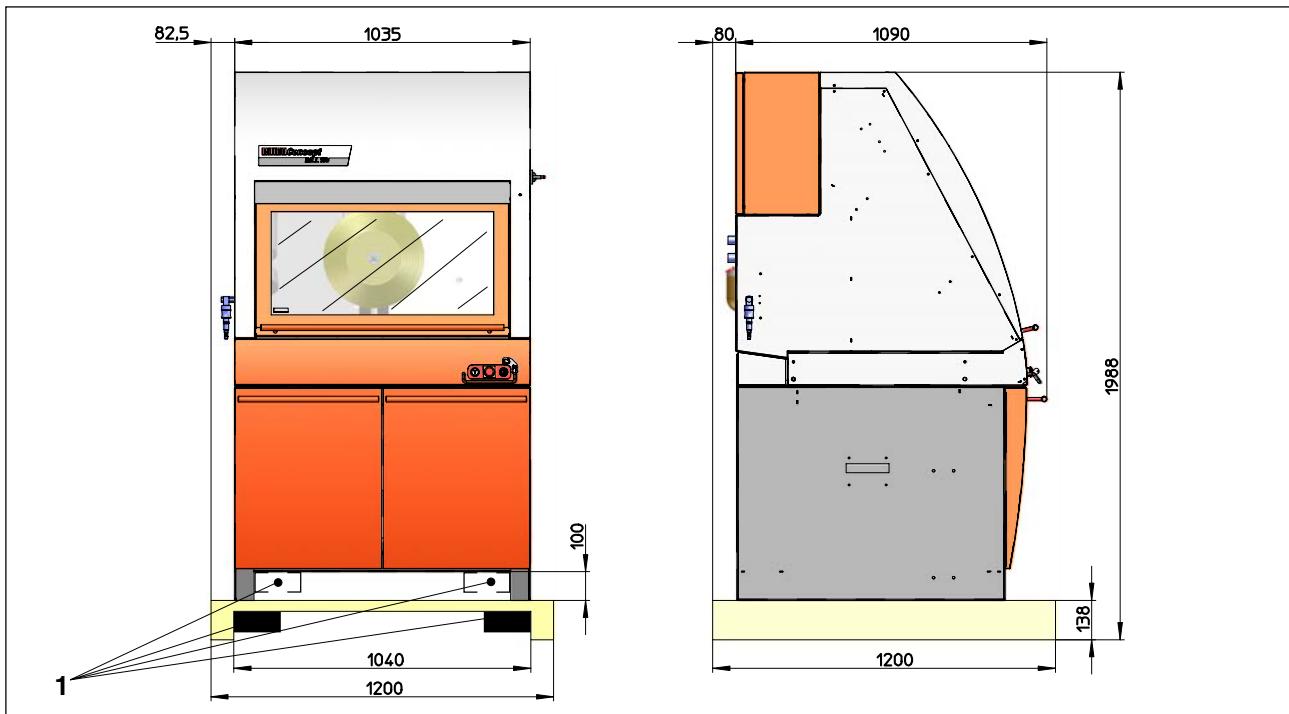


Attention:

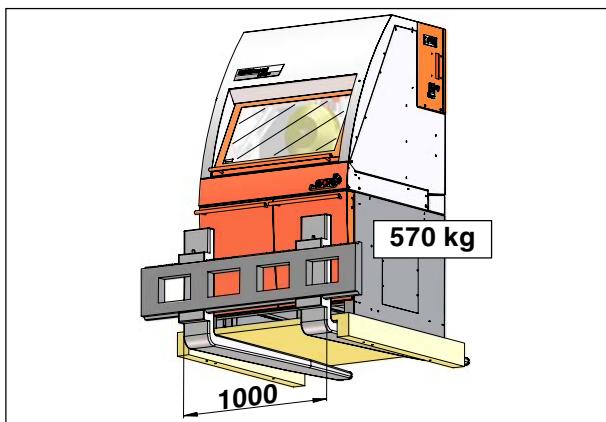
Mind that the lifting angles are screwed firmly with the machine!

Lifting capacity min. 400 kg
Lifting bars Ø35 x min. 1 300 mm

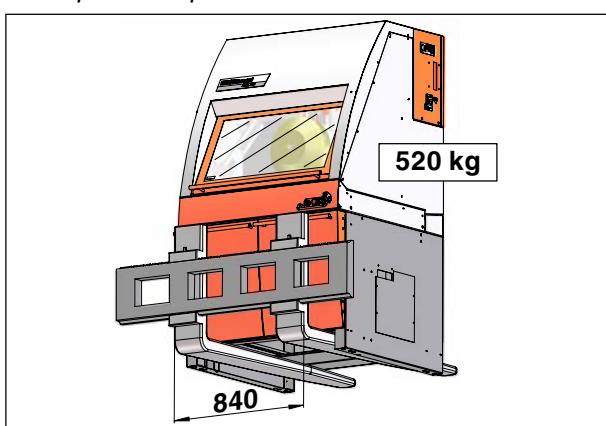
Transport with machine base (option)



Position of stack forks(1) with the transport



Transport with pallet



Transport without pallet

Transport with pallet



Attention:

The machine may only be transported on the pallet if the machine is fixed on the pallet by means of anchor bolts.

Lifting capacity min. 570 kg
 Fork width 800 - 1 000 mm
 Fork length min. 1 200 mm

Transport without pallet



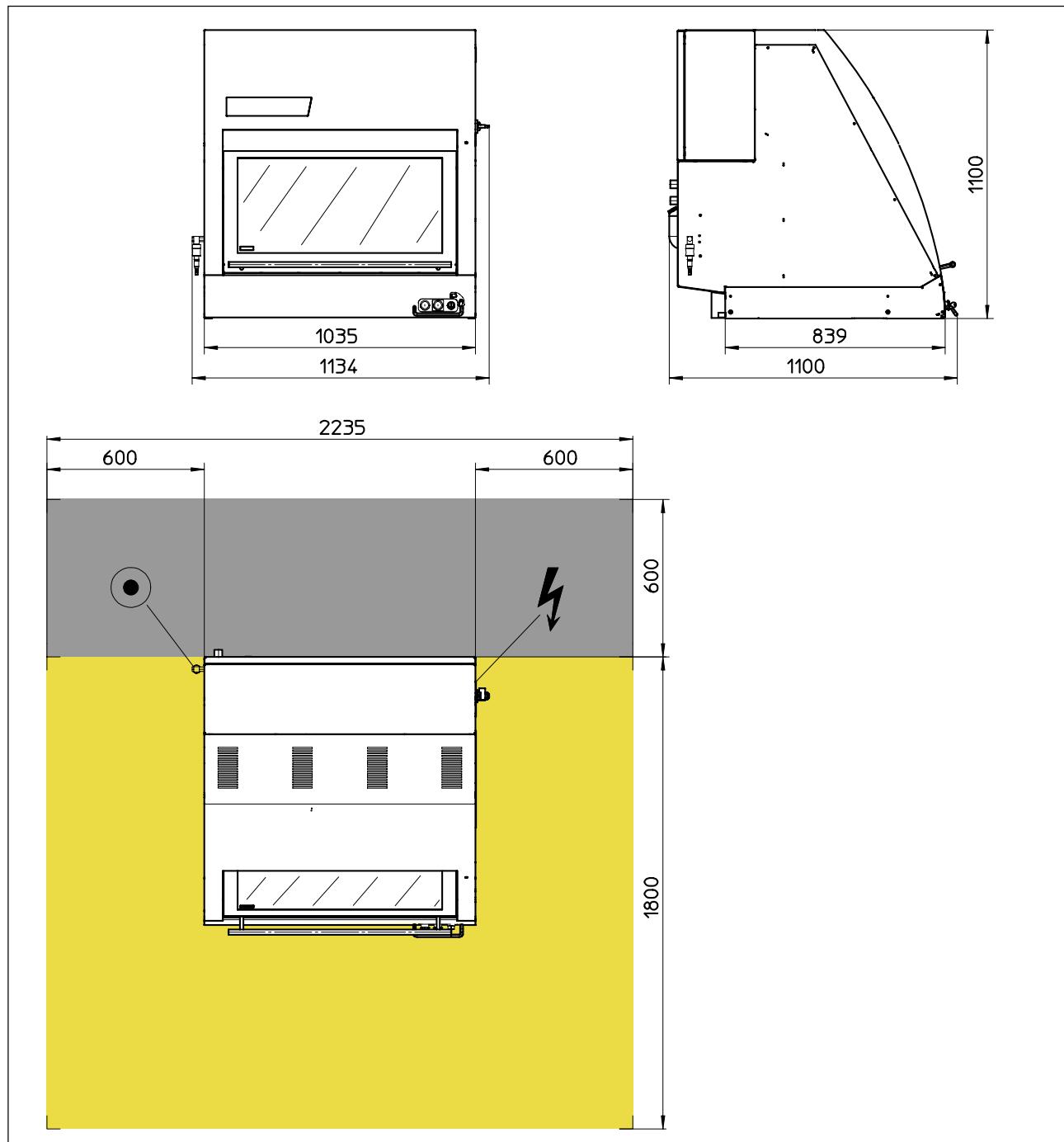
Attention:

The lifting points and the fork widths have to be adhered to exactly so that there is no deformation at the machine base.

Lifting capacity min. 520 kg
 Fork width 700 - 800 mm
 Fork length min. 1 200 mm

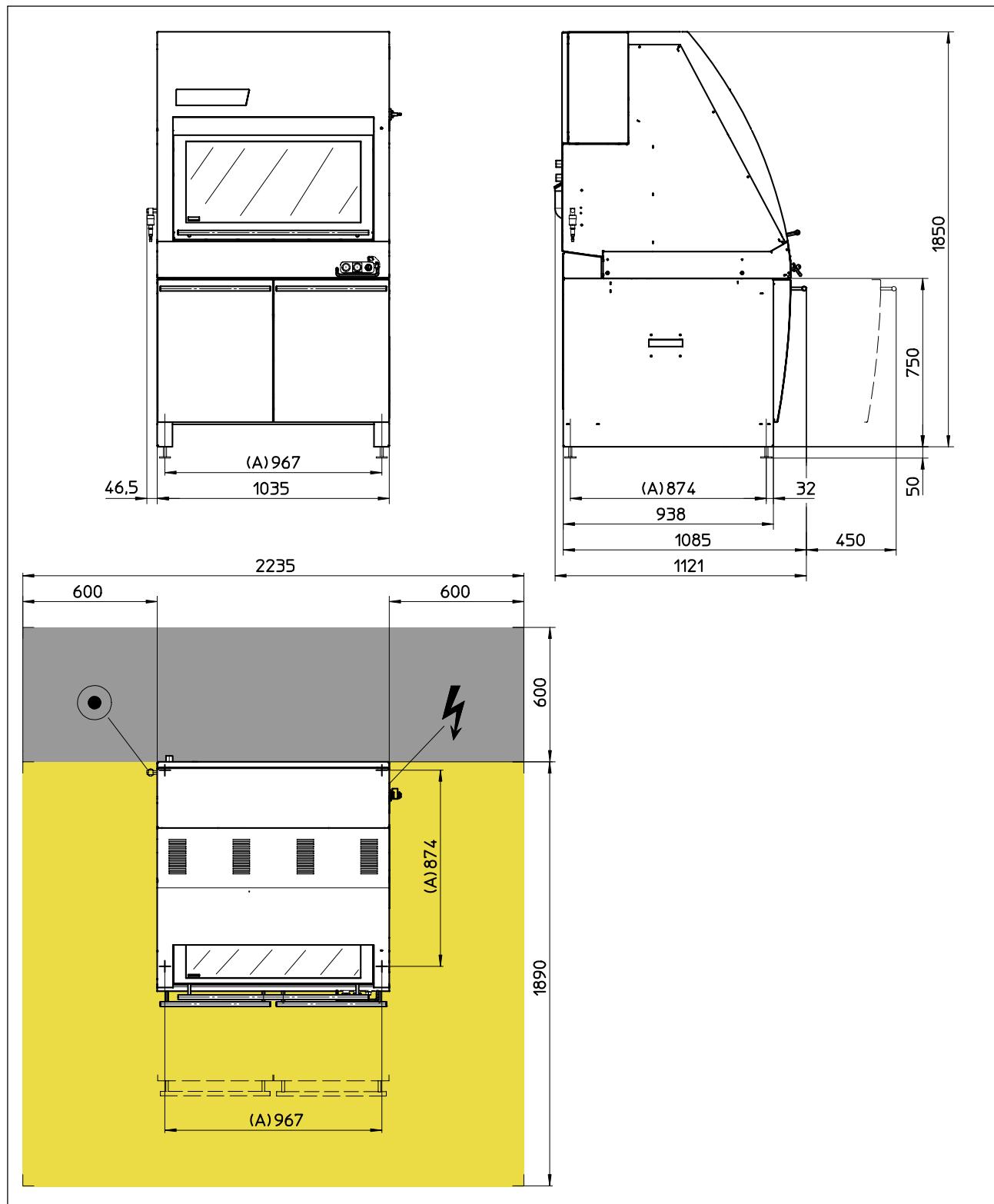
Installation plan, dimensions of the machine

Machine without base



 Space for operation

 Space for maintenance

Machine with base (option)

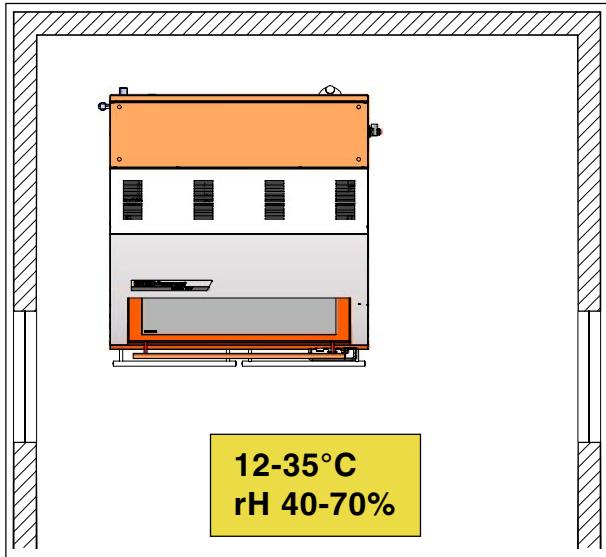
A Setting screws (8) resp. levelling elements (4)
(see "Installation criteria" in this chapter)

Space for operation

Space for maintenance

Installation criteria

General



Room climate at installation site

Installation site

Mind that the selected installation site is adequately clean (free of excessive dust exposure etc.) to take care of the machine as well as the PC and the peripheral devices.

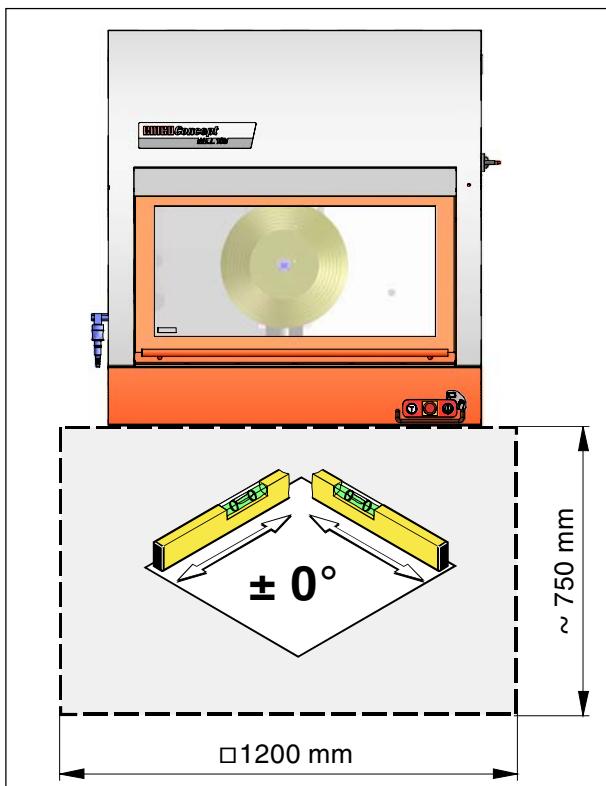
Furthermore, the following requirements must be met:

Room temperature 12-35°C
Atmospheric moisture 40-70%

Ergonomy

Due to its ergonomic design the machine provides optimum operation.

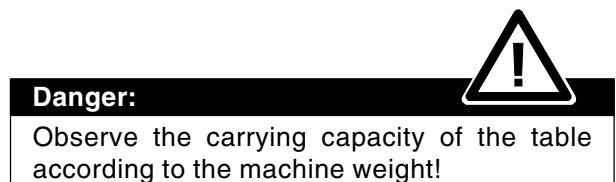
However, when choosing the installation site pay attention to sufficient lighting.



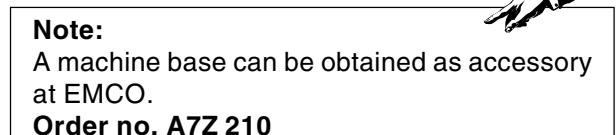
Aligning the machine

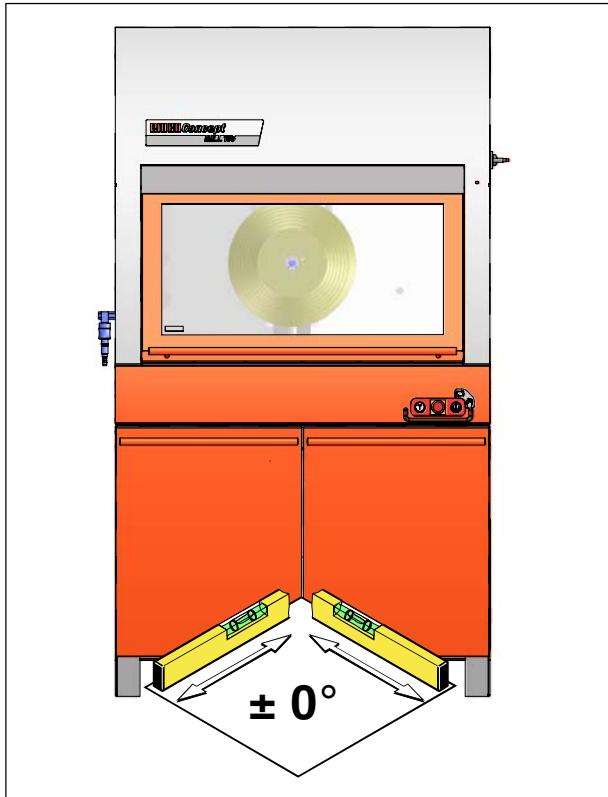
Machine without machine base

The machine is to be installed on a stable base.

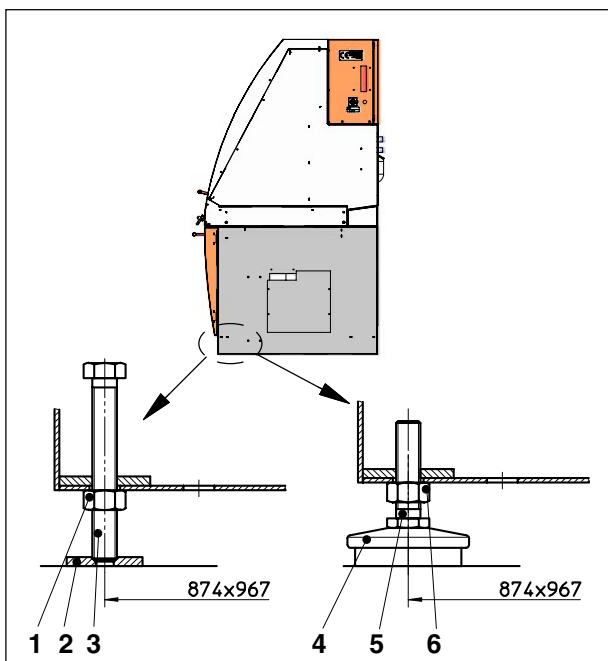


Weight of the machine 350 kg
Ideal table height approx. 750 mm
Installation width xinst. depth 1200 x 1200 mm





Aligning the machine



Installation with steel plates or levelling elements

Machine with base (option)

Requirements on installation surface

The machine is to be installed on a pavement as horizontal as possible with adequate carrying power and vibration stability.

Installation with steel plates

- Use the supports (2) delivered with the machine as a base.
- Align the machine horizontally at the setting screws (3).
- Fix alignment by tightening the counter nuts (1).

Installation with levelling elements

To obtain a certain level of vibration dampening we recommend the use of levelling elements (4). Order no. (4 pcs. required) **F3Z 150**

- Screw the setting screws (5) and counter nuts (6) delivered with the elements from below into the machine stand.
- Put machine with the setting screws on the levelling elements (4) and align machine horizontally.
- Fix alignment by tightening the counter nuts (6).



Additional criteria for installation

In addition to the required capacity and vibration stability further requirements are to be met by the installation surface and the installation site:

- The installation site has to comply with building authority regulations so that in case of possible leakage of cooling lubricant, lubricating and hydraulic oil, the environment is not burdened.
- An ideal situation would be provided if the installation site at the same time fulfilled the function of a collecting tray.
- Vibration-proof features as favourable as possible to avoid a transmission of vibrations (particularly when working in the upper speed range, with bar work, when machining heavily unbalanced workpieces, with interrupted cut, when using driven tools etc.) to nearby objects.
- Good and sufficient lighting of the working space facilitates operation of the machine and increases quality and security of work.

- The specific noise load of a machine operator is to be noted.

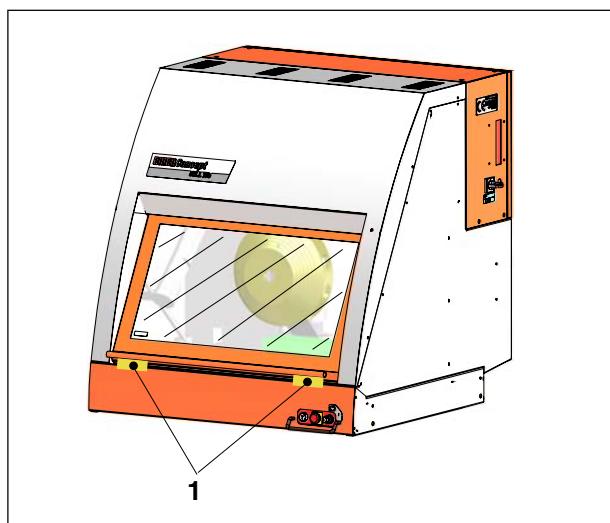
- It has to be taken into account that in accordance with the operating situation a highly qualified operator works on the lathes who has to carry out exacting programming and supervising activities.

Sometimes the situation can be improved by sound insulation walls.

From studies we know that the double distance to a nearby source of noise decreases the sound level by 3 to 5 dB(A).

When doubling the number of similar sources of noise the level is increased by 3 dB(A).

- Heat sources with inconstant temperature near the machine as well as air drafts will influence the quality of the place of work as well as the operating position of the machine. If necessary, adequate measures for protection are to be taken.



Transport safety device on the machine

Transport safety device

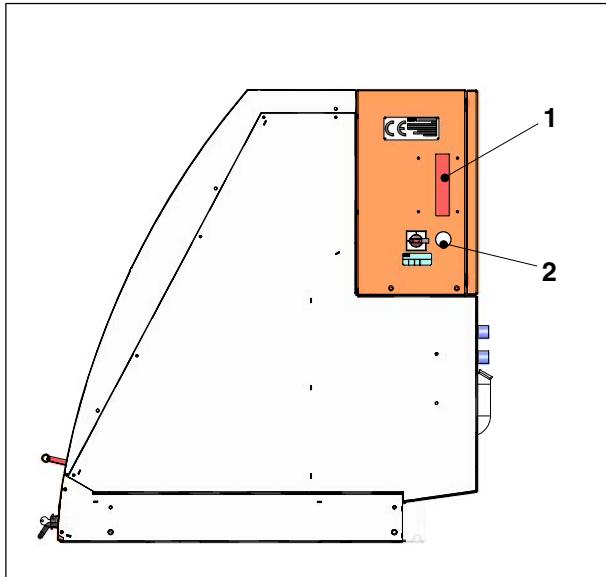
The machine door is saved with inlays in a way, that the door cannot be closed completely.



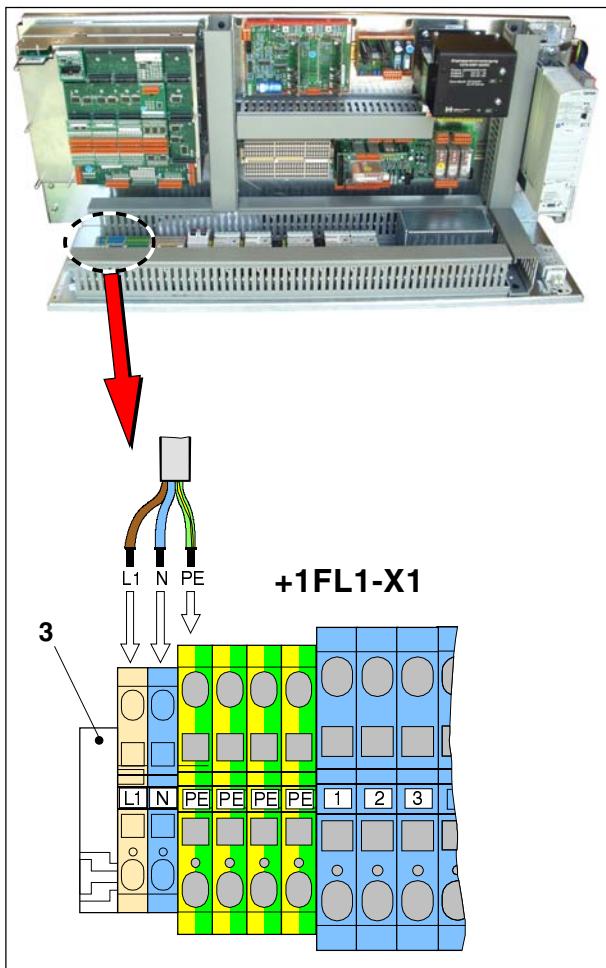
Note:

Dismount the transport safety device of the machine door only when the machine is connected to the supply network, because the machine door would be locked by closing completely.

The door locking device may only be disengaged by switching machine on



Cable screwed joint at the machine



E-cabinet and connecting terminal

Electrical connection



Danger:

The electrical connection of the machine and its accessories may only be established by an electrics expert.
Feed cables must be idle during the connection.

- Thread feed cable through the cable screwed joint (2) laterally at the electrical cabinet (1).
- Connect the phase L to the terminal strip +1FL1-X1 (3) (connecting terminal L1).
- Connect zero conductor to terminal N of the terminal strip +1FL1-X1 (3).
- Connect earth contact (yellow/green core) to the connecting terminal PE of the terminal strip (3).

Mains connection data



Attention:

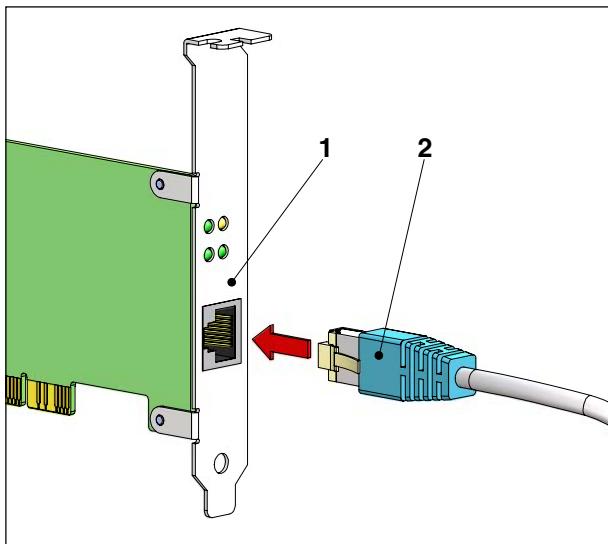
A preliminary fuse is ordered forcible!
The specified value of the fuse has to be kept strictly.

Power supply	1/N/PE ~ 230 V
Frequency.....	50/60 Hz
Max. voltage fluctuations	±10%
Connected load	1.4 kVA
Max. preliminary fuse.....	16 A/slow
Feed cross section	min. 3 x 2.5 mm ²

Note:

Further information about electrical connection is to be found in the electrical documentation of your machine.
In case of different specifications the data in the electrical documentation are valid.

Connection machine - PC



Connection machine - PC-network-card

The machine is controlled by a PC.

You can use either the PC keyboard as input device or the control keyboard which can be obtained as accessory from EMCO.



Note:

To enable the connection of the machine with the PC, a network-card must be mounted and installed in the PC.

Mounting, installation and network adjusting see WinNC-Control descriptions, chapter "Installation".

Network card: Ethernet-network

- Plug in network-cable of the machine with the connector (2) at the connection of the network-card (1).

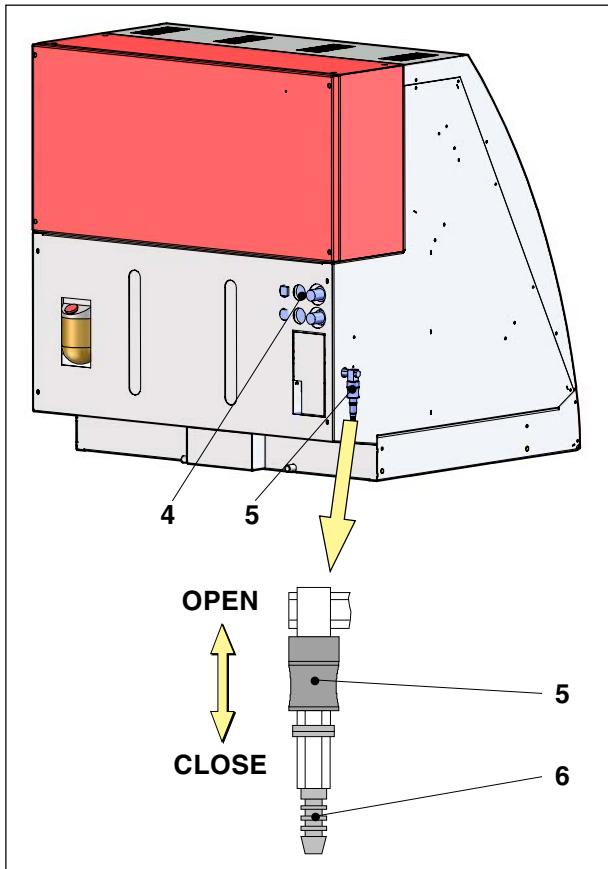
Pneumatic connection

Machines with basic equipment are fitted out with a basic pneumatic unit for the blow-out device of the milling spindle.

The connection is lateral on the machine.

By machines with automatization (pneumatic vice, automatic door) lateral on the machine there is a pneumatic unit which is fitted out appropriately.

Working pressure min.4 – max.6 bar



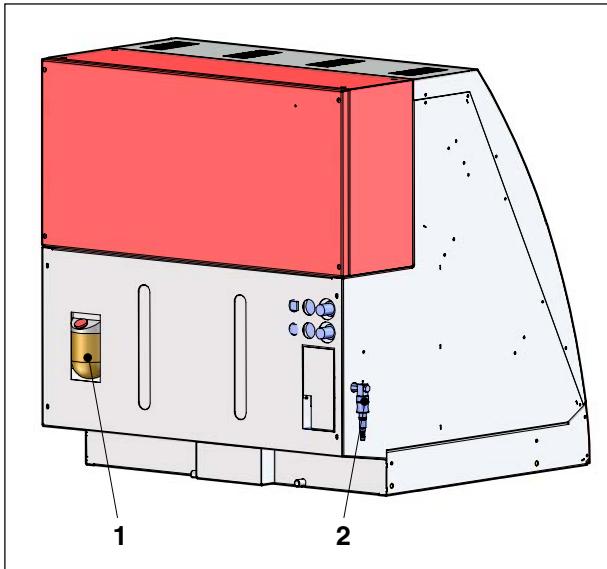
Pneumatic connection of the machine

- Connect air supply at the connection piece (6) of the pneumatic unit laterally at the machine (compressed air hose ø10 mm).

- The set pressure can be read at the manometer (4) at the rear side of the machine.

- By pushing the manual slide (5) upwards the filter and the valves are supplied with compressed air.

Initial start- up



Central lubrication and air-supply

- All blank parts are to be cleaned from rust preventive agent with a clean cloth.
- Control all Connections to the machine.
- Prior to start-up grease the machine (see maintenance of the machine).
- Check oil level of the central lubrication at the tank (1), if necessary, refill oil (see Maintenance of the machine).
- Open air supply at the valve (2).
- 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.

Note:



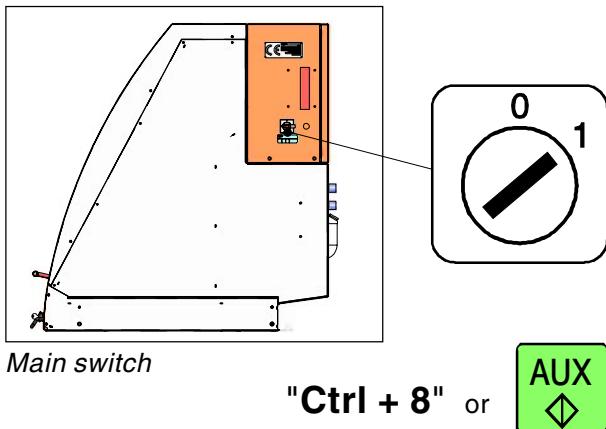
If the machine is not used for a major period:

- 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.

Switch On/Off Sequence

Switch On the Machine



Open air supply (option).

Switch on main switch at the electrical cabinet

Open and close the chip guard door once for checking the door safety switch.

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.

Approach Reference Point

Possibility A:

Referencing axis by axis

Press the +Z key

The slide traverses to the reference point in Z.

Press the +X key

The slide traverses to the reference point in X.
(Only after the collision-free area was reached in Z)

Press the +Y key

The slide traverses to the reference point in Y.
(Only after the collision-free area was reached in Z)

Note:

After reaching the reference points the software limit switches are active.



"5" or 

Possibility B:

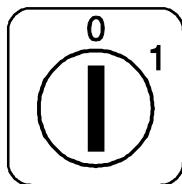
Automatic referencing

Press the key "reference". The axes traverse to the reference point one after the other.

For further operation of the machine please see your **"Software description"**.

Switching off the machine

"**Ctrl + -**" or 



"**Ins**" or 

Press key AUX OFF.

Terminate control software (WinNC).

Terminate Windows.

Switch off main switch

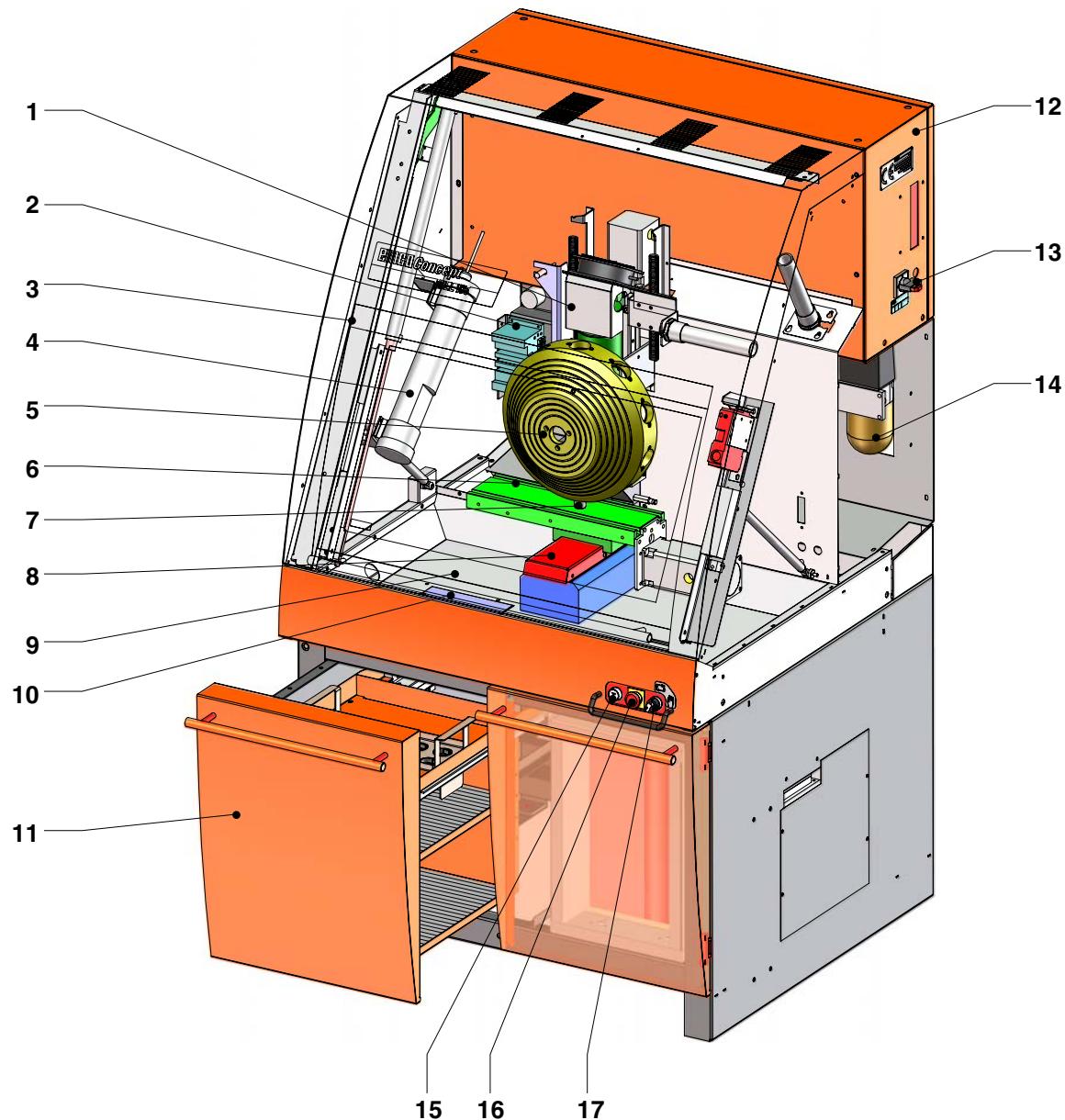
Lock air supply.



Notes

- The machine is switched off by means of the main switch.
We recommend to switch off the machine only in inoperative position of the tool turret.
- Operation is interrupted by means of the Reset key.
All current machine functions are interrupted with RESET.

B Description of the machine

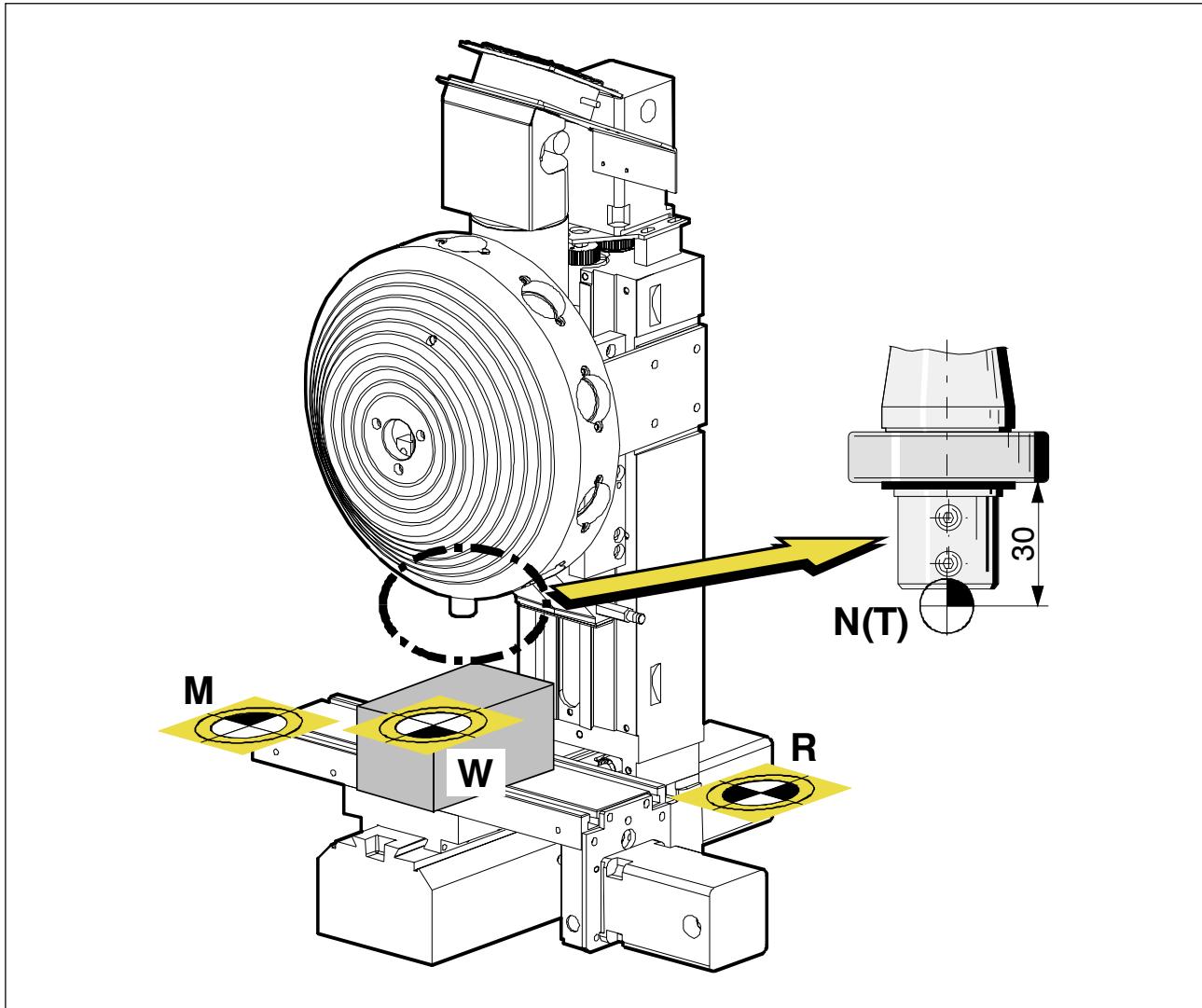


Main elements- Survey

- 1 Z-slide
- 2 Pneumatics maintenance unit
- 3 Chip guard door
- 4 Machine lamp
- 5 Tool drum
- 6 Milling table with X slide
- 7 Milling spindle
- 8 Y-slide
- 9 Chip area

- 10 Machine base (accessory) with tool drawer and PC case
- 11 Chip strainer
- 12 E-cabinet
- 13 Main switch
- 14 Central lubrication plant
- 15 Consent key
- 16 EMERGENCY OFF key
- 17 Key switch

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.

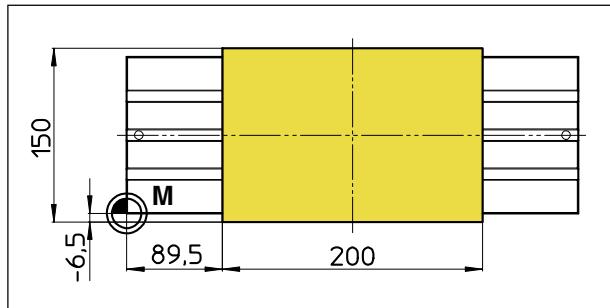
Toolholding-fixture reference point N(T)

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.

Working area

Working area in X- and Y-axes



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.

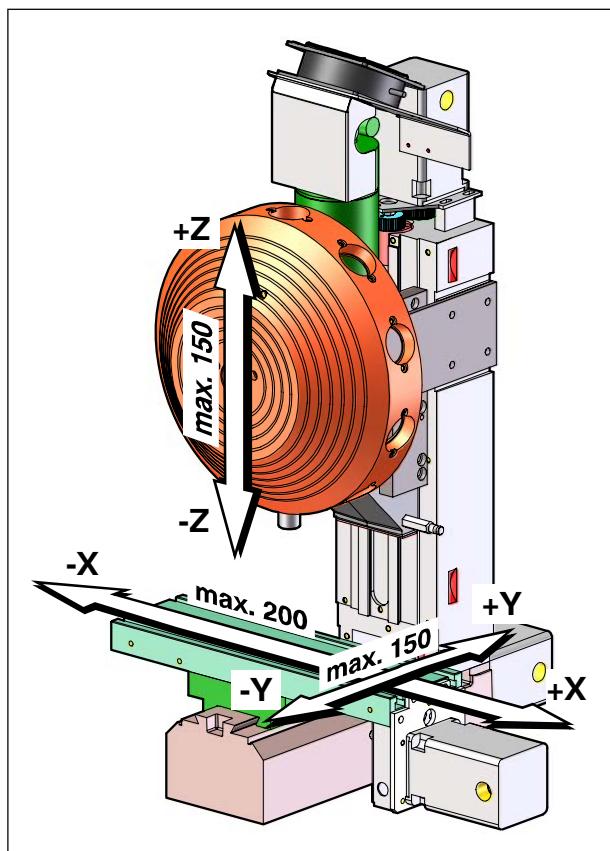
effective Z-stroke 150 mm

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.

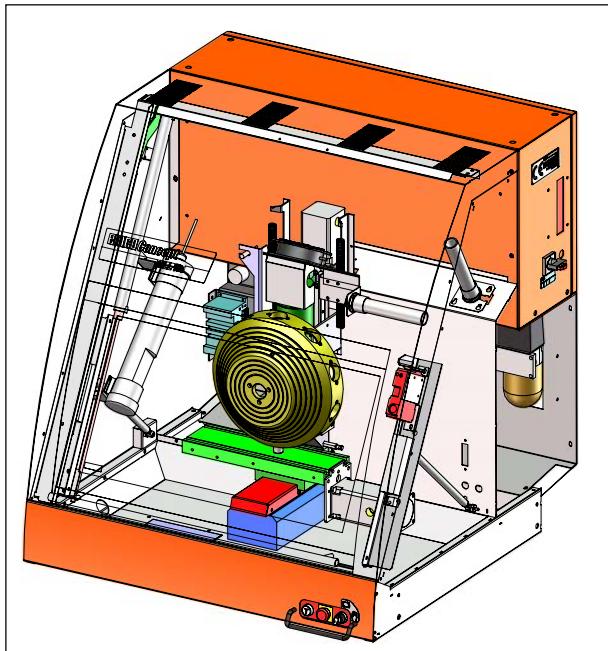
By means of the software limit switches a mechanical overload of the axis spindles due to fixed stops is avoided.



Coordinate system

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.



Slide system and milling spindle

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.

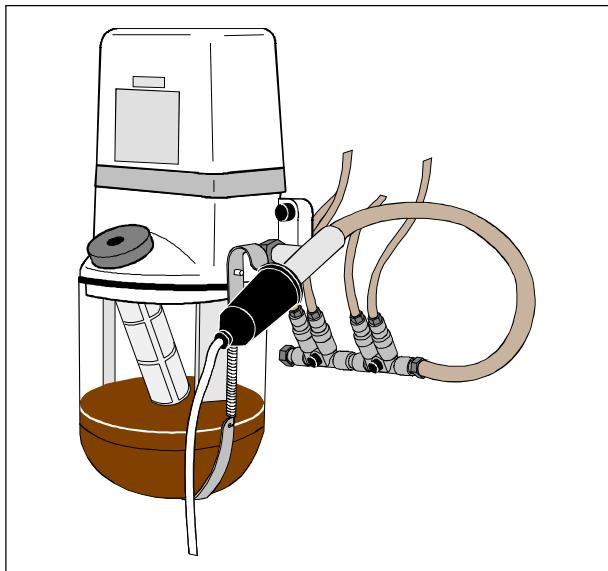
The amply dimensioned spindles, the rigid spindle nuts and the axial bearings without backlash provide high positioning and working accuracy.

Feed speed 0-5000 mm/min
 Rapid motion speed 7000 mm/min
 Step resolution 1.5 µm
 max. feed force X-/Y-slides 2000 N
 max. feed force Z-slide 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 5 Nm



Central lubrication

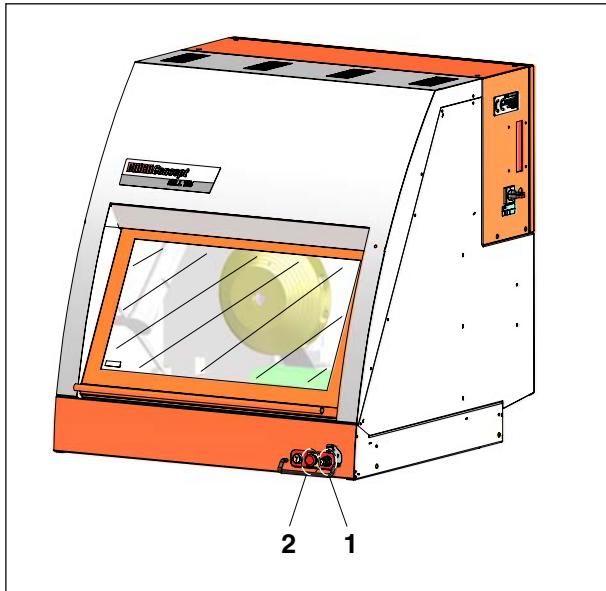
Central lubrication

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

The pump is automatically switched on after a slide traversing path of 5 m.

Safety devices

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



EMERGENCY-OFF key and konsent-key



Danger:

The safety devices must never be removed from the machine.
Also mechanic or electric bridgings of the safety devices are prohibited.

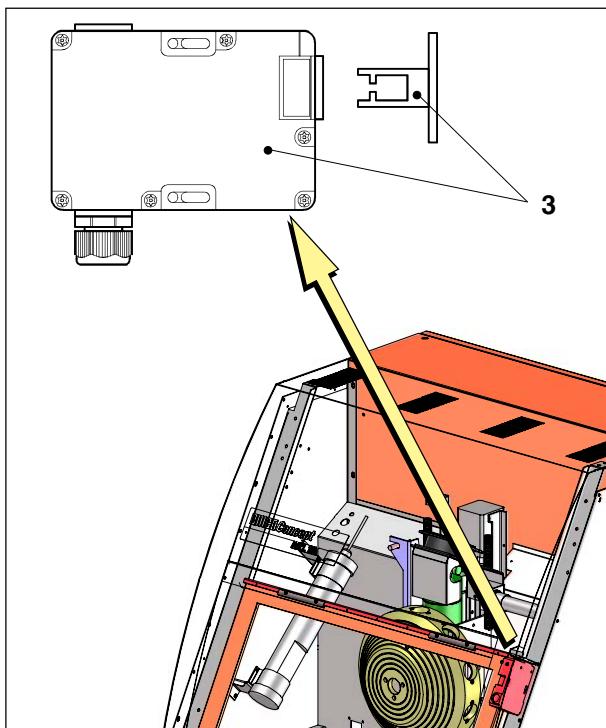
EMERGENCY-OFF key

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 pull out knob.



Note:

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

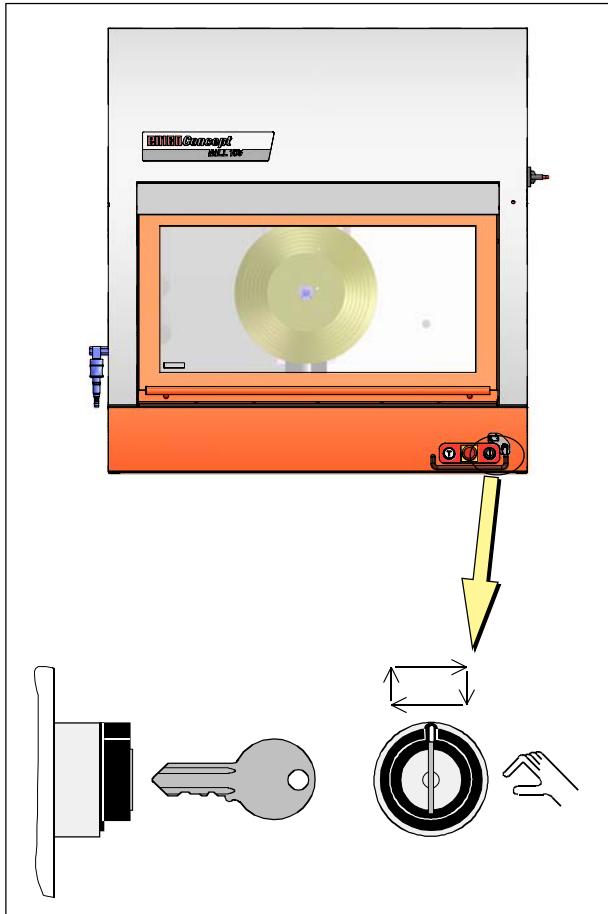


Door locking device

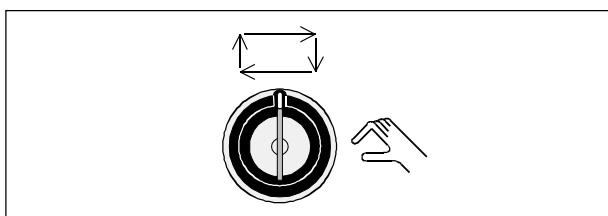
Door locking device

In the machine a door locking device (3) is installed with which the chip guard door can be opened only during standstill of the main drive.
A program start with an open door is not possible.

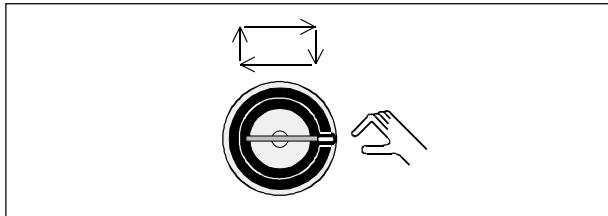
Opening the door by pressing the key "T".



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 in 2 different positions:

Position "automatic"

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

Note:

Manual traversing of the slide is only possible with closed chip guard door as soon as the reference point has been approached, or the key switch is in position "setting operation".



Position "Setting operation"

In this switch position it is possible to traverse the slides manually by opened machine door (Two-hand mode in connection with the consent key - see next page).

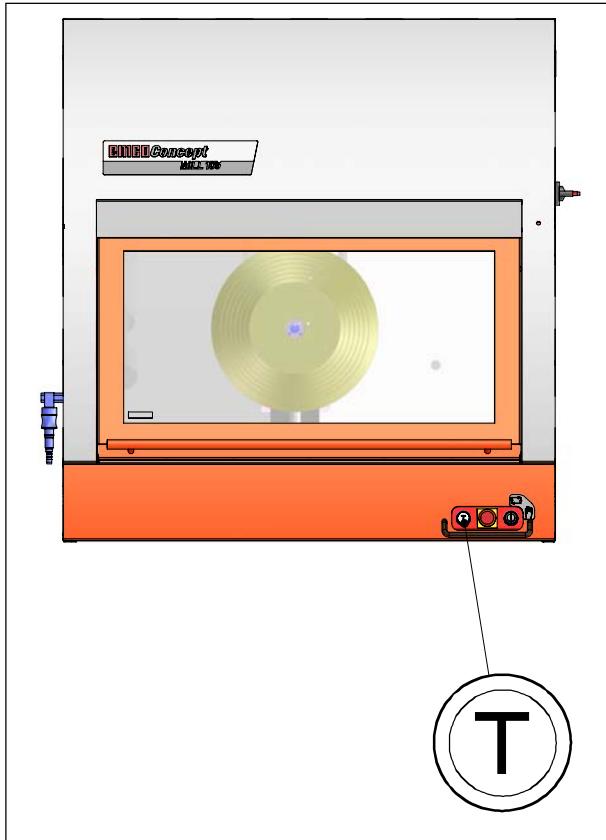


Danger:

- 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.

Consent key

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



Position of the consent key

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.



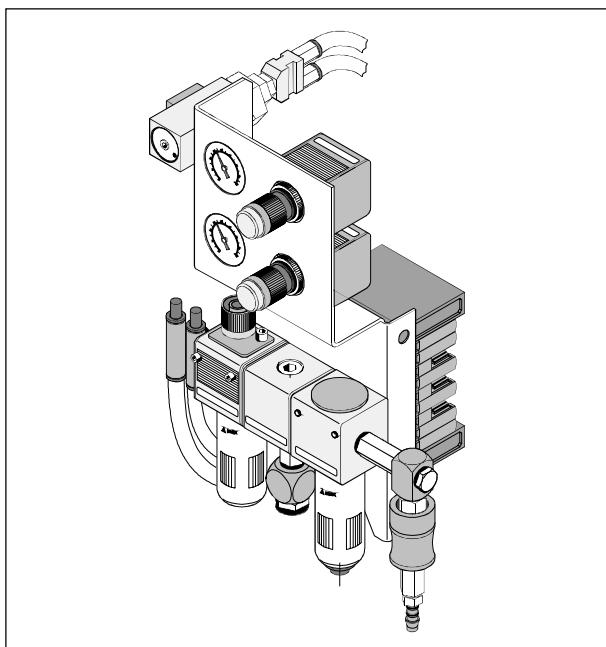
Functions of the consent key

Key switch in "automatic" position

- Releasing the interlocking bolt of the chip guard door with main spindle out of operation.
The machine door is to be opened.

Key switch in "setting" position

- Traversing of slides in the JOG-manual, with non activated reference point and opened machine door.
- Manual traversing of the slide with open chip guard door.
- Swivelling the tool turret with open chip guard door (swivelling by one position respectively)



Pneumatic maintenance unit

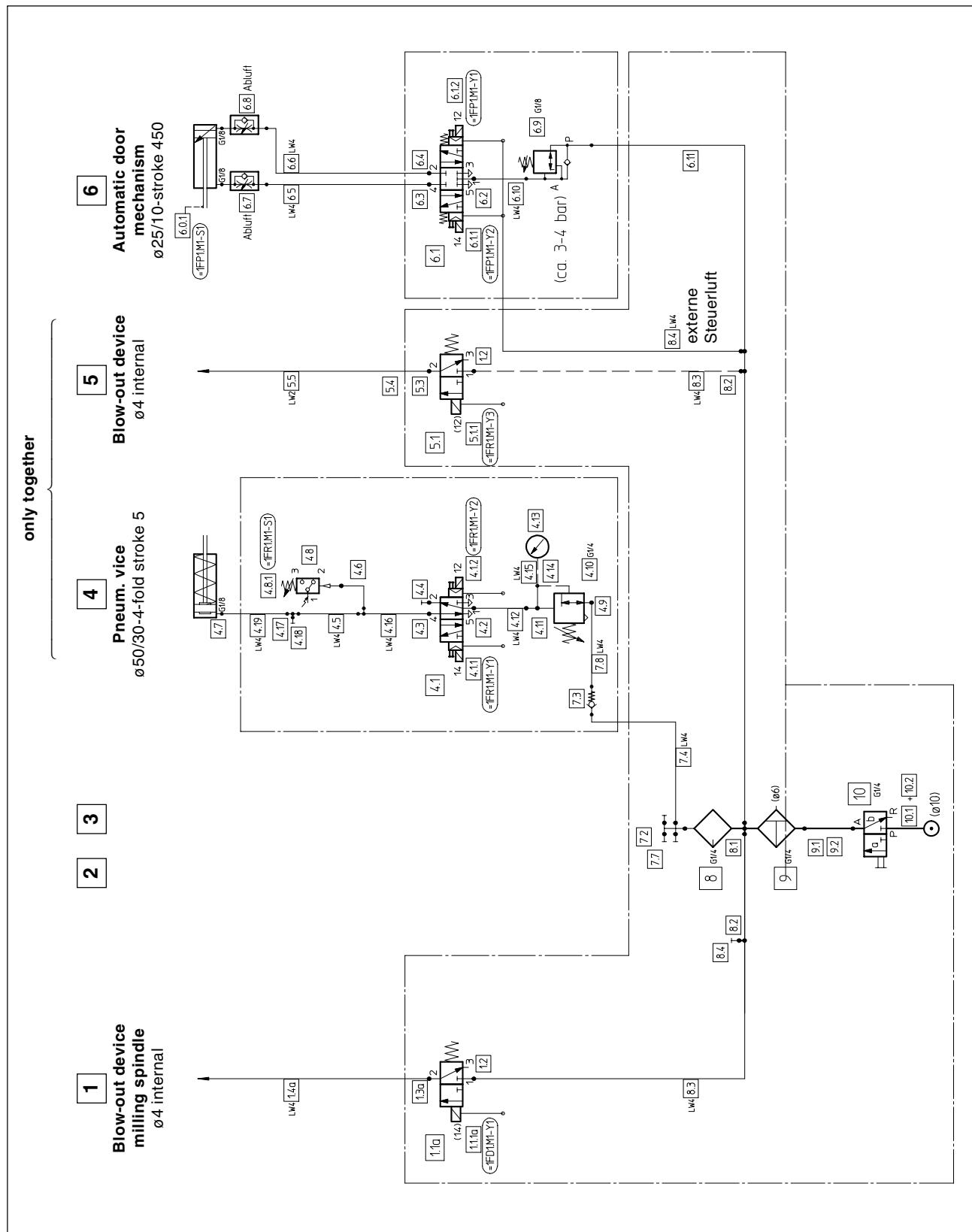
Pneumatic maintenance unit

The basic equipment of the pneumatic maintenance unit contains valves and switches 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, push switches, pressure regulators and valves to trigger the automatic door mechanism and the pneumatic vice with the blow-out device.

Supply pressure 4-6 bar
Pneumatic connection ø10 mm

Pneumatic scheme



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 program or by pressing a key via a pneumatic cylinder (1).

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

Robotics interface (option)

With the robotics interface in addition to the general triggering of the periphery (such as automatic door mechanism) 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.

Tool system

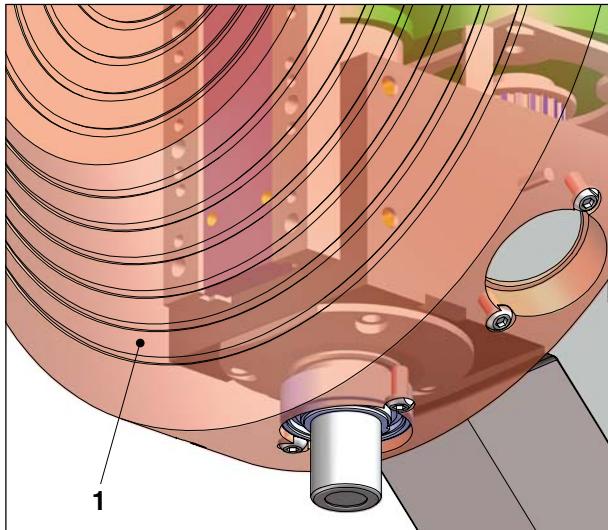
All tools are mounted on the toolholders.

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 with milling head

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).

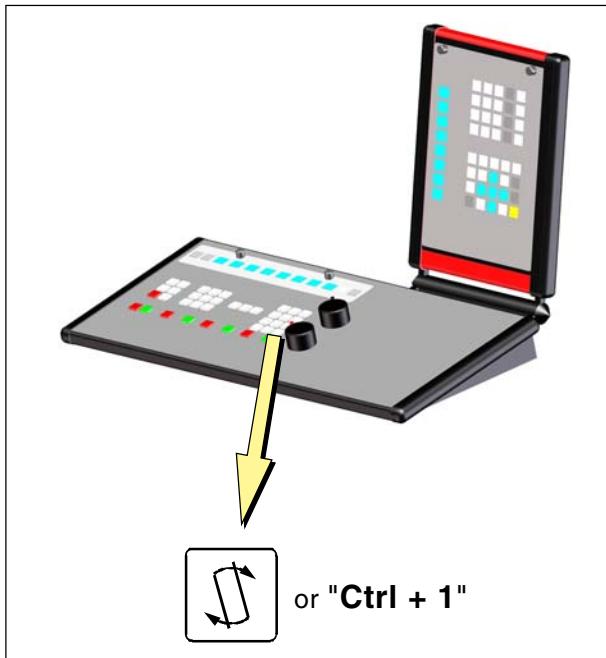
Note:

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



Initialization of the tool turret

After the interruption of a tool change procedure (current interrupted, EMERGENCY-OFF KEY, interruption key) the tool turret must be initialized to adjust the control to the position of the tool turret.



Key panel (option)

Alarm message

"7022 Initialize tool turret"

- The interrupted tool change procedure is terminated by pressing the tool turret key.

Alarm message

"6040 WZW - static interlock control"

If this alarm message is displayed on the screen the tool turret is in a position not identified by the control.

The tool has not been clamped correctly after a tool change procedure.



Attention:

To avoid a damage at the machine the main spindle must not be started on any account if this alarm message is displayed !

- Switch the mode selection switch to "JOG operation".
- Acknowledge alarm message by pressing the key .
- Start manual tool change procedure to swivel out the tool not correctly clamped.
- Release and check tool.
(For tool change see the following pages).
- Clamp tool again and retry to clamp the tool again.
- If the alarm message is displayed again, contact the EMCO service department.

Automatic Offset-Compensation of the axis

If the reference-signals will not be detected during the referencing (the referencing will not be completed), the offset-compensation of the axis has to be done.

Prerequisites for the compensation

- Machine ist switched on
- Auxiliary drives are switched on (AUX ON)
- Machine door closed
- Message "7209 Reference point not reached" on the screen.
- Key-switch "Special operation" in position "Set-up"
- Key-switch "Data protection" in position "1"

"Ctrl + 4" or



"Ins" or



Process

- Press keys "NC-start" and "Feed-start" at the same time.
On the screen the message "7270 Offset compensation active" appears for about 10 sec.
- If all datas are counted and saved the message "7271 Compensation finished, data saved" appears.
- Quit message with the "Reset-key".

Toolholder

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.

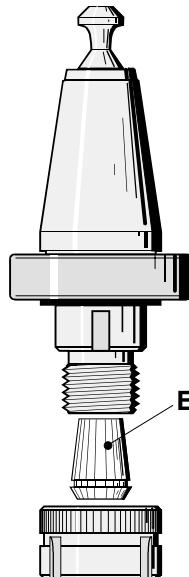
Taps are clamped in special tap holders with longitudinal compensation.

All toolholders are available as accessory at EMCO.

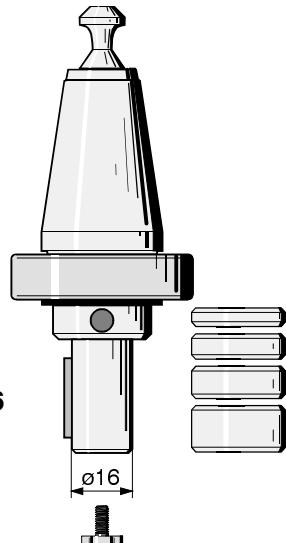
A special miller support is available for the end-milling cutters ø10, ø12 and ø16 mm.

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

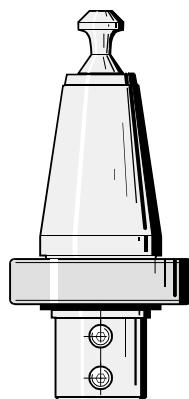
Collet holder



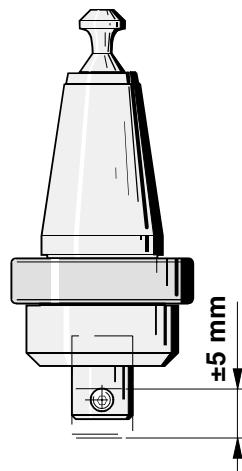
Shell end mill arbor



Miller support



Tap holder

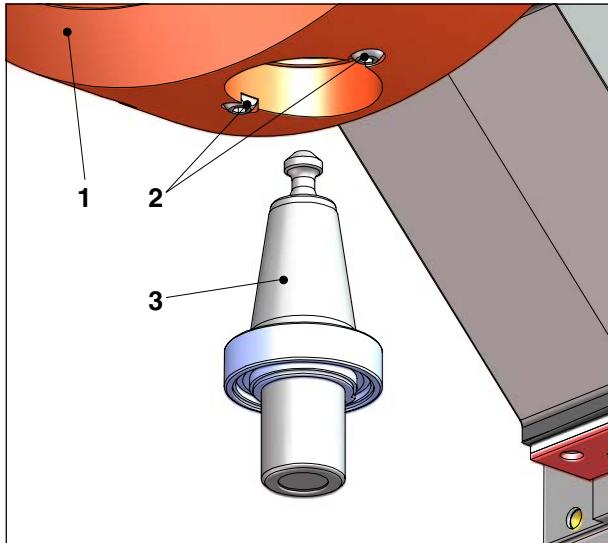


Toolholder

Order numbers

Toolholder	Order no.
Collet holder	ESX 16 F1Z 910
Shell end mill arbor	ø16 F1Z 860
	ø10 F1Z 830
Miller support	ø12 F1Z 840
	ø16 F1Z 850
Tap holder	M2 F1Z 760
	M3 F1Z 870
	M4 F1Z 880
	M5-M8 F1Z 890

Mounting the toolholder into the tool drum



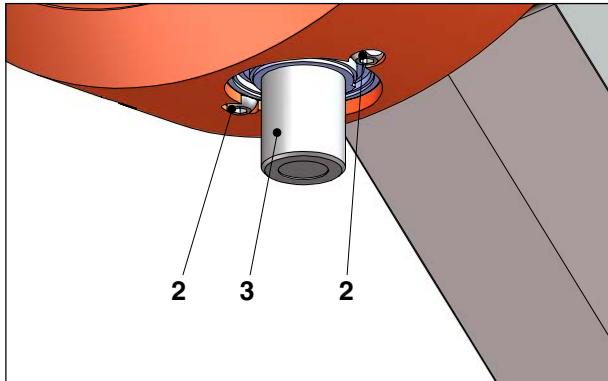
Mounting the toolholder

Danger:

- 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.



- Twist the clamping screws (2) in such a way at the tool drum (1) so that the flat part of the screws shows in the direction of the tool support. Thus, it is possible to insert the tool into the support.
- Insert toolholder (3) with mounted tool into the support of the tool drum (1).
- Tighten clamping screws (2) so that the toolholder sticks safely in the support.



Mounted toolholder

Attention:

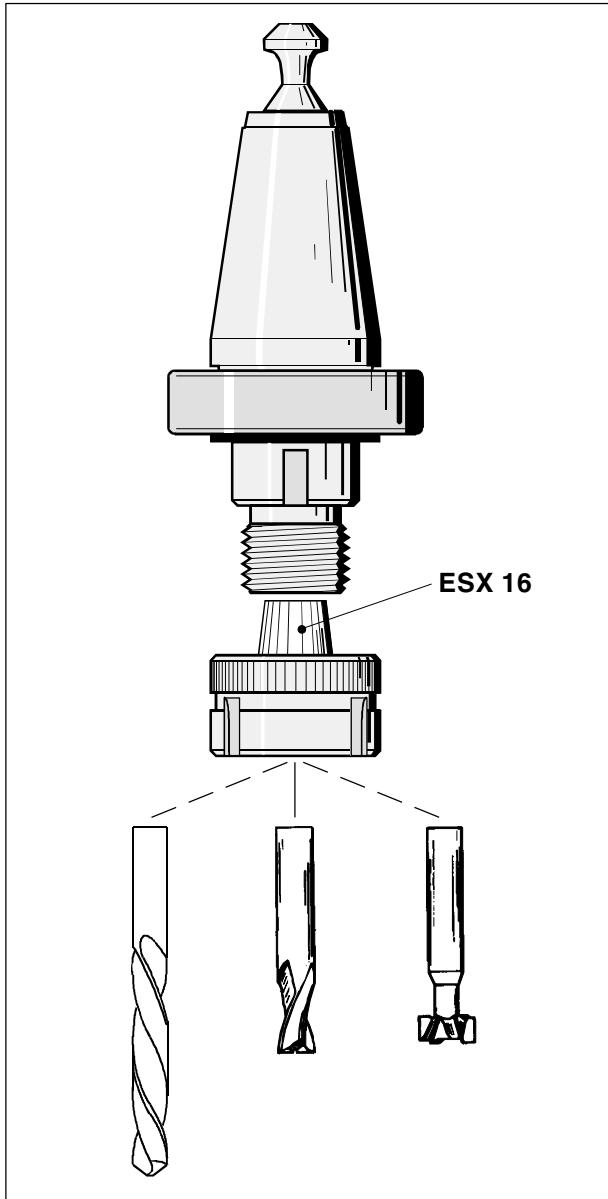
While tightening the clamping screws (4) mind that the flat parts (B) of the screws are directed away from the the tool support. Thus, it is assured that the toolholder cannot fall out from the support.



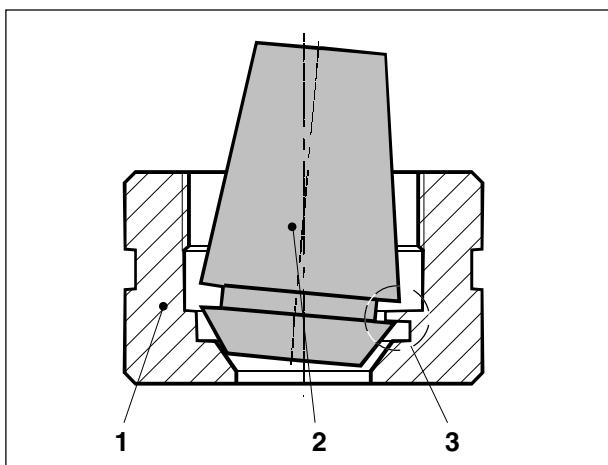
- Swivel tool drum by one position to mount next tool.

Dismounting the toolholder

- Swivel in tool.
- Loosen clamping screws (2) so that the toolholder (3) can be removed. Hold the toolholder tight so that the toolholder does not fall down and the tool is not damaged.
- Remove dirt and chips from the released tool and oil the tool shank 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. F1Z 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.



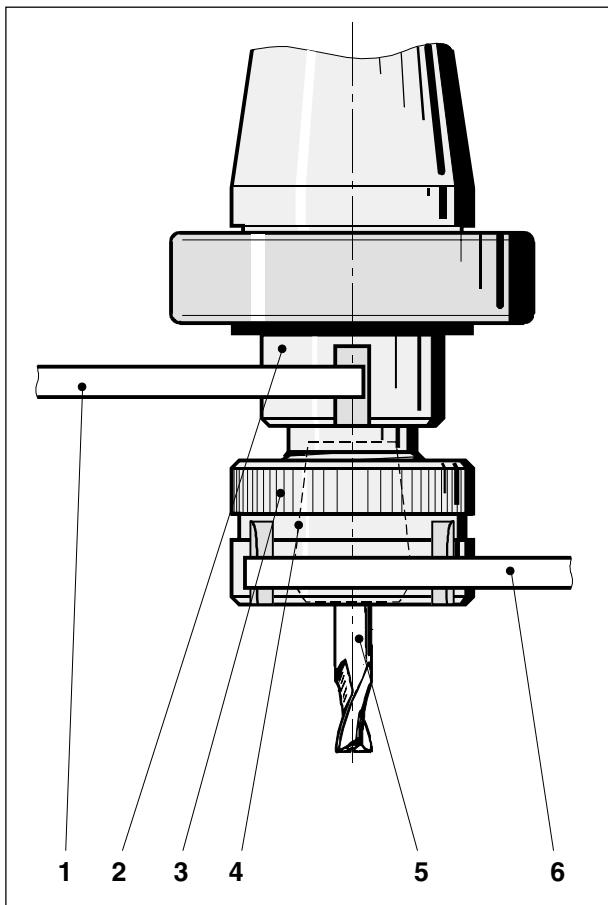
Danger:

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.

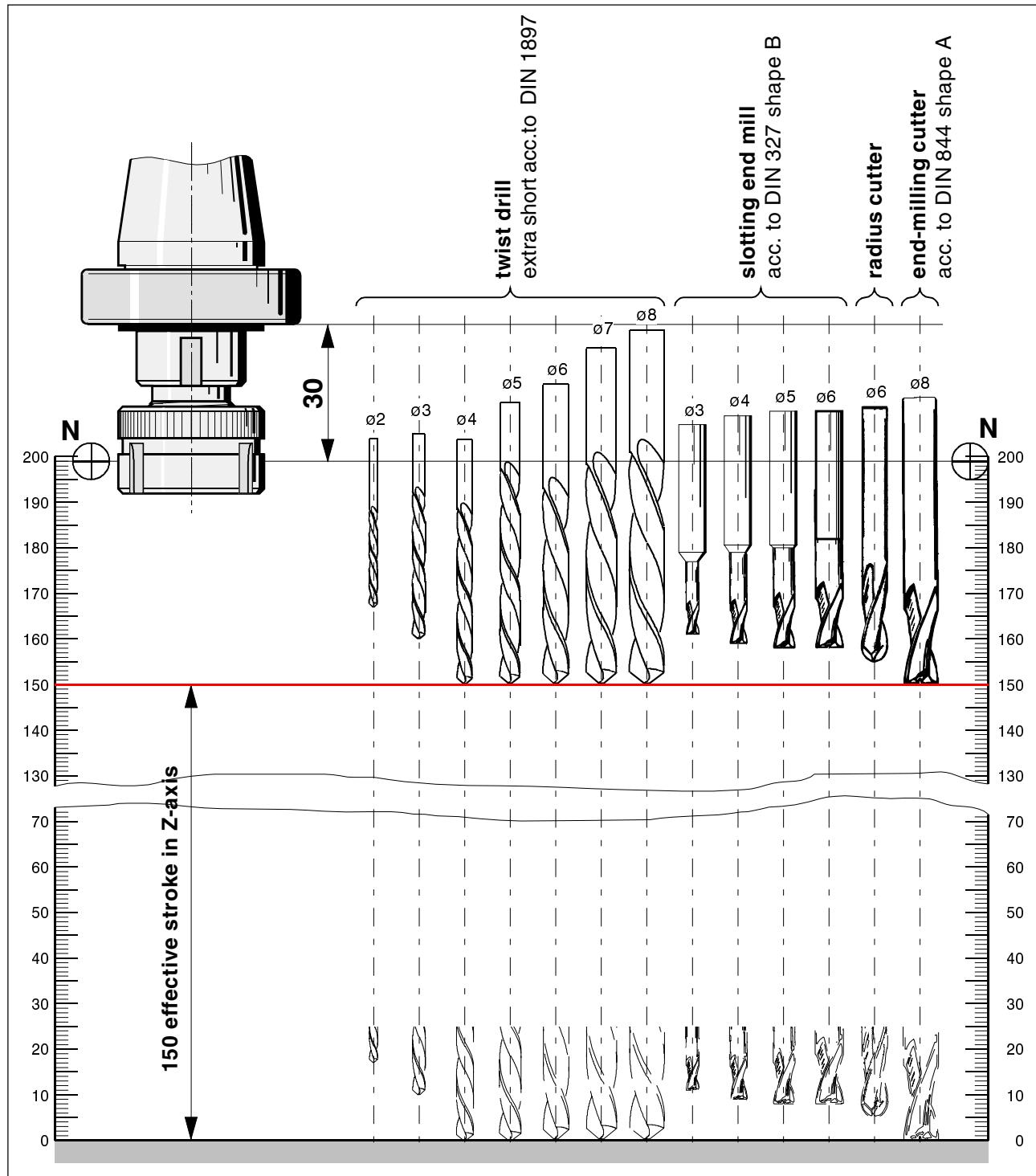


Clamping ranges

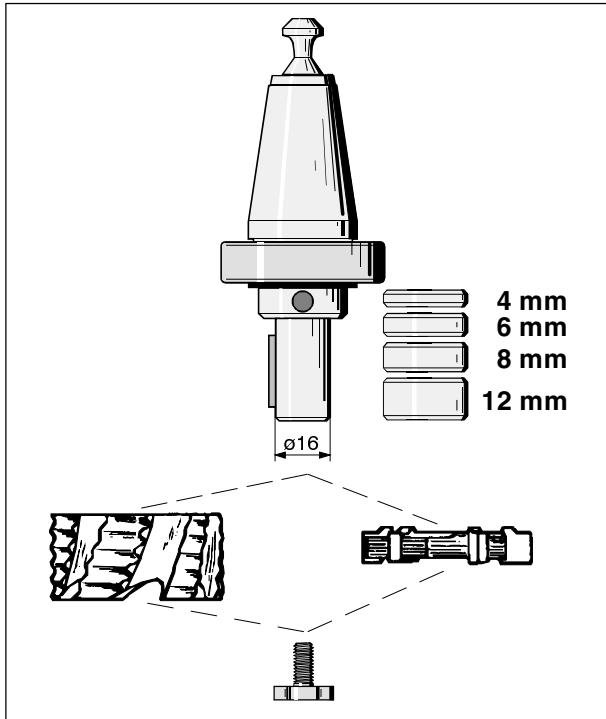
The clamping ranges are engraved in the collets.

Nominal diameter of the collet	Clamping range		Order no.
	[mm]	[inch]	
1,0	0,5-1,0	1/64-1/32	152 710
1,5	1,0-1,5	3/64	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 (ø1,0 - ø10,0)			152 700

Working ranges of the tools



Working ranges with the collet holder



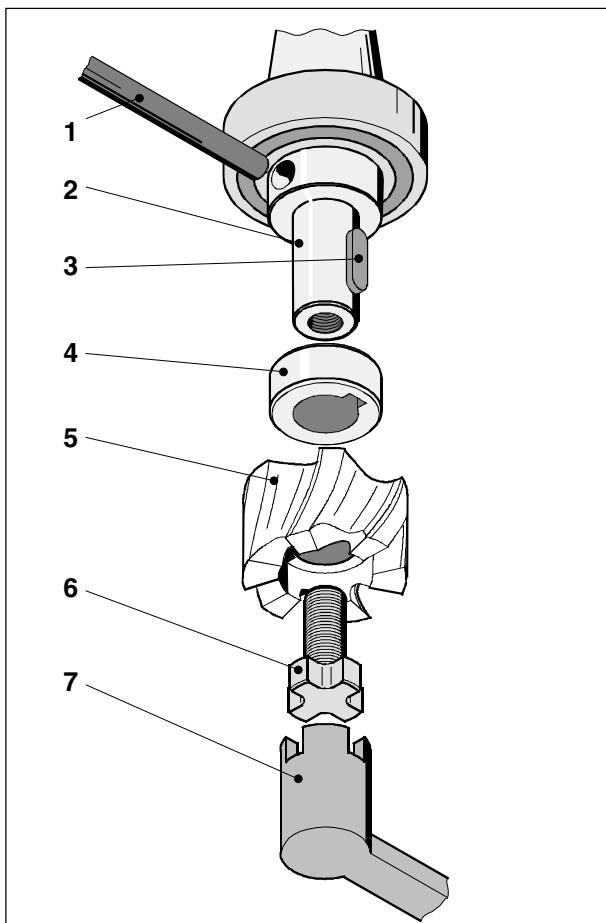
Shell end mill arbor

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. F1Z 860
Tool support shaft Ø16 mm



Clamping the tools into the shell end mill arbor

Clamping the tools in the shell end mill arbor

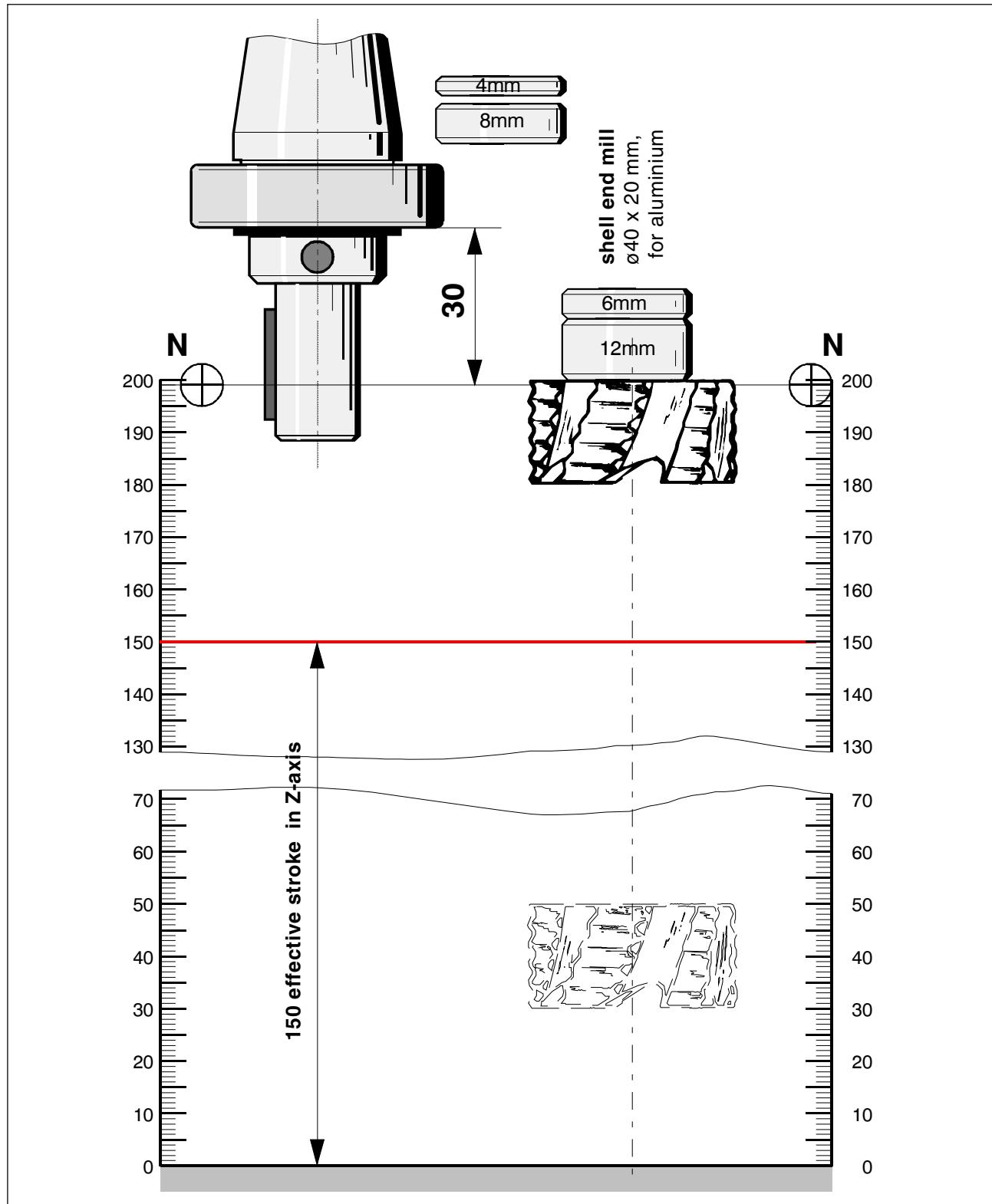


Danger:

- 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

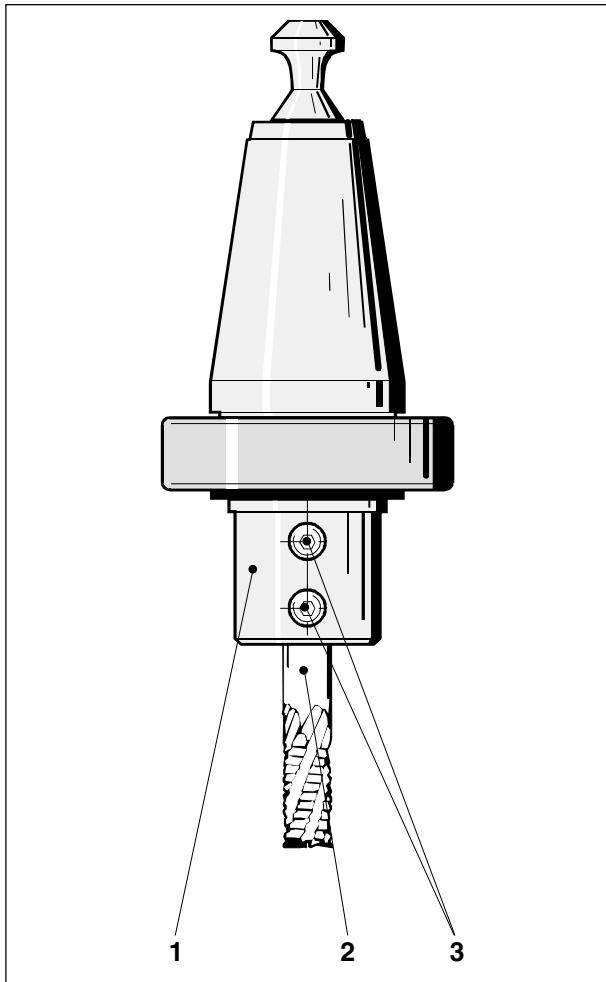
Miller support

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 F1Z 830
miller support ø12 mm F1Z 840
miller support ø16 mm F1Z 850



Clamping the tools into the miller support

Clamping the tools into the miller support

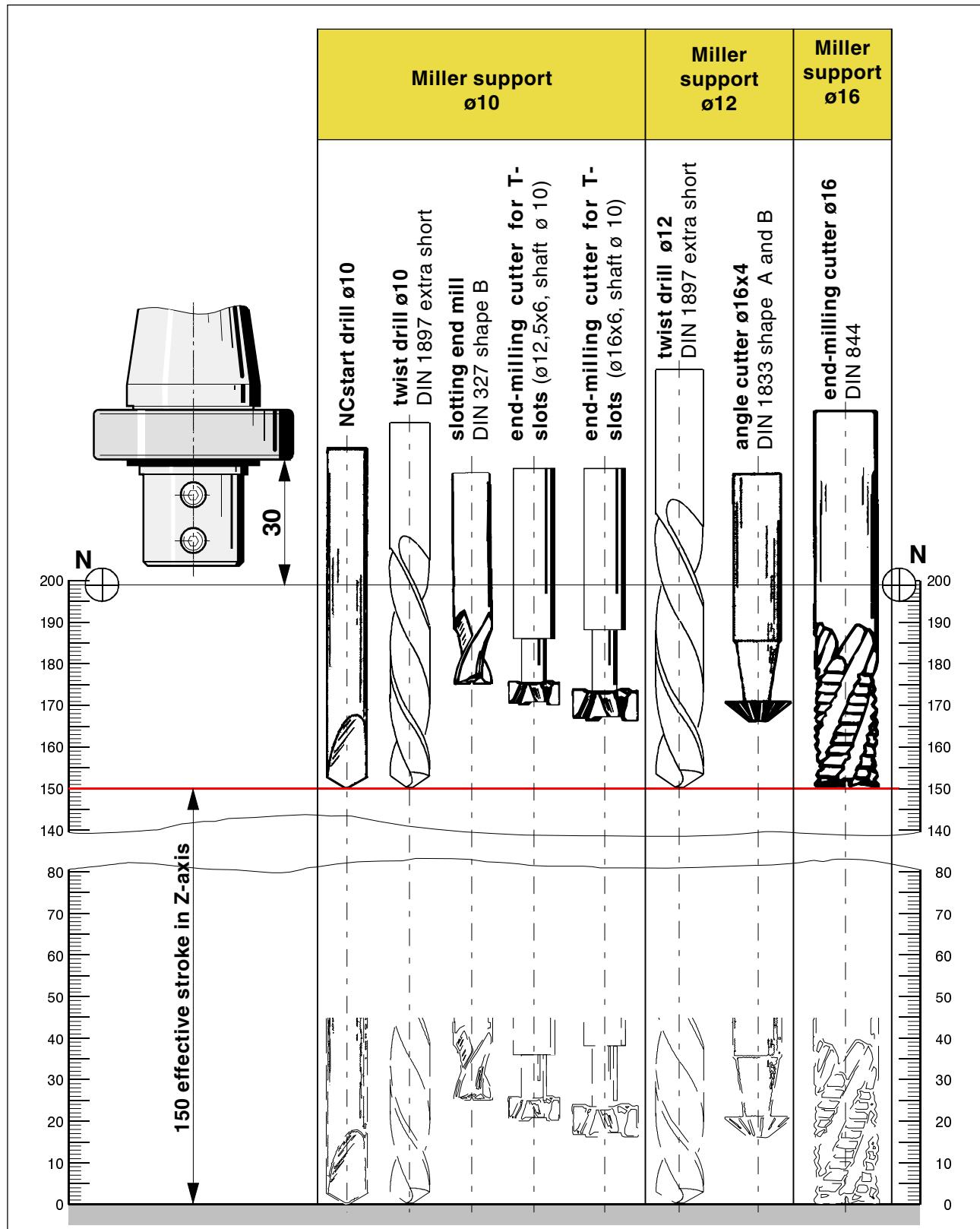


Danger:

- 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

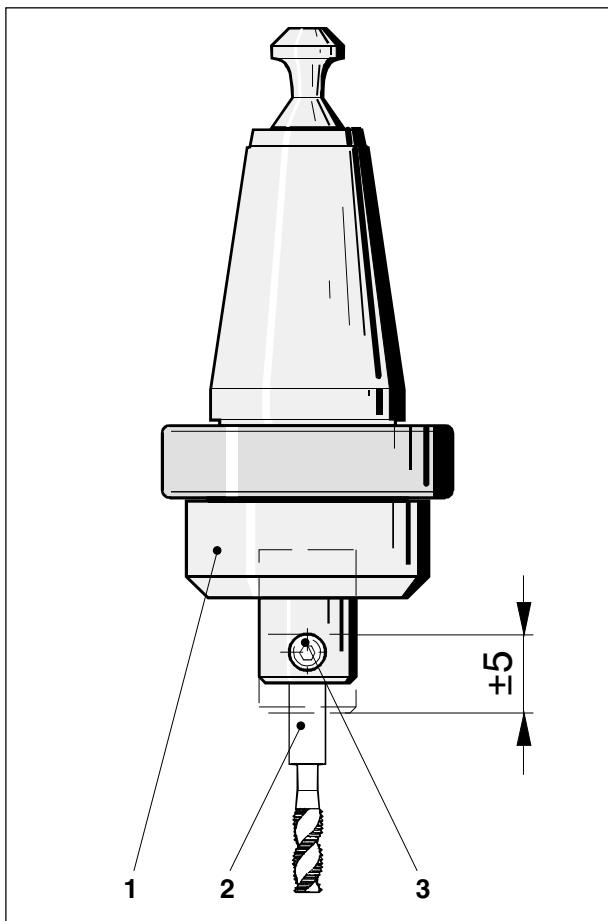
Taps are not clamped in the collet holder but in the tap holder.

The tap holder has a length compensation of 10 mm (± 5 mm).

We distinguish between 4 tap holders according to the thread size.

Order numbers:

tap holder M2	F1Z 760
tap holder M3	F1Z 870
tap holder M4	F1Z 880
tap holder M5-M8	F1Z 890



Clamping of tap holders

Clamping the tools in the tap holder

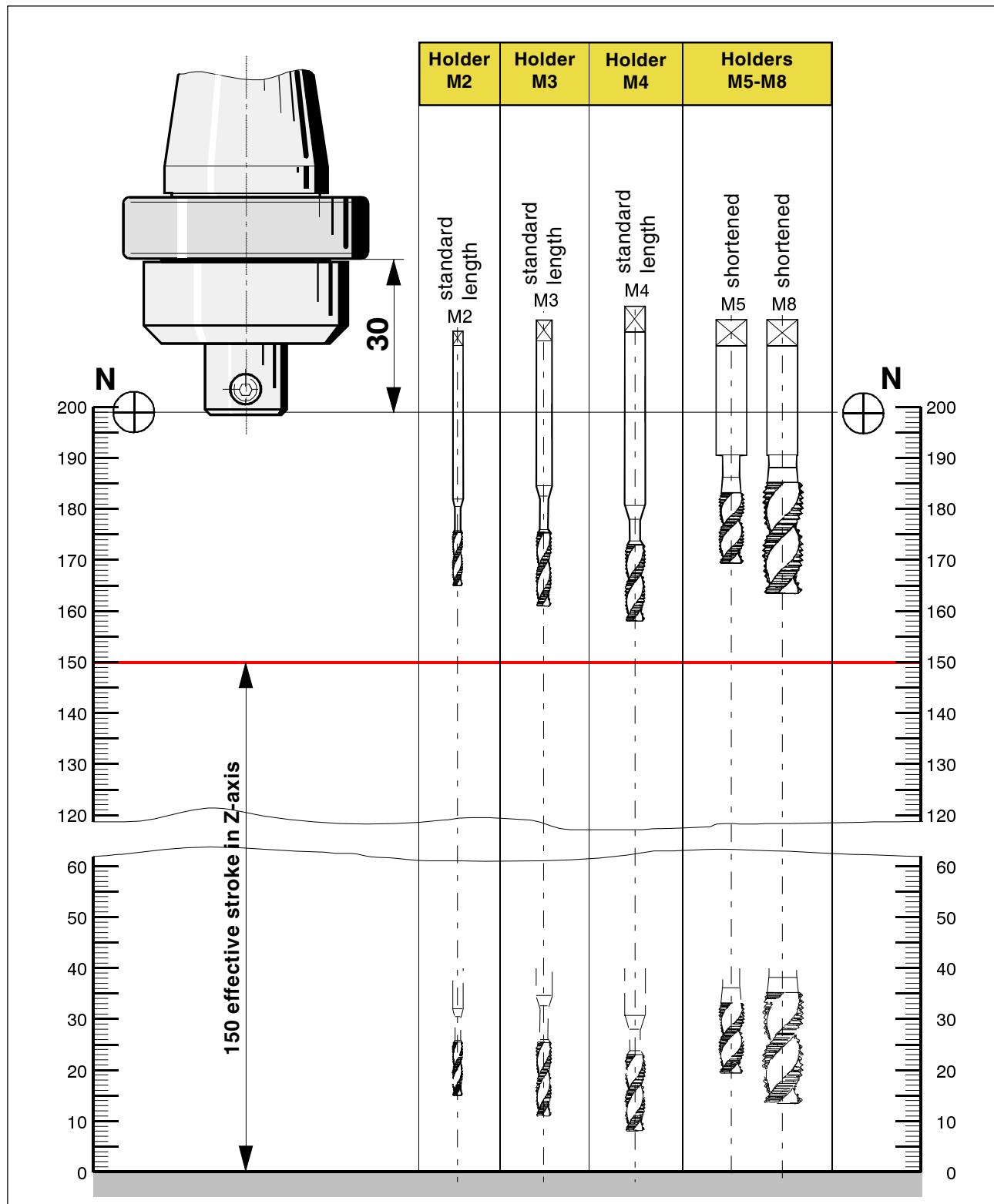


Danger:

- 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.

- Loosen thread pin (3) with the hexagonal key (wrench size 2,5).
- Put in tap (2) into the seat of the holder (1) and turn it in a way, that the square of the tap gears into the square of the holder
- Tighten thread pin (3) to fix the tap (2).

Working ranges of the tools



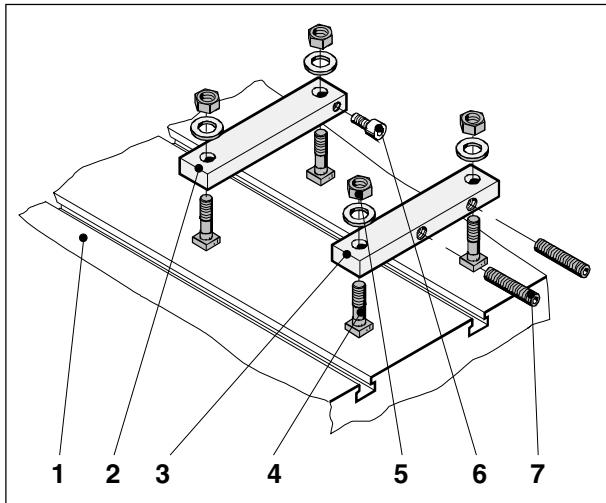
Working range with the tap holder

Clamping devices for workpieces

All clamping devices can be obtained from EMCO as accessories.

Clamping rails

Order-No. F1Z 060



Mounting the 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.

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

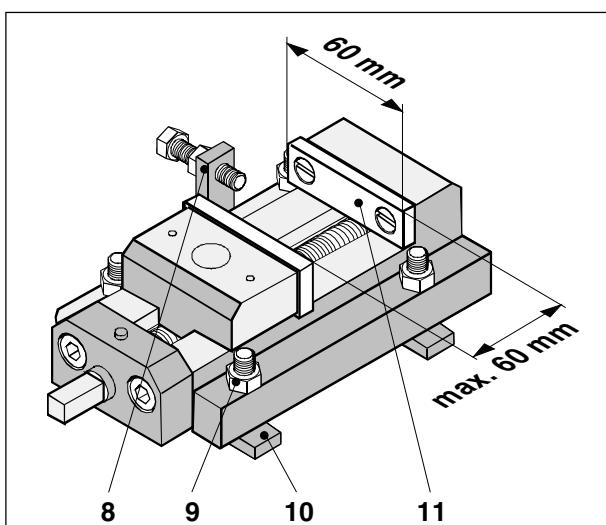
The machine vice is provided with exchangeable clamping jaws (11) and a stop (8).

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

Order No. F1Z 310

Jaw width 60 mm

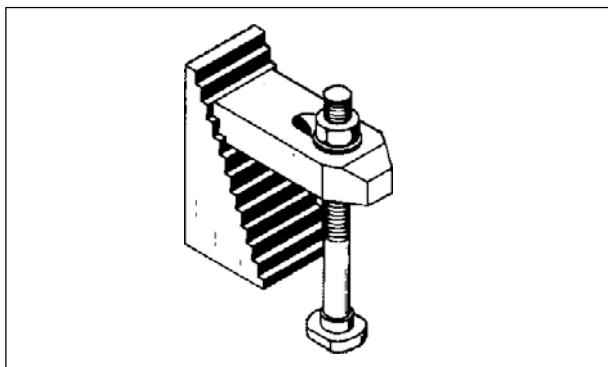
Clamping width max. 60 mm



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

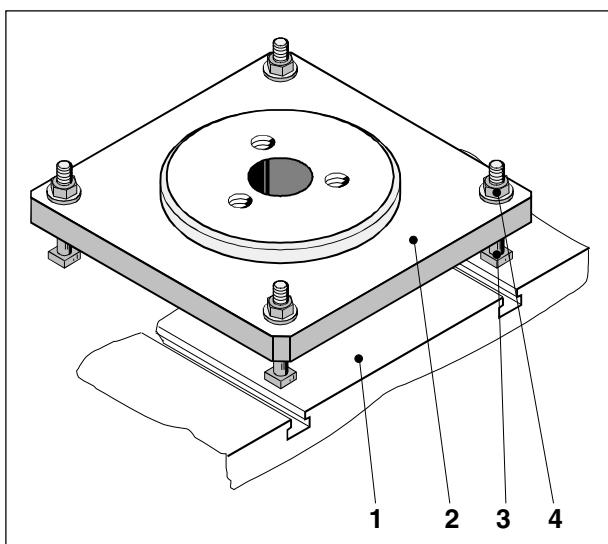
Incremental straps are suitable for clamping irregular and high workpieces.

For clamping a workpiece at least 2 incremental straps are required.

Order no. C3Z 300
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.

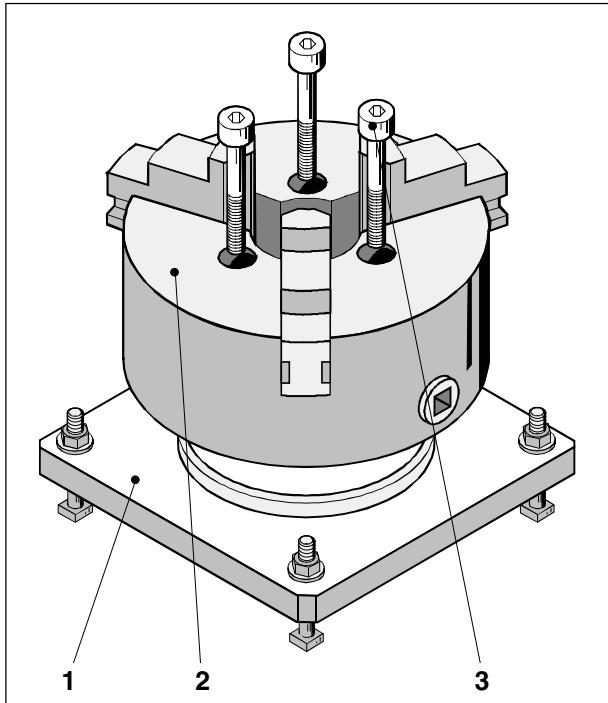
Order no. F1Z 800

Mounting the intermediate flange

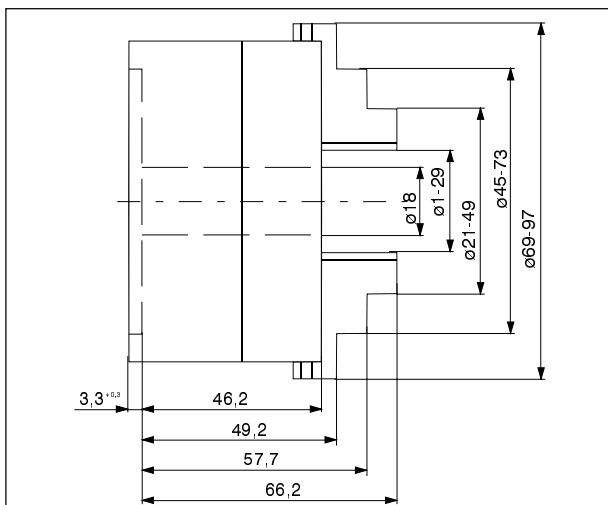
**Danger:**

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

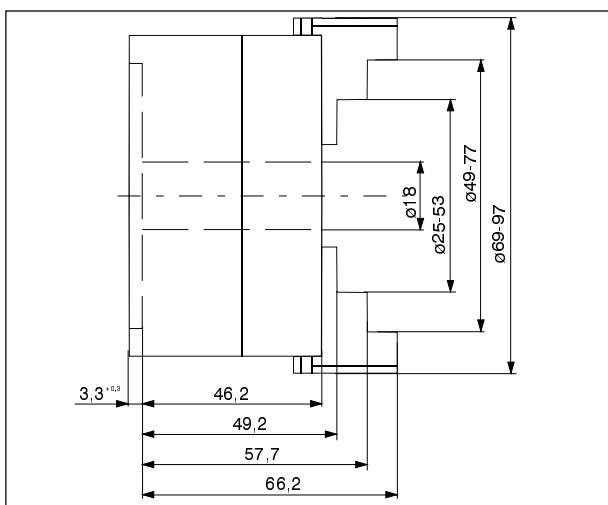
- Thread intermediate flange (2) with the 4 T-slot screws (3) at the milling table (1).
- Tighten hexagon nuts SW13 (4).



Mounting the chuck at the intermediate flange



Clamping range - externally graduated jaws



Clamping range - internally graduated jaws

Three-jaw chuck ø82 mm

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

Order no. V4W 186R



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.

During the adjustment of the copper tube mind that the tools clamped in the tool drum can swivel 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.

Distance of jaws max. 70 mm

Width of jaws 72 mm

Jaw stroke 5 mm

Clamping force max. 3000 N

Order no. **F1Z 720**

- Set clamping device state of the control on "Release" (message "Vice open!" is displayed on the screen).

- Place workpiece on vice against the clamping jaw (3) of the vice.

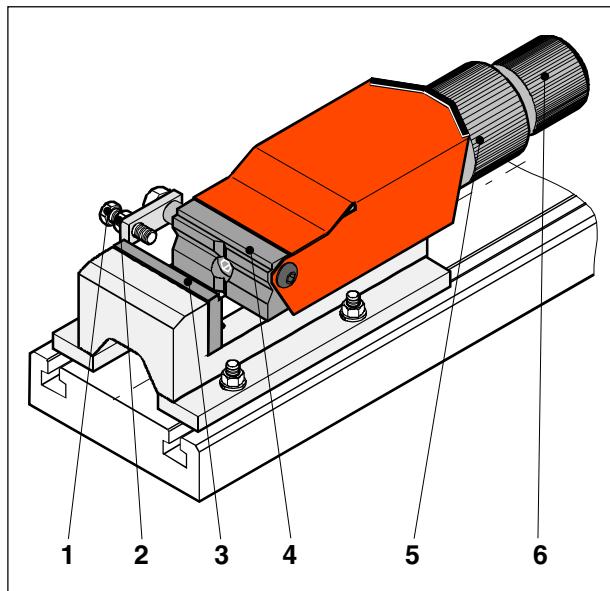
- Approach clamping jaw (4) of the vice by turning the knurling wheel (5) up to a distance of approx. 2 mm from the workpiece (adjust jaw distance via the workpiece length to be clamped).

When turning the knurling wheel mind that the sliding valve (6) does not turn with the wheel (counterhold).

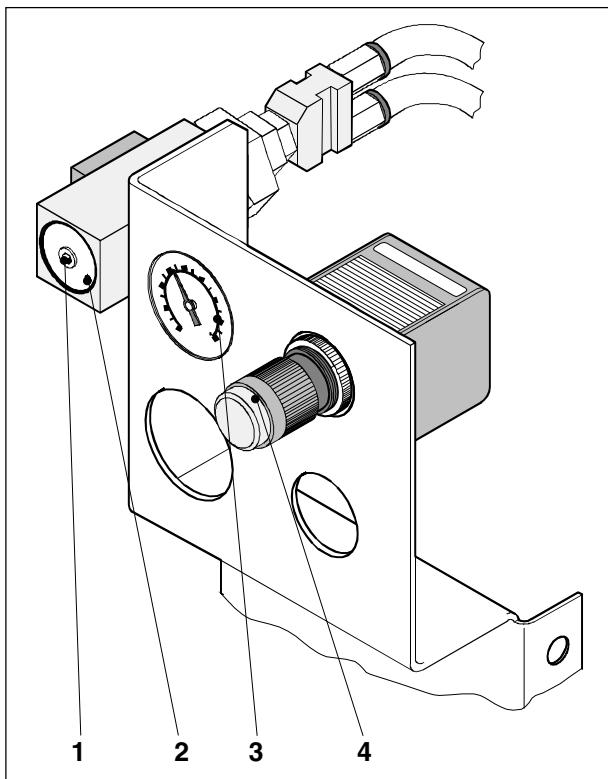
- Laterally at the vice a stop is mounted on the clamping jaw (4) which has to be adjusted by twisting the hexagon screw M6x40, SW10 (1). The adjustment is fixed by means of the counter nut SW10 (2).

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.

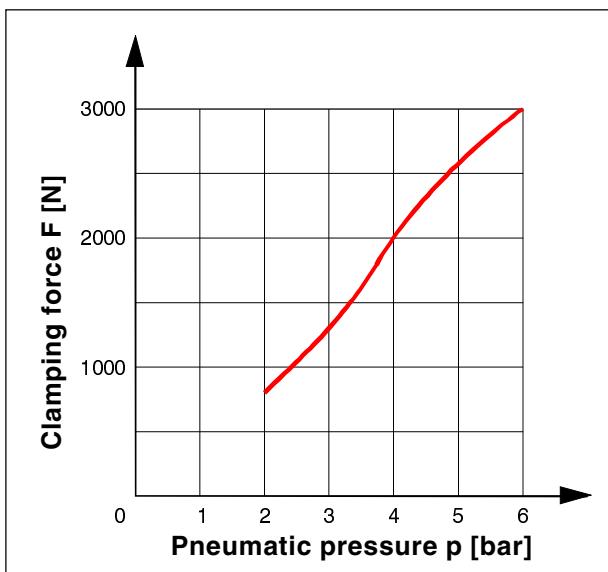
- When closing the vice via the control the workpiece is clamped with the set pressure (the jaw stroke of the clamping jaw (4) is 5 mm).



pneumatic vice



Setting the clamping device pressure



Clamping force diagram for vice

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.

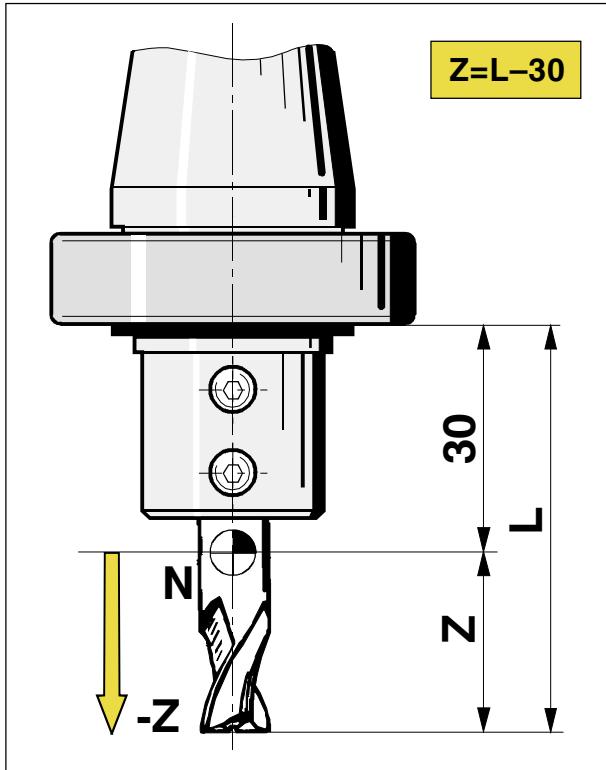
If the set pressure is not achieved an alarm message is displayed on the screen.

- 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 "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.

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.

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.

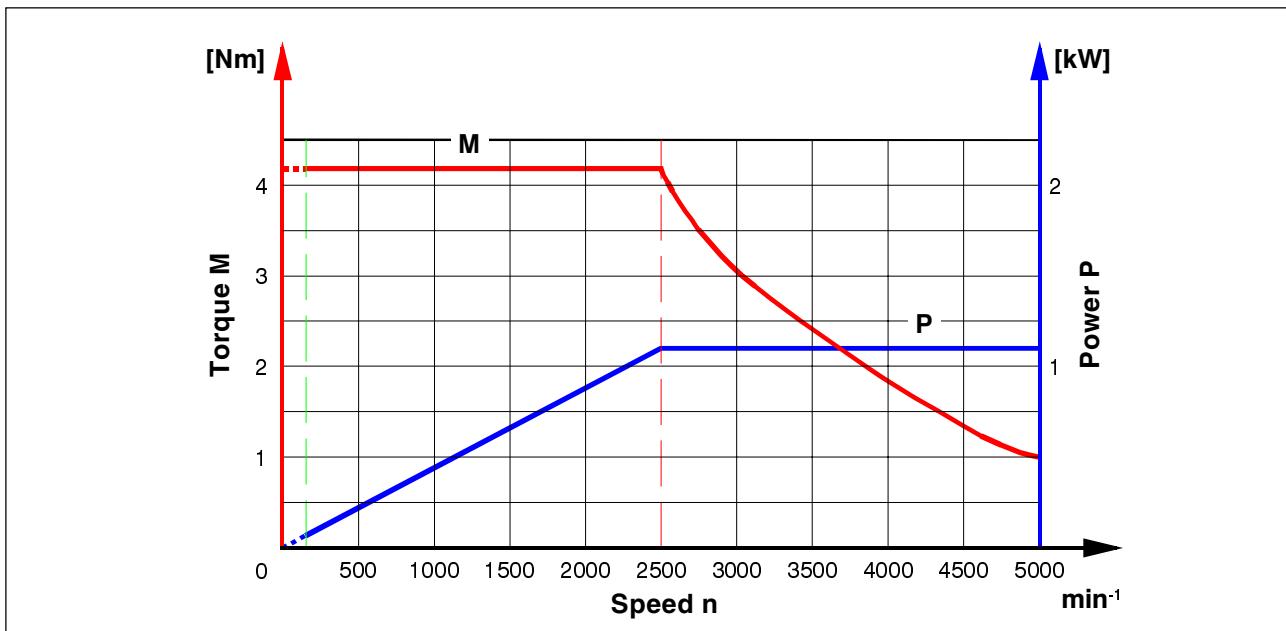
The calculated value is the $-Z$ -dimension which has to be entered into the tool register of your control.

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.



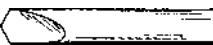
Characteristic curves of the main spindle



Tools

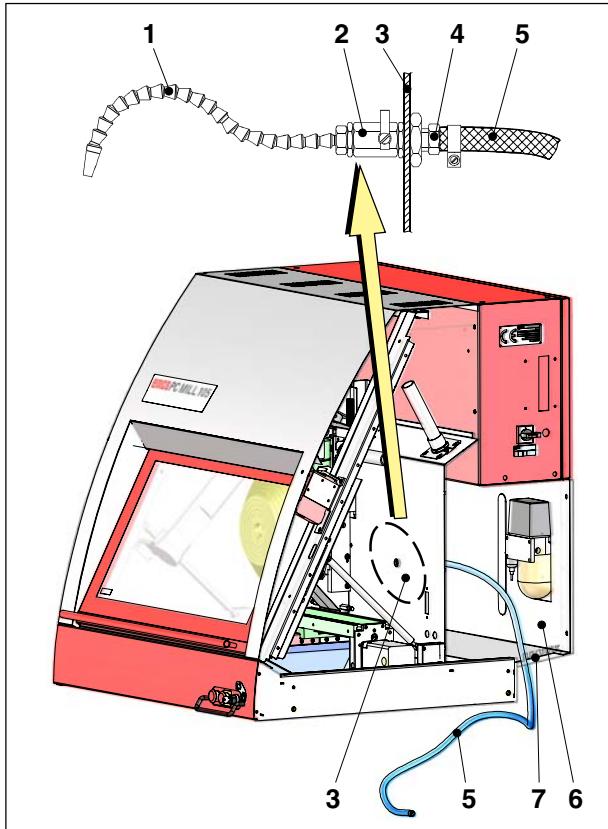
All listed tools are to be ordered by EMCO with the given Order-Numbers.

Milling tools

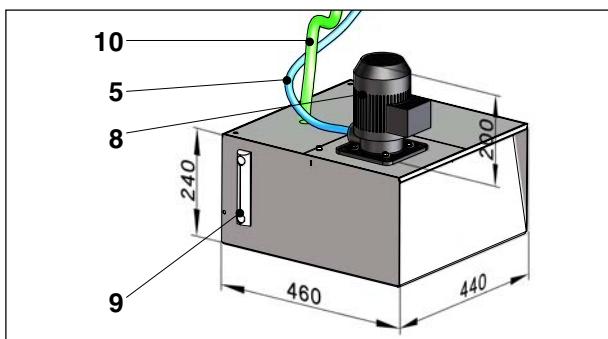
Description		Order no.
	NC start drill (HSS) acute angle 120°, shaft ø10mm	771 010
	Edge tracer ø4/ø10mm, shaft ø10mm	F1Z 090
	Slot milling cutter HSS, DIN 327-shape B milling cutter ø3 mm (shaft ø6 mm) milling cutter ø4 mm (shaft ø6 mm) milling cutter ø5 mm (shaft ø6 mm) milling cutter ø6 mm (shaft ø6 mm) milling cutter ø8 mm (shaft ø8 mm) milling cutter ø10 mm (shaft ø10 mm) milling cutter ø12 mm (shaft ø12 mm)	764 301 764 302 764 303 764 304 764 306 764 308 773 100
	Heavy-duty shank end mill HSS, DIN 844-shape A milling cutter ø8 mm (shaft ø8 mm) milling cutter ø10 mm (shaft ø10 mm) milling cutter ø12 mm (shaft ø12 mm) milling cutter ø16 mm (shaft ø16 mm)	764 200 781 152 781 151 771 020
	Radius cutter HSS shaft ø6 mm shaft ø8 mm	771 030 771 040
	Angle cutter HSS, DIN 1833, shape A-60° milling cutter ø16 mm, shaft ø12 mm	764 400
	Angle cutter HSS, DIN 1833, shape B-45° milling cutter ø16x4 mm, shaft ø12 mm	771 050
	Boring bar for bores ø16-40 mm shank ø15 mm	F1Z 050
	Shell end mill HSS finishing and roughing teeth ø40x20 mm, boring hole ø16 mm	764 410
	Staggered tooth side mill (HSS) ø35x5mm, bore ø16 mm	764 900

Boring tools

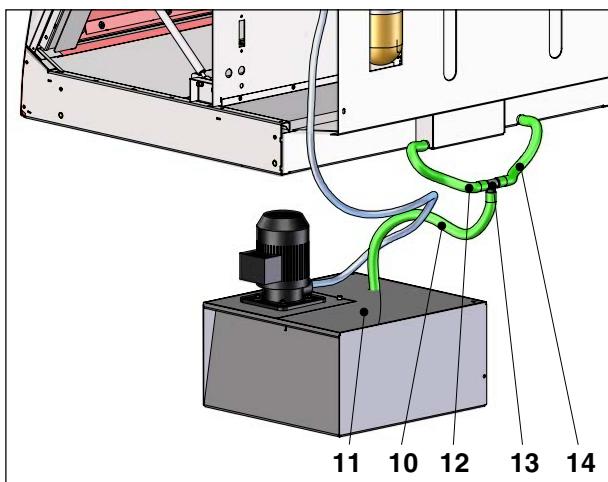
Description		Order no.
	Set of twist drills HSS 25 twist drills ø1-13 mm (in increments of 0.5 mm) 9 twist drills ø2-10 (in increments of 1 mm)	781 280 260 628
	Set of core hole drills HSS 6 core hole drills ø2.5-8.5 mm 5 core hole drills ø2.5; 3.3; 4.2; 5.0; 6.8	271 230 771 120
	Centre drill HSS ø6.8 mm A8, DIN333	573 770 271 220
	Set of taps HSS, DIN 352/371 5 taps M3-M8	781 300
	Taps HSS, DIN 352/371 M3 (shaft ø3.5 mm) M4 (shaft ø4.5 mm) M5 (shaft ø6 mm) M6 (shaft ø6 mm) M8 (shaft ø8 mm)	781 301 781 302 781 303 781 304 781 305



Placing the coolant hoses



Coolant tank



Rear side of the machine

Coolant attachment (Accessory)

Order no. F1Z 730
Coolant capacity approx. 35 l
Conveying capacity at the nozzle approx. 3.5 l/min

All bores, connections and chips screens are already contained in the basic machine.

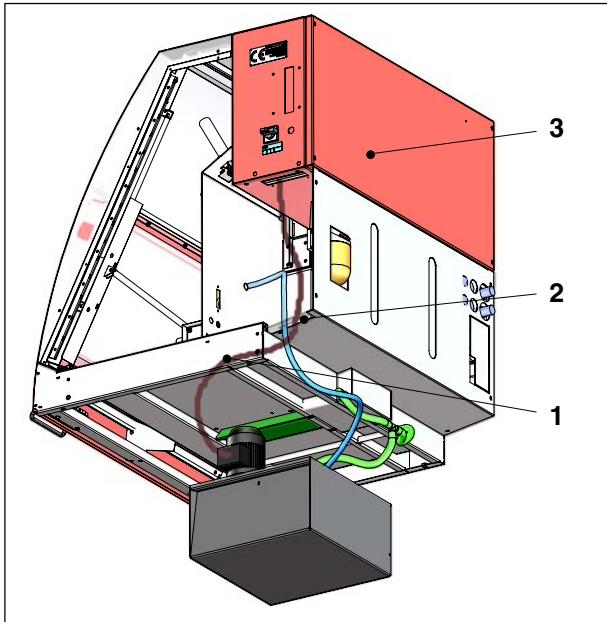
Mounting the coolant attachment



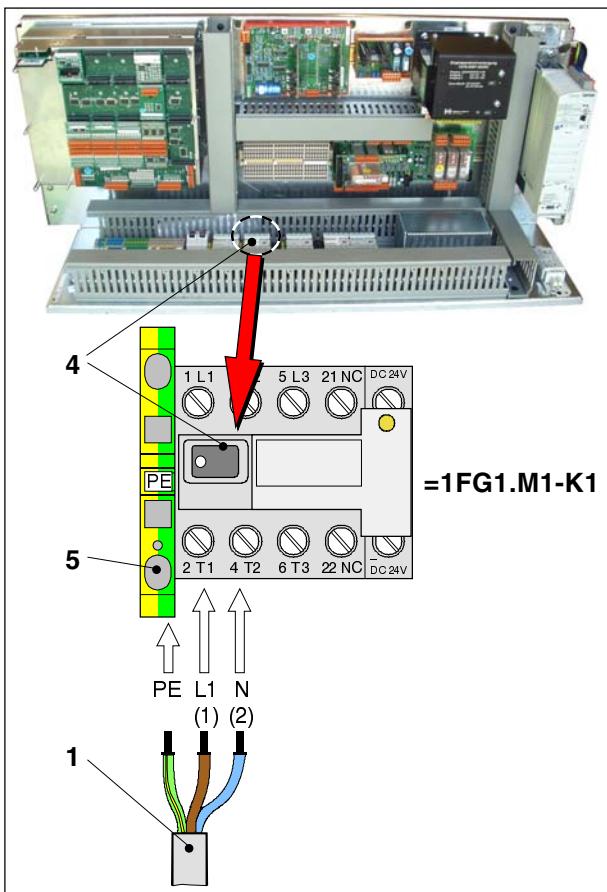
Danger:

The coolant attachment may only be mounted during standstill of the machine!
 (Switch off main switch of machine!)

- Screw level indicator (9) onto coolant tank.
- Unscrew back panel (6) of the machine.
- Mount premounted unit, consisting of plug valve (2), pipe coupling (4) and flexible coolant hose with nozzle (1) at the bulkhead (3) through the bore ø21.
 For this purpose use flat hexagon nut R½".
- Thread coolant hose ø15 x 3700 mm (5) through the opening (7) at the machine.
 Connect hose with enclosed hose fittings at the pipe coupling (4).
 Connect second end of the hose (5) at the pressure exit of the coolant pump (8).
 Mind to place the hose so that no siphon traps result where inclusions of air might form (if nec. shorten hose)!
- The two short hoses ø16 x 400 mm (12 and 14) are to be mounted with hose clamps at the drain hoses of the machine.
 The other two ends of the hoses connect with the T-fitting (13).
- Mount long hose ø16x1100 mm (10) at the free connection of the T-fitting.
 Pass second end through the bore at the cover (11) of the coolant tank.
 Plug the hose max. 10 cm into the coolant tank, to make shure that the coolant can flow into the tank (mark with binder).



Placing the cables in the electrical cabinet



Connection of the cable in the electrical cabinet

Electrical connection



Danger:

The electrical connection of the coolant attachment may only be established by an electrical expert. Prior to the connection the machine must be separated from the mains.

- Unscrew cover of electrical cabinet (3).
- Thread cable (1) of the coolant pump through the opening (2) and then into the electrical cabinet.
- Connect cable cores L1 or 1 and N or 2 at the contactor "=1FG1.M1-K1" (4) at the terminals "2 T1" and "4 T2".
- Connect earthing core at the earthing terminal (5) at the left beside the contactor.
- Remount cover of electrical cabinet back panel.

Switch-on/off of the coolant attachment

The coolant pump is switched on and off by pressing the coolant key at the operating panel or via an NC program (also see software description).

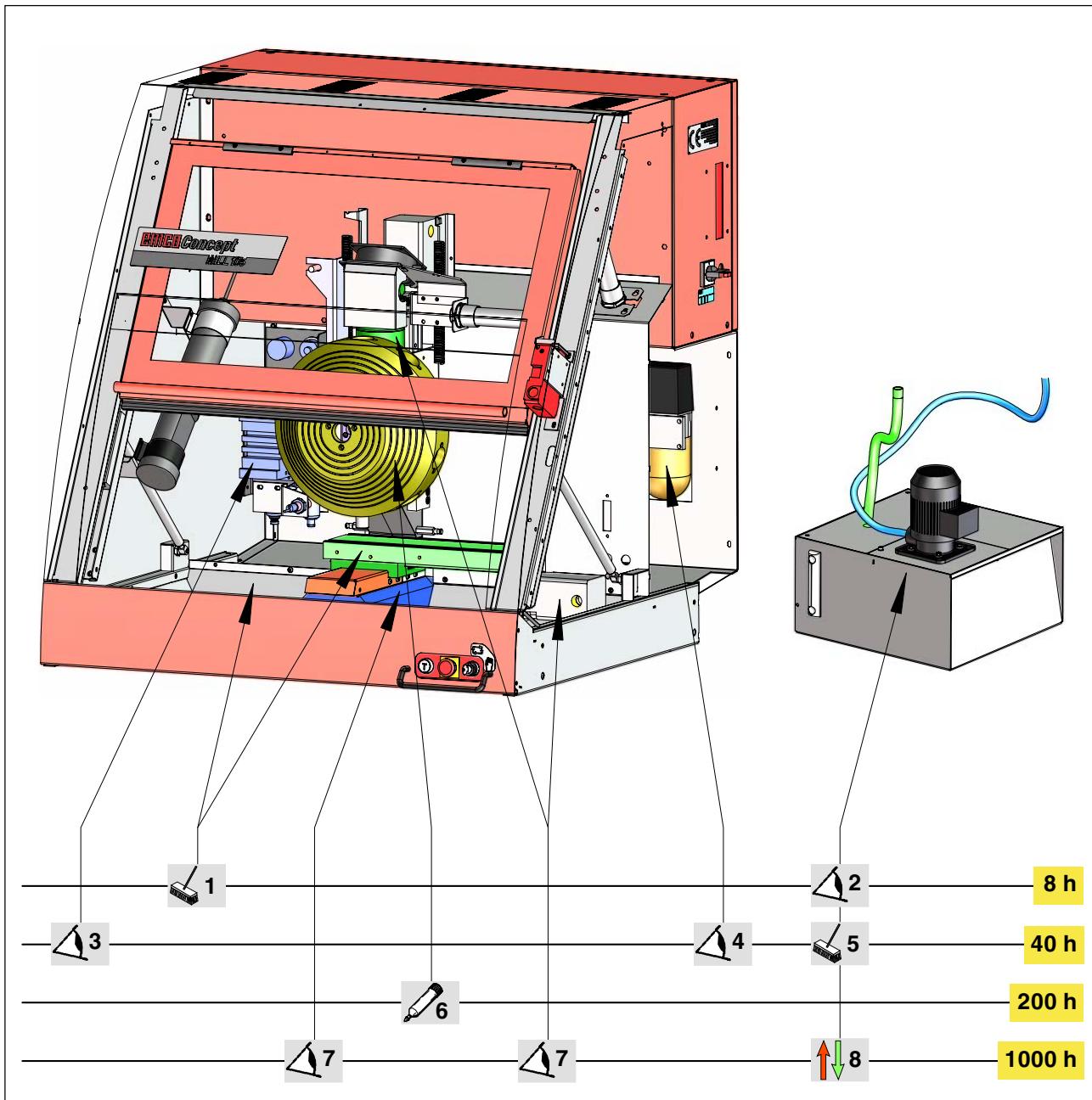
In addition there is a plug valve at the flexible coolant hose for regulating the flow quantity.

"Ctrl + 2" or



C Maintenance of the machine

Survey



Danger:

All maintenance work may only be carried out with the machine switched off.



manual lubrication (lubricating nipple)



clean



check, if necessary supplement



exchange

No.	Lubrication point	Activity/lubrication	Interval [h]
1	Working area, milling table	clean	8
2	Coolant level	check	8
3	Pneumatic maintenance unit	check	40
4	Central lubrication	check oil level	40
5	Coolant container	clean	40
6	Tool magazine slide	oil (slideway oil)	200
	Milling spindle pressure piece	oil (slideway oil)	200
7	Belt tension main motor and feed motors	check	1000
8	Coolant	change	1000

Filling quantities

Container	Quantity
Central lubrication	0,7 l
Pneumatic oiler	4,5 cl
Coolant tank	35 l

Lubricant recommendations

Application	Denomination acc. to DIN	Recommendation	
Central lubrication Tool turret slide	Slideway oil: CGLP DIN 51502 ISO VG 68	BP CASTROL KLÜBER MOBIL OMV TRIBOL	Maccurat D68 Magnaglide D 68 Lamora Super Pollad 68 Vactra 2 Glide 68 1060/68
Compressed-air oiler	Pneumatic oil: DIN 51524 ISO VG32	CASTROL MOBIL	Magnaglide D 32 HLP 32

Chlorin-free Coolants

Hints for cooling lubricant selection:



An incorrectly selected or used cooling lubricant may show decisive effects on the manufacturing process and thus, cause high costs indirectly.

process and thus, cause high costs mainly. After the end of service life cooling lubricants represent special waste that need supervision and have to be disposed of adequately. The disposal costs occurring are of decisive influence on the economy of the cooling lubricant use.

If machining is carried out with high power, the main task of a cooling lubricant consists in an effective cooling of tool and workpiece. Therefore use of water-soluble cooling lubricants is to be preferred.

For complicated machining processes better results can be achieved with non-water soluble cooling lubricants.

High efficiency for flushing away the chips is influenced less by the type of cooling lubricant than by the kind and arrangement of the cooling lubricant nozzles as well as by the quantity and pressure of the cooling lubricant stream.

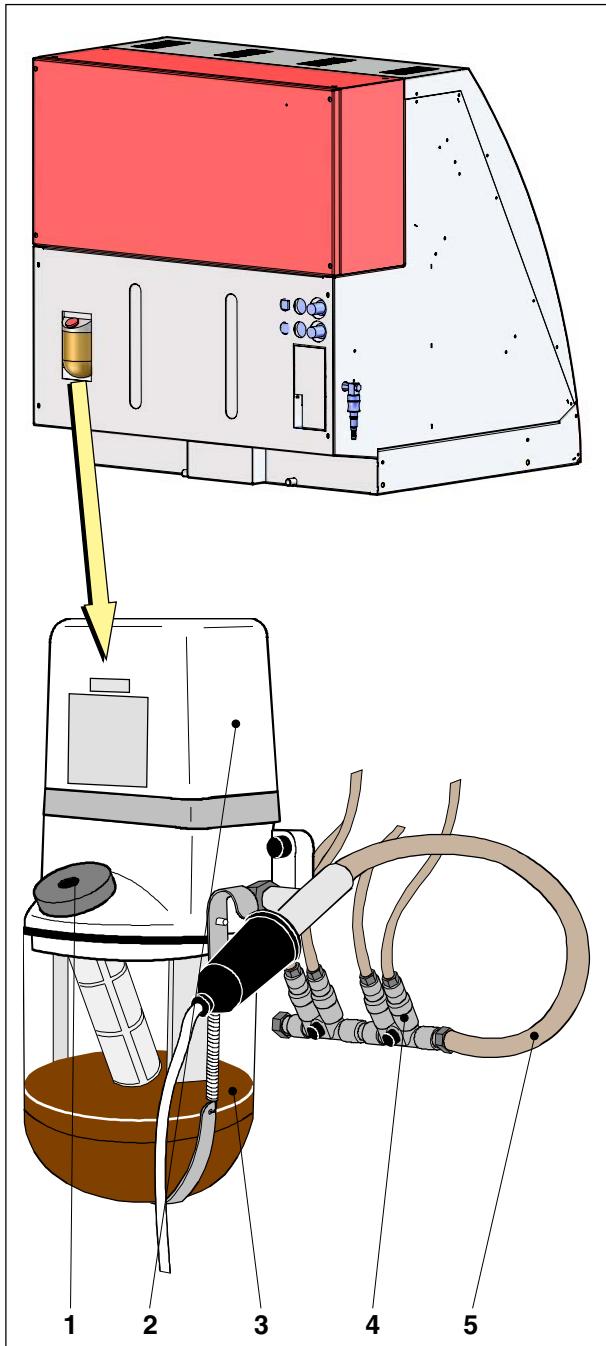
In addition the following items are to be observed:

- Disposal (cleavage-, decomposition property)
 - Content mateials (chlorine, nitrite, phenols, etc.)
 - Corrosion protection
 - Viscosity
 - Resistance to aging, serving life
 - Resistance against microorganisms
 - Emulsifying capacaty
 - Foaming behaviour
 - Dirt elimination property
 - Wetting capacity
 - Filtering capacity
 - Transparency
 - Compatibility with metals, plastics
 - Residual behaviour
 - Inflammability
 - odour
 - Compatibility with health (formation of mist, skin compatibility, toxicity, cancerogenity,...)

Non-water soluble cooling lubricants are generally without problems.

Problems occur with the formation of mist and chip deoiling.

Central lubrication



Central oil lubrication

Longitudinal and cross slides are supplied with glideway oil via the central oil lubrication. The distribution elements (4) distribute the glideway oil evenly to the lubricating points. As soon as the slide has passed a travel path of 5 m the pump (2) is switched on automatically.

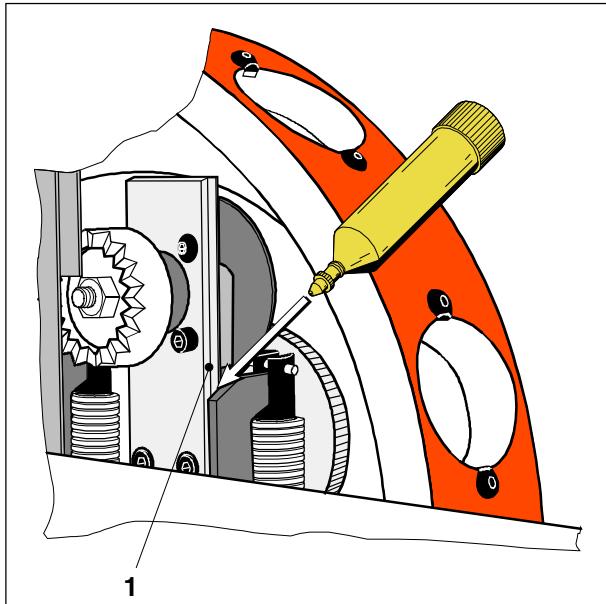
The central lubrication can also be activated manually by means of the "AUX" key or "Ctrl+8". If the "AUX ON" is pressed for a major period the pump is switched on every 6 s (also see initial start-up in chapter "A Installation of the machine").

- Check the level of the lubricant tank (3) 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

Deaerating 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 (4).

- Unscrew lubricant line (5) in front of the distribution elements.
- Carry out lubrication with "AUX" key or "Ctrl+8" until only oil is pressed out of the line (5).
- Retighten lubrication line (5).



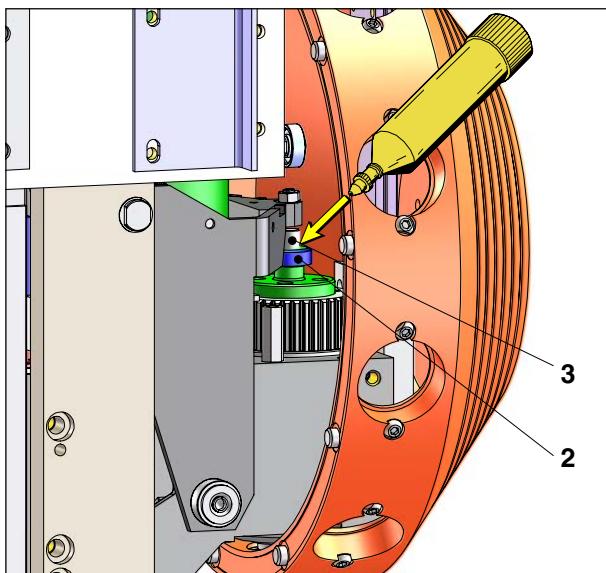
Tool magazine slide

The tool magazine slide (1) is not supplied by the central lubrication system.

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

Lubrication interval every 200 hours
Lubricant slideway oil

- Slightly oil slide (1) on both sides with slideway oil.



Milling spindle pressure piece

During the tool change procedure the toolholder is clamped and released in the milling spindle via the pressure piece.

The pressure piece is not supplied by the central lubrication system and therefore must be oiled manually in regular intervals.

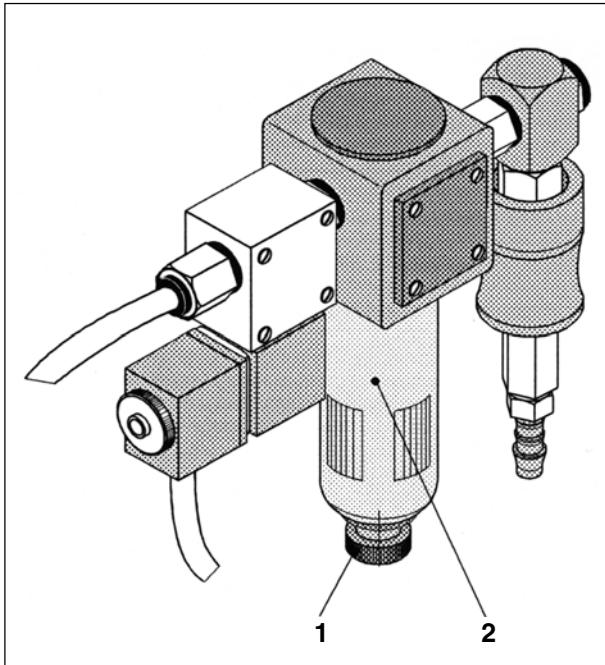
Lubrication interval every 200 hours
Lubricant slideway oil

- Drip 2-3 drops of slideway oil between pressure piece (3) and drive pinion (2).

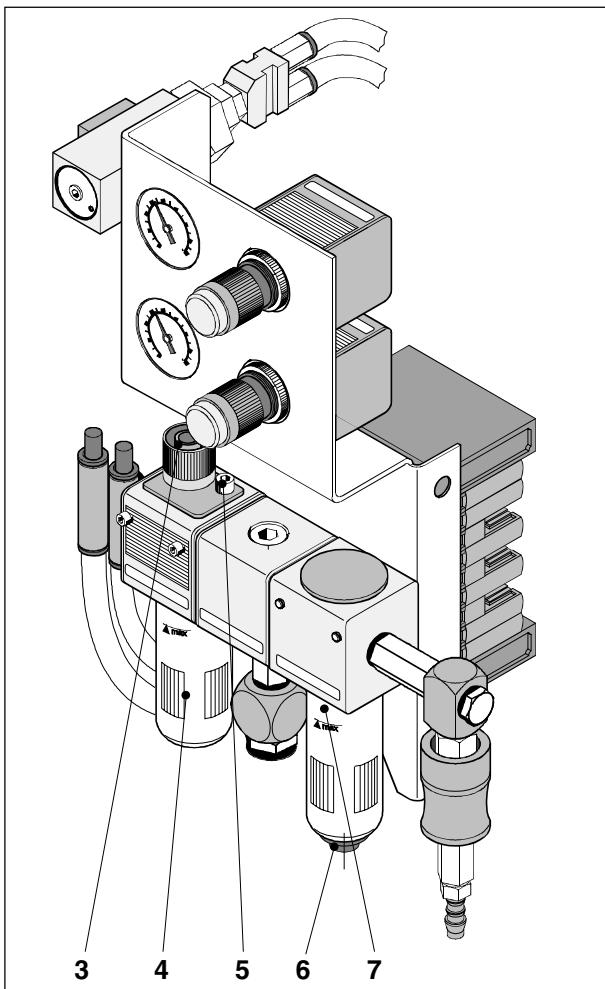
Note:

Instead of the oil-press you also may use an aerosol container with lubricant.
 But be careful, that no lubricant may be sprayed at the driving belts.





pneumatic maintenance unit (basic equipment)



Refilling the pneumatic oil

Pneumatic unit (basic equipment)

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.

Oil quality for compressed-air oiler

Pneumatic oil DIN 51 524 ISO VG 32
e.g. CASTROL Magnaglide D 32
MOBIL HLP 32

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 (7) is emptied by unscrewing the screw plug (6).

Coolant device

Cooling lubricant level

Check interval 8 h
 Exchange of the coolant 1000 h

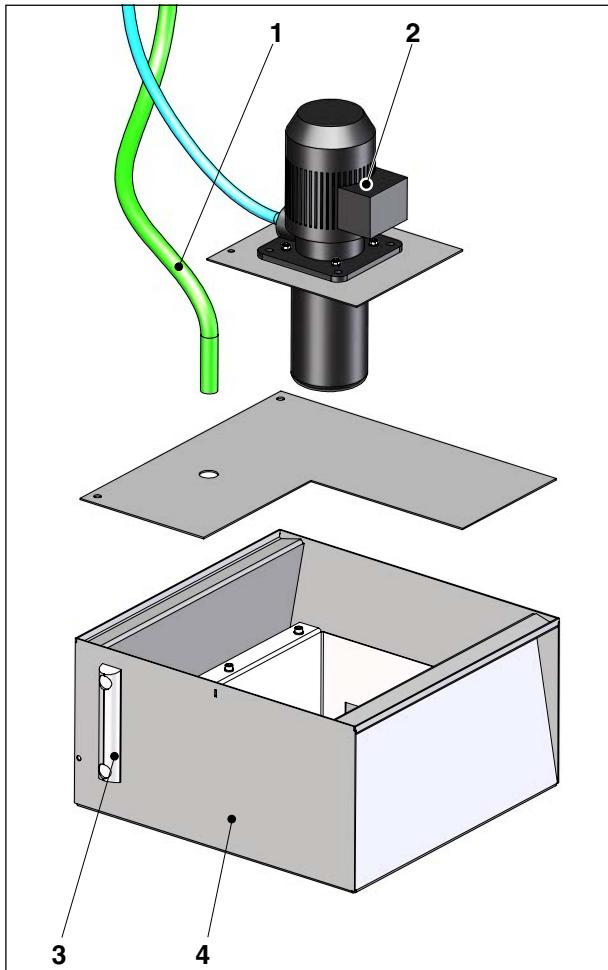
The cooling lubricant level is checked at the front side of the machine on the display (3) of the cooling lubricant tank(4).

When refilling the cooling lubricant observe the composition and the miscibility of the existing liquid (also see cooling lubricant recommendations).



Attention:

- For a regular function of the coolant pump the minimum coolant level must be 90 mm. The maximum filling level is 20mm below the container height.
- In general only use chlorine-free coolants. The chlorine part in the coolant is responsible for the rust on bright parts.



Cleaning the coolant tank

Cleaning the coolant tank

Cleaning interval 40 h

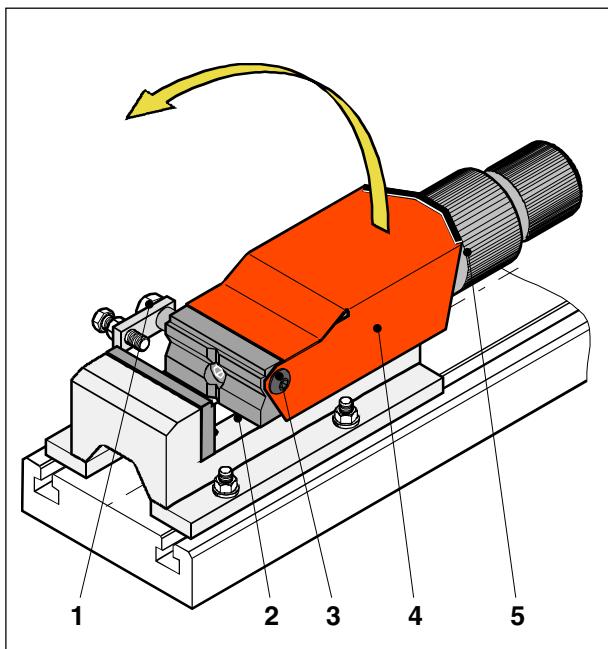
- Take out coolant pump (2).
- Remove dirt from coolant tank (4).
- Check return flow line (1) for cleanliness and rinse it if necessary.
- Mount pump (2).



Notes:

- Dispose cooling lubricants acc. to environmental requirements (special waste!).
- Do not use fluorine chlorinated hydrocarbons (e.g. trichloroethylene, trichloroethane etc.) for cleaning the tank!
- During cleaning mind complete elimination without residues of deposits! Remaining contaminations are sites of growth for bacteria which attack the newly filled emulsion and reduce its service life.
- Dirty cleaning rags (cleaning paper) have to disposed of as special waste.

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).