

Emco Concept Mill 55

PC-controlled milling machine for training



Machine Description Emco Concept Mill 55

Ref.-No. EN 2055 Edition A2003-09

EMCO Maier Ges.m.b.H.

P.O. Box 131

A-5400 Hallein-Taxach/Austria

Phone ++43-(0)62 45-891-0

Fax ++43-(0)62 45-869 65

Internet: www.emco.at

E-Mail: service@emco.co.at

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.

All rights reserved, duplication only upon authorization of Messres. EMCO MAIER
© EMCO MAIER Gesellschaft m.b.H., Hallein/Taxach 2003

Contents

Adequate use	7	8 Position Tool Changer (option)	29
Warranty conditions for new EMCO machines	7	Technical Data	29
Safety recommendations	8	General Notes	29
Technical Data of the Machine	10	Tooling the magazine	30
PC-Configuration	12	Error messages of the tool changer	31
Declaration of conformity	13	7055 Open tool clamping system	31
		7057 Tool holder occupied	31
		7058 Move axis in basic configuration	31
A Installation of the Machine		Toolholder	32
Machine acceptance	15	Order numbers	32
Machine number	15	Collet holders	33
Electrics number	15	Maintenance of collets and collet holders	33
Scope of supply	16	Mounting the collets	33
Basic machine	16	Dismounting the collets	33
Further Options	16	Clamping the tools into the collet holder	34
Control software - Option (11)	16	Clamping ranges	34
Transport of machine	17	Working ranges of the tools	35
Dimensions of machine	17	Shell end mill arbor	36
Installation criteria	18	Clamping the tools in the shell end mill arbor	36
General	18	Working ranges of the tools	37
Installation site	18	Tap holder	38
Ergonomy	18	Clamping tools in the tap holder	38
Electrical connection of the machine	19	Working ranges of the tools	39
Adjustment of the required supply voltage	19	Engraving Spindle	40
Modification on transformer for 100V mains supply	19	Technical data	40
Connection of the power cable	20	Range	40
Connection machine - PC	20	Mounting the high speed spindle unit	40
Initial start-up	20	Mounting the collets	41
Switch On/Off Sequence	21	Mounting the tools	41
Switch On the Machine	21	Changing the belt	41
Manual Referencing	21	Working range of the engraving spindle	42
Automatic Referencing	21	Clamping devices for workpieces	43
Approach Reference Point	21	Clamping rails	43
Switching off the machine	22	Mounting the clamping rails	43
		Clamping the workpieces	43
		The machine vice	43
		Mounting the machine vice	43
		Incremental straps	44
B Description of the Machine		Automatic door mechanism (option)	44
Machine Elements - Survey	23	Robotics interface (option)	44
Points at the Machine	24	DNC-interface (option)	44
Machine zero point M	24	Tools	45
Reference point R	24	Milling tools	45
Workpiece zero point W	24	Boring tools	46
Tool-holding fixture reference point N (T)	24	Determination of the tool length Z with the gauge	46
Working area	25	Technological data	47
Working area in X- and Y-axes	25	1. Cutting speed V	47
Working area in Z-axis	25	2. Speed S	47
Limitation of traversing paths	25	3. Feed F	47
Coordinate system	25	Determination of the speed S during milling and drilling	48
Slides	26	Determination of the cutting depth t during milling	49
Slide drives	26	Determination of the feed speed F during milling	49
Milling spindle	26	Determination of the feed speed F during drilling	50
Safety package	27	Characteristic curve on the milling spindle	51
Key switch	27	Machine Lamp (Accessory)	52
EMERGENCY-OFF key	27	Mounting	52
Standard milling head	28	Electrical Connection	52
Mounting the toolholder	28	Maintenance of the machine	53
Dismounting the toolholder	28	Slideway oil	53

Adequate use

The machine is designed for milling and turning work of machinable metals (aluminium, brass and, to a limited degree, steel) 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. Occuring defects must be immediately reported to the EMCO representative or the next EMCO service department with detailed description of the defect in written or oral form, followed by a written verification.
4. Defects which are correctly reported and under warranty will be corrected by either repair or replacement delivery to the original buyer free-of-charge; defective parts are to be returned to EMCO or the EMCO authorized representative, freight prepaid, if requested.
5. Warranty for spare parts: Emco guarantees to the original buyer that, only those parts sold directly by Emco or through an authorized representative will be free from defects, which render part commercially unacceptable in material and workmanship, for a period according to applicable national law, at least three (3) months, but not to exceed six (6) months from the date of initial shipment or installation by Emco or its representative.
In the case of repeated claims for the same part: Warranty replacement does not extend the period of the original warranty.
6. There is no claim of warranty for defects which occurred by:
Negligence of operating instruction manuals, safety and handling regulations or other instructions regarding delivery, installation, set-up or usage of the machine, incorrect set-up resp. installation, as well as, unauthorized, not expressed regulated or allowed alternations 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 electrician 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]	190
Slideway cross (Y axis)	[mm]	140
Slideway vertical (Z axis)	[mm]	260
effective Z-stroke standard / with tool changer	[mm]	190 / 120
Distance spindle nose - table surface	[mm]	77-337
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]	ø35
Type of bearing		spindle bearing
Toolholding fixture similar to DIN7920 - SK30		works standard
Tensioning bolt		works standard
Tool clamping		manually
Max. tool diameter standard / with tool changer	[mm]	ø60 / ø40
Milling spindle drive		
Rotary current motor AC		
Max. power	[kW]	0,75
Speed range (infinitely variable)	[min ⁻¹]	150-3500
nominal torque at the milling spindle	[Nm]	3,7
max. speed with high speed spindel unit (accessory)	[min ⁻¹]	14 000
Tool changer (option)		
"pick-up"-System with swivel arm, complete with pneumatic-unit and blow-out device		
Number of tool stations	[1]	8
Max. tool weight	[kg]	1
Max. tool diameter	[mm]	ø40
Speed of tool swivel arm	[m/min]	10
Tool clamping		automatically
Feed drives		
AC step motors in X/Y/Z axis		
Step resolution	[µm]	0,5
Max. feed force X/Y/Z	[N]	800 / 800 / 1000
Working feed in X/Y/Z (infinitely variable)	[m/min]	0 - 2
Rapid traverse speed X/Y/Z	[m/min]	2
Medium positioning variation X/Y/Z according to DIN VDI 3441	[µm]	8 / 8 / 8
Lubrication system		
Guideways, feed spindle nuts		oil-lubrication
Main spindle		life time lubrication

Subject to technical modifications!

Pneumatic unit (option)		
Pneumatic unit for options with pneumatic operation		
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		
Dividing head (option)		
Dividing head completely with covers and material for mounting on milling table		
Spindle height	[mm]	50
Total height	[mm]	95
Positioning		infinitely variable
Nominal torque	[Nm]	45
Rapid traverse speed	[min ⁻¹]	8
Accuracy of indexing	["]	±100
Repeating accuracy	["]	±15
Tailstock for dividing head		
Center height	[mm]	50
Cone of tailstock quill		MT1
Stroke of tailstock quill	[mm]	35
Electrical connection		
Power supply (changeable)	[V]	1/N/PE 110/230~
Max. voltage fluctuations	[%]	+5/-10
Frequency	[Hz]	50/60
Connected load of the machine	[kVA]	0,85
Max. preliminary fuse for the machine	[A-slow]	12
Dimensions, weight		
Total height	[mm]	980
Installation surface WxD	[mm]	960 × 1000
Total weight of the machine	[kg]	ca. 220
Room climate, operating conditions		
Room temperature	[°C]	12-35
Humidity rH	[%]	40-70
Sound pressure level		
Medium sound pressure level	[db(A)]	70
With the following conditions:		
Masuring method: enveloping surface according to DIN 45635		
Operating mode: maximum speed during idle running		

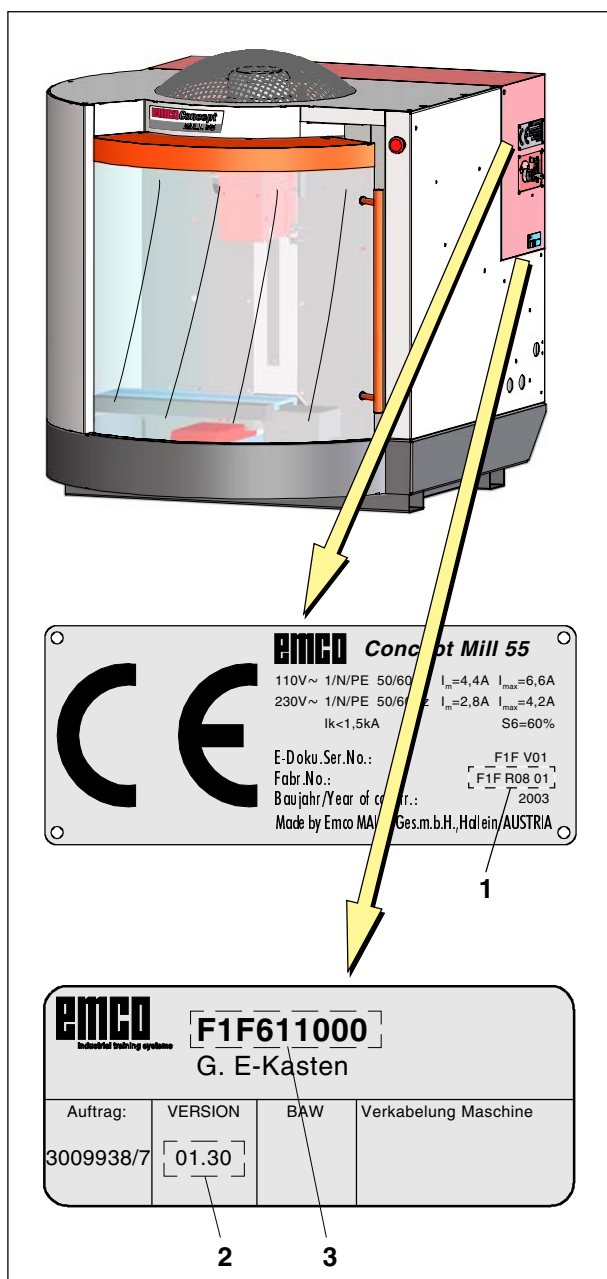
Subject to technical modifications!

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!

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 (3) followed by the version number (2).

Example of a complete electrics number:

F1F 611 000 V1.30 (see illustration)

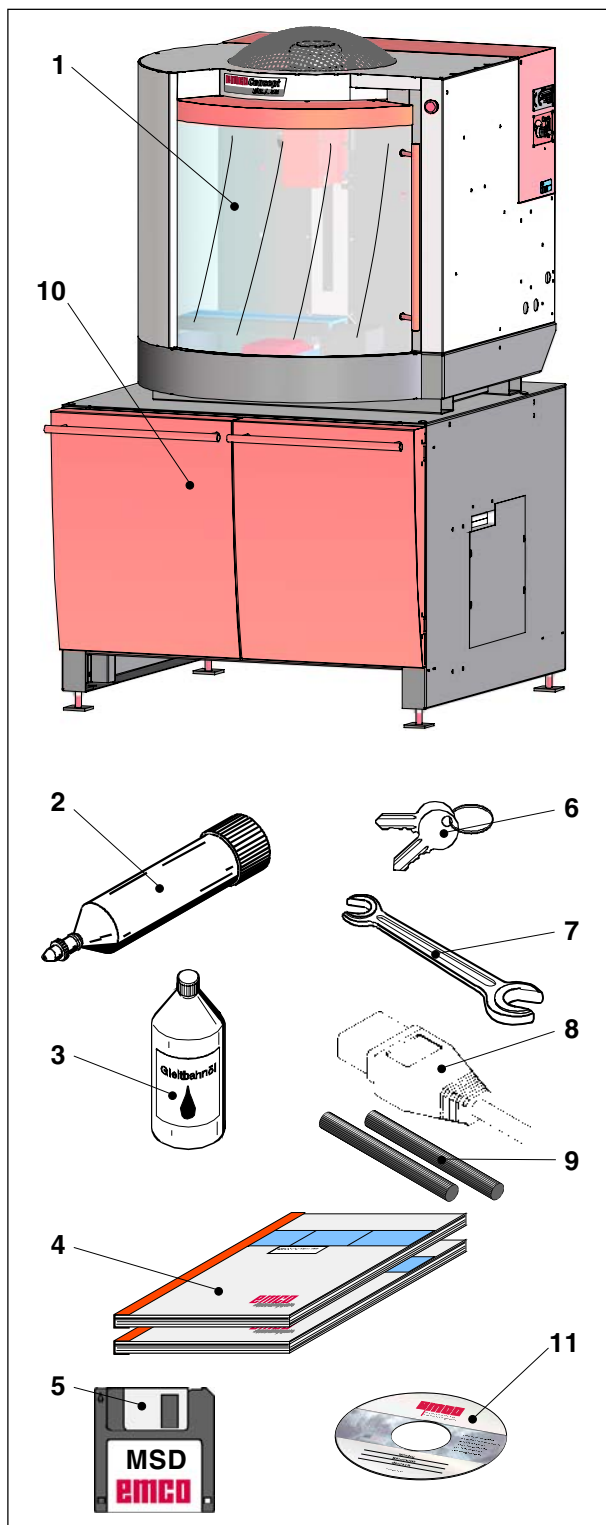
Note:

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 677 915** 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 55 with:
 - full shell with chip tray
 - complete electric equipment
 - safety devices according to CE-standard
- (2) oil gun
- (3) 1 bottle (0.25l) of slideway oil
- (4) machine description and electrical documentation
- (5) disk with machine data (MSD)
- (6) 2 keys for main switch
- (7) 1 hexagonal key SW10x13
- (8) 1 power cable
- (9) 2 clamping pins

Further Options

- ☐ Machine base (10)
- ☐ 8 position tool changer
- ☐ Minimal coolant device
- ☐ Dividing head
- ☐ Automatic door
- ☐ Machine lamp
- ☐ Automatic machine vice
- ☐ Robotic-Interface
- ☐ DNC-Interface

Control software - Option (11)

- ☐ Siemens 810/820
- ☐ Siemens 810D/840D
- ☐ GE Fanuc Series 0
- ☐ GE Fanuc Series 21
- ☐ Emcotronic TM02
- ☐ Heidenhain TNC 426/430
- ☐ PAL
- ☐ Emco WinCam

Transport of machine

Transport with pallet



Attention:

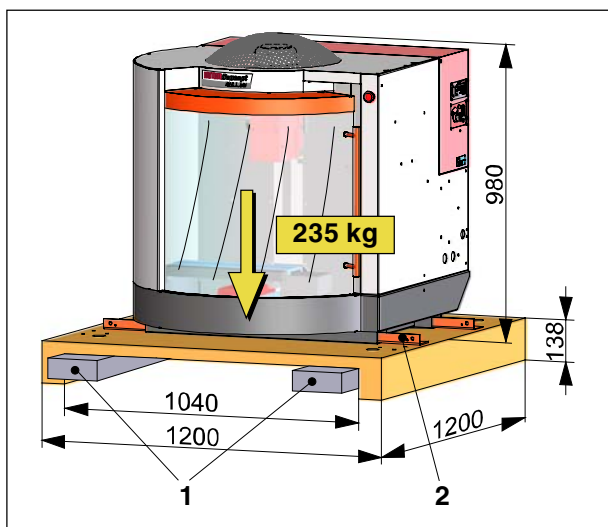
The machine may only be transported on the pallet if the machine is fixed on the pallet by means of angle sheets (2).

Note the positions of the stack forks (1).

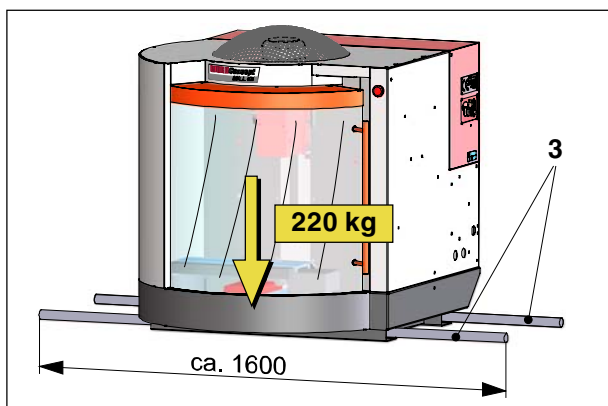
Lifting capacity min. 235 kg

Fork width 800 - 1 000 mm

Fork length min. 1 200 mm



Transport with pallet



Transport with lifting bars

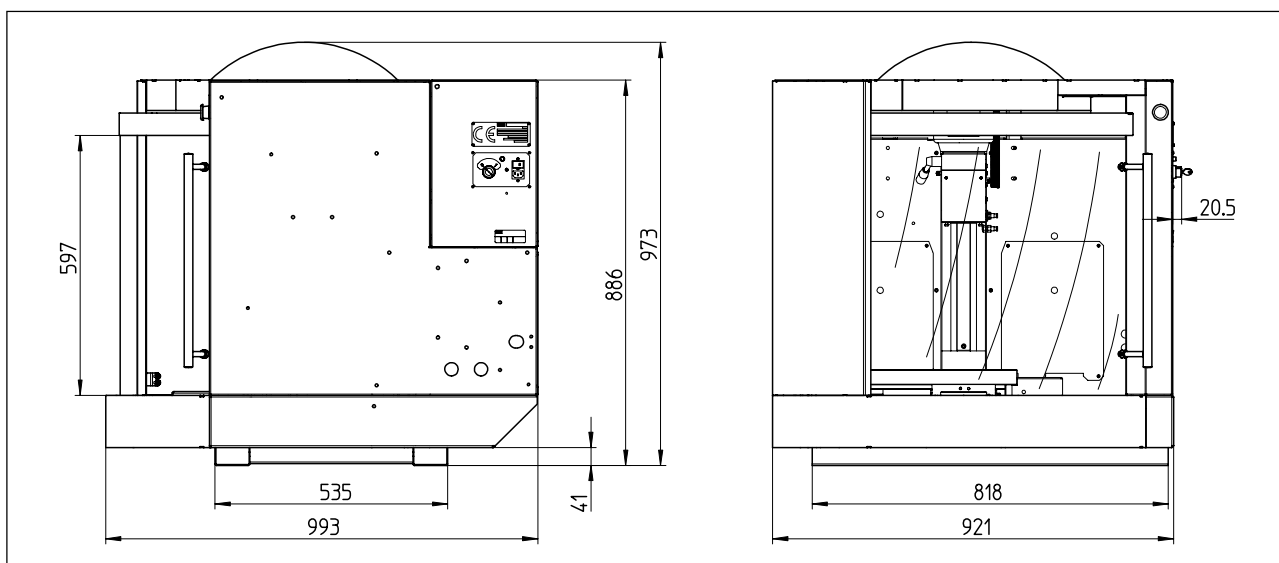
Transport with lifting bars

The machine is transported with adequate lifting bars (3) which are passed through the machine base.

Lifting capacity min. 220 kg

Lifting bars $\varnothing 35 \times$ min. 1 300 mm

Dimensions of machine



Dimensions

Installation criteria

General

The machine is to be installed on a stable base.



Danger:

Observe the carrying capacity of the table according to the machine weight!

Weight of the machine 220 kg

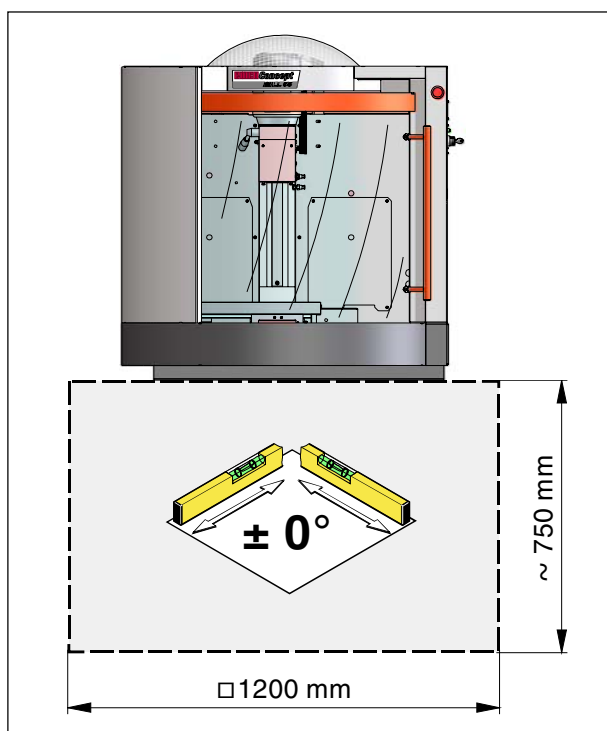
Ideal table height ca. 750 mm

Installation width × inst. depth ... 1200 × 1200 mm

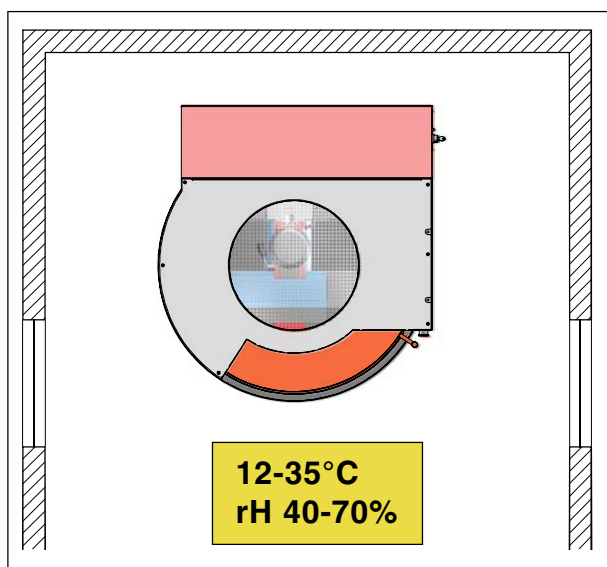
Hinweis:

Ein Maschinenuntersatz ist von EMCO als Zubehör erhältlich.

Bestell-Nr. A7Z 210



Installation possibility



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.

Electrical connection of the machine



Danger:

A ground wire contact has to be available at the socket.

Voltages: 100 V 1/N/PE ~ 50/60 Hz
110 V 1/N/PE ~ 50/60 Hz
230 V 1/N/PE ~ 50/60 Hz

Connected load: 0,85 kVA

Preliminary fuse: max. 12 A/slow

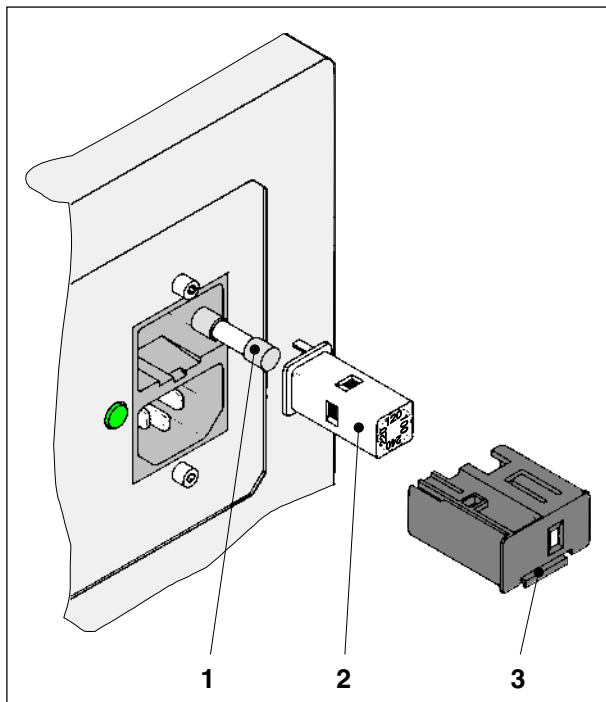
Max. voltage fluctuations: +5/-10%

Adjustment of the required supply voltage

- Push up the latch on the casing (3) and remove the casing with the fuse (1) and the selector pin (2).
- Turn the selector pin (2) in such a way that in the window of the casing (3) the following voltage setting appears:

Mains supply	Setting in control window
*100V ~	"100V" + transformer
110V ~	"120V"
230V ~	"220V"

- Put the whole unit with fuse (1), selector pin (2) and casing (3) again into the socket.



Adjustment of the supply voltage



Attention:

With the 100V mains supply there has to be done a modification on the transformer of the machine!

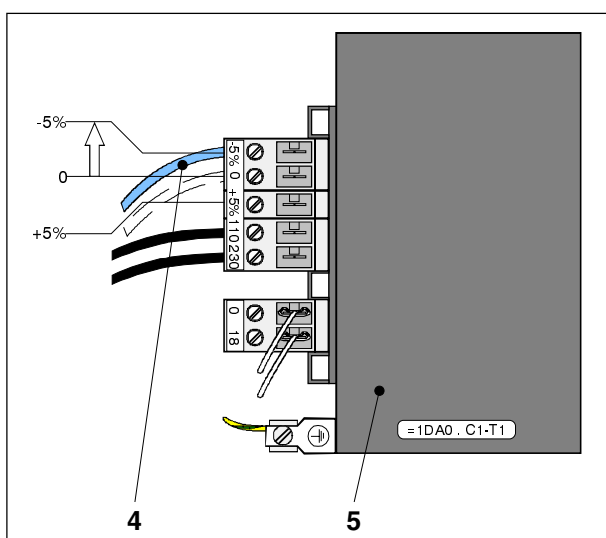
Modification on transformer for 100V mains supply



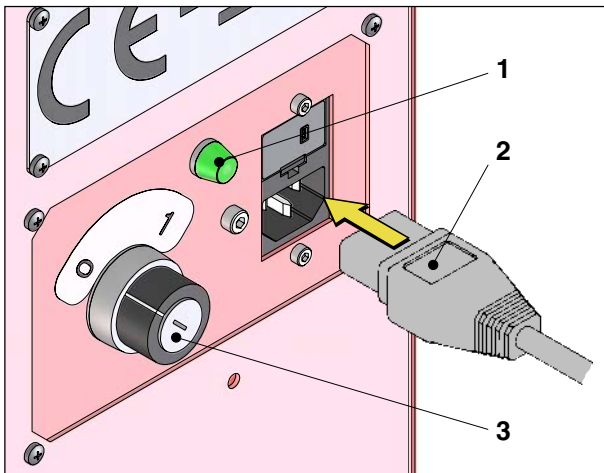
Danger:

Modifications in the electric cabinet may only be carried out by an electrician expert.

- Unscrew cover of the electric cabinet on the rear side of the machine.
- Connect blue core (4) on the transformer (5) from setting "0" to setting "-5%".
- Remount cover of electric cabinet.



100V-voltage adjustment on the transformer



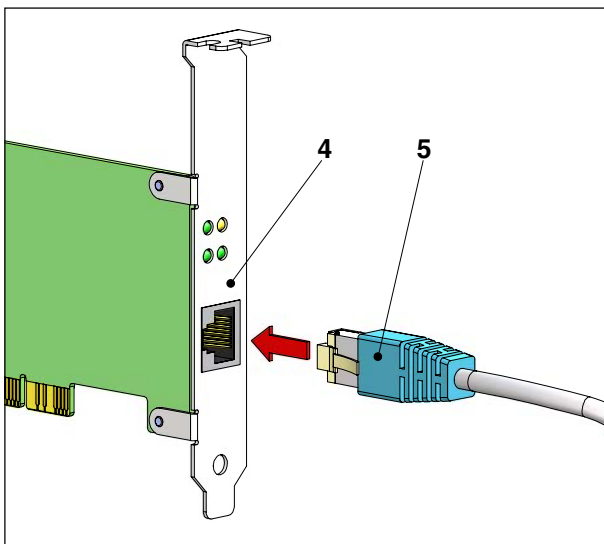
Power connection of the machine

Connection of the power cable

- Plug in the power cable (2) at the machine and the other end at a socket with ground wire contact.
- The LED (1) shows you the main supply, when main switch (3) is switched on.

Connection machine - PC

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.



Connection machine - PC-network-card

Note:

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

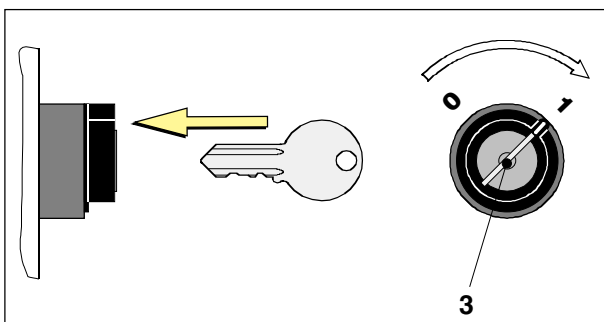
Mounting, installation and network adjustments see WinNC-Control descriptions, chapter "Installation".

Network card:Ethernet-network

- Plug in network-cable of the machine with the connector (5) at the connection of the network-card (4).

Initial start-up

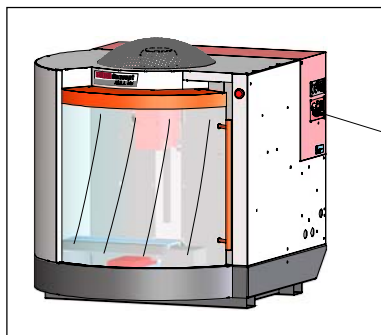
- Machine is to be cleaned from rust preventive agent with a clean cloth.
- Establish power connection.
- Switch on machine at key switch (3).



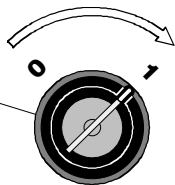
Key switch on the machine

Note:

If the machine is not used for a longer period of time, slightly oil blank parts, protect machine against unauthorized start-up (take off key) and cover machine with dust protection.



Main switch



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.


Manual Referencing

"2" or 

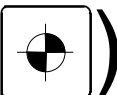
Press the -Z key
The slide traverses to the reference point in Z.

"6" or 

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

"9" or 

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

("5" or 


Machine with tool changer:

Press the Reference-key
After the X-, Y- and Z-slides are referenced, the tool changer can be referenced by pressing the reference-key.

Note:

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



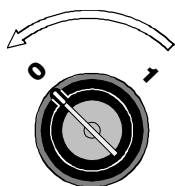
"5" or 

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



Terminate control software (WinNC).

Terminate Windows.

Switch off main switch

Lock air supply.

"Ins" or

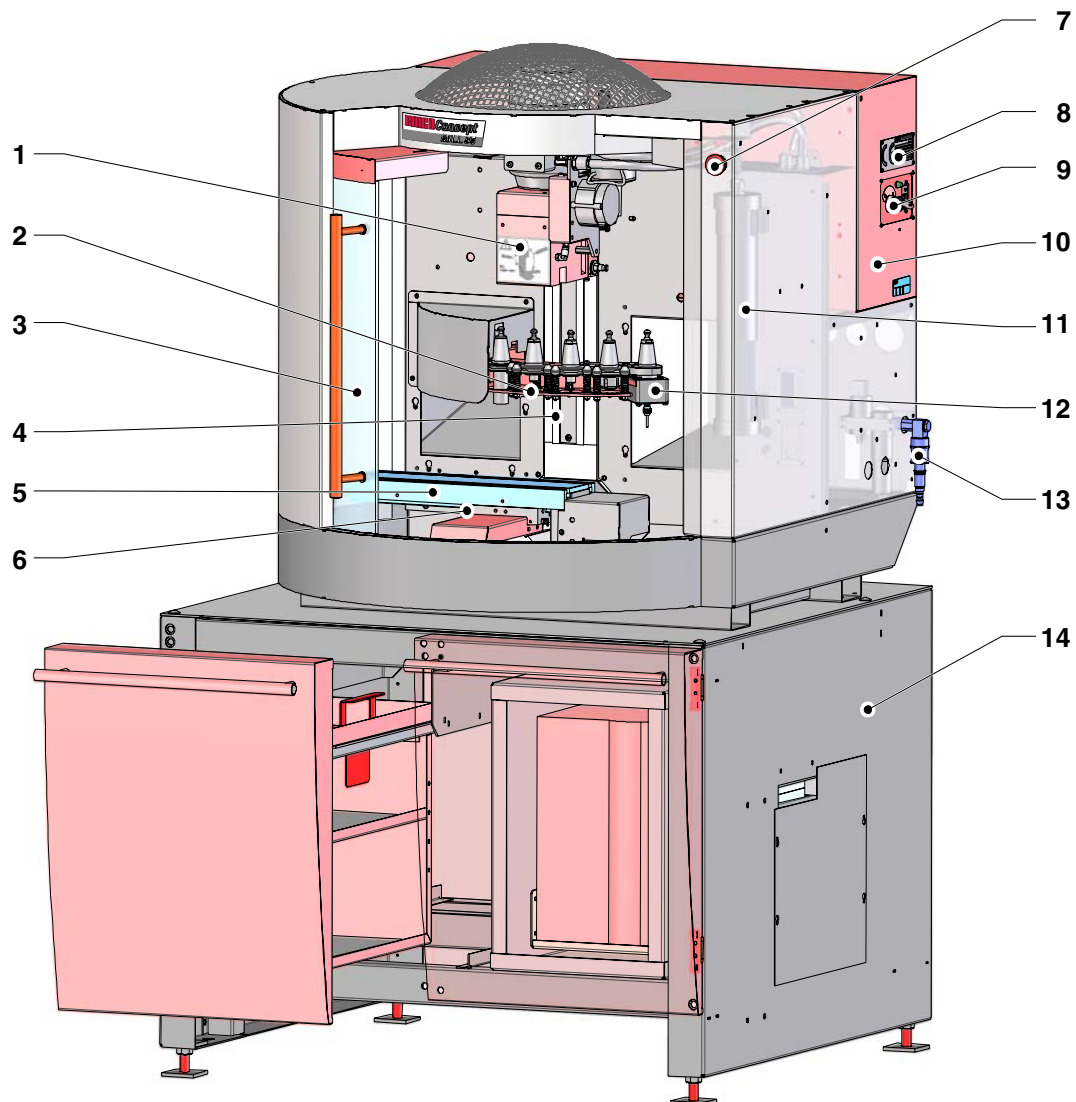


Notes

- 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.



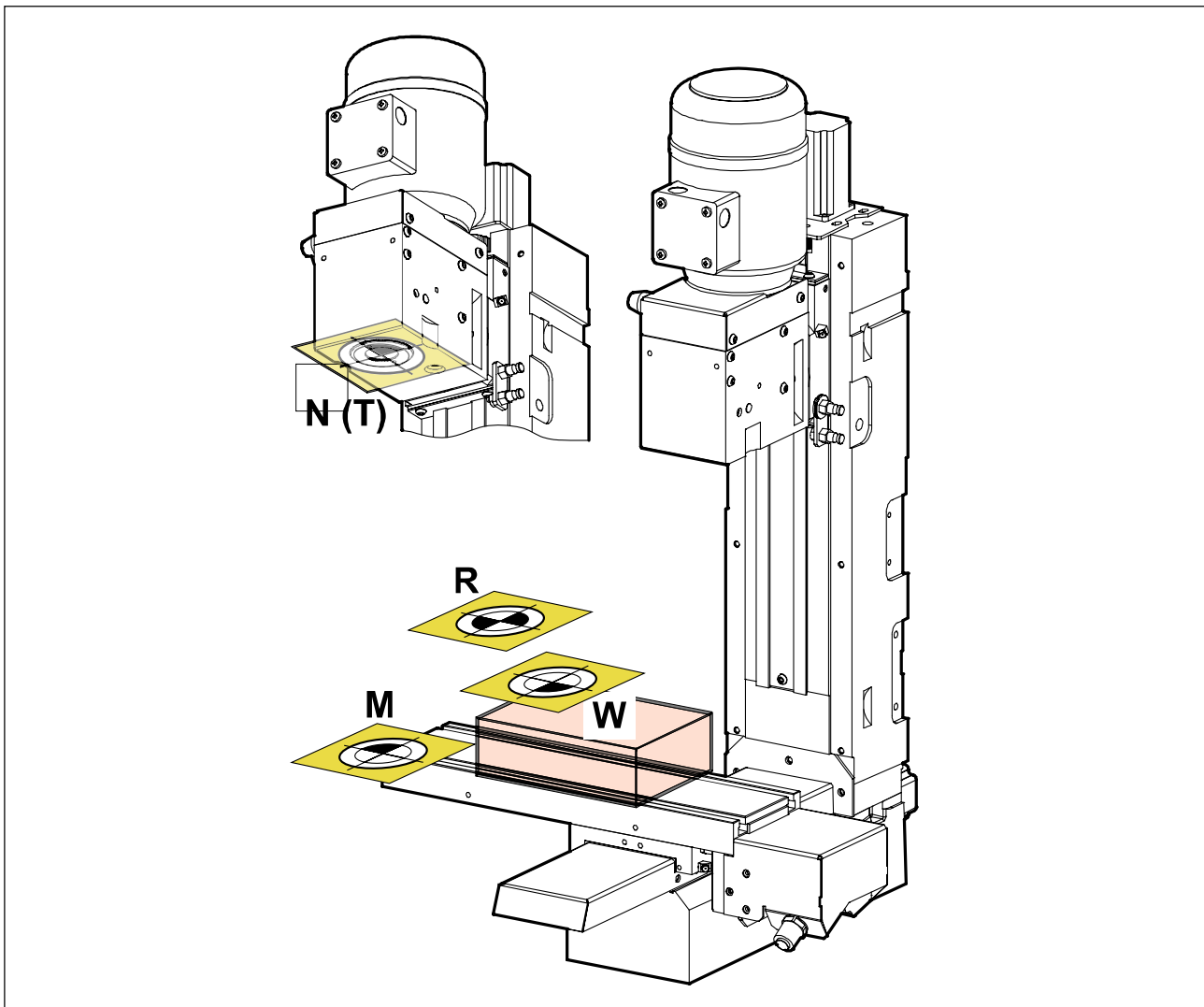
B Description of the Machine



Machine Elements - Survey

- | | |
|------------------------------------|--|
| 1 Milling head | 9 Key switch |
| 2 8 position tool changer (option) | 10 E-cabinet |
| 3 Chip guard door | 11 Machine lamp (accessory) |
| 4 Z-slide | 12 High spindle speed unit (accessory) |
| 5 Milling table with | 13 Pneumatics maintenance unit (option) |
| 6 X-, Y-compound table | 14 Machine base (accessory) with tool drawer and PC case |
| 7 EMERGENCY OFF key | |
| 8 Nameplate | |

Points at the Machine



Point at the machine

Machine zero point M

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

Reference point R

The reference point is a fixed point on the machine. It serves for the calibration of the measuring system. The reference point 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.

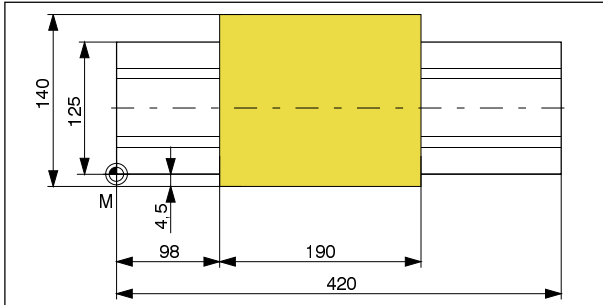
Tool-holding fixture reference point N (T)

The tool-holding fixture reference point N (T) lies exactly in the rotary axis at the front of milling spindle nose. The tool lengths are described from this point.

Working area

Working area in X- and Y-axes

Traversing path X-axis 190 mm
Traversing path Y-axis 140 mm



Traversing paths of the X- and Y-slides

Note:

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

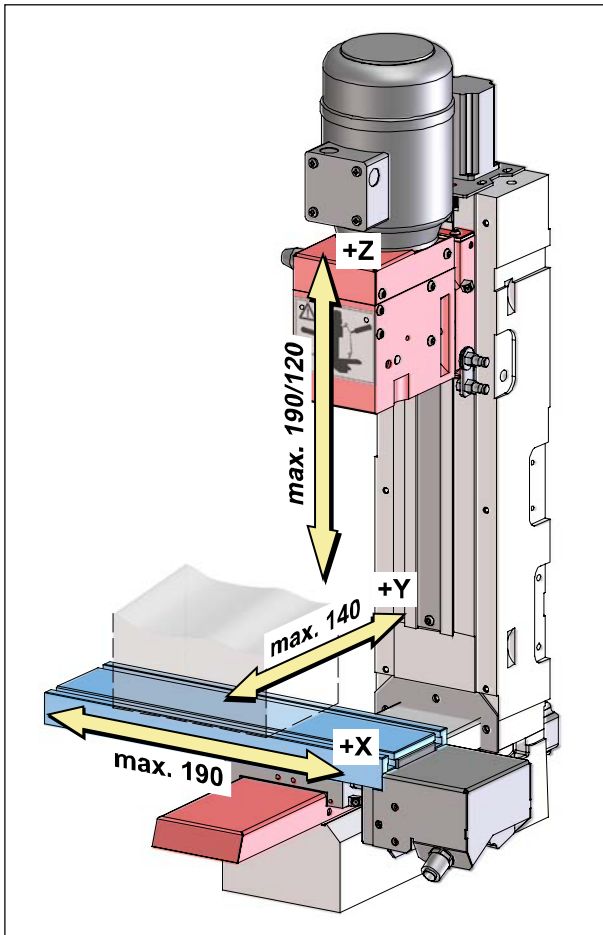


Working area in Z-axis

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

effective Z-stroke:

Standard machine 190 mm
Machine with tool changer 120 mm



Coordinate system

Limitation of traversing paths

The traversing paths of the slides are limited by software limit switches.

When reaching a software limit switch the respective feed motor stops and a message is indicated at the monitor of the control.

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

Coordinate system

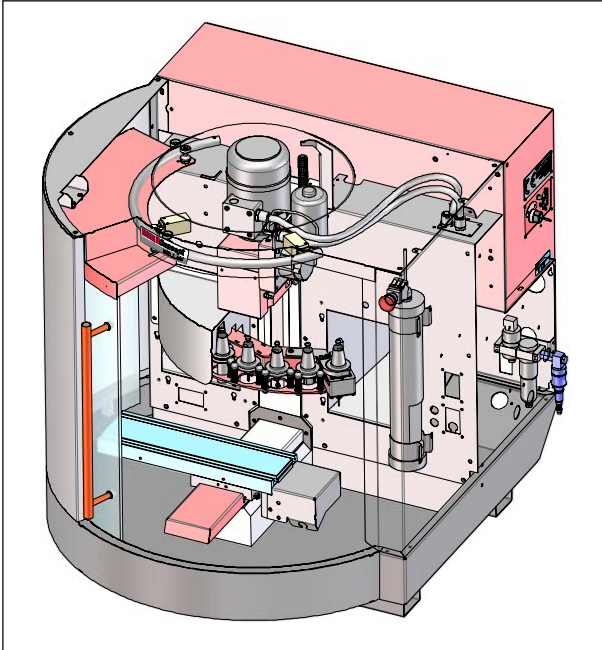
The coordinate system is turning in clockwise direction. The origin lies in the machine zero point M or in the workpiece zero point W.

Slides

The slides run in precisely ground dove-tail guides.

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

The lubrication of the slides will be done at the lubricating nipples with slideway-oil.



Slide system and milling spindle

Slide drives

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

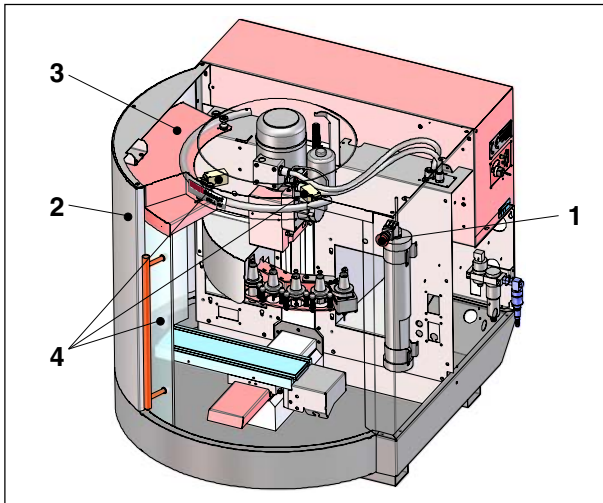
The amply dimensioned spindles, the rigid spindle nuts and the axial bearings without backlash provide high positioning and working accuracy.

Feed speed 0-2000 mm/min
 Rapid motion speed 2000 mm/min
 Step resolution 0,5 μ m
 max. feed force X-/Y-slides 800 N
 max. feed force Z-slide 1000 N

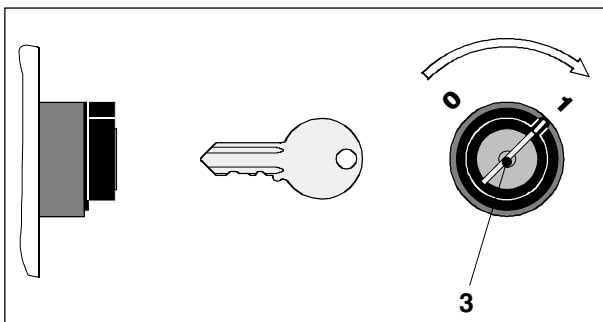
Milling spindle

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 150-3500 rpm
 Nominal torque 3,7 Nm



Working area with safety devices



Key switch at the machine

Safety package



Danger:

Modifications on safety devices as well as bridgings of control devices are prohibited!

The safety package is contained in the base machine and facilitates generally risk-free operation of the machine.

By opening the chip guard door the power supply to main and feed motors is interrupted.

The safety package comprises:

- EMERGENCY-OFF key (1)
- Protective cover around the entire working area of the machine (2)
- Protection cap (3)
- Chip guard door with limit switch (4)

Key switch



Danger:

Always take off key to protect the machine against unauthorized start-up.

With the key switch position "1" and released EMERGENCY-OFF key the machine is ready for operation.

The main and feed motors are supplied with power.

EMERGENCY-OFF key

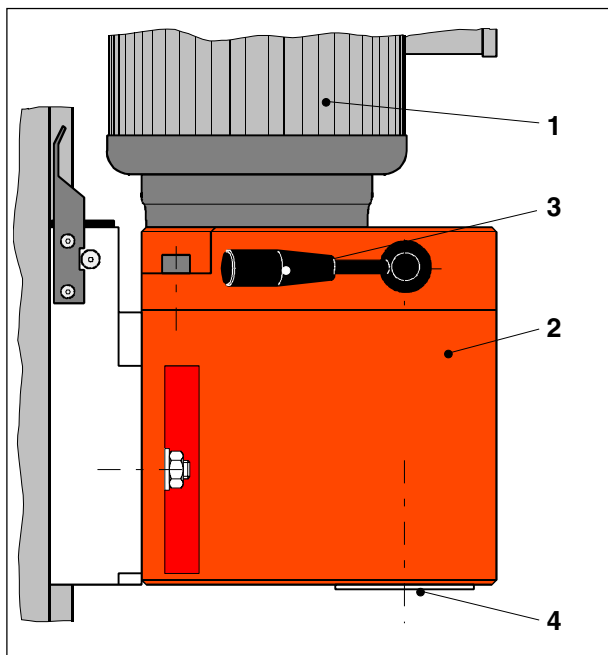


Danger:

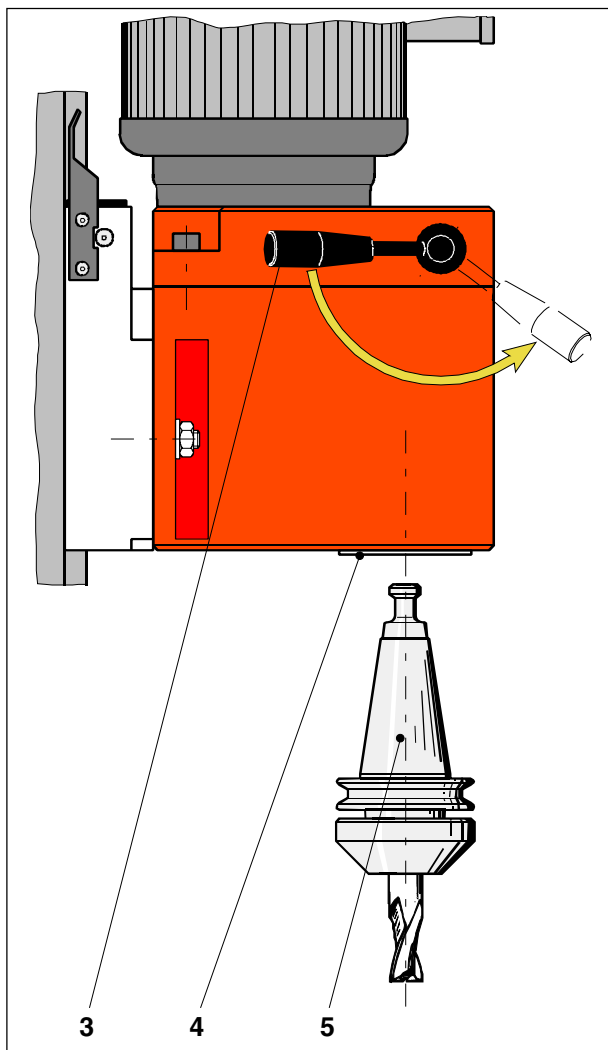
The EMERGENCY-OFF key is to be actuated immediately in any hazard situation.

When actuating the EMERGENCY-OFF key (1) the power supply to the main and feed motors is interrupted.

For unlocking turn knob in clockwise direction.



Milling head



Mounting and dismounting the toolholder

Standard milling head

In the milling head (2) the milling spindle (4) with the inner cone and the clamping device (3) for the tool support are placed.

The drive motor (1) for the milling spindle is mounted on the milling head .

Mounting the toolholder



Danger:

- Mounting and dismounting the toolholder may only be carried out during machine standstill.
- Due to the modified DIN tool support only toolholders bought particularly for this machine from EMCO may be clamped.

- Pull forward spring-weighted clamping lever (3) until stop (turn to the right) and hold in this position.
- Insert toolholder (5) into the support (4). Do not release the toolholder.
- Let clamping lever (3) swivel back slowly (lever turns to the left).
- The toolholder (5) is clamped into the tool support (4) by the spring power.



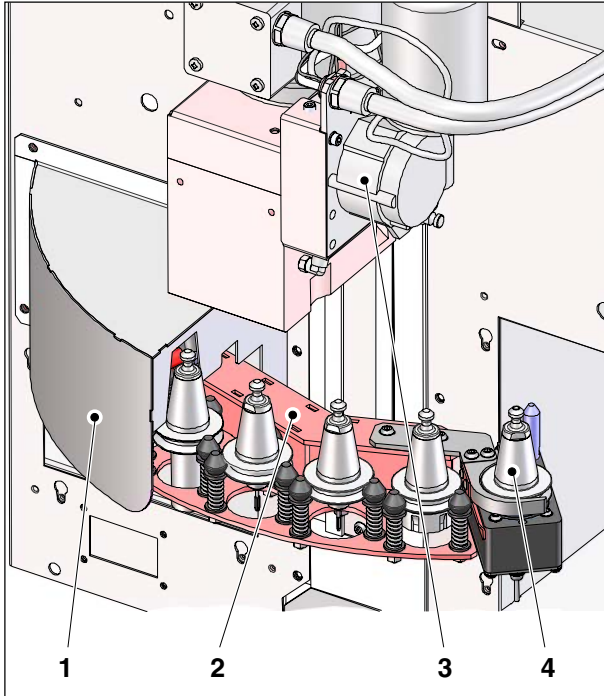
Note:

When mounting the toolholder clamping taper of the toolholders and inner cone of the tool support must be free of dirt and grease.

Dismounting the toolholder

- Hold fast toolholder (5).
- Pull forward clamping lever (3) (turn to the right) with the other hand .
- The toolholder (5) falls out of the tool support (4).

8 Position Tool Changer (option)



8 position tool changer

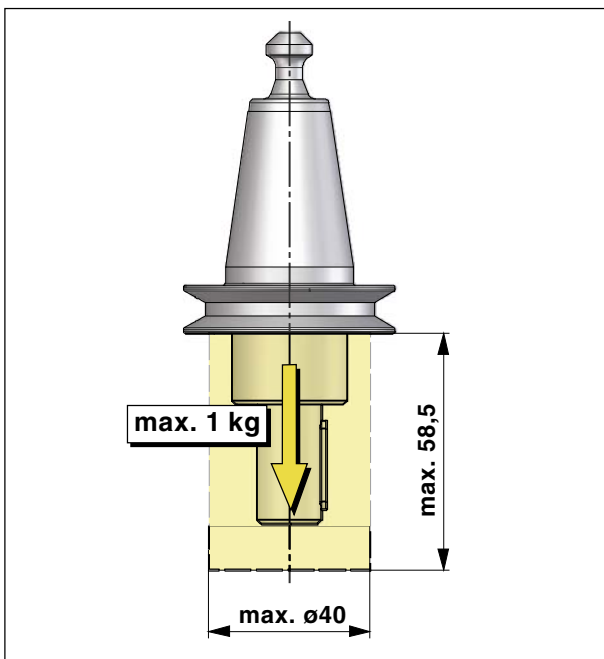
The tool changer will be delivered as option, he will be mounted by manufacturer, and isn't retrofittable.

Essentially he consists of the tool magazine (2) with the magazine cover (1) and the automatic clamping device (3) with integrated blow-out device.

The magazine arm is to be driven by a gear drive with A.C. step motor.

Technical Data

Number of tool supports	8
Max. tool weight	1 kg
Max. tool diameter	ø40 mm
Traverse rate of tool magazine	10 m/min

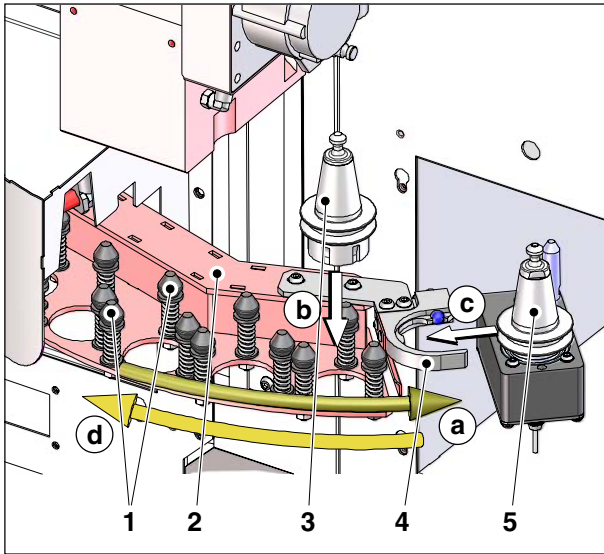


max. tool dimensions

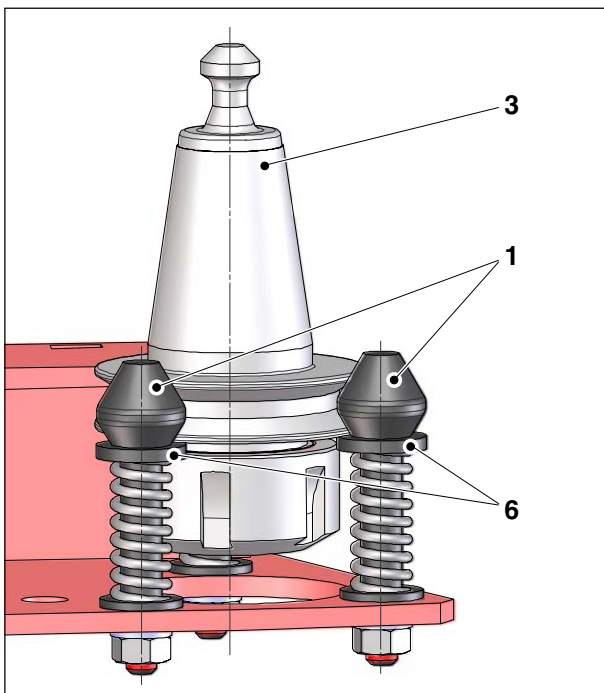
General Notes

- For operating the tool changer, compressed air will be needed (blowing-out the taper shank of the milling spindle during tool changing)
- The accessory engraving spindle (4) may only be mounted at the position 1 of the tool magazine.
- Pay attention to the maximum tool dimensions and tool weights by tooling the magazine.
- Pay attention to the cleanliness of the tool holders, to avoid damages at tools and milling head.

Tooling the magazine



Tooling procedure



engaging of the tool holder - detail

"5" or

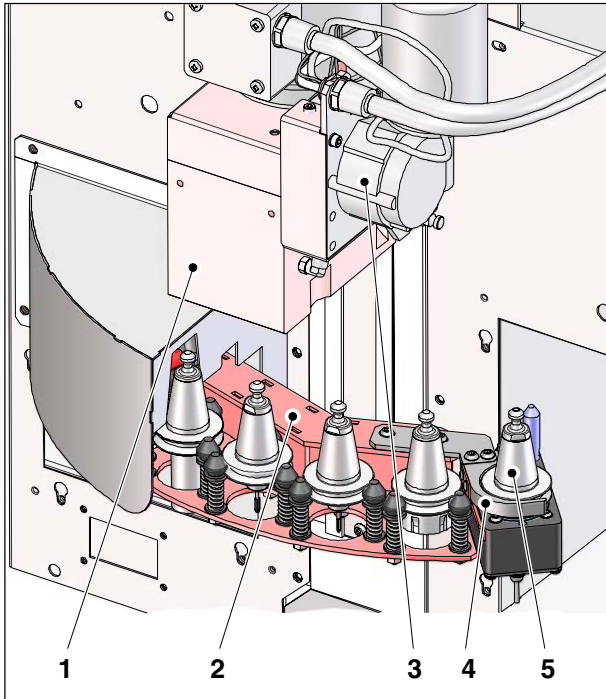


Note:

The tooling of the magazine is only possible in "MDA"- or "AUTO"-mode, **not** in "JOG"-mode.



- Set WinNC control to "MDA"- or "AUTO"-mode.
- Select the tool "**T0**" with the control.
The tool, clamped in the milling spindle will be placed in the magazine, the milling head moves upwards.
- **Machine with roation axis (dividing head):**
The milling table traverses to the software limit switches +X and +Y.
- Open machine door.
- Pull out the magazine arm (2) manually in direction of the arrow "a".
- Set-in tool holders (3) from above (direction "b") at the positions 2 to 8, until the holders engage in the holding fixtures (1) an seat at the washers (6).
- Plug in tool holder (5) for position 1 (e.g. engraving spindle) lateral into the clutch (4) until he engages (direction "c").
- Push-back the magazine arm (2) manually to end-stop (direction "d").
- Close machine door.
- On srceen of the control the message "7017 reference point".
Push keys for referencing.
The tool magazine and the rotation axis (dividing head), if activated, will be referenced, the message on screen delets.
- The clamping of the tool holder into the milling spindle is to be done with the WinNC-control.



8 position tool changer

"Ctrl + 1" or



"5" or



JOG



"5" or



Error messages of the tool changer

7055 Open tool clamping system 7057 Tool holder occupied

If the tool, clamped in the milling head (1), cannot be placed in the magazine, or the automatic clamping device (3) is in an undefined position, one of this two error messages will appear on screen.

Remedy

- Open machine door
- Unclamp tool/open clamping device:
If a tool is clamped in the milling head (1), hold it.
Press the clamp-key, the clamping device will be opened, the tool can be taken out.
- Pull out the magazine arm (2), and set the unclamped tool to the right position of the magazine.
- Push-back magazine to end-stop.
- Close machine door
- Reference tool magazine.

7058 Move axis in basic configuration

If the position of the magazine arm cannot be defined during the tool changing, the message "7058 Move axis in basic configuration" appears on screen.

Remedy

- Open machine door.
- Select the "JOG"-mode.
- Move milling head upwards (+Z).

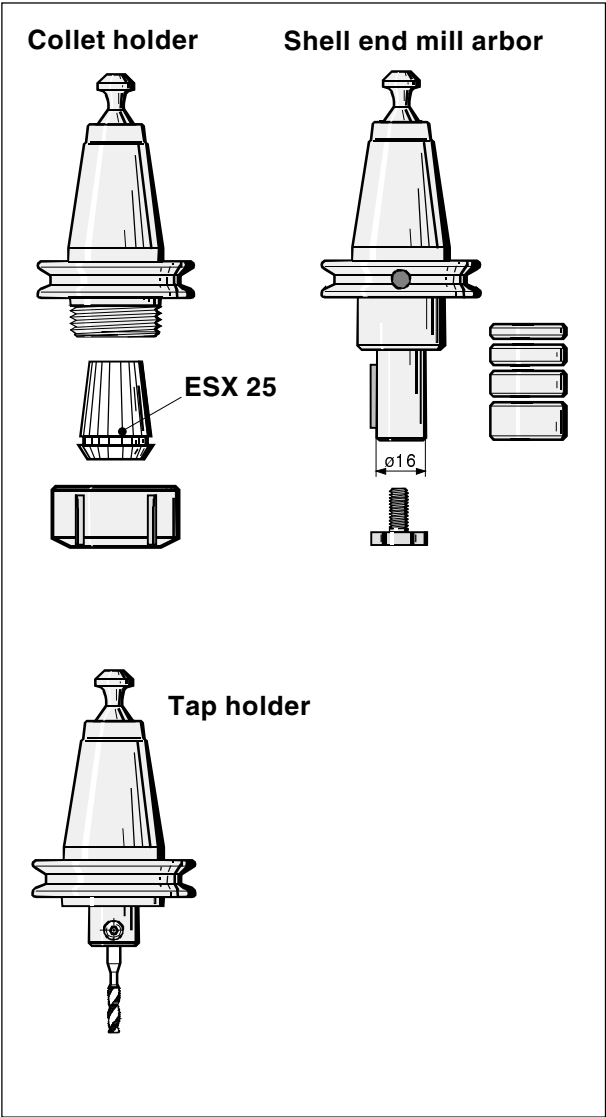
Caution:

If the tool (5) of the **position 1** (engraving spindle) is clamped, the milling head **may not** be traversed upwards, otherwise the clutch (4) will be damaged.



- Push-back magazine to end-stop.
- Close machine door
- Reference tool magazine.

Toolholder

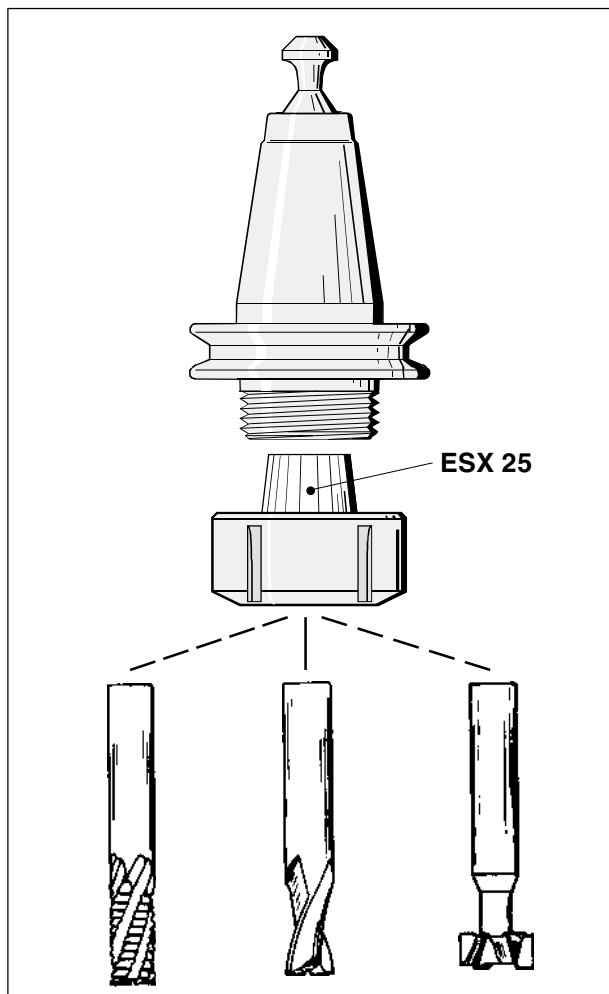


Toolholder

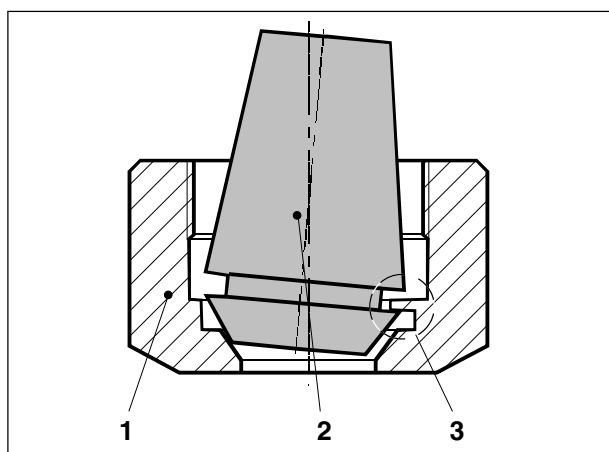
The machining tools are mounted on the toolholder.
Drills, end-milling cutters and profile cutters are clamped by means of collets into the collet holder, shell end mills and disk milling cutters are mounted on the shell end mill arbor.
Taps are clamped in special tap holders with longitudinal compensation.
All toolholders are available as accessory at EMCO.
Tool support similar to DIN 2079 SK 30
Clamping bolt works standard

Order numbers

Tool holder		Order-no.
Collet holder	ESX 25	F1Z 100
Shell end mill arbor	$\varnothing 16$	F1Z 110
Tap holder	M3	F1Z 360
	M4	F1Z 370
	M5-M8	F1Z 380



Collet holder



Mounting the collets

Collet holders

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

Order no. F1Z 100
Clamping range 0.5 up to 16 mm
Collet type ESX 25

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.

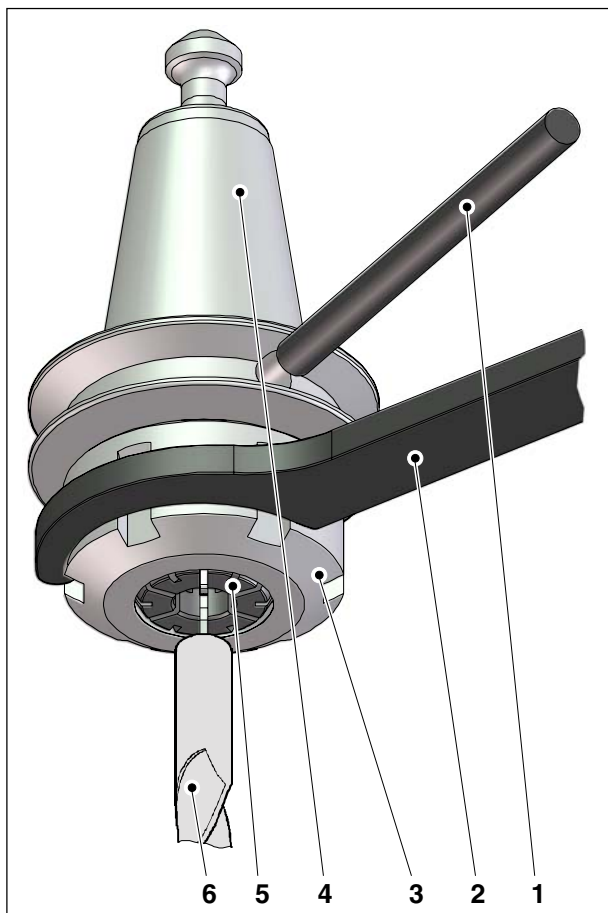
Danger:



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 (5).
- Insert tool (6) into the collet (5). 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 (2). Countertighten the collet holder (4) with the pin (1).



Danger:

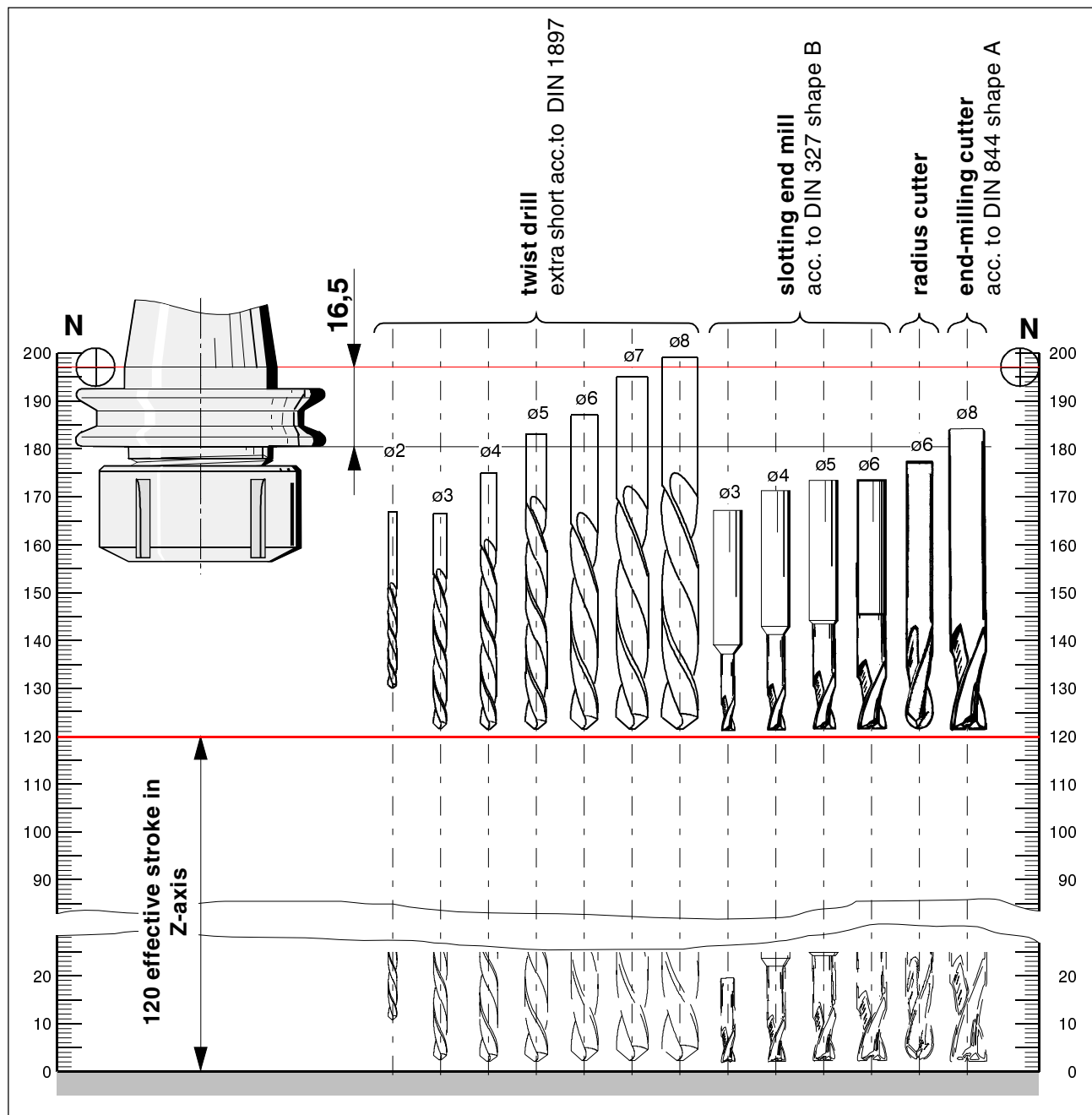
- Mounting and dismounting the tools may only be carried out during machine standstill.
- The values indicated in the table "clamping ranges" must always be complied with, otherwise the tools cannot be clamped safely.

Clamping ranges

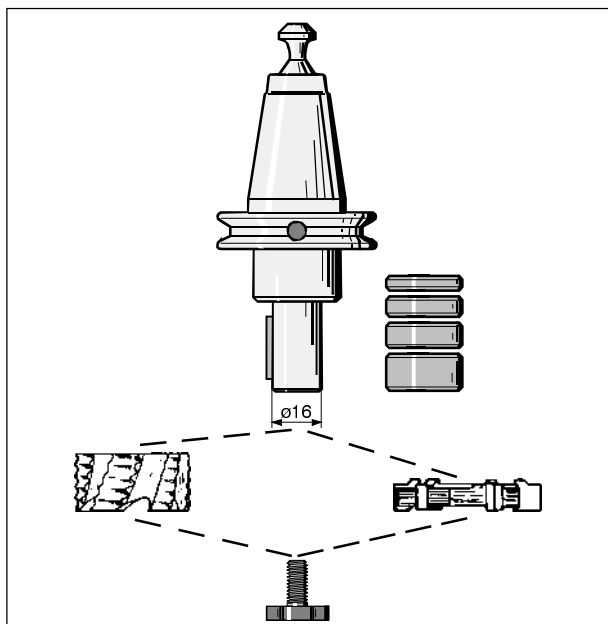
The clamping ranges are engraved in the collets.

Nominal diameter of collet	Clamping range		Order-no.
	[mm]	[inch]	
2,0	1,5-2,0	1/16-5/64	225 020
2,5	2,0-2,5	3/32	225 025
3,0	2,5-3,0	7/64	225 030
4,0	3,0-4,0	1/8-9/64-5/32	225 040
5,0	4,0-5,0	11/64-3/16	225 050
6,0	5,0-6,0	13/64-7/32-15/64	225 060
7,0	6,0-7,0	1/4-17/64	225 070
8,0	7,0-8,0	9/32-19/64-5/16	225 080
9,0	8,0-9,0	21/64-11/32	225 090
10,0	9,0-10,0	23/64-3/8-25/64	225 100
11,0	10,0-11,0	13/32-27/64	225 110
12,0	11,0-12,0	7/16-29/64-15/32	225 120
13,0	12,0-13,0	31/64-1/2	225 130
14,0	13,0-14,0	33/64-17/32-35/64	225 140
15,0	14,0-15,0	18/32-38/64	225 150
16,0	15,0-16,0	19/32-39/64-10/16	225 160
Set of collets (ø2,0 - ø14,0)			225 000

Working ranges of the tools



Working ranges with the collet holder



Shell end mill arbor

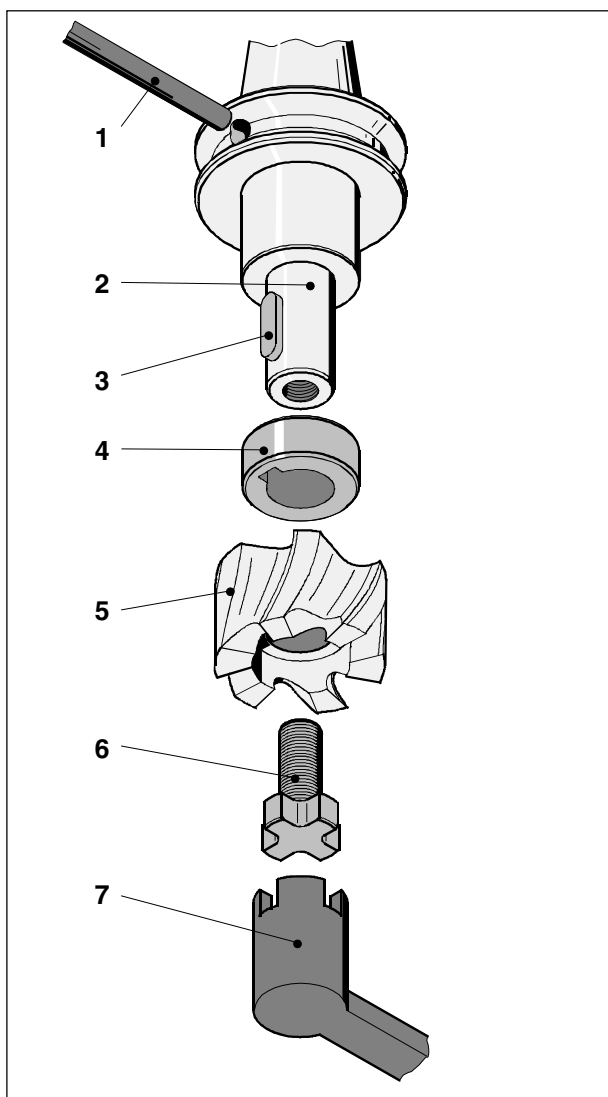
Shell end mill arbor

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 110

Tool support shaft ø16 mm



Clamping the tools into the shell end mill arbor

Clamping the tools in the shell end mill arbor

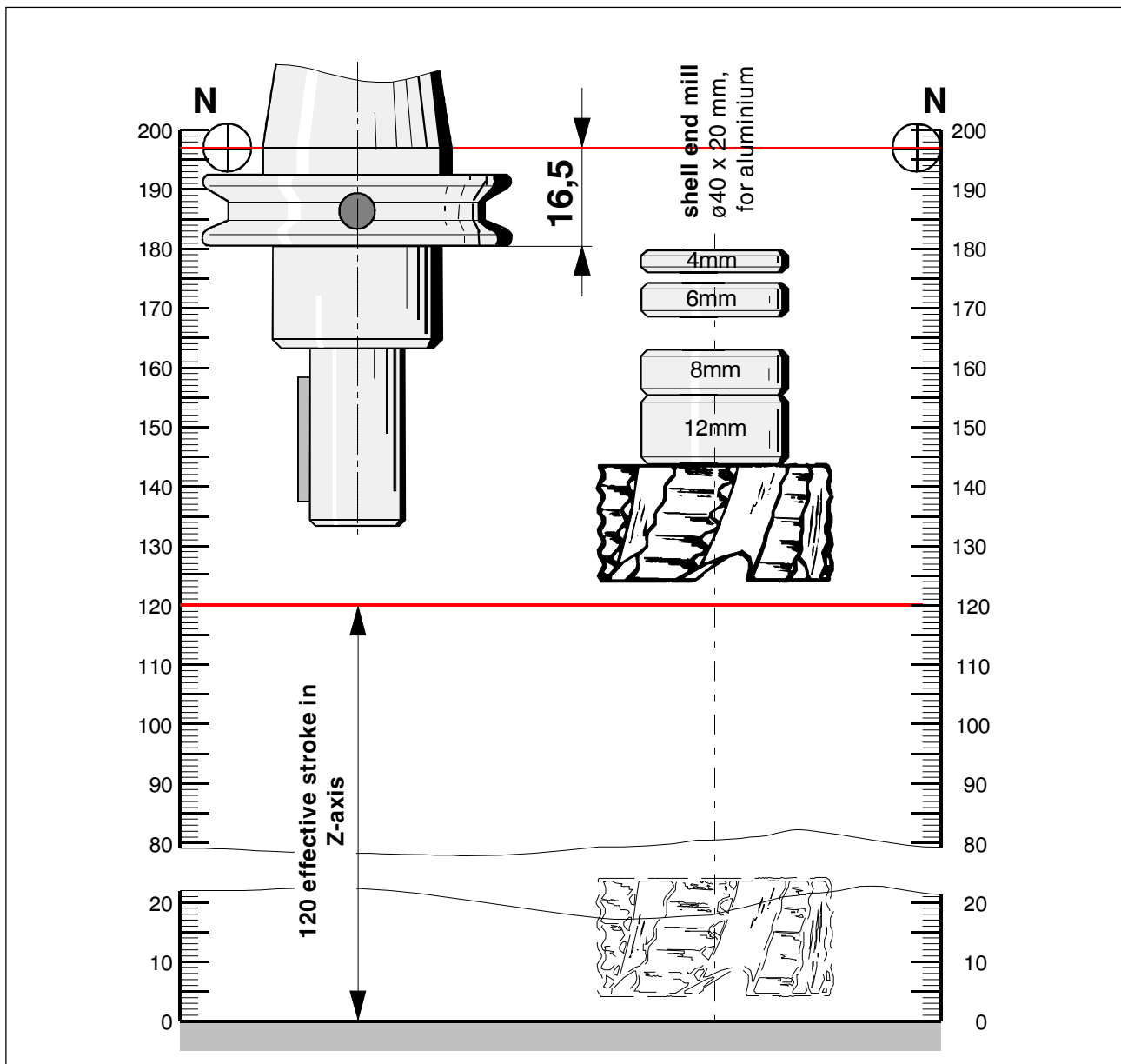
Danger:



- 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

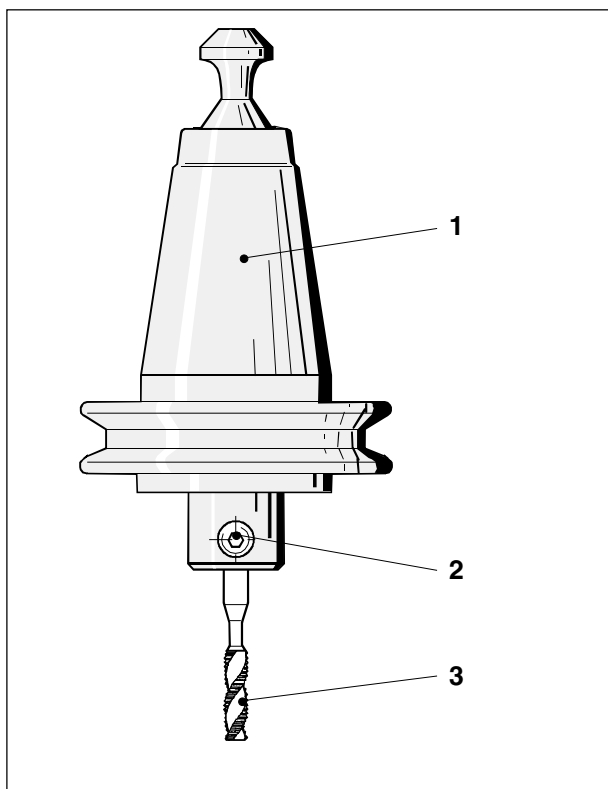
Tap holder

Because of the tap holder with integrated length compensation it is possible to tap.

Three different tap holders are offered:

Order -No.:

Tap holder M3	F1Z 360
Tap holder M4	F1Z 370
Tap holder M5, M6, M8	F1Z 380
Length compensation	±6 mm



Mounting of the tap

Clamping tools in the tap holder

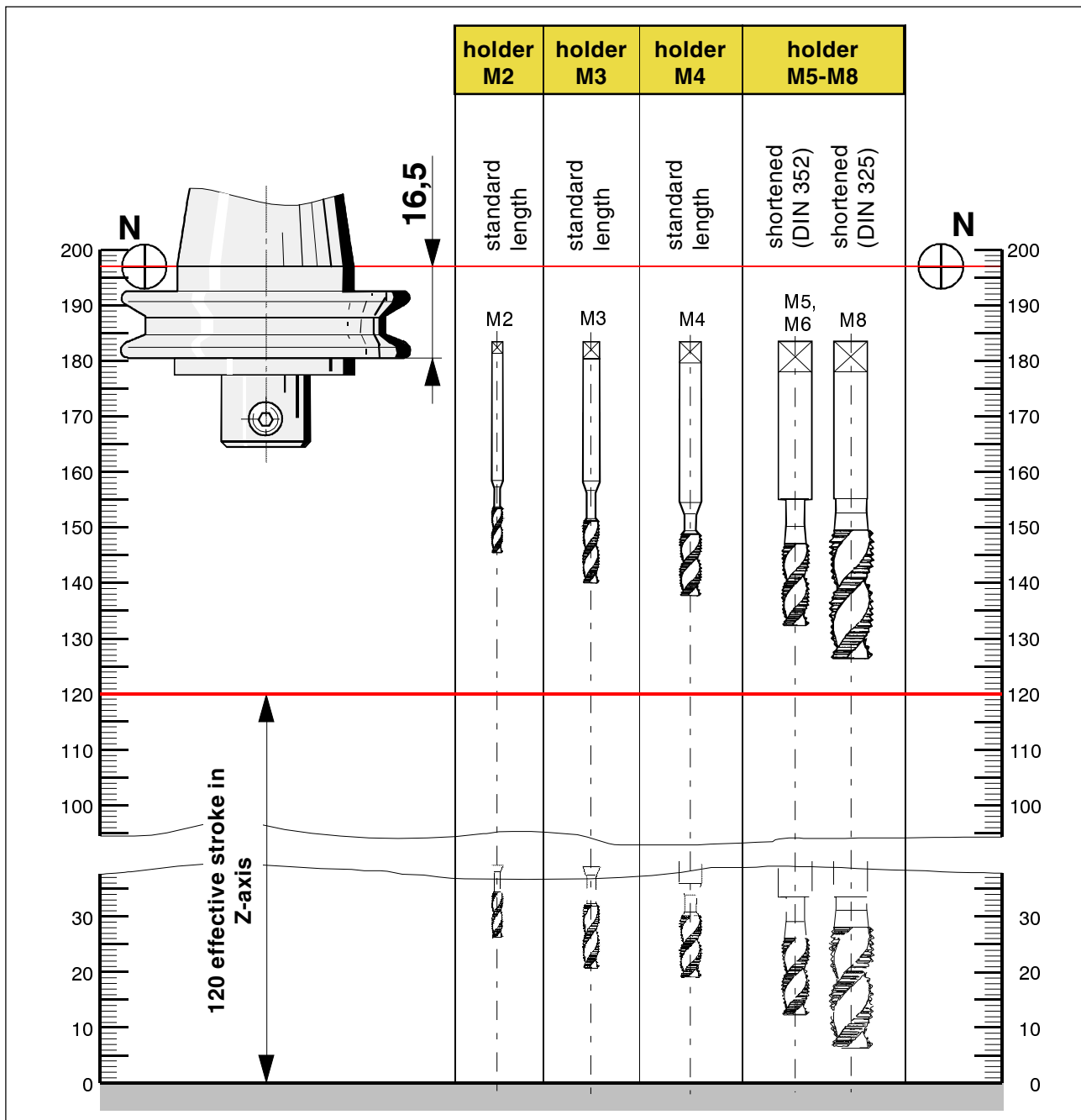
Danger:



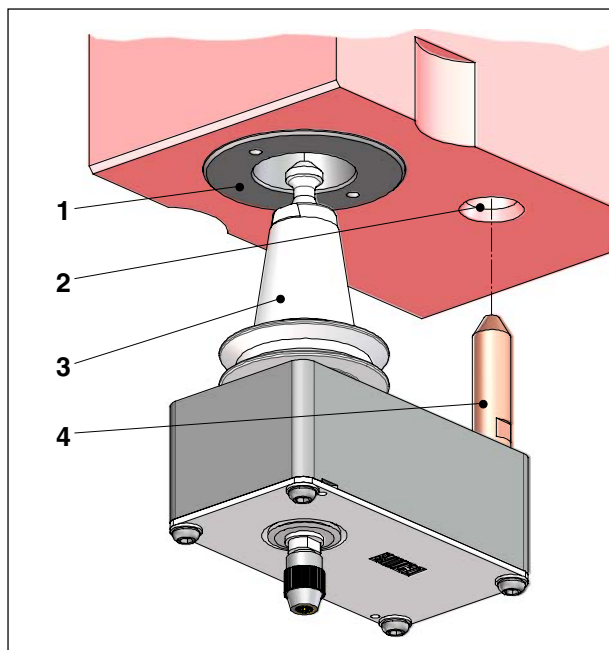
- Clamping the tools in the tap holder may only be carried out during machine stand-still!
- Only taps may be clamped in the tap holder, which are designated clearly for the used tap holder!

- Loosen thread pin (2) with the hexagonal key (wrench size 2,5).
- Put in tap (3) 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 (2) to fix the tap (3).

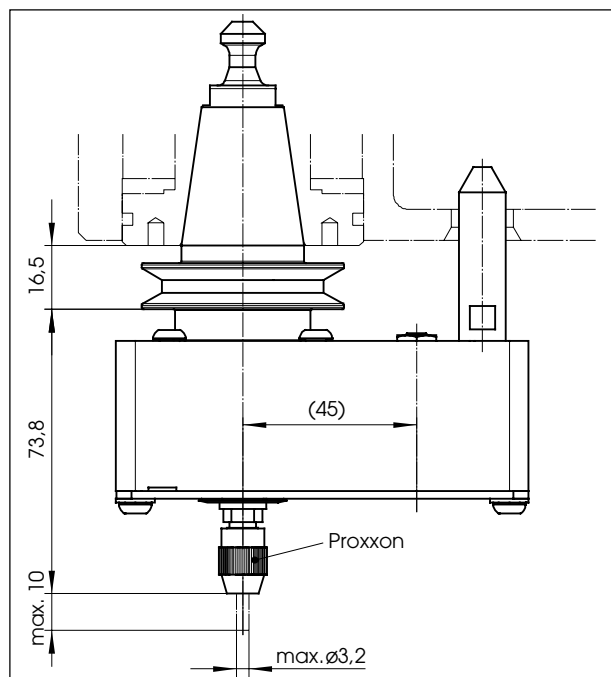
Working ranges of the tools



Working range with the tap holder



High Speed Spindel Unit - mounting



High Speed Spindel Unit - connecting dimensions

Engraving Spindle

Order-no. **F1Z 190**

In cause of the gear ratio to a very high spindle-speed with this accessory, engraving works are possible.

The engraving spindle will be delivered completely with 6 collets and handling tools.

Technical data

Spindle speed max. 14 000 rpm
 gear ratio $i = 1:4$
 clamping diameter for tools max. $\varnothing 3,2$ mm
 clamping system Proxxon-collets
 Max. stroke in Z-direction 96 mm

Range

Engraving

Qualified for aluminium, nonferrous metals, plastics and hardwood

Boring

Aluminium, nonferrous metals max. $\varnothing 2$ mm
 Plastics, hardwood max. $\varnothing 3$ mm



Danger:

The engraving spindle may not be used for milling-works!
 Otherwise the spindle and the tool would be damaged, and persons could be hurt!

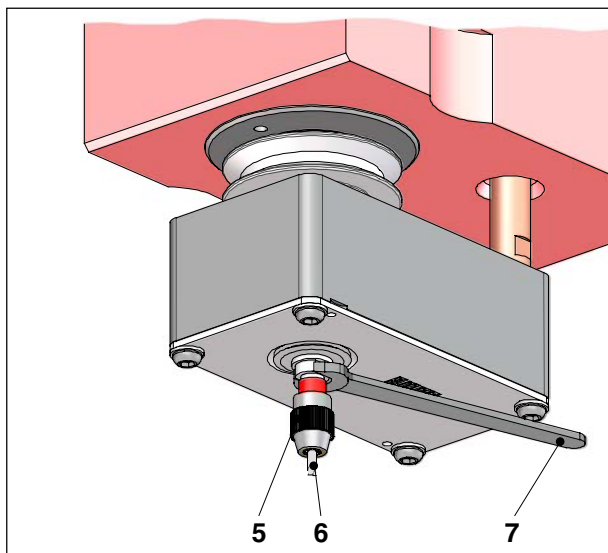
Mounting the high speed spindle unit



Danger:

Mounting and dismounting the engraving spindle may only be carried out during machine standstill.

- Clamp spindle unit with shaft (3) in the milling spindle (1) of the machine
 Therefore set the bolt (4) into the bore (2) of the milling head.



Mounting the tools

Danger:

All setting up and maintenance works may only be carried out during machine standstill.

Mounting the collets

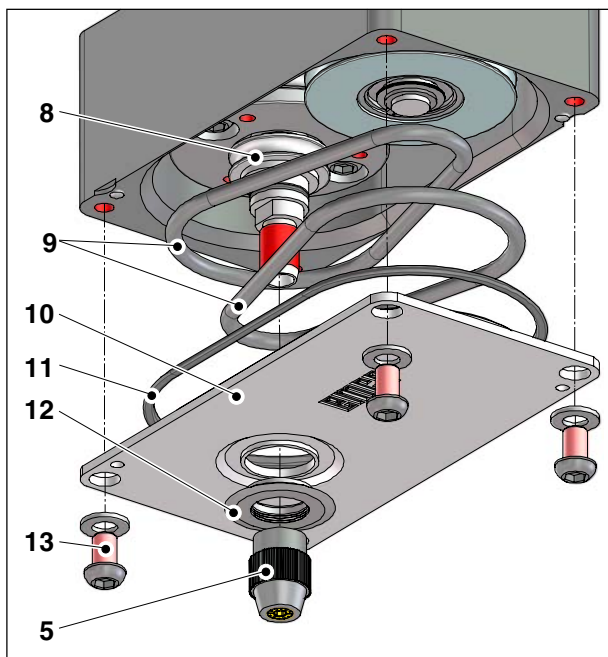
- Unscrew clamping nut (5).
- Insert desired collet into the holding device and screw clamping nut (5).
- To hold up the engraving spindle use the delivered face wrench (7).

Mounting the tools

- Loosen clamping screw (5).
- Insert tool (6) into the collet and lock it by screwing the clamping nut (5).
To hold up the spindle use the delivered face wrench (7).

Clamping ranges of the delivered collets (Proxxon-collets)

1,0	0,8 – 1,0 mm
1,5	1,2 – 1,5 mm
2,0	1,8 – 2,0 mm
2,4	2,2 – 2,4 mm
3,0	2,8 – 3,0 mm
3,2	3,0 – 3,2 mm



Changing belt

Note:

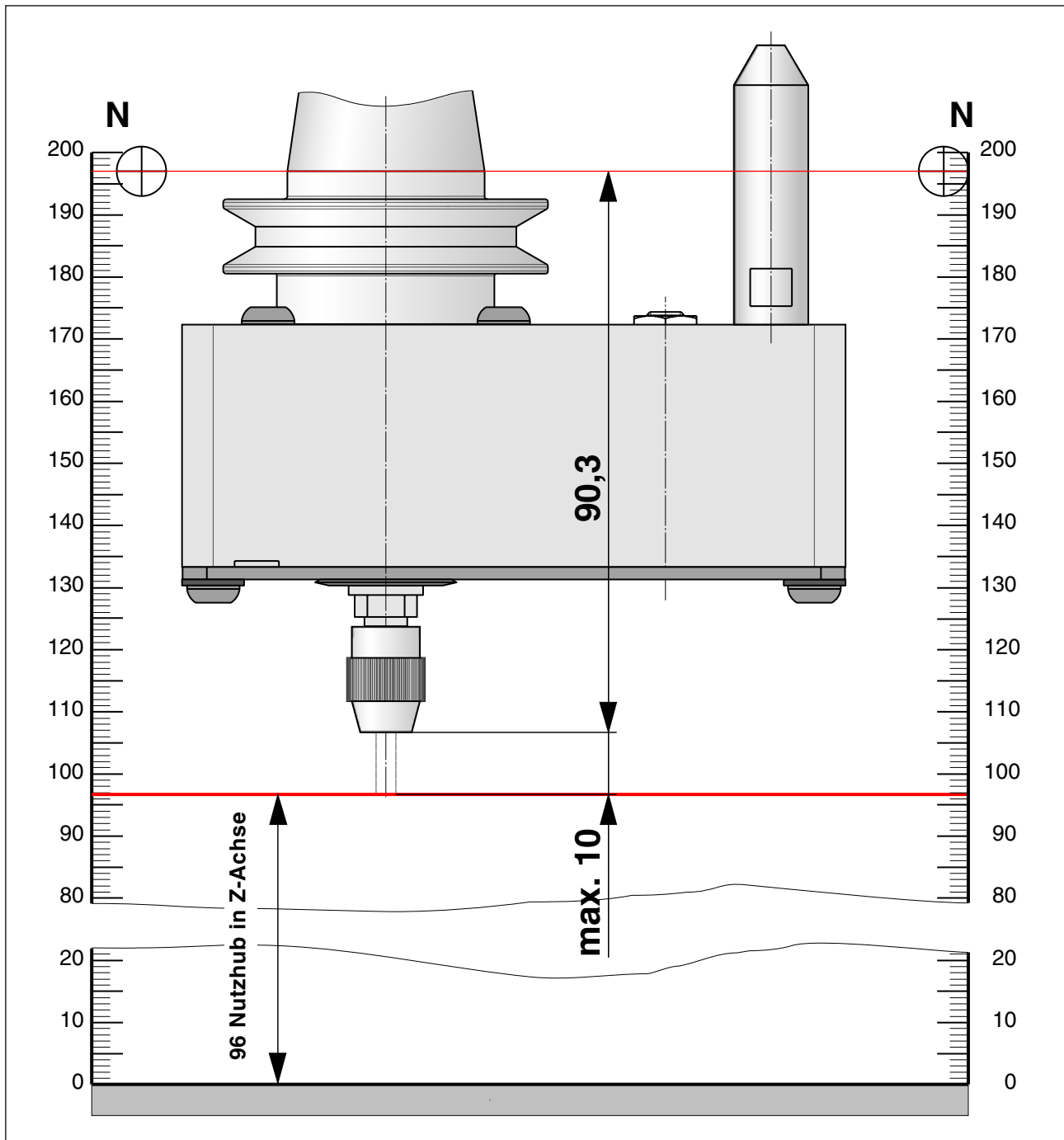
Engraving tools, boring tools and suitable collets are obtainable in the specialised trade (Proxxon-collets).

Changing the belt

The belts will be changed as required (brittle belts, frequently belt slippage).

- Unscrew clamping screw (5) and withdraw the sealing ring (12) from the spindle (8).
- Unscrew lens head screws (13) and dismount cover (10) with sealing ring (11).
- Change both belts (9).
- Mount unit.

Working range of the engraving spindle



Working range with the engraving spindle

Clamping devices for workpieces

All clamping devices can be obtained from EMCO as accessories.

Clamping rails

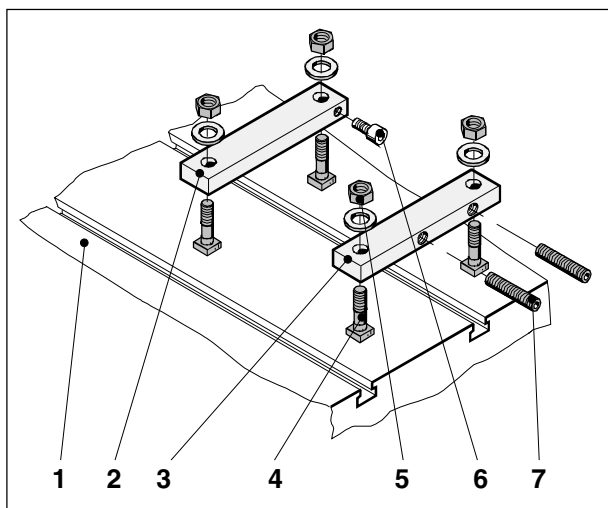
Order-No. F1Z 060

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).



Mounting the clamping rails

Danger:



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

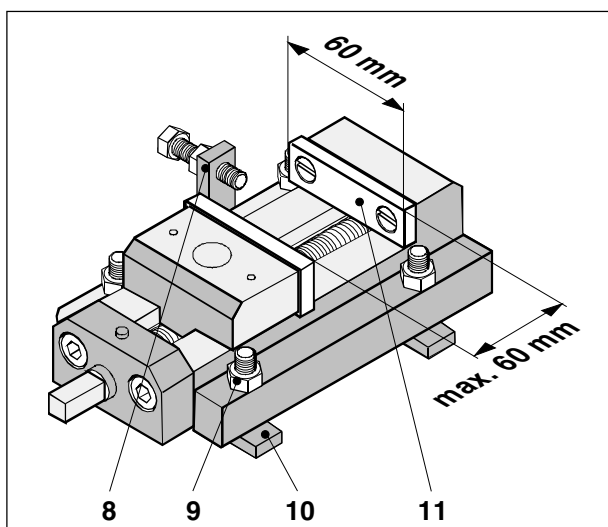
The machine vice

The machine vice is provided with exchangeables 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

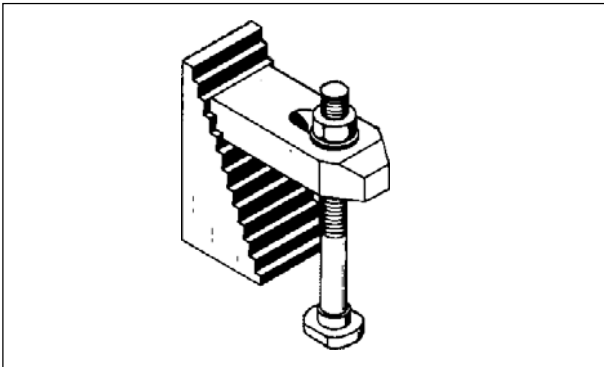
Clamping width max. 60 mm



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.

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)





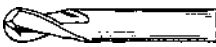





Via the DNC-interface the machine can be operated via a host. In contrast to the robotics interface, in addition to standard functions, e.g. programs can be transmitted or started from the host.

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






Tools

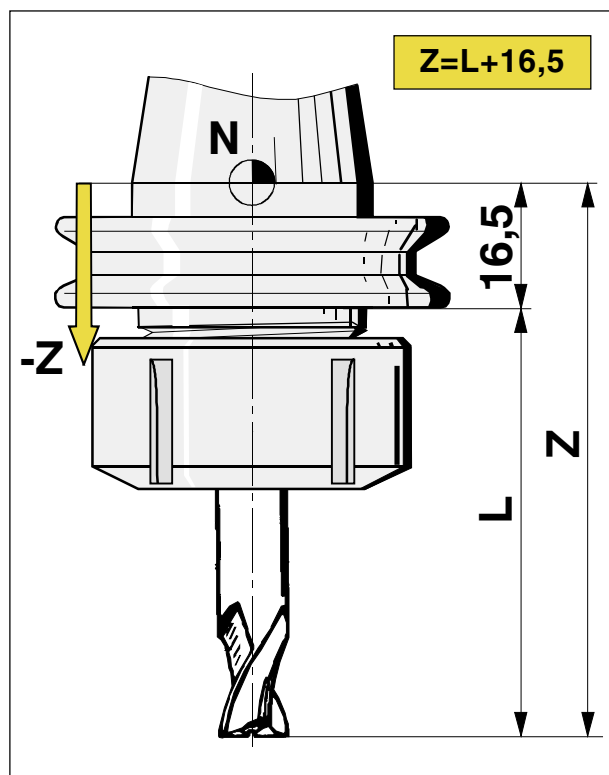
All listed tools are to be ordered by EMCO with the given Order-Numbers.

Milling tools

	Description	Order no.
	NC start drill (HSS) acute angle 120°, shaft ø10mm	771 010
	Edge tracer ø6 mm	F1Z 390
	Slot milling cutter HSS, DIN 327-shape B milling cutter ø3 mm (shaft ø6 mm)	764 301
	milling cutter ø4 mm (shaft ø6 mm)	764 302
	milling cutter ø5 mm (shaft ø6 mm)	764 303
	milling cutter ø6 mm (shaft ø6 mm)	764 304
	milling cutter ø8 mm (shaft ø8 mm)	764 306
	milling cutter ø10 mm (shaft ø10 mm)	764 308
	milling cutter ø12 mm (shaft ø12 mm)	773 100
	Heavy-duty shank end mill HSS, DIN 844-shape A milling cutter ø8 mm (shaft ø8 mm)	764 200
	milling cutter ø10 mm (shaft ø10 mm)	781 152
	milling cutter ø12 mm (shaft ø12 mm)	781 151
	milling cutter ø16 mm (shaft ø16 mm)	771 020
	Radius cutter HSS shaft ø6 mm	771 030
	shaft ø8 mm	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 \varnothing 1-13 mm (in increments of 0.5 mm) 9 twist drills \varnothing 2-10 (in increments of 1 mm)	781 280 260 628
	Set of core hole drills HSS	
	6 core hole drills \varnothing 2.5-8.5 mm 5 core hole drills \varnothing 2.5; 3.3; 4.2; 5.0; 6.8	271 230 771 120
	Centre drill HSS \varnothing 6.8 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 \varnothing 3.5 mm)	781 301
	M4 (shaft \varnothing 4.5 mm)	781 302
	M5 (shaft \varnothing 6 mm)	781 303
	M6 (shaft \varnothing 6 mm)	781 304
	M8 (shaft \varnothing 8 mm)	781 305



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 at the spindle nose of the milling spindle, 16.5 mm above the clamping ring of the tool holder.

Measure the entire length "L" from the clamping ring to the tool tip and add 16.5 mm to 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.



Technological data

1. Cutting speed V

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

V [m/min]cutting speed
 D [mm]dia. of workpiece
 S [rpm]speed of main spindle

The max. admissible cutting speed depends on:

- **Material of workpiece**
 The higher the strength of the material, the lower the cutting speed.
- **Material of tool**
 Hard metal tools allow for a higher cutting speed than HSS-tools.
- **Feed value**
 The larger the feed the lower the cutting speed.
- **Depth of cut**
 The larger the depth of cut the smaller the cutting speed.

Cutting speed for programming exercises on the Emco Concept Mill 55:

Aluminium (Torrador B) 44 m/min
 Steel (9S20),
 tender synthetic material 35 m/min
 hard synthetic material 25 m/min

2. Speed S

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

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

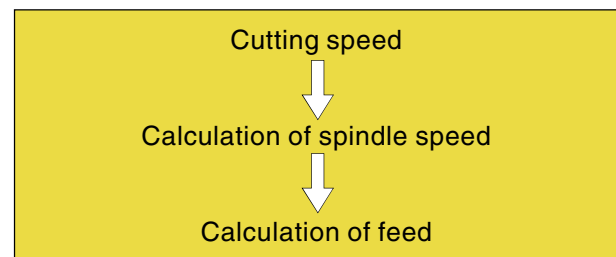
3. Feed F

On the Emco Concept Mill 55 the feed F is programmed in [mm/min].

$$F \text{ [mm/min]} = S \text{ [rpm]} \times F \text{ [mm/rev]}$$

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

Summary



The charts on the following page save the calculation work.

Determination of the speed S during milling and drilling

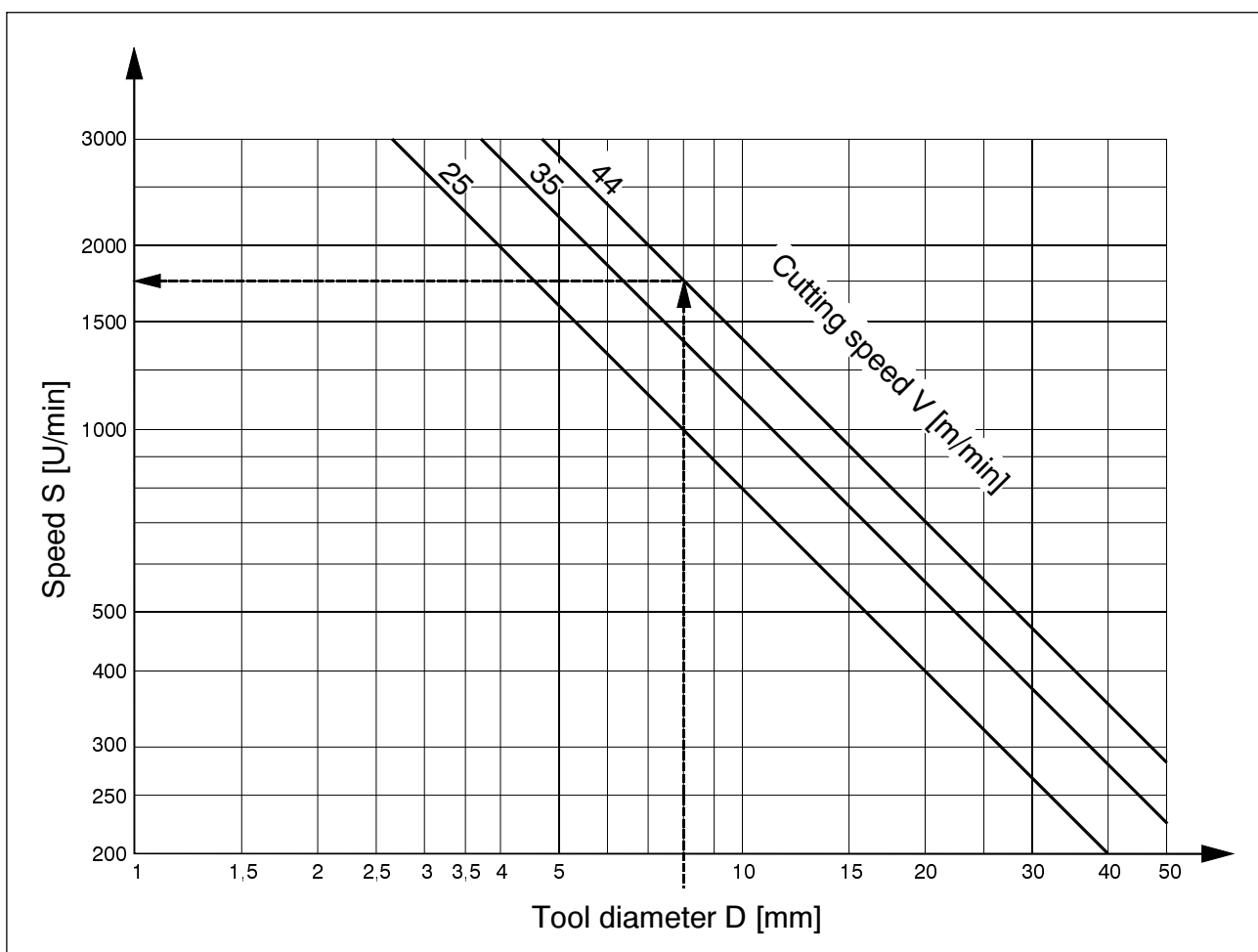
Example:

You know:

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

You want to know:

- speed S in [rpm]



Determination of the speed

Solution:

speed $S = 1750 \text{ rpm}$

Determination of the cutting depth t during milling

Example:

You know:

- workpiece material Torradur B
- diameter of milling cutter $D = \varnothing 12 \text{ mm}$
- feed speed $F = 70 \text{ mm/min}$

You want to know:

- cutting depth t in [mm]

Determination of the feed speed F during milling

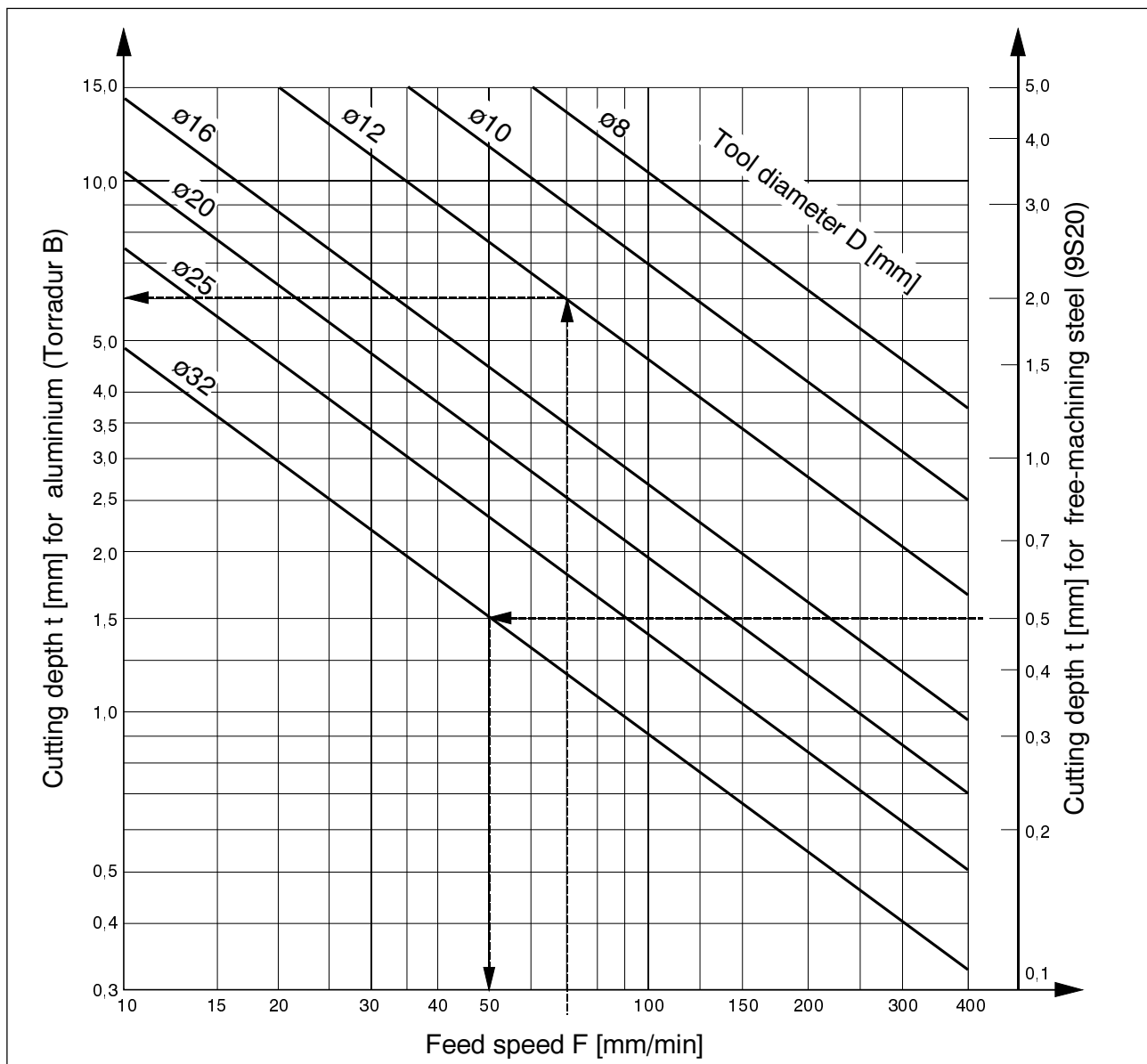
Example:

You know:

- workpiece material .. free-machining steel 9S20
- diameter of the milling cutter $D = \varnothing 32 \text{ mm}$
- cutting depth $t = 0,5 \text{ mm}$

You want to know:

- feed speed F in [mm/min]



Milling - determination of the cutting depth t and the feed speed F

Solution:

cutting depth $t = 6 \text{ mm}$

Solution:

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

Determination of the feed speed F during drilling

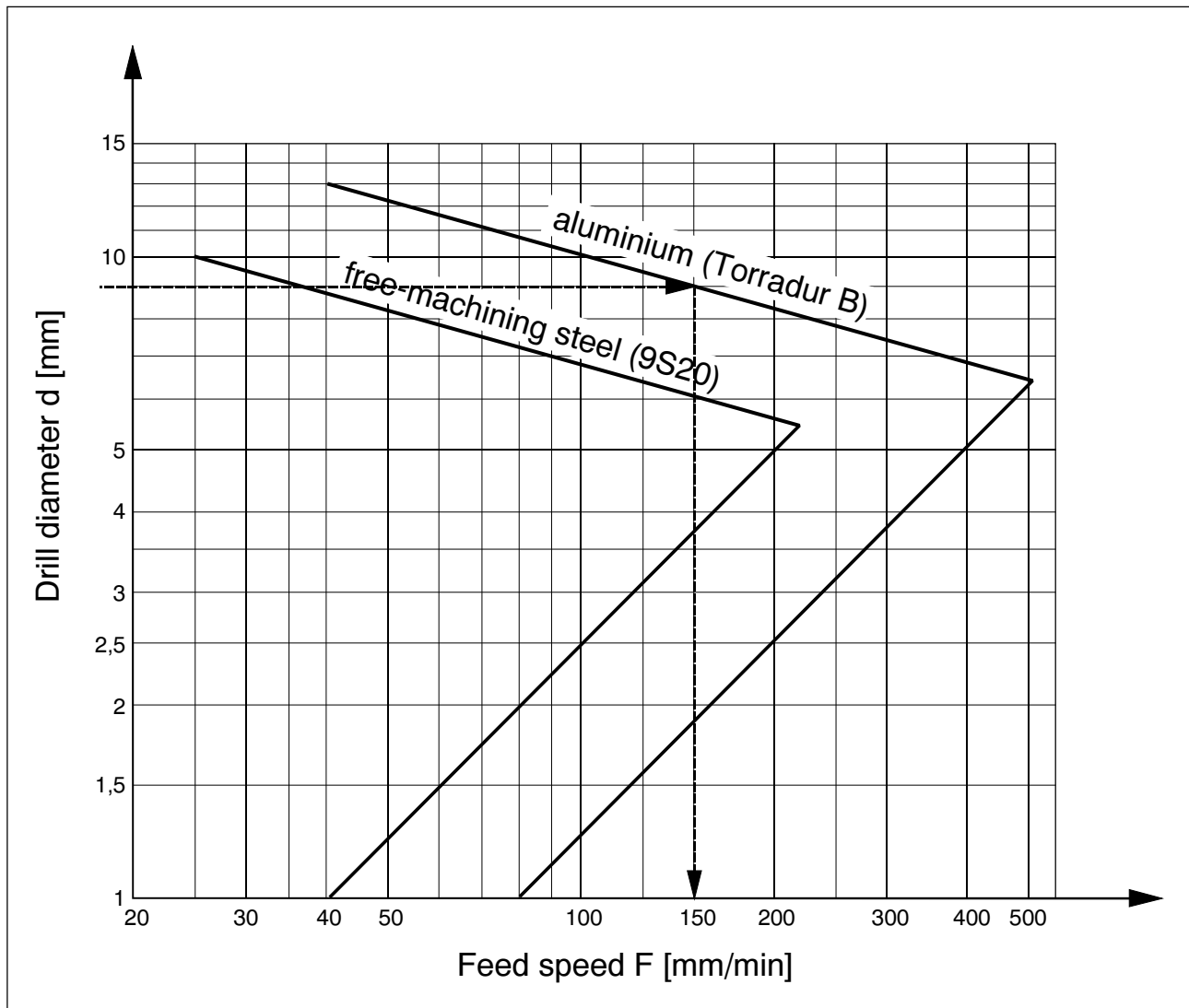
Example:

You know:

- workpiece material Torradur B
- diameter of drill $D = \varnothing 9 \text{ mm}$

You want to know:

- Feed speed F in [mm/min]

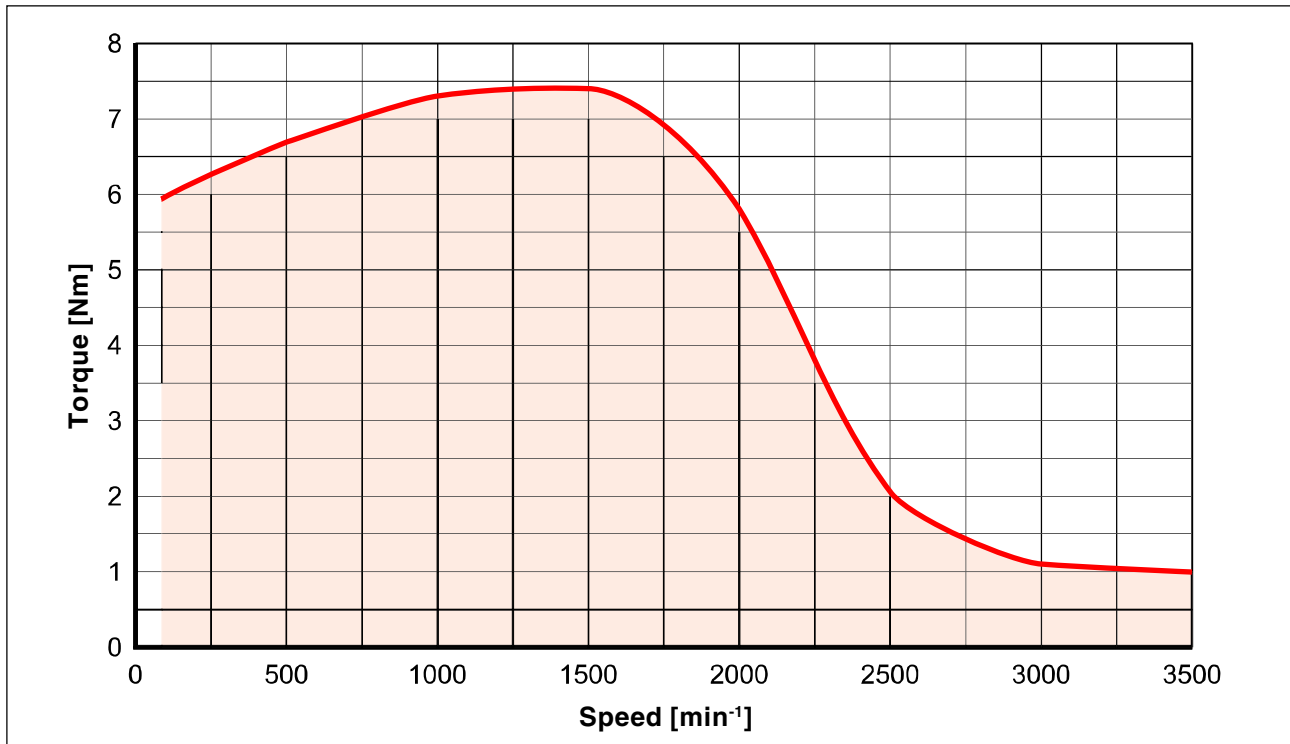


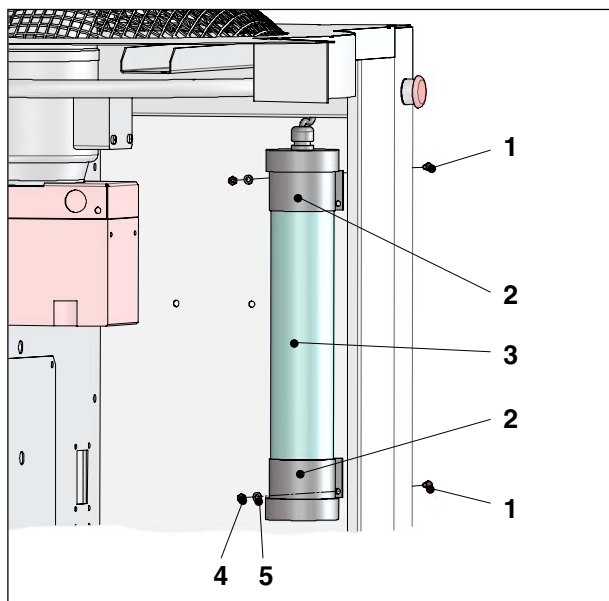
Drilling - Determination of the feed speed

Solution:

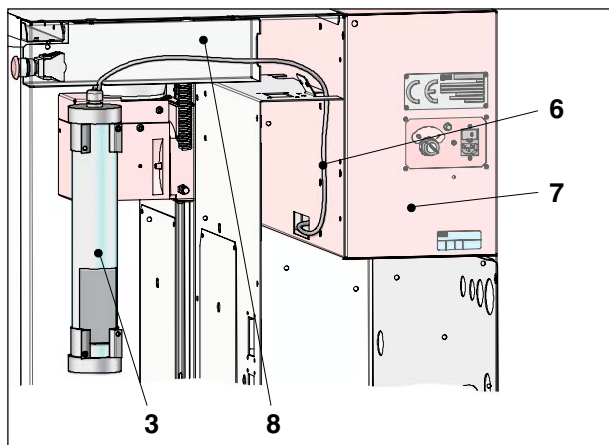
feed speed $F = 150 \text{ mm/min}$

Characteristic curve on the milling spindle

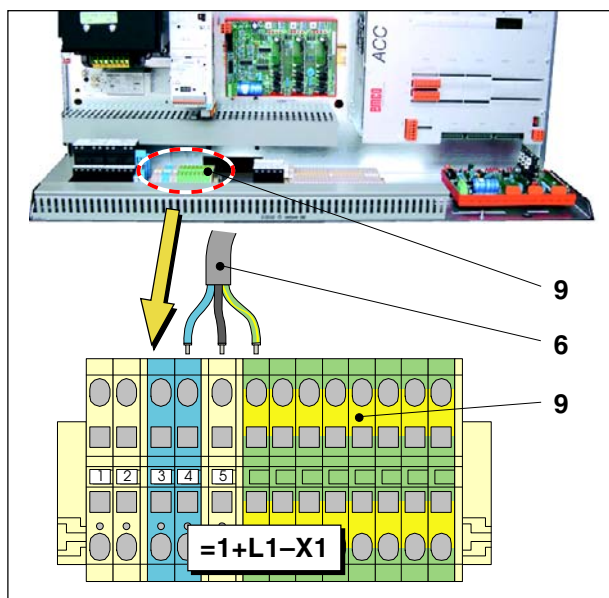




Mounting the machine lamp



Installation of the cable



electrical connection of the machine lamp

Machine Lamp (Accessory)

Order-no. **F1Z 170**

The delivery consists of the machine lamp completely with cable and mounting material.

The machine lamp will be connected in such a way, that the lamp will be automatically switched on, when main switch of the machine is on.



Danger:

Mounting and electrical connection of the machine lamp may only be carried out, when the machine is unplugged from the mains supply.

Mounting

- Mount the machine lamp (3) on the right casing of the machine with the holders (2). Therefore use the delivered filister-head screws M5×12 (1) with the washers (5) and the nuts M5 (4). The bores in the casing are already done (capped with stoppers).
- Install the connecting cable (6) through the cable duct (8) along the already installed cables into the electrical cabinet (7).

Electrical Connection

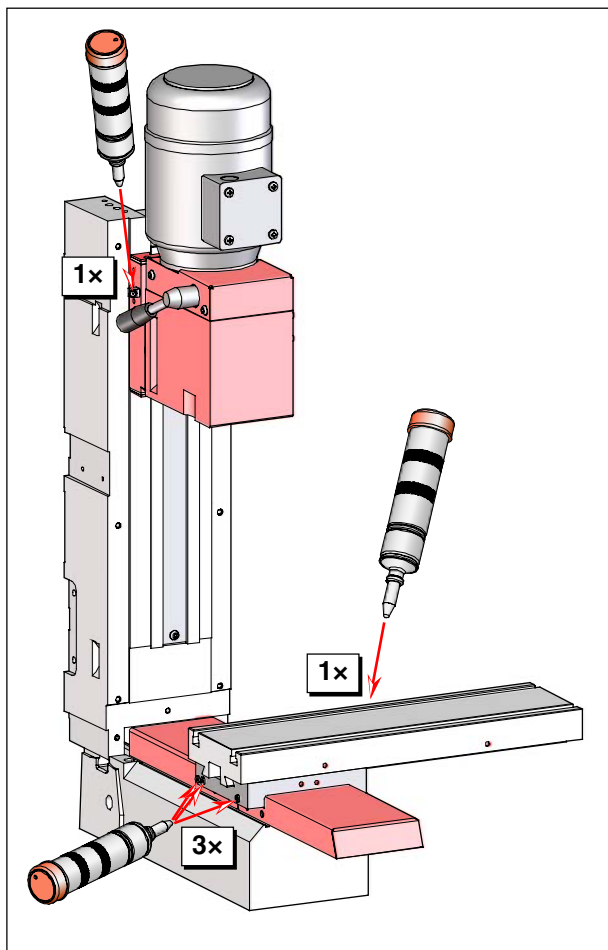
- Connect the single wires of the connecting cable (6) at the terminal block "=1+L1-X1" (9) in the electrical cabinet, as follows.

blue wire terminal 4
black wire terminal 5
yellow/green wire terminal PE



Caution:

Additional informations please see in the Électrical Documentation to your machine.



Lubricating nipples at the machine

DIN
CGLP
68
51502

Maintenance of the machine



Danger:

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

Clean the machine carefully from chips and other dirt after each operation.



Note:

Never clean the machine with compressed air since chips get jammed in the guides and thus could cause damages at the guides.

Slightly oil the milling table and the blank guides every day with slideway oil.

The guideways are supplied daily with slideway oil via the 5 lubricating nipples.

Main spindle bearing and bearings of the ball screws of the slide guides are maintenance-free.

Slideway oil

DIN designation: CGLP DIN 51 502 ISO VG 68

e.g.:

BP	Maccurat 68
CASTROL	Magnaglide D 68
KLÜBER	Lamora Super Pollad 68
MOBIL	Vactra No. 2
OMV	Glide 68
TRIBOL	1060/68

