Introduction

For more than five decades EMCO has been developing and building wood and metal working machines and has been successfully on the market since 1980 with computer controlled machine tools.

This high degree of experience is also an advantage for the lathe EMCO MAXIMAT SUPER 11 CD.

The large accessory range allows you to solve practically all occurring lathe and milling problem.

Due to the worldwide use of our machines we have of a service network which covers all world areas. Immediately available service engineers, telephone service as well as a 100% spare part 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 workpieces or tools etc.) and their retrofitting 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 these instructions completely before machine start-up.

Safety covers are not mounted in all illustrations in this manual due to clear presentation.

Or any inquiries or proposals for improvement with a view to the present operating instructions please get directly in touch with

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Abteilung Technische Dokumentation
A-5400 Hallein, Austria

EC conformity
The CE sign certifies together with the EC declaration of conformity that the machine and the manual corresponds to the guidelines applicable for these products.
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Declaration of conformity

Spare parts list
Adequate use

The machine EMCO MAXIMAT SUPER 11 CD is designed for turning machinable metals. Machining of other materials is not admitted and may be carried out in particular cases only after consultation with the 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 woodworking machines have to be complied with at any time.

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

Warranty conditions for new EMCO machines

1. The warranty period for new EMCO machines is, without limitation of operating hours, 12 months after initial shipment of the machine from EMCO or its authorized representative. Should the installation be completed by EMCO or its authorized representative, the warranty period begins with the completed installation of the machine.
   If a delay of installation occurs which is not caused by EMCO or its representative, the warranty period becomes invalid 12 months after scheduled installation date.

2. The warranty extends to the elimination of all defects in material or workmanship which affect the regular function of the machine.

3. 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, electrochemical 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.

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Safety recommendations

Read documentation
Read this documentation completely before you start the machine.

Electrical connection
The electrical connection and interferences with the control cabinet must only be carried out by electricians. The machine may only be connected to sockets with earthing conductors.

Authorized operation
The machine may only be operated by trained and authorized persons. It must be protected against unauthorized start-up (main switch can be locked).

Obligation of supervision
Never leave running machine unattended.
After end of work switch off main switch and protect against unauthorized start-up using a padlock.

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. Non-compliance represents a hazard to the operator and the function of the machine. Furthermore, any guarantee claim will expire.

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.

Wear body protection
Wear hair protection, eye protection and tight clothing.

Work during standstill of machine
Carry out measuring, clamping work, tool and workpiece change and adjusting work only during standstill of machine and EMERGENCY-OFF key actuated.

Removing of objects
Prior to the operation all free-lying objects, such as e.g. redundant clamping jaws, wrenches, measuring instruments, tools etc. have to be removed from the clamping area.

Tools
Only work with perfectly ground tools. Mind rotary direction of the tools.

Dangerous materials
Machining magnesium and its alloys is not admissible because of fire hazard.

Clamping keys
Chuck keys etc. must not be attached to the machine by chains, cords or similar means and have always to be taken off prior to machining start.

Do not reach into running machine!
In case of hazards - EMERGENCY-OFF
In case of hazards immediately stop machine with EMERGENCY-OFF key.

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

Claim
In the event of a collision or instance of damage, contact the representative or manufacturer.
In case of complaints, damage, confusions and spare parts orders always indicate the machine number. For parts not supplied by EMCO, EMCO will not assume liability.

Cleanliness
Always keep working place and machine clean. Never remove chips with running machine. Use chip hook, brush or whisk for this purpose. An untidy working place and a dirty machine increase the hazard of accidents.

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

Working place
Set up machine in such a way that there is enough space for operation and maintenance of the machine. Do not deposit or store anything or lay electric lines in these areas.

Machine lamp
The distance between machine lamp and lighted surface must be at least 0.1 m, otherwise the lamp might be destroyed because of heat flow.

According to ÖVE: 0.1 m

Safe clamping
Prior to start of operation check if workpiece and tool are clamped safely.
Cover extending parts
When working on tubes or pipes which extend to the side of the headstock, these must be covered over the whole length.

Always use chuck guard

Adjust stop pin
The stop bolts of the longitudinal stop (accessories) and the lateral stop (accessories) must be clamped so that the distance between the stop element and the bolt ends is at least 25 mm (1").

Don't remove keep-off wedge and tailstock stop
A keep-off wedge (1) and a tailstock stop pin are mounted on the longitudinal slide to prevent contusion of your fingers between slide and tailstock. These safety devices must not be removed. A bolt (length 25 mm) mounted on the longitudinal slide prevents contusion of your fingers between slide and tailstock plate. This bolt must not be removed.
Safe clamping
Always clamp workpieces only on pre-turned and premachined surfaces!

Clamp only short workpieces in cantilevered mode.
If the outstanding workpiece length is longer than the triple diameter, the workpiece must be supported with the tailstock (with live centre) or with the steady.
Cause:
Otherwise the workpiece will be bended by the cutting pressure and start chattering.
Result:
Bad turning result, breaking of the tool, bending or catapulting out of the workpiece.

Travelling steady
Slender workpieces will be bended by the cutting pressure.
Use the travelling steady as support.
The travelling steady will be mounted on the longitudinal slide.

Fixed steady
If the outstanding length of the tool is too long and supporting by the tailstock is not possible, use the fixed steady.
The fixed steady will be mounted at the machine bed.
Dangers without fixed steady:
Bad turning result, breaking of the tool, bending or catapulting out of the workpiece.

Clamp the tool as short as possible!
A tool which is clamped too long will bend, start vibrating and will break.
The fragments will shoot out like gun bullets.
The tool tip must be exactly at turning centre height.

Never clamp the workpiece too short (A)
The workpiece must be well attached, otherwise it will be catapulted out of the chuck.

Avoid small clamping diameters (d) with large turning diameters (D).
The clamping forces at the small diameter would get too small, the workpiece will be catapulted out.
Always tighten all chuck pinions.

Never exceed the clamping range of the chucks!
Too far outstanding jaws will break and shoot out like gun bullets.
The maximum clamping range of a chuck is determined by the chuck manufacturer.
Working hints

Switch during standstill
Switch lever for speed setting only during standstill of the machine.
Switch all operating levers always in lock-in position never in intermediate position.
all switchings at the headstock have to be carried out only during standstill of the machine.

Shearing pin
For safety reasons the shearing pin of the lead screw is made of an aluminium alloy. If this pin breaks due to overstress it has to be replaced by an original shearing pin (by no means a pin of a harder material).

Locking
Thread and feed control are interlocked to each other.

Clean machine
after working with coolant clean and oil machine.
Never clean machine with compressed air otherwise chips might enter the guideways.

By correct handling of the chips you can avoid that lubricants and emulsions get into the ground water.
Chips are not worthless waste but rather represent valuable raw materials. By collecting the chips according to kinds the quality of this raw material can be essentially improved (e.g. separation of aluminium and steel chips).
The better the chips are cleaned from residual oils, (mind that a sufficiently long drop-off period is provided as well as adequate temperature) the less is the environmental burden during intermediate storage and transport as well as the usability of the chips in the re-cycling process.

Work with maximum speed step (2200 rpm) with 115 volt version
For the starting period of the maximum speed step first you have to switch on the switch (5) and within another 2.5 seconds (starting capacitor package is connected during this period) the switch (4) must be advanced from position 1 to position 2.
If you switch directly to position 2 the main spindle does not achieve its nominal speed.

Recurrent symbols

The "Attention" symbol indicates hazards of injury.
You will find it in the Instruction Book wherever specific hazards are indicated.

After the info hand you will find advice to avoid damage at the machine and to provide correct operation respectively.

The environment symbol informs you on how you can avoid or reduce environmental burdens.
Technical data

Working area
Distance between centers ........................................... 650 mm
Center height .......................................................... 140 mm
Swing over bed .......................................................... 280 mm
Swing over cross slide ................................................. 170 mm
Bed width ...................................................................... 155 mm
Travel of longitudinal slide ......................................... 590 mm
Travel of cross slide ..................................................... 135 mm
Travel of top slide ........................................................ 100 mm
Distance centre-top slide .............................................. 23 mm
Swivel area top slide .................................................... +/- 180°
Tool cross section ......................................................... 12x12 mm

Main spindle
Spindle nose according to DIN 55021 .............................. size 3
Caml. ASA 5.9 D1 ............................................................. size 4
Inner taper DIN .............................................................. MT 4
Inner taper CAMLOCK ................................................... MT 5
Spindle bore DIN/CAMLOCK ........................................... ø26/ø35 mm
Spindle diameter in front bearing .................................. 45 mm
Spindle speeds ............................................................. 8
Speeds .................................................................. 55, 110, 200, 300, 410, 600, 1100, 2200 rpm

Pole changing drive motor (IEC)
Power (three-phase) S6-60% ........................................... 1.1/1.4 kW
Power (single-phase) S6-60% ......................................... 0.75/1.0 kW

Feeds
Metric machine:
14 longitudinal (0.00118-0.0118 inch/rev.)................. 0.03-0.3 mm/rev.
14 transversal (0.00059-0.0059 inch/rev.) ................. 0.015-0.15 mm/rev.

Inch type machine:
15 longitudinal .................................................. 0.00118-0.0128 inch/rev.
15 transversal .................................................. 0.0009-0.064 inch/rev.

Thread cutting
Thread pitches metric machine:
14 metric threads (0.01-0.1") ....................................... 0.25-2.5 mm (M1-M22)
9 inch threads .................................................. 9-96 t.p.i.

With change gear set additionally:
13 metric threads (0.005-0.19") .......................... 0.125-5 mm
29 inch threads .................................................. 29-76 t.p.i.
12 module threads ................................................ 0.25-2.5
25 diam. pitch ................................................ 96-11

Thread pitches inch type machine:
6 metric threads (0.0059-0.078") .......................... 0.15-2 mm
15 inch threads .................................................. 64-9 t.p.i.

With change gear set additionally:
21 inch threads .................................................. 126-4 t.p.i.
13 metric threads (0.010.24") .......................... 0.25-6 mm
29 diam. pitch .................................................. 128-9
7 module threads ................................................ 0.5-2.0

Tailstock
Center sleeve diameter ........................................... 30 mm
Inside taper .............................................................. MT 2
Stroke of center sleeve ........................................... 80 mm
Set-over ................................................................. +10/-8 mm

Graduated collar division of handwheels
Longitudinal slide .................................................... 0.02 mm
Cross slide ............................................................... 0.05 mm
Top slide ................................................................. 0.025 mm
Tailstock ................................................................. 0.05 mm

Admissible workpiece weights
Flying ................................................................. 45 kg
With tailstock ......................................................... 80 kg

Electrical connection
Power supply .................................................. 230 V~/1N/PE/50/60Hz
Power supply .................................................. 230 V~/3/PE/60Hz
Power supply .................................................. 400 V~/3/PE/50/60Hz
Max. voltage fluctuations ...................................... +6/-10%
Connection lead ...................................................... 3 kVA
Preliminary fuse for machine ................................. 16 A slow

Machine dimensions
Total length ......................................................... 1385 mm
Total width ............................................................ 714 mm
Total height ........................................................... 1166 mm
Turning spindle above the floor ............................... 1050 mm
Weight of the machine .......................................... 243 kg

Sound pressure level
Max. sound pressure level .................................. 77 dB(A)
With the following conditions:
- Measuring method: enveloping surface method
  according to DIN 45635
- Measuring point 1 m distance and 1.6 m above
  ground
- Operating mode: max. speed during idle running

Subject to technical modifications!
A Start-up

Machine acceptance

Mind the following hints for machine acceptance:

- Check machine for possible transport damage and completeness of scope of supply. In case of defects get immediately in touch with supplier, transport company and/or insurance company indicating exactly machine name, machine number and electrics number.

- In case of transport damage protect machine and accessories against further damage (e.g. influence of weather).

Machine number and electrics number

The machine number (1) is punched into the machine bed at the position shown.

The adhesive plate (2) with the electrics number is to be found laterally at the switch cabinet.

The electrics number consist of a 9-digit number (e.g. Y5A 300 000). The version number is indicated in table form (e.g. V1). V1 means electric version 1. The circuit diagram belonging to this electric equipment is to be found in the electrical documentation order no. ZVP674373 V1 for single-phase version and for 3-phase machine version in the electrical documentation order no. ZVP674374 V1 (to be found in the switch cabinet).

Scope of supply (Basic equipment)

Bed with Vee-guides, machine base, spindle headstock-wheel gear, tailstock, longitudinal, cross and top slides,indle tool post (clamping claw), electr. chuck guard, feed gear mechanism, feed shaft with sliding clutch, lead screw with claw clutch, gear quadrant with change gears (Z30, Z90, Z120, Z127), 1 solid lathe center MT 4 or MT 5, 1 solid lathe center MT 2, 3 pcs. shearing pl lathe dog, holding pin, grease gun, operating instructions and electrical documentation.

Handling tools consisting of:
- 1 pc. double-ended ring spanner 17x13 DIN837
- 1 pc. slip-on wrench B13x17-A DIN896
- 1 pc. hexagonal key wrench size 5 DIN911
- 1 pc. hexagonal key wrench size 6 DIN911
- 1 pc. double-ended spanner 8x10 DIN895
- 1 pc. single-ended spanner wrench size 13 DIN894
Transport

Danger

Mind the maximum permissible lifting capacity of the hoist and the gravity center position when lifting the machine.

- Fork length ........................................... min. 1000 mm
- Lifting capacity (incl. packaging) .... min. 350 kg

Transport with pallet

The packaging of the machine varies according to the country of supply. The pallet, however, is carried out equally for all packaging variants.

Positions the lift fork (1) in the pallet in such a way that the gravity center lies in the center of the lift fork.

The lift fork must be inserted at least 900 mm into the pallet.

Transport without pallet

- Remove the screw connections of the machine with the pallet.
- Position the lift fork (1) in the machine as shown (observe gravity center).

Attention:
Prior to inserting the lift fork (1) put wooden boards (2) onto the lift fork to avoid damaging the machine.
Criteria for installation

Ground

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

Ergonomic design

Due to its ergonomic design the machine provides optimum operation.

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

Space required for operation and maintenance

Space required for operation and maintenance
Dimensions of the machine

Subject to technical modifications!
Installation possibilities

The machine bed is mounted exactly at the machine stand.

Attention:
To avoid an influence on the accuracy of the machine mount the machine vertically only with the three setting screws (2) and counter. After aligning the machine just adjust the setting screw (6) to the respective support and counter it, too.

Installation with levelling shoes

Required:
4 levelling shoes order no. 585 110
* Screw the setting screws (2) M10x45 (enclosed pack) into the support threads in the recesses on the machine support. Prior to it loosen counter nuts (3).
* Place the machine in such a way on the levelling shoes (1) that the setting screws (2) are exactly in the grooves of the levelling shoes.
* Align machine with setting screws (2).
* Counter setting screws (2) with nuts (3).
* Adjust setting screw (6) only slightly and counter them, too.

Instead of levelling shoes also flat-bar steel 80x80x10 can be used.

Screwing down the machine

If the machine is to be screwed down three bores for wood screws (5) with washers and pins S10 have to be provided on the ground (dimensions for bores see "Dimensions of the machine").

We recommend wood screws 8x70 DIN 571.

The machine is aligned with three setting screws (2) M10x45 and respective counter nuts, the machine is fixed by tightening the wood screws (5).

Adjust setting screw (6) only slightly and counter it, too.

Use flat-bar steel 80x80x10 (4) as support so that the setting screws do not incorporate in the ground.
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 of the machine has to be entirely sealed against ground water and soil to avoid that any leakage of coolant grease, lubricating or hydraulic oil become environmental hazards. An ideal situation would be provided if the installation site at the same time fulfills 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.

* 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. Thus, the medium noise level should not exceed 70 to 75 dB(A). Sometimes the situations 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).

* Good and sufficient lighting of the working space facilitates operation of the machine and increases the quality of work.

* Unfavourable light and sun radiation may lead to reflections on the control screen and, thus, impair the visibility of information items.

* 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 protection

The longitudinal slide is clamped with a hexagon screw (1). Loosen the screw prior to start of operation. For exact facing it is recommended to clamp the longitudinal slide.

Mounting the coolant device
(accessory)

**Danger**

Mounting the coolant device may only be carried out by an electrics expert with machine switched off and EMERGENCY-OFF key actuated.

**Technical data of the coolant device**

Power of the pump motor .................. 110W
Tank capacity .................................. 27l
Max. pump capacity ......................... 40l/min

- Mount coolant pump onto coolant tank.
- Attach return flow hose of chip tray to coolant tank.
- Thread coolant pump cable through clamping angle (1) into electrical cabinet and connect it as follows:
  - With single-phase machine version clamp both cores onto the terminals 13 and 14 of the terminal strip X1.
  - Clamp the yellow-green core to the earthing bus bar (2).
- With three-phase machine version clamp the black core on terminal 13, the brown core on terminal 14 and the blue core on terminal 15 of the terminal strip X1.
- Clamp the yellow-green core to the earthing bus bar (2).
- Push coolant tank on the rear side of the machine into the machine.
- Fill coolant into the coolant tank.

**Attention:**

A switch is to be found at the coolant motor. Take care that this switch is always switched on. Otherwise the coolant pump cannot be switched on via the operating panel.

For quality and service life of the coolant please see chapter "Maintenance".
Electrical connection

Connected loads

Variant 1 .................. 230V~ 1/N/PE/50/60Hz
Variant 2 .................. 230V~ 3/PE/60Hz
Variant 3 .................. 400V~ 3/PE/50/60Hz
Max. voltage fluctuation ................. +6/-10%
Preliminary fuse for machine ............. 16 A slow
Connected load ....................... 3 kVA
Cross-section of cable:
Single-phase ...................... min. 3x2.5 mm²
Three-phase ...................... min. 4x2.5 mm²

Check of transformer connection

This transformer in the electric-box produces the internal control voltage (24V~).
Both black wires must be connected according to the drawings depending on voltage supply.
To obtain the control voltage of 24V the right-hand wire may be connected either to 200V or to 230V
(resp. either to 400V or to 440V in version 3) and/or
the left-hand wire may be connected either to +5% or -5%

Safety regulation:

• Prior to reclamping the phases switch off voltage.

• The electrical connection of the machine must be established by an electrics expert only.

• Important:
The Transformer must be reconnected only between 200V and 230V (Variant 1+2) or between 400V and 440V (Variant 3)
(=Voltage adaption)
Reconnection from the 400/440V-area to the 200/230V-area or backward will destroy the machine.
**Connection of the power supply cable**

**Danger**
The electrical connection to the operational mains may only be carried out by an electrician expert.

**Note**
Prior to connecting the power supply cable check the transformer connection in any case. Otherwise the power supply might be disconnected again for this operation.

* Open the electrical cabinet.
* Thread power supply cable at the rear side through clamping angle into the electrical cabinet.
* With three-phase version connect phases L1, L2, L3 to the terminal strip X1 as shown.
* With single-phase version connect phase L1 and the zero conductor to terminal strip X1 as shown.
Clamp yellow-green core PE to terminal (4) 1/2
* Fasten clamping angle with screws.

**Checking the correct mains connection**

Check if the rotating direction of the main spindle is correct after switch-on. If the spindle movement does not correspond to the switch symbols at the main spindle switch (1), with three-phase version of the machine two phases, e.g. L1 with L2, have to be interchanged when clamping them on terminal strip X1.

**Danger**
Prior to interchanging the phases separate power supply cable from the mains.

**Fuses**
See electrical documentation, which can be found in the electrical cabinet.
Caution:
Connecting this machine to a mains protected by leakage current circuit breaker is admissible only with using an all-current-sensitive leakage current breaker.

Reason:
The drives used for this machine can cause DC leakage currents which will impair the protective function of the leakage current breaker (no release).

Types of the all-current-sensitive leakage current breaker tested by EMCO:
SIEMENS 5 SZ6 468 - OKG00
EMCO-Ref.No.: ZME 280 720
Other possible Type: ABB F804-63/0,3

Initial start-up

- All blank parts are to be cleaned from rust preventing agent with a clean cloth and subsequently to be oiled slightly.

- Lubricate the guideways during initial start-up and after major standstill of the machine.

- Check the oil level for headstock gear and feed gear at the inspection glasses (1) and (2). Oil has already been filled in in delivery state.

- In case of existing coolant device (accessory) fill in coolant.

- Switch on machine using the main switch.
B Working with the machine

Notes for operators

In addition to the constantly increasing requirements of productivity and flexibility of working processes the demand for environmental compatibility has become of utmost importance. Avoiding environmental damage in the past years has become a central issue of society. We can no longer shift the blame on others according to the principle “don’t hit me but hit the others”. Rather, everybody has to contribute in his sphere of responsibility.

Machining production, too, contains many areas that may represent a burden to environment.

The main burdens are:
* chips contaminated with cooling lubricant
* auxiliary materials and utilities (cooling lubricants, cutting oils, lubricating oils etc.)
* special waste (oily cleaning rags, used emulsions etc.)
* formation of oil mist
* annoyance caused by noise; vibrations
* waste heat
* etc.

Based on the necessity of the protection of our environment, laws and stipulations were created the observation of which aims at the improvement of the present situation. Additionally, the control of the compliance with these regulations has become stricter recently. Increasingly, also small companies are subjected to this trend and have to guarantee an environmental compatibility as high as possible of their production. Thus, reacting in time a to a changed situation turns out to be of utmost importance for the business.

It is EMCO’S aim to contribute to an improvement of the present environmental and waste disposal situation in machining production.

The following important hints are to be intended as a contribution. By observing these hints you will render a direct service for the protection of our environment in general and also for the quality improvement of your own working area. The hints are described in such a way that their observation will not cause additional costs and in most cases even a reduction of costs is possible in the short-term perspective. For a better comprehension of the solutions offered a short outline on the environmental problems occurring in machining production is provided prior to the hints proper.

1. Environmental burdens in machining production

1.1 Lubricants

The use of lubricants in machining production is indispensable. Frequently the lubricants are not used with optimum efficiency out of ignorance. Particularly when storing the lubricants the materials are handled in a careless way which is why the lubricants reach the soil and add to burdening the ground water. Leakages, damaged barrels, carelessness when handling oils, lacking or poorly serviced oil separators, empty barrels being "washed out" by the rain in the open air are just a few examples for the situation to be found too often in the companies. Nor does the existence of oil barrels in the most out-of-place corner of production represent a desirable solution. Oil-contaminated bay floors and dirty machines - as a result of incorrect handling of lubricating oils - represent an essential impairment of the quality of the place of work and, thus, indirectly also of the quality of the results achieved.

1.2 Cooling lubricants

Just like greases, cooling lubricants, too, are an indispensable factor in machining production. Cooling lubricants are highly developed chemical products that require careful handling. Wrong handling may lead to serious damage of health. Finely sprayed emulsions (open working space) reach the "lung" and are not eliminated any more. Similarly, the wrong handling of emulsions may lead to skin desease (oil acne, oil excema etc.) and via injuries of the skin also to infections. By adequate hygienic measures of the company these dangers can be avoided. Emulsions are highly dangerous to ground water and must in no case be spilled away carelessly. Biodegradable cooling lubricants do not represent a solution in this respect since these emulsions are innocuous for the environment when being supplied but during operation, due to the contaminations occurring (leakage oils from lost oil lubrication, frictions etc.) loose their biological innocuousness and thus cannot be disposed of any more via sewage system. A particular source of danger are the residual emulsions that adhere to the chips. When storing the chips in the open air or under roofs permeable to water the residual emulsion may be washed out by the rain and
thus reaches the sewage system or the ground water.

The durability of cooling lubricants is limited. Since cooling lubricants contain organic substances they are prone to infestation by microorganisms. If their number increases too much the emulsion “tilts” over and has to be renewed. If the growth of these microorganisms is avoided the service life can be prolonged.

By service measures and careful handling of emulsions the durability can be prolonged considerably.

Essentially, these microorganisms reach the emulsion:
* via the air
* via dirty water
* via leakage oils
* via waste getting in touch directly or indirectly with the emulsion (cigarette ends, empty tins of drinks etc.)
* via the workpiece machined
* via operating staff
* via lacking hygienic conditions in the company

Observing the following hints of care you can contribute considerably to an improvement of the situation and to cost savings.

1.3 Solvents and cleaning agents

Cleaning agents are amply used in machining production for washing of machined workpieces as well as in repairs and for cleaning utilities. But the chlorinated hydrocarbons (e.g. trichloroethylene, trichloroethane, perchloroethylene etc.) are amply used. For the user these substances represent a source of danger that is not evident. Particularly due to the seemingly non-problematic use of these substances (inflammable, very good liposolubility, little odour etc.) these substances obscure the fact that they are serious poisons of the liver and the nerves. Therefore, it is necessary to handle these substances adequately. Additionally, these substances are able, due to their little density, to penetrate without problems through concrete floors (even very thick ones) and thus contaminate the ground water. Due to their low boiling point these substances evaporate from open plants (e.g. open cleaning tray). A very unfavourable feature is the fact that these substances are not decomposed biologically and thus represent a serious environmental hazard. In the past this has led to environmental burdens which today lead to a contamination of the ground water reservoir.

1 kg of chlorinated hydrocarbons may render forever unusable 40 millions litres of drinking water!

1.4 Special problems with chips containing residual oil

With the chips considerable quantities of lubricants and emulsions are “discharged” by the machine. By drop-off of the chips a part of these substances can be recovered (as valuable auxiliary materials). The remaining quantities are “lost” during transport and storage until further use and thus also contribute to ground water contamination.

Chips are not waste but represent valuable raw materials!

Therefore, it is necessary:
* that the chip containers are not used as waste baskets (cigarette ends, plastic cups etc. are not to be thrown into the chip container)
* that the chips are collected in accordance with grades
* that the chips reach their further use without oil, if possible, since otherwise they burn more when charged into the steel furnace.

1.5 Problems with oil mists and oil vapours, dust etc.

Oil mists are caused by evaporation and mixing of lubricants or emulsions by draughts in the working space. An essential factor in the formation of oil mist is also represented by the user of compressed air when cleaning workpieces, machines and devices. The same holds also true for dust development during dry machining.

In addition to representing a burden to the working environment (machines and devices become oily), oil mists and vapours contribute to health hazards of the operating staff.

1.6 Further burdens

In addition to the burdens illustrated particularly annoyance by excessive noise, problems with accumulating waste heat and the use of other
problem substances connected indirectly with machining production (e.g. cold cleaning agents, pour-in resins, packaging materials etc.) represent further burdens for the machine operating staff and the environment.

2. Measures of environmentally compatible design in machining production

2.1 General hints

The best way to remove waste is to not cause it at all!
Thus, avoid as much as possible any special waste! Handle substances noxious to the environment with great efficiency!
Mind correct operation when handling dangerous substances!
"Carefree“ handling of problematic substances is not a simple offence, it damages your health and increases the burden on environment and on costs!
Use the right dosages!
Observe the instructions of the manufacturer!
Avoid any unnecessary waste!

2.2 Hints for correct handling of utilities

2.2.1 Lubricant oils

Storage of lubricant oils:
Avoid any kind of loss of lubricant; during storage, use (leaking lines, sealings), during refilling and transport etc. Accordingly, this also applies to used oil.
Pay attention that the storage is on solid ground and that the oil containers cannot tilt.
Drop trays must be able to collect the residual oil.
Lock empty oil barrels stored in the open air against wash-out by rain.
Used lubricant oils are special waste and have to be disposed of as such.

Identify clearly those containers which are available for the collection of different disposal substances (e.g. used oil, barrel for used oil filters, oily cleaning rags etc.).

Use of lubricant oils:
Only use adequate lubricants (wrong lubricants are consumed faster, lead to formation of fumes and to unnecessary disposal quantities).
When using lubricant oils mind the compatibility with other auxiliary materials (e.g. emulsions); instructions are provided by the manufacturer of the products.
In case of doubt try to get information since the wrong use of the product may lead to considerable costs...
Take care of the lubricants! Regular cleaning or change of filters will increase service life.
Close carefully the filling outlets.

2.2.2 Cooling lubricants

Only use cooling lubricants that are compatible with the lubricants used. (Incompatibility among each other will result in shorter life time of the cooling lubricant used.)
If possible, use cooling lubricant without halogens (these are considerably cheaper for disposal).
Observe the storage conditions for the concentrate containers (no frost, no excessive heat etc.).
Multi-use containers help to reduce disposal quantities and are therefore to be preferred.
Take particular care of your cooling lubricants! Due to thorough care the service life is at least doubled. Mind the following hints for care:

* Avoid any contamination of the emulsion.

* The cooling lubricant container is not a waste basket. Avoid mixing of residual oils in the emulsion (used oils are lighter than the emulsion and remain on top. They cover the emulsion and prevent oxygen supply. Thus, there is an ideal source for anaerobe microorganisms).

* Regularly eliminate the used oils on top (daily prior to operation start), or simply by skimming off.

* Avoid contamination of the emulsion by leaking oils (e.g. untight pneumatic system etc.).
• Check regularly the concentration of the emulsion (too fat emulsions lead to a major health hazard and also attack machine parts).

• Check daily the filling level of the emulsion; too little emulsion quantities are warmed up excessively and thus promote bacterial growth.

• Avoid unnecessary splashing of emulsions (e.g. by skinning geometries).

• With major standstill times of the machines repump the emulsion quantity at least once daily (oxygen activation!).

• Remove the chips after operation from the machine (short after-running of the chip conveyor will be sufficient in most cases).

• Mind during change of emulsion:
  - The used emulsions are to be pumped into containers designated clearly for that purpose (independently of persons; to be understood by everybody as a prevention against emergencies) to avoid confusion!
  - Do not mix carelessly the emulsions to be disposed of with other substances since the disposal costs might increase considerably.
  - Clean the entire coolant circuits very carefully (contaminations particularly in corners of difficult access are a source for bacteria which will attack again immediately the freshly prepared emulsion).

Mind: When using system cleaning agents the costs of the disposal of the emulsion may be increased!
  - Mind the correct mixing ratio during fresh preparation!
  - Emulsions should not be mixed for storage and then stocked.

2.2.3 Hints for correct handling of chips

Chips represent a valuable raw material! They are not to be treated as waste.

When handled incorrectly, chips may contaminate the ground water and the soil (if adhered with emulsions and lubricants).

Chips are to be stored in the state as they leave the machine tool in an oil-proof container which makes it possible to drop off the residual emulsion (used oils). On the bottom of the container a collecting tray has to be placed where the dropped-off emulsion may collect without mixing with the chips. An outlet valve should facilitate emptying of the dropped-off lubricant.

A sufficiently long drop-off period is to be provided as well as an adequately high temperature (in winter not in unheated environments) so that the residual materials show a viscosity which favours a complete drop-off.

The collection of emulsions (oils) has to be according to grades so that during refilling into the cooling lubricant circuit necessary contamination items will not reach the circuit.

The chips should also be collected and stored according to the grades since a mix-up will lead to an impairment of the quality of the raw material.

The chip container must not represent the waste basket in production; waste must not be mixed with valuable raw materials.

After drop-off the chips - also classified according to grades - are to be stored temporarily until being carried away by the scrap dealer.

The collection of the residual oil droppings down has to be guaranteed so that in this phase there is no hazard to soil and ground water. In any case the storage in the open air or under inadequately fixed roofs is to be avoided since here the residual oils may be washed out by rain.

2.2.4 Hints for the correct handling of dangerous substances

Try to resort to alternative substances; use dangerous substances only if it is indispensable to use them!

The cost argument can frequently not be supported with a view to increasing disposal costs and often also because of the incorporation of the disposal costs in the overhead costs.

Avoid the use of dangerous substances whenever it is possible by:
Quantitative avoidance:
by renouncing problem substances and/or change to products that can be recycled or decompose
Qualitative avoidance:
by saving measures and optimization in use
If dangerous substances cannot be avoided only such substances should be used that can be recycled by:
* material reutilization (recycling)
* biochemical reutilization (composting)
* energetic reutilization (burning)

Waste that cannot be avoided nor recycled has to be disposed of as innocuously as possible (disposal after adequate pretreatment).

So-called special waste requires particularly careful handling. A list of these special wastes is to be found on the following pages. This outline forms an extract of ÖNORM S 2101 in which special wastes are indicated that need supervision. For all these substances the following applies:
* information and notification required
* records required
* innocuous disposal required
* declaration required (accompanying certificate)
<table>
<thead>
<tr>
<th>Designation</th>
<th>Key number</th>
<th>Properties</th>
<th>State</th>
<th>1) Note</th>
<th>2) Origin (examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>oil-contaminated soil (excavated material)</td>
<td>31423</td>
<td>hazard to water</td>
<td>solid (also pasty)</td>
<td>1) during collection, transport and storage is protect against heat</td>
<td>2) oil accidents, mineral oil extraction, old charges</td>
</tr>
<tr>
<td>used filter and absorption masses if charged with other special waste that needs supervision</td>
<td>31434</td>
<td>hazard to water see (1)</td>
<td>solid</td>
<td>1) classification with a view to properties is to be carried out according to the filtered material</td>
<td>2) water preparation, production of foods and luxury foods, chemical industry, laundries, adsorbate gas and liquid cleaning processes</td>
</tr>
<tr>
<td>metal wastes</td>
<td>35</td>
<td>toxic, hazard to water, explosive</td>
<td>solid</td>
<td>1) may contain lead, cadmium, arsenic, beryllium. Particular measures avoid dust explosions required.</td>
<td>2) production of processing of prongs.</td>
</tr>
<tr>
<td>dust containing nonferrous metals</td>
<td>35321</td>
<td>toxic, hazard to water</td>
<td>solid</td>
<td>2) Production of aluminium. Foundries, production of lead. Production of magnesium, ignition stones and pyrotechnical products, electrical engineerit.</td>
<td></td>
</tr>
<tr>
<td>mercury batteries</td>
<td>35324</td>
<td>toxic, hazard to water</td>
<td>solid</td>
<td>2) production of batteries, trade, application</td>
<td></td>
</tr>
<tr>
<td>dry batteries, containing mercury and silver</td>
<td>35325</td>
<td>toxic hazard to water</td>
<td>solid</td>
<td>2) production of batteries, trade, application</td>
<td></td>
</tr>
<tr>
<td>waste produced by mineral oil products</td>
<td>54</td>
<td>hazard to water, caustic with pH &lt; 3, may form explosive gases with air</td>
<td>liquid</td>
<td>2) textile industry</td>
<td></td>
</tr>
<tr>
<td>oils acid *)</td>
<td>54101</td>
<td>hazard to water, residues from used oil treatment may be toxic, may form explosive gases with air</td>
<td>liquid to solid</td>
<td>1) also hydraulic oils and brake liquids trade and industry, filling stations, 2) car repair workshops</td>
<td></td>
</tr>
<tr>
<td>used oils *)</td>
<td>54102</td>
<td>hazard to water, residues from used oil treatment may be toxic, may form explosive gases with air</td>
<td>liquid to solid</td>
<td>1) also hydraulic oils and brake liquids trade and industry, filling stations, 2) car repair workshops</td>
<td></td>
</tr>
<tr>
<td>drilling cutting and grinding oils *)</td>
<td>54109</td>
<td>hazard to water, may form explosive gases with air</td>
<td>liquid</td>
<td>2) metal machining</td>
<td>2) metal machining</td>
</tr>
<tr>
<td>synthetic coolants and lubricants *)</td>
<td>54401</td>
<td>hazard to water</td>
<td>liquid</td>
<td>2) metal machining</td>
<td>2) metal machining</td>
</tr>
<tr>
<td>drilling and grinding oil emulsions and emulsions mixes *)</td>
<td>54402</td>
<td>hazard to water</td>
<td>liquid</td>
<td>2) metal machining</td>
<td>2) metal machining</td>
</tr>
<tr>
<td>oil water mixes *)</td>
<td>54408</td>
<td>hazard to water</td>
<td>liquid</td>
<td>2) metal machining</td>
<td>2) metal machining</td>
</tr>
<tr>
<td>Designation</td>
<td>Key number</td>
<td>Properties</td>
<td>State</td>
<td>1) Note</td>
<td>2) Origin (examples)</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>------------</td>
<td>---------------------------------</td>
<td>------------------------------</td>
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<td>----------------------</td>
</tr>
<tr>
<td>contents of oil separators and of petrol separators *)</td>
<td>54702</td>
<td>hazard to water</td>
<td>liquid to solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sludge from oil separating plants *)</td>
<td>54703</td>
<td>hazard to water</td>
<td>liquid to solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sludge from container cleaning and barrel cleaning *)</td>
<td>54704</td>
<td>hazard to water</td>
<td>liquid to solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>paraffine oil sludge *)</td>
<td>54706</td>
<td>hazard to water</td>
<td>liquid to solid</td>
<td>2)</td>
<td>petrol chemistry, commerical trade, metal, glass and rock machining</td>
</tr>
<tr>
<td>grinding sludges, oil-containing *)</td>
<td>54710</td>
<td>hazard to water</td>
<td>liquid to solid</td>
<td>2)</td>
<td></td>
</tr>
<tr>
<td>used oil binding materials *)</td>
<td>54926</td>
<td>hazard to water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>used oil and air filters (containing mineral oil *)</td>
<td>54928</td>
<td>hazard to water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>perchlorethylene (per)</td>
<td>55209</td>
<td>hazard to water</td>
<td>liquid</td>
<td>2)</td>
<td>chemical industry, textile industry, laundries, degreasing, production of coating agents</td>
</tr>
<tr>
<td>trichlorethane</td>
<td>55212</td>
<td>hazard to water toxic only 1.1.2 trichlorethane detrimental to health</td>
<td>fimoig</td>
<td>2)</td>
<td>chemical industry, textile industry, laundries, degreasing, production of coating agents</td>
</tr>
<tr>
<td>trichlorethylene (tri)</td>
<td>55213</td>
<td>hazard to water, detrimental to health</td>
<td>liquid</td>
<td>2)</td>
<td>chemical industry, textile industry, laundries, degreasing, production of coating agents</td>
</tr>
<tr>
<td>cold cleaning agents, halogen-containing solvent mixes, halogen-containing</td>
<td>55214</td>
<td>hazard to water</td>
<td>liquid</td>
<td>2)</td>
<td>industry and trade</td>
</tr>
<tr>
<td></td>
<td>55220</td>
<td>hazard to water, may be toxic</td>
<td>liquid</td>
<td>2)</td>
<td>industry and trade</td>
</tr>
<tr>
<td>diluent for cellulose lacquers</td>
<td>55359</td>
<td>hazard to water, may form explosive gases with air</td>
<td>liquid</td>
<td>2)</td>
<td>cleaning and degreasing of metallic surfaces, production of coating agents, textile industry, plastics processing, chemical industry</td>
</tr>
<tr>
<td>paraffine oil</td>
<td>55360</td>
<td>hazard to water, may form explosive gases with air</td>
<td>liquid</td>
<td>2)</td>
<td>cleaning and degreasing of metallic surfaces</td>
</tr>
<tr>
<td>solvent mixes, halogen-free</td>
<td>55370</td>
<td>hazard to water, may form explosive gases with air</td>
<td>liquid</td>
<td>2)</td>
<td>trade and industry</td>
</tr>
<tr>
<td>solvent-containing sludges, halogen coating</td>
<td>55401</td>
<td>may be toxic, hazard to water</td>
<td>liquid to pasty</td>
<td>2)</td>
<td>industry and trade, concentration plants</td>
</tr>
<tr>
<td>solvent-coating sludges, halogen free</td>
<td>55402</td>
<td>may be toxic, hazard to water</td>
<td>liquid to pasty</td>
<td>2)</td>
<td>industry and trade, concentration plants</td>
</tr>
</tbody>
</table>
Main and operating elements

1 Lockable main switch
2 Switch for coolant pump
3 Electrical cabinet
4 EMERGENCY-OFF key
5 Switch for vertical unit
6 Switch speed range slow/quick
7 Switch on/off; (left/right)
8 Feed lever for longitudinal and cross feed
9 Apron nut lever
10 Handwheel for cross slide
11 Handwheel for longitudinal slide
12 Sliding clutch
13 Engaging and disengaging claw clutch
14 Inspection glass oil level feed gear
15 Control knobs for feeds and pitches
16 Machine base
17 Inspection glass oil level headstock
18 Reverse control knob for feed
19 Control knobs speed
20 Chuck guard
21 Headstock
22 Feed gears
23 Splash protection wall
24 Top slide
25 Nuts for fixation of the top slide
26 Locking screw for cross slide
27 Locking screw for longitudinal slide
28 Handwheel for top slide
29 Tailstock sleeve
30 Clamping lever for tailstock sleeve
31 Lever for tailstock fixation
32 Lubricating nipple for tailstock sleeve
33 Handwheel for tailstock
34 Tailstock
35 Machine bed
36 Cross slide
37 Apron

EMCO

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Speed setting

The machine is provided with 8 different speeds to be adjusted mechanically.

Setting is carried out by means of the control knob (1) and (2) in accordance with the diagram (3).

During switching turn the main spindle slightly by hand so that the control levers snap in distinctly and easily.

**Attention**
Speed setting may be carried out only during standstill of the machine.

**Example**
With a desired speed of 600 rpm the control levers (1, 2) have to be set as shown in the speed diagram.

The main spindle is switched on by means of the switch (4) after setting the speed and after switching on the main switch (6). Thus, when turning to the right the main spindle is switched on in clockwise run - and when turning to the left it is switched on in counter-clockwise run. By means of the switch (5) you can select between slow speed (positions 1 on the speed diagram) and rapid speed (positions 2).

**Note**
* All toothed wheels are ground and hardened. Inexpert switching may damage the tooth profile leading to an increase of the running noise.
* If a speed is to be set which is in the intersection range of two speeds, in general to lower speed is to be set. Thus, a larger torque is achieved.
* With single-phase machines observe in any case the items indicated under chapter working hints "Noise burden of single-phase machines during lower speeds" and "Work with maximum speed step (2200 rpm) with 115 volt version".
Feed setting

The automatic feed can be used for movements in longitudinal (Z-) and cross axis (X-).
To the feed gear a reverse gear is connected in series. Thus, a reversal of direction of the feed with equal rotary direction of the main spindle is possible.
In the feed diagram the feed values are indicated in [mm/rev.] with metric version and in [inch/rev.] with inch version.
However, you have to take into consideration that the feed values for the cross feed are carried out only
- by half of the indicated value with metric machines;
- by 2/3 (67%) of the indicated value with inch type machines.
Furthermore, in the diagram also the location of the change gear wheels can be seen.

Attention
* The feed levers may be set only during machine standstill.
* Eine Richtungsumkehr des Vorschubes mit dem Drehknopf (1) darf nur bei Stillstand der Maschine durchgeführt werden.

Note
If automatic feed is not used set turning knob (1) to "0" so as not to needlessly burden the feed drive.

The feed direction is selected with the control knob (1).
In position "0" the power flow between spindle and feed gear is interrupted.
Feed gear, change gear wheels, lead screw and feed shaft are in standstill also with the main spindle running.
Select the desired feed value in accordance with the diagrams (4) and (5) by means of the control knobs (2) and (3).

During setting, turn the main spindle slightly by hand so that the turning knobs snap in distinctly and easily in the switching positions.
For easier turning of the main spindle set a high speed or insert chuck key.
Switching the feeds and pitches

**Danger**

During work with automatic feed never put your hand between tailstock and slide, otherwise injuries (contused wound) might be caused during the slide travel.

Only the direction, which is shown with an arrow-symbol on the feed lever, can be obtained. In the order to change to the other feed, the lever has to be pulled out and turned 180°.

**Setting the longitudinal feed**

* Pull out feed lever and turn to longitudinal feed (see arrow).
* Pull out feed lever and swing upwards.

**Setting the cross feed**

* Pull out feed lever and turn to cross feed (see arrow).
* Pull out feed lever and swing downwards.

**Coupling the half-nut for thread-cutting**

By swinging the half-nut lever clockwise, the half-nut engages with the leadscrew. When leadscrew is not moving, the longitudinal slide is slightly moved by means of the handwheel, until the half-nut can be engaged easily.
Cutting speeds

Cutting speed in m/min (feet/min.)

Workpiece diameter in mm (inch)
Approximate values for cutting speed

Values valid for dry cutting with:
High-speed steel tools for cutting speed v60 (age 60 min), Carbon tipped tools for cutting speed v240 (age 240 min), side angle γ = 45°, point angle ε = 90°, angle of inclination λ = 0°...8°, for light alloy and plastic λ = 5°...10°;

Cutting speed v = \frac{d \cdot \pi \cdot n}{1000}\text{ in m/min}

These values hold good for cuts up to 5 mm deep, over 5 mm the cutting speed should be reduced by 10°...20%.

<table>
<thead>
<tr>
<th>Workpiece material</th>
<th>Tensile strength in kp/mm²</th>
<th>Tool</th>
<th>Cutting angle</th>
<th>Feed in mm/rev.</th>
<th>Coolant and lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clearance α</td>
<td>Top γ</td>
<td>Cutting speed v in m/min</td>
</tr>
<tr>
<td>Steel, St 34, St 37, St 42 up to 50</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>14</td>
<td>260</td>
</tr>
<tr>
<td>St 50, St 60 50...70</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>14</td>
<td>240</td>
</tr>
<tr>
<td>St 70 70...85</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>14</td>
<td>200</td>
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<tr>
<td>Cast steel 50...70</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>118</td>
</tr>
<tr>
<td>Alloys 85...100</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td>Mn-Steel, Cr-Ni-Steel, Cr-Mo-Steel 100...140</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>95</td>
</tr>
<tr>
<td>Other alloys 140...180</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Tool steel 150...180</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>GG-20, GG-25</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>106</td>
</tr>
<tr>
<td>Cooper alloys hardness Brinell 200...250</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>600</td>
</tr>
<tr>
<td>Cast bronze hardness Brinell 80...120</td>
<td>S1</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>355</td>
</tr>
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<td>Plastics and hard rubber</td>
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<td>Bakelite, Novolac, Pertinax hard plastic</td>
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<td>12</td>
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</table>

SS = high speed steel  S1 H1 G1 = tipped tools  E = cutting emulsion  P = paraffin  tr. = dry  L = air

* Do not use with water or water mixtures (DANGER OF FIRE)
Thread cutting

The pitches which can be cut without the change gear set are indicated on the cover of the gearbox.

For thread cutting, only the leadscrew is used. It is engaged for this purpose.

A thread is cut in several work operations. The half-nut is not disengaged at the end of the thread, as it would then be difficult to find the cut thread path again without the thread dial indicator. For this reason, at the end of a thread, the cross slide is turned back. By switching the direction of motor revolution, the longitudinal slide is again brought back to the beginning position.

The number of thread pitches, the type of pitch (Module, Diametral, etc.) and the range of pitches can be increased as required with the set of change gears.

The following charts indicate all standard pitches which are required.

Calculating special pitches is not always easy, even for experienced machinists. If such pitches are required, our technicians would be glad to be of assistance in the calculation upon request.
### Module pitches

<table>
<thead>
<tr>
<th></th>
<th>Modul</th>
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### Diametral pitches

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Additional threads and pitches with change gear set (inch type machine)

Additional metric threads on inch type machine

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Additional inch threads on inch type machine

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### Modul pitches on inch type machine

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### Diametral pitches on inch type machine

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</table>
Mounting the change gears

**Danger**

* Reinsertion of change gears may be carried out only during machine standstill and with the EMERGENCY-OFF key actuated.
* Never start the machine when the change gear cover has been taken off.

**General:**

There should be a small amount of clearance between gears. This does not reduce accuracy.

The number of teeth is engraved on each gear wheel.

**Example of mounting**

Required thread: module thread m 0.5  
(actual pitch = m x p = 0.5 x 3.14 = 1.57 mm)  
(see Thread cutting/Module pitches)

From the chart you can see:

1. Gear 55 drives gear 90.
2. Gear 90 drives gear 70.
   Gear 70 and gear 80 are on the same bush and therefore have the same speed.
3. Gear 80 drives gear 60 which is mounted on the primary shaft of the feed gear.
4. Levers are switchd to positions A5 or B1.

**Mounting**

1. Swivel down the gear quadrant
   The presently-mounted gears are dismounted.
   The axis with the change gear set (1) is mounted to the bottom arm of the quadrant (see arrow).

1. Quadrant
2. T-nut
3. Pressure washer
4. Axis
5. Bearing bush
2. Gear 55 is mounted onto the spline shaft; gear 60 is mounted onto the primary shaft.

6. Spline shaft
7. Spacer
8. Gear 55
9. Tightening washer
10. Socket head screw
11. Gear 60

3. Gears 80 (11) and 70 (12) are mounted onto the bearing bush of the bottom arm of the quadrant and axially fixed with the compensating washer (13) and the knurled nut (14).

The axis is now tightened, so that gears 60 and 80 mesh.

A spacer is placed onto the second bearing bush and then gear 90 is mounted onto this bush and then axially tightened as described above with compensating washer (13) and knurled nut (14).

4. Gear 90 is brought to mesh with gear 55 by swivelling the quadrant. The quadrant is then fixed with the hexagon nut.

5. Remount gear cover.
The tailstock

The tailstock is set on the rear Vee of the lathe bed and is made of high-grade vibration-free cast-iron.

The tailstock sleeve is moved via the handwheel (travel of tailstock sleeve 90 mm (3.54")). A graduated scale is engraved into the tailstock sleeve. Accurate feed is guaranteed by a scale ring on the tailstock handwheel. Scale graduations on metric machines 0.025 mm, on inch type machines 0.001".

Note:
Tailstock sleeve should always be clamped, except during drilling work.

The inside taper of the tailstock sleeve (MT 2) serves for receiving centers and drill chuck. By turning back the sleeve, the center or drill chuck is automatically ejected. The tailstock itself is clamped to the lathe bed with the clamping lever.

Resetting the clamping lever
The clamping lever can be reset from 60° to 60°, in order to place the lever in the most convenient position for working.

Resetting
The clamping lever (1) is turned out so far, until the hexagon screw (2) can be turned in the slot of the wedge (3). The wedge is prested up against the clamping plate (4).

Setting-over the tailstock

Example: Setting-over the tailstock to the front

The rear screw is loosened. By turning the front screw (1) clockwise, the tailstock is moved to the front. When the required set-over position is achieved, the rear screw is tightened again.

With the aid of the line marks (2), the tailstock can again be brought to the required position.
**Taper turning using the tailstock set-over**

Long and slight tapers can be machines also with automatic feed, by setting-over the tailstock. The workpiece must be clamped between centers.

Tailstock set-over \[ v = \frac{D-d}{2} \times \frac{L}{l} \]

Example: \( D = 70 \text{ mm}; d = 65 \text{ mm}; \)
\( L = 400 \text{ mm}; l = 200 \text{ mm} \)

result:
\[ v = \frac{70-65}{2} \times \frac{400}{200} = \frac{5}{2} \times 2 = 5 \text{ mm} \]
Mounting clamping device onto DIN spindle

The main spindle has a spindle bore of ø26 mm. The spindle nose is standardized according to DIN 55021.

The maximum chuck diameter is 140 mm. The maximum diameter of the face plate is 152 mm.

Mounting the clamping device on the main spindle

Note
Prior to mounting a clamping device on the spindle nose, the spindle nose and the chuck have to be cleaned from chips and other dirt.

Danger
Mounting and dismounting the clamping device may only be carried out during standstill of the machine and high swivelled chuck protection.

Procedure
Place clamping device (with stud bolt) onto spindle nose and fasten with the three hexagon nuts M10.
Mounting clamping device onto Camlock-spindle

The main spindle has a spindle bore of ø 35 mm. The spindle nose is in accordance with DIN 55029.

The maximum diameter of chuck is 140 mm.
The maximum diameter of face plate is 152 mm.

Note
Prior to mounting a clamping device on the spindle nose, the spindle nose and the chuck have to be cleaned from chips and other dirt.

Danger
Mounting and dismounting the clamping device may only be carried out during standstill of the machine and high swivelled chuck protection.

Screwing in the Camlock bolts into the clamping device
All 6 Camlook bolts (2) are to be screwed into the support thread of the clamping device (4). The Camlock bolts have to be turned in only until the recesses (3) at the bolts are at the same level of the plane surface of the clamping device (see figure on front page) and the clocking screws (1) can be screwed in.
Screw in and tighten the 6 blocking screws (1).

Danger
If the recess at the Camlock bolt is above or below the plane surface of the clamping device, safe clamping cannot be guaranteed anymore.

Mounting the clamping device
Stick clamping device (4) with the Camlock bolts (3) into the supports of the spindle nose (2). Fix clamping device by turning the 3 clamping cams (1) with a square spanner in clockwise direction at the spindle nose.
The clamping cams (1) are open if the marks at the cams are in accordance with the marks at the spindle nose.
C Maintenance/Readjustment works

Lubricant scheme

Danger
All maintenance work may only be carried out with the main switch switched off and the EMERGENCY-OFF key actuated.

1. Headstock (remove cover for oil change)
2. Oil sight glass on headstock
3. Drain plug on headstock
4. Filling screw in gearbox
5. Oil sight glass on gearbox
6. Drain plug on gearbox
7. Grease nipple for carriage
8. Grease nipple for tailstock spindle
9. Grease nipple on cross slide
10. Grease nipple for leadscrew support
11. Grease nipple for change gears bolt
12. Top slide guideway
13. Cross slide guideway
14. Tailstock sleeve
15. Bed guideways
16. Leadscrew
17. Toothed rack

Note to Pos. 2 and 5
The oil level must not be above the middle of the oil sight glass, rather a little below.
## Lubricant table

<table>
<thead>
<tr>
<th>Machine part</th>
<th>Lubrication position</th>
<th>Control position</th>
<th>Material</th>
<th>Type of lubrication</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle stock</td>
<td>1</td>
<td>2</td>
<td>Oil</td>
<td>Oil bath</td>
<td>approx. 0.4 l</td>
<td>approx. 500 hours</td>
</tr>
<tr>
<td>Gear box</td>
<td>4</td>
<td>5</td>
<td>Oil</td>
<td></td>
<td>approx. 0.4 l</td>
<td></td>
</tr>
<tr>
<td>Carriage</td>
<td>7</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tailstock spindle</td>
<td>8</td>
<td>-</td>
<td>Grease</td>
<td>Grease gun</td>
<td>approx. 24 hours</td>
<td></td>
</tr>
<tr>
<td>Top slide spindle</td>
<td>9</td>
<td>-</td>
<td>Oil</td>
<td>Oil can</td>
<td>Several times a day, especially leadscrew when thread-cutting</td>
<td></td>
</tr>
<tr>
<td>Leadscrew</td>
<td>10</td>
<td>-</td>
<td>Grease</td>
<td></td>
<td>approx. 24 hours</td>
<td></td>
</tr>
<tr>
<td>Change gear bolt</td>
<td>11</td>
<td>-</td>
<td>Oil</td>
<td>Oil can</td>
<td>approx. 24 hours</td>
<td></td>
</tr>
<tr>
<td>Top slide</td>
<td>12</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross slide</td>
<td>13</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tailstock ram</td>
<td>14</td>
<td>-</td>
<td>Oil</td>
<td>Oil can</td>
<td>approx. 300 hours</td>
<td></td>
</tr>
<tr>
<td>Bed guideways</td>
<td>15</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadscrew</td>
<td>16</td>
<td>-</td>
<td>Grease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toothed rack</td>
<td>17</td>
<td>-</td>
<td>Oil</td>
<td>Oil can</td>
<td>weekly</td>
<td></td>
</tr>
<tr>
<td>Vertical unit</td>
<td>18</td>
<td>19</td>
<td>Oil</td>
<td>Oil bath</td>
<td>approx. 0.5 l</td>
<td>approx. 300 hours</td>
</tr>
<tr>
<td>Pinion</td>
<td>20</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spindle</td>
<td>21</td>
<td>-</td>
<td>Oil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td>22</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Lubricant and coolant recommendations

<table>
<thead>
<tr>
<th>Use</th>
<th>Designation according to DIN</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle gear</td>
<td>Hydraulic oil HLP DIN 51524/2 ISO VG46</td>
<td>BP CASTROL EUROL ESSO KLÜBER MOBIL</td>
</tr>
<tr>
<td>Feed gear</td>
<td></td>
<td>Energol HLP 46 Vario HDX Spezial K Nuto H 464 Croucanol 46 DTE 25</td>
</tr>
<tr>
<td>Slide guideways</td>
<td>Guideway oil CGLP DIN 51502 ISO VG68</td>
<td>BP CASTROL ESSO KLÜBER MOBIL</td>
</tr>
<tr>
<td>Tallstock sleeve</td>
<td></td>
<td>Maccurat 68 Magnaglide D68 Febis K 68 Lamora Super Pollad 68 Vectra 2</td>
</tr>
<tr>
<td>all grease lubricant points (lubricating nipple) change gears</td>
<td>Grease DIN 51804/T1 NLGI 2 DIN 51807 1</td>
<td>EMCO BP CASTROL KLÜBER MOBIL RÖHM</td>
</tr>
<tr>
<td>Metal machining</td>
<td>Cooling lubricant</td>
<td>BP BP BP</td>
</tr>
</tbody>
</table>

45
Hints for cooling lubricant selection

* The costs for the procurement of cooling lubricants in machining are of rather subordinate importance (most frequently below 1% of machining of production costs). However, an incorrectly selected or used cooling lubricant may show decisive effects on the manufacturing process and thus, cause high costs indirectly.

* After the end of service life cooling lubricants represent special waste that need supervision and have to be disposed of adequately. The disposal costs accruing are of decisive influence on the economy of the cooling lubricant use.

* The main tasks of the cooling lubricant are:

COOLING LUBRICATING
FLUSHING CHIPS

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

For complicated machining processes - e.g. threading, screw-tapping, reaming, turning-off - the main feature for the cooling lubricant is an efficient lubrication of the contact surface between tool and workpiece as well as of the chips. In these cases 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 to these main criteria in cooling lubricant selection the following items are to be observed more or less according to application and operating framework conditions.

Disposal (cleavage property, decomposition property)
Content materials (chlorine, nitrite, phenols,...)
Corrosion protection
Viscosity (also in connection with chip de-oiling)

Resistance to aging, service life
Resistance against microorganisms
Emulsifying capacity
Foaming behaviour
Dirt elimination property
Wetting capacity
Filtering capacity
Transparency
Washability of remaining film
Compatibility with metals, plastics, lacquers
Residual behaviour
Inflammability
Odour
Compatibility with health (formation of mist, skin compatibility, toxicity, cancerogenity,...)

* Non-water soluble cooling lubricants are generally without problems in the use on machines as far as maintenance, handling, service life, corrosion protection and compatibility are concerned. Problems occur with the formation of mist and chip de-oiling.

Cleaning of the cooling lubricant tank

* The used lubricants are to be filled in a clearly marked container to avoid confusion with other liquids!

* Residues in the cooling lubricant circuit (sludges) are special waste and must not be disposed of together with household waste.

* For cleaning of the cooling lubricant tank liposoluble fluorine chlorinated hydrocarbons are not to be used (e.g. trichloroethylene, trichloroethane, perchloroethylene etc.) since the use of these substances in open circuits is highly detrimental to health.

* During cleaning mind elimination without residues of deposits (particularly in edges and corners of difficult access). Remaining contaminations are points of growth for bacteria which attack the newly filled emulsion and drastically reduce its service life.

* Oil-contaminated rags are classified as special waste and must not be disposed of with the household waste.

* Cleaning rags and solvents are to be used as efficiently as possible to keep the accumulating special waste quantity as small as possible.
Readjustment works

**Danger**

All readjustment works on the machine may be carried out only if the main switch is set to "0" and the EMERGENCY-OFF key is actuated.

Adjustment of the main spindle bearings

The precision main spindle bearings are correctly adjusted and preloaded at the factory, so that the main spindle runs without play. If play becomes evident after considerable use, the bearing must be adjusted.

Adjustment of the bearings

Loosen set screw (1), tighten slotted clamping nut (2) clockwise with a "C" spanner. Then re-tighten the set screw again to secure nut.

Checking the correct adjustment

Disengage sliding gears in the headstock. Set reversing gear into neutral (0) position. If the chuck is turned strongly by hand, then the spindle should make one more free revolution.

**Note**

Excessive preloading of the bearings will cause unnecessary heating-up and wear of the bearings.

Compensating play of the cross slide spindle in the cross slide nut

Necessary when cross slide does not move when the handwheel is turned a certain angle.

Adjustment

Dismount the top slide and adjust set screw (1) until backlash is compensated.

Checking

The cross slide should run smoothly. Excessive adjustment causes unnecessary wear of the cross slide nut.
Compensating play of the top slide spindle in the top slide nut

Cross and top slides are equipped with gibbs. Adjustment of play-free guidance is done with the set-screws, which press onto the gib via the pressure pins.

Adjustment
Dismount the top slide and adjust set screw (1) on the bottom side of the top slide, until backlash is eliminated.

Checking
The top slide should run smoothly. Excessive adjustment causes unnecessary wear of the top slide nut.

Adjustment of the dovetail guideways of cross and top slides

Cross and top slides are equipped with gibbs. Adjustment of play-free guidance is done with the set screws (3), which press onto the gib via the pressure pins.
The hexagon nuts (2) are for securing the set screws (countering).

Adjustment
Loosen hexagon nuts and adjust set screws until slides run without play, but smoothly. When countering hexagon nuts, hold the set screw with a screwdriver in the adjusted position, to prevent further turning of the set screw. Further turning would clamp the slides.
Compensating of too much play between half-nuts and leadscrew

Unscrew the socket head screw (1) 2 or 3 turns. Engage the half-nut completely with leadscrew by means of half-nut lever.

Now turn in the socket head screw until the other part of the half-nut is touched, but not moved.

Now make a further half turn of the socket head screw and the correct play will exist between half-nut and lead-screw.

Note
This correct play does not influence the precision of cut threads. Without this play, there is the danger of rubbing and unnecessary wear.

Adjustment of half-nut guidance

If the half-nut lever turns downwards by itself during thread cutting, the guidance must be adjusted.

Adjustment
Loosen hexagon head screws (2), adjust set screw (3). Re-tighten hexagon head screws again.

Checking
The operation of the half-nut lever must be smooth.

Adjusting axial play of the leadscrew

(Necessary when the leadscrew can be moved axially by hand)

Adjustment
Adjust the securing nut (1) until the axial play is not more than 0.05 mm (0.002"). For holding the leadscrew when adjusting, engage the half-nut.

Checking
If you cannot turn the leadscrew by hand, the securing nut is too tight.
Replacing the shearing pin on the leadscrew

If the shearing pin (1) breaks through over loading or incorrect handling of the machine, replace it only with an original shearing pin.

Procedure
Remove the rest of the shearing pin with a punch. Insert a new one.

*Shearing pin for leadscrew*
D Accessories

The toolpost grinder

**Danger**

Mounting and dismounting the toolpost grinder may only be carried out with the machine switched off and the EMERGENCY-OFF key actuated.

**Technical data**

Spindle speeds: 13000 rpm
10000 rpm
7000 rpm

Distance between mounting base and grinding base: 23 mm (0.9")

Motor: IEC Standardized motor

Frequency: 50/60 Hz

Motor capacity: 185 W

Dust- and splashproof according to: IP 54

**Grinding wheels - Speeds**

Straight grinding wheel for outside grinding:
φ 80 x 10 x 20 mm
Corresponding speed 7000 rpm

Straight grinding wheel for internal grinding:
φ 20 x 10 x 6 mm
Corresponding speed 13000 rpm

Cup grinding wheel for face grinding:
φ 45 x 30 x 20 mm
Corresponding speed 10000 rpm

**Scope of supply**

Toolpost complete with drive motor power supply cable, grinding arbors, service tools and a set of 3 grinding wheels, grit 80.

**Electrical connection**

The plug of the toolpost grinder is plugged into the tip jack at the electrical cabinet (1).

**Mounting the toolpost grinder**

Dismount the toolholder and fix the toolpost grinder on the top slide with the hexagon nut. Axis of grinding spindle and lathe must be parallel.
Adjustment of spindle speeds

There is a speed plate mounted on the main base which shows the belt positions with the corresponding speeds.

1. Dismount the belt guard and loosen the two hexagon bolts.
2. Swivel motor toward the front and shift belt to the position for the required speed.
3. Swivel motor toward the back and clamp the motor so that the belts are tensioned correctly and tighten the two hexagon bolts. Remount belt guard.

Mounting the grinding wheels

Straight grinding wheel ø80 x 10 x 20 mm
Cup grinding wheel ø45 x 30 x 20 mm

1. Mount wheel guard.
2. Fix the wheel arbor (2) with the tensioning screw (3). The key face on the belt pulley serves for counter-holding.
3. Mount the grinding wheel onto the arbor and tighten it with the nut (4). The key face on the arbor serves for counter-holding.

Dismounting the arbor (2) from the grinding spindle

Turn the pressure screw (5) into the inside thread of the arbor, this causes the arbor to be ejected. The key flats on the belt pulley serve for counter-holding.

Mounting the internal grinding arbor ø20 x 10 x 6 mm

1. Turn the stud (6) into the grinding spindle.
2. Screw the arbor onto the extending end of the stud so that it fits tightly on cone of the grinding spindle. The key flats on the arbor and on the belt pulley serve for tightening.

Mount grinding wheel as shown.
Important tips:

- Speed of the workpiece: max. 110 rpm.
- Feed of the toolpost grinder should be approx.
  2 mm (0.1") per revolution of the workpiece clamped in the lathe.
- Dress grinding wheels.
- The guideways of the lathe must be carefully covered before grinding. The grinding dust would damage the precision guideways.

---

**Danger**

- Always wear eye protection during grinding.
- Never work without pulley and disc guards.
- Place grinding wheel guard always above grinding wheel.
- Read instructions carefully before mounting discs.
- Grinding discs must be stored so that they are protected from any possible impact.
- The bore of the grinding wheel may not be further enlarged, as this would cause breakage.
- A resonance test should be carried out before mounting the grinding wheel.
- Before using a new grinding disc, a test run should be carried out.
- Dress discs which run out of balance.
- Follow general rules for accident prevention.
Foot brake

Danger
Mounting and dismounting the foot brake may only be carried out with the main switch switched off and EMERGENCY-OFF key actuated.

Function
By operating the foot brake the main motor is switched off and the main spindle is stopped by a mechanic brake.

Mounting the foot brake
Groups of the foot brake are reassembled. In the exploded drawing every part is shown single.

a) Insert the rod brake (1) into the left machine stand and its pin (A) into the hole of the right machine stand. The screw (32) is used to be a stop and is locked with nut (19). The nut is feed in from the backside of the machine stand.

b) Assemble the pivoting lever (5) to the bearing rod (6) with the two retaining rings (24). Mount the bearing rod (6) with the two washers (30) and hexagon head screws (21) to the machine stand.

c) Connect the arbor of the brake rod with the pivoting lever (5) by means of the hexagon head screw (20) and the clamping bolt (9). Mount the second clamping bolt (9) to the machine stand with the hexagon nut (16). Mount the tension spring (14) onto the two ends of the clamping bolts (9).
d) Insert the pressure rod (3) through the top hole of the machine stand, put the compression spring (15) on the pressure rod and mount it to pressure bolt (2) with the set screw (25). The hexagon nut (17) is for securing the set screw.

Note:
1) The set screw must fit into the groove of the pressure rod.
2) The pressure rod must not be fixed with the set screw.
   The set screw must only secure the pressure rod from slipping out of the pressure bolt.

e) Preload the compression spring by screwing down the hexagon nut on the pressure rod (819) so that the distance pressure bolt - hexagon nut is approximately 20 mm.

f) Dismount the change gear cover.
   Mount brake mechanism with bolt (7). Remove the premounted adjusting nut (4) and thread it so far onto the pressure rod that space between brake block (8) and wheel is 1-2 mm in remounted condition.
   Use the right number and thickness of shim rings (29) for the profiles of brake block (8) and pulley fits to each other.

g) Mount the limit switch (12) with flat head screws (22) to the machine stand.
   If the necessary thread holes (M4) do not exist, they must be produced according to the dimensioned drawing above.

Electrical connection of the limit switch

Danger

The connection of the foot brake may only be carried out by an electrics expert with the machine switched off and EMERGENCY-OFF key actuated.

* Open the electrical cabinet.
* Remove the bridgings of terminals 8 and 9 on terminal strip X3.
* Thread cable of the limit switch through clamping angle into electrical cabinet.
* Connect both cores to terminals 8 and 9 of terminal strip X3.
* Tighten clamping angle.

Electrical connection foot brake

Readjustment works:

The space of brake block can be adjusted with the nut (4). Completely worn brake blocks must be replaced.
Thread dial indicator

Mounting

**Danger**

Mounting and dismounting the thread dial indicator may only be carried out during machine standstill and with the EMERGENCY-OFF key actuated.

- Traverse the tailstock in utmost right position.
- Traverse also the tool slide extremely to the right.
- Unscrew both socket head screws (4) of the spindle cover and take off spindle cover.
- Unscrew set screw (5).
- Saw off the nearly completely cut off corner (6) of the spindle cover (7) and chamfer saw points.
- Engage prescribed gear with lead screw. Tighten socket head screw (1) only slightly.
- Swivel in apron nut and tighten socket head screw.
- Loosen slotted screw (2) and turn counter (3) so that the division mark and one of the possible numbers on the counter correspond. Tighten slotted screw.
- Remount spindle cover.

**Thread cutting**

Open lead screw nut at the end of a cutting operation and move slide back. Engage lead screw nut when the disc shows the indicated number.

**Example**

Pitch = 0.8 mm, gear 16 is engaged. The lead screw nut can be engaged. The lead screw nut can be engaged at mark 1, 2 or 4.

<table>
<thead>
<tr>
<th>Table for metric machine (Pitch of main spindle 3 mm)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Pitch mm/rev.</th>
<th>z1 = 14</th>
<th>z2 = 15</th>
<th>z3 = 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td>1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.35</td>
<td>1, 2</td>
<td>1, 2, 4</td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0.45</td>
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<td>0.7</td>
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<td>0.8</td>
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<td>1, 2</td>
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</tr>
<tr>
<td>0.9</td>
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</tr>
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<td>1.25</td>
<td>1, 3</td>
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</tr>
<tr>
<td>1.75</td>
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</tr>
<tr>
<td>2</td>
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<td>1, 2, 4</td>
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</tr>
<tr>
<td>2.25</td>
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<td>1</td>
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</tr>
<tr>
<td>2.5</td>
<td></td>
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</tr>
<tr>
<td>3.5</td>
<td>1, 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>1, 2, 4</td>
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</tr>
<tr>
<td>4.5</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1, 3</td>
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</tr>
</tbody>
</table>

**Table for inch type machine**

(Lead screw pitch 1/8")

<table>
<thead>
<tr>
<th>Pitch n&quot;</th>
<th>Marking of disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>6, 8, 22, 26, 38, 44, 52, 72, 80, 96, 112, 128</td>
<td>1, 2, 4</td>
</tr>
<tr>
<td>5, 7, 11, 13, 19, 27</td>
<td>1, 2</td>
</tr>
<tr>
<td>4½, 9½</td>
<td>1</td>
</tr>
</tbody>
</table>

**Note**

With pitches not shown in the table the lead screw nut can be engaged in every position.
Taper turning attachment

Technical data
Maximum taper length: 210 mm
Maximum taper diameter: 80 mm
Taper \((\alpha/2) \pm 9^\circ\)

Mounting

**Danger**

Mounting and dismounting the taper turning attachment may only be carried out during standstill of the machine and with the EMERGENCY-OFF key actuated.

- Fit the compound slide (1) onto the machine cross slide, with 4 T-slot tongues and cheese head bolts M8 x 20.
- Fasten the clamping table (2) to the base, with the clamping plate. The clamping plate grips into the base undercut.
- The turning tool can be fitted blade upwards or vice versa. Ensure that the direction of spindle rotation is correct!

Adjusting to the diameter
- Adjust the cross slide of the lathe.
- Adjust the compound slide position on the machine cross slide.

Adjusting the taper position in the longitudinal direction
Clamp the connection rod (3) accordingly.

Adjusting the taper angle
Loosen the cheese head bolts on the straight edge (4), and adjust the straight edge according to the graduated scale.
Tighten the cheese head bolts.

Readjusting the guides
- The saddle and cross slides of the taper turning attachment are equipped with adjustable strips. Adjustments can be made as for the cross slide of the lathe.
- The cross slide of the taper turning attachment is guided along the straight edge by 3 support rolls.

Working note:
For heavier cuts, clamp the lathe cross slide.

Example for taper calculation

\[ i = 1:10, \alpha =? \]
\[ \tan \alpha = \frac{h}{b}, \quad \alpha = \arctan \frac{1}{10}, \quad \alpha = 5.71^\circ \]
Machine lamp

**Danger**
Mounting and electrical connection of machine lamp may only be carried out by an electrics expert, during standstill of the machine and with the EMERGENCY-OFF key actuated.

* Mount machine lighting fixture (5) to sheet metal holder (2) using the four socket head cap screws M4x16 (4) together with the matching washers and nuts.
* Insert the four lens-head screws M5x12 (1) through the holes on the splashguard (3) of the machine; afterwards bolt sheet-metal holder (2) to splashguard using the washers and nuts M5.
* Thread cable within the rear sheet coating of the headstock and via machine base into the switch cabinet (through clamping angle).
* Connect the phases of the cable (6) to terminals 16 and 17 of the terminal strip X3.
* Tighten clamping angle.

**Note**
The distance between machine lamp and lighted surface must be at least 0.1 m, otherwise the lamp might be destroyed because of heat flow.

According to ÖVE: 0.1m
Declaration of conformity

<table>
<thead>
<tr>
<th>Product:</th>
<th>Lathe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Machine data:</strong></td>
<td><strong>Model</strong></td>
</tr>
<tr>
<td></td>
<td>EMCO</td>
</tr>
<tr>
<td><strong>Address of manufacturer:</strong></td>
<td>Emco Maier Ges.m.b.H</td>
</tr>
<tr>
<td></td>
<td>Salzachtal Bundesstraße Nord 58</td>
</tr>
<tr>
<td></td>
<td>A-5400 Hallein</td>
</tr>
<tr>
<td><strong>Bases of standards:</strong></td>
<td>EN 292-1; EN 292-2; EN 294; EN 418; EN 60204-1; prEN 954-1;</td>
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<td></td>
<td>prEN 1037; prEN 1050; prEN 1088</td>
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<tr>
<td><strong>Regulations:</strong></td>
<td>MSV (BGBl. Nr. 306/1994, 27.4.94)</td>
</tr>
<tr>
<td><strong>Test certificates:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Particular notes, enclosures:</strong></td>
<td>Electrical documentation as applicable</td>
</tr>
</tbody>
</table>

We herewith declare that the above-mentioned product referring to the subject declaration is in conformity with the currently valid stipulations of the directive of the Council dated June 14th, 1989 for the alignment of the legal stipulations of the member states for machines (89/392/EEC) and its modifications dated June 20th, 1991 (91/368/EEC), June 14th, 1993 (93/44/EEC), July 22nd, 1993 (93/68/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, 26.01.98

**Authorized person:** Head of quality department Peter Binggl