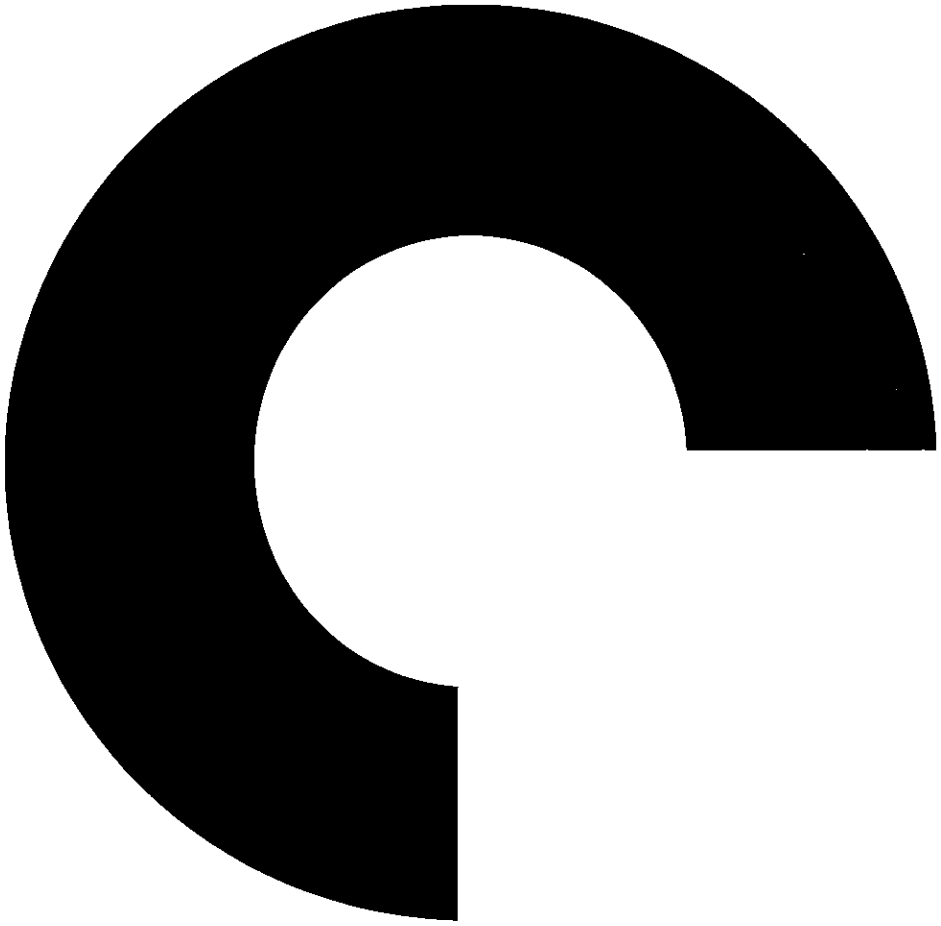
Qualitäts-Management-System
I S O 9 0 0 1
SQS-Register Nr. 13359



MEWAG

Operating manual
RB 42 FK Digital

MEWAG Maschinenfabrik AG • Dorfstrasse 51 • CH-3457 Wasen i. E.
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Safety Regulations and Precautions

MEWAG-bending machines are built to the latest status of the art. They are designed to be reliable. To ensure a perfect and reliable operation of this MEWAG Machine an appropriate transportation, professional erection and start-up as well as careful operation and maintenance are required.

Use of the machine

The tube and section bending machine **RB 42 FK CNC** is designed for bending right and left. Specifications of the used material as well as of the bending capacity can be taken from the operating instructions (chapter 1.2 „ Technical data").

Use the machine:

- only by trained and/or instructed personnel
- only in technical perfect condition
- by awareness of safety and risk potential
- by observation of the operating manual
- in trouble-free and safe surrounding
- under observation of the maintenance regulations

Comment:

The use for other purposes than prescribed is not allowed. If the above mentioned machine is used for other operations than mentioned, the manufacturer, respectively the seller are not liable for any resulting damage.

Such risks have to be borne by the User Company.

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Explanation of Symbols and Comments

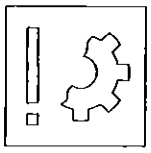
Warning, Voltage

This symbol is used to warn with relevant information about the danger of bodily harm through an electric stroke. Using electrical control devices, certain parts of the machine are under dangerous voltage. The disregarding of these warning-information can cause serious bodily injury or material damage. The machine should be operated by qualified personnel only. This personnel must be seriously familiar
with all warnings maintenance steps of this operating manual.

Warning, Caution

This symbol is used to warn against possible danger and injury independent of the particular risk.

Warning, damaged machine, material damage



This symbol is to warn of possible material damage on the machine.

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General Instructions for Safe Working

- The machine can cause danger of bodily injury, health or material damage if it is operated improperly, not as directed or operated or serviced by untrained personnel.

- The User-Company has to guarantee that qualified and authorised personnel only operates the machine.

Fixed or mobile protective installations for isolation
Incorporated safety devices must **not** be taken out of operation.

The User-Company has to secure that the operating, maintenance personnel has been acquainted with the safety regulations and to ensure that they are observed.
Working procedures which reduce the operational safety of the machine are not allowed.

- The operator is obliged to announce to the responsible immediately any changes which will impair the safety.
- As far as necessary the User-Company has to impose on the operating personnel to wear personal safety-accessories as well as tight fit clothes.
- The safety of the equipment can be less effective if:
  - reconstruction or changes are made to the machine with other supplementary equipment than recommended and approved by the manufacturer.
  - other spare- and wear-parts are used than foreseen from the manufacturer.

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Oil, Lubricants

Due to the ingredients (additives) these substances can be a possible danger to the health and the environmental side. The User-Company is responsible for the selection and use of oil and lubricants. The operating manual to be worked out by the User Company is to set regulations for the use of these substances. It should contain:

- Name of the substances
- Dangers for human beings
- Safety precautions
- Reaction and advice in case of spillage outside the machine respectively in case of danger, first aid.
- appropriate disposal

Operation

Master-switch
During the bending cycle - unless in an emergency - the Master-Switch normally should not be switched off, otherwise damage to the machine could be the result.

Emergency Shut-off
The Emergency Shut-off operation is applicable only to eliminate danger. In this case the bending cycle is stopped immediately, the hydraulic clamping however remains under pressure.

Before the machine is switched-on, the filling volume and the leakage of oil and lubricants have to be checked.

Cleanliness and access of the working area are to be ensured.

The guide rails should be cleaned and oiled before the machine is stopped for a longer period.

Threshold values of the technical data are to be observed at any time.

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Maintenance and Repair

Before starting maintenance and repair-work ,the Master Switch has to be switched off and secured by means of a Padlock

If for certain repair work the machine should be ready for operation,
special cautions are necessary:

- **It must be guaranteed that under no circumstances people are in the danger zone.**
- **The danger zone must be secured against unauthorised access of people by additional barriers or fences**
- For repair on electrical equipment, the relevant regulations must be observed (ICE. EN, or other as requested in the Accident Regulations of the relevant Country)
- Maintenance, servicing and repair is only to be executed by specially trained personnel.
- The machine is to be put out of operation for taking off the safety equipment for repair or maintenance. Immediately after termination of the repair- or maintenance-work the safety equipment is to be mounted again.
- In accordance with the grease- and oil-table only relevant lubricants and hydraulic oil are to be used.
- Information on the service and maintenance of the machine are to be strictly observed.
- The machine should not be cleaned with wool. Only cloths and papers which do no lose fibres should be used.
- The machine must not be cleaned by compressed air, because particles could enter into the guide rails and bearings.

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Guarantee

MEWAG will not accept liability or take guarantee

- if the Instructions of the Operating Manual for the machine and the Operating Manual of the control device are not observed.
- if the machine including the supplementary equipment are operated improperly.
- if the machine including the supplementary equipment are not duly serviced and kept in good condition by repeating maintenance.
- if safety installations are not used or have been put out of operation.
- if any technical or functional modifications are carried out without the written approval of MEWAG.

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DATA OF THE MACHINE

- ***Comments to the machine***

The machine is delivered in one unit. The control desk is freely standing.

Right hand bending and left hand bending can be done with the RB 42 FK CNC

The bending drive is provided by an electric motor

The auxiliary functions (tube clamping etc.) are pneumatically actuated.

For safety reasons the machine is delivered without hydraulic oil.

Marking of the axis and directions:

X-Axis: Tube feeding
Y-Axis: Bending
Z- Axis: Tube rotation

Directions of axes

X-Axis:	+ back	= movement in direction of mandrel retraction device
	- forward	= movement in direction of bending centre
Y-Axis:	+ Bending	
	- return movement	
Z-Axis:	+ clock wise	
	- anti clock wise	

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• *Technical Data*

Bending capacity	steel	= ø42 x 2 mm
Range		
With standard clamping device:		
• Centre line radius maximal	CLR max.	= 210 mm
• Inner radius minimal	Ri min.	= 25 mm
Tube length over the mandrel	customer specific (2-6m)	
Feeding (X-Axis)		
Range	customer specific (2-6m)	
Accuracy	+/- 0,1 mm	
Max speed	60 m/min	
Bending drive (Y-Axis)		
• Max. bending speed	130°/sec	
(10 different speeds; speed 9 ⇒ 100%)		
• Positioning accuracy	+/- 0,1°	
• Angle:		
- With standard clamping device	190°	
- With special instalation indefinite angle (i. e. circular bending)		
Rotation (Z-Axis)		
Range	1/- 360 °	
Accuracy	+/- 0,1°	
Max rotating speed	270 °/sec	
Clamping device		
• pressure adjustable		
• maximal clamping pressure (if 250bar)	40 kN	
Mandrel retraction		
• retraction speed adjustable		
• retraction point adjustable (anticipated mandrel retraction)		
Noise	< 70 dB	

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Adjustable hydraulic pressure, max. 200 bar

Working height	approx. 1000 mm

Dimensions of machine (tube length over mandrel 3000mm):

• length	3400 mm
• width	900 mm
• height	1300 mm

Weight of machine	ca. 700 kg

Electrical connection

• Voltage	400 V AC
• Frequency	50 Hz
• Fuse protection	16 A

• *Explanation of the operation elements*

MASTER SWITCH	switch on control desk
EMERGENCY - STOP	NOT - STOP red switch
HYDRAULIC ON	Lamp is on if hydraulic is on.
HYDRAULIC OFF	hydraulic off.
KEY SWITCH	pre selection of bending direction right bending (CW) or left bending (CCW).
RED FOOD SWITCH	start handling function
YELLOW FOOD SWITCH	start bending process
RED LAMP (BEDAR)	invitation for pressing the red food switch
YELLOW LAMP (BEDAR)	invitation for pressing the yellow food switch

(see also operation manual MS-3000)

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Emergency - Shut off (Control desk)

The Emergency-Shut-off must be actuated only in emergency case.
The bending cycle is then stopped immediately, the hydraulic unit is disconnected. The cylinders as a result will stay in their position (however without pressure).
Further procedure to get back to normal operation:

- Unlock the emergency **Shut-off** key Hydraulic-unit **Shut-off**
- Initiate the Hydraulic-unit **On** by pressing the button.
- The bending cycle is finished by pressing the 2-hand-operation.

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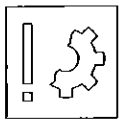
• *Manual Operation*



If functions are operated manually, special attention is to be paid that no collision is occurring.
Procedure see also Operating Manual „Controlling Device".

• *Basic Setting of the Machine*

the different elements have following positions:

- bending drive: 0°
- pressure die support: open
- clamp die: open
- mandrel: in front
- hydraulic: without pressure
- mandrel lubrication [1]: off
- following pressure die [1]: returned

[1] if delivered with the machine

Basic Setting of the Machine :

- Press Key for **Start** (yellow lamp is flashing)
- Press 2-hand operation (Machine initiates)

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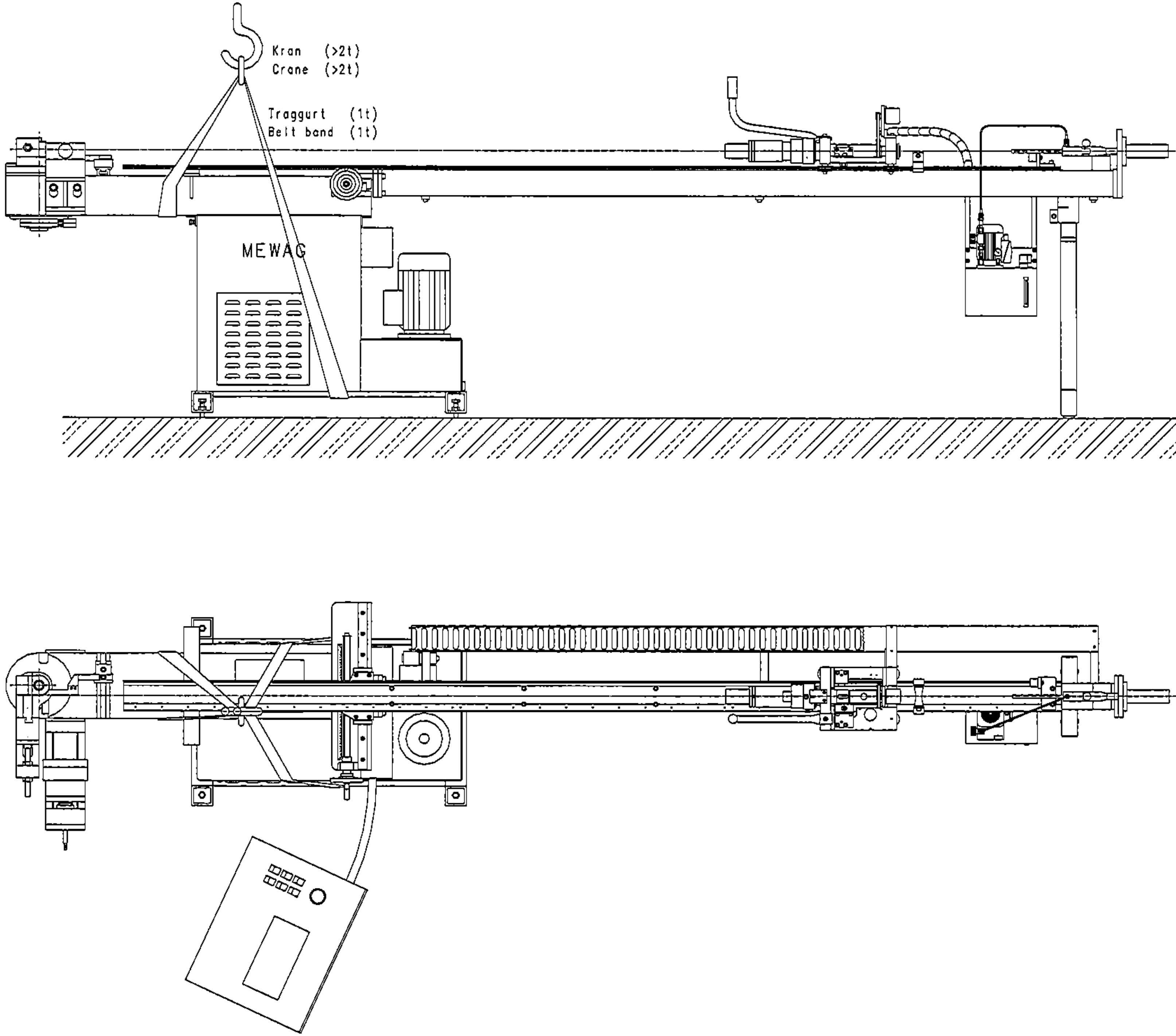
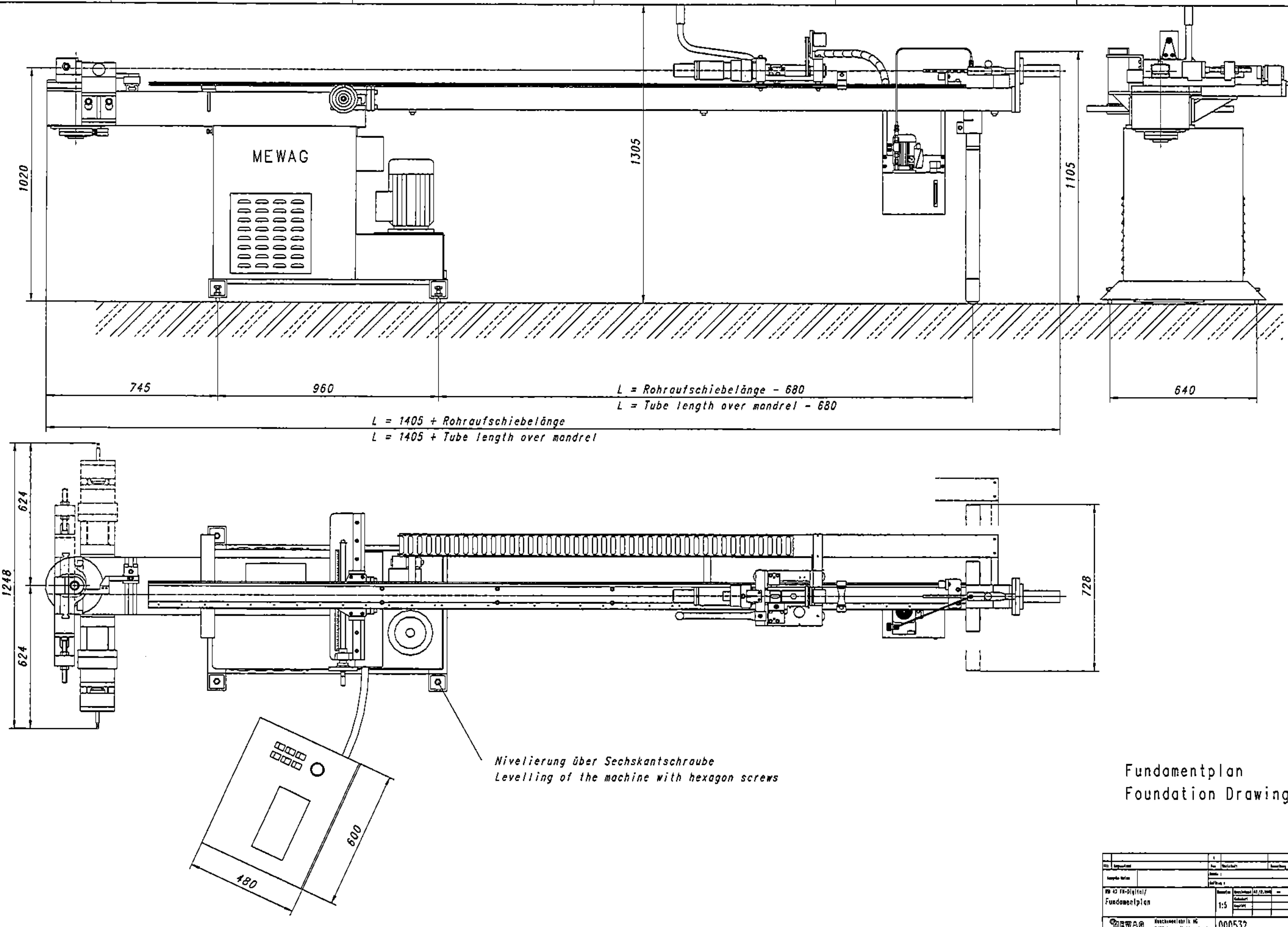


Transportplan
Transportation Drawing

RB 42 (K-Digital)/ Transportplan	1:5
MEWAG Maschinenfabrik AG	000533



Fundamentplan
Foundation Drawing

Fundamentplan
1:5
MEWAG
000532

INSTALATION OF THE MACHINE

• *Transport*

The machine is delivered completely mounted.
Depending on the type the boom is separated of the machine.
For the unloading a cable holding at least 1t is necessary.
Transportation of the machine only the way shown in drawing no. 000533!

• *Positioning of the Machine*

The place of position must be completely flat. A special foundation is not necessary.

The required space can be taken from the foundation Drawing-No. 000532.

If the boom is delivered separately, it must be mounted on the machine. The hydraulic tubes must be fixed on the boom. The electrical wires must be connected.

The machine can be levelled by 4 hexagon screws.

Place foot switch outside the bending arm (see rotating circle of bend arm)

• *Electrical Connections*

The electrical connections are to be executed only by specially trained personnel.
At first the working voltage has to be checked. The main cable is to be connected to the clips marked accordingly

Voltage	400 V AC / 50 Hz
Fuse protection	16 A

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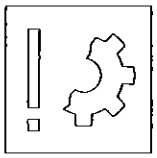
• *Start of Hydraulic Unit*

Consult also "Start and Maintenance of Hydraulic Equipment" Chapter 3

Oil filling hydraulic-Unit
We recommend to use only first-class brand-name hydraulic oil, with a viscosity of 3 - 5 E (e.g. Energol HLP 46) For further information look at recommendation paper, Chapter 3, „recommended hydraulic oil"



Important: Oil of different brands should not be mixed
Oil quantity: approx. 30 l

Aeration of the hydraulic circuit
This work should be executed after dismantling of the hydraulic circuit.

A properly de-aerated hydraulic system guarantees for a perfect function of the cylinder motions.
Procedure: The corresponding functions are to be done according to the Operating Manual of the Controlling Device. During the actuation of the cylinder the air escape-screw should be loosened, so that the air can escape.

• *Initiation*

- Switch on the Master Switch
- Switch on the hydraulic system
- Press Key START (yellow lamp is flashing)
- Press 2-hand operation (Machine initiates)

If this operation is done correctly, the machine is ready for use. After each interruption of the current the machine (Master Switch) must be initiated again. (see also the Operating Manual of the Controlling Device)

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• *Safety Regulations*

Based on the regulations of the Committee „Eisen und Metall II"we point out:

Specific danger spots, i.e. possible human squeeze areas due to projecting- bent tubes, are to be protected safely by **the Operators, respectively. Personnel of the User Company.**

Repairs of the controlling unit and of the electrical control should be done by specially trained Electricians or Engineers. The operator has to pay attention that nobody remains in the danger zone when working with the machine.

Automatically operated bending machines are to be protected in the operating area, e.g. through fences with supervised doors, lining of the danger-zone with electrical safety mats, 2-hand operation or protection through photoelectric barriers.

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MAINTENANCE INSTRUCTIONS

The machine must be switched-off before starting any cleaning-, maintenance- and lubrication service.
The machine must be secured by means of a padlock.

• *Cleaning and Maintenance of Machine*

The general rules according to VDI 3011 and DIN 8659 are applicable. To achieve best conditions for long, precise operation without difficulties, the machine should be serviced according to the given schedule.

For cleaning a normal cleaning cloth is suitable. The use of compressed air should be avoided at all, because particles could enter into the guide rails and bearings.

• *Maintenance Schedule of Machine*

• Every year	- control of the toothed belt of the bending drive. If necessary increase the tension: Attention: To much initial tension causes strong noise and high erosion of the belt and the bearings.
•	
• Every 5000 operating hours	- change of oil - change of hydraulic oil filter elements
• For worn machine parts	- gaskets of the gearing - gaskets on the cylinders - gaskets of the hydraulic system - change the flexible tubes of the hydraulic system - supporting bearing (Bronce) on the bending plate

• *Lubrication Advice*

The machine is to be lubricated according to lubrication schedule 000707. The lubricant-survey and the intervals are to be taken from the Lubrication Advice.

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Lubricant - Survey

DIN - Marking	Works - Description	Remarks
Hydraulic Oil	See specification of Manufacturer	HLP 46 according of Manufacturer DIN51502
Sliding oil (mandrel lubrication)	See separate sheet	
Gear lubricant oil	See specification of Manufacturer	Lubricating oil CLP ISO VG 220 (DIN51502)

Lubrication Advice

Lubrication Position	Schedule [1]	Volume of Lubrication / Remarks
1	weekly	oiling slightly
2,3	weekly	oiling of the clamping device and the pressure die support
4		oiling of the spindle at every change of the tooling
5	weekly	fill up to the oil level mark
6	all 5000 working hours or all 5 years	oiling of the taper roller bearing of the bending head
7	Oil change all 10000 working hours or all 5 years	Quantity 6,1 litres (approx.) fill in gear till oil level See specification of Manufacturer
8	monthly	fill up to the oil level mark
	Oil change all 5000 working hours or all 5 years	volume 30 lt.

1) For single shift operation

Oil level to be regularly controlled at the oil level indicator.

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Operation and Maintenance of Hydraulic Systems

1. General

Reliable operation of oil-hydraulic systems depends primarily on careful servicing. In contrast to a wide spread opinion, the operating lift of the hydraulic elements is generally longer than that of the mechanical elements (e.g. ball bearings).
To supplement the VI Specifications „Operation and Maintenance of Oil Hydraulic System", VDI 3027 and the recommendations of CETOP, we provide our customers with some further information:

2. Operation

Before start of operation a number of points are to be noted:

2.1 Is everything clean?

A final check should of tanks and pipes should be made before filling in the liquid to ensure that they are clean. It is essential that this operation is performed directly before filling in the liquid. If necessary, the entire system should be flushed out again.
A careful check should be made of tanks with an internal coating to determine whether the hydraulic fluid to be used is compatible with the paint. The liquid tanks in the oil hydraulics are not generally coated on the inside since there is too great a risk of the paint peeling off or of other chemical reactions occurring. If highly flame resistant liquids are used, a check should be made before filling them, to ensure that all of the hydraulic units in the system are equipped with seals which are compatible with highly flame resistant liquids. This check should not be limited to valves and pumps but should also cover if necessary screw connections and flanges.

2.2 Is everything correctly connected?

Wrong piping or wrong wiring is generally not noticed until the system is to be put into operation and the desired functions cannot be met. Conversion at this stage is generally very difficult. It is therefore urgently recommended to make a careful check of the piping and wiring on the basis of the circuit diagram with the relevant cycle tables before filling the hydraulic liquid into the tank.

2.3 Are all parts correctly fixed and aligned?

This question applies particularly to pumps and the relevant electric motors. A possible alignment fault between electric motor and pump can result in premature wear of the pump.

2.4 Pressure accumulators

Pressure accumulators - if not already supplied ready for operation - should be properly filled with the specified Nitrogen before installing the system. It is good practice to note the gas pretension on the accumulator itself (e.g. with an adhesive label) and also in the circuit diagram to simplify a subsequent comparative check if required.

2.5 Hydraulic liquid

The liquid should be filled into the system through a filter. Whereas the mesh size of the filter specified by manufacturers for pumps varies, a filter size of 100 micron is adequate in our experience for the equipment which we manufacture. An exception to this are of course the Servo-Systems.

2.6 Adjusting pressure

The pressure at the limiting valves should first of all be set to a low level for starting-up. An exception to this are the typetested pressure limiting valves for hydro accumulator systems to which no change may be made due to the fact that the fixed setting has been predetermined and lead sealed.

2.7 Electric motor

The electric motors can now be switched on for a short time (5-10 sec)- The direction of rotation of the motors should be checked. At the same time it can be determined whether any couplings or other connecting parts are loose. The specifications of the individual pump manufacturers apply to this work.

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2.8 Operation pressure

Before the operation pressure setting can be slowly increased, a check should be made to determine whether the pump is delivering steadily and smoothly. Any leakage should immediately be eliminated. The system should be bled while operating at a low pressure setting. When bleeding the system, keep a check on the liquid level in the tank and fill up with liquid in good time if necessary (same grade!).

2.9 Switches

Once the operating pressure has been reached and the function test has been performed satisfactorily, the pressure switches, float switches, thermostats etc. can be set.

2.10 Acceptance test report

All the settings should be recorded in an acceptance test report.

3. Maintenance of oil-hydraulic system

3.1 It is recommended in any case to start a Maintenance Book from the moment of starting up, which is then later continued by the maintenance personnel. The intervals at which particular parts have to be checked can e.g. be recorded in this book.

3.2 The liquid level should be checked constantly during the start-up period, following start-up it should then be checked daily first of all and later weekly.

3.3 Filters should be checked during start-up at intervals of 2 to 3 hours and cleaned if necessary. Following this, they should be cleaned daily initially and after about one week as required. Particular care must be paid to the maintenance of suction filters. They should be checked or cleaned at least once a week after the running-in period.

3.4 Replacing the system liquid depends on the number of operating and is determined by the extent of aging and polluting. On systems with a ratio of pump delivery flow to volume of approx. 1 : 3 or greater, the liquid should first be changed approx. 50 - 100 hours after start-up. Later, it is sufficient to keep a constant check. On large systems, however, the liquid should be replaced no later than after 10.000, on small systems after approx. 5.000 operating hours. As a constant check, it is sufficient to take a sample once a week and run it through the filter paper or clean cloth. The colouring of the residue does provide certain information on the extent of aging. The black-blue colouring is an indication that an oil change is urgently required.

3.5 The pre-pressure of pressure accumulators at the nitrogen end should be checked at regular intervals as required. The accumulator must be pressureless at the oil end when performing this check.

3.6 Operating temperature should be measured not only in the oil tank but also bearing points of the pumps. A rise in temperature is an indication of wear (increasing friction and leakage with conversion of the hydraulic energy to heat).

3.7 The pipeline system should be checked at regular intervals for leaks. This is particularly important with underfloor piping since oil flowing out can cause not only losses and damages to the equipment but also can completely destroy the concrete floor within a short time.

3.8 The main and control pressures should be checked at intervals of one week. Pressure adjustments should be recorded in the Maintenance Book. The need to frequently adjust the pressure is an indication among other thing of wear to the pressure limiting valve.

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Recommended Hydraulic Oil

Operating conditions	Normal Conditions			Special Heavy Duty conditions		
Surrounding temperature	unter 0°C	0 - 30°C	über +30°C	unter 0°C	0 - 30°C	über 30°C
Identification Din 51502	HL 32	HL 46	HL 68	HLP 32	HLP 46	HLP 68
ARAL	Aral Vitam GF 32, Aral Vitam DE 32	Aral Vitam GF 46, Aral Vitam DE 46	Aral Vitam GF 68, Aral Vitam DE 68	Aral Vitam GF 32, Aral Vitam DE 32	Aral Vitam GF 46, Aral Vitam DE 46	Aral Vitam GF 68, Aral Vitam DE 68
BP	BP Energol HL 32	BP Energol HL 32	BP Energol RC 32 BP Energol THB 68	BP Energol HLP 32 BP Energol HLP-D 32 BP Energol SHF 32	BP Energol HLP 46 BP Energol HLP-D 46 BP Energol SHF 46	BP Energol HLP 68 BP Energol HLP-D 68
Chevron	Chevron Hydraulic Oil 32 Chevron EP Hydraulic Oil 32	Chevron Hydraulic Oil 46 Chevron EP Hydraulic Oil 46	Chevron Hydraulic Oil 32 Chevron EP Hydraulic Oil 68	Chevron EP Hydraulic Oil 32	Chevron EP Hydraulic Oil 46	Chevron EP Hydraulic Oil 68
ESSO	ESSTIC 32	ESSTIC 46	ESSTIC 68	NUTO H 32 HLPD-OEL 32	NUTO H 46 HLPD-OEL 46 TERESSOEP46	NUTOH 68
FUCHS	RENOLIN DTA 10	RENOLIN DTA 15	RENOLIN DTA 20	RENOLIN MR 10 RENOLIN B 10	RENOLIN MR 15 RENOLIN B 15	RENOLIN MR 20 RENOLIN B 20
Mobil	Mobil D.T.E. Oil Light, Mobil Vactra Oil light, Mobil Vacuoline Oil 1405	Mobil D.T.E. Oil Medium, Mobil Vactra Oil Medium	Mobil D.T.E. Oil Heavy Medium, Mobil Vactra Oil Heavy Medium, Mobil Vacuoline Oil 1409	Mobil D.T.E. 24 Mobil D.T.E. 13	Mobil D.T.E. 25	Mobil D.T.E. 26
Shell	Shell Tellus Oel C 32 Schell Tellus Oil 32	Shell Tellus Oel C 46 Schell Tellus Oil 46	Shell Tellus Oel C 68 Schell Tellus Oil 68	Shell Tellus Oel C 32 Schell Hydrol DO 32	Shell Tellus Oel C 46 Schell Hydrol DO 46	Shell Tellus Oel C 68 Schell Hydrol DO 68
TEXACO	Rando Oil 32, Regal Oil R&O 32	Rando Oil 46, Regal Oil R&O 46	Rando Oil 68, Regal Oil R&O 68	Rando Oil HD A-32, Rando Oil HD AZ-32	Rando Oil HD B-46	Rando Oil HD C-68, Rando Oil HD CZ-68
V VALVOLINE	VALVOLINE ETC-25	VALVOLINE ETC-10	VALVOLINE ETC-35	VALVOLINE ETC-25, VALVOLINE	VALVOLINE ETC-30	VALVOLINE ETC-35

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Lubrication Table

Application	Spur wheel gear, spur wheel gear motor bevel gear, bevel gear motor					Roller bearing	
Lubrication types	**Oil**				**Grease***	**Grease**	**Spec. Grease**
Surrounding-Temperature °C	**40 bis 0**	**25 bis -15**	**10 bis -30**	**-20 bis -50**	**40 bis -15**	**60 bis -30**	**80 bis -30**
kin.Visco - sity at 40°C (cSt) mm^2/s	**748 bis 612**	**242 bis 198**	**165 bis 90**	**16,5 bis 13,5**			
ARAL	ARAL Degol BG 680	ARAL Degol BG 220	ARAL Degol BG 100	———	Aralub FDP 00	Aralub HL3	Wacker Silicon Grease 511 medium
BP	BP Energol GR-XP 680	BP Energol GR-XP 220	BP Energol GR-XP 100	BP Energol LPT 22	BP Energol HT - EP 00	BP Energreas LS3	Supplier: Wacker-Chemie
Esso	SPARTAN EP680	SPARTAN EP220	SPARTAN EP150	Univis J 13	Fibrax EP 370	Esso Multy purpose Grease Beacon 2	Remarks: for lubrication of the brake-side bearing on brake-motors
Mobil	Mobilgear 636	Mobilgear 630	Mobil D.T.E.18	Mobil D.T.E.11	Mobiplex 44	Mobulix 3	
Shell	Shell Getriebeöl 140 Shell Omala Oel 680	Shell Getriebeöl 90 Shell Omala Oel 220	Shell Getriebeöl 80 Shell Omala Oel 100	Aero Shell Fluid 4	Shell Spezial Getriebefett H Shell Grease S3655	Shell Alvania Fett R 3	
TEXACO	Meropa 220	Meropa 220	Meropa 220	Airkraft Hydraulik Oil 15	Multifak EP 0	Glissando FT 3	

Application	Warm Gear, Warm-Motor					General		Hydr. Start-Coupling
Lubricant Types	**Oil**				**Grease**	**Synth. Oil**	**Synth. Grease**	**Oil**
Surrounding Temperature °C	**40 bis 0**	**25 bis -15**	**10 bis -30**	**-20 bis 50**	**40 bis -15**	**80 bis -25**	**60 bis -25**	**> 0 < 0**
kin. Viscosity at 40°C (cSt) mm2/s	**242 bis 198**	**165 bis 90**	**74,8 bis 13,5**	**16,5 bis 13,5**		**352 bis 198**		**ca. 40 ca. 14**
ARAL	ARAL Degol BG 220	ARAL Degol BG 100	ARAL Degol BG 48	———	Aralub FDP 00	ARAL Degol GS 220	———	Aral Degol BG32 Aral Vitam GF 10
BP	BP Energol GR-XP 220	BP Energol GR-XP 100	BP Energol GR-XP 68	BP Energol LPT 22	BP Energol HT - EP 00	BP Energol SRG - XP 220	———	BP Energol HLP 32 BP Energol HLP 10
Esso	SPARTAN EP220	SPARTAN EP150	Esso Automatic Transmission Fluid	Univis J 13	Fibrax EP 370	———	Getriebe Fliessfett EGL 3818 A	Nuto H 32 Nuto H 15
Mobil	Mobilgear 630	Mobilgear 629	Mobil D.T.E.15	Mobil D.T.E.11	Mobiplex 44	Mobil Glygoyle 30	RR 103 B	Mobil D.T.E. 25 Mobil D.T.E. 21
Shell	Shell Getriebeöl90 Shell Omala Oel 220	Shell Getriebeöl80 Shell Omala Oel 100	Shell Tellus Oel T32	Aero Shell Fluid 4	Shell Spezial Getriebefett H Shell Grease S3655	Shell Tivela Oel WB	Shell Tivela Compound A	Shell Tellus Oel T 32 Shell Tellus Oel T 15
TEXACO	Meropa 220	Meropa 220	Meropa 220	Airkraft Hydraulik Oil 15	Multifak EP 0	———	———	Rando Oil 32 Rando Oil 10

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Mandrel lubrication:

For common works the same lubricant is used for mandrels in steel or bronze.

The selection of lubricant depends of the tube material.

Please find the recommendations of MEWAG.

Automatic mandrel lubrication:

• common steel tubes	:	thick flowing oil for gears - BP : GR - XP 220
• stainless steel	:	water soluble cooling lubricant - Blasocut 4000 Strong -BP : Culora MZ
• aluminium- and cooper tubes	:	water soluble cooling lubricant - Blasocut 4000 Strong - BP : Culora MZ

Mandrel lubrication by grease groitspray (Option):

The details to the used system, you will find in a separate documentation (annex to the technical documentation).
Recommended lubricant: -ML 40 from Eduard Müller, D-Stuttgart

manual mandrel lubrication:

it is recommended the grease the tube before loading.

recommended lubricant:

- Wicoform D307 from Wilke (for all materials)

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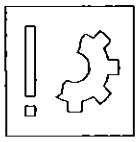
SETTING-UP OF THE MACHINE

Fundamentally the machine for safety reason is to be completely shut-off during setting-up. If for setting-up the machine has to be activated, both the setting up and the control of the machine must be executed by the same person. This work is to be executed by a properly trained and instructed operator. It is not permitted for any person to stay in the danger zone of the machine.

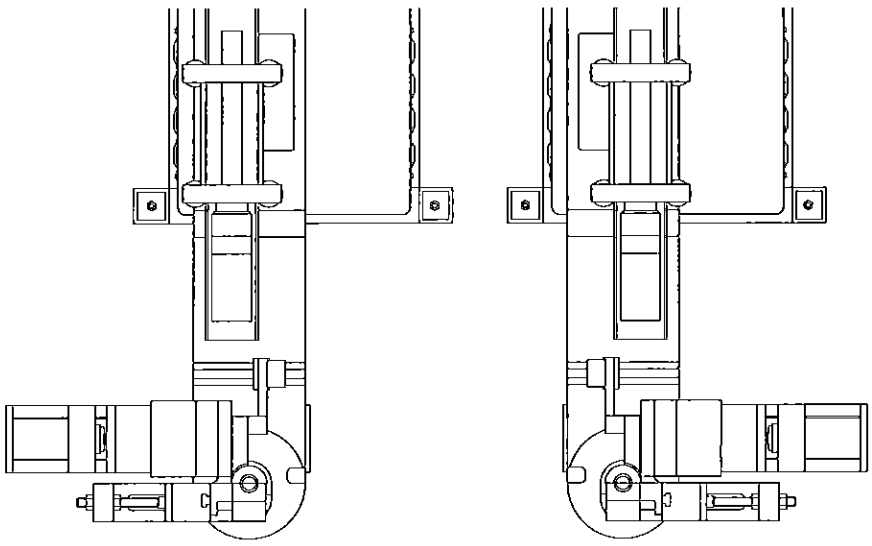


Special attention has to be paid when operating the machine that no collision can occur.

- ***Installation for right and left bending***

The construction of the low profile elongated bending head and the ability to change the bending direction from right to left-hand permit the production of difficult bend configurations.

Left hand bending **Right hand bending**



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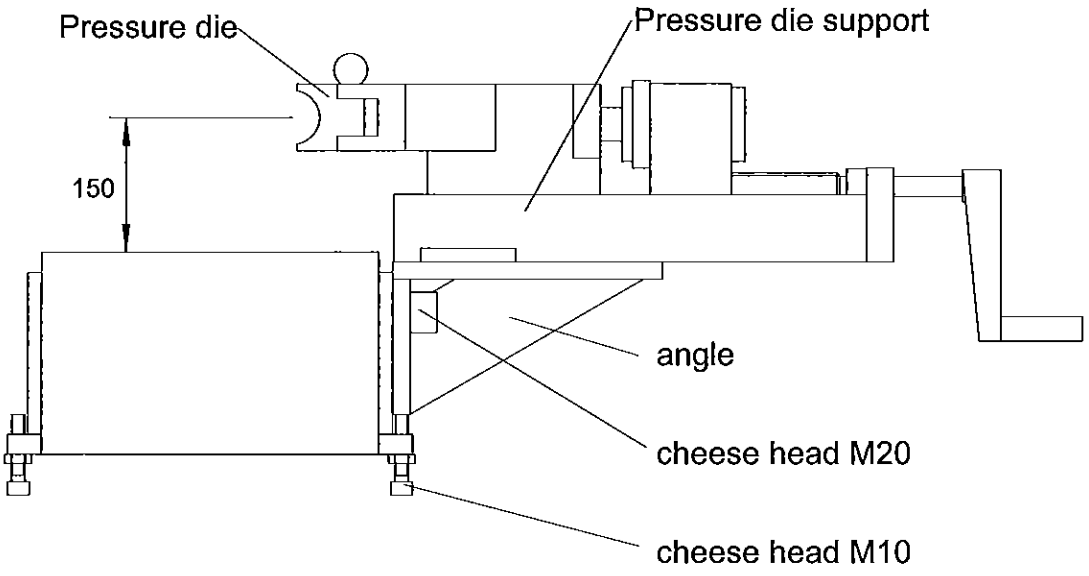
- **Change of bending direction**

(from right to left hand or vice versa)

- unload tube.
- machine in basic position (see chapter 1.5).
- stop machine (hydraulic off and master switch off).
- take off flexible tube of mandrel lubrication (if it exists).
- take off mandrel rod with mandrel.
- take off flexible tube of tube clamping device and support
- take off wiper die (see chapter 4.2.6).
- take off clamping device and bend die (see chapter 4.2.1)
    - untie screw M 12 which fixes the bend die.
- take off tube support device and fix at the opposite:
    - Slightly untie the two cheese heads M20
    - lift the whole support together with the angle for approx. 25 mm and pull it over the cheese heads M20.
    - install the two cheese heads M 20 on the other side of the bending head
    - pull the support over the cheese heads and fasten them



If necessary the level of the pressure die can be changed and adapted with the two cheese heads M 10.

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- If necessary change the spindle (see chapter 4.2.1 and. 4.2.7)
- oiling of the spindle
- mount bend die and tube clamping device (see chapter 4.2.1 and 4.2.7)
- change position of boom (see chapter 4.2.3 and 4.2.4)
- fix flexible tubes of clamping device and support.
- install clamping device and support (see chapter 4.2.1, 4.2.2 and 4.2.7).
- mount wiper die (see chapter 4.2.5).
- mount mandrel rod.
- fix flexible tube of mandrel lubrication (if it exists)
- for more information about settings see chapter 4.2 and 4.3.
- switch on and initialise machine (see chapter 2.5 and operation manual MS-3000).
- load tube and continue the bending job.

- **Bending tools and exchangeable parts**

One set of tooling includes:

- Bend die with locking bar and with lever for tool return.
- Clamp die
- Pressure die
- Mandrel
- Mandrel rod with mandrel rod accommodation (with or without connection for automatic lubrication)
- Wiper die (is only used for small CLR)

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- **Change of bending tools**

- machine in basic position (see chapter 1.5).
- turn off machine (hydraulic off and master switch off).
- If it exists, take off wiper die (see chapter 4.2.6).
- take of flexible tube off mandrel lubrication (if existent).
- take off mandrel rod
- take off bend die (see chapter 4.2.1).
- take off clamp die (see chapter 4.2.1).
- take off pressure die (see chapter 4.2.2).
- If necessary change the tool post (spindle) (see chapter 4.2.1).
- adjust clamping device approx. for new CLR (see chapter 4.2.1).
- mount new bend die (see chapter 4.2.1).
- mount clamp die (see chapter 4.2.1).
- adjust support approx. for new CLR (see chapter 4.2.2).
- mount new pressure die (see chapter 4.2.2).
- set boom to the new position (see chapter 4.2.3).
- mount mandrel rod with mandrel
- fix flexible tube of mandrel lubrication (if it exists)
- set clamping device (see 4.2.1)
- set pressure die support (see 4.2.2)
- if necessary, mount wiper die (see chapter 4.2.6).
- if requested, make settings as mentioned in chapter 4.3.

- ***Erection***

Depending on tube dimensions and CLR different parts of the tooling must be exchanged.

How to install and set the tooling is described in the following chapters.

Therefore the machine must be in basic position. (see chapter 1.5).

To install the different elements take off the mandrel rod.

The control (machine) must be in the mode manual operation (=TEST)

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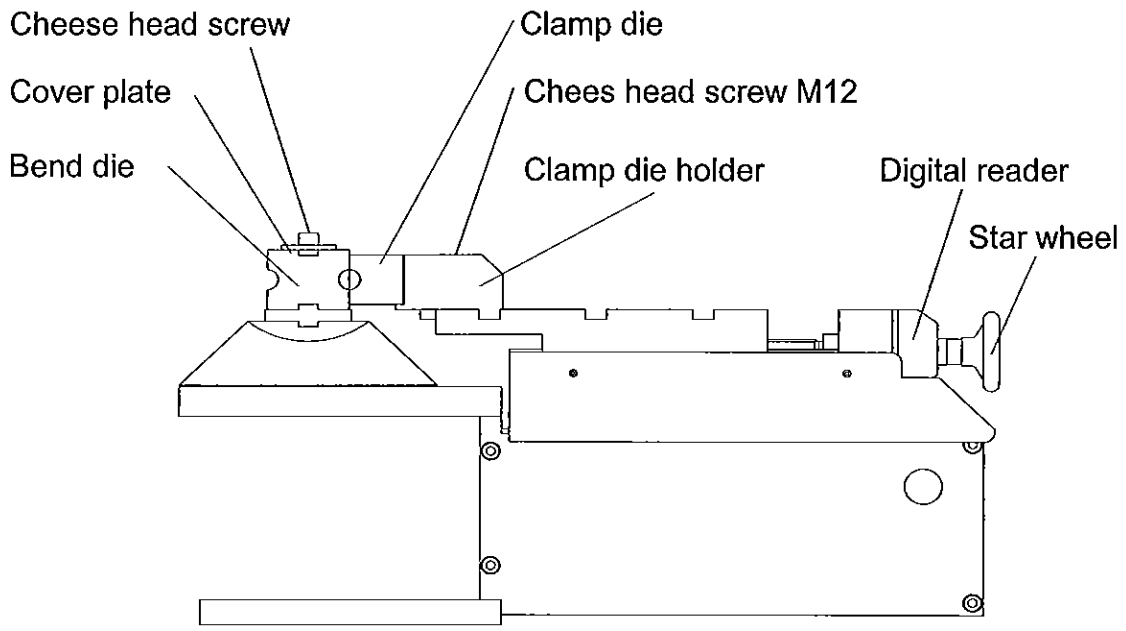
- **Bend die and tube clamping device**



- take off cover plate (cheese head screw M12)
- take off clamping device
- take off bend die
- take off two screws and take off clamp die
- if necessary change the tool post by untighten the cheese head screw M12. Tool post can be lifted and be taken away
- grease tool post (= shaft which accommodates the bend die)
- put on the new bend die
- mount cover plate and tighten the cheese head screw M12
- put in the clamp die
- set clamping device to the new CLR (CLR + 5 mm) by using star wheel and digital reading
- close clamping device (see operation manual MS 3000)
- close the clamp die with star wheel until it touches the bend die
- open the clamping device
- now close the clamp die with star wheel for an other approx. 2 mm
- fix the setting with the clamping screw

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The clamping pressure can be adjusted by regulating the pressure on the hydraulic device (maximal 250 bar = 50kN).

Possible reasons if the tube slides in the clamp die

1) clamping pressure to little
2) error in the settings of the clamping device or the pressure die support
3) clamp die clamps ball mandrel

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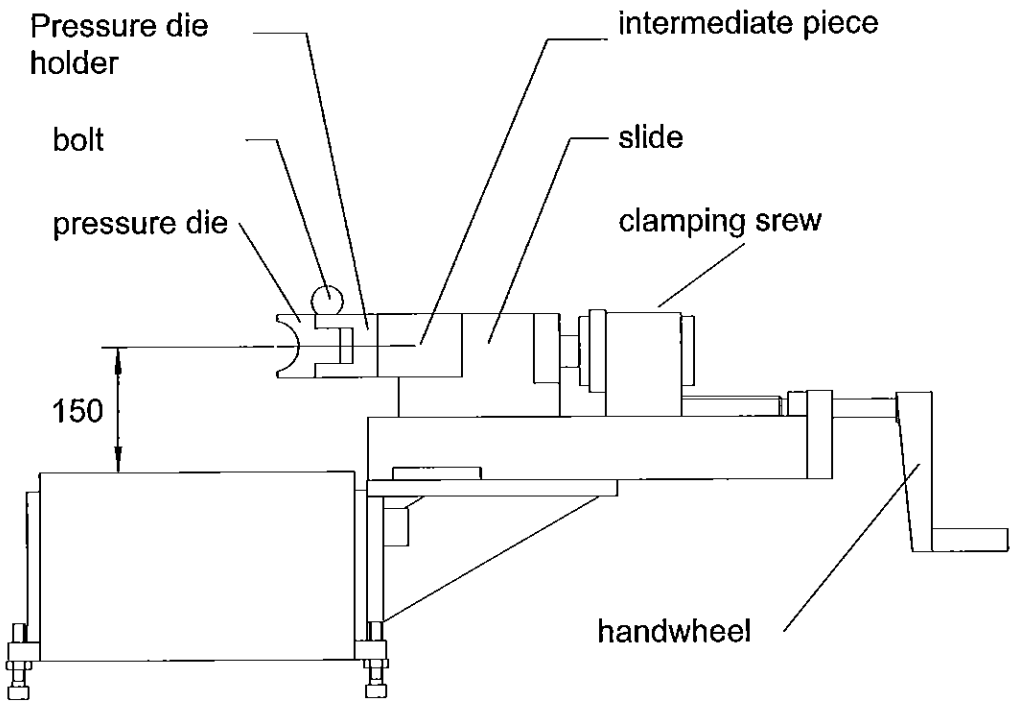
- **Pressure die support and pressure die**



- till CLR approx. 100 mm the intermediate piece must be mounted
- over CLR 100 mm the pressure die holder is directly fixed to the slide
- fix the pressure die with the 2 bolts to the pressure die holder
- load tube
- bring bend die in basic position and close clamp die (see operation manual MS 3000)
- close slide with the hand wheel in order that the pressure die comes with little pressure against the tube
- tighten screws
- fix the setting with the clamping screw

Comment:
If wipers arise at the inside of the bend increase the pressure of the pressure die

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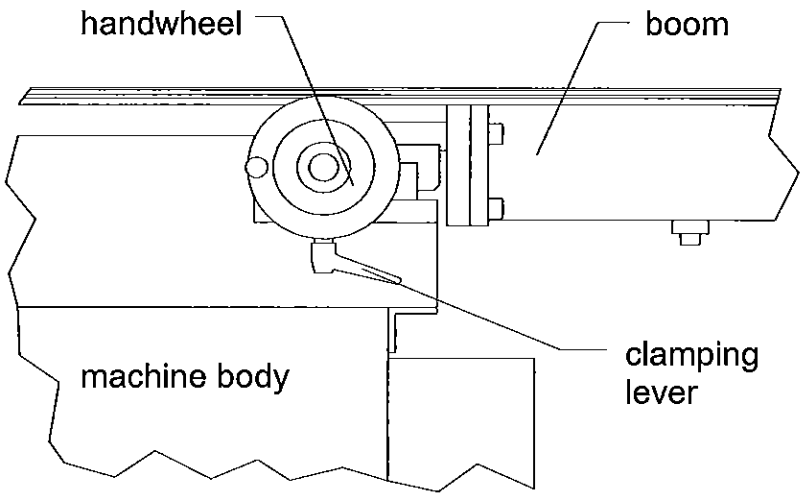
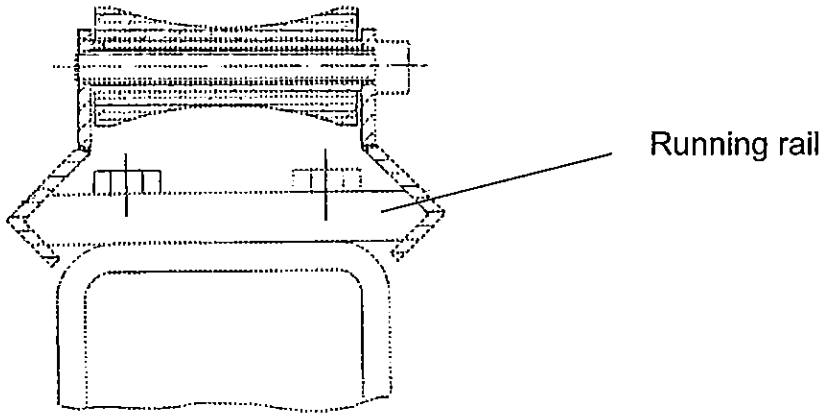
- **Boom, set the CLR**



- untie the clamping lever
- adjust the position of the boom by using the hand wheel (scale reading)
- tighten the clamping lever

- **Rest of the mandrel rod**



- Is used when short tubes are bent to provide that the mandrel rod touches the running rail.

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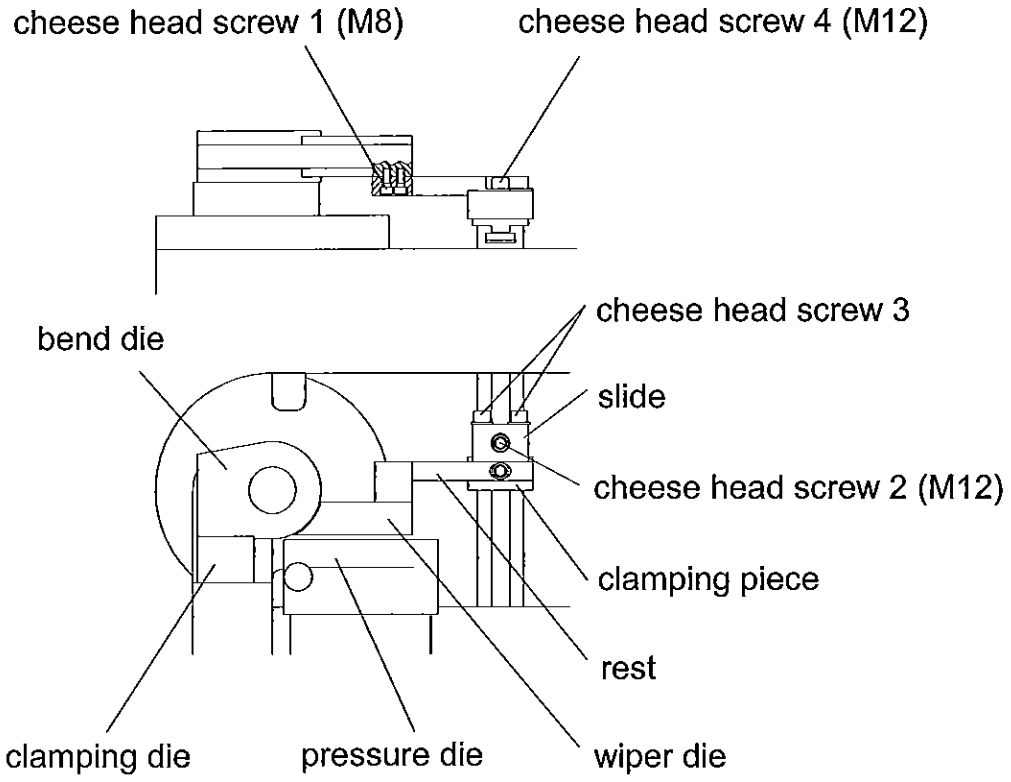
- **Wiper die (option)**



- Fix the wiper die on the rest with two screws 1 (M8).
- Put the slide with mounted clamping piece into the T-groove.
- Put the rest with the wiper die into the claming piece and mount the cheese head screws but do not tighten them.
- Place the wiper die exactly into the groove of the bending die
- Fix that position by tightening the screws 2, 3 and 4 (all M12)

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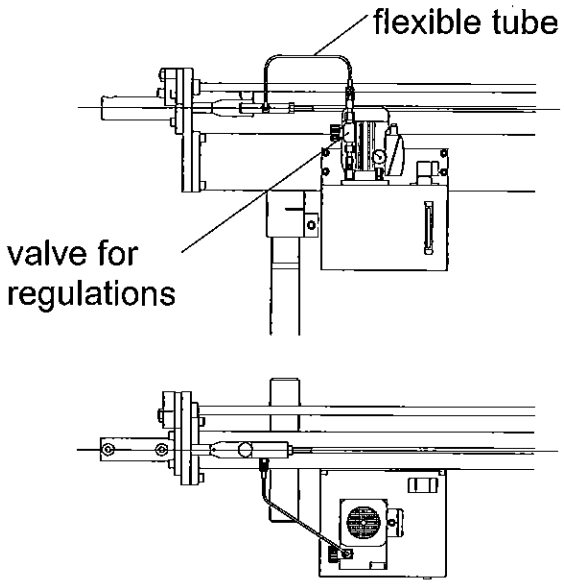
- **Automatic mandrel lubrication (option)**



- fix flexible tube on mandrel rod
- regulate the oil quantity with the valve depending on tube diameter
- the automatic mandrel lubrication is activated in the bending program (see operation manual MS 3000)
- fill in oil weekly to the oil level

See lubrication advice in chapter 3

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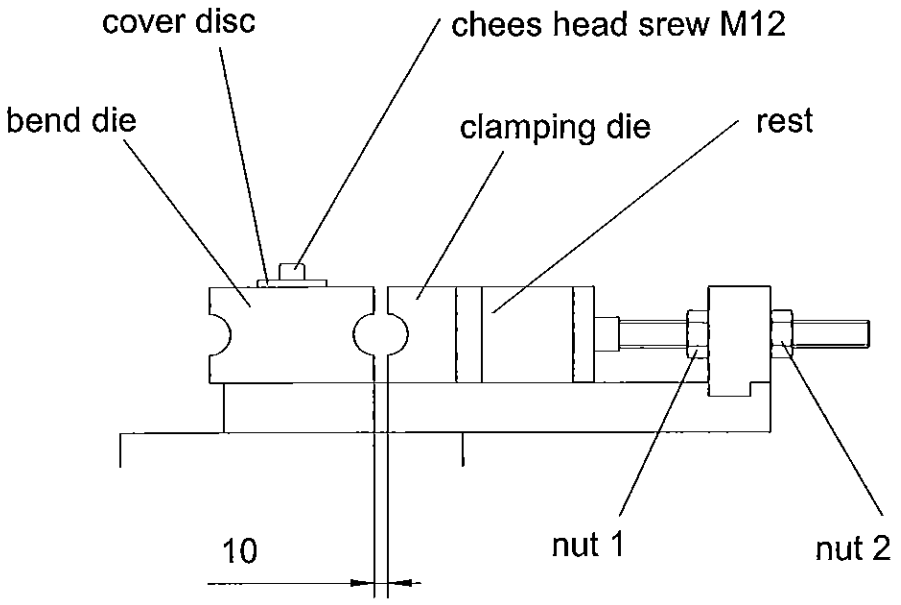
- **Open clamping device (option)**



- Dismount cover disc (cheese head screw M12).
- Pull off bend die.
- If necessary change tool post (spindle). (untie hexagon screw M16 under the bending head; spindle can be dismounted pulling it up.)
- mounting the new tool post and rotate it until the safety bolt against twisting locks in.
- oiling slightly the spindle.
- mounting the bend die (for CLR < than 30 mm the bend die is mounted with the purchased distance plate).
- mount covering disc with cheese head screw M12.
- close the clamping device (see manual MS 3000)
- put clamp die in T-groove.
- advance the clamp die with nut 1 until it rests fully on the bend die .
- open the clamping device (see manual MS 3000) and advance the clamp for another 1 - 2 mm.
- Fixing the position by tightening nut 2.

The clamping pressure can be adjusted by regulating the pressure on the hydraulic device (maximal 250 bar = 50kN).

Possible reasons if the tube slides in the clamp die

1) clamping pressure to low
2) error in the settings of the clamping device or the pressure die support
3) clamp die clamps ball mandrel

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- ***Settings***

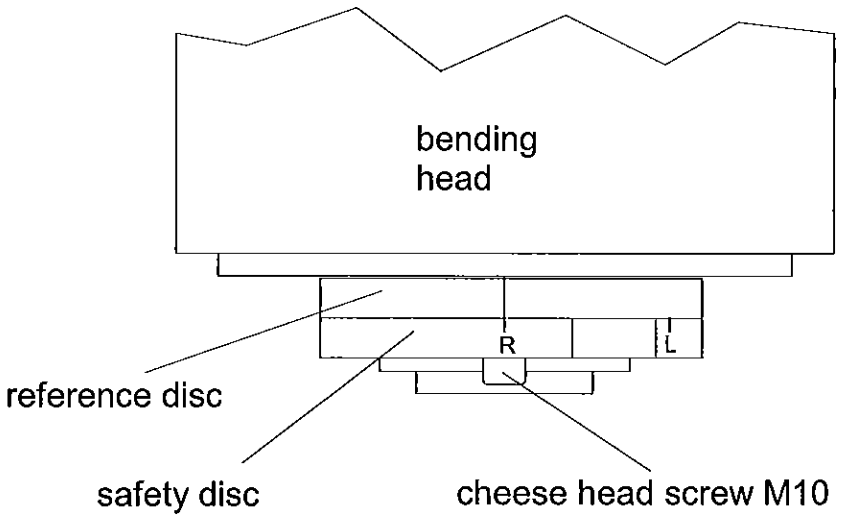
- **Bending direction**

According the desired bending direction the key operated switche it to put into „left" (anti clockwise) or right (clockwise) position.

The safety disc on the bottom side of the bending head must be brought into the right position:

Procedure
- Untie the two cheese head screws M10 just for approximately one turn.
- Rotate the safety disc (Pay attention to the marks: R = right hand bending, L = left hand bending).
- Tighten cheese head screws M10.

Note: If the safety disc is in the wrong position the machine will actuate an emergency stop reaching a bending angle of 120 °



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- **Bending speed**

- The speed for each bend can be defined by the MS 3000.
- 10 speeds are possible (speed 9 = 100%).
- Manual operation (=TEST), two speeds are available (+/- = slowl; ++/-- = fast)

See operation manual MS3000 chapter 4.

- **Mandrel retraction speed respective**

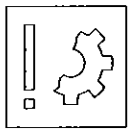
- Anticipated mandrel retraction: x degrees before the bend is finished the mandrel is returned.
- The inserted value depends on the bending speed.
- In most cases 5° is a good value.
- Also see operation manual MS 3000 chapter 4.
- The mandrel speed can be regulated at the valve of the mandrel retraction cylinder.

Rule:

When finishing the bend, the head of the mandrel shall pass the bending centre.

Notice:

A good setting improves the quality of the bend



For machines without automatic lubrication device, MEWAG recommends to grease the tube manually with a brush. Bending is made easier and the mandrel has a longer live.
Lubrication advice see chapter 3.

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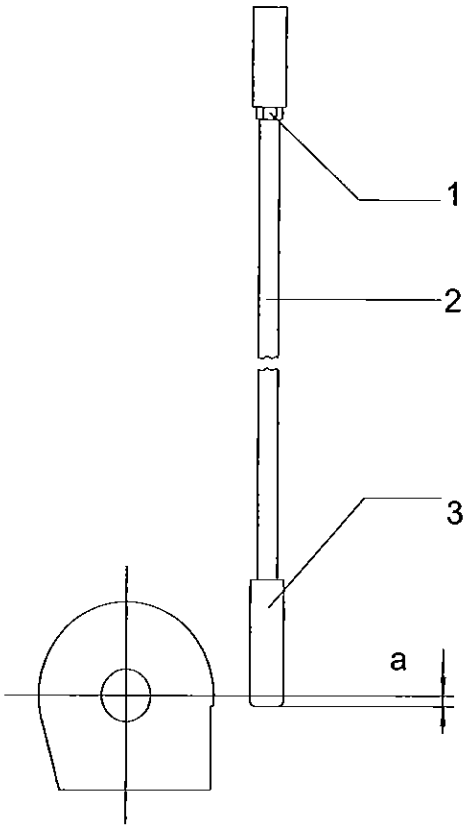
- **Setting of mandrel**



For making a good quality bend the mandrel must pass the bending centre for the value "a". Find "a" by making tests.

If the machine is in basic position also the mandrel is in 0-position.

Change of the mandrel position:

• nut	"1"	unscrew
• mandrel rod	"2"	rotate till the
• mandrel	"3"	has the desired position.

- **Bending angle**

- The bending angle is programmed on the control.
- How to consider springback and elongation see operation manual MS 3000 chapter 4.

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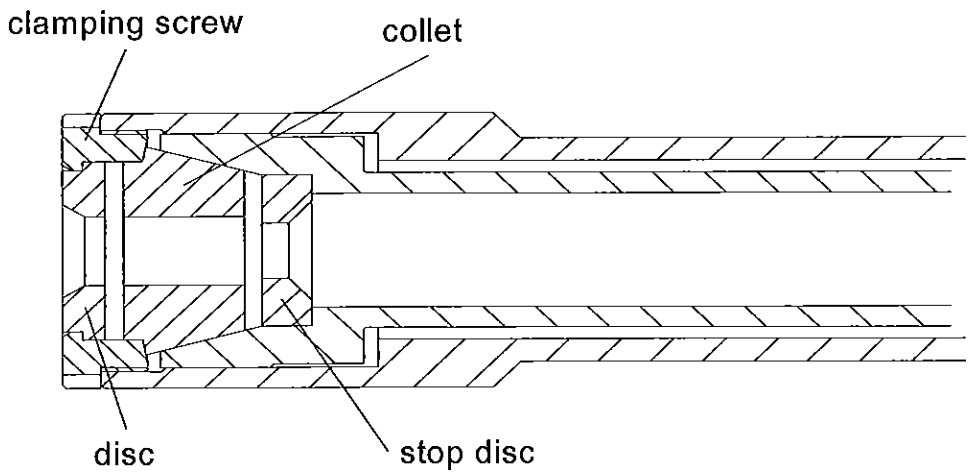
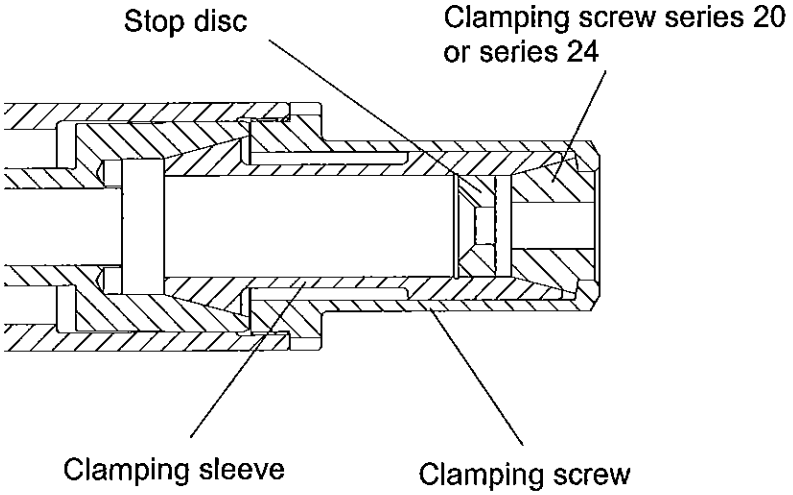
- **Collet**



- Open collet (see manual of control).
- Untie clamp screw
- Change disc, collet and if used also stop disc
- Fasten the clamping screw.

4.2.5 Accomodation for collets (Option)

for tube diameter 4-26 (series 20)
for tube diameter 6-30 (series 24)



- Open collet (see manual of control).
- Untie standard clamp screw
- Insert the collet into the special clamping screw
- Insert clamping sleeve with the stop disc into the special clamping screw
- Mount the complete device on the plan of bent and fasten it

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• *How to proceed if the production is interrupted*

- Press **emergency stop**
- Shut **off** master switch, **wait 3** seconds, switch **on** master switch.
- Unlock **emergency stop.**
- Hydraulic **on.**
- Select menue TEST (= manual operation).
- Open with manual operation the clamp die, the pressure die and the collet.
- Unload tube.
- Initialise machine (see chapter 2.5)
- Start program (see operation manual MS-3000)

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