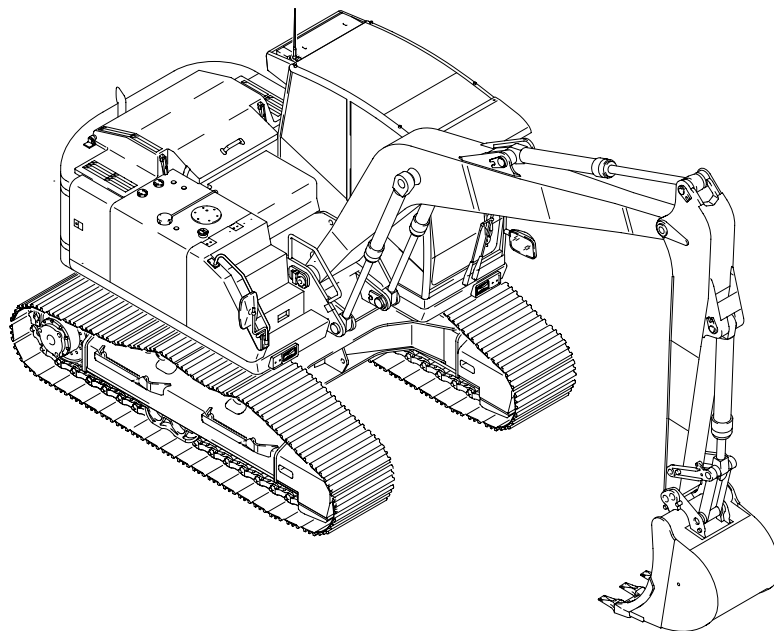


Workshop-Manual



ATLAS 1504/1604 LC

The present **Workshop Manual** was compiled specifically for service technicians belonging to the **TEREX-ATLAS** organization.

Generally, service technicians work under their own responsibility for industrial safety during maintenance and repair work on **TEREX-ATLAS** products.

For your own safety, note and comply with the safety hints of this manual.

Only qualified and trained specialists are authorized to service and repair **TEREX-ATLAS** products properly.

The service technicians are obliged to perform training courses.

For machine care and maintenance work, refer to the Operating Manuals.

For information on Workshop Manual amendments visit:

www.atlas-terex.de

Carry out the necessary changes and update the Record of Amendments.

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TEREX-ATLAS GmbH

Ganderkesee / Germany

Tel.: 04222 / 954 - 0

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Record of Amendments

Amendment		Carried out by (Name and signature)	Date	Notes
No.	Date of issue			

Amendment		Carried out by (Name and signature)	Date	Notes
No.	Date of issue			

Chapter 1

Technical data

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1 Technical data

	Unit	1504 LC	1604 LC
Service weight	t	17,7	22
Max. shovel capacity	l	1120	1150
Motor manufacturer		Deutz	Deutz
Typ		BF4M2012EC	BF6M2012EC
Power	kW	88	121
	(PS)	120	165
Speed	min ⁻¹	2300	2200
Hydraulic system		AWE04	AWE04
Max. volume	l/min	240	300
Max. pressure	bar	340	340
Slewing speed	min ⁻¹	8,5	8,5
Slewing radius	mm	2190	2585
Dimensions			
Track	mm	2200	2200
Length Substructure	mm	4000	4450
Height (C)	mm	2975	3045
Single track width		600	600
Max. driving speed	km/h	4,8	4,8
Creeping speed	km/h	2,1	2,1

	Unit	1504 LC	1604 LC
Monobloc-system			
Dredging depth	mm	5850	6300
Dredging width	mm	9200	9400
Max. tear-out force	kN	82	92
Max. break-away force	kN	130	122
Sound level in acc. with EG 2000/14			
LWA outside level	dB(A)	101	104
LPA cab level	dB(A)	75	76

	Unit	1504 LC	1604 LC
Hydraulic pump, open circuit			
Nominal volume	ccm	105	135
Slewing direction right			
Maximum speed (load)	min ⁻¹	2300	2200
Driving power	kW	88	121
max. operating pressure	bar	340	340
max. rate of flow	l/min	240	300
min. rate of flow	l/min	103	127
Load Sensing (S)			
set at differential pressure	bar	25	25

Chapter 2
General information on hydraulics

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1 Introduction

The question "What is hydraulics?" can be answered as follows for the technical department.

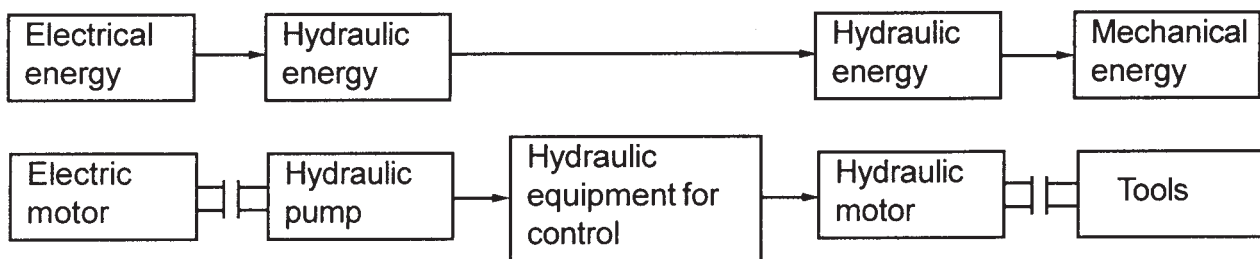
Hydraulics can be understood to mean the transmission and control of forces and movements by means of liquid matters.

Hydraulic systems and hydraulic units are quite common in technical applications. They are applied for instance, in:

- Machine tool manufacture
- Press manufacture
- Plant manufacturing
- Vehicle manufacturing
- Aircraft construction
- Ship building

The benefits of the hydraulic system lie in the generation and transmission of stronger forces in the application of smaller structural elements and in good closed and open-loop control. The switching units can also be well remote-controlled (mostly electrically). Running from the standstill state under maximum load is possible with hydraulic-cylinder and hydraulic motor. The fast reversal of direction can be realized through the respective switching units. Pressure, force, torque and the speed of the working elements are infinitely variable. The hydraulic units have a high service life due to self-lubrication.

Energy conversion in hydraulic installations



There are also disadvantages alongside these benefits. The disadvantages are largely in the transmission medium, on the pressurized liquid itself.

There are risks of accident in the high pressure of the hydraulic pressurized liquid. Care shall therefore be taken that all connections are tightened and leak-proof.

In other words, the hydraulic system has special benefits and focal points - as those specified above. Good solutions can be realized for production-technical problems in connection with the electrical technology, mechanics and the pneumatic system.

Pre-requisites to be met by the user of the hydraulic system:

- Knowledge of the physical fundamental principles of hydrostatics and hydrodynamics
- Knowledge of the units and physical magnitudes of hydraulics
- Knowledge of hydraulic components and their interaction in hydrosystems.

2 Explanation of symbols and bases of calculation

The tearing forces and working speed of a hydraulic excavator can be calculated with simple formula from the given engine performance or hydraulic capacity (conveyance volume and pressure) and the diameters of the cylinder. The understanding of hydraulic installations is expected to be intensified with this brief theoretical introduction. Confident assessment in times of failures is possible only with a mastery of the inner processes of an excavator Formula in accordance with the international units system (SI).

Symbol DIN 1304	Units symbol DIN 1301
A - Area	cm ²
d - Cylinder diameter	cm
F - Force in Newton	N
n - rotary speed	1/min
P - Performance	kW
p - Pressure in bar	daN/cm ²
Q - Conveyance volume in l/min	dm ³ /min
v - Speed	m/s
k - const. conversion factor	

To be able to convert the magnitudes directly into the formula, they must be expanded or converted to the following units:

P	in	kW
p	in	da N/cm ² (bar)
Q	in	dm ³ /min (l/min)
A	in	cm ²
d	in	cm
F	in	1daN = 10 N ≈ 1 kp

$$\text{Performance}_{\text{hydr.}} = \frac{\text{Pressure} \cdot \text{Conveyance volume}}{k}$$

$$\triangleright P_{\text{hydr}} = \frac{p \cdot Q}{600} \text{ [kW]}$$

Should the pressure p in bar be requested, the formula is as follows:

$$\text{Pressure} = \frac{\text{Performance}_{\text{hydr.}} \cdot k}{\text{Conveyance volume}}$$

$$\triangleright p = \frac{P_{\text{hydr}} \cdot 600}{Q} \text{ [daN/cm}^2\text{]}$$

If the conveyance volume Q in l/min is required, the formula must be reversed to Q;

$$\text{Conveyance volume} = \frac{\text{Performance}_{\text{hydr.}} \cdot k}{\text{Pressure}}$$

$$\triangleright Q = \frac{P_{\text{hydr}} \cdot 600}{p} \text{ [dm}^3\text{/min]}$$

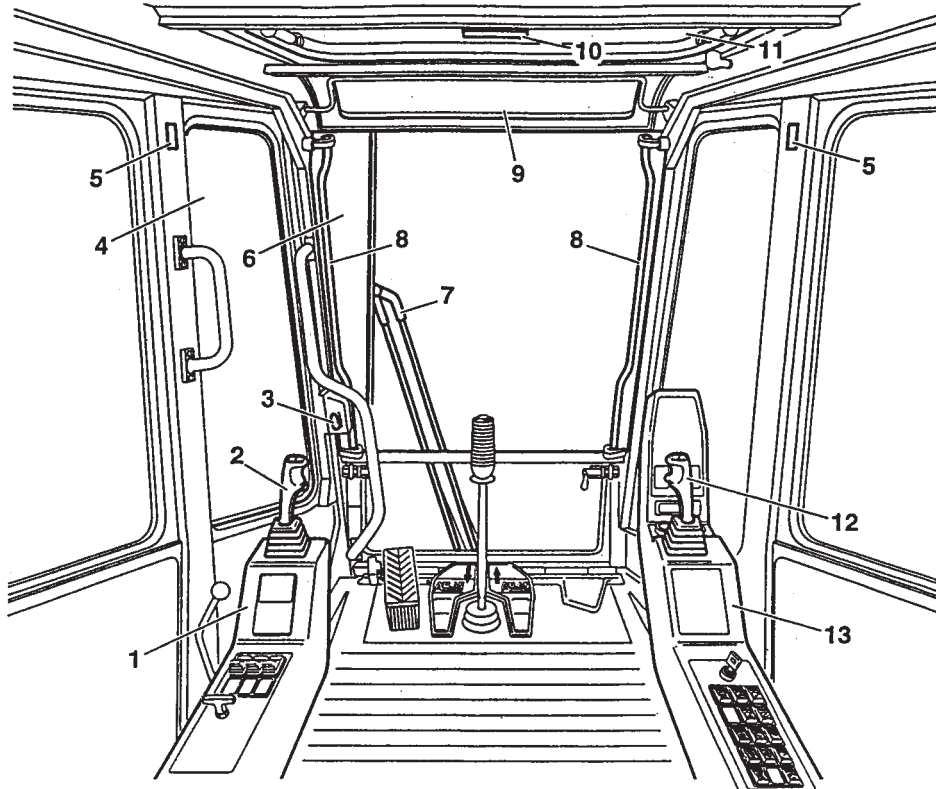
Chapter 3

Cab Serial 935

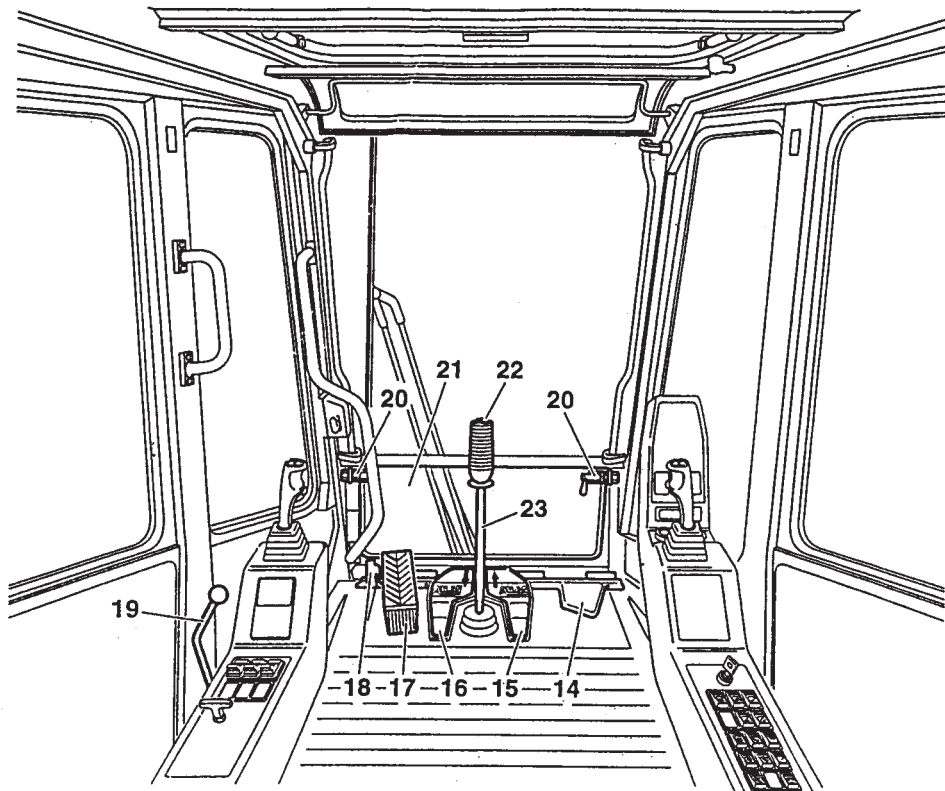
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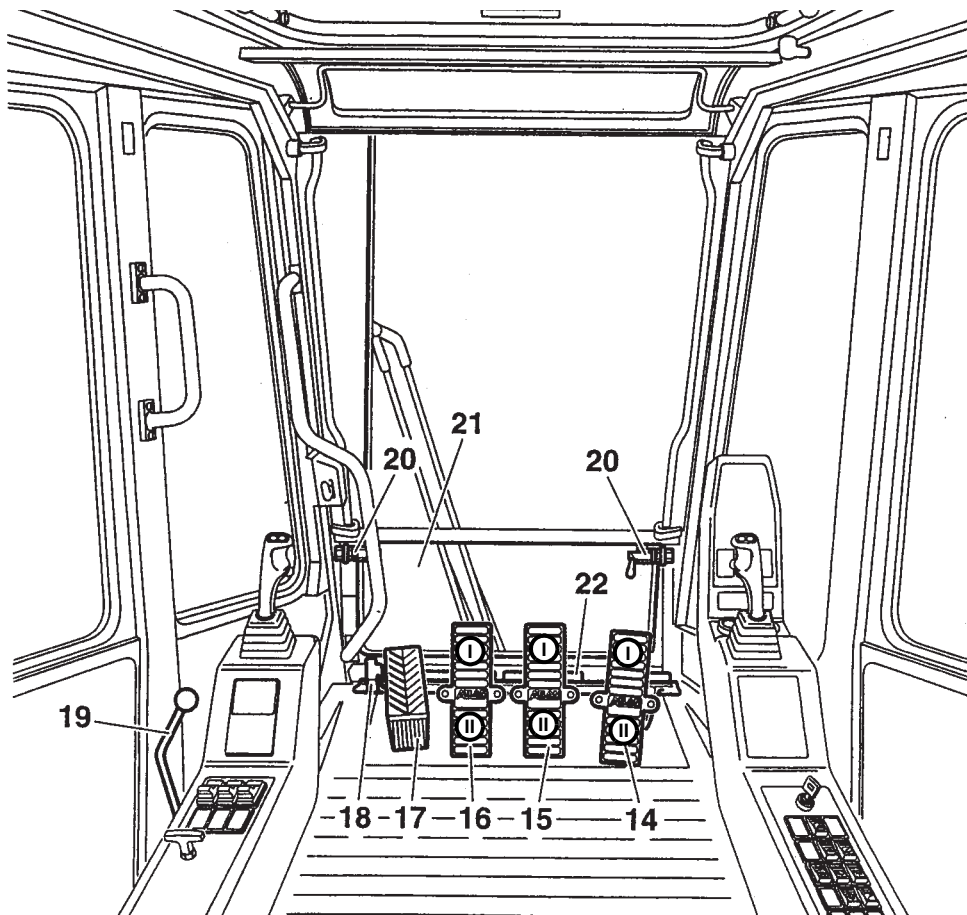
1 General view of cab



- 1 Left console
- 2 Control lever for: Jib / Slewing
- 3 Lever for cab door
- 4 Cab door
- 5 Interior lights
- 6 Windshield
- 7 Windshield wiper
- 8 Windshield locking rods, left/right
- 9 Sun visor
- 10 Skylight lock
- 11 Skylight
- 12 Control lever for: Lifting / Lowering, Bucket / Grab
- 13 Right console

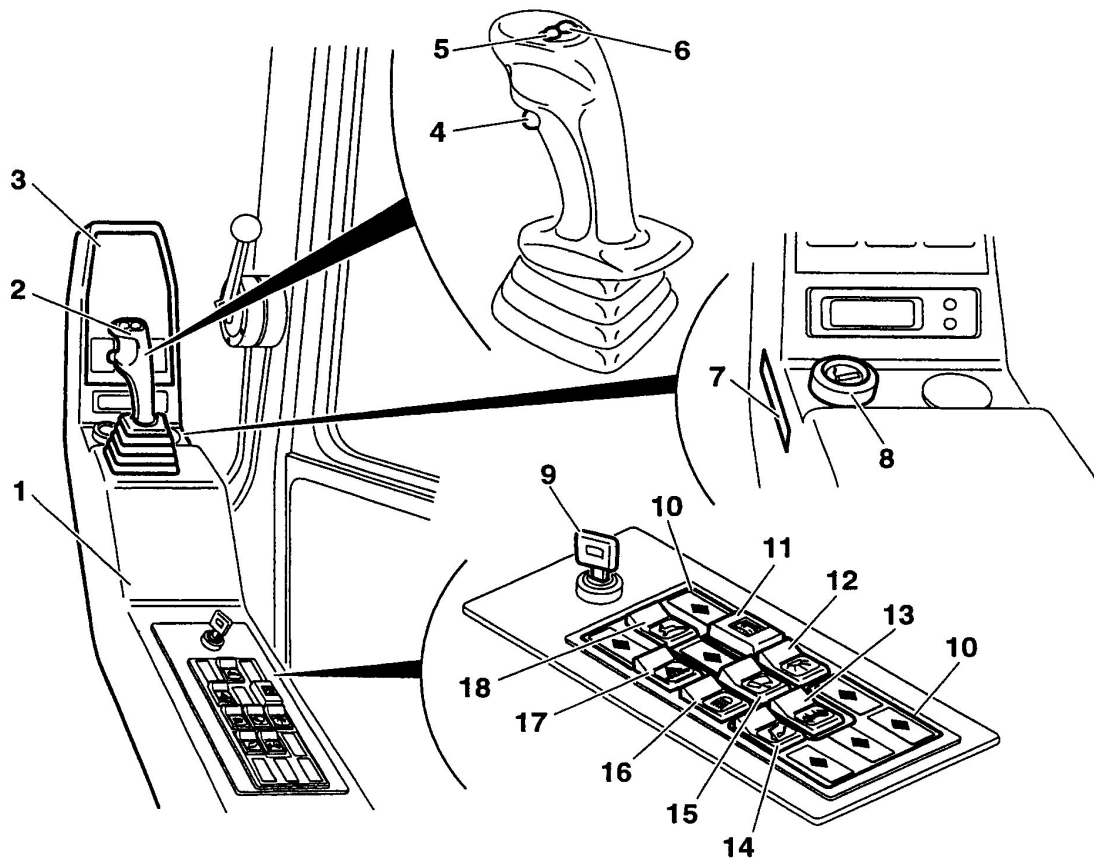


- 14 Windshield vent outlet
- 15 Pedal for: Forward travel, luffing boom
- 16 Pedal for: Reversing, retracting luffing boom
- 17 Slewing brake pedal
- 18 Slewing brake pedal lock
- 19 Hydraulic pilot control circuit shutdown
- 20 Plug-in window catch
- 21 Plug-in window
- 22 Speed selector switch
- 23 Control lever for travel



- 14 Pedal for operating boom:
 - I Extend luffing boom
 - II Retract luffing boom
 - 15 Pedal for travel:
 - I Right¹ crawler track forwards
 - II Right¹ crawler track reverse
 - 16 Pedal for travel:
 - I Left¹ crawler track forwards
 - II Left¹ crawler track reverse
 - 17 Slewing brake pedal
 - 18 Slewing brake pedal lock
 - 19 Hydraulic pilot control circuit shutdown
 - 20 Plug-in window catch
 - 21 Plug-in window
 - 22 Windshield vent outlet
1. Superstructure and undercarriage in forward direction

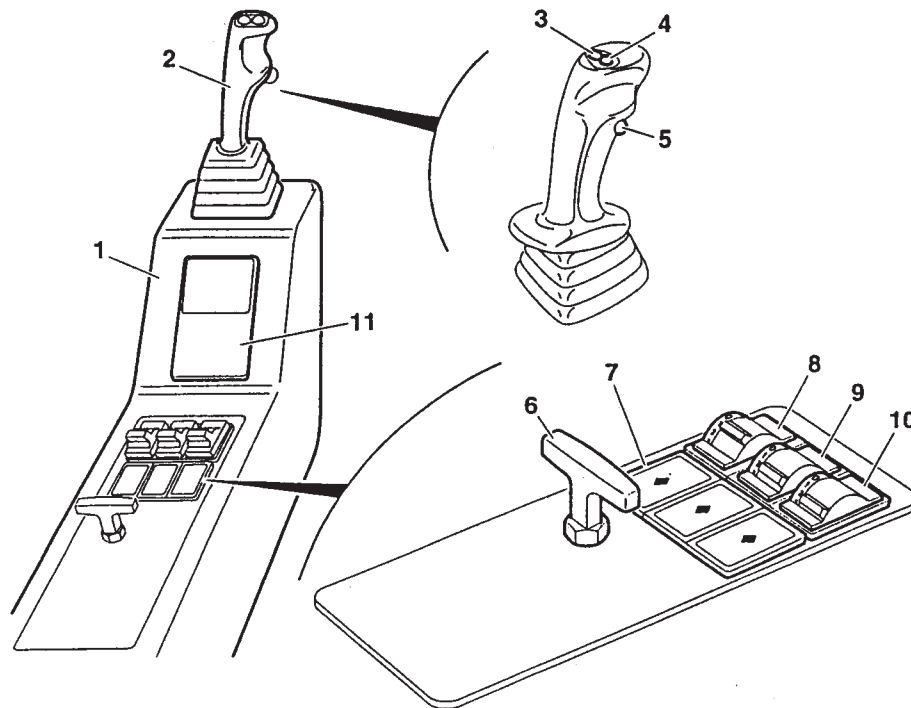
2 Right switch panel



Right switch panel

- 1 Right console
- 2 Control lever for:
Lifting
Lowering
Bucket/grab
- 3 Display panel with control and warning lights
- 4 Pushbutton to cancel precision control
- 5 Pushbutton to rotate grab to left
- 6 Pushbutton to rotate grab to right
- 7 Operating hour meter
- 8 Cigarette lighter/electric power socket
- 9 Ignition key
- 10 Spare, for optional extra (♦)
- 11 Continuously variable potentiometer for precision control
- 12 Interior lights switch
- 13 Swing axle lock switch
- 14 Switch to cancel jib cut-off
- 15 Windshield wiper switch
- 16 Switch for parking and driving lights
- 17 Hazard warning flasher switch
- 18 Switch for external oil summation and separation control

3 Left switch panel



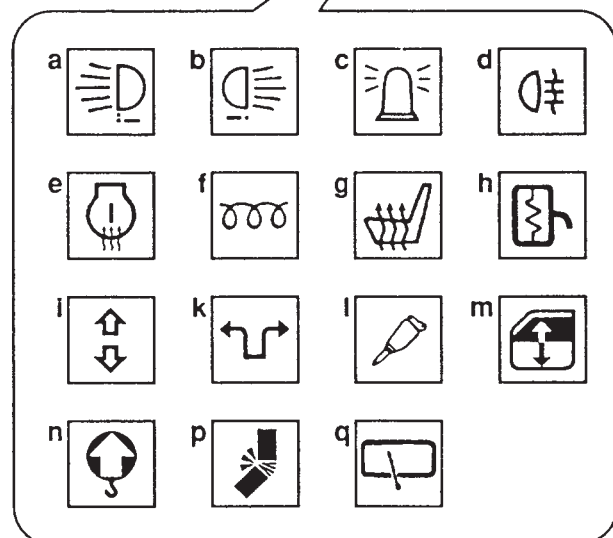
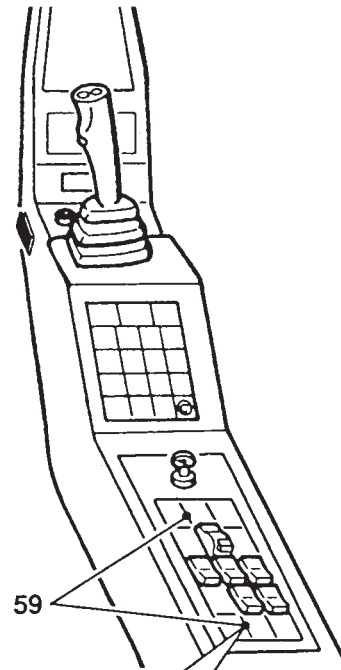
- 1 Left console
- 2 Control lever for: Folding jib, Slewing
- 3 Left pushbutton for additional working attachments
- 4 Right pushbutton for additional working attachments
- 5 Pushbutton for horn
- 6 Pull switch for heating
- 7 Spare, for optional extra
- 8 Blower switch (speeds 1 to 2)
- 9 Preselector switch for left pushbutton (3)
(positions 0 to 4)
- 10 Preselector switch for right pushbutton (4)
(positions 0 to 4)
- 11 Ashtray

Hint: The allocation of the preselector switches (9, 10) depends on the optional extras for the excavator. Which working attachment or which function can be selected with which switch position can be taken from the switch symbols for the preselector switches (9, 10) on the symbol panel on the cab wall.

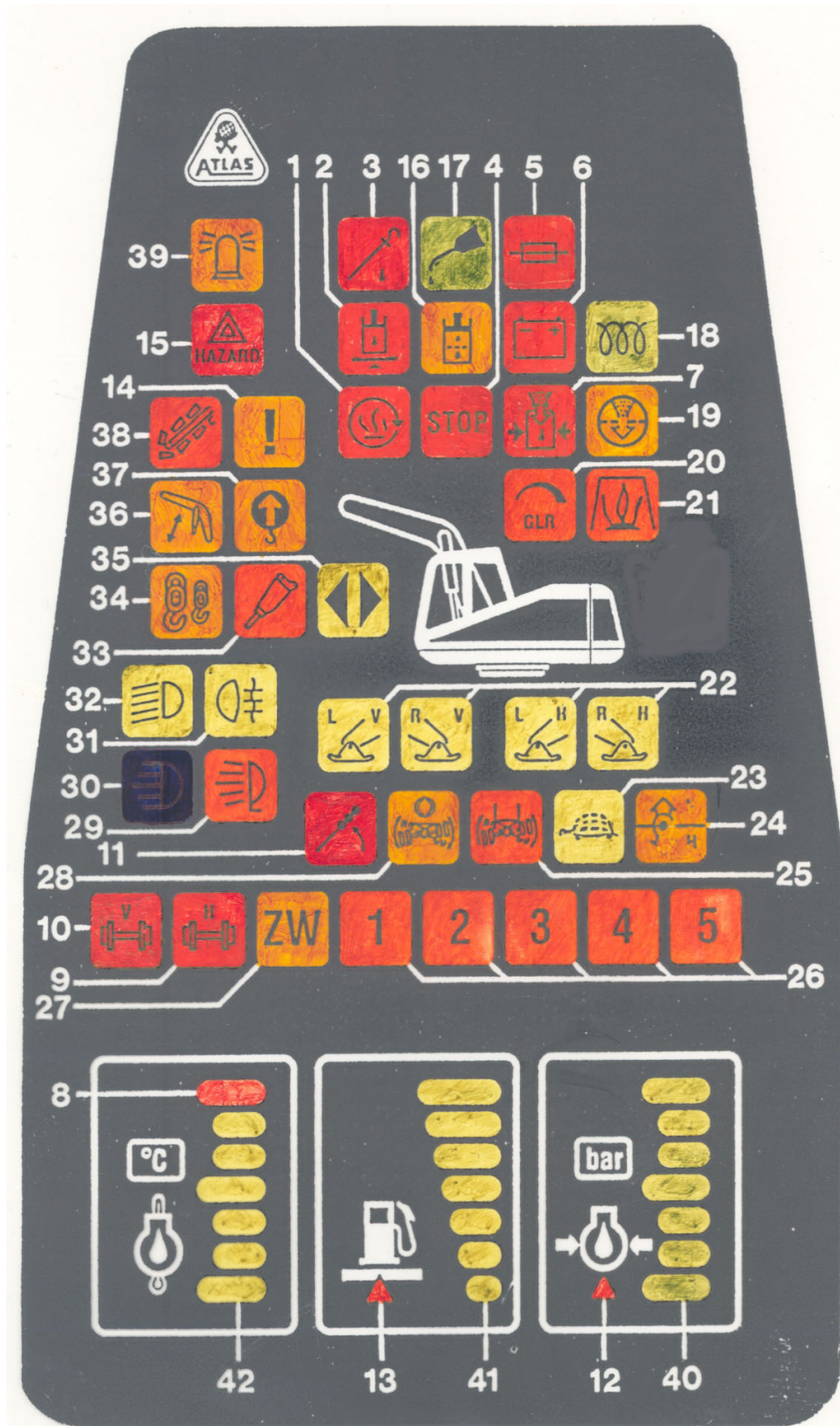
4 Special equipments ♦

Available functions (59) in switch block on right

- a** Headlight on roof, front (orange)
- b** Headlight on roof, rear (orange)
- c** Rotary beacon (yellow)
- d** Rear fog light (green)
- e** Fuel preheating (yellow)
- f** Hydraulic oil heating (green)
- g** Seat heating (yellow)
- h** Mirror heating (yellow)
- i** Cab lift up / down (green)
Vario cab up / down (green)
- k** Vario cab forward / back (red)
- l** Hydraulic hammer (blue)
- m** Electric window lift (green)
- n** Overload warning device (yellow)
- p** Reverse safety function (red)
- q** Rear window wiper (green)



5 Display and controls



1. Cylinder head temperature / hydraulic fluid temperature (1704 - 1804)

warning light - red
in case of overheating of cylinder head - permanent lighting
sensor in 1. cylinder head (only air cooled engine)
in case of overheating of hydraulic fluid - flashing light
sensor in suction line of oil pressure pump
If these faults occur the pump capacity will automatically
be reduced

2. Hydraulic fluid level (1004 - 1304 extra), 1404 - 1804 serie

warning light - red
If the hydraulic fluid level is too low - permanent lighting
controlling takes place only during starting the engine.
Additional visual control on sight glass of oil tank.

3. Engine oil level (not installed)

warning light - red
For automatic controlling of engine oil level.
Controlling takes place only during starting the engine.

4. Stop engine

warning light - red V- belt defective (air cooled engine 1204 - 1804)	- permanent lighting - additionally a buzzer sounds
Engine oil pressure too low	- permanent lighting, additionally the warning light (12) flashes, and
Main hydraulic brake pressure below (<100 bar)	a buzzer sounds with the engine running.
Engine oil overheating ($<120^{\circ}$) (air cooled engines)	- permanent lighting, additionally the warning light (8) flashes and a buzzer sounds.
Cooling water ($>118^{\circ}$) (water cooled engines)	- flashing, additionally the warning light (8) flashes and a buzzer sounds.
Cooling water level too low (water cooled engine)	- permanent lighting, additionally the warning light (8) lights up and a buzzer sounds.

5. Fuse monitor

warning light - red
Turn ignition key into position (1) - permanent lighting.
If the engine runs only permanent lighting.
Fuse defective. Each single defective fuse will be indicated on the board by a luminous diode.

6. Generator, charge telltale

warning light - red
charge telltale - permanent lighting

7. Air pressure - hydraulic fluid tank
(excavator without air pressure system no indication)

warning light - red
No or too low air pressure (<0.3 bar) in the hydraulic fluid tank - permanent lighting
Pressure switch at the hydraulic fluid tank.

8. Engine oil monitoring

(air cooled engine)
warning light - red
If the engine oil is overheated (>120°)

- flashing lights
the warning light (4)
lights up additionally
and a buzzer sounds.

Water check temperature
and water level
(water - cooled engines)
If the cooling water is overheated

- flashing lights
the warning light (4)
lights up additionally
and a buzzer sounds.
- permanent lighting
the warning light (4)
lights up additionally
and a buzzer sounds.

Cooling water level too low

9. Track roller pressure - rear

warning light - red
Contact pressure too low
Only for 2 - way - excavator

- permanent lighting
and a buzzer sounds.

10. Track roller pressure - front

warning light - red
Contact pressure too low
Only for 2 - way - excavator

- permanent lighting
and a buzzer sounds.

11. Hand brake

Excavator already braked - permanent lighting
Pressure switch below the cabin

12. Engine oil pressure

warning light - red
If engine oil pressure is too low at running engine -
flashing light, and the warning light (4) lights up,
and a buzzer additionally sounds.
Pressure switch on engine (filter console)

13. Fuel level - minimum

warning light - red
If the fuel level is going down to 1/8 - flashing light
Sensor inside the tank

14. Caution

warning light - yellow
Fault inside the computer - permanent lighting
Incandescent lamp defective (brake light,
flash turn indicators) - flashing light

15. Hazard warning flashers

warning light - red
If hazard warning flashers is engaged - flashing light,
also the control light (35) is flashing.

16. Hydraulic fluid filter

control light - yellow
Hydraulic fluid filter contaminated - permanent lighting
Remarks: 4 seconds after switching on the ignition the engine
oil temperature and cooling water temperature will be
interrogated once

In case of $<40^{\circ}\text{C}$

In case of $>40^{\circ}\text{C}$

- the control light will be suppressed for 30 minutes
- the control light will immediately light up if the hydraulic fluid filter is contaminated.

17. Central lubrication (extra, 1804 series)

warning light - green

Every 3 hours automatically a lubrication process of 8 minutes is being carried out.

(from EPROM V 2.09 the lubrication process is being carried out every 4 operating hours)

(from EPROM V 2.11 the lubrication process is being carried out every 4 operating hours for 3 minutes.

During this process - permanent lighting

18. Additional heater

control light - green

switched on pressurized oil heater - permanent lighting

19. Air cleaner warning device/water in the mesh strainer fuel filter

control light - yellow

with blocked air cleaner - permanent lighting/with water in the mesh strainer fuel filter - flashing

Air cleaner pressure switch/water sensor in mesh strainer fuel filter

20. Power limit controlled system GLR (1004-1604)

control light - yellow

In case of troubles in the limited load regulation and

with emergency control switched on - permanent lighting

The mistakes are automatically displayed through LED no. 8 in the diagnosis window of the LINDE box.

Power limit controlled system (1704 - 1804)

In case of troubles in the limit load regulation - permanent lighting

The mistakes can be called through a diagnosis of errors.

Precision control (extra - 1304)

precision control switched on - permanent lighting

21. Preheater (extra)

control light - orange

Turn ignition key on position II and wait for light to come on - start engine.

22. Stabilizer choosing

control light - green
The choosed stabilizer will be indicated - permanent lighting

LV - left front
RV - right front
LH - left rear
RH - right rear

The change-over valves will be operated by high and low gear.

23. Crawler speed

control light - green
with switched crawler speed (switch at steering column-down)
permanent lighting
Magnet valve under cabin

24. Indicator - driving direction

control light - yellow
with choosed driving direction - permanent lighting
Attention: with switched indicator - no engine start possible

25. Swing axle lock

control light - orange
The switch has three positions

Position 0 = axle is unlocked
Position 1 = axle is locked with footbrake
Position 2 = axle continuously locked - permanent lighting

26. Control lights 1 - 5

control lights - orange
1.) Windscreen wiper interval
2.) Slewing restriction
3.) Seat heater, mirror heater, air condition
4.) Changeover from stabilizer to dozer blade, automatic idling system
5.) Reserve

27. Two way excavator

control light - yellow
Switched on - permanent lighting
Warning light is flashing

28. Swing axle lock

see description item 25

29. Working light (extra)

control light - yellow

30. Head light

control light - blue
(Switch right from steering column-down)
permanent lighting
Attention: head light only on wheeled excavators.

31. Rear fog light (extra)

control light - green

32. Parking- and low beam headlights

control light - green
when lights are switched on - permanent lighting

33. Hydraulic hammer (extra)

control light - orange
hammer operation on - permanent lighting
hammer will be operated over foot-key.

34. Pressure cut in stage (heavy lift)

control light - yellow
pressure cut in stage on - permanent lighting
(1704 / 1804 no control light)

35. Flashing indicators

control light - green
flashing indicator switched on - flashing light,
a buzzer additionally sounds in flashing frequency

36. Lifting/lowering limit function (extra, except two way excavator)

control light - yellow
when in operation - permanent lighting

37. Overload warning device

control light - yellow
overload warning device on
permitted load limit exceeded

- permanent lighting
- flashing light
a buzzer additionally sounds in
flashing frequency

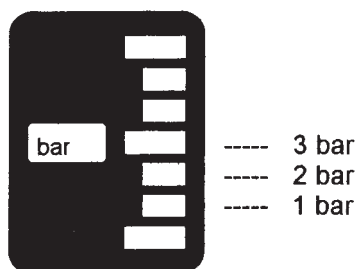
38. Trench cutter (extra)

control light - orange
when in operation - permanent lighting

39. Rotating beacon (extra)

control light - yellow
when in operation - permanent lighting

40. Engine oil pressure

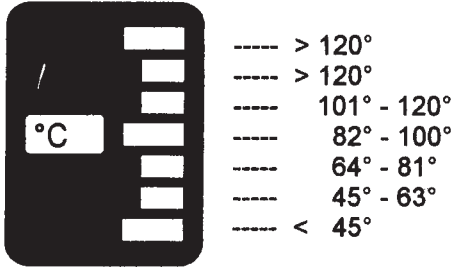


bar display - green
the momentary engine oil pressure is displayed.
If the cable or sensor is faulty, the bar in the
middle is flashing.

41. Fuel level

bar display - green
the actual fuel level is displayed
If the cable or sensor is faulty, the bar in the
middle is flashing.

42. Engine oil temperature (air-cooled engine)



bar display - green

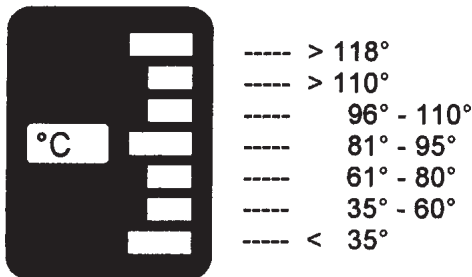
the actual engine temperature is displayed

Remarks:

Should there be any short circuit or interruption the middle bar display does not flash.

If the transmitter line is interrupted only the first bar display lights up. In case of a short circuit on the transmitter line all the green bars will light up.

Cooling water temperature (water-cooled engine)



bar display - green

the actual cooling water temperature is displayed by the bar display

Remarks:

Should there be any short circuit or interruption the middle bar display does not flash.

If the transmitter line is interrupted only the first bar display lights up. In case of a short circuit on the transmitter line all the green bars and the red bar (warning contact) will light up, additionally the warning light (4) lights up and the buzzer sounds.

6 Description of the starting procedure

After switching on the ignition a light test of approx. 4 seconds will be carried out. During this time all control and warning lights will light up.

If the light test is finished the following control and warning lights continue to light up or flash:

- 4 Stop engine
- 6 Generator
- 12 Engine oil pressure,
triangle flashing light, red
- 20 IGLR - power limit controlled system (1704-2004)
(only for units with GLR)
- 41 Fuel level, bar display
- 42 Engine oil temperature / Cooling water temperature

Ignition key into position (III) - Start of engine

- 12 Engine oil pressure, off, depending on oil pressure
the bar display is on (40) - green
- 20 GLR, off (1704-2004) - load sensing (1304)
- 41 Fuel level, depending on inside level the bar
display is on - green
- 42 Engine oil temperature/Cooling water temperature,
depending on temperature the bar display is on - green

Chapter 4

Hydraulics

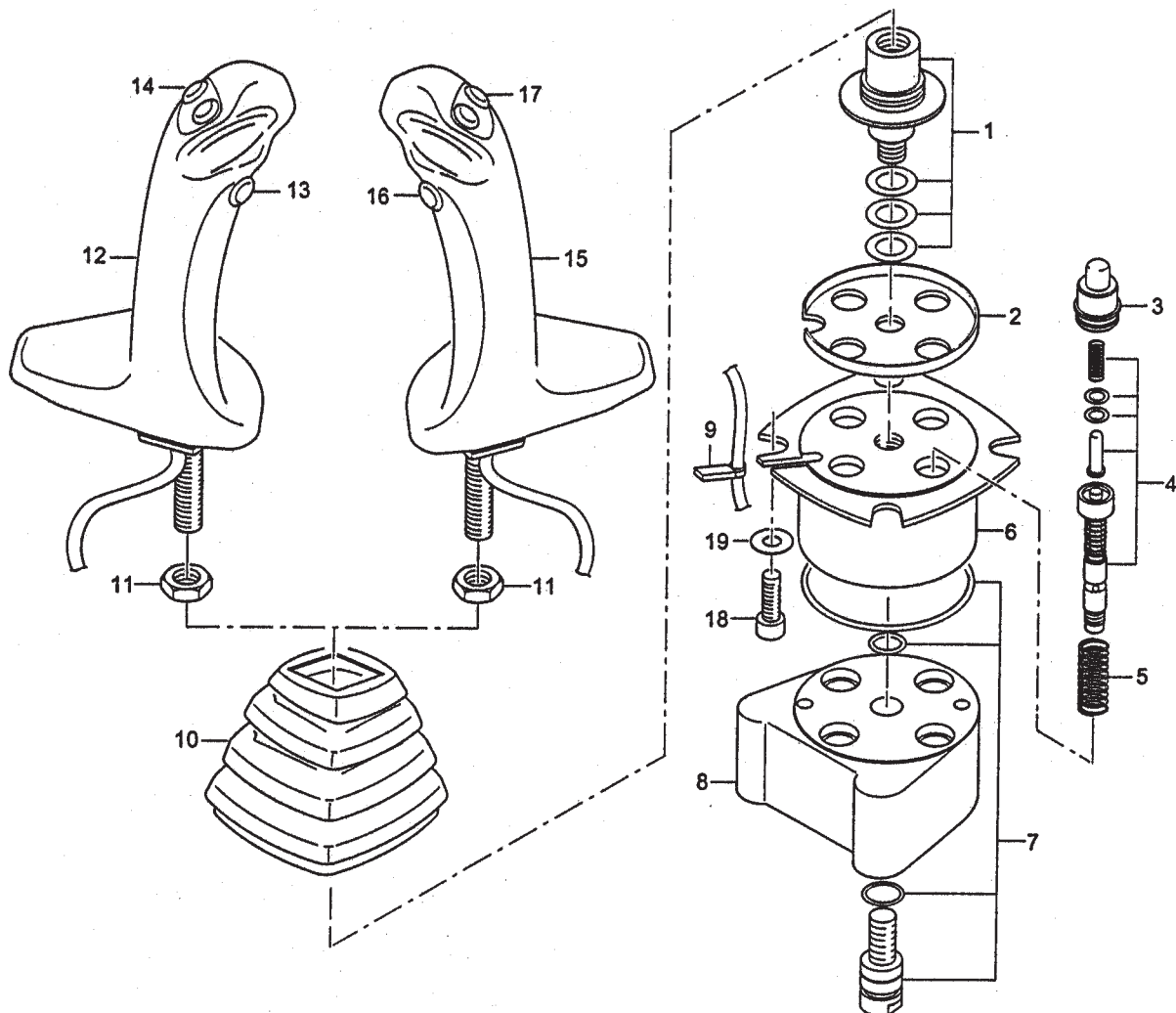
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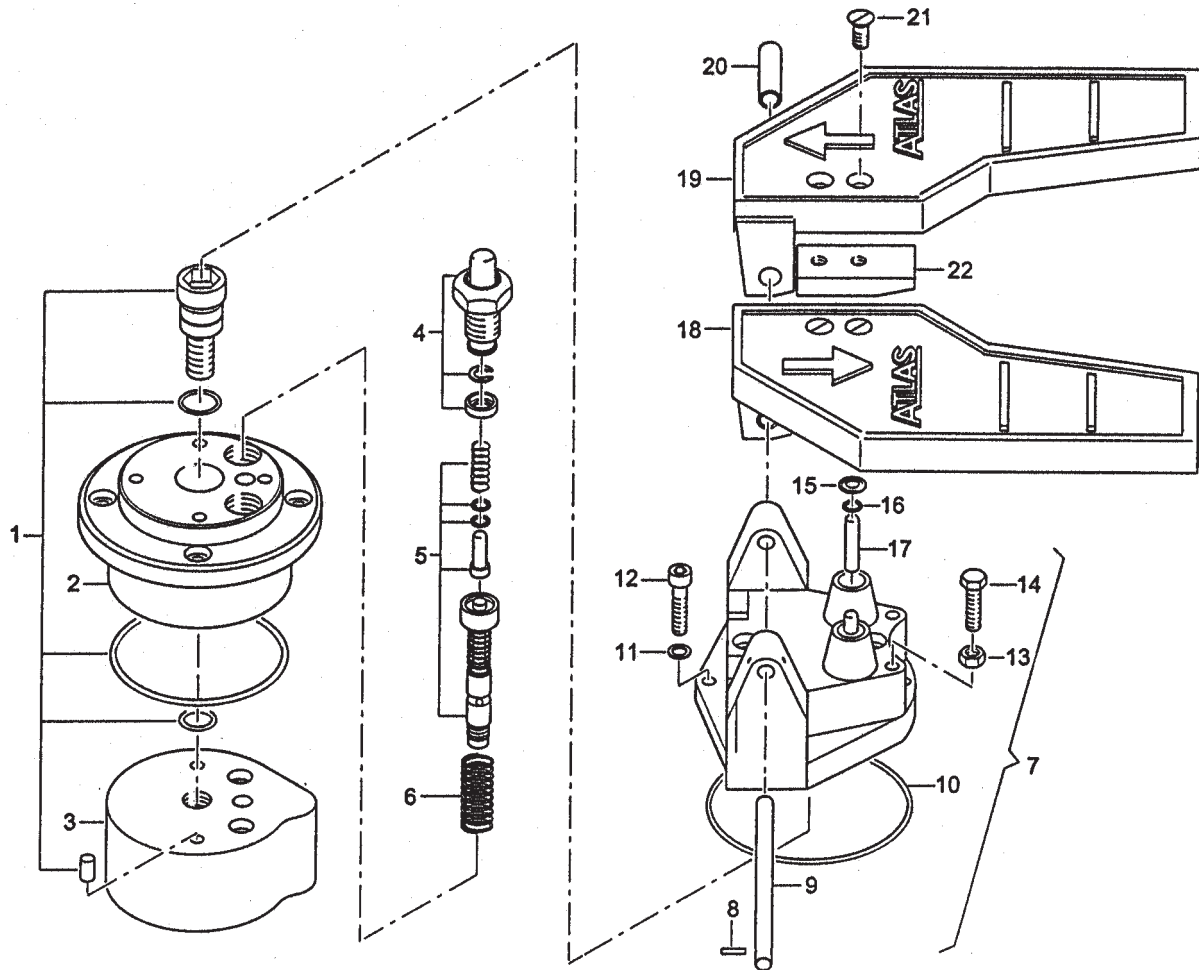
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1 Servo control unit

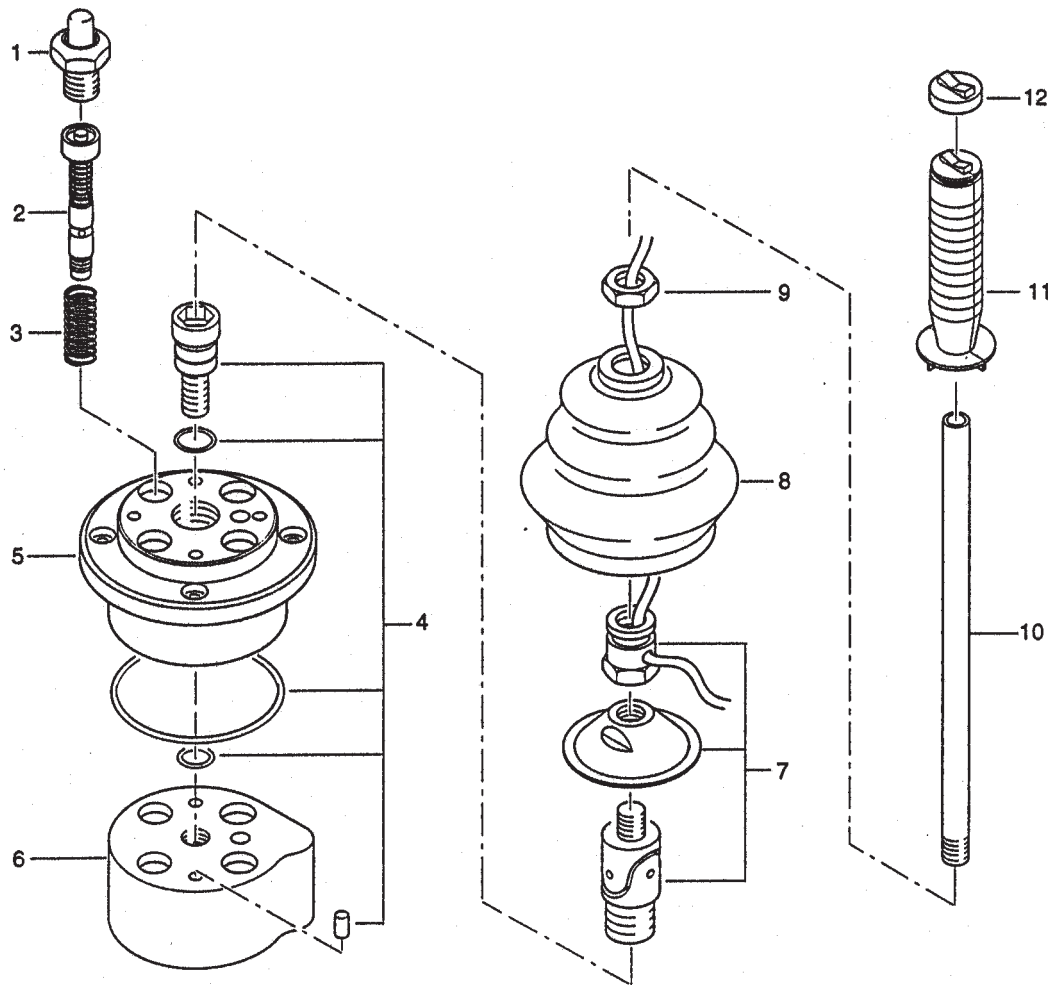


- 1 Cardan joint
- 2 Plate
- 3 Repairing set
- 4 Valve Case
- 5 Spring Set
- 6 Upper part
- 7 Repairing set
- 8 Lower part
- 9 Clip
- 10 Gaiter
- 11 Nut A3C
- 12 Servo control handle L

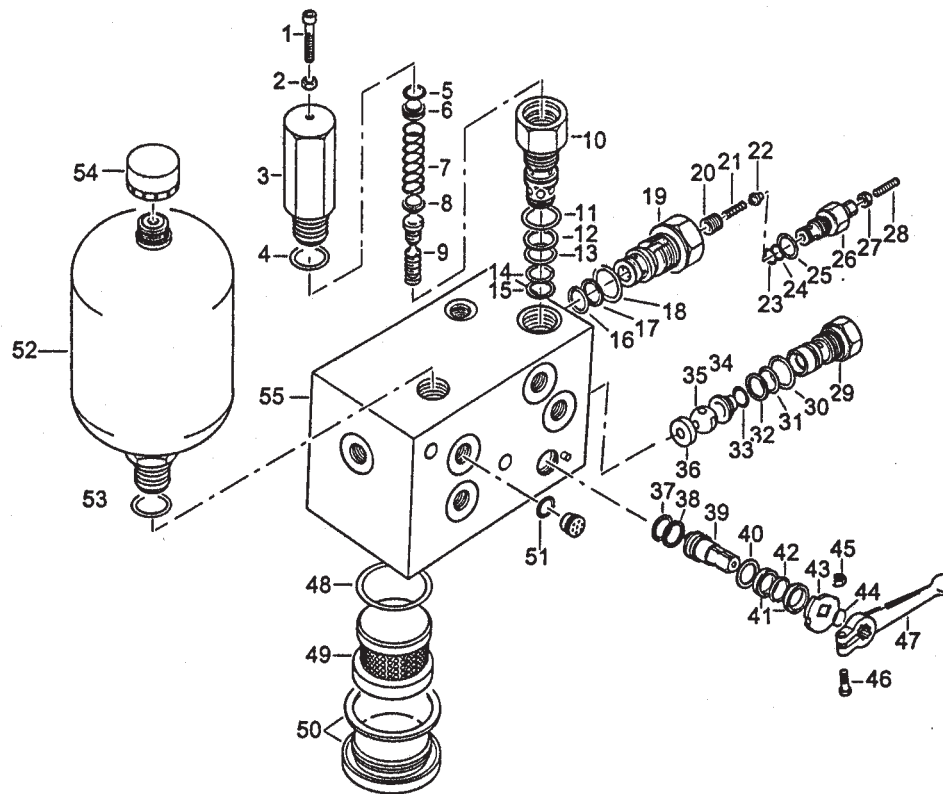
- 15 Servo control handle R
- 16 Att part switch
- 17 Att part switch
- 18 Allen screw A3C
- 19 Disk A3C



- 1 Repairing set
- 2 Upper part
- 3 Lower part
- 4 Repairing set
- 5 Valve case
- 6 Spring set
- 7 Repairing set
- 18 Pedal L
- 19 Pedal R
- 20 Bush
- 21 Counters screw A3C
- 22 Plate



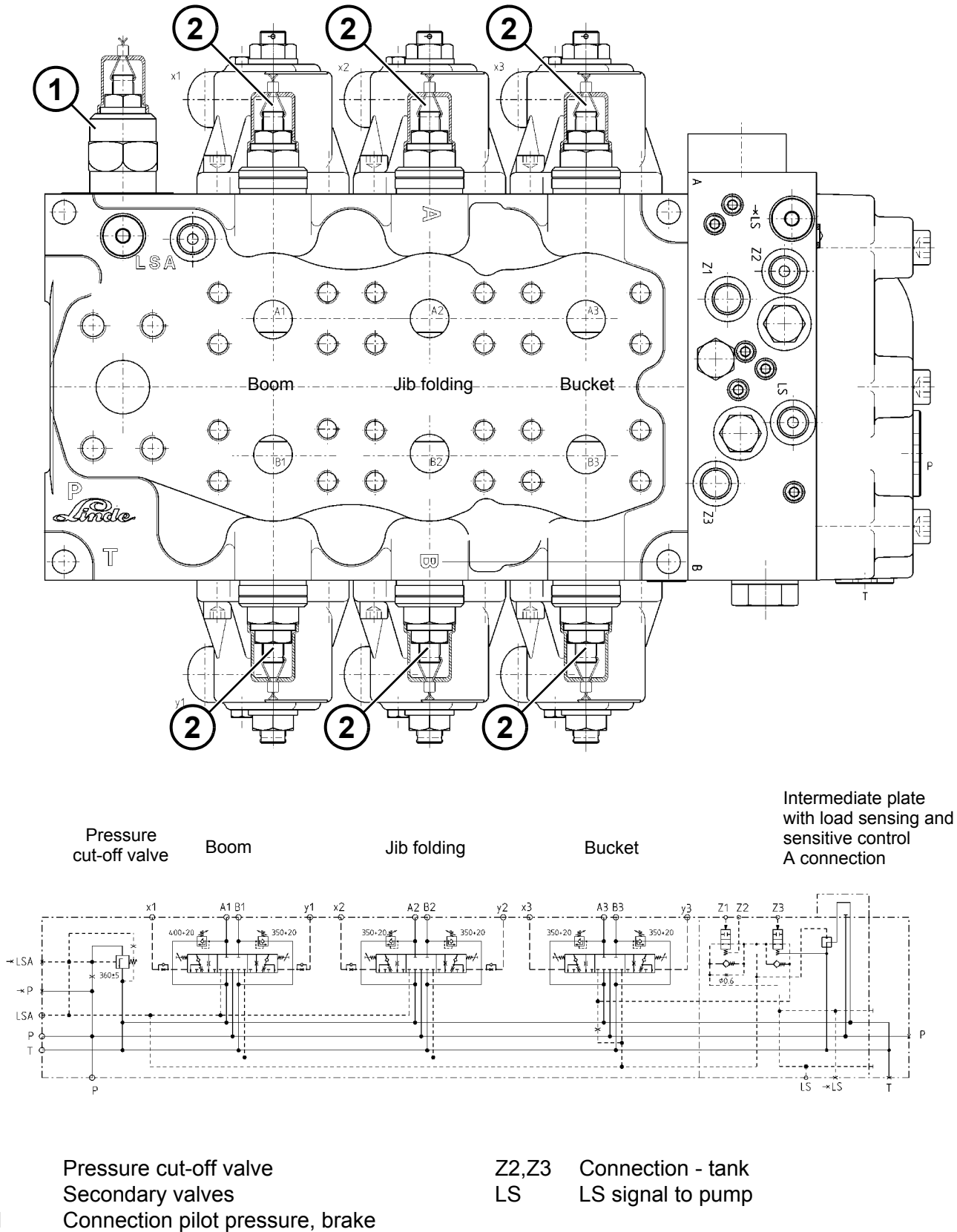
- 1 Repairing set
- 2 Valve Case
- 3 Spring Set
- 4 Repairing set
- 5 Upper part
- 6 Lower part
- 7 Kardansatz
- 8 Gaiter
- 9 Nut
- 10 Control lever
- 11 Cap



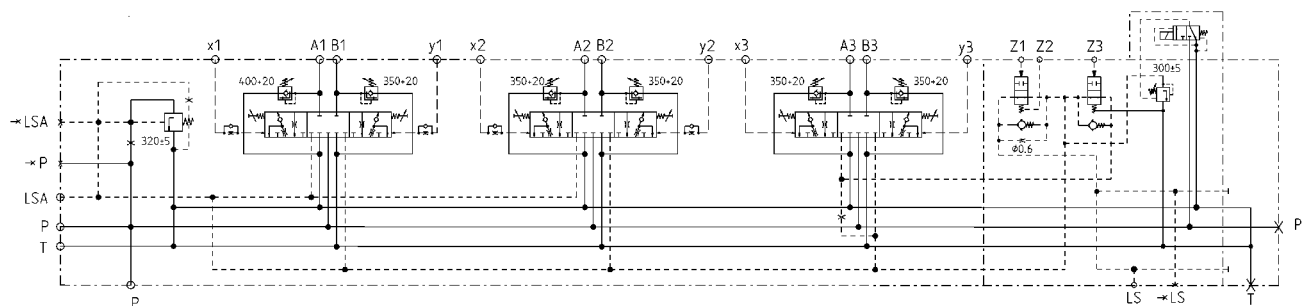
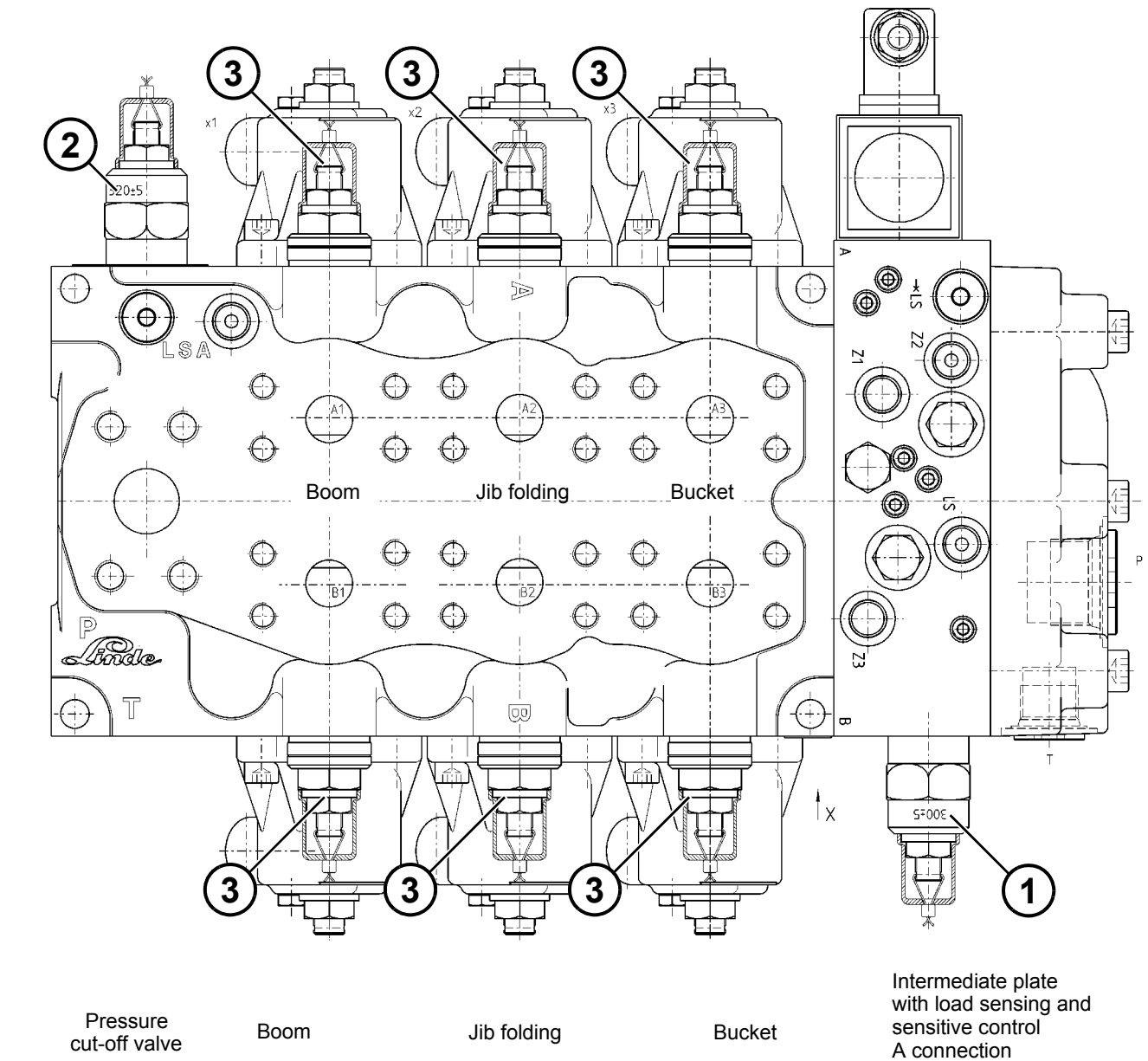
- | | | | |
|----|--------------------|----|----------------------|
| 1 | Allen screw A3C | 29 | Adaptor |
| 2 | Nut B A3C | 35 | Ball |
| 3 | Housing | 39 | Spindle |
| 6 | Spring plate | 41 | Ring |
| 7 | Compression spring | 43 | Disk |
| 8 | Spring plate | 47 | Control lever |
| 9 | Piston | 48 | O-ring |
| 10 | Valve body | 49 | Small filter element |
| 22 | Nozzle | 50 | Plug A3C |
| 26 | Servo control | 51 | Non return valve |
| 27 | Nut A3C | 53 | O-ring |
| 28 | Threaded pin | | |

2 Distributor valves VW

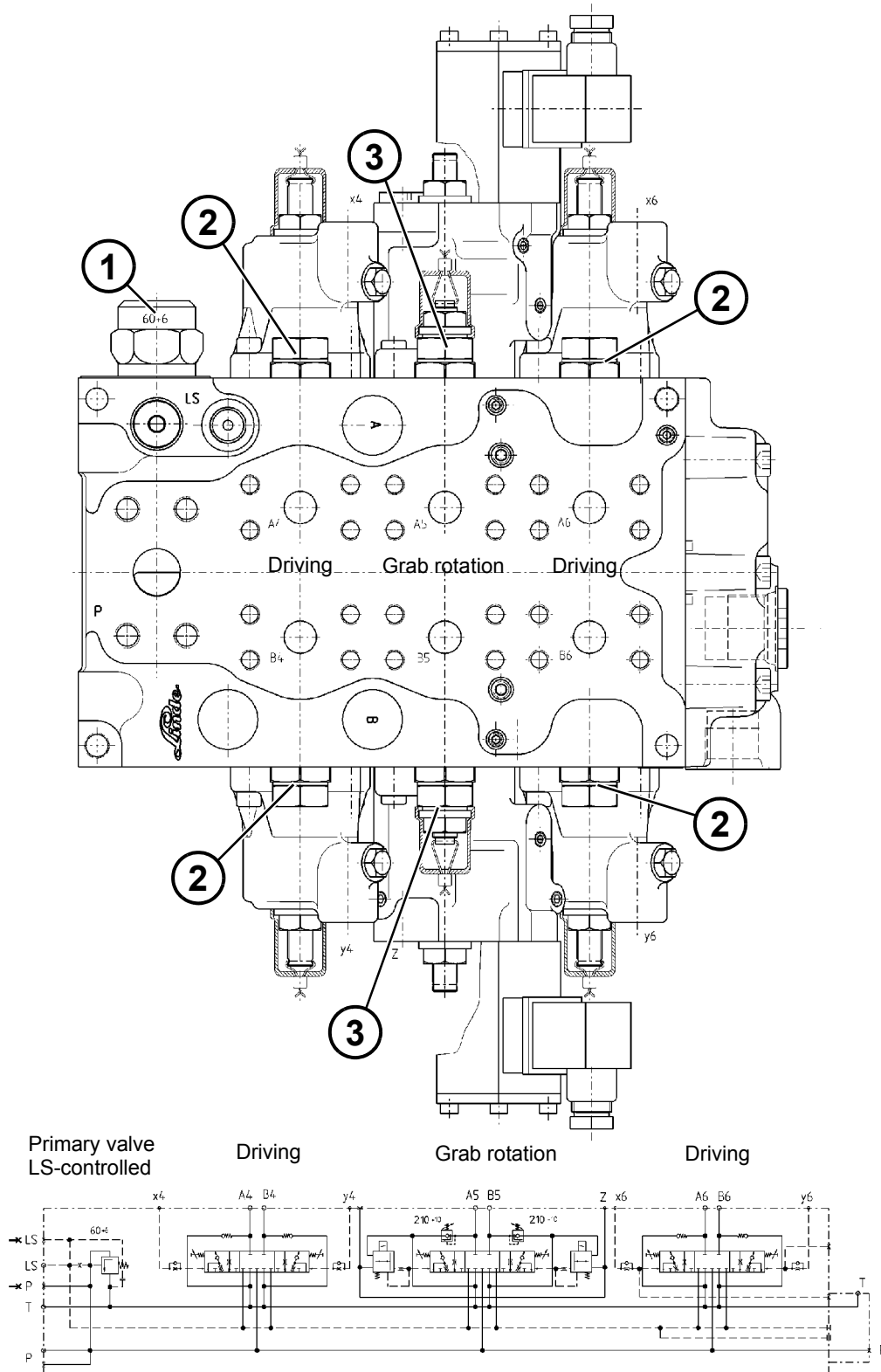
2.1 Distributor valve VW 18 for 1504 LC



2.2 Distributor valve VW 18 for 1604 LC



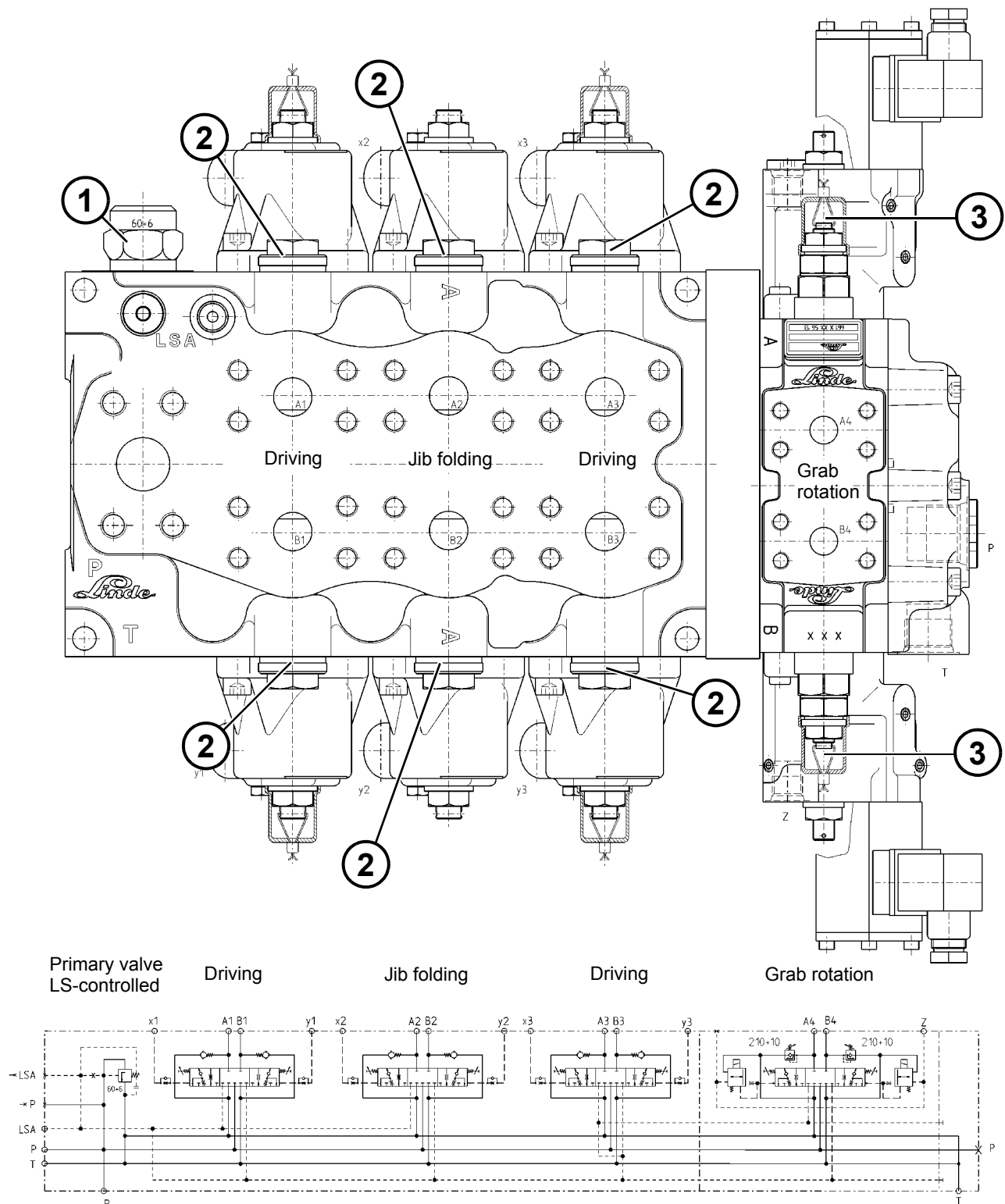
2.3 Distributor valve VW 14 for 1504 LC



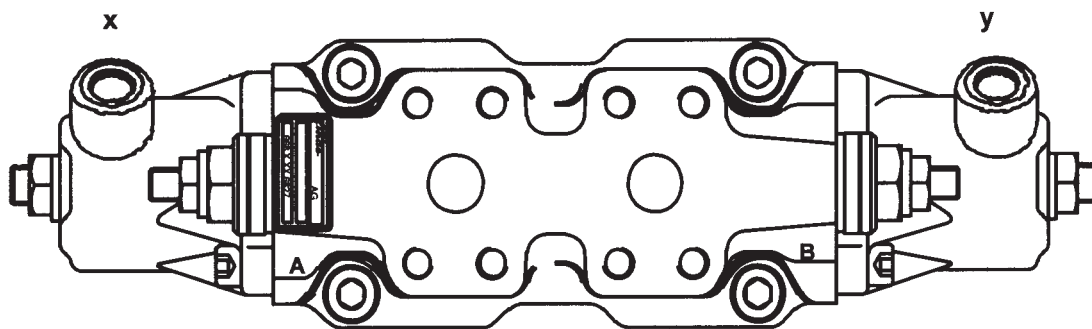
- 1 LS-controlled primary valve
- 2 Anticavitation valves

- 3 Secondary valves

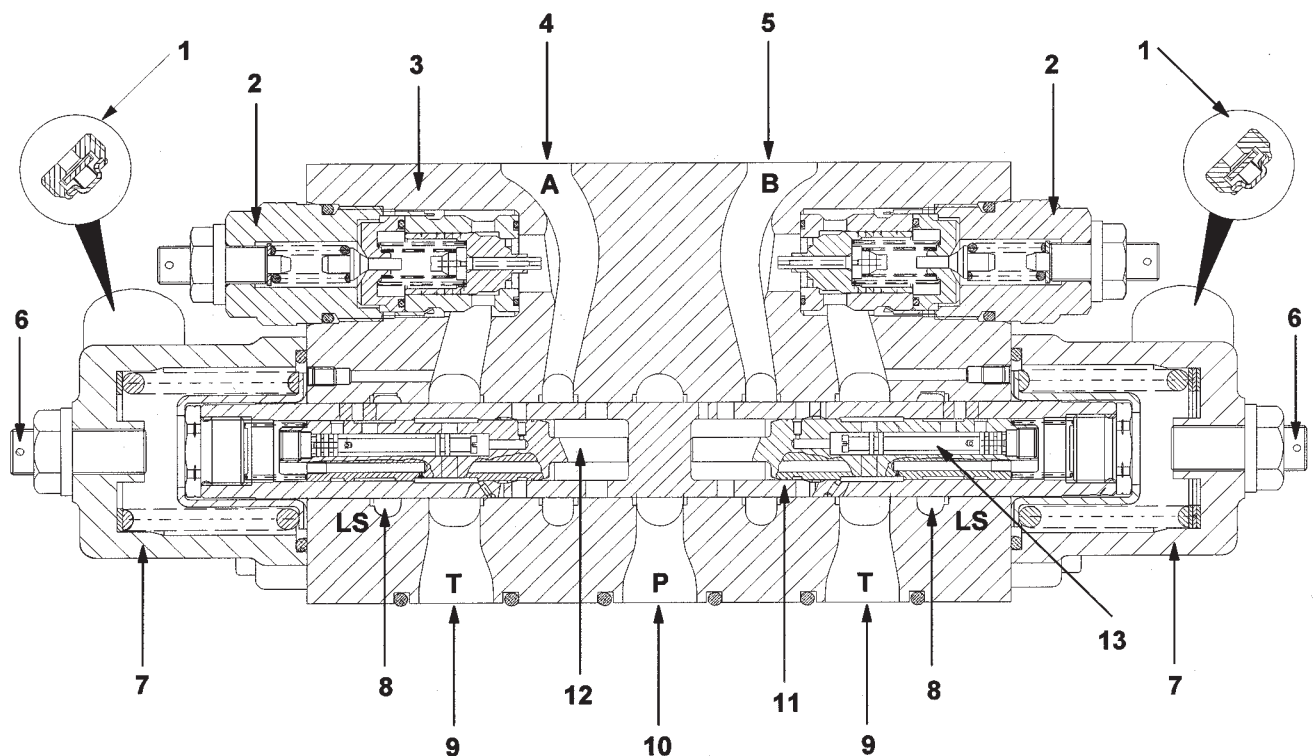
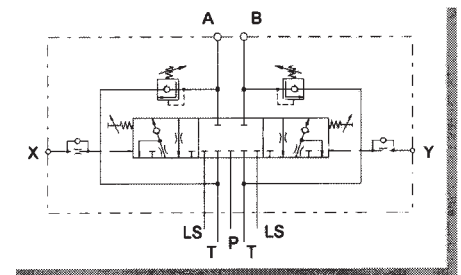
2.4 Distributor valve VW 14 for 1604 LC



3 Directional control valve VW 18/25



3.1 Design



- | | |
|-------------------------------------|------------------|
| 1 throttle check valve | 8 LS port |
| 2 combined relief and make-up valve | 9 return (tank) |
| 3 housing | 10 pump supply |
| 4 port "A" | 11 control spool |
| 5 port "B" | 12 compensator |
| 6 mechanical stroke limiter | 13 shuttle valve |
| 7 pilot cap | |

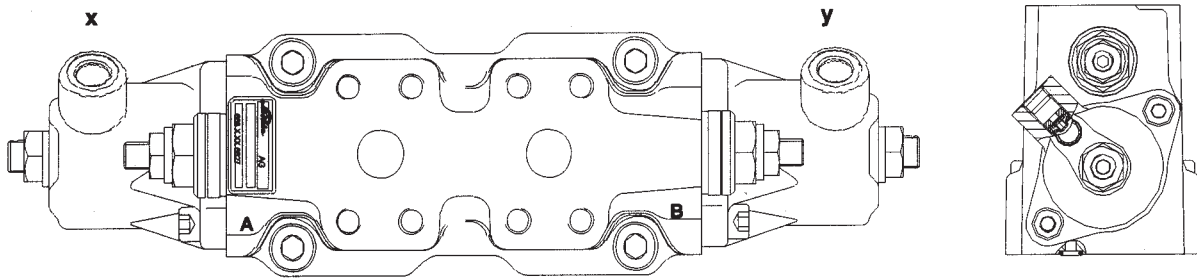
This VW valve is mounted on the manifold and consists of the housing (3) with manifold ports P (10), LS (8), T (9) and, on top, implement ports A (4) and B (5).

The valve contains a control spool (11) and two pressure compensators (12), which in turn contain the shuttle valves (13). On the secondary side there is one each combined pressure relief and make-up valve (2).

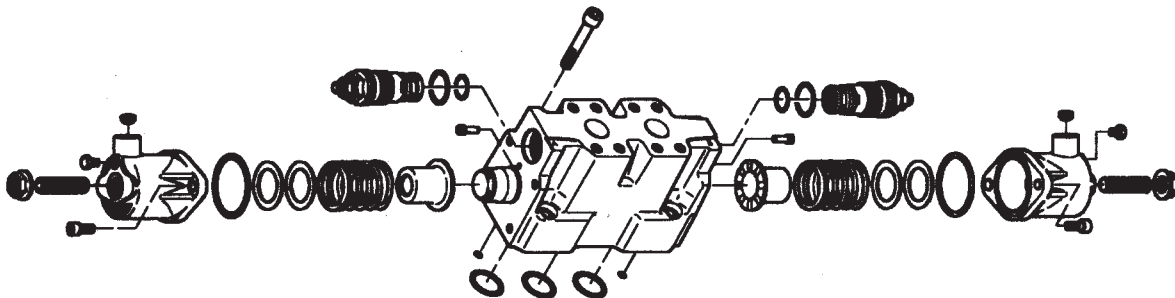
Throttle check valves (1) are fitted in the control pressure connection ports of the pilot caps (7). Pilot control pressure can enter the valve unrestrictedly, but return oil is throttled. The throttle check valves are used to dampen control spool (11) movement, for better control of the function.

4 Directional control valve VW 18/25 for cylinder implement

4.1 Design

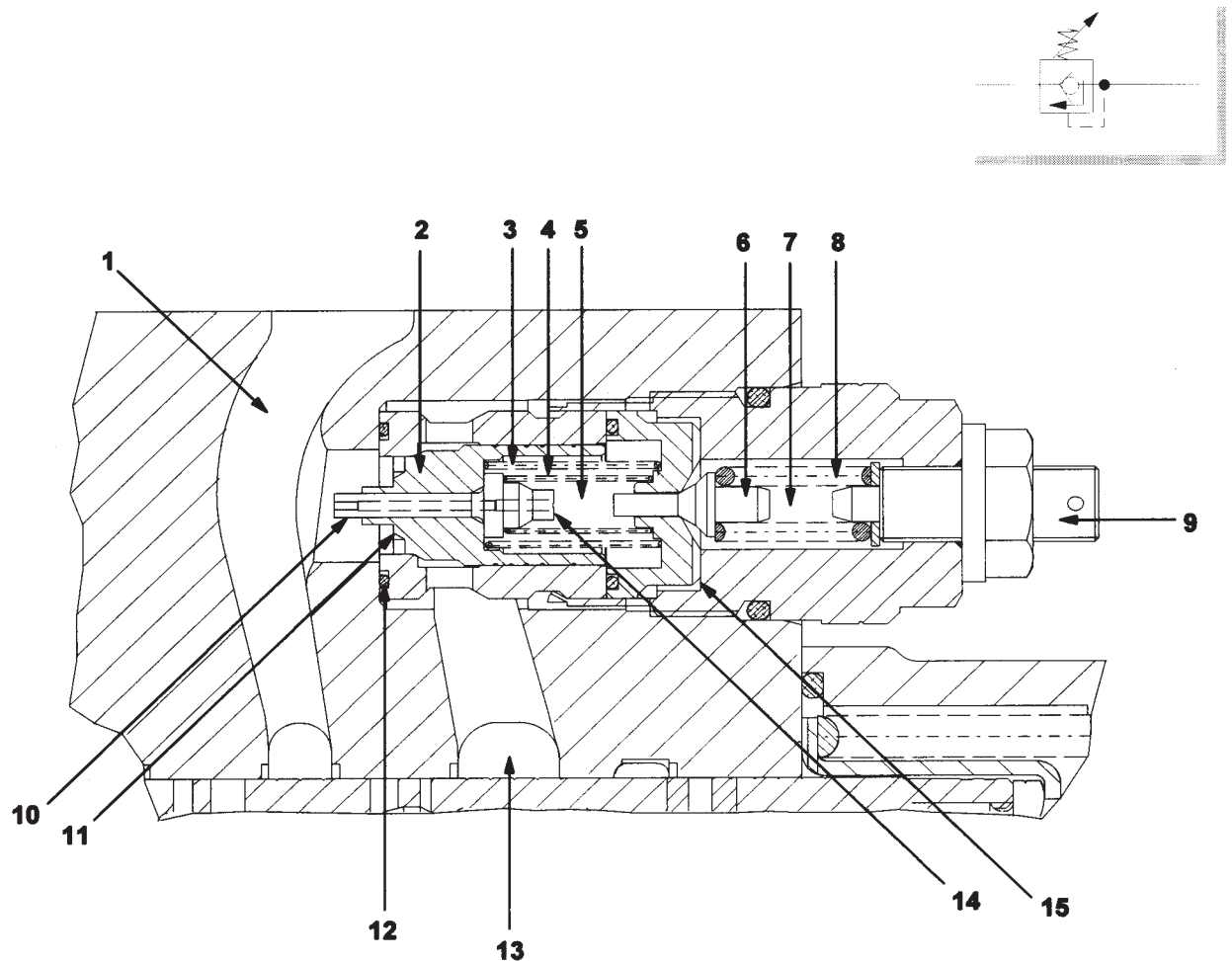


4.2 Exploded view



4.3 Combined relief and make-up valve as secondary valve

4.3.1 Design



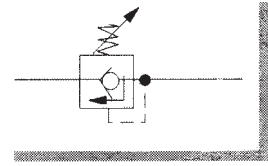
- | | | | |
|---|------------------------------|----|------------------------------------|
| 1 | chamber "B" (implement line) | 9 | setting screw |
| 2 | piston | 10 | needle piston |
| 3 | spring | 11 | piston area |
| 4 | spring | 12 | O-ring |
| 5 | chamber "C" | 13 | chamber "T" (return line to blank) |
| 6 | valve poppet | 14 | slot |
| 7 | chamber "D" | 15 | passage "T1" |
| 8 | spring | | |

The combined relief and make-up valves fitted in the control valve block consist of the housing with a function portion and a piloting portion.

The function portion consists of piston (2) with needle piston (10) and is forced down tight on its seat by springs (3) and (4).

The piloting portion contains the valve poppet (6) which is held down on its seat by spring (8). By means of setting screw (9) the force of spring (8) acting on the valve poppet (6) can be changed, so as to adjust the response value of the pressure limitation to the requested level.

4.3.2 Functional description



4.3.2.1 Operation as a pressure relief valve

If pressure in chamber "B" (1) arrives in chamber "C" (5) through the bore in the needle piston (10) and reaches the set value of the valve poppet (6) this will open up. The fluid behind the valve poppet in chamber "D" (7) can get to chamber "T" (13) via passage "T1" (15). This causes a pressure drop in chamber "C" (5), and due to the pressure on the effective piston area (11), piston (2) with needle piston (10) is pushed to the right, and needle piston (10) touches the face of the valve poppet.

A connection is established from chamber "B" (1) to chamber "T" (13) so that back pressure can be discharged.

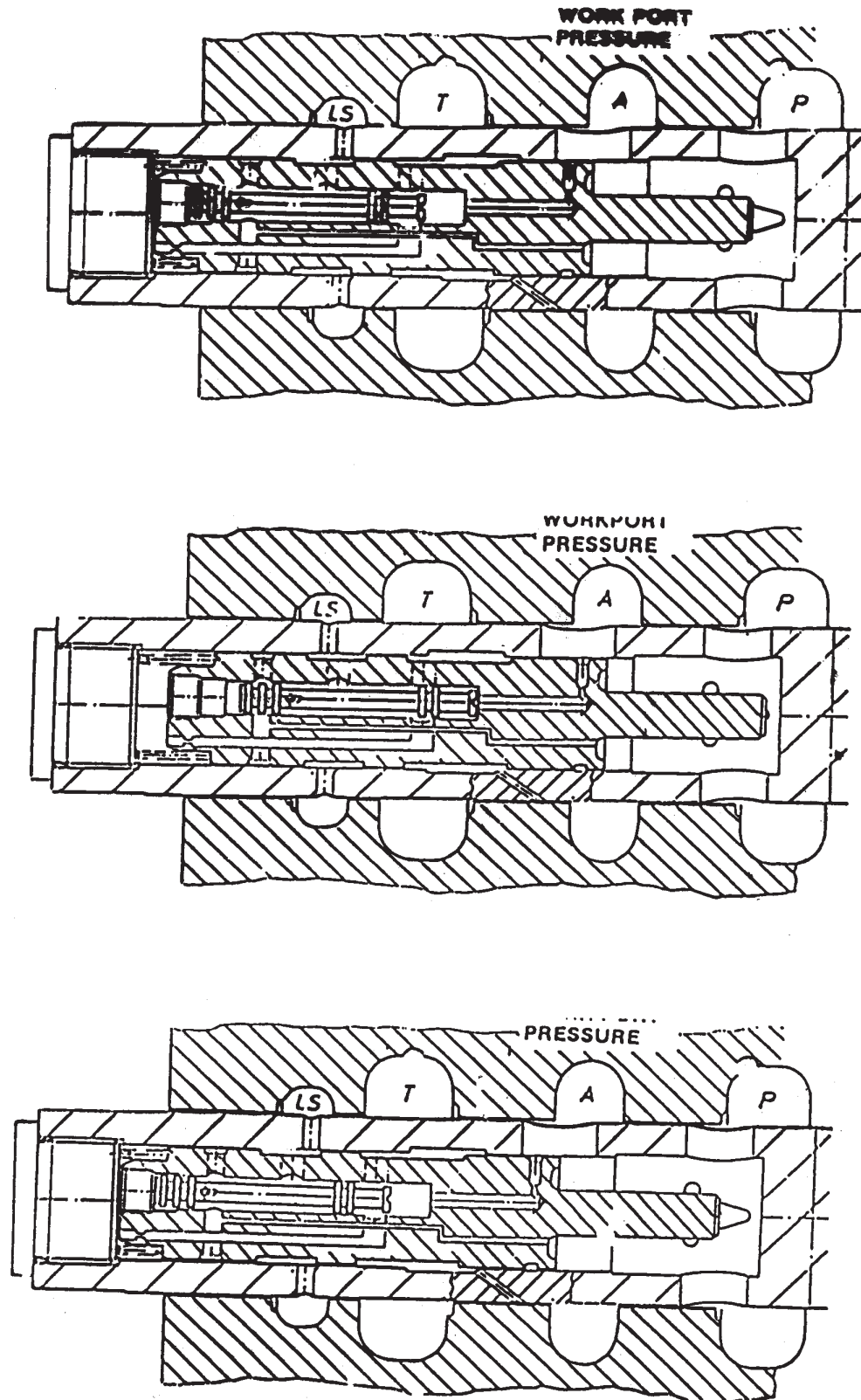
For better control of the relief valve there is a transversal slot (14) in the upper face of the needle piston (10).

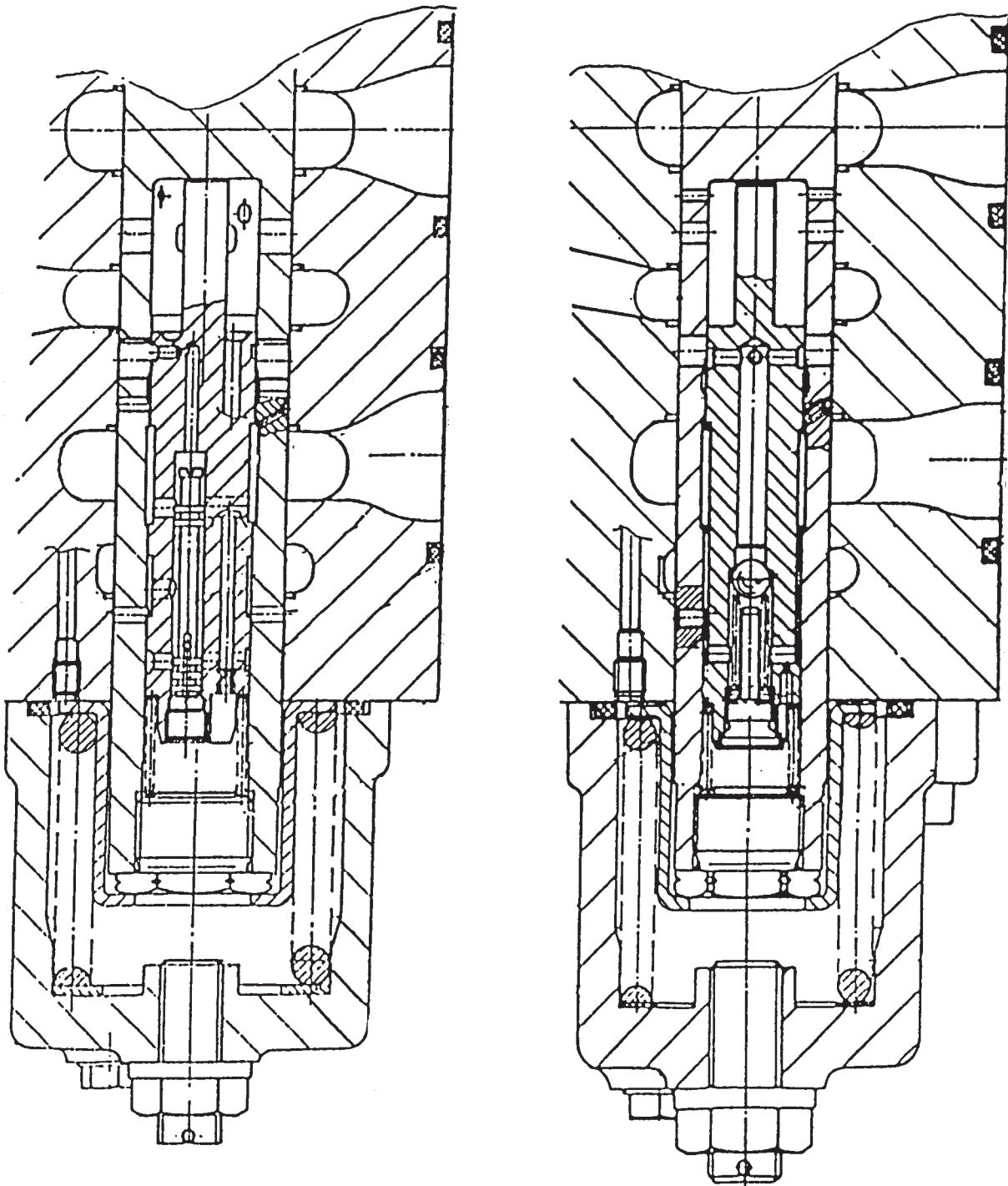
When the needle piston (10) rests on the valve poppet (6) the transversal groove acts as a restrictor. The throttled oil flows through the needle piston bore and, via the transversal slot in the upper face (14), into the chamber "C" (5). When pressures are again the same in the chambers "B" (1) and "C" (5), the force of the springs (3) and (4) acts on piston (2) and pushes it back on its seat.

4.3.2.2 Operation as a make-up valve

There is always pressure in the "T" line (13), owing to the preloading valve in the hydraulic system. Should pressure in chamber "B" be lower than in the "T" line (13), pressure in chamber "T" (13), due to the differential pressure, acts on the effective piston area (11). The piston (2) is shifted against the force of the springs (3) and (4), opening up the connection between the chambers "T" (13) and "B" (1). Pressures are balanced off, thus avoiding cavitation.

4.4 Control block

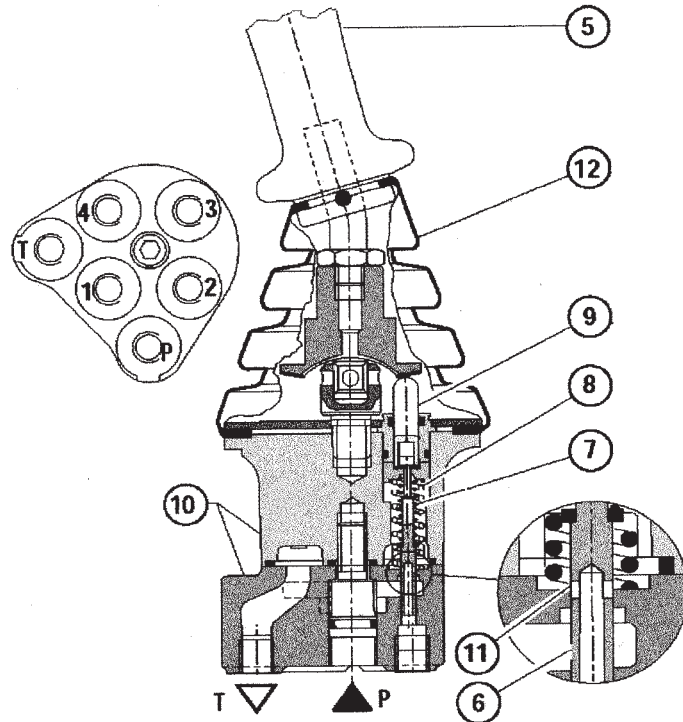




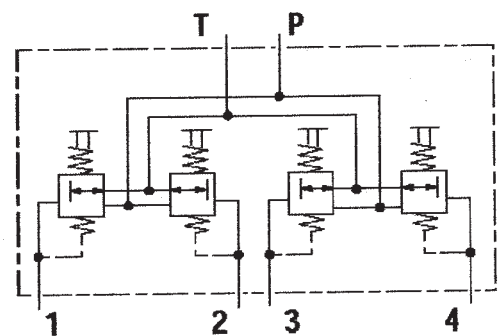
4.5 Servo unit (Folding jib, slewing, lifting/lowering, bucket/grab)

Unions

P	Supply
T	Tank
1,2,3,4	Control unions



Symbol, hydraulic



4.5.1 Structure

Pilot control equipment is mainly composed of an operation lever (5), four pressure adjusting valves and a housing (10). Each pressure adjusting valve consists of a variable piston (6), a variable spring (7), a restoring spring (8) and a tappet (9).

4.5.2 Function

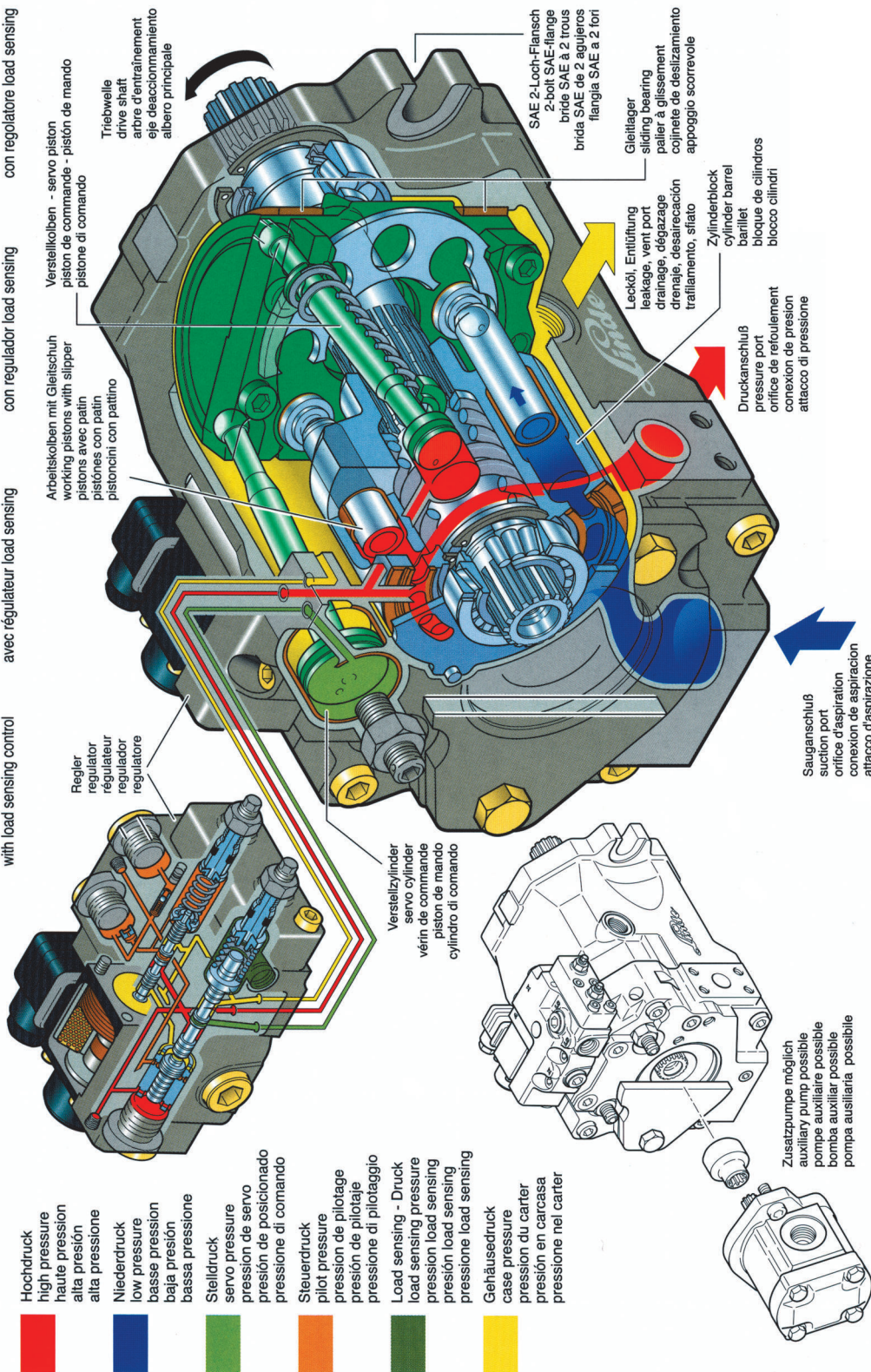
When the control level is not Operated, it is kept in zero position by the four restoring springs (8). Control unions (1, 2, 3, 4) are linked to tank union T by means of the bore hole (11). On excursion of control lever (5) the tappet (9) presses against restoring spring (8) and variable spring (7). Variable spring (7) first displaces the variable piston (6) down, closing the link between the concerned union and the tank union T. At the same time, bore hole (11) is used to link the concerned union to union P. The variable control phase starts once the variable piston (6) has found the balance between the force of the variable spring (7) and the force resulting from hydraulic pressure in the concerned union (union 1, 2, 3 or 4). The combined action of variable piston (6) and variable spring (7) has the effect that pressure in the concerned unions is proportional to the stroke of tappet (9) and thus to the position of control lever (5). Rubber collar (12) protects the mechanical components of the hydraulic pilot control equipment against pollution from the outside.

5 Variable Displacement Pump HPR 105/135-02

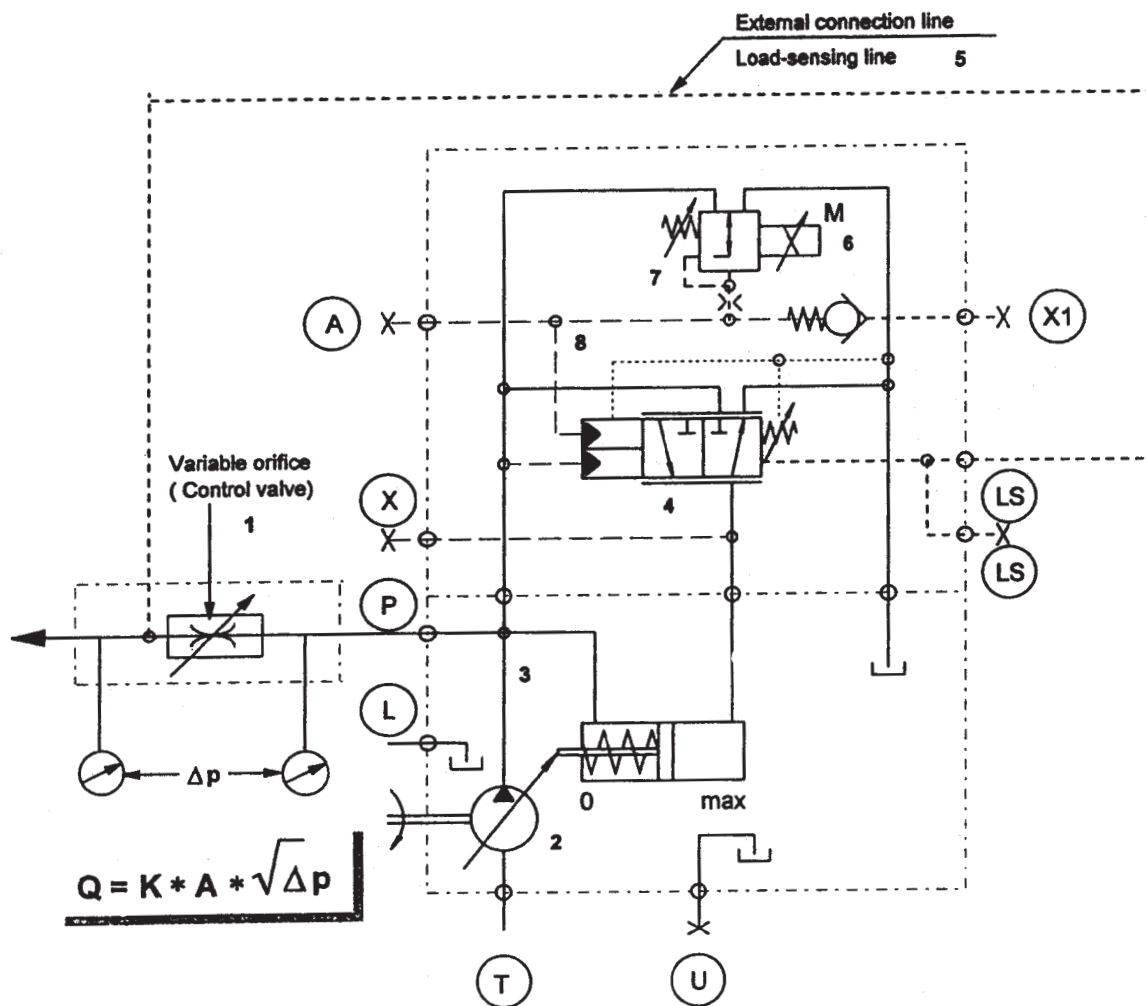
HYDRO - REGELPUMPE HPR...-02

MIT LOAD SENSING - REGELUNG
con regolatore load sensing

REGULATING PUMP - POMPE REGLABLE
with load sensing control avec régulateur load sensing



5.1 Circuit diagram



EXPLANATIONS

- P Discharge port SAE
 - T Suction port SAE
 - X1 Control pressure port for emergency operation (max. 30 bar) M14x1.5
 - A Gage port, control pressure M14 x 1.5
 - LS Load-sensing connection 2x M14 x 1.5
 - X Gage port, actuating pressure M14 x 1.5
 - L U Drain (filling, vent) ports
- Port enabling case to be filled with oil

Solenoid switching operations

M d.c. proportional solenoid
12/24 V, according to specification

Not component parts of HPR 02 :

- 5 External connection line
- 1 Variable throttle (control valve)

5.2 Functional description

The HPR - 02 R E1 L models are self priming swash-plate type axial piston pumps with a variable displacement volume for open loops.

The controller of the HPR pump is a combination of two types of controls:

- load-sensing control
- electrical pressure control valve.

5.2.1 Load-sensing controller

The principle of the load-sensing control of the HPR pump is as follows: it controls the displacement starting from a zero pump flow condition. If no flow is demanded, only the "stand-by" pressure required by the system is maintained by the pump. When the main control valves are actuated, the load-sensing controller of the HPR automatically matches the displacement, and consequently the flow, to the "flow on demand" required by the control valves, up to the maximum available pump flow. The pump pressure is only approximately 20 bar higher than the (highest) pressure of the active loads. The load-sensing control system thus is a "flow on demand" control which matches the pump output flow to the variable metering orifice size by keeping a constant Δp across the measuring orifice of the directional control valve.

$$Q = K \times A \times \sqrt{\Delta p}$$

5.2.2 Electrical pressure control valve

The pressure control valve is actuated via a proportional solenoid. The pressure control valve

reduces the, internally provided pump pressure in relation to the applied current.

This pressure signal changes the set pressure Δp (reduction of the stroke volume) by means of an additional metering area on the LS control spool.

With additional components such as the Linde CEB electronic controller, the pressure control

valve can be used for anti stall control as well as for mode controls.

5.3 Technical description

5.3.1 Load-sensing controller

When there is no function activated and when the control spool (1) is in the neutral position (see circuit diagram), then the pump (2) delivers only such a quantity of oil that the pressure in the pump line (3) which acts on the load-sensing controller (4) (LS) maintains the spring on the opposite side of the control spool and the swivel spring (on the displacement piston V_{min}) in balance. Every change in pressure P and LS makes the LS spool move and leads to an immediate change of pump displacement. Upon actuation of the control piston (1) the connection from the pump output (2) to the load port is opened. Essentially, the area which is opened represents a metering orifice.

If a constant flow of oil is to flow continuously through this orifice, independent of the load pressure, then the pressure difference at this point must be kept constant. If the control spool (1) is opened, the pump pressure proceeds up to this function. At the same time, the load pressure acts upon the spring side of the LS spool (4), through the LS line (5), causing the pump (2) to go on stroke and the pressure in the P line (3) to increase.

If the pump pressure exceeds the load pressure, the load starts moving and the following oil flow produces a drop in pressure across the control edge (metering orifice). Balance is achieved when this drop in pressure corresponds to the spring preload of the LS controller (4).

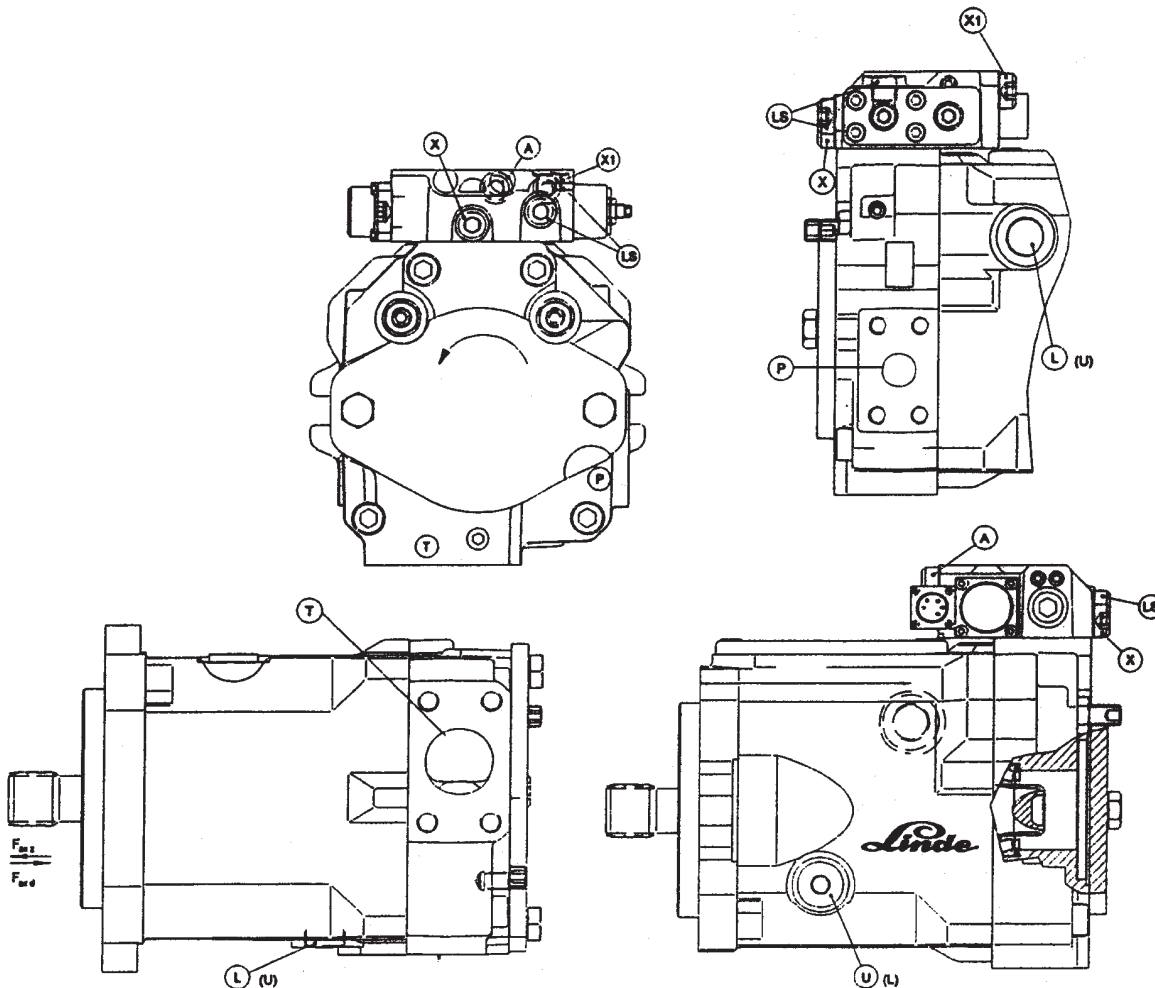
The pump (2) reacts to each control spool movement because it tries to fully stabilize each variation of the metering orifice and to maintain always a constant pressure difference.

5.3.2 Electrical pressure control valve

When the solenoid (2) is in the de-energized state, the pilot spool of the pressure control valve (7) is in the position in which the connection channel (3) (pump pressure) to the channel (8) (metering area on LS pilot) is blocked. The channel (8) is released to the tank (interior of HPR pump housing). If a predetermined current exists in the solenoid (2), then the solenoid pin moves the pilot spool of the pressure control valve (7) to the position in which the channels (3) and (8) are connected. Solenoid force " F_m " is then converted into hydraulic force " F_h " proportionally in relation to the level of the applied current. This signal (control pressure) causes the set pressure difference Δp to be reduced by means of an additional metering area on the LS control spool (4).

Result: A reduction of the displacement of the HPR pump.

5.4 Connection and gage port diagram



EXPLANATIONS

Nominal ratings (cm ³)		105	135
P	Discharge port SAE	1"	1"
T	Suction port SAE	2"	2"
L U	Drain (filling vent) ports Port enabling case to be filled with oil	M22x1.5	M22x1.5
A	Gage port, control pressure M14 x 1.5		
LS	Load-sensing port 2x M1 4 x 1 .5		
X	Gage port, actuating pressure M14 x 1.5		
X1	Control pressure port for foroperation operation emergency operation (max. 30 bar) M 14 x 1.5		

Solenoid switching operations

M d.c. proportional solenoid 12/24 V,
according to specification

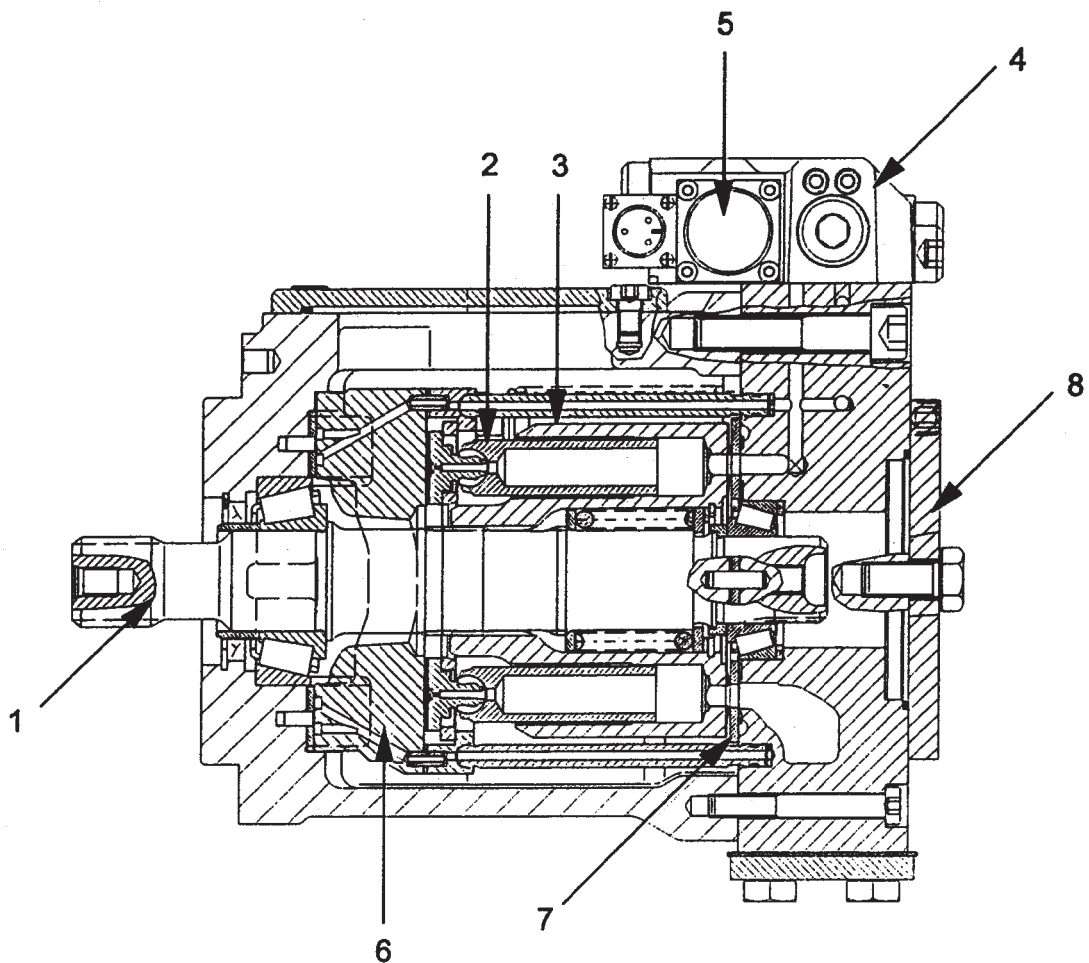
Oil type (see technical data sheet)

Permissible casing inner pressure
1,5 bar. Casing to be filled with oil and
bled before start of operation observe
mounting instructions !

For other specifications, see technical
data sheets.

For applications involving radial shaft
loadings please contact LFH.

5.5 Basic design of rotating group



- 1 shaft
- 2 piston assembly
- 3 cylinder barrel
- 4 control
- 5 proportional solenoid
- 6 swash plate
- 7 port plate
- 8 PTO

5.6 Basic design of port

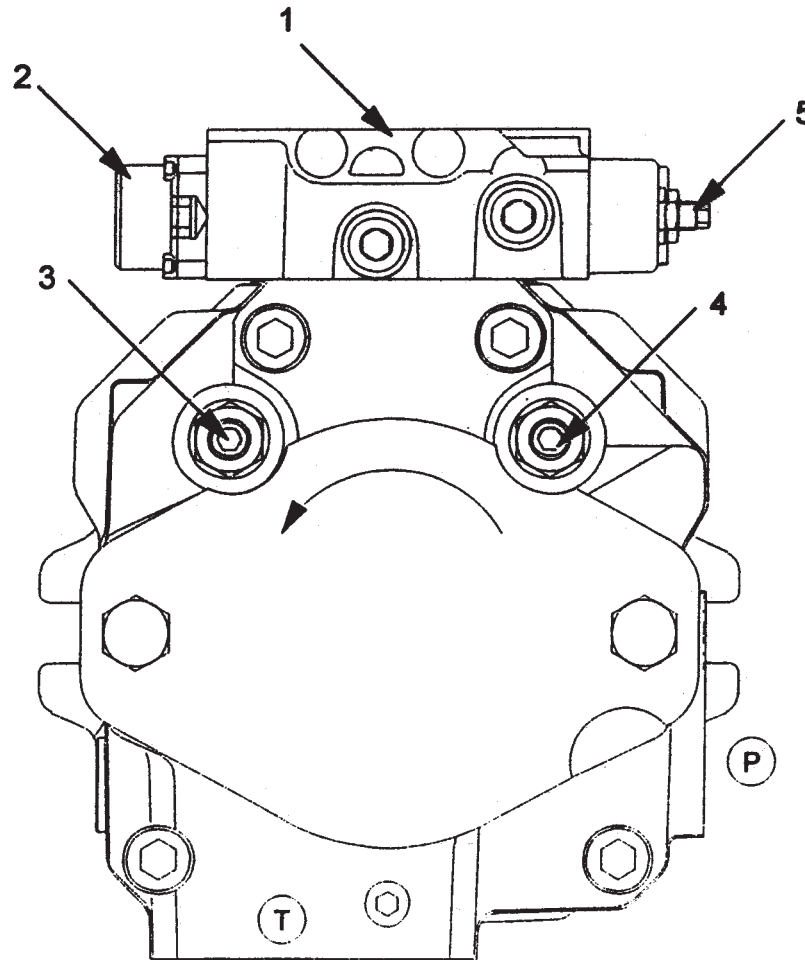
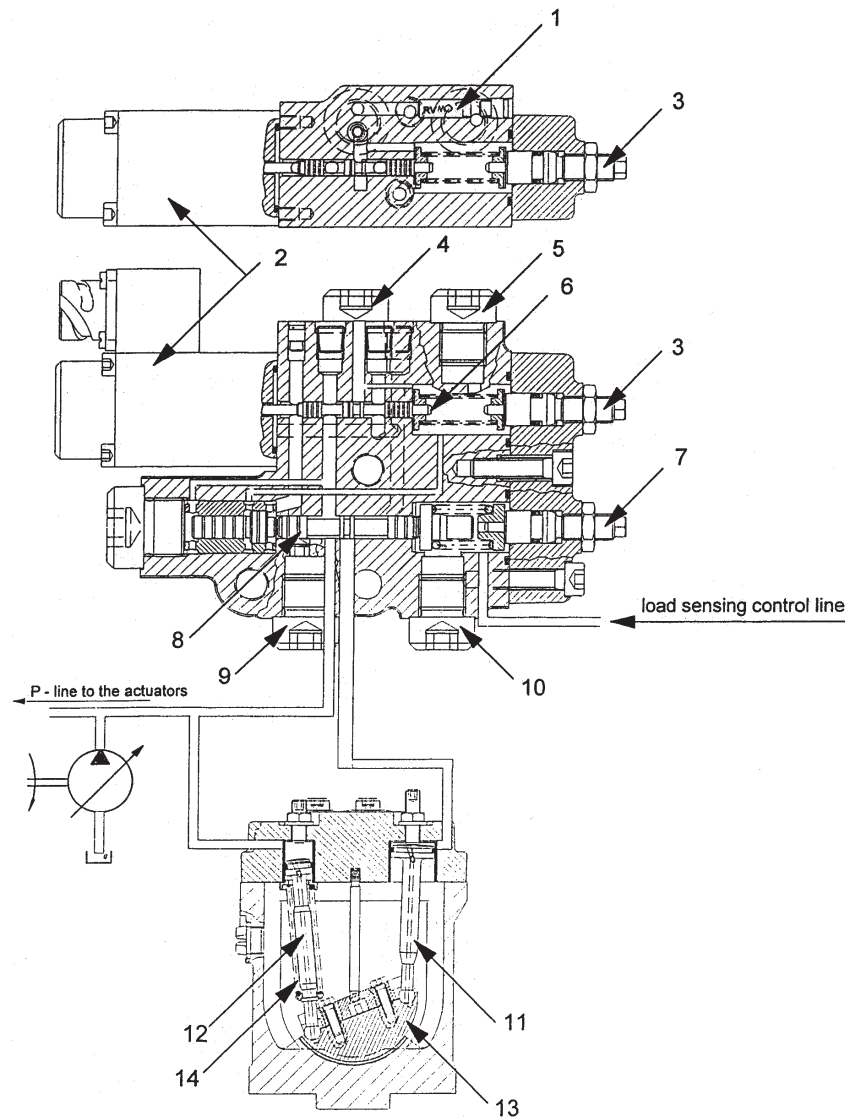


plate housing

- 1 control
- 2 proportional solenoid
- 3 stop screw Vmax
- 4 stop screw Vmin
- 5 set screw LS - control $\Delta p = P_p - LSp$

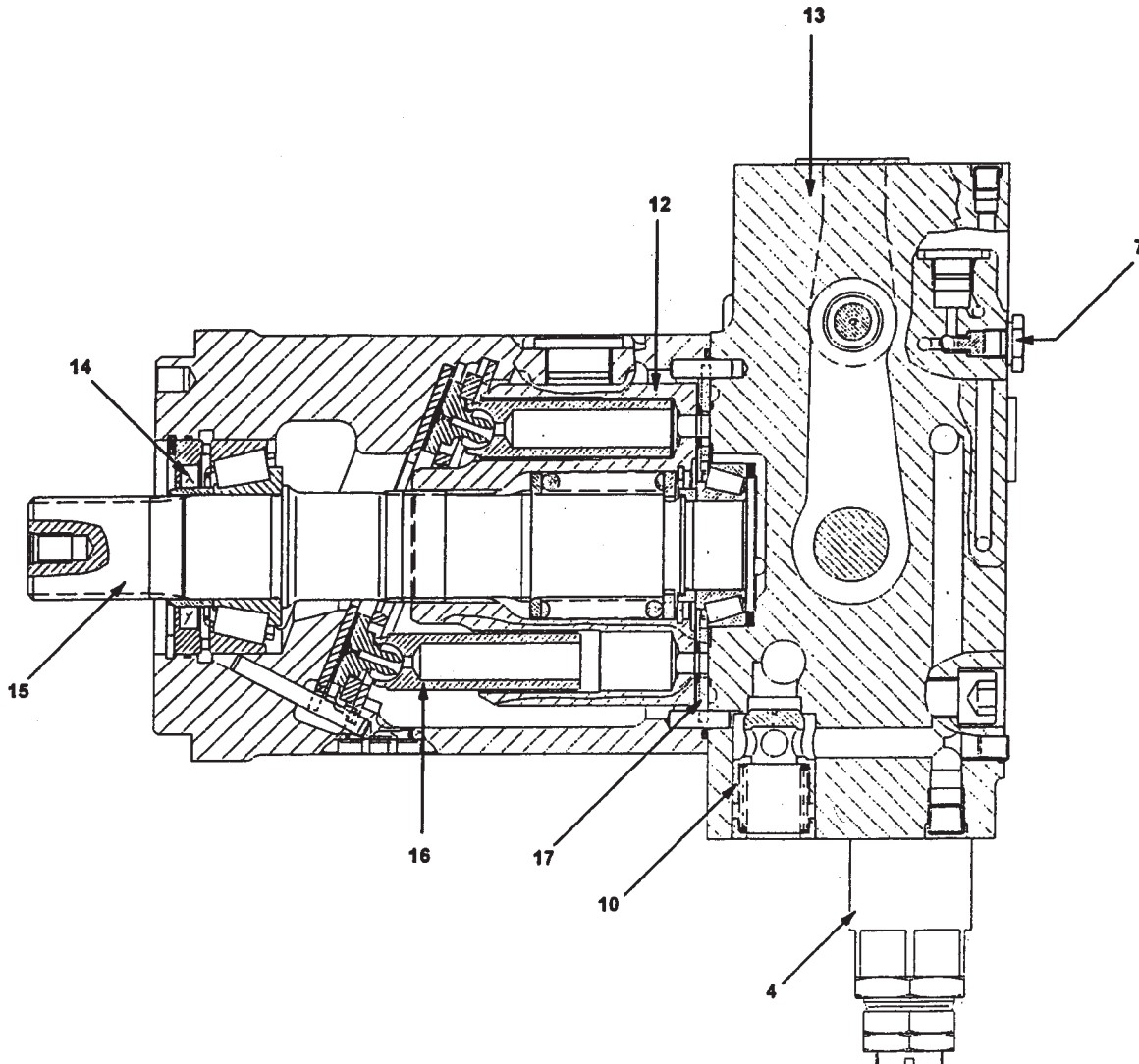
5.7 Basic design of control system

- 1 check valve
- 2 proportional solenoid
- 3 set screw control pressure
- 4 gage port A
- 5 control pressure port for emergency operation X1
- 6 pilot spool (el. pressure control valve)
- 7 set screw $\Delta p = P_p - LSp$
- 8 pilot spool load sensing control
- 9 gage port X
- 10 gage port LS
- 11 actuator piston Vmax
- 12 actuator piston Vmin
- 13 swash plate
- 14 swivel spring



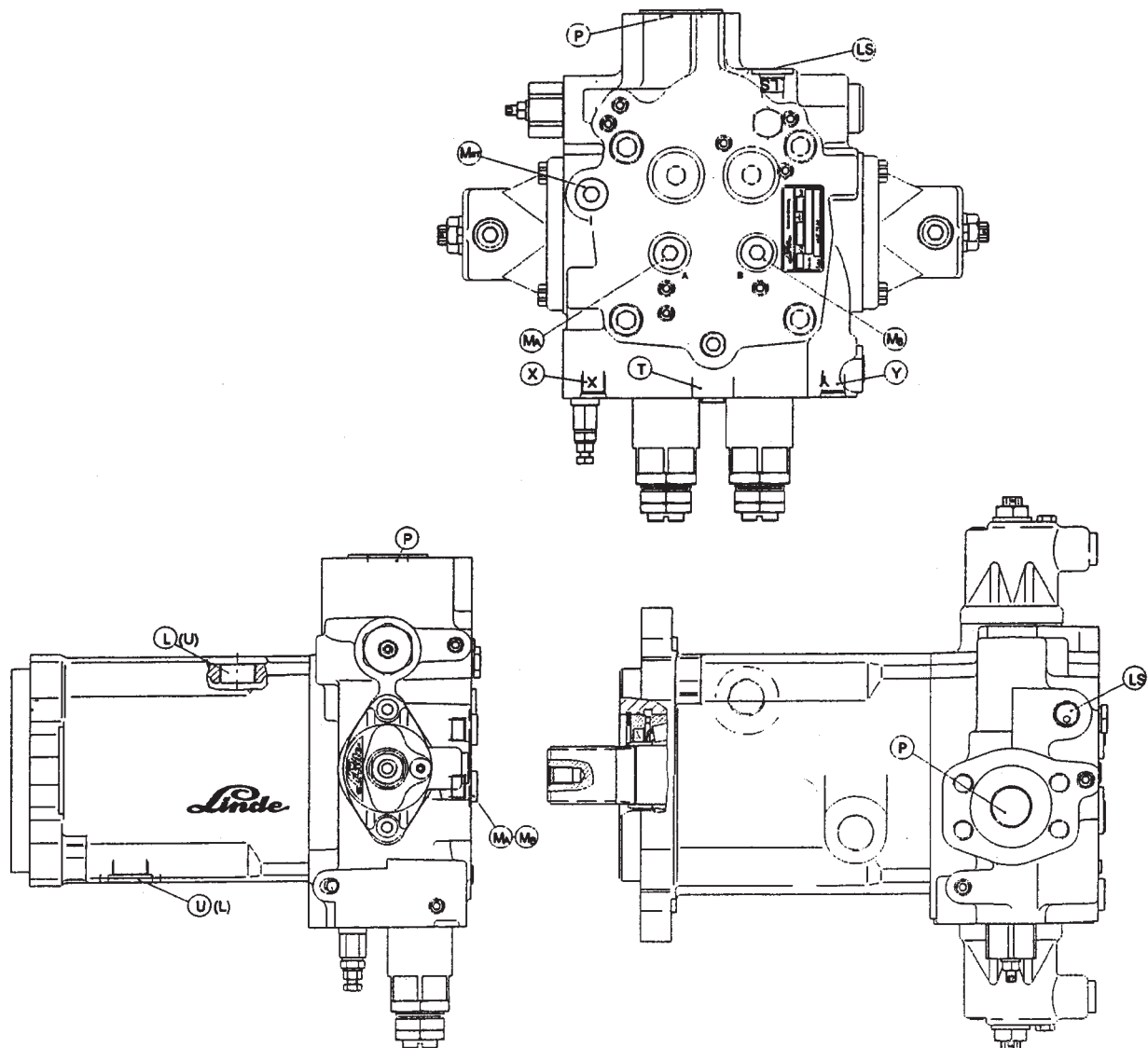
6 Slewing motor HMF-02P

6.1 Arrangement



- 4 High pressure relief and make up valves
with relief pressure step up VD 20-05
- 7 Check valve (LS passage)
- 10 Check valve (return oil to reservoir)
- 12 Cylinder barrel
- 13 Valve plate housing
- 14 Shaft seal
- 15 Shaft
- 16 Working piston
- 17 Valve plate

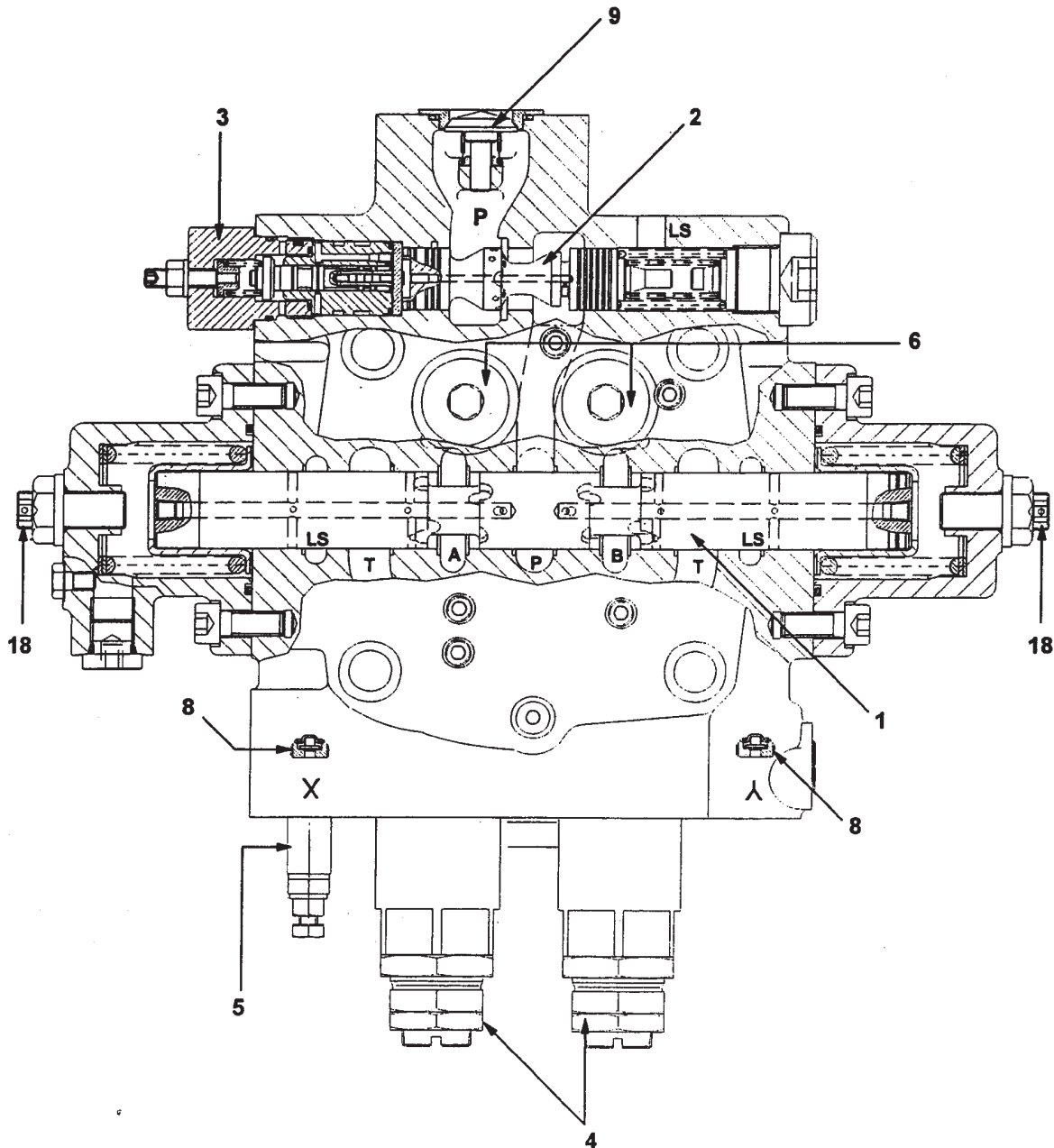
6.2 Working gage and connection ports



Explanations

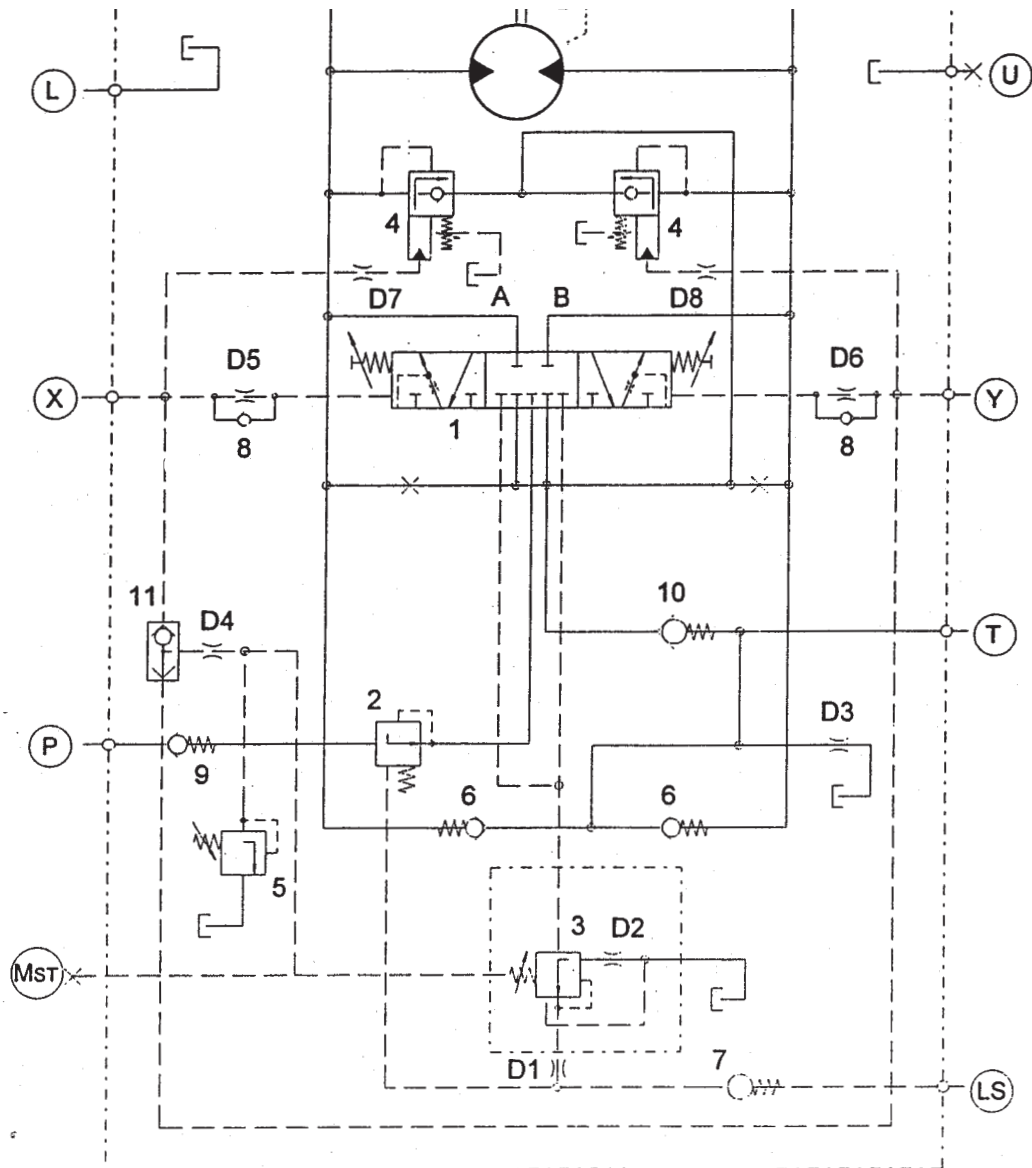
P	Pump
T	Tank
LS	Load sensing signal
L,U	Drain and vent connection ports, ensuring filling of case
X,Y	Pilot pressure ports
MA, MB	Gauge ports, slewing pressure
Mst	Control pressure, at TC valve
X	Pilot pressure (in) - rotation clockwise
Y	Pilot Pressure (in) - rotation counter clockwise

6.3 Arrangement



- 1 Main valve spool
- 2 Priority pressure balance valve (Compensator)
- 3 TC valve cartridge
- 4 High pressure relief and make up
with relief pressure step up VD - 20-05
- 5 Pressure relief valve for max. TC pressure DBE6
- 6 Feed valves
- 8 Throttle check valves
- 9 Check valve
- 18 Mechanical stroke limitation

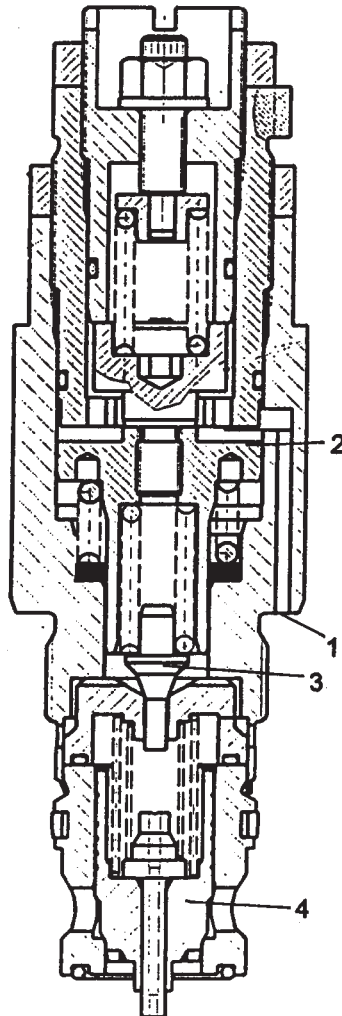
6.4 Circuit diagram



Explanations

P	Pump
T	Tank
LS	Load sensing signal
L,U	Drain and vent connection ports, ensuring filling of case
X,Y	Pilot pressure ports
MA, MB	Gauge ports, slewing pressure
Mst	Control pressure, at TC valve
X	Pilot pressure (in) - rotation clockwise
Y	Pilot pressure (in) - rotation counter clockwise

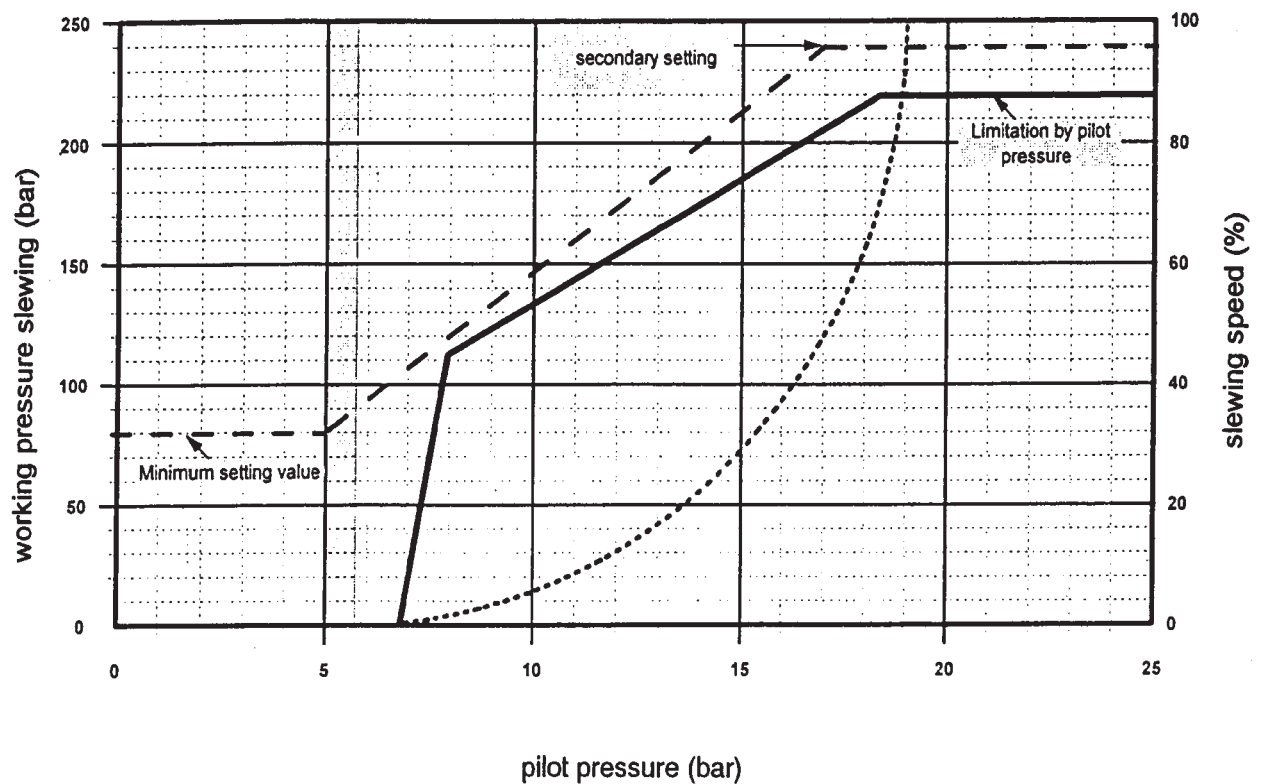
6.5 Secondary valve with pressure cut in stage



- 1 Connection servo slewing
- 2 Piston
- 3 Pilot piston
- 4 Operating piston

6.6 Diagram

Torque control

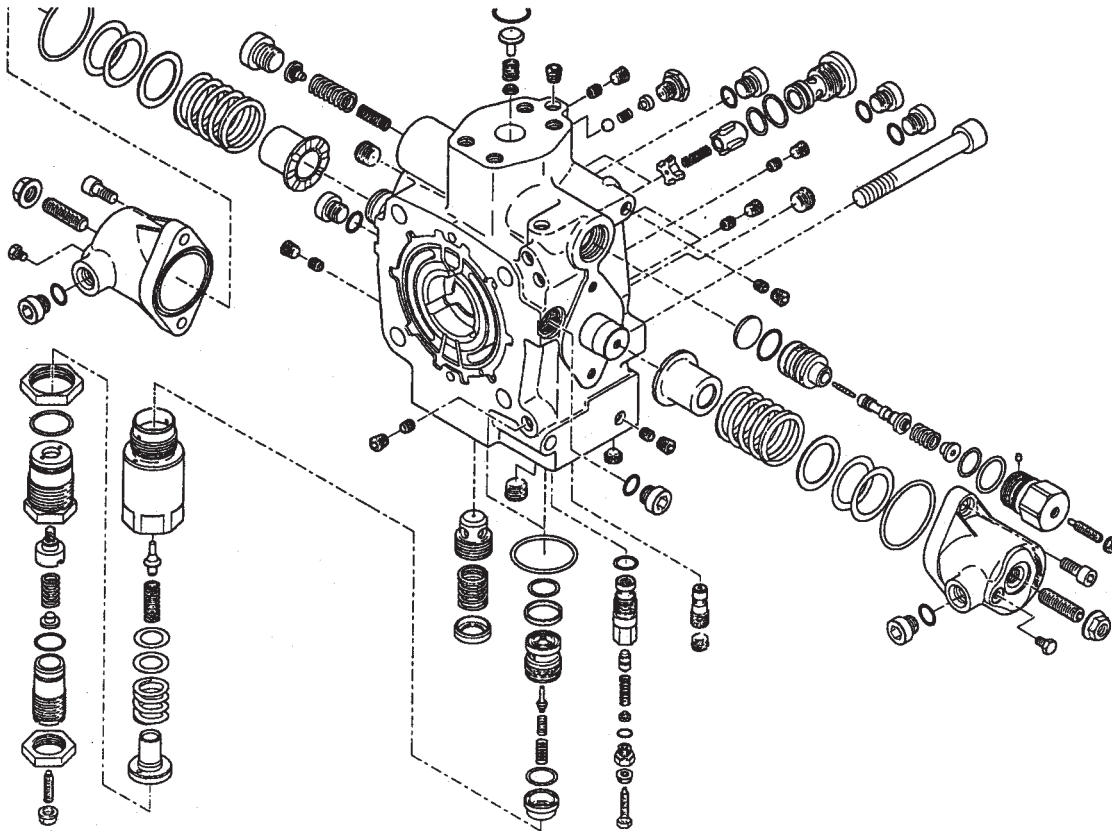


TC – characteristic (bar)

Secondary valve (bar)

Speed (%)

6.7 Exploded view of valve plate housing



6.8 Functional description

The basic unit is a fixed displacement motor of the HMF ... - 02 P type. It is an axial piston motor of swash plate design for open loop. This motor has been designed for use as swing motor. It has been equipped with all functions for optimum swing drive. The following functions are integrated in the valve plate housing of the motor:

6.9 Technical description

6.9.1 Directional control valve

The control spool (1) of the directional control valve (please refer to circuit diagram) is used for controlling the speed of the motor. This control spool is centered in neutral position by two springs. The pump pressure is fed to the motor via port "P". Depending on the requested direction of swing pressure is built up within the respective spring chamber (X or Y) by means of a pilot controller (joystick). The control spool (1) is moved acc. to the pre selected control pressure and connects oil flow from P to A (B) and B (A) to T. The opened cross-section has the function of an orifice behind which LS - pressure is taken off and is reported to the pump control. Depending of the pilot pressure the oil quantity (swing speed) is adjusted. The max. spool stroke and consequently the max. flow can be limited by means of an adjusting screw. The throttle check valves (8) dampen the control spool (1) in both directions.

6.9.2 Priority swing drive function

Inside channel "P" and connected in series to the control spool (1) there is an up stream compensator (2) . Together with the check valve (7) priority for the swing drive is realized.

6.9.3 Torque control (TC-valve)

The TC - valve (3) defines the accelerating pressure. By means of the pilot controller the operator selects not only the requested oil quantity but also the variable accelerating pressure. Thus waste of energy by oil passing the high - pressure relief valves (4) (secondary valves) is avoided. The max. accelerating pressure is defined at the TC - pressure relief valve (5) (please refer to diagram page , example). It should be below the setting of the high - pressure relief valves (4).

6.9.4 High pressure relief and make up valves with relief pressure step up VD 20-05

These relief valves are variable. They are set at a basic value (see diagram, example). With a pilot pressure > 5 bar at port X or Y the set pressure of the valve is raised from basic to top value. As control pressure the remote control pressure of the directional control valve is used. During the acceleration phase the setting of the respective valve is changed by pilot pressure to the maximum setting according to a characteristic curve. If smooth coasting is desired by the shovel operator, the pilot valve must be held in zero position.

The upper carriage will then run against the lower setting of the secondary valves (minimum setting 50 bar). If the upper carriage is to stop harshly, the driver has to overcenter and switch the corresponding secondary valve to its maximum value. Now the upper carriage will brake against the maximum pressure. According to the pilot pressure chosen by the operator the ; braking pressure can be tuned along a curve between the maximum and minimum value. Both the maximum and minimum value are mechanically adjustable from the outside, see corresponding Service Info.

The correlation between pilot pressure and TC curve can also be adjusted from outside.

The discharge side of the pressure relief valves (4) is always connected to the pressurized return line to reservoir so that the make up valves can fulfil their function.

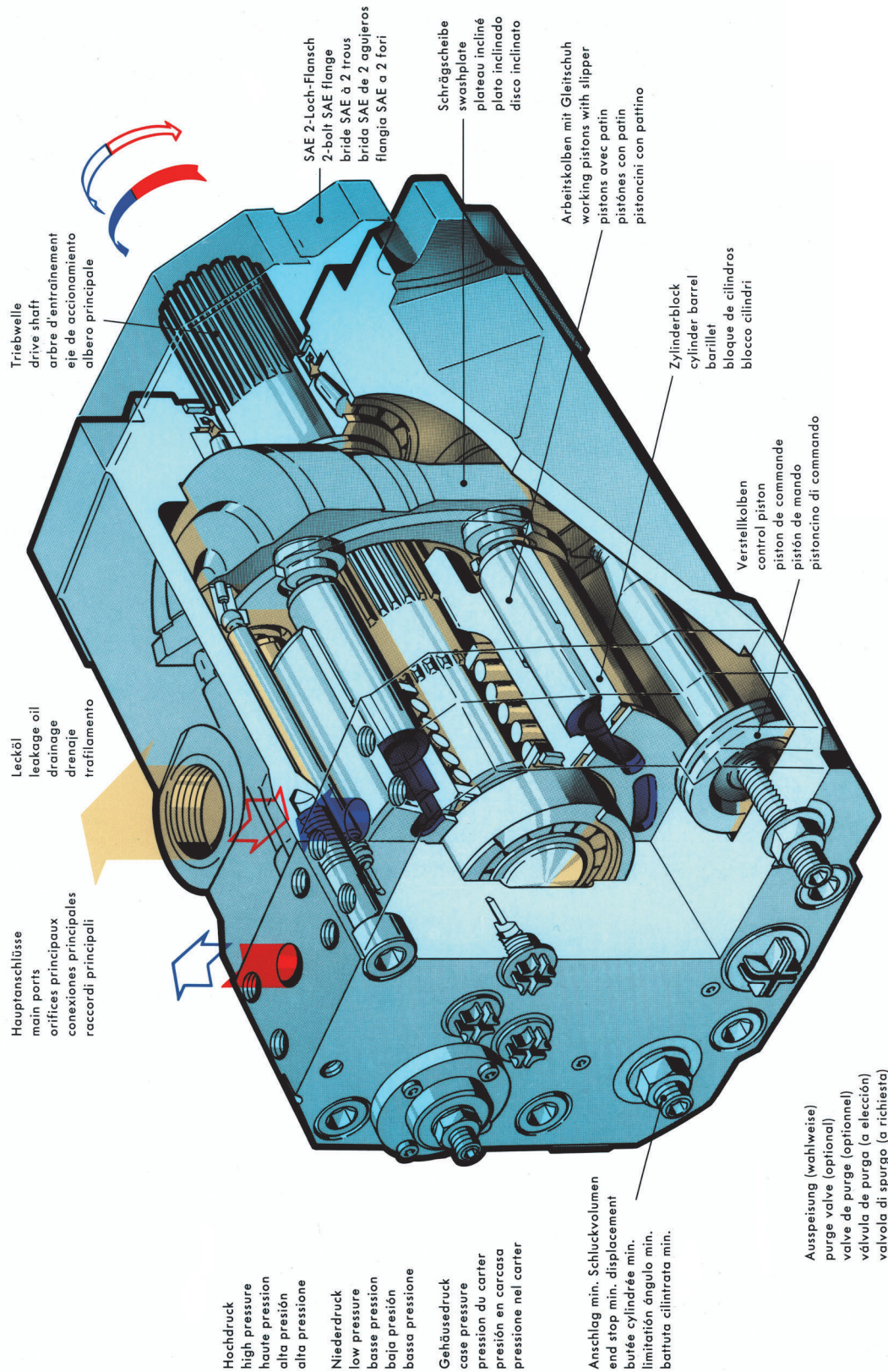
6.9.5 Feed valves

In order to avoid cavitation direct feeding of the swing system via the feed valves (6) which are connected to the return line to reservoir is possible. The check valve (9) (in P-line) makes sure that this function is maintained even during counteracting and at lowest system pressure.

7 Variable displacement motor HMV 105-02

HYDRO-VERSTELLMOTOR HMV...-02

VARIABLE DISPLACEMENT HYDRAULIC MOTOR - MOTEUR HYDRAULIQUE A CYLINDREE VARIABLE - MOTORE IDRAULICO DE CAUDAL VARIABLE - MOTORE IDRAULICO A PORTATA VARIABLE



7.2 Functional description

The HMV 105 -02 type variable displacement motor is a swashplate design axial piston motor for open loop application.

The motor is equipped with a two step displacement control device (flip-flop).

Open loop travel drives require a counter balance valve. This valve prevents motor against overspeeding in the push mode. Please study the specific functional description of counter balance valve .

Two-position control (flip-flop)

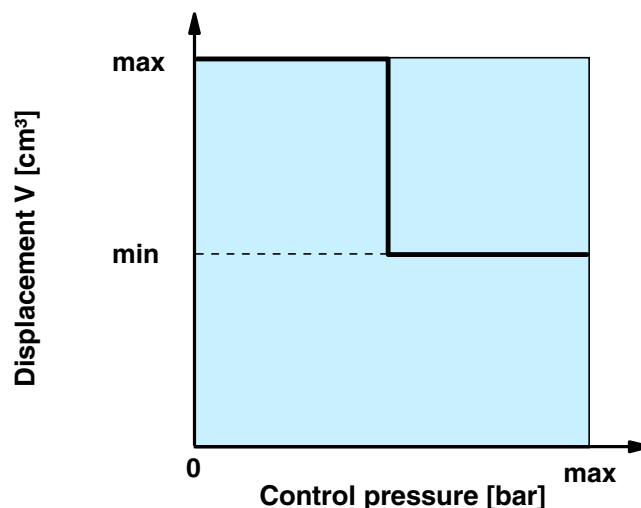
This control system has the motor stay in the maximum swash angle position (V_{max}), as long as there is no control pressure signal in port X1. When a control signal is applied at port X1 motor makes a smooth transition to minimum swash angle position (V_{min}).

By means of the two check valves (2) and (3) the higher pressure of the high pressure ports "A" and "B" is selected and connected as sort of servo pressure to the displacement piston via pilot valve (1) and channel (4) which effects "maximum displacement". The second displacement piston is relieved through channel (5) and pilot valve (1) into the interior of the motor casing.

With 20 to 40 bar external control pressure at port "X1" the motor can be switched to "minimum displacement". In this case servo pressure is connected to the displacement piston positioning the motor in its minimum displacement through pilot valve (1) and channel (5).

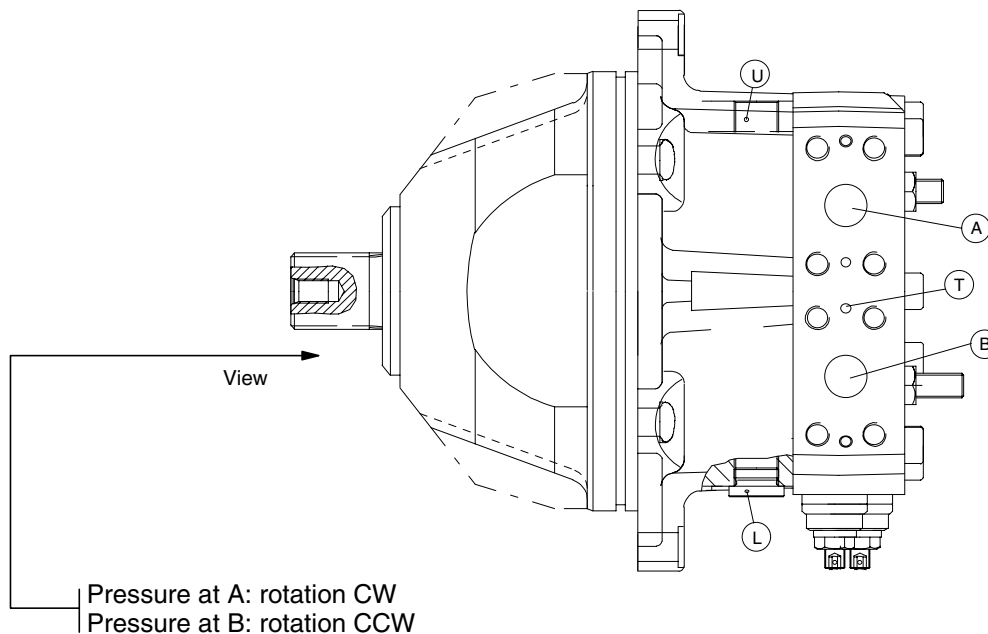
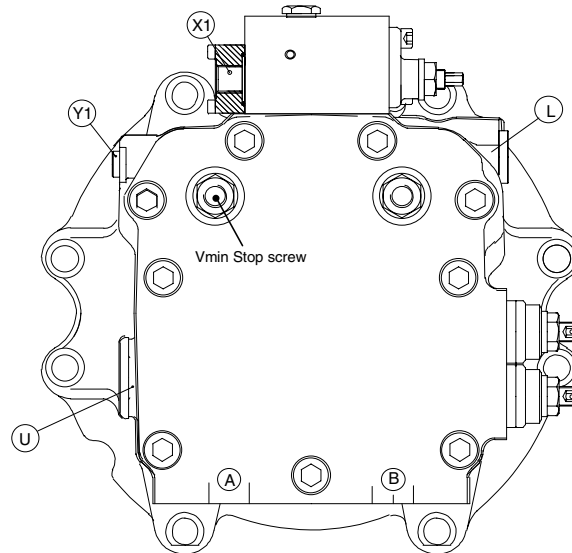
Measurable at the gage port "Y1". The second displacement piston is relieved into the interior of the motor casing via channel (4) and pilot valve (1).

Diagramme



7.3 Connection and gage port diagram

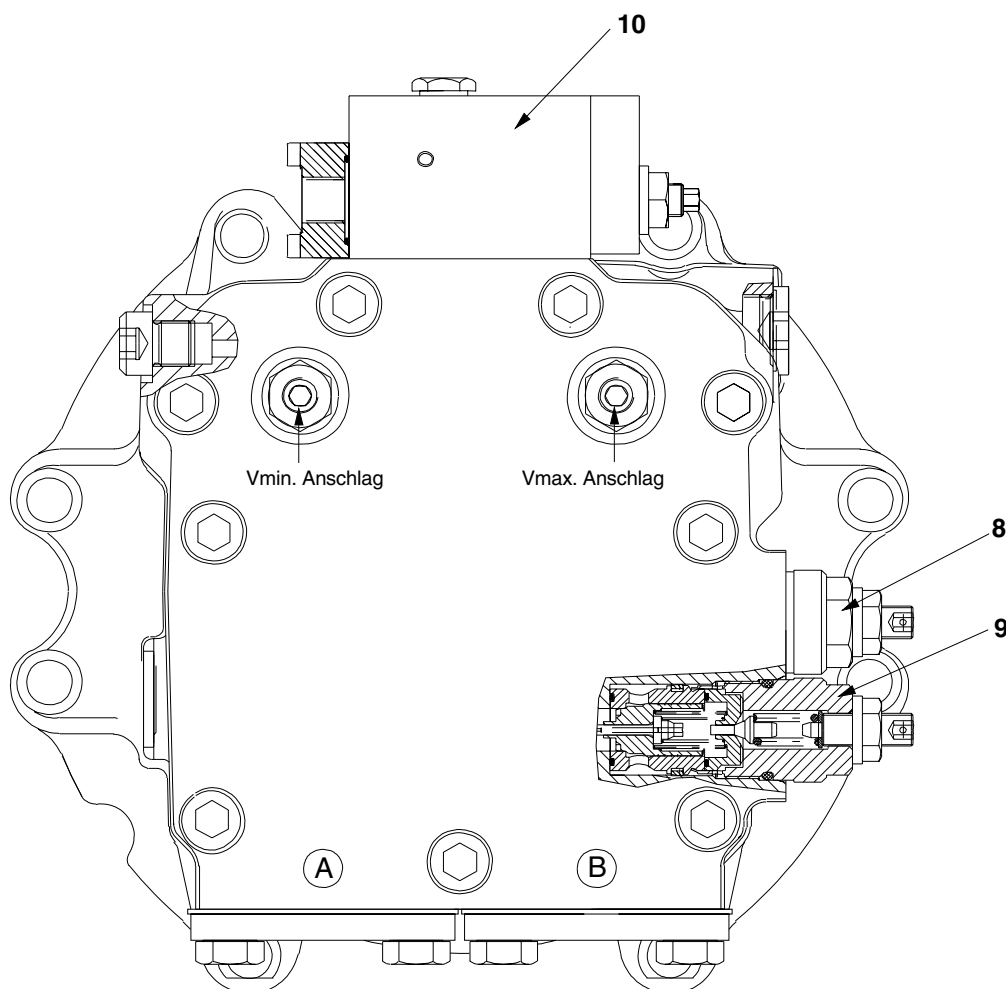
Hydraulicmotor	1 turn on the Vmin screw [cm ³ /revolution]	1 turn on the Vmax screw [cm ³ /revolution]
HMV 105	6,2	6,2



EXPLANATIONS	
A, B	High pressure port
X1	Control pressure Px1 20-40 bar
Y1	Servo pressure gage port
U, L	Oil filling, drain, tank and vent port
T	Return flow from counterbalance travel valve

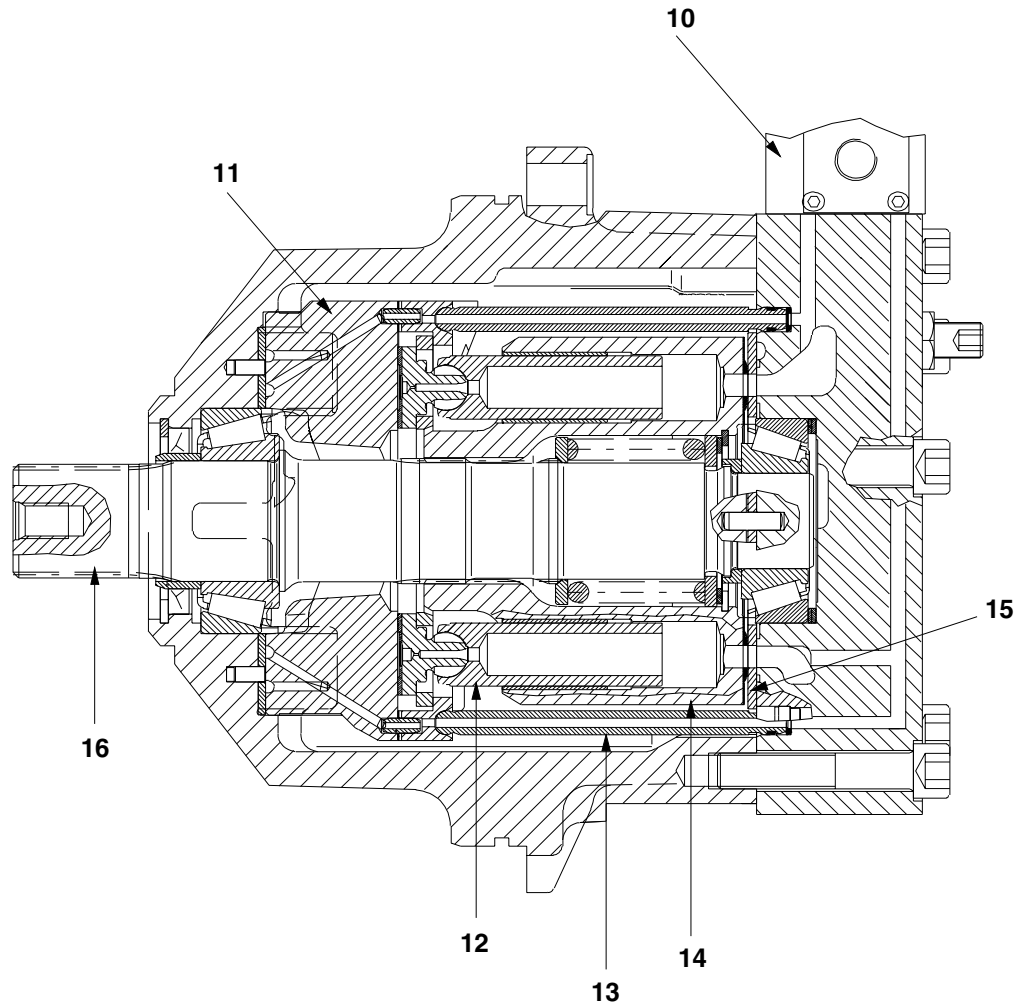
Oil type (see technical data sheet)
Permissible casing pressure 1,5 bar (2,5 abs.)
Casing to be filled with oil and vented before start of operation. Observe mounting instructions !
For other specifications, see technical data sheets.
For applications involving radial shaft loads please contact LFH.

7.4 Basic design of port plate housing



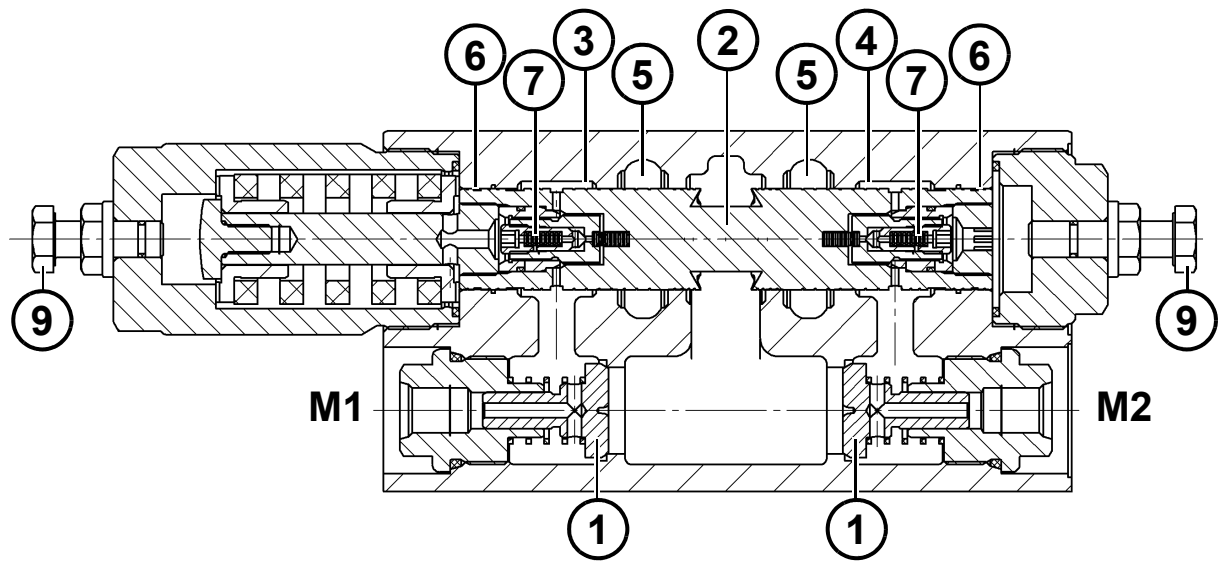
- 8 high-pressure relief valve VD 20-04
- 9 high-pressure relief valve VD 20-04
- 10 two position control

7.5 Basic design of rotating group



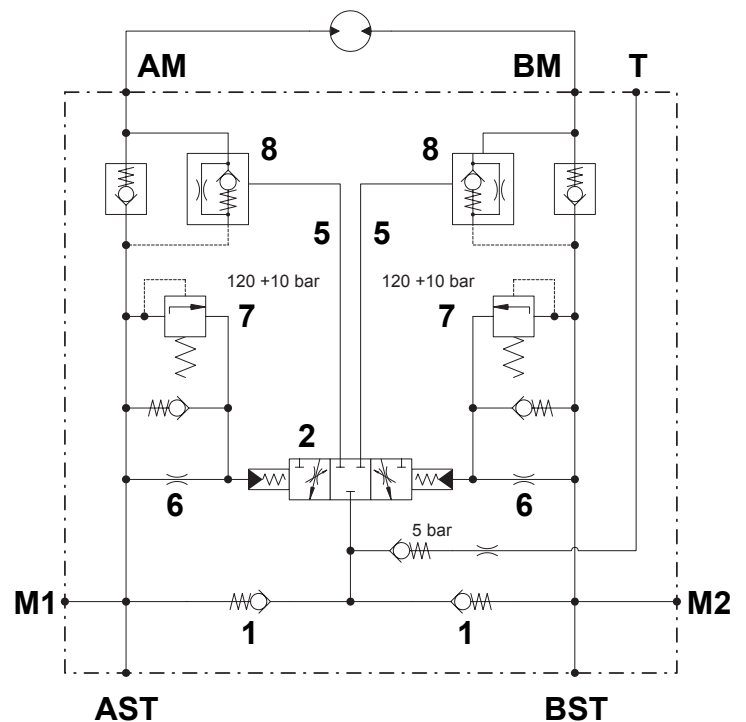
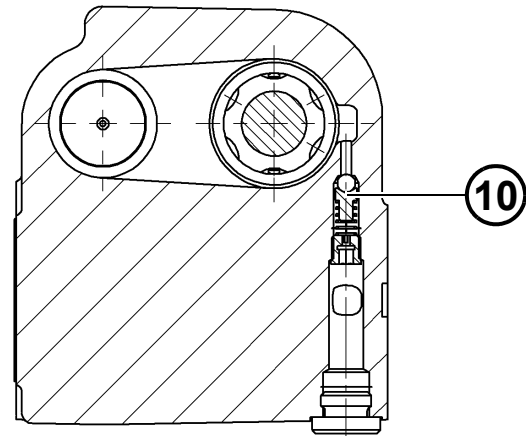
- 10 two position control
- 11 swash plate
- 12 working piston
- 13 tube
- 14 cylinder barrel
- 15 port plate
- 16 shaft

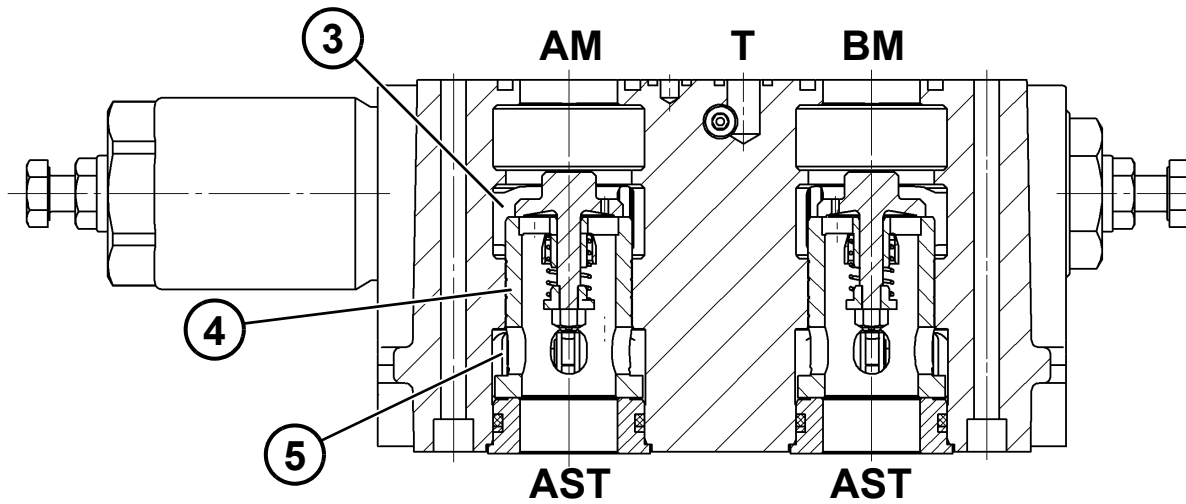
8 Brake valve



- 1 Check valves
- 2 Brake piston
- 3 Line from - AST
- 4 Line from - BST
- 5 Line to the brake piston
- 6 Tolerance at the brake piston
- 7 Cold start valves /
Check valves - with preload
- 8 Flow divider (Check valve)
- M1/M2 Measuring unions
- 9 Adjusting screw
- 10 Scavenging valve

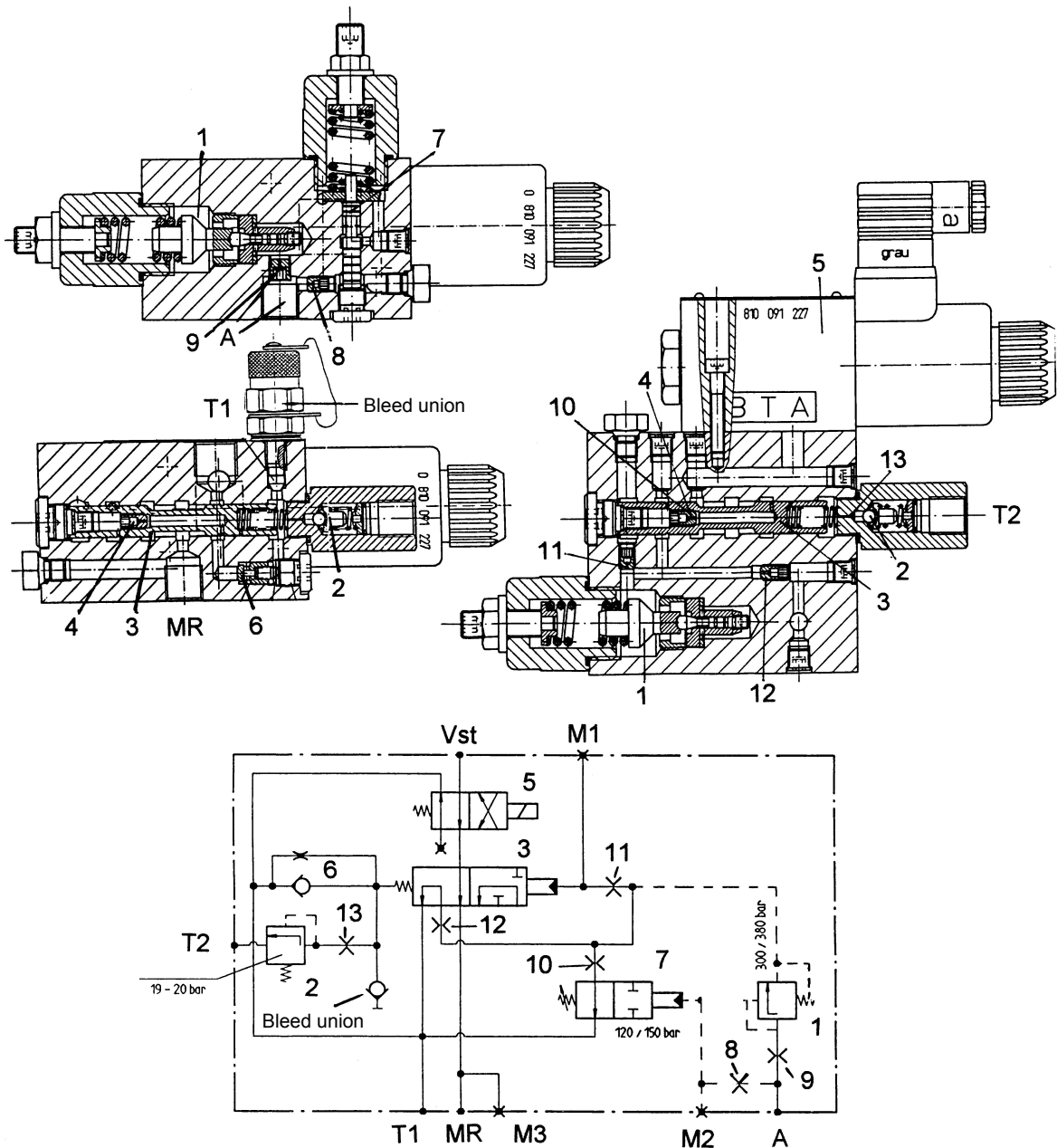
Tighten the eight mounting screws with a torque of 60 Nm.





- 3 Line to the break piston
- 4 Flow divider with check valve
- 5 Connection line to AST
- AST Connection - Distributor
- BST Connection - Distributor
- AM Connection -Drive motor
- BM Connection -Drive motor
- T Scavenging/Drive motor

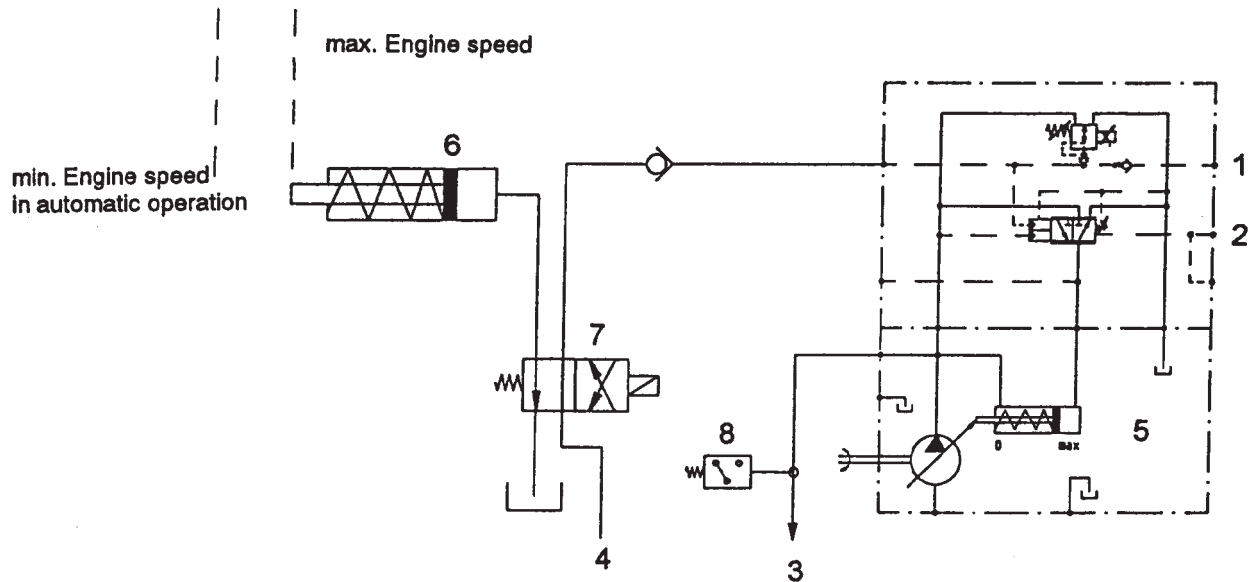
9 Variable drive motor with automatic control system



- 1 Pressure reducing valve
- 2 Pressure relief valve
- 3 Change over piston
- 4 Non return valve (with relief bore)
- 5 Solenoid valve
- 6 Non return valve
- 7 Change over valve
- 8 Orifice Ø 0,5 mm
- 9 Orifice Ø 0,7 mm
- 10 Orifice Ø 0,8mm
- 11 Orifice Ø 0,5 mm
- 12 Orifice Ø 0,8 mm
- 13 Orifice Ø 0,5 mm

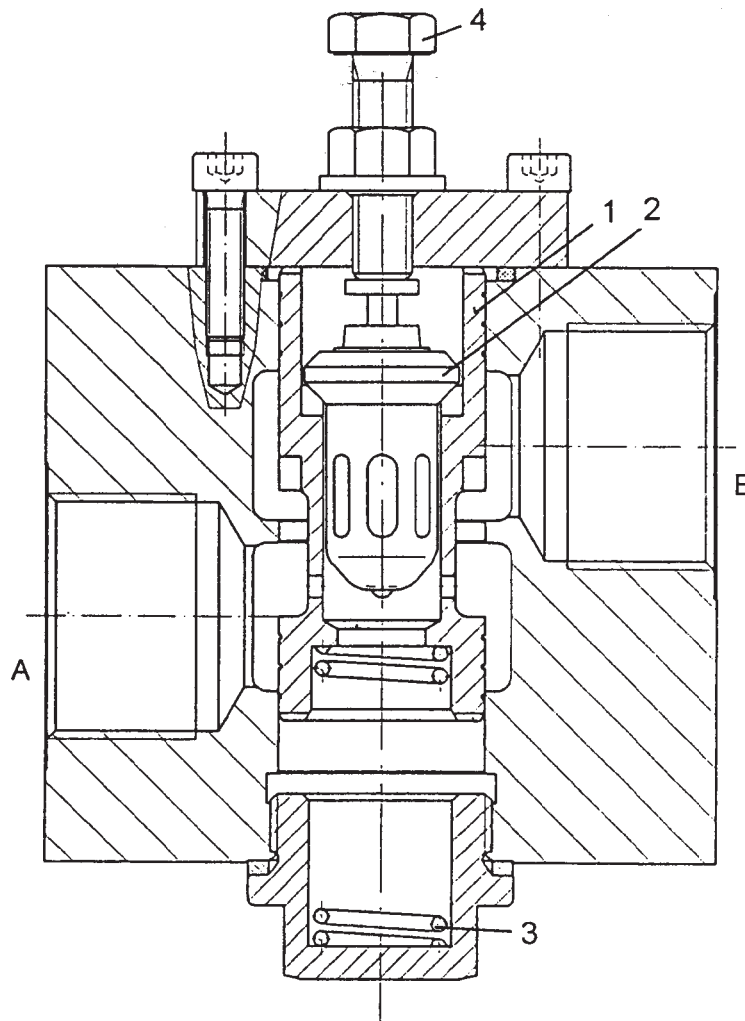
- A - Connection - Driving pressure
- MR - Connection - Regulation of Driving motors
- T1 - Connection - Tank
- T2 - Connection - Tank
- VST - Connection - Servo pressure
- M1 - Measuring union
- M2 - Measuring union
- M3 - Measuring union

10 Automatic engine idle system



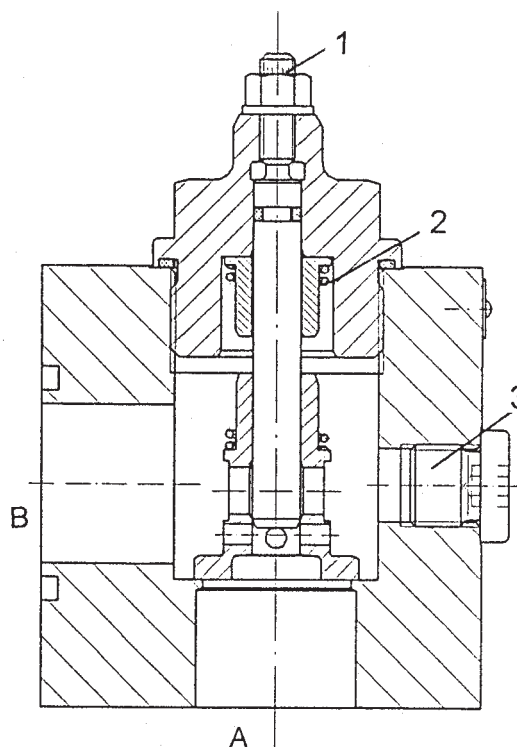
- 1 Connection - Emergency system
- 2 Connection - Load sensing line - Distributor valve
- 3 Connection - Pressure line
- 4 Connection - Servo pressure
- 5 Variable pump HPR
- 6 Hydraulic cylinder (build on speed adjusting device)
- 7 Solenoid valve (coil energized - min. engine rpm.)
- 8 Pressure switch (setting pressure 70 bar)

11 Thermostat valve



- A Return line from distributor valve
- B Return line tank
- 1 Shut off piston
- 2 Thermoelement
- 3 Spring
- 4 Adjusting screw

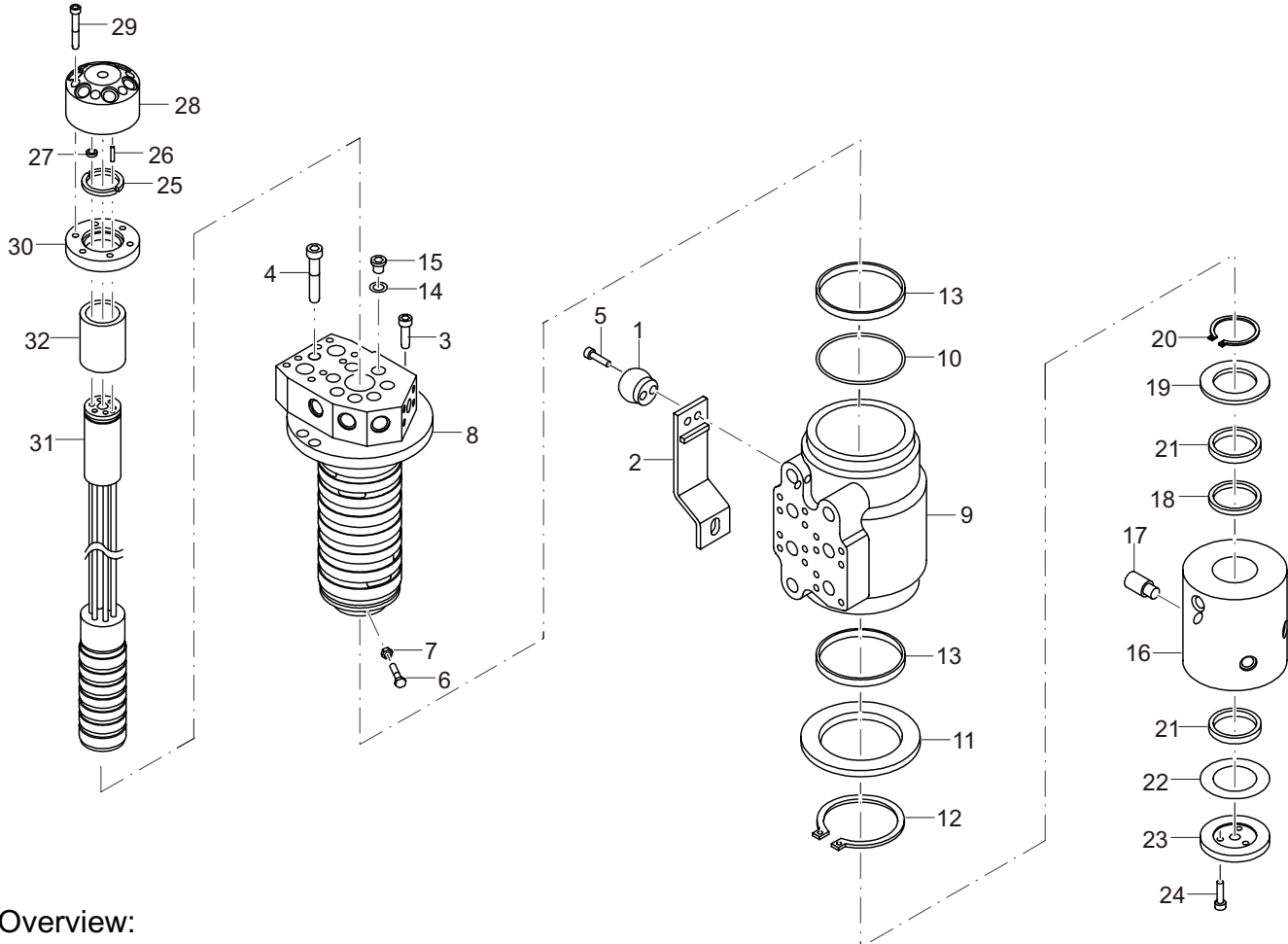
12 Restrictor



- A Connection - Distributor valve
- B Connection - Ram
- 1 Adjustment screw
- 2 Spring
- 3 Measuring connection

13 Main rotation connection

13.1 Rotation connection and rotary transmission lead-through



Overview:

Rotary connection Items 8-15

Rotary transmission lead-through Items 16-32

Pos. 29-32 not applicable

- | | |
|------------------------------|---------------------------|
| 1. Spherical head | 2. Lock |
| 3. Cap screw | 4. Cap screw |
| 5. Cap screw | 6. Hexagon head cap screw |
| 7. Hexagon nut | 8. Inner part |
| 9. Outer part | 10. Rotation set |
| 11. Sliding disc | 12. Circlip |
| 13. Lip seal | 14. Sealing ring |
| 15. Screw plug | 16. Outer part |
| 17. Hub | 18. Rotomatic ring |
| 19. Sliding disc | 20. Circlip |
| 21. Lip seal | 22. Stop disc |
| 23. Flange | 24. Cap screw |
| 25. Disc | 26. Cylinder pin |
| 27. Stirromatic sealing ring | 28. Terminal block |
| 29. Cap screw | 30. Counter-ring |

The branch circuit connections are indicated:

Rotary connection:

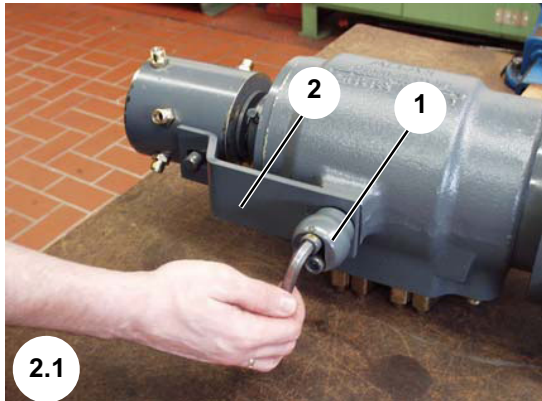
- Connection 1 = brake (right-left)
- 2 = regulator bypass (right-left)
- 3 = drive right
- 4 = drive right
- 5 = drive left
- 6 = drive left
- 7 = overflow oil (right-left)

Rotary transmission lead-through¹:

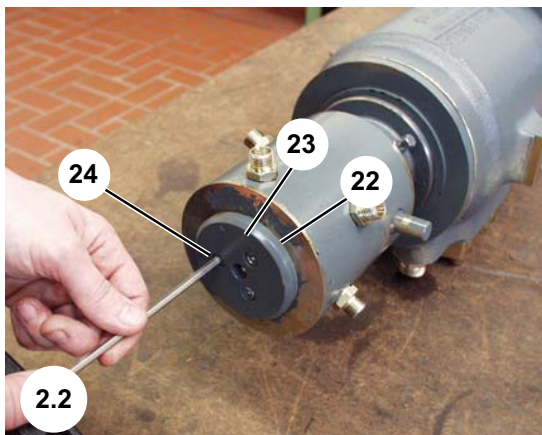
- Connection 1 =
- 2 =
- 3 =
- 4 =
- 5 =
- 6 =

1. not applicable

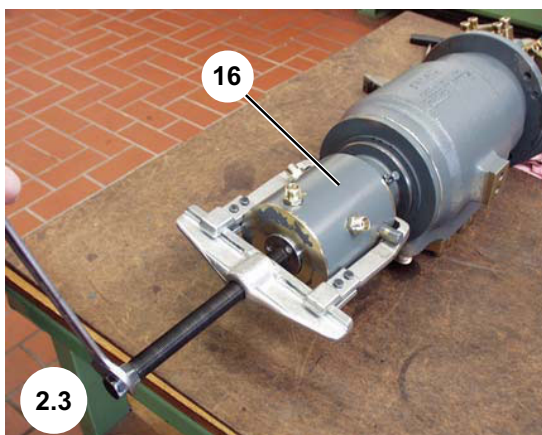
13.2 Maintenance of the rotary connection



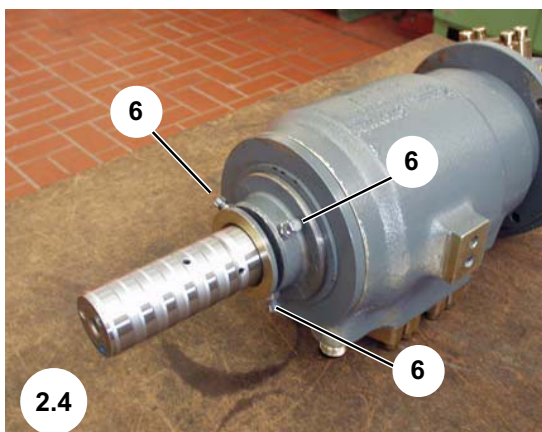
Screw off the spherical head (1) and remove the locking device (2).



Remove the cap screws (24) and the flange (23) with the stop disc (22).

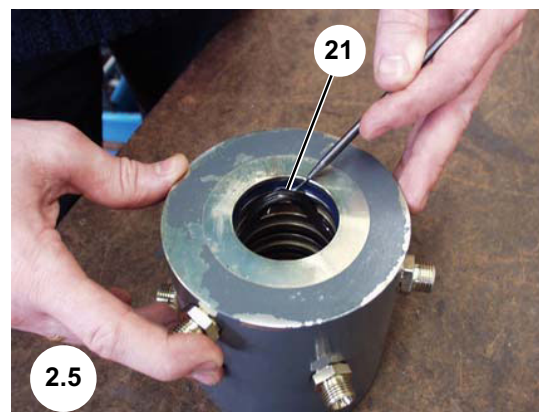


Pull off the outer part (16).

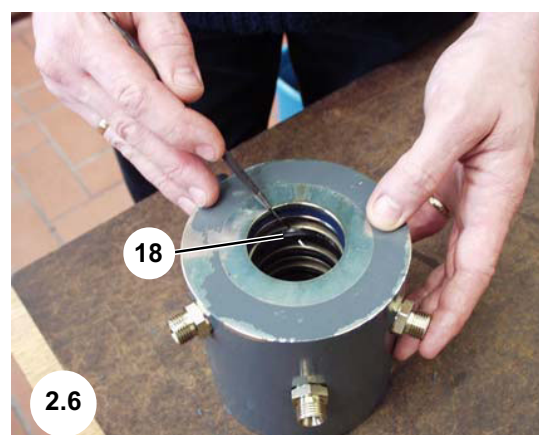


Screw out the securing screws (6).

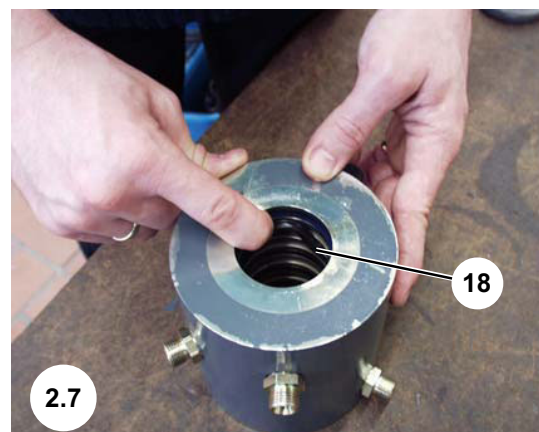
Remove the lip seals (21).



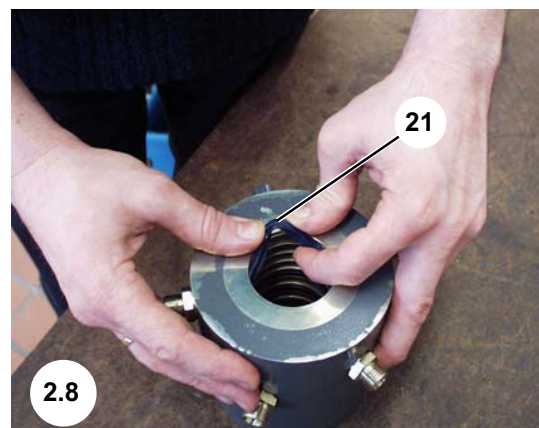
Remove the rotomatic rings (18).



Replace the rotomatic rings (18).

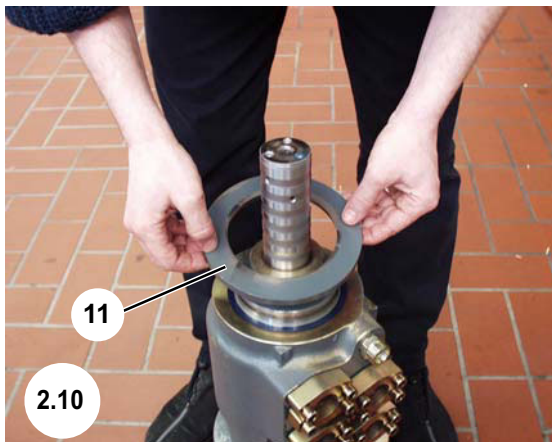


Replace the lip seals (21).

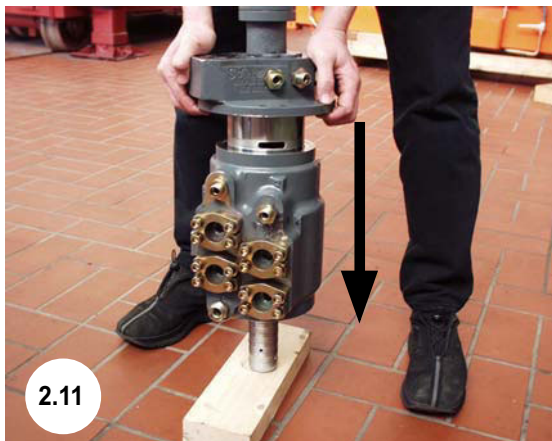




Mark the outer part on the inner part. Have the circlip (12) rebound.



Remove the sliding disc (11).



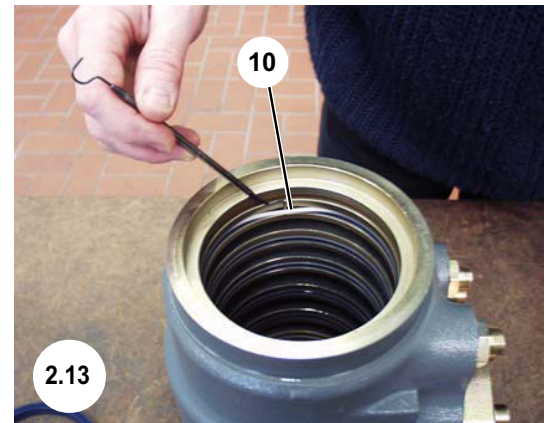
Separate the outer part from the inner part by means of placing it lightly on the floor.



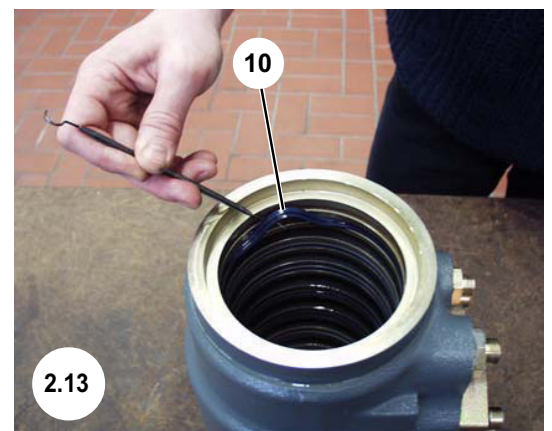
Remove the lip seals (13).

Remove the rotating sealing sets (10):

bearing rings



sealing rings



Clean the outer part and the inner part and examine them to ensure that they are not damaged.
Replace the rotation sealing set (10):

sealing rings

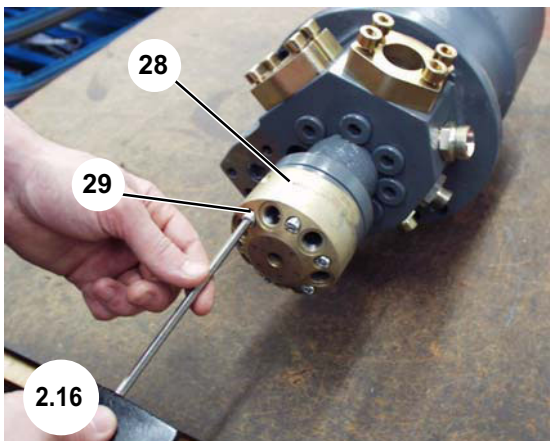


bearing rings

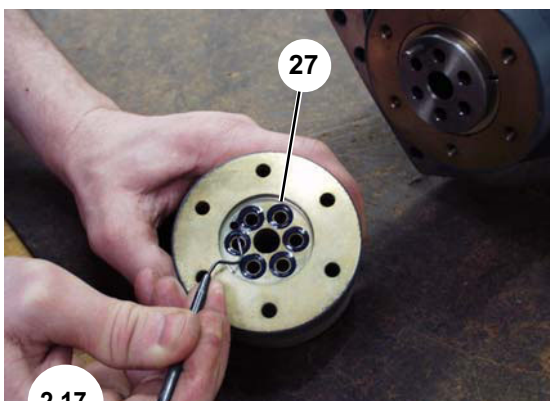




Oil the inner part and press the outer part onto it. If necessary, knock slightly.



Screw out the cap screws (29) and remove the terminal block (28).



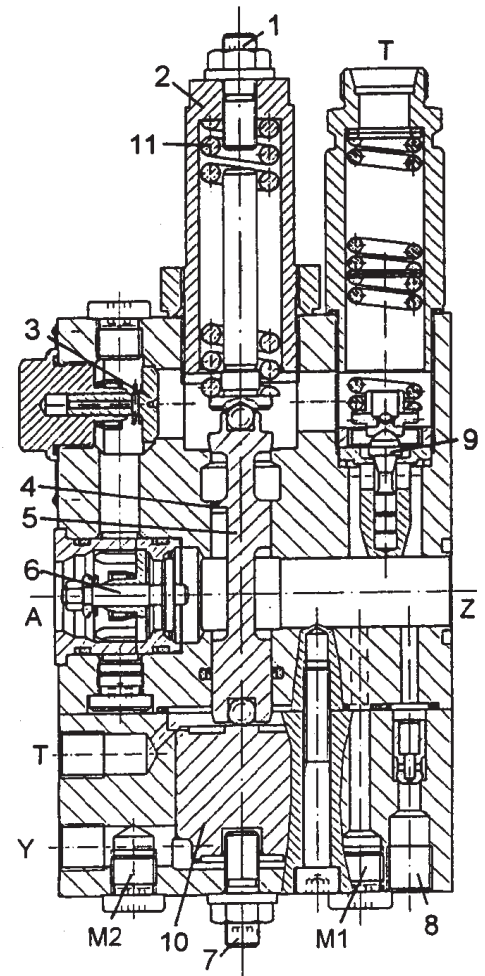
Exchange the stirromatic sealing (27).

The remaining assembly procedure takes place in reverse order.

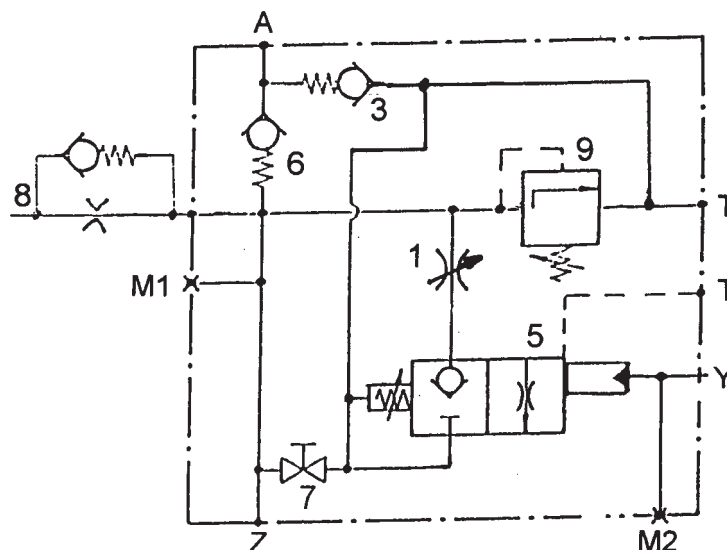
14 Line break protection

14.1 Arrangement

- 1 Lowering speed adjusting screw
- 2 Adjusting cap/Switching point shut-off piston
- 3 Non-return valve
- 4 Hole, 0.5 mm diameter
- 5 Shut-off piston
- 6 Non-return valve
- 7 Emergency lowering
- 8 Balance line with one-way restrictor
- 9 Secondary valve (Fixed setting)
- 10 Piston
- 11 Spring
- A Union - plate valve
- Z Union - cylinder
- Y Union - pilot control „Lowering“
- T Union - tank
- M1/M2 Measuring union



14.2 Valve



14.3 General

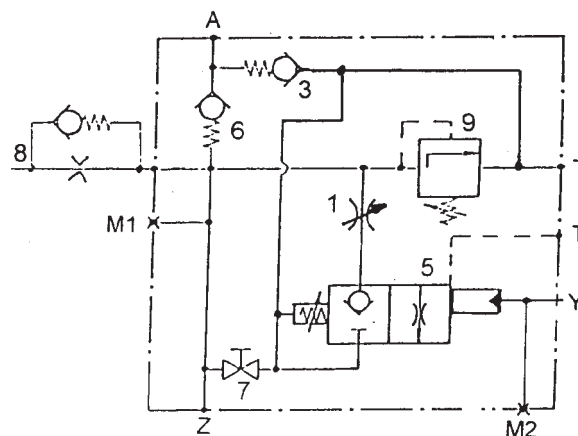
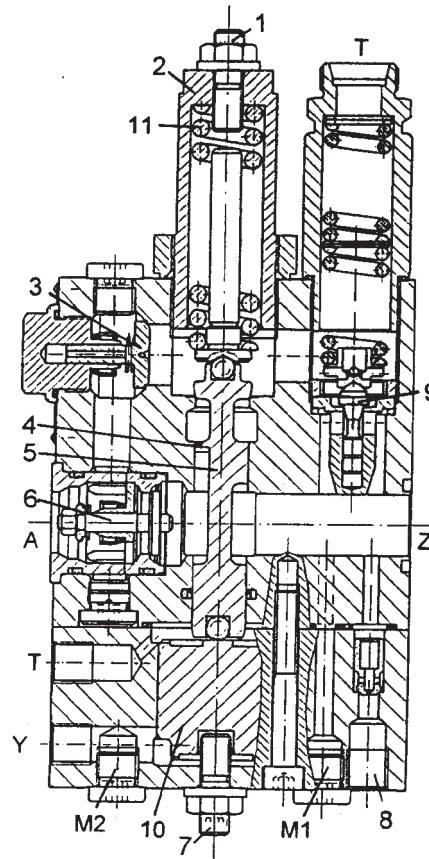
According to the CE standard, hydraulic excavators with a maximum permitted load of more than 1000 kg in accordance with ISO 10567 must be fitted with a line break safeguard if they are to be used with lifting gear. Use of lifting gear includes lifting, transporting and lowering loads with lifting tackle (rope, chain etc.) where the load must be attached and released by hand. For lifting applications, the lines must be protected in such a way that the load and the tackle cannot fall in an uncontrolled manner.

The line break safeguard required is flanged directly to the cylinders. The use of pipes and hoses for connecting cylinders to the line break safeguard is not permitted.

More detailed information on the technical requirements can be found in ISO 8643 (excerpt from EC standard on requirements for hydraulic excavators).

14.4 Arrangement

- 1 Adjusting screw for the lowering speed
- 2 Adjusting screw - switching point - shut-off piston
- 3 Non-return valve
- 4 Shut-off piston
- 5 Emergency lowering
- 6 Non-return valve
- 7 Hole Ø 0.5 mm
- 8 Balance line with one-way restrictor
- 9 Secondary valve
- 10 Piston
- 11 Spring
- A Union - plate valve
- Z Union - cylinder
- Y Union - pilot control "Lowering"
- T Union - tank
- M1/M2 Measuring union



14.5 Operation

14.5.1 Jib -raising

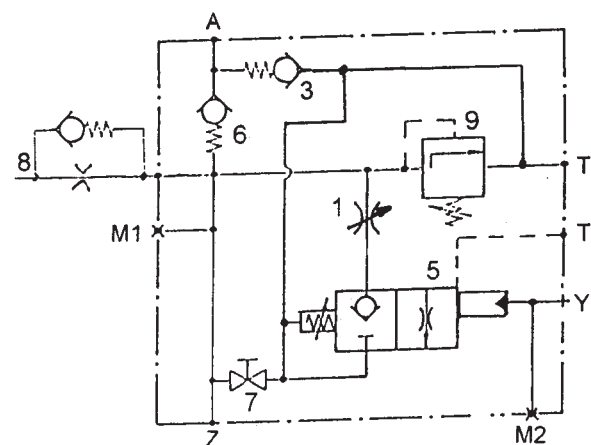
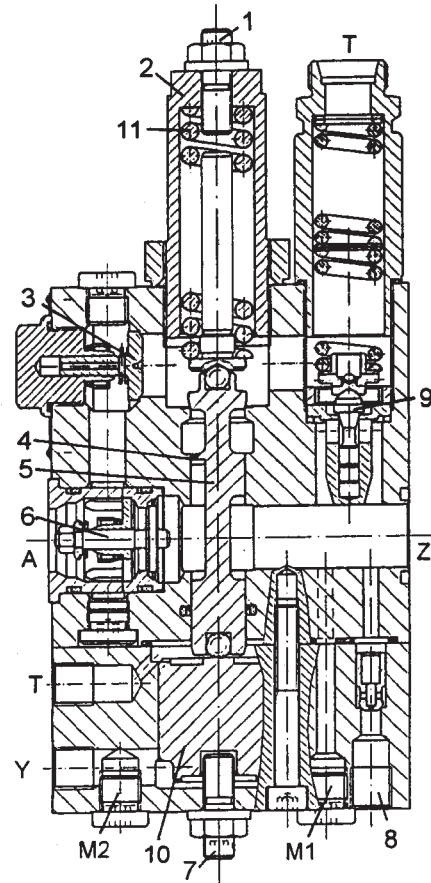
From the control block, the oil flows to the lifting cylinder (Z) via union (A) and non-return valve (6). If a line breaks during the lifting procedure, non-return valve (6) is immediately closed by the static pressure of the lifting cylinder. This prevents the jib from descending in an uncontrolled manner.

Union (8) is for the balance line and the union for the overload warning device between the two lifting cylinders. If one of these lines breaks, the one-way restrictor in union (8) ensures that only a small amount of oil can flow out and the jib descends slowly. This is permitted by ISO 8643.

14.5.2 Jib - lowering

To lower the jib, pilot pressure is applied to the control spool in the plate valve and, via union (Y) to piston (10). Piston (10) rests mechanically against the shut-off piston (5).

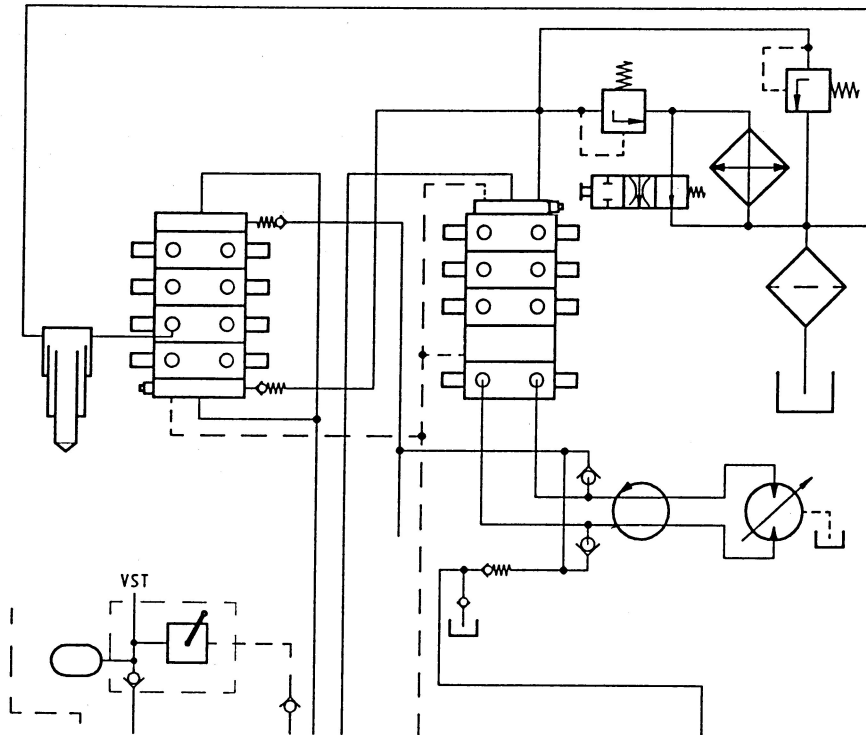
If piston (10) switches, the shut-off piston (5) is operated counter to the spring (11). The shut-off piston opens and the oil flows from the cylinder (Z) to union (T). As the lowering speed increases, the non-return valve (3) opens and the oil flows via union (A) to the plate valve.



15 Hydraulic diagrams 1504 LC, 1604 LC

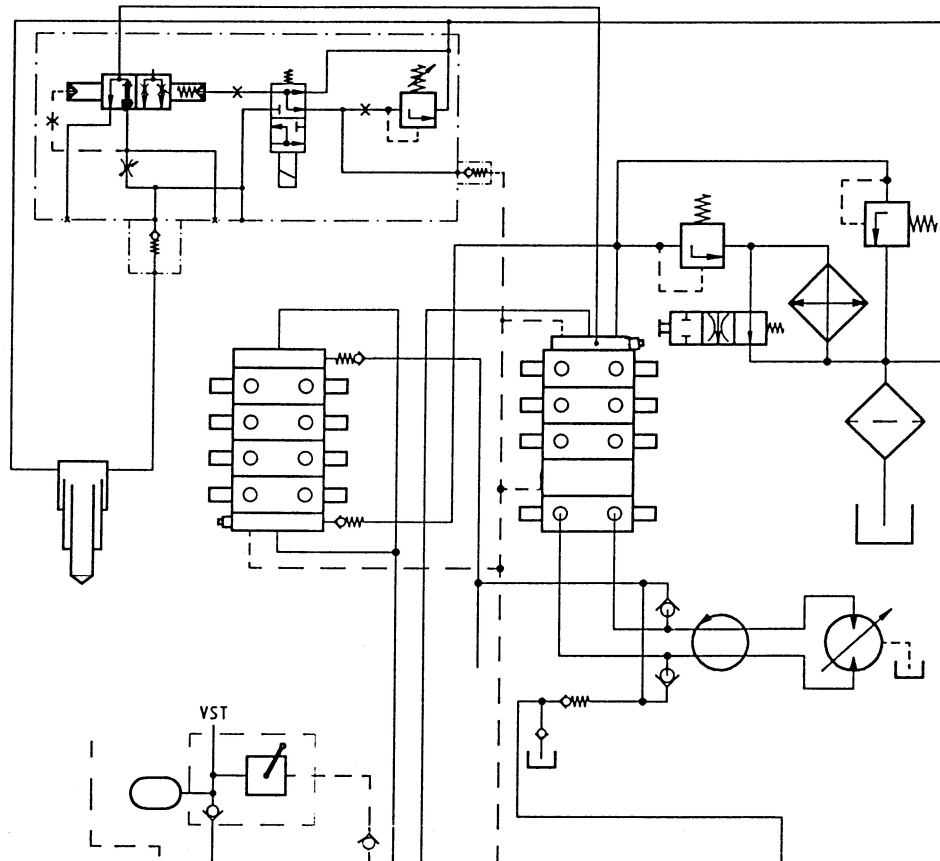
15.1 Hydraulic hammer equipment to 130 ltr

Function „Grab rotation“:



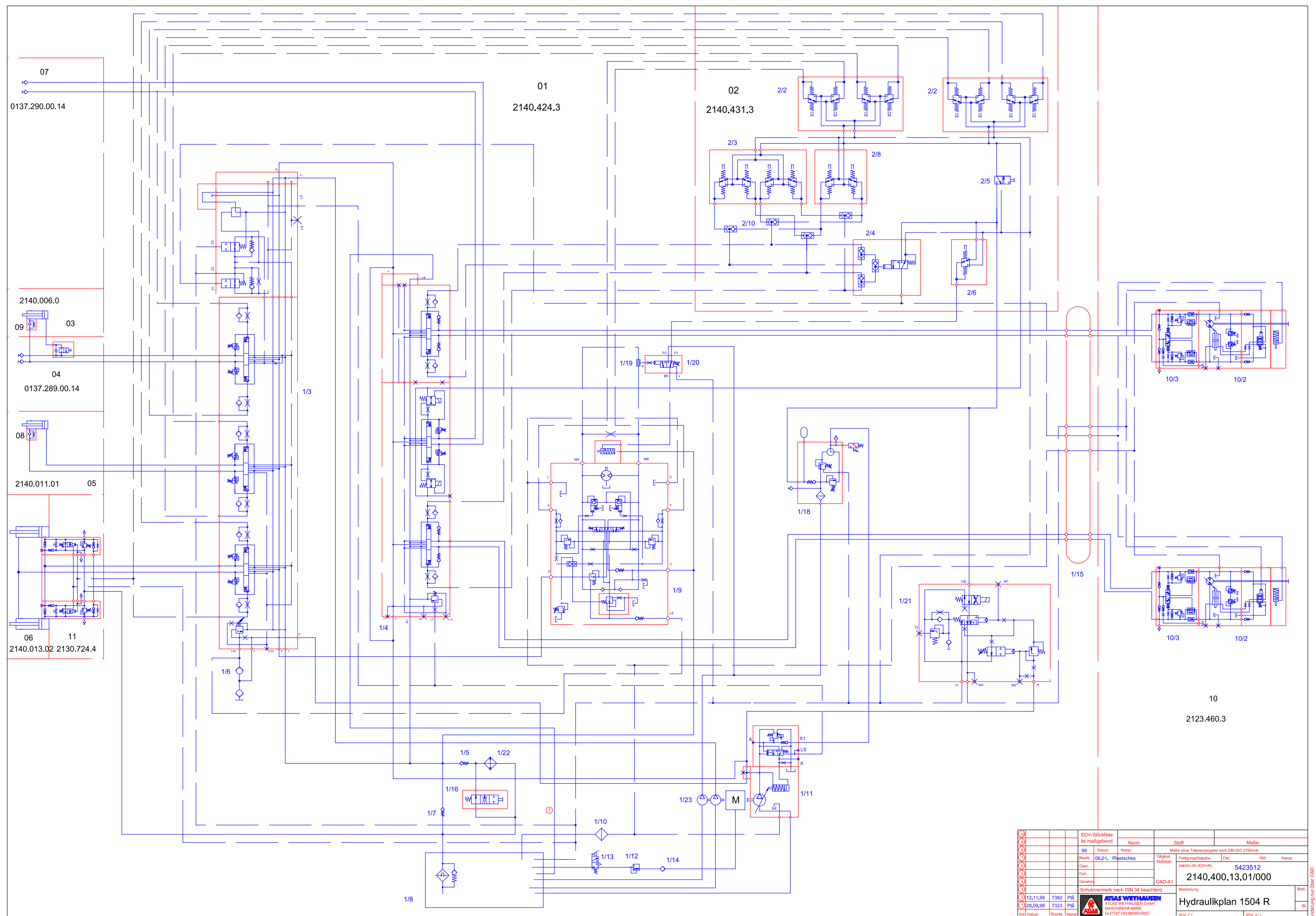
15.2 Hydraulic hammer equipment to 200 ltr

Function „Grab rotation“ with additional pressure balance valve:



15.3 Hydraulic diagram 1504 LC

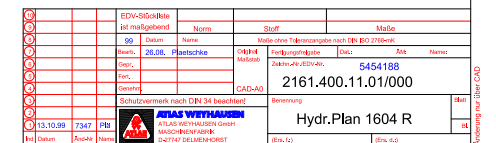
M	Engine BF4M2012C
P1	Variable pump HPR 105-02
P2	Gear pump
P3	Servo pump
1	Pressure cut-off valve
2	Lifting cylinder with line break protection valve
3	Jib folding
4	Bucket/Grab operating cylinder
5	Grab rotation
6	Partial-flow filter
7	Primary valve LS controlled
8	Slewing brake
9	Shut-off valve slewing brake
10	Slewing motor HMF 55-02 including distributor valve
11	Servo unit
12	Shut-off valve servo unit
13	Brake relief unit
14	Brake valve
15	Driving motors HMV 105-02
16	Valve unit for Servo-Emergency system
17	Thermostat valve/Hydraulic oil cooler
18	Regulation device of the driving motors
19	Rotary transmission
20	Cooler protective valve
21	Check valve



19				EDV-Stückliste ist maßgebend	Norm	Stoff	Maße		
20				99 Datum Name	Original Fertigungsfreigabe Dtl.: Abl: Name: 5423512 2140.400.13.01/000	Maße ohne Toleranzangabe nach DIN ISO 2768-xt			
21				Bearb. 06.01. Plattschke					
22				Zeichn. EDV4r.					
23				Fert.					
24				Genehm.					
25					CAD-A1				
26				Schutzvermerk nach DIN 34 beachten!					
27	12.11.99	7382	Pli	 ATLAS WEYHMANNS ATLAS WEYHMANNS GmbH MASCHINENFABRIK D-27747 DELMENHORST	Benennung	Hydraulikplan 1504 R		Blatt	
28	28.09.99	7323	Pli					Bl	
29					1. Aufl. Name	ES 1.1	ES 1.1		

15.4 Hydraulic diagram 1604 LC

M	Engine BF6M2012C
P1	Variable pump HPR 135-02
P2	Gear pump
P3	Servo pump
1	Pressure cut-off valve
2	Lifting cylinder with line break protection valve
3	Jib folding
4	Bucket/Grab operating cylinder
5	Grab rotation
6	Plate valve Jib folding II
7	Primary valve LS controlled
8	Slewing brake
9	Shut-off valve slewing brake
10	Slewing motor HMF 75-02 including distributor valve
11	Servo unit
12	Shut-off valve servo unit
13	Brake relief unit
14	Brake valve
15	Driving motors HMV 105-02
16	Valve unit for Servo-Emergency system
17	Thermostat valve/Hydraulic oil cooler
18	Regulation device of the driving motors
19	Rotary transmission
20	Cooler protective valve
21	Check valve



Chapter 5

Adjusting instructions and tables for 1504 LC

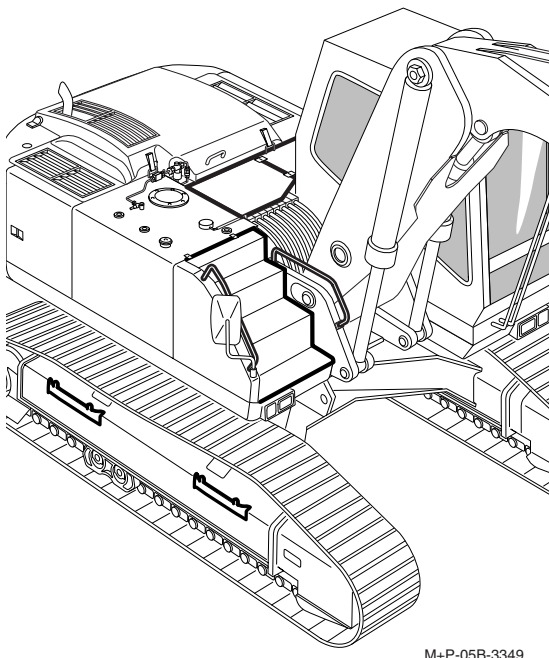
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1 Safety instructions for adjustment work

- Only qualified personnel may carry out adjustment work.
- Always read the operating/adjusting instructions, before you carry out any adjustment work.
- Read the corresponding Deutz operating instructions before performing any adjustment work on the engine.
- Do not perform any adjustment work not described in the adjustment works found in the adjusting instructions.
- Note the risk of fire and explosion when you carry out the adjustment work.
Do not smoke, keep naked flames away from the excavator, and keep a fire extinguisher ready to hand.
- To avoid unnecessary downtime in operation, TEREX-ATLAS recommends seals be renewed on all adjustment work described.
- Use only genuine TEREX-ATLAS spare parts.
- When boarding and leaving the excavator, use only the steps and handrails provided.

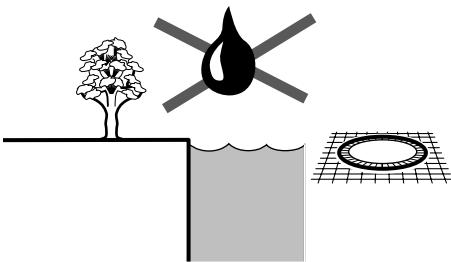


- Never climb on to the boom/jib. Use a ladder or work platform, if necessary.
- Remove all mud, oil, lubricating grease, ice and snow from the steps, handrails and contact area to ensure a safe working circumstances.

- Wear anti-slip footwear.
- Do not use the excavator again until adjustment work has been effectively completed.
- If adjustment work is done at a job site (e.g., on a construction site), cordon off the job site.
- Carry out adjustment work only if the stability of the excavator is ensured.
- Lower the boom/jib and dozer blade to the ground, or support them.
- Never work under the excavator, if it is being held only by the hydraulic system.
- When the excavator is raised, support it with suitable material (e.g., stands).
- The engine must be stopped before adjustment work is carried out, wherever applicable.
- Absolute cleanliness is essential.
Dirt may cause considerable damage to the excavator.
- Beware of hot components of the excavator such as hot oil, hot hydraulic fluid and hot coolant.
- Battery acid harms the skin and eyes.
Wear acid-proof gloves and protective goggles.
- Oil, hydraulic fluid, lubricating grease, fuel, coolant and cleaning agents harm the skin.
Use skin lotions and/ or protective equipment.
- Release the preload pressure from the hydraulic fluid tank before working on the hydraulic system.
- Switch off the electrical system with the battery isolator switch before working on the electrical system.
- Checks of the electrical system might damage it. Use therefore only a digital multimeter or a voltage tester. Do not use a test lamp.



- Note the risk of fire and explosion!
Do not smoke, do not use a naked flame,
keep a fire extinguisher ready to hand.



- Comply with environmental protection laws.
- Collect engine oil, hydraulic fluid, fuel and coolant separately and dispose of them as specified in the regulations.
- Wipe up fuel, lubricants, hydraulic fluid and coolant which have run out or been spilled, or use appropriate binding agents on them.

2 Adjustment table 1504, part 1

* Check/adjust at max. engine speed ** Check/adjust at app. 1400 rpm engine speed *** Check with hand pump					
		Index	Figure	Tolerance	Unit
1	ENGINE SPEEDS				
2	Min. idle speed		1050	+100/-50	min ⁻¹
3	Max. idle speed		2470	+50/-100	min ⁻¹
4	Nominal speed		2300	-40	min ⁻¹
5	PRIMARY VALVES				
6	Pump		50-60		bar
7					
*	8 Pressure cut-off		340	+10	bar
9					
10					
*	11				
*	12 Pilot pump		25-27		bar
*	13 Primary valve -emergency shift		22		bar
14					
15					
16					
17	POWER SHIFT CONTROLLER (delta P)				
*	18 Pump		25	+1 / -1	bar
*	19 Fine mode poti		8-25		bar
*	20 Load limit control valve (+ air pressure on hydraulic tank)		8,5	+0,2	bar
21	SECONDARY VALVES				
***	22 Lifting cylinder -raising -leak-free cut-off -line break protection valve		385	+20	bar
**	23 -Plate valve		385	+25	bar
**	24 -Lowering		365	+25	bar
25					
**	26 Jib folding cylinder (retract-extend)		365	+25	bar
27					
**	28 Bucket/Grab operating cylinder		365	+25	bar
*	29 Slewing motor -motor		50/250	+10 /+20	bar
*	30 -TC plate		220	+5 / -5	bar
31					
**	32 Drive motor -tracked		400	+20	bar
33	Drive motor -switching		300	+10	bar
34	Drive motor -switching back		130	+20	bar
**	35 Grab rotation -plate valve		210	+20	bar
36	-plate valve for quick change device and		210	+20	bar
37	trenching bucket slewable				
38	-motor		75		bar
39					
40					
2140.445.00.01.000					
1504					
 TEREX ATLAS Adjustment chart			6012270		Sheet 1

3 Adjustment table 1505, part 2

* Check/adjust at max. engine speed ** Check/adjust at app. 1400 rpm engine speed *** Check with hand pump			Index	Figure	Tolerance	Unit
	46					
	47					
	48					
	49					
	50					
	51					
	52	FEED PRESSURE VALVES				
	53	(without tank preload)				
*	54	Check valve return line		6,3		bar
*	55	Cooler protection valve		2,5		bar
	56					
	57					
	58	RETURN FLOW THROTTLES				
	59	(without implements + 15 bar)				
*	60	Lowering		50		bar
*	61	Folding		90	+10	bar
*	62	Closing bucket		80	+10	bar
	63					
	64					
	65	SPEEDS				
	66					
*	67	Slewing		8,5		min ⁻¹
2140.445.00.01.000						
1504						
 TEREX ATLAS Adjustment chart			6012270			Sheet 2

4 Adjusting instruction



WARNING

Adjustment work is performed at high pressures. Take appropriate protective action, e.g. wear protective goggles.



WARNING

Before opening any drain plugs etc., relieve the preload pressure from the hydraulic fluid tank.



NOTE

Hydraulic fluid temperature must be 40° - 60° C.

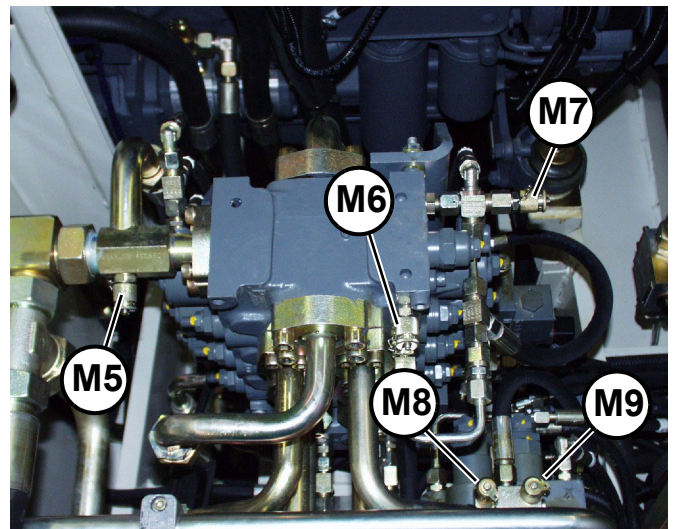
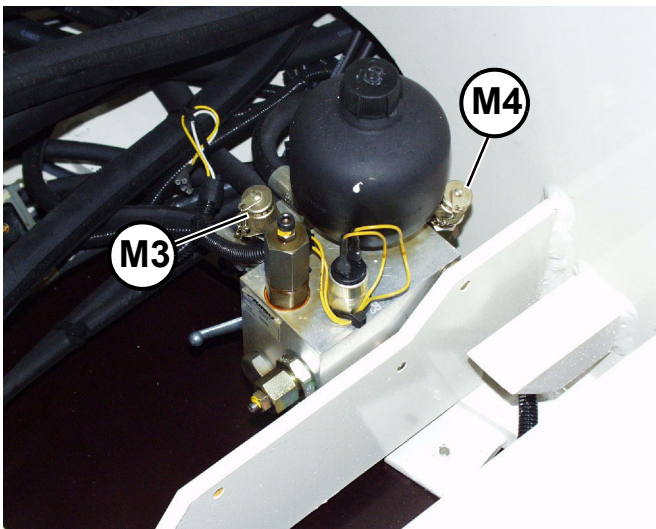
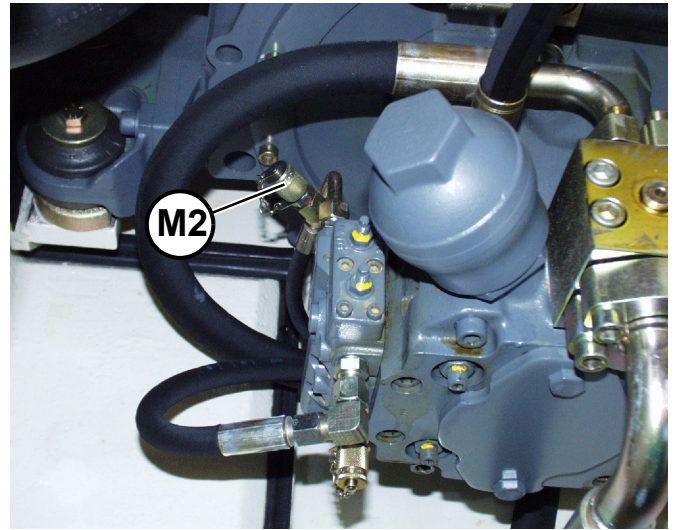
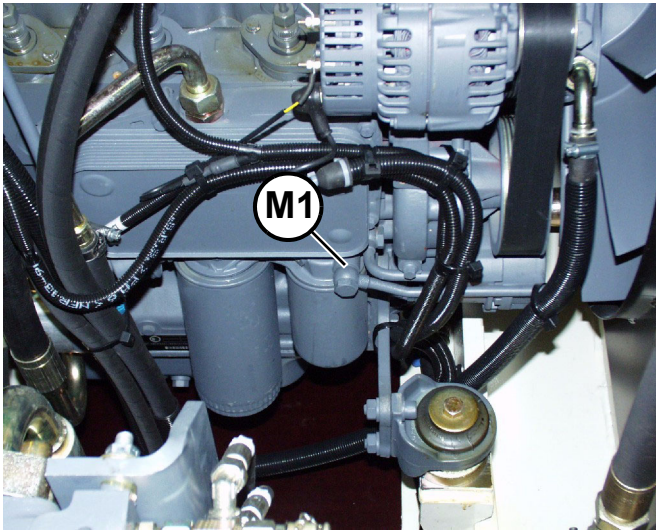
The hydraulic system comes up to operating temperature by normal actuation of the individual operating movements, but the levers must only remain at their limit stops for brief periods to avoid the damage to the excavator.



NOTE

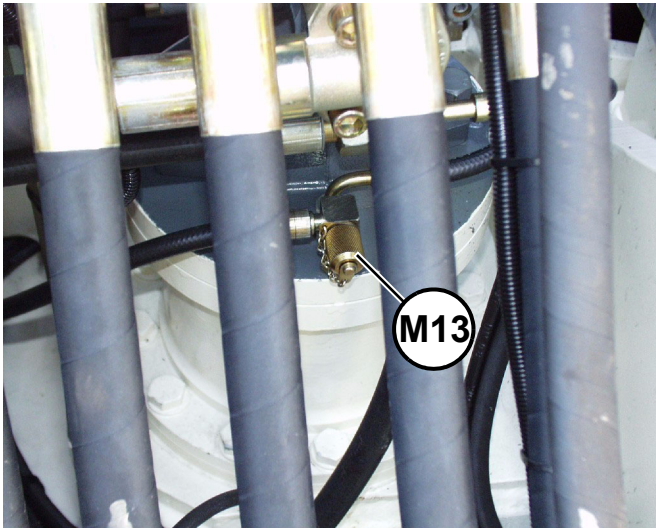
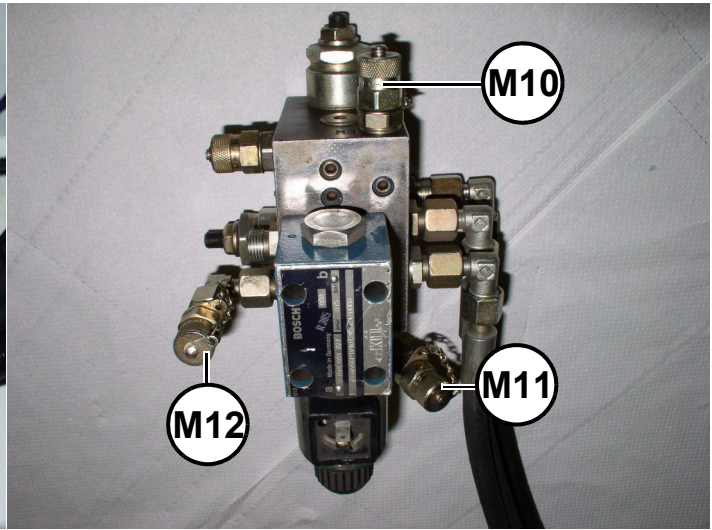
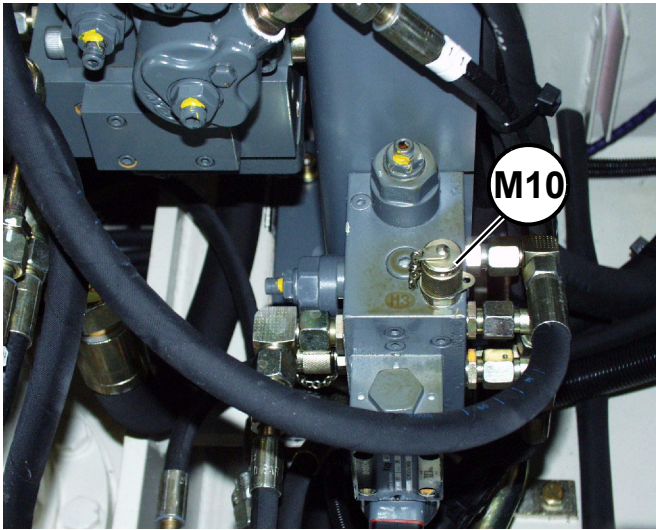
Refer to the pressure adjustment table for relevant adjustment values.

4.1 Measuring unions



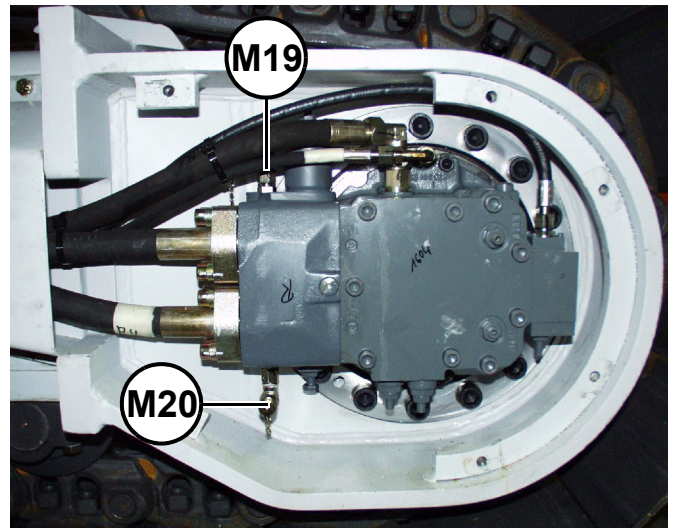
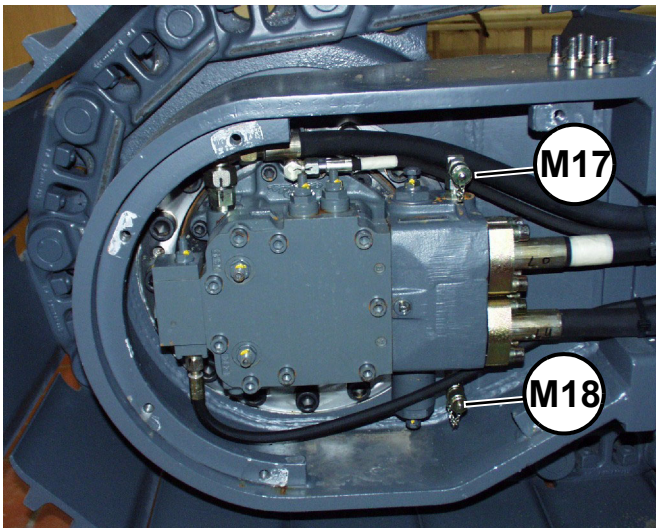
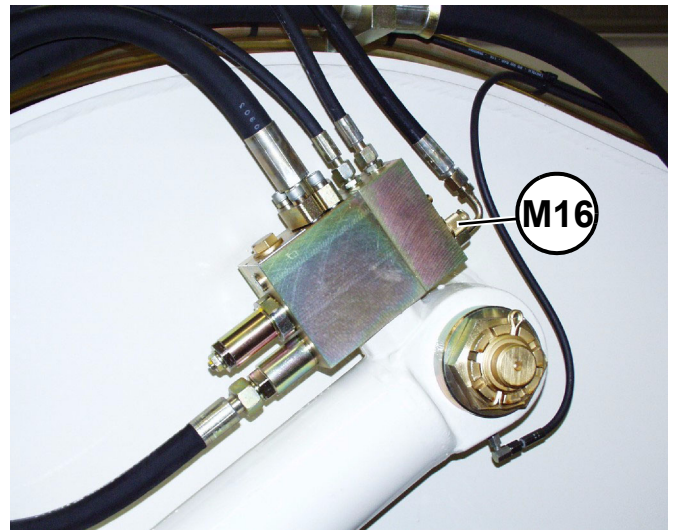
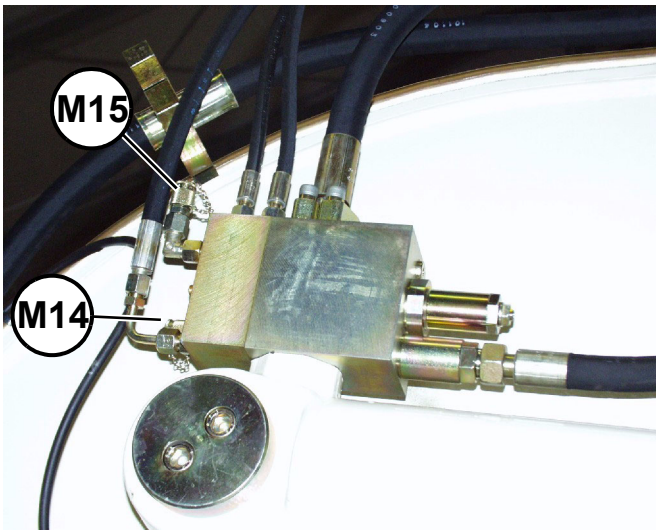
- M1 Fuel admission pressure
- M2 Load-limit pressure regulating valve
- M3 Emergency shift
- M4 Pilot control
- M5 Return line

- M6 LS-pressure
- M7 Pump
- M8 Slew to left
- M9 Slew to right



M10 Pilot pressure travel motor adjustment
M11 Travel pressure

M12 Bleeding control valve
M13 Slewing brake



- M14 Valve A static pressure
- M15 Pilot pressure lowering
- M16 Valve B static pressure
- M17 Secondary pressure forward travel, left

- M18 Secondary pressure reverse travel, left
- M19 Secondary pressure forward travel, right
- M20 Secondary pressure reverse travel, right

4.2 Bleeding the system



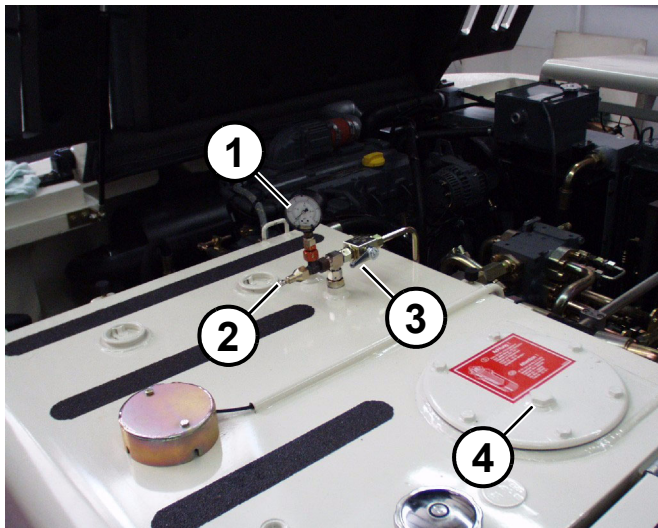
WARNING

Before starting up for the first time or after exchanging the pump, it is necessary to bleed the system.

If the system is not bled, the pump could be damaged during operation, since the pump will not be lubricated sufficiently.

When starting up for the first time and after repairing the control valve, all system must be bled additionally, see section 4.18 on page 62.

4.2.1 Bleeding hydraulic fluid tank



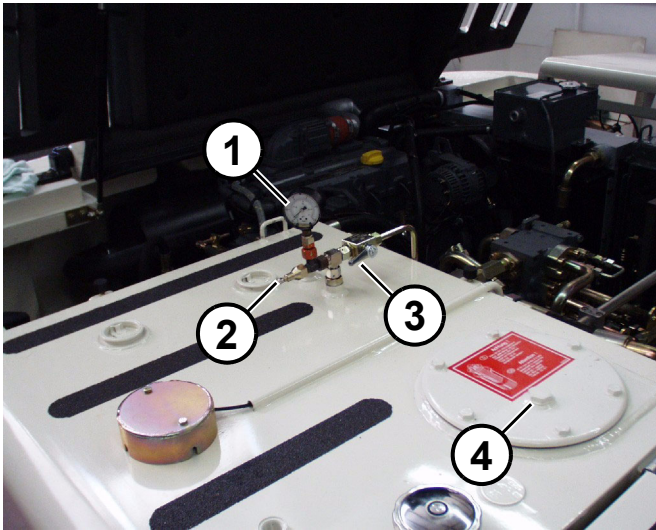
1. Connect a pressure gauge (1) to compressed air union (2).
2. Pressurise the hydraulic fluid tank with external compressed air supply via the union (2).



WARNING

The pressure gauge reading must not exceed 0.5 bar.

3. Open the valve (3).
4. Slacken off bleed screw (4).
5. Tighten the bleed screw, as soon as the hydraulic fluid emerging from there is free from air bubbles.



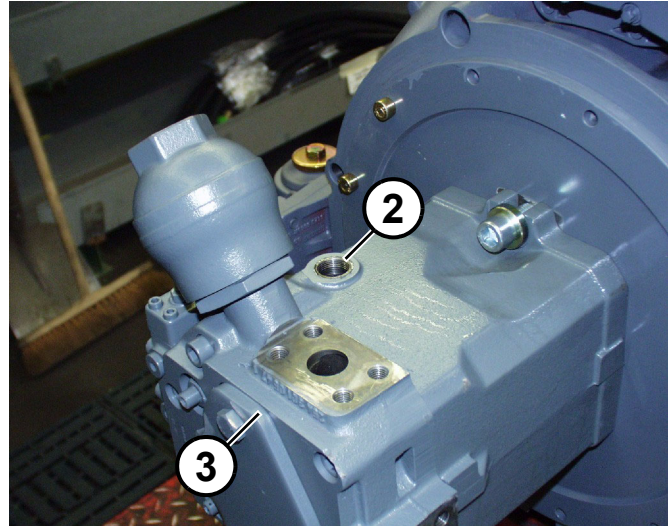
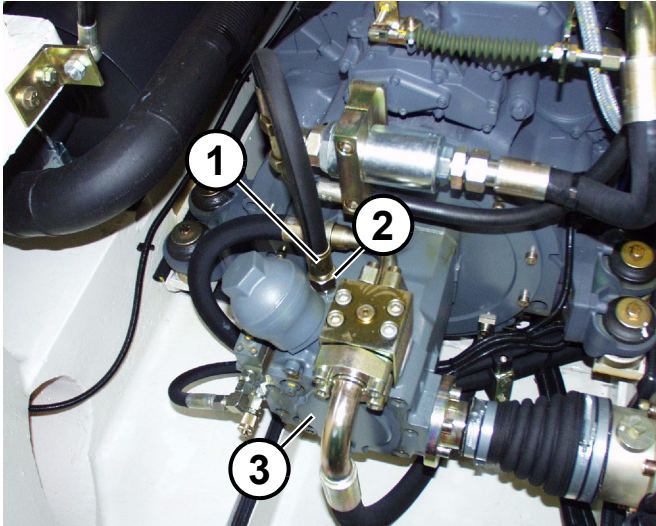
6. Close the valve (3).
7. Disconnect the external compressed air supply.
8. Remove the pressure gauge (1).

4.2.2 Bleeding hydraulic pump



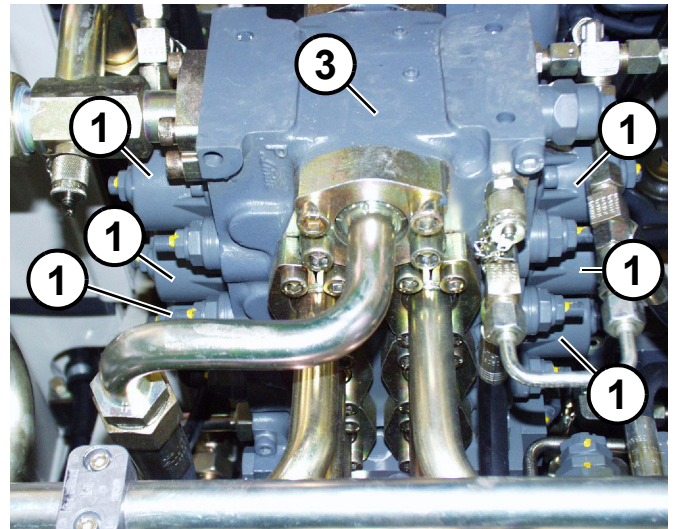
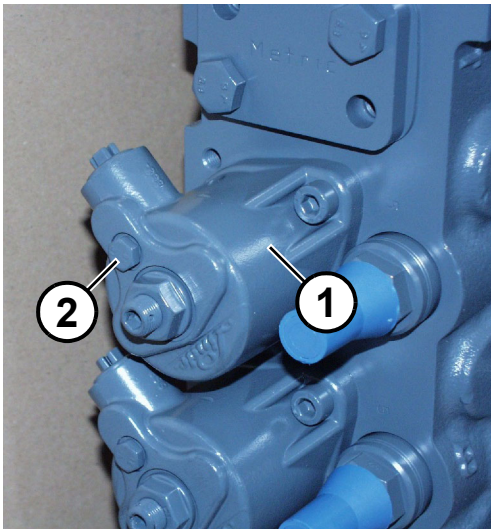
WARNING

Make sure that the pressure from the hydraulic pipe is completely released.

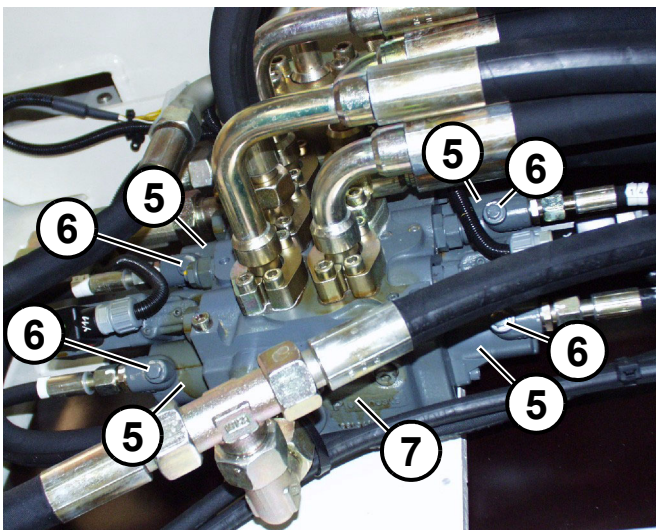


1. Disconnect the hydraulic pipe (1) at the screw connection (2) in the hydraulic pump (3).
2. Fill the hydraulic pump (3) with hydraulic fluid via the screw connection (2) up to the edge of the screw connection (2).
3. Connect the hydraulic pipe (1) at the screw connection (2) in the hydraulic pump (3).

4.2.3 Bleeding valve caps



1. Pressurise the system with external compressed air supply, see section 4.2.1 on page 12.
2. Slacken off the corresponding bleed screw (2) on the control block (3) to bleed the valve caps (1).



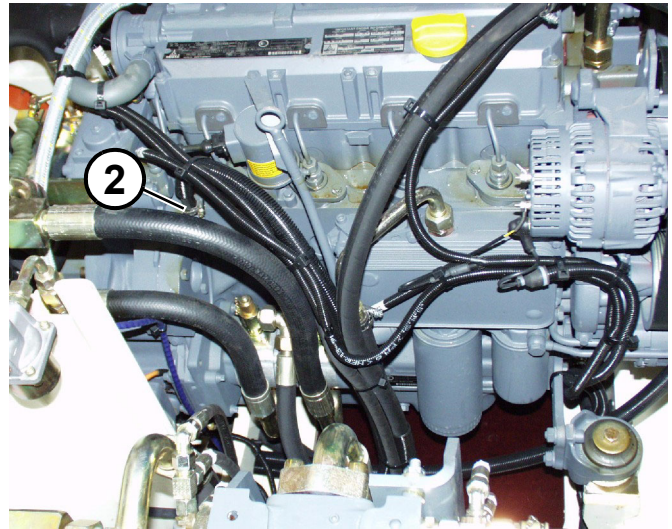
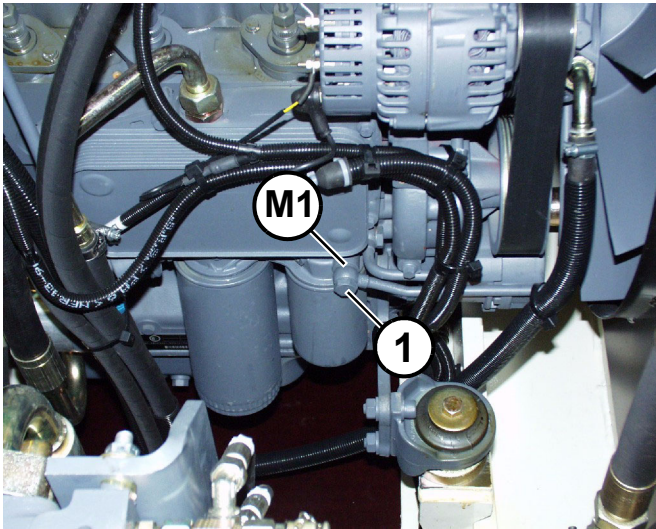
3. Slacken off the corresponding bleed screw (6) on the control block of secondary functions (7) to bleed the valve caps (5).

4.3 Fuel admission pressure



NOTE

Replace the fuel filter before checking the fuel admission pressure.



1. Remove the hollow screw (1) from measuring union "fuel admission pressure" (M1).
2. Screw in a suitable adapter, and connect the pressure gauge.
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. The fuel admission pressure on measuring union "fuel admission pressure" (M1) should read between 5 bar and 5.5 bar.



NOTE

Check the pressure-holding valve (2), in case fuel admission pressure is insufficient.

6. Switch off the engine.
7. Remove the adapter and the pressure gauge.
8. Close measuring union "fuel admission pressure" (M1) with the hollow screw (1).

4.4 Engine speed control



NOTE

Checking and adjusting the engine speed control is necessary, only if repair work on engine speed control is carried out, or the electronic box has been replaced.



NOTE

Check the fuel admission pressure before adjusting the engine speed control, see section 4.3 on page 16.

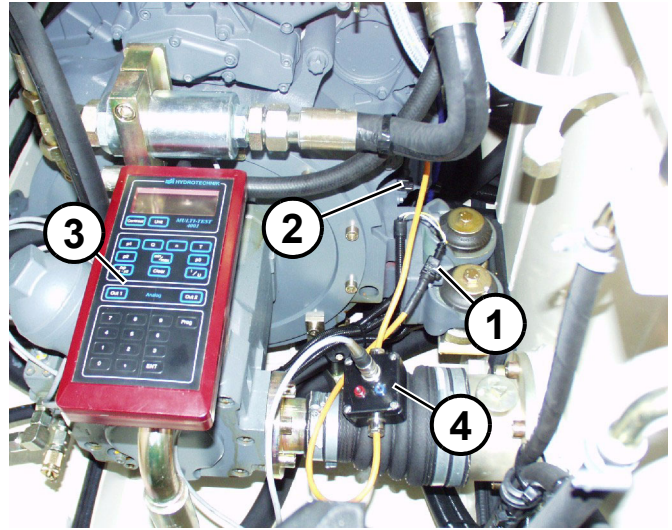
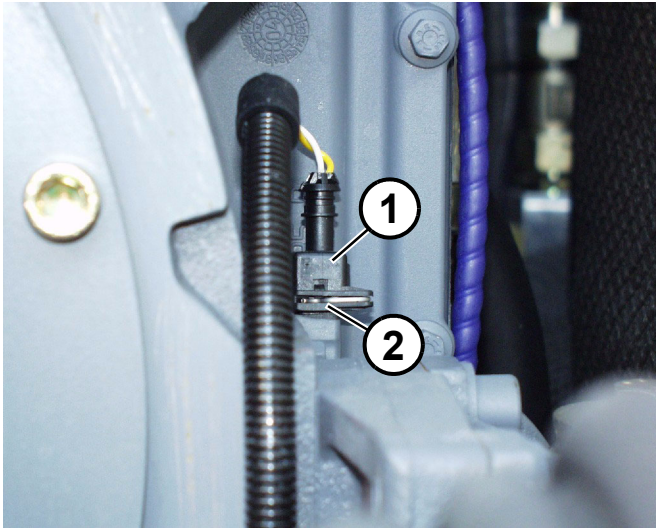


NOTE

In case bowden cable needs to be replaced, note the following:

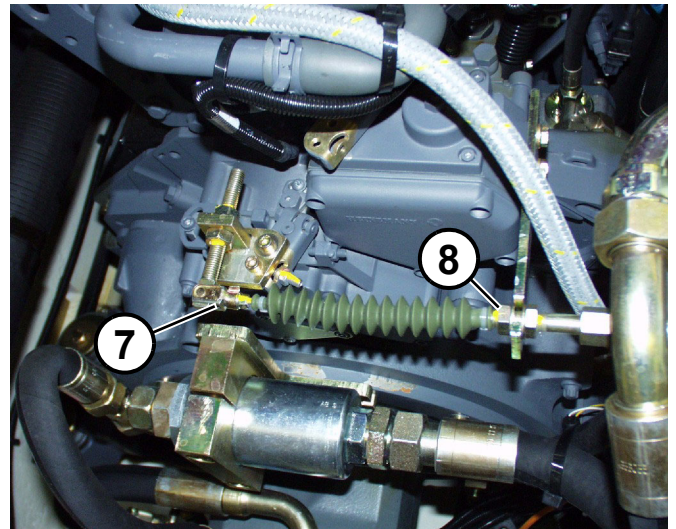
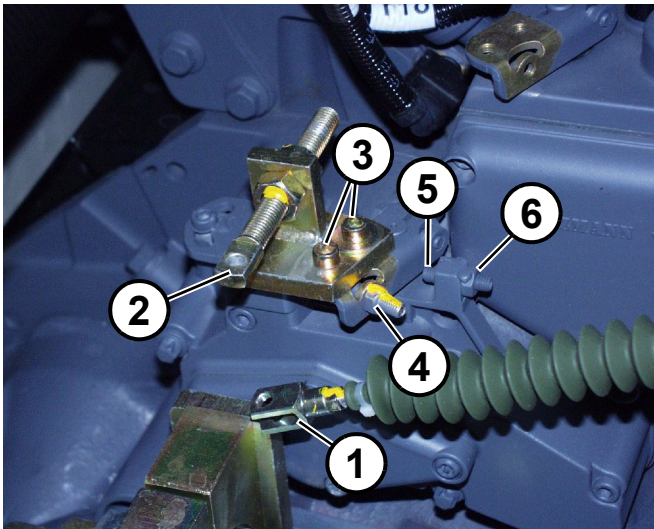
- Ensure that the bowden cable is not twisted when fixing it.
- In the speed adjusting device, trim off the rest of the bowden cable immediately after the clamping screw.
- When assembling the speed adjusting device, ensure that the converter drive plate is in the correct position.

4.4.1 Speed measurement



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Remove the connector (1) from the speed sensor (2).
3. Connect up revolution counter (3) through a suitable adapter (4) between the speed sensor (2) and the connector (1).
4. Set the revolution counter (3) to 129 pulses per revolution.

4.4.1.1 Minimum engine speed



1. Disengage fork head (1).
2. Position the threaded rod (2) of the speed adjustment parallel to the crankshaft.
3. Correct if necessary at the adjusting screws (3).
4. Start the engine.
5. The minimum engine speed displayed must be $(1050 +100 / -50)$ rpm.
6. Correct if necessary at the adjusting screws (4).

4.4.1.2 Maximum engine speed

1. Move the speed adjustment at the threaded rod (2) towards the stop (5) by hand.
2. The maximum engine speed displayed must be $(2470 +50 / -100)$ rpm.
3. Correct if necessary at the adjusting screws (6).
4. Switch off the engine.

4.4.2 Bowden-cable play

1. Connect the fork head (1) without any play. The bowden-cable should **not hang down slack**.

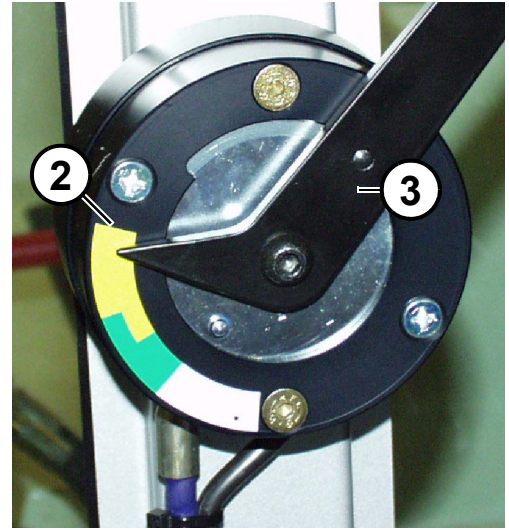
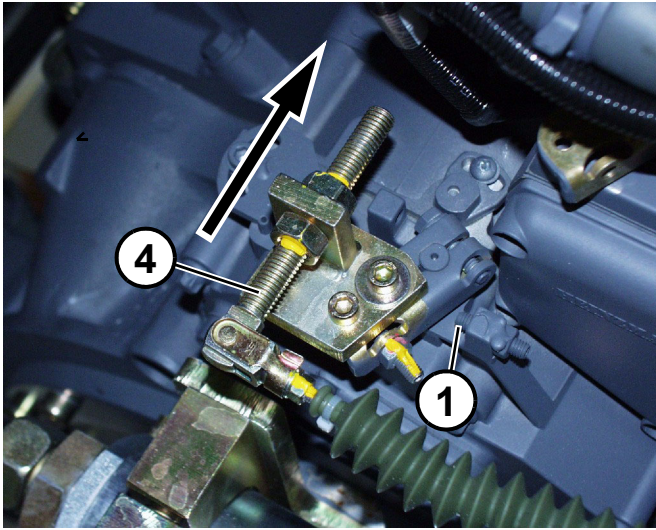


NOTE

Ensure that the split pin (7) is in the correct position.

2. Correct the bowden-cable play, if necessary at the adjusting screw (8).

4.4.3 Mechanical stop



NOTE

The maximum mechanical stop (1) for the controller should be located shortly before the stop position (2) for the speed adjusting lever (3).

1. Correct the mechanical stop if necessary at the threaded rod (4) on the speed adjustment (engine control).



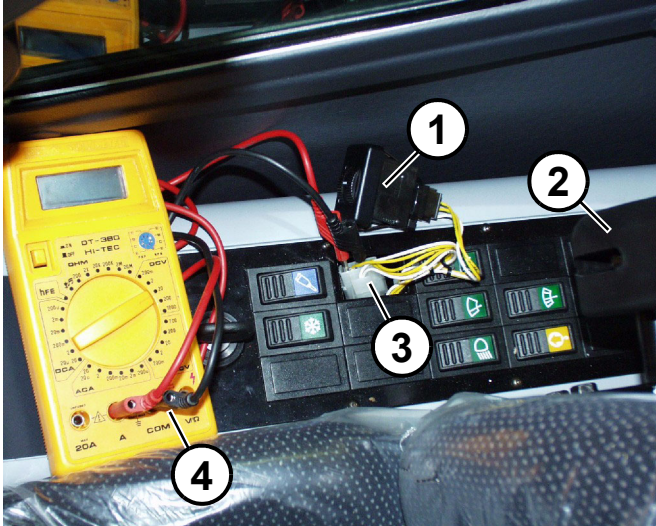
NOTE

If the threaded rod is adjusted in arrowed direction, the stop position on the speed adjusting lever (3) is reached later.

If the threaded rod is adjusted against arrowed direction, the stop position on the speed adjusting lever (3) is reached earlier.

4.4.4 Speed adjusting lever

4.4.4.1 Checking



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Pull out the rotary switch (1) on the right-hand armrest console (2).
3. Connect an appropriate voltmeter (4) to the three-pole plug (3) of the rotary switch (1).

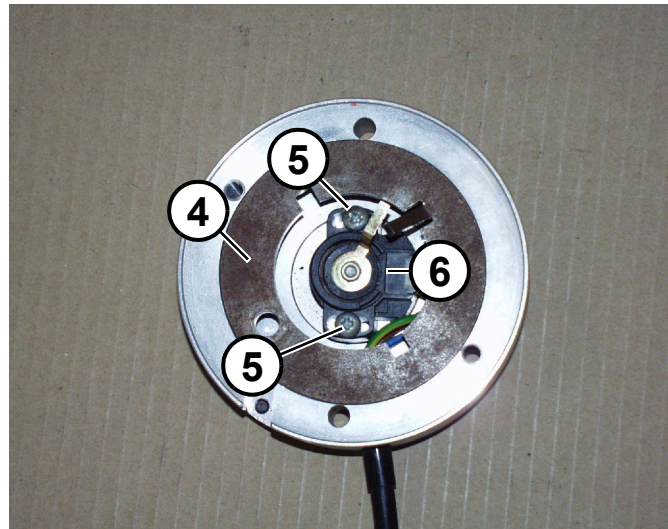
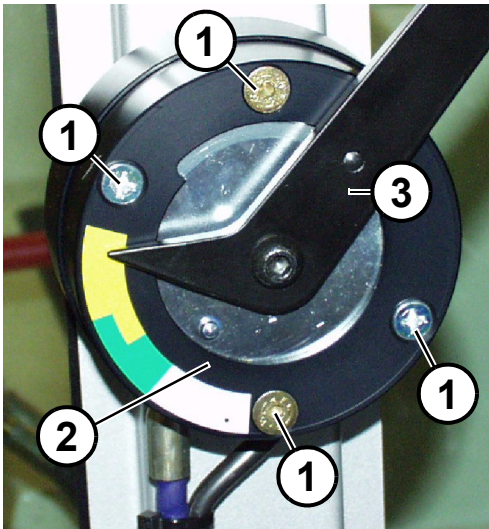


NOTE

Connect the voltmeter earth to the plug-in connection (green/yellow) of the three-pole plug (3).
Connect the voltmeter input to the plug-in connection (brown) of the three-pole plug (3).

4. Switch on the ignition, ignition key in position "I".
5. Move the engine speed adjusting lever to the minimum speed position (to its stop). The voltage should be between 0.15 Volt and 0.60 Volt.
6. Move the speed adjusting lever to the maximum speed position (to its stop). The voltage should be between 4.00 Volt and 4.85 Volt.
7. Switch off the ignition, ignition key in position "0".
8. Correct if necessary, see section 4.4.4.2 on page 22, and after that check the voltage once again (steps 4 to 8).
9. Remove the voltmeter (4).
10. Put the rotary switch (1) back in place on the right-hand armrest console (2).

4.4.4.2 Setting



1. Screw out four screws (1) and remove the cover (2) together with speed adjusting lever (3).
2. Impress the correct position of the drive plate (4).
3. Remove the drive plate (4).



NOTE

Check, if the rest of the bowden cable in the speed adjusting device is immediately trimmed off after the clamping screw. Trim off if necessary.

4. Slacken off both screws (5).
5. Rotate the potentiometer (6) to adjust if necessary.

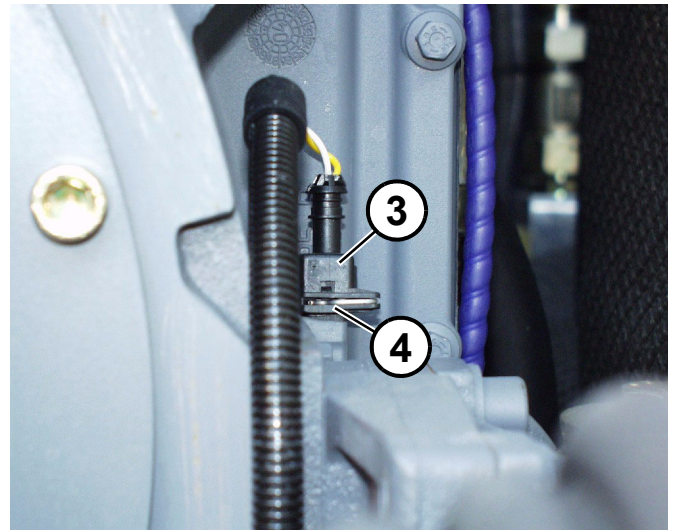
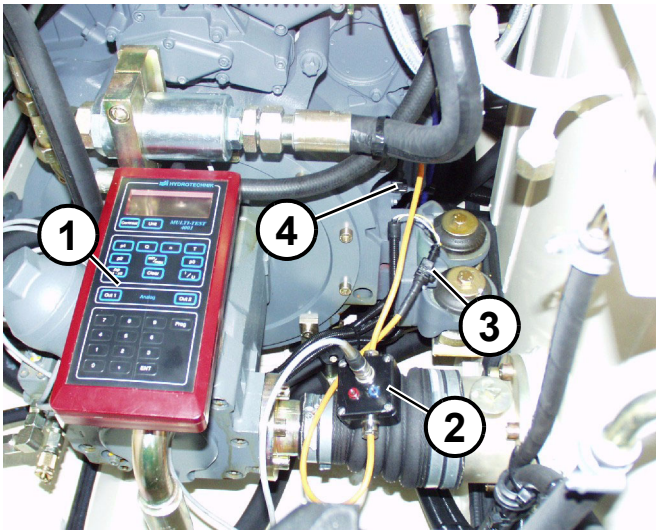


NOTE

If the potentiometer is rotated clockwise, the voltage drops.

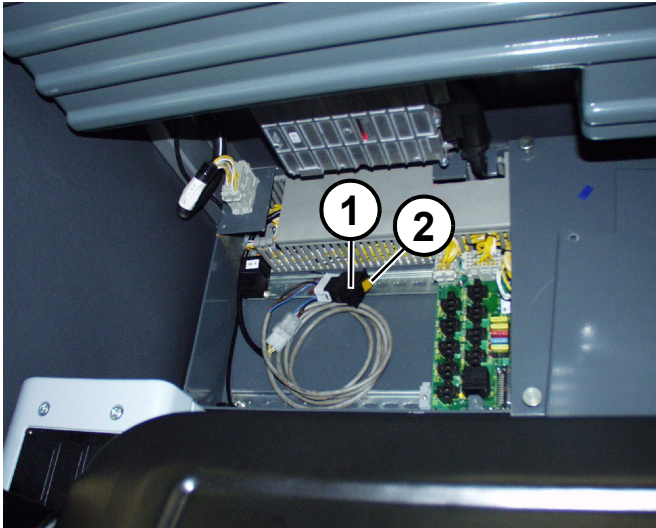
6. Tighten both screws (5).
7. Engage the drive plate (4). When assembling, ensure that the drive plate (4) is in the correct position.
8. Fix the cover (2) together with speed adjusting lever (3) back in again and fasten four screws (1).

4.4.5 Testing speed



1. Start the engine.
2. Check the speed at minimum speed position (to its stop) and at maximum speed position (to its stop) in the engine speed adjusting lever.
3. Switch off the engine.
4. Repeat the entire adjusting procedure if necessary, see section 4.4.4.2 on page 22.
5. Remove the revolution counter (1) and the adapter (2).
6. Connect the plug (3) to the speed sensor (4).

4.5 Teach-in the electronic box



NOTE

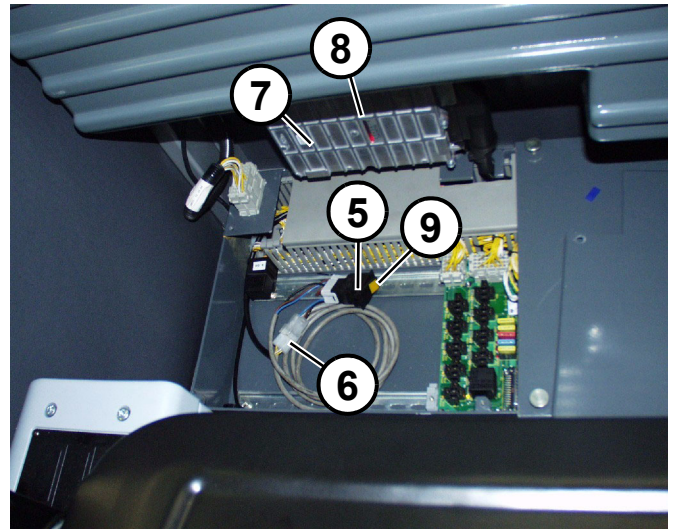
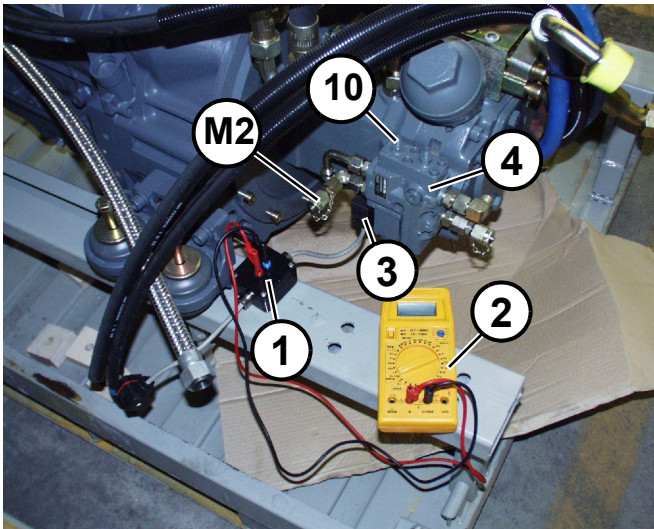
The teach-in procedure can be interrupted at any time. Hold the teach-in switch (1) depressed until the telltale (2) in the teach-in switch (1) goes out.



NOTE

The teach-in procedure is interrupted if the ignition is switched off. The last teach-in characteristic which have been determined remains valid.

4.5.1 Load-limit regulating valve



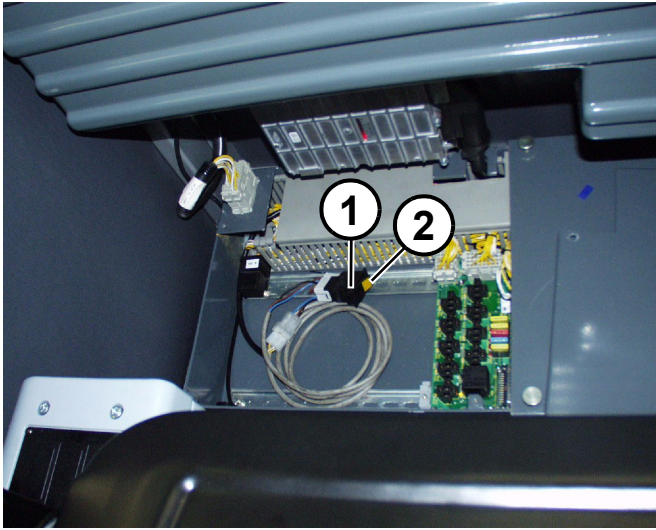
1. Connect a pressure gauge to the measuring union "load-limit regulating valve" (M2).
2. Connect the electronic measuring instrument (2) between the plug (3) and the connecting line of the load-limit regulating valve (4) via an appropriate adapter (1).
3. Connect the teach-in switch (5) into plug (6) to the electronic box (7).
4. Switch on the ignition, ignition key in position "I". The red LEDs 1 - 8 (8) in the electronic box (7) must come on for about 3 seconds (bulb test). After that the LED 1 ("speed sensor") remains on. If the electronic box (7) has been exchanged, the LED 8 ("teach-in phase") lights up additionally, see troubleshooting table, see section 4.6.2 on page 29.
5. Start the engine. The LED 1 ("speed sensor") must go out.
6. Move the engine speed adjusting lever to the minimum speed position (to its stop).
7. Press the teach-in switch (5) for about 5 seconds. Telltale (9) in teach-in switch lights up (permanently). A control current (300 +/- 5) mA now emitted by the electronic box (7) energises the load-limit regulating valve (4). The control pressure shown in the pressure gauge display falls to about 2 to 5 bar, then slowly rises to the set value of (8.5 +/- 0.2) bar plus the tank delivery pressure.
8. Correct this value at the adjusting screw (10) if necessary.
9. Quit the teach-in procedure by pressing the teach-in switch (5) for about 1 second. Telltale (9) starts flashing.



NOTE

If only the load-limit regulating valve is to be adjusted, press the teach-in switch (5) until telltale (9) goes out and continue with step 24 on page 27.

4.5.2 Engine speed



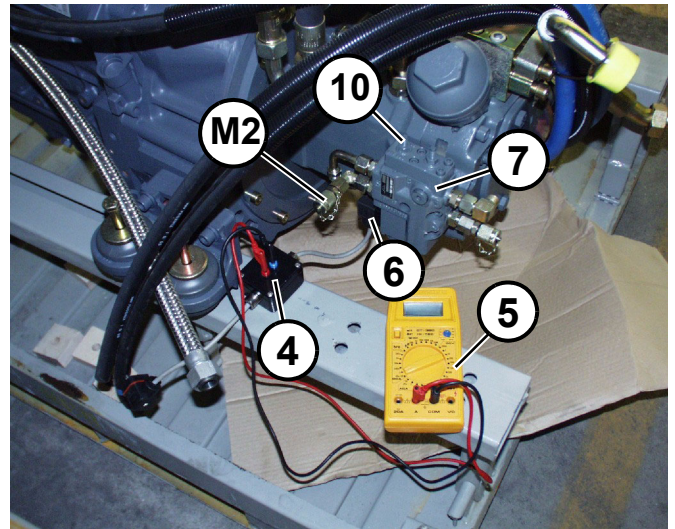
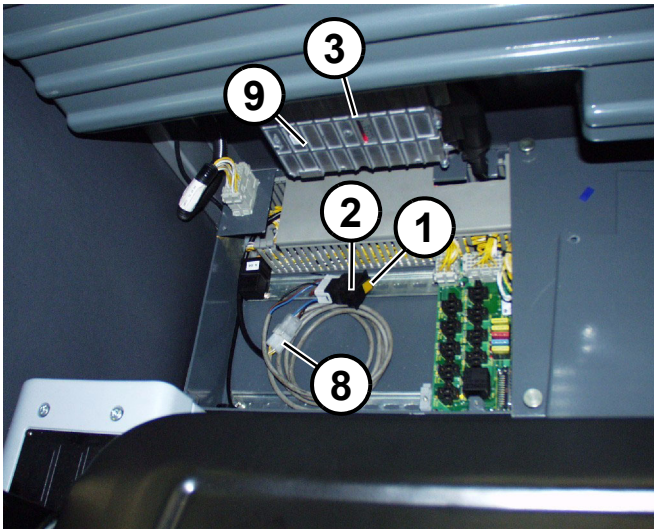
4.5.2.1 Maximum engine speed

10. Move the engine speed adjusting lever to the maximum speed position (to its stop).
11. Wait for the engine speed to settle down.
12. Press the teach-in switch (1) for about 1 second. Telltale (2) starts flashing rapidly.

4.5.2.2 Minimum engine speed

13. Move the engine speed adjusting lever to the minimum speed position (to its stop).
14. Wait for the engine speed to settle down.
15. Press the teach-in switch (1) for about 1 second. Telltale (2) starts flashing, with "on" flashing phase longer than the "off" phase.

4.5.2.3 Four points on the speed characteristic



16. **Slowly** raise the speed with the engine speed adjusting lever until telltale (1) stops flashing and remains on permanently.
17. Wait for the engine speed to settle down.
18. Press the teach-in switch (2) for about 1 second. Telltale (1) starts flashing, with "off" phase longer than the "on" flashing phase.
19. Repeat each step from 16 to 18 two more times without exceeding the set value. Raise the speed **slowly** during the procedure.



NOTE

If telltale (1) in the teach-in switch (2) flashes rapidly, the set value has been exceeded. Move the speed adjusting lever back to minimum engine speed (to its stop) and start with step 16 again.

20. Move the engine speed adjusting lever to the maximum speed position (to its stop).
21. Wait for the engine speed to settle down.
22. Press the teach-in switch (2) for about 1 second. Telltale (1) flashes for about 1 second and then goes out.
23. LED 8 (3) goes out. The teach-in procedure is then complete.
24. Switch off the engine, ignition key in position "0" (the ignition is switched off).
25. Remove the pressure gauge.
26. Remove the adapter (4) and the electronic measuring instrument (5).
27. Connect the plug (6) and the connecting line of the load-limit regulating valve (7).
28. Remove the teach-in switch (2) from the plug (8) in the electronic box (9).

4.6 Error diagnosis

4.6.1 General notes



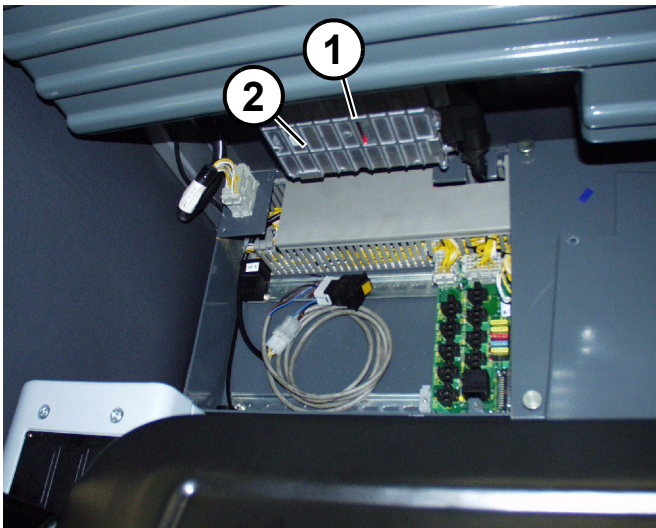
NOTE

Error diagnosis can only be performed while the engine is running.



NOTE

Not all faults in the electronics unit and the load-limit regulation system are displayed by a continuous light at the indicator lamps (GLR) on the display panel.



NOTE

Fault displays are issued automatically: the appropriate LED (1) in the cover (2) of the electronic box lights up, see section 4.6.2 on page 29.



NOTE

Once the ignition key has been switched into position "I", all LEDs (1) lights up for about 3 seconds (bulb test).

4.6.2 Troubleshooting table



NOTE

The troubleshooting table display for LED in the electronic box is shown from top to bottom. The downmost is LED 1, the upmost is LED 8.

LED	Component	GLR indicator lamp
8	Electronic box teach-in phase not completed or faults occurred during the teach-in phase ¹	flashes
7	Connection between electronic box and computer circuit board broken or pressure switch on	-
6	LS-magnet in load-limit regulating valve	lights up
5	Electronic box	lights up
4	Voltage supply of potentiometer for speed adjusting lever and Δp -lowered (delta p)	lights up
3	-	-
2	Pressure switch "driving" ² and "kickdown" ² switch	-
1	Speed sensor	lights up

¹ see section 4.6.2.2

² see section 4.6.2.1

4.6.2.1 LED 2

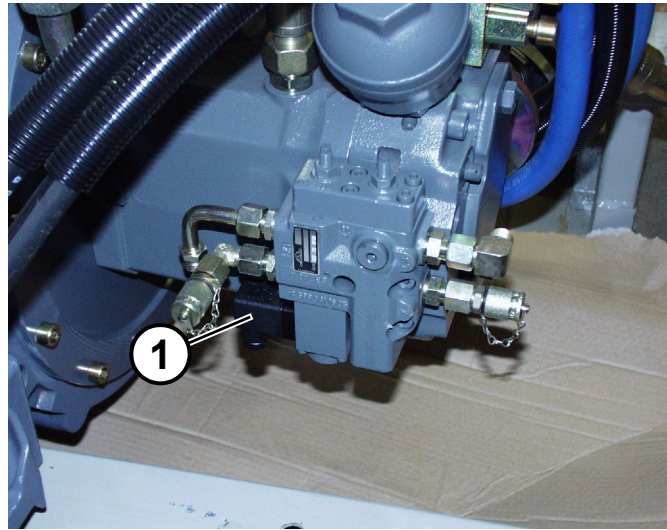
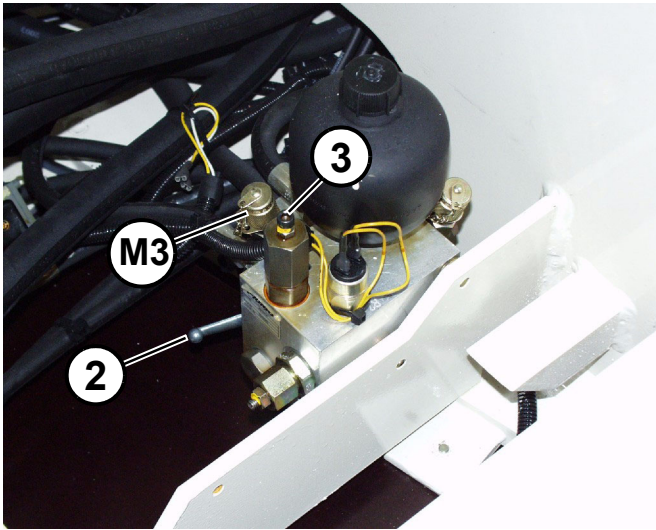
LED 2 comes on for about 3 seconds, when the appropriate contacts "driving" or "kickdown" are opened or closed.

4.6.2.2 LED 8

LED 8 indicates various faults. The following faults are displayed by flashing in different ways:

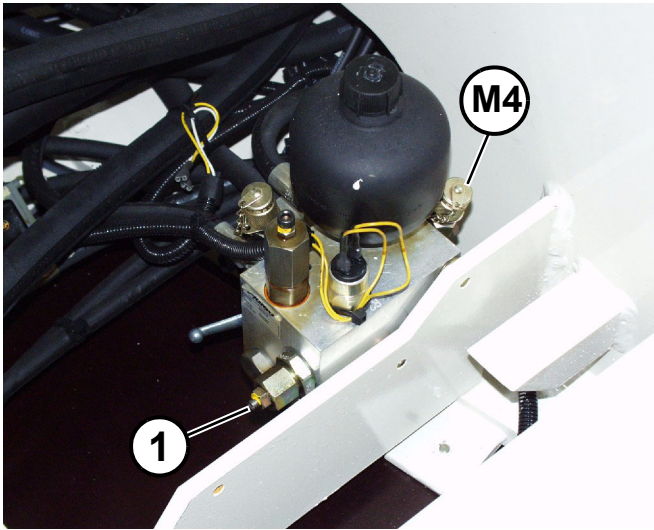
LED 8 flashes:	Faults
1 flash	Minimum engine speed outside tolerance range
2 flashes	Maximum engine speed outside tolerance range
3 flashes	Engine speed - potentiometer voltage outside tolerance range
4 flashes	Engine speed - potentiometer faulty

4.7 Emergency shift



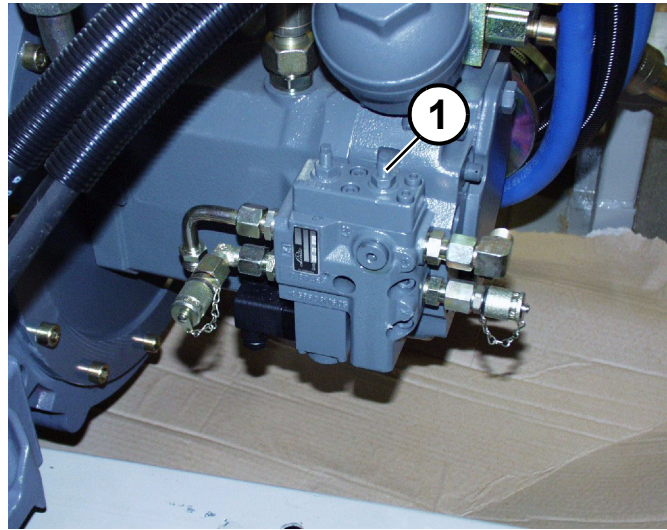
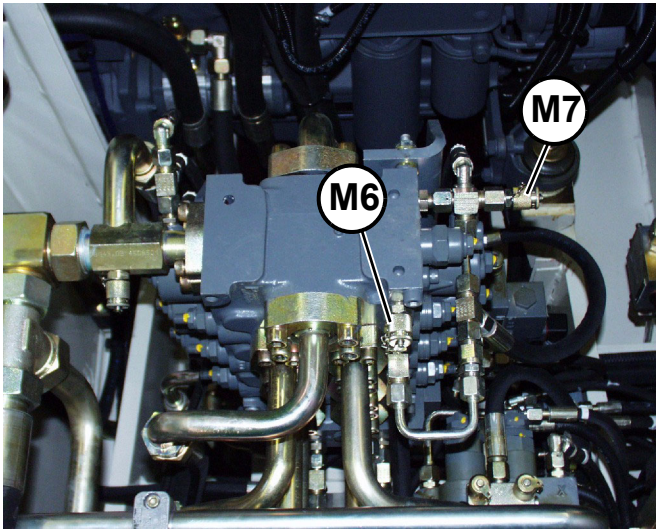
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "emergency shift" (M3).
3. Remove the plug (1) from the load-limit regulating valve.
4. Activate the emergency shift by switching the control lever (2) to a vertical position.
5. Start the engine.
6. Move the engine speed control lever to the maximum speed position (to its stop).
7. Adjust the set pressure value for the pressure limiting valve of emergency shift by screwing in/out the adjusting screw (3).
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Deactivate the emergency shift by switching the control lever (2) to the original horizontal position.
10. Connect the plug (1) to the load-limit regulating valve.
11. Remove the pressure gauge from the measuring union "emergency shift" (M3).

4.8 Pilot control



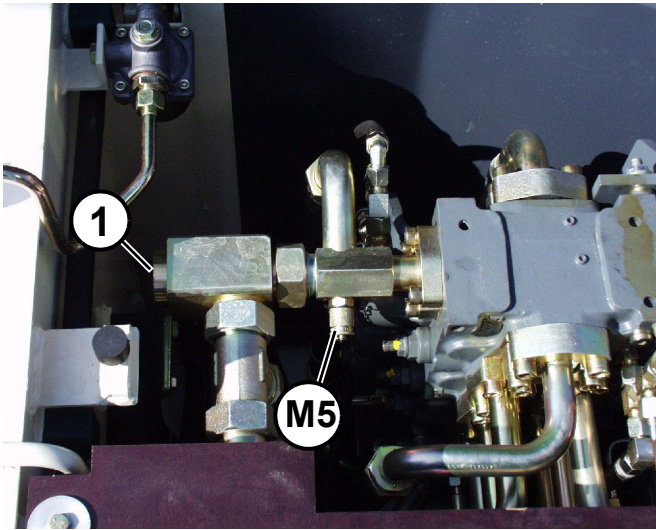
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "pilot control" (M4).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Adjust the set pressure value for the pilot control pump by screwing in/out the adjusting screw (1).
6. Switch off the engine, ignition key in position "0" (the ignition is switched off).
7. Remove the pressure gauge.

4.9 LS-controller



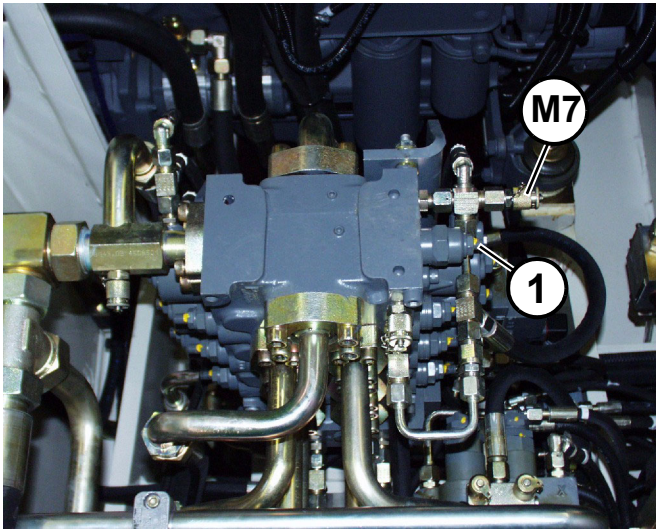
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect the differential pressure measurement to the measuring union "pump" (M7) and "LS-controller" (M6).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Slowly select the "raising" function.
6. Adjust the set pressure value for differential pressure of the LS-controller by screwing in/out the adjusting screw (1).
7. Switch off the engine, ignition key in position "0" (the ignition is switched off).
8. Remove the differential pressure measurement.

4.10 Return line control block



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "return line" (M5).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Activate any hydraulic function, such as the "jib folding out" function.
6. The pressure on measuring union "return line" (M5) should be 7 bar while the hydraulic function is activated.
7. Correct the pressure at the adjusting screw on the valve (1) if necessary.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge.

4.11 Pressure cut-off device



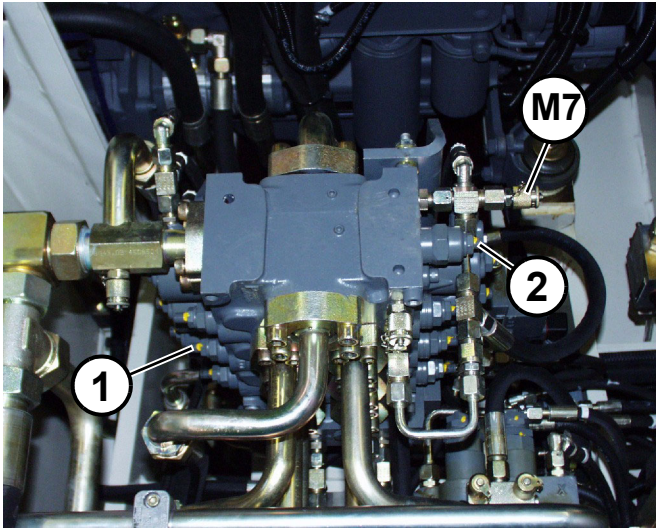
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "pump" (M7).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Move "jib folding out" function to its stop position and hold it.
6. Adjust the set pressure value for pressure cut in stage by screwing in/out the adjusting screw (1).
7. Lower the boom/jib.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge.

4.12 Secondary valves

Before adjusting the secondary valves, the pressure P must be raised by adjusting at the pressure cut-off device, see section 4.12.1 on page 36.

After adjusting the secondary valves, the pressure P must be set to the correct value by adjusting at the pressure cut-off device, see section 4.12.7 on page 42.

4.12.1 Raising pressure P



1. Connect a pressure gauge to measuring union "pump" (M7).
2. Start the engine.
3. Set the engine speed to approx. 1700 rpm.
4. Move "jib folding out" function to its stop position and hold in place. The pressure of the "jib folding out" is displayed at measuring union "pump" (M7).
5. Tighten the adjusting screw (1) for the secondary valves "jib folding out" by approx. one turn. The pressure at measuring union "pump" (M7) is now limited by the pressure cut-off device while the "jib folding out" function is active.

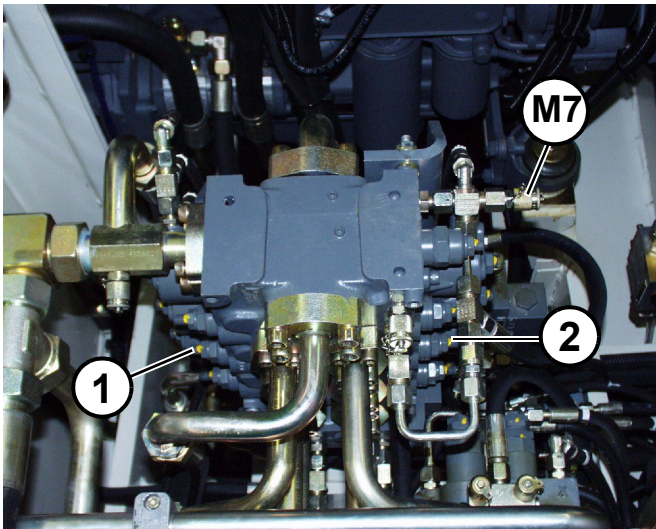


WARNING

The pressure displayed at measuring union "pump" (M7) should not exceed 460 bar during the following adjustments.

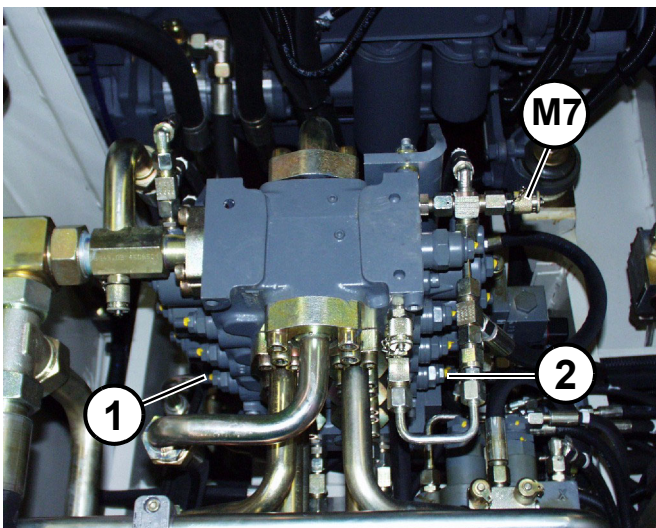
6. Move "jib folding out" function to its stop position and hold it. The pressure of the pressure cut-off device is displayed at measuring union "pump" (M7).
7. Tighten the adjusting screw (2) for the pressure cut-off device to set the pressure at measuring union "pump" (M7) 20 bar above the maximum secondary pressure setting.
8. Repeat steps 6 to 8 as necessary.

4.12.2 Adjusting secondary valve "jib folding in/out"



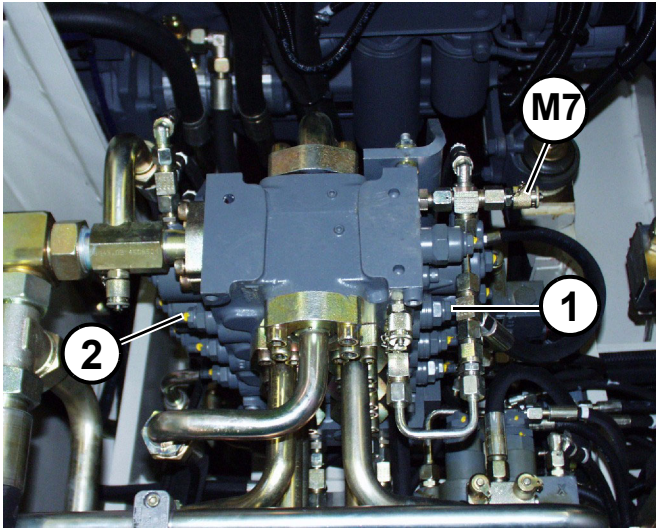
1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "jib folding out" (1) or "jib folding in" (2).

4.12.3 Adjusting secondary valve "opening/closing bucket"



1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "opening bucket" (1) or "closing bucket" (2).

4.12.4 Adjusting secondary valve "raising/lowering"



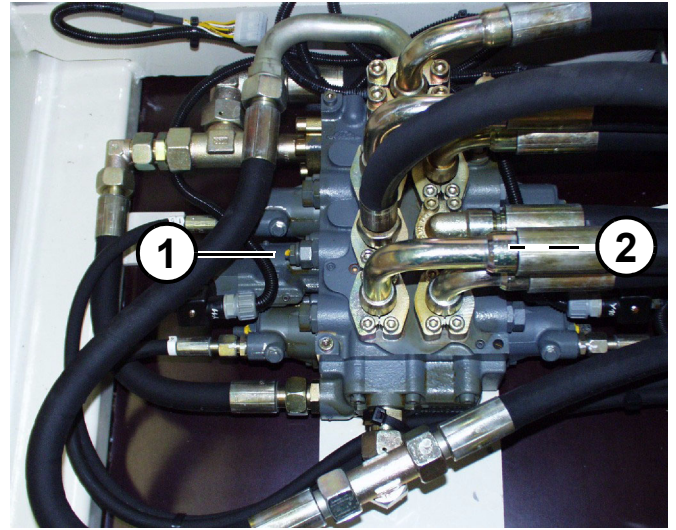
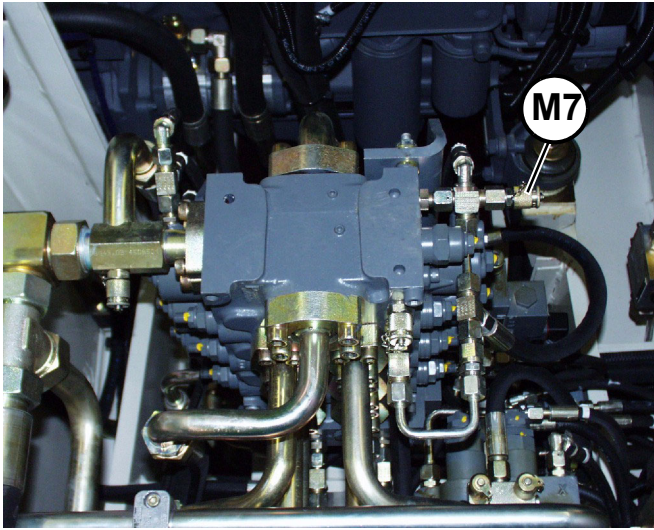
1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "raising" (1) or "lowering" (2).



NOTE

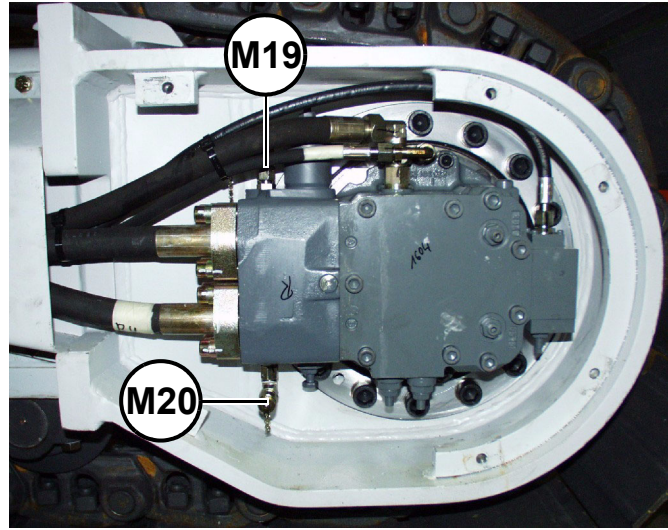
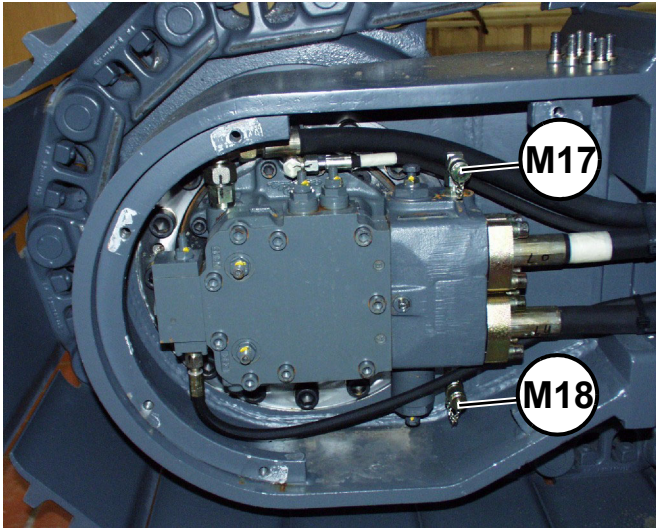
If the prescribed pressure value for the secondary valve is not reached, check the adjustment of the line break protection valve at the lifting cylinder, see section 4.20 on page 66.

4.12.5 Adjusting secondary valve "grab rotation"

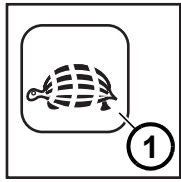


1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "rotate to right" (1) or "rotate to left" (2).

4.12.6 Adjusting secondary valve "travel"

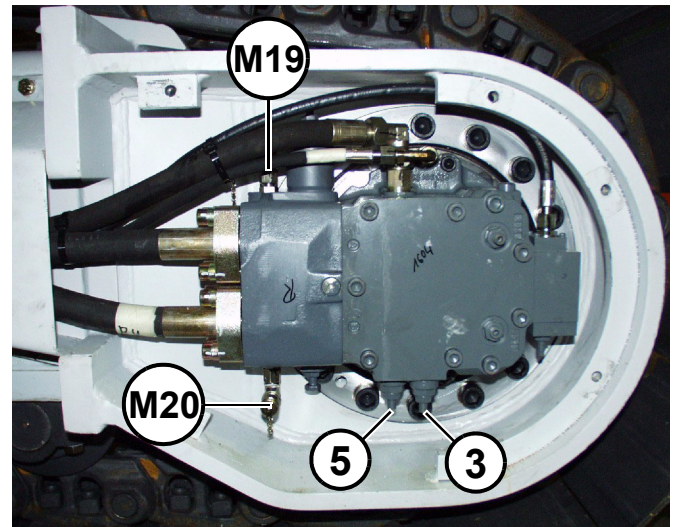
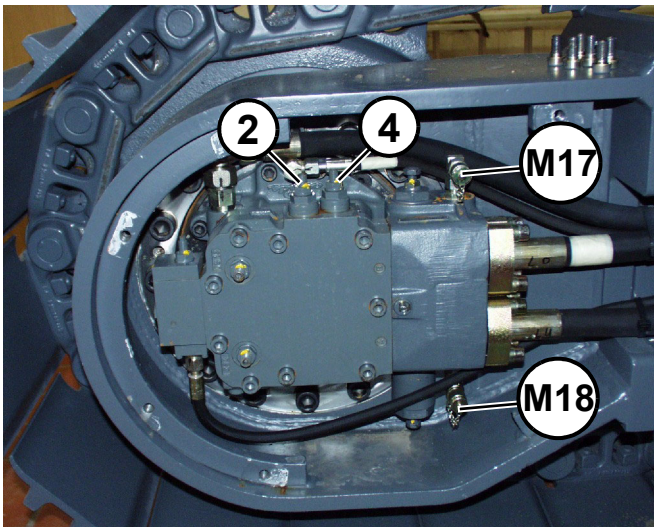


1. Lock the drive units, see section 4.16.1 on page 57.
2. Connect pressure gauges to measuring union "secondary pressure forward travel, left" (M17), "secondary pressure reverse travel, left" (M18), "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).
3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.
5. Shift selector switch to crawler speed I ("higher speed").



WARNING

Ensure that the selector switch is shifted to position crawler speed I ("higher speed"), the symbol (1) "turtle" in the display panel should not light up, otherwise the disc break can be destroyed.



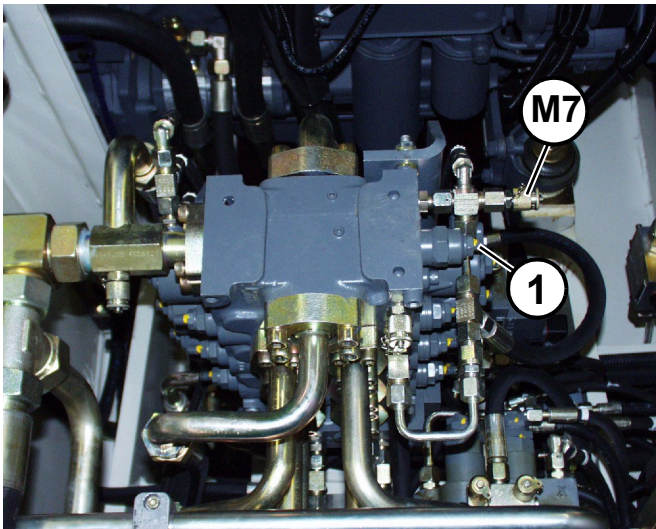
6. The pressure of secondary valve is displayed at the measuring union "secondary pressure forward travel, left" (M17), "secondary pressure reverse travel, left" (M18), "secondary pressure forward travel, right" (M19) or "secondary pressure reverse travel, right" (M20). Check each crawler track **separately** by operating the control handle.
7. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "forward travel" (2) or (3), and/or "reverse travel" (4) or (5), located on both inner back sides of the crawler unit.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauges from measuring union "secondary pressure forward travel, left" (M17), "secondary pressure reverse travel, left" (M18), "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).
10. Release the drive units, see section 4.16.2 on page 59.

4.12.7 Adjusting pressure P



WARNING

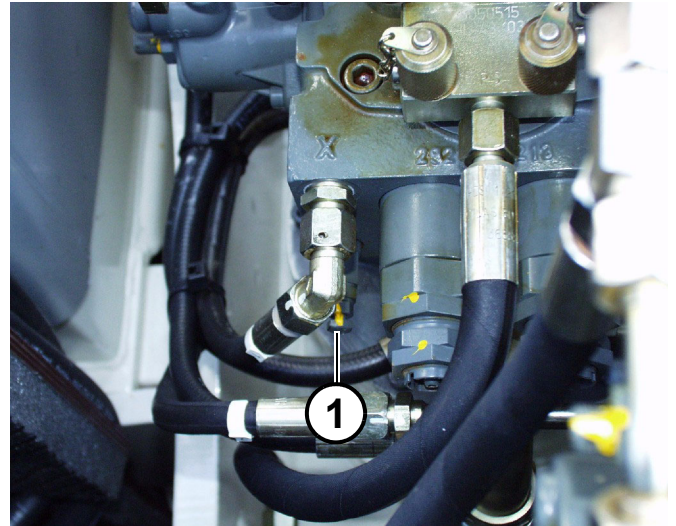
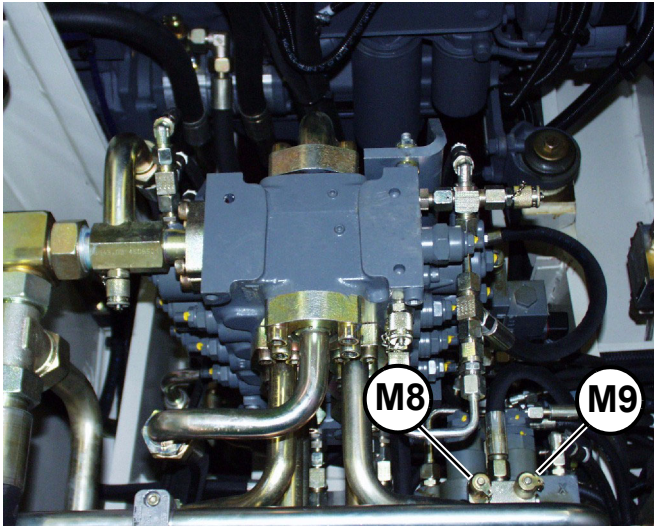
The pressure displayed at measuring union "pump" (M7) should not exceed 460 bar during the following adjustments.



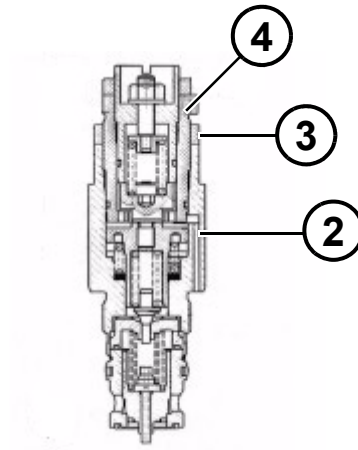
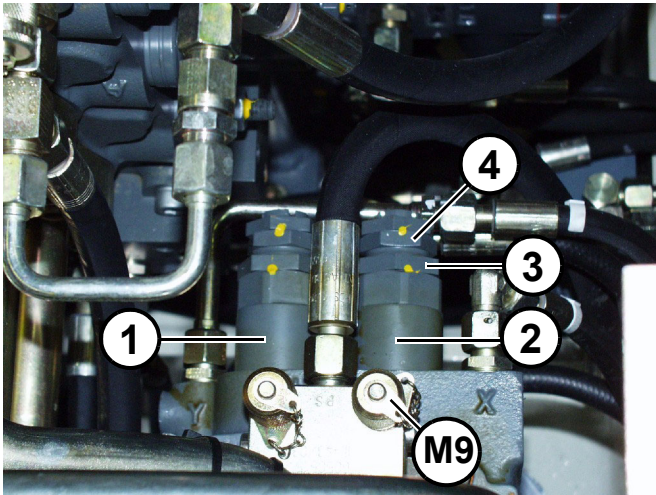
11. Start the engine.
12. Move the engine speed control lever to the maximum speed position (to its stop).
13. Adjust the pressure at the measuring union "pump" (M7) of the pressure cut-off device to the specified value by screwing in/out the adjusting screw (1).
14. Switch off the engine, ignition key in position "0" (the ignition is switched off).
15. Remove the pressure gauges.

4.13 Secondary valve "slewing"

4.13.1 Adjusting secondary valve "slewing"



1. Connect pressure gauges to the measuring unions "slew to left" (M8) and "slew to right" (M9).
2. Tighten the adjusting screw on the TC-valve (1) fully.
3. Secure the superstructure of the excavator.
4. Start the engine.
5. Move the engine speed control lever to the maximum speed position (to its stop).



The adjustment on both "slew to left" (1) or "slew to right" (2) valves are carried out as follows (steps 6 to 9):

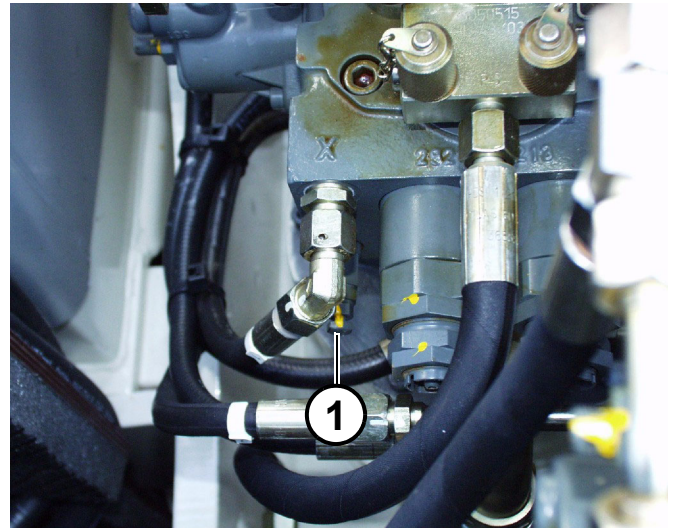
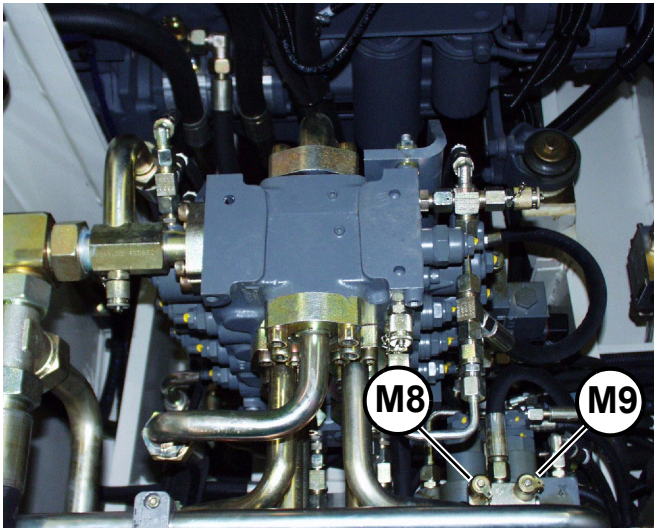
6. Loosen the fixing nut (3) of the valve to be adjusted (in picture above, "slew to right" shown).



WARNING

Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

7. Turn the screw (4) of the valve to be adjusted (here for example, "slew to right") until the corresponding pressure at the secondary valve (here for example, pressure at measuring union "slew to right" (M9)) reaches the specified value, while the corresponding function is activated (here for example, "slew to right").
8. Lock the screw (4) with the fixing nut (3). While securing, make sure not to change the adjustment of the screw (4).
9. Check the pressure again, while the corresponding function is activated (here for example, "slew to right"); repeat steps 6 to 9 if necessary.



10. Set the pressure for TC-valve at the measuring union "slew to right" (M9) to the specified value by screwing in/out the screw (1), while the "slew to right" function is activated.
11. Switch off the engine, ignition key in position "0" (the ignition is switched off).
12. Remove the pressure gauges.

4.13.2 Adjusting brake pressure



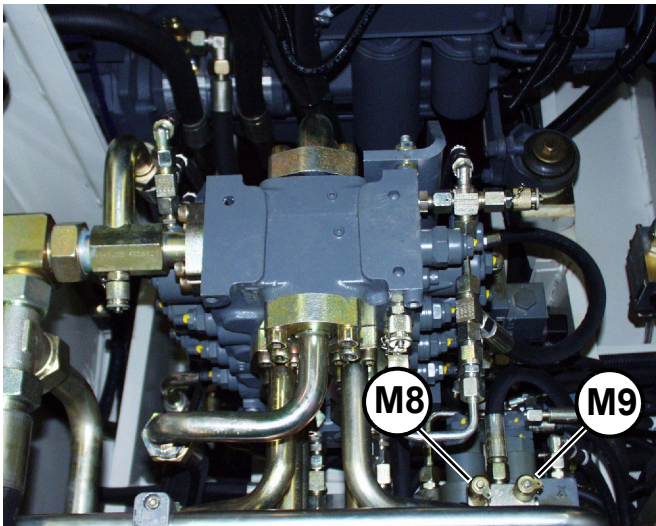
NOTE

For adjusting the pressure brake, a special tool is necessary.

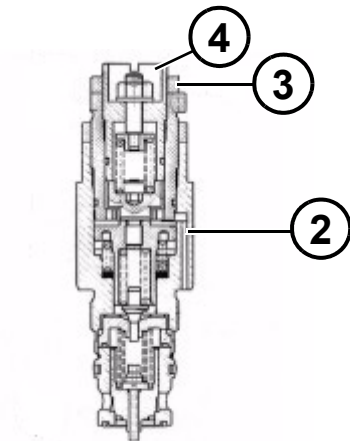
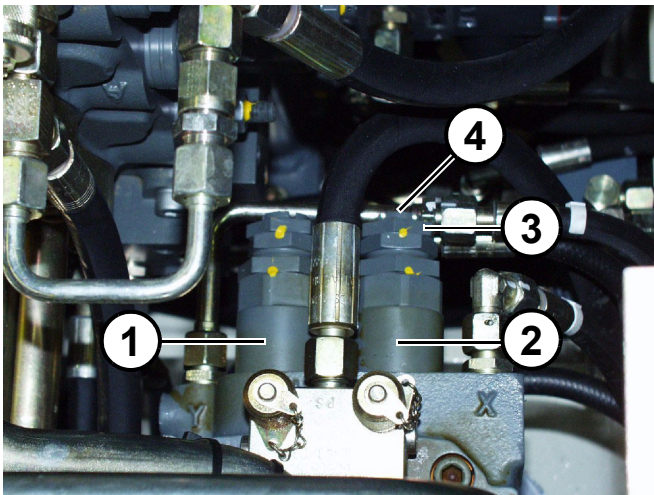


NOTE

If the brake pressure is incorrectly set, the pressure control characteristic must be re-adjusted, see section 4.13.3 on page 48.



1. Connect pressure gauges to the measuring unions "slew to left" (M8) and "slew to right" (M9).
2. Start the engine.
3. Move the engine speed control lever to the maximum speed position (to its stop).



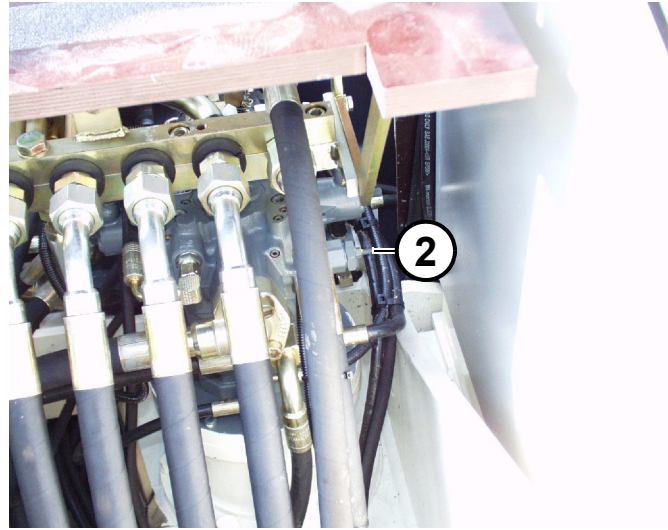
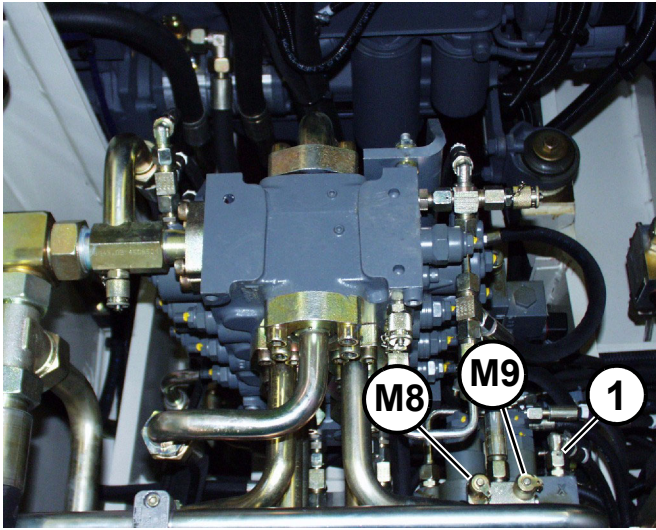
For the slewing direction the settings are

- **to the left** on the valve "slew to right" (2) and measuring union "slew to right" (M9)
- **to the right** on the valve "slew to left" (1) and measuring union "slew to left" (M8)

and are to be carried out as follows (steps 4 to 10):

4. Loosen the fixing nut (3) of the valve to be adjusted (in picture above, valve "slew to right" (2) shown).
5. Activate the corresponding function (here for example, "slew to left") and slew the superstructure in the direction of the adjustment (here for example, to the left) at maximum speed.
6. As the control handle is released, the brake pressure (here for example, pressure at measuring union "slew to right" (M9)) is displayed immediately.
7. Turn the screw (4) of the valve (here for example, "slew to right") until the corresponding brake pressure (here for example, pressure at measuring union "slew to right" (M9)) reaches the specified value.
8. Repeat steps 5 to 7 until the specified pressure is set.
9. Lock the screw (4) with the fixing nut (3). While securing, make sure not to change the adjustment of the screw (4).
10. Check the brake pressure again, repeat steps 4 to 10 if necessary.
11. Repeat the adjustment (steps 4 to 10) respectively for the reverse slewing direction (here for example, the "slew to right" function on valve "slew to left" (1)).
12. Switch off the engine, ignition key in position "0" (the ignition is switched off).
13. Remove the pressure gauges.

4.13.3 Adjusting the pressure control characteristic



1. Connect pressure gauges to the measuring unions "slew to left" (M8) and "slew to right" (M9).
2. Connect a pressure gauge to the "pilot control, slewing" line (1) (here for example, "slew to right") with a T-connector.



NOTE

The measuring union for the "pilot control, slewing" (1) is not part of the standard equipment and must be installed for adjustment purposes.

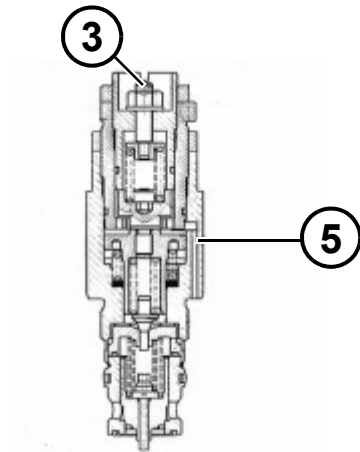
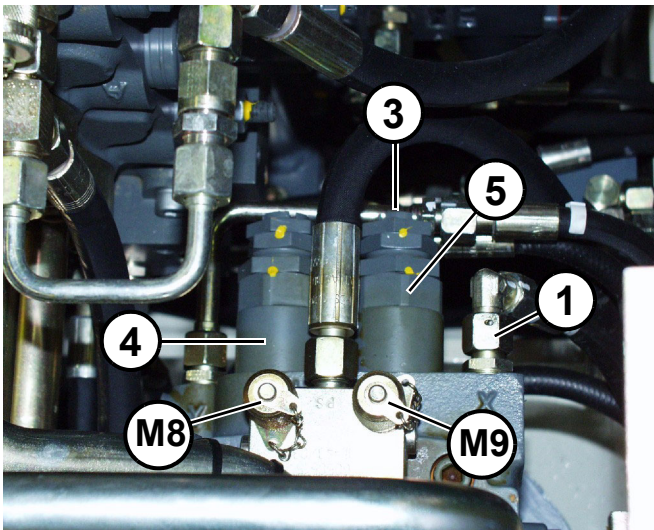
3. Screw in the adjusting screw (2) of the TC-characteristic valve by two turns.
4. Secure the superstructure.
5. Start the engine.
6. Move the engine speed control lever to the maximum speed position (to its stop).



WARNING

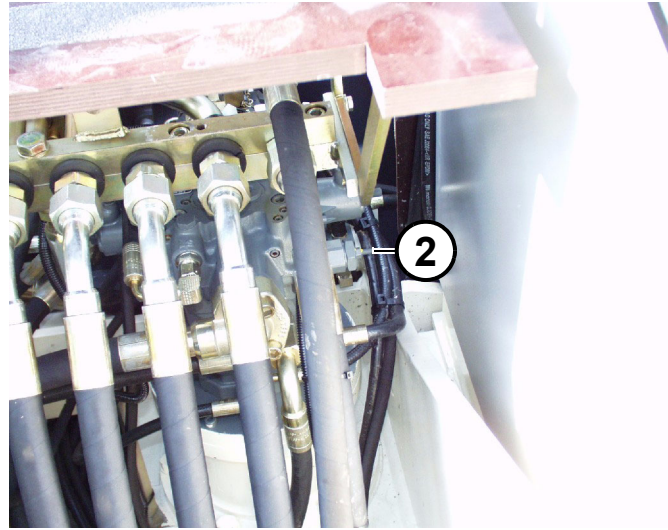
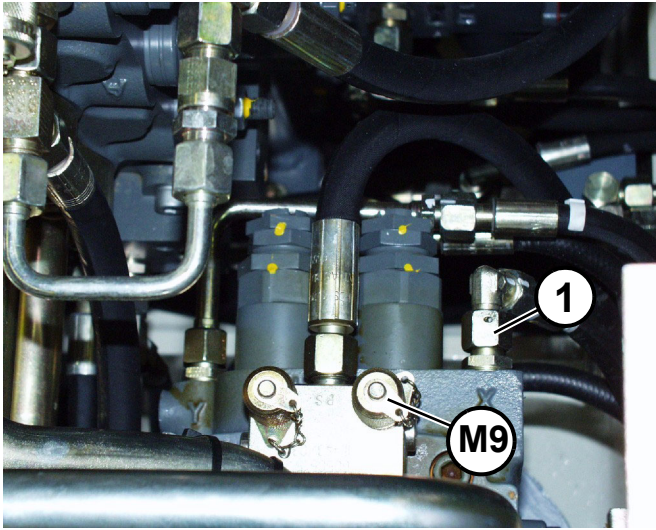
Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

7. Activate the corresponding slewing function (here for example, "slew to right") and build up a pressure between 8 bar and 9 bar at "pilot control, slewing" line (1), and make sure to keep this value.
The pressure of the corresponding secondary valve (here for example, pressure at measuring union "slew to right" (M9)) has to be 120 bar, while the corresponding slewing function is activated.



8. Set the pressure for the corresponding valve "slew to left" (4) or "slew to right" (5) at the adjusting screw (3) to 120 bar by screwing it in/out (in picture above, "slew to right" (5) shown).
9. Switch off the engine, ignition key in position "0" (the ignition is switched off).
10. Remove the pressure gauges from the measuring unions "slew to left" (M8) and "slew to right" (M9).
11. Remove the T-connector and the pressure gauge from the "pilot control, slewing" line (1) and connect the "pilot control, slewing" line (1) back again.
12. Adjust the TC-characteristic valve, see section 4.13.4 on page 50.

4.13.4 Adjusting TC-characteristic valve



1. Connect a pressure gauge to the measuring union "slew to right" (M9).
2. Connect a pressure gauge to the "pilot control, slewing" line (1) with a T-connector.



NOTE

The measuring union for the "pilot control, slewing" line (1) is not part of the standard equipment and must be installed for adjustment purposes.

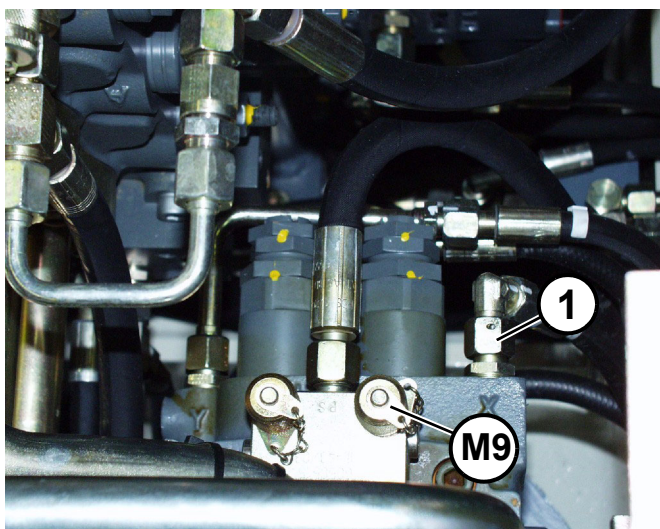
3. Secure the superstructure.
4. Start the engine.
5. Move the engine speed adjusting lever to the maximum speed position (to its stop).



WARNING

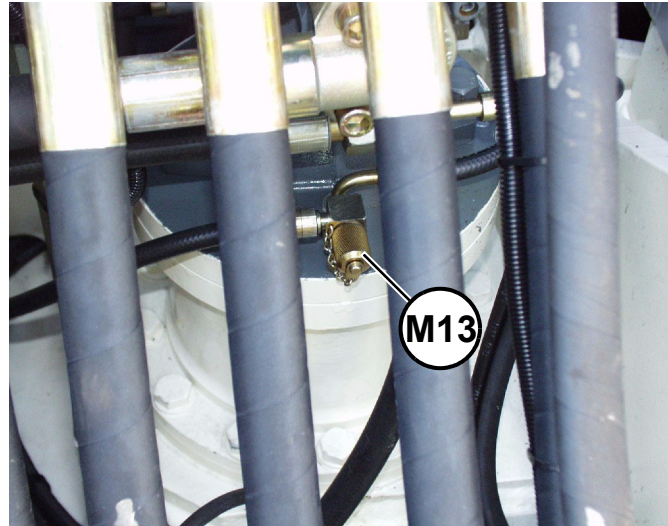
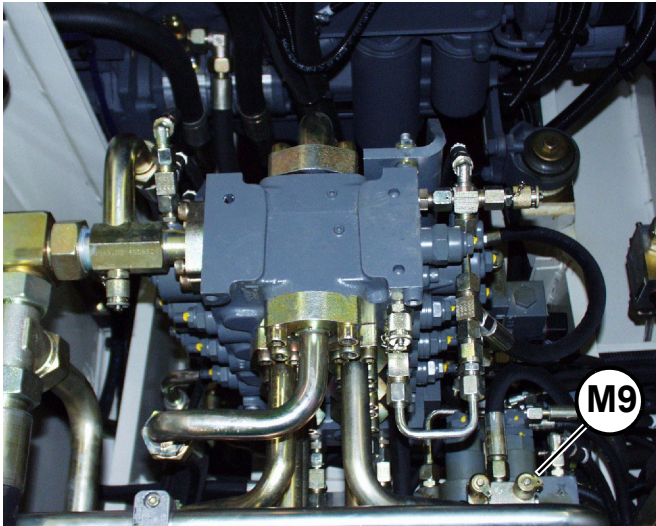
Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

6. Activate the "slew to right" function and build up a pressure of 16 bar at "pilot control, slewing" line (1), and make sure to keep this value. The pressure at measuring union "slew to right" (M9) must have 190 bar.
7. If necessary, set the pressure for the TC-characteristic valve at the adjusting screw (2) to 190 bar by screwing it in/out.



8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge from the measuring union "slew to right" (M9).
10. Remove the T-connector and the pressure gauge from the "pilot control, slewing" line (1) and connect the "pilot control, slewing" line (1) back again.

4.14 Pressure cut-off valve



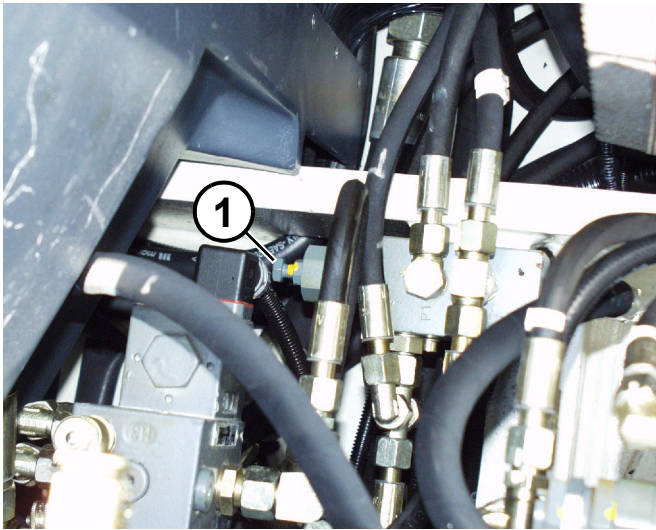
1. Connect pressure gauges to the measuring unions "slew to right" (M9) and "slewing brake" (M13).
2. Secure the superstructure.
3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.



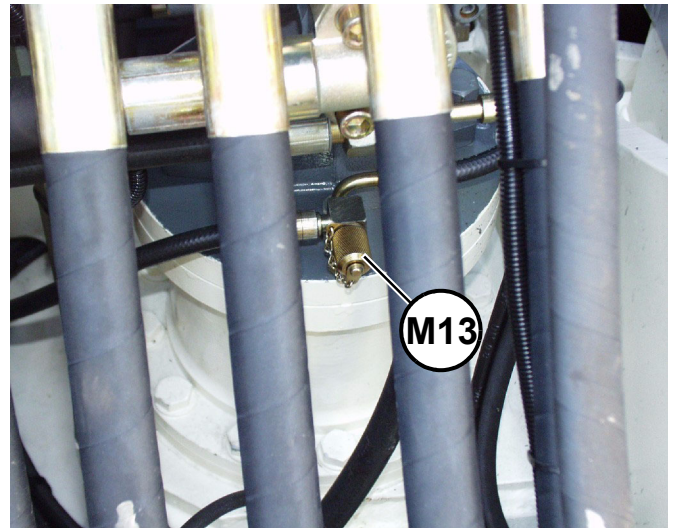
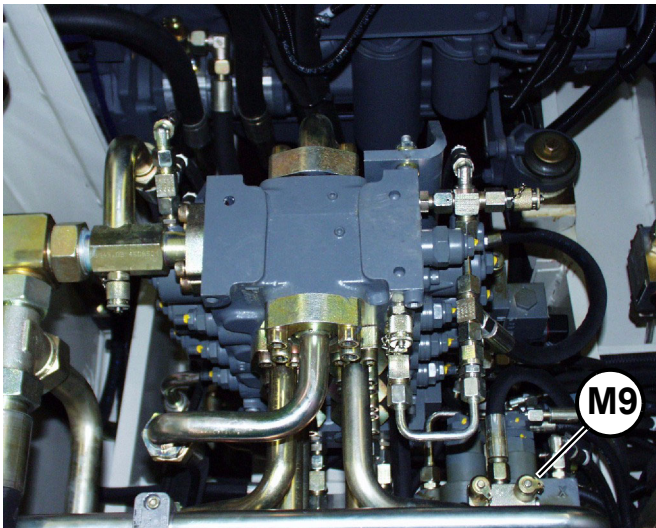
WARNING

Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

5. Activate the "slew to right" function. This produces a pressure increase at the measuring union "slew to right" (M9). After the pressure at the measuring union "slew to right" (M9) reaches a pressure of approx. 120 bar, the pressure at the measuring union "slewing brake" (M13) should start rising.



6. If necessary, adjust the response value of the pressure cut-off valve by screwing in/out the adjusting screw (1).
7. Repeat steps 5 and 6 if necessary.



8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge.

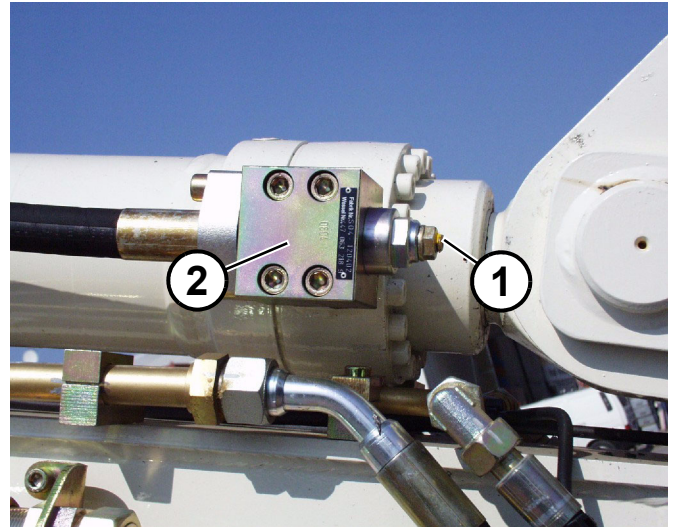
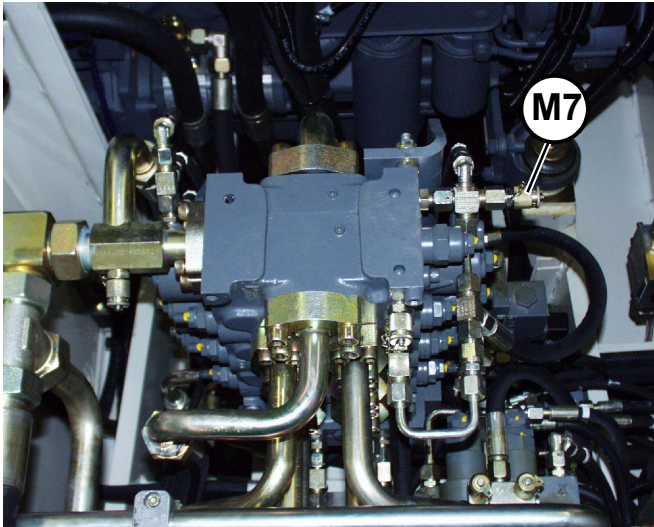
4.15 Return flow throttle



NOTE

The following adjustment must be carried out with the tool mounted.

4.15.1 Return flow throttle "jib folding ram"

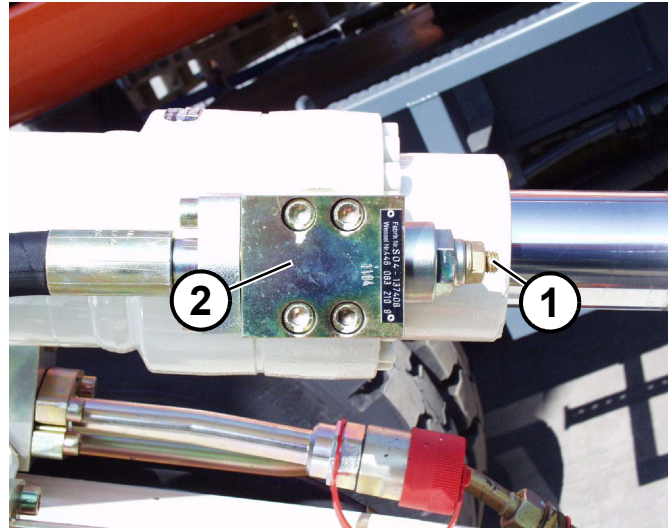
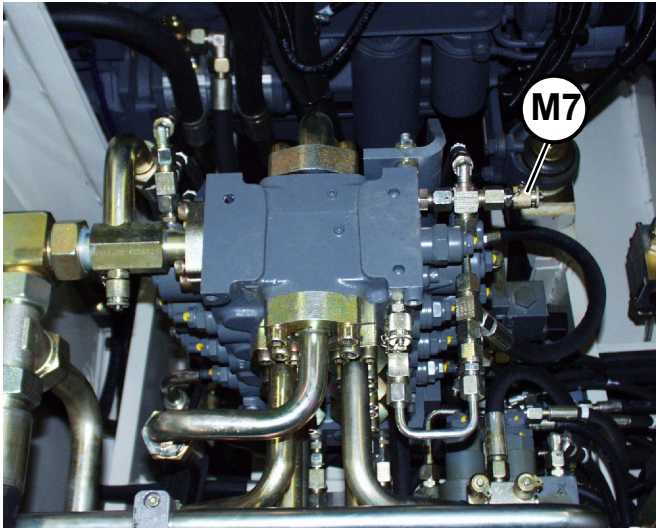


WARNING

Never move the boom/jib, before ensuring that no one is remaining within the slewing area.

1. Connect a pressure gauge to the measuring union "pump" (M7).
2. Start the engine.
3. Move the engine speed adjusting lever to the maximum speed position (to its stop).
4. Extend the boom/jib fully (retract the piston rod of the jib folding ram fully).
5. Activate the "jib folding in" function and let it run fully.
6. Read off the pressure value at the measuring union "pump" (M7), while the "jib folding in" function is running.
7. Lower the boom/jib.
8. Set the pressure for the return flow throttle "jib folding ram" (2) to the required value at the adjusting screw (1).
9. Repeat steps 4 to 8 if necessary.
10. Switch off the engine, ignition key in position "0" (the ignition is switched off).
11. Remove the pressure gauge.

4.15.2 Return flow throttle "bucket ram"



1. Connect a pressure gauge to the measuring union "pump" (M7).
2. Start the engine.
3. Move the engine speed adjusting lever to the maximum speed position (to its stop).



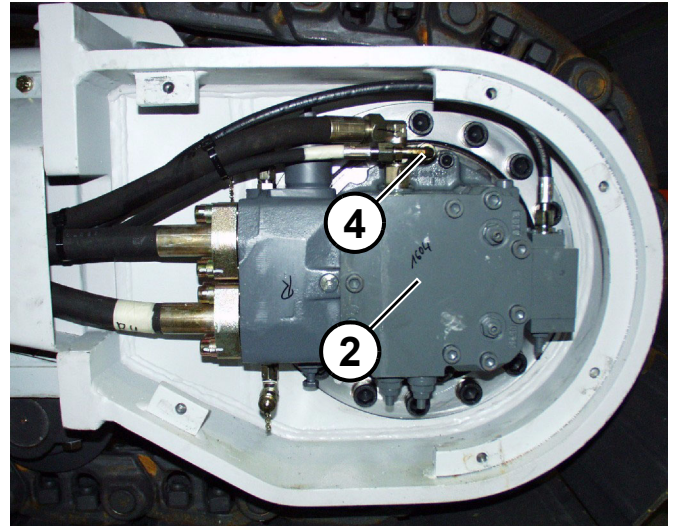
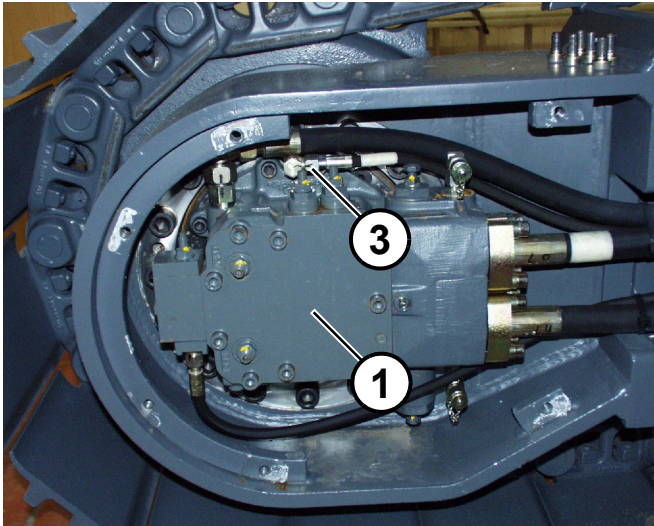
WARNING

Never move the boom/jib, before ensuring that no one is remaining within the slewing area.

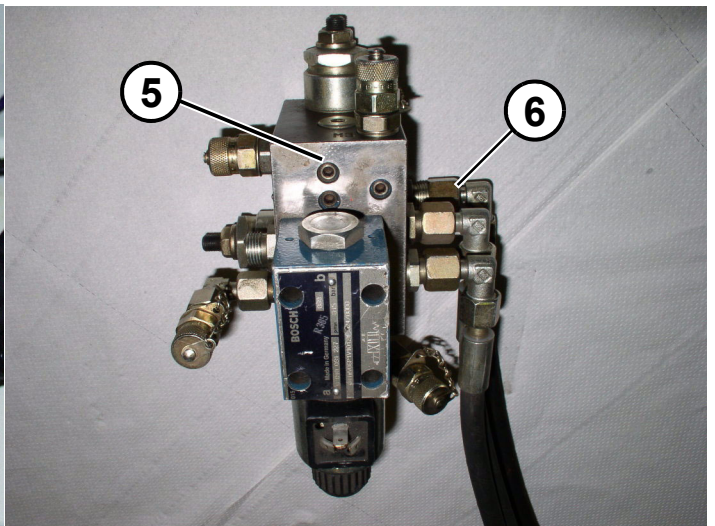
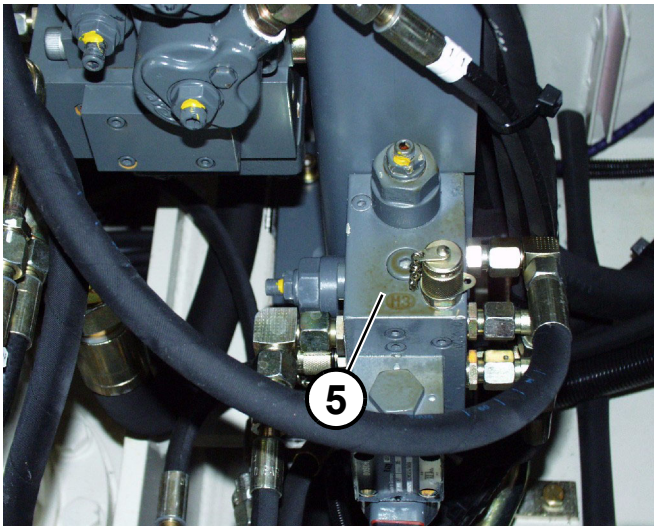
4. Raise the boom/jib and open the bucket fully (retract the piston rod of the bucket ram fully).
5. Activate the "closing bucket" function and let it run fully.
6. Read off the pressure value at the measuring union "pump" (M7), while the "closing bucket" function is running.
7. Lower the boom/jib.
8. Set the pressure for the return flow throttle "bucket ram" (2) to the required value at the adjusting screw (1).
9. Repeat steps 4 to 8 if necessary.
10. Switch off the engine, ignition key in position "0" (the ignition is switched off).
11. Remove the pressure gauge.

4.16 Locking/releasing the drive units

4.16.1 Locking the drive units



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Disengage the brake hoses (3) and (4) from both drive units (1) and (2). Insert a blind plug in both brake hoses (3) and (4).



Only prior to adjusting the "travel" secondary valves:

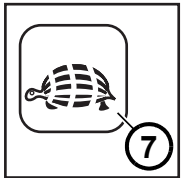
3. Remove the hose (6) from the control valve (5) and close the hose (6) off with a blind plug.

Check the locking as follows:

**WARNING**

Ensure that no one is remaining within the working area of the excavator. Keep in mind that the excavator should not make any movement, while the following checking procedure is carried out.

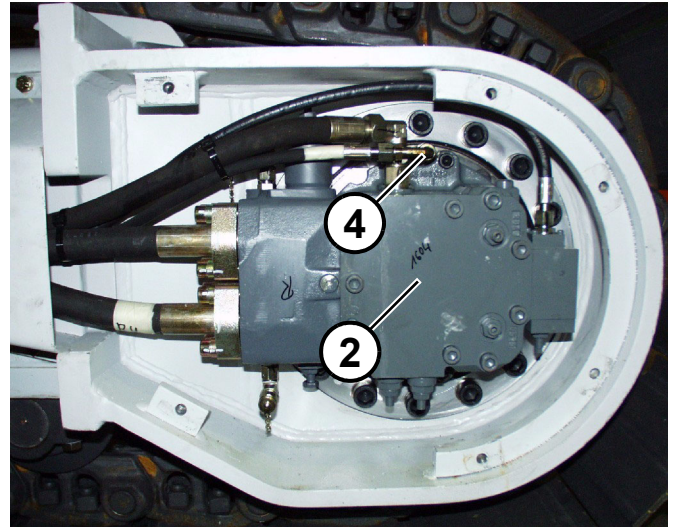
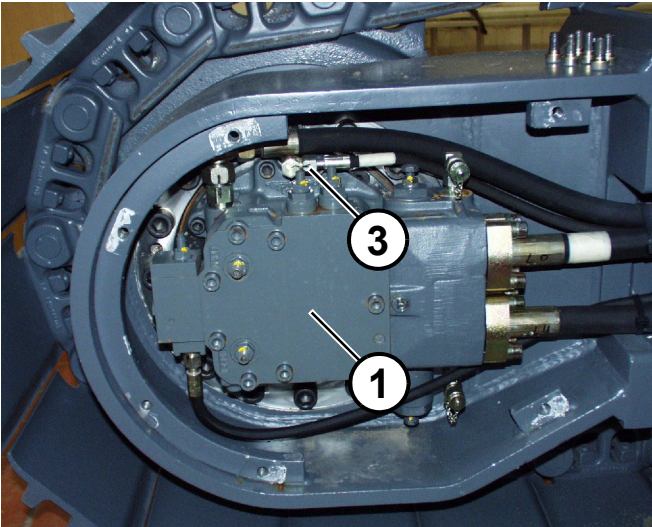
4. Start the engine.
5. Set the engine speed to approx. 1400 rpm.
6. Shift selector switch to crawler speed I ("higher speed").

**WARNING**

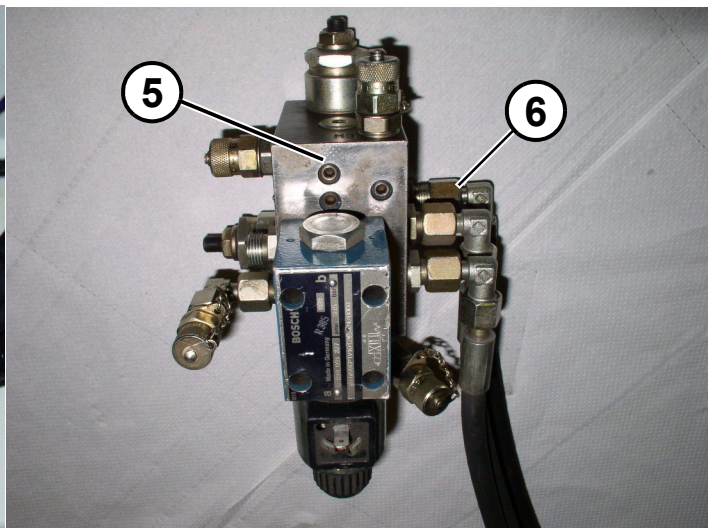
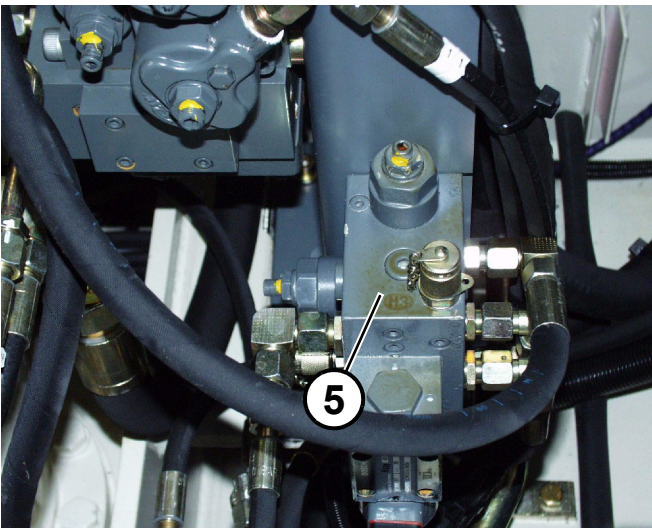
Ensure that the selector switch is shifted to position crawler speed I ("higher speed"), the symbol (7) "turtle" in the display panel must not light up, otherwise the disc break can be destroyed.

7. Activate the "travel" function and check whether the excavator is locked.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).

4.16.2 Releasing the drive units



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Remove the blind plugs from both brake hoses (3) and (4), and connect both brake hoses (3) and (4) to the respective drive units (1) and (2) back again.



Only after adjusting the "travel" secondary valves:

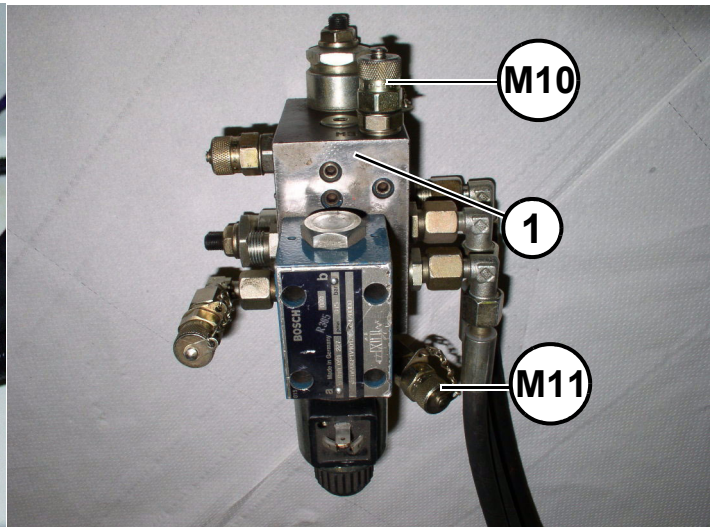
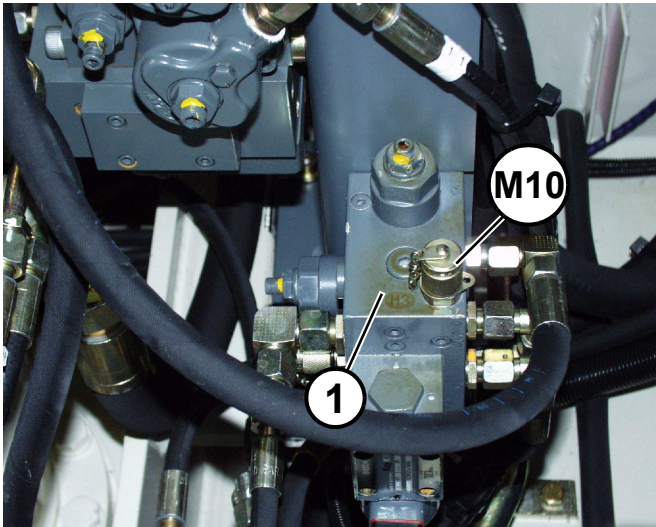
3. Remove the blind plug from the hose (6) and connect the hose (6) to the control valve (5).

4.17 Adjusting travel motor



NOTE

Before starting up for the first time and after repairing work on the control valve (1), the valve must be bled, see section 4.18 on page 62.



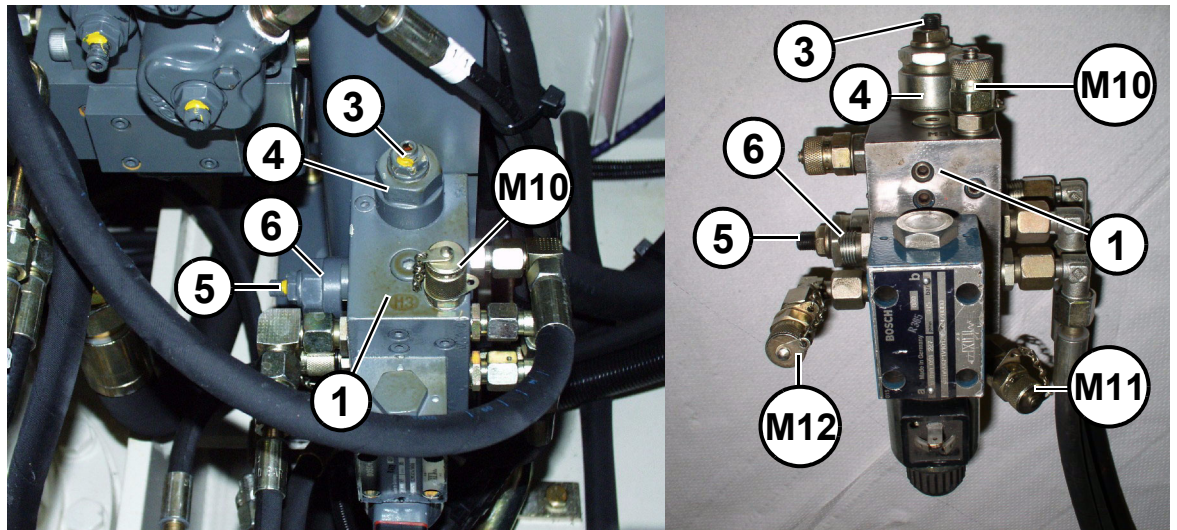
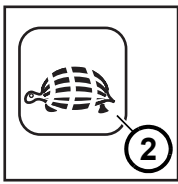
1. Connect pressure gauges to the measuring unions "pilot pressure travel motor adjustment" (M10) and "travel pressure" (M11).
2. Lock the drive units, see section 4.16.1 on page 57.



WARNING

Ensure that no one is remaining within the working area of the excavator. Keep in mind that the excavator should not make any movement, while the following adjustment is carried out.

3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.
5. Shift selector switch to crawler speed I ("higher speed").
6. The pressure at the measuring union "pilot pressure travel motor adjustment" (M10) should be between 25 bar and 27 bar.



WARNING

Ensure that the selector switch is shifted to position crawler speed I ("higher speed"), the symbol (5) "turtle" in the display panel must not light up, otherwise the disc break can be destroyed.



NOTE

Pressure may also be generated by activating the "closing bucket" function.

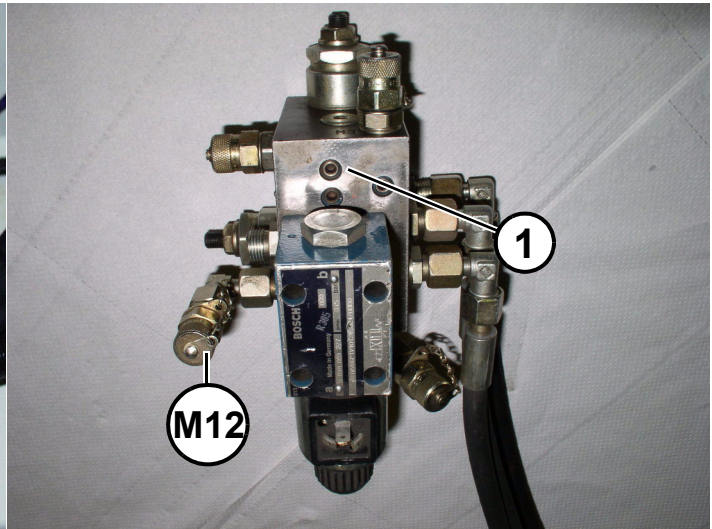
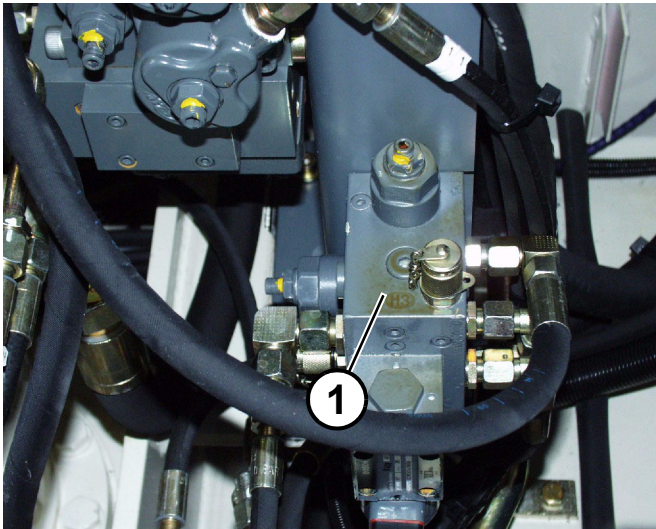
7. **Slowly** raise the pressure at the measuring union "travel pressure" (M11) using the travel lever. After the pressure at the measuring union "travel pressure" (M11) reaches a pressure of 310 bar, the pressure at the measuring union "pilot pressure travel motor adjustment" (M10) should start dropping.
8. If necessary, adjust the pressure at the control valve (3) by screwing in/out the adjusting screw (2) and repeat steps 6 to 8.
9. **Slowly** reduce the pressure at the measuring union "travel pressure" (M11) until it reaches 150 bar. The pressure at the measuring union "pilot pressure travel motor adjustment" (M10) should be between 25 bar and 27 bar.
10. If necessary, adjust the pressure at the control valve (5) by screwing in/out the adjusting screw (4) and repeat steps 6 to 9.
11. Switch off the engine, ignition key in position "0" (the ignition is switched off).
12. Remove the pressure gauges.
13. Release the drive units, see section 4.16.2 on page 59.

4.18 Bleeding control valve



NOTE

Before starting up for the first time and after repairing work on the control valve (1), the valve must be bled.



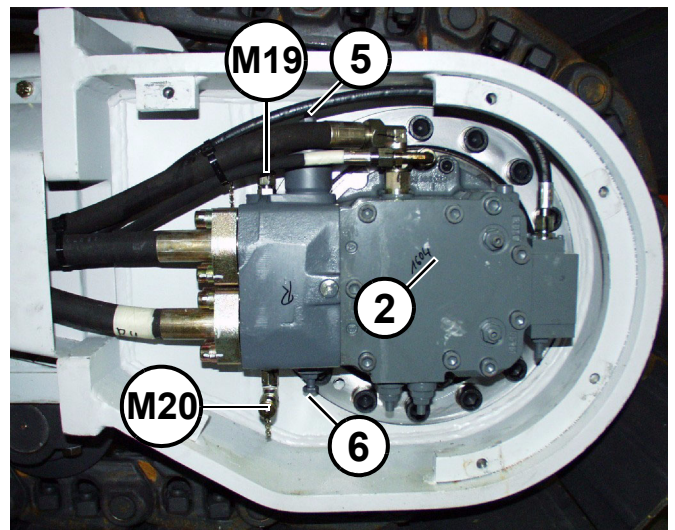
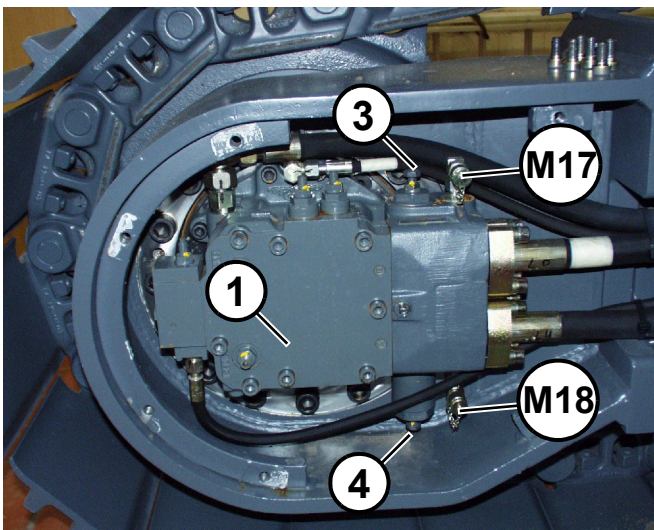
1. Connect a "Minimess" hose to the "bleeding control valve" (M12) and put the end of the hose in a suitable container to catch the escaping hydraulic oil.
2. Lock the drive units, see section 4.16.1 on page 57.
3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.
5. Activate the "travel" function.
6. Hydraulic oil leaks out from the "Minimess" hose. The bleeding of valve is completed, as soon as the hydraulic oil emerging is free of air bubbles.
7. Switch off the engine, ignition key in position "0" (the ignition is switched off).
8. Remove the "Minimess" hose from the measuring union "bleeding control valve" (M12).
9. Release the drive units lock back again, see section 4.16.2 on page 59.

4.19 Adjusting the dynamic pressure of the braking valve



NOTE

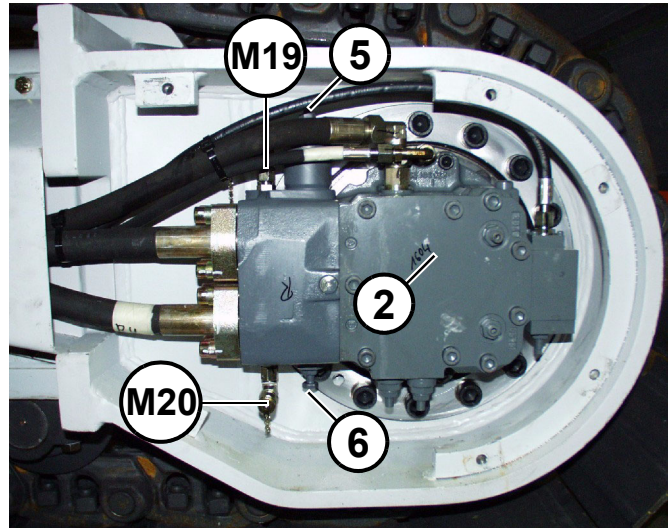
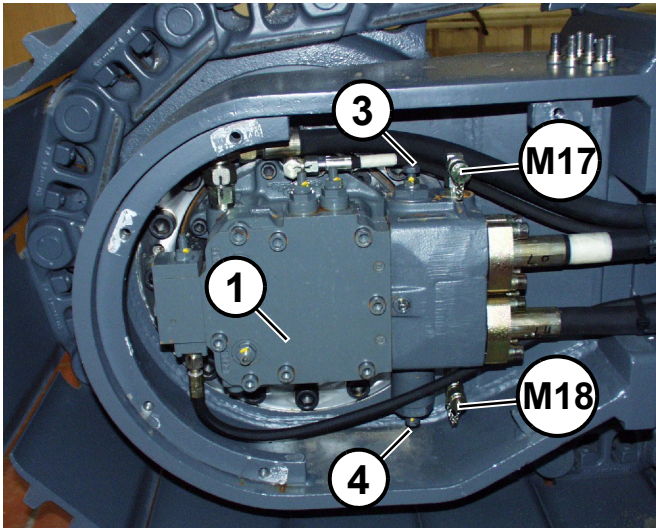
Adjustment of the dynamic pressure of the braking valve is normally not required. Always carry out adjustment of the dynamic pressure, when a drive unit is replaced.



NOTE

The travel gear could lower unintended. Ensure that no one is remaining under the excavator.

1. Slew the superstructure at a angle of 90° to the side of the drive unit with the braking valve which is to be adjusted.
2. Tilt the excavator using the boom/jib so that the corresponding crawler tracks is able to turn in an uninhibited manner.
3. Switch off the engine, ignition key in position "0" (the ignition is switched off).
4. Connect the pressure gauges to the corresponding measuring unions as necessary: "secondary pressure forward travel, left" (M17) and "secondary pressure reverse travel, left" (M18), and/or "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).



WARNING

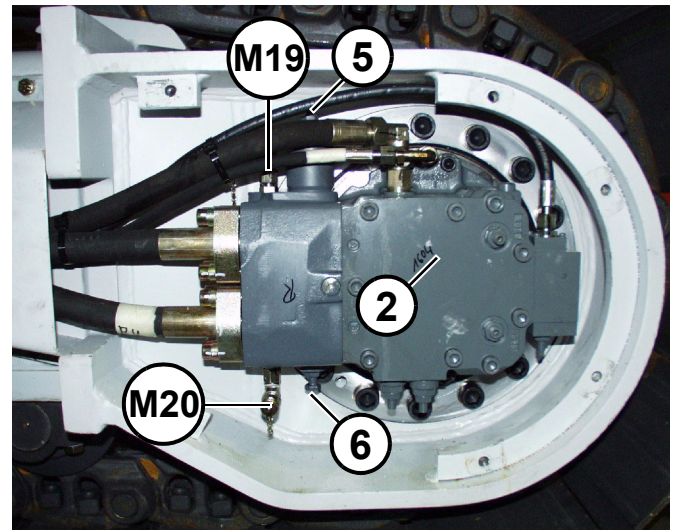
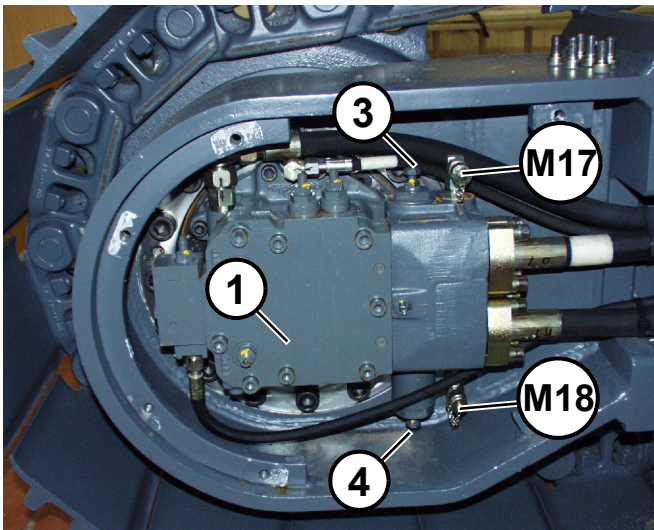
Ensure that no one is remaining within the crawler track area and other rotating parts of the excavator, before carrying out the following adjustment procedure.



WARNING

Make sure only to move the crawler track raised.

5. Start the engine.
6. Move the engine speed adjusting lever to the maximum speed position (to its stop).
7. Shift selector switch to crawler speed II ("slow speed").
8. Set the maximum forward travel speed of the crawler track using the control lever.
9. Screw out the adjusting screws (3) and (4), and/or (5) and (6) for the dynamic pressure at the corresponding drive unit (1) or (2), until the pressure at the measuring union "secondary pressure forward travel, left" (M17) and/or "secondary pressure forward travel, right" (M19) stops dropping.
10. Screw in the adjusting screw (4) and/or (6), until the pressure at measuring union "secondary pressure forward travel, left" (M17) and/or "secondary pressure forward travel, right" (M19) rises approx. 1 bar.



11. Set the reverse travel movement of the crawler track raised to its maximum stage using the control lever.
12. Screw out the adjusting screw (3) and/or (5), until the pressure at the measuring union "secondary pressure reverse travel, left" (M18) and/or "secondary pressure reverse travel, right" (M20) stops dropping.
13. Screw in the adjusting screw (3) and/or (5), until the pressure at measuring union "secondary pressure reverse travel, left" (M18) and/or "secondary pressure reverse travel, right" (M20) rises approx. 1 bar.



NOTE

Ensure that no one is remaining within the travel gear area of the excavator.

14. Lower the excavator.
15. Switch off the engine, ignition key in position "0" (the ignition is switched off).
16. Remove the pressure gauges from the measuring union "secondary pressure forward travel, left" (M17) and "secondary pressure reverse travel, left" (M18), and/or "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).

4.20 Line break protection valve, lifting cylinder

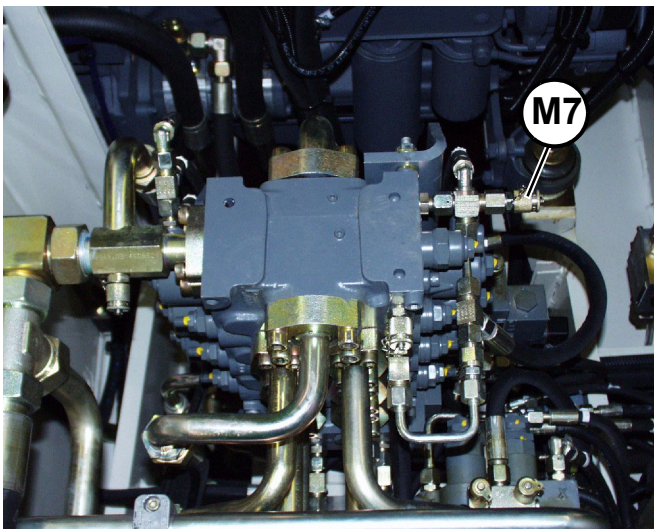
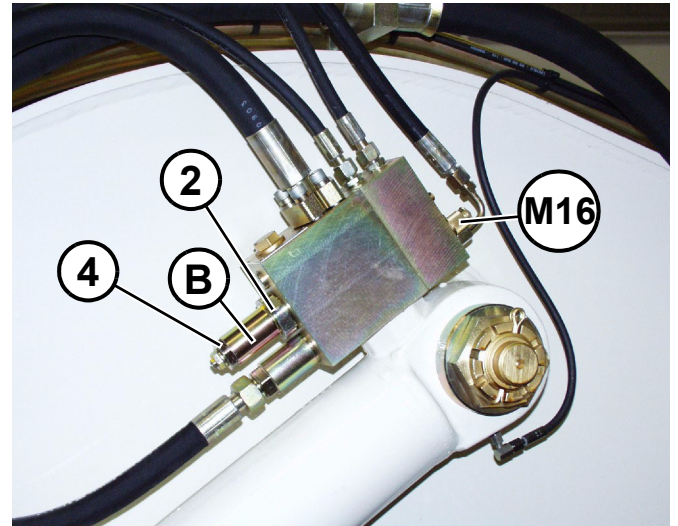
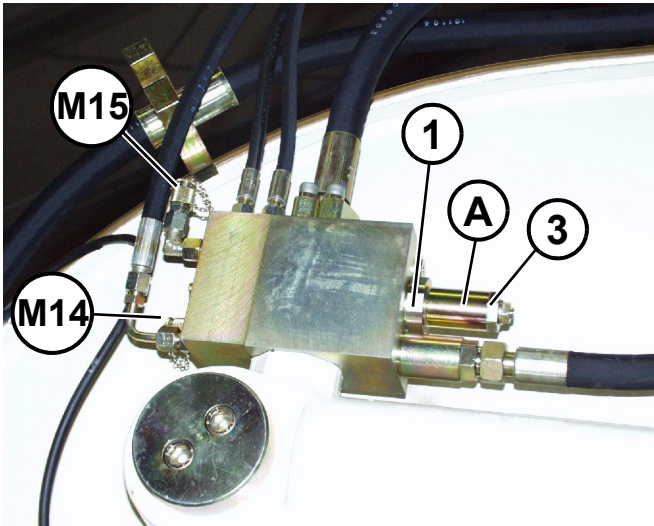


NOTE

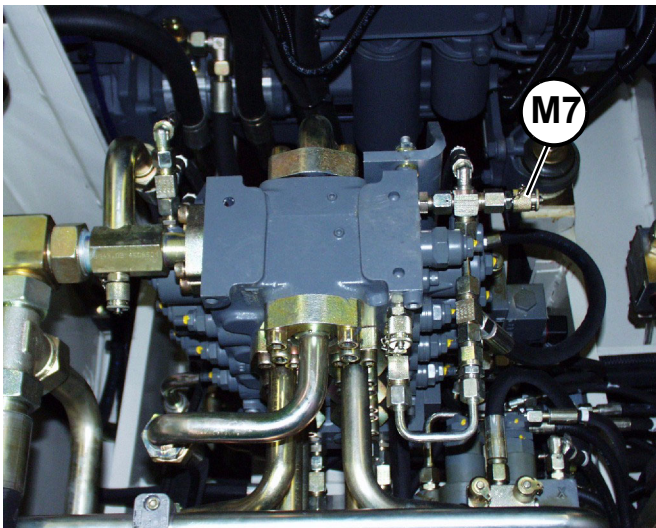
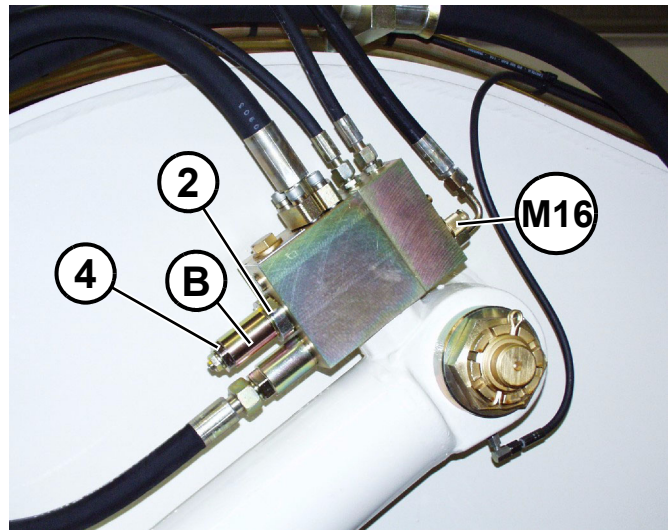
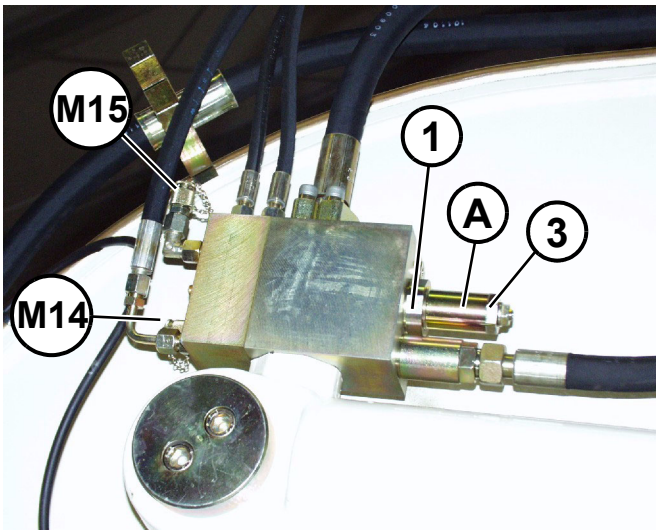
The following adjustment must be carried out with the tool mounted.

4.20.1 Switch-point of the shut-off piston

4.20.1.1 Determining switch-point of control spool



1. Connect pressure gauges to measuring union (M14) and (M16) of valves (A) and (B), to measuring union "pump" (M7) and also to measuring union "pilot pressure lowering" (M15).
2. Loosen the fixing nuts (1) and (2) of both valves (A) and (B).
3. Screw in the adjusting screws (3) and (4) for the shut-off piston switching point at both valves (A) and (B) by approx. 3 turns.



4. Start the engine.
5. Set the engine speed to approx. 1400 rpm.

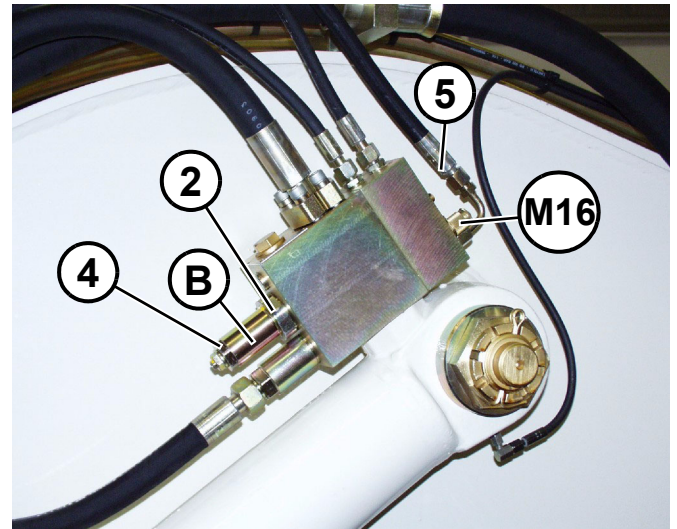
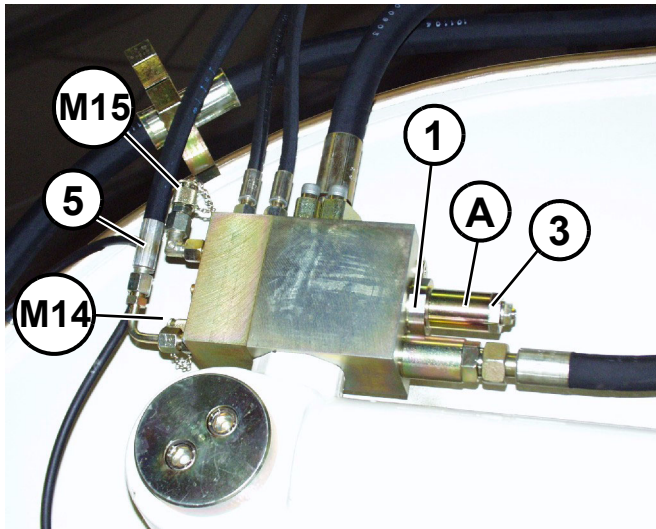


WARNING

Never move the boom/jib, before ensuring that no one is remaining within the slewing area.

6. Lift the boom/jib from the ground for about 3 m. The static pressures of each lifting cylinder is displayed on the pressure gauge at measuring union (M14) or (M16).
7. **Slowly** activate the "lowering" function. Read off the pressure on the measuring union "pilot pressure lowering" (M15), as soon as the pressure at measuring union "pump" (M7) starts to rise. This pressure corresponds to the control valve switch-point in the control block.

4.20.1.2 Adjusting switch-point of shut-off piston



WARNING

Lower the boom/jib to the ground.

8. Switch off the engine, ignition key in position "0" (the ignition is switched off).



WARNING

Make sure that the balance line (5) is unpressurized.

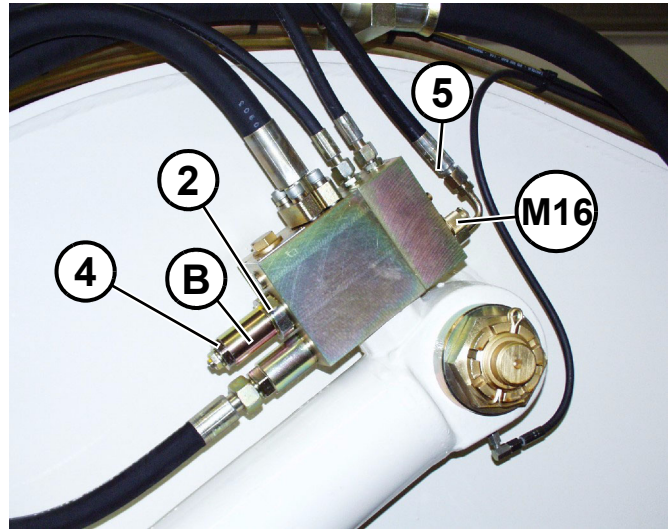
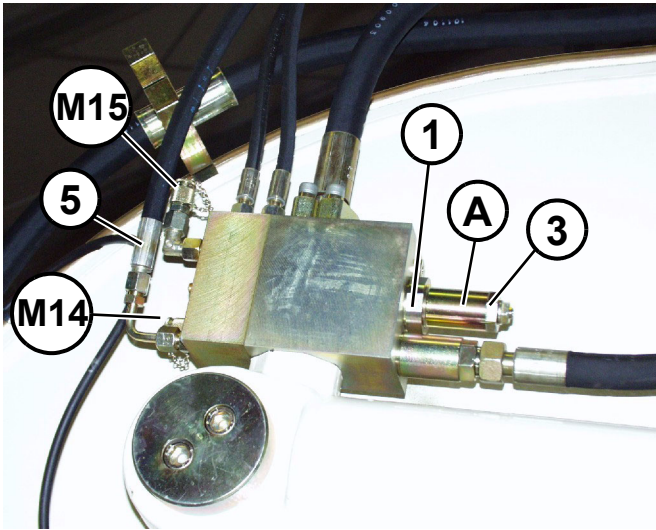
9. Disengage the balance line (5) from both valves (A) and (B), and insert blind plugs in the valves.
10. Start the engine.
11. Set the engine speed to approx. 1400 rpm.



WARNING

Ensure that no one is remaining within the slewing area of the boom/jib, before moving the boom/jib.

12. Lift the boom/jib from the ground for about 3 m.



13. **Slowly** activate the "lowering" function, until the pressure on the measuring union "pilot pressure lowering" (M15) shows 1 bar below the switch-point of the control spool. Keep this pressure.
14. Screw out the adjusting screw (3) of valve (A), until the static pressure at the measuring union (M14) starts to drop.
15. Screw out the adjusting screw (4) of valve (B), until the boom/jib starts lowering itself.
16. Check adjustment by extending the lifting cylinder fully.
17. **Slowly** lower the boom/jib.
18. During the lowering is carried out **in precision control mode**, check whether both shut-off pistons open simultaneously (same pressure at measuring union (M14) and (M16)). A pressure difference of 30 bar is permitted. If correction is necessary, adjust the screw (4) at valve (B).
19. Switch off the engine, ignition key in position "0" (the ignition is switched off).
20. Lock the adjusting screws (3) and (4) at valves (A) and (B) with fixing nuts (1) and (2). While locking, make sure not to change the adjustment of the screws.

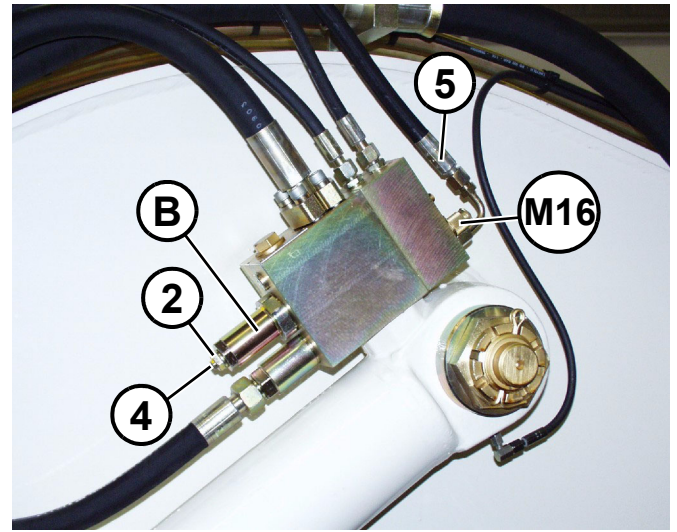
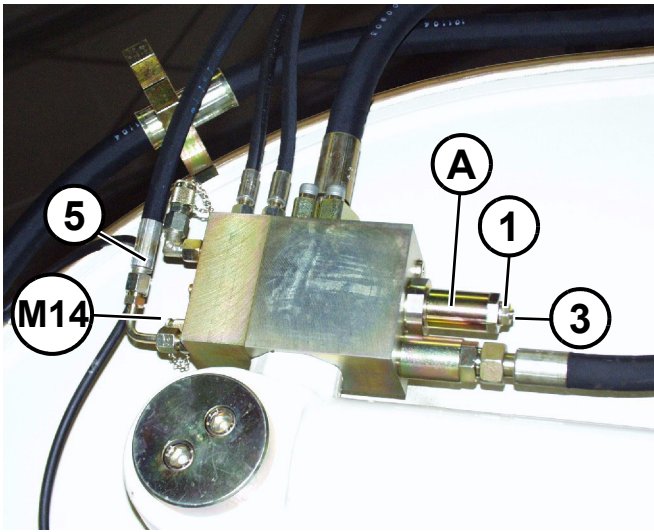


WARNING

Make sure that the boom/jib is lowered and blind plugs are unpressurized.

21. Remove the blind plugs and connect the balance line (5) to both valves (A) and (B) back again.
22. Remove the pressure gauges.

4.20.2 Adjusting return flow throttle "lowering"



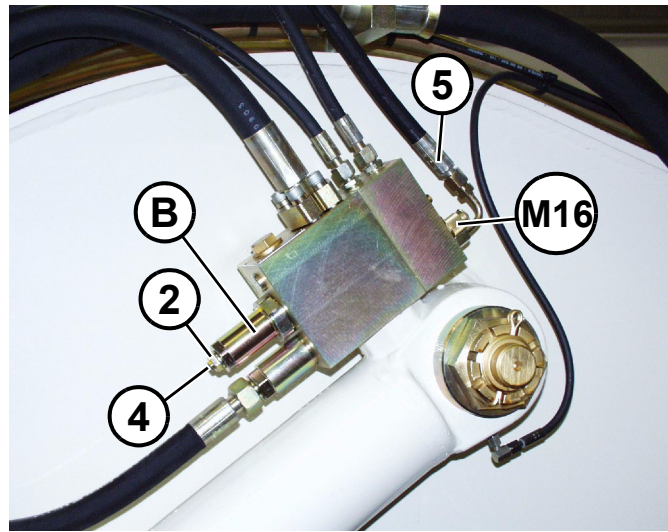
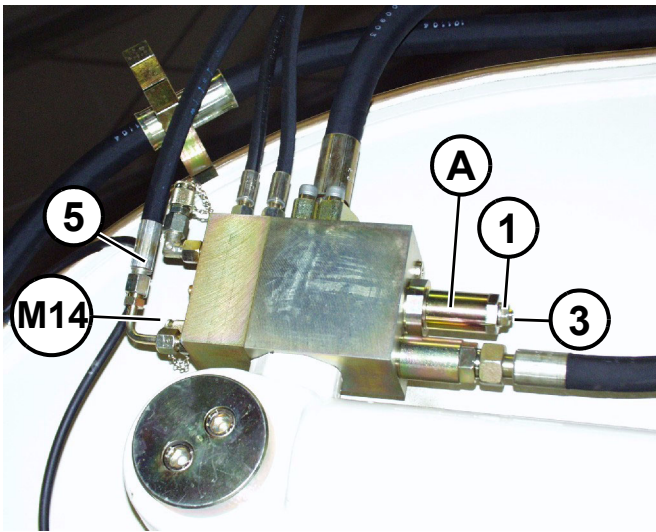
1. Connect pressure gauges to the measuring union (M14) and (M16) at valves (A) and (B).
2. Loosen the fixing nuts (1) and (2) of both valves (A) and (B).
3. Switch off the engine, ignition key in position "0" (the ignition is switched off).



WARNING

Make sure that the balance line (5) is unpressurized.

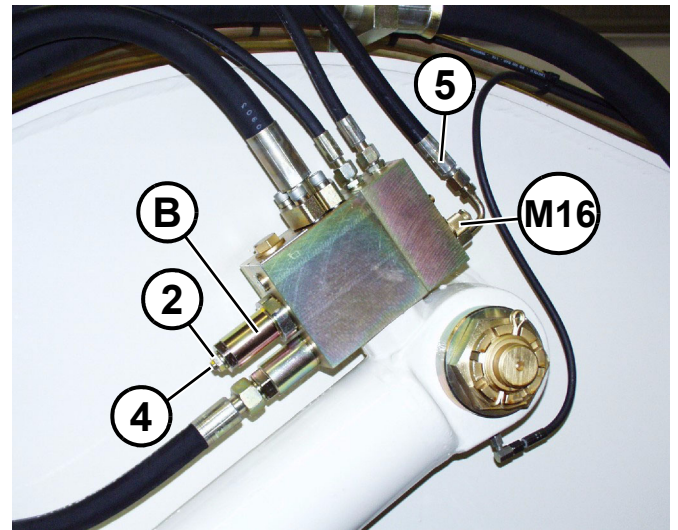
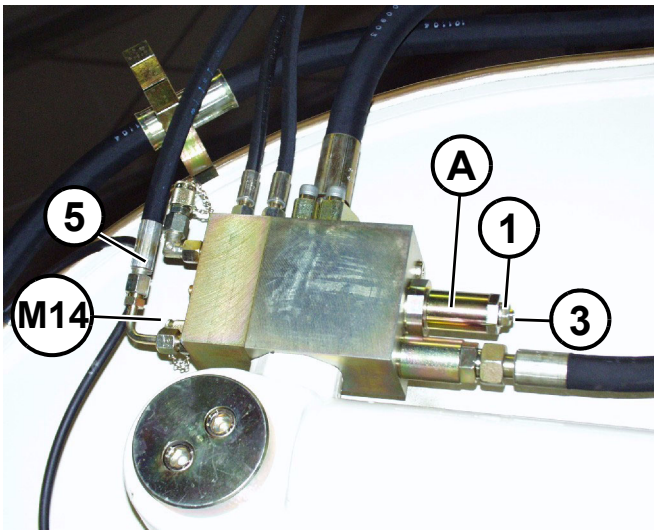
4. Disengage the balance line (5) from both valves (A) and (B), and insert blind plugs in the valves.
5. Start the engine.
6. Move the engine speed adjusting lever to the maximum speed position (to its stop).



WARNING

Ensure that no one is remaining within the slewing area of the boom/jib, before moving the boom/jib.

7. Lift the boom/jib and extend the lifting cylinder fully.
8. Fold out the jib fully (extend the jib cylinder fully).
9. Fully activate the "lowering" function.
10. The pressure gauges at measuring union (M14) and (M16) indicate the pressures of both lowering-throttles.
11. If necessary, correct the pressure by screwing in/out the adjusting screws (3) and (4) of valves (A) and (B). A maximum pressure difference between measuring union (M14) and (M16) of 5 bar is permitted. The adjustment should be carried out in such way that the lowering/lifting speeds are approx. equal.



12. Switch off the engine, ignition key in position "0" (the ignition is switched off).
13. Lock adjusting screws (3) and (4) at valves (A) and (B) with fixing nuts (1) and (2). While locking, make sure not to change the adjustment of the screws.

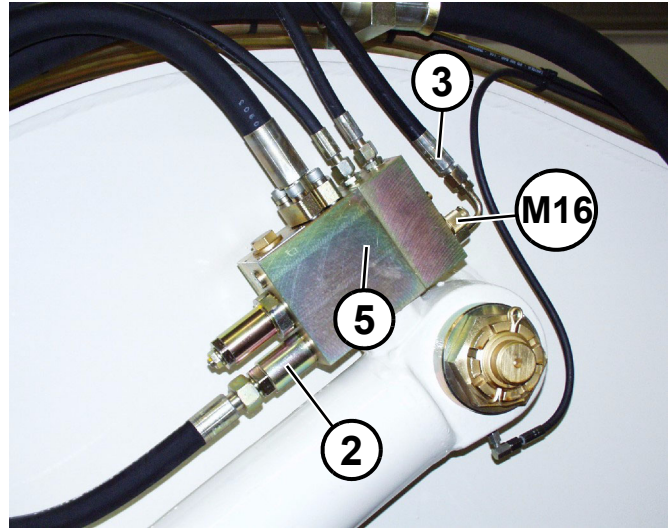
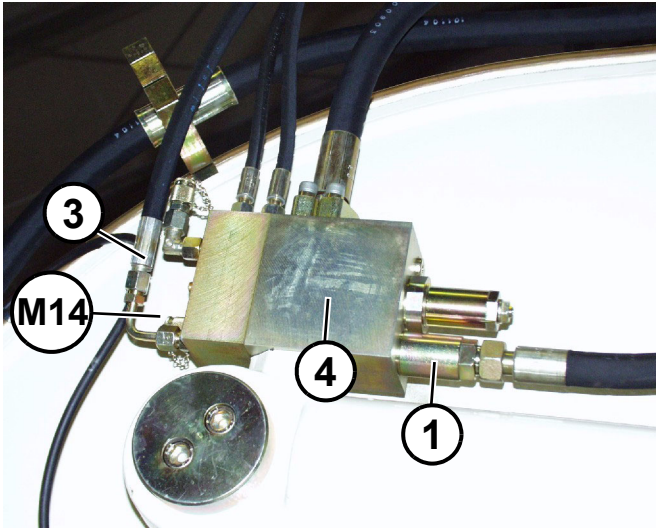


WARNING

Make sure that the boom/jib is lowered and blind plugs are unpressurized.

14. Remove the blind plugs and connect the balance line (5) to both valves (A) and (B) back again.
15. Remove the pressure gauges.

4.20.3 Secondary valves



The secondary valves (1) and (2) are set at the factory and do not need to be adjusted. However, if a checking and/or adjusting needs to be performed, carry out the following procedure:



WARNING

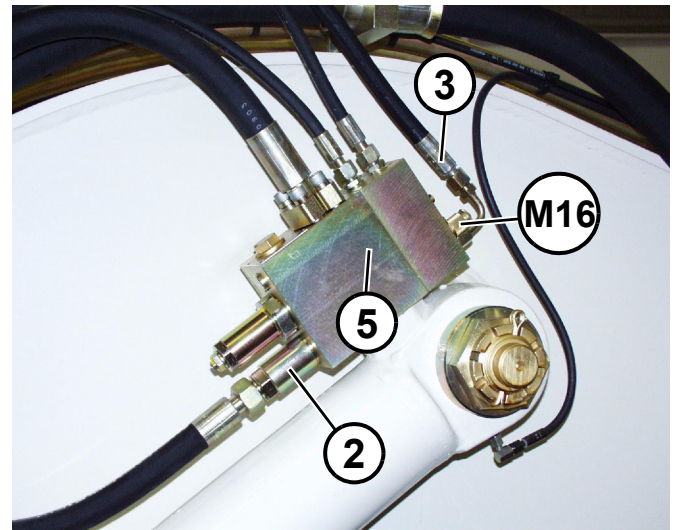
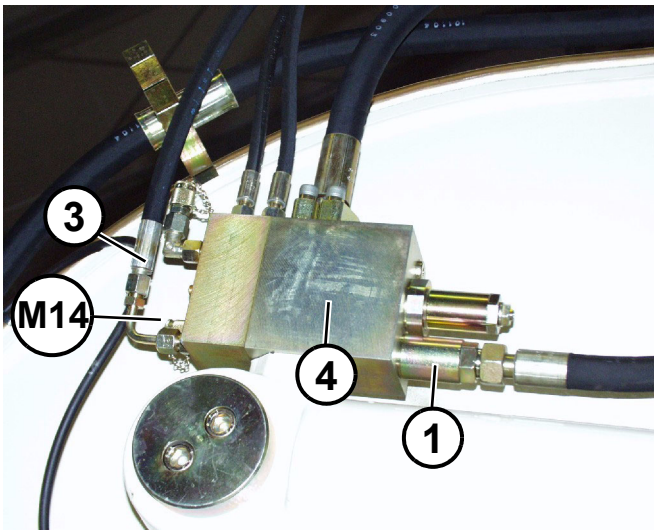
Both valves must be checked and adjusted if necessary.



WARNING

Make sure that the boom/jib is lowered and the balance line (3) is unpressurized.

1. Disengage the balance line (3) from both valve blocks (4) and (5), and insert blind plugs in the valve blocks (4) and (5).
2. Connect a hand pump with a pressure gauge to the measuring union (M14) and/or (M16) at the secondary valve (1) and/or (2) of which to be adjusted.



3. Start the engine.
4. Move the engine speed adjusting lever to the maximum speed position (to its stop).



WARNING

Ensure that no one is remaining within the slewing area of the boom/jib, before moving the boom/jib.

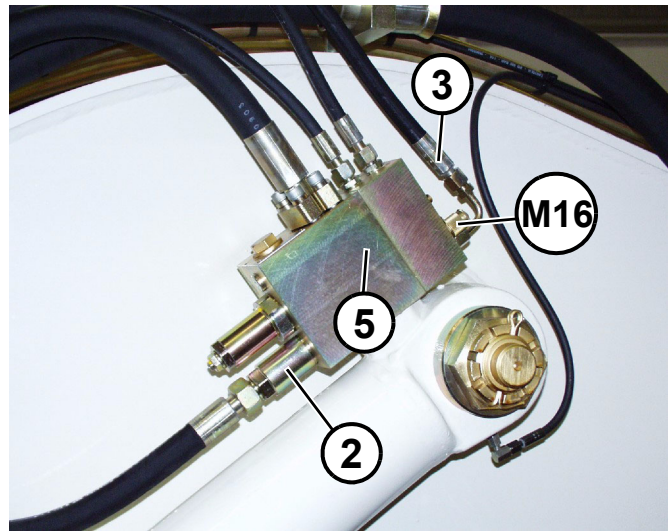
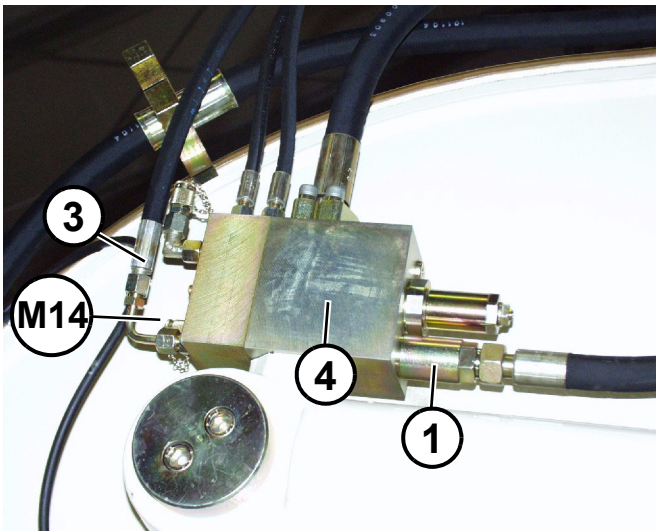
5. Extend the lifting cylinder fully.
6. Switch off the engine, ignition key in position "0" (the ignition is switched off).
7. Build up pressure using the hand pump until no further pressure change occurs. The pressure indicated is the setting pressure of the secondary valve (1) and/or (2).



WARNING

Before carrying out the adjustment make sure, that the secondary valves (1) and (2) are unpressurized and the boom/jib is lowered.

8. Correct by using the adjusting pads for the secondary valve (1) and/or (2).



WARNING

Lower the boom/jib to the ground and make sure that the blind plugs are unpressurized.

9. Remove the blind plugs and connect the balance line (3) to both valve blocks (4) and (5) back again.
10. Remove the hand pump with pressure gauge.

Chapter 6

Adjusting instructions and tables for 1604 LC

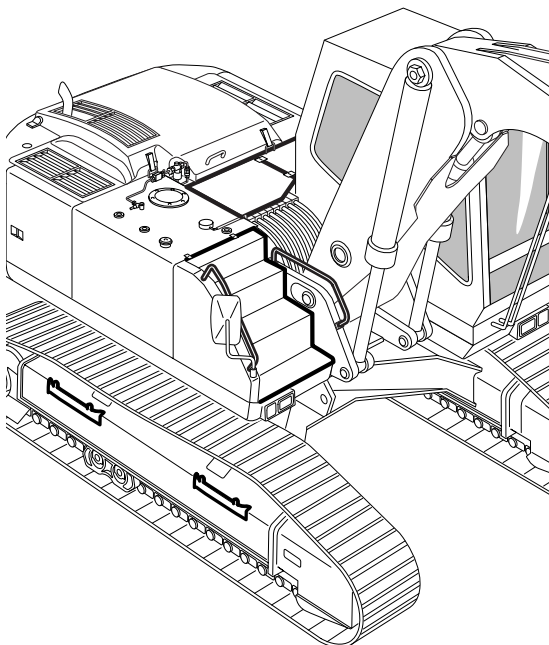
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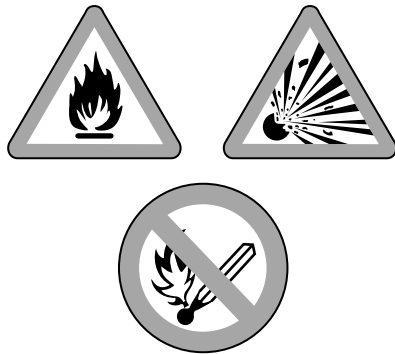
1 Safety instructions for adjustment work

- Only qualified personnel may carry out adjustment work.
- Always read the operating/adjusting instructions, before you carry out any adjustment work.
- Read the corresponding Deutz operating instructions before performing any adjustment work on the engine.
- Do not perform any adjustment work not described in the adjustment works found in the adjusting instructions.
- Note the risk of fire and explosion when you carry out the adjustment work.
Do not smoke, keep naked flames away from the excavator, and keep a fire extinguisher ready to hand.
- To avoid unnecessary downtime in operation, TEREX-ATLAS recommends seals be renewed on all adjustment work described.
- Use only genuine TEREX-ATLAS spare parts.
- When boarding and leaving the excavator, use only the steps and handrails provided.

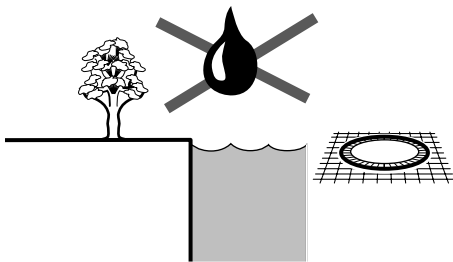


- Never climb on to the boom/jib. Use a ladder or work platform, if necessary.
- Remove all mud, oil, lubricating grease, ice and snow from the steps, handrails and contact area to ensure a safe working circumstances.

- Wear anti-slip footwear.
- Do not use the excavator again until adjustment work has been effectively completed.
- If adjustment work is done at a job site (e.g., on a construction site), cordon off the job site.
- Carry out adjustment work only if the stability of the excavator is ensured.
- Lower the boom/jib and dozer blade to the ground, or support them.
- Never work under the excavator, if it is being held only by the hydraulic system.
- When the excavator is raised, support it with suitable material (e.g., stands).
- The engine must be stopped before adjustment work is carried out, wherever applicable.
- Absolute cleanliness is essential.
Dirt may cause considerable damage to the excavator.
- Beware of hot components of the excavator such as hot oil, hot hydraulic fluid and hot coolant.
- Battery acid harms the skin and eyes.
Wear acid-proof gloves and protective goggles.
- Oil, hydraulic fluid, lubricating grease, fuel, coolant and cleaning agents harm the skin.
Use skin lotions and/ or protective equipment.
- Release the preload pressure from the hydraulic fluid tank before working on the hydraulic system.
- Switch off the electrical system with the battery isolator switch before working on the electrical system.
- Checks of the electrical system might damage it. Use therefore only a digital multimeter or a voltage tester. Do not use a test lamp.



- Note the risk of fire and explosion!
Do not smoke, do not use a naked flame,
keep a fire extinguisher ready to hand.



- Comply with environmental protection laws.
- Collect engine oil, hydraulic fluid, fuel and coolant separately and dispose of them as specified in the regulations.
- Wipe up fuel, lubricants, hydraulic fluid and coolant which have run out or been spilled, or use appropriate binding agents on them.

2 Adjustment table 1604, part 1

* Check/adjust at max. engine speed ** Check/adjust at app. 1400 rpm engine speed *** Check with hand pump					
		Index	Figure	Tolerance	Unit
1	ENGINE SPEEDS				
2	Min. idle speed		1050	+ 100/-50	min ⁻¹
3	Max. idle speed		2370	+50/-100	min ⁻¹
4	Nominal speed		2200	-40	min ⁻¹
5	PRIMARY VALVES				
6	Pump		50-60		bar
7					
*	8 Pressure cut-off		340	+10	bar
9					
10					
11					
*	12 Pilot pump		25-27		bar
*	13 Primary valve -emergency shift		22		bar
14					
15					
16					
17	POWER SHIFT CONTROLLER (delta P)				
*	18 Pump		25	+1 / -1	bar
*	19 Fine mode poti		8-25		bar
*	20 Load limit control valve (+ air pressure on hydraulic tank)		8,5	+0,2	bar
21	SECONDARY VALVES				
***	22 Lifting cylinder -raising -leak-free cut-off -line break protection valve		385	+20	bar
**	23 -Plate valve		385	+25	bar
**	24 -Lowering		365	+25	bar
25					
**	26 Jib folding cylinder (retract-extend)		365	+25	bar
27					
**	28 Bucket/Grab operating cylinder		365	+25	bar
*	29 Slewing motor -motor		50/250	+10 /+20	bar
*	30 -TC plate		240	+5 / -5	bar
31					
**	32 Drive motor -tracked		400	+20	bar
33	Drive motor -switching		300	+10	bar
34	Drive motor -switching back		130	+20	bar
**	35 Grab rotation -plate valve		210	+20	bar
36	-plate valve for quick change device and		210	+20	bar
37	trenching bucket slewable				
38	-motor		75		bar
39					
40					
2161.445.00.01.000					
1604					
 TEREX ATLAS Adjustment chart		6012354		Sheet	1

3 Adjustment table 1605, part 2

* Check/adjust at max. engine speed ** Check/adjust at app. 1400 rpm engine speed *** Check with hand pump						
			Index	Figure	Tolerance	Unit
	46					
	47					
	48					
	49					
	50					
	51					
	52	FEED PRESSURE VALVES				
	53	(without tank preload)				
*	54	Check valve return line		6,3		bar
*	55	Cooler protection valve		2,5		bar
	56					
	57					
	58	RETURN FLOW THROTTLES				
	59	(without implements + 15 bar)				bar
*	60	Lowering		50		bar
*	61	Folding		105		bar
*	62	Closing bucket		115		bar
	63					
	64					
	65	SPEEDS				
	66					
*	67	Slewing		7,5	+0,5	min ⁻¹
2161.445.00.01.000						
1604						
 TEREX ATLAS Adjustment chart			6012354		Sheet 2	

4 Adjusting instruction



WARNING

Adjustment work is performed at high pressures. Take appropriate protective action, e.g. wear protective goggles.



WARNING

Before opening any drain plugs etc., relieve the preload pressure from the hydraulic fluid tank.



NOTE

Hydraulic fluid temperature must be 40° - 60° C.

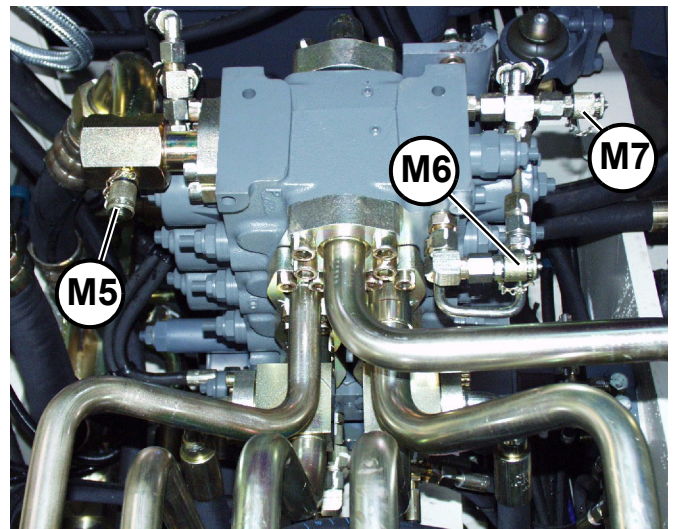
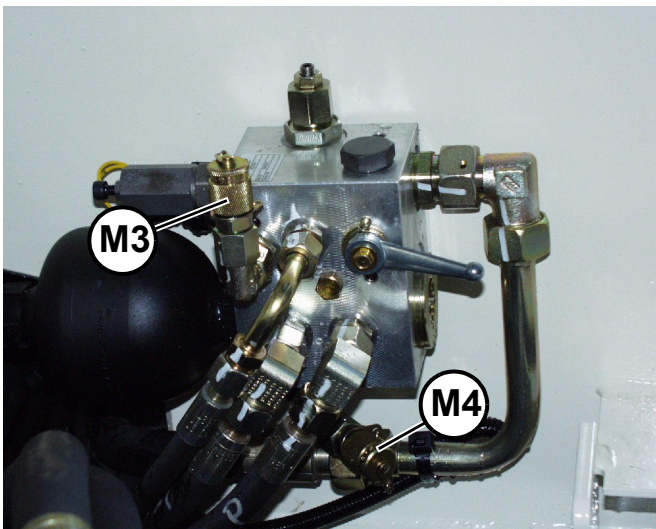
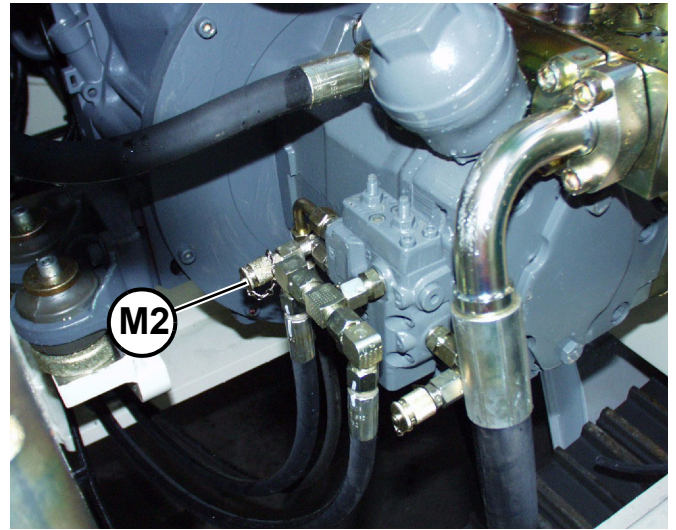
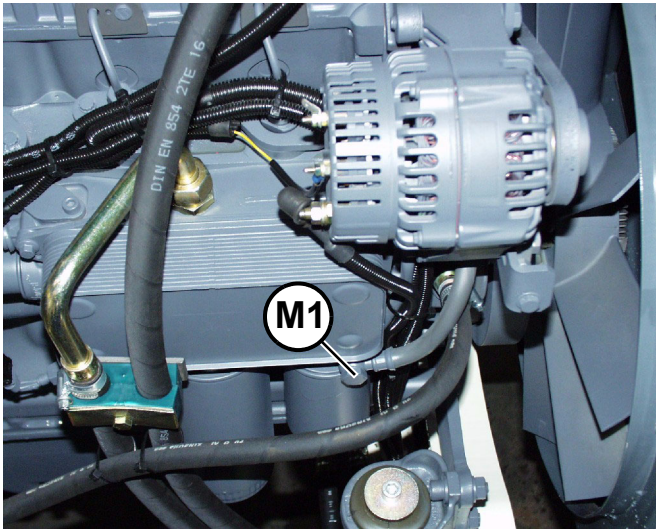
The hydraulic system comes up to operating temperature by normal actuation of the individual operating movements, but the levers must only remain at their limit stops for brief periods to avoid the damage to the excavator.



NOTE

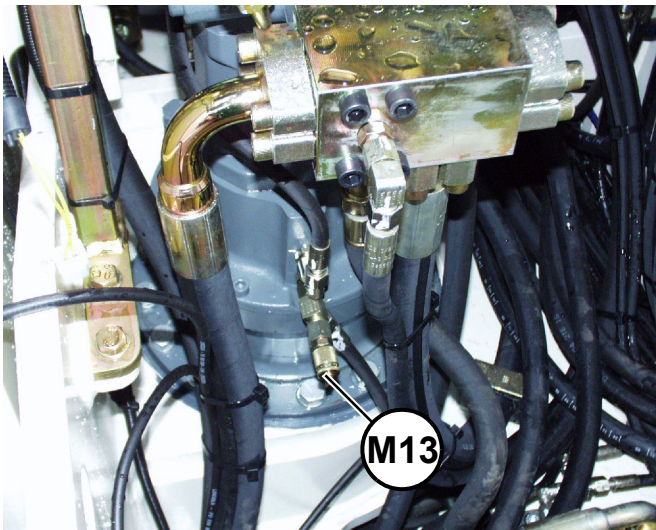
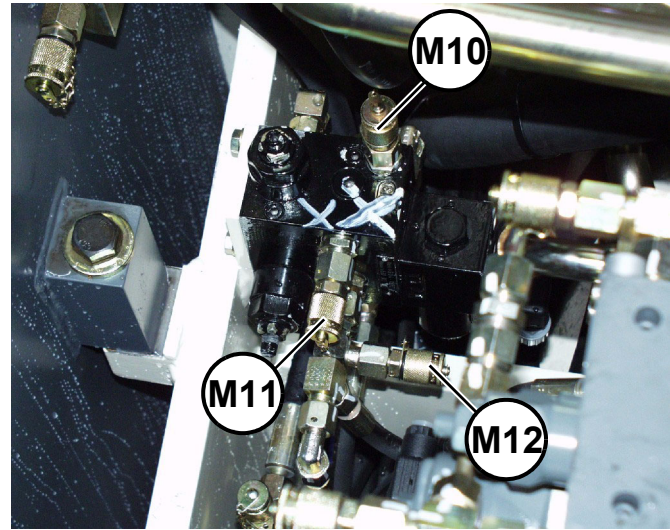
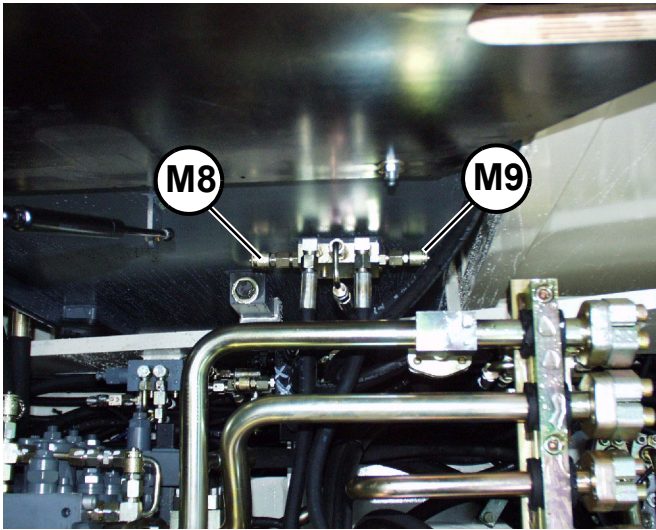
Refer to the pressure adjustment table for relevant adjustment values.

4.1 Measuring unions



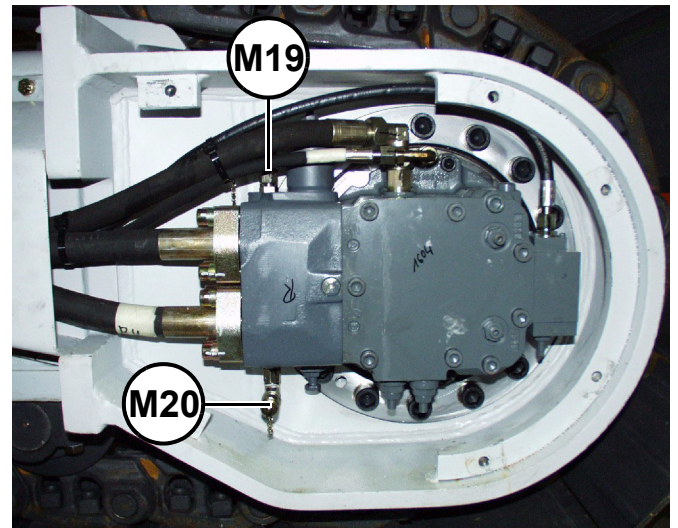
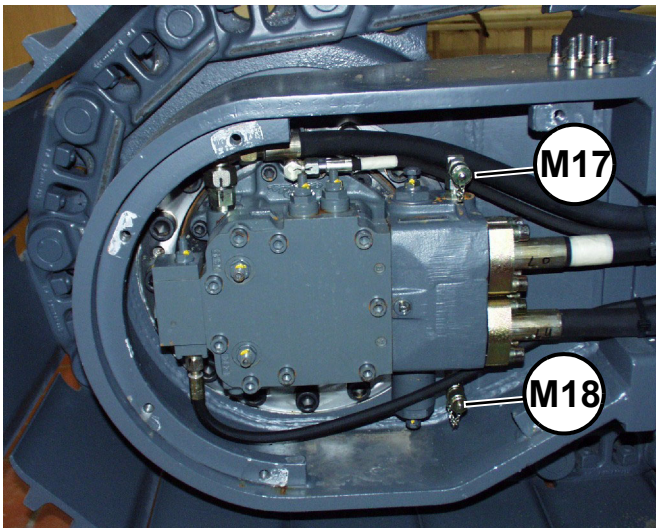
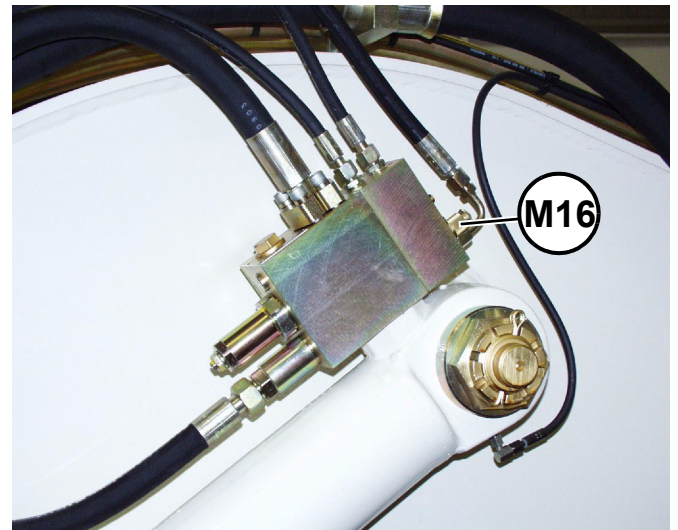
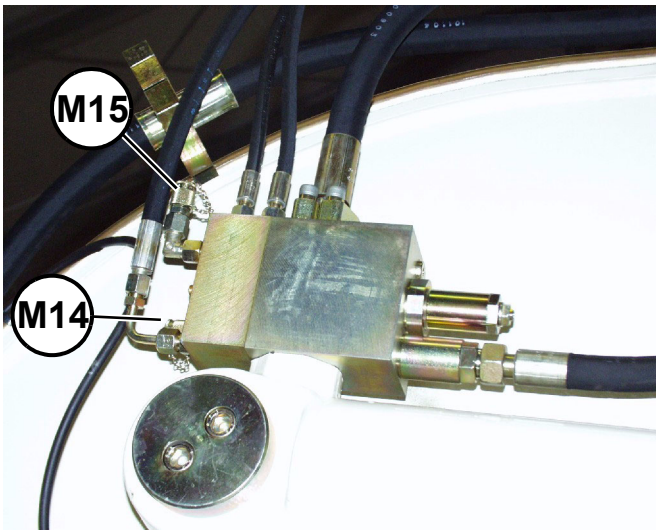
- M1 Fuel admission pressure
- M2 Load-limit pressure regulating valve
- M3 Emergency shift
- M4 Pilot control

- M5 Return line
- M6 LS-pressure
- M7 Pump



M8 Slew to left
M9 Slew to right
M10 Pilot pressure travel motor adjustment

M11 Travel pressure
M12 Bleeding control valve
M13 Slewing brake



- M14 Valve A static pressure
- M15 Pilot pressure lowering
- M16 Valve B static pressure
- M17 Secondary pressure forward travel, left

- M18 Secondary pressure reverse travel, left
- M19 Secondary pressure forward travel, right
- M20 Secondary pressure reverse travel, right

4.2 Bleeding the system



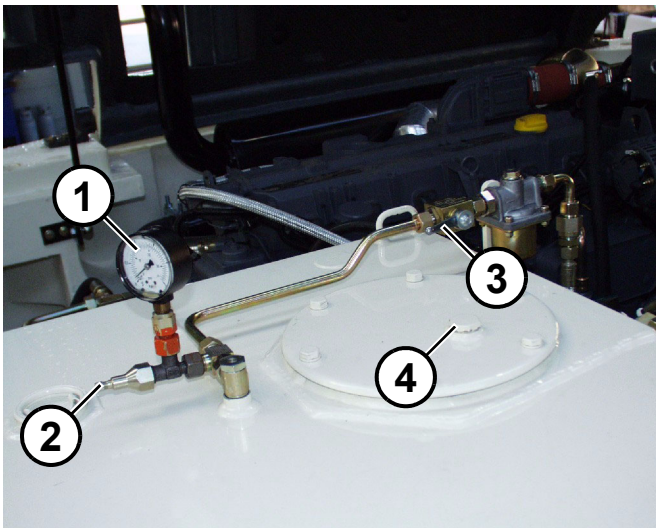
WARNING

Before starting up for the first time or after exchanging the pump, it is necessary to bleed the system.

If the system is not bled, the pump could be damaged during operation, since the pump will not be lubricated sufficiently.

When starting up for the first time and after repairing the control valve, all system must be bled additionally, see section 4.18 on page 62.

4.2.1 Bleeding hydraulic fluid tank



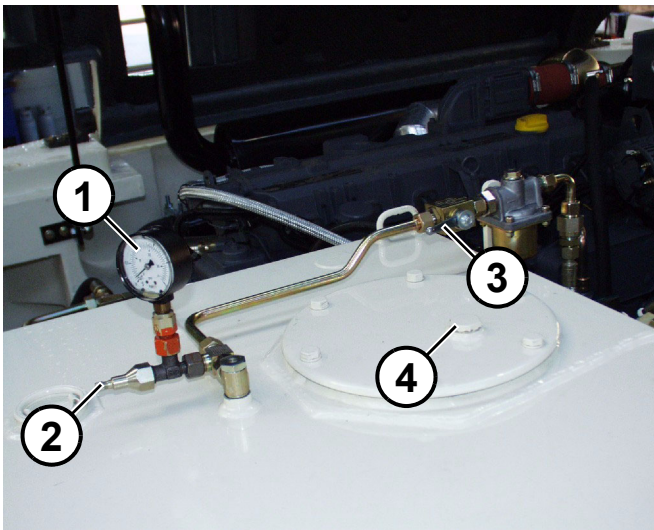
1. Connect a pressure gauge (1) to compressed air union (2).
2. Pressurise the hydraulic fluid tank with external compressed air supply via the union (2).



WARNING

The pressure gauge reading must not exceed 0.5 bar.

3. Open the valve (3).
4. Slacken off bleed screw (4).
5. Tighten the bleed screw, as soon as the hydraulic fluid emerging from there is free from air bubbles.



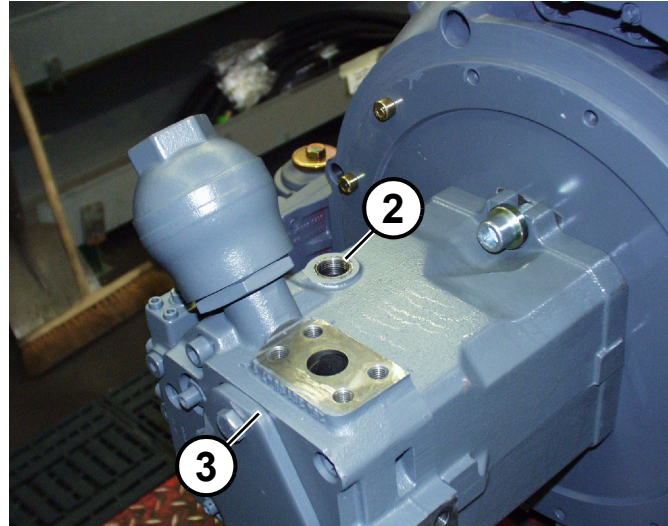
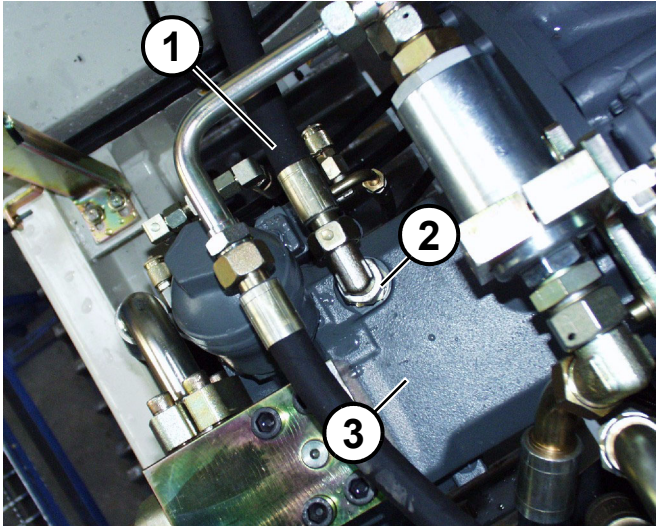
6. Close the valve (3).
7. Disconnect the external compressed air supply.
8. Remove the pressure gauge (1).

4.2.2 Bleeding hydraulic pump



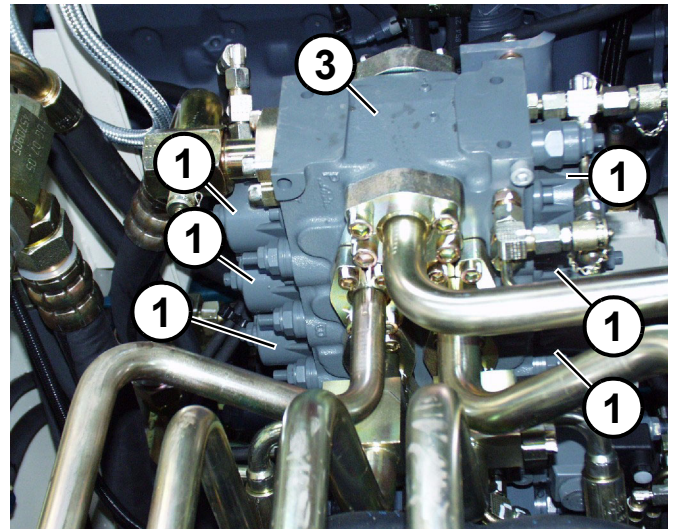
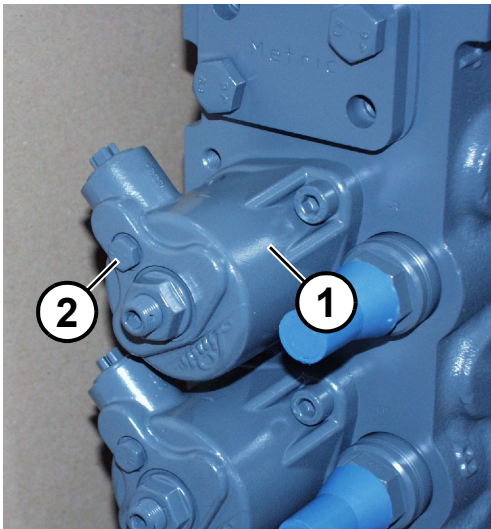
WARNING

Make sure that the pressure from the hydraulic pipe is completely released.

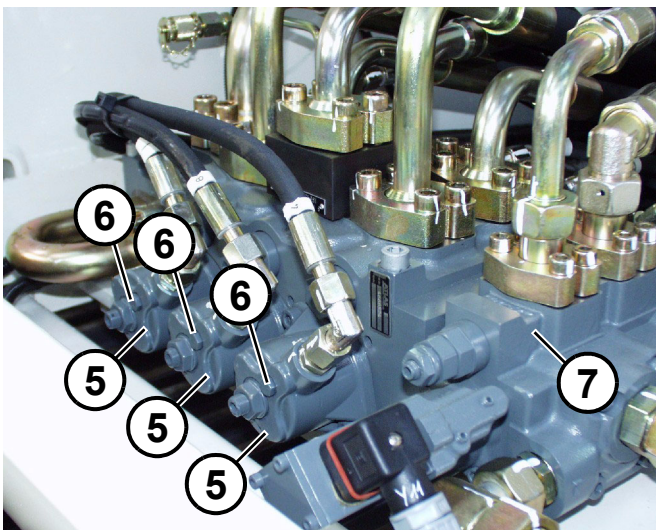


1. Disconnect the hydraulic pipe (1) at the screw connection (2) in the hydraulic pump (3).
2. Fill the hydraulic pump (3) with hydraulic fluid via the screw connection (2) up to the edge of the screw connection (2).
3. Connect the hydraulic pipe (1) at the screw connection (2) in the hydraulic pump (3).

4.2.3 Bleeding valve caps



1. Pressurise the system with external compressed air supply, see section 4.2.1 on page 12.
2. Slacken off the corresponding bleed screw (2) on the control block (3) to bleed the valve caps (1).



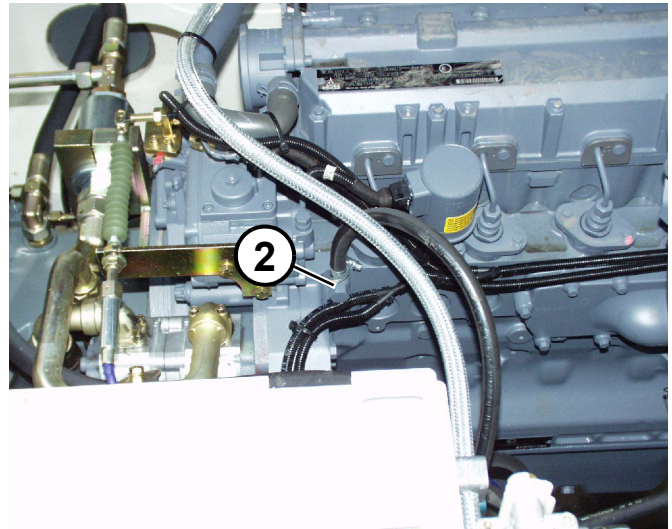
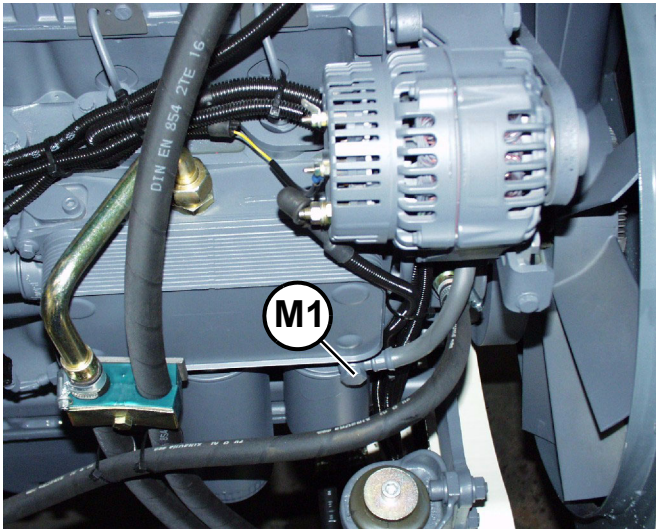
3. Slacken off the corresponding bleed screw (6) on the control block of secondary functions (7) to bleed the valve caps (5).

4.3 Fuel admission pressure



NOTE

Replace the fuel filter before checking the fuel admission pressure.



1. Remove the hollow screw (1) from measuring union "fuel admission pressure" (M1).
2. Screw in a suitable adapter, and connect the pressure gauge.
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. The fuel admission pressure on measuring union "fuel admission pressure" (M1) should read between 5 bar and 5.5 bar.



NOTE

Check the pressure-holding valve (2), in case fuel admission pressure is insufficient.

6. Switch off the engine.
7. Remove the adapter and the pressure gauge.
8. Close measuring union "fuel admission pressure" (M1) with the hollow screw (1).

4.4 Engine speed control



NOTE

Checking and adjusting the engine speed control is necessary, only if repair work on engine speed control is carried out, or the electronic box has been replaced.



NOTE

Check the fuel admission pressure before adjusting the engine speed control, see section 4.3 on page 16.

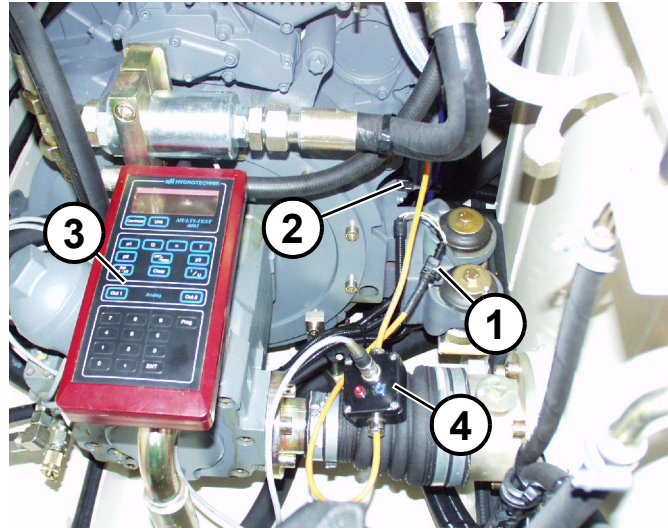
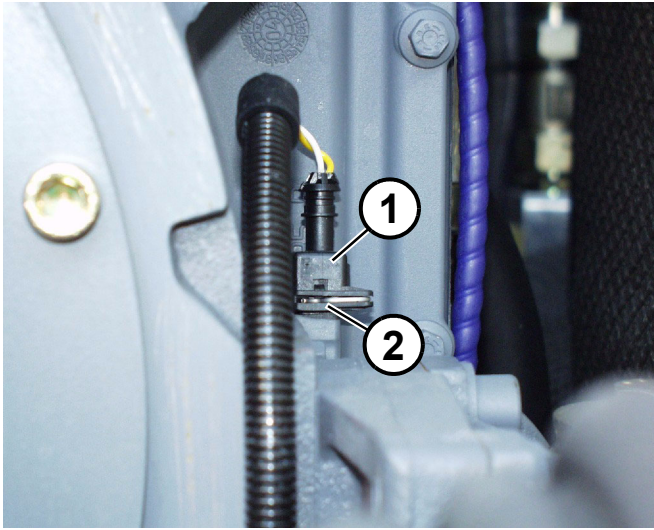


NOTE

In case bowden cable needs to be replaced, note the following:

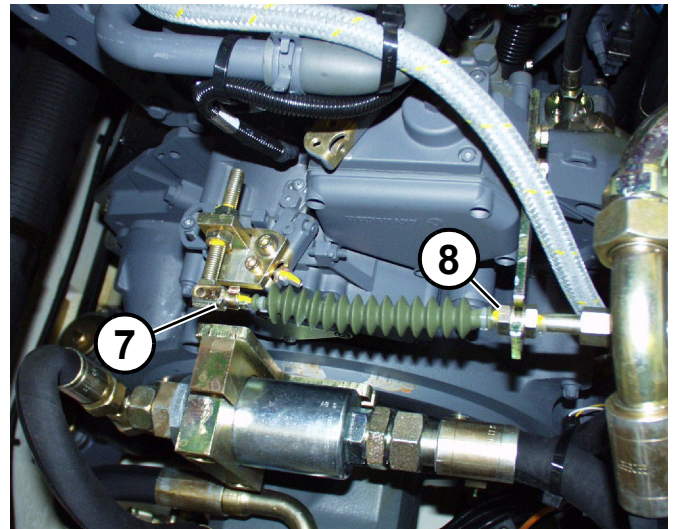
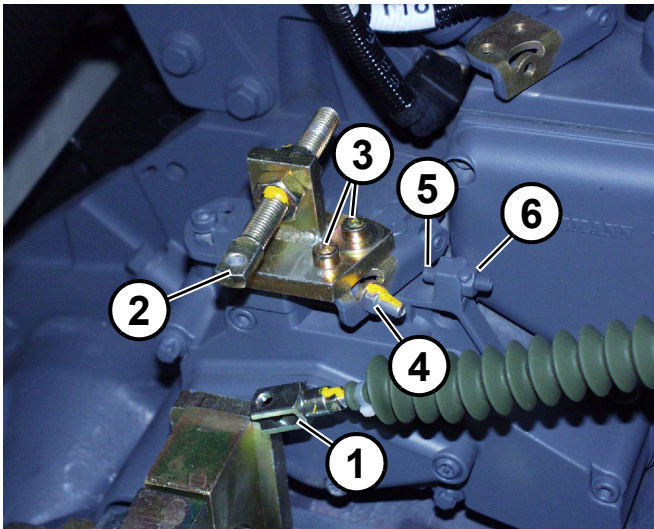
- Ensure that the bowden cable is not twisted when fixing it.
- In the speed adjusting device, trim off the rest of the bowden cable immediately after the clamping screw.
- When assembling the speed adjusting device, ensure that the converter drive plate is in the correct position.

4.4.1 Speed measurement



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Remove the connector (1) from the speed sensor (2).
3. Connect up revolution counter (3) through a suitable adapter (4) between the speed sensor (2) and the connector (1).
4. Set the revolution counter (3) to 129 pulses per revolution.

4.4.1.1 Minimum engine speed



1. Disengage fork head (1).
2. Position the threaded rod (2) of the speed adjustment parallel to the crankshaft.
3. Correct if necessary at the adjusting screws (3).
4. Start the engine.
5. The minimum engine speed displayed must be $(1050 +100 / -50)$ rpm.
6. Correct if necessary at the adjusting screws (4).

4.4.1.2 Maximum engine speed

1. Move the speed adjustment at the threaded rod (2) towards the stop (5) by hand.
2. The maximum engine speed displayed must be $(2470 +50 / -100)$ rpm.
3. Correct if necessary at the adjusting screws (6).
4. Switch off the engine.

4.4.2 Bowden-cable play

1. Connect the fork head (1) without any play. The bowden-cable should **not hang down slack**.

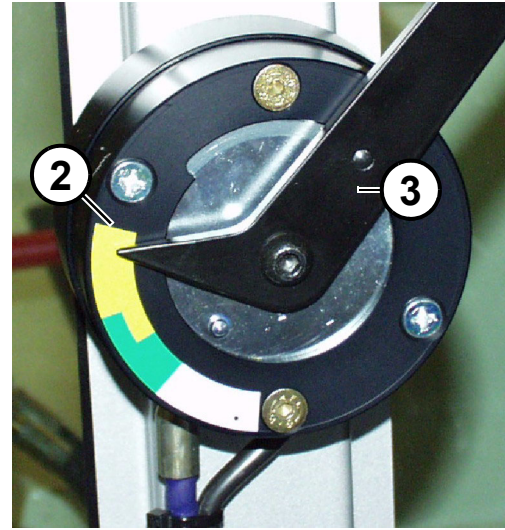
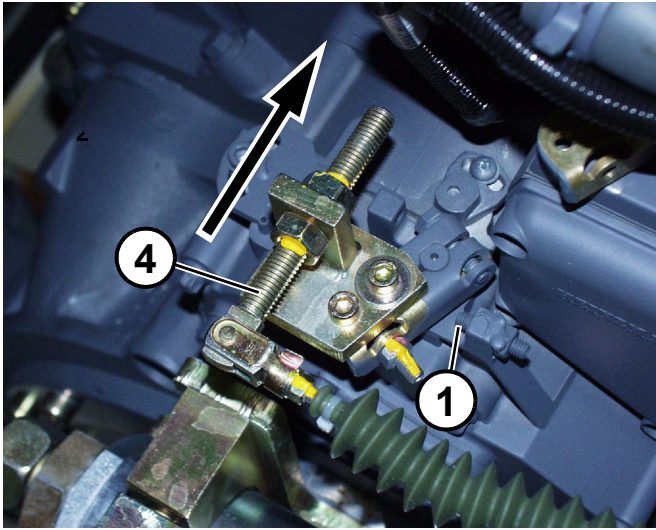


NOTE

Ensure that the split pin (7) is in the correct position.

2. Correct the bowden-cable play, if necessary at the adjusting screw (8).

4.4.3 Mechanical stop



NOTE

The maximum mechanical stop (1) for the controller should be located shortly before the stop position (2) for the speed adjusting lever (3).

1. Correct the mechanical stop if necessary at the threaded rod (4) on the speed adjustment (engine control).



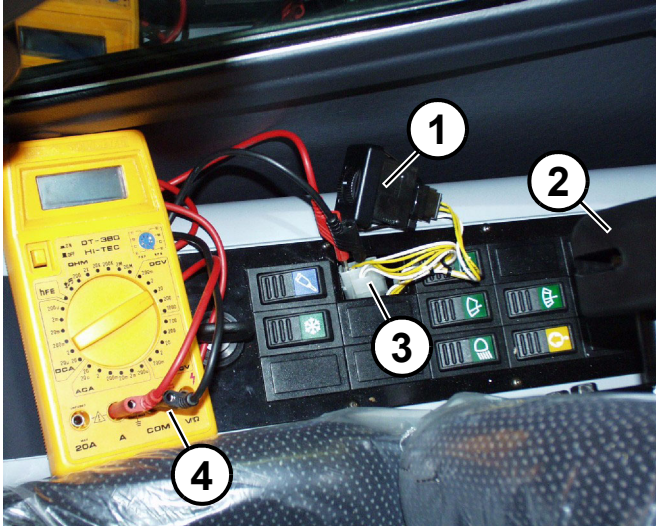
NOTE

If the threaded rod is adjusted in arrowed direction, the stop position on the speed adjusting lever (3) is reached later.

If the threaded rod is adjusted against arrowed direction, the stop position on the speed adjusting lever (3) is reached earlier.

4.4.4 Speed adjusting lever

4.4.4.1 Checking



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Pull out the rotary switch (1) on the right-hand armrest console (2).
3. Connect an appropriate voltmeter (4) to the three-pole plug (3) of the rotary switch (1).

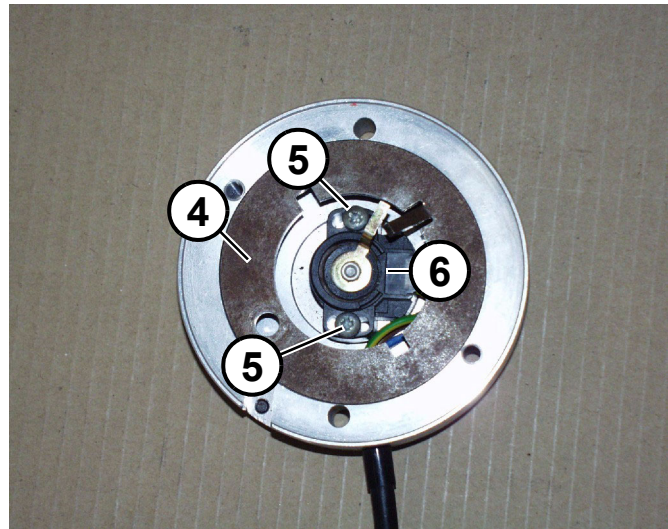
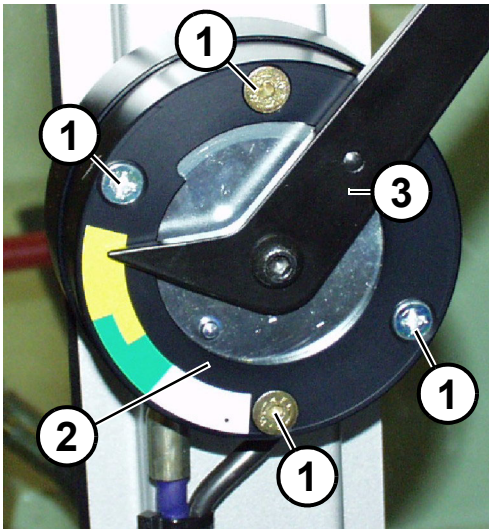


NOTE

Connect the voltmeter earth to the plug-in connection (green/yellow) of the three-pole plug (3).
Connect the voltmeter input to the plug-in connection (brown) of the three-pole plug (3).

4. Switch on the ignition, ignition key in position "I".
5. Move the engine speed adjusting lever to the minimum speed position (to its stop). The voltage should be between 0.15 Volt and 0.60 Volt.
6. Move the speed adjusting lever to the maximum speed position (to its stop). The voltage should be between 4.00 Volt and 4.85 Volt.
7. Switch off the ignition, ignition key in position "0".
8. Correct if necessary, see section 4.4.4.2 on page 22, and after that check the voltage once again (steps 4 to 8).
9. Remove the voltmeter (4).
10. Put the rotary switch (1) back in place on the right-hand armrest console (2).

4.4.4.2 Setting



1. Screw out four screws (1) and remove the cover (2) together with speed adjusting lever (3).
2. Impress the correct position of the drive plate (4).
3. Remove the drive plate (4).



NOTE

Check, if the rest of the bowden cable in the speed adjusting device is immediately trimmed off after the clamping screw. Trim off if necessary.

4. Slacken off both screws (5).
5. Rotate the potentiometer (6) to adjust if necessary.

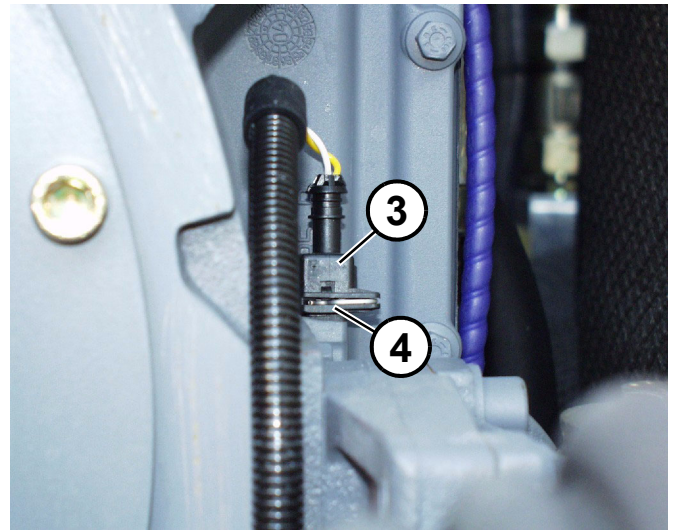
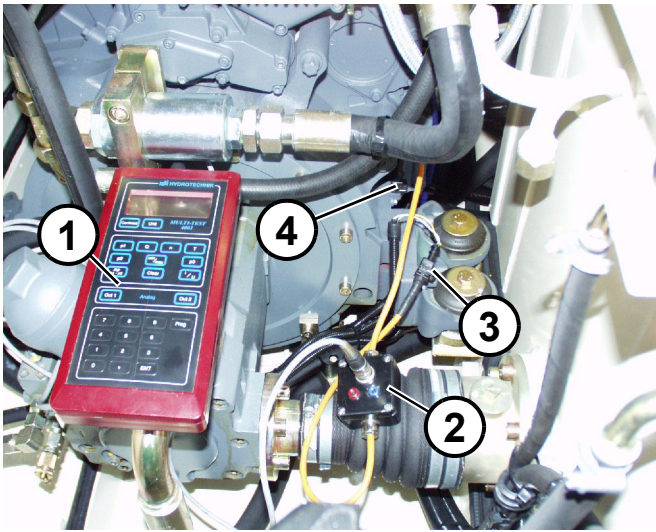


NOTE

If the potentiometer is rotated clockwise, the voltage drops.

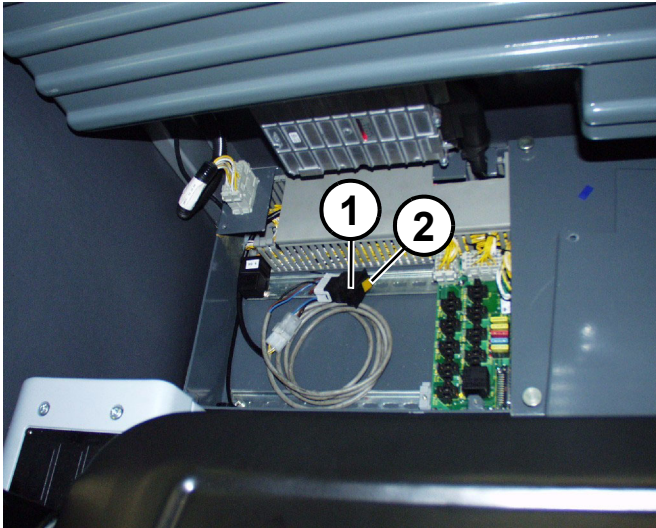
6. Tighten both screws (5).
7. Engage the drive plate (4). When assembling, ensure that the drive plate (4) is in the correct position.
8. Fix the cover (2) together with speed adjusting lever (3) back in again and fasten four screws (1).

4.4.5 Testing speed



1. Start the engine.
2. Check the speed at minimum speed position (to its stop) and at maximum speed position (to its stop) in the engine speed adjusting lever.
3. Switch off the engine.
4. Repeat the entire adjusting procedure if necessary, see section 4.4.4.2 on page 22.
5. Remove the revolution counter (1) and the adapter (2).
6. Connect the plug (3) to the speed sensor (4).

4.5 Teach-in the electronic box



NOTE

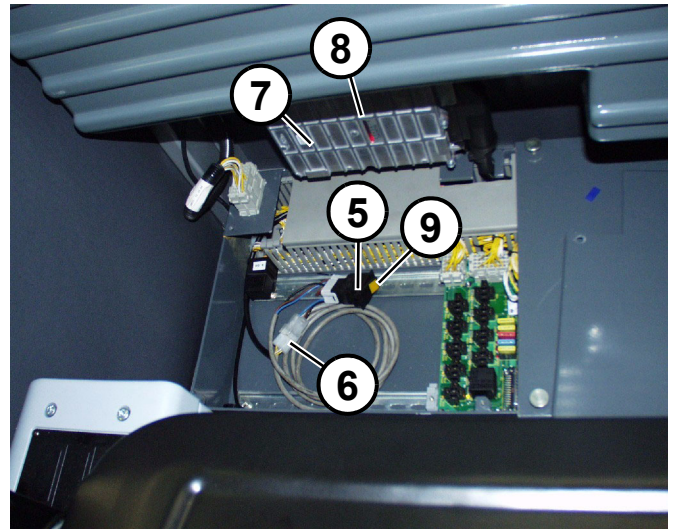
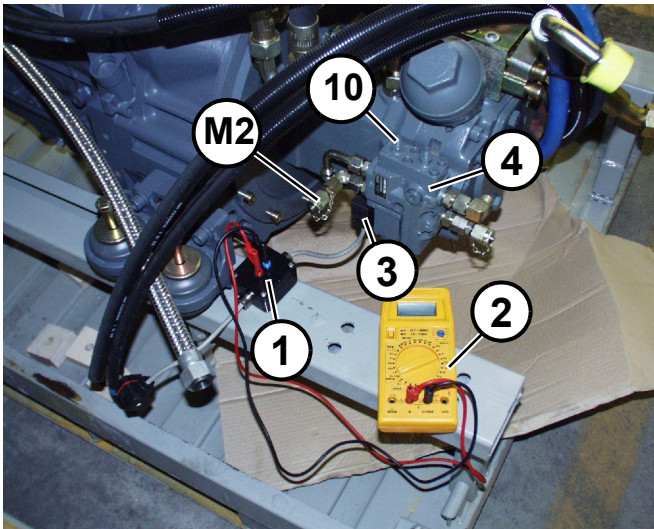
The teach-in procedure can be interrupted at any time. Hold the teach-in switch (1) depressed until the telltale (2) in the teach-in switch (1) goes out.



NOTE

The teach-in procedure is interrupted if the ignition is switched off. The last teach-in characteristic which have been determined remains valid.

4.5.1 Load-limit regulating valve



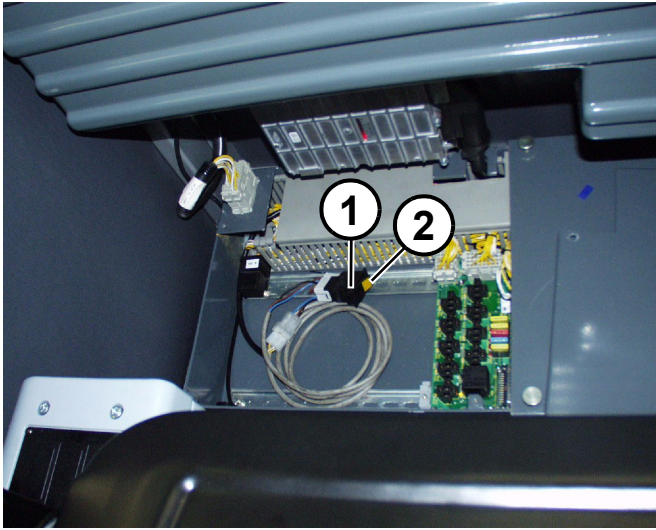
1. Connect a pressure gauge to the measuring union "load-limit regulating valve" (M2).
2. Connect the electronic measuring instrument (2) between the plug (3) and the connecting line of the load-limit regulating valve (4) via an appropriate adapter (1).
3. Connect the teach-in switch (5) into plug (6) to the electronic box (7).
4. Switch on the ignition, ignition key in position "I". The red LEDs 1 - 8 (8) in the electronic box (7) must come on for about 3 seconds (bulb test). After that the LED 1 ("speed sensor") remains on. If the electronic box (7) has been exchanged, the LED 8 ("teach-in phase") lights up additionally, see troubleshooting table, see section 4.6.2 on page 29.
5. Start the engine. The LED 1 ("speed sensor") must go out.
6. Move the engine speed adjusting lever to the minimum speed position (to its stop).
7. Press the teach-in switch (5) for about 5 seconds. Telltale (9) in teach-in switch lights up (permanently). A control current (300 +/- 5) mA now emitted by the electronic box (7) energises the load-limit regulating valve (4). The control pressure shown in the pressure gauge display falls to about 2 to 5 bar, then slowly rises to the set value of (8.5 +/- 0.2) bar plus the tank delivery pressure.
8. Correct this value at the adjusting screw (10) if necessary.
9. Quit the teach-in procedure by pressing the teach-in switch (5) for about 1 second. Telltale (9) starts flashing.



NOTE

If only the load-limit regulating valve is to be adjusted, press the teach-in switch (5) until telltale (9) goes out and continue with step 24 on page 27.

4.5.2 Engine speed



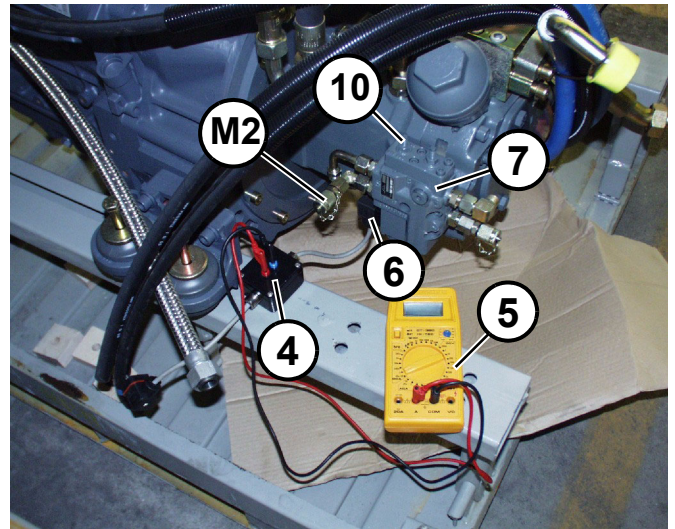
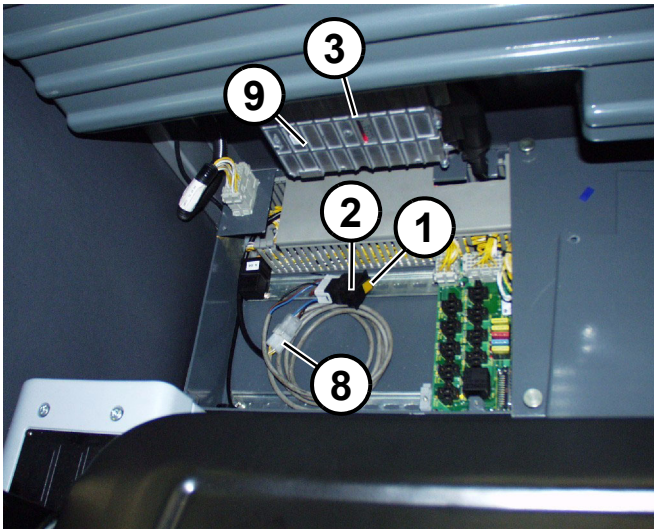
4.5.2.1 Maximum engine speed

10. Move the engine speed adjusting lever to the maximum speed position (to its stop).
11. Wait for the engine speed to settle down.
12. Press the teach-in switch (1) for about 1 second. Telltale (2) starts flashing rapidly.

4.5.2.2 Minimum engine speed

13. Move the engine speed adjusting lever to the minimum speed position (to its stop).
14. Wait for the engine speed to settle down.
15. Press the teach-in switch (1) for about 1 second. Telltale (2) starts flashing, with "on" flashing phase longer than the "off" phase.

4.5.2.3 Four points on the speed characteristic



16. **Slowly** raise the speed with the engine speed adjusting lever until telltale (1) stops flashing and remains on permanently.
17. Wait for the engine speed to settle down.
18. Press the teach-in switch (2) for about 1 second. Telltale (1) starts flashing, with "off" phase longer than the "on" flashing phase.
19. Repeat each step from 16 to 18 two more times without exceeding the set value. Raise the speed **slowly** during the procedure.



NOTE

If telltale (1) in the teach-in switch (2) flashes rapidly, the set value has been exceeded. Move the speed adjusting lever back to minimum engine speed (to its stop) and start with step 16 again.

20. Move the engine speed adjusting lever to the maximum speed position (to its stop).
21. Wait for the engine speed to settle down.
22. Press the teach-in switch (2) for about 1 second. Telltale (1) flashes for about 1 second and then goes out.
23. LED 8 (3) goes out. The teach-in procedure is then complete.
24. Switch off the engine, ignition key in position "0" (the ignition is switched off).
25. Remove the pressure gauge.
26. Remove the adapter (4) and the electronic measuring instrument (5).
27. Connect the plug (6) and the connecting line of the load-limit regulating valve (7).
28. Remove the teach-in switch (2) from the plug (8) in the electronic box (9).

4.6 Error diagnosis

4.6.1 General notes



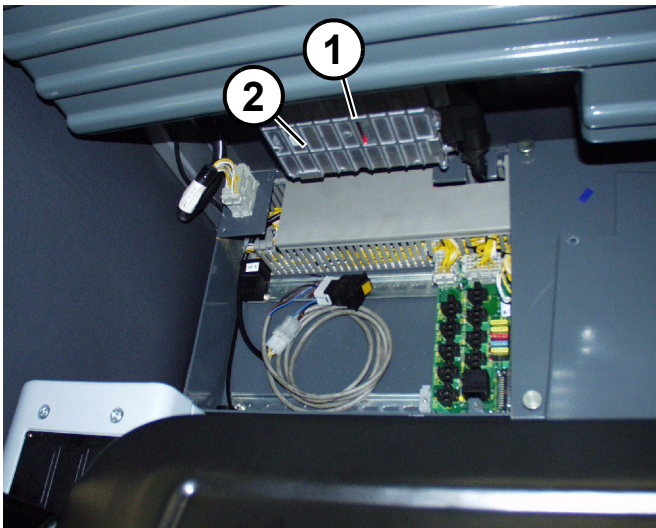
NOTE

Error diagnosis can only be performed while the engine is running.



NOTE

Not all faults in the electronics unit and the load-limit regulation system are displayed by a continuous light at the indicator lamps (GLR) on the display panel.



NOTE

Fault displays are issued automatically: the appropriate LED (1) in the cover (2) of the electronic box lights up, see section 4.6.2 on page 29.



NOTE

Once the ignition key has been switched into position "I", all LEDs (1) lights up for about 3 seconds (bulb test).

4.6.2 Troubleshooting table



NOTE

The troubleshooting table display for LED in the electronic box is shown from top to bottom. The downmost is LED 1, the upmost is LED 8.

LED	Component	GLR indicator lamp
8	Electronic box teach-in phase not completed or faults occurred during the teach-in phase ¹	flashes
7	Connection between electronic box and computer circuit board broken or pressure switch on	-
6	LS-magnet in load-limit regulating valve	lights up
5	Electronic box	lights up
4	Voltage supply of potentiometer for speed adjusting lever and Δp -lowered (delta p)	lights up
3	-	-
2	Pressure switch "driving" ² and "kickdown" ² switch	-
1	Speed sensor	lights up

1 see section 4.6.2.2

2 see section 4.6.2.1

4.6.2.1 LED 2

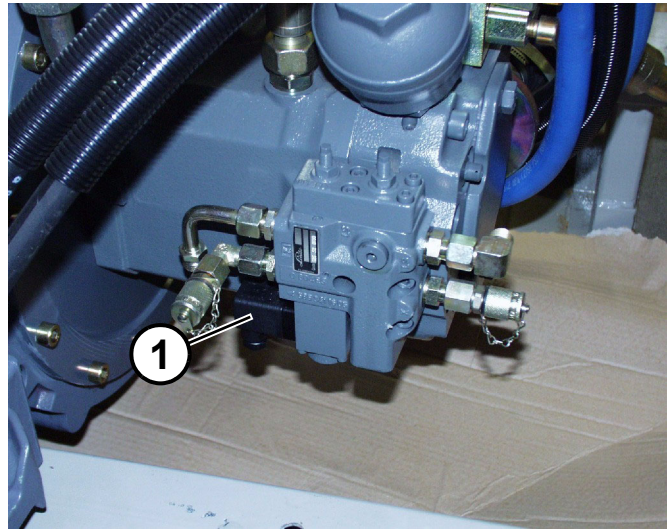
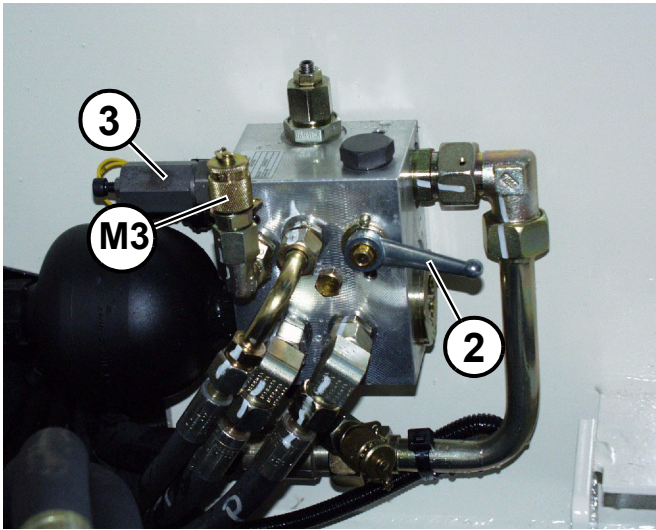
LED 2 comes on for about 3 seconds, when the appropriate contacts "driving" or "kickdown" are opened or closed.

4.6.2.2 LED 8

LED 8 indicates various faults. The following faults are displayed by flashing in different ways:

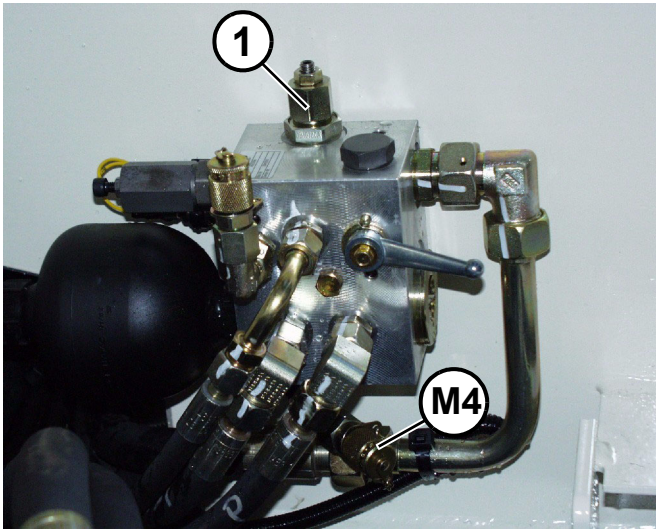
LED 8 flashes:	Faults
1 flash	Minimum engine speed outside tolerance range
2 flashes	Maximum engine speed outside tolerance range
3 flashes	Engine speed - potentiometer voltage outside tolerance range
4 flashes	Engine speed - potentiometer faulty

4.7 Emergency shift



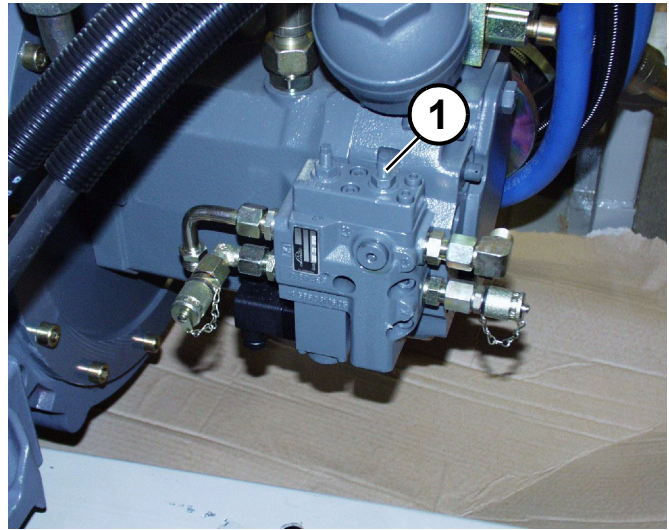
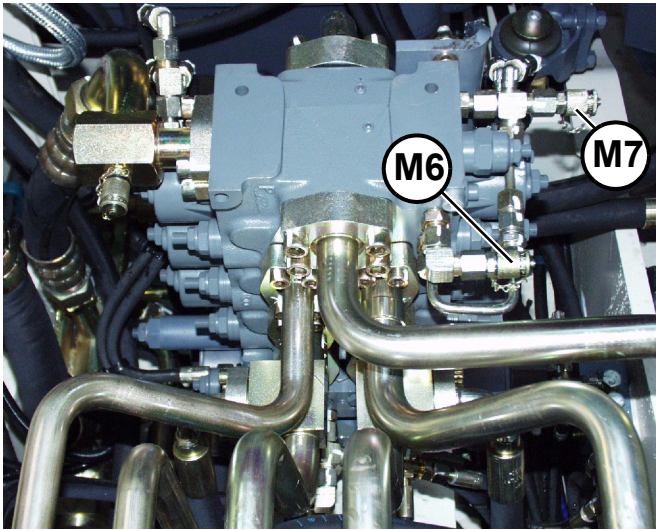
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "emergency shift" (M3).
3. Remove the plug (1) from the load-limit regulating valve.
4. Activate the emergency shift by switching the control lever (2) to a vertical position.
5. Start the engine.
6. Move the engine speed control lever to the maximum speed position (to its stop).
7. Adjust the set pressure value for the pressure limiting valve of emergency shift by screwing in/out the adjusting screw (3).
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Deactivate the emergency shift by switching the control lever (2) to the original horizontal position.
10. Connect the plug (1) to the load-limit regulating valve.
11. Remove the pressure gauge from the measuring union "emergency shift" (M3).

4.8 Pilot control



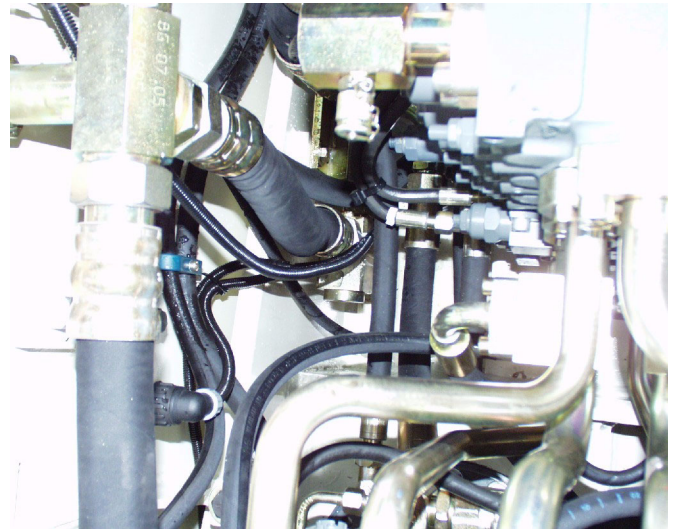
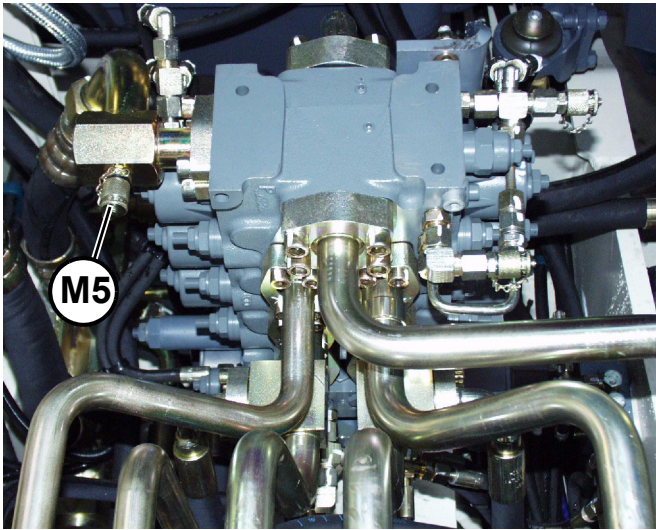
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "pilot control" (M4).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Adjust the set pressure value for the pilot control pump by screwing in/out the adjusting screw (1).
6. Switch off the engine, ignition key in position "0" (the ignition is switched off).
7. Remove the pressure gauge.

4.9 LS-controller



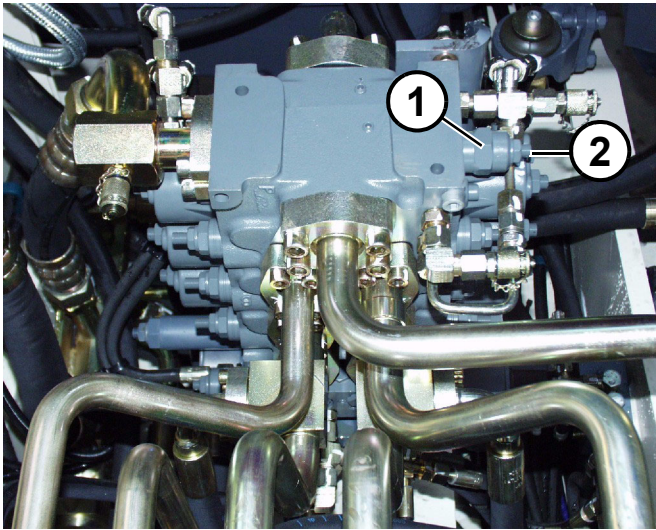
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect the differential pressure measurement to the measuring union "pump" (M7) and "LS-controller" (M6).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Slowly select the "raising" function.
6. Adjust the set pressure value for differential pressure of the LS-controller by screwing in/out the adjusting screw (1).
7. Switch off the engine, ignition key in position "0" (the ignition is switched off).
8. Remove the differential pressure measurement.

4.10 Return line control block



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Connect a pressure gauge to measuring union "return line" (M5).
3. Start the engine.
4. Move the engine speed control lever to the maximum speed position (to its stop).
5. Activate any hydraulic function, such as the "jib folding out" function.
6. The pressure on measuring union "return line" (M5) should be 7 bar while the hydraulic function is activated.
7. Correct the pressure at the adjusting screw on the valve (1) if necessary.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge.

4.11 Pressure cut-off device



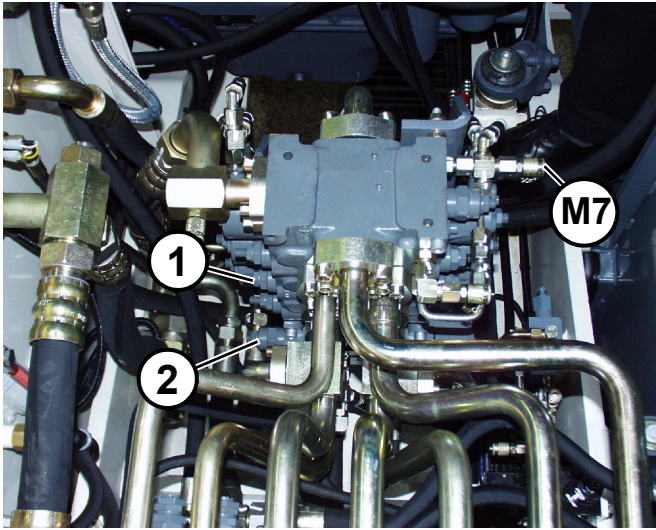
1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Fully tighten the adjusting screw (2) of the pressure cut in stage (1).
3. Screw out the adjusting screw (2) of the pressure cut in stage (1) by six complete turns.

4.12 Secondary valves

Before adjusting the secondary valves, the pressure P must be raised by adjusting at the pressure cut-off device, see section 4.12.1 on page 36.

After adjusting the secondary valves, the pressure P must be set to the correct value by adjusting at the pressure cut-off device, see section 4.12.7 on page 42.

4.12.1 Raising pressure P



1. Connect a pressure gauge to measuring union "pump" (M7).
2. Start the engine.
3. Set the engine speed to approx. 1700 rpm.
4. Move "jib folding out" function to its stop position and hold in place. The pressure of the "jib folding out" is displayed at measuring union "pump" (M7).
5. Tighten the adjusting screw (1) for the secondary valves "jib folding out" by approx. one turn. The pressure at measuring union "pump" (M7) is now limited by the pressure cut-off device while the "jib folding out" function is active.

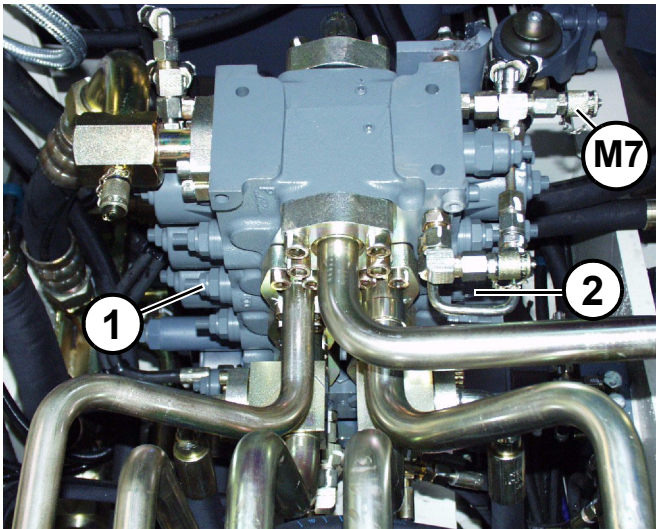


WARNING

The pressure displayed at measuring union "pump" (M7) should not exceed 460 bar during the following adjustments.

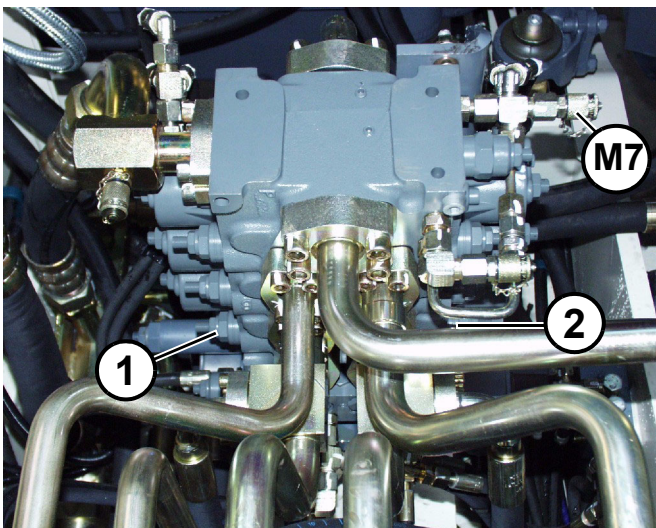
6. Move "jib folding out" function to its stop position and hold it. The pressure of the pressure cut-off device is displayed at measuring union "pump" (M7).
7. Tighten the adjusting screw (2) for the pressure cut-off device to set the pressure at measuring union "pump" (M7) 20 bar above the maximum secondary pressure setting.
8. Repeat steps 6 to 8 as necessary.

4.12.2 Adjusting secondary valve "jib folding in/out"



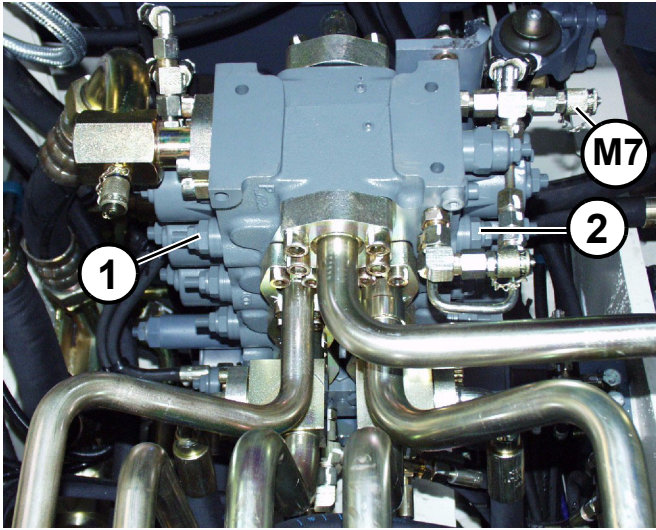
1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "jib folding out" (1) or "jib folding in" (2).

4.12.3 Adjusting secondary valve "opening/closing bucket"



1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "opening bucket" (1) or "closing bucket" (2).

4.12.4 Adjusting secondary valve "raising/lowering"



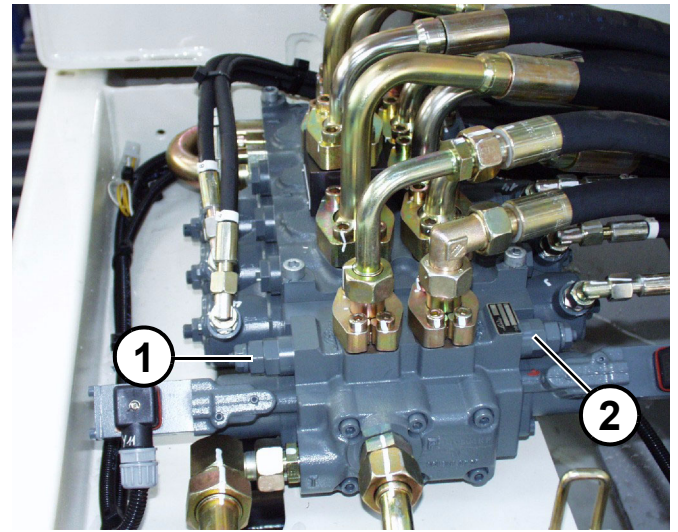
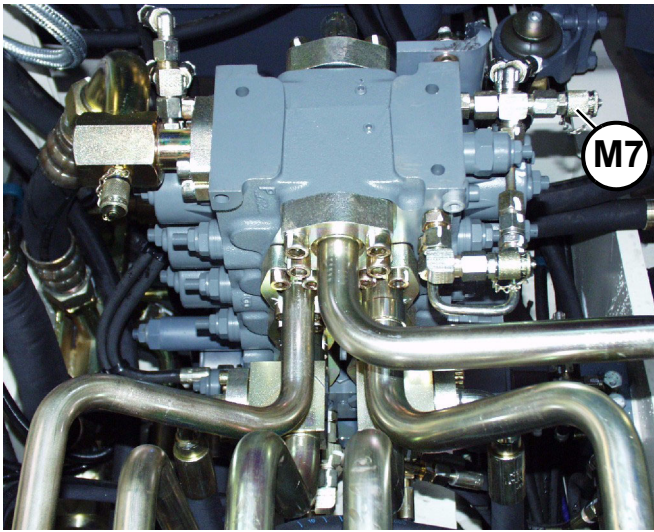
1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "raising" (1) or "lowering" (2).



NOTE

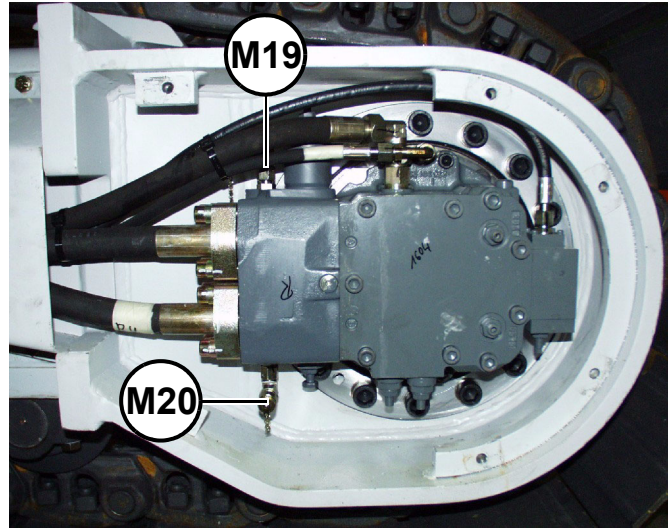
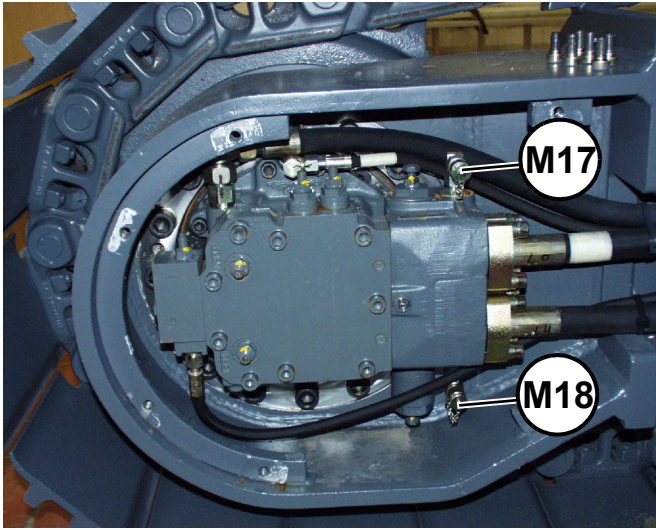
If the prescribed pressure value for the secondary valve is not reached, check the adjustment of the line break protection valve at the lifting cylinder, see section 4.20 on page 66.

4.12.5 Adjusting secondary valve "grab rotation"

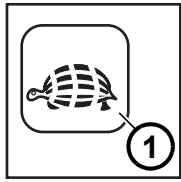


1. Set the engine speed to approx. 1400 rpm.
2. The pressure of secondary valve is displayed at the measuring union "pump" (M7) by activating the corresponding function.
3. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "rotate to right" (1) or "rotate to left" (2).

4.12.6 Adjusting secondary valve "travel"

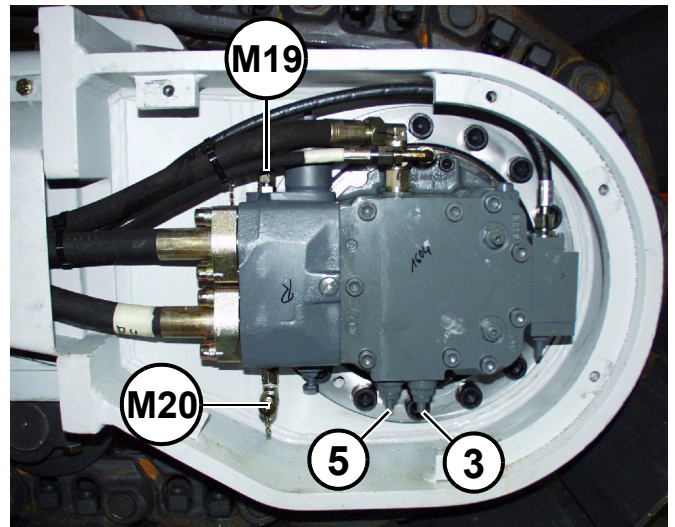
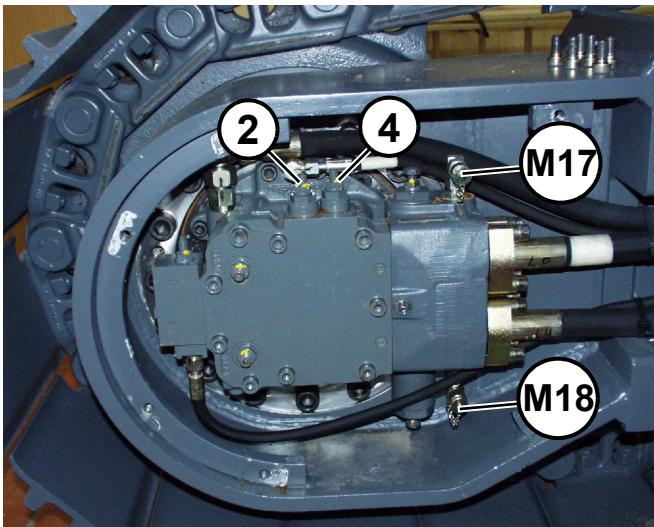


1. Lock the drive units, see section 4.16.1 on page 57.
2. Connect pressure gauges to measuring union "secondary pressure forward travel, left" (M17), "secondary pressure reverse travel, left" (M18), "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).
3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.
5. Shift selector switch to crawler speed I ("higher speed").



WARNING

Ensure that the selector switch is shifted to position crawler speed I ("higher speed"), the symbol (1) "turtle" in the display panel should not light up, otherwise the disc break can be destroyed.



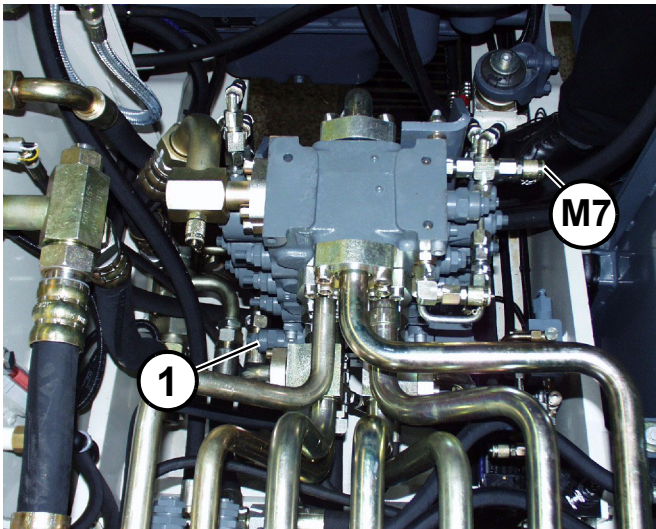
6. The pressure of secondary valve is displayed at the measuring union "secondary pressure forward travel, left" (M17), "secondary pressure reverse travel, left" (M18), "secondary pressure forward travel, right" (M19) or "secondary pressure reverse travel, right" (M20). Check each crawler track **separately** by operating the control handle.
7. The adjustment for the corresponding secondary valve is carried out by screwing in/out the respective adjusting screws for "forward travel" (2) or (3), and/or "reverse travel" (4) or (5), located on both inner back sides of the crawler unit.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauges from measuring union "secondary pressure forward travel, left" (M17), "secondary pressure reverse travel, left" (M18), "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).
10. Release the drive units, see section 4.16.2 on page 59.

4.12.7 Adjusting pressure P



WARNING

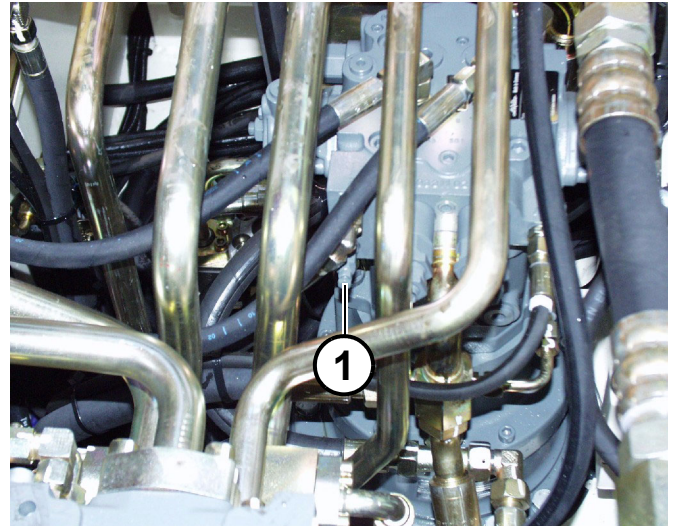
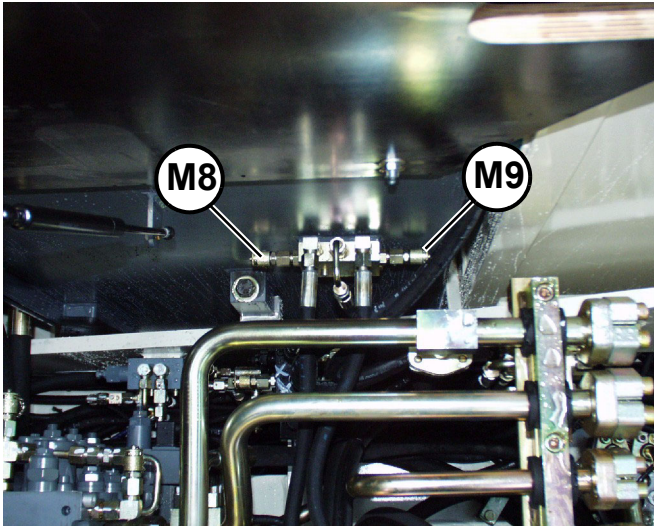
The pressure displayed at measuring union "pump" (M7) should not exceed 460 bar during the following adjustments.



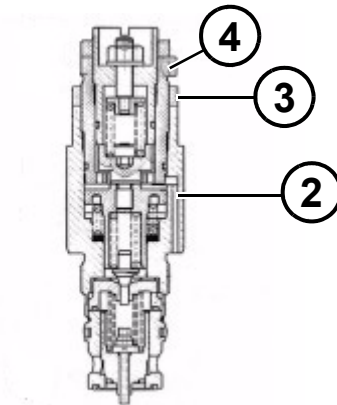
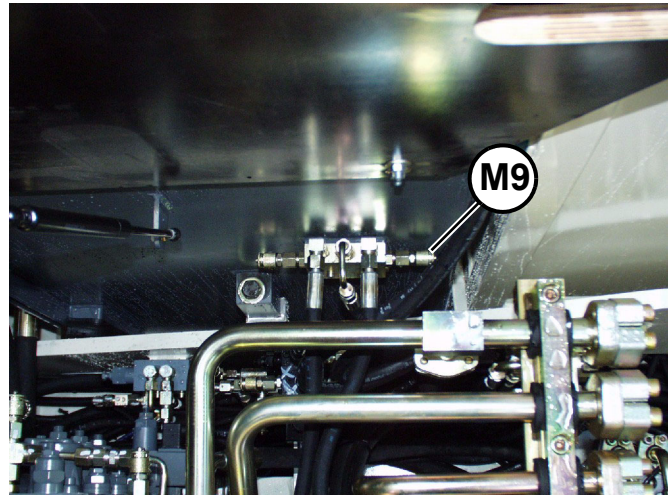
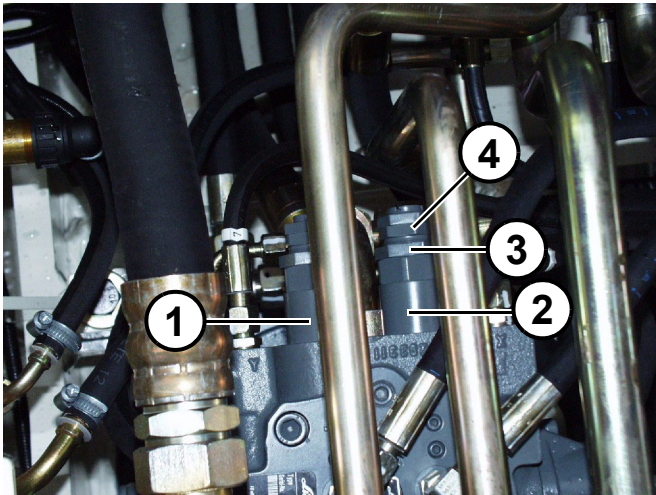
11. Start the engine.
12. Move the engine speed control lever to the maximum speed position (to its stop).
13. Adjust the pressure at the measuring union "pump" (M7) of the pressure cut-off device to the specified value by screwing in/out the adjusting screw (1).
14. Switch off the engine, ignition key in position "0" (the ignition is switched off).
15. Remove the pressure gauges.

4.13 Secondary valve "slewing"

4.13.1 Adjusting secondary valve "slewing"



1. Connect pressure gauges to the measuring unions "slew to left" (M8) and "slew to right" (M9).
2. Tighten the adjusting screw on the TC-valve (1) fully.
3. Secure the superstructure of the excavator.
4. Start the engine.
5. Move the engine speed control lever to the maximum speed position (to its stop).



The adjustment on both "slew to left" (1) or "slew to right" (2) valves are carried out as follows (steps 6 to 9):

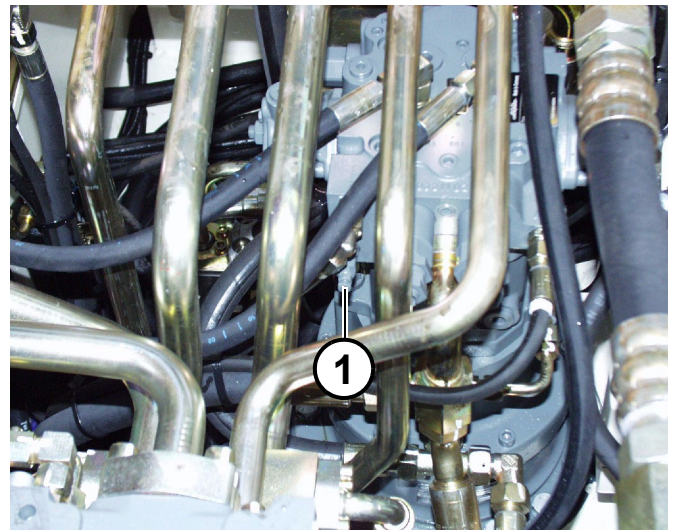
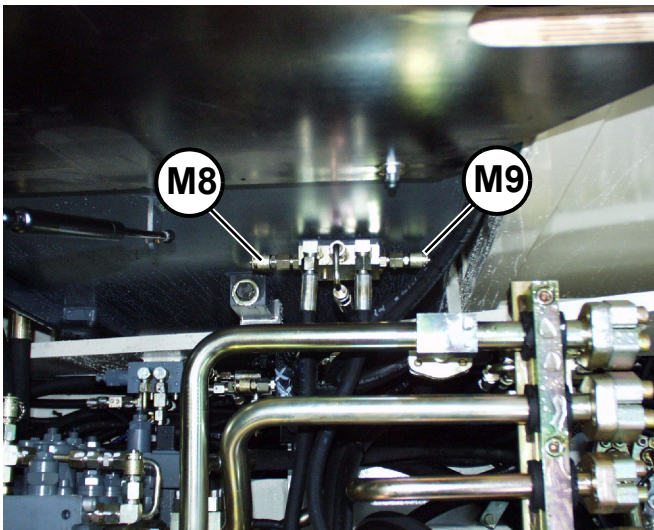
6. Loosen the fixing nut (3) of the valve to be adjusted (in picture above, "slew to right" shown).



WARNING

Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

7. Turn the screw (4) of the valve to be adjusted (here for example, "slew to right") until the corresponding pressure at the secondary valve (here for example, pressure at measuring union "slew to right" (M9)) reaches the specified value, while the corresponding function is activated (here for example, "slew to right").
8. Lock the screw (4) with the fixing nut (3). While securing, make sure not to change the adjustment of the screw (4).
9. Check the pressure again, while the corresponding function is activated (here for example, "slew to right"); repeat steps 6 to 9 if necessary.



10. Set the pressure for TC-valve at the measuring union "slew to right" (M9) to the specified value by screwing in/out the screw (1), while the "slew to right" function is activated.
11. Switch off the engine, ignition key in position "0" (the ignition is switched off).
12. Remove the pressure gauges.

4.13.2 Adjusting brake pressure



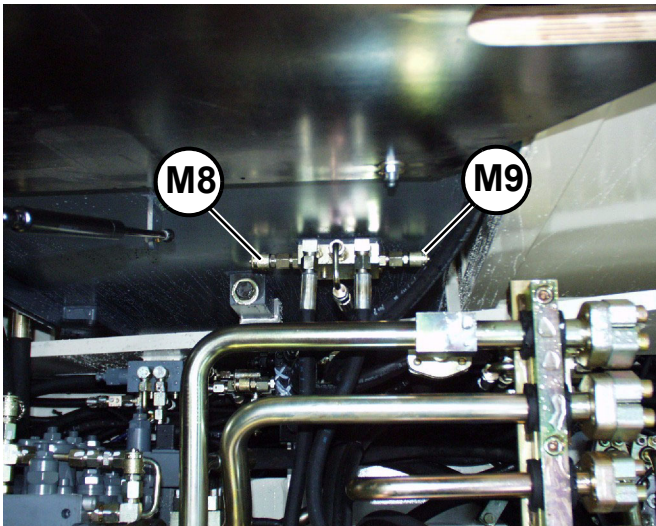
NOTE

For adjusting the pressure brake, a special tool is necessary.

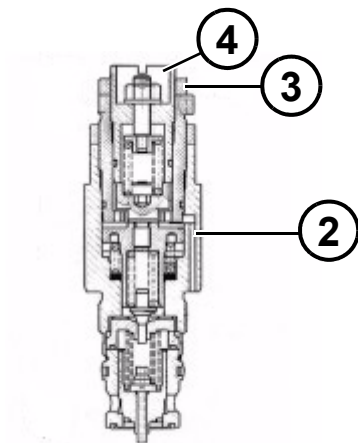
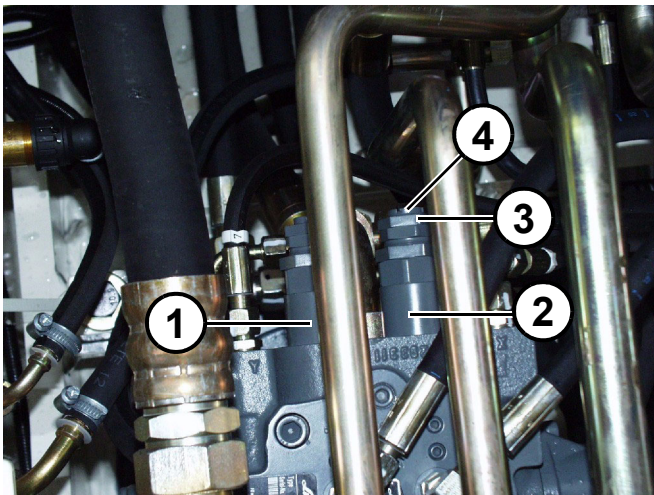


NOTE

If the brake pressure is incorrectly set, the pressure control characteristic must be re-adjusted, see section 4.13.3 on page 48.



1. Connect pressure gauges to the measuring unions "slew to left" (M8) and "slew to right" (M9).
2. Start the engine.
3. Move the engine speed control lever to the maximum speed position (to its stop).



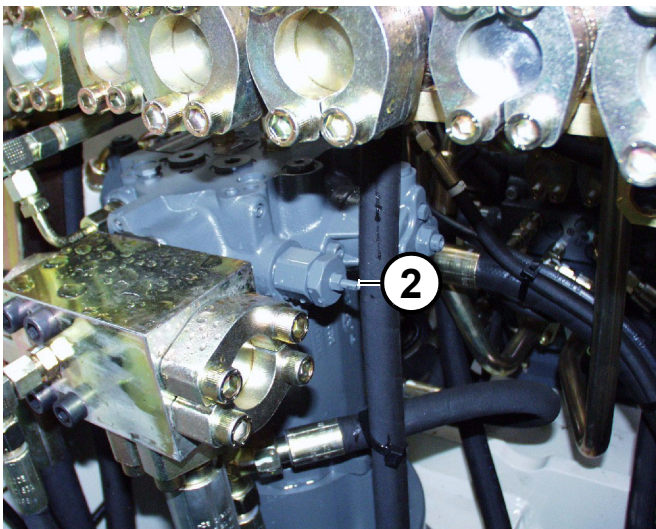
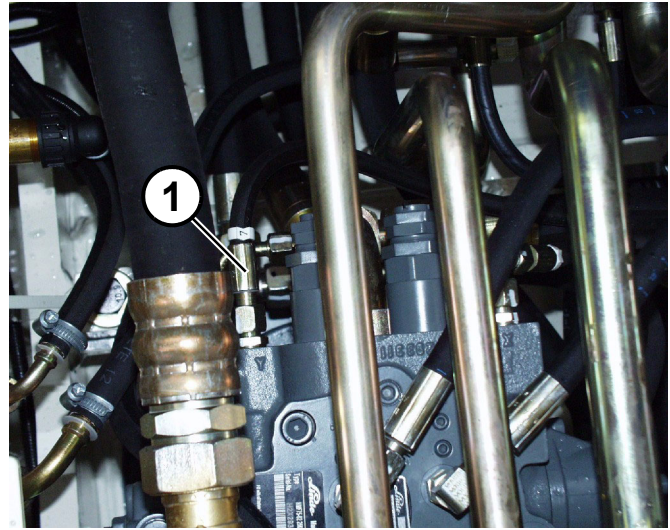
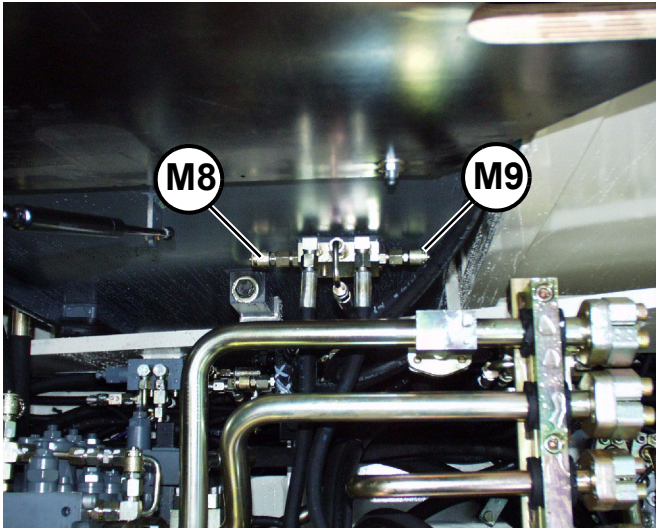
For the slewing direction the settings are

- **to the left** on the valve "slew to right" (2) and measuring union "slew to right" (M9)
- **to the right** on the valve "slew to left" (1) and measuring union "slew to left" (M8)

and are to be carried out as follows (steps 4 to 10):

4. Loosen the fixing nut (3) of the valve to be adjusted (in picture above, valve "slew to right" (2) shown).
5. Activate the corresponding function (here for example, "slew to left") and slew the superstructure in the direction of the adjustment (here for example, to the left) at maximum speed.
6. As the control handle is released, the brake pressure (here for example, pressure at measuring union "slew to right" (M9)) is displayed immediately.
7. Turn the screw (4) of the valve (here for example, "slew to right") until the corresponding brake pressure (here for example, pressure at measuring union "slew to right" (M9)) reaches the specified value.
8. Repeat steps 5 to 7 until the specified pressure is set.
9. Lock the screw (4) with the fixing nut (3). While securing, make sure not to change the adjustment of the screw (4).
10. Check the brake pressure again, repeat steps 4 to 10 if necessary.
11. Repeat the adjustment (steps 4 to 10) respectively for the reverse slewing direction (here for example, the "slew to right" function on valve "slew to left" (1)).
12. Switch off the engine, ignition key in position "0" (the ignition is switched off).
13. Remove the pressure gauges.

4.13.3 Adjusting the pressure control characteristic



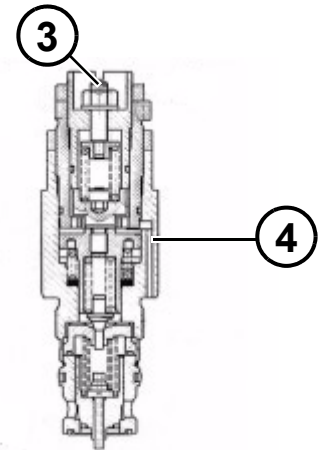
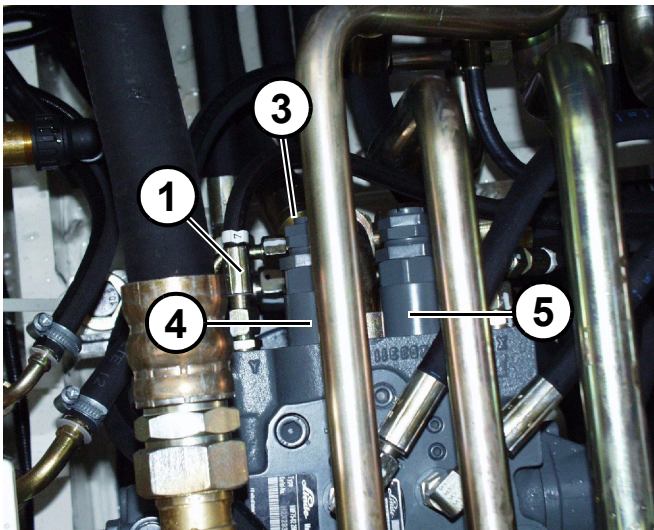
1. Connect pressure gauges to the measuring unions "slew to left" (M8) and "slew to right" (M9).
2. Use a T-connector to connect each of two additional pressure gauges to the corresponding "pilot control, slewing" lines (1) (in picture above, "slew to left" shown).



NOTE

The measuring unions for the "pilot control, slewing" lines (1) (in picture above, "slew to left" shown) are not part of the standard equipment and must be installed for adjustment purposes.

3. Screw in the adjusting screw (2) of the TC-characteristic valve by two turns.



4. Secure the superstructure.
5. Start the engine.
6. Move the engine speed control lever to the maximum speed position (to its stop).

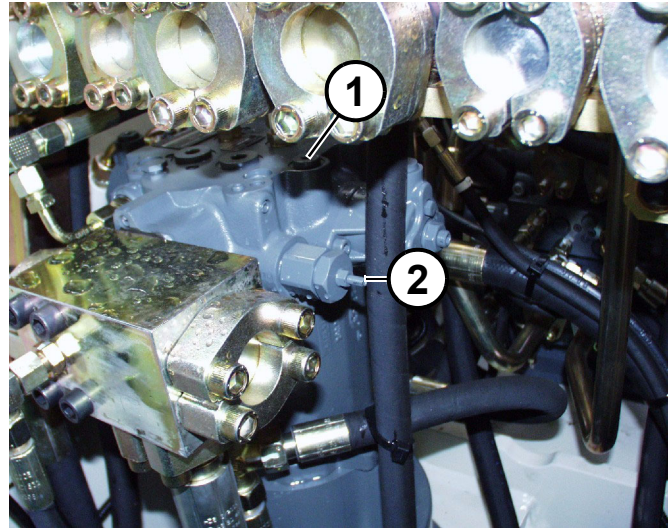
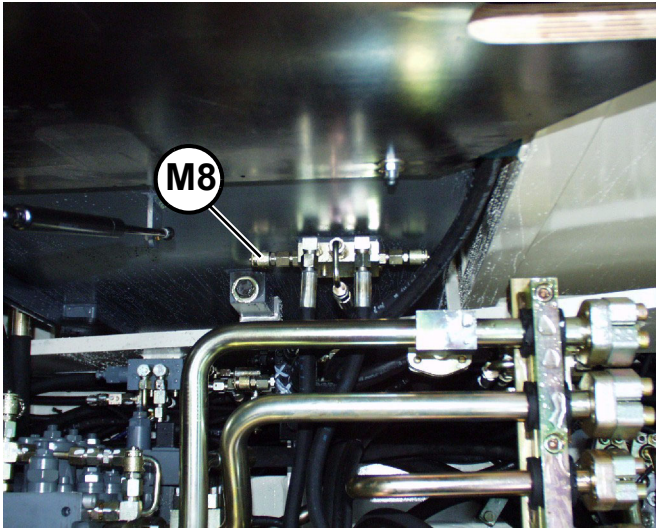


WARNING

Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

7. Activate the corresponding slewing function (here for example, "slew to left") and build up a pressure between 8 bar and 9 bar at "pilot control, slewing" line (1) (here for example, "slew to left"), and make sure to keep this value.
The pressure of the corresponding secondary valve (here for example, pressure at measuring union "slew to left" (M8)) has to be 120 bar, while the corresponding slewing function is activated.
8. Set the pressure for the corresponding valve "slew to left" (4) or "slew to right" (5) at the adjusting screw (3) to 120 bar by screwing it in/out (in picture above, "slew to left" shown).
9. Switch off the engine, ignition key in position "0" (the ignition is switched off).
10. Remove the pressure gauges from the measuring unions "slew to left" (M8) and "slew to right" (M9).
11. Remove the T-connectors and the pressure gauges from the "pilot control, slewing" lines (1) (in picture above, "slew to left" shown) and connect the "pilot control, slewing" lines (1) (in picture above, "slew to left" shown) back again.
12. Adjust the TC-characteristic valve, see section 4.13.4 on page 50.

4.13.4 Adjusting TC-characteristic valve



1. Connect a pressure gauge to the measuring union "slew to left" (M8).
2. Use a suitable adapter to connect another pressure gauge to the "pilot control, slewing" line (1).



NOTE

The measuring union for the "pilot control, slewing" line (1) is not part of the standard equipment and must be installed for adjustment purposes.



NOTE

If no measuring union can be installed:

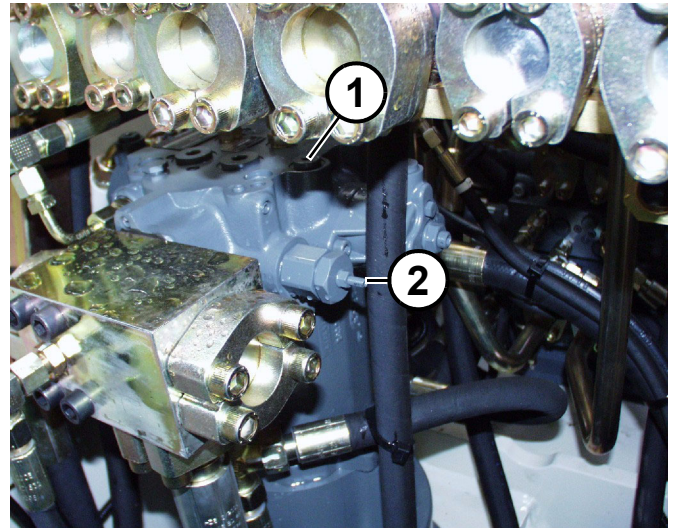
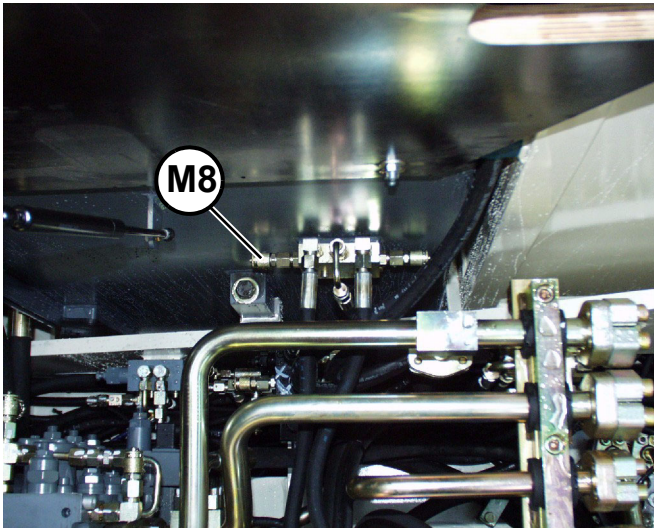
Use a T-connector to connect the pressure gauge onto the "pilot control, slewing to left" line, see section 4.13.3 on page 48.

3. Secure the superstructure.
4. Start the engine.
5. Move the engine speed adjusting lever to the maximum speed position (to its stop).



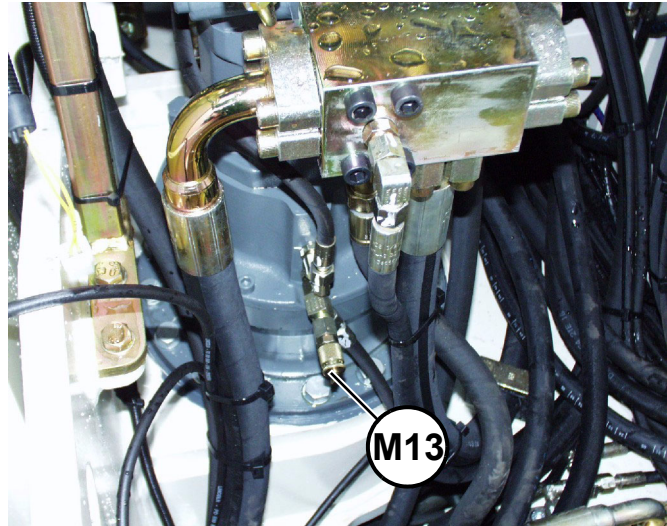
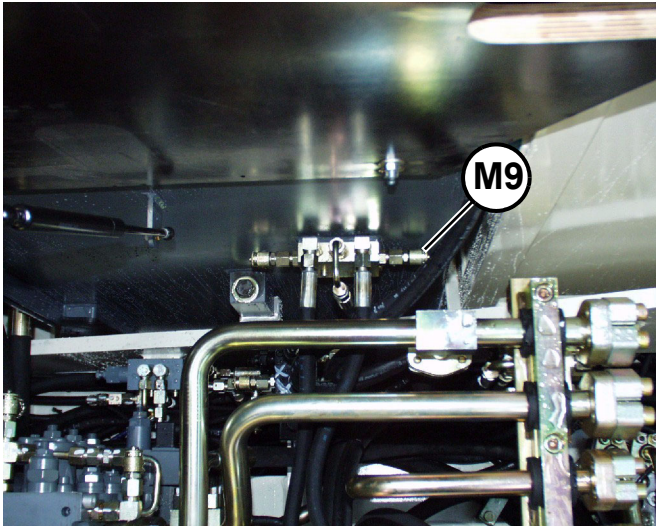
WARNING

Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.



6. Activate the "slew to left" function, so that a pressure of 16 bar is set on the "pilot control, slewing" line (1) (or "pilot control, slewing to left" line) and make sure to keep this value. The pressure at measuring union "slew to left" (M8) must then have 190 bar.
7. If necessary, set the pressure for the TC-characteristic valve at the adjusting screw (2) to 190 bar by screwing it in/out.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge from the measuring union "slew to left" (M8).
10. Remove the pressure gauge from the "pilot control, slewing" line (1) (or "pilot control, slewing to left" line, see section 4.13.3 on page 48).

4.14 Pressure cut-off valve



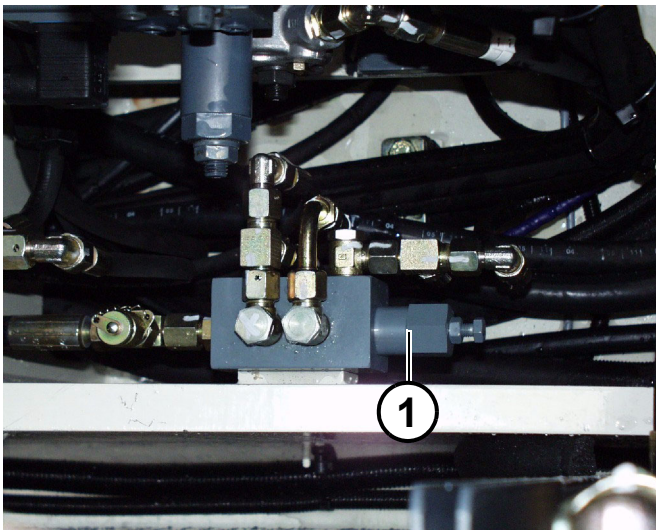
1. Connect pressure gauges to the measuring unions "slew to right" (M9) and "slewing brake" (M13).
2. Secure the superstructure.
3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.



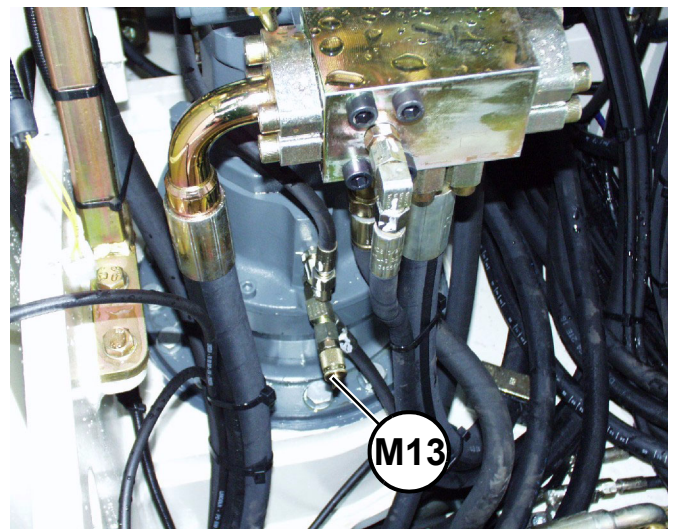
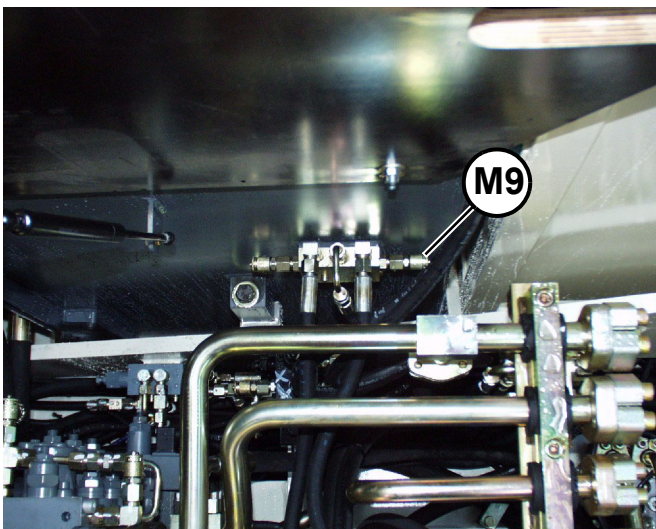
WARNING

Before activating the "slew to left" or alternatively "slew to right" function, make sure that the superstructure is secured.

5. Activate the "slew to right" function. This produces a pressure increase at the measuring union "slew to right" (M9). After the pressure at the measuring union "slew to right" (M9) reaches a pressure of approx. 120 bar, the pressure at the measuring union "slewing brake" (M13) should start rising.



6. If necessary, adjust the response value of the pressure cut-off valve by screwing in/out the adjusting screw (1).
7. Repeat steps 5 and 6 if necessary.



8. Switch off the engine, ignition key in position "0" (the ignition is switched off).
9. Remove the pressure gauge.

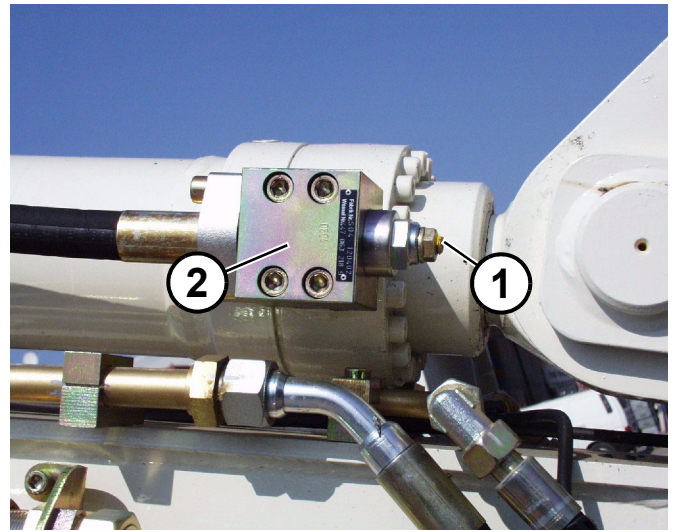
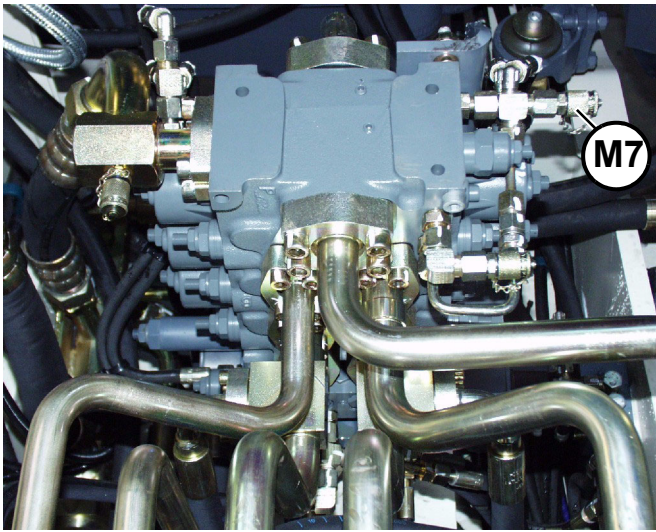
4.15 Return flow throttle



NOTE

The following adjustment must be carried out with the tool mounted.

4.15.1 Return flow throttle "jib folding ram"

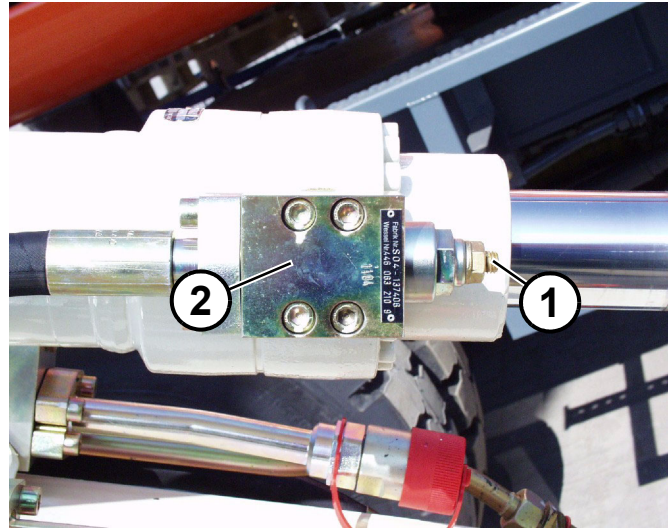
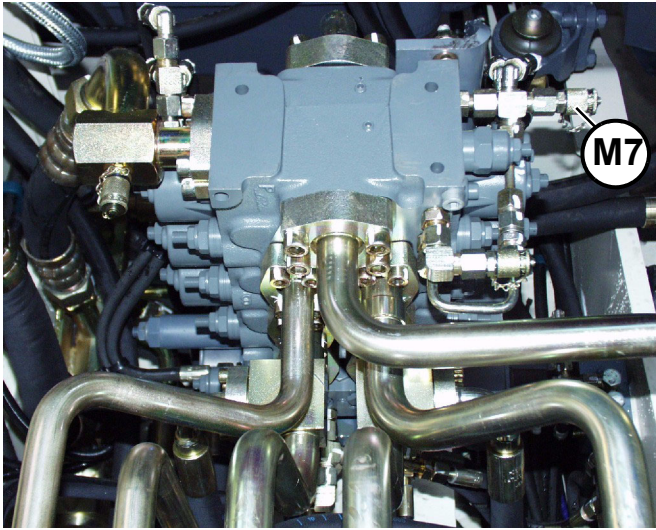


WARNING

Never move the boom/jib, before ensuring that no one is remaining within the slewing area.

1. Connect a pressure gauge to the measuring union "pump" (M7).
2. Start the engine.
3. Move the engine speed adjusting lever to the maximum speed position (to its stop).
4. Extend the boom/jib fully (retract the piston rod of the jib folding ram fully).
5. Activate the "jib folding in" function and let it run fully.
6. Read off the pressure value at the measuring union "pump" (M7), while the "jib folding in" function is running.
7. Lower the boom/jib.
8. Set the pressure for the return flow throttle "jib folding ram" (2) to the required value at the adjusting screw (1).
9. Repeat steps 4 to 8 if necessary.
10. Switch off the engine, ignition key in position "0" (the ignition is switched off).
11. Remove the pressure gauge.

4.15.2 Return flow throttle "bucket ram"



1. Connect a pressure gauge to the measuring union "pump" (M7).
2. Start the engine.
3. Move the engine speed adjusting lever to the maximum speed position (to its stop).



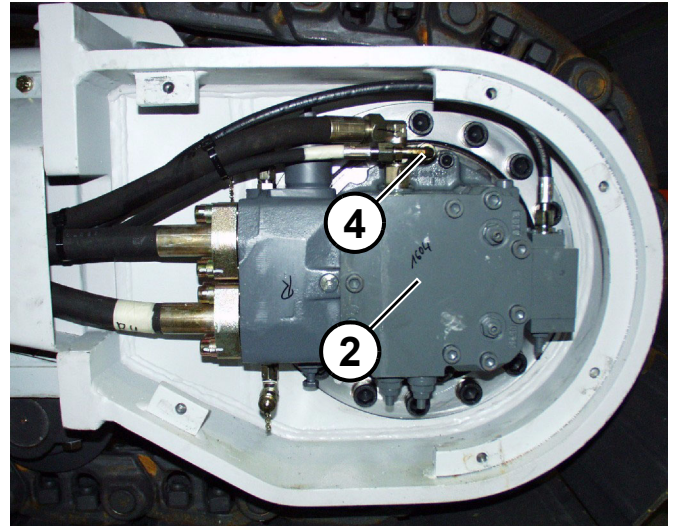
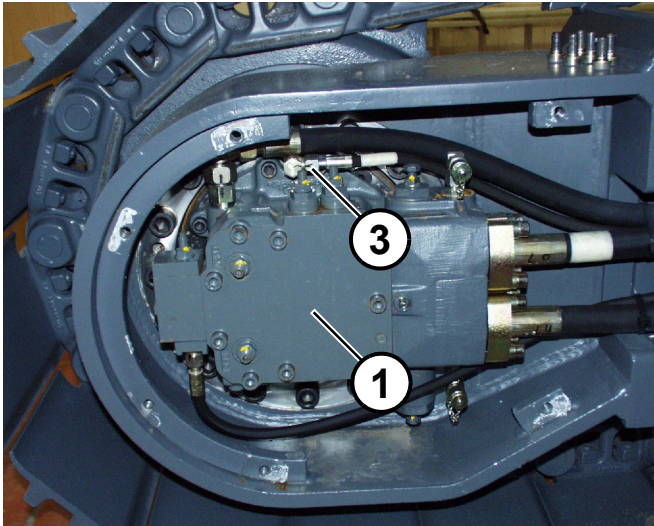
WARNING

Never move the boom/jib, before ensuring that no one is remaining within the slewing area.

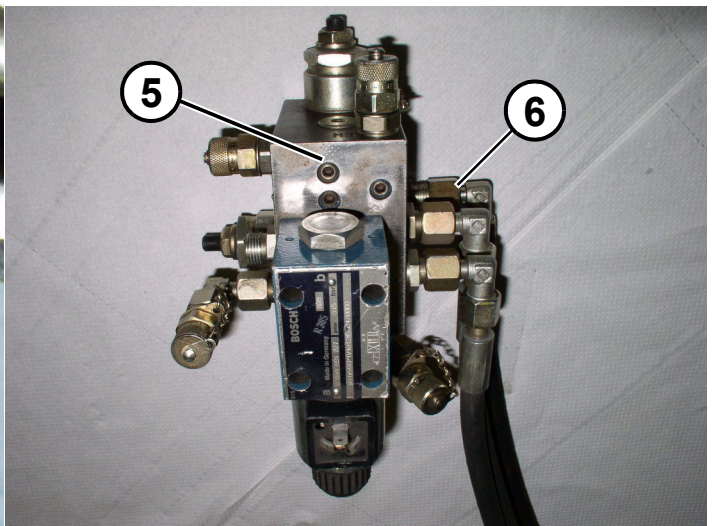
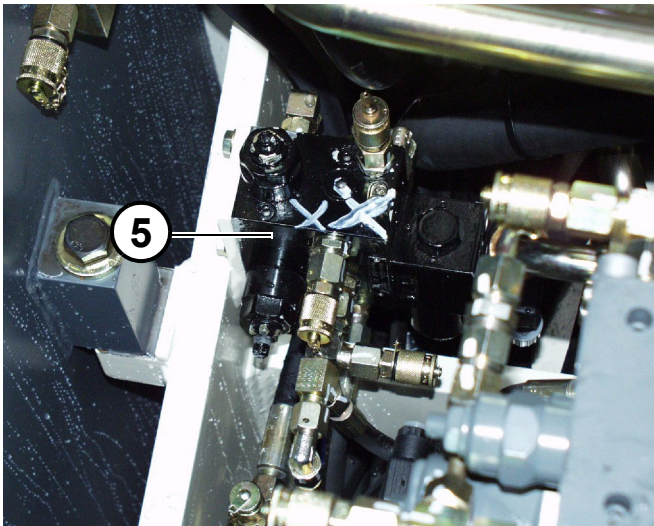
4. Raise the boom/jib and open the bucket fully (retract the piston rod of the bucket ram fully).
5. Activate the "closing bucket" function and let it run fully.
6. Read off the pressure value at the measuring union "pump" (M7), while the "closing bucket" function is running.
7. Lower the boom/jib.
8. Set the pressure for the return flow throttle "bucket ram" (2) to the required value at the adjusting screw (1).
9. Repeat steps 4 to 8 if necessary.
10. Switch off the engine, ignition key in position "0" (the ignition is switched off).
11. Remove the pressure gauge.

4.16 Locking/releasing the drive units

4.16.1 Locking the drive units



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Disengage the brake hoses (3) and (4) from both drive units (1) and (2). Insert a blind plug in both brake hoses (3) and (4).



Only prior to adjusting the "travel" secondary valves:

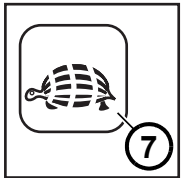
3. Remove the hose (6) from the control valve (5) and close the hose (6) off with a blind plug.

Check the locking as follows:

**WARNING**

Ensure that no one is remaining within the working area of the excavator. Keep in mind that the excavator should not make any movement, while the following checking procedure is carried out.

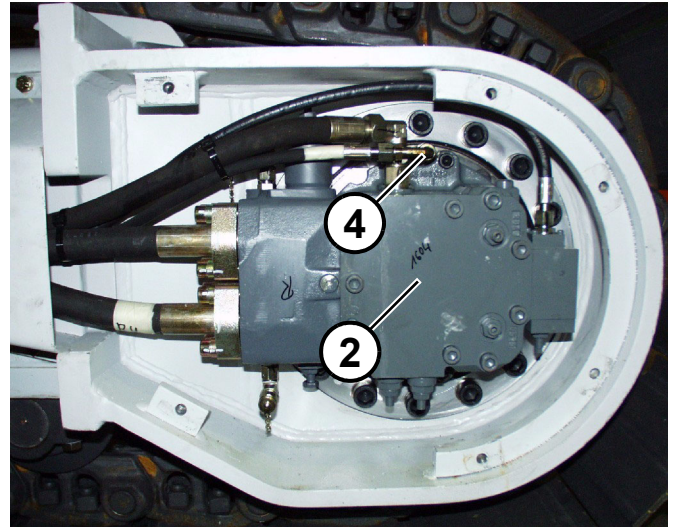
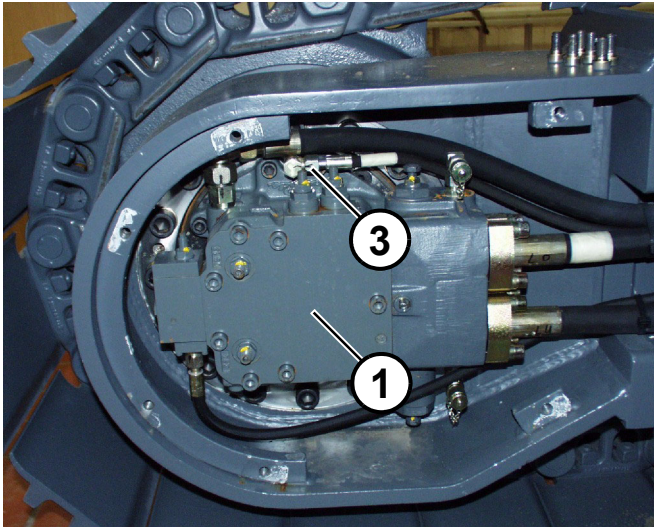
4. Start the engine.
5. Set the engine speed to approx. 1400 rpm.
6. Shift selector switch to crawler speed I ("higher speed").

**WARNING**

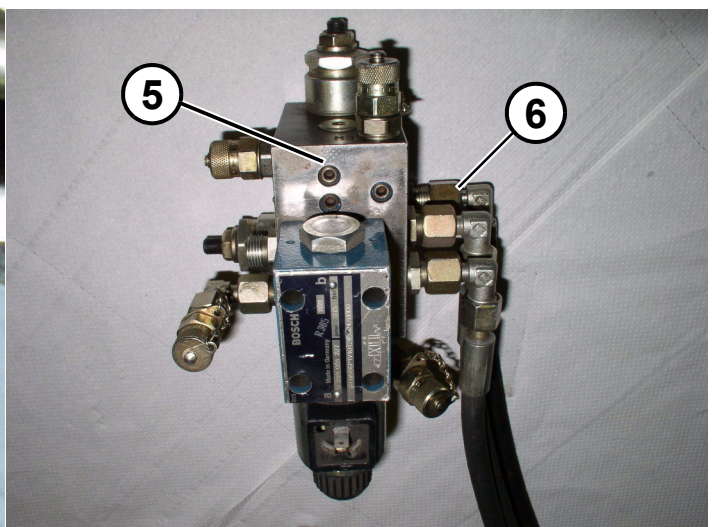
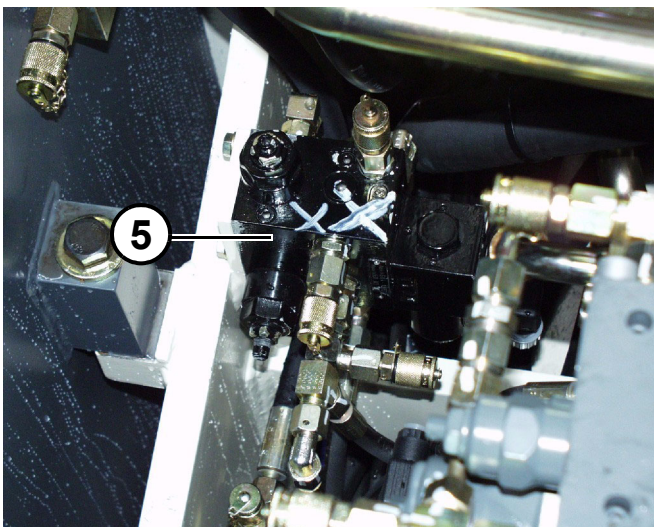
Ensure that the selector switch is shifted to position crawler speed I ("higher speed"), the symbol (7) "turtle" in the display panel must not light up, otherwise the disc break can be destroyed.

7. Activate the "travel" function and check whether the excavator is locked.
8. Switch off the engine, ignition key in position "0" (the ignition is switched off).

4.16.2 Releasing the drive units



1. Switch off the engine, ignition key in position "0" (the ignition is switched off).
2. Remove the blind plugs from both brake hoses (3) and (4), and connect both brake hoses (3) and (4) to the respective drive units (1) and (2) back again.



Only after adjusting the "travel" secondary valves:

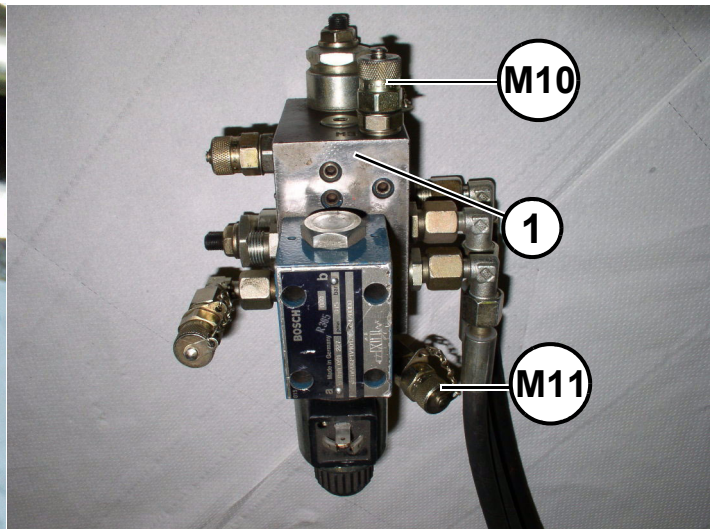
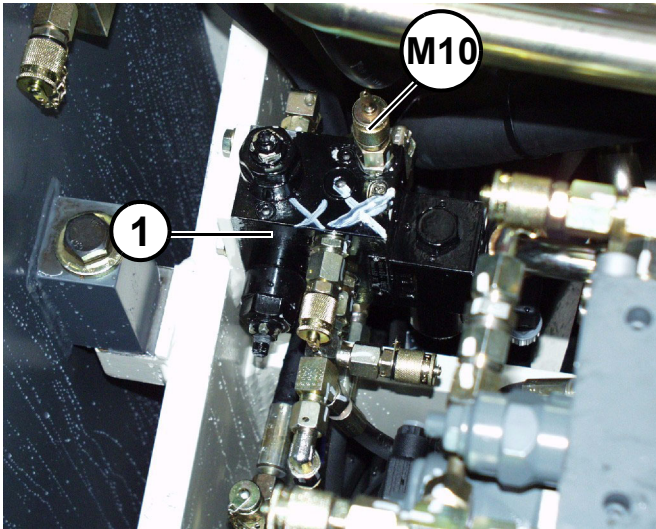
3. Remove the blind plug from the hose (6) and connect the hose (6) to the control valve (5).

4.17 Adjusting travel motor



NOTE

Before starting up for the first time and after repairing work on the control valve (1), the valve must be bled, see section 4.18 page 62.



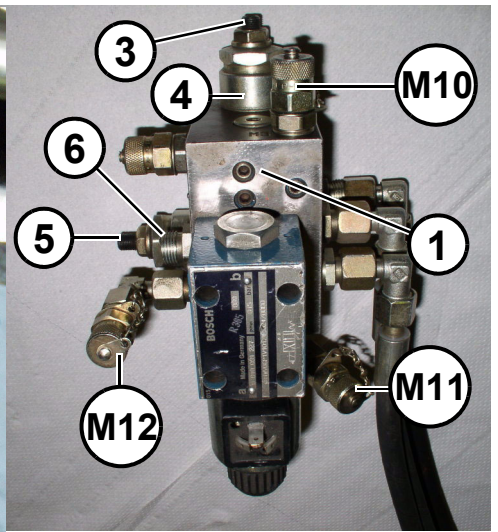
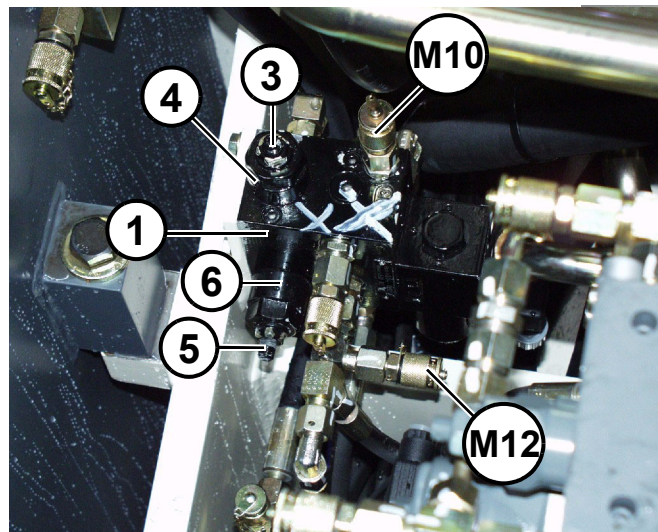
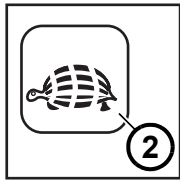
1. Connect pressure gauges to the measuring unions "pilot pressure travel motor adjustment" (M10) and "travel pressure" (M11).
2. Lock the drive units, see section 4.16.1 on page 57.



WARNING

Ensure that no one is remaining within the working area of the excavator. Keep in mind that the excavator should not make any movement, while the following adjustment is carried out.

3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.
5. Shift selector switch to crawler speed I ("higher speed").
6. The pressure at the measuring union "pilot pressure travel motor adjustment" (M10) should be between 25 bar and 27 bar.



WARNING

Ensure that the selector switch is shifted to position crawler speed I ("higher speed"), the symbol (5) "turtle" in the display panel must not light up, otherwise the disc break can be destroyed.



NOTE

Pressure may also be generated by activating the "closing bucket" function.

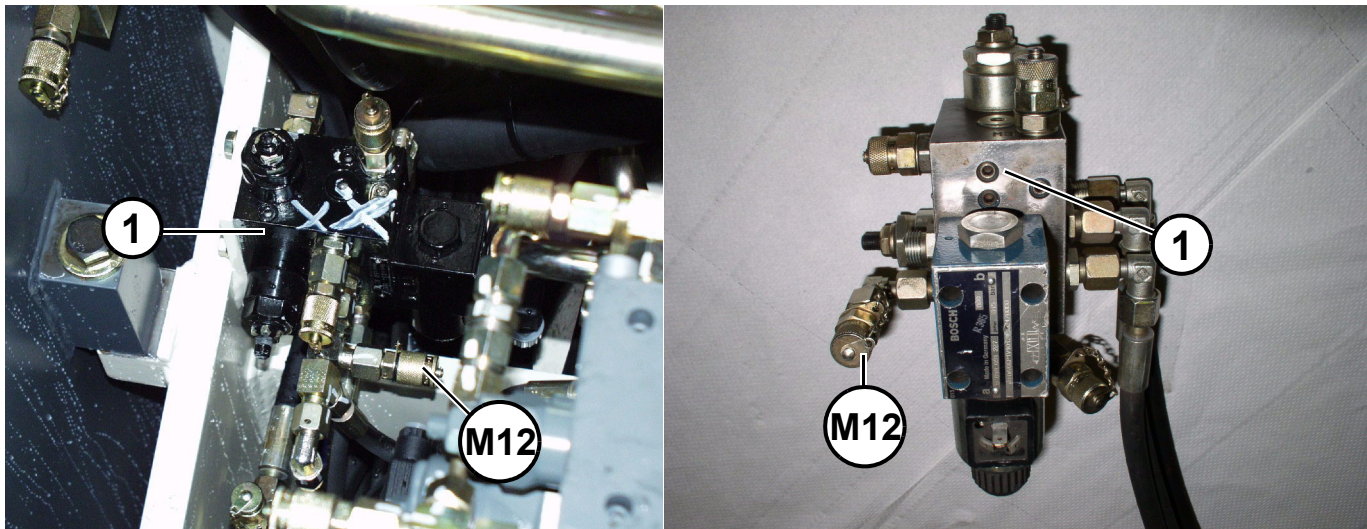
7. **Slowly** raise the pressure at the measuring union "travel pressure" (M11) using the travel lever. After the pressure at the measuring union "travel pressure" (M11) reaches a pressure of 310 bar, the pressure at the measuring union "pilot pressure travel motor adjustment" (M10) should start dropping.
8. If necessary, adjust the pressure at the control valve (4) by screwing in/out the adjusting screw (3) and repeat steps 6 to 8.
9. **Slowly** reduce the pressure at the measuring union "travel pressure" (M11) until it reaches 150 bar. The pressure at the measuring union "pilot pressure travel motor adjustment" (M10) should be between 25 bar and 27 bar.
10. If necessary, adjust the pressure at the control valve (6) by screwing in/out the adjusting screw (5) and repeat steps 6 to 9.
11. Switch off the engine, ignition key in position "0" (the ignition is switched off).
12. Remove the pressure gauges.
13. Release the drive units, see section 4.16.2 on page 59.

4.18 Bleeding control valve



NOTE

Before starting up for the first time and after repairing work on the control valve (1), the valve must be bled.



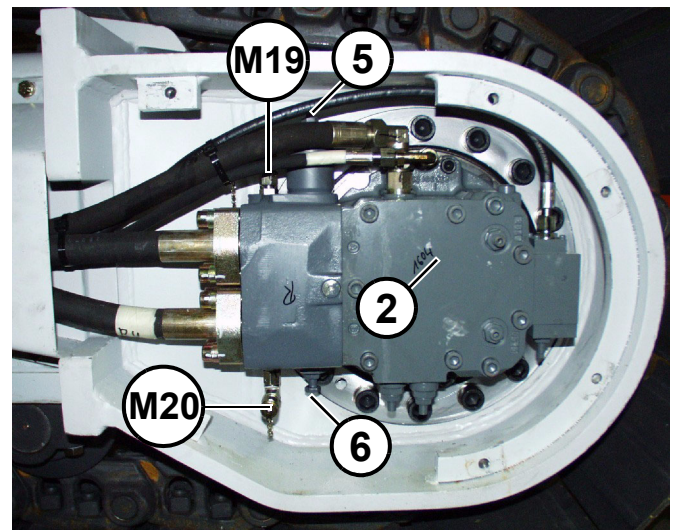
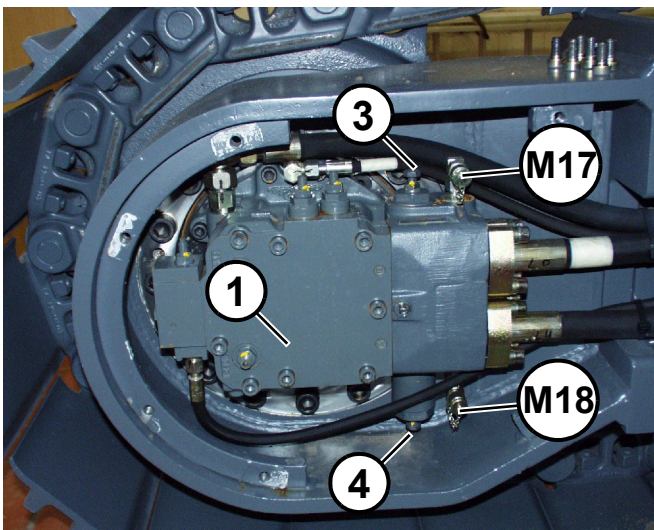
1. Connect a "Minimess" hose to the "bleeding control valve" (M12) and put the end of the hose in a suitable container to catch the escaping hydraulic oil.
2. Lock the drive units, see section 4.16.1 on page 57.
3. Start the engine.
4. Set the engine speed to approx. 1400 rpm.
5. Activate the "travel" function.
6. Hydraulic oil leaks out from the "Minimess" hose. The bleeding of valve is completed, as soon as the hydraulic oil emerging is free of air bubbles.
7. Switch off the engine, ignition key in position "0" (the ignition is switched off).
8. Remove the "Minimess" hose from the measuring union "bleeding control valve" (M12).
9. Release the drive units lock back again, see section 4.16.2 on page 59.

4.19 Adjusting the dynamic pressure of the braking valve



NOTE

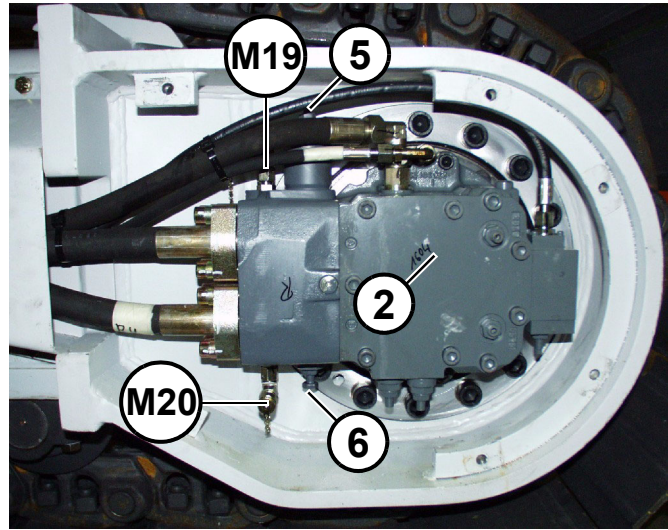
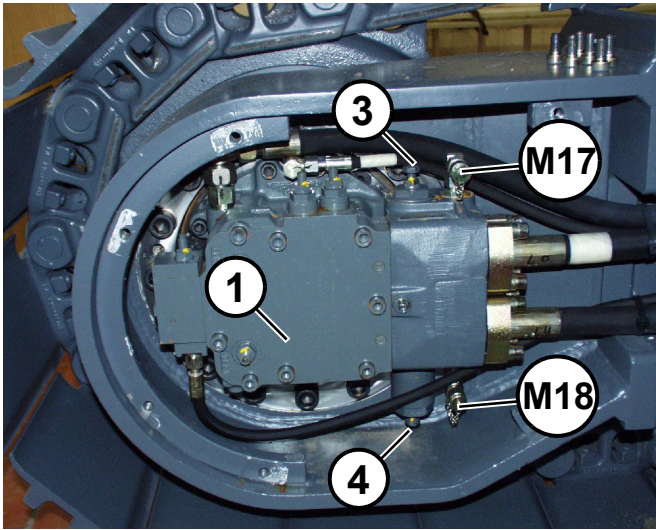
Adjustment of the dynamic pressure of the braking valve is normally not required.
Always carry out adjustment of the dynamic pressure, when a drive unit is replaced.



NOTE

The travel gear could lower unintended. Ensure that no one is remaining under the excavator.

1. Slew the superstructure at a angle of 90° to the side of the drive unit with the braking valve which is to be adjusted.
2. Tilt the excavator using the boom/jib so that the corresponding crawler tracks is able to turn in an uninhibited manner.
3. Switch off the engine, ignition key in position "0" (the ignition is switched off).
4. Connect the pressure gauges to the corresponding measuring unions as necessary: "secondary pressure forward travel, left" (M17) and "secondary pressure reverse travel, left" (M18), and/or "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).



WARNING

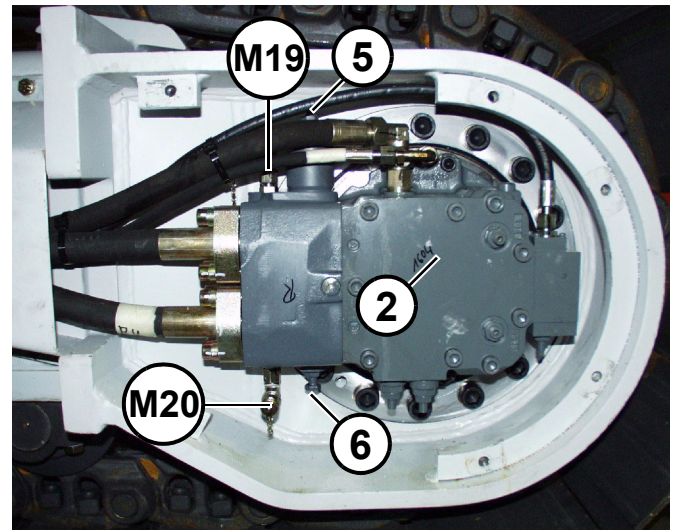
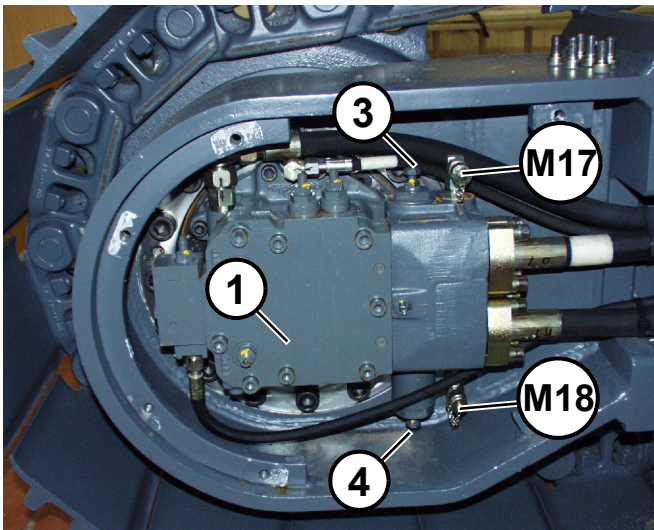
Ensure that no one is remaining within the crawler track area and other rotating parts of the excavator, before carrying out the following adjustment procedure.



WARNING

Make sure only to move the crawler track raised.

5. Start the engine.
6. Move the engine speed adjusting lever to the maximum speed position (to its stop).
7. Shift selector switch to crawler speed II ("slow speed").
8. Set the maximum forward travel speed of the crawler track using the control lever.
9. Screw out the adjusting screws (3) and (4), and/or (5) and (6) for the dynamic pressure at the corresponding drive unit (1) or (2), until the pressure at the measuring union "secondary pressure forward travel, left" (M17) and/or "secondary pressure forward travel, right" (M19) stops dropping.
10. Screw in the adjusting screw (4) and/or (6), until the pressure at measuring union "secondary pressure forward travel, left" (M17) and/or "secondary pressure forward travel, right" (M19) rises approx. 1 bar.



11. Set the reverse travel movement of the crawler track raised to its maximum stage using the control lever.
12. Screw out the adjusting screw (3) and/or (5), until the pressure at the measuring union "secondary pressure reverse travel, left" (M18) and/or "secondary pressure reverse travel, right" (M20) stops dropping.
13. Screw in the adjusting screw (3) and/or (5), until the pressure at measuring union "secondary pressure reverse travel, left" (M18) and/or "secondary pressure reverse travel, right" (M20) rises approx. 1 bar.



NOTE

Ensure that no one is remaining within the travel gear area of the excavator.

14. Lower the excavator.
15. Switch off the engine, ignition key in position "0" (the ignition is switched off).
16. Remove the pressure gauges from the measuring union "secondary pressure forward travel, left" (M17) and "secondary pressure reverse travel, left" (M18), and/or "secondary pressure forward travel, right" (M19) and "secondary pressure reverse travel, right" (M20).

4.20 Line break protection valve, lifting cylinder

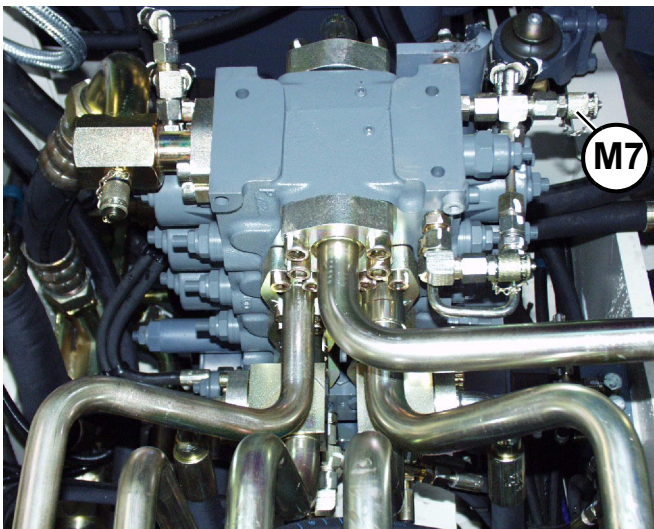
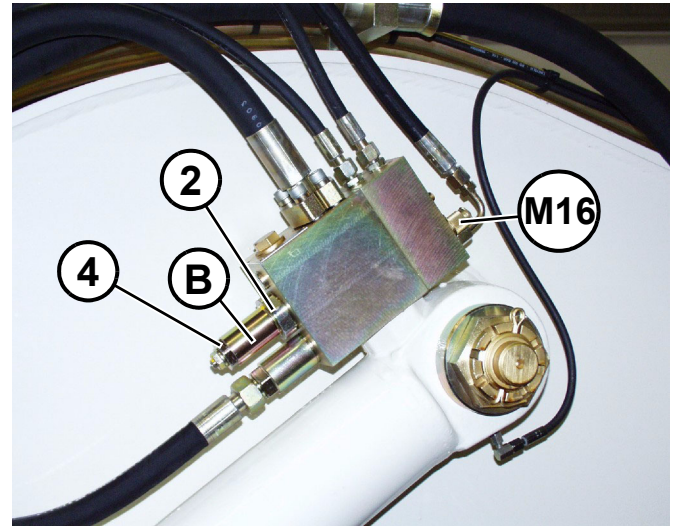
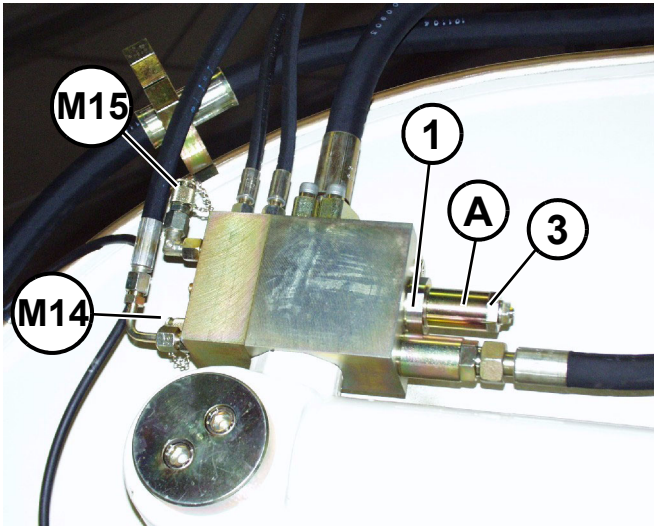


NOTE

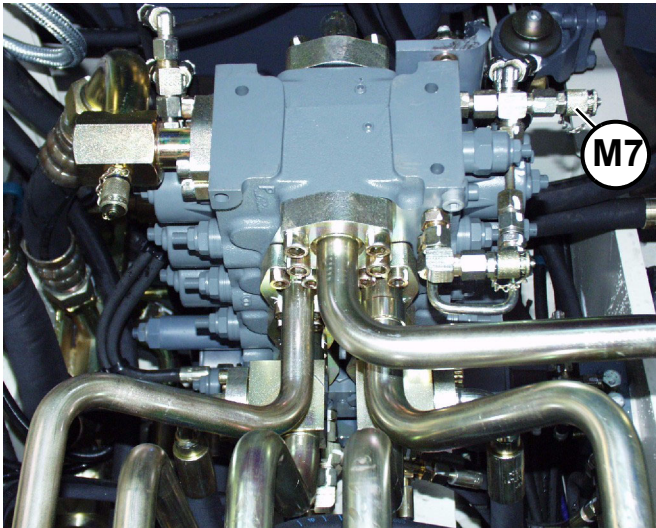
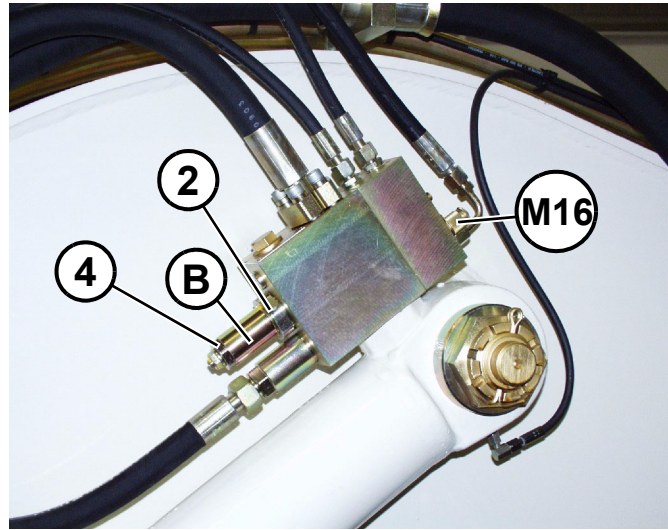
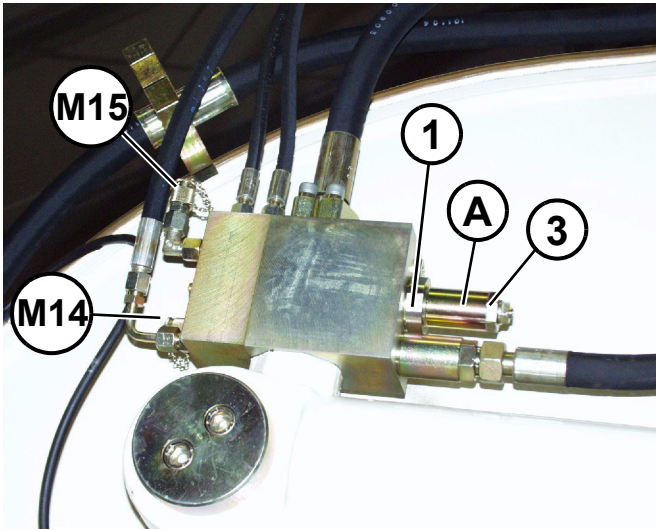
The following adjustment must be carried out with the tool mounted.

4.20.1 Switch-point of the shut-off piston

4.20.1.1 Determining switch-point of control spool



1. Connect pressure gauges to measuring union (M14) and (M16) of valves (A) and (B), to measuring union "pump" (M7) and also to measuring union "pilot pressure lowering" (M15).
2. Loosen the fixing nuts (1) and (2) of both valves (A) and (B).
3. Screw in the adjusting screws (3) and (4) for the shut-off piston switching point at both valves (A) and (B) by approx. 3 turns.



4. Start the engine.
5. Set the engine speed to approx. 1400 rpm.

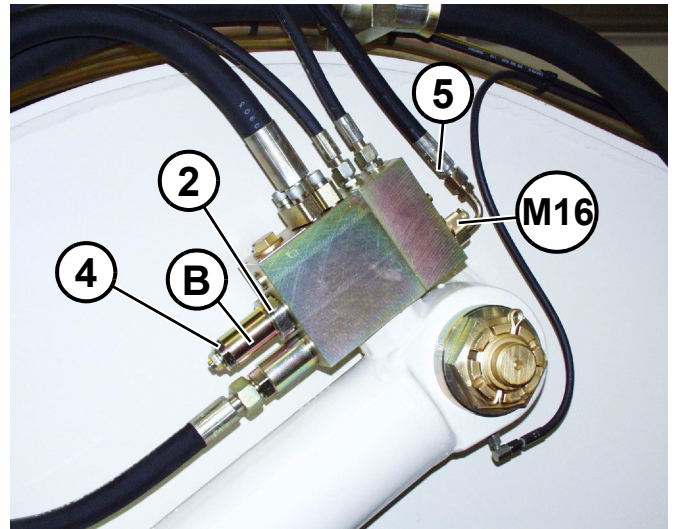
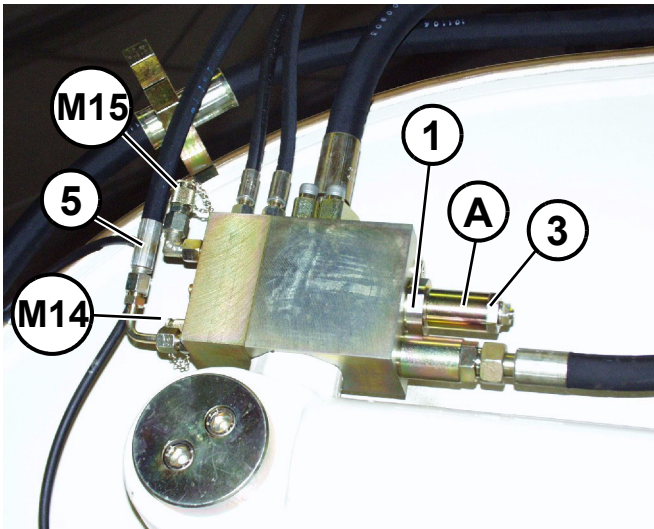


WARNING

Never move the boom/jib, before ensuring that no one is remaining within the slewing area.

6. Lift the boom/jib from the ground for about 3 m. The static pressures of each lifting cylinder is displayed on the pressure gauge at measuring union (M14) or (M16).
7. **Slowly** activate the "lowering" function. Read off the pressure on the measuring union "pilot pressure lowering" (M15), as soon as the pressure at measuring union "pump" (M7) starts to rise. This pressure corresponds to the control valve switch-point in the control block.

4.20.1.2 Adjusting switch-point of shut-off piston



WARNING

Lower the boom/jib to the ground.

8. Switch off the engine, ignition key in position "0" (the ignition is switched off).



WARNING

Make sure that the balance line (5) is unpressurized.

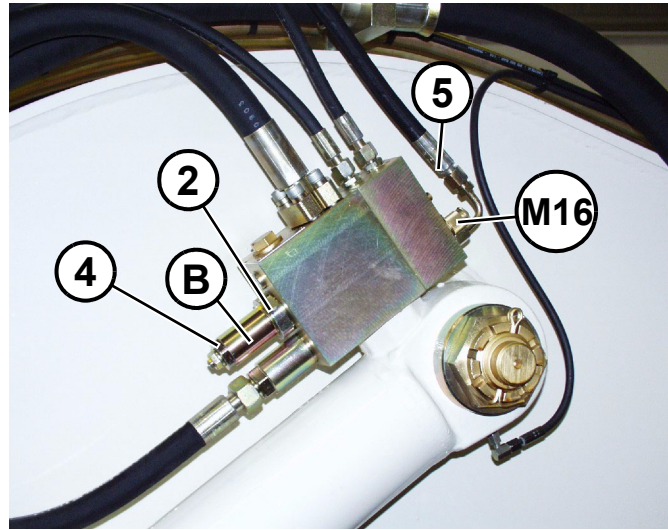
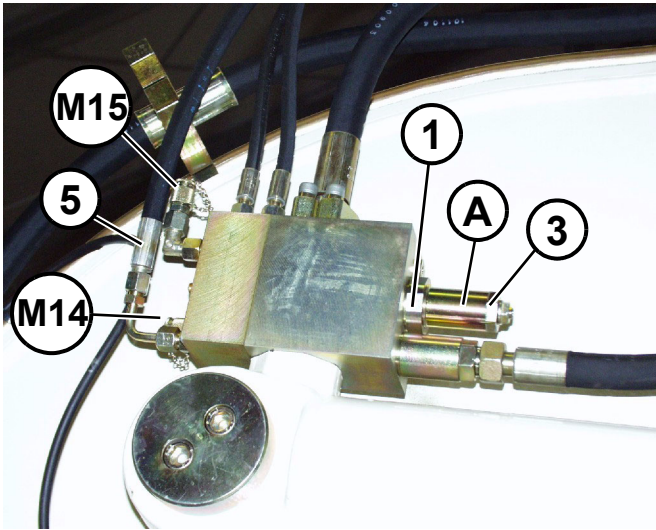
9. Disengage the balance line (5) from both valves (A) and (B), and insert blind plugs in the valves.
10. Start the engine.
11. Set the engine speed to approx. 1400 rpm.



WARNING

Ensure that no one is remaining within the slewing area of the boom/jib, before moving the boom/jib.

12. Lift the boom/jib from the ground for about 3 m.



13. **Slowly** activate the "lowering" function, until the pressure on the measuring union "pilot pressure lowering" (M15) shows 1 bar below the switch-point of the control spool. Keep this pressure.
14. Screw out the adjusting screw (3) of valve (A), until the static pressure at the measuring union (M14) starts to drop.
15. Screw out the adjusting screw (4) of valve (B), until the boom/jib starts lowering itself.
16. Check adjustment by extending the lifting cylinder fully.
17. **Slowly** lower the boom/jib.
18. During the lowering is carried out **in precision control mode**, check whether both shut-off pistons open simultaneously (same pressure at measuring union (M14) and (M16)). A pressure difference of 30 bar is permitted. If correction is necessary, adjust the screw (4) at valve (B).
19. Switch off the engine, ignition key in position "0" (the ignition is switched off).
20. Lock the adjusting screws (3) and (4) at valves (A) and (B) with fixing nuts (1) and (2). While locking, make sure not to change the adjustment of the screws.

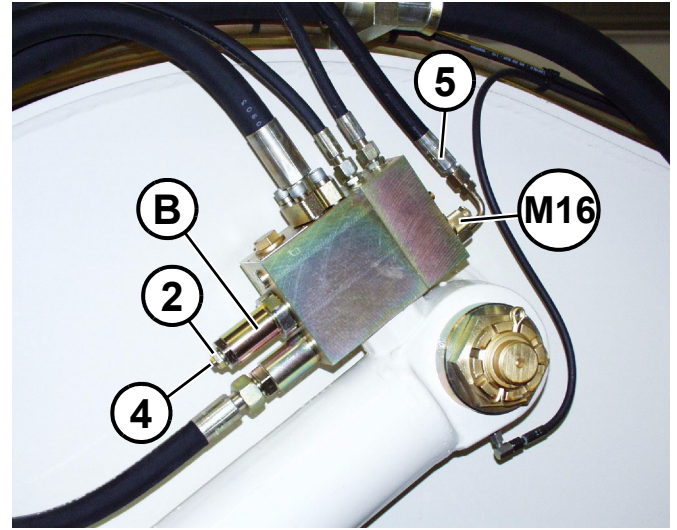
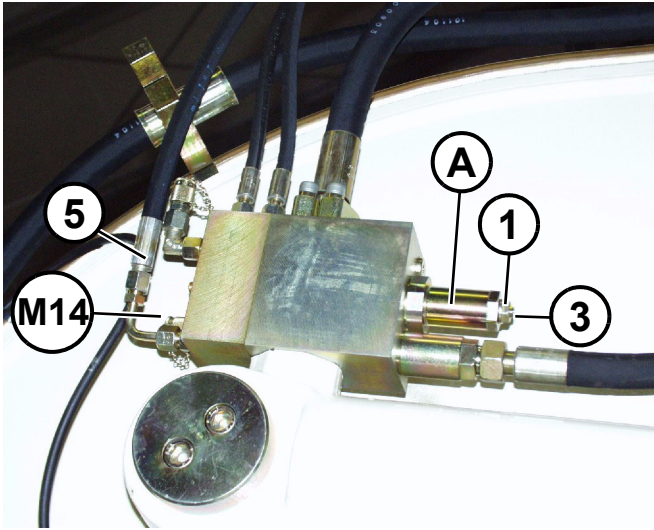


WARNING

Make sure that the boom/jib is lowered and blind plugs are unpressurized.

21. Remove the blind plugs and connect the balance line (5) to both valves (A) and (B) back again.
22. Remove the pressure gauges.

4.20.2 Adjusting return flow throttle "lowering"



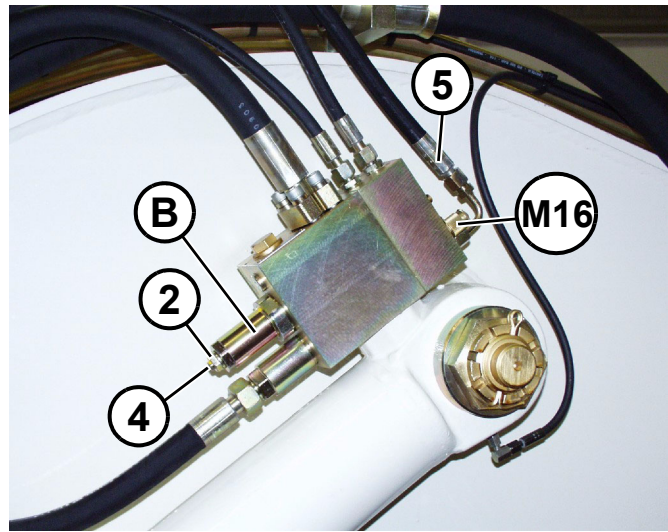
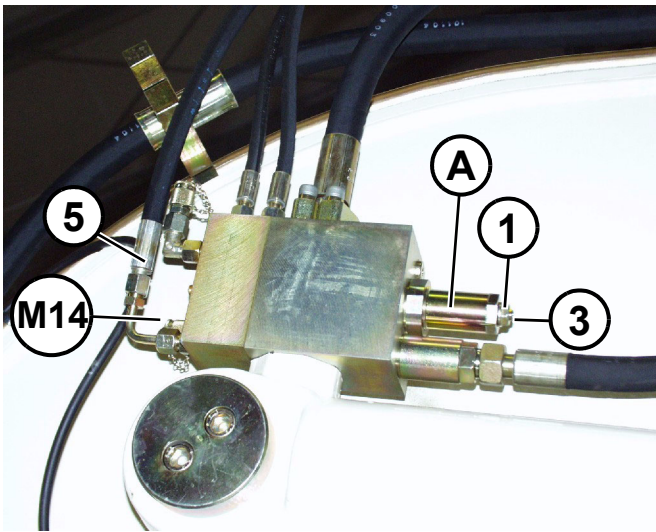
1. Connect pressure gauges to the measuring union (M14) and (M16) at valves (A) and (B).
2. Loosen the fixing nuts (1) and (2) of both valves (A) and (B).
3. Switch off the engine, ignition key in position "0" (the ignition is switched off).



WARNING

Make sure that the balance line (5) is unpressurized.

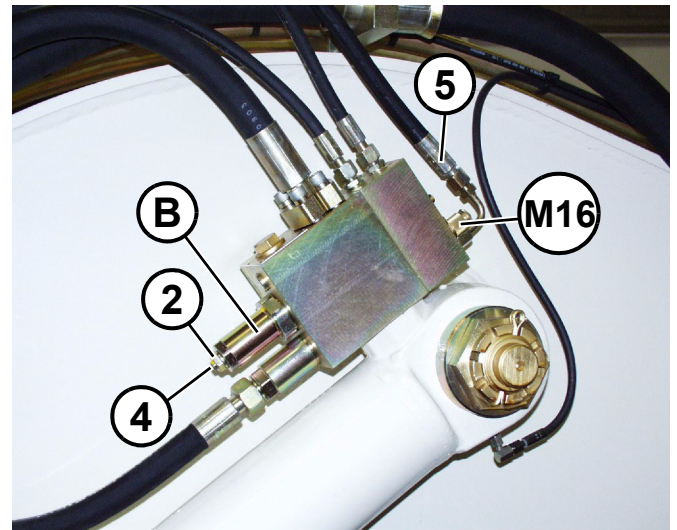
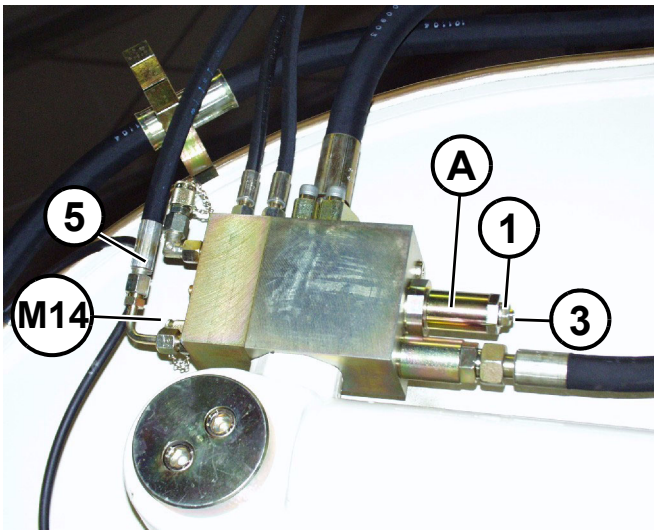
4. Disengage the balance line (5) from both valves (A) and (B), and insert blind plugs in the valves.
5. Start the engine.
6. Move the engine speed adjusting lever to the maximum speed position (to its stop).



WARNING

Ensure that no one is remaining within the slewing area of the boom/jib, before moving the boom/jib.

7. Lift the boom/jib and extend the lifting cylinder fully.
8. Fold out the jib fully (extend the jib cylinder fully).
9. Fully activate the "lowering" function.
10. The pressure gauges at measuring union (M14) and (M16) indicate the pressures of both lowering-throttles.
11. If necessary, correct the pressure by screwing in/out the adjusting screws (3) and (4) of valves (A) and (B). A maximum pressure difference between measuring union (M14) and (M16) of 5 bar is permitted. The adjustment should be carried out in such way that the lowering/lifting speeds are approx. equal.



12. Switch off the engine, ignition key in position "0" (the ignition is switched off).
13. Lock adjusting screws (3) and (4) at valves (A) and (B) with fixing nuts (1) and (2). While locking, make sure not to change the adjustment of the screws.

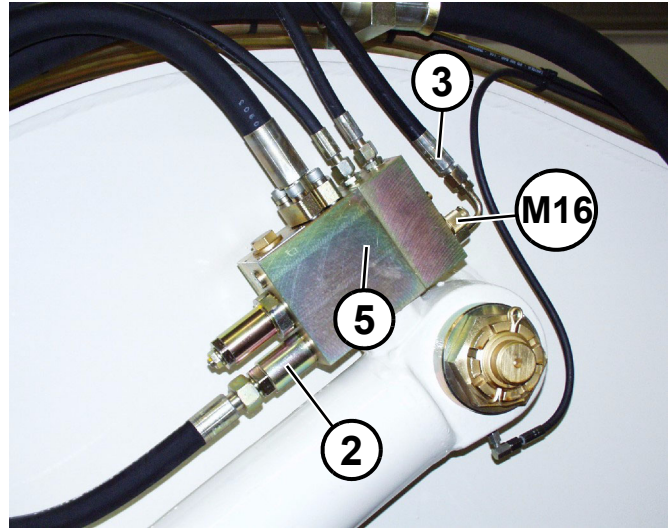
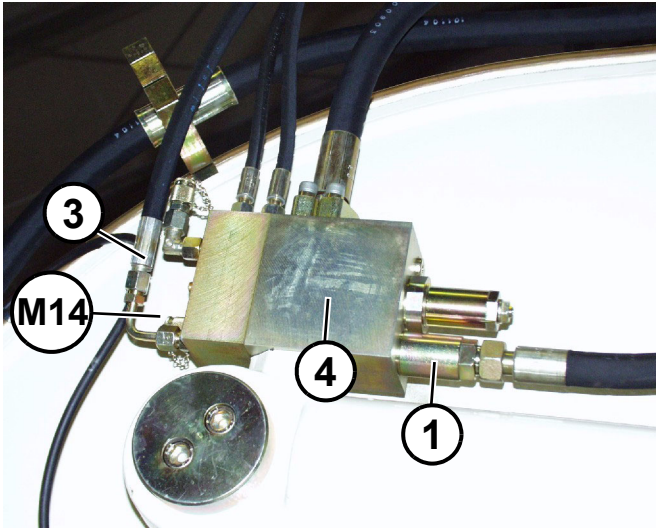


WARNING

Make sure that the boom/jib is lowered and blind plugs are unpressurized.

14. Remove the blind plugs and connect the balance line (5) to both valves (A) and (B) back again.
15. Remove the pressure gauges.

4.20.3 Secondary valves



The secondary valves (1) and (2) are set at the factory and do not need to be adjusted. However, if a checking and/or adjusting needs to be performed, carry out the following procedure:



WARNING

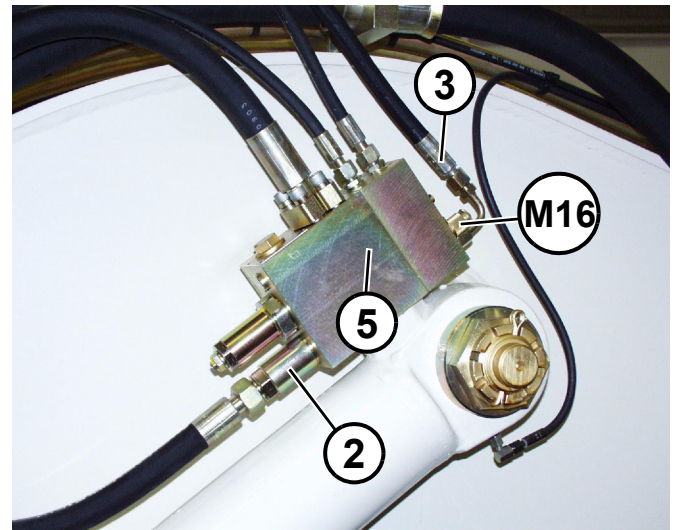
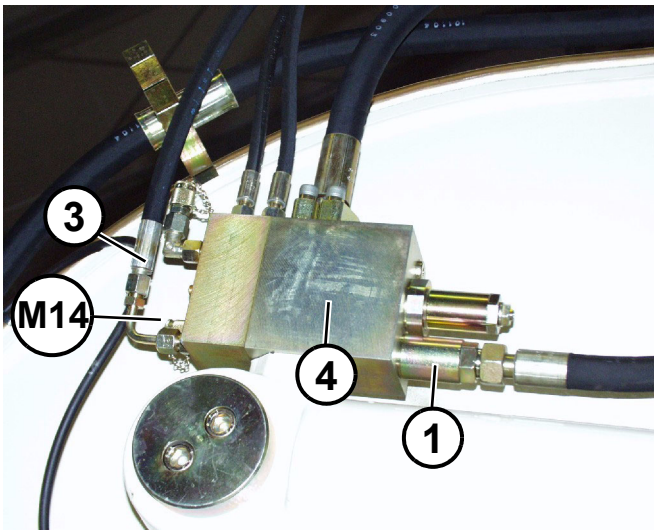
Both valves must be checked and adjusted if necessary.



WARNING

Make sure that the boom/jib is lowered and the balance line (3) is unpressurized.

1. Disengage the balance line (3) from both valve blocks (4) and (5), and insert blind plugs in the valve blocks (4) and (5).
2. Connect a hand pump with a pressure gauge to the measuring union (M14) and/or (M16) at the secondary valve (1) and/or (2) of which to be adjusted.



3. Start the engine.
4. Move the engine speed adjusting lever to the maximum speed position (to its stop).



WARNING

Ensure that no one is remaining within the slewing area of the boom/jib, before moving the boom/jib.

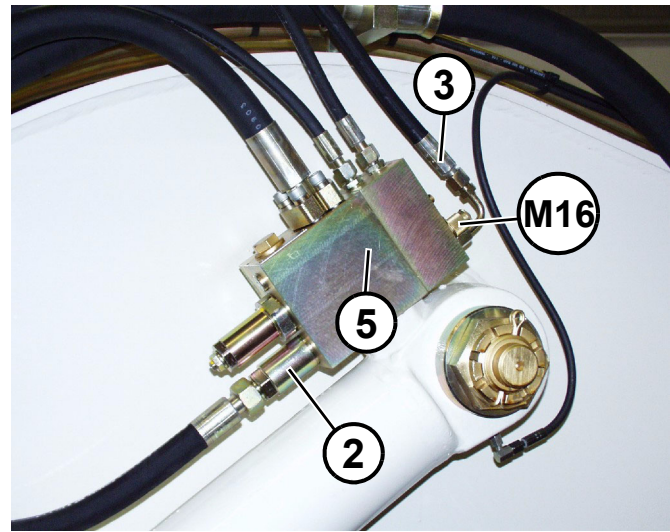
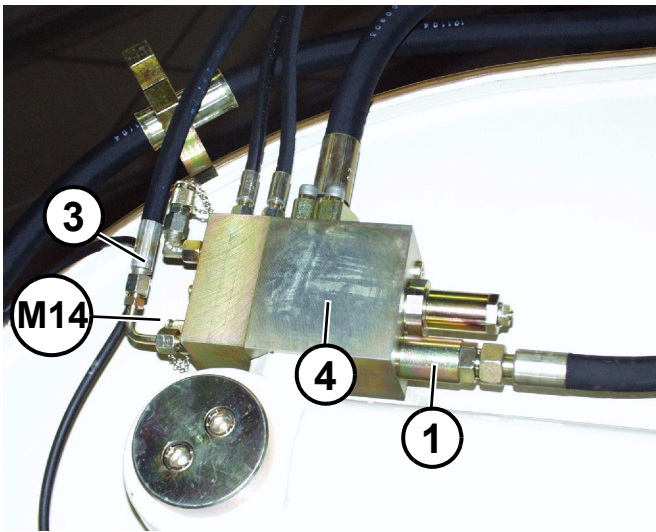
5. Extend the lifting cylinder fully.
6. Switch off the engine, ignition key in position "0" (the ignition is switched off).
7. Build up pressure using the hand pump until no further pressure change occurs. The pressure indicated is the setting pressure of the secondary valve (1) and/or (2).



WARNING

Before carrying out the adjustment make sure, that the secondary valves (1) and (2) are unpressurized and the boom/jib is lowered.

8. Correct by using the adjusting pads for the secondary valve (1) and/or (2).



WARNING

Lower the boom/jib to the ground and make sure that the blind plugs are unpressurized.

9. Remove the blind plugs and connect the balance line (3) to both valve blocks (4) and (5) back again.
10. Remove the hand pump with pressure gauge.

Chapter 7

Electric

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1 Code letters, terminal designations

<u>Operating equipment</u>	<u>Code letters</u>	<u>Examples</u>
A Assemblies	A1	= Display zone
B Converters	B1	= Engine oil temperature sensor
D Memories	D12	= Input modules
E Lights	E1	= Headlight, front left
F Protective equipment	F1	= Main fuse (160A)
G Alternators, power suppliers	G1	= Battery
	G3	= Alternator
H Signalling devices	H1	= Operating hours count
	H2	= Buzzer
K Relays	K1	= Input relay
M Motors	M2	= Starter
R Resistors	R1	= R = 2.21 Kilo Ohm
S Switches	S1	= Main battery switch
	S3	= Ignition starter switch
V Diodes, LEDs	V2	= Diode
	V3	= LED
X Terminal, plug connections	X1/13	= Terminal
	X5/1	= Plug connections
Y Electrically-operated mechanical equipment	Y	= Solenoid valve

	<u>Terminal designations</u>	
30 Permanently positive	WK	Warning contact for telltales, e.g. oil pressure/oil temperature
31 Negative	G	Sensor contact for display
15 Ignition		e.g. oil pressure/oil temperature
19 Ignition starter switch, preheating	86	Relay activation +, coil
17 Ignition starter switch, preheating when starting	85	Relay activation -, coil
50a Ignition starter switch, starter activation	30	Relay switch input
58 Parking light	87	Relay switch output, make contact
58R Parking light, right	87a	Relay switch output, break contact
58L Parking light, left	49	Flasher relay, input
56 Driving light	49a	Flasher relay, output
56a High-beam light	C	Flasher relay, check
56b Low-beam light	53a	Windscreen wiper motor, input
R Turn indicator, right	53	Windscreen wiper motor, 1st stage
L Turn indicator, left	53b	Windscreen wiper motor, 2nd stage
54 Brake light		
B+ Alternator, battery + (terminal 30)	31b	Windscreen wiper motor, limit-position shutdown
D+ Alternator for charge monitoring (engine stationary = negative /engine running = positive)		

2 Symbols

Housing or assembly disconnection

Line, general

Permanent connection

Detachable connection

Plug-in connection

Earth (ground) connection

Fuse

Resistance e.g. $R = 2.21 \text{ kilo Ohm}$

Variable resistance

Diode

Z-type diode

Light-emitting diode (LED)

Power supply source, e.g. battery

Relay or magnetic coil

Note: continued on another page,
e.g. P1.1 = board1/B1.10 = page 10/6 = section 6

Note: continued on another page,
from board to board via D-sub
e.g. P1.4 = board 4/BI.1 = page 1/6 = section 6

Make contact

Break contact

Changeover contact

Manual momentary switch activation

Manual maintain contact switch activation

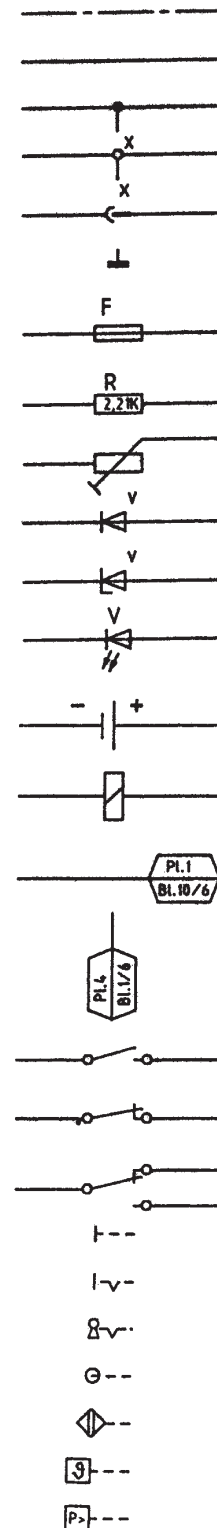
Key switch activation

Mechanical activation, e.g. V-belt switch

Electronic activation, e.g. proximity switch

Temperature activation

Pressure activation



3 Line number codes

Example 1:

5 - 31 Q6



06 =

Cross-section 2,50 mm²

31 =

Pin 31 on printed circuit board

5 =

Plug X5 on printed circuit board

Example 2:

0 - 28 Q3



Q3 =

Cross-section 0,75 mm²

28 =

Consecutive numbers without reference

0 =

No direct connection to printed circuit board

All lines are „yellow“
except negative lines (31) which are „white“.

Line cross sections

Q2 = 0,50 mm²
Q3 = 0,75 mm²
Q4 = 1,00 mm²
without Q = 1,50 mm²
Q6 = 2,50 mm²

Q7 = 4,00 mm²
Q9 = 6,00 mm²
Q10 = 10,00 mm²
Q12 = 25,00 mm²
Q15 = 50,00 mm²

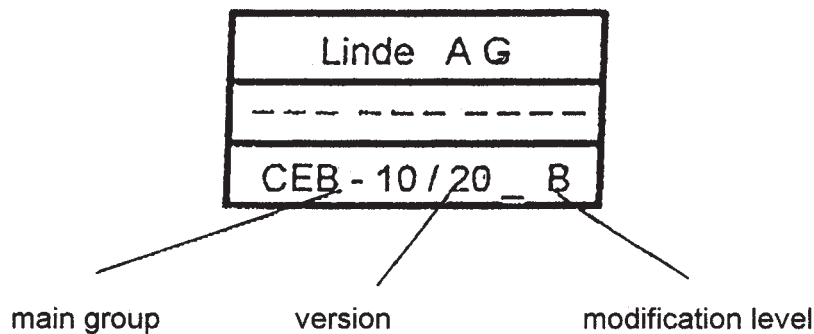
4 Jump starting, starting with a flat battery

The following rules must be observed in order to protect installed electronic components:

- Chargers with starting aid (220 - 240 V mains units): only use chargers with a controlled and stabilised output.
- If the excavator is to be started by another vehicle using jump leads, to avoid voltage peaks the other vehicles engine should not be running.
- When jump starting, make sure the leads are connected up to the correct poles, otherwise the excavators electronic system could be damaged.
- When jump starting, voltage should never exceed 24 Volt.
- Use a charger with controlled and stabilised output to charge batteries. In addition, disconnect batteries from vehicles electrical system.
- When quick-charging the batteries, open the cell cover to prevent batteries from exploding.
- Make sure the specified battery water level is maintained. If it needs topping up, use distilled water only.
- Check charge state, i. e. acid density, if possible.
- Never run the engine with the batteries disconnected.
- Never activate the battery disconnecting switch with the engine running, as voltage peaks could damage printed circuit boards.

5 Identification of the „Linde electronic box“

There are two Linde electronic boxes for all excavator types.
For the excavator types 1004 up to 1604 the electronic box CEB-12/... is used.
For the excavator types 1704 and 1804 the electronic box CEB-10/... is used.
The different controls and the modification levels can be noted from the nameplate.



Any indications not intended for the identification are only being started by a line.
Additionally the Linde boxes are being provided with a further nameplate from the second half of the year 1994 on which the ATLAS EDP No. is mentioned.

6 The Linde CEB - 12/10 Load Limit Control System

Due to the introduction of new types of excavators the CEB-12/01 control unit needs to be provided with a higher computer frequency. The new control unit bears the description CEB-12/10.

The first design of this new control unit is only suitable for the 1404 and 1504 excavator types with water-cooled engine. The subsequent CEB-12/10 design can be used for all types of excavator from the 1004 - 1604 series.

This control unit may not, however, be used as a substitute for the 1204 and 1404 (air-cooled) excavators which still require the CEB - 12/01_G control unit.

The possibilities of encoding the Linde-Box have been extended with a fifth encoder-pin. The encoding of the excavators is earned out in the factory by using cable links in the X 125 socket on the Linde box. The codification is displayed over the diagnosis LED's for about ten seconds after engaging the ignition. Thus the excavator codification can be checked in conjunction with the coding table.

Main group / version	Alteration state	Excavator type	Transmission LS - Controller	Transmission LS - Controller	Standard I design	Standard design	Industrial design	Industrial design	ZW-Excavator	ZW-Excavator	Comments
			1:1	1:1,25	ac	wc	ac	wc	ac	wc	
CEB- 12/10 4642662	_A	1404 1504		X X		X X					Special control for the pre - series of the excavators 1404 and 1504 with water-cooled engines. Encoding through pins instead of previously four.
CEB- 12/10 4656646	_B	1004 1104 1204 1302 1304 1404 1504 1604	X X . X X . . .	X X X X X X X X	X X	. . X X X X X X		 X		 X	Applicable for all of excavator (1004 - 1604) except the 1204 and 1404 excavators with air-cooled engines.

ac = air cooled

we = water cooled

Attention: The load limit regulator with the transformation ratio 1 : 1,25 has this marked on the regulating housing. Additional to this the plugs on the have got a flat head.

7 Explanation of the Eprom

Label and use

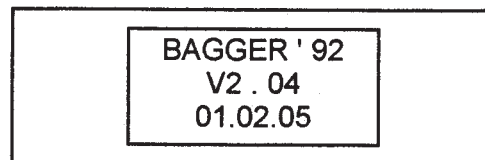
The EPROM is an electronic module that is used to program and store the complete electronic control program.

There are currently five different electronic control systems that require such an EPROM and the program that goes with it.

Each control system is equipped with an appropriate EPROM version on the computer circuit board that goes with it.

There is a sticker on the EPROM that shows which control system it is programmed for.

Example: EPROM for the excavator electronics



Bagger ' 92	=	Excavator with electronics
V2	=	Version 2
04	=	Fourth change
01.02.95	=	Date of change (01 Feb. 95)

Version	Program	Location
V1	Track roller control for the road/rail excavator (old version, type reference 164 s)	Computer circuit board on the superstructure
V2	Excavator electronics control system (new generation)	Computer circuit board 1
V3	Special control system for stationary excavator with electric motor	Computer circuit board 1
V4	Track roller control for the road/rail excavator (ZW - 2 generation)	Computer circuit board 2.1 in conection board 5
V5	Track roller control for the road/rail excavator (ZW - 3 generation)	Computer circuit board 2.1 in conection board 5.1
V6	Oil volume and pressure regulation	Computer circuit board 8
V7	Track roller control for the road/rail excavator (ZW - 4 generation)	Computer circuit board 2.2 in conection board 5. 1

8 Encoding Linde box CEB - 12/...

Excavator type coding CEB - 12/...

Coding is performed by inserting cable links in the 38-pin plug (X125) on the electronics box. From version CEB - 12/10 onwards, the code is indicated by the first 5 LEDs in the diagnostic display for 10 seconds after the system is switched on (see coding table).

Please note: On excavator types 1404 / 1504 from production No. 143M301391 and 150R301418 onwards, an additional non-return valve is fitted at the measuring unions of control block MV 18, between P and LS.

The coding of these excavators corresponds to excavator types 1204 - 1304.

Encoding is effected by inserting cable bridges in the 38-pin plug at the electronic box.

Encoding is effected by inserting cable bridges in the 38 - pin plug at the electronic box.

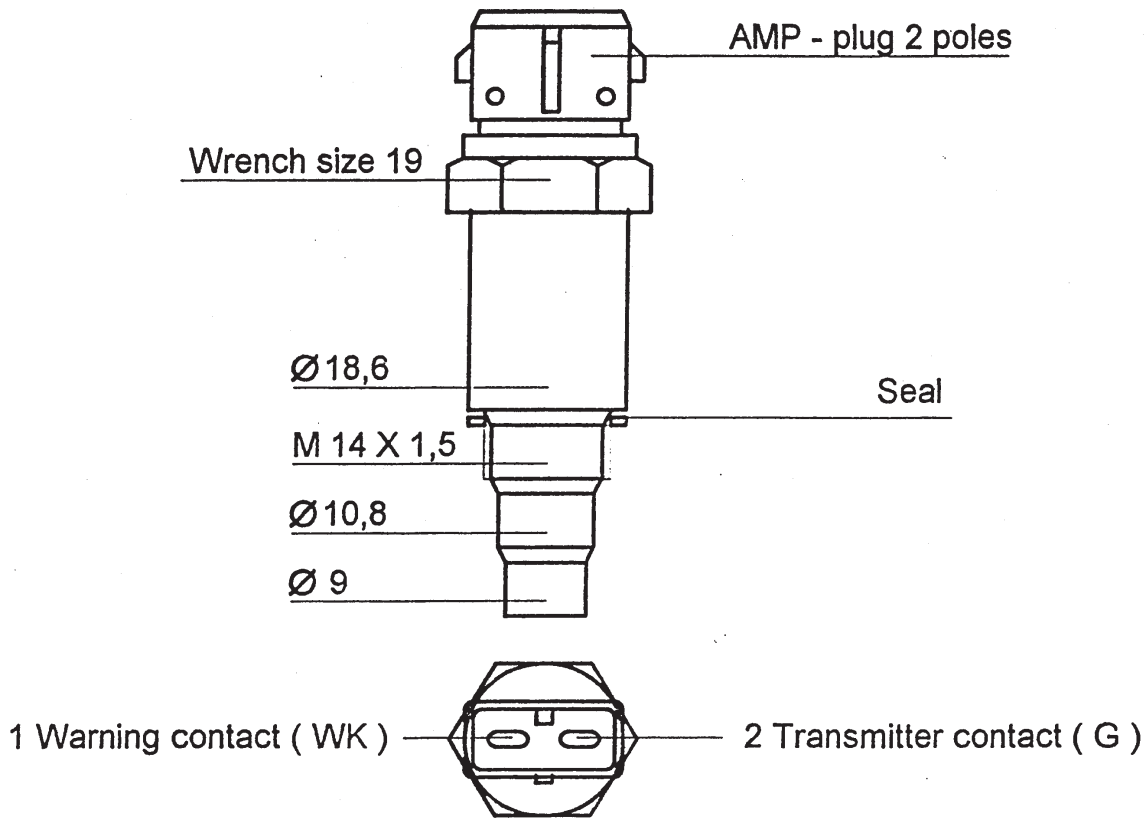
Excavator type	1004		1104		1204		1404		1204 - 1504				1604				
	M				R	M	R	M	R		M+R	M	M	R			
	N								N+I				I	ZW	N+I		
	LK								WK/4						WK/6		
	1:1		1:1,25		1:1		1:1,25		1:1		1:1,25		1:1		1:1,25		
X125/18 auf X125/...	2	2	—	—	—	2	—	2	—	—	2	2	2	2	—	2	—
X125/18 auf X125/...	3	3	3	3	—	—	—	—	3	3	3	3	3	—	3	3	—
X125/18 auf X125/...	4	4	4	4	4	4	—	—	—	—	—	—	—	—	—	—	4
X125/18 auf X125/...	5	5	5	5	5	5	5	5	5	5	5	5	—	—	—	—	—
X125/18 auf X125/...	—	23	—	23	—	—	—	—	—	23	—	23	—	—	—	23	23
Display of excavator type from version CEB- 12/10 -A for 10 sec. after system - ON - in the diagnostic field of E-Box.	LED 1	○	1														
	LED 2	○	2														
	LED 3	○	3														
	LED 4	○	4														
	LED 5	○	5														
	LED 6	○															
	LED 7	○															
	LED 8	○															

- M = Wheeled excavator
- R = Tracked excavator
- N = Standard design
- I = Industrial design
- ZW = Two-way excavator
- LK = Air cooled engine
- WK = Water cooled engine (4 and 6 cylinder)
- 1 : 1 = Transformation ratio Load limit regulator
- 1 : 1.25 = Transformation ratio Load limit regulator

Attention: The load limit regulator with the transformation ratio 1:1.25 has this marked on the regulator housing. Additional to this the plugs on the regulator housing have got a flat head.

9 Sensor for watertemperature

This sensor for watertemperature is valid for all watercooled engines



Tightening torque max. 20 Nm

Switch power output (without induced current) max. 3 W

Nominal voltage 6 - 24 V DC

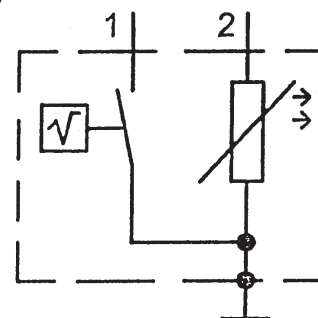
Switching point (WK) at 118°C

Switching off point max. 5°C below switching on point

Closing with increasing temperature

EDP - No. 3667976

Wiring diagram



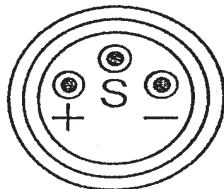
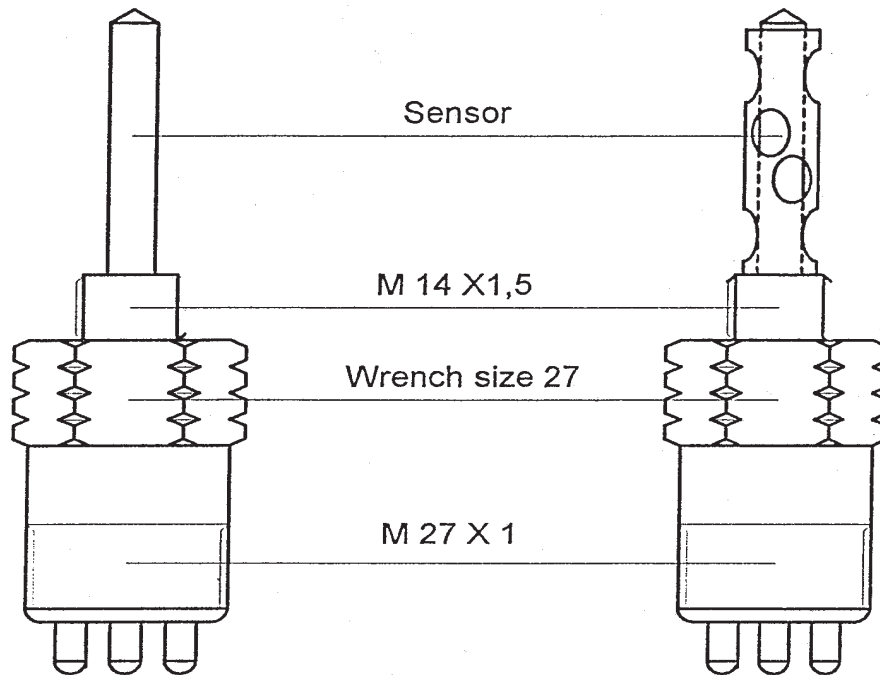
Resistance values at the following temperatures

at + 20°C =	1138,3 Ohm + /- 140,8 Ohm
at + 60°C =	225,5 Ohm + /- 22,9 Ohm
at + 90°C =	83,3 Ohm + /- 7,0 Ohm
at + 120°C =	36,8 Ohm + /- 2,2 Ohm
at + 130°C =	28,9 Ohm + /- 1,5 Ohm

10 Fluid sensors

Sensor for aqueous media
EDP - No. 3649601

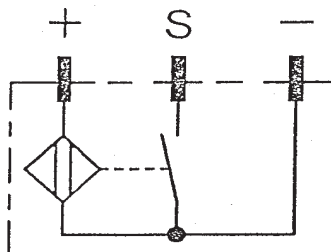
Oil and fuel sensor
EDP - No. 3625943



Technical data

Operating voltage	9 - 36 V DC
Output power	24 W at 24 V (1 A) transistor output
Signal delay	7 sek.
Pressure on sensor	max. 25 bar
Temperature of medium	Water -30°C bis +110°C Oil -30°C bis +125°C
Switch contact closes when sensor is in medium	

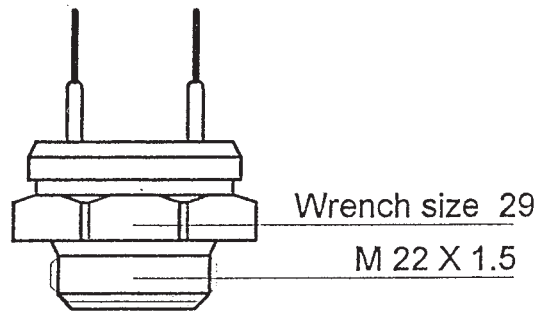
Wiring diagram



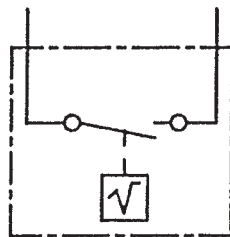
WARNING: There is a risk of permanent damage if the negative potential is connected to the signal connection and the positive potential to the negative connection.

11 Thermostat switch

Thermostat switch to control the electric fan motor at the hydraulic fluid cooler on new - generation excavators of Type 1004 and 1104.



Wiring diagram

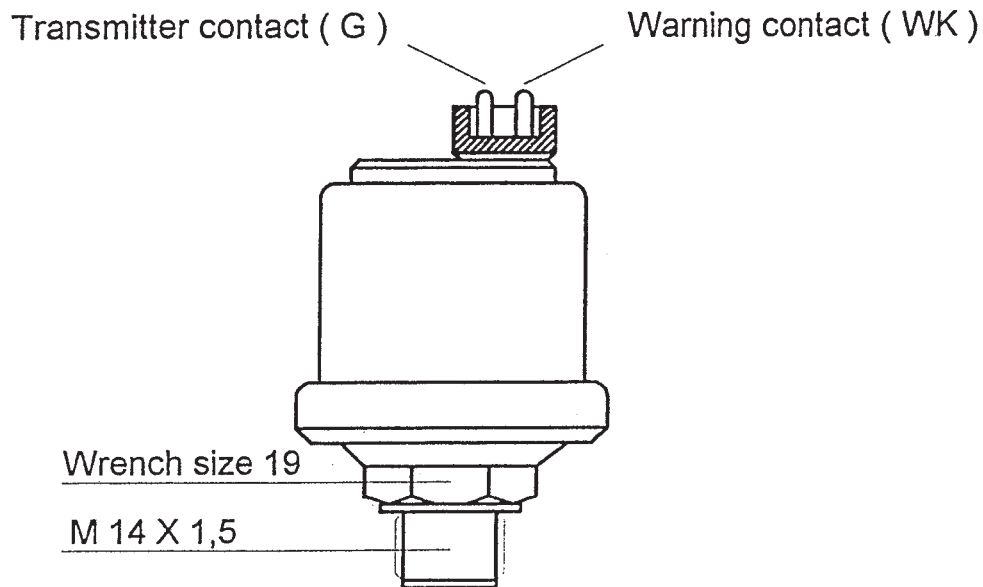


Tightening torque max. 70 Nm
Switching capacity (non - inductive) 240 W (10 A)
Nominal voltage 24 V
Closes when temperatures increase
Switch - on point 55 °C
Switch - off point 50 °C

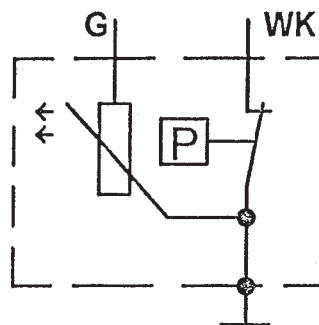
EDP - No. 3686275

12 Oil pressure switch

Engine - oil pressure switch for all water - cooled engines.



Wiring diagram

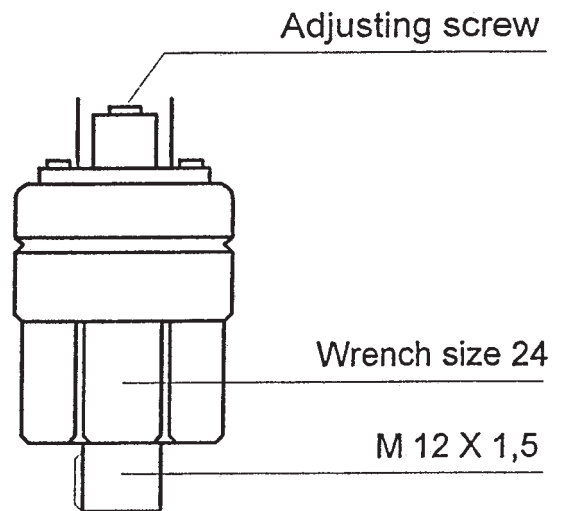


Tightening torque max. 60 Nm
Measuring range 0-5 bar
Switching capacity (non - inductive) max. 5 W
Nominal voltage 6 - 24 V DC
Warning contact closes when pressure drops
Switching point of warning contact 0,4 + 0,2 bar
EDP - No. 3668035

Resistance values at the following pressures
at 0 bar = 10 Ohm +/- 4 Ohm
at 1 bar = 48 Ohm +/- 4 Ohm
at 2 bar = 82 Ohm +/- 4 Ohm
at 3 bar = 116 Ohm +/- 5 Ohm

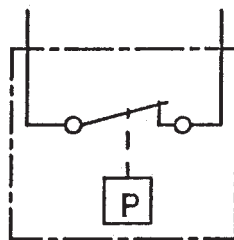
13 Pressure switch for emergency control

Pressure switch for the emergency controls „On“ functional display
(excavator types 1004 - 1604 with load limit control).



EDP - No. 3676353

Wiring diagram



Measuring range	2 -10 bar
Set pressure value	4 bar
Overpressure protection	400 bar
Nominal voltage	42 V
Load	2 A
Opens when pressure increases	

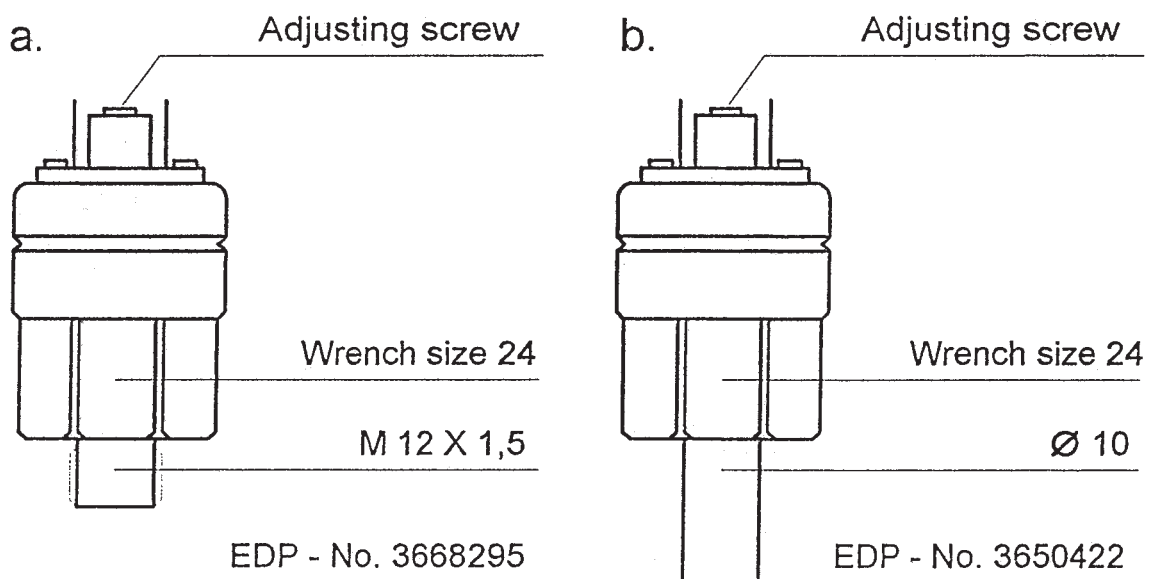
14 Pressure-operated switch

This pressure switch is installed in two connection versions:

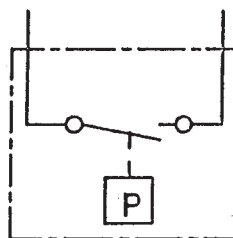
- M 12 X 1,5 mm connecting thread
- Pipe element for collar nut 10 L with cutting ring

The technical data of these pressure - operated switches are identical. The pressure switch is used for the following functions:

- „Travel“ switch signal on all machines fitted with load limit control.
- Pressure step - up during travel (only on 1604 with 90 KW engine).
- Locking of swing axel when actuating the foot brake, on all excavator types fitted with a power brake system.
- Releasing the slewing movement restriction (ZW - 3).

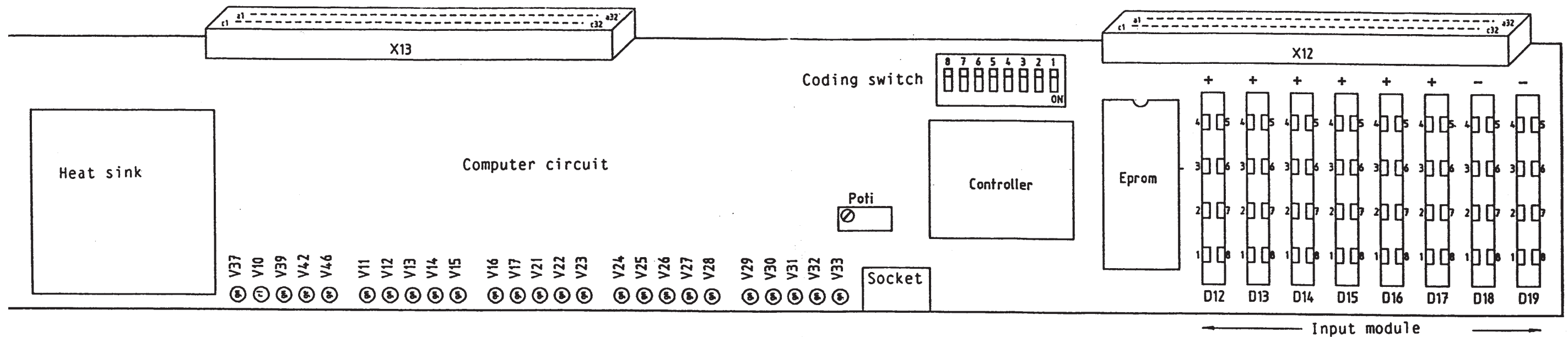


Wiring diagram



Measuring range	2- 10 bar
Set pressure value	5 bar
Overpressure protection	400 bar
Nominal voltage	42 V
Load current	2 A
Closes when pressure increases	

15 Circuit and location diagrams 1504 LC, 1604 LC

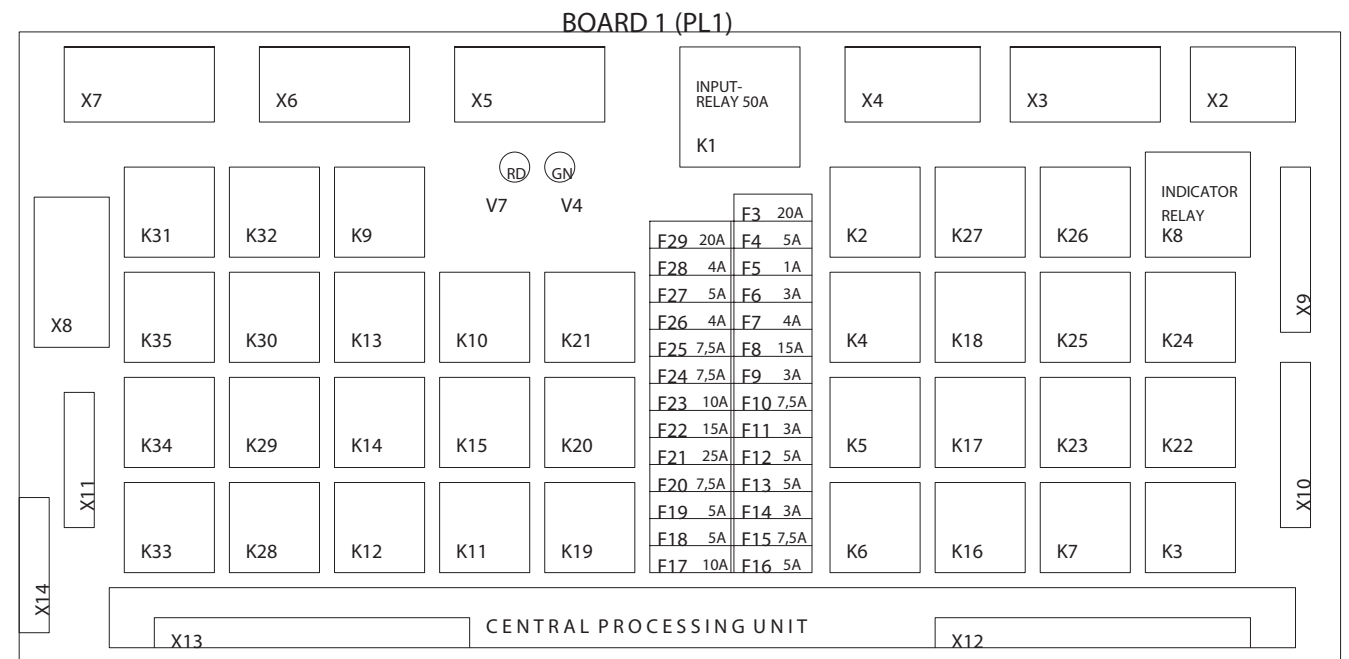
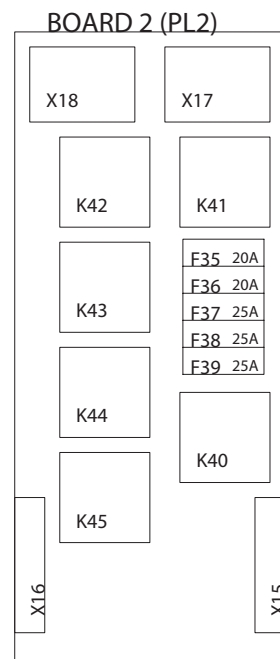
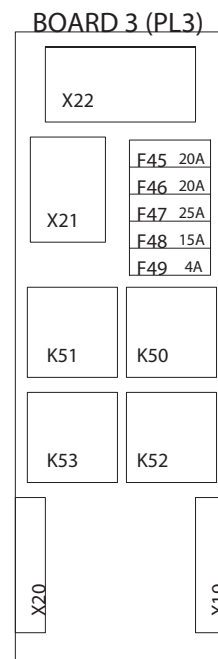
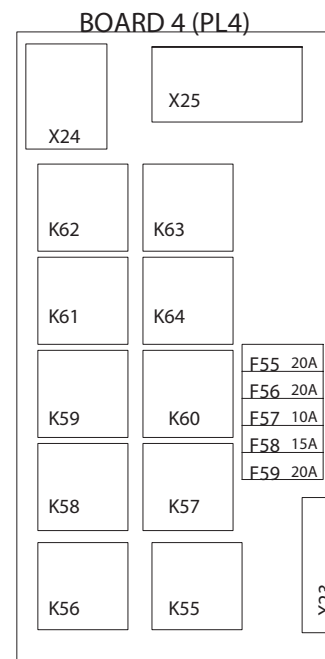


Inputs / outputs

V37	+ Output	Precision control (1304)	>	Solenoid valve	Y12
V10	+ Output	Computer fault (rt)	>	Display zone	A1
V39	+ Output	Bulb monitoring	>	Display zone	A1
V42	+ Input	Fault (GLR) (ge)			
V46	+ Input	Cylinder-head temp. - permanent light (ge)	<	Control unit (GLR)	A4
		Hydraulic fluid temp. - flashing light (ge)	<	Control unit (GLR)	A4
V11	+ Output	Buzzer	>	Buzzer	H2
V12	+ Output	Windscreen washer pump	>	Relay	K15
V13	+ Output	Intermittent windscreen wipers	>	Relay	K13
V14	+ Output	Central lubricating pump	>	Relay	K12
V15	+ Output	Display zone test	>	Display zone	A1
V16	- Output	Automatic idling (1304-1604)	>	Relay	K56
V17	Spare				
V21	+ Output	Additional fuel pump	>	Relay	K10
V22	+ Output	Preselector switch, left, 1st stage	>	Relay	K28
V23	+ Output	Preselector switch, left, 2nd stage	>	Relay	K29
V24	+ Output	Preselector switch, left, 3rd stage	>	Relay	K30
		Refuelling pump			
V25	+ Output	Preselector switch, left, 4th stage	>	Relay	K31
V26	+ Output	Grab rotation, anti-clockwise	>	Relay	K24
V27	Spare				
V28	+ Output	Horn via control lever	>	Relay	K9
V29	+ Output	Preselector switch, right, 1st stage	>	Relay	K32
V30	+ Output	Preselector switch, right, 2nd stage	>	Relay	K33
V31	+ Output	Preselector switch, right, 3rd stage	>	Relay	K34
V32	+ Output	Preselector switch, right, 4th stage	>	Relay	K35
V33	+ Output	Grab rotation, clockwise	>	Relay	K2534

Inputs

D12		D16
+		+
1 = Turn indicator, left		1 = Stabiliser, rear left
2 = Turn indicator, right		2 = Stabiliser, rear right
3 = Horn via control lever		3 = Dozer blade
4 = Safety system for reversing		4 = Overload reached
5 = Grab rotation, clockwise		5 = Restricted lifting/lowering
6 = Kick-down		6 = Engine speed control
7 = Intermittent windscreen wipers		7 = Slew restriction "ON"
8 = Grab rotation, anti-clockwise		8 = Overload "ON"
D13		D17
+		+
1 = Two-way excavator, light		1 = Hammer
2 = Two-way excavator, additional lifting power		2 = Trench cutter
3 = Two-way excavator, slew restriction, anti-clockwise		3 = Air conditioning
4 = Two-way excavator, slew restriction, clockwise		4 = Seat heating
5 = Two-way excavator, pressure loss		5 = Safety system for reversing
6 = Two-way excavator, fault		6 = Starting procedure (terminal 50a)
7 = Two-way excavator, track rollers, rear		7 = Heated mirror
8 = Two-way excavator, track rollers, front		8 = Independent heating
D14		D18
+		+
1 = Flame pre-heat system		1 = Attachments, left
2 = Two-way excavator		2 = Attachments, right
3 = Main-beam light		3 = Pressure cut-in, automatic idling (1304-1604)
4 = Running engine		4 = Central lubricating system
5 = Rear fog lights		5 = Filter contamination
6 = Reverse travel		6 = Handbrake
7 = Work-area lights		7 = V-belt
8 = Rotating beacon		8 = Engine oil temperature (terminal WK)
D15		D19
+		+
1 = Forward travel		1 = Engine oil level
2 = Crawling gear		2 = Monitoring central lubrication
3 = Automatic idling (1304-1604)		3 = Tank preload
4 = Pressure cut-in stage (1304-1604)		4 = Hydraulic fluid filter
5 = Stabiliser, front right		5 = Refuelling pump "ON"
6 = Stabiliser, front left		6 = Spare
7 = Axle locking, via brake		7 = Engine oil pressure
8 = Axle locking, continuous operation		8 = Hydraulic fluid level

FUSE

F55 = 20A CL.30 INPUT FUSE
F56 = 20A CL.30 INPUT FUSE
F57 = 10A CL.15 AUTOMATIC IDLING (1304-1604)
PRESSURE CONNECTION STEP (1004-1604)
ELECTRIC POWER WINDOW
REVERS.SAFETY DEVICE
F58 = 15A CL.15 REAR WINDOW WIPER
WARNING BEACON
F59 = 20A CL.15 FLOOD LAMP

RELAY

K55 = INPUT RELAY
K56 = AUTOMATIC IDLING (1304-1604)
K57 = PRESSURE CONNECTION STEP (1004-1604)
K58 = ELECTRIC WINDOW
K59 = ELECTRIC WINDOW
K60 = REVERSING SAFETY DEVICE
K61 = REAR WINDOW WIPER
K62 = WARNING BEACON
K63 = FLOOD LAMP FRONT
K64 = FLOOD LAMP REAR

FUSE

F45 = 20A CL.30 INPUT FUSE
F46 = 20A CL.30 INPUT FUSE
F47 = 25A CL.30 AUXILIARY HEATING
F48 = 15A CL.15 SEAT HEATING
SEAT ADJUSTMENT
F49 = 4A CL.15 VARIO CABIN OR
CABIN LIFT
MIRROR HEATING
MIRROR ADJUSTMENT

RELAY

K50 = INPUT RELAY
K51 = SEAT HEATING
K52 = VARIO CABIN OR CABIN LIFT
K53 = VARIO CABIN OR CABIN LIFT

FUSE

F35 = 20A CL.30 INPUT FUSE
F36 = 20A CL.30 INPUT FUSE
F37 = 25A CL.17 or 19 FLAME GLOW SYSTEM
OR HEATING PLUG
F38 = 25A CL.15 PROTECTION VENTILATION SYSTEM
AIR CONDITIONING SYSTEM
F39 = 25A CL.15 FUEL FILTER HEATING
OIL PRESSURE HEATING

RELAY

K40 = INPUT RELAY
K41 = PROTECTION VENTILATION SYSTEM
K42 = AIR CONDITIONING SYSTEM
K43 = FUEL FILTER HEATING
K44 = OIL PRESSURE HEATING
K45 = OIL PRESSURE HEATING

FUSE

F1 = 160A CL.30 MAIN FUSE (IN BATTERY CASE)
F2 = NOT PRESENT
F3 = 20A CL.30 INPUT FUSE "BOARD 1"
F4 = 5A CL.15 INPUT FUSE "CENTRAL PROCESSING UNIT"
F5 = 1A CL.15 RUNNING TIME METER / OIL LEVEL
F6 = 3A CL.15 DISPLAY
F7 = 4A CL.15 (24 V) VOLTAGE TRANSFORMER - RADIO
F8 = 15A CL.15 CIGARETTE LIGHTER
F9 = 3A CL.15 SWITCH ILLUMINATION
F10 = 7.5A CL.30 TIMER / SIDELIGHTS (58)
F11 = 3A CL.58L LEFT SIDELIGHTS
F12 = 5A CL.56b DIPPED HEADLIGHTS LEFT
F13 = 5A CL.56a MAIN BEAM LEFT
F14 = 3A 58R SIDELIGHT RIGHT
F15 = 7.5A CL.56b DIPPED HEADLIGHT RIGHT
F16 = 5A CL.56a MAIN BEAM RIGHT
F17 = 10A CL.15 MAIN BEAM (56)
F18 = 5A CL.15 BRAKE LIGHT (54)
F19 = 5A CL.15 FLASHING UNIT (L,R)
F20 = 7.5A CL.30 HAZARD WARNING LIGHTS
F21 = 10A CL.15 HORN / SOUND SIGNAL / MOTOR STOP
SUPPLEMENTARY FEED VALVE / EHFC
F22 = 15A CL.15 VAS (PUMP SUMMATION) OR
HYDRAULIC OIL COOLING FAN
CENTRAL LUBRICATION SYSTEM
F23 = 10A CL.15 WINDSCREEN WIPER FRONT
WINDSCREEN WASHER
F24 = 7.5A CL.15 HEATER FAN
F25 = 7.5A CL.15 GEAR SHIFTING 1.2. GEAR
DRIVE SHIFTING FORWARD, BACKWARD
CREEP SPEED (BY-PASS CONTROL)
MA (MOTOR ADJUSTMENT)
F26 = 4A CL.15 FULL FLOATING AXLE INHIBITION
TURN GRAB "LEFT" AND "RIGHT"
CLAW CONTROL (PRESELECTION)
F27 = 5A CL.15 OVERLOAD DISPLAY / FINE CONTROL
PRESSURE CONNECTION STEP LLSC (1704-2004)
F28 = 4A CL.15 LLSC (LOAD LIMIT SENSING CONTROL)
F29 = 20A CL.15 ADDITIONAL FUNCTIONS, E.G.
REFUEL PUMP

RELAY

K1 = INPUT RELAY 50A
K2 = STARTER SAFEGUARD LOCK
K3 = VOLTAGE WITH RUNNING ENGINE
K4 = SIDELIGHT
K5 = DIPPED HEADLIGHT
K6 = MAIN BEAM (MUST BE PLUGGED IN AT ALL TIMES)
K7 = BRAKE LIGHT
K8 = INDICATOR RELAY
K9 = HORN / SOUND SIGNAL
K10 = SUPPLEMENTARY FEED VALVE (INJECTION PUMP)
K11 = VAS (PUMP SUMMATION) OR HYDR. OIL COOLING FAN
K12 = PUMP CENTRAL LUBRICATION
K13 = DISCONNECTION WIPER WITH FRONT WINDOW "OPEN"
K14 = WIPER FRONT
K15 = PUMP WINDSCREEN WASHER
K16 = SOLENOID VALVE 2.GEAR
K17 = SOLENOID VALVE 1.GEAR
K18 = SOLENOID VALVE BACKWARD
K19 = SOLENOID VALVE FORWARD
K20 = SOLENOID VALVE CREEP SPEED
K21 = SOLENOID VALVE MA (MOTOR ADJUSTMENT)
K22 = SOLENOID VALVE FULL FLOATING AXLE INHIBITION
K23 = TWO-WAY DIGGER
K24 = SOLENOID VALVE TURN GRAB "LEFT"
K25 = SOLENOID VALVE TURN GRAB "RIGHT"
K26 = FREE
K27 = SOLENOID VALVE PRES. CONNEX. STEP LLSC (1704-2004)
K28 = 1.STEP ADDITIONAL FUNCTION L
K29 = 2.STEP ADDITIONAL FUNCTION L
K30 = 3.STEP ADDITIONAL FUNCTION L, E.G. REFUEL PUMP
K31 = 4.STEP ADDITIONAL FUNCTION L
K32 = 1.STEP ADDITIONAL FUNCTION R
K33 = 2.STEP ADDITIONAL FUNCTION R
K34 = 3.STEP ADDIT. FUNCTI. R, E.G. SWITCH OVER FOOT PEDAL
K35 = 4.STEP ADDITIONAL FUNCTION R

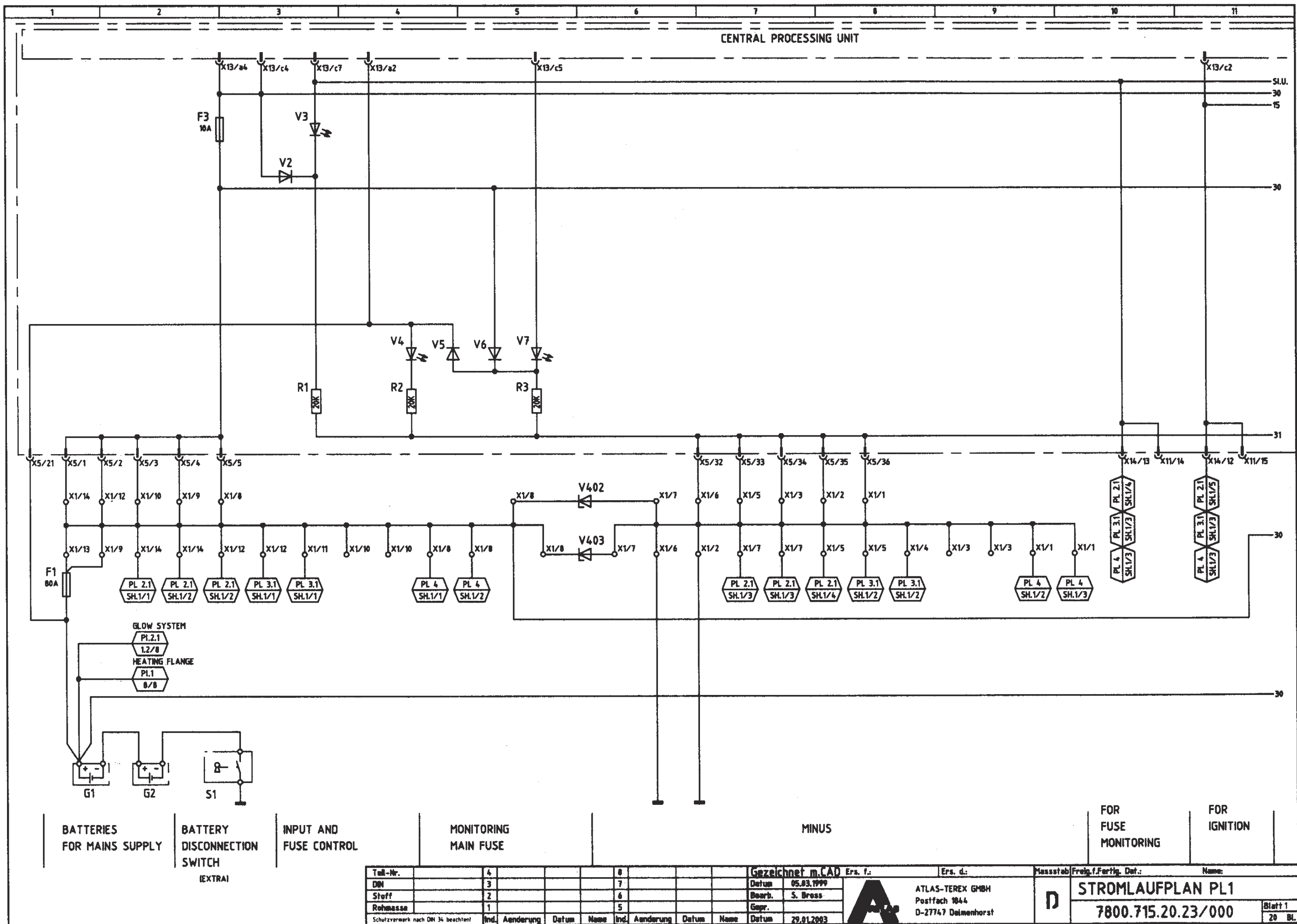
LIGHT EMITTING DIODES (LED)

V4 = INPUT MONITORING PERMANENT PLUS (30)
V7 = FUSE MONITORING F1 (160A)

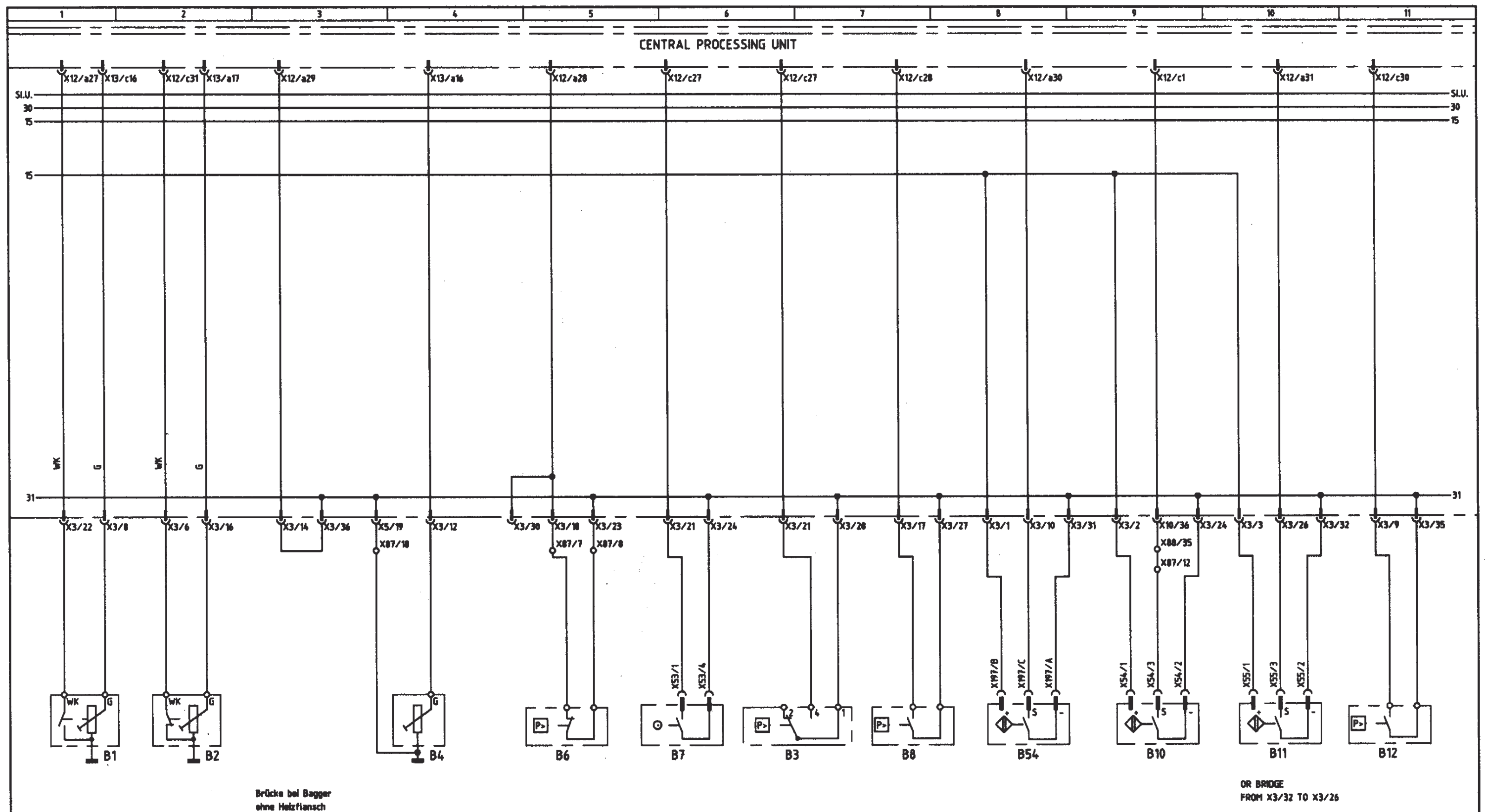
ATTENTION !!

TO PREVENT DAMAGE TO THE ELECTRICAL INSTALLATION, NOTE THE ATTENTION !

- ELECTRIC CONNECTIONS MUST BE DISCONNECTED AND CONNECTED BE CURRENTLESS, I.E. IGNITION "OFF"
- CHECK CORRECT AMPERAGE (DAMAGE TO BOARDS) WHEN CHANGING FUSES
- ALL FUSES MUST BE PLUGGED IN AT ALL TIMES (FUSE MONITORING)
- WELDING: PROVIDE GOOD EARTH CONNECTION AS CLOSE AS POSSIBLE TO WELDING WELDING JOINT AND DO NOT DISCONNECT BATTERIES (DISCONNECT CONTROL DEVICE LLSC-LINDE)
- DISCONNECT BATTERIES FROM ELECTRICAL SYSTEM WHILE USING CHARGER
- IN CASE OF EXTERNAL IGNITION PLEASE CHECK IF POWER SOURCE IS STABLE
- OPERATE ONLY WITH DIGITAL-MULTIMETER (EDP: 3607861) OR VOLTAGE TESTER (EDP: 3607872) (NO TEST LAMP)



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Schutzvermerk nach DIN 34 beachten!			Datum	29.01.2003				
Ind. Aenderung Datum Name			Ind. Aenderung Datum Name			ATLAS-TEREX GMBH Postfach 1844 D-27747 Delmenhorst		
						D		
						STROMLAUFPLAN PL1		
						7800.715.20.23/000		
						Blatt 1		
						20 BL.		



WATER
TEMPERATURE

MOTOR OIL
PRESSURE

TANK TRANSMITTINGHAND BRAKE
DEVICE

(MOBILE)

PRESSURE TANK

AIR FILTER
POLUTION

WATER LEVEL
FUEL FILTER

WATER LEVEL

HYDRAULIC OIL
LEVEL
(FROM 1404 EXTRA)

HYDRAULIC OIL FILTE
DIRT OF

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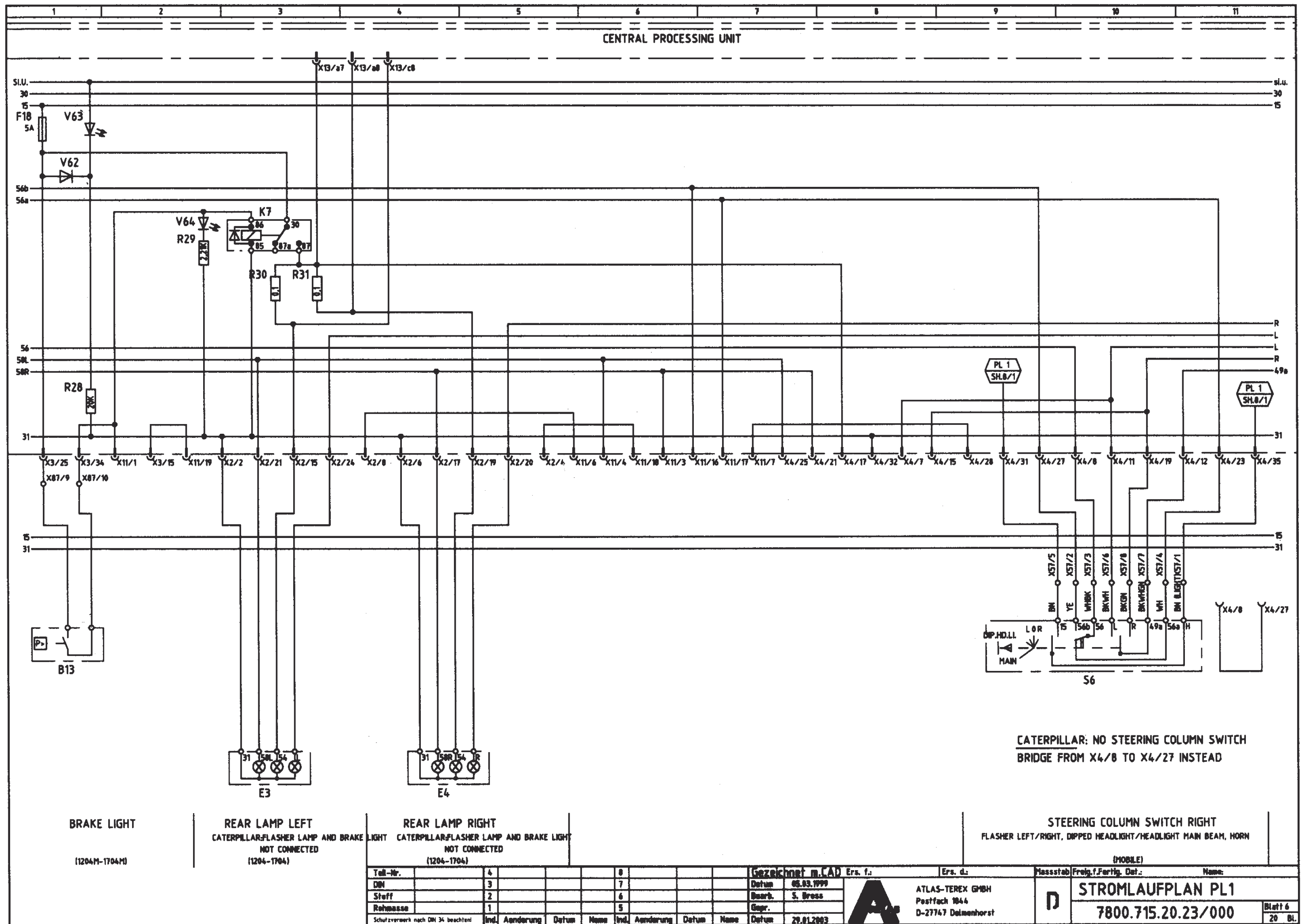


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D-27747 Delmenhorst

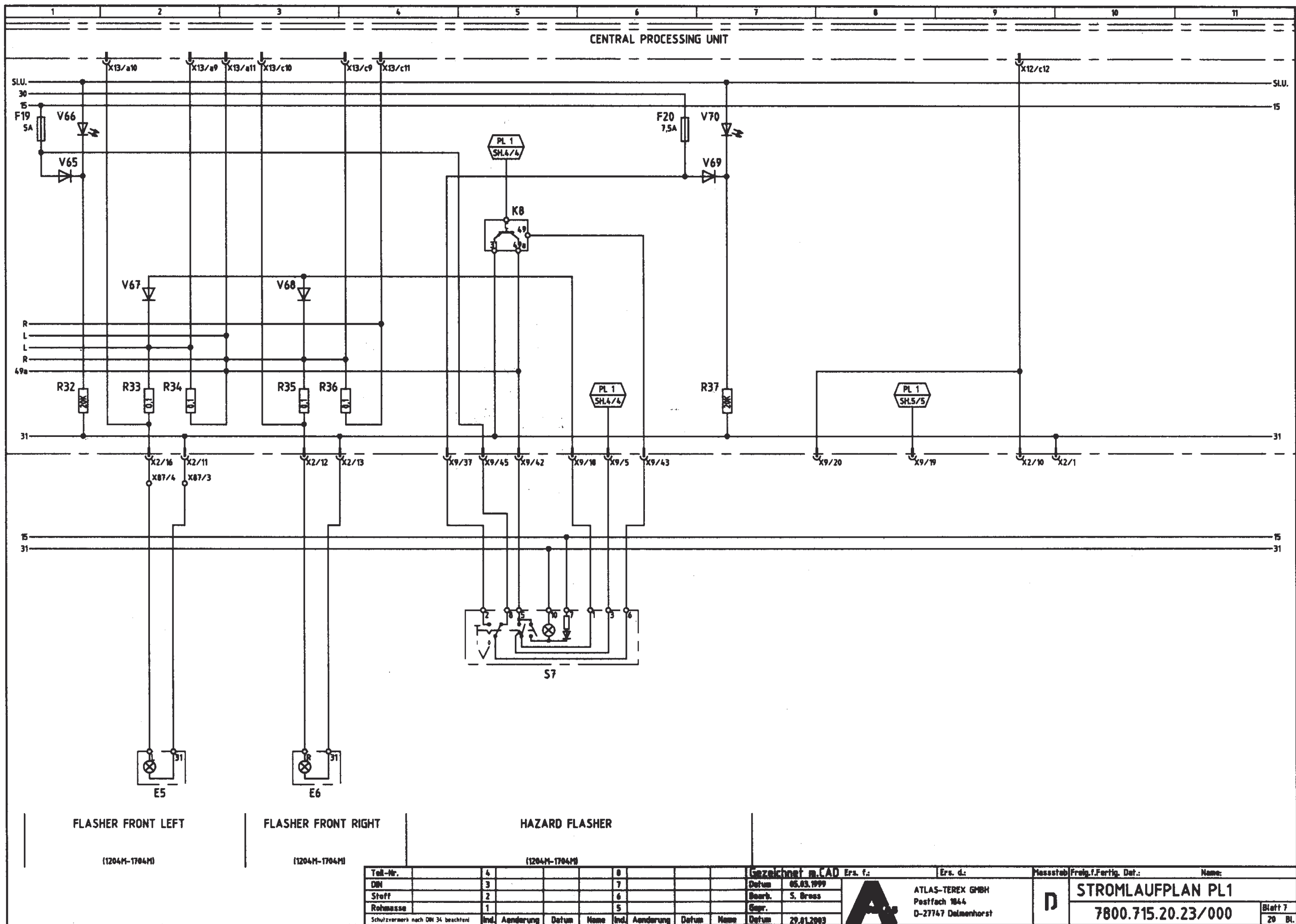


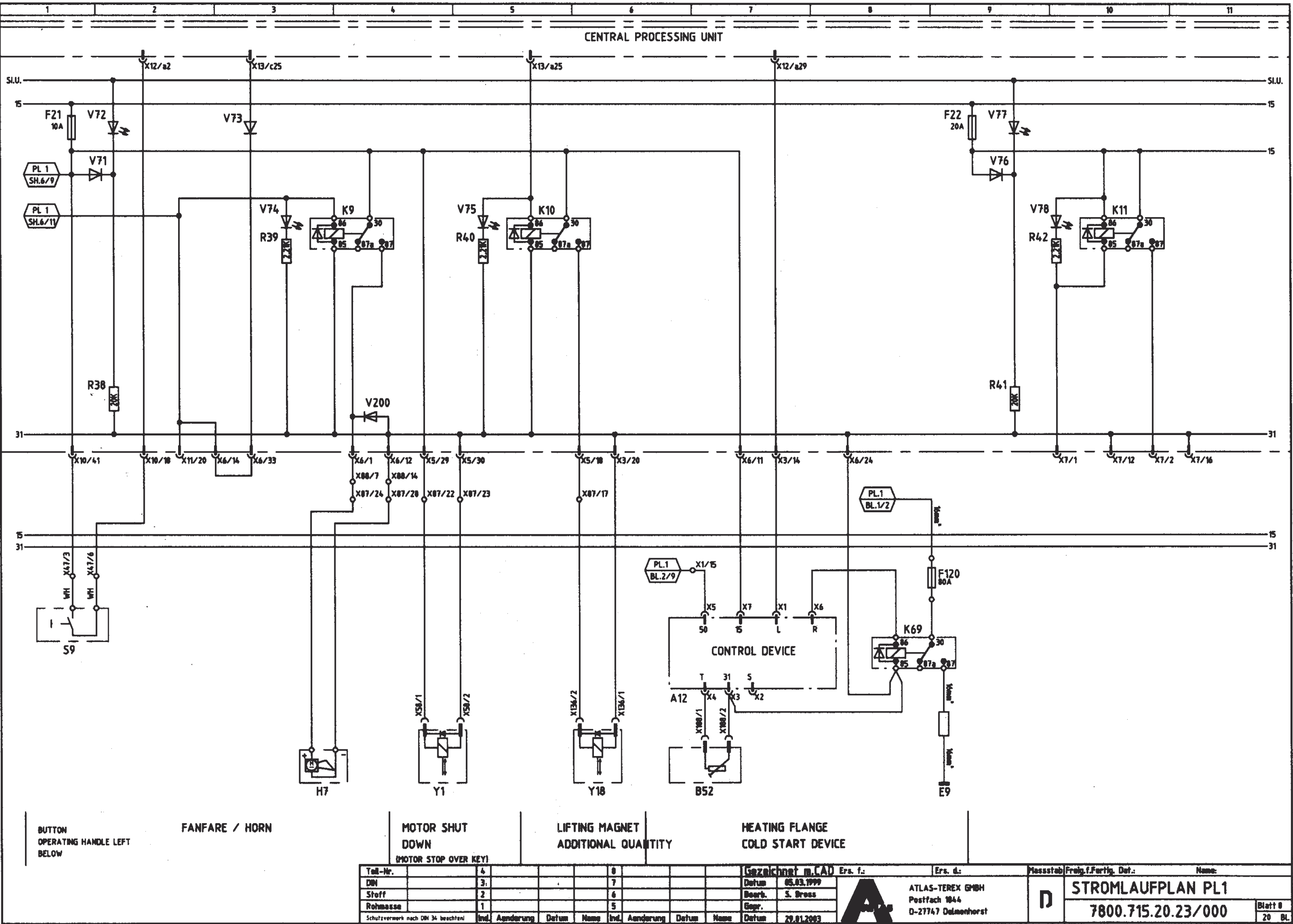
STROMLAUFPLAN PL1
7800.715.20.23/000

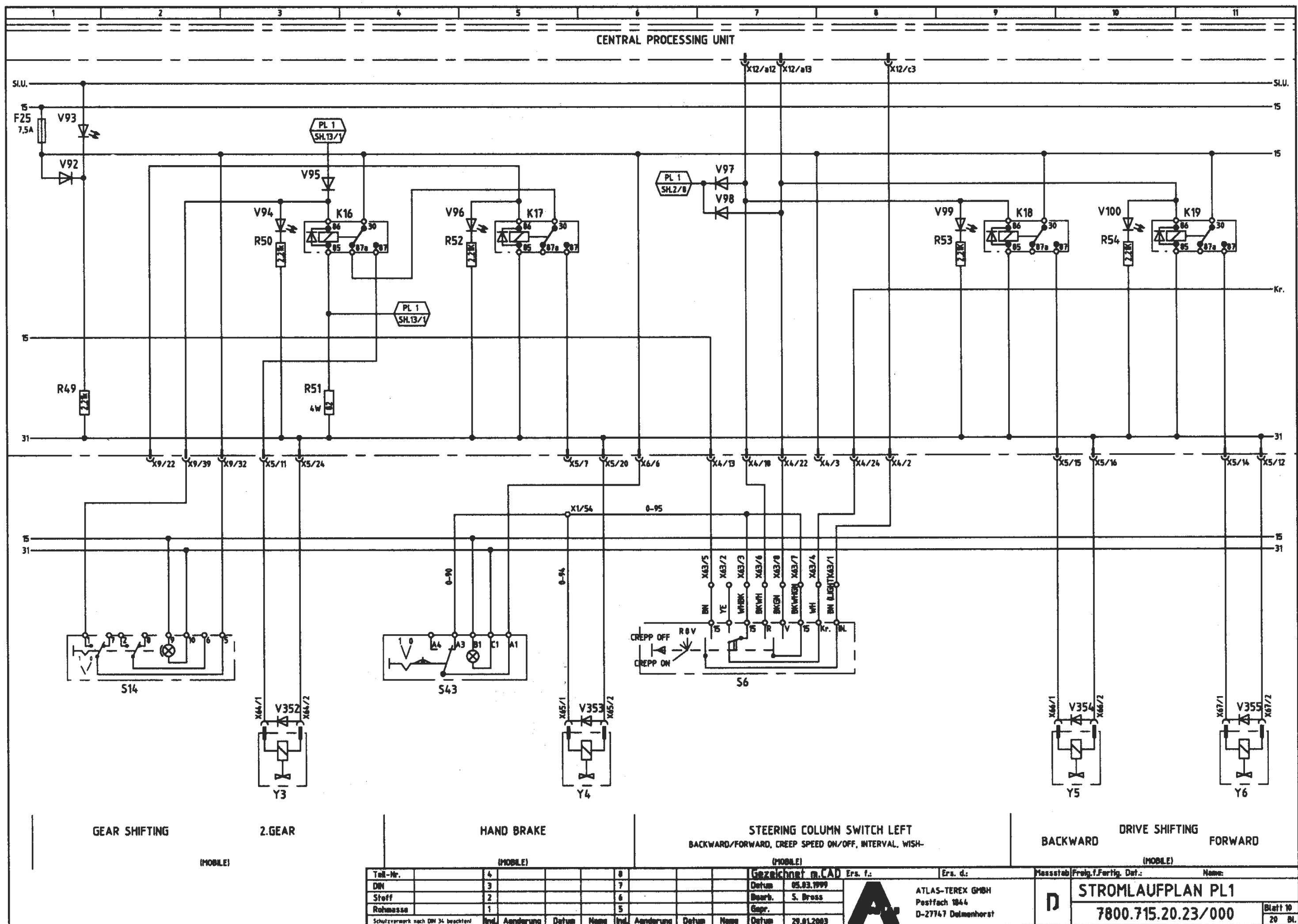
Blatt 3
20 BL.

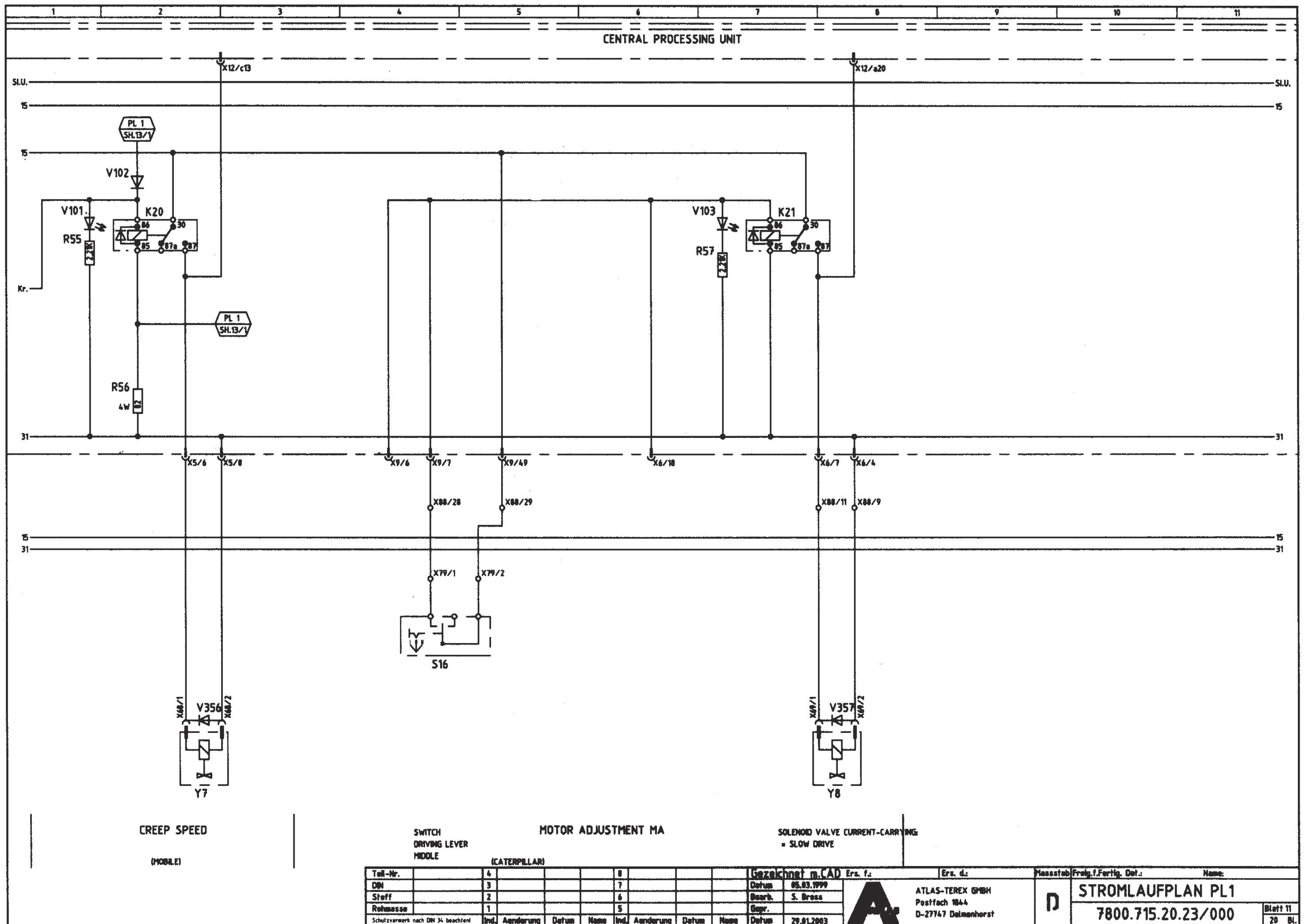


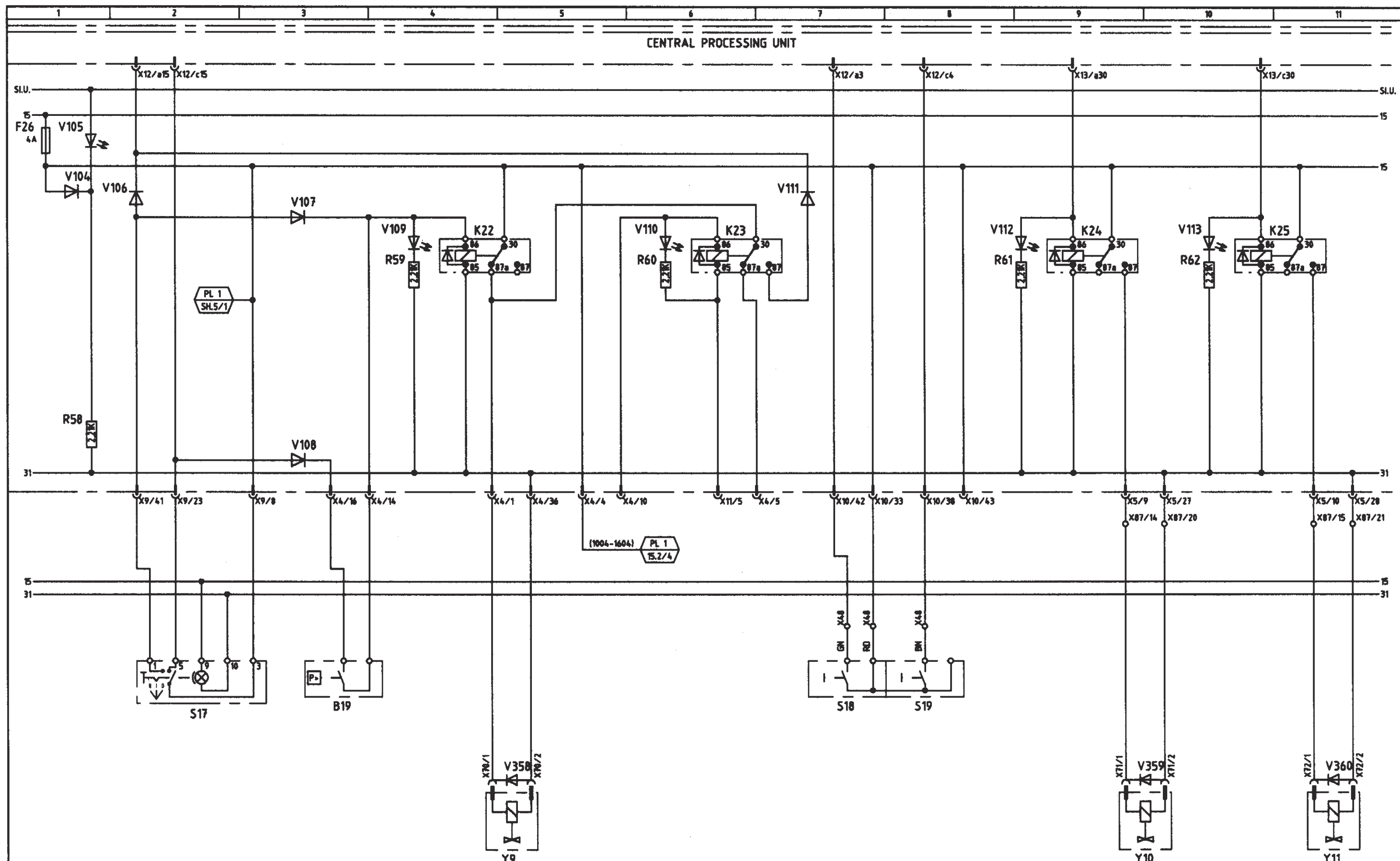
CATERPILLAR: NO STEERING COLUMN SWITCH
BRIDGE FROM X4/8 TO X4/27 INSTEAD











FULL FLOATING AXLE INHIBITION
(MOBILE)

SOLENOID VALVE CURRENT-CARRYING
= AXLE FREE

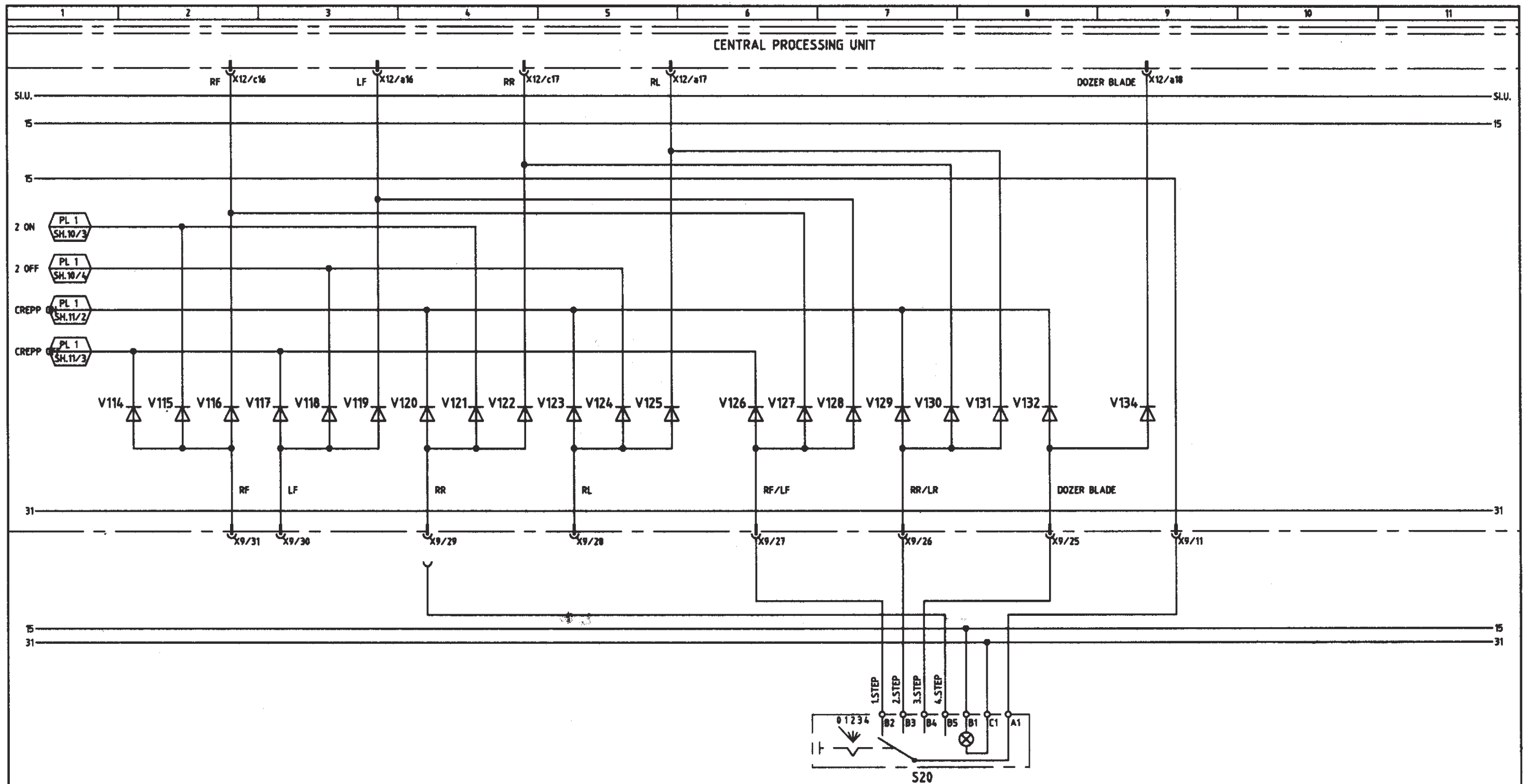
TURN GRAB LEFT
BUTTON
OPERATING HANDLE RIGHT
INSIDE

TURN GRAB RIGHT
BUTTON
OPERATING HANDLE RIGHT
OUTSIDE

TURN GRAB
LEFT

TURN GRAB
RIGHT

										11204-1704 / EXTRA										
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Stoff		2				6	Boerb.		S. Bross											
Reihense		1				5	Gep.													
Schutzvermerk nach DIN 34 beachten!						Ind. Änderung	Datum	Name	Ind. Änderung	Datum	Name	Datum	20.01.2003				7800.715.20.23/000		Blatt 12 20 Bl.	



CLAW CONTROL

RIGHT FRONT 2.STEP LEFT FRONT 1.STEP RIGHT REAR 4.STEP LEFT REAR 3.STEP FRONT REAR DOZER BLADE

WHEN IN INDIVIDUAL CONTROL:

(MOBILE EXTRA)

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Reihe	1	5	Gepr.					
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Ind.	Aenderung	Datum	Name	Ind.	Aenderung	Datum	Name	



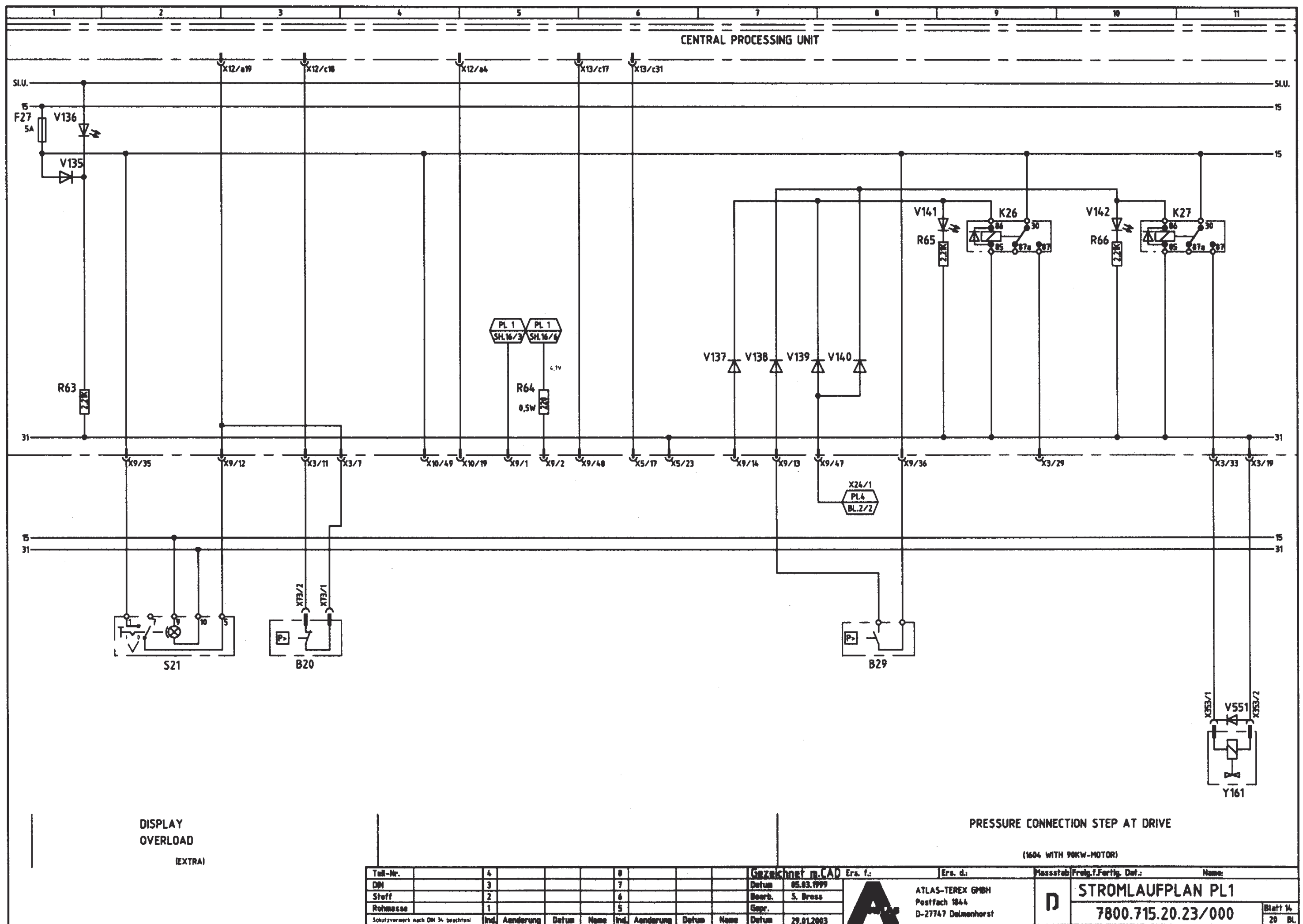
ATLAS-TEREX GMBH
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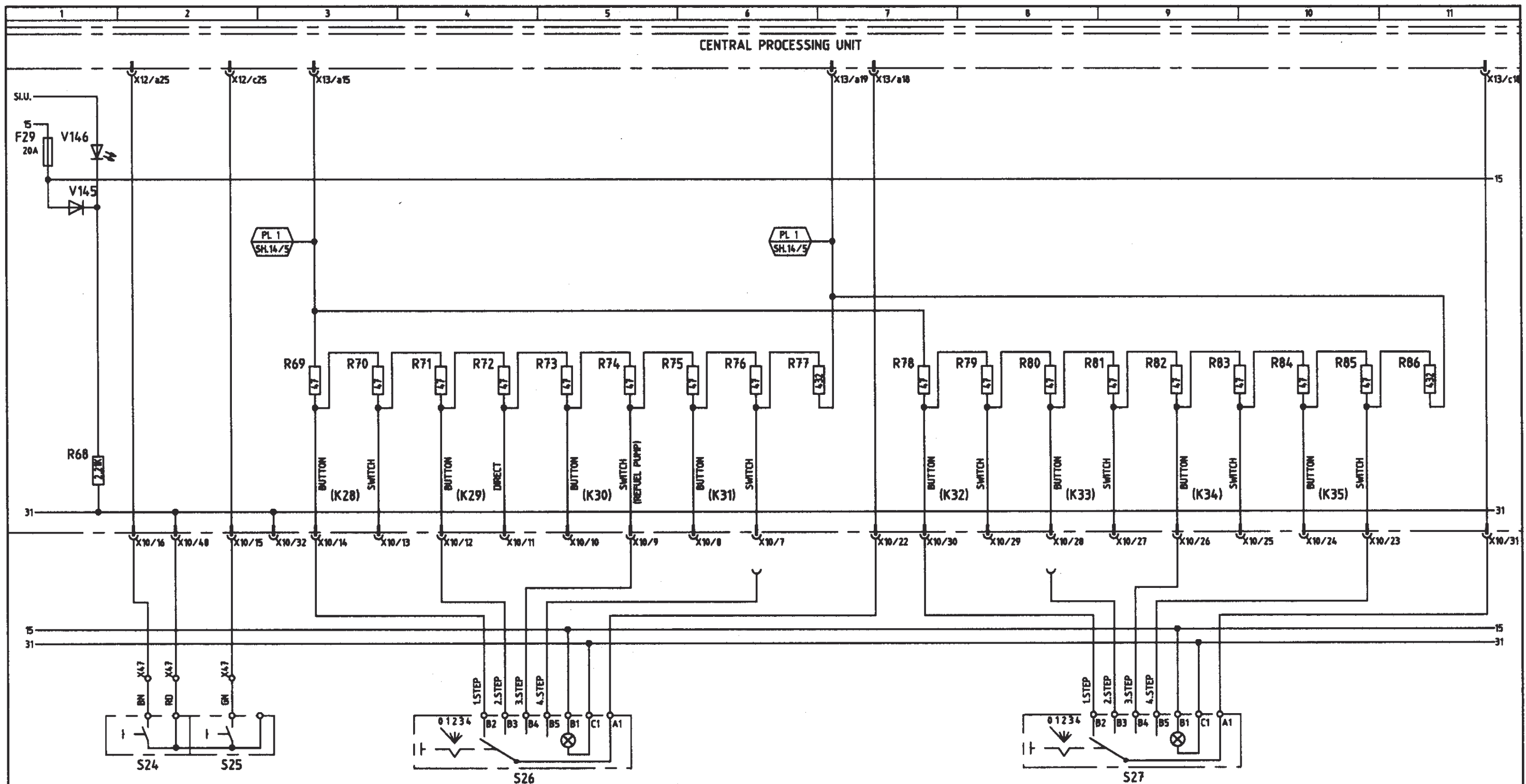
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STROMLAUFPLAN PL1

7800.715.20.23/000

Blatt 13
20 Bl.





AUXILIARY TOOLS LEFT
BUTTON
OPERATING HANDLE LEFT
OUTSIDE

AUXILIARY TOOLS RIGHT
BUTTON
OPERATING HANDLE LEFT
INSIDE

PRESELECTION SWITCH L.

FOR BUTTON
OPERATING HANDLE LEFT
OUTSIDE

PRESELECTION SWITCH R.

FOR BUTTON
OPERATING HANDLE LEFT
INSIDE

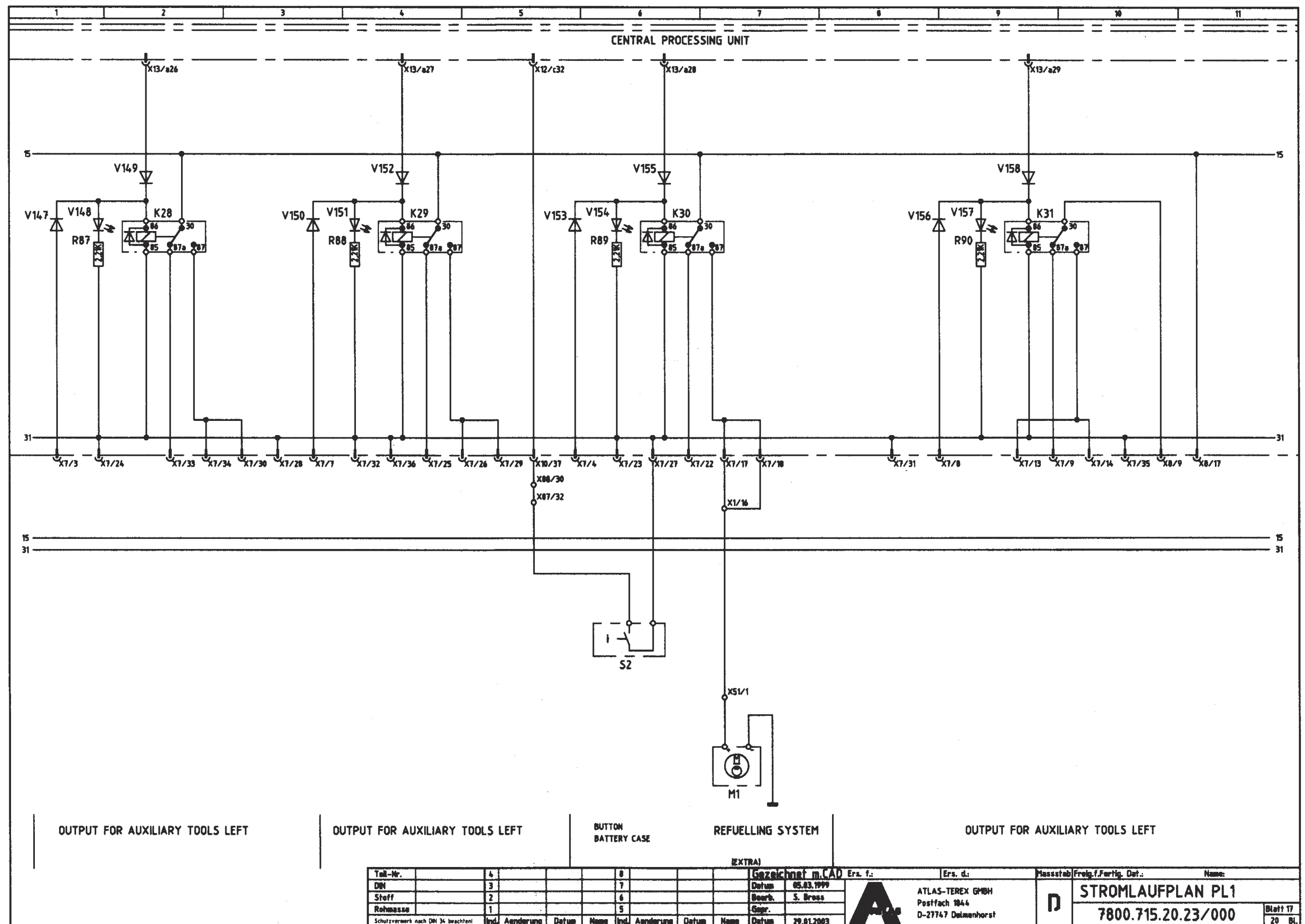
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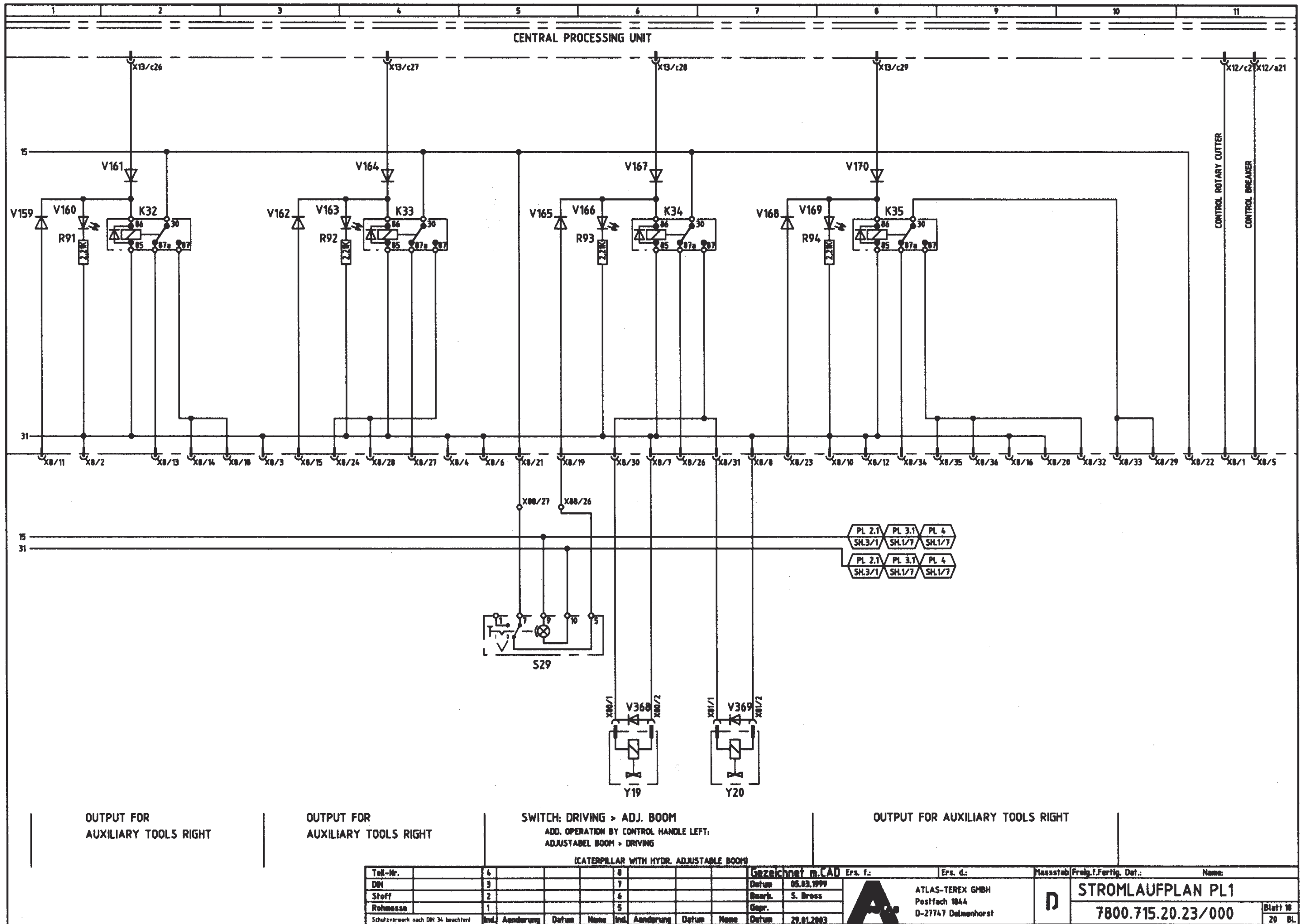
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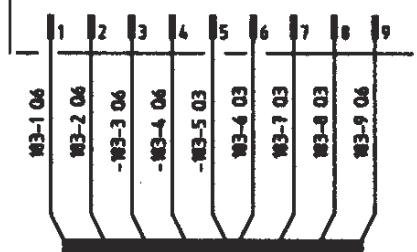
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Blatt 16
20 BL

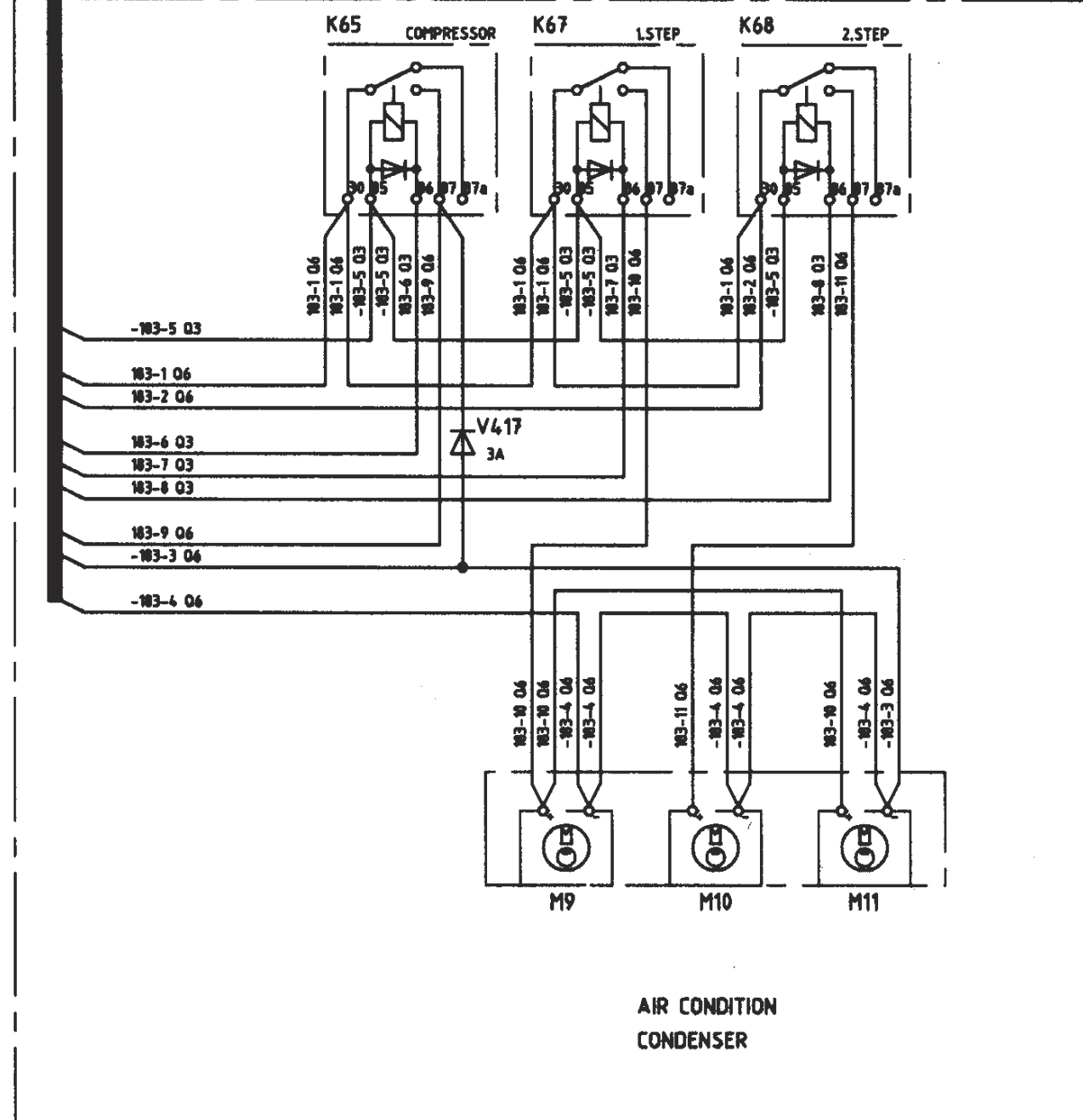




X183



AREA: UPPER PART OF CABIN



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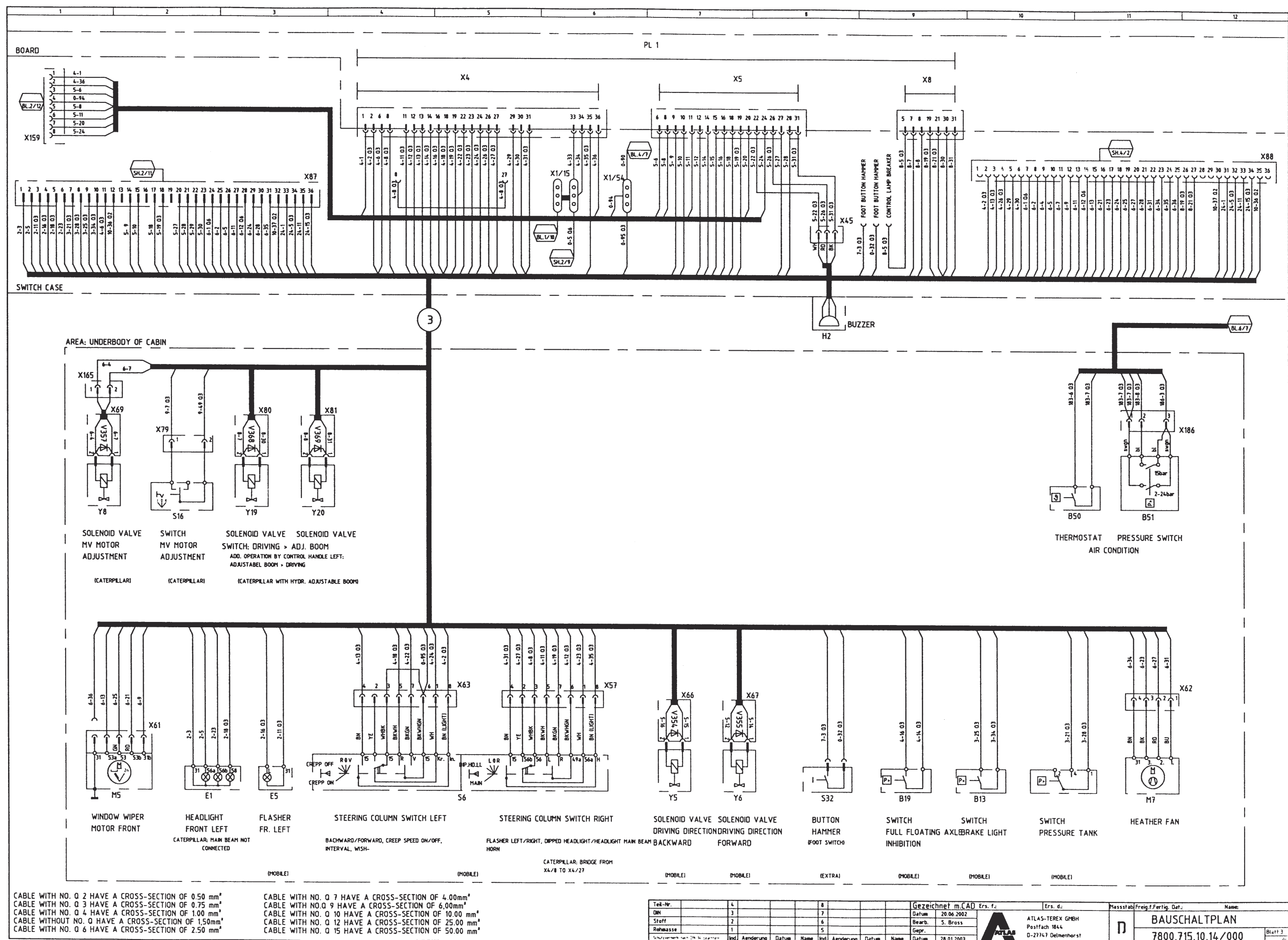


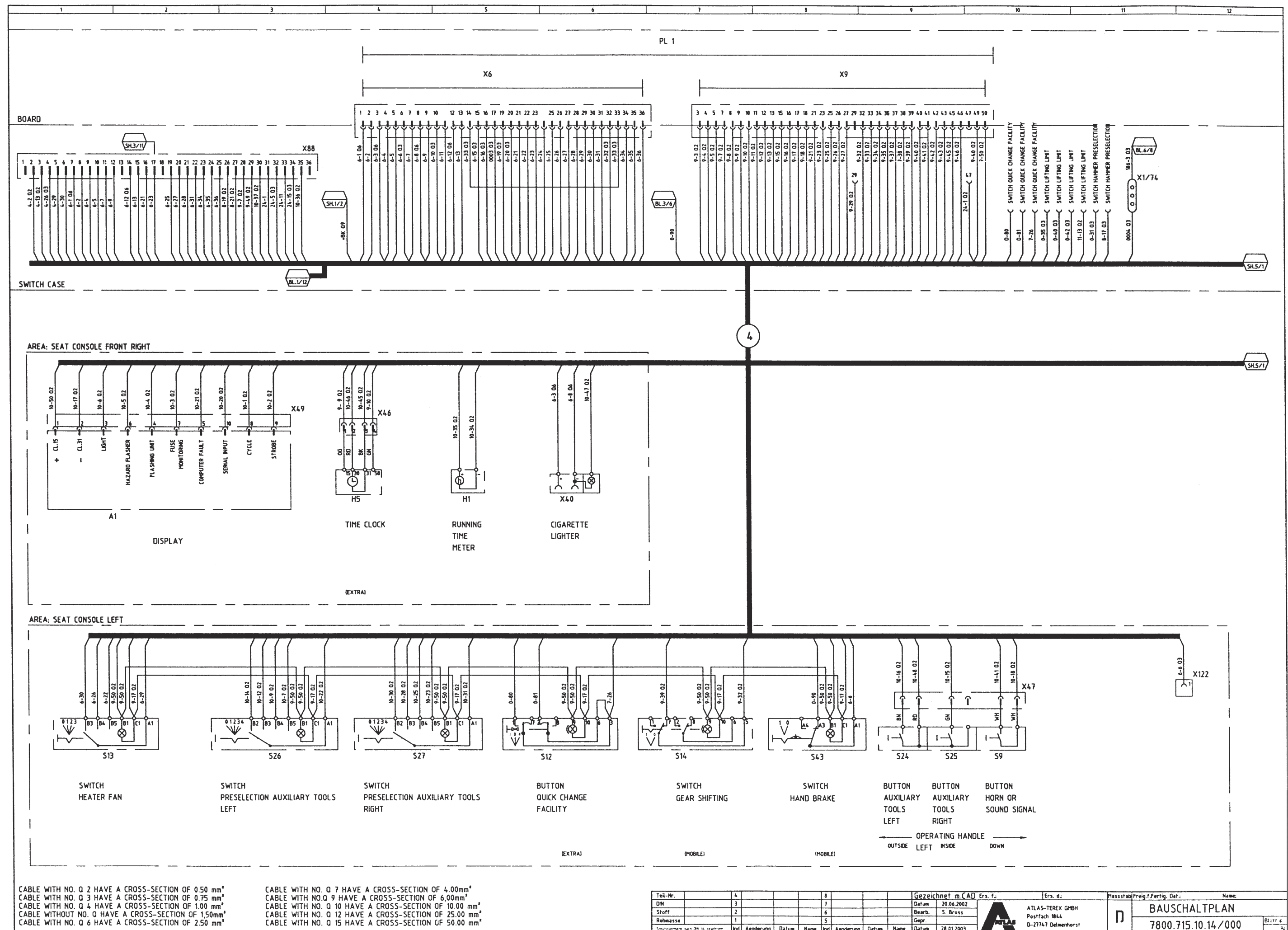
ATLAS-TEREX GmbH
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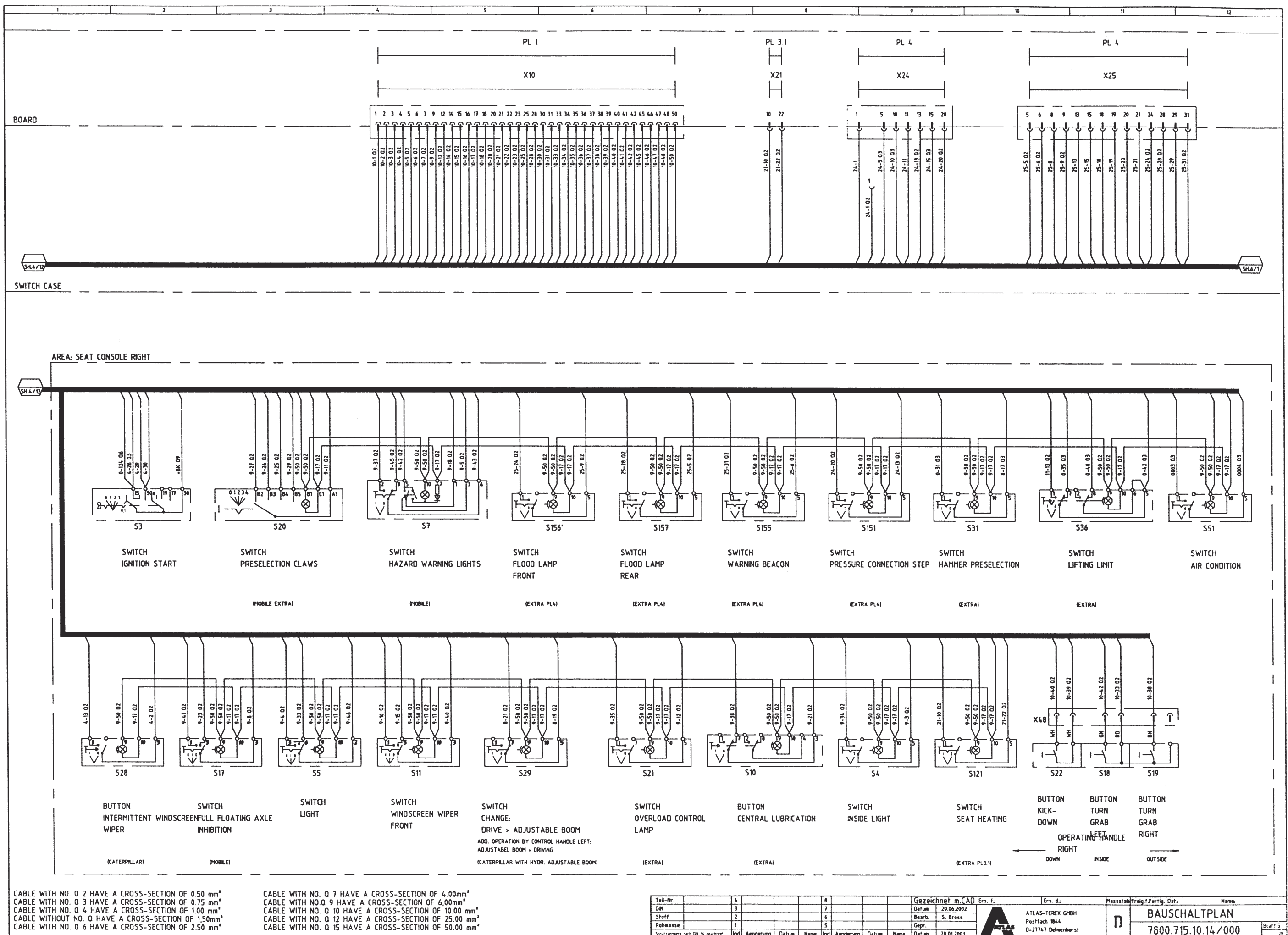


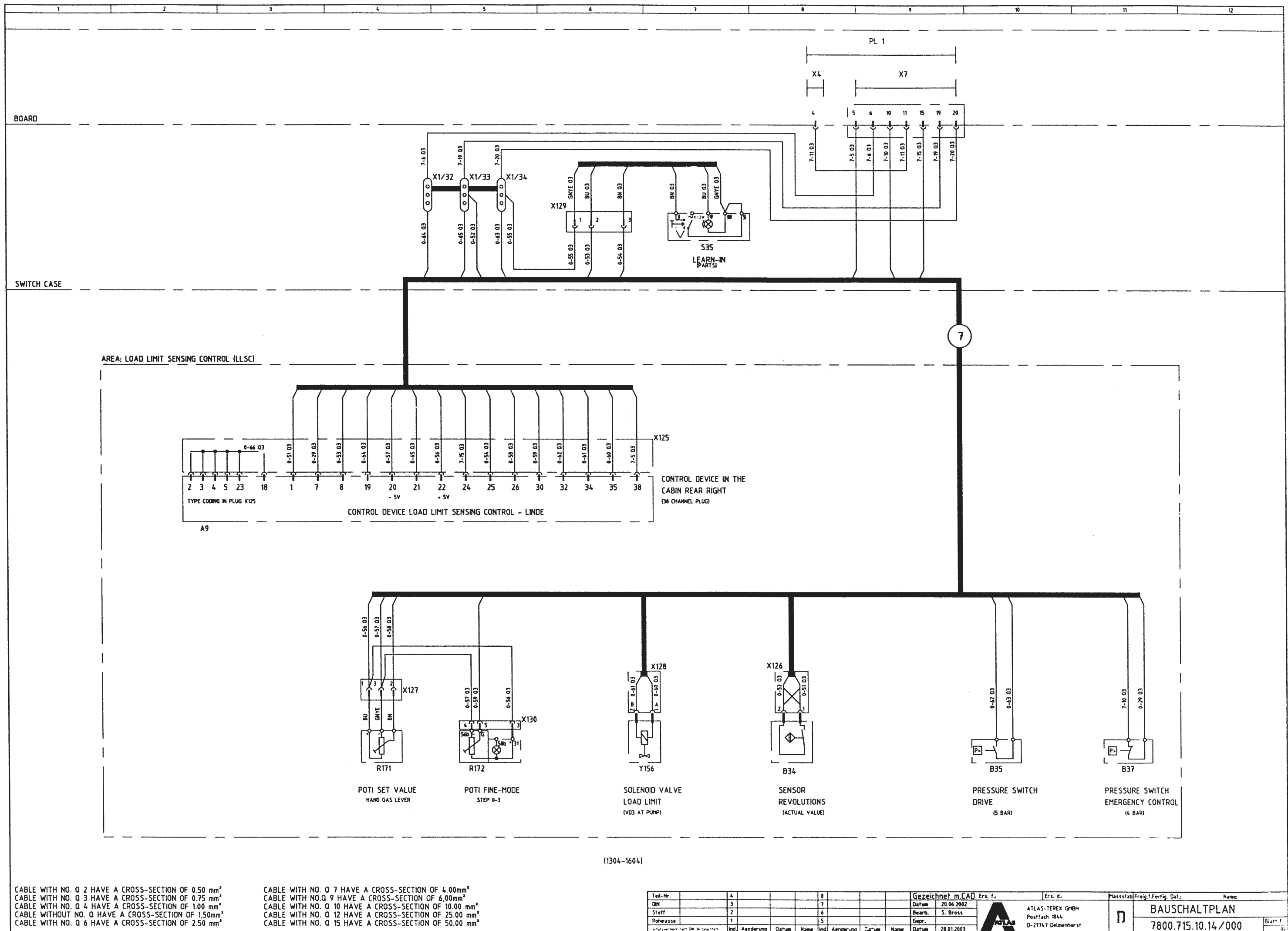
STROMLAUFPLAN PL1
7800.730.20.75/000

Blatt 20.1
Bl.









Chapter 8
Engine

Contents

1	Setting of valves.....	2
1.1	Adjusting instruction.....	2
1.2	Valve free-play scheme	4

1 Setting of valves

1.1 Adjusting instruction

Valve free-play

Too much or too little valve free-play may lead to engine damage as a result of mechanical and thermal overload. It must therefore be verified at recommended intervals - see Operating Manual - and readjusted when necessary.

The valve free-play shall be verified and adjusted at an oil temperature of <80 °C. Values for the engines BFM 2012:

Inlet valve = 0.3 mm
Outlet valve = 0.5 mm

After initial assembly or after replacement of the cylinder-head gasket

Inlet valve = 0.4 mm
Outlet valve = 0.6 mm

The respective feeler gage must be capable of being pushed between the rocker-arm cog and the valve with little resistance.

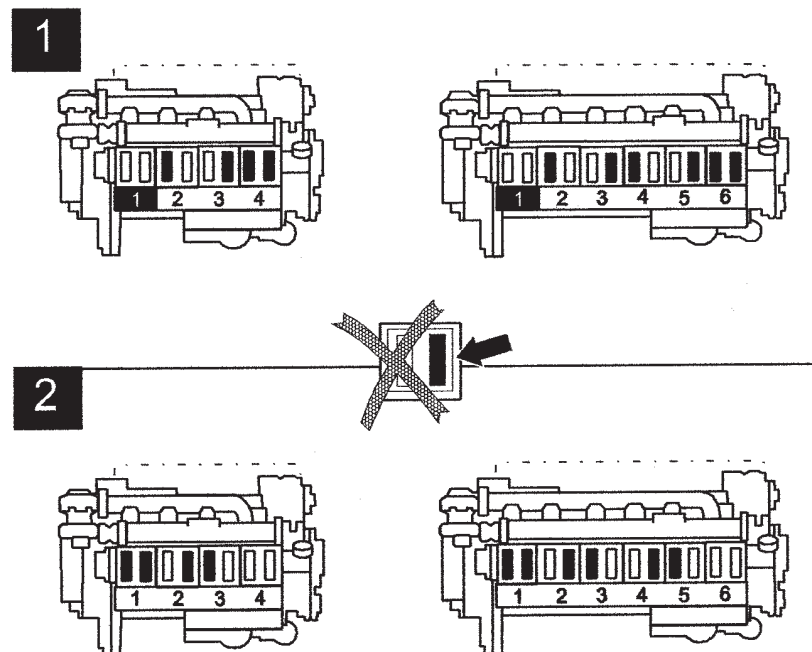
If the gap is too wide or too tight for the feeler gage, the free-play must be re-adjusted:

- For the re-adjustment loose the counter-nut 1 with the spanner by 2 - 3 turns.
- Regulate the adjusting screw with the hexagon socket screw key in such a way that the feeler gage can be pushed in and drawn out with less resistance while the counter-nut is tightened.

Verification and adjustment works shall be constantly performed on all valves!

Adjust valve free-play in accordance with the general layout.

The valve free-play adjustment is performed in two crankshaft positions independent of the number of cylinders the engine has:



General layout for valve free-play adjustment

Crankshaft position 1:

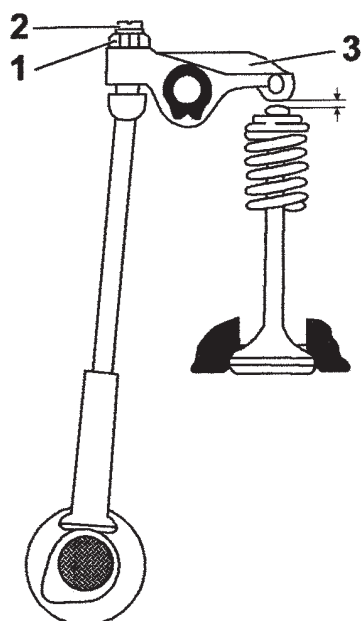
Turn the crankshaft in the rotary direction of the engine until the two valves in cylinder 1 overlap (i.e. the outlet valve is not yet shut and the inlet valve is beginning to open up). The valve layout shows (under crankshaft position 1) which valves are to be adjusted.

Crankshaft position 2:

Turn the crankshaft further by one revolution (360°C). The remaining valves can now be adjusted.

For reasons of simplification, the valves adjusted under crankshaft position 1 shall be marked with chalk.

1.2 Valve free-play scheme



- 1 Counter-nut
- 2 Adjustment screw
- 3 Rocker arm

Chapter 9

Ball rotation connection

Contents

1	Transport and storage.....	2
2	Delivery status	2
3	Installation	2
4	Lubrifcation and maintenance	4
4.1	Lubricants	4
4.2	Lubrication intervals for the conveying system	5
4.3	Lubrication intervals for the gearing	5
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4.5	Checking the running system.....	5
5	Starting after the swing angle method	6

1 Transport and storage

As any other machine element, live rings too require careful treatment. Transport and storage only in horizontal status, in the case of a vertical transport, equip the internal support with a transport cross. Bumps, especially those in radial direction should be avoided.

2 Delivery status

(if there aren't any special regulations):

Conveyor system

is lubricated with one of the listed lubricants of high quality.

Gearing

is not lubricated, treatment as the exterior areas.

Exterior areas

Tectyl 502 C. Removable by washing with paraffine, Diesel and grease solvents, e.g. Mirobo A 151.

Storage

approximately 6 months - storage areas with roof,

approximately 12 months - closed tempered rooms. Longer storage requires special conservation.

After storing the live rings for a long time, the rotation resistance at the starting and the operation can occur by sucking the lip seals. By a carefully lifting with a blunt article at the whole circumference and by rotating the live ring several times for more than 360° to the right and the left, the rotation resistance is reduced to the normal value.

3 Installation

An even surface/basis is a required condition.

The upper and lower ring must fitsnugly as well. This can be checked with the levelling device or the thickness gauge. Cutting editing is required. Welding beads, mesh forming, too intensive colour spots and other sonstige unevennesses must be removed.

The maximum plan deviation including the bending „P" (mm) of the lower or the upper support area must not exceed the values listed in table 1 , depending on the style and the diameter of the rotor circuit "D_L" of the live rings.

For the bending of the processed support areas, the table values must be related to 100 mm support width.

In order to avoid greater deviations and tip formations in smaller sectors, an eventual deviation in the area of 0°-90°-180° should increase or decrease only steadily. The smooth running of the

bearing, in which the loose bearing is turned two times should be checked before the installation. If the permissible plan deviations including the bending are exceeded, we recommend a mechanical processing. As an alternative, the support area can be underpoured with hardened casting resin.

Attention: Pay attention to the reduced permissible area pressing of the screw connection. We must check it.

In the case of bearings of the standard series KD 320, RD 700 and RD 900, the installation position must correspond to the drawing position.

Clean the upper and lower support area of the live rings as well as the gearing of the tinning. Do not allow any detergent to reach any sealing or the conveying lines! Do not clean the gearing, if it is lubricated.

The lubricator nipples must all be easily accessible. If necessary, lubrication pipes must be provided so that future lubrications can be done by any of the lubrication connections.

We recommend automatic central lubrications.

Hardness slipping

The soft part between the start and the end of the conveyor hardening has been marked by pounded "S" (type shield or filling plug) at the interior or exterior diameter of any bearing ring. The hardness plug is marked on the axial area at the geared ring. Remember the last Plug position "S" and its point load must be located outside of the main load zone.

Gearing

Place of the maximum deviation of the part circle at the three green marked gears. This can be done by a perfect setting of the flank clearance. At the narrowest place the flank clearance should be min. $0,03 \times \text{module}$. After the final tightening of the bearing, the flank clearance must be checked once more for the whole circumference. A head edge rounding and head flank return should be done at the the pinion (refer to the earth main catalogue).

Check the correspondence of the screw holes in the bearing with the drillings of the connection construction! Otherwise the bearing can easily be disformed. Passage drillings according to DIN/ISO 273, central series, refer to table 2.

Fastening screws and nuts (without surface treatment) normal in property class 10.9 according to DIN 267. Please keep provided amount and diameters. Carefully pre-tighten the screws crosswise to the given values; table 2 shows some reference values.

The area pressing below the screw head or the nut must not exceed the permissible limit value. If the limit area pressing is exceeded, plain washers of appropriate size and strength must be provided. The minimum screw length must be provided. If a hydr. pre-tension device is used, the respective plain washers must be inserted (refer to the Red Earth (Rote Erde) main catalog).

The determination of the starting torques is not only based on the property class of the screws, but it also depends on the friction in the thread and at the support area screw head/nut.

The starting torques provided in the table are reference values, which refer to lightly lubricated

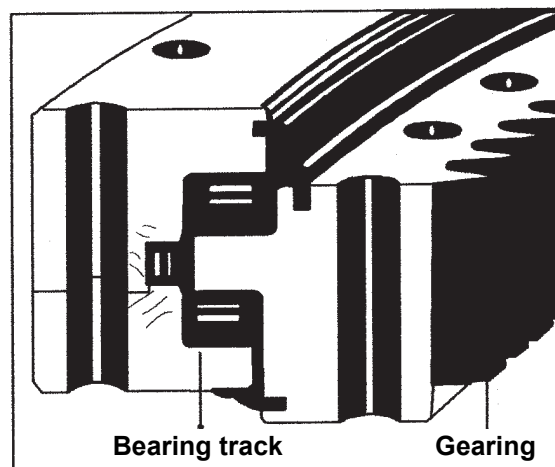
threads and support areas. Dry threads require higher and heavily lubricated threads of lower starting torques. Therefore, the values can vary very much.

This is particularly true for threads after M 30 or 1 1/4". Above this size we recommend hydraulic tensile stress systems (refer also to page 6). Welding of the live rings as well as the welding works in the environment of the bearing is forbidden because of the increase of heat and possible delays. Exceptions to this rule depend upon talking with us.

4 Lubrification and maintenance

The first additional lubrication of the conveyor system and lubrication of the gearing immediately after the installation. Use the lubricants of the table 3 for this and for every other future lubrications.

These conveyor belt lubricants are exclusively KP 2 K greases, that is, lithium-stranded mineral oils of the NLGI class 2 with EP additions. The lubricants for the installation which have been listed in table 3 can be mixed with each other. The order of the listed lubricants does not imply a comment on its quality. The grease will reduce friction, seal, and protect against corrosion. Therefore, always lubricate sufficiently, so that a grease frame of fresh grease is formed at the complete circumference of the bearing columns or sealings. Turn the bearing during the later lubrication.



4.1 Lubricants

Questions related to lubricants must be clarified with the respective lubricant producer. The greases which have been listed in table 3 are provided for our live rings and in terms of the compatibility with the materials we use for distance keepers and sealings.

A control of other lubricants can be done by us only in terms of the evaluation of the aggressivity of this grease in comparison with the plastic parts we use (distance keeper and sealings).

Therefore, when using other lubricants, the user must obtain the confirmation of the producer or supplier of the lubricants, that the selected lubricant is appropriate for the individual case and meets the minimum requirements of the greases which have been listed in our table in terms of its properties. It must be guaranteed that the lubricant will experience no change in terms of its

composition in future deliveries. If automatic lubrication systems are used, the producer of the lubricants must guarantee that it will be provided in the future.

In the case of low temperature use, special lubricants will be required. It is among the tasks of the maintenance personnel to specify the individual consumption amounts by purposeful checking of the lubrication status of the bearing races and the gearing.

4.2 Lubrication intervals for the conveying system

must be selected according to the operating conditions. In general, this will be approximately every 100 operating hours, roller bearings will be every 50 operating hours. Shorter lubrication intervals:

In the tropics in the case of high humidity, great dust and dirt effects, strong temperature change as well as continuous rotation.

Special regulations will be applied for bogie storages of rail and street vehicles as well as storages for wind energy systems.

In case there are standstill periods between the storage installation and the starting of the device, the necessary maintenance must be done, such as e.g. the additional lubrication under the rotation no later than after 3 months or in future intervals of 3 months. Before and after a long shut down times of the device, an additional lubrication is quite necessary. This applies especially for the winter break. When cleaning the device, make sure that no detergent damages the sealings or enters the conveying lines. Check the sealings once every 6 months.

4.3 Lubrication intervals for the gearing

We recommend automatic gearing lubrication. In case of manual lubrication, the gearing and the pinion must be lubricated sufficiently with a gearing fett which has been listed in table 3. We recommend a weekly gearing lubrication . The gearing must have a sufficient grease film/layer.

4.4 Checking the screws

In order to compensate the setting apperances, a re-tightening of all the bolts with the prescribed starting torque becomes necessary. The screw connection of additional stress should be relieved of outside forces. This check must be done after approximately 100 operating hours. Then, a control becomes necessary approximately every 600 operating hours or 3 months. However, the control period must be changed for testing regulations which depend on the device.

4.5 Checking the running system

Live rings have bearing clearances in the delivery status, which guarantee a good running property and function. We recommend you to make a basis reading for the starting. After a long operating time, the storage clearances increase. Therefore it is necessary, that this axial momevent or dropping is checked in specific intervals (refer to the Rothe Erde main katalog or apply to us and ask for more information).

5 Starting after the swing angle method

1 . Step: Pre-tension

The screws must be tightened according to a pre-tension moment of **50 Nm (5kpm)**.

2. Step: More tightening

Depending on the quality, the diameter, and the length, the screws must be turned one specific swing angle more (independent from the lubrication of the threads and support areas)

Shaft	Quality	Screw length		
		60-80 mm	80-125 mm	125-180 mm
M 12 (x1,75)	12.9	150°	210°	240°
	10.9	120°	170°	190°
M 16 (x2)	12.9	135°	180°	210°
	10.9	110°	140°	170°
M 20 (x2,5)	12.9	90°	150°	180°
	10.9	70°	120°	140°

All values apply with a tolerance of +30°/-15°.

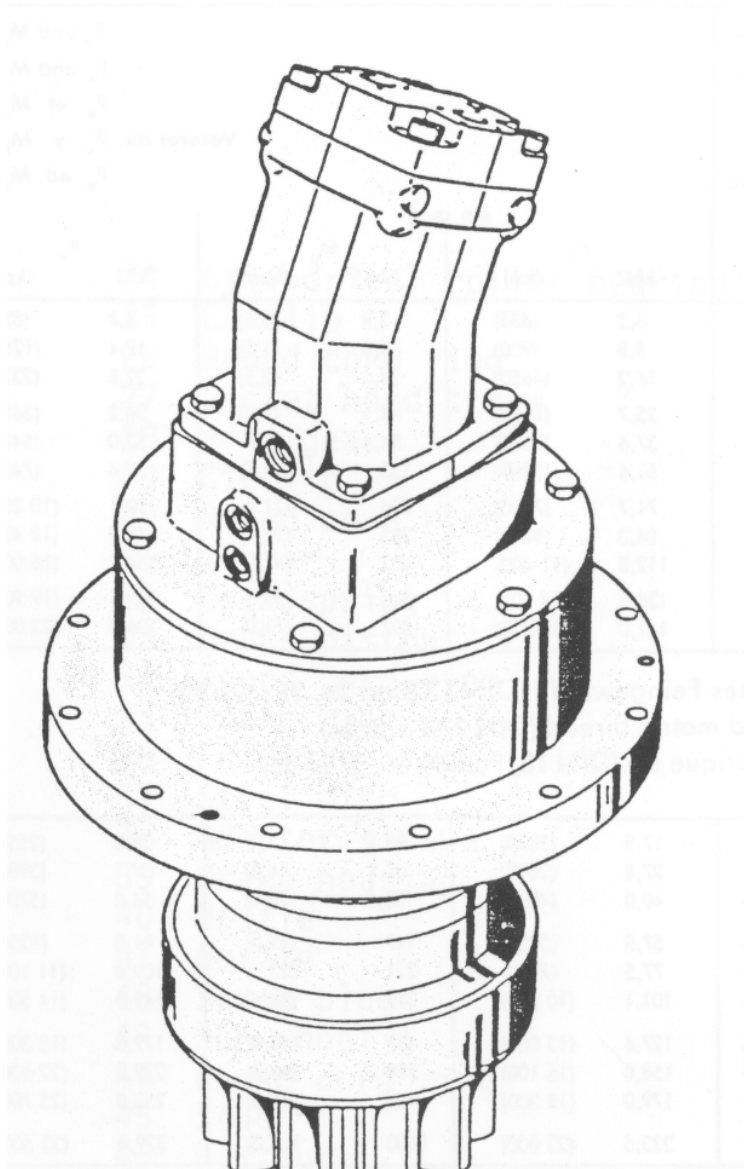
Attention: Screws which have been tightened with the swing angle method must not be used again.

Chapter 10

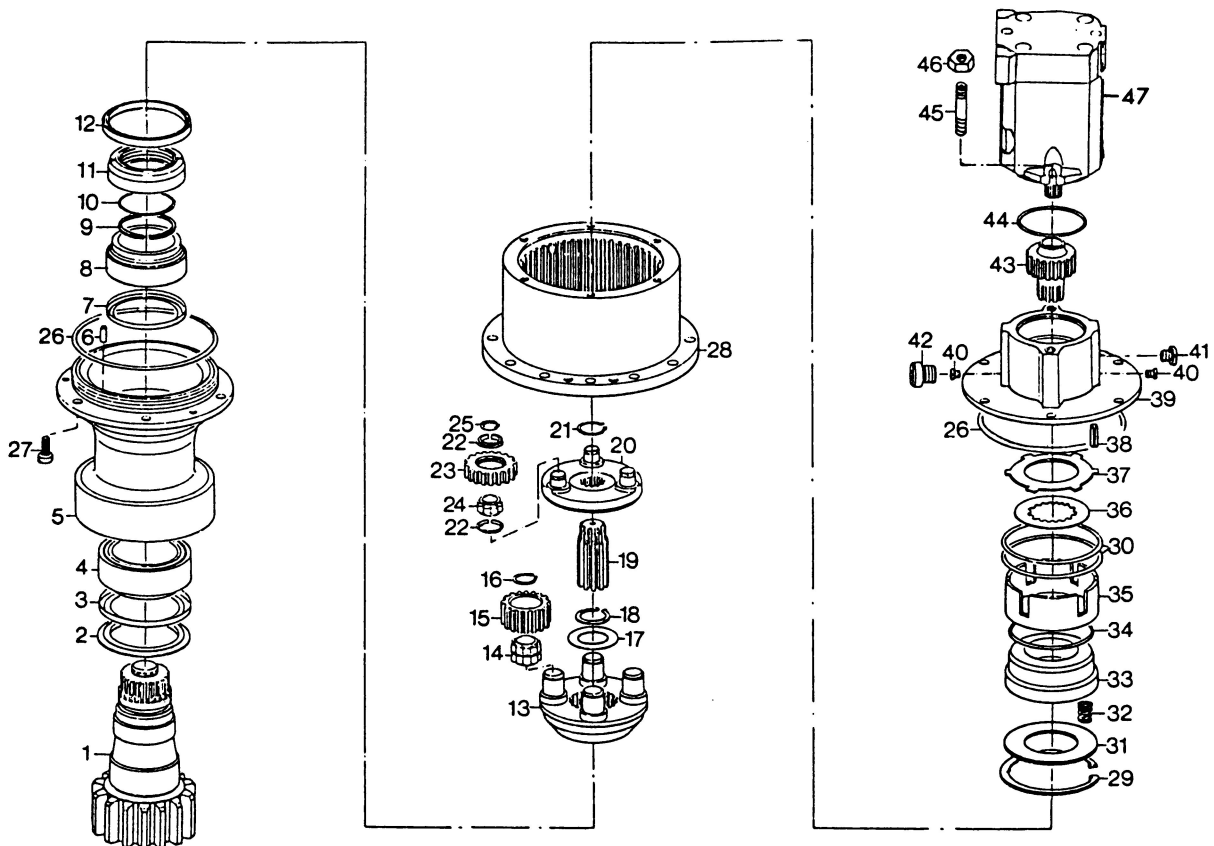
Slewing gear

Contents

1	Exploded view slewing gear - GD5/GD6.....	3
2	Bolt pre-loadings and tightening torques	4
3	Maintenance	5



1 Exploded view slewing gear - GD5/GD6



- 1 Pinion shaft
- 2 Cap ring
- 3 Nilos ring
- 4 Taper roller bearing
- 5 Output housing
- 6 Round bar magnet
- 7 Nilos ring
- 8 Taper roller bearing
- 9 Spacer ring
- 10 Round core ring
- 11 Bearing race
- 12 Shaft sealing ring
- 13 Planet carrier 1
- 14 Cylindrical roller bearing
- 15 Planet wheel 1
- 16 Circlip
- 17 Washer
- 18 Circlip
- 19 Sun wheel 2
- 20 Planet carrier 1
- 21 Circlip
- 22 Angle snap ring
- 23 Planet wheel 2

- 24 Cylindrical roller bearing
- 25 Circlip
- 26 Round cord ring
- 27 Socket head screw
- 28 Ring gear
- 29 Circlip
- 30 Round cord ring
- 31 Washer
- 32 Coil spring
- 33 Brake piston
- 34 Round cord ring
- 35 Outer ring
- 36 Friction disc
- 37 Steel disc
- 38 Adapter sleeve
- 39 Brake housing
- 40 Nozzle
- 41 Nozzle
- 42 Screw plug
- 43 Sun wheel 1
- 44 Round cord ring
- 45 Stud
- 46 Hex nut
- 47 Hydraulic motor

2 Bolt pre-loadings and tightening torques

To ensure reliable connections, always comply with the prescribed tightening torques when installing bolts.

Refer to the stated pre-loading P_v and tightening torque M_a values for adjusting the torque wrench.

The following table states the standard pre-loading P_v and tightening torque M_a values according to thread sizes.

The stated values apply unless a different value is stated on the assembly drawing.

Standard metric thread (DIN 13 Page 34)

Threads

P_v and M_a of the quality grades

	8.8 (8G)				10.9 (10K)				12.9 (12K)			
	P _v		M _a		P _v		M _a			P _v	M _a	
	kN*	(kp)	Nm**	(kpm)	kN	(kp)	Mm	(kpm)	kN	(kp)	Nm	(kpm)
M 5	6,2	(635)	5,9	(0,6)	8,8	(895)	7,9	(0,8)	10,5	(1070)	9,8	(1,0)
M 6	8,8	(WO)	9,8	(1,0)	12,4	(126Q)	13,8	(1,4)	14,8	(1510)	16,7	(1,7)
M 8	16,2	(1650)	24,6	(2,5)	22,8	(2320)	34,4	(3,5)	24,3	(2790)	40,2	(4,1)
M 10	25,7	(2620)	48,1	M.9)	36,2	(3690)	67,8	(6,9)	43,5	(4430)	81,5	(8,3)
M 12	37,6	(3830)	84,4	(8,6)	53,0	(5400)	118	(12,0)	63,4	(6450)	142	(14,5)
M 14	51,6	(5250)	133	(13,5)	72,6	(7400)	187	(19,0)	87,0	(8850)	226	(23,0)
M 16	71,7	(7300)	206	(21,0)	100,1	(10200)	290	(29,5)	121,0	(12300)	348	(35,5)
M 18	86,3	(8800)	285	(29,0)	122,0	(12 400)	398	(40,5)	145,0	(14800)	476	(48,5)
M 20	112,0	(11400)	402	(41,0)	157,0	(16000)	570	(58,0)	187,5	(19200)	677	(69,0)
M 22	138,5	(14 100)	540	(55,0)	195,5	(19900)	765	(78,0)	234,5	(23900)	914	(93,0)
M 24	161,0	(16400)	697	(71,0)	226,0	(23000)	980	(100,0)	271,0	(27603)	1180	(120,0)

Standard metric thread (DIN 13 Page 34)

M 8x1	17,8	(1810)	26,5	(2,7)	25,0	(2550)	37,3	(3,8)	30,0	(3060)	44,2	(4,5)
M 10x1	27,8	(2830)	47,1	(4,8)	39,1	(3980)	68,8	(7,0)	46,8	(4770)	81,5	(8,3)
M 12x1,5	40,0	(4070)	88,4	(9,0)	56,0	(5700)	123	(12,5)	67,2	(6850)	147	(15,0)
M 14x1,5	57,5	(5850)	147	(15,0)	81,0	(8250)	206	(21,0)	97,3	(9900)	246	(25,0)
M 16x1,5	77,5	(7900)	221	(22,5)	109,0	(11 100)	309	(31,5)	130,5	(13300)	373	(38,0)
M 18x1,5	101,1	(10300)	319	(32,5)	142,0	(14500)	451	(46,0)	171,0	(17400)	540	(55,0)
M 20x1,5	127,6	(13000)	451	(46,0)	179,5	(18300)	628	(64,0)	216,0	(22000)	755	(77,0)
M 22x1,5	158,0	(16 100)	599	(61,0)	222,0	(22600)	845	(86,0)	266,0	(27 100)	1030	(105,0)
M 24x2	179,0	(18300)	765	(78,0)	253,0	(25 700)	1080	(110,0)	303,5	(30900)	1275	(130,0)
M 27x2	233,5	(23800)	1130	(115,0)	329,0	(33500)	1570	(160,0)	395,0	(40200)	1915	(195,0)

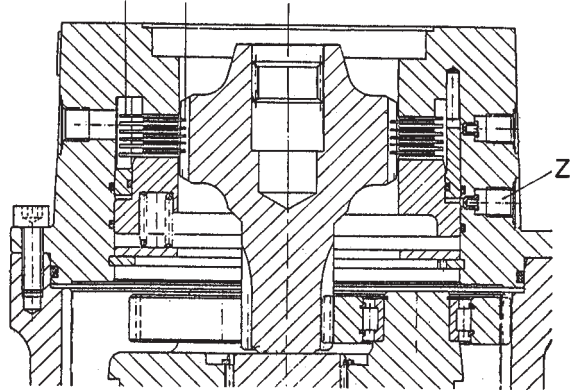
*kN = Kilo-Newton **Nm = Newton-Meter

3 Maintenance

Checking or renewing brake discs

Z air connection

To gain access to friction discs (36) and steel discs (37), the complete brake assembly (28 - 41) has to be removed.



A suitable press is required when renewing the brake discs.

Renewing the brake assembly

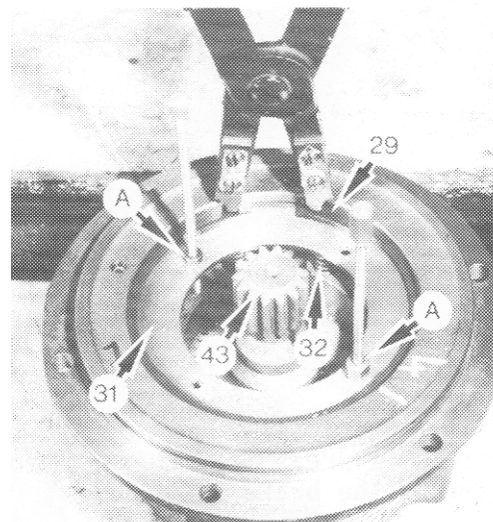
Unscrew and remove the socket head screws ...



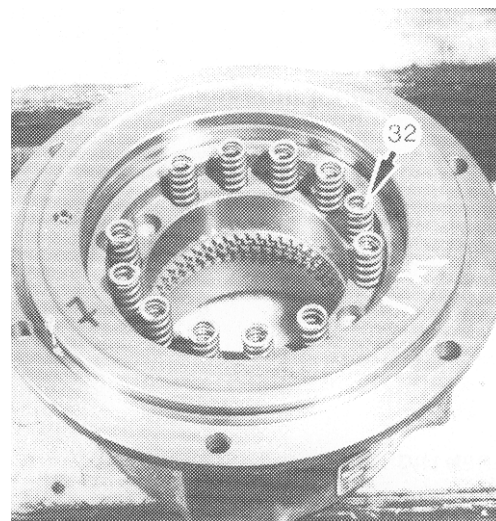
.. and lift off the brake assembly.



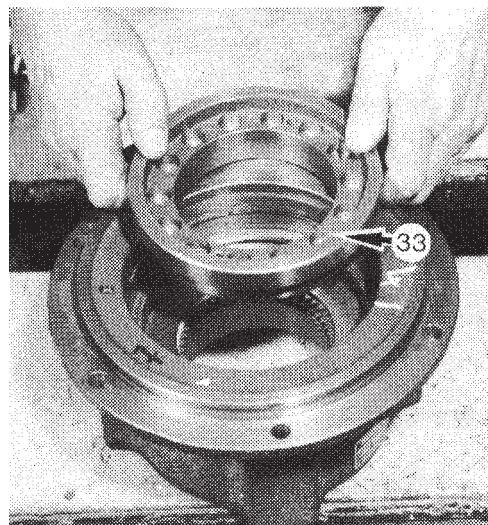
Take out sun wheel 1 (43). Tighten nuts (A) to compress coil springs (32). Disengage circlip (29) and remove brake plate (31) ...



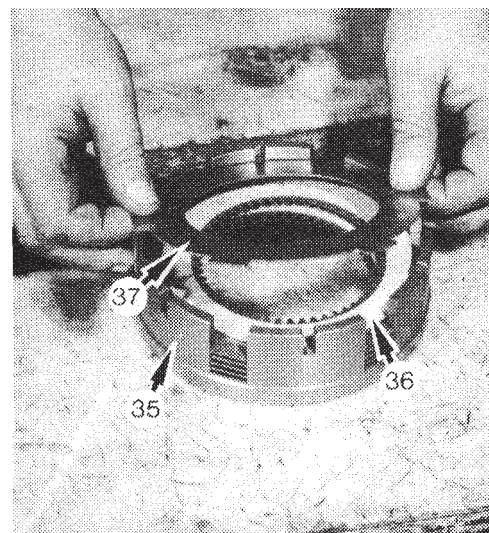
...coil springs (32)...



...and brake piston (33).

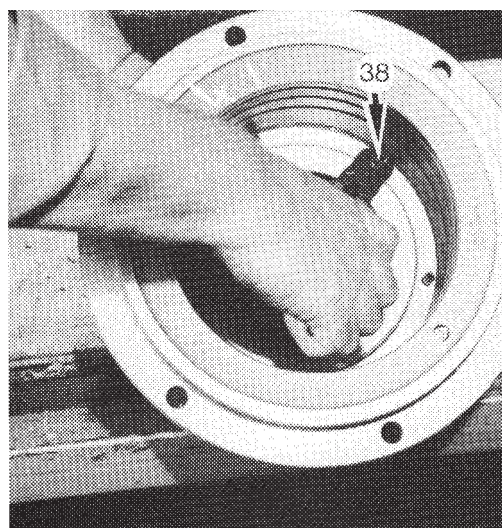


Check outer ring (35) with friction discs (36) and steel (37) discs. Lift out with a hook.



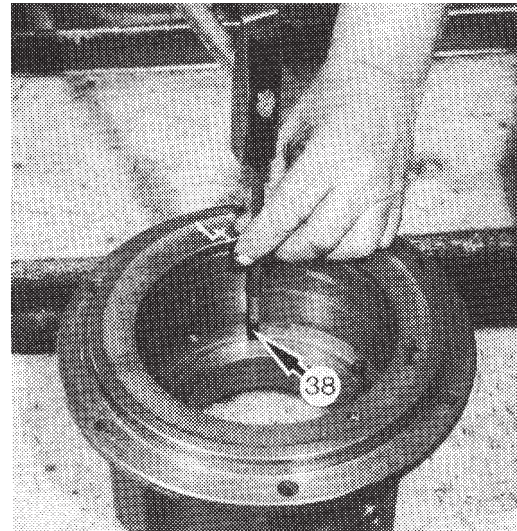
Examine adapter sleeve (38) for damage and renew if necessary.

Removing a damaged adapter sleeve.

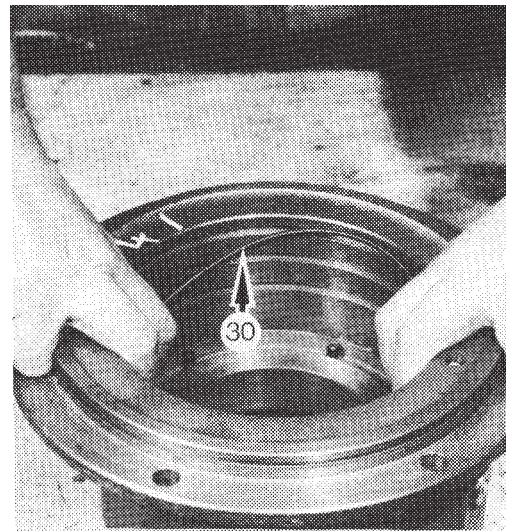


Assembly

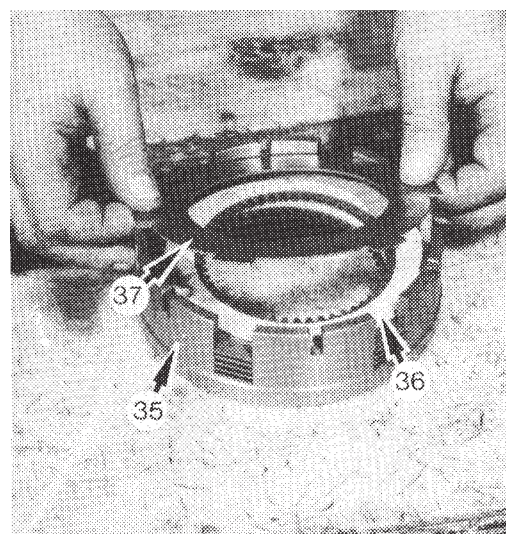
Drive in adapter sleeves (38).
Install with the slot facing inwards
or outwards.



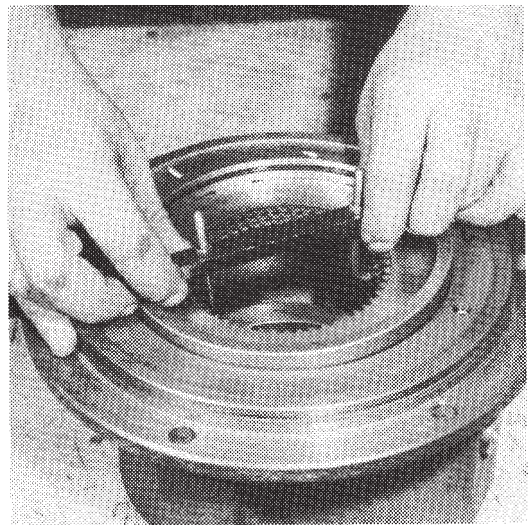
Renew round cord ring (30).



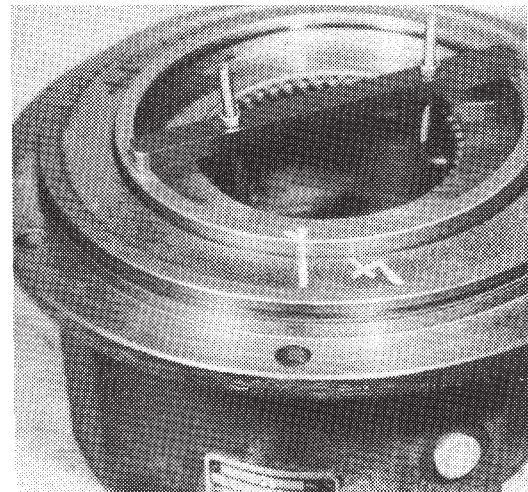
Using grease to aid assembly,
insert the discs in outer ring (35) in
the correct order (steel disc (37),
friction disc (36) etc.).



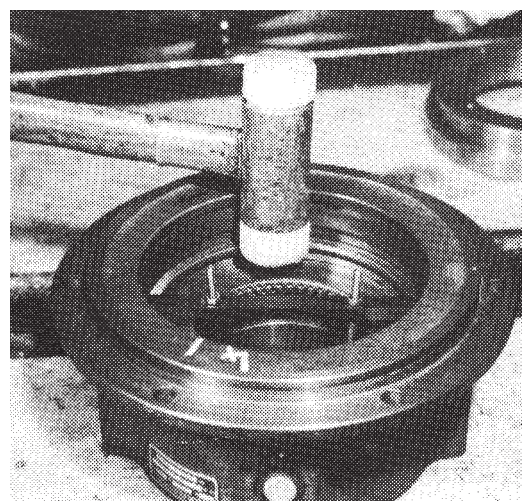
Attach the holding device to the multi-disc brake assembly ...



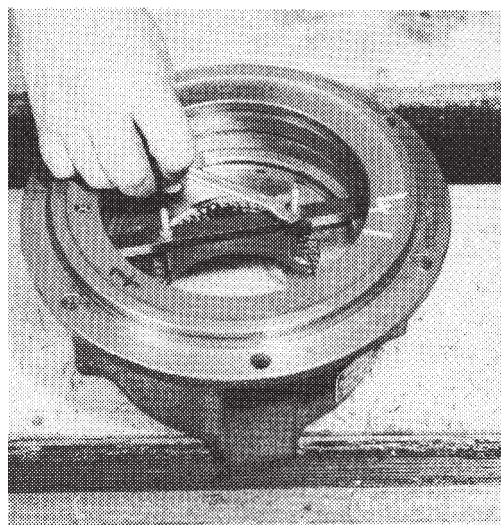
... and make a mark where the groove in the outer ring and adapter sleeve (38) in brake housing (39) meet.



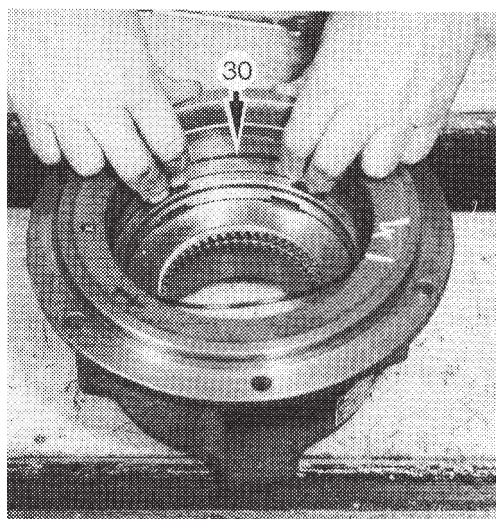
Carefully drive in the multi-disc brake assembly with a hammer until the outer ring is seated in the brake housing.



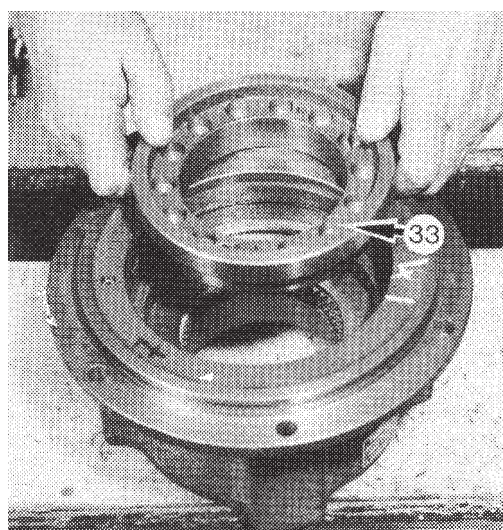
Remove the holding device.



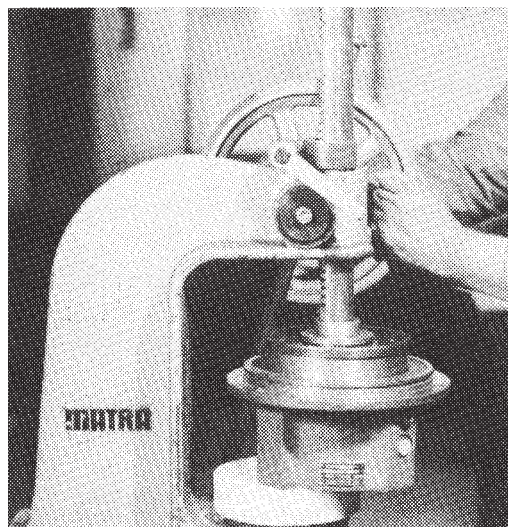
Renew round cord ring (30)



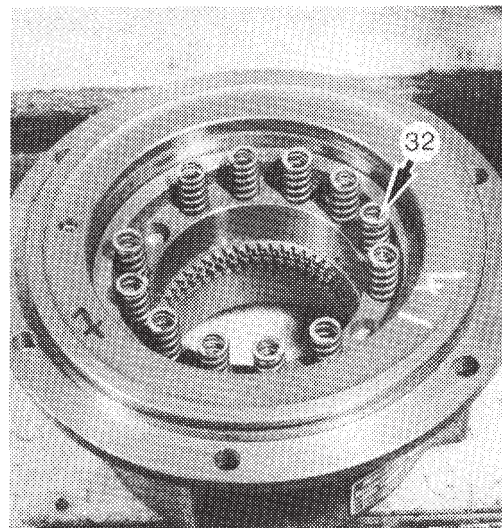
Insert brake piston (33)...



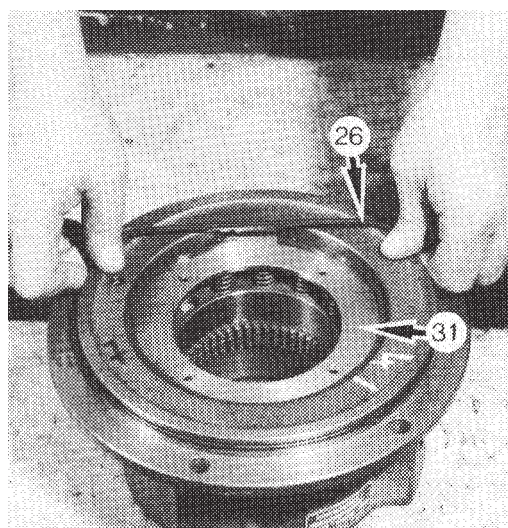
...and press it in.



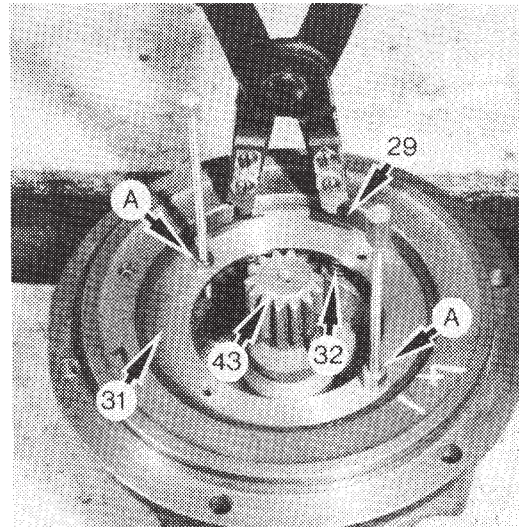
Insert coil springs (32).



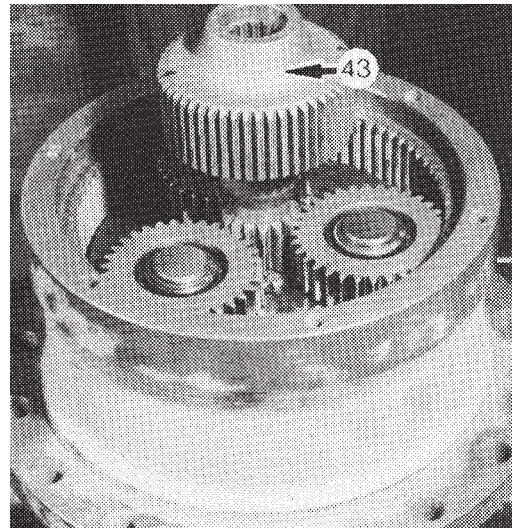
Insert brake plate (31) and attach round cord ring (26).



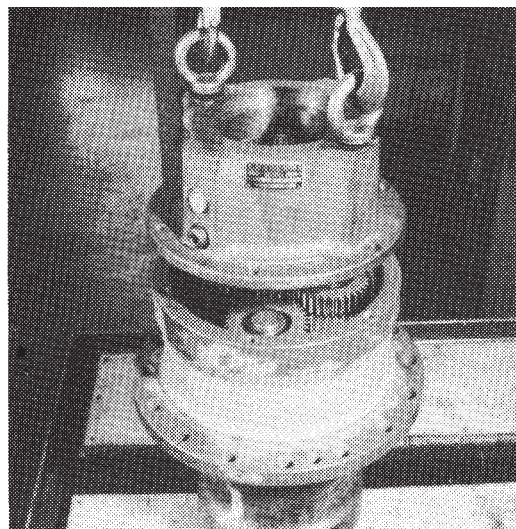
To engage circlip (29), tighten nuts (A) to compress coil springs (32) and align the friction plate teeth with sun wheel 1 (43), or align the teeth by venting the brake with compressed air at 15 bar via connection "Z".



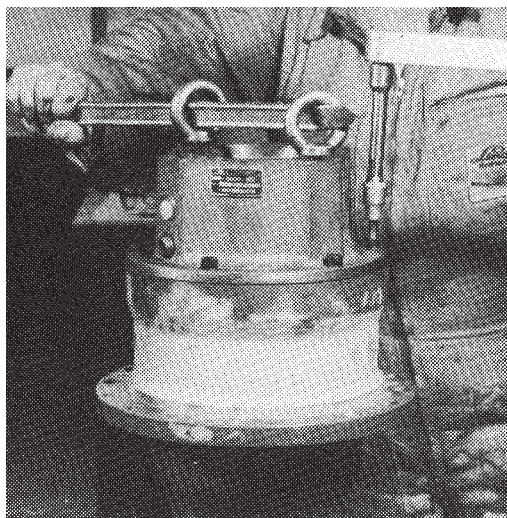
... on the planetary transmission with sun wheel 1 (43).



Place the brake assembly ...



Tighten socket head screws to 49 Nm.

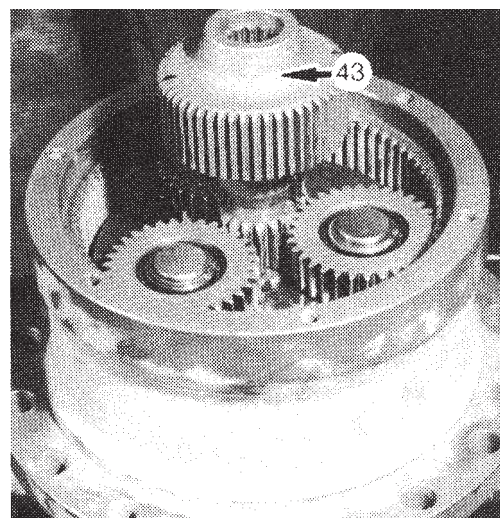


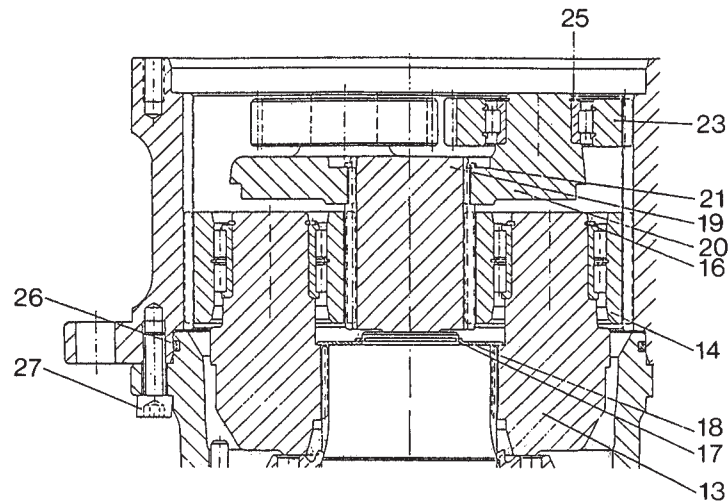
Checking transmission stages 1 and 2

Remove the hydraulic motor with the brake assembly (motor need not be removed separately).

Checking transmission stage 1

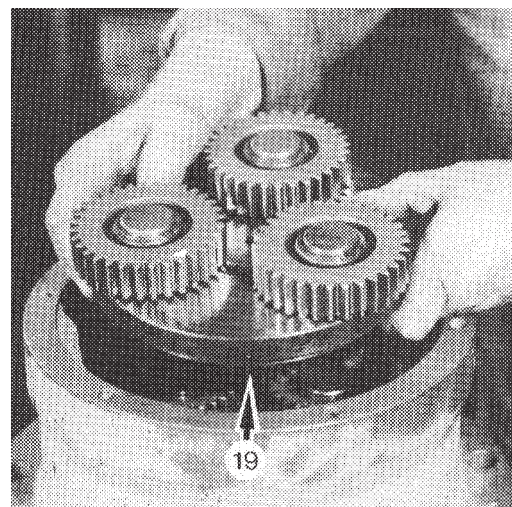
To check transmission stage 1, pull out sun wheel 1 (43).



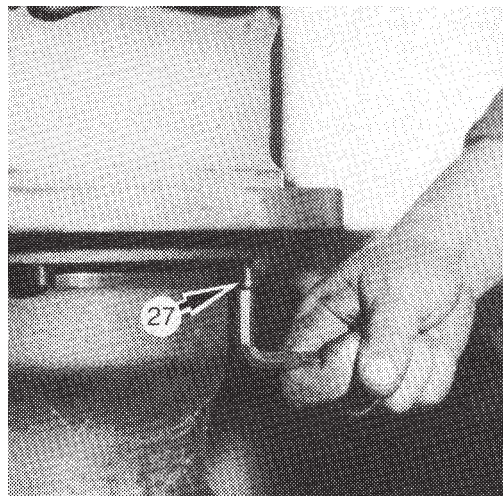


To check transmission stage 2, stage 1 has to be removed.

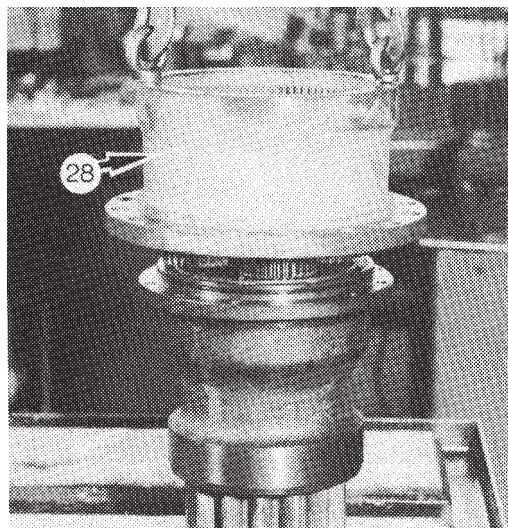
Take out transmission stage 1 with sun wheel 2 (19) of stage 2 attached.



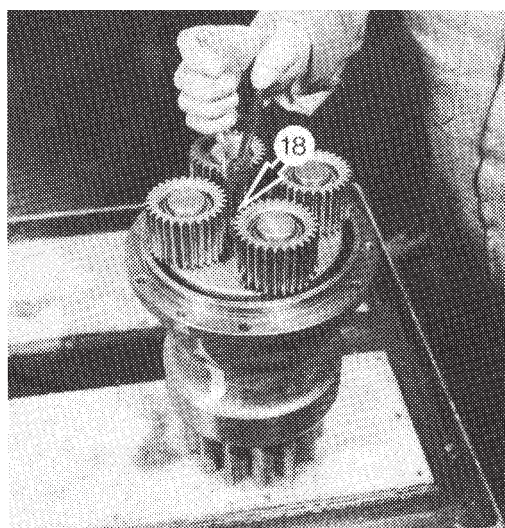
Release socket head
screws (27)...



IMPORTANT: ring gear (28) can
only be removed in the workshop
with the transmission removed.
... and lift off ring gear (28).



Checking transmission stage 2
To check stage 2, circlip (18) has to
be disengaged.



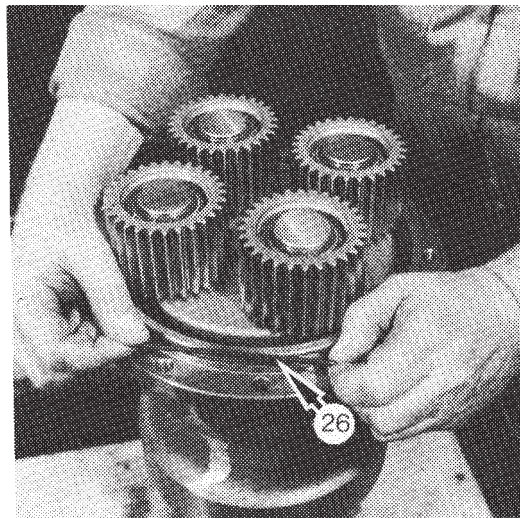
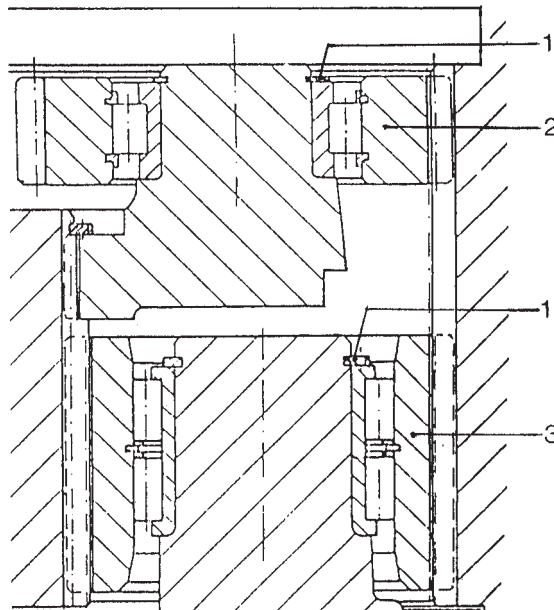
Planet wheels and their bearings

- 1 Circlips
- 2 Planet wheel 1 with cylindrical roller bearing
- 3 Planet wheel 2 with cylindrical roller bearing

IMPORTANT: the planet wheels and cylindrical roller bearings can only be renewed together since the planet wheels also functions as the outer bearing races.

To remove: disengage the circlip and pull off the planet wheel with bearing (use a claw-type puller).

To install: insert the planet wheel with bearing using a press, with a bushing mounted on the inner bearing race.

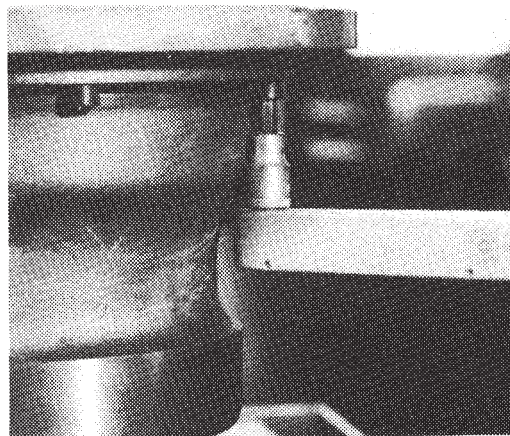


Renew round cord ring (26)

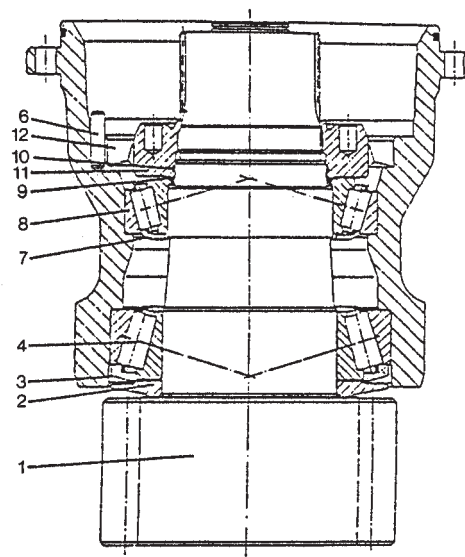
After checking:

Reassemble the individual stages in reverse order.

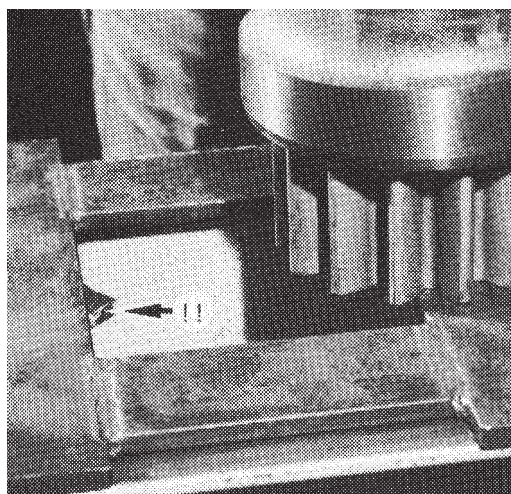
Screw on the ring gear and tighten to 49 Nm.



Renewing sealing elements and
checking taper roller bearings

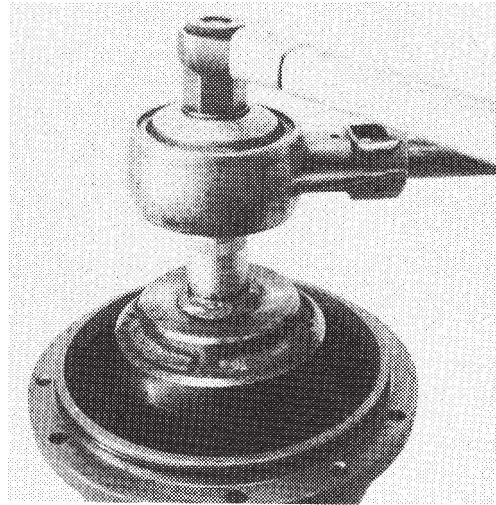


In the event of a mechanical fault
occurring, the complete final drive
(1 - 12) has to be renewed.

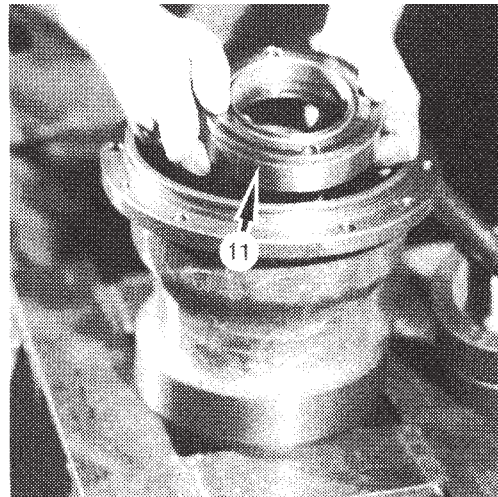


To remove, place the transmission
with pinion in a holding fixture...

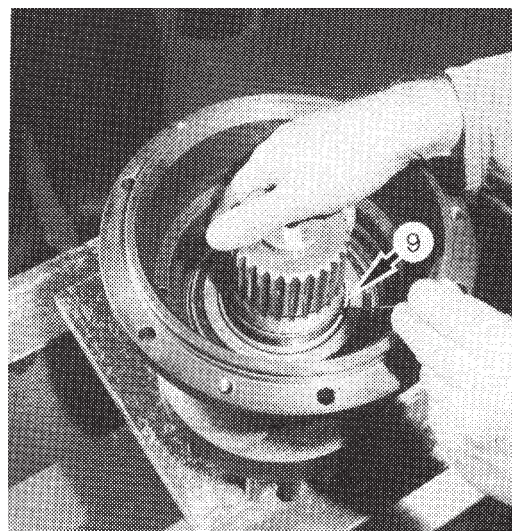
... and release bearing race (11)
with a socket wrench and torque
multiplier.



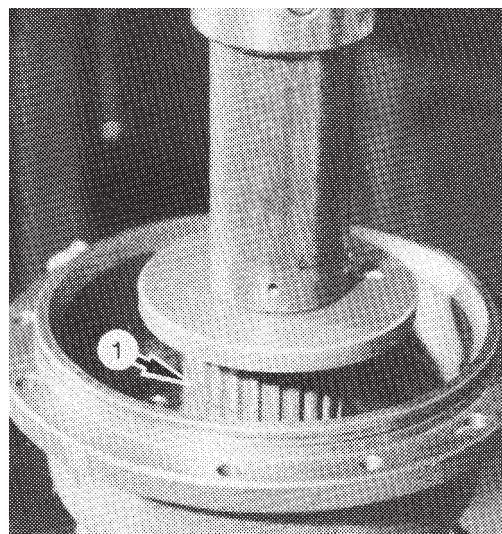
Unscrew and remove bearing race
(11) ...



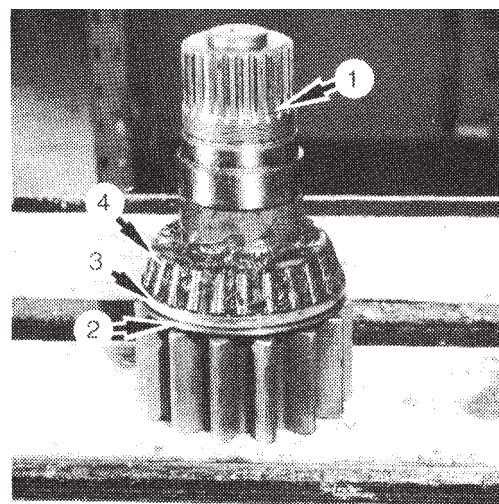
... and disengage spacer ring (9).
IMPORTANT: the spacer ring has
been ground to size.



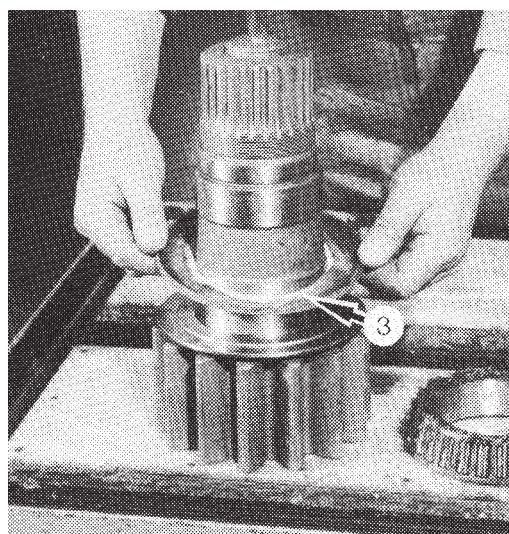
Force pinion shaft (1) out of the housing using a press.



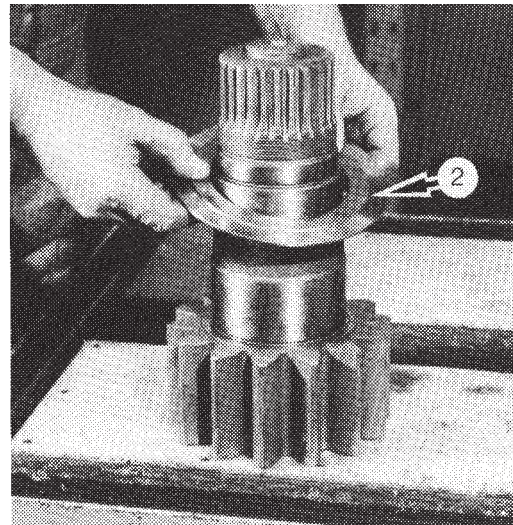
Pinion shaft (1) after removal
Pull off lower taper roller bearing (4) with Nilos ring (3) and cap ring (2) (use a claw-type puller).



Examine Nilos ring (3)...

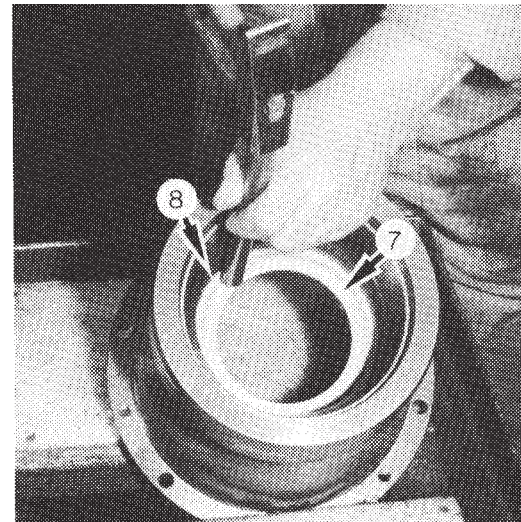


... and cap ring (2).

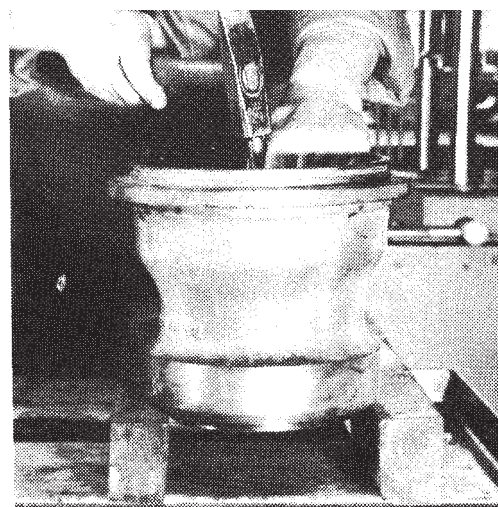


Drive out the outer bearing race of upper taper roller bearing (8) taper with Nilos ring (7).

Offer up the arbor between the outer Nilos ring kink and the housing wall to avoid damaging the Nilos ring.

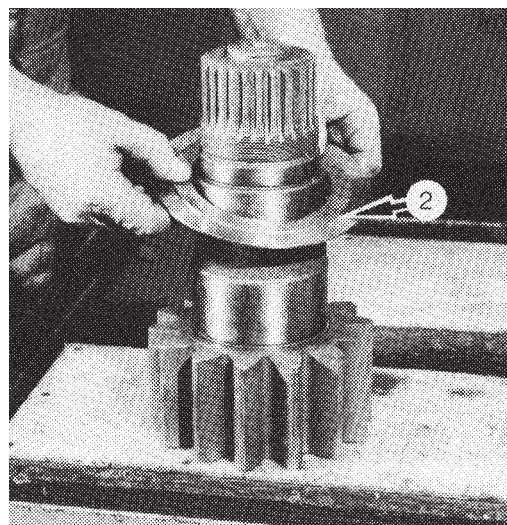


Drive out the outer bearing race of the lower taper roller bearing.

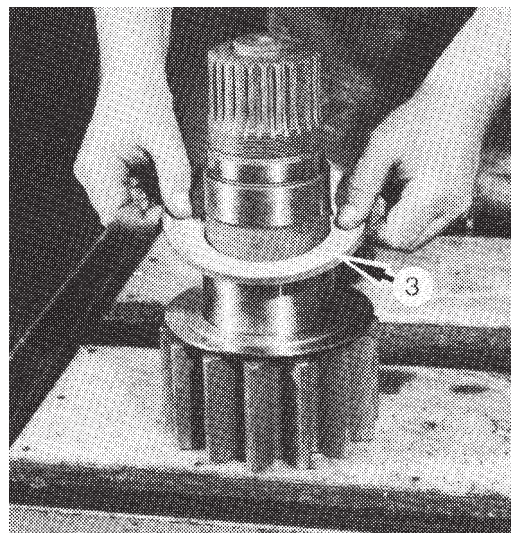


IMPORTANT: use only lithium based grease for packing Nilos rings and the corresponding bearings.

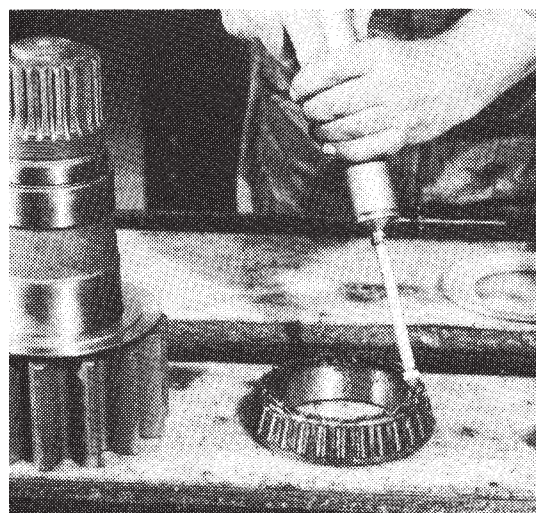
Install cap ring (2) with the bevel facing downwards.



Pack Nilos ring (3) with lithium based grease and push on to the pinion shaft with the raised edge facing upwards.

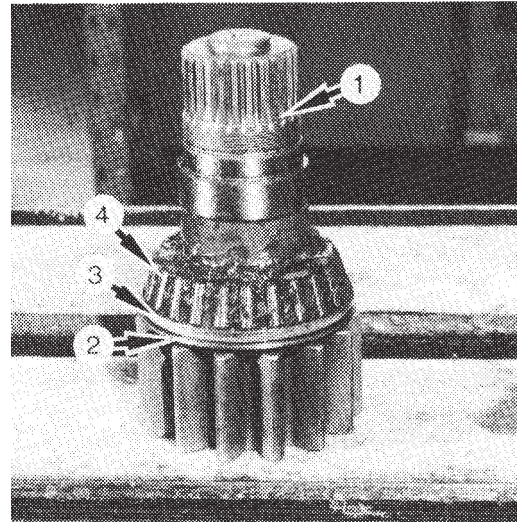


Pack the bearing with lithium based grease...



... and press it in. Alternatively, heat on a hot plate, push it on and then pack with lithium based grease.

- 1 Pinion shaft
- 2 Cap ring
- 3 Nilos ring
- 4 Taper roller bearing



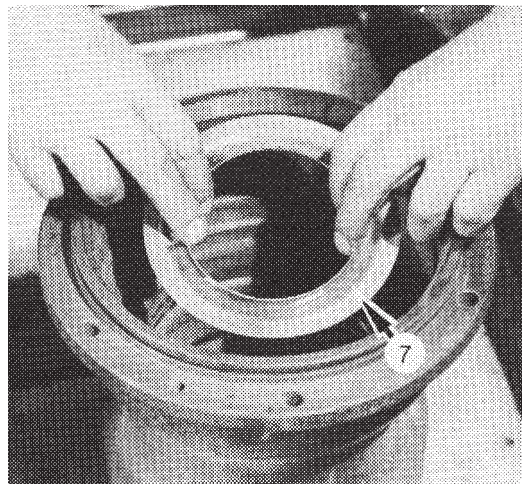
Drive in the lower taper roller bearing outer race ...



... and locate it properly on the seat.



Pack upper Nilos ring (7) with lithium based grease and place it in the output housing (inner edge facing upwards).



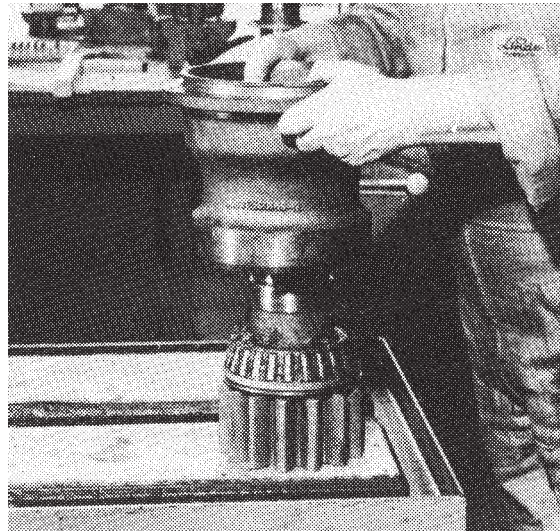
Insert upper outer bearing race...



... and locate it properly on the seat.



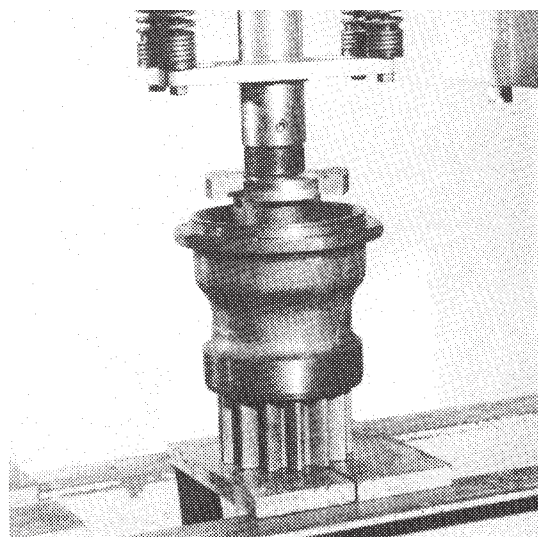
Put on the output housing.



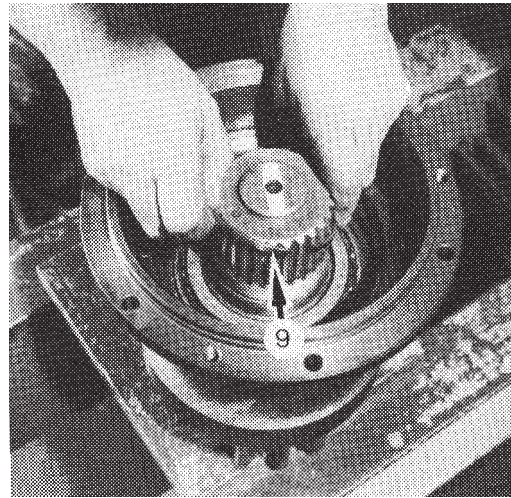
Pack the upper bearing with lithium based grease, attach it...



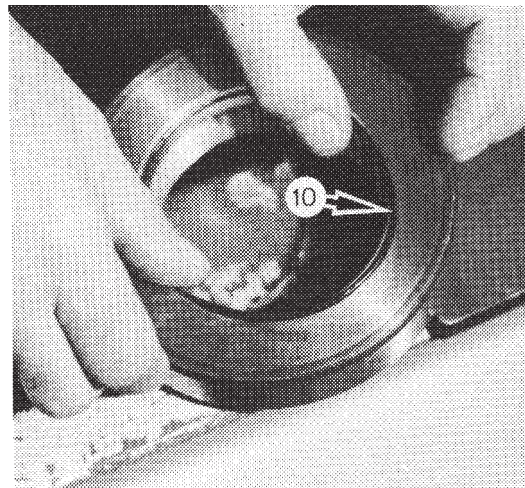
... and press it on to the pinion shaft



Attach the spacer ring (9) so that the points at the joint are facing upwards; this facilitates subsequent removal.

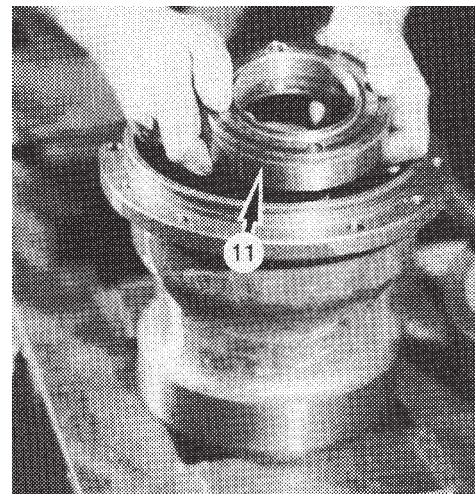


Renew round cord ring (10).



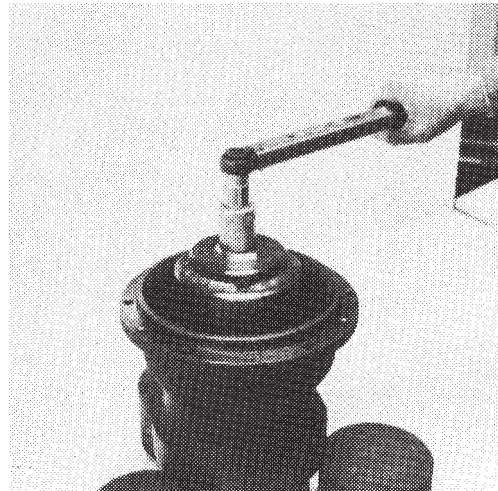
Place the transmission with output pinion in the assembly fixture and tighten bearing race (11) using a socket wrench and torque multiplier. The housing must be rotated several times while tightening.

Tightening torque: 2000 Nm

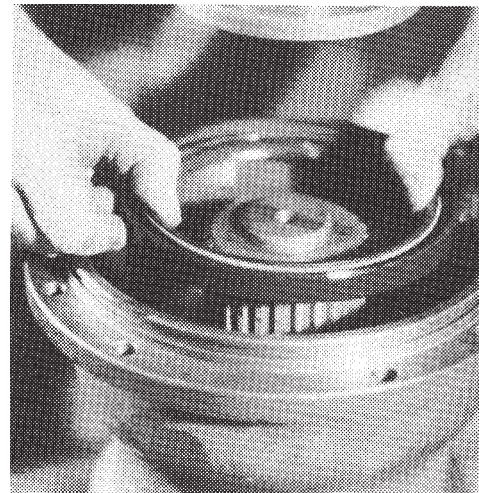


The breakaway torque of the output shaft must now be 22 - 29 Nm.

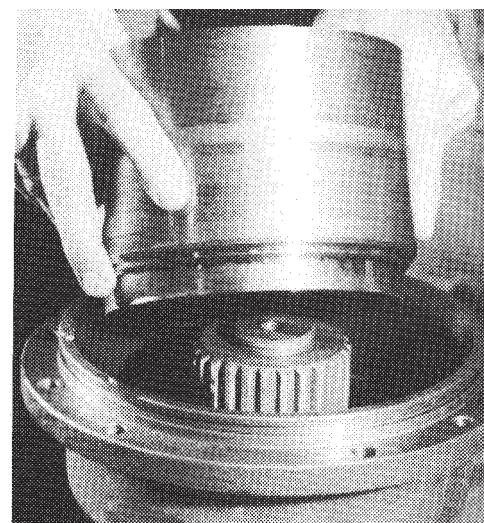
If this value is not reached or if it is exceeded, the existing spacer ring must be modified accordingly. If this is not possible, a new spacer ring must be fitted as appropriate.



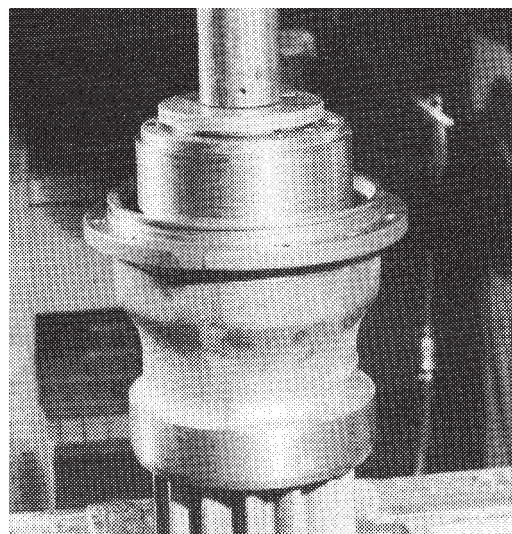
Insert the oiled radial sealing ring....



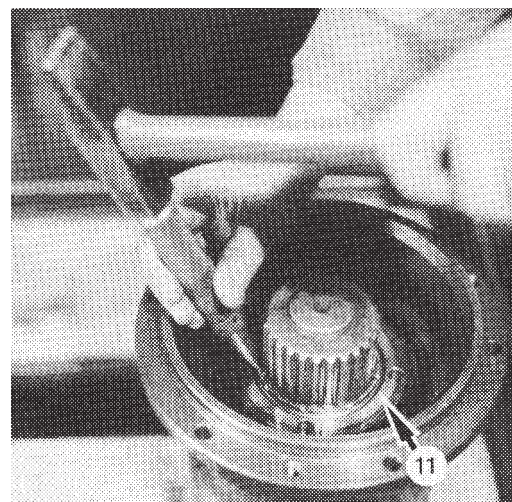
...and press it in...



...using a sleeve as an aid.

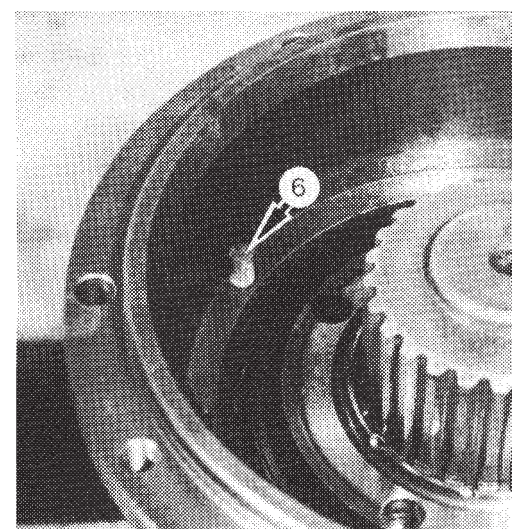


Caulk bearing race (11) at five points on the circumference with a centre punch.



Always clean the round bar magnet (6).

Install the planet stages and brake assembly as described above.



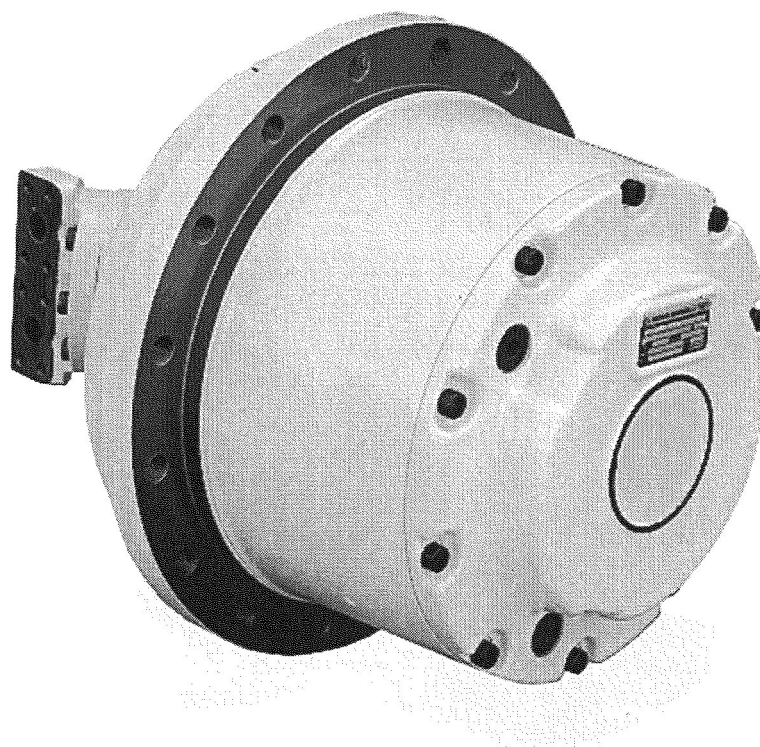
Chapter 11

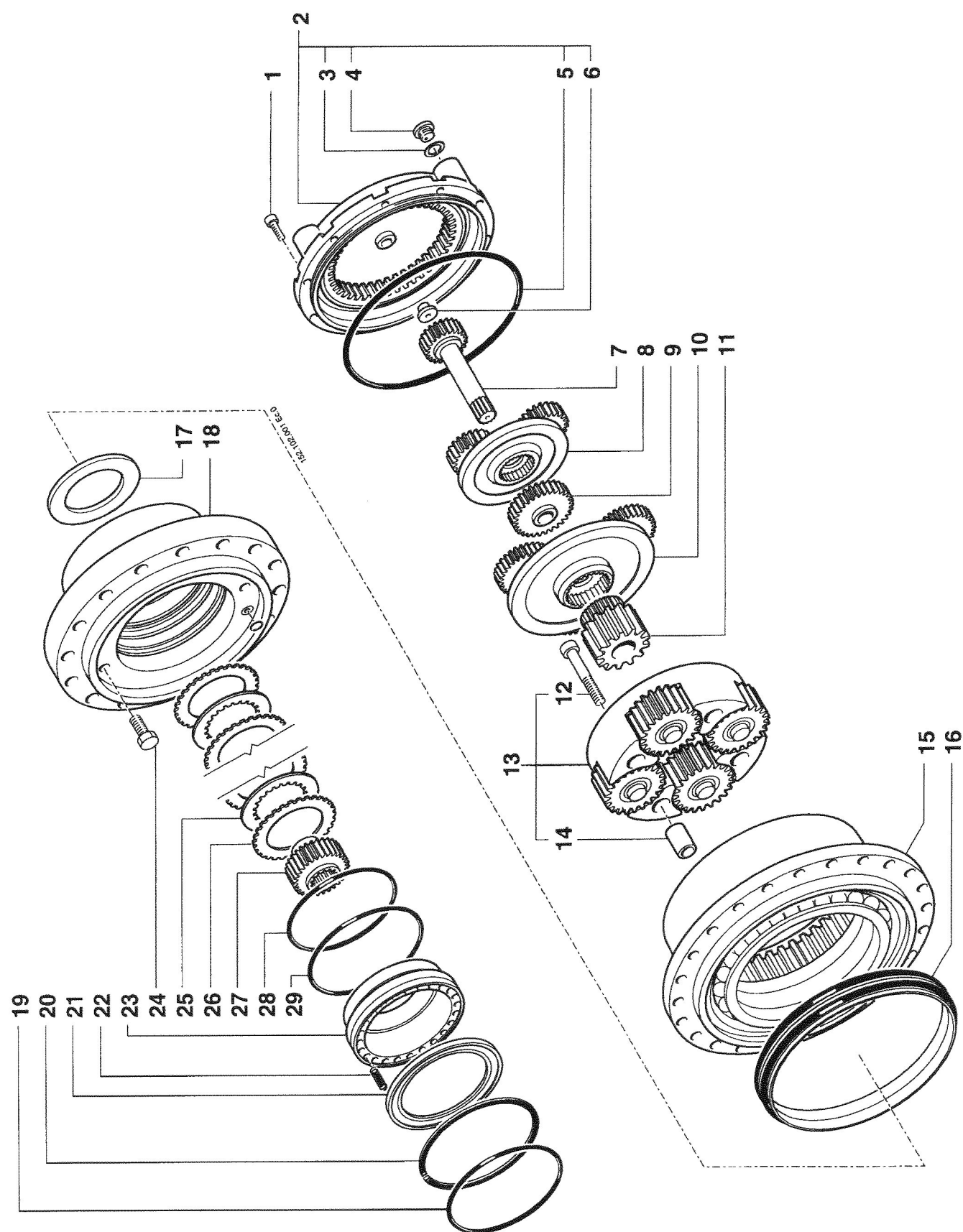
Gear box

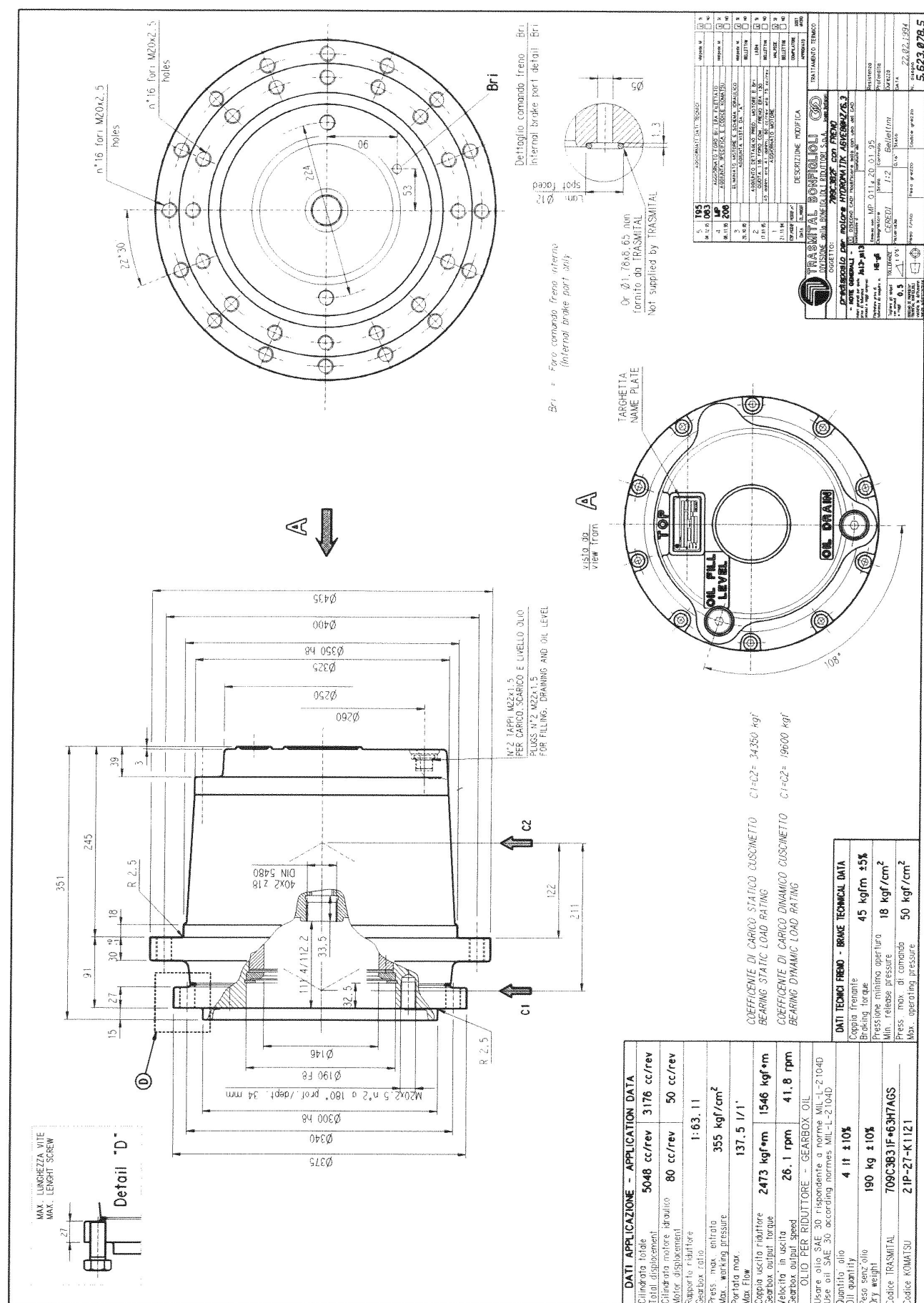
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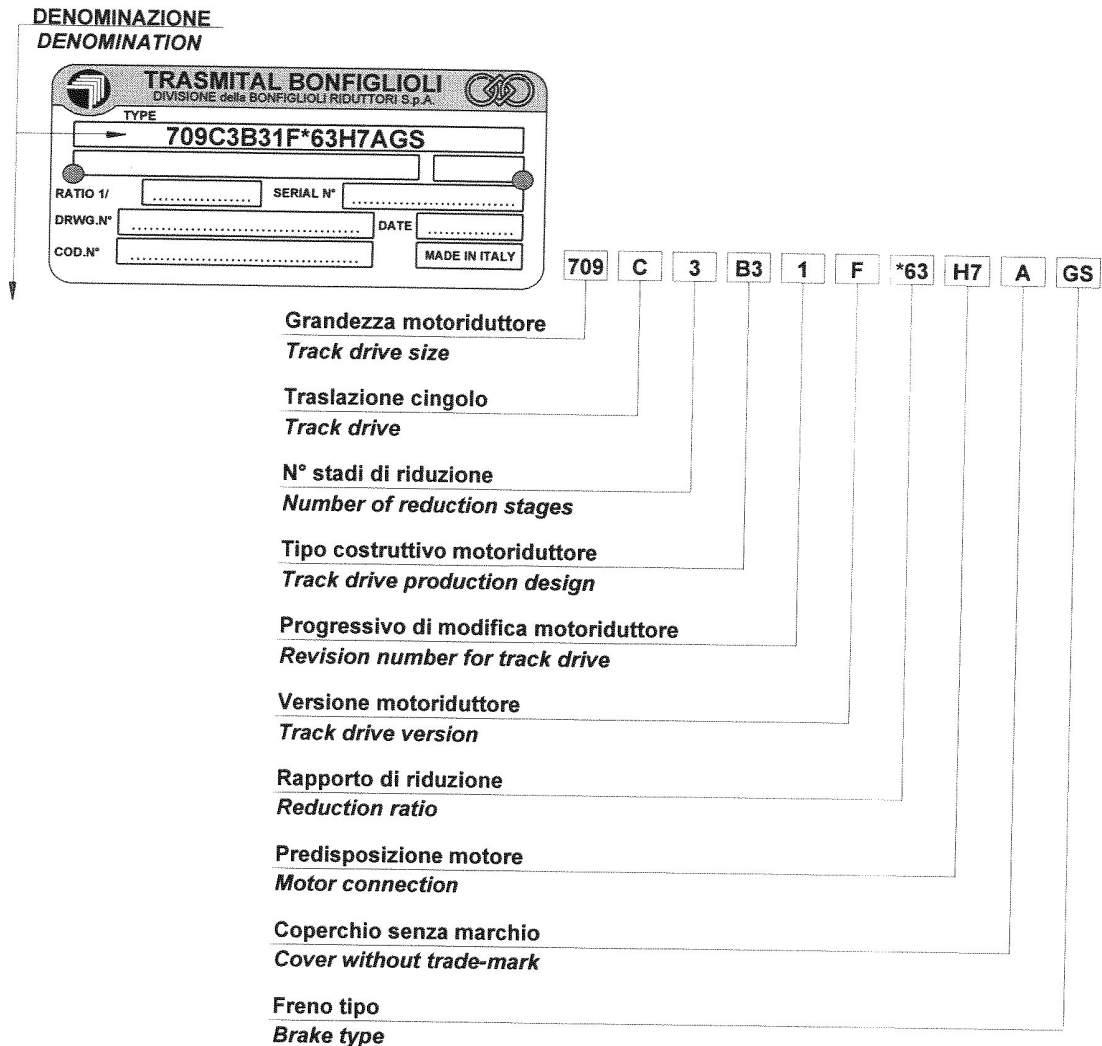






1.0 TARGHETTA IDENTIFICATIVA

1.0 NAME PLATE



Dis.3 - Targhetta riduttore

Dwg.3 - Gearbox name plate

Attenzione

Le targhette debbono essere sempre conservate leggibili in tutti gli elementi in esse contenuti. Usare i dati identificativi indicati per i rapporti con il costruttore, come per esempio: richiesta di ricambi, informazioni, assistenza.

Nota

La completa e costante osservanza delle indicazioni contenute nel presente manuale tecnico garantisce la migliore economia di esercizio ed una più lunga durata di funzionamento del riduttore.

La documentazione fotografica ed i disegni sono forniti allo scopo esplicativi in modo da descrivere esaurientemente le operazioni da eseguire sul riduttore.

Anche se il riduttore in vostro possesso si discostasse in parte dalle illustrazioni contenute in questo manuale tecnico, la sicurezza e le informazioni del riduttore stesso sono garantite.

Caution

The informations printed on the plates must be always readable. Use the identification data as follows: request of spare parts, information and assistance

Note

A full and constant observance of the informations indicated in this technical manual grant the best saving of consumptions and a longer operation of the unit.

The photographic documentation and the drawings are supplied as samples and explain the workings to be done on the gearbox.

Even if the gearbox in your possession differs partially from the executions presented in this technical manual, the gearbox security and the informations are still granted.

2.0 NOTE

2.1 CONDIZIONI DI FORNITURA

I motoriduttori vengono forniti dalla **TRASMITAL BONFIGLIOLI** nelle seguenti condizioni:

- Già predisposti per essere installati nella posizione di montaggio come definito in fase di ordine:
- Senza olio** ed internamente unti da un velo d'olio usato per il collaudo finale del riduttore ed esattamente :
olio **tipo IP IDEX OIL SAE 10W/20**.
- Verniciati con una vernice di fondo antiossidante all'acqua di colore grigio (**tipo IDRAYON PRIMER-RAL 7042/C441**) sopra verniciabile.
- Le superfici di accoppiamento non sono verniciate.
- La verniciatura finale è a cura del cliente.
- Collaudati.
- Appositamente imballati.

2.2 TRASPORTO

Durante il trasporto e' norma trattare i motoriduttori come merce delicata per evitare danni.

Durante i trasporti interni dei motoriduttori senza imballo, evitare che questi prendano urti per non danneggiare le parti delicate.

2.3 MAGAZZINAGGIO

Bisogna evitare in ogni caso lo stoccaggio dei motoriduttori all'aperto o direttamente appoggiati a terra.

Per un periodo di stoccaggio superiore a 60 giorni, proteggere le parti esterne lavorate con un apposito prodotto antiossidante (**tipo MOBIL MOBILARMA 247 od EQUIVALENTI**).

Per un periodo di stoccaggio superiore a 6 mesi, bisogna riempire il riduttore con olio e le parti esterne lavorate vanno ricoperte con grasso per evitare ossidazioni.

2.0 NOTES

2.1 CONDITIONS OF SUPPLY

*Gearboxes units are supplied by **TRASMITAL BONFIGLIOLI** in the following condition:*

- Ready for installation in the mounting position specified when ordering.*
- Without lubricant** but the internal components are slightly lubricated due to the final test of the unit :
oil type **IP IDEX OIL SAE 10W/20**.*
- Externally painted with an antioxidant grey-coloured water paint (**type IDRAYON PRIMER-RAL 7042/C441**) suitable for finish painting.*
- Mating surfaces not painted.*
- Finish coat to be applied by the customer.*
- 100% factory tested.*
- All units suitably packed for freight.*

2.2 SHIPMENT

During transportation we recommend that the gearboxes are handled carefully in order to avoid any damage.

When removing the gearboxes from their packaging, please use extra caution to avoid impacts, such as dropping the unit, which may cause damage to delicate parts.

2.3 STORAGE

In all cases, please avoid storing the gearboxes in the open, exposed to the elements, or setting the units directly on the ground.

*For a storage period longer than 60 days, protect the external machined parts with a proper antioxidant (**type MOBIL MOBILARMA 247 or EQUIVALENT**).*

For a storage period longer than 6 months, it is necessary to fill the gearbox with oil, and the external machined parts must be protected with grease in order to avoid corrosion of parts.

3.0 INSTALLAZIONE

3.1 INSTALLAZIONE DEL MOTORE IDRAULICO

Pulire la zona di accoppiamento ed il centraggio dove va inserito il motore idraulico.

Prima di montare il motore, verificare, con un calibro per interni, la quota assiale del riduttore rappresentata dalla battuta del mozzo flangiato con l'albero freno:

Quota assiale = 111,4-112,2 mm.

Posizionare il motore idraulico e serrare le 2 viti TE M20x50, classe di resistenza 8.8, con una chiave dinamometrica alla coppia di 41,5 daNm.

3.2 INSTALLAZIONE DEL RIDUTTORE SULLA MACCHINA

- Pulire le zone di accoppiamento da protettivi o vernice ed installare il riduttore sul sottocarro.
- Fissare il riduttore al telaio con 16 viti M20 classe minima di resistenza 8.8, serrate con una chiave dinamometrica alla coppia di 41,5 daNm.
- Pulire la zona di accoppiamento alla ruota motrice. Per il fissaggio della ruota usare 16 viti M20 classe di resistenza 8.8, serrate alla coppia di 41,5 daNm.

3.0 INSTALLATION

3.1 FITTING OF THE HYDRAULIC MOTOR.

Clean the mating area and the pilot diameter of the gearbox where the motor is to be mounted.

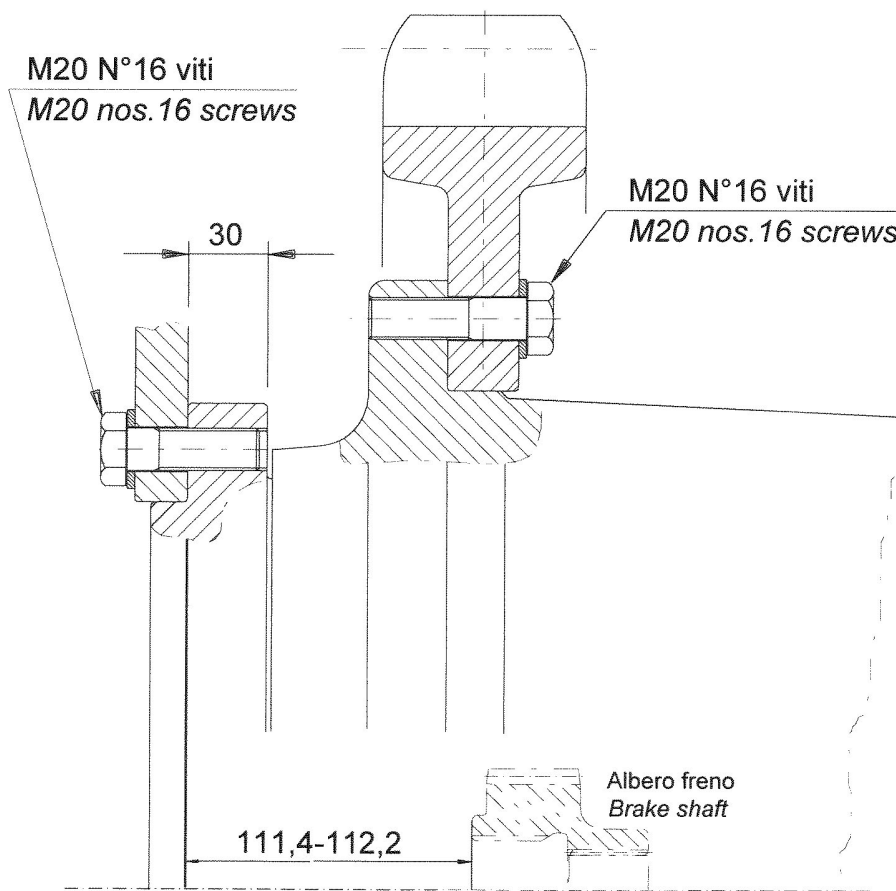
After mounting the motor, verify, through of a depth slide gauge, the axial dimension of the gearbox measured from input side of the flanged hub to the brake shaft:

Axial dimension = 111,4-112,2 mm.

Place the hydraulic motor and tighten the 2 hexagonal head screws M20x50, grade 8.8, by a torque wrench at a torque of 41,5 daNm.

3.2 INSTALLATION OF THE GEARBOX TO THE MACHINE

- Clean the mating surfaces from oils or paint and fit the gearbox to the undercarriage.
- Fix the gearbox to the frame with 16 screws M20 minimum grade 8.8, tightened by a torque wrench at a torque of 41,5 daNm.
- Clean the area which mates to the sprocket. To fit the sprocket use 16 screws M20, grade 8.8, tightened at 41,5 daNm torque.



Dis.4 - Schema di installazione riduttore

Dwg.4 - Gearbox installation scheme

3.3 COLLEGAMENTO DEL FRENO

Il riduttore e' provvisto di un freno negativo a dischi multipli di sicurezza a comando idraulico (freno di stazionamento). Il freno è comandato dal motore idraulico con una valvola di commutazione.

3.3 CONNECTION OF THE BRAKE PIPE

The gearbox is supplied with a safety negative multidisc brake hydraulically driven (parking brake). The brake is operated by the hydraulic motor through a brake release valve.

CARATTERISTICHE FRENO / BRAKE PERFORMANCES		
N° DISCHI ACCIAIO / Nbr. OF STEEL DISCS	[qty.]	5
N° DISCHI SINTERIZZATI / Nbr. OF SINTERED DISCS	[qty.]	6
N° MOLLE / Nbr. OF SPRINGS	[qty.]	18
PRESSIONE MINIMA DI APERTURA / MINIMUM BRAKE RELEASE PRESSURE	(bar)	18±10%
PRESSIONE MASSIMA DI APERTURA / MAXIMUM BRAKE RELEASE PRESSURE	(bar)	50±10%
COPPIA FRENANTE / BRAKING TORQUE	(daNm)	44,2±5%

4.0 LUBRIFICAZIONE

4.1 LUBRIFICAZIONE RIDUTTORE

La lubrificazione è separata fra motore e riduttore. La lubrificazione del riduttore e' a sbattimento in bagno d'olio.

L'olio specifico richiesto da KOMATSU e' del tipo **SAE 30** rispondente a norme **MIL-L-2104 D**.

Durante l'esercizio e solo per brevi momenti l'olio può raggiungere, ma non superare, la temperatura di **90-95°C** intermittente.

4.2 RIEMPIMENTO OLIO

Attenzione Il riduttore viene fornito privo di olio. Prima della messa in funzione occorre fare il riempimento. Con l'asse del riduttore in orizzontale, ruotare il corpo in modo che il tappo di scarico sia posizionato in basso sull'asse verticale del coperchio di chiusura (vedi dis.5). Svitare il tappo di carico olio e riempire dal foro superiore fino a che l'olio non fuoriesca.

Quantita' olio indicativa = 4 litri ±10%

4.3 SCARICO OLIO

Ruotare il corpo riduttore fino a che il tappo di scarico olio si trovi in basso sull'asse verticale del coperchio (vedi dis.5). Svitare i tappi e scaricare l'olio; per agevolare l'operazione di scarico e' bene operare con olio caldo.

4.4 CAMBIO OLIO E CONTROLLO

Il primo cambio olio deve essere effettuato circa dopo **100÷150 ore di funzionamento** del riduttore. Successivamente effettuare il cambio ogni **1000 ore o almeno 1 volta all'anno**. E' buona norma comunque controllare il livello almeno ogni **100 ore di lavoro** e aggiungerne se necessario.

4.0 LUBRICATION

4.1 GEARBOX LUBRICATION

The motor and the gearbox have separate lubrication. The gearbox is lubricated by oil splashing.

The specific oil requested by KOMATSU is type **SAE 30** complying with **MIL-L-2104 D**.

During operation the oil temperature must not exceed **90-95°C** intermittent.

4.2 OIL FILLING

Caution The gearbox is supplied without oil. Before putting the gearbox into operation, it is necessary to fill it with oil. Check that the gearbox axis is on horizontal. Rotate the gearbox housing, so that the draining oil plug is on the bottom of the vertical axis of the cover (see dwg.5). Unscrew the filling oil plug and fill from the upper hole until the oil flows out.

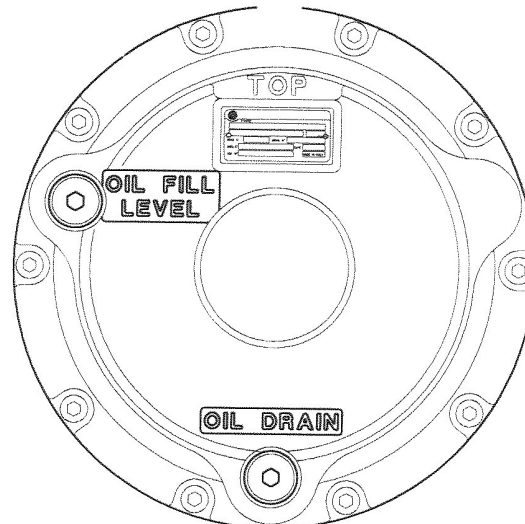
Approximate oil capacity = 4 liters ±10%

4.3 OIL DRAINING

Rotate the gearbox housing until the plug is on the bottom of the vertical axis of the cover (see dwg.5). Unscrew the plugs and discharge the oil; in order to facilitate draining, it is better to operate with the oil still warm.

4.4 OIL REPLACEMENT AND ROUTINE CHECKS

The first oil replacement must be carried out after about **100÷150 operating hours** of the gearbox. Subsequently, replace the oil every **1000 hours or at least once per year**. It is a good practice in any case to check the oil level every **100 working hours** and add it if necessary.



Dis.5 - Schema di carico, scarico e livello olio

Dwg.5 - Filling, draining and oil level scheme

5.0 MESSA IN ESERCIZIO

Far partire il motoriduttore dopo aver riempito il corpo del motore con olio idraulico.

Eliminare eventuale aria residua dal circuito idraulico tenendo aperte le valvole di sfiato fino a che l'olio non fuoriesce senza la schiuma, ed aggiungerne se necessario.

La presenza di aria residua nel circuito idraulico si manifesta con la presenza di schiuma nel serbatoio e causa un funzionamento a strappi del motore ed un'eccessiva rumorosità del motore e delle valvole.

Avviare il motoriduttore a bassa velocità ed incrementare gradualmente, dopo avere verificato che il funzionamento è corretto ed in assenza di rumore e vibrazioni.

Non arrivare alla massima pressione sino a quando l'impianto non sia stato filtrato per l'eliminazione di eventuali particelle di impurità.

Durante il funzionamento controllare che:

- non vi siano perdite olio,
- il numero dei giri ed il senso di rotazione siano corretti,
- la temperatura dell'olio (sia del motore che del riduttore) non raggiunga valori troppo elevati,
- il funzionamento sia regolare ed in assenza di rumore eccessivo e vibrazioni,
- non vi siano altri problemi.

6.0 MANUTENZIONE

In caso di normale funzionamento il riduttore non necessita di alcuna manutenzione. Sono necessari interventi di assistenza solo in seguito ad anomalie di funzionamento.

5.0 START UP

Operate the gearbox after the motor is filled with hydraulic oil.

Leave breather open and fill with oil until oil flows out without foam. Add more oil if necessary.

Air trapped in the hydraulic system may generate noise in motor and valves as well as foaming in the tank.

Start the gearbox at low speed and increase speed gradually after checking that the gearbox runs smoothly with no noise or vibrations.

Do not run at max pressure until all solid particles are captured and removed by the filter.

Checks the following points:

- no oil leaks,*
- revolution and direction of rotation are correct,*
- the oil temperature (both motor and gearbox) does not rise exceed prescribed values,*
- operation is smooth without noise or vibrations,*
- no other defects.*

6.0 MAINTENANCE

Under normal operating circumstances, no routine maintenance is required, other than routine oil checks and oil changes. As recommended in this manual, unusual operating characteristics, such as noise or overheat, should indicate further investigation.

7.0 SMONTAGGIO

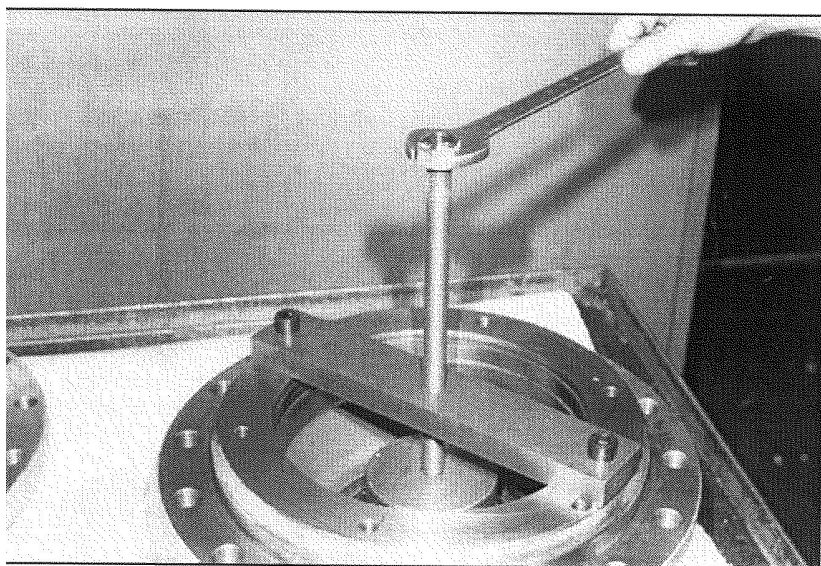
Per le prime verifiche degli ingranaggi e del motore idraulico, è possibile intervenire senza smontare il cingolo e il motoriduttore dalla macchina.

Per dare inizio alla fase di smontaggio, fare defluire completamente l'olio lubrificante dal riduttore secondo quanto descritto al paragrafo 4.3, svitare e sfilare le 2 viti M20x50 (pos.24), classe di resistenza 8.8 e togliere il motore idraulico e la guarnizione O-ring (pos.19)

7.0 DISASSEMBLING

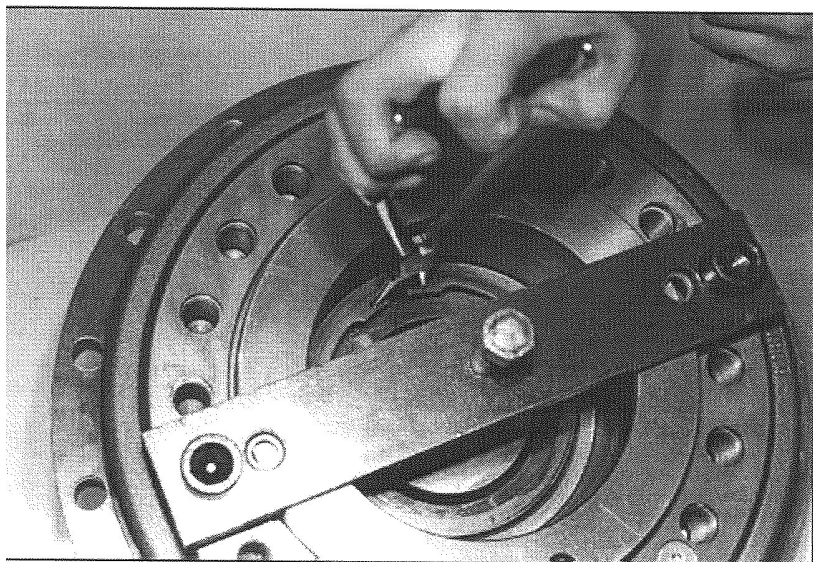
Initial inspection of the gears and the hydraulic motor, can be made without dismantling the track and the track drive from the machine.

Prior to dismantling make sure that the oil is discharged as to instructions specified in section 4.3, unscrew and remove the 2 screws M20x50 (pos.24), grade 8.8, and remove the hydraulic motor and the O-ring (pos.19).



FASE 1 Fissare l'attrezzatura AT709C15 sul mozzo flangiato (pos.18); avvitare la barra filettata (part.C), premendo la pastiglia (part.B) sul disco spingimolle (pos.21), allentando così la pressione delle molle (pos.22) sull' anello elastico (pos.20), favorendone la sua estrazione.

STEP 1 Fix the equipment AT709C15 on the flanged hub (pos.18), by screwing the threaded bar, push the disc on the discs retainer (pos.21), thus removing the force of the springs (pos.22) on the circlip (pos.20) and allowing its disassembling.



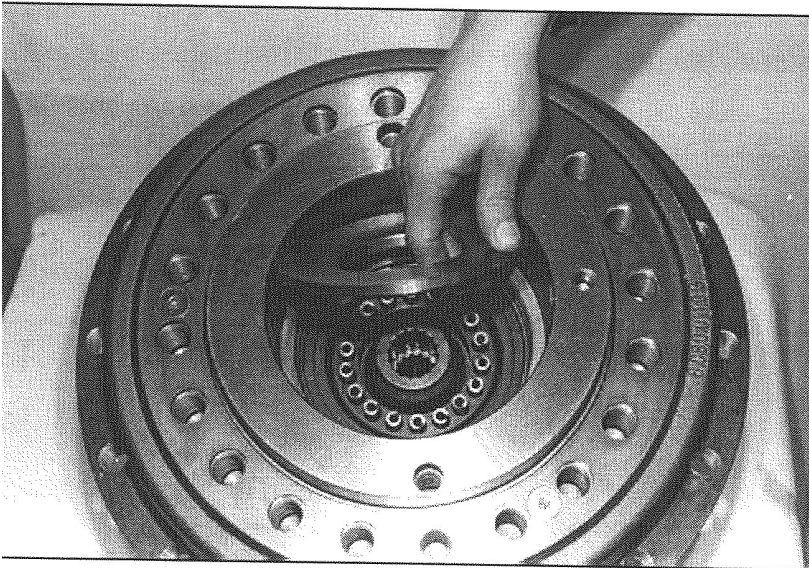
FASE 2

Con l'ausilio di pinze sfilare l'anello elastico (pos.20) dalla propria sede nel mozzo flangiato (pos.18).

STEP 2

Using pliers remove the circlip (pos.20) from its groove in the the flanged hub (pos.18).

-SMONTAGGIO / DISASSEMBLING-

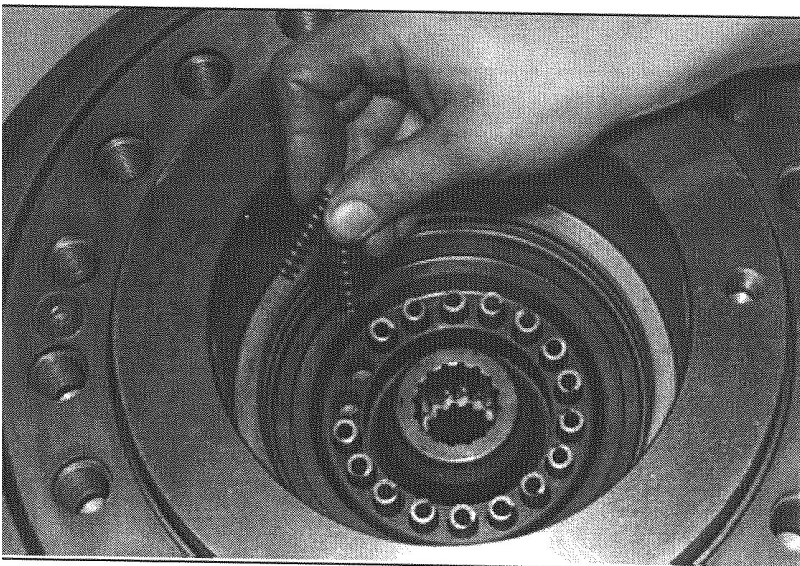


FASE 3

Sfilare il disco spingimolle (pos.21) dal mozzo flangiato (pos.18).

STEP 3

Remove springs retainer (pos.21) from the flanged hub (pos.18).

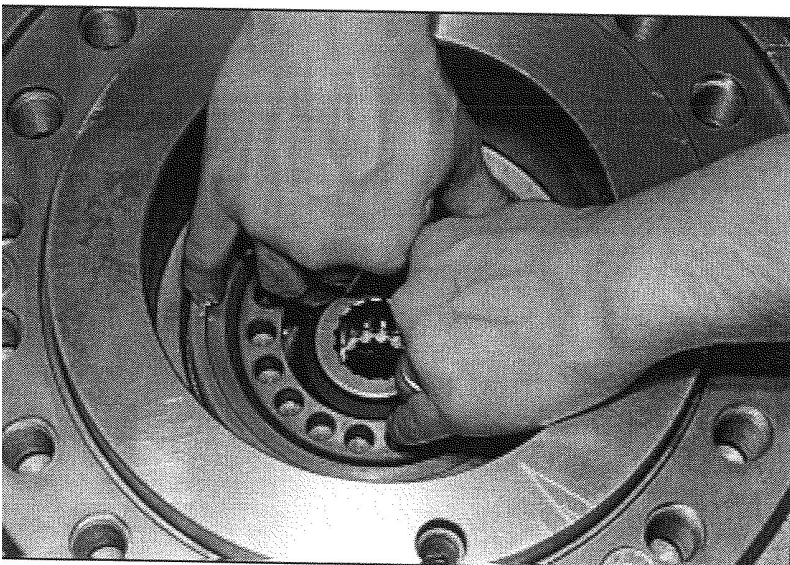


FASE 4

Sfilare le molle (pos.22) dalle proprie sedi nel pistone freno (pos.23).

STEP 4

Remove the springs (pos.22) from their grooves in the brake piston (pos.23).



FASE 5

Sfilare il pistone freno (pos.23).

 Attenzione

Per facilitare l'operazione, immettere aria compressa nel foro comando freno (max.0,2 bar)

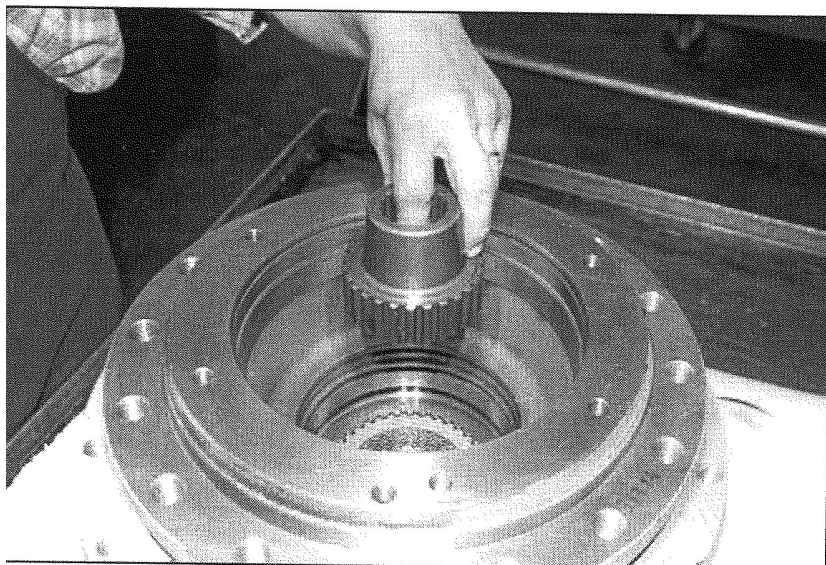
STEP 5

Remove the brake piston (pos.23).

 Caution

To get it easier, pumping compressed air into the brake port hole (max.0,2 bar).

-SMONTAGGIO / DISASSEMBLING-

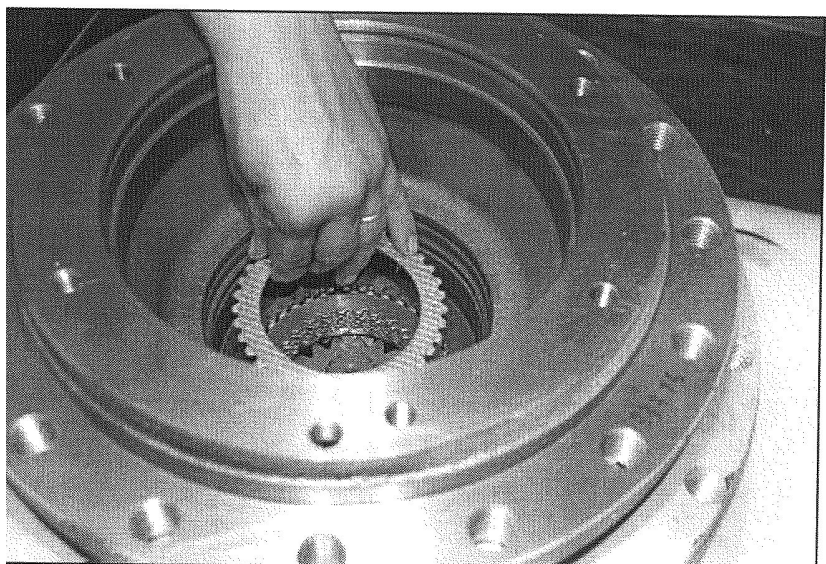


FASE 6

Sfilare l'albero freno (pos.27).

STEP 6

Remove the brake shaft (pos.27).

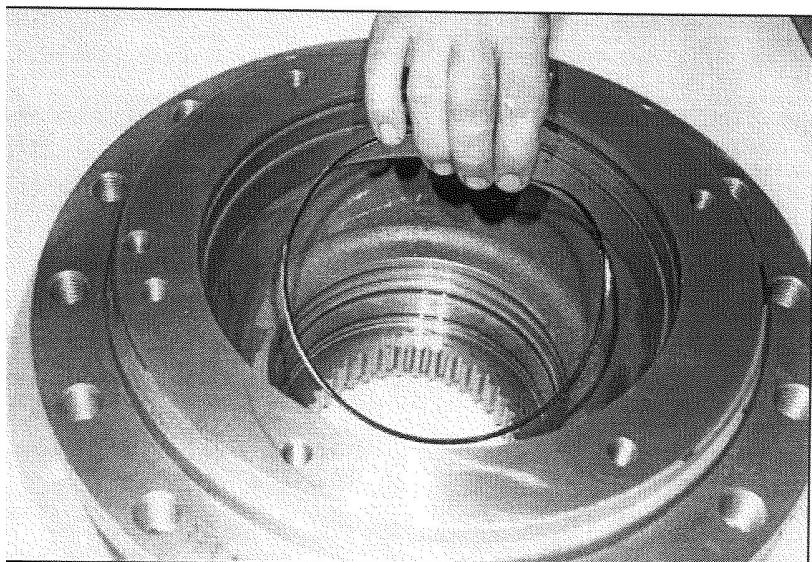


FASE 7

Sfilare il pacco dei dischi freno (pos.25-26).

STEP 7

Remove brake discs pack (pos.25-26).



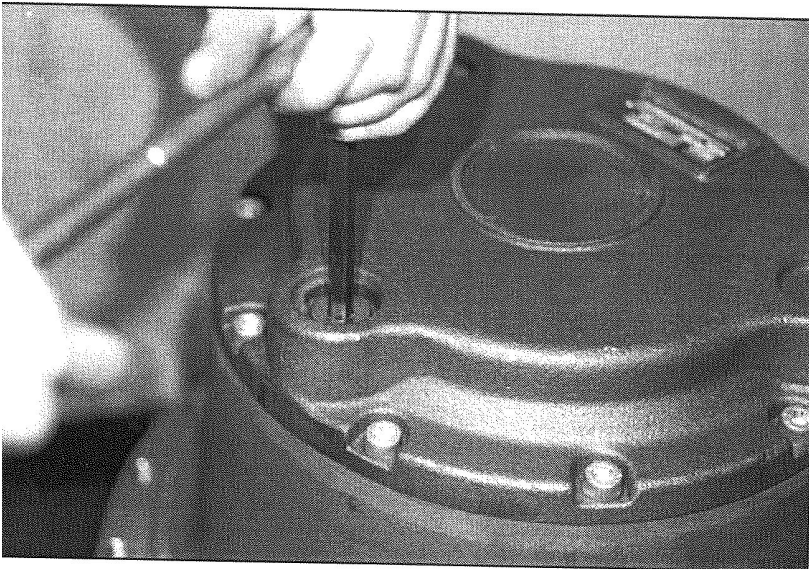
FASE 8

Togliere le guarnizioni O-ring (pos.28-29) dalle proprie sedi situate nel mozzo flangiato (pos.18).

STEP 8

Remove the O-rings (pos.28-29) from their groves in the flanged hub (pos.18).

-SMONTAGGIO / DISASSEMBLING-

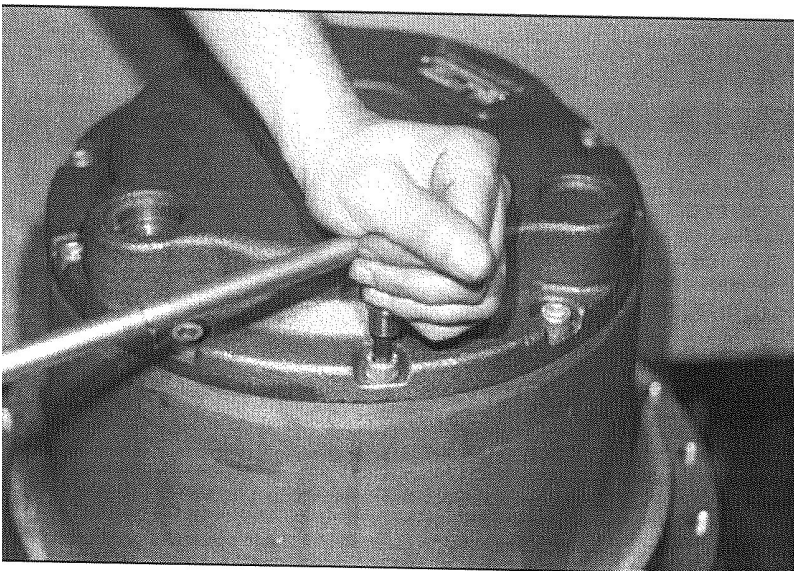


FASE 9

Capovolgere il riduttore, svitare e sfilare i due tappi di sfiato M22x1,5 (pos.4) e le relative rondelle (pos.3) dal coperchio di chiusura (pos.2).

STEP 9

Overturn the gearbox, unscrew and remove the 2 plugs M22x1,5 (pos.4) and the 2 washers (pos.3) from the end cover (pos.2).

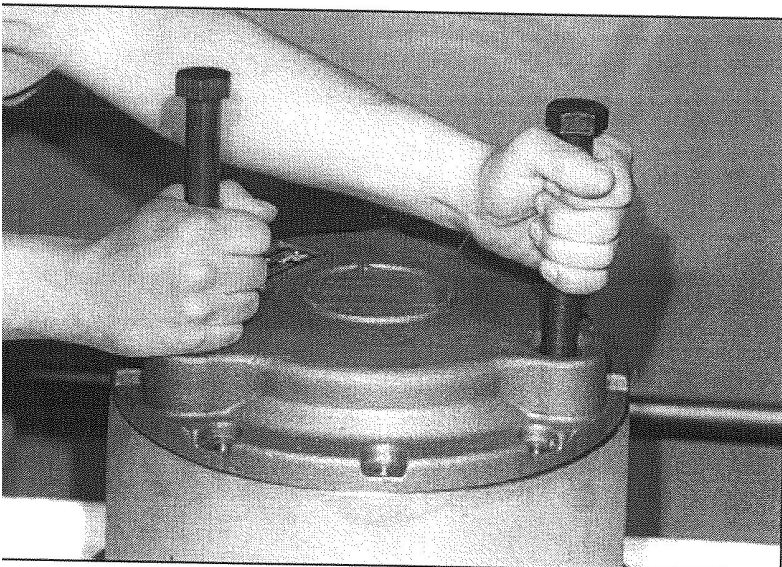


FASE 10

Svitare e sfilare le 10 viti TCEI M10x25 (pos.1), classe di resistenza 12.9, dal coperchio di chiusura (pos.2).

STEP 10

Unscrew and remove the 10 socket head screws M10X25 (pos.1), grade 12.9, from the cover (pos.2).



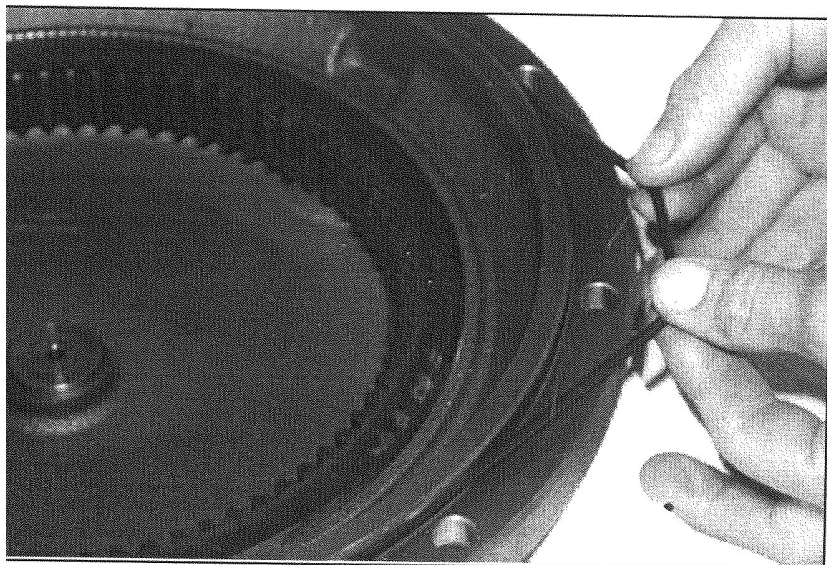
FASE 11

Sfilare il coperchio di chiusura (pos.2) con l'ausilio di 2 viti M22x1,5 avvitate nei fori dei tappi olio.

STEP 11

Remove the end cover (pos.2) using 2 screw M22x1,5 tightened to the oil plugs holes.

-SMONTAGGIO / DISASSEMBLING-

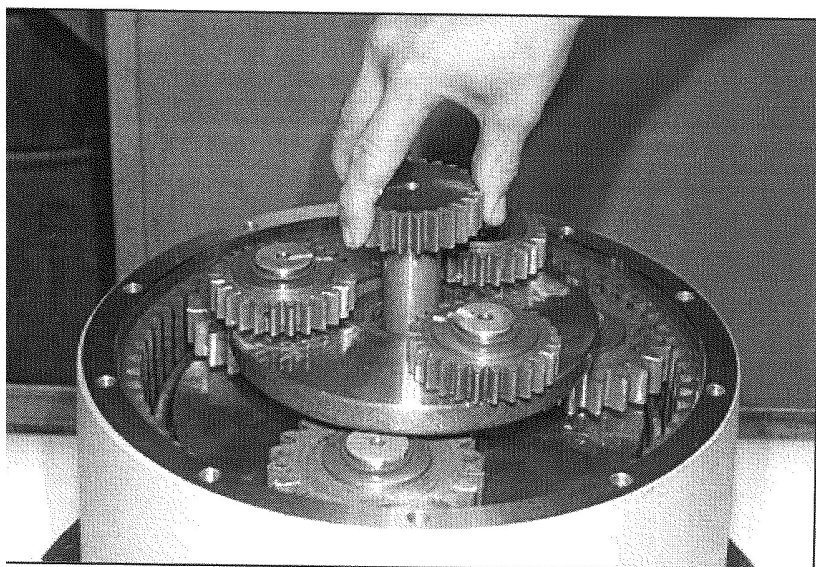


FASE 12

Togliere la guarnizione O-ring (pos.5) dalla propria sede nel coperchio di chiusura (pos.2).

STEP 12

Remove the O-Ring (pos.5) from its groove in the end cover (pos.2).

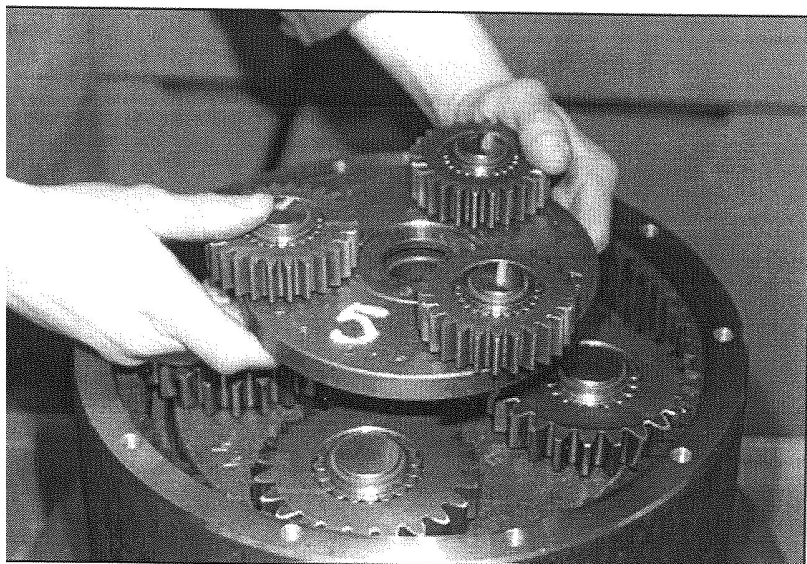


FASE 13

Sfilare il solare di 1°riduzione (pos.7).

STEP 13

Remove the 1st stage sun gear (pos.7).



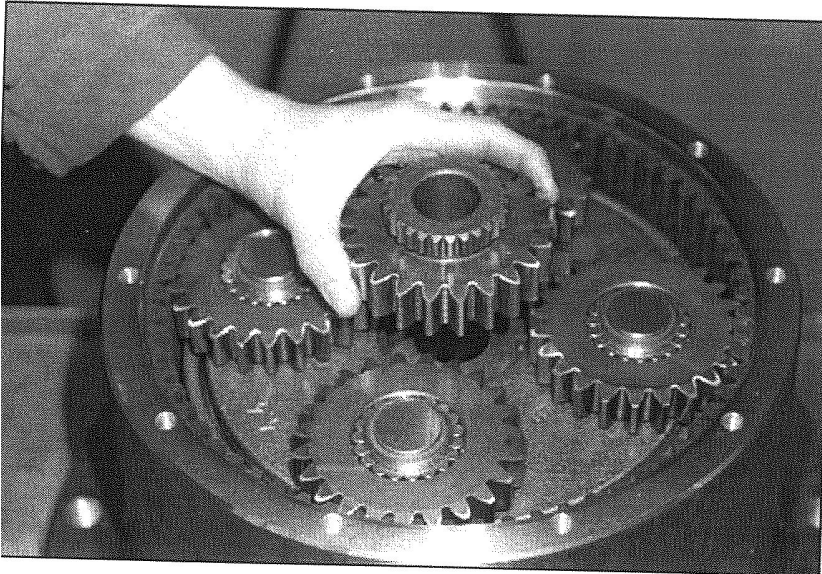
FASE 14

Estrarre la 1°riduzione (pos.8).

STEP 14

Remove the 1st reduction assembly (pos.8).

-SMONTAGGIO / DISASSEMBLING-

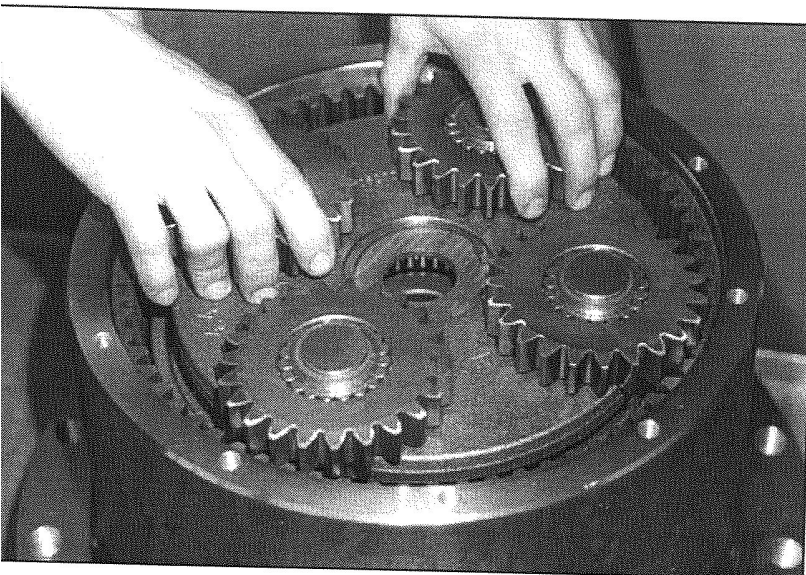


FASE 15

Sfilare il solare di 2°riduzione (pos.9).

STEP 15

Remove the 2nd stage sun gear (pos.9).

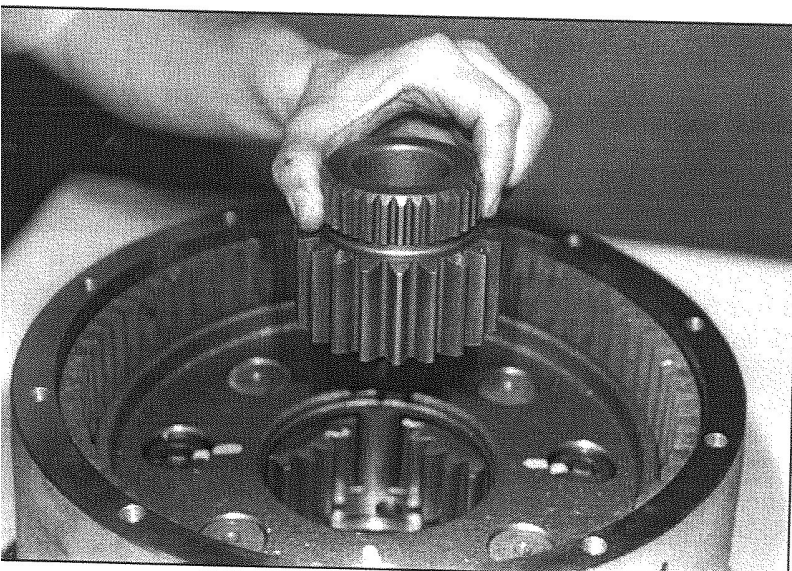


FASE 16

Estrarre la 2°riduzione (pos.10).

STEP 16

Remove the 2nd reduction assembly (pos.10).



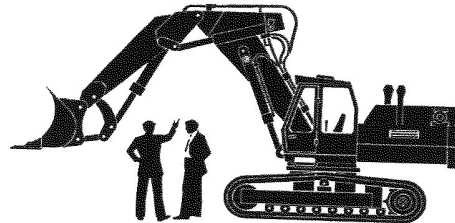
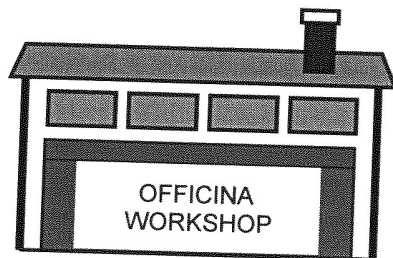
FASE 17

Sfilare il solare di 3°riduzione (pos.11).

STEP 17

Remove the 3rd stage sun gear (pos.11).

-SMONTAGGIO / DISASSEMBLING-

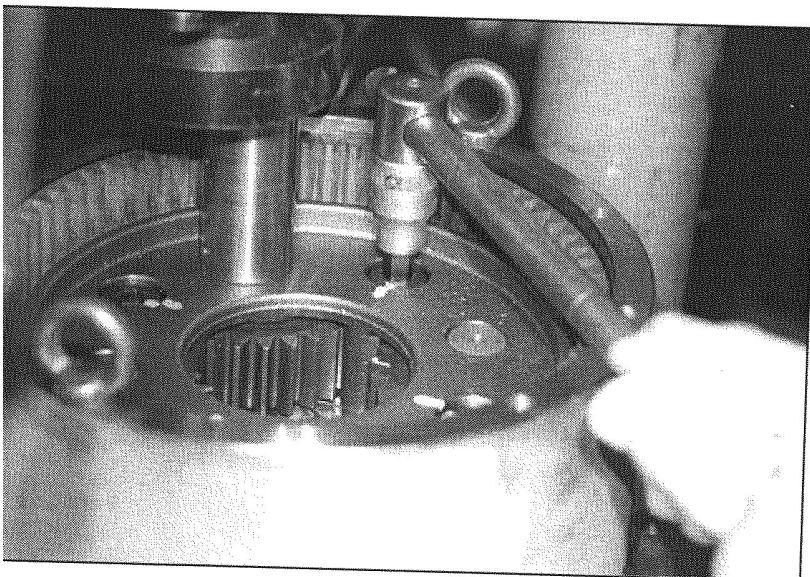


Nota

Per proseguire nello smontaggio del riduttore, occorre a questo punto smontarlo dalla macchina e recarsi in una officina opportunamente attrezzata.

Note

In order to proceed with the slew drive disassembling, it is now necessary to remove it from the machine and bring it to a properly equipped workshop.

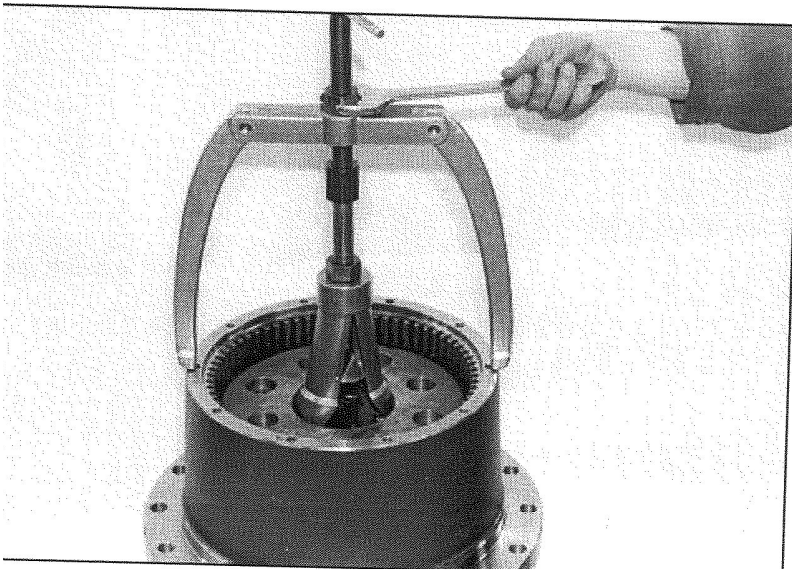


FASE 18

Svitare le 4 viti TCEI M20x100 (pos.12), classe di resistenza 10.9, che fissano la 3° riduzione (pos.13) al mozzo flangiato (pos.18).

STEP 18

Unscrew the 4 socket head screws M20x100 (pos.12), grade 10.9, fixing the 3rd reduction assembly (pos.13) to the flanged hub (pos.18).



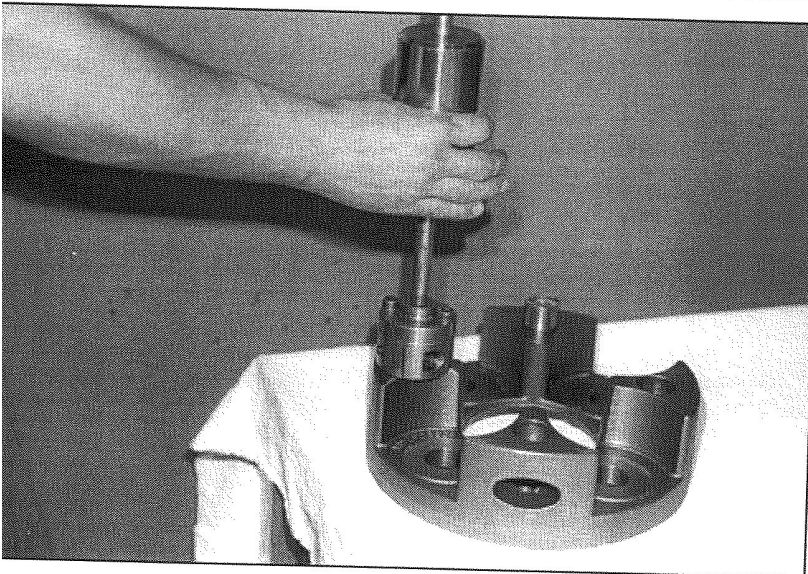
FASE 19

Servendosi di un estraattore, sfilare il portaplanetario di 3° riduzione da mozzo flangiato (pos.18).

STEP 19

By means of a puller, remove the 3rd reduction planet carrier from the flanged hub (pos.18).

-SMONTAGGIO / DISASSEMBLING-

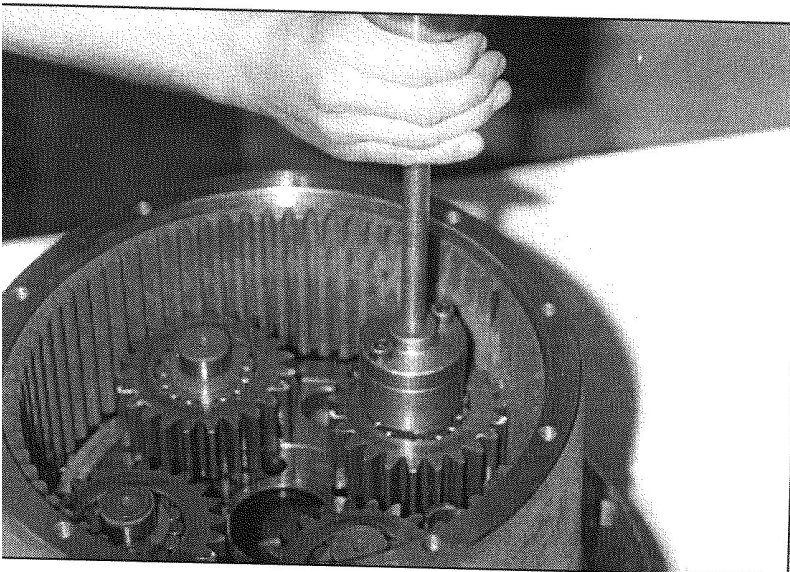


FASE 20

Utilizzando l'attrezzatura AT709C16, sfilare le boccole (pos.14) dal mozzo flangiato (pos.18) o dal portaplanetari di 3° riduzione.

STEP 20

Using the equipment AT709C16, remove the bush (pos.14) from the flanged hub (pos.18) or from the 3rd reduction planet carrier.



FASE 21

Utilizzando l'attrezzatura AT709C16, sfilare i 4 gruppi planetari di 3°riduzione (pos.13).

STEP 21

Using the equipment AT709C16 remove the 4 planet assemblies of the 3rd reduction (pos.13).



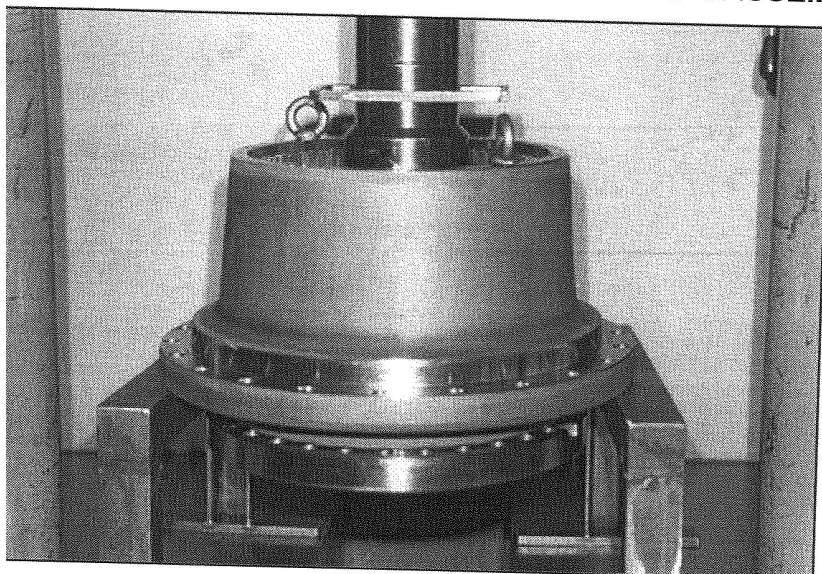
FASE 22

Sfilare l'anello di centraggio (pos.17) dal mozzo flangiato (pos.18).

STEP 22

Remove the centering ring (pos.17) from the flanged hub (pos.18).

-SMONTAGGIO / DISASSEMBLING-



FASE 23

Servendosi di una pressa e di un tampone metallico, sfilare il mozzo flangiato (pos.18) dal corpo riduttore (pos.15).

STEP 23

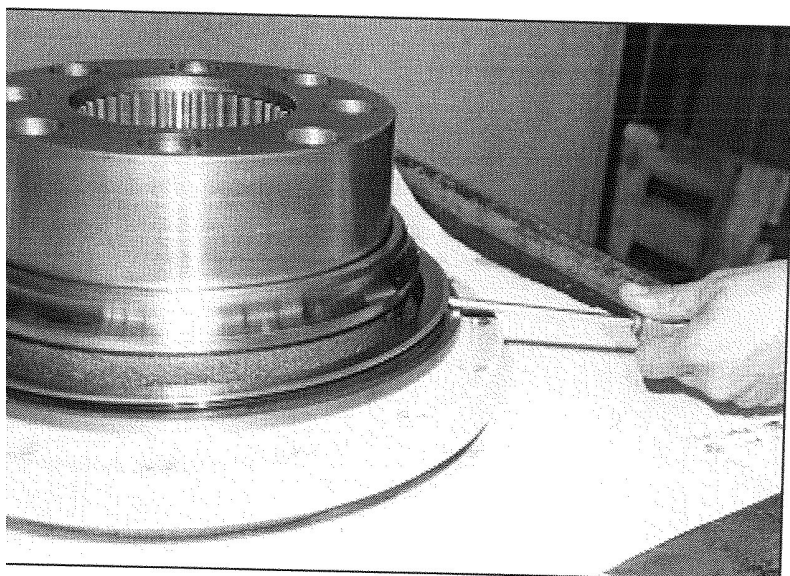
Using a press and a metal stopper, remove the flanged hub (pos.18) from the gearbox housing (pos.15).

7.1 CONTROLLO TENUTA FRONTALE

⚠ Attenzione Puo' essere necessario in caso di perdite olio, dover provvedere al controllo ed alla eventuale sostituzione della tenuta frontale (pos.16), cioe' di entrambe le parti metalliche e delle guarnizioni O-rings.

7.1 LIFETIME SEAL CHECK

⚠ Caution In case of oil leakages, it should be necessary to check and eventually replace the lifetime seal (pos.16), wich means both the metal rings parts and the O-rings.



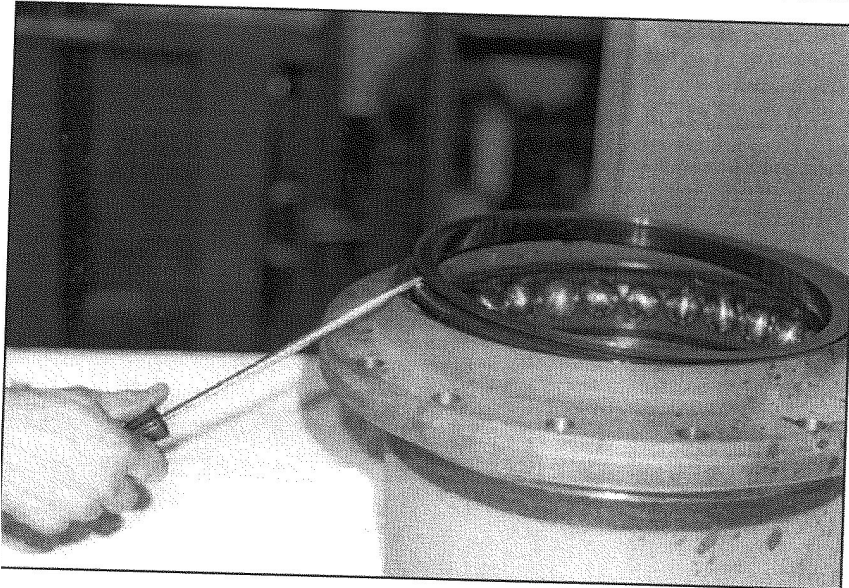
FASE 24

Smontare la 1°semitenuta frontale (pos.16) dal mozzo flangiato (pos.18).

STEP 24

Remove the 1st half seal (pos.16) from the flanged hub (pos.18).

-SMONTAGGIO / DISASSEMBLING-

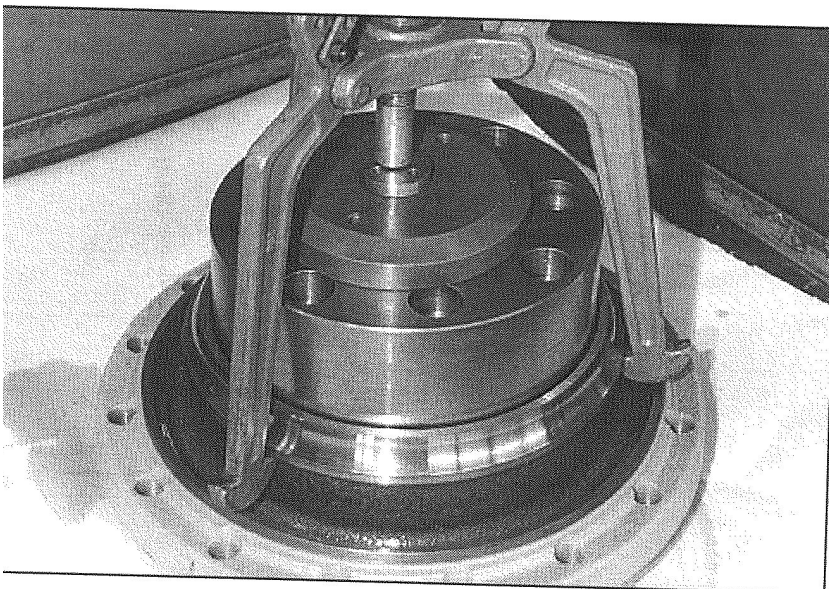


FASE 25

Smontare la 2ª semitenuta frontale (pos. 16) dal corpo riduttore (pos. 15).

STEP 25

Remove the 2nd half seal (pos. 16) from the gearbox housing (pos. 15).



FASE 26

Servendosi di un estrattore, sfilare l'anello interno del cuscinetto dal mozzo flangiato (pos. 18).

STEP 26

Using a puller remove the inner ring of the bearing from the flanged hub (pos. 18).

 Nota

Lo smontaggio del riduttore termina con quest'ultima operazione: tutti i particolari sono ora a disposizione per le verifiche necessarie.

 Note

The track drive disassembling ends with the above operation: all items are now available for the necessary inspections.

8.0 RIMONTAGGIO

8.1 NOTE IMPORTANTI PRIMA DEL RIMONTAGGIO

Quando si procede al rimontaggio del riduttore occorre attenersi ad alcune regole fondamentali:

- Nel caso di ingranaggi danneggiati, esempio un planetario, non sostituire il singolo ingranaggio ma tutta la riduzione.
- sostituire sempre le guarnizioni O-ring interessate alla parte da rimontare dopo aver pulito con attenzione le sedi di montaggio ed aver aggiunto un film di grasso sulle sedi stesse e sulle guarnizioni per facilitarne il montaggio.

8.2 ISTRUZIONI PER IL MONTAGGIO DELLE SEMITENUTE FRONTALI.

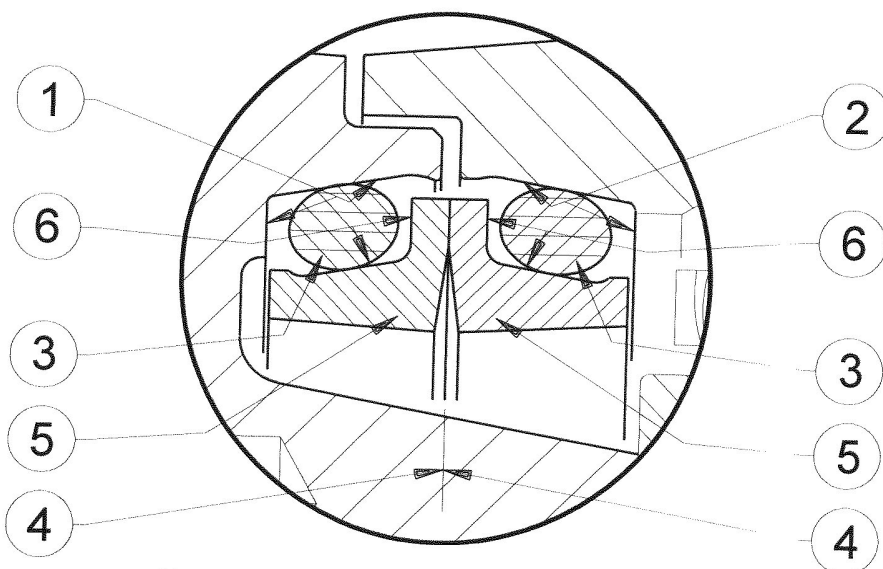
8.0 REASSEMBLY

8.1 IMPORTANT NOTES BEFORE REASSEMBLY

When proceeding with the gearbox reassembly, it is necessary to follow up the rules listed below:

- In case of damaged gears, for example a planet, do not replace the single gear, but the whole reduction stage.
- Always replace the O-rings of the item to be reassembled after having carefully cleaned the seats and having buttered some grease on the grooves themselves and on the O-rings to make easier the reassembly.

8.2 INSTRUCTIONS FOR THE INSTALLATION OF THE HALF SEALS.



Dis.6 - Particolare di tenuta frontale Dwg.6 - Detail of seal

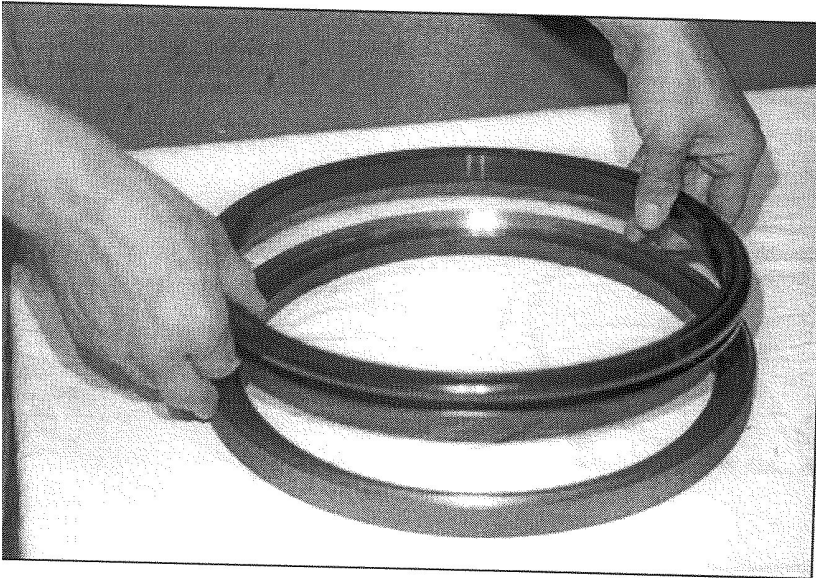
Per ottenere una perfetta tenuta, e' necessario procedere al montaggio degli anelli nel seguente modo:

- Effettuare una accurata pulizia degli alloggiamenti "1" e "2" facendo uso, se necessario, di spazzole metalliche o solventi (le superfici a contatto con gli anelli di gomma "3" devono essere perfettamente pulite ed asciutte).
- Assicurarsi che le superfici di tenuta "4" degli anelli "5" siano esenti da qualsiasi rigatura, ammaccatura o corpi estranei e che le superfici "6" degli stessi anelli siano perfettamente pulite ed asciutte.
- Togliere dalle superfici lappate "4" degli anelli "5" ogni traccia di polvere o impronte digitali e umettarle poi con un leggero strato di olio, avendo cura di non ungere le rimanenti parti.

To follow these instructions at the time of fitting, in order to obtain the correct seal:

- Carefully clean the seats "1" and "2" using, if necessary, metal brushes or solvent (surfaces in contact with or "3" must be perfectly clean and dry).
- Make sure that sealing surfaces "4" of metal rings "5" are free from scratches, dings or foreign substances; metal ring surfaces must be perfectly clean and dry.
- Carefully clean the lapped surface "4" of metal rings "5" and remove dust or fingerprints. Then lubricate them with a thin oil film, taking care not to oil the other components.

-RIMONTAGGIO / REASSEMBLING-

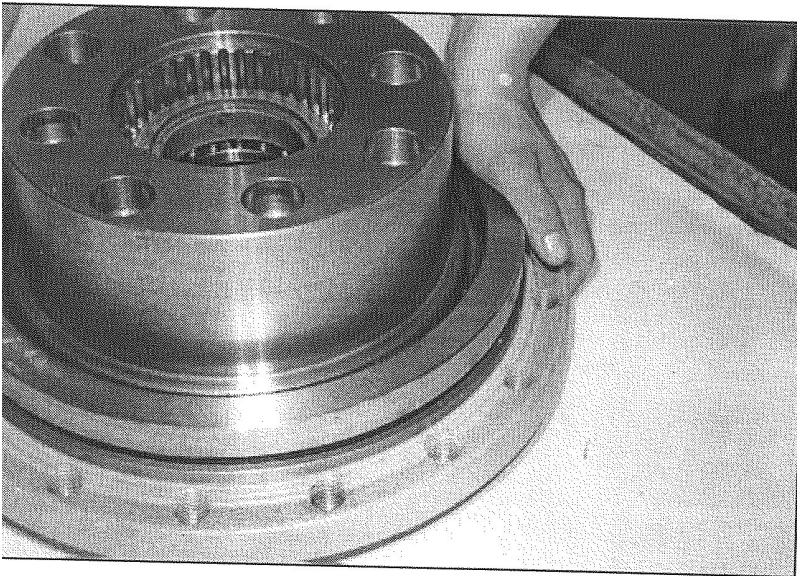


FASE 27

Montare le semitenute frontali (pos.16) sull' attrezzo AT709C07.

STEP 27

Assemble the half seals (pos.16) on the tool AT709C07.

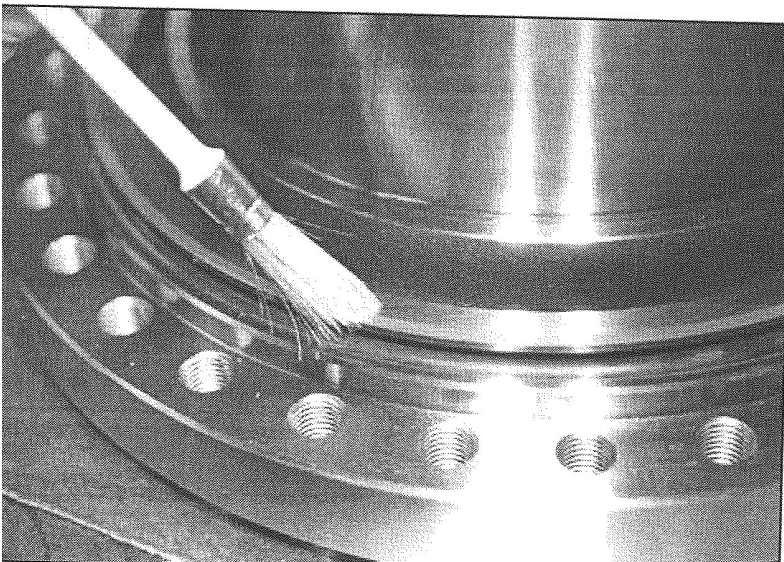


FASE 28

Montare, sempre con lo stesso attrezzo AT709C07, la semitenuta frontale (pos.15) sul mozzo flangiato (pos.18).

STEP 28

Assemble, by using the same tool AT709C07, the half seal (pos.15) on the flanged hub (pos.18).



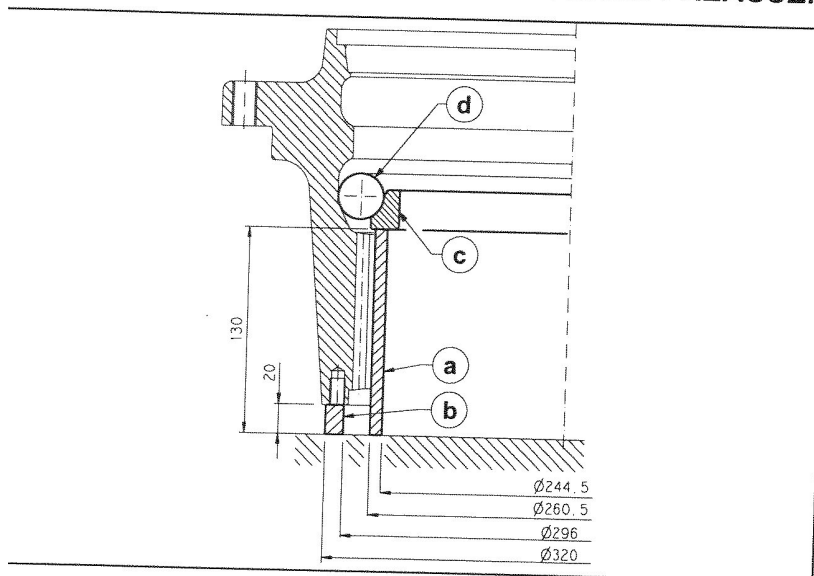
FASE 29

Pulire le parti metalliche delle semitenute frontali da eventuali residui o polvere, e stendere sulla loro superficie un leggero strato di olio.

STEP 29

Clean carefully the metallic faces of the half-seals, and lube them with a thin oil film.

-RIMONTAGGIO / REASSEMBLING-

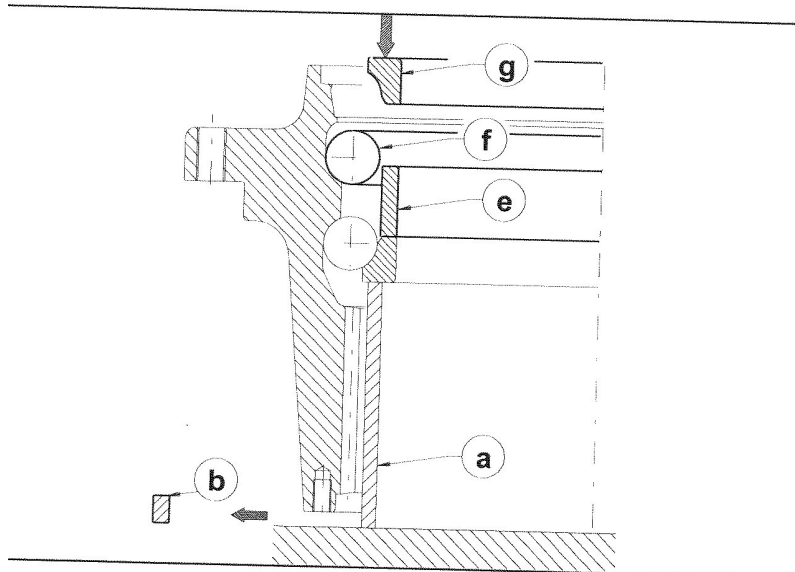


FASE 30

Montare sul corpo riduttore (pos.15) il giro di sfere inferiore (rif.d), sostenendo l'anello interno (rif.c) tramite i distanziali (rif.a-b).

STEP 30

Fit the lower ball row (ref.d), into the gearbox housing (pos.15) holding the inner raceway (ref.c) with spacers (ref.a-b).



FASE 31

Sfilare il distanziale (rif.b).
Montare il giro di sfere superiore (rif.f), dopo aver posizionato il distanziale del cuscinetto (rif.e).
Inserire l'anello interno del cuscinetto (rif.g).

STEP 31

*Remove the spacer (ref.b).
Place the bearing spacer (ref.e) into its position and drop the upper ball row (ref.f).
Drop the inner raceway (ref.g).*



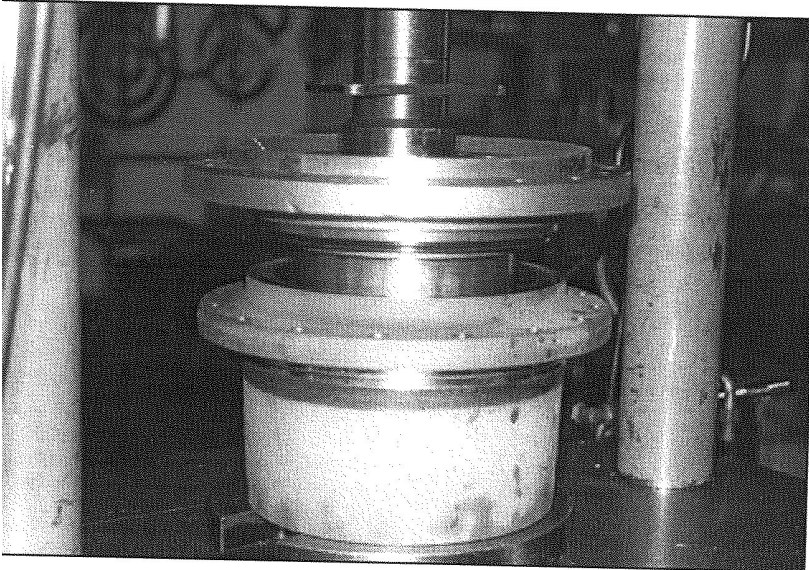
FASE 32

Eeguire il montaggio della 1° semi-tenuta frontale (pos.16) sul corpo riduttore (pos.15).

STEP 32

Assemble the 1st half seal (pos.16) on the gearbox housing (pos.15).

-RIMONTAGGIO / REASSEMBLING-

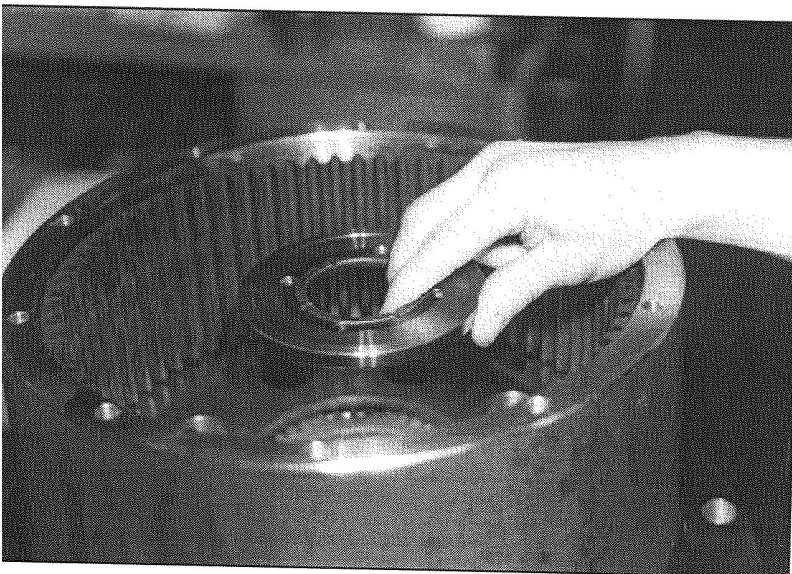


FASE 33

Posizionare il mozzo flangiato (pos.18) all'interno del corpo riduttore (pos.15). Servendosi di una pressa e di un tampone metallico, spingere il mozzo flangiato (pos.18) in battuta sul corpo riduttore (pos.15) fino ad ottenere il completo assemblaggio del gruppo.

STEP 33

Place the flanged hub (pos.18) inside the gearbox housing (pos.15). Using a press and a metallic stopper, push the flanged hub (pos.18) against the shoulder on the gearbox housing (pos.15) until assembling of the unit is complete.

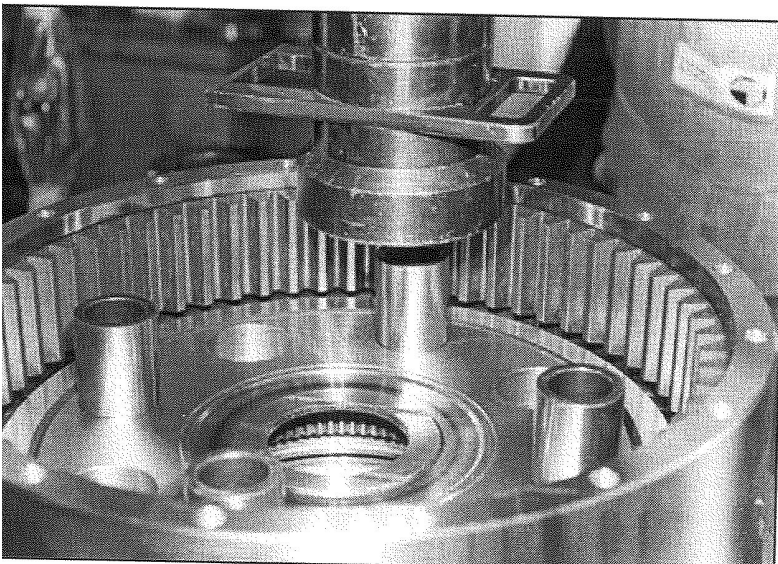


FASE 34

Montare correttamente l'anello spingidischi (pos.17) nel mozzo flangiato (pos.18).

STEP 34

Assemble correctly the discs retainer (pos.17) in the flanged hub (pos.18).



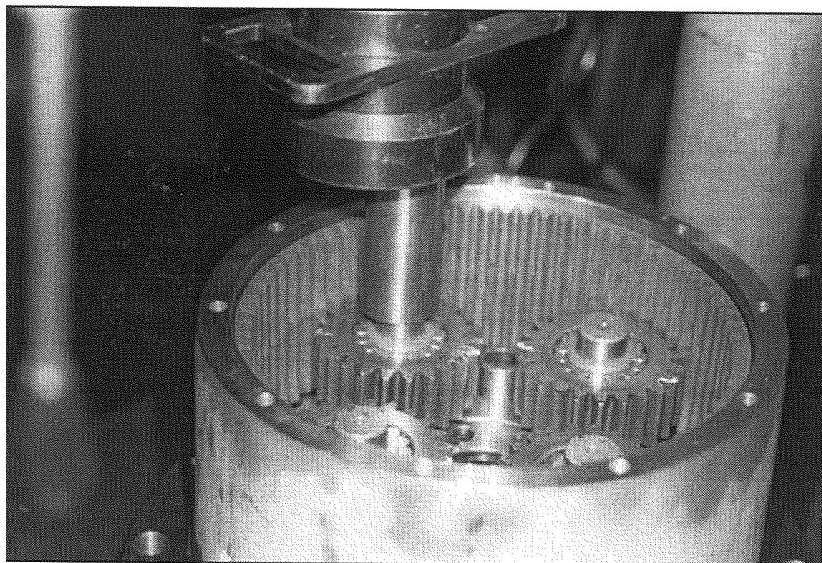
FASE 35

Posizionare le 4 boccole (pos.14) nelle proprie sedi nel mozzo flangiato (pos.18). Con la pressa spingere le boccole (pos.14) in battuta sul mozzo flangiato (pos.18) fino ad ottenere il completo assemblaggio.

STEP 35

Place the 4 bushes (pos.14) into their groves on the flanged hub (pos.18). Through a press, push the bushes (pos.14) against the shoulder inside their groves into the flanged hub (pos.18) until assembling is complete.

-RIMONTAGGIO / REASSEMBLING-

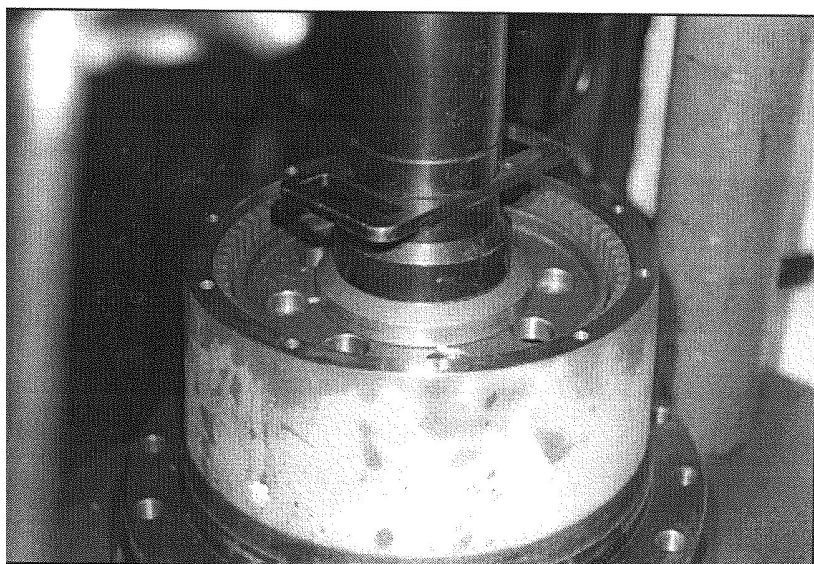


FASE 36

Servendosi di una pressa spingere i 4 gruppi planetari di 3°riduzione (pos.13) in battuta sul mozzo flangiato (pos.18).

STEP 36

Using a press, push the 4 planet assemblies of the 3rd reduction (pos.13) against the shoulder on the flanged hub (pos.18).

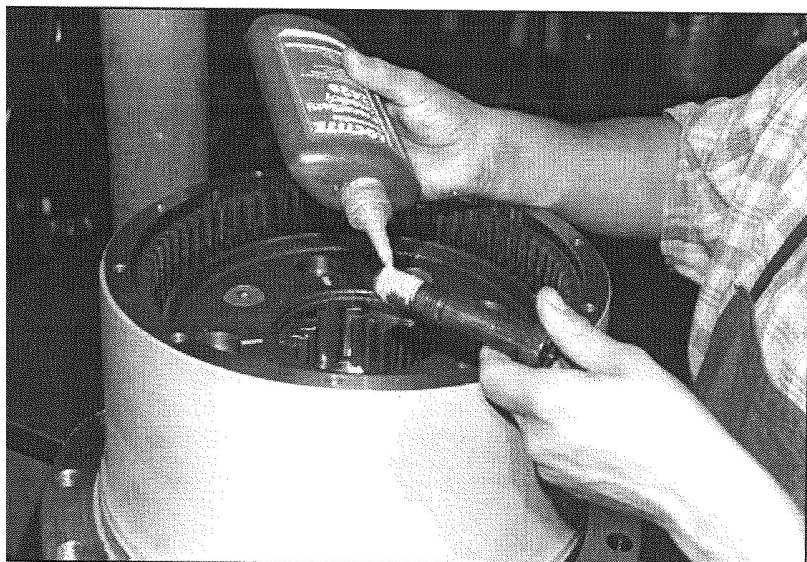


FASE 37

Posizionare il portaplanetari di 3°riduzione sul mozzo flangiato (pos.18), e con la pressa, spingere quest'ultimo in battuta fino ad ottenere il completo assemblaggio.

STEP 37

Place the 3rd reduction planet carrier (pos.13) on the flanged hub (pos.18) and trough a press push it against the shoulder until assembling is complete.



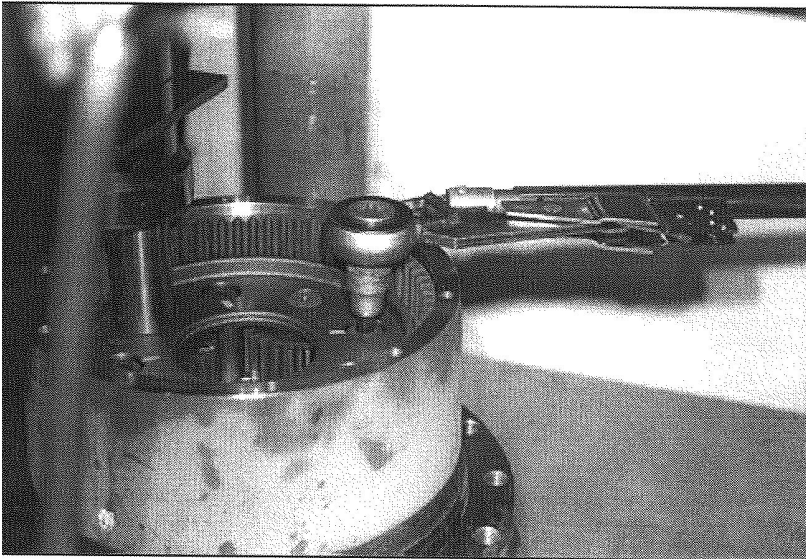
FASE 38

Applicare LOCTITE tipo 242 sulle 4 viti TCEI M20x100 (pos.12), classe di resistenza 10.9, ed inserirle nei rispettivi fori.

STEP 38

Apply LOCTITE type 242 on the 4 socket head screws M20x100 (pos.12), grade 10.9, and insert them in the thread holes.

-RIMONTAGGIO / REASSEMBLING-

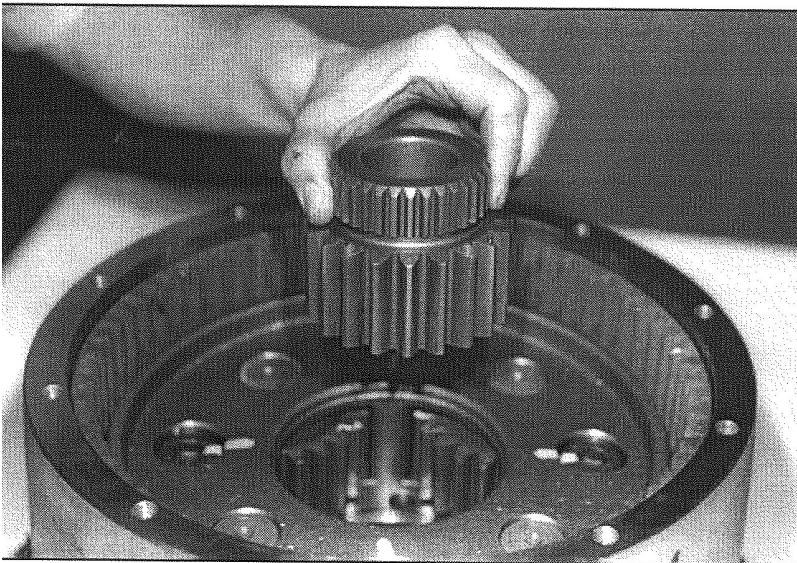


FASE 39

Serrare le 4 viti TCEI M20x100 (pos.12), classe di resistenza 10.9 con una chiave dinamometrica alla coppia di 58,5 daNm.

STEP 39

Tighten the 4 socket head screws M20x100 (pos.12), grade 10.9, by a torque wrench at a torque of 58,5 daNm.

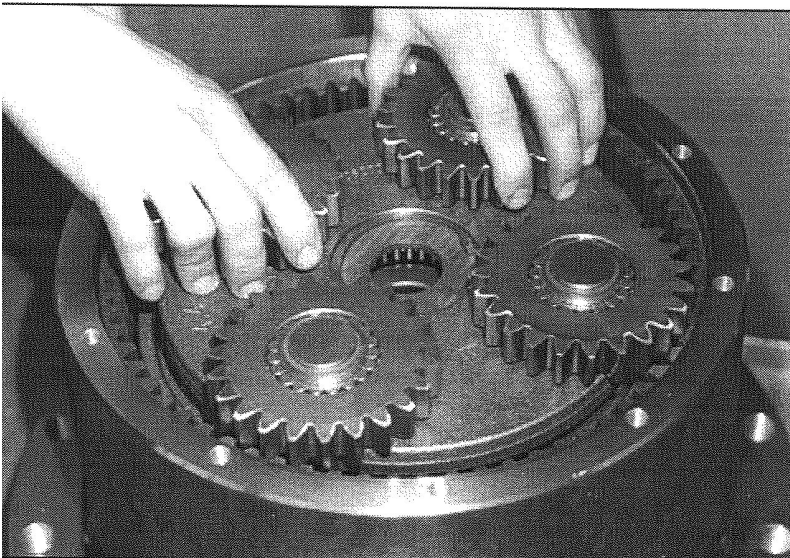


FASE 40

Inserire il solare di 3° riduzione (pos.11).

STEP 40

Insert the 3rd stage sun gear (pos.11).



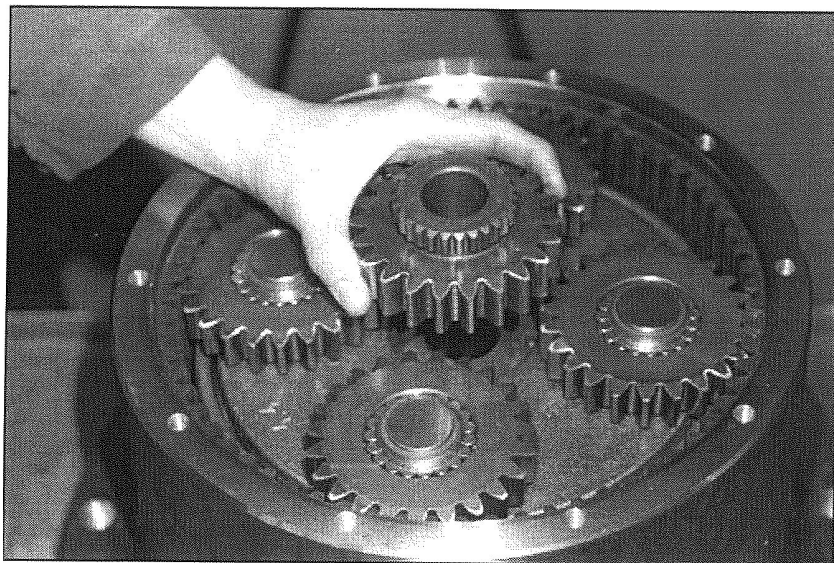
FASE 41

Montare la 2° riduzione (pos.10).

STEP 41

Assemble the 2nd reduction assembly (pos.10).

-RIMONTAGGIO / REASSEMBLING-

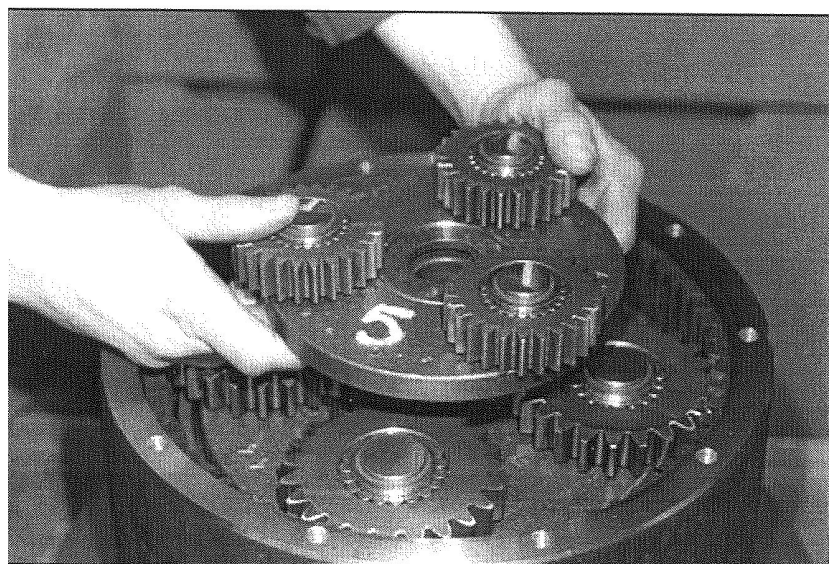


FASE 42

Inserire il solare di 2° riduzione (pos.9).

STEP 42

Insert the 2nd stage sun gear (pos.9).

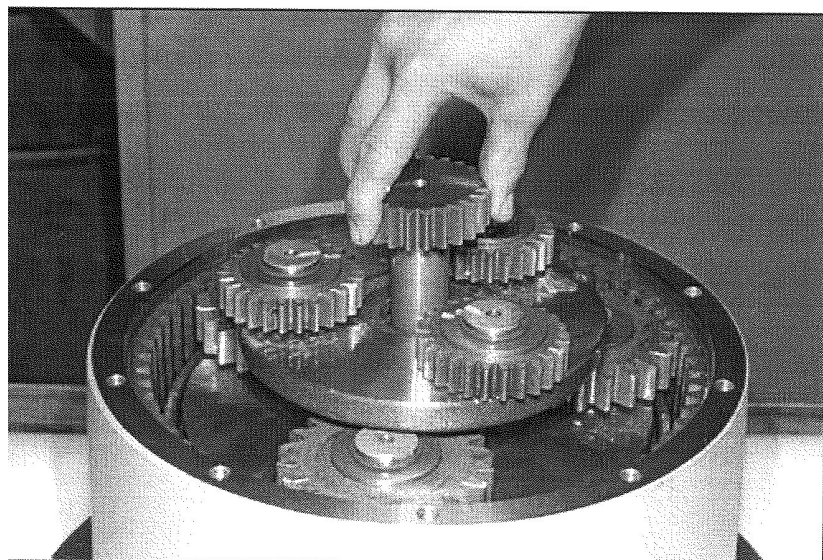


FASE 43

Montare la 1° riduzione (pos.8).

STEP 43

Assemble the 1st reduction assembly (pos.8).



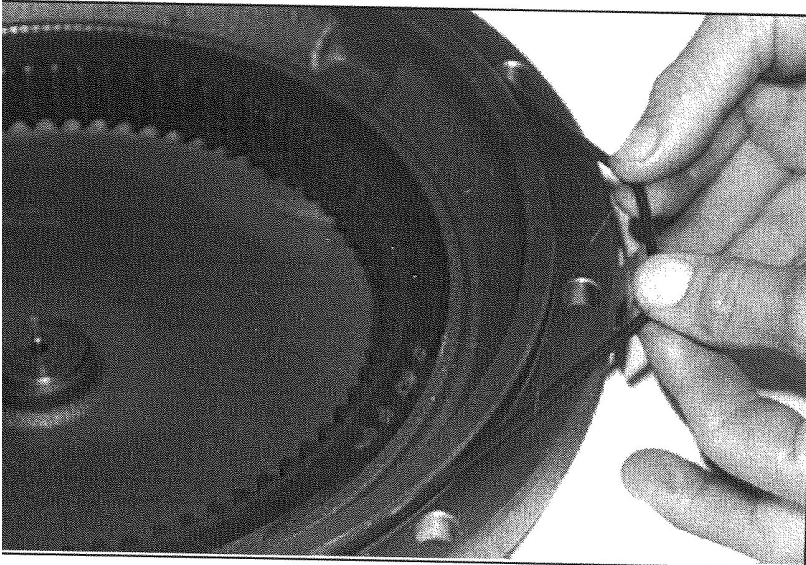
FASE 44

Inserire il solare di 1° riduzione (pos.7).

STEP 44

Insert the 1st stage sun gear (pos.7).

-RIMONTAGGIO / REASSEMBLING-



FASE 45

Montare la guarnizione O-ring (pos.5) nella propria sede nel coperchio di chiusura (pos.2).

STEP 45

Mount the O-ring (pos.5) into its groove in the cover (pos.2).

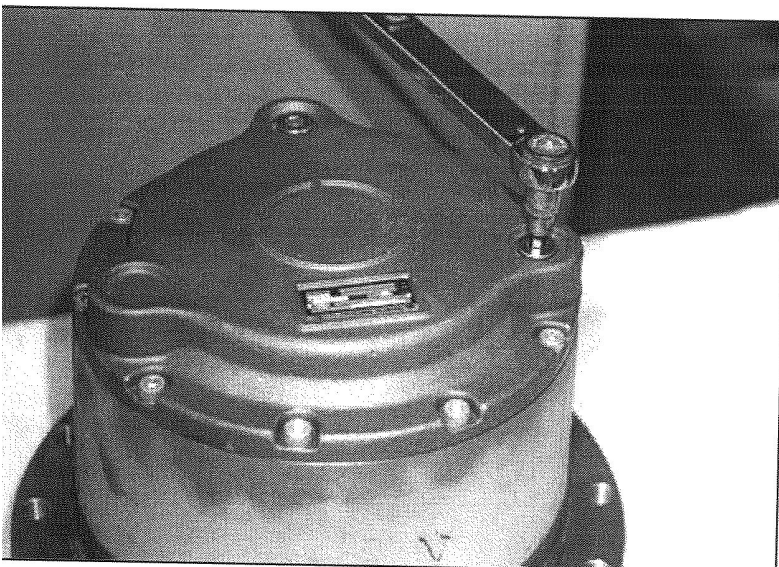


FASE 46

Posizionare il coperchio di chiusura (pos.2) sul corpo riduttore (pos.15) e fissarlo tramite le 10 viti TCEI M10x25 (pos.1), classe di resistenza 12.9, serrate con una chiave dinamometrica alla coppia di 7,5 daNm.

STEP 46

Place the cover (pos.2) on the gearbox housing (pos.15) and fix it through 10 socket head screws M10x25 (pos.1) grade 12.9, tightened by a torque wrench at a torque of 7,5 daNm.



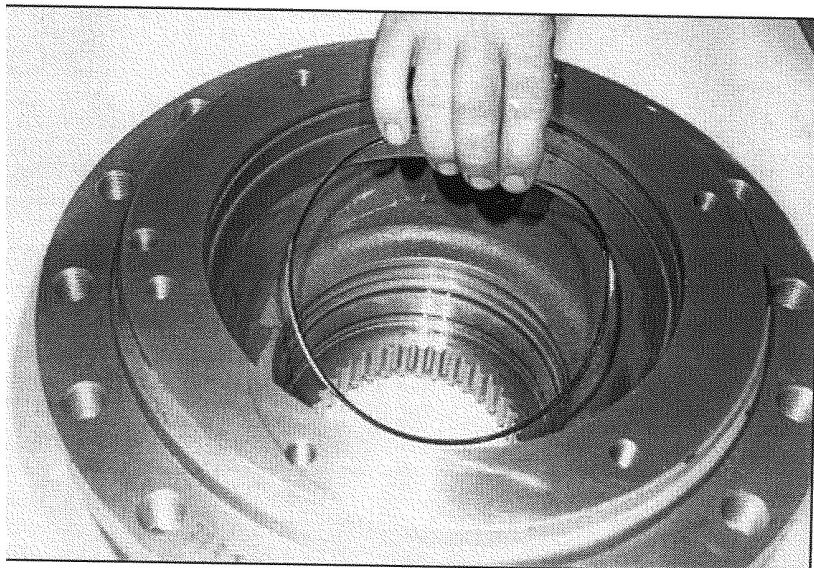
FASE 47

Inserire le rondelle (pos.3) e serrare i tappi M22x1,5 (pos.4) con una chiave dinamometrica alla coppia di 6-8 daNm.

STEP 47

Mount the washers (pos.3) and tighten the plugs M22x1,5 (pos.4) by a torque wrench at a torque of 6-8 daNm.

-RIMONTAGGIO / REASSEMBLING-

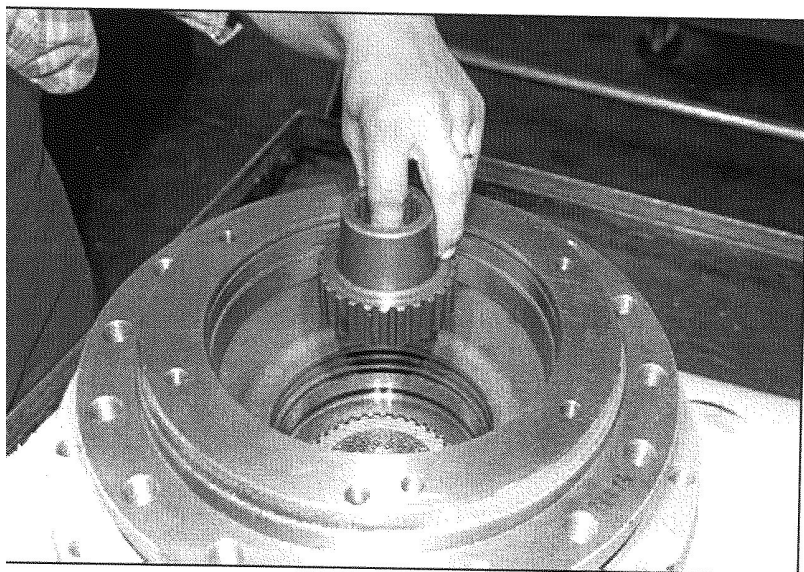


FASE 48

Applicare nelle sedi delle guarnizioni del mozzo flangiato (pos.18) uno strato di grasso e montare gli O-ring (pos.28-29).

STEP 48

Apply in the internal seal's grooves of the flanged hub (pos.18) a coat of grease, and insert the O-rings (pos.28-29).

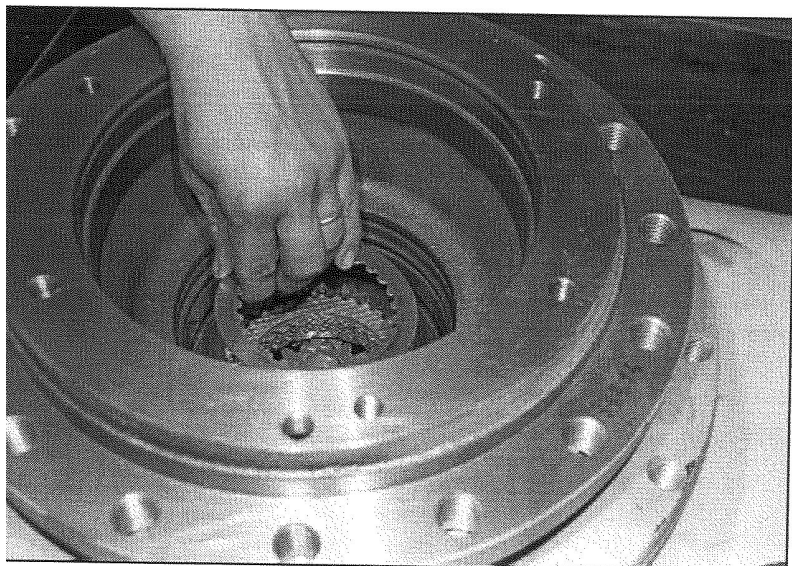


FASE 49

Montare l'albero freno (pos.27).

STEP 49

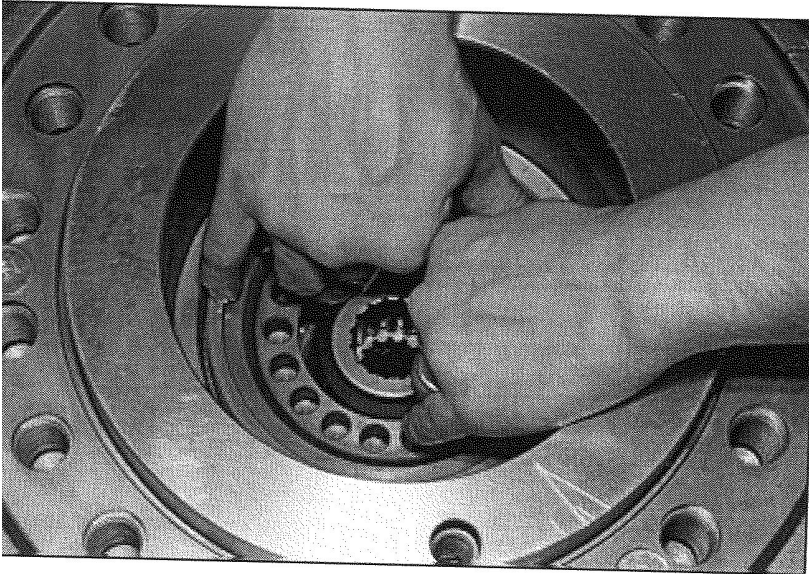
Assemble the brake shaft (pos.27).



FASE 50 Montare un pacco nuovo di dischi freno secondo il seguente ordine: inserire per primo un disco in bronzo sinterizzato (pos.26) a dentatura esterna. Inserire successivamente un disco in acciaio (pos.25) a dentatura interna. Ripetere l'operazione sino ad ottenere una successione di n°6 dischi in bronzo sinterizzato e n°5 in acciaio.

STEP 50 *Assemble a new brake discs package according to the following order: firstly insert an external toothed sintered bronze disc (pos.26). Then insert, an internal toothed steel disc (pos.25). Repete the operation untill reaching the number of 6 sintered bronze and 5 steel discs.*

-RIMONTAGGIO / REASSEMBLING-

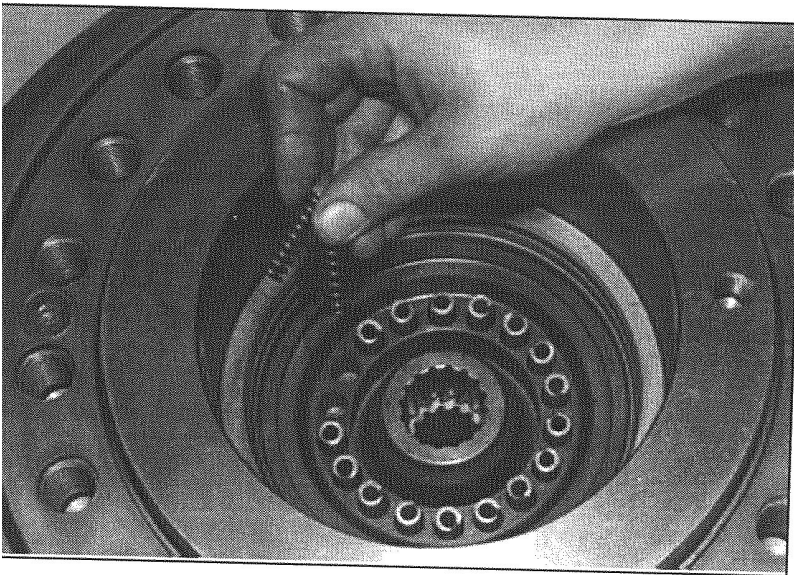


FASE 51

Inserire il pistone freno (pos.23) all'interno del mozzo flangiato (pos.18) facendo attenzione a non danneggiare le guarnizioni precedentemente montate.

STEP 51

Insert the brake piston (pos.23) inside the flanged hub (pos.18), paying attention not to damage the seals already fitted.

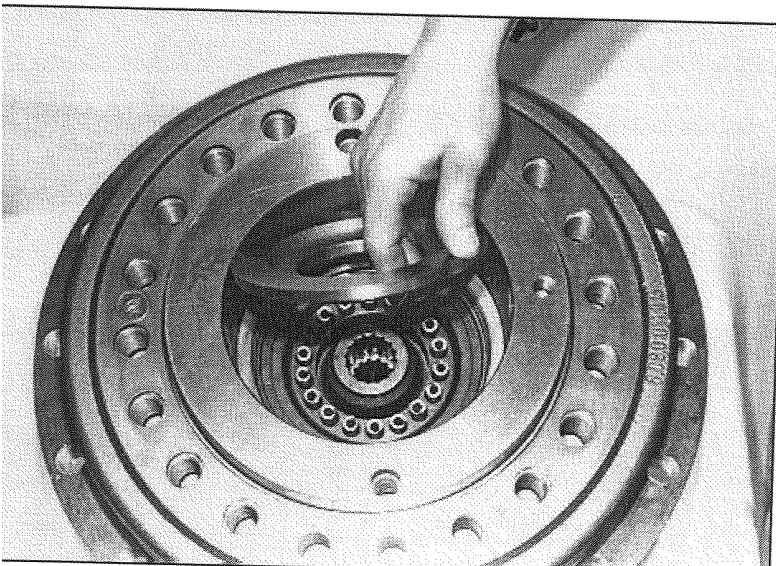


FASE 52

Inserire le molle (pos.22) nelle sedi del pistone freno (pos.23).

STEP 52

Insert the springs (pos.22) into the grooves in the brake piston (pos.23).



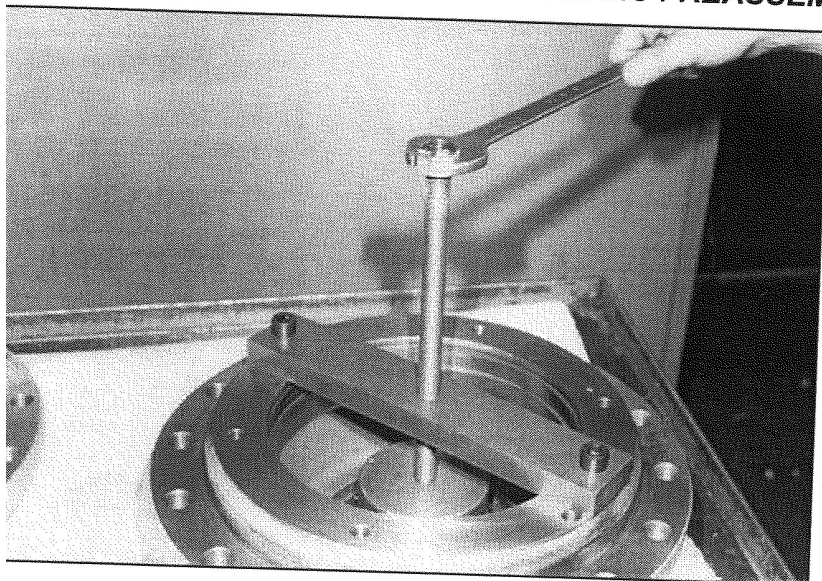
FASE 53

Inserire il disco spingimolle (pos.21).

STEP 53

Insert the springs retainer (pos.21).

-RIMONTAGGIO / REASSEMBLING-

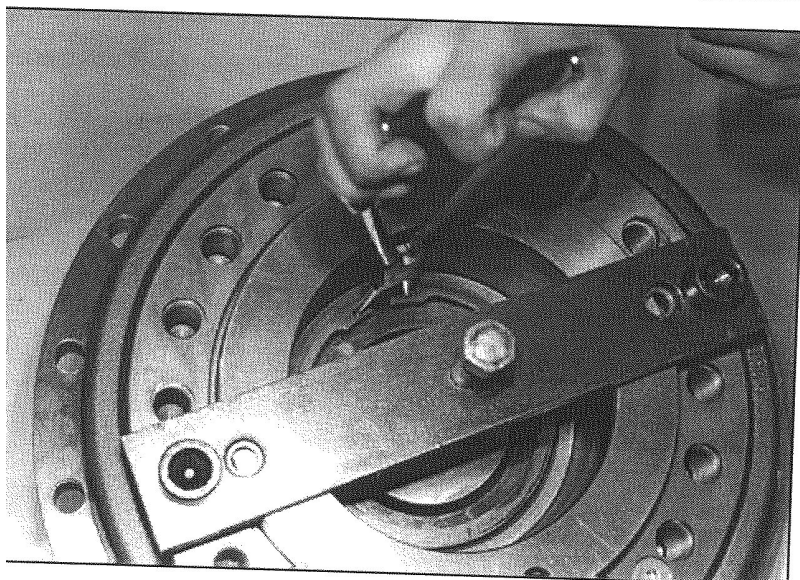


FASE 54

Fissare l'attrezzatura AT709C15 al mozzo flangiato (pos.18) e avvitare la vite filettata fino a quando il disco spingimolle (pos.21) non e' sceso al di sotto della sede dell' anello elastico (pos.20).

STEP 54

Fixed the equipment AT709C15 to the flanged hub (pos.18) and srew the threaded screw up the springs retainer disc (pos.21) is lowered below the circlip groove (pos.20).

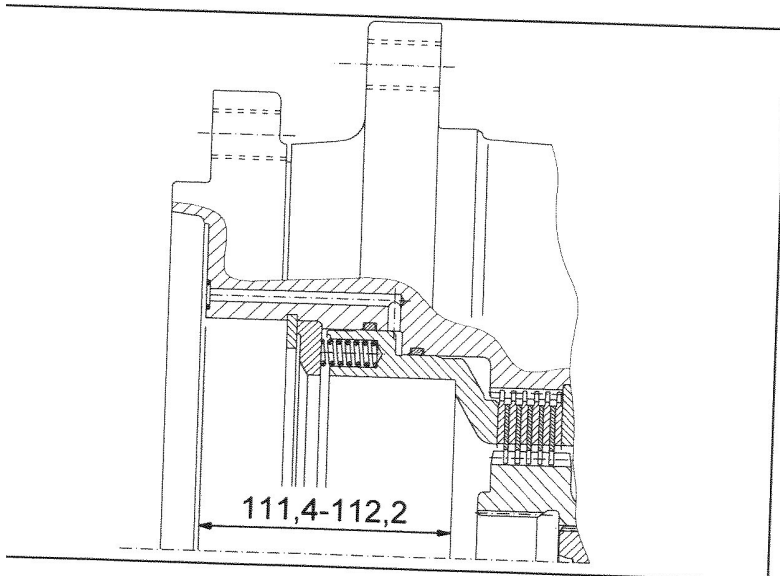


FASE 55

Con l'aiuto di pinze, montare l'anello elastico (pos.20) nella propria sede.

STEP 55

Through pliers, assemble the circlip (pos.20) into its groove.



FASE 56 **Nota**

Prima di montare il motore idraulico, verificare, con un calibro per interni, la quota assiale del riduttore rappresentata dalla battuta del mozzo flangiato (pos.18) con l'albero freno (pos.27).

Quota assiale = 111,4-112,2 mm

STEP 56 **Note**

After mounting the hydraulic motor, verify, trough a depth slide gauge, the axial dimension of the gearbox measured by input side of the flanged hub (pos.18) to the brake shaft (pos.27).

Axial dimension = 111,4-112,2 mm

9.0 CONTROLLO FRENO

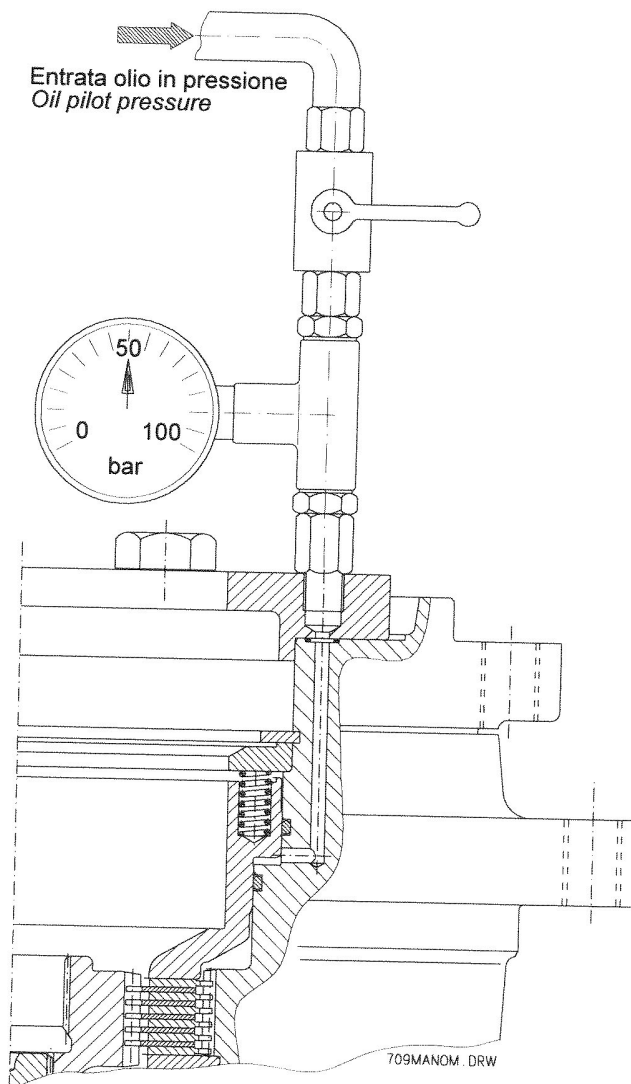
Per verificare il corretto assemblaggio del gruppo freno, e' necessario effettuare una prova di tenuta delle guarnizioni. Collegare il foro di comando freno ad una pompa e sbloccare il freno immettendo olio in pressione. Con l'ausilio di un manometro verificare che la pressione non diminuisca (vedi dis.9). In caso contrario le guarnizioni di tenuta del freno perdono olio ed e' necessario rimontare il gruppo freno e provvedere alla loro sostituzione.

Dati prova: **Pressione olio = 50 bar**
Durata della prova = 3 minuti

9.0 BRAKE CHECK

In order to verify the correct assembly of the brake group, it is necessary to carry out a test of the seal rings. Connect the brake port to a pump and release the brake by pumping oil. By means of a pressure gauge verify that the pressure does not decrease (see dwg.9). In Otherwise case, the seal rings of the brake leak oil and it is necessary to disassembly the brake and provide for their replacement.

Test data: **Oil pressure = 50 bar**
Test duration = 3 minutes



Dis.7 - Verifica del corretto assemblaggio del freno

Dwg.7 - Correct brake assembly check

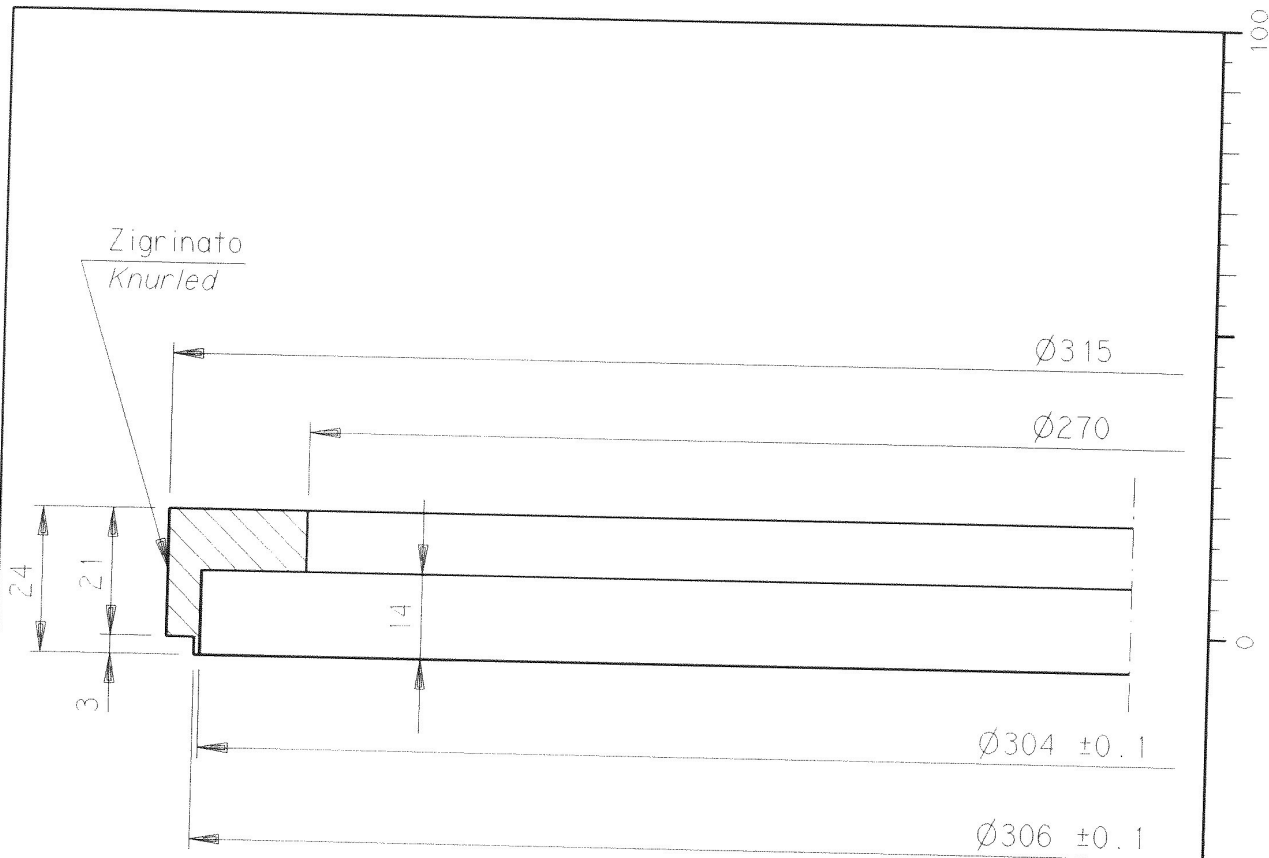
FASE 57

Al termine delle operazioni rimontare il motore idraulico completo della sua guarnizione O-ring (pos.19), fissandolo al riduttore con le 2 viti TE M20x50 (pos.24), classe di resistenza 8.8, serrate ad una coppia di 41,5 daNm. Effettuare il riempimento olio come illustrato al paragrafo 4.2.

STEP 57

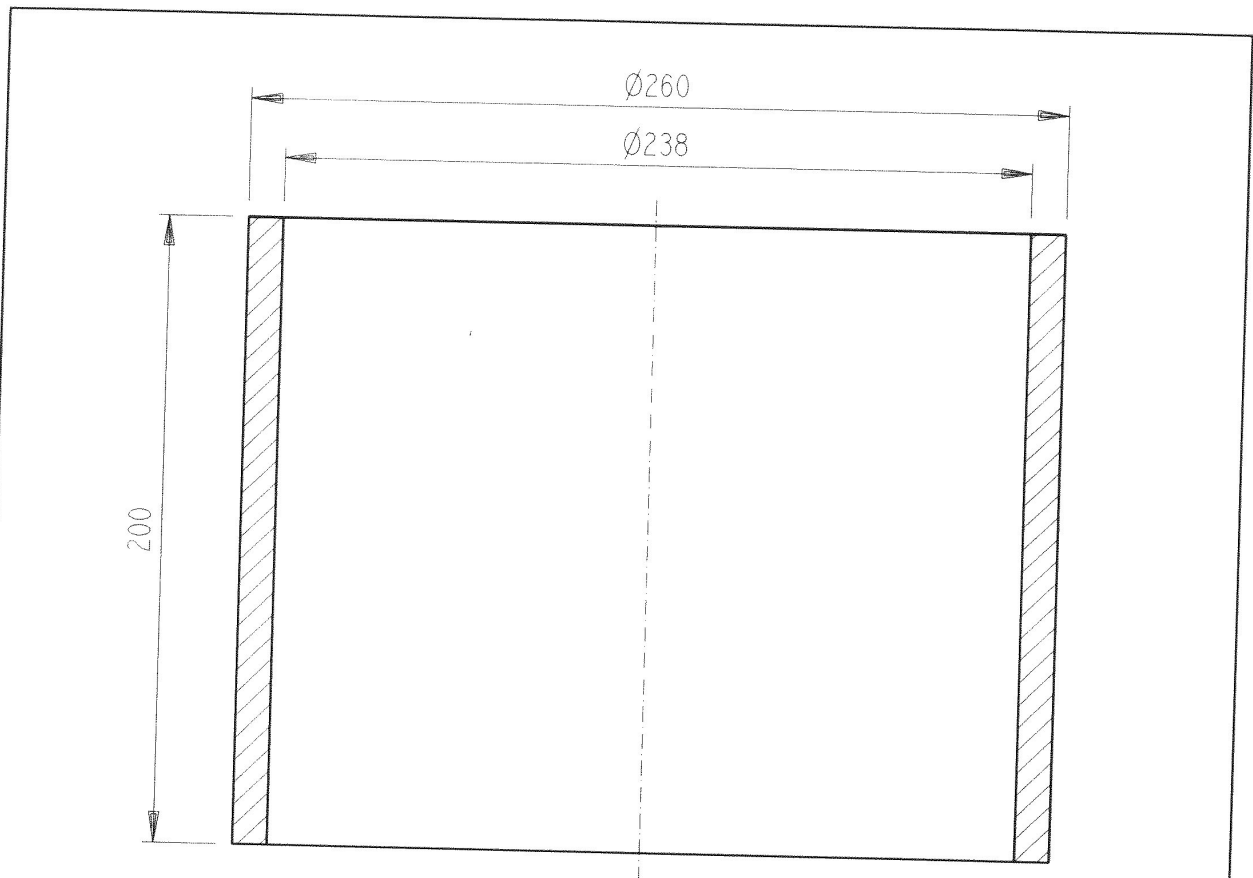
After having reassembled the gearbox, fit the hydraulic motor (taking care to include the O-ring pos.19), through 2 fixing screws M20x50 (pos.24), grade 8.8 tightened at a torque of 41,5 daNm. Fill the gearbox with the lubricant oil as shown in section 4.2.

10 Fixture drawings and schemes



TOOL FOR HALF SEALS MOUNTING
TRACK DRIVES 709C3B-710C3K

TRASMITAL BONFIGLIOLI DIVISIONE della BONFIGLIOLI RIDUTTORI S.p.A.		Gruppo Bonfiglioli		TRATT. TERMICO/HEAT TREATMENT	
OGGETTO/OBJECT: ANELLO DI MONTAGGIO					
TENUTE FRONTALI PER RIDUTTORE 709C3B-710C3K					
TOGLIERE GLI SPIGOLI CON SMUSSI O RAGGI TAKE AWAY EDGES WITH CHAMFER OR RADIUS 0.5		☒ DISEGNO CAD: Modificare solo con uso del CAD --- NOTE GENERALI//GENERAL NOTES --- VALORI GENERALI PER QUOTE PRIVE DI TOLLERANZA. SMUSSI E RAGGI COMPRESI GENERAL VALUES FOR DIMENSIONS WITHOUT TOLERANCES. CHAMFER AND FILLETS FILETTATURE PRIVE DI TOLLERANZA DA ESEGUIRE IN: H6-g6 THREADS WITHOUT TOLERANCE HAVE TO BE DONE:		RESISTENZA/ULTIMATE STRENGTH	
TOLLERANZE TOLERANCES		± 0°6'		PROFONDITA'/DEPTH	
DISEGNO TRASMITAL VIETATA LA DIFFUSIONE SENZA AUTORIZZAZIONE TRASMITAL DRAWING PROPERTY AND USABLE ONLY UNDER TRASMITAL AUTORIZATION		DISEGNATORE/DRAWN BY: Cignani P. SCALA/SCALE: 1:1 CONTROLLO/CHECKED BY:		DUREZZA/HARDNESS	
		DATA/DATE: 02/05/95		N° DISEGNO/DRAWING Nbr	
MATERIALE/MATERIAL: C40		COD. ATTREZZ/TOOL CODE: 033.212.911		CODICE FILE/FILE CODE: AT709C07.DRW AT709C07	



*TUBE GUIDE FOR FITTING MAIN BEARING
AND HOUSING TO THE GEARBOX 709C3B*



				☐ SI
				☐ NO
				☐ SI
				☐ NO
Espon. Mod.	Mod. n. Cl. mod.	DESCRIZIONE MODIFICA	Data Firma	Sost. Micro



TRASMITAL BONFIGLIOLI

S.p.A. Gruppo Bonfiglioli

OGGETTO:

**TUBO PER MONTAGGIO RICAMBIO
CORPO CON CUSCINETTO RID. 709C3B**

TRATTAMENTO TERMICO

- NOTE GENERALI -

Valori generali
per quote prive
di tolleranza
smussi e raggi
compresi

J13-j13

☒ DISEGNO CAD: Modificare solo con uso del CAD

Emesso con

DISEGNATORE

SALAROLI

SCALA

1:2

CONTROLLO

MATERIALE

Q.TA

STATO

Resistenza

Profondità

Durezza

DATA

10.07.1991

Togliere gli spigoli
con smussi
o raggi

0.5

TOLLERANZE

± 0.06

DISEGNO TRASMITAL
vietata la diffusione
senza autorizzazione

PESO FINITO

PESO GREZZO

COD. FILE

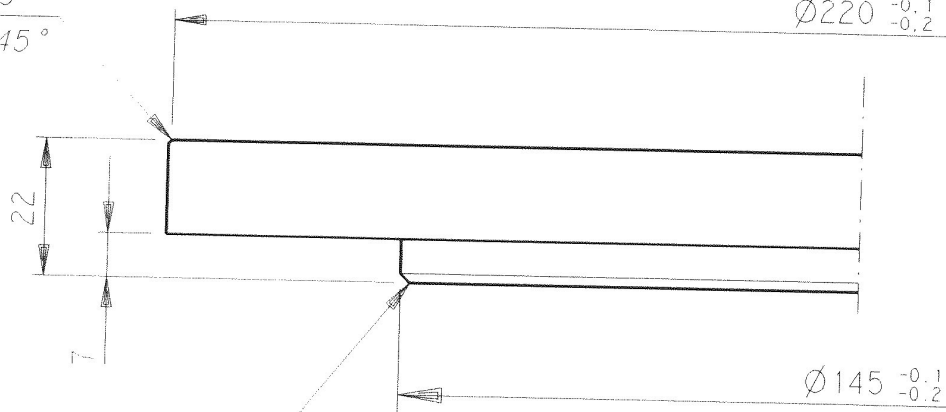
AT709C09.DRW

N. DISEGNO/DRAWING

AT709C.09

SMUSSO 1x45°

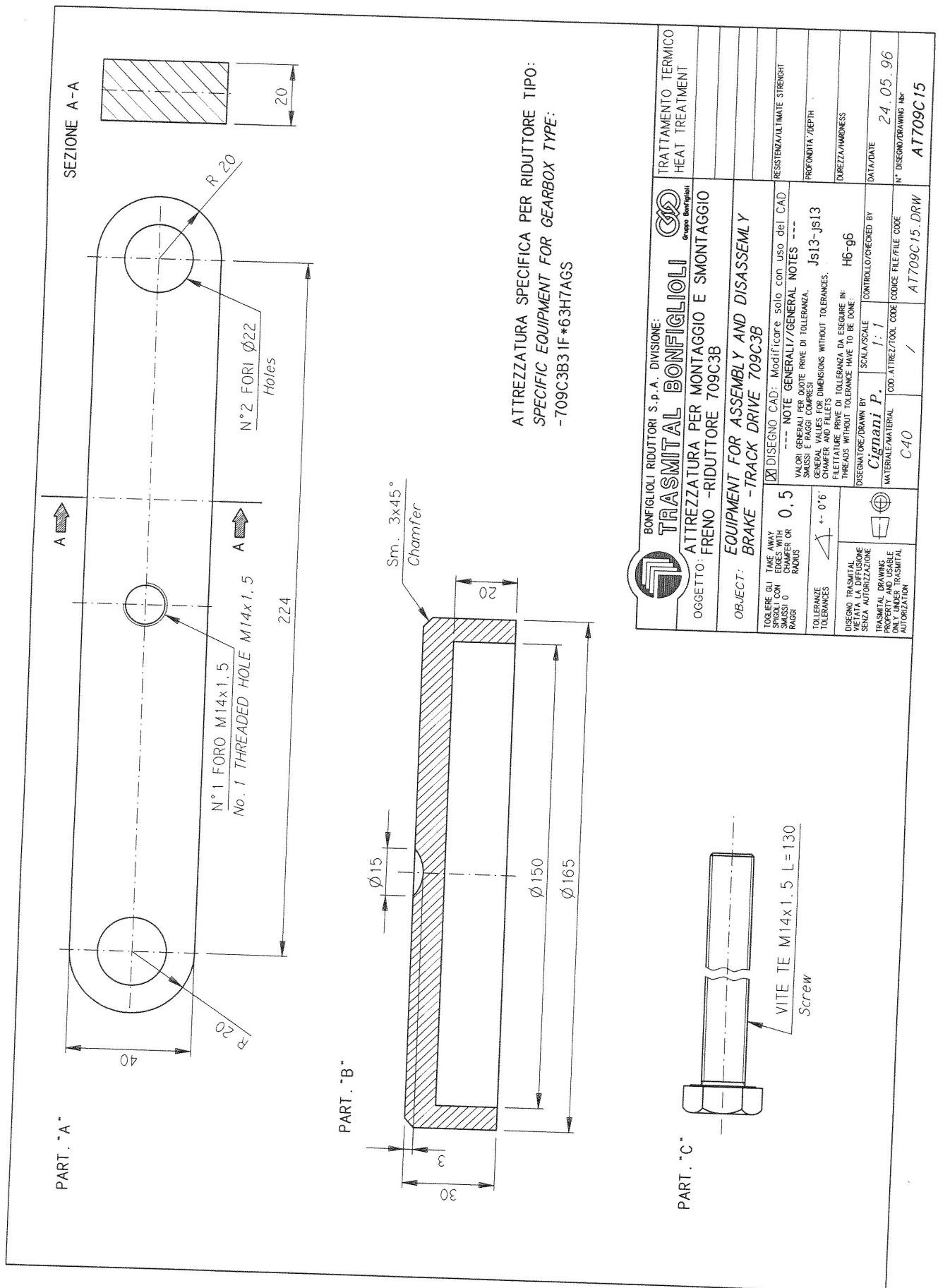
CHAMFER 1:45°



SMUSSO 1.5x45°

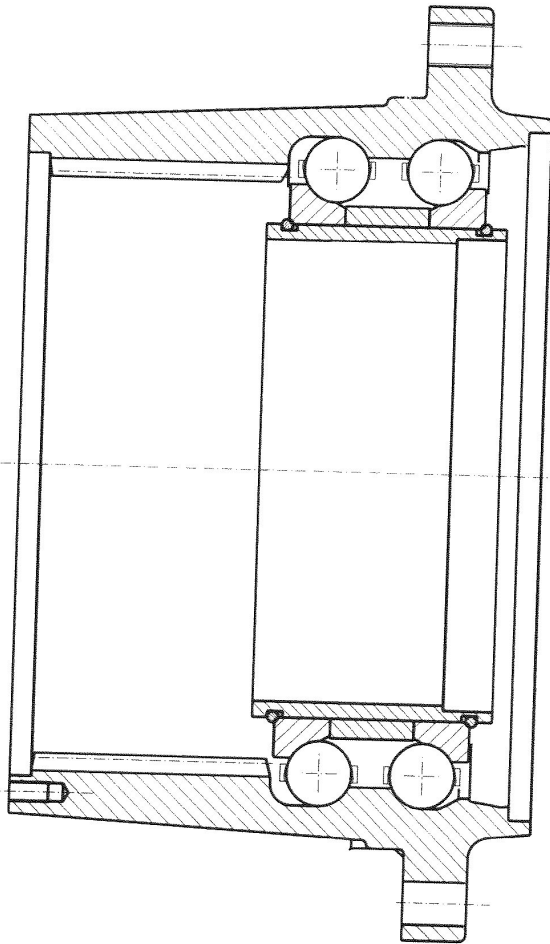
CHAMFER 1:45°

 BONFIGLIOLI RIDUTTORI S.p.A. DIVISIONE: TRASMITAL BONFIGLIOLI				TRATTAMENTO TERMICO HEAT TREATMENT	
OGGETTO: FLANGIA PER MONTAGGIO CORPO RIDUTTORE CON CUSCINETTO -RID. 709C3B30F-709C3B31F					
OBJECT: FLANGE FOR GEARBOX HOUSING AND MAIN BEARING FITTING -TRACK DRIVE 709C3B30F-31F					
TOGLIERE GLI SPIGOLI CON SMUSO O RAGGI		TAKE AWAY EDGES WITH CHAMFER OR RADIUS		0.5	
TOLLERANZE TOLERANCES		 ± 0°6'		☒ DISEGNO CAD: Modificare solo con uso del CAD --- NOTE GENERALI//GENERAL NOTES --- VALORI GENERALI PER QUOTE PRIVE DI TOLLERANZA, SMUSO E RAGGI COMPRESI GENERAL VALUES FOR DIMENSIONS WITHOUT TOLERANCES, CHAMFER AND FILLETS FILETTATURE PRIVE DI TOLLERANZA DA ESEGUIRE IN THREADS WITHOUT TOLERANCE HAVE TO BE DONE:	
DISEGNO TRASMITAL VIETATA LA DIFFUSIONE SENZA AUTORIZZAZIONE TRASMITAL DRAWING PROPERTY AND USABLE ONLY UNDER TRASMITAL AUTORIZATION		DISEGNATORE/DRAWN BY Cignani P.		SCALA/SCALE 1:1	
		CONTROLLO/CHECKED BY		DATA/DATE 29.05.96	
MATERIALE/MATERIAL C40		COD. ATTREZZ/TOOL CODE /		CODICE FILE/FILE CODE AT709C13.DRW	
				N° DISEGNO/DRAWING Nbr AT709C13	



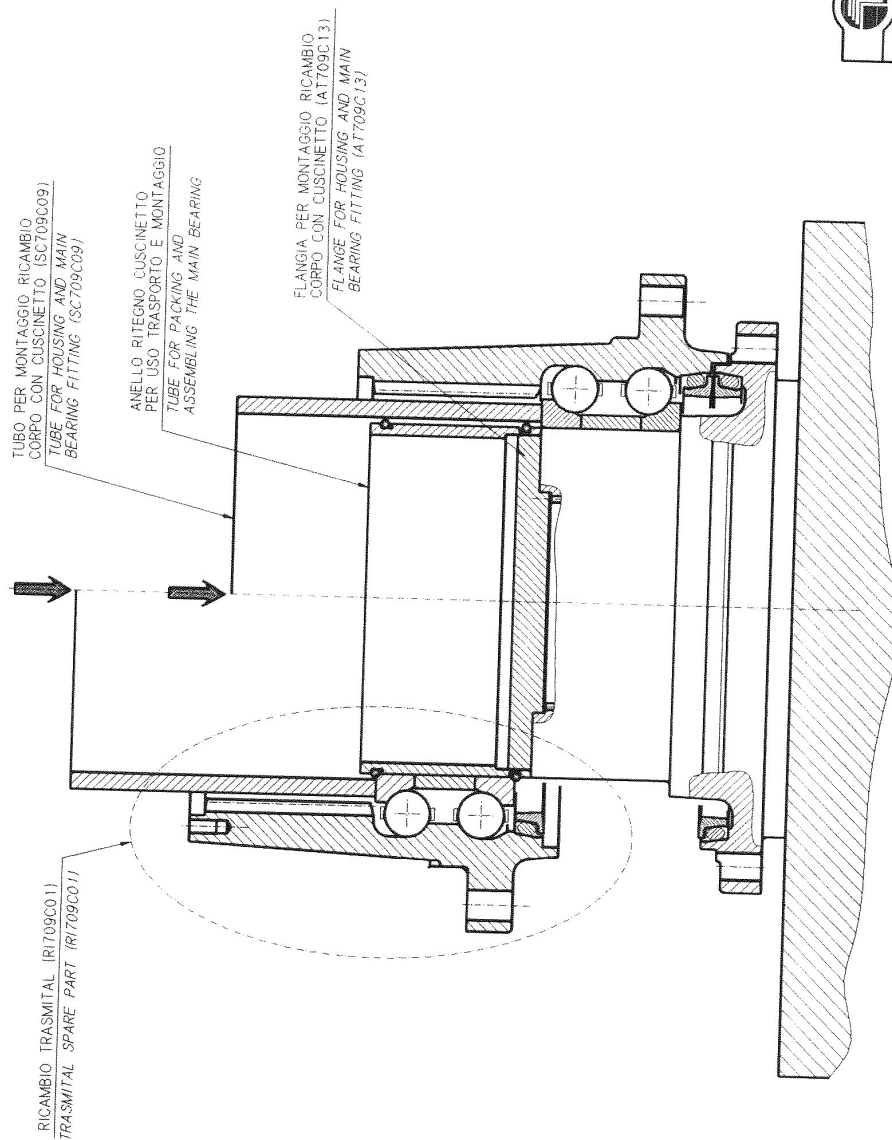


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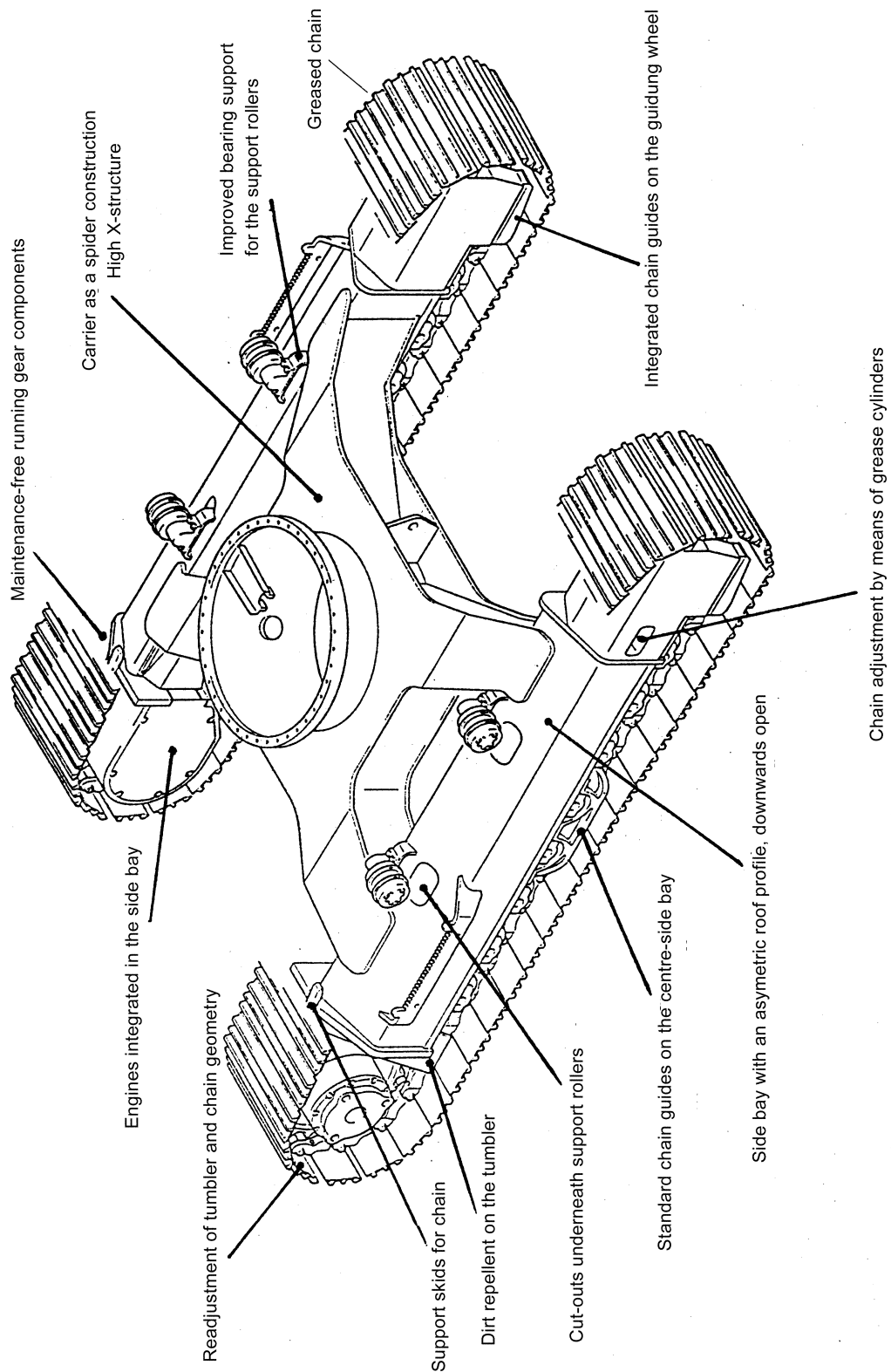


SPARE PART INCLUDING HOUSING AND
MAIN BEARING GEARBOX 709C3B-30F-31F

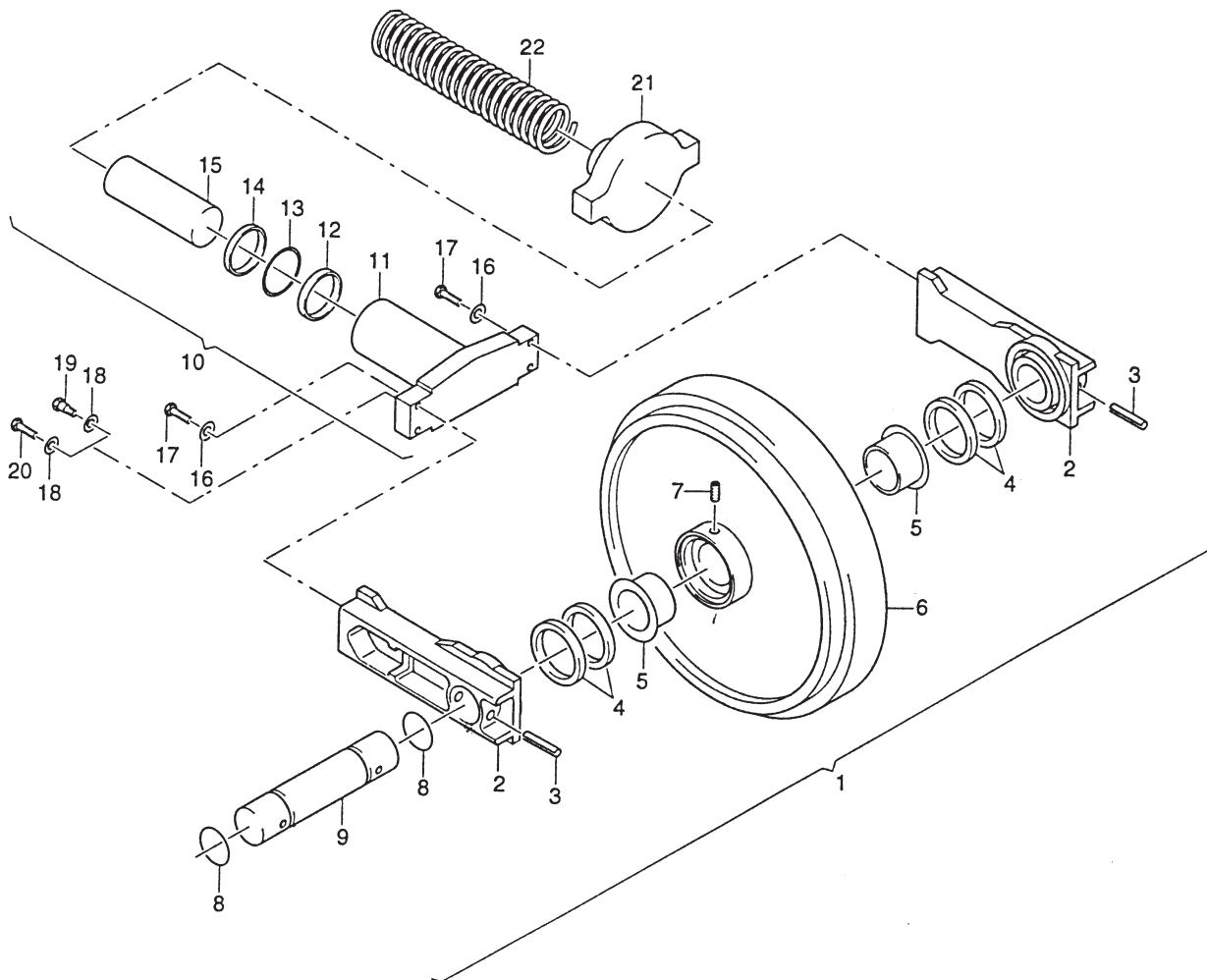
 TRASMITAL BONFIGLIOLI DIVISIONE della BONFIGLIOLI RIDUTTORI S.p.A. Oggetto: Riduttore		TRATT. TERMICO/HEAT TREATMENT	
CUSCINETTO RIDUTTORE 709C3B-30F-31F		RESISTENZA/ULTIMATE STRENGTH	
TOLLERANZE DI TAKE AWAY SPECIFICHE PER SMUSI 0 RAGGI 0 RADIUS 0.5		PROFONDITA' /DEPTH	
TOLLERANZE TOLERANCES ± 0.5		DUREZZA/HARDNESS	
DISEGNO TRASMITAL SENZA AUTORIZZAZIONE THIS DRAWING IS TRASMITAL PROPERTY AND USABLE ONLY UNDER TRASMITAL AUTORIZATION		DATA/DATE	
DISEGNO CAD: Modificare solo con uso del CAD --- NOTE GENERALI//GENERAL NOTES --- VALORI GENERALI GENERAL VALUES PER QUOTE PRIVE FOR DIMENSIONS DI TOLLERANZA, WITHOUT TOLERANCES, SMUSI E RAGGI CHAMFERS AND COMPRESI FILLETS		N° DISEGNO/DRAWING N°	
DISEGNATORE/DRAWN BY CIGNANI P.		09/06/94	
SCALA/SCALE 1:2		R709C.01	
MATERIALE/MATERIAL C40		R709C01.DRW	
CODICE FILE/FILE CODE R709C01.DRW			

[illegible]

11 Substructure general view



12 Idler unit B60



- | | | | |
|----|----------------------|----|-------------------|
| 1 | IDLER W SLIDER D6 | 12 | U-RING |
| 2 | SLIDER | 13 | THRUST RING |
| 3 | ADAPTOR SLEEVE | 14 | WIPER SEAL |
| 4 | PACKING LIFETIME | 15 | PISTON |
| 5 | BUSH | 16 | SPRING WASHER A3C |
| 6 | IDLER | 17 | BOLT A3C |
| 7 | PLUG A3C | 18 | GASKET |
| 8 | O-RING | 19 | GREASE NIPPLE |
| 9 | AXLE | 20 | BOLT A3C |
| 10 | HYDRAULIC ADJUST RAM | 21 | SPRING PLATE |
| 11 | RAM | 22 | SPRING |

Chapter 12

Cylinder

Contents

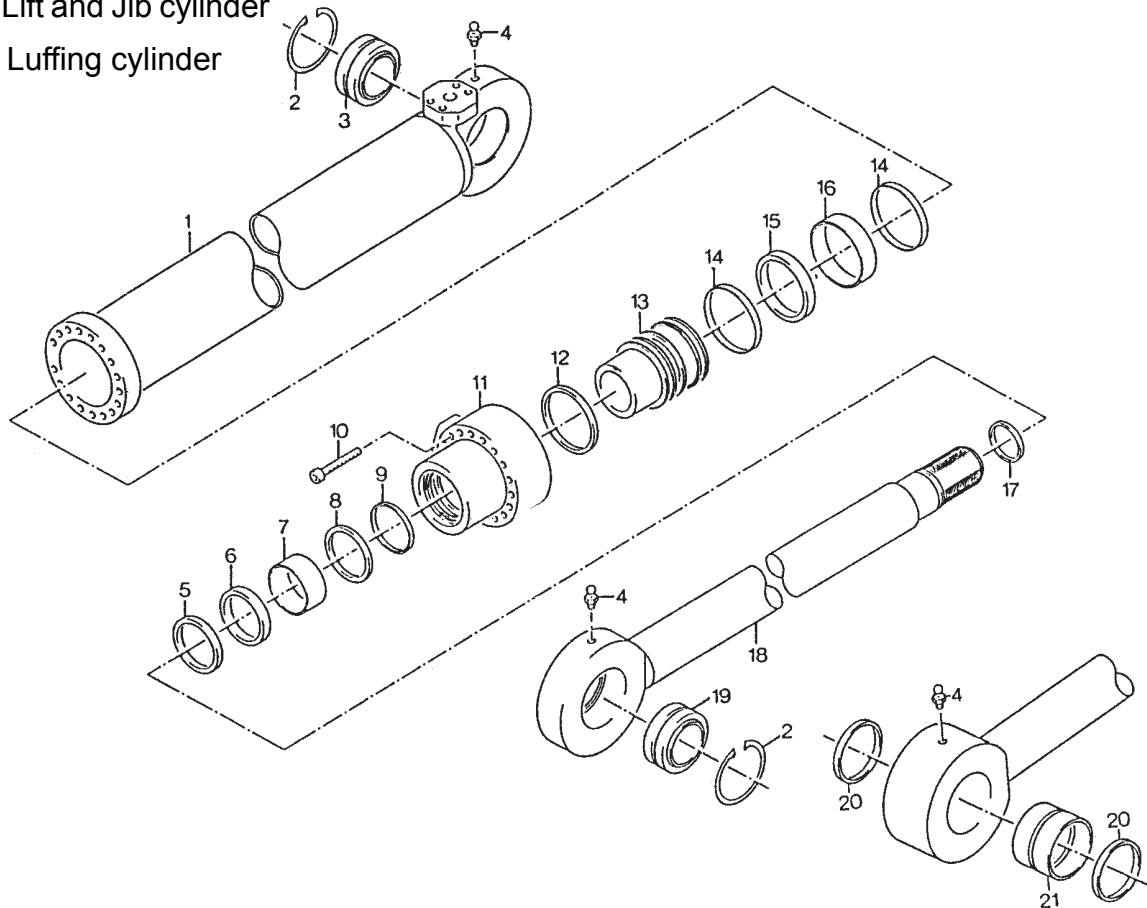
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2	Assembly	3
2.1	Spherical bearing	3
2.2	Piston rod with brass bush	3
2.3	Cylinder nut Ø 100mm, Ø 105mm, Ø 140mm	3
2.4	Ø 140 mm Cylinder nut (first design)	5
2.5	Piston	7
2.6	Cylinder assembly.....	8

1 General view

Ø 100 mm Bucket cylinder

Ø 105 mm Lift and Jib cylinder

Ø 140 mm Luffing cylinder



- | | |
|---------------------|------------------------|
| 1 Cylinder tube | 12 PUR - profile ring |
| 3 Spherical bearing | 13 Piston |
| 4 Grease nipple | 14 Guide ring |
| 5 Wiper seal | 15 Comp. - piston pack |
| 6 U - ring | 16 Guide bush |
| 7 Guide bush | 17 PUR - profit ring |
| 8 Rod packing | 18 Piston rod |
| 9 Guide ring | 19 Spherical bearing |
| 10 Allen screw | 20 Wiper seal |
| 11 Cylinder nut | 21 Bush |

Necessary mounting tools :

Ø 100 mm Cylinder

Socket wrench, order no. 4500365

Assembly sleeves

Ø 105 mm Cylinder

Socket wrench, order no. 4500376

Ø 140 mm Cylinder

Socket wrench, order no. 3183619

2 Assembly



NOTE

Oil must be applied to various parts before assembly. Use hydraulic oil only.

2.1 Spherical bearing



NOTE

When installing the spherical bearing, always make sure that lubrication point (1) is located in the cylinders load zone (L).

1. Figure F1:
Insert a circlip and press or drive in the oiled spherical bearing.
2. Figure F1:
Check function of lubrication point (3).

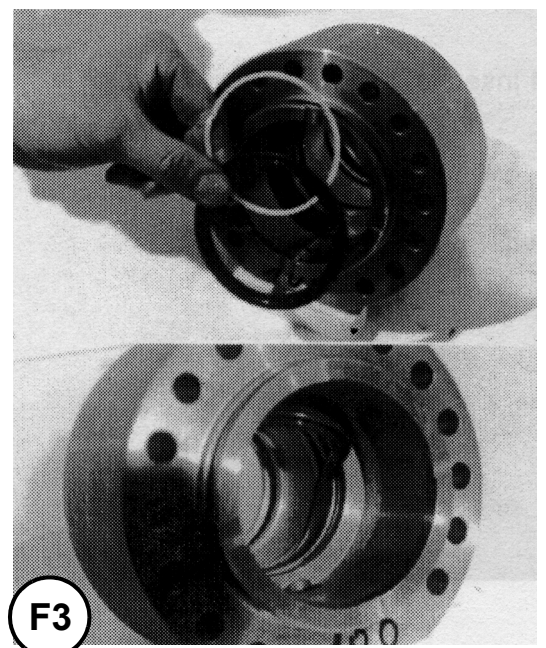
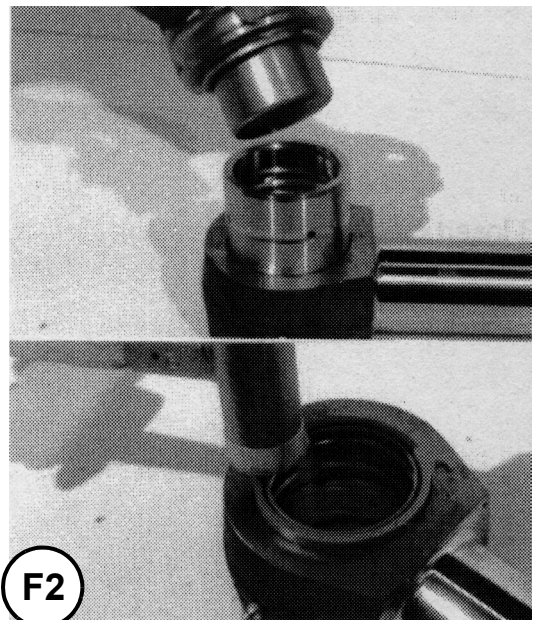
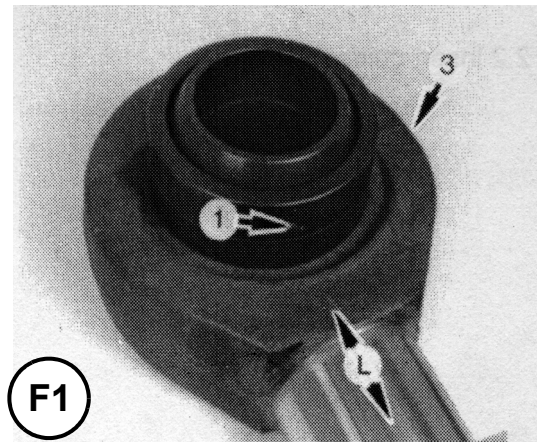
2.2 Piston rod with brass bush

3. Figure F2:
Press in oiled brass bush and both wiper seals.

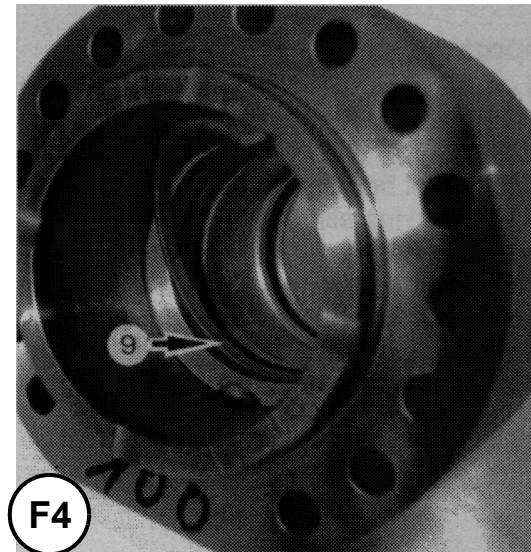
2.3 Cylinder nut

Ø 100mm, Ø 105mm, Ø 140mm

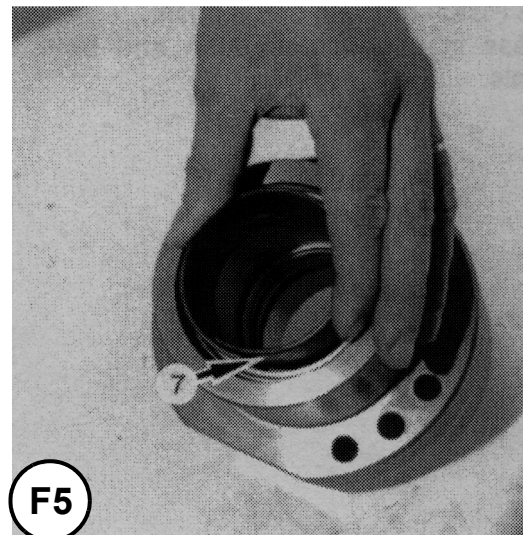
4. Figure F3:
Assembly the PUR profil ring.



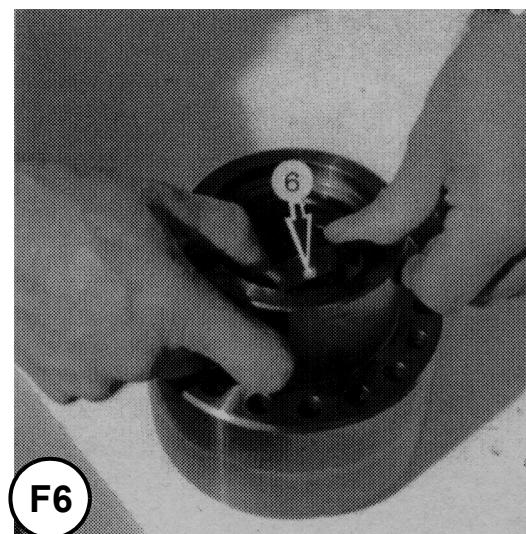
5. Figure F4:
Insert guide ring (9).



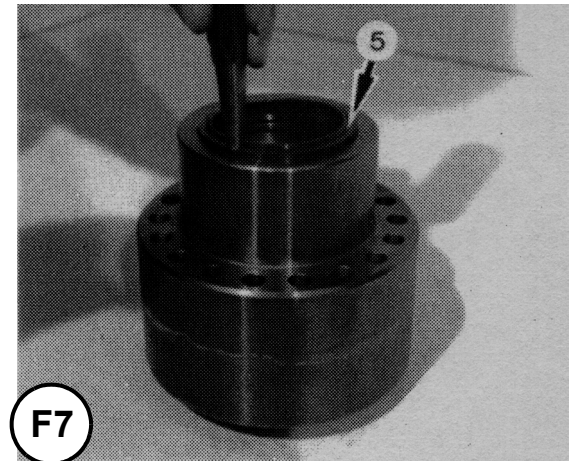
6. Figure F5:
Insert guide bush (7).



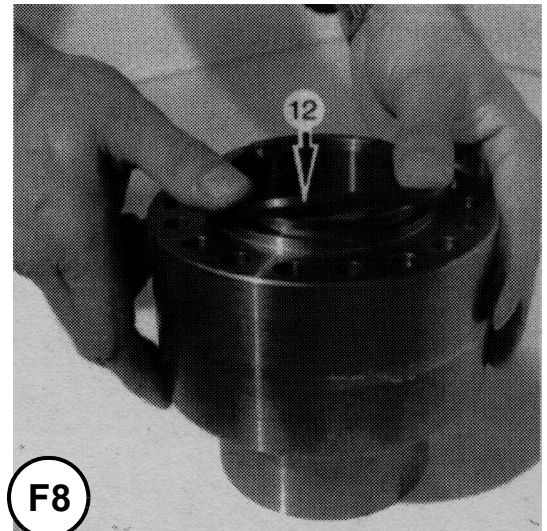
7. Figure F6:
Insert U -ring.



8. Figure F7:
Press or drive in wiper seal (5).

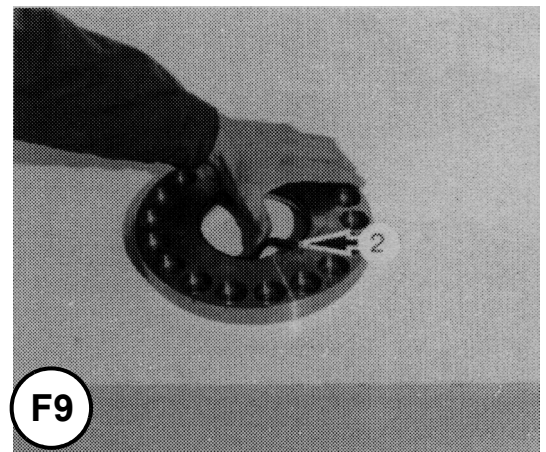


9. Figure F8:
Insert PUR - profile ring (12).

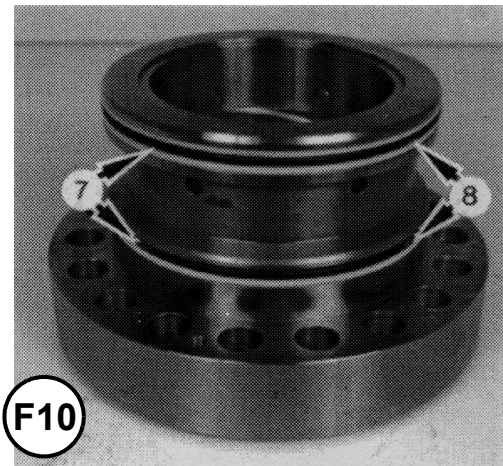


2.4 Ø 140 mm Cylinder nut (first design)

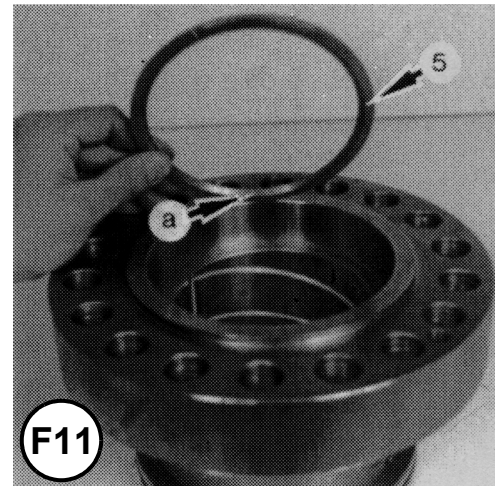
10. Figure F9:
Insert wiper seal (2).



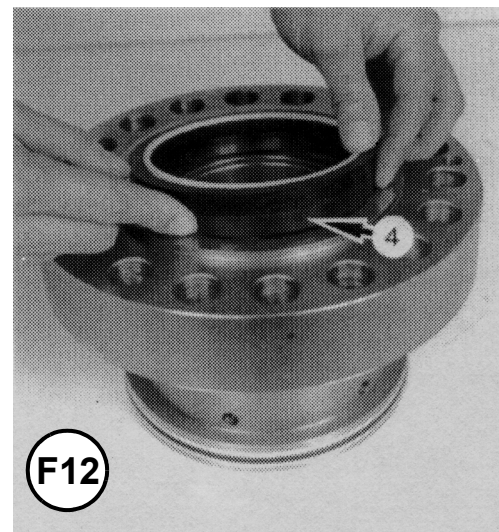
11. Figure F10:
Insert Backing rings (7) and O - rings (8).



12. Figure F11:
Insert washer (5) with chamfer facing to the (brass) guide bush.



13. Figure F12:
Insert compact rod seal (4) with the sealing lip facing (brass) guide bush.



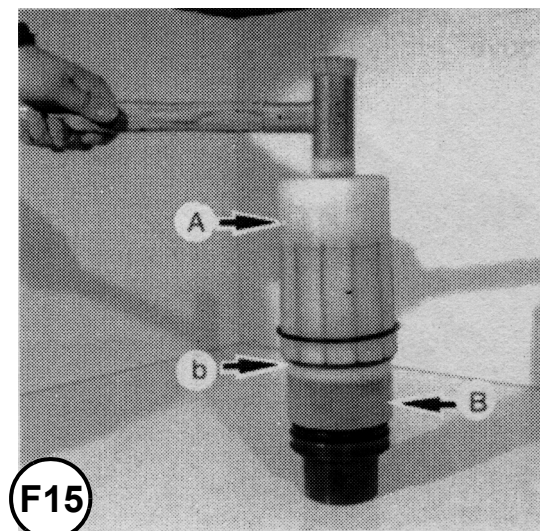
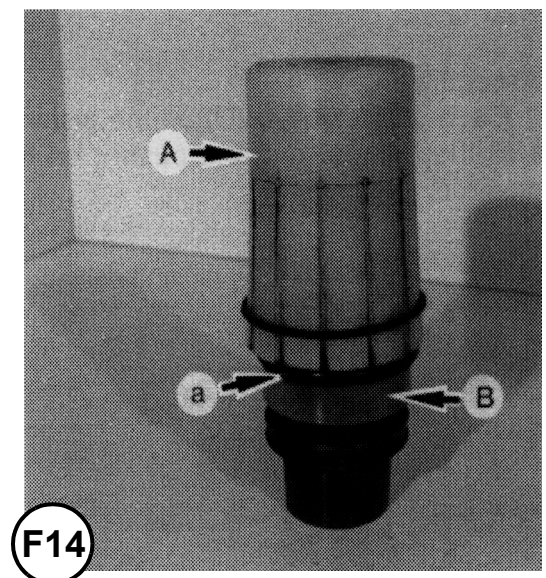
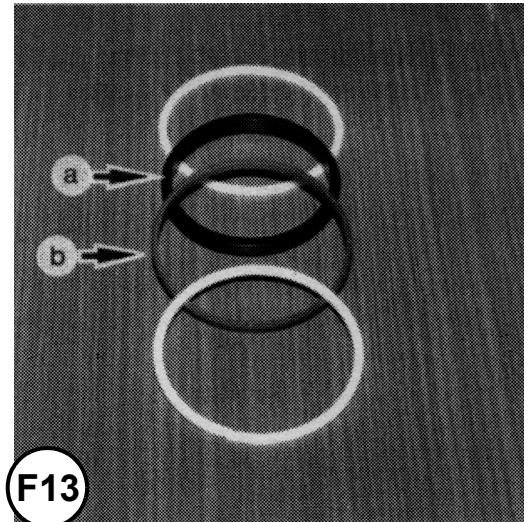
2.5 Piston



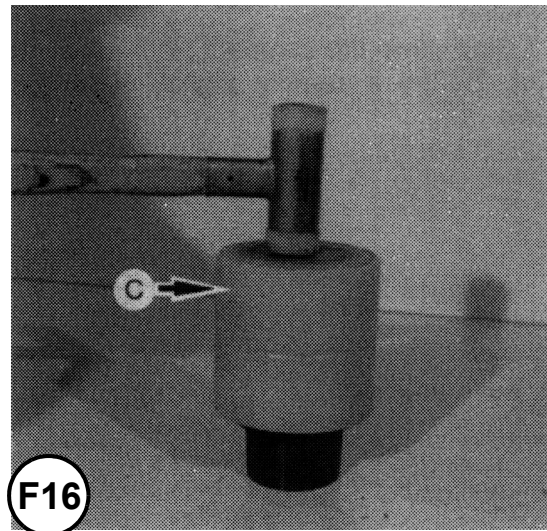
NOTE

Before assembly slightly warm up the seals.

14. Figure F13:
Strip down the compact piston seal, see (15) of general view on page 2.
15. Figure F14:
Force inner seal component (a) on to the piston by pushing spreader sleeve (A) over guide sleeve (B) .
16. Figure F15:
In the same way, force outer seal component (b) on to the piston by pushing spreader sleeve (A) over guide sleeve (B).

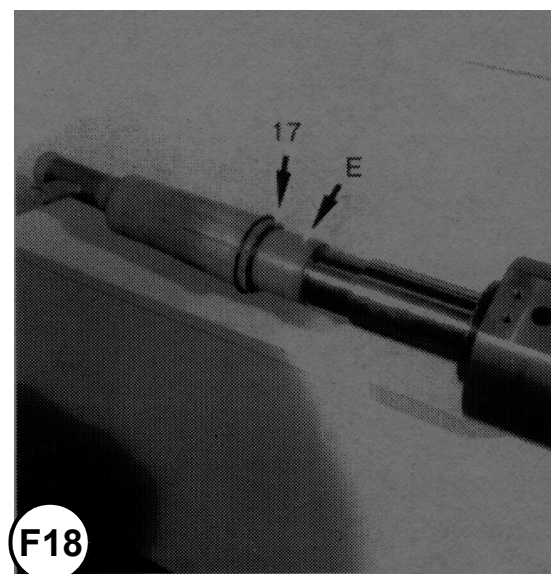
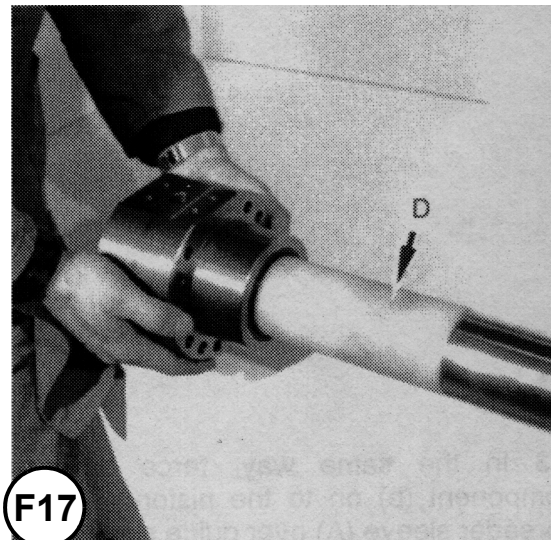


17. Figure F16:
Press outer seal component back to its original shape with assembly sleeve (C).



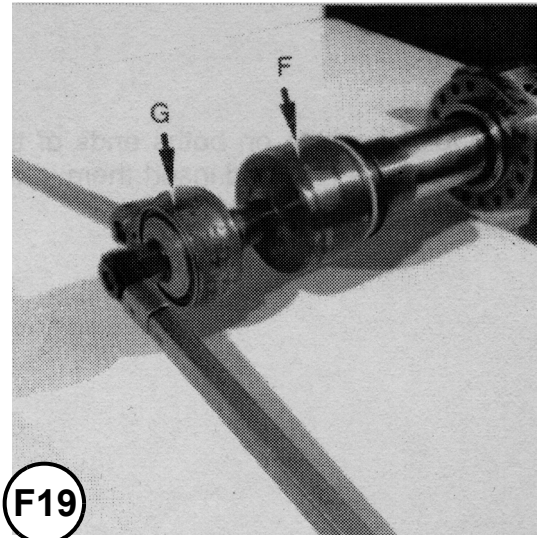
2.6 Cylinder assembly

18. Figure F17:
Place guide sleeve (D) on the piston rod.
19. Figure F17:
Oil all the cylinder nut and push it on to the piston rod.
20. Figure F18:
Attach protective sleeve (E) and push PUR - profile ring (17) in the piston rod groove.



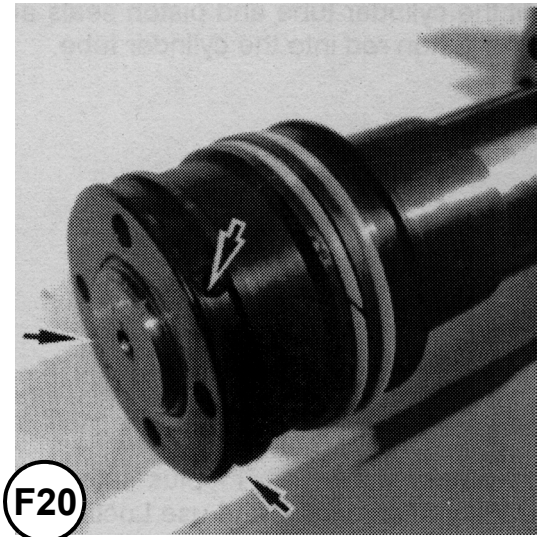
21. Figure F19:
Oil thread of the piston rod.

22. Figure F19:
Screw on
piston with a special socket wrench (F) and
tighten it fully.
Tightening torque 1000Nm.
Use torque multiplier (G).

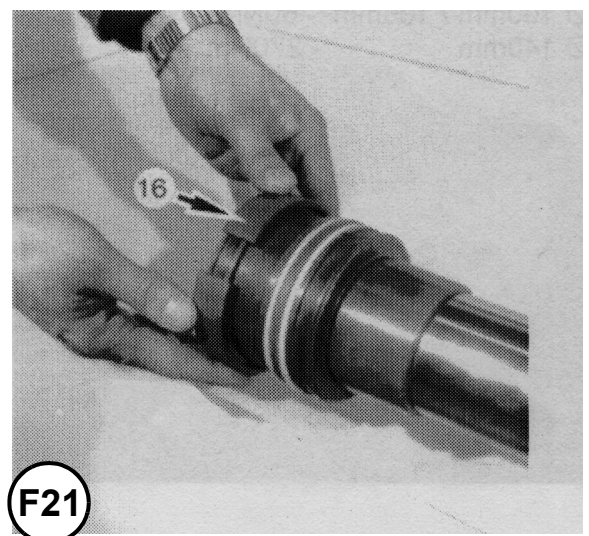


23. Figure F20:
Tighten the 3 safety screws;
always comply with the following
tightening torques:

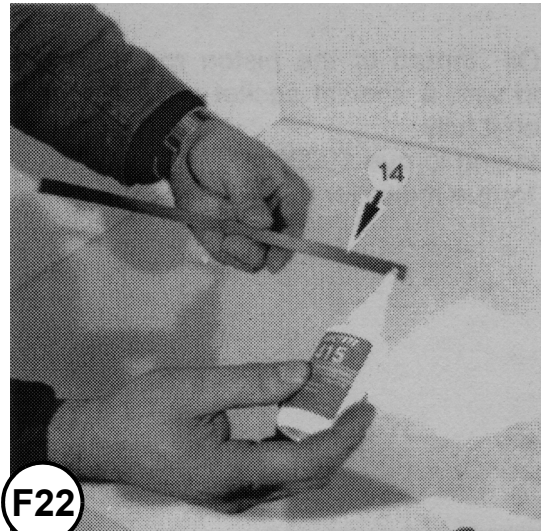
M 8	22 Nm
M 16	120 Nm



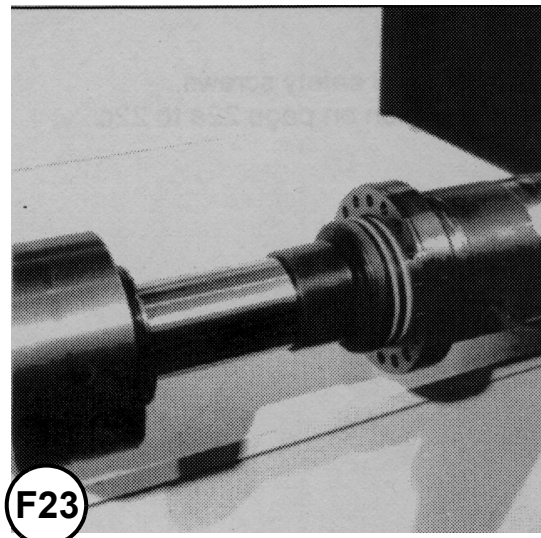
24. Figure F21:
Insert the guide bush (16).



25. Figure F22:
Use Quick Locktite on boths ends of the
guide (band) rings (14) and insert them in
piston groove.

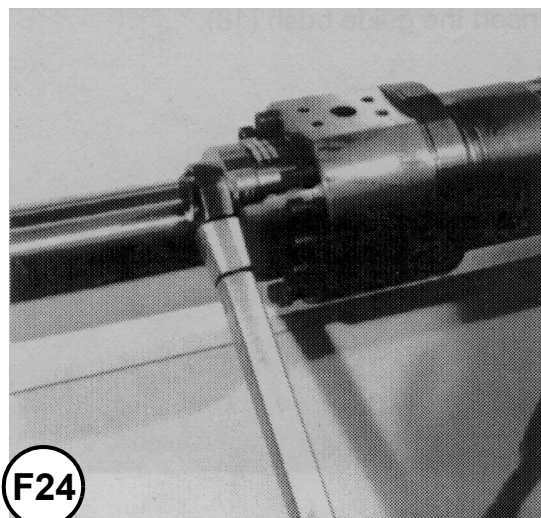


26. Figure F23:
Oil the cylinder tube and piston seals.
27. Figure F23:
Slide the piston rod into the cylinder tube.



28. Figure F24:
Use Allen screw with I - plus safety glue
or ordinary Allen screw and use Loctite 243.
29. Figure F24:
Attach the cylinder nut with cylinder tube by
lighting Allen scews.

Tightening torque:
Ø 100mm / 105mm - 60Nm
Ø 140mm -270Nm



Chapter 13

Air condition system

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1 Safety instructions for work on AC system



WARNING

Maintenance or repair work on the AC system should only be done by skilled and authorized personal.



WARNING

Because the cooling circuit system has to be emptied before work on it, only service technicians which have passed the required courses are allowed to perform maintenance or repair work on the cooling circuit system of the AC system.



WARNING

Risk of injury!

Stop the engine before carrying out any work on the AC system.

Wait for all hot parts of the excavator to cool down before starting maintenance or repair work.



WARNING

Risk of injury!

Do not grasp into the system and do not put any things into the fans of the evaporator or condenser.

Especially avoid to touch the fins of the open condensor/evaporator.



WARNING

Risk of explosion!

Do not heat the cooling circuit system (for example by soldering or welding directly at parts of the system or near of them).



WARNING

Do not blow-off refrigerant. Dispose of refrigerant properly.



M+P-05B-6592



WARNING

Risk of injury!
Liquid refrigerants can damage eyes and skin.
Wear protective goggles and protective gloves.

2 Function

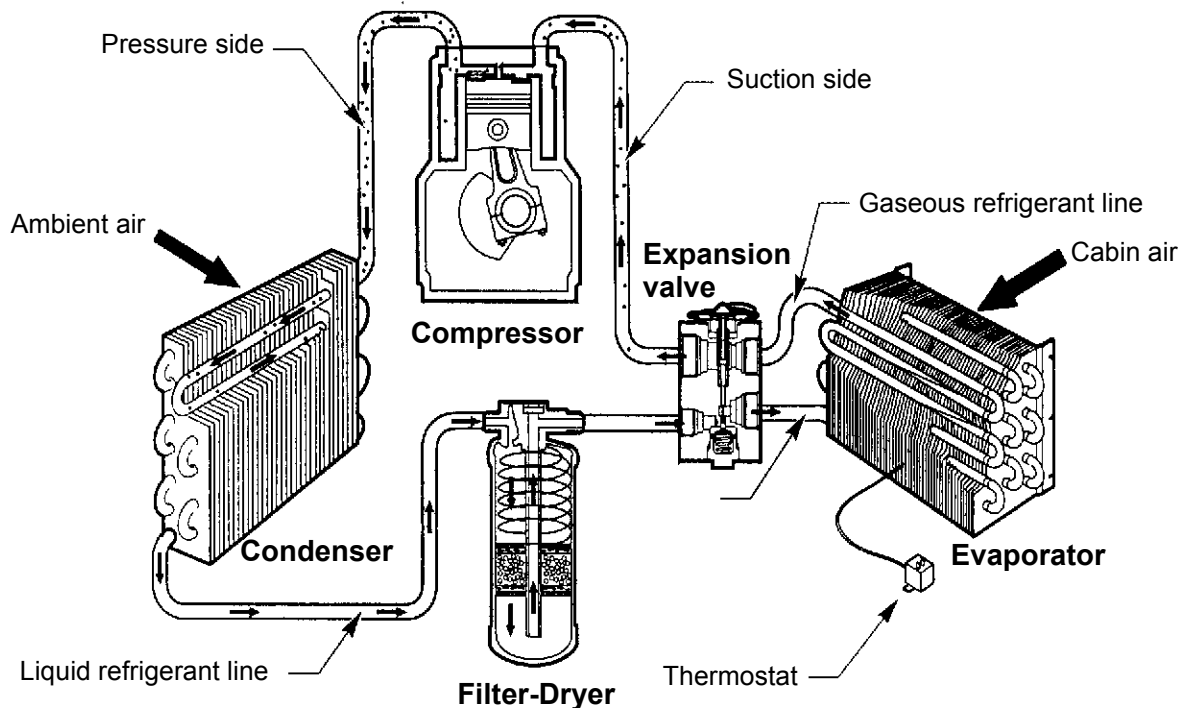
An A/C System contains five components:

- **Compressor**
- **Condenser**
- **Filter-Dryer**
- **Expansion valve**
- **Evaporator**

These components are connected by lines and form a closed circuit system, in which the refrigerant circulates.

2.1 Cooling circuit system

2.1.1 Diagram



2.1.2 Description

Integrated in the evaporator cell you will find the thermostat; if the adjusted temperature is lower as the temperature available in the evaporator, it activates the pressure switch (located above the filter-dryer) until the required temperature is achieved in the evaporator. On the other hand the pressure switch leads power to the magnetic clutch of the compressor.

1. The compressor transports the gaseous refrigerant from the evaporator to the condenser. During this the pressure rises from approximately two to ten bar and temperature from -10°C to 40°C .
2. While the refrigerant flows through the condenser, it dispenses heat and condenses. During inflow and outflow pressure and temperature are equal with $p = 10 \text{ bar}$ and $t = 40^{\circ}\text{C}$; but the refrigerant turns from gas to liquid.
3. Inside the dryer eventual humidity is removed, which could damage compressor and expansion valve.
4. When the liquid refrigerant gets from the dryer to the expansion valve it expands immediately and turns into gas again. In this connection the pressure drops to two bar and the temperature to ten degrees.
5. Afterwards the refrigerant inside the evaporator absorbs the heat which is inside the cabin.

2.2 Refrigerant Reclin ® 134a

Due to the FCKW rules, as well as EG-rule 3952/92 it is not allowed to install AC systems since 01.01.1995 including FCKW-refrigerants, e.g., R12 or R502. Moreover the German Federal Gazette Nr.245 of 30.12.1998 ordered that all R12-AC systems must be converted to an alternative refrigerant until 30.06.1998.

In this case the use of an HFKW-refrigerant like R134a is recommended.

- Usage- and evaporating temperature : -25 °C ... 20 °C
- Structural formula: CH₂F-CF₃

Important advantages: Reclin ® 134a does not contain chlorine. Therefore it does not cause damage to the ozonosphere. Due to the small stability of the chemical combination the eventual attribute to the greenhouse effect is minimized. Reclin ® 134a is nontoxic, non flammable and demands less energy.

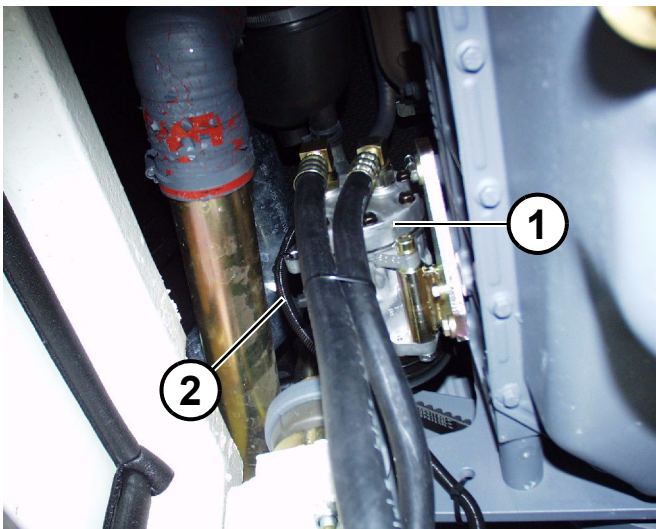
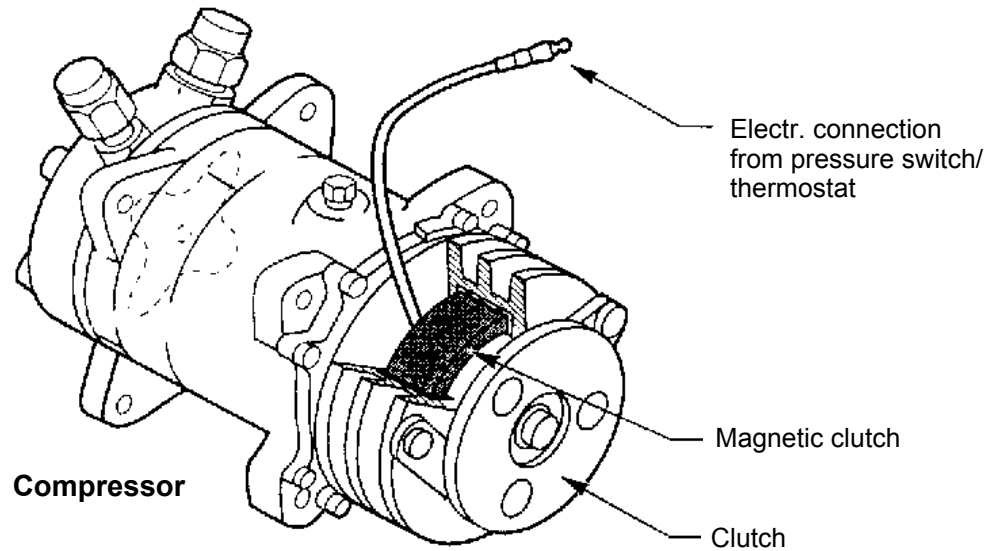
3 Components

3.1 Compressor

3.1.1 Technical Specifications

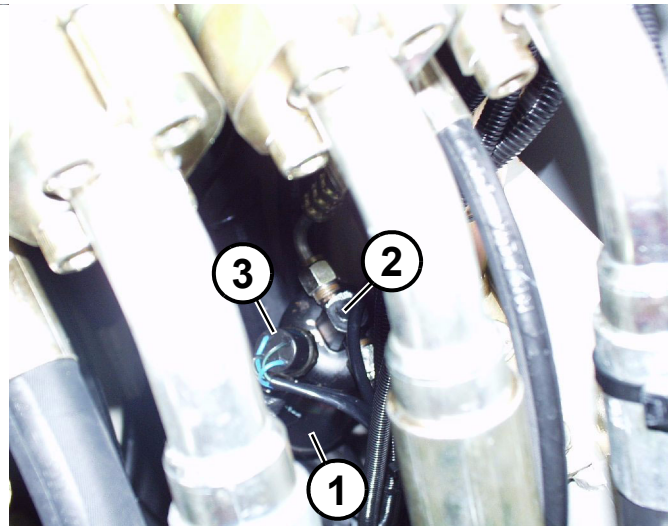
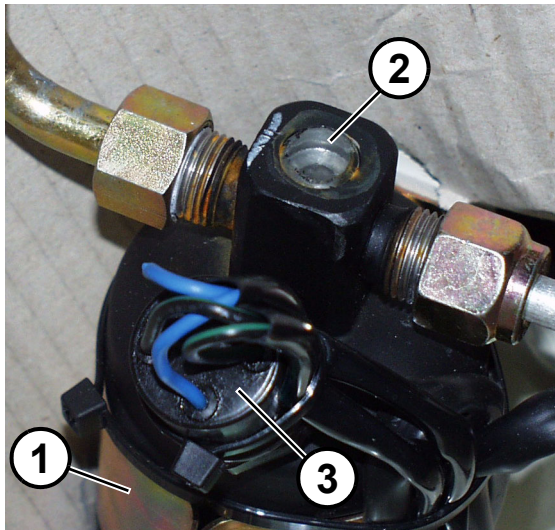
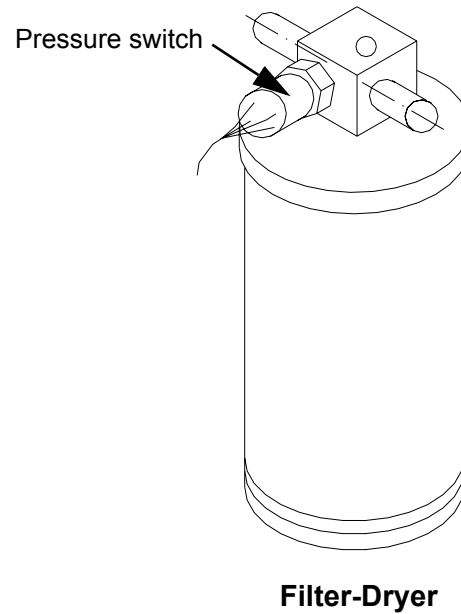
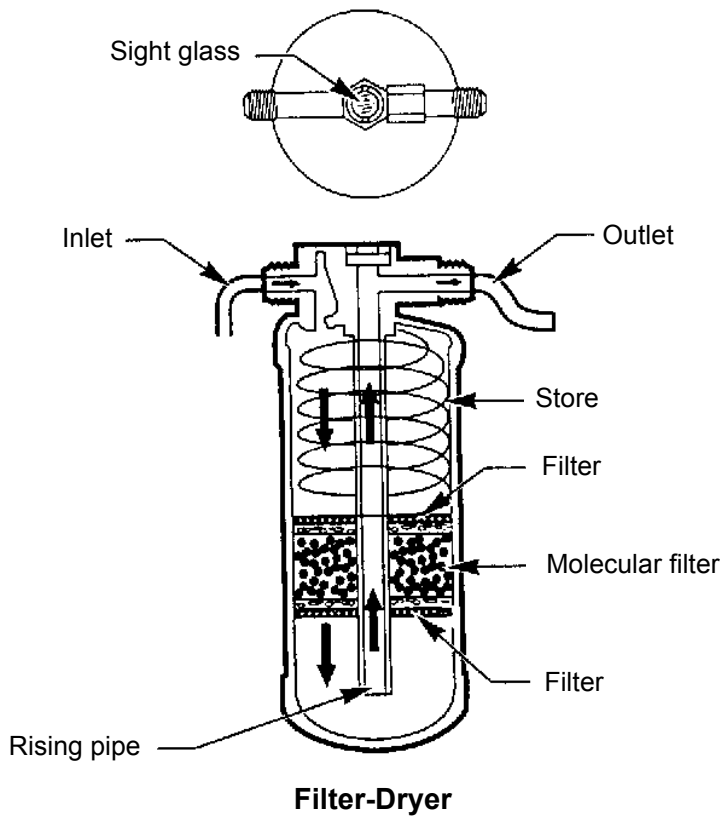
Power consumption - max.	3.3 kW (4.5 PS)
Power consumption	2.6 kW (3.5 PS)
Power consumption - electric	24 V, 3 A
Weight	8 kg
Rotations - max.	6000 rpm

3.1.2 Diagram



- 1 Compressor
- 2 Electr. connection

3.2 Filter-Dryer



1 Filter-Dryer
2 Sight glass

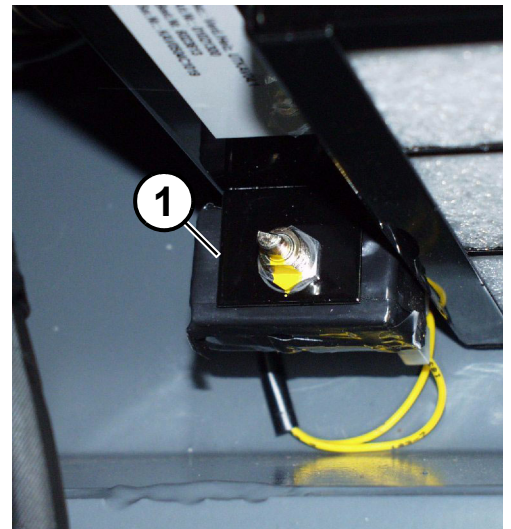
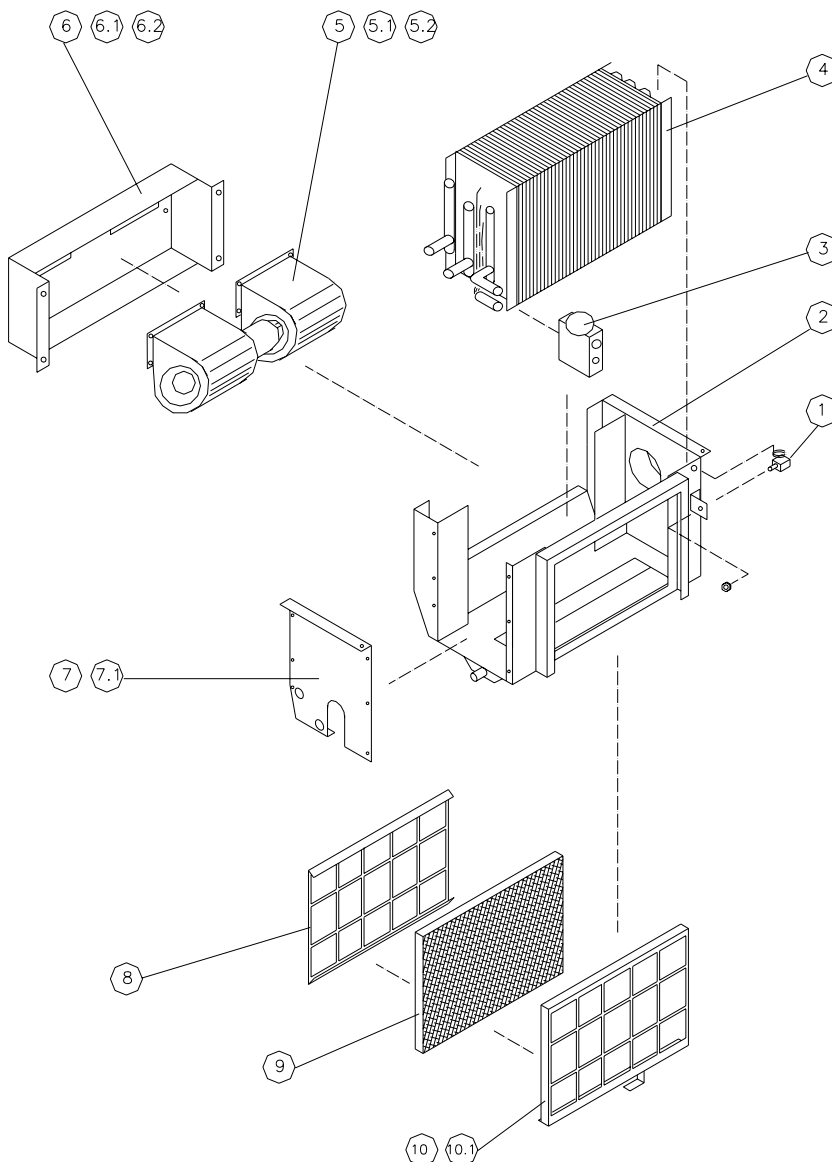
3 Pressure switch

3.3 Evaporator

3.3.1 Technical Specifications

Capacity of blower assembly - max.	650 m ³ /h
Power consumption - max.	24 V, 6 A

3.3.2 Diagram



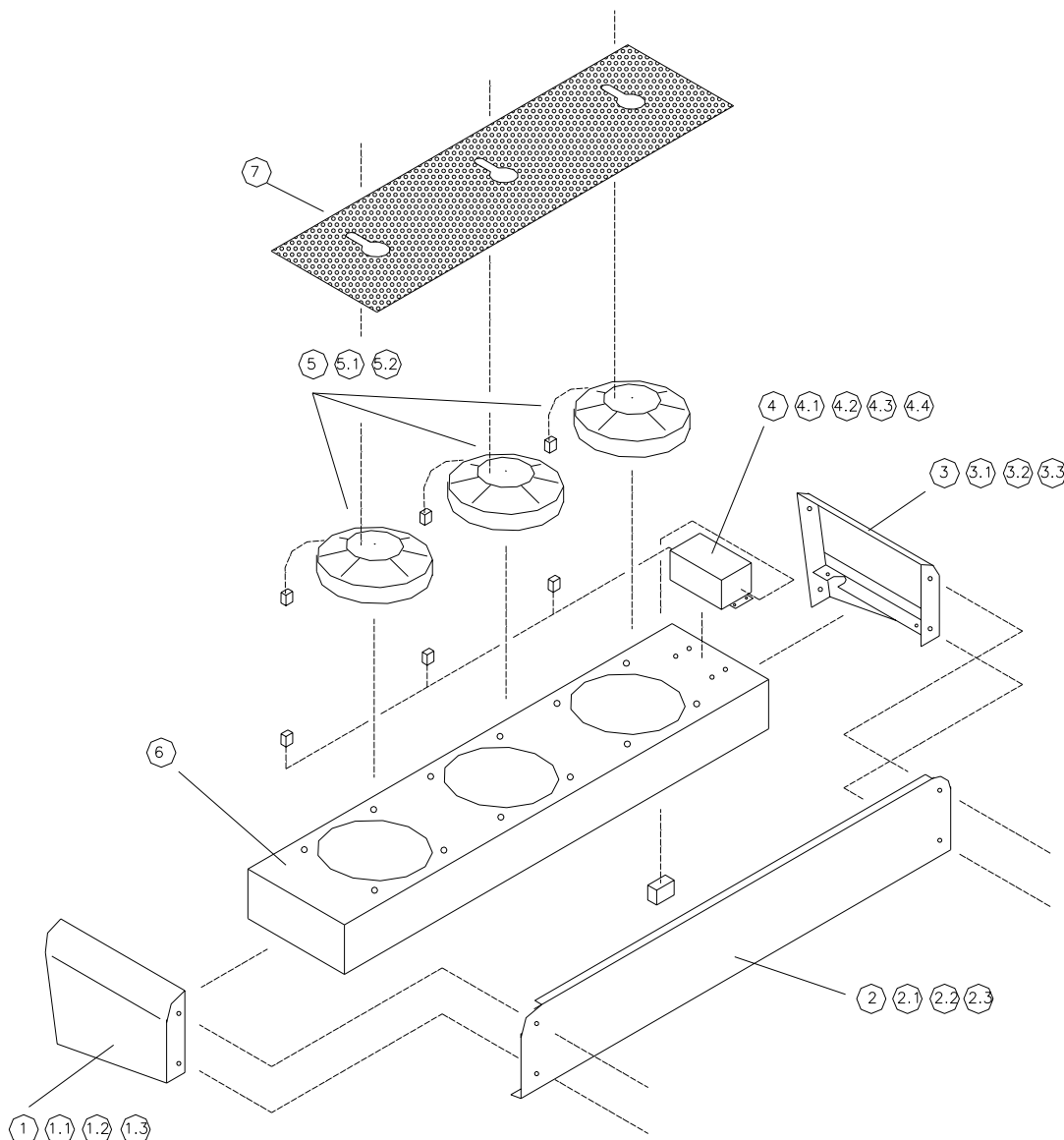
- | | | | |
|---|----------------------------|------|----------------|
| 1 | Thermostat | 7 | Cover |
| 2 | Cabinet | 8 | Lattice |
| 3 | Expansion block | 9 | Filter |
| 4 | Inlet - Evaporator/Heating | 10 | Filter housing |
| 5 | Blower assembly | 10.1 | Fastener |
| 6 | Blower housing | | |

3.4 Condenser

3.4.1 Technical Specifications

Capacity of blower assembly	2070 m ³ /h
Power consumption - max.	24 V, 7.5 A
Cooling capacity	approx. 6 kW

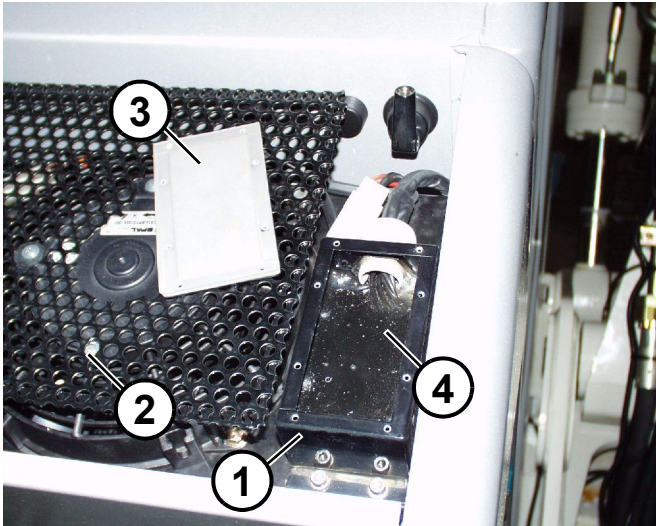
3.4.2 Diagram



- 1 Site plate
- 2 Rear panel
- 3 Site plate
- 4 Cable loop with cabinet including relays

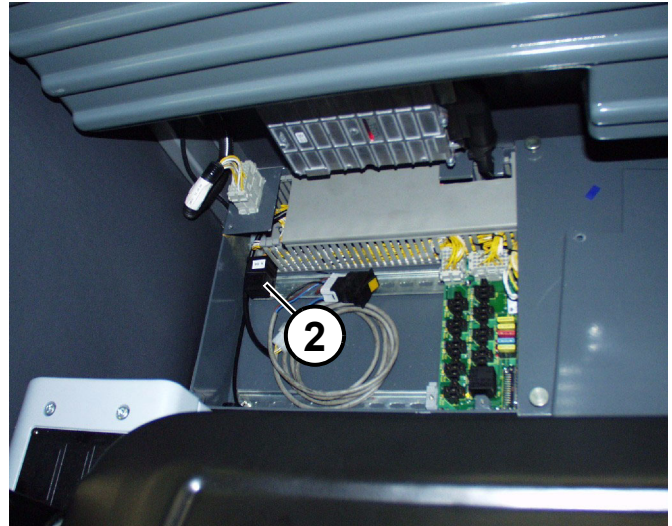
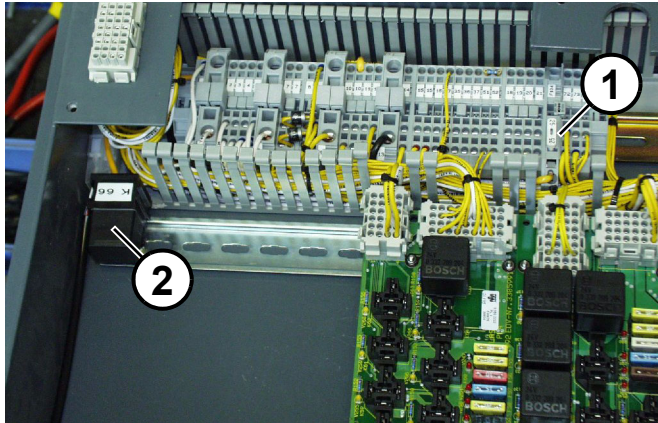
- 5 Fan, 24 Volt
- 6 Condenser-Inlet
- 7 Cover plate

3.5 Connection box



The connection box (1) is mounted near the condenser (2).
To avoid corrosion and other moisture related problems the connection box (1) is potted.
The cover (3) of the connection box (1) is removed here to show the potting resin (4).

3.6 Fuse and relay



- 1 AC system fuse (25 A)
- 2 AC system relay K66

4 Operation

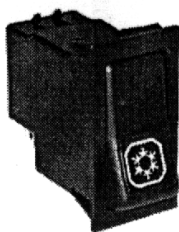
4.1 General

All components of the AC system are integrated into the vehicle.
Therefore the airconditioner is just working in connection with the original fan system.

The airconditioner just works if:

- the motor of the vehicle is running
- the fan system is switched on
- the airconditioner is switched on by turning the toggle switch
- if there is sufficient refrigerant inside the system, see section 8 on page 22.

Below the toggle switch S51 is illustrated, which is located in the indicator light panel of the vehicle.



Toggle switch with
visual indicator

If the airconditioner is working, the visual indicator of the switch is lighting.

4.2 Advices to the operator

The airconditioner can only produce the maximum of capacity if the windows of the vehicle are closed.

Due to the fan system the cooled air can stream out as much as necessary.



WARNING

Risk of cold!

Avoid to focus the air flow of the AC system directly to your body.

Please note two possibilities of regulation:

- Switch on/off heating
- Switch on/off airconditioner

We recommend that the temperature in the cabin should not be adjusted more than 6 °C to 8 °C lower than the ambient temperature.



NOTE

At least please switch the airconditioner on once a month for the period of 5 to 10 minutes.

Especially during cold seasons you avoid that the wire seal inside the compressor is becoming refractory and the oil does not separate of the refrigerant.

5 Maintenance



WARNING

Maintenance or repair work on the AC system should only be done by skilled and authorized personal.



WARNING

Because the cooling circuit system has to be emptied before work on it, only service technicians which have passed the required courses are allowed to perform maintenance or repair work on the cooling circuit system of the AC system.

Please read and comply to the Safety instructions, see section 1 on page 3.

5.1 Weekly checks

Check weekly if the condenser is dirty.
In case of fouling the condenser must be cleaned by air pressure.



WARNING

Do not use a high-pressure cleaner.
The fins of the condenser could be damaged.

5.2 Monthly checks

The following must be checked monthly:

- Condition and tension of the vee-belt o.k?
- Is the compressor correctly fixed?
- Are there chafe marks at hoses and cables?
- Is Draining of the condensation possible?
- Liquid level of the system o.k?
While the airconditioner is running no bubbles should be seen in the refrigerant through the sight glass.

5.3 Yearly checks by skilled worker

The following must be checked yearly:

- The quantity of refrigerant
- Suction- and high pressure via manometer

6 Renewing the filter-dryer



WARNING

Maintenance or repair work on the AC system should only be done by skilled and authorized personal.



WARNING

Because the cooling circuit system has to be emptied before work on it, only service technicians which have passed the required courses are allowed to perform maintenance or repair work on the cooling circuit system of the AC system.

Please read and comply to the Safety instructions, see section 1 on page 3.



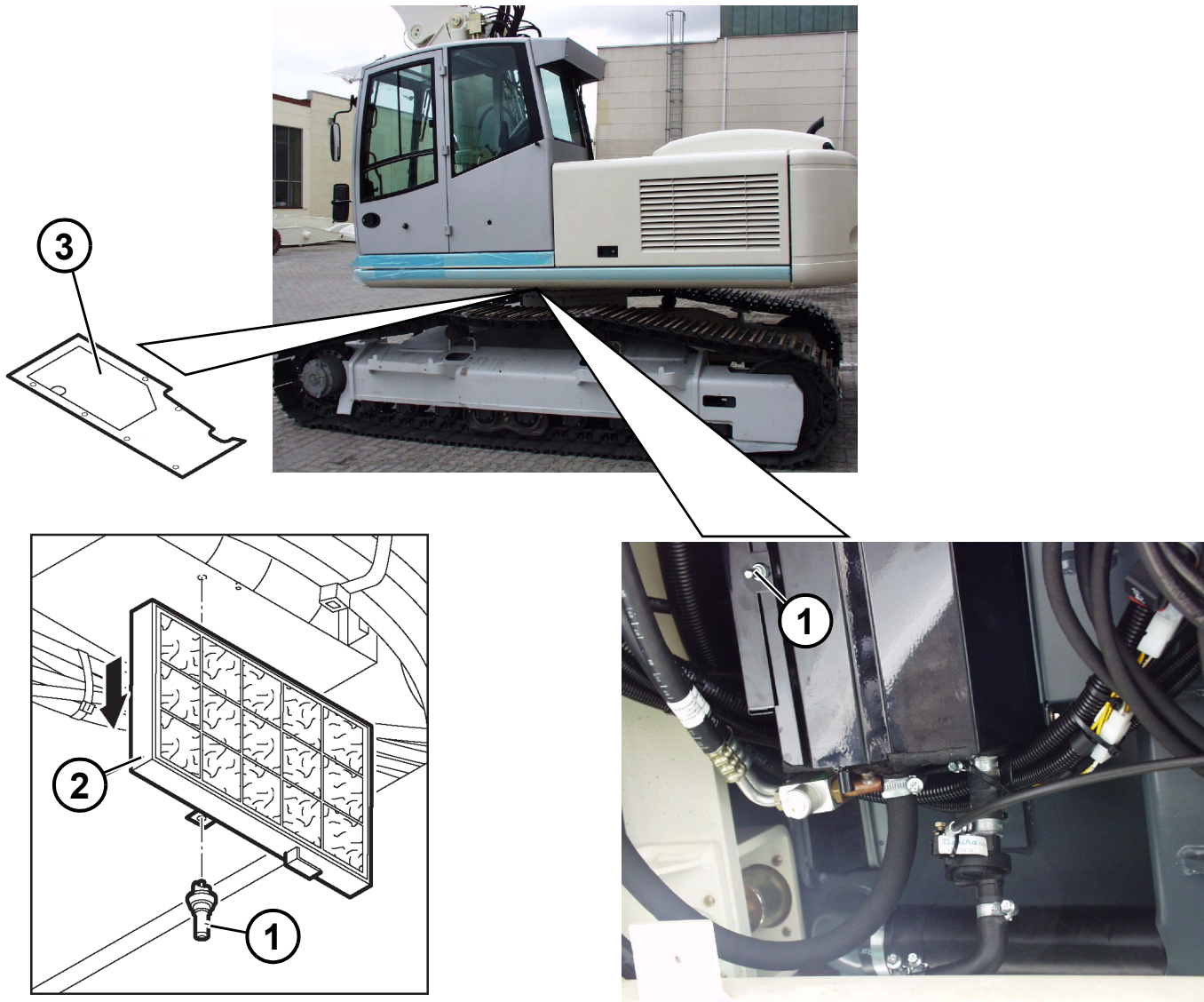
NOTE

Every two years the filter-dryer must be replaced.

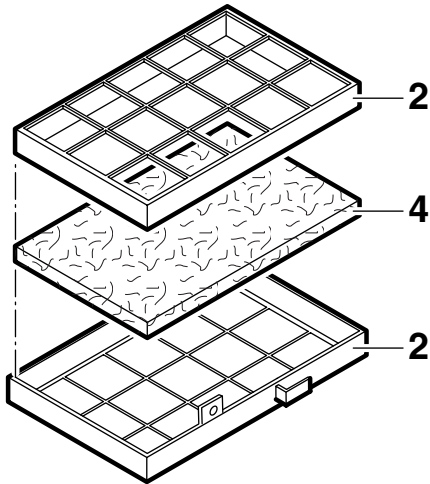
7 Cleaning/renewing filter mat of air suction filter

Please read and comply to the Safety instructions, see section 1 on page 3.

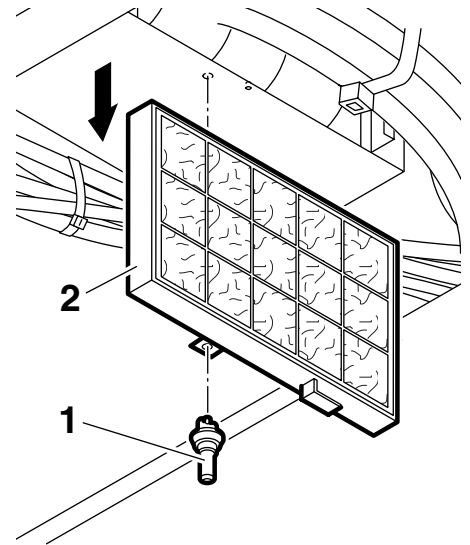
Every 100 hours of operation.



- Slew superstructure so that work can be done underneath the cab without difficulty.
- Stop the engine.
- Remove cab bottom panel (3).
- Turn the sealing cover (1) ca. 90° to the right or left and pull the filter cassette (2) downwards out of the air suction cowling.



M+P-05B-6594



M+P-05B-6595

- Open filter cassette (2) and take out filter mat (4).
- Tap out the filter mat (4) and clean the cassette (2), renew the filter mat (4), if necessary.
- Fit in the filter mat (4) and assemble the cassette (2).
- Insert the filter cassette (2) into the air suction cowling and lock with the sealing cover (1).
- Install cab bottom panel.

8 Troubleshooting

8.1 General troubleshooting

8.1.1 System does not work

Possible cause	Remedy
Fan switch at level 0	Switch to level 1, 2 or 3
Air conditioning switch set to "Off"	Switch on
Defective fuse (2 fuses: control and load current!)	Change
Plug connection loose / open- Condenser (E box), - thermostat (evaporator), - pressure switch (dryer), - compressor	Check tightness, fit
Relay slipped out of socket (E box) E-box board defective - encapsulated after mid-2003!	Put in relay Change E box
Pressure below 2 bar Pressure switch not actuated by - X186-1/3-black/green	Insufficient refrigerant; find and repair leak
Compressor coupling stuck	Change the compressor
Thermostat blocked, even though fully open (clockwise)	Change the thermostat (only use dust-proof)
Pressure switch blocked, although refrigerant is present ($p > 2$ bar) - X186-1/3-black/green	Change the pressure switch

8.1.2 Low power

Possible cause	Remedy
Dirty condenser	Clean the condenser
Fan on condenser does not work Up to 15 bar - the outside fans; >15 bar all three fans	Check plug connectors and relays (E box)
V-belt too loose	Tighten the V-belt
Permanent bubble formation at the sight glass - while the compressor is running + sight glass on compressor does not cool down	Insufficient refrigerant - find and repair leak
Hardly any pressure difference PS/PD/PR	Change the expansion valve
The intake pressure fall below 0 bar The dryer outlet is cold	Replace the dryer and check that no com- ponents or pipes are blocked
Heater is turned up fully	Switch off the heater
Heater valve does not close properly	Change the heater valve
Insufficient air supply to cab	Change the air filter Evaporator iced up - turn down the ther- mostat slightly (anticlockwise) Change if necessary Check the condensate outlet and clean if necessary

8.2 Description of electrical functions

8.2.1 Conditions for operating the air conditioning system

The following conditions must be met before you can switch on the air conditioning system:

- The engine must be running:
 - The switch contact, pin 30 on the relay K66 (see section 3.6 on page 14, 2) is then energised (via the connector X1/10 (terminal 30), which is then live).
 - The relay K66 is activated at pin 86 (via the connector X8/22 (terminal 15), which is then live). This switches voltage from the relay K66 to pin 87 and from there via the fuse F104 (see section 3.6 on page 14, 1) and pins 1 and 2 of the connector X183 to the switch contacts pin 30 of the relays K65, K67 and K68 in the connection box.
- The fan must be switched on:
 - Pin 5 on the switch S51 (see section 4.1 on page 15) is then energised (via the connector X6/17 (PL1), which is then live).

8.2.2 Switching on

Press the switch S51 (see section 4.1 on page 15) to switch on the air conditioning system. This supplies voltage via pin 3 of the connector X186 to the pressure switch B51 (see section 3.2 on page 10, 3).

The contact (2 bar to 27 bar) between pins 1 and 3 of the pressure switch B51 closes if the pressure in the cooling circuit at the pressure switch B51 is more than 2 bar and less than 27 bar.



NOTE

The thresholds of the pressure switch B51 ensure:

- **That the compressor only operates when there is sufficient coolant and when the cooling circuit has no leaks (the pressure must be more than 2 bar).**
- **That the compressor does not operate if the pressure in the cooling circuit is too high (the pressure must be less than 27 bar).**

When the pressure switch (2 bar to 27 bar) B51 is closed:

- The relay K67 (step 1) in the connection box is activated via pin 1 of the connector X186 and pin 7 of the connector X183. This switches on the two ventilators M9 and M11 of the condenser (see section 3.4 on page 12).
- The thermostat B50 (see section 3.3 on page 11, Pos 1) is energised.

The contact of the thermostat B50 opens if the temperature of the evaporator falls below a default value of 1 °C. The contact of the thermostat B50 closes at a temperature of 8 °C.



WARNING

Do not adjust the factory-set value of the thermostat, as otherwise the evaporator may be damaged by freezing water.



NOTE

The thermostat B50 stops the compressor if the temperature of the evaporator falls below the factory-set value of 1 °C.

This prevents the evaporator from freezing up due to water condensing from the air and then freezing at 0 °C.

Thus, the evaporator cannot be damaged by water expanding as it freezes.



NOTE

During normal cooling operation, the temperature of the evaporator fluctuates between the values set on the thermostat B50, because the compressor is switched on and off by the thermostat B50 depending on the temperature.

When the contact of the thermostat B50 is closed, the relay K65 (compressor) in the connection box is activated via pin 6 of the connector X183. This switches on the compressor Y75.

If the pressure in the cooling circuit increases during operation to more than 15 bar at the pressure switch B51, another contact (15 bar) closes between pins 2 and 3 of the connector X186. This activates the relay K68 (step 2) in the connection box via pin 8 of the connector X183. This switches on the ventilator M10 of the condenser (see section 3.4 on page 12).

8.3 Detailed troubleshooting

1. Check the cooling circuit for traces of corrosion (green discoloration). This indicates leaks in the cooling circuit.
2. Check if you can see coolant in the sight glass (see section 3.2 on page 10, 2). If not, there are probably leaks in the cooling circuit.
3. Check the evaporator for signs of icing. If there is icing, switch off the air conditioning system and wait until the evaporator has thawed out before continuing with the checks. If icing occurs again, the thermostats of the air conditioning system is defective or incorrectly set. Have the thermostat checked, adjusted or repaired by an authorised engineer.
4. Check whether the fuse F104 (see section 3.6 on page 14, 1) is defective.
If the fuse is defective, replace it with a new one of the specified rating.
5. Switch on the engine.
6. Check whether there is voltage at pins 30 and 86 of relay K66 (see section 3.6 on page 14, 2).
If there is no voltage, have the electrical system of the digger checked and repaired by an electrician.
7. Check whether there is voltage at the fuse F104 (see section 3.6 on page 14, 1).
If there is no voltage, the relay K66 is defective and must be replaced.
8. Check whether there is voltage at pin 1 (coupling) and pin 2 (coupling) of the connector X183.
If there is no voltage, the wiring between the fuse F104 and the connector X183 is defective and must be replaced.



NOTE

The connector X183 is outside the cab under the condenser.

9. Switch on the fan.
10. Check whether there is voltage at pin 5 of the switch S51 (see section 3.2 on page 10, 3).
If there is no voltage, have the electrical system of the digger checked and repaired by an electrician.

11. Switch on the air conditioning system with the switch S51.
12. Check whether there is voltage at pin 1 of the switch S51.
If there is no voltage, the switch S51 is defective and must be replaced.



NOTE

Testing without measuring voltage:

Bridge pins 1 and 5 on the switch S51.

If the air conditioning system still operates, the switch S51 is defective and must be replaced.

13. Check whether there is voltage at pin 3 (coupling) of the connector X186.
If there is no voltage, the wiring between pin 1 of the switch S51 and pin 3 (coupling) of the connector X186 is defective and must be repaired.
14. Bridge pins 2 and 3 of the connector X186.
If the ventilator M10 of the condenser does not start, check whether there is voltage on the ventilator M10 of the condenser.
If there is no voltage, there is a fault in the connection box.
Replace the connection box.
If there is voltage, the ventilator M10 is defective.
Replace the ventilator M10.
15. Now check if **only** the ventilator M10 of the condenser (see section 3.4 on page 12) runs.
If **only** the ventilator M10 of the condenser runs, the pressure in the cooling system may be too high. This can be caused by overload or by a fault in the air conditioning system.
Switch off the air conditioning system for an hour and then switch it on again. If still **only** the ventilator M10 of the condenser runs, then there is a fault in the cooling circuit or the pressure switch. Have the cooling circuit and the pressure switch checked and repaired by an authorised engineer.

16. Check whether there is voltage at pin 1 of the connector X186.
If there is no voltage, there is a fault in the cooling circuit or the prepressure switch. Have the cooling circuit or pressure switch checked and repaired by an authorised engineer.

**NOTE**

Testing without measuring voltage:

Bridge pins 1 and 3 of the connector X186 for a few seconds.

If the compressor and/or the ventilators M9 and M11 of the condenser (see section 3.4 on page 12) start up, there is a fault in the cooling circuit or the pressure switch.

Have the cooling circuit and the pressure switch checked and repaired by an authorised engineer.

**WARNING**

Only bridge pins 1 and 3 of the connector X186 for a few seconds.

If you bridge pins 1 and 3 of the connector X186 for longer or permanently, the compressor or the cooling circuit can be irreparably damaged.

**WARNING**

Only bridge pins 1 and 3 of the connector X186 for a few seconds.

If pins 1 and 3 of the connector X186 are bridged for longer or permanently, excessive pressure can accumulate in the cooling circuit, causing it to burst.

17. Check whether the ventilators M9 and M11 the condenser (see section 3.4 on page 12) start.
If either of the ventilators M9 or M11 of the condenser do not start, check whether there is voltage at that ventilator.
If there is no voltage, there is a fault in the connection box.
Replace the connection box.
If there is voltage, the ventilator M9 or M11 is defective.
Replace the ventilator M9 or M11.
18. Bridge the two connections of the thermostat B50 (see section 3.3 on page 11, 1).
If the compressor starts, there is a fault in the thermostat B50.
Have the thermostat B50 checked and repaired by an authorised engineer.

19. Check whether there is voltage at pin 6 (coupling) of the connector X183.
If there is no voltage, the wiring between the thermostat B50 and pin 6 (coupling) of the connector X183 is defective and must be repaired.
20. Bridge pins 1 and 9 (coupling) of the connector X183 for a few seconds.
If the compressor starts, there is a fault in the connection box.
Replace the connection box.
If the compressor does start, it is defective.
Have the compressor replaced by an authorised engineer.



WARNING

**Only bridge pin 1 (coupling) and 9 (coupling) of the connector X183 for a few seconds.
If you bridge pin 1 (coupling) and pin 9 (coupling) of the connector X183 for longer or permanently, the compressor or the cooling circuit can be irreparably damaged.**

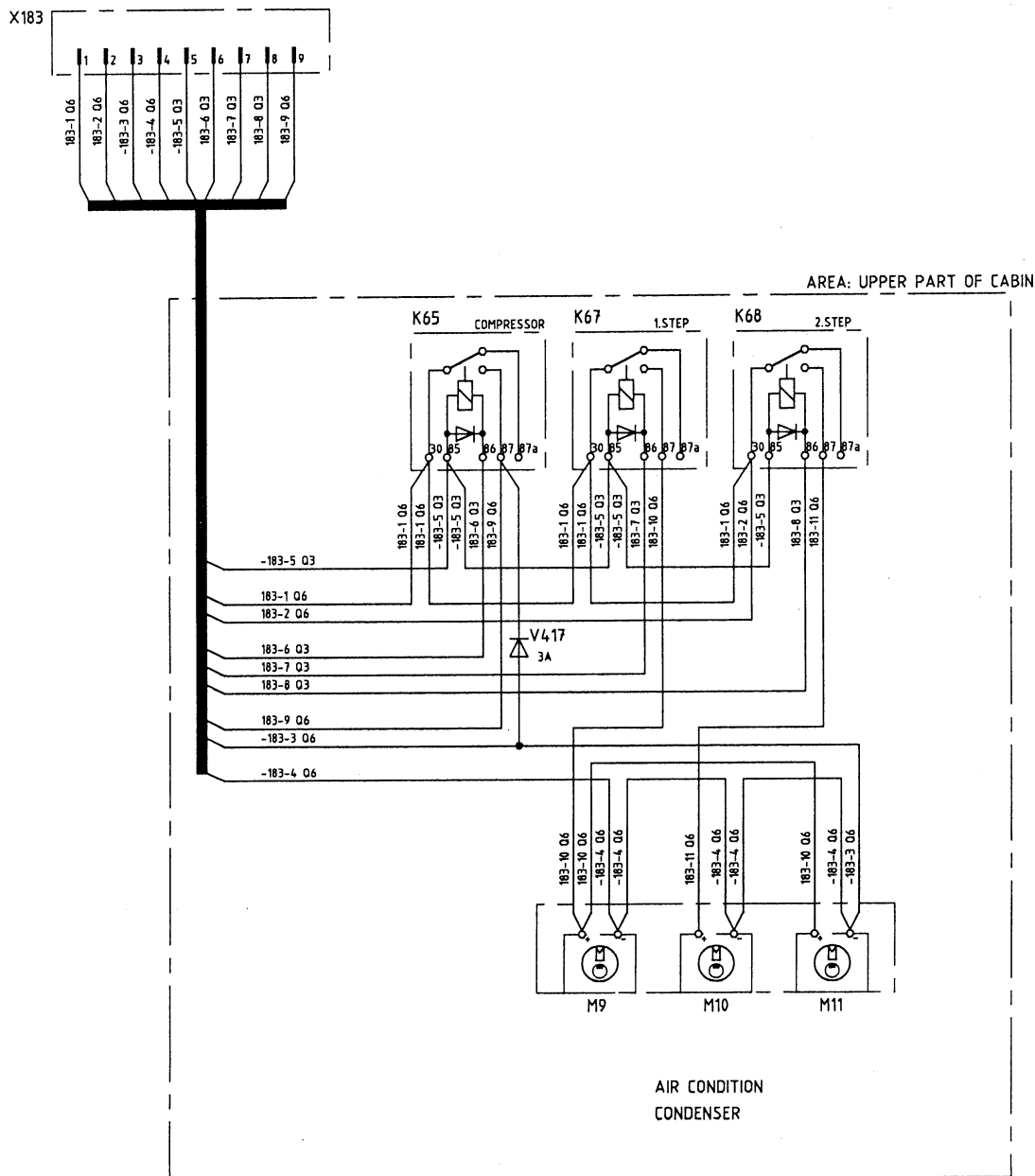


WARNING

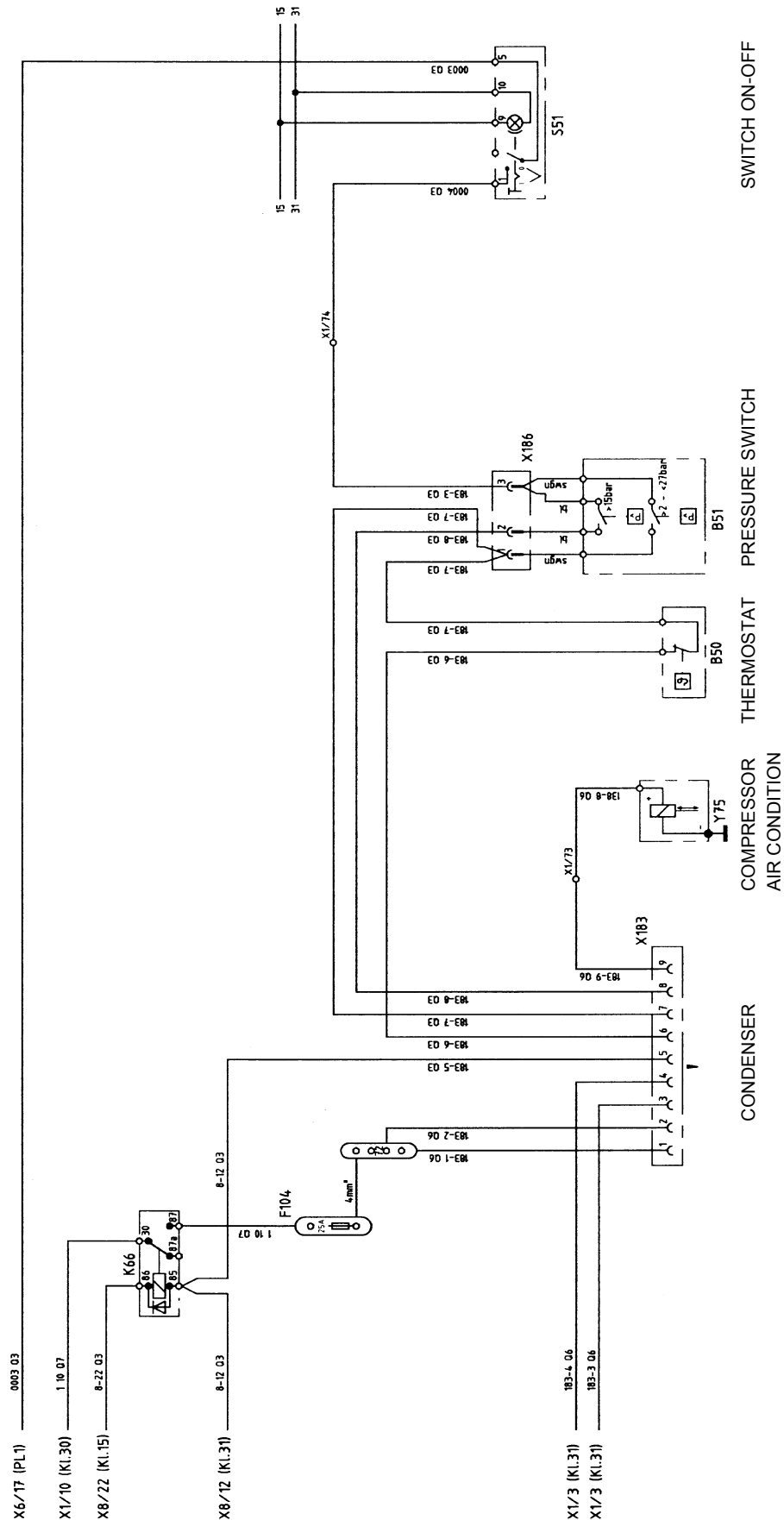
**Only bridge pin 1 (coupling) and 9 (coupling) of the connector X183 for a few seconds.
If pins 1 (coupling) and 9 (coupling) of the connector X183 are bridged for longer or permanently, excessive pressure can accumulate in the cooling circuit, causing it to burst.**

8.4 Circuit diagrams

8.4.1 Connection box



8.4.2 System



Chapter 14

Maintenance

Contents

1	Safety instructions for maintenance	2
2	Renewing hydraulic fluid filter element	6
3	Renewing mesh strainer fuel filter.....	8
4	Renewing fuel filter	10
5	Changing engine oil, renewing engine oil filter	11
6	Maintenance schedule	14
7	Lubrication points of excavator	15
8	Lubricants	17

1 Safety instructions for maintenance



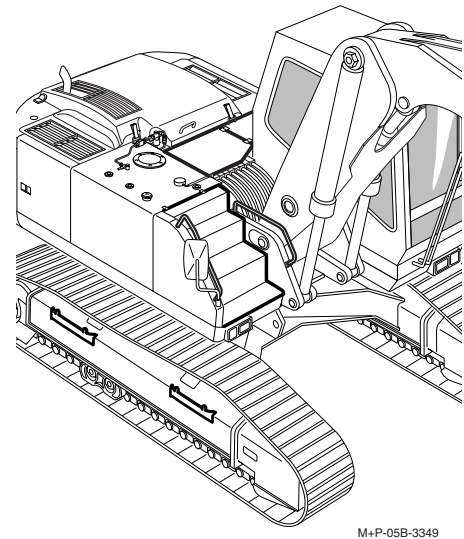
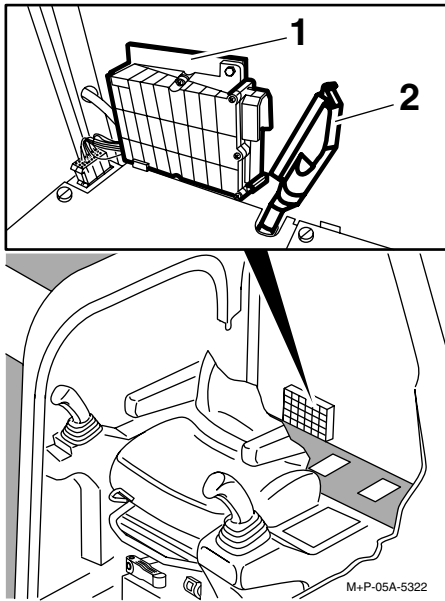
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- Only qualified personnel may carry out maintenance.
- Always read the maintenance instructions before you carry out any maintenance.
- Read the Deutz operating instructions before performing any maintenance on the engine.
- Do not perform any maintenance not described in the maintenance instructions.
- To avoid unnecessary downtime in operation, TEREX-ATLAS recommends seals to be renewed on all maintenance work described.
- Use only genuine TEREX-ATLAS spare parts.
- Do not use the excavator again until maintenance has been effectively completed.
- If maintenance is done at a job site (e. g., on a construction site), cordon off the job site.
- Do maintenance only if the stability of the excavator is ensured.
- Lower the boom/jib to the ground, or support them.
- Never work under the excavator, if it is being held up only by the hydraulic system!
- When the excavator is raised, support it with suitable material (e.g., stands).

- The engine must be stopped before any maintenance is carried out.
- Absolute cleanliness is essential!
Dirt may cause considerable damage to the excavator.
- Risk of scalding!
Beware of hot oil and hot coolant.
- Battery acid harms the skin and eyes!
Wear acid-proof gloves and protective glasses.
- Oil, lubricating grease, fuel, coolant and cleaning agents harm the skin!
Use skin lotions and/or protective equipment.
- Release the pressure from the hydraulic fluid tank before working on the hydraulic system.
- Switch off the electrical system with the battery isolator before working on the electrical system.

Checks of the electrical system might damage it!

- Use only a digital multimeter or a volt-age tester.
- Do not use a test lamp.

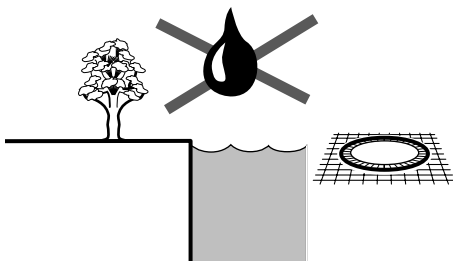


Welding work on the excavator might damage the electrical system!

- The battery must be connected up and the electrical system switched on with the battery isolator.
- A good earth connection for the welding equipment must be made close to the welding point.
- Remove plug (2) from the electronics box (1).
- When boarding and leaving the excavator, use only the steps and handrails provided.
- Never climb on to the boom/jib.
- Use a ladder or work platform, if necessary.



- Note the risk of fire and explosion:
do not smoke,
do not use a naked flame,
keep a fire extinguisher ready to hand.



- Comply with environmental protection laws.
- Collect engine oil, hydraulic fluid, fuel and coolant separately and dispose of them as specified in the regulations.
- Wipe up fuel, lubricants and coolant which have run out or been spilled, or use appropriate binding agents on them.

2 Renewing hydraulic fluid filter element

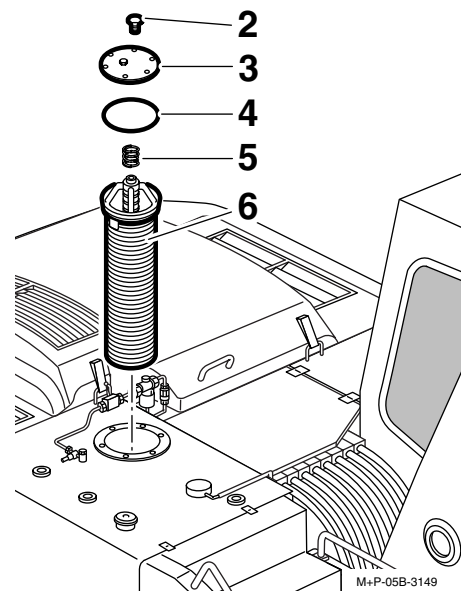
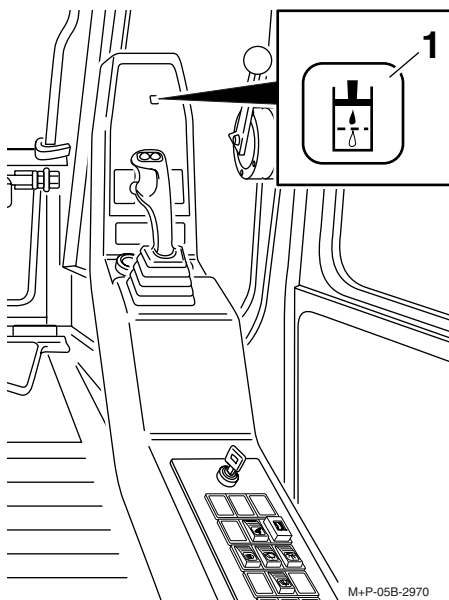


DANGER!

Risk of accident from escaping hydraulic fluid!

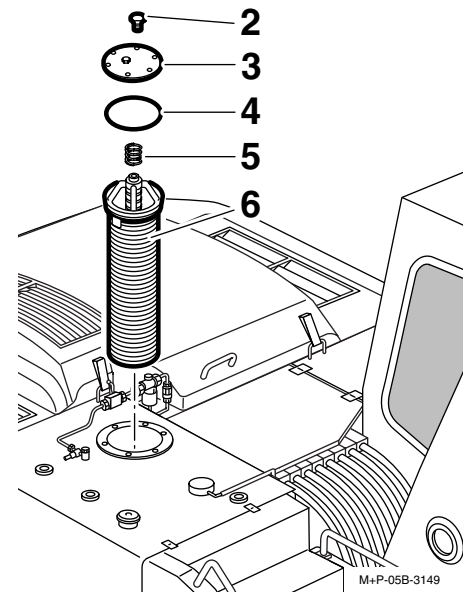
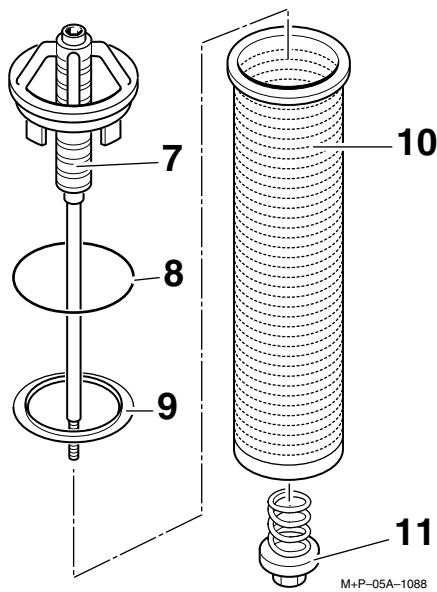
Before any work is performed on the hydraulic system, the preload pressure in the hydraulic fluid tank must be released; see operating instructions.

For the first time after 50 hours of operation, then every 500 hours of operation.



When the control light (1) comes on, the hydraulic fluid filter element must be renewed.

- Trap the fluid in a suitable vessel.
- Unscrew hex.-head bolts (2) and take off cover (3).
- Remove O-ring (4) from cover (3).
- Remove spring (5) from hydraulic fluid filter (6).
- Take out hydraulic fluid filter (6) and allow the hydraulic fluid to drain out of the filter.



- Unscrew hex.-head bolt (11) and take off filter element (10).
- Take off sealing ring (9) and O-ring (8).
- Clean magnetic rod (7).
- Place a new O-ring (8) and a new sealing ring (9) in position.
- Place a new filter element (10) in position and tighten hex.-head bolt (11).
- Insert hydraulic fluid filter (6) into the hydraulic fluid tank and place spring (5) on it.
- Fit a new O-ring (4) into cover (3).
- Place cover (3) in position and tighten crosswise the hex.-head bolts (2) uniformly.
- Dispose of any hydraulic fluid which has run out, as specified in the regulations.
- Pressurize the hydraulic fluid tank again.
- Operate the excavator equipment several times; see operating instructions.
- Check the hydraulic fluid level, top up if necessary; see operating instructions.

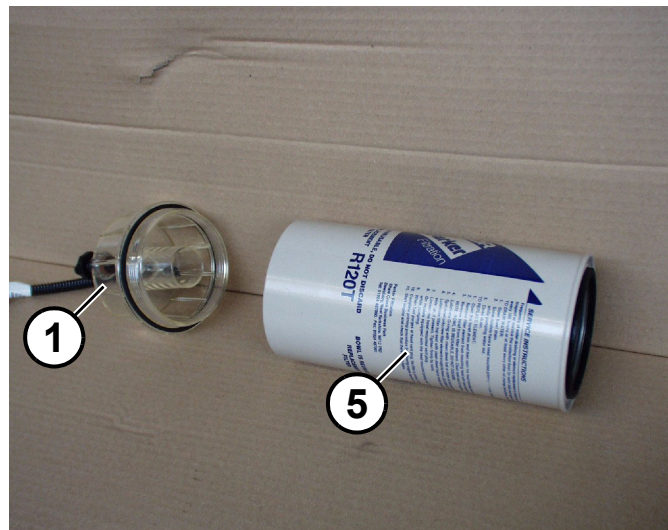
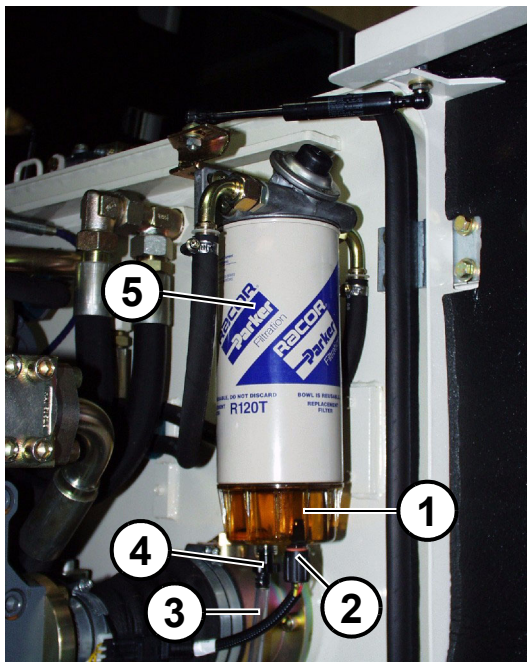
3 Renewing mesh strainer fuel filter

Every 500 hours of operation.

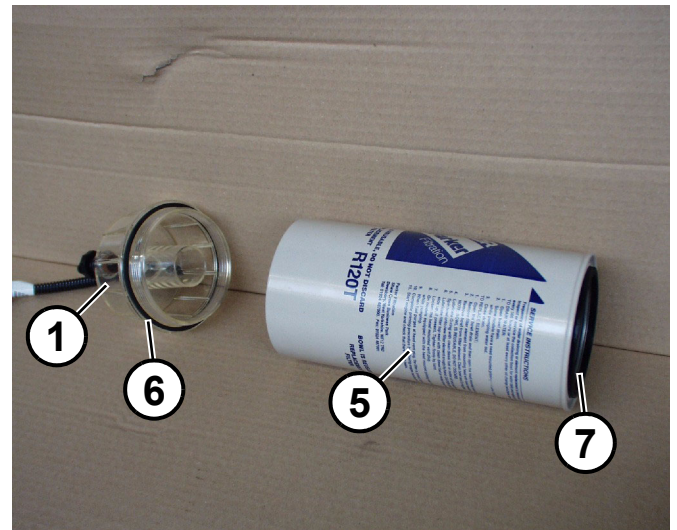
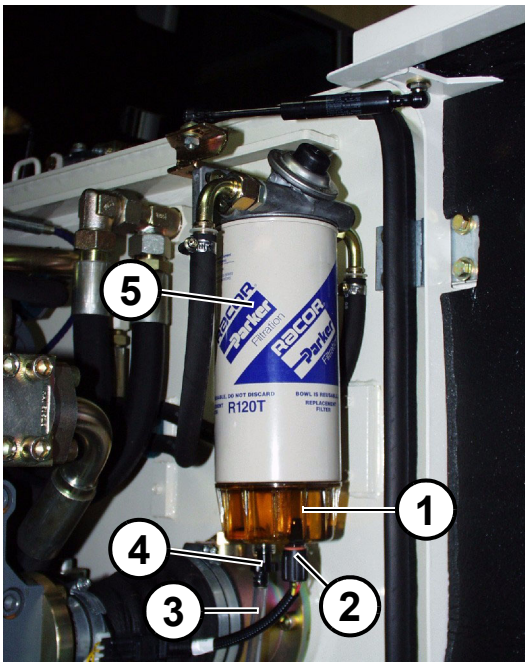


DANGER!

Only genuine ATLAS-TEREX spare parts are to be used.

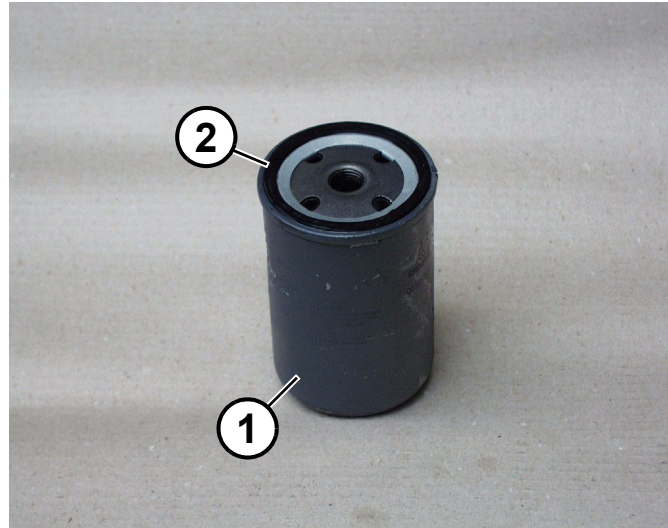
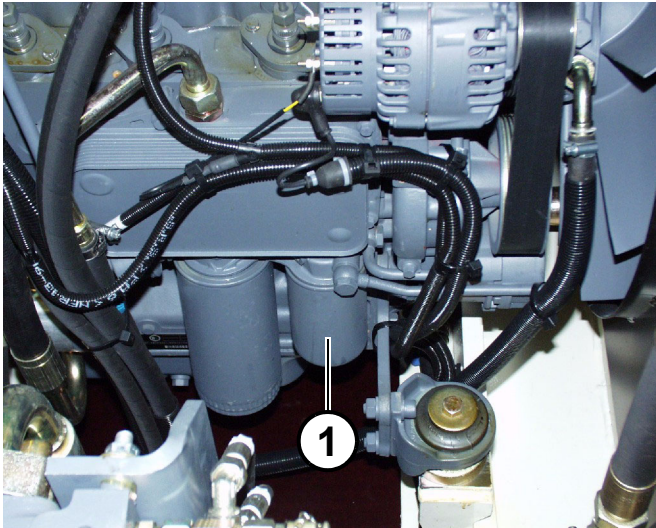


- Stop the engine.
- Cut off the fuel supply.
- Place a suitable vessel underneath the mesh strainer fuel filter and underneath the drain hose (3).
- Open the drain valve (4) by turning it anti-clockwise and drain off a little fuel.
- Close the drain valve (4) by turning it clockwise and disconnect the plug-in connection (2).
- Screw off the filter (5) with the sight glass (1).
- Screw the filter (5) off the sight glass (1) and dispose of the filter (5) in accordance with regulations.



- Clean the sight glass (1).
- Use a new sealing ring (6), if necessary.
- Apply engine oil to the sealing ring (6).
- Screw the sight glass (1) with the sealing ring (6) onto the new filter (5).
- Apply engine oil to the new rubber packing ring (7).
- Screw the new filter (5) until the new rubber packing ring (7) fits tightly and screw it tight with another half-turn.
- Connect the plug (2).
- Open up the fuel supply.
- Bleed the fuel system, if necessary; see operating instructions.

4 Renewing fuel filter



For the first time after 50 hours of operation, then every 1000 hours of operation.



DANGER!

Risk of accident from rotating parts!
Renew fuel filter only with the engine stopped.



DANGER!

Only genuine ATLAS-TEREX spare parts are to be used.

- Stop the engine.
- Place a suitable vessel underneath the fuel filter (1).
- Unscrew fuel filter (1) and dispose of it as specified in the regulations.
- Apply engine oil to the new rubber seal (2) of the new fuel filter (1).
- Screw on the new fuel filter (1) until the new rubber seal (2) makes contact, then tighten by a further half-turn.
- Bleed the fuel system, if necessary; see operating instructions.

5 Changing engine oil, renewing engine oil filter

For the first time after 50 hours of operation, then every 500 hours of operation (at the latest after 12 months).

- Allow the engine to warm up to operating temperature.



DANGER!

Risk of accident from rotating parts!

Change engine oil and renew engine oil filter only with the engine stopped.

- Stop the engine.
- Remove engine compartment bottom panel (1).
- Unscrew protective cap (3).
- Trap the oil in a suitable vessel.

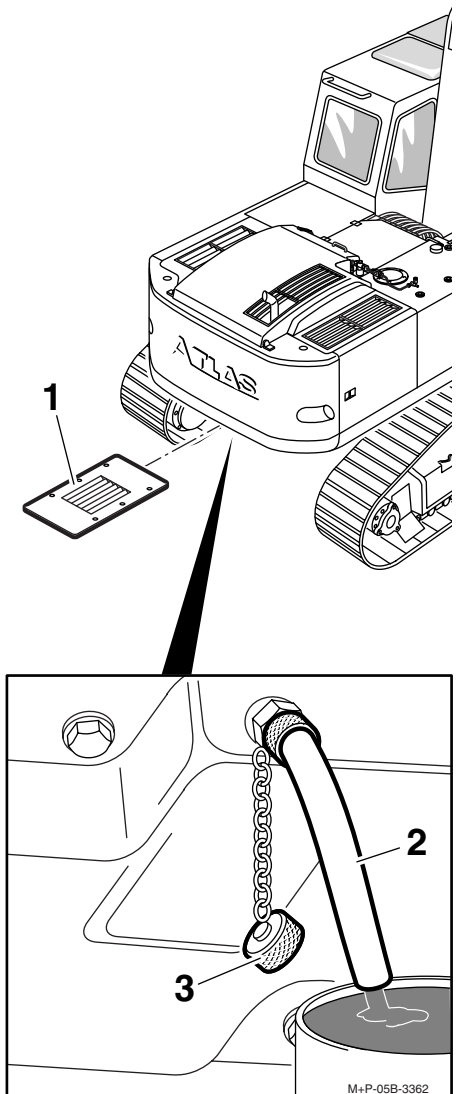


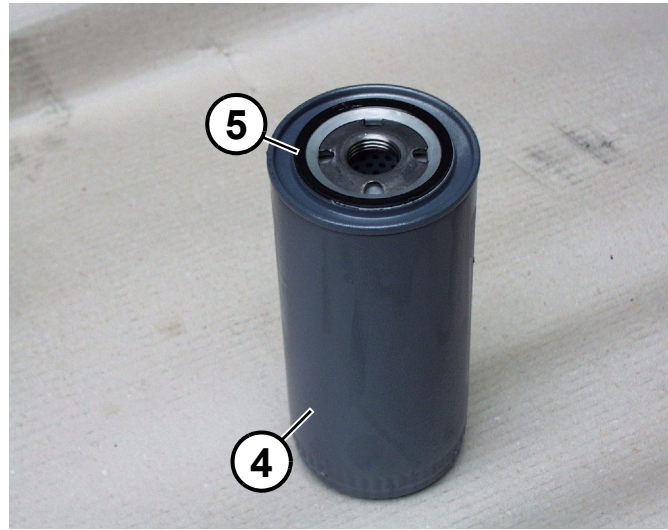
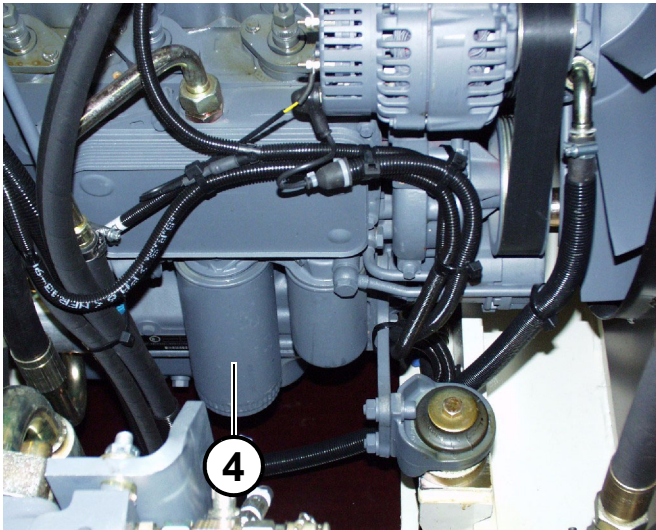
DANGER!

Risk of scalding from hot oil!

The oil drain valve opens automatically when the oil drain hose is screwed tight.

- Hold the free end of oil drain hose (2) in the oil trap vessel and screw the other end with the grommet to the oil drain valve. The engine oil is drained.
- After the engine oil has drained out completely, take off oil drain hose (2) and screw protective cap (3) back on.
- Dispose of used oil as specified in the regulations.
- Install engine compartment bottom panel (1).

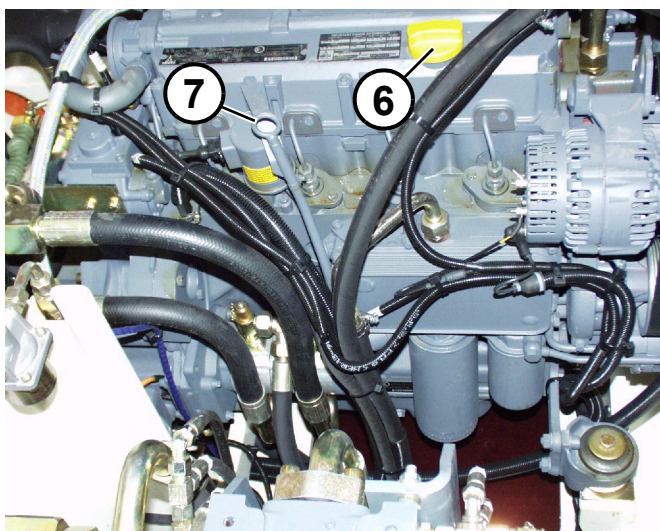




DANGER!

Risk of scalding!
Engine oil is hot.

- Place a suitable vessel underneath the engine oil filter (4).
- Unscrew the engine oil filter (4) and dispose of it as specified in the regulations.
- Apply engine oil to the new rubber seal (5) on the new engine oil filter (4).
- Screw on the new engine oil filter (4) until the rubber seal makes contact, then tighten by a further half-turn.



- Unscrew filler neck cap (6) and add oil through the filler neck up to the MAX mark on dipstick (7).
- For filling capacities and lubricants; see operating instructions.
- Run the engine, then stop it and check the engine oil filter for leaks.
- Check the oil level again, and add more oil if necessary.

6 Maintenance schedule

		Daily 10 Oh	Every 50 Oh	Every 100 Oh	Every 500 Oh	Every 1000 Oh	Every 2000 Oh	Every 3000 Oh	
Lubricate	Lubrication points	➡	➡	➡	➡				
	Slewing ring			* ➡					
Engine	Engine oil	👁	(1. 🛢)		🛢				
	Engine oil filter		(1. 🛢)		🛢				
	Coolant				👁		🛢		
	Mesh strainer fuel filter		🔥		🛢				
	Fuel filter		(1. 🛢)			🛢			
	* Air cleaner					🛢			
	* V-belts		(1. 👁)		👁				
	* Radiator	👁							
Hydr. system	Hydraulic fluid							🛢	
	Hydraulic fluid filter element		(1. 🛢)		🛢				
	* Hydraulic fluid cooler	👁							
Transmission	Crawler gearbox		(1. 👁)	👁	(1. 🛢)		🛢		
Travel gear	Crawler tracks			👁					
Elec. system	Batteries			👁					
Heating and ventilation system	* Air suction filter			🔧					

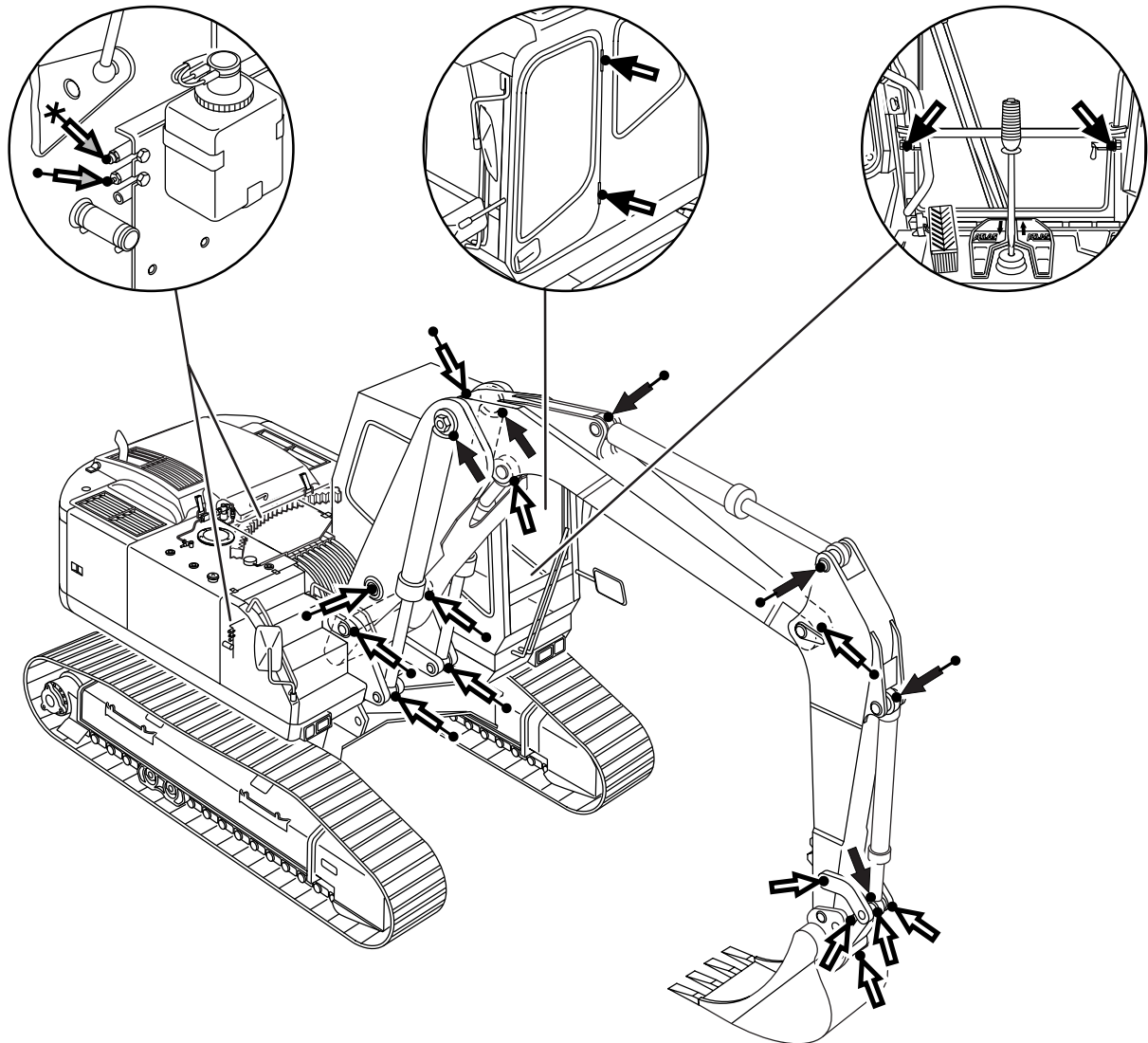
- * Reduce this period in very dusty conditions
- ➡ Lubrication points, every 10 Oh
- ➡ Lubrication points, every 50 Oh
- ➡ Lubrication points, every 100 Oh
- * ➡ Lubricate gear teeth with special grease, (Order No. 3620153), every 100 Oh
- ➡ Lubrication points, every 500 Oh

- (1.) First time only
- 👁 Check
- 🔧 Clean
- 🛢 Renew
- 🔥 Drain water
- Oh Operating hours



Have this maintenance work performed by TEREX-ATLAS Service after 50 hours of operation and then every 500 hours of operation.

7 Lubrication points of excavator



M+P-05B-3350

- ➔ every 10 hours of operation (daily)
- ⇒ every 50 hours of operation
- ⇒ every 100 hours of operation
- *⇒ every 100 hours of operation approx. 1 cartridge of special grease for grease nipple on slewing ring. (Order No. 3620153). This grease nipple has a different shape.
- ⇒ every 500 hours of operation
- automatic lubrication of excavators with central lubrication system ♦
- Only a small quantity of grease should be used to lubricate the grease nipples of the plug-in window catches and of the cab door hinges.
- Clean the grease nipples thoroughly.
- Continue to pump in grease until it emerges.
- Coat the piston rods which never or only rarely run in the hydraulic rams with acid-free Vaseline.

♦ = Optional extra

8 Lubricants

	Designation	Viscosity / Order No. / DIN
Engine	Engine oil API-CG-4	arctic climate: SAE 10 W ¹⁾ moderate climate: SAE 20 W-20 ¹⁾ or SAE 30 ¹⁾ tropical climate: SAE 40 ¹⁾ all climatic zones: SAE 15 W-40 ¹⁾
	Corrosion-protection antifreezer BASF Glysantin G48/24	Order No. 4653892
	Diesel fuel ²⁾	- DIN 51601 - CEN EN 590 and/or DIN EN 590 - Nato codes F 54 and F 75 - BS 2869: A1 and A2 ³⁾ - ASTM D 975-88: 1-D und 2-D

¹⁾This viscosity class is also complied with by viscosity class MIL-L-2104 C or MIL-L-46152.

²⁾Only use Diesel fuel containing less than 0.5 % of sulphur.

³⁾Observe sulphur content when using A2.

	Designation	Viscosity / Order No. / DIN
Hydraulic system	ATLAS-TEREX special hydraulic fluid ⁴⁾	
Transmission	Transmission oil API GL 5 - GO 90	from -10°C to +15°C: SAE 80 W-90 ⁵⁾ from +5°C to + 30°C: SAE 90 ⁶⁾ over +30°C: SAE 140 ⁶⁾
Lubrication point of slewing ring (toothed flanks)	ATLAS-TEREX special grease	Order No 3620153
Other lubrication points	Multipurpose grease with MoS ₂	DIN 51818, NLGI-2 (Lithium soap grease)

⁴⁾ If not available, use engine oil API-CD:

- SAE 10 W⁷⁾ below +15° C,
- SAE 20 W-20⁷⁾ above +15° C.

⁵⁾ This viscosity class is also complied with by viscosity class MIL-L-2105 C.

⁶⁾ This viscosity class is also complied with by viscosity class MIL-L-2105 B.

⁷⁾ This viscosity class is also complied with by viscosity classes MIL-L-2104 C or MIL-L-46152.

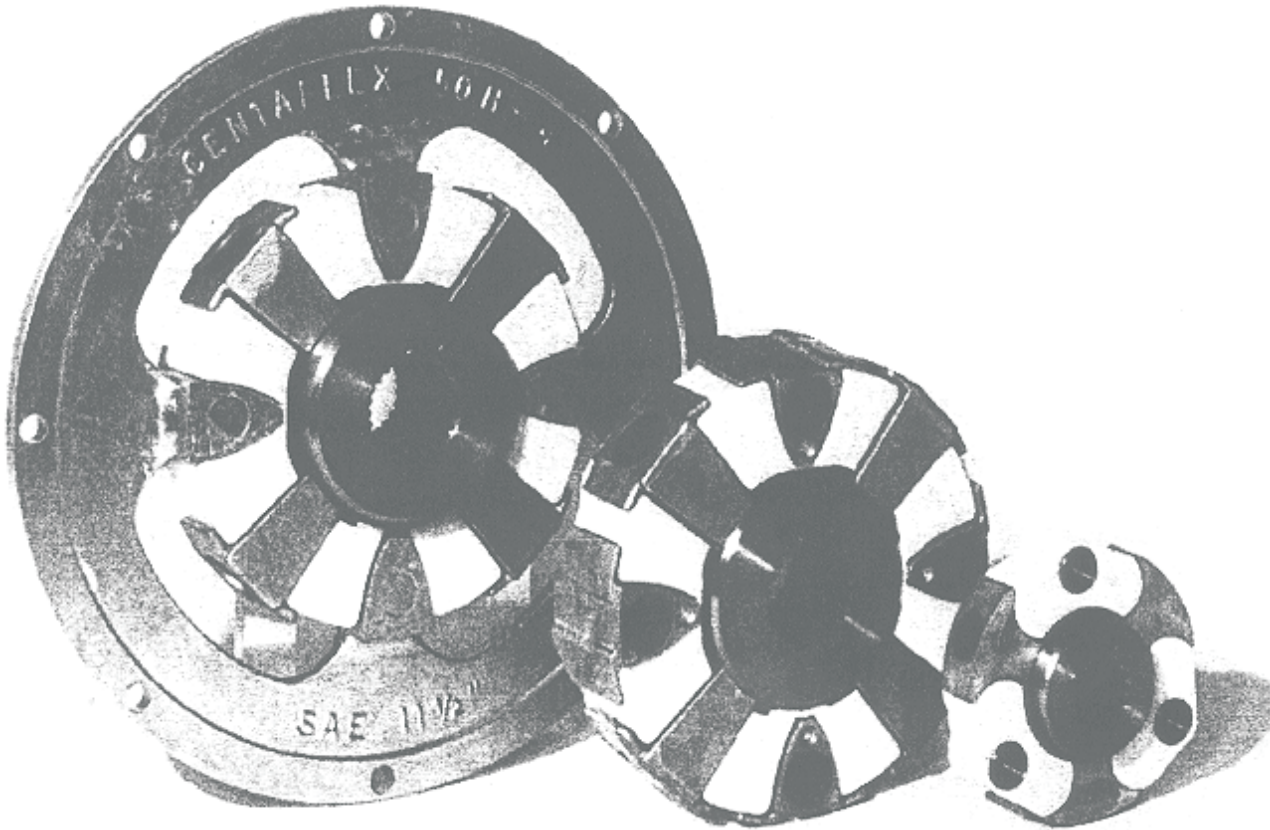
Chapter 15

Miscellaneous

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1 Centaflex coupling



1.1 Centaflex Type H - design and special features

Centaflex Type H has the following excellent features:

- **High capacity at compact dimensions**
- **High torsion stiffness, but capable of dislocation and vibration-damping,**
- **High maximum limit speeds**
- **Extremely high resistance to extreme temperatures: -50 +150° C**
- **Oilproof**
- **Easy to assemble - plug-type installation - free of axial forces**
- **Wearing-free clamping connection hub-shaft**
- **Maintenance-free, low-noise**
- **Cost-efficient**

This coupling was developed specifically for the connection

Diesel engine - hydrostatic pump

Since such pumps generally have relatively small centrifugal mass, it is of advantage to couple them stiff against torsion with the Diesel engine. Critical speeds are displaced to speed ranges above engine speed. So the drive will be rated below critical values and is free of such critical speeds over the whole speed range of the engine free of such critical speeds which could result in dangerous rotary vibrations.

The coupling is generally installed in a housing between Diesel engine and hydraulic pump or distributor gearing. This housing is, of course, subjected to high temperatures inside.

Due to its extremely high temperature-resistance of 150° C, the Centaflex Type H is best suited for this purpose, even when the housing is fully sealed. Moreover it is oilproof.

Structural design of Centaflex Type H

The main component of the coupling is the elastic part, a structural part from high-strength Hytrel with inserted bushings from aluminium, or steel, which are screwed together alternately axially and radially. Metal parts are not vulcanized on this design 'H', but only inserted into the prestrained elastic structural part. (This distinguishes the 'H' design from the standard Centaflex coupling design, in which metal parts are firmly vulcanized into the rubber and the rubber part is installed with prestress). All metal parts to be screwed in axially are bolted against a plane surface (flywheel or flange, for instance), all metal parts to be screwed in radially are bolted down on a single cylindrical hub.

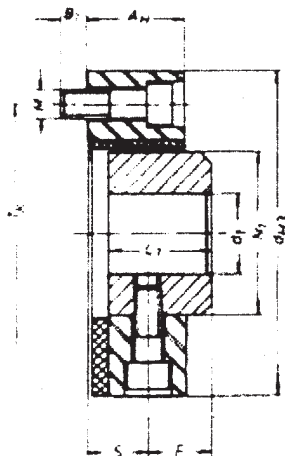
Force flow passes from the flywheel, or from the plate, to the axially bolted or cast on metal parts, and from there to the radially bolted aluminium segments and to the cylindrical output hub. This hub is generally arranged on the pump shaft.

If possible, the coupling is screwed directly to the Diesel engine flywheel (design 1). Deutz and Perkins Diesel engines are provided with corresponding threaded bores in the flywheel. On other engines, the coupling can be mounted to any flywheel imaginable with the help of a simple intermediate plate (design 3).

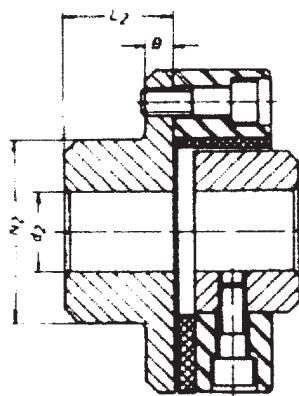
1.2 Technical data and dimensions of Centaflex Type H

Coupling size			8H	16 H	25 H	30 H	50 H	90 H	110H	140 H	160 H	400 H
Rated torque	T_{KN}	Nm	100	200	350	500	800	950	1200	1600	2000	4000
Max torque	T_{Kmax}	Nm	280	560	875	1400	2000	2200	2500	4000	4000	10000
Max. speed	n_{max}	min^{-1}	6500	5500	5000	4000	4000	4000	4000	3600	3600	2500
Dyn. stiffness to torsion	$C_{Tdyn} \times 10^4$	$0,25 T_{KN}$	0,65	1,7	3,2	3,5	6,7	11,6	15,5	17,2	26,4	80,9
		$0,50 T_{KN}$	0,84	2,2	5,3	4,4	11,5	16,1	22,5	23,0	38,1	131,0
		Nm/rad										
+/-20%		$0,75 T_{KN}$	1,3	2,9	8,0	6,0	16,5	21,0	29,0	29,5	50,2	188,0
Relative damping	$\Psi = 0,5$	$1,00 T_{KN}$	2,3	3,6	12,0	8,8	26,2	35,0	40,0	44,0	73,0	275,0

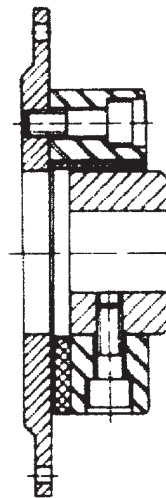
Design Type 1



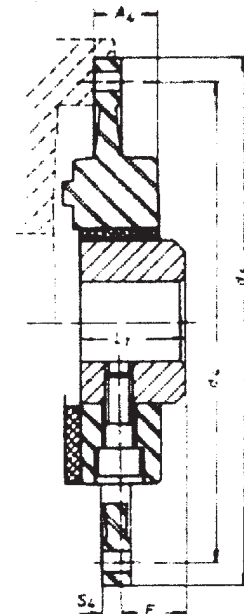
Design Type 2



Design Type 3



Design Type 4



Size	d ₁		d ₂		d _{H3}	A _H	B	B ₁	L ₁	F _{min}	L ₂	M	N ₁	N ₂	S	S ₄	A ₄	T _K	Partition	Design 4 SAE Conn.	d ₄	d ₅	Weight kg			
	Vorb	max	Vorb	max																			Type1	Type2	Type4	
8 H	12	38	18	55	125	34	10	10	42	28	13	42	M 10	60	80	20 ⁺³ ₂	-	-	100I	3x120°	-	-	1,3	3,1	-	
16 H	15	48	20	70	157	43	12	12	50	32	17	50	M 12	70	100	26 ⁺³ ₂	-	-	125I	3x120°	-	-	2,3	4,8	-	
25 H	15	55	20	85	182	47	14	14	55	35	20	55	M 14	85	115	27 ⁺³ ₂	-	-	140I	3x120°	-	-	4,4	10,1	-	
30 H	20	65	25	100	205	58	16	16	66	41	23	66	M 16	100	140	35 ⁺³ ₂	21 ⁺³ ₂	44	165I	3x120°	10"	295,3	314,3	5,2	13,3	6,5
50 H	20	65	25	100	205	58	16	16	66	41	23	66	M 16	100	140	35 ⁺³ ₂	6,7 ⁺³ ₂	29,7	165I	4X 90°	11 1/2"	333,4	382,4	5,6	13,7	7,0
90 H	20	65	25	100	215	56	16	15	66	41	23	66	M 16	100	140	35 ⁺³ ₂	-	-	165I	4x 90°	-	-	6,5	14,6	-	
110 H	20	63	-	-	230	56	-	18	66	41	23	-	M 18	100	-	35 ⁺³ ₂	-	-	180I	4x 90°	-	-	7,8	-	-	
140 H	30	85	30	110	273	58	19	17	80	55	25	80	M 20	125	160	33 ⁺³ ₂	6,5 ⁺³ ₂	31,5	215I	4x 90°	11 1/2"	333,4	352,4	12,0	29,0	14,5
160 H	30	85	30	110	270	59	19	20	80	55	25	80	M 20	125	160	37 ⁺³ ₂	-	-	215I	4x 90°	-	-	11,4	28,4	-	
400 H	38	85	-	-	397	58	-	20	80	S+F=128 ⁺³ ₀	-	M 20	125	-	-	-	-	324,5I	8x 45°	-	-	-	25,0	-	-	

* The tolerances indicated are the maximum limit axial clearance in the coupling for compensation of length tolerances of the coupled-on powerpacks.

** Standard lengths, can be varied upon request.

All dimensions in mm, subject to modifications.

1.3 Assembly instructions for Centaflex Type H

Order

- 1a) With sizes 30, 50 and 110, screw elastic part with inserted axially mounted aluminium segments to flange hub, and/or flange plate or flywheel. Assembly device available.
- 1b) With sizes 8, 16, 25, 140 and 400, screw axial bushings to flange hub, and/or flange plate or flywheel.
- 2.) Radially mounted aluminium segments are to be screwed to cylindrical hub. If already screwed on when delivered, do not dismount! Then mount cyl. hub to pump shaft. If clamping hub, tighten the clamping screws at the torque indicated below.
- 3.) With sizes 8, 16, 25, 140 and 400, push elastic part on the hub.
- 4.) Driven powerpack (eg pump) is to be pushed together in axial direction with mounted-on cylindrical hub and screwed-on radial aluminium segments (and elastic part for sizes 8, 16, 25, 140 and 400).

Make sure to observe the following items:

- a) Allen screws (DIN 912, Inbus Plus) fixing axial and radial coupling parts on the hub or on the flywheel should **be tightened at the tightening torque indicated below with a torque wrench**.
- b) To reduce friction between screw head and aluminium part, insert a small amount of grease under the cylindrical screw head prior to assembly.
- c) **Important:** Ensure that during assembly of the radial segments on to the cylindrical hub these segments are not distorted by the screws, but have a straight seat so that cylindrical surfaces of hub and aluminium part fully contact each other.
- d) Use the screws of quality "Inbus Plus" included in the supply only, which are marked by a blue compound on the thread. This compound contains some microcapsulated adhesive gluing the screws in the thread and securing them reliably against loosening.

If these screws should not be available, for whatever reason, carefully lock the screws with another glue (eg. Loctite or Omnifit).

CENTAFLEX size	8H	16H	25 H	30H	50H 90H	110H	140 H 160 H	400 H
Fixing screws, axial and radial DIN 912 InbusPlus Tightening torque TA Nm	6 Off M 10x30 50	6 off M 12x35 85	6 off M 14x40 140	6 off M 16x50 220	8 off M 16x50 220	8 off M 18x55 310	8 off M 20x50 500	16 off M 20x50 8 axial 600 Nm 8 radial 500 Nm 16 Off M 12x25 120 Nm
Hub clamping screws DIN 915 Tightening torque TA Nm	M10 30	M12 50	M14 70	M16 120	M16 120	M16 120	M20 200	M20 200

All indications and dimensions non-binding, subject to modifications.

2 Repair Instruction for Welded Assemblies

2.1 Introduction

2.1.1 Service consultation

This regulation was created for ATLAS excavators and ATLAS cranes. In case welding is needed for repair, it is always important to obtain assistance from the Service organization. The repair should be discussed with the Service organization to clarify details and to eliminate difficulties in advance.

2.1.2 Area of application

This Repair Instruction offers replies to the most common and most basic questions arising when welding work has to be done in cases of damage. It can be used for damage on all components on either cranes or excavators; please note that you should consult the Service organization in certain cases.

2.1.3 General problems

Grundsätzlich muss man wissen, dass immer mehr Komponenten im Kran-, aber auch mittler-weiYou should be generally aware of the fact that an ever-increasing number of components in the crane, even in the excavator field, are manufactured from high-strength fine-grained structural steels. These materials should be treated specifically to prevent the material from losing its beneficial properties. Moreover, the components are charged by oscillations, and the material is loaded with the limit to reduce weight.

Any repair welding work should always be carried out, as far as possible, in a preferred welding position (trough location). This might require the dismounting of the component to be welded, unless the weld is of a minor importance.

The machines will arrive from service and will therefore be splashed with oil, dirty and also primed and painted.

On the next pages you will find a description how to cope with these difficulties.



NOTE

Only repairs which are completed with extreme care will be permanently lasting!

2.2 Damage evaluation

2.2.1 General

If you find a crack in a component, start action immediately. For damage evaluation, it is better to first clean the surroundings of the damaged place with the help of a high-pressure cleaner. Then remove any paint or other coatings from the area of the crack. Also take off any parts which might be obstructive to inspection (pipes, hoses, control boxes, electric cables etc.).

2.2.2 Course of crack

The course of the crack is vital for all repairs to be carried out accordingly. To determine the crack head and tail end with maximum precision, use appropriate means (dye penetration test, magna-flux test or such). Prior to consulting the Service organization, determine the following criteria:

- a) Crane / excavator serial no.
- b) Accurate crack position
- c) Length of crack
- d) Crack in a weld or through the basic material

2.3 Consulting the Service organization

2.3.1 General

Discuss all items which are necessary for repair. The Service organization will determine if repair is possible.

If the crack area is close to the seat of a bearing and negative impact on the associated fit must be expected from warping due to welding, repair may generally be out of question.

If this is not the case, the repair should be either completed according to this Repair Instruction for Welded Modules, or the Service organization will suggest special procedures fixed for the concerned type of damage.

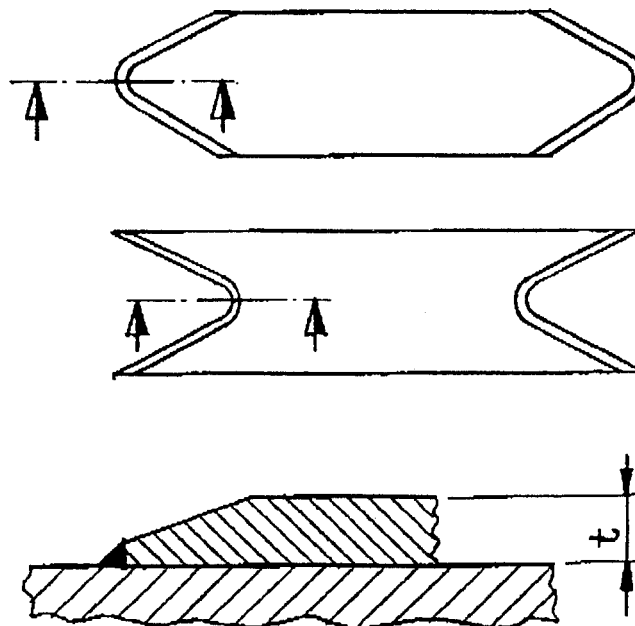
2.3.2 Doubler of metal sheet

If a doubler of metal sheet is necessary from the point of view of the Service organization, you have to fix dimensions and material.

Material:	similar to basic material
Sheet metal thickness:	approximately $\frac{2}{3}$ x basic material thickness
Shape:	soft transitions to eliminate stiffness leaps

2.3.3 Drawings / Examples

chamfer as from 10 mm



2.4 Preparing the repair

2.4.1 Cleaning

Thoroughly remove any traces of grease, oil, paint, moistness and other pollutions and coatings, since these would strongly affect the weld quality.

2.4.2 Drilling

Always bore out the crack head and tail end. Bore hole diameters have to be adapted to sheet metal thickness:

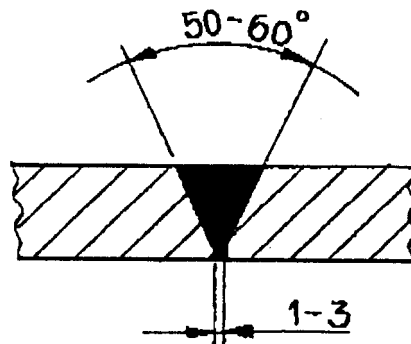
with $t = 3$ mm sheet metal thickness - bore hole 5 mm

with $t > 10$ mm sheet metal thickness - bore hole 10 mm

2.4.3 Grinding

Grind the crack internally in the shape of a V over its whole length. Opening angle should be between 50 and 60 degrees.

Drawing



You can also produce the groove by means of a gouging blowpipe or groove electrodes. Here gain, groove flanks should be clean and smooth, ground with the help of an angle grinder, if necessary.

If you wish to carry out the repair in the open, protect the welding area from atmospheric exposure (wind, rain, snow).

2.4.4 Preheating the welding area

Preheating is required if:

- a) workpiece temperature is lower than 5 °C when the welding process is started.
- b) the design of the component for repair is very rigid.
- c) components of fine-grained structural steel of a wall thickness exceeding 10 mm are used or repaired respectively. Preheating temperature abt. 150 - 200 °C
- d) components from S355 J2G3 of a wall thickness exceeding 20 mm.
Preheating temperature abt. 120 °C

2.5 Qualification of the welding personnel

2.5.1 General

Only welders with proof of qualification are authorized to carry out repair welding work!
Welding qualification acc. to DIN EN 287 Part 1

The choice of the welder should be based on the basic material, welding method, welding position and other criteria. Have an experienced welder carry out the repair to ensure that the welding work is solid and of a high quality.

Qualified welders

111 - welding process: manual arc welding

135 - welding process: Active gas metal-arc welding (MAG)

P - sheet metal

BW - butt welding

FW - fillet weld

W01 - material group: plain carbon steel

W03 - material group: fine-grained structural steels, upper yield point $> 355\text{N/mm}^2$

wm - with filler metal

t - sheet metal thickness

PF - welding position: rising

ss - single-fillet welding

nb - welding without weld pool securing

2.6 Selecting the filler metal

2.6.1 General

The filler metal depends on the basic material. As most components nowadays consist of high-strength fine-grained structural steels, you also have to use corresponding welding rods or stick electrodes. The manufacturer's instructions have to be observed imperatively:

- such as current type and polarity
- Back-drying
- Current intensity
- Welding position

2.6.2 Welding wire selection

Basic material		Welding wire		Welder acc. (DIN EN 287/19)
name		name		
new	former	new	former	
S235 J2G3	ST37-3	G4 Si 1	SG 3	135 PBW W01 wm t10 PF ss nb
S355 J2G3	ST52-3	G4 Si 1	SG 3	
StE 460	-	G4 Si 1	SG 3	
StE 550	-	NiMo	-	135 PFW W03 w m t1 0 PF ss nb
StE 690	-	NiMo	-	

2.6.3 Stick electrode selection

Basic material		Stick electrodes DIN EN 499	Welder acc. (DIN EN 287/19)
name			
new	former		
S235 J2G3	ST37-3	E35 4 B 42 H5	111 PBW W01 Bt10 PF ss nb
S355 J2G3	ST52-3	E42 2 RB 32 H10	
StE 460	-	E42 2 RB 32 H10	
StE 550	-	E50 4 B 42 H5	111 PFW W03 Bt10 PF ss nb
StE 690	-	E69 6 Mn NiCrMo B 42 H5 prEN 757	

Stick electrodes should be preheated prior to being processed.

Preheating temperature: 220 - 250 °C

2.7 Repair sequence

When all preparatory work is finished, start with the repair welding work. The following criteria have been observed:

- a) material quality and sheet metal thickness
- b) component and/or preheating temperature
- c) welders with appropriate qualifications
- d) filler metal selection according to present basic material
- e) processing instructions supplied by the filler metal manufacturer
- f) notes and rules of the Service organization

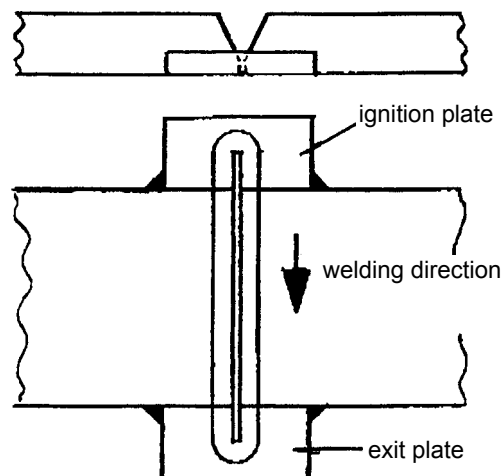
When treating fine-grained structural steels, which are most commonly used, it is important to weld with low drawing energy, ie you should weld thin and narrow welds. Wide welds will allow a large application of heat and thus reduce the mechanical strength properties of the basic material.

If the crack is going as far as to the material outside edge, you have to ensure with an ignition plate that approach errors are not situated within the weld but in the ignition plate which you remove afterwards. This plate should be ground and must not be knocked off in order to prevent the material from tearing.

Welding should be done:

- from the outside towards the inside
- shear welds prior to tension welds prior to compression welds
- always in the most beneficial welding position (descending welds are prohibited)
- with extreme care

ignition plates + exit plates (drawing)



2.8 Follow-up work

Remove the ignition plate without damaging the basic material. Then grind the weld end to remove notches.

Welding work with removal of notches are especially important for transition areas from the weld to the basic material.

If the Service organization has recommended the attachment of a reinforcement metal sheet, weld this one on, making sure that a minimum amount of air remains between the metal sheets during tacking.

If no crack is visible any more, clean the repaired area and apply some appropriate antirust agent.

