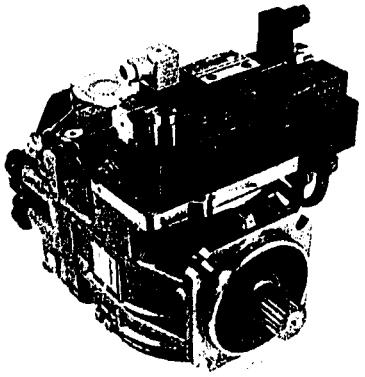
SAUER SUNDSTRAND

Series 90

Functional Description 2

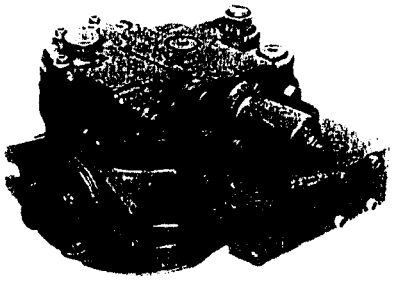
90000241

PV with Electric Displacement Control



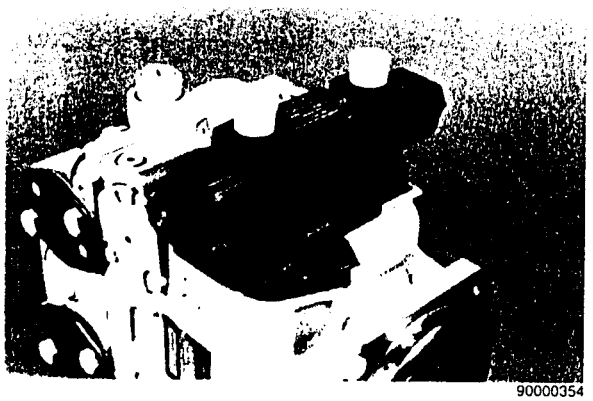
90000353

PV with Automotive Control (AC)



F000645

PV with Automotive Control Type II (AC II)



90000354

PV with 3-Position (FNR) Electric Control

2.5.3 Electric Displacement Control (EDC)

The electric displacement control is similar to the hydraulic displacement control with the input signal pressure controlled by a pressure control pilot (PCP) valve. The PCP valve converts a DC electrical input signal to a hydraulic signal which operates a spring-centered four-way servo valve. This valve ports hydraulic pressure to either side of a dual-acting servo piston. The servo piston rotates the cradle swashplate through an angular rotation of ±17°, thus varying the pump's displacement from full displacement in one direction to full displacement in the opposite direction. The control is designed so the angular position of the swashplate is proportional to the EDC input. For neutral adjustment see Sec. 8.2.4; for repairs see Sec. 9.3.5, 9.3.6, and 9.3.8.

2.5.4 Automotive Control (AC and AC II)

Automotive Control (AC) allows a vehicle to be driven in a manner similar to an automobile with an automatic transmission.

The AC control includes a three-position electric control to provide direction control.

The AC II control can be combined with a manual, hydraulic, or electric displacement control to provide both direction control and control over maximum vehicle speed. It may also be combined with a 3-position electric control to provide direction control.

2.5.5 3-Position (FNR) Electric Control

This control utilizes a 12 or 24 VDC electrically operated spool valve to port pressure to either side of the pump displacement control piston. Energizing one of the solenoids will cause the pump to go to its maximum displacement in the corresponding direction.

All functions of the three-position (FNR) electric control are preset at the factory. For repairs, see Sec. 9.3.7.

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2.6 Motor Features

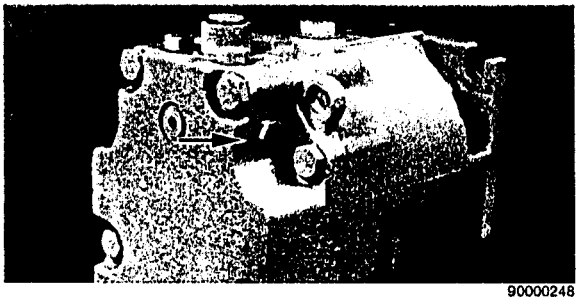
2.6.1 Motor Loop Flushing Valve and Charge Relief Valve

All Series 90 motors are designed to accommodate a loop flushing valve. The loop flushing valve is used in installations which require additional fluid to be removed from the main hydraulic circuit because of transmission cooling requirements, or unusual circuits requiring additional loop flushing to remove excessive contamination in the high pressure circuit.

A shuttle valve and charge relief valve are installed in the motor end cap to provide the loop flushing function. The shuttle valve provides a circuit between the low pressure side of the closed loop and the charge relief valve in the motor end cap.

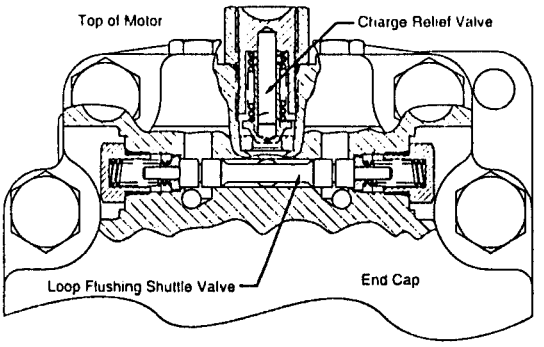
The motor charge relief valve regulates the charge pressure level only when there is a pressure differential in the main loop. The shuttle valve is spring centered to the closed position so that no high pressure fluid is lost from the circuit when reversing pressures.

For charge relief valve adjustment see Sec. 8.3.1, for repairs see Sec. 9.4.1.



90000248

MF showing location of Loop Flushing Valve



90000238

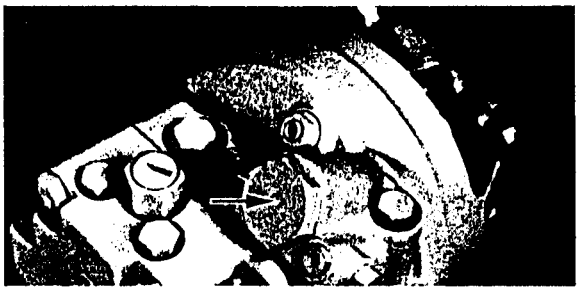
Motor Charge Relief Valve and Loop Flushing Shuttle Valve

2.6.2 Variable Motor Displacement Limiters

All Series 90 variable motors include mechanical displacement (stroke) limiters. Both the maximum and minimum displacement of the motor can be limited.

The range of the settings is as follows:

	055 MV Frame	075 MV Frame
Minimum Displacement	19 - 40 cm^3 1.2 - 2.4 in^3	26 - 54 cm^3 1.6 - 3.3 in^3
Maximum Displacement	65 - 100%	65 - 100%



90000352

MV Maximum Displacement Limiter
(Minimum Displacement Limiters on Opposite Side)

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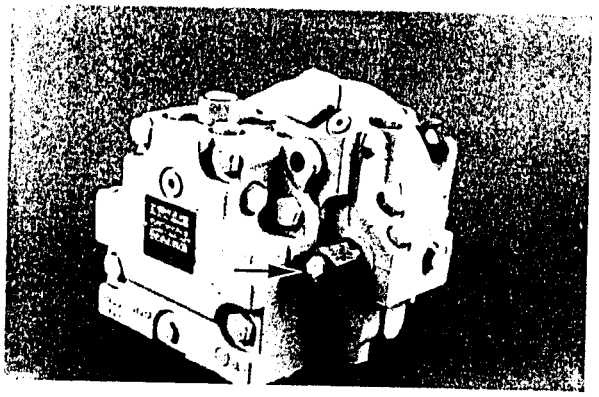
Series 90 Functional Description 2

2.7 Variable Motor Controls



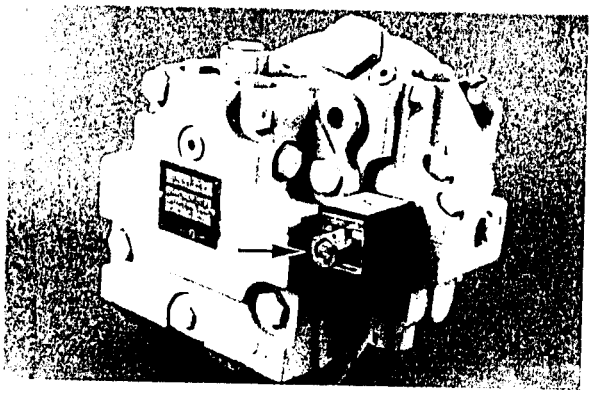
90000350

MV with Hydraulic 2-Position Control

2.7.1 Hydraulic 2-Position Control

This control utilizes a hydraulically operated three-way hydraulic valve to port system pressure to either of the motor displacement control pistons. The motor is normally held at its maximum displacement. Supplying pilot hydraulic pressure to the valve will cause the motor to go to its minimum displacement.

All functions of the hydraulic two-position control are preset at the factory. For repairs see Sec. 9.5.2 and 9.5.4.



90000351

MV with Electric 2-Position Control

2.7.2 Electric 2-Position Control

This control utilizes an electric solenoid operated three-way hydraulic valve to port system pressure to either of the motor displacement control pistons. The motor is normally held at its maximum displacement. Energizing the solenoid will cause the motor to go to its minimum displacement.

All functions of the electric two-position control are preset at the factory. For repairs see Sec. 9.5.1 and 9.5.4.

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3. Technical Specifications

3.1 General Specifications

Design
Variable Pumps and Motors: Axial piston pump of variable displacement, cradle swashplate design.

Fixed Motors: Axial piston motor with fixed displacement, fixed swashplate design.

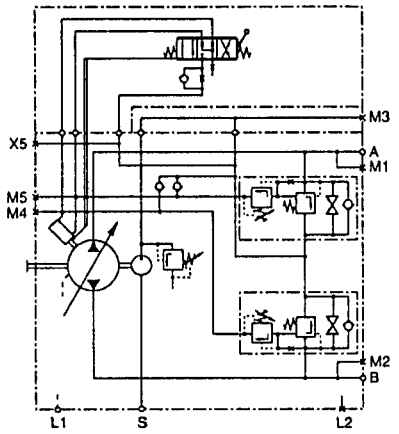
Type of Mounting (per SAE J744)
SAE flange, Size "B" mounting pad, 2 bolts
SAE flange, Size "C" mounting pad, 4 bolts
Cartridge flange, 2 bolts (for motor only)

Port Connections (See Sec. 4.2 for exact specs.)
Main pressure ports: SAE flange, Code 62
Remaining ports: SAE straight thread O-ring boss

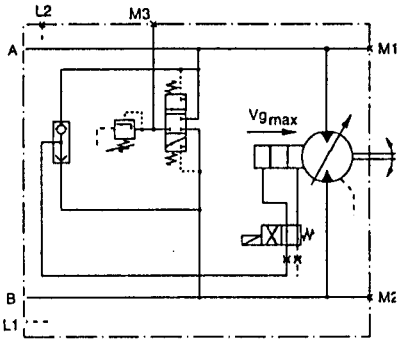
Direction of Rotation
Clockwise or counterclockwise (motors are bidirectional)

Installation Position
Installation position is discretionary. The housing must always be filled with hydraulic fluid, so note position of drain ports.

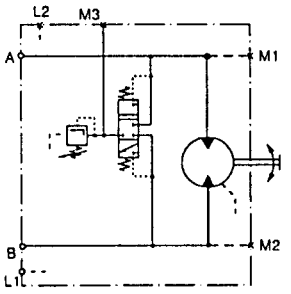
3.2 Circuit Diagrams



PV with charge pump and manual displacement control



MV with electrohydraulic two-position control



MF

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Series 90 Technical Specifications 3

3.3 Hydraulic Parameters

System Pressure Range

Maximum Pressure	480 bar	[6960 psi]
Rated Pressure	420 bar	[6000 psi]

Charge Pump Inlet Vacuum (on pumps only)

Maximum Vacuum, Continuous	0.7 bar abs	[10 in Hg]
Maximum Vacuum, Cold Start	0.2 bar abs	[25 in Hg]

Case Pressure

Maximum, Continuous	3 bar	[44 psi]
Maximum, Intermittent or Cold Start	5 bar	[73 psi]

Hydraulic Fluid

Refer to SAS publication BLN 9887 or Publication SDF (Id. No. 697581). Also refer to publication ATI-E 9101 for information relating to biodegradable fluids

Temperature Range[1]

Minimum, Intermittent or Cold Start	-40°C	[-40°F]
Maximum, Continuous	104°C	[220°F]
Maximum, Intermittent	115°C	[240°F]

Fluid Viscosity Limits

Minimum, Intermittent	5 mm^2/s	[42 SUS]
Minimum, Continuous	6.4 mm^2/s	[47 SUS]
Minimum, Optimum	13 mm^2/s	[70 SUS]
Maximum, Continuous	110 mm^2/s	[510 SUS]
Maximum, Intermittent or Cold Start	1600 mm^2/s	[7400 SUS]

Filtration

Required cleanliness level: ISO 4406 Class 18/13 or better. Refer to SAS publications BLN 9887 or Publication SDF (Id. No. 697581) and ATI-E 9201.

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Series 90 Technical Specifications 3

3.4 Technical Data

Table 1 - Variable Displacement Pumps

	Dimension	030 PV	042 PV	055 PV	075 PV	100 PV	130 PV	180 PV	250 PV
Displacement (maximum)	cm^3 in^3	30.0 1.83	42.0 2.56	55.0 3.35	75.0 4.57	100.0 6.10	130.0 7.93	180.0 10.98	250.0 15.25
Minimum speed	min^{-1} (rpm)	500	500	500	500	500	500	500	500
Rated speed*	min^{-1} (rpm)	4200	4200	3900	3600	3300	3100	2600	2300
Maximum speed*	min^{-1} (rpm)	4600	4600	4250	3950	3650	3400	2850	2500
Max. attainable speed* at max. disp.	min^{-1} (rpm)	5000	5000	4700	4300	4000	3700	3150	2750
Theoretical torque at max. disp.	Nm / bar lbf•in/1000 psi	0.48 290	0.67 380	0.88 530	1.19 730	1.59 970	2.07 1260	2.87 1750	3.97 2433
Weight (Base Unit)	kg lb	28 62	34 75	40 88	49 108	68 150	88 195	136 300	154 340

Table 2 - Fixed and Variable Displacement Motors

		Dimension	030 MF	042 MF	055 MF	075 MF	100 MF	130 MF	055 MV	075 MV
Displacement (maximum)		cm^3 in^3	30.0 1.83	42.0 2.56	55.0 3.35	75.0 4.57	100.0 6.10	130.0 7.93	55.0 3.35	75.0 4.57
Displacement (minimum)		cm^3 in^3	—	—	—	—	—	—	19.0 1.16	26.0 1.59
Rated speed*	at max. disp.	min^{-1} (rpm)	4200	4200	3900	3600	3300	3100	3900	3600
	at min. disp.	min^{-1} (rpm)	—	—	—	—	—	—	4600	4250
Maximum speed*	at max. disp.	min^{-1} (rpm)	4600	4600	4250	3950	3650	3400	4250	3950
	at min. disp.	min^{-1} (rpm)	—	—	—	—	—	—	5100	4700
Max. attainable speed* at max. disp.		min^{-1} (rpm)	5000	5000	4700	4300	4000	3700	4700	4300
Theoretical torque at max. disp.		Nm / bar lbf•in/1000 psi	0.48 290	0.67 380	0.88 530	1.19 730	1.59 970	2.07 1260	0.88 530	1.19 730
Maximum flow at max. disp.		l / min gal / min	138 36.5	193 51	234 62	296 78	365 96	442 117	234 62	296 78
Max. corner power		kW hp	111 149	155 208	187 251	237 318	292 392	354 475	224 300	282 378
Weight (SAE Flange)		kg lb	11 24	15 34	20 45	26 57	34 74	45 99	39 86	44 98
Weight (Cartridge Motor)		kg lb	—	17 37	26 57	33 72	—	—	40 88	46 101

* = Refer to Series 90 Technical Information manual for definitions

4. Pressure Measurement

4.1 Required Tools

The service procedures described in this manual for Series 90 pumps and motors can be performed using common mechanic's tools. Special tools, if required are shown.

Pressure gauges should be calibrated frequently to ensure accuracy. Snubbers are recommended to protect pressure gauges.

4.2 Port Locations and Pressure Gauge Installation

The following sections list the ports for each type of hydraulic unit. The recommended pressure gauge and fitting are also specified.

Outline drawings showing port locations follow the tables.

4.2.1 Variable Pump

Port	Function	Recommended Gauge Size and Fitting
M1	System Pressure Port "A"	1000 bar or 10 000 psi Gauge 9/16—18 O-Ring Fitting
M2	System Pressure Port "B"	1000 bar or 10 000 psi Gauge 9/16—18 O-Ring Fitting
M3 (M6)	Charge Pressure	50 bar or 1000 psi Gauge 9/16—18 O-Ring Fitting
M4 M5	Servo Pressure	50 bar or 500 psi Gauge 9/16—18 O-Ring Fitting

Port	Function	Recommended Gauge Size and Fitting	
L1 L2	Case Pressure	10 bar or 100 psi Gauge	
		SAE O-Ring Fitting:	
		030, 042	7/8—14
		055, 075, 100	1-1/16—12
		130	1-5/16—12
		180, 250	1-5/8—12
X1 X2	HDC / EDC Pressure	50 bar or 1000 psi Gauge 7/16 — 20 O-Ring Fitting or 9/16 — 18 O-Ring Fitting	
X3	Ext. Control Pressure	50 bar or 1000 psi Gauge 9/16 — 18 O-Ring Fitting	
S	Charge Pump Inlet	Vacuum Gauge, Tee into Inlet Line	
		SAE O-Ring Fitting:	
		030, 042	1-1/16 — 12
		055, 075	1-5/16 — 12
		100, 130, 180	1-5/8 — 12
		250	1-1/2 SAE Split Flange

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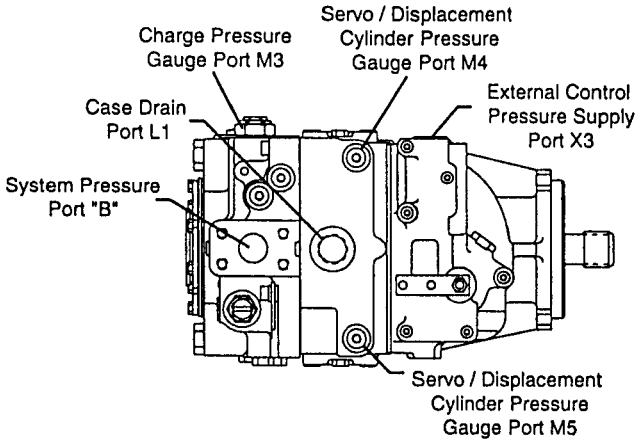
Series 90 — Pressure Measurement — 4



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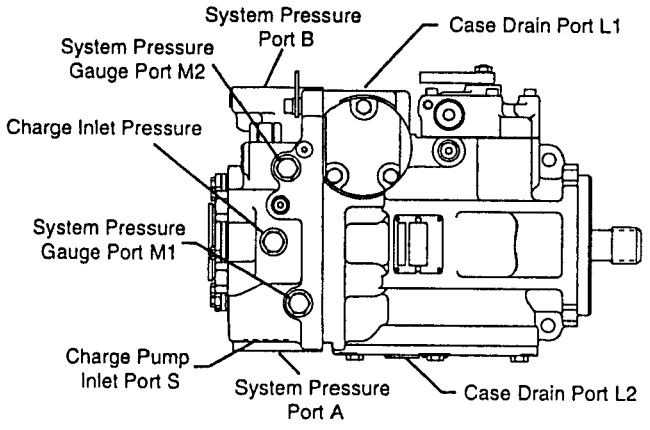
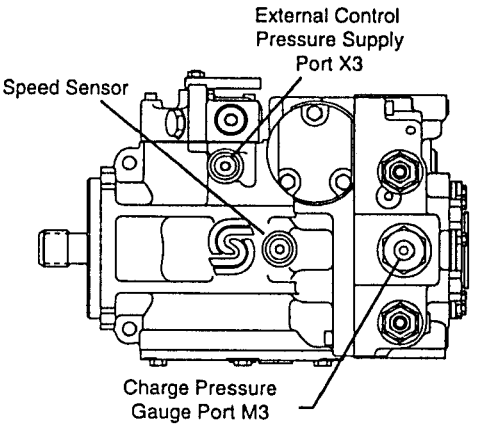
Top View



Left Side View



Right Side View

90000815
90000816

PV with Side Port End Cap and Manual Displacement Control

5. Initial Start-Up Procedure

The following start-up procedure should always be followed when starting-up a new Series 90 installation or when restarting an installation in which either the pump or motor had been removed.

WARNING
The following procedure may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing the procedure in order to prevent injury to the technician and bystanders. Take necessary safety precautions before moving the vehicle/machine.

Prior to installing the pump and/or motor, inspect the units for damage incurred during shipping and handling. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

Fill the reservoir with recommended hydraulic fluid. This fluid should be passed through a 10 micron (nominal, no bypass) filter prior to entering the reservoir. The use of contaminated fluid will cause damage to the components, which may result in unexpected vehicle/machine movement. See the publications BLN-9887 and SDF 697581 for further related information.

The inlet line leading from the reservoir to the pump must be filled prior to start-up. Check inlet line for properly tightened fittings and make sure it is free of restrictions and air leaks.

Be certain to fill the pump and/or motor housing with clean hydraulic fluid prior to start up. Fill the housing by pouring filtered oil into the upper case drain port.

Install a 50 bar (or 1000 psi) pressure gauge in the charge pressure gauge port (see Sec. 4.2 for location) to monitor the charge pressure during start-up.

It is recommended that the external control input signal (linkage for MDC, hydraulic lines for HDC, or electrical connections for EDC) be disconnected at the pump control until after initial start-up. This will ensure that the pump remains in its neutral position.

WARNING
Do not start prime mover unless pump is in neutral position (0° swashplate angle). Take precautions to prevent machine movement in case pump is actuated during initial start up.

"Jog" or slowly rotate prime mover until charge pressure starts to rise. Start the prime mover and run at the lowest possible RPM until charge pressure has been established. Excess air may be bled from the high pressure lines through the high pressure system gauge port.

Once charge pressure has been established, increase speed to normal operating RPM. Charge pressure should be as indicated in the pump model code (see Sec. 8.1.1). If charge pressure is inadequate, shut down and determine cause for improper pressure. Refer to Troubleshooting Sec. 7.

WARNING
Inadequate charge pressure will affect the operator's ability to control the machine.

Shut down the prime mover and connect the external control input signal. Also reconnect the machine function if disconnected earlier. Start the prime mover, checking to be certain the pump remains in neutral. With the prime mover at normal operating speed, slowly check for forward and reverse machine operation.

Charge pressure may slightly decrease during forward or reverse operation. Continue to cycle slowly between forward and reverse for at least five minutes.

Shut down prime mover, remove gauges, and plug ports. Check reservoir level and add filtered fluid if needed.

The transmission is now ready for operation.

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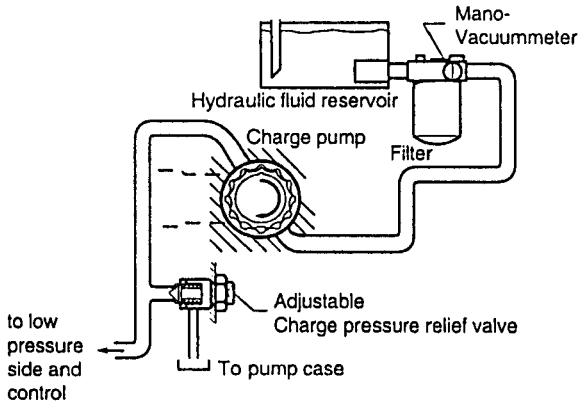
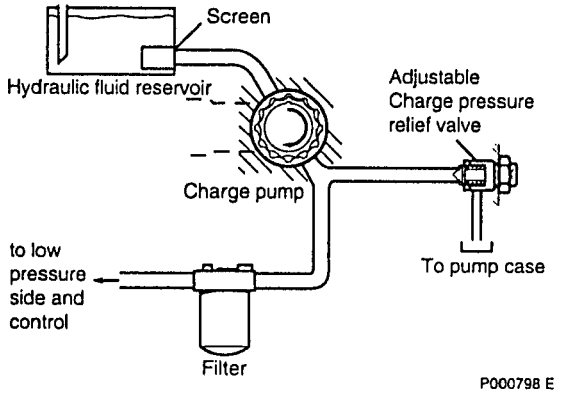
6. Fluid and Filter Maintenance



Suction Filtration Schematic



Charge Pressure Filtration Schematic (Partial Flow)

To ensure optimum service life of Series 90 products, regular maintenance of the fluid and filter must be performed. Contaminated fluid is the main cause of unit failure. Care should be taken to maintain fluid cleanliness while performing any service procedure.

Check the reservoir daily for proper fluid level, the presence of water (noted by a cloudy to milky appearance, or free water in bottom of reservoir), and rancid fluid odor (indicating excessive heat). If either of these conditions occur, change the fluid and filter immediately.

It is recommended that the fluid and filter be changed per the vehicle/machine manufacturer's recommendations or at the following intervals:

System with a sealed-type reservoir	2000 hours
System with a breathing-type reservoir	500 hours

It may be necessary to change the fluid more frequently than the above intervals if the fluid becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid has been subjected to temperature levels greater than the recommended maximum. Never reuse fluid.

The filter should be changed whenever the fluid is changed or whenever the filter indicator shows that it is necessary to change the filter.

Filters can be in either pressure filtration or suction filtration configurations. For suction filtration, filters should have a Beta-ratio of β_{10}>2. For charge pressure filtration, filters should have a Beta-ratio of β_{10}>10. See Sauer-Sundstrand publication BLN-9887 or 697581 and ATI-E 9201 for more information on filtration.

7. Troubleshooting

This section provides general steps to follow if certain undesirable system conditions are observed. Follow the steps in a section until the problem is solved. Some of the items will be system specific. For areas covered in this manual, a section is referenced. **Always observe the safety precautions listed in Sec. 1.2 and related to your specific equipment.**

7.1 "Neutral" Difficult or Impossible to Find

Item	Description	Action
1. Check input to pump control.	Input to control module is operating improperly.	Check control input and repair or replace as necessary.
2. Check pump displacement control.	Control linkages are not secure, control orifices are blocked, etc.	Adjust, repair, or replace control module as necessary (8.2 and 9.3).
3. Repair or replace pump.		Consult a Sauer-Sundstrand Authorized Service Center.

7.2 System Operating Hot

Item	Description	Action
1. Check oil level in reservoir.	Insufficient hydraulic fluid will not meet cooling demands of system.	Fill reservoir to proper level.
2. Inspect heat exchanger.	Heat exchanger not sufficiently cooling the system.	Check air flow and input air temperature for heat exchanger. Clean, repair or replace heat exchanger.
3. Check charge pressure.	Low charge pressure will overwork system.	Measure charge pressure (4.2). Inspect and adjust or replace charge relief valve (8.1.1 and 9.2.3). Or repair leaky charge pump (9.2.4).
4. Check charge pump inlet vacuum.	High inlet vacuum will overwork system. A dirty filter will increase the inlet vacuum. Inadequate line size will restrict flow.	Check charge inlet vacuum (4.2). If high, inspect inlet filter and replace as necessary. Check for adequate line size, length or other restrictions.
5. Check system relief pressure settings.	If the system relief settings are too low, the relief valves will be overworked.	Verify settings of pressure limiters and high pressure relief valves and adjust or replace multi-function valves as necessary (8.1.2, 9.2.1)
6. Check for internal leakage in motor.	Leakage will reduce low side system pressure and overwork the system.	Monitor motor case flow without loop flushing in the circuit (use defeat spool 9.4.1.3). If flow is excessive, replace motor.
7. Check system pressure.	High system pressure will overheat system.	Measure system pressure (4.2). If pressure is high reduce loads.
8. Replace transmission.		Replace pump and motor.

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Series 90 Troubleshooting 7

7.3 Transmission Operates Normally in One Direction Only

Item	Description	Action
1. Check input to pump control.	Input to control module is operating improperly.	Check control input and repair or replace as necessary.
2. Check pump displacement control.	Control linkages are not secure, control orifices are blocked, etc.	Repair or replace control module as necessary (8.2 and 9.3).
3. Interchange system pressure limiters, high pressure relief valves, and system check valves.	Interchanging the multi-function valves will show if the problem is related to the valve functions contained in the multi-function valves.	Interchange multi-function valves. If the problem changes direction, repair or replace the valve on the side that does not operate (8.1.2 and 9.2.1).
4. Check charge pressure.	If charge pressure decays in one direction the loop flushing valve may be "sticking" in one direction.	Measure charge pressure in forward and reverse (4.2). If pressure decays in one direction, inspect and repair the motor loop flushing valve (9.4.1.1).

7.4 System Will Not Operate in Either Direction

Item	Description	Action
1. Check oil level in reservoir.	Insufficient hydraulic fluid to supply system loop.	Fill reservoir to proper level.
2. Check input to pump control.	Input to control module is operating improperly.	Check control input and repair or replace as necessary.
3. Check pump displacement control.	Control linkages are not secure, control orifices are blocked, etc.	Repair or replace control module as necessary (8.2 and 9.3).
4. Ensure bypass valve(s) are closed.	If bypass valve(s) is open, the system loop will be depressurized.	Close bypass valves (8.1.3). Replace multi-function valve if defective (9.2.1).
5. Check charge pressure with pump in neutral.	Low charge pressure insufficient to recharge system loop.	Measure charge pressure with the pump in neutral (4.2). If pressure is low, go to step 6; otherwise continue with step 5.
6. Check charge pressure with pump in stroke.	Low charge pressure with the pump in stroke indicates a motor charge relief valve or system pressure relief valve may be improperly set.	Measure charge pressure with pump in stroke (4.2). If pressure is low, adjust or replace motor charge relief valve (8.3.1 and 9.4.1.2), otherwise go to step 9.
7. Inspect pump charge relief valve.	A pump charge relief valve that is leaky or set too low will depressurize the system.	Adjust or replace pump charge relief valve as necessary (8.1.1, 9.2.3)
8. Check charge pump inlet filter.	A clogged filter will undersupply system loop.	Inspect filter and replace if necessary.

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Series 90 — Troubleshooting — 7

9. Check charge pump.	A malfunctioning charge pump will provide insufficient charge flow.	Repair or replace the charge pump (9.2.4). If OK go to last step.
10. Check pump displacement control.	Control linkages are not secure, control orifices are blocked, etc.	Repair or replace control module as necessary (8.2 and 9.3).
11. Check system pressure.	Low system pressure will not provide power necessary to move load.	Measure system pressure (4.2). Continue with next step.
12. Check system multi-function valves.	Defective multi-function valves will cause system pressure to be low.	Repair or replace multi-function valve(s) (9.2.1).
13. Replace transmission.		Replace pump and motor.

7.5 Low Motor Output Torque

Item	Description	Action
1. Check system pressure at motor.	Low system pressure at the motor will reduce torque.	Measure system pressure at motor (4.2). If pressure limiter setting is low, increase setting.
2. Variable motor stuck at minimum displacement.	Minimum motor displacement yields low output torque.	Check control supply pressure (4.2.3) or repair displacement control (9.5). Check motor control orifices (9.5.4).
3. Check for internal leakage.	Internal leakage will reduce system pressure.	Check for leakage in O-rings, gaskets, and other fittings (9.1.1 and others). Repair unit as required, or replace leaky unit.
4. Replace transmission.		Replace pump and motor.

7.6 Improper Motor Output Speed

Item	Description	Action
1. Check oil level in reservoir.	Insufficient hydraulic fluid will reduce motor speed.	Fill oil to proper level.
2. Check charge pressure.	Incorrect charge pressure can result in a low speed motor.	Measure charge pressure (8.1.1), adjust charge system as necessary (9.2.3 and 9.2.4).
3. Check pump output flow.	Incorrect outflow will affect output speed. Incorrect output flow indicates the swashplate is out of position.	Measure pump output flow by teeing into outflow hose. Check for proper pump speed and see that the pump is in full stroke.
4. Check variable motor displacement control.	If variable motor displacement control is not functioning correctly, variable motor swashplate may be in wrong position.	See if variable motor displacement control is responding. If not, repair or replace control (9.5).

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7.7 Excessive Noise and/or Vibration

Item	Description	Action
1. Check oil in reservoir.	Insufficient hydraulic fluid will lead to cavitation.	Fill reservoir to proper level.
2. Air in system.	Air bubbles will lead to cavitation.	Look for foam in reservoir. Check for leaks on inlet side of system loop. Afterwards, let reservoir settle until bubbles are gone. Run system at low speed to move system fluid to reservoir. Repeat.
3. Check pump inlet vacuum.	High inlet vacuum will create noise. A dirty filter will increase the inlet vacuum.	Inspect and replace filter as necessary. Check for proper suction line size.
4. Inspect shaft couplings.	A loose shaft coupling will cause excessive noise.	Replace loose shaft coupling in charge pump (Sec. 9.2.4) or replace pump or motor.
5. Inspect shaft alignment.	Unaligned shafts will create excessive frictional noise.	Align shafts.

7.8 System Response is Sluggish

Item	Description	Action
1. Check oil level in reservoir.	Insufficient hydraulic fluid will reduce output pressure.	Fill reservoir to proper level.
2. Check multi-function valves' pressure settings.	Incorrect pressure settings will affect system reaction time.	Adjust or replace multi-function valves (8.1.2 and 9.2.1).
3. Check pump inlet vacuum.	High pump inlet vacuum will reduce system pressure.	Measure charge inlet vacuum (4.2). If high replace inlet filter.
4. Check prime mover speed.	Low engine speed will reduce system performance.	Adjust engine speed.
5. Check charge and control pressures.	Incorrect charge or control pressures will affect system performance.	Measure charge and control pressures and correct if necessary (4.2 and others).
6. Check system internal leakage.	Internal leakage will reduce system pressure.	Check for leakage in O-rings, gaskets, and other fittings (9.1.1 and others).
7. Replace transmission.		Replace pump and motor.

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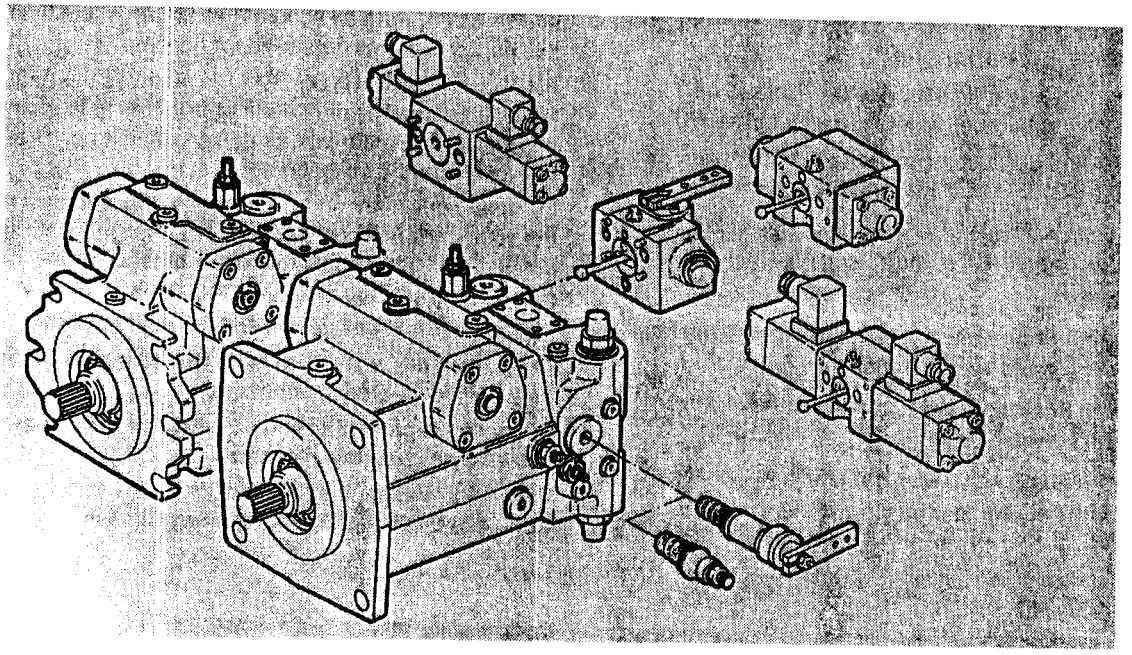


NOTICE

Specifications, descriptions and illustrative material shown herein were as accurate as known at the time this publication was approved for printing.

BRUENINGHAUS HYDROMATIK reserves the right to discontinue models or options at any time or to change speci-fications, materials, or design without notice and with-out incurring obligation.

Optional equipment and accessories may add cost to the basic unit, and some options are available only in combination with certain models or other options.

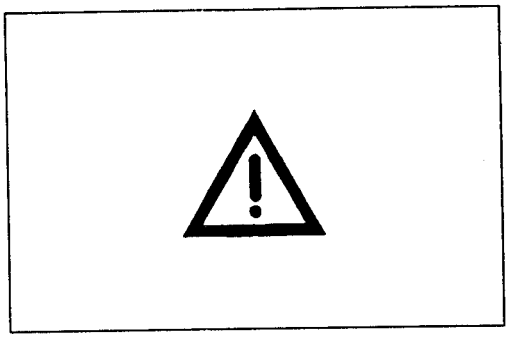
For the available combinations refer to the relevant data sheet for the basic unit and the desired option.

Adjustment and tests have to be carried out on the test bench under operating temperatures.

Protection of personnel and property has to be guar-anteed by appropriate measures.

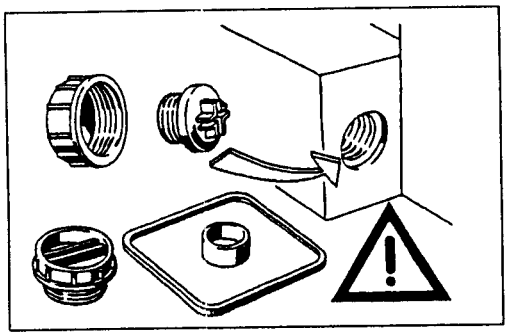
Expert knowledge, the precondition of any service work, can be obtained in our training courses.

CONTENTS



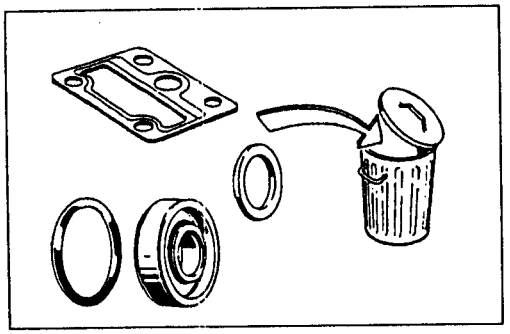
Achtung!
Nachfolgend Hinweise bei allen Reparaturarbeiten an Hydraulikaggregaten beachten!

Attention!
Observe the following notices when carrying out repair work at hydraulic aggregates!



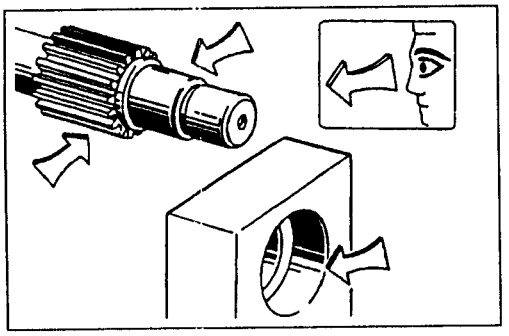
Alle Öffnungen der Hydraulikaggregate verschließen.

Close all ports of the hydraulic aggregates.



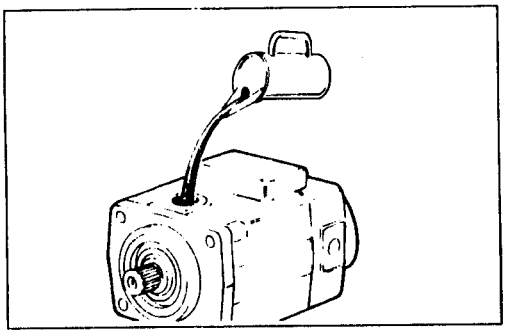
Alle Dichtungen erneuern.
Nur original HYDROMATIK-Ersatzteile verwenden.

Replace all seals.
Use only original HYDROMATIK spare parts.



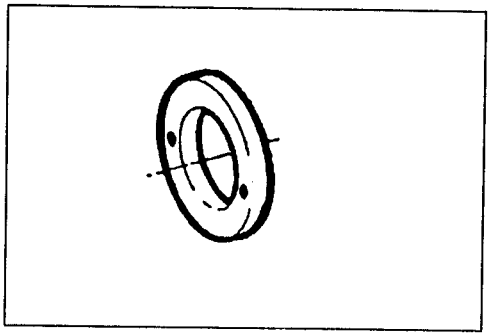
Alle Dicht- und Gleitflächen auf Verschleiß prüfen.
Achtung: Nacharbeiten an Dichtflächen z.B. durch Schleifpapier kann die Oberfläche beschädigen.

Check all seal and sliding surfaces for wear.
Attention: Rework of sealing area f. ex. with abrasive paper can damage surface.



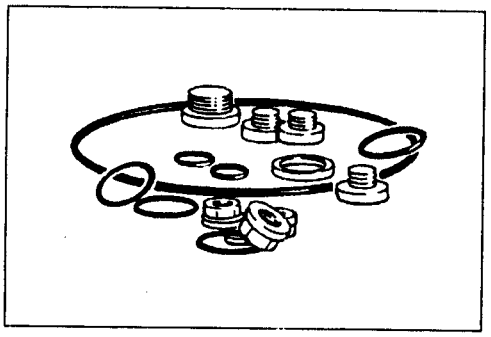
Hydraulikaggregate vor Inbetriebnahme mit Betriebsmedium befüllen.

Fill up hydraulic aggregates with medium before start- up.



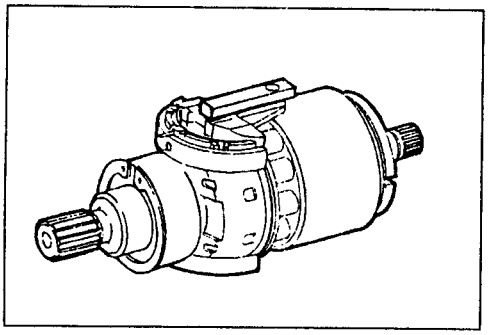
1 Dichtsatz für Triebwelle.

Seal kit for drive shaft.



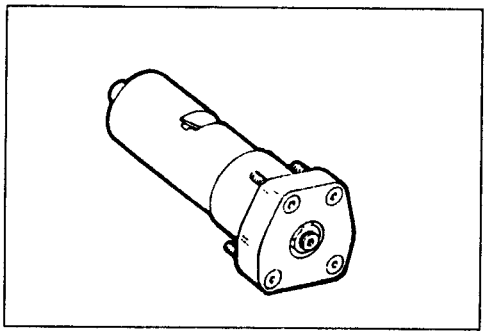
2 Äußerer Dichtsatz.

External seal kit.



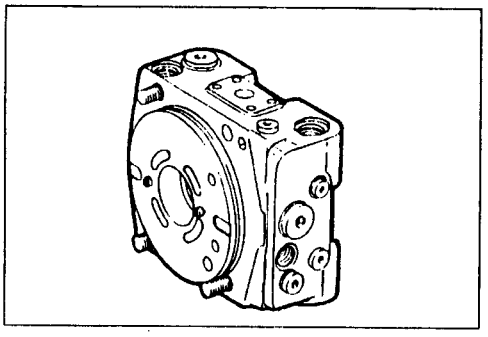
3 Triebwerk komplett.

Complete rotary group.



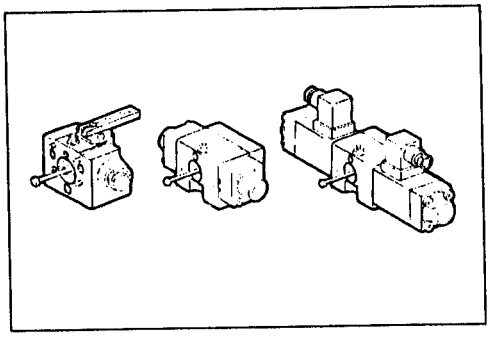
4 Stellkolben

Positioning piston



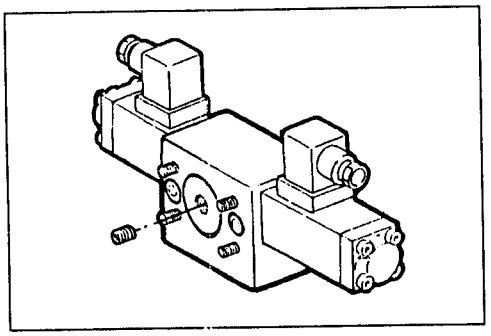
5 Anschlußplatte

Valve plate



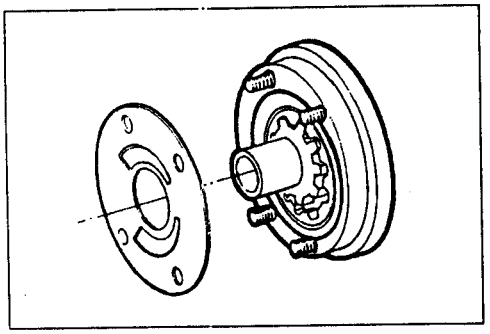
6 Ansteuergeräte **HW, HD, EP**
Hinweis:
NG 71 wie NG 40 - 56 mit Flachdichtung.

Control device **HW, HD, EP**
Note:
Size 71 control device as size 40 - 56 with flat seal.



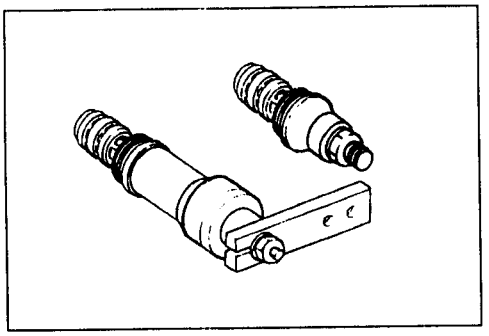
7 Ansteuergerät **DA**
Hinweis:
NG 71 wie NG 40 - 56 mit Flachdichtung.

Control device **DA**
Note:
Size 71 control device as size 40 - 56 with flat seal.



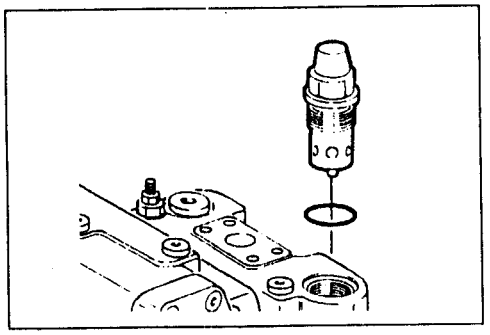
8 Hilfspumpe

Boost pump



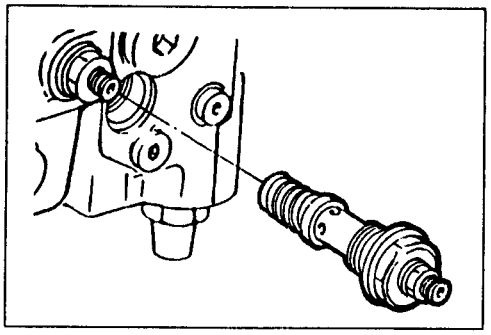
9 Regelventil

Control valve



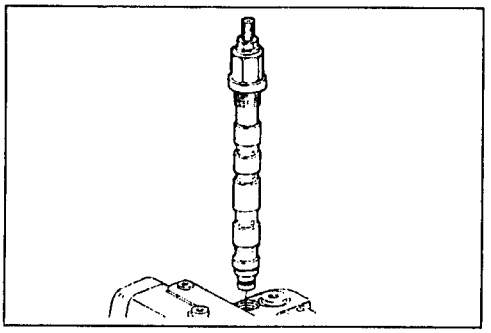
10 HD - Ventil

High pressure valve



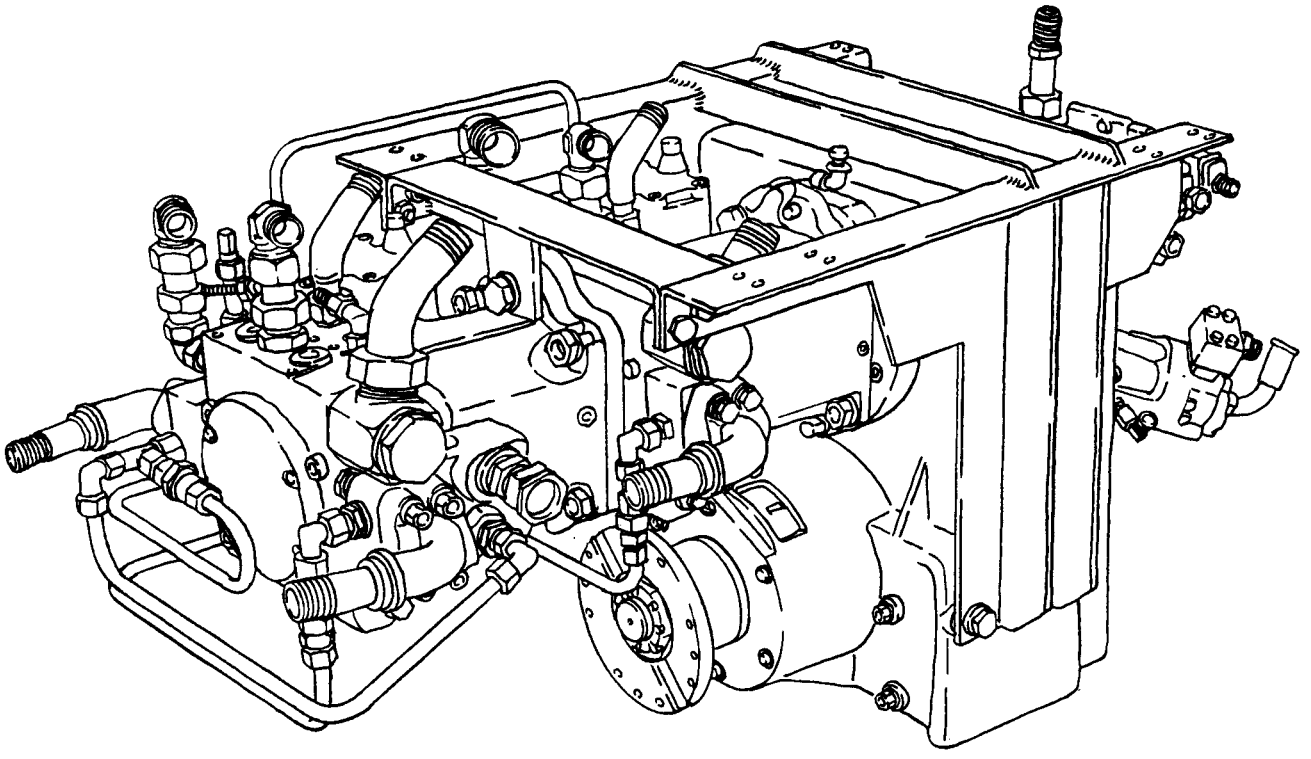
11 ND - Ventil

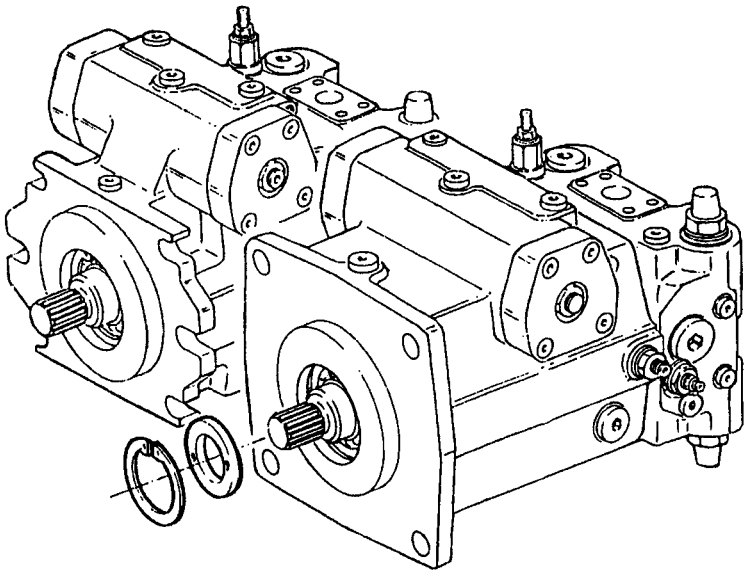
Low pressure valve



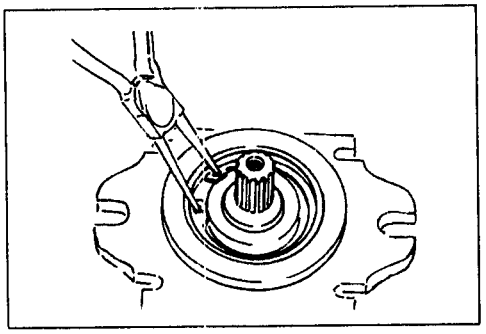
12 Druckabschneidung

Pressure cut-off



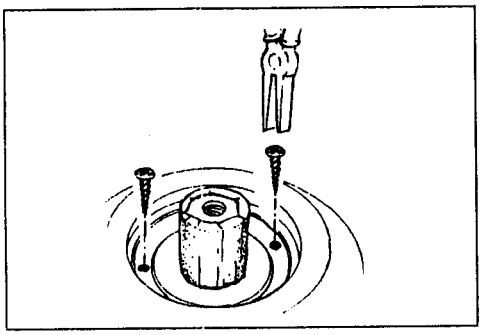


13



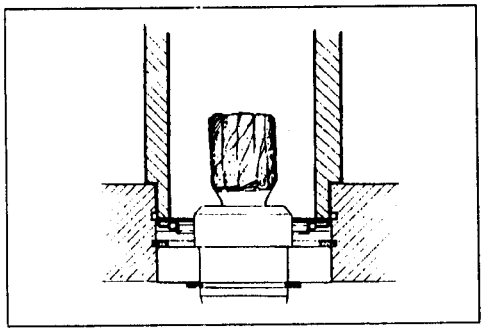
14 Triebwelle abkleben.
Sicherungsring ausbauen.

Protecting the drive shaft.
Remove retaining ring.



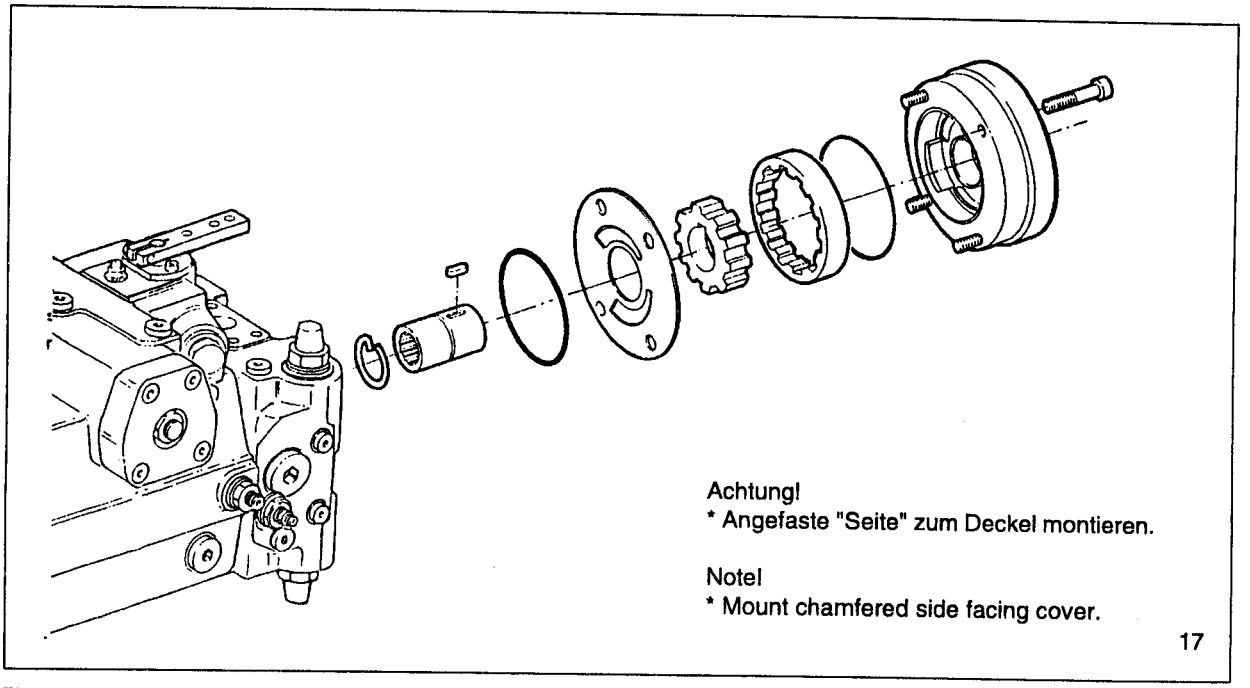
15 Blechschraube in die mit Gummi gefüllten Löcher eindrehen.
Mit Zange WDR herausziehen.

Screw in sheet metal screw into the holes fitted with rubber.
Pull out shaft seal with pliers.



16 Wellendichtring mit Buchse auf Anschlag einpressen.
Sicherungsring einbauen.

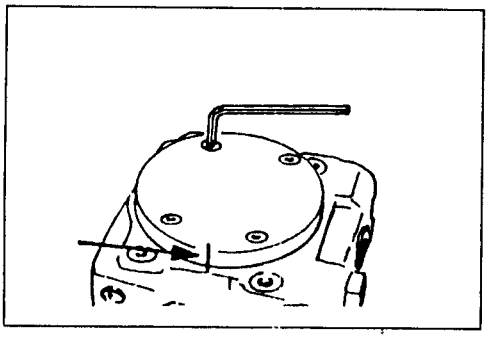
Press-in shaft seal with bush to stop.
Assemble retaining ring.



Achtung!
* Angefaste "Seite" zum Deckel montieren.

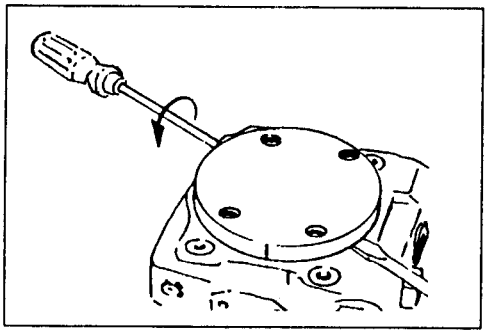
Notel
* Mount chamfered side facing cover.

17



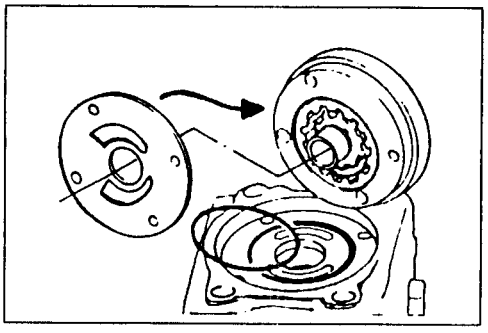
18 Lage kennzeichnen,
Befestigungsschrauben ausbauen.

Mark position,
remove fixing screws.



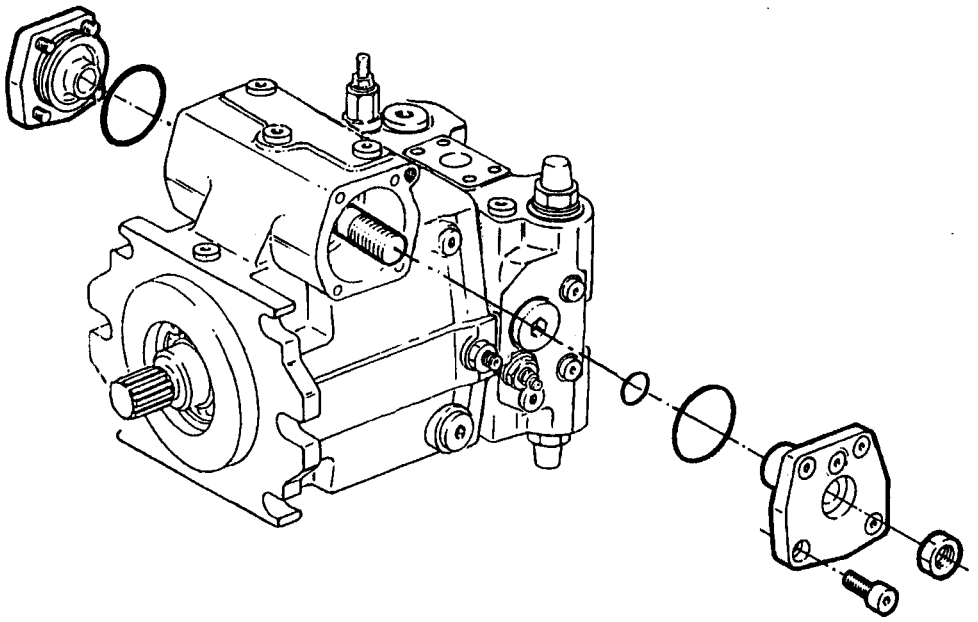
19 Deckel abdrücken.

Pry-off cover.



20 Kontrolle:
O-Ring, Nut,
Lauffläche, Anschlußplatte.

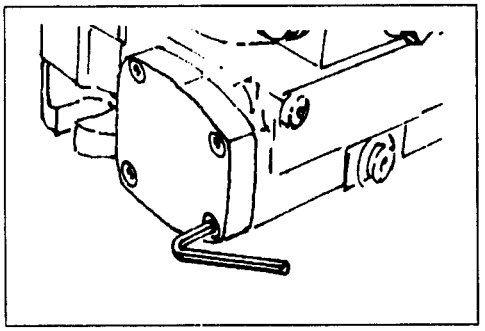
Check:
O-ring, groove,
gliding surface, connection plate.



Achtung!
Korrekt mechanische 0-Lageneinstellung überprüfen

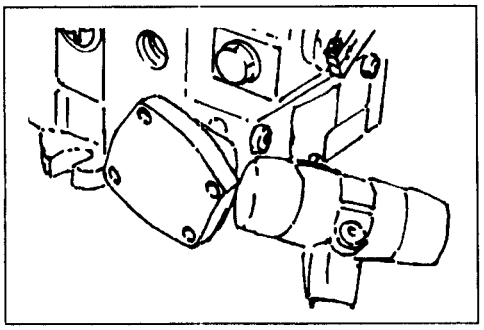
Attention!
Check correct mechanical 0-position.

21



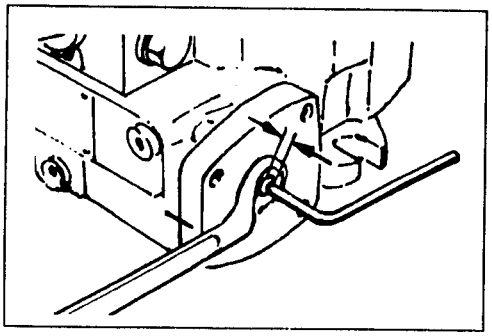
22 Lage kennzeichnen.

Mark position.



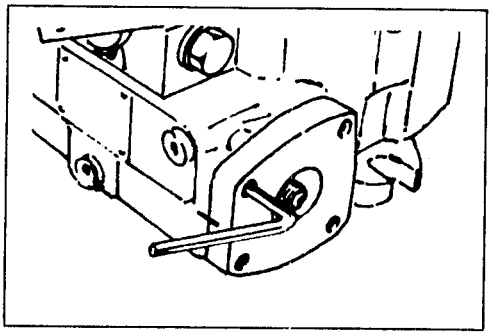
23 Deckel verdrehen und mit leichten Hammerschlägen lösen.

Rotate cover and release by tapping gently with hammer.



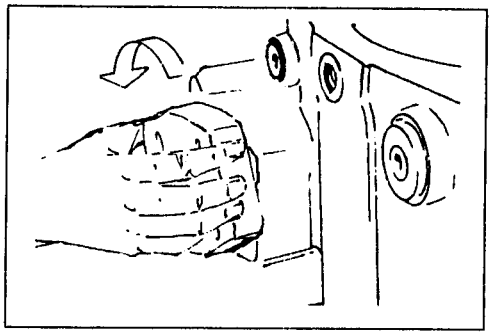
24 Deckel kennzeichnen. Maß festhalten, Kontermutter lösen, Stellschraube gegenhalten.

Mark cover. Must be fixed, loosen counter nut, hold adjustment screw.



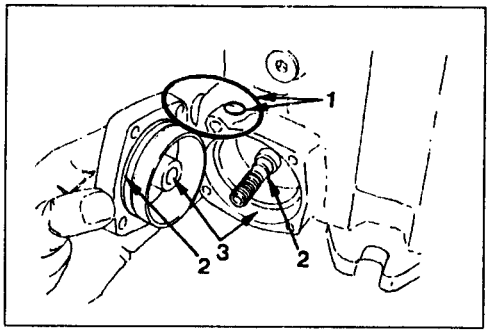
25 Deckel demontieren.

Remove cover.



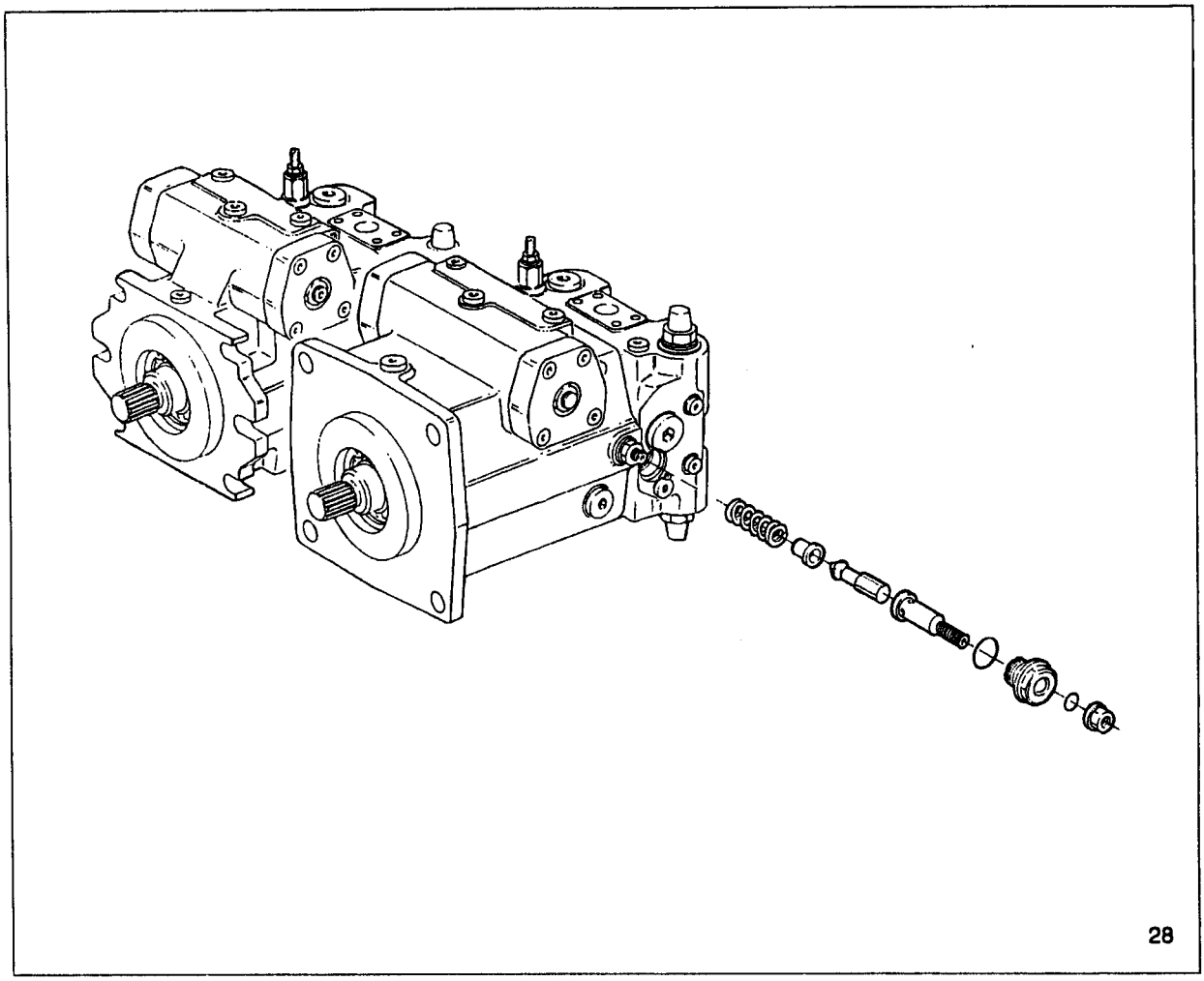
26 Deckel von Stellschraube "abschrauben".

Lift off by turning the setting screw.



27 Kontrolle!
O-Ring (1), Nut (2), Gehäuse (3).

Check!
O-ring (1), groove (2), housing (3).



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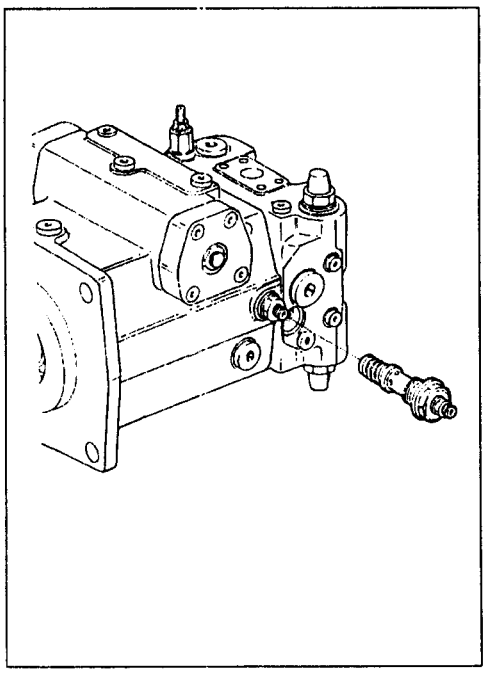
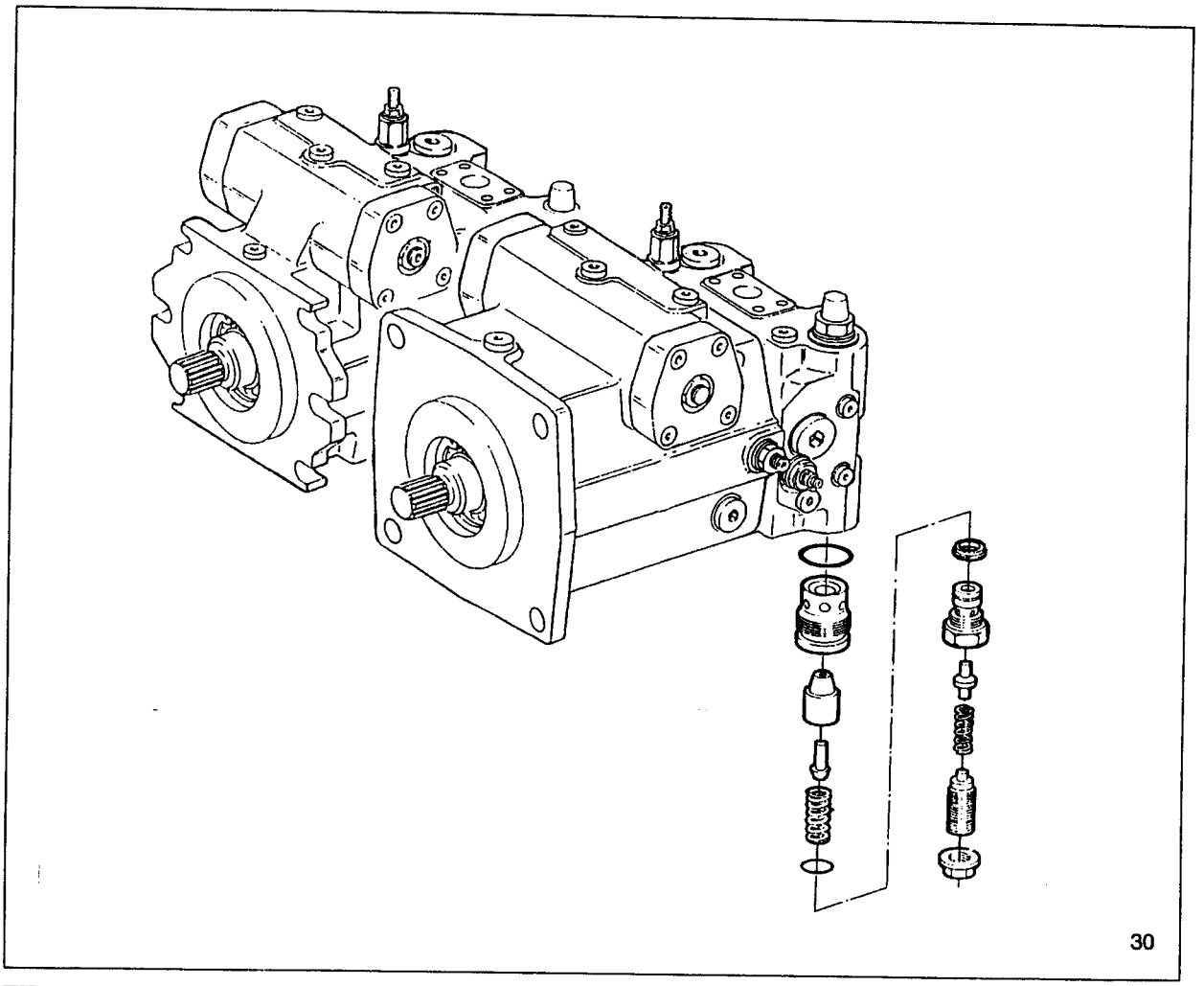
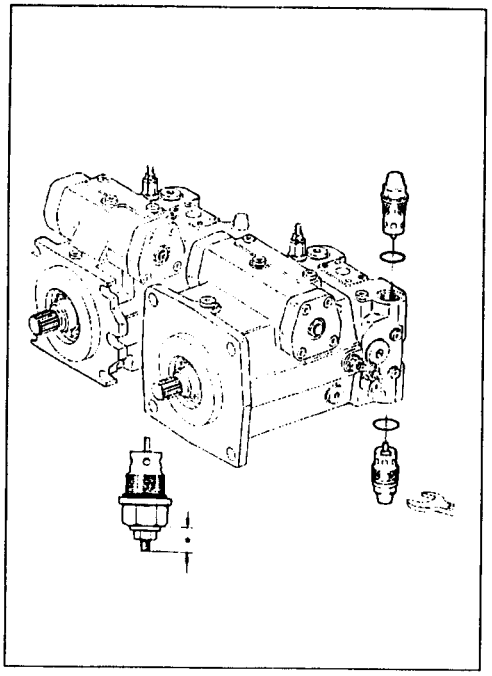


29 Ventil komplett ausbauen.
Hinweis:
Einstellschraube nicht verändern.
Achtung!
Nach Einbau Ventileinstellung überprüfen!

Remove valve completely:
Note:
Do not change adjustment screw.
Attention!
Check valve setting after installation.



30



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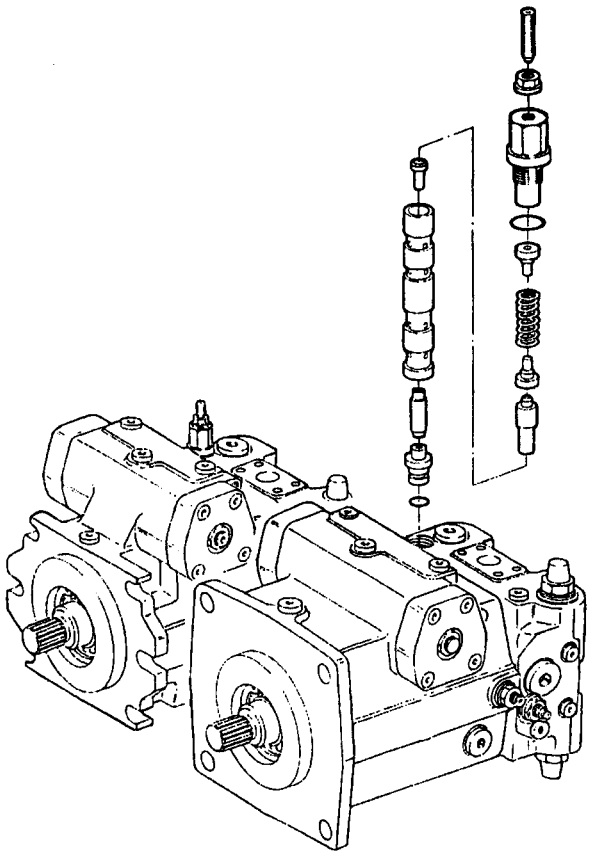
Ventil komplett ausbauen.
Kontrolle: O-Ring, Gehäuse.
Wechsel der Dichtmutter - Einstellmaß (*) festhalten.
Achtung!
Nach Einbau "Ventileinstellung" überprüfen.

Remove valve completely.
Control: O-ring, housing.
Replacement of the tightening nut, record measure (*).
Attention!
After assembly check "valve setting".



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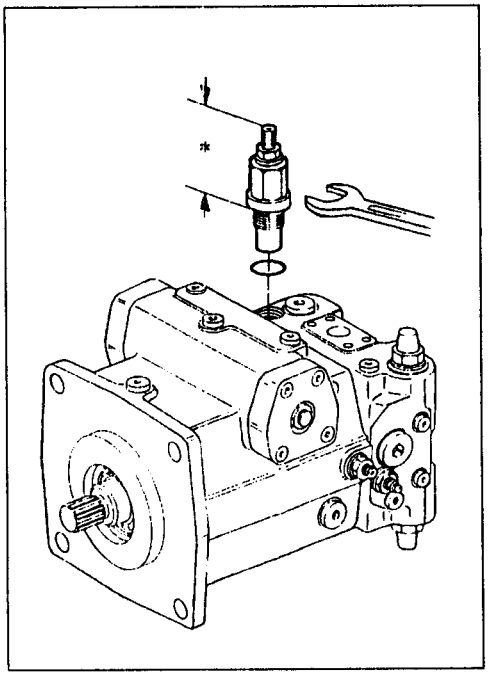

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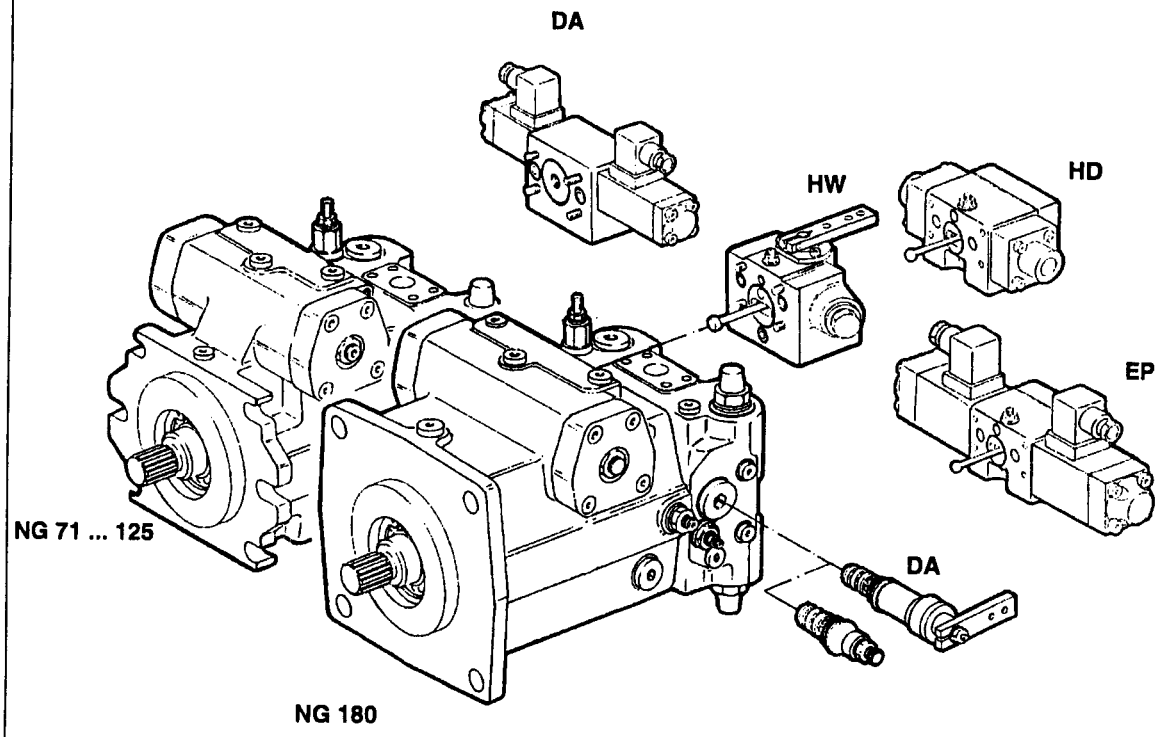
Einstellteil komplett ausschrauben.
Kontrolle: O-Ring, Gehäuse.
Wechsel der Dichtmutter - Einstellmaß (*) festhalten.
Achtung!
Nach Einbau "Ventileinstellung" überprüfen.

Unscrew setting cartridge completely.
Control: O-ring, housing.
Replacement of the tightening nut, record measure (*).
Attention!
After assembly check "valve setting".

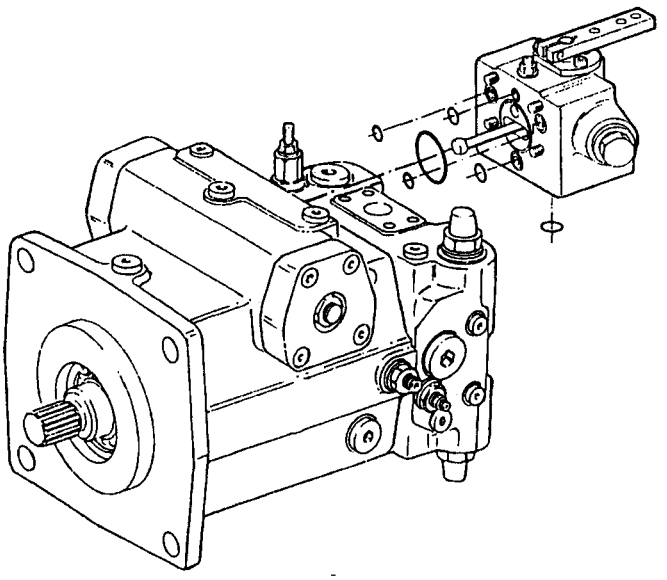


Ansteuergerät abbauen.

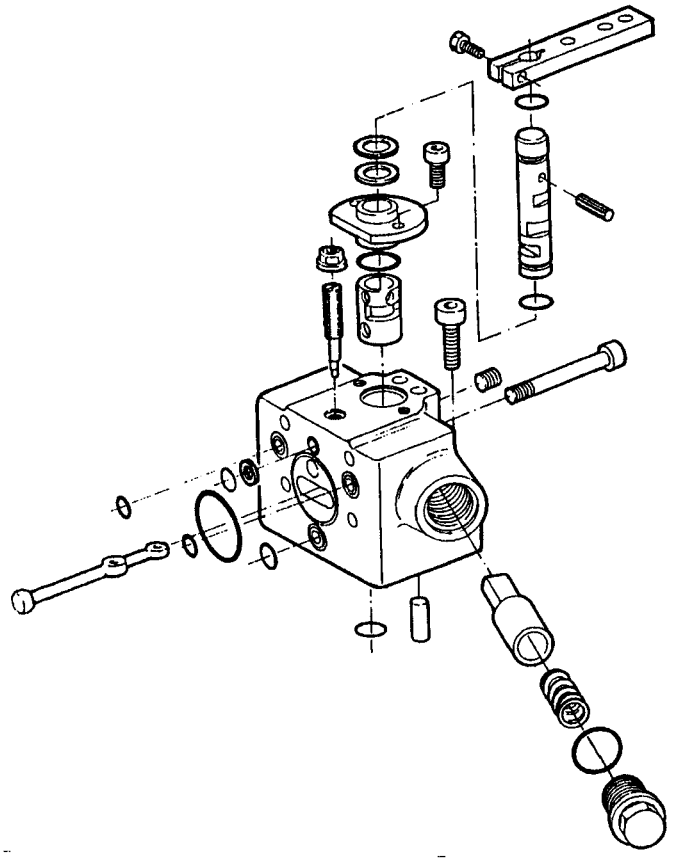
Remove control device.

Hinweis:
NG 71: Abdichtung der Ansteuergeräte wie NG 40 - 56 mit Flachdichtung.
Achtung!
Korrekte hydraulische Nullageneinstellung überprüfen.

Note:
Size 71: Sealing of control device as size 40 - 56 with flat seal.
Attention!
Check correct hydraulic 0-position.



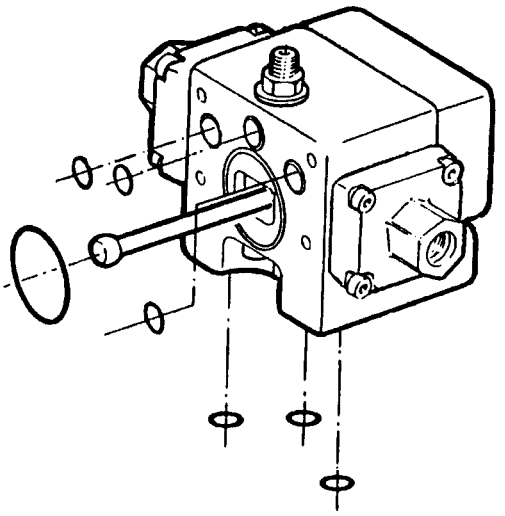
35



Kontrolle:
O-Ringe und Dichtung.

Check:
O-rings, gasket.

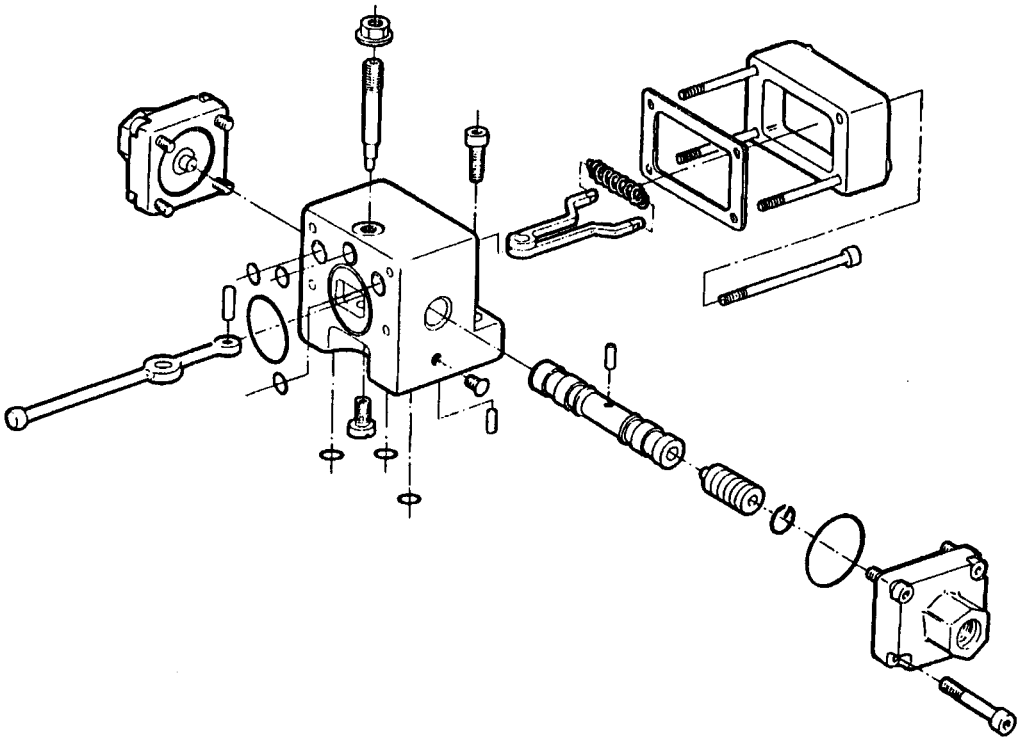
36



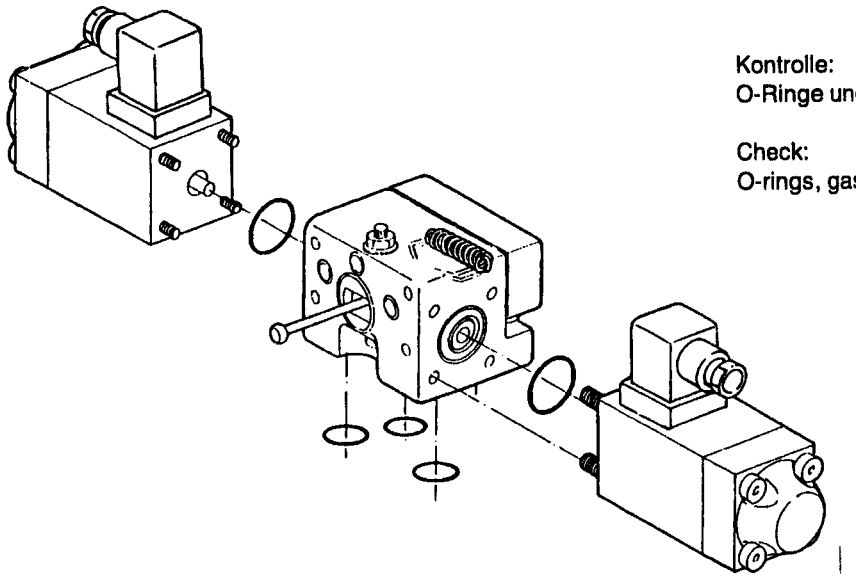
Kontrolle:
O-Ringe

Check:
O-rings

37



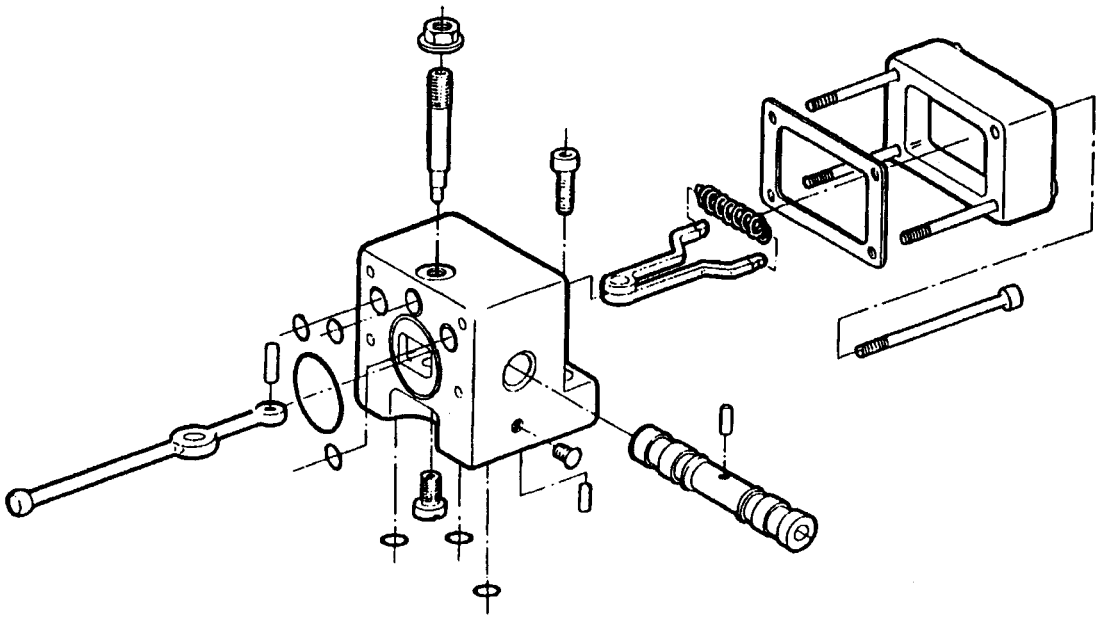
38



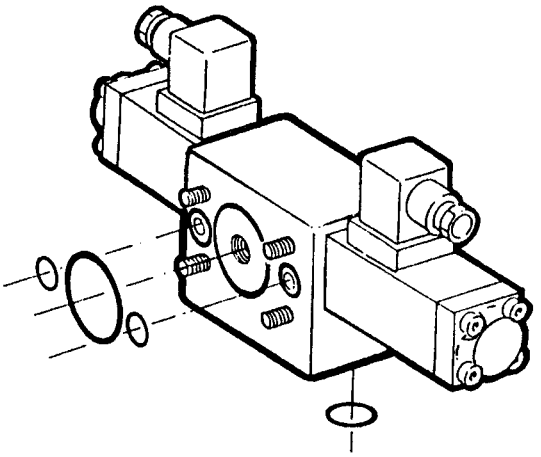
Kontrolle:
O-Ringe und Dichtung.

Check:
O-rings, gasket.

39



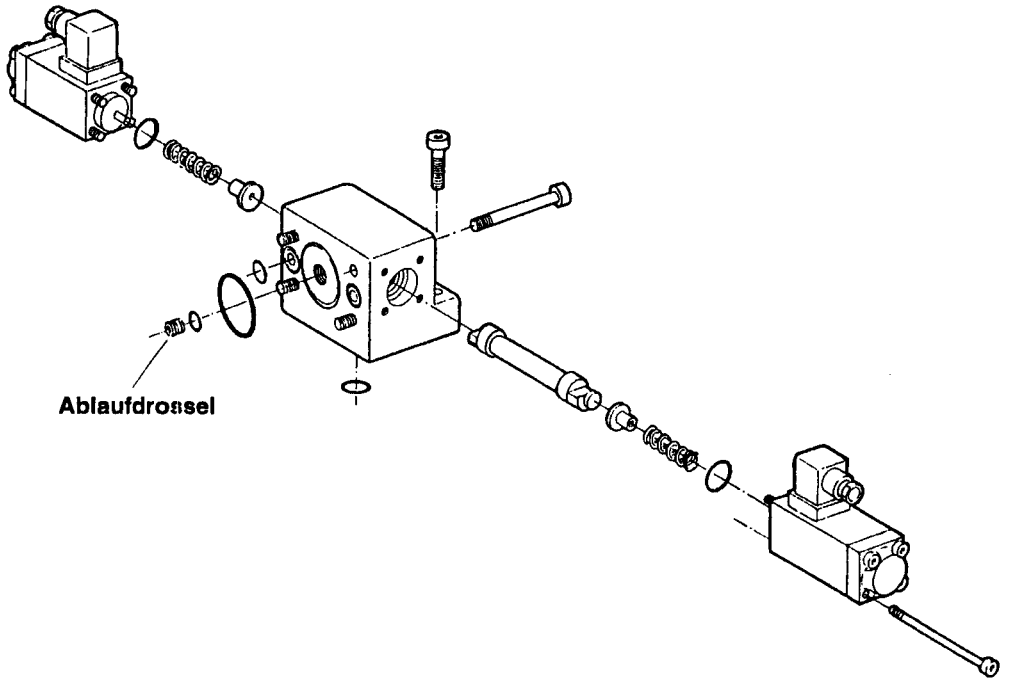
40



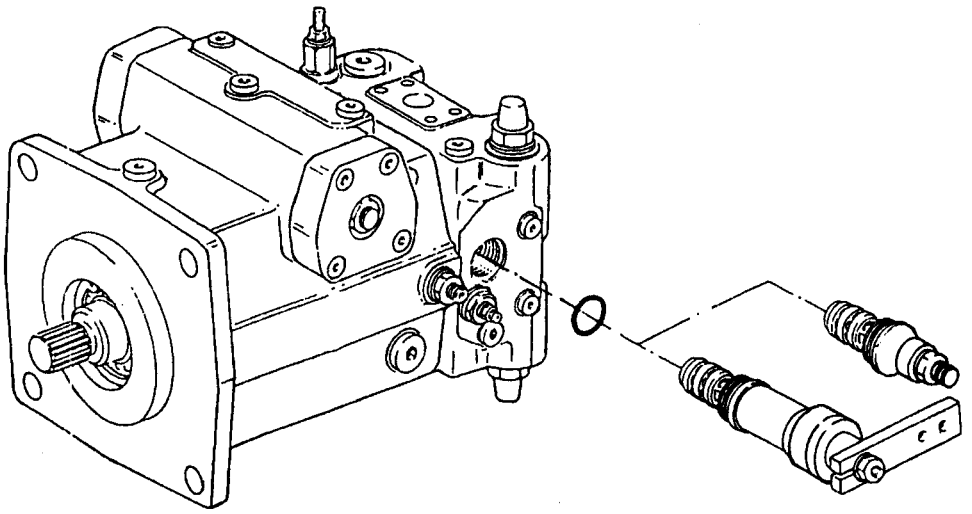
Kontrolle:
O-Ringe

Check:
O-rings

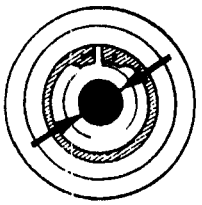
41



42

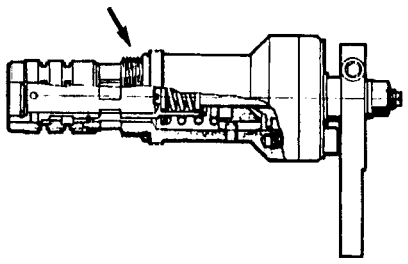


43



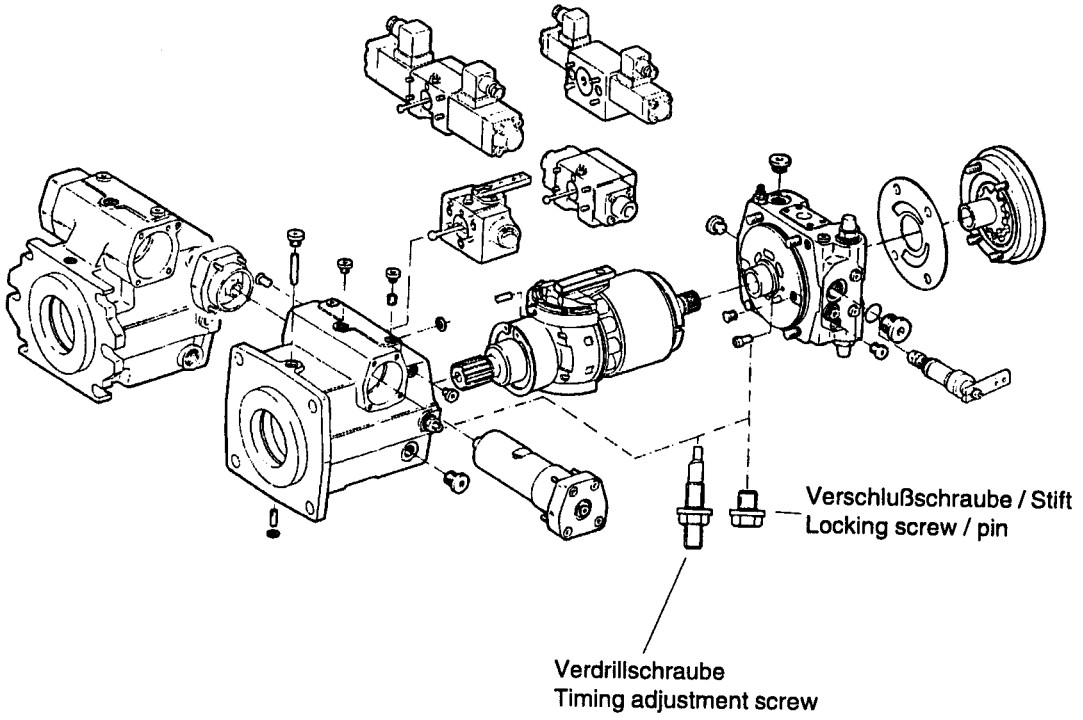
44 Blende überprüfen.
Keine Beschädigung.

Inspect orifice.
No damage.

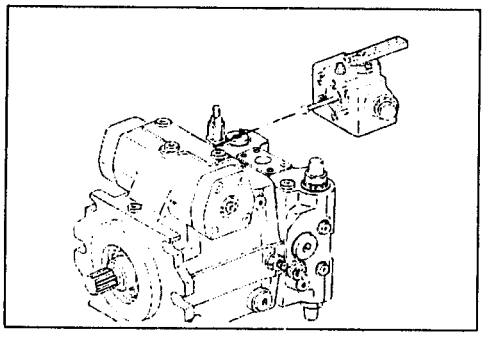


45 Gewinde abkleben.
O-Ring einsetzen.

Cover threads.
Insert O-ring.

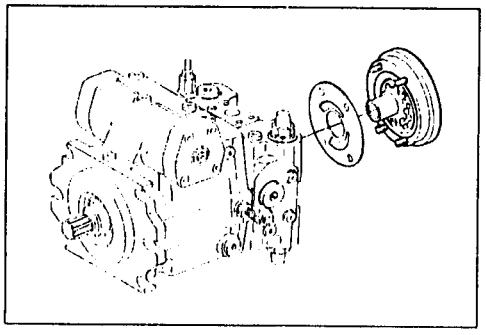


46



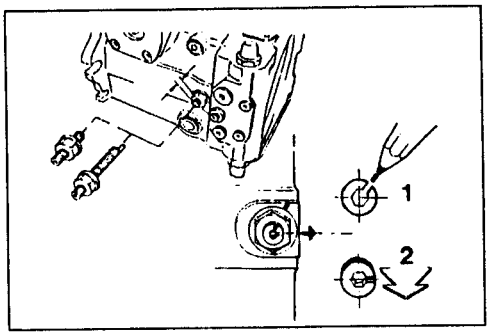
47 Ansteuergerät abbauen.

Remove control device.



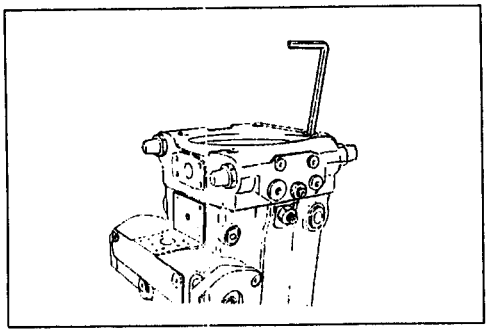
48 Hilfspumpe ausbauen.
Hinweis:
Einbaulage kennzeichnen.

Remove auxiliary pump.
Note:
Mark assembly position previously.



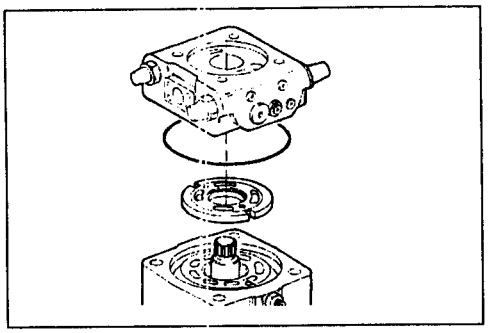
49 Lage der Verdrillschraube markieren (1).
Einstellmaß festhalten.
Verdrillschraube auf Demontageposition stellen (2).

Mark the position of the indexing screw (1).
Record setting measure.
Set the indexing screw to disassembly position (2).



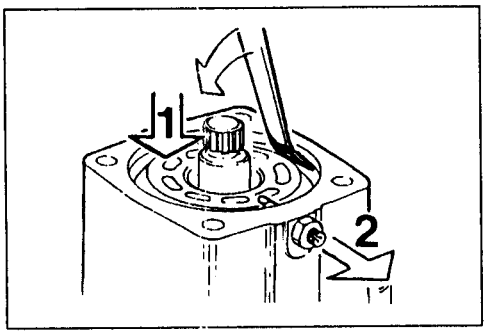
50 Lage der Hilfspumpe und Anschlußplatte markieren.
Anschlußplattenbefestigung lösen.

Mark position of the connection plate.
Loosen connection plate fixation.



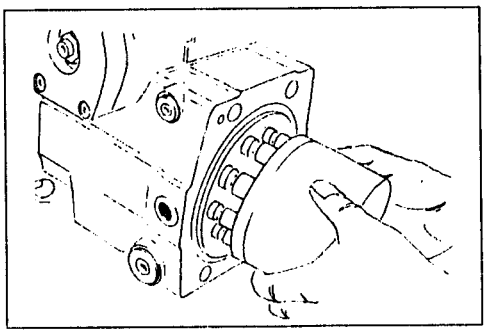
51 Anschlußplatte und Steuerplatte abheben.

Lift off port plate and control plate.



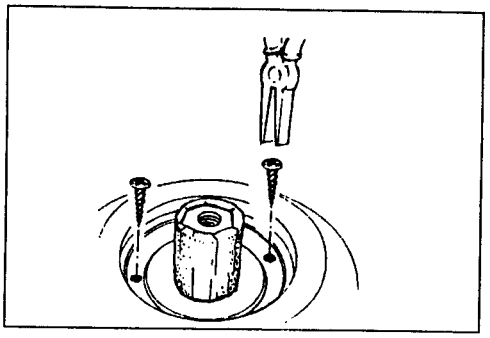
52 1. Zylinder nach unten drücken.
2. Verdrillschraube herausdrehen.

1. Press the cylinder to the bottom.
2. Remove fixing indexing screw.



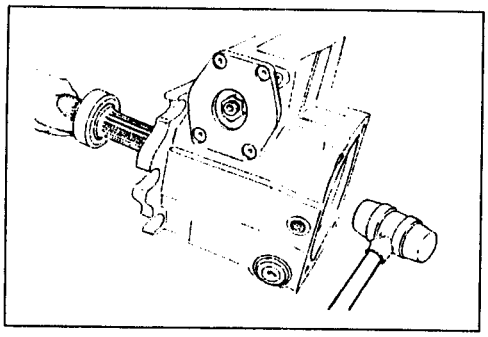
53 Zylinder komplett mit Kolben und
Rückzugeinrichtung ausbauen.

Push off hydraulic section of rotary group.



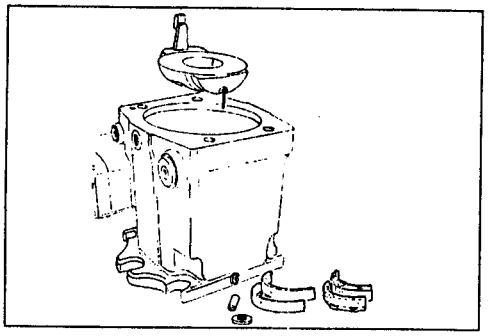
54 Seegerring / WDR ausbauen.

Remove retaining ring and radial seal ring.



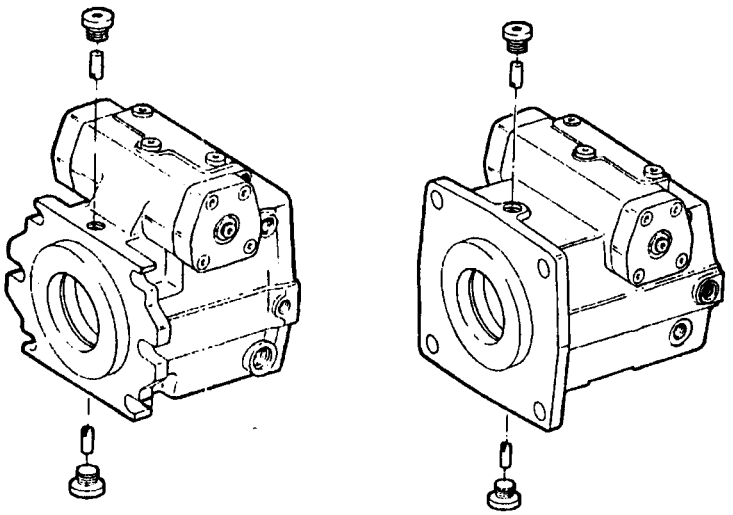
55 Triebwelle mit leichten Hammerschlägen austreiben.

Remove drive shaft with slide hammer strokes.



56 Schwenkwiege / Lager komplett ausbauen.

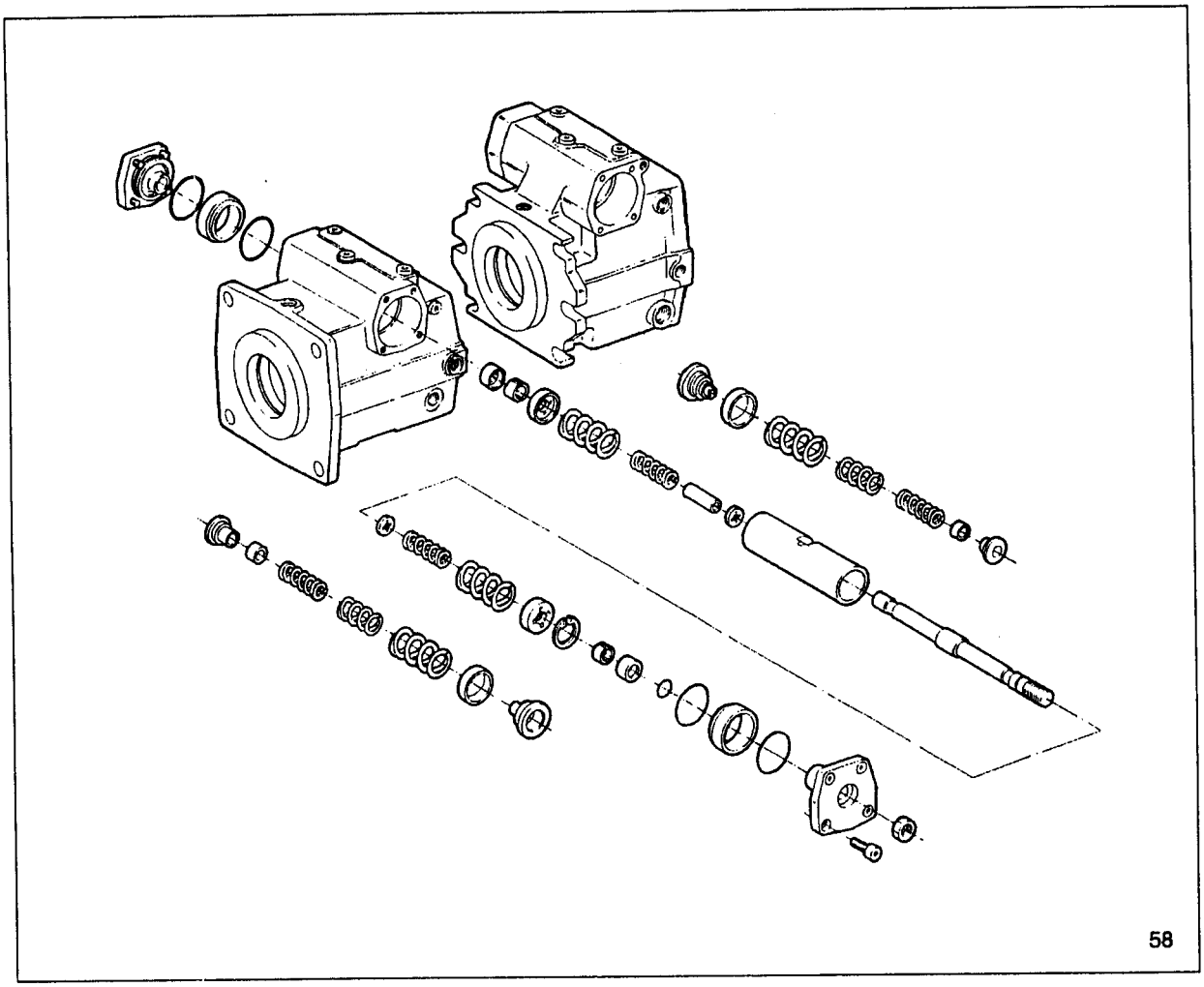
Remove swash plate / bearing cups.



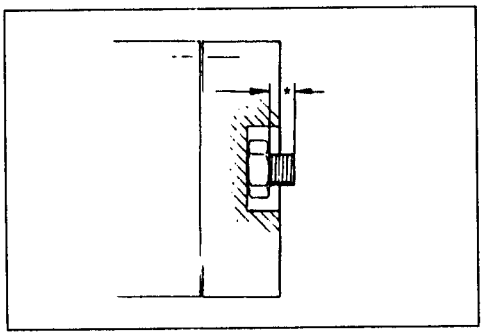
Gelenkstift ausbauen.

Remove joint pin.

57

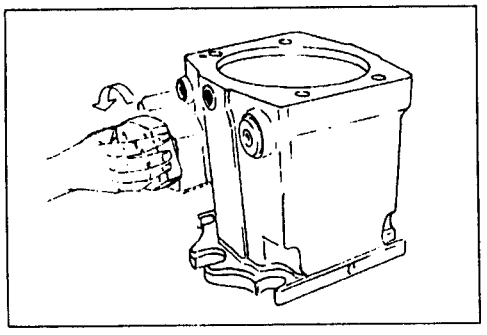


58



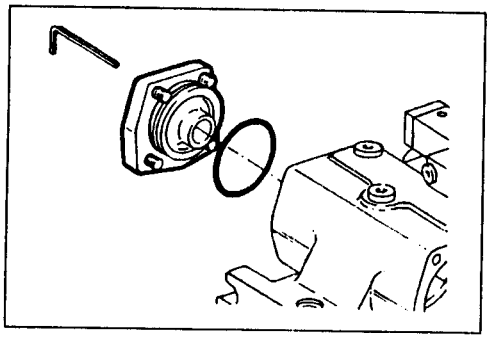
59 Lage vom Deckel markieren, Maß "Nullage" festhalten, Mutter lösen.

Mark position of the cover, note measure of "zero position". Loosen nut.



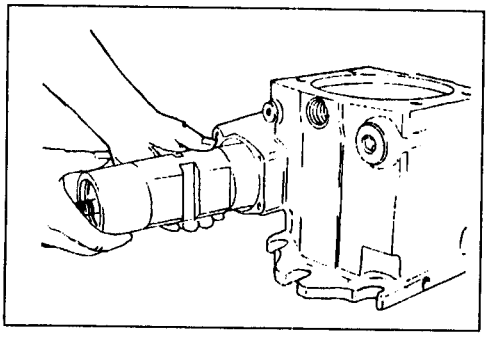
60 Deckel abdrehen.

Remove cover.



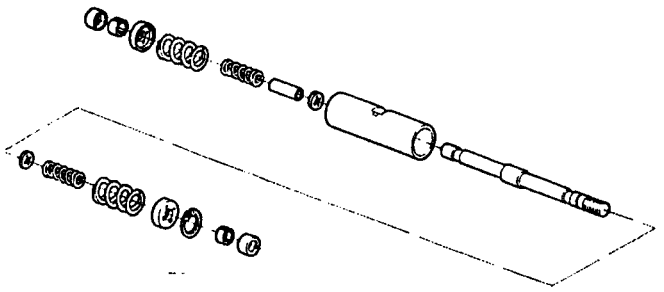
61 Lage des Deckels markieren.
Befestigungsschrauben lösen, abbauen.

Mark position of the cover.
Loosen locking screw, remove cover.

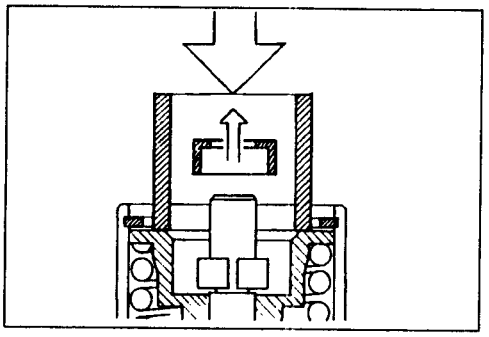


62 Stellzylinder ausbauen.

Remove positioning ring.

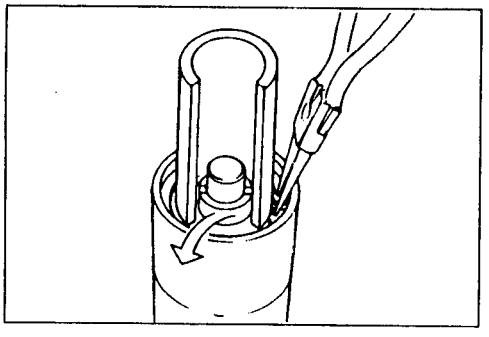


63



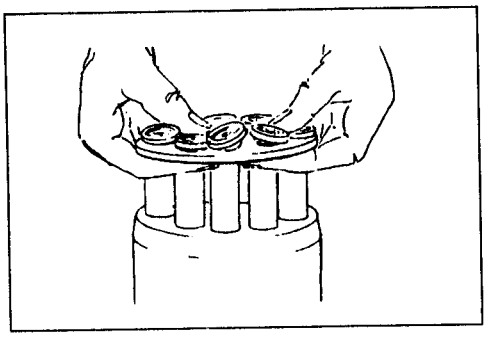
64 Vorrichtung aufsetzen und Feder vorspannen.
Aufnahmering ausbauen.

Fit tool device and preload spring.
Remove take-off ring.



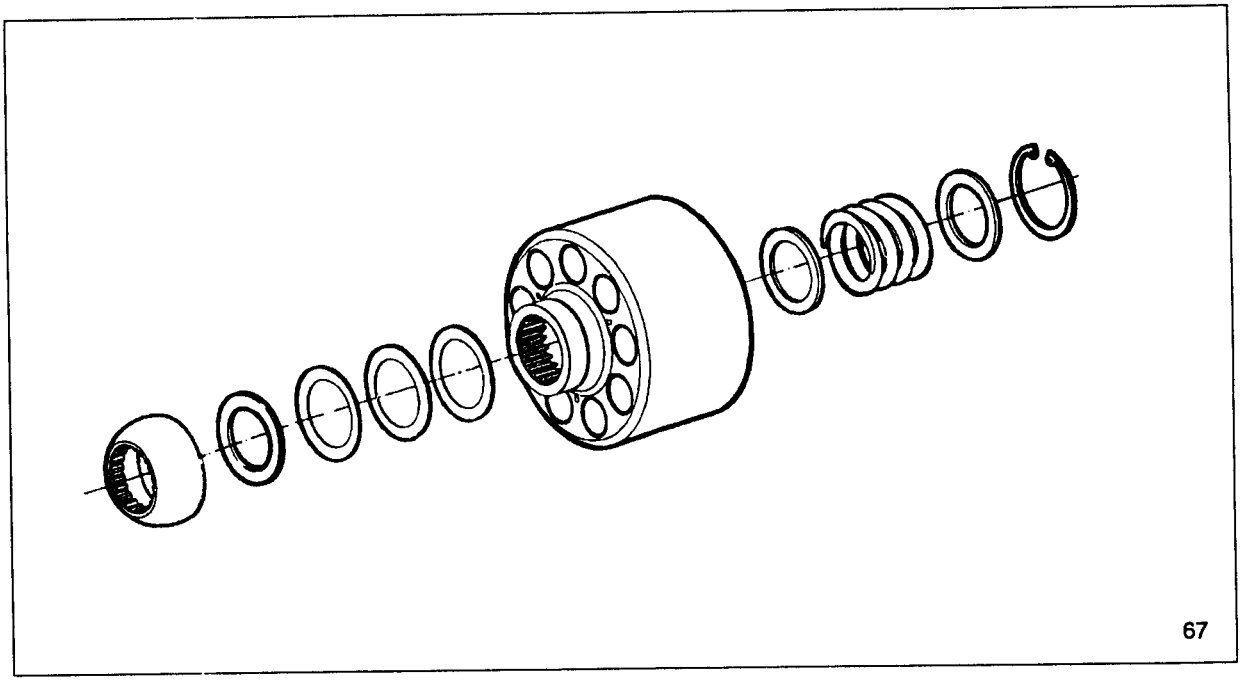
65 Ringe ausbauen.
Sicherungsring ausbauen.
Achtung: Teile stehen unter Federvorspannung.

Remove rings.
Remove safety ring.
Attention: Parts are under spring load.

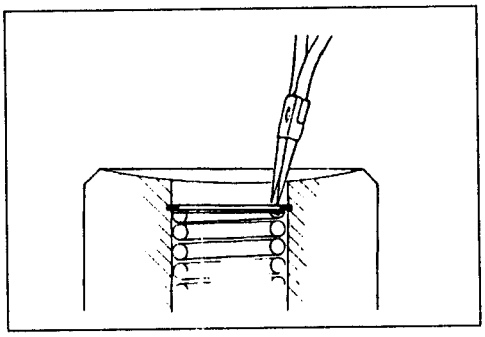


66 Kolben mit Rückzugeinrichtung ausbauen.
Tragkugel mit Tellerfedersäule abheben.

Remove piston with retaining plate.
Remove retaining ball with spring cup assembly.

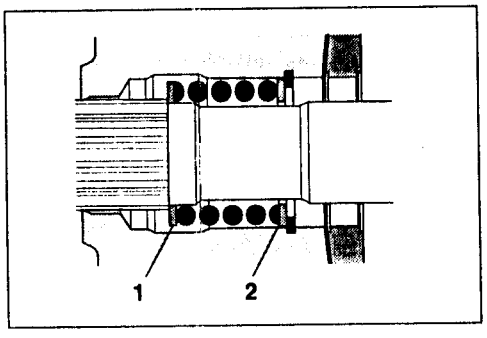


67



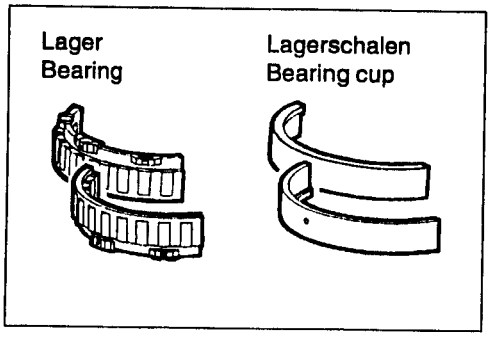
68 Sicherungsring ausbauen.

Remove safety ring.



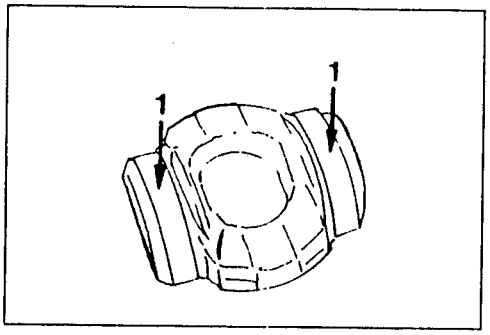
69 Scheibe 1, 2

Disc 1, 2



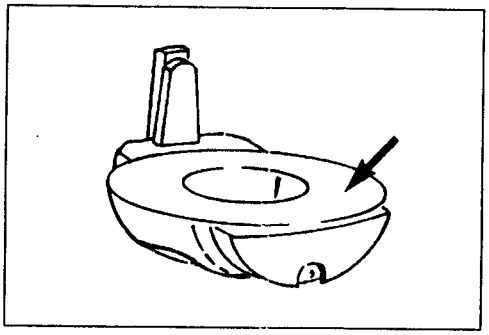
70 Kontrolle!
Käfig-Paar (1),
Lagerschalenpaar (2).

Check!
Cage set (1),
Bearing cup set (2).



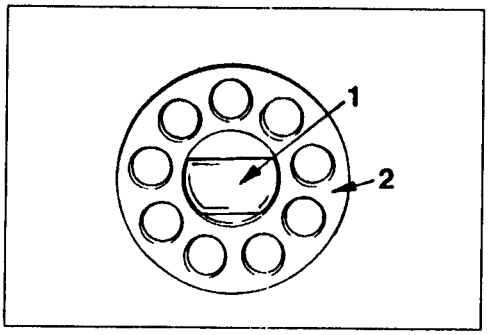
71 Kontrolle!
Lagerbahnen (1)

Check!
Bearing surfaces (1)



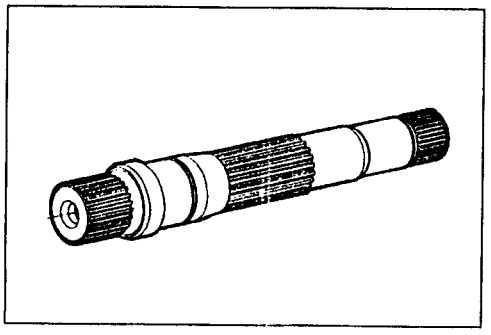
72 Kontrolle!
Gleitfläche riefenfrei.

Check!
Sliding surface free from scoring.



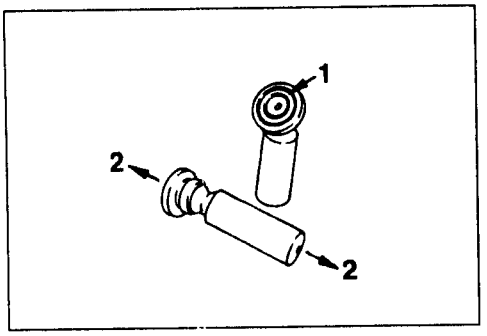
73 Kontrolle!
Rückzugeinrichtung riefenfrei.

Check!
Check that return device is free of scoring.



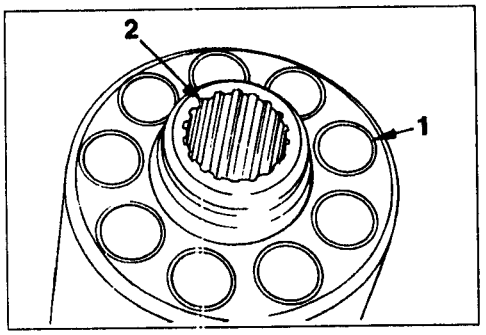
74 Kontrolle!
1. Verzahnung "ausgeschlagen", Passungsrost.
2. Laufflächen.
3. Lauffläche - Wellendichtring.

Check!
1. Splines for damage or fretting.
2. Running surfaces.
3. Groove cut by shaft seal.



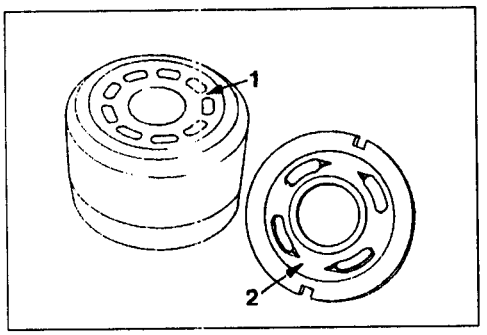
75 Kontrolle!
Lauffläche (1) keine Kratzer, keine Metalleinlagerungen, kein Axialspiel (2), (Kolben nur satzweise tauschen).

Check!
Check that there are no scratches or metal deposits on sliding surface (1), and there is no axial play (2), (otherwise: pistons must be replaced in sets).



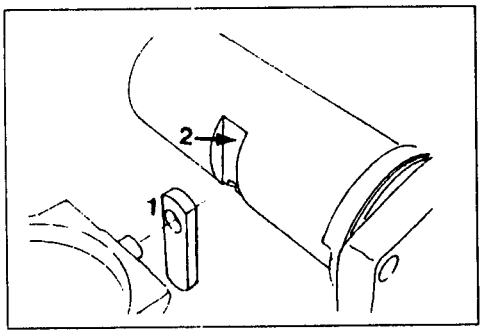
76 Kontrolle!
Zylinderbohrungen (1), Verzahnungen (2).

Check!
Cylinder bores (1), splines (2).



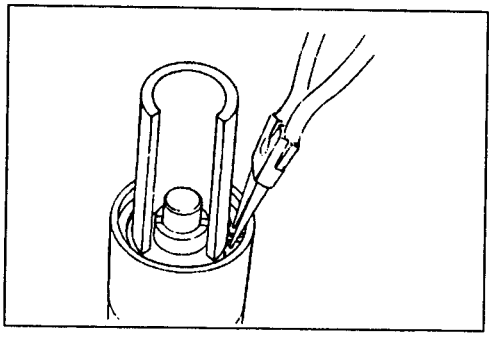
77 Kontrolle!
Zylindergleitfläche (1) riefenfrei.
Steuerplatte (2) nicht riefig.

Check!
Cylinder surface (1) free of scoring.
Control plate (2) without scoring.



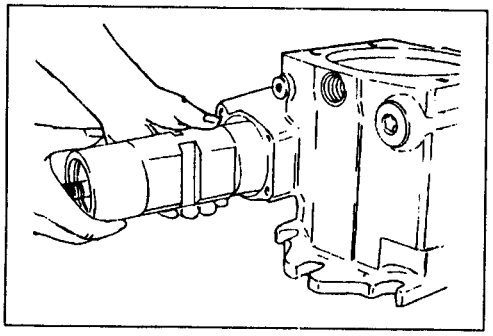
78 Kontrolle!
Stellkolben - Schwenkwiegenverbindung
Gleitstein (1), Nut im Stellkolben (2), Stellkolben.

Check!
Positioning piston - cradle linkage
Gliding stone (1), groove at the positioning piston (2).
Positioning piston.



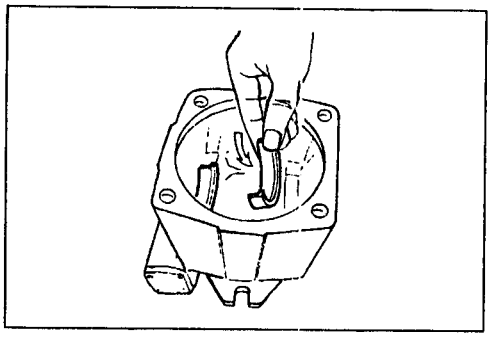
79 Stellkolben montieren.
Hinweis:
Auf korrekten Sitz der geteilten Ringe "achten".

Assemble positioning piston.
Instruction:
Observe correct fit of the divided rings.



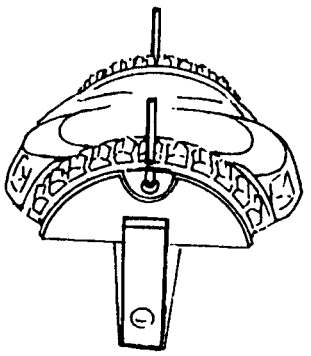
80 Stellkolben ins Gehäuse einsetzen.
Hinweis:
Stellkolben vor Einbau einölen.

Insert positioning piston into the housing.
Instruction:
Oil positioning piston before assembly.



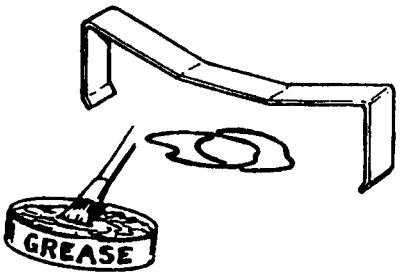
81 Lagerschalenpaar einsetzen.

Insert bearing cup set.



Lager, Draht, Gleitstein und Gelenkstift
montieren.
Montagehilfe: z.B. - Klammer / Gummiringe / Fett

Assemble bearing, wire, gliding stone
and articulating pin.
Assistance: Devices e.g. - Clamp / rubber rings / grease



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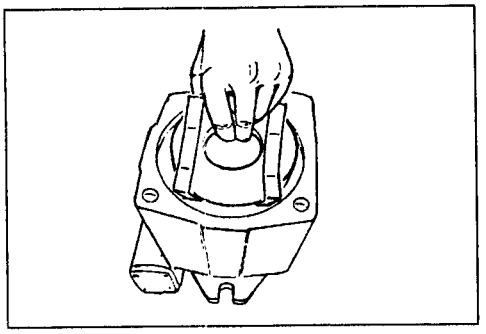
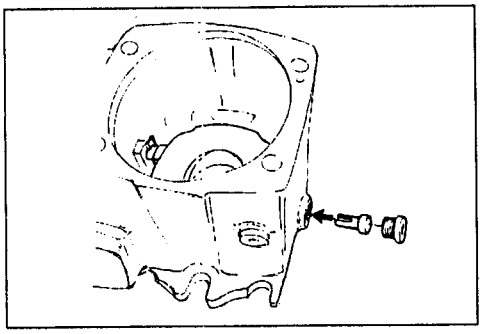


83 Schwenkwiege komplett ins Gehäuse einsetzen.
Auf korrekten Sitz der Schwenklager im Gehäuse "achten".

⚠ Montagehilfe ausbauen.

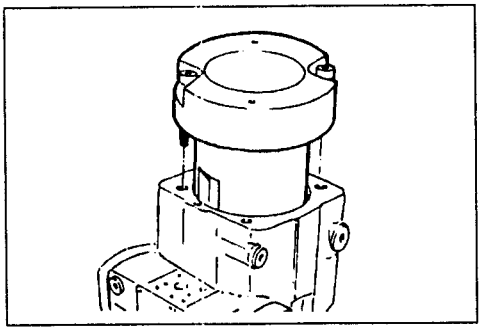
Insert completely swivel cradle into the housing.
Pay attention for correct seat of the swivel cradle in the housing.

⚠ Remove auxiliary device.



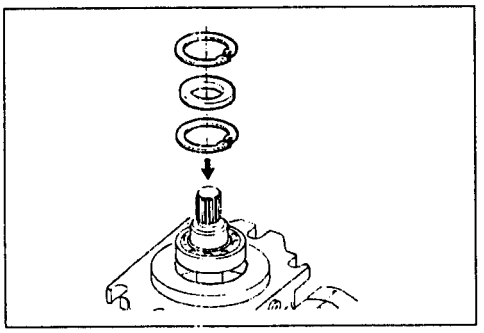
84 Gelenkstifte montieren.

Assemble articulating pins.



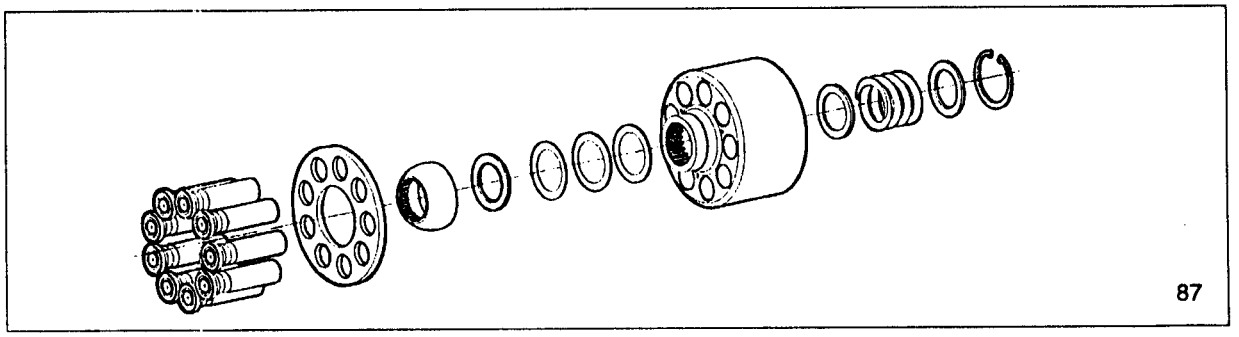
85 Vorrichtung zum Fixieren der Schwenkwiege montieren.

Assemble device for fixation of the swivel cradle.

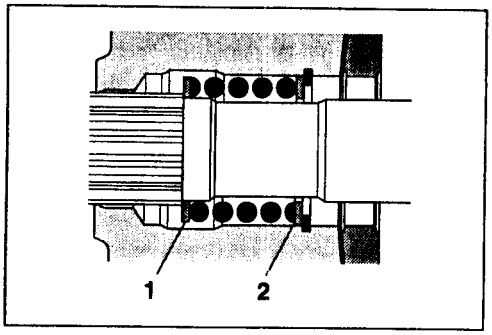


86 Neue Montageposition!
Triebwelle mit Lager und Wellendichtring einbauen.

Assemble drive shaft with bearings and radial seal rings.

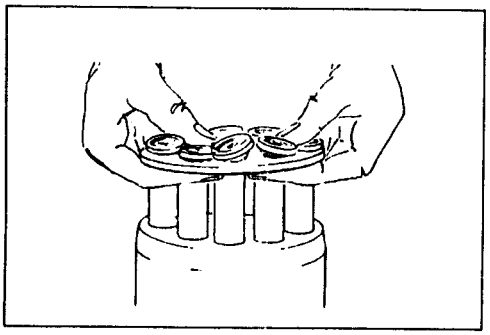


87



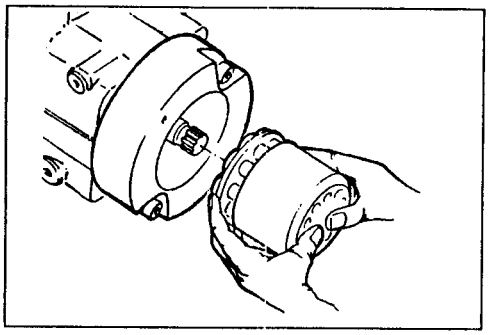
88 Scheibe 1, 2

Disc 1, 2



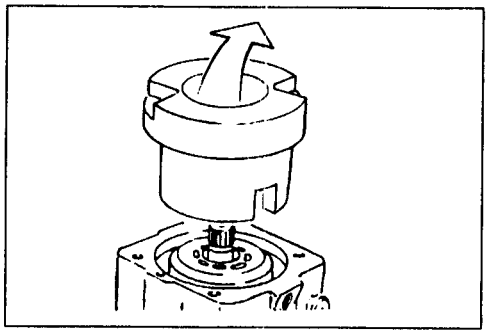
89 Kolben mit Rückzugeinrichtung montieren.
Hinweis:
Kolben, Gleitschuhe einölen.

Assemble piston with retaining plate.
Note:
Oil piston and piston pad.



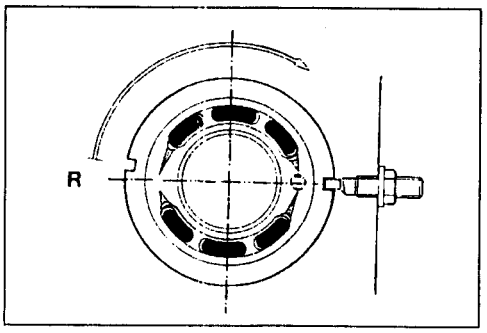
90 Zylinder komplett einbauen.

Assemble cylinder completely.



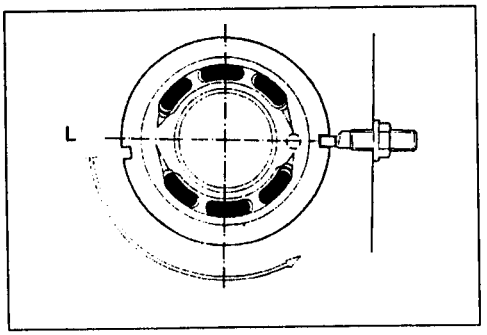
91 Vorrichtung ausbauen.

Remove assembly device.



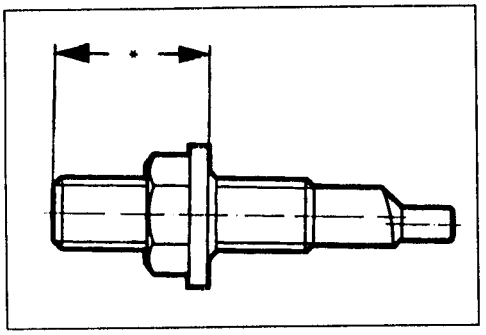
92 Steuerplatte Rechtslauf - in Drehrichtung verdreht.
Achtung!
Geräuschkerben sind drehrichtungsbezogen eingeschliffen.

Control plate clockwise rotation - indexed in the direction of rotation.
Note!
Noise grooves are machined - in based on direction of rotation.



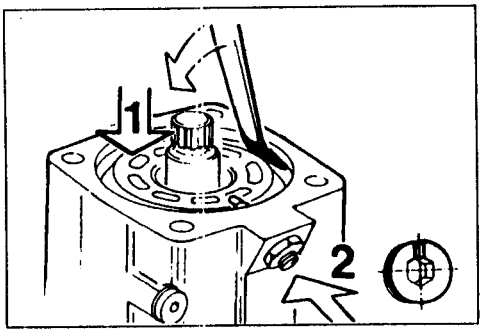
93 Steuerplatte Linkslauf - in Drehrichtung verdreht.
Achtung!
Geräuschkerben sind drehrichtungsbezogen eingeschliffen.

Control plate counter clockwise rotation - indexed in the direction of rotation.
Note!
Noise grooves are machined - in based on direction of rotation.



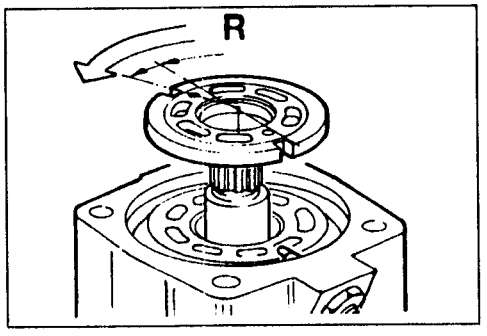
94 Grundeinstellung - Verdrillschraube
A4VG...71 * = 28 ± 0,75 mm A4VG...90 * = 29 ± 0,75 mm
A4VG...125 * = 20 ± 0,75 mm A4VG...180 * = 22 ± 0,75 mm.

Basic setting - indexing screw
A4VG...71 * = 28 ± 0,75 mm A4VG...90 * = 29 ± 0,75 mm
A4VG...125 * = 20 ± 0,75 mm A4VG...180 * = 22 ± 0,75 mm.



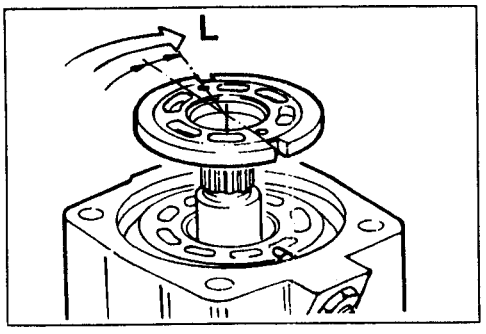
95 Steuerplatte einsetzen - Rechtslauf.

Insert the control plate - clockwise rotation.



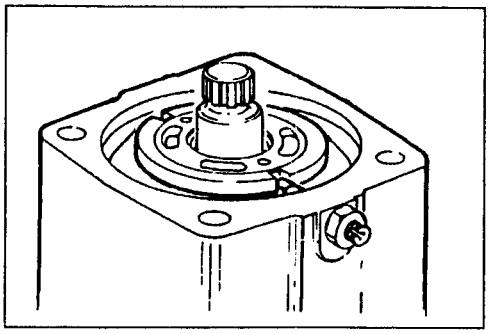
96 Zylinder nach unten drücken (1).
Verdrillschraube einbauen (2).
Kerbe in Montageposition.

Press the cylinder to the bottom (1).
Screw in the indexing screw (2).
Groove in mounting position.

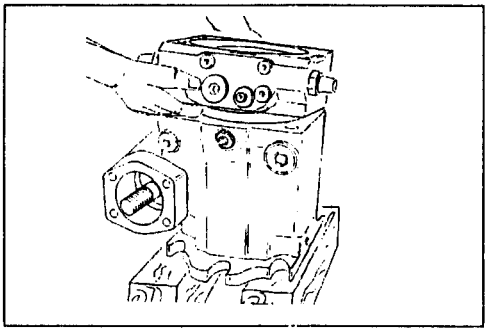


97 Steuerplatte einsetzen - Linkslauf.

Insert the control plate - Counter- clockwise rotation.



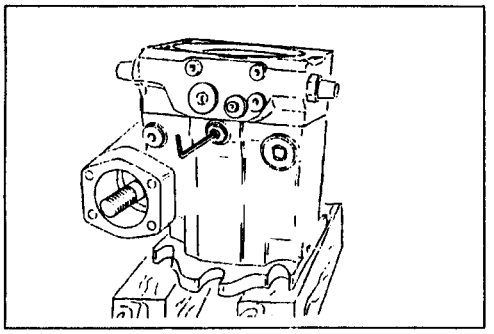
98



99

Anschlußplatte aufbauen.
Achtung! Federvorspannung!
Mit zwei Befestigungsschrauben überkreuz Anschlußplatte in Gehäuseführung einsetzen - Fertigmontage!

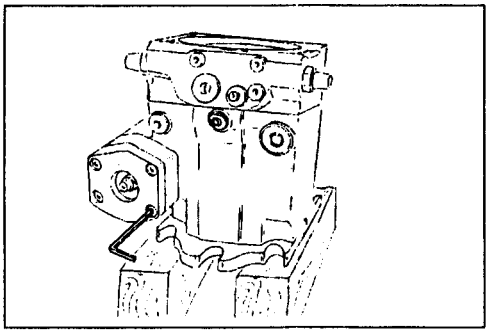
Assemble connection plate.
Attention! Spring preloaded!
Insert control plate into housing, guidance with two locking screws crossing over -Finish assembly!



100

Verdrillschraube - Nach Markierung ausrichten.

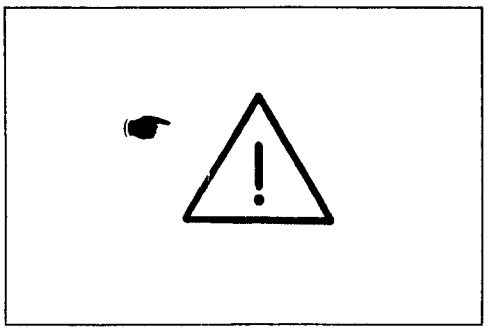
Locking screw - Observe adjusting measure.



101

1. Deckel montieren.
2. Nullage nach Maß einstellen.

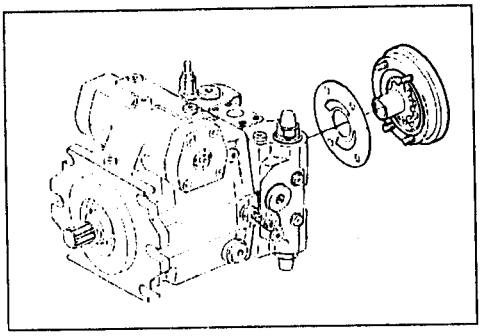
1. Assemble cover
2. Adjust zero position according to measure.



102

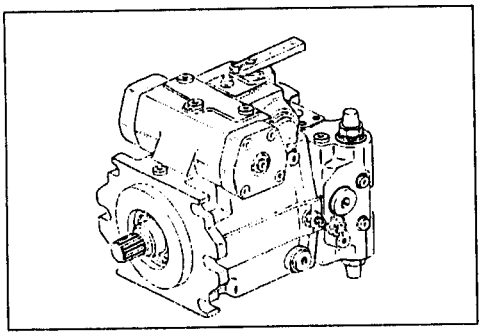
Achtung!
Korrekte mechanische Nullageneinstellung muß nach Einbau im Gerät bzw. Prüfstand erfolgen.

Attention!
Adjustments of the correct zero position to be carried out after installation into the machine or on the bench test.



103 Hilfspumpe montieren.
Hinweis: Drehrichtung beachten.

Assemble auxiliary pump.
Note: Take care of direction of rotation.



104 Ansteuergerät montieren.

Assemble control device.

Tightening torques for shaft bolts (Metric ISO Standard Thread)

The values for tightening torques shown in the table are valid only for shaft bolts with metric ISO- standard threads and head support surface dimensions in accordance with DIN 912, DIN 931 and DIN 933. These values are also valid only for light or unoiled, untreated surface as well as for use only with torque-indicating wrenches and force limiting tools.

Thread size	Strength Classes 8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 3	0,8	1,2	1,4
M 4	2,1	3,0	3,6
M 5	4,4	6,3	7,4
M 6	7,4	10,3	12,5
M 8	18,4	25,8	30,2
M10	36,1	50,9	61,2
M12	63,4	88,4	106,9
M14	99,5	140,0	169,5
M16	154,8	217,4	261,6
M18	213,7	298,5	357,4
M 20	302,2	427,5	508,5
M 22	405,4	574,9	685,4
M 24	523,5	737,0	884,4
M 27	773,9	1105,5	1326,6
M 30	1068,7	1474,0	1768,8

Tightening torques for locking screws VSTI (Metric ISO fine thread)

Thread size	Designation		Tightening torques (lb.ft)
M 8 x 1	VSTI 8 x 1	-ED/SA	= 4
M 10 x 1	VSTI 10 x1	-ED	= 7
M 12 x 1,5	VSTI 12 x 1,5	-ED	= 15
M 14 x 1,5	VSTI 14 x 1,5	-ED	= 22
M 16 x 1,5	VSTI 16 x 1,5	-ED/SA	= 22
M 18 x 1,5	VSTI 18 x 1,5	-ED/SA	= 29
M 20 x 1,5	VSTI 20 x 1,5	-ED/SA	= 37
M 22 x 1,5	VSTI 22 x 1,5	-ED	= 44
M 26 x 1,5	VSTI 16 x 1,5	-ED/SA	= 51
M 27 x 2	VSTI 27 x 2	-ED	= 66
M 30 x 1 ,5	VSTI 30 x 1,5	-ED/SA	= 74
M 33 x 2	VSTI 33 x 2	-ED/SA	= 88
M 42 x 2	VSTI 42 x 2	-ED/SA	= 147
M 48 x 2	VSTI 48 x 2	-ED	= 220

Tightening torques for cross-slotted lens head screws DIN 7985 (Metric ISO- Standard Thread)

The values for tightening torques shown in the table are valid only for cross-slotted lens head screws DIN 7985 of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength classes 8.8	10.9	12.9
	Tightening torques (lb.ft)		
M 3	0,8		
M 4	2,1		
M 5	4,4		
M 6	7,4		
M 8	18,4		
M10	36,1		

Tightening torques for seal-lock nuts (Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for seal-lock nuts of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength classes 8.8	10.9	12.9
	Tightening torque (lb.ft)		
M 6	7,4		
M 8	16,2		
M 10	29,5		
M 12	50,9		
M 14	81,1		
M 16	125,3		

General advice

- Make yourself familiar with the equipment of the machine.
- Only operate the machine if your are completely familiar with the operating and control elements as well as the functioning of the machine.
- Use your safety equipment like helmet, safety shoes and hearing protection.
- Make yourself familiar with your working field.
- Only operate the machine for its intended purpose.

Please observe the guidelines of the Professional Association and the machine manufacturer.

Before starting

- Observe the operating instructions before starting.
- Check the machine for obvious faults.
- Do not operate the machine with defective instruments, warning lights or control elements.
- All safety devices must be in a secure position.
- Do not carry with you movable objects or secure them to the machine.
- Keep oily and inflammable material away from the machine.
- Before entering thc driver's cabin, check if persons or obstacles are beside or beneath the machine.
- Be careful when entering the driver's cabin, use stairs and handles.
- Adjust your seat before starting.

Start

- When starting all operating levers must be in "neutral position".
- Only start the machine from the driver's seat
- Check the indicating instruments after start to assure that all functions are in order.
- Do not leave the machine unobserved when the motor is running.
- When starting with battery connection cables connect plus with plus and minus with minus. Always connect negative (-) cable last and disconnect negative cable first.

Attention

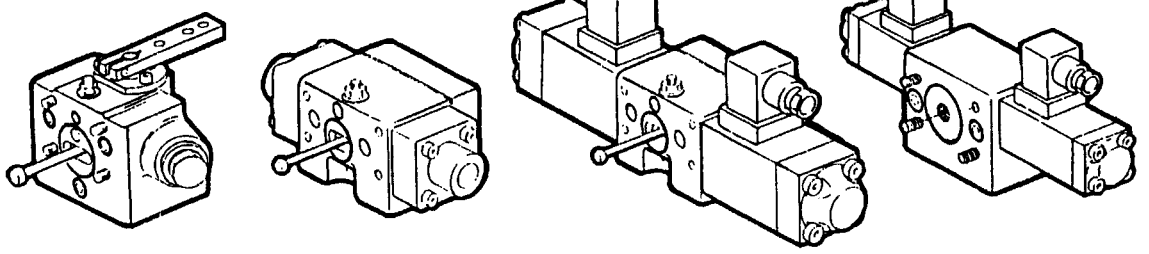
- Exhaust gas is dangerous. Assure sufficient fresh air when starting in closed rooms!

Hydraulic equipment

1. Hydraulic equipment is standing under high pressure.

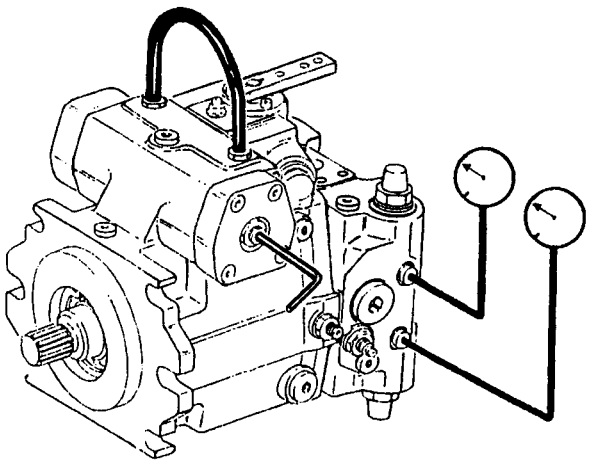
   ⚠ High pressure fluids (fuel, hydraulic oil) which escape under high pressure can penetrate the skin and cause heavy injuries.
   Therefore immediately consult a doctor as otherwise heavy infections can be caused.
2. When searching leakages use appropriate auxiliary devices because of the danger of accidents.
3. Before working at the hydraulic equipment, lower pressure to zero and lower working arms of the rnachine.
4. When working at the hydraulic equipment, absolutely stop motor and secure machine against rolling away (parking brake, shim)!
5. When connecting hydraulic cylinders and motor pay attention to correct connection of hydraulic flexible hoses.
6. In case of exchanging the ports, the tunctions are vice versa (f. ex. lift-up/lower) - danger of accidents!
7. Check hydraulic flexible hoses regularly and replace them in case of dammage or wear! The new hose pipes must comply with the technical requirements of the machine manufacturer!

⚠ Orderly disposal or recycling of oil, fuel and filters!



HW HD EP DA

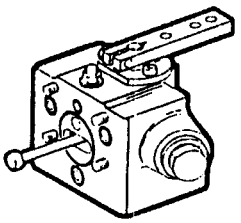
105



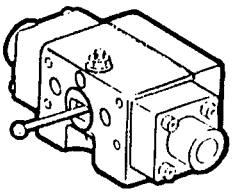
Achtung!
Sicherheitsbestimmungen beachten!
Mit Schlauch NW6 beide Stellkammern verbinden. Vermeidung von Restsignal aus hydraulischer Nullage.
Manometer an M_A und M_B anschließen.
Nullage so einstellen, daß bei blockiertem Antrieb beide Manometer auf gleichem Druckwert stehen.
Hinweis:
Totband der Nullage - vermitteln.

Attention!
Observe safety regulations!
Connect both control chambers with hose NW6. Avoidance of rest signal from hydraulic zero position.
Connect manometer to M_A and M_B. Adjust zero position so that at blocked drive both manometer indicate the same pressure valve.
Note:
Adjust death line of zero position.

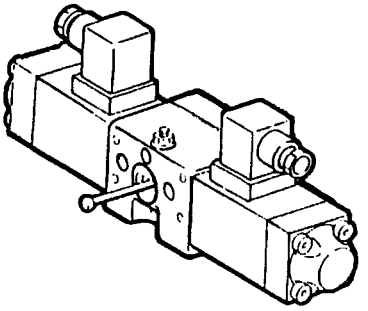
106



HW



HD

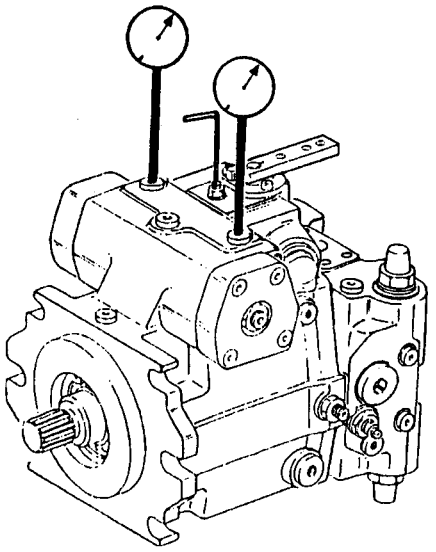


EP

Achtung!
Sicherheitsbestimmungen beachten!

Attention!
Observe safety regulations!

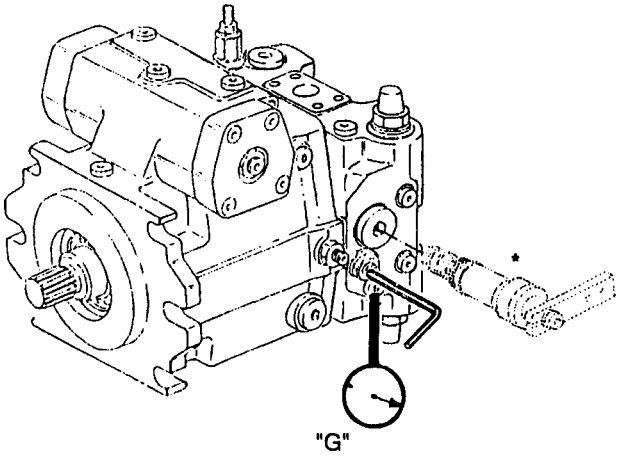
107



Manometer an X_1 und X_2 anschließen.
Nullage so einstellen, daß bei blockiertem Antrieb beide Manometer auf gleichem Druckwert stehen.
Hinweis:
Excenterjustierung
- nicht über ±90° verdrehen.

Connect manometer to X_1 and X_2.
Adjust zero position so that at blocked drive both manometer indicate the same pressure value.
Note:
Eccentric adjusting
- Do not turn over ±90°.

108



Achtung!
Sicherheitsbestimmungen beachten!

Hinweis:
Nachjustierung nur bei Betriebstemperatur.

Manometer an "G" anschließen.

Achtung!
* Speisedruckeinstellung!
Nenndruck p_H - 18 bar
Höchstdruck p_H - 40 bar
Bei Max.-Drehzahl.

Hinweis:
Einstelldaten nach Werksauftrag.

* bei DA-Ausführung

Attention!
Observe safety regulations!

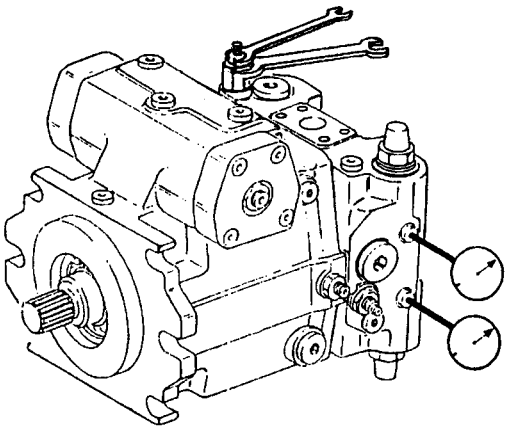
Note:
Readjusting only at operating temperature.

Connect manometer to "G".

Attention!
* Boost pressure setting!
Nominal pressure p_H - 18 bar
Peak pressure p_H - 40 bar
at max. speed.

Note:
Adjusting data according to order.

Druckabschneidung
Pressure cut-off



110

Achtung!
Sicherheitsbestimmungen beachten!

HD-Ventil ohne Bypass

1 . HD- Ventile sind immer 10% höher eingestellt als die Druckabschneidung.
Bei Veränderung eines Einsteilwertes immer beide kontrollieren.
2. Nachjustierung nur bei Betriebstemperatur

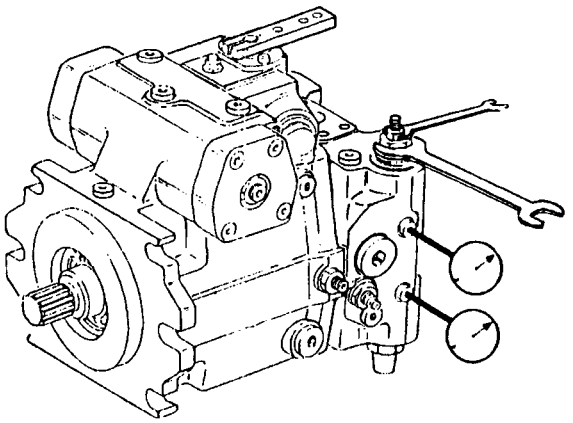
Manometer an M_A und M_B anschließen.
Druckabschneidung: Maß X Einstellschrauben notieren! Einstellschraube auf Block drehen.

HD- Ventile: Mit geringer Pumpenmenge über Ventile fahren. Einstellwert kontrollieren.
(Nur kurzzeitig "Temperatur".)

Drucklos "Einstellwert" verändern - Kontrolle

Druckabschneidung:
Einstellschraube auf Maß (*) zurückdrehen.
Druckwert kontrollieren bzw. nachjustieren.
Achtung! Differenz von 10% HD- Ventile und Druckabschneidung beachten!
Hinweis: Einstelldaten nach Werksauftrag.

HD- Ventile
HP- valves



111

Attention!
Observe safety regulations.

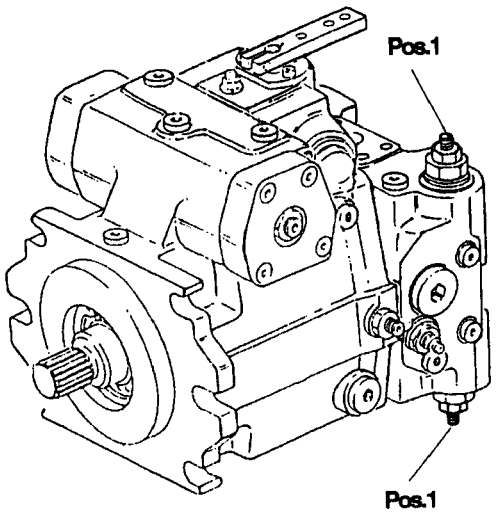
HP valve without bypass-function

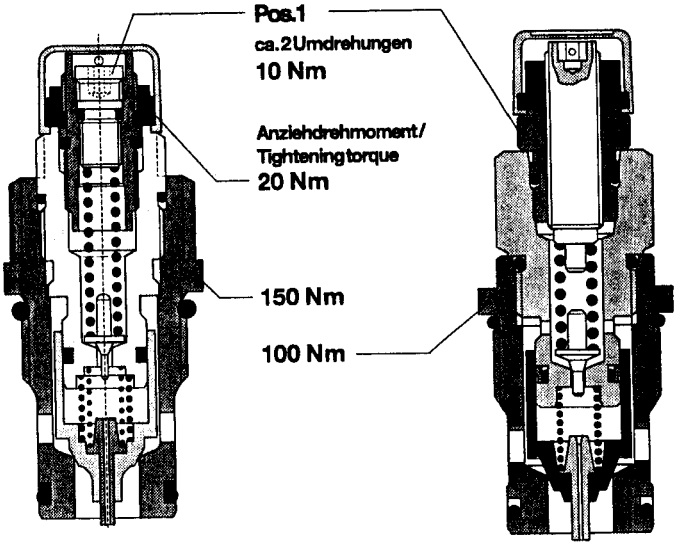
1 . HP valves are always adjusted 10% higher than the pressure cut-off.
If one setting value is changed, always check both values.
2. Readjusting only at operating temperature.

Connect manometer M_A and M_B.
Pressure cut-off: Note measure X setting screw! Turn setting screw on block.
HP valves: Operate valves with small pump flow volume.
Check setting value. ("temperature" only for a short time).
Change "setting value" - check.

Pressure cut-off:
Turn back setting screw to measure (*).
Check pressure value and readjust.
Attention! Observe 10% pressure difference HP valves and pressure cut-off!

A4VG 71 - 90





Neu / New

Alt / Old

Fahrzeuge mit rein-hydrostatischem Fahrantrieb bzw. mit hydrostatischem Fahrantrieb und Schaltgetriebe ohne Leerlaufstellung (Freilauf).

Hydrostatischer Antrieb / Bypaß-Schaltung

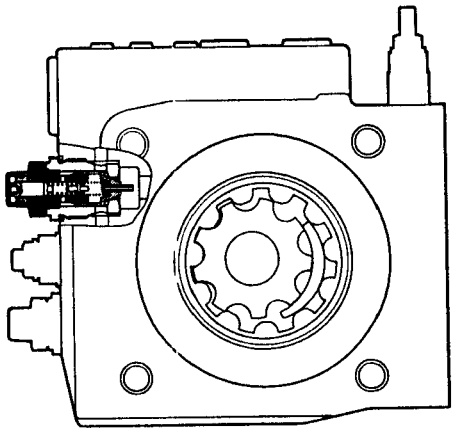
In diesem Fall wird der Fahrantrieb auf freien Umlauf geschaltet. Zu diesem Zweck haben die in der Verstellpumpe integrierten Hochdruckbegrenzungsventile eine sogenannte Bypaß-Funktion. D.h. durch Drehen der entsprechenden Schraube (Pos.1) wird der Ventil-Einsatz so entspannt, daß ein freier Öl-Umlauf möglich ist.

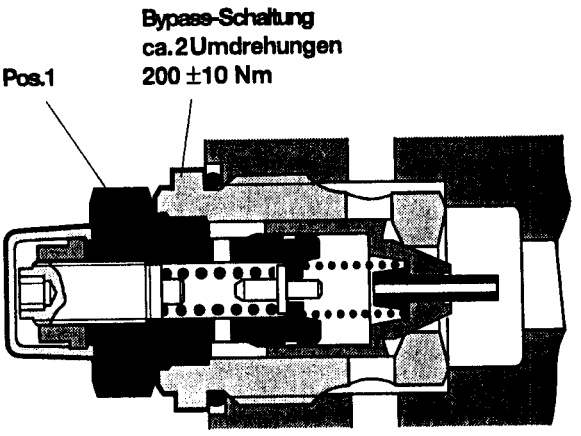
Vehicle with hydrostatic transmission and gear shift without idling setting position (free wheeling).

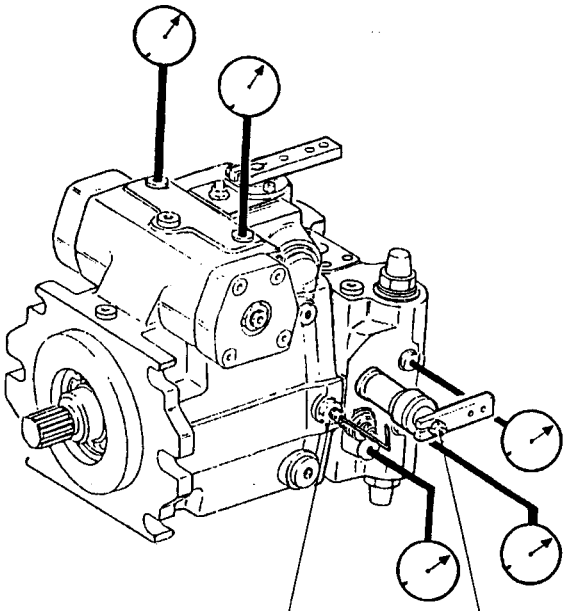
Hydrostatic transmission / Bypass-switching

In this case the travel transmission is switched on to free wheeling. For this purpose the variable displacement pump has incorporated high pressure relief valves with bypass function.
The screw (item 1) is unscrewed to such an extent, that the valve cartridge is released and free oil circulation is possible.

A4VG 125 - 250







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Achtung!
Sicherheitsbestimmungen beachten!

Überprüfung der Einstelldaten
Betriebstemperatur soll während des Überprüfungsvorgangs weitgehend konstant gehalten werden.
Antriebsmotor starten, Leerlaufdrehzahl

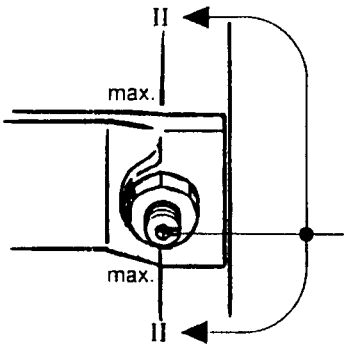
Blockzustand
Fahrtrichtungsschalter "0"
Motordrehzahl langsam steigern bis zur max. Motordrehzahl, dabei Meßgeräte beobachten.
Speisedruck:
Leerlaufdrehzahl
Psp = ca. 15-20 bar
max. Motordrehzahl
Psp = ... bar*

Blockzustand
Fahrtrichtungsschalter - vorwärts
(Straßengang und Festgebremst)

Einstelldaten Pumpe A4V/DA überprüfen
Regelbeginn
HD 40 - 50 bar
Motordrehzahl . min.[1] * Psp . . . . . bar*
HD . . . . . bar
Nachjustierung - Regelbeginnschraube

Regelende
HD . . . . . bar*
Motordrehzahl . . . . . min.[1] * Psp . . . . . bar*
Nachjustierung - Verdrillschraube

Hinweis:
Excenterjustierung - Drehrichtung beachten



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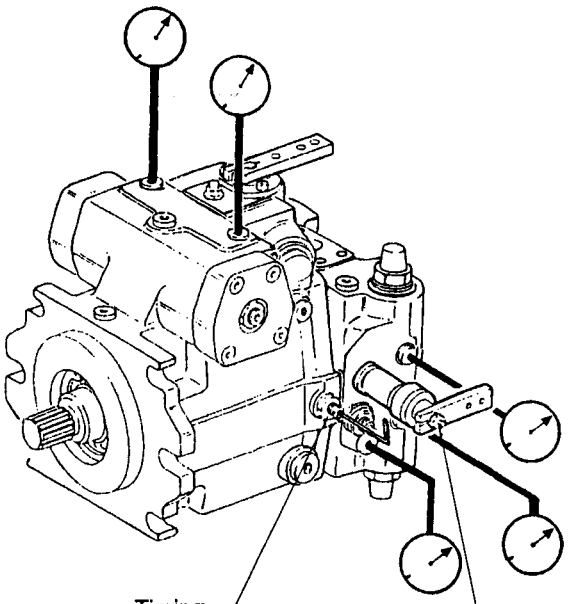
Hinweis: * Einstelldaten nach Werksauftrag!



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Attention!
Observe safety regulations!

Check setting data.
Operating temperature should be kept largely constant during the check procedure.
Start prime mover, idle speed.

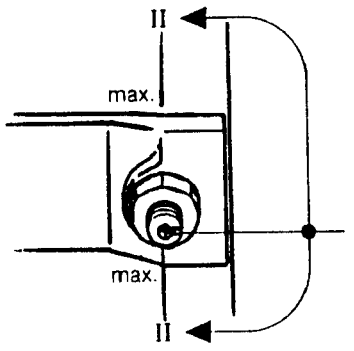
Block position
Drive direction switch - "**0**".
Slowly increase motor speed up to the max. motor speed and thereby observe measuring instruments.

Boost pressure:
Idle speed of prime mover
Psp = approx. 15 - 20 bar
max. motor speed
Psp = ... bar*

Block position
Drive direction switch - **forward**
(Road gear and fully applied brake)

Check setting data pump A4VIDA
Begin of control:
HD 40 - 50 bar
Motor speed . . . . . rpm* Psp . . . . . bar*
HD . . . . . bar*
Readjusting - control start screw

End of control
HD . . . . . bar
Motor speed . . . . . rpm* Psp . . . . . bar*
Readjusting timing adjustment screw



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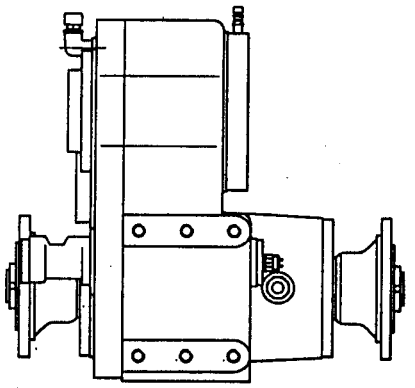
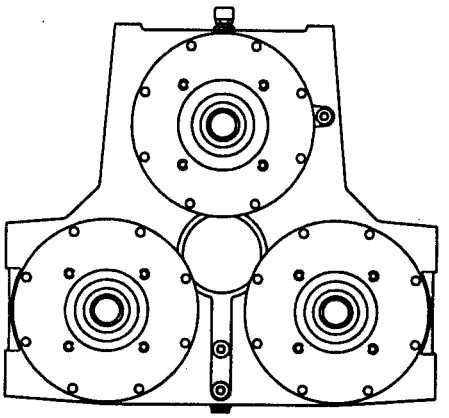
Note:
Eccentric adjusting - observe direction of rotation

* Setting data according to order!

STIEBEL POWER TAKE-OFF GEAR

STIEBEL GETRIEBE





Contents

1. Technical Data

STIEBEL D51545 WALDBROEL

Typ 4400.02.09904.97-
Nr. 459005
kW n_1 min^{-1}
T_2 Nm i= 1:1,6289
Bj. 1997 kg
GETRIEBEOEL 8.50L
CLP220 DIN51517

2. Foreword

These operating instructions contain important advice on the safe, correct and economic operation of the gear and plant.

Following this advice helps to prevent hazards and damage, reduce repair costs and breakdown times and to increase the reliability and service life of the gear.

Important: Always read information marked with this ⚠ symbol. Such information warns of danger. Non-observance can lead to personal injury and damage to property.

3. Prescribed Use

The above-mentioned product is intended for installation in a machine. It may not be commissioned until it has been ascertained that the machine in which the above-mentioned product is to be installed complies with the conditions of the EC guideline on machinery.

The product may only be used for the technically designed purpose agreed. The product may not be operated with outputs, torques or external loads which exceed the structural design (see technical data and catalogue).

Installation and commissioning may only be carried out by properly qualified personnel.

Any applicable national, local and plant-specific conditions and requirements concerning the prevention of accidents must be observed.

Qualified personnel are those persons who, on the basis of their training, experience and instruction, along with their knowledge of relevant standards, conditions, regulations for the prevention of accidents and operating conditions, have been authorized by the person responsible for the safety of the plant to carry out the necessary activities and in so doing are able to detect and prevent possible hazards.

4. Transport and Storage

Transport

⚠ For risk-free handling, the hoisting lugs and pegs or threaded bore-holes provided must be used. Hoisting lugs and similar aids attached to the gears are designed only for the weight of the gear and may not be used for raising extension components such as motors, drum shafts or similar. Only use suitable and technically faultless lifting equipment and load suspension devices (e.g. ropes, eye bolts etc.) with sufficient load-bearing capacity. See indication of weight in the technical data or on the type plate. The indications of weight must be regarded as approximate as weights can vary slightly, e.g. by different oil levels.
Do not remain or work under suspended loads.

Storage

Storage from delivery to commissioning should be in dry, dust-free and vibration-free. Enquiries should be addressed to the manufacturer in the case of differing storage conditions.

Protection against Corrosion

The standard preservation of the shafts, hollow shafts etc. is effective for one year maximum under the above-mentioned conditions. It is not suitable for outside storage.

5. Set-up and putting into operation

Assembly and commissioning may only be carried out by suitably qualified personnel.

⚠ Before commissioning and the test run it must be ensured that the moving and rotating components (e.g. shafts, couplings etc.) do not represent a hazard. This means that the necessary contact protection must be provided or measures taken to ensure a safe distance from the machine is maintained. During the test run without attached machinery, the keys in the shaft ends are to be secured against being spun out.

⚠ Before work on the gear unit or attached equipment is performed, the power supply must be disconnected. Action must be taken to prevent the power being inadvertently switched on again. Where necessary, mechanical devices (special equipment, supports etc.) must ensure that the machine cannot move or rotate.

⚠ It must be ensured before commissioning that the specified amount of lubricant has been poured into the machine. For the oil quantity and oil grade, see nameplate or operating manual. Check the oil level by undoing the overflow screw or by using the oil dipstick or oil sight glass if these devices are fitted.

⚠ Never operate without a breather filter otherwise the excess pressure resulting from the gear unit heating up will cause an oil leak.

⚠ After prolonged operation the lubricant and gear unit surface may reach temperatures which could cause skin burns.

⚠ Oil mist is produced in the gear units. It is therefore dangerous to work with a naked flame near the gear unit openings. There is a risk of fire or explosion.

⚠ High-speed machines into which these gear units are installed may generate loud noises which can damage your hearing if they persist. In this case the operating staff should be provided with ear protection. In order to reduce the noise, all technical possibilities should be used to observe the statutory regulations.

⚠ It must be ensured that the gear units are not continuously subjected to severe vibrations, e.g. from low-speed diesel engines.

Technical information

Housings:	Torsionally rigid housings made of aluminium or grey cast iron
Gearing:	casehardened, tooth flanks ground
Lubrication:	Splash lubrication, pressurised circulation lubrication

Assembly of the gear units

Before assembly, check the surfaces, edges of the shaft end, keys and external shaft splines for damage, and remedy any damage discovered.

In the case of key and splined shaft connections apply lubricating paste (e.g. Optimol White T) to the shaft end. The paste facilitates assembly of the units and prevents corrosion which would make subsequent dismantling much more difficult. It must be ensured that the shaft seals are not dirty, damaged or coated with paint. When the units are being painted, cover the seals and running surfaces of the shafts or protect with grease. This is the only way to prevent damage and thus oil losses.

Oil baffle plates which may be installed on the pump mounting flanges must not be damaged or dismantled.

Assembly of input and output elements

Couplings, belt pulleys or similar elements should be mounted with the appropriate jigs (threaded spindle which is screwed into the centring bore of the shaft). Severe hammering must be avoided as antifriction bearings, retaining rings and other internals would be damaged!

Hydraulic pumps must be connected with the mounting flanges so that they are oil-tight and must not exert any axial pressure on the gear unit shafts! The coupling elements and the splines must be adequately lubricated before assembly; we recommend Optimol White T or Staburags NBU 30 PTM. Exception: Splined hollow shafts which have their own oil filling from the gear unit lubrication system; the relevant mounting flange is then provided with screw plugs for the oil level and oil drain as well as a breather. In these cases the oil level as well as the oil quantity required to fill the gear unit flange is entered in the assembly drawing.

Lubricants

The gear units are as a rule supplied without oil; they are then provided with a label "Caution! Not filled with oil!". Normally gear oil CLP220 to DIN 51517 (mineral oil) or PGLP 220 to DIN 51502 (synthetic oil) is used. These grades are suitable for normal operating conditions at an ambient temperature of -5° to +35°C or -25° to +80°C with synthetic oil. Consult the manufacturer in the event of special operating and application conditions.

Commissioning

Before commissioning, the gear units and, if necessary, the mounting flanges must be properly filled with oil; for the oil grade and oil level, refer to the technical data or the nameplate and assembly drawing. During commissioning the plant must not be operated immediately at full capacity. Only after 3-4 hours is the load to be slowly increased so that the plant can then be run under full load. Oil and gear unit temperatures up to 80°C, or up to 100°C with synthetic oil, are not unusual and do not have any negative impact on the functioning of the gear units. The oil level is to be checked after about 15 min. running time as oil collects in the mounting flanges or is dammed there to lubricate the splined hollow shafts. If necessary, replenish oil up to the specified oil level mark. We recommend you to repeat this procedure until the oil level no longer changes. This is especially important if oil pumps, oil coolers and the like also have to be filled with oil.

Installation positions

Stiebel power take-off, pump power take-off and variable-speed gear units can be operated in several installation positions depending on the type. The manufacturer must always be consulted in the event of installation positions which deviate from the position ordered or shown in the assembly drawing.

Power take-off variable-speed gear units

⚠ The gear units must not be switched under load; this operation may only be performed at standstill. Any contravention of this will result in damage to the geared coupling and no claims under the guarantee will be accepted.

- Pneumatic gear-shifting: The pneumatics must be designed so that the side subjected to pressure is continuously under a pressure of 6 bar. A mist oiler must be installed in the pneumatic system to ensure proper lubrication of the operating piston and to protect it against any corrosion.

- Mechanical gear-shifting: A spring element (gear-shifting aid) must be installed in the shift linkage so that, if the geared coupling in the gear unit is in an unfavourable position (tooth on tooth), the shift linkage can be locked. When the motor starts up, the coupling then engages. The tensile and compressive forces of the shift linkage in the engaged condition must not exceed 500 N.

6. Conversions and modifications

Do not make any changes, provide attachments or perform conversion work on the gear unit or components which could reduce safety without the manufacturer's permission! In particular any protective facilities provided (e.g. covers, overload protection) must not be removed or changed.

7. Notes on maintenance

Change oil regularly in accordance with the operating manual. Refer to lubrication chart, pump power take-off gear units. If the mounting flanges have their own oil filling, it is designed as long-life lubrication and no oil change is necessary. For the oil quantity and oil grade, see nameplate or operating manual; the oil quantities are to be regarded as approximations. The oil level indicated in the assembly drawing is always decisive. Check the oil level by undoing the overflow screw or by using the oil dipstick provided these devices are part of the fittings. At each oil change check all the seals and screw fittings for any leaks and, if necessary, retighten the screws. If possible, a visual leak check should be made every day. A rise in the oil level in the gear unit or mounting flanges with their own oil filling is a sign of defective seals in the hydraulic units.

Premature gear unit failure may occur as a result of running dry caused by oil loss, the ingress of water into the gear unit housing or the presence of foreign matter in the lubricant.

⚠ When changing, replenishing or draining the oil or when taking oil samples, it must be guaranteed that no oil can escape onto the ground, penetrate the ground or surface water or enter the sewage system.

⚠ Prolonged contact with lubricants can cause injury to your skin. Use a protective skin ointment.

⚠ After prolonged operation the lubricant and surface of the gear unit may reach temperatures which can cause skin burns. When working on hot components, wear protective clothing, e.g. protective gloves.

The lubricant is best drained while still warm from operation so that a complete change of the old lubricant is ensured. If the oil is highly contaminated, the gear unit should be rinsed with the same lubricant.

⚠ Under no circumstances may different types of lubricant, such as mineral oil, synthetic oil or grease, be mixed with each other.

⚠ The applicable national, local and plant-specific regulations and requirements concerning accident prevention and environmental protection are to be observed.

⚠ To prevent faults, it is necessary to carry out the regular maintenance and inspection work prescribed. Any changes compared with normal operation (higher power input, temperatures or vibrations, unusual noises or smells, response of monitoring devices etc.) are an indication that the unit is not functioning properly. To avoid faults which could result in injury to people or damage to property, the maintenance staff responsible must be notified immediately. In case of doubt switch off the relevant item of equipment and ensure it cannot be switched on again.

⚠ To prevent damage from overheating, dirt and dust deposits should be regularly removed from the gear unit surface.

8. Spare parts and repairs

Spare parts must satisfy the technical requirements specified by the manufacturer. This is always guaranteed with original spare parts. When ordering spare parts, the type number and serial number (to be found on the nameplate or in the technical data) in addition to the spare part number must be indicated. Spare parts drawings and spare parts lists can be requested from the manufacturer.

Repairs and overhauls are carried out by the manufacturer at short notice. When carrying out your own repairs, make sure that the expendables and auxiliary materials and parts which have been replaced are disposed of safely and without polluting the environment.

⚠ The applicable national, local and plant-specific regulations and requirements concerning accident prevention and environmental protection are to be observed. The manufacturer does not assume any liability for damage caused by improper repair work or the use of non-original spare parts.

⚠ Prolonged contact with lubricants can cause skin damage. Use a protective skin ointment. After prolonged operation the lubricant and the surface of the gear unit may reach temperatures which can cause skin burns. Before starting repairs, let the gear unit cool down.

STIEBEL POWER TAKE-OFF GEAR

Schmierstoffe Lubricants Lubrifiants

Schmierstoffe für / Lubricants for / Graisses pour	Schmierstoffart siehe Typenschild / Lubricant type see name plate / Type de graisse voir plaque de type	Umgebungstemp. in °C / Ambient temperature in °C / Température ambiante en °C	Kinem. Viskosität in cSt bei 40° C / Kinem. viscosity in cSt at 40° C / Viscosité kiném. en cSt à 40° C	ARAL	BP	Calypsol	Castrol	Chevron	Esso	KLÜBER LUBRICATION	Mobil	Shell	DEA
STIEBEL-Getriebe / STIEBEL-Gears / STIEBEL-Réducteurs – mineralisch / mineral / minérale	Öl / Oil / Huile CLP DIN 51517	+ 5···+ 45	460	Degol BG 460	Energol GR-XP 460	UK-ECUBSOL Öl 8140	Alpha SP 460	NL-Gear Compound 460	Spartan EP 460	Klüberoil GEM 1-460	Mobilgear 634	Shell Omala Öl 460	Falcon CLP 460
		0···+ 40	320	Degol BG 320	Energol GR-XP 320	UK-ECUBSOL Öl 8060	Alpha SP 320	NL-Gear Compound 320	Spartan EP 320	Klüberoil GEM 1-320	Mobilgear 632	Shell Omala Öl 320	Falcon CLP 320
		− 5···+ 35	220 (standard)	Degol BG 220	Energol GR-XP 220	UK-ECUBSOL Öl 8050	Alpha SP 220	NL-Gear Compound 220	Spartan EP 220	Klüberoil GEM 1-220	Mobilgear 630	Shell Omala Öl 220	Falcon CLP 220
		−15···+ 25	100	Degol BG 100	Energol GR-XP 100	UK-ECUBSOL Öl 8030	Alpha SP 100	NL-Gear Compound 100	Spartan EP 100	Klüberoil GEM 1-100	Mobilgear 627	Shell Omala Öl 100	Falcon CLP 150
		−50···−10	15	—	Bartran HV 15	—	Alphasyn T 15	Mechanism LPS 15	Univis N 15	ISOFLEX MT 30 ROT	Mobil DTE 11	Shell Tellus Öl T 15	Astron Z HLP 15
	Fließfett / Fluid grease / Graisse fluide	−20···+ 50	—	Aralub FDP 00	Energrease HT 00–EP; Energrease FG 00–EP	Calypsol D 6024; Calypsol D 8024	CLS-Grease	Dura-Lith. EP Grease 00	Fibrax EP 370; Fibrax 370	MICROLUBE GB 00	Gargoyle Fett 1200 W	Shell Spezial Getriebefett H; Shell Tivela Compound A	Glissando 283 EP 00; Orona DR 00
STIEBEL-Getriebe / STIEBEL-Gears / STIEBEL-Réducteurs – synthetisch / synthetic / synthétique	Öl / Oil / Huile PGLP DIN 51502	−15···+100	460	Degol GS 460	Energol SG-XP 460	UK-ECUSYNTH Öl PG 460	Alphasyn T 460	—	—	Klübersynth GH 6-460	Mobil Glygoyle 80	Shell Tivela Oil SD	Polydea CLP 460
		−25···+ 80	220	Degol GS 220	Energol SG-XP 220	UK-ECUSYNTH Öl PG 220	Alphasyn T 220	—	Umlauföl S 220; Umlauföl EZL 502	Klübersynth GH 6-220	Mobil Glygoyle 30	Shell Tivela Oil WB	Polydea CLP 220
		−35···+ 60	100	—	—	—	—	—	—	Klübersynth GH 6-100	Mobil Glygoyle 11	Shell Tivela Oil WA	—
	Fließfett / Fluid grease / Graisse fluide	−35···+ 60	—	—	Energrease GSF	—	CLS-Grease	—	Fließfett S 420	Klübersynth GE 46-1200	—	Shell Tivela Compound A	—
Wälzlager / Roller bearings / Paliers à roulement	Fett / Grease / Graisse	−30···+ 60	— (standard)	Mehrzweckfett Aralub HL 2	Mehrzweckfett L 2; Energrease LS 2	Calypsol H 441; Mehrzweckfett Calypsol 20	Spheerol AP 2	Dura-Lith. EP Grease 2	Beacon 2; Unirex N 2	CENTOPLEX 2 EP; CENTOPLEX 2	Mobilgrease MP; Mobilux 2	Shell Alvania Fett G 2; Shell Alvania Fett R 2	Glissando R EP 2; Glissando 20
		−50···+110	—	—	—	Calypsol H 729	LZV-EP		—	ISOFLEX TOPAS NCA 52	Mobiltemp SHC 100	Aeroshell Grease 7	—

Schmierstoffwechselintervalle für / Intervals of lubricant changing for / Termes de changement de lubrifiant pour			
	STIEBEL-Standardgetriebe Erster Ölwechsel nach ca. 500 Betriebsstunden; danach alle 4.000 h. jedoch maximal nach 18 Monaten.	**STIEBEL-Pumpenverteilergetriebe, STIEBEL-Getriebe mit besonderer Schmieranweisung** Erster Ölwechsel nach ca. 200 Betriebsstunden; danach alle 2.000 h. jedoch maximal nach 12 Monaten.	**Wälzlager** Neubefüllung alle 10.000 Betriebsstunden. Füllmenge: 1/3 Lagerinnenraum.
	STIEBEL-Standard gears First oil change after approx. 500 operating hours; further every 4,000 h. or at least after 18 months.	**STIEBEL-Pump distributor gears, STIEBEL-Gears with special lubrication instruction** First oil change after approx. 200 operating hours; further every 2,000 h. or at least after 12 months.	**Roller bearing** New filling every 10,000 operating hours. Quantity: 1/3 inner space of roller bearing.
	STIEBEL-Réducteur standard Changement premier d'huile après environ 500 heures de service; toutes les 4.000 h. de plus ou au plus tard après 18 mois.	**STIEBEL-Réducteur à sorties multiples pour pompes STIEBEL-Réducteur avec des préseptes spéciaux de graissage** Changement premier d'huile après environ 200 heures de service; toutes les 2.000 h. de plus ou au plus tard après 18 mois.	**Palier à roulement** Remplissage nouveau après 10.000 heures de service. Quantité: 1/3 de l'intérieur du palier à roulement.

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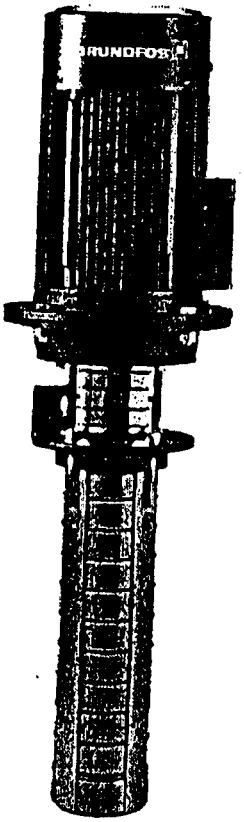
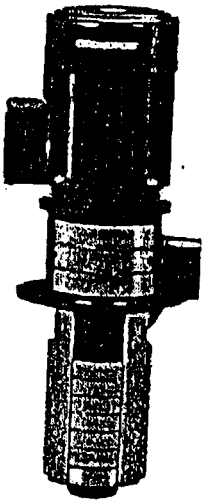
CRK WASH WATER PUMP





(GB) Installation and Operating Instructions
(D) Montage- und Betriebsanleitung
(F) Notice d'installation et d'entretien
(DK) Monterings- og driftsinstruktion

CRK

CONTENTS

1. Applications

The GRUNDFOS CRK pumps are multistage centrifugal pumps designed for the pumping of cooling and cutting liquids for machine tools, condensate transfer, liquid transfer in industrial washing machines and similar applications.

GB

CRK pumps are designed for the pumping of liquids with a density and viscosity corresponding to those of water. The pumped liquid must not contain abrasive particles or fibres.

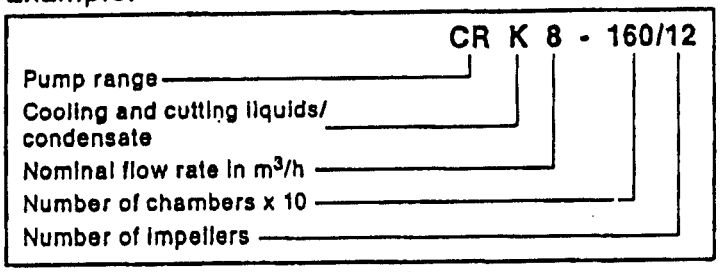
When pumping liquids with a density or viscosity higher than that of water, motors with correspondingly higher outputs must be used, if required.

2. Type Designation

The standard range of CRK pumps encompasses complete impeller in chamber combinations. On request, other lengths, against duty combinations, can be supplied by fitting empty intermediate chambers instead of standard chambers with impellers.

The pump key on the pump nameplate indicates the number of chambers and impellers fitted to the pump.

Example:



3. Operating Conditions

Liquid Temperature:	−15°C to +90°C.
Ambient Temperature:	−30°C to +40°C.
Enclosure Class:	IP 55.
Relative Air Humidity:	Maximum 90%.
Operating Pressure:	Maximum 25 bar.

4. Installation

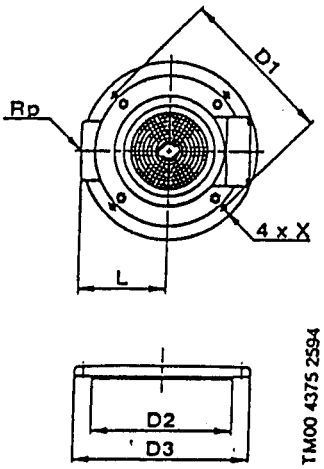
4.1 Pump Location

GB

The pump is designed for tank mounting in a vertical position. The pump is positioned in a hole cut into the cover of the tank (upper side) and is secured to the tank by four set screws through the holes in the mounting flange. It is recommended to fit a sealing gasket between the pump flange and tank.

Fig. 1
Pump Mounting Flange Dimensions

	CRK 2 and 4	CRK 8 and 16
D1	160	225
D2	140	200
D3	180	250
L	100	125
Rp	1¼	2
X	ø7	ø9



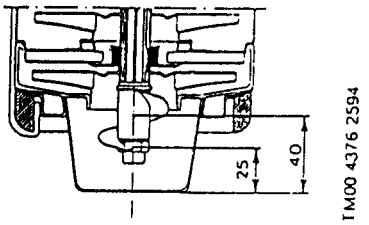
4.2 Suction Conditions

The CRK pumps are designed to provide full performance down to a liquid level of 40 mm (CRK 2/4) or 50 mm (CRK 8/16) above the bottom of the pump strainer.

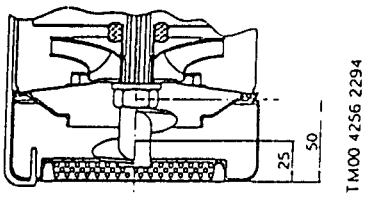
At a liquid level between 25 and 40/50 mm above the bottom of the strainer, the built-in priming screw will protect the pump against dry-running, see fig. 2.

Fig. 2

CRK 2 and CRK 4



CRK 8 and CRK 16



5. Electrical Connections

The electrical connections should be carried out in accordance with local regulations.

The operating voltage and frequency are marked on the pump nameplate. Please make sure that the motor is suitable for the electricity supply on which it will be used.

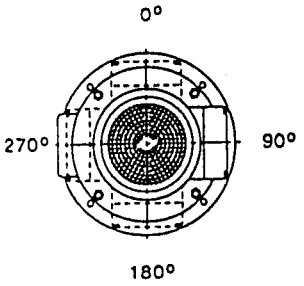
GB

Single-phase GRUNDFOS motors incorporate a thermal switch and require no additional motor protection.

Three-phase motors must be connected to a motor starter.

To ensure easy access to the electrical connections, the terminal box can be turned to the positions shown in fig. 3.

Fig. 3



TM00 4257 2294

Remove the coupling guards which are kept in position by spring tension.

To change the position of the terminal box, remove the four screws securing the motor to the motor stool. Turn the motor to the required position, replace and tighten the four screws.

Replace the coupling guards.

Do not start the pump until it has been submerged in the pumped liquid.

The electrical connection should be carried out as shown in the diagram inside the terminal box cover.

In the case of **frequency converter** operation, the motor should not be loaded by more than 90% of the power stated on the motor nameplate, unless otherwise stated by the frequency converter manufacturer.

6. Start-Up

The pump can be started against an open or a closed discharge side.

- If the discharge side is open and the pump body is partly filled with liquid when the pump is started, the air will escape through the discharge pipe.
- If the discharge side is closed and the pump body is partly filled with liquid when the pump is started, the air will be pressed down through the pump body and out into the tank, and the pump will very quickly reach its maximum operating pressure.

Before starting the pump, make sure:

1. that the direction of rotation of the pump is correct.
   When seen from the top, the pump should rotate counter-clockwise.
   (Start the pump for a short period and check the direction of rotation at the motor cooling fan).
2. that all pipe connections are tight.
3. that the pump body is partly filled with liquid (partly submerged).
4. that the strainer is not blocked by impurities.

7. Operation and Maintenance

7.1 Lubrication and Maintenance

Pumps installed in accordance with these instructions require very little maintenance.

The mechanical shaft seal is self-adjusting and has wear-resistant seal rings which are lubricated and cooled by the pumped liquid.

The pump bearings are also lubricated by the pumped liquid. Motor bearings are grease packed and sealed for life. No further lubrication is necessary.

7.2 Filters

Chip trays, filters, etc. should be cleaned at regular intervals to ensure a correct flow of liquid.

7.3 Periodic Checks

At regular intervals, depending on the conditions and time of operation, the following checks should be made:

- Check the quantity of liquid and operating pressure.
- Check that there are no leaks.
- Check that the motor is not overheating.
- Check the tripping of the motor starter.
- Check that all controls are operating satisfactorily.

If the above checks do not reveal any abnormal operating details, no further checks are necessary. Should any faults be found, check the symptoms with section 8. "Fault Finding Chart".

8. Fault Finding Chart

Before removing the terminal box cover and before any removal/dismantling of the pump, make sure that the electricity supply has been switched off.

Fault	Cause
1. Motor does not run when started.	a) Supply failure. b) Fuses blown. c) Motor starter overload has tripped out. d) Main contacts in starter are not making contact or the coil is faulty. e) Control circuit fuses are defective.
2. Motor starter overload trips out immediately when supply is switched on.	a) One fuse is blown. b) Contacts in motor starter overload are faulty. c) Cable connection is loose or faulty. d) Motor winding is defective. e) Pump mechanically blocked.
3. Motor starter overload trips out occasionally.	a) Overload setting too low. b) Periodic supply failure. c) Low voltage at peak times.
4. Motor starter has not tripped out but the pump does not run.	a) Check 1 a), b), d) and e).
5. Pump capacity not constant.	a) Pump strainer partly blocked by impurities. b) Liquid level in tank too low. See 4.2 "Suction Conditions".
6. Pump runs but gives no liquid.	a) Pump strainer blocked by impurities. b) Liquid level in tank too low. See 4.2 "Suction Conditions". c) Pump rotates in the wrong direction.

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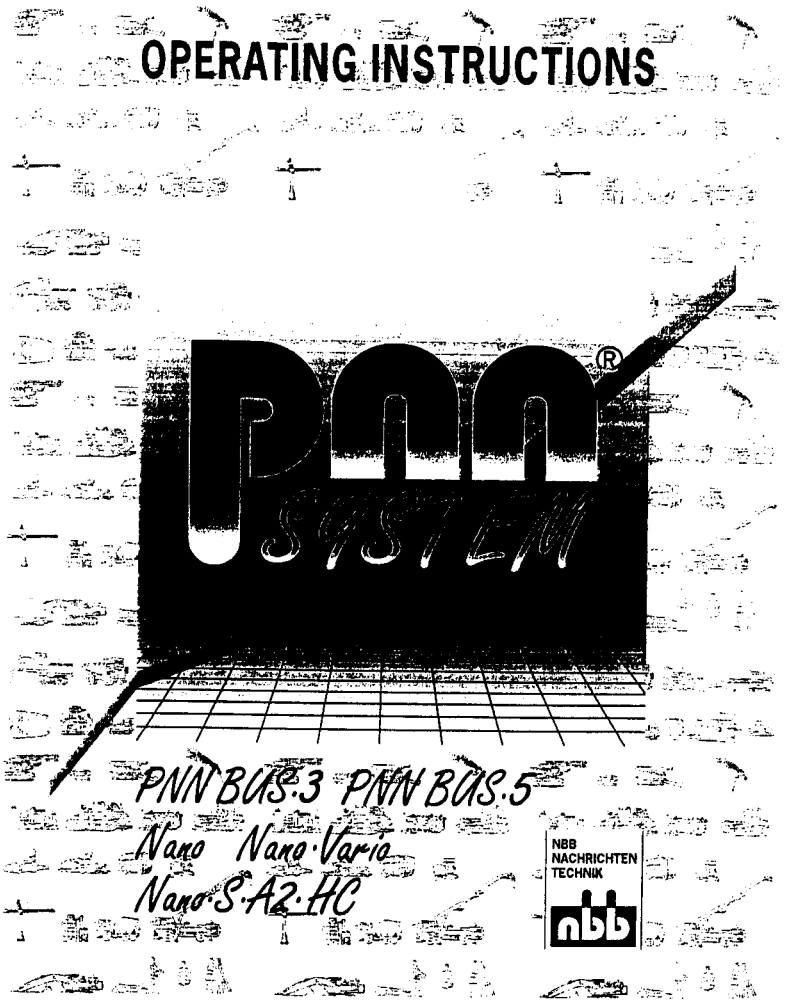


1. STANDARD SPECIFICATION

- Portable transmitter with two replaceable 7,2 volt NiCd batteries, halter and waist straps
- Receiver with NBB adapter plate for fastening purposes (Only PNN-BUS-3)
- Receiver with 4 fastening angles (PNN-BUS-5)
- Multi-pole connecting cable for the receiver, to your specifications
- Automatic battery charger with charging adapter (rapid charging in three hours)

The actual delivery specification is as detailed on the confirmation of order or the delivery note accompanying the goods!

2. SAFETY PRECAUTIONS

Even if you are accustomed to working with radio control systems, read these operating instructions without fail before using this equipment. Only this document contains the latest information relating to your NBB radio control system.

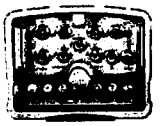
Please refer to the accompanying registration documents for the explanatory notes on obtained an operating permit. Observe all applicable work-safety and accident prevention regulations without fail. Only fully trained, authorized personnel may use the NBB radio control equipment. Components, etc. built into the NBB equipment for safety purposes must be regularly inspected. (See point 6 of this instruction)

If the NBB radio control unit develops a fault, it must be shut down immediately. The transmitter should be switched off with the EMERGENCY-OFF switch. The connecting cable must be disconnected from the crane connecting socket (terminal) on the receiver. The repair of the equipment must not be carried out other than by NBB or an NBB authorized technician.

Failure to observe these recommendations will put both you yourself and others at risk. Under these circumstances, NBB rescinds the guarantee and any other form of liability. This radio control unit is designed exclusively for the control of construction machines and industrial plants. Only under these conditions are the safety systems (EMERGENCY-OFF, zero setting) fully effective. No other form of use is permitted. Any non-observance of this condition will relieve NBB of all liability.

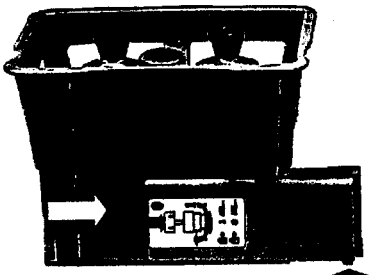
Nano, Nano-S-A2-HC

Nano-Vario

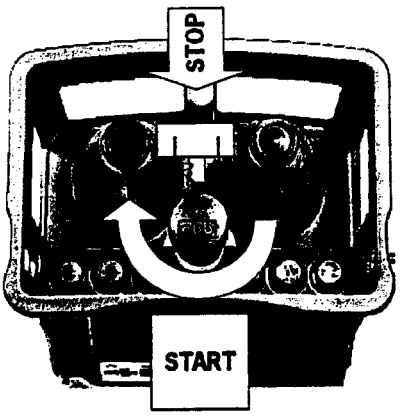


3. TRANSMITTER

To make the unit ready for use, insert the battery into the battery compartment. To remove the battery, depress the pin and push out the battery. The power supply to the transmitter is activated with the EMERGENCY-OFF switch (when depressed, the EMERGENCY-OFF switch can also be secured by removing the key cap). The green LED on the transmitter control panel must flash regularly. Commands can now be input by means of the controls. The operating period with a charged battery is approximately 8 hours with the transmitter in continuous use. When the red "Battery" indicator lamp lights up, the battery is nearing exhaustion.
The transmitter can be operated for approximately 15 minutes more in this condition. During this time, bring the crane to a safe position and install a new battery.
Removal of the battery inerrupts the radio link. As a result, the master switch for the crane must be switched on again.
Charge the discharged battery with the charger supplied.

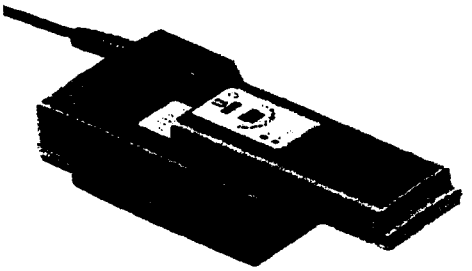


Depress the pin and push out the battery



4. BATTERY CHARGER

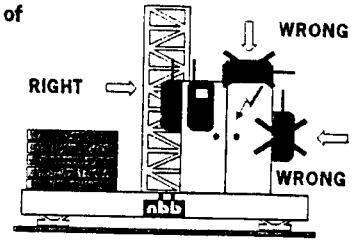
The red indicator lamp indicates that the battery charger is ready for use. Place the battery in the charging well; it will now be charged. When the red LED goes out, the charging process is concluded. No harm will come to the battery if it is left in the charger beyond the required charging time.
Do not use the charger other than in dry rooms having a min-max temperature range of 0-40°C. A charged battery is a concentrated energy source. Never store a charged battery in a toolbox or similar where it could be short-circuited by metal components (even a key in your trouser pocket can cause a short circuit).



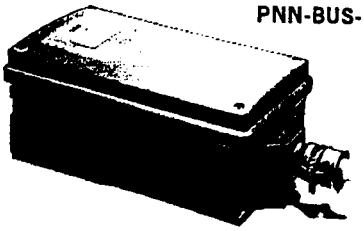
5. RECEIVER (PNN-BUS-3 and PNN-BUS-5)

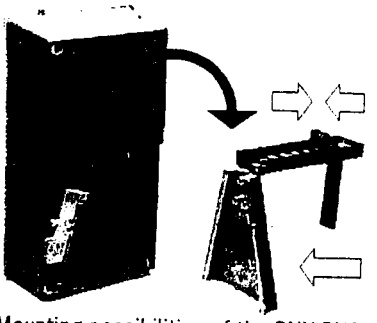
The receiver is connected to the crane with the multi-pole connecting cable supplied. Please observe the instructions issued by the crane manufacturer. The power supply to the receiver is generally effected by way of the connecting cable.

- **In general, an earth lead is required in the case of cranes which have not previously been operated under radio control. Failing this, the receiver electronic circuit will not receive any power supply.**
  Take care to ensure that the operating voltage of the receiver complies with the electrical specifications of the crane.
  The applicable operating voltage is specified in the supplement.
- **Never expose the receiver to a high pressure cleaning jet.**
  This also applies to the transmitter.
- **The receiver should always be fixed vertical at the outside panel of the switching cabinet.**
  The antenna should reach over the top of the panel.



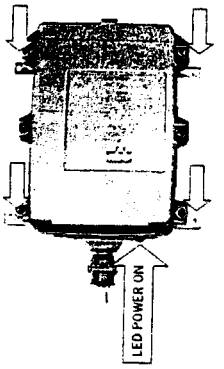
PNN-BUS-3



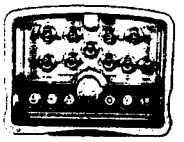


Mounting-possibilities of the PNN-BUS-3 or of the PNN-BUS-5.

PNN-BUS-5



Nano·Vario



6. OPERATING THE SYSTEM

Safety equipment in the NBB radio control system:

In the transmitter:
- EMERGENCY-OFF switch with automatic disconnection from the power supply
- Automatic zeroing

In the receiver:
- Duplicated 2-channel evaluation of the EMERGENCY-OFF signal
- Automatic zeroing when switched on again after radio signal interruption
- Inhibition of radio control commands at the relay level if EMERGENCY-OFF circuit defective.

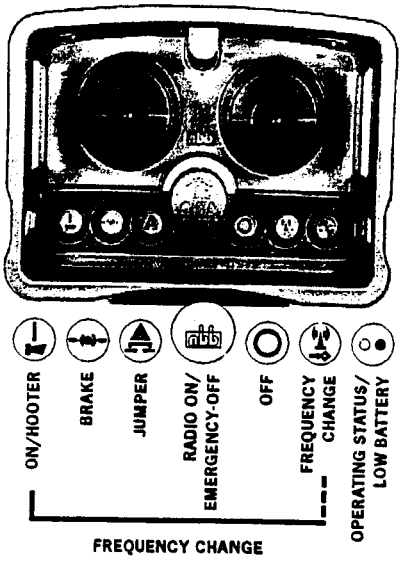
To ensure troublefree operation, observe the following operating instructions precisely. Subject to the transmitter being in operating condition, the crane's master switch can only be switched on provided no command transmitter is actuated. The necessary command for this purpose is initiated by the "ON/HOOTER" button. This activates a warning signal on the crane. After the crane has been switched on, this button serves for the subsequent activation of the hooter as required by safety at work regulations.

If the NBB radio control unit remains unused for a prolonged period, we strongly recommend that the battery be charged from time to time (approximately every four weeks). This will prevent it from becoming discharged and will prolong its working life. If an extended period of disuse is intended, we recommend that the battery be removed from the transmitter.

Changing the frequency:

To change the frequency, hold down the "ON/HOOTER" button while simultaneously operating the "FREQUENCY CHANGE" button until the hooter sounds. (Please observe the accompanying registration conditions, see page 5, point 9).

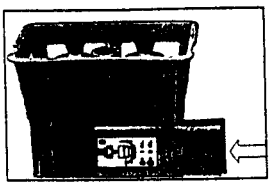
Nano / Nano-S-A2-HC



TEACH-IN: Individual Setting of Analog Channels (Basic Setting) at Nano Transmitter*.
The output signals of the analog channels can be individually programmed by the transmitter.

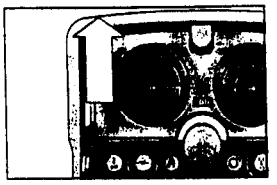
Activate programming mode

1 Set all analog channels to zero position. (potentiometer without automatic release) Insert the TEACH-battery into the battery compartment, release the EMERGENCY-OFF switch and press the "ON/HORN" key. Now the programming mode is activated.



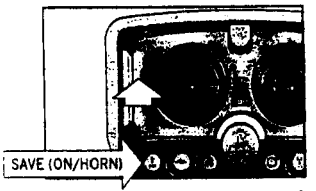
Select analog function

2 To determine which analog function is to be programmed, it is sufficient to turn briefly the appropriate master switch fully in the direction of this function.



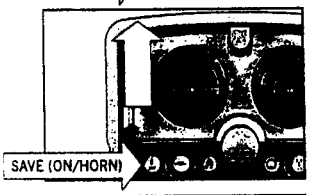
Save "contact point"

3 Now the "50%/100%" switch has to be turned into the "50%" position.
The master switch is now turned until the required "contact point" is reached.
To save this value, the "SAVE" ("ON/HORN") key must be pressed at this position.



Save maximum speed

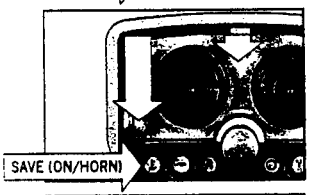
4 The "50%/100%" switch has to be turned into the "100%" position.
The upper initial value is saved by turning the master switch until the maximum speed of the function is reached then pressing again the "SAVE" ("ON/ HORN") key.



Program opposite direction ?

No / Yes

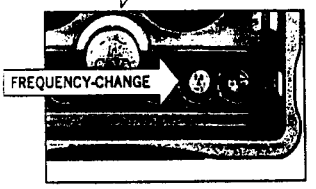
5 The opposite direction of this function can then be programmed the same way immediately afterwards.
See point **3** and **4** .



Programming of next function ?

No / Yes

6 When programming several analog channels consecutively, the "FREQUENCY-CHANGE" key must be pressed once after saving a function.
Continue point **2** .



Check the programmed values

7 By pressing and holding the "FREQUENCY-CHANGE" key it is possible to change to the working mode to check the programmed values.
As soon as the key is released, the programming mode can be commenced, as described above. (Point **2** to **5** .)

Close the programming mode

8 Press the EMERGENCY-OFF switch, push out the TEACH battery of the battery compartment , insert the normal working battery, release the EMERGENCY-OFF switch again and prepare the control to operate by pressing the "ON/HORN" key.

The control is ready to operate.

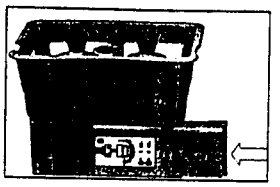
Please note:
In the programming mode all functions are locked, except "ON/HORN" and each selected function.

*** Please refer to the scope of supply of your facility.**

TEACH-IN: Individual Setting of Analog Channels (Basic Setting) at Nano Transmitter with Potentiometer Control*.
The output signals of the analog channels can be individually programmed by the transmitter.

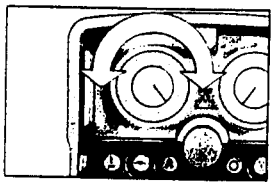
Activate programming mode

1 Set all analog channels to zero position. (potentiometer without automatic release) Insert the TEACH-battery into the battery compartment, release the EMERGENCY-OFF switch and press the "ON/HORN" key. Now the programming mode is activated.



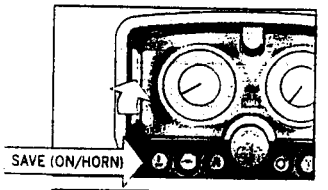
Select analog function

2 To determine which analog function is to be programmed, it is sufficient to turn briefly the appropriate potentiometer fully in the direction of this function.



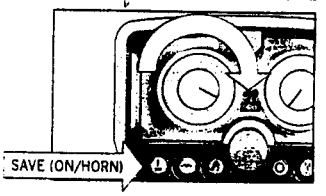
Save "contact point"

3 Now the "50%/100%" switch has to be turned into the "50%" position.
The potentiometer is now turned until the required "contact point" is reached.
To save this value, the "SAVE" ("ON/HORN") key must be pressed at this position.



Save maximum speed

4 The "50%/100%" switch has to be turned into the "100%" position.
The upper initial value is saved by turning the potentiometer until the maximum speed of the function is reached then pressing again the "SAVE" ("ON/ HORN") key.



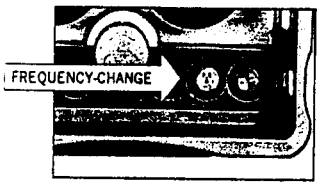
5 No opposite direction.

Programming of next function ?

No

Yes

6 When programming several analog channels consecutively, the "FREQUENCY-CHANGE" key must be pressed once after saving a function.
Continue point **2** .



Check the programmed values

7 By pressing and holding the "FREQUENCY-CHANGE" key it is possible to change to the working mode to check the programmed values.
As soon as the key is released, the programming mode can be commenced, as described above. (Point **2** to **5** .)

Close the programming mode

8 Press the EMERGENCY-OFF switch, push out the TEACH battery of the battery compartment , insert the normal working battery, release the EMERGENCY-OFF switch again and prepare the control to operate by pressing the "ON/HORN" key.

The control is ready to operate.

Please note:
In the programming mode all functions are locked, except "ON/HORN" and each selected function.

*** Please refer to the scope of supply of your facility.**

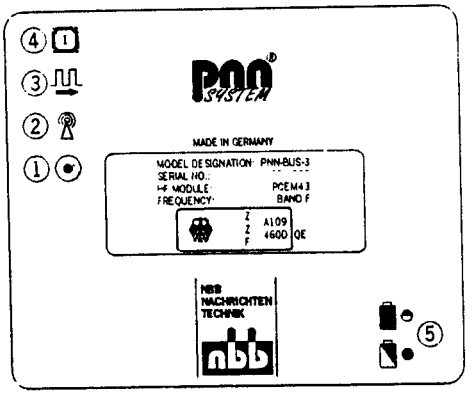
7. FUNCTION CHECKS

Regular function checks of the NBB radio control unit are essential to ensure that operating safety is maintained. In the case of a single-shift daily operation, we recommend that the checks be carried out once a week. They can be performed with the aid of the indicator lamps on the receiver. For this purpose, the transmitter must be in operating condition.

- First, connect only the receiver - the transmitter remains switched off.
- Switch on the transmitter by releasing the EMERGENCY-OFF button.
- Now test the command functions (always starting at the lowest stage) and check that the crane responds correctly. In particular, make sure that the danger area is clear of all personnel. **Failure to do so may result in an ACCIDENT.**
- **EMERGENCY-OFF check.** Press the EMERGENCY-OFF button on the transmitter until it locks. The crane's master contactor must drop out after a maximum of 1/2 second.

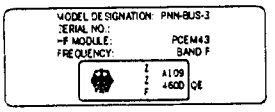
Checking the LEDs of the receiver

- **LED1:** POWER ON. If the LED does not light up, check the power supply. If the power supply lead is in satisfactory condition, notify your service centre.
- **LED2:** HF AVAILABLE. Remains lit continuously when the transmitter is switched on.
  (not significant in the case of scanner operation).
- **LED3:** Flashes at regular intervals during fault-free operation. Irregular flashing means that the HF channel is probably disrupted. In this case, select an alternative channel.
- **LED4:** If this LED flashes, the HF channel is disrupted.
- **LED5** (Battery operation): state of charge of the battery.



8. RATING PLATES

Rating plates contain the serial number, model designation, type of HF module and frequency. In the event of a query, please give the serial number without fail.



9. REGISTRATION

Explanatory notes on obtaining an operating permit for your NBB radio control system will be found in the accompanying registration documents.

10. MAINTENANCE

The NBB radio control unit is largely maintenance-free. Nevertheless, please observe the following points:

- The EMERGENCY-OFF button must operate freely.
- Keep the unit clean of any contamination from building materials.
- If any electrical welding is carried out on the crane, disconnect the control cable from the receiver, otherwise the receiver electronics may be damaged.

11. GUARANTEE

All NBB radio control units (transmitter, receiver, battery charger) are guaranteed to operate satisfactorily for a period of six months from the date of sale. The terms of the guarantee include parts and labour. Transport costs are the buyer's responsibility. The following are excluded from the guarantee: wearing parts, relays and batteries. The guarantee does not cover damage, accidental damage, negligence, improper use, non-adherence to operating conditions, the non-observance of operating, testing and servicing instructions, or repairs or modifications to the unit not authorized by NBB.
NBB will not be liable for consequential damage. It reserves the right to effect repairs or replacements at its own discretion.

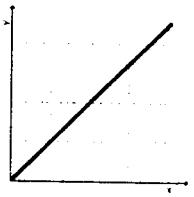
12. ACTION IN THE EVENT OF A FAULT

Do not continue to work with a defective NBB radio control unit. Even a minor defect in the first instance may eventually lead to a major fault!
Do not try to repair the NBB radio control unit yourself. In the event of a fault, please notify your dealer or contact us!

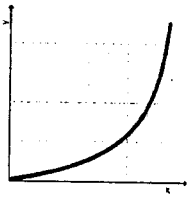
TECHNICAL SUPPLEMENT

NANO: Board E-AN04A2V1/1 TEACH-IN*

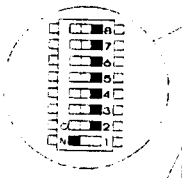
DIL switch (SW2) for setting various transmission characteristics:

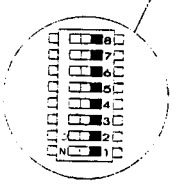


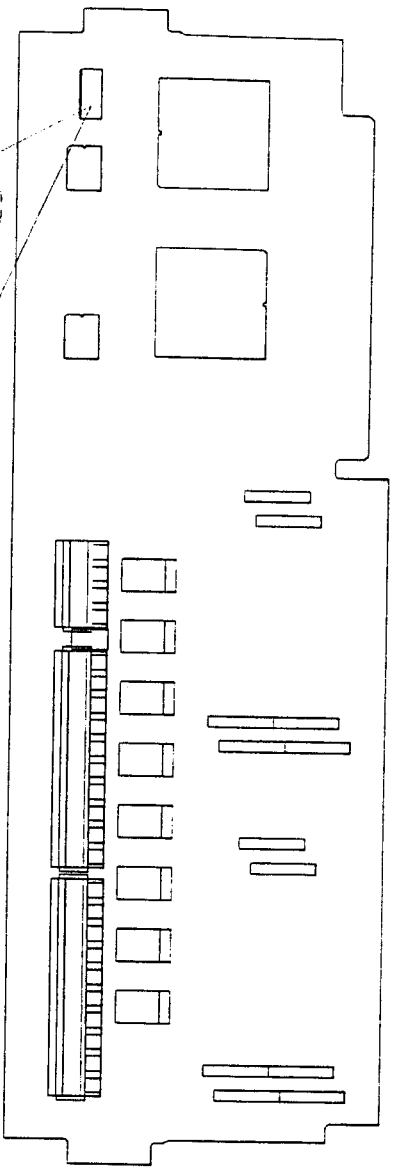
Setting for linear characteristic



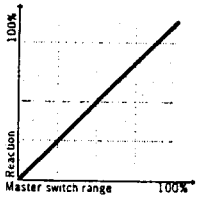
Setting for non-linear characteristic

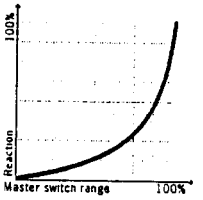




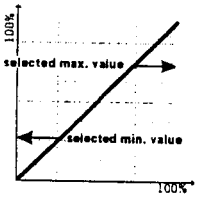


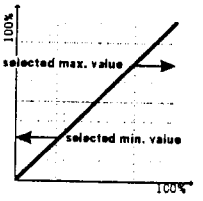
Characteristics linear or non-linear



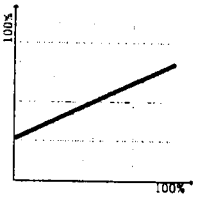


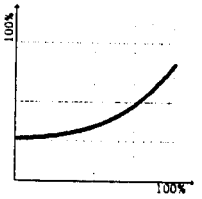
Characteristics in Teach-In mode





Characteristics after Teach-In mode





DIL switch no. 8 : OFF: 50% switching variable
ON : 50% switching fixed

***Please refer to the scope of supply of your facility.**

TECHNICAL DATA

PNN® SYSTEM

Operating ambient temperature	-20 to +65 °C
Insulation class - Protection	IP 65

TRANSMITTER

Pocket-S Nano Nano-L Nano-M

Transmission frequency range	400 - 477 MHz, 25 mW FM

The use of synthesizer technology permits frequencies to be selected in accordance with the appropriate waveband for the country of use.

Low frequency modulation	FSK signal to CCITT V.23
Data repetition rate	about 60 ms
Baud rate	1200 baud (bits per sec.)
Range	300 up to 1000 m
Power input	about 60 mA
RF ouput	10 mW

	Weight (without battery)	Size (L x W x H)
Pocket	0,2 kg	8,7 x 3,5 x 14 cm
Nano	0,7 kg	17,5 x 12,6 x 12,2 cm
Nano-L	1,0 kg	24,7 x 13,9 x 11,7 cm
Nano-M	1,5 kg	28,3 x 14,4 x 16,7 cm

RECEIVER

PNN-BUS-3, PNN-BUS-5

Reception frequency range	400 - 477 MHz

Data security:
Generates a CRC code with a Hamming distance = 4. Generates a neutral position Addressing of each transmitter with its own, unique combination (32768 possible combinations). Parity - Bit parameters with addressing.

Data reception security:
2 diversitary evaluators (1 hardware evaluator, 1 software - controlled evaluator). CRC. EMERGENCY OFF and neutral position bits. Restart inhibitor if EMERGENCY OFF relay defective.

Contact loading for EMERGENCY OFF and commands.

max. switching voltage	250 V
max. switching current	6 A
max. switching power	1000 VA

	Weight	Size (L x W x H)
PNN-BUS-3	3,0 kg	30,6 x 18,1 x 13 cm
PNN-BUS-5	4,7 kg	36,4 x 28,3 x 15,2 cm

BATTERY

7,2V / 0,6 Ah

CHARGING UNIT

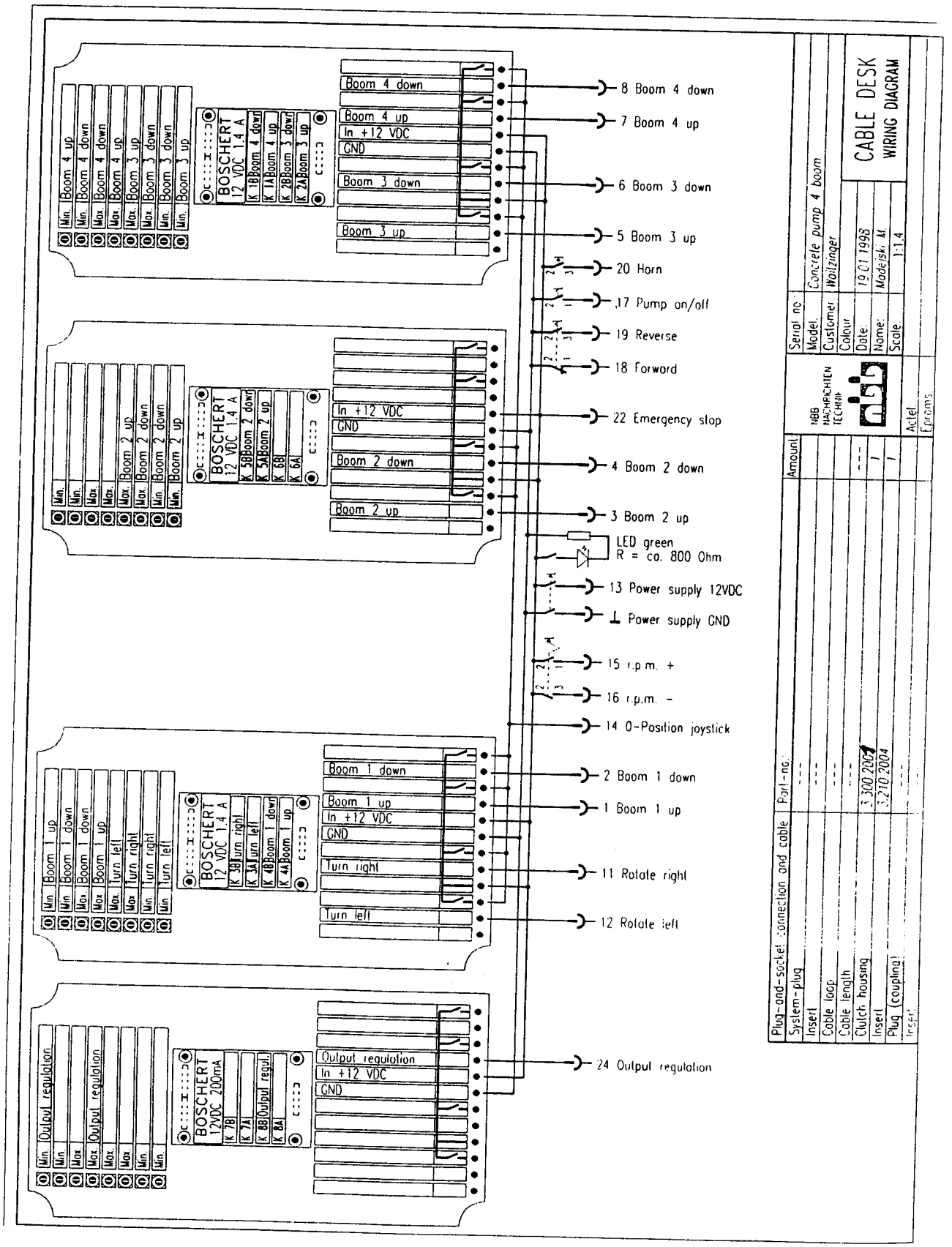
Operating voltage external charging unit	12V/24V DC
	110V/230V AC
Operating voltage /PNN-BUS-3/PNN-BUS-5	90V - 270V AC
	40V - 270V AC
	40V - 130V AC
	8V - 50V DC
	24V DC

REED
CONCRETE PLACING EQUIPMENT

PNN SYSTEM
CABLE REMOTE CONTROL

VENDR

FIGURE 08
PAGE 08



REVISION:

REVISION:

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: G120913F

Zus. Kennzeichen: LFD-D

Objektbezeichnung: E-EM43 AO

Zulassungsinhaber: NBB
Nachrichtentechnik GmbH
Otto-Hahn-Str. 3
D-75248 Ölbronn-Dyrrn

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlagen für gewerbliche und industrielle Fernsteuerungs- und Fernmeßzwecke

Das Zulassungsobjekt erfüllt die Zulassungsvorschrift BAPT 222 ZV 125, Ausgabe Dezember 1994 auf der Grundlage der angewandten technischen Vorschrift I-ETS 300 220, Ausgabe August 1993

Saarbrücken, den 05.10.1995

Im Auftrag

Hans-Werner Dies

1 Anlage

Bundesamt für Zulassungen in der Telekommunikation, Talstraße 34-42, D-66119 Saarbrücken, Tel.: (06 81) 5 66-0, Fax: (06 81) 5 66-18 00

Anlage 1 zur Zulassungsurkunde
Nr. G120913F vom 05.10.1995
Vorgangs-Nr.: 49202 2
Seite 1 (2)

SYSTEMBESCHREIBUNG

Objektbestandteil: Empfangsmodul: E-EM43 AO

Objektmerkmale:

Frequenzbereich:	433,05 MHz bis 434,79 MHz
Betriebsfrequenzbereich:	433,100 MHz bis 434,750 MHz
Sendeart:	F 1 D
Betriebsart:	Simplex
Spannungsversorgung des Empfängers:	12V, DC
Antenne des Empfängers:	Antennenbuchse
Anzahl der schaltbaren HF-Kanäle:	67

REED CONCRETE PLACING EQUIPMENT

PNN SYSTEM
CABLE REMOTE CONTROL

VENDR
FIGURE 08
PAGE 09