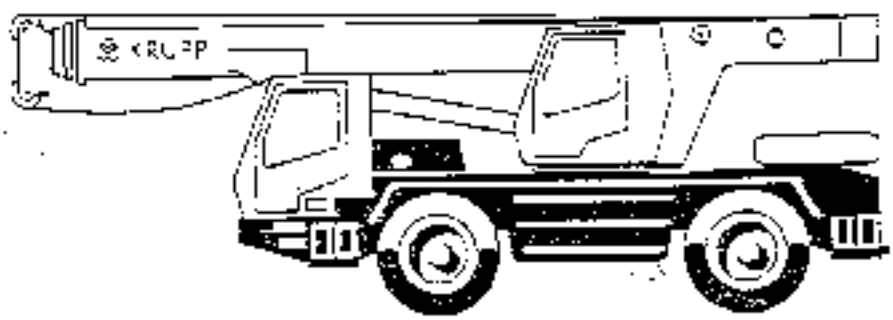
KMK 2025

Repair Manual



Description of operation

Malfunctions

Adjusting procedures

Repair procedures

General repair procedures

Axles

Description of operation

During on-the-road travel, a cardan shaft of the integrated manual gearbox transfer case drives crane axle 2 only.

For all-wheel drive, axle 1 can also be engaged.
Both axles are fitted with transverse longitudinal differential locks.

Axle functions

	On-the-road travel	All-wheel drive	Off-the-road travel
Axle 1	non-driven steering axle	connectible steering axle	connectible steering axle
Axle 2	driven steering axle	driven steering axle	driven steering axle

Axle design

Both axles are steering axles. The only difference between them lies in their brakes: axle 1 is fitted with disc brakes and axle 2 with drum brakes.

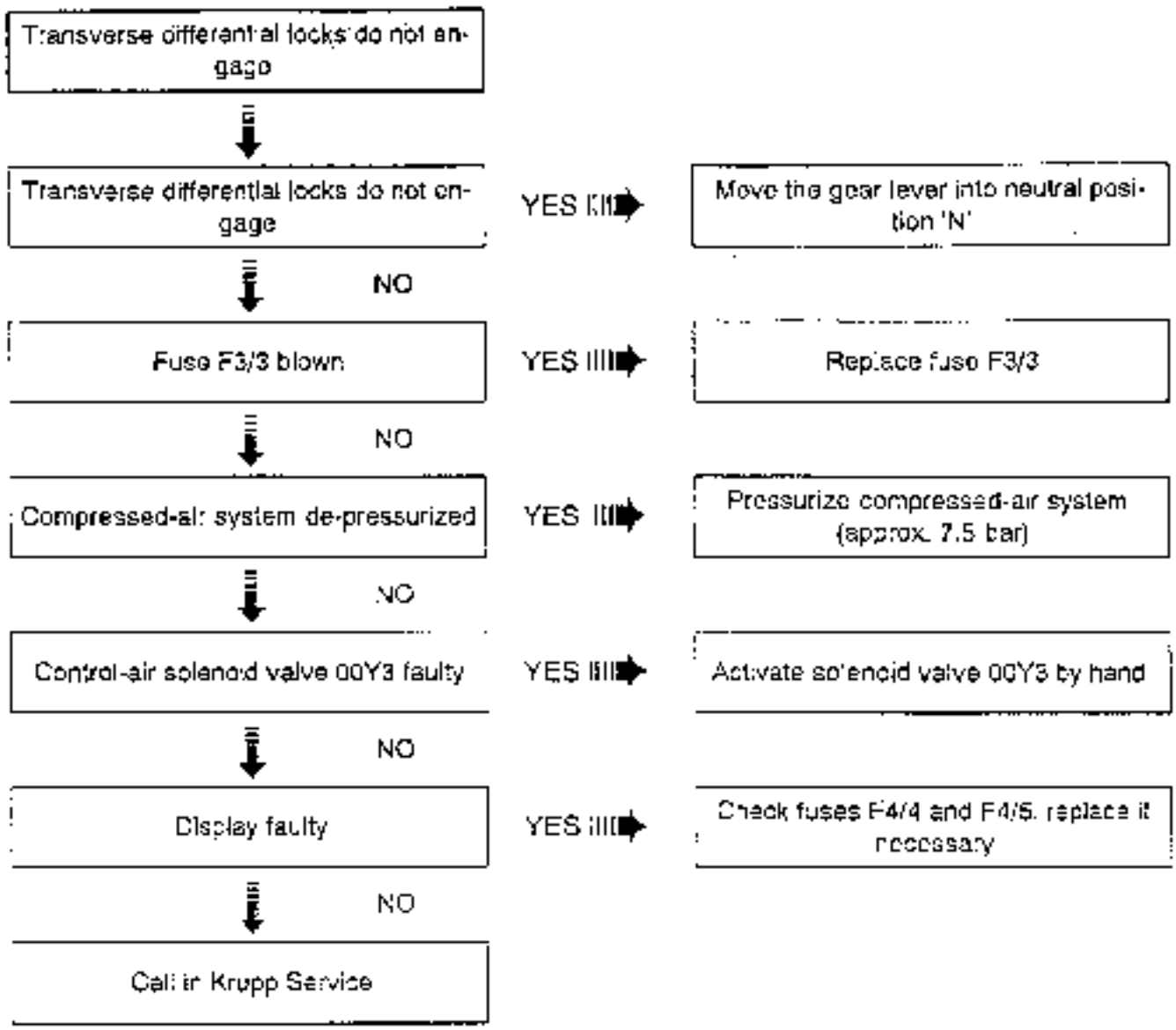
The axles consist of the axle body, in the middle of which the differential gear is housed.

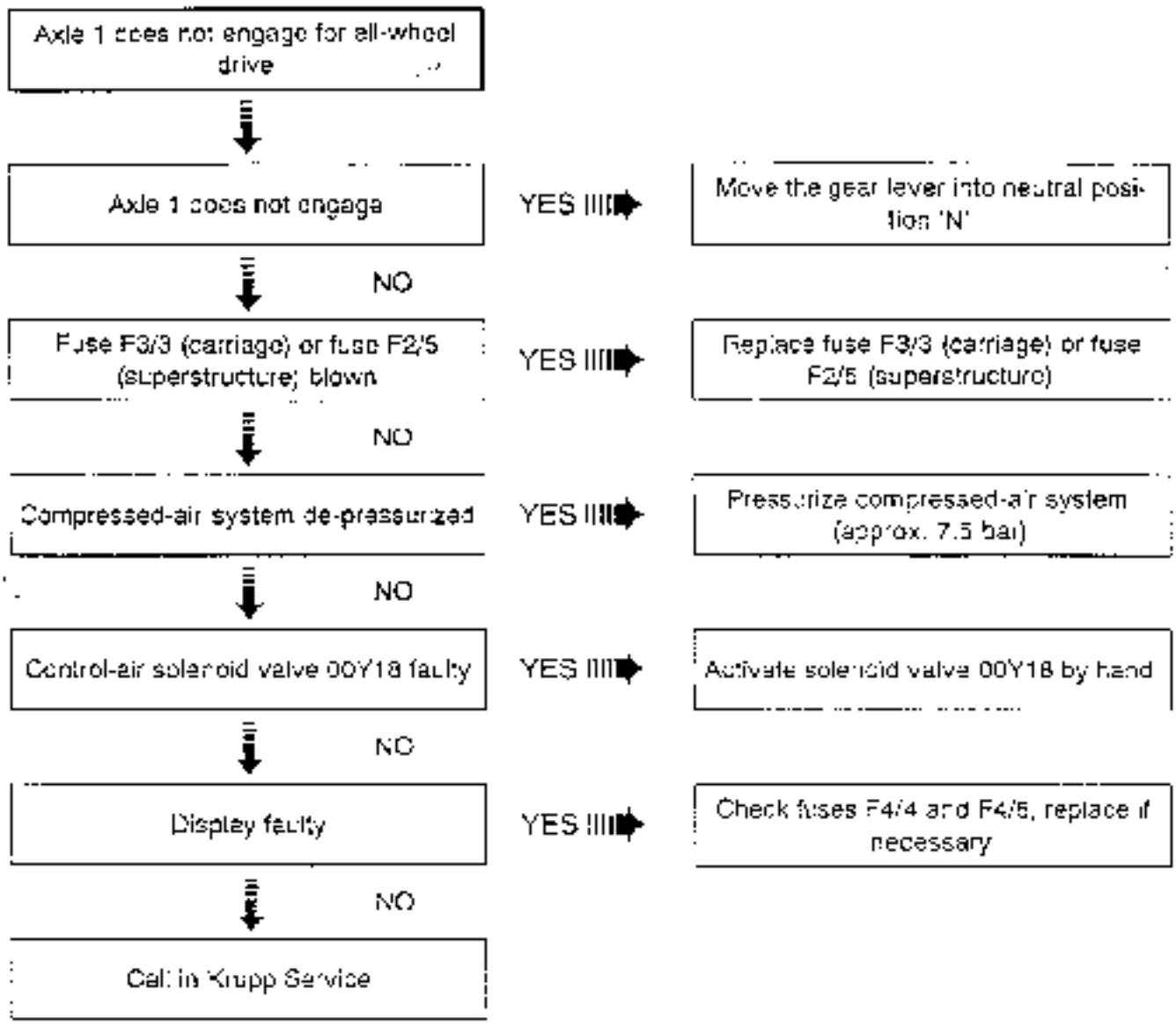
The wheel ends consist of the wheel bearing, a planet gear and the brake. The differential and planet gears are connected via twin cardan shafts

The wheel bearing is adjustable, see 'Adjusting procedures'.

The planet and differential gears contain oil, see Maintenance manual.

1.6.3 Malfunctions and corrections





Symptoms, reasons and action

Symptoms	Reasons	Action	Comments
Axle 1 does not engage	Fuse F3/3 blown	Replace fuse	
	Compressed-air system faulty	Check compressed-air system. Check compressed-air supply for circuit 3	see Section 'Compressed-air supply'
	Control-air solenoid valve 00Y18 faulty	Check current at solenoid head plug. If live, activate solenoid valve by hand. If valve functions, change solenoid head	see Section 'General repairs'
	Solenoid head functions, valve faulty	Check valve and replace if necessary	see Section 'General repairs'
	No current at magnetic head upon activation of push button S13	Check valve and replace if necessary	
		Measure the current at terminals X2/13 and X6/13. If dead, measure the current at switch S13 terminals 1 and 9. If live, replace switch S13	
Transverse differential locks do not engage	Same cause as above	Same correction procedure as above	
	Control-air solenoid valve 00Y3 does not function	Check solenoid valve 00Y3 and switch S14. Check current at terminal X5/6. If live, replace switch S14	
Oil loss in the axle drives	Shaft sealing rings leaking	Check shaft sealing rings, and replace if necessary	
	Oil drain plugs leaking	Replace oil drain plug sealing rings	see Maintenance manual
Oil loss in the wheel drives	Wheel drive sealing rings leaking	Check sealing rings, and replace if necessary	
	Oil drain and/or filler plug(s) leaking	Check and re-seal plug(s), top up oil	see Maintenance manual

Adjusting procedures

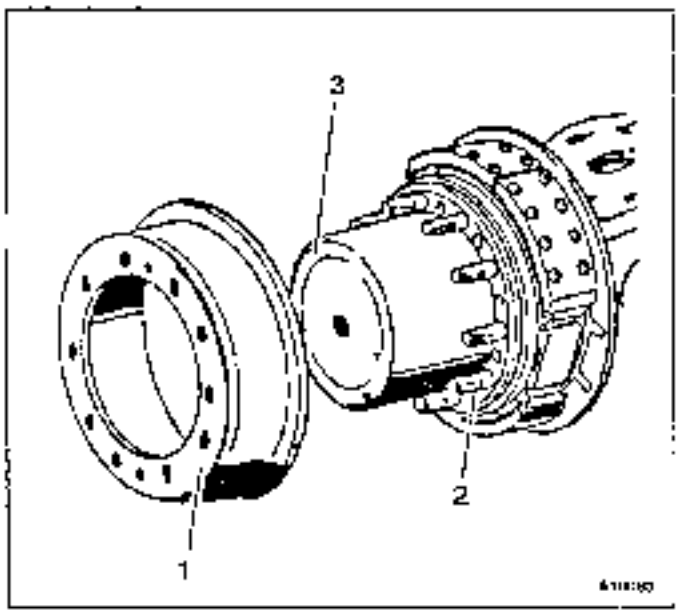
.... Adjusting the wheel-drive wheel bearings

Using the outriggers, jack the crane up until the wheels are off the ground.

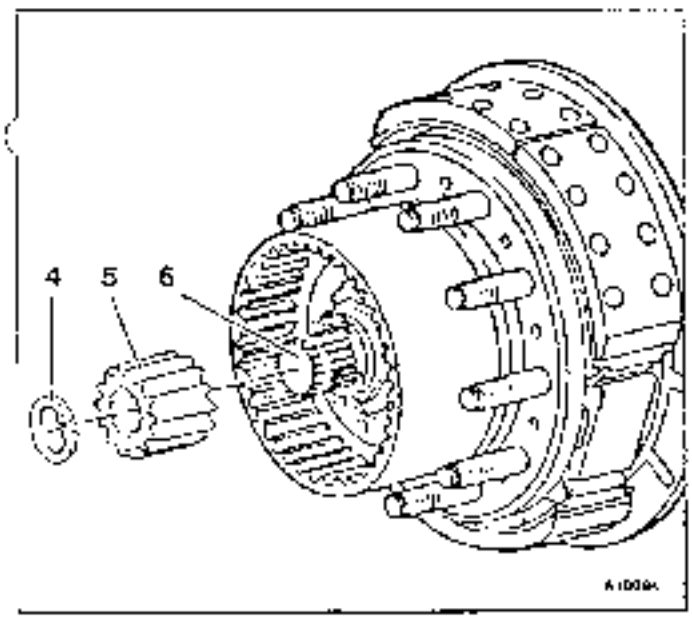
Unscrew the wheel nut from the relevant wheel and remove the wheel

Remove the oil drain plug and drain the oil into a suitable container.

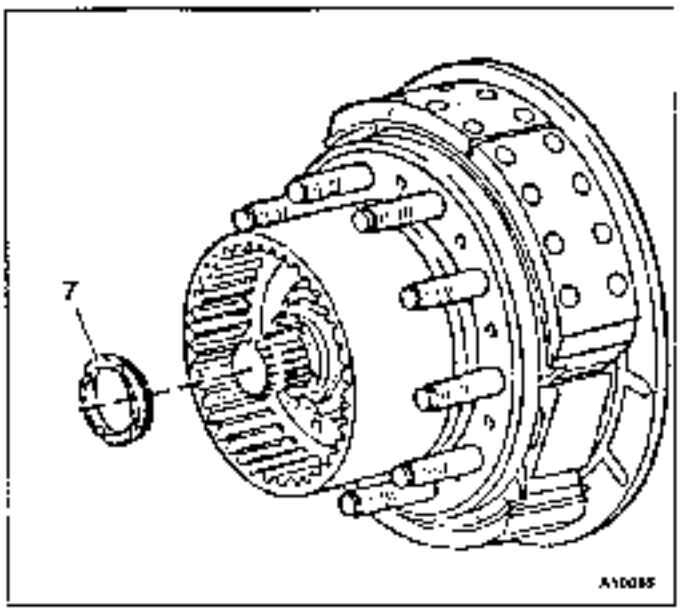
Note: For adjusting procedures on wheel drive 2, first remove the brake drum, for instructions, see 'Brakes'



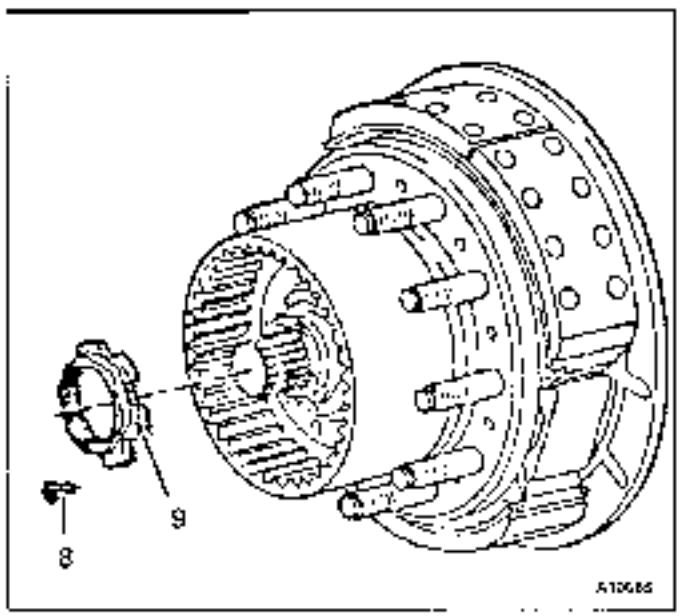
- For axle 2 only: remove brake drum (1).
- Unscrew the six planet gear housing (3) retaining bolts (2) and remove the planet gear housing



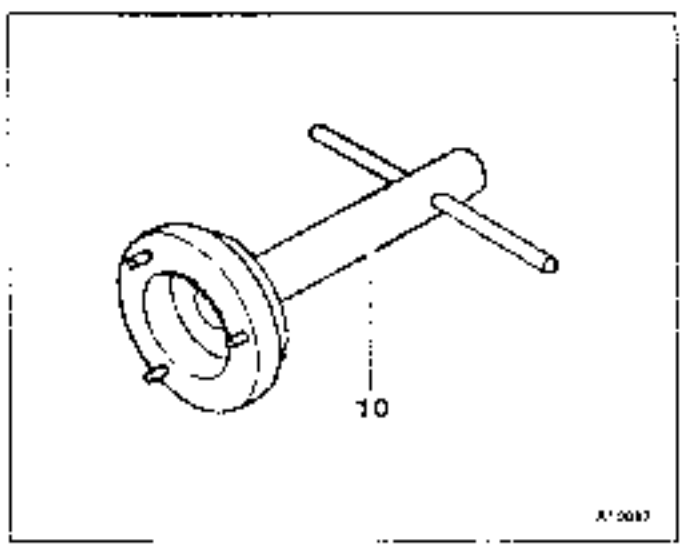
- Remove the retaining ring (4) from the twin cardan shaft (5) and remove the sun wheel (6).



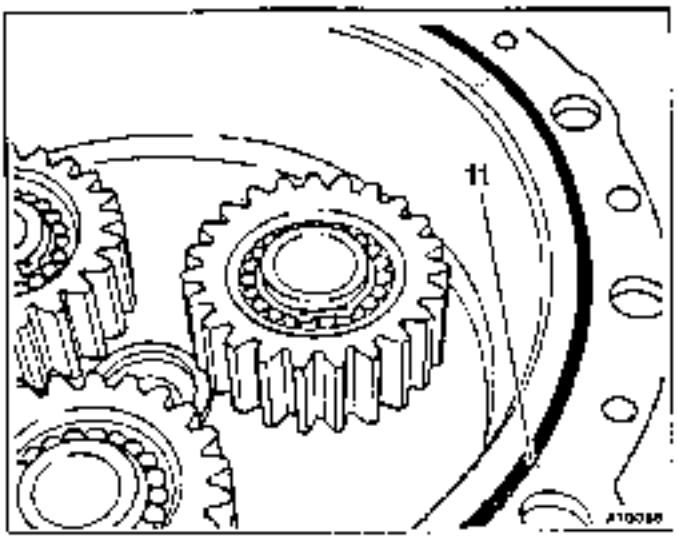
- Remove the thrust washer (7) from the twin cardan shaft.



- Remove the retaining screw (8) from the wheel (9) using a hexagon socket screw key.



- Tighten the wheel nut (9) using a special three-socket wrench (special tool) (10) until the wheel cannot be turned by hand.
- Mark the ring gear housing and the wheel nut.
- Twist the wheel nut back approx. 10° and screw the nut into one of the six retaining bores using Loctite 242. If necessary, tightening the wheel nut slightly so that one wheel nut is aligned with one ring bore.



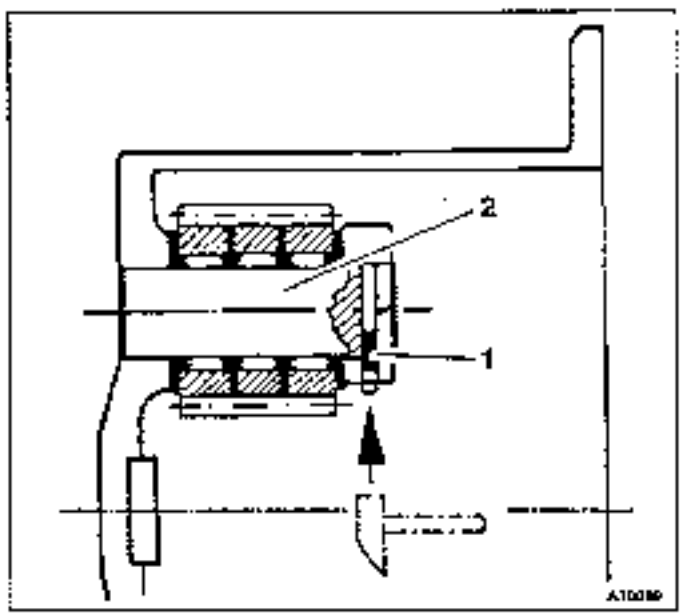
- Insert a new sealing ring (11) into the planet gear housing.
- Mount the sun wheel on the twin cardan shaft and secure with the retaining ring.
- Mount the planet gear housing.
- Re-fill with oil in accordance with the lubricants table contained in the Maintenance manual.

Repair procedures

... Replacing wheel-drive planet wheels

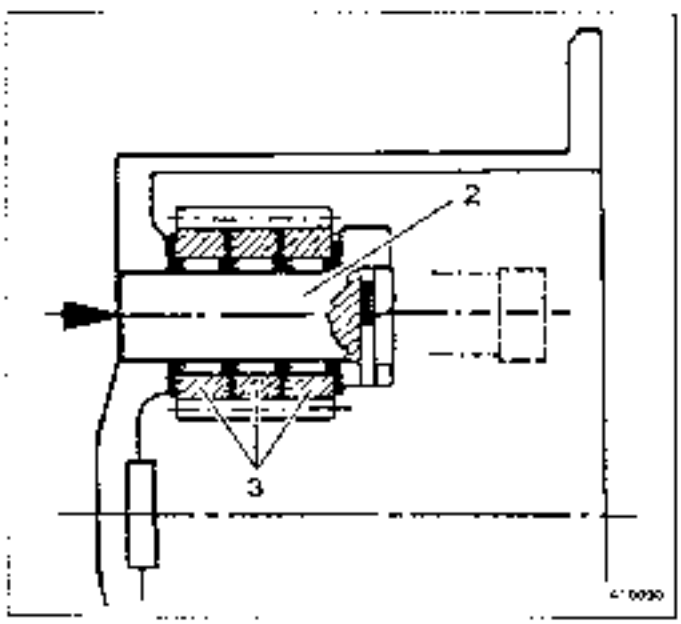
- Remove the planet gear housing as per the instructions contained in 'Adjusting procedures'

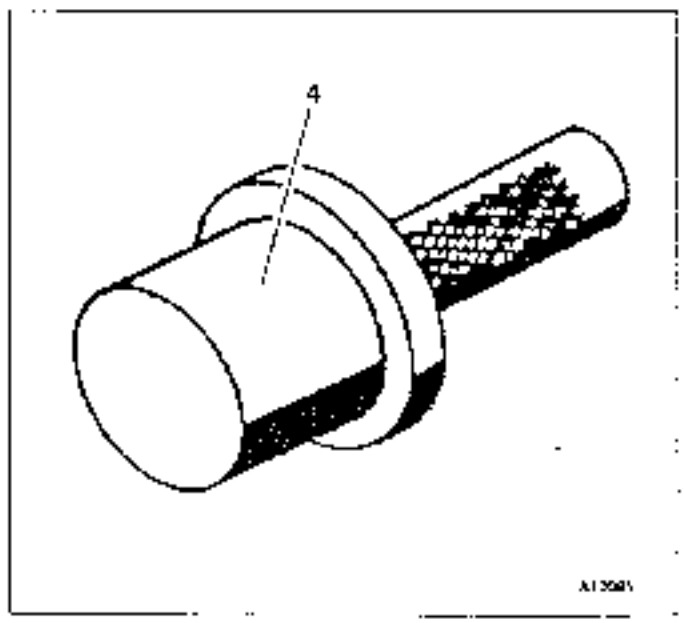
- Place the planet gear housing on a flat surface.



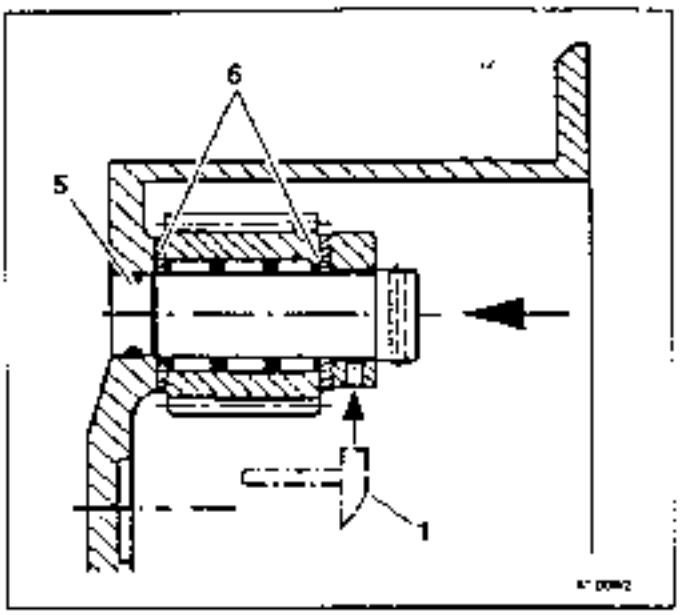
- Remove the retaining pin (1) from the bolt (2).
- Press the bolt (2) out towards the inside of the planet gear housing.

Caution: The diameters of the planet wheel bolts are graded. To avoid damage, only press the bolts out towards the inside of the planet gear housing





- Press the needle bearing (3) out of the planet wheel using the special tool (4). Press in the new bearing using the same special tool.

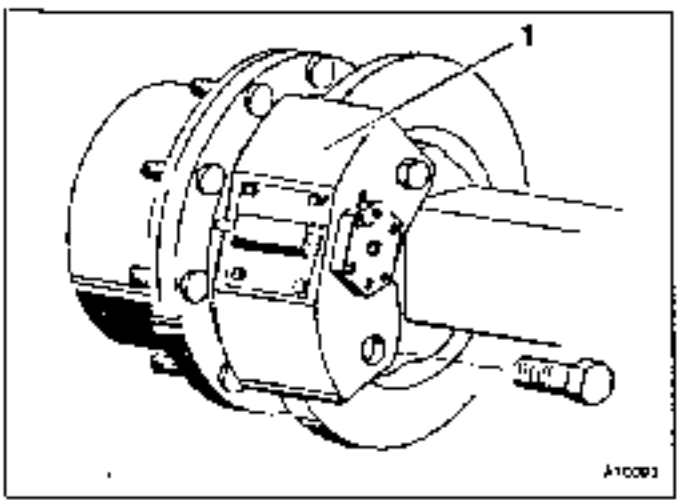


- Replace the O-ring (5) in the planet gear bore.
- Fit the planet wheel with thrust washers (6) in the planet gear housing.
- Press the bolt into the bore from the inside of the planet gear housing and secure with the retaining ptr. (1).
- Mount the planet gear housing and re-fill with oil

Replacing kingpins and/or the twin cardan shaft

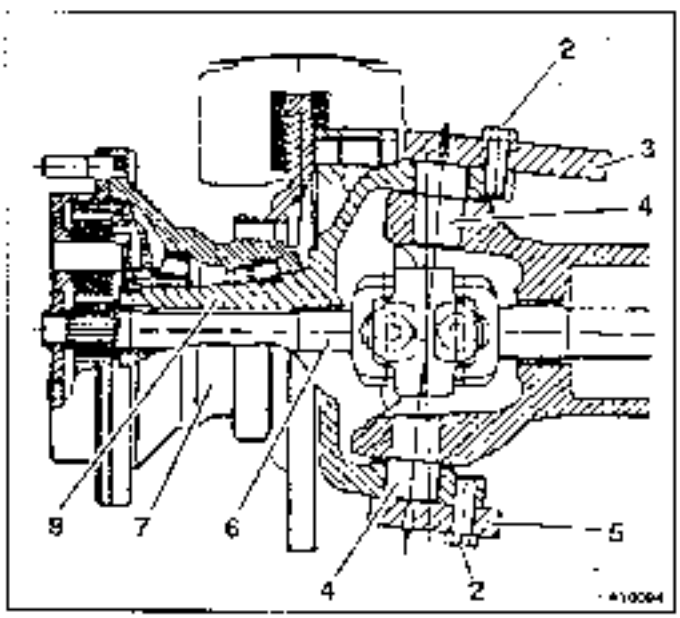
Caution: When replacing kingpins or the twin cardan shaft, always fit new kingpin and axle housing shaft sealing rings.
When carrying out repairs, always use the special tools mentioned below.

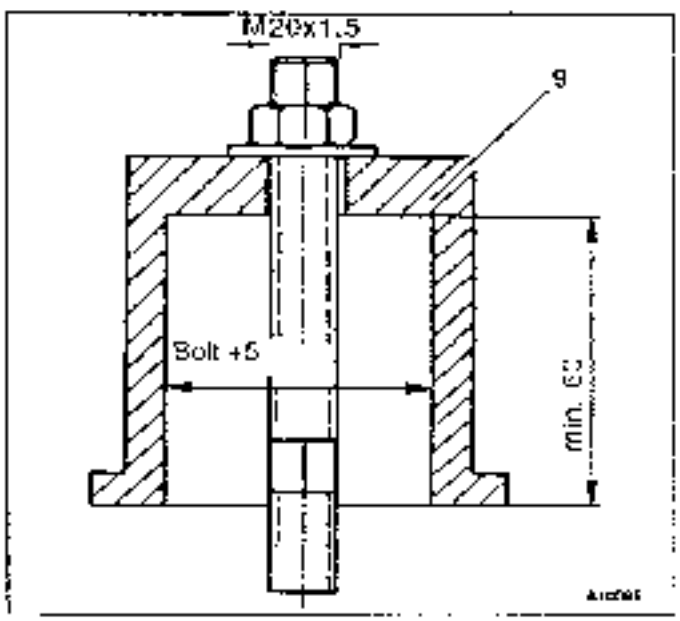
- Remove the planet gear as per 'Adjusting procedures' and remove the sun wheel as described.



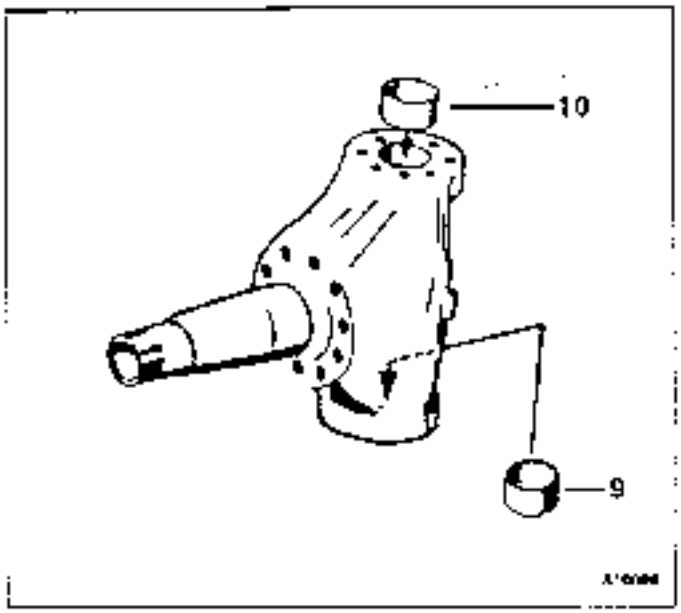
Note: In the case of axle 1, always remove all disc brake calipers (1). Secure the calipers and hoses against damage.
In the case of axle 2, always remove the diaphragm cylinder. For removal and installation, see 'Brakes'.

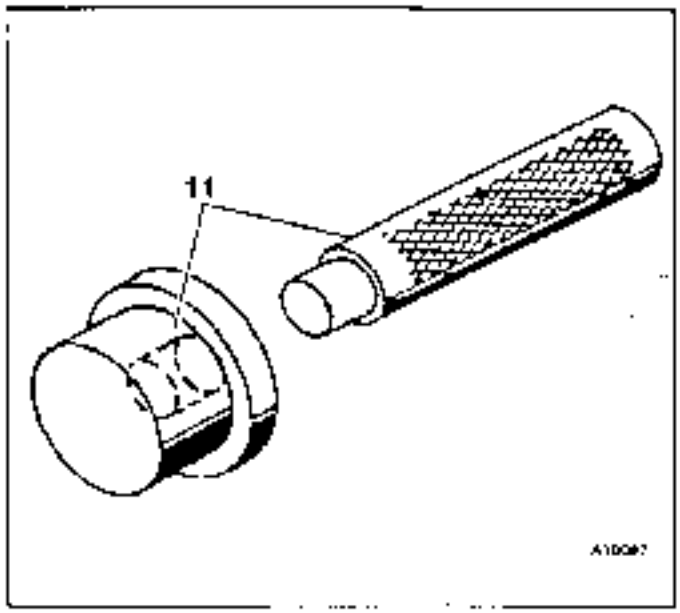
- For axle 1 only, remove the steering rod from the steering box and steering arm.
- Remove the tracking rod.



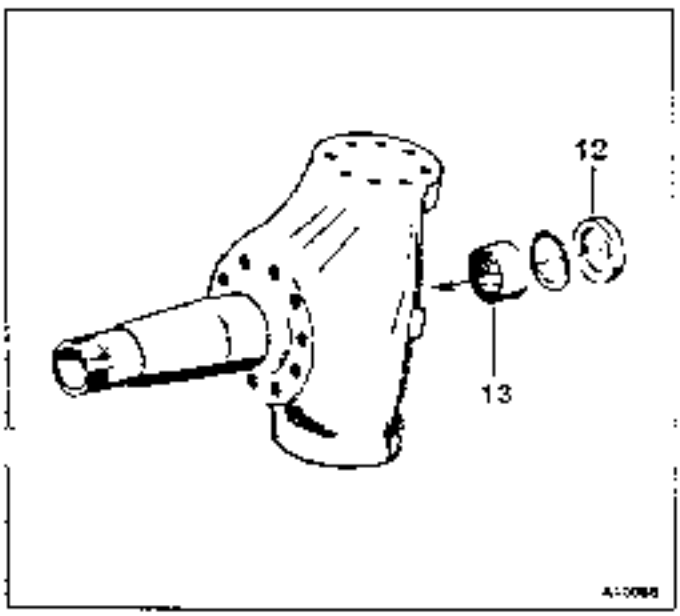


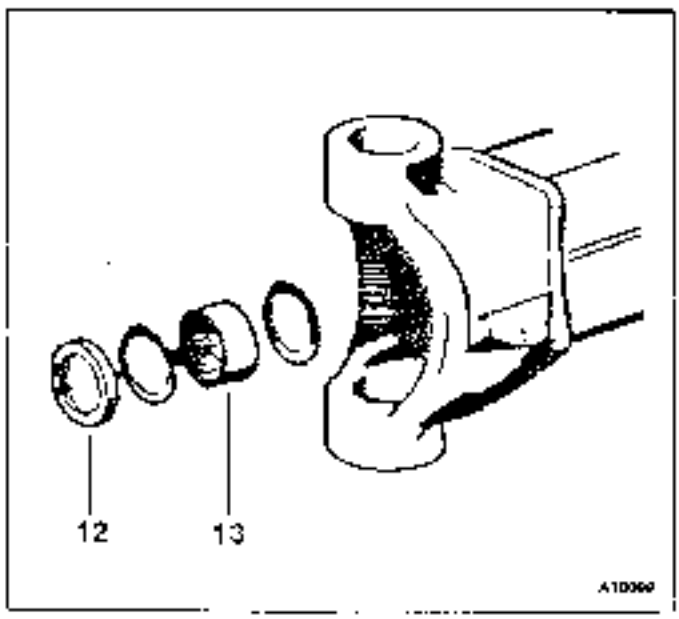
- Remove the steering (3) and tracking (5) arm retaining bolts (2).
- Remove both kingpins (4) using the extractor (9).
- Carefully remove the wheel hub (7) and kingpin (8) from the twin cardan shaft.





- Press the bearing bushings out of the kingpin bores. Clean the kingpins and press in the new bushings (10) using the special tool (11). Spray the outer surface of the bushings with the lubricant Volvo A.C. before inserting.
- Pull the twin cardan shaft (6) out of the differential gear.

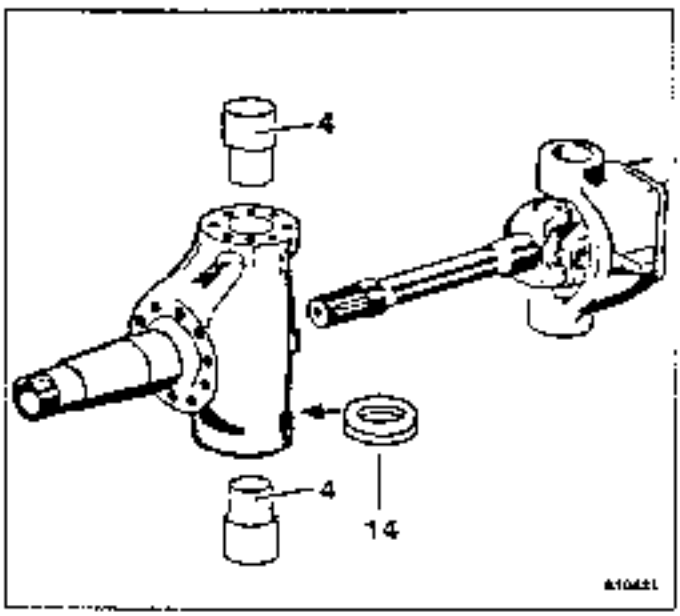




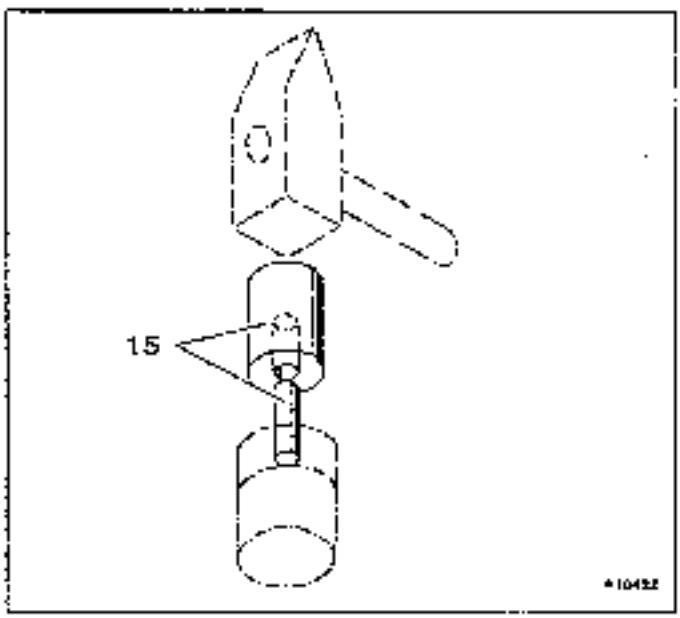
- Pull the shaft sealing rings (12) out of the axle housing and the kingpin.
- Check the needle bearings (13) in both components and replace if necessary
- Coat the outer surfaces of the new shaft sealing rings with KP-L2K roller bearing grease and press into the axle housing and kingpin

- Insert the twin cardan shaft into the differential gear, with a new shaft if necessary.

Caution: In order to avoid any damage to the shaft sealing rings, insert the twin cardan shaft into the axle housing with care.



- Carefully mount the kingpin on the twin cardan shaft and fit the thrust washers (14) between the kingpin and the axle housing on both ends.

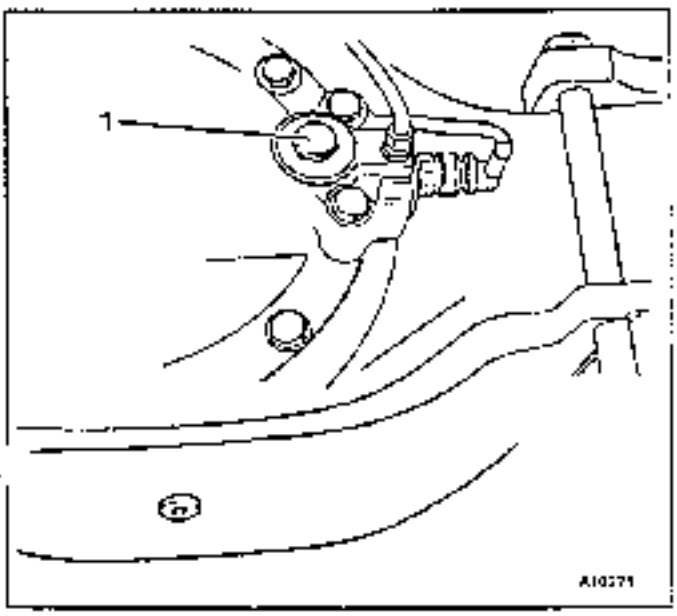


- Spray the new kingpin bolt (4) with Volert A.C. and insert using the special tool (15).

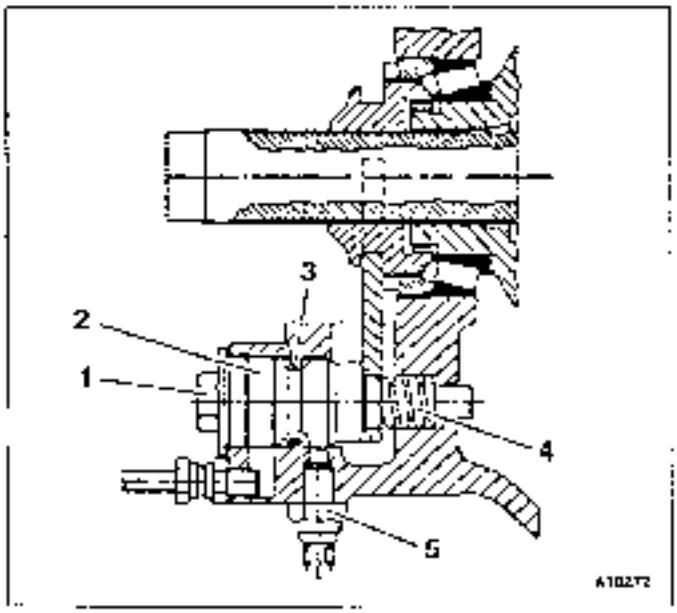
- Fit the steering and tracking arms and tighten to a torque of 46 Nm, coat the retaining bolt threads with Loctite 262.
- Fit the tracking rod.
- For axle 1 only: re-fit the steering rod to the steering box.
- Re-assemble the planet gear.
- Fit the calipers (axle 1) or the diaphragm cylinder (axle 2).

Replacing the differential lock piston and switch

- Jack up the crane using the outriggers.
- Switch off the engine and the ignition and secure against any unauthorized activation.



- Remove the locking screw (1) from the differential lock.
- Remove the piston (2).
- Remove the spring (4).
- Remove the switch (5).
- Inspect the piston and spring for signs of damage, fit a new O-ring (3) to the piston (2).
- Re-fit all parts in the reverse sequence of steps.
- Start the engine, pressurize the compressed-air system and conduct a functional test on the differential lock.



Suspension cylinders

Description of operation

The axles are affixed to the crane by means of parabolic springs. Suspension cylinders provide the suspension.

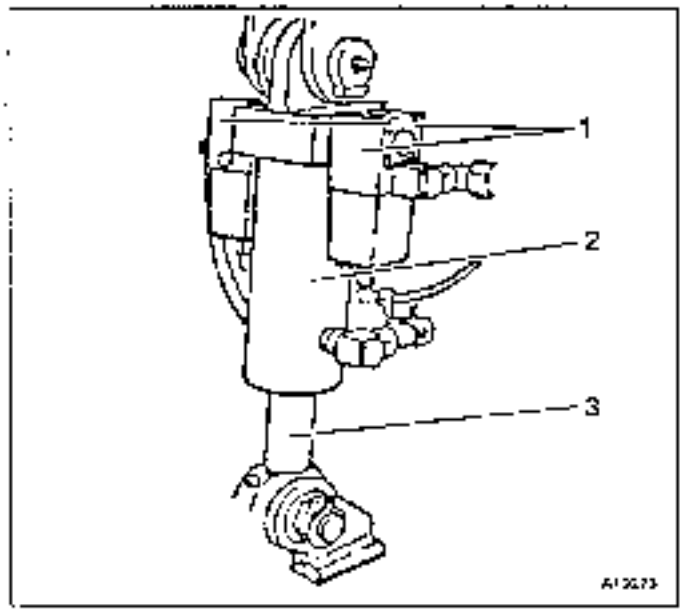
The suspension cylinders can be blocked for crane operation.

The right- and left-hand axle cylinders are each connected to a pressure accumulator pre-set to a pressure of 4 bar.

During compression travel, the oil flows out of the piston area of the right-hand cylinder into the piston ring area of the left-hand cylinder and into the pressure accumulator.

During rebound travel, the oil is forced into the pressure accumulator and, from the opposite piston ring end, into the piston area.

The suspension system is designed so that this rebound travel takes place so quickly that the wheels of the corresponding axles are always in contact with the ground.



1 Blocking valves

2 Cylinder barrel (affixed to the crane chassis)

3 Piston rod (affixed to the axle)

1.7.2 Technical data

Manufacturer:	Buchholz Hydraulik
Length:	510 mm
Piston diameter:	80 mm
Stroke:	150 mm
Operating pressure:	Piston surface: 350 bar Ring surface: 180 bar
Temperature range	–40 °C to 180 °C

Malfunctions

Suspension malfunctions are usually hydraulic faults or faults in the electrical control system.

Symptoms, reasons and action

Malfunction	Symptoms	Reasons	Action
The crane does not remain in the required position with regard to the suspension when the suspension is blocked. The crane lowers of its own accord.	Blocking valve faulty	Replace blocking valve	See Section 'Suspension locking system'.
	Piston seal in axle suspension cylinder leaking	Replace axle suspension cylinder	

Adjusting procedures

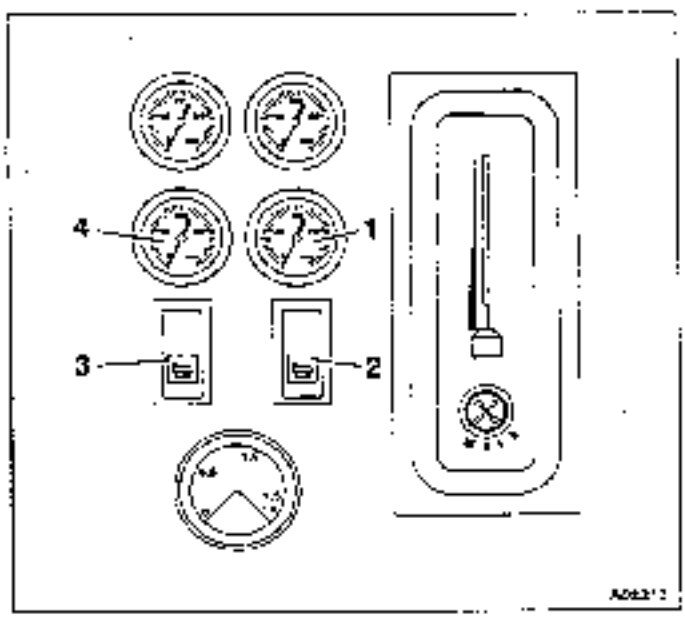
The suspension cylinders do not require adjusting

Repairs

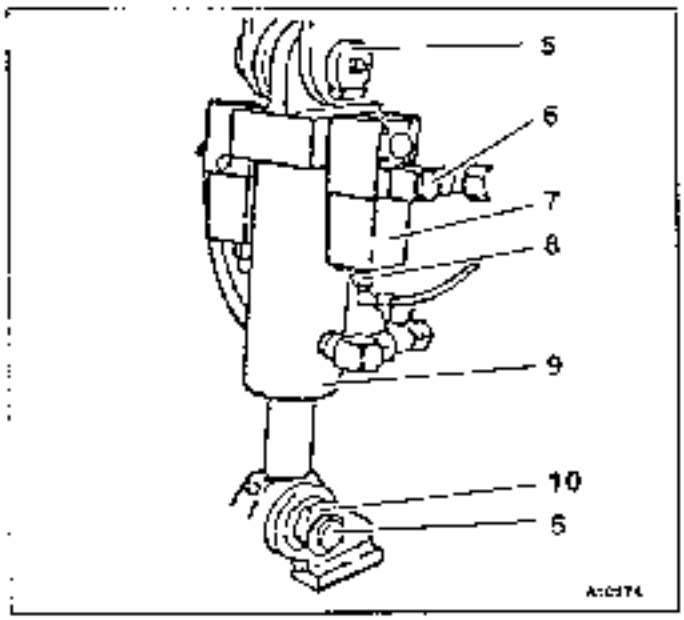
Replacing suspension cylinders

Any suspension cylinder leaking oil should be replaced.

- The suspension system must be unlocked and the control light on the front instrument panel must be extinguished.
- Extend the outriggers, the wheels remain in contact with the ground.



- Push the toggle switches (2) and (3) forwards until the pressure gauge (1) and (4) readings are zero.
- Switch off the engine and secure against any unauthorized activation.
- De-pressurize compressed-air circuit I, actuating the bleeder valve on the compressed-air reservoir until the reservoir is completely drained.



- Disconnect the hydraulic (6) and compressed-air (8) lines from the blocking valve (7).
- Remove the crown nuts (10) from the bolts and knock out the bolts (5).
- Fit the new suspension cylinder (9).
- Secure the crown nut (5) with new split pins.
- Restore the compressed air and hydraulic lines to the blocking valve, checking the O-rings in the screw fittings and replacing if necessary
- Pressurize compressed-air circuit I.
- Pressurize the suspension system, see 'Setting suspension system pressures'
- Carry out a functional test and a test drive.

Steering

1.8.1 Description of operation

The crane's steering system comprises a dual circuit ZF semi-integral power steering system connected mechanically to axle 1. Both axles are fitted with two hydraulic cylinders.

The steering can be switched to steering from the driver's cab or the crane operator's cab.

The steering is served by a flange mounted triple gear pump on the manual gearbox. Pump 2 serves steering circuit I, pump 3 steering circuit II.
Pump 1 drives the oil cooler fan motor.
A stand-by steering pump is driven directly by the integrated manual gearbox transfer case and is thus driven when the crane is moving.

The crane is steered with the steering wheel via an angle gear to the mechanical steering gear (hydro-mechanical) where the movement is transmitted to the steering nut and from there, to the sector shaft.

The steering gear is switched hydraulically with two hydraulic control valves in front of and behind the steering nut. These two steering control valves control the hydraulic oil in circuits II or I completely independently of each other.

The valve behind the steering nut controls steering circuit II, the valve in front of the nut, steering circuit I. Steering circuit I is served by the engine-driven pump, pump 2 or, should this pump fail, by the stand-by steering pump when the crane is moving.

The hydraulic force is transmitted to the steered axle by hydraulic cylinders which are connected to the steering arms on the kingpins by balljoints.

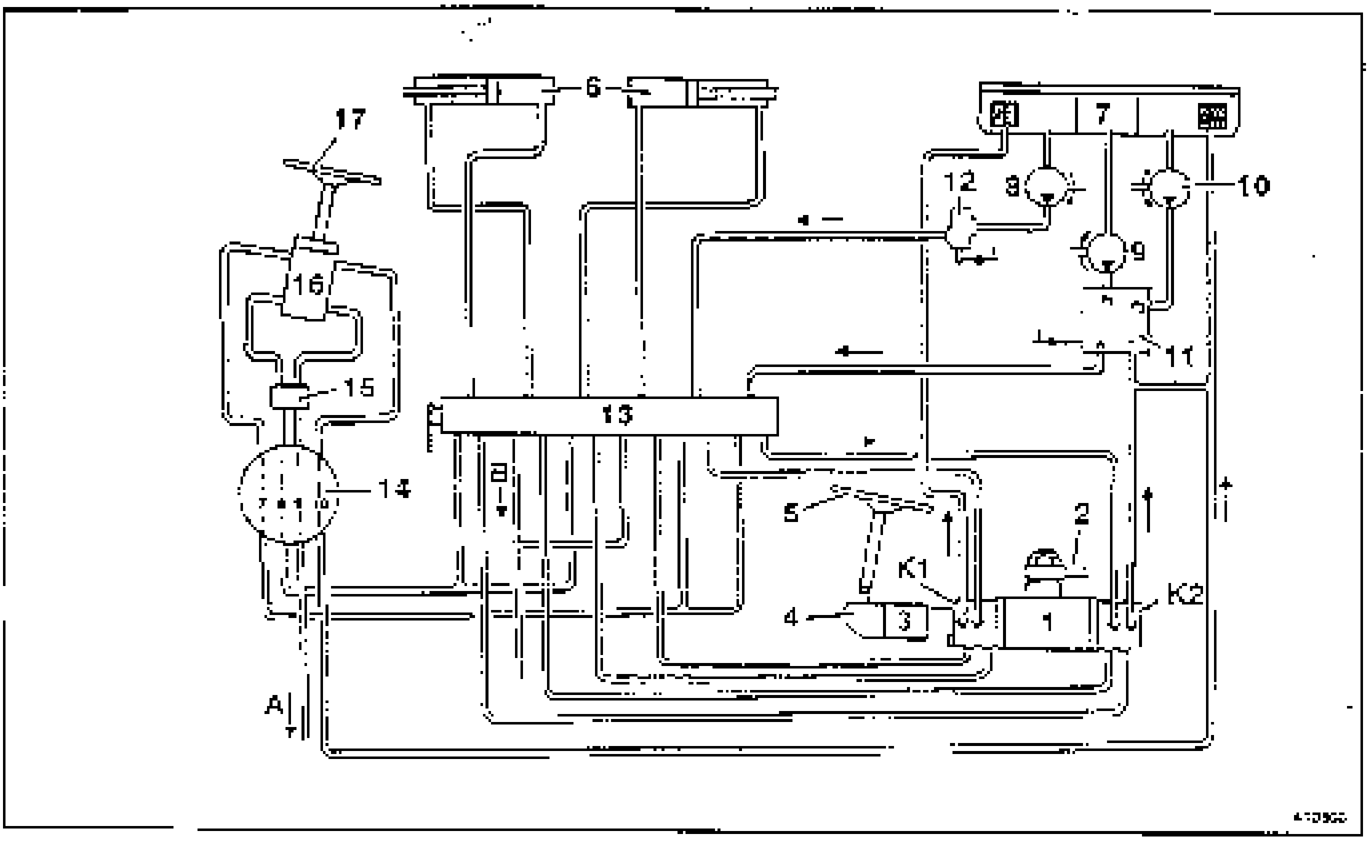
The steering and crane hydraulic systems share a common hydraulic tank fitted with a hydraulic oil filter. The tank is sub-divided into three chambers in order to facilitate the supply of each steering circuit and the stand-by steering pump from seperate chambers.

The hydraulic system can be monitored from the driver's cab. Steering circuit failures are indicated by warning lights on the instrument panel.

The steering hydraulic system consists of the following main components:

- pumps 2 and 3 of the triple gear pump
- stand by steering pump
- valve groups for steering circuits I and II
- steering gear (hydro-mechanical)
- steering wheel and steering transmission, driver's cab
- control switch for axle 2 steering in the driver's cab
- steering wheel and servomechanism, driver's cab
- control switch for axle 2 steering in the crane operator's cab
- steering valves for all-wheel drive
- tie-rods from the steering gear to axle 1
- steering cylinder on the steered axles
- steering circuit and hydraulic oil filter warning lights in the driver's cab

Circuit diagram of a two-circuit steering system



1	ZF semi integral power steering, two-circuit design	
K_1	Control valve for steering circuit I	
K_2	Control valve for steering circuit II	
2	Steering drop arm	
3	Mechanical steering limiter	
4	Angle gear	
5	Steering column with universal joint	
6	Hydraulic cylinders	
7	Hydraulic oil tank with overflow bulkheads	
8	Engine-driven pump 3 for steering circuit II	
9	Vehicle-driven stand by steering pump	
10	Engine-driven pump 2 for circuit I	
11	Valve block for engaging the stand by steering pump with flow meter	
12	Flow meter with indicator lamp	
13	6-fold three-way directional control valve	
14	Hydraulic rotary connection	
15	Valve for unidirectional steering (solenoid valve)	
16	Servostat	
17	Steering wheel of crane operator's cab	
A, B	to the rear axle steering (all-wheel steering)	

Technical data

Make:	ZF, Schwäbisch Gmünd
Model:	Semi-integral with ball nut
Ratio	1 – 25.8
Construction:	Dual-circuit, semi-integral hydraulic steering system connected mechanically to axle 1 and the hydraulic cylinders on both axles Can be switched to steering from the crane operator's cab Hydrostatic power-assisted steering system in the superstructure
Hydraulic cylinders:	2 per axle; 70/32 mm diameter, 200 mm stroke
Hydraulic oil supply:	Pumps 2 and 3 of the triple gear pump For technical data, see Section 1.15.2.1
Max. delivery pressure:	150 bar
Stand-by steering pump:	ZF radial piston pump, type 8605 955.115, flanged to the transfer case (Q = 12 l/min) Oil flow is switched to this pump automatically if the main pump fails as a result of the fact that the vehicle is moving
On-road travel:	Axle 1 is steered by the steering wheel
All-wheel drive:	Axle 1 is steered by the steering wheel Axle 2 is steered by a pressure switch The steering direction of axle 2 is contrary to that of axle 1
Crab movement:	Axle 1 is steered by the steering wheel Axle 2 is steered by a pressure switch The steering direction of axle 2 is the same as that of axle 1

Malfunctions and action (action to be taken by the crane driver)

Any symptoms indicating that the steering system is not functioning properly will generally be noticed by the crane driver during operation.

Malfunctions can be recognized by the following:

Steering is stiff in both directions	⇒	Check oil level
	⇒	Check the steering cylinders and tie-rods visually
Steering is stiff on one side	⇒	Call in Krupp Service
Steering is stiff during quick steering movements	⇒	Check oil level
	⇒	Check the steering cylinders visually
Wheels retard return to the straight-ahead position	⇒	Check tie-rods
The crane straight-ahead position is not exact	⇒	Check oil level
	⇒	Check tie-rods
Knocking/judder in the steering system when the crane is driven in the straight-ahead position and when the steering wheel is turned	⇒	Check oil level

The steering wheel has too much play	⇒	Call in Krupp Service
The steering wheel turns automatically to the right or to the left	⇒	Call in Krupp Service
Noises in the steering system when the vehicle is steered	⇒	Check oil level
The hydraulic system for the steering is losing oil	⇒	Check oil level

Symptom, reasons and action (action by service personnel)

Symptoms	Reasons	Action	Comments
Steering is stiff in both directions	Oil level in carrier tank too low	Top up oil Check steering system for leaks	
	Hydraulic system draws in	Check oil level, top up if necessary	
		Replace sealing rings in the steering system, bleed hydraulic system if necessary	
	Filters dirty	Replace filter elements	
	Oil flow rate too low, control valve faulty	Clean control valve in suction line, or replace if necessary	
	Tie-rods stiff	Check rods, and replace ball-joint if necessary	
	Separate valves stiff or cannot be switched properly	Suction valve, clean flow-control valve or replace if necessary	
	Steering cylinder on steered wheels leaking or bent	Replace steering cylinder	
	Steering pump faulty	Have pump checked and replaced if necessary,	Call in Krupp Service
Steering stiff in one direction	Steering limit set incorrectly mechanically	Reset steering limit mechanically	
	Fault in steering gear	Have steering gear checked and replaced if necessary	
			Call in Krupp Service
Steering stiff during quick steering movements	Hydraulic system draws in air	Check oil level and top up if necessary	see Maintenance manual
		Check sealing rings in the steering system and replace if necessary; if necessary bleed hydraulic system	
	Pump delivery too low	Clean flow-control valves or replace if necessary	
	Steering pump faulty	Have steering pump checked and replace if necessary	Call in Krupp Service
	Steering cylinder faulty	Check all steering cylinders and replace where necessary	

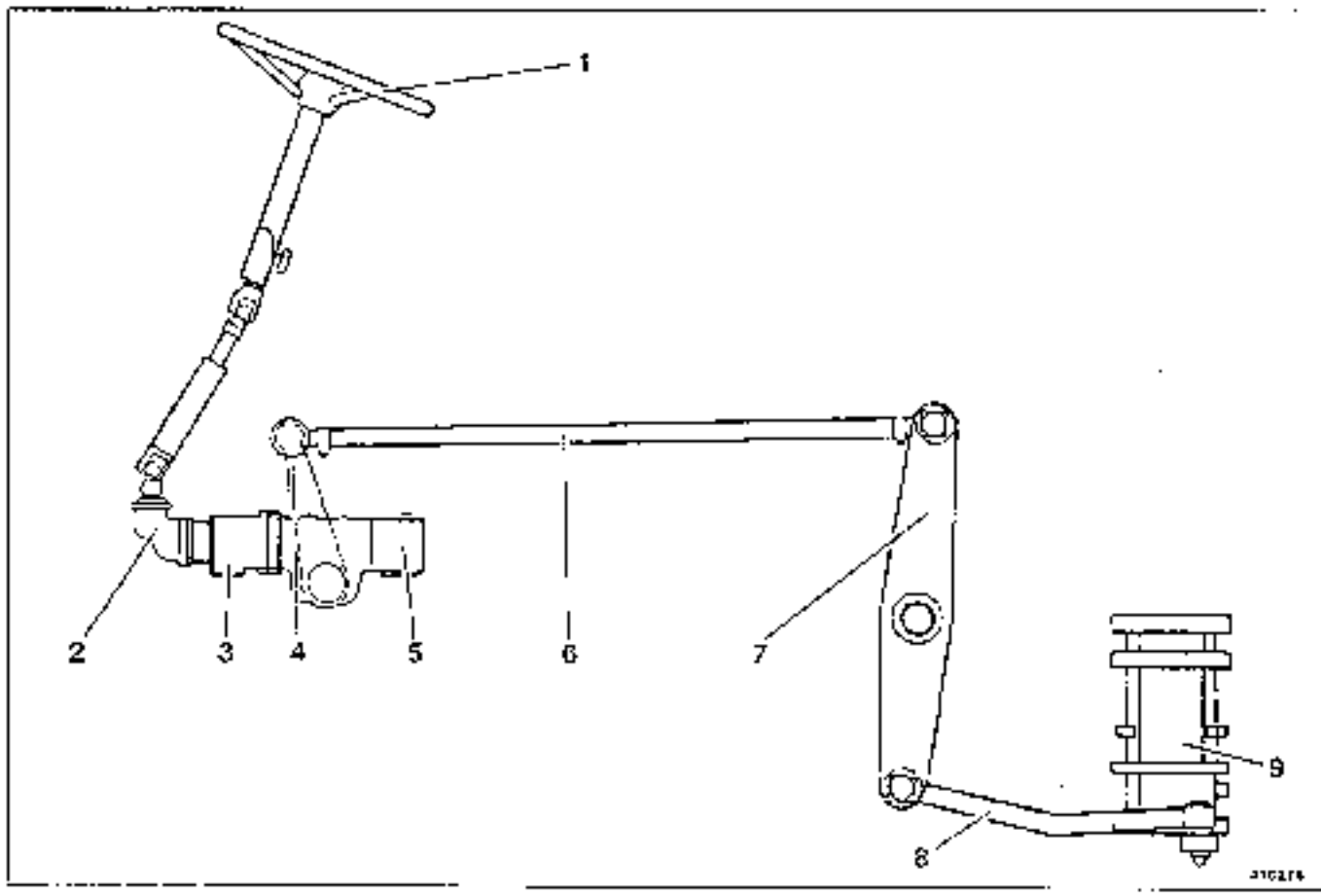
Symptoms	Reasons	Action	Comments
Wheels retard return to the straight-ahead position	Tie rods to the wheels stiff	Check rods and replace stiff ball joints if necessary	
	Tie-rod from steering wheel to steering gear stiff	Check steering rod and replace any faulty components	
	Angle gear faulty	Check oil fill in angle gear and top up oil or replace angle gear if necessary	
	Too much steering in straight-ahead position	Check steering play (setting for centre of pressure) and adjust play	
	Steering cylinder faulty	Replace steering cylinder	
	Steering gear faulty	Have steering gear checked	Call in ZF Service
The crane straight-ahead position is not exact	Oil level in hydraulic tank too low	Check oil level and top up if necessary Check sealing rings in the steering system and replace if necessary. Bleed hydraulic system	
	Play of ball joints in steering rods too large	Replace balljoints	
	Universal joint between steering wheel tie-rod and steering gear worn	Replace universal joint	
	Steering rods to the wheels are stiff	Grease steering	
	Hydraulic system draws in air	Check oil level and top up if necessary Check sealing rings in the steering system and replace if necessary, Bleed hydraulic system	
	Too much steering play	Check steering play (centre of pressure setting) and adjust	

Symptoms	Reasons	Action	Comments
Knocking/judder in the steering system when the vehicle is driven in the straight-ahead position or is steered	Oil level in hydraulic oil tank too low	Check oil level and top up if necessary	
	Hydraulic system draws in air	Check sealing rings in the steering system and replace if necessary; if necessary bleed hydraulic system	
	Play in the steering wheel to rod to the steering gear	Check the universal joint and angle gear and replace if necessary	
	Too much steering play	Check steering play (centre of pressure setting) and adjust	
	Steering gear faulty	Have steering gear checked and replace if necessary	Call in ZF Service
Steering wheel has too much play	Fixing bolts for steering not tight enough	Tighten fixing bolts for steering and steering column observing correct tightening torques	
	Too much steering play	Check steering play (centre of pressure point) and adjust	
	Steering gear faulty	Check steering gear and replace if necessary	Call in ZF Service
Steering wheel turns automatically to the right or left	Hydraulic centre not adjusted	Set hydraulic centre	
Noises from the steering system when the crane is steered	Oil level in hydraulic oil tank too low	Top up oil. Repair any leaks	
	Pipe/hose system leaking	Check pipe/hose system. Repair any leaks	
	Hydraulic pressure too low	Check flow control valve and replace if necessary. Check the system	
The hydraulic system for the steering is losing oil	Sealing rings in steering gear faulty	Check shaft sealing rings and O-rings in the steering gear and replace if necessary	Call in ZF Service
	Steering cylinder leaking	Check steering cylinders and replace if necessary	
	Hydraulic system leaking	Check oil level and top up if necessary	
	Further leaks in the system	Check the sealing rings in the steering system and replace if necessary; if necessary bleed hydraulic system.	

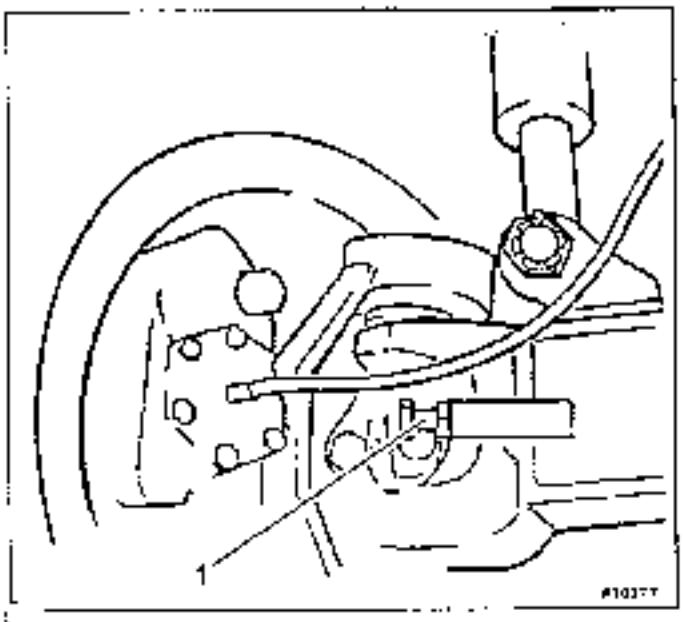
Instructions for setting and adjusting the steering

Raise the crane with the outriggers so that the wheels are off the ground. Let the engine run in neutral.

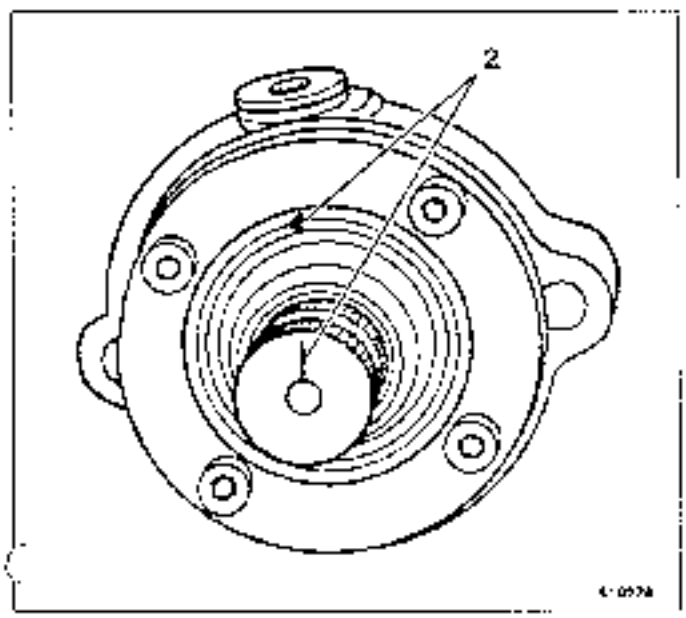
1 Steering wheel
2 Angle gear
3 Mechanical steering limits
4 Drop arm
5 Hydro-mechanical
6 Steering rod
7 Reversing lever
8 Steering rod
9 Axle



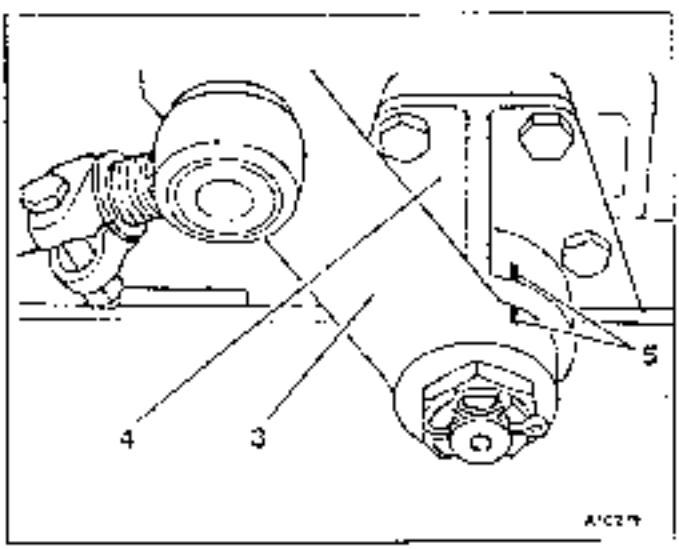
Setting the steering limits



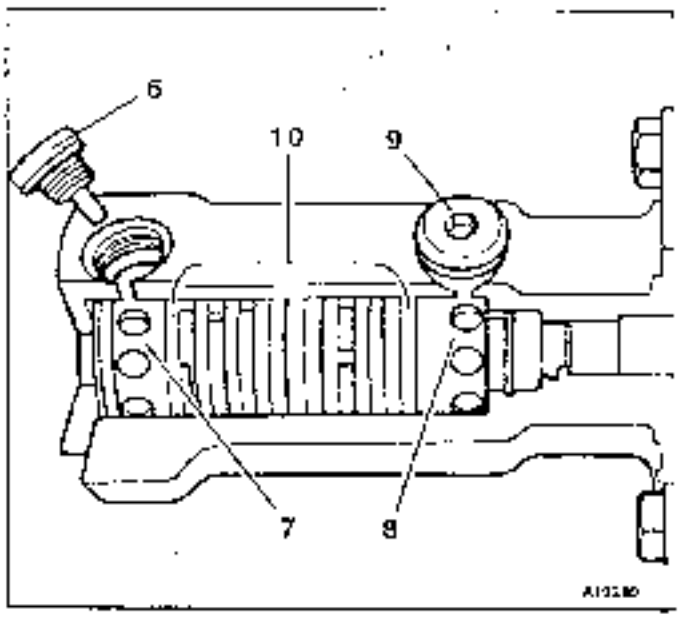
- Screw the axle steering limits (1) right in.
- Set the wheels to the straight-ahead position.
- The steering wheel must be in the straight-ahead position.



- The markings (2) on the shaft and on the housing must be in alignment.



- Mark the drop arm (3) and the steering gear housing (4) with paint (5).
- Using the steering wheel turn the wheels to the right or left almost as far as the wheel stop (insert 2-3 mm thick spacing plate).
- Release the steering wheel (steering retracts approx. 1/4 of a steering wheel turn).
- Switch off engine.



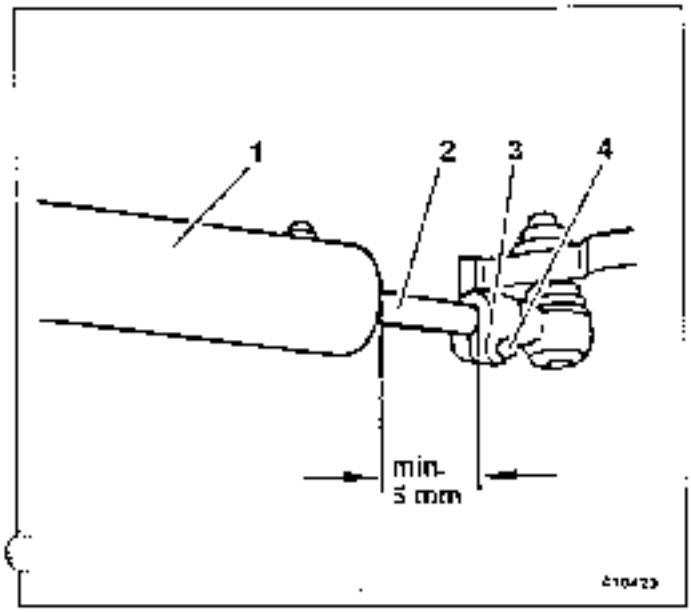
- Remove the shank screw (6) and (9).

Note: Removing the shank screws allows access to the setting rings for the left (7) and right (8) steering limits

- The setting rings have holed rings and can be turned using a screwdriver or suitable mandrel.
- Turning the setting ring (7) for left-hand turns in a clockwise direction reduces the drop arm angle; turning the ring in an anti-clockwise direction increases the drop arm angle.
- Turn the setting rings until you feel considerable resistance, indicating that the dogs on all of the rings (10) are touching each other.
- In this position, turn the steering back until the shank screw can be inserted into the next bore.
- Insert the shank screw with a new sealing ring and tighten.
- Start the engine, turn the steering almost as far as the left-hand stop and switch off the engine.
- The right-hand turn is set at setting ring (8). Turning the setting ring in an anti-clockwise direction reduces the drop arm angle; turning the ring in a clockwise direction increases the angle.
- When the right-hand turn has been set, insert the shank screw, if necessary, turning the steering wheel back until the screw fits into a bore and can be tightened.
- Start the engine. Lower the crane onto the wheels using the outriggers.
- Engage the steering on both sides as far as the stop. Set the wheel stops (1) to a clearance of 2 mm.

Setting the steering cylinders

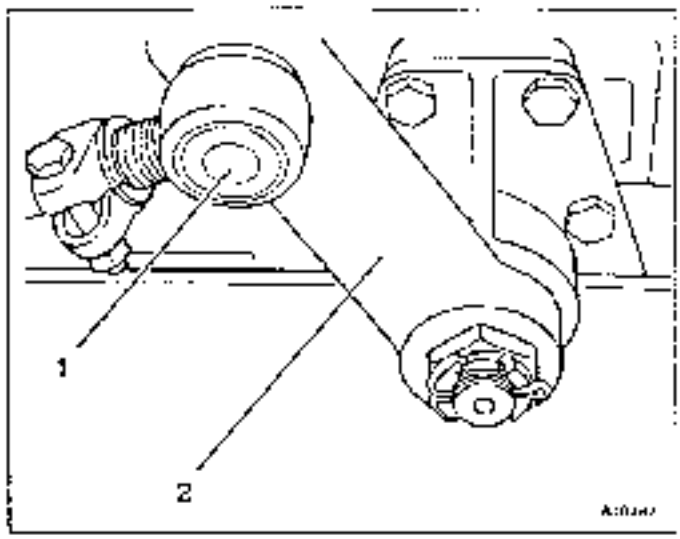
When the steering limits have been set, the stroke of the steering cylinders has to be checked.



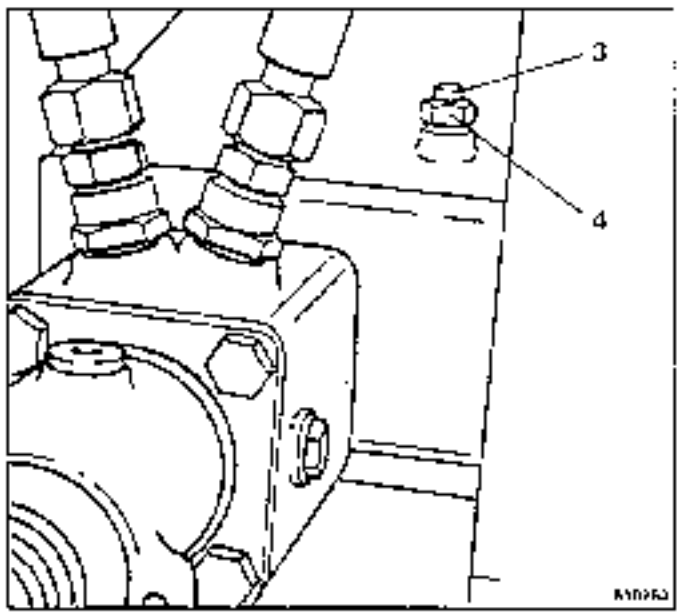
- When the piston rod (1) is fully retracted, there must be a remaining stroke (distance) of 5 mm between the cylinder (2) and the thread on the piston rod (3).
- When the piston rod is fully extended, this distance must be (constructive value):
  245 mm for piston rods 250 mm long
  295 mm for piston rods 300 mm long
- Axle 1 stroke length 200 mm
  Axle 2 stroke length 200 mm
- If the steering cylinders on the crane do not meet these stipulations, they must be reset.
- Remove the clamping screws (4) on the ball heads and alter the length of the piston rod as required by turning it.
- Tighten the clamping screws again and resecure them.

Setting the steering play for the straight-ahead position

Note: The steering system may only be adjusted by qualified personnel who have received special training for the steering system. Special tools are required.



- Raise the crane using the outriggers.
- Unscrew the steering rod (1) from the drop arm (2).
- Start the engine and set it to run in neutral.
- Set the steering in the straight-ahead position by halving the total number of turns of the steering wheel, and if necessary, check this on the mechanical steering limits.



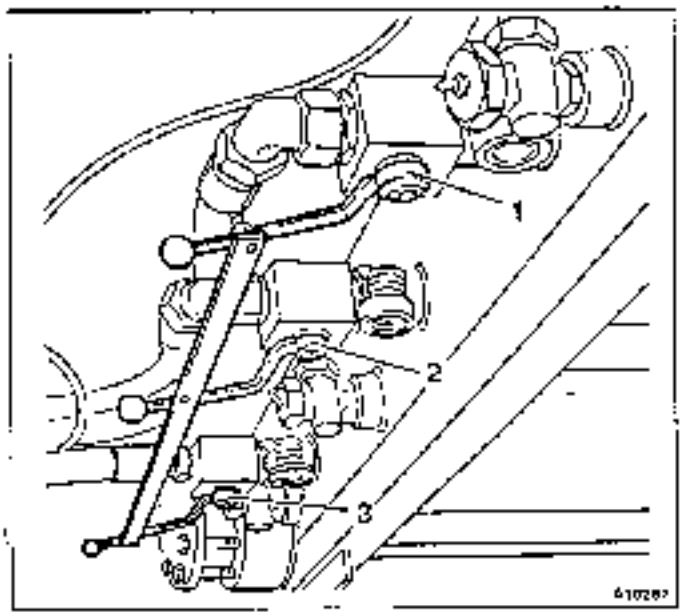
- Unscrew the sealing screw (lock nut) (4) on the upper steering gear housing.
- Measure the friction torque required to turn the steering out of the straight-ahead range into one of the end positions (approx. half a turn before the end stop), turning the steering with a torque wrench applied to the steering wheel nut.
- Then measure the friction torque at the centre of pressure (centre position) by turning the steering half a turn to the left and right from the straight-ahead position, applying the torque wrench to the steering wheel nut.

- Tighten the setting screw (3) on the steering gear until the friction torque on the torque wrench is 30-60 Ncm higher than the previous measured value (turn the steering out of the straight-ahead range).
- Tighten the sealing screw (4) without disturbing the setting of the setting screw (3).
- Check the set friction torque again with the torque wrench and re-fit the steering rods or to the drop arm.

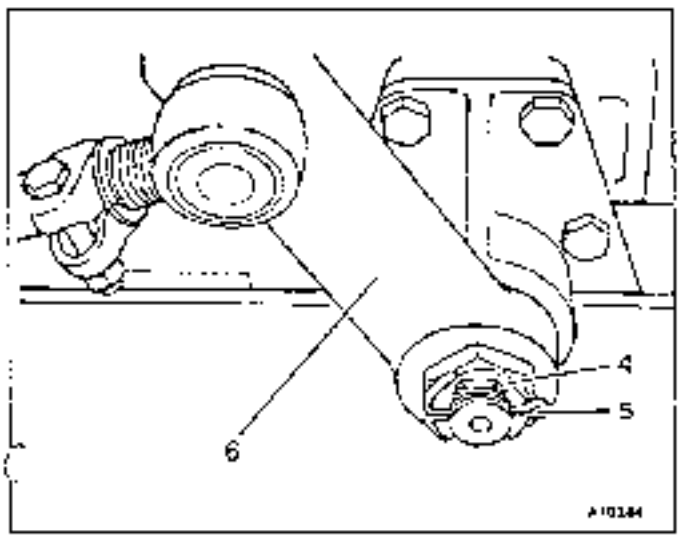
Note: A higher friction torque setting than 30-60 Ncm in the straight-ahead position will not improve the steering or meshing in the steering gear in any way. It would furthermore result in higher pressure on the teeth, increasing wear.

1.8.6 Repairs

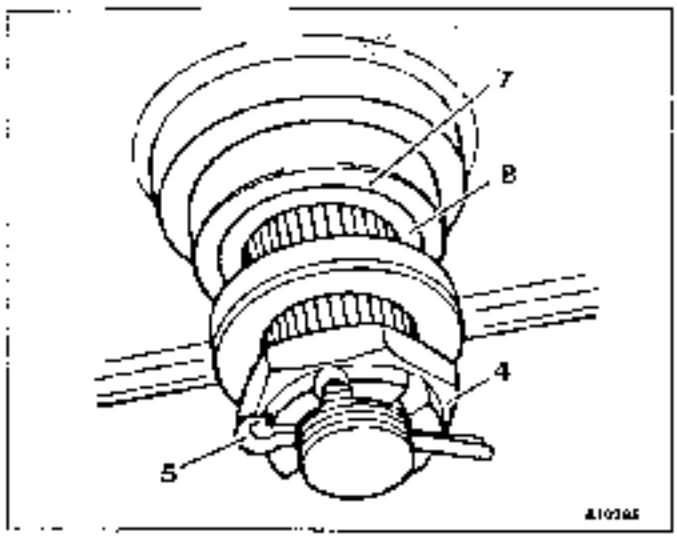
1.8.6.1 Replacing the sealing rings on the (hydro-mechanical) steering gear

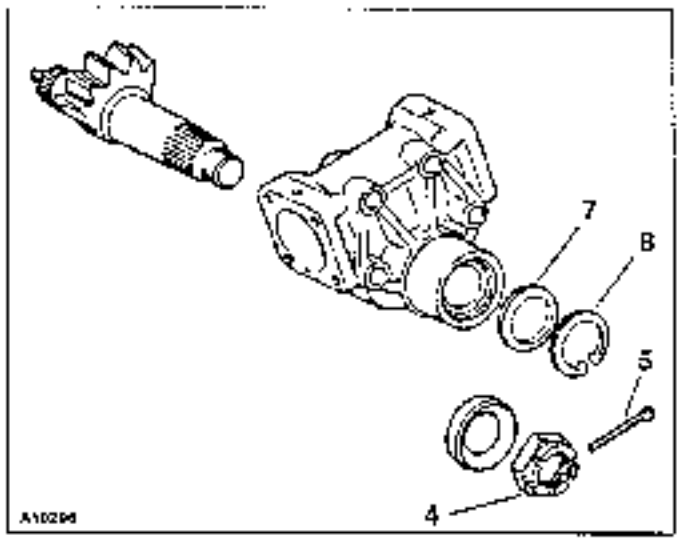


- Close the stop-cocks (1), (2) and (3) on the hydraulic oil tank



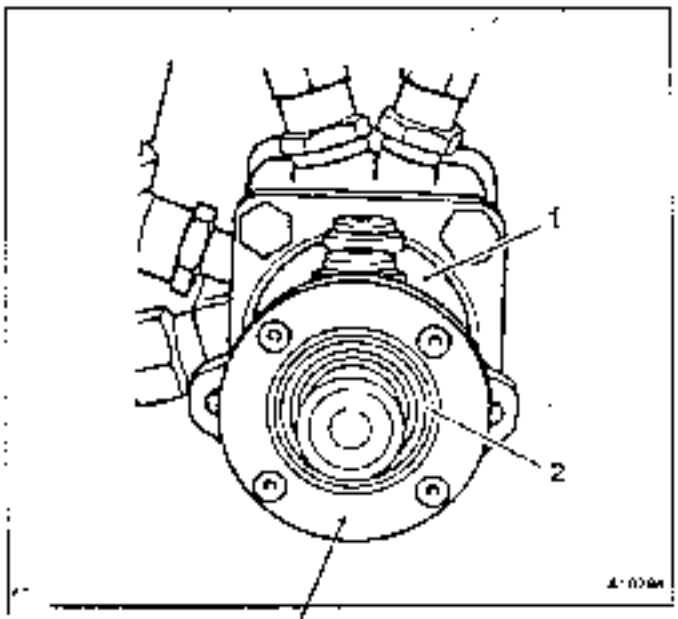
- Remove the split pin (5) from the castellated nut (4).
- Unscrew the nut and remove the drop arm (6) using a suitable extractor.
- Remove the retaining ring (8) from the neck of the housing.
- Press the shaft sealing ring (7) out of the neck of the housing using a suitable screw driver. Remove any rubber particles from the outer seat for the shaft seal.

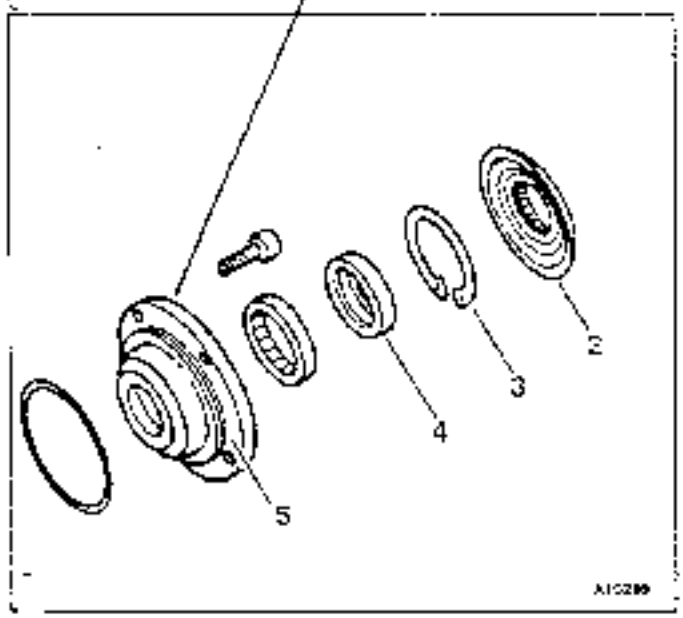




- Fit the fitting sleeve (special tool) for the new shaft seal onto the steering shaft.
- Fit the new shaft seal with the seal lip over the bush and press it into the neck of the housing using the special tube (special tool).
- Replace the retaining ring (8).
- Push the drop arm onto the shaft, ensuring that the marks on the drop arm and steering shaft match up.
- Tighten the hex nut (4) to a torque of 400 Nm and secure it with a new split pin (5).

Replacing the steering rings on the mechanical steering limits

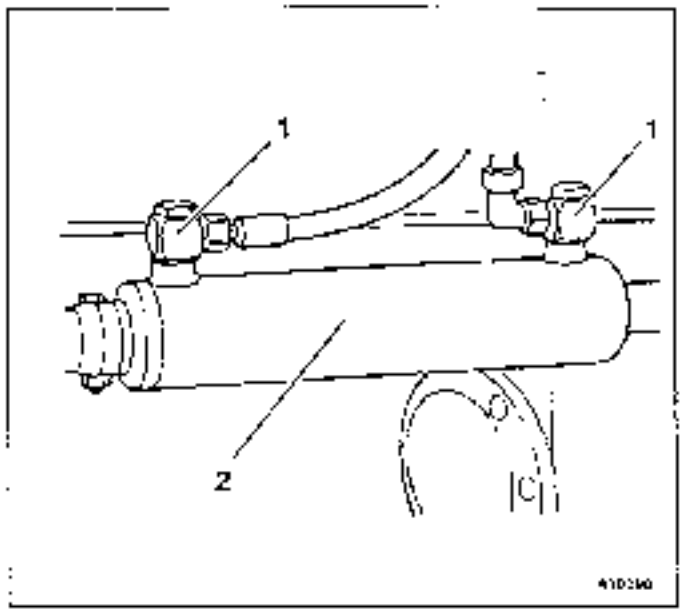


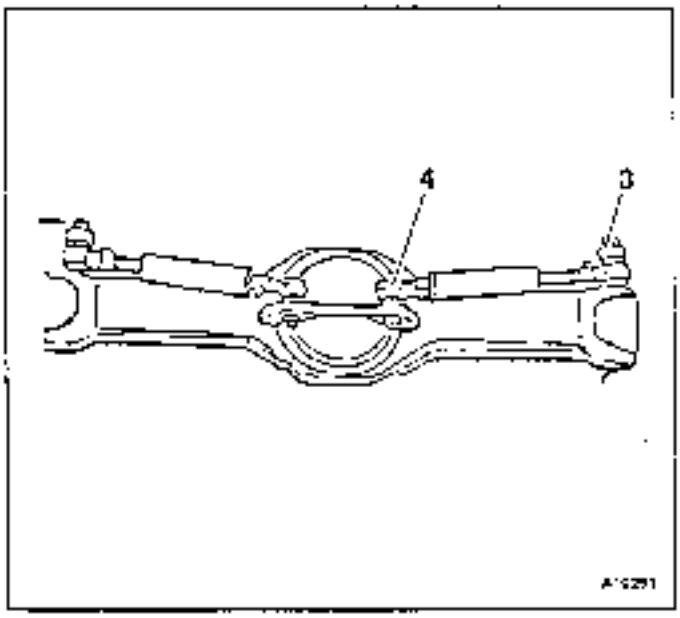


- Turn off the driving engine and ensure that it cannot be turned on accidentally.
- Remove the tie-rod on the steering gear (1).
- Clean the affected area.
- Remove the cap (2) from the mechanical steering limits. Remove the retaining ring (3) and take the shaft seal (4) out of the end flange (5).
- Insert a new sealing ring, fit the retaining ring and replace the cap.
- Re-fit the tie-rod and carry out an operating test.

Replacing steering cylinders

Caution: Before a steering cylinder is replaced, the steering system has to be de-pressurized. Turn off the engine and ensure that it cannot be switched on again accidentally. Close the stop cocks in the suction line on the hydraulic oil tank. Clean the affected area thoroughly before commencing repairs.





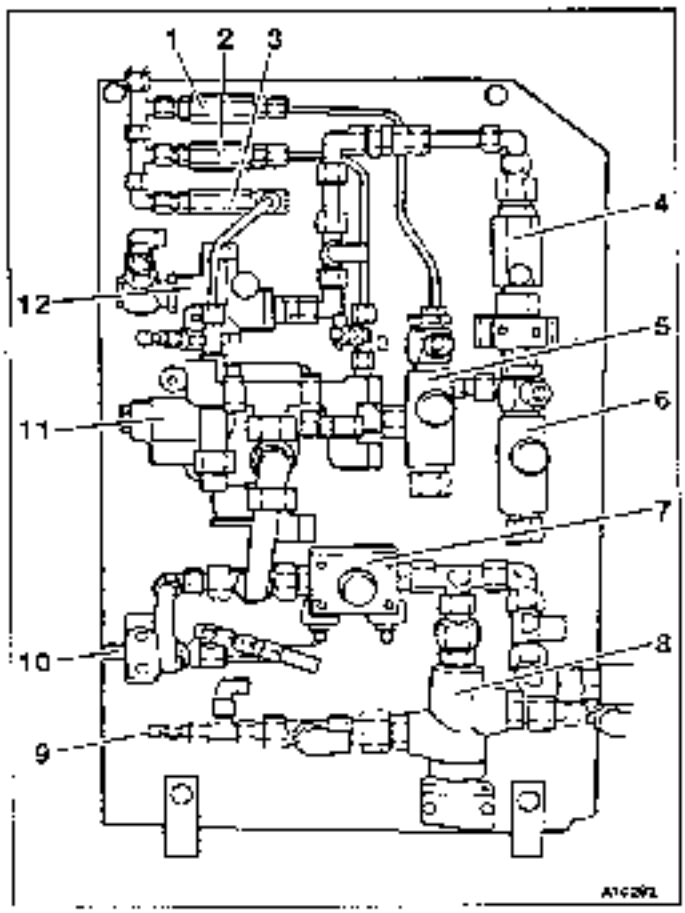
- Disconnect the hydraulic hoses (1) from the steering cylinder (2) and allow the hydraulic oil to drain into suitable containers.
- Remove the split pins from the ball heads (3 and 4) and unscrew the castellated nuts.
- Withdraw both ball heads and remove the steering cylinder.
- Fit the new steering cylinder (fitting is a reversal of removal).
- Restore the hydraulic connections, checking the O-rings in the screw connections and replacing if necessary.
- Activate the hydraulic system. Remove one hose connection and turn the steering wheel until the oil flowing out of the connection is free of bubbles.
- Repeat the bleeding procedure on the opposite side of the cylinder.

Caution: Always drain oil into a suitable container.

Replacing the steering valves

Note: The steering valves are located on a base plate attached to the side of the hydraulic oil tank in front of axle 2 on the left-hand side of the crane.
In order to access the valves, remove the corner cover and the dashboard located in front of the left-hand rear wheel.

Base plate arrangement:



1 Bleeder valve steering circuit II

2 Bleeder valve steering circuit I

3 Bleeder valve stand-by steering pump

4 Flow meter steering circuit II

5 Flow-control valve steering circuit I

6 Flow-control valve steering circuit II

7 Pressure-relief valve 180 bar
Pump circuit 3 of the quadruple gear pump

8 Flow-control valve slewing gear/outriggers in pump circuit 3

9 Gauge port M16

10 Pressure-relief valve 40 bar
Pump circuit 4 of the quadruple gear pump

11 Valve block steering circuit I

12 Pressure-relief valve 150 bar
Steering circuit I

Caution: Prior to replacing or opening any valve located on the base, the steering system must be de-pressurized and the engine switched off and secured against any unintentional activation.

- Close the stop-cocks in the suction lines on the hydraulic oil tank.
- Clean the affected area thoroughly before commencing repairs.

Flow meter (4)

- Disassemble and clean the flow meter as per exploded view (fig. 2)

Flow-control valves (5), (6) and (8)

- Disassemble and clean the flow-control valves as per exploded view (fig. 3)

Pressure-relief valve (7)

- Disassemble and clean the pressure-relief valve, see Section 5 2.6.

Valve block (11)

- Disassemble and clean the valve block as per exploded view (fig. 1), fitting new seals.

- Before restoring the pipe connections and re-fitting them to the valves, check the O rings and replace if necessary.

Valve block(11)

1	Valve body	43	Screw plug	Port P1	Inlet from main flow pump
7	Valve piston	44	Bushing	Port P2	Inlet from stand by pump
8	Spring	45	Contact pick-up	Port A	to the hydraulic circuit
9	O-ring	46	Screw-in connection	Port B	Return line to oil tank
10	Screw plug	47	Washer		
15	Valve	48	Flat-cable plug		
15.1	Internal valve parts	49	Lock nut		
15.2	Valve bush	50	Cap		
15.3	O-ring	51	Connector		
16	Retaining ring/spring				
16	Screw plug/ retaining ring				
24	Model plate				
25	Grooved drive stud, round head				
29	Pressure-relief valve				
30	O-ring				
40	Gasket				
41	Spring washer				
42	Spring				

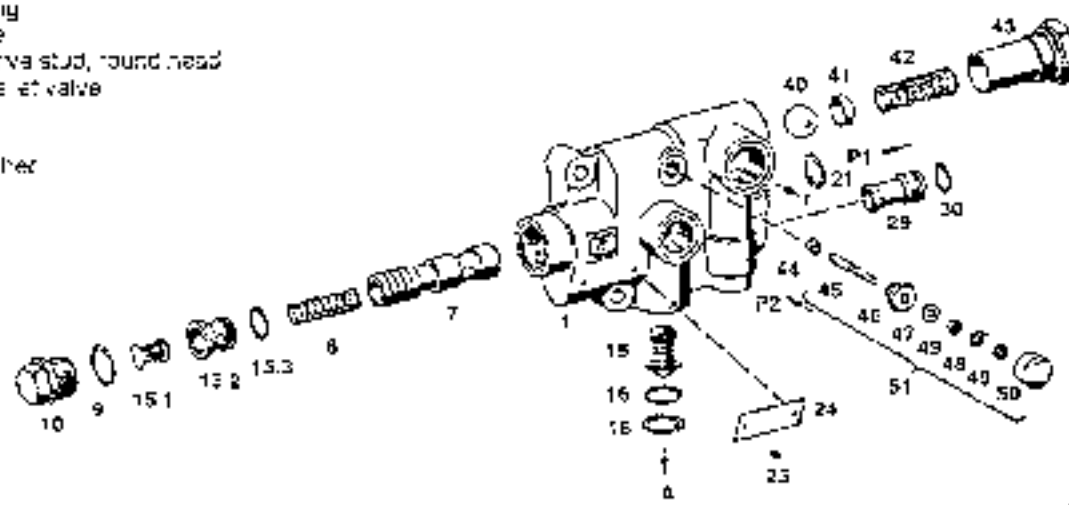


Abb. 1

Electrical flow indicator (4)

504 Valve body
529 Plunger, complete
536 Spring
537 O-ring
538 Guide pin
538.1 Contact holder
539 Model plate
540 Grooved drive stud, round head
570 Lock ring
578 O-ring
579 Washer
597 Sliding contact

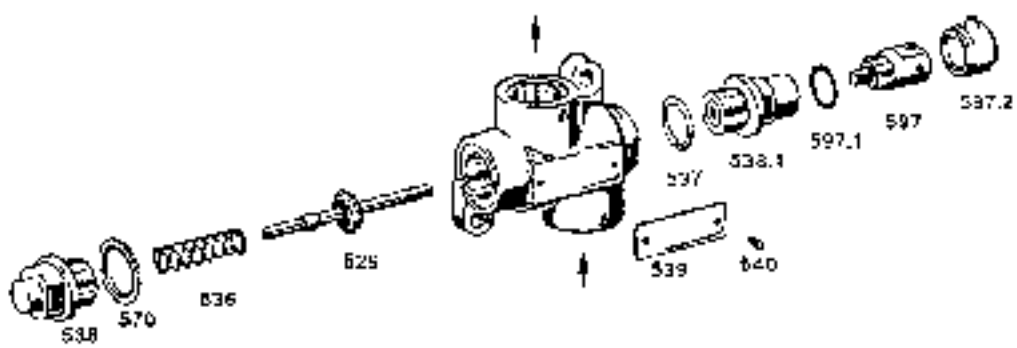


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Abb. 2

Flow control valves (5), (6) and (8)

2 Spring
3 Ball
4 Nozzle
5 Piston
6 Nozzle
7 Snap ring
8 Screw plug

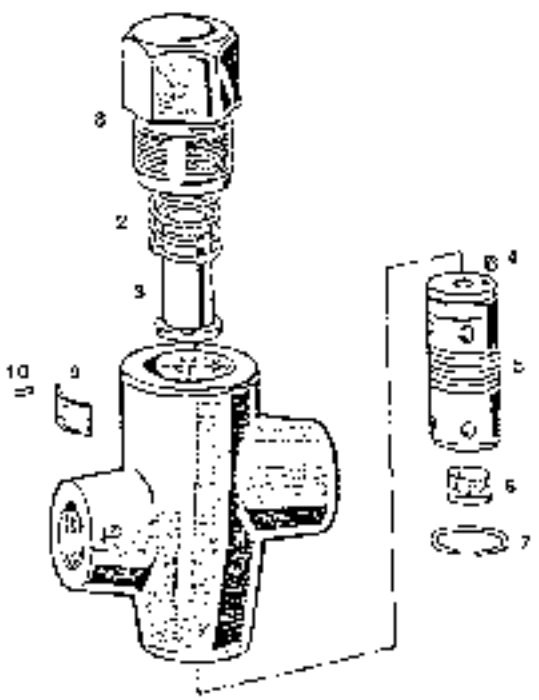

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Abb. 3

Brakes

Description of operation

The crane is fitted with a hydro-pneumatic brake system for axle 1 and a pneumatic brake system for axle 2.

Axle 1 is fitted with a disc brake and axle 2 with a drum brake (simplex expanding wedge brake).

The braking system can be actuated from both the driver's and the crane operator's cab.

The service brake (foot brake) acts on both axles, the parking brake (hand brake) on axle 2 only.

The service brake system consists of two circuits.

Brake circuit I acts on two pairs of brake pistons on each side of axle 1, and brake circuit II acts on the drum brakes of axle 2 and on one pair of brake pistons on each side of axle 1.

The parking brake is located in compressed-air circuit II and acts indirectly on axle 2 via diaphragm spring brake cylinders.

A warning light in the driver's cab indicates any brake circuit failure.

Only brake circuit II can be actuated from the operator's cab.

Technical data

Service brake axle 1

Manufacturer:	Deutsche Perrot-Bremsen
Construction:	Disc brake
Model:	285 F and 485 F
Actuation:	hydro-pneumatic fixed caliper brake
Brake lining:	Textar 467, asbestos-free
Brake lining surface:	206 cm^2 (285 F) and 412 cm^2 (485 F)
Brake disc:	Diameter 430 mm, 45 mm thick

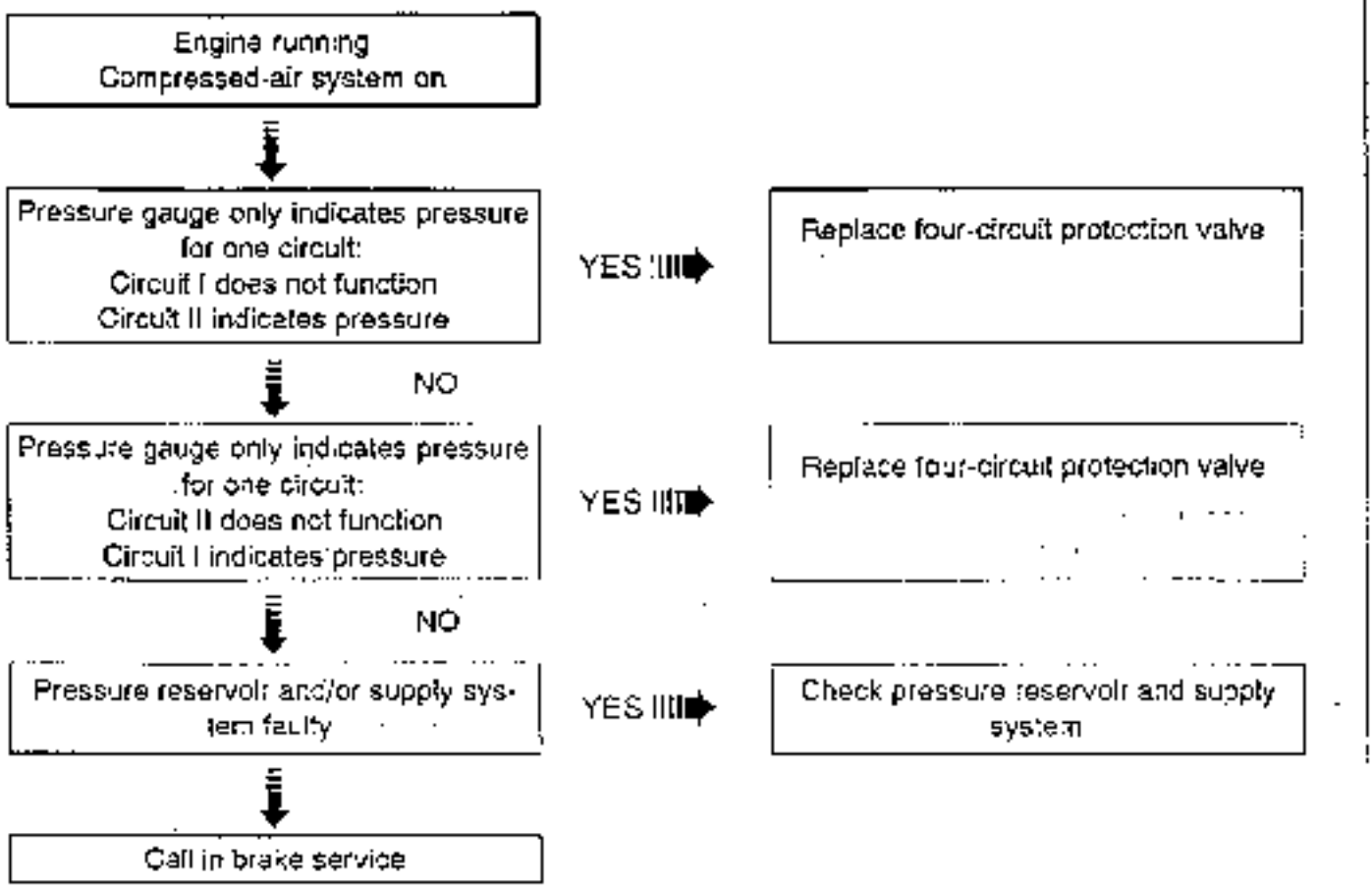
Service brake axle 2

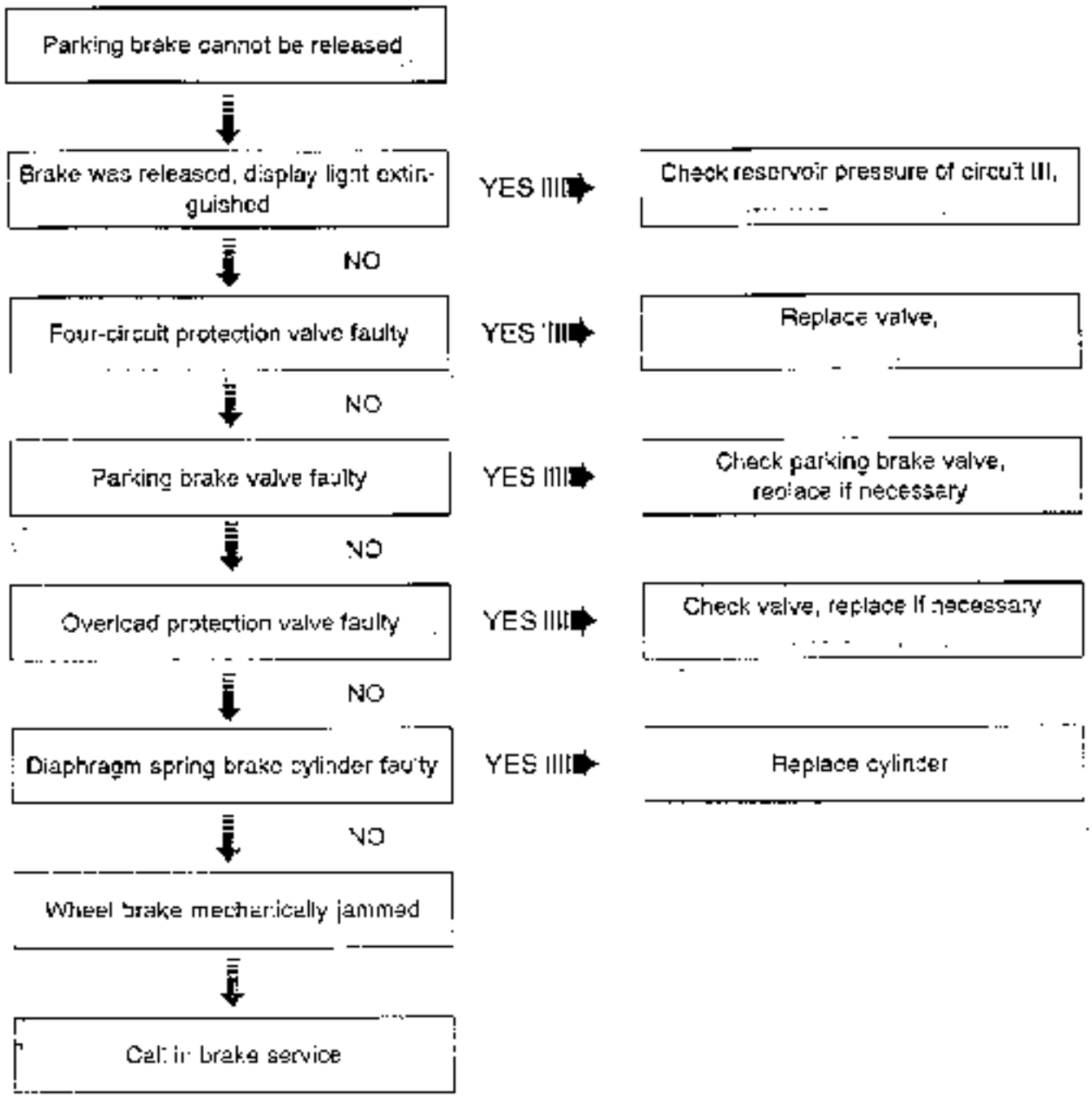
Manufacturer:	Deutsche Perrot-Bremsen
Construction:	Drum brake
Model:	500x120 ZE
Actuation:	pneumatic simplex expancing wedge brake
Brake lining:	Jurid 545, asbestos free
Brake lining surface:	2 x 549 cm^2
Brake cylinder:	Diaphragm spring brake cylinder type 16/24
Pressure limitation:	4.3 bar

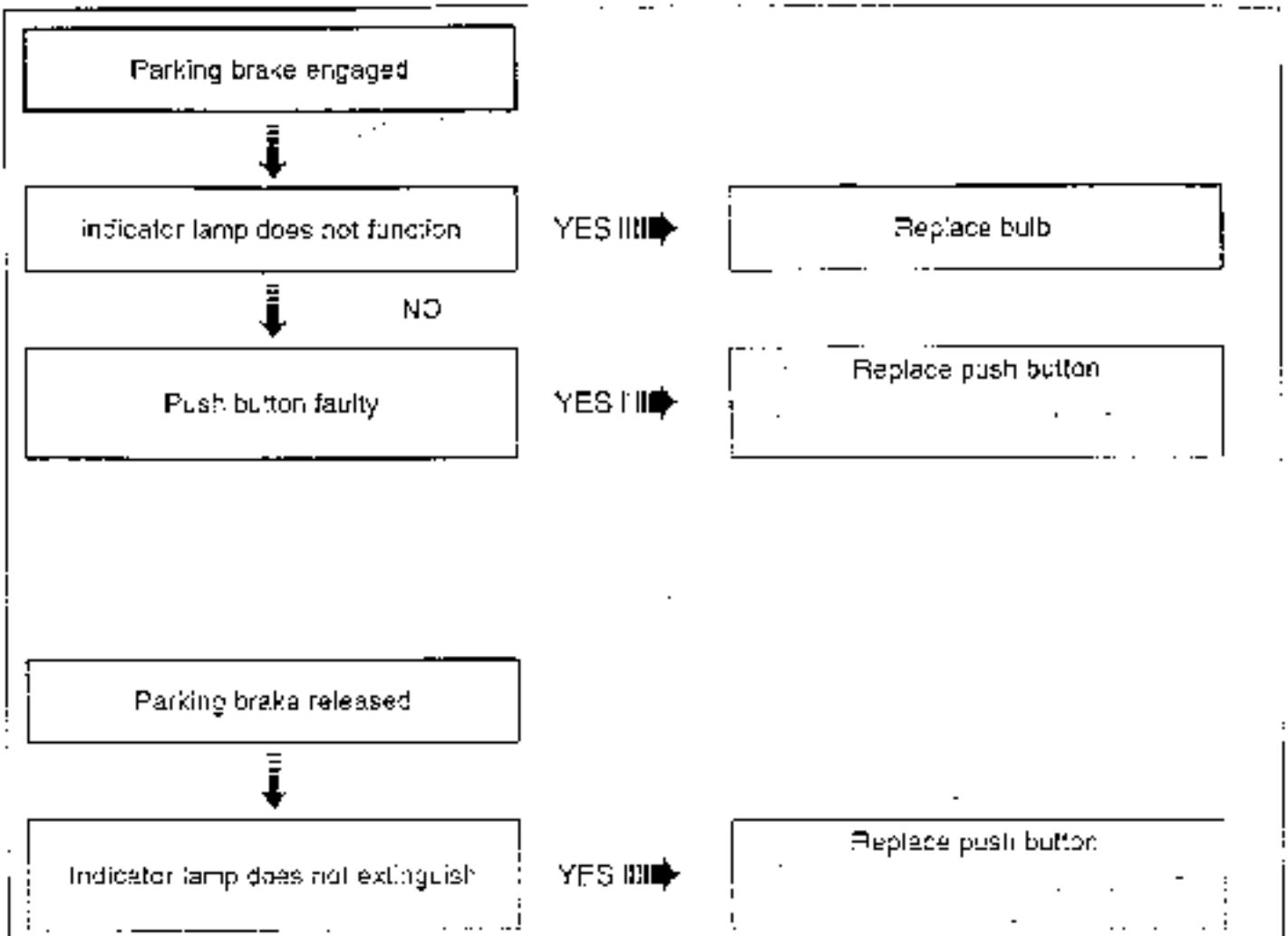
Parking brake (axle 2)

Construction:	Pneumatic brake indirectly acting on the spring brake cylinders on axle 2. Mechanical spring-induced braking force. Mechanical parking brake actuation facility in case of supply-line failure
Brake circuit:	Brake circuit II The warning light in the operator's cab indicates that the brake is on or that there is insufficient pressure (5.0 bar) to release the brake. The parking brake can also be actuated from the crane operator's cab

Malfunctions







1.9.4 Symptoms, reasons and action

Symptoms	Reasons	Action	Comments
Upon release of the parking brake valve axle 2 brakes are actuated too slowly	Operating pressure in circuit II too low	Check four-circuit protection valve, replace if necessary	
	Parking brake valve faulty	Replace parking brake valve	
In the release position compressed air escapes into the open	Parking brake valve faulty	Replace parking brake valve	
Parking brake does not release	Check, if parking brake valve (superstructure) is set to "parking brake on", (knob pulled)	Pull knob to engage it	
	Parking brake valve faulty	Replace parking brake valve	

Adjusting procedures

1 Disc brakes

The disc brakes do not require adjusting.

2 Drum brakes

Each drum brake is fitted with a self-adjusting expanding device which adjusts the distance between the brake linings and the brake drum.

The expanding device only requires adjusting if the brake linings are replaced.

Pressure-regulating valves for axle 1 disc brakes

The two disc brake circuits are fitted with Wabco pressure-regulating valves. These valves regulate the air pressure to the brake hydraulic system in accordance with the required braking force.

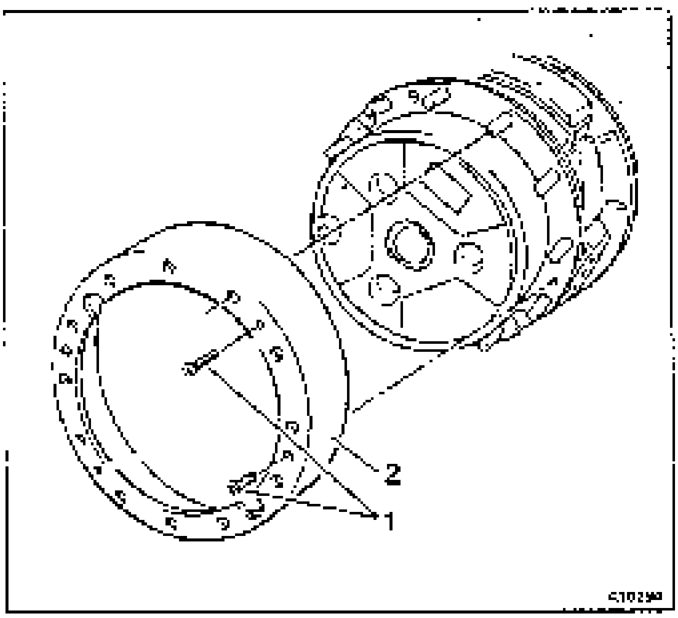
Caution: The pressure-regulating valve settings are fixed by the manufacturer and do not require adjusting.

1.9.6 Repair procedures

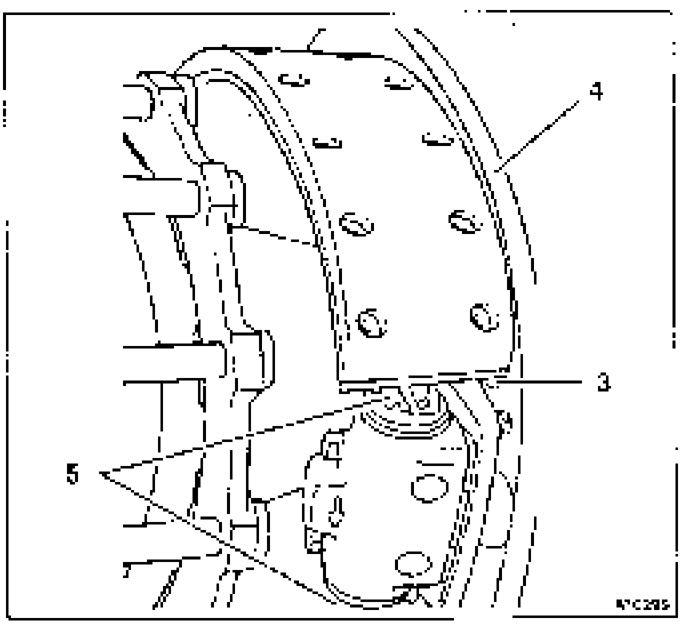
1.9.6.1 Replacing the drum brake linings

Caution: Always replace all the brake linings of one axle.

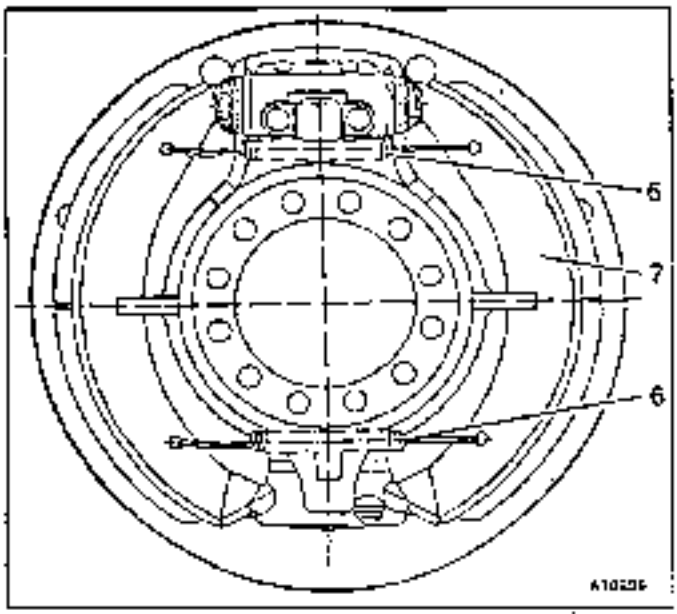
- Raise the crane using the outriggers, switch off the engine and secure against unauthorized activation.
- De-pressurize the compressed-air system by repeatedly actuating the service brake and drain all the compressed air out of the reservoirs via the bleeder valves. The compressed-air gauge in the driver's cab must read 0 bar.
- Unscrew the wheel nuts and remove the wheels



- Remove the brake drum (2) retaining bolts (1).



- Turn back the teeth (5) through the bores (3) in the brake plate (4) until the brake drum can be removed from the wheel hub



- Disconnect the tension springs (6) from the brake linings (7) and inspect the condition of the springs. Both tension springs should be the same length and the spring coils must lie close together. Replace any badly corroded or stretched tension springs.
- Remove the brake linings (7).
- Check the brake drum (2) for scoring and circular distortion, removing if necessary (max. diameter: $503^{+0.1}$ mm)
- Rinse all components with a grease-dissolving cleansing agent.
- Fit the new brake linings (7), replace the tension springs (6) and coat the brake lining bearings with a thin layer of graphitized grease.

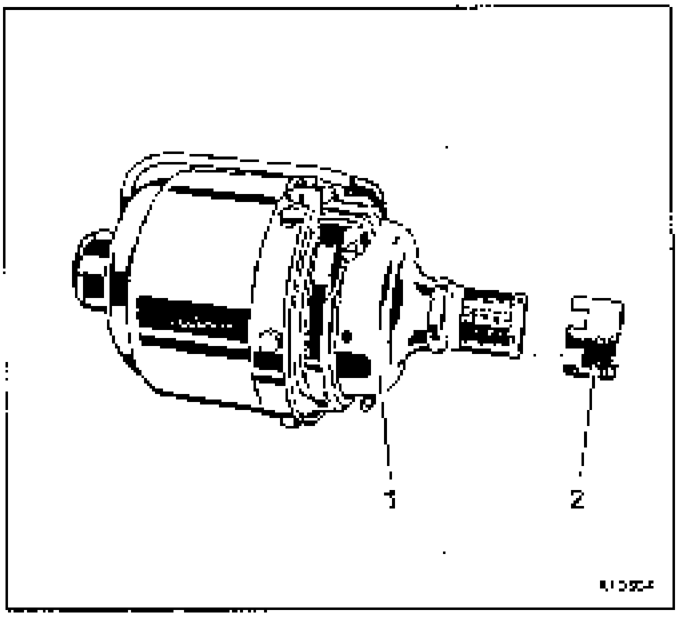
Caution: Do not bend the tension springs during replacement.

- Push the brake drum on the wheel studs and secure with the bolts (1)
- Fit the wheel and tighten the wheel nuts to a torque of 550 Nm
- Turn the teeth (5) of the expanding device in an anti-clockwise direction until there is perceptible resistance. Both brake linings are now positioned against the brake drum.
- Turn the tooth back half a tooth. Neither brake lining is now in contact with the brake drum; the air gap measures approx. 0.75 mm.
- Carry out a test drive of between 10 and 20 km and wear in the brake linings by repeatedly applying light pressure to the brakes. Following the test drive, it is possible to monitor and, if necessary, adjust, the air gap when cold. Next, monitor the braking performance during driving by braking sharply. If necessary, the adjusting procedure should be repeated.

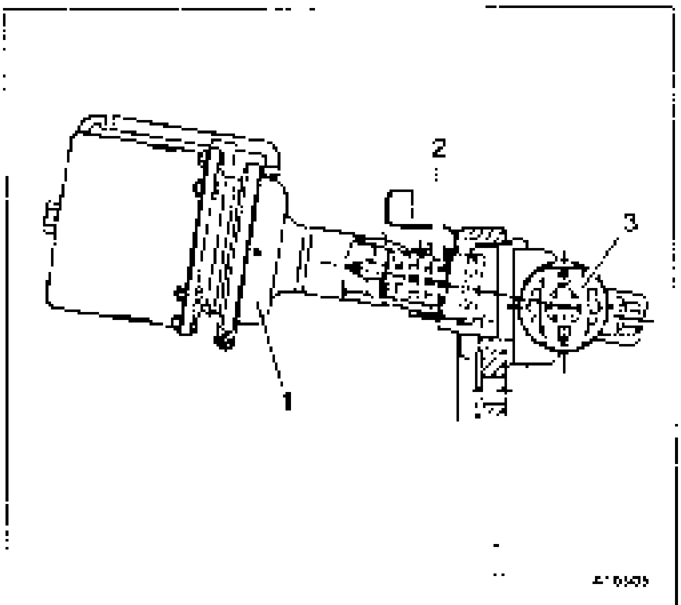
Replacing diaphragm spring brake cylinders (axle 2)

Caution: Mark the connections for the vehicle and parking brakes. Do not confuse the connections.

- Depressurize the compressed-air system



- Disconnect the compressed-air lines from the diaphragm spring brake cylinder (1).
- Remove the lock nut (2) and unscrew the diaphragm spring brake cylinder out of the expanding wedge.
- Screw the lock nut (2) at least 22 mm onto the new diaphragm spring brake cylinder and coat the thread with a sealing agent (e.g. Teroson Atmosit).



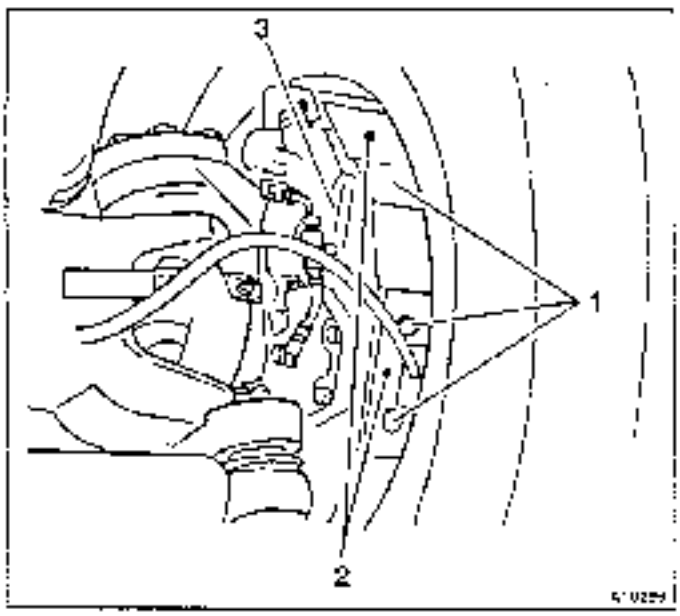
- Screw the cylinder (1) tightly into the expanding wedge (3).
- Align the cylinder with the compressed-air line connections.
- Restore the compressed air line connections to the cylinder, checking the O rings and replacing if necessary.
- Pressurize the compressed-air system.
- When the system is operational, tighten the lock nut (2) to a torque of 160 ± 20 Nm.

Replacing the disc brake linings

Caution: Always replace all the axle brake linings.

Note: A special tool from Kessler & Co is required for replacing the brake linings

- Raise the crane using the outriggers and remove the wheels from axle 1.



- Unscrew the bolts (1) out of the brake calipers (3) and remove the brake caliper covers (2).
- Remove the old brake linings out of the brake calipers using a hook (special tool) (appropriate holes are located in the brake lining carriers).
- Remove any dirt from the brake piston using water, washing petrol or spirit.

Note: Check the brake discs for scoring and distortion

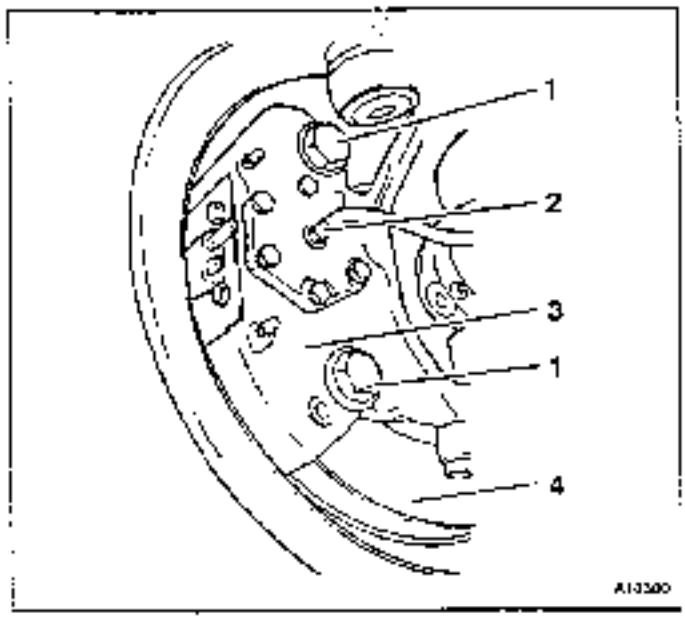
It is advisable to grind the brake discs no later than the second change of brake linings. Maximum permissible grinding on both sides is 2 mm.

- Using a suitable tool, press the piston back into the cylinder until it is possible to fit the new brake linings.

Caution: Depending on the size of the equalizing reservoirs, turning back the piston might cause displaced brake fluid to spill over.

- Fit the new brake linings, replace the caps (2), insert the bolts (1) and tighten
- Bleed the brake system.
- Fit the wheels and tighten the wheel nuts to a torque of 650 Nm.
- Carry out a functional braking test.

Removing and installing the brake calipers



- Remove the retaining bolts (1) from the brake plate.
- Remove the brake caliper (3) from the brake disc (4). Secure the hoses (2) and cables (only in the case of an electric abrasion gauge) against damage.
- Fit the new brake caliper to the brake disc and insert the retaining bolts (1).
- Measure the air gap between the brake linings and the brake disc using a feeler gauge and correct any uneven gaps by emplacing washers between the brake caliper and the brake disc.
- Tighten the retaining bolts to a torque of 1070 Nm.

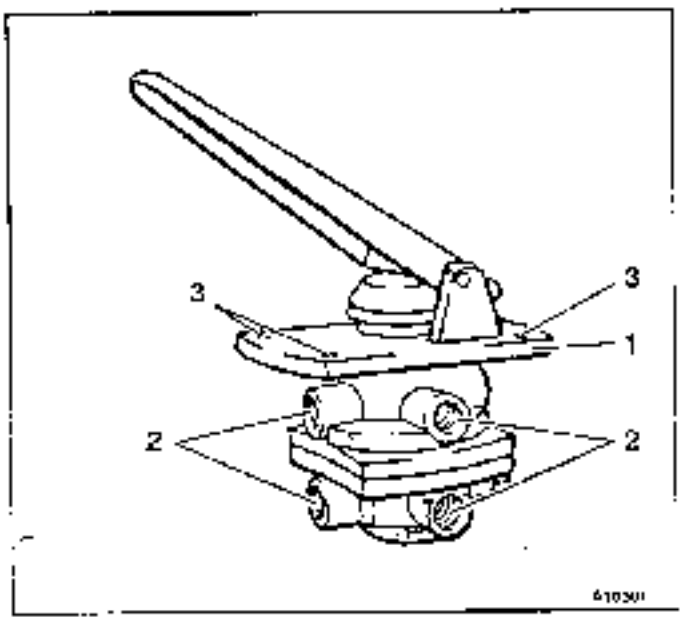
1.9.6.5 Repair procedures in the brake fluid system

Repairs to the brake hydraulic system may only be carried out by Krupp Service or an authorized workshop. Such repairs include:

– Changing the brake fluid
– Replacing or repairing the main and braking cylinders
– Replacing or repairing the disc brake pistons.

Replacing the service brake valve

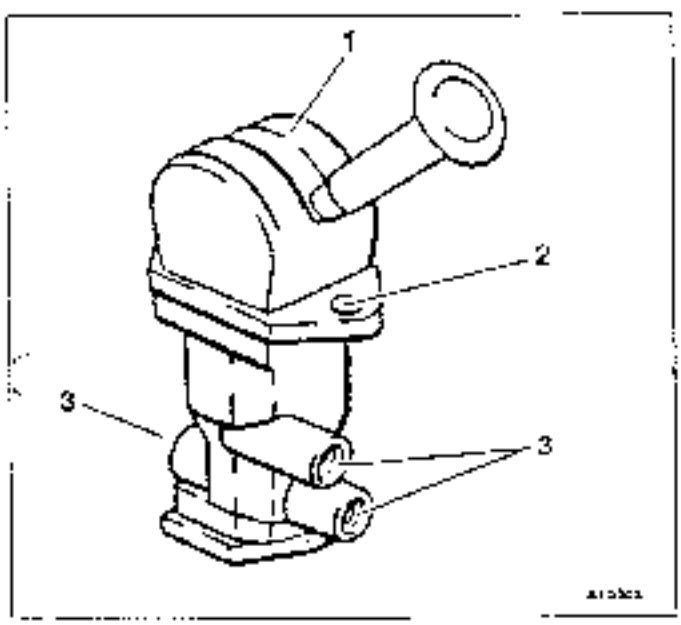
- Depressurize the compressed-air system.



- Disconnect the compressed-air lines (2) from the service brake valve (1).
- Remove the retaining bolts (3).
- Replace the service brake valve.
- Installation is performed in the reverse sequence of steps.
- When restoring the compressed-air line connections, check the O-rings in the screw connections and replace if necessary.
- Activate the compressed-air system and carry out a functional test.

1.9.5.7 Replacing the parking brake valve

- Depressurize the compressed-air system.



- Disconnect the compressed-air lines (3) from the service brake valve (1).
- Remove the retaining bolts (2).
- Replace the parking brake valve.
- Installation is performed in the reverse sequence of steps.
- When restoring the compressed-air line connections, check the O-rings in the screw connections and replace if necessary.
- Activate the compressed-air system and carry out a functional test.

Outriggers

Description of operation

The crane has an outrigger system with four telescopic outrigger beams with integrated outrigger cylinders. The outriggers are built into the crane in front of axle 1 and behind axle 2.

Each outrigger beam consists of welded beams with a single-stage telescopic cylinder and an outrigger cylinder.

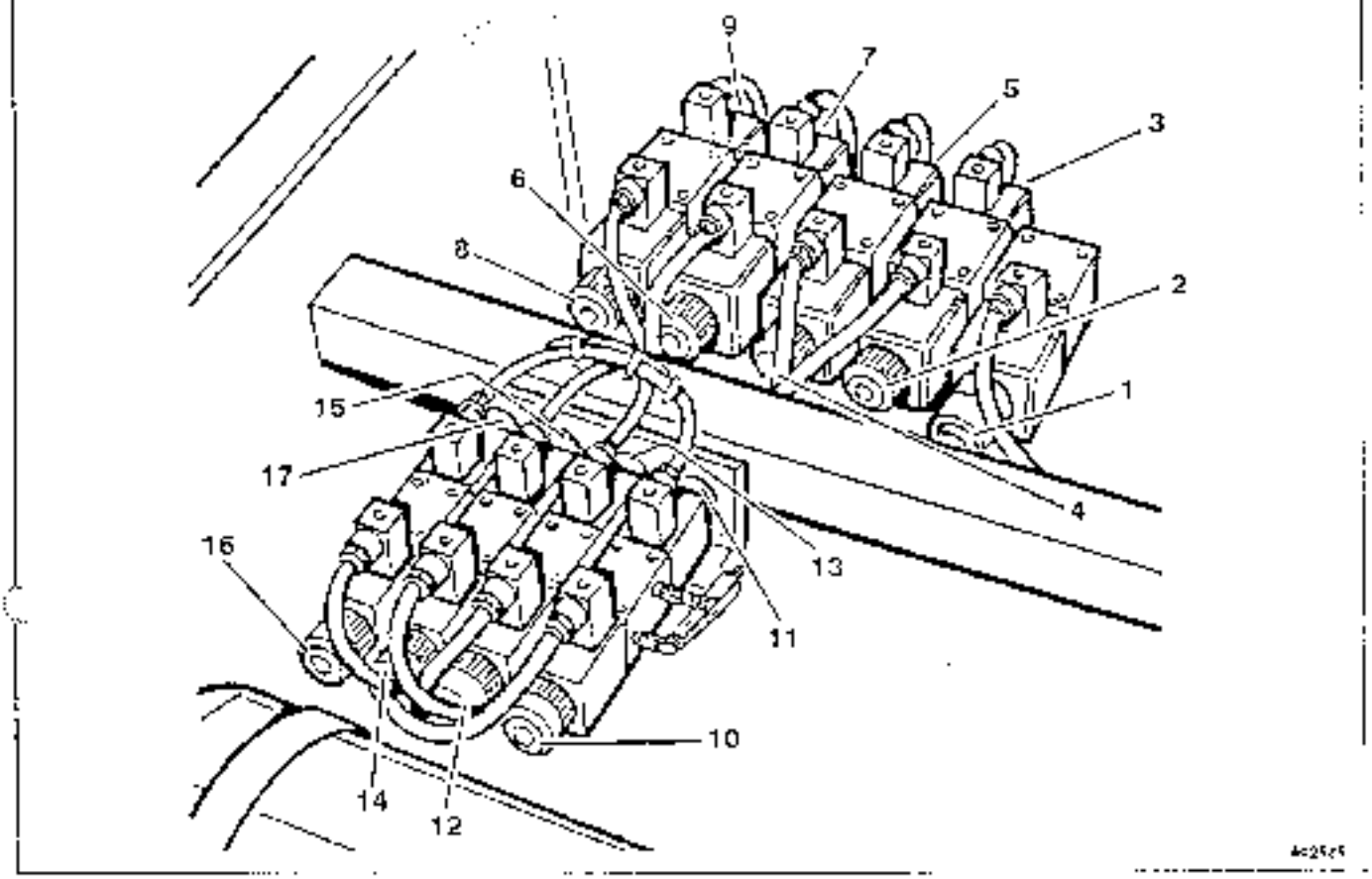
The telescopic outrigger beams are extended on each side to a length of 1.63 m, giving an outrigger width of 5.5 m. The distance from the front to the rear outrigger measures 5.70 m.

The outrigger cylinders act on outrigger pads which have to be mounted on the cylinder for outrigging operations. The dimensions of the outrigger pads are 300 x 300 mm. The stroke of the outrigger cylinder measures 500 mm.

The hydraulic pressure is produced by pump P3 of the quadruple gear pump.

The outriggers are controlled from the crane operator's cab or by means of push buttons located on the operating panels on the right- and left-hand sides between axles 1 and 2.

The two control blocks are located above axle 2 and house the control valves for the telescopic outrigger beams and the outrigger cylinders.



Ref. no.	Function	Switching function designation
1	Pressure build-up valve	8 Y 1
2	Extend front left-hand outrigger cylinder	10 Y 1
3	Retract front left-hand outrigger cylinder	10 Y 5
4	Extend front right-hand outrigger cylinder	10 Y 2
	Retract front right-hand outrigger cylinder	10 Y 6
6	Extend rear left-hand outrigger cylinder	10 Y 3
7	Retract rear left-hand outrigger cylinder	10 Y 7
8	Extend rear right-hand outrigger cylinder	10 Y 4
9	Retract rear right-hand outrigger cylinder	10 Y 8
10	Extend front left-hand telescopic outrigger beam	9 Y 1
11	Retract front left-hand telescopic outrigger beam	9 Y 5
12	Extend front right-hand telescopic outrigger beam	9 Y 2
13	Retract front right-hand telescopic outrigger beam	9 Y 6
14	Extend rear left-hand telescopic outrigger beam	9 Y 3
15	Retract rear left-hand telescopic outrigger beam	9 Y 7
16	Extend rear right-hand telescopic outrigger beam	9 Y 4
17	Retract rear right-hand telescopic outrigger beam	9 Y 8

1.10.2 Technical data

Design:	Four-point telescopic outrigger system, single-telescoping
Control:	Can be controlled individually both horizontally and vertically from both sides of the carrier and from the operator's cab.
Outrigger span:	5.7 x 5.5 m
Outrigger cylinder stroke:	500 mm
Outrigger pad dimensions:	300 x 300 mm
Outrigger pad surface area:	900 cm^2
Crane alignment monitoring	With the aid of circular spirit levels on both sides of the carrier and in the crane operator's cab.

Malfunctions

Outrigger controls not working

↓

Key switch OW/UW (superstructure/carrier) set to OW — YES → Change setting to UW

↓ NO

Ignition off — YES → Activate ignition in the driver's cab

↓ NO

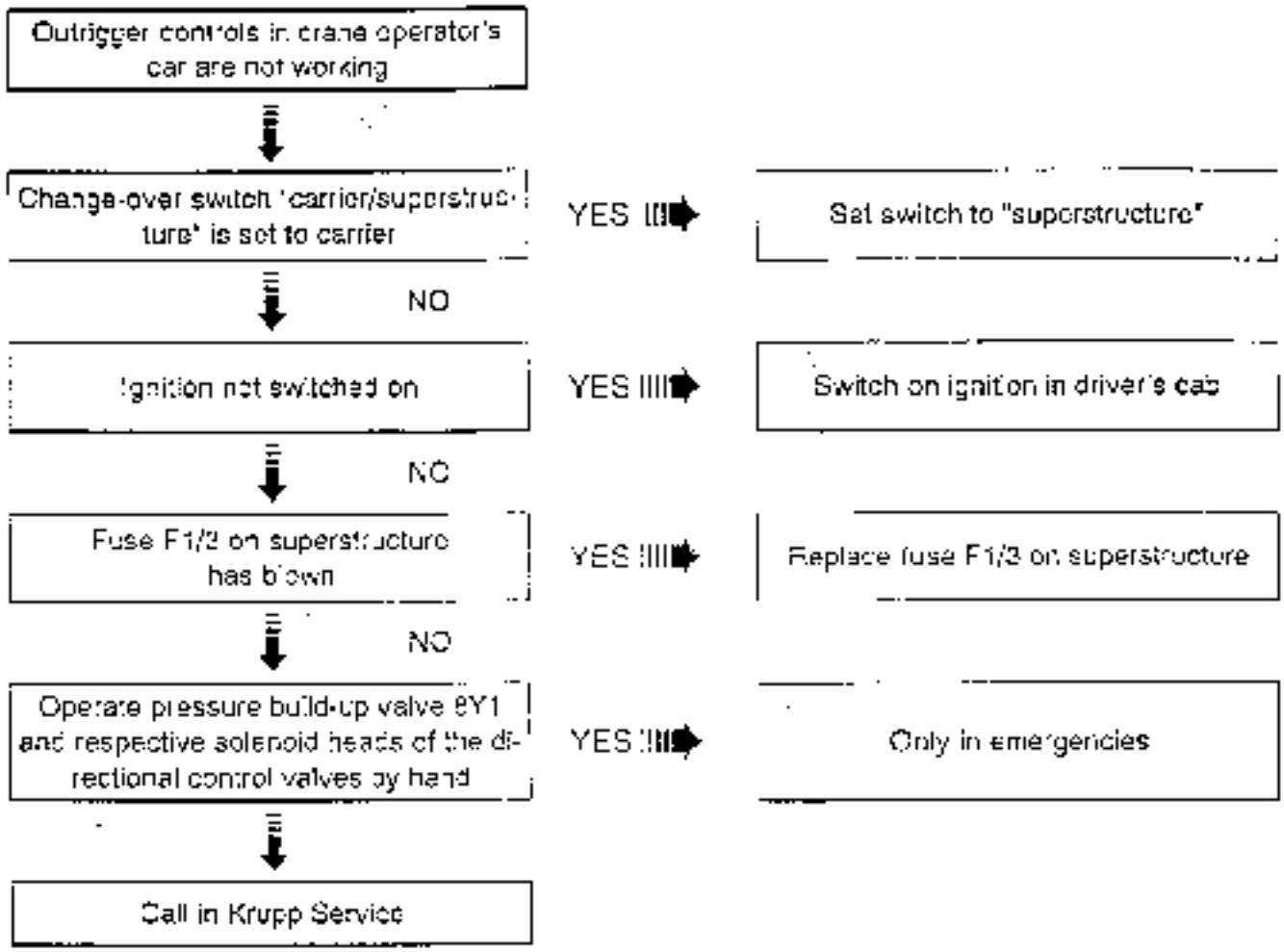
Fuses F1/1 UW and F2/4 UW blown — YES → Replace fuses F1/1 UW and F2/4 UW

↓ NO

Activate pressure build-up valve 2Y1 and the respective solenoid heads of the directional control valves by hand — YES → Only in emergencies

↓

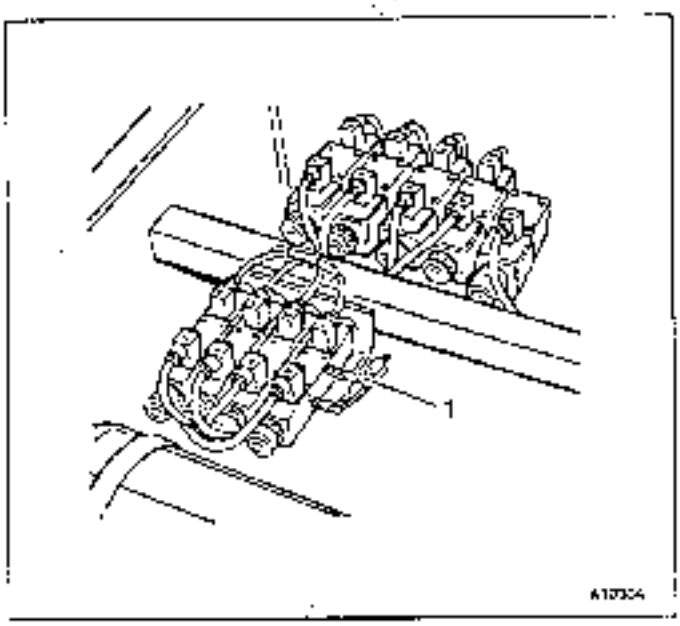
Call in Kroop Service

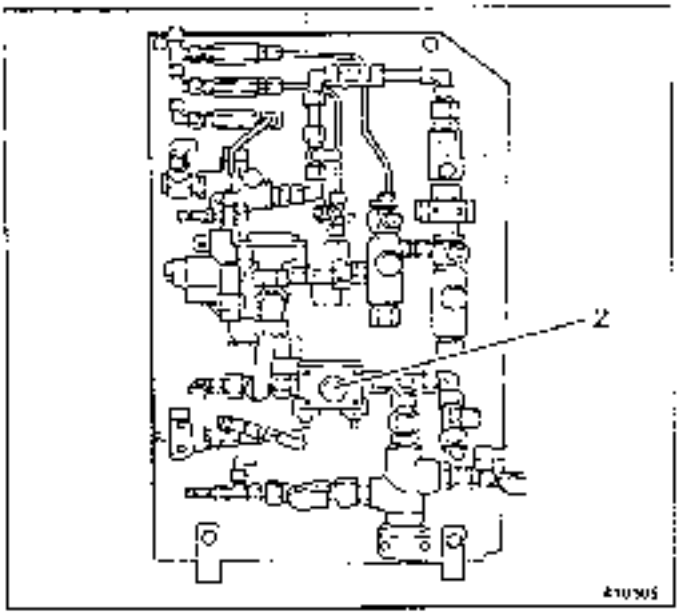


Symptoms, reasons and action

Symptoms	Reasons	Action	Comments
Neither the telescoping nor the outrigger system works when the controls are pressed	Fuses F1/1 OW and F2/1 OW blown	Check fuses and replace if necessary	
	Switch S34 or S55 in the OW outrigger controls faulty	Replace switch	
Neither the telescoping nor the outrigger system works when the controls are pressed	Fuse F1/2 OW blown	Check fuse and replace if necessary	
	Switch S25 in the instrument panel OW faulty	Replace switch	
	Change-over switch S7 UW/OW on the front instrument panel in the driver's cab not set to correct position	Set change-over switch to correct position	
	Pressure build-up valve 8Y1		
	– Solenoid head faulty	Press solenoid head by hand. Valve functions, Replace solenoid head	See Section 'General repair procedures'
	– Valve faulty	Replace valve	
	– Operating pressure incorrectly set (240 bar)	Upon activation of pressure build-up valve 8Y1 pump P3 of the quadruple gear pump must read 240 bar	
		– If there is insufficient pressure, set pressure-relief valve to 240 bar.	
	If there is no pressure	– No delivery from pump P3, Replace pump	
None of the telescopic cylinders functioning	Pressure build-up valve 100 bar is set incorrectly or is faulty	When pressure build-up valve 8Y1 is activated and one of the telescoping functions is initiated there must be a pressure reading of 100 bar. If this pressure is not indicated, set valve to 100 bar	See Section 'General repair procedures'
None of the individual telescopic or outrigger cylinders function when activated	Switch for the affected outrigger side faulty	Check switch and replace if necessary	
	Solenoid heads of the corresponding control valves faulty	Activate solenoid heads by hand, check and replace if necessary	See Section 'General repair procedures'
	Valve faulty	Replace valve	

Adjusting procedures





- The only parts which can be adjusted in the outrigger hydraulic system are the pressure-relief valve 240 bar (2) and the pressure-relief valve 100 bar (1). The adjusting procedures are explained in Section 'General repair procedures'.

Note: The pressure-relief valve 240 bar regulates the entire hydraulic circuit of pump P3 of the quadruple gear pump.

Note: The pressure-relief valve is located on a base plate attached to the side of the hydraulic oil tank in front of axle 2 on the left-hand side of the crane.
In order to access the valves, remove the cam lever cover and the dashboard located in front of the left-hand rear wheel.

Repair procedures

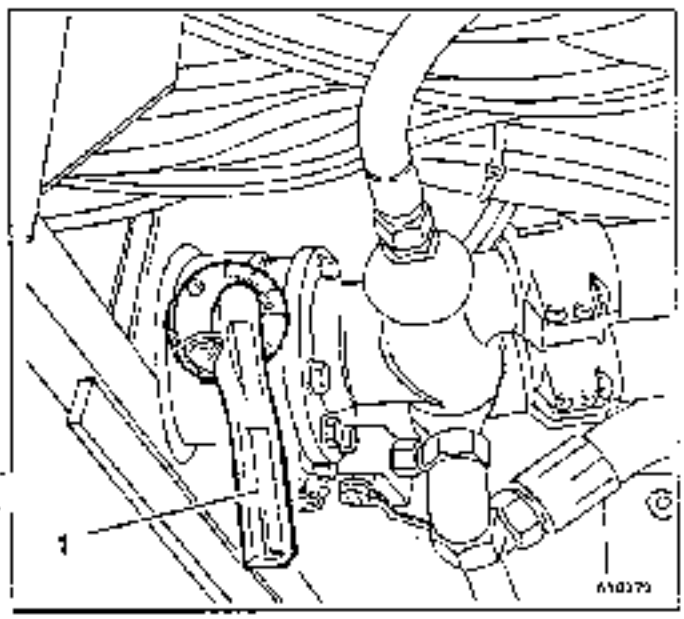
Caution: Before commencing repairs to the hydraulic system, clean the affected area thoroughly.

– Monitoring and replacing the solenoid heads (see Section 5 'General repair procedures')
– Monitoring and replacing the hydraulic valves (see Section 5 'General repair procedures')
– Checking the electrical system (see Section 5 'General repair procedures', Section 1.14 'Electrical system UW' and Section 2.10 'Electrical system').

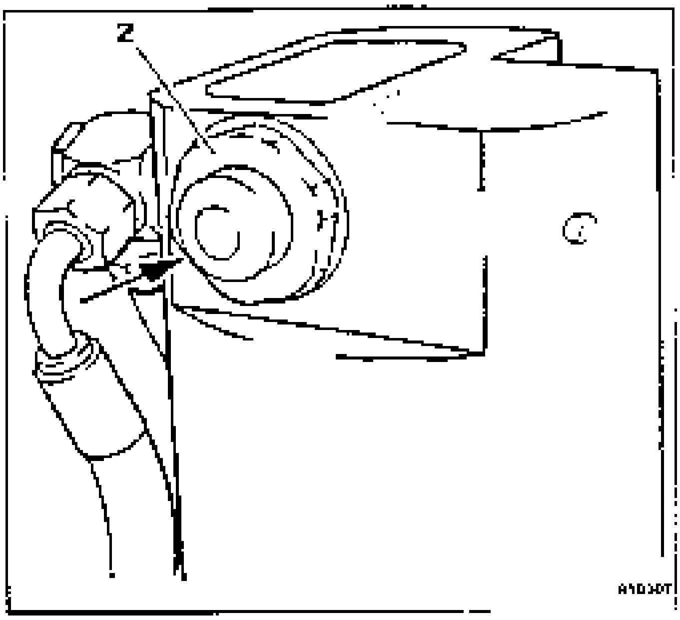
Replacing the blocking valve on the outrigger cylinder

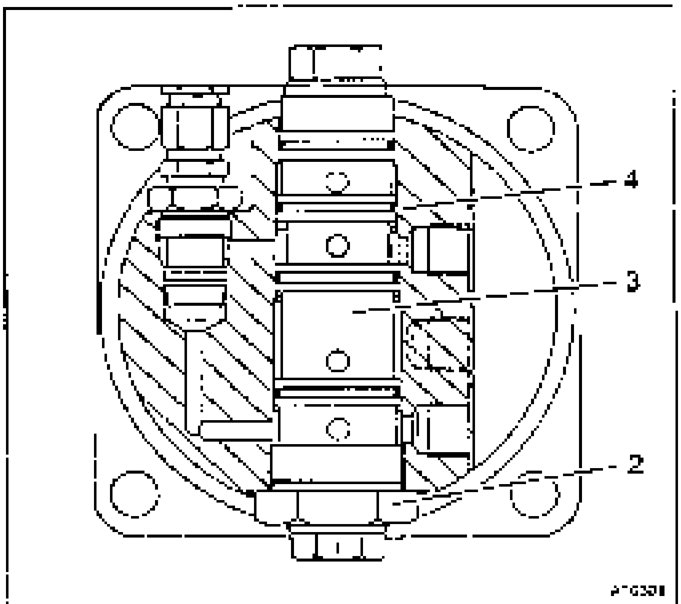
A blocking valve is located at the upper end of the outrigger cylinders.

- Extend the affected outrigger
- Switch off the engine and secure against unauthorized activation.



- Close the stop-cock (1) to the quadruple gear pump suction lead on the hydraulic oil tank





- Remove the screw-in nipple (2) on each side of the blocking valve (3).
- From the rear side (arrow), press the blocking valve out of the outrigger cylinder using a suitable tool.
- Carefully insert a new blocking valve with new sealing rings (4) into the outrigger cylinder.
- Insert the screw-in nipples (1) and tighten.
- Activate the hydraulic system and carry out a functional test on the outriggers.

Compressed-air system

Description of operation

Compressed air which is produced in the compressor passes via the pressure regulator, which keeps the pressure in the system at a constant pressure of between 6.5 - 7.5 bar, to the air drier. Here, the moisture in the compressed air is removed and is conveyed through the vent system in the drier into the open air.

At a temperature of approx. 10°C, a cartridge heater is switched on which assists the drying process. The dried compressed air passes to the four-circuit protection valve. The four-circuit protection valve divides the compressed air supply into three individual circuits. In the event of damage to one or more circuits, this prevents pressure losses in the other circuit(s).

Compressed-air circuit I serves the service brake - brake circuit I and the secondary consumers.

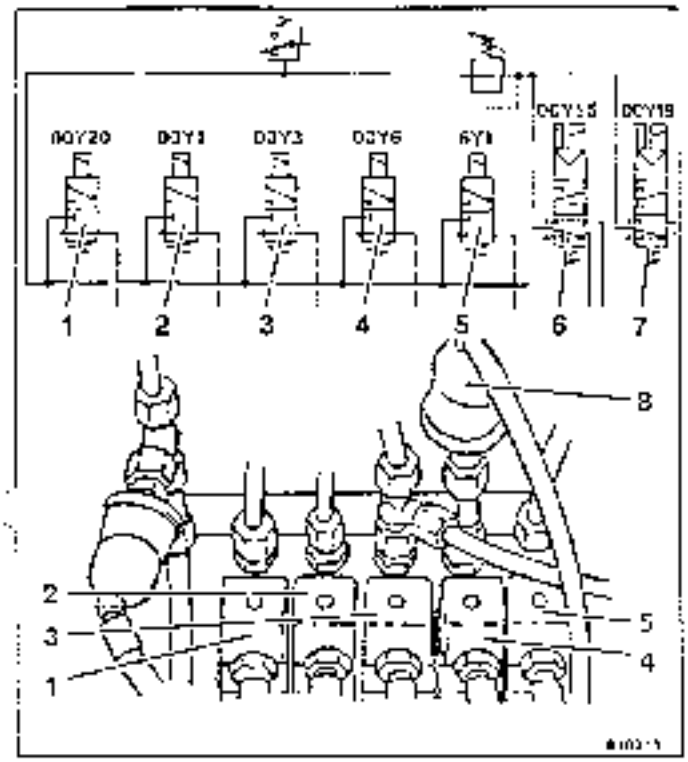
Compressed-air circuit II serves the service brake - brake circuit II

Compressed-air circuit III serves the parking brake and engine speed adjustment.

The fourth four-circuit protection valve connection can serve a trailer connection (special equipment).

Compressed-air circuit I: secondary consumers

* = Reference no. in original Krupp compressed-air chart



1 Transverse oscillation 00Y20

2 Engine stop 00Y1

3 Differential locks 00Y3

4 Suspension locking system 00Y6

5 All-wheel steering 6Y1
(axle 2 steering lock release)

6 Auxiliary drive on manual gearbox 00Y15
(for quadruple gear hydraulic pump)

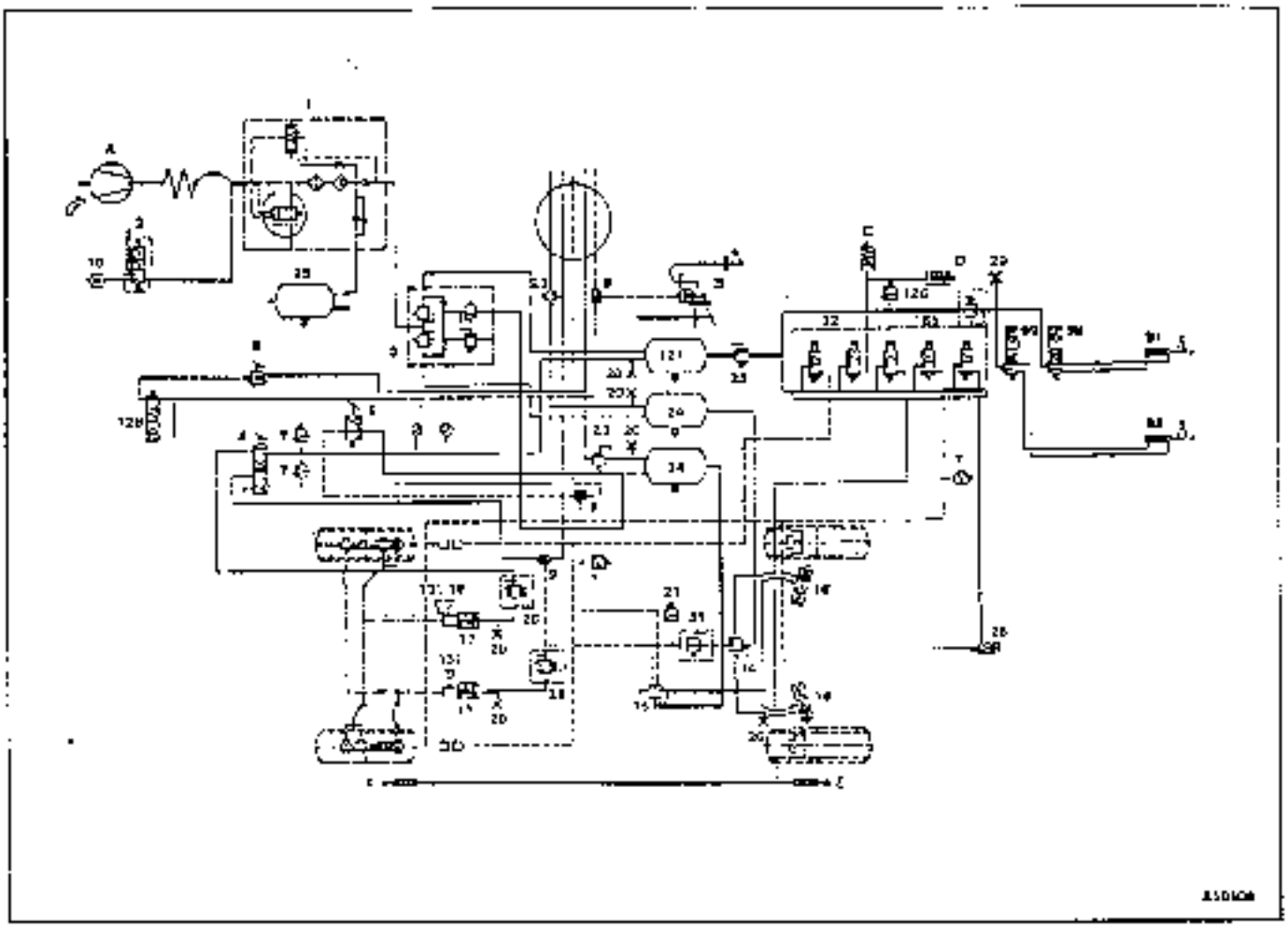
7 Drive 1 engagement, Axle on manual gearbox 00Y16 (all-wheel drive)

8 Pressure switch 00b5 for locking the suspension (item 7*)

Valves 1 to 5 (item 22*) are located on a base plate in the crane chassis above axle 2. They are only accessible from below.

Valves 6 and 7 (item 99*) are located on the left next to the manual gearbox inside the sound insulation lining and are likewise only accessible from below.

Compressed-air assembly group



Note: The reference numbers in the compressed air chart are identical with the item numbers on the original Krupp compressed-air chart. The item numbers are also indicated in the following descriptions, e.g. (item 17)

A Diesel engine compressor

B Diesel engine speed adjustment

C Diesel engine stopping cylinder

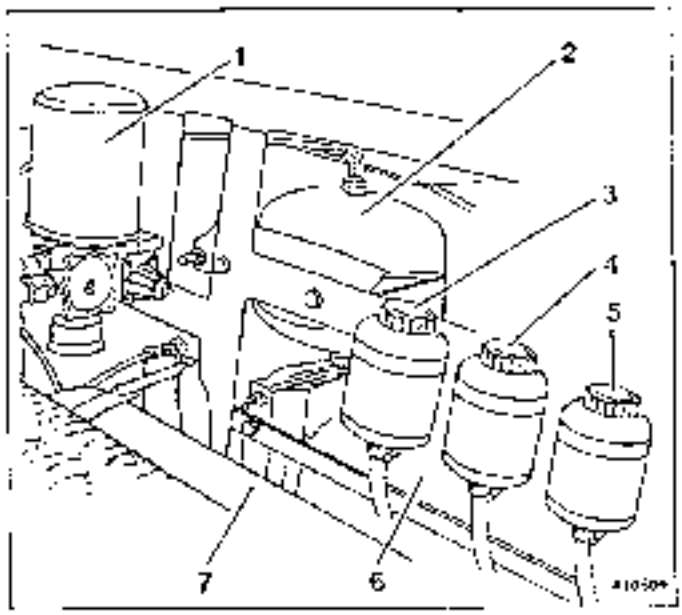
D Adjusting cylinder of engine brake flap

E Cylinder of axle 2 for engaging the transverse differential lock

F Cylinder of axle 1 for engaging the transverse differential lock

* = Reference no im Original Krupp-Druckluftplan

The following units are behind the central steps on the right-hand side of the carrier:



1 Air drier (Item 1*)

2 Compressed-air reservoir (Item 25*)

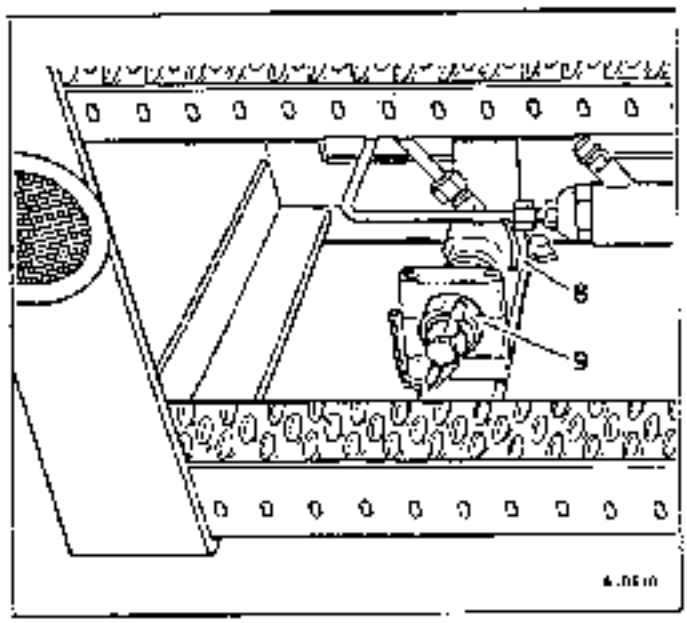
3 Expansion tank (Item 19*) for the front main cylinder

4 Expansion tank (Item 131*) with switch (00638) for the front main cylinder

5 Expansion tank (Item 131*) with switch (00639) for the rear main cylinder

6 Compressed-air reservoir (Item 121*) with testing connection (Item 20*) for compressed-air circuit

7 Compressed-air reservoir (Item 24*) with testing connection (Item 20*) for compressed-air circuit II



8 Tyre inflation valve (Item 2*)

9 Non-return valve (Item 10*) of external filling point

The following units are not shown:

10 Four-circuit protection valve (Item 3*) is between the 20-litre and 30-litre compressed air reservoirs and is accessible from the side

11 Front main cylinder 17*) with testing connection (Item 20*) for the double brake caliper of axle 1

12 Rear main cilynder (Item 17*) with testing connection (Item 20*) for the single brake caliper of axle 1

13 Control valve (Item 28*) for the front main cylinder

14 Control valve (Item 25*) for the rear main cylinder

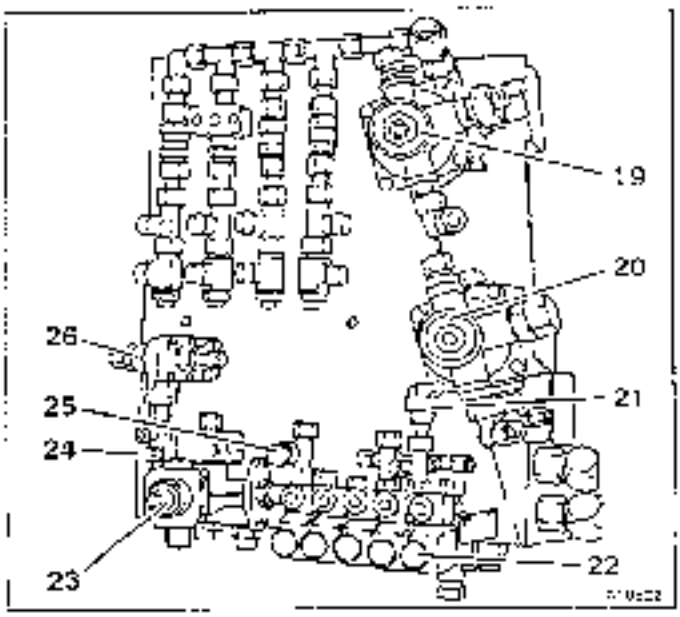
15 Overflow valve (Item 23*) with pressure switch 00b65 (Item 165*) for releasing the power take-off directly on the compressed-air reservoir I

16 Overflow valve (Item 23*) in the feed line leading to the superstructure, between compressed-air reservoir II and fuel tank

17 Pressure limiting valve (Item 165*) with testing connection (Item 20*), visible from below, on the corner of the fuel tank

18 Two-way directional control valve (Item 8*) in brake circuit II under compressed-air tank II

The following parts are mounted on a plate attached to the rear outrigger box above the rear axle:



19 Relay valve (Item 15*)

20 Relay valve (Item 14*)

21 Pressure switch 00b5 (Item 7) for blocking the suspension

22 Block with magnets (Item 22*)

23 Pressure relief valve (Item 31*)

24 Pressure switch 00b22 (Pos 7*) for the parking brake

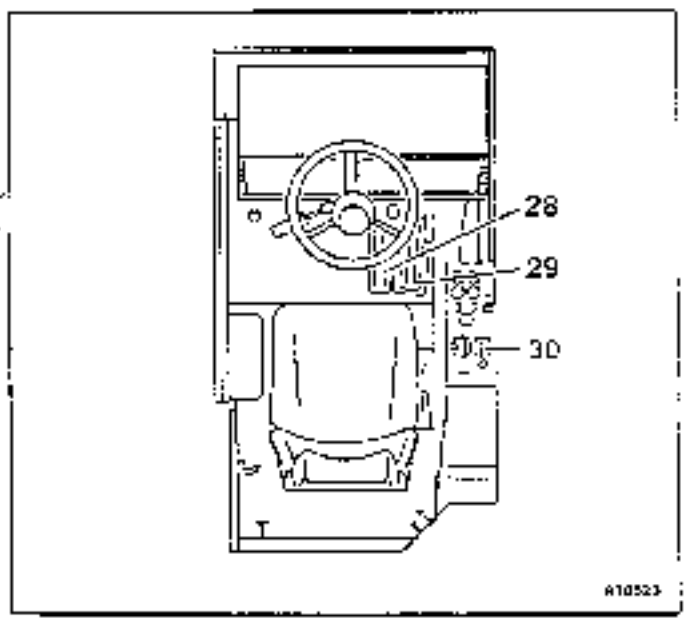
25 Brake light switch 00b8 (Item 21*)

26 Two-way directional control valve (Item 9*) for the parking brake

The following parts are not shown:

27 Compressed-air reservoir (Item 24*) with overflow valve (Item 23*) and testing connection (Item 20*) for compressed air circuit III

The following parts are inside the driver's cab:



28 Brake valve (Item 4*) used as service brake

29 Foot-operated fine-regulation valve (Item 9*) used as accelerator

30 handbrake valve (Item 5*)

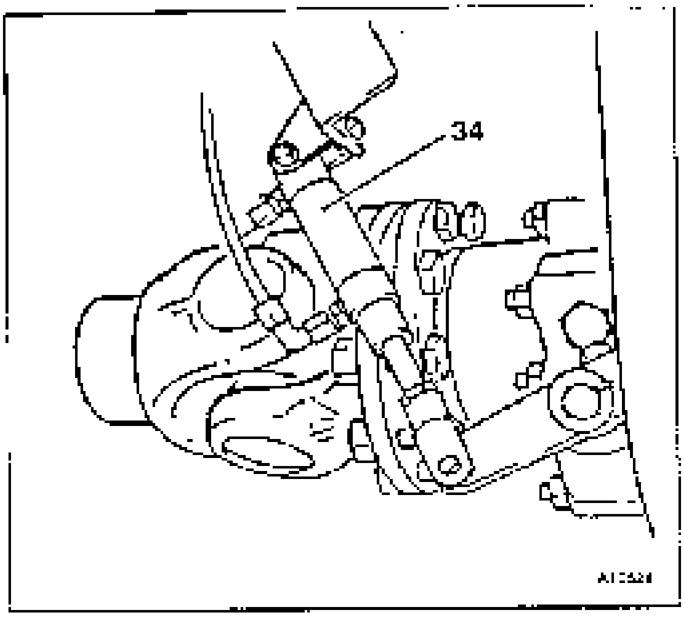
The following parts are not shown:

31 Pressure switch 00b20 (Item 7*) for compressed air circuit I behind the front grille under the driver's cab

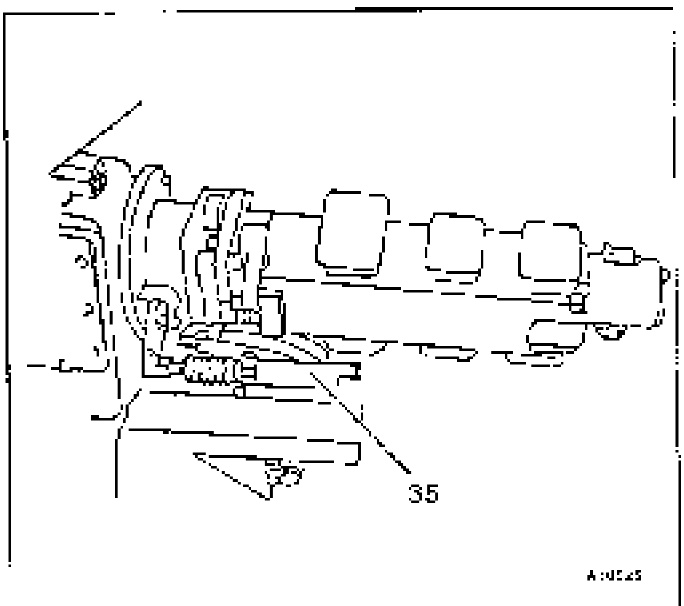
32 Pressure switch 00b21 (Item 7*) for compressed-air circuit II behind the front grille under the driver's cab

33 3/2-way directional control valve (Item 128*) used as accelerator blocking valve on the left-hand side of the vehicle behind the step leading to the driver's cab

The following parts are attached to the manual gearbox:

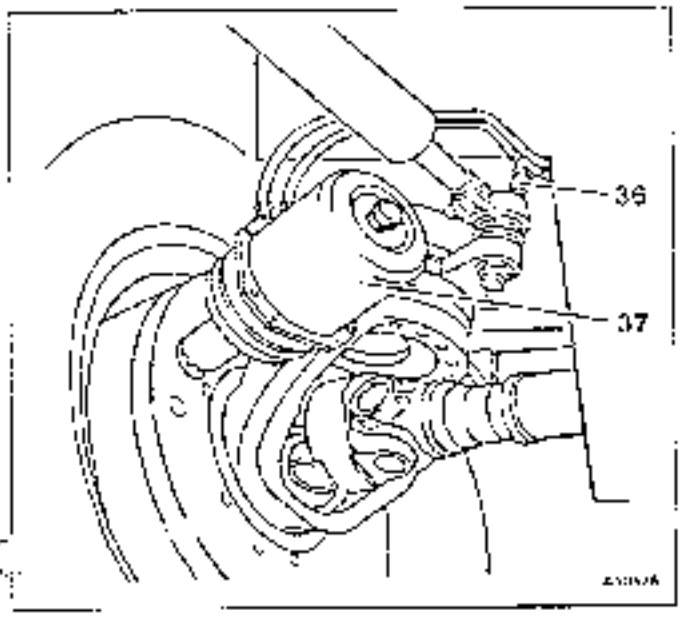


34 Working cylinder (Item 91*) for engaging the drive of the front axle



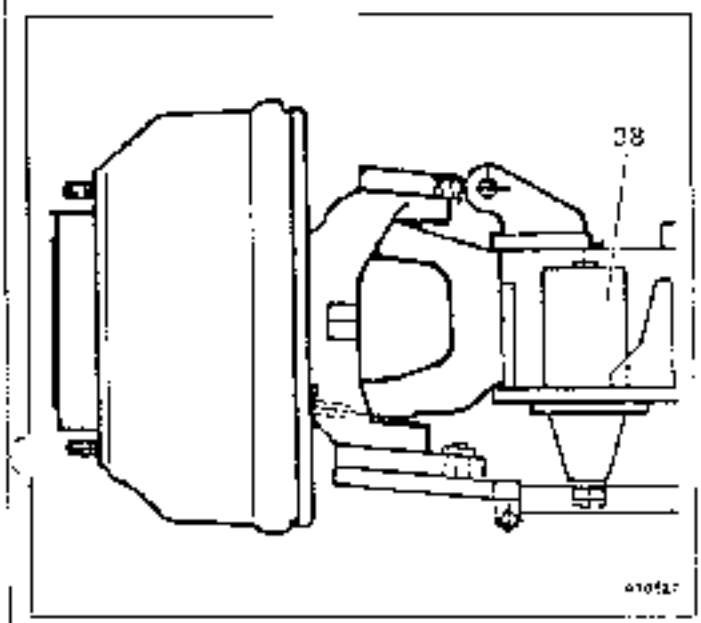
35 Working cylinder (Item 96*) for engaging the power take-off

The following parts are attached to the rear axle:



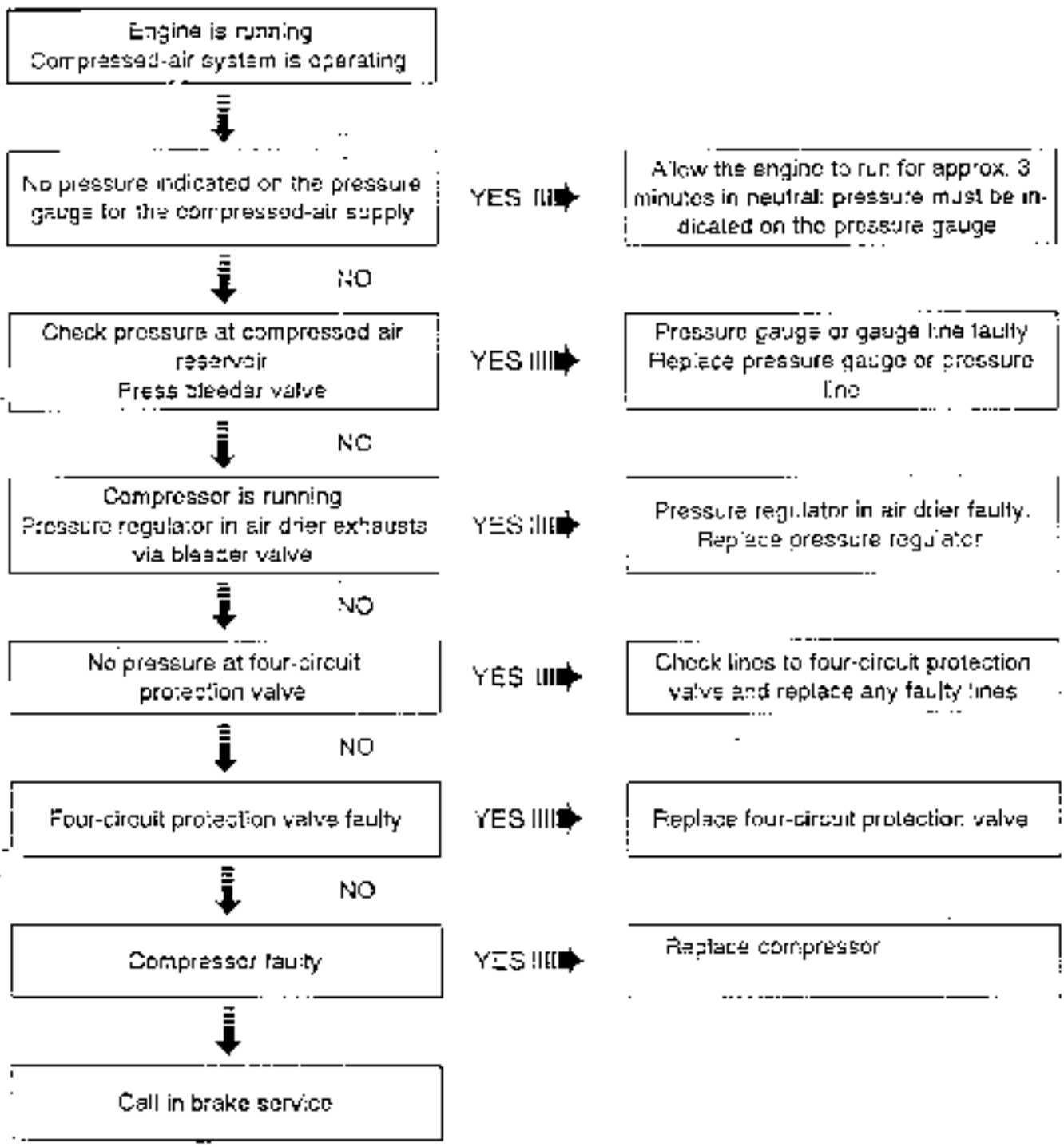
36 Testing connection (item 20*) on the left-hand wheel

37 Spring brake diaphragm cylinder (item 16*)



38 Diaphragm cylinder (item 26*) on the right-hand front side of the axle for unlocking the steering system

Malfunctions



1.13.2 Technical data

Compressor:	Single-cylinder compressor, flange-mounted on the engine
Air drier:	Air drier with integrated heating cartridge and separate conditioning tank The heater switches on at temperatures below 10 °C
Pressure regulator:	Built in to the air drier
	Cut-out pressure 7.5 bar
	Switching range 0.6 – 0.1/-0 bar
	Connection for external filling and for filling the tyres
Protection valve:	Four-circuit protection valve
	Protected pressure 6.7 ± 0.3 bar
	The air reservoirs of compressed-air circuits I and II are initially filled up to a protected pressure of 7.0 bar
	Then the reservoirs in compressed-air circuit III are filled
Air reservoirs:	1 x 20 l air reservoir for circuit I (service brake and secondary consumers)
	1 x 30 l air reservoir for circuit II (service brake)
	1 x 30 l air reservoir for circuit III (parking brake)

1.13.4 Troubleshooting

Symptoms	Reasons	Action	Comments
If compressed-air circuit 1 fails the pressure drops in all circuits	Four-circuit protection valve (ref.no.3*) faulty	Replace four-circuit protection valve	
In the engaged position compressed-air escapes into the open air through the vent in the vehicle brake valve	Relay valve (ref.no 13*) faulty	Check relay valve. Via control port 41 air can flow to part 22 of the vehicle brake valve and escape into the open through the opened outlet. Replace the relay valve.	
	Vehicle brake valve faulty	Replace vehicle brake valve	
Axle 2 blocks when the brake is pressed part of the way	Pressure-relief valve (ref.no 31*) incorrectly set or faulty	Check and set the pressure at the gauge port on the brake cylinder of axle 2 or replace if necessary	
Pressure regulator keeps switching on and off	Fault in the line connecting the four-circuit protection valve and the pressure regulator	Check line and repair any leaks	
	Pressure regulator faulty	Screw the setting screw on the pressure regulator in one turn and then unscrew again into its original position. If the pressure regulator is not working, replace the pressure regulator	
The pressure in the compressed-air reservoir does not reach the cut-out point	Compressor has no delivery	Replace compressor	
	Pressure regulator faulty (ref.no.1*), switches off too early	Check cut-out pressure and replace pressure regulator if necessary	
	Leak in line between compressor and compressed-air reservoir	Check line and repair any leaks	

Repair procedures

The compressed-air system is inspected with the engine running (in neutral) and the pressure is read off the pressure gauge in the driver's cab. The pressure must be between 6.5 and 7.5 bar.

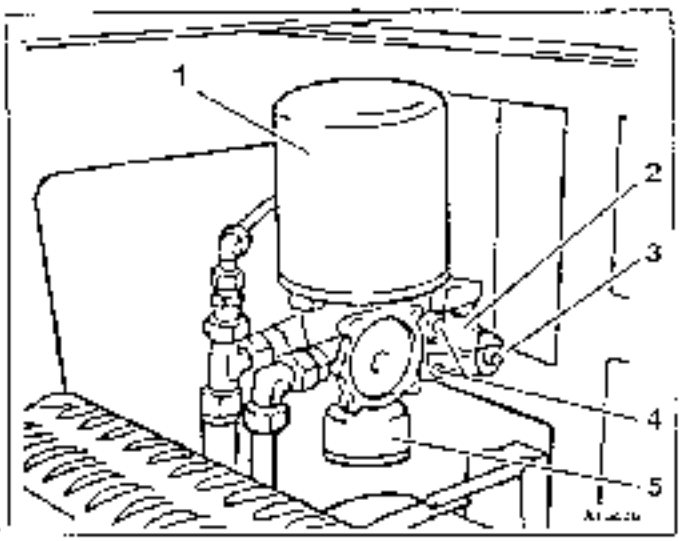
Caution: Before starting repair work, turn off the engine, switch off the ignition and ensure that it cannot be switched on again accidentally.

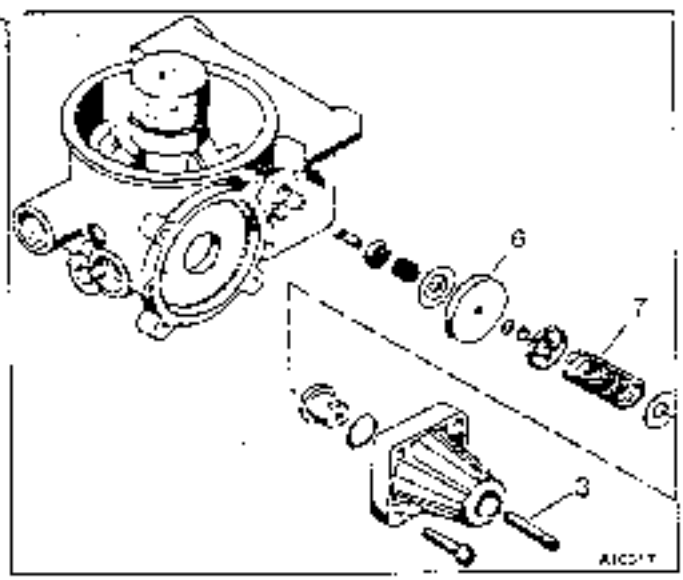
De-pressurize the compressed-air system via the vehicle brake valve or drain all the compressed air out of the affected reservoirs via the bleeder valves.

1 Replacing the pressure gauge or gauge line

Remove the pressure gauge on the front instrument panel in the driver's cab or remove the gauge line of the affected brake circuit. Fit the new components, pressurize the compressed-air system and carry out a functional test.

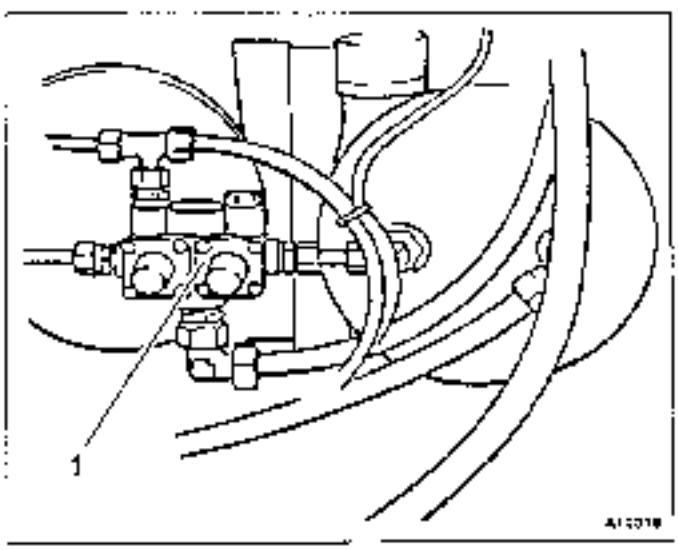
Checking or replacing the pressure regulator on the air drier





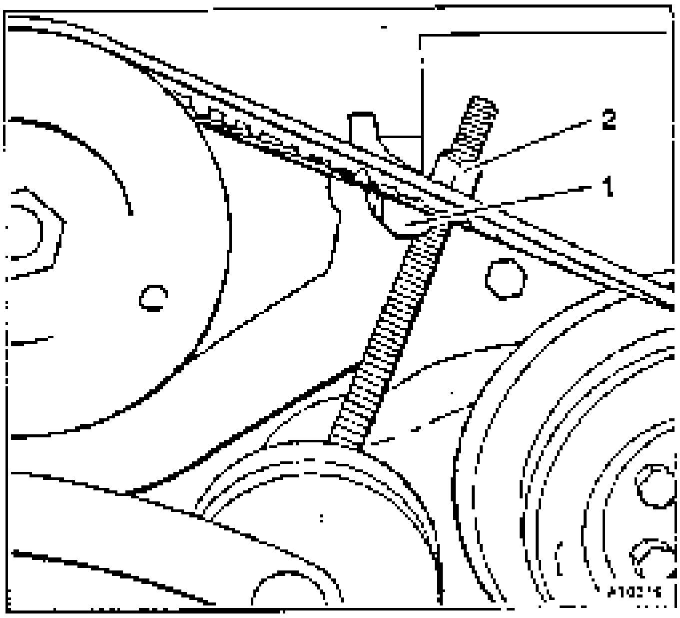
- If the bleeder valve in the silencer (5) releases pressure before reaching the cut-out pressure, check the pressure regulator (2) and replace if necessary.
- Completely drain the conditioning tank and remove the locking screw.
- Completely unscrew the setting screw (3) from the pressure regulator.
- Remove the retaining bolts (4) and remove the pressure regulator. Check the pressure regulator and replace the cup-shaped sleeve (6) and spring (7) if faulty.
- Installation is performed in the reverse sequence of steps.
- Pressurize the compressed-air system and carry out a functional test.
- Set the pressure regulator, adjusting the setting screws (3), until the pressure reaches 7.5 bar.

Replacing the four-circuit protection valve

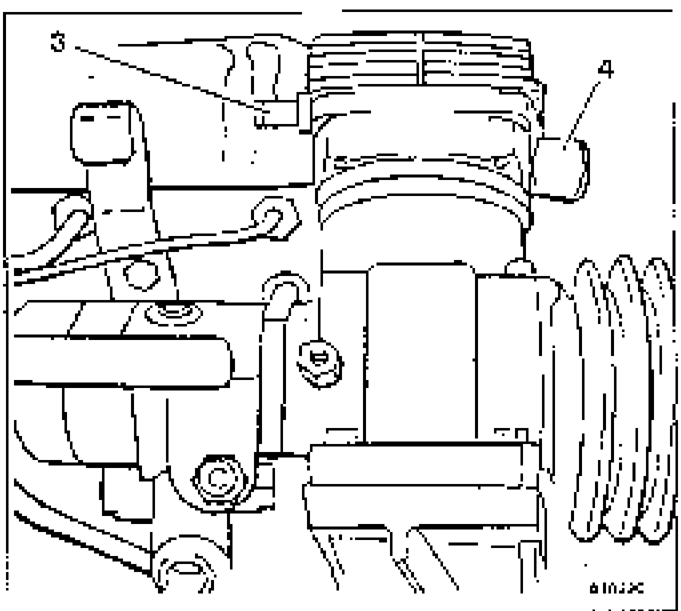


- De-pressurize the compressed-air system as per 1.13.0 above.
- Disconnect the compressed-air lines from the four-circuit protection valve (1).
- Replace the four-circuit protection valve.
- Installation is performed in the reverse sequence of steps.
- Restore the compressed-air line connections to the four-circuit protection valve, checking the O-rings in the screw connections and replacing if necessary.
- Pressurize the compressed-air system and carry out a functional test, adjusting the pressure regulator if necessary.

Replacing the compressor



- Remove the setscrew (1). Slacken the V-belt for the compressor using the turnbuckle (2) and remove.



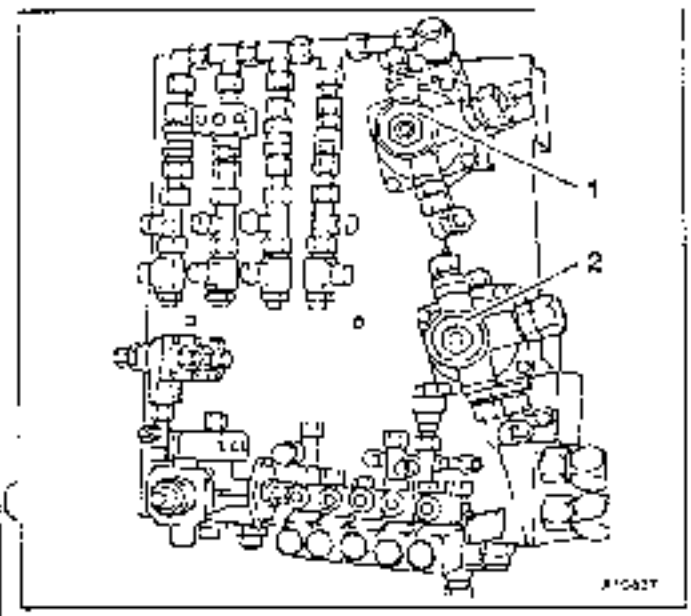
- Disconnect the suction (3) and compressed-air lines (4) from the compressor.
- Unscrew and remove the compressor.

Note: In the event of an oil leak between the compressor console and the control housing, fit a single-piece spacer in the housing.
When fitting a new compressor, check the compressed-air lines between the compressor and the four-circuit protection valve for coking. In the event of any line cross section reduction, replace the lines, the pressure regulator and the four-circuit protection valve.

- Fit the compressor to the console and tighten.
- Restore the suction line (3) and the compressed-air line connections (4) to the compressor, checking the O-rings and replacing if necessary.
- Fit the V-belt to the compressor, tension using the turnbuckle (2) and tighten the setscrew (1).

Replacing relay valves

* = Reference no. in original Krupp compressed air chart



- (1) Relay valve (item 147)
- (2) Relay valve (item 157)
- De-pressurize the compressed-air system as per 1.13.6 above.
- Disconnect the compressed-air lines from the relay valve (1).
- Replace the relay valve.
- Installation is the reverse of removal.
- Restore the compressed-air line connections to the relay valve, checking the O-rings in the screw connections and replacing if necessary.
- Activate the compressed-air system and carry out a functional test.

Note: If compressed air is still escaping from the vehicle brake valve, the brake valve should be replaced (

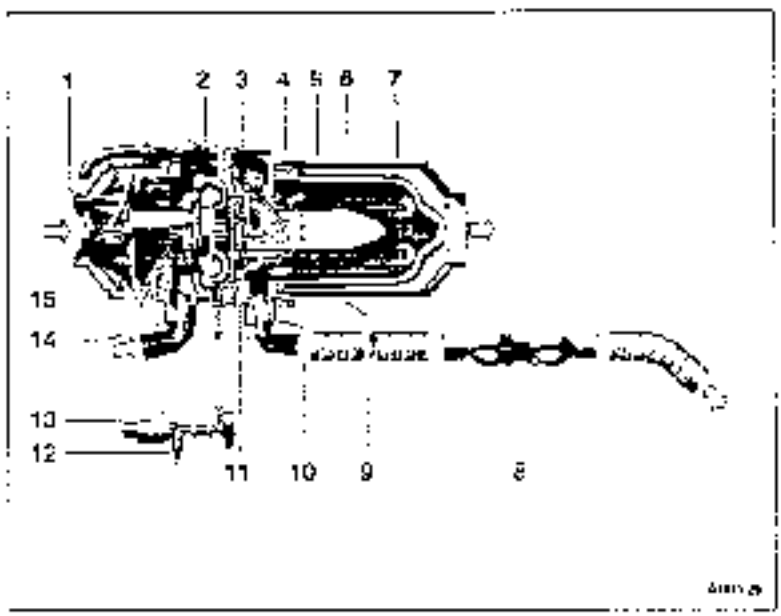
Battery box heating system

Operation

When the temperature outside is very low the battery box can be preheated with an air heater.

The heater is inside the storage box and is attached in front of the battery box. The hot air is blown by a fan into the battery box and from there to the diesel engine for preheating the cylinder heads.

Heat is produced by combusting fuel from the tank of the carrier engine.



1	Hot air fan
2	Combustion air fan with motor
3	Glow plug
4	Flame detector
5	Thermostat
6	Combustion tube
7	Heat exchanger
8	Exhaust silencer
9	Heat pipe
10	Exhaust
11	Evaporator (Vlies)
12	Fuel connection
13	Metering pump
14	Combustion air inlet
15	Safety switch

Note: Switching on the heater repeatedly without bleeding the fuel supply system leads to premature glow plug wear.

Bleeding the fuel supply system

Connect 24 V (–) at one-second intervals with a cable to the connection of the metering pump (pump is controlled by pulses) until all fuel lines are filled.

Caution: When carrying out electric welding on the crane, remove the fuses for the heating system to protect the control unit.

Activating the heater

Plug B1 (A2*) of the control unit is constantly connected to plus through fuses F1/1 and F5/1. When the heater is switched on, positive current is also supplied to the control unit's electronic system via control unit plug B3 (A9*).

- Indicator lamp H* lights up.
- The pre-heating system is switched on.
- After pre-heating (approx. 90 seconds), positive cycle voltage is applied through transistor V101 to control unit plug A5 (D3*). From control unit plug A5 (D3*), metering pump Y is served via thermostat B2 and safety switch S6.
- The safety period (approx. 90 seconds) and fuel supply time (approx. 5 seconds) begin.
- When the fuel supply time has elapsed, motor M is switched on via control unit plug A2 (D1*).

If a flame is produced during the safety period, the flame sensor B1 indicates "bright". The safety period is interrupted and the glow plug switches off. This process normally takes approx. 15 seconds.

Repeated start: If no flame is produced during the safety period, a second attempt at starting the system is initiated automatically.

Run-on

The run-on period consists of the cooling down period for the flame sensor (approx. 20 seconds) and an electric run-on period lasting 140 seconds. If the flame sensor does not indicate "dark" after a period of 80 seconds, the control unit initiates the electric run-on period of 180 seconds so that the heater is always switched off after 260 seconds.

The drive continues to run during the run-on period. The run-on period serves to ventilate and remove gases from the combustion chamber and to cool down the heat exchanger to prevent damage due to overheating.

At the end of the run-on period motor M stops. The heating system is then no longer in operation.

1.19.2 Technical data

Heater

Manufacturer:	Webasto
Model:	HL-32 D
Type:	Air heater with vaporizing burner
Output:	Full load 2750 kcal/h Partial load 1400 kcal/h
Fuel:	Diesel
Power supply	24 Volt

Fan

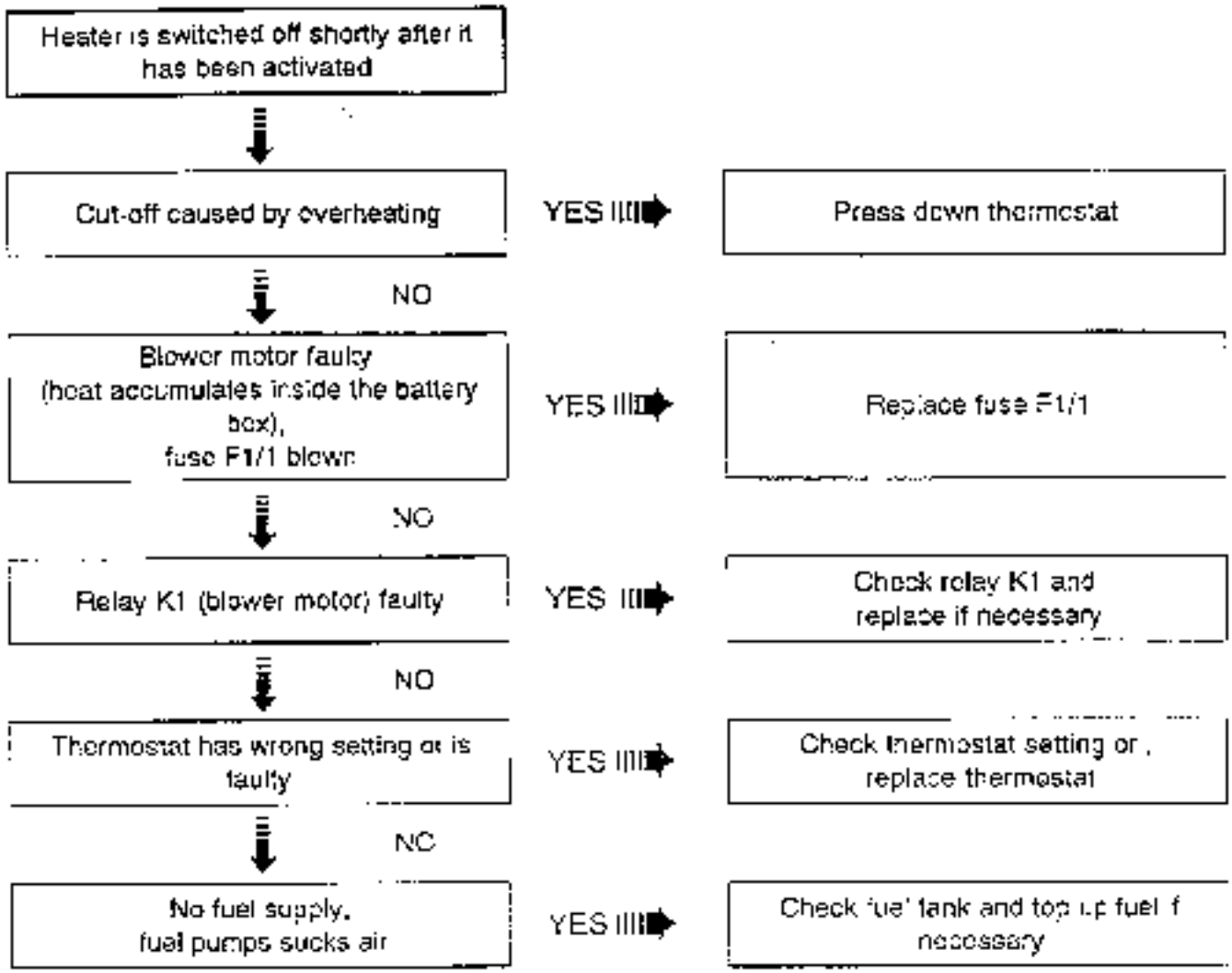
Manufacturer:	Pabst
Model:	Multifan 3314
Type:	Axial fan
Output:	80 m3/h
Power supply:	24 Volt

Malfunctions and remedies

Note: The malfunctions described in the following are restricted to the peripheral equipment. If the heater is not working properly please refer to the "Webasto" documentation.

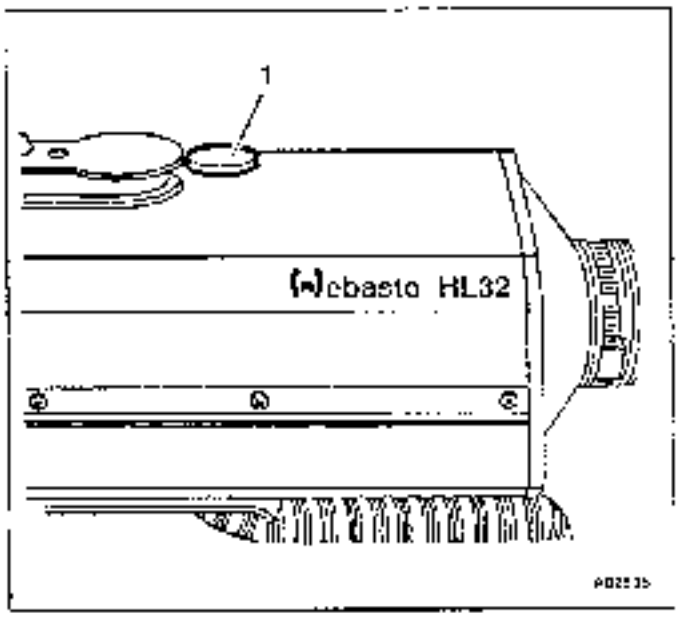
Battery box heating system does not work

Malfunction (if NO, continue to next row)		Remedy
Fuse F1/1 or F5/2 blown	YES	Replace fuse F1/1 or F5/2
Fuel supply interrupted	YES	Check fuel tank and top up fuel if necessary
Blocked fuel filter	YES	Clean or replace fuel filter
Selector switch faulty	YES	Check switch and replace if necessary
Control unit faulty	YES	Replace control unit
Heater faulty	YES	Replace heater



Clearing the thermostat of the battery box heating system

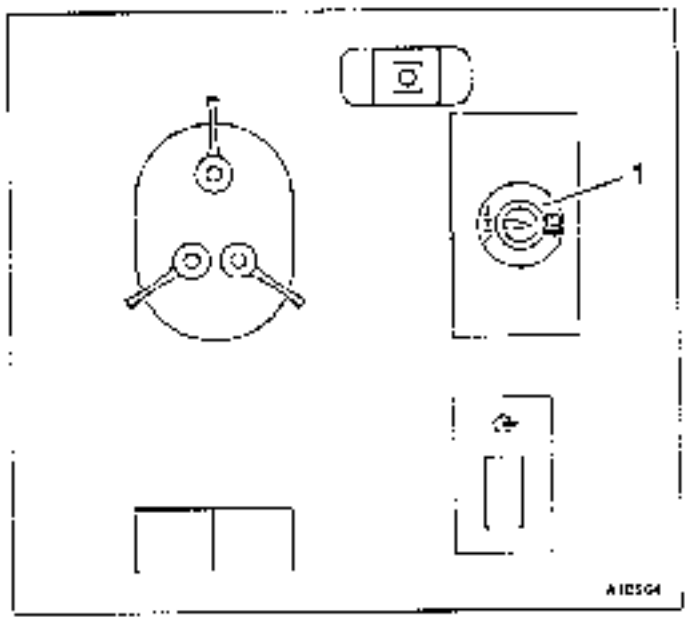
If the heating system is switched off due to overheat the thermostat can be pressed down for clearance.



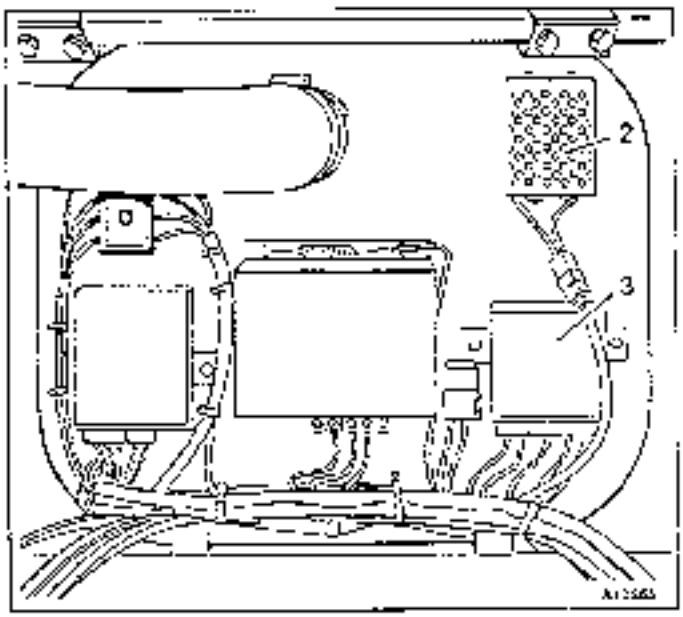
- Press down the cap (1). By pressing the cap a pin on the thermostat is pushed down so that the thermostat is cleared

Repair procedures

Note: Troubleshooting and repairs are described in a separate Webasto workshop manual.



The switch (1) for the battery box heating system is on the rear side instrument panel in the driver's cab.



The protective resistor (2) of the glow plug and the control unit (3) are attached to the rear cover on the rear wall of the storage box.

Hoist

Description of operation

Lifting

When the control lever is operated, the 6 bar pressure switch (P1) in the control line (pilot valve for pump P1) is activated. The triggering of the pressure switch via relay K6 (located in the front superstructure instrument panel) means that current flows to the directional control valve (1Y1). The directional control valve opens, allowing the control pressure to act upon the hoist brake. The hoist brake is opened. At the same time, the directional control valve HW-S/H is activated via control port 2.

The hydraulic oil now flows from pump P1 via the rotary connection (duct 2) and the directional control valve to the hoist motor (port B1). The hoist motor commences turning in the direction "lifting".

Maximum pressure for lifting is 240 bar (depending on the load). The pressure can be set on relief valve DB–HW. The return line oil flows from motor port A back into the oil tank via the directional control valve.

Lowering

When the control lever is operated, the 3 bar pressure switch (P2) in the control line (pilot valve for pump P1) is activated. The triggering of the pressure switch via relay K7 (located in the front superstructure instrument panel) means that current flows to the directional control valve (1Y1). The directional control valve opens, allowing the control pressure to act upon the hoist brake. The hoist brake is opened. At the same time, the directional control valve HW-S/H is activated via control port 1.

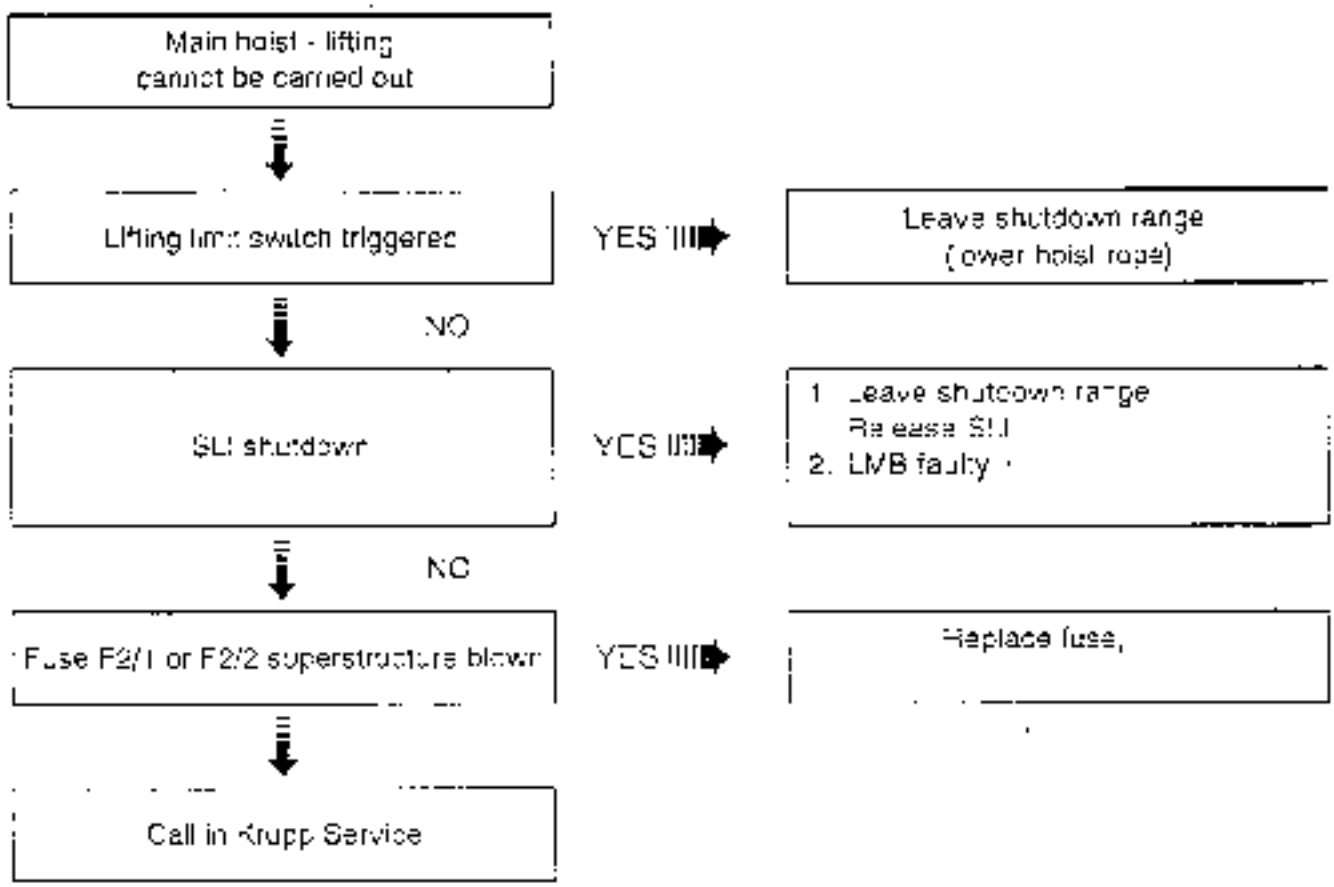
The hydraulic oil now flows from pump P1 via the rotary connection (duct 2) and the directional control valve to the hoist motor (port A1). At the same time, the hydraulic pressure passes through throttle valve SH6 to the lowering brake valve.
The lowering brake valve is opened, and lowering begins. The return line oil flows from hoist motor port B back into the oil tank via the lowering brake and directional control valves.

Technical data

Make:	Siebenhaar
Model:	CUHE 110L2-34.4-HX (2 possible versions)
Drum diameter:	255 mm
Rope diameter:	13 mm
Rope length:	135 m
Max. rope pull:	29.0 kN / cord
Drive:	Hydraulic axial piston variable displacement motor
Make:	Hydromatik
Model:	A2FM 45/61 W-PZ 602
Output:	P_{max} = 129 kW
Brake:	Hydraulic disc brake

Malfunctions and action

Lifting



Lowering

Main hoist - lowering cannot be carried out

Lowering limit switch triggered — YES → 1 Check condition of rope on drum (minimum of 5 turns on drum ?) 2 Raise hoist rope - leave shutdown range

NO

Fuse F 2/1 blown — YES → Replace fuse.

NO

Call in Krupp Service

Symptoms, reasons and action

Hoist - lifting and lowering cannot be carried out

Symptoms	Reasons	Action	Comments
Hoist not working, pressure P1 and pressure Pst are present	Directional control valve HW-S/H on control block or solenoid valves 1Y1 or 7Y0		
	– not working	Check fuse F2/1 or F 2/2, and pressure switches P1 and P2, and replace if necessary	
	faulty	Replace valves	
Hoist not working, there is a reading on the pressure gauges	Hoist motor is faulty	Check motor and replace if necessary	
Hoist - lifting and lowering cannot be carried out, all other hoist functions operating	Directional control valve control block, solenoid head 1Y1 or 7Y0	Carry out all checks with the engine running and operating the control lever "lifting". Before any checks are carried out, ensure valves, relays and switches are earthed	
	– No +24 V voltage	Check voltage on the superstructure instrument panel	
		– Check plug contact X2/1 (+) and (-) from relays K6 and K7	
		– Check plug contact X22/2 and X22/3 (+) and (-) from pressure switches P1 and P2 when control lever is operated	
		– Check relays K6 and K7, and replace if necessary	
		– Check pressure switches P1 and P2, and replace if necessary. Check relay K5 and SLI valve	
	– Solenoid head faulty, (+) is present, but switching does not take place	Replace solenoid head	
	– Pilot valve (control lever) faulty	Check pilot valve, and replace if necessary	

Hoist - lowering cannot be carried out

Symptoms	Reasons	Action	Comments
Hoist - lowering cannot be carried out	Lowering limit switch (6S1)		
	– shut down	Raise hoist. Leave shutdown range. Check condition of rope on drum. A minimum of three turns must be left on the drum	
	– incorrectly set	Check setting of lowering limit switch. Re-set lowering limit switch	
	– faulty	Replace lowering limit switch, set and check. Shutdown should take place during lowering when there is a minimum of three turns on the drum	
	Brake valve 1Y1 is not working	– Check current at plug contact. – If there is current, solenoid head faulty, press solenoid head by hand, if valve is working, replace solenoid head – If valve is faulty, replace valve	

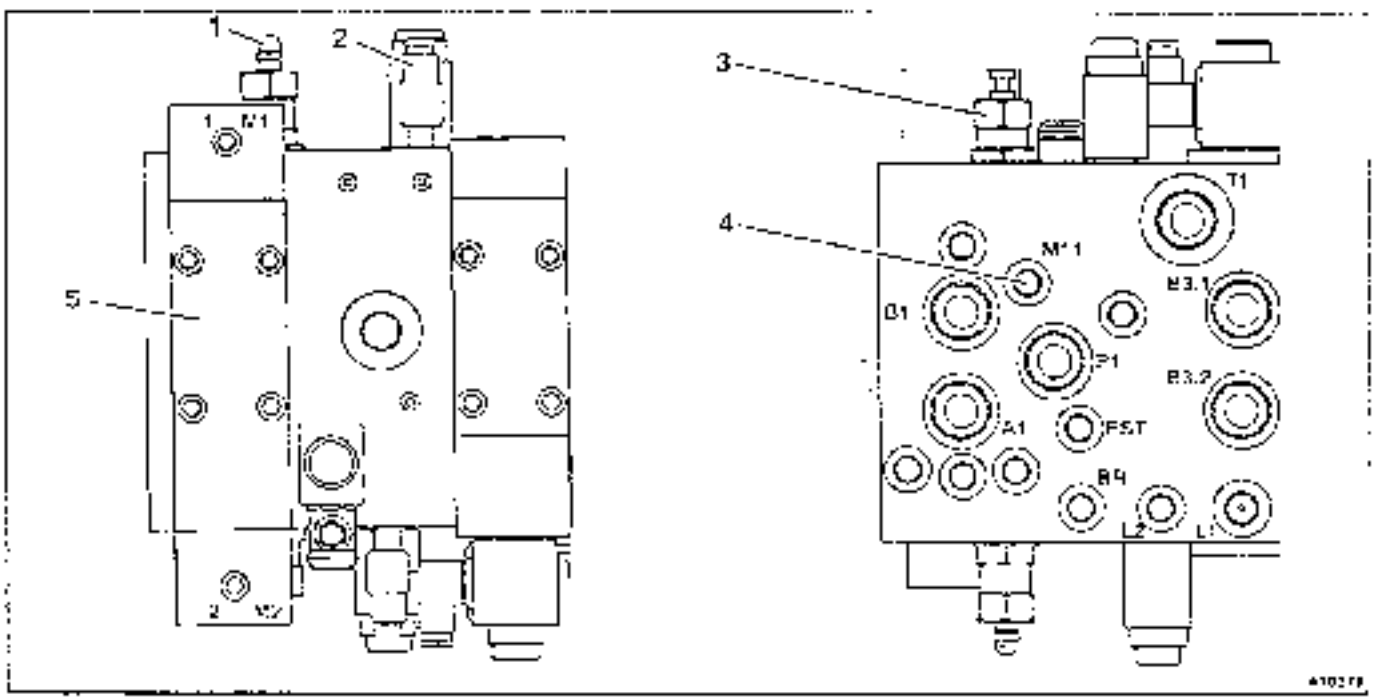
Adjusting procedures

Lifting

- Connect the 400 bar pressure gauge to gauge port M11 (4) on the superstructure control block.
- Disconnect the plug from solenoid valve 1Y1 (2).
- Start the diesel engine and activate the auxiliary drive.
- Move the control lever to "lifting".
  The hydraulic oil flows from pump P1 via control valve HW-S/H (5) and applies pressure to the hoist motor with the hoist brake engaged.
- The pressure gauge must show a hydraulic pressure reading of 240 bar. If the pressure reading is more or less than this figure, re-set the pressure relief valve DB-HW/H (3), see Section 2 8 5 'Adjusting procedures'.
- Re-connect the plug to solenoid valve 1Y1.

Lowering

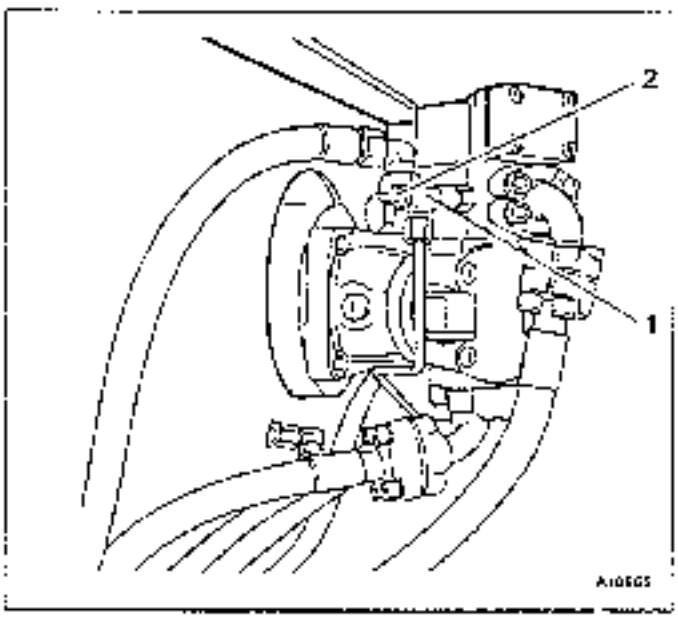
- Connect the 400 bar pressure gauge to gauge port M11 (4) on the superstructure control block.
- Disconnect the plug from solenoid valve 1Y1 (2).
- Start the diesel engine and activate the auxiliary drive.
- Move the control lever to "lowering".
  The hydraulic oil flows from pump P1 via control valve HW-S/H (5) and applies pressure to the hoist motor with the hoist brake engaged.
- The pressure gauge must show a hydraulic pressure reading of 120 bar. If the pressure reading is more or less than this figure, re-set the pressure relief valve DB-HW/S (1), see Section 2 8 5 'Adjusting procedures'.
- Re-connect the plug to solenoid valve 1Y1.



- Setting the lowering brake valve

Note: If the hoist runs jerkily during lowering, adjust the hydraulic oil flow rate at throttle valve SH8.

- Start the diesel engine and activate the auxiliary drive. Let the engine run in neutral.
- Move the control lever slightly towards "lowering"; the hoist commences turning.

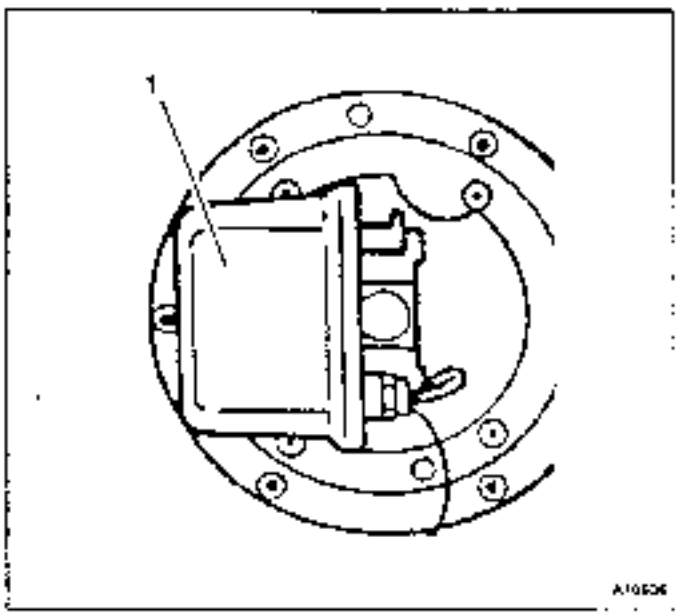


- Completely close throttle valve SH8 (1) using the setting screw (2); the hoist ceases turning.
- Slowly open throttle valve SH8 until the hoist turns smoothly.

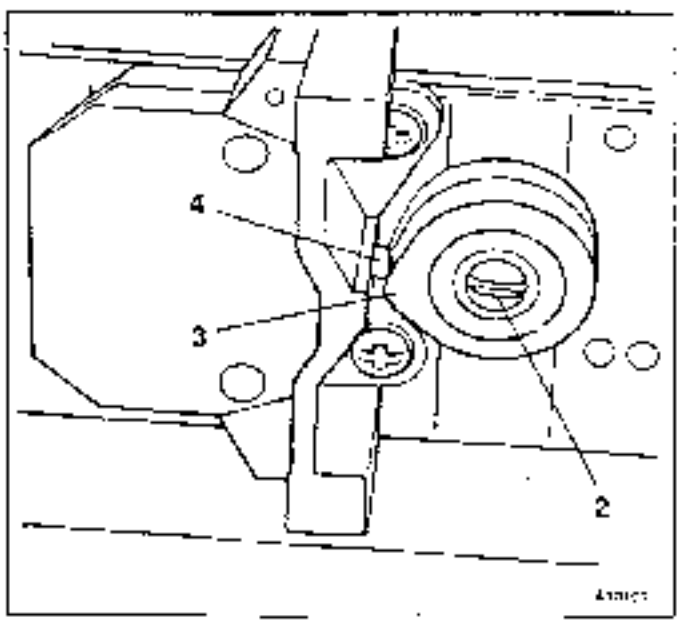
Setting the lowering limit switch

Caution: The lowering limit switch must always be re-set following repairs to the hoist or a change of rope. Always replace a faulty lowering limit switch !

- Reeve the hoist rope with four falls on the hook block.
- Fully extend the boom and raise into the end position.
- Lower the hook block until there are only five rope turns remaining on the hoist drum.



- Remove the cover from the lowering limit switch (1).
- Loosen the cam disc (3) retaining bolt (2).
- Turn the cam (3) until the microswitch (4) can be heard to engage.
- Tighten the retaining bolt (2).
- Replace the cover on the lowering limit switch and secure ensuring that the seal is fitted correctly.
- Raise the hook block until there are approx. 10 rope turns on the hoist drum, and then re-lower the hook block.
- The lowering limit switch must de-activate the hoist when there are still five rope turns on the hoist drum.



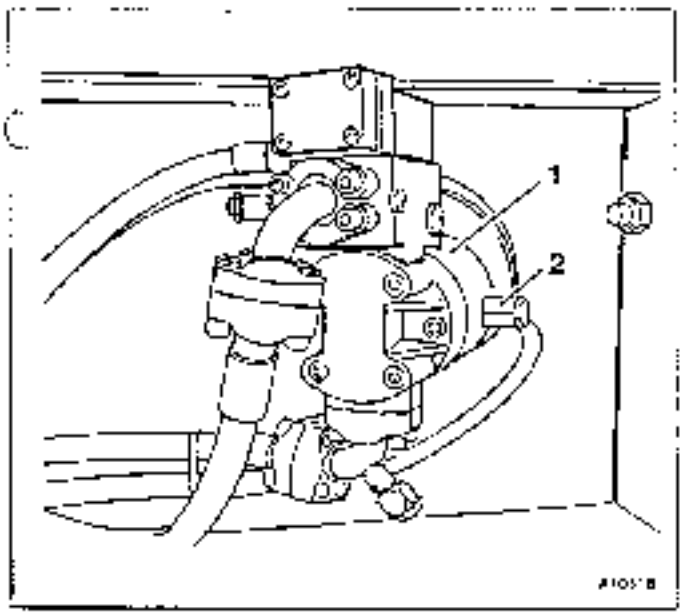
Repair procedures

The following checking and repair procedures are contained in sections 'General repairs to the electrical and hydraulic systems':

- Checking and replacing the solenoid valves
- Checking and replacing the pilot valves
- Checking and replacing the directional control valves
- Checking and replacing the pressure switches
- Checking and replacing the electric control system and checking the contacts

Checking the hoist motor, replacing the motor

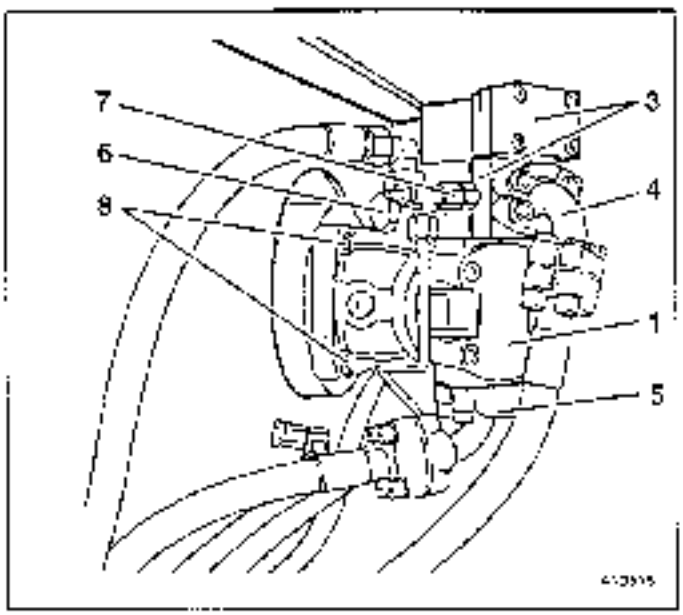
Checking the hoist motor consists of inspecting the motor for oil leaks



- Warm up the hydraulic oil to a temperature of approx. 40 °C by, for example, retracting the telescope.
- Switch off the diesel engine and ignition, securing both against unauthorized activation.
- Disconnect the electric plug from brake valve 1Y1.
- Disconnect the leakage oil line (2) from the hoist motor (1)
- Hold the leakage oil line in a 10 l measuring container.
- Activate the hydraulic system.
- Hold the control lever in the lowering position for approx. 1 minute. Leakage oil then flows into the measuring container. If more than 3.9 l of leakage oil is collected, replace the hoist motor.

Replacing the hoist motor

Caution: Prior to commencing repairs, remove the hook block or place the block on the ground. Next, switch off the diesel engine and ignition, securing both against unauthorized activation.



- Disconnect the hydraulic lines (4) to (7) from the hydraulic motor (1) and from the brake shut-off valve (3), collecting any escaping oil in a suitable container.
- Remove the motor retaining bolts (8).
- Remove the hoist motor.
- Remove the brake shut-off valve (3) from the hoist motor.

Install the new hoist motor in the reverse sequence of steps, and fit new seals.

– If necessary, fill the hydraulic system with hydraulic oil.
– Bleed the hydraulic system.

Note: When any work is carried out on open hydraulic systems, ensure that the assembly area is kept meticulously clean. Prior to fitting, clean all new components thoroughly.

Checking the hoist brake, replacing the brake

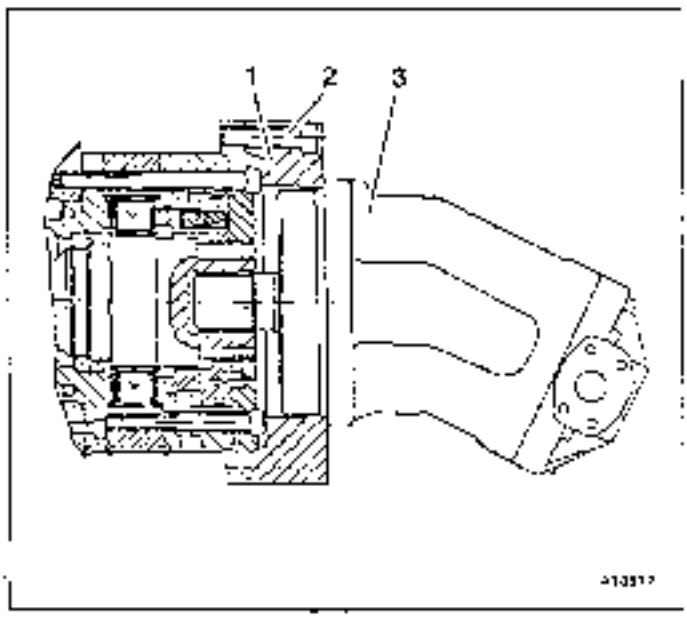
Checking the hoist brake

- Disconnect the plug from solenoid valve 1Y1.
- Start the diesel engine and activate the auxiliary drive.
- Move the control lever in the direction of "lifting".

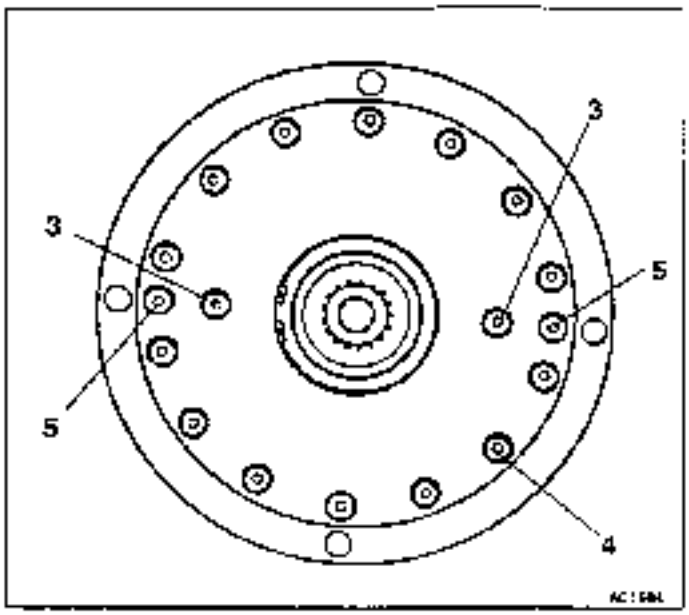
The hoist must not turn. If there is any jerking movement from the hoist, the hoist brake must also be replaced immediately.

Replacing the hoist brake

Caution: Prior to commencing repairs, remove the hook block or place the block on the ground. Next, switch off the diesel engine and ignition, securing both against unauthorized activation.



- Remove the hoist motor (3).
- Remove the motor flange (1), unscrew the bolts (2).
- Disconnect the hydraulic lines from the hoist brake.



- Release the disc brake mechanically, inserting threaded bolts into the threaded bores (3) in the piston.
  Pull the piston up to the brake intermediate flange screwing in each bolt alternately one turn.
- Unscrew the hoist brake retaining bolts (4) with the exception of the two horizontal bolts (5) opposite each other.
- Remove the brake from the hub.

Note: Retaining the two horizontal bolts (5) in place prevents the discs from falling out.

Fitting the new hoist brake is a reversal of removal.

Derricking gear

Description of operation

Lowering the boom

When the control lever is moved to the lowering position, the directional control valve WW-E/A is activated. The directional control valve allows the boom to be lowered.

From pump P2, the hydraulic oil flows via the rotary connection - duct 3 - and the directional control valve direct to port X on the lowering brake valve. At a pressure build-up of approx. 5 bar, the lowering brake valve SBV-W opens. This allows the oil from the piston chamber to flow into the tank via the directional control valve. The dead weight of the boom presses the piston rod into the derricking cylinder. The boom lowers.

Raising the boom

When the control lever is moved to the raising position, the directional control valve WW-S/A is activated. The directional control valve allows the boom to be raised .

From pump P2, the hydraulic oil flows via the rotary connection - duct 3 -, the directional control valve and the lowering brake valve SBV-W to the derricking cylinder piston chamber. The hydraulic pressure must not exceed 250 bar. The displaced hydraulic oil flows through the control block back into the tank. The boom raises

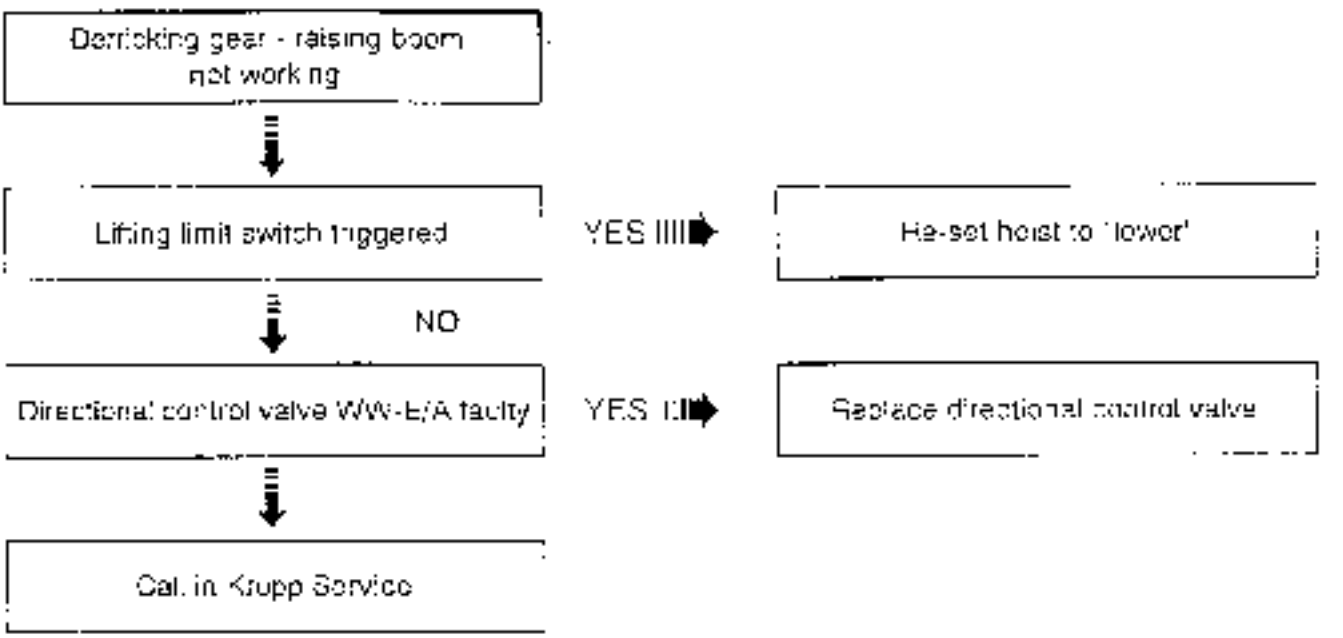
Technical data

Cylinders:	Differential
Adjusting angle	-3° to +80° from the horizontal
Diameter:	190 / 160 mm
Stroke:	2440 mm
Weight:	367 kg

Malfunctions

Raising the boom

Caution These malfunction and troubleshooting procedures cannot be carried out without first activating the auxiliary drive, see Section 1.15 'Hydraulic systems - carrier'



Lowering the boom

Derricking gear - lowering boom not working

SLI shutdown

YES →

1. Move boom out of shutdown range (raise boom)
   Release SLI
2. SLI faulty, see Chapter 4.1 'Safe load indicator'

NO

Lifting limit switch triggered

YES →

Re-set hoist to 'lower'

NO

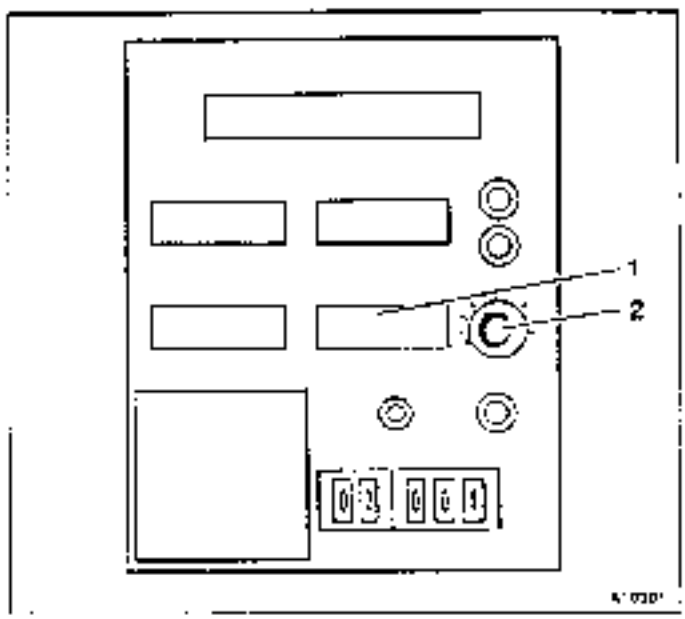
Call in Krupp Service

Symptoms, reasons and action

Symptoms	Reasons	Action	Comments
Boom cannot be raised or lowered	No 40 bar pilot pressure	Check pump P4 and pressure relief valve (DB-40 bar) and replace if necessary	
	Pilot valve (control lever) faulty	Check pilot valve, and replace if necessary	see Section ... 'Repair procedures for the hydraulic system'
	Directional control valve WW-E/A faulty	Check directional control valve, and replace if necessary	
	Pressure relief valve DB-WW (250 bar) faulty	Check pressure relief valve, and replace if necessary	
	Pump P2 faulty	Check pump P2, and replace if necessary	Call in Krupp Service
Boom lowers of own accord	Lowering brake valve faulty	Check lowering brake valve, and replace if necessary	
	Derricking cylinder faulty	Check derricking cylinder, and replace if necessary	
Boom lowers too slowly or not at all	Throttle valve dirty	Clean throttle valve	
	Hydraulic filter dirty	Clean or replace hydraulic filter	
	Lowering brake valve faulty	Replace lowering brake valve	

Adjusting procedures

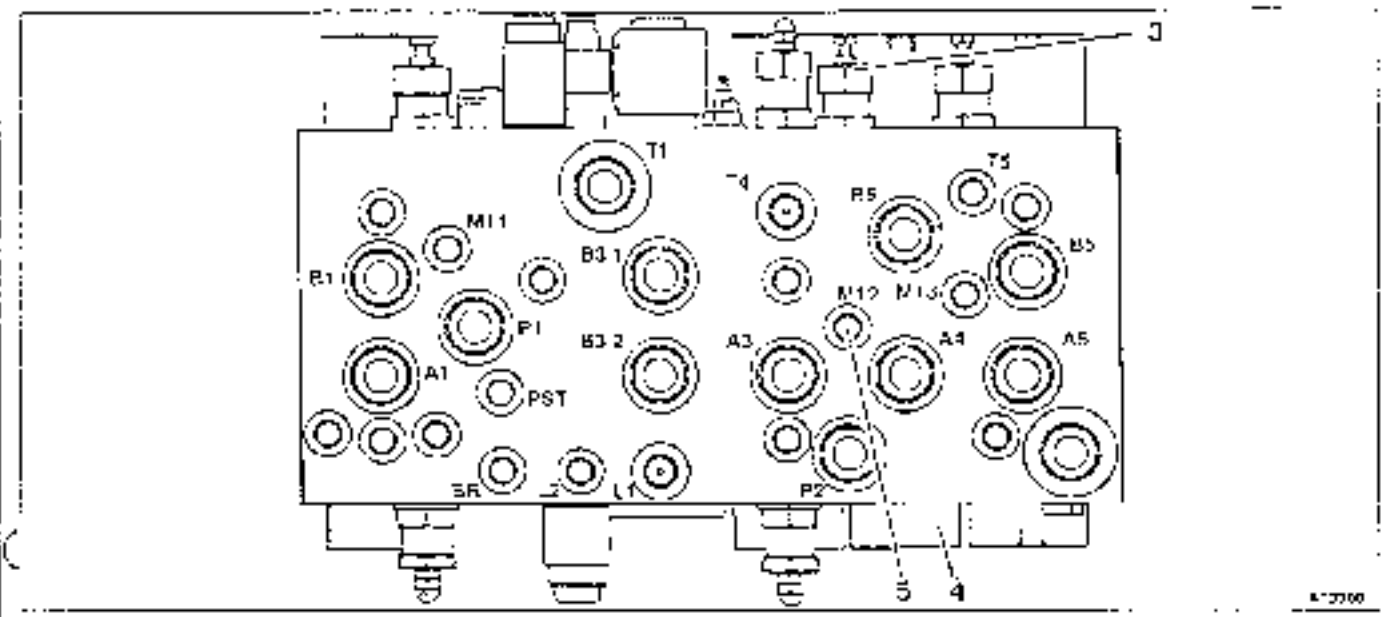
Monitoring the pressure in the derricking cylinder



There is a pressure sensor on the derricking cylinder which transmits the cylinder pressure in the lower chamber (piston chamber) of the derricking cylinder to the SLI via a load cell.

- Set the selector switch (2) on the central SLI unit to position f.
- The gauge (1) then indicates the hydraulic pressure at the piston surface in bar.

Setting the pressure relief valve in the control block



- Connect the 400 bar pressure gauge to gauge port M12 (5) on the superstructure control block
- Start the diesel engine and activate the auxiliary drive.
- Move the control lever in the direction "raising boom".
  The hydraulic oil flows from pump P2 via the directional control valve WW-E/A (4) and the lowering brake valve into the derricking cylinder piston chamber.
- The boom is raised into the steepest position. In this position, the hydraulic pressure reaches its maximum level. The pressure gauge must indicate a hydraulic pressure reading of 250 bar.
- If the pressure exceeds this figure, re-set the pressure relief valve DE WW/E (3).

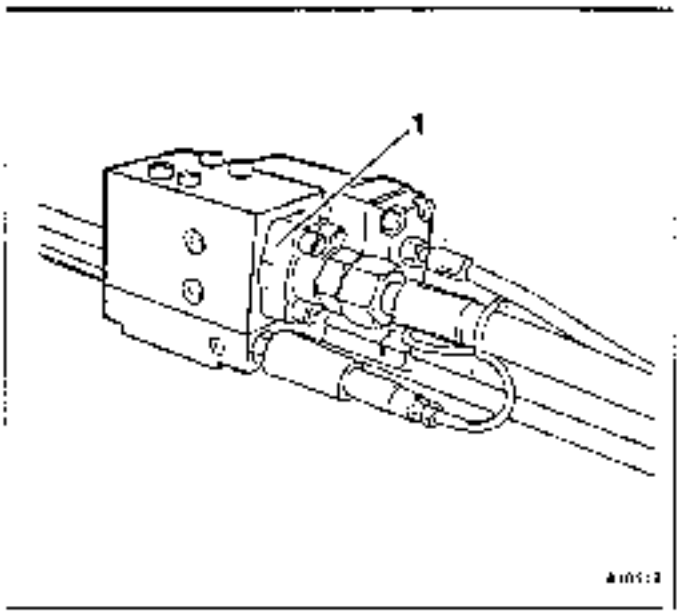
Setting the derricking speed

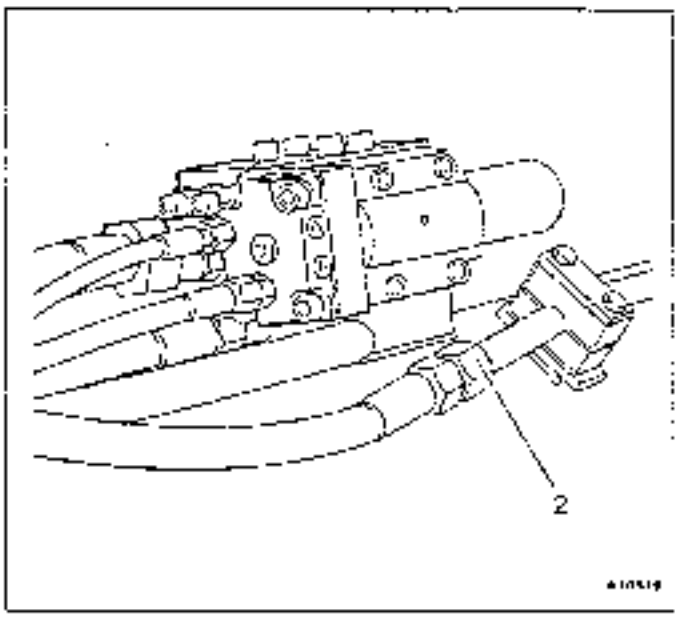
The derricking speed can be set at the brake shut-off valve on the derricking cylinder.

Repair procedures

Checking the lowering brake valve and the derricking cylinder

Note: During these checking procedures oil escapes from the open hydraulic connections. Always keep a suitable container at hand for collecting the escaping oil.



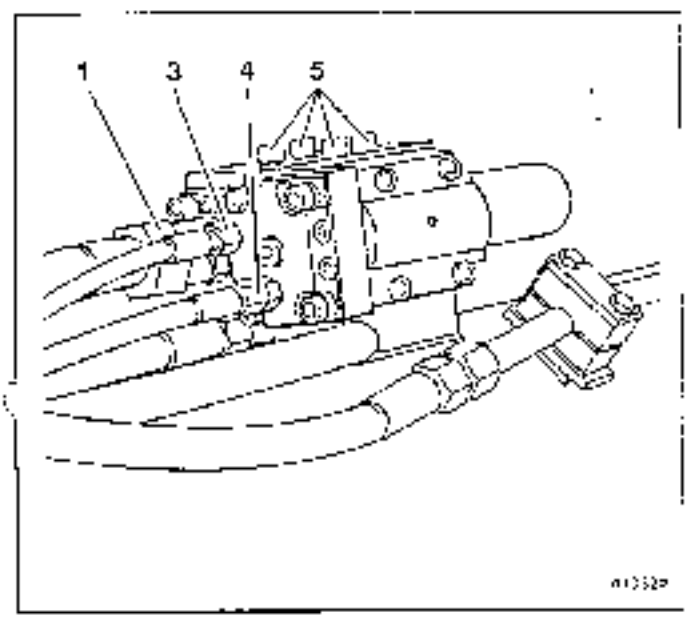


- Raise the boom to a position of approx. 45°.
- Extend the boom to a maximum length of one telescope section.
- Affix a load slightly lower in weight than the shutdown value.
- Raise the load no higher than 50 cm off the ground.
- Disconnect the hydraulic line from port A of the boom-raising line (1) on the lowering brake valve.
- If the valve emits a clicking sound and oil escapes from the port, the lowering brake valve must be replaced.
- Upon replacement of the lowering brake valve, the check should be repeated.
- If there is no hydraulic oil leak, re-secure the hydraulic line.
- Disconnect the hydraulic line from the upper derricking cylinder barrel of the boom-lowering line (2).
- If oil escapes from the port when the boom is lowered, the derricking cylinder is faulty. The derricking cylinder is faulty and must be replaced.
- Upon replacement of the derricking cylinder, the check should be repeated.
- Upon completion of the check, re-secure the hydraulic lines.

Note: Check the O-rings before re-storing the pipe and flange joint connections. Replace the O-rings if necessary.

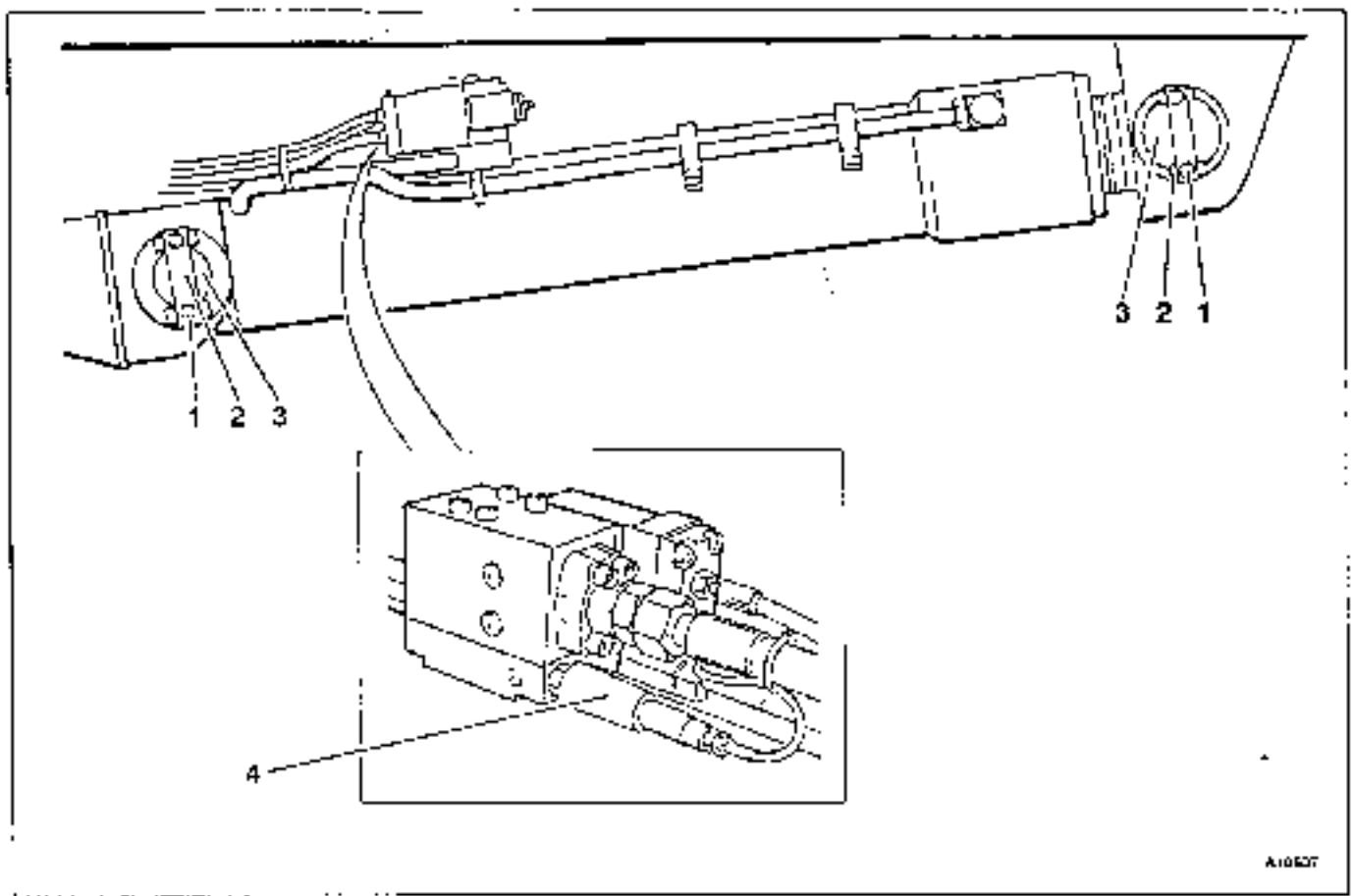
Replacing the lowering brake valve

Caution: Prior to commencing repairs, fully retract the boom and place on the boom support. Next, switch off the diesel engine and ignition, securing both against unauthorized activation.



- Disconnect the hydraulic lines (1), (3) and (4) from the lowering brake valve
- Remove the four lowering brake valve retaining bolts (5) and remove the valve
- Install a new lowering brake valve, fitting new seals between the derricking cylinder and the lowering brake valve and to the pipe and flange joint connections.

Replacing the derricking cylinder



- Turn the superstructure sideways through an angle of 90°. Place the boom on a support assembly or support with a second crane.
- Lower the hook block onto the ground.
- Switch off the diesel engine and ignition, securing both against unauthorized activation.
- Disconnect the hydraulic lines from the derricking cylinder, collecting the hydraulic oil in suitable containers.
- Remove the electric plug from the pressure sensor (4).
- Remove the retaining bolts (1) from the securing plates (2).
- Support the derricking cylinder with a crane.
- Remove the bearing pins (3) from the derricking cylinder, using a hydraulic extractor if necessary.

Caution: The new derricking cylinder is filled with oil. Open the hose connections with caution!

- Fit the new derricking cylinder in the reverse sequence of steps.
- Activate the system and conduct a functional test.

Telescope gear control

Description of operation

Telescope gear - extending

When the control lever is moved towards "extending", directional control valve TW-E/A is activated. The directional control valve opens up telescope cylinders I or II.

From pump P2, the hydraulic oil flows via the rotary connection - duct 3 - and the directional control valve to telescope cylinders I or II

Selection of telescope cylinders I and II is made via switch S15 behind the slewing/telescope gear control lever. Switch S15 triggers solenoid valve 3Y2, which activates change-over valve UW (carrier) I/II. Change-over valve UW I/II opens up telescope cylinders I or II

Telescope cylinder I

Telescope cylinder I extends the single-stage telescope section I. Switch S15 occupies normal position and solenoid valve 3Y2 is dead. The hydraulic oil flows through directional control valve TW-E/A and change-over valve UW I/II to telescope cylinder I, from where the hydraulic oil flows through the shut-off valve and the longitudinal bore in the piston rod in the piston chamber. The hydraulic oil displaced from the piston chamber flows back into the hydraulic oil container through the directional control valve and the control block.

Telescope cylinder II

The two-stage telescope cylinder II extends telescope sections II and III. Solenoid valve 3Y2 is activated by switch S15. The hydraulic oil flows through directional control valve TW-E/A and change-over valve UW I/II to telescope cylinder I, from where the hydraulic oil flows into the piston rod through a telescopic duct as far as the bottom of the piston chamber. From the bottom of the piston chamber, the hydraulic oil flows down a line to telescope cylinder II, from where, through a shut-off valve, it continues flowing as far as the piston chamber of cylinder stage 1, extending as it does so telescope section 1.

Extending telescope stage 1 opens up telescope stage 2, and telescope section II is extended by telescope cylinder II

The hydraulic oil displaced from the piston chamber flows back into the hydraulic oil container via the piston ring chamber of telescope cylinder I, the directional control valve and the control block.

Telescoping gear - retracting

When the control lever is moved towards "retracting", directional control valve TW-E/A is activated. The directional control valve opens up telescope cylinders I or II

From pump P2, the hydraulic oil flows via the rotary connection - duct 3 - and the directional control valve to telescope cylinders I or II.

Selection of telescope cylinders I and II is made via switch S15 behind the slewing/telescope gear control lever. Switch S15 triggers solenoid valve 3Y2, which activates change-over valve UW (carrier) I/II. Change-over valve UW I/II opens up telescope cylinders I or II.

Telescope cylinder I

Telescope cylinder I retracts the single-stage telescope section I. Switch S15 occupies normal position and solenoid valve 3Y2 is dead. The hydraulic oil flows through directional control valve TW-E/A onto the ring surface of telescope cylinder I, inside which a shut-off valve opens simultaneously, allowing the hydraulic oil displaced from the piston chamber to flow back into the hydraulic oil tank through the change-over valve, the directional control valve and the control block.

Telescope cylinder II

The two-stage telescope cylinder II retracts telescope sections II and III. Solenoid valve 3Y2 is activated by switch S15. The hydraulic oil flows through directional control valve TW-E/A and the ring chamber of telescope cylinder I to the ring chamber of telescope cylinder II. At the same time, the shut-off valves in telescope cylinders I and II are opened, allowing the hydraulic oil displaced from the piston chambers of telescope cylinders I and II to flow back into the hydraulic oil tank via the piston chamber of telescope cylinder I and through the change-over valve, the directional control valve and the control block, retracting as it does so telescope section III.

When cylinder stage 2 is retracted, oil flows to cylinder stage 1 and telescope section II is retracted by telescope cylinder II.

Boom extends of its own accord without the control system being operated

As a result of the technical design of the two-stage telescope cylinder for telescope sections II and III, it is possible that telescope sections II and III may telescope out of their own accord.

This is prevented by a retaining clamp on the boom between telescope sections II and III.

Caution: Always retract the telescope sections far enough for the bolt to engage in the retaining clamp.

Technical data

Telescope cylinder I:	Single-stage telescope cylinder for telescope section 1 with oil supply to the next, two-stage telescope cylinder, telescope cylinder II
Diameter:	120 / 100 mm
Stroke:	5200 mm
Telescope cylinder II:	Two-stage telescope cylinder for telescope sections II and I 1
Diameter.	Stage I: 130 / 115 mm Stage II: 105 / 185 mm
Stroke.	Stage I. 5220 mm Stage II: 5220 mm

Malfunctions

Retracting

Telescope section I cannot be retracted

↓

Switch in wrong position (toggle switch S 15) — YES → Move switch to correct position (toggle switch S 15)

↓ NO

Call in Krupp Service

2.5.3.2 Extending

Telescope I cannot be extended

↓

Switch in wrong position (toggle switch S 15) — YES → Move switch to correct position (toggle switch S 15)

↓ NO

Lifting limit switch triggered — YES → Leave shutdown range. Lower hoist

↓ NO

SLI shutdown — YES →
1. Leave shutdown range, Release SLI
2. SLI faulty, see Section 'Safe load indicator (SLI)'

↓ NO

Superstructure fuse F 2/1 blown — YES → Replace fuse, see Section 'Electrical system'

↓ NO

Call in Krupp Service

Retracting telescope sections II and III

Telescope section II: cannot be retracted

↓

Switch in wrong position (toggle switch S 15) — YES I:II → Move switch to correct position (toggle switch S 15)

↓ NO

Superstructure fuse F 1/6 blown — YES IIII → Replace fuse, see Section 'Electrical system'

↓ NO

Call in Krupp Service

Extending telescope sections II and III

Telescope sections I/II cannot be extended

↓

Switch in wrong position (toggle switch S 15) — YES IIII → Move switch to correct position (toggle switch S 15)

↓ NO

Lifting limit switch triggered — YES III → Leave shutdown range Lower hoist

↓ NO

SLI shutdown — YES IIII →
1. Leave shutdown range Release SLI
2. SLI faulty, see Section 'Safe load indicator (SLI)'

↓ NO

Superstructure fuse F 1/5 or F2/1 blown — YES III → Replace fuse see Section 'Electrical system'

↓ NO

Call in Krupp Service

Symptoms, reasons and action

Boom cannot be extended or retracted

Symptoms	Reasons	Action	Comments
Boom cannot be retracted or extended. All other crane functions working	Directional control valve TE-E/A faulty	Check directional control valve, and replace if necessary	Call in Krupp Service
	Pilot valve (control lever) faulty	Check connection on pilot valve / pump P4	
		– Measure control pressure at gauge ports M5 and M6	
		– No reading on pressure gauge, Replace control lever	
Boom cannot be retracted or extended, derricking gear not working	Derricking gear pressure relief valve (230 bar) faulty	Check pressure relief valve, and replace if necessary	see Adjusting procedures (max. pressure with a fully extended derricking cylinder)
	Pump P2 faulty	– Check pump pressure	
		– If not reaching maximum pressure, Engage fast speed	
		– If now reaching maximum pressure, pump P2 is faulty and must be replaced	Call in Krupp Service
Boom cannot be extended	DB-TA (190 bar) faulty	Check pressure relief valve, and replace if necessary	see Section 'Repair procedures'
Boom cannot be retracted	DB-TE (220 bar) faulty	Check pressure relief valve, and replace if necessary	see Section 'Repair procedures'

2.5.4.2 Telescope cylinder II cannot be retracted or extended

Symptoms	Reasons	Action	Comments
Telescope cylinder II cannot be retracted or extended	Solenoid valve SY2 faulty		see Section 'Repair procedures'
	– Solenoid head faulty	Replace solenoid head	
	– Valve faulty	Repair valve, or replace if necessary	
	Change-over valve UM II/1 faulty	Repair valve, or replace if necessary	Call in Krupp Service
	Directional control valve TE-E/A faulty	Repair directional control valve, and replace if necessary	

Telescope cylinder I cannot be extended

Symptoms	Reasons	Action	Comments
Telescope cylinder I cannot be extended, telescope cylinder II extends	– Solenoid valve 3Y2 sticking when open	Check solenoid valve 3Y2, and replace if necessary	see Section 'Repair procedures'
	Change-over valve UM I/II in telescope cylinder II position	Check change-over valve and replace if necessary	
	– Switch S15 in telescope I position	Check switch S15, and replace if necessary	

Telescope cylinder II cannot be extended

Symptoms	Reasons	Action	Comments
Telescope cylinder II cannot be extended, telescope cylinder I extends	– Solenoid valve 3Y2 dead	– Check power supply (X2/4)	
		– Replace fuse F1/2	
		– Check switch S15, and replace if necessary	
	– Solenoid valve 3Y2 faulty	– Check solenoid valve 3Y2, and replace if necessary	
	– Change-over valve UM I/II faulty (sticking)	– Check change-over valve, and replace if necessary	Call in Krupp Service

Telescope cylinders retracting and extending too slowly

Symptoms	Reasons	Action	Comments
Telescope cylinders I and II extend too slowly	DB-TWA 190 bar faulty	Check pressure relief valve, reset, and replace if necessary	see 'Adjusting procedures'
Telescope cylinders I and II retract too slowly	DB-TWE 220 bar faulty	Check pressure relief valve, reset, and replace if necessary	see 'Adjusting procedures'

Adjusting procedures

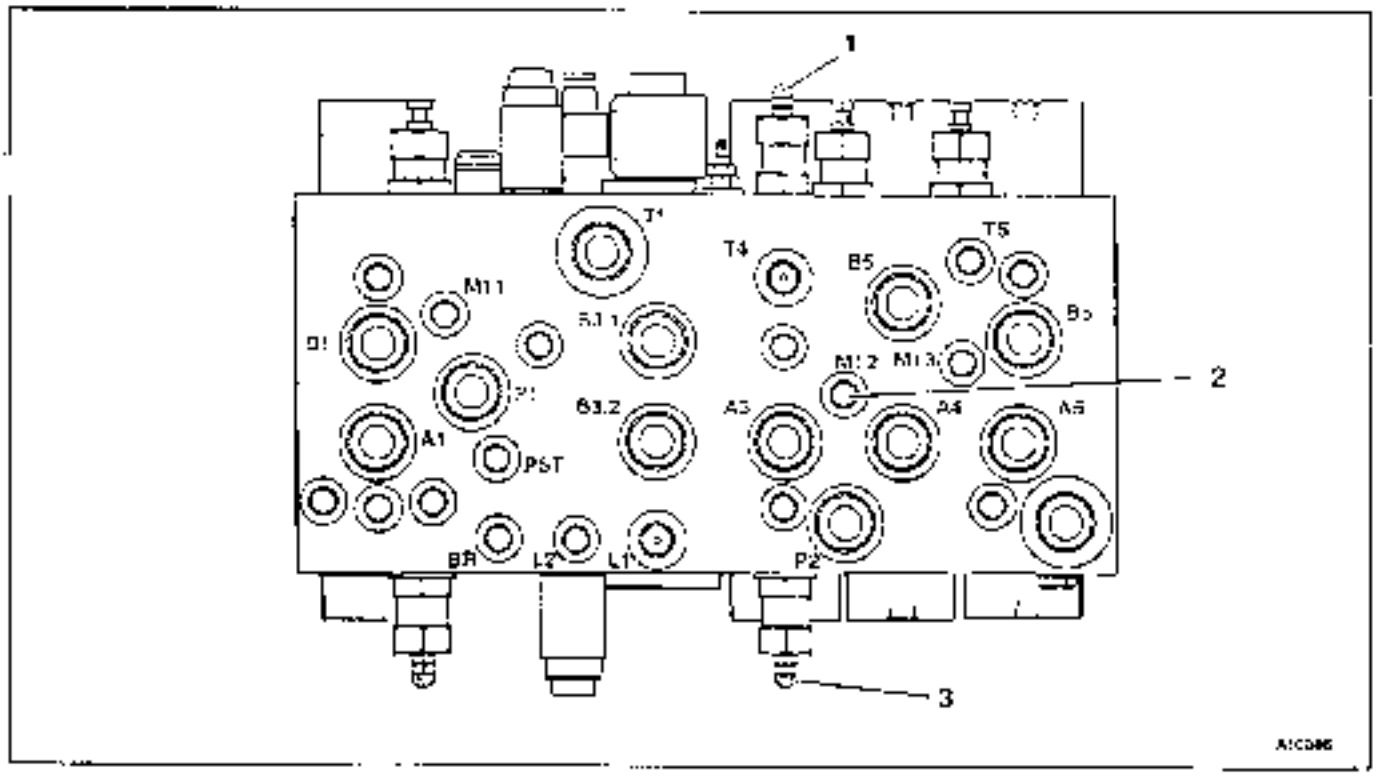
Setting the pressure relief valves for extending the boom

- Connect the pressure gauge (400 bar) to gauge port M12 (2) on the control block.
- Start the diesel engine and activate the auxiliary drive. Bring the diesel engine up to maximum speed.
- Move the control lever into the "extend" position.
- Extend the telescope cylinder as far as the stop and maintain the control lever in this position.
- The pressure gauge must indicate hydraulic pressure of 190 bar. If the pressure is more or less than this figure, pressure relief valve DB-TWA (1) on the control block must be re-set, see Section 'Adjusting procedures'.

Setting the pressure relief valves for retracting the boom

- Connect the pressure gauge (400 bar) to gauge port M12 (2) on the control block.
- Start the diesel engine and activate the auxiliary drive. Bring the diesel engine up to maximum speed.
- Move the control lever into the "retract" position.
- Retract the telescope cylinder as far as the stop and maintain the control lever in this position.
- The pressure gauge must indicate hydraulic pressure of 220 bar. If the pressure is more or less than this figure, pressure relief valve DB-TWE (3) on the control block must be re-set, see Section 'Adjusting procedures'.

Gauge ports on the superstructure control block



Repair procedures

Checking telescope cylinder I

Check 1

- Erect the boom to an angle of approx. 45°
- Fully extend te escope cylinder I
- Disconnect the hydraulic line from port 'B3.1' (1) on the superstructure control block.

Note: Drain oil into a suitable container (there is a large quantity of oil in the line between the telescope cylinder and the control valve).

- When the oil in the line has drained out, no more oil should come out of the line
  If oil continues to come out of the line, the shut-off valve is faulty.

If telescope section I retracts of its own accord, the telescope cylinder is caking and must be repaired (call in Krupp Service).

Check 2

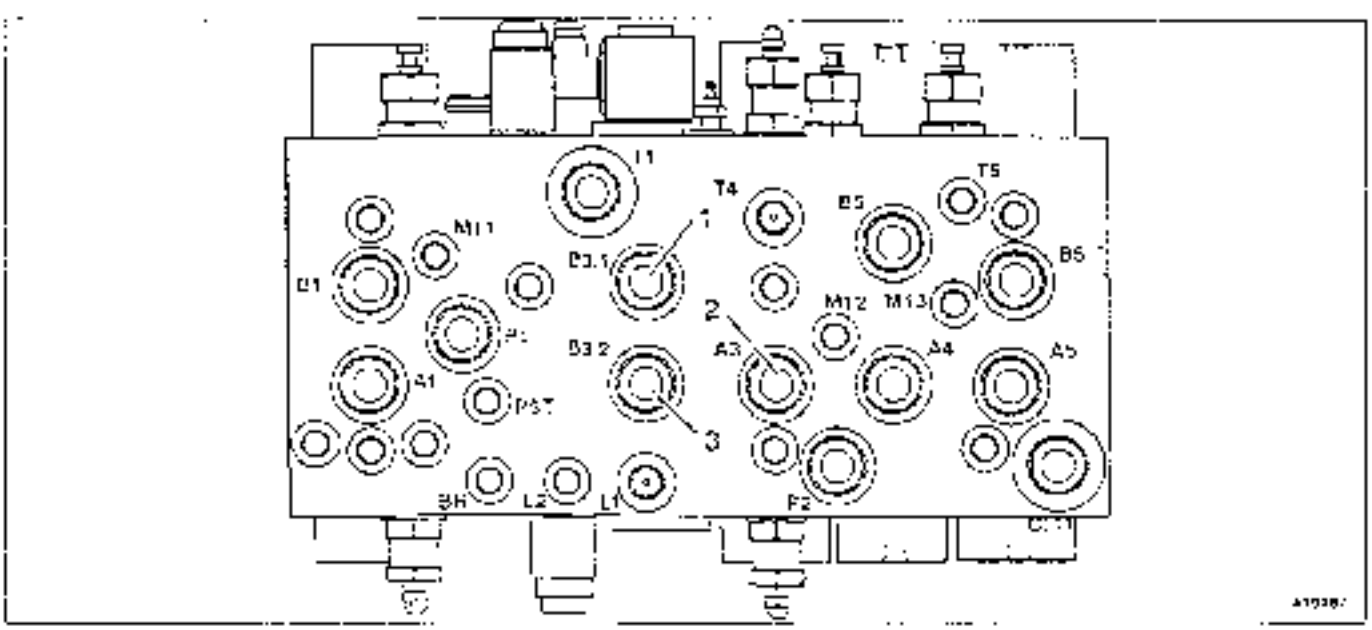
- Extend telescope section I to 3 positions, approx. 100 mm, half and fully.
- Disconnect the hydraulic lead from port A3 (2) on the control block,

Note: Drain oil into suitable containers (there is a large quantity of oil in the line between the te escope cylinder and the control valve)

- No oil must come out of the respective connections in any of the three telescope positions
- If oil does come out, the cylinder is faulty and must be replaced (call in Krupp Service)

Check 3

If the problem was not found in the first or second check, but telescope section I continues to retract, the inner seal in the through line in the telescope cylinder is faulty. Replace the telescope cylinder (call in Krupp Service).



Checking telescope cylinder II

Check 1

- Extend telescope section I to between 100 mm and 500 mm
- Disconnect the hydraulic line from port "B2.2" (3) on the superstructure control block.

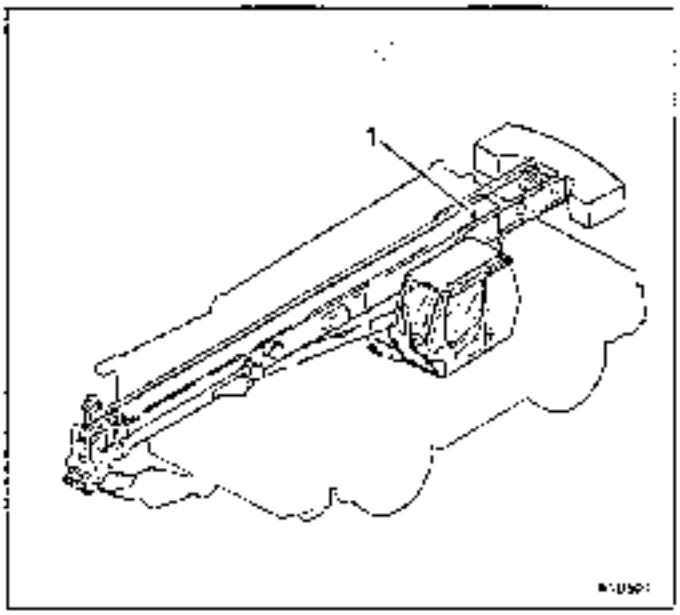
Note: Drain oil into suitable containers (there is a large quantity of oil in the line between the telescope cylinder and the control valve)

- When the oil in the line has drained out, no more oil should come out of the line.
  If oil continues to come out of the line, the shut-off valve is faulty
- Replace the shut-off valve

Check 2

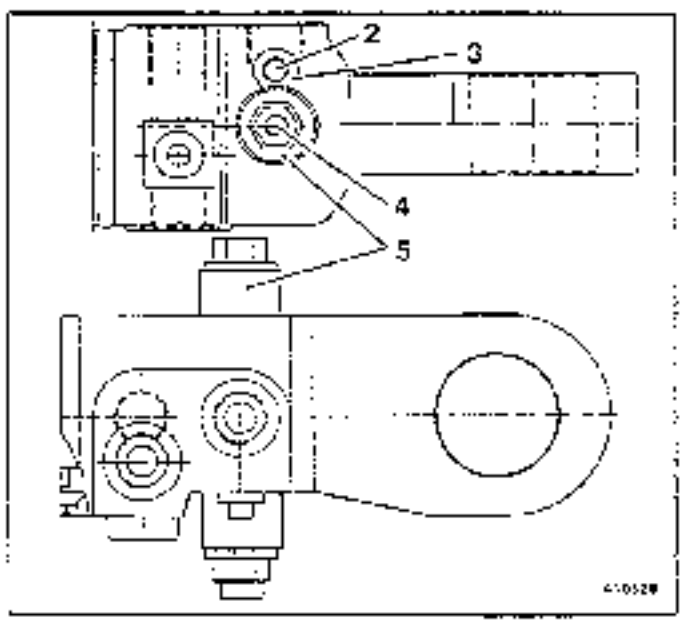
- Extend telescope section II to between 100 mm and 500 mm
- Disconnect the hydraulic line from port "A3" (2) on the control block
- If oil comes out continuously or drips out, the change over valve is faulty and must be replaced.

Replacing the shut-off valve cartridge in telescope cylinder I



- Place the boom in transport position
- Extend telescope section I until the shut-off valve cartridge is accessible through the upper boom (1) orifice

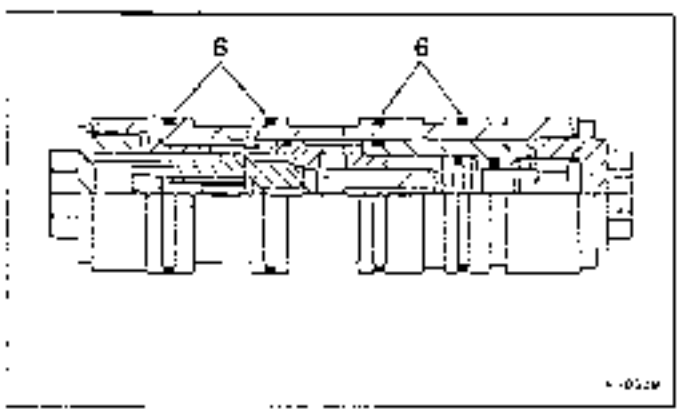
Caution: Prior to commencing repairs, switch off the diesel engine and ignition, securing both against unauthorized activation



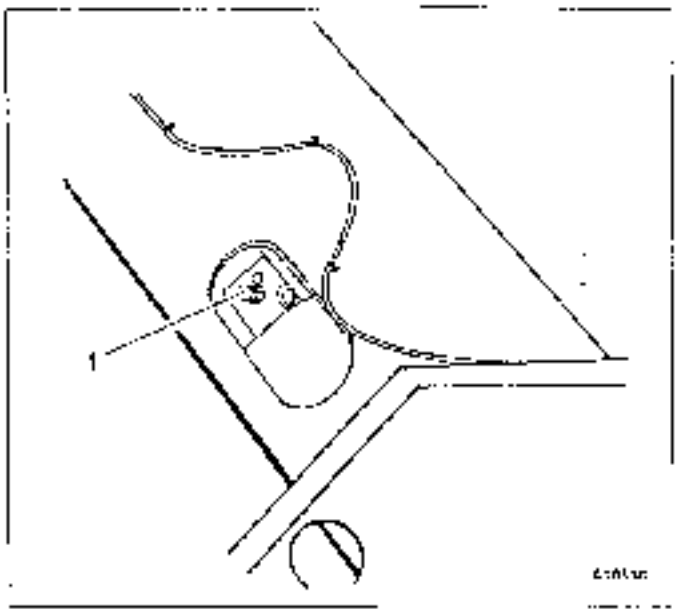
- Unscrew the hexagon socket head bolt (2) from the locking ring (3) and remove the locking ring.
- Screw a bolt or extractor into the thread (4) of the shut-off valve cartridge (5).
- Pull the shut-off valve cartridge (5) out of telescope cylinder I
- Carefully slip a new shut-off valve cartridge into the bore.

Note: Do not damage the O-rings (6) on the cartridge.

- Fasten the locking ring with the hexagon socket head bolt.

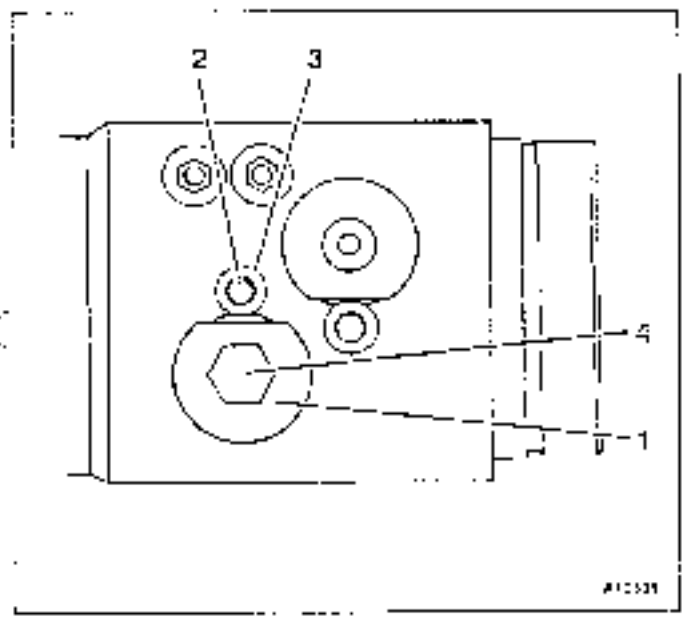


Replacing the shut-off valve cartridge in telescope cylinder II



- Lower the boom until the shut-off valve cartridge (1) is accessible through the opening on the left-hand side of the boom.

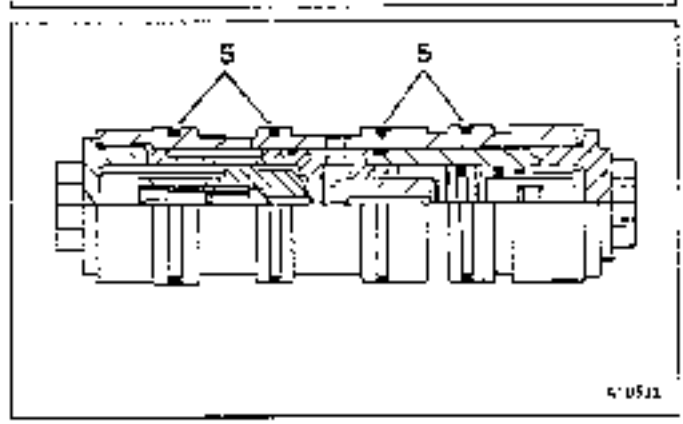
Caution: Prior to commencing repairs, switch off the diesel engine and ignition, securing both against unauthorized activation.



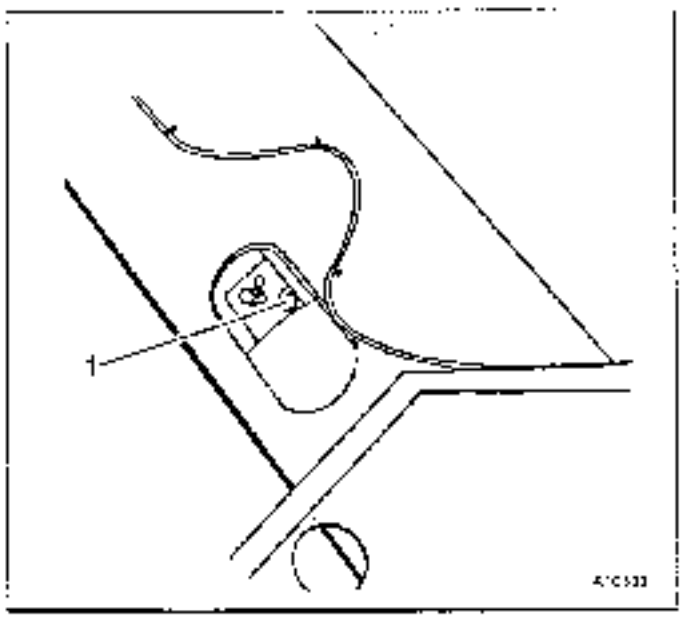
- Unscrew the hexagon socket head bolt (2) from the locking ring (3) and remove the locking ring.
- Screw a bolt or extractor into the thread (4) of the shut-off valve cartridge (1).
- Pull the shut-off valve cartridge (1) out of telescope cylinder II.
- Carefully slip a new shut-off valve cartridge into the bore.

Note: Do not damage the O-rings (5) on the cartridge.

- Fasten the locking ring with the hexagon socket head bolt.

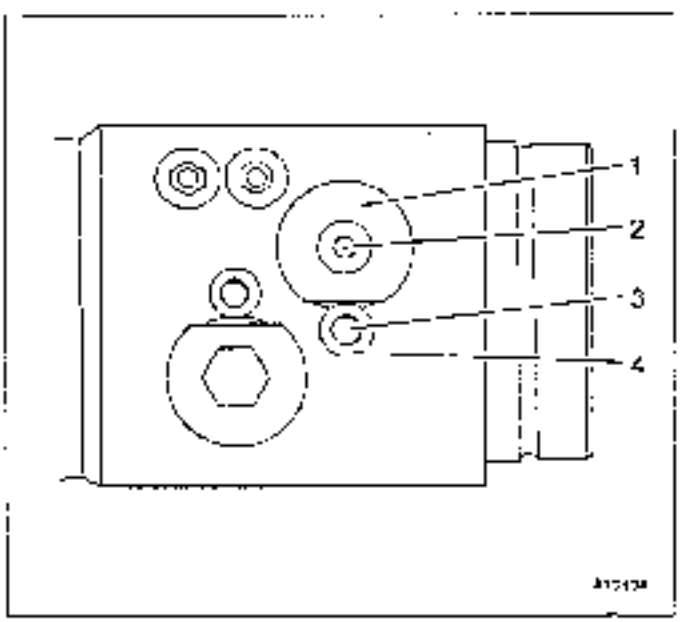


Replacing the shuttle valve of telescope cylinder II



- Lower the boom until the shuttle valve (1) is accessible through the opening in the side of the boom.

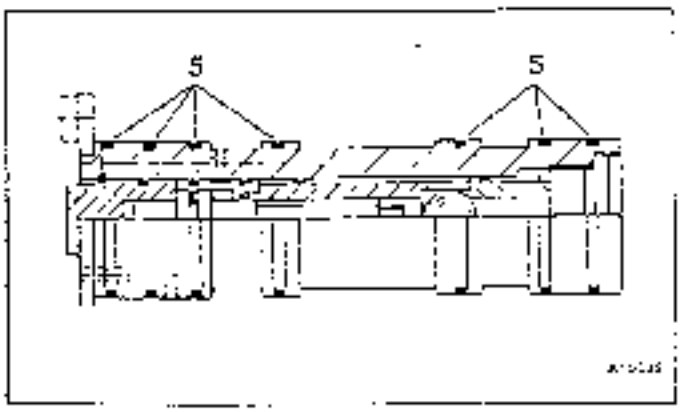
Caution: Prior to commencing repairs, switch off the diesel engine and ignition, securing both against unauthorized activation.



- Unscrew the hexagon socket head bolt (3) from the locking ring (4) and remove the locking ring.
- Screw a bolt or extractor into the thread (2) of the shuttle valve (1).
- Pull the shuttle valve (1) out of telescope cylinder I.
- Carefully slip a new shuttle valve into the bore.

Note: Do not damage the O rings (5) on the shuttle valve.

- Fasten the locking ring with the hexagon socket head bolt.



Slewing gear

Description of operation

The pilot pressure generated by pump P4 ahead of the control lever is 40 bar.

When the control lever is moved to "slewing gear to the right or the left", directional control valve DW-L/R is activated.

Pump P3 supplies hydraulic oil to the slewing gear motor via the rotary connection - duct 6 - and the hydraulic directional control valve.

For limiting the hydraulic circuit pressure, there is a 180 bar DB-DW pressure relief valve in the superstructure control block.

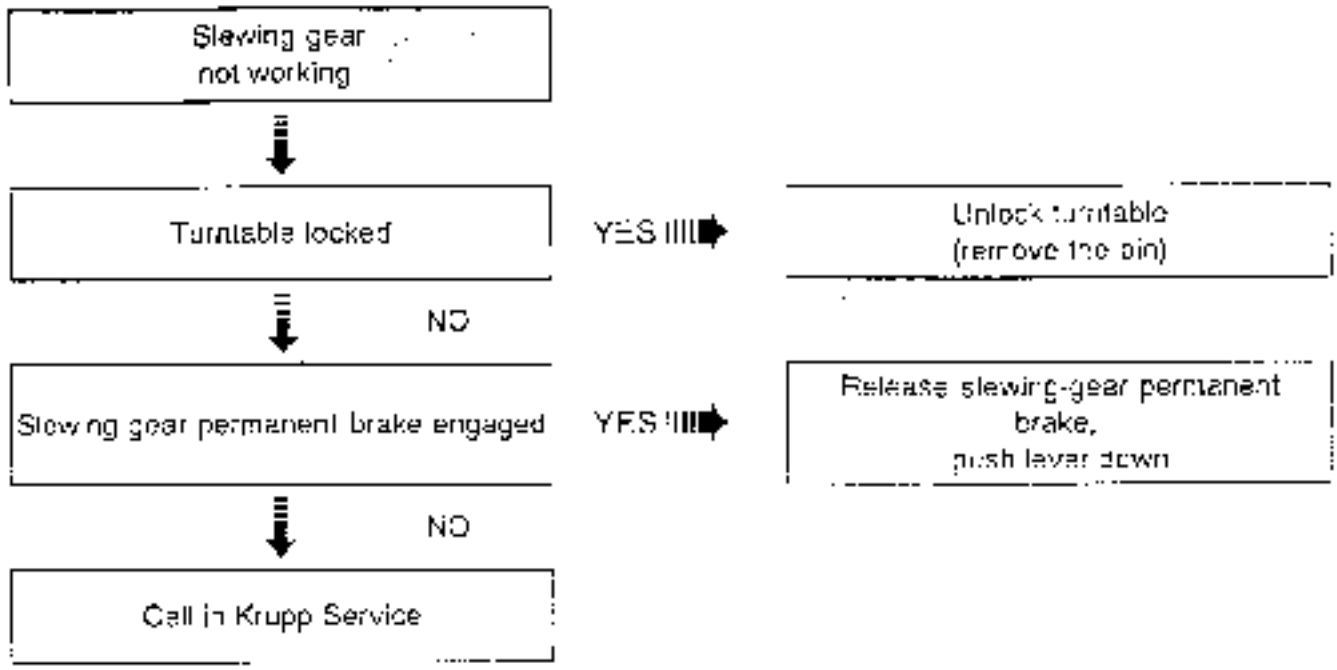
Prior to commencing slewing, the slewing gear drum brake must be released using the hand brake lever on the right-hand side behind the seat of the crane operator.

The slewing movement is braked by pressing down the foot-operated brake valve.

Technical data

Make:	Siebenhaar
Model:	CUDE 11C2 - 43.9 - HN
Drive:	Hydraulic vane-type fixed displacement motor
Manufacturer:	Hydromatik
Model:	M4C - 043 - 3N03-A104
Delivery:	Q = 76.0 cm^3/rev.
Gear unit:	Planetary gear i = 43.9
Brake:	Drum brake as service and permanent brake
Manufacturer:	Deutsche Ferrot-Bremse GmbH
Type:	160 x 40
Slewing rim:	Single-row ball-bearing slewing rim with external toothing Tightening torque of the bolts M20 : 520 Nm

Malfunctions

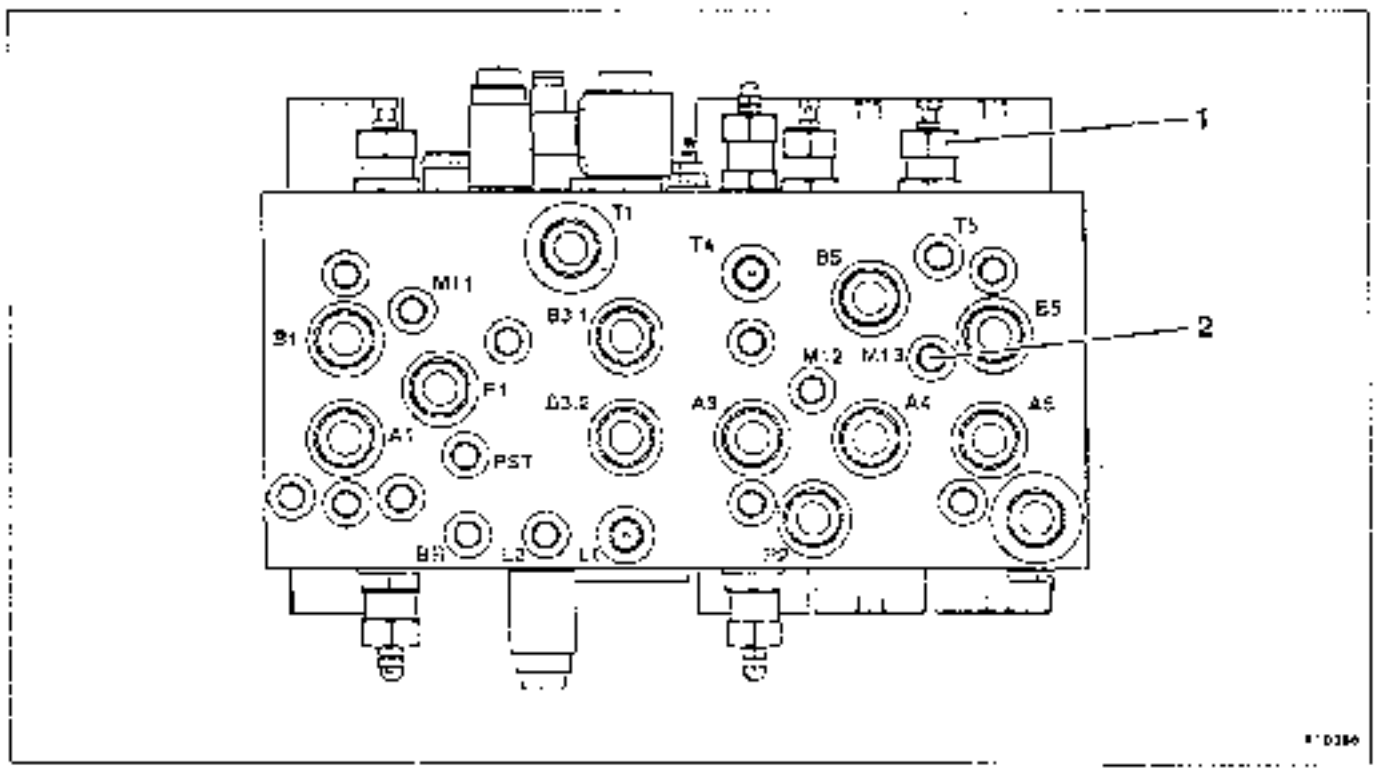


Symptoms, reasons and action

Symptoms	Reasons	Action	Comments
Slewing gear cannot be turned	Pressure relief valve DS-DW (180 bar)		
	incorrectly set	Re-set pressure relief valve DS-DW (180 bar)	
	– faulty	Replace pressure relief valve	
Slewing gear brake not released	Cable for operating the brake is faulty	Replace cable	
	Slewing gear motor faulty	Check slewing gear motor and replace if necessary	

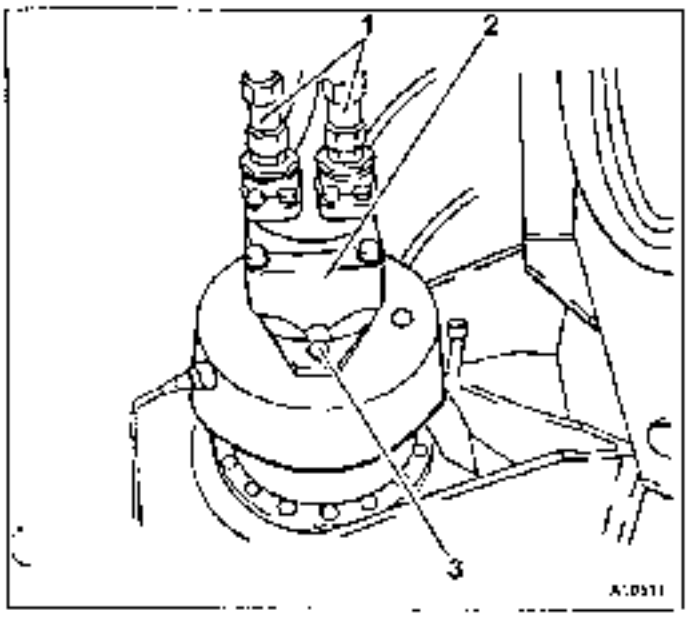
Adjusting procedures

- Lock the superstructure.
- Disconnect the plug from solenoid valve 3Y3.
- Connect the 400 bar pressure gauge to gauge port M13 (2).
- Start the diesel engine and activate the auxiliary drive.
- Move the control lever towards "slewing".
- The pressure gauge must indicate hydraulic pressure of 160 bar. If the pressure is more or less than this figure, pressure relief valve DB-TWE (3) (180 bar) on the control block must be re-set or replaced.



Repair procedures

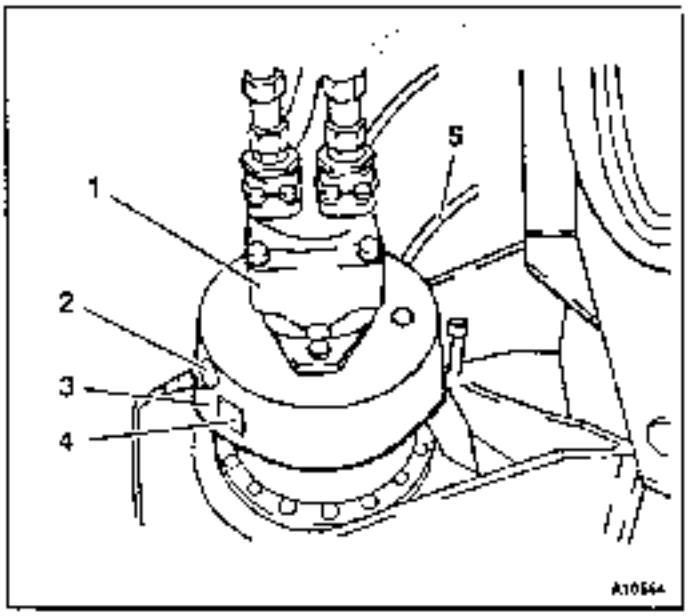
Replacing the slewing gear motor

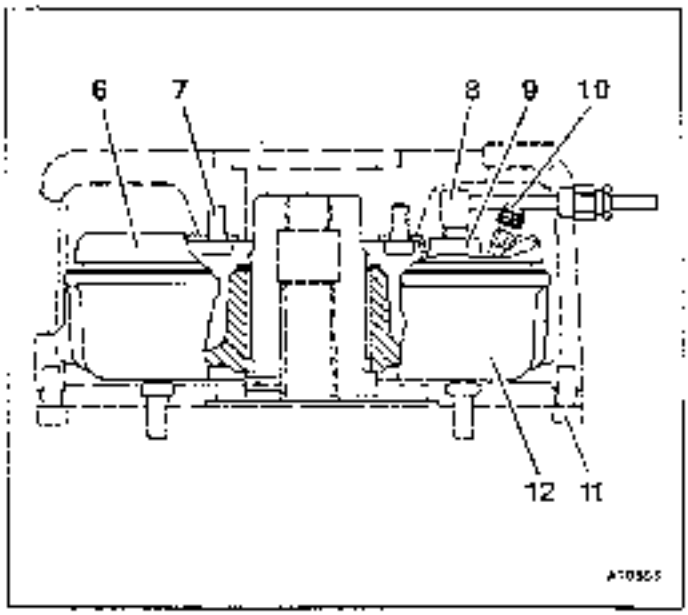


- Lock the superstructure.
- Disconnect the hydraulic lines (1) from the slewing gear motor (2).
- Remove the retaining bolts (3) from the motor.
- Remove the slewing gear motor from the gear unit of the slewing gear.
- Replace the O-ring between the slewing gear motor and the drum brake.
- Fit the new slewing gear motor and secure with retaining bolts.
- Re-connect the hydraulic lines to the slewing gear motor.

Note: Before re-connecting the hydraulic lines, check the O-rings in the pipe and flange joint connections and replace if necessary

Replacing the slewing gear brake





- Remove the slewing gear motor (1) as described in Section 2.6.6.1.
- Disconnect the brake line (2) from the brake (3).

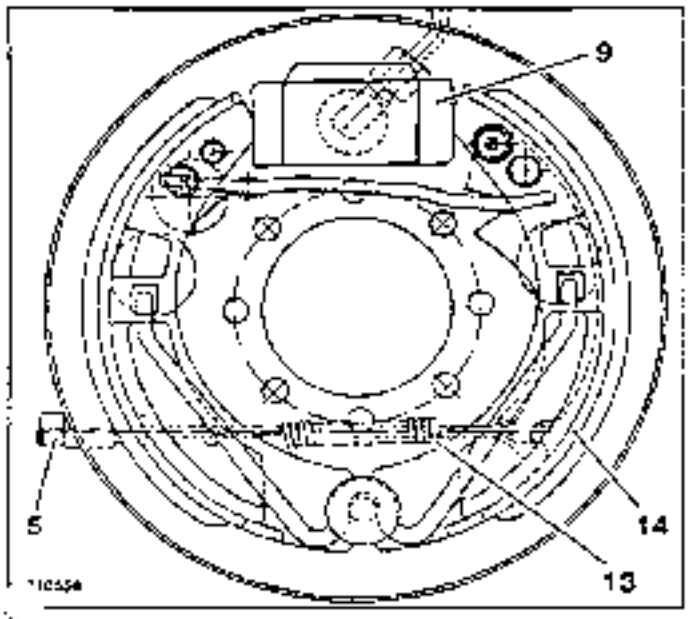
Note: Collect brake fluid in a suitable container.

- Unscrew the bolts of the cover plate (4) from the brake and take off the cover plate.
- Unscrew the coupling (8) from the brake cylinder (9) through the opening.
- Release the Bowden cable (5) from the brake.
- Unscrew the bolts (11) of the brake housing.
- Turn the eccentric through the opening in the side of the brake housing until the shoes of the brake release the brake drum.
- Pull the brake housing (3) with the entire shoe-type brake off the slewing gear.

Replacing the entire brake

- Unscrew the bolts (7) holding the brake anchor plate (6).
- Replace the entire brake.

Replacing the brake shoes



- Remove the return springs (13) from the brake shoes (14) and check the condition of the springs. The two return springs must have the same length and the springs must be compact with no spaces between the spirals. Heavily corroded or expanded (elongated) return springs must be discarded and replaced by new springs.
- Remove the brake shoes (14).
- Check the brake drum for score marks and check if it runs true. Turn the drum on a lathe if necessary (max. $182^{+0.1}$ mm diameter).
- Clean all parts with a grease dissolving detergent.
- Install new brake shoes (14) and return springs (13) and coat the bearing points of the brake shoes with a thin layer of graphite grease.

Caution: Do not bend the return springs.

Replacing the brake cylinder

- Unscrew the air bleeder screw from the brake cylinder (9)
- Remove the return spring (13).
- Push the brake shoes (14) away from the brake cylinder.
- Replace the brake cylinder (9).

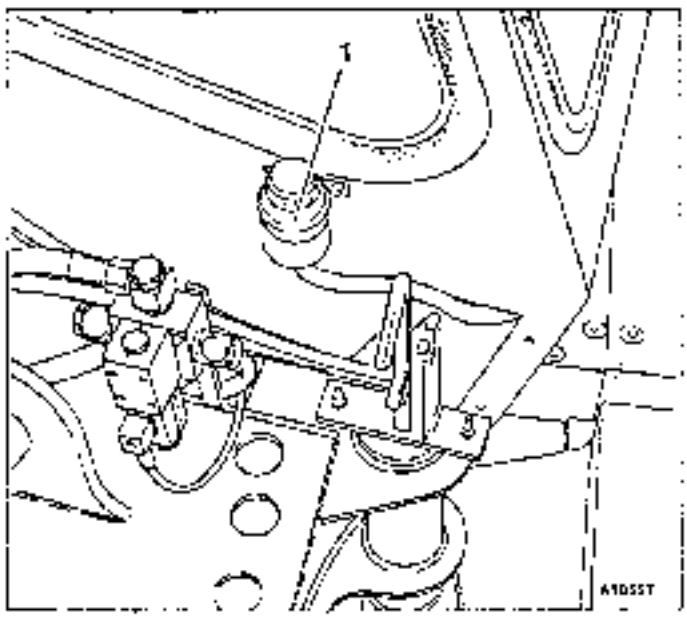
After the parts have been replaced, the brake is installed reversing the steps required for removing the brake.

- Screw the brake anchor plate (6) to the brake housing (3)
- Push the brake housing (3) with brake anchor plate onto the slewing gear unit and fasten it
- Connect the brake's Bowden cable.
- Install the slewing gear motor (1) and connect the hydraulic lines.
- Check the brake fluid level in the expansion tank (15) and top up fluid if necessary. Bleed the brake system.

Changing the brake fluid and bleeding the brake system

Caution: Only use brake fluids in accordance with SAE Specification J1703 and US Safety Standard FMV 116.
The brake fluid must be kept absolutely clean.

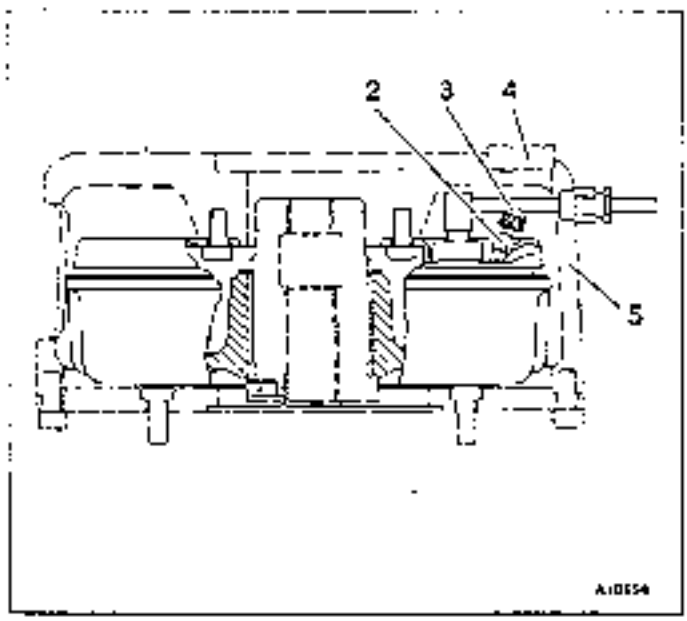
Changing the brake fluid



- Drain all brake fluid from the reservoir (1) and from the line leading to the slewing gear brake
- Connect the line back to the housing of the slewing gear brake
- Fill in new brake fluid.

Note: Only fill in or top up new brake fluid

Bleeding the brake system

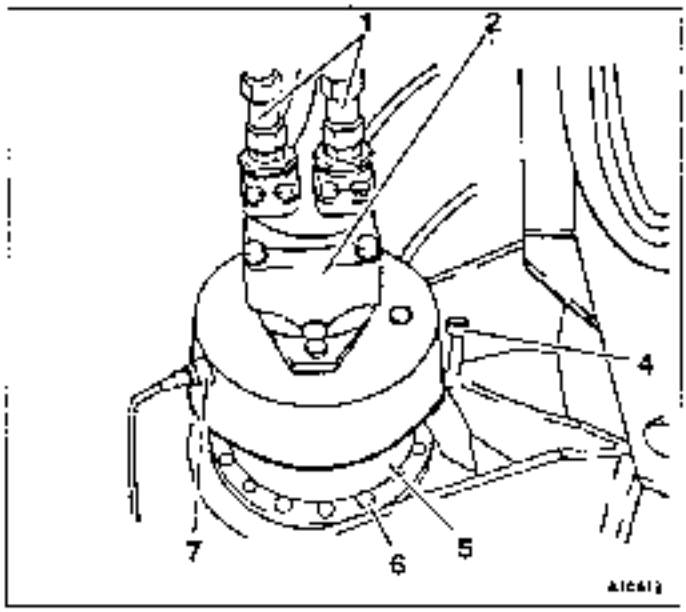


- Unscrew the plug (4) from the brake holder (5).
- Remove the dust cap (3) from the air bleeder valve (2) through the opening.
- Slip a plastic hose onto the air bleeder valve and put the other end of the hose into a container half filled with brake fluid.

Note: When air is bled from the system the hose end must be submerged into the brake fluid.

- Use an offset ring spanner to open the air bleeder valve half a turn.
- Press down the slewing gear brake pedal until all the air has escaped through the plastic hose. Fill in brake fluid into the reservoir during bleeding.

Replacing the gear unit of the slewing gear



- Remove the pinion cover.
- Disconnect the hydraulic lines (1) and (7) from the slewing gear motor (2).
- Remove the retaining bolts (6).
- Remove the gear unit (5) of the slewing gear out of the turntable.
- Remove the slewing gear motor and the slewing gear brake
- Combine the new gear unit of the slewing gear with the slewing gear brake and slewing gear motor.
- Replace the screw plug with a ventilation filter (4).
- Install the gear unit of the slewing gear in the turntable.
- Align the gear unit of the slewing gear in the turntable mounting using the eccentric.
  The backlash between the slewing gear pinion and the outer toothing of the ball-bearing slewing rim should lie between 0.24 mm and 0.32 mm.
- Screw in the retaining bolts (6). Tightening torque: 110 Nm.
- Re-connect the hydraulic lines to the slewing gear motor.

Note: Before securing the pipe screw coupings, check the O-ring and replace if necessary

- Check the oil level in the gear unit of the slewing gear and top up oil if necessary, see Maintenance manual

Hydraulic system - superstructure

Description of operation

The superstructure hydraulic system supplies all hydraulic consumers required for operating the crane with hydraulic oil.

These consumers comprise:

- Hoist
- Derricking gear
- Telescope gear
- Slewing gear
- Outriggers (on the carrier)
- Suspension system (on the carrier)

The hydraulic oil is stored in the hydraulic oil tank on the carrier. From there, the oil passes to the quadruple gear pump in the carrier. The pump is powered by a connectible power take-off on the manual gearbox.

From the quadruple gear pump, the individual pump circuits flow through the rotary connection to the control block.

The directional control valves on the control block are activated hydraulically and open up the operational channels to the individual drives.

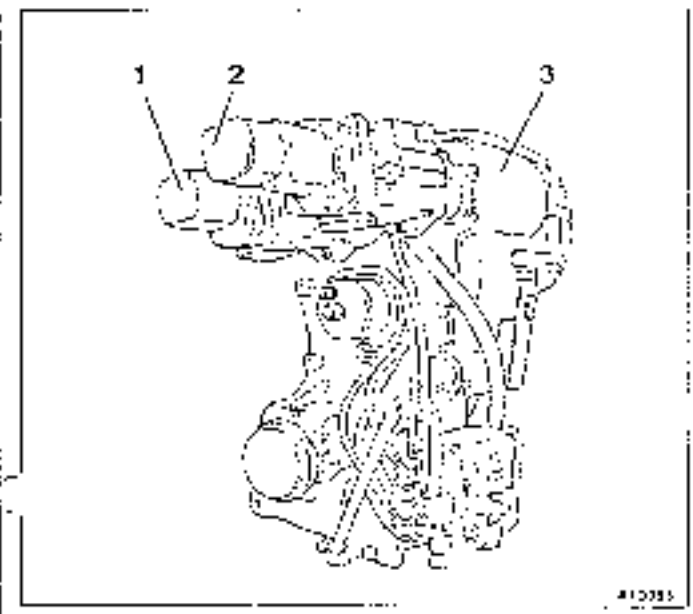
For carrier operations, the hydraulic oil flows direct from pump P3 to the appropriate control blocks.

The individual hydraulic systems are described in the sections concerned:

- Outriggers,
- Suspension locking system,
- Hoist,
- Derricking gear
- Telescope gear - control,
- Slewing gear,

Arrangement of the hydraulic components

Location of the hydraulic pumps on the carrier

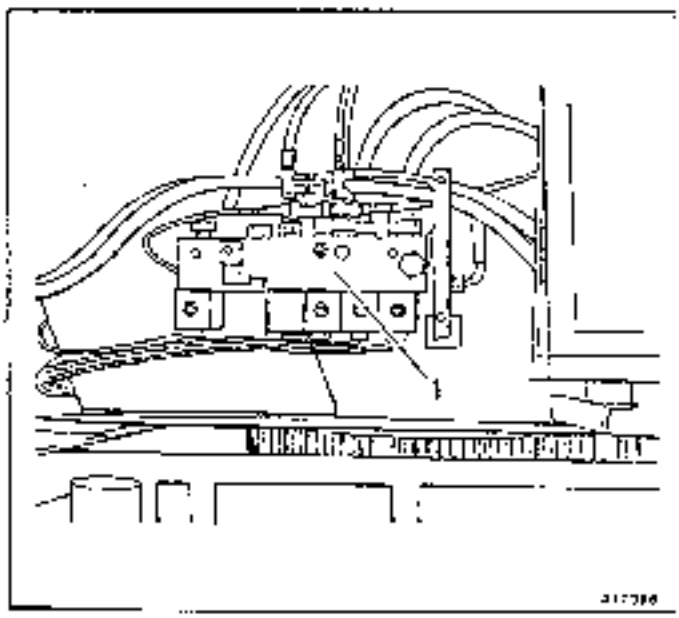


1 Triple gear pump (steering and fan drive)

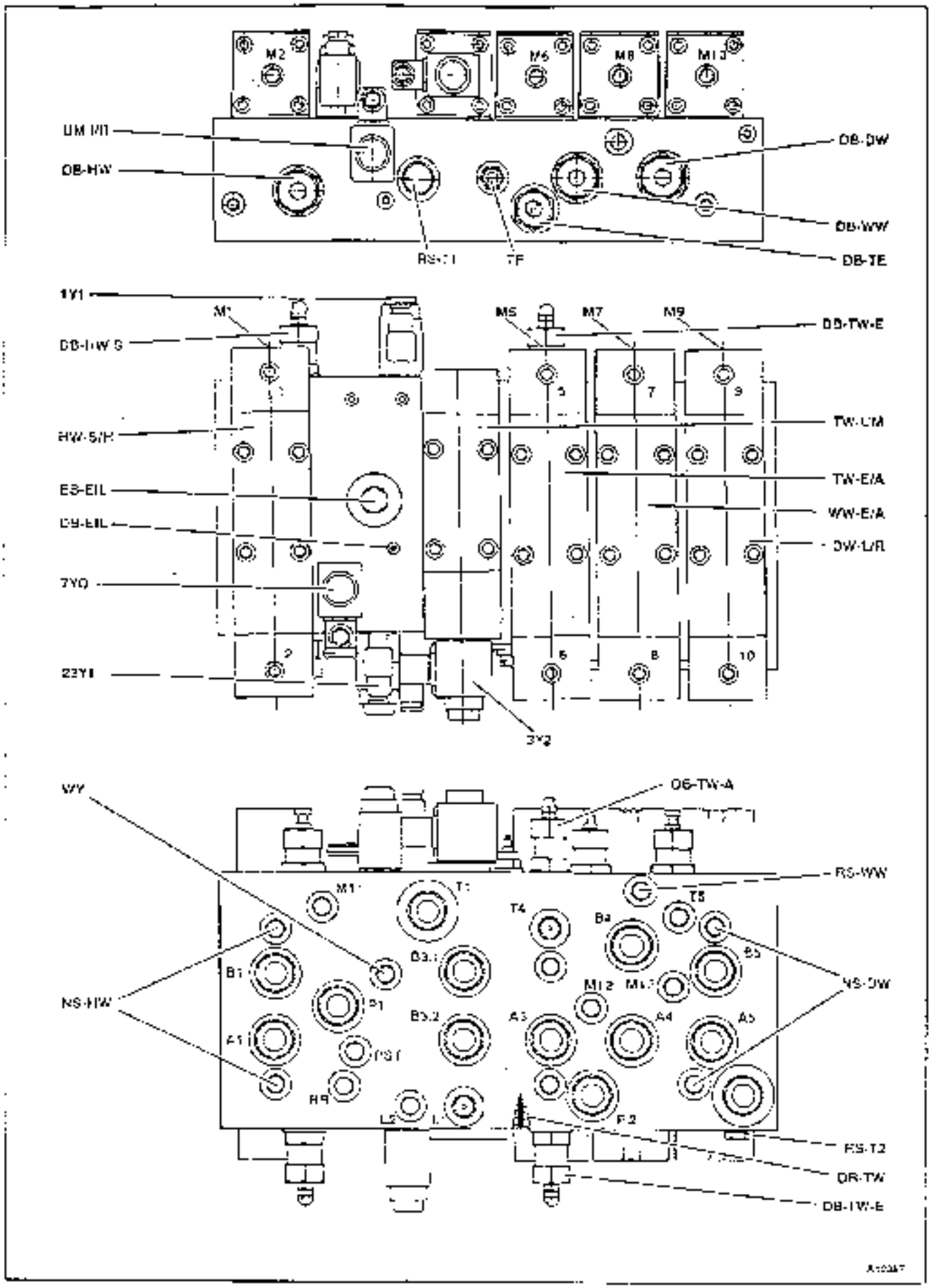
2 Quadruple gear pump (crane operations)

3 Manual gearbox

Superstructure control block location



1 Control block



Superstructure control block

P1	Pump connection - hydraulic circuit 1
M11	Gauge port - pump line 1
DB-HW	Pressure relief valve - pump circuit 1 (240 bar)
HW S/H	Control block - main hoist "lowering/raising"
A1	Connection "lowering"
B1	Connection "raising"
1	Control connection "lowering"
M1	Gauge port - control line "lowering"
2	Control line "raising"
M2	Gauge port - control line "raising"
DB-HW S	Pressure relief valve - lowering main hoist (*20 bar)
NS HW	Suction valves - main hoist lines
SY1	Solenoid valve, bleeding - hoist brake
PST	Pump connection, bleeding control pressure - hoist brake
BR	Control connection, bleeding - hoist brake
P2	Pump connection hydraulic circuit 2
M12	Gauge port - pump line 2
DB-WW	Pressure relief valve - pump circuit 2 (250 bar)
TW-A/E	Control block - extending/retracting telescope gear
A3	Connection "retracting telescope cylinders I/II"
B3.1	Connection "extending telescope cylinder I"
B3.2	Connection "extending telescope cylinders"
5	Control connection "retracting telescope"
M5	Gauge port - control line "retracting telescope"
6	Control connection "extending telescope"
M6	Gauge port - control line "retracting telescope"
DB-TW E	Pressure relief valve - retracting telescope (220 bar)
DB-TW A	Pressure relief valve - extending telescope (*30 bar)
DR-TW	Throttle orifice 2 mm
TW-UW	Control block - change-over - telescope cylinders I/II
SY2	Solenoid valve, control line - telescope cylinder change-over
WW-A/E	Control block - derricking gear "lowering/raising boom"
A4	Connection - cylinder piston chamber - "raising boom"
B4	Connection - cylinder piston chamber - "lowering boom"
7	Control connection "raising boom"
M7	Gauge port - control line - "raising boom"
8	Control connection - "lowering boom"
M8	Gauge port - control line - "lowering boom"
BS	Control connection - lowering brake valve
RS-WW	One-way valve - derricking gear

P3	Pump connection - hydraulic circuit 3
M13	Gauge port - pump line 3
DB-DW	Pressure relief valve - pump circuit 3 (180 bar)
DW-R/L	Control block - slewing gear "to the right/to the left"
A5	Connection - slewing gear "to the left"
B4	Connection - slewing gear "to the right"
9	Control connection "slewing to the left"
M9	Gauge port - control line - "slewing to the left"
10	Control line "slewing to the right"
M10	Gauge port - control connection "slewing to the right"
NS-DW	Suction valve - slewing gear lines
7Y0	Solenoid valve "SLI"
23Y1	Solenoid valve "fast speed"
WV-E L	Change-over valve "fast speed"
DR-EIL	Throttle orifice 1 mm
EB-EIL	Integral valve "fast speed"
T1, T2, T4	Tank connections
RS-T1	One-way valve - tank line (pre-pressurized to 2 bar)
RS-T2	One-way valve - tank line (pre-pressurized to 2 bar)
L1, L2	Leakage oil connections from the control lines
TF	Temperature gauge

Malfunctions and action

Descriptions of all possible malfunctions are contained in the individual drive sections.

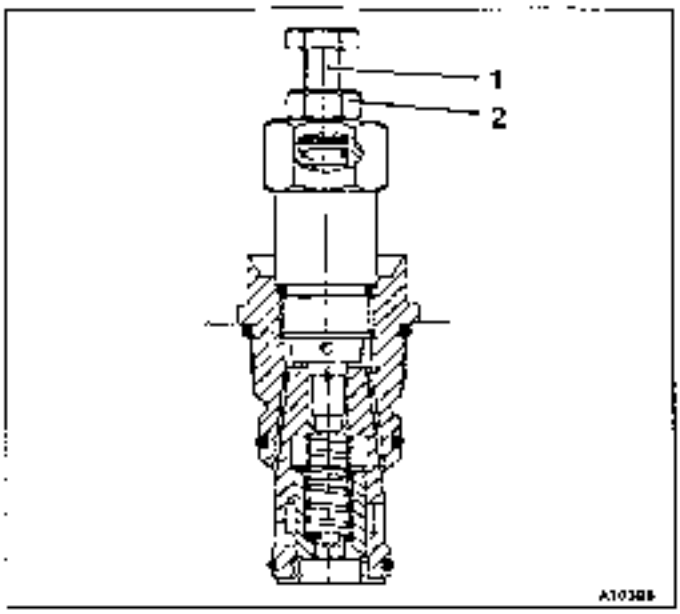
Symptoms, reasons and action

Descriptions of all possible malfunctions, causes and corrections are contained in the individual drive sections.

Adjusting and repair procedures

Instructions on the appropriate pressure-gauge connections, control block pressure-relief valves and pressure-build up proccoures are contained in the indiv dual drive sections.

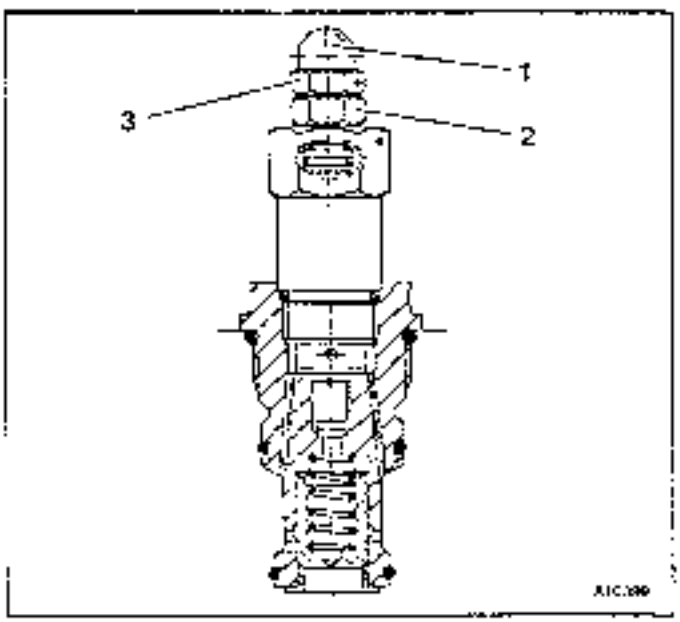
Setting the pressure relief valves of pump circuits 1 to 3



Setting the pressure relief valves:
DB-HW Pump circuit 1
DB-WW Pump circuit 2
DB-DW Pump circuit 3

- Loosen the lock nut (2).
- Turn the adjusting screw (1) until the pressure gauge shows the correct reading.
- Tighten the lock nut (2)

Setting the hoist and telescope gear pressure relief valves



setting the pressure relief valves:
DB--WS Main hoist lowering
DS-TWF Telescoping in
DS-TWA Telescoping out

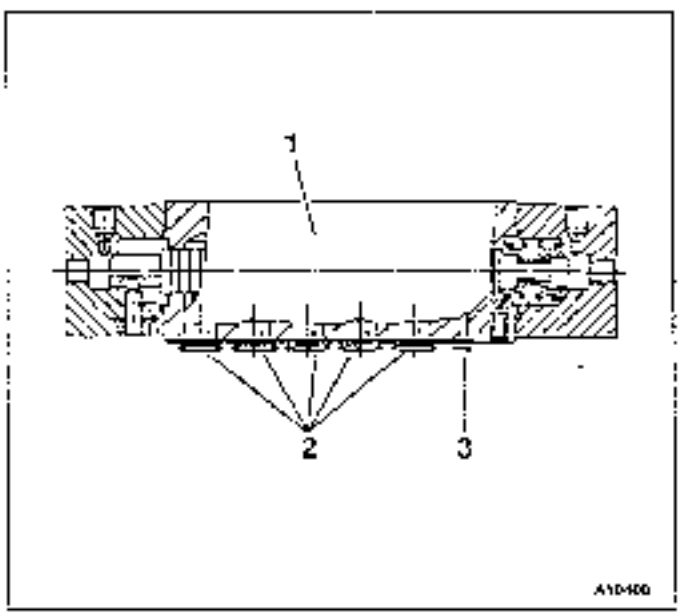
- Remove the cap nut (1).
- Loosen the lock nut (2).
- Turn the adjusting screw (3) until the pressure gauge shows the correct pressure.
- Tighten the lock nut (2)
- Fit the cap nut (1)

Repair procedures

This section contains repair procedures for the individual control block components. Before commencing any repairs, always:

- De-activate the auxiliary drive.
- Switch off the engine and ignition.
- Ensure that the affected component is clean.
- Ensure that suitable containers are at hand for collecting any escaping oil.
- Check and, if necessary, replace the O-rings before refitting any pipe joint connections.
- Tighten the retaining bolts to the prescribed torque.

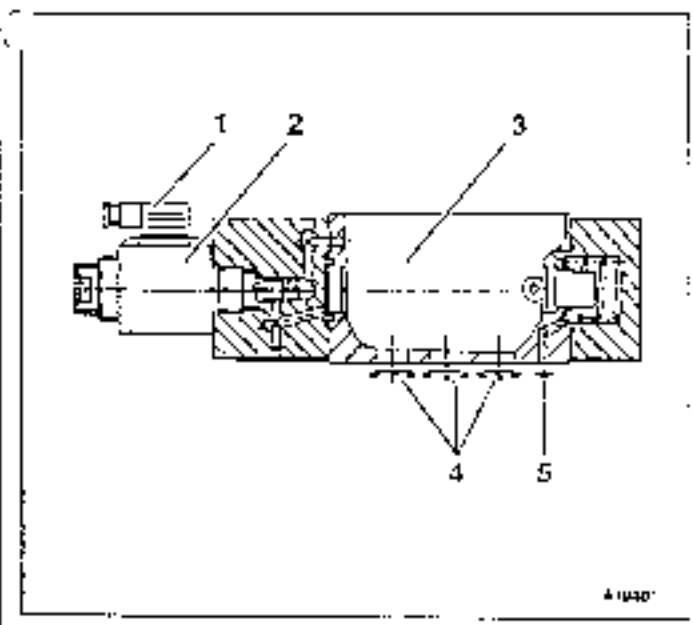
Directional control valves



Directional control valve with solenoid valve

Replacing the directional control valves
HW-S/H Main hoist
TW-A/E Telescope
WW-A/E Derricking gear
DW-P/L Slewing gear

- Disconnect the hydraulic lines.
- Remove the retaining bolts
- Remove the directional control valve (1) from the control plate and fit a new valve. During valve emplacement, ensure that the O-rings (2) and (3) between the control plate and the directional control valve are fitted correctly.
- Re-connect the hydraulic lines.

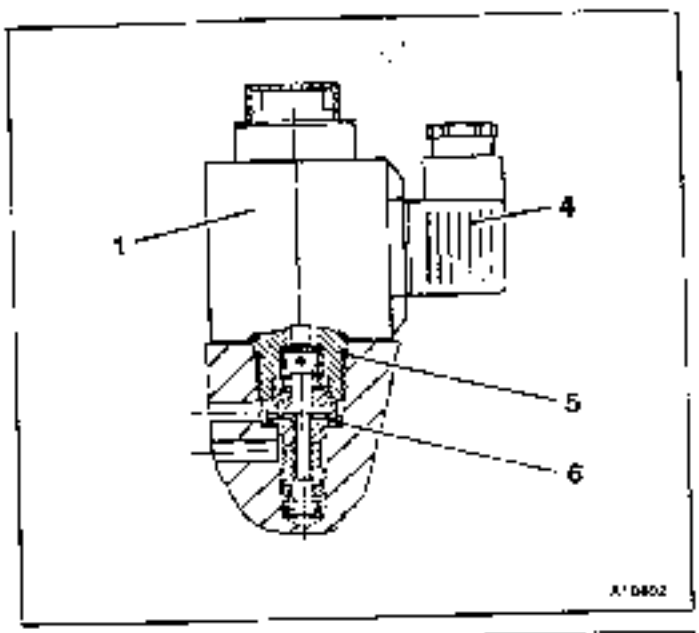


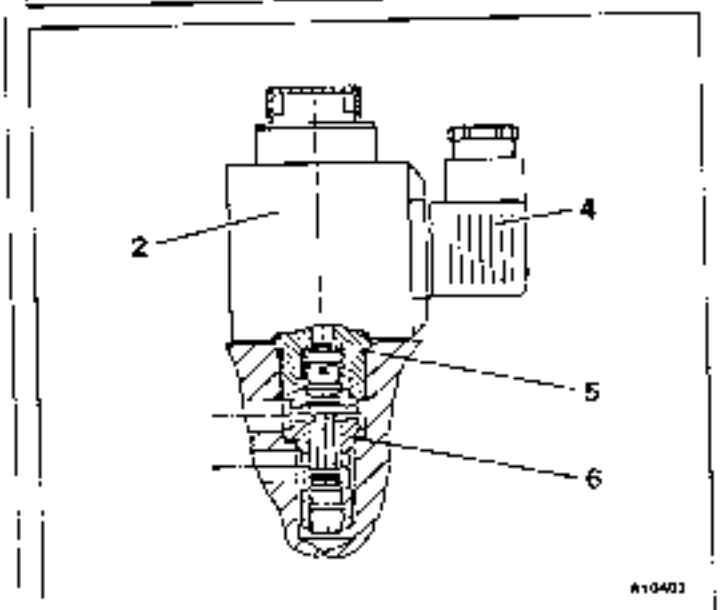
Replacing the directional control valve
TW-D/V Change-over - telescope cylinders I/II
For replacing the solenoid valve, :

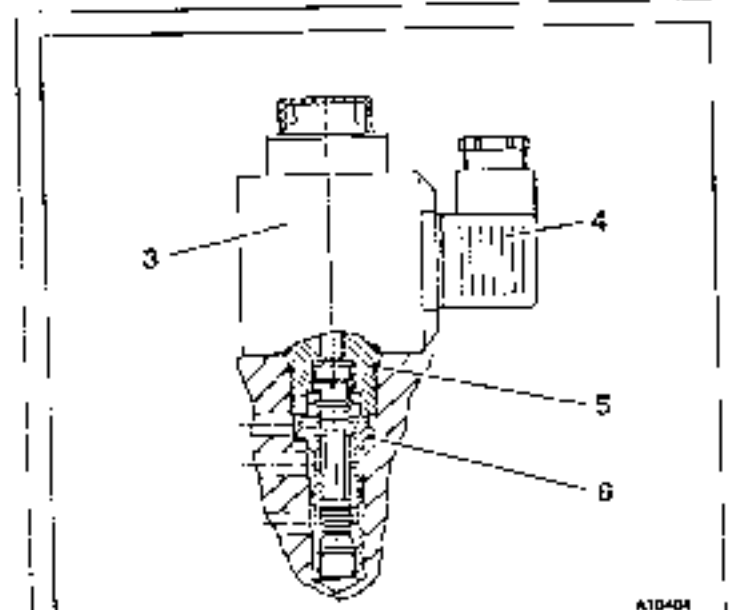
3Y2 Change-over - telescope cylinders I/II

- Disconnect the plug (1) from the solenoid valve (2).
- Disconnect the hydraulic lines.
- Remove the retaining bolts from the directional control valve (3).
- Remove the directional control valve (3) from the control plate and fit a new valve. During valve emplacement, ensure that the O-rings (4) and (5) between the control plate and the directional control valve are fitted correctly.
- Re-connect the hydraulic lines.

Solenoid valves





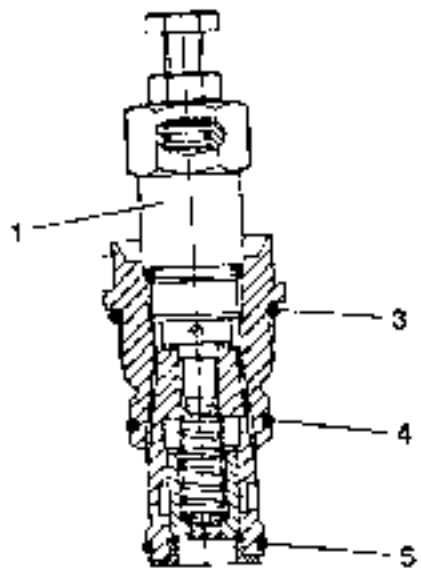


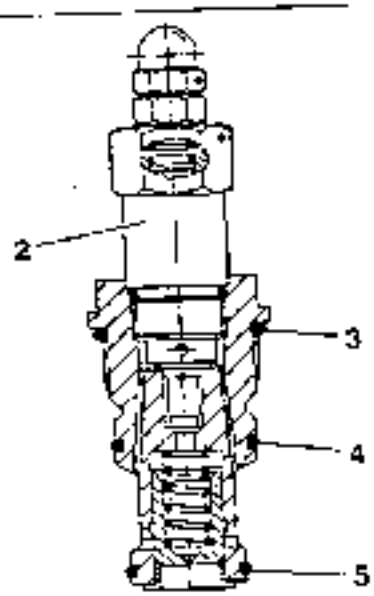
Replacing the solenoid valves

1	1Y1	Brake bleeding - hoist
1	3Y2	Change-over telescope cylinders I/II
2	7Y3	SLI valve
3	23Y1	Fast speed

- Remove the plug (4) from the solenoid valve.
- Remove the solenoid valve from the control block and fit a new valve.
  During valve emplacement, ensure that the seals (5) and (6) are fitted correctly.
- Re-connect the plug to the solenoid valve

Pressure relief valves



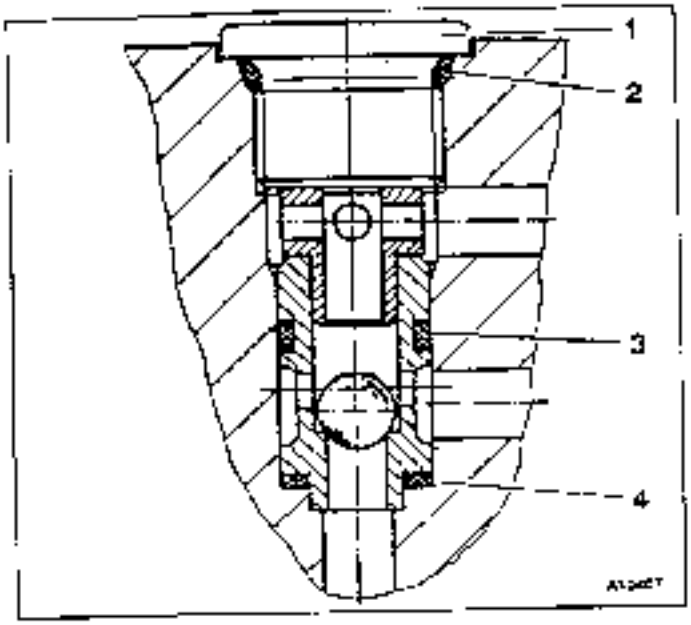


Replacing the pressure relief valves

1	DR-HW	Pump circuit 1
1	DR-WW	Pump circuit 2
1	DB-DW	Pump circuit 3
2	DB-HW S	Hoist lowering
2	DB TW E	Telescoping in
2	DB TW A	Telescoping out

- Remove the pressure relief valve from the control block and fit a new valve.
  During valve emplacement, ensure that the seals (3), (4) and (5) are fitted correctly.

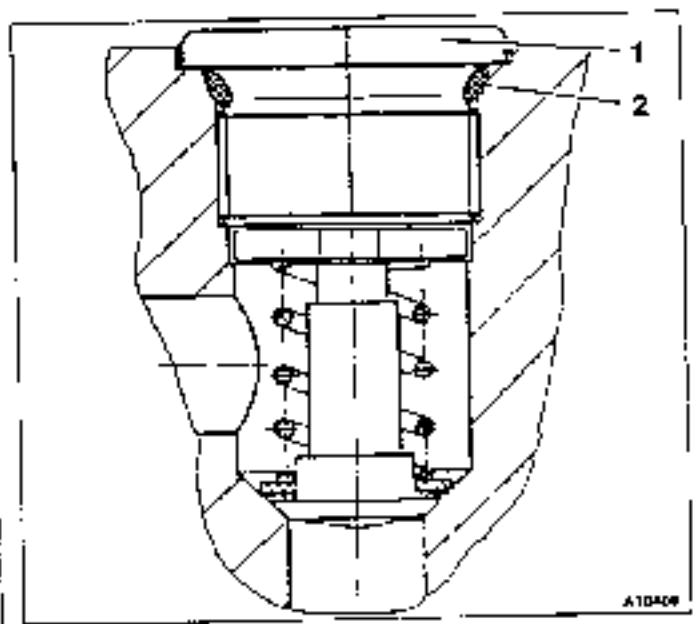
Shuttle valve



Replacing shuttle valve WV-EIL

- Remove the shuttle valve (1) from the control block and fit a new valve.
  During valve emplacement, ensure that the seals (2), (3) and (4) are fitted correctly.

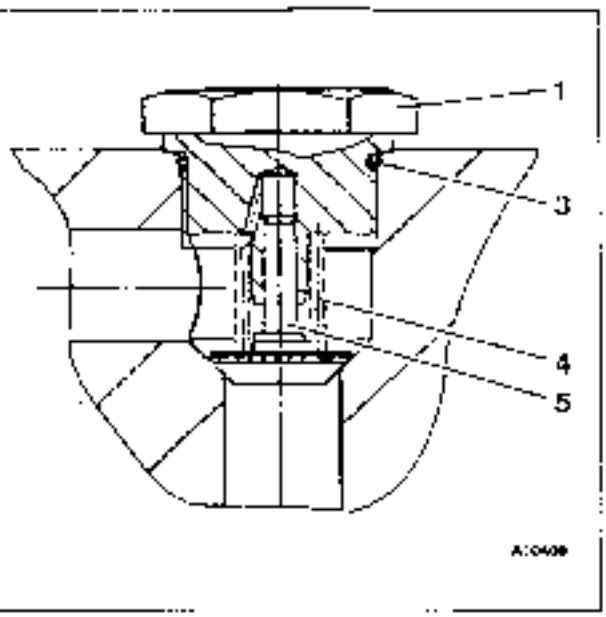
Suction valves



Replacing the suction valves
NS-HW Hoist
NS-DW Slewing gear

- Remove the suction valve (1) from the control block and fit a new valve.
  During valve emplacement, ensure that the O-ring (2) is fitted correctly.

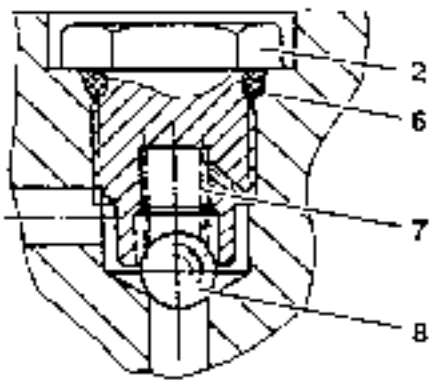
Non-return valves



Replacing the non-return valves

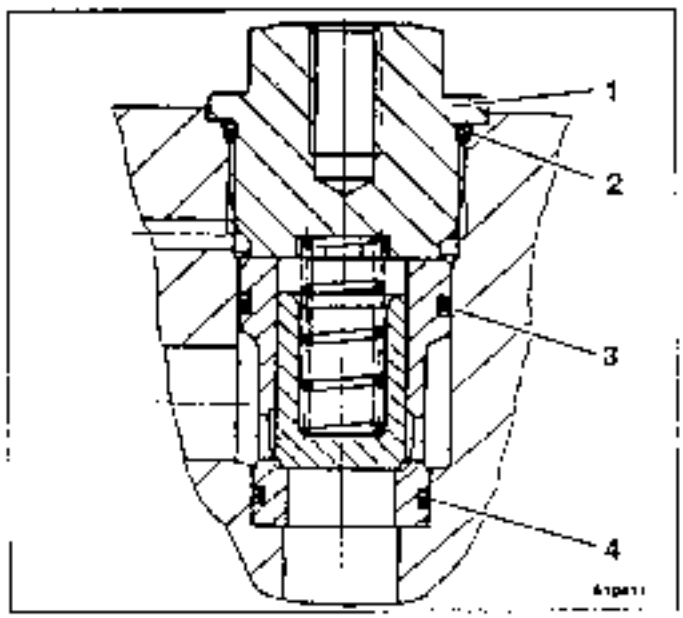
1	RS-T1	Tank line T1
1	RS-T2	Tank line T2
2	RS-WW	Derricking gear

- Remove the non-return valve (1) from the control block and fit a new valve.
  During valve emplacement, ensure that the seat (3), compression spring (4) and pin with grummet (5) are fitted correctly.



- Remove the non-return valve (2) from the control block and fit a new valve.
  During valve emplacement, ensure that the seals (6), compression spring (7) and ball (8) are fitted correctly.

Integral valve

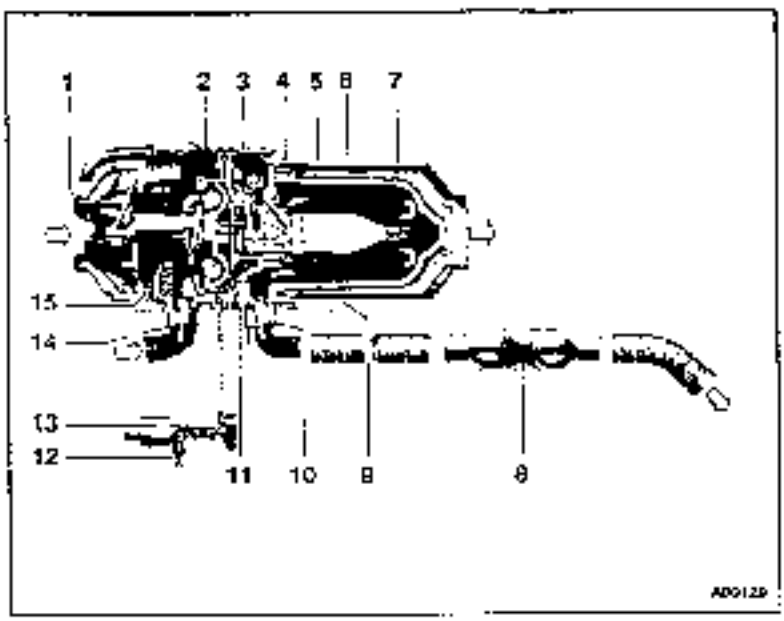


Replacing the integral valve
EB-EIL Fast speed

- Remove the integral valve (1) from the control block and fit a new valve.
  During valve emplacement, ensure that the seals (2), (3) and (4) are fitted correctly.

Heating system of the crane operator's cab

The crane operator's cab is equipped with a Webasto heater model HL32D.
For troubleshooting and repair instructions please see the "Webasto workshop manual".



1	Hot air fan
2	Combustion air fan with motor
3	Glow plug
4	Flame sensor
5	Thermostat
6	Combustion tube
7	Heat exchanger
8	Exhaust silencer
9	Heat pipe
10	Exhaust
11	Evaporator (Vlies)
12	Fuel connection
13	Metering pump
14	Combustion air inlet
15	Safety switch

Note: Switching on the heater repeatedly without bleeding the fuel supply system leads to premature glow-plug wear.

Bleeding the fuel supply system

Connect 24 V (+) at one-second intervals with a cable to the connection of the metering pump (pump is controlled by pulses) until all fuel lines are filled.

Caution: When carrying out electric welding on the crane, remove the fuses for the heating system to protect the control unit.

Activating the heater

Plug B1 (A2*) of the control unit is constantly connected to plus through fuse F1. When the heater is switched on, positive current is also supplied to the control unit's electronic system via control unit plug B3 (A6*).

- Indicator lamp H1 lights up.
- Relay K3 responds.
- Relay K1 switches on the pre-heating system.

- After pre-heating (approx. 90 seconds), positive cycle voltage is applied through transistor V101 to control unit plug A5 (D3*). From control unit plug A5 (D3*), metering pump Y is served via thermostat B2 and safety switch S6.
- The safety period (approx. 90 seconds) and fuel supply time (approx. 5 seconds) begin.
- When the fuel supply time has elapsed, motor M is switched on via relay K2 and control unit plug A2 (D1*).

If a flame is produced during the safety period, the flame sensor B1 indicates "bright" and relay K1 drops out. The safety period is interrupted and the glow plug switches off. This process normally takes approx. 15 seconds.

Repeated start. If no flame is produced during the safety period, a second attempt at starting the system is initiated automatically.

Run-on

The run-on period consists of the cooling down period for the flame sensor (approx. 20 seconds) and an electric run-on period lasting 180 seconds. If the flame sensor does not indicate "dark" after a period of 30 seconds, the control unit initiates the electric run-on period of 180 seconds so that the heater is always switched off after 260 seconds.

The drive continues to run during the run on period. The run-on period serves to ventilate and remove gases from the combustion chamber and to cool down the heat exchanger to prevent damage due to overheating.

At the end of the run on period relay K2 drops out and motor M stops. The heating system is then no longer in operation.

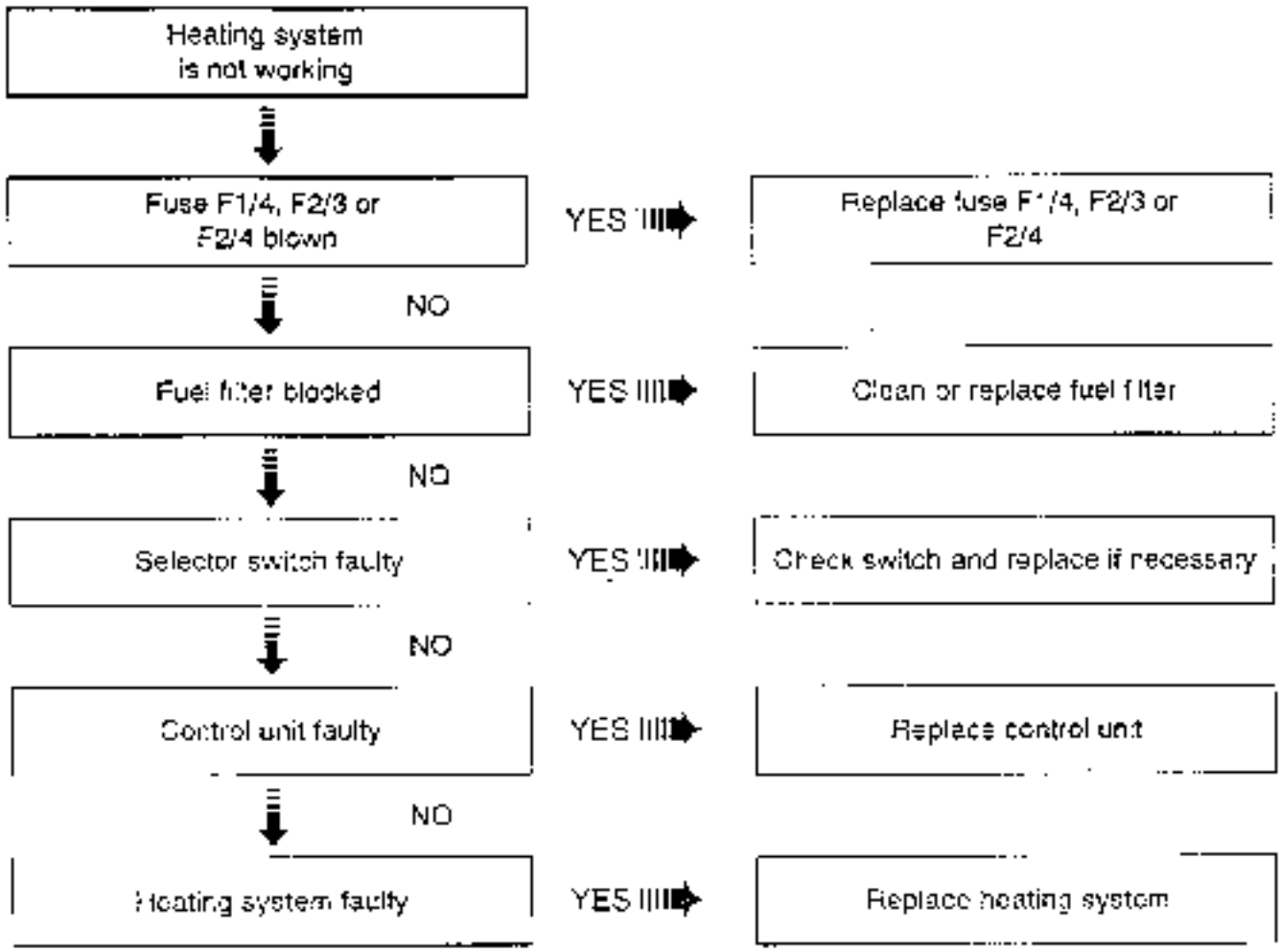
Cut-out due to overheating

If the system overheats the thermostat B2 interrupts the power supply of the metering pump. This stops the fuel supply and the flame goes out.

Caution: Before the system is switched on again the thermostat (5) must be reset by pressing it in.

Malfunctions

Note: The malfunctions described in the following are restricted to the peripheral equipment. If the heater is not working properly please refer to the Webasto documentation.



Heater is switched off shortly after it has been activated

↓

Cut-out caused by overheating — YES → Press down thermostat

↓ NO

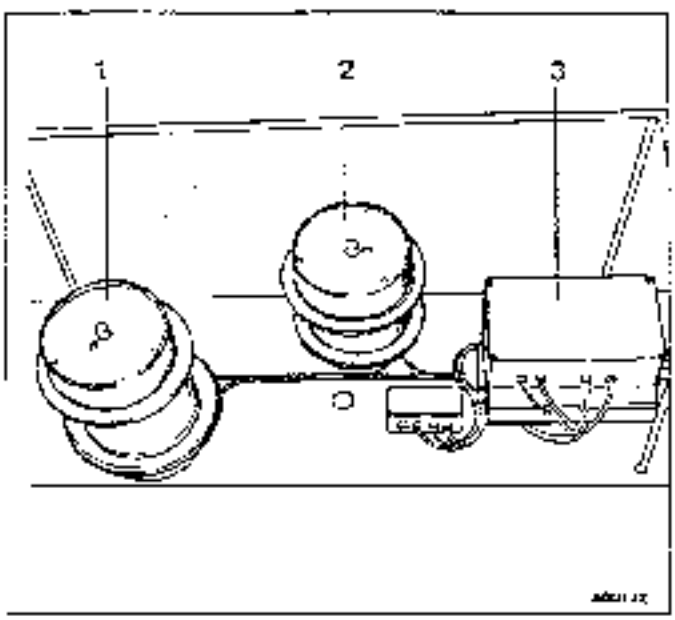
Relay K1 (blower motor) faulty — YES → Check relay K1 and replace if necessary

↓ NO

No fuel supply, fuel pumps sucks air — YES → Check fuel tank and top up fuel if necessary

SLI data sensor

SLI data sensor and transmitter on the boom

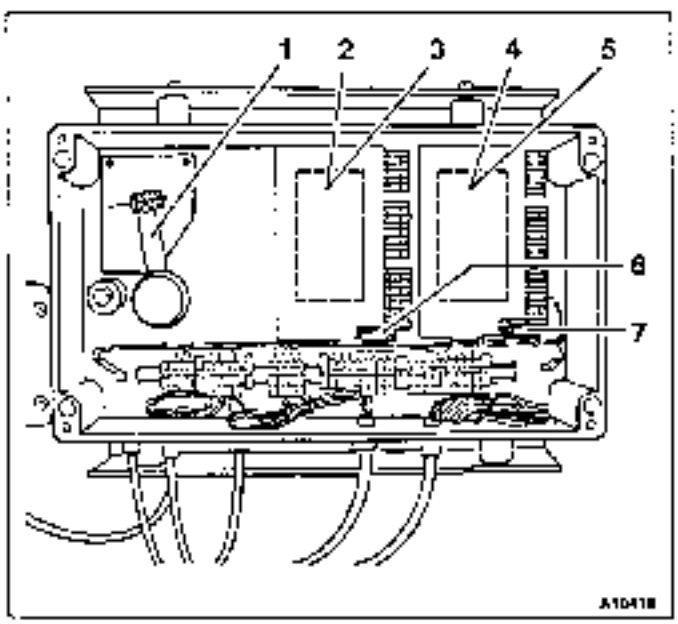


1 Cable drum with potentiometer for length - telescope sections II and III

2 Cable drum with potentiometer for length - telescope section I

3 Boom unit with angle measurement and data transmitter for angle and length

Boom unit with angle measurment



1 Angle potentiometer

2 Data transmitter - boom angle (bottom)

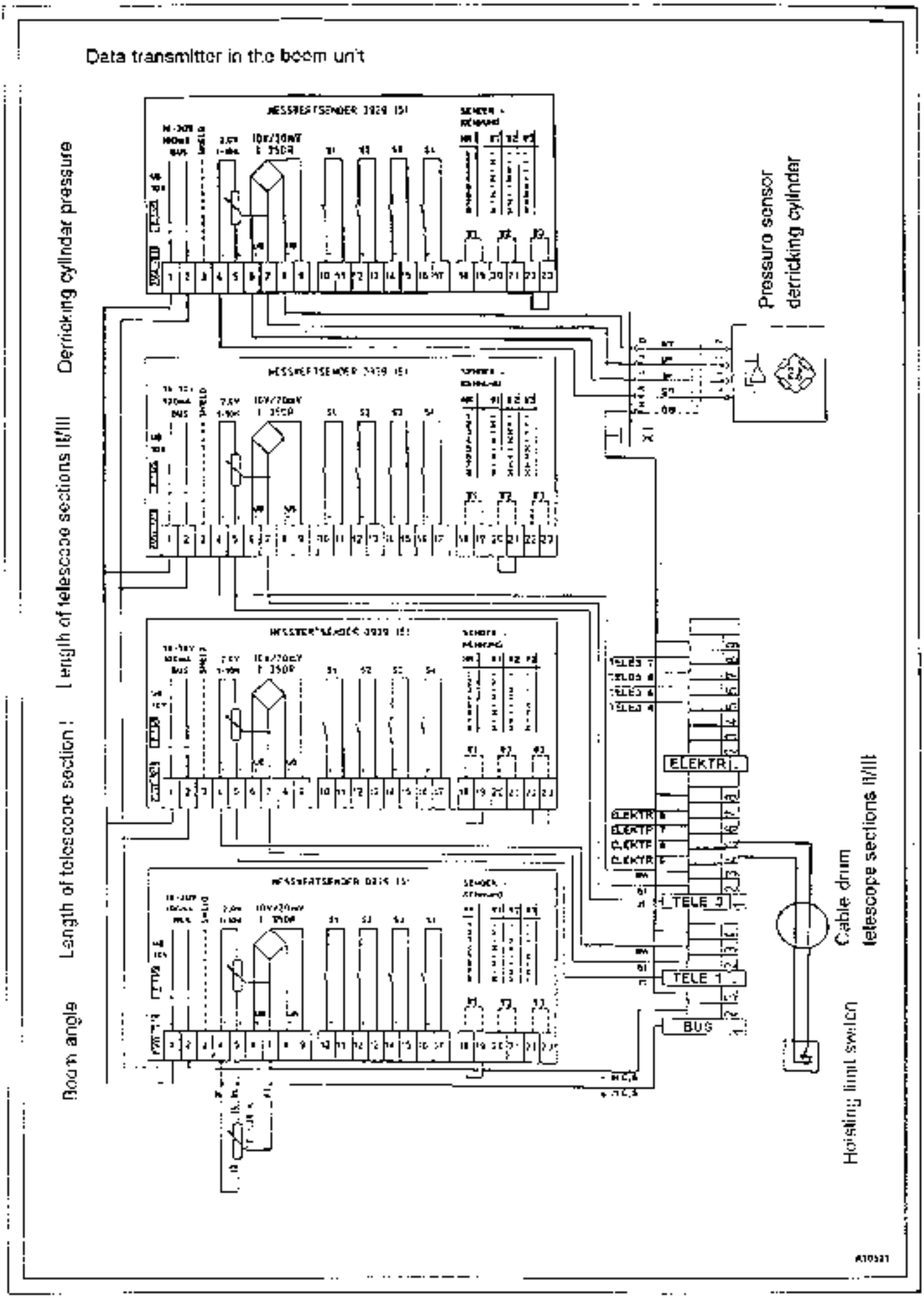
3 Data transmitter - length of telescope section I (top)

4 Data transmitter - length of telescope sections II/I.I (bottom)

5 Data transmitter - derricking cylinder pressure (top)

6 Fuse 0.16 A M (semi time-lag)

7 Fuse 0.16 A M (semi time-lag)



Description of operation of the electronic safe load indicator EKS 83 (SLI)

Selection of lifting capacity tables

The system selects the correct lifting capacity on the basis of the operating configuration setting selected on the central unit and the actual boom configuration (length, telescoping status).

Radius calculation

The radius is calculated from the boom length and angle as well as from the boom load derived from the hydraulic pressure measurement in the derricking cylinder, taking the deflection of the boom into account. By selection of the corresponding operating configuration, the boom extension and the fixed inclined position of the boom extension are taken into consideration.

Reference value calculation

Using the radius as a reference, the appropriate reference value (= maximum load with indicated crane configuration) is selected from the chosen lifting capacity table. The calculation of the reference value takes the reeving configuration selected on the central unit into account.

Load calculation

The pressure measurement in the derricking cylinder produces a signal which is proportional to the load moment. The load is calculated after subtraction of the inherent moment, taking into account the reeving configuration set on the central unit.

Warning and shutdown in case of overloads

Reference value and calculated load are continually monitored and compared. If the load reaches the current radius and standard warning threshold (threshold = 100% of the reference value), the warning is activated (buzzer, relay, 'Warning' and status indication). If the load reaches the shutdown threshold (standard shutdown threshold = 104% of the reference value), shutdown is activated. A buzzer sounds and the red LED "shutdown" warning lamp lights up. The "shutdown" relay interrupts the power supply to the SLI valve. The valve changes over and blocks the control pressure for crane operations. The shutdown is indicated on the status display.

Measurement of variables

Data sensing

- Boom angle from the horizontal with pendulum-driven potentiometer.
- Boom angle with multi-speed potentiometer, driven by length measuring wire or electric cable and gear unit.
- Derricking cylinder pressure with one load cell in the lower derricking cylinder chamber (piston chamber).

Data translation and transmission

The measured values are digitalized in the data transmitters, converted into signals and transmitted time-delayed as impressed current in the central unit through the common dual-line data bus.

Checking data transmitters

Any data transmitter failure is registered by the central unit (the central unit registers the absence of the signal with the corresponding transmitter identification) and displayed as a malfunction (cut-out and message "d=.")
Possible malfunctions:

- Fuse in data transmitter faulty: replace
  If a second fuse fails:
  – Check pick-up for short-circuiting
  – Replace transmitter
- No data bus 24 V voltage supply at terminals 1 and 2
- No or incorrect pick-up voltage supply
  – Pick-up short circuit
  – Replace transmitter
- Check transmitter identification bridges (terminals 18 to 23)

Identification	transmitter
2	Angle of main boom
3	Extended length up to the end of telescope sections II and III
5	Derricking cylinder piston surface pressure
6	Extended length up to the end of telescope section I

Incorrect signals can be detected by comparing the actual crane configuration with the information displayed when the switch is in the appropriate position.

- Check data pick ups:
  – mechanical parts
  – transmitter connections
  – transmitter input voltages
- Check transmitter by substitution (e.g. substitute transmitter 'length' by transmitter 'angle'). Caution ! Note transmitter identifier !

If these steps do not help in locating the fault and a service call-out becomes necessary, a precise and detailed malfunction description can prove a useful exercise and might help to avoid future service call-outs. Such a description should address the following points in particular.

1. Exact malfunction description

2. Under which crane configurations (operating configurations) do these malfunctions occur ?

3. What does the text display indicate ?

4. What do the numerical displays "information", "radius", "shutdown value" and "load" indicate ?

5. What does the information display indicate at each individual switch position ?

Malfunctions and corrections

SLI inoperative
No buzzer signal
No displays (dark)

↓

Power supply switched off → YES → 1. Switch on ignition 2. Switch on crane switch S 7

↓ NO

Fuse F 2/2-A1 blown → YES → Replace fuse F 2/2-A1

↓ NO

Fuse F1 on back of SLI blown → YES → Replace fuse 3.15 A

↓ NO

Call in Krupp Service

SLI shutdown !
Red lamp on !
Release button does not respond !

Overload

YES

Leave overload range !
Press SLI release button

NO

Call up SLI fault code

NO

Press and hold release button

NO

One of the letters "abcdefghijk" is displayed

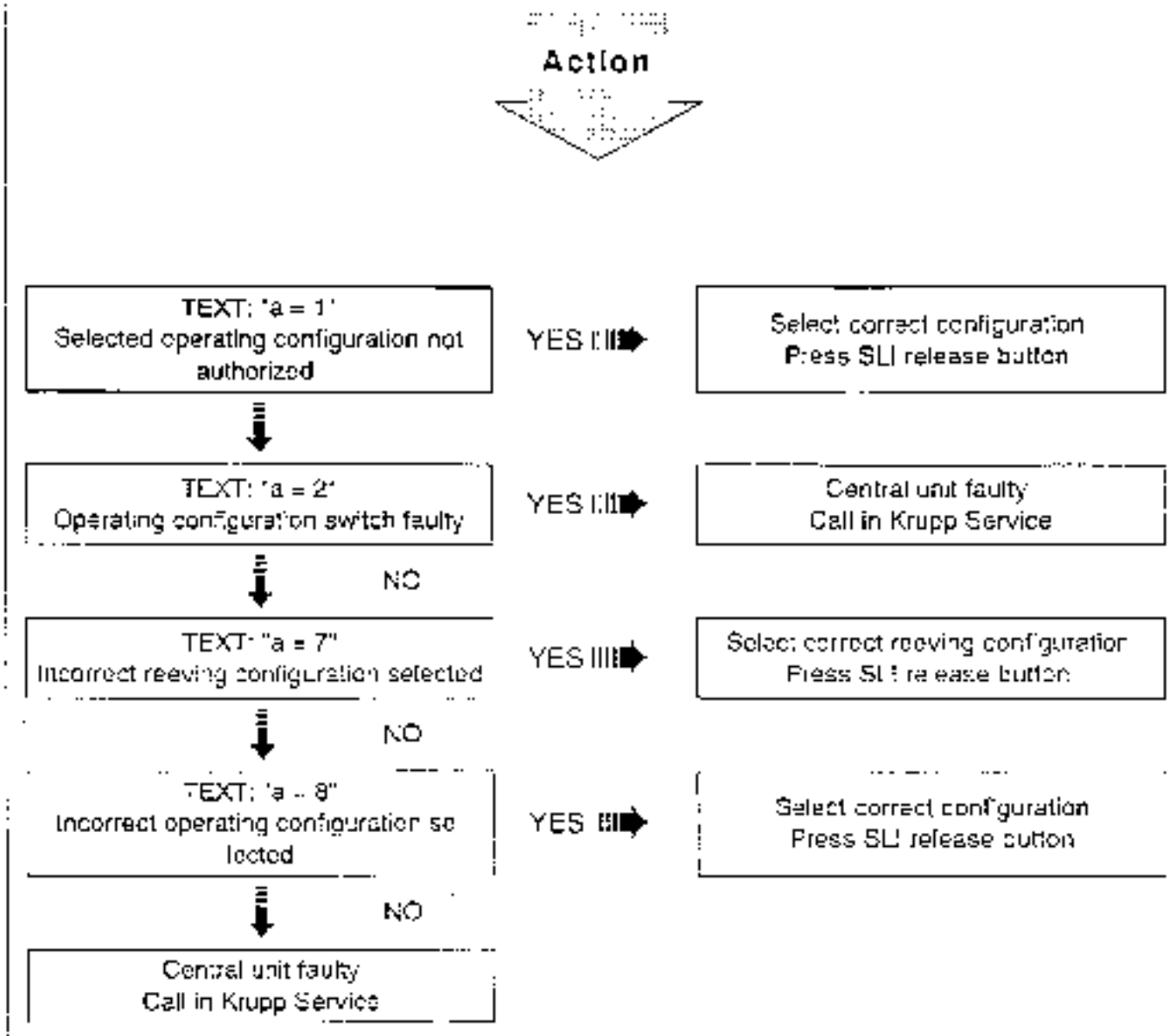
NO

Select required letter using information switch

NO

SLI displays a letter a to k and a number 1 to 8

Action



Action

TEXT: "b = 1" to "b = 8"

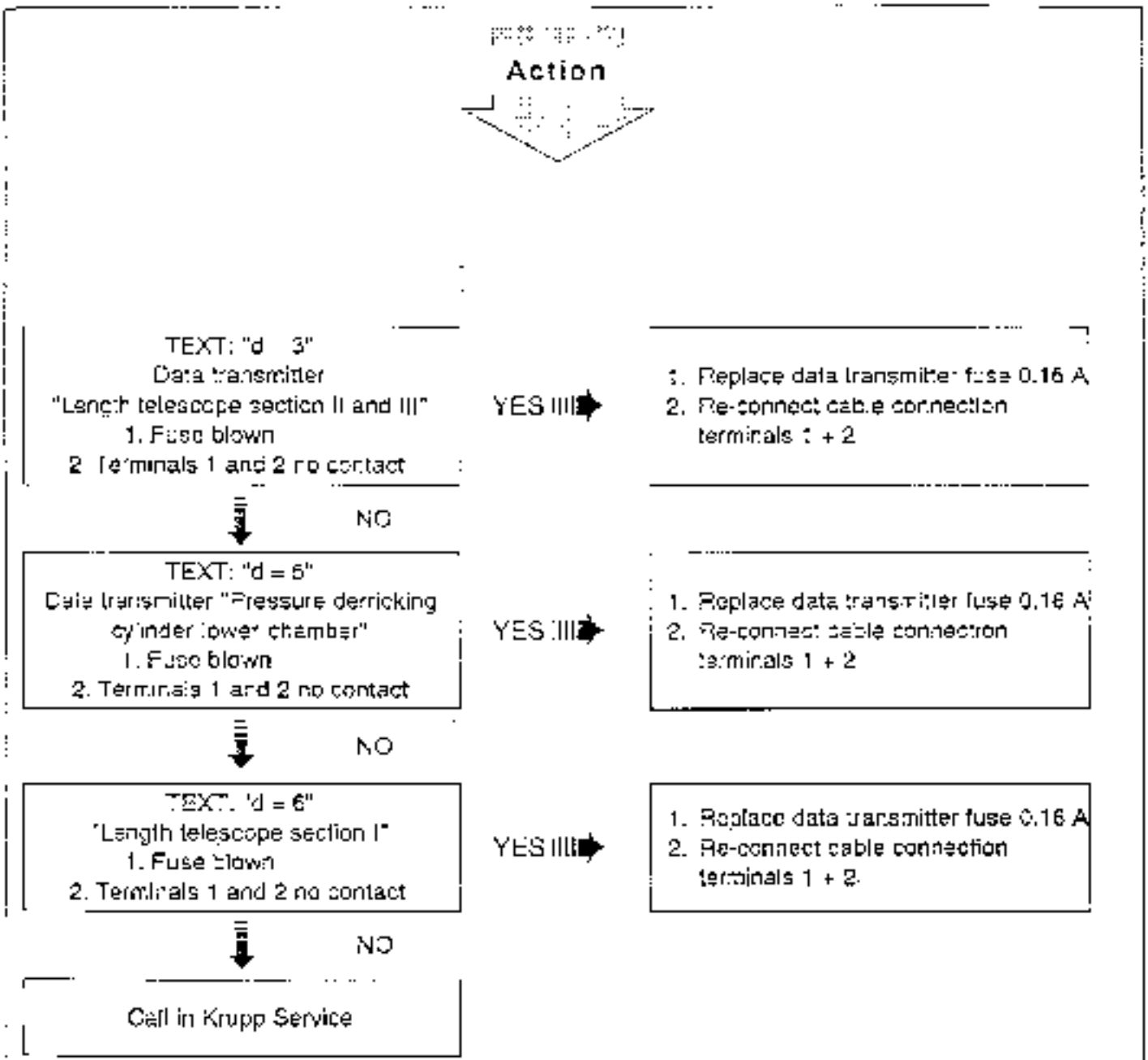
Correct crane type and country set

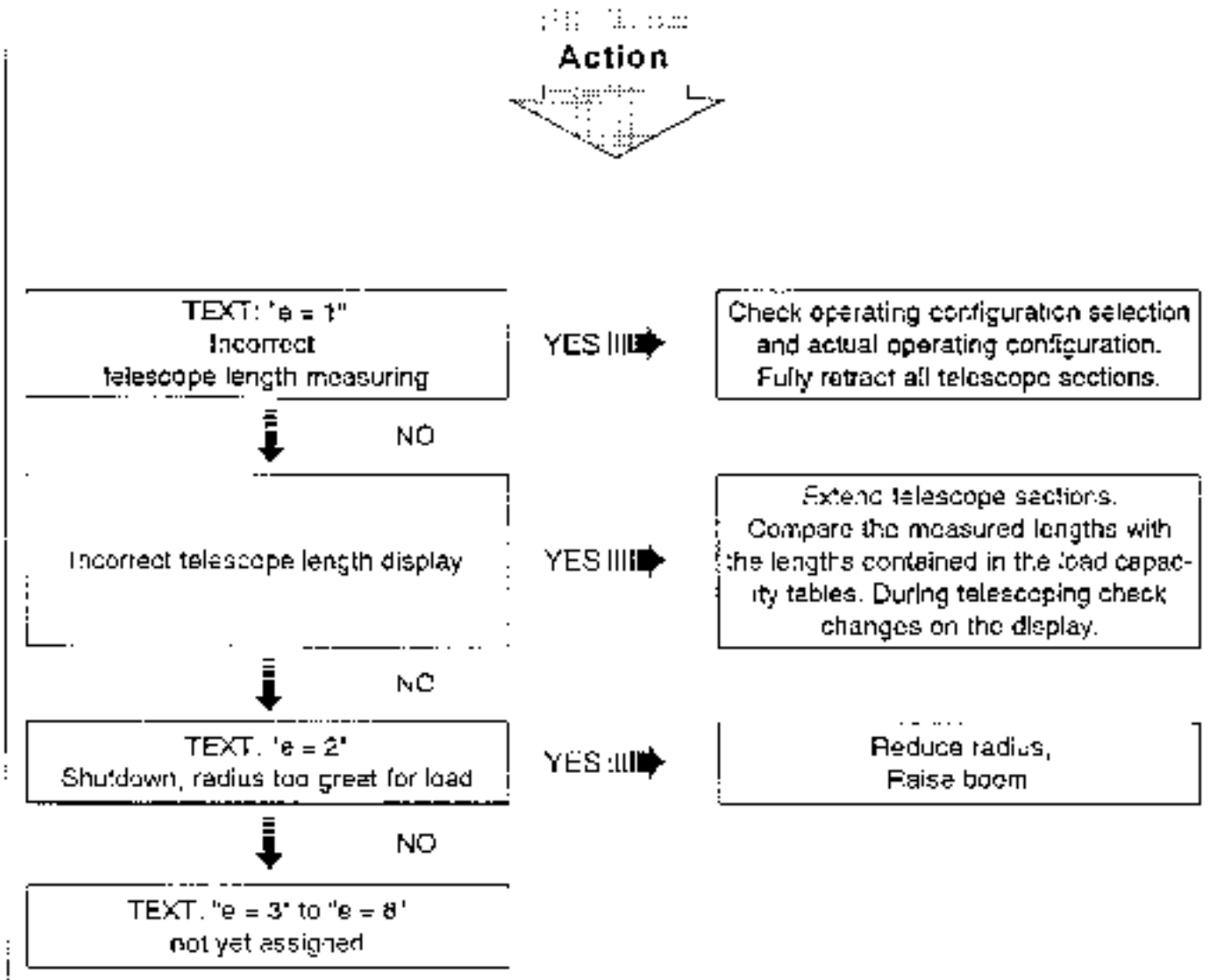
Action

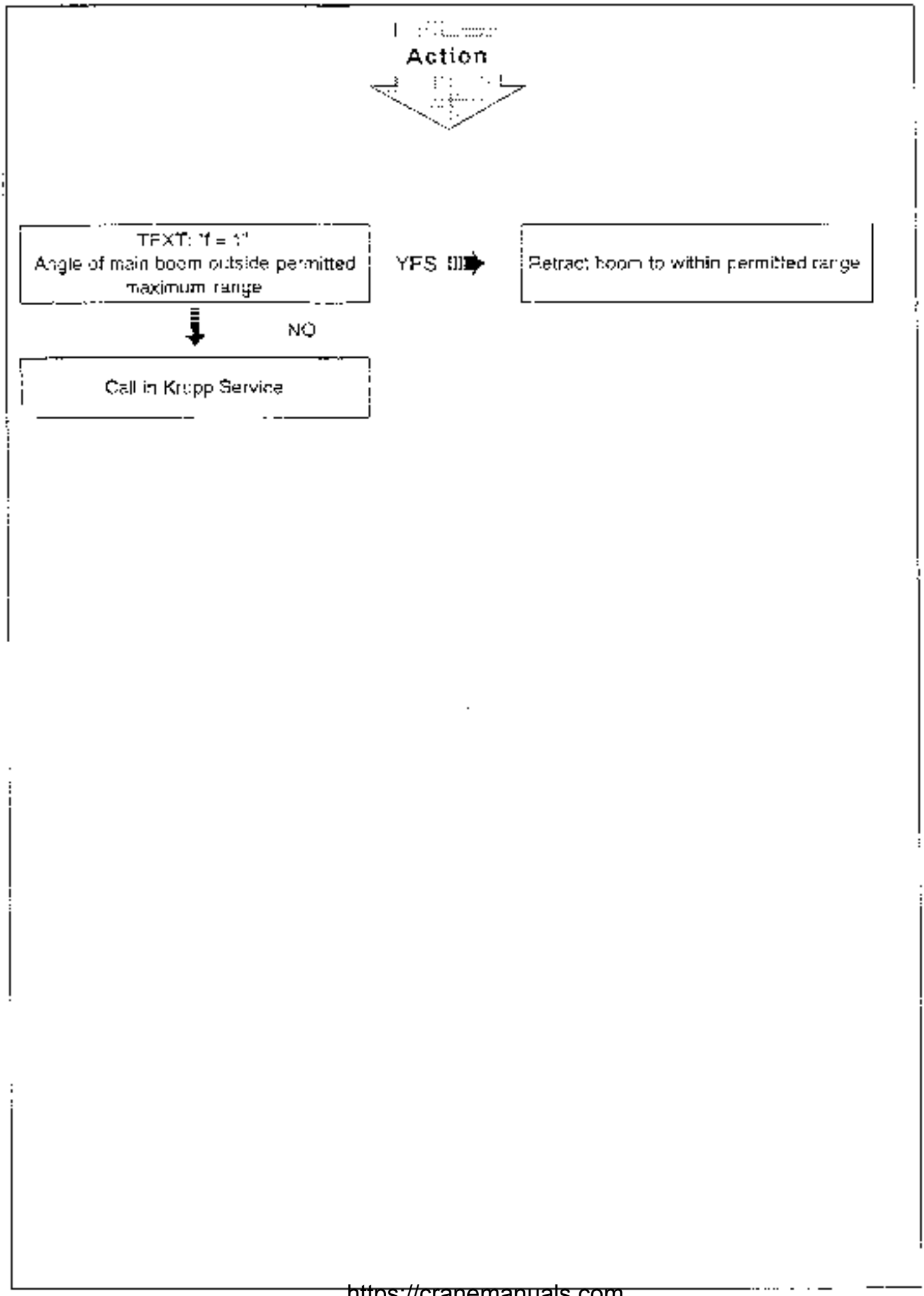
TEXT: "b = 1" to "b = 8"

Correct crane type and country set

Fault	Action
TEXT: "d = 1" to "d = 6" Power supply to all data transmitters interrupted. Fuse F2 in SLI blown	YES ⇒ Remove SLI central unit (remove 4 retaining screws, lift the central unit out of the instrument panel), Replace fuse F2 1.25 A Fuse blown again. Short circuit in the system Call in Krupp Service
NO ⇓	
Cable to data transmitters interrupted	YES ⇒ 1. Secure plug on rear of SLI 2. Secure connections on the boom unit, particularly terminals 1 and 2 on the data transmitter in the boom unit
NO ⇓	
TEXT: "d = 2" Data transmitter "Angle of main boom" 1. Fuse blown 2. Terminals 1 and 2 no contact	YES ⇒ 1. Replace data transmitter fuse 0.16 A 2. Re-connect cable connection terminals 1 and 2







TEXT: "L" Overload	YES ➡	Reduce load moment
TEXT: "M" Shutdown	YES ➡	Leave shutdown range, and have SLI repaired
TEXT: "N" Warning, At shutdown range	YES ➡	Leave shutdown range

Note: When **L** appears, all movements which increase the load moment are shut down. At this point, only those movements which reduce the load moment are possible.

Shut-down movements	Permitted movements
Hoist raising	Hoist lowering
Boom lowering	Boom raising
Boom extending	Boom retracting

The group displays **a** to **f** and the display **L** are always accompanied by the display **M**.

Caution: Always terminate crane operations the moment a malfunction message is displayed ! SLI repairs may only be carried out by trained personnel !

Repairs to the electrical system

This section describes checking and repair procedures for both carrier and superstructure electrical components.

These electrical components are common to both carrier and superstructure, and have therefore been described in one section.

These repairs are cross-referenced in the section entitled 'Troubleshooting' for the individual consumers.

Before starting work, check that you have all the correct measuring instruments and testing equipment.

Caution: Unless otherwise stated, always disconnect the electrical system at the master switch before commencing repairs.

General VDE regulations for terminal markings

- Battery (+)	Terminal	No. 30
- Battery (-)	"	" 31
- Operating connection (+) via ignition	"	" 15
- Operating connection (+) via flasher relay	"	" 49
- Operating connection (-) at windscreen wiper	"	" 31b
- Parking light (+)		" 58
- Dipped beam (+)	"	" 56b
- Headlight (+)	"	" 56a
- Braking light (+)	"	" 54
- Indicator, right (+)	"	" 54R
- Indicator, left(+)	"	" 54L
- Starter cable	"	" 50
- Windscreen wiper supply lead	"	" 53/53a

Relay

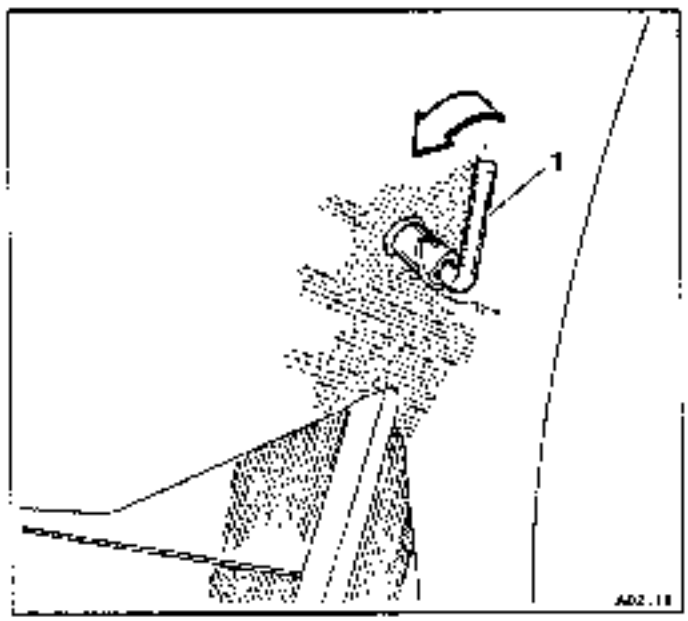
- Coil supply lead (-)	"	" 85
- Coil supply lead (+)	"	" 86
- Live line from relay	"	" 87
- Dead line from relay	"	" 87a
- Twin-contact relay	"	" 87b

Master battery switch configuration

Two types of battery supply the truck crane with a 24 V on-board network:

- Standard battery: 2 x 12 V 143 Ah
- Special battery: 4 x 12 V 125 Ah (-40 °C version)

The three-phase generator has a capacity of 28 V/90 A

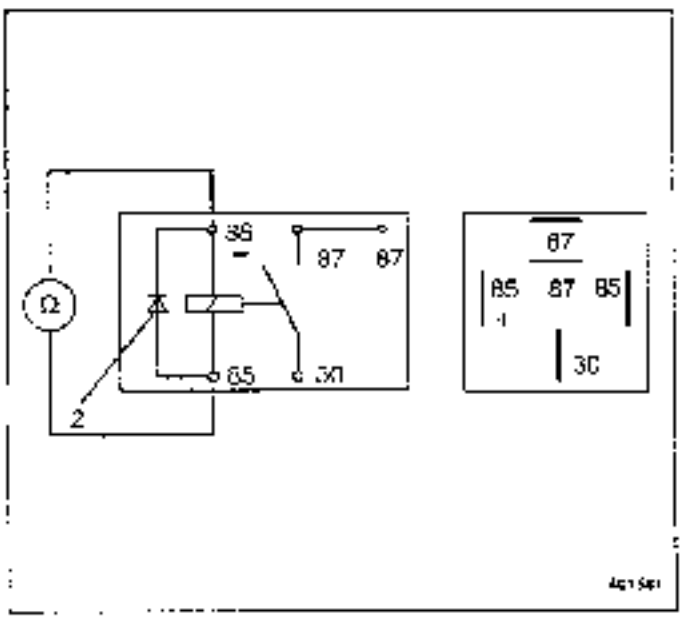


- The battery master switch (1) is located at the back of the cab behind the driver's seat.

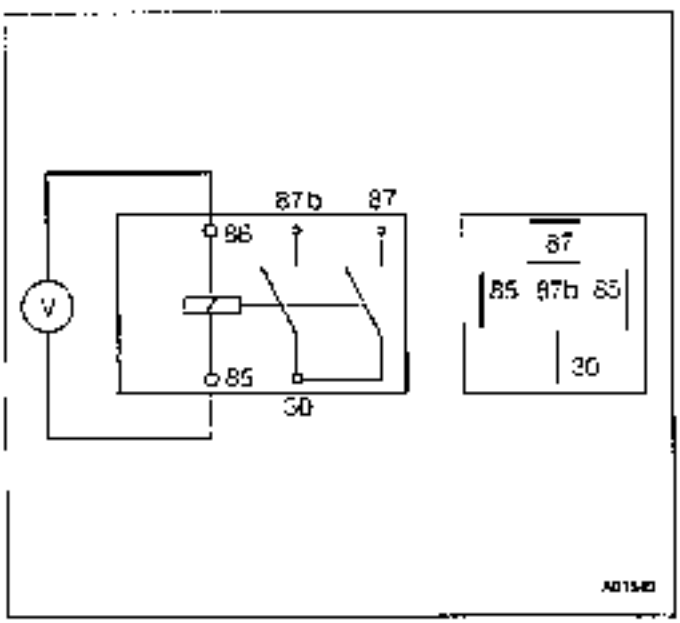
Checking procedures

Checking relays

Checking Bosch relays



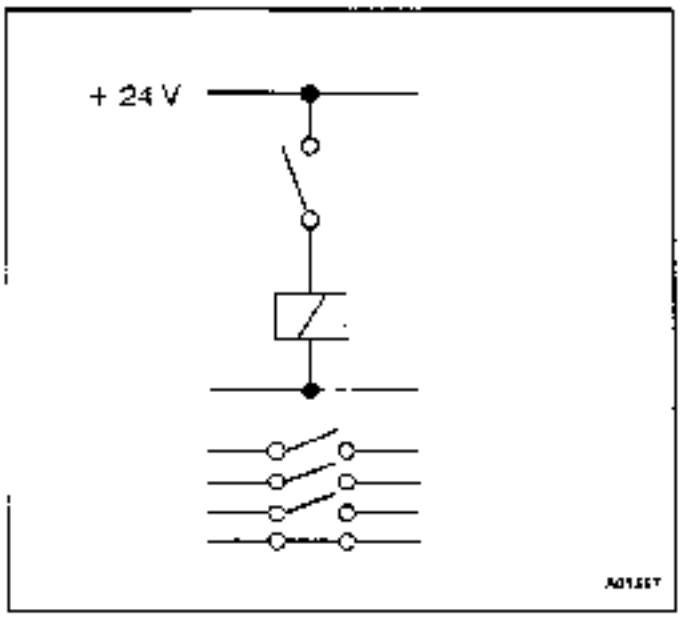
- Isolate the relay
- Remove the cap.
- Remove the diode (2).
- Connect the ohmmeter to contacts 85 and 86.
- Conduct a coil test. If the ohmmeter shows a reading the relay coil is operative.
- Check the contacts.
- Connect the ohmmeter to contacts 30 and 87.
- If the ohmmeter shows a reading, the contacts are operative.
- Upon completion of the checking procedure, replace the diode.



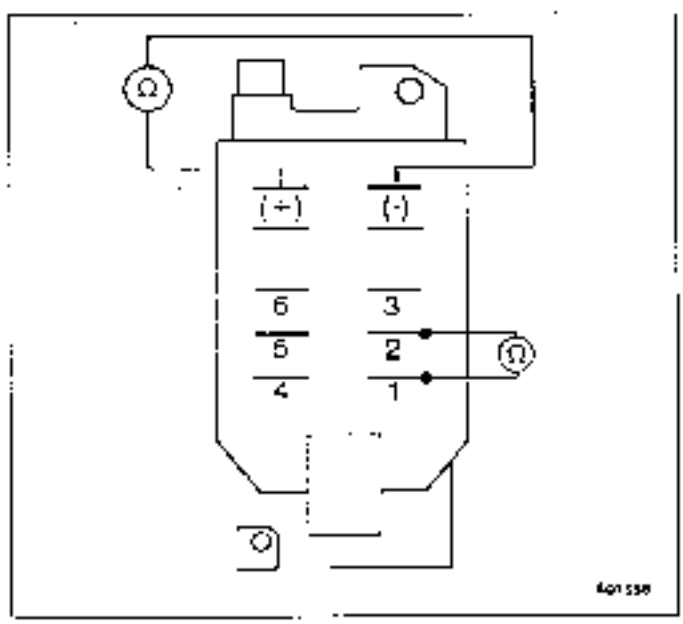
The relay can also be subjected to a voltage test (12/24 V relay).

If both the resistance and voltage measurements read zero, fit a new relay.

Checking a Siemens relay



- Isolate the relay.
- Connect the ohmmeter to contacts (+) and (-).
- Conduct a coil test. If the ohmmeter shows a reading, the relay coil is operative.



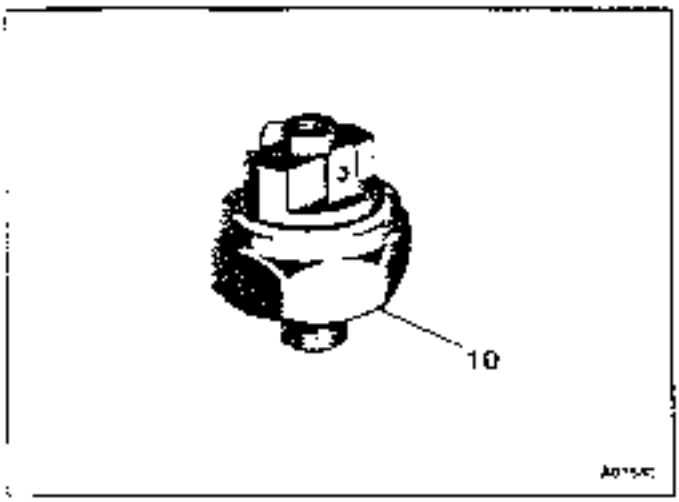
- Check the contacts.
- Connect the ohmmeter to contacts 1 and 2.
- If the ohmmeter shows a reading, the contacts are operative.

The relay can also be subjected to a voltage test (24 V relay).

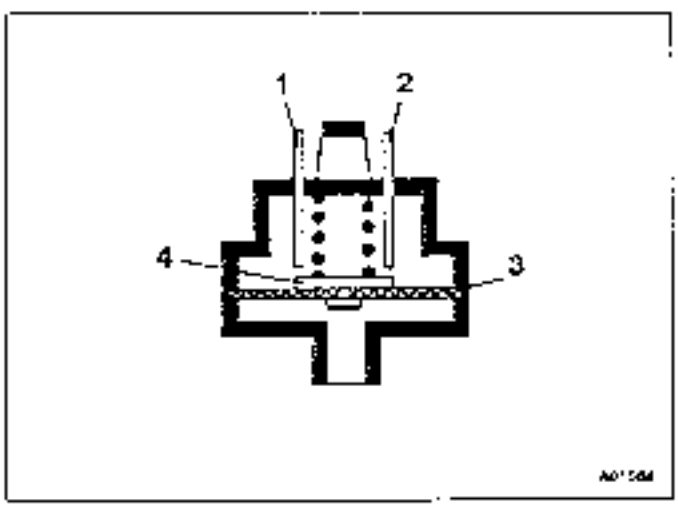
If both the resistance and voltage measurements read zero, fit a new relay.

Checking a pressure switch

Contact element

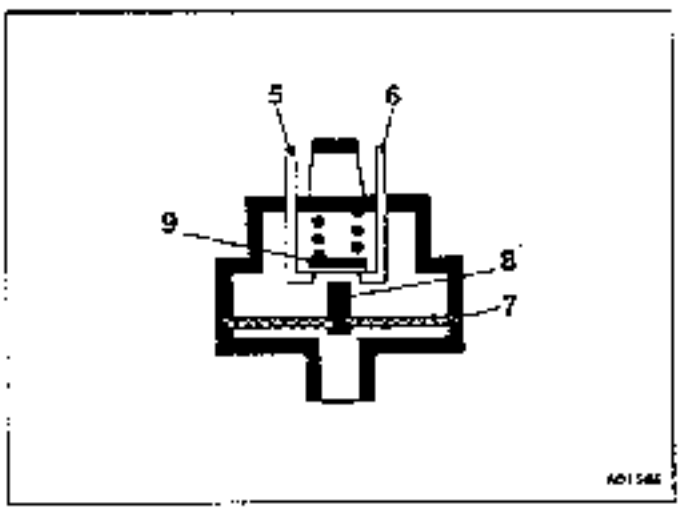


- The pressure switch (10) is part of the compressed air system.



- Connect the ohmmeter to contacts (1) (+) and (2) (-).
- Activate the compressed-air system. the diaphragm (3) with contact plates (4) rises.
- The contacts (1 and 2) are connected and the ohmmeter must show a reading.
- If a reduction in pressure or an inherent defect results in no pressure switch connection, no reading will show.
- Fit a new pressure switch.

Break contact element



- Connect the ohmmeter to contacts (5) (+) and (6) (-).
- Activate the compressed-air system; the diaphragm (7) with plunger (4) rises and the contact plate (9) breaks the contacts (5) and (6).
- The ohmmeter must read zero.
- If a reduction in pressure or an inherent defect results in no pressure switch connection, a reading will show.
- Fit a new pressure switch.

Repairs to the hydraulic system

This section contains checking and repair procedures for carrier and superstructure hydraulic parts.

These repair procedures are cross-referenced under troubleshooting in the individual sections.

Before starting, check that you have all the correct measuring instruments, testing equipment and special tools and suitable containers for collecting the hydraulic oil.

Caution: Before commencing any repairs, always switch off the diesel engine and secure against unauthorized activation.

Caution: When handling hydraulic parts, absolute cleanliness is essential. Only use genuine spare parts. Do not attempt to repair faulty parts. The hydraulic system operates under extreme pressure levels, and thus, the hydraulic parts are subjected to extreme levels of stress. Before disconnecting any hydraulic lines or removing any hydraulic parts, always ensure that the affected area is depressurized.

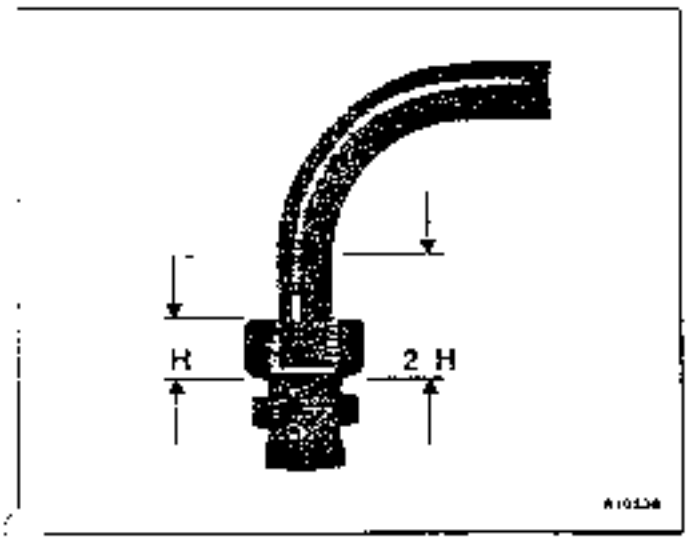
The Maintenance section contains all the relevant information on handling hydraulic oil.

Pipe screw couplings

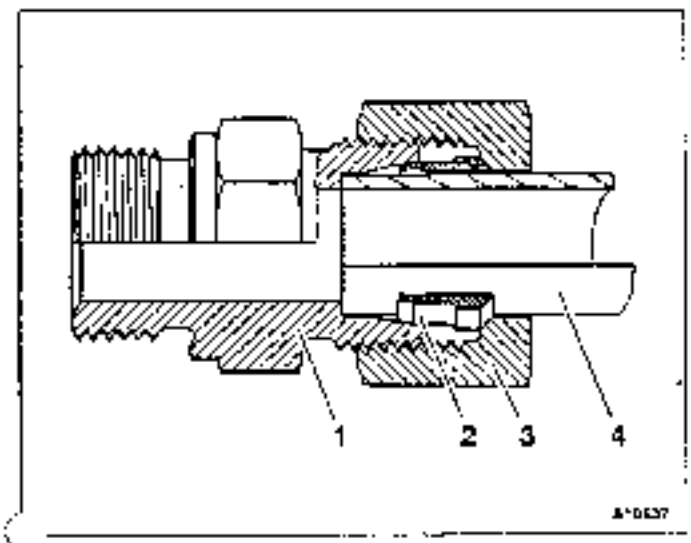
Many pipes are coupled using a cutting ring. If pipes are coupled in this way special care must be taken to avoid leaks. If plastic pipes have to be coupled, a stiffening sleeve must be used.

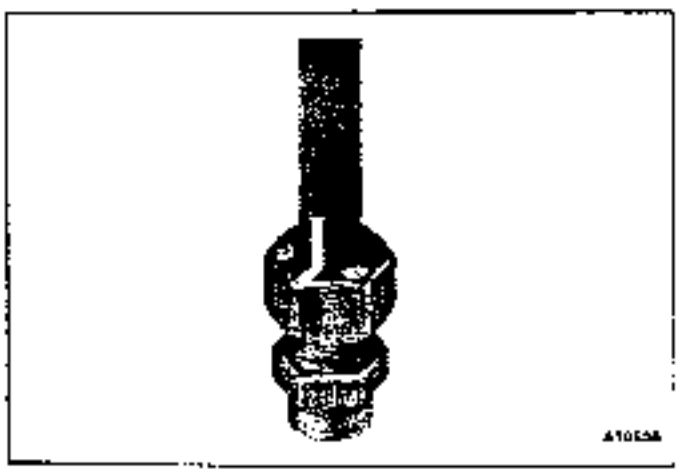
Caution: If pipes are coupled always use the screw neck employed for fitting the cutting ring. If pipes are replaced, the screw coupling consisting of the screw neck, cutting ring and coupling nut must also be replaced. Do not re-use screw necks.

Steel pipes



Note: The length of the straight section (between the end of the pipe and the elbow) must be at least twice the height of the coupling nut.



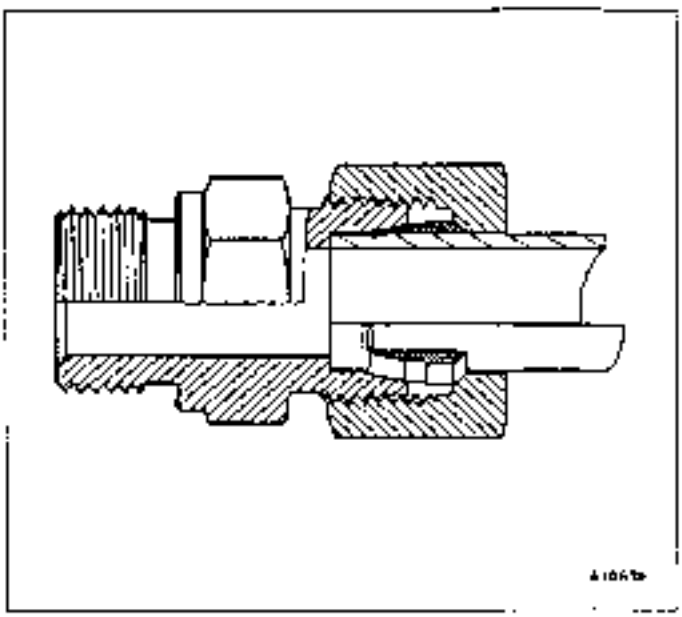


- Saw off the pipe (4) at a right angle.
- Remove burrs on the inside and outside of the pipe.
- Lubricate the thread on the outside and the cone on the inside of the screw neck (1) with oil. Do not use grease.
- Clamp the screw neck in a vice.
- Lubricate all sides of the cutting ring (2) with oil. Do not use grease.
- Lubricate the internal thread of the coupling nut (3) with oil. Do not use grease.
- Slip the coupling nut onto the pipe, its internal thread facing the end of the pipe
- Push the end of the pipe with coupling nut and cutting ring as far as it will go into the screw neck
- Screw on the coupling nut as far as it will go by hand.
- Mark the screw neck and coupling nut.
- Use a hexagon spanner to tighten the coupling nut 3/4 of a turn.

Note: Hold the pipe so that it cannot turn with the coupling nut. The cutting ring enters the end of the pipe.

- Turn the coupling nut with the spanner another 3/4 of a turn.

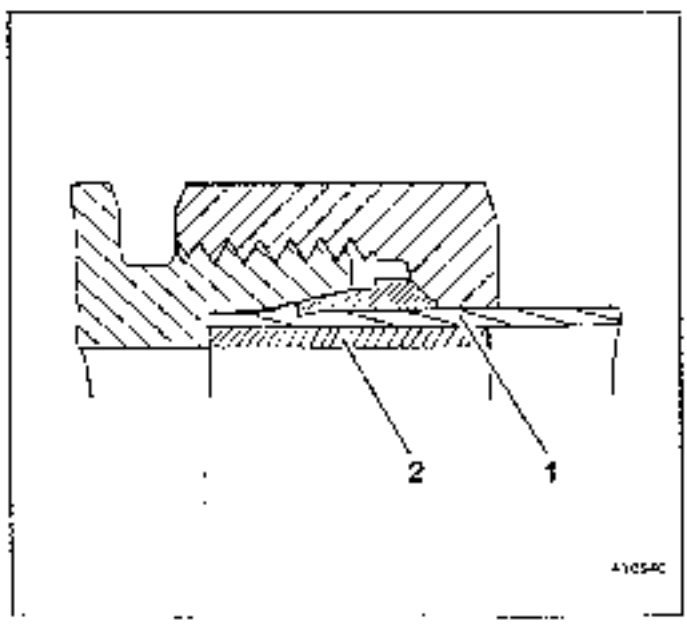
Note: The ring cuts into the end of the pipe and produces a collar.



- Unscrew the coupling nut and check the seat of the cutting ring.
  There must be a smooth transition between the collar and the front edge of the cutting ring. If the collar is too small, the coupling nut must be tightened once again.

- Once the pipes are properly coupled the screw coupling can be tightened without effort (this also applies after the screw coupling is loosened).

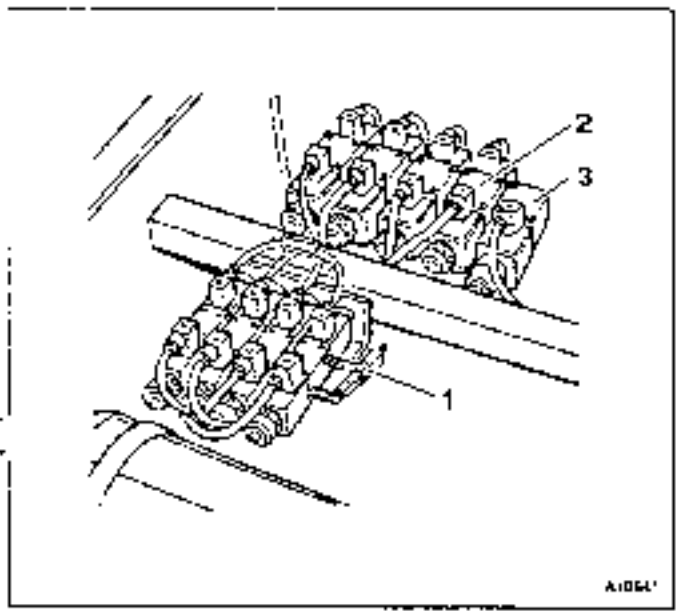
: Plastic pipes



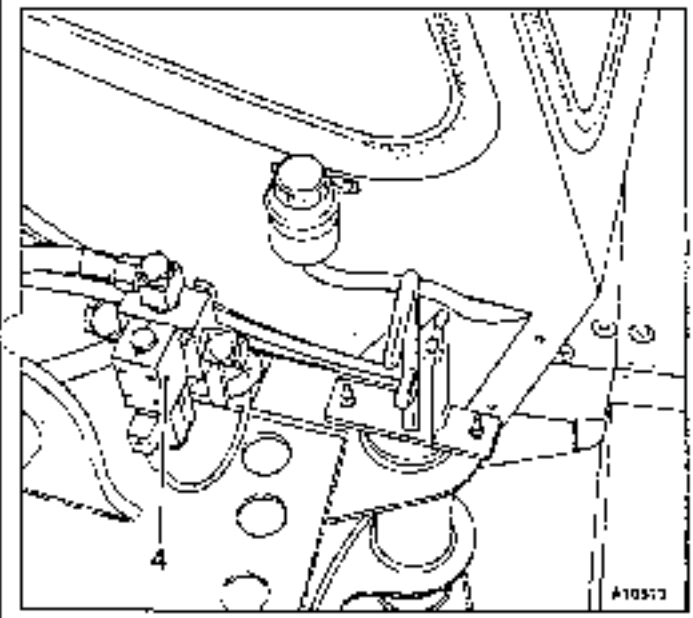
- Saw off the plastic pipe (1) at a right angle and remove the burrs on the inside and outside.
- Push the stiffening sleeve (2) into the end of the pipe until pipe end and sleeve end are flush.

Checking and replacing the solenoid valves

Apart from the valves in the hydraulic control block on the superstructure and the valves in the control block of the suspension blocking system, several solenoid valves are used in various assembly groups.

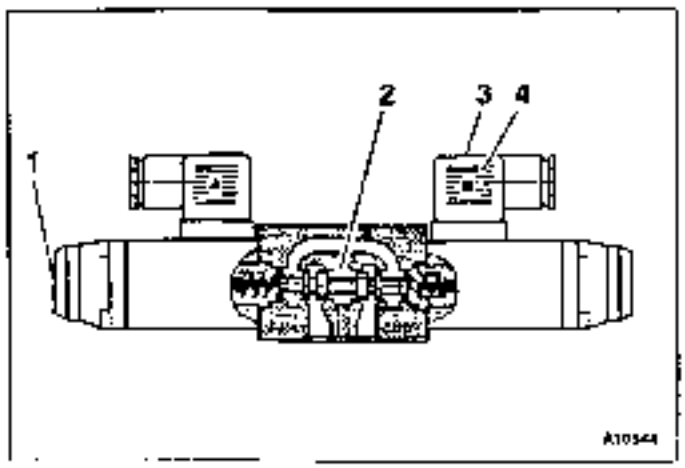


- Solenoid valves (1) to (3) for the rear outrigger system, accessible behind the control cover plate at the rear end of the vehicle.



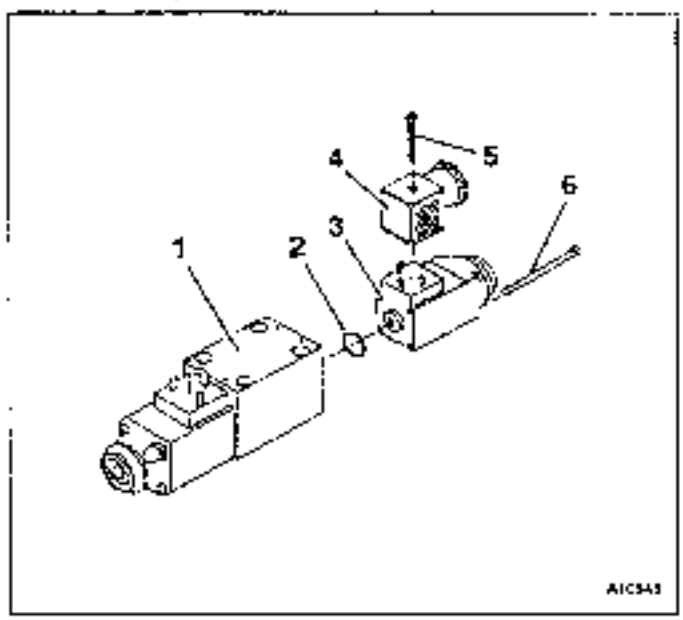
- Solenoid valve (4) used as valve for unidirectional steering, accessible on the turntable on the right-hand side of the crane operator's cab.

Checking the solenoid valves



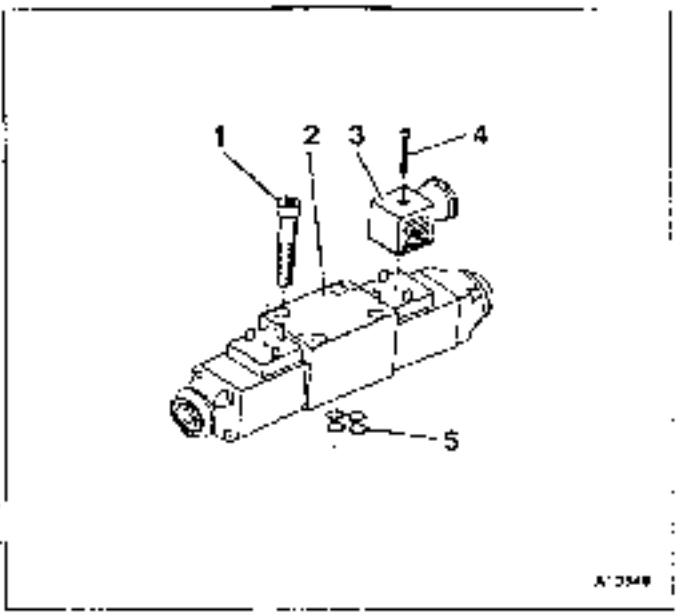
- Check if the pistons of the solenoid valves are in working order by using the emergency operating facility (1) to shift the control piston (2).
- Loosen the screw (3) in the plug (4).
- Remove the plug (4).
- Check the voltage on the contacts.

Replacing the magnetic head



- Loosen the screw (5) in the plug (4).
- Remove the plug (4)
- Unscrew the hexagon socket head bolts (6) from the valve body (1)
- Remove the magnetic head (3) from the valve body (1).
- Install a new magnetic head with a new O-ring (2) and attach it with bolts (6).
- Insert the plug (4) and fasten it with the screw (5).

Replacing the solenoid valve



- Loosen the screw (4) in the plug (3).
- Remove the plug (3)
- Unscrew the hexagon socket head bolts (1) from the valve plate.
- Remove the solenoid valve from the valve plate.
- Collect hydraulic oil in a suitable container.
- Install a new solenoid valve with new O-rings (5) on the valve plate and fasten it with bolts (1).
- Insert the plug and fasten it with the screw.

Checking, setting and replacing the pressure relief valves

The pressure relief valves of the outrigger system, suspension blocking system, fan motor and pump circuits 3 and 4 are in the relevant control blocks or in the hydraulic lines of the respective components. REXROTH and HAWE pressure relief valves are installed in the truck crane.

5.2.3.1 Checking the pressure relief valves

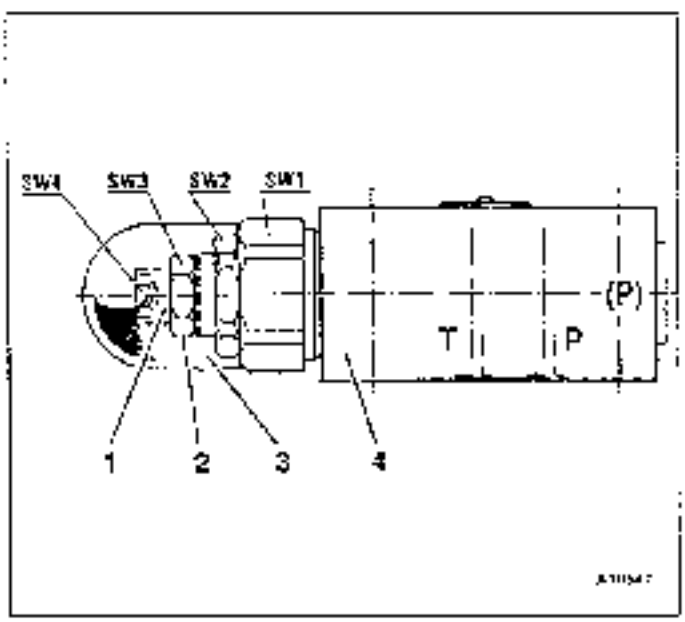
- Put the hydraulic system into operation.
- Read the pressure off a testing pressure gauge connected to the gauge port of the section of the hydraulic system which is to be checked.
- If the pressure indicated on the gauge is higher or lower than the pressure specified on the hydraulic circuit diagram the pressure relief valve must be adjusted or replaced.

Caution: Always replace faulty valves which are sealed (set at the factory).

Setting and replacing (Rexroth) pressure relief valves

There are two types of valve housings for:
a) subplate mounting
b) thread connection mounting

Setting the pressure relief valve



Pressure relief valve (4) for:

- Pump circuit III (*20 bar) on the hydraulic plate behind the hydraulic oil reservoir.
- Fan motor (175 bar) on the right hand side of the vehicle, attached to the chassis near the cooler for the engine coolant.

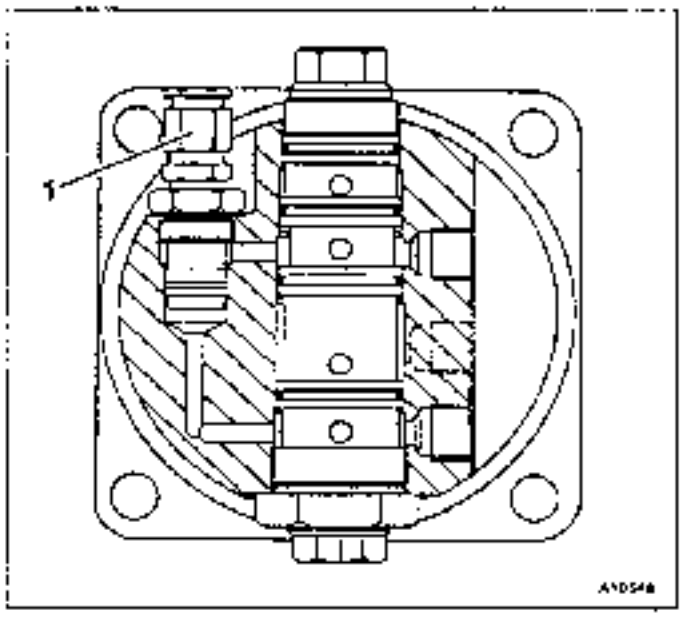
- Remove the cap (3).
- Loosen the counternut (2).
- Turn the setscrew (1) to the left or right until the correct pressure is indicated on the pressure gauge.
- Tighten the counternut (2).
- Put the cap (3) back on the valve

Replacing the pressure relief valve

- Unscrew the faulty pressure relief valve cartridge from the housing.
- Collect hydraulic oil in a suitable container.
- Install a new valve cartridge with new seals

Setting and replacing HAWE pressure relief valves (Type MV..)

Setting the pressure relief valve



Pressure relief valves:

– in the outrigger cylinder (300 bar),

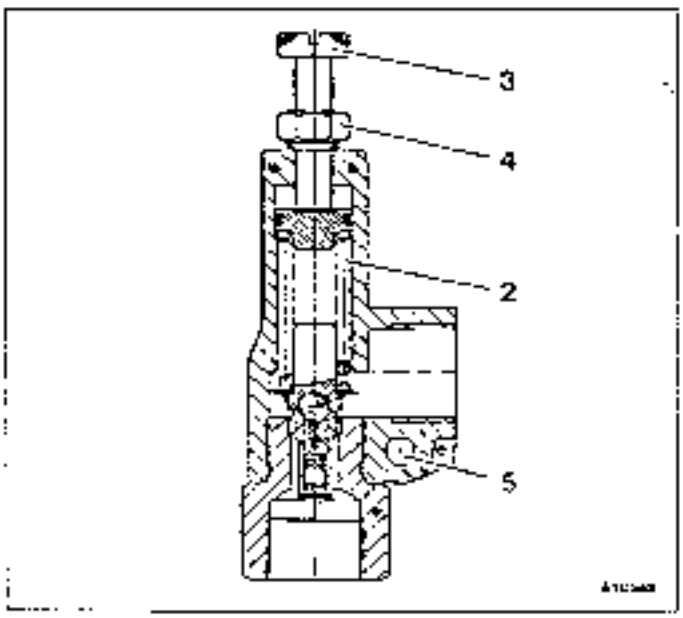
Note: The HAWE valve type MVE (1) has a factory setting and cannot be adjusted.

– for outrigger beams (100 bar), on the sub-plate with the solenoid valves for the rear outrigger system,

– for pump circuit IV (40 bar), on the hydraulic plate behind the hydraulic oil reservoir

- Loosen the counternut (4).
- Turn the setscrew (3) to the right or left until the correct pressure is indicated on the pressure gauge.
- Tighten the counternut (4).

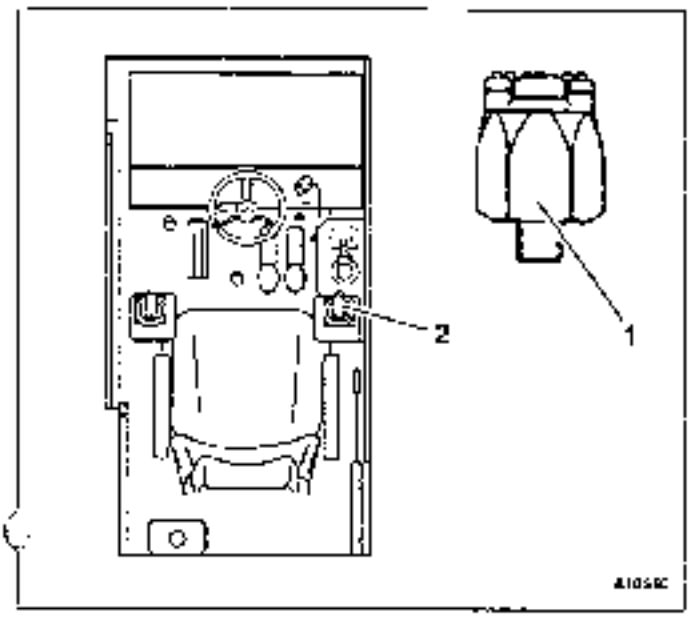
Replacing the pressure relief valve



- Unscrew the faulty pressure relief valve type MVE (1) from the outrigger cylinder.
- Collect the hydraulic oil in a suitable container.
- Carefully screw a new pressure relief valve into the cylinder taking particular care not to damage the O-rings on the pressure relief valve

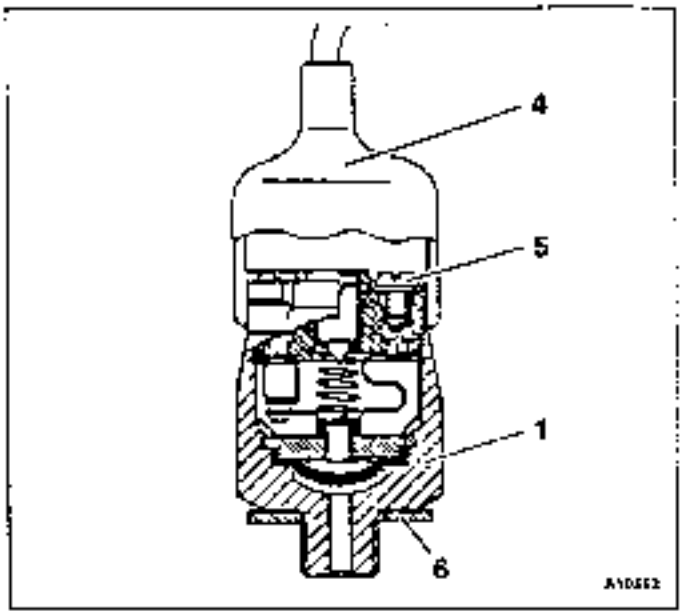
- If one of the pressure relief valves type MV (2) is faulty, remove the pipes or hoses from the valve
- Collect hydraulic oil in a suitable container.
- Unscrew the attachment bolt (5)
- Fitting a new pressure relief valve is the reverse of removal

Testing and replacing the pressure switch



The pressure switches P1 and P2 (1) for controlling the solenoid valve 1Y1 (hoist brake) are on the right-hand control panel (2) in the crane operator's cab.

Testing the pressure switch



Pressure switch (1) is not working.

- Remove the cap (4) from the pressure switch.
- Disconnect the cables (5) from the pressure switch.
- Test the voltage (+24 V) on the plug with a suitable testing instrument. If a voltage is indicated on the instrument, replace the pressure switch.

Replacing the pressure switch

Caution: Before a pressure switch (1) is replaced the diesel engine and ignition must be turned off and secured against unauthorized activation.

- Remove the cap (4) from the pressure switch.
- Disconnect the cables (5) from the pressure switch.
- Unscrew the pressure switch from the pipe end.
- Fitting a new pressure switch with new seal (6) is the reverse of removal.

Retaining bolt tightening torques

Standard bolts

Standard metric thread Fine-pitch metric thread			Guidelines		
Thread size (mm)	Spanner width (mm)		Tightening torque for maximum permissible initial tension for lubricated bolts (Nm)		
			Bolt quality		
	Hexagon bolt	Cheese head bolt	8.8	10.9	12.9
M 6 M 6 x 1	13	6	23 24	32 34	36 41
M 10 M 10 x 1.25	17	8	44 47	62 66	75 79
M 12 M 12 x 1.5	19	10	78 81	110 113	130 135
M 14 M 14 x 1.5	22	12	120 135	170 189	210 225
M 16 M 16 x 1.5	24	14	165 203	190 264	320 342
M 18 M 18 x 1.5	27	14	260 293	365 414	435 495
M 20 M 20 x 1.5	30	17	370 414	520 576	620 693
M 22 M 22 x 1.5	32	17	500 549	700 774	840 945
M 24 M 24 x 1.5	36	19	640 702	900 990	1080 1170
M 30	46	22	1300	1800	2160
M 33	50	24		2700	
M 36	55	27		3300	

Special bolts and nuts

Designation	Thread size (mm)	Spanner width (mm)		Tightening torque (Nm)
		Hexagon bolt	Cheese head bolt	
Retaining bolts Ball bearing slewing rim	M 20	30	17	520
Wheel nuts	M 22 x 1.5	32		650