



# Technical Handbook

## ContChamp DC 4160-4560

This Handbook deals with the design and maintenance of Kalmar LMV container machines.

In addition, it gives details of troubleshooting and the most common corrective maintenance.

Operation and other matters that are primarily of interest to the operator are included in the Operator's Manual

*Kalmar LMV*

*We reserve the right to modify our design and material specifications without prior notice.*

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The Volvo six-cylinder turbocharged TD 100 G engine, combined with a four-speed gearbox with torque converter, provides smooth power whenever needed.

The drive axle with hub reduction, oil-cooled hydraulic brake system and pendulum-mounted steered axle with double-acting steering cylinder satisfy very strict demands on strength and mobility when travelling on irregular surfaces.

The hydraulic system is reliable and has high performance. It comprises three hydraulic pumps that supply:

- Lift, boom extension, steering, attachment functions and the hydraulic servo system.

### Component units

- Sound-insulated and safety-tested operator's cab with excellent all-round visibility. The non-slip, substantial steps provide convenient access to the cab. All models in the series can be equipped with a rotatable operator's seat. As an optional extra, a hydraulically movable cab is available.
- Clearly arranged instrument panel, with a circuit board for fuses and relays.
- Engine - Volvo TD 100 G six-cylinder, four-stroke, turbocharged diesel engine with direct injection and thermostatically controlled water cooling.

The engine is equipped with:

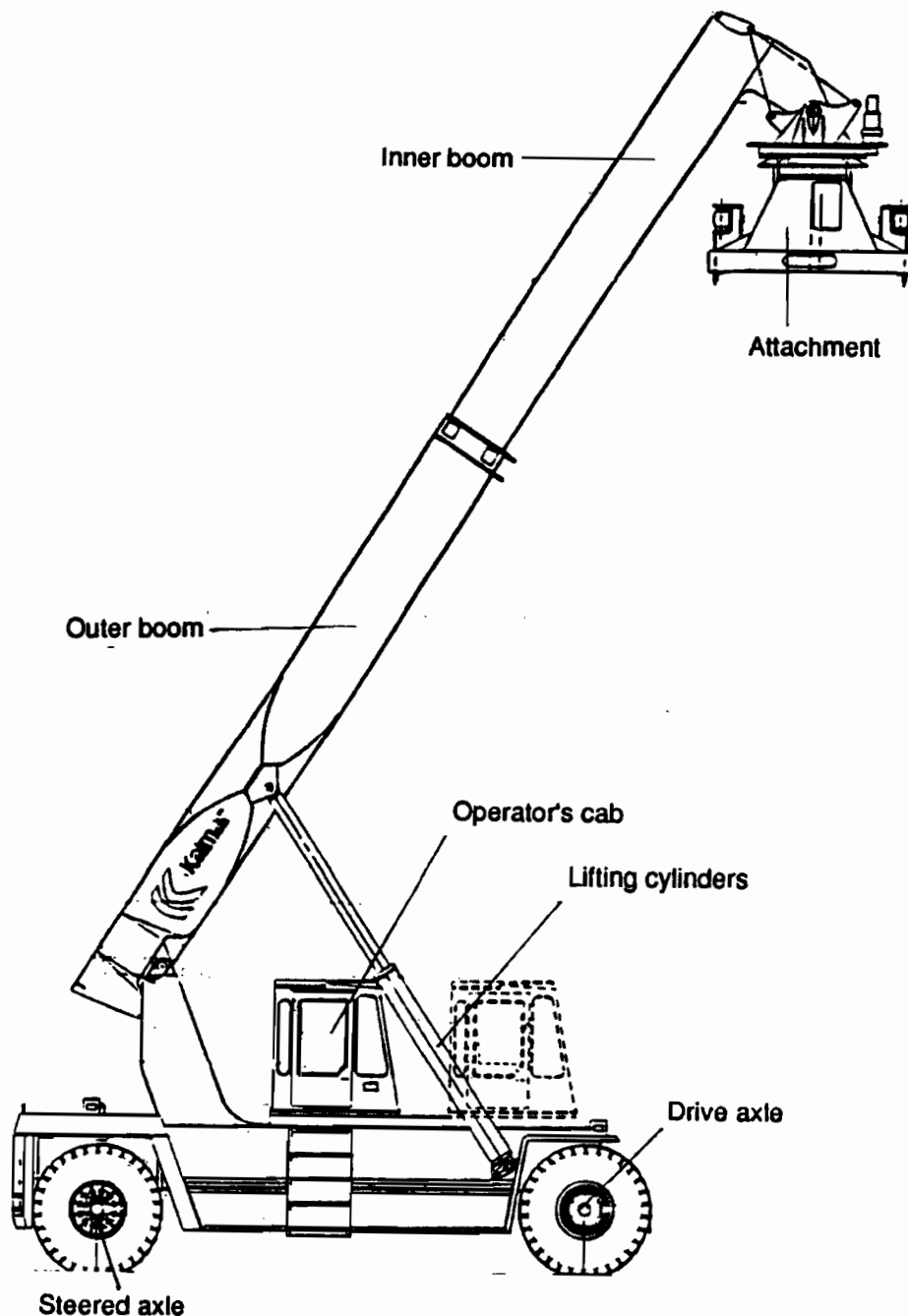
- Injection pump with centrifugal governor that compensates for load variations.
- Alternator.
- Gearbox with torque converter
  - Constant-mesh gearbox changes by means of hydraulically activated clutches which are electrically operated.
  - Torque converter, which is a hydraulic coupling that amplifies the output torque on an increase in load. Torque conversion takes place smoothly and steplessly throughout the engine speed range.
  - Oil cooler connected to the engine cooling system for cooling the oil in the gearbox and torque converter.
  - Oil pump which supplies oil under pressure to the gearbox and torque converter.
  - Full-flow oil filter for effective cleaning of the gearbox oil.
- Drive axle with two-stage reduction - in the differential and the hub reductions.
  - Hydraulic, oil cooled disk brakes - wet disk brakes - for the foot brake.
  - Disc type parking brake applied by sturdy springs and released by hydraulic oil pressure.

### Chassis

The chassis consists of:

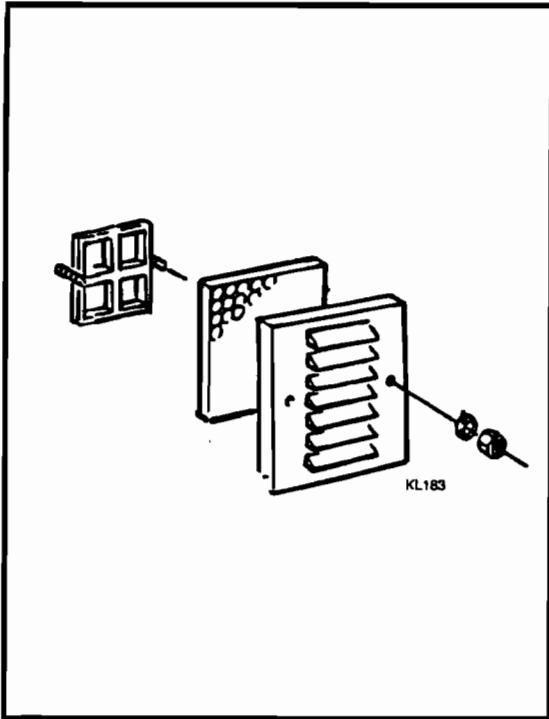
- A unit construction frame built up around two box- sections for best possible strength.
- Mountings for the drive axle, steered axle, telescope-boom, lifting cylinders and transmission.
- The necessary counterweights to provide a very low centre of gravity. Moreover, the steered axle is designed to serve as an additional counterweight.

The hydraulic oil tank and the fuel tank are produced as separate units and are bolted to the side of the chassis. The tanks have a low profile, which contributes to the good visibility.



**Changing the fresh air filter**  
(every 1000 hours)

- Remove the filter casing retaining bolts and remove the filter element.
- Fit a new filter element.



**Automatic electric gear-changing system**

Fuse 5 A

**Outputs:**

All outputs are short-circuit protected and can withstand a load of 1A.

However, the total output must not exceed 4A.

9 outputs for gear selection.

Output for engine control.

Output for lock-up.

Output for fault indication.

**Inputs:**

8 inputs for gear selection control.

Input for manual gear-changing.

Input for lock-up.

Input for kick-down.

2 inputs for fault indication, one of which can be used for monitoring the engine speed.

Input for tacho pulses from the output shaft.

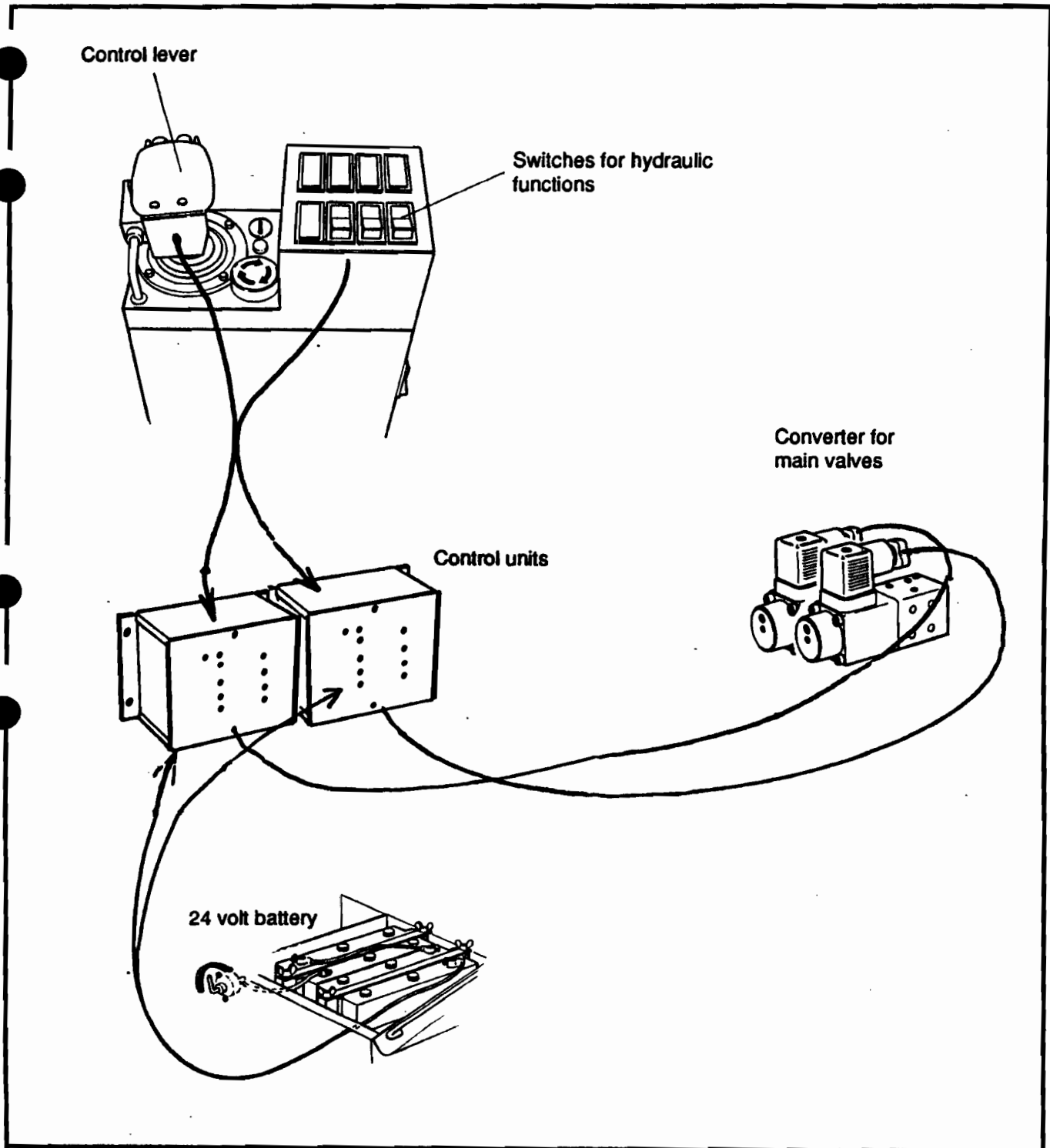
Heat dissipation 15 W

### General

The electro-hydraulic servo system consists of the following components:

- Control lever
- Switches
- Control units
- Converters on the main valves

In addition there are relays, solenoid valves and sensors in the system. This is made clear in the circuit diagrams for respective units.



#### Uncontrolled movements

1. The relevant function starts as soon as the power is switched on.
  - Remove the protective cover from the lever unit and check that the current collector in the control lever unit is not in contact with the potentiometer track when the lever is in neutral. If it is, turn the adjusting screw at the bottom of the potentiometer anti-clockwise. The setting is correct if contact takes place at a lever movement of 2 - 3°.
  - Check that the control lever unit is correctly connected as described in the section entitled Description. Check that none of the diodes in the lever unit have burnt out.
2. A function operates unintentionally when another is operated.
  - Check the wiring against the circuit diagram. The relevant functions have been connected either in series or in parallel.
3. A function has been started but fails to stop when the lever is returned.
  - Check that the hydraulic servo pressure is 30 - 40 bar. Check that the pressure does not drop when a load is applied.
  - Check the converter which actuates the movement. Fit a different converter and check the movement again. If the function is not correct, the original converter was defective and must be replaced.

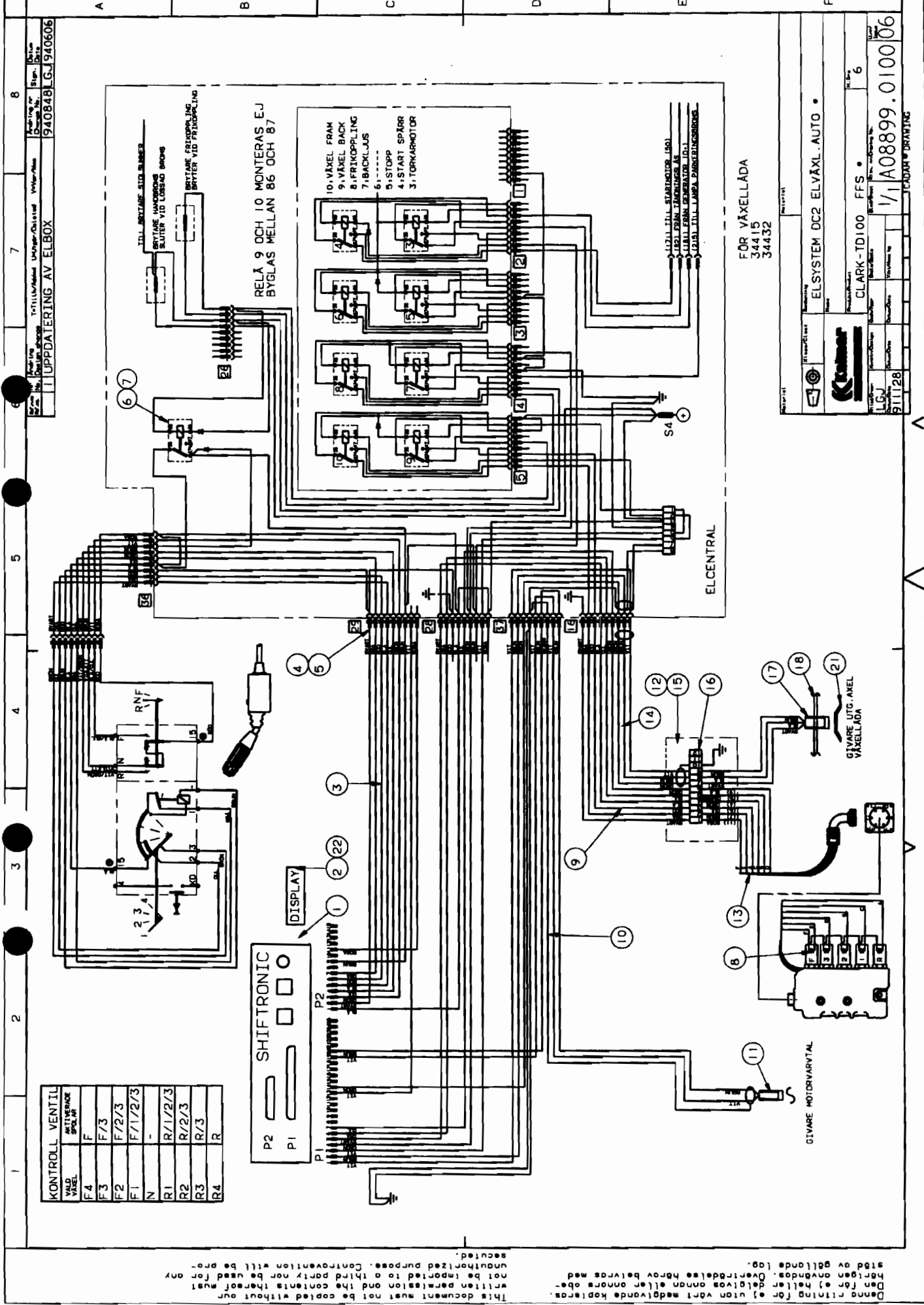
#### Jerky movements when starting and stopping

1. Remove the plastic cover from the relevant control unit. See the section entitled Description to determine where the relevant function is located. Operate the lever to check which LED is a light. Turn the MIN potentiometer adjacent to this diode anti-clockwise.
2. If the reduction described in point 1. above provides a large amount of lever play but the jerkiness persists, the converter pilot valve may be sticking. Check by replacing the converter with another unit which performs well in another function.
3. Check the potentiometers in the relevant control lever unit. If necessary, adjust the clearance between the current collector and the potentiometer track, so that the collector comes into contact with the track when the lever has been moved 2 - 3°.

#### Excessive "dead" movement of the control lever

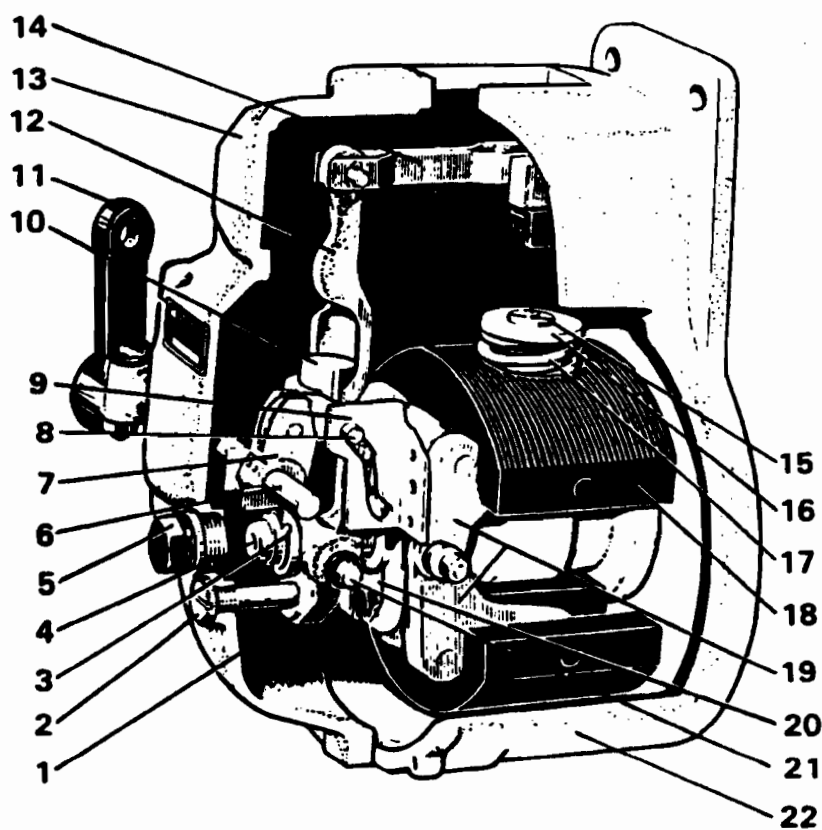
1. Adjust the start pressure by means of the MIN potentiometer
  - Remove the plastic cover from the regulator unit. Check which diodes lights up by moving the control lever. Turn the MIN potentiometer for the relevant diode in a clockwise direction.
2. If voltage adjustment does not help
  - Check the lever unit. Remove the protective cover, test by turning the adjustment screw for the relevant potentiometer in a clockwise direction. Do not turn the adjustment screw more than that the current collector reaches the winding when the lever is at an angle of 2.5°.





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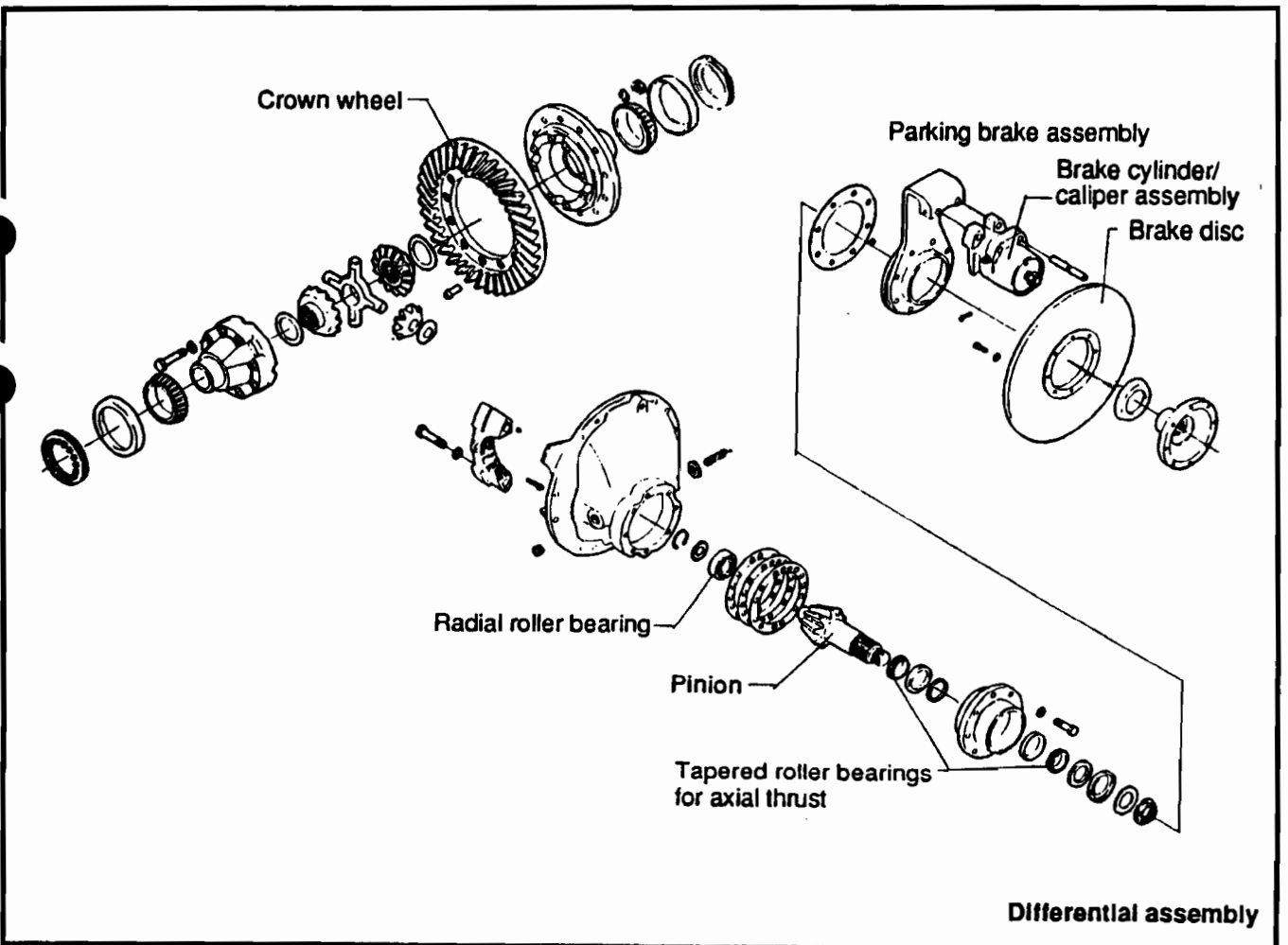
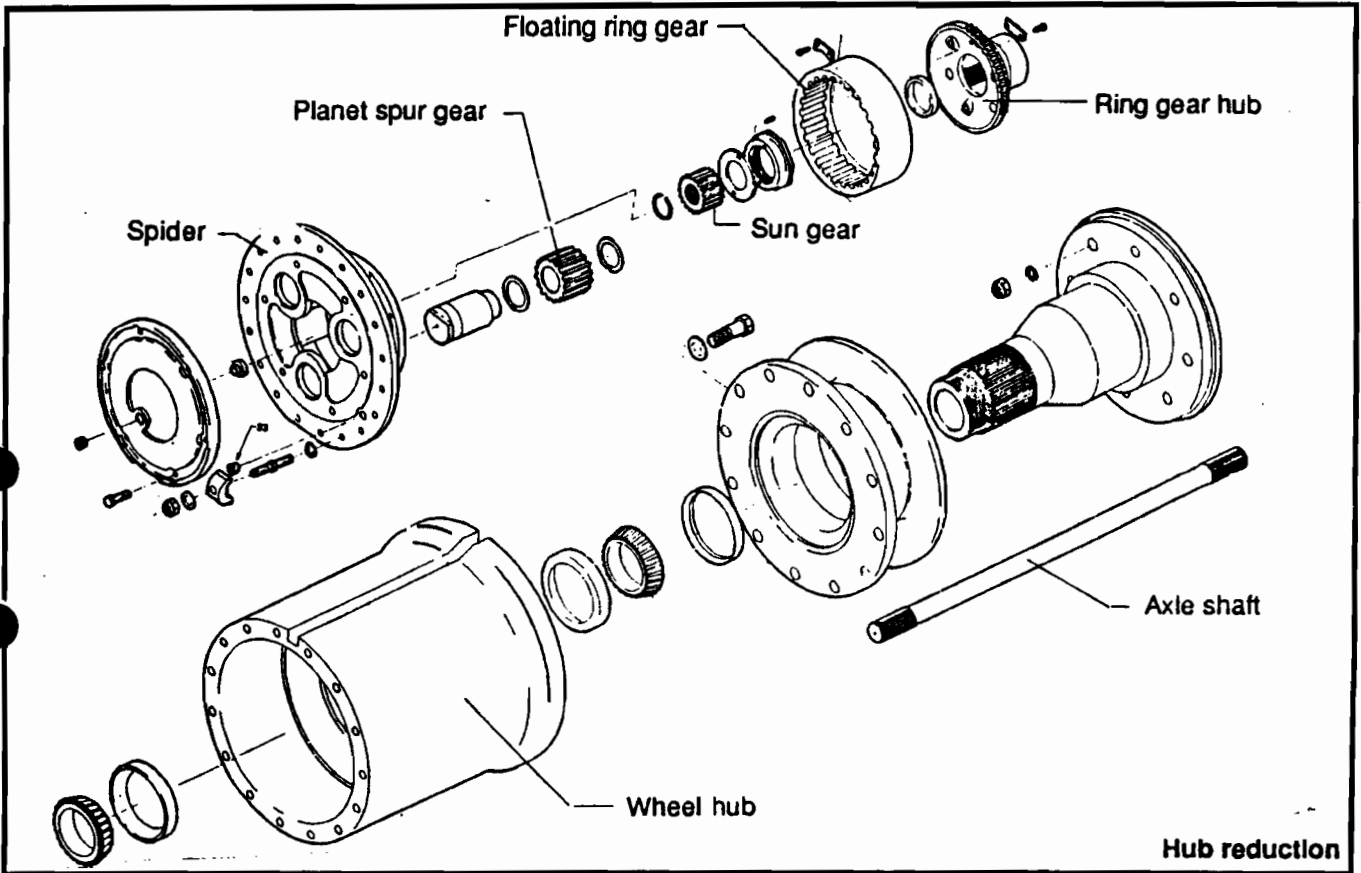
Injection pump - located on the left-hand side of the engine and driven by gears. The pump is equipped with an RSV governor which has a steep control characteristic at low engine speeds. As a result, the engines appear more powerful and have a higher tractive effort at low speeds.



1. Link piece
2. Control screw
3. Locking ring
4. Adjusting bolt
5. Plug
6. Axle
7. Link arm
8. Dowel
9. Lead cam
10. Slipper
11. Control arm
12. Governor arm
13. Cover
14. Link rod
15. Adjustment nut
16. Spring cup
17. Governor spring
18. Governor weight
19. Bell crank
20. Locking washer
21. Control axle
22. Housing

RSV centrifugal governor





## Group 60

### Steered axle

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# Group 70

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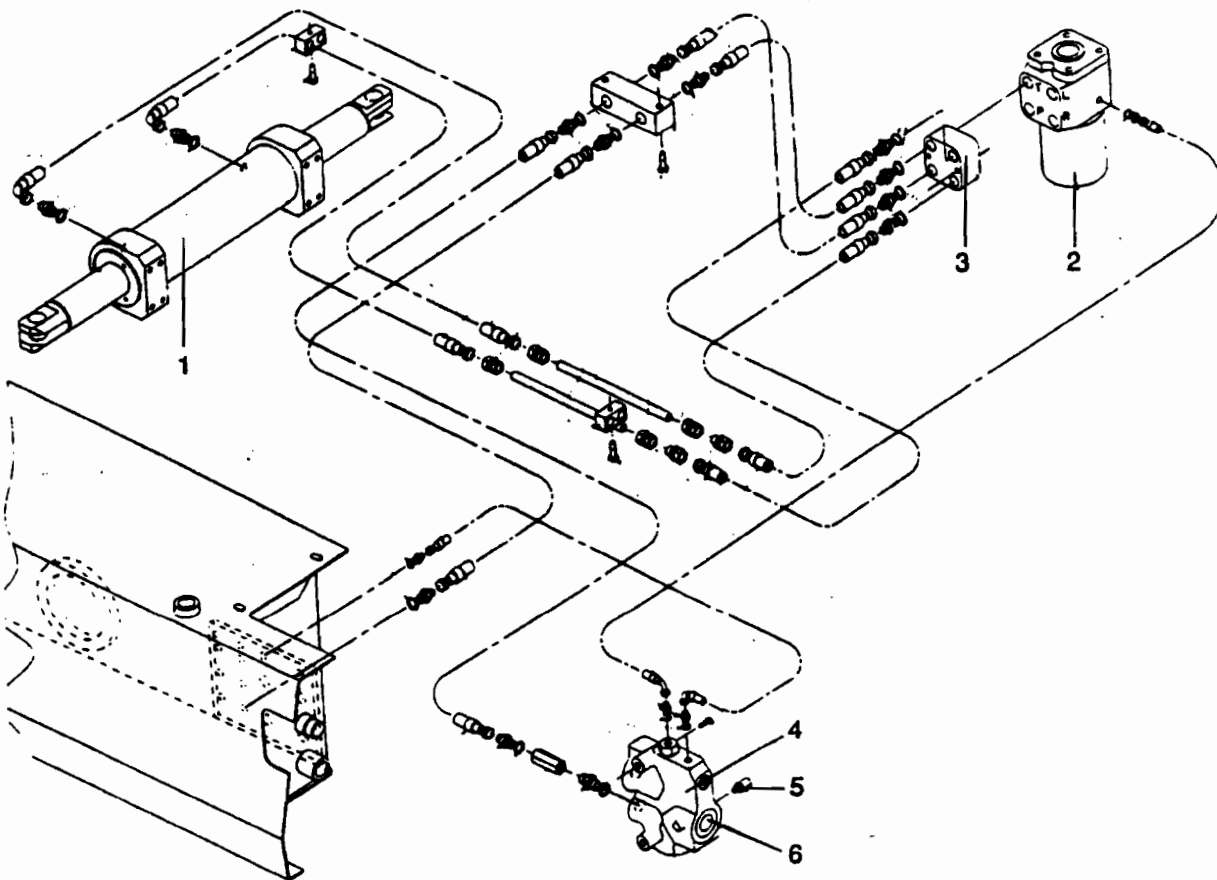
### Steering system

The steering system is supplied from hydraulic pump C, which also supplies the main hydraulics for the attachment.

A priority valve ensures that the steering valve will always be supplied with a sufficient amount of fluid. Any remaining fluid is routed to the main hydraulics.

A certain signal pressure at connection CF in the priority valve is always in communication with pressure connection P of the steering valve. As soon as the steering wheel is operated, a load signal LS will immediately be applied to the priority valve which changes over and supplies a sufficient quantity of fluid to the steering valve.

The pressure in the steering system is determined by a relief valve in the priority valve.



1. Steering cylinder
2. Steering valve
3. Valve, block
4. Priority valve
5. Test outlet, steering pressure
6. Feed from pump

Steering system

### Cooling circuit

When the accumulators are charged, oil is fed to the cooling oil cavities in the drive axle. A by-pass valve between the supply and return lines ensures that the cooling oil pressure will not exceed 1,5 bar, in order to protect the drive axle.

The supply fluid, and optionally also the return fluid, is thoroughly filtered. Since the suction and return lines of the cooling system are both connected to the tank, the total hydraulic oil volume of the truck will be involved in cooling, which contributes to the excellent cooling capacity of the system.

### Main components of the brake system

The figures refer to the hydraulic diagram for the WDB brake system without external cooling.

1. The variable displacement hydraulic pump, which generates the brake pressure and is driven by a power take-off on the engine.
3. Accumulator charging valve set to 175 bar and serving as a priority valve which gives first priority to the brake system. The remaining flow is delivered to the cooling circuit.
6. Accumulators which are charged by the accumulator charging valve, are pre-charged with nitrogen and ensure that pressure will be available in the brake circuit even if the engine should temporarily stop.
9. Parking brake valve which supplies fluid at a reduced pressure from the accumulator to the parking brake cylinder when the parking brake is released. Sensor 7 switches on the parking brake warning lamp when the parking brake is applied, and sensor 8 initiates a signal to a buzzer in the cab to indicate that the operator has left the seat without applying the parking brake.
14. Right-hand front brake pedal. Supplies oil at a reduced pressure from the accumulator to the drive axle disc brake assembly. This pedal is used as a normal foot brake.
15. Left-hand front brake pedal. Apart from the normal braking function, the pedal disengages the transmission via connection 12 at a given brake pressure.
17. Parking brake cylinder. Actuated by a heavy spring when the brake is applied, i.e. when the oil has been discharged through the parking brake valve. The brake is released by hydraulic oil from the parking brake valve.
21. Disc assemblies in the wheel hubs.

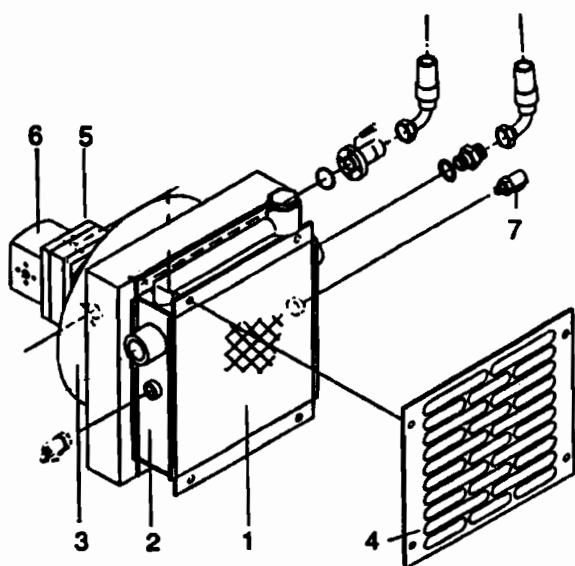
### Air-cooled oil cooler – only WDB-system with external cooling

The air-cooled oil cooler which dissipates the heat generated in the wet disc brake system consists of the components shown in the figure below.

The cooling element consists of copper tubes and aluminium fins. The tube ends are secured to steel headers, and this design ensures high compression and fatigue strength.

The tubes are equipped with internal baffles which break down the laminar flow and ensure good cooling capacity even at low oil flows.

The inlet and outlet are located in the top header, which also includes the combined thermostatic and by-pass valve. The valve is fully open at oil temperatures up to 40 °C. At higher temperatures, the valve gradually closes to increase the cooling capacity and maintain the correct working temperature. The by-pass function, which is set to operate at a pressure of approx. 0.2 MPa, protects the cooler against excessive pressure.

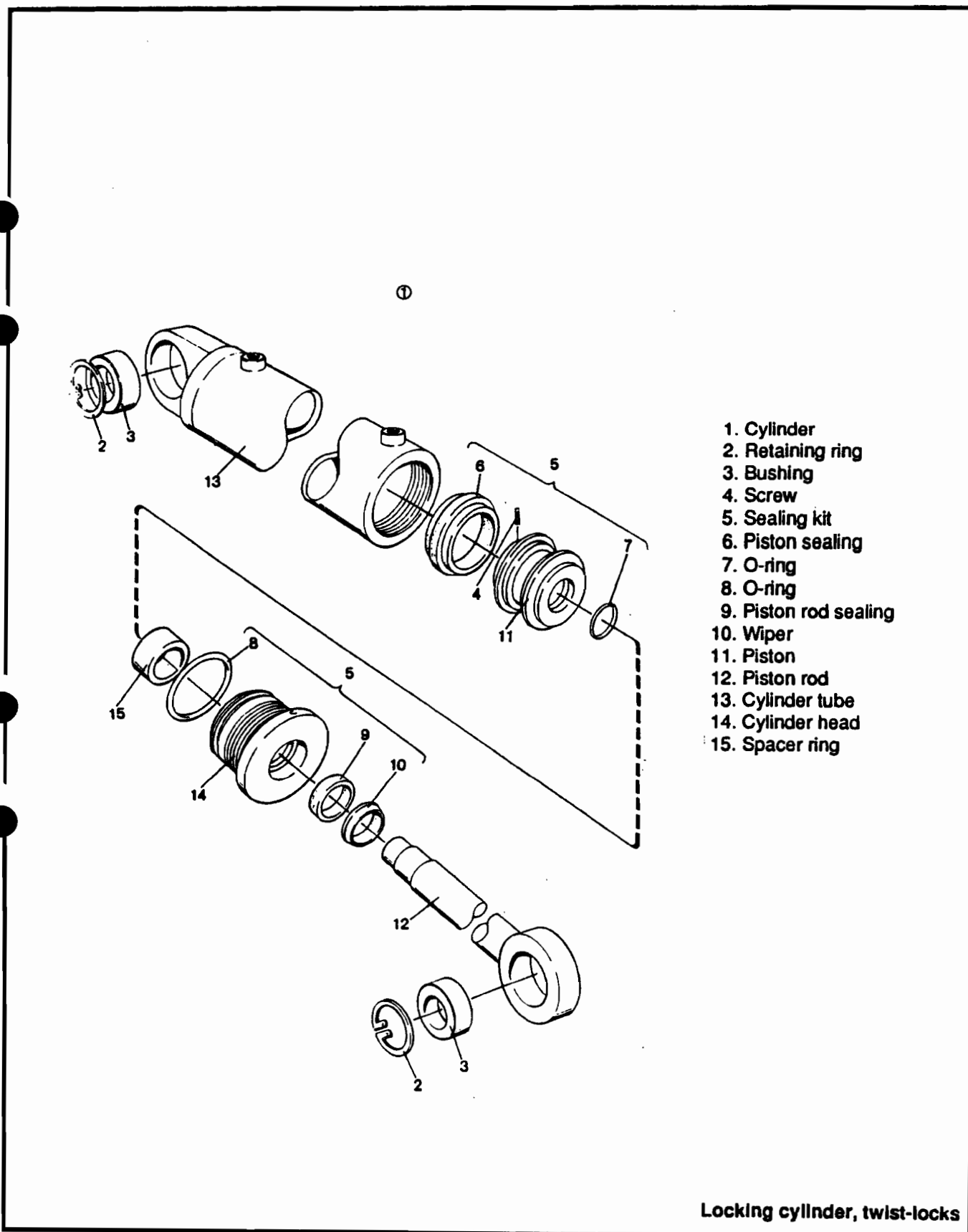


1. Cooling element
2. Header
3. Axial-flow fan
4. Protective grille
5. Circulation pump
6. Hydraulic motor
7. Test outlet from pressure drop across cooler

Air-cooled oil cooler

### Locking cylinders, twist-locks

1. The cylinder end mounting lug is provided with a bushing. The cylinder head is threaded into the cylinder tube.
2. The piston rod end is threaded onto the piston rod.



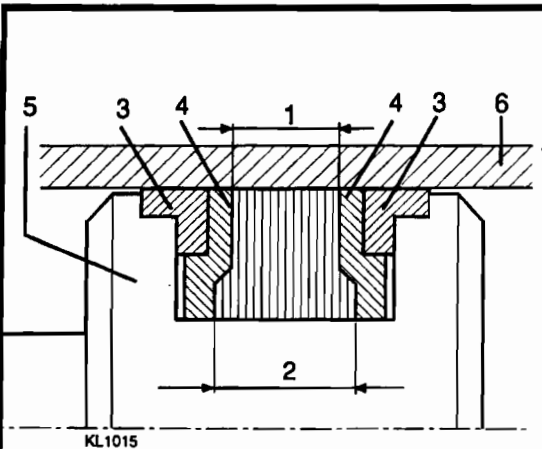
1. Cylinder
2. Retaining ring
3. Bushing
4. Screw
5. Sealing kit
6. Piston sealing
7. O-ring
8. O-ring
9. Piston rod sealing
10. Wiper
11. Piston
12. Piston rod
13. Cylinder tube
14. Cylinder head
15. Spacer ring

Locking cylinder, twist-locks



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- KL1015
1. Moving sealing surface against cylinder pipe
  2. Static sealing surface against piston
  3. Guide ring
  4. Support ring
  5. Head of piston
  6. Cylinder pipe

### Double action piston seals

Double action seals function with pressure from both directions, e.g., in a steering cylinder.

The whole of the surface within the cylinder pipe is the sealing surface, it is therefore extremely important that this surface is not damaged in any way.

Be very careful when fitting the piston in the cylinder pipe to avoid any damage to the seal from the threading in the cylinder pipe.

### Dismantling

1. Remove guide rings and support rings.
2. Move the sealing body over to one side of the sealing groove.
3. Press up the materials so that there is a gap between the seal and the piston.
4. Without damaging the surface of the piston, cut the seal off with a knife.
5. Carefully check the seal to discover any damage that can have caused leakage. This can be achieved most easily by bending over the seal section by section and checking the sealing surface with a finger nail.

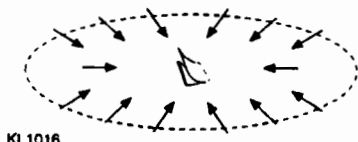
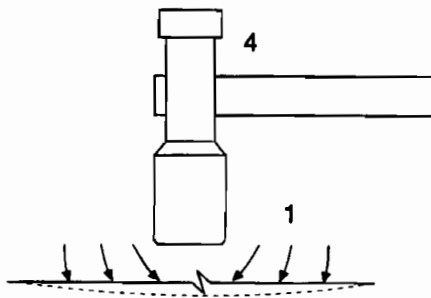
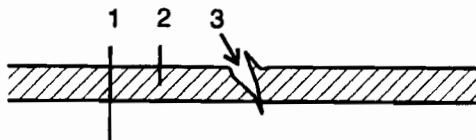
### Fitting

1. All double action piston seals are constructed in the same way, a middle sealing body, thereafter support rings and finally, guide rings, see illustration.
2. First fit the sealing body, thereafter the support rings and finally the guide rings - everything must be done by hand, without the use of tools, in order to prevent damage.

### Repairing the piston rod surface

The smallest damage to a piston rod can be enough to cause leakage. The chromium plating has a thickness of 20-50  $\mu$  and can be worked on to repair smaller damage. This can be a viable alternative to costly dismantling.

1. Locate the damage with finger tips and finger nails.
2. Use a small, finely polished, panel beating hammer and work in the material from the area surrounding the damage, work from the outside in towards the damage.
3. Instead of a sharp mark, there will now be a more even irregularity in the chrome surface.
4. Polish with emery cloth, in stages, use grades from 240 - 600. Wrap the emery cloth around a file to support the cloth well. N.B. Sufficient chrome must always be visible at the point of damage.
5. It is important, before both dismantling and fitting, to repair small dents and other physical damage so that they do not damage the cylinder head.
6. For larger damage to a piston rod:
  - fill the damaged area with a weld
  - completely remove all welding cinder
  - file down the weld to the same level as the chrome surface
  - polish to an even finish with emery cloth



KL1016

1. Piston rod
2. Chrome surface
3. Damaged surface
4. Finely polished hammer

**Warning!**  
**No service work on boom and attachment is allowed when the engine is running.**

**Note! Do not use any other lubricant. The sliding surfaces and plates could be damaged.**

### Checking lubrication

Check regularly that hoses and connections are undamaged. Also check that the lubricant actually reaches the point of lubrication.

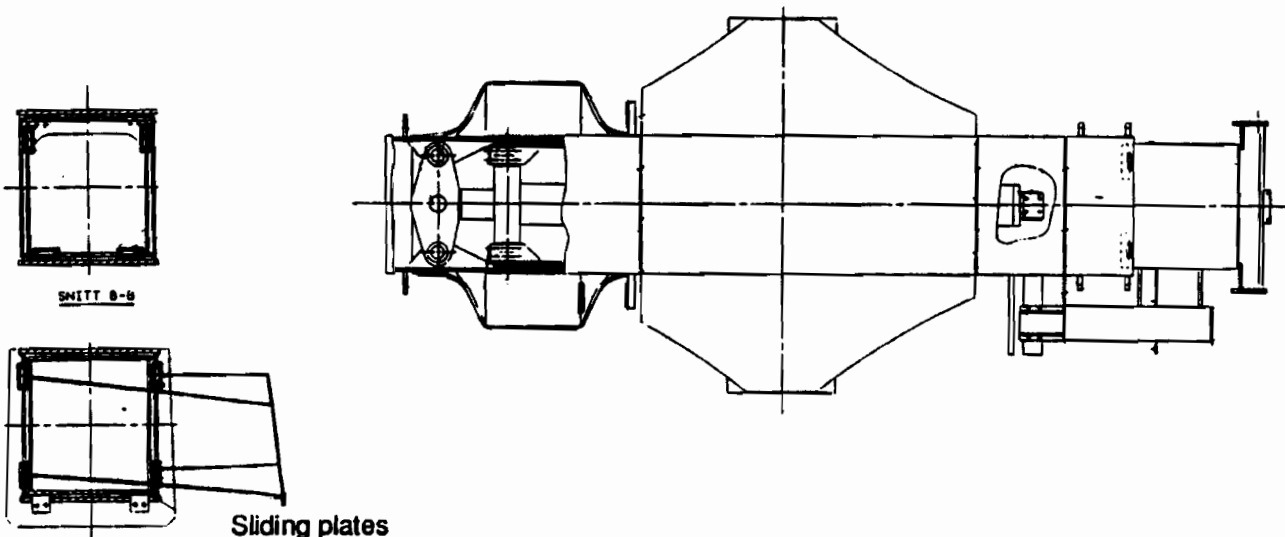
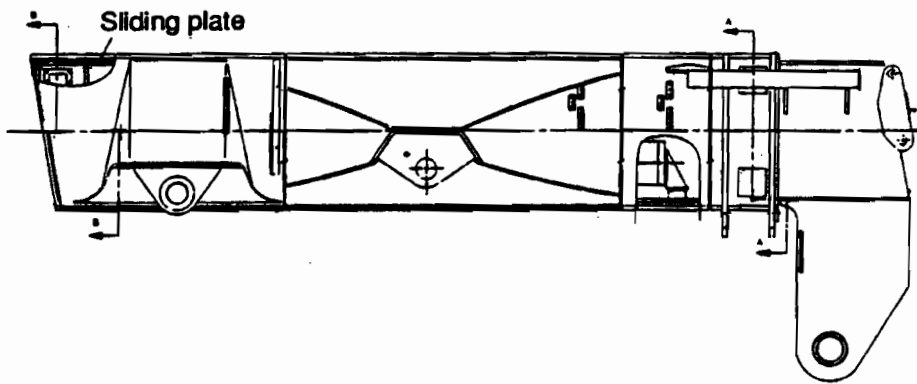
### Checking boom fixtures, extension boom and fixed boom

1. Check all parts for damage or wear. Check the sliding surfaces and sliding plates especially.

### Checking sliding plates

The sliding plates are positioned inside the fixed boom and outside the extension boom. Also the top-lift frame is equipped with sliding plates.

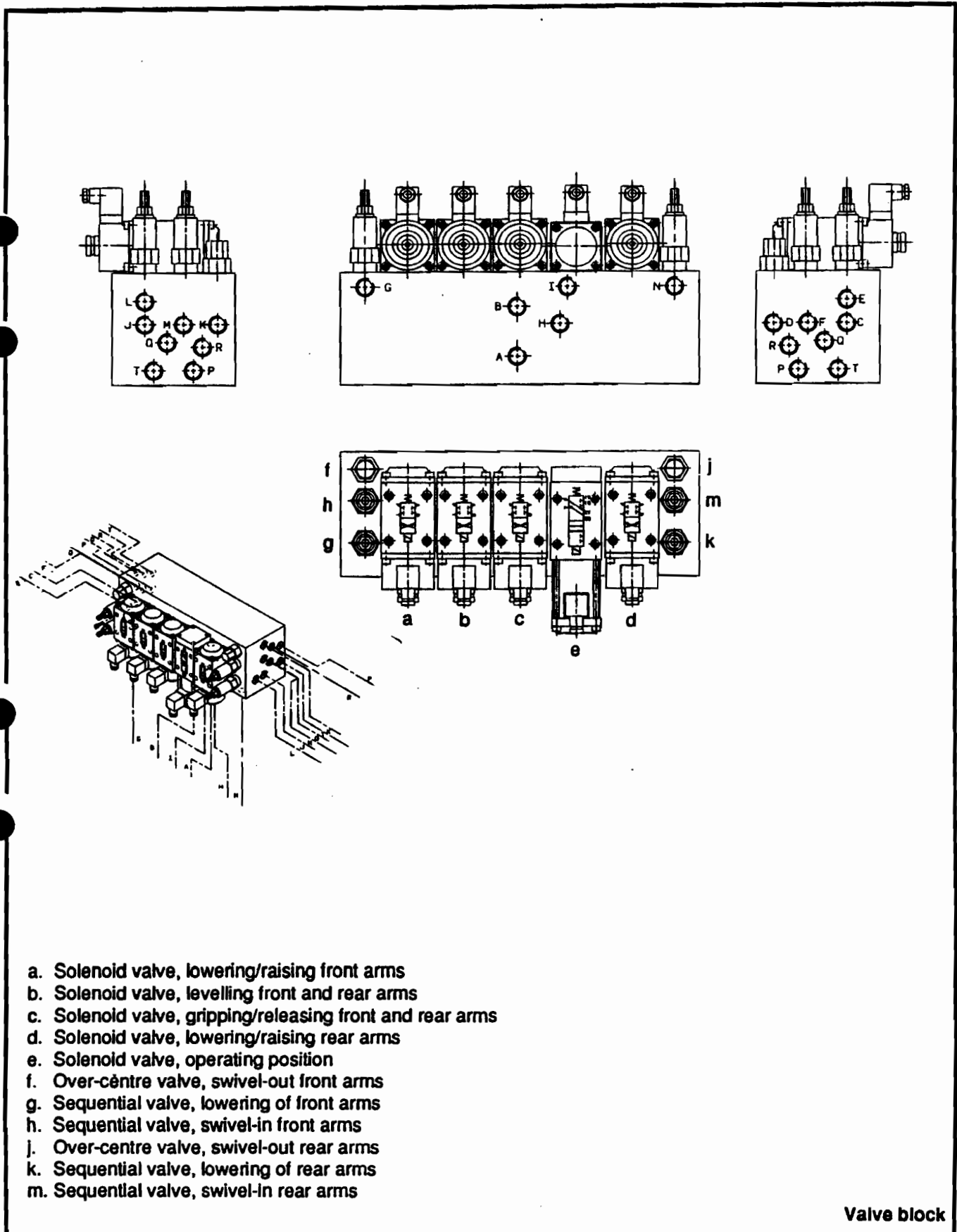
Every 100 hours, the boom has to be fully extended for treatment with a special lubricant, which can be ordered from Kalmar LMV Part. No. 923110.0360. The lubricant is applied with a glazing knife. Spread a thin layer of the lubricant on the extension boom.



Position of sliding plates, telescope-boom

### Valve block

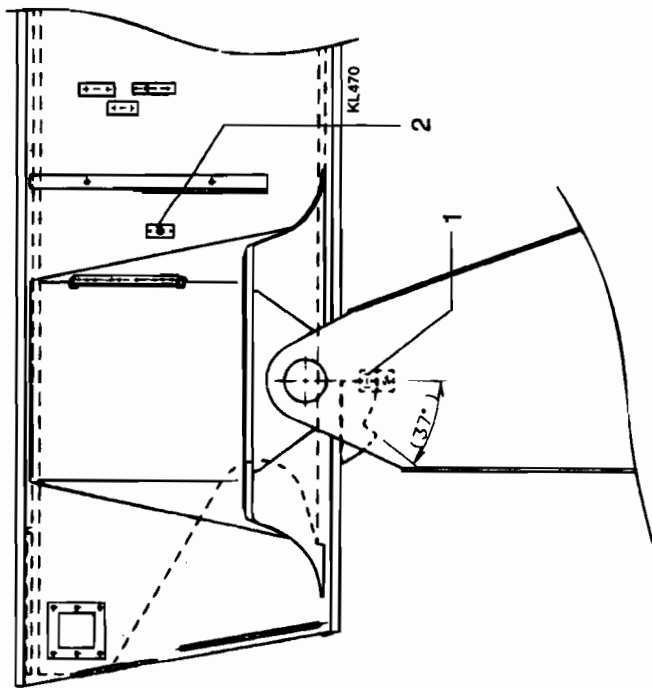
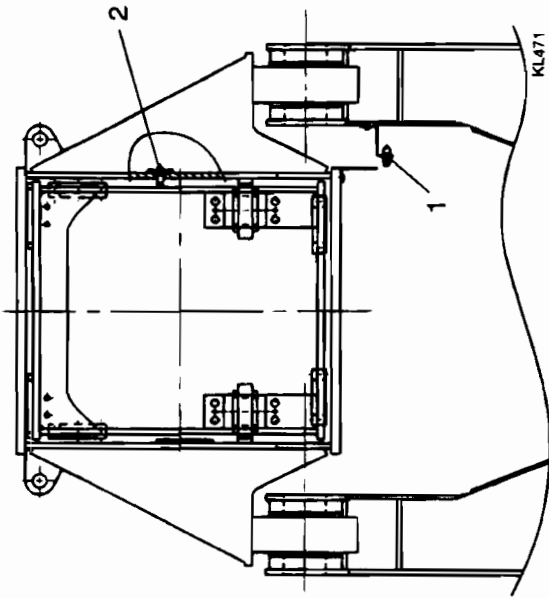
A valve block with solenoid valves and pilot pressure steered over-centre valves is located on each side of the attachment. These control the lowering and raising of the arms.



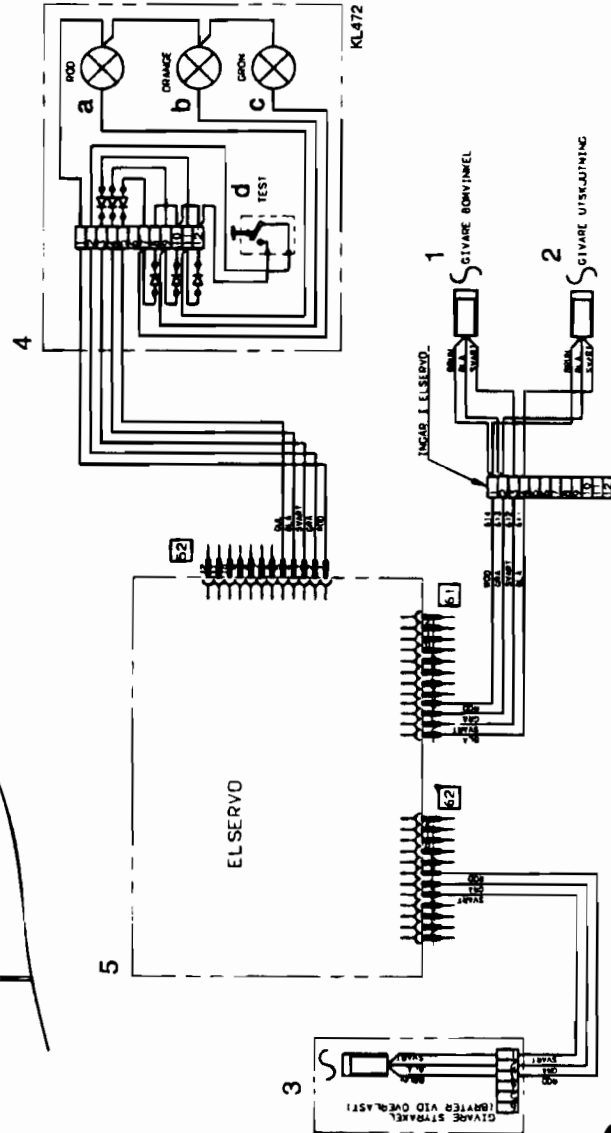
- a. Solenoid valve, lowering/raising front arms
- b. Solenoid valve, levelling front and rear arms
- c. Solenoid valve, gripping/releasing front and rear arms
- d. Solenoid valve, lowering/raising rear arms
- e. Solenoid valve, operating position
- f. Over-centre valve, swivel-out front arms
- g. Sequential valve, lowering of front arms
- h. Sequential valve, swivel-in front arms
- j. Over-centre valve, swivel-out rear arms
- k. Sequential valve, lowering of rear arms
- m. Sequential valve, swivel-in rear arms

Valve block



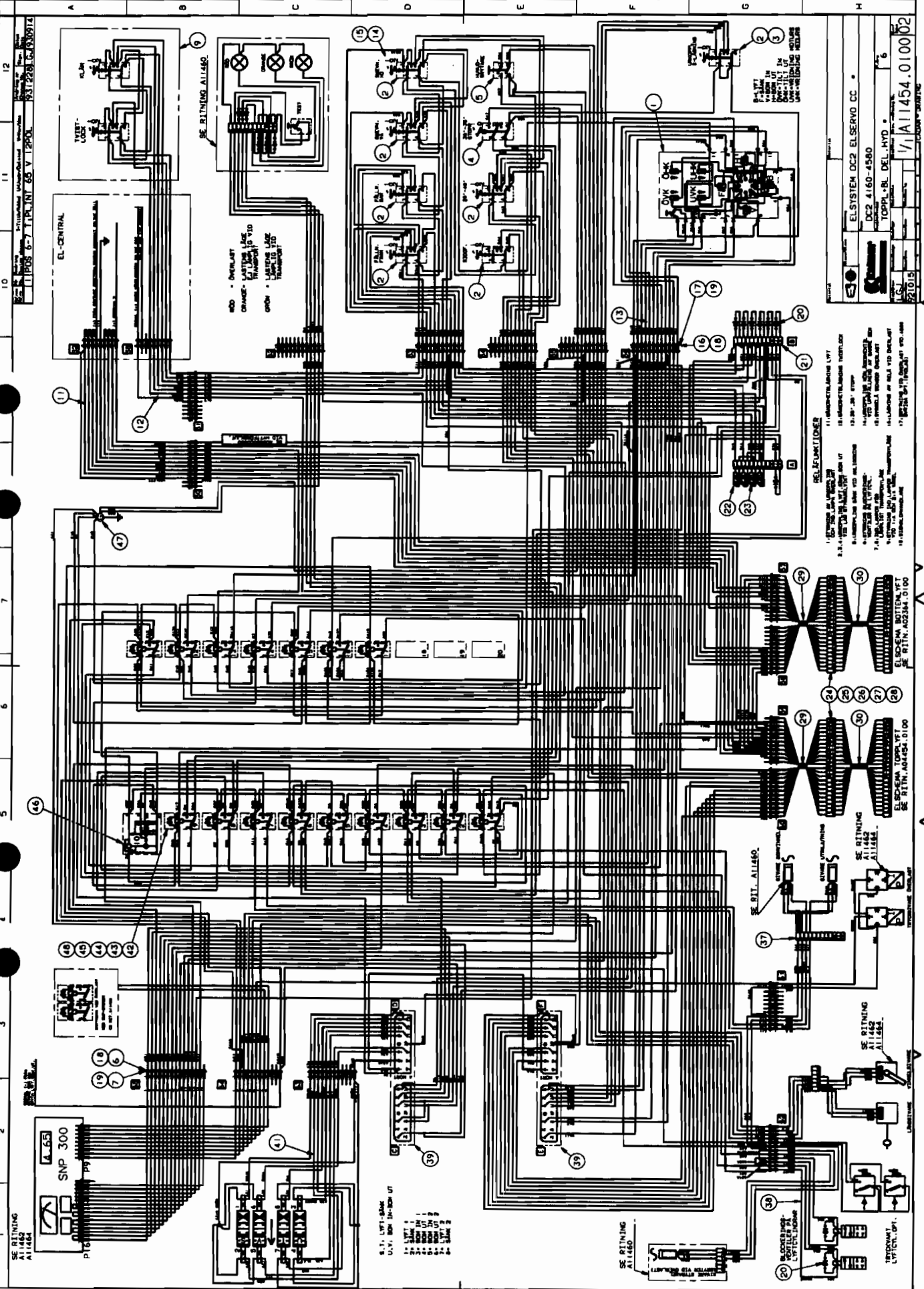


1. Inductive sensor, boom angle
2. Inductive sensor, boom extension
3. Inductive sensor, at steered axle, brakes at overload
4. Lamp panel in operator's cab
  - a. Red=overload
  - b. Orange=load position is not suitable for transport
  - c. Green=load position is OK for transport
  - d. Test button for lamp check
5. Servo circuit



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Additional diagram, overload indication system



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A. 65  
 SNP 300

EL-CENTRAL

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RELAYBLOCKER

EL-SYSTEM DC2 ELSERVO CC  
 DC2 4160-4580  
 TOPPL #BL DEL HYD #

EL-SERVO BOTTEL VFT  
 EL-SERVO TOPPL VFT

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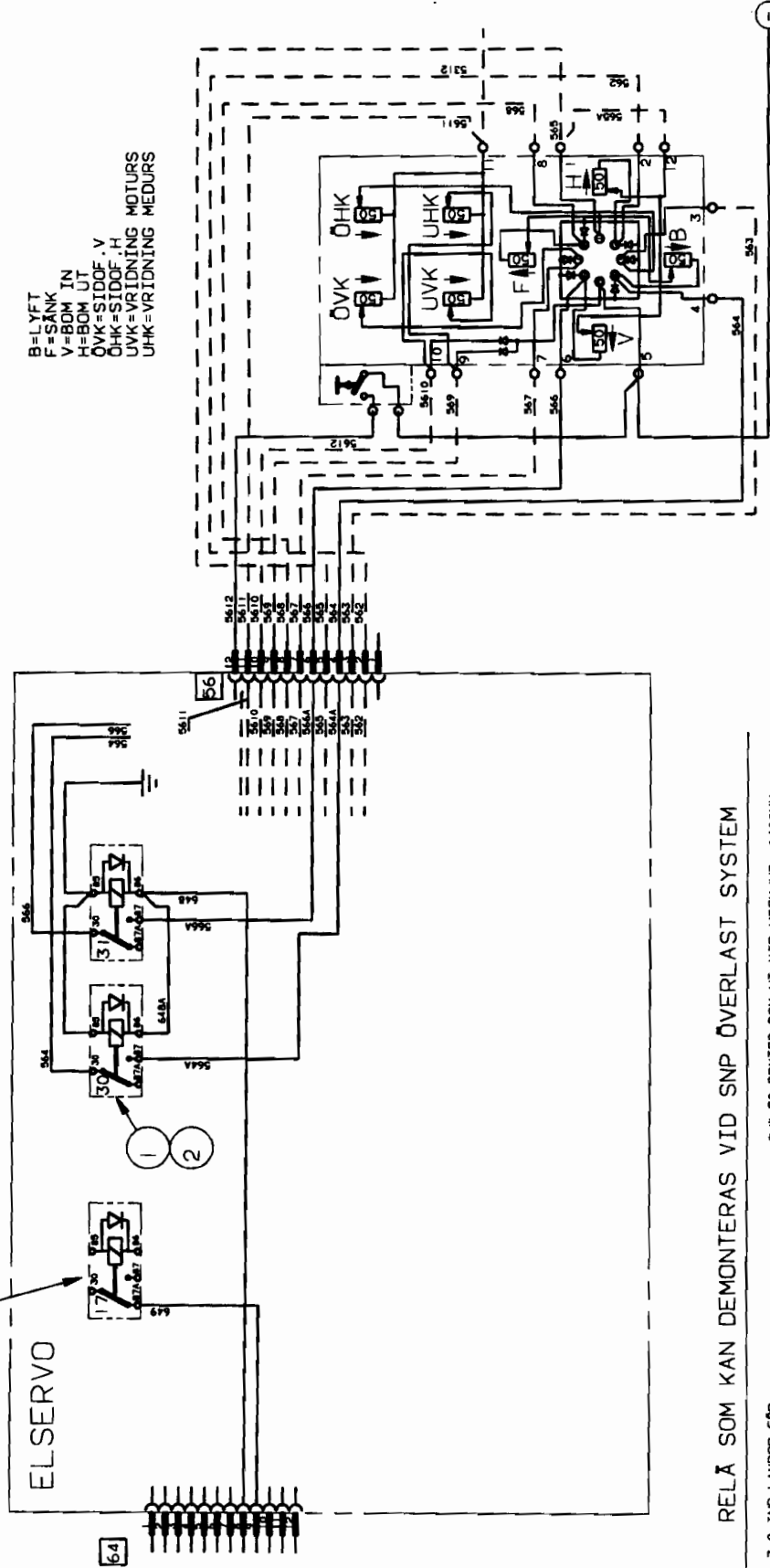
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INGÅR I ELSYSTEM DC2 ELSERVO



RELÄ SOM KAN DEMONTERAS VID SNP ÖVERLAST SYSTEM

- \*\* 7.8: IND.LAMPOR FÖR LÄMPLIGT TRANSPORTLÄGE
- \*\* 9: STYRNING IND.LAMPOR TRANSPORTLÄGE VID 1:1 A OCH 2:1 A VÄXEL
- \*\* 17: BRYTNING VID ÖVERLAST (BYGLAS)
- \*\* 20: BRYTER BOM UT VID UTSKJUT. 6400MM
- \*\* 21: STYRNING VENTIL LÄGRE TRYCK BOM UT, LYFT (BOMVINKEL ÖVER 59°)
- \*\* 22: BLOCKERING AV LYFT 2(S)
- \*\* 23: BLOCKERING AV UTSKJUTNING 2 (V) UT
- \*\* 24: STYRNING RELÄ 25
- \*\* 25: URKOPPLING SÄNK OM UTSKJUT. STÖRRE AN 6400 UNDER VINKEL 59°

\*\* = BYGLAS 30-87A

SE ELSYSTEM DC2 ELSERVO CC

Material	Material
Klasser/Class	Benämning
	ELSYSTEM DC2 T. ÖVERLAST *
Ritm/Drawn	Notes
LGJ	Product/Product
921019	BRYT V ÖVERLAST *
921019	Order/Order
	Sheet/Sheet
	Drawn/Drawn
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