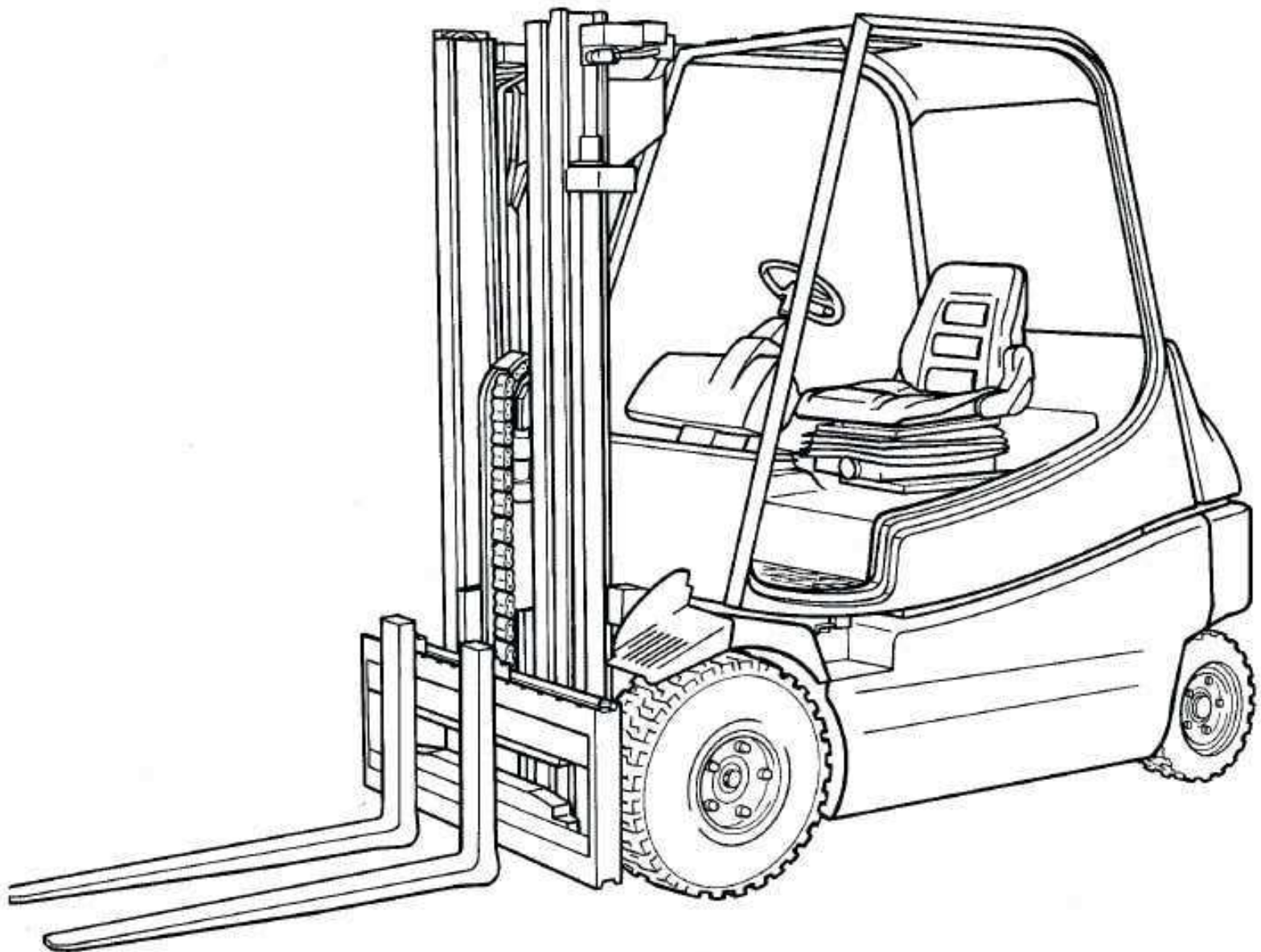


# Service Training



## **Linde Electric Fork Truck E 20 / 25 / 30 Series 336**





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## 2.1.2 TRACTION MOTOR FROM 7/95

|                     |   |                           |  |
|---------------------|---|---------------------------|--|
| Type:               | DC series-wound motor with armature reversal      |                           |  |
| Model:              | E 20  | Juli GF 144-14/5.4        |  |
|                     | E 25 / 30   | Juli GF 146-14/7.8        |  |
| Voltage:            | 80 V  |                           |  |
| Power:              | E 20  | 5.0 kW S2 (60 min rating) |  |
|                     | E 25 / 30   | 6.4 kW S2 (60 min rating) |  |
| Type of protection: | IP00 / IP23 DIN 40 050                            |                           |  |
| Brush dimensions:   | 12.5x40x40 mm                                     |                           |  |
| Permissible wear:   | down to 16 mm                                     |                           |  |
| Collector diameter: | original 104 mm                                   |                           |  |
| Reworking down to:  | 100 mm  |                           |  |
| Components:         | 1 thermal sensor; potential-free brush monitoring |                           |  |

Connector 1X7 for RH traction motor 1M1

- 1 Brush switch 6B4
- 2 Brush switch 6B4
- 3 Thermal sensor 6B1
- 4 Thermal sensor 6B1

Connector 1X8 for RH traction motor 1M2

- 1 Brush switch 6B5
- 2 Brush switch 6B5
- 3 Thermal sensor 6B2
- 4 Thermal sensor 6B2

Armature terminals A1 and A2  
Field terminals D1 and D2





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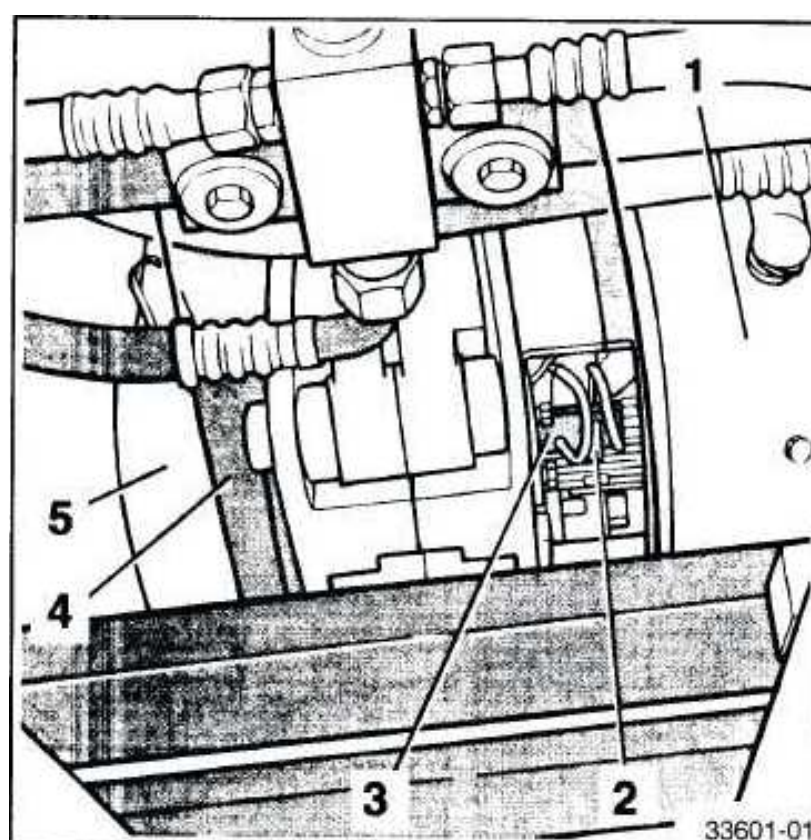
## 2.1.3 CHECKING AND RENEWING THE TRACTION MOTOR BRUSHES

The motor brushes can be checked for wear and free movement after opening the driver's overhead guard.

- Block up the truck at the axle.
- Raise the fork carriage and secure against inadvertent lowering.
- Chock the wheels
- Turn off the key switch.
- Disconnect the battery plug.
- Open the overhead guard as far as the second detent position.
- Lift up the rubber covers (4) over the traction motors.
- Remove the brush cover on the traction motors (1) and (5).
- Lift up the pressure springs (2).

**NOTE:** When lifting the springs from the motor brushes and putting them on the holder, be sure that they do not slide off and open, as compressing them when the motors are installed is extremely difficult

- Pull the motor brushes (3) out of the guide.
- Check the length of the motor brushes (minimum length 16 mm).
- Renew worn motor brushes only as a set.
- After renewing the brushes, check the brushes for free movement in the guides and the brush leads for security.



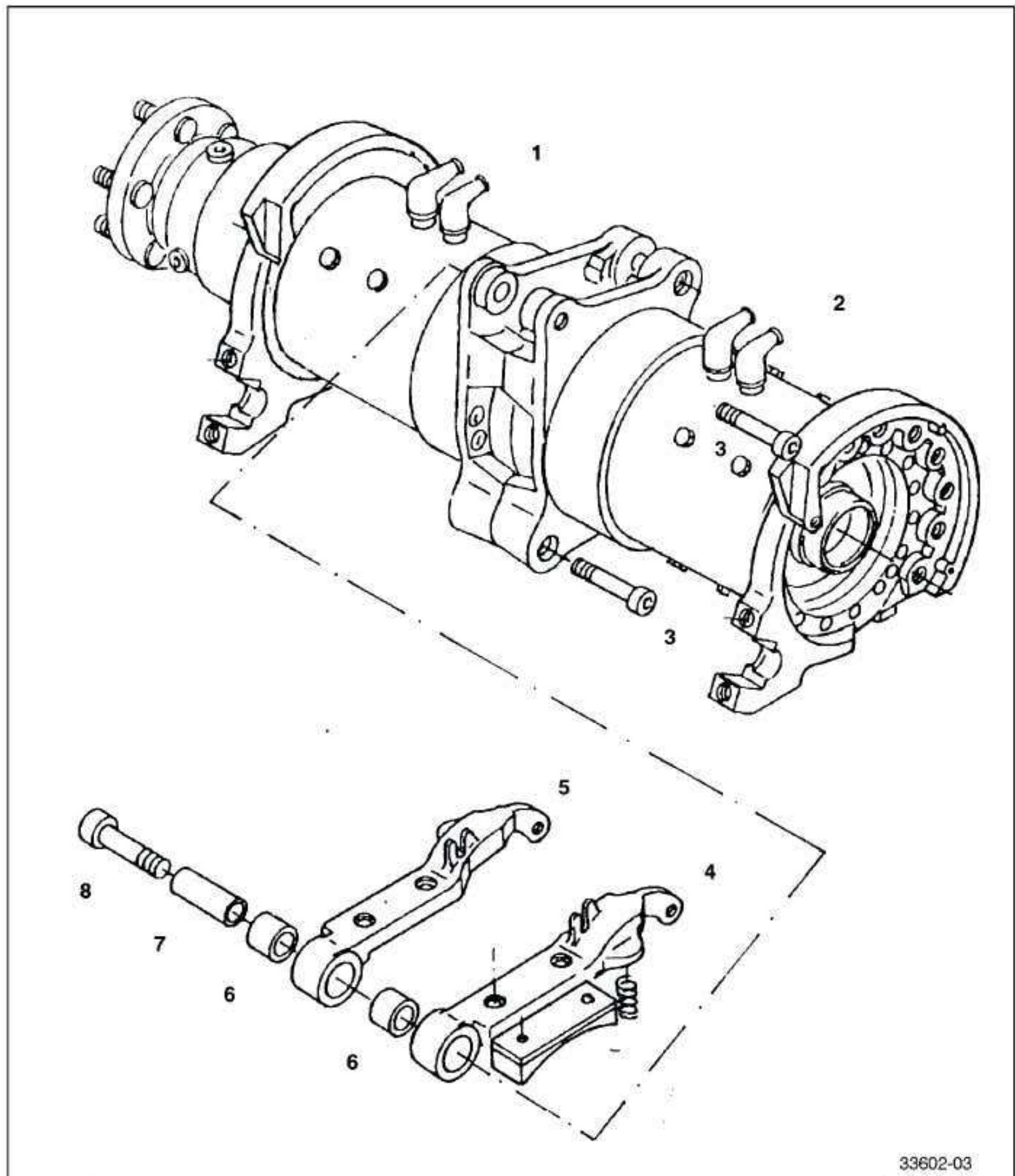
## 2.2.2 DRIVE AXLE DISASSEMBLY AND ASSEMBLY

### Disassembly:

- Remove the motor brush cover on each traction motor.
- Remove the fan along with the air duct.
- Remove the two lower socket head screws (3).
- Remove socket head screws (8).
- Take out the brake shoes (4) and (5) with bushings (6) and (7).
- Separate the two drive halves (1) and (2).

### Assembly:

- Join the two drive halves (1) and (2) and bring them into alignment.
- Insert the brake shoes (4) and (5) with bushings (6) and (7).
- Screw in socket head screws (8).
- Screw in the lower socket head screws (3).
- Torque socket head screws (3) and (8) to 540 Nm.
- Install the fan along with the air duct.
- Fasten the motor brush cover on each traction motor.



## 2.2.3 PLANETARY HUB REDUCTION GEARBOX (FROM 1/95 TO 5/95)

**NOTE:** For design reasons, the planetary hub reduction gearbox on trucks to series 12/94 can only be exchanged as an assembly.

### 2.2.3.1 REMOVING THE PLANETARY HUB REDUCTION GEARBOX FROM THE TRACTION MOTOR

- Jack up and secure the truck.
- Remove the wheel nuts and wheels.
- Place an oil pan underneath the gearbox.
- Remove the oil filler plug (1).
- Remove the oil drain plug (14) and copper sealing ring (15).
- Drain the transmission oil.
- Remove the 14 socket head screws (13).
- Remove the planetary hub reduction gearbox from the bearing plate, taking care not to lose the O-ring (17).
- Clean the sealing areas.

### 2.2.3.2 DISASSEMBLY OF THE PLANETARY HUB REDUCTION GEARBOX

- Remove the hexagonal head screw (6).

**NOTE:** The hexagon head screw (6) is self-locking and can therefore only be used once.

- Remove the two plugs (8).
- Use a puller to extract the flange (10).
- Put the flange (10) aside and secure it against sliding.
- Insert a drift alternately into the two access holes (9) and knock the bearing inner race (12) off the flange.
- Remove and renew the shaft sealing ring (11).
- The O-ring (4) is accessible after pressing out the washer (7) from the flange (10).
- Check and renew, if necessary, O-rings (5) and (4).

**NOTE:** There are shims (3) mounted between the flange (10) and washer (7). During assembly all shims must be installed again with the 0.5 mm shim on the profile side of the flange (10).

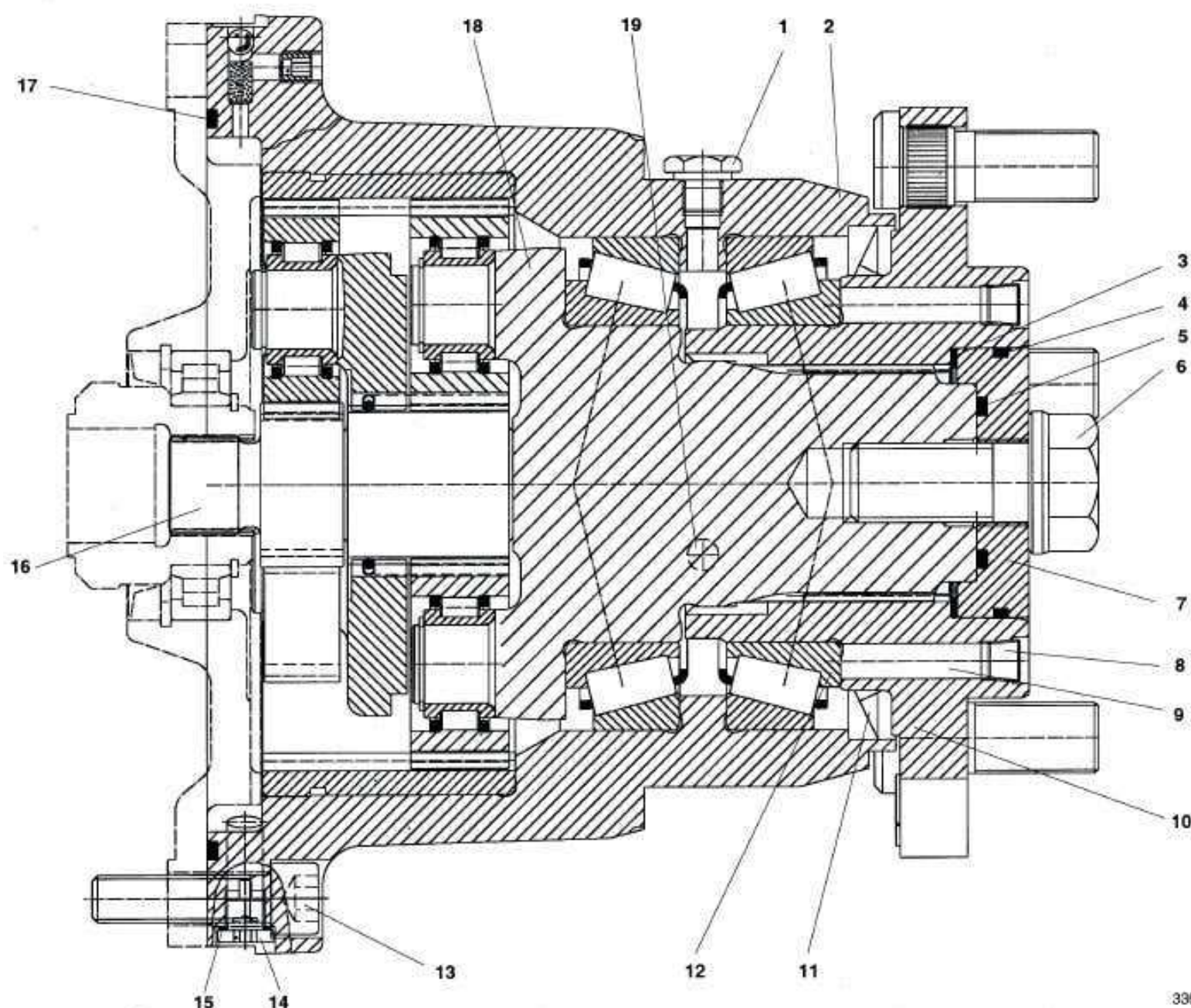
### 2.2.3.3 ASSEMBLY OF THE PLANETARY HUB REDUCTION GEARBOX

- Put the gearbox housing vertical and secure it against sliding.
- Install the bearing inner race (12), making sure that it is seated evenly.
- Half fill the sealing shaft ring (11) with grease and drive it into the housing (2).
- Install the shims (3) in the flange (10).
- Position the O-ring (5) on the washer (7) and secure it with grease.
- Press the washer (7) and O-ring (4) into the flange (10).
- Position the flange (10) and washer (7) on the planetary hub reduction gearbox (18), taking care not to damage the teeth.
- Install the hexagon head screw (6) through the washer (7) and carefully tighten it to seat the flange (10) and washer (7) correctly (torque to 810 Nm).
- Install the 2 plugs (8) in the flange (10) (torque to 20 Nm).



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|---|--------------------|----|--------------------|----|-------------------|
| 1 | Plug               | 7  | Washer             | 13 | Socket head screw |
| 2 | Housing            | 8  | Plug               | 14 | Oil drain plug    |
| 3 | Shim               | 9  | Hole               | 15 | Sealing ring      |
| 4 | O-ring             | 10 | Flange             | 16 | Sun gear          |
| 5 | O-ring             | 11 | Shaft sealing ring | 17 | O-ring            |
| 6 | Hexagon head screw | 12 | Bearing inner race | 18 | Planetary carrier |
|   |                    |    |                    | 19 | Plug              |

## 2.2.3.4 INSTALLING THE PLANETARY HUB REDUCTION GEARBOX ON THE TRACTION MOTOR

- Install the O-ring (17) in the housing.
- Position the planetary hub reduction gearbox on the bearing plate with the plug (14) showing down, being sure that the holes are in alignment.
- When installing the gearbox, take care that the sun gear (16) meshes with the internal toothing of the motor shaft without damage.
- Install the 14 socket head screws (13) and torque them to 86 Nm.
- Install the oil drain plug (14) and copper sealing ring (15) and torque to 18 Nm.
- Fill 250 ml of gear oil SAE 85W/90 into the filler plug bore.
- Install the plug (1) and tighten to 18 Nm.

## **2.2.4 PLANETARY HUB REDUCTION GEARBOX (FROM SERIES 6/95)**

### **2.2.4.1 REMOVING THE PLANETARY HUB REDUCTION GEARBOX FROM THE TRACTION MOTOR**

- Jack up and secure the truck.
- Remove the wheel nuts and wheels.
- Place an oil pan underneath the gearbox.
- Remove the oil filler plug (6) and copper sealing ring (7).
- Remove the oil drain plug (15) and copper sealing ring (16).
- Drain the transmission oil.
- Remove plug (8)
- Remove the 14 socket head screws (14).
- Remove the planetary hub reduction gearbox from the bearing plate, taking care not to lose the O-ring (18).
- Clean the sealing areas.

### **2.2.4.2 DISASSEMBLY OF THE PLANETARY HUB REDUCTION GEARBOX**

- Remove the four hexagonal head screws (4).
- Use a puller to extract the flange (1),
- Paying attention to the O-rings (3), (5) and (10).
- O-ring (2) is accessible after pressing the washer (11) out of the flange (1).
- If necessary, remove and renew the shaft sealing ring (13).

### **2.2.4.3 ASSEMBLY OF THE PLANETARY HUB REDUCTION GEARBOX**

- Half fill the sealing shaft ring (13) with grease and drive it into the housing (19).
- Position the O-rings (3), (5) and (10) on the planetary carrier (12) and secure it with grease.
- Carefully slide the flange (1) onto the planetary carrier (12), taking care not to damage the toothing.
- Hit the washer (11) and O-ring (2) into the flange, making sure that the holes are in alignment.
- Install the four hexagon head screws (4) and torque to 110 Nm.

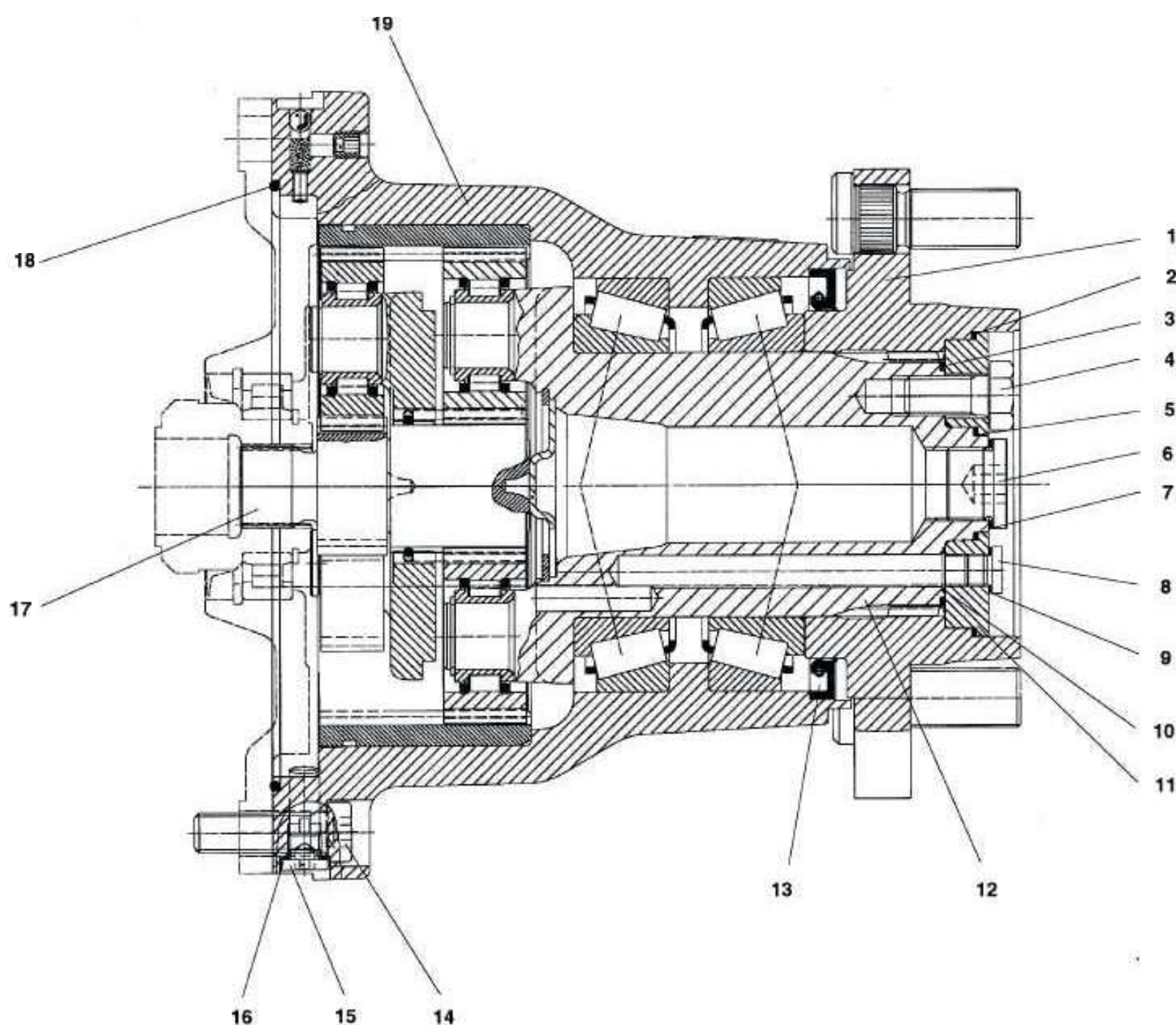
### **2.2.4.4 MOUNTING THE PLANETARY HUB REDUCTION GEARBOX ON THE TRACTION MOTOR**

- Install the O-ring (18) into the housing.
- Position the planetary hub reduction gearbox on the bearing plate with the oil drain plug opening showing down, being sure that the holes are in alignment.
- When installing the gearbox, take care that the sun gear (17) meshes with the internal toothing of the motor shaft without damaging it.
- Install the 14 socket head screws (13) and torque to 86 Nm.
- Install the oil drain plug (15) and copper sealing ring (16) and torque to 18 Nm.
- Fill 250 ml of gear oil SAE 85W/90 into the filler plug bore.

**NOTE:** The oil level must reach the lower edge of the threaded bore for plug (8).

- Install the plug (8) and sealing ring (9), and torque to 18 Nm.
- Install the oil filler plug (6) and copper sealing ring (7), and torque to 102 Nm.

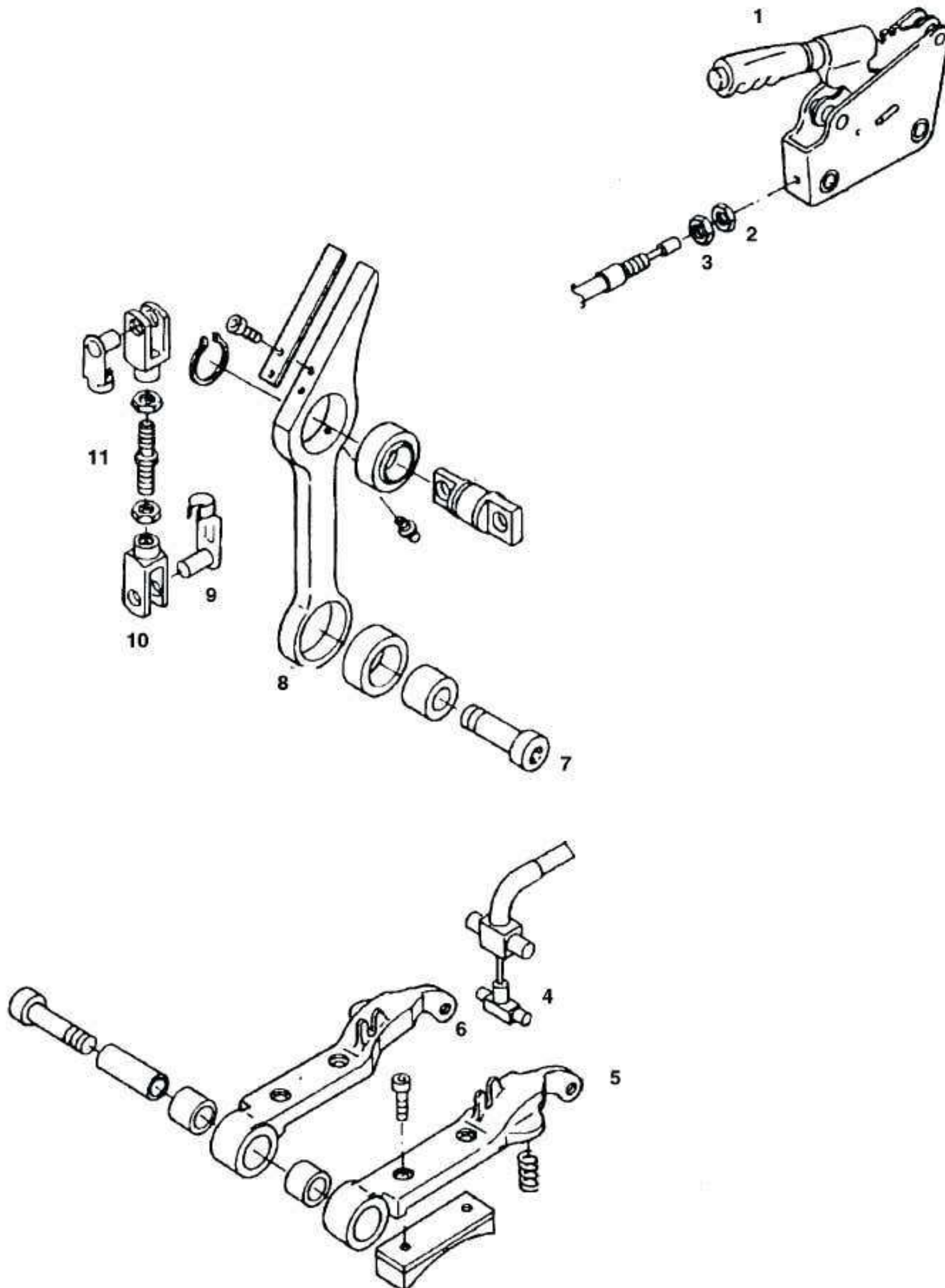




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- |    |                    |    |                    |
|----|--------------------|----|--------------------|
| 1  | Flange             | 11 | Washer             |
| 2  | O-ring             | 12 | Planetary carrier  |
| 3  | O-ring             | 13 | Shaft sealing ring |
| 4  | Hexagon head screw | 14 | Socket head screw  |
| 5  | O-ring             | 15 | Oil drain plug     |
| 6  | Plug               | 16 | Sealing ring       |
| 7  | Sealing ring       | 17 | Sun gear           |
| 8  | Plug               | 18 | O-ring             |
| 9  | Sealing ring       | 19 | Housing            |
| 10 | O-ring             |    |                    |

# Service Training



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# Service Training

## 2.3 CHASSIS

The series 336 fork trucks are available for various load capacities.

| Type | Standard Version | Higher Seat Version | Load Capacity |
|------|------------------|---------------------|---------------|
| E 20 | 400 Ah           | 480 Ah              | 2.0 t         |
| E 25 | 500 Ah           | 600 Ah              | 2.5 t         |
| E 30 | 500 Ah           | 600 Ah              | 3.0 t         |

The standard versions of the trucks can be used with containers. With the option “higher driver’s seat”, batteries with a higher capacity rating can be used.

### 2.3.1 SEAT SWITCH

Method of operation to series 6/95:

A seat switch is installed in the driver’s seat, which activates timer 1A3 when actuated. In order to prevent a faulty operation of the switch on uneven roadways, the timer cuts off the enable signal for the traction and lift control after a delay of approx. 2 seconds when the seat switch is no longer actuated. Timer 1A3 is mounted opposite the voltage converter on the contactor board. The timer is connected to the main cable harness via a 8-pin connector.

Method of operation from series 7/95:

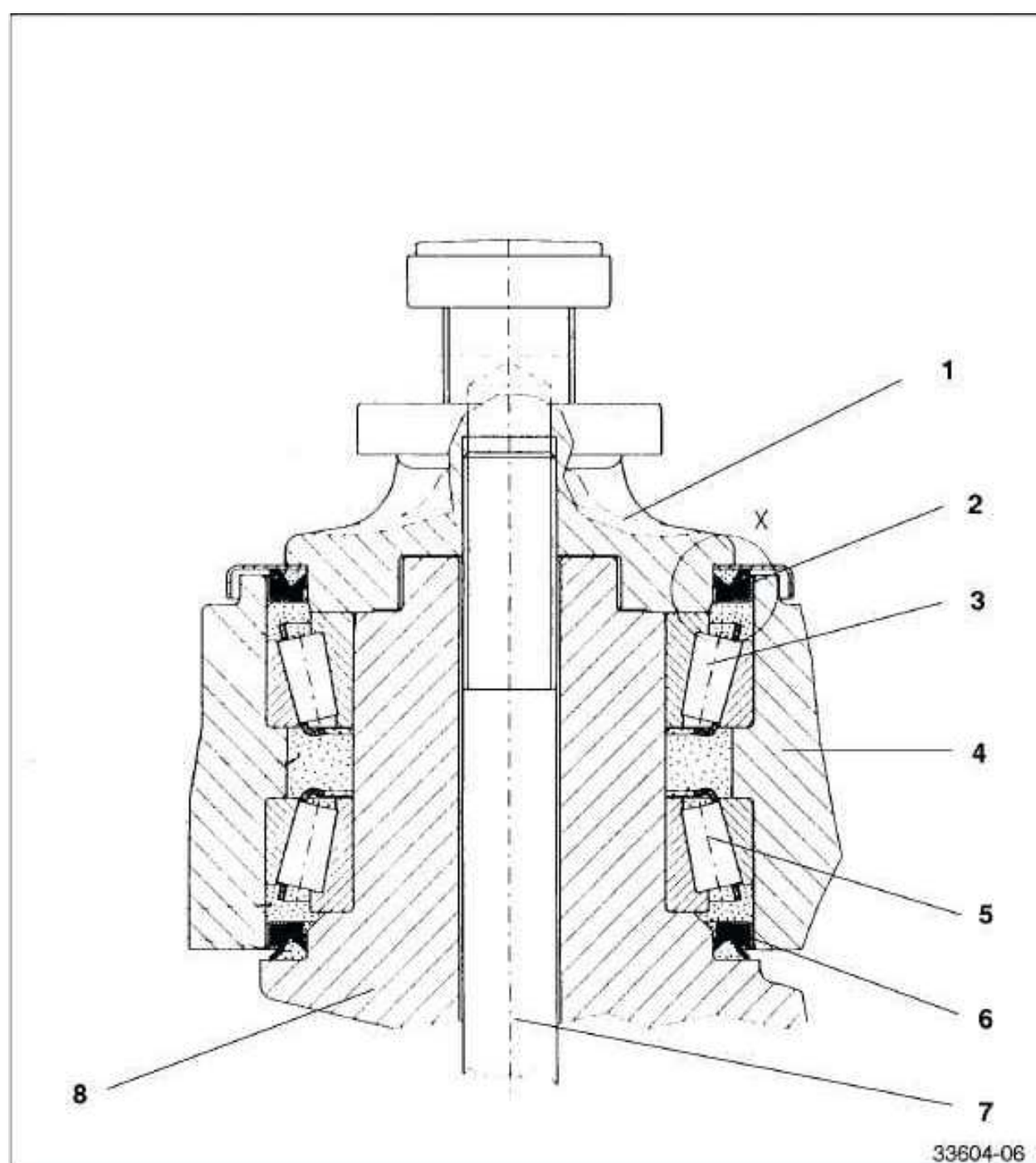
The timer 1A3 has been omitted on trucks built since 7/95. The travel control time delay is integrated into the electronic travel unit 1A2. Starting with this series, the working hydraulics can be operated without the seat switch having to be activated.

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- Install the steering knuckle arm (1) and insert the retaining screw (7).
- At first torque the retaining screw (7) only to 120 - 150 Nm so that the rollers in the tapered roller bearings can come into alignment.
- Move the axle body through the full swivel range several times so that the rollers in the tapered roller bearings can become aligned.
- Tighten the retaining screw (7) to the full torque of 1100 Nm.

**NOTE:** The steering axle of the E 20 truck has two retaining screws, each of which must be torqued to 295 Nm.

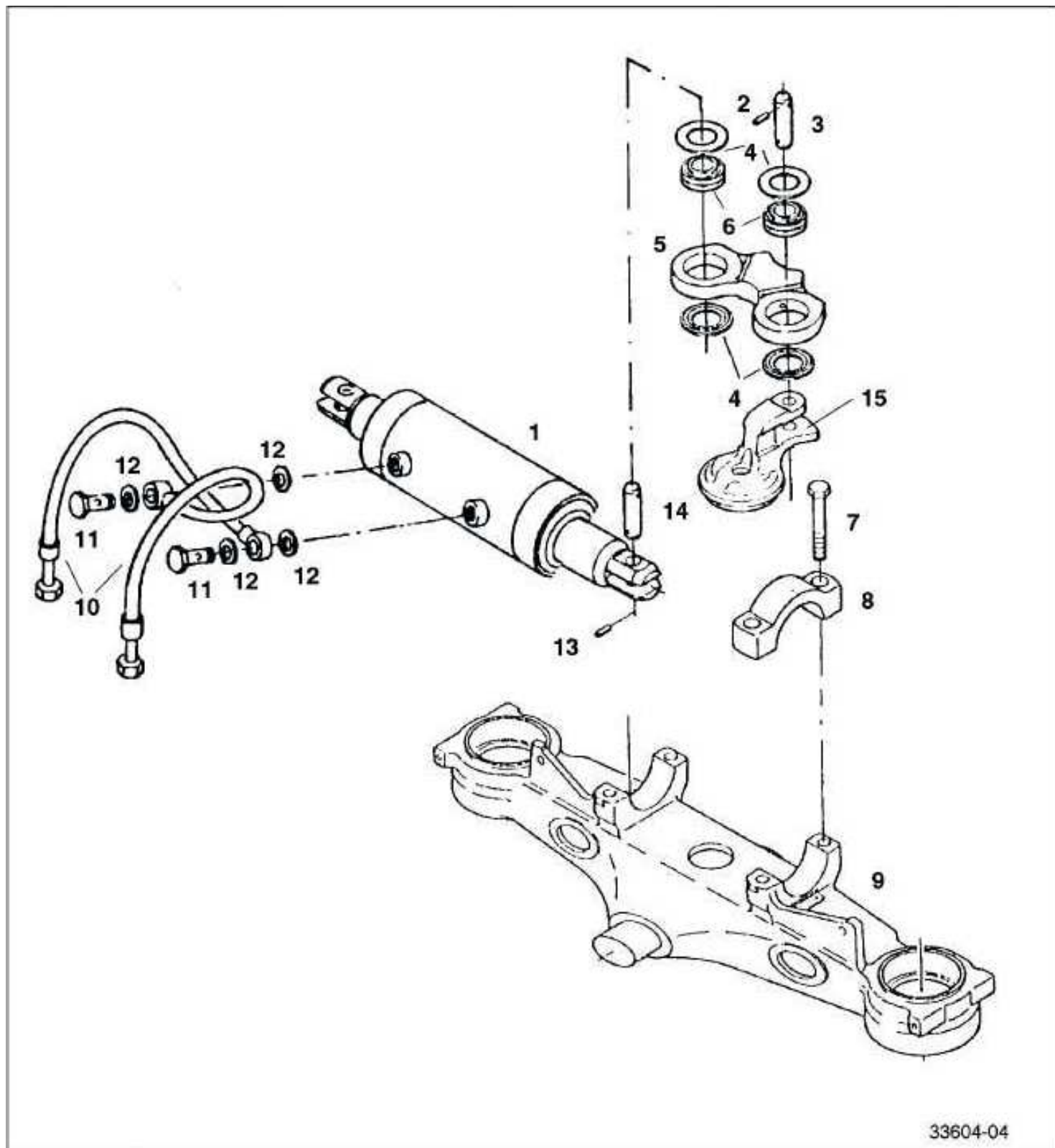


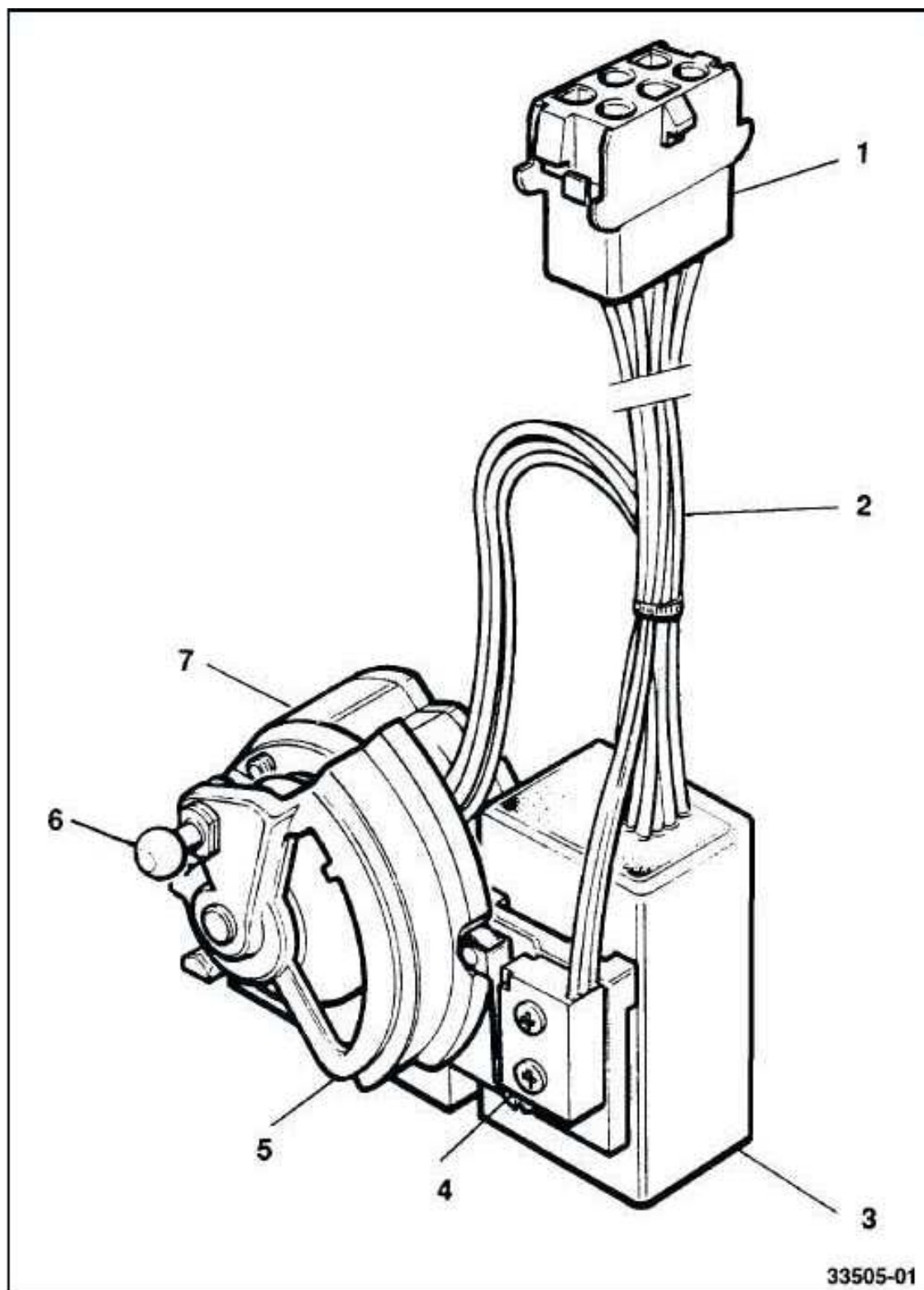
## 2.4.1.6 INSTALLING THE STEERING CYLINDER AND TRACK ROD LINK

- Insert the track rod links (5) into the steering cylinder (1).
- Coat the pin (14) with MoS<sub>2</sub> grease and press it in (pressing force 5 - 50 kN).
- Secure the pin (14) with a roll pin (13).
- Place the steering cylinder along with the track rod links on the centre axle (9).
- Install the marked bearing brackets (8) correctly and fasten them with screws (7) (torque to 425 Nm).
- Coat the pin (3) with MoS<sub>2</sub> grease and press it into the track rod link (5) and steering knuckle arm with the roller pin pointing up (pressing force 4 - 38 kN).

**NOTE:** When pressing in pin (3), support the steering knuckle arm from below to prevent any damage to it.

- Secure pin (3) with a roll pin (2).
- Install the hydraulic hoses (10) along with the banjo screws (11) and O-rings (12) on the steering cylinder (1).



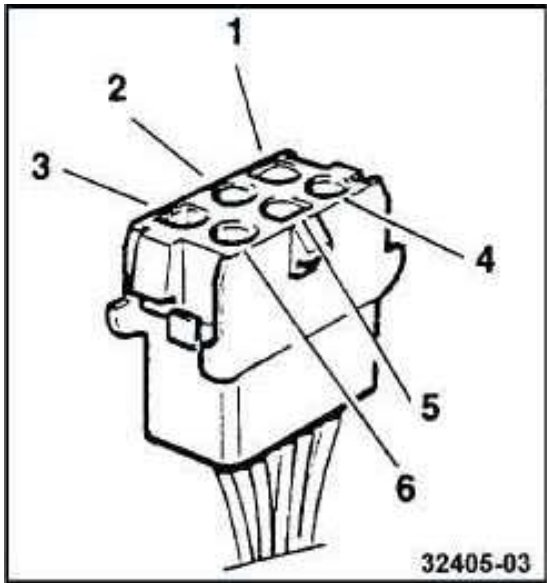


## DESCRIPTION

- 1 Connector
- 2 Cable harness
- 3 Transducer
- 4 Microswitch
- 5 Control cam
- 6 Ball
- 7 Potentiometer

2.5.1.1.1 ACCELERATOR SENSOR OUTPUT SIGNALS

The accelerator output signal can be measured at connector 1X10.



- Pin arrangement 1X10
- 1=(15 V)
  - 2=(output signal)
  - 3=(-)
  - 4=(1 S12 direction of travel)
  - 5=(+ U<sub>B</sub> direction of travel)
  - 6=Enable

The output signal can vary within the following range:

|                                      | Neutral Position | Max. Reverse | Max. Forward |
|--------------------------------------|------------------|--------------|--------------|
| Output signal<br>measured (1X10/2-3) | 7.5 V            | 11.25±0.65 V | 3.75±0.65 V  |

The control range for the accelerator sensor is between 7.5 V and 11.25 V for reverse travel and between 7.5 V and 3.75 V for forward travel.  
The following voltages are important for the control range when checking the traction control for proper function.

|                           | Reverse | Forward |
|---------------------------|---------|---------|
| Neutral position:         | 7.5 V   | 7.5 V   |
| Contactors makes:         | 8.2 V   | 6.8 V   |
| Clocking starts:          | 8.4 V   | 6.6 V   |
| End-point signal approx.: | 11.25 V | 3.75 V  |
| Contactors breaks:        | 8.0 V   | 7.0 V   |

2.5.1.1.2 ADJUSTMENT OF THE NEUTRAL POSITION

After loosening both locknuts, adjust the connecting rod from the pedals to the accelerator sensor so that the travel required to actuate the accelerator sensor microswitch is equal in both directions of travel.



## 2.5.2 BRAKING

### 2.5.2.1 RENEWING THE BRAKE LININGS

The brake linings must be replaced when the linings are 2 mm thick at the thinnest point.

- Open and tilt the overhead guard to the second detent.
- Loosen the locknut (3) on the handbrake lever (1) and the adjusting nut (2) on the parking brake cable (4).
- Unhook the handbrake cable (4) at the brake shoes (5) and (6).
- Remove one pin retainer (10) on each of the two brake shoes (5) and (6).
- Tilt the brake shoes up.
- Remove the fastening screws (7) for the brake shoes (8).
- Fit new brake shoes (8).
- Fit handbrake cable

### 2.5.2.2 ADJUSTING THE FOOT BRAKE

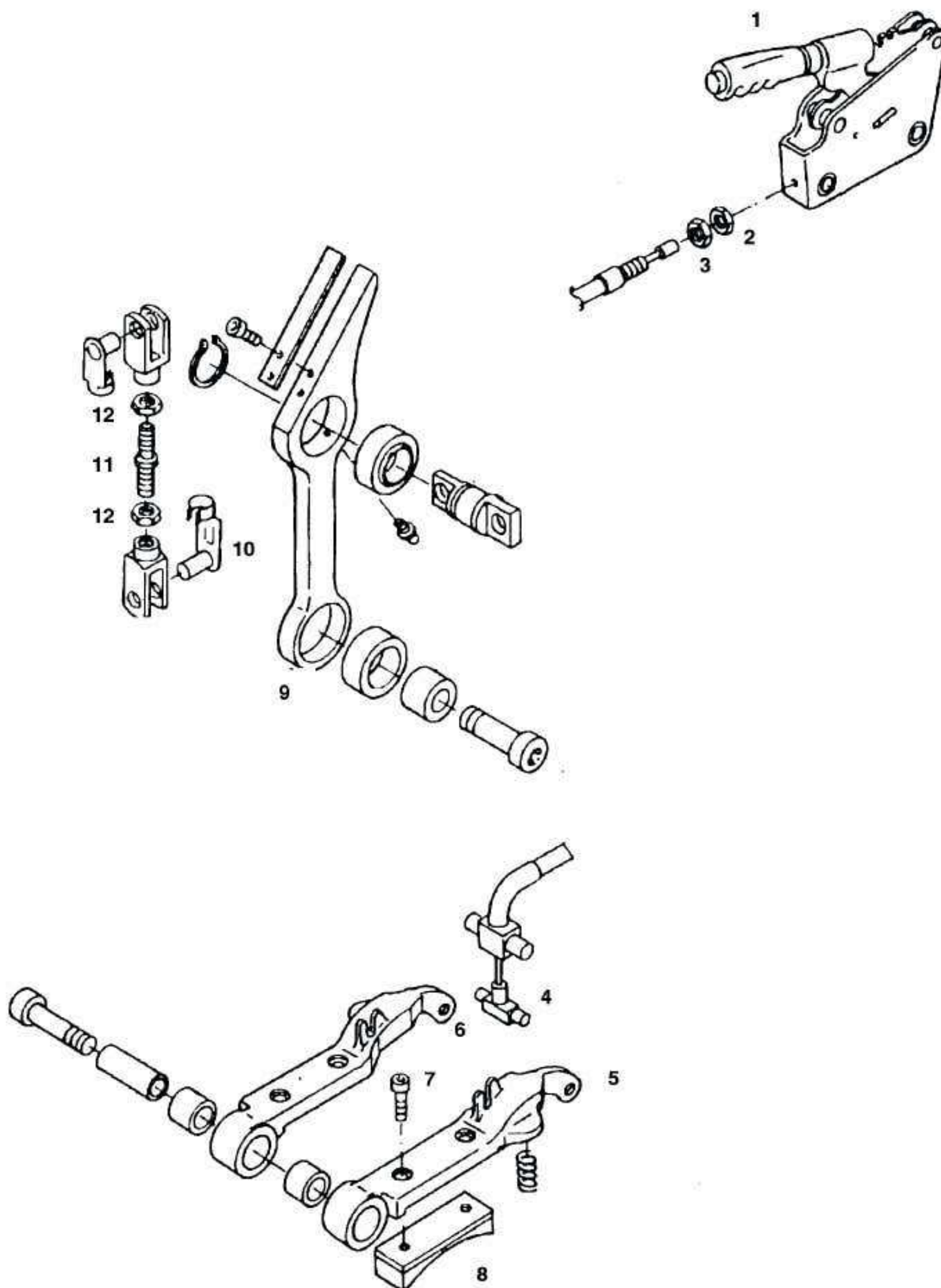
The foot brake can be adjusted if the brake linings are worn.

- Open and tilt the overhead guard to the second detent.
- Slowly press the lever (9) with the hand.
- The lever must then be approx. 20 mm from the end stop of the lever.
- For the adjustment, loosen the locknut (12) at the threaded pin (11) and adjust the threaded pin.
- Tighten the locknuts (12) again.

### 2.5.2.3 ADJUSTING THE HANDBRAKE

- Open and tilt the overhead guard to the second detent.
- Slowly engage the handbrake (1) while watching lever (9).
- The lever must move jointly with the handbrake lever until the point of higher spring pressure (brake lining contacts the brake disc) is reached.
- Release the release button.
- The brake must be applied when the handbrake has clicked five times.
- If an adjustment is necessary, loosen the locknut (3) for the handbrake cable on the handbrake lever to adjust the tension of the handbrake cable (4) with the adjusting nut (2).







## 2.6 ELECTRICAL SYSTEM

The series 336 trucks are equipped with a compact LTM control for the travel drive and the working hydraulic system. The steering system is controlled via the lift LTM control.

The compact LTM control has the following advantages over the previous LTM control:

- less space required
- easier installation
- available as replacement part
- integrated freewheel diode
- integrated brake diode
- integrated regenerative braking diode
- easier troubleshooting
- improved dissipation of heat

Features of the power unit:

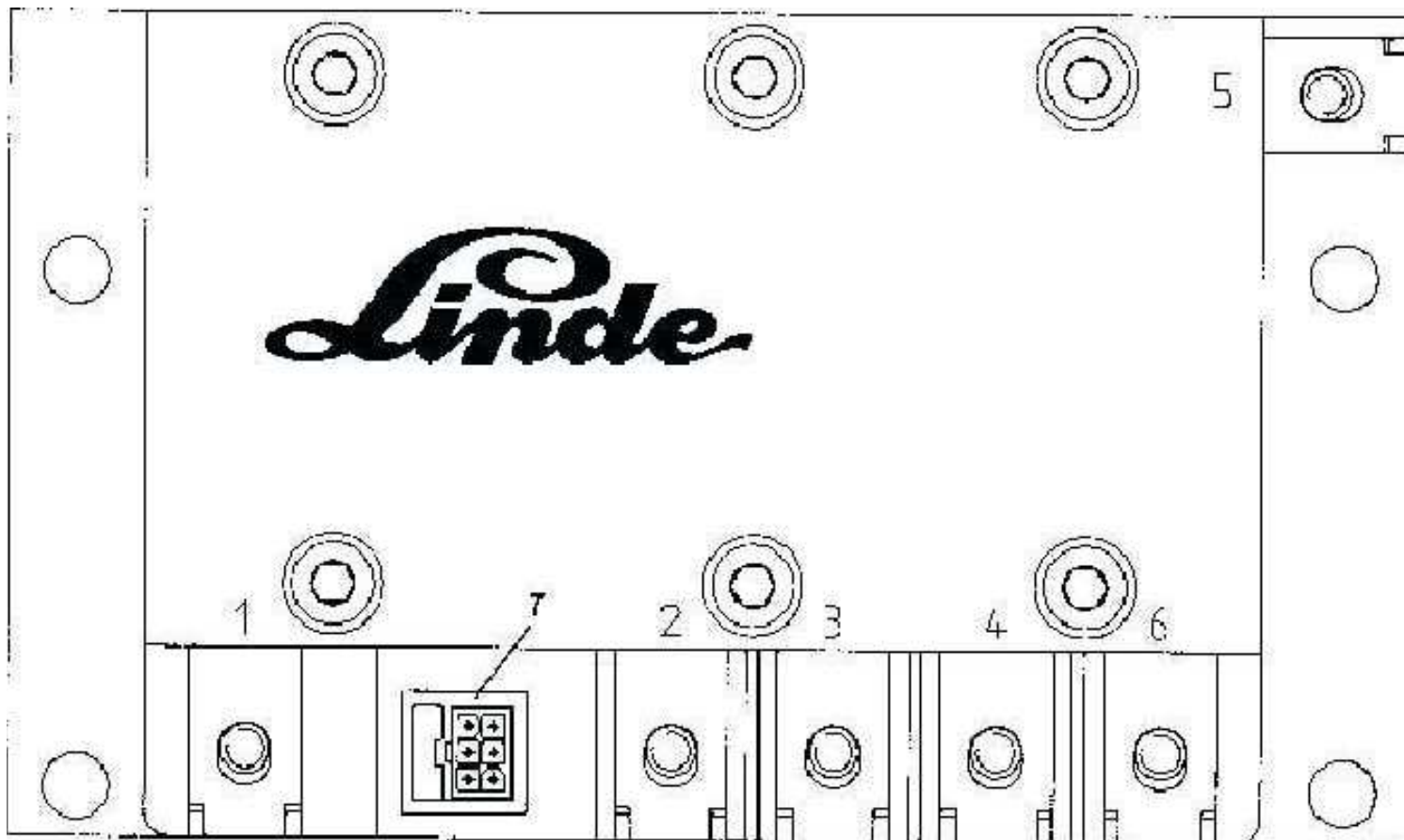
- N-type channel enhancement type MOSFET
- Zener diode for active overvoltage protection
- gate-source Zener diode and resistor against static overvoltage at the gate
- integrated gate resistors against internal oscillations
- insulated aluminium base plate
- longer air gaps

Regenerative braking is standard equipment for this series, which returns part of the energy generated during braking back to the battery. The control unit and the fan are supplied with 24 V direct current via a separate voltage converter.

Trucks equipped with optional lighting require a separate voltage converter.

## 2.6.1 COMPACT POWER MODULE

### 2.6.1.1 TRACTION POWER MODULE



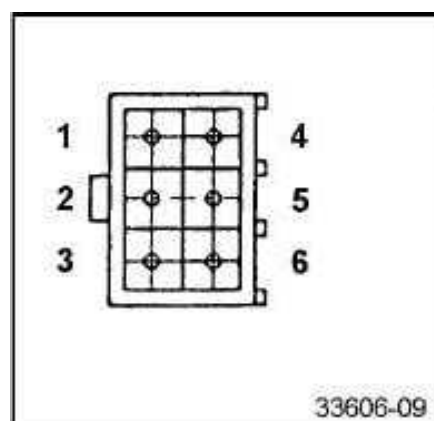
33606-11

Main terminals:

- 1 Source
- 2 Drain
- 3 Anode of brake diode 1 V51 (for motor 1 M1)
- 4 Anode of brake diode 1 V52 (for motor 1 M2)
- 5 Anode of regenerative current diode 1 V53
- 6 Cathode terminals of freewheel and brake diodes

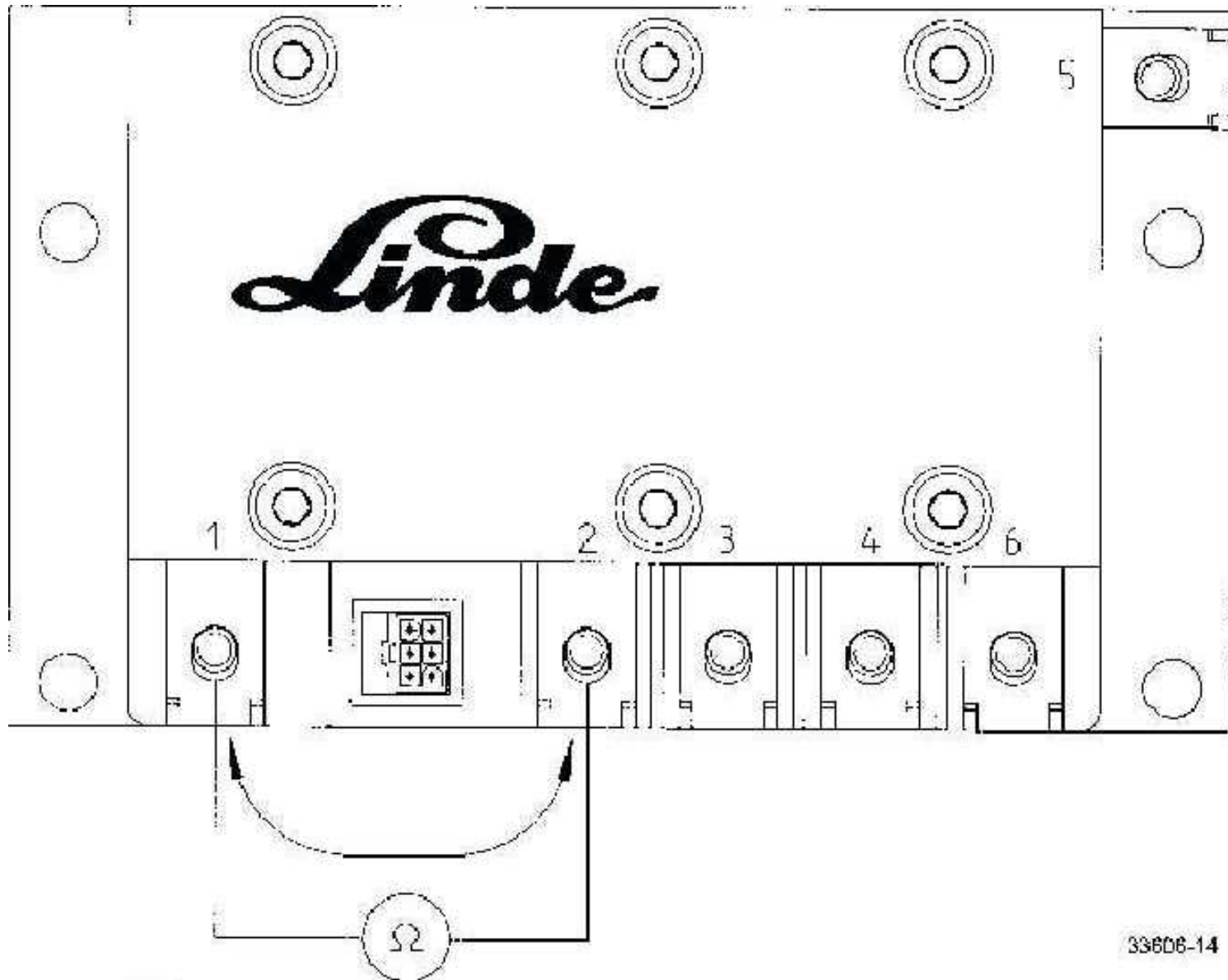
Connector (7)

- 1 Auxiliary source S
- 2 Not used
- 3 Gate
- 4 Not used
- 5 Not used
- 6 Auxiliary drain D



33606-09

### TESTING THE PROTECTIVE DIODE IN THE POWER MODULE



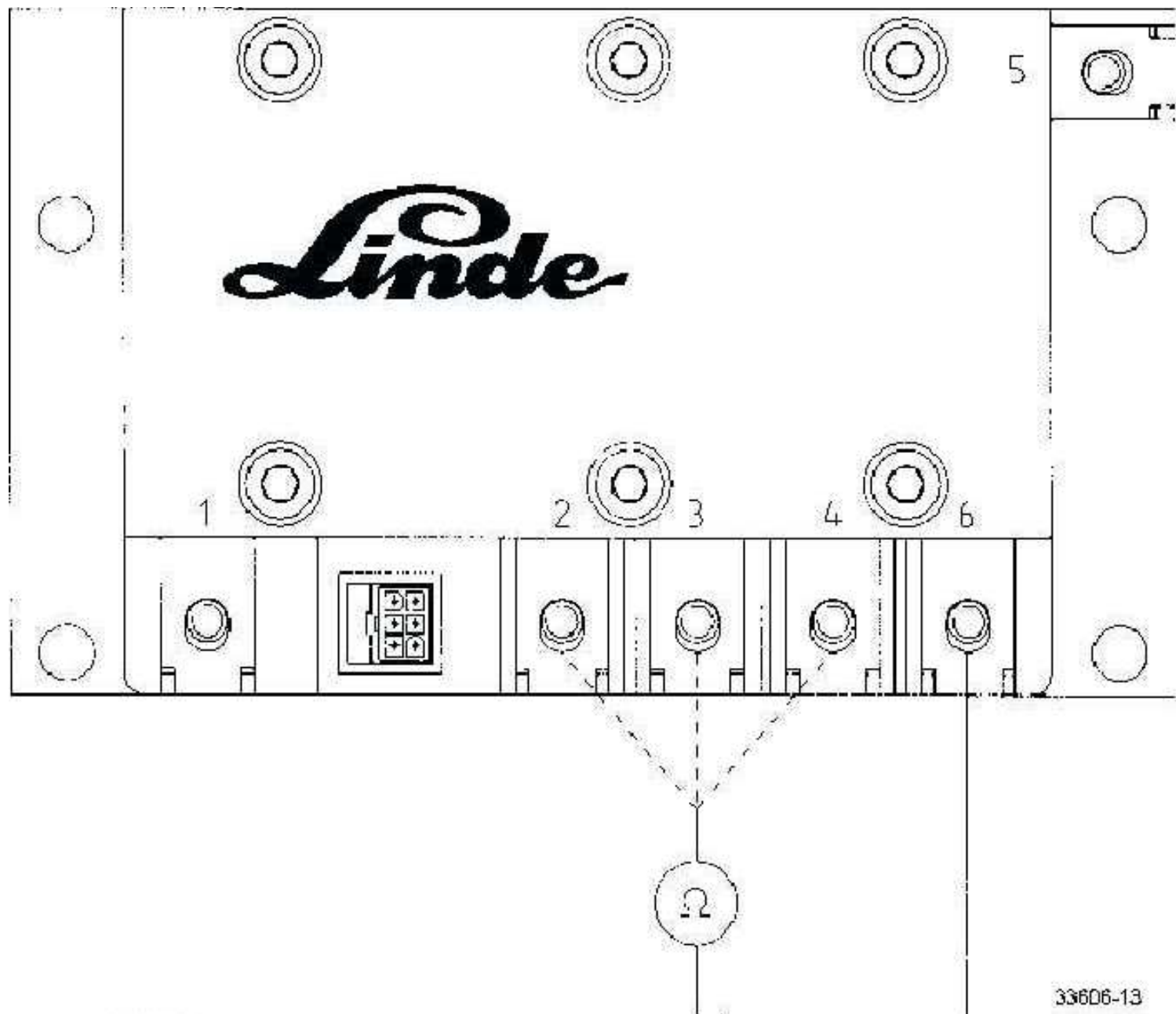
33606-14

- Perform the test with the multimeter set to the Ohm range, + lead connected to source 1, - lead connected to drain 2.  
The protective diode does not block, low impedance indicated.
- + lead connected to drain 2, - lead connected to source 1.  
The protective diode blocks, high impedance is indicated.
- If both readings are the same, the diode is defective.

# Service Training

Section 2.6  
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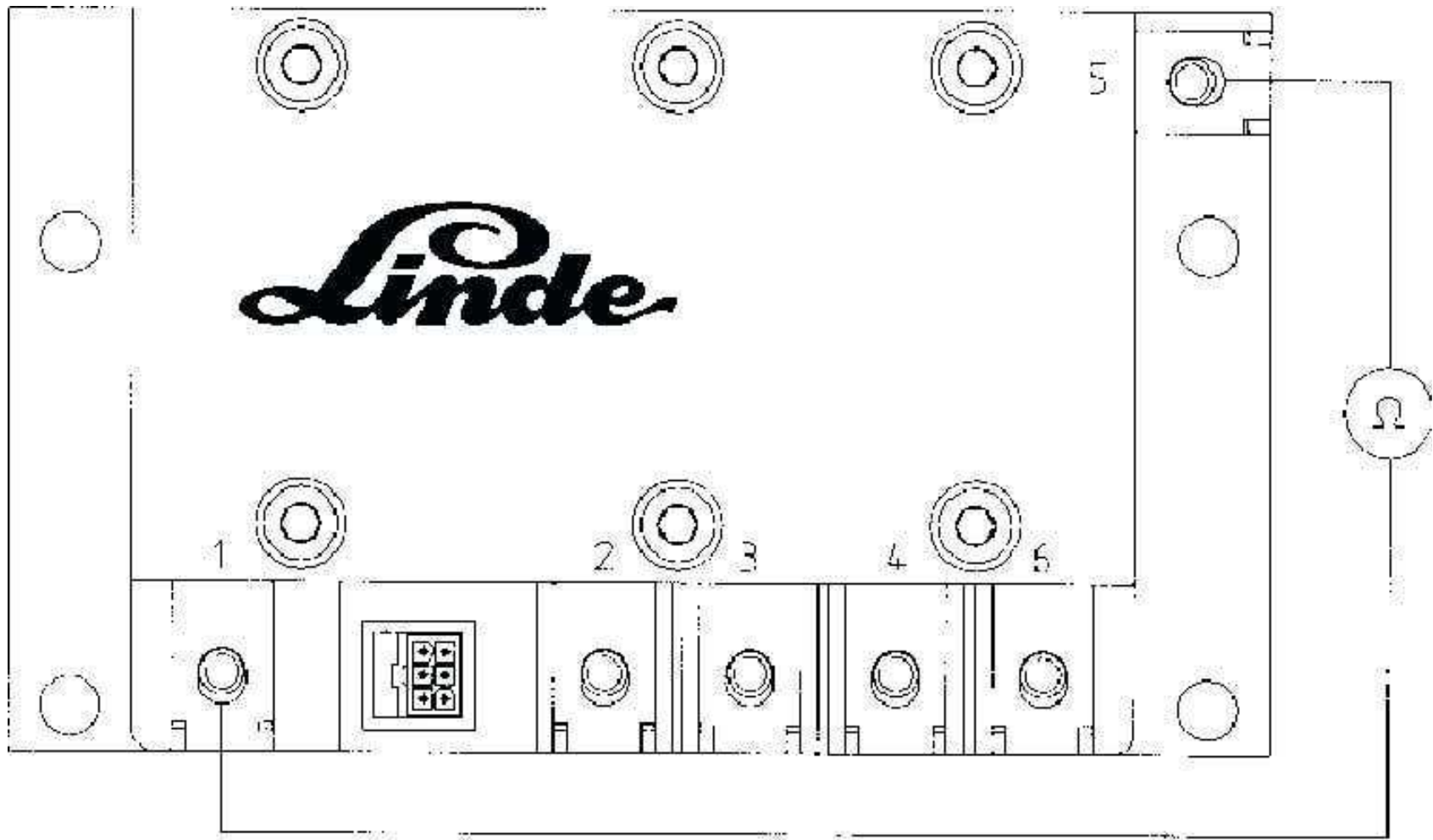
## TESTING THE FREEWHEEL AND BRAKE DIODES IN THE POWER MODULE



- Perform the test with the multimeter set to the Ohm range, + lead connected to 6, - lead connected one after the other to 2, 3 and 4.  
The diodes block, high impedance is indicated.
- - lead connected to 6, + lead connected one after the other to 2, 3 and 4.  
The diodes do not block, low impedance is indicated.
- If both readings are the same, the protective diode is defective.



## TESTING THE REGENERATIVE BRAKING DIODE IN THE POWER MODULE



33606-15

- Perform the test with the multimeter set to the Ohm range, + lead connected to 5, - lead connected to 1.  
The diodes block, high impedance is indicated.
- - lead connected to 5, + lead connected to 1.  
The diodes do not block, low impedance is indicated.
- If both readings are the same, the diode is defective.

# Service Training

## 2.6.1.4 INSTALLATION OF THE POWER MODULES

The power modules used are of the MOSFET type. MOS transistors react sensitively to static discharges. Static charges can already arise when walking over a carpet. In the worst case, the body can be charged up to 35,000 V.

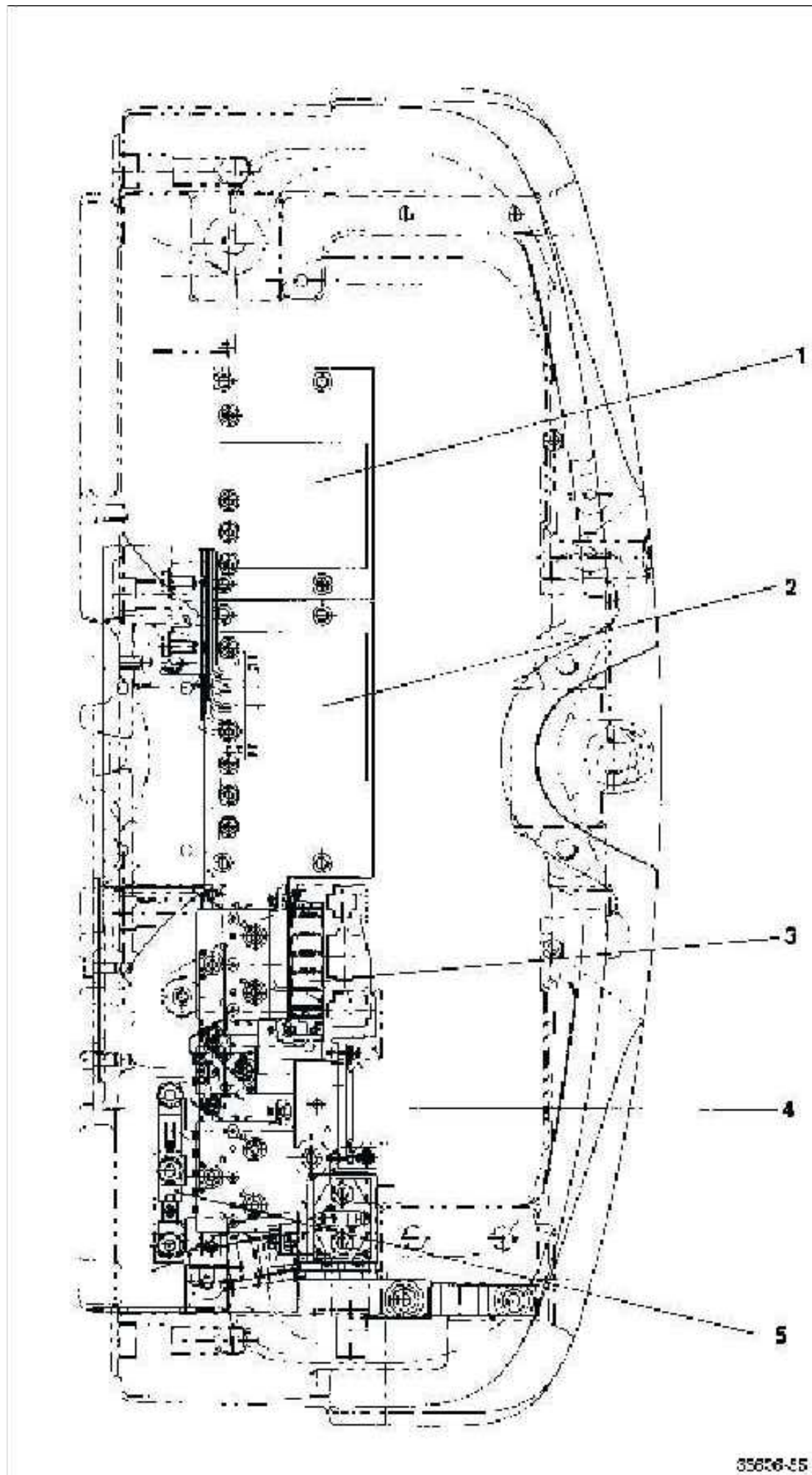
**CAUTION:** Before working on the power modules, the human body must be discharged by touching earth (e.g. water pipe).  
Handle the power modules carefully to prevent damage to the cooling area and to the connector.

- Clean the underside of the power module in the area of the heat sink of any dust and foreign objects.
- To reduce the heat transfer resistance between the power module and the counterweight, using a spatula, apply a thin coating of thermal compound WPV10 to the mounting area of the power module
- Position the power module correctly.
- Tighten the M10x35 socket head screws alternately to a torque of 49 Nm.
- Insert the plug.

**CAUTION:** The M10x35 socket head screws must be tightened to the proper torque to ensure the correct contact of the power module.  
After 30 minutes, tighten alternate M10x35 socket head screws again.



## 2.6.1.5 ARRANGEMENT OF CONTROL PANELS IN E 20 MODEL

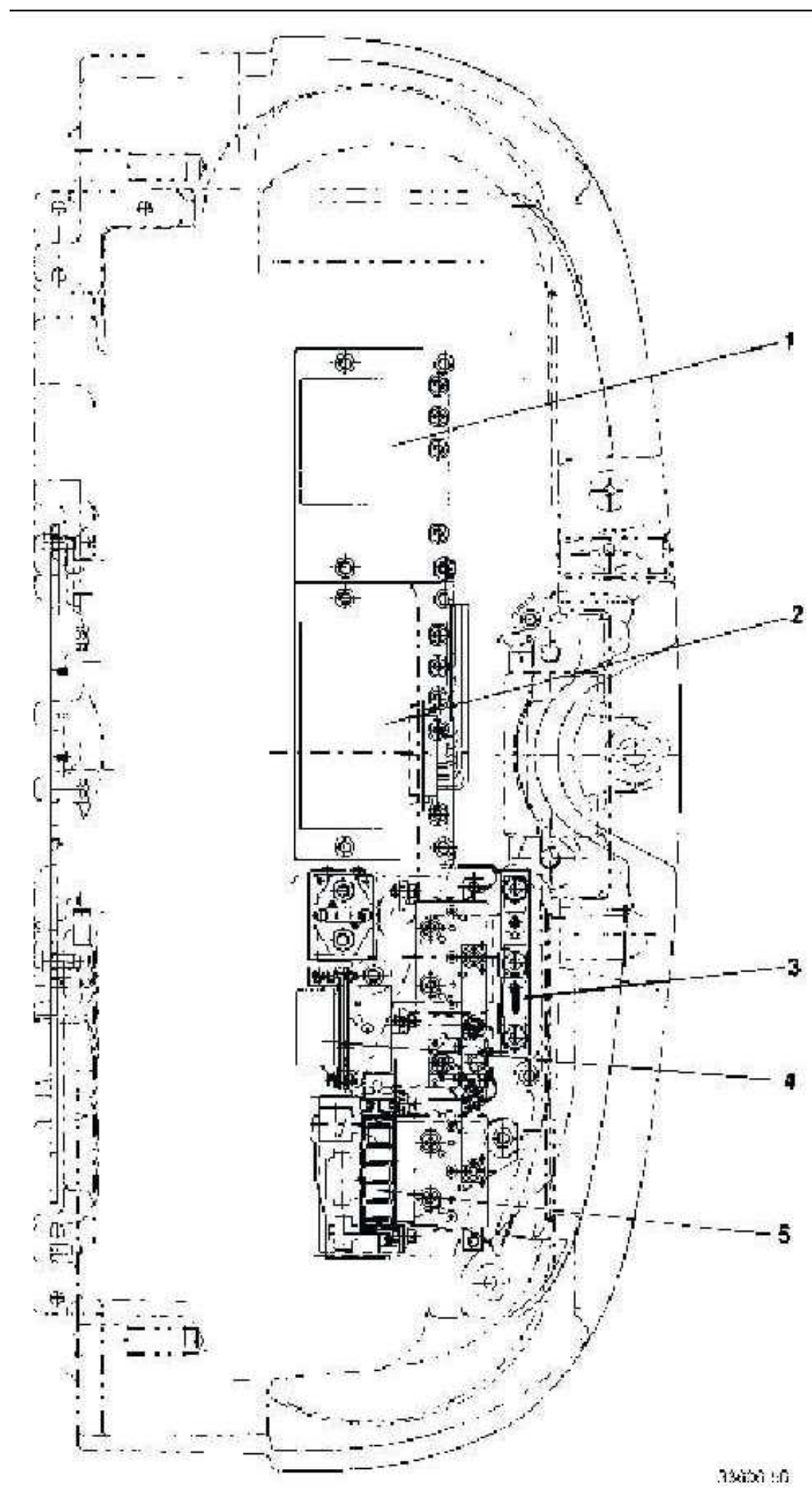


- |   |                  |   |  |
|---|------------------|---|--|
| 1 | Lift control     | 3 | Control current fuses                  |
| 2 | Traction control | 4 | Timer 1A3 (to series 6/95 trucks only) |
|   |                  | 5 | Main circuit fuses                     |

# Service Training

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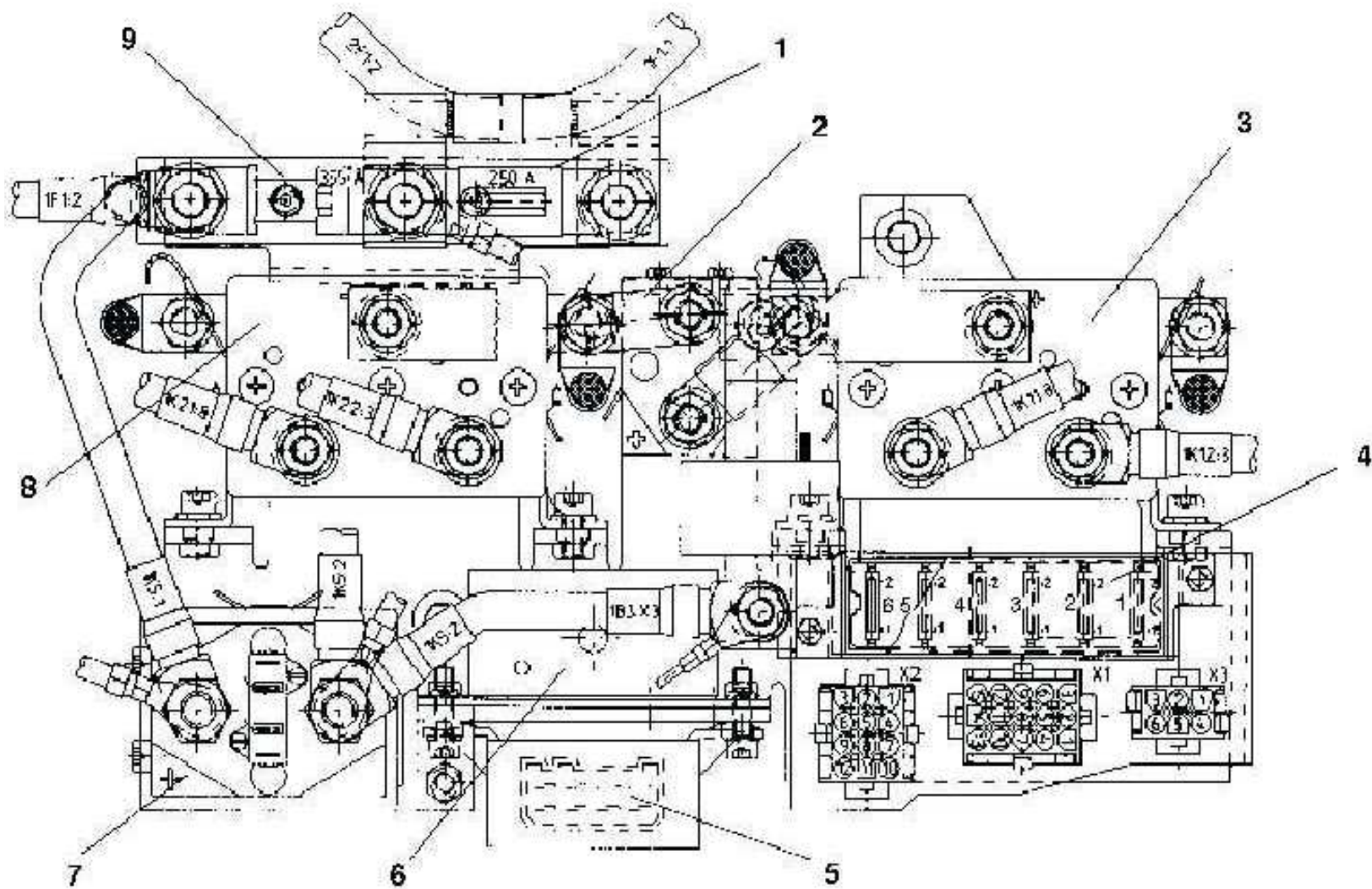
## 2.6.1.6 ARRANGEMENT OF CONTROL PANELS IN E 25 / E 30 MODEL



- |   |                    |   |  |
|---|--------------------|---|--|
| 1 | Lift control       | 4 | Timer 1A3 (to series 6/95 trucks only) |
| 2 | Traction control   | 5 | Control current fuses                  |
| 3 | Main circuit fuses |   |  |



## 2.6.1.7 CONTACTOR PANELS



93606-48

- 1 Main circuit fuse 2F1 for pump motor
- 2 Circuit breaker 1K6
- 3 Directional contactors 1K11, 1K12
- 4 Control current fuses
- 5 Timer 1A3 (to series 6/95 trucks only)
- 6 Voltage converter U1
- 7 Regenerative current contactor 1K5
- 8 Directional contactors 1K21, 1K22
- 9 Main circuit fuse 1F1 for traction motors



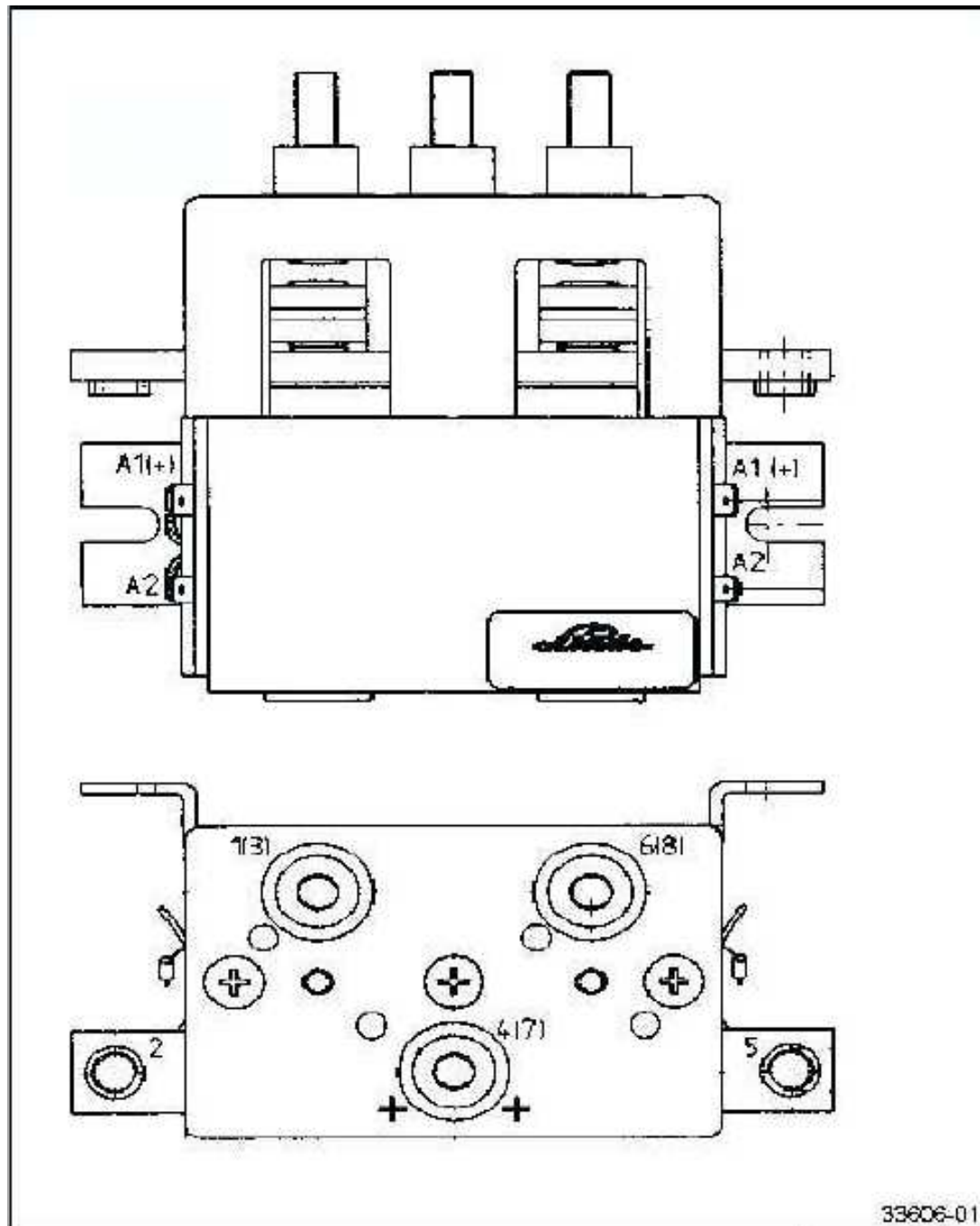
# Service Training

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|---------|-----|
| Section | 2.6 |
| Page    | 15  |

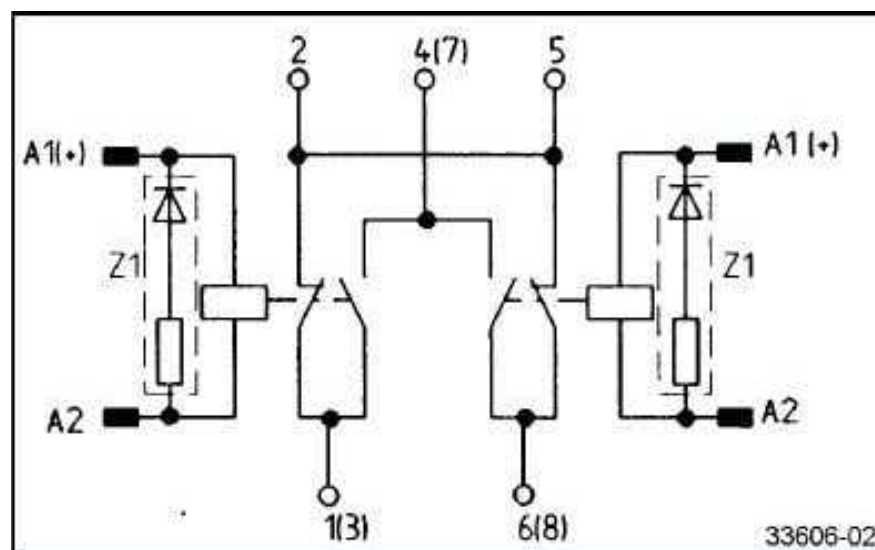
## 2.6.2 CONTACTORS

### 2.6.2.1 DIRECTIONAL CONTACTORS



33606-01

Circuit diagram:



33606-02

# Service Training

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## 2.6.10.1.7 TRAVEL DIRECTION INDICATOR (OPTION)

With the single-pedal option the chosen direction of travel is signalled by the two indicator lights. With this function the battery negative signal from the travel direction switch to the electronic traction unit is evaluated by the combined instrument.

## 2.6.10.1.8 HYDRAULIC OIL TEMPERATURE WARNING LIGHT (OPTION)

With this option, a thermal switch located in the hydraulic oil reservoir is activated when the oil temperature is too high. A battery negative signal is applied to terminal 6X9:25, which illuminates the light.

## 2.6.10.1.9 HYDRAULIC OIL LEVEL WARNING LIGHT (OPTION)

When the hydraulic oil level is too low, a battery negative signal is applied to terminal 6X9:24 of the combined instrument by a float switch.

## 2.6.10.1.10 FAN WARNING LIGHT (FROM SERIES 7/95)

When the temperature in a motor exceeds 140 °C, this light is illuminated in addition to the motor temperature warning light to signal that the operation of the respective fan should be checked.

## 2.6.10.1.11 SERVICE INTERVAL INDICATOR LIGHT

The illumination of the service interval indicator light signals to the operator that an inspection or lubrication service is due. The interval can be modified in certain areas. The modification and the reset is done with the diagnostic unit.

## 2.6.10.2 BATTERY DISCHARGE INDICATOR

The battery discharge indicator consists of 10 LEDs (7 green, 1 orange and 2 red). Depending on the battery state of charge, the row of illuminated LEDs goes off from battery fully charged (right green LED) to battery discharged (both red LEDs flashing). When the two red LEDs flash, the speed of the working hydraulics is reduced by 50 %.

The condition of a battery is always reflected in its discharge voltage gradient. In the case of the Linde discharge indicator, the battery voltage is measured and from this value the voltage of the cells is deduced. The cell voltage drops as the battery discharges. The cell voltage is also influenced by the momentary current consumption. The surge in cell voltage with a load is lower with a charged battery than with a discharged one. The registration of battery discharge is based on the voltage surges measured over a period of time.

The discharge voltage gradient varies with the type, age and discharge period of the battery. Various discharge characteristic curves are stored in the operating software of the combined instrument for various types of batteries. The correct curve must be chosen for the battery installed. The battery type can be modified with menu item 21.

- 1 Standard wet cell Varta (factory setting)
- 2 Standard wet cell Deta
- 3 Performance enhanced battery
- 4 Gel battery

The discharge period and the age of the battery also affect the discharge characteristic. The programmed discharge characteristic can be shifted in certain ranges in order to show the correct discharge information on the display.

When the battery discharge reaches 80 percent, the speed of the working hydraulics is reduced to warn the operator that the battery must be charged. This value can be increased to a residual capacity of 40 percent.

Depending on the type of application and battery, the discharge indicator must be optimised. An optimisation is done with the diagnostic unit using the following menu items:

- 21 Battery type
- 22 Upper discharge characteristic
- 23 Cut-out point

The changes should be done in the smallest possible steps. The installed battery type should be programmed first. Then a fine adjustment can be performed with menu item 22 (upper discharge characteristic), which corresponds to the adjusting potentiometer (range A to E) on the Curtis discharge indicator, and with menu item 23 (cut-out point).



# Service Training

The table below serves as a programming aid for the various types of batteries and applications. Depending on the application and type of battery, menu numbers 22 and 23 can be altered according to the following table. A detailed description regarding the application of the diagnostic unit in connection with the combined instrument is given in section 2.6.11.

| Type of Application and Battery                                  | Time for Reduction | Change in Menu No. 22. | Change in Menu No. 23 |
|--|--------------------|------------------------|-----------------------|
| Particularly heavy duty<br>Battery charging under 4 hrs required | Too early          | Reduce                 | Increase              |
| Particularly light duty<br>Battery charging once a week          | Too late           | Increase               | Increase              |
| Trucks with many options<br>(basic loads e.g. heater, etc.)      | Too late           | Increase               | Increase              |
| Performance enhanced<br>PzS battery                              | Too late           | Increase by 0.03 V     | Increase              |
| PzV battery  | Too late           | Increase by 0.06 V     | Increase              |
| CSM battery  | Too late           | Increase by 0.09 V     | Increase              |

The battery discharge indicator is reset to "battery fully charged" by the increase in cell voltage after charging of the battery. This cell voltage is programmed to be 2.09 V per cell as standard value. This value can be modified with menu item 22. The cell voltage value must be applied for a certain period of time after turning on the key switch before the discharge indicator is reset. When the truck is delivered, this value is set to 0.1 min. This time can be changed with menu item 24.

## 2.6.11 LINDE DIAGNOSTIC UNIT

In future Linde will use more microprocessor-based controls. For this reason Linde has developed the diagnostic unit P/N 390 360 5405. This special tool and measuring unit (WM 136) can now be ordered from parts Service.

The Linde diagnostic unit is used for communication (programming, initialization and queries) with the microprocessor-based controls of Linde components provided with an ISO Interface (DIN/ISO 9141). The diagnostic unit contains terminal software which allows communication with the unit in question through the ISO interface.

The internal operating software is integrated in an EPROM and it controls the input, output and display. No adaption of the operating software to newly developed or modified components is required.

The diagnostic unit is equipped with an LCD (liquid crystal display) with 4 lines, each consisting of 20 digits, and a foil keyboard with 20 keys. A cable supplied with the diagnostic unit is used to connect the unit to the Linde component in question.

Power is supplied by four 1.5 V round cells R6 or by electrical system of the Linde truck. The installed round cells are tested each times the diagnostic unit is switched on.

If no key is touched, the diagnostic unit is automatically switched off after 80 sec. to spare the round cells. If visibility is poor, the display can be illuminated pressing the appropriate key.

The contrast of the LCD display can be set with a potentiometer in the diagnostic unit.



|                  |                                   |                          |                   |
|------------------|-----------------------------------|--------------------------|-------------------|
| <div>EIN</div>   | Switching on the diagnostic unit  | <div>DATEN<br/>NEU</div> | Start a new input |
| <div>AUS</div>   | Switching off the diagnostic unit | <div>ENTER</div>         | Data transmission |
| <div>RESET</div> | Resetting diagnostic unit         | <div>CE</div>            | No function       |
| <div>LICHT</div> | Display lighting                  | <div>0 - 9<br/>+ -</div> | Input keys        |

2.6.11.1 OPERATION OF THE DIAGNOSTIC UNIT IN CONNECTION WITH THE COMBINED INSTRUMENT

With the aid of the diagnostic unit, various functions can be programmed with the combined instrument and data can also be read out of the memory of the combined instrument. All functions can be accessed with the menu numbers. It is possible to differentiate between

|                                   |                   |
|-----------------------------------|-------------------|
| Programmable functions            | Menu No. 11 to 24 |
| Reset of service interval display | Menu No. 31       |
| Programmable hours                | Menu No. 32 to 35 |
| Read-out function                 | Menu No. 41 to 43 |

The functions of the separate menu items are described in the following table.

| Menu No. | Function                                 | Factory setting | Possible settings                                | Explanation of funktion   |
|----------|--|-----------------|--|---|
| 11       | Fan version                              | 1               | 1<br>2   | Both fans are turned on when temperature at one motor reaches 80 °C<br>Fan of motor in question is turned on when temperature at one motor reaches 80 °C  |
| 12       | Servive hour variant                     | 1               | 1<br>2   | Hour meter runs when activated by key switch and seat switch<br>Hour meter runs when accelerator pedal and working hydraulics are operated  |
| 13       | Service interval period                  | 250 h           | -----, 250, 500<br>750, 1000h                    | Service hours at which service interval indicator light is illuminated (deactivated with ---)   |
| 14       | Number of motors                         | 2               | 2<br>1   | Two traction motors installed in truck<br>1) One traction motor installed in truck  |
| 15       | Thermal sensors                          | 1               | 1<br>0   | Thermal sensor installed in motor<br>2) No thermal sensor installed in motor  |
| 21       | Type of battery                          | 1               | 1<br>2<br>3<br>4                                 | Battery characteristic for standard PsZ cell Varta<br>Battery characteristic for standard PsZ cell Deta<br>Battery characteristic for enhanced PsZ cell<br>Battery characteristic for gel battery |
| 22       | Upper discharge characteristic           | 2,09 V          | 2,00, 2,03<br>2,06, 2,09<br>2,12, 2,15<br>2,18 V | Battery cell voltage value interpreted by discharge indicator as fully charged battery  |
| 23       | Cut-out point for discharge indicator    | 20%             | 20, 25, 30<br>35, 40 %                           | Residual battery capacity at which power reduction of working hydraulics set in   |
| 24       | Discharge indicator disable time         | 0,1min          | 0,1, 1,1, 2,1<br>3,1, 4,1, 5,1<br>6,1, 7,1, 8,1  | Time after which discharge indicator jumps to full charge when cell voltage set in menu item 22 is reached  |
| 31       | Reset Service Lamp                       |                 |  | 3) Freely programmable if total service hrs <00000.0  |
| 32,33    | Service hours with accelerator depressed |                 |  | 3) Freely programmable if total service hrs <00000.0  |
| 34       | Service hours 2M1                        |                 |  | 3) Freely programmable if total service hrs <00000.0  |
| 35       | Totoal Service hours                     |                 |  | 3) Freely programmable if total service hrs <00000.0  |
| 41       | Motor overheating                        |                 |  | Display of last three motor overheatings (over 160 °C) with motor number and service hours  |
| 42       | Brush wear                               |                 |  | Display of last three brush wear signals with motor number and service hours  |
| 43       | Discharge limit                          |                 |  | Display of last five service hour values at which the battery was discharged up to the cut-out point of discharge indicator   |

1) Not on series 336 trucks  
2) On trucks to series 6/95  
3) Only possible once with a new combined instrument. Input is with numeric key pad (6 digits) and it must be concluded by pressing ENTER.



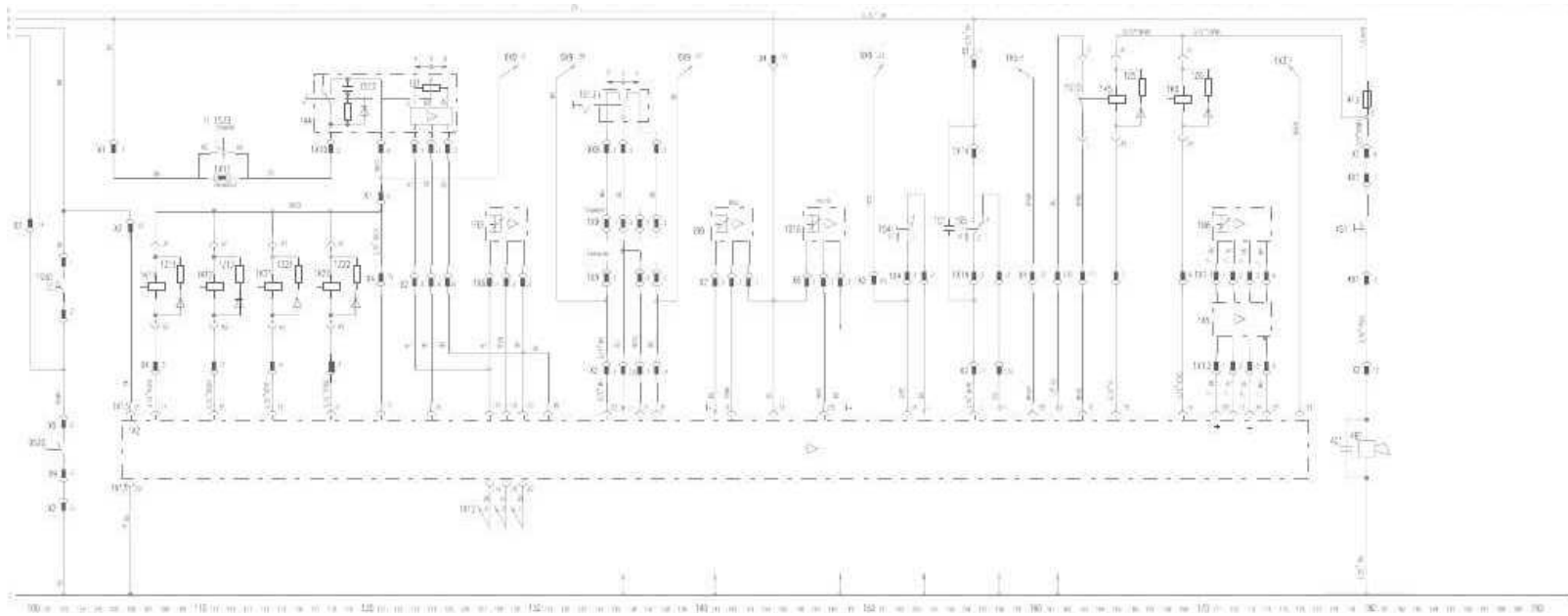
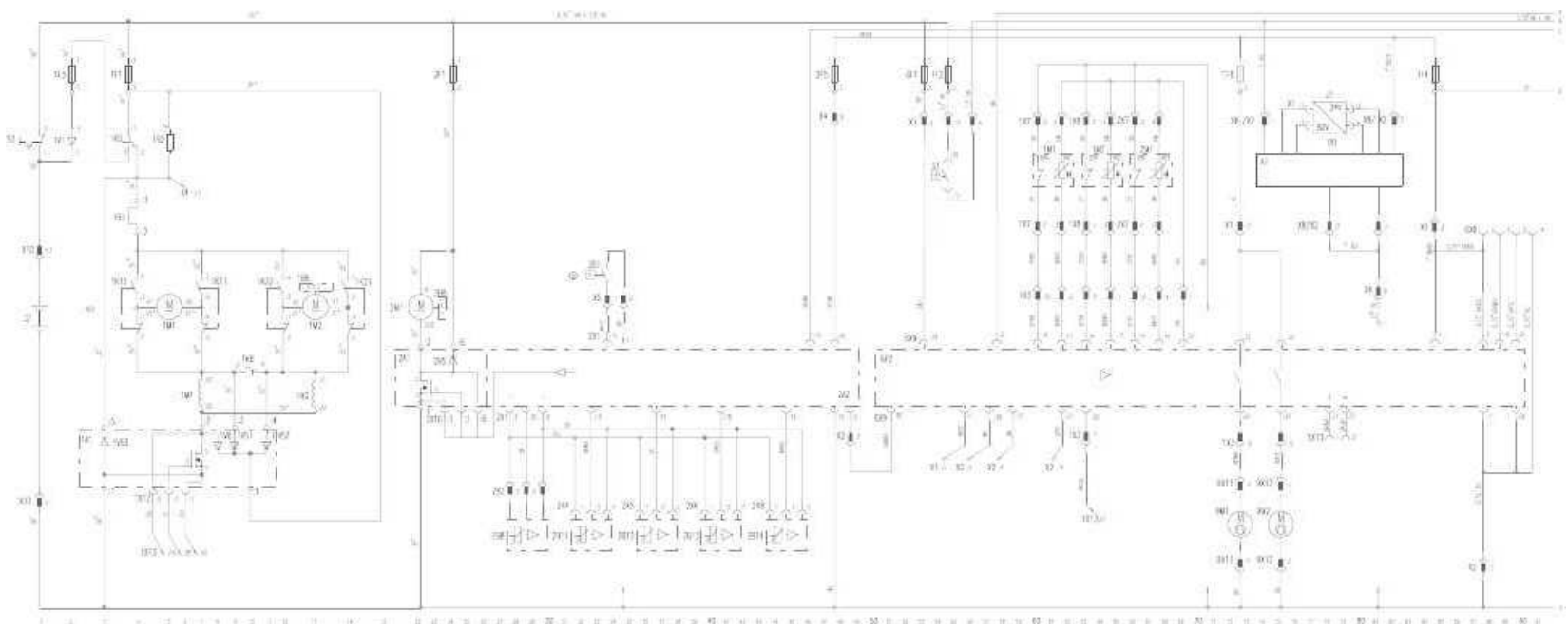
## 2.6.13.2 WIRING DIAGRAM FROM SERIES 7/95

|       |                                      |            |         |  |          |
|-------|--------------------------------------|------------|---------|--|----------|
| 1A1   | Traction control power module        | 3-11       | X1      | 15-pin connector                                 |          |
| 1A2   | Traction control                     | 106-176    | X2      | 12-pin connector                                 |          |
| 1A4   | Accelerator sensor                   | 118-124    | X4      | 15-pin connector                                 |          |
| 1A5   | Amplifier for speed sensor           | 171-174    | X5      | Reed contact 3S1 terminal                        | 34, 35   |
| 2A1   | Lift control power module            | 22-26      | X6      | Left curve sensor, 4-pin connector               | 147-149  |
| 2A2   | Lift control                         | 27-49      | X7      | Right curve sensor, 4-pin connector              | 141-143  |
| (1B1) | (Accelerator sensor potentiometer)   | 123-126    | X8      | Voltage converter connector                      | 74, 82   |
| 1B3   | Current sensor                       | 14,127-130 | X9      | Overhead guard, 3-pin connector                  | 102      |
| 1B8   | Speed sensor 1M2                     | 13,171-174 | X10     | Battery plug                                     | 1        |
| 1B9   | Curve sensor, left                   | 141-143    | 1X1 1.2 | 4-pin connector                                  | 171-174  |
| 1B10  | Curve sensor, right                  | 146-148    | 1X3     | 10-pin connector                                 | 60-69    |
| 2B8   | Speed sensor 2M1                     | 22,28-30   | 1X4     | 3-pin connector                                  | 152-154  |
| 2B11  | Lift sensor                          | 32-34      | 1X6     | 3-pin connector                                  | 127-129  |
| 2B12  | Lift tilt                            | 36-38      | 1X7     | 4-pin connector                                  | 60-62    |
| 2B13  | Aux. hydraulics sensor 1             | 40-42      | 1X8     | 4-pin connector                                  | 63-65    |
| 2B14  | Aux. hydraulics sensor 1             | 44-46      | 1X9     | 4-pin connector                                  | 134-138  |
| 4B1   | Horn                                 | 180        | 1X10    | 6-pin connector                                  | 118-125  |
| 6B1   | Thermal sensor in 1M1                | 62         | 1X11    | 2-pin connector                                  | 112, 113 |
| 6B2   | Thermal sensor in 1M2                | 65         | 1X12    | Connection, power module - traction control unit | 4-6      |
| 6B3   | Thermal sensor in 2M1                | 68         | 1X13    | 42-pin connector                                 | 106-176  |
| 6B4   | Brush wear switch, 1M1               | 60         | 1X14    | 3-pin connector                                  | 156, 157 |
| 6B5   | Brush wear switch, 1M2               | 63         | 2X1     | 25-pin connector                                 | 28-48    |
| 6B6   | Brush wear switch, 2M1               | 66         | 2X2     | 4-pin connector                                  | 28-30    |
| 1C1   | Suppressor capacitor, brake switch   | 255        | 2X4     | 3-pin lift signal connector                      | 23-25    |
| 4C1   | Suppressor capacitor                 | 179        | 2X5     | 3-pin tilt connector                             | 27-29    |
| 1F1   | Traction fuse 355 A                  | 4          | 2X6     | 3-pin aux. hydraulics 1 connector                | 30-32    |
| 1F2   | Control fuse 15 A                    | 55         | 2X7     | 4-pin 2M1 connector.                             | 66-68    |
| 1F3   | Fuse 100 A                           | 2          | 2X8     | 3-pin aux. hydraulics 2 connector                | 33-35    |
| 1F4   | Traction control fuse 5 A            | 85         | 2X10    | Connection, power module - lift control unit     | 23-25    |
| 1F6   | Fan fuse 5 A                         | 73         |         | 2-pin connector                                  | 180      |
| 2F1   | Lifting fuse 250 A                   | 24         | 4X1     | 3-pin connector turn signal indicator            | 78, 79   |
| 2F5   | Lifting fuse 5 A                     | 48         | 5X13    | Diagnostic connector 4-pin                       | 87-90    |
| 4F3   | Horn fuse 5 A                        | 280        | 6X6     | 36-pin connector                                 | 51-90    |
| 6F1   | Fuse 15 A discharge indicator        | 53         | 6X9     | 3-pin connector                                  | 134-138  |
| G1    | Battery                              | 1          | 9X8     | 2-pin connector                                  | 71       |
| 1K5   | Regenerative current contactor       | 4, 164     | 9X11    | 2-pin connector                                  | 75       |
| 1K6   | Circuit breaker contactor            | 10, 169    | 9X12    | Quench circuit                                   | 167      |
| 1K11  | Reverse directional contactor, right | 7,107      | 1Z5     | Quench circuit                                   | 171      |
| 1K12  | Forward directional contactor, right | 4, 111     | 1Z6     | Quench circuit                                   | 109      |
| 1K21  | Reverse directional contactor, left  | 14, 115    | 1Z11    | Quench circuit                                   | 112      |
| 1K22  | Forward directional contactor, left  | 12, 118    | 1Z12    | Quench circuit                                   | 116      |
| 1M1   | RH traction motor                    | 5, 6       | 1Z21    | Quench circuit                                   | 120      |
| 1M2   | LH traction motor                    | 13         | 1Z22    | Quench circuit                                   |          |
| 2M1   | Pump motor                           | 22         |         |  |          |
| 9M1   | Fan motor (traction and pump motor)  | 73         |         |  |          |
| 9M2   | Fan motor (motor compartment)        | 75         |         |  |          |
| 6P2   | Combined instrument                  | 50-90      |         |  |          |
| 1R1   | Resistor for speed reduction         | 131        |         |  |          |
| 1R2   | Resistor for field excitation        | 5          |         |  |          |
| S1    | Key switch                           | 54         |         |  |          |
| S2    | Emergency stop switch                | 1          |         |  |          |
| 1S4   | Parking brake switch                 | 153        |         |  |          |
| 1S5   | Brake pedal switch                   | 156        |         |  |          |
| 1S10  | Regenerative current switch          | 163        |         |  |          |
| 1S12  | Accelerator sensor switch            | 118        |         |  |          |
| 1S13  | Directional switch                   | 110-113,   |         |  |          |
|       | single-pedal model                   | 134-137    |         |  |          |
| 1S50  | Seat switch                          | 102        |         |  |          |
| 3S1   | Steering switch                      | 34         |         |  |          |
| 4S1   | Horn button                          | 180        |         |  |          |
| 9S20  | Overhead guard switch                | 102        |         |  |          |
| U1    | Voltage converter                    | 77-79      |         |  |          |
| 1V6   | Traction freewheel diode             | 8          |         |  |          |
| 1V51  | Armature diode (1M1)                 | 9          |         |  |          |
| 1V52  | Armature diode (1M2)                 | 11         |         |  |          |
| 1V53  | Regenerative current diode           | 3          |         |  |          |
| 2V6   | Pump motor freewheel diode           | 25         |         |  |          |

Colour code:

|    |        |    |        |
|----|--------|----|--------|
| BK | black  | GN | green  |
| WH | white  | VT | violet |
| BU | blue   | RD | red    |
| OG | orange | YE | yellow |
| BN | brown  | GY | grey   |







# Service Training

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## 2.7 HYDRAULIC SYSTEM

### 2.7.1 HYDRAULIC PUMP MOTOR

|                     |  |
|---------------------|--|
| Type:               | DC compound-wound motor  |
| Model:              | GF 144-14/4.3  |
| Voltage:            | 80 V, 200 A, 2550 rpm  |
| Power:              | 13.5 kW S3 15%   |
| Type of protection: | IP00/23  |
| Insulation class:   | F  |
| Carbon brushes:     | 12.5x40x40 mm with dust groove   |
| Admissible wear:    | down to 16 mm  |
| Equipment:          | Motor brush monitor - thermal switch to series 6/95; thermal sensor from series 7/95, speed sensor |

### 2.7.2 RENEWING THE HYDRAULIC PUMP MOTOR BRUSHES

- Tilt the overhead guard to the 2nd detent.
- Remove the hydraulic pump motor brushes.
- Lift up the brush springs.
- Pull the brushes out of their guides.
- Renew the brushes.

### 2.7.3 REMOVING THE HYDRAULIC PUMP UNIT

- Tilt the overhead guard to the 2nd detent.
- Loosen the hose clamp on the hydraulic reservoir and disconnect the suction line.
- Screw off the hydraulic pump supply line P at the steering control valve.
- Remove the air duct.
- Disconnect the connector 2X7 from the pump motor to the main cable harness.
- Disconnect the speed sensor connector 2X2.
- Remove the cover on top of the sensor transmitter.
- Screw an eyebolt into the motor shaft.
- Lift the hydraulic pump unit out of the vehicle with suitable lifting equipment.

## 2.7.4 CONTROL VALVE

### 2.7.4.1 REMOVING THE CONTROL VALVE

- Lower the fork carriage and tilt the mast forward.
- Release the pressure in the hydraulic system.
- Tilt the overhead guard to the 2nd detent.
- Disconnect the hydraulic lines to the control valve.
- Remove connectors 2X4, 2X5, 2X6 and 2X8 at the bottom of the control valve.
- Loosen the grub screw on the linkage rods from the control levers to the control valve and remove the rods.
- Unscrew the three hexagonal screws on the back of the control valve and remove the control valve.

### 2.7.4.2 ADJUSTING THE PRESSURE-RELIEF VALVE

The pressure-relief valve is installed in the control valve block end plate.

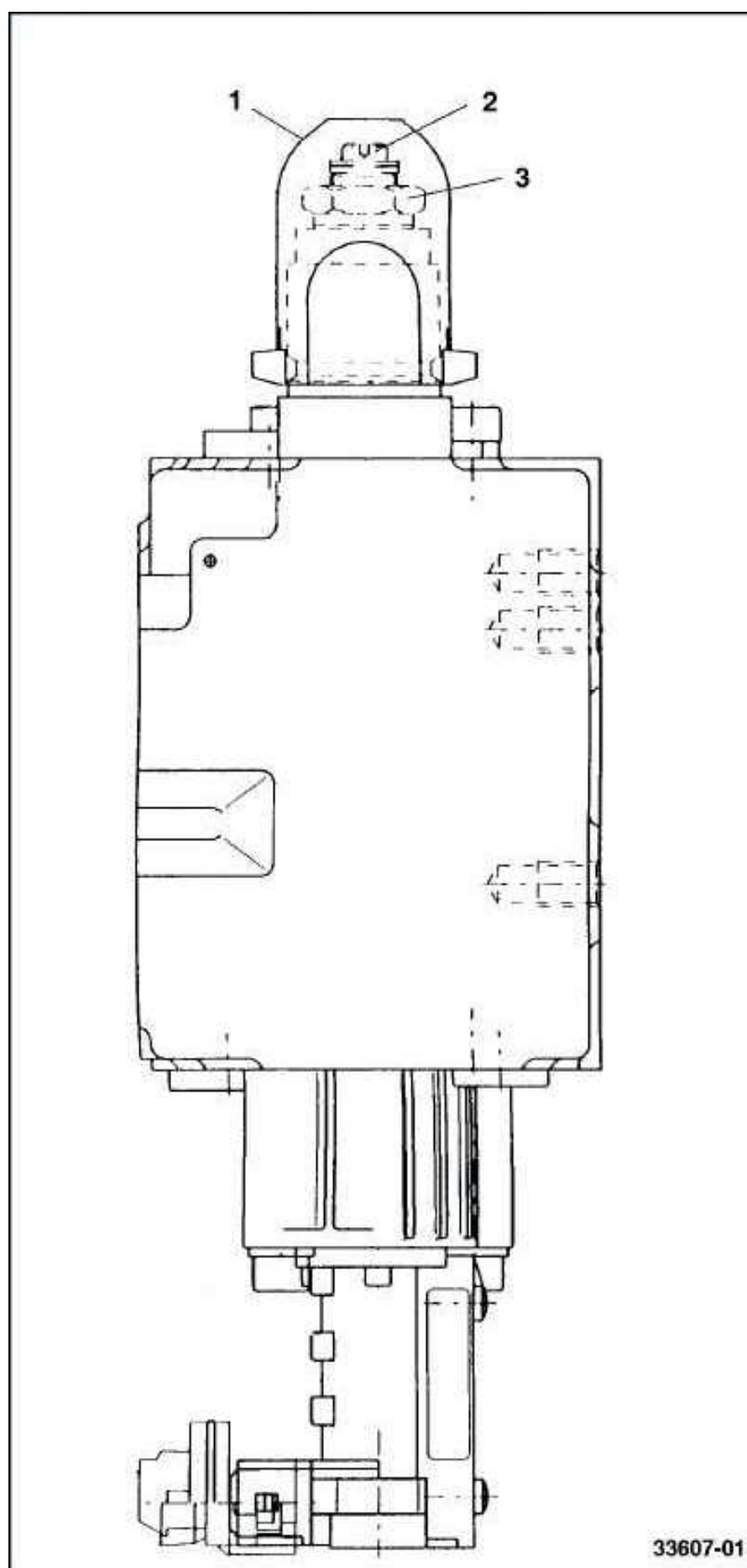
- Install a pressure gauge on the working hydraulics (if equipped with auxiliary hydraulics, preferably at the quick-disconnect coupling)
- Remove the cap (1) on the adjusting screw (2).
- Loosen the locknut (3) on the adjusting screw (2).
- Operate the control lever for the working hydraulics.
- Set the pressure at the adjusting screw (2) according to the table.

Pressure settings:

|          |                | E20/25     | E30         |
|----------|----------------|------------|-------------|
| Standart | mast type 163* | 170 +5 bar | 190 + 5 bar |
| Duplex   | mast type 164  | 170 +5 bar | 195 + 5 bar |
| Triplex  | mast type 165  | 180 +5 bar | 205 + 5 bar |

\* not for E 20

|          |               | E20        | E25        |
|----------|---------------|------------|------------|
| Standard | mast type 183 | 190 +5 bar | 165 +5 bar |
| Duplex   | mast type 183 | 205 +5 bar | 165 +5 bar |
| Triplex  | mast type 183 | 215 +5 bar | -----      |



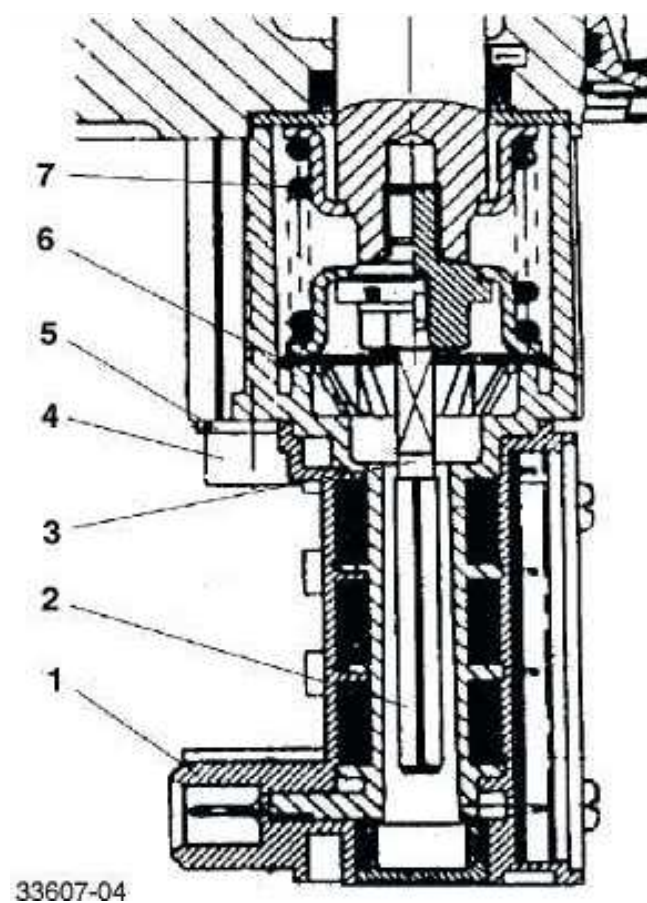
### 2.7.4.3 Distance sensor

A replaceable distance sensor is installed on each hydraulic segment of the control valve.

#### Distance sensor removal

- Jack up and secure the truck.
- Tilt the cabin back to the 2nd detent.
- Disconnect the battery plug.
- Pull the control valve assembly approx. 5 - 6 cm out of the mounting with a pry bar and support the valve.
- Disconnect the connector on the distance sensor (1).
- Remove the two socket head screws (4) and lock washer (5).
- Carefully pull the distance sensor down and out of the sleeve retainer (3), taking care not to lose any shims (6).

**NOTE:** The shims are necessary for the mechanical adjustment of the distance sensor. Depending on the version of the control valve, one or more shims may be installed. These shims must be re-installed during the installation of the distance sensor.



- |   |                   |
|---|-------------------|
| 1 | Distance sensor   |
| 2 | Sleeve            |
| 3 | Sleeve retainer   |
| 4 | Socket head screw |
| 5 | Lock washer       |
| 6 | Shims             |
| 7 | Spring            |



# Service Training

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## Installation:

- Carefully position the distance sensor (1) on the sleeve retainer (3) or spring (7), being sure that the number and location of the shims is correct. Retain the original connector position.
- Screw in and hand tighten the two socket head screws (4) and lock washers (5).
- Install the plug on the distance sensor.
- Remove the support at the control valve and lower the control valve.

The control of the distance sensor output signal is described in the section 2.6 on the electrical system.

## 2.7.5 WORKING AND STEERING HYDRAULICS CIRCUIT DIAGRAM

### A WORKING HYDRAULICS

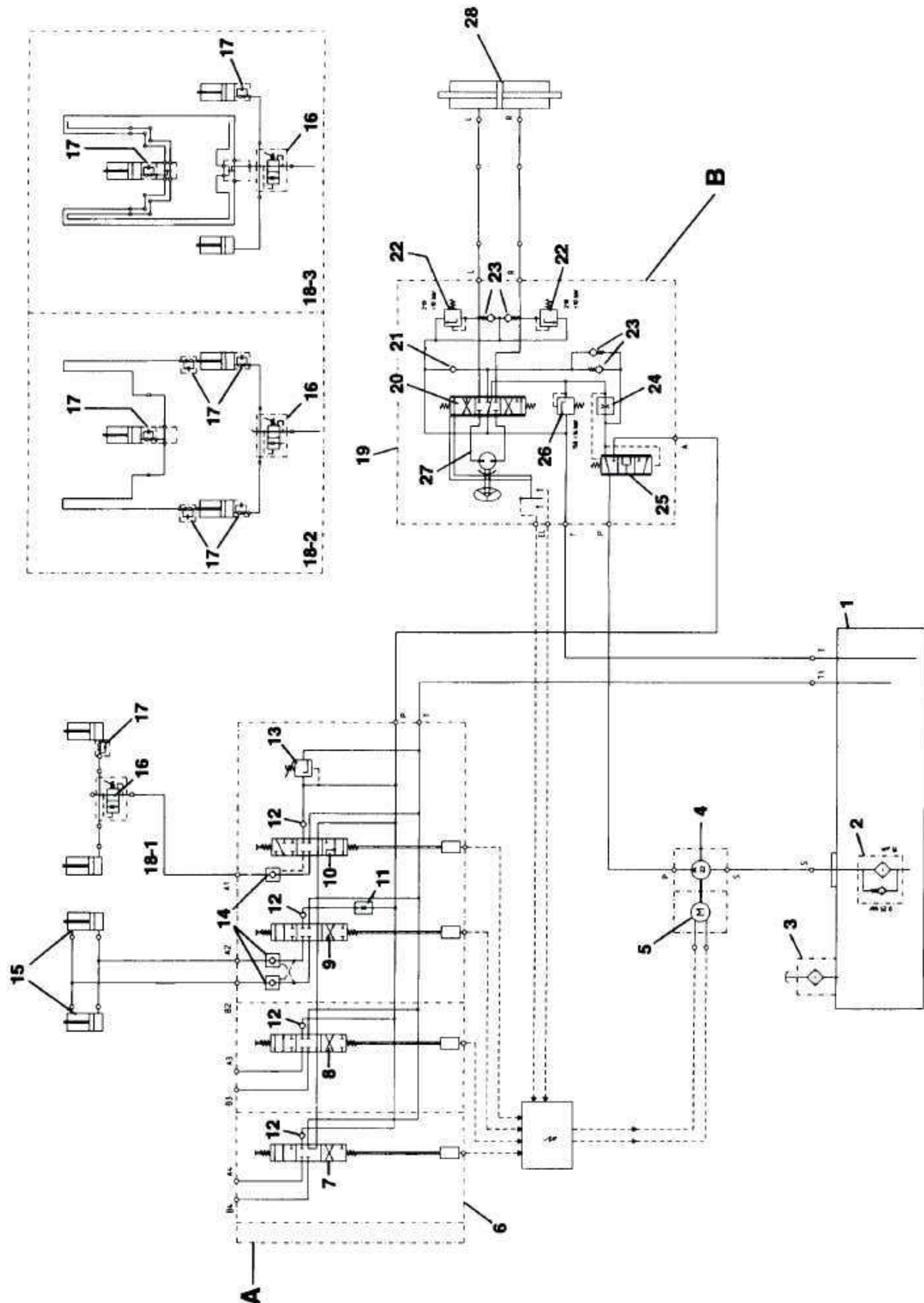
- 1 Hydraulic oil reservoir.
- 2 Suction filter (15 µm) 0.25 bar
- 3 Breather filter
- 4 Hydraulic pump 22 cu cm/rev
- 5 Electric motor
- 6 Control valve
- 7 5/3 way valve for double auxiliary hydraulics
- 8 6/3 way valve for single auxiliary hydraulics
- 9 6/3 way valve for tilting
- 10 6/3 way valve for lifting
- 11 Restrictor
- 12 Make-up valve
- 13 Maximum pressure valve
- 14 Pressure holding valve
- 15 Tilt jack
- 16 Brake lower valve
- 17 Pipe safety valve
- 18-1 Lift jack, standard mast
- 18-2 Lift jack, duplex mast
- 18-3 Lift jack, triplex mast

### B Steering hydraulics

- 19 Steering control valve
- 20 7/3 way valve
- 21 Non-return valve
- 22 Shock valve
- 23 Make-up valve
- 24 Restrictor
- 25 3/3 way valve
- 26 Maximum pressure valve
- 27 Power steering control
- 28 Steering jack

# Service Training

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# Service Training

## 2.9 OPTIONS

### 2.9.1 LIGHTING, WIPERS AND HEATER

#### 2.9.1.1 VOLTAGE CONVERTER

The options such as heater, lighting or wipers operate with a power supply of 12 V. The battery voltage of 80 V is reduced to this value by the voltage converter.

The voltage converter functions according to the chopper principle. This means that the battery voltage is converted into a 20 kHz rectangular voltage. This rectangular voltage is reduced by a transformer and subsequently rectified.

The input side is galvanically separated from the output side and is not connected to ground. The output is not regulated, i.e. the output voltage varies with input voltage and load. The output voltage is indicated by a light emitting diode. The output fuse makes the converter short-proof. There is a false pole protection at the input side of the converter.

**CAUTION:** The maximum power of the voltage converter is 200 W. If the required power is higher, a second voltage converter must be installed. This voltage converter must not be connected in parallel to the existing one. The two voltage converters must be separated on the secondary side at the fuse socket.

Maximum load for a voltage converter (200 Watt) corresponds to

- 3 working lights with 55 W each

or

- 2 working lights with 55 W each and front and rear windscreen wipers

or

- truck lighting and traffic options

Specifications:

|                           |                        |
|---------------------------|------------------------|
| Type:                     | G80G12/16WDC0,2        |
| Input voltage:            | 80 V $\pm$ 10%         |
| Output voltage:           | 12 V                   |
| Power:                    | 200 Watt               |
| Output fuse:              | 15 Ampere slow-blowing |
| Input fuse:               | 4 Ampere slow-blowing  |
| Ambient temperature:      | -10 °C to +55 °C       |
| Efficiency:               | 80% to 85%             |
| Max. housing temperature: | 45 °C with max. load   |

## 2.9.1.4 WIRING DIAGRAM

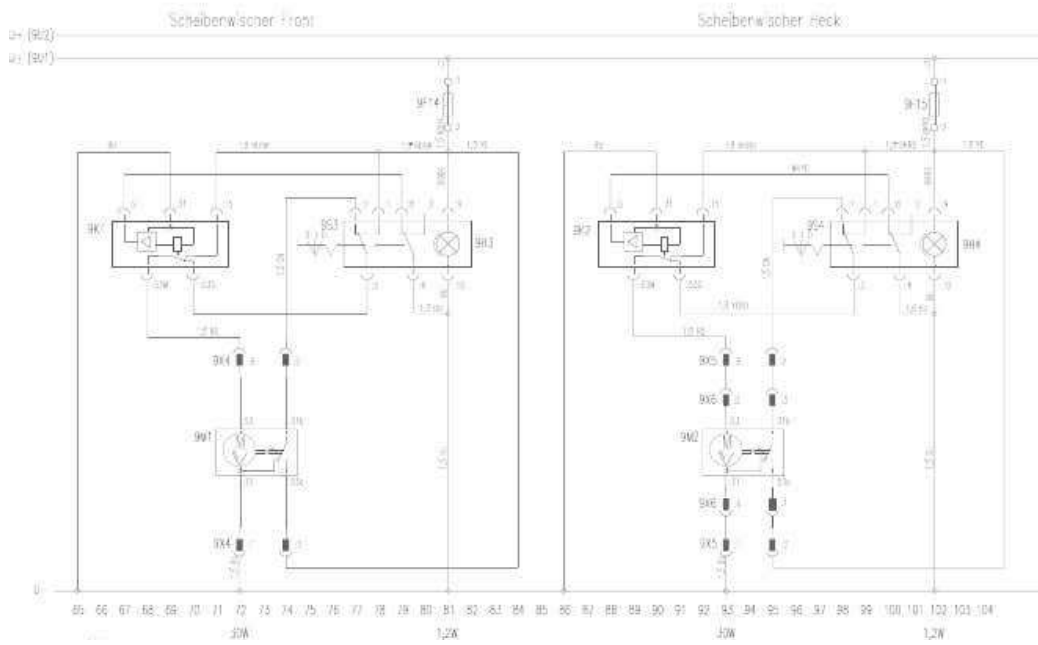
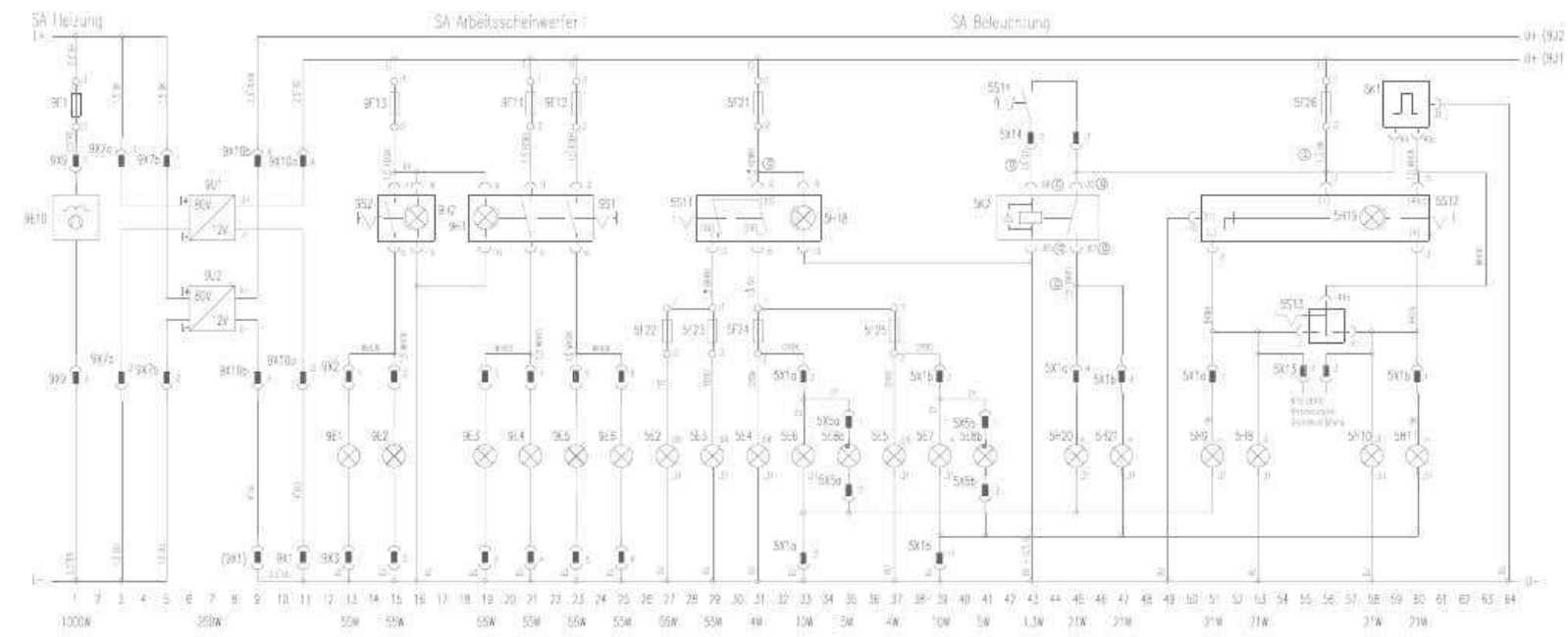
|           |                                    |             |
|-----------|------------------------------------|-------------|
| 5E2       | Dip beam, left                     | 19          |
| 5E3       | Dip beam, right                    | 20          |
| 5E4       | Parking light, left                | 21          |
| 5E5       | Parking light, right               | 24          |
| 5E6       | Side marker light, rear left       | 22          |
| 5E7       | Side marker light, rear right      | 25          |
| 5E8a      | License plate light, left          | 23          |
| 5E8b      | License plate light, right         | 26          |
| 9E1-9E6   | Working lights                     | 12-18       |
| 9E10      | Heater                             | 1           |
| 5F21      | Fuse, light switch 15 A            | 21          |
| 5F22      | Fuse, left dip beam 15 A           | 19          |
| 5F23      | Fuse, right dip beam 15 A          | 20          |
| 5F24      | Fuse, left side marker light 15 A  | 21          |
| 5F25      | Fuse, right side marker light 15 A | 24          |
| 5F26      | Fuse, flasher system 15 A          | 31          |
| 9F1       | Fuse, heater 20 A                  | 1           |
| 9F11      | Fuse, working light 20 A           | 16          |
| 9F12      | Fuse, working light 20 A           | 17          |
| 9F13      | Fuse, working light 20 A           | 13          |
| 9F14      | Fuse, front wiper 15 A             | 53          |
| 9F15      | Fuse, rear wiper 15 A              | 67          |
| 5H8       | Turn signal light, front left      | 31          |
| 5H9       | Turn signal light, rear left       | 30          |
| 5H10      | Turn signal light, front right     | 33          |
| 5H11      | Turn signal light, rear right      | 34          |
| 5H12      | Turn signal indicator light        | 32          |
| 5H18,5H19 | Switch lighting                    | 22,23       |
| 5H20      | Stop light, left                   | 27          |
| 5H21      | Stop light, right                  | 28          |
| 9H1-4     | Switch lighting                    | 14,15,53,67 |
| 9H5       | Switch lighting                    | 39          |
| 5K1       | Flasher                            | 33,34       |
| 9K1       | Front wiper intermittent relay     | 41-45       |
| 9K2       | Rear wiper intermittent relay      | 55-59       |
| 9M1       | Front wiper motor                  | 45-47       |
| 9M2       | Rear wiper motor                   | 59-61       |
| 5S11      | Light switch                       | 20-22       |
| 5S12      | Hazard warning switch              | 30-34       |
| 5S13      | Turn signal switch                 | 31,32       |
| 5S14      | Stop light switch                  | 28          |
| 9S1,2     | Working light switch               | 13-18       |
| 9S3       | Front wiper switch                 | 49-53       |
| 9S4       | Rear wiper switch                  | 63-67       |
| 9U1,9U2   | Voltage converter                  | 7-9         |
| 5X1       | Connector, 6-pin                   | 22-34       |
| 5X5a      | Connector, 3-pin                   | 23          |
| 5X5b      | Connector, 3-pin                   | 26          |
| 5X14      | Connector, 6-pin                   | 28          |
| 9X1       | Connecting strip                   | 10,11       |
| 9X2       | Connector, 6-pin                   | 12-18       |
| 9X3       | Connector, 6-pin                   | 12-18       |
| 9X4       | Connector, 6-pin                   | 46,47       |
| 9X5       | Connector, 6-pin                   | 60,61       |
| 9X6       | Connector, 4-pin                   | 60,61       |
| 9X7a      | Connector, 3-pin                   | 4           |
| 9X7b      | Connector, 3-pin                   | 6           |
| 9X9       | Connector, 2-pin                   | 1           |
| 9X10a     | Connector, 2-pin                   | 11          |
| 9X10b     | Connector, 2-pin                   | 10          |

### NOTE:

All loads are marked on voltage converter U1.  
Depending on the equipment, connect the other loads to a second converter.  
Colour code:

|    |        |
|----|--------|
| BK | black  |
| WH | white  |
| BU | blue   |
| OG | orange |
| BN | brown  |
| GN | green  |
| VT | violet |
| RD | red    |
| YE | yellow |
| GY | grey   |







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## 2.10 SPECIALS

### 2.10.1 PIN CONNECTORS

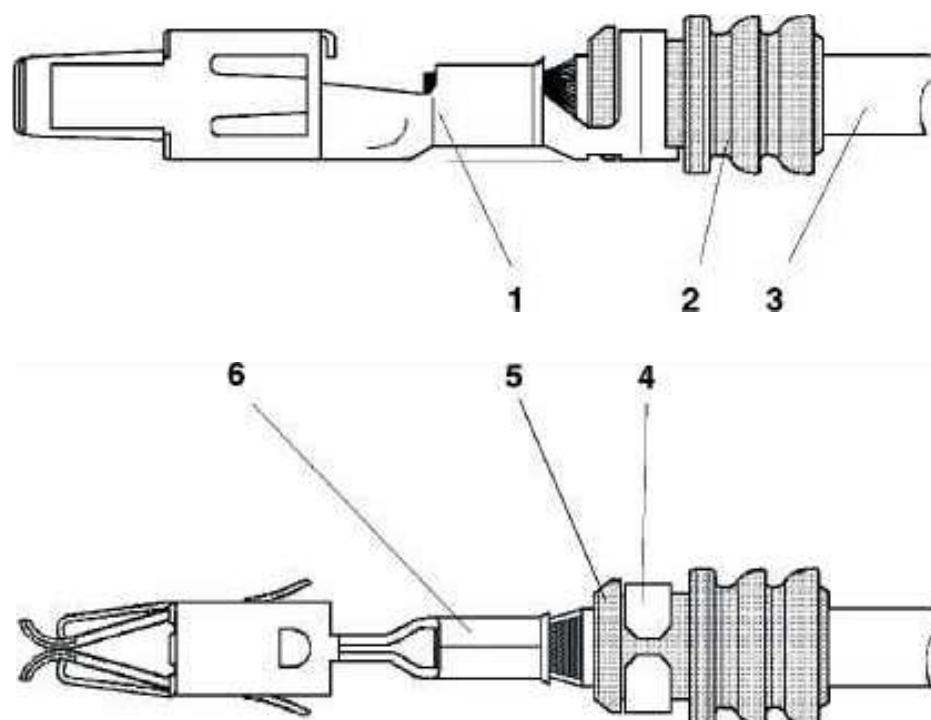
#### 2.10.1.1 AMP-SAAB PIN CONNECTORS

The majority of the pin connectors fitted on trucks of the type 336 will be of the type AMP SAAB in the future. These pin connectors are watertight, each pin having it's own seal with the connections locking together mechanically.

The following description will help to explain how to crimp the pins.

- Push the single seal (2) into the correct position over the insulated wire (Ensure that the shrouded end (5) is in the correct position on the insulated wire)
- With the aid of a pair wire strippers remove 5 mm the insulation, taking care not to damage the inner wire.
- The insulation of the wire must protude 1 mm from the seal (2).
- Place the wire (3) with the seal (2) into the connector pin (1) as illustrated below.
- With the crimping pliers WM 145 first crimp the connector pin onto the seal (2) in the area marked (4)
- Secondly the contactor pin should be crimped in the area marked (6)
- Press fully the contactor pin with attached wire into the plug housing.

**NOTE:** To remove the contactor pin there is a special extraction tool WM 143 available. For the smaller contactor pins on the 42pin connector there is also a extraction tool WM 141 available.



33610-01



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