Workshop literature

STILL
ELECTRONIC
DOCUMENTATION
SYSTEM

Electric forklift truck

RX20-15
RX20-16
RX20-18
RX20-20

CE

6210 6211 6212 6213 6214 6215 6216 6217

Ident no. 170441 - 12/2007 - EN

34 Driver's compartment

42 Steering system

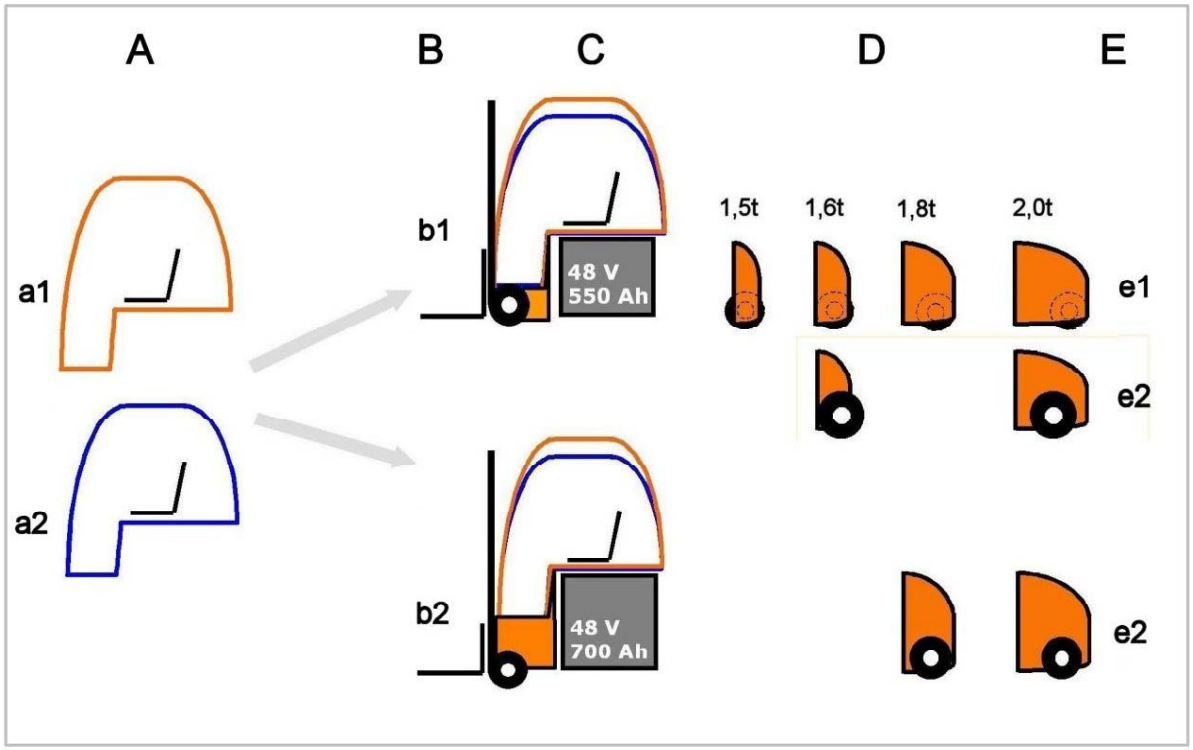
49 Brake system

50 Driver's controls

56 Display elements

Foreword

About the RX20-15 - 20



Overhead guard
A Overhead guard
a1 Standard roof
a2 Container roof (variant)

Chassis
B Chassis
b1 Lower chassis
b2 Higher chassis

Battery
C Battery sizes

Counterweight
D Load lifting classes

Steering axle
E Steering axle
e1 3-wheel, fifth-wheel
e2 4-wheel, swing axle

Special features

This forklift family is constructed in a modular system.

A few units with a high proportion of interchangeable parts make up many different trucks of different versions.

The container roof with its reduced overall height can be added as a variant to all truck types. However, the truck's actual container compatibility depends on the height of the chassis and must be checked separately. (See operating instructions, Chapter 7: "Technical data")

Type designation	Version				Type carrier
	Chassis	Battery	Counterweight	Steering axle	
RX20 - 15	Low	48 V / 550 Ah	1.5 t	3-wheel	6210
RX20 - 16	Low	48 V / 550 Ah	1.6 t	3-wheel	6211

RX20 - 16	Low	48 V / 550 Ah	1.6 t	4-wheel	6212
RX20 - 18	Low	48 V / 550 Ah	1.8 t	3-wheel	6213
RX20 - 18	High	48 V / 700 Ah	1.8 t	4-wheel	6214
RX20 - 20	Low	48 V / 550 Ah	2.0 t	3-wheel	6215
RX20 - 20	Low	48 V / 550 Ah	2.0 t	4-wheel	6216
RX20 - 20	High	48 V / 700 Ah	2.0 t	4-wheel	6217

Safety instructions

Symbols Used

The signal terms **Danger**, **Warning**, **Caution**, **Note** and **Environment note** are used in this document as hazard warnings or for unusual information that requires special identification:

⚠ DANGER

means that failure to comply involves risk to life and/or major damage to property can occur.

⚠ WARNING

means that failure to comply involves risk of serious injury and/or major damage to property can occur.

⚠ CAUTION

means that failure to comply involves risk of material damage or destruction.

NOTE

means that particular attention is drawn to combinations of technical factors which may not be evident even to a specialist.

ENVIRONMENT NOTE

The instructions listed here must be complied with as otherwise environmental damage may result.

For your safety, additional symbols are also used. Please heed the various symbols.

Safety instructions
Electrical system

Work on the inverters

⚠ DANGER

Due to the internal energy accumulator in the inverters and control units, in the event of a fault there can be dangerously high voltages at the electrical connections, even after the battery plug has been disconnected.

Do not touch energised contact points such as the positive and negative connections of the power control unit!

Before working on electrical power connections, always check the voltage between all contacts and between the contact and the truck chassis using a suitable measuring device (capable of measuring up to 1000V DC).

Discharge the intermediate circuit.

Jacking up the rear of the truck

General

⚠ DANGER

Risk of accident!

When jacking up the truck, always secure it with appropriate means (chocks, wooden blocks) to prevent rolling or tipping.

The truck has to be jacked up for various maintenance tasks.

Always comply with the following:

- Use only jacks with an adequate load capacity.
- Jack up the truck only on a level surface
- Secure the truck against rolling and dropping.

⚠ WARNING

Risk of injury!

Apply the parking brake and disconnect the battery plug before jacking up the truck.

⚠ CAUTION

Risk of damage to the battery door!

Do not place jacks or square timbers under the battery door.

Open the battery door and snap into place before jacking up the truck.

Jacking up
Swing axle version

– Park the truck on a level surface.

– Turn the key switch OFF.

– Apply the parking brake.

– Open the battery door and snap into place.

– Place the jack on a square timber at the designated position (1) at the counterweight. ▷

– Jack up the truck until the wheels are no longer in contact with the ground.

– Place square timbers on both sides at the designated position (2) under the counterweight.

– Carefully lower the truck until it rests securely on the timbers.

Jacking up
Fifth-wheel version (RX20)

– Park the truck on a level surface.

– Turn the key switch OFF.

– Apply the parking brake.

– Open the battery door and snap into place.

Right side of the truck:

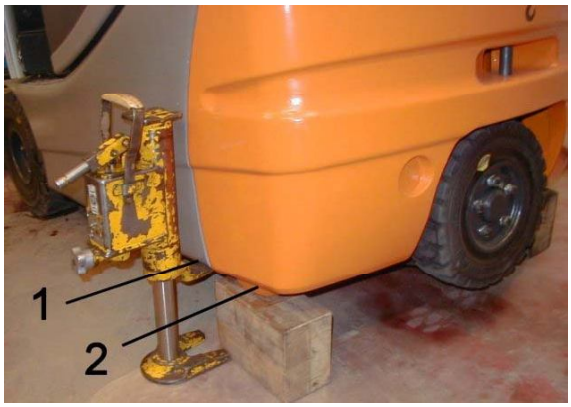
– Place the jack on a square timber at the designated position (3) at the chassis.
– Jack up the truck until the square timber fits under the chassis at the designated position (2).
– Place the square timber at the designated position (4) under the counterweight.
– Carefully lower the jack until the truck is resting on the square timber.

Left side of the truck:

▷

– Place the jack at the designated position (1) at the chassis
– Jack up the truck until the wheel is no longer in contact with the ground.
– Place the square timber at the designated position (2) under the counterweight.
– Carefully lower the truck until it rests securely on the timbers.

▷



Jacking up the front of the truck

General

⚠ DANGER

Risk of accident

When jacking up the forklift truck, always secure it with appropriate means (chocks, wooden blocks) to prevent rolling or tipping.

The forklift truck has to be jacked up for various maintenance tasks.

Always comply with the following:

- Use only jacks with an adequate load capacity
- Only jack up the forklift truck on a level surface
- Secure the forklift truck against rolling and dropping.

⚠ WARNING

Risk of injury!

Apply the parking brake and disconnect the battery plug before jacking up the forklift truck.

⚠ WARNING

Risk of injury!

Jack up the forklift truck to such a height that shoes cannot be caught by turning wheels.

Jacking up

▷

– Park the forklift truck on a level surface.
– Turn the key switch OFF.
– Apply the parking brake.
– Apply the jack at the lift mast.
– Jack up the forklift truck until the wheels are no longer in contact with the ground.
– Insert square timbers under the chassis on both sides.
– Carefully lower the forklift truck until it rests securely on the square timbers.

Securing the fork carriage

General

⚠ DANGER

Risk of accident!

When working at the front of the truck, always secure the fork carriage to prevent it dropping.

⚠ DANGER

Risk of accident!

Use only chains with adequate lifting capacity to secure the particular lift mast.

⚠ CAUTION

Potential damage to the ceiling!

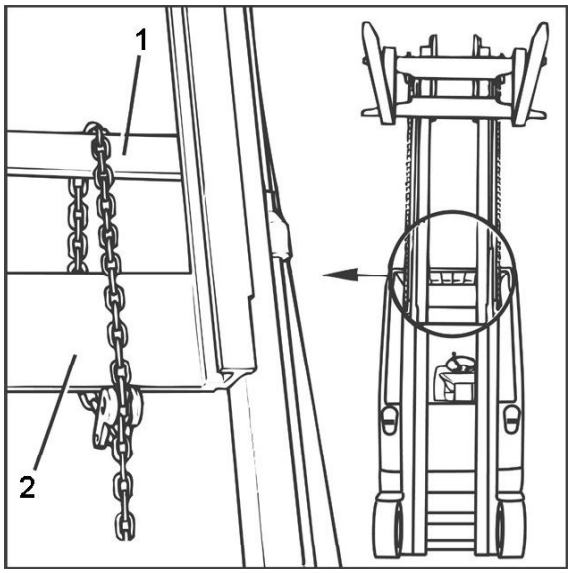
Note the maximum lift height of the particular lift mast.

Securing the tele list mast

- Extend the lift mast.
- Route the chain along the cross traverse of the outer mast (1) and connect it underneath the cross traverse of the inside mast (2).
- Lower inside mast until it strikes the chain.

NOTE

Extend the lift mast to slacken the chain.

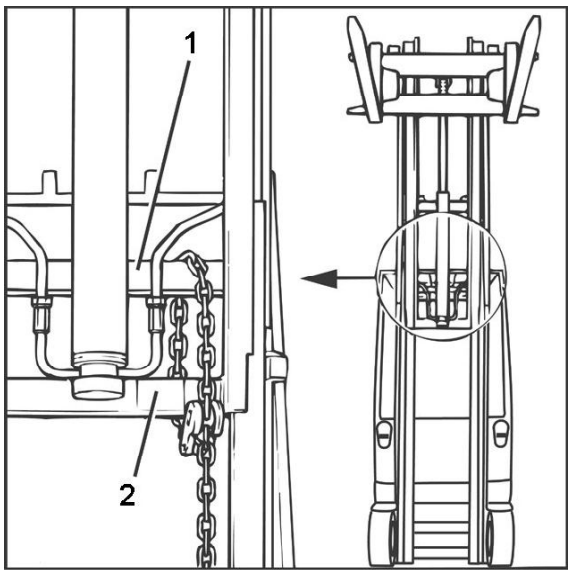


Securing the Hi-Lo lift mast

- Extend the lift mast.
- Route the chain along the cross traverse of the outer mast (1) and connect it underneath the cross traverse of the inside mast (2).
- Lower lift mast until it sttrikes the chain.
- Lower fork carriage down to the stop.

NOTE

Extend the lift mast to slacken the chain.

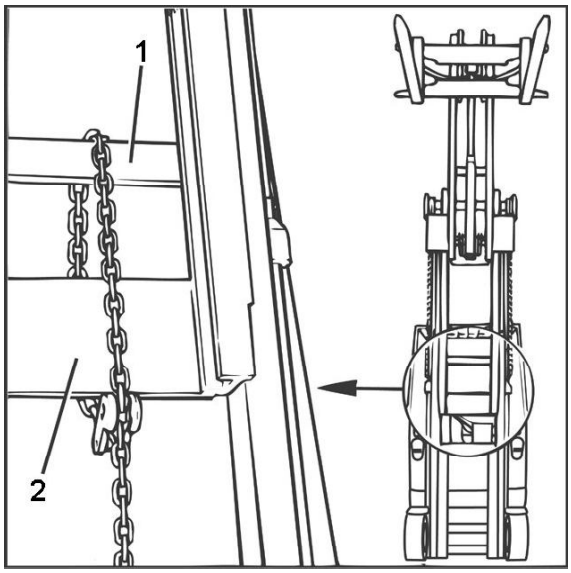


Securing the triple lift mast

- Extend the lift mast.
- Route the chain along the cross traverse of the outer mast (1) and connect it underneath the cross traverse of the middle mast (2).
- Lower lift mast until it sttrikes the chain.
- Lower fork carriage down to the stop.

NOTE

Extend the lift mast to slacken the chain.



Traction motor

General technical data

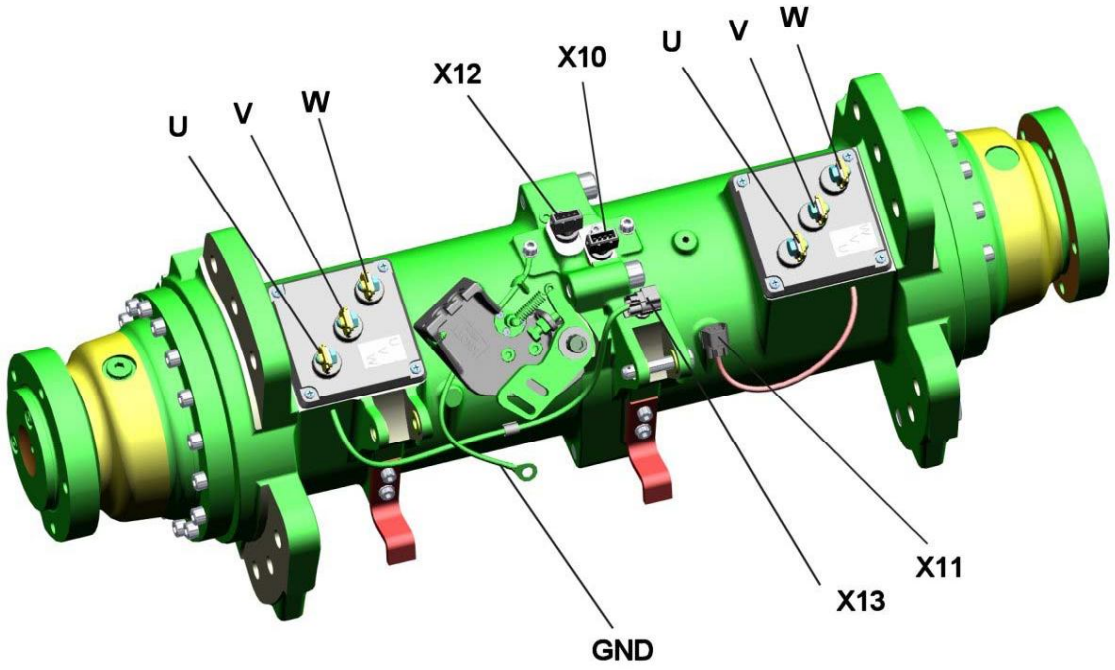
Traction motor	RX20
Manufacturer	Juli
Designation	AF-104-K1
Operating voltage	48V
Motor type	4-pin three-phase A.C. motor with cage rotor
Connection	Star
Design voltage (nominal)	3 x 28 V
Design current (nominal)	128 A
Design speed (nominal)	2000rpm
Maximum speed	4076rpm at 16 km/h
Design output (nominal)	2 x 4.5 kW
Operating mode (nominal)	S2 (60 min)
Index of Protection	IP 54
Insulation class	F
Weight	Approx. 56 kg per motor
Cooling	Surface / convection
Temperature sensor	KTY84 - 130
Speed sensor	Rheintacho Co.

Electrical connections

Circuit diagram

The windings of the traction motors are wired in star inside the motors.

Location of the electrical connections



Location and type of electrical connections:

- As insulated and watertight screw connections, the main power connections U/V/W are led out of the motor through a removable terminal board
- Speed sensor X10 and X12 — 4-pin Junior Power Timer plug
- Temperature sensor X11 and X13 — 4-pin mark II plug
- GND earthing cable to the pump motor as a screw connection

Insulation testing of traction motor

General

Insufficient insulation values in the vehicle can lead to undefined errors that may not be detected through a diagnosis.

The insulation testing applies to the RX20 and RX60 truck series. Technical differences regarding testing can be taken from the table.

Vehicle	Type carrier	Number of traction motors	Inverter plug	Temperature sensor	Battery voltage
RX20	6110 - 6217	2	X151, X152	X11, X13	48 Volt
RX60-16 – 20	6311, 6313, 6315	2	X151, X152	X11, X13	80 Volt
RX60-25 – 35	6321 - 6325	1	X151	X11	80 Volt
RX60-40 – 50	6327 - 6329	1	X151	X11	80 Volt

Test configuration

– Disconnect battery plug.

– De-energise the traction motor inverters by disconnecting all power cables "U, V, W, +, -".

⚠ CAUTION

The test voltage may destroy the inverters.

You must disconnect the tractor motor's connections (power cables) from the inverters.

– Jumper the traction motors' temperature sensors at the connections.

⚠ CAUTION

The test voltage may destroy the temperature sensors.

The temperature sensors must be jumpered at the connections.

Traction motor measurement

Test voltage: 100 V DC.

– Measurement of windings U, V, W of the traction motor in relation to the housing.

Traction motor test value

The insulation of the electrical system and the traction motor must have a minimum value of 1000 Ω/Volt.

If the values are less than this, the insulation is insufficient.

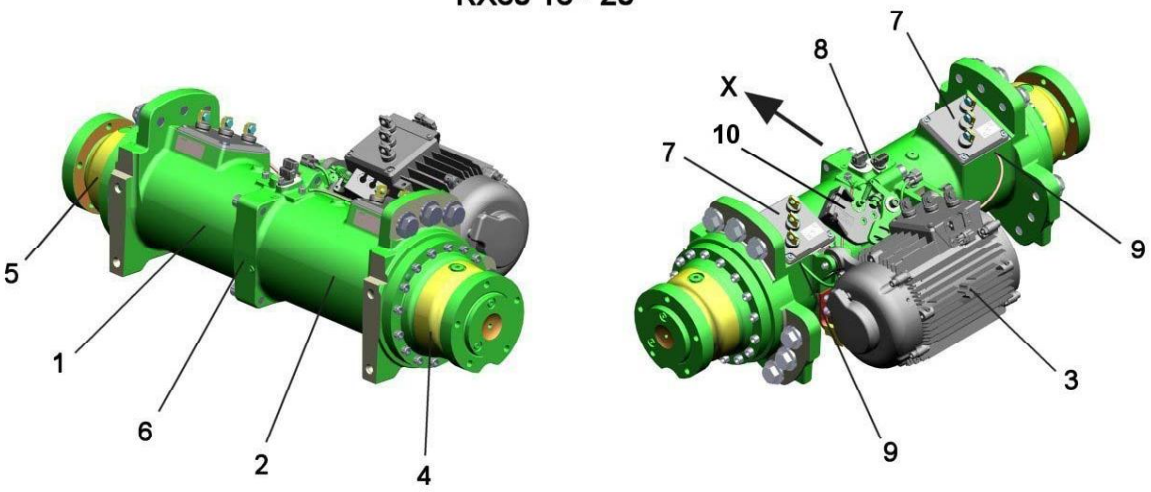
Ending the test

When testing is complete, or when any necessary repairs have been carried out, all connections must be made and the jumpers removed from the temperature sensors.

Traction drive

General

RX20 15 - 20
RX60 16 - 20 (AE18)



X	Travel direction	6	Multi-disc brake
1	Right-hand traction motor (FM1)	7	Motor connections
2	Left-hand traction motor (FM2)	8	Speed sensors
3	Pump unit	9	Temperature sensors
4	Left drive wheel	10	Brake actuator
5	Right drive wheel		

Both traction motors are fully integrated into the drive axle. The drive axle also acts as a holding fixture for the pump unit.

The traction motors are connected via the motor housing. A wet-running multi-disc brake is located between the motors.

On each side there is a drive wheel unit outside the traction motors.

The motor connections U, V, W are fed upwards out of the motors as screw connections.

The speed sensors are inserted in the axle from the outside, sealed with an O-ring and secured with a screw.

The temperature sensors are embedded in the stator winding. The plugs are led out of the motors.

Traction motor

The traction motors are three-phase AC asynchronous motors, which are equipped with short-circuit cage rotors.

Aluminium conductors are fused into the grooving of the rotor core, which are connected at the ends with short-circuit rings. The conductors with the short-circuit rings form the cage rotors and hold the rotor core together.

The stator consists of the 4-pole stator core and the stator windings, which are pressed into the motor housing as a unit.

The applied voltage is induced in the rotor bars by the stator winding and causes a current to flow in the rotor. The resultant rotor current and the rotating field acting on the stator generate the torque.

Method of operation

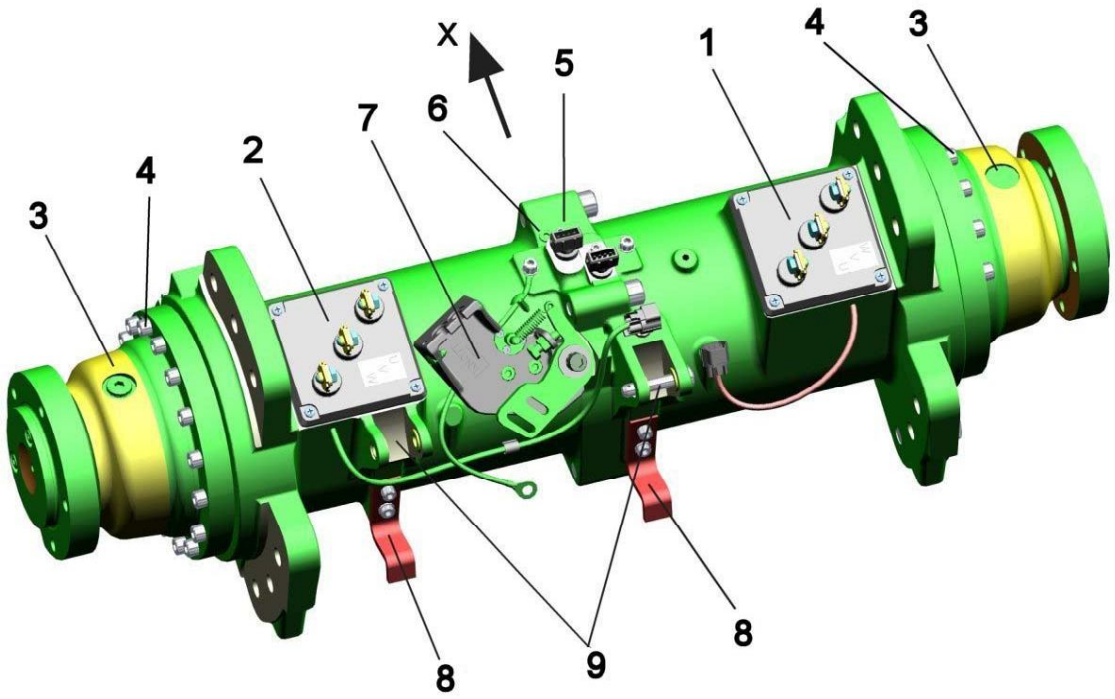
The motors are each controlled by an inverter. Change in speed takes place principally via a change in the frequency and voltage of the applied AC voltage.

In the motor, each of the three phases is distributed to four poles in the stator, thereby generating the rotating field. The motors are operated in a star circuit and supplied with pulsating voltage by the inverter.

The motors are controlled using pulse width modulation at a frequency of approx 16 kHz.

Traction motor

General



1	Right-hand traction motor (FM1)	6	Brake oil filler plugs
2	Left-hand traction motor (FM2)	7	Brake actuator
3	Wheel drive	8	Pump motor bearing pins
4	Drive wheel unit fixing screws	9	Pump motor support bearings
5	Multi-disc brake		

The two traction motors are almost identical to each other in mirror image and, together with the drive wheel units, form the drive axle.

The multi-disc brake is located centrally between the traction motors. The drive wheel units are on the left and right-hand sides.

To change a traction motor, the entire drive axle must be removed from the truck and dismantled.

Removal

NOTE

- *Removal of the individual units is described in detail in the corresponding chapters.*
- *The pump motor can remain in the truck during removal of the drive axle.*
- *Discharge the gear lubricant oil and brake oil at an early stage so that the oil has time to drain off.*

– Park the vehicle safely.

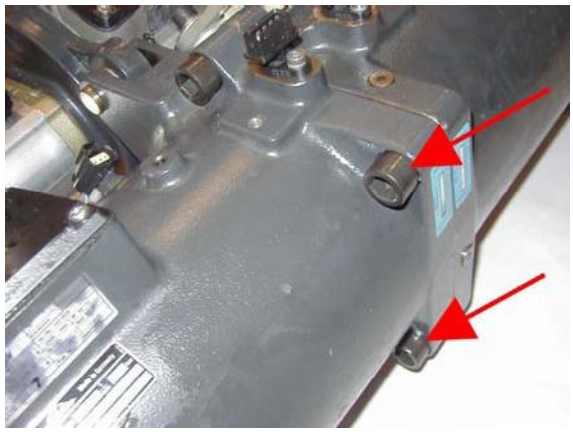
- Apply the parking brake.
- Draining the gear lubricant oil
- Disconnect battery plug.
- Remove the lift mast
- Release the wheel bolts, but do not unscrew completely
- Remove the lift mast, see chapter "Lift mast - installation / removal"
- Jack up the front of the truck, see chapter "Safety instructions"
- Remove the wheel bolts and take off the drive wheels
- Release parking brake
- Remove the drive axle; see the chapter entitled "Removing/installing the drive axle"
- Retain and reuse the support bearings' spring elements
- Before disassembling the left-hand traction motor, the brake control must be removed: to do so, release the two socket head screws

⚠ WARNING

Once the connecting screws have been removed, the drive axle splits into two parts.

Prevent the halves of the axles from rolling away

- To separate the traction motors, release the four M16 connecting screws ▷



NOTE

Screw the lower mast bearing screw on the right-hand side back in again to act as a torque damper when releasing the connecting screws.

- Remove the individual parts of the multi-disc brake and put them aside

– Unscrew the drive wheel unit from the traction motor housing ▷

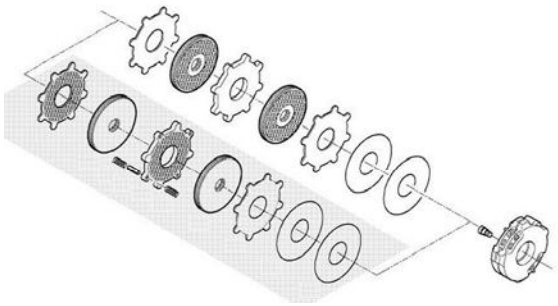
Installation

NOTE

- *Installation of the individual assemblies is described in detail in the corresponding chapters.*
- *Check tightening torques and screw quality.*
- *Check gear lubricant oil and brake oil quality*
- *For values, see "General technical data" in the chapter entitled "Drive axle"*

– Screw the drive wheel unit onto the traction motor housing

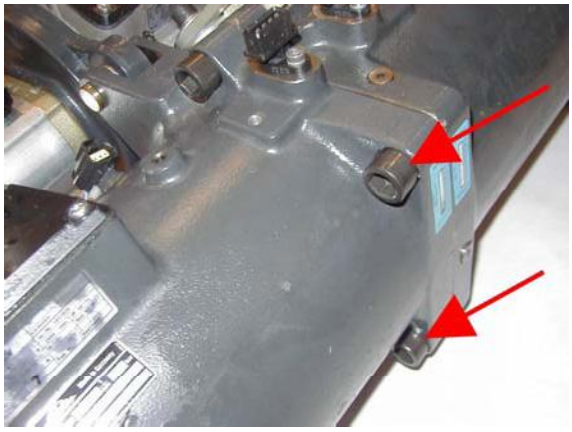
– Insert the brake disc packages into the drive axle in the order of installation ▷



– Insert the O-ring between both halves of the axle

– Join the halves of the axle in such a way that the guide pins slot into the guide holes

– Tighten the four connecting screws ▷



– To assemble the left-hand traction motor, screw on the brake control using two socket head screws

– Place the spring elements on the support bearings

– Install the drive axle; see the chapter entitled "Removing/installing the drive axle"

– Fill both drive wheels with gear lubricant oil

– Fill the multi-disc brake with brake oil

– Attach the drive wheels

– Attach the lift mast, see chapter "Lift mast - installation / removal"

– Lower the truck.

– Connect the battery plug

– Check the traction drive for correct operation