



## Workshop literature

### Diesel/LPG forklift trucks

RX70-22  
RX70-25  
RX70-30  
RX70-35



7321 7322 7323 7324 7325 7326  
7327 7328 7329 7330

171866 EN - 12/2015

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## Foreword

### Product overview RX70 22-35



Type designation	Design	Variant since 09/2011	Type carrier	Type carrier Previous model
RX70 - 22	Diesel (SDI)		<b>7321</b>	7065
RX70 - 22	Diesel (TDI)		<b>7329</b>	7065
RX70 - 25	Diesel (SDI)		<b>7322</b>	7066
RX70 - 25	Diesel (TDI)		<b>7330</b>	7066
RX70 - 30	Diesel (TDI)	Diesel (SDI) + Hybrid I	<b>7323</b>	7067
RX70 - 35	Diesel (TDI)	Diesel (SDI) + Hybrid I	<b>7324</b>	
RX70 - 22 T	LPG		<b>7325</b>	7068
RX70 - 25 T	LPG		<b>7326</b>	7069
RX70 - 30 T	LPG		<b>7327</b>	7070
RX70 - 35 T	LPG		<b>7328</b>	

### Special features of this series

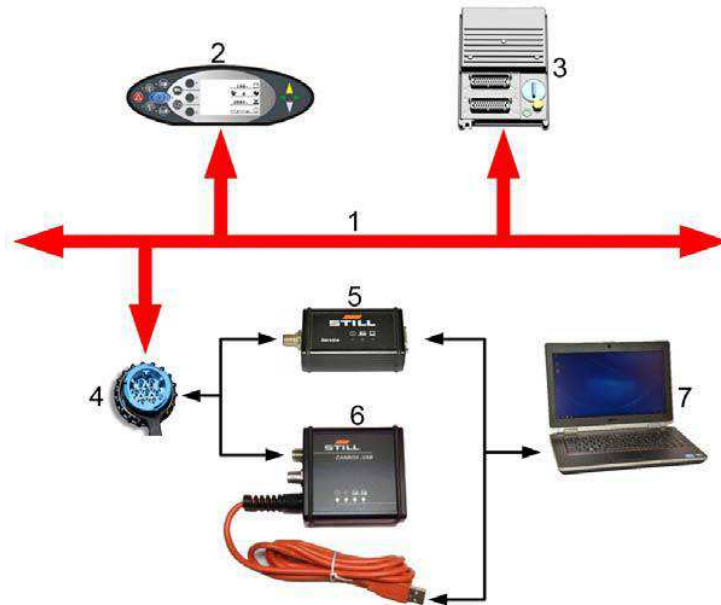
The series described belongs to the RX family. A small number units with a high proportion of common parts make up many different trucks of various versions.

- Ergonomic driver's workplace
  - Generation 2 mini-lever
  - Generation 2 display operating unit
- Diesel-electric drive with three-phase AC technology
  - Closed-loop AC drive technology

## Maintenance - 1000 hours/annually

At operating hours										Carried out			
1000		2000		4000		5000		7000		8000		✓	*
10000		11000		13000		14000							
<b>Chassis, bodywork and fittings</b>													
Check chassis for cracks													
Check overhead guard/cab and panes of glass for damage													
Check controls, switches and joints for damage, and apply grease and oil													
Check driver's seat for correct function and for damage													
Check driver restraint system for correct function and for damage, and clean.													
Check the dual pedal variant for damage and correct function, and lubricate													
<b>Tyres and wheels</b>													
Check tyres for wear and check the air pressure													
Check wheels for damage and check the tightening torques													
<b>Power unit</b>													
Drive axle: Check mounting, check for leaks, and clean cooling fins													
Check gearbox oil level													
<b>Combustion engine</b>													
Check condition of the combustion engine (visual inspection)													
Change engine oil and oil filter													
Check toothed belt, spur gears and V-belt													
Turbo variant: Replace vacuum unit air filters													
LPG: Replace the spark plugs													
Check the air filter and the microfilter, and replace if necessary													
Check cooling system for leaks and correct function													
Check coolant, top up if necessary													
Check exhaust system													
Variant: Maintain particle filter													
<b>Fuel system</b>													
Check fuel system for leaks and correct function													
Change fuel filter													
<b>LPG system</b>													
Check the LPG system for damage													
Check the solenoid shut-off valve, and if necessary check the high-pressure relief valve (1.7 bar)													
Check gas cylinder valve for cleanliness and correct function, check over-pressure safety device (30 bar)													
Change the LPG filter													
Change the evaporator (C Series) or overhaul the evaporator (MD/Cobra) Replace the sticker													
Check the screw joints for secure attachment and perform a leak test													
Check CO content in the exhaust gas													
Check that the duration of engine run-on before the engine stops is acceptable													
<b>Steering</b>													
Check steering system for correct function and for leaks													
Check that the steering wheel is firmly attached and check the turning handle for damage													
Steering axle: Check that it is firmly attached, check for leaks, and apply grease													

**Diagnostic set-up**



- |   |                                  |   |                 |
|---|----------------------------------|---|-----------------|
| 1 | Truck CAN bus (red)              | 5 | CAN box, serial |
| 2 | Display and operating unit (ABE) | 6 | CAN box, USB    |
| 3 | Truck control unit (MCU, TCU)    | 7 | Notebook        |
| 4 | Diagnostic connector             |   |                 |

The notebook is connected to the diagnostic connector on the truck via a CAN box.

The "red" truck CAN bus connects the diagnostic connector to the display and operating unit and the truck control unit.

Depending on the type of CAN box used, the connection to the notebook can be made using a Sub-D plug or USB cable. In either case, the diagnostics options are always identical.

**Connection, notebook with CAN box, USB**

The notebook (7) is connected directly to the CAN box via the connecting line.

The CAN box (3) is connected to the diagnostic connector on the truck (1) via the adaptor cable (2).



- |   |   |
|---|---|
| 1 | Diagnostic connector, 7-pin                   |
| 2 | Adaptor cable for diagnostic connector, 7-pin |
| 3 | CAN box, USB                                  |
| 5 | Notebook                                      |

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

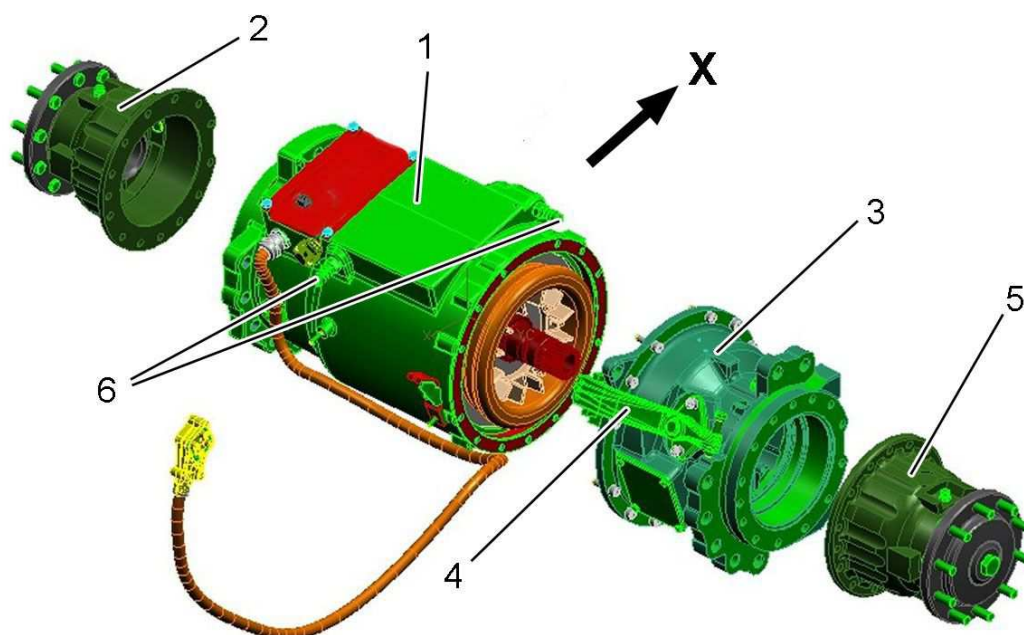
### Function

The motor is controlled by a converter. The speed is changed by changing the frequency and voltage of the applied AC voltage.

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

## Traction motor

### General



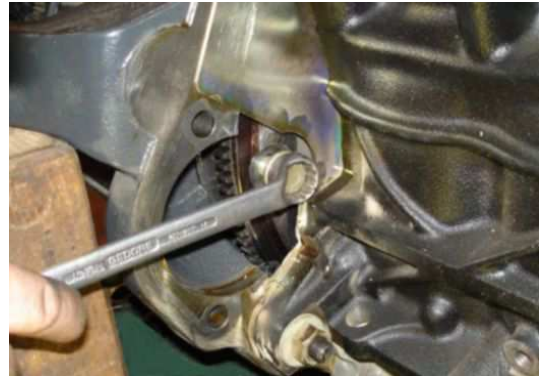
x Direction of travel forwards  
 1 Traction motor  
 2 Left drive wheel unit  
 3 Differential gear train

4 Brake actuator  
 5 Right drive wheel unit  
 6 Coolant connection

The traction motor is integrated into axle housing (1).

To change a traction motor, the entire drive axle must be removed from the truck. The following components must be removed from the traction motor: "drive wheel unit", "differential gear train" and "brake actuator".

- Loosen and remove the bolt that is now visible in the starter opening. ▷
- Rotate the crankshaft (engine) an additional 120° in the same direction.
- Loosen and remove the visible bolt.
- Rotate the engine an additional 120° in the same direction using the crankshaft until cylinder 1 is in TDC position.
- Loosen and remove the visible bolt.



#### ⚠ CAUTION

Without transport protection, the alternator will be damaged.

Always slide strips of cardboard between the rotor and stator for protection during transport.

- Remove the rubber plugs and slide the strips of cardboard between the rotor and stator. ▷
- Secure the alternator with a lifting sling and a second forklift truck.
- Loosen and remove the four connecting screws between the generator and the bearing flange.
- Pull the generator off the starter ring gear, remove the two guard plates and place them to one side.
- Put the alternator down with the aid of the second forklift truck.



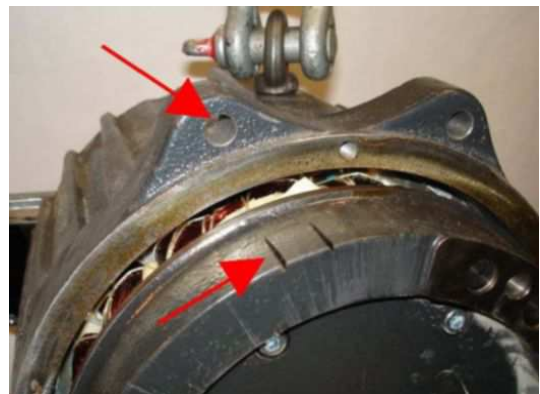
### Installation

#### NOTE

- *Check tightening torques and screw quality.*

After the generator has been removed, cylinder 1 in the internal combustion engine is in TDC position.

The spare-part generators are always delivered with cylinder 1 in TDC position. This means that the TDC mark on the generator is close to the screw bore on the left. ▷



## Starter ring gear

### General

The starter ring gear (3) is located in the bearing flange (2). The starter ring gear is freely accessible once the generator has been disconnected from the bearing flange.

The starter ring gear sits on the crankshaft (5) of the internal combustion engine and is bolted to it. The drilling template for the six mounting screws (6) prevents incorrect orientation of the starter ring gear.

A two-piece guard plate (6) is fitted behind the starter ring gear to prevent contamination in the starter motor area.

### Preparation



#### NOTE

- *It is recommended that the entire engine be removed from the truck.*
- *For information on removing the engine, see the "Engine" chapter.*
- *For information on removing the alternator, see the "Alternator removal-installation" chapter.*
- After removing the engine, place it securely on its mounts on three square timbers.
- The alternator is separated from the engine.



#### NOTE

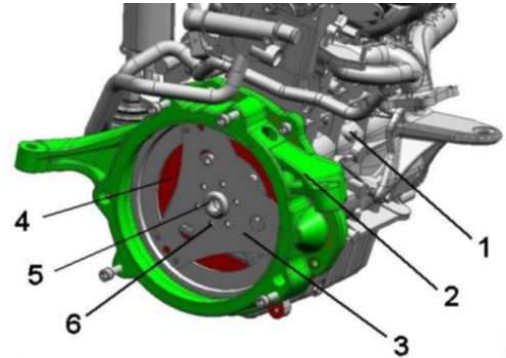
*The 6 mounting screws are anti-fatigue screws and must not be re-used. They must always be changed.*

### Removal

- Slacken the four screws and remove the bearing flange from the internal combustion engine.
- Fix the guard plates using two screws.
- Loosen the six mounting screws on the starter ring gear and destroy them; do not reuse.
- Pull the starter ring gear off the crankshaft.

### Installation

- Place the starter ring gear on the crankshaft, paying attention to the correct location of the guard plates.



- |   |                            |
|---|----------------------------|
| 1 | Internal combustion engine |
| 2 | Bearing flange             |
| 3 | Starter ring gear          |
| 4 | Guard plates               |
| 5 | Crankshaft                 |
| 6 | Mounting screws            |

- Coolant pump
- Coolant thermostat
- 0B1 coolant temperature transmitter
- Ancillary unit bracket and tensioner
- Three-phase generator 9G2
- 4 glow plugs 9E13 - 9E16
- Identification plate in line with 97/68/EC
- Connecting plate

**Not included in the scope of delivery:**

- Flywheel
- Fuel filter
- Starter motor
- V-ribbed belt (crankshaft / three-phase generator)

**Components fitted outside of the engine:**

- 1A07 immobiliser
- Engine control unit ECU A43
- Starter motor
- Fuel level transmitter 6B3
- Coolant level transmitter 6B12
- Suction pipe temperature transmitter 0B04
- Accumulator

**Special features of VW 1.9l TDI**

**Deviations to the SDI:**

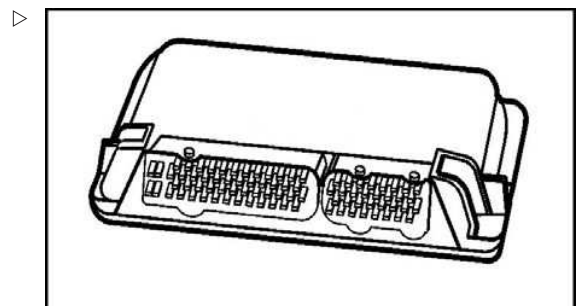
- Volkswagen industrial engine with engine code letters BEU.
- A 1.9 litre, water-cooled, four-cylinder inline diesel engine with direct injection forms the basis.
- Exhaust turbocharger without intercooling.
- Vacuum pump driven via camshaft.

**Engine control unit VW 1.9l SDI/TDI**

**General**

The engine control unit ECU is in two parts and consists of the A43 engine control unit and the 1A07 immobiliser. The engine control unit is derived from car technology, whereas the immobiliser is **not** an immobiliser in the car technology sense of interacting with a transponder in the key.

The engine control unit is mounted on the overhead guard at the rear right-hand side behind the seat.



## Air intake / filter

### Air intake

#### General

Fresh air is drawn in at the rear right in the vicinity of the fuel tank opening (diesel). On LPG trucks, fresh air is drawn in at the same location. The intake opening is protected against the ingress of large particles by a coarse-mesh screen.

The fresh air passes through the filter, where it is cleaned.

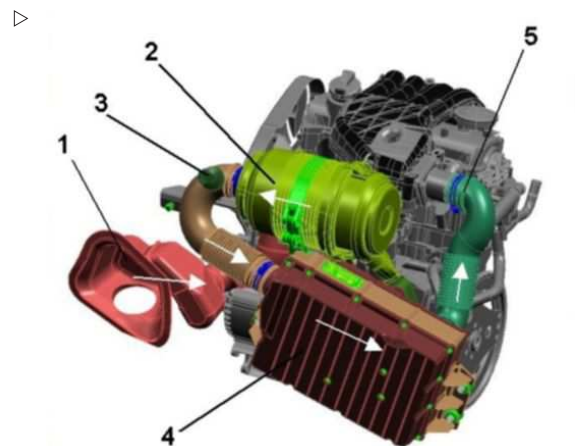
The air filter maintenance switch 6S2 monitors the condition of the filter. If the filter is dirty, a message appears in the display.

Clean air from the filter is directed across the aluminium heat sink, thereby cooling the converter. Downstream from the converter, the filtered air is introduced into the internal combustion engine. Differences in the air duct result because of different engine models and the attached accessories.

#### Air duct VW 1.9I SDI

Air duct in sequence:

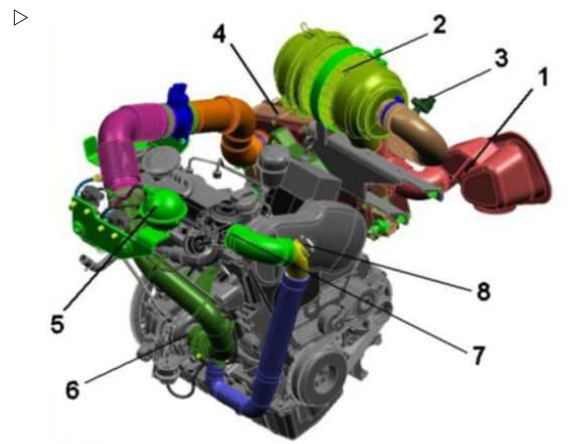
- Air intake(1)
- Air filter(2)
- Air filter maintenance switch 6S2 (3)
- Converter(4)
- Intake manifold(5)



#### Air duct VW 1.9I TDI

Air duct in sequence:

- Air intake(1)
- Air filter(2)
- Air filter maintenance switch 6S2 (3)
- Converter(4)
- Vacuum storage unit for the turbocharger(5)
- Turbocharger (6)
- Intake manifold(7)
- Temperature and pressure sensor(8)



### Installation

- Lift the complete radiator in diagonally over the engine and place in position.
- Secure the radiator to the sheet metal holder using four screws.
- Attach all coolant hoses to the radiator.

#### ⚠ CAUTION

Improper installation can result in damage to the fan wheel rotor

The fan wheel rotor must not rub against the air duct

- Fill up with coolant; see the chapter entitled "Changing the coolant".
- Connect the battery; see the chapter entitled "Battery".
- Re-attach all covers to the counterweight
- Install the lower bottom plates into the chassis; see the chapter entitled "Bottom plates".
- Close the bonnet, install as necessary; see the chapter entitled "Bonnet".
- Functional test.

### Fan wheel rotor - fan motor

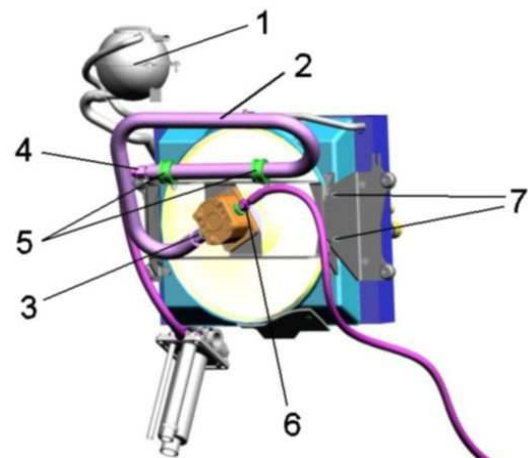
#### Fan unit removal

- Park the truck safely.
- Remove all covers from the counterweight.
- Disconnect and remove the battery, see the chapter entitled "Battery".
- Unscrew the preheating relay from the battery support plate.
- Unscrew expansion reservoir (1) and put it to one side.
- Unscrew the coolant hose and clip from the battery sheet metal holder.
- Unscrew the battery support plate.
- **Heavy dust guard:** Remove the intake pipe.
- **Top exhaust outlet:** Remove the rear silencer.



#### ENVIRONMENT NOTE

*Hydraulic oil can run out during the following steps. Place a collection tray and rags into the counterweight. Protect all hydraulic hoses against contamination.*



- |   |  |
|---|--|
| 1 | Expansion reservoir                        |
| 2 | Oil cooler                                 |
| 3 | Oil cooler, fan motor connection           |
| 4 | Oil cooler, return hose connection         |
| 5 | Oil cooler, mounting on sheet metal holder |
| 6 | Fan motor, hydraulic line connection       |
| 7 | Air duct, mounting on sheet metal holder   |

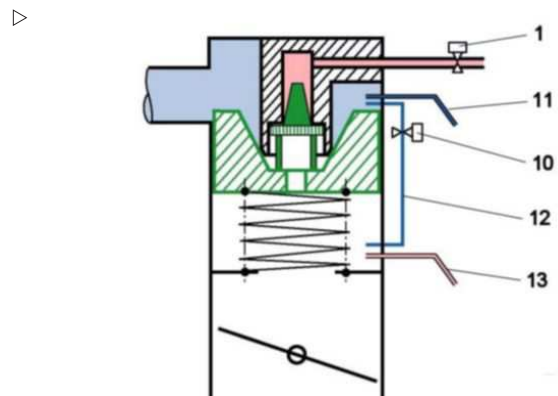
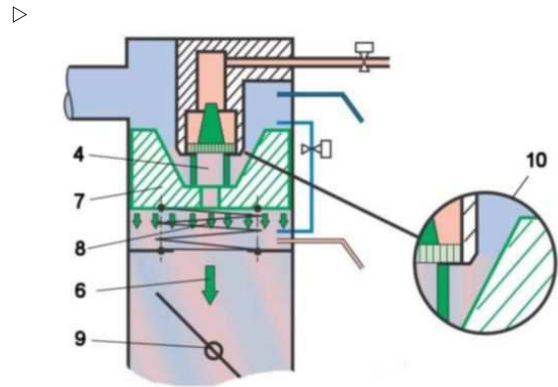
When the engine is running, the vacuum in the intake pipe (6) acts directly on the piston (7). The vacuum draws the piston downwards against the spring force, causing the venturi tube (4) to open.

The vacuum in the intake pipe in front of the butterfly valve (9) is responsible for the piston stroke and is dependent on the spring force and the air resistance of the air filter and the mixer's upper part.

The spring force and the cone shape and cross-sections in the mixer are matched to the relevant engine in question. Due to the shape of the piston and cone combination (10), only a specific cross-section of the gas outlet pipe is released in each position, thus determining the fuel/air ratio.

Basic calibration is carried out via two screws. The gas and air mixture for full throttle is set via the full-load mixture adjustment screw (1). The idle mixture is set in the bypass (12) via the idle mixture adjustment screw (10).

The expansion line (11) connects the mixer with the evaporator. In regulated LPG systems, the actuator is connected to the expansion line (11) and the vacuum line (13).



## Suction module

### General

**i** NOTE

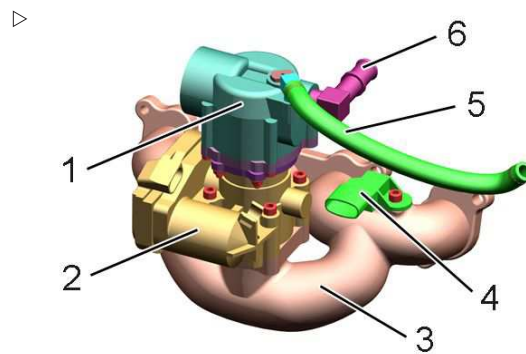
*The appearance of the intake pipe, as well as the position of the MAP/MAT sensor, may differ from the image, depending on the engine.*

In the gas mixer (1), the intake combustion air is combined with gas from the evaporator at a constant ratio and then sent to the engine via the electronic butterfly valve (2) and the intake pipe (3).

**i** NOTE

*The gas mixer is adapted for the equipment installed in the truck. The different hose lengths are the deciding factor. For this reason, the gas mixers are different and are not interchangeable between the "unregulated" and "regulated" variants or between other trucks.*

The MAP/MAT sensor (4) monitors the vacuum in the intake pipe. The engine control unit uses this



- 1 Gas mixer
- 2 Electronic butterfly valve
- 3 Intake pipe
- 4 MAP/MAT sensor
- 5 Balancing line
- 6 Gas pipe from evaporator

**Idle speed test**

- Start the engine and drive the vehicle until the coolant hoses between the engine and radiator can be felt to warm up.
- Stop the truck, apply the parking brake.
- Let the engine run at idle speed.
- Insert a CO tester into exhaust tailpipe, following the manufacturer's specifications regarding usage.
- Only carry out testing once the engine speed has reached a steady state.
- Only if needed: Open the bonnet and adjust via the idle mixture adjustment screw.
- Unscrew the idle mixture adjustment screw (1) as far as required.

**"Tilting against the stop" test**

- Start the engine and drive the vehicle until the coolant hoses between the engine and radiator can be felt to warm up.
- Stop the truck, apply the parking brake.
- Allow the engine to run under load (tilting against the stop).
- Insert a CO tester into exhaust tailpipe, following the manufacturer's specifications regarding usage.
- Only carry out testing once the engine speed has reached a steady state.

**NOTE**

*The engine must run evenly, with the engine speed rising continually to  $2400 \pm 50$  rpm. Speed fluctuations must not exceed 30 rpm.*

**▲ CAUTION**

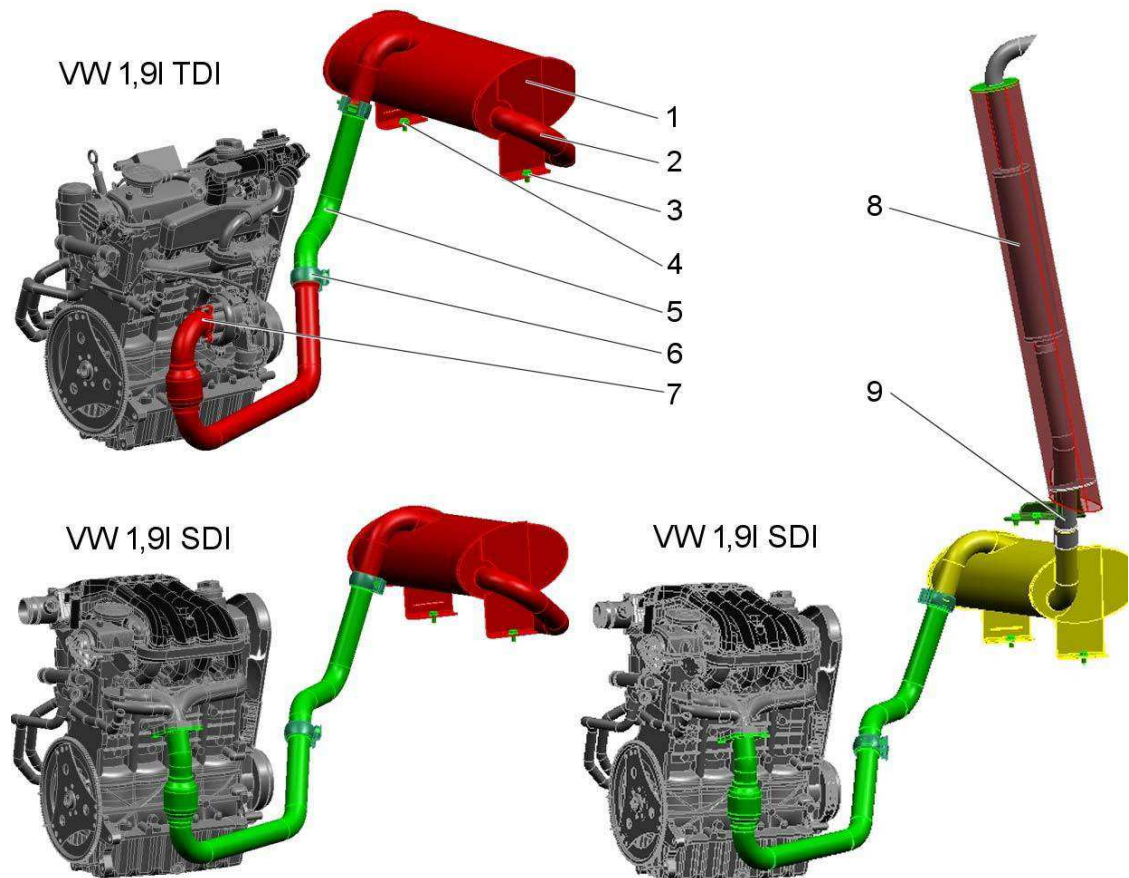
The engine can reach overload.

Do not let the engine run under full load for longer than 60 seconds.

- Only if necessary: Open the bonnet and adjust via the full-load mixture adjustment screw.
- Turn the full-load mixture adjusting screw (2) towards L (lean) as far as required.

## Exhaust system - diesel

### Exhaust system



- |   |                                 |   |  |
|---|---------------------------------|---|--|
| 1 | Silencer                        | 6 | Clip   |
| 2 | Bottom exhaust pipe (standard)  | 7 | Exhaust manifold                                   |
| 3 | Mounting screw                  | 8 | Rear silencer for top exhaust gas outlet (variant) |
| 4 | Mounting screw                  | 9 | Top exhaust pipe (variant)                         |
| 5 | Flexible exhaust pipe on engine |   |  |

The exhaust system comprises:

- Bottom exhaust gas outlet (standard)
- Exhaust pipe on engine
- Silencer

There are also the following variants for the exhaust system:

- Top exhaust gas outlet (variant)
- Eberspächer particle filter

This allows the lambda sensor to be installed a long distance from the engine, and removes the dependence on continuous full load operation.

**The function of voltage measurement**

The measurement is based on the residual oxygen content of the exhaust gas. The residual oxygen content of the exhaust gas is strongly dependent on the air-fuel ratio of the mixture. This dependency allows the oxygen proportion in the exhaust gas to be used as an index of the air-fuel ratio.

The outer part of the ceramic body of the lambda sensor lies in the exhaust gas flow, the inner part is in contact with the ambient air.

From about 300°C the ceramic material is conductive to negative oxygen ions.

If the oxygen proportion is different on the two faces of the lambda sensor, ion diffusion occurs, whereby only the positive oxygen atomic nuclei pass through the ceramic. The negative electrons are prevented from passing through.

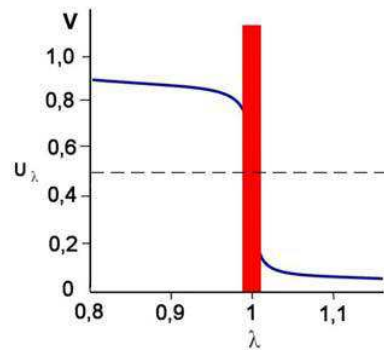
This effect causes an electric voltage to be generated and measured at the electrodes.

**Lambda 1**

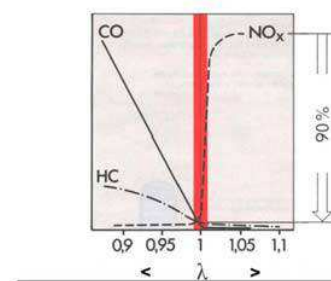
This voltage is the measure of the air-fuel ratio and is communicated directly to the engine control unit.

Voltage ranges corresponding to the oxygen proportion in the exhaust gas:

- rich mixture ( $\lambda < 1$ )  
800 - 1000 mV
- lean mixture ( $\lambda > 1$ )  
0 - 150 mV
- Control threshold approx. lambda 1  
500 mV



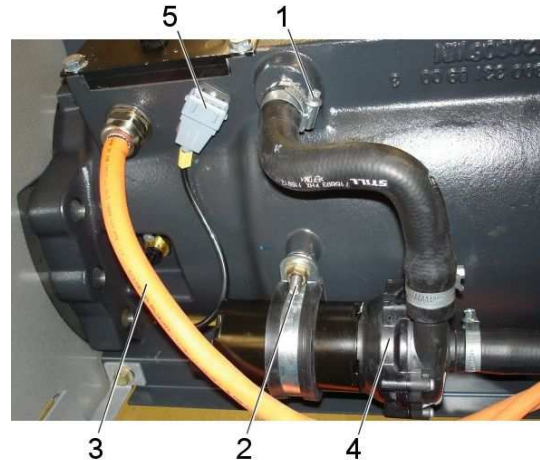
In a very narrow cross-over range around lambda = 1, a range referred to as the lambda window, the characteristic curve is extremely steep. Within this range the voltage changes almost abruptly as a function of the air-fuel ratio. The harmful substances reduce by up to 90% within this narrow range of the lambda window.



**The function of temperature**

As well as the oxygen proportion in the exhaust gas, the temperature of the ceramic body also plays a critical role.

- Disconnect the coolant connection (1) from the axle. ▷
- Unscrew the coolant pump (4) with support (2) from the axle.
- Detach sensor plugs X10 (5) and X11 from the traction motor.
- Unscrew the power cable X175 (3) from the converter; see the chapter entitled "Converter removal". Pull the cable out of the cable guide.



- Remove the ES bolt from the parking brake and disconnect the cable. ▷
- Remove the front lower bottom plate; see the chapter entitled "Bottom plate".



- Disconnect the brake pipe at the axle and move the end to the level of the brake fluid reservoir so that the brake oil does not run out. ▷



**ENVIRONMENT NOTE**

*Dispose of any escaping brake oil in an environmentally friendly manner.*

- Position a lift truck with timbers beneath the drive axle. ▷
- Lift the lift truck until the timbers are in contact with the drive axle.



## Hood — covering — insulation

### Motor hood

#### Removal



#### NOTE

*If the truck has a cab, first remove all cab sections from the right hand side.*

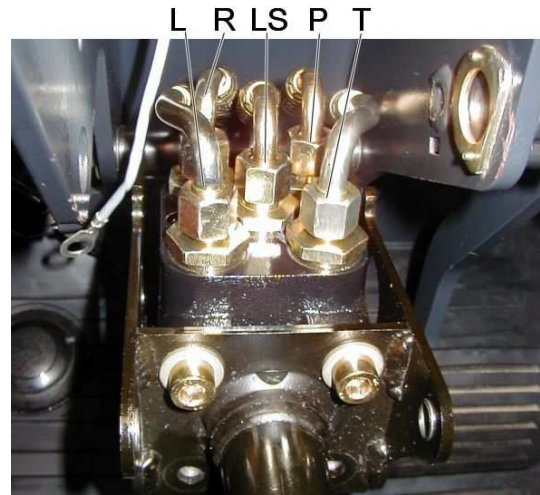
- Unscrew the battery cover from the rear of the overhead guard.
- Unscrew the inner panelling at the rear of the seat from the overhead guard.
- Pull the wiring harness for the seat, joystick, heating system and card reader with the rubber grommet down and out through the bonnet.
- **ABE 1 only:** Remove the generation 1 display operating unit and feed the wiring harness out through the bonnet. Disconnect the seat contact and display operating unit plug.
- Push the driver's seat all the way forwards.
- Open the motor hood.
- Remove the ES bolts for the gas strut on the bonnet and place the gas strut down. As necessary, release the lower ES bolt too and remove the gas strut completely.
- Close the motor hood.
- From the rear, unscrew the bonnet hinges from the overhead guard on both sides (SW13).
- Lift the motor hood out of the vehicle with the assistance of another person.

#### Installation

- Lift the motor hood onto the vehicle with the assistance of another person.
- From the rear, insert the hinge screws (2 x M8 x 20 each) into the bonnet hinges on both sides.
- Tighten all hinge screws once the hinges are in the correct position.
- Open the motor hood.
- Install the gas strut with ES bolts.
- Feed the wiring harness for the seat, joystick, heating system and card reader with the rubber grommet down through the bonnet.
- Close the motor hood.
- **ABE 1 only:** Install the generation 1 display operating unit and feed the wiring harness in

**Installation**

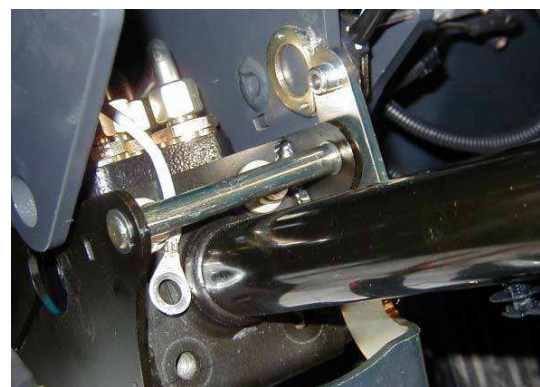
- Insert the steering column along with the bearing axle into the front structure from the right-hand side.
- Screw on the bearing axle with nut (SW19).



- Attach fork clevis (1) of the service brake cable to the front structure and secure with ES bolts.
- Attach recuperating spring (2) to the brake pedal.
- Tightly screw the steering unit onto the steering column using the two front mounting screws.
- Connect all hydraulic connections.



- Insert the steering column adjustment into the mount.
- Swivel the steering column upwards and hook on the steering column adjustment.



## Axle stub

### Dismantling the axle stub



#### NOTE

*A press is required to remove the axle stub. For this reason, the steering axle should be completely removed beforehand; see the chapter entitled "Removing and installing the steering axle".*

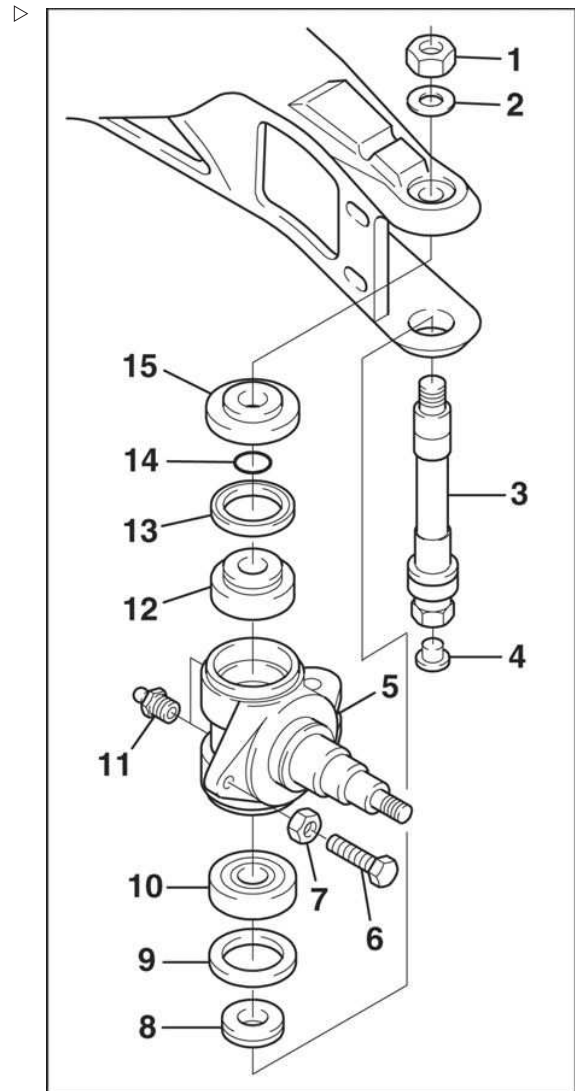
- Drive out the pin between the tie rod and the axle stub
- Slacken the hexagon nut (1)
- Take out the washer (2)
- Drive the steering pivot pin (3) out downwards
- Take the axle stub (5) off the axle
- Take the spacer washers, O-ring, wiper rings and tapered roller bearings (8 - 15) off the axle stub

### Reassembling the axle stub



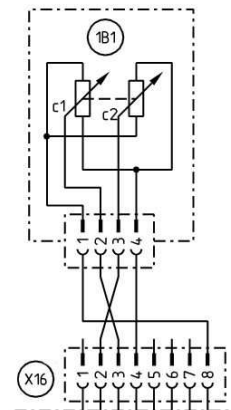
#### NOTE

- *Check the quality of screws and lubricant, as well as the correct tightening torques.*
- *Values vary according to type of axle; see "General technical data" in the chapter entitled "Steering axle".*
- Grease both tapered roller bearings (10, 12) well and insert them
- Carefully grease the sealing lips of the wiper rings (9, 13)
- Insert the wiper rings (9, 13), both spacer washers (8, 15) and the O-ring (14)
- Insert the axle stub (5) into the axle
- Lightly oil the steering pivot pin (3) and insert it from below
- Fit the washer (2)
- Fit and tighten the new hexagon nut (1)
- Drive in the pin between the tie rod and the axle stub, and secure it with slotted spring pins



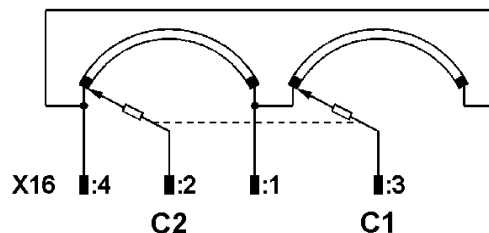
- |    |                        |
|----|------------------------|
| 1  | Hexagon nut            |
| 2  | Washer                 |
| 3  | Steering pivot pin     |
| 4  | Sealing plug           |
| 5  | Axle stub              |
| 6  | Stop screw             |
| 7  | Nut                    |
| 8  | Spacing washer         |
| 9  | Wiper ring             |
| 10 | Tapered roller bearing |
| 11 | Lubricating nipple     |
| 12 | Tapered roller bearing |
| 13 | Wiper ring             |
| 14 | O-ring                 |
| 15 | Spacing washer         |

Electrical connections



8-pin Mark II plug X16				
X16/1		Free		
X16/2	1B1/3	1B1 - C2	X47/36	Signal C2
X16/3	1B1/2	1B1 - C1	X47/35	Signal C1
X16/4	1B1/4	1B1 - C1/C2	X47/37	GND accelerator
X16/5		Free		
X16/6		Free		
X16/7		Free		
X16/8	1B1/1	1B1 - C1/C2	X47/34	12 Volt accelerator

Test



Test	Measuring points	Measured values [Volt]	Correction
Supply voltage	X16/4 - X16/1	11.4 — 12.6	
C1 accelerator not actuated	X16/4 - X16/2	5.3 — 6.6	Correction by turning the potentiometer.
C2 accelerator not actuated	X16/4 - X16/3	5.3 — 6.6	Correction by turning the potentiometer.
C2 accelerator fully actuated, forwards	X16/4 - X16/2	8.0 — 11.4	Correction by turning the support
C1 accelerator fully actuated, forwards	X16/4 - X16/3	1.1 — 3.8	Correction by turning the support
C2 accelerator fully actuated, reverse	X16/4 - X16/2	1.1 — 3.8	Correction by turning the support
C1 accelerator fully actuated, reverse	X16/4 - X16/3	8.0 — 11.4	Correction by turning the support

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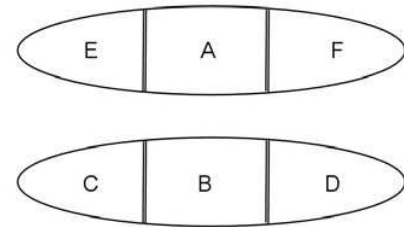
The pictograms show all functions that can be operated with the right joystick and the function key for the 5th hydraulic function. ▷

**Operation of 3rd and 4th hydraulic function:**

- (A): Move the right joystick in the direction of arrow (A).
- (B): Move the right joystick in the direction of arrow (B).
- (C): Move the right joystick in the direction of arrow (C).
- (D): Move the right joystick in the direction of arrow (D).

**Operation of 5th hydraulic function:**

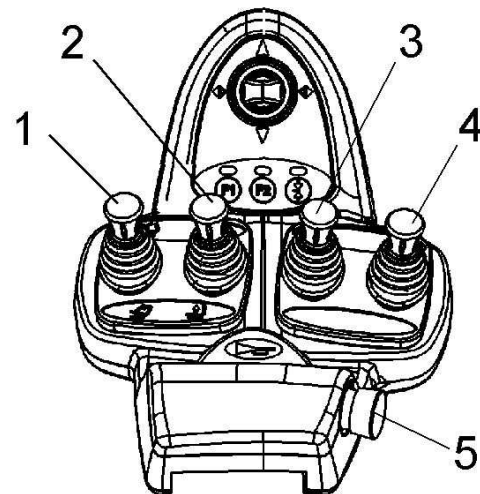
- (E): Actuate the function key and move the right joystick in the direction of arrow (A).
- (F): Actuate the function key and move the right joystick in the direction of arrow (B).



**Four-way mini-lever**

The four levers (1-4) can only be moved forwards and backwards in one axis. ▷

The emergency stop switch is a variant

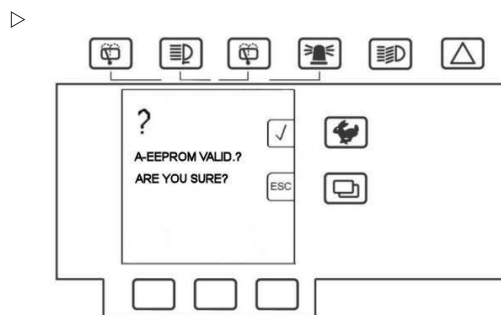


- 1 Lift - lower
- 2 Tilt
- 3 Auxiliary hydraulics 1
- 4 Auxiliary hydraulics 4
- 5 Emergency stop switch



The manual transfer begins with the question in the display A-EEPROM VALID?. This means: "Are the parameters of the TCU (device A) supposed to be used?"

- Load software flash package; see chapter entitled "Software compatibility"
- Start calibration.
- Delete the error memory.
- Function check.



## Drive direction turn indicator display

### General

The drive direction turn indicator display is positioned to the right-hand side of the driver's field of vision in the front structure.

The five lights of the drive direction turn indicator display represent the drive direction, the turn indicators and malfunctions.



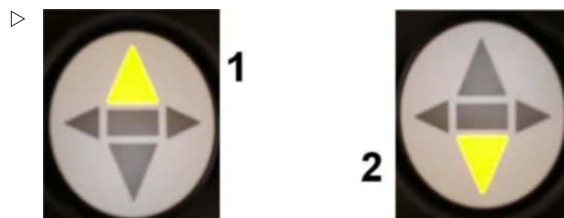
*Since October 2009, the drive direction turn indicator display is no longer being fitted to the trucks as a separate component. The drive direction turn indicator display is integrated in the generation 2 display operating unit.*



### Direction of travel display

Direction of travel forwards (1)

Direction of travel backwards (2)

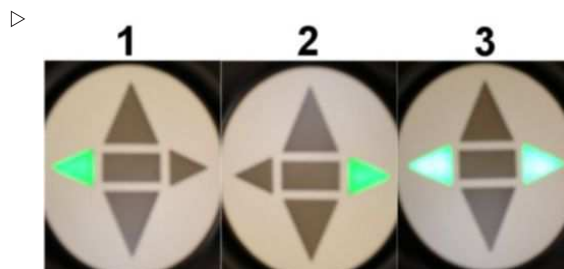


### Flasher display

Left flasher (1)

Right flasher (2)

Hazard warning lights (3)



**⚠ DANGER**

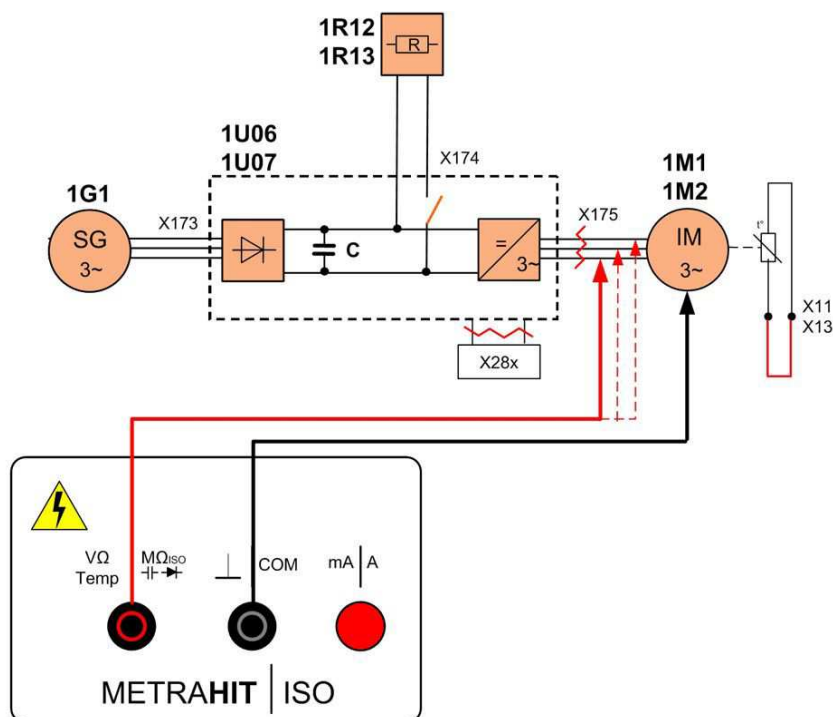
**Dangerously high voltages can be present in the electric drive system (generator, converter, brake resistor, traction motor)!**

Always observe the safety information, see chapter "Safety information".

Before working on the converters, first check the charging state of the intermediate circuit voltage.

- If the intermediate circuit voltage is not discharged to 0 Volt, take particular care when working on the converter.
- Follow the correct sequence for removing the converter.

Test values	
Test voltage	500 Volt
Insulation resistance	> 2 MΩ

**Traction motor insulation measurement**

- Disconnect plug X175 from the converter.
- Disconnect plug X28x from the converter
- Disconnect and short-circuit temperature sensor X11/X12
- Connect the negative cable of the gauge to the traction motor housing.

Possible shut-off	Truck is stationary, driver is not seated	Truck is stationary, driver is seated	Shut-off depending on drive direction
Working spotlights	X	X	X
Lighting	X	X	
Windscreen wipers	X	X	X
Seat heater and cab heating	X		

Individual parameterising settings can be made using the truck diagnostics in the notebook to determine which of the electrical consumers are to be switched off.

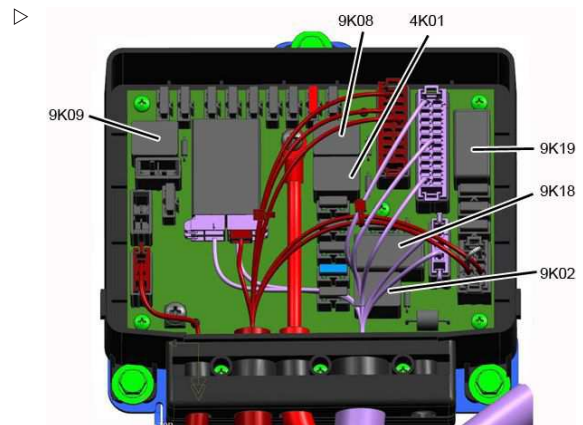
### Parameterising

Address	Value	Description
A 00 160	00	Blue-Q not activated
A 00 160	3A	Mode FIX Blue-Q is always ON once the truck is started
A 00 160	35	Mode STANDARD Blue-Q can be switched ON/OFF using the button
A 00 160	3F	Mode FIX-FLEX Blue-Q is active once the truck is started and can then be switched ON/OFF using the button. This mode is a combination of FIX and STANDARD

Fuse		Connection	Location - exception
9F6	50 A	Engine glow plug relay	Diesel only For the location, see chapter "Overview of electrical components"
F1	5 A	5th hydraulic function, 12 Volt	Option board
F2	10 A	Clamp light	Option board
F3	10 A	Material Management System (MMS)	Option board

## Relays in the fuse box

The relays are soldered onto the printed circuit board in the fuse box and cannot be replaced individually.



Designation	Connection	Comment
4K01	Signal horn	
9K02	Starter motor, terminal 50	LPG
	Fuel pump	Diesel
9K08	Enable of engine control unit (ECU)	LPG
	Enable of terminal 15	Diesel
9K09		Not used
9K18	Key switch, terminal 15, TCU run-on	
9K19	Key switch, terminal 15, TCU run-on	

The load should now swing freely without touching the ground. After a short time, the weight of the load is shown in the display.

An invalid measurement is shown in the display with the value -9999 kg.

If a lowering procedure is not performed after the button is actuated, the LOWER FORKS message is shown in the display after approx. 3 - 5 seconds.

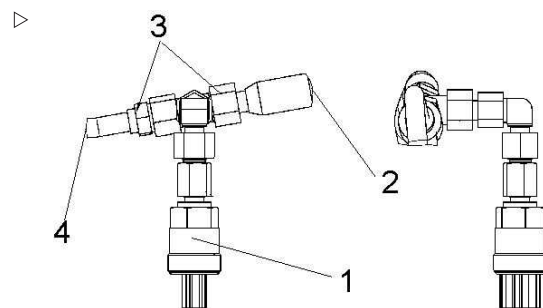
## Load measurement pressure sensor

### Function

The pressure sensor is used in the lifting hydraulic line or directly at connection H on the directional control valve block. The installation position is dependent on the truck type and is the same as that of the well known "load detection" FleetManager™ function.

### Technical data

Pressure sensor	Danfoss, model MBS3250
Connection	G1/4 A
Measuring range	0 - 250 bar 0.5 - 5 Volt



- 1 Pressure sensor
- 2 on the lift mast
- 3 Lifting separation point (example)
- 4 on the directional control valve block

### Electrical connections

Mark II plug, 3-pin				A22
7B45/1 br	Brown	12 V	3	X34A/1
7B45/2 bl	Blue	GND	2	X34A/3
7B45/3 sw	Black	Signal OUT 1	1	X34A/2

## Truck control unit

### Truck Control Unit (TCU)

#### General

The Truck Control Unit (TCU) acts as master (main processor) when controlling the truck and is responsible for controlling, regulating, monitoring and enabling.

The individual TCU duties are listed by function:

- Error management
  - Management of A-error numbers (TCU)
- Main fuse circuit
  - Parent contactor controller
  - Enabling and blocking of drive unit and hydraulic drive
- Drive unit
  - Controlling, regulating, monitoring
- Hydraulic functions
  - Controlling, regulating, monitoring
- Processing of output signals:
  - Accelerator, brake sensor, servo hydraulics
  - Drive direction switch
  - All switches in the front truck area
- Monitoring and safety concept
- Additional electrical installation evaluation
- Processing of FleetManager™ data (variant)
- Diagnostics, downloading
- Storing truck parameters
- Parameter backup for all other units
- Buffer battery (G5)
  - Data storage, as well as storing time, date, km counter and BDE.
  - Operating hours are recorded in the EEPROM and are not lost.



#### Electrical connections

Plug		
X47, X46	42-pin SAAB plug	Direct wiring of all standard functions for the drive unit 12 volt output voltage for external transmitter and switch CANopen as standard
X48	42-pin SAAB plug	Servo hydraulics (variant) Servo hydraulics as standard for RX70-16-20
X45	CAN bus connector	Supply of the drive direction turn indicator module (variant)
G5	Cover	Buffer battery

- Screw on the three power plugs X173, X174, X175 and connect plug X28. ▷
- Attach the converter cover to the converter.
- Attach the air filter support.
- **Diesel:** attach the fuel filter with support.
- **LPG:** attach the chassis module to the air filter support.
- Attach the air intake hoses to both sides of the converter.
- Install the entire air filter housing with air filter.
- Connect plug from the air filter maintenance switch 6S2.
- Install the panelling for the directional control valve block.
- Install the floorplate with the accelerator pedal and connect the plug connector.
- Close the bonnet.
- Connect the battery.
- Load software flash package; see chapter entitled "Software compatibility"
- Start calibration.
- Delete the error memory.
- Function test.



X173 X174 X28 X175

## Brake resistor

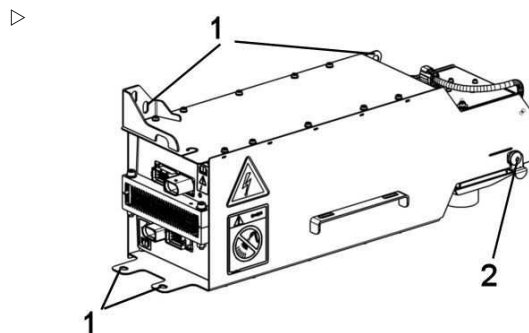
### Electric brake function

The electric brake function is influenced by the drive mode, accelerator position and drive direction. Refer to the chapter entitled "Drive mode - driving behaviour".

What happens during the electric brake function?

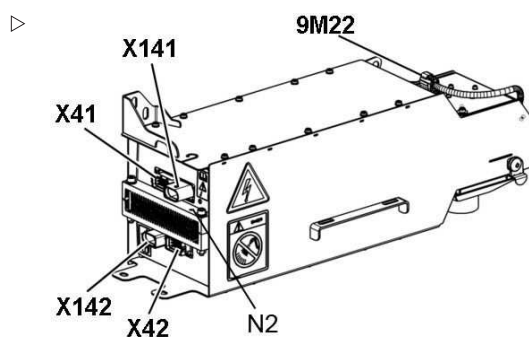
- The drive wheels power the traction motor.
- The traction motor works at this moment like a generator and produces energy.
- The energy is fed via the inverter to the brake resistor.
- The brake resistor puts load on the drive, and the energy is converted into heat.
- The heat is released via the cooling circuit of the internal combustion engine.
- The truck brakes.

The storage module is fixed to the overhead guard using 4 screws (1). The knurled-head screw (2) holds the fan filter carrier mat.



The plugs X141 and X142 can only be disconnected with difficulty, as they are equipped with interlocks and strong seals. Follow the steps below to unlock and remove the plugs:

- Slide in the plug up to the stop.
- Pull back the red slider.
- Using your thumb, move the interlock diagonally in the direction of the arrow. When you hear a click, the plug is unlocked.
- Pull out the plug with force.



## Forced ventilation

### Technical data

Fan	
Supplier	Ebm-Papst
Direction of rotation	Clockwise
Insulating material class	E
Nominal voltage	12 volts

4-pin mark II plug		
1	Red	12 volts
2	Blue	GND
3	Violet	PWM
4	White	Speed

3500	5000	min.	0.175	1.05	1.23	1.40	1.58
		max.	0.536	3.22	3.75	4.29	4.82
5000		min.	0.290	1.74	2.03	2.32	2.61
		max.	0.886	5.32	6.20	7.09	7.97

### Testing

Measurement is performed over the entire tilt range.

Speeds are measured at operating temperature.

For oil temperatures > 50°C, the permissible deviation from the table values is +20%.

#### ▲ CAUTION

Operating error!

With the simultaneous actuation of more than one valve function higher tilt speeds may occur.

### Lowering operating speeds

	Lowering speed with nominal load (m/s)		
	Tele	Hi-Lo	Triple
<b>Max. speed</b> Mean value from lift 1 and lift 2	0.60		
<b>Min. speed</b> Mean value from lift 1 and lift 2	0.45	0.40	

### Testing

Speeds are measured at operating temperature.

#### ▲ CAUTION

Max. lowering speed of 0.60 m/s should not be exceeded!

Do not adjust settings on lowering brakes.

- The flow control valve limits the oil flow for tilting.
- NO pressure relief valve

The pressure relief valve is part of the pump controller (12) on the hydraulic pump and protects the hydraulic system against overloading.

- Lift out the filter housing from the tank completely.

### Installing the return line filter

- Place the seal in the tensioned cover for the filter housing.
- Place the filter housing into the tank.
- Tighten the four mounting nuts complete with washers, remembering to reattach the earth wire to one of the stud bolts.
- Connect the return line from the solenoid valve.
- Connect the return line from the steering and fan motor.
- Connect the leak-oil pipe from the hydraulic pump and fan control valve.

## Breather

### General

The breather and oil dipstick form a single unit in the hydraulic tank cover. The filter prevents dust and dirt entering the hydraulic tank.

### Technical data

Filter mesh: 8 µm nominal

Filter material: nonwoven plastic mesh

Maintenance interval: 3000 operating hours or 2 years

### Changing the filter element



#### ENVIRONMENT NOTE

*The filter element should be disposed of according to the environmental regulations.*

- Unscrew the breather
- Remove the filter cover
- Remove and exchange the filter element
- Replace the filter cover
- Screw the breather back on.

**NOTE**

- *When assembling a threaded elbow pipe, always use a new one.*
- *Note the location of the threaded elbow pipes.*
- During assembly, bear in mind that the location of the threaded elbow pipes depends on the design of the tilt cylinders.
- Insert the threaded elbow pipe and screw it in by hand up to the TUFLOK coating.
- Then use a tool to screw it in at least 4 turns and no more than 5.

**▲ CAUTION**

Leakages caused by incorrectly fitted threaded elbow pipes.

If a threaded elbow pipe has been screwed in too far, it must not be unscrewed again. A new threaded elbow pipe must always be used.

- Functional test.

## Directional control valve block

### General

The directional control valve is a monoblock design and comes in 2 versions:

- Directional control valve, three-way  
Lift, tilt, auxiliary hydraulics 1
- Directional control valve, four-way  
Lift, tilt, auxiliary hydraulics 1, auxiliary hydraulics 2

The function and structure of the monoblocks are identical in both versions. If a truck is later equipped with auxiliary hydraulics, the whole monoblock must be exchanged.

The directional control valve block contains the following functional components:

- Lowering-balance valve (lowering brake) in the lift valve spool
- Two load holding valves in the tilt slider
- Tilt orifice, depending on the nominal lift
- Check valve for hydraulics blocking function (from 12/2009)
- The pressure relief valve is a component of the pump regulator.

The solenoid coil (2Y2) pushes on the lowering valve and opens the connection (H) to the return line (T).

The check valve (1) is located in the LS chain and releases the control pressure as soon as the seat contact switch is closed.

The discharge pressure governor (4) fulfils the functions of the lowering brake, and limits and regulates the lowering speed, regardless of the load. The lowering speed is set by the adjustment screw (4a) on the lowering cartridge.

The load holding valves are integrated in the directional control valve block and prevent the load from tilting by itself.

Legend:	
No entry	There is no hydraulic adapter present.
0	There is no line break safety valve installed at this point.
1	Number of line break safety valves installed.

## Telescopic lift mast

### Telescopic lift mast (108/117/130)

#### Function

The telescopic lift mast is a high-visibility lift mast. The mast profile is a double-T profile. The fork carriage and mast profiles are guided through support rollers (4); these also absorb the lateral forces.

When the load is lifted, the inner mast is also raised along with the fork carriage. After a small free lift of approx. 150 - 160 mm, the overall height of the truck changes immediately. This must be taken into consideration if there are low ceilings and gates.

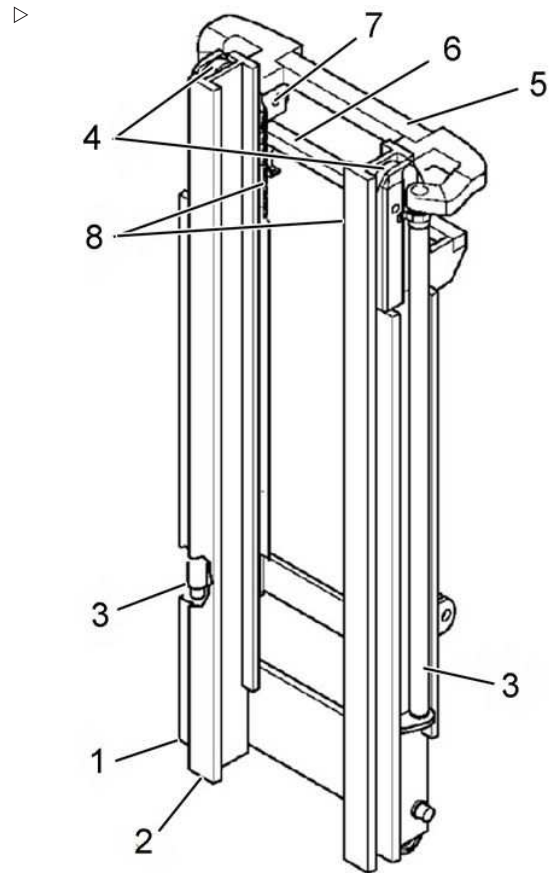
The telescopic lift mast consists of an inner mast (2) and an outer mast (1). A lift cylinder (3) is fitted on each side in the outer mast profiles. The lift pistons are connected to the inner mast crossmember (5).

The load chains (8) are connected to the outer mast crossmember (6) via clamping bolts. The load chains are redirected by chain rollers (7) on the inner mast. The end links of the load chains are connected to the fork carriage.

If the lift cylinders are supplied with hydraulic oil, the lift pistons extend and take the inner mast with them. The redirection of the load chains causes the inner mast to extend towards the fork carriage at a ratio of 1:2.

The end stop is located in the lift cylinder.

A run-out barrier prevents the fork carriage from tilting outwards; see the chapter entitled "Run-out barrier".

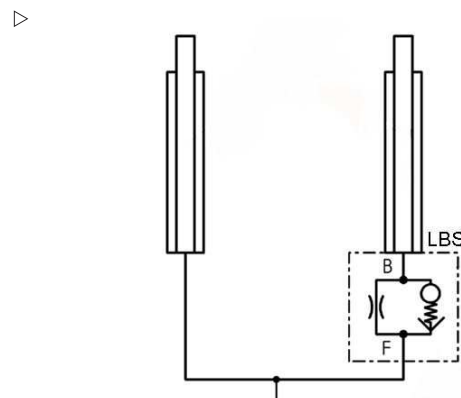


- |   |                        |
|---|------------------------|
| 1 | Outer mast             |
| 2 | Inner mast             |
| 3 | Lift cylinder          |
| 4 | Support roller         |
| 5 | Inner mast crossmember |
| 6 | Outer mast crossmember |
| 7 | Chain roller           |
| 8 | Load chains            |

#### Hydraulic oil flow within the lift mast

The hydraulic oil comes from the directional control valve block. It is distributed via a T-piece and is directed down to the two outer cylinders on the left and right.

The line break safety valve (LBS) is installed in the outer cylinder. This valve prevents the load from lowering too quickly in the event of line breakage; see the chapter entitled "Line break safety valve".



- Slowly lower the inner mast until the support rollers are freely accessible at the bottom of the inner mast. ▷

#### ⚠ CAUTION

During the lowering process, the inner mast moves clear of the upper guide and tilts forwards slightly. Hydraulic hoses and other components may become damaged during this process. However the inner mast cannot fall out forwards!

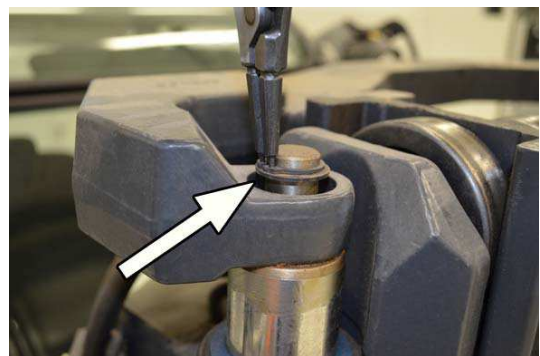
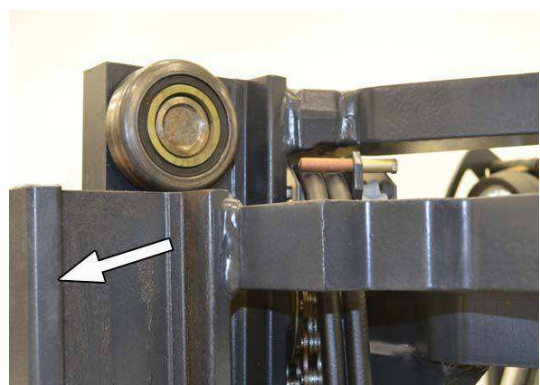
- To avoid any possible damage, lower the hydraulic jack slowly.

- At the same time, the support rollers at the top of the middle mast become free. The inner mast is tilted forwards slightly. ▷
- Remove the 4 support rollers at the top and bottom from the bearing pins.
- Clean the bearing pins and fit new support rollers, adding shim rings as required.
- Adjust the play of the support rollers; see the chapter entitled "Support roller play"

#### Support rollers: bottom of middle mast and top of outer mast

- Use the hydraulic jack to lift the inner mast until it is once again guided by the upper support roller on the middle mast.
- Place the inner mast on a flat supporting block. ▷

- At the top of the middle mast crossmember, disassemble the locking rings from the piston rods. ▷
- Left hand side: Unscrew the pipe line from the hydraulic adapter.
- Unscrew the auxiliary hydraulics hoses from the middle mast.



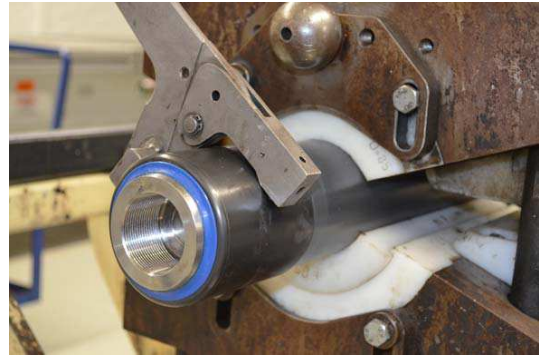
**▲ CAUTION**

Damage due to the fork carriage coming into contact with the run-out barrier!

Never compensate for tyre wear by retightening the load chain because the load chain will then be too short.

---

- Using protective jaws, clamp the cylinder pipe in the vice. ▷
- Unscrew the cylinder head using a hook spanner. The cylinder head is secured with Loctite, so it may be necessary to gently heat the thread.



- Remove the cylinder head from the piston rod. ▷
- Remove the set of seals.

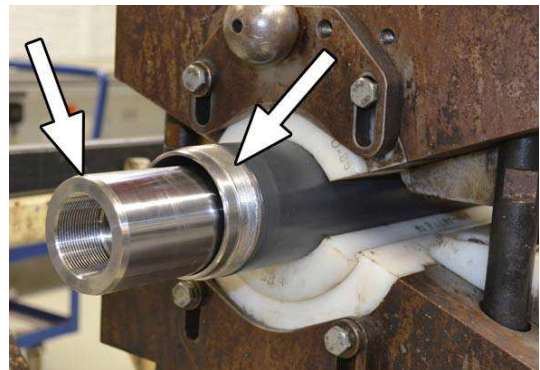


### Assembly

- Clean the cylinder head and check for signs of wear and damage. ▷
- Insert a new set of seals into the cylinder head.
- Lightly coat the seals with hydraulic oil.



- Check the piston rod and the chamfer for damage. ▷
- Clean and degrease the thread in the cylinder pipe and cylinder head.
- Secure the thread by spreading three drops of **Loctite 243** over the entire thread.



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