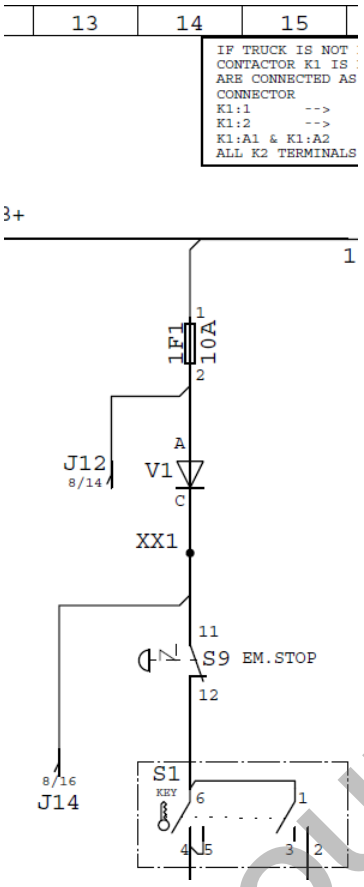


Figure 80. Page 1/8, zone 13, wiring reference J14

Note the numbers above the wiring reference J14. These numbers (8/16) direct you to the page and zone where the wire is connected.

This procedure is used to follow the circuits throughout the schematic diagram. If the numbers are given without the slash (/), the connection is on the same page of the schematics.

Table 4 below explains the different identifiers used in the schematic diagram. # stands for a number.

Table 4. Schematic diagram identifiers

IDENTIFIER	DESCRIPTION
S#	Switches and other state changing devices (for example, most sensors).
#F#	Fuse
J#	Reference. All references marked with an even ”J” (e.g. J2) are positive (+). All references marked with an odd “J” (e.g. J3) are negative (-).

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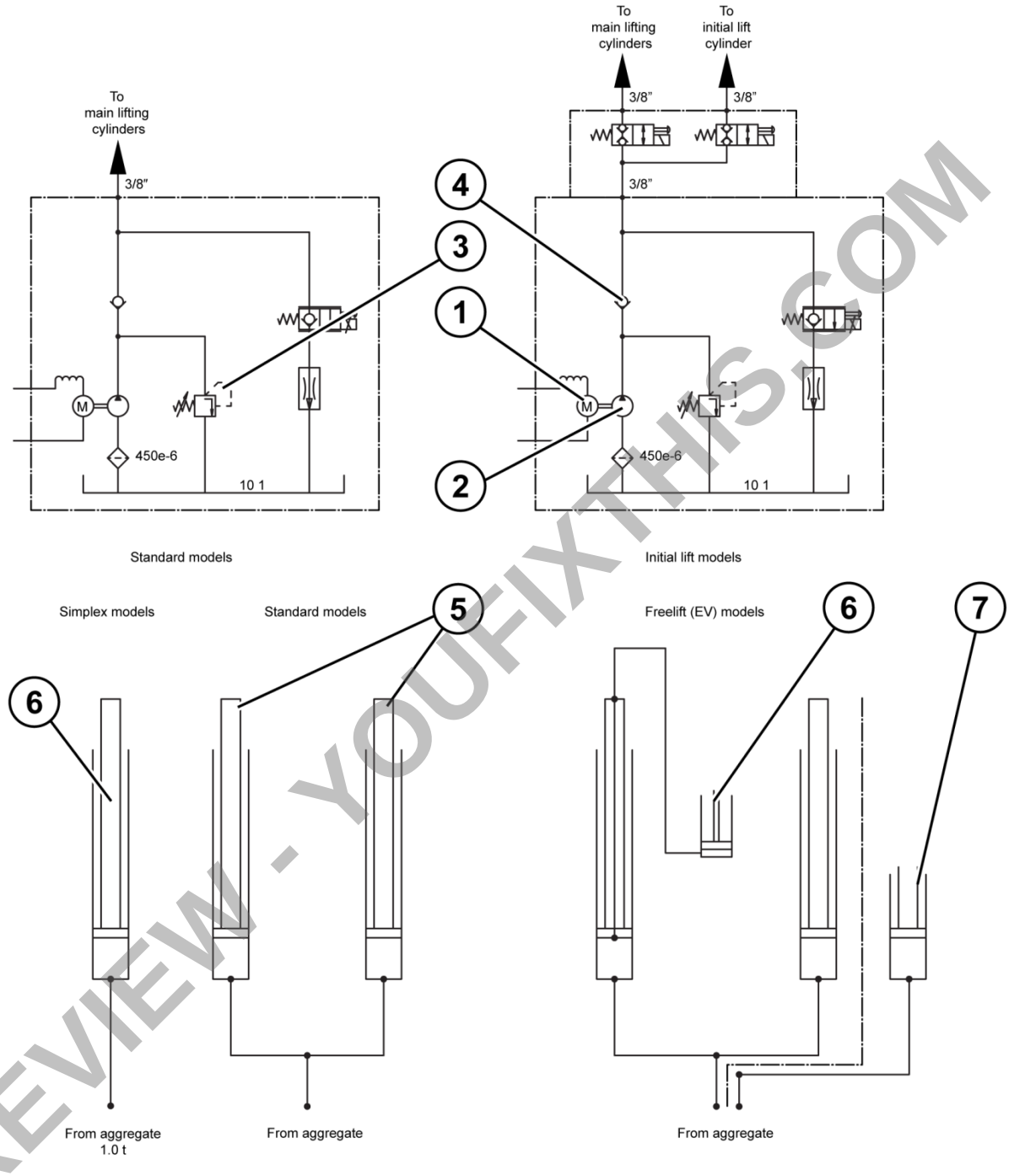


Figure 119. Hydraulic system overview (1.0 t / 1.2 t / 1.4 t and 1.6 t models)

1. *Electrical motor*
2. *Hydraulic gear pump*
3. *Relief valve*
4. *No-return valve*
5. *Main lifting cylinders*
6. *Free lift cylinder*
7. *Initial lift cylinder*

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13 Alarm codes

This chapter explains the meaning of the various alarms that the different controllers may produce. Refer to the chapter 11 for information on the TruckTool diagnostics application.

13.1 Traction controller

NOTE: Before you start to troubleshoot the truck, make sure that all the power supplies, fuses and connections are in order. Low voltage in the traction controller can cause different sorts of alarms.

The fault diagnostic system of the traction controller is divided into two main groups:

- Alarms

  These are faults, which open the power bridge and, when possible, also the main contactor is opened and the magnetic brake activated. Failures in the motor, the controller or the safety functions cause alarms.

- Warning

  These are faults, which do not stop the truck or stop the truck by using regeneration braking. The controller is working well, but it has detected some conditions that reduce the performance or stop the truck without opening the power devices. Incorrect operation sequences or conditions requiring performance reductions (for example, high temperatures) cause warnings.

The text “Stored” means that the alarm or warning is stored in the traction controller logbook.

Table 14. Traction controller alarm codes

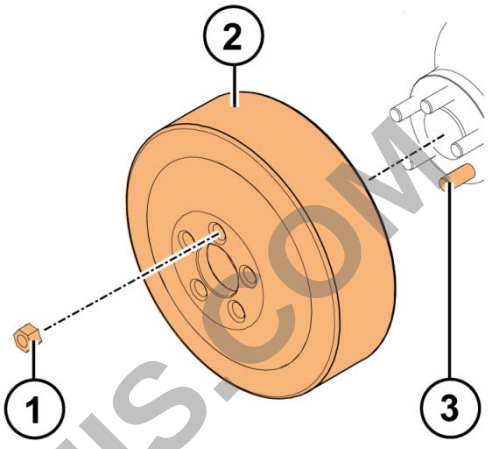
CODE	TRUCKTOOL AND DISPLAY DESCRIPTION		
8	Self diagnosis test failed WATCHDOG	(Alarm)	Stored
	This is a safety-related self diagnosis test within the logic between the master (drive) and slave (pump) microcontrollers. The alarm indicates that the master and slave watchdog message is missing or late. This alarm can be caused by a CAN bus malfunction, which blinds the master-slave communication. Check all the CAN bus cables and measure the bus resistance between CAN high and low. The bus resistance value should be 60 Ω. Measure also the CAN cables’ resistance between the truck chassis and the 0 cables. There should not be any significant connection and the resistance value should be over 1 MΩ. If CAN bus is OK, the problem is in the controller and it must be replaced.		

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5.7.1 Disassembly of the traction wheel

1. Remove the five rounded cone nuts holding the traction wheel in place.
2. Remove the traction wheel.
3. Check the condition of the wheel shaft bolts. Replace the bolts, if needed. For instructions, see section 5.7.1.1 below.



5.7.1.1 Replacing the wheel shaft bolts

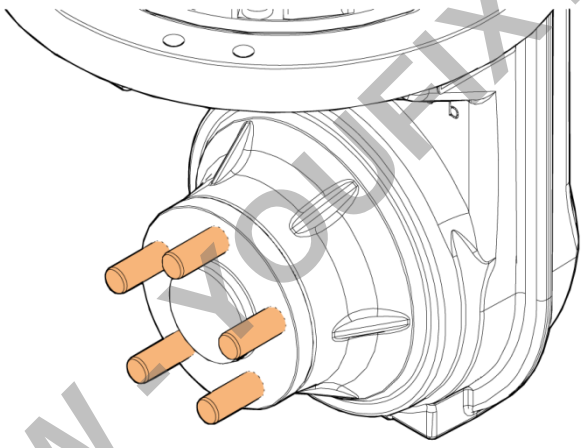
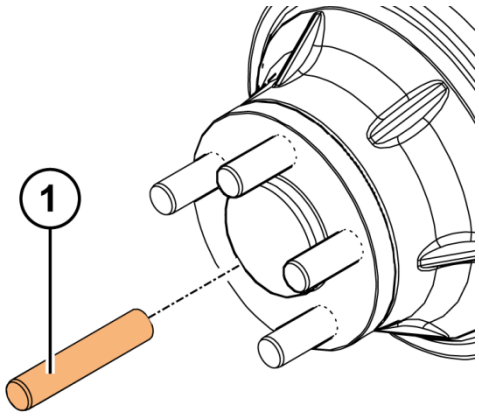


Figure 28. Wheel shaft bolts overview

If the wheel shaft bolts of the traction wheel are defective, you need to replace them.

1. Unscrew the defective wheel shaft bolt.



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IDENTIFIER	DESCRIPTION
M#	Motor
V#	Diode
A#	Controllers and displays
K#	Contactors and relays
X#	Connector. Contact numbers are marked on individual wires.
XX#	Splice. Multiple wires are connected together at this point.

Figure 81 shows the reference to which Figure 80 referred.

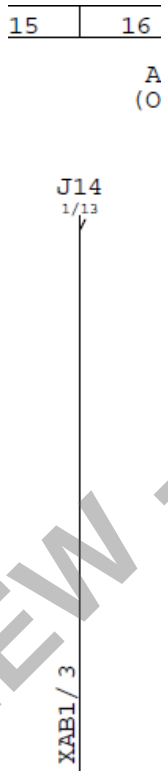


Figure 81. Page 8, zone 16, wiring reference J14

Once again, note the numbers below the wiring reference J14. These numbers (1/13) direct you back to the page (and zone) shown in Figure 80.



Figure 82. Page numbers (4/9), circuit diagram number (3-7109) and revision letter (H)

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The principle of the truck's hydraulic operation is as follows:

Lifting:

1. The electrical motor operates the hydraulic gear pump.
2. The hydraulic fluid is pressurized.
3. The fluid pressure is maintained using the relief valve, which opens at a certain pressure. In such cases, the hydraulic fluid is returned to the fluid tank. The opening pressure of the relief valve is indicated in the hydraulic schematics.
4. The pressurized hydraulic fluid flows through the no-return valve to the lifting cylinder.
5. The lifting cylinder piston lifts the forks.

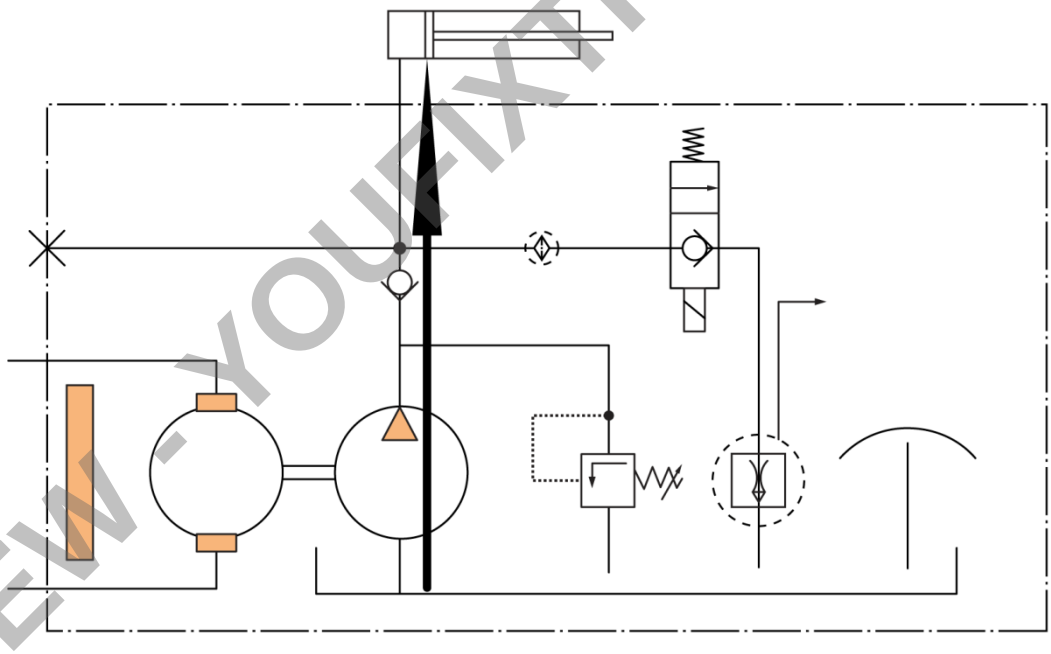


Figure 120. Hydraulic fluid flow during lifting

Lowering

1. The solenoid valve is opened with the lowering switch.
2. The hydraulic fluid flows through the 300 µ sieve back to the fluid tank.
3. As the hydraulic pressure reduces, the lifting cylinder piston retracts and the forks are lowered.

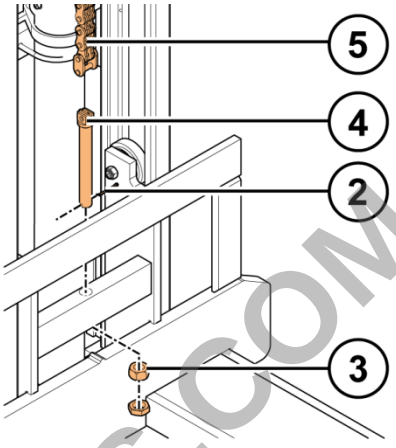
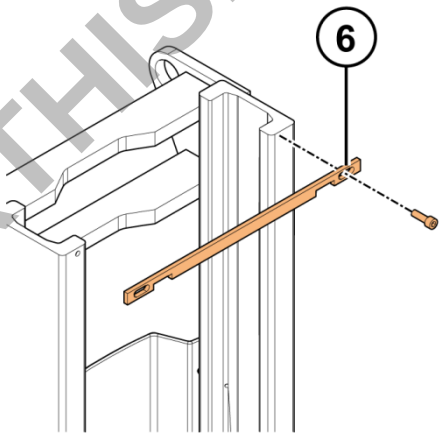
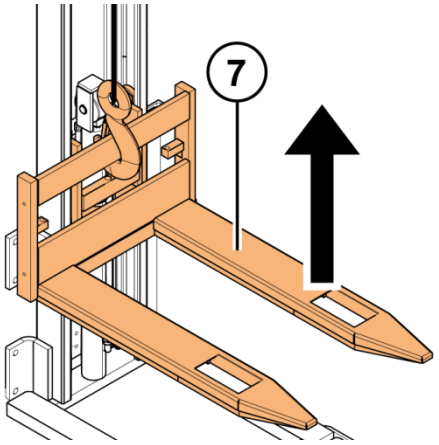
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CODE	TRUCKTOOL AND DISPLAY DESCRIPTION		
13	Controller memory error EEPROM KO	(Warning)	Stored
	This warning is caused by a hardware or software defect of the non-volatile embedded memory supporting the controller parameters. This alarm does not prevent truck operation, but the truck will work with the default values. In case of this warning, perform a CLEAR EEPROM operation. Switch the key off and on to check the result. If the alarm occurs permanently, replace the traction controller. If the alarm disappears, the previously stored parameter values will have been replaced by the default values.		
17	Hardware high current protection failure LOGIC FAILURE #3	(Alarm)	Stored
	This alarm is caused by a hardware problem in the logic card circuit for high current (overload) protection. This fault is not related to external components, so when it appears, replace the traction controller.		
18	Motor voltage feedback circuit damaged LOGIC FAILURE #2	(Alarm)	Stored
	This alarm is caused by a fault in the logic board managing the phase's voltage feedback. This fault is not related to external components, so when it appears, replace the traction controller.		
19	Over or under voltage detected LOGIC FAILURE #1	(Alarm)	Stored
	This alarm is displayed when the controller detects an overvoltage or undervoltage condition. The overvoltage threshold is 35 V and the undervoltage threshold is 9.5 V in the 24V controller. If the alarm is displayed at startup or in the standby mode, it is due to an undervoltage. In such a case, check the following: • The key input signal voltage drops below the undervoltage threshold due to external loads, such as DC/DC converters starting up or relays or contactors energizing or de-energizing. • If no voltage transient is detected on the supply line and the alarm is displayed every time the key is switched ON, the problem is in the traction controller. If fault is displayed during motor driving, it is due to an undervoltage or an overvoltage condition. • If the alarm occurs during traction acceleration or driving hydraulic functions, it is caused by an undervoltage condition. In such a case, check the battery charge level and the power cable connections. • If the alarm occurs during release braking, it is caused by an overvoltage condition. In such a case, check the line contactor tips and the battery power cable connections. In some cases, this error can also happen during normal operation. Sharp hits may cause the emergency stop switch contacts to open for a short period of time. This causes a short 0 V pulse to the key line causing this error.		

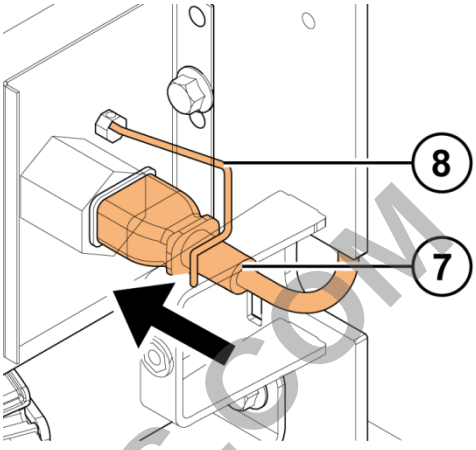
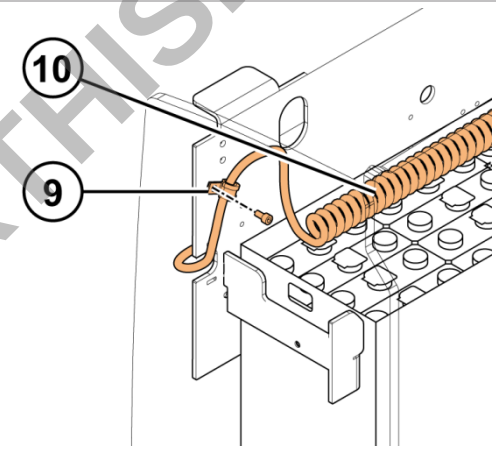
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2. Remove the locking pin from the chain anchor attached to the lifting carriage. **3.** Remove the two nuts from the chain anchor. **4.** Remove the chain anchor from the mounting hole. **5.** Remove the chain anchor from the chain.	
6. Remove the level rod.	
7. Attach a lifting device to the lifting carriage and lift it out of the lifting carriage.	
8. Support the mast unit by attaching a lifting device to the lift points at the top of the mast and tightening the lifting ropes/chains.	

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7. Install the internal charger connector to the internal charger. **8.** Attach the clip holding the cable in place.	
9. Attach the connector to the battery compartment frame using a cable tie. **10.** Place the internal charger connector on top of the battery.	

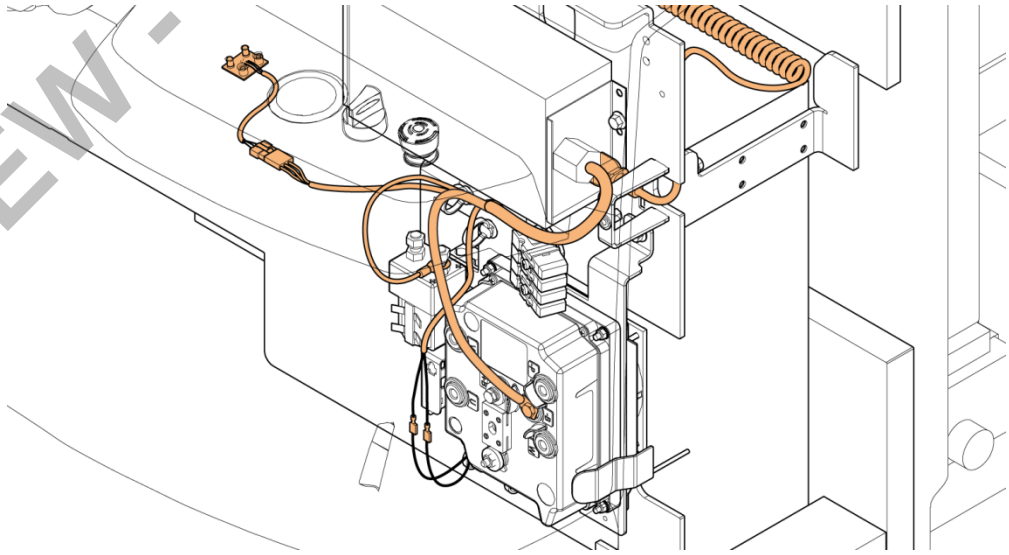


Figure 134. Internal charger wiring

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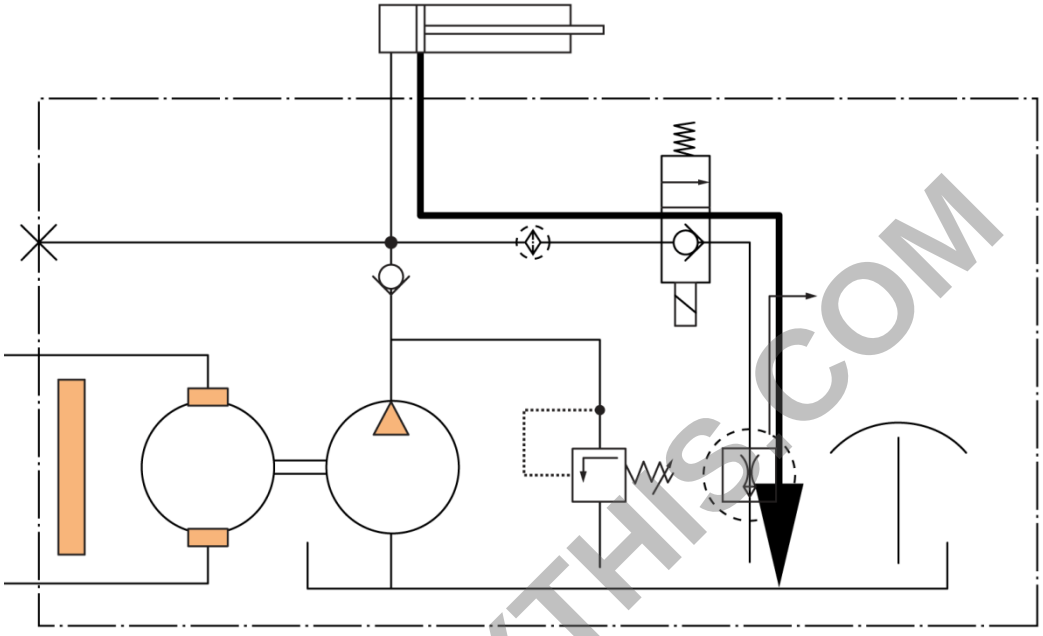
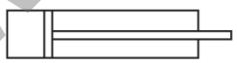
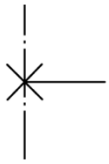
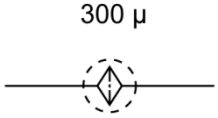


Figure 121. Hydraulic fluid flow during lowering

NOTE: Different truck models can have different hydraulic system configurations.

10.1 Hydraulic symbols

SYMBOL	DESCRIPTION
	Lifting cylinder
	Plugged measuring point
	No-return valve
	300 µ sieve

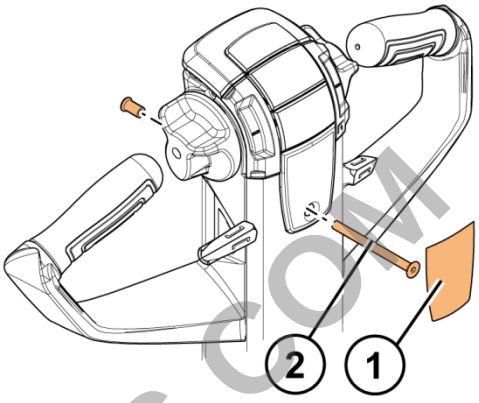
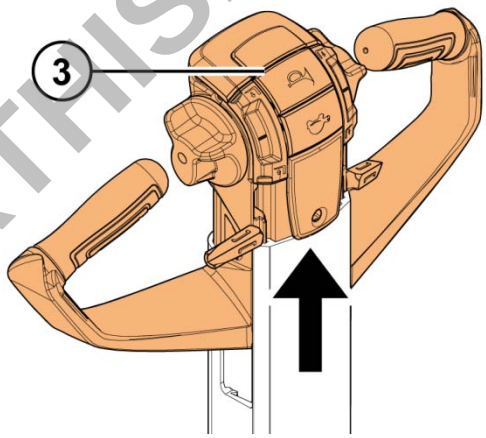
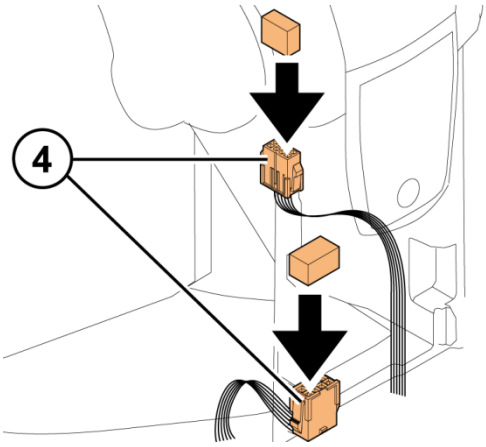
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CODE	TRUCKTOOL AND DISPLAY DESCRIPTION		
28	Pump motor output voltage error (low) PUMP VMN LOW	(Alarm)	Stored
	Cause 1: Startup test Before switching the main contactor on, the software checks the power bridge. It turns on the high side power MOSFETs one by one and expects the phase voltage to increase toward the bus capacitor value. If the phase voltage does not increase, this alarm occurs. In such a case (the main contactor does not close at all), check the following: • Motor internal connections (ohmic continuity) • Motor power connections • Motor leakage current to the truck frame If the motor connections are OK, the problem is in the traction controller. **Cause 2: Motor run-up test** When the motor is running and the power bridge is on, the motor voltage feedback is tested. If the motor voltage feedback is lower than the commanded value, this alarm occurs. In such a case, check the following: • Motor connections • Whether the motor's phase windings or cables have leakage currents towards the truck frame • That the main contactor closes properly, with a good contact If no faults are found, the problem is in the traction controller.		
29	Pump motor output voltage error (high) PUMP VMN HIGH	(Alarm)	Stored
	This test is carried out when the pump motor is running. The alarm indicates that the pump motor output is higher than expected. In such a case, check the following: • Motor connections • If the motor windings or cables have leakage currents towards the truck frame If no problems are found on the motor, the problem is in the traction controller.		

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1. Remove the logo plate. **2.** Remove the tiller head fixing screw.	
3. Lift the tiller head carefully upwards until you can feel the connector wires tightening. Be careful not to damage the wiring. When pulling the tiller head up, note that the pipe edges are sharp and may cut you.	
4. Disconnect the connectors.	
5. Remove the tiller head from the pipe.	

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2 How to read this manual

2.1 Safety-related signs

The following table explains the safety-related signs used in this document.

⚠ DANGER	**DANGER** indicates a hazard with a high level of risk which, if not avoided, will result in serious injury or death.
⚠ WARNING	**WARNING** indicates a hazard with a medium level of risk which, if not avoided, could result in serious injury or death, or damage to your machine.
⚠ CAUTION	**CAUTION** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury, or damage to your machine.

NOTE: Notes are used to indicate important information and useful tips.

2.2 Symbols and abbreviations

2.2.1 Safety symbols

Hazard symbols

These symbols indicate a hazardous situation or action. Symbols are used to warn of situations, which may cause environmental damage and personal injury.

General hazard symbol



General warning sign

Hazard symbols



Explosion and fire hazard



Corrosive hazard

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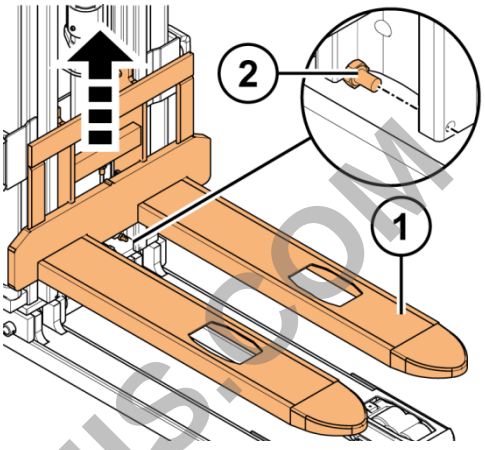
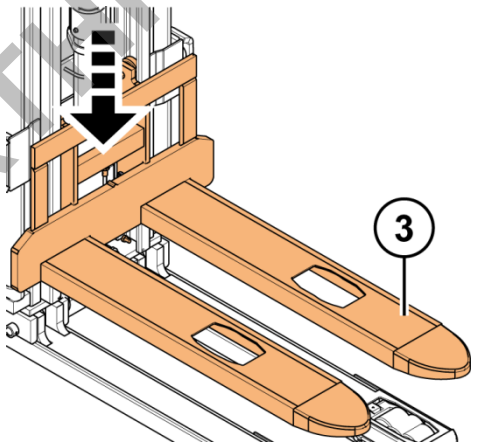
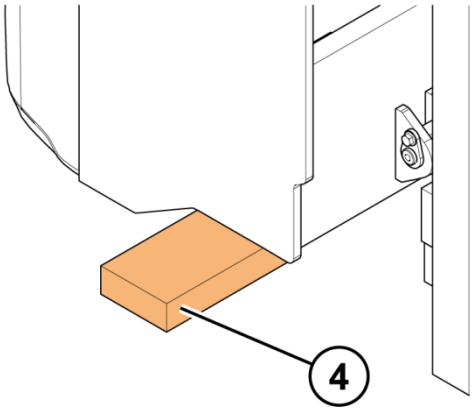
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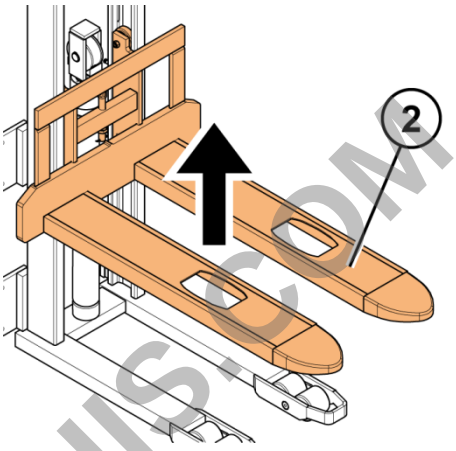
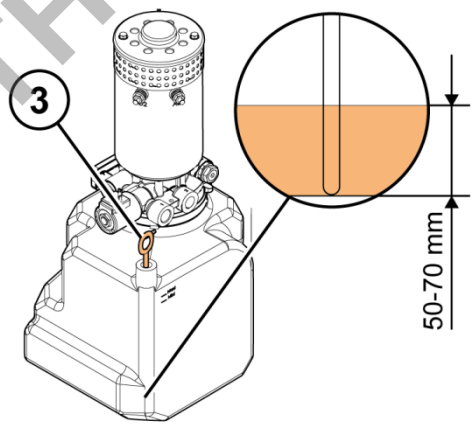
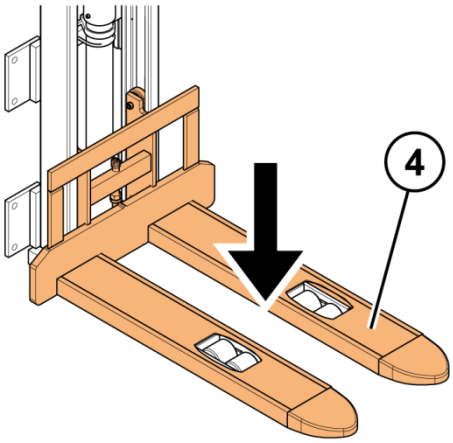
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5.11.4.5 Duplex and triplex masts with free lift and initial lift

1. Lift the forks up. **2.** Remove the locking bolts underneath the lifting carriage.	
3. Lower the forks.	
4. Support the truck frame against the floor.	

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1. Bleed out the air from the free lift cylinder. For instructions, see section 5.11.13.3.	
2. Lift the forks to their upmost position.	
3. Check the hydraulic fluid level in the tank using a dipstick. The correct level is approximately 50-70 mm when measured from the bottom of the oil tank.	
4. Lower the forks.	

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11 TruckTool Diagnostics

Software maintenance can be performed with a diagnostics application called TruckTool. This program runs on a laptop PC and connects to the truck's data bus (CAN) via a special adapter and wire harness.

TruckTool can be used to receive, display and modify settings, update (flash) controller firmware, reset settings to hardware defaults, review and clear alarms, perform calibrations, execute a quick truck setup and monitor digital and analogue inputs and outputs.

The TruckTool program's usage instructions are available in the application itself. Additional training is required to use the program.



Figure 124. TruckTool Diagnostics

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