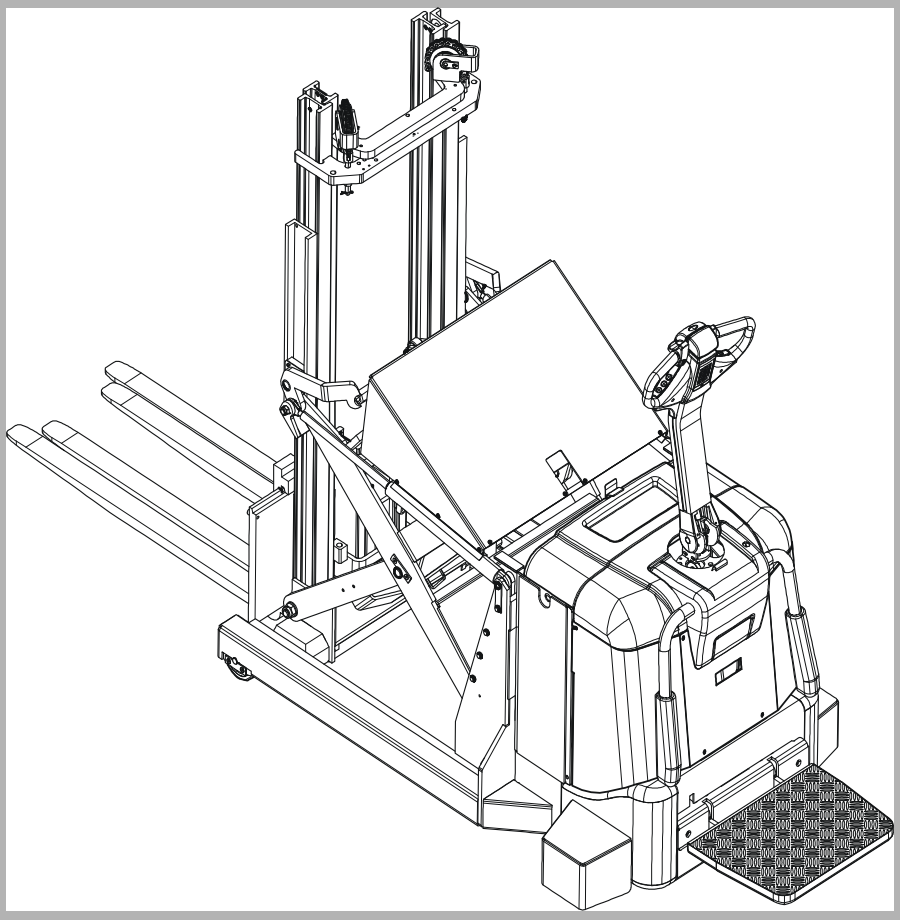
Repair manual 7550623-040

SPE120XR, SPE120XRD.



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2. General introduction

2.1 How to use this manual

The repair manual is divided into chapters containing the following information:

- Function – This chapter provides a basic description of the main functions of the truck.
- Parameters– This chapter provides a basic description of the truck and control system parameters.
- Installation – This chapter describes the preparatory work that is to be done before the truck is used for the first time
- Maintenance – the chapter contains a general periodic maintenance schedule and a detailed description of the maintenance to be carried out
- Troubleshooting – The troubleshooting chapter describes the error codes that are displayed when the truck is partially or completely out of service. It also describes the cause of the problem together with suggested remedies.
- Remedies – This chapter describes the various truck systems, e.g. the hydraulic system and includes descriptions of system parts and the necessary service procedures. These descriptions are divided according to the C code system of the truck manufacturer.
- Appendices - The appendices include:
  - Instructions for disposal
  - Information about electrical components and wiring diagrams
  - Hydraulics diagram
  - List of required tools
  - Information about general tightening torques
  - Oil and grease specifications
  - Technical data

2.2 Warning symbols

The following warning symbols are used throughout the service manual:

DANGER!

DANGER! means there is a risk of accident potentially leading to death or serious injury and material loss or damage. This is always indicated by the warning symbol.

WARNING!

WARNING! means that there is a risk of damage to components that are sensitive to electrostatic discharge.

Heed applicable ESD safety precautions.

Note:

Note: means there is a risk of material loss or damage if the instructions are

4. Operation and connection sequences

4.1 Description of functions

 means constantly on  means flashing.

This section provides a basic description of the truck's main functions in tabulated form. Simply, it explains what happens when you use any of these functions.

- Event - The main stages in performing any of the truck's main functions are referred to as "Events". Each event is numbered.
- Prior events - Indicates the event number which must have taken place immediately before in order for the latter to be performed correctly.
- Action(s) - A required action from the operator for the event to occur.
- Influencing elements - conditions which must be fulfilled in order for the event to occur. Certain parameter settings may also affect the outcome of the event.
- Resulting conditions – Describe the key events that can be checked in order to confirm a function.

Note that "resultingconditions" show what is expected when no error conditions are present. Items shown in square brackets [ ] refer to electric component designations as stated in the electrical wiring diagrams.

High means ≈ 24 V and low ≈ 0 V unless otherwise stated.

5.1.7 Description of operator parameters

 # 2 - Maximum speed, high speed range

Allows the adjustment of the truck's maximum speed in high speed range. The high speed range is active when the gates are raised and the platform is lowered.

 # 3 - Maximum acceleration

Allows adjustment of the truck's maximum acceleration. The lower the value of the parameter, the longer it takes to accelerate the truck to the speed requested via the speed control [L1].

 # 4 - Neutral braking effect

Allows adjustment of the braking force applied when the speed control [L1] returns to the neutral position. The lower the value of the parameter the longer it takes to bring the truck to a standstill.

 # 6 - Maximum speed, low speed range

Allows the adjustment of the truck's maximum speed in low speed range. The low speed range is active when the side guards are down and the platform is up.

 # 7 - Maximum speed, "Turtle" range

Allows the adjustment of the truck's maximum speed in "Turtle" range.

Value 2: Valve starting point for fork lowering

To optimise the fork lowering function, the control signal for the proportional lowering valve must be trimmed (fine-tuned). The point when the valve just starts to open is called the valve starting point.

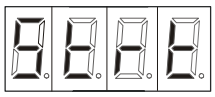
The recommendation is not to use this function with the present hydraulic unit as the valve start point is not as well defined as those on earlier units.

The default value gives a good function and performance, but there is the possibility to calibrate the valve start point Be aware that the valve gets changed characteristics when the calibration is completed.

The default valve for the valve start point is "60".

Proceed as follows to calibrate the valve starting point:

- Select parameter #36 and set its value to 2.
- Switch off the truck by pressing  on the keypad.

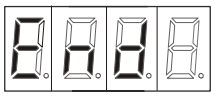
Press  on the keypad.  is shown on the display.

- Place a load on the forks (between 300 kg & max. load) and run the main lift approx. 1 m above the floor. The secondary lift must be at the bottom.
- Press and hold the horn button [S18].

The display will show a value representing the valve start signal. After a delay, the forks will begin to lower.

- Release the horn button [S18] immediately the forks begin to lower.

Note:
If the horn button [S18] is released before the calibration is complete, all truck functions are cancelled. In this way, it functions as a "dead man's grip"

The display will show the calibration value for 3 seconds and the display is then changed to  .

- Switch off the truck by pressing  on the keypad.
- Press  on the keypad. Valve starting point calibration is now complete.

Parameters #16–19 configurable optional functions

- Each parameter can be allocated a certain number of basic options.
- Each optional function can have up to 4 arguments associated with it.
- Each argument holds a value that can be changed to configure the function.

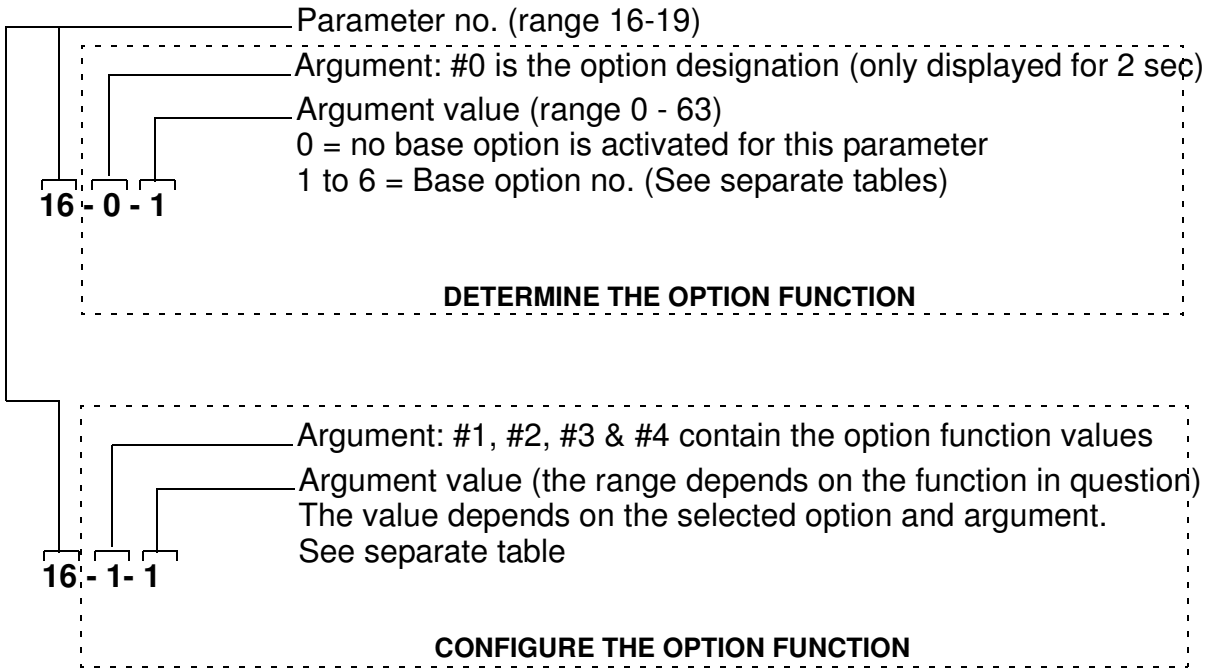
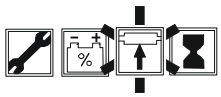


Fig. 4 Overview - option parameter

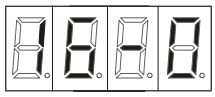
Changing configurable option functions

To activate a configurable option, the base option must first be assigned to one of the parameters #16 to #19. This is achieved by setting argument #0 to the base option number. Once this has been done, the option's arguments must be configured. This is done by changing the values for the arguments #1, #2, #3 and #4.

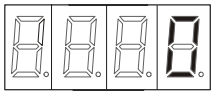
- Ensure the truck is in parameter mode.

The parameter symbol lights. 

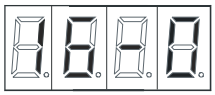
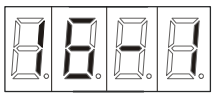
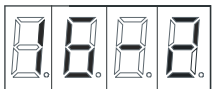
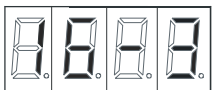
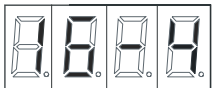
- Select parameter #16, #17, #18 or #19 using [L1].



Argument #0 is displayed.



The argument value is displayed after 1 second. A value of "0" indicates that no option is assigned to this parameter, in which case continued operation of the speed control [L1] will display the next parameter.

Base option 9 – single-working hydraulic function		
Argument #0	Option designation	
Initial display  (value shown after 2 seconds)	Values	Meaning
	9	Activates the option parameter to manage base option 9
Argument #1	Selection of output on A3-board.	
Initial display  (value shown after 2 seconds)	Values	Meaning
	0	The option is handled by outputs A3:2 and A3:3.
	1	The option is handled by outputs A3:4 and A3:7.
Argument #2	Selection of option button for single-acting hydraulic function	
Initial display  (value shown after 2 seconds)	Values	Meaning
	0	activated by option buttons 2 and 5.
	1	activated by option button 1.
	2	activated by option button 2.
	3	activated by option button 3.
	4	activated by option button 4.
	5	activated by option button 5.
	6	activated by option button 6.
	7	activated by option buttons 3 and 4.
Argument #3	Pump motor power limitation	
Initial display  (value shown after 2 seconds)	Values	Meaning
	0-7	Max. pump power adjustable from 30–100% formula: = 30 + 10*Arg.3 E.g. 30 + 10*4 = 70%
Argument #4	Pump motor current reduction	
Initial display  (value shown after 2 seconds)	Values	Meaning
	0-7	Max. current to pump motor adjustable from 30-100% formula: = 30 + 10*Arg.4 E.g. 30 + 10*4 = 70%

- Always use protective equipment to protect the eyes, face and skin while checking, handling or topping up batteries
- Ensure there is a shower and an eye rinsing device nearby in case an accident happens
- Batteries generate explosive gases. Never use an open flame or other sources of ignition in close vicinity to a battery.
- Do not place tools or other metal objects on the battery as they can cause short-circuits resulting in explosion.

Installation of/replacing the battery

See section "14.5.2 Changing the battery".

6.4.2 Parameter setting

The parameters covered in this section are only those parameters that need to be set when the truck is used for the first time. For more information about parameters, See section "5.1 Parameter settings".

Check to make sure all parameters are set to the desired values in terms of

- #24 Optiledge function, service parameter. See section "5.1.8 Summary of service parameters".
- Maximum speed. For a more detailed description, see “5.1.6 Summary of operator parameters”.
- Acceleration. For a more detailed description, see “5.1.6 Summary of operator parameters”.
- PIN codes. For a more detailed description, see “5.1.6 Summary of operator parameters”.

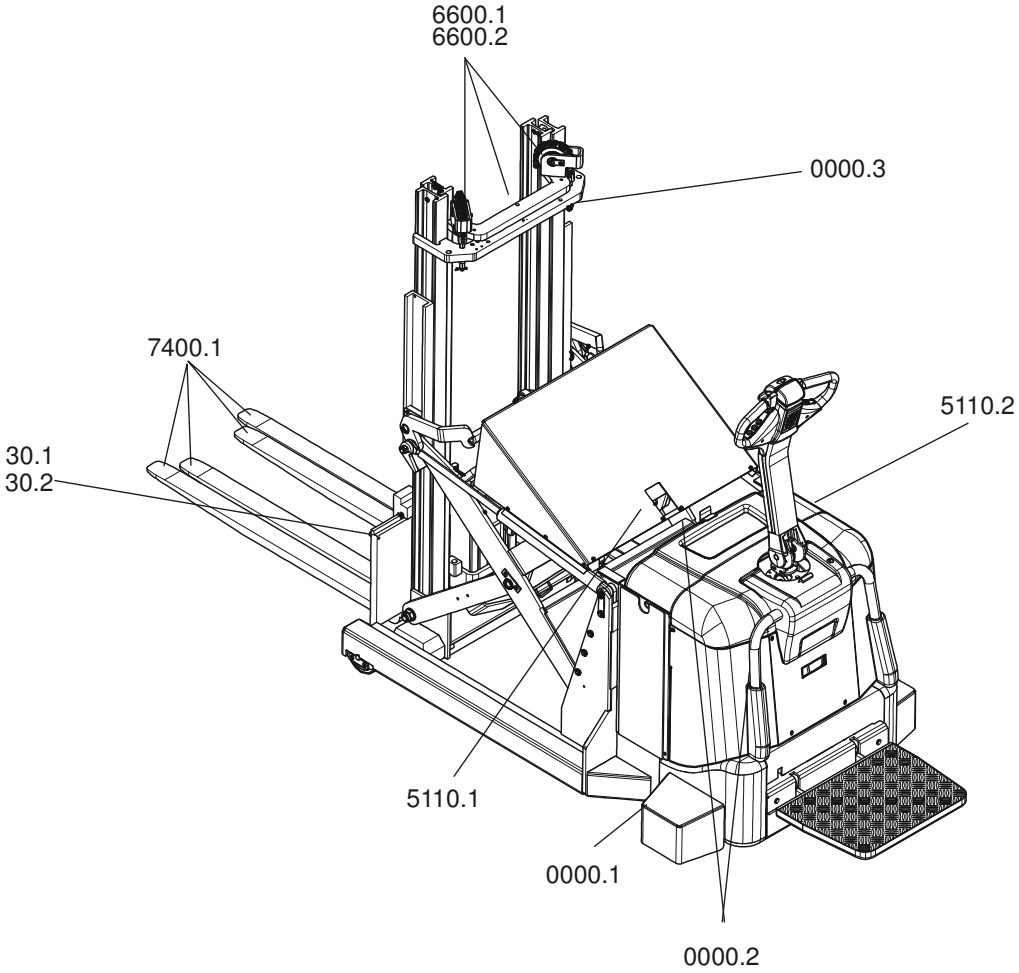
Note!
When you check or set a parameter, remember to generate a truck report with the truck’s specific parameter values. This separate information on truck-specific parameters can come in handy, e.g. in case of downtime, since the information is not available elsewhere.

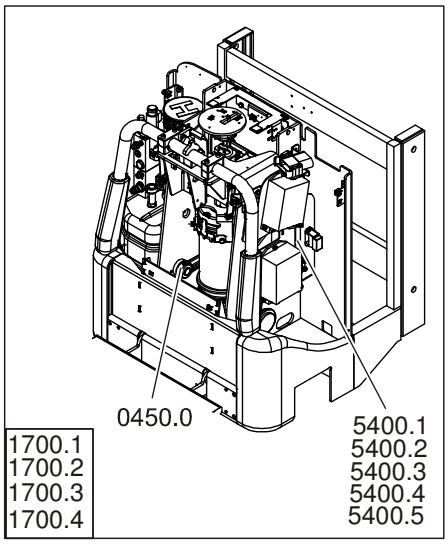
6.4.3 Test driving and checks

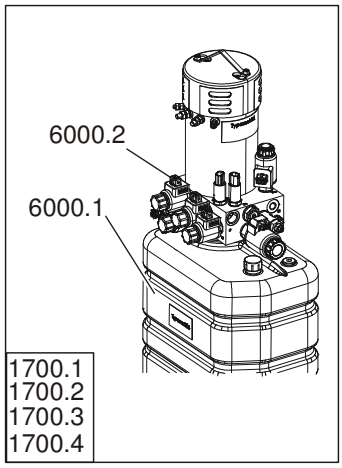
Prior to putting the truck into operation, check the following points:

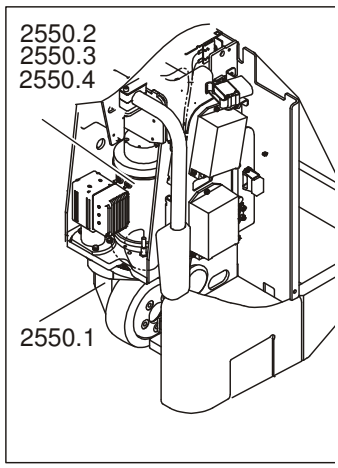
Inspection point	Procedure
Operating controls	Check functionality.
Switch for safety reversing	Check functionality.
Horn	Check functionality.
Steering	Check functionality.
Brake	Check functionality.
Emergency switch off	Check functionality.

7.5.2 Every 1000 operating hours/12 m



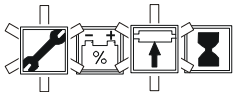
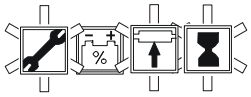
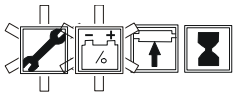
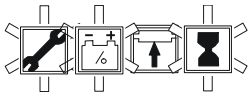
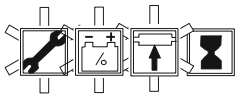






List of caution codes

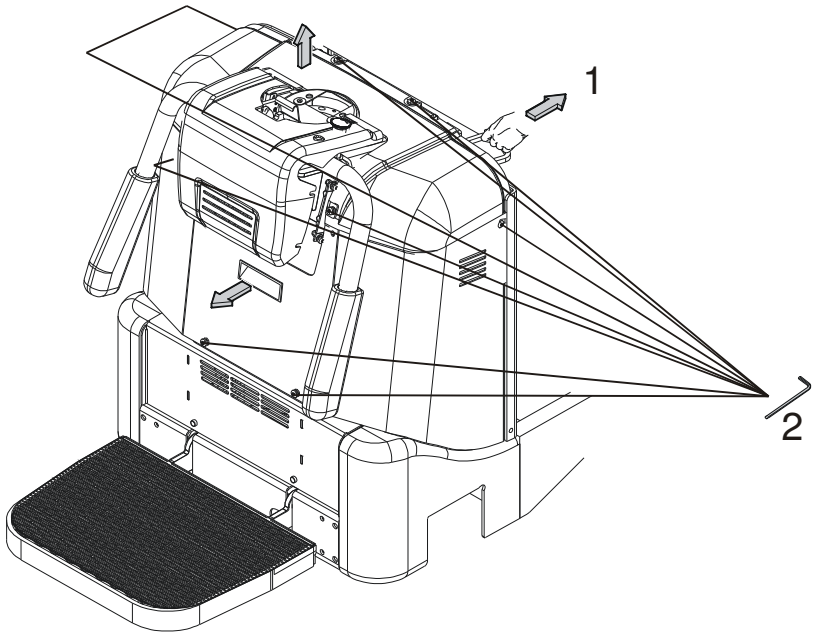
Code	Description	Possible cause/ *Action*
C30	Max. fork load exceeded	The load on the forks has exceeded the truck's rated lift capacity. / *Ensure the load to be lifted does not exceed the rated lift capacity* Check that lifting is not done against the mechanical stop. Applies to both main lift and secondary lift. Make sure the mast sections and lifting chains move freely. Check the pressure sensor output voltage [B4:INP.PRESSURE LIFT] ≈ 0.5 V with no load & lowered forks Carry out calibration for max. load. See "# 36 - Calibration" on page 5–14
C31	Max. fork load exceeded, inner and outer fork pairs (SPE120XRD)	The load on the inner and outer fork pairs exceeds the truck's rated lift capacity. / *Ensure the load to be lifted does not exceed the rated lift capacity* Check that lifting is not done against the mechanical stop. Applies to both main lift and secondary lift. Make sure the mast sections and lifting chains move freely. Check the pressure sensor output voltage [B4/B70:INP.PRESSURE LIFT] ≈ 0.5 V with no load & lowered forks Carry out calibration for max. load. See "# 36 - Calibration" on page 5–14
C35	Steering servo, internal temperature warning	The internal temperature of the steering servo [A5] has exceeded +68 °° C/ . *Steering servo may have been used too intensively.*
C41	Battery, under voltage warning for drive motor transistor regulator	Drive motor transistor regulator [A1] has detected battery voltage < 17 V Battery parameter incorrectly adjusted. *See "#21 - Battery size" on page 5–12 for setting of parameter #21.* *The battery must be charged.*
C42	Battery, overvoltage warning for drive motor transistor regulator	Drive motor transistor regulator [A1] has detected battery voltage >33 V Can be caused by having a fully-charged battery and energy return feed to the battery during heavy braking
C43	Drive motor transistor regulator, thermal cutback	Drive motor may have been stressed too much. Defective drive motor transistor regulator [A1].
C47	Battery, under voltage warning for pump motor transistor regulator	Pump motor transistor regulator [A3] has detected battery voltage< 17 V Battery parameter incorrectly adjusted. *See "#21 - Battery size" on page 5–12 for setting of parameter #21.* *The battery must be charged.*
C48	Battery, overvoltage warning for pump motor transistor regulator	Pump motor transistor regulator [A3] has detected battery voltage > 33 V
C49	Pump transistor regulator, thermal cutback	Lift function may have been used too intensively. Defective pump transistor regulator [A3].
C60	Pressure sensor error, lifting system	Voltage at input [B4:INP.PRESSURE LIFT] outside defined range +0.3 V to +7.7 V. / *Check pressure sensor [B4] cabling and function.* Defective pressure sensor [B4].

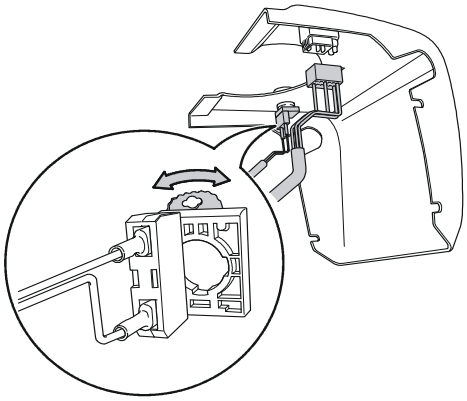
Built-in test functions			
Test mode	**Flashing symbol**	**Data shown**	**Unit**
9		Rotor current to pump motor [M3]	A
10		Field current to pump motor [M3]	A
11		Rotor pulse width modulation to pump motor [M3]	%
12		Signal from pressure sensor [B4] (Hydraulic pressure in lift circuit)	bar
13		Signal from pressure sensor [B5] (hydraulic pressure in PowerTrak circuit)	bar
14		Maximum lift pressure setting	bar

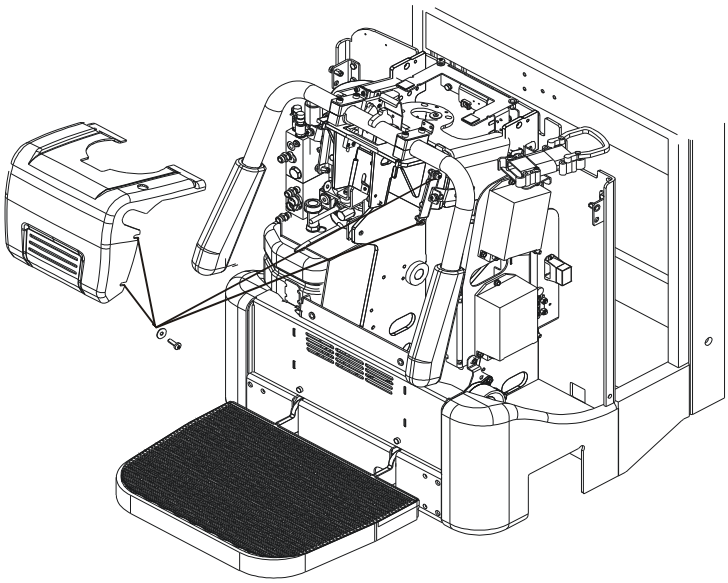
9. Frame/Chassis C0000

9.1 Inspection covers C0340

9.1.1 Opening the motor compartment







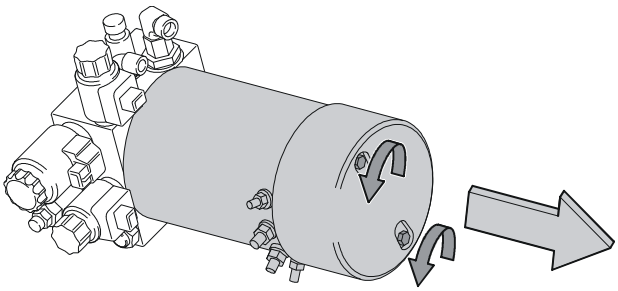
To open the motor compartment:

- Disconnect the truck battery
- Slacken the lower motor hood's six fastening screws.
- Grip the motor hood handle and pull straight up
- Raise the battery cover and slacken the upper hood's two fastening screws.
- Remove the hood.
- Undo the 2 screws of the centre cover.

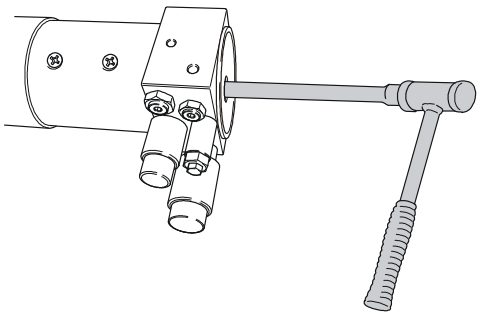
10. Motors C1000 – Action

10.1 Pump motor C1710

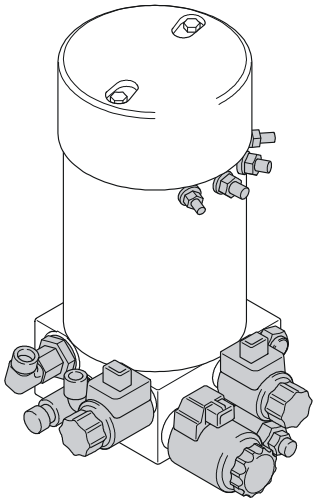
10.1.1 Replacing the pump motor



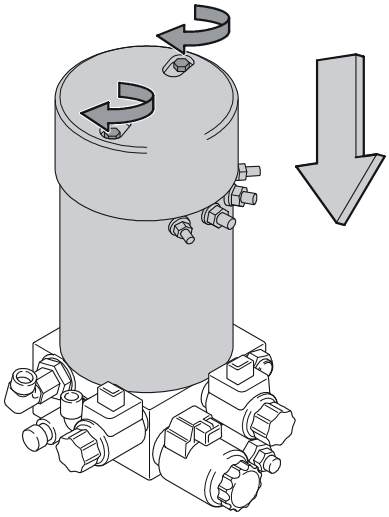
Step 6



Step 7



Step 9

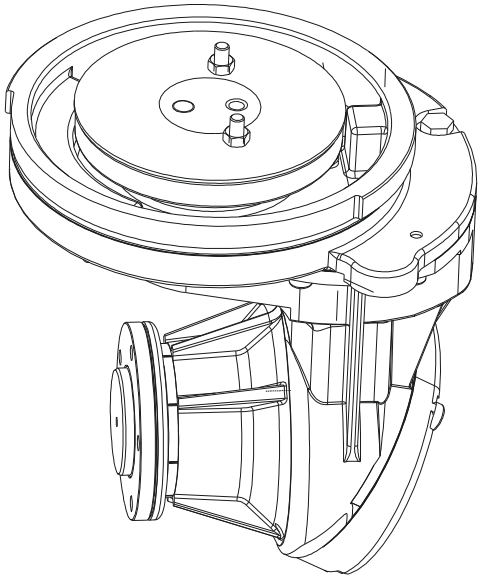


Step 10

11. Drive gear C2000

The drive gear is a two-stage angle gear which is integrated with the motor and brake to form a complete drive unit that can be steered through 180°.

The drive unit is anchored to the chassis with 8 screws At the top edge of the gear, the steering bearing and a gear ring for the steering motor (option) are fitted.



The drive gear is equipped with conical roller bearings for the drive shaft and pinion. The bearings are pre-tensioned to reduce the risk of play.

The input shaft has splines with which the drive motor's output shaft meshes.

The steering bearing and the steering gear ring are bolted to the drive gear and can be replaced once the drive unit has been removed from the truck and the motor unbolted from the drivegear.

12. Brakes and wheels C3000

12.1 Parking brake C3370

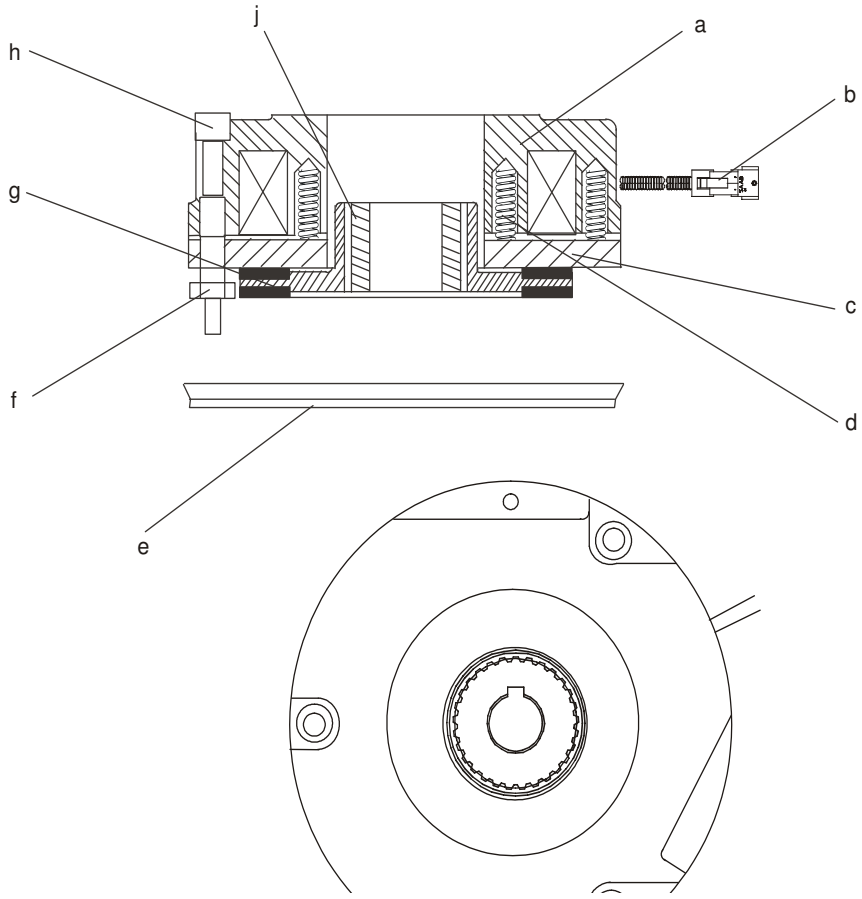
DANGER!

Risk of brake function being lost.

When work is done in the brake system, there is a risk of brake function being partly or completely lost.

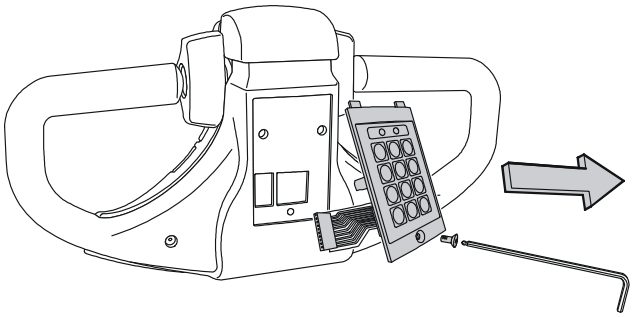
Only the actions described in this section may be done to the parking brake and the instructions must be followed strictly.

12.1.1 Overview

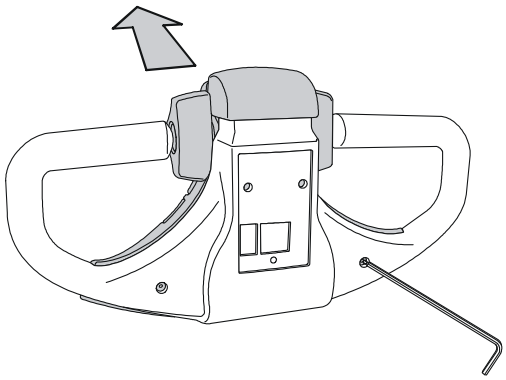


Pos.	Description	Pos.	Description
a	Magnetic coil	h	Mounting bolts
b	Electric wire	j	Hub
c	Pressure plate		
d	Compression springs		
e	Friction disc		
f	Adjusting locking nut		
g	Brake disc		

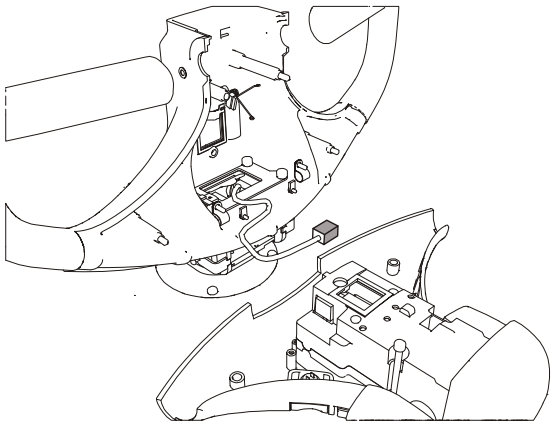
13.1.2 Disassembling/assembling the steering unit handle



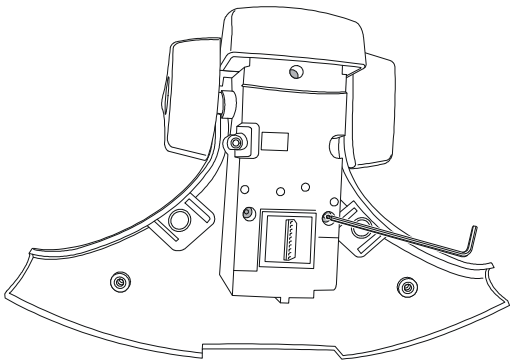
Step 2



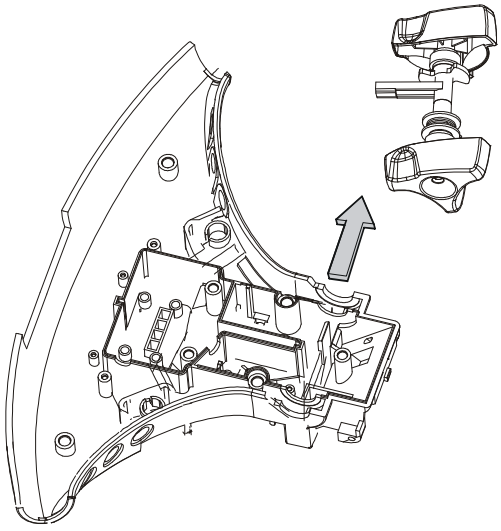
Step 3



Step 4



Step 5



Step 6

13.3 Adjustment

13.3.1 Reference sensor.

If replacement or adjustment of the reference sensor is to be done, screw it all the way down until it touches the highest part of the ring gear (12). Then screw it upwards two full turns and lock it with the nut. Calibrate the system using parameters 36 and 37.

13.3.2 Calibration

Calibration and adjustment of the steering servo is done using parameters 36 and 37.

Parameter 36

Parameter 36 calibrates the steering servo and must be adjusted when the following components are replaced.

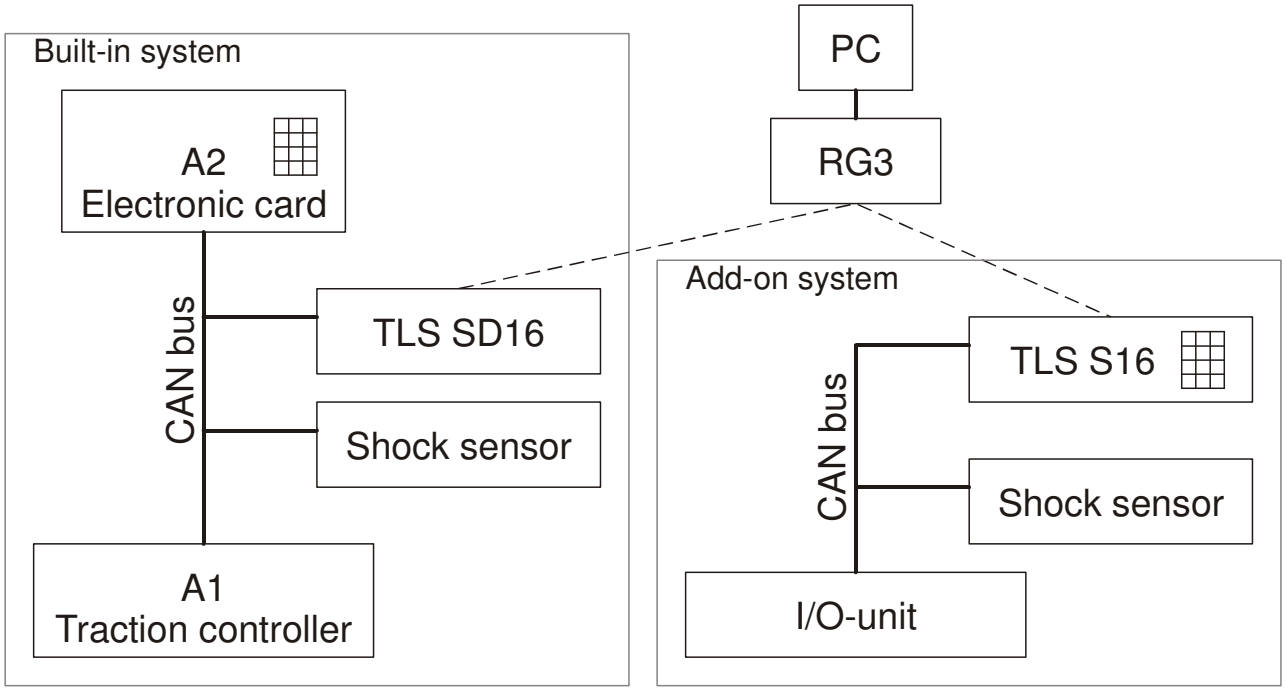
- Complete steering servo assembly or parts of the steering servo assembly.
- Reference sensor.
- Potentiometer.
- Following any work on the steering unit.

Detailed instructions as to the function of parameter 36 are presented in C code 5000.

Parameter 37

Parameter 37 adjusts the drive wheel centre position. The wheel can be adjusted 30 degrees to either side. Prior to adjustment of parameter 37, parameter 36 must be adjusted to ascertain the wheel's zero position.

Detailed instructions as to the function of parameter 37 are presented in C code 5000.



Logging in/out SD16

Logging in and out is performed as usual via the keyboard on the handle (or by using an ID unit). The difference is that communication passes through the TLS, which makes all the decisions.

Logging in/out S16

Logging in and out is performed using the keyboard on the TLS.

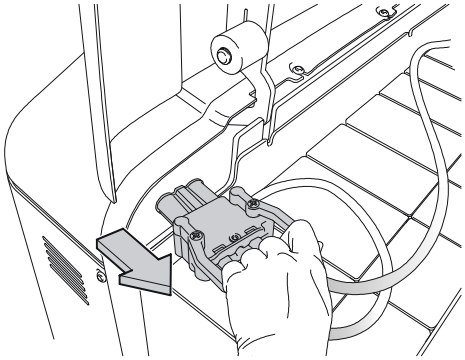
Collision sensor

If a collision sensor (shock sensor) is installed on the CAN bus, this registers when the truck bumps against something. If the impact exceeds a certain level, it is classified as a collision and the truck comes to a halt. It can be reset by entering the PIN code for "resetting the collision sensor" (see table below).

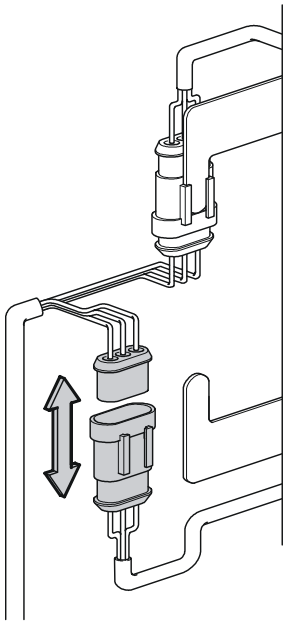
Settings

To change the TLS settings, additional equipment (software and wiring harness) is required from Davis Derby.

14.6.2 Replacing the position sensor for the secondary lift



Step 1



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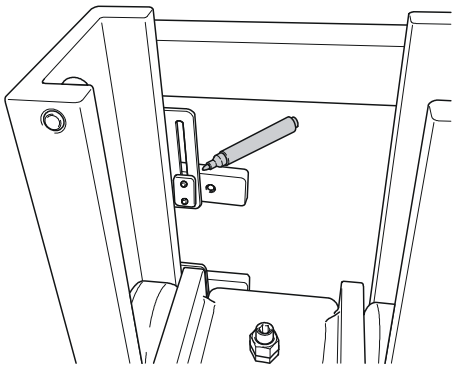
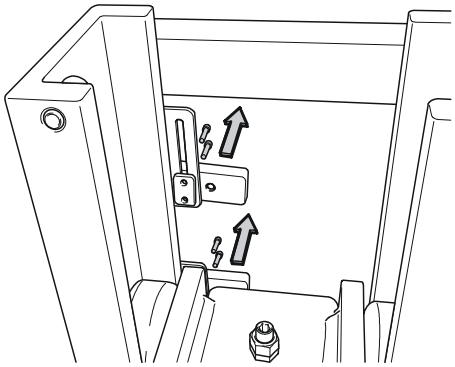
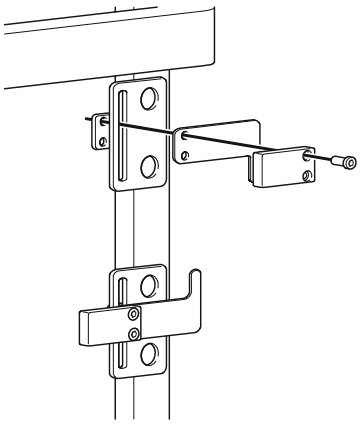


Step 3



Step 4



Step 5

15.4 Main valve C6210

15.4.1 Pressure limiting valve

The pressure limiting valve protects the system from excessively high pressure.

If the pressure in the hydraulic system rises to 210 bar, the pressure limiting valve will open. When the pressure limiting valve opens, oil will flow back to the tank.

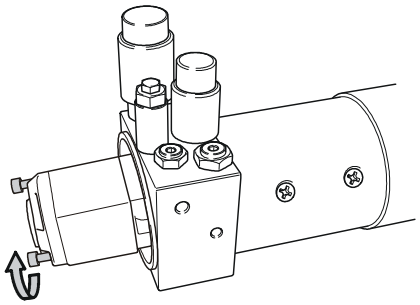
15.4.2 Pressure sensor

The pressure sensor [B4] [B4, B70 XRD] is used to adjust the speed and is affected by the load.

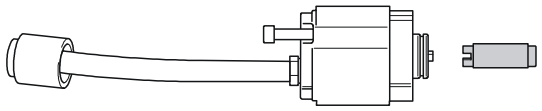
Load < 800 kg. Travel speed = 8.0 km/h.

Load > 800 kg. Travel speed = 7.0 km/h. Declines linearly to 7.0 km/h at maximum load.

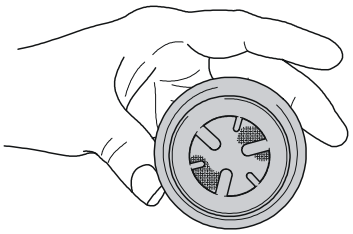
15.7.10 Replacing the oil pump



Step 4



Step 5



Step 7

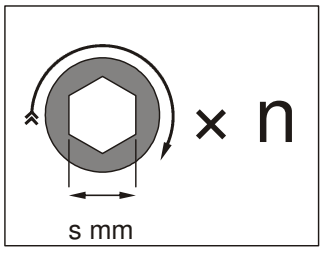
Method

1: Open the motor compartment. See section "9.1.1 Opening the motor compartment".

2: Remove the hydraulic unit. See section "15.7.8 Removing/installing the hydraulic unit".

3: Remove the reservoir from the motor. See section "15.7.9 Replacing the tank".

4: Remove the oil pump motor from the main valve by removing its two fastening screws. Make a note of the position of the oil pump.



Step 6: s = 6, n = 2
M_V = 20+5 Nm

5: When fitting, align the coupling between the oil pump and pump motor.

6: Carefully fit the oil pump so that the sealing is not damaged. Torque tighten the screws to 20+5Nm. Make sure that the oil pump ends up in the correct position.

7: If the oil pump strainer is to be refitted, it must be first cleaned.See section "15.7.1 Washing".

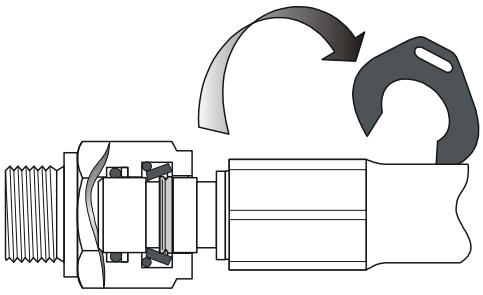
8: Fit the reservoir to the motor. See section "15.7.9 Replacing the tank".

9: Fit the hydraulic unit. See section "15.7.8 Removing/installing the hydraulic unit".

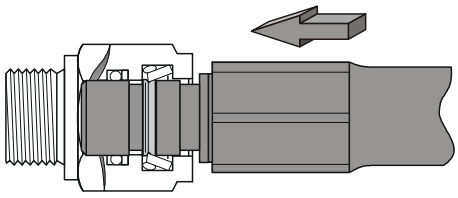
10: Close the motor compartment See section "9.1.2 Close the motor compartment".

11: Connect the battery.

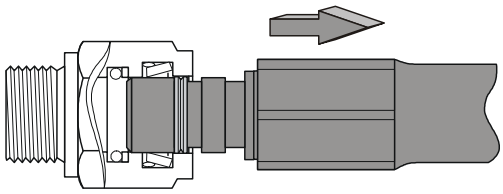
Dismantling the quick change connector



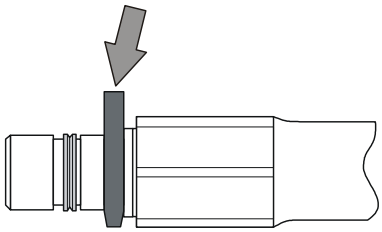
Step 1.



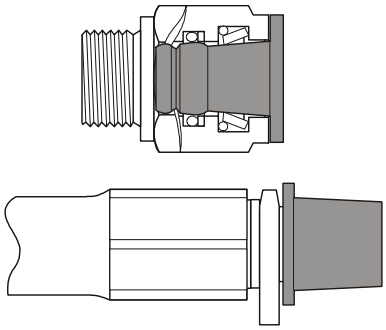
Step 2.



Step 3.



Step 4.



Step 5.

1: Use a screwdriver or similar to remove the assembly stop.

2: Push the male fitting all the way into the female fitting.

3: Pull the male fitting out of the female fitting.

4: Refit the assembly stop to the male fitting.

5: Fit the protective plugs on the connection and hose to prevent oil spillage.

Method

1. Remove the forks to facilitate handling.
2. Remove the secondary mast: See section "16.2.1 Removing the secondary mast/cylinder".
3. Remove the plexigas at the top member.
4. Disconnect the electrical cables from the mast.
   See section "14.6.1 Replacing the position sensor with 1.8 m XR/XRD".
5. Detach the hose running to the main lift cylinders.

Note!
Oil leaking.
Risk of valve or cylinder failure if dirt enters the hydraulic connections.
Therefore, plug all hydraulic connections.

6. Prepare the lift of the mast by attaching a suitable lifting yoke or attach lifting straps around the mast frame's top beam.
   Note, you cannot lift using the guides' top beam.

DANGER!

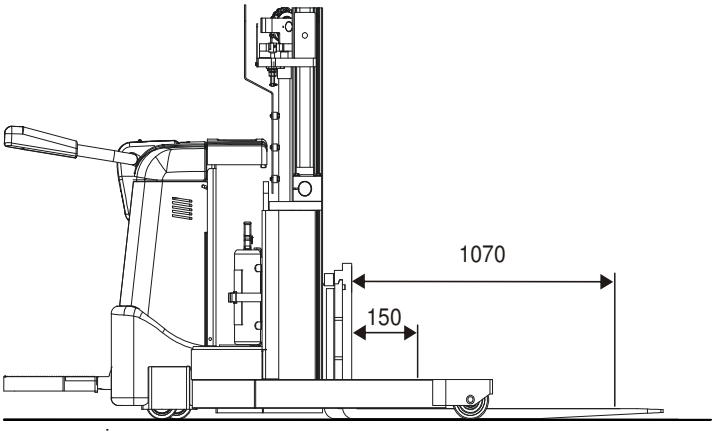
Make sure that the lifting straps are properly secured to the mast.

7. Tension the lifting straps by using a lifting device (overhead crane, crane or truck).
8. Remove the lower mast mount (E, G, H).

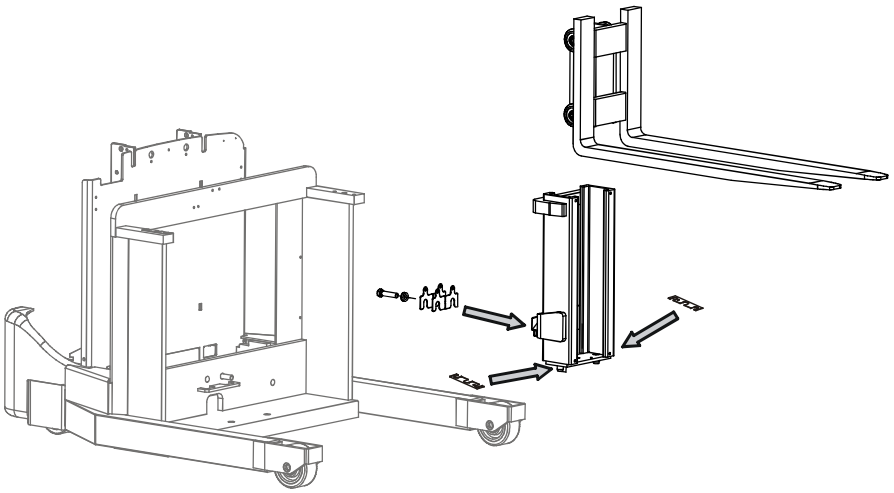
Position	Description
A	Screw
B	Nut
C	Pin
D	Guide roller
E	Mast mount
F	Bushing
G	Washer
H	Nut

9. Loosen the lower screws and nuts used to adjust the rollers in the mast (A, B).
10. Carefully angle the mast by using the overhead crane to guide the rollers on the lower part of the mast outside of the roller beam so that the mast can be lifted.
11. Carefully lift out the mast and place it horizontally on some pallets or suchlike.

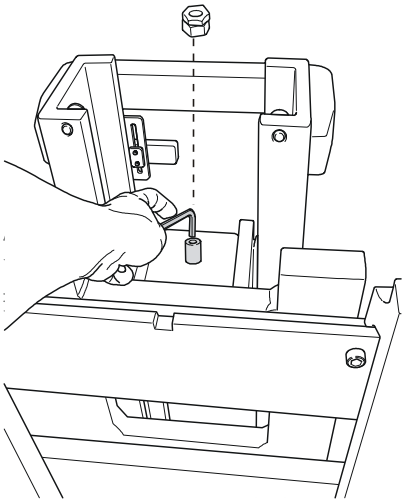
16.2.3 Adjusting and shimming the secondary mast.



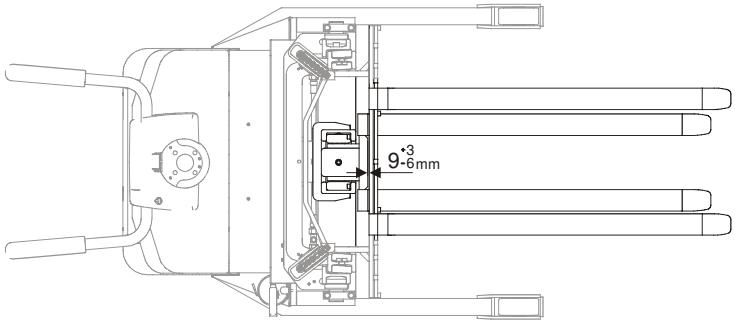
Step 1



Step 2

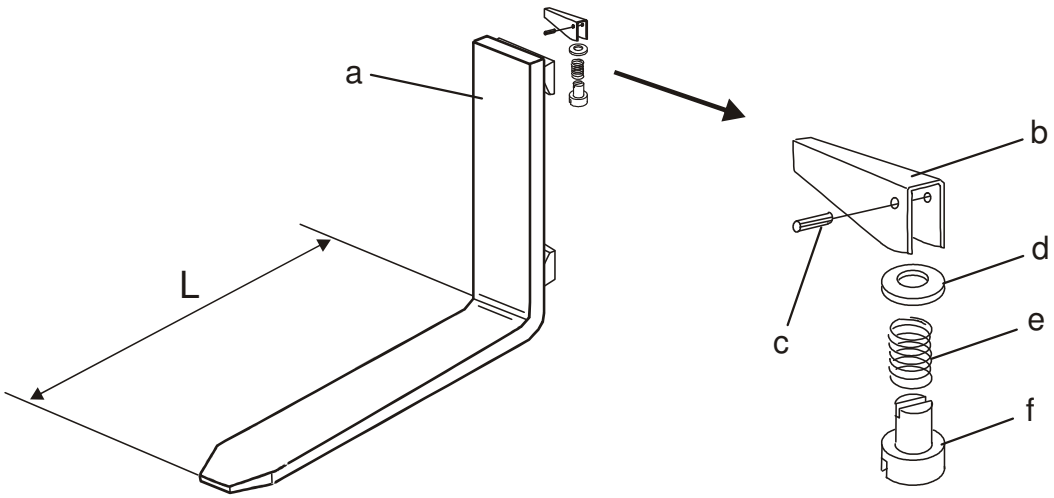


Step 3



Step 4

Forks-general

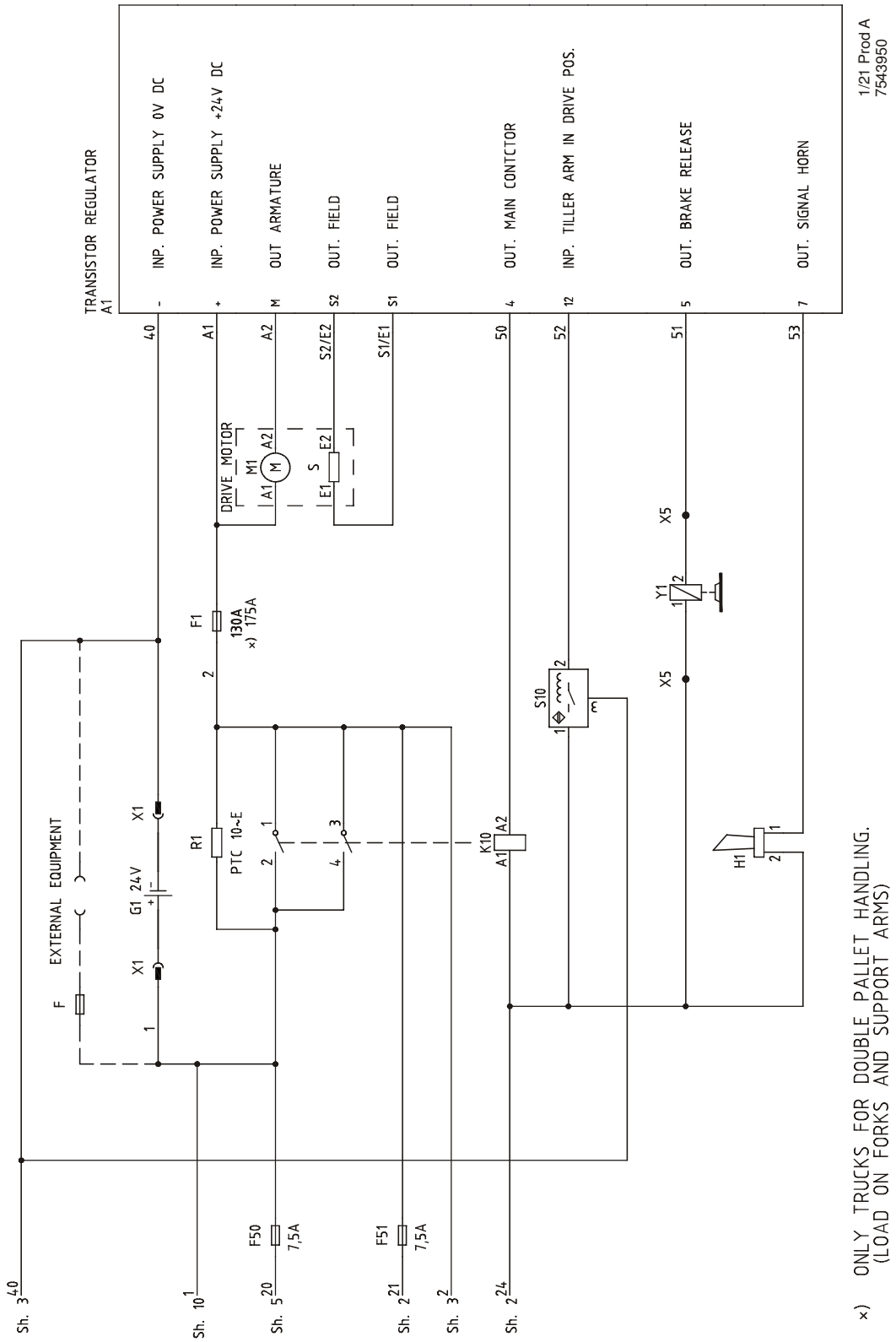


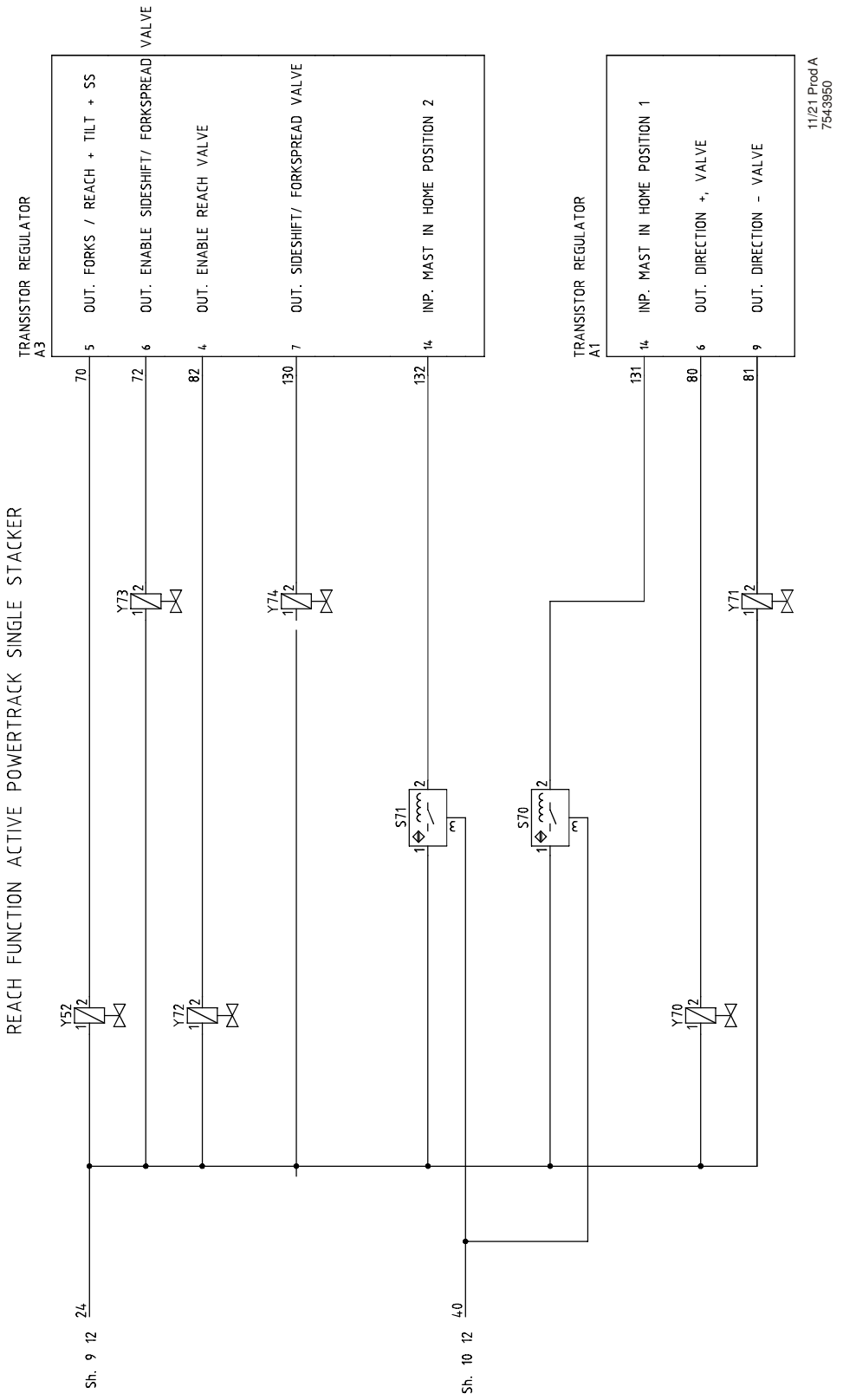
a. Fork
b. Clamp
c. Spring pin
d. Washer
e. Spring
f. Lock

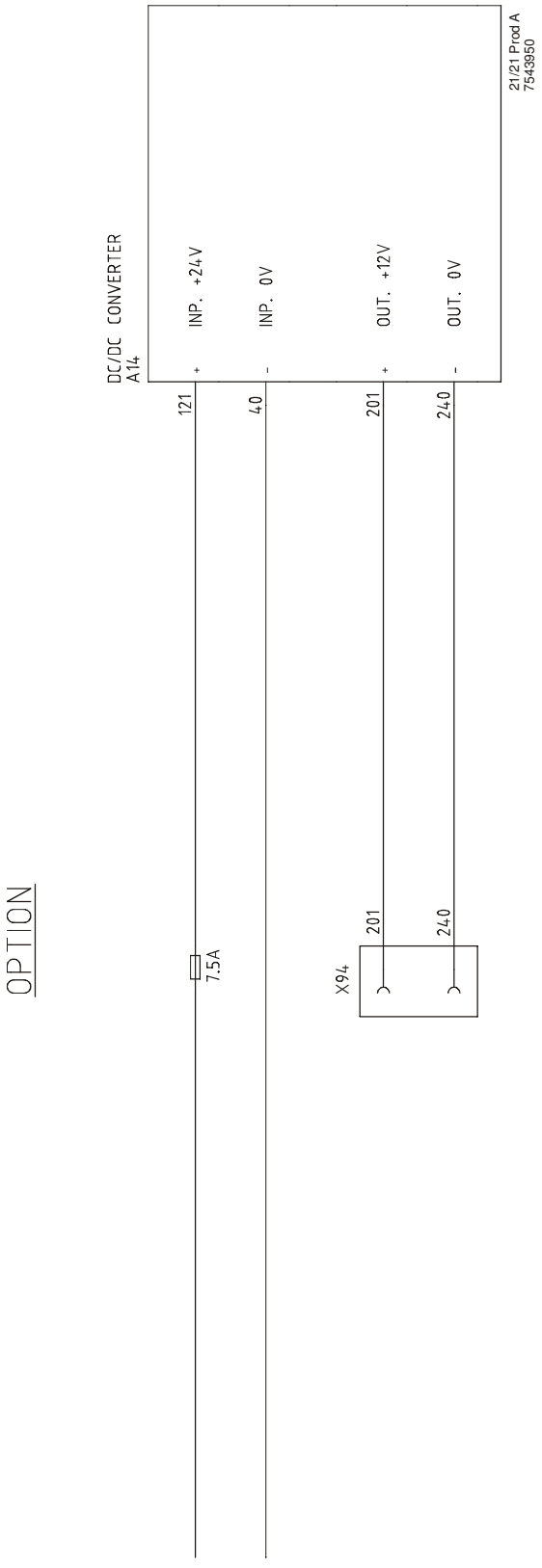
Component	Category	Comment
Tiller arms	Electronic components Wires Iron/steel, also gas dampers	Be sure to depressurise dampers
Electrical system	PCBs, transistor regulators, Expansion unit SEU, contactors: Electronic components Wires	Hazardous waste
	Small batteries	Hazardous waste
	Fluorescent tubes	Hazardous waste. Because of the chemical content in fluorescent tubes, do not destroy them. Used fluorescent tubes must be packaged and transported according to local regulations.
Mast	Mast beams, rollers, cylinders, hydraulic pipes: Iron/steel Hydraulic hoses: Oil-polluted () Wires Sensors/switches: Electronic components Plastic components: According to marking or as combustible waste	Oil-polluted components should be handled as hazardous waste
Chargers and connectors	Electronic components Wires	

— Slut på avsnittet —

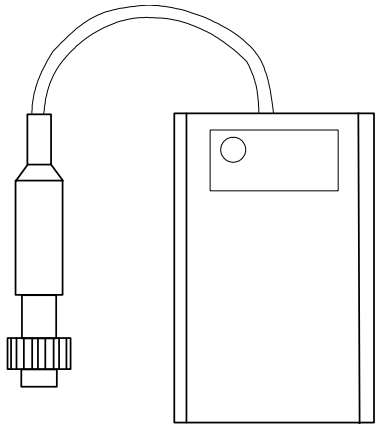
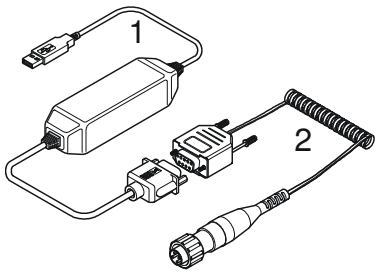
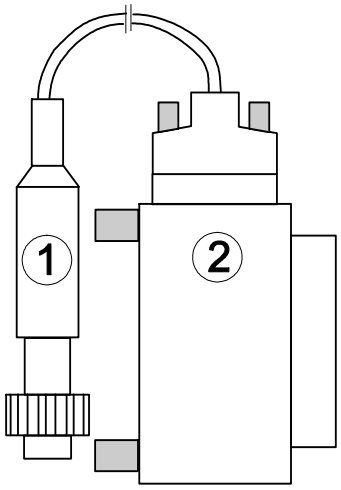
19.4 Wiring diagrams




REACH FUNCTION ACTIVE POWERTRACK SINGLE STACKER
TRANSISTOR REGULATOR
A3
5 OUT. FORKS / REACH + TILT + SS
6 OUT. ENABLE SIDESHIFT/ FORKSPREAD VALVE
4 OUT. ENABLE REACH VALVE
7 OUT. SIDESHIFT/ FORKSPREAD VALVE
14 INP. MAST IN HOME POSITION 2
TRANSISTOR REGULATOR
A1
14 INP. MAST IN HOME POSITION 1
6 OUT. DIRECTION +, VALVE
9 OUT. DIRECTION - VALVE
70
72
82
130
132
131
80
81
Y52
Y73
Y72
Y74
S71
S70
Y70
Y71
24
Sh. 9 12
40
Sh. 10 12
11/21 Prod A
7543950


21/21 Prod A
7543950
DC/DC CONVERTER
A14
INP. +24V
INP. 0V
OUT. +12V
OUT. 0V
+
-
+
-
121
40
201
240
OPTION
7.5A
X94
201
240

21.5 Other tools

Tools	Number	Use
	7516708	Service instrument (CAN)
	1=7521083 2=163793	Service instrument (CASTOR USB) for programming
	1=163793 2=163792	Service instrument for program changes