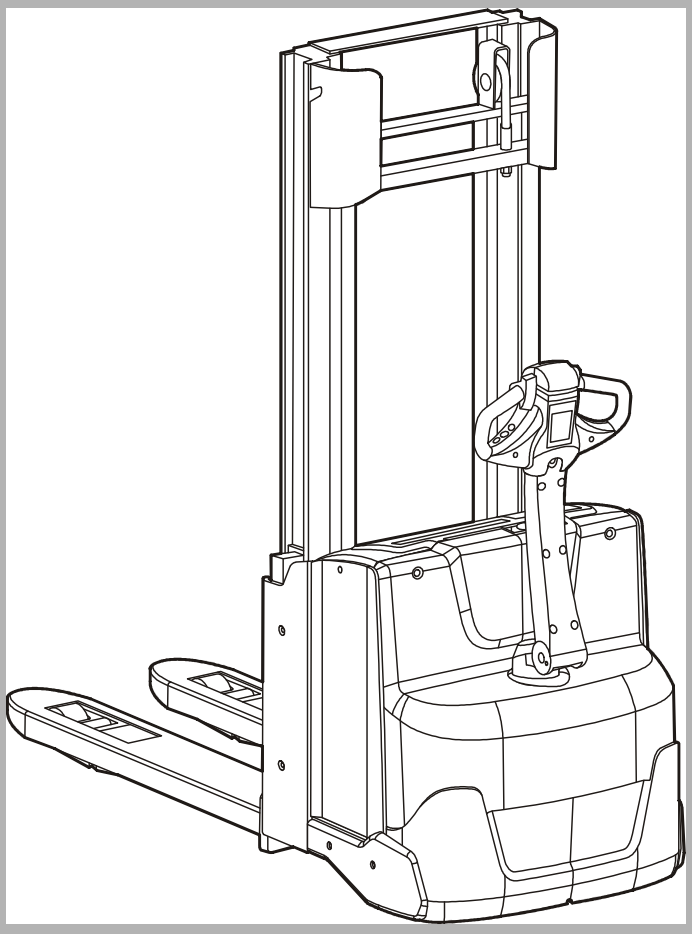
Repair manual 7588857-040

S210, S212, S212S, S212L, S214, S214L, S220D.



Translation of the original instructions.

Document revisions:

Issue date	Order number	Changes
2015-09-01	7588857-040	Completely new issue.
2016-12-01	7588857-040	Chapter 4: Operations and connection sequence - Updated Chapter 7: Maintenance - New value for clearance Chapter 8: Troubleshooting - New error codes added Chapter 12: Brake system/wheels - New dust cover and brake clearance Chapter 15: Hydraulics - Replacing the hose rupture valve added
2017-09-30	7588857-040	Chapter 8: Troubleshooting - Error codes 3:547 and 3:583 updated Chapter 12: Brake system/Wheels - Updated Chapter 13: Steering system - Updated Chapter 23: Lubricants specification - added lubricants for the food processing industry
2018-05-01	7588857-040	Chapter 5: Parameter - Parameter 109 updated Chapter 6: Installation - PIN codes updated Chapter 8: Troubleshooting - Error code 8:033 added Chapter 12: Brake system/wheels - New dust cover Chapter 16: Mast - Added replacing the idler roller and the chain bolt

This manual contains information on the following trucks:

T-Code	Model:	Serial number
841	S210	6384351-
841	S212	6384351-
842	S212L	6384351-
841	S214	6384351-
842	S214L	6384351-
842	S220D	6384351-
843	S212S	6384351-

1. Contents

2. General introduction

2.1 How to use this manual

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

- **General safety rules.**
- **Operation and connection sequences** – This chapter provides a basic description of the main functions of the truck and their interdependencies.
- **Parameters** – This chapter provides a basic description of the truck parameters.
- **Installation** – This chapter describes the preparatory work that is to be done before the truck is used for the first time.
- **Maintenance** – This chapter provides an overview of periodic maintenance.
- **Troubleshooting** – This chapter describes the action you should take when the truck is completely or partially malfunctioning. It also describes the cause of the problem together with suggested remedies.
- **C codes** – 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 Cesab's C code system.
- **Instructions for disposal** – This chapter specifies the proper sorting categories for the materials used in the various truck components.
- **Wiring diagram** – This chapter provides information on electrical components and wiring diagrams.
- **Hydraulic diagram** – This chapter provides information on hydraulic components and hydraulic diagrams.
- **Tools** – This chapter provides a list of the special tools required.
- **Service data and grease specifications** – This chapter contains information on general tightening torques and an oil and grease specification.
- **Technical data**.

2.2 Warning levels and symbols

The following warning levels and symbols are used in the repair manual:

DANGER

Indicates a dangerous situation that – if not avoided – will cause death or serious bodily injury.

WARNING

Indicates a dangerous situation that – if not avoided – will cause a slight or minor bodily injury.

NOTE

Indicates a dangerous situation that – if not avoided – will cause a slight or minor bodily injury.

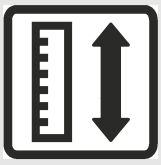
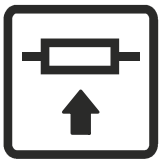
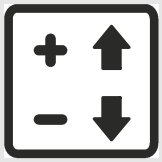
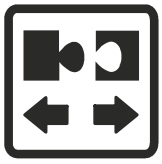
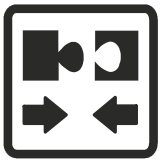
Note:

Used in connection with actions that can cause material damage but not bodily injury.

Note:

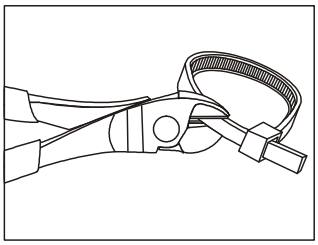
Used to attract attention and to give information about various actions.

2.3 Pictograms

Symbol	Measure	Symbol	Measure
	Visual inspection of condition, wear and loose connections.		Component replacement.
	Cleaning		Measurement
	Check of fluid level and check for leaks.		Check that bolts, nuts, etc. are tightened to torque.
	Listening for noise.		Lubrication, application.
	Check of functions.		Calibration
	Adjustment		Welding
	Disassembly/removal		Assembly/installation

Symbol	Measure	Symbol	Measure
	Open		Close
	Refilling		Emptying
	Update		

An example of another type of pictogram is “Cut cable ties”:



Additional information under the pictogram can, for example, indicate the number of cable ties to be cut.

— Slut på avsnittet —

3. General safety rules

Only personnel trained in servicing and repair of this type of truck are authorised to carry out service and repair activities.

3.1 Work safety

To make work safer and prevent accidents, always keep the following in mind:

- Keep the maintenance work site clean. Oil and water on the floor will make it slippery.
- Use the correct working posture. Service work often involves sitting on your knees or bending over forwards. Try sitting on a toolbox, for example, to relieve the strain on your knees and back.
- Loose items and jewellery can get caught in moving parts of the truck. So never wear loose articles or jewellery while working on the truck.
- Exercise caution and always follow applicable local regulations when working at high heights.
- Use the correct tools for the work you are carrying out.
- Keep all tools well maintained.
- Make sure that all safety equipment including guards and covers are properly secured and that they work as intended before starting the repair work. If a guard or cover must be removed in order to perform the repair work, extra care must be taken, and when the repair work is finished the guard or cover must be refitted.
- Relieve the system pressure slowly before starting work on the truck's hydraulic system.
- Use paper or a stiff piece of cardboard when checking for possible oil leaks. Do **not** use your hands.
- Drive unit oil and the hydraulic system oil may be hot.

DANGER!
Risk of burn injury.
Hot drive unit and hydraulic oil.
Allow the truck to cool down before changing the oil.

- Only fill the hydraulic system with new and clean oil.

DANGER!

The hydraulic system can be damaged.

If the oil is contaminated, the hydraulic components will suffer damage.

Always use new and clean oil in the hydraulic system.

- Store and transport changed oil according to applicable local directions.
- Do not flush solvents, etc. down the drain unless they are intended to be disposed of in this way.
  Follow local disposal regulations.
- Disconnect the battery prior to performing any welding work on the truck.

Note:

The battery could be damaged.

When welding with an electric welding unit, the current may enter the battery.

The battery must be disconnected.

- Prior to welding or grinding on painted surfaces, be sure to remove the paint at least 100 mm around the welding/grinding area by using sandblasting equipment or paint remover.

DANGER!

Harmful gasses.

Heated paint gives off harmful gases.

Remove all paint within 100 mm of the welding/grinding site.

3.2 Electrical system

When working on the electrical system of the truck, remember the following:

- Never wear loose items or jewellery when working with the truck.

DANGER!
Short-circuiting/Burn injury.
Short circuits and burn injuries can occur if metal objects come into contact with live electrical connections when working on the truck's electrical system.
Remove wristwatches, rings and other metal objects beforehand.

- Always use insulated tools when working on the electrical system.
- Always disconnect the battery before opening any covers to drive units or the electrical system.
- Always disconnect the battery prior to welding work using an electric welding unit. The welding current may damage the battery.
- Always disconnect the battery when carrying out maintenance or repair work on the truck unless otherwise stated in this repair manual.
- Clean electric motors using a rag or a vacuum cleaner.
- Clean electrical panels, electronic cards, contactors, contacts, magnetic valves, etc. with a dampened cloth and a cleaning agent that will not damage the part.

Note:
Risk of short-circuiting that may damage electrical components.
Do not break the warranty seal on the logic cards.

3.3 Safe lifting

All lifting must be carried out on a level, non-slip and stable surface. Asphalt surfaces should be avoided if possible.

To prevent the truck moving while it is being lifted, it must not be lifted with anyone on the platform or with the tiller arm in the lowered position.

If the drive wheel, which is braked, is being lifted the other wheels must be chocked to stop the truck from moving.

Select the lifting point so that the lift is as light as possible, for example one corner at a time. If the truck has marked lifting points on the lower part of the chassis, these must be used to ensure balanced lifting.

Make sure the surface where the jack is placed is clean and free of oil and grease.

Make sure your hands and the jack lever are free of grease and oil.

Only use the lever supplied with the jack. If the lever is too short, more exertion than is necessary will be required. If the lever is too long, there is a risk that the jack will be overloaded.

DANGER!

Risk of crushing since a poorly supported truck could fall down.

Never work under a truck that is not supported by trestles and secured by a lifting device.

Support the truck:

- as close to the lifted part of the chassis as possible in order to reduce the falling height if the truck should collapse
- so the truck cannot move.

Never support the jack on trestles to achieve a higher lift.

Never work under a raised truck without it being properly supported on trestles.

3.4 Truck modifications

Any modification of the truck must be approved beforehand. No modification of truck may be performed that may influence the capacity, stability and safety of the truck without prior written approval from the manufacturer, its representative or successor.

In the case of the manufacturer no longer being in business and there being no successor, the user of the truck may arrange for modifications on the precondition that the user:

- makes sure that an engineer with expert knowledge of industrial trucks and their safety designs, tests and implements the modification,
- files all documentation of the designs, tests and implementation of the modification,
- approves and makes the applicable changes to the capacity plate, adhesive labels, markings and operator’s manual and
- affixes a permanent and well visible sign to the truck stating how the truck has been modified, together with the date of the modification and the name and address of the company that carried out the modification work.

— Slut på avsnittet —

4. Operation and connection sequences

This section provides a basic description of the main functions of the truck.

The terms below are used in the description of the truck's main functions.

- Event – Use of one of the truck's main functions is referred to as an event.
- Prior event – Indicates an event which must have taken place immediately before the current event in order for the latter to be performed correctly.
- Action(s) – An action that the driver must perform in order for an event to happen.
- Influencing elements – Conditions that must be fulfilled in order for an event to happen. 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 resulting conditions indicate what is assumed to occur when there is no error state.

Text within square brackets [ ] refer to the electrical component names in the truck's electrical diagram.

{High} means ˜ 24 V and {low} means ˜ 0 V unless otherwise specified.

Symbols on keypad and display

Symbol	Description
	ON button This button is used to start the truck and confirm entered settings during PIN code management
	OFF button
	Error code
	Battery charge as a percentage
	Parameter
	Hour counter

4.1 Battery is connected

Event	Connection of battery
Preceding event	-
Action(s)	Connect the truck battery [G1]
Influencing elements	Main power fuses OK [F1] Operating circuit fuses OK [F50, F51]
Resulting conditions	The status LED for the transistor regulator lights continuously [T1].

4.2 Login via keypad

Event	Logging in
Preceding event	The battery is connected.
Action(s)	Enter a valid PIN code and press the ON button on the keypad [S223].
Influencing elements	The emergency stop [S21] has not been activated [T1:INP. SUPPLY+24V DC] {high}. Tiller arm sensor in drive position [B60].
Resulting conditions	The power indicator lamp is lit. Main display shows the hour counter for 4 seconds and after this the battery charge level as a percentage of full charge. The mechanical brake remains applied [Q1] [T1:OUT.BRAKE RELEASE] {high}.

4.3 Tiller arm lowered for driving

Event	Tiller arm lowered for driving
Preceding event	Start the truck.
Action(s)	Lower the tiller arm.
Influencing elements	Tiller arm sensor in drive position [B60].
Resulting conditions	Tiller arm sensor in drive position activates [B60] [T1:INP. TILLER ARM IN DRIVE POS] {low}.

4.4 Driving in fork direction

Event	Driving in fork direction
Preceding event	Tiller arm is lowered to the drive position.
Action(s)	Turn the speed control in the fork direction.
Influencing elements	Speed control with Hall sensor [A5:S310-318] Settings of operator parameters 4, 5 and 6 determine truck travel performance.
Resulting conditions	The main contactor output voltage goes {low} [T1:OUT. MAIN CONTACTOR] The main contactor closes [Q10]. [T1:OUT.BRAKE RELEASE] goes {low}. Brake coil [Q1] is activated, and the mechanical brake is released. Power is fed to the drive motor's field coils (S2 +ve and S1 -ve). Pulsed current feed to drive motor rotor is proportional to speed control actuation.

4.5 Driving in the drive wheel direction

Event	Driving in the drive wheel direction
Preceding event	Tiller arm is lowered to the drive position.
Action(s)	Turn the speed control in the drive wheel direction.
Influencing elements	Speed control with Hall sensor [A5:S300-308] Settings of operator parameters 4, 5 and 6 determine truck travel performance.
Resulting conditions	The main contactor output voltage goes {low} [T1:OUT. MAIN CONTACTOR] The main contactor closes [Q10]. [T1:OUT. BRAKE RELEASE] goes {low}. Brake coil [Q1] is activated, and the mechanical brake is released. The current feed to the drive motor field winding (S2 -ve and S1 +ve). Pulsed current feed to drive motor rotor is proportional to speed control actuation.

4.6 Neutral position braking

Event	Neutral braking
Preceding event	Truck travels in fork or drive wheel direction.
Action(s)	Allow the speed control to return to the neutral position.
Influencing elements	Setting of operator parameter 5.
Resulting conditions	The drive motor [M1] works as a generator and via the transistor regulator [T1] it converts the truck's kinetic energy into electricity, thus reducing the truck’s speed. The excess energy, in the form of electricity, is fed back to the battery [G1] helping to recharge it. The mechanical brake [Q1] is applied when the truck stops. [T1:OUT.BRAKE RELEASE] goes {high}.

4.7 Reverse braking

Event	Reverse braking
Preceding event	Truck travels in fork or drive wheel direction.
Action(s)	Speed control turned to opposite travel direction.
Influencing elements	Parameter 201.
Resulting conditions	The drive motor [M1] works as a generator and via the transistor regulator [T1] it converts the truck's kinetic energy into electricity, thus reducing the truck’s speed. The excess energy, in the form of electricity, is fed back to the battery [G1] helping to recharge it. The braking effect increases the more the speed control is turned. The mechanical brake [Q1] [T1:OUT. BRAKE RELEASE] is applied when the truck stops.

4.8 Mechanical braking

Event	Mechanical braking
Preceding event	Truck travels in fork or drive wheel direction.
Action(s)	The tiller arm is folded completely up or down.
Influencing elements	Tiller arm sensor in drive position [B60].
Resulting conditions	Sensor for tiller arm in drive position [B60] is deactivated [T1: INP. TILLER ARM IN DRIVE POS] {low}. When the tiller arm is completely raised or lowered, maximum permitted brake reduction is applied for 200 ms or until the travel speed is lower than 0.8 m/s. After this, the mechanical brake [Q1] is applied. [T1:OUT.BRAKE RELEASE] {high}.

4.9 Emergency reversal

Event	Emergency reversal
Preceding event	Driving in the drive wheel direction
Action(s)	When driving in the drive wheel direction, the emergency reversal button is pressed
Influencing elements	Emergency reversal
Resulting conditions	The Hall sensor [A5:S317] is immediately activated. The card [A5] interprets this signal as a command to the transistor regulator [T1] to run the drive motor at a reduced speed in the fork direction as long as the button is depressed. The normal drive command signal received from [L1] is blocked until [L1] is released and returns to neutral position.

4.10 Fork lifting

Event	Fork lifting
Preceding event	Start the truck.
Action(s)	Press the fork lift button [A5:S320].
Influencing elements	Main contactor [Q10]. Fuse [F1]. Lift forks button [A5:S320] Battery status OK (battery discharge indicator > 0 or battery charge > 20 %).
Resulting conditions	Pump motor [M3] starts.

4.11 Fork lifting (S210)

Event	Fork lifting
Preceding event	Start the truck.
Action(s)	Press the fork lift button [A5:S320].
Influencing elements	Main contactor [Q10]. Fuse [F1]. Lift forks button [A5:S320] Battery status OK (battery discharge indicator > 0 or battery charge > 20 %).
Resulting conditions	Pump motor [M3] starts.

4.12 Support arm lift (S212L, 214L, S220D)

Event	Fork lifting
Preceding event	Start the truck.
Action(s)	Press the button for support arm lift [A5:S321].
Influencing elements	Main contactor [Q10]. Fuse [F1]. Button for support arm lift [A5:S321]. Battery status OK (battery discharge indicator > 0 or battery charge > 20 %).
Resulting conditions	Pump motor [M3] starts.

4.13 Fork lowering

Event	Fork lowering
Preceding event	Start the truck or commence fork lifting.
Action(s)	Press the fork lowering button [A5:S321].
Influencing elements	Main contactor [Q10]. Fork lowering button [A5:S321].
Resulting conditions	[T1:OUT. LOWER VALVE] goes {low}, the hydraulic lowering valve [Q4] opens.

4.14 Support arm lowering (S212L, 214L, S220D)

Event	Fork lowering
Preceding event	Start the truck or commence fork lifting.
Action(s)	Press the support arm lowering button [A5:S321].
Influencing elements	Main contactor [Q10]. Support arm lowering button [A5:S321].
Resulting conditions	[T1:OUT. LOWER VALVE] goes {low}, proportional valve [Q4] opens.

4.15 Click-2-Creep

Event	Click-2-Creep
Preceding event	Start the truck.
Action(s)	Quick double-actuation of the speed control to activate the function. Set the tiller arm in the vertical position and drive the truck at creep speed (2.5 km/h).
Influencing elements	Main contactor [Q10]. Setting of factory parameter 1002.
Resulting conditions	[T1:OUT.BRAKE RELEASE] goes {low}. Brake coil [Q1] is activated, and the mechanical brake is released. Power is fed to the drive motor's field coils (S2 +ve and S1 -ve). Pulsed current feed to drive motor rotor is proportional to speed control actuation. “SLO” is displayed (flashes).

4.16 Turtle function (option)

Event	Turtle function (option)
Preceding event	Tiller arm is lowered to the drive position.
Action(s)	Press [S206] to activate this function. Turn the speed control in either direction.
Influencing elements	Main contactor [Q10]. Option button 1 [S206]. Setting of operator parameter 7 and service parameter 202.
Resulting conditions	[T1: OUT. BRAKE RELEASE] goes {low}. Brake coil [Q1] is activated, and the mechanical brake is released. Power is fed to the drive motor's field coils (S2 +ve and S1 -ve). Pulsed current feed to drive motor rotor is proportional to speed control actuation. The maximum travel speed is determined by operator parameter 7. “SLO” is displayed (lit continuously).

5. Parameters

5.1 General

The truck's control system can store a number of different parameters. These are used to configure the truck according to the task to be performed. The parameters are divided into groups:

- **Operator parameters** – The driver parameters (1-100) are used to adapt the truck’s characteristics to a specific driver or task. Up to 10 operator parameter profiles can be stored.
- **Service parameters** – The service parameters (range 101–1000) are used to adapt the truck's performance/response and cover all other parameters not covered by the operator parameters.
- **Factory parameters** – (range 1001-1250). Truck-specific parameters.

Operator parameters are displayed and changed only for a selected operator, but if a CAN service key is connected, the parameters for all operators can be displayed and changed. Operator parameters can be changed by the operator if the truck's program is set up for this.

The service parameters can be changed once a suitable CAN service key or PDA/PC has been connected to the truck.

Factory parameters can only be changed using the TruckCom software application.

5.1.1 Show/change parameters

1: Make sure that the truck is switched off. Connect the CAN key or enter the PIN code. Note: **Do not** press the ON switch.

2: Press and then release the horn button. “Info“ is shown on the display.

3: Move between menus by turning the speed control several times.

4: “Par” is shown on the display.

5: Press the horn button to select. The parameter symbol lights up.

6: By pressing the speed control repeatedly, you can move through the parameter list.

See section “5. Parameters”.For setting parameters.

To show a parameter, release the speed control when the required parameter is shown on the display. Press the horn button to change the parameter.

5.1.2 Operator parameters

Note:

Changing specific truck parameters changes the truck's driving properties. Do not change any parameter values without the necessary know-how.

5.1.3 Overview

Par.	Description
3	Acceleration
4	Deceleration
6	Maximum speed
7	Maximum speed, forks above 1.8 m

5.1.4 Connection to logged-in operator

The operator parameters can be adjusted individually to the available log-in profiles. The parameter's connection to the operator is done by a combination of operator and parameter numbers where the single digit always corresponds to the parameter.

Operator profile	Parameter range
1	1 – 7
2	11 – 17
3	21 – 27
4	31 – 37
5	41 – 47
6	51 – 57
7	61 – 67
8	71 – 77
9	81 – 87
10	91 – 97

Description of operator parameters

Parameters 3 and 4 – Acceleration/Deceleration

These two parameters can be used to get a smoother acceleration/ deceleration where the application or operator profile so requires.

Par.	Description	Min.	Default	Max.	Increment	Unit
3	Acceleration	10	80	100	5	%
4	Deceleration	10	90	100	5	%

#3 - Acceleration

The lower the parameter value, the more time is needed to accelerate to the maximum speed.

#4 - Deceleration

Defines plug braking force when speed control [L1] returns to the neutral position. The lower the value of parameter, the longer it takes to reduce speed.

Parameters 6 and 7 – Maximum travel speed

These two parameters are used to limit the maximum travel speed for the logged-in operator profile.

Par.	Description	Min.	Default	Max.	Increment	Unit
6	Maximum speed	30	100	100	5	%
7	Maximum speed, forks above 1.8 m	30	100	100	5	%

The maximum travel speed can also be limited by factory parameter #1044 and it is always the lowest speed for a parameter that is the limiting one.

6 - Maximum speed

Determines the maximum travel speed.

7 - Maximum speed, forks above 1.8m

Adjusts the truck maximum speed when the forks are above 1.8 m, Is set as a % of parameter 203.

5.2 General service parameters

Before any service parameter can be changed, the CAN service key must be connected to the contact [X41].

5.2.1 Overview

Note:
Changing specific truck parameters changes the truck's driving properties. Do not change any parameter values without the necessary know-how.

Par.	Description
101	Service intervals
102	Operator access
103	Start-up - alternative
104	Automatic logout/min
105	Collision sensor X level
106	Collision sensor Y level
107	Battery adjustment, Ah
109	Battery type, built-in charger
110	Battery size, built-in charger
111	Reset following a collision
112	Clear application data

5.2.2 Description

Parameter 101/104 – Service/Log-out

Par.	Description	Min.	Default	Max.	Increment	Unit
101	Service intervals	0	0	2000	50	h
104	Time to automatic logout	0	20	20	1	min.

#101 - Service intervals

This parameter determines the time value (in hours) to the next service from 0 to 2000 hours in increments of 50 hours. Whenever this value is changed, the timer is reset and will start to count the truck activity time. On reaching the set value, code “S - 0h” is shown on the display and the red LED flashes.

If the value is set as '0', no service interval is given

#104 - Time to automatic log-out

Gives the time, in minutes, before automatic log-out if the truck is inactive.

If the value is set as ‘0’, logout takes place after 4 hours.

Parameter 102 - Operator access

Par.	Description	Min.	Default	Max.	Increment	Unit
102	Operator access	1	3	10	1	

#102 - Operator access

Specifies which login method should be used and if the operator will have the possibility of changing the operator parameter settings.
Values 1 and 2 = Key
Values 3 and 4 = Keypad with 100 PIN codes. See section “6.6 Programming PIN codes”.
Values 5 and 6 = Keypad with DHU
Values 7 and 8 = ID unit

Values 9 and 10 = SA2
Odd values = Operator parameters are open and can be changed by the operator.
Even values = Operator parameters can only be changed with a CAN key connected.

Parameter 103 - Start-up display

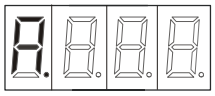
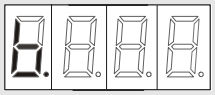
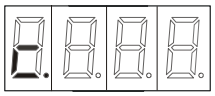
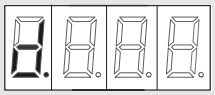
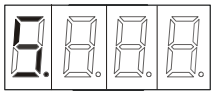
Par.	Description	Min.	Default	Max.	Increment	Unit
103	Start-up display	1	2	5	1	

#103 - Start-up display

Sets which value is shown on the display when the truck is started.

When the truck is started, one of the truck's 5 values is shown on the hour meter display "H" (hour meter display) for 5 seconds. After the menu has disappeared, the battery capacity is continuously shown in the numeric field at the same time as the battery indicator is lit.

The truck control system stores five different time values. "Value 2 - Operating time" is the default value on the start-up display.

Hour meter values	Display
Value 1 = (A) Key time The total time the truck has been in use	
Value 2 = (B) Operating time Combined time during which the pump or drive motor has been in operation. Default display.	
Value 3 = (C) Drive motor time The total time the drive motor has been in operation.	
Value 4 = (D) Pump motor time Total time the pump motor has been in operation.	
Value 5 = (S) Remaining time until next service. Parameter 101 controls the initial value.	

Parameter 105/106 - Collision sensor sensitivity for X/Y (Optional)

Par.	Description	Min.	Default	Max.	Increment	Unit
105	Collision sensor X-degree of sensitivity	0	0	100	1	
106	Collision sensor Y-degree of sensitivity	0	0	100	1	

#105 - Collision sensor X sensitivity degree

Indicates the degree of sensitivity for what should be interpreted as a frontal/ rear-end impact. 0 = Collision sensor not activated

The collision sensor can also be used in combination with DHU. In such cases, the parameters should not be set in the truck. Collision monitoring is instead administrated via I_Site.

This parameter must be set during truck installation.

#106 - Collision sensor Y sensitivity degree

Indicates the degree of sensitivity for what should be interpreted as a side impact. 0 = Collision sensor not activated

The collision sensor can also be used in combination with DHU. In such cases, the parameters should not be set in the truck. Collision monitoring is instead administrated via I_Site.

This parameter must be set during truck installation.

Parameter 107 – Battery size

Par.	Description	Min.	Default	Max.	Increment	Unit
107	Battery size	1	9	20	1	

 # 107 - Battery size

Specifies what type of battery the truck is equipped with.

The parameter can be used to compensate for different ways of driving by:

- increasing the value to discharge the battery even more.
- reducing the value if the battery is discharged too much.

In order to set the meter for battery charge level, consideration must be given to the following:

- Acid density when the battery is fully charged; to check the quality of the battery. This value should be between 1.27 and 1.29.

  Please note that the acid density may vary between different kinds of battery.
- When the lifting capacity is disabled (battery 80% discharged), the value must be close to (but not below) 1.14.

Table applicable to P214, 216, 218, 220

Refer to the table below for recommended parameter settings.

Parameter 107		Battery size Lead/acid battery	Battery size Hawker Evolution	Battery size gel battery
Slight discharge ↑	1			
	2			
	3			
	4			
	5			
	6			
	7	311-330 Ah	261-280 Ah	271-290 Ah
	8	291-310 Ah	241-260 Ah	251-270 Ah
	9	271-290 Ah	221-240 Ah	231-250 Ah
	10	251-270 Ah	201-220 Ah	211-230 Ah
	11	231-250 Ah	181-200 Ah	191-210 Ah
	12	216-230 Ah	161-180 Ah	171-190 Ah
	13	201-215 Ah	141-160 Ah	151-170 Ah
	14	186-200 Ah	120-140 Ah	131-150 Ah
	15	171-185 Ah		110-130 Ah
	16	156-170 Ah		
	17	141-155 Ah		
Deeper discharge ↓	18	125-140 Ah		
	19			
	20			

Table concerning P225

Refer to the table below for recommended parameter settings.

Parameter 107		Battery size Lead/acid battery	Battery size Hawker Evolution	Battery size gel battery
Slight discharge ↑	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9	311-330 Ah	261-280 Ah	271-290 Ah
	10	291-310 Ah	241-260 Ah	251-270 Ah
	11	271-290 Ah	221-240 Ah	231-250 Ah
	12	251-270 Ah	201-220 Ah	211-230 Ah
	13	231-250 Ah	181-200 Ah	191-210 Ah
	14	216-230 Ah	161-180 Ah	171-190 Ah
	15	201-215 Ah	141-160 Ah	151-170 Ah
	16	186-200 Ah	120-140 Ah	131-150 Ah
Deeper discharge ↓	17	171-185 Ah		110-130 Ah
	18	156-170 Ah		
	19	141-155 Ah		
	20	125-140 Ah		

DANGER!

Battery service life will be reduced if the value of parameter 107 is set too high. The standard setting of parameter 107 is set for normal truck handling. Other applications may require a different setting of parameter 107. Check that the parameter setting is the correct one using the instructions below.

Table concerning S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Refer to the table below for recommended parameter settings.

Parameter 107		Battery size Lead/acid battery	Battery size Hawker Evolution	Battery size gel battery
Slight discharge ↑	1			
	2			
	3			
	4			
	5			
	6		271-280 Ah	271-290 Ah
	7		251-270 Ah	251-270 Ah
	8		231-250 Ah	231-250 Ah
	9	286-320 Ah	211-230 Ah	211-230 Ah
	10	251-285 Ah	191-210 Ah	191-210 Ah
	11	221-250 Ah	171-190 Ah	171-190 Ah
	12	206-220 Ah	151-170 Ah	151-170 Ah
	13	191-205 Ah	131-150 Ah	131-150 Ah
	14	176-190 Ah	120-130 Ah	110-130 Ah
	15	161-175 Ah		
	16	146-160 Ah		
	17	131-145 Ah		
Deeper discharge ↓	18	115-130 Ah		
	19			
	20			

WARNING!

Battery service life will be reduced if the value of parameter 107 is set too high. The standard setting of parameter 107 is set for normal truck handling. Other applications may require a different setting of parameter 107. Check that the parameter setting is the correct one using the instructions below.

Verifying parameter settings for freely ventilated batteries (lead-acid batteries)

1. Charge the battery.
2. Use the truck in its normal application until the battery indicator shows a discharged battery (0% on the display).
3. Disconnect the battery from the truck and allow it to rest for at least two minutes.

Note:
Do not charge or discharge during this time.

4. Measure the specific gravity of the electrolyte at ambient temperature.

If the specific gravity is below 1.15 g/cm^3, the parameter value must be reduced.

If the value is considerably higher than 1.15 g/cm^3 the risk of damage to the battery is reduced. At the same time, the operating time of the truck is reduced. If extended operating time is desired, then increase the parameter value by no more than one unit.

Note:
Each change should be followed up by a new verification of the parameter setting.

Verifying the parameter setting for valve-regulated batteries (Exide)

1. Charge the battery.
2. Operate the truck in its normal application until the battery indicator indicates a discharged battery (0% in the display).
3. Disconnect the battery from the truck and allow it to rest for at least two hours.

Note:
Do not allow any charging or discharging during this time.

4. Measure the battery voltage at room temperature.

   If the voltage is less than U_{end} (see the table below) the parameter value **must** be reduced. If the value is considerably higher than U_{end} the risk of damage to the battery is reduced. At the same time, however, the operating time of the truck decreases. If extended operating time is desired, then increase the parameter value, but maximum by one unit.

Note:
Each change should be followed up by a new verification of the parameter setting.

Battery type	Battery voltage while resting, U_{end}
Exide	24.24 V

Parameters 109/110 - Built-in charger (option)

Par.	Description	Min.	Default	Max.	Increment	Unit
109	Battery type, built-in charger	0	0	32766	1	
110	Battery size, built-in charger	100	100	300	1	Ah

#109 - Battery type, built-in charger

Sets the type of battery in case of built-in charger. This parameter has no use unless there is a built-in charger.

#0 = No charging

#1 = Lead/acid battery

#2 = Hawker Evolution battery

#3 = Exide gel battery

32766 = TMHMS Li-ion battery

#110 - Battery type, built-in charger (Optional)

Sets the battery size used with the built-in charger so the correct charging current is chosen. For Hawker Evolution only the sizes 134 Ah, 174 Ah and 201 Ah are approved. This parameter has no use unless there is a built-in charger.

Parameter 111 - Reset procedure after collision (option)

Par.	Description	Min.	Default	Max.	Increment	Unit
111	Resetting procedure after collision	0	0	3	1	

#111 - Reset procedure after collision

Specifies the condition for how the truck is to be taken into operation again after the collision sensors have been triggered.

Value	Function
0	Function not activated
1	The operator can reset the truck.
2	Horn sounds once every five seconds.
3	Options 1 and 2 combined.

The PIN code to be activated for resetting can be found in operator profile 1 and special block 10. Page 6–4

Parameter 112 - Clear application data

Par.	Description	Min.	Default	Max.	Increment	Unit
112	Erase application data	0	0	2	1	

#112 - Clear application data

Specifies whether information from the histogram/collision sensor is to be deleted at login.

Value	Function
0	Do not clear
1	Clear histogram at start-up
2	Clear collision log at start-up

The histogram data consists of the logged motor temperature, motor control and steering motor in the form of a histogram. You clear this data by setting parameter 112 =1. This is useful when transferring the truck from one client to another.

The collision log is a log with the 10 latest collisions are stored together with the operator PIN code. You clear this data by setting parameter 112 =2.

5.3 Service parameters, travel functions

5.3.1 Overview

Par.	Description
201	Braking force when reversing the travel direction
202	Maximum speed Turtle mode activated
203	Maximum speed, forks above 1.8 m
204	Acceleration, forks above 1.8 m
205	Braking force when reversing the travel direction, forks above 1.8 m
206	Automatic deceleration, forks above 1.8 m

5.3.2 Description

Parameter 201 – Deceleration when reversing

Par.	Description	Min.	Default	Max.	Increment	Unit
201	Deceleration when reversing	70	100	100	5	%

 # 201 - Deceleration when reversing

Sets how hard the truck will brake when the speed control is turned in the opposite direction, and used to get a smoother deceleration where the application requires this for all operator profiles.

Parameter 202 – Maximum speed Turtle mode activated

Par.	Description	Min.	Default	Max.	Increment	Unit
202	Maximum speed Turtle mode activated	0.5	3.0	6.0	0.5	km/h

#202 - Maximum speed Turtle mode activated

Sets the maximum speed when Turtle mode is activated

.

Parameter 203 - Maximum speed, forks above 1.8 m

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
203	Maximum speed, forks above 1.8 m	0.5	2.5	5.0	0.5	km/h

 # 203 - Maximum speed, forks above 1.8m

Sets the maximum speed when the forks are above 1.8 m.

Parameter 204 - Maximum acceleration, forks above 1.8 m

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
204	Maximum acceleration, forks above 1.8 m	10	45	60	5	%

#204 - Maximum acceleration, forks above 1.8 m

Sets the maximum acceleration when the forks are above 1.8 m. As a percentage of maximum acceleration for this application.

Parameter 205 - Maximum reversing, forks above 1.8 m

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
205	Maximum reversing, forks above 1.8 m	45	80	80	5	%

#205 - Maximum reversing, forks above 1.8 m

Sets the maximum reversing when the forks are above 1.8 m. As a percentage of maximum acceleration for this application.

Parameter 206 - Automatic speed reduction, forks above 1.8 m

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
206	Automatic speed reduction, forks above 1.8 m	45	60	80	5	%

#206 - Automatic speed reduction, forks above 1.8 m

Sets the maximum speed reduction when the forks are above 1.8 m. As a percentage of maximum acceleration for this application.

5.4 Service parameters, hydraulic functions

Par.	Description
301	Lowering stop ramp
302	Fork lowering speed
303	EVP startup mode
304	Support arm, lowering speed
305	EVP slow lowering speed
306	Enable two speeds for lifting/lowering
307	Automatic support arm lowering
499	(Not applicable - for field test software only)

5.4.1 Description

Parameter 301 – Ramping value for lowering stop

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
301	Lowering stop ramp	3	7	20	1	

 # Parameter 301 – Ramping value for lowering stop

Determines the closing ramp of the proportional valve.

Parameter 302 - Fork, lowering speed

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
302	Fork lowering speed	70	190	255	5	

 # Parameter 302 - Fork, lowering speed

Determines the maximum lowering speed of the forks. This parameter can be adjusted manually or can be set by using the calibration function

Parameter 303 - EVP start mode

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
303	EVP startup mode	30	90	150	5	

 # Parameter 303 - EVP start mode

Determines the start position of the proportional valve. This parameter can be adjusted manually or can be set by using the calibration function

Parameter 304 - EVP support arm lowering speed

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
304	EVP support arms, lowering speed	50	130	220	5	

Parameter 304 - EVP support arm lowering speed

Specifies the lowering speed of the support arms. This parameter can be adjusted manually or can be set by using the calibration function

Parameter 305 - EVP slow lowering speed

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
305	EVP slow lowering speed	40	105	220	5	

Parameter 305 - EVP slow lowering speed

Determines the slow lowering speed when using "Click-2-Creep". This parameter can be adjusted manually or can be set by using the calibration function

Parameter 306 - Activation of “Click-2-Creep” lifting/lowering

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
306	Activate “Click-2-Creep” lifting/lowering	0	1	1	1	

Parameter 306 - Activation of “Click-2-Creep” lifting/lowering

Activate “Click-2-Creep” lifting/lowering

Value	Function
0	OFF
1	On:

Parameter 307 - Automatic support arm lowering (On/Off)

Applies to S208L, 210, 212S, 212L, 212, 214L, 214, 220D

Par.	Description	Min.	Default	Max.	Increment	Unit
307	Automatic support arm lowering	0	1	1	1	

#307 - Automatic support arm lowering (On/Off)

Controls whether the support arms should be lowered automatically when the forks reach the 1.8 m sensor.

Value	Function
0	OFF
1	On:

Parameter 499 - (Not applicable)

This parameter is only used for field test software

5.5 Factory parameters

The truck's factory parameters are preset in the truck during production at the factory. Factory parameters can only be changed using the TruckCom software application.

Note:

Remember that a change of specific truck parameters changes the truck's properties. Do not change any parameter values without the necessary know-how. Only authorised service technicians with personal TruckCom user identities have the rights to change factory settings. The parameters should only be changed when a specific need for this arises.

The user ID and time of changing parameters will be logged in the logic card housed in the tiller arm handle.

5.5.1 Overview

Par.	Description
1001	Truck type
1002	Non-configurable option
1003-1042	Optional functions FUNC1 - FUNC8
1044	Master maximum speed
1045	Battery type
1046	Special truck
1101	Built-in charger
1102	Controls for hydraulic function
1110	BDI
1118	Hardware version

5.5.2 Description

Parameter 1001 - Type of truck

Par.	Description	Min.	Default	Max.	Increment	Unit
1001	Truck type	0	0	108	1	

 # Parameter 1001 - Truck type

This parameter is used to set which truck type the program is to adapt operational data for.

Value	Function
0	Unknown truck type
1	P214
2	P216
3	P218
4	P220
5	P225
101	S210
102	S212
103	S214
104	S212L
105	S214L
106	S220D
107	S208L
108	S212S

Parameter 1002 - Non-configurable options

Par.	Description	Min.	Default	Max.	Increment	Unit
1002	Non-configurable option	0	1	7	1	

#1002 - Non-configurable options

3 different functions are accessible via parameter 1002. These functions are either active or inactive. The functions do not require any further adjustment and are thus referred to as non-configurable options.

Value	Function
0	No optional function
1	CLICK-2-CREEP
2	TURTLE
3	CLICK-2-CREEP and TURTLE
4	SAFETY REVERSING HORN
5	SAFETY REVERSING HORN and CLICK-2-CREEP
6	SAFETY REVERSING HORN and TURTLE
7	SAFETY REVERSING HORN, CLICK-2-CREEP and TURTLE

Parameters 1003-1042 – Optional functions

Par.	Description	Min.	Default	Max.	Increment	Unit
1003	Optional function 1	0	0	21	1	
1004	Optional function 1Arg1	0	0	255	1	
1005	Optional function 1Arg2	0	0	255	1	
1006	Optional function 1Arg3	0	0	255	1	
1007	Optional function 1Arg4	0	0	255	1	
1008	Optional function 2	0	0	21	1	
1009	Optional function 2Arg1	0	0	255	1	
1010	Optional function 2Arg2	0	0	255	1	
1011	Optional function 2Arg3	0	0	255	1	
1012	Optional function 2Arg4	0	0	255	1	
1013	Optional function 3	0	0	21	1	
1014	Optional function 3Arg1	0	0	255	1	
1015	Optional function 3Arg2	0	0	255	1	
1016	Optional function 3Arg3	0	0	255	1	
1017	Optional function 3Arg4	0	0	255	1	
1018	Optional function 4	0	0	21	1	
1019	Optional function 4Arg1	0	0	255	1	
1020	Optional function 4Arg2	0	0	255	1	
1021	Optional function 4Arg3	0	0	255	1	
1022	Optional function 4Arg4	0	0	255	1	
1023	Optional function 5	0	0	21	1	
1024	Optional function 5Arg1	0	0	255	1	
1025	Optional function 5Arg2	0	0	255	1	
1026	Optional function 5Arg3	0	0	255	1	
1027	Optional function 5Arg4	0	0	255	1	
1028	Optional function 6	0	0	21	1	
1029	Optional function 6Arg1	0	0	255	1	
1030	Optional function 6Arg2	0	0	255	1	
1031	Optional function 6Arg3	0	0	255	1	
1032	Optional function 6Arg4	0	0	255	1	
1033	Optional function 7	0	0	21	1	
1034	Optional function 7Arg1	0	0	255	1	
1035	Optional function 7Arg2	0	0	255	1	
1036	Optional function 7Arg3	0	0	255	1	
1037	Optional function 7Arg4	0	0	255	1	
1038	Optional function 8	0	0	21	1	
1039	Optional function 8Arg1	0	0	255	1	
1040	Optional function 8Arg2	0	0	255	1	
1041	Optional function 8Arg3	0	0	255	1	
1042	Optional function 8Arg4	0	0	255	1	

Parameters #1003-1042

Factory parameters # 1003 to 1042 - configurable optional functions

Parameters #1003 to #1042 are reserved in the truck's control system for extra truck options and/or special product modifications. The parameters configure and control the Spider expansion unit (SEU) that must be fitted to the truck, in some cases it is enough to have an empty I/0 in the motor control. This method of implementation enables use of the standard program. This eliminates the need for any special program.

Normally, these parameters are configured by the manufacturer when the truck is modified or customised. It is advisable to upload the parameter settings from the truck when carrying out any modification. If the main control unit [A2] has been replaced, the original parameter settings can be transferred to the new unit, thus ensuring that special options function correctly.

Factory parameter no. #1003, #1008, #1013, #1018, #1023, #1028, #1033 and #1038 can be adjusted to allow up to a maximum of 8 pre-programmed "Basic options" to be activated and configured to suit a specific special option or customisation.

Activation of optional functions

The system can use up to eight configurable optional functions simultaneously. Each configurable function is controlled by five factory parameters. During activation, an index parameter (#1003, #1008, #1013, #1018, #1023, #1028, #1033, #1038) must first be set to a value equivalent to an optional function. Four parameters that can be modified to configure the optional function are linked to each index parameter.

- The index parameter is allocated one optional function (optional function is determined).
- Each optional function can have up to 4 arguments associated with it. Each argument holds a value which can be changed to configure the function (optional function is configured).
- If the value of an argument is outside of the highest or lowest permitted value, an error code is generated and the option cannot be used. The error code cannot be eliminated until the argument is given a permissible value.

Basic option 1 - Option switch controls SEU output			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital output		
	Values	Meaning	Pin no.
	0	activates digital output 1 (1.6 A) on SEU	16
	1	activates digital output 2 (1.6 A) on SEU	30
	2	activates digital output 3 (1.6 A) on SEU	2
	3	activates digital output 4 (1.6 A) on SEU	3
Argument #3	Selection of option switch		
	Values	Meaning	
	0	activated by option switch 2 or 5	
	1	activated by option switch 1	
	2	activated by option switch 2	
	3	activated by option switch 3	
	4	activated by option switch 4	
	5	activated by option switch 5	
	6	activated by option switch 6	
	7	activated by option switch 3 or 4	
Argument #4	Type of switching		
	Values	Meaning	
	0	activated when the switch is pressed	
	1	option is toggled when switch is pressed	

Basic option 2 - Reduced travel speed via SEU inputs			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital input		
	Values	Meaning	Pin no.
	0	activates digital input 1 (1 mA) on SEU	5
	1	activates digital input 2 (1 mA) on SEU	19
	2	activates digital input 3 (1 mA) on SEU	33
	3	activates digital input 4 (1 mA) on SEU	6
	4	activates digital input 5 (7 mA) on SEU	20
	5	activates digital input 6 (7 mA) on SEU	34
	6	activates digital input 7 (7 mA) on SEU	7
	7	activates digital input 8 (7 mA) on SEU	21
Argument #3	Speed limitation as a percentage of max. speed		
	Values	Meaning	
	0-100	Max. speed adjustable from 0-100% (driving is not possible when value = 0)	
Argument #4	Speed range		
	Values	Meaning	
	0	Affects only high speed range	
	1	Affects only low speed range	
	2	Affects both speed ranges	

Basic option 3 - Truck movement activates SEU output			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital output		
	Values	Meaning	Pin no.
	0	activates digital output 1 (1.6 A) on SEU	16
	1	activates digital output 2 (1.6 A) on SEU	30
	2	activates digital output 3 (1.6 A) on SEU	2
	3	activates digital output 4 (1.6 A) on SEU	3

Basic option 3 - Truck movement activates SEU output

Argument #3 — Selection of activation movement

Values	When driving fork direction	When driving drive wheel direction	Fork lifting	Fork lowering
1	X			
2		X		
3	X	X		
4			X	
5	X		X	
6		X	X	
7	X	X	X	
8				X
9	X			X
10		X		X
11	X	X		X
12			X	X
13	X		X	X
14		X	X	X
15	X	X	X	X
16				
17	X			
18		X		
19	X	X		
20			X	
21	X		X	
22		X	X	
23	X	X	X	
24				X
25	X			X
26		X		X
27	X	X		X
28			X	X
29	X		X	X
30		X	X	X
31	X	X	X	X

Argument #4 — Output switching mode

Values	Meaning
0	Output continuously on
1	Output switches at 1 Hz
2	Output switches at 2 Hz

Basic option 4 - Activate main contactor by SEU input			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital input		
	Values	Meaning	Pin no.
	0	activated by digital input 1 (1 mA) on SEU	5
	1	activated by digital input 2 (1 mA) on SEU	19
	2	activated by digital input 3 (1 mA) on SEU 3	33
	3	activated by digital input 4 (1 mA) on SEU	6
	4	activated by digital input 5 (7 mA) on SEU	20
	5	activated by digital input 6 (7 mA) on SEU	34
	6	activated by digital input 7 (7 mA) on SEU	7
	7	activated by digital input 8 (7 mA) on SEU	21
Argument #3	Hold time in minutes		
	Values	Meaning	
	0-30	Contactor is held from 0 to 30 minutes after the digital input is activated	
Argument #4	Not used		

Basic option 5 - Activate lifting/lowering by SEU input			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital inputs		
	Values	Meaning	Pin no.
	0	Lift - SEU digital input 1 on SEU Lower - SEU digital input 2 on SEU Lowering block - SEU digital input 3 on SEU	5 19 33
	1	Lift - SEU digital input 2 on SEU Lower - SEU digital input 3 on SEU Lowering block - SEU digital input 4 on SEU	19 33 6
	2	Lift - SEU digital input 3 on SEU Lower - SEU digital input 4 on SEU Lowering block - SEU digital input 5 on SEU	33 6 20
	3	Lift - SEU digital input 4 on SEU Lower - SEU digital input 5 on SEU Lowering block - SEU digital input 6 on SEU	6 20 34
	4	Lift - SEU digital input 5 on SEU Lower - SEU digital input 6 on SEU Lowering block - SEU digital input 7 on SEU	20 34 7
	5	Lift - SEU digital input 6 on SEU Lower - SEU digital input 7 on SEU Lowering block - SEU digital input 8 on SEU	34 7 21
Argument #3	Enable/disable lowering block		
	Values	Meaning	
	0	Lowering block disabled	
	1	Lowering block enabled	
Argument #4	Selection of fork/support arm		
	Values	Meaning	
	0	Selects fork lifting/lowering	
	1	Selects support arm lifting/lowering	

Basic option 6 - Lift height limitation by SEU input and override			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital input for limitation switch		
	Values	Meaning	Pin no.
	0	activates digital input 1 (1 mA) on SEU	5
	1	activates digital input 2 (1 mA) on SEU	19
	2	activates digital input 3 (1 mA) on SEU	33
	3	activates digital input 4 (1 mA) on SEU	6
	4	activates digital input 5 (7 mA) on SEU	20
	5	activates digital input 6 (7 mA) on SEU	34
	6	activates digital input 7 (7 mA) on SEU	7
	7	activates digital input 8 (7 mA) on SEU	21
Argument #3	Selection of option switch for override function		
	Values	Meaning	
	0	activated by option switch 2 or 5	
	1	activated by option switch 1	
	2	activated by option switch 2	
	3	activated by option switch 3	
	4	activated by option switch 4	
	5	activated by option switch 5	
	6	activated by option switch 6	
	7	activated by option switch 3 or 4	
	8	no override possible	
Argument #4	Selection of time interval for override function		
	Values	Meaning	
	0	option switch must be kept pressed for override	
	1-15	value corresponds to time in seconds, e.g. value 1 = 1 second	

Basic option 11 - Automatic height preselector			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 (A36)	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of option switch for automatic lifting and lowering movement		
	Values	Meaning	
	0	option not activated by option button	
	1	activated by option switch 1 and 2	
	2	activated by option switch 2 and 3	
	3	activated by option switch 3 and 4	
	4	activated by option switch 4 and 5	
	5	activated by option switch 5 and 6	
	6	activated by option switch 1.6 and 2.5	
	7	activated by option switch 2.5 and 3.4	
Argument #3	Selection of SEU digital inputs/outputs		
	Values	Meaning	Pin no.
	0	photocell - digital input 1 on SEU lowest position - digital input 2 on SEU highest position - digital input 3 on SEU external lifting switch - digital input 4 on SEU external lowering switch - digital input 5 on SEU lamp - digital output 1 on SEU	5 19 33 6 20 16
	1	photocell - digital input 2 on SEU lowest position - digital input 3 on SEU highest position - digital input 4 on SEU external lifting switch - digital input 5 on SEU external lowering switch - digital input 6 on SEU lamp - digital output 2 on SEU	19 33 6 20 34 30
	2	photocell - digital input 3 on SEU lowest position - digital input 4 on SEU highest position - digital input 5 on SEU external lifting switch - digital input 6 on SEU external lowering switch - digital input 7 on SEU lamp - digital output 3 on SEU	33 6 20 34 7 2
	3	photocell - digital input 4 on SEU lowest position - digital input 5 on SEU highest position - digital input 6 on SEU external lifting switch - digital input 7 on SEU external lowering switch - digital input 8 on SEU lamp - digital output 4 on SEU	6 20 34 7 21 3

Basic option 11 - Automatic height preselector		
Argument #1	Selection of SEU unit 1 or 2	
Argument #4	Activation/deactivation external lifting/lowering switch	
	Values	Meaning
	0	external lifting/lowering switch deactivated
	1	external lifting/lowering switch activated

Basic option 13 – Activates SEU outputs at login			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 [A36]	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital output		Pin no.
	0	activates digital output 1 (1.6 A) on SEU	16
	1	activates digital output 2 (1.6 A) on SEU	30
	2	activates digital output 3 (1.6 A) on SEU	2
	3	activates digital output 4 (1.6 A) on SEU	3
Argument #3	Not used		
Argument #4	SEU output's connection mode		
	Values	Meaning	
	0	Output continuously on	
	1	Output switches at 1 Hz	
	2	Output switches at 2 Hz	

Basic option 14 – Activate restrictions on hydraulics via operator profiles		
Argument #1	Not used. SEU unit not required	
Argument #2	Selection of operator profile	
	Values	Meaning
	1	Operator profile 1
	2	Operator profile 1-2
	3	Operator profile 1-3
	4	Operator profile 1-4
	5	Operator profile 1-5
	6	Operator profile 1-6
	7	Operator profile 1-7
	8	Operator profile 1-8
	9	Operator profile 1-9
	10	Operator profile 1-10
Argument #3	Connecting restrictions. The values in argument #3 can be combined through addition, e.g. value 1 + value 8 = value 9	
	Values	Meaning
	1	Block the lift/pressurising of hydraulic function 1
	2	Block the lowering/depressurising of hydraulic function 1
	4	Block the lift/pressurising of hydraulic function 2
	8	Block the lowering/depressurising of hydraulic function 2
	16	Block the lift/pressurising of hydraulic function 3
	32	Block the lowering/depressurising of hydraulic function 3
	64	Block the lift/pressurising of hydraulic function 4
	128	Block the lowering/depressurising of hydraulic function 4
Argument #4	Not used	

Basic option 15 – Activate restrictions on hydraulics via SEU inputs			
Argument #1	Selection of SEU unit 1 or 2		
	Values	Meaning	
	0	option is handled by SEU unit 1 [A36]	
	1	option is handled by SEU unit 2 (the second SEU unit)	
Argument #2	Selection of SEU digital input		
	Values	Meaning	Pin no.
	0	activates digital input 1 (1 mA) on SEU	5
	1	activates digital input 2 (1 mA) on SEU	19
	2	activates digital input 3 (1 mA) on SEU	33
	3	activates digital input 4 (1 mA) on SEU	6
	4	activates digital input 5 (7 mA) on SEU	20
	5	activates digital input 6 (7 mA) on SEU	34
	6	activates digital input 7 (7 mA) on SEU	7
	7	activates digital input 8 (7 mA) on SEU	21
Argument #3	Connecting restrictions. The values in argument #3 can be combined through addition, e.g. value 1 + value 8 = value 9		
	Values	Meaning	
	1	Block the lift/pressurising of hydraulic function 1	
	2	Block the lowering/depressurising of hydraulic function 1	
	4	Block the lift/pressurising of hydraulic function 2	
	8	Block the lowering/depressurising of hydraulic function 2	
	16	Block the lift/pressurising of hydraulic function 3	
	32	Block the lowering/depressurising of hydraulic function 3	
	64	Block the lift/pressurising of hydraulic function 4	
	128	Block the lowering/depressurising of hydraulic function 4	
Argument #4	Override switch		
	Values	Meaning	
	0	Option switch 2 or 5 gets the override function	
	1	Option switch 1 gets the override function	
	2	Option switch 2 gets the override function	
	3	Option switch 3 gets the override function	
	4	Option switch 4 gets the override function	
	5	Option switch 5 gets the override function	
	6	Option switch 6 gets the override function	
	7	Option switch 3 or 4 gets the override function	
	8	No override possible	

Parameter 1044 - Master maximum speed

Par.	Description	Min.	Default	Max.	Increment	Unit
1044	Master maximum speed	0.5	6.0	6.0	0.5	km/h

#1044 - Master maximum speed

Sets the maximum speed for the application. The speed can never exceed the value of this parameter, regardless of the settings of the other parameters.

Parameter 1045 - Type of battery in the truck

Par.	Description	Min.	Default	Max.	Increment	Unit
1045	Type of battery in the truck	0	0	1	1	

1045 - Type of battery in the truck

Specifies the type of battery found in the application.

Value	Function
0	Lead/acid battery
1	Li-ion battery

Parameter 1046 - Adapting to special trucks

Par.	Description	Min.	Default	Max.	Increment	Unit
1046	Adapting to special trucks	0	0	1	1	

Parameter 1046 - Adapting to special trucks

Value	Function
0	Function not activated
1	The function is activated

Parameter 1101 - Built-in battery charger

Par.	Description	Min.	Default	Max.	Increment	Unit
1101	Built-in battery charger	0	0	1	1	

#1101 - Built-in charger

Indicates if there is a battery charger on the application. If there is a battery charger, parameters 109 and 110 must also be set.

Value	Function
0	No battery charger
1	Battery charger present

Parameter 1102 - Controls for hydraulic function

Par.	Description	Min.	Default	Max.	Increment	Unit
1102	Controls for hydraulic function	1	1	4	1	

#1102 - Controls for hydraulic function

Value	Function
1	The rear lifting and lowering control is connected to the second hydraulic function, while the front control is connected to the first hydraulic function
2	The rear lifting and lowering control is connected to the first hydraulic function, while the front control is connected to the second hydraulic function
3	Both lifting and lowering controls are connected to the first hydraulic function. There is no second hydraulic function.
4	The analogue lifting and lowering control is connected to the first hydraulic function, while the front control is connected to the second hydraulic function.

Note: The rear one means the control towards the operator

Parameter 1110 – Reset voltage for BDI

Par.	Description	Min.	Default	Max.	Increment	Unit
1110	BDI	24.8	25.2	27.0	0.1	V

#1110 – Reset voltage for BDI

After the battery is charged to full capacity, BDI is reset to 100% provided that battery voltage comes up to the pre-programmed reset value. If the reset voltage value is not reached, it could be due to a voltage drop between the battery and the logic card.

In case of reset problems:

- Charge the battery to full capacity following the instructions in the operator's manual.
- Then drive the truck for at least 25 seconds before logging out.
- BDI is only set to 100% if the battery has been disconnected/reconnected.
- Check the voltage across the battery compared to the voltage between wires 20 and 40 on the tiller arm logic card (A5)
- A voltage drop between the battery and the logic card (A5) could be caused by poor connectors/connections or a loose connection in the battery connector.

Parameter 1118 - Hardware version

Par.	Description	Min.	Default	Max.	Increment	Unit
1118	Hardware version	0	1	1	1	

#1118 - Hardware version

Determines the [T1] ACT version on the truck

Value	Function
0	Before 2010-03-22
1	After 2010-03-22

* Matrix for hardware/software compatibility

See the matrix below for the correct setting of factory parameter 1118. The setting depends on which version of motor control is installed on the truck.

- Value 0 = 1.5 kHz (default value)
- Value 1 = 8 kHz

Motor controller	Factory parameter 1118	
	Value = 0	**Value = 1**
243428-001/-002 **246889-001/-002** **246890-001/-002**	OK	Not permitted
7513528-001/-newer **7513526-001/-newer** **7513527-001/-newer**	Not recommended	OK

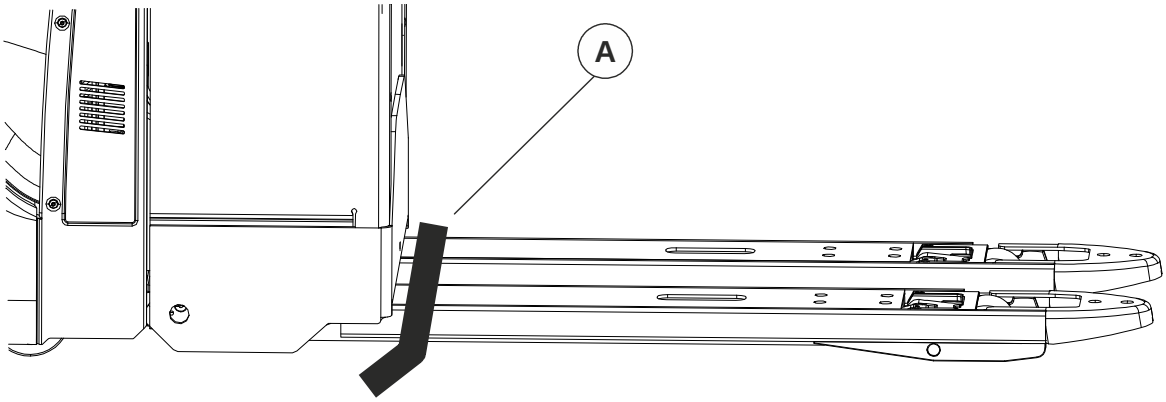
— Slut på avsnittet —

6. Installation and commissioning

This chapter describes the work that is necessary before the truck can be put into use.

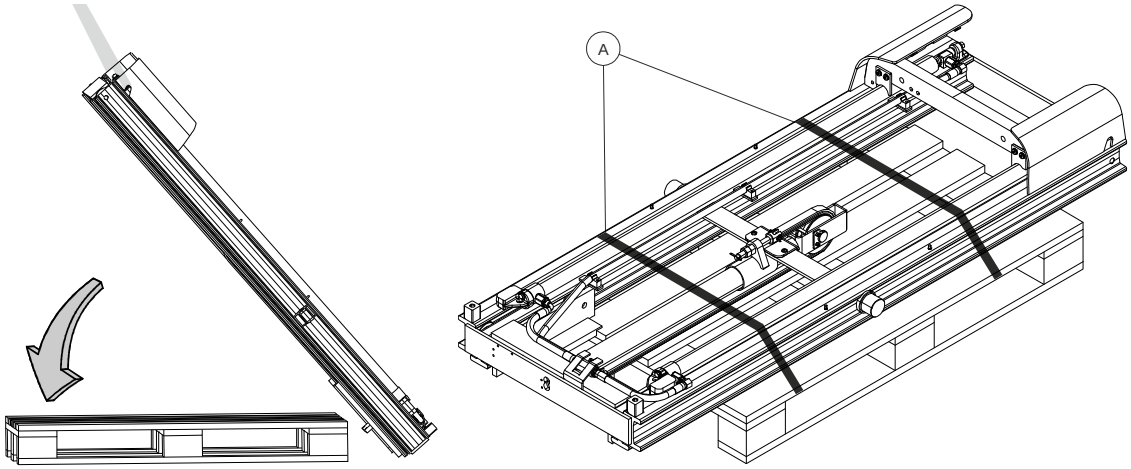
6.1 Transporting the truck

When transporting the truck on a lorry or the like, the truck must be properly anchored with stropping (A). Use inserts and sheets of shock-absorbing material to prevent damage to the truck during lashing and transport.

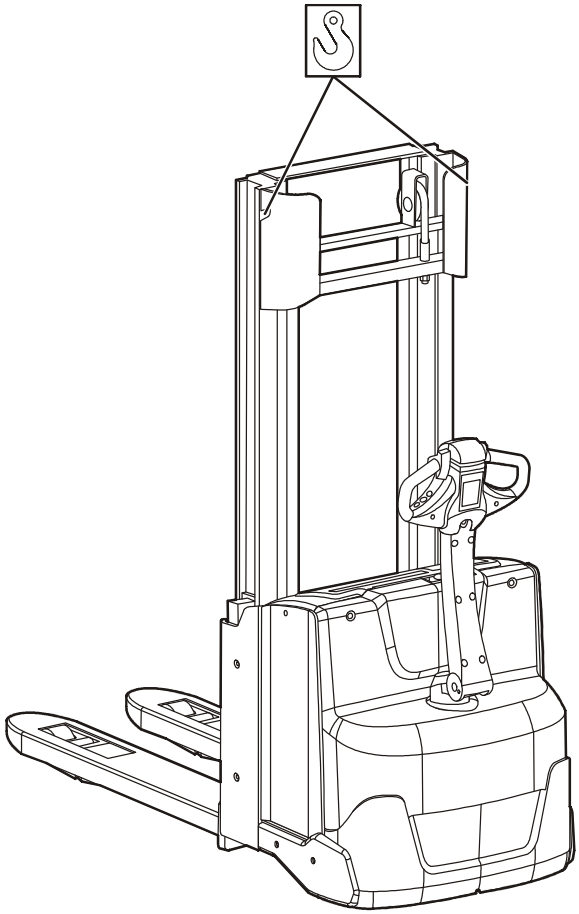


6.2 Transporting the mast

When transporting the mast alone, you must properly anchor all loose parts. The guides must be secured so that they cannot glide apart. Chains and any hoses must be fastened so that they cannot come loose or be damaged. The entire mast is then strapped to load pallets or another suitable support for transport.



6.3 Safe lifting



- Lift the truck at its centre of gravity using another fork lift truck.
- Secure the truck to the forks of the lifting truck.
- Lift it very carefully.

WARNING!
Risk of tipping.
The truck may tip over if it is lifted incorrectly.
Always lift the truck when it has been fastened to the forks of the lifting truck and its centre of gravity between the forks.

- Only lift the truck at the indicated lifting points using suitable lifting equipment.

WARNING!
Risk of tipping.
The truck may tip over if it is lifted in the wrong places.
Always lift the truck in the indicated lifting points.

6.4 Installing the battery

The battery to be installed in the truck must be of the right size. If the battery is too small in terms of size and weight, it can seriously affect the truck's braking ability and truck stability when lifting goods. See the truck's identification plate for the correct battery data.

1. Lift the battery into place using an approved lifting device and a suitable battery lifting yoke or lifting loops.

DANGER!

To prevent the battery from falling down when it is released from the lifting device, prepare trestles or other suitable supports of the right height to support it. Check the height of the supporting material before releasing the lifting hook.

2. Check the electrolyte level in the battery. Normally, the level should be around 10-15 mm above the cell plates.
3. Connect the battery cables/battery connector.

DANGER!

Check that the polarity is correct when connecting the battery cables. Compare the markings on the cables with those on the battery terminals. An incorrectly connected battery may cause short-circuiting.

4. Close battery compartment.
5. Refit the battery disconnecter.
6. Check and if required reset the parameters for the battery and battery charger. See the "Setting the parameters for the battery and battery charger" section in this chapter.
7. Test the functions of the truck, and check that the sensor for the lift height limiter is correctly set before using the truck.

6.5 Using PIN codes

6.5.1 General

PIN codes can be used e.g. to link different operator experience levels to specific truck characteristics – Operator profiles.

Operator parameters can be adjusted individually for up to ten different operator profiles.

The PIN codes are organised in blocks and profiles. Each block can hold ten operator profiles, each with its own PIN code.

In order to use the PIN codes in a block, the block must first be activated.

By default, block one (1) is activated, which means that initially the truck has three ready-to-use operator profiles. Page 6–7

PIN codes can be activated or changed according to the preferences of the operator. An operator profile is activated upon normal log-in by all PIN codes whose block number is activated.

6.5.2 PIN code for resetting after a collision

If the truck has stopped as a result of a collision, it needs to be reset by entering a special PIN code. This PIN code must be programmed by a service technician during installation. Page 6–6

The PIN code to be activated can be found in operator profile 1 and special block 10. The default value of the PIN code is 0000. This must be changed to the PIN code selected by the service technician.

Note:

The PIN code cannot contain the same combination of digits as any of the other programmed PIN codes.

With parameter #111, it is possible to change how the reset after a collision is carried out. Page 5–16

6.5.3 Programming PIN codes

Note:
There are two possible methods for programming PIN codes. The first and the simplest is to use TruckCom, which provides clear instructions. The other alternative is to use the truck keypad.

If the truck is configured to handle PIN codes, 100 different PIN codes can be programmed.

The first time a block is activated, all PIN codes in the block are set to “0000”. If a block with PIN codes not set to “0000”, is deactivated and later reactivated, the PIN codes with other values than “0000” will again be valid.

Use of PIN code “0000” is permitted, but it means that the position is deactivated. It is never possible to log in with PIN code “0”.

The truck program stores a standard set of PIN codes as indicated in the table in the section “PIN code defaults”.

Note:
The truck program will not accept attempts to program PIN codes that have already been set. The previous code will be restored.

When a PIN code is programmed, there is a check to ensure that it is not used elsewhere in the table, regardless of whether the block is active or inactive.

The PIN code setting menu is used for managing PIN codes; the menu can only be accessed when a service key is connected.

6.5.4 PIN code at delivery

Trucks that normally require a PIN code to start are delivered with a four-number delivery code, which is indicated by a protective film covering the keypad.

Remove the protective film when supplying the truck to the customer, and change the PIN codes for the truck.

(Trucks with Smart Access are delivered with a transport key card)

All truck are delivered with the same set of PIN codes: Three (3) codes for manual trucks and four (4) codes for auto trucks. See “PIN code defaults” on page 7.

6.6 Programming PIN codes

1. Make sure that the truck is switched off. Connect the CAN service key to connector [X41]. Enter the PIN code.
2. Press and then release the horn button. “Info“ is shown on the display.
3. Turn the speed control several times until “Pin” is shown on the display.
4. Press and then release the horn button to select.
5. Select programming commands from the table below:

Function	Programming	Comments
Restore factory settings.	Press **1** + ON button	Blocks 0-9 are deactivated, and all PIN codes are reset to 0000.
Activate a new PIN code's block.	Press **2** + b + ON button	b = Block 0-9 Upon activation of a PIN code's block, the codes already stored become available again.
Deactivate a PIN code's block	Press **3** + b + ON button	b = Block 0-9 No codes will be deleted. They will be available again when the PIN code's block is reactivated.
Programming a new PIN code	Press **4** + b + P + NNNN + ON button Note: The block that should apply must first be activated (see function 2 in the table above). If the PIN code is correct, the code is shown for 3 seconds, followed by the text "donE" for 2 seconds. It is possible to enter a new PIN code within these 5 seconds by pressing a key on the keyboard. If the PIN code is wrong, the display shows “Err”. If you press the red button, the new PIN code is not saved.	b = Block 0-9 P = Operator profile 1-10 NNNN = PIN code Note: It is only possible to assign one digit to an operator profile. As a result, operator profile 10 should be assigned as 0 (zero).
PIN code programming for truck reset after collision	Press 6 + NNNN + ON button The PIN code that is activated can be found in operator profile 1 and special block 10. The default value of the PIN code is 0000. This must be changed to the PIN code selected by the service technician.	NNNN = PIN code

6. Switch off the truck by pressing the OFF switch.
   PIN code programming is now complete. Verify that programming has been done correctly by logging in using one of the new PIN codes.

For PIN code management via TruckCom, refer to the *TruckCom manual.*

Note:
It is important to ensure the correct operator profile is activated when a specific PIN code is entered. This is especially important when an operator profile has been set to apply for a specific truck application.

6.6.1 PIN code defaults

The PIN codes are factory set so that only block 1/operator profiles 1-10 are activated. Note: It is only possible to assign one digit to an operator profile. The operator profile 10 should be set to 0 (zero).

Block 10 and operator profile 1 are only used for PIN code programming for truck reset after collision, the remaining operator profiles in block 10 are not used.

Note:

Service personnel are urged to keep notes on activated blocks, changed PIN codes and special operator profile settings.

Default assignment of PIN codes

Operator profile no.	1	2	3	4	5	6	7	8	9	10 Note: Entered as 0
Block 0	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 1	1258	2258	3258	0000	0000	0000	0000	0000	9258	0000
Block 2	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 3	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 4	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 5	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 6	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 7	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 8	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 9	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
Block 10	0000									

The factory-set operator profiles are classified as follows:

Profile	Characteristic	Remarks
1	Standard profile	Transport PIN code for all trucks, as indicated on the transport sticker (1258)
2	Beginner profile	Factory pre-set PIN code at the time of delivery (2258).
3	Advanced profile	Factory pre-set PIN code at the time of delivery (3258). Operator parameters set to max. values
4	Standard profile	–
5	Standard profile	–
6	Standard profile	–
7	Standard profile	–
8	Standard profile	–
9	Standard profile	Factory pre-set PIN code at the time of delivery (9258), only for automatic trucks.
10	Standard profile	–

6.7 Setting parameters

This chapter covers only those parameters that need to be set upon commissioning of the truck and which require detailed descriptions. Fore more information on the parameters, please refer to the Parameters chapter.

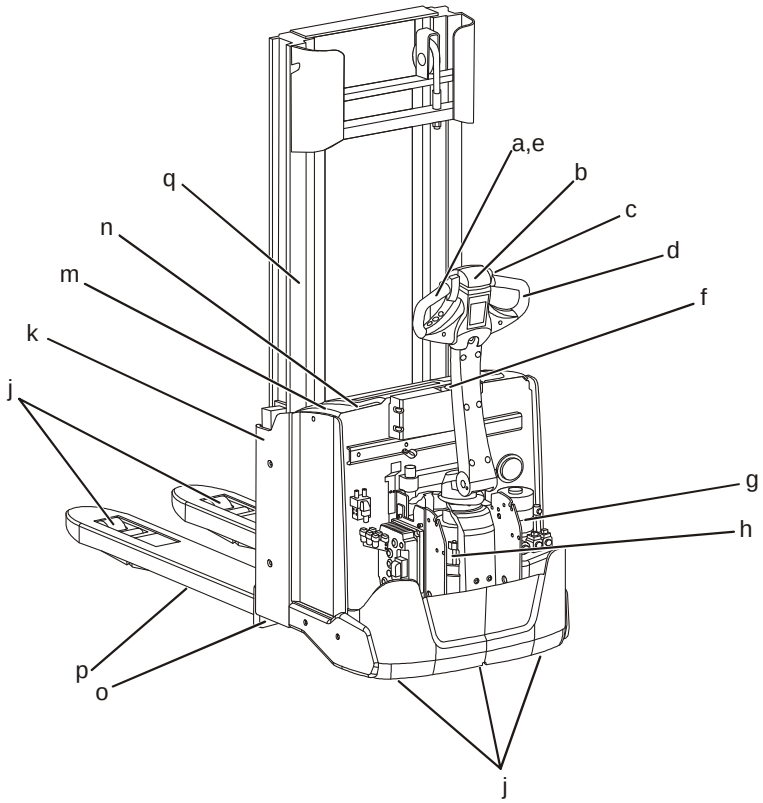
Check to make sure all parameters are set to the desired values in terms of

- maximum speed, operator parameter - Page 5–3
- acceleration, operator parameters - Page 5–3
- deceleration, operator parameters - Page 5–3
- collision sensor (option) - Page 5–9
- battery - Page 5–10
- battery charger (option) - Page 5–15Page 5–42

Note:

When checking or setting parameters, be sure to keep written records, e.g. in a truck report, of 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.

6.8 Function and safety checks



Prior to putting the truck into use, check the following items:

Pos.	Inspection point	Procedure
a	Driving control	Check the function
b	Safety reversing switch	Check the function
c	Sound signal	Check the function
d	Control units	Check the function
e	Brake	Check the function
f	Emergency switch off	Check the function
g	Hydraulic system	Check all components
h	Power pack	Check for any noise or oil leakage
j	Wheels	Inspect for any damage, remove dirt etc.
k	Chassis	Inspect for any damage, remove dirt etc.
m	Battery cover and lock	Check the function
n	Battery	Inspect the battery acid level and charge level
o	Fork carriage	Inspect for any damage, remove dirt etc.
p	Support arms	Inspect for any damage, remove dirt etc.
q	Mast	Inspect for any damage, remove dirt etc.

7. Maintenance

7.1 Introduction

To maintain a high level of truck safety and to minimise downtime, all the points specified in the service programme must be carried out.

The intervals specified are those that fulfil the truck manufacturer's requirements for a truck used in standard applications. The local operating environment may require service intervals that differ from those specified.

Once a truck's service intervals have been determined, the hour recorder is primarily used for determining when servicing is to be carried out.

To maintain truck safety, only spare parts approved by the truck manufacturer may be used for servicing and repairs.

During the truck's warranty period: If repairs/servicing have been carried out by non-authorised personnel, or if non-approved spare parts are used, the truck warranty ceases to be valid.

7.2 Maintenance instructions

7.2.1 Cleaning and washing

Cleaning and washing the truck is an important factor in maintaining truck reliability.

- Carry out general cleaning and washing each week.

Note:
Risk of short circuiting.
Risk of damage to the electrical system.
Disconnect the battery before washing by pulling out the battery connector.

7.2.2 High-pressure washers

High-pressure washing may only be performed on metal surfaces.

Under no circumstances may high-pressure washing be performed in the truck's motor compartment.

When using a high-pressure wash, the jet must be directed in such a way that it does not damage electric cables, electric sensors, hydraulic hoses or decals.

Lifting chains, piston rods and end pieces of hydraulic cylinders, ball and roller bearings – including those that are fully enclosed – must not be exposed to the jet, as there is a risk that water may penetrate and cause corrosion.

After performing a high-pressure wash, all bearings and chains must be lubricated/greased as specified in the maintenance instructions.

7.2.3 Degreasing agents

When using degreasing agents, only environmentally-friendly cold degreasing agents may be used, such as those that are designed for general vehicle cleaning and do not damage paintwork, plastic components, cables, hydraulic hoses or decals.

7.2.4 Cleaning the exterior

- Remove rubbish, etc. from the wheels daily
- Degreasing agents can be used as needed, in line with the previous section.
- Rinse off loose grime using tepid water.

Note:
Seizing, corrosion.
Risk of damage to mechanical parts.
Once washed, the truck should be lubricated as set out in the maintenance instructions.

7.2.5 Cleaning the chain

We recommend you to replace a chain that is very dirty.

Dirty chains should be cleaned before they are lubricated, e.g. by washing with solvent such as diesel or petrol.

The chain should be blown dry using compressed air and lubricated directly after cleaning.

Note:
Exercise care with degreasing agents as these can contain abrasives.

7.2.6 Cleaning the motor compartment

- Cover electric motors, connectors and valves prior to washing.

Note:
Risk of short circuiting.
Risk of damage to the electrical system.
Electrical components must never be cleaned using high-pressure washing equipment.

- Clean the motor compartment using a well-known degreasing agent, diluted to a suitable concentration
- Rinse off loose grime using tepid water.

7.2.7 Electric components

- Clean electric motors using vacuum cleaner or a rag.
- Clean electric panels, logic cards, contactors, connectors, magnetic valves, etc. with a rag moistened with water and a suitable detergent.

Note:
Risk of short circuiting.
Risk of damage to electrical components.
Do not break the warranty seals on the electronic circuit boards.

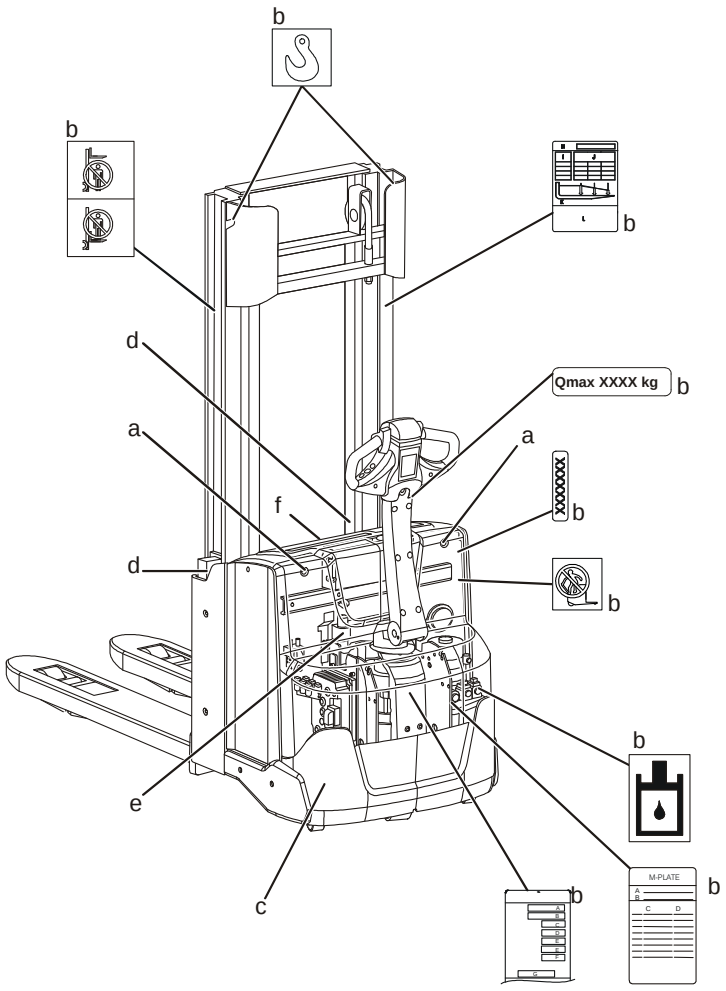
7.3 Maintenance schedule

Service maintenance should be performed in intervals of 750 operating hours or every 12 months, whichever occurs first.

The order in the maintenance schedule is not optimal for the working order; it is simply sorted according to the C codes.

For details on oil and grease specifications, see chapter 23.2

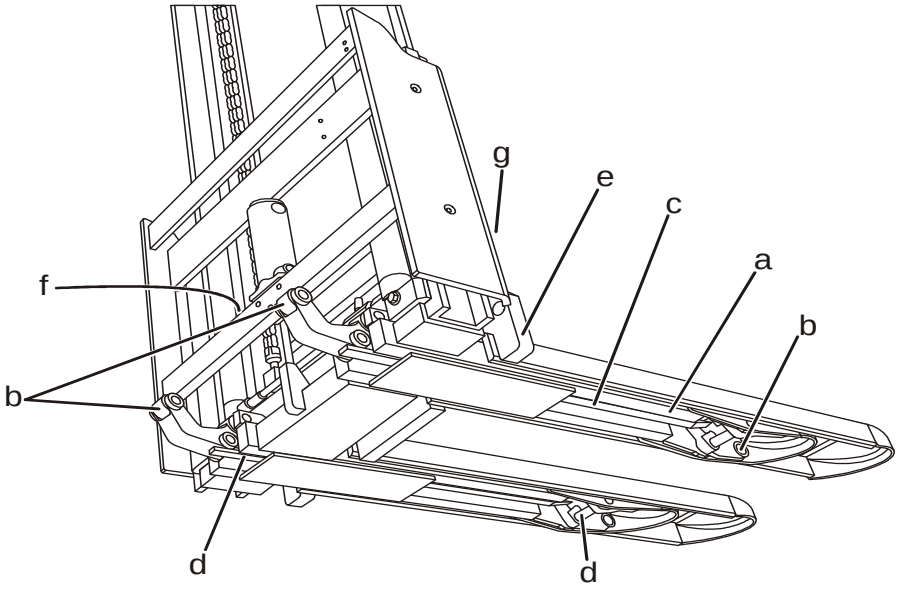
Truck area	Pos.	Measure	750h/12m	Time expenditure
0000 Chassis	a	Inspect cover mountings.	X	5:20 minutes including removal of covers.
	b	Check signs and adhesive labels.	X	
	c	Check for cracks and damage.	X	
	d	Check the mast fixing bolts.	X	
	e	Check for cracks and damage to the motor fixing points.	X	
	f	Secure the paper holder strap if necessary	X	



*The M-label is only affixed on specially produced trucks.

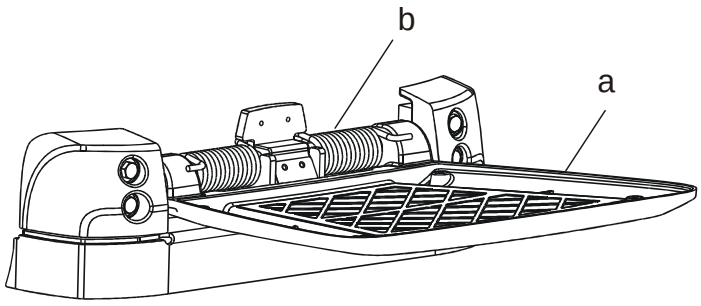
Truck area	Pos.	Measure	750h/12m	Time expenditure
Support arms – 0350	a	Check for cracks and damage.	X	1:30 minutes.
	b	Inspect bushings and links for possible play[1].	X	
	c	Check for cracks and damage to the push rods.	X	
	d	Check all shafts, links and spring pins.	X	

1. Only applies to trucks with support arm lift (S212L, S214L and S220D)



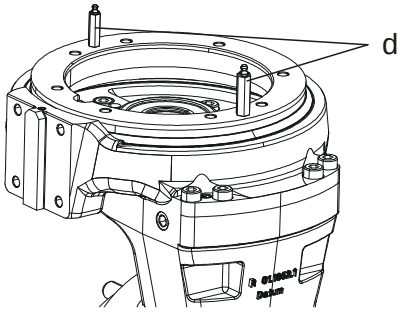
Truck area	Pos.	Measure	750h/12m	Time expenditure
0380 Fork carriage –	e	Check for cracks and damage.	X	1:30 minutes.
	f	Check the rollers for looseness.	X	
	g	Check the load support (Option).	X	
		Inspect the fork stop screws (S212S)	X	
		Check that the battery locks are attached and work properly, also check the bracket on the battery tray.	X	

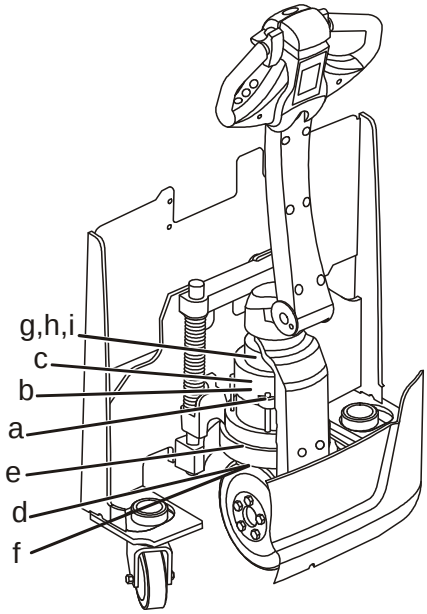
Truck area	Pos.	Measure	750h/12m	Time expenditure
0560 Platform and mountings	a	Check for cracks and damage	X	1:30 minutes.
	b	Check the spring and that the platform returns to the upright position from the lowered position	X	



Truck area	Pos.	Measure	750h /12m	Time expenditure
1700 Drive motor	a	Check the drive motor's attachment.	X	4:30 minutes (excluding oil change for drive gear)
	b	Clean the drive motor.	X	
	c	Inspect for abnormal noise in the drive motor bearings.	X	
2550 Drive gear	d	Check for abnormal noise	X	
	d	Lubricate the steering bearing, lubricant type G See section "11.5 Fitting grease nipples, steering bearings (Option)".	(X[1])	
	e	Inspect the steering bearing for correct mounting and play.	X	
	f	Change the drive gear oil	X[2]	
3180 Brakes	g	Inspect the brake disc for wear. Minimum brake disc thickness: 7.9mm,	X	
	h	Check the air gap in the released position. 0.4±0.3mm Measuring must be done around the entire pressure disc, both on the inside and the outside.	X	
	i	Clean the brake.	X	

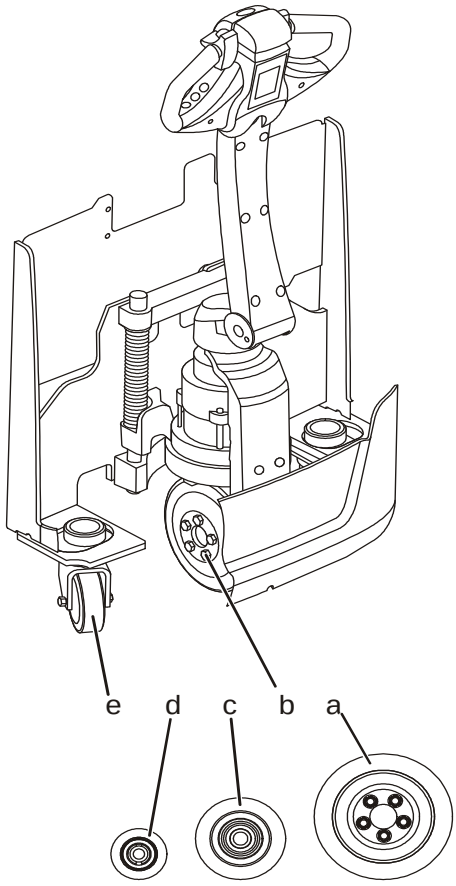
1. Option! Does not need any lubrication when used normally. For trucks that are used intensively or in cold storages, we recommend lubrication every 1500 hrs.
2. Note: The oil in the drive gear only needs to be replaced after 750 hrs. For trucks that are used intensively or in cold storages, we recommend replacing the oil more often.





Truck area	Pos.	Measure	750h/12m	Time expenditure
3500 Wheels	a	Inspect the drive wheel for wear.	X	2 minutes
	b	Check the nuts.	X	
	c	Inspect castor wheel wear.[1]	X	
	d	Check for wear on support arm wheels	X	
	e	Check whether the castor wheels swivel freely	X	

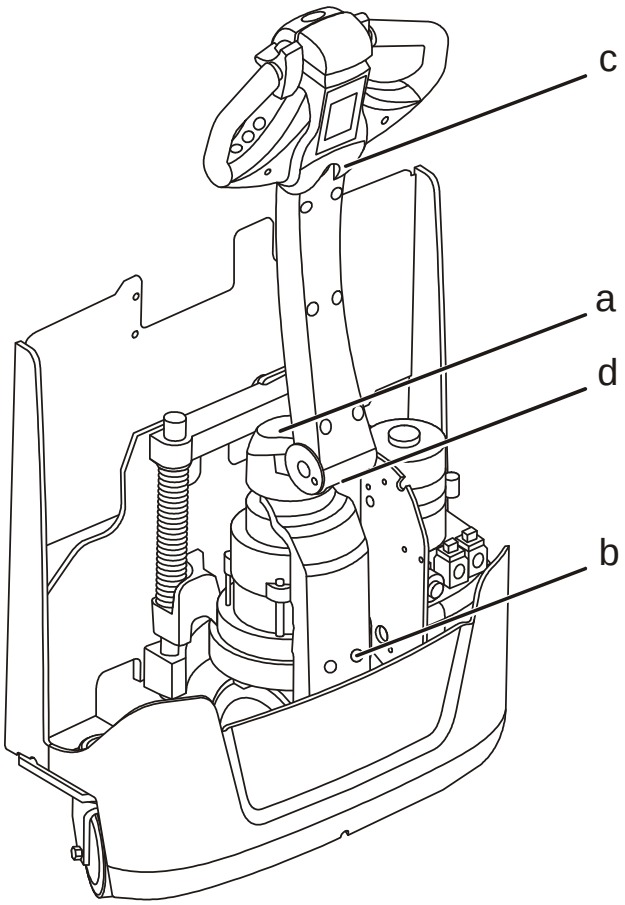
1. Not applicable for S212S



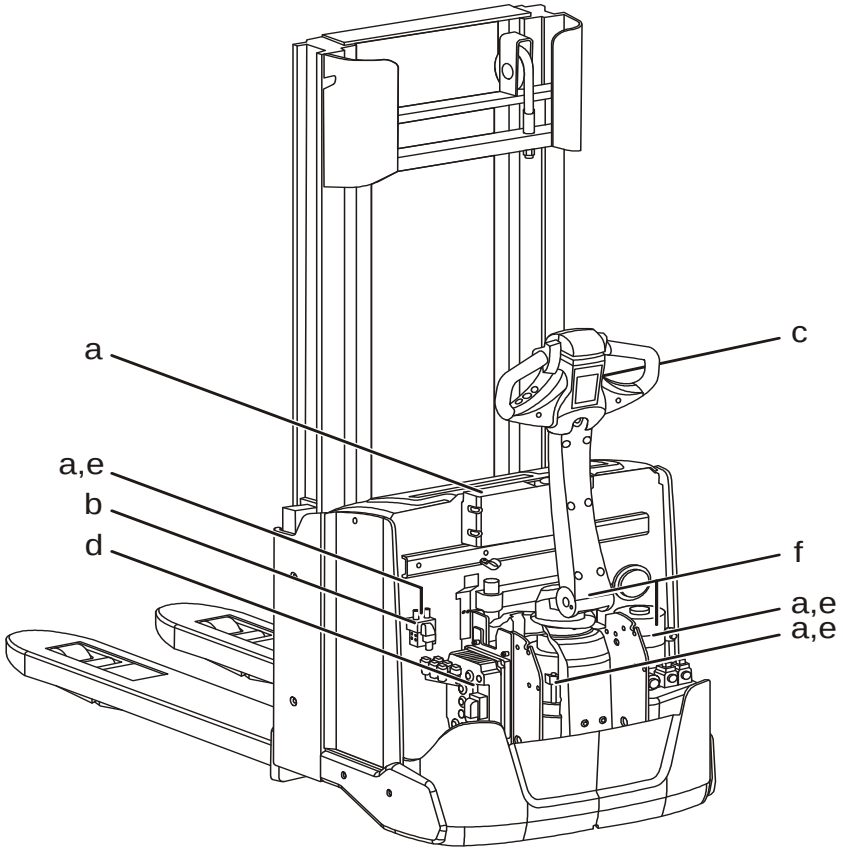
Wheels	Standard measurements, mm	Minimum dimensions, mm
Drive wheel	30	15
Castor wheels[1]	10	5
Support arm wheels	11	5.5

1. Not applicable for S212S

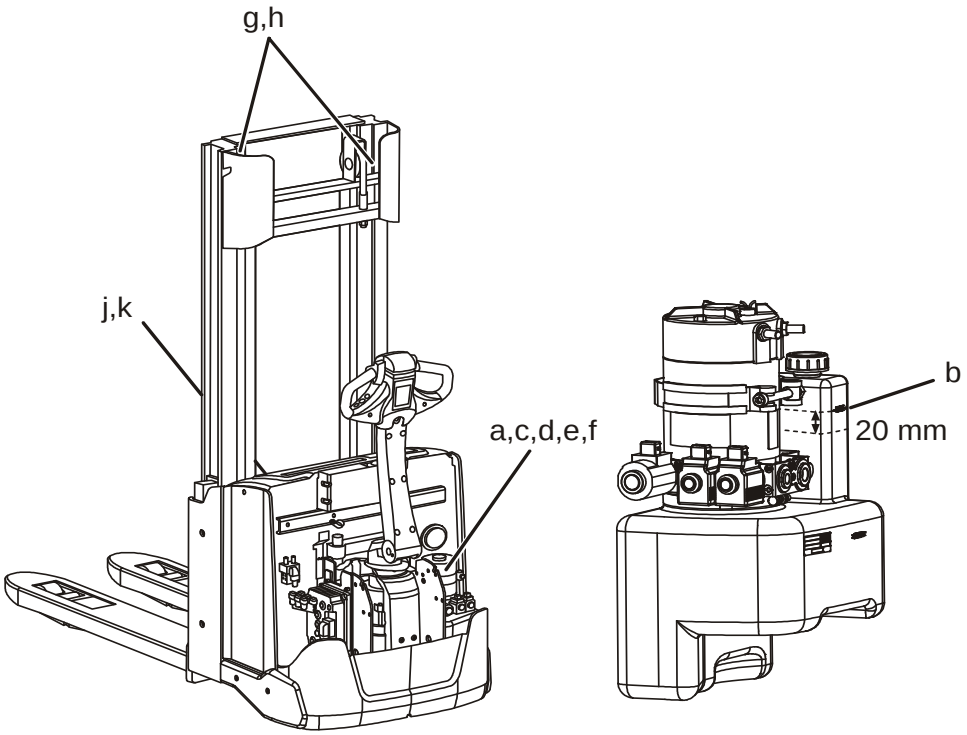
Truck area	Pos.	Measure	750h/12m	Time expenditure
4110 Tiller arm	a	Check for proper attachment.	X	1:45 minutes
	b	Inspect the operating console for correct mounting.	X	
	c	Check the mounting of the handle.	X	
	d	Check the force and locking of the gas spring. The tiller arm should return to the top position both from the bottom position and from the lower position where the brake is applied.	X	
		Check that the braking function is activated in both upper and lower tiller arm positions.		



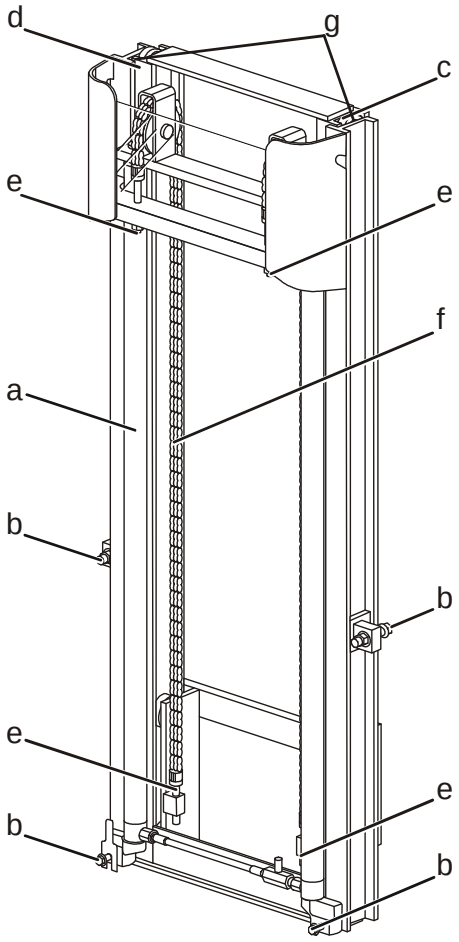
Truck area	Pos.	Measure	750h/12m	Time expenditure
5000 Electrical system	a	Inspect the contacts, wiring harness (including the battery cables), cable insulation and that all cables can move freely.	X	4:30 minutes
	b	Inspect the contactors for correct operation.	X	
	c	Check error code log, operating times and all the segments on the display.	X	
	d	Clean and check that there is no play between the steering box and the heat dissipation plate.	X	
	e	Check and tighten the cable connections.	X	
	f	Check all switches and sensors.	X	



Truck area	Pos.	Measure	750h/12m	Time expenditure
6000 Hydraulic system	a	Check wear on hoses and pipes.	X	16 minutes
	b	Check the oil level. (Recommended window for the oil level when forks are lowered according to illustration)	X	
	c	Check the mounting of the hydraulic unit.	X	
	d	Inspect the hydraulic system for possible leakage.	X	
	e	Change the oil and clean the oil tank. Note: Initially after 750 h/12 m, then every 4500 h/36 m.	X	
	f	Clean the oil strainer. Note: Initially after 750 h/12 m, then every 4500 h/36 m.	X	
6600 Lift cylinder	g	Inspect the lifting cylinder for leakage.	X	
	h	Inspect the lifting cylinder for correct mounting	X	
	j	Inspect the lifting cylinder (support arm lift) for leaks	X	
	k	Inspect the cylinder (support arm lift) for correct mounting	X	



Truck area	Pos.	Measure	750h/12m	Time expenditure
7100 Mast	a	Check for any cracks or damage.	X	16 minutes
	b	Check that there is no looseness in the mast's mounting points.	X	
	c	Check for play between the mast beam and the inner runner's rollers.	X	
	d	Check the inner runner's side play.	X	
	e	Check for wear on the lifting chains and chain rollers. See section "16.3 Main lift chain system 7120".	500h	
	f	Check the adjustment of the lifting chains. See section "16.3 Main lift chain system 7120".	500h	
	g	Lubricate the inside surfaces of beam flanges	X	



8. Troubleshooting

8.1 General

The troubleshooting section describes the error codes that are displayed when the truck is partially or completely disabled. It also describes the cause of the problem together with corrective remedies.

The electronic control system of the truck has built-in error code display and logging. When an error occurs, the error code is shown on the display and the error code LED flashes.

The first time an error code is displayed, try to restart the truck to check whether the error condition remains.

If the error cannot be remedied through troubleshooting, contact the supplier for more information.

Note:
The request "Restart the truck" means that the battery connector must be disconnected before attempting to start the truck again.

Software compatibility

Ensure that the logic card ICH [A5], motor control ACT [T1] and battery charger BCU [A30] have software from the same software package.

To ensure full functionality, the latest software package must be downloaded.

8.2 Towing a defective truck

The towed truck shall always have an operator who can steer and apply the brake when towing using a tow-truck and tow-rope.

Always remove the load before towing or transporting the truck to the specified repair site.

Tow or transport a defective truck as follows:

- Start the truck, move the tiller arm to the drive position and push the truck by hand.

DANGER!
The truck can start to roll when the parking brake function is disabled.
Never leave the truck with the parking brake disconnected, chock the wheels in a satisfactory manner.

Tow using a tow truck and tow wagon:

1. Lift the truck onto the tow wagon. See the instructions under *Lifting a truck*.
2. Connect the truck to the wagon.
3. Drive with care.
4. Lift off the truck according to the instructions under *Lifting a truck*.

8.3 Emergency driving mode

If the truck for some reason stops operating and remains immobile in an unsuitable place, it is possible to active the emergency travel mode to move the truck out of the way (max. 1.3 km/h). In this mode, it is possible to lower and lift the forks.

1. Make sure that the truck is switched off. Enter your PIN code.
2. Press and then release the horn button. “Info“ is shown on the display.
3. Turn the speed control several times until “Ed” is shown on the display.
4. Press and then release the horn button to select.
5. All lamps flash and “SLO” is shown on the display.

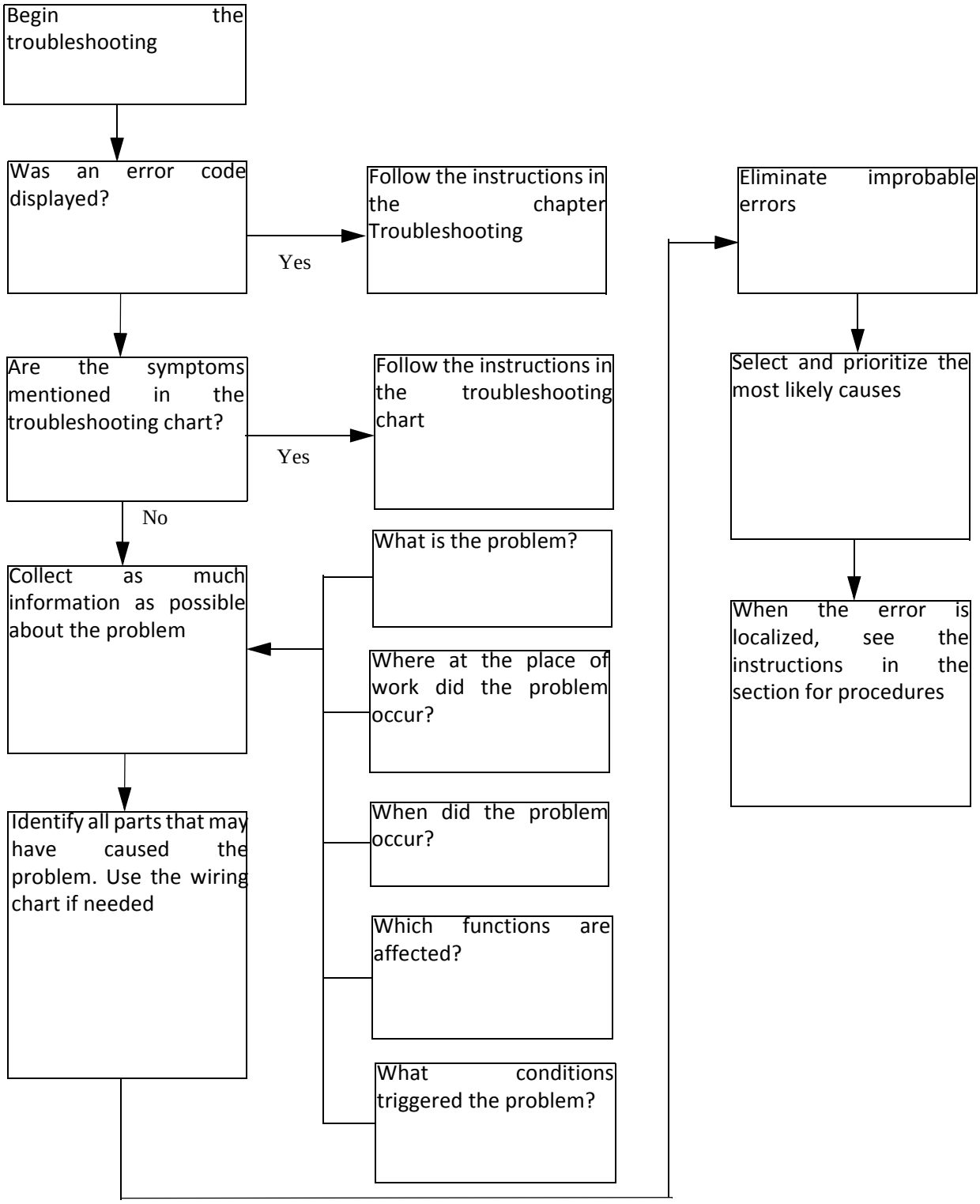
It is now possible to drive the truck, but exercise extreme caution. It is not possible to brake suddenly by raising the steering unit.

If the truck is on an incline, be even more careful when using the emergency travel mode. If you apply too much throttle, there is a risk the truck will roll away. To stop the truck, turn the sped control in the opposite drive direction.

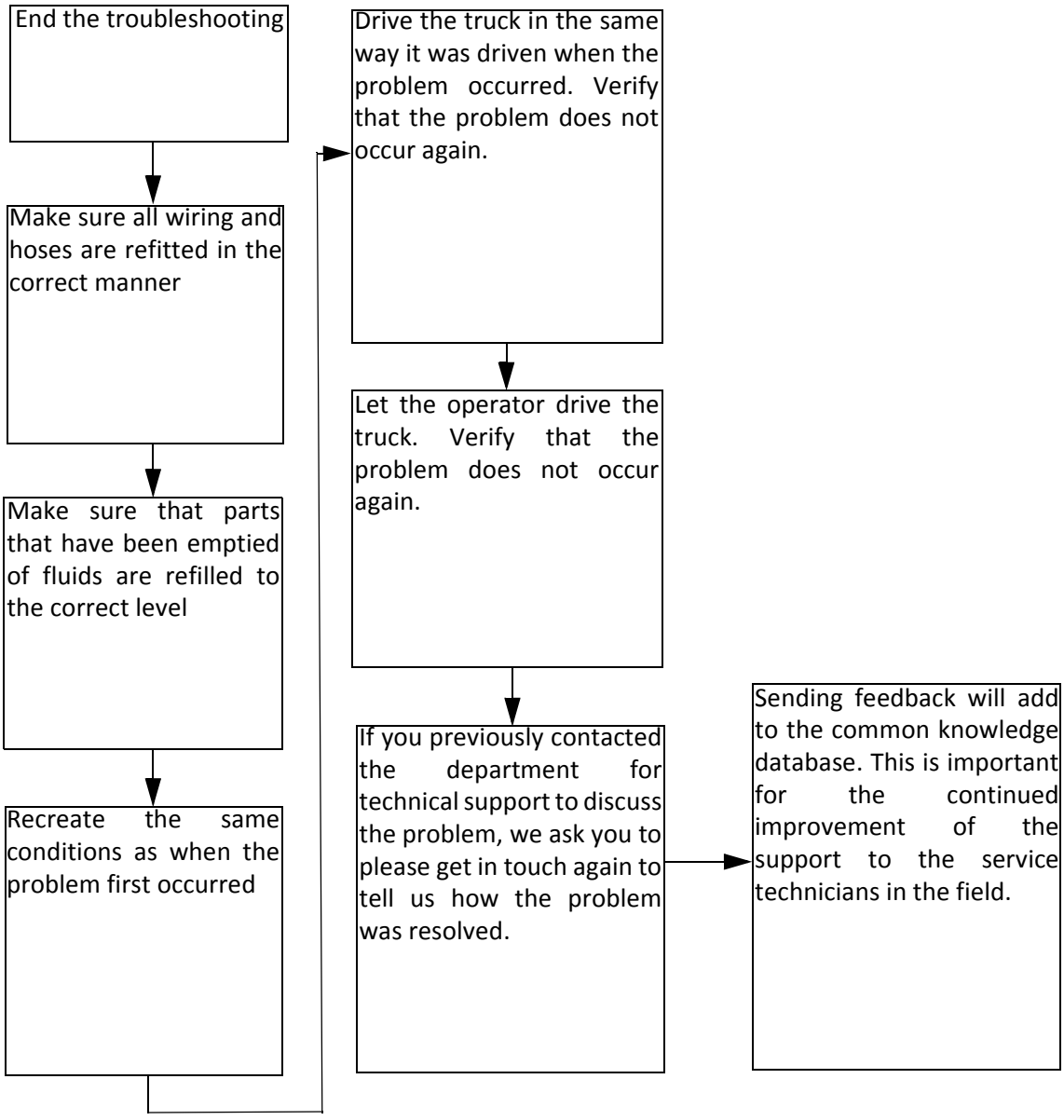
Note:
Some errors block emergency travel mode. You then cannot obtain information on the error.

8.4 Troubleshooting methods

8.4.1 General initial troubleshooting



8.4.2 Concluding troubleshooting



8.5 Error code history

Up to 50 of the most recent error code events can be stored in a log along with the hour meter reading when the error occurred. The error code log displays error codes in chronological order starting with the most recent error code.

Do as follows to display the error code log:

1. Make sure that the truck is switched off. Connect the CAN key or enter the PIN code. Note: **Do not** press the ON switch.
2. Press and then release the horn button. “Info“ is shown on the display.
3. Press and then release the horn button to select the "Info" menu.
4. Turn the speed control several times until “E” is shown on the display. The error code symbol lights up.
5. Press and then release the horn button to select.
6. The most recent error is then displayed. The display alternates between the error code and the hour counter reading when the error occurred. If the error code log contains more than one error code, the codes can be displayed by repeatedly pressing the speed control.
7. Switch off the truck by pressing the OFF switch or return to the previous menu by selecting "ESC".
   The display of error code history is now complete.

8.6 Error code system

See the tables below for an explanation of the error code system.

Structure	Description
X.YZZ	Example: 3.510
X (3)	Group. Indicates which truck system is affected by the error.
YZZ (510)	Sequential number

Group.	Description
1	Not used.
2	Main control unit A5 (ICH)
3	Drive system
4	Hydraulic system
5	Steering system
6	Not used.
7	Not used.
8	Option/auxiliary system
9	Not used.

8.7 Error codes

Please note that some error codes are saved in the log and disappear from the display, while other error codes remain on the display and require that the truck be switched off and then on again for the error code to disappear.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:002	Parameters set to default values. At start-up, it was detected that one or more parameters were not within acceptable intervals; they have therefore been reset to default values	Not influenced	1: New software has been loaded in the truck, adding a new parameter, or it has changed the parameter limit values 2: Corrupt memory A5	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 2: Replace A5:
2:004	Backup copies do not match. Backup copy in secondary unit (T1) does not match data in primary unit (A5)	Not influenced	1: Hardware (T1 or A5) has been replaced. 2: Software has been updated to an older version 3: Corrupt memory T1 4: Corrupt memory A5	1: Copy the truck configuration using TruckCom • See the separate manual for TruckCom. 2: Copy the truck configuration using TruckCom • See the separate manual for TruckCom. 3: Replace T1 4: Replace A5
2:005	Internal program error	Everything is stopped at once, the parking brake is activated, and the main contactor opens	Internal program error A5	• Create a truck report. Send a report to the manufacturer. • Update the truck software to the latest version.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:006	Saving to memory failed. Saving to memory failed because low battery voltage. Battery voltage below 15 V at the time of saving	Not influenced	1: Battery connector disconnected from truck that is started 2: Voltage loss on supply to A5 3: The battery is defective 4: Battery parameter #107 has an erroneous value	1: Connect the battery connector. 2: Check battery voltage • Check the voltage using the built-in test procedure and comparing with value from external volt meter • Check connectors, joints and splices for damage or corrosion. • Check fuses F1 and F50 3: Check the battery. 4: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
2:007	Internal program error A5	Not influenced	Internal program error	• Create a truck report. Send a report to the manufacturer. • Update the truck software to the latest version.
2:008	Internal program error A5	Not influenced	Internal program error	• Create a truck report. Send a report to the manufacturer. • Update the truck software to the latest version.
2:009	Internal program error A5	Not influenced	Internal program error	• Create a truck report. Send a report to the manufacturer. • Update the truck software to the latest version.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:010	CAN communication warning. A5 has received too may erroneous signals	Not influenced	1: Error on CAN bus wiring or connections 2: Loose connections 3: CAN node defective 4: Software failure	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm 2: Check for loose connections • Switch on the truck, and pull carefully in the branches of the wiring harness to find any loose connections, and note when/if the error code appears. 3: Check the CAN node • Deactivate and disconnect the option unit connected to the CAN wiring. Activate and then connect them one by one to identify which unit produces the communication error. 4: Update the truck software • Update the truck software package to the latest available version.
2:011	New software. New software installed. In order to look in the error code log to see when new software was installed.	Not influenced	New software installed	Logged in the error log to see when the software was updated
2:080	Internal program error	Creep speed, blocked lifting/ lowering movement	1: Internal program error 2: Manufacturing defect in A5	1: Create a truck report. Send a report to the manufacturer. • Update the truck software to the latest version. 2: Replace A5:

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:102	Configuration error. Truck configuration does not match parameter 1102	Creep speed, blocked lifting/ lowering movement	Incorrect value for parameter 1102	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
2:180	Internal program error	Creep speed, blocked lifting/ lowering movement	Internal program error	• Create a truck report. Send a report to the manufacturer. • Update the truck software to the latest version.
2:285	Incorrect signal combination from the support arm position sensor	Creep speed, blocked lifting/ lowering movement	1: High signal from both B62 and B65 2: Constantly high signal at inputs (T1:94) and (T1:87)	1: Check the sensor signal • Check that the distance between the sensor and the opposite part is correct. • Check that there is no dirt or foreign objects on the sensor • Inspect cabling. • Measure the signals from the sensor with a volt meter and verify using TruckCom or the built-in test that the signal is correct 2: Check the signal to the unit • Compare the signals from the sensor with the input signal (use a volt meter and verify using TruckCom or the built-in test that the signals are the same) • Check the pins on the unit and in the connector • Replace the unit if you cannot get it to work properly

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:501	Low battery voltage below 16.8 Volts for more than 2 seconds	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: The battery is discharged 2: Voltage loss on supply to A5 3: The battery is defective 4: Battery parameter #107 has an erroneous value	1: Charge the battery. 2: Check battery voltage • Check the voltage using the built-in test procedure and comparing with value from external volt meter • Check connectors, joints and splices for damage or corrosion. • Check fuses F1 and F50 3: Check the battery. 4: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
2:502	Truck type not set Parameter 1001 is incorrectly set	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: A5 is replaced and/or erroneous value for factory parameters 2: Incorrect value for parameter 1001	1: Copy the truck configuration using TruckCom • See the separate manual for TruckCom. 2: Check parameters. • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
2:503	Wrong truck model set. Parameter 1108 is wrongly set in combination with 1001	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: A5 is replaced and/or erroneous value for factory parameters 2: Wrong value for parameter 1108 and/or 1001	1: Copy the truck configuration using TruckCom • See the separate manual for TruckCom. 2: Check parameters. • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:511	A5 has received too may erroneous signals	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Error on CAN bus wiring or connection 2: Loose connections 3: CAN node defective 4: Software failure	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm 2: Check for loose connections • Switch on the truck, and pull carefully in the branches of the wiring harness to find any loose connections, and note when/if the error code appears. 3: Check the CAN node • Deactivate and disconnect the option unit connected to the CAN wiring. Activate and then connect them one by one to identify which unit produces the communication error. 4: Update the truck software • Update the truck software to the latest version.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:515	No return signal from K110 (DHU/ TWIS) within 0.6 seconds after logging on	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Error on CAN bus wiring or connection 2: Wrong setting for parameter 102 3: No connection with K110 4: Loose connections 5: Software failure	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm 2: Check parameters. • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 3: Check K110 (DHU/TWIS) • Check that the DHU's green LED is lit. If the LED is not lit: Check the DHU's feed voltage = battery voltage • Make sure it is possible to connect TruckCom to the DHU. If it is possible to connect them, check the DHU's configuration. If there is a power supply but no communication, check the CAN bus. If it still not possible to communicate with the DHU, replace the unit. 4: Check for loose connections • Switch on the truck, and pull carefully in the branches of the wiring harness to find any loose connections, and note when/if the error code appears. 5: Update the truck software • Update the truck software to the latest version.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:516	A5 has an incorrect box address. There is a jumper/ short circuit in contact X203 between pin 1 and 0 V internally on the A5 card.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	Box address error on A5	1: Check whether contact X203 is short circuited. If a jumper is fitted, remove it. 2: Replace A5
2:520	The checksum of the parameter values does not match the parameter values.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: New software has been loaded in the truck, adding a new parameter, or it has changed the parameter limit values 2: Corrupt memory circuit 3: Checksum error	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 2: Replace A5 3: Set new checksum • If the problem with the check sum occurs directly in connection with the software update, proceed as follows: • Change the value of one parameter in each category, operator parameters, service parameters and calibration parameters. • Save the changes and restart the truck. • Reset the values you changed in the previous step back to their original values. • Restart the truck. • The program will have performed a new checksum calculation.

Code	Description	Truck behaviour	Error cause(s)	Procedure
2:522	Incorrect power supply to the Hall sensors. High (or low) signal from all Hall sensors A5:S300-S318	Plug braking to stop, then the parking brake is activated and the main contactor opens	Incorrect power supply to the Hall sensors.	1: Check the Hall sensors • Check with TruckCom or the built-in test that the Hall sensors work the way they should. • A Hall sensor that is being influenced should give a low signal. • Replace A5 if the Hall sensors have an error function.
2:523	Internal memory (FRAM or RAM) is faulty Reading from or writing to memory failed	Everything is stopped at once, the parking brake is activated, and the main contactor opens	• Corrupt memory circuit	1: Replace A5
2:580	The Hall element for the speed control gives a signal (active low) when it should not	Plug braking to stop, then the main contactor opens and the parking brake is activated	A5 defective	1: Check the Hall sensors • Check with TruckCom or the built-in test for the Hall sensors that they work the way they should. A Hall sensor that is being influenced should give a low signal. • Replace A5 if the Hall sensors have an error function.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:001	The speed control was not in the neutral position at start-up One or more Hall elements for the speed control give an active signal at start	The truck cannot be driven, other functions OK	1: Control manipulated. 2: The speed control does not spring back to neutral position. 3: A5 defective	1: Let go of the control, and wait for four seconds 2: Check the speed control • Check the spring function • Check that the speed control is not seized • Check that the plastic cover where the spring is attached is intact. 3: Check the Hall sensors • Check with TruckCom or the built-in test for the Hall sensors that they work the way they should. A Hall sensor that is being influenced should give a low signal. • Replace A5 if the Hall sensors have an error function.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:002	The motor control unit temperature exceeds +85°C.	The motor control is limiting the voltage	1: Cooling is reduced or the temperature sensor is defective.	1: Check the cooling • Check the cooling flanges of the transistor regulator, motor and steering motor as well as the battery charger and fans and filters for accumulations of dirt and dust. Too much dust and dirt cause the cooling not to work properly. • Check that the fans work when the speed control is activated (fans behind T1 and motor fan) • Check that the fan on charger T14 works when the charging starts, i.e. when the mains cable is connected • Check the signal from the temperature sensors for T1 and T13 and from B1 using the integrated test or TruckCom. Determine if the temperature signals are plausible relative to the real temperatures of the components. If not, replace T1,T13 or replace B1 with a repair kit.
3:040	Incorrect power saving function in the standby mode.	Not influenced	1: Internal error in T1	1: Restart the truck. 2: If the error persists, replace the motor control T1.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:080	The temperature sensor in the motor control power stage is outside the limit values. Above 130℃	The motor control is limiting the voltage.	1: Cooling is reduced or the temperature sensor is defective.	1: Check the cooling • Check the cooling flanges of the transistor regulator, motor and steering motor as well as the battery charger and fans and filters for accumulations of dirt and dust. Too much dust and dirt cause the cooling not to work properly. • Check that the fans work when the speed control is activated (fans behind T1 and motor fan) • Check that the fan on charger T14 works when the charging starts, i.e. when the mains cable is connected • Check the signal from the temperature sensors for T1 and T13 and from B1 using the integrated test or TruckCom. Determine if the temperature signals are plausible relative to the real temperatures of the components. If not, replace T1,T13 or replace B1 with a repair kit.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:081	The motor temperature sensor is outside of limit values. Above 210℃.	Creep speed and motor control limits the voltage.	1: Cooling is reduced or the temperature sensor is defective.	1: Check the cooling • Check the cooling flanges of the transistor regulator, motor and steering motor as well as the battery charger and fans and filters for accumulations of dirt and dust. Too much dust and dirt cause the cooling not to work properly. • Check that the fans work when the speed control is activated (fans behind T1 and motor fan) • Check that the fan on charger T14 works when the charging starts, i.e. when the mains cable is connected • Check the signal from the temperature sensors for T1 and T13 and from B1 using the integrated test or TruckCom. Determine if the temperature signals are plausible relative to the real temperatures of the components. If not, replace T1,T13 or replace B1 with a repair kit.
3:100	Motor control warning. Unknown warning	Creep speed, blocked lifting/ lowering movement	1: Internal program error 2: Software failure	1: Create a truck report. Send a report to the manufacturer. 2: Update the truck software to the latest version.
3:101	Internal error in T1	Creep speed, blocked lifting/ lowering movement	1: The motor control is using pre-set power amplification. Internal error	1: Restart the truck. 2: If the error persists, replace the motor control T1.
3:120	Incorrect checksum for the motor control parameters	Creep speed, blocked lifting/ lowering movement	Motor control corrupt	1: Update the truck software to the latest version. 2: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:121	The motor control T1 cannot use internal memory.	Creep speed, blocked lifting/ lowering movement	Internal error in T1	1: Restart the truck. 2: Update the truck software • Update the truck entire software package to the latest available version. 3: If the error persists, replace T1
3:140	Hardware protection in T1 detects a short circuit in the output for the horn. The current through the horn is above the valid limit value. Maximum value = 500mA, continuous value = 300mA	Not influenced	High power consumption or short circuit	1: Check for overcurrent or short circuit: • Check the ohms and the amperes of the component, compare them to the setpoint values if they outside the accepted range. • Check the connections and wiring harness for short-circuit. • Check that the component does not seize or is jammed. • If points 1-3 are OK, it indicates that the output stage is short circuited - Replace the power-supplying component

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:303	Motor control start-up failed	The truck cannot be started	1: Error on CAN bus wiring or connection 2: Incorrect value for parameter 1001 3: No power supply 4: Wrong kind of motor control	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm 2: Check parameters. • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 3: Check wiring after the break. • Disconnect the battery • Using instruments, check that there is no break in any wire. • Measure and check the voltage for the activated functions 4: Replace T1
3:500	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	Defective motor control	1: Replace T1
3:501	Defective motor controller	Everything is stopped at once, the parking brake is activated, and the main contactor opens	Defective motor control	1: Check: • T1 • Factory parameter 1001 (Truck type). 2: If the error persists, replace T1.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:502	Error in T1 when saving parameters	Everything is stopped at once, the parking brake is activated, and the main contactor opens	Defective motor control	1: Replace T1
3:505	Unknown error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	No software compatibility	1: Update the truck software • Update the truck entire software package to the latest available version.
3:507	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	Defective motor control	1: Replace T1
3:511	CAN communication problem between T1 and A5, A5 gets no signals from T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Error on CAN bus wiring or connection 2: CAN module in A5 defective	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm 2: Replace A5
3:512	CAN communication problem between A5 and T1, T1 gets no signals from A5	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Error on CAN bus wiring or connection	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:514	CAN communication problem, A5 cannot send to T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Error on CAN bus wiring or connection 2: CAN module in A5 defective	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm 2: Replace A5
3:515	The motor control has detected low motor voltage.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Short circuit in motor 2: Short circuit in motor wiring harness 3: Short circuit in power stage	1: Check the motor • Disconnect motor wiring including sensor wires. • Insulation test. Check that the coils are not electrically connected to the chassis. Replace M1 if the motor is not isolated 2: Check the motor wiring harness • Visual check of the motor wiring harness. Check that there is no contact between the pole connections on the motor/motor control. Search for contact and damaged insulation on the wiring harness. • Disconnect the motor wiring harness at the motor control and the motor and measure the ohms of the wiring harness between the phases and verify that there is no contact. 3: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:521	The motor control has detected high motor voltage.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Short circuit in motor 2: Short circuit in motor wiring harness 3: Short circuit in power stage	1: Check the motor • Disconnect motor wiring including sensor wires. • Insulation test. Check that the coils are not electrically connected to the chassis. Replace M1 if the motor is not isolated 2: Check the motor wiring harness • Visual check of the motor wiring harness. Check that there is no contact between the pole connections on the motor/motor control. Search for contact and damaged insulation on the wiring harness. • Disconnect the motor wiring harness at the motor control and the motor and measure the ohms of the wiring harness between the phases and verify that there is no contact. 3: Replace T1
3:526	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Software failure 2: Defective motor control	1: Update the truck software to the latest version. 2: Replace T1
3:529	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Software failure 2: Defective motor control	1: Update the truck software to the latest version. 2: Replace T1
3:530	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Software failure 2: Defective motor control	1: Update the truck software to the latest version. 2: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:531	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Software failure 2: Defective motor control	1: Update the truck software to the latest version. 2: Replace T1
3:532	Internal error in T1	Everything is stopped at once, the parking brake is activated, and the main contactor opens	• The motor control has detected an internal problem in the AD converter.	• Replace T1
3:533	The charging voltage for the motor control capacitor indicates abnormal values.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	• The charging voltage for the motor control capacitor indicates abnormal values.	1: Check: • connections and wiring harness • Wire 20 • The connection point (T1:84) must be 24 V • Motor controller • Pump contactor 2: If the error persists, replace T1
3:535	Incorrect checksum for the motor control parameters.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	• Incorrect checksum for the motor control parameters.	1: Update the truck software • Update the truck entire software package to the latest available version.
3:537	Internal error in A5	Everything is stopped at once, the parking brake is activated, and the main contactor opens	• Multi-direction command issued by handle.	• What to do?

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:539	The motor control detects that the battery voltage is between 18 V and 28.8 V.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: The battery is discharged 2: Voltage loss on power supply to T1 3: The battery is defective 4: Battery parameter # 107 has an erroneous value	1: Charge the battery. 2: Check the voltages in T1 • Check fuses F50 and F1 • Check the voltage using a volt meter (Measuring point F50 - B-) and compare with the TruckCom value “Battery Voltage” (Node:ACT, Analogue I/O) (Limit values?) (TBD) • Check the voltage using a volt meter (Measuring point F1 - B-) and compare with the TruckCom value “Battery Voltage” (Node:ACT, Analogue I/O) (Limit values?) If the contactor is open, there is several volts of difference -- normal. If the contactor is closed, voltage should match the point across ±XX • Check the connectors, joints and splices • Check that any extra equipment is connected in accordance with our recommendation. 3: Check the battery. 4: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:540	Hardware in T1 detects a short circuit in the power stage and a phase-to-phase short circuit, phase B- and phase B+	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Short circuit in motor 2: Short circuit in motor wiring harness 3: Short circuit in power stage	1: Check the motor • Disconnect motor wiring including sensor wires. • Insulation test. Check that the coils are not electrically connected to the chassis. Replace M1 if the motor is not isolated 2: Check the motor wiring harness • Visual check of the motor wiring harness. Check that there is no contact between the pole connections on the motor/motor control. Search for contact and damaged insulation on the wiring harness. • Disconnect the motor wiring harness at the motor control and the motor and measure the ohms of the wiring harness between the phases and verify that there is no contact. 3: Replace T1
3:545	Hardware protection in T1 detects a short circuit in the output to the brake (Q1) The current through the brake exceeds the limit values. Maximum value = 5.95A, continuous value = 3A	Everything is stopped at once, the parking brake is activated, and the main contactor opens	High power consumption or short circuit	1: Check for overcurrent or short circuit: • Check the ohms and the amperes of the component, compare them to the setpoint values if they outside the accepted range. • Check the connections and wiring harness for short-circuit. • Check that the component does not seize or is jammed. • If points 1-3 are OK, it indicates that the output stage is short circuited - Replace the power-supplying component

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:546	Hardware protection in T1 detects a short circuit or current through the main contactor (Q10) exceeds valid limit values. Maximum value = 2.5A, continuous value = 1.5A	Everything is stopped at once, the parking brake is activated, and the main contactor opens	High power consumption or short circuit	1: Check for overcurrent or short circuit: • Check the ohms and the amperes of the component, compare them to the setpoint values if they outside the accepted range. • Check the connections and wiring harness for short-circuit. • Check that the component does not seize or is jammed. • If points 1-3 are OK, it indicates that the output stage is short circuited - Replace the power-supplying component
3:547	Hardware protection in T1 detects a short circuit in the output “High Side driver”	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Components are using too much power or wiring is short circuited. 2: No software compatibility 3: Short circuit in power stage	1: Check components that are supplied with power from the High Side Out (Main contactor, pump contactor (if powered pallet truck), brake coil and lowering valve). • Check the ohms and the amperes of the component, compare them to the setpoint values if they outside the accepted range. • Check the connections and wiring harness for short-circuit. • Check that the component does not seize or is jammed. • If points 1-3 are OK, it indicates that the output stage is short circuited - Replace the power-supplying component 2: Update the truck software • Update the truck software to the latest version. 3: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:548	Hardware protection in T1 detects a short circuit or current through the main contactor (Q10) exceeds valid limit values. Maximum value = 2.5A, continuous value = 1.5A	Everything is stopped at once, the parking brake is activated, and the main contactor opens	High power consumption or short circuit	1: Check for overcurrent or short circuit: • Check the ohms and the amperes of the component, compare them to the setpoint values if they outside the accepted range. • Check the connections and wiring harness for short-circuit. • Check that the component does not seize or is jammed. • If points 1-3 are OK, it indicates that the output stage is short circuited - Replace the power-supplying component
3:549	The motor control detects missing phases to the motor	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Short circuit in motor 2: Low power consumption or break 3: Short circuit in power stage	1: Check the motor • Disconnect motor wiring including sensor wires. • Insulation test. Check that the coils are not electrically connected to the chassis. Replace M1 if the motor is not isolated 2: Check wiring and component after the break • Disconnect the battery • Visually check the wiring harness • Using instruments, check that there is no break in any wire • Check the Ohms and the Amperes of the component, compare them to the setpoint values, and replace the unit if they are outside the accepted range. • Reconnect the battery. Measure and check the voltage for the activated functions. 3: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:563	The amperage is below the limit value 100mA on the output to brake (Q1)	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Low power consumption or break	1: Check wiring and component after the break • Disconnect the battery • Visually check the wiring harness • Using instruments, check that there is no break in any wire • Check the Ohms and the Amperes of the component, compare them to the setpoint values, and replace the unit if they are outside the accepted range. • Reconnect the battery. Measure and check the voltage for the activated functions.
3:564	The amperage is below the limit value 100mA on the output to main contactor (Q10)	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Low power consumption or break	1: Check wiring and component after the break • Disconnect the battery • Visually check the wiring harness • Using instruments, check that there is no break in any wire • Check the Ohms and the Amperes of the component, compare them to the setpoint values, and replace the unit if they are outside the accepted range. • Reconnect the battery. Measure and check the voltage for the activated functions.

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:582	The transistor regulator's output for power supply has the wrong voltage level.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Low power consumption or break 2: Short circuit in power stage	1: Check wiring and component after a break (main contactor, lowering valve, brake, pump contactor) • Disconnect the battery • Visually check the wiring harness • Using instruments, check that there is no break in any wire • Check the Ohms and the Amperes of the component, compare them to the setpoint values, and replace the unit if they are outside the accepted range. • Reconnect the battery. Measure and check the voltage for the activated functions. 2: Replace T1
3:583	Internal transistor regulator voltage supply has not been switched on.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Defective RPM sensor 2: Defective motor control	1: Defective RPM sensor • Check cables and connectors after interruption • Replace the speed sensor 2: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:590	The change exceeds 1000 rpm in 20 ms	The drive is stopped immediately with the parking brake	1: Broken wiring 2: Defective component 3: Change in surface friction combined with slippage	1: Check wiring after the break. • Disconnect the battery • Using instruments, check that there is no break in any wire. • Measure and check the voltage with the functions activated 2: Check the rotational speed sensor • Disconnect the B11. Check that there are no metal fragments on B11 sensor points. • Check that the toothed wheel on the motor axle is clean, intact and properly mounted. 3: Drive carefully if there is a risk of slipping
3:592	Internal electrical fault. Sensor offset is too high	The drive is stopped immediately with the parking brake	1: Defective motor control	1: Replace T1

Code	Description	Truck behaviour	Error cause(s)	Procedure
3:597	The motor temperature exceeds +180℃.	The drive is stopped immediately with the parking brake	1: Intensive use of the truck 2: Cooling is reduced or the temperature sensor is defective.	1: Intensive use of the truck. Let the truck cool down. 2: Check the cooling • Check the cooling flanges of the transistor regulator, motor and steering motor as well as the battery charger and fans and filters for accumulations of dirt and dust. Too much dust and dirt cause the cooling not to work properly. • Check that the fans work when the speed control is activated (fans behind T1 and motor fan) • Check that the fan on charger T14 works when the charging starts, i.e. when the mains cable is connected • Check the signal from the temperature sensors for T1 and T13 and from B1 using the integrated test or TruckCom. Determine if the temperature signals are plausible relative to the real temperatures of the components. If not, replace T1,T13 or replace B1 with a repair kit.
4:001	Lifting/lowering control is not in neutral position at start-up. Lifting is prevented until the lifting/lowering controller is back in the neutral position.	Blocked lifting/ lowering movement	1: Control manipulated	1: Let go of the control, and wait for four seconds 2: Check • wiring in the handle • the potentiometer. If defective, replace the potentiometer.
4:101	Signal from the sensilift potentiometer detects abnormal values.	Creep speed, blocked lifting/ lowering movement	1: Control manipulated	1: Let go of the control, and wait for four seconds 2: Check • wiring in the handle • the potentiometer. If defective, replace the potentiometer.

Code	Description	Truck behaviour	Error cause(s)	Procedure
4:102	Signal from the sensilift potentiometer detected even though parameter 1102 does not have the value 4.	Creep speed, blocked lifting/ lowering movement	1: Incorrect value for parameter 1102 2: Error in hydraulic controls	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 2: Replacement of the hydraulic control.
4:125	Pump motor current feedback remains zero when the pump motor operates.	Creep speed, blocked lifting/ lowering movement	1: Defective power supply to the motor control.	• Replace T1
4:126	Excessive pump motor current feedback at start-up and in the standby mode.	Creep speed, blocked lifting/ lowering movement	1: Defective power supply to the motor control.	• Replace T1
4:521	Pump motor voltage too low.	The main contactor opens	1: Wire break between T1 and the pump motor 2: The pump motor	1: Check wiring after the break. • Disconnect the battery • Using instruments, check that there is no break in any wire. • Measure and check the voltage with the functions activated 2: Check the pump motor • Disconnect motor wiring including sensor wires. • Insulation test. Check that the coils are not electrically connected to the chassis. Replace if the motor is not isolated

Code	Description	Truck behaviour	Error cause(s)	Procedure
4:522	Pump motor voltage too high.	The main contactor opens	1: Wire break between T1 and the pump motor 2: The pump motor	1: Check wiring after the break. • Disconnect the battery • Using instruments, check that there is no break in any wire. • Measure and check the voltage with the functions activated 2: Check the pump motor • Disconnect motor wiring including sensor wires. • Insulation test. Check that the coils are not electrically connected to the chassis. Replace if the motor is not isolated
4:540	The transistor regulator output to the lowering valve has short-circuited.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: The transistor regulator output to the lowering valve has short-circuited. 2: Internal short-circuit in the motor control.	1: Inspect the connections and wiring harness. • Disconnect the lowering valve and try restarting the truck. 2: If the error remains, replace the lowering valve of the T1
4:541	The transistor regulator output to the lowering valve has short-circuited with B-.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Broken wiring	1: Check wiring after the break. • Disconnect the battery • Using instruments, check that there is no break in any wire. • Measure and check the voltage with the functions activated
4:560	The transistor regulator output to the lowering valve is open.	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Broken wiring 2: Lowering valve	1: Check wiring after the break. • Disconnect the battery • Using instruments, check that there is no break in any wire. • Measure and check the voltage with the functions activated 2: Check the lowering valve solenoid

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:001	Collision sensor has registered collision levels outside set limit values as defined by parameters 105 and 106.	Creep speed	1: Collision 2: Parameters 105 and 106 set too low.	1: Resetting truck after collision 2: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
8:002	The truck was intentionally taken out of service via I_site	Creep speed	1:	1:
8:003	Argument error in option. Invalid configuration in one or more options.	Not influenced. The alarming option does not work.	1: Option argument error, parameters 1003 - 1042	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
8:004	One or more option buttons on A5 is activated at start-up.	Not influenced. All option buttons are non-functional until the option button that is influenced is not influenced any more.	1: Option button pressed during start-up	1: Check your option buttons • Check the function of the option buttons via the built-in test mode, Service Information mode 9 or TruckCom. • If there is still a signal from a seemingly uninfluenced button, the button must be checked for jamming or unwanted connection.
8:010	CAN communication problem with the built-in charger T14 at start-up	Not influenced	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:011	CAN communication problem with the built-in charger T14.	Not influenced	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm
8:020	T14 detects no battery, voltage below valid level: 6V	Not influenced	1: Battery not connected to charger	1: Check the battery charger cables. • Disconnect the battery by disconnecting the connector and power cable from the charger. • Measure the ohms on red and black wires from T14 to X1. Replace the cables in case of breakage.
8:021	T14 detects low battery voltage when charging. Voltage below valid level: 19.8V	Not influenced	1: The battery is defective	1: Check the battery.
8:022	T14 detects high battery voltage when charging. Voltage above valid level: 34.8V	Not influenced	1: The battery is defective	1: Check the battery.
8:023	T14 detects low temperature when charging.	Not influenced	1: Truck used in cold environments.	1: Inform the client that the truck should be stored in normal ambient temperatures to avoid unnecessary wear and tear of the battery and other components.

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:024	T14 has reduced the charging current to 0A because of high temperature.	Not influenced	1: Cooling is reduced or the temperature sensor is defective.	1: Check the cooling • Check the cooling flanges of the transistor regulator, motor and steering motor as well as the battery charger and fans and filters for accumulations of dirt and dust. Too much dust and dirt cause the cooling not to work properly. • Check that the fans work when the speed control is activated (fans behind T1 and motor fan) • Check that the fan on charger T14 works when the charging starts, i.e. when the mains cable is connected • Check the signal from the temperature sensors for T1 and T13 and from B1 using the integrated test or TruckCom. Determine if the temperature signals are plausible relative to the real temperatures of the components. If not, replace T1,T13 or replace B1 with a repair kit.
8:027	Internal error in T14	Not influenced	1: No software compatibility 2: Defective component	1: Update the truck software • Update the truck software to the latest version. 2: Replace the T14
8:028	The main charging time is exceeded by 5-11 hours depending of battery capacity.	Not influenced	1: Battery parameters 109 and 110 incorrectly set. 2: The battery is defective	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 2: Check the battery.

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:029	Charged capacity exceeds battery capacity.	Not influenced	1: Battery parameters 109 and 110 incorrectly set. 2: The battery is defective	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly. 2: Check the battery.
8:030	Communication with charger T14 exists, but factory parameter 1101 is not activated.	Not influenced	1: Incorrect value for parameter 1101	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
8:031	Saving parameter in T14 failed.	Not influenced	1: No software compatibility	1: Update the truck software • Update the truck software to the latest version.
8:032	Wrong battery type selected via parameters 109 and 110.	Not influenced	1: Battery parameters 109 and 110 incorrectly set.	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
8:033	CAN communication problems between BMS and BCU (A30)	Creep speed, blocked lifting/ lowering movement	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:110	CAN communication problems between A5 and A36/A37	Creep speed, blocked lifting/ lowering movement	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm
8:111	CAN communication problems between A5 and A36/A37	Creep speed, blocked lifting/ lowering movement	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm
8:112	CAN communication problems between A5 and B90	Not influenced	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:123	Argument error in option. Invalid configuration in one or more options.	Creep speed, blocked lifting/ lowering movement	1: Argument error option	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.
8:130	CAN communication error with li-ion battery	Creep speed, blocked lifting movement If CAN key connected - creep speed	1: Error on CAN bus wiring or connections	1: Check the CAN bus • Check that CAN bus is intact in terms of wiring harness, resistance and connectors. Disconnect the battery. Check that the resistance between (X41:3) and (X41:4) is 54 - 66 ohms. • Check that the CAN wiring harness is not pinched. Measure resistance between the chassis and CAN connector. Limit value >24 kOhm
8:131	Temperature in the li-ion battery is too high	Creep speed, blocked lifting movement	1:	1: Let the battery cool down
8:132	Current in the li-ion battery is too high	Creep speed, blocked lifting movement	1: Regenerative braking with fully-charged battery. 2:	1: No action. 2: Check battery voltage • Check the voltage using the built-in test procedure and comparing with value from external volt meter • Check connectors, joints and splices for damage or corrosion. • Check fuses F1 and F50
8:133	Li-ion battery temperature below permitted level	Creep speed, blocked lifting movement	1:	1: Move the truck to a warmer area
8:134	Defective hardware in the li-ion battery	Creep speed, blocked lifting movement	1: Defective sensor in the module.	1: Contact the battery manufacturer.
8:135	Internal CAN problem in the li-ion battery	Creep speed, blocked lifting movement	1: Communication problem between modules in the battery.	1: Contact the battery manufacturer.

Code	Description	Truck behaviour	Error cause(s)	Procedure
8:136	Overvoltage in the li-ion battery	Creep speed, blocked lifting movement	1: A module in the battery has been switched off because its voltage is too high.	1: Restart the battery.
8:137	Battery cells deactivated by internal monitoring	Creep speed, blocked lifting movement	1: Some battery functions are not working.	1: Overvoltage, undervoltage, temperature too high, temperature too low. Let the battery rest and then restart the battery.
8:138	Low battery voltage in the li-ion battery	Creep speed, blocked lifting movement	1: Battery discharged 2: Voltage drop.	1: Charge the battery 2: Check battery voltage • Check the voltage using the built-in test procedure and comparing with value from external volt meter • Check connectors, joints and splices for damage or corrosion. • Check fuses F1 and F50
8:139	Wrong battery type selected via parameter 1045	Creep speed, blocked lifting movement	1: Battery parameter 1045 has incorrect setting.	1: Check parameters • Check that factory parameters are set according to the truck configuration. • Check that other parameters are set correctly.

Code	Description	Truck behaviour	Error cause(s)	Procedure
HOT	The power stage in T1 shows a high temperature. The temperature is above 85℃. The motor temperature sensor detects a high temperature. The motor temperature exceeds +145℃	The motor control reduces the maximum accelerating voltage linearly	1: Intensive use of the truck 2: Cooling is reduced or the temperature sensor is defective.	1: Intensive use of the truck. Let the truck cool down. 2: Check the cooling • Check the cooling flanges of the transistor regulator, motor and steering motor as well as the battery charger and fans and filters for accumulations of dirt and dust. Too much dust and dirt cause the cooling not to work properly. • Check that the fans work when the speed control is activated (fans behind T1 and motor fan) • Check that the fan on charger A30 works when the charging starts, i.e. when the mains cable is connected • Check the signal from the temperature sensor for T1 and from B1 using the built-in test or TruckCom. Determine if the temperature signals are plausible relative to the real temperatures of the components. If not, replace T1 or replace B1 with a repair kit.
ESO	Emergency stop circuit open. Low voltage on T1:83	Everything is stopped at once, the parking brake is activated, and the main contactor opens	1: Emergency stop activated 2: Open electrical circuit	1: Return the emergency stop to the normal position and restart the truck 2: Check the circuit of the emergency stop • Check that the emergency stop is in the normal position • Check fuse F51 • Check wiring and S21 after the break
S-0h	Time for service	Not influenced	1: Time for service	1: After service is complete, enter a new or the same value in parameter 101

Code	Description	Truck behaviour	Error cause(s)	Procedure
SLO	Reduced travel speed	Reduced speed and acceleration	1: Travel speed reduced because of activated Click-2-Creep, turtle or emergency drive mode.	1:
StOP	It is not possible to lift the support arms or the forks because of the interlock.	**B**locked lifting movement	1: The forks cannot be lifted above 1.8 m if the support arms are raised, 2: The support arms cannot be raised if the forks are > 1.8m	

8.8 Troubleshooting chart

The following section describes the type of errors that can occur together with a description of the cause.

Troubleshooting is divided into groups according to truck symptoms:

- The truck cannot be driven.
- The truck can be driven but only at reduced speed
- The truck can be driven but behaves abnormally
- Defective hydraulic functions.

8.8.1 The truck cannot be driven.

Symptom	Influencing elements	Possible cause
Mechanical brake cannot be applied.	Sensor [B60]	• Sensor in wrong position or disrupted by metal • Defective sensor
	Tiller arm handle always "On" in travel mode	Damaged wiring harness or incorrect plus/minus current supply
	Motor control, input [T1:95].	Motor control defective
Mechanical brake cannot be released.	Sensor [B60]	• Sensor in wrong position or cannot be normally actuated • Defective sensor • Break in sensor wiring harness.
	Motor control, input [T1:95] Motor control, output [T1:90]	Motor control defective
	Corrosion	Brake has seized due to corrosion
Truck cannot travel after start-up although tiller arm handle was in raised position.	Sensor [B60]	• Sensor in wrong position and affected by metal • Defective sensor
	Tiller arm handle always "On" in travel mode	Damaged wiring harness or incorrect plus/minus current supply
	Motor control, input [T1:95].	Motor control defective.

8.8.2 Truck only travels at reduced speed

Symptom	Influencing elements	Possible cause
Speed always reduced	Click-2-Creep function	Click-2-Creep function activated
	Turtle function	Turtle function activated
	Operator parameter 6 - speed	Operator parameter 6 has not been set to the maximum value
	Pulse transducer [B11]	Defective or disconnected pulse transducer [B11]
	Motor cable connections	• One of the phases U, V, W has been disconnected • Broken wiring
	Mechanical brake	• Partially applied brake • Incorrect gap.

8.8.3 The truck can be driven but behaves abnormally

Symptom	Influencing elements	Possible cause
Truck travels in wrong direction.	Motor cable connections	Incorrect U, V, W connections
Acceleration always reduced	Operator parameter 4	Value setting low.
Reversing braking always reduced.	Service parameter 201	Value setting low.
Neutral braking always reduced	Operator parameter 5	Value setting low
The truck cannot be switched off.	Parameter 102. The Red off key on the keypad does not work.	Parameter 102 has been incorrectly set for the log-in unit installed in the truck.
Speed always reduced	Pulse transducer [B11]	Defective or disconnected pulse transducer [B11]
	Motor cable connections	• One of the phases U, V, W has been disconnected • Broken wiring

8.8.4 The truck can be driven, but some functions do not work

Software compatibility

Ensure that the correct software for logic card [A5], motor control [T1] and battery charger [A30] is installed on the truck. See section “8.1 General”.

Hardware compatibility matrix

Make sure the correct software for the logic card [A5] and motor control [T1] are installed on the truck by referring to the matrix below.

	Motor control ACT[T1] not replaced	**Motor control ACT[T1] replaced**
ICH logic card [A5] not replaced	OK	Warning 2.004. Use TruckCom to download new backup values. Open TruckCom, and select “Copy configuration to secondary unit: ACT”
ICH logic card [A5] replaced	Error code 2.101. Use TruckCom to upload new backup values. Select “Copy configuration to primary unit: ICH”	Replace one node at a time and implement the corresponding measure. See 17.2 and 16.5.2

8.8.5 Defective hydraulic functions

Symptom	Influencing elements	Possible cause/Remedy
The forks can be lowered but not raised.	Low or no hydraulic pressure	• Low oil level • Clogged suction filter • Defective or incorrectly adjusted pressure limiting valve • Defective hydraulic pump; replace the hydraulic unit
	Pump contactor [Q25] does not close	• Measure current and voltage through pump contactor [Q25]. **For more information, see the table below: *Pump contactor [Q25] does not close:*** • Pump contactor [Q25] voltage/current normal • No current or voltage through/ across the contactor coil [Q25] • Voltage across contactor coil [Q25], but no current through the coil.
	Pump motor [M3] does not work	• Hydraulic unit fuse [F1] has blown; replace fuse. **For more information, see the following table *Pump motor [M3] does not work:*** • Measure current and voltage through and across the pump motor [M3]. • Pump motor [M3] voltage/ current normal • No current or voltage through/ across the motor [M3] • Voltage across the motor [M3], but no current through the motor
	Height switch [B61] does not work	• Inspect the switch and its connections

Symptom	Influencing elements	Possible cause/Remedy
Forks can be raised but not lowered.	The proportional valve [Q4] for lowering the forks does not open	• Measure current and voltage through and across the valve coil. **For more information, see the table below *Solenoid valve [Q4] for lowering the forks does not open:*** • Solenoid valve voltage/ current normal • No current or voltage through/ across the solenoid valve coil • Voltage across solenoid valve coil, but no current through the coil.
Forks can neither be raised nor lowered	Defective fuse [F50] 7.5 A	Replace the fuse
	Logic card [A5] faulty	Replace the logic card
	Defective motor control [T1]	Replace the motor control
	Factory parameter 1023	Check the parameter value settings

Cont'd. Pump contactor [Q25] does not close		
Symptom	**Influencing elements**	**Possible cause/Remedy**
Pump contactor [Q25] voltage/current normal	Defective contact tongues	Replace the pump contactor
No current or voltage through/across the contactor [Q25] coil	Damaged wiring harness or connections in the pump contactor	Check the wiring harness for interruptions or short-circuits to other electric components
	Tiller arm Hall sensor for fork lifting defective	Replace the logic card [A5]
	The motor control [T1], output 107 “OUT.PUMP CONTACTOR” defective	Replace the motor control [T1]
	Motor control [T1], output 82 “OUT. +24 V HIGH SIDE DRIVER” defective	See the troubleshooting chart ***The truck cannot be driven***

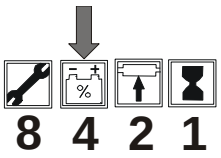
Cont'd. Pump contactor [Q25] does not close		
Symptom	**Influencing elements**	**Possible cause/Remedy**
Voltage across contactor coil [Q25], but no current through the coil.	Interruption in the pump contactor coil [Q25]	Replace the pump contactor

Cont'd. Pump motor [M3] does not operate:		
Symptom	**Influencing elements**	**Possible cause/Remedy**
Pump motor [M3] voltage/ current normal	Mechanical fault in the pump	Replace the hydraulic unit
No current or voltage through/ across the motor [M3]	Damaged wiring harness or connections in the pump motor [M3]	Check the wiring harness for interruptions or short-circuits to other electric components
Voltage across the motor [M3], but no current through the motor	Open circuit in the pump motor [M3]	Replace the hydraulic unit

Cont'd. The solenoid valve [Q4] for lowering the forks does not open:		
Symptom	**Influencing elements**	**Possible cause/Remedy**
Solenoid valve [Q4] voltage/ current normal	Mechanical fault in the valve [Q4]	Replace the hydraulic unit
Low or no current/voltage through/across the solenoid valve coil [Q4]	Damage to the solenoid valve [Q4] wiring harness or connections	Check the wiring harness for interruptions or short-circuits to other electric components
	Tiller arm Hall sensor for fork lowering defective	Replace the logic card [A5]
	The motor control [T1], output 108 “OUT.LOWER VALVE” defective	Replace the motor control [T1]
	Motor control [T1], output 82 “OUT. +24 V HIGH SIDE DRIVER” defective	See the troubleshooting chart ***The truck cannot be driven***
Voltage across solenoid valve coil [Q4], but no current through the coil	Break in the solenoid valve coil [Q4]	Replace the hydraulic unit

8.9 Built-in test function

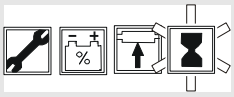
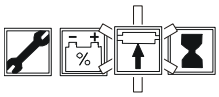
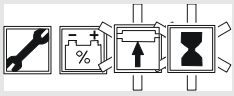
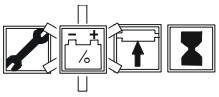
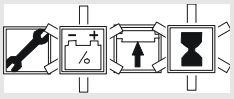
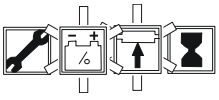
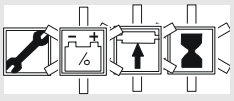
The truck has a service information mode that is a useful aid for troubleshooting. To activate:

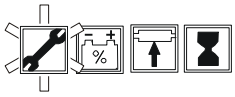
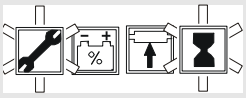
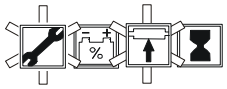
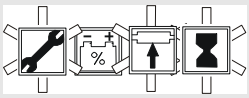
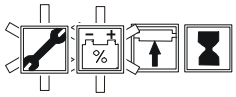
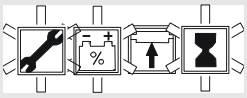
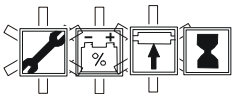
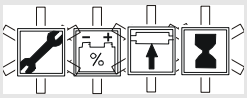


1. Connect the CAN service key to [X41] and log in.
2. The battery status symbol lights up.
3. Press the horn button [S18] repeatedly to select the desired mode in the service information mode.

Note

All truck functions work as normal when the service information mode is active. Care should be taken when operating the truck and reading the display at the same time.

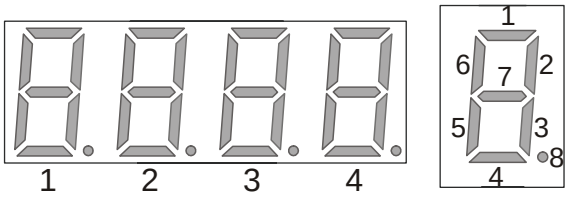
Data	Flashing symbol	Description	Resolution	Unit	Standard value
-		BDI	10	%	0-100
1		Battery voltage	0.1	V	Depending on battery type. Compare with the real battery voltage
2		Battery voltage, the value indicated in an approximate value of motor and pump voltages.	1	A	0-450A
3		The set speed that is signalled to ACT from ICH. Positive value in the drive wheel direction. Negative value in the fork direction.	0.1	km/h	-12.5 - 12.5 km/h (depending on truck type)
4		Speed value from the speed sensor. Positive value in the drive wheel direction. Negative value in the fork direction.	0.1	km/h	-12.5 - 12.5 km/h (depending on truck type)
5		Forks or support arms, lifting or lowering command. 100% shown for on/off checked signals	1	%	0-100%
6		N/A			
7		N/A			

Data	Flashing symbol	Description	Resolution	Unit	Standard value
8		N/A			
9		Digital I/0 for ICH and ACT. See description in “Test mode "9" –” on page 56	-	-	-
10		TBD	-	-	-
11		Maximum value for collision sensor X and Y. “nonE” is shown if no sensor exists.	0.1	G	0 G - 10 G
12		SEU digital I/0. See description in “Test mode “12” – Expansion unit SEU (option).” on page 58 “nonE” is shown if no SEU exists.	-	-	-
13		Steering angle	1	°	0-90°
14		Drive motor temperature	1	℃	?
15		ACT temperature	1	℃	?

8.10 Digital input/output status

8.10.1 Test mode "9" –

In this mode, the digital inputs and outputs are tested by checking specific segments on the display according to the following tables.

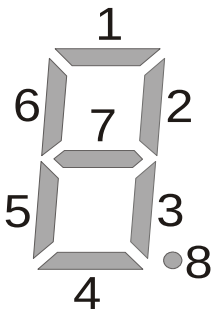


Position:

1. Digital input of ICH [A5]
2. Digital input/output of ICH [A5]
3. Transistor regulator inputs
4. Transistor regulator inputs

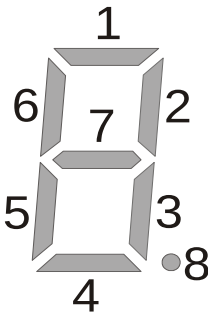
1 – 8: Reference to segment

Digit 1, ICH digital in



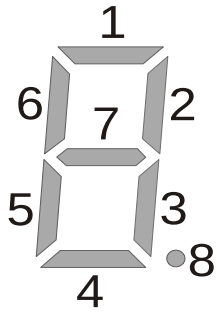
Segment	Description
1	Option button 6
2	Option button 5
3	Option button 4
4	Option button 1
5	Option button 2
6	Option button 3
7	ICH address (node ID)
8	-

Digit 2, ICH digital in/out



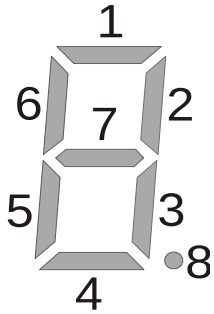
Segment	Description
1	Rear button up
2	Rear button down
3	Front button up
4	Front button down
5	Main contactor
6	Horn input
7	Brake output
8	Pump

Digit 3, ICH digital in

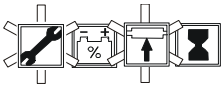


Segment	Description
1	Top position sensor not active (B61)
2	Steering arm active (B60)
3	Operator on platform (B119)
4	Input 4
5	Input 5
6	Platform up (B120)
7	Gate up (121)
8	Gate down (B122)

Digit 4, ICH digital in

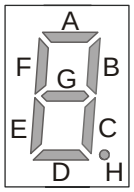


Segment	Description
1	Input 9
2	Input 10
3	Input 11
4	Input 12
5	Input 13
6	Input 14
7	Motor encode, channel A
8	Motor encode, channel B



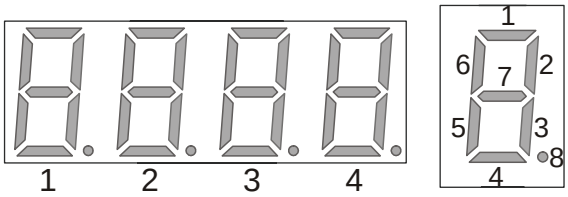
8.10.2 Test function “10” – Logic card

Function	Pos 1	Pos 2	Pos 3	Pos 4	
-	A	*	*	*	Not assigned
-	B	*	*	*	Not assigned
-	C	*	*	*	Not assigned
Front fork lift button [A5:S19]	D	*	*	*	Lit: Button depressed
Front fork lowering button [A5:S20]	E	*	*	*	Lit: Button depressed
Rear fork lift button [A5:S21]	F	*	*	*	Lit: Button depressed
Rear fork lowering button [A5:S22]	G	*	*	*	Lit: Button depressed
Sound signal control [S18]	H	*	*	*	Lit: Button depressed
Outermost option button, right side [S116]	*	A	*	*	Lit: Button depressed
Centre option button, right side [S115]	*	B	*	*	Lit: Button depressed
Innermost option button, right side [S114]	*	C	*	*	Lit: Button depressed
Outermost option button, left side [S113]	*	D	*	*	Lit: Button depressed
Centre option button, left side [S206]	*	E	*	*	Lit: Button depressed
Innermost option button, left side [S111]	*	F	*	*	Lit: Button depressed
-	‘	G	*	*	Not assigned
-	*	H	*	*	Not assigned



8.10.3 Test mode “12” – Expansion unit SEU (option).

In this mode, the digital inputs and outputs are tested by checking specific segments on the display according to the following tables.

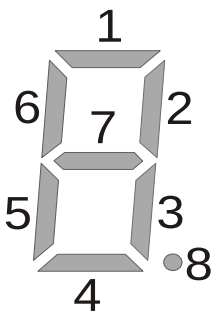


Position:

1. SEU 0 inputs
2. SEU 0 outputs
3. SEU 1 inputs
4. SEU 1 outputs

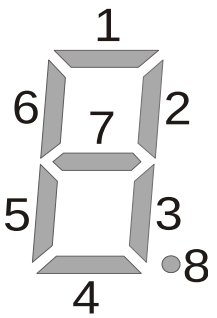
1 – 8: Reference to segment

Digit 1, SEU 0 digital in



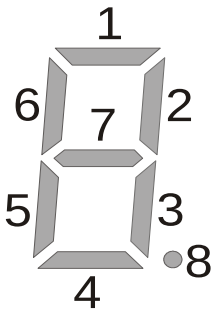
Segment	Description
1	In 1
2	In 2
3	In 3
4	In 4
5	In 5
6	In 6
7	In 7
8	In 8

Digit 2, SEU 0 digital out



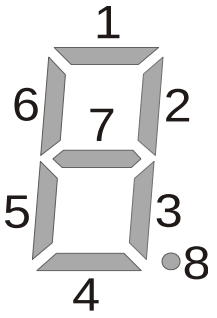
Segment	Description
1	Out 1
2	Out 2
3	Out 3
4	Out 4
5	
6	
7	
8	

Digit 3, SEU 1 digital in



Segment	Description
1	In 1
2	In 2
3	In 3
4	In 4
5	In 5
6	In 6
7	In 7
8	In 8

Digit 4, SEU 1 digital out



Segment	Description
1	Out 1
2	Out 2
3	Out 3
4	Out 4
5	
6	
7	
8	

8.11 Built-in test function for the tiller arm

1: Make sure the battery is connected.

2: Check that the truck is switched off. Press the OFF switch.

3: Connect the CAN key or enter the PIN code. Note: Do not press the ON switch.

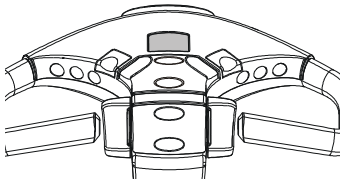
4: Press and then release the horn button. “Info“ is shown on the display.

5: Press and release the horn button to select the "Info" menu.

6: Turn the speed control several times until “tESt” is shown on the display.

7: Press the horn button and release it to enter the test mode.

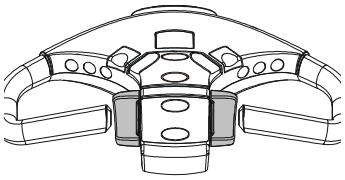
8: The first one you arrive at is the display test. Press on the button/function you want to test to proceed. In this mode, the 2 LEDs on the keypad flash.



8.11.1 Display test

The digital display [A6] can be tested to verify all the segments of the display function correctly. A moving 8 tests all the segments of the display.

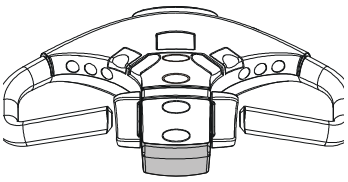
8.11.2 Speed control



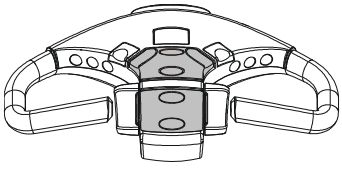
The Hall elements are tested by moving the speed control all the way back and forth. Follow these steps to test the Hall elements:

Move the rocker from the neutral position to begin the test. This is visualised as number X Y when the rocker is moved in the fork direction and X-Y when the rocker is moved in the drive wheel direction. X is the total number of Hall elements that are affected by the magnet and Y is the number of existing Hall elements. At full movement in both directions 9-9 or 9 9 is shown when all Hall elements are OK.

8.11.3 Safety reversing



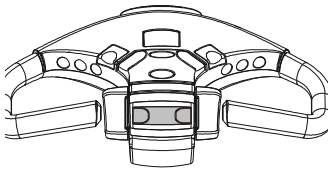
Press the button for safety reversing “Er 1” is shown in the display



8.11.4 Controls for lifting/lowering

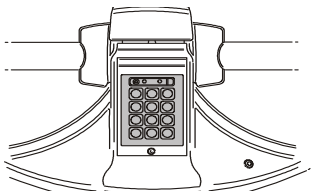
Press a button for lifting/lowering in order to start the test. “L1”, “L2”, “L3” or “L4” is shown in the display depending on which button has been pressed.

8.11.5 Sensilift



Move the sensilift rocker switch from the neutral position to begin the test. The analogue value from the sensilift potentiometer is shown in mV.

8.11.6 Keypad



Press a number to start testing the keypad. “b1” up to “b11” is shown in the display depending on which button is pressed. The numbers 0-9 are shown as “b0” to “b9”. The red button “b10” and the green button “b11”

9: Switch off the truck by pressing the OFF button or return to the previous menu by pressing the horn button.

8.12 Checking the built-in battery charger

This checklist must be filled in and sent in together with the replaced charger.

Applies to the following part numbers:

7513327

7513328

7539122

7539123

The unit must not be opened under any circumstances.

- Connect the charger to mains voltage and ensure the battery connector is connected.

	Check	Yes	No
1	Are all of the charger's connectors properly connected?		
2	Does the fan blow air out of the charger? (it should begin running at start-up)		
3	Does battery voltage increase when the charger is connected to mains voltage? (Measure across the battery terminals)		
4	Are the parameter settings for the battery set as specified in the repair manual?		
5	If any parameter setting was incorrect, does it have the correct setting now?		---
6	Is the correct software completely downloaded? If not, follow the emergency downloading instructions found in the TruckCom manual.		

If you answered Yes to all of the questions, the charger is functioning properly and does not require replacement.

If not, fill in the rest of the checklist on the next page.

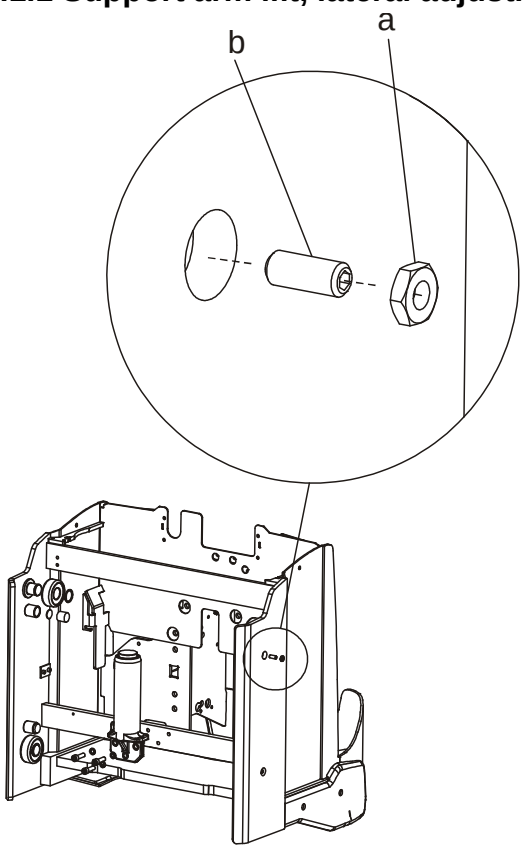
This part of the checklist is intended to help us in our improvement work.

	Check	Yes	No
1	Is there any evidence of moisture on the inside or outside? (Investigate for interior moisture through the perforated sides.)		
2	Has the truck been used in an environment with a temperature below 0°Celsius?		
3	Has the truck been used outdoors?		
4	Are there signs of mechanical damage?		
5	Has the truck travelled over uneven floors or loading ramps?		
6	Are there any error codes? If yes, please specify.		

9. Chassis 0000

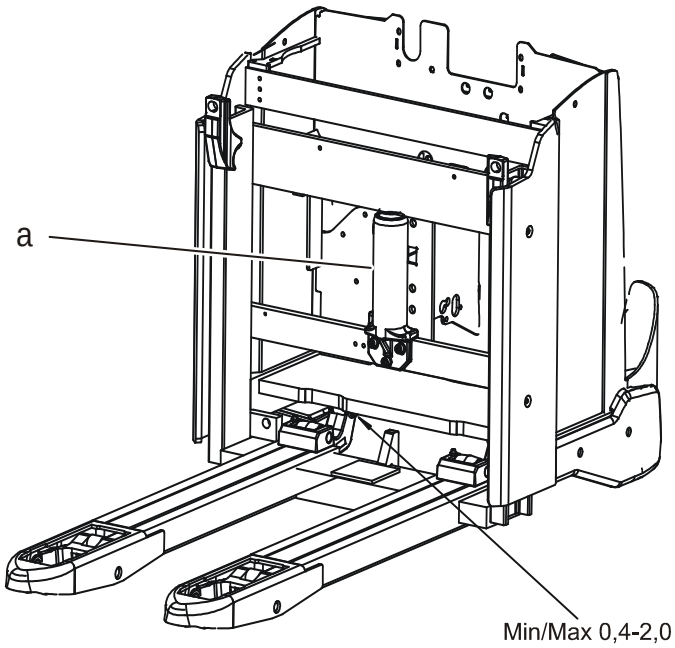
9.1 Support arm 0350

9.1.1 Support arm lift, lateral adjustment



1. Loosen the locking nut
2. Adjust the lateral guides using the adjustment screw (b). There are four adjustment screws.
3. Adjust the lateral guides so that there is no play but so that the lowering does not jam.
4. Lock the adjustment screws position with the locking nut.

9.1.2 Adjusting the kneeling action



The gap between the chassis pressure plate and the support arm link roller must be between the minimum value of 0.4 and the maximum of 2.0.

1. Check the gap. A precondition for checking the gap is that the roller is fitted and that they are in the lowered position.
2. Loosen the cylinder (a) if the gap is incorrect (6 mm Allen)
3. Place a suitable number of shims 7501642 under the cylinder (a).
4. Tighten the cylinder.
5. Check that the gap is correct.

9.2 Motor mounts 0450

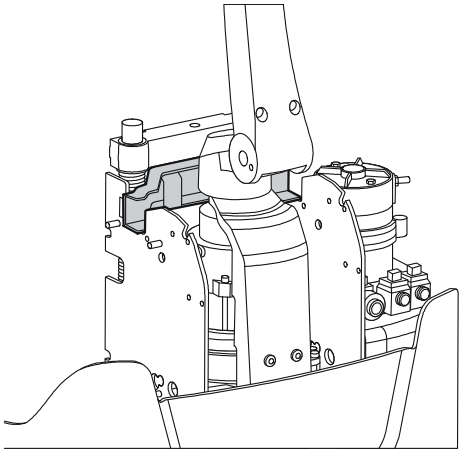
9.2.1 Replacing springs (not applicable for S212S)

Proceed as follows to replace the springs that press the drive unit against the ground:

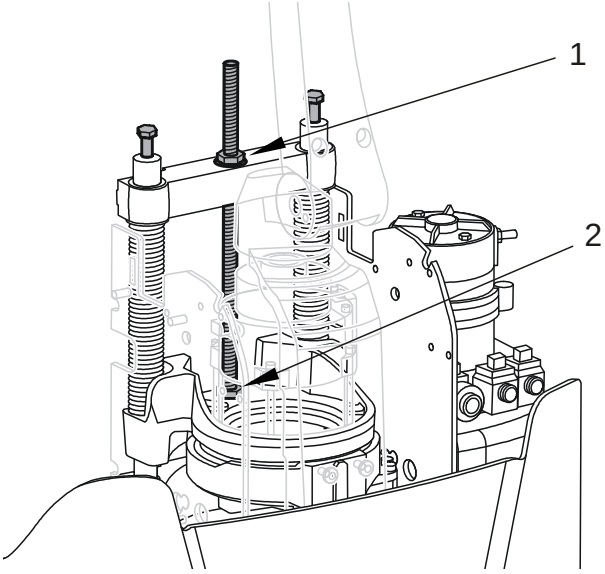
1. Remove the covers and the battery door.

   The top cover is secured with Velcro tape. Be careful when detaching the cover. Use of a suitable tool is recommended.

2. Lift out the battery.
3. Disconnect the cables to the drive motor and the pump motor and also the wiring harness.
4. Disconnect the cable duct.

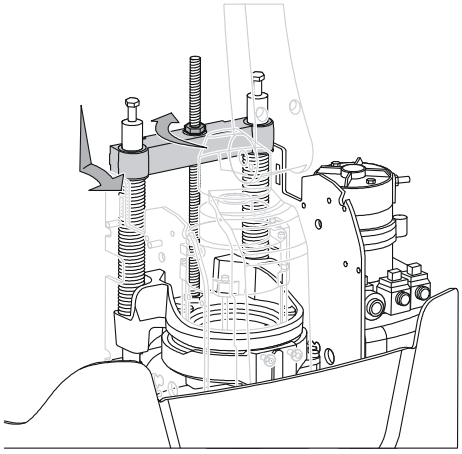


5. Unfasten the battery connector and the battery cable bracket.
6. Install the threaded M16 bar. See section "Tools".

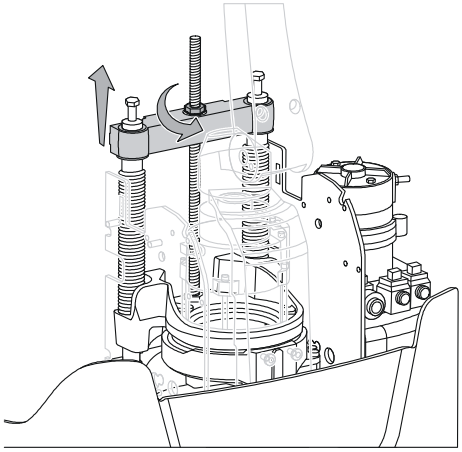


7. (1) Washer and nut on the top side. (2) Screw the shaft into the threaded hole and tighten with the nut.

8. Change the upper stop screws for M8 x 120, washers are not needed.
9. Remove and discard the screws to the upper bracket.
10. Remove the lower screws.
11. Compress the spring assembly using the threaded bar until the lips are clear.



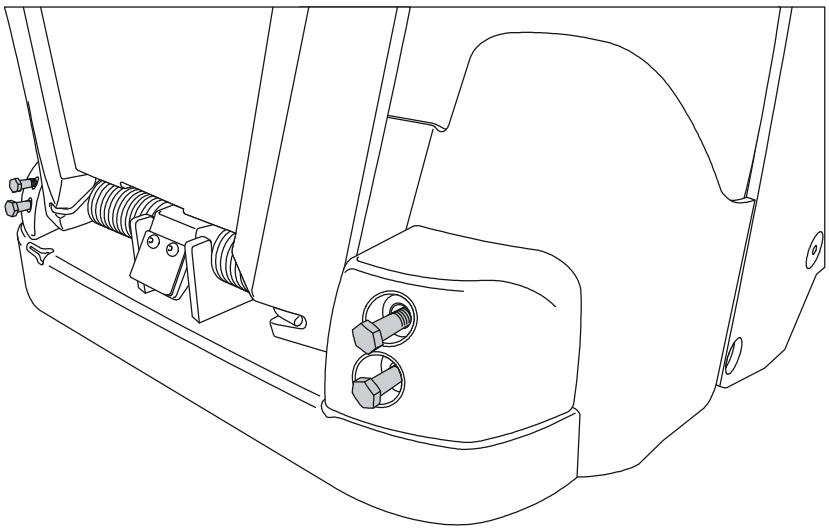
12. Unload the springs by prying up the bracket using the threaded bar.



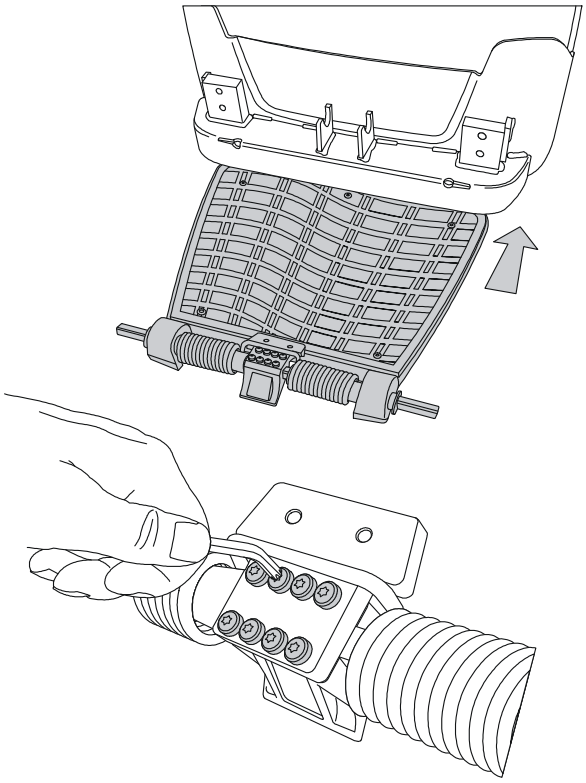
Note:
Check that the bushings do not get stuck or become damaged during reassembly.

9.3 Removing the platform

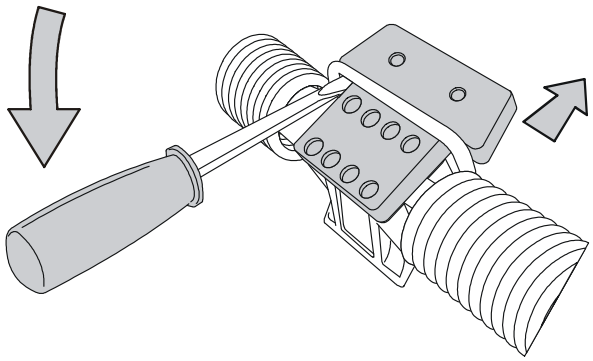
1. Apply a load on the platform and loosen the upper dampening stop together with the spring cover plate.



2. Disassemble the platform from the truck by loosening the four bolts.
3. Put the platform on the floor behind the truck with the spring facing you and placing the other edge under the truck's foot guard.



4. Loosen all 8 screws securing the bracket, which the spring clamp is pushing against.

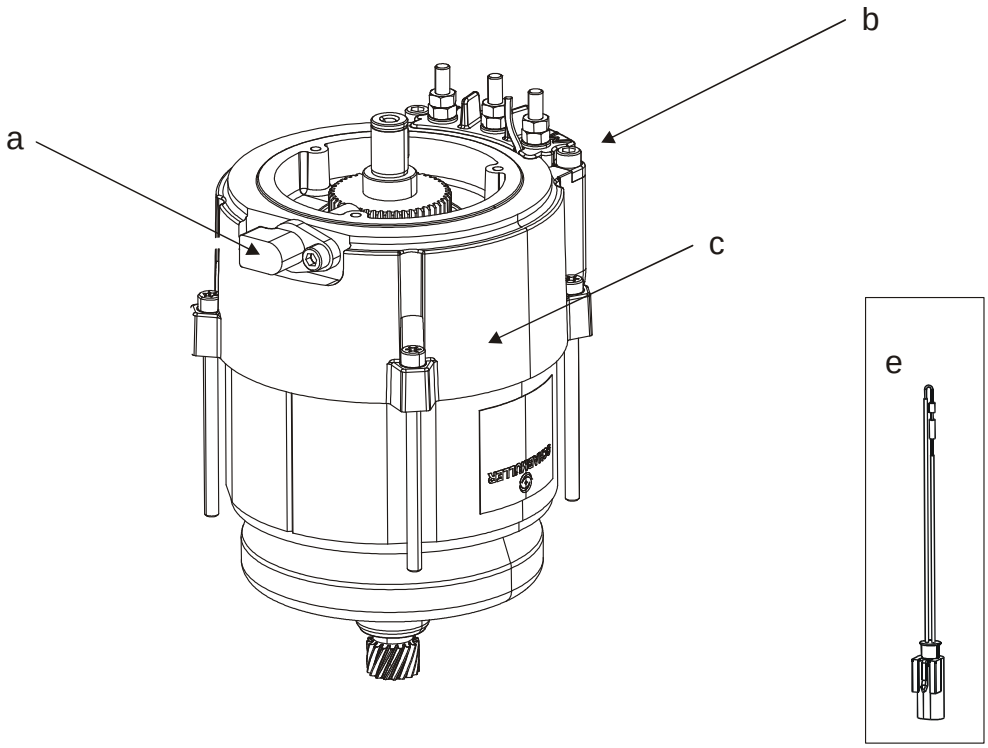


Note: Pay utmost attention when working with tensioned springs.

5. Relieve the spring using a crowbar or a large screwdriver and carefully remove the bracket.
6. Pull out the axle and replace the part(s) that should be replaced.
7. Install in reverse order.

10. Electric drive motor 1700

10.1 Overview



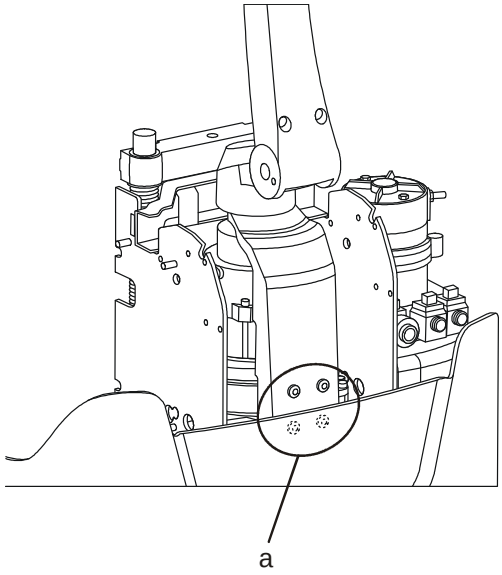
Pos.	Description
a	Speed sensor
b	Connection, motor cables
c	Motor: S212L/214/214L/220D 1.5kW
c	Motor: S210/212/212S 1.0kW
e	Temperature sensor

10.2 Removing the motor from the truck

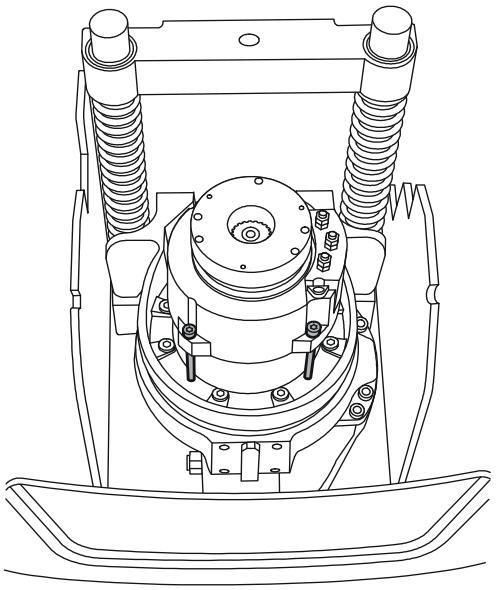
1. Remove the covers.

   The top cover is secured with Velcro tape. Be careful when detaching the cover. Use of a suitable tool is recommended.

2. Cut off the cable ties of the cable duct on the transistor regulator side and disconnect cable connections X5 and X65.



3. Loosen the operating console's mounting screws (a) and remove the operating console and tiller arm.
4. Remove the brake's cable connection Q1.
5. Remove the speed sensor's cable connector B11.



6. Remove the temperature sensor B1
7. Disconnect the motor cables and unscrew the motor retaining screws.

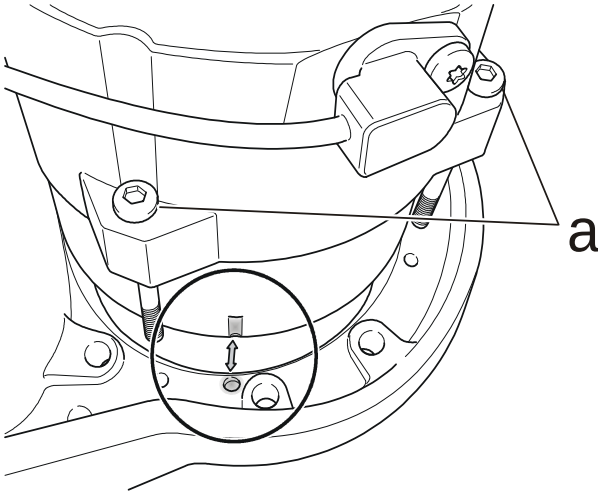
8. Lift out the motor from the truck.
9. If needed, remove the brake and the speed sensor.

Note:
Cover the drive gear to prevent loose items from falling into the drive gear after the drive motor has been removed.

Install the motor in the reverse order.
See section "10.7 Drive motor tightening torques".

Note:
During installation, it is very important for the motor to be adjusted so that the grooves in the motor and motor bracket face each other before the retaining screws are tightened. See the illustration below.

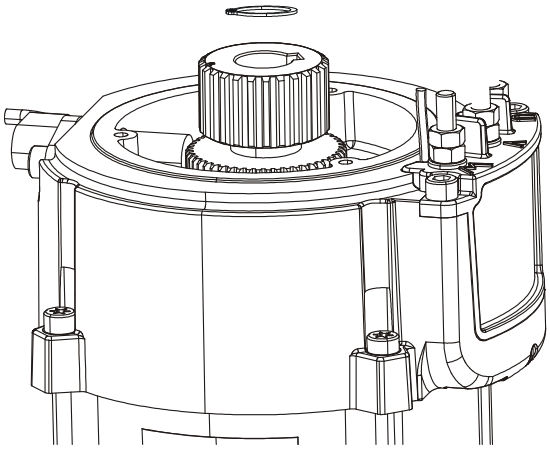
Tighten the 4 drive motor mounting screws (a). The screws must be tightened crosswise and in two stages. In other words, do not tighten to full torque during the first stage. See section "10.7 Drive motor tightening torques".



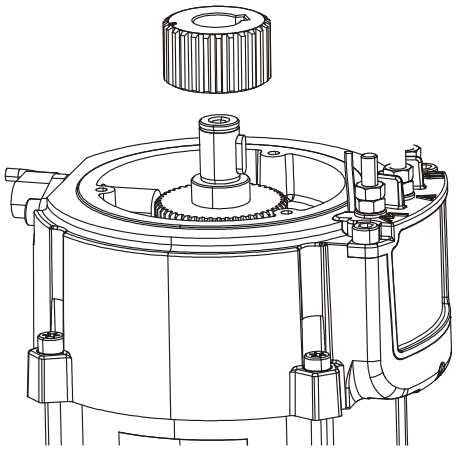
10.3 Removing the toothed wheel

- Remove the motor from the truck. Page 10–2

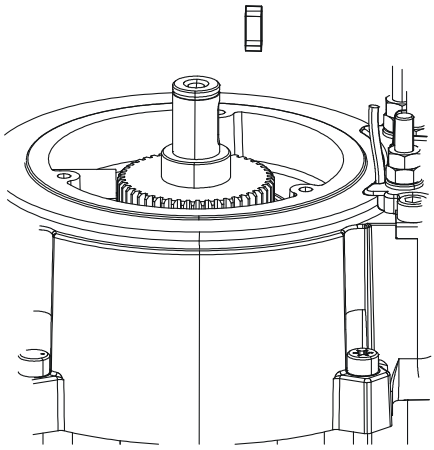
Note: Place the motor on a working surface and make sure that it is secured and cannot fall over.



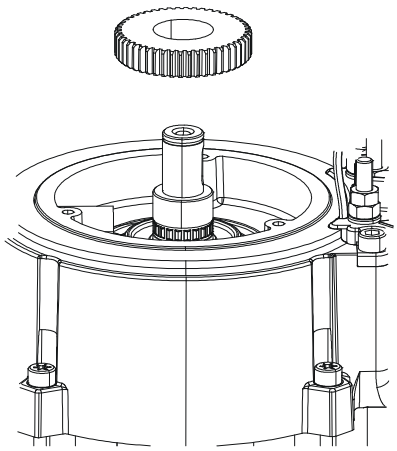
1. Remove the circlip



2. Remove the brake hub



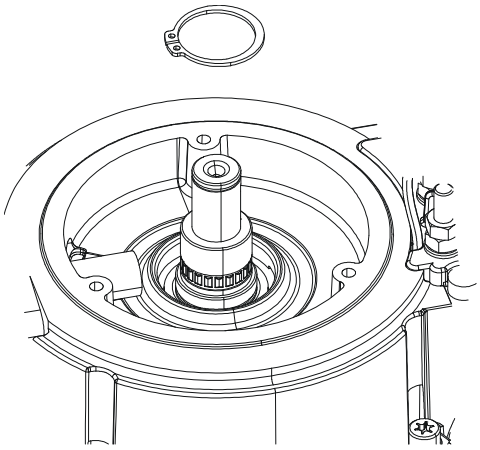
3. Remove the key



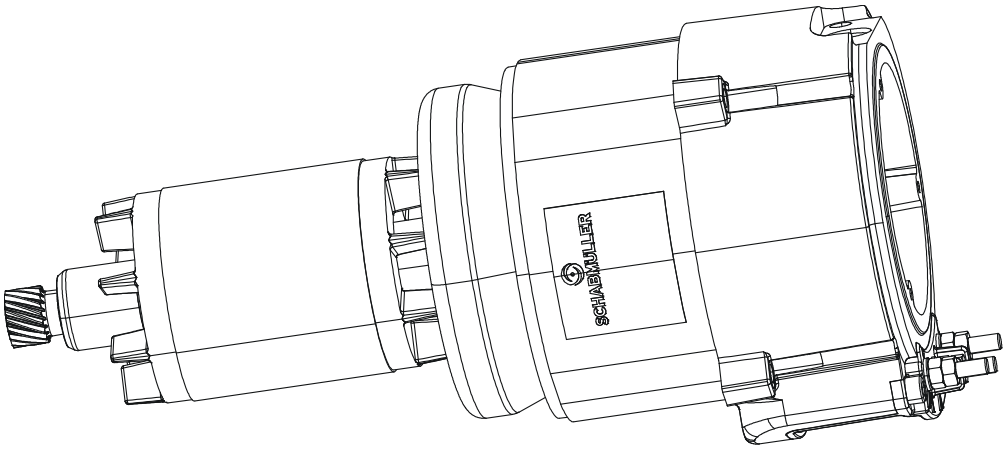
4. Remove the toothed wheel
5. Reassemble in reverse order

10.4 Removing motor bearings

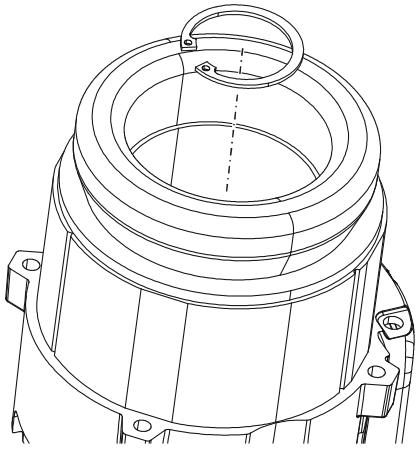
- Remove the toothed wheel Page 10–4



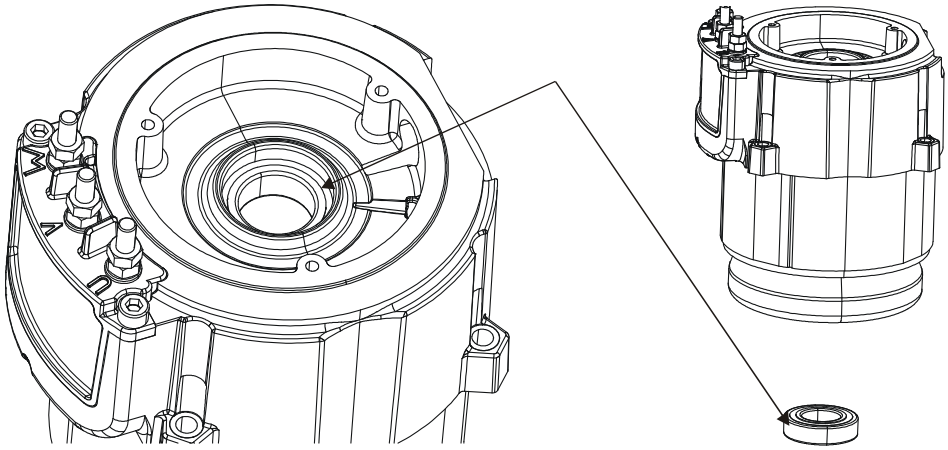
6. Remove the circlip from above



7. Carefully knock out the stator



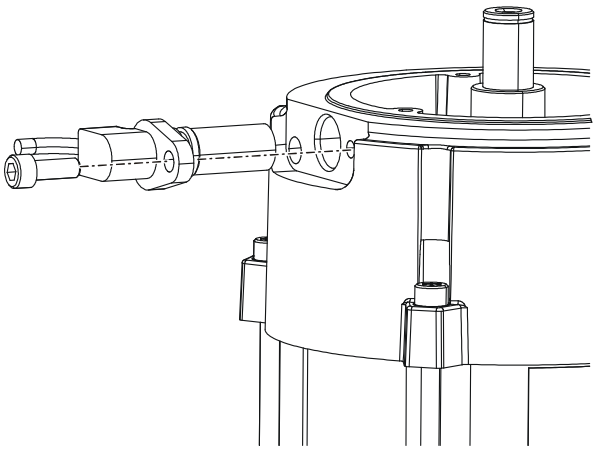
8. Remove the circlip inside the motor



9. Knock out the bearing
10. Reassemble in reverse order

10.5 Removing the RPM sensor

- Remove the hood



1: Undo the screw and pull the RPM sensor straight out. Disconnect connector B11.

2: Install in reverse order.

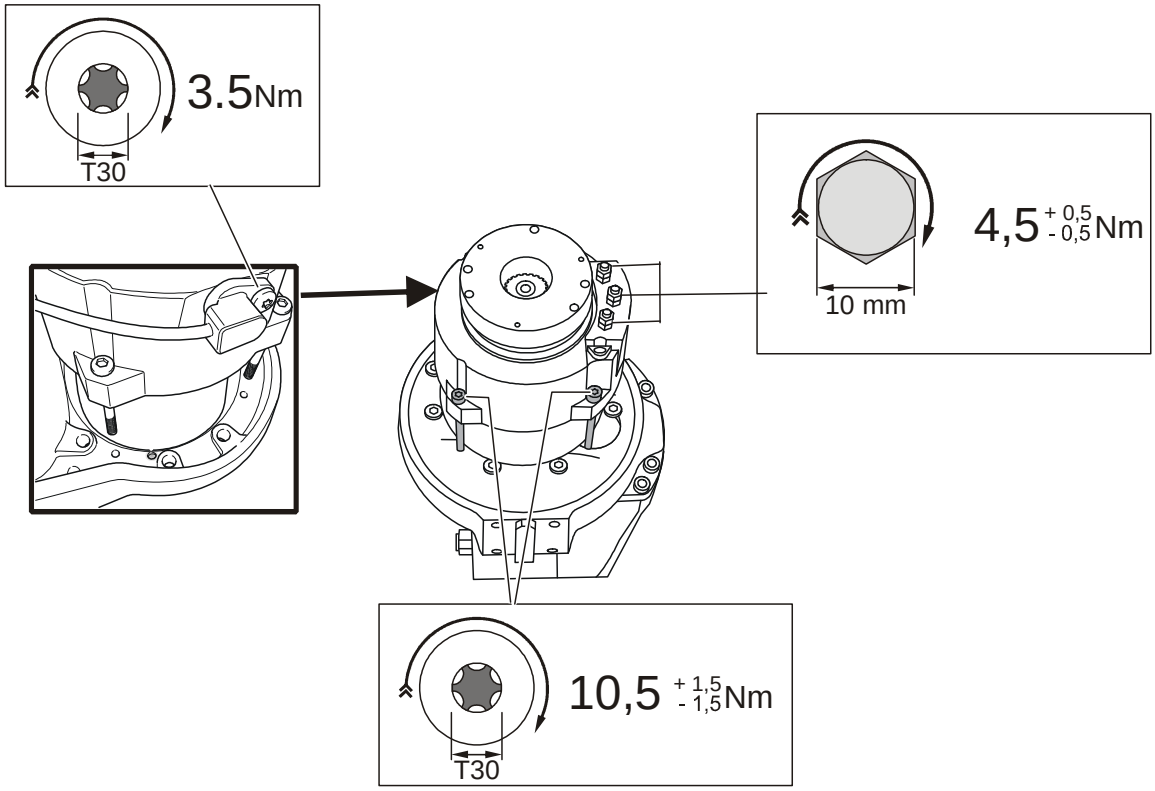
10.6 Installing the temperature sensor

1. Cut off the wiring to the broken temperature sensor, and splice on the new one
2. Position the new temperature sensor on the motor.
3. Carefully clean the area and make sure all surfaces are dry.
4. Apply plastic steel by pushing out a string that is half the length of the curing agent compared to the putty, then carefully mix the two (be careful not to mix a larger amount than will be used in 5 minutes).
5. Apply a layer of plastic steel, at least 4 mm thick, and make sure the repaired surface has an overlap of at least 2 cm.
6. Secure the steel plastic with masking tape and allow it to cure.
7. Remove the masking tape.

   The temperature sensor should now be completely covered by plastic steel.
8. Following curing, it is recommended to apply another layer of plastic steel.

10.7 Drive motor tightening torques

The drive motor tightening torques are depicted in the figure below:



10.8 Cleaning

Keep the motor as clean as possible since this is a decisive factor for correct operation. Regularly inspect the motor and motor compartment for build-up of dust, oil and other contaminants.

Dirty and/or greasy components should be cleaned with a rag moistened with solvent. Use a rag of lint-free cloth material. Do not use too much solvent as it could penetrate into the motor parts.

After cleaning, dry the components thoroughly. The easiest way is by heating.

Note:

Windings and insulation must not be heated over 125℃ and not for longer than 6 hours.

11. Drive gear 2550

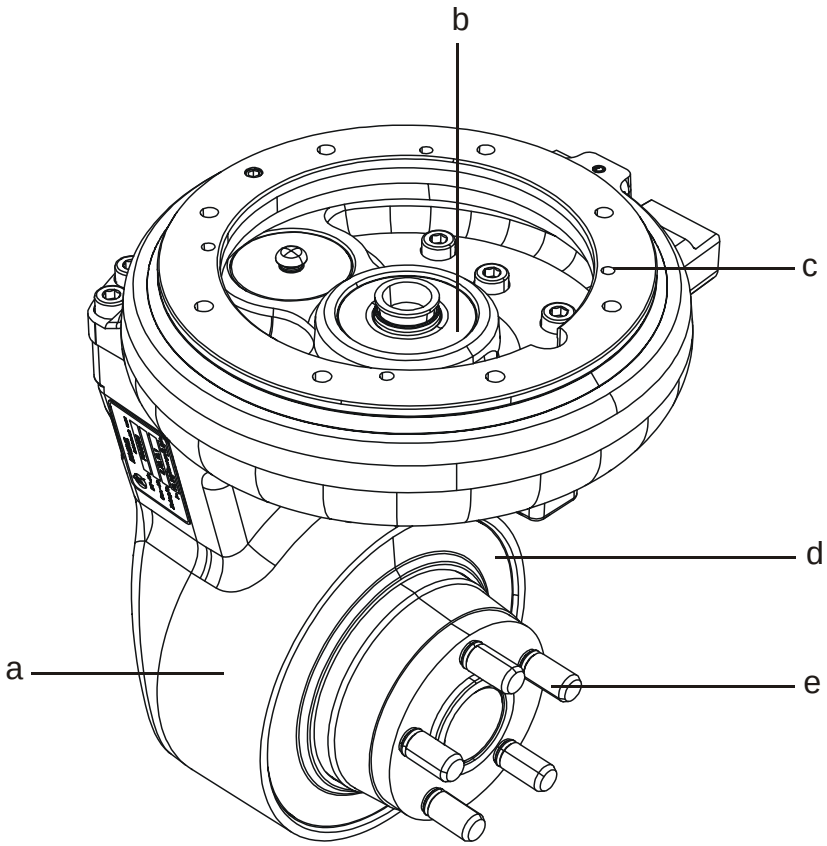
11.1 General

The drive gear is a two-stage angle gear that is integrated with the motor and brake assembly in a complete drive unit. The drive gear is fitted to the chassis with bolts. At the top edge of the gear, the steering bearing and a gear ring for the steering motor (option) are fitted.

These service instructions cover descriptions of service performed on site at the customer. A complete reconditioning of the drive gear must be performed in the workshop by trained technicians.

11.2 Overview

Description	Value
Gear ratio	29.85
Oil quality	0.8 litres
Drive wheel	Ø 230



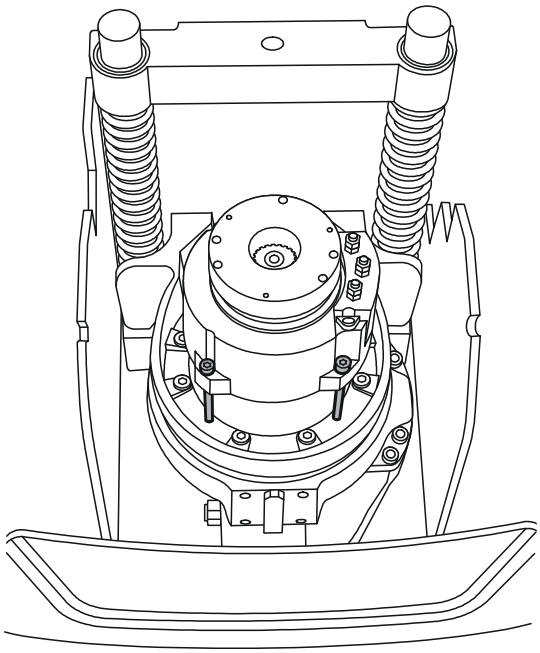
Pos.	Description	Notes
a	Transmission housing	
b	Motor bearing and packing box	
c	Steering bearings	
d	Seal and cover ring	
e	Stud bolt	M12x1.5

11.3 Removing the gear from the truck (not applicable for S212S)

1. Remove the covers.

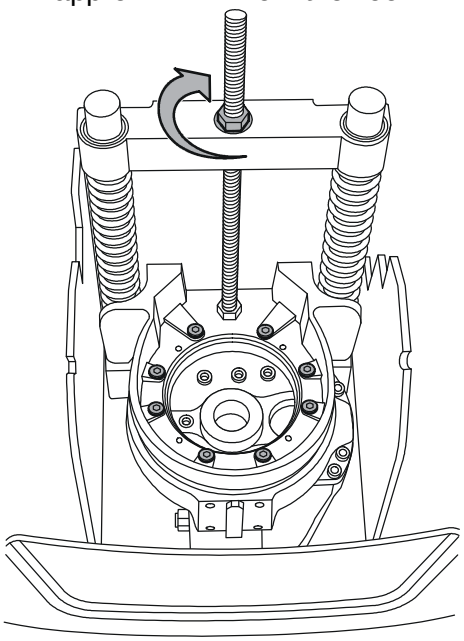
   The top cover is secured with Velcro tape. Be careful when detaching the cover. Use of a suitable tool is recommended.

2. Cut off the cable ties of the cable duct on the transistor regulator side and disconnect cable connections X5 and X65.
3. Unscrew the retaining screws of the steering console and remove the steering console and the tiller arm.
4. Disassemble the speed sensor and disconnect the cable connections Q1 and B1.
5. Disconnect the motor cables and unscrew the motor retaining screws.

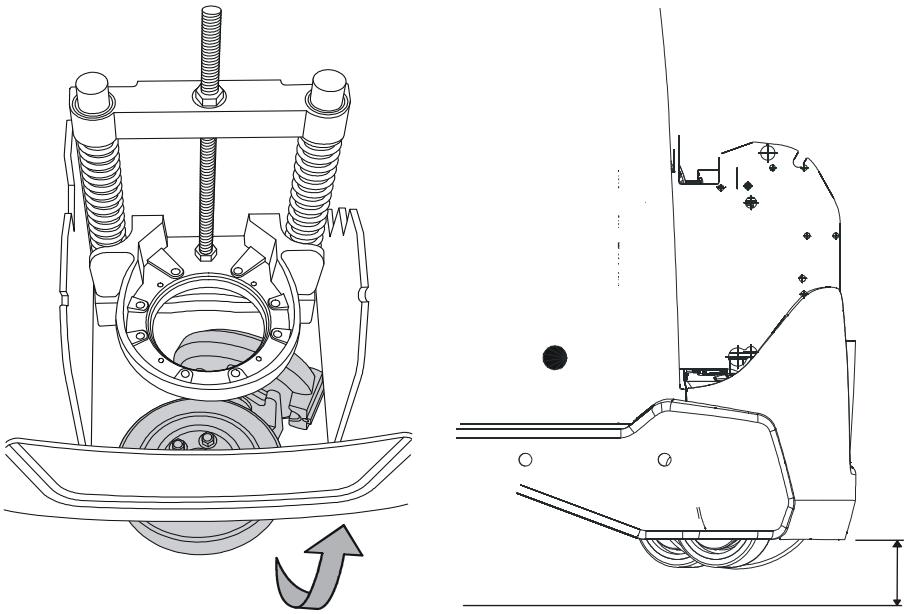


6. Lift out the motor from the truck.
7. Insert a 30 mm plug in the hole in the gear housing to prevent oil leakage when the gear is removed from the truck.
8. Disconnect the cable duct.
9. Install the threaded M16 bar.

10. Lift the motor bracket using the threaded rod until the drive wheel is lifted approx. 4 mm from the floor.



11. Unscrew the retaining screws of the gear box.
12. Lift carefully approx. 125 mm lay the gear down on the floor.
13. Lift a further 100 mm, a total of 225 mm and pull it out to the rear edge.



Steps 12, 13

Install in reverse order.

Please note the risk of crushing when installing the unit.

11.4 Removing the drive gear from the truck (S212S)

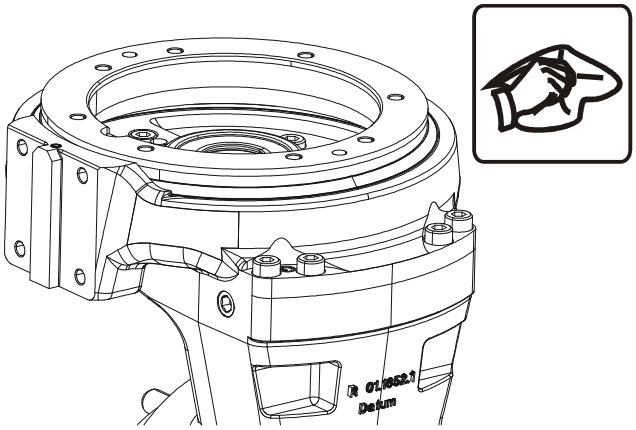
1. Elevate the drive unit approx 190 mm.
2. Loosen the drive wheel.
3. Remove the covers.

   The top cover is secured with Velcro tape. Be careful when detaching the cover. Use of a suitable tool is recommended.
4. Cut off the cable ties of the cable duct on the transistor regulator side and disconnect cable connections X5 and X60.
5. Unscrew the retaining screws of the steering console and remove the steering console and the tiller arm.
6. Disassemble the speed sensor and disconnect the cable connections Q1 and B1.
7. Disconnect the motor cables and unscrew the motor retaining screws.
8. Lift out the motor from the truck.
9. Insert a plug in the hole in the gear housing to prevent oil leakage when the gear is removed from the truck.
10. Unscrew the retaining screws of the gear box.
11. Put down the gear and pull it out to the rear edge.

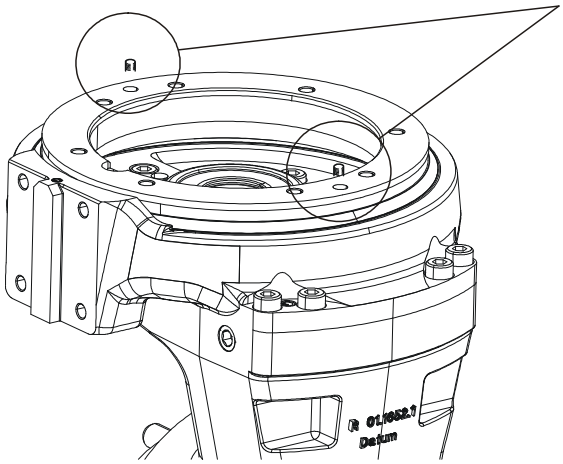
Install in reverse order.

Put a wooden block under the gearbox to facilitate reassembly.

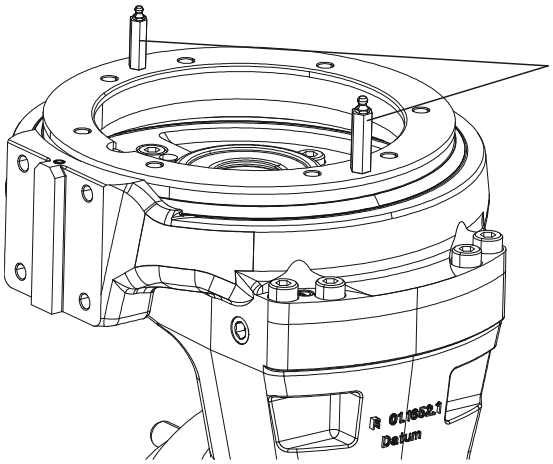
11.5 Fitting grease nipples, steering bearings (Option)



Step 1



Step 2



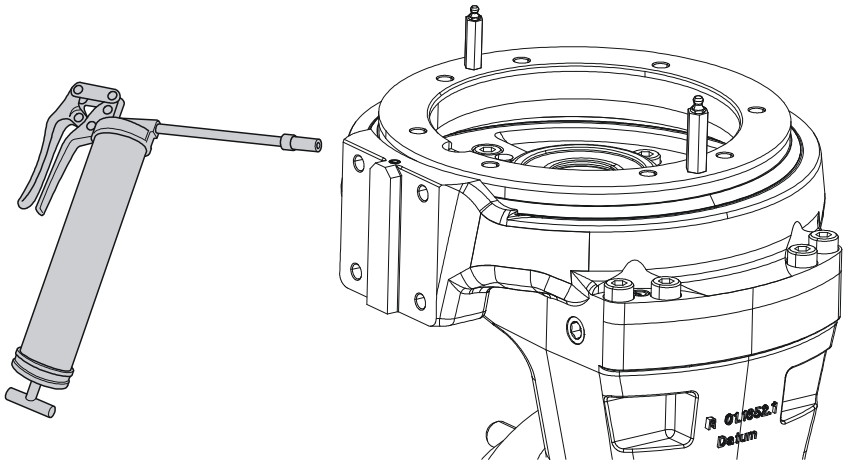
Step 3

1: Clean the surface, remove all dirt from the recess for the grease nipples.

2: Unscrew the stop screws

3: Screw in the grease nipples using an extension piece, 2 each

11.6 Lubrication the steering bearings (Option)



1: Turn the steering wheel to the end position.

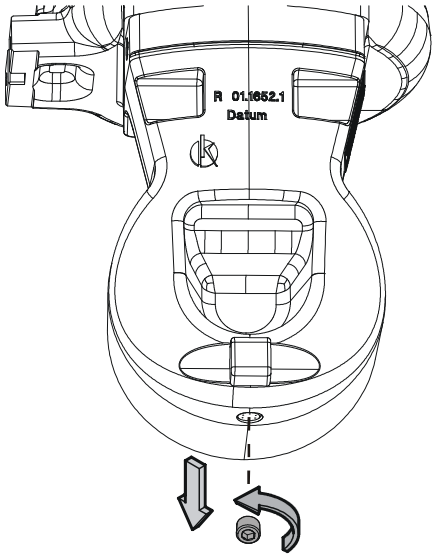
2: Press in some grease, not so much that the seal lifts, check the seal at the grease nipple position.

3: Turn the wheel about 15 degrees, press in some more grease, continue to the other end position.

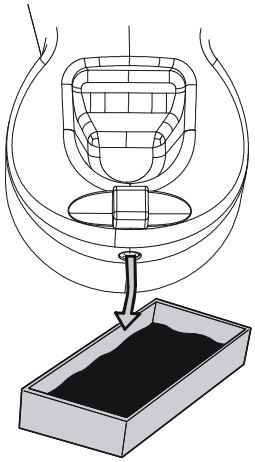
4: Do the same with the other grease nipple to lubricate the entire bearing.

11.7 Checking and changing the oil

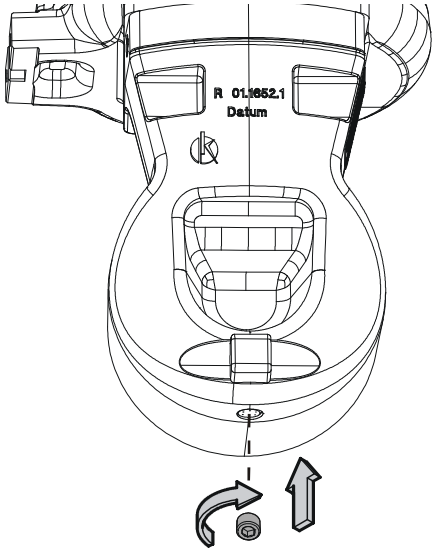
11.7.1 Draining oil



Step 1



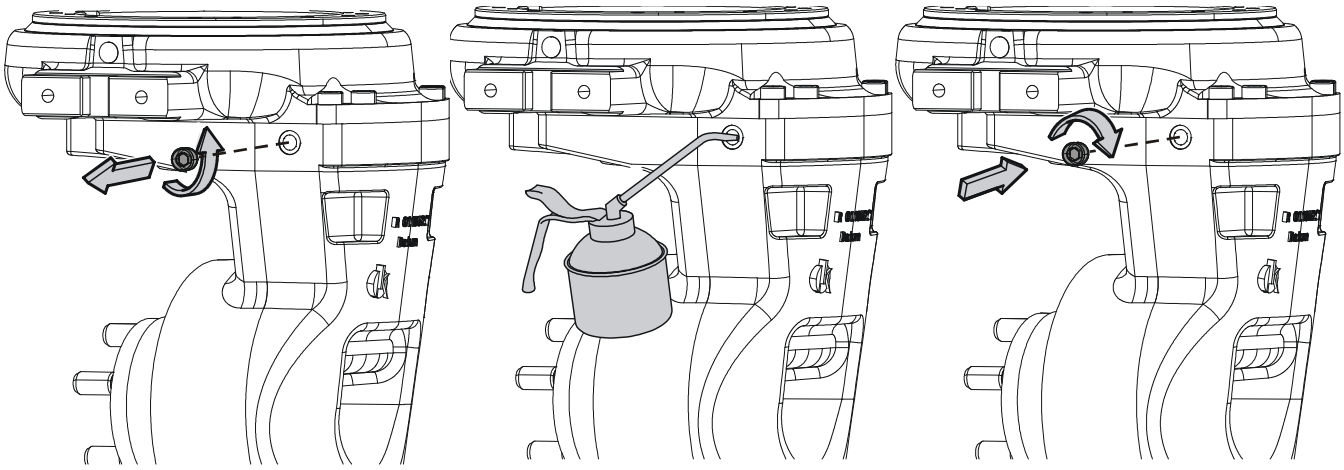
Step 2



Step 3 T=20 Nm

1: Undo and remove the oil plug on the lower part of the gear housing.
2: Drain all old oil into a suitable receptacle.
3: Clean away dirt and metal shavings from the oil plug before fitting.

11.7.2 Checking/refilling oil

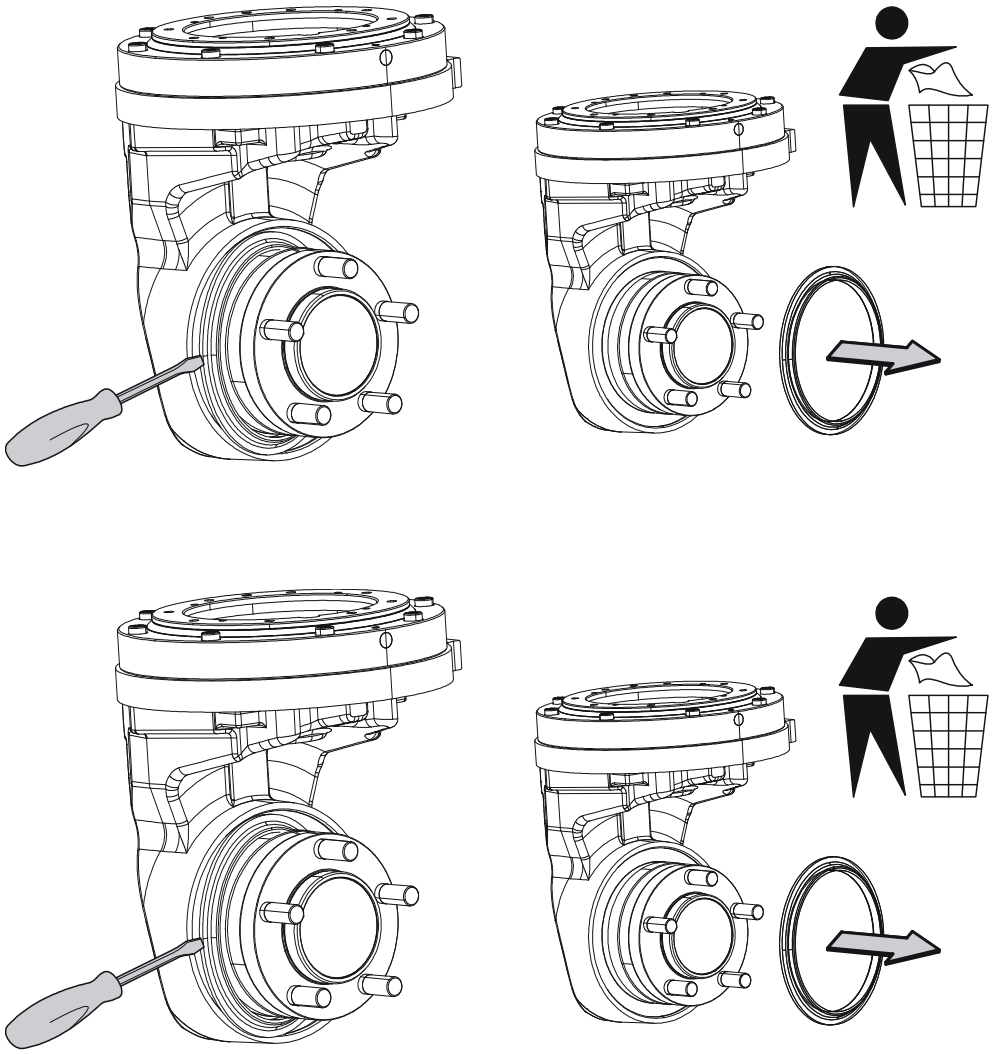


Step 1 Step 2 Step 3

1: Remove the oil filler plug on the upper part of the gear housing.
2: Top up with oil up to the lower edge of the hole to reach the correct level.
3: Screw in the plug.

11.8 Replacing the wheel hub seal

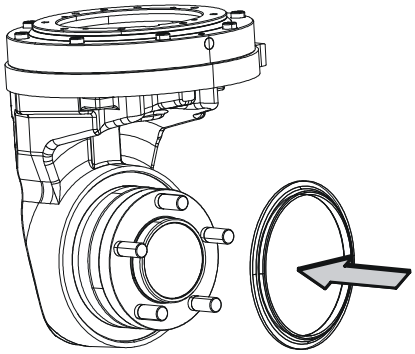
Removing the seal



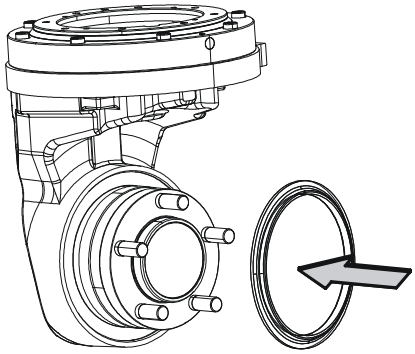
1: Remove the cover ring using a screwdriver or similar.

2: Remove the seal using a screwdriver or similar.

Fitting the seal



Step 1



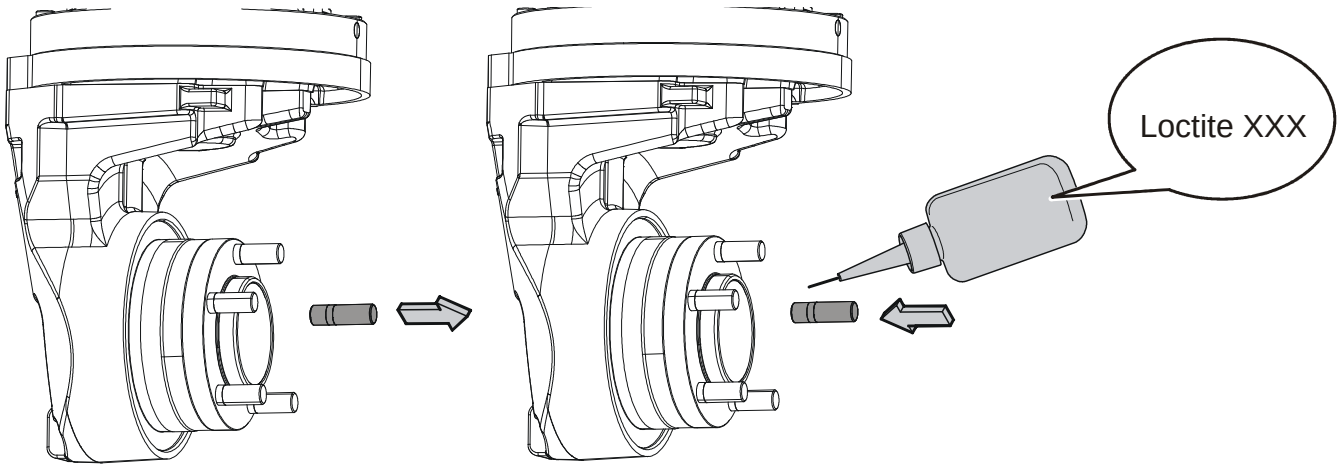
Step 2

1: Fit a new seal. Tap lightly to get it into the right position.

2: Fit a new cover ring. Tap it lightly into place.

11.8.1 Replacing studs

The drive wheel is fixed to the hub with five studs, conical washers and nuts.



Step 1 Steps 2, 3 T=35 Nm

1: Remove the damaged studs.
- Use a stud tool to remove any studs with damaged threads.
- For broken studs, there are two methods:

Method 1: Drill a hole in the centre of the stud and remove it using a bolt extractor.

Method 2: If the stud will not come loose with a bolt extractor, it will have to be drilled out
- Drive a centre punch as close to the centre of the stud as possible
- Drill a pilot hole through the stud using a 5 mm bit
- Drill out the screw with a drill.
- Try to remove the stud remains using pliers, etc. If that does not work, remove the remains by clearing the threads with a tap.

2: Apply Loctite® 270 to the stud thread.

3: Use the stud tool to fit the new stud and tighten to 35 Nm.

12. Brake system/Wheels C3000

12.1 Brake system - C3100

12.1.1 Description

The truck has three different types of brake:

- travel brake,
- parking brake,
- emergency brake.

Travel brake

- Regenerative motor braking using the drive motor.

Parking brake

The brake [Q1] is a single stage electromechanical spring-loaded brake that is released when the magnetic coil is energised. This brake serves as a parking brake and emergency brake.

The parking brake is activated/is active as follows:

- The parking brake is applied automatically when the truck stops during operation. The brake is released when the truck moves off.
- The parking brake remains active after the main power has been switched on.

Emergency brake

Emergency braking of the truck takes place in the event of a fault with the steering system or a serious fault in the electrical system.

The parking brake on the drive motor is the main emergency brake.

Motor braking can operate during emergency braking provided there is a supply voltage.

12.2 Parking brake 3180

In normal work environments, the brake should not require any maintenance.

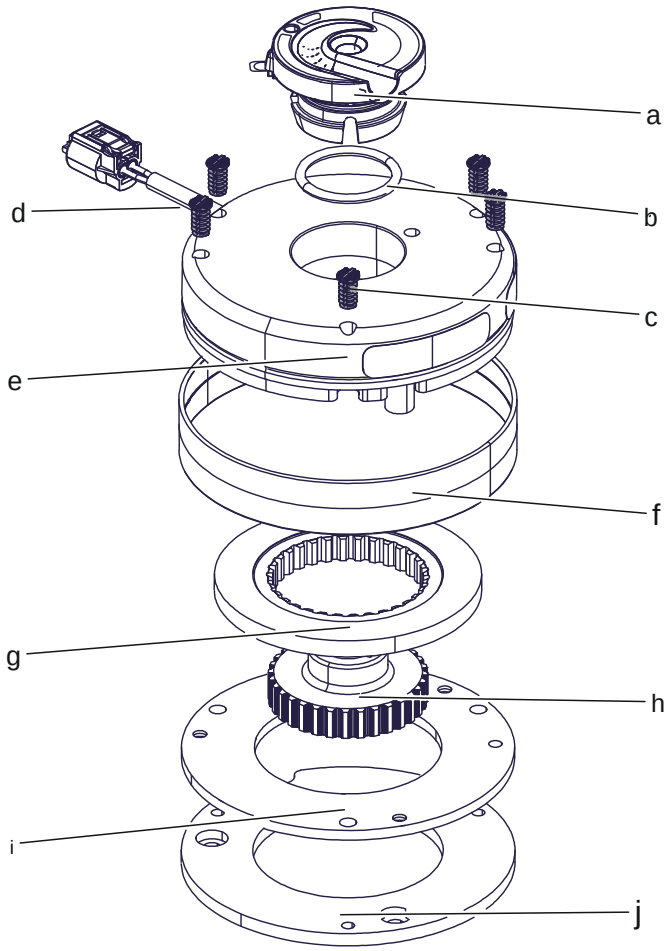
DANGER!

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 carried out on the parking brake.

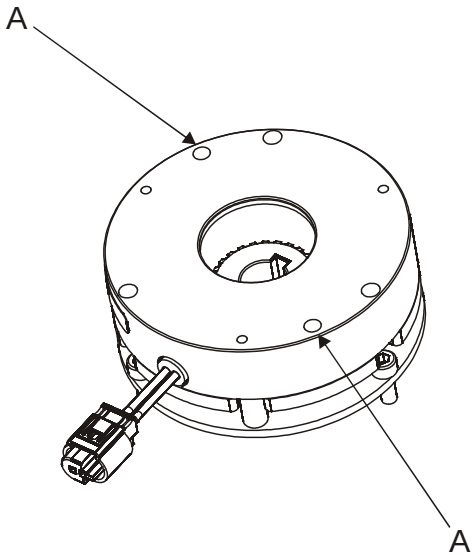
12.2.1 Overview



Pos. no.	Description
a	Dust seal
b	O-ring
c	Dust seal
d	Wiring harness
e	Magnet housing
f	Dust seal
g	Friction disc
h	Hub
i	Pressure disc
j	Mounting plate

12.2.2 Emergency release of the parking brake

Note:
An emergency release of the brakes should only be performed when the truck needs to be moved in connection with work for service and repairs.



The brakes on the truck can be manually released by screwing two screws (M5) into the holes (A). The screws should be 30-35 mm long.

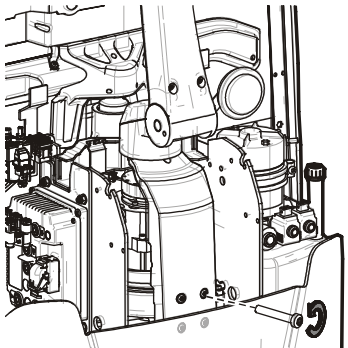
Note:
Remember to remove the screws before operating the truck again.

12.3 Removing the parking brake

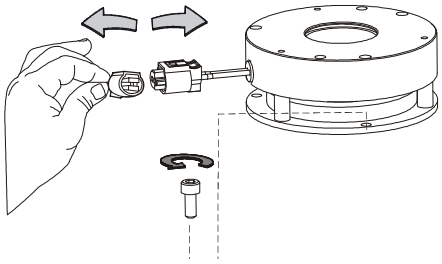
DANGER!
Risk of brake function being lost.

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

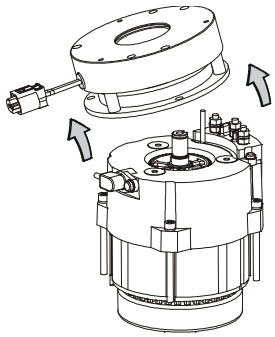
- Truck switched off and the battery disconnected
- Motor compartment open



1. Remove the steering yoke from the truck together with the tiller arm (see the repair manual). Note the position of the conduit entry so that refitting is done correctly.

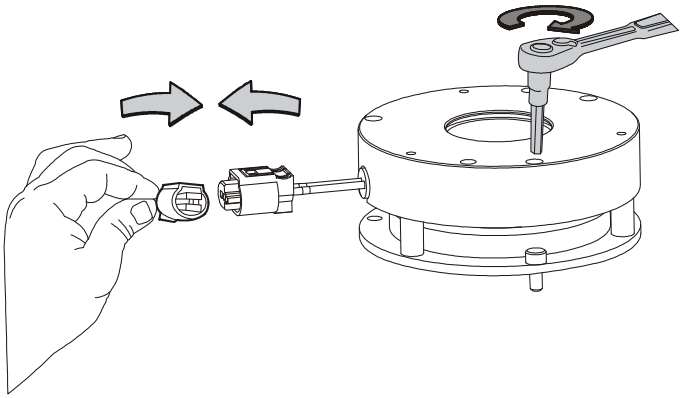


2: Remove the brake and the cable connector Q1.

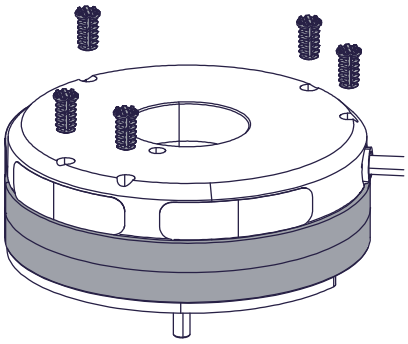


3. Remove the brake unit from the truck. Note the position of the brake so that refitting is done correctly.

12.4 Fitting the parking brake

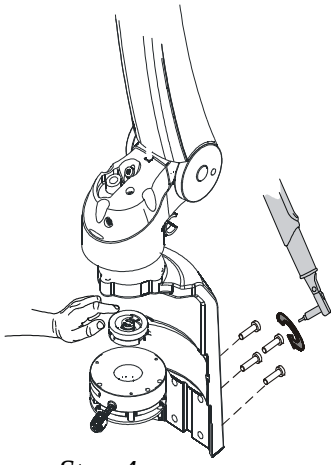


Steps 1 and 2
T=5Nm



Step 3

1. Torque tighten the brake retaining screws to 5 Nm.
2. Fit the connector Q1.
3. Install the dust caps.



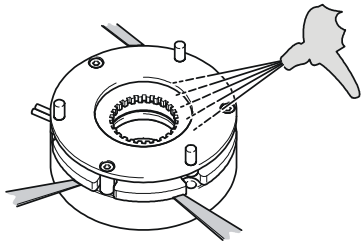
Step 4
T=23Nm

4. Fit the tiller arm and the steering yoke and tighten the mounting bolts to 23Nm
   Make sure the wire grommet is mounted securely to the brake and placed according to your notes.

- Connect the battery and close the motor compartment cover.
- Start the truck and check that the brake works correctly.

12.5 Checking the air gap

- Remove the parking brake

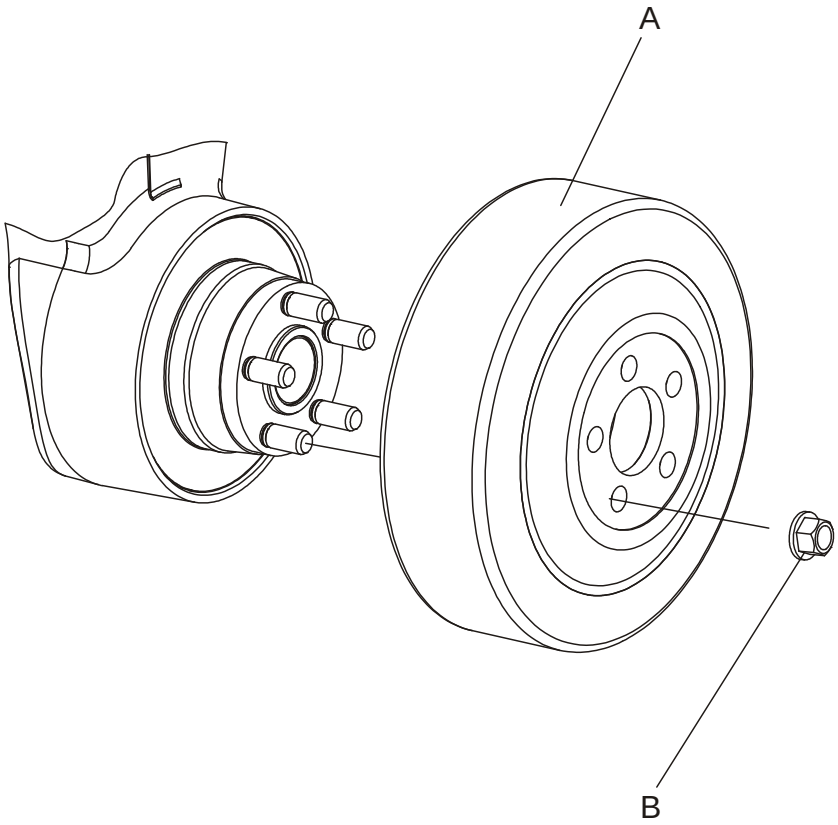


Steps 1, 2 and 3
Spacing=0.2 - 0.7mm

1: Place the parking brake on a workbench with the magnet housing facing downwards.
2. Clean the brake using compressed air. Clean from the inside outwards.
3. If there are particles that cannot be cleared away with compressed air, these may be carefully scraped away.
   Measure the air gap between the magnet housing of the brake unit and the movable pressure disc. Measuring must be done around the entire pressure disc, both on the inside and the outside.

Note:
It is most important to maintain a clearance of 0.2-0.7mm all around the brake. If the prescribed measurement cannot be maintained, the brake must be replaced

12.6 Drive wheel 3530



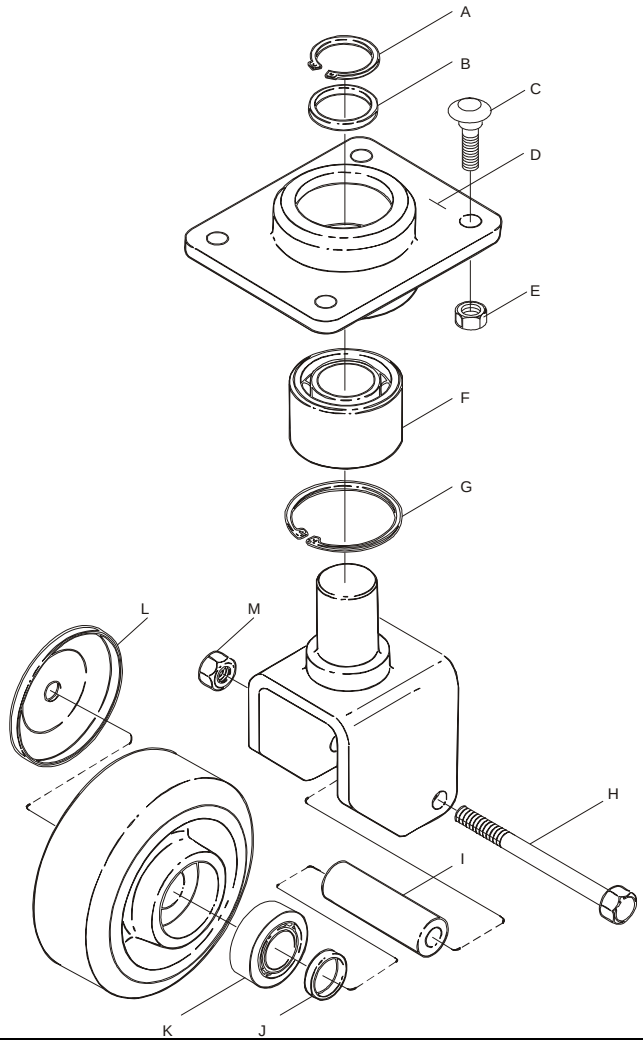
12.6.1 Replacing the drive wheel

1. Raise the forks and lift the truck (approx. 100 mm).
2. Disassemble the drive wheel (A).

   It is simplest to loosen the drive wheel between the forks. Angle the wheel to the side in order to work more easily under the truck.
3. Put the new wheel in position (A) and tighten the nuts (B) 81 ±19 Nm.

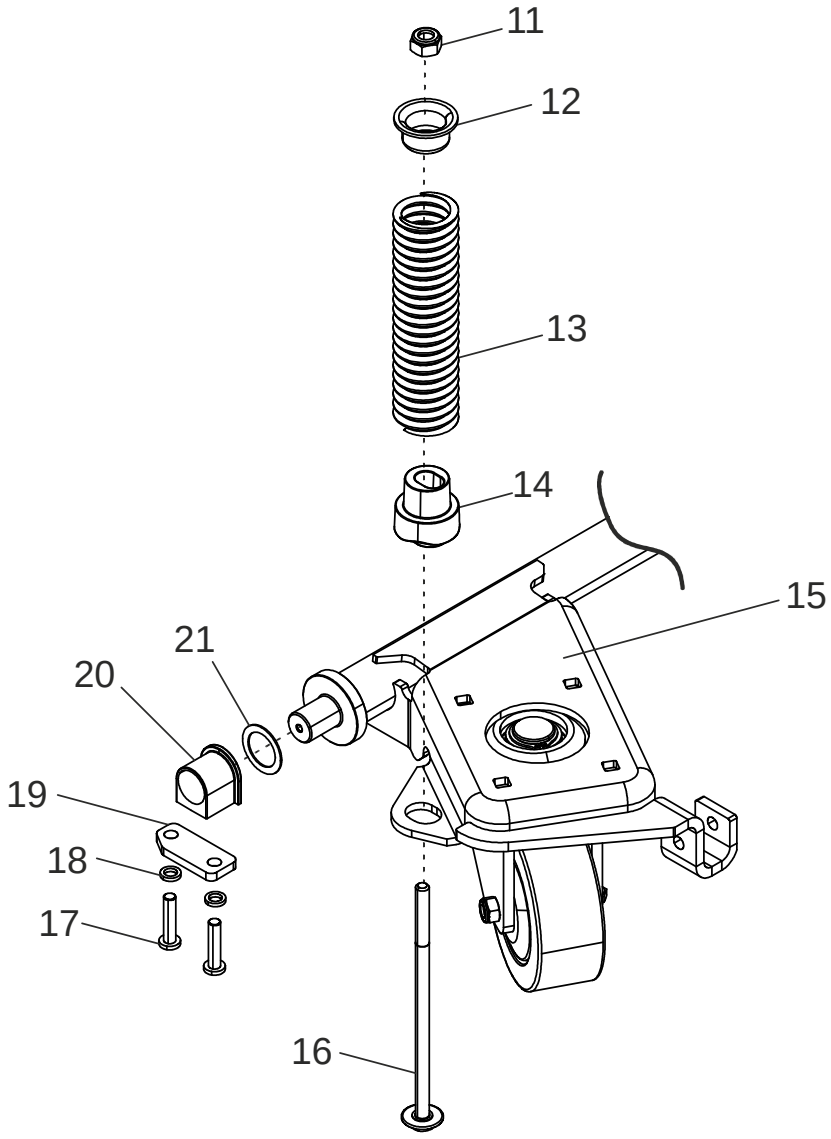
12.7 Castor wheels 3540

12.7.1 Overview



Pos.	Description	Pos.	Description
A	Circlip	H	Screw
B	Washer	I	Spacer
C	Screw	J	Spacer
D	Bracket	K	Bearings
E	Nut	L	Guard
F	Bearings	M	Nut
G	Circlip		

12.7.2 Castor wheel mounting



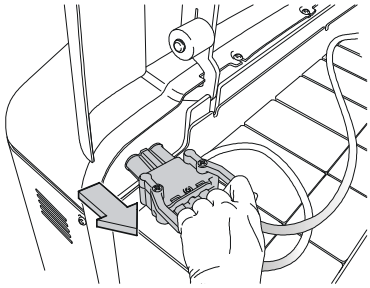
Pos.	Description	Pos.	Description
11	Nut	17	Screw
12	Control units	18	Washer
13	Spring	19	Bracket
14	Control units	20	Bushing
15	Cradle	21	Shims, max 1mm gap. Add as needed.
16	Screw		

12.7.3 Replacing the castor wheel

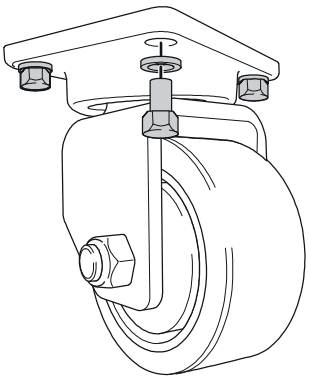
DANGER!

Risk of crushing since a poorly supported truck could fall down.

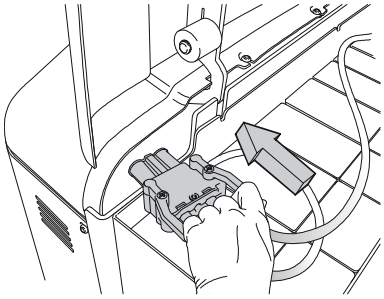
1. Secure the truck in a safe manner.
2. Disconnect the truck battery.



3. Unscrew the castor wheel.
4. Refit the castor wheel and its four fastening screws and washers.



5. Connect the battery.



6. Remove the support trestles.

12.7.4 Disassembling the castor wheel cradle

1. Raise the forks.
2. Remove the inspection cover.
3. Loosen the spring fasteners.
4. Loosen the bracket for the castor wheel mounting.
5. Lift the drive unit so that the cradle is free.

Install in reverse order.

12.8 Spring replacement

12.8.1 Removing springs

1. Loosen the upper locking nuts.
2. Lift the drive unit so that the springs are released from the upper bracket.
3. Loosen the lower locking nut on the spring that is to be changed.

Note:
The spring is pre-tensioned, take care when loosening the lower locking nut.

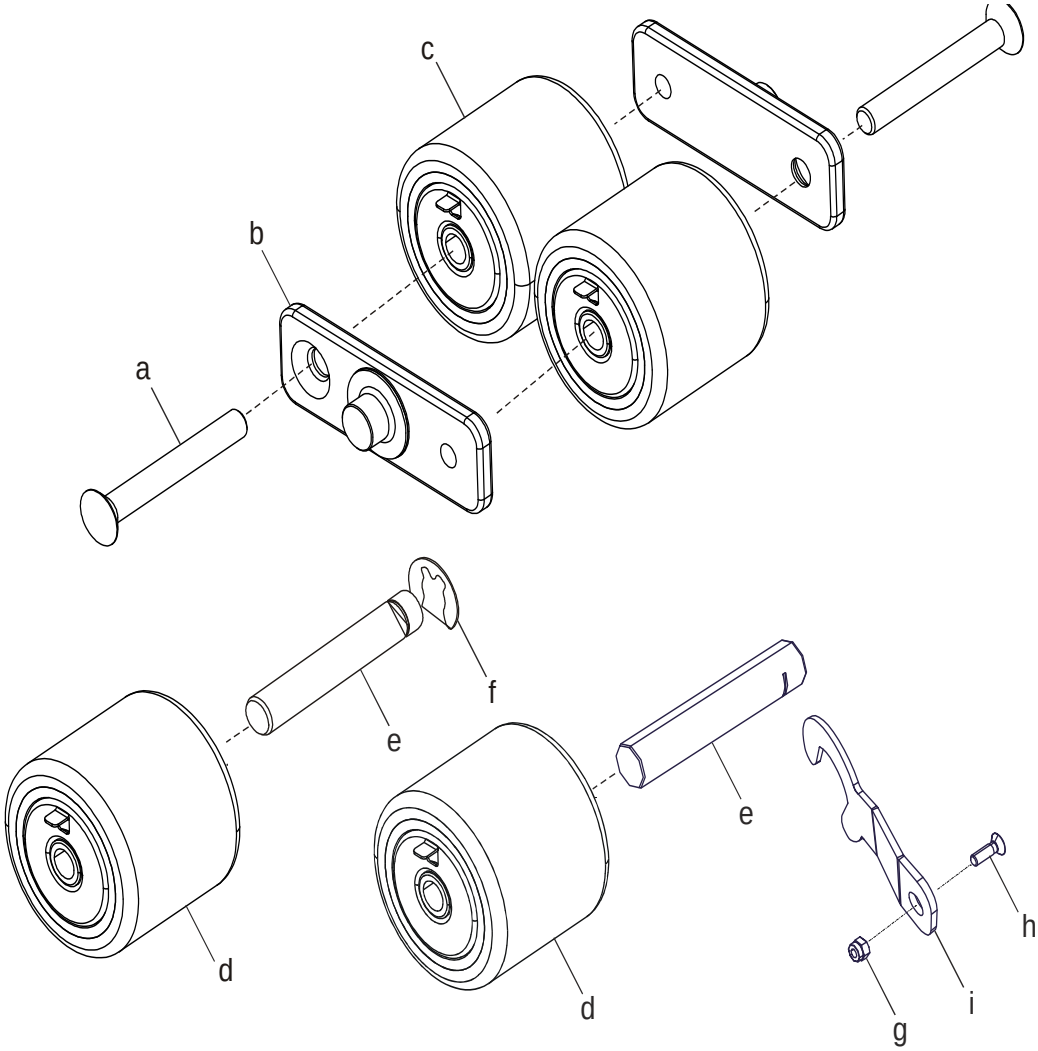
12.8.2 Fitting the spring

1. Place a block under the spring bolt so that the spring screw is held in place.
2. Fit the spring with the lower locking nut and washer.

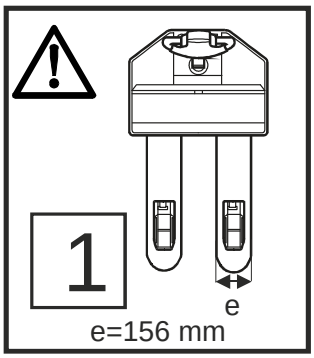
   Use a short sleeve in order to screw the lower locking nut tight whilst pressing the spring together.
3. Screw down the lower locking nut so that the distance between the edge of the washer and the top of the screw is 15 mm.
4. Make sure that the springs are sitting correctly in the upper fasteners when the drive part is lowered.
5. Screw the upper locking nuts tightly.

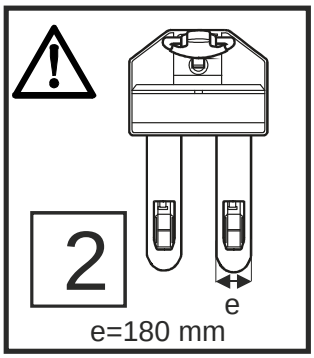
12.9 Support arm wheel 3550

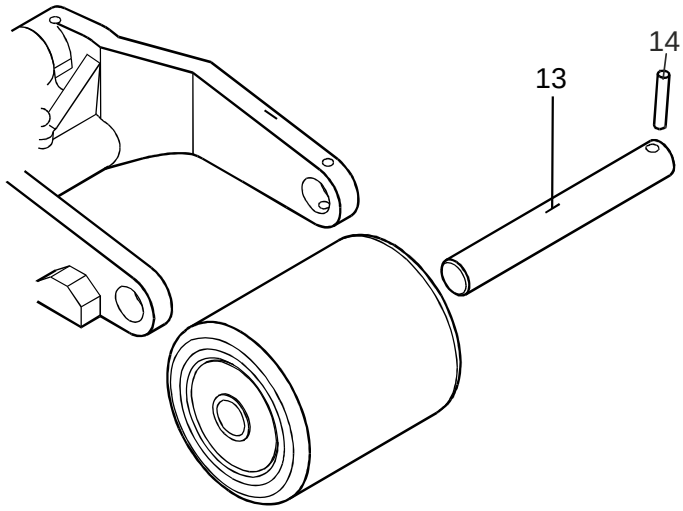
12.9.1 Overview

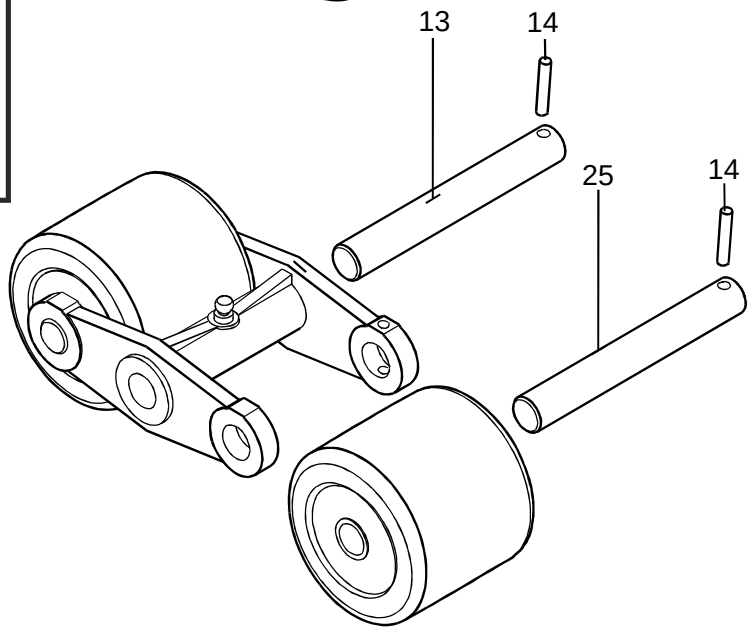


Pos.	Description
a	Screw
b	Bracket
c	Bogie wheel
d	Single wheel
e	Shaft
f	Circlip
g	Nut
h	Screw
i	Bracket







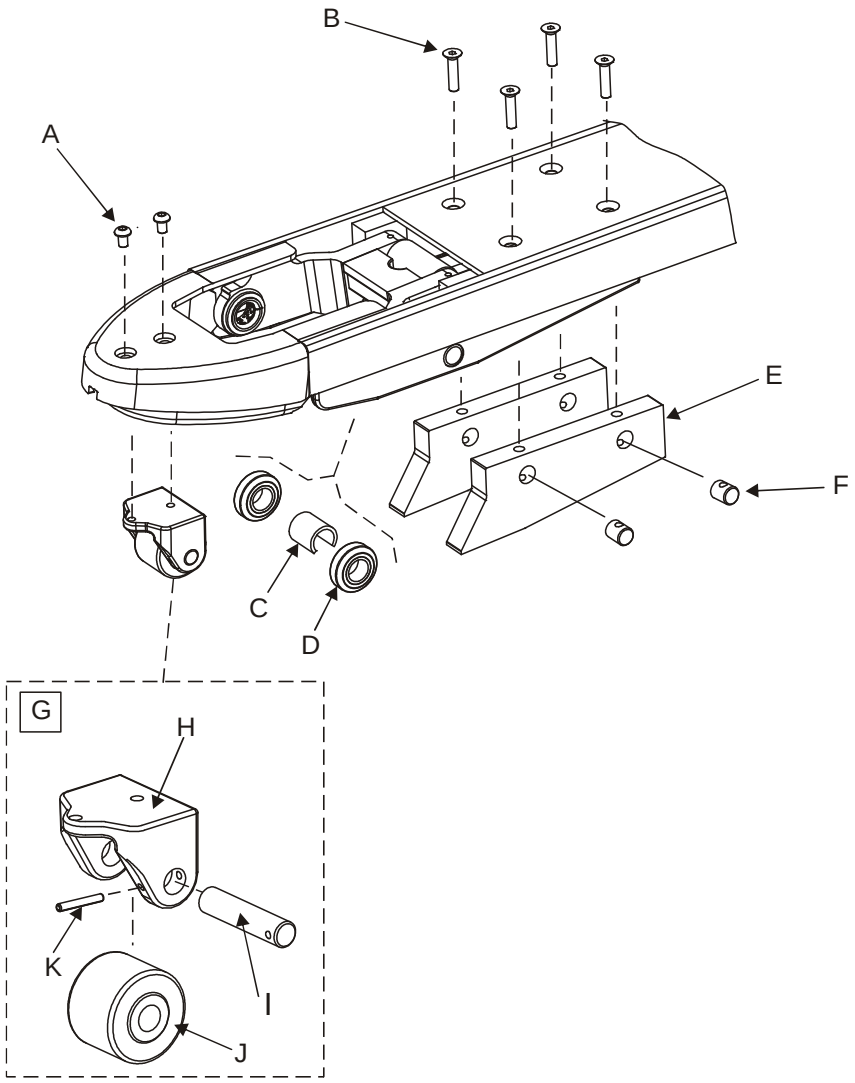


Pos.	Description
13	Shaft
14	Pin
25	Shaft

Pos.	Description
1	P214/216
2	P218/220/225

12.10 Climber wheels

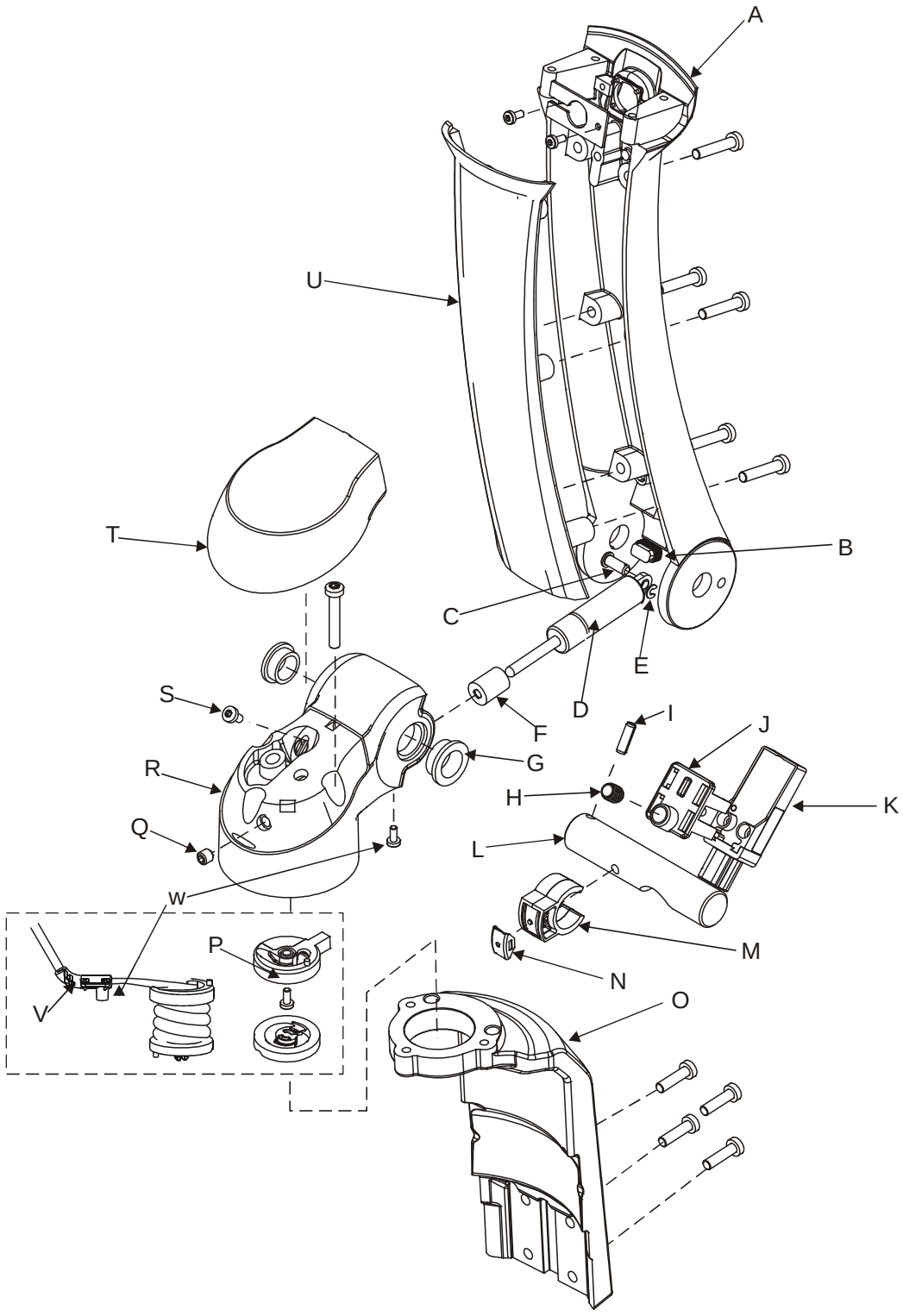
12.10.1 Overview



Pos.	Description	Pos.	Description
A	Screw, K6S 8x12	G	Wheel, assy
B	Screw, MF6S 8x35	H	Wheel bracket
C	Sleeve	I	Shaft
D	Climber wheels	J	Wheels
E	Slide pad	K	Spring pin
F	Lock nut M8		

13. Tiller arm 4000

13.1 Overview



Pos.	Description	Pos.	Description
A	Tiller arm	M	Indicator sleeve
B	Rubber buffer	N	Plate
C	Cylindrical bolt	O	Yoke
D	Gas strut	P	Cable clamp
E	Circlip	Q	Screw
F	Rubber buffer	R	Yoke
G	Bushing	S	Screw
H	Threaded insert	T	Cover
I	Stop screw	U	Cover
J	Holder	V	Cable clamp
K	Safety sensor B60	W	Cable clamp screw
L	Shaft		

13.2 Removing the tiller arm

1. Remove the inspection cover.
2. Remove the cover (T).
3. Unscrew the retaining screws of the yoke (R).
4. Detach the cable clamp (P) by pressing on the clamp with your thumbs and lifting it upwards. Pull the cable clamp out through the hole in the steering console.

Note:
Do not try to prise away the cable clamp with a screwdriver.

5. Cut off the cable ties of the cable duct on the transistor regulator side and disconnect cable connections X5 and X65.

Install in reverse order.

13.3 Replacing an gas strut

1. Remove the cover (T).
2. Remove the cable clamp retaining screw (W)
3. Unscrew the adjusting screw (Q).
4. Remove the locking mechanism (E) from the gas strut lock shaft (C)
5. Detach the gas strut lock shaft (C).
6. Remove the gas strut.

Install in reverse order.

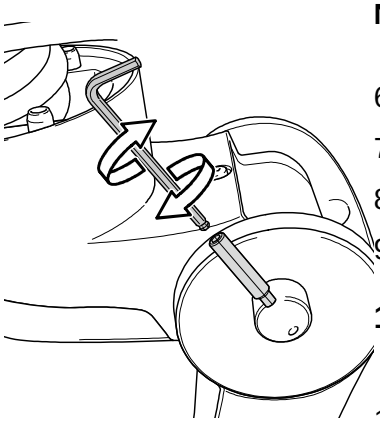
Note:
Pay attention during assembly and make sure no cables are pinched.

13.4 Replacing the safety sensor

13.4.1 Removal

1. Remove the gas strut. See section “13.3 Replacing an gas strut”.
2. Unscrew the stop screw (I) of the shaft (L). See figure.
3. Turn the shaft (L) until the back of the indicator sleeve (M) becomes accessible.
4. Loosen the indicator sleeve (L).

   To prevent damage to the sleeve, pry the indicator sleeve loose from both sides at the same time.
5. Tap out the shaft (L).



Note:
Make sure that the handle does not drop down and damage the cables.

6. Remove the cable clamp retaining screw (W).
7. Remove the sensor retaining screw (S).
8. Detach contact B60 from the sensor (K).
9. Remove the sensor.

13.4.2 Installation

1. Fit the sensor (K)
2. Attach connector B60 to the sensor.
3. Apply Loctite to the sensor retaining screw (S) or replace it. Fasten the screw.
4. Fasten the cable clamp retaining screw (W).

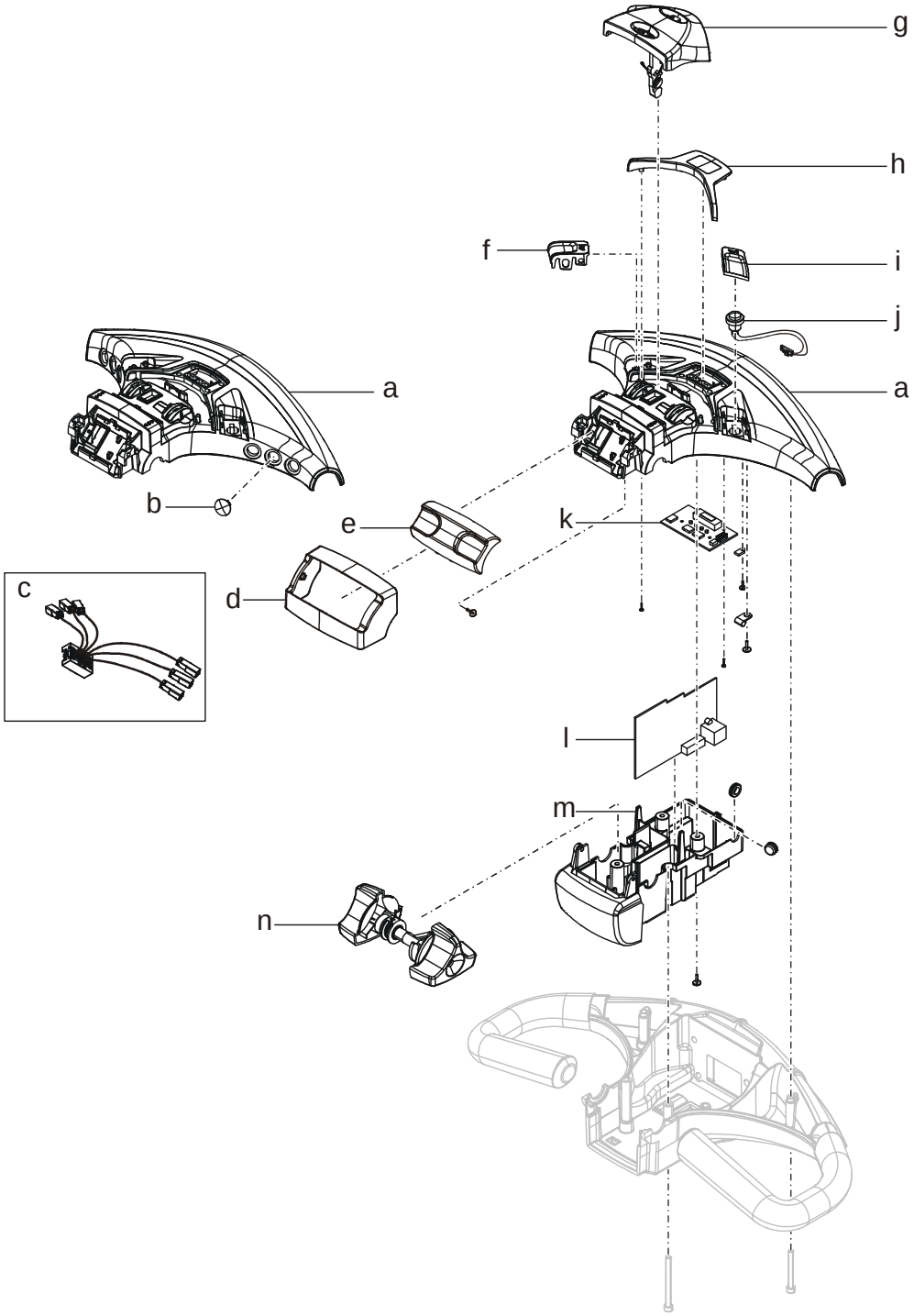
Note:
The cable must be routed to the right of the sensor (K), towards the spring pin.

5. Screw the stop screw (I) into the shaft (L). See figure.
6. Install the gas spring See section “13.3 Replacing an gas strut”.
7. Check for correct operation of the safety sensor.

13.5 Electric steering system – 4000

13.5.1 Tiller arm handle C4110

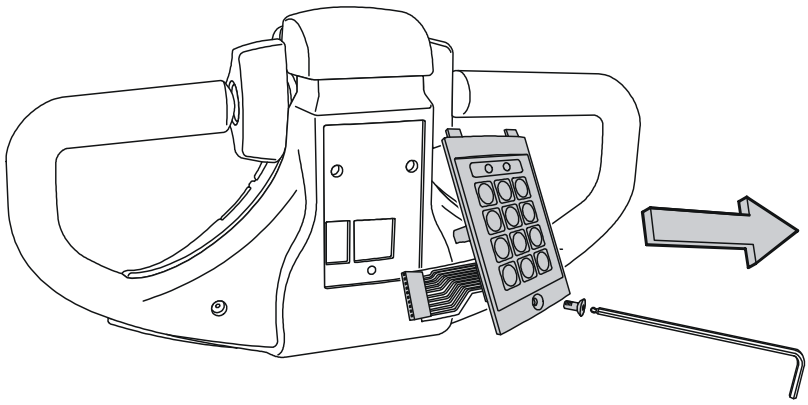
13.5.2 Overview



Pos.	Description
a	Cover
b	Plug
c	Wiring harness
d	Cover
e	Toggle switch
f	Horn button
g	Button "lifting/lowering"
h	Display
i	Horn button
j	Switch "horn"
k	Display
l	Electronic card “A5”
m	Stomach button
n	Speed control

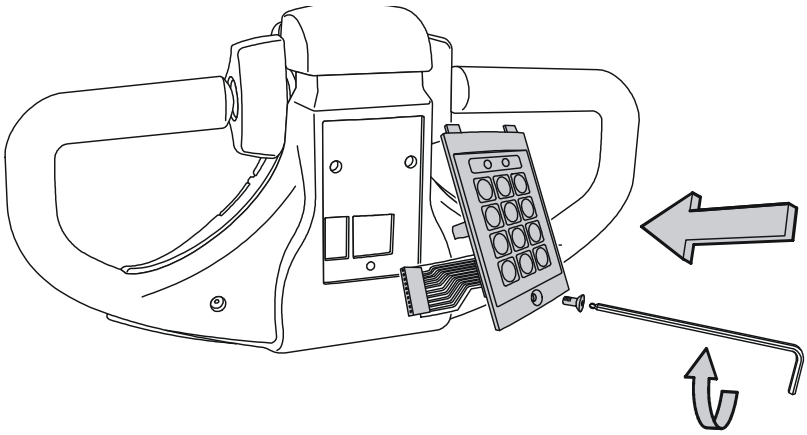
13.5.3 Replacing the keypad C9420

Removing the keypad



Detach the keypad and disconnect it from the logic card

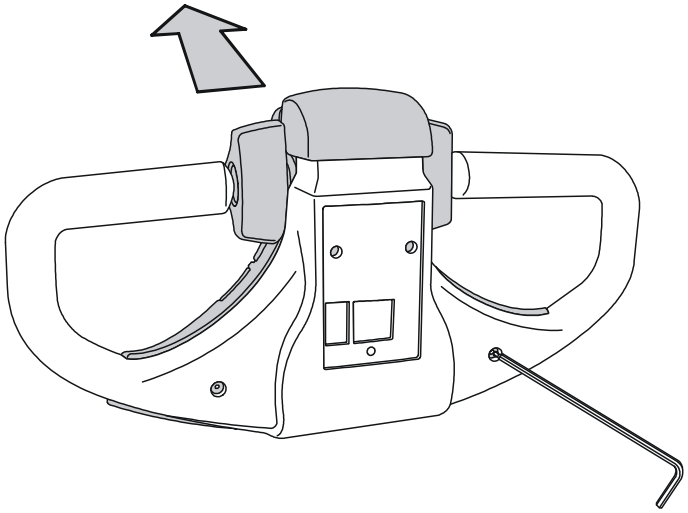
Installing a keypad



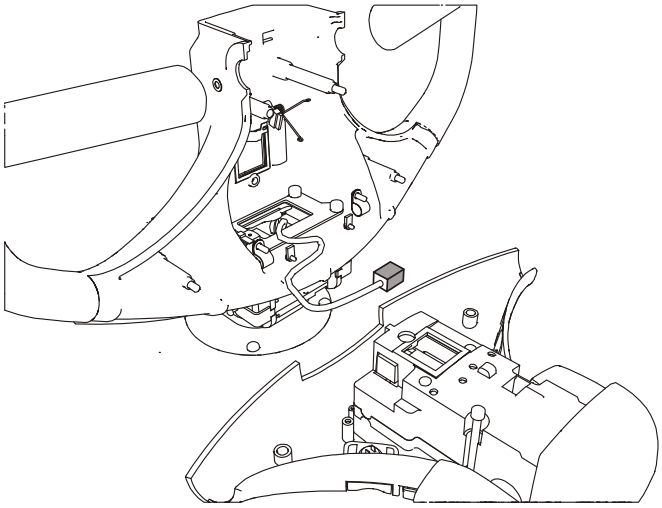
Connect the keypad and screw it in position

13.5.4 Replacing the upper cover C4110

Removing the upper cover



Step 1



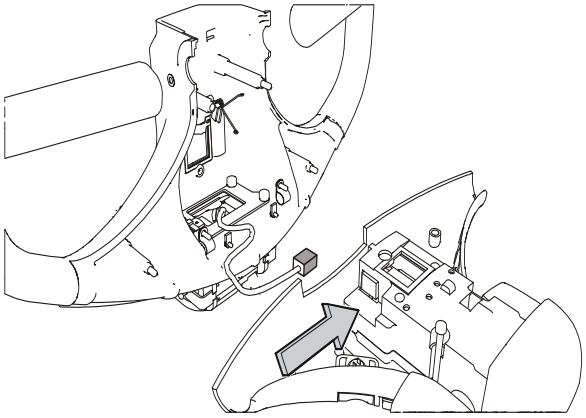
Step 2

- Remove the keypad. Page 13–7

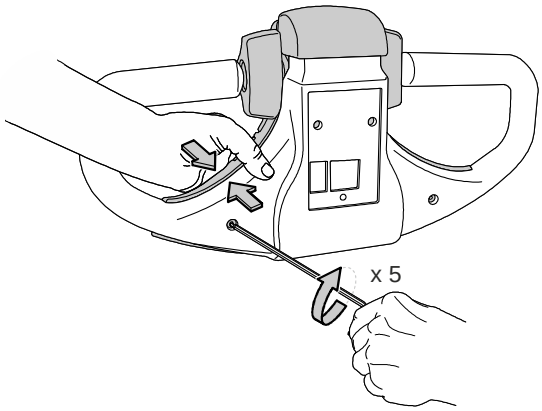
1: Remove the screws holding the upper cover and keep hold of the upper cover to prevent damage to the cable to the logic board

2: Disconnect the CAN connection to the logic card

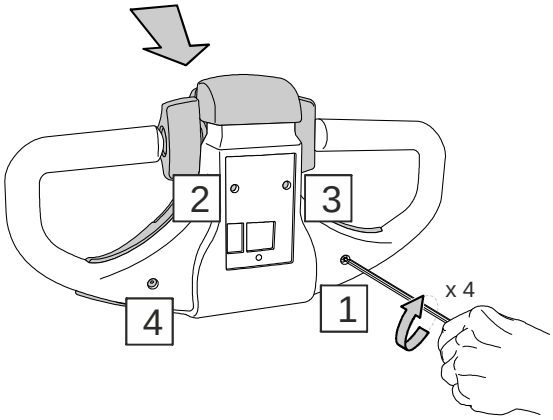
Installing the upper cover



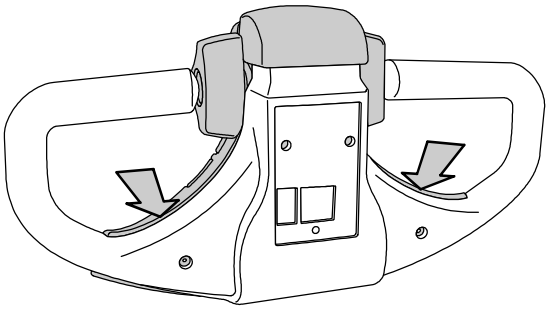
Step 1



Step 2



Step 3



Step 4

1: Connect the CAN bus connection to the logic card

2: Press together the upper and the lower parts, and turn the screws five complete turns. Start with the left side, and then proceed with the right side.

3. Turn the screws crosswise as depicted below a further four complete turns (a total of nine turns, which corresponds to 1 Nm).

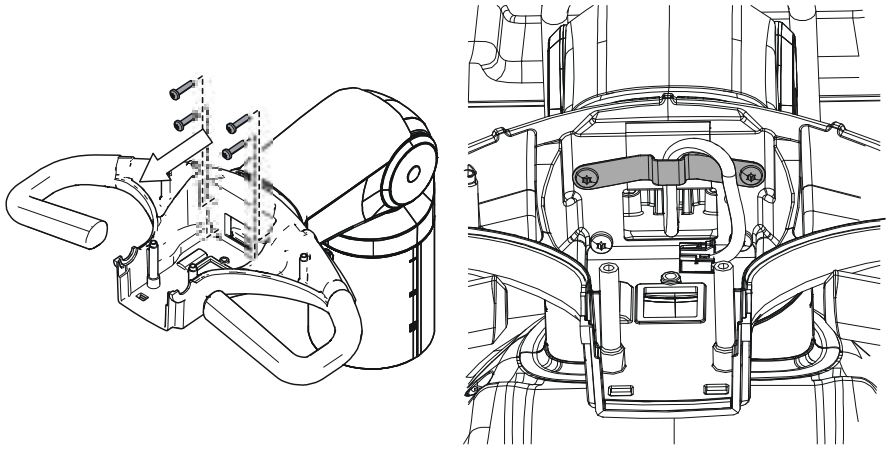
4. Check that there is no space between the handle and the steering head.

5: Make sure that the control can be moved back and forth without difficulty, and that the control returns to the neutral position.
If the control shows signs of being difficult to move: Re-adjust the screws according to step 3.

Fit the keypad. Page 13–7

13.5.5 Replacing the tiller arm handle

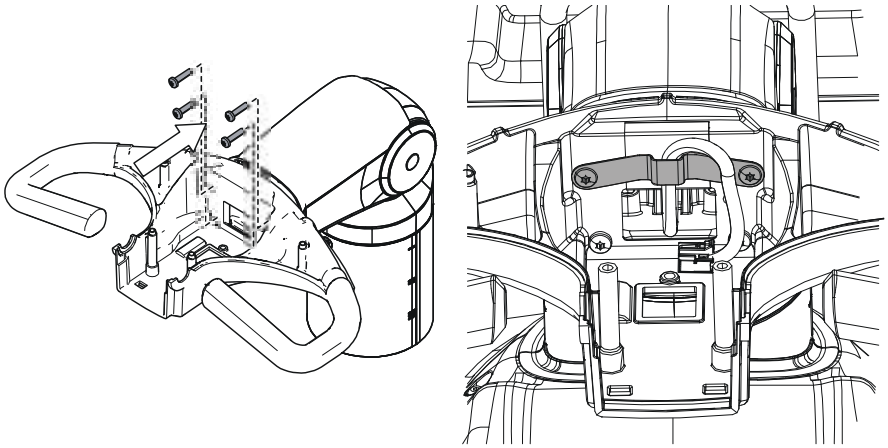
Removing the tiller arm handle



- Remove the upper cover. Page 13–8

1: Remove the cable bracket/handle in the tiller arm.

Fitting the tiller arm handle



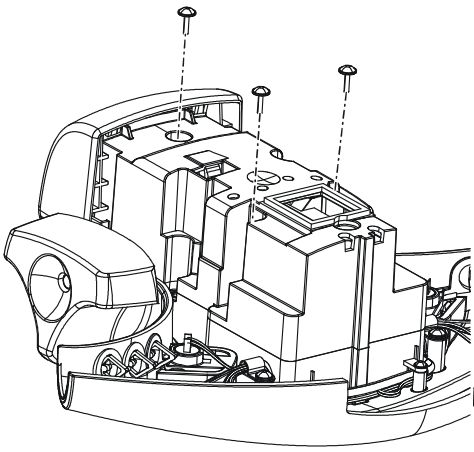
T=12Nm

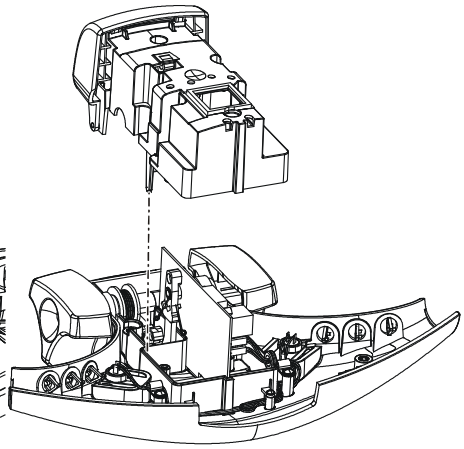
1: Fit the handle/cable bracket.
Note: Mount the wiring harness so that it does not get pinched.

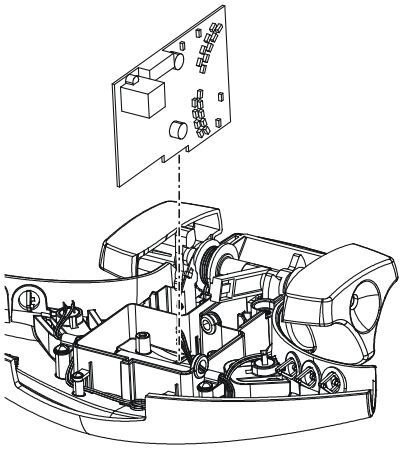
- Fit the upper cover. Page 13–9

13.5.6 Replacing the logic card

Removing the logic card


Step 1


Step 1


Step 2

- Remove the upper cover. Page 13–8

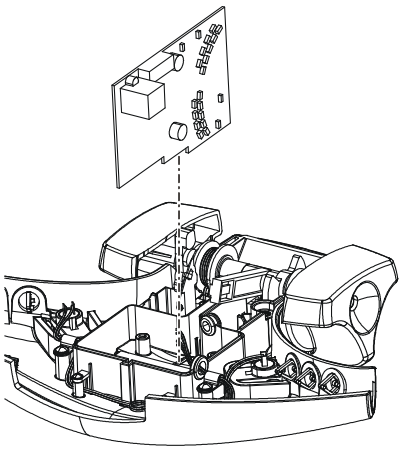
Warning!
Static electricity!
Risk of static discharge that can damage the electronics.
Make sure you take the necessary steps to prevent static electricity, ESD protection, before starting work on the steering module.

1: Remove the screws holding the cover for the logic card and carefully lift away the cover.

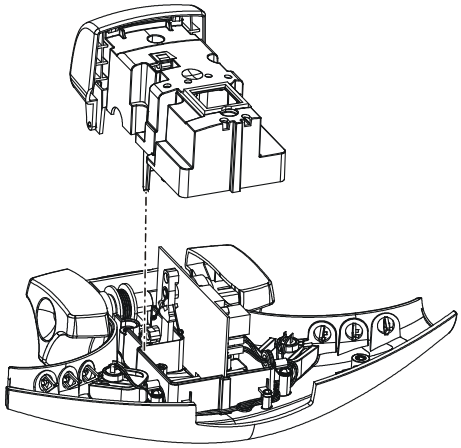
Hint: Hold a finger between the cover and the shaft for the speed control buttons to prevent the speed control assembly from falling down.

2: Pull out the logic card, and pull off the connectors.

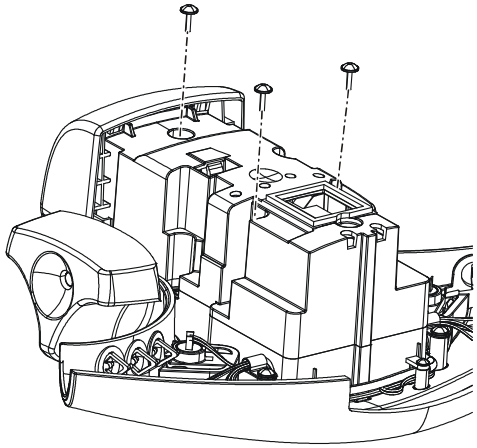
Installing a logic card



Steps 1, 2



Step 3



Step 3

1: Fit the new logic card in place and connect it.

2: Check the cable connection on the logic card and that the connectors are correctly connected.

3: Fit the cover in place and screw it down. Make sure the conduit entry is intact and correctly positioned.

- Fit the upper cover. Page 13–9

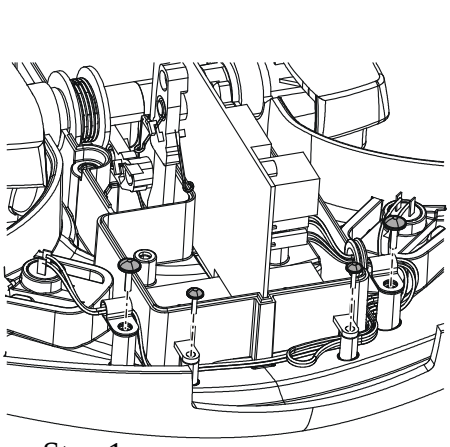
13.5.7 Checking the handle

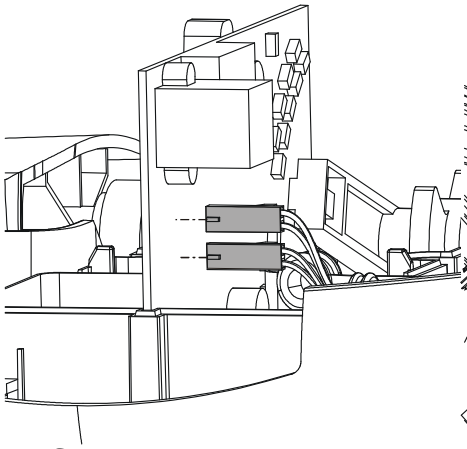
Test drive the truck and check the functions of the handle

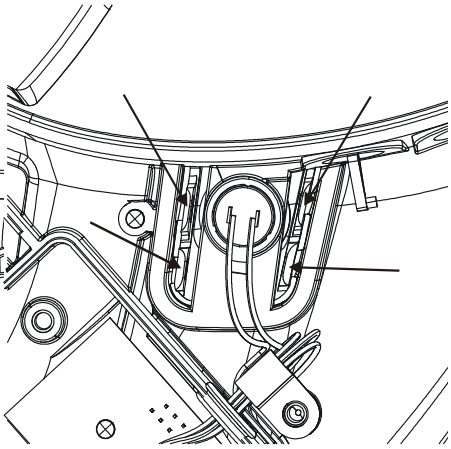
13.5.8 Update the software

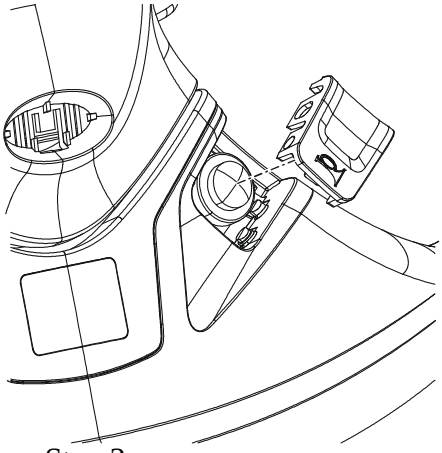
If a new logic card without software has been installed, use TruckCom to download software and reset the parameters.
See the TruckCom manual.

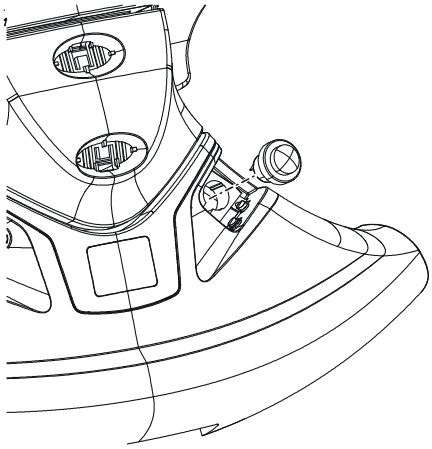
13.5.9 Replacing the signal button/switch


Step 1


Step 2


Step 3


Step 3


Step 4

- Remove the stomach button Page 13–17

1: Remove the screws to the wire fittings.

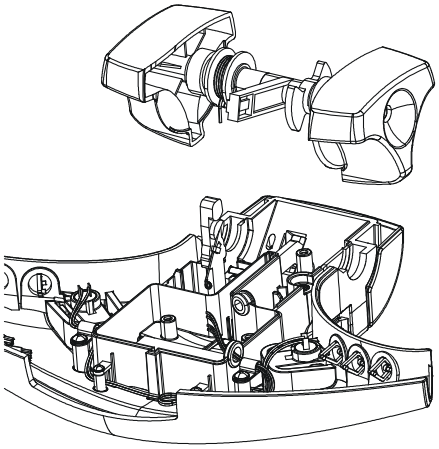
2: Remove the connectors to the logic card

3: Remove the horn button, use a screwdriver to carefully prise it off the clip fasteners.

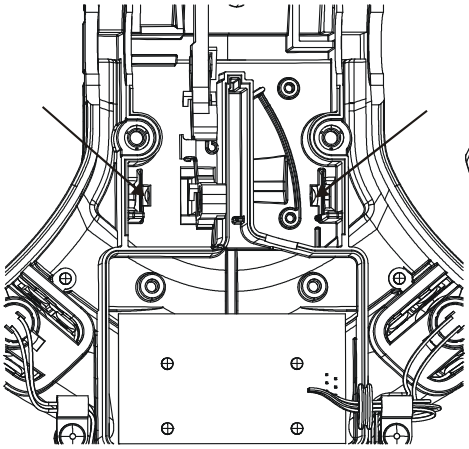
4: Remove the switch by pulling it straight up.

- Install in reverse order.

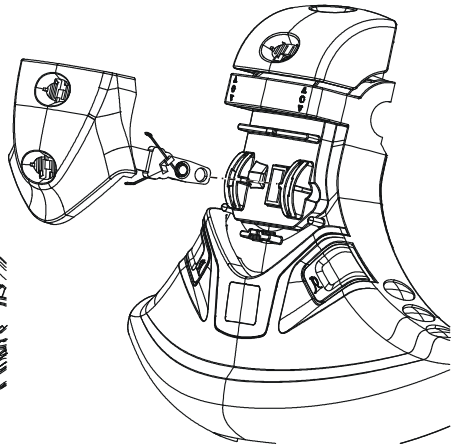
13.5.10 Replacing the lift/lower button



Step 1



Step 2



Step 3

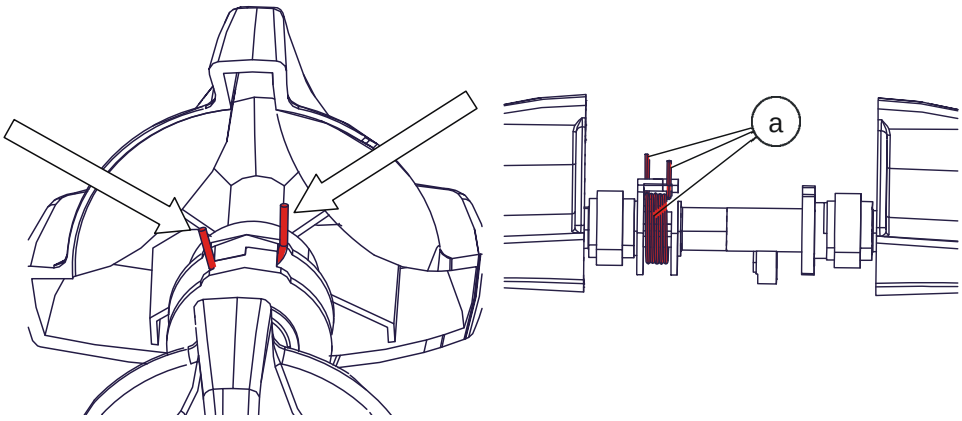
- Remove the stomach button Page 13–17

1: Remove the speed control

2: Use a screwdriver and carefully press down the button fitting

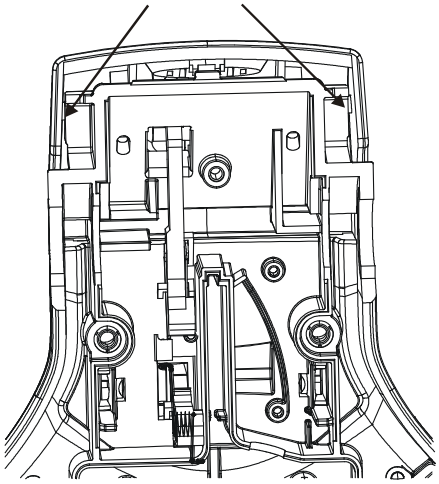
3: Pull the button straight out, compress the spring when removing it

- Reassemble in reverse order
- Lubricate the spring (a) with Molcate PC 75
- Make sure there is no play when operating the rocker, adjust the spring legs if necessary.
- In case the control does not spring back: Check that the spring is fitted correctly.

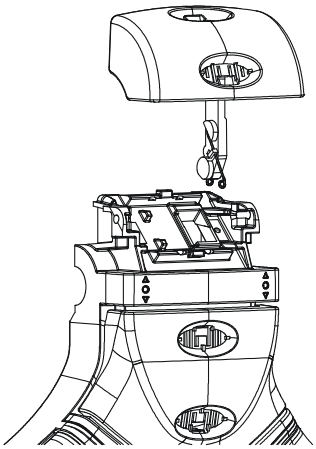


Fit the stomach button Page 13–17

13.5.11 Replacing the sensilift



Step 1



Step 2

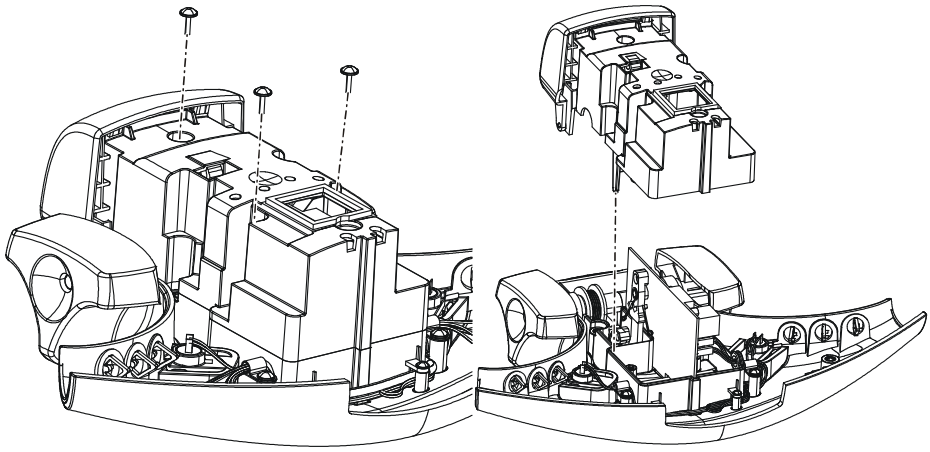
- Remove the stomach button Page 13–17

1: Remove the button, use a screwdriver to carefully prise it loose

2: Pull it straight up

- Reassemble in reverse order

13.5.12 Replacing the stomach button



Step 1 Step 1

- Remove the upper cover Page 13–8

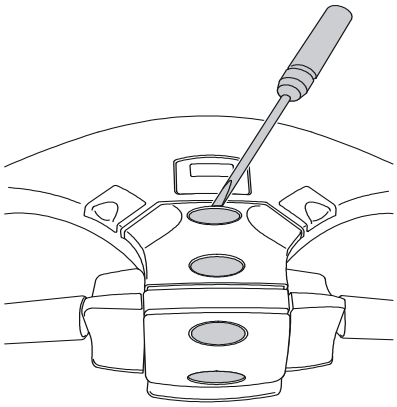
1: Remove the screws holding the cover/stomach button over the logic card and carefully lift away the cover.

Hint: Hold a finger between the cover and the shaft for the speed control buttons to prevent the speed control assembly from falling down.

Note: The stomach button must not be replaced by itself, the complete cover and button must be replaced as a unit.

13.5.13 Changing the position of the controls - support arm lift/ fork lift

1. Pry off the lift control buttons using a thin screwdriver and switch the positions with the rear buttons.



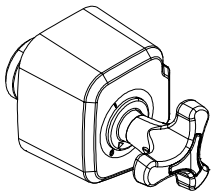
2. Make sure the lips catch when the new buttons are inserted.
3. Connect a PDA or PC and use TruckCom to change parameter 1023 to 2.
4. Start the truck and make sure the change is correct.

14. Electrical components-5000

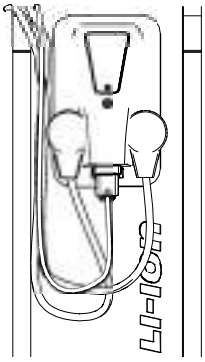
14.1 Li-ion battery (Hoppecke)

14.1.1 Resetting/restarting the battery

If error codes are generated or the battery lamp does not light with a steady green glow, the battery can be restarted.



1: Disconnect the battery yoke
Note: the yoke must be removed from the battery.



2: Disconnect the CAN connector X111.

3: Wait until the light goes out.

4: Connect the CAN connector.

5: Wait until the lamp on the battery shows steady green.

6: Reconnect the battery yoke.

14.2 Inspecting the battery

1: Check that a green lamp is lit on the battery. This indicates that everything is OK.

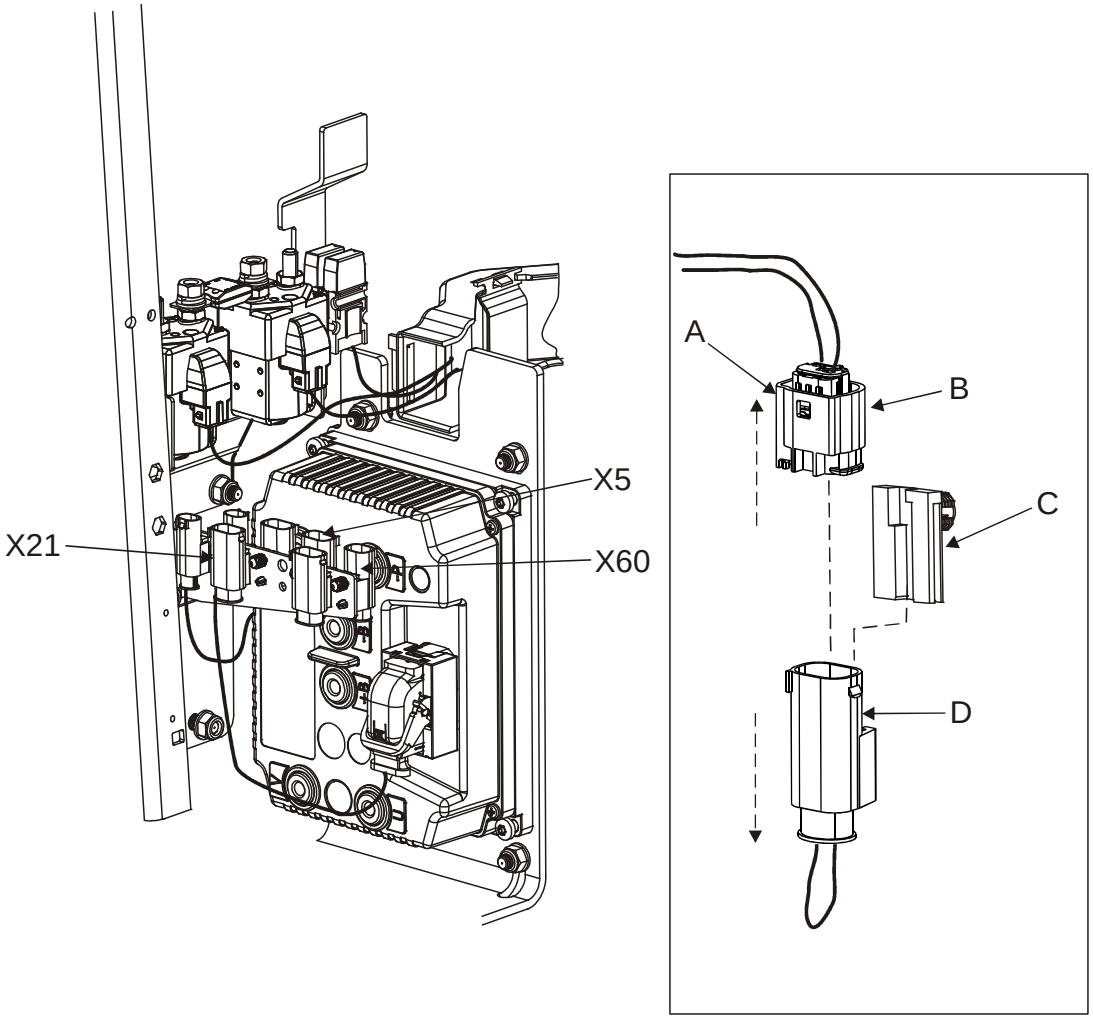
2: Check the attachment of the brackets.

3: Check electrical connections on the CAN wiring harness.

4: Check the attachment of the battery lock.

5: Check that the covers have been refitted properly.

14.3 Replacing the wiring harness



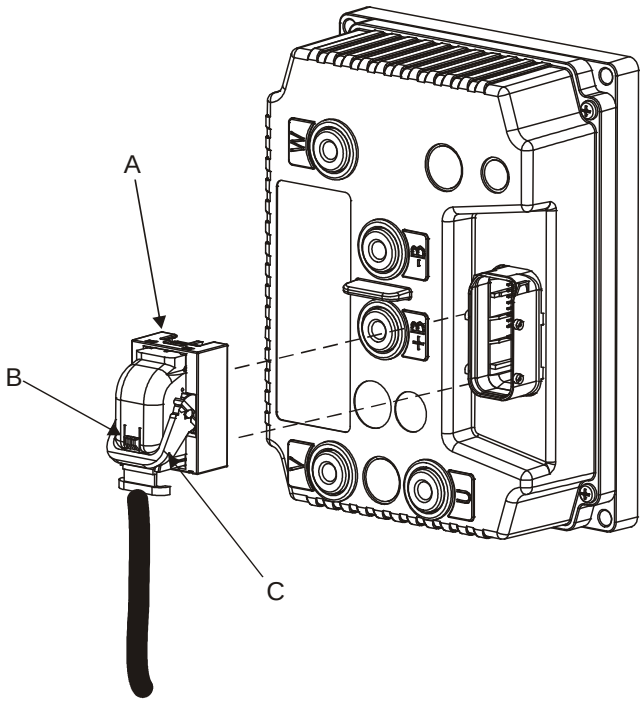
Pos.	Description
A	Connector clamp
B	Connector, female part
C	Bracket
D	Connector, male part

Proceed as follows when replacing the wiring harness:

1. When prying the X connectors apart, press in the connector lock (A) of the female part (B) and pull upwards.
2. Disconnect the female part (B) of the connector from the male part (D).
3. Then disconnect the male part (D) by pulling it downwards.

   The bracket (C) remains on the connector panel.

14.3.1 Replacing the transistor regulator wiring harness



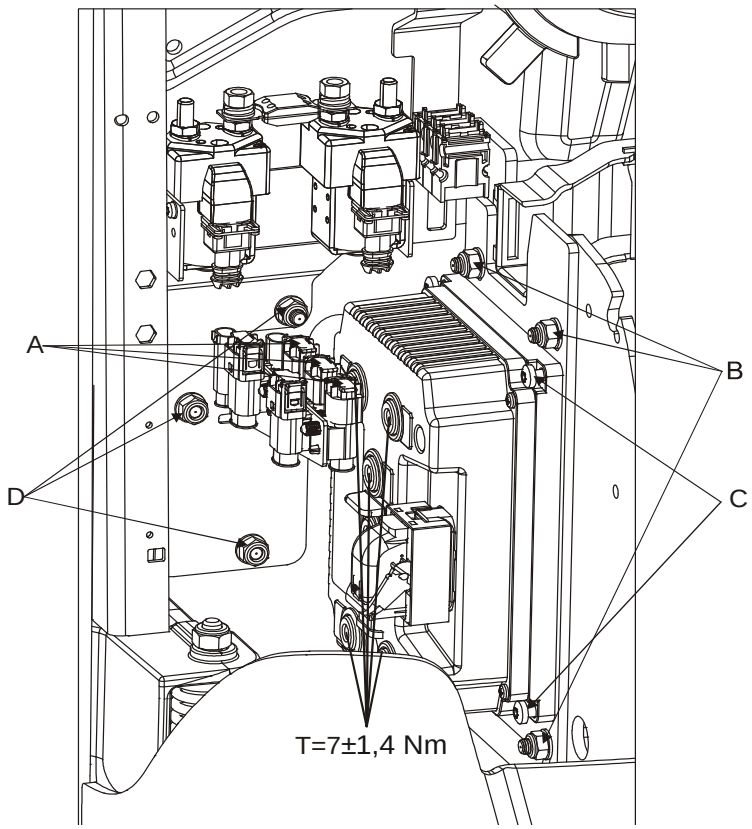
Keep the following in mind if it becomes necessary to disconnect the connector (A) of the transistor regulator:

- First press down on the bracket clamp (B).
- Then lift up the connector lever (C).

14.4 Replacing the transistor regulator

Note:

This action requires access to TruckCom!



1. Remove the inspection cover.
2. Cut off the cable ties of the cable duct on the transistor regulator side.
3. Disconnect the connectors (A) from the connector bracket.
4. Undo the screws (D) and move the connector bracket aside.
5. Disconnect all cables and connectors from the transistor regulator.
6. Loosen the fastening nuts (B) of the fixing plate.
7. Remove the transistor regulator.

   Angle out the top edge of the fixing plate and turn it in the drive wheel direction in order to remove it from the truck.
8. Unscrew the transistor regulator from the fixing plate (C).

   Assembly is done in reverse.

After installation of the new transistor regulator, the truck will display error code 2.004.

1. Connect TruckCom.
2. Select “Copy truck configuration”.
3. Select “Copy configuration to secondary unit: ACT”

15. Hydraulic system 6000

15.1 General

Always take the following safety precautions prior to commencing work on the truck's hydraulic systems:

- Slowly depressurise system pressure.
- Use some paper or a stiff piece of cardboard when checking for possible oil leaks. Do **not** use your hand.
- Be careful since the oil in the transmission and hydraulic systems can be scalding hot.

DANGER!

Risk of burns if hot transmission oil or hydraulic oil gets onto the skin. Allow the truck to cool down before changing the oil.

15.2 Hydraulic hygiene

Note:

Risk of malfunction.

If impurities get into the hydraulic system, there is a risk of malfunctions in part or all of the hydraulic system. There is also a risk of severe damage to components.

For all work on the hydraulic system, the following instructions must be followed.

Note:

Use only new and clean oil when refilling the hydraulic oil system. If the oil is contaminated, the hydraulic components will suffer damage.

15.2.1 Washing

Hydraulic components, including hydraulic hoses and pipes, must be cleaned with a filtered washing fluid using a method suitable for the components concerned.

The washing fluid must have purity code 19/16/13 in accordance with ISO4406:1999 or 16/13 in accordance with ISO4406:1987.

Blowing clean with dry filtered air may be done when this is the only practical method to carry out cleaning.

15.2.2 Packaging

After cleaning, all openings must be sealed with protective plugs. Connecting surfaces must be protected against handling damage and dirt penetration.

Completely dry components can be packed in plastic bags or boxes with lids.

The packaging (protective plugs, masking, plastic bag, etc.) must not be removed until immediately before the component is to be fitted in a workplace suitable for handling hydraulic components.

Tape must never be used without cleaning afterwards.

Protective plugs must be stored in plastic bags or boxes with lids until they are used.

After use, discard the plugs and plastic bags.

15.2.3 Handling

Hydraulic components must be handled and transported with the greatest care.

Transportation packaging must be used throughout the entire handling chain.

This packaging must be clean and free from dust, etc.

15.2.4 Storage

Hydraulic components must be handled and stored so that:

- no rusting can occur
- dust and dirt particles are shielded out
- no mechanical deformation can occur

15.2.5 Work procedures

When working on the hydraulic system, great cleanliness must be observed so that no impurities can enter the system.

No work that generates particles may be carried out in the same workplace or close to where work is being carried out on the hydraulic system.

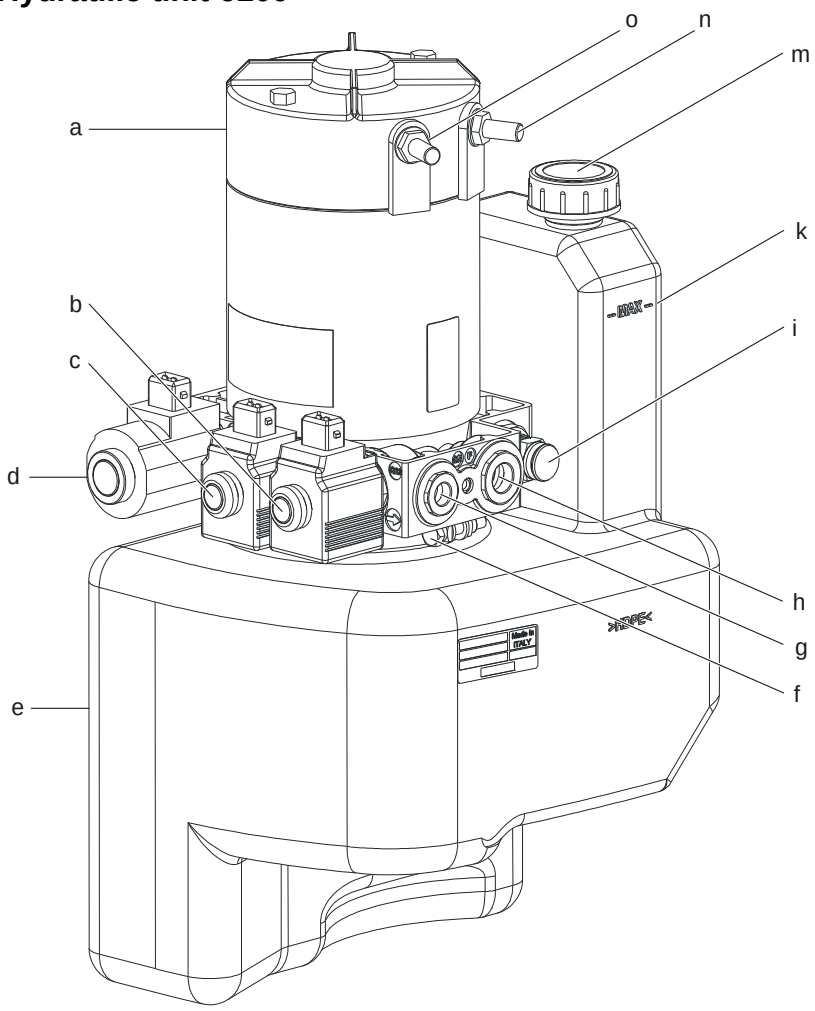
The service technician must ensure that the components to be used are carefully deburred and cleaned.

Couplings for pipe ends or other openings must never be removed until the part is to be fitted to the receiving component.

Note:

All hydraulic components that have not been cleaned, e.g. pipe couplings and nipples, must be blown clean before fitting.

15.3 Hydraulic unit 6100



Pos.	Description	Pos.	Description
a	Pump motor [M3]	h	Hydraulic fork connection
b	Solenoid valve, support arm selection [Q23][1]	i	Pressure limiting valve
c	Solenoid valve, fork selection [Q22]<Superscript>1	k	Maximum oil level
d	Proportional valve, lowering [Q4]	m	Filling cap
e	Tank (suitable oil volume 5 l)	n	Pump motor cable connection
f	Screw	o	Pump motor cable connection
g	Hydraulic connection, support arm		

1. Only applies to S212L, S214L and S220D

15.3.1 Emptying the hydraulic tank

1. Loosen all cables and tubes to the hydraulic unit.
2. Loosen the hydraulic unit from the truck by releasing the clamps that surround the pump motor.
3. Loosen the tank from the hydraulic unit by loosening screw (f).

15.3.2 Hydraulic system, bleeding

Cylinders with bleeding valve

1. Loosen all bleeding screws 2 revolutions.
2. Lift slowly at a constant rate until the forks begin to rise (30-40 cm).
3. Close the bleeding screws.
4. Lower the forks and continue to press the lowering button for 10-15 s.
5. Top up with oil.
6. Lift the forks to max.
7. Lower and check the oil level.

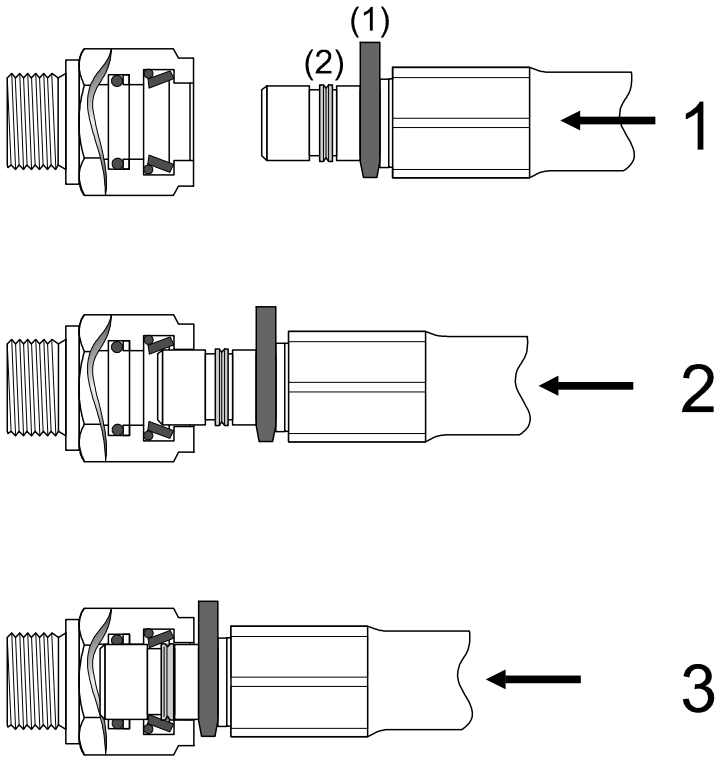
Cylinders without bleeding valve

1. Lift slowly at a constant rate until the forks begin to rise.
2. Lower the forks and continue to press the lowering button for 10-15 s.
3. Repeat a couple of times.
4. Fill with oil.
5. Lift the forks to max.
6. Lower to min.
7. Allow to stand approx. 30 min (info for customer).

15.4 Hydraulic connections 6230

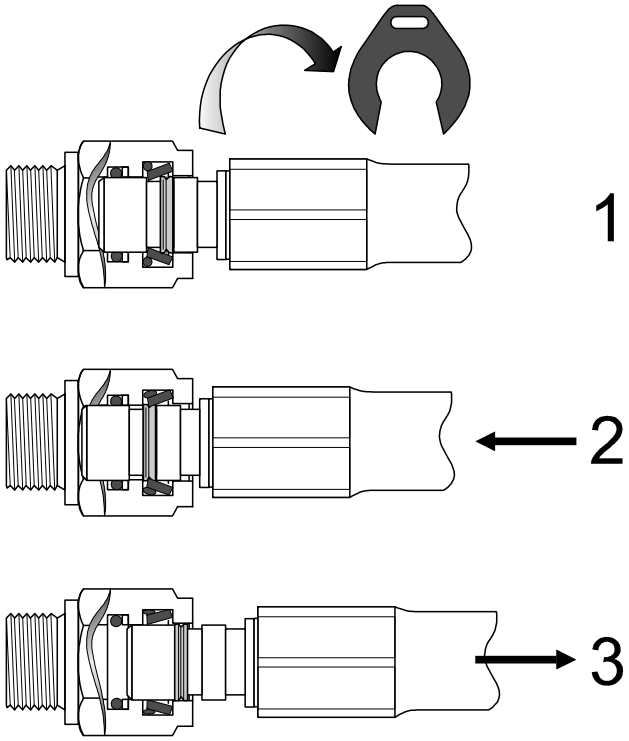
15.4.1 Quick change connectors

Connecting the quick change connector



1. Place the assembly stop (1) on the male fitting and make sure that the dismantling ring (2) runs freely in the groove.
2. Push the male fitting into the female fitting until the assembly stop makes contact with the female fitting.
3. The coupling is now made and locked.

Disassembly of the quick change connector



1. Remove the assembly stop (with the aid of a screwdriver or similar tool).
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 on the male fitting.
5. Place protective plugs on the valve and hose.

15.5 Hose rupture valve

15.5.1 Replacing the hose rupture valve

The hose rupture valve is built into the cylinder/hydraulic hose bracket.

Note:
When fitting these components, it is very important that no dirt etc. enters the hydraulic system.

1: Detach the hydraulic hose from the cylinder and plug the connection.

2: Unscrew the hydraulic hose bracket/hose rupture valve from the cylinder.

3: The new hose rupture valve should be torque tightened to 40 +5 Nm.

15.6 Hydraulic calibration

A calibration function can be used to handle the proportional valve's [Q4] tolerance. Service mode “cal” must have the setting “1” and the truck must be restarted in order to activate the calibration mode. When performing a calibration, the service key must be connected, and the maximum rated load must be loaded onto the forks.

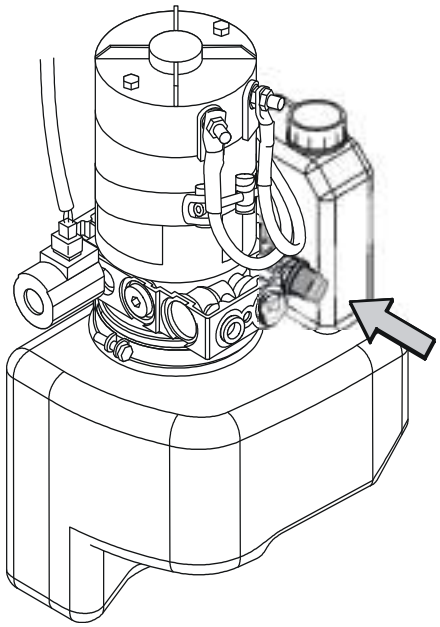
In the calibration mode, “strt” is shown on the display, waiting for one of the two horn buttons to be pressed. The calibration begins when one of the two horn buttons is pressed. The lowering valve is then opened slowly. As soon as the operator notices the movement of the forks, the horn button must be released. Wait until the display shows “end” and then restart the truck. Service parameter 108 s re-set automatically when the calibration is finished.

The calibration process affects the following parameters:

- Maximum lowering speed of the fork (parameter 302)
- Starting position of the proportional valve (parameter 303)
- Lowering speed of the support arms (parameter 304)
- Slow lowering speed (parameter 305)

All parameters may be adjusted manually after calibration.

15.7 Adjusting the pressure limiting valve

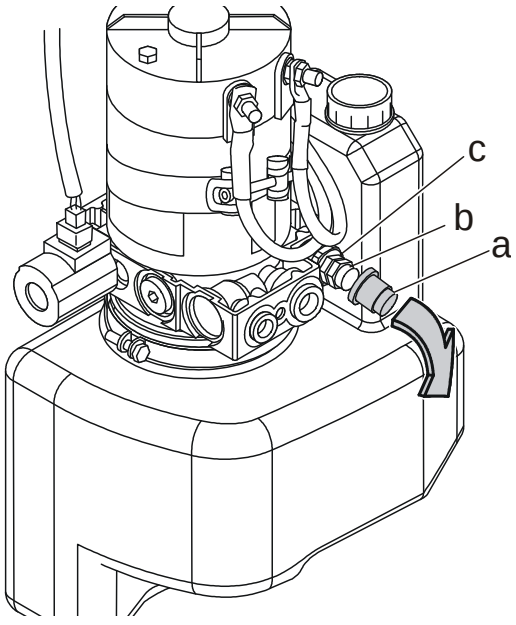


Valve location

The truck must be able to handle the rated load on the forks.

Place a rated load on the forks and verify that the truck is able to lift it.

If the truck **cannot** lift the rated load:



1. Pry off the sealing cap (a) attached to the pressure limiting valve using a screwdriver.
2. Remove the protective cover (b) (17 mm) by turning it anti-clockwise. Remove the protective cover and the washer housed inside it.
3. Loosen the locking nut (c) (17 mm) by turning it anti-clockwise.

4. Turn the adjusting screw clockwise until the truck is able to lift the load without any problem.
5. Tighten the locking nut (c) clockwise.
6. Refit the washer and protective cover (b)
7. Push a new sealing cap (a) onto the pressure limiting valve

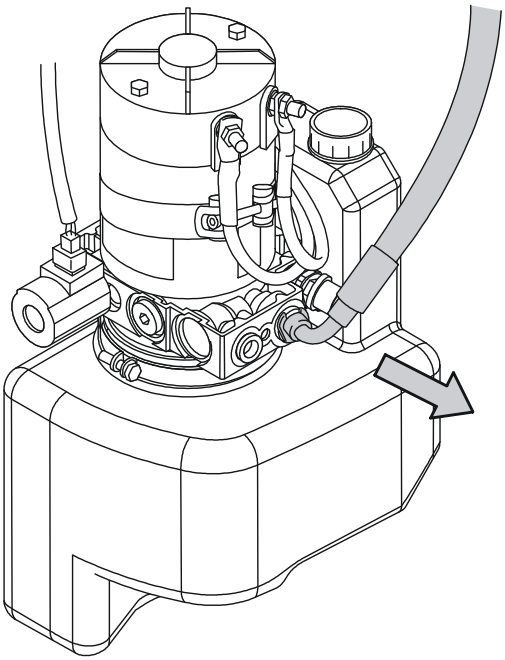
Once the truck **manages** to lift the rated load, apply an additional 100 kg on the forks. Verify that the truck cannot lift the load.

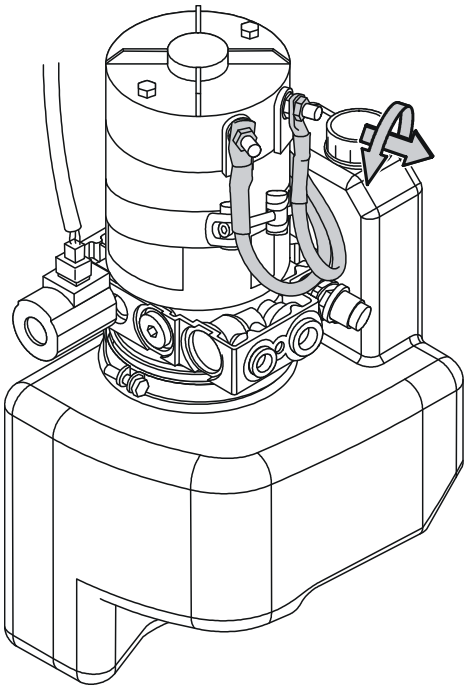
If the truck is able to lift 100 kg more than its rated load:

1. Pry off the sealing cap (a) attached to the pressure limiting valve using a screwdriver.
2. Remove the protective cover (b) (17 mm) by turning it anti-clockwise. Remove the protective cover and the washer housed inside it.
3. Loosen the locking nut (c) (17 mm) by turning it anti-clockwise.
4. Turn the adjusting screw counter-clockwise until the truck cannot lift the load.
5. Tighten the locking nut (c) clockwise.
6. Refit the washer and protective cover (b)
7. Push a new sealing cap (a) onto the pressure limiting valve

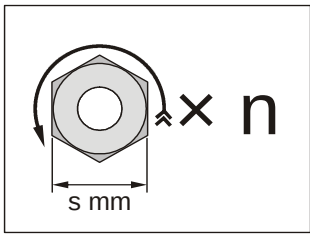
15.8 Disassembling the hydraulic unit

Before commencing any work on the hydraulic unit, make sure the forks have been fully lowered.

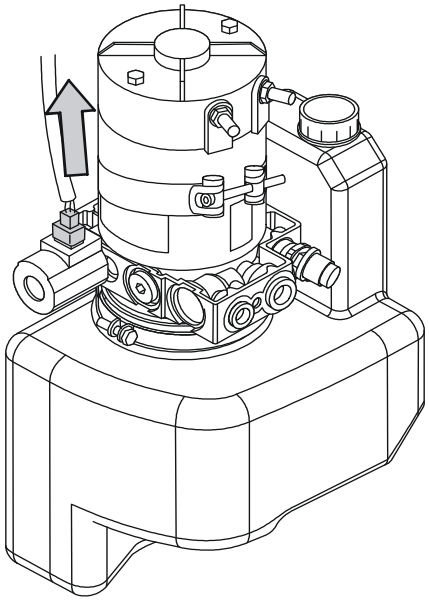




Step 2.

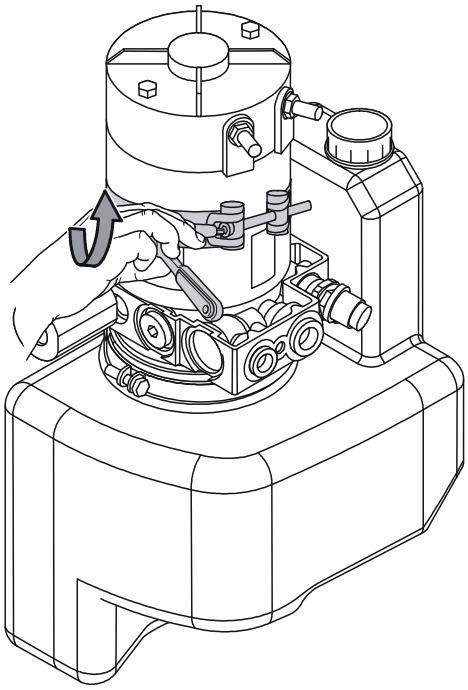


s: 13mm, n: 2ea

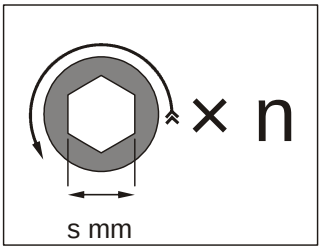


Step 3.

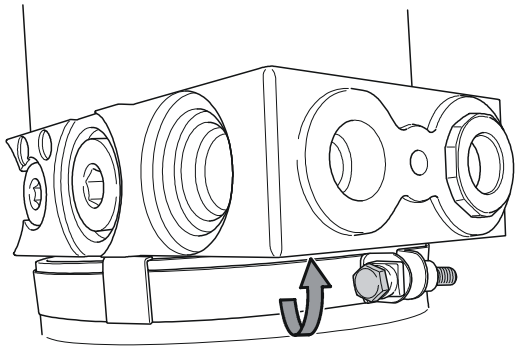
1. Disconnect the hydraulic hose. See section "15.4.1 Quick change connectors".
2. Disconnect the motor cables using a wrench.
3. Disconnect the electric connection to the lowering valve.



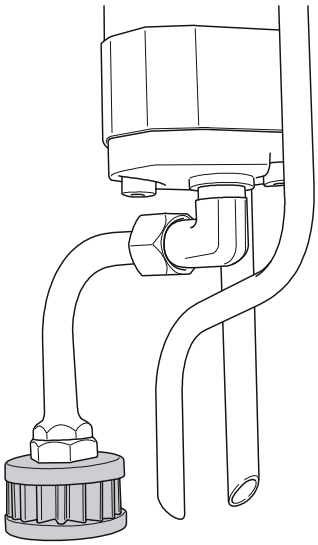
Step 4.



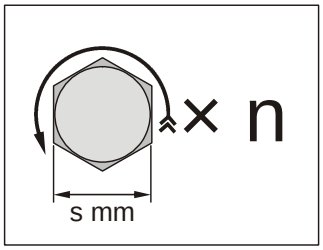
s: 6mm, n: 1ea



Step 5.



Step 6.



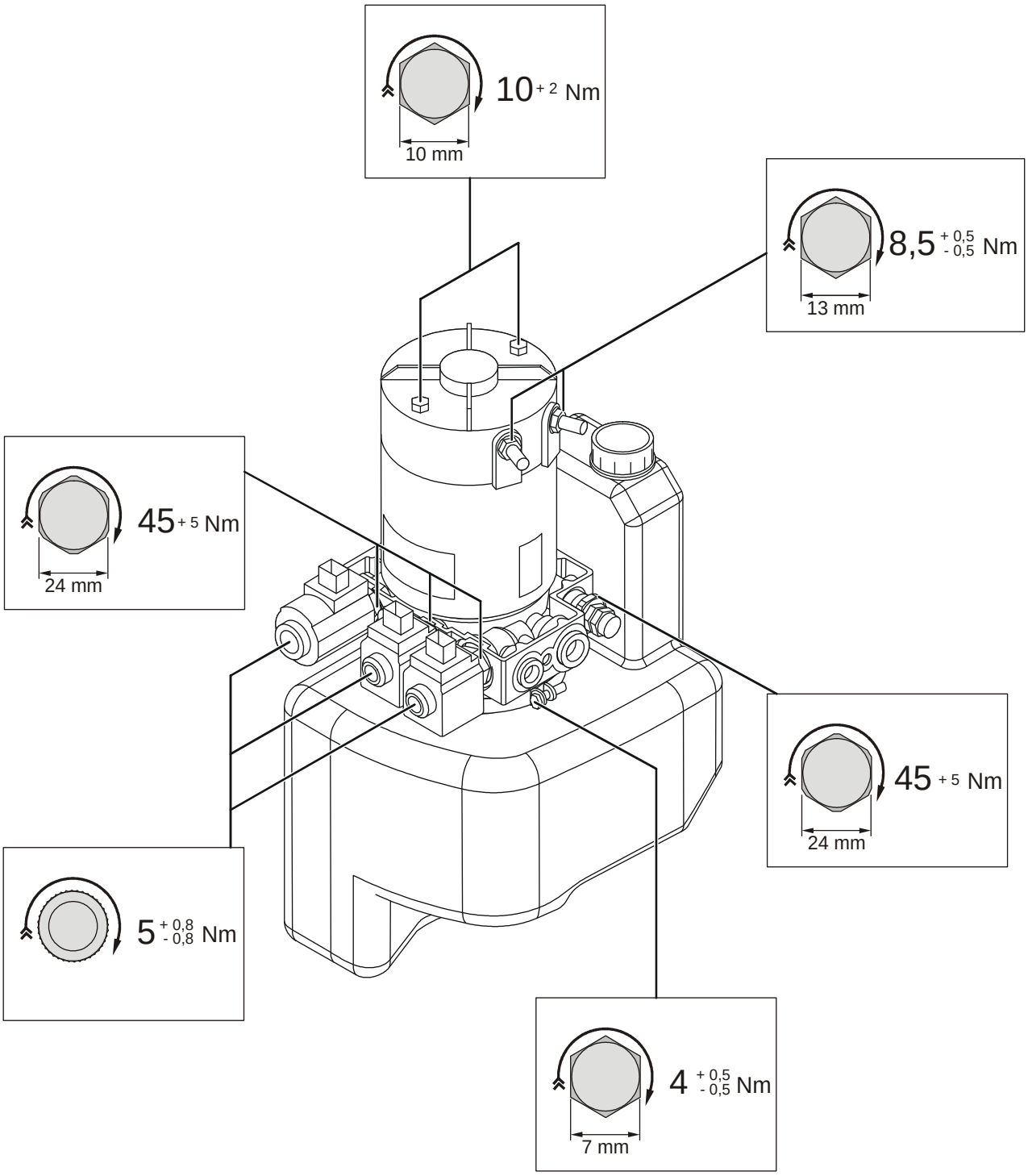
s: 7mm, n: 1ea

4. Loosen the hydraulic unit bracket and lift out the unit from the truck.
5. Undo the clamp to be able to detach the tank from the motor and lift the valve unit away from the tank.
6. Remove and clean the strainer, then reattach it in the correct position.
7. Change the oil and clean the tank.
8. Reassemble everything in reverse order. See section "15.9 Hydraulic unit tightening torques".

Note:
Be careful with the hydraulic unit seals when re-installing

15.9 Hydraulic unit tightening torques

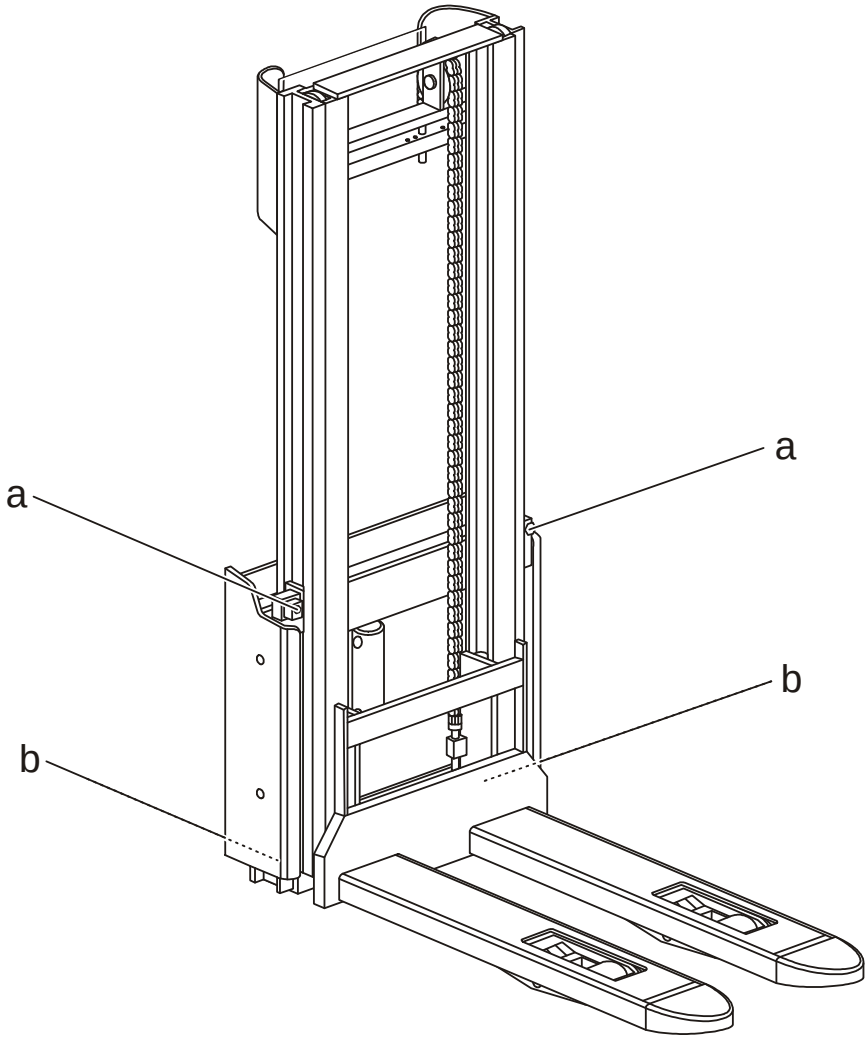
The hydraulic unit tightening torques are depicted in the picture below:



16. Mast C7000

16.1 Main mast 7100

16.1.1 Components



Pos.	Description	Tightening torque
a	Upper mast fixing points.	189 ± 8 Nm
b	Lower mast fixing points.	83±4Nm

16.1.2 Maintenance

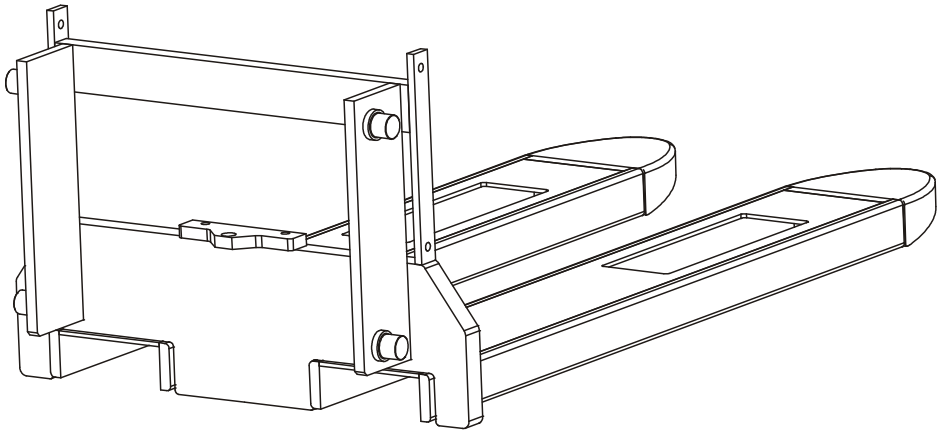
Fixing point

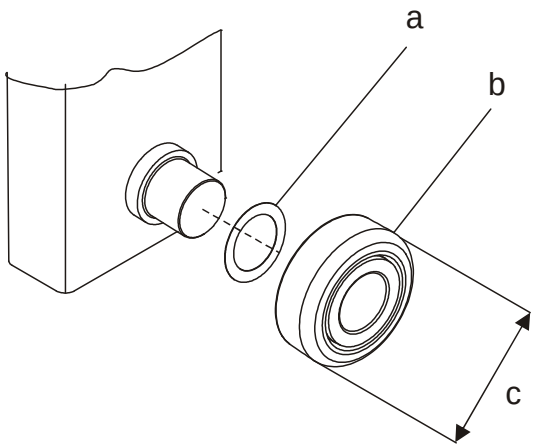
According to the maintenance chart, the mast mounting bolts (a) should only be visually inspected and not re-tightened on inspection. If the mast needs to be replaced or if the bolts have come loose, then be sure to use new bolts and washers. The tightening torque should be according to the torque table.

Lubrication

Lubricating the beam	
1	The inside of the beam flanges are lubricated with (Q8 Rembrandt EP2).

16.2 Fork carriage 7420





Pos.	Description
a	Shim
b	Roller

16.2.1 Maintenance

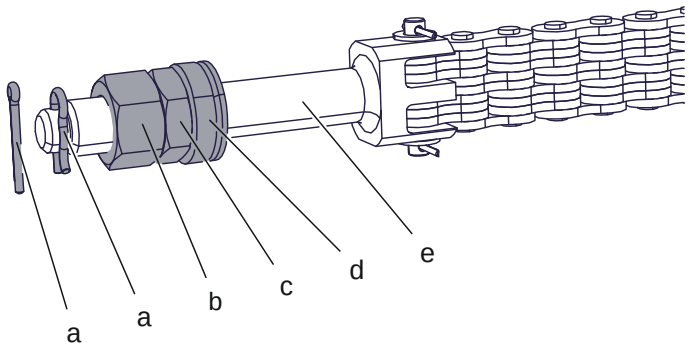
- Check that the play in the fork carriage is not excessive.
- Adjust with shims (a) if needed.
- There are rollers with different diameters (c) to compensate for any wear on the guide rails.

16.3 Main lift chain system 7120

16.3.1 General

Note: Replacing the chain bolt

- When replacing the chain, be sure to also replace the chain bolt
- When the chain assembly with chain bolt is replaced, the counter nuts and the cotter pin/safety cotter must be replaced at the same time.



Pos.	Description
a	Cotter pin/safety cotter
b	Wide locking nut
c	Narrow locking nut
d	Spherical washer
e	Complete chain including anchor bolt

16.3.2 Checking the chain setting

The lifting chains must be adjusted at regular periods due to stretching; see below. The chain is checked during servicing as set out in the maintenance schedule.

Any adjustment is made with the chain mounting bolts.

Adjust the fork height according to C code 7100, 7420, 7700 and 7800 as applicable.

16.3.3 Checking the chain

The chains are subjected to two types of wear – outline wear and stretching. Wear to the bolts and plate holes causes the chain to stretch. The chains are also affected by the environment in which they are used.

Noise

If there has been insufficient lubrication, there will be metallic friction on the chain and this will result in noise.

Replace the chain.

Surface rust

Surface rust is easy to recognise as the chain will be reddish brown. Deep-seated rust has generally started and the strength of the chain is impaired.

Replace the chain.

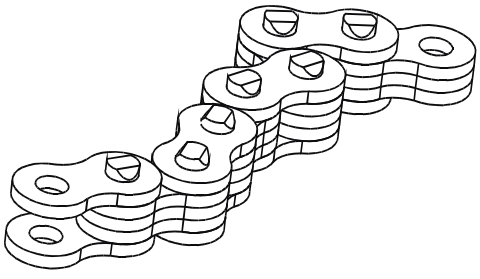
Rusty links

Fretting corrosion results in a reddish-brown powder being visible on the outer plates. It can also appear as if the chain is bleeding if lubricated.

Replace the chain.

Stiff links

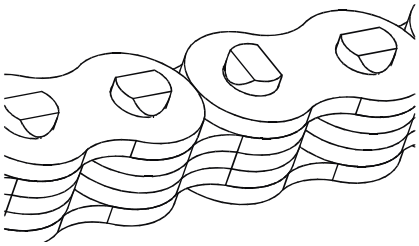
If it is not possible to pull out the chain to its normal position this can be because of link rust or seizing.



Replace the chain.

Bolt rotation

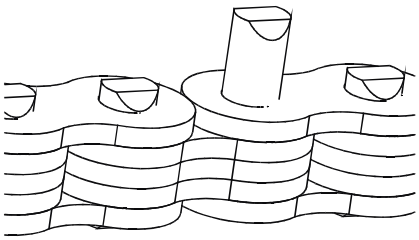
Bolt rotation can be a phenomenon of stiff links. The fault is easy to see when comparing with a new chain.



Replace the chain.

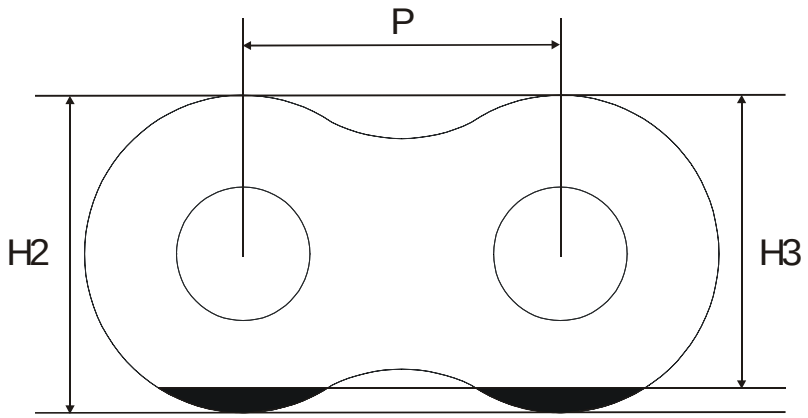
Loose bolts

If a bolt is loose it will protrude from the side of the chain, and this is due to a stiff link or bolt rotation.



Replace the chain.

Outline wear

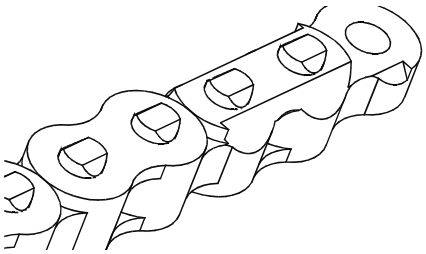


P = Pitch.

H2 = Nominal disc height.

H3 = Minimum disc height

A new lifting chain has a specific nominal plate thickness (H2 in the figure). As the truck is used, the lifting chain wears radially on the side that rolls over the chain wheel. The minimum plate height (defined as H3 in the figure) denotes the minimum permitted value of the plate height.



Maximal permitted outline wear is 5% of the thickness H2. If a lifting chain reaches the maximum level of wear, it must be replaced.

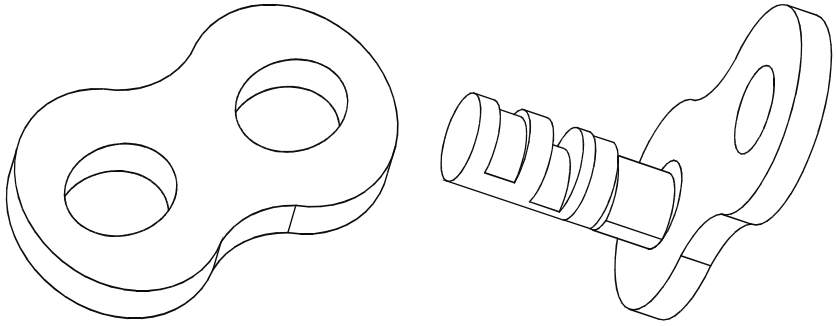
The nominal and minimum Plate heights for respective lifting chains are stated in the table in the section “Stretching”.

Stretching

The amount of stretch on a lifting chain is measured on the part of the chain that runs over the chain roller. The amount of stretch may, at the most, be 2% on the most worn section of the chain.
The measurement is best made over 300-1000 mm of chain.

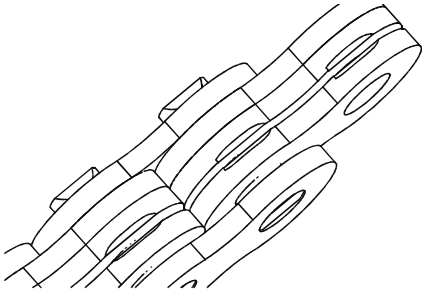
The nominal and maximum permitted chain lengths for lift chains are stated in the table below.

Type of chain	Nominal disc height H2 (mm)	Minimum plate height H3 (mm)	Pitch P (mm)	Nominal chain length for 20/30/50 plates (mm)	Maximum permitted chain length for 20/30/50 plates (mm)
3/4", 2x3	17.8	16.9	19.05	381/572/953	389/583/972
3/4”, 3x4	17.8	16.9	19.05	381/572/953	389/583/972
3/4”, 4x6	17.8	16.9	19.05	381/572/953	389/583/972
1", 4x4	23.6	22.4	25.4	508/762/1270	518/777/1295
1”, 6x6	23.6	22.4	25.4	508/762/1270	518/777/1295



Wear to the bolts and around the holes on the discs is one reason why the chain stretches. The chain must be replaced if is stretched more than 2%.

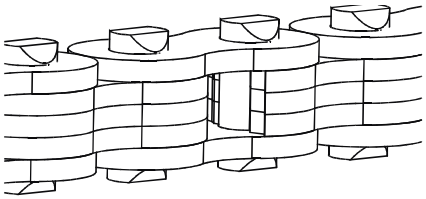
Damage



The chain should be replaced if damaged in any way.

Damaged plates

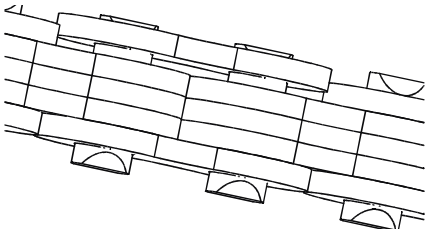
If a plate has broken on the chain, this may be due to overloading or corrosion.



Replace the chain.

Damaged bolts

It can be difficult to determine whether a bolt has broken. It can appear as bolt rotation and/or that the outer plate is loose.



Replace the chain.

Dirty chain

If a chain is very dirty replacement is recommended first and foremost. It can also be removed and cleaned as set out in the chapter “Cleaning”.

16.3.4 Cleaning

We recommend you to replace a chain that is very dirty.

Dirty chains should be cleaned before they are lubricated, e.g. by washing with solvent such as diesel or petrol.

The chain should be blown dry using compressed air and lubricated directly after cleaning.

Note:

Exercise care with degreasing agents as these can contain abrasives.

16.3.5 Lubrication

Both mineral and synthetic oils can be used to lubricate Rexnord chains.

Note:
Lubricants must not contain substances such as molybdenum disulphide, PTFE or such.

The weight of the fork carriage should be offloaded from the lifting chain (hanging free) when the chain is lubricated.

- **Lubrication intervals:**
  - 500 hours with normal operations
  - 100 hours when operating in rugged environments such as cold stores and corrosive environments.

The chains are sprayed with lubricant. Please note that the entire chain must be lubricated, even the fastening bolts. It is particularly important that the part of the chain that runs over the chain wheel is well lubricated.

The lubricate must comply with the viscosity demands at respective temperatures as set out in the table below. The following lubricants are recommended:

Ambient temperature	Viscosity class	Recommended products*
> - 40°C < - 30°C	VG 15	Klüberoil 4UH 1-15, Klüber Lubrication
> - 30°C < + 5°C	VG 68	Klüberoil 4UH 1-68N, Klüber Lubrication Anticorit LBO 160 TT, Fuchs DEA
> + 5°C < +45°C	VG 150	Klüberoil 4UH 1-150N, Klüber Lubrication Anticorit LBO 160, Fuchs DEA Rexoil, Rexnord Kette
>+ 45°C <+ 80°C	VG 220	Klüberoil 4UH 1-220N, Klüber Lubrication

* Similar products from other manufacturers may be used.

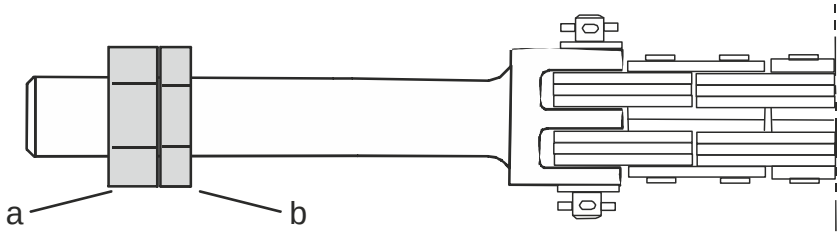
Note:

Do not use any special rustproofing agents to prevent corrosion of the lifting chains.
These agents impair lubrication of the chains. Regular lubrication is the best method to prevent rusting.

16.3.6 Adjustment

The lifting chains must be adjusted at regular periods due to stretching. This is to be done when other service work with chains is performed.

The lock nuts on the lifting chains are to be tightened with 50 Nm (+12.5 Nm / -5 Nm). .

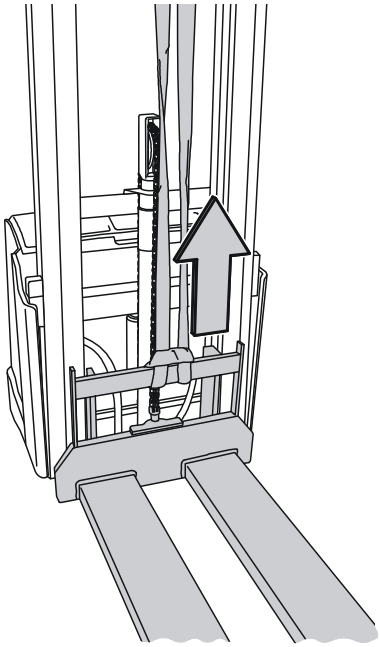


1. Make sure that the thinner nut (b) is placed closest to the chain fitting.
2. Use a fixed spanner and a torque wrench set to 50 Nm to ensure the correct torque.

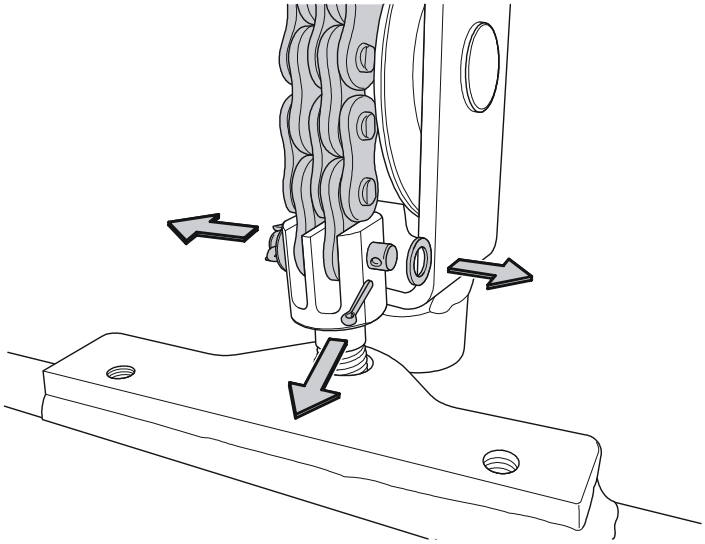
Using the main lifting chains, the mast guides must be adjusted so that the bottom part of the mast is level.

16.4 Replacing the fork carriage

1. Lift the fork carriage with an overhead crane or with another truck to take the load off the chain.

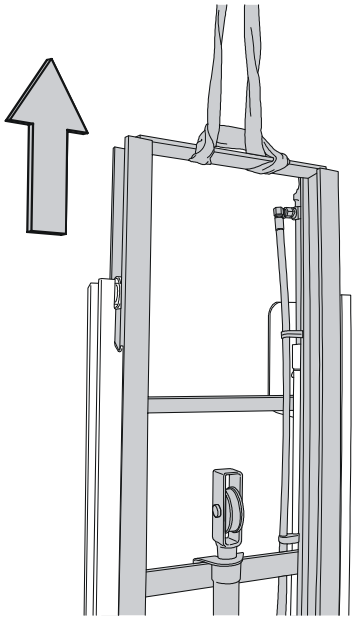


2. Remove the chain bolt.

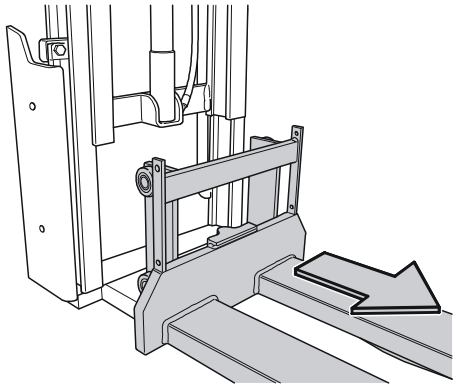


3. Lower the fork carriage.

4. Lift the inner guides.



5. Remove the fork carriage.

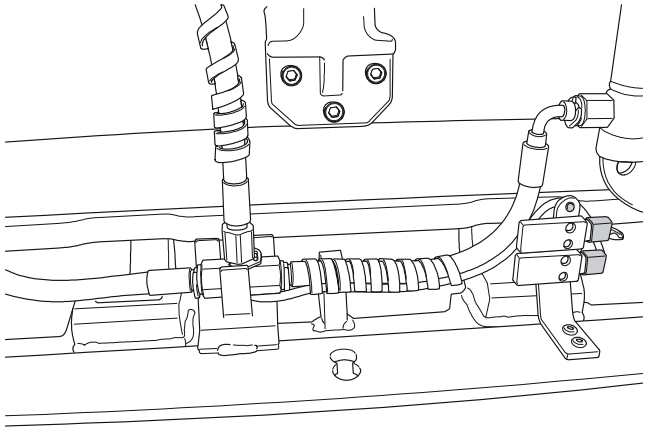


6. Install in reverse order.

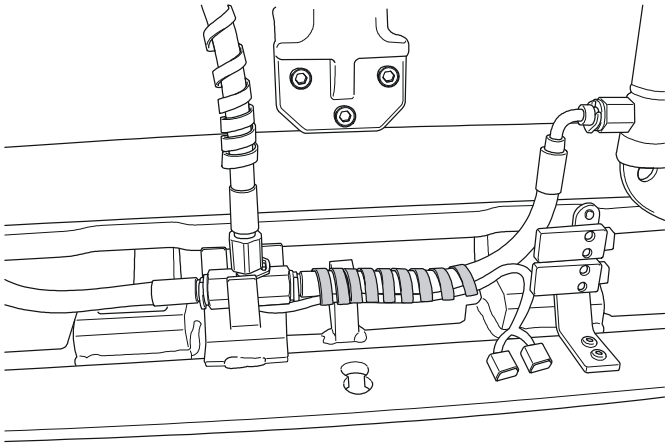
16.5 Replacement of the mast

We use a Duplex Hilo mast in this example.

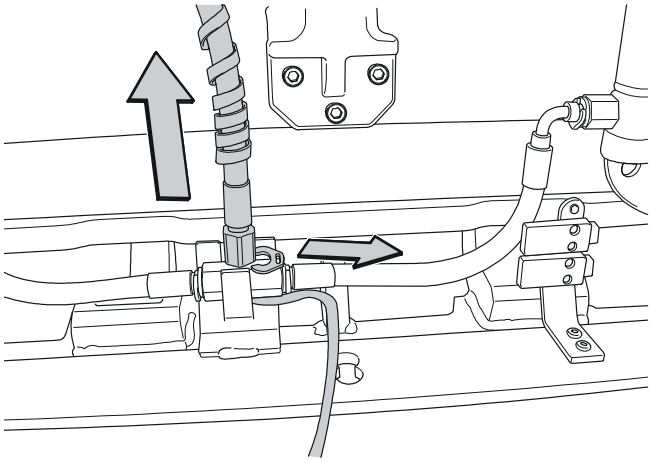
1. Start by disconnecting the fork carriage according to the example above.
2. Disconnect all connectors to the lift height switches.



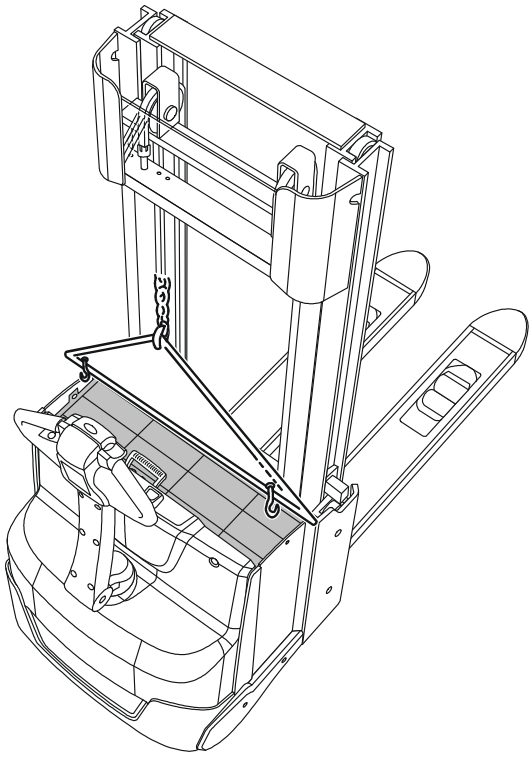
3. Remove the spiral hose.



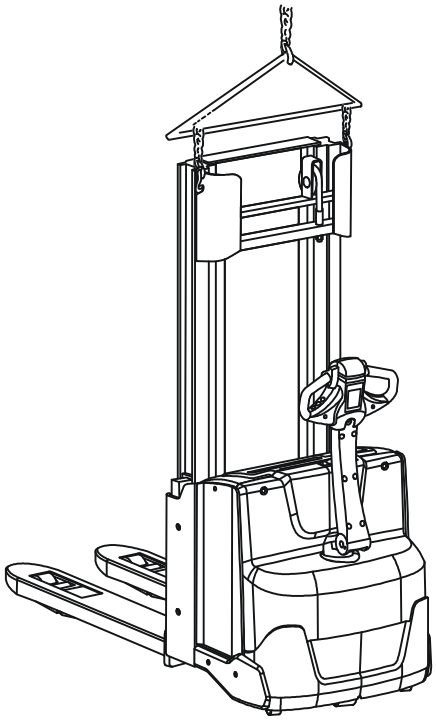
4. Disconnect the main hydraulic hose from the T-connector.



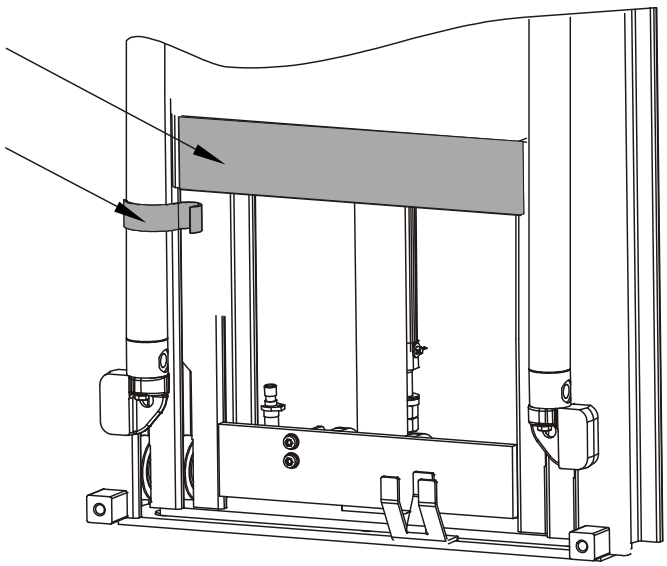
5. Connect a hose plug in the hose to stop the oil flow.
6. Lift out the battery.



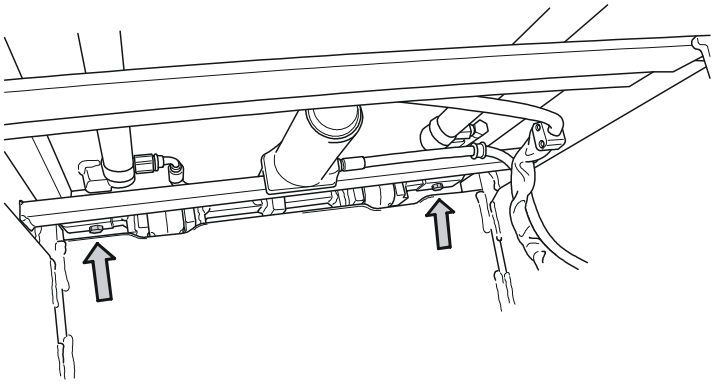
7. Lower the mast and secure it in both lifting points with the help of an overhead crane or another truck.See section “22.5 Other tools”.

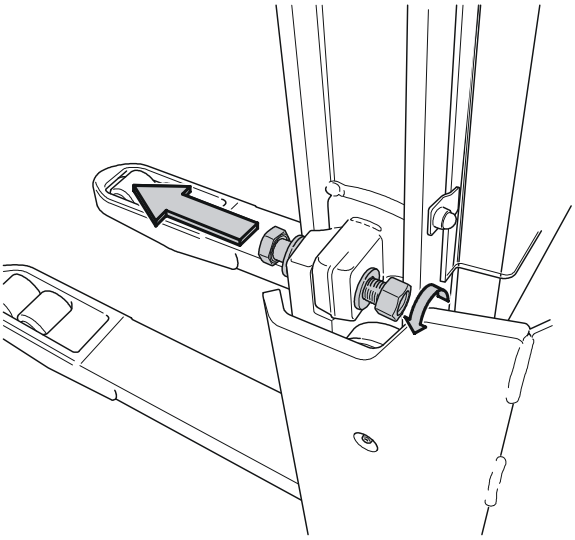


8. Remove the lower finger protectors and the bracket for the hydraulic hose on the cylinder.

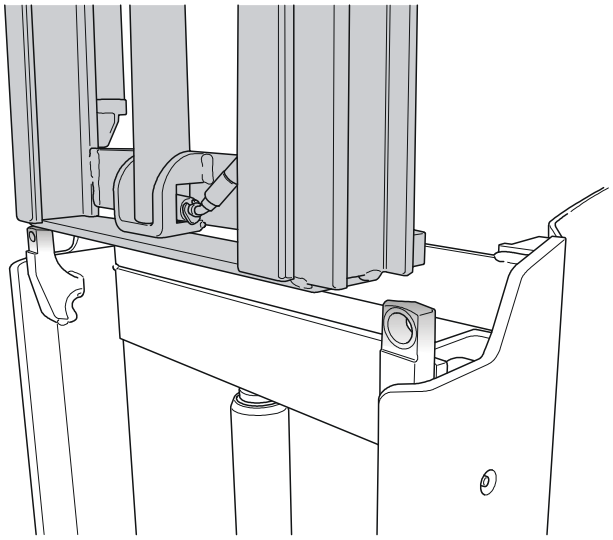


9. Remove the four bolts holding the mast.





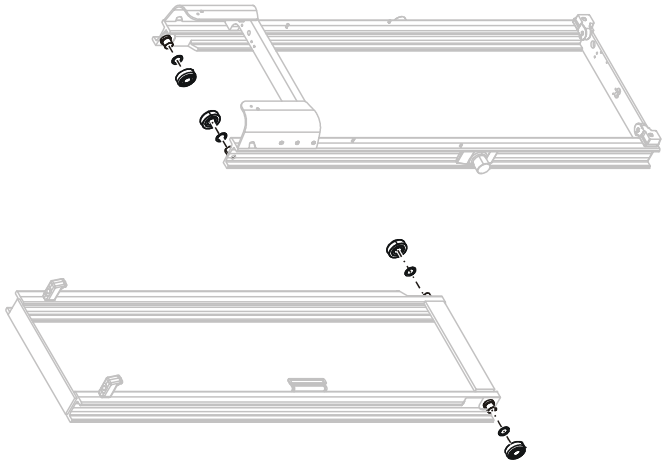
10. Make sure that the mast is freed, and lift it past the guide lugs.



11. Attach the new mast in reverse order.

16.6 Replacing the idler roller

Remove the mast, and place it on a pallet or similar

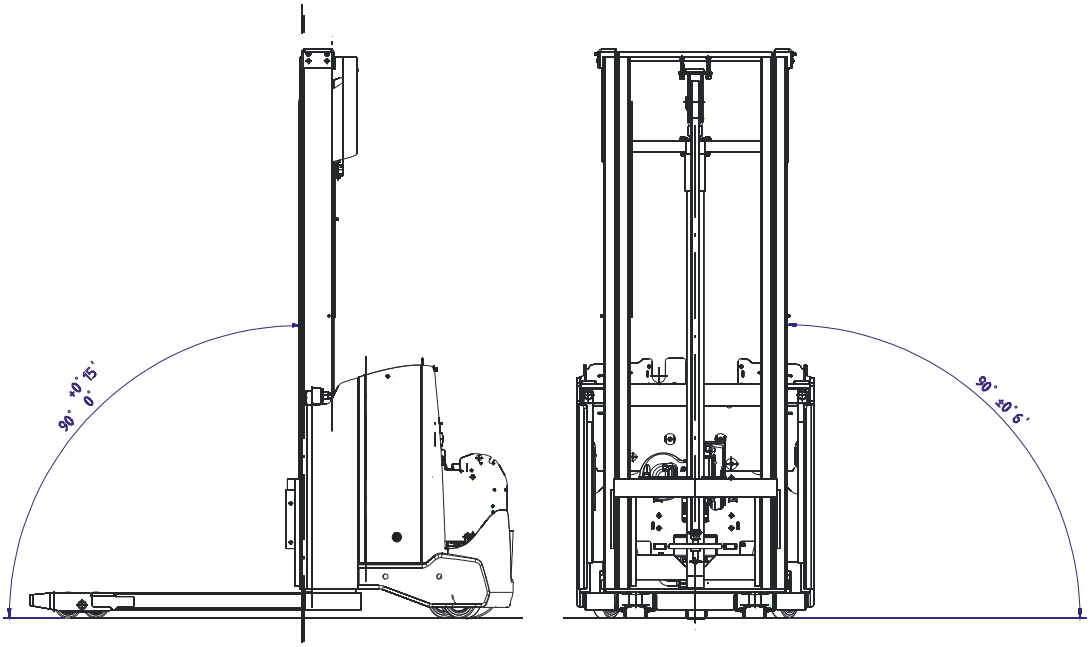


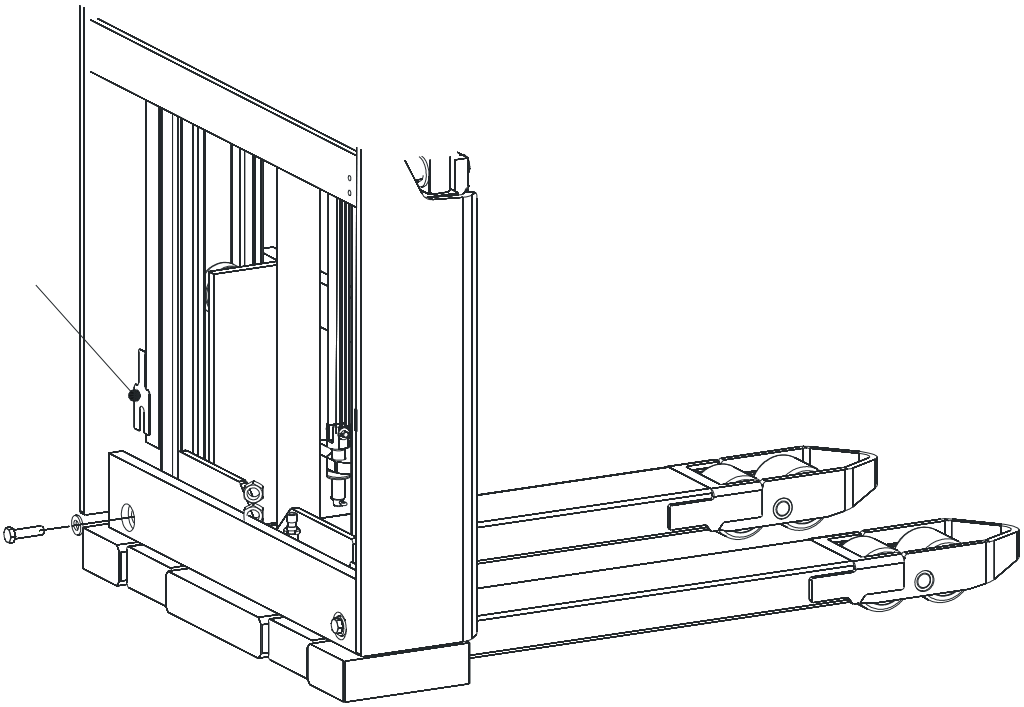
1: Use a puller to remove the roller.
Make a note of the number of shims.

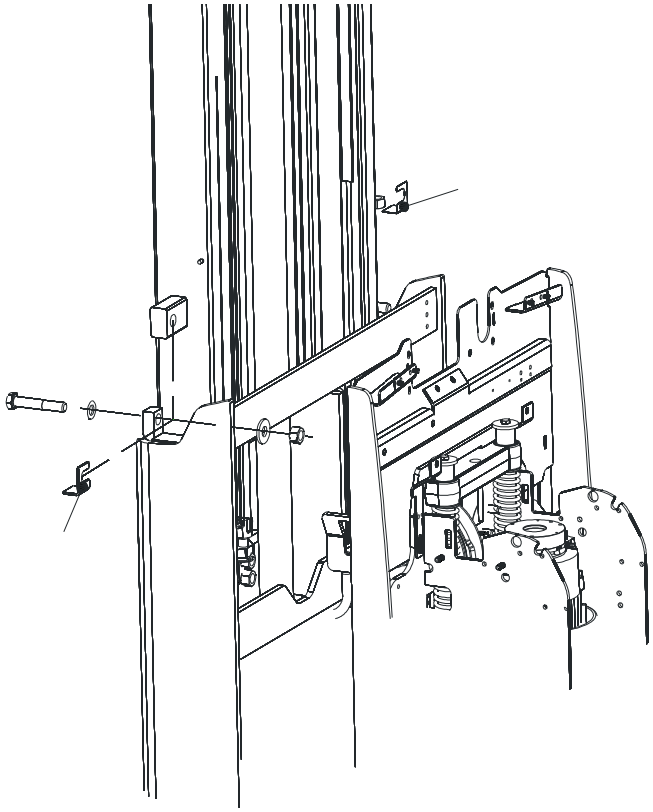
2: Install the roller, fit the same number of shims as were installed before.
Make sure the guides can move freely and the there is not too much play before you install the mast in the truck.

16.7 Adjusting the mast

The angle of the mast must be checked after replacement. Make sure that the truck is standing on a level surface when checking. Fit shims according to the instructions below if needed.







Tighten the screws that hold the mast

See section “16.1.1 Components”.with the correct tightening torque.

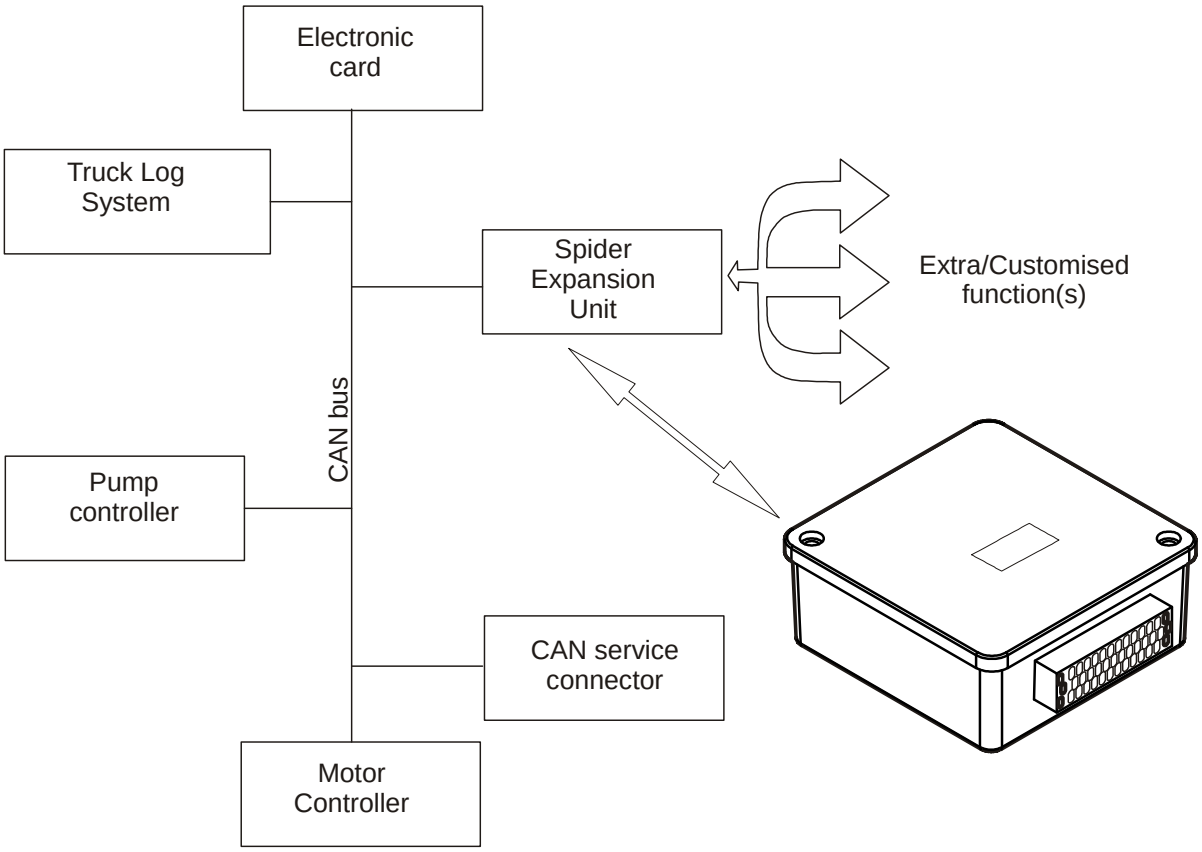
17. Peripherals C8000

18. Accessories

18.1 Spider expansion unit

The spider expansion unit, called SEU, allows the main logic card to handle a greater number of inputs and outputs. The SEU does not have its own truck controller logic, which means that a defective SEU can be replaced without the replacement affecting any truck functions.

The SEU is used for modification of the truck to meet special customer requirements. .



The picture above shows how the SEU is used to allow a greater number of functions to be controlled via the CAN bus. SEU has a 42-pin, multi-pin contact that manages all inputs, outputs, CAN and power supply signals.

18.2 TLS - Truck log system

See the separate manual that is included with the truck log system.

18.3 ID unit

See the separate manual that is included with the software.

18.4 DC/DC converter

The truck can be equipped with a DC/DC converter to supply power to equipment such as a PC, scanner, etc. The converter on the input side is protected against polarity reversal, short circuit and thermal overload. The chassis is not live, and the in/outputs are galvanically separated. The output sits on the E-bar profile.

18.5 Collision sensor

If a collision sensor is installed on the CAN bus, this registers when the truck bumps against something. If an impact exceeds a certain level, specified by parameters 105 and 106, this is counted as a collision.

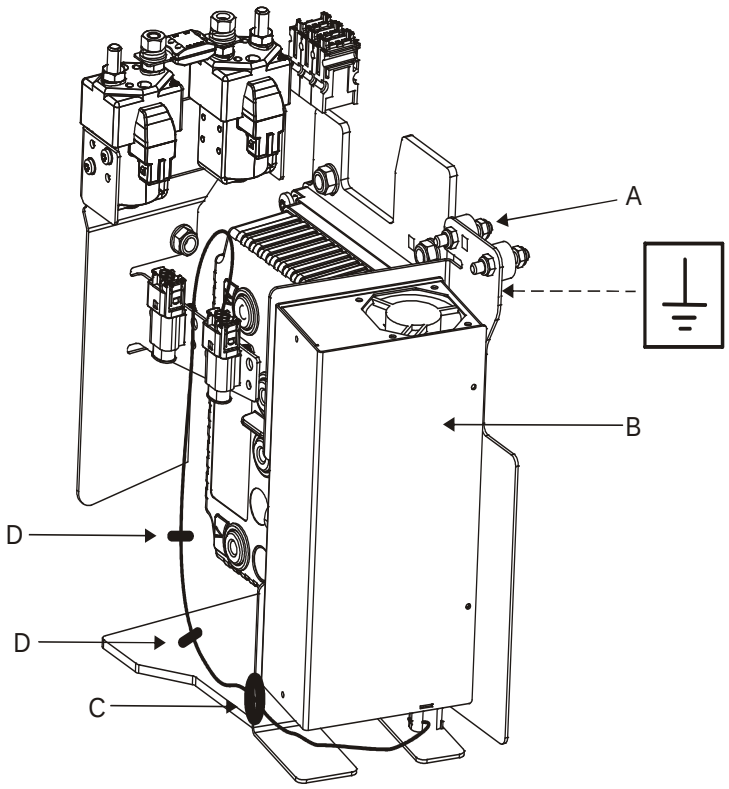
18.6 Built-in battery charger

Note:

If retrofitting the built-in battery charger, TruckCom is required to be able to set all necessary parameters. TruckCom is not needed if replacing an existing charger. When installing the charger, torque tighten nuts (A) to max. 1.6 Nm.

If the truck is factory-fitted with a battery, the battery charger is adjusted to suit the battery.

If the truck is delivered from the factory without a battery, the customer/ technician must set the right parameters based on battery type and size



18.6.1 Technical data

Designation	SMCO 24/30
Dimensions, mm	240x111x77
Weight, kg	1.7
Ambient temperature, ºC	-25 - +40
Mains voltage, V AC	195-264
Rated voltage, V DC	24
Rated current, A	30
Maximum output, W	800

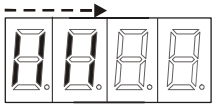
18.6.2 Charging the battery

To start charging, open the battery compartment cover and connect the charger connector to a wall outlet.

Note:
Prior to commencing charging, switch off the truck and disconnect all other electrical connections to the truck.

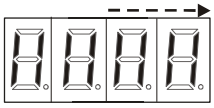
When the truck is charging, the following is indicated on the display:

Main charging



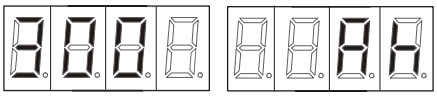
During the charging process, lines appear sequentially from left to right as the battery is charged. The battery symbol and the OFF button flash.

Equalising charging



Four lines at the left in the display light continuously while four lines on the right appear sequentially. The battery symbol and the OFF button flash.

Charging completed



The battery capacity value and unit (Ah) appear alternately in the display. The battery symbol is lit continuously, while the OFF button flashes.

Disconnect the contact from the wall socket once the battery has been charged. The OFF button then lights continuously. The truck is now ready for use.

19. Instructions for disposal

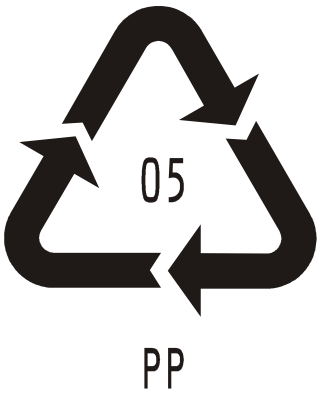
19.1 General

The disposal instructions were developed to support our company's objective of protecting the environment. By recycling materials, resources can be utilised more efficiently, while reducing emissions.

The instructions below indicate the proper sorting category for the materials used in the various truck components. To achieve optimum sorting, all components should be disassembled to a level corresponding to the sorting categories.

19.2 Marking of plastics

19.2.1 General marking of products and packaging



Markings on plastics consist of three arrows, a number and usually also a designation of the plastic material used. This example shows the marking for polypropylene.

- 01: PET – Polyethylene terephthalate
- 02: PE-HD – Polyethylene with high density
- 03: PVC – Polyvinyl chloride
- 04: PE-LD – Polyethylene with low density
- 05: PP - Polypropylene
- 06: PS – Polystyrene
- 07: O – Other

19.2.2 Marking according to the manufacturer's standards

Standards: 58-02-001, 58-02-003 and 58-02-004.

A few examples of markings are given here. For more information, please refer to the standards above.

The product material and trade name of each item are indicated between arrows. Example: >PP<.

Abbreviations

- ABS: acrylonitrile/butadiene/styrene
- HDPE: High Density Polyethylene
- LDPE: Low Density Polyethylene
- PA: Polyamide
- PA6: Amide resin 6
- PA66: Amide resin 66
- PBT: Polybutylene terephtalate
- PC: Polycarbonate
- PET: Polyethylene terephtalate
- PMMA: Plexiglas
- POM: Polyoxymethylene, Polyformaldehyde
- PP: Polypropylene
- PUR: Polyurethane

Marking examples

Products made from a single substance

ABS (acrylonitrile/butadiene/polystyrene):

>ABS<

Polyurethane:

>PUR<

Plastic compounds

A compound based on acrylonitrile/butadiene/polystyrene and carbonate plastic:

>ABS+PC<

Filled or reinforced materials

Polypropylene with 30% mineral powder:

>PP-MD30<

19.3 Pressure vessels

Pressure vessels sent for recycling/destruction must have been depressurised beforehand and, if possible, opened.

Examples of existing pressure vessels are gas struts and accumulators used in hydraulic systems.

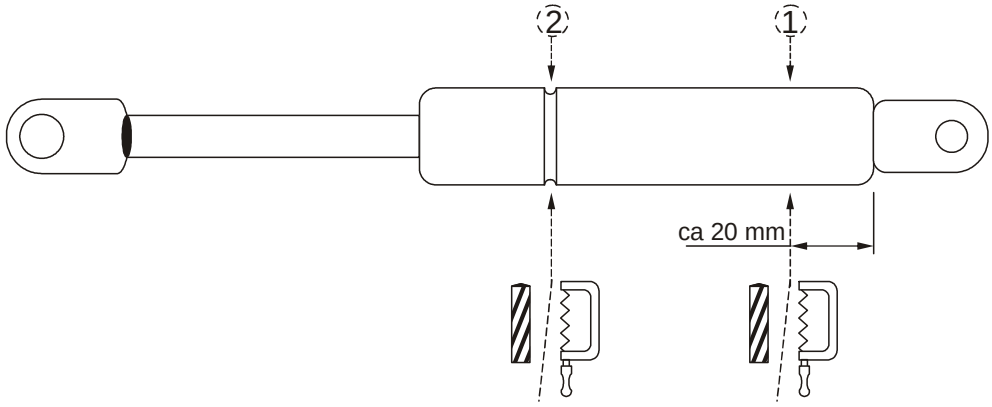
19.3.1 Gas struts

WARNING!

Gas struts have extremely high internal pressure. To prevent injury, always follow the instructions of the manufacturer.

Wear safety goggles when disassembling springs.

To allow the gas to escape, only open and disassemble gas struts as recommended by the manufacturer. An example of how to perform this is given for "Stabilus Lift-O-Mat/Inter-stop":



1: Drill or cut a hole in the cylinders, approximately 20 mm from the bottom.

2: Drill or cut a hole in the recess at the piston rod end.

19.4 Sorting categories

- Plastic and rubber material
- Iron/steel (including bolts, washers and nuts)
- Oils
- Oil filters
- Oil-polluted material
- Electronic parts (including switches and sensors)
- Wires
- Hazardous waste
- Complex materials - large amounts in several categories but non-combustible and not hazardous
- Combustible material, including small plastic and rubber parts
- Please return batteries to the manufacturer.

Component	Category	Comments
Chassis	Iron/steel	
Inspection covers, sheet metal	Iron/steel Handle: >ABS<	
Inspection covers, plastic	Plastic	Sort according to the material marking
Forks and frames	Iron/steel	
Operator's platforms	Iron/steel, including any gas struts Mats, cushions: combustible	Be sure to depressurise struts
Roofs and overhead guards	Iron/steel	
Gates and operator protective devices	Iron/steel Plastic handles: >PA< Crush protectors: >PMMA<	
Hydraulic unit	Oil Hydraulic hoses: Oil-polluted material Oil tank: >PP< Motor, valves: Electronic components Pump: Iron/steel Accumulator: Iron/steel	Ensure that the system has been depressurised. Carefully drain all oil. Any accumulators should be emptied of gas and if possible opened.
Travel motors	Motor: Electronic components Wires Parking brake: Hazardous waste	
Drive gears	Iron/steel Oil	Carefully drain all oil Hazardous waste
Wheels	Tread: Plastic according to marking Hub: Iron/steel	If the tread and hub cannot be separated, then sort the wheel as complex material

Component	Category	Comments
Tiller arms	Electronic components Wires Iron/steel, also gas struts	Be sure to depressurise struts
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 break them. Obsolete 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 —

20. Electrical components and wiring diagrams

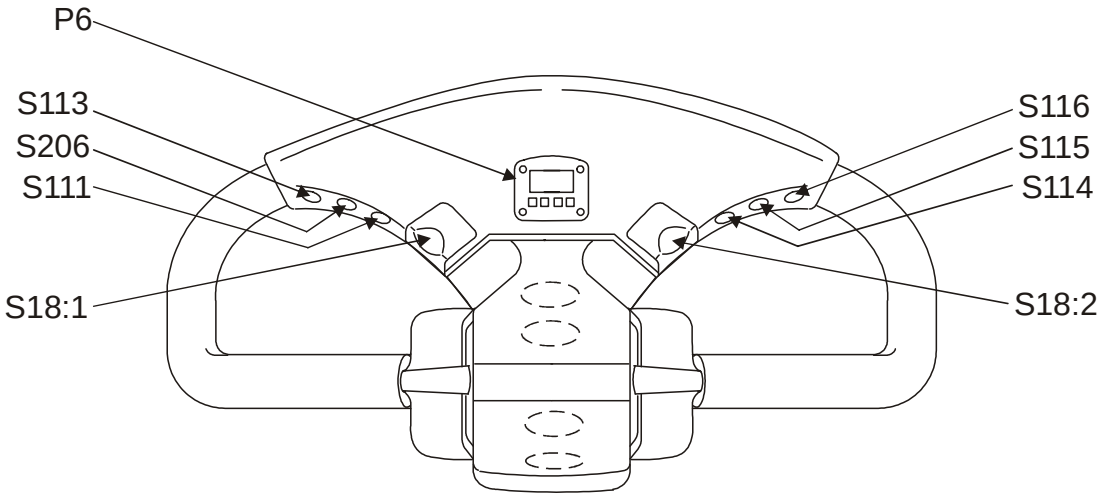
20.1 Electric components

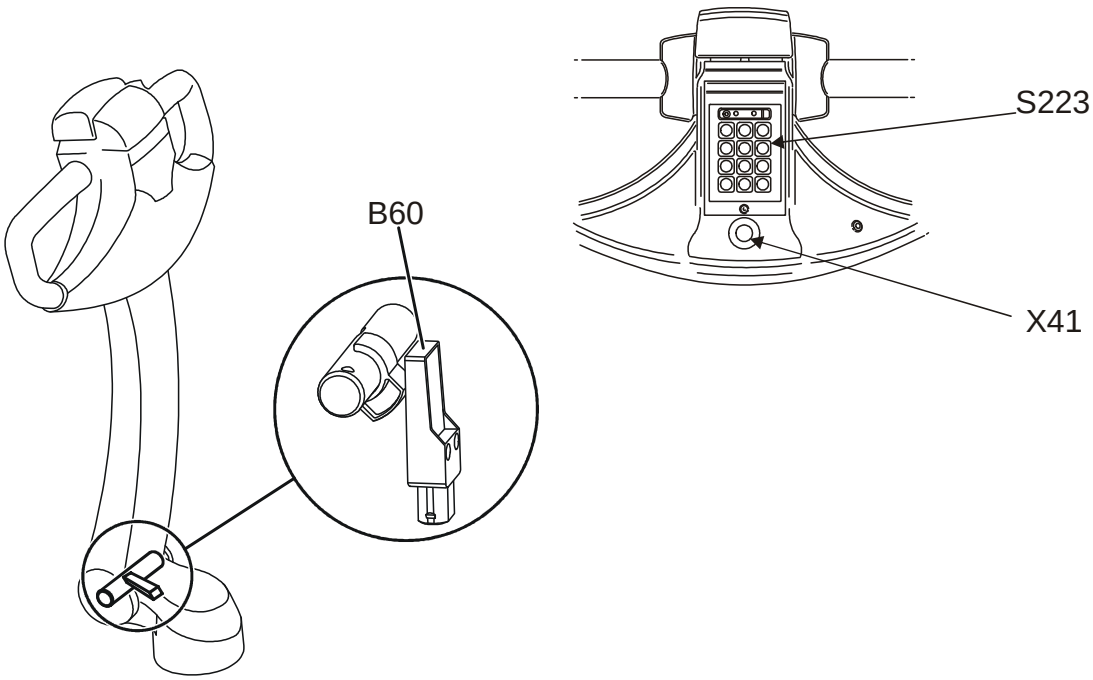
The table below shows a summary of the major electric components of this truck.

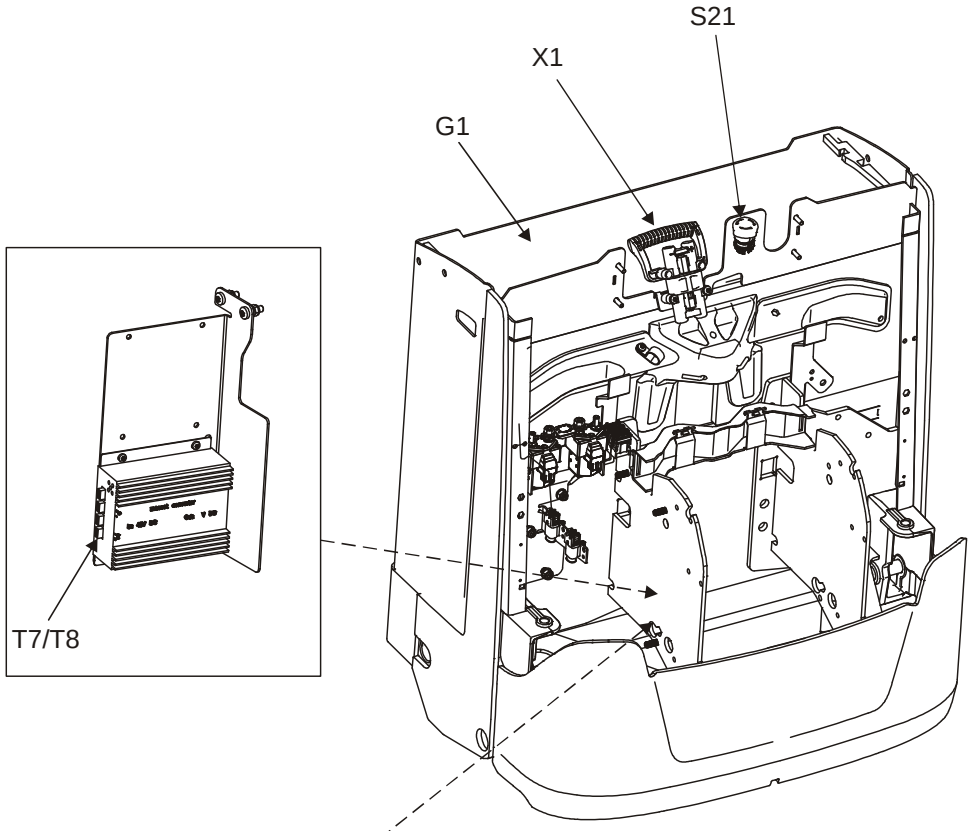
Symbol	Description	Function	Remarks
A5	Logic card	Tiller arm logic card	
A30	Battery charger	On-board battery charger	Option
B1	Temperature sensor	Drive motor temperature sensor	
B11	Pulse transformer	Speed sensor	
B60	Inductive switch	Mechanical activation of the brake	
B62	Inductive switch	Support arms, lowered position.	
B63	Inductive switch	Mast switch 1	
B64	Inductive switch	Mast switch 2	
B65	Inductive switch	Support arms, uppermost position.	
B90	Collision sensor		Option
F1	Fuse	Main fuse	150 A
F50	Fuse	Operating circuit A5	7.5 A
F51	Fuse	Operating circuit T1	7.5 A
F52	Fuse	Optional equipment	Option
G1	Battery		24 V
K110	Data Handling Unit (DHU)	Data handling unit	Option
M1	Motor	Truck traction	
M3	Motor	Pump motor	
P4	Horn		
P5	Warning lamp		Option

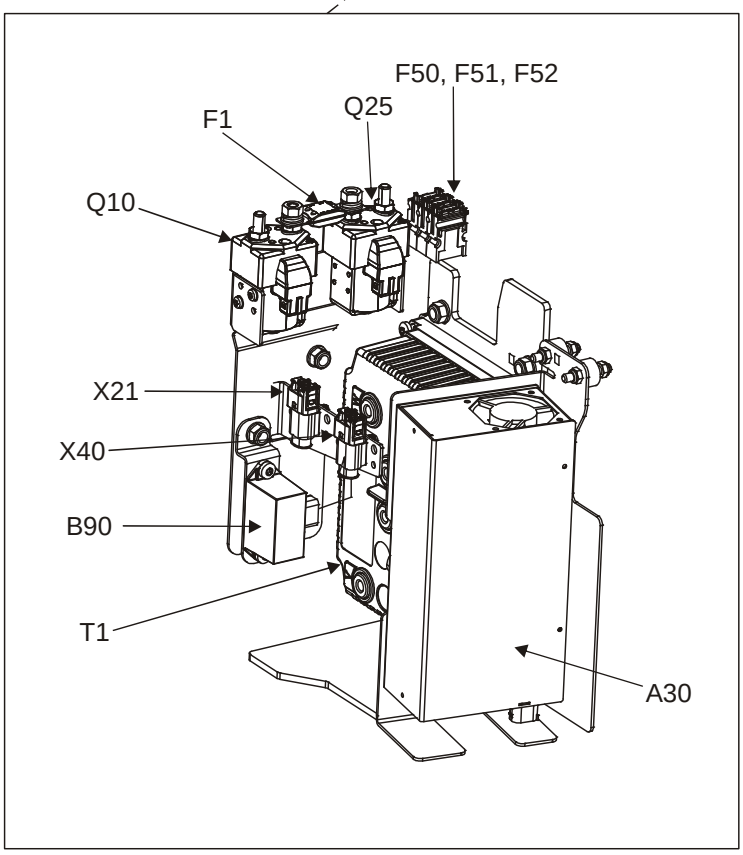
P6	Display	Truck function display	
Q1	Electromechanical brake	Mechanical brake	
Q4	Solenoid valve	Fork lowering	
Q10	Contactor	Main contactor	
Q22[1]	Solenoid valve	Fork selector	
Q23[2]	Solenoid valve	Support arm selector	
S18	Switch	Horn button	
S21	Switch	Emergency switch off	
S97	Switch	Warning lamp P5	Option
S206	Switch	Turtle function	Option
S111	Switch	Option button	Option
S113	Switch	Option button	Option
S114	Switch	Option button	Option
S115	Switch	Option button	Option
S116	Switch	Option button	Option
S223	Keypad/Smart card	Login with PIN code	
S224	Controls	Sensilift	Option
T1	Transistor regulator		
T7/T8	DC/DC converter	T7=24V/12V T8=24V/24V	Option
T20	Antenna	Antenna	Option
X1	Connector	Battery	
X21	Port	DC/DC converter	Option
X40	Port	CAN communication (Extra I/O)	
X41	Port	CAN communication (External)	
X65	Port	Tiller arm:	

1. Applies only to S212L, 214L and 220D.
2. Applies only to S212L, 214L and 220D.





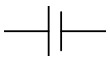
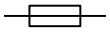
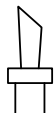
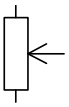
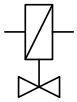
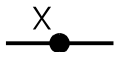
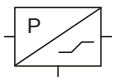




20.2 Wiring diagram

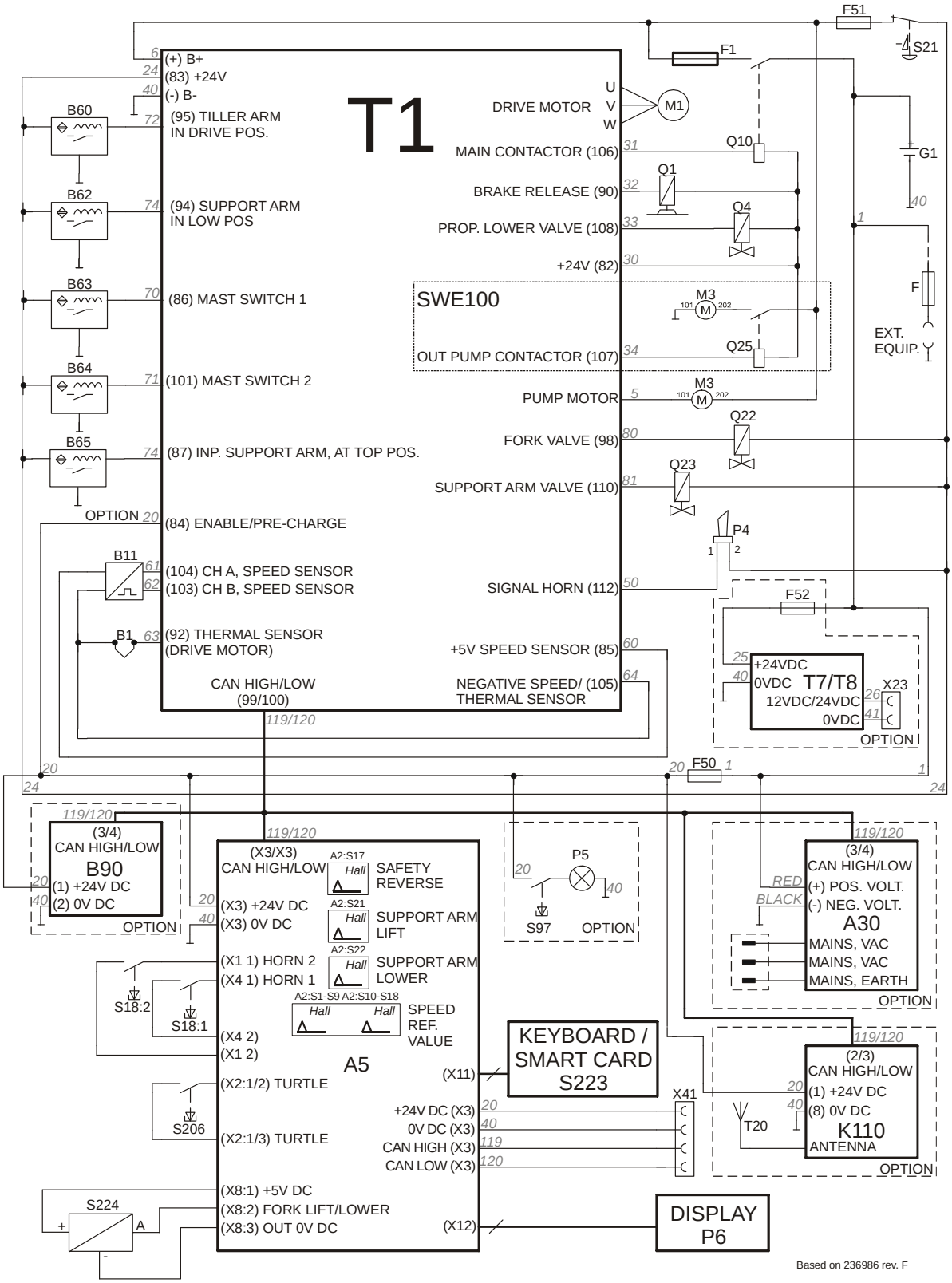
20.2.1 List of symbols

Table 1: List of symbols

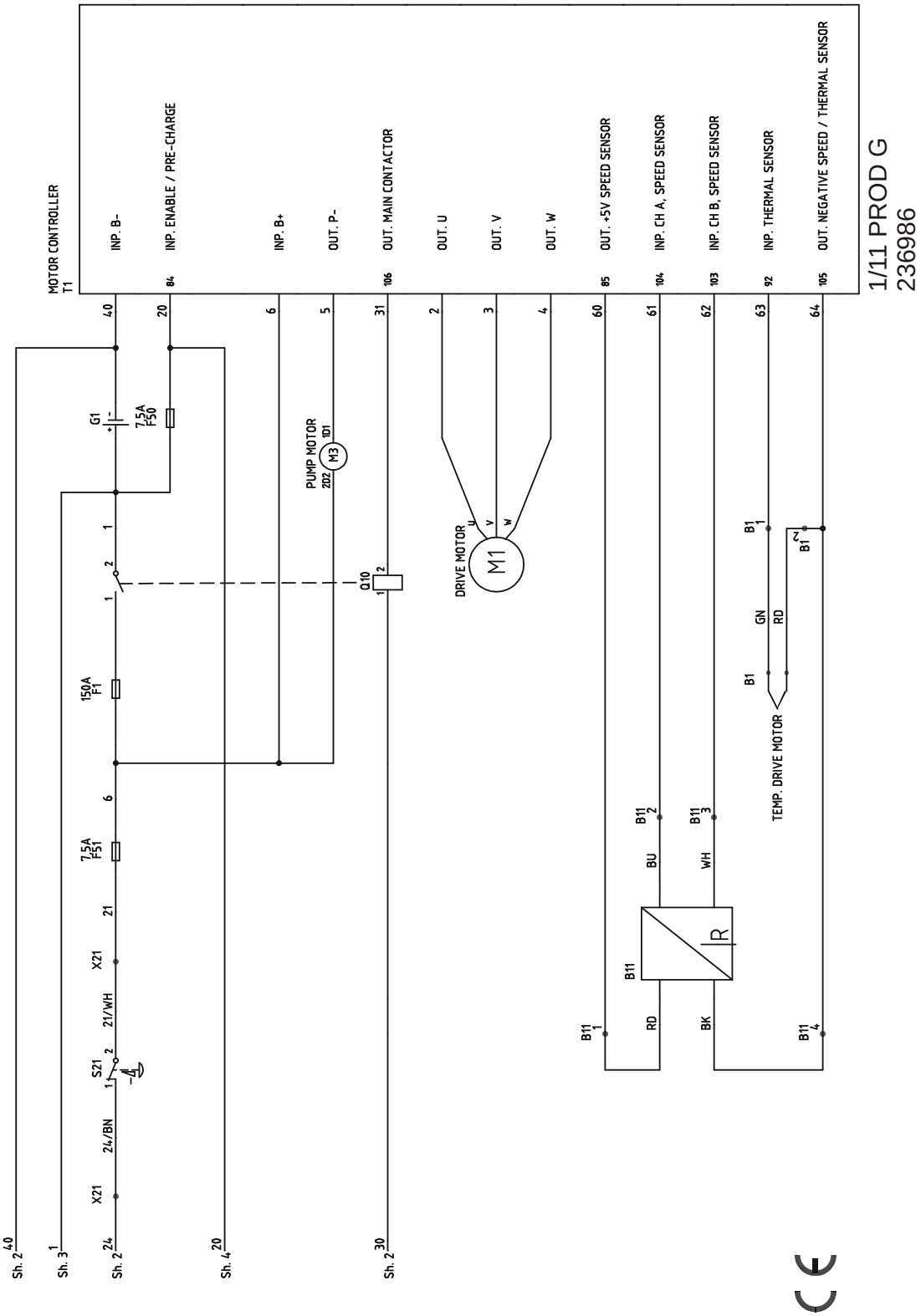
Symbol	Description	Symbol	Description
	Truck battery.		Emergency switch off NC
	Fuse		Switch, pressure (weight) operated
	Horn		Sensor, inductive NO
	Motor, AC[1]		Sensor, inductive NC
	Contactor		Variable resistance (potentiometer)
	Brake coil (normally applied)		Push switch NO
	Coil for the hydraulic solenoid valve		Multi-pin connector
	Pressure sensor, analogue	NO = Normally open NC = Normally closed	

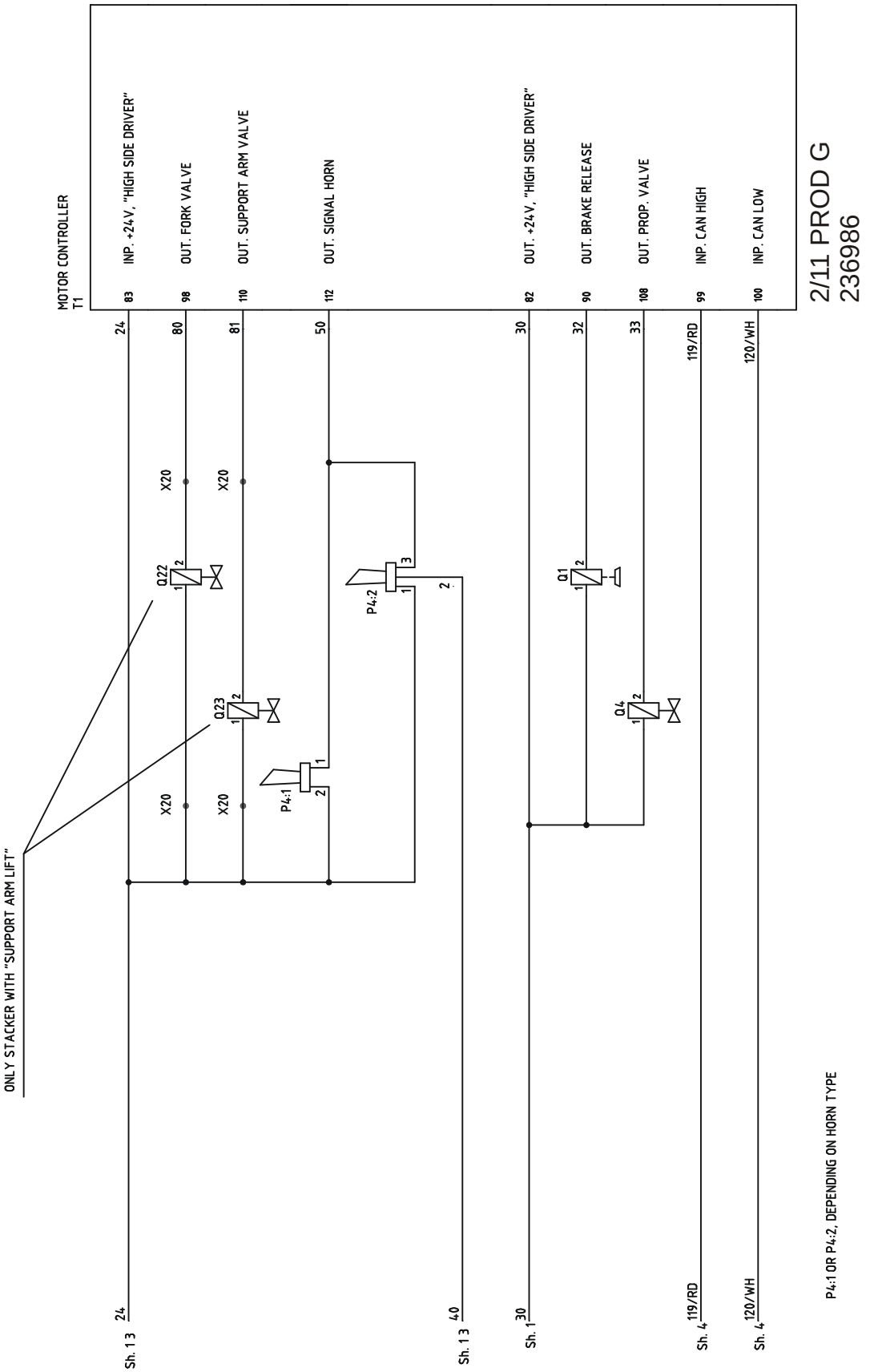
1. AC = Alternating Current

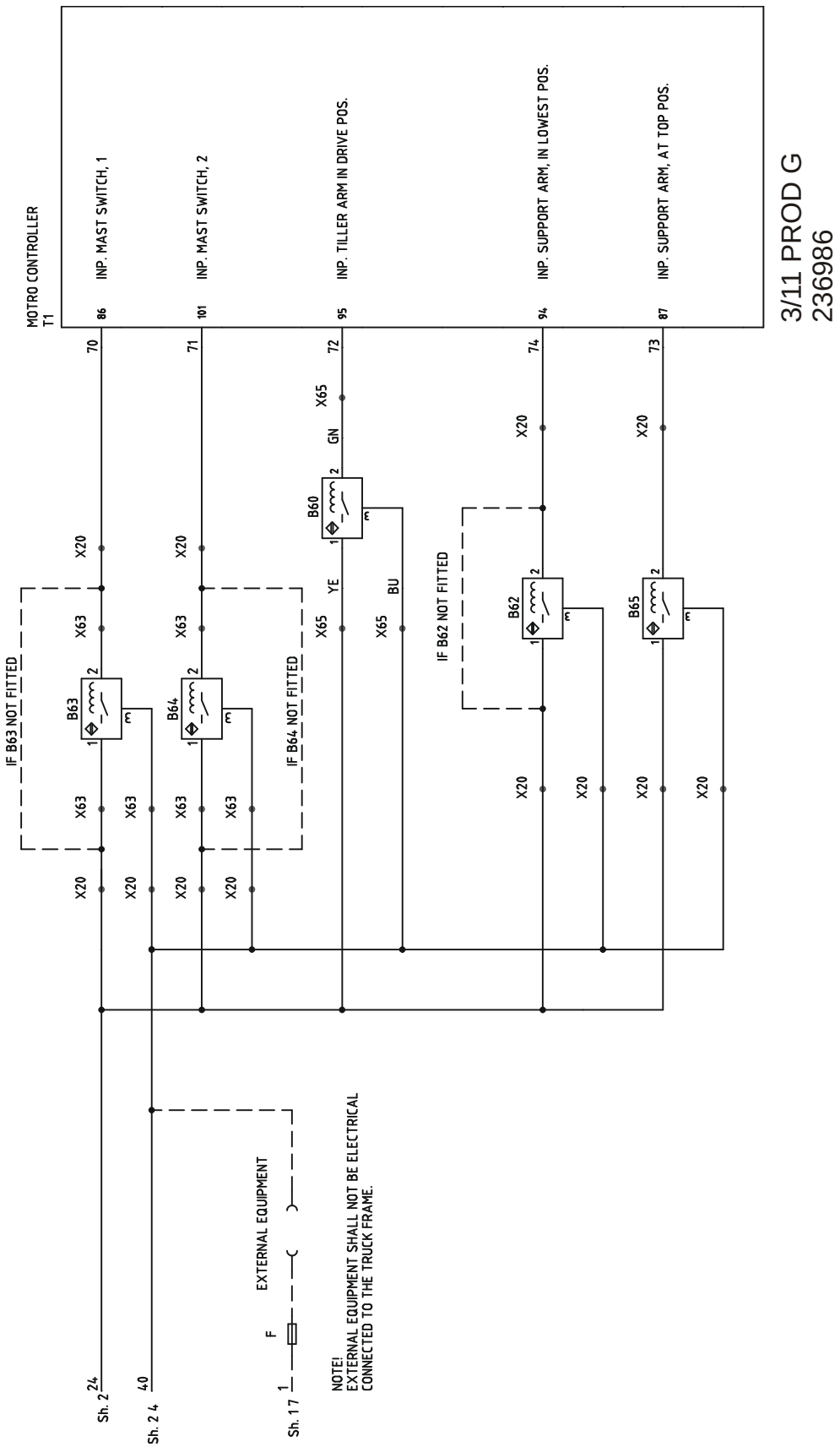
20.2.2 General wiring diagram

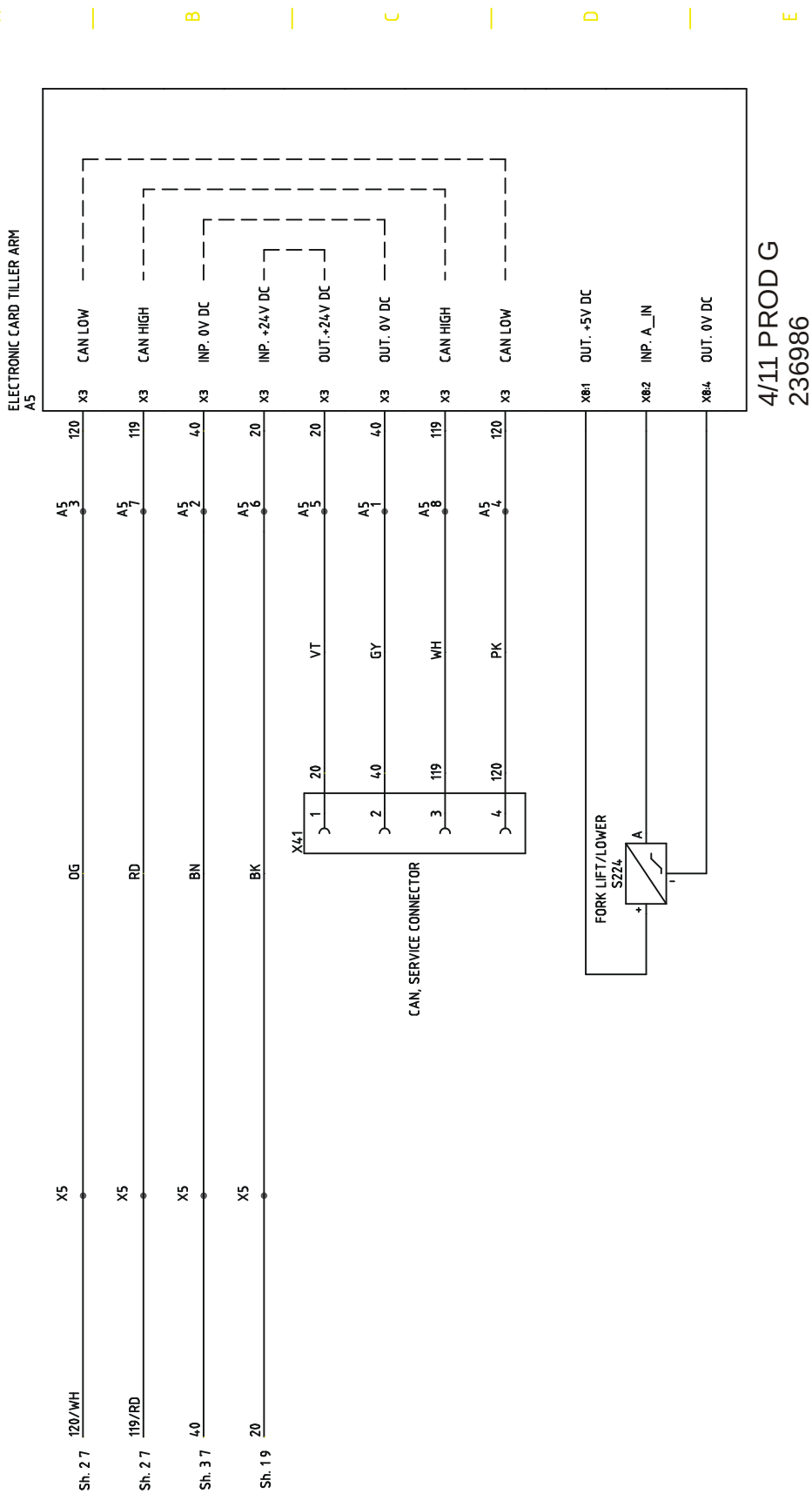


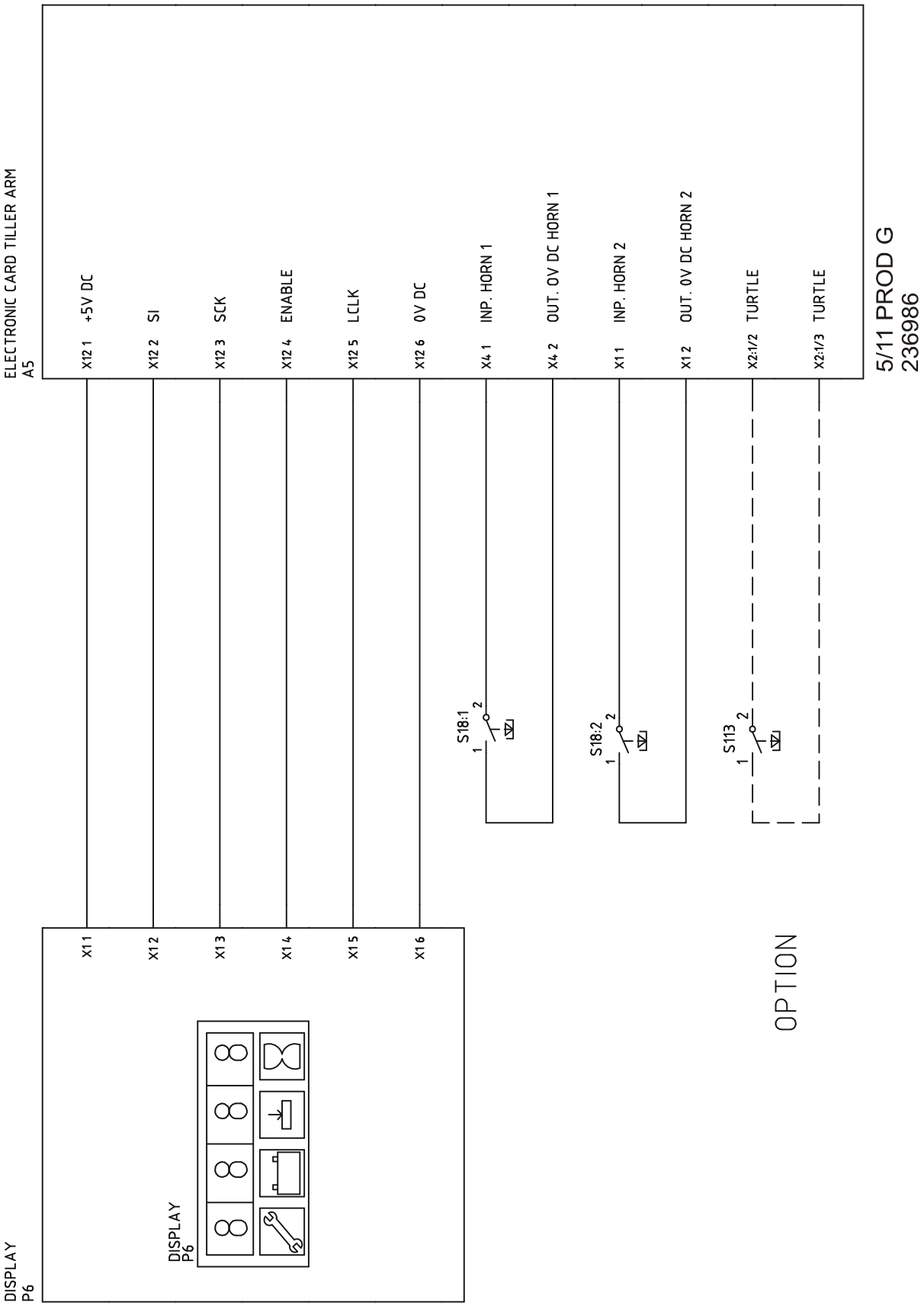
20.2.3 Wiring diagram

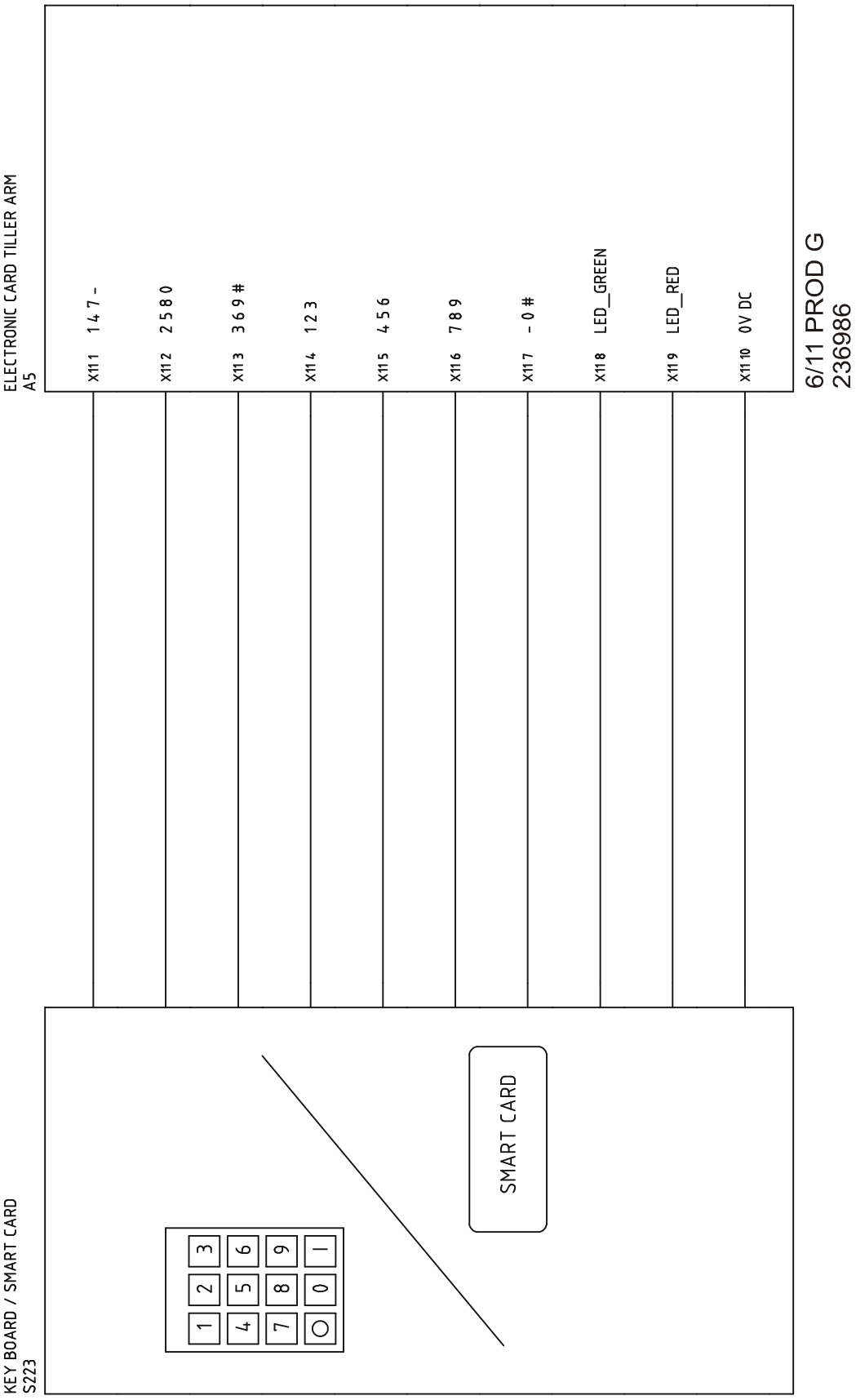


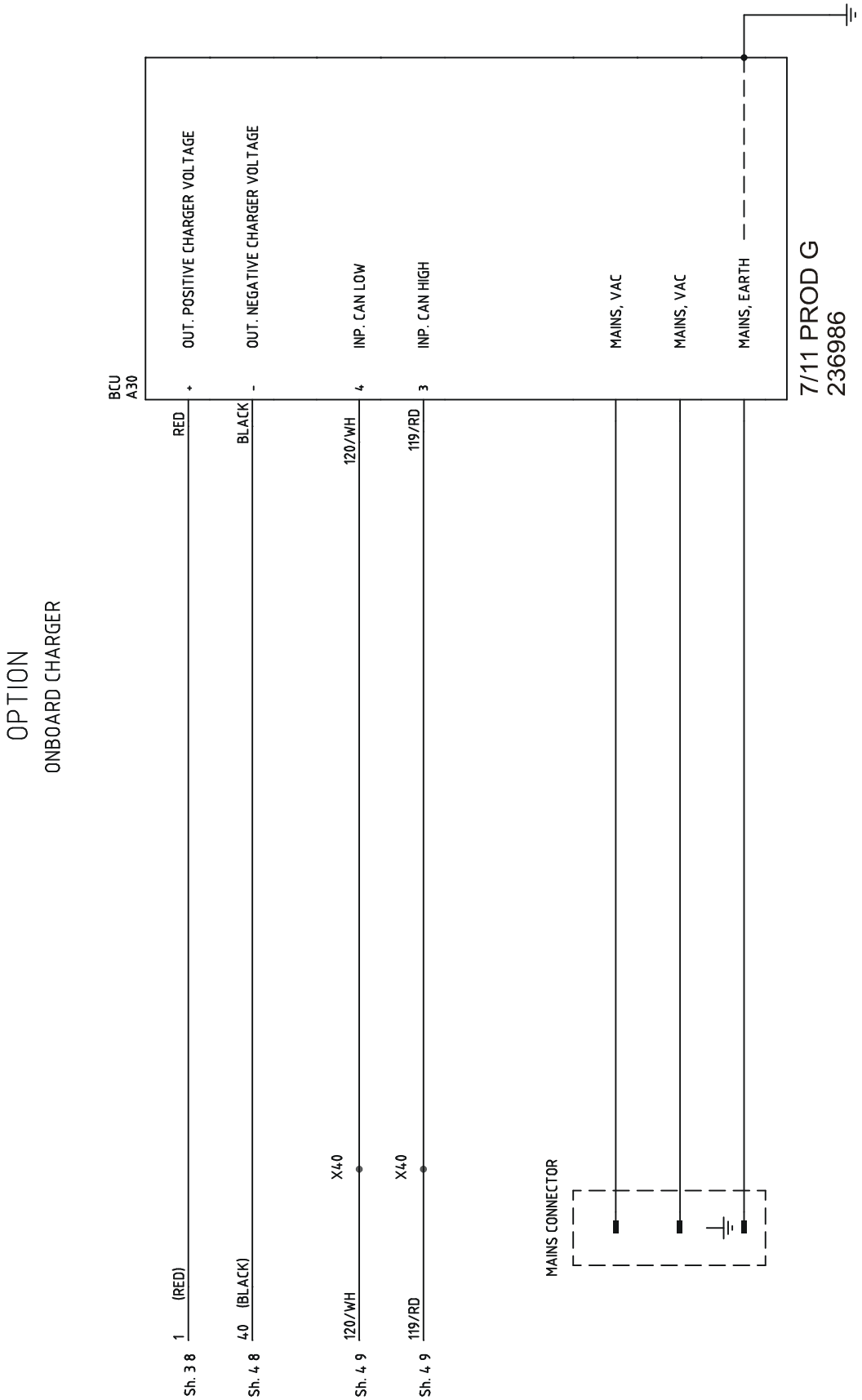


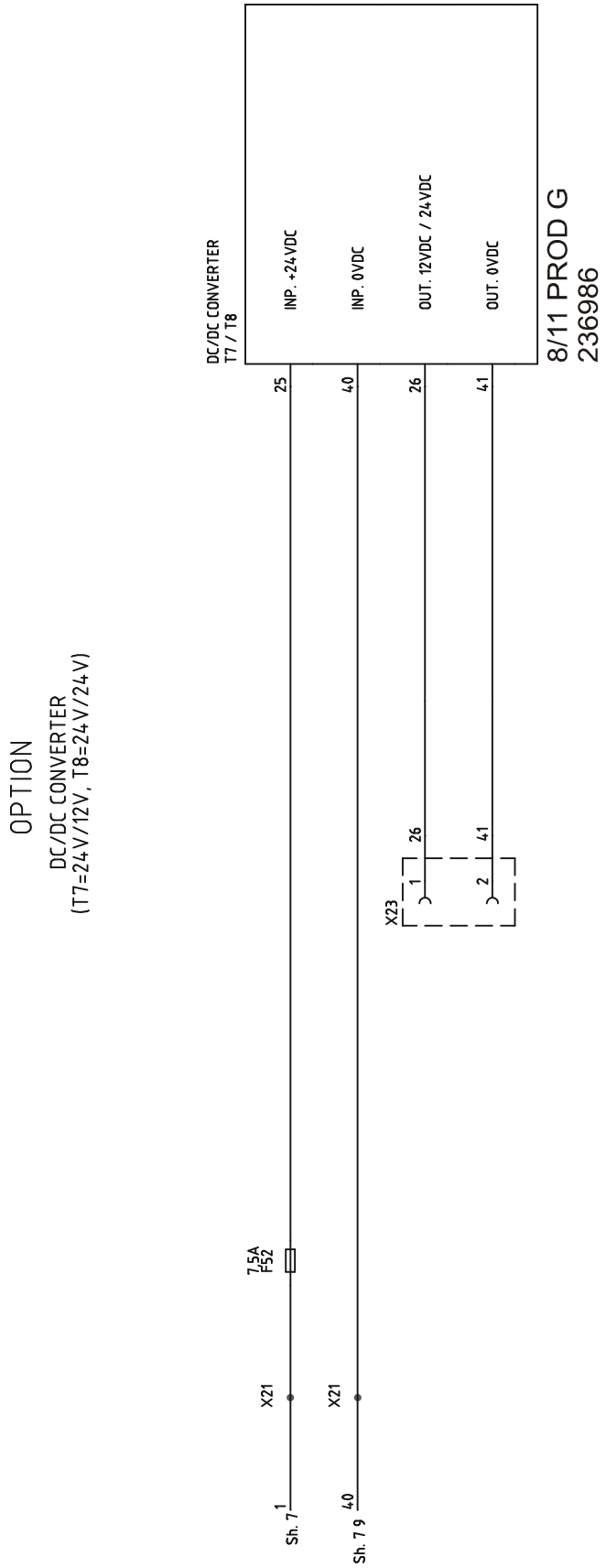


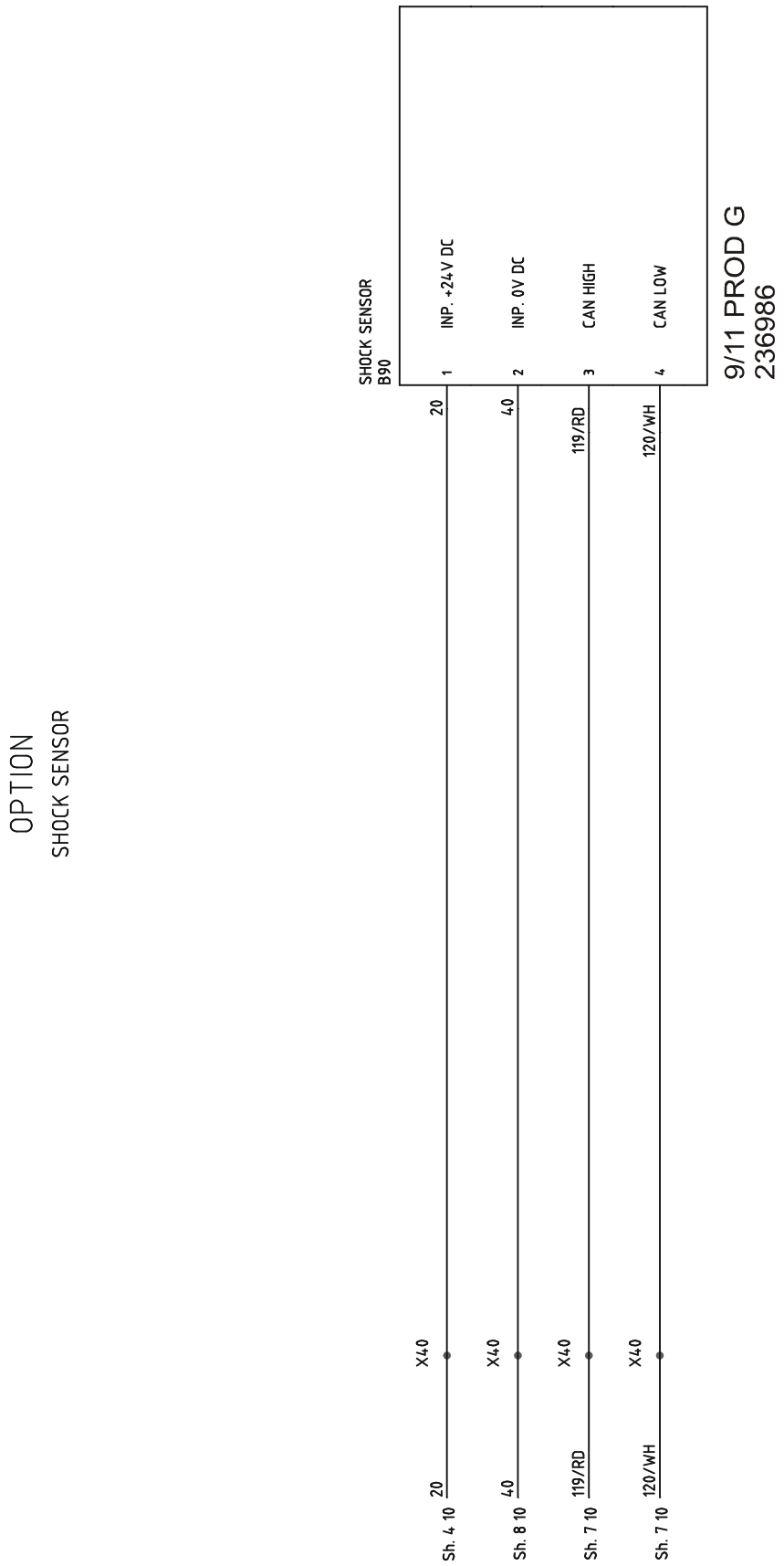


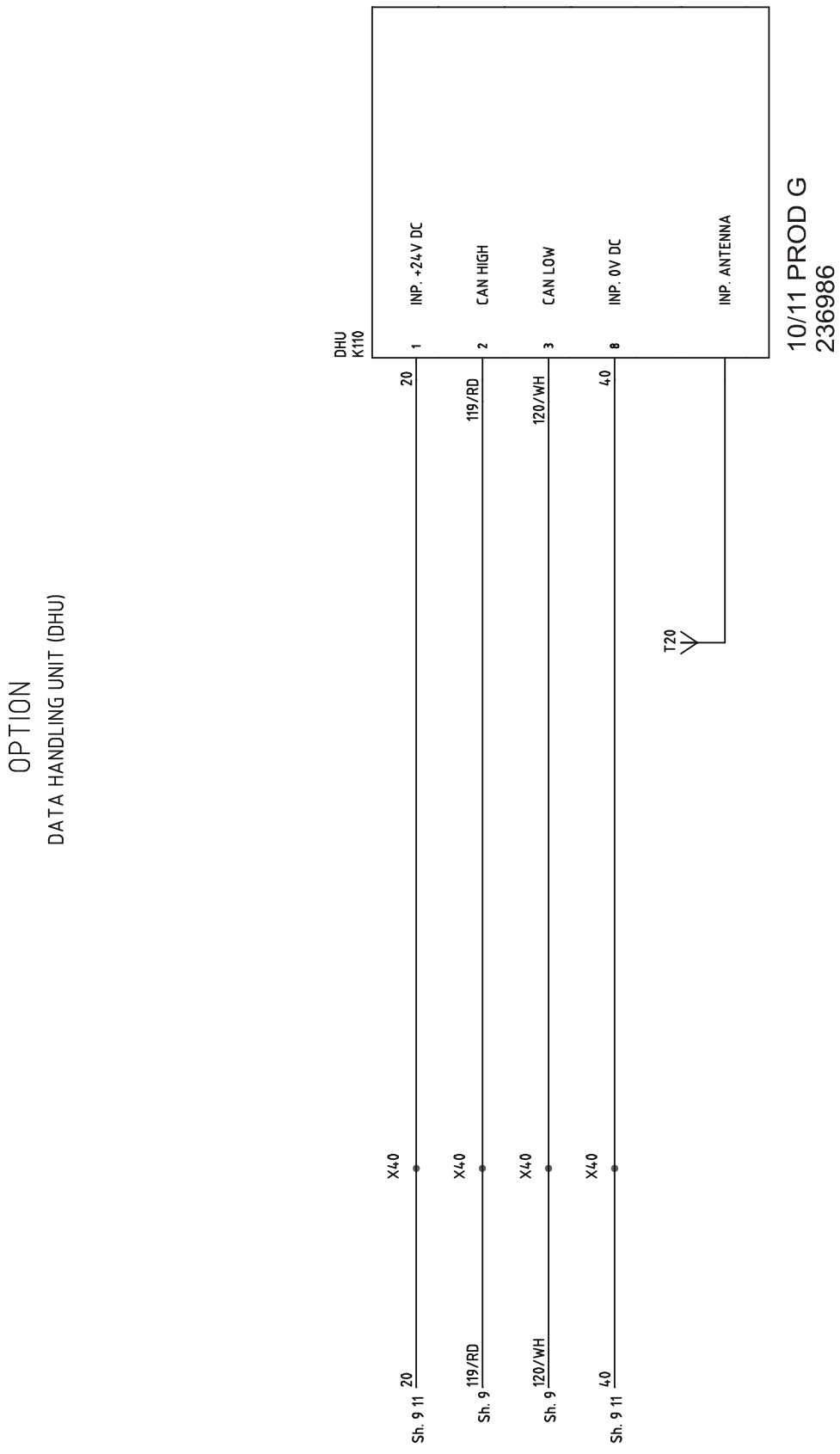


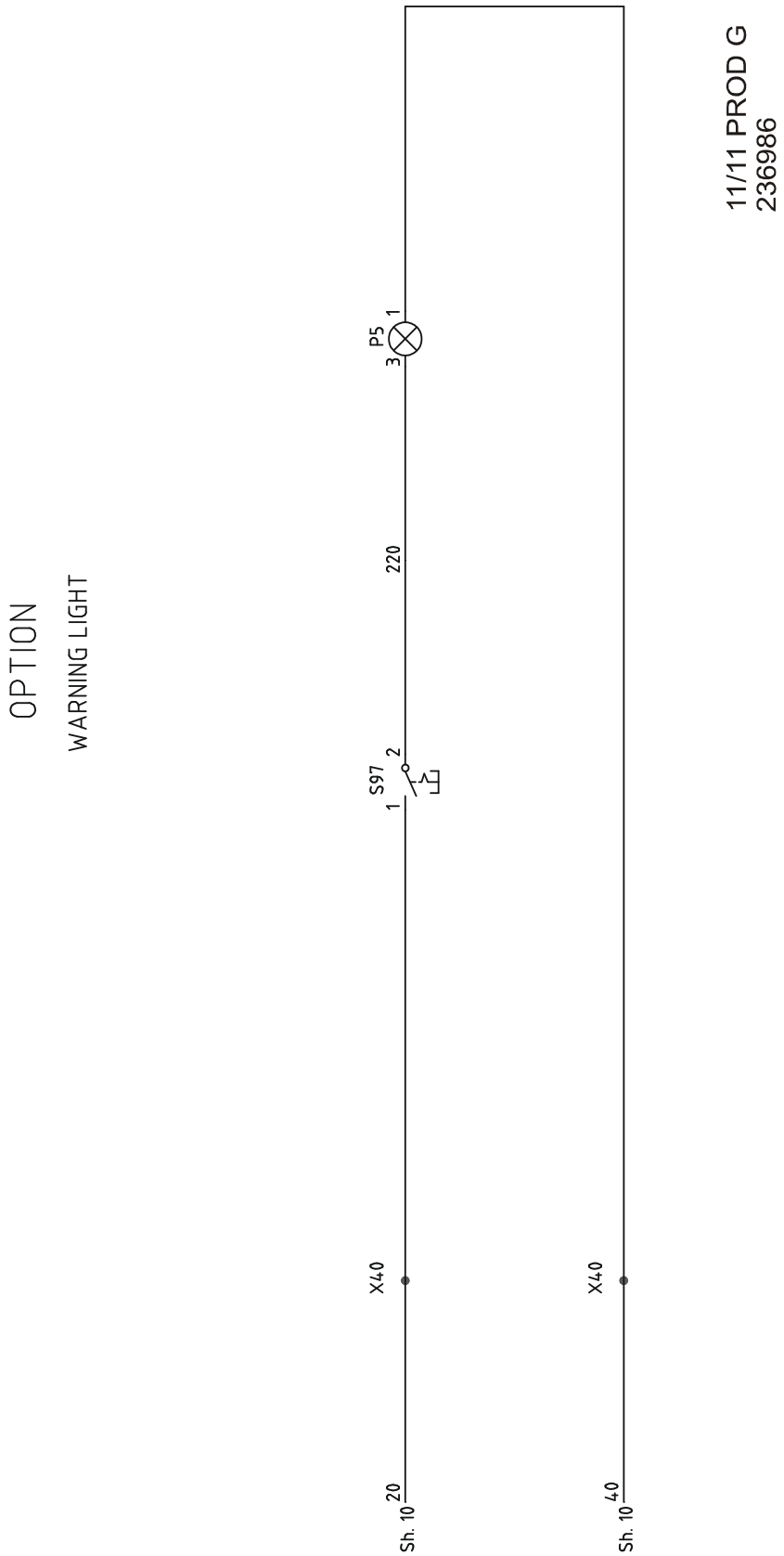




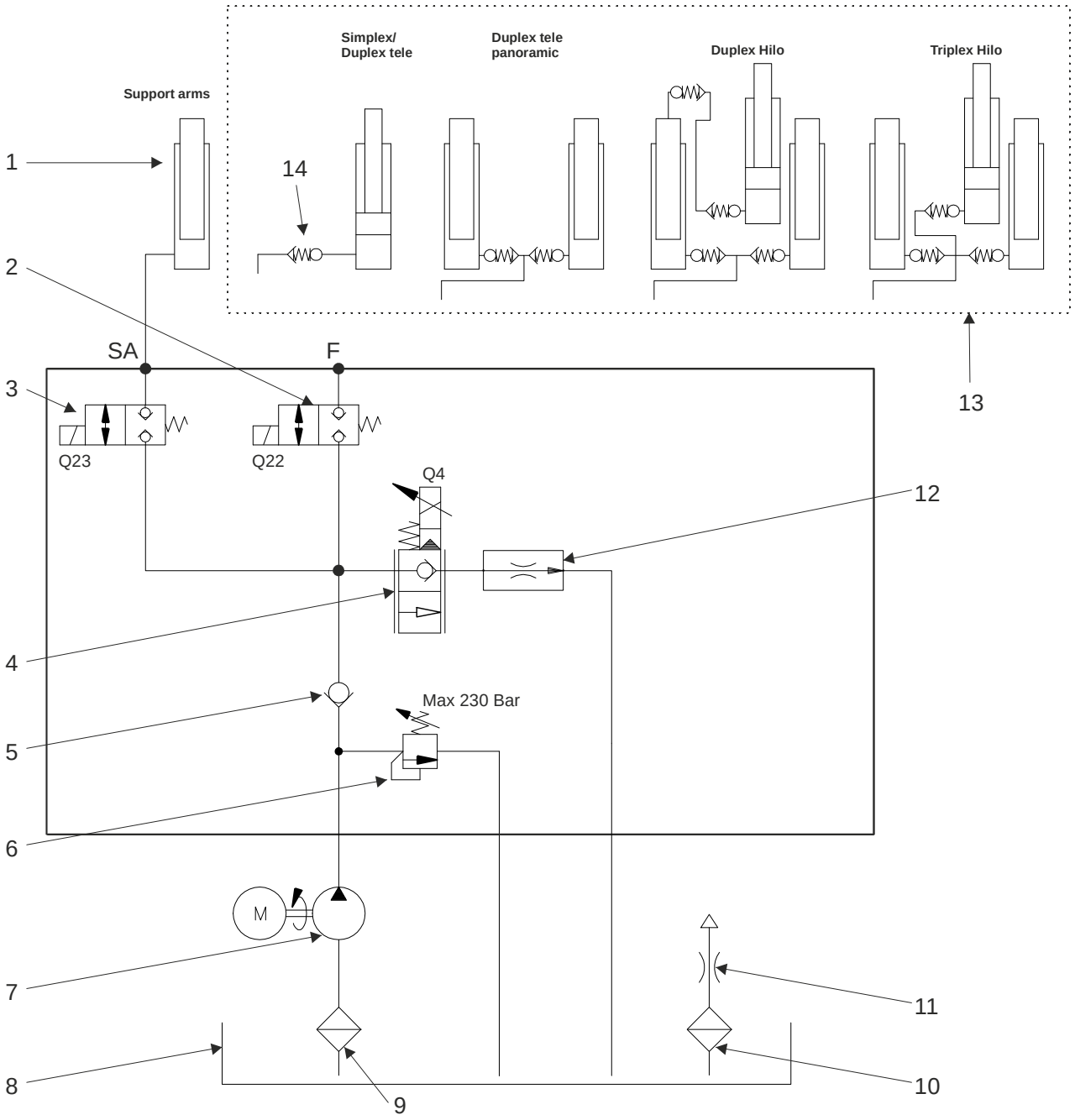








21. Hydraulics chart

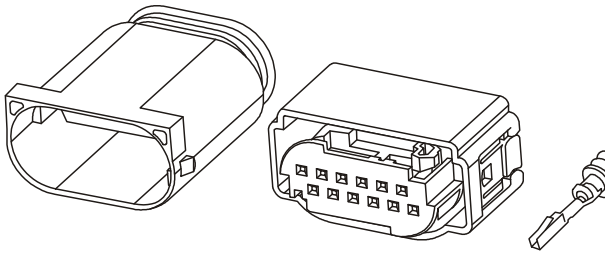


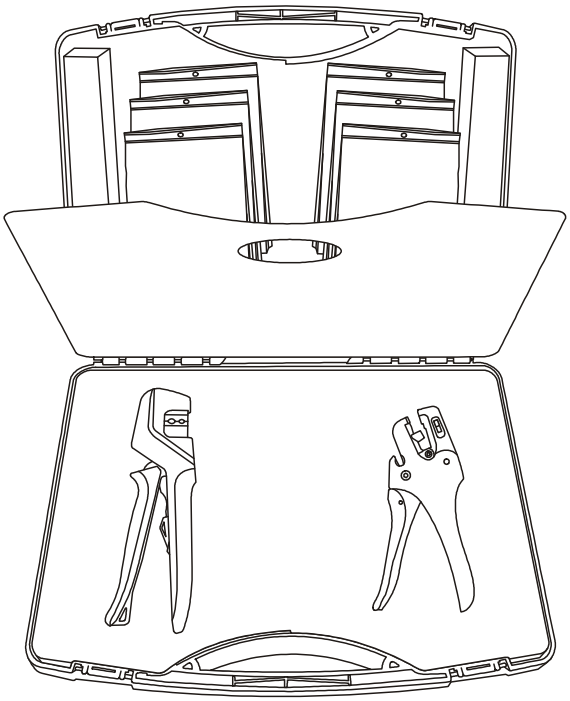
Pos.	Description	Pos.	Description
1	Lift cylinder, support arm[1]	8	Tank
2	Solenoid valve, fork selection [Q22]	9	Filter
3	Solenoid valve, support arm selection [Q23]	10	Filter
4	Proportional valve, lowering [Q4]	11	Air filter
5	Non-return valve	12	Flow regulator valve
6	Pressure limiting valve, max. 230 Bar	13	Lift cylinder, mast
7	Pump	14	Hose rupture valve

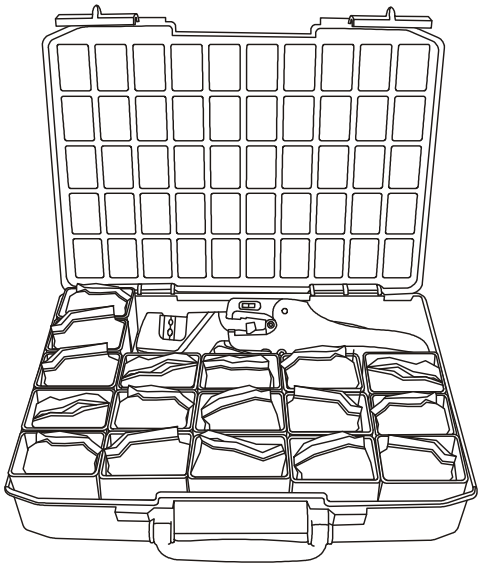
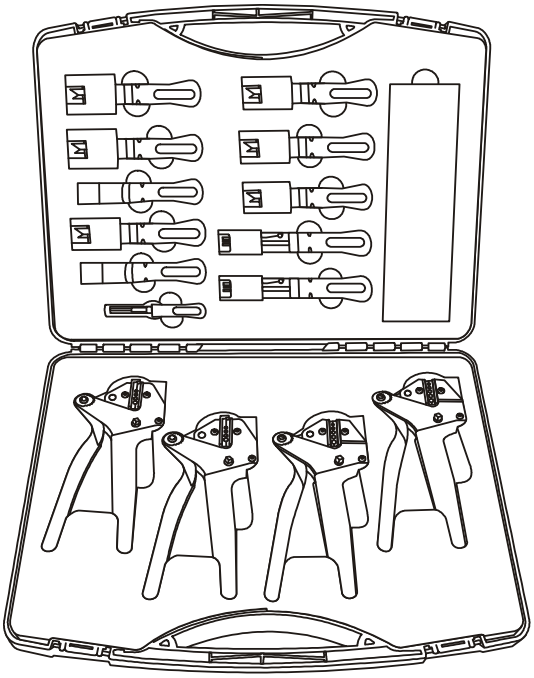
1. Only applies to S212L, S214L and S220D

22. Tools

22.1 MQS contacts



Tools	Number	Use
	257841	MQS Basic toolbox. The box contains: 1 set pliers with tools 25 x splice sleeves 0.5-1.5 mm^2 2x complete 2, 3, 4, 6, 8 and 12-pin connectors (male and female) with pre-wired cables and splicing sleeves. Please use to replace damaged connectors on the truck.

Tools	Number	Use
	257842	MQS refill box. Use to refill the “MQS 257843 Complete toolbox”. The refill box contains: 200 x sleeves 0.2-0.5 mm^2 200 x sleeves SWS 0.2-0.5 mm^2 400 x sleeves SWS 0.5-0.75 mm^2 100 x sleeves S"Clean body" 0.5-0.75 mm^2 200 x pins SWS 0.2-0.5 mm^2 400 x pins SWS 0.5-0.75 mm^2 1200 x seals 200x blind plugs
	257843	MQS Complete toolbox. Contains 4 pliers with tools: MQS SWS 0.25-0.5 mm^2 MQS SWS 0.5-0.75 mm^2 MQS Std&Clean body 0.25-0.5 mm^2 MQS Std&"Clean body" 0.5-0.75 mm^2 Puller for 2, 3, 4, 6, 8 and 12-pin male and female connectors.

22.2 AMP connectors

PT = Power Timer (4.8. 5.8. 6.3 mm)

JPT = Junior Power Timer (2.8 mm)

MPT = Micro Power Timer (1.5 mm)

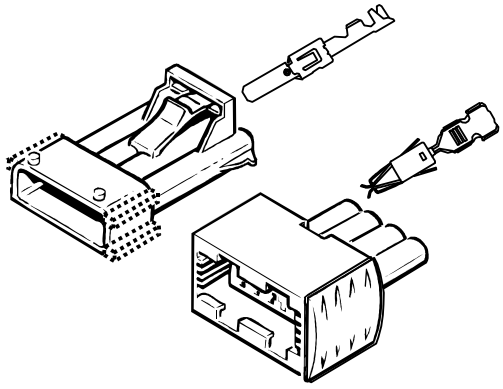
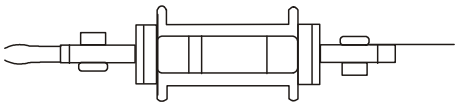
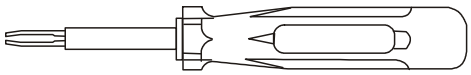
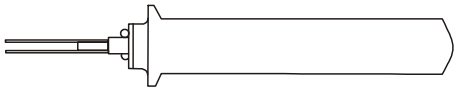
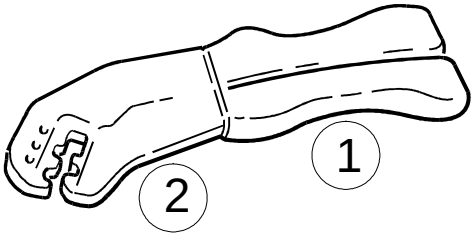
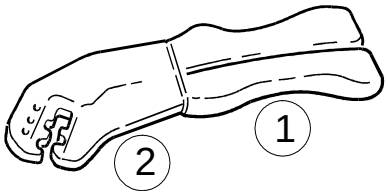


Figure	Number	Use
	151080 (PT)	Removal tool for pins/ sleeves
	213296 (JPT)	Removal tool for pins/ sleeves
	213298 (MPT)	Removal tool for pins/ sleeves
	1=163787 (JPT) 2=163788 (JPT) 1=213336 (MPT) 2=213337 (MPT)	Crimping tool (sleeves only)
	1=213336 (JPT) 2=213549 (JPT)	Crimping tool for fitting pins For 0.5–2.5 mm^2

22.2.1 AMP connectors, Multilock series 040

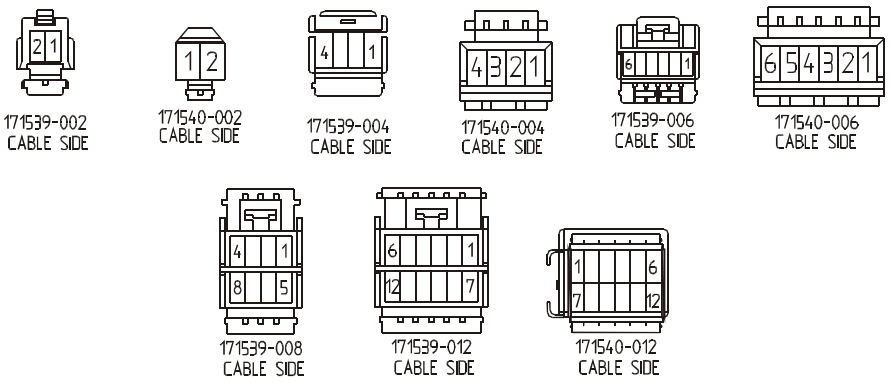
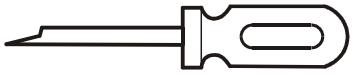
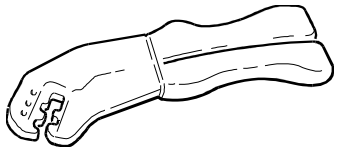


Figure	Number	Use
	213130	Pin removal tool
	213129	Crimping tool for pins

22.3 Molex connectors

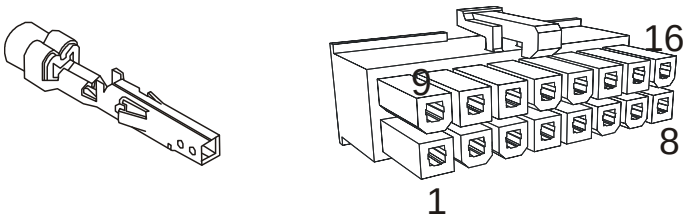
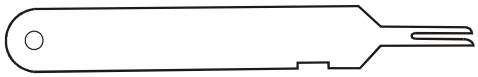
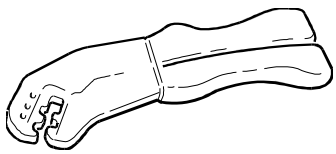
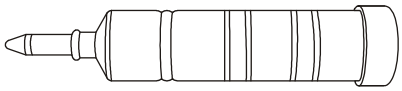
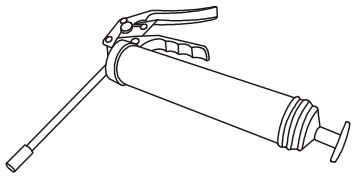
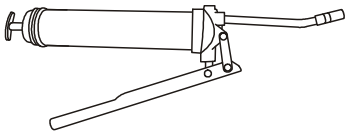
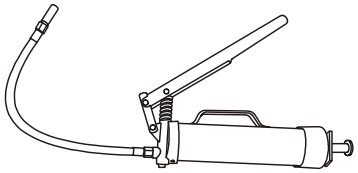
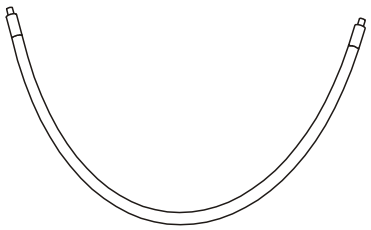
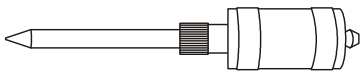
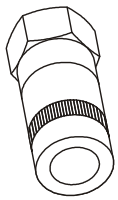


Figure	Number	Use
	156937	Crimping tool for pins
	156936	Crimping tool for fitting sleeves/pins

22.4 Grease guns

Figure	Number	Use
	24981	A tool with a pointed nozzle used to apply grease. Length 170 mm.
	755132	Single-hand grease gun with straight discharge pipe and nozzle.
	755142	Two-handed grease gun with angled discharge pipe and nozzle.
	755152	Two-handed grease gun with hose and nozzle.
	755145 755146 755147	Lubricating hose 450 mm Lubricating hose 750 mm Lubricating hose 1500 mm
	202154PM	Pointed nozzle for grease guns used to apply grease in recessed nipples. Fits grease guns with hose and discharge pipe. Length 125 mm.
	755140	Nozzle for necked nipples. Fits grease guns with hose and discharge pipe.

22.5 Other tools

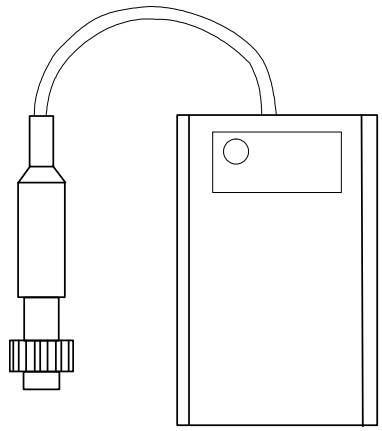
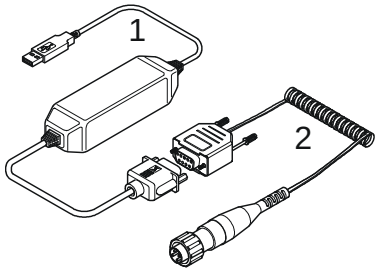
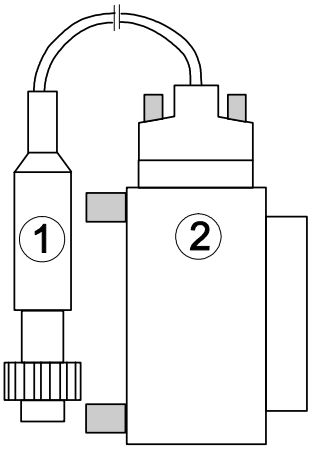
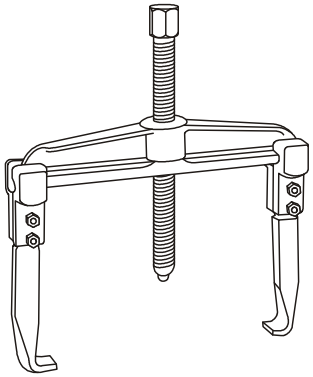
Figure	Number	Use
	7513225	Service key (CAN)
	1=7521083 2=163793	Service instrument (CASTOR USB) for programming
	1=163793 2=163792	Service instrument for program changes

Figure	Number	Use
	08-13022	Drive gear puller

23. Lubricants specification

23.1 General tightening torques

Millimetre threads M3 to M24. The following applies in the case of good conditions, e.g. steel against steel.

Galvanised, not oiled screws				Untreated, oiled screws		
Strength class:			Dimension	Strength class:		
8.8	10.9	12.9		8.8	10.9	12.9
1.1	1.6	2.0	M3	1.2	1.7	2.1
2.8	3.8	4.7	M4	2.9	4.0	4.9
5.5	7.7	9.3	M5	5.7	8.1	9.7
9.5	13	16	M6	9.8	14	17
23	32	38	M8	24	33	40
45	62	76	M10	47	65	79
78	109	130	M12	81	114	136
123	174	208	M14	128	181	217
189	266	320	M16	197	277	333
370	519	623	M20	385	541	649
638	898	1075	M24	665	935	1120

Tightening torque ‘T’ (Nm)

Note:

Experience has shown that if the torque wrench is adjusted to the values for untreated screws, the correct torque value for galvanised screws will also be obtained. Do not tighten more than the values indicated in the table, otherwise the screws can be destroyed.

23.2 Lubricants specification

Lubricant type		Specification		Usage
		> -15℃	< -15℃	
A	Grease	S213366 Q8 Rubens WB	S213366 Q8 Rubens WB	Bearings and bushes
C	Transmission oil	Synthetic base hypoid oil SAE 75W-90 Class API-GL5		Gears
C	Transmission oil	Cassida Fluid GL 150 Synthetic NSF H1 NSF ISO 21469		Gears Approved for the food processing industry
D	Grease	See table below	See table below	Chains
E	Grease	Grafloscon A-G1 (Klüber)	Grafloscon A-G1 (Klüber)	Gear ring
F	Grease	Gletmo 805	Gletmo 805	Beams, rib
F	Grease	Rembrandt EP2	Rembrandt EP2	Beams, flanges
G	Grease	Castrol Spheerol LC2 Castrol Tribol 4020/460-2		Steering bearings
H	Grease	Klüberplex BEM 34-132		Steer axle/steering damper

Pos.	Ambient temperature	Viscosity class	Usage
B	0 °C-40 °C	ISO VG 32 ISO 6743-4 category HM DIN 51524 part 2 = HLP	Hydraulic system
B	-35 °C-40 °C	ISO VG 27.5 ISO 6743-4 category HV DIN 51524 part 3 = HVLP	Hydraulic system
B	0 °C-40 °C	Cassida Fluid HF 32 / ISO VG 32 ISO 6743-4 category HM DIN 51524 part 2 = HLP NSF H1 NSF ISO 21469	Hydraulic system Approved for the food processing industry

Pos.	Ambient temperature	Viscosity class	Recommended products*
D	> -40°C < -30°C	VG 15	Klüberoil 4UH 1-15, Klüber Lubrication
D	> -30°C < +5°C	VG 68	Klüberoil 4UH 1-68N, Klüber Lubrication Anticorit LBO 160 TT, Fuchs DEA
D	> +5°C < +45°C	VG 150	Klüberoil 4UH 1-150N, Klüber Lubrication Anticorit LBO 160, Fuchs DEA Rexoil, Rexnord Kette
D	> +45°C < +80°C	VG 220	Klüberoil 4UH 1-220N, Klüber Lubrication

* Equivalent products from another manufacturer may be used.

24. Technical data

24.1 S210, S212, S214

Model	S210	S212	S214
Drive motor			
Type	Iskra AML7108		Iskra AML7109
Power, kW	1.0,		1.5
Duty cycle	S2-60 min		
Weight, kg	9		10.5
Brake			
Type	Warner PK10		
Braking force, Nm	15		
Power, W	51/13		
Resistance, coil, Ω	10.5-12.0		
Nominal gap in actuated position, mm	0.2-0.55		
Minimum thickness of brake disc, mm	7.9		
Thickness of new brake disc, mm	8.2		
Transmission/gear mechanism			
Type	Kordel Genius 5.72.02.1		
Gear ratio	30.204		
Oil volume, litres	0.8		
Oil	See section “23.2 Lubricants specification”.		

Model	S210	S212	S214
Wheels			
Drive wheel, mm	230		
Wheel pressure (kg/mm²)	0.2	0.22	0.24
Axle pressure without load, kg	350	400	450
Axle pressure at rated load, kg	350	400	450
Wheel bolts tightening torque, Nm	81±19		
Support arm wheels, mm	125		
Axle pressure without load, kg	235	285	285
Axle pressure at rated load kg	1185	1445	1640
Castor wheel, mm	85		
Axle pressure without load, kg	230	250	200
Axle pressure at rated load, kg	280	290	245
Hydraulic system			
Power, kW	2.2		
Duty factor, %	S2,60 min		
Min. carbon brush length, mm	8		
Min. commutator thickness/ diameter, mm	-		
Pressure at rated load, bar	See section “24.4 Overflow pressure for mast”.		
Overflow pressure, bar			
Pump flow, litres/minute			
Tank volume, litres	4.5		
Hydraulic oil	See section “23.2 Lubricants specification”.		
Fuses			
Drive motor circuit, A	125		
Pump motor circuit, A	125		
Control circuit, A	7.5		

Model	S210	S212	S214
Battery compartment, Batteries			
Capacity, Ah	150	225	
Weight, kg min/max	189/280	189/280	189/280
Truck travel speeds			
Unloaded, km/h Unloaded, m/s		6.0 1.7	
With rated load, km/h With rated load, m/s		6.0 1.7	
Lifting/lowering speed			
Lifting without load, m/s	0.28	0.28	0.25
Lift with rated load, m/s	0.14	0.12	0.11
Lowering without load, m/s	0.38	0.38	0.38
Lowering with rated load, m/s	0.38	0.38	0.37
Gradient capability			
With rated load, %	8	8	8
Dimensions			
Short Medium Long	1831 1888 1938	- 1906 1956	- 1901 1951
Lift height	3300	4500	4755
Weight			
Truck without battery, Medium	650	715	715

24.2 S212L, S214L, S220D

Model	S212L	S214L	S220D
Drive motor			
Type	Iskra AML7109		
Power, kW	1.5		
Duty cycle	S2-60 min		
Weight, kg	10.5		
Brake			
Type	Warner PK10		
Braking force, Nm	15		
Power, W	51/13		
Resistance, coil, Ω	10.5-12.0		
Nominal gap in actuated position, mm	0.2-0.55		
Minimum thickness of brake disc, mm	7.9		
Thickness of new brake disc, mm	8.2		
Transmission/gear mechanism			
Type	Kordel Genius 5.72.02.1		
Gear ratio	30.204		
Oil volume, litres	0.8		
Oil	See section “23.2 Lubricants specification”.		

Model	S212L	S214L	S220D
Wheels			
Drive wheel, mm	230		
Wheel pressure (kg/mm²)	0.24	0.24	0.27
Axle pressure without load, kg	450	450	570
Axle pressure at rated load, kg	450	450	570
Wheel bolts tightening torque, Nm	81±19		
Support arm wheels, mm	125		
Axle pressure without load, kg	265	265	215
Axle pressure at rated load kg	1345	1525	1155
Castor wheel, mm	85		
Axle pressure without load, kg	220	220	100
Axle pressure at rated load, kg	340	360	360
Hydraulic system			
Power, kW	2.2		
Duty factor, %	S2,60 min		
Min. carbon brush length, mm	-		
Min. commutator thickness/ diameter, mm	-		
Pressure at rated load, bar	See section “24.4 Overflow pressure for mast”.		
Overflow pressure, bar			
Pump flow, litres/minute			
Tank volume, litres	4.5		
Hydraulic oil	See section “23.2 Lubricants specification”.		
Fuses			
Drive motor circuit, A	125		
Pump motor circuit, A	125		
Control circuit, A	7.5		

Model	S212L	S214L	S220D
Battery compartment, Batteries			
Capacity, Ah	225		
Weight, kg min/max	189/280		
Truck travel speeds			
Unloaded, km/h Unloaded, m/s	6.0 1.7		
With rated load, km/h With rated load, m/s	6.0 1.7		
Lifting/lowering speed			
Lifting without load, m/s	0.25		
Lift with rated load, m/s	0.12	0.11	0.12
Lowering without load, m/s	0.28		
Lowering with rated load, m/s	0.39	0.38	0.39
Gradient capability			
With rated load, %	9	8	9
Dimensions			
Short Medium Long	- 1910 1960		
Lift height	3300	3255	2100
Weight			
Truck without battery, Medium	715	715	665

24.3 S212S

Model	S212S
Drive motor	
Type	Iskra AML7108
Power, kW	1.0
Duty cycle	S2-60 min
Weight, kg	9
Brake	
Type	Warner PK10
Braking force, Nm	15
Power, W	51/13
Resistance, coil, Ω	10.5-12.0
Nominal gap in actuated position, mm	0.2-0.55
Minimum thickness of brake disc, mm	7.9
Thickness of new brake disc, mm	8.2
Transmission/gear mechanism	
Type	Kordel Genius 5.72.02.1
Gear ratio	30.204
Oil volume, litres	0.8
Oil	See section “23.2 Lubricants specification”.

Model	S212S
Wheels	
Drive wheel, mm	230
Wheel pressure (kg/mm²)	0.32
Axle pressure without load, kg	675
Axle pressure at rated load, kg	635
Wheel bolts tightening torque, Nm	81±19
Support arm wheels, mm	100
Axle pressure without load, kg	340
Axle pressure at rated load kg	1580
Castor wheel, mm	-
Axle pressure without load, kg	-
Axle pressure at rated load, kg	-
Hydraulic system	
Power, kW	2.2
Duty factor, %	S2,60 min
Min. carbon brush length, mm	-
Min. commutator thickness/ diameter, mm	-
Pressure at rated load, bar	See section “24.4 Overflow pressure for mast”.
Overflow pressure, bar	
Pump flow, litres/minute	
Tank volume, litres	4.5
Hydraulic oil	See section “23.2 Lubricants specification”.
Fuses	
Drive motor circuit, A	125
Pump motor circuit, A	125
Control circuit, A	7.5

Model	S212S
Battery compartment, Batteries	
Capacity, Ah	225
Weight, kg	214
Truck travel speeds	
Unloaded, km/h Unloaded, m/s	6.0 1.7
With rated load, km/h With rated load, m/s	6.0 1.7
Lifting/lowering speed	
Lifting without load, m/s	0.21
Lift with rated load, m/s	0.11
Lowering without load, m/s	0.24
Lowering with rated load, m/s	0.33
Gradient capability	
With rated load, %	8
Dimensions	
Short Medium Long	- 1946 1996
Lift height	4755
Weight	
Truck without battery, Medium	795

24.4 Overflow pressure for mast

Mast (rated load)	Pressure at rated load (on main lift for HiLo-mast)	Pump flow at rated load (from graph for hydraulic unit)	Recommended overflow pressure
Simplex (1000kg)	140 bar	7.1	165 bar
Simplex (1200kg)	165 bar	6.5	190 bar
Tele (1000kg)	145 bar	7.0	170 bar
Tele (1200kg)	170 bar	6.4	195 bar
Tele ClearView (1000kg)	150 bar	6.8	175 bar
Tele ClearView (1200kg)	175 bar	6.3	200 bar
Tele ClearView (1400kg)	200 bar	5.9	225 bar
Duplex HiLo (1200kg)	150 bar	6.8	170 bar
Duplex HiLo (1400kg)	170 bar	6.4	190 bar
Triplex HiLo (1200kg)	185 bar	6.2	210 bar
Triplex HiLo (1400kg)	210 bar	5.8	235 bar