

LVE40

THREE WHEEL, COUNTERBALANCED LIFT TRUCK

**Operation
Maintenance
Repair Parts List**

NOTE:For the most current parts information and service updates, please refer to the Big Joe Support site at www.bigjoesupport.com

WARNING

Do not operate this truck unless you have been authorized and trained to do so, and have read all warnings and instructions in Operator's Manual and on this truck.

Do not operate this truck until you have checked its condition. Give special attention to tires, horn, battery, controller, lift system (including forks or attachments, chains, cables and limit switches), hydraulics (including hoses), brakes, steering mechanism, guards and safety devices.

Operate truck only from designated operating position. Never place any part of your body into the mast structure or between the mast and the truck. Do not carry passengers. Keep feet clear of truck and wear foot protection.

Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.

Start, stop, travel, steer and brake smoothly. Slow down for turns and on uneven or slippery surfaces that could cause truck to slide or overturn. Use special care when traveling without load as the risk of overturn may be greater.

Travel with lifting mechanism as low as possible. Always look in direction of travel. Keep a clear view, and when load interferes with visibility, travel with load trailing.

Use special care when operating on ramps. Travel slowly and do not angle or turn. Travel with the load facing downhill.

Do not overload truck. Check data plate for capacity and load center information.

Space forks as far apart as load will permit. Before lifting, be sure load is centered, forks are completely under load, and load is as far back as possible against load backrest.

Do not handle unstable or loosely stacked loads. Use special care when handling long, high, or wide loads to avoid tipping, loss of load, or striking bystanders.

Do not handle loads which are higher than the load backrest or load backrest extension unless load is secured so that no part of it could fall backward.

Elevate forks or other lifting mechanism only to pick up or stack a load. Watch out for obstructions, especially overhead.

Do not lift personnel except on a specially designed work platform securely attached. USE EXTREME CARE WHEN LIFTING PERSONNEL. Make sure mast is vertical, place truck controls in neutral and apply brakes. Lift and lower smoothly. Remain in operating position as long as personnel are on the work platform. Never transport personnel on forks or work platform.

Do not allow anyone to stand or pass under load or lifting mechanism.

Do not operate in the rain, store in the rain, or drive through any standing water. Also, cleaning by means of a water hose or pressure washer is not permitted. Water exposure could cause incorrect truck functioning and/or damage to the electrical components

When leaving the truck, neutralize travel control, fully lower lifting mechanism and set brake. When leaving truck unattended, also shut off power.

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SECTION 1 DESCRIPTION

1-1. INTRODUCTION.

This publication describes the 48 volt three wheel LVE40 lift truck distributed by Big Lift LLC. Included are operating instructions, planned maintenance instructions, lubrication procedures, corrective maintenance procedures and a complete parts list with part location illustrations.

Users shall comply with all requirements indicated in applicable OSHA standards and current edition of A.N.S.I. B56.1 Part II. By following these requirements and the recommendations contained in this manual, you will receive many years of dependable service from your LVE40 lift truck.

1-2. GENERAL DESCRIPTION.

The LVE40 comes in a TRIMAST model with a lift height of either 189 inches or 197 inches.

The LVE40 truck lifts and transports payloads up to 4000 pounds on adjustable forks.

The forward and reverse motion is controlled by a direction control switch on the right hand side armrest. Stopping is controlled by the brake pedal. Control levers on the right hand side armrest control the Lift, Lower, Tilt, Side Shift and additional attachments.

Two reversible motors propel the lift truck in forward or reverse direction throughout the available speed range. The LVE40 lift truck can be driven with forks raised or lowered; however, the speed is restricted when the platform is raised above a preset limit.

The model number will be found on the name plate ([Figure 1-1](#)) along with the serial number, lifting capacity, and load center. [Figure 1-2](#) shows the locations of the truck's main components.

1-3. SAFETY FEATURES.

The LVE40 lift truck is designed and engineered to provide maximum safety for operator and payload. Some of the safety features incorporated into the design are:

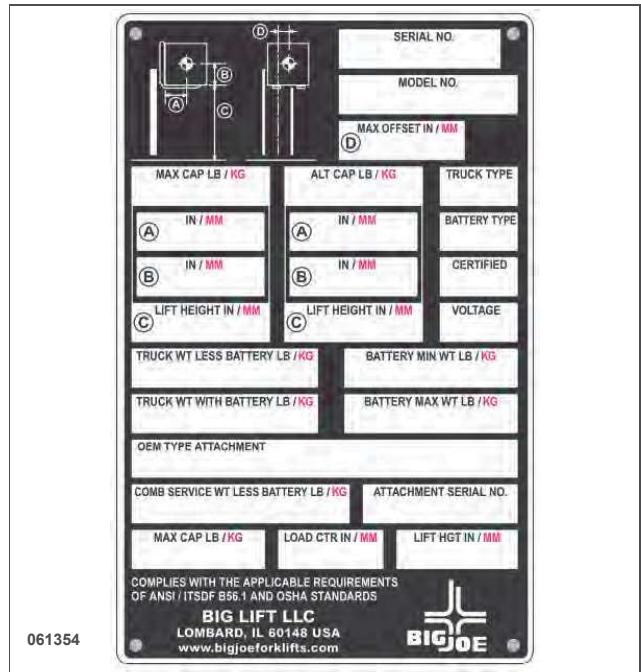
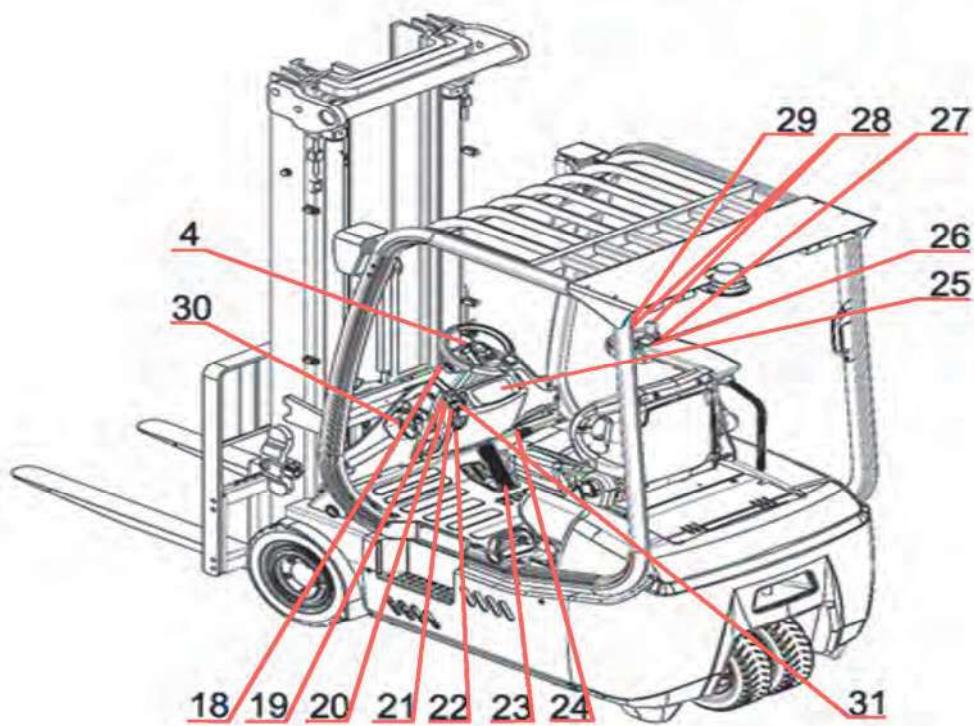
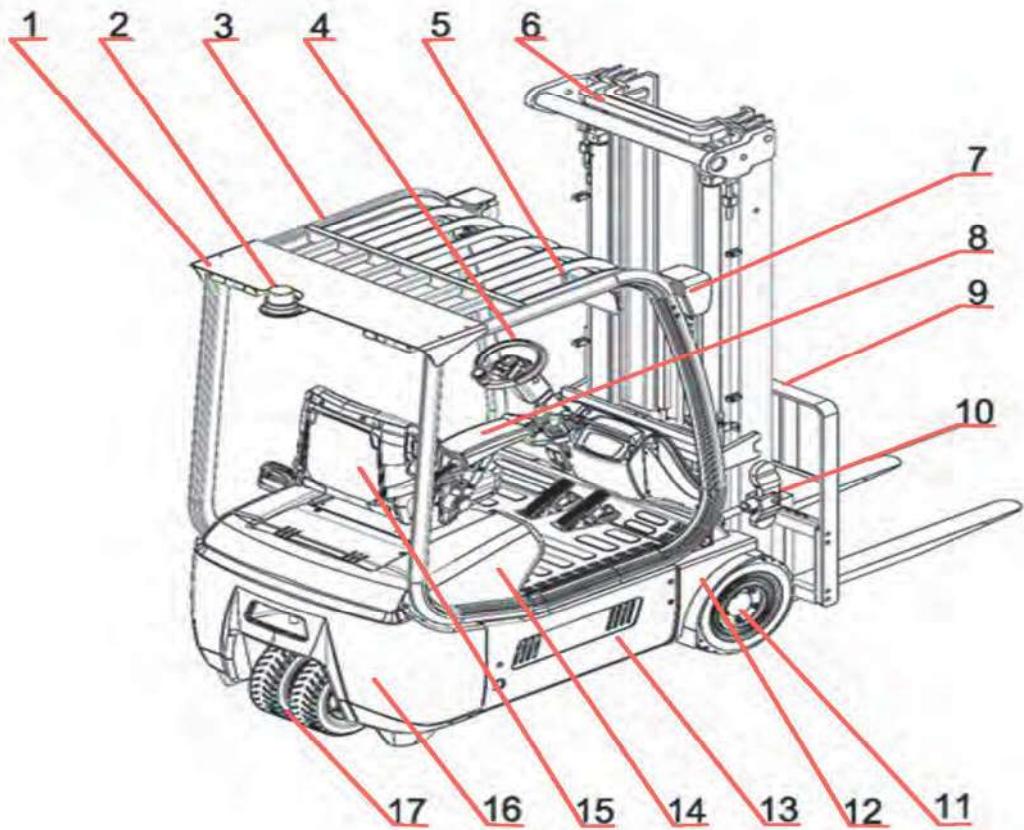


Figure 1-1 Name Plate

- Operator Presence switch to shut off power and apply brake when operator leaves seat.
- All control functions automatically return to "OFF" when released.
- Emergency disconnect switch within operator's reach.
- Separately fused control circuits and power circuits.
- Readily accessible horn button.
- Load backrest extension helps stabilize the load.
- Handle on the front left pillar of overhead guard to provide a firm hand hold for operator.
- A step on the side for mounting and dismounting the truck.
- Relief valve maintains hydraulic pressure within prescribed limits.
- High visibility color scheme of truck provides visual alert of truck's presence.
- Instrument panel and display.



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Figure 1-2 LVE40 Lift Truck

LVE40 Lift Truck

ITEM	COMPONENT	ITEM	COMPONENT
1	LED Rear combination lights	17	Rear wheel
2	Strobe light	18	Turning light switch
3	Overhead guard	19	Headlight switch
4	Steering wheel	20	Hazard light switch
5	Rear view mirror	21	Parking brake switch
6	Mast	22	Key switch
7	LED headlight	23	Brake pedal
8	Operating armrest	24	Accelerator pedal
9	Load back rest	25	Display
10	Fork	26	Direction switch
11	Front wheel	27	Horn button
12	Chassis	28	Four way rocker switch
13	Right side plate	29	Emergency disconnect switch
14	Upper counter weight	30	Steering column tilt adjuster
15	Seat	31	Blue light switch
16	Lower counter weight		

NOTES

SECTION 2 OPERATION

2-1. GENERAL

This section gives detailed operating instructions for the LVE40 lift truck. The instructions are divided into the various phases of operations, such as operating lift, driving, and stopping. Routine precautions are included for safe operation.

2-2. OPERATING PRECAUTIONS

WARNING: Improper operation of the lift truck may result in operator injury, or load and/or lift truck damage. Observe the following precautions when operating the LVE40 lift truck.

The following safety precautions must be adhered to at all times.

- Do not operate this truck unless you have been trained and authorized to do so.
- All warnings and instructions must be read and understood before using the equipment.
- Equipment must not be altered in any way.
- Equipment must be inspected by a trained qualified person on a regular basis.
- Do not exceed the rated capacity. Overloading may result in damage to the hydraulic system and structural components.

- Be certain that the lifting mechanism is operating smoothly throughout its entire height, both empty and loaded.
- Be sure that mast is vertical - do not operate on a side slope.
- Be sure the truck has a firm and level footing.
- Avoid overhead wires and obstructions.
- Check for obstructions when raising or lowering the lift carriage.
- Do not handle unstable or loosely stacked loads. Use special care when handling long, high, or wide loads to avoid tipping, loss of load, or striking bystanders.
- Center and carry the load as far back as possible toward the lift carriage back rest. The center-of-gravity of the load must not exceed the load center listed on the data plate. See [Figure 2-1](#) for load center limitations.
- Pick up loads on both forks. Do not pick up on only one fork.
- When traveling, always lower the load as far as possible.
- When stacking pallets in racks and it is necessary to move the load in a raised position, use caution. Operate truck smoothly.

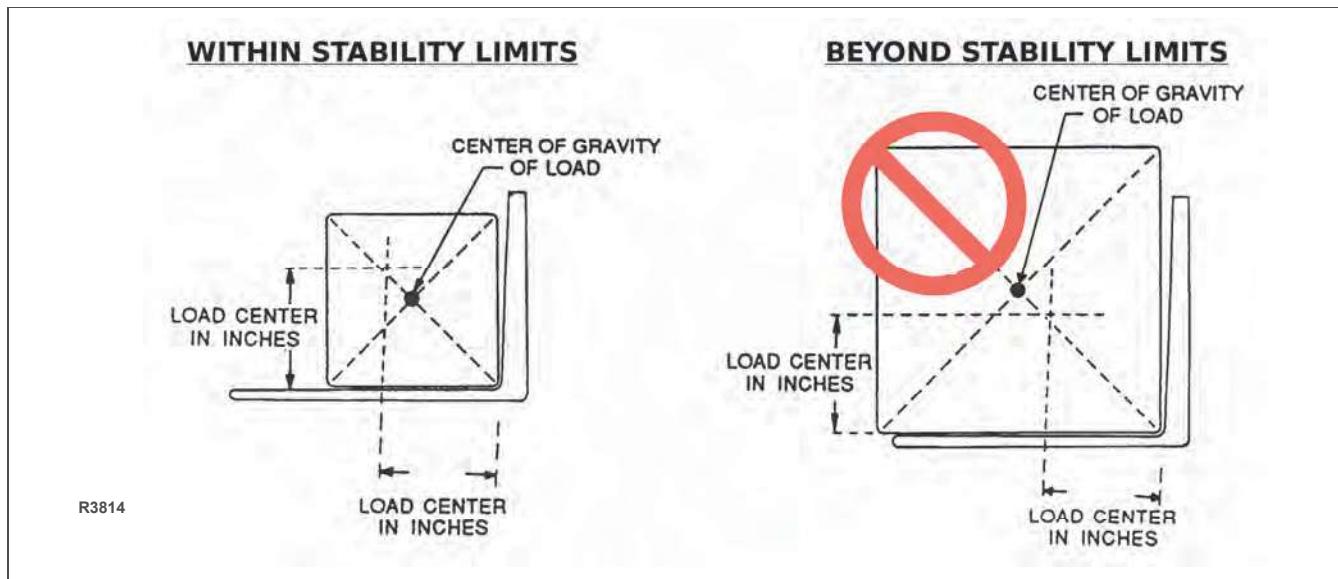


Figure 2-1 Load Center

- Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.
- Operate truck only from designated operation position. Never place any part of your body between the mast uprights. Do not carry passengers.
- Do not allow anyone to stand or pass under load or lifting mechanism.
- When leaving truck, neutralize travel control. Fully lower the forks and set parking brake. When leaving truck unattended, turn off key switch, remove key and disengage the emergency stop switch

2-3. BEFORE OPERATION

Table 2-1 covers important inspection points on the LVE40 lift truck which should be checked prior to operation. Depending on use, some trucks may require additional checks.

Figure 2-2 shows a sample format for an Operator Checklist, which can be modified as necessary to fit your operation.

Table 2-1 Operator Checks

ITEM	PROCEDURE
Transmission, hydraulic and cylinder systems	Check for signs of fluid leakage.
Forks	Check for cracks and damage; that they are properly secured.
Chains, cables and hoses	Check that they are in place, secured correctly, functioning properly and free of binding or damage.
Guards and load backrest	Check that safety guards are in place, properly secured and not damaged
Safety signs	Check that warning labels, nameplate, etc., are in good condition and legible.
Horn	Check that horn sounds when operated.
Steering	Check for binding or looseness when steering.
Travel controls	Check that the accelerator operates in all speed ranges in forward and reverse.

WARNING: Periodic maintenance of this truck by a QUALIFIED SERVICE TECHNICIAN is required.

CAUTION: A QUALIFIED SERVICE TECHNICIAN should check the truck monthly for proper lubrication, proper fluid levels, brake maintenance, motor maintenance and other areas specified in the SECTION 3.

WARNING: If the truck is found to be unsafe and in need of repair, or contributes to an unsafe condition, report it immediately to the designated authority. Do not operate it until it has been restored to a safe operating condition. Do not make any unauthorized repairs or adjustments. All service must be performed by a qualified service technician.

ITEM	PROCEDURE
Wheels	Check front drive wheel for cracks or damage. Move truck to check load wheel for freedom of rotation.
Hydraulic controls	When unloaded check the operation of lift, tilt and side shift. Make sure the side shift can reach their maximum positions left and right.
Brakes	Check that the brake pedal engages and disengages the brakes.
Parking brake	Check that the parking brake button engages and disengages the brakes.
Emergency stop switch	Check that emergency stop switch can be disengaged and reengaged. Full truck power should be interrupted and restored with the switch.
Battery charge	Check the instrument panel battery indicator.



BIG LIFT LLC LIFT TRUCK SALES AND SERVICE

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Electric Truck Daily Operator Checklist

Date: _____ Operator: _____

Truck No.: _____ Serial Number: _____

Department: _____ Shift: _____

Hour Meter Reading Drive: _____ Hour Meter Reading Lift: _____

Daily Check	O.K.	Repairs Needed
Load Wheels:	_____	_____
Drive Tire:	_____	_____
Mast:	_____	_____
Chains:	_____	_____
Forks:	_____	_____
Load Backrest:	_____	_____
Seatbelt:	_____	_____
Covers Secured:	_____	_____
Steering:	_____	_____
Hydraulic Leaks:	_____	_____
Transmission Leaks:	_____	_____
Cylinder Leaks:	_____	_____
Attachment:	_____	_____
Key Switch:	_____	_____
Horn:	_____	_____
Lights:	_____	_____
Brakes:	_____	_____
Emergency Stop Switch:	_____	_____
Lift/Lower:	_____	_____
Forward/Reverse:	_____	_____
Tilt Forward/Backward:	_____	_____
Battery Disconnect:	_____	_____
Battery Charger:	_____	_____
Safety Decals/Data Plate:	_____	_____

Operators Signature: _____

TO BE COMPLETED BY THE DESIGNATED OPERATOR AND FORWARDED TO THEIR SUPERVISOR PRIOR TO BEGINNING OF SHIFT

CAUTION: This is not a complete list of all items which may require attention. Operators are responsible for ensuring the truck is in proper working condition in accordance with the manufacturers' specifications.

DO NOT operate the truck if a problem is detected. Report all problems immediately to your supervisor .The truck should be tagged and taken out of service.

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Figure 2-2 Sample of Operator Check List

2-4. GENERAL CONTROL OPERATION.

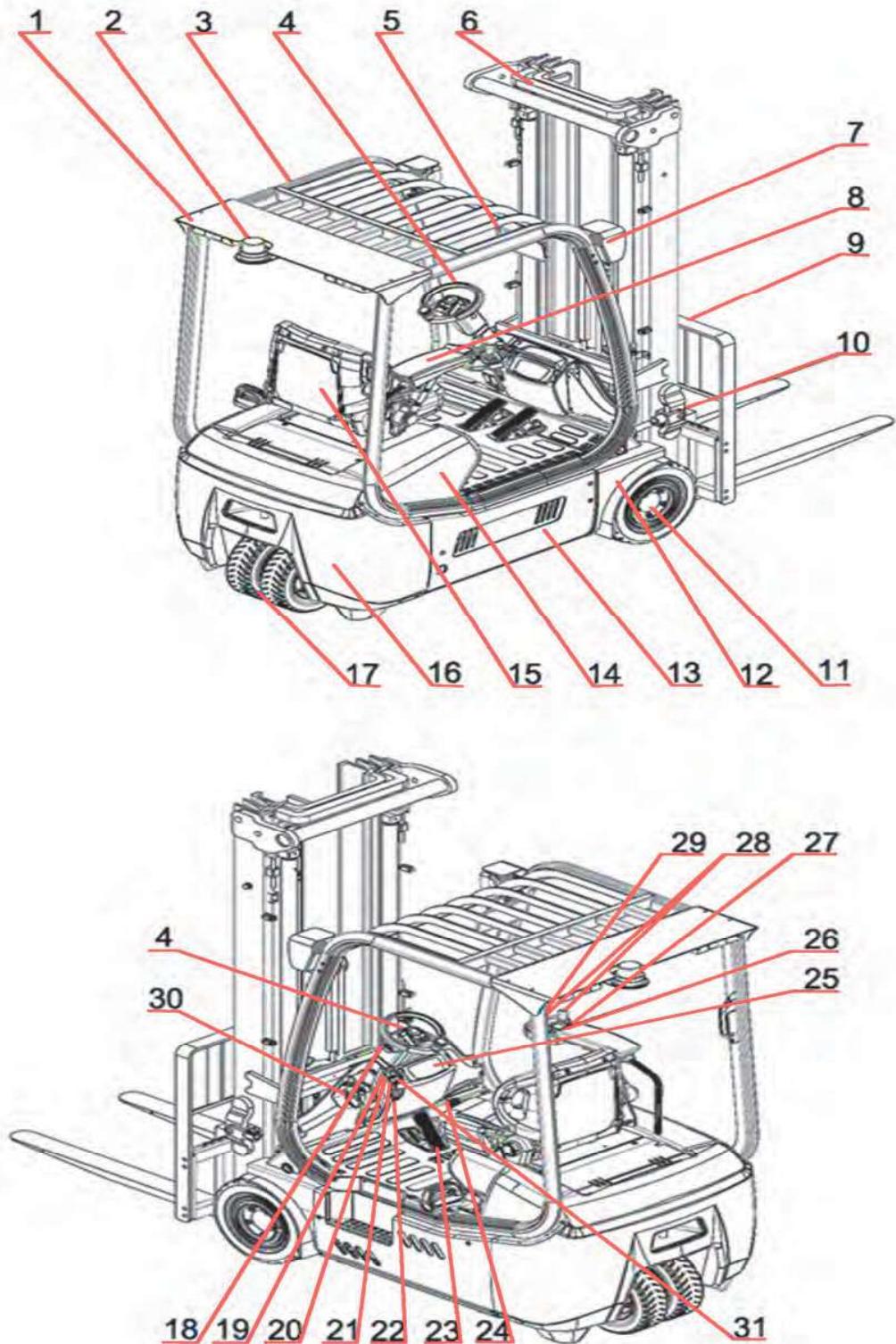


Figure 2-3 Controls

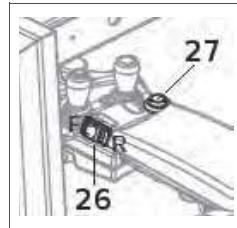
2-4.1. Parking Brake Switch (21)

Push on the parking brake button (21) to apply brakes. To release the brakes, press the button again.

2-4.2. Directional Shift Button (26)

The directional switch (26) controls forward, neutral and reverse travel. The truck will move in the direction that the switch is positioned. When the switch is pushed forward the truck will move forward (fork direction) and when the switch is pulled back the truck will move in reverse. If the switch is in the middle position the truck is in neutral and it will not drive forward or reverse.

If the switch changes position while driving the electric brake will engage and reduce the speed to a stop and then engage the drive according to the new position of the switch.

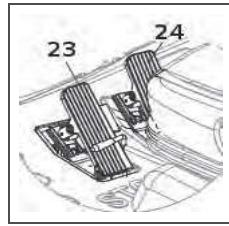


2-4.3. Horn Button (27)

Use switch to sound the horn.

2-4.4. Brake Pedal (23)

Press the brake pedal (23) to slow or stop.



2-4.5. Accelerator Pedal (24)

As the accelerator pedal (24) is slowly pressed, the drive motor starts turning and the truck will begin to move. The speed is proportional to the pedal position.

2-4.6. Steering Wheel (4)

The steering wheel (4) is operated in the conventional manner. The rear wheels steer the truck causing the rear of the truck to swing out when a turn is made. When steering wheel is turned to the right the truck will turn to the right and when turned to the left the truck will turn left.

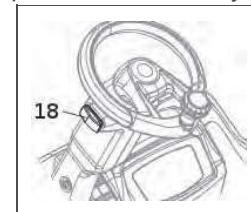
2-4.7. Rear Combination Light (1)

This combined light (1) operates the turn signals, brake lights and the reversing lights.

2-4.8. Turn Signal (18)

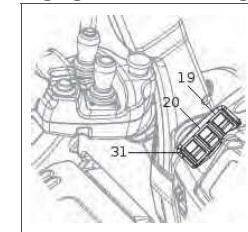
Move the switch (18) backward to indicate a left turn or forward to indicate a right turn

NOTE: The switch does not automatically return to the neutral position. Reset it by hand.



2-4.9. Head Light Switch (19)

The light switch (19) has two positions. First position engages the combination lamp running lights. The second position engages the headlights.



2-4.10. Strobe Light Switch (20)

Use switch (20) to turn on or off the strobe light.

2-4.11. Blue Light Switch (31)

Use switch (31) to turn on or off the blue light.

2-4.12. Head Lights (7)

LED headlights (7) with floodlight and steering lights are installed at the front of the truck on the overhead guard.

2-4.13. Key Switch (22)

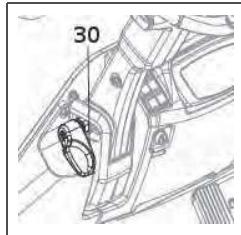
The key switch (22) has two positions, ON and OFF. Be sure the directional switch is in the neutral position and the acceleration pedal is released before the key switch is turned on.

Removing the key prevents the truck from being used by unauthorized personnel.

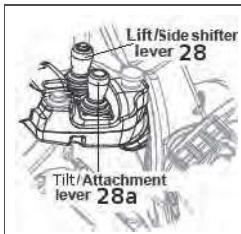
NOTE: If the directional switch is not in neutral or the acceleration pedal is depressed, an error code may appear on display (9) and the truck won't operate. When the correct procedure is used, the error code will clear.

2-4.14. Steering Column Tilt Lever (30)

This lever (30) is used to adjust the steering column to suit individual operators (range is -12.5 degrees). Move the lever counterclockwise and adjust the steering column. Then move the lever clockwise to lock the column in place.



2-4.15. Four Way Rocker Switch (28)



2-4.15.1. Lift Control Lever (28)

This lever is used to lift the forks. Pulling the lever backwards will raise the forks. Pushing it forward will lower the forks. The speed of the lift/lowering can be controlled by the pressure on the lever. Motor speed or accelerator pedal does not affect the lowering speed.

2-4.15.2. Side Shift Control Lever (28)

This lever is used to side shift the forks (Left/Right). Pushing the lever to the left will side shift left and pushing the lever to the right will side shift right. The speed of the side shift can be controlled by the pressure on the lever.

2-4.15.3. Tilt Control Lever (28a)

This lever is used to tilt the mast. Pulling the lever back will tilt the mast backwards. Pushing it forward will tilt the mast forward. The speed of the tilt can be controlled by the pressure on the lever.

NOTE: The hydraulic control valve has a built in tilt Lockout mechanism that will not allow the mast to tilt forward when the truck is shut down.

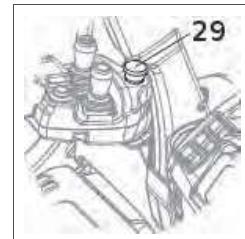
2-4.15.4. Attachment Lever (28a)

If the forklift is equipped with an attachment this lever will control the function of the attachment.

2-4.16. Emergency Stop Switch (29)

This switch is used to cut off the main power to the truck in case of an emergency.

NOTE: Do not use this as a substitute to the key switch.

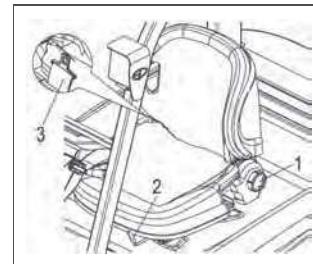


2-4.17. Seat Adjustment

Before operating the truck, adjust the operator's seat so that it suits the operator. The seat can be moved forward or backwards by using the lever (2) and pushing the seat forward or backwards. After releasing the lever (2) make sure that the seat is locked in place by moving the seat forward or backwards until you hear that it's locked in place.

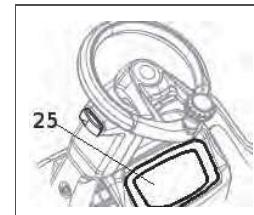
You can adjust the seat back angle by rotating the knob (1) clockwise or counter clockwise to the desired angle.

Before operating the truck make sure to buckle the seat belt (3)..



2-4.18. Instrument Panel (25)

The instrument panel (25) contains various displays and controls (see section for Instrument Panel below).



2-5. THE INSTRUMENT PANEL

The instrument panel contains the following displays and controls:

Refer to the following illustration for the location of the displays and controls.

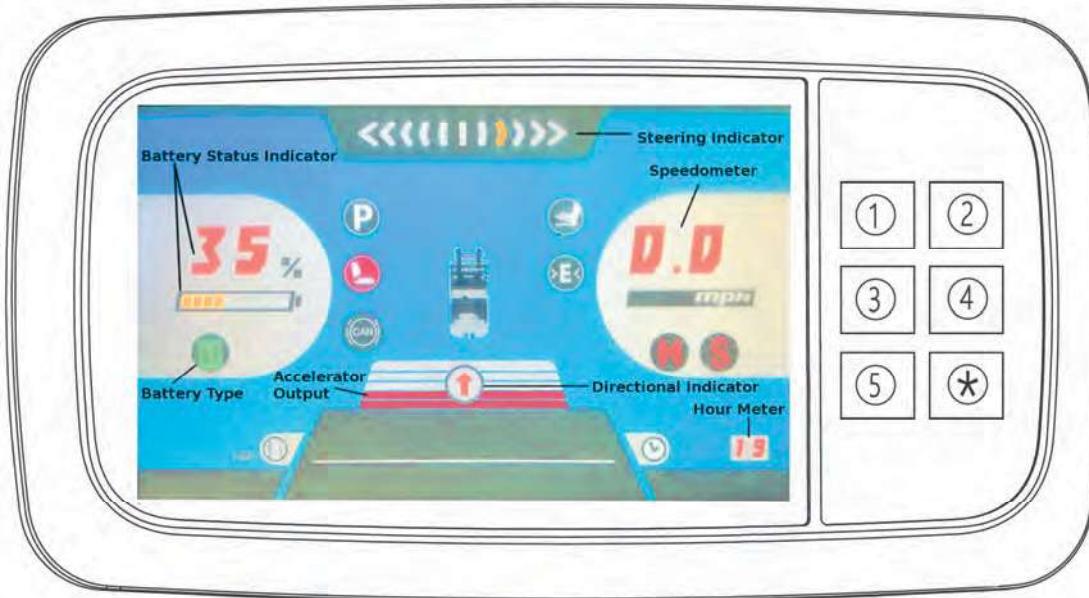


Figure 2-4 Instrument Panel

2-6. LED DISPLAY

When the key switch is turned on, the system will self-diagnose and the LED display will show battery capacity among other data. A blank LED display indicates a dead battery. The battery should be charged when the low battery warning indicator is on (20%).

If you reach that level the truck will only be able to operate the drive function so the lift function is not available. Notify your supervisor or proper authority.

When traveling, the LED display will show the truck speed.

When an internal fault occurs, the LED display will show a fault code. Notify your supervisor or proper authority.

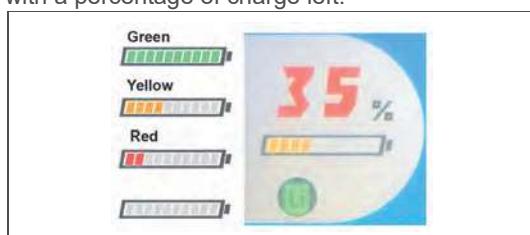
2-7. LED INDICATORS

These are the indicators:

2-7.1. Battery Indicator:

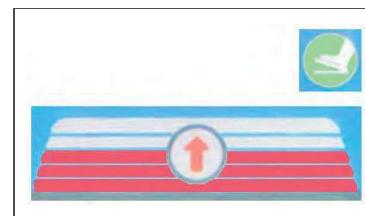
This will display the charge of the battery, 10 bars is equal to a fully charged battery.

The charge of the battery is also indicated above the led bars with a percentage of charge left.



2-7.2. Accelerator Information:

The acceleration will be displayed by a moving led bar. When the accelerator pedal is pushed down you will see the accelerator icon light up and the led bars will start to fill in from the bottom to top showing how much you have left to accelerate.

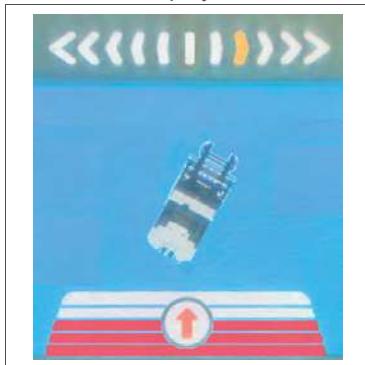


In the accelerator bar field you will see a circle that will show an arrow pointing in the direction your directional switch is positioned. If you see the letter "N" that means you are in Neutral position.



2-7.3. Driving Direction:

At the top of the display there is an area that have white arrows pointing to the left and right with a yellow bar in the center when the steering wheel is centered. The more you turn the steering wheel the yellow bar will travel to the left or right depending on which direction you are turning the wheel and at the same time the display will show a truck turning.



2-7.4. Fault Code Information:

This area will show fault code information

1. Fault Code
2. Failure Node
3. Failure Description



2-7.5. Display Icons:

	If this icon is on the display the truck is in high speed mode.
	If this icon is on the display the truck is in medium speed mode (default).
	If this icon is on the display the truck is in low speed mode.
	If this icon is on the display the truck is in high acceleration mode.
	If this icon is on the display the truck is in normal acceleration mode (default).

	If this icon is on the display the truck is in low acceleration mode.
	If this icon is red the parking brake is on.
	If this icon is red the truck is on and the seat switch is open.
	If this icon is red the brake pedal has been activated.
	If this icon is red the accelerator pedal has been activated.
	If this icon is grey the brake pedal has not been activated.
	If this icon is green the brake pedal has been activated with low pressure.
	If this icon is orange the brake pedal has been activated with medium pressure.
	If this icon is red the brake pedal has been activated with high pressure.
	If this icon is on the display the low battery protection is on and lift function is cut off.
	If this icon is on the display the low battery protection is on. Lift function is cut off and speed is reduced to 50% of max speed.
	If this icon is on the display the low battery protection is on. Lift function is cut off and speed is reduced to 30% of max speed.
	If this icon is on the display the low battery protection is on. Hydraulic and drive functions are cut off.
	This shows the total operating hours
	This shows the speed in miles per hour (mph).

2-8. CONTROL BUTTONS

There are six control buttons :

	Enter Button: Used to enter changes.
	Roll Up Button: Used to change highlighted digit on the instrument panel display.
	Roll Down Button: Used to change highlighted digit on the instrument panel display.
	Set Up Button: Used to shift the highlight to the previous digit on the instrument panel display.
	Set Down Button: Used to shift the highlight to the following digit on the instrument panel display.
	Out Button: Used to cancel changes.

2-9. PREPARING FOR OPERATION

Preparing the truck for operation after delivery or transport:

1. Visually inspect the entire truck (in particular wheels and forks) for obvious damage.
2. Check the hydraulic oil level. Refer to SECTION 3.
3. Charge the battery. Refer to SECTION 3.

2-10.DURING BREAK-IN

Operating the truck under light load conditions is recommended. Limited load is 70 to 80% of the rated load. During the first 100 hours of operation observe the following:

1. Prevent the new batteries from over-discharging.
2. Perform preventive maintenance services carefully and completely.
3. Avoid sudden stops, starts or turns.
4. Perform oil changes and lubrication.

2-11.STARTING THE TRUCK

1. Place the directional switch in neutral.
2. Hold the steering wheel, keep your foot off the accelerator pedal and turn on key switch.
3. Slightly lift and tilt the forks back.

2-12.DRIVING AND STOPPING PROCEDURES

2-12.1.Travel

1. Place the directional switch in forward or reverse.
2. Slowly step on the accelerator pedal until the desired speed is obtained.

WARNING: Do not step on the accelerator pedal and the brake pedal at the same time.

2-12.2.Decreasing Speed

1. Slowly release the accelerator pedal. The truck will decelerate. You can also apply the brake and that will slow the speed down.

2-12.3.Steering

The steer wheels are located at the rear of the truck causing the rear to swing out when turning. Slow down and turn the wheel in the desired direction of travel.

2-12.4.Stopping and Parking

1. Slow down and press the brake pedal to stop the truck.
2. Place the directional switch in neutral.
3. Activate the parking brake.
4. Tilt the forks until parallel with the floor.
5. Lower the forks to the ground.
6. Turn off the key switch and remove the key.

2-13.LOADING AND UNLOADING

2-13.1>Loading

1. Place the truck in front of the load.
2. Adjust the forks sideways to maintain proper balance of the load. Keep forks as wide as the load allows.
3. The pallet should be evenly positioned across both forks.
4. Insert the forks into the pallet a far as possible.

5. To raise the load from the ground:
 - a. Slightly lift the load.
 - b. Be sure the load is stable.
 - c. Tilt the forks back to level the load.
6. When handling bulky loads which restrict your vision, operate the truck in reverse except when climbing grades

2-13.2.Unloading

1. Tilt the forks forward, to level the load.
2. Slowly lower the load to the ground.
3. Check around the truck to ensure that the path of travel is unobstructed and back away slowly.
4. Lift the forks slightly off the ground and tilt them back.
5. Drive to your next destination.

2-13.3.Stacking

1. Slowly approach the deposit area.
2. Stop the truck in front of the area. Ensure truck is lined up straight to rack face/load area.
3. Check the condition of the deposit area.
4. Tilt the mast forward until forks are horizontal.
5. Raise the forks until they are a little higher than the deposit area.
6. Move forward to place the load directly over the desired area and stop the truck.
7. Make sure you load is just over the desired area and slowly lower the load into position. Make sure the load is securely stacked.
8. Disengage forks from the load using necessary lift and tilt operation. Check around the truck to ensure that the path of travel is unobstructed and back away slowly.
9. After making sure the fork tips are clear of the load, lower the forks and tilt backwards.

2-13.4.Un-stacking

1. Slowly approach the load to be retrieved.
2. Stop the truck right in front of the load. Ensure truck is lined up straight to load.

3. Check the condition of the load.
4. Tilt the mast forward until forks are horizontal.
5. Raise the forks up to the position of the pallet or skid.
6. Make sure the forks are positioned properly for the pallet. Slowly move forward to insert the forks into the pallet as far as possible and then stop the truck.
7. Make sure you have clearance above your load and slowly lift the load.
8. Check around the truck to ensure that the path of travel is unobstructed and back away slowly.
9. Lower the forks and tilt backwards.
10. Drive to your next destination.

2-14.PARKING

When finished with moving loads, return the truck to its maintenance or storage area. Turn off the key switch. Charge the battery as necessary. Refer to battery care instructions.

SECTION 3

PLANNED MAINTENANCE

3-1. GENERAL

Planned maintenance consists of periodic visual and operational checks, parts inspection, lubrication, and scheduled maintenance designed to prevent or discover malfunctions and defective parts. The operator performs the checks in [SECTION 2](#), and refers any required servicing to a trained, qualified service technician who performs the scheduled maintenance and any required servicing.

3-2. MONTHLY AND QUARTERLY CHECKS

[Table 3-1](#) is a monthly and quarterly inspection and service chart based on normal usage of equipment eight hours per day, five days per week. If the lift truck is used in excess of forty hours per week, the frequency of inspection and service should be increased accordingly. These procedures must be performed by a trained, qualified service technician or your Big Lift LLC Service Representative.

3-3. BATTERY CARE

3-3.1. General

The LVE40 lift trucks is equipped with a lithium-ion battery.

Voltage leakage from battery terminals to battery case can cause misleading trouble symptoms with the truck electrical system. Since components of the truck electrical system are insulated from truck frame, voltage leakage will not normally affect the truck operation unless a short circuit or breakdown of circuit wire insulation to truck frame occurs.

The care and maintenance of the battery is very important in order to obtain efficient truck operation and maximum battery life. Make sure that the battery stays clean in order to avoid voltage leakage and misleading troubleshooting symptoms.

Although a voltage leakage reading of zero volts may not be possible, a cleaner battery will have more usable charge for truck operation and not affect operation of electronic devices on the unit.

Table 3-1 Monthly and Quarterly Inspection and Service Chart

INTERVAL	VISUAL CHECKS	INSPECTION OR SERVICE
Monthly	Check rear steering wheels for wear or damage.	
Monthly	Inspect wiring for loose connections and damaged insulation.	
Monthly	Check Operator Presence switch for proper operation.	
Monthly	Check lift chain tension, lubrication & operation (see paragraph 3-7.)	
Quarterly	Check lift cylinder for leakage.	
Quarterly	Check for excessive jerking of steering when stopping or starting.	
Semi-annually	Inspect for chain wear (See SECTION 8)	

3-3.2. Safety Rules

- Wear protective clothing, such as rubber apron, gloves, boots and goggles when performing any maintenance on battery.
- Do not lay metallic or conductive objects on battery. Arcing will result.
- Do not touch non-insulated parts of DC output connector or battery terminals to avoid possible electrical shock.
- De-energize all AC and DC power connections before servicing battery.
- Do not charge a frozen battery.
- Do not use charger if it has been dropped or otherwise damaged.

3-3.3. Battery Care and Charging

CAUTION: Never smoke or bring open flame near the battery.

1. Charge the battery only in areas designated for that use.
2. Make certain battery used meets weight and size requirements of truck. NEVER operate truck with an undersized battery.
3. For more information please see Battery Manufacturers Recommendations.

3-4. CHARGING BATTERY

Charging requirements will vary depending on depth of discharge and temperature. Follow safety rules when placing a battery on charge.

Proceed as follows:

1. Park truck at charging station with carriage lowered and turn the key switch off.

2. Apply the parking brake.

3. Check the condition of the AC cord and the charger cable and pins. If there are any cuts in the cable, any exposed wires, loose plugs or connectors, DO NOT attempt to charge the battery. Contact appropriate personnel for repairs to be made.

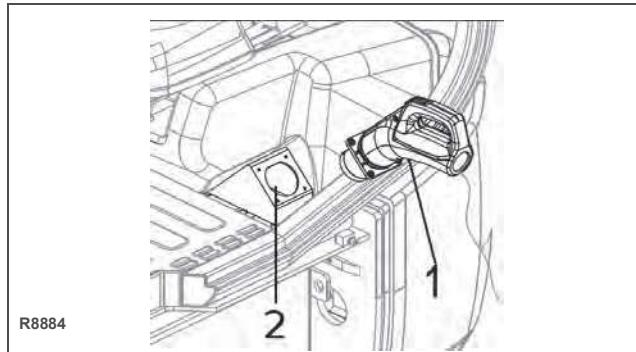
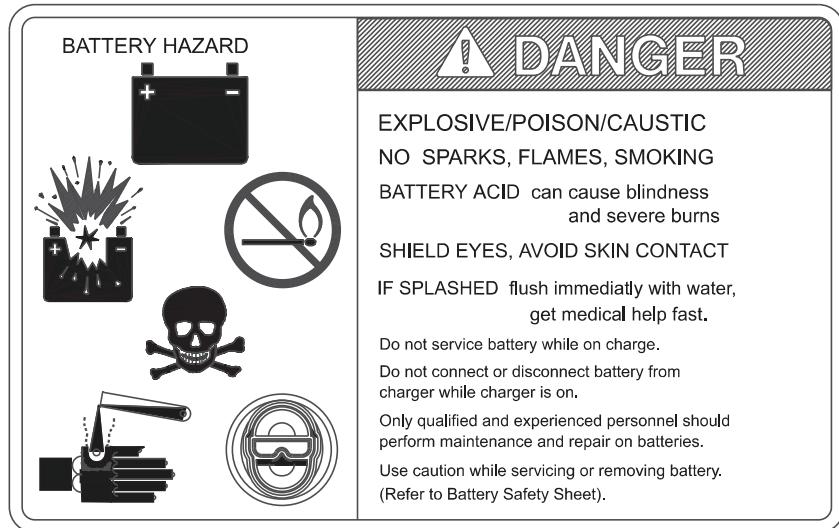


Figure 3-1 Charging Port

4. Locate the charging port (2, [Figure 3-1](#)) on the left side of the truck and open the lid.
5. Connect the charging connector (1).
6. Connect the charger to the appropriate power supply.

NOTE: The battery charging station should be plugged into a standard 480 V, 240V, or 120 Volt depending on the incoming power requirements of the selected lift truck supplied and approved charger. The charging connector may only be connected or disconnected when the key switch and emergency switch on the truck and the charger are turned off.



3-5. BATTERY

3-5.1. Battery Removal

1. Park truck on level floor with carriage lowered, apply the parking brake and turn the key switch off and engage the emergency disconnect switch.
2. Remove the two screws (8, Figure 3-2) that secures the left side battery cover door (1) and remove the door.

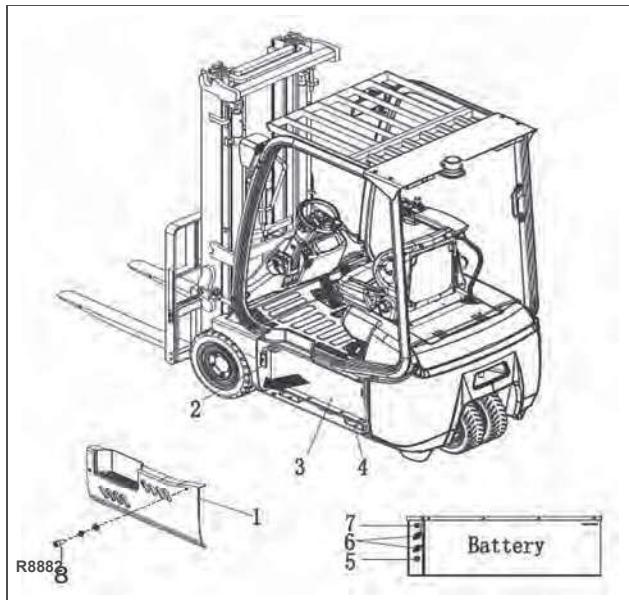


Figure 3-2 Battery

3. Remove the two bolts from the left door mounting plate (2) and remove the mounting plate.
4. Remove the two bolts (4) that secures the battery shelf to the chassis.

5. Remove the power cable (6).
6. Remove the charge communication cable (7).
7. Remove the discharge communication cable (5).
8. Use a forklift and carefully lift the battery out of the truck using the fork pockets under the battery.

3-5.2. Battery Installation

1. Install in reverse order of paragraph 3-5.1.

3-6. LUBRICATION.

Refer to for the recommended types of grease and oil. [Table 3-3](#) in conjunction with [Figure 3-3](#) identifies the items requiring lubrication.

3-7. LIFT CHAIN MAINTENANCE.

Fully raise and lower lift carriage while observing chains as they move over chain sheaves. Ensure chain is aligned and tracking properly and all links are pivoting freely. With lift carriage fully lowered, spray or brush on a film of SAE 30 or 40 engine oil.

**Table 3-2 Recommended Lubricants
(See [Table 3-3](#) for Application)**

A	Hydraulic oil - L-HM32# (Cleanliness grade 9, in compliance with NAS1638) 189" Lift = 4.73 Gallons (17.9L) 197" Lift = 4.85 Gallons (18.35L)
B	Multi-purpose Grease - Polylub GA 352P
C	Heavy duty gear oil - ATF220

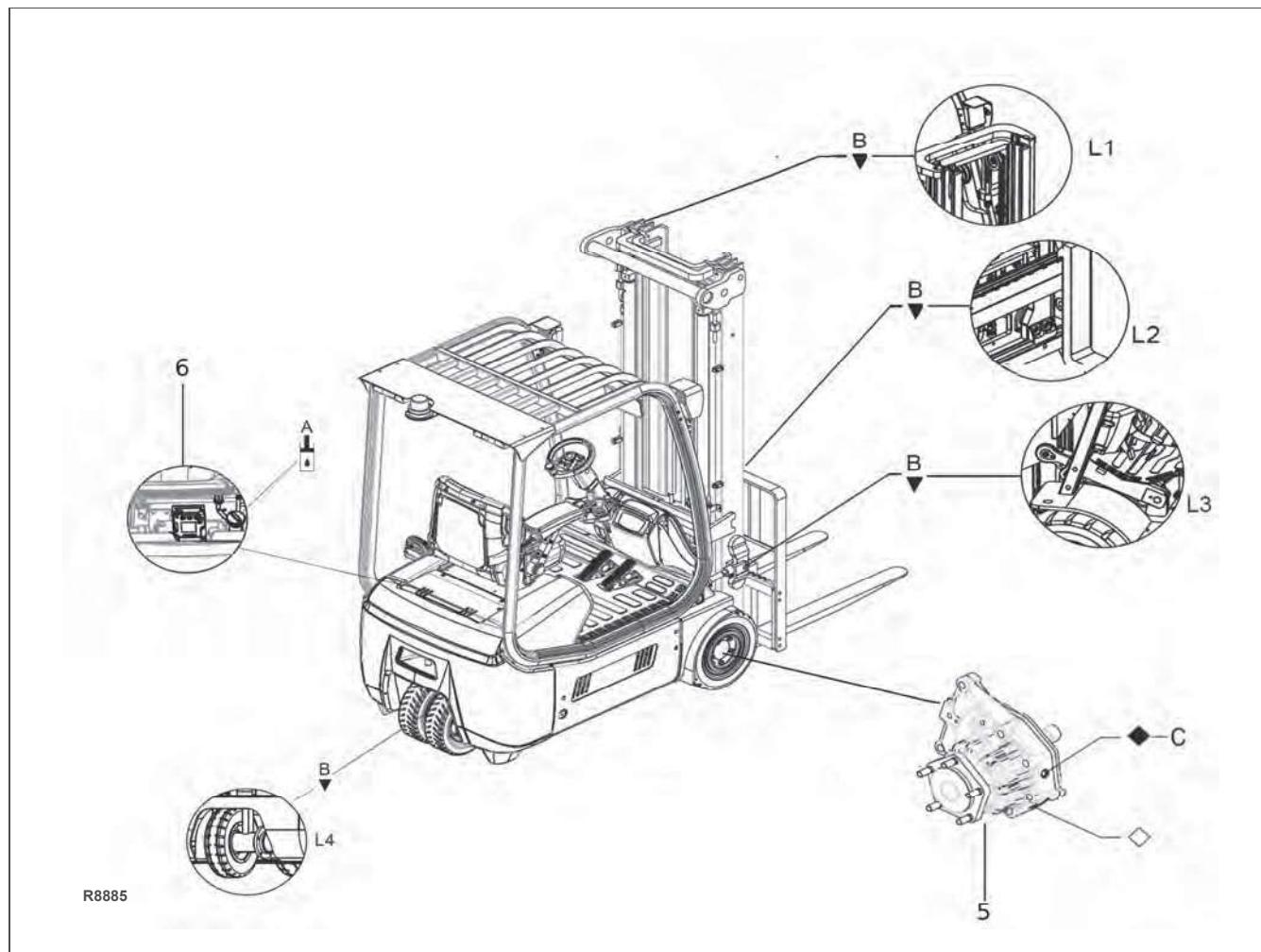


Figure 3-3 Lubrication Diagram

Table 3-3 Lubrication Chart

FIG 3-4 INDEX NO.	LOCATION	METHOD OF APPLICATION	TYPE (Table 3-2)	APPLICATION OF LUBRICANT
L1	Lift Chain	Spray	B	See Paragraph 3-7.
L1	Inner & Outer Mast	Spray	B	Full length of channel where rollers operate.
L2	Lift Carriage	Spray	B	Light coating where forks slide.
L3	Mast Mounting Shaft	Spray	B	Apply as needed
L4	Rear Steering Wheels	Can	B	Apply as needed
5	Transmission	Can	C	Fill to level plug.
6	Hydraulic Reservoir	Can	A	With lift carriage fully lowered, fill reservoir with hydraulic oil to level on dip stick.

SECTION 4

TROUBLESHOOTING

4-1. GENERAL

Use Table 4-1 as a guide to determine possible causes of trouble. The table is divided into five main categories: "Power Supply Failure",

"Vehicle Does Not Operate Forward or Reverse", "Hydraulic Problems with Lifting and Lowering", "General Problems With Lifting Or Lowering", "Trouble With Steering" and "Miscellaneous malfunctions".

Table 4-1 Troubleshooting Chart

NOTE: Carry out the corrective actions in the order listed for each malfunction.		
MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
POWER SUPPLY FAILURE		
• Whole vehicle power outage	a. Power supply failure. b. Fuse failure. c. Emergency stop switch or circuit failure. d. Key switch or circuit failure.	1. Check the voltage of storage battery. 2. Check the fuses. 3. Check emergency stop switch and its circuit. 4. Check key switch and its circuit.
VEHICLE DOES NOT OPERATE FORWARD OR REVERSE		
• Forward and reverse operation failure but other functions are normal.	a. Parking brake switch and seat switch or its circuit connection failure. b. Gearbox failure. c. Travel switch or its circuit connection failure. d. Drive motor or its circuit connection failure. e. Controller failure.	Controller failure error, carry out troubleshooting according to the fault code information on the instrument. 1. Check if parking brake switch and seat switch or the connection of its circuit is normal. 2. Check the gearbox. 3. Check the travel switch and its connection circuit. 4. Check the drive motor and its connection circuit. 5. Replace the controller.
• No travel at high speed.	Failures due to external factors: a. Motor bearing binding. b. Gearbox bearing binding. Failures due to internal factors: a. Drive motor speed encoder failure. b. Controller failure.	Controller failure error, carry out troubleshooting according to the fault code information on the instrument. 1. Check if the motor bearing and rotation is normal. 2. Check the speed encoder and its connection circuit. 3. Remove the gearbox, check if the gear rotation is smooth and if there is something blocking the movement. Check the gearbox bearing so that it's not binding. 4. Replace the controller

Table 4-1 Troubleshooting Chart - Continued

NOTE: Carry out the corrective actions in the order listed for each malfunction.		
MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
HYDRAULIC PROBLEMS WITH LIFTING OR LOWERING		
• Fork carriage not lifting.	<p>If pump motor does not work:</p> <ul style="list-style-type: none"> a. Parking brake switch and seat switch or its circuit connection failure. b. Pump motor or its circuit connection failure. c. Control switch or its circuit connection failure. d. Controller failure. 	<ul style="list-style-type: none"> 1. Check if parking brake switch and seat switch or the connection of its circuit is normal. 2. Check the pump motor and its connection circuit. 3. Check the lift/tilt lever and its connection circuit. 4. Replace the controller.
	<p>If pump motor does work:</p> <ul style="list-style-type: none"> a. Load too heavy. b. Not enough hydraulic oil. c. Hydraulic pipe/hose leaking. d. The pump motor is in reverse rotation. e. Cylinder failure. f. Solenoid valve is blocked and can't reset. g. Valve body failure: Excessive wear of lift pump, internal leaks, insufficient pressure or blocked relief valve or check valve. 	<ul style="list-style-type: none"> 1. Refer to capacity rating on name plate. 2. Lower the mast to the floor and make sure that the amount of hydraulic oil meets the requirements. 3. Check the truck and make sure that there are no leaks on any of the pipes/hoses. 4. Check the pump motor wiring. 5. Check the cylinders for leaks or damages, if needed remove cylinder and check for wear and tear. 6. Clean or replace the solenoid spool. 7. Clean or replace the valve body.
• Fork carriage not lowering	<ul style="list-style-type: none"> a. Solenoid valve (or manual valve) or its circuit connection failure. b. Lowering switch or its circuit connection failure. c. Cylinder damage. d. Valve failure. e. Explosion-proof valve blocked 	<ul style="list-style-type: none"> 1. Check the lowering button and its connection circuit. 2. Check the solenoid valve and its connection circuit. 3. Check the cylinder for deformation, remove the cylinder to check if the internal assembly is undamaged. 4. Clean or replace the valve. 5. Replace the explosion-proof valve.

NOTE: If the lift and lowering function normal but there is a hydraulic failure to either the tilt or side shift perform troubleshooting on the corresponding control switch and circuit.

Table 4-1 Troubleshooting Chart - Continued

NOTE: Carry out the corrective actions in the order listed for each malfunction.		
MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
GENERAL PROBLEMS WITH LIFTING OR LOWERING		
<ul style="list-style-type: none"> • Fork carriage lifts slowly • Fork carriage lowers slowly • Uneven lifting or lowering of fork carriage. 	<ul style="list-style-type: none"> a. Overloaded b. Hydraulic pipe / hose leak. c. Valve failure: Lift pump wear, internal leakage, insufficient relief valve pressure or a blockage. a. Solenoid valve blocked. b. Valve body failure: Throttle valve failure or blockage a. Slack in the Lift chain. b. Poor lubrication between the mast channel and rollers. c. Improper adjustment or blocked rollers. 	<ul style="list-style-type: none"> 1. Refer to the load capacity rating on name plate. 2. Check hydraulic pipe / hose for leaks and replace. 3. Clean or replace the valve body. 1. Clean or replace the solenoid spool. 2. Clean or replace the valve body. 1. Adjust the chain tension 2. Check the mast channel grease, clean and re-lubricate mast and rollers as needed. 3. Adjust the side roller spacing by using the roller screw or replace the roller.
NOTE: If the lift and lowering is functioning normally but there is a hydraulic failure to either the tilt or side shift perform troubleshooting on the corresponding control switch and circuit.		
TROUBLE WITH STEERING		
<ul style="list-style-type: none"> • No steering but forward and reverse is working. 	<ul style="list-style-type: none"> a. Steering potentiometer or it's circuit connection failure. b. Redirector or hose connection failure. c. Steering bridge or hose connection failure. d. Pump motor failure. e. Gear pump failure. f. Pump controller failure. 	<p>Controller failure error, carry out troubleshooting according to the fault code information on the instrument.</p> <ul style="list-style-type: none"> 1. Check the steering potentiometer or its connection circuit. 2. Check if the mechanical connection between steering wheel and redirector is solid. 3. Check the redirector or the hose connections. 4. Check the steering bridge or the hose connections. 5. Check the pump motor or it's connection circuit. 6. Check the pump. 7. Replace the controller.
MISCELLANEOUS PROBLEMS		
<ul style="list-style-type: none"> • Lights do not turn on 	<ul style="list-style-type: none"> a. Light failure or it's circuit is not connected. b. Lighting switch or it's circuit connection failure. c. Fuse failure. d. DC-DC converter failure. 	<ul style="list-style-type: none"> 1. Check the light and it's circuit connection. 2. Check the lighting switch and its connection circuit. 3. Check the fuse and its connection circuit. 4. Check the DC-DC converter and its connection circuit.

Table 4-1 Troubleshooting Chart - Continued

NOTE: Carry out the corrective actions in the order listed for each malfunction.		
MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
• Horn does not sound	a. Horn switch or it's circuit is not connected. b. Horn failure. c. Fuse failure. d. DC-DC converter failure.	1. Check the horn button and it's circuit connection. 2. Check the horn and it's connection circuit. 3. Check the fuse and it's connection circuit. 4. Check the DC-DC converter and it's connection circuit.

4-2. CONTROLLER TROUBLESHOOTING

4-2.1. Zapi Smart Console Handset

A Zapi Smart Console Handset is available and it is designed specifically for use with the Zapi controller. It serves multiple functions such as reading diagnostic data, testing vehicle operation, setting options, making adjustments and parameter changes to the controller. The Zapi Smart Console Handset is available through your Big Lift LLC dealer. If you require dealer location information, contact Big Lift LLC.



Figure 4-1 Zapi Controller

4-2.2. Fault Detection

4-2.2.1. General

The microprocessor in the controller records the last five Alarms that have occurred. Items remembered relative to each Alarm are:

- The alarm code
- The times that each alarm occurs consecutively
- The Hour Meter value when the latest event for each alarm occurred

This function permits a deeper diagnosis of problems as the recent history can be revisited.

4-2.2.2. Logbook Access

Locate the 4 Pin Can Connection Under the dash board below the display. Push & press the Power On Button for 3s the display will show

1. Press the \triangleleft or \triangleright button until CAN CONSOLE shows on the display.
2. The display will show:
Cons AFG ZP021* CAN CONSOLE
Press OK to go into the CAN COSOLE Menu.
3. The display will show:
SELECT NODE X
Press the \triangleleft or \triangleright to toggle between the different nodes: 2 for Traction, 5 for Lift Pump and 6 for Steering.
Press OK to go into the controller you picked.
4. The display will show one of the following depending on which node you picked:
A0ML2BCPTVEPx.xx = NODE 2
A0ML2BCPTVEPx.xx = NODE 5
EPSDC05 EPx.xx = NODE 6

Press OK to go into the Main Menu. **Main Menu**

press \triangleleft or \triangleright button to go the Alarms menu then press OK.

5. To clear the Alarm faults press the F1 button, it will ask if you are sure press OK, then the ESC Button.

4-2.3. Testing Vehicle Operation.

Locate the 4 Pin Can Connection on the harness under the dashboard.

1. Push & press the Power On Button for 3s the display will show **Cons AFG ZPxxxx**
2. Press the \wedge or \vee button until CAN CONSOLE shows on the display.
3. The display will show:
Cons AFG ZP021*CAN CONSOLE
Press OK to go into the CAN COSOLE Menu.
4. The display will show:
SELECT NODE X
Press the \wedge or \vee to toggle between the different nodes: 2 for Traction, 5 for Lift Pump and 6 for Steering.
Press OK to go into the controller you picked.
5. The display will show one of the following depending on which node you picked:
A0ML2BCPTVEPx.xx = NODE 2
A0ML2BCPTVEPx.xx = NODE 5
EPSDC05 EPx.xx = NODE 6

Press OK to go into the Main Menu.

Main Menu

*press \wedge or \vee to TESTER,
press OK and you can test and see the status of
the electrical system.*

6. Press the **ESC** button to get out of that menu

4-2.4. Factory Settings

Parameter settings are not to be changed from factory settings without explicit written permission from Big Lift LLC. To verify the parameter settings proceed as follows and refer to **Table 4-2: Locate the 4 Pin Can Connection on the harness next to the Zapi controllers**

1. Push & press the Power On Button for 3s the display will show: **Cons AFG ZPxxxx**
2. Press the \wedge or \vee button until CAN CONSOLE shows on the display.
3. The display will show:
Cons AFG ZP021*CAN CONSOLE
Press OK to go into the CANCOSOLE Menu.

4. The display will show:

SELECT NODE X

Press the \wedge or \vee to toggle between the different nodes: 2 for Traction, 5 for Lift Pump and 6 for Steering.

Press OK to go into the controller you picked.

5. The display will show one of the following depending on which node you picked:

A0ML2BCPTVEPx.xx = NODE 2

A0ML2BCPTVEPx.xx = NODE 5

EPSDC05 EPx.xx = NODE 6

*Press OK to go into the Main Menu. **Main Menu***

*press \wedge or \vee to PARAMETER CHANGE,
press OK and you can adjust Parameters in the
electrical system.*

6. Press the ESC button to get out of that menu, it will ask you Do you want to save changes. Press OK to apply the changes.

ACCELER. DELAY	2
RELEASE BRAKING	2
RELEASE BRK STER	0.1
TILLER BRAKING	0.1
INVERS. BRAKING	0.5
DECCEL. BRAKING	1
SPEED LIMIT BRK.	1
BELLY BRAKING	0.5
STEER BRAKING	0.1
MAX SPEED FORW	100%
MAX SPEED BACK	100%
AUX LIFT SPEED	-100%
AUX LOWER SPEED	100%
AUX LIFT ACCELER	0.5
AUX LIFT DECELER	0.5
AUX LOWER ACCEL.	0.5
AUX LOWER DECEL.	0.5
CUTBACK 1 A7 TIL	25%
CUTBACK 2 C7	20%

**Table 4-2 Sample Parameter Adjustments
(For actual Settings please contact Factory)**

Table 4-3 Troubleshooting Chart (Drive / Lift Controller)

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
0		NONE	NONE	NONE
8		WATCHDOG	This is a safety related test. It is a self-diagnosis test that involves the logic between master and supervisor micro controllers.	This alarm could be caused by a CAN bus malfunctioning, which blinds master-supervisor communication.
17		LOGIC FAILURE #3	A hardware problem in the logic board due to high currents (overload). An overcurrent condition is triggered even if the power bridge is not driven.	The failure lies in the controller hardware. Replace the controller
18		LOGIC FAILURE #2	Fault in the hardware section of the logic board which deals with voltage feedbacks of motor phases.	The failure lies in the controller hardware. Replace the controller.
19		LOGIC FAILURE #1	This fault is displayed when the controller detects an undervoltage condition at the KEY input. Undervoltage threshold depends on the nominal voltage of the controller	<p>1- Fault can be caused by a key input signal characterized by pulses below the undervoltage threshold, possibly due to external loads like DC/DC converters starting-up, relays or contactors during switching periods, solenoids energizing or de-energizing. Consider to remove such loads.</p> <p>2- If no voltage transient is detected on the supply line and the alarm is present every time the key switches on, the failure probably lies in the controller hardware. Replace the logic board.</p> <p>3- If the alarm occurs during motor acceleration or when there is a hydraulic-related request, check the battery charge, the battery health and power-cable connections.</p>
28		PUMP VMN LOW	The pump motor output is lower than expected, considering the PWM duty cycle applied.	<p>A) If the problem occurs at start up (the LC does not close at all), check:</p> <ul style="list-style-type: none"> - Motor internal connections; - Motor power cables connections; - If the motor connection are OK, the problem is inside the controller. <p>B) If the problem occurs after closing the LC (the LC closes and then opens back again), check:</p> <ul style="list-style-type: none"> - Motor internal connections; - If motor windings/cables have leakages towards truck frame; - If no problem are found on the motors, the problem is inside the controller. <p>C) If the alarm occurs during motor running, check:</p> <ul style="list-style-type: none"> - Motor internal connections; - If motor windings/cables have leakages towards truck frame; - That the LC power contact closer properly, with a good contact; - If no problem are found on the motors, the problem is inside the controller, it is necessary to replace the logic board.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
29		PUMP VMN HIGH	This test is carried out when the pump motor is turning (PWM applied). The pump motor output is higher than expected, considering the PWM applied.	-Motor internal connections -If motor windings/cables have leakages towards truck frame -If no problem are found on the motors, the problem is inside the controller, it is necessary to replace the logic board.
30		VMN LOW	Start-up test. Before switching the LC on, the software checks the power bridge: it turns on alternatively the high-side power MOSFETs and expects the phase voltages increase toward the positive rail value. If one phase voltage is lower than a certain percentage of the rail voltage, this alarm occurs. Motor running test. When the motor is running, the power bridge is on and the motor voltage feedback tested; if it is lower than expected value (a range of values is considered), the controller enters in fault state.	If the problem occurs at start up (the LC does not close at all), check: - Motor internal connections (ohmic continuity); - Motor power-cables connections; - If the motor connections are OK, the problem is inside the controller; replace it. If the alarm occurs while the motor is running, check: - Motor connections; - that the LC power contact closes properly, with a good contact; - If no problem is found, the problem is inside the controller. Replace it.
31		VMN HIGH	Before switching the LC on, the software checks the power bridge: it turns on alternatively the low-side power MOSFETs and expects the phase voltages decrease down to -B. If the phase voltages are higher than a certain percentage of the nominal battery voltage, this alarm occurs. This alarm may also occur when the start-up diagnosis has succeeded and so the LC has been closed. In this condition, the phase voltages are expected to be lower than half the battery voltage. If one of them is higher than that value, this alarm occurs.	A) If the problem occurs at start-up (the LC does not close), check: - Motor internal connections (ohmic continuity); - Motor power cables connections; - If the motor connections are OK, the problem is inside the controller. Replace it. B) If the alarm occurs while the motor is running, check: - Motor connections; - that the LC power contact closes properly, with a good contact; - if no problem is found, the problem is inside the controller. Replace it.
37		CONTACTOR CLOSED	Before driving the LC coil, the controller checks if the contactor is stuck. The controller drives the power bridge for several dozens of milliseconds, trying to discharge the capacitors bank. If the capacitor voltage does not decrease by more than a certain percentage of the key voltage, the alarm is raised.	It is suggested to verify the power contacts of LC; if they are stuck, is necessary to replace the LC.
38		CONTACTOR OPEN	The LC coil is driven by the controller, but it seems that the power contacts do not close. In order to detect this condition the controller injects a DC current into the motor and checks the voltage on power capacitor. If the power capacitors get discharged it means that the main contactor is open.	LC contacts are not working. Replace the LC.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
52		PUMP I=0 EVER	While the pump motor is running, the current feedback is constantly stuck to zero.	1- Check the motor connection, that there is continuity. If the motor connection is opened, the current cannot flow, so the test fails and the error code is displayed; 2- If everything is ok for what it concerns the motor, the problem could be in the current sensor or in the related circuit.
53		STBY I HIGH	In standby, the sensor detects a current value different from zero.	The current sensor or the current feedback circuit is damaged. Replace the controller.
60		CAPACITOR CHARGE	When the key is switched on, the inverter tries to charge the power capacitors through the series of a PTC and a power resistance, checking if the capacitors are charged within a certain timeout. If the capacitor voltage results less than a certain percentage of the nominal battery voltage, the alarm is raised and the main contactor is not closed.	1- Check if an external load in parallel to the capacitor bank, which sinks current from the capacitors-charging circuit, thus preventing the caps from charging well. Check if a lamp or a dc-dc converter or an auxiliary load is placed in parallel to the capacitor bank. 2- The charging resistance or PTC may be broken. Insert a power resistance across line-contactor power terminals; if the alarm disappears, it means that the charging resistance is damaged. 3- The charging circuit has a failure or there is a problem in the power section. Replace the controller.
62		TH. PROTECTION	The temperature of the controller base plate is above 85 °C. The maximum current is proportionally decreased with the temperature excess from 85 °C up to 105 °C. At 105 °C the current is limited to 0 A.	It is necessary to improve the controller cooling. To realize an adequate cooling in case of finned heat sink important factors are the air flux and the cooling- air temperature. If the thermal dissipation is realized by applying the controller base plate onto the truck frame, the important factors are the thickness of the frame and the planarity and roughness of its surface. If the alarm occurs when the controller is cold, the possible reasons are a thermal-sensor failure or a failure in the logic board. In the last case, it is necessary to replace the controller.
65		MOTOR TEMPERAT.	This warning occurs when the temperature sensor is open (if digital) or if it has overtaken the MAX. MOTOR TEMP. threshold (if analog).	1- Check the temperature read by the thermal sensor inside the motor through the MOTOR TEMPERATURE reading in the TESTER function. 2- Check the sensor ohmic value and the sensor wiring. 3- If the sensor is OK, improve the cooling of the motor. If the warning is present when the motor is cool, replace the controller.

Table 4-3Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
66		BATTERY LOW	Parameter BATTERY CHECK is other than 0 (SET OPTION) and battery charge is evaluated to be lower than BATT.LOW TRESHLD (ADJUSTMENTS).	1- Check the battery charge and charge it if necessary 2- If the battery is actually charged, measure the battery voltage through a voltmeter and compare it with the BATTERY VOLTAGE reading in the TESTER function. If they are different, adjust the ADJUST BATTERY parameter (ADJUSTMENTS list) with the value measured through the voltmeter. 3- If the problem is not solved, replace the logic board.
74		DRIVER SHORTED	The driver of the LC coil is shorted.	1- Check if there is a short or a low impedance pull-down between NMC (A12) and -B. 2- The driver circuit is damaged; replace the logic board. 3- the SET POSITIVE PEB parameter is not correct.
75		CONTACTOR DRIVER	The LC coil driver is not able to drive the load. The device itself or its driver circuit is damaged.	This type of fault is not related to external components; replace the logic board.
78		VACC NOT OK	At key-on and immediately after that, the travel demands have been turned off. This alarm occurs if the ACCELERATOR reading (in TESTER function) is above the minimum value acquired during the PROGRAM VACC procedure	1- Check the wirings. 2- Check the mechanical calibration and the functionality of the accelerator potentiometer. 3- Acquire the maximum and minimum potentiometer value through the PROGRAM VACC function. If the problem is not solved, replace the logic board
79		INCORRECT START	Incorrect starting sequence. Possible reasons for this alarm are: 1- A travel demand active at key-on. 2- Man-presence sensor active at key on.	1- Check wirings. 2- Check microswitches for failures. 3- Through the TESTER function, check the states of the inputs are coherent with microswitches states. 4- If the problem is not solved, replace the logic board.
80		FORW + BACK	This alarm occurs when both the travel requests (FW and BW) are active at the same time.	1- Check that travel requests are not active at the same time. 2- Check the FW and BW input states through the TESTER function. 3- Check the wirings relative to the FW and BW inputs. 4- Check if there are failures in the microswitches. 5- If the problem is not solved, replace the logic board

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE	ALARM	EXPLANATION	TROUBLESHOOTING
82	ENCODER ERROR	This fault occurs when the frequency supplied to the motor is higher than 30 Hz and the signal feedback from the encoder has a too high jump in few tens of milliseconds. This condition is related to an encoder failure..	1- Check the electrical and the mechanical functionality of the encoder and the wires crimping. 2- Check the mechanical installation of the encoder, if the encoder slips inside its housing it will raise this alarm. 3- Also the electromagnetic noise on the sensor can be the cause for the alarm. In these cases try to replace the encoder. If the problem is still present after replacing the encoder, the failure is in the controller
86	PEDAL WIRE KO	-	-
126	CHAIN SENSOR KO	The slack chain sensor is not in normal status	1- Check that chain sensor switches are not active. 2- Check the wirings relative to the chain sensor switches. 3- Check if there are failures in the microswitches. 4- If the problem is not solved, replace the logic board.
129	WRONG CONFIG	Wrong set of controller type and model type	1- Check the parameter controller type in "special adjustment" menu 2- Check the parameter model type in "special adjustment" menu
130	REACH OUT OF RNG	Reach pot out of the normal range	1- Do the teaching again 2- Check the wiring of the reach pot
131	VACC REACH NOTOK	The output of reach pot is present but the enable switch is not active.	1- Check the reach pot 2- Check the wiring.
132	ALL ACQU. REACH	Do the wrong way of reach pot teaching	Do the teaching in correct way
133	TLT OUT OF RANGE TILT OUT OF RNG	Tilt pot out of the normal range	1- Do the teaching again 2- Check the wiring of the tilt pot
134	VACC TILT NOT OK	the output of tilt pot is present, but the enable switch is not active	1- Check the tilt pot 2- Check the wiring
135	SFT OUT OF RANGE SHIFT OUT OF RNG	Side shift pot out of the normal range	1- Do the teaching again 2- Check the wiring of the side shift pot
136	VACC SHFT NOT OK	The output of side shift pot is present, but the enable switch is not active.	1- Check the side shift pot 2- Check the wiring
137	ALL ACQU. TILT	The wrong way of tilt pot teaching	Do the teaching in correct way
138	ALL ACQU. SHIFT	The wrong way of side shift pot teaching	Do the teaching in correct way
139	NO CAN TILL EP NO CAN TILLER EP	The controller lost the communication with EP tiller at least once, when the truck is using	1- Check the wiring of can cable 2- Try to replace the EP tiller 3- Replace the controller
140	WAIT TILL EP WAIT TILLER EP	Wait the EP tiller CAN-BUS communication when key-on	1- Check the wiring of can cable 2- Try to replace the EP tiller 3- Replace the controller
141	NO CAN BRAKE EP	If set the PEDAL BRK TYPE is optio#1, but the controller can't get the can message from brake, the alarm occurs.	1- Check the wiring of can-brake 2- Check if the can-brake is broken 3- Try to set the PEDAL BRK TYPE=NONE
142	WAIT ACTIVATION	If download a SW with activation function, but haven't do any activation before, the alarm occurs.	Do activation with EP TOOLS

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
143		WRONG PASSWORD	If the EP PASSWORD function is active but haven't enter the correct password, the alarm occurs.	1- Enter the correct password 2- Disable the password function
144		NO CAN DISP EP	When the truck is running, if the DISPLAY TYPE=5, but the controller lose the communication with EP DISPLAY, this alarm occurs	1- Check the communication wiring between EP DISPLAY and controller. 2- Check if the EP DISPLAY is broken
145		WAIT DISP EP	If the DISPLAY TYPE=5, but the controller can't get message from EP DISPLAY when the truck start, this alarm occurs.	1- Check the communication wiring between EP DISPLAY and controller 2- Check if the EP DISPLAY is broken 3- Try to set the DISPLAY TYPE into a correct value
146		RENTAL TIMEOUT	If the rental function is activated, but the rental enable time is run out, this alarm occurs.	1- Check the rental hour left in TESTER menu 2- Use EP TOOLS to disable the rental function
147		NO CAN BMS EP	If the communication between BMS and controller is out of time, this alarm occurs.	1- Check the communication wiring between BMS and controller 2- There's a fault on BMS can device, replace the BMS
148		EP BMS MC OPEN	If the battery charge level is to low, the BMS require the main contactor open, this alarm occurs.	1- Check the battery charge level 2- Check if the battery is ok 3- Replace the BMS
149		EP BMS TRAC CTB	If the battery charge level is to low, the BMS require the controller to reduce the traction speed, this alarm occurs.	1- Check the battery charge level 2- Check if the battery is ok 3- Replace the BMS
150		EP BMS LIFT STOP	If the battery charge level is to low, the BMS require the controller to stop the lift function, this alarm occurs.	1- Check the battery charge level 2- Check if the battery is ok 3- Replace the BMS
151		EP BMS TRAC STOP	If the battery charge level is to low, the BMS require the controller to stop the traction function, this alarm occurs.	1- Check the battery charge level 2- Check if the battery is ok 3- Replace the BMS
152		SENSOR SUPPLY XX		
153		OFFSET SPD.SENS.	It is necessary to acquire the offset angle between the stator and the speed sensor, i.e. they mutual angular misalignment. An automatic function is dedicated to this procedure.	Perform the teaching procedure: in OPTIONS, select ABS SENS. ACQUIRE.
155		WAIT MOTOR STILL	The controller is waiting for the motor to stop rotating. This warning can only appear in controllers for brush less motors.	-
161		RPM HIGH	This alarm occurs in Gen. Set versions when the speed exceeds the threshold speed.	-
170		WRONG KEY VOLT.	The measured key voltage is not the right one for the inverter.	1- Check if the SET KEY VOLTAGE parameter in the ADJUSTMENTS list is set in accordance with the key voltage. 2- Check if the key voltage is ok using a voltmeter, if not check the wiring. 3- In case the problem is not solved, replace the logic board.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE	ALARM	EXPLANATION	TROUBLESHOOTING
177	COIL SHOR. EB.	This alarm occurs when an overload of the EB driver occurs.	1- Check the connections between the controller outputs and the loads. 2- Collect information about characteristics of the coil connected to the driver and ask for assistance to a EP technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded. 3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
178	MOTOR TEMP. STOP	The temperature sensor has overtaken the threshold defined by STOP MOTOR TEMP.	1- Check the temperature read by the thermal sensor inside the motor through the MOTOR TEMPERATURE reading in the TESTER function. 2- Check the sensor ohmic value and the sensor wiring. 3- If the sensor is OK, improve the cooling of the motor. 4- If the warning is present when the motor is cool, replace the controller.
179	STEER SENSOR KO	The voltage read by the microcontroller at the steering-sensor input is not within the STEER RIGHT VOLT ÷ STEER LEFT VOLT range, programmed through the STEER ACQUIRING function	1- Acquire the maximum and minimum values coming from the steering potentiometer through the STEER ACQUIRING function. If the alarm is still present, check the mechanical calibration and the functionality of the potentiometer. 2- If the problem is not solved, replace the logic board.
180	OVERLOAD	The motor current has overcome the limit fixed by hardware.	If the alarm condition occurs again, ask for assistance to a EP technician. The fault condition could be affected by wrong adjustments of motor parameters.
181	WRONG ENC SET	Mismatch between parameters ENCODER PULSES 1 and ENCODER PULSES 2	Set the two parameters with the same value, according to the adopted encoder
182	EVP2 COIL OPEN	No load is connected between the EVP2 output and the electrovalve positive terminal.	1- Check the EVP2 condition. 2- Check the EVP2 wiring. 3- If the problem is not solved, replace the logic board.
183	EVP2 DRIV. SHORT	1- The EVP2 driver is shorted. 2- The microcontroller detects a mismatch between the valve set-point and the feedback of the EVP2 output.	1- Check if there is a short circuit or a low-impedance conduction path between the negative of the coil and -B. 2- Collect information about: - the voltage applied across the EVP2 coil, - the current in the coil, - features of the coil. Ask for assistance to EP in order to verify that the software diagnoses are in accordance with the type of coil employed. 3- If the problem is not solved, it could be necessary to replace the controller.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE	ALARM	EXPLANATION	TROUBLESHOOTING
184	EVP2 DRIVER OPEN	The EVP2 driver is not able to drive the EVP2 coil. The device itself or its driving circuit is damaged.	This fault is not related to external components. Replace the logic board.
185	TILLER ERROR	-	-
186	WAIT MOT.P STILL	If DC Pump option is set to ON, the software expects the voltage on -P output to be at a "steady state" value, before switching the LC on. If the voltage is different, it could be due to the fact that the motor connected to -P is not still. For this reason, the software waits 30 seconds for the voltage to be at the "steady state" value (and for the pump motor to be still). After this time, the software assumes that the problem is not due to the fact that the pump motor is not still, and show the PUMP VMN NOT OK alarm.	1- If the motor connected to -P is still moving, just wait for it to be still. 2- If not, in 30 seconds the alarm PUMP VMN NOT OK will appear.
187	MANY PUMP REQ.	if there's more than one pump function request, e.g. lift+tilt, the alarm occurs	1- Check the microswitches status 2- check the wiring of pump functions 3- Disconnect the wire on the controller side 4- If the problem is not solved, replace the logic board.
188	PUMP VACC NOT OK	The minimum voltage of the lift potentiometer is not correctly set.	1- It is suggested to repeat the acquiring procedure of MIN LIFT and MAX LIFT 2- Check the wiring of the lift pot 3- Check if it's the lift pot fault
189	PUMP INC START	Man-presence switch is not enabled at pump request	1- Check wirings. 2- Check microswitches for failures. 3- Through the TESTER function, check the states of the inputs are coherent with microswitches states. 4- If the problem is not solved, replace the logic board.
190	PUMP VMN NOT OK	Switching the LC on, the software checks the output voltage on -P connector, and expects that it is at a "steady state" value (if DC PUMP option is set to ON, see HYDRO SETTINGS). If the voltage is too low, this alarm occurs.	1- The motor connected to -P must be completely still before this alarm occurs. The software waits 30 seconds before showing this alarm. During this time it shows the WAIT MOTOR STILL warning. 2- Motor internal connections 3- Motor power cables connections 4- Motor leakage to truck frame 5- If the motor connections are ok, the problem is inside the controller it is necessary to replace the logic board.
191	PUMP I NO ZERO	In standby condition (pump motor not driven), the feedback coming from the current sensor in the pump chopper gives a value out of a permitted range, because the pump current is not zero.	This type of fault is not related to external components; replace the controller.

Table 4-3Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
192		PUMP VACC RANGE	For COMBIAC0 and COMBIACX. it means the output of lift pot is out of the normal range.	1- Checking the wire of the lift pot 2- Checking if the lift pot is dead 3- Do the adjustment of the lift pot and see if the value is ok.
193		SMARTDRIVER KO	There is a hardware problem in the smart driver circuit . The driver is set to be ON but the output voltage does not increase.	1- Verify that the EB coil is connected correctly between pin A2 and pin A4. 2- Verify that the parameter POSITIVE E.B.is set in accordance with the actual configuration (see paragraph 8.2.5). The software, in fact, depending on specific parameter value, makes a proper diagnosis; a wrong configuration of this parameter could generate a false fault. 3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
194		AUX BATT. SHORT.	For the versions where the smart driver is not installed (36/48V and 80V), it is possible to decide where the positive supply for pin A2 comes from by choosing a dedicated hardware configuration. The parameter POSITIVE E.B. has to be set in accordance with the hardware configuration, because the software makes a proper diagnosis depending on the parameter; a wrong setting could generate a false fault. The available choices are: - 0 = PEB is managed by the smart driver (available for 24V version only). - 1 = PEB comes from the TILLER input (A1). - 2 = PEB comes from PEV (A3). PEV must be connected to terminal +B of the controller. This is the default configuration for 36/48V and 80V version. This alarm can only appear if POSITIVE E.B. is set as 1 TILLER/ SEAT.	1- Verify that the parameter POSITIVE E.B. is set in accordance with the actual coil positive supply (see paragraph 8.2.5). 2- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
195		POS. EB. SHORTED	The voltage on pin A2 is high even if the smart driver is turned OFF	1- Verify that the parameter POSITIVE E.B. is set in accordance with the actual coil positive supply. 2- Check if there is a short or a low impedance path between pin A2 and of the +B. In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
196		MOT.PHASE SH.	Short circuit between two motor phases. The hexadecimal value "XX" identifies the shorted phases: 36: U – V short circuit 37: U – W short circuit 38: V – W short circuit	1- Verify the motor phases connection on the motor side. 2- Verify the motor phases connection on the inverter side. 3- Check the motor power cables. 4- Replace the controller. 5- If the alarm does not disappear, the problem is in the motor. Replace it.

Table 4-3Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
197		WRONG SLAVE VER.	Wrong software version on supervisor uC.	Upload the correct software version
198		M/S PAR CHK MISM	At start-up there is a mismatch in the parameter checksum between the master and the supervisor micro controllers.	Restore and save the parameters list again.
199		PARAM TRANSFER	Master uC is transferring parameters to the supervisor.	Wait until the end of the procedure. If the alarm remains longer, re-cycle the key.
200		VDC OFF SHORTED	The logic board measures a voltage value across the DC-link that is constantly out of range, above the maximum allowed value	1- Check that the battery has the same nominal voltage of the inverter. 2- Check the battery voltage, if it is out of range replace the battery. 3- If the battery voltage is ok, replace the logic board.
201		TORQUE PROFILE	There is an error in the choice of the torque profile parameters.	Check in the HARDWARE SETTINGS list the value of those parameters.
202		VDC LINK OVERV.	This fault is displayed when the controller detects an overvoltage condition. Overvoltage threshold depends on the nominal voltage of the controller. Nominal voltage 24V 36/48V 72/80V 96V Overvoltage threshold 35V 65V 115V 130V As soon as the fault occurs, power bridge and MC are opened. The condition is triggered using the same HW interrupt used for undervoltage detection, uC discerns between the two evaluating the voltage present across DC-link capacitors: - High voltage Overvoltage condition - Low/normal voltage Undervoltage condition.	If the alarm happens during the brake release, check the line contactor contact and the battery power-cable connection.
203		HW FAULT MC	the Mcu and the Scu check the status of the main contactor is different from each other.	This type of fault is related to internal components. Replace the logic board.
204		BRAKE RUN OUT	The CPOT BRAKE input read by the microcontroller is out of the range defined by parameters SET PBRK. MIN and SET PBRK. MAX	1- Check the mechanical calibration and the functionality of the brake potentiometer. 2- Acquire the minimum and maximum potentiometer values. 3- If the alarm is still present, replace the logic board.
205		EPS RELAY OPEN	The controller receives from EPS information about the safety contacts being open.	Verify the EPS functionality
206		INIT VMN HIGH	Before closing the LC, the software checks the power-bridge voltage without driving it. The software expects the voltage to be in a "steady state" value. If it is too high, this alarm occurs. The hexadecimal value "XX" identifies the faulty phase: 81: phase U 82: phase V 83: phase W	1- Check the motor power cables. 2- Check the impedance between U, V and W terminals and -B terminal of the controller. 3- Check the motor leakage to truck frame. 4- If the motor connections are OK and there are no external low impedance paths, the problem is inside the controller. Replace it.

Table 4-3Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
207		INIT VMN LOW	Before closing the LC, the software checks the power-bridge voltage without driving it. The software expects the voltage to be in a "steady state" value. If it is too low, this alarm occurs. The hexadecimal value "XX" identifies the faulty phase: 01: phase U 02: phase V 03: phase W	1- Check the motor power cables. 2- Check the impedance between U, V and W terminals and -B terminal of the controller. 3- Check the motor leakage to truck frame. 4- If the motor connections are OK and there are no external low impedance paths, the problem is inside the controller. Replace it.
208		EEPROM KO	the connection of the EEPROM is not ok	This type of fault is related to internal components. Replace the logic board.
209		PARAM RESTORE	The controller has restored the default settings. If a CLEAR EEPROM has been made before the last key re-cycle, this warning informs you that EEPROM was correctly cleared.	1- A travel demand or a pump request does cancel the alarm. 2- If the alarm appears at key-on without any CLEAR EEPROM performed, replace the controller.
210		WRONG RAM MEM.	The algorithm implemented to check the main RAM registers finds wrong contents: the registeris "dirty". This alarm inhibits the machine operations.	Try to switch the key off and then on again, if the alarm is stillpresent replace the logic board.
211		STALL ROTOR	The traction rotor is stuck or the encoder signal is not correctly received by the controller	1- Check the encoder condition. 2- Check the wiring. 3- Through the TESTER function, check if the sign of FREQUENCY and ENCODER are the same and if they are different from zero during a traction request. 4- If the problem is not solved, replace the logic board.
212		POWER MISMATCH	The error between the power setpoint and the estimated power is out of range.	Ask for assistance to a EP technician about the correct adjustment of the motor parameters.
213		POSITIVE LC OPEN	The positive voltage of LC is different from expected.	1- Verify LC coil is properly connected. 2- Verify CONF. POSITIVE LC parameter is set in accordance with the actual coil positive supply (see paragraph 8.2.5). Software, depending on the parameter value, makes a proper diagnosis; a mismatch between the hardware and the parameter configuration could generate a false fault. 3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
214		EVP COIL OPEN	No load is connected between the EVP output (A24) and the electrovalve positive terminal.	1- Check the EVP condition. 2- Check the EVP wiring. 3- If the problem is not solved, replace the logic board.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
215		EVP DRIV. SHORT.	1- The EVP driver (output A24) is shorted. 2- The microcontroller detects a mismatch between the valve set-point and the feedback of the EVP output.	11- Check if there is a short circuit or a low-impedance conduction path between the negative of the coil and -B. 2- Collect information about: o the voltage applied across the EVP coil, - the current in the coil, - features of the coil. Ask for assistance to EP in order to verify that the software diagnoses are in accordance with the type of coil employed. If the problem is not solved, it could be necessary to replace the controller.
216		EB. COIL OPEN	This fault appears when no load is connected between the NEB output (A4) and the EB positive terminal PEB (A2)	1- Check the EB coil. 2- Check the wiring. 3- If the problem is not solved, replace the logic board.
217		PEV NOT OK	Terminal PCOM is not connected to the battery or the voltage is different from that defined by parameter SET POSITIVE PEB (see ADJUSTMENTS list). This alarm can occur if output NAUX1 is present (and the related setting is active) or the AUX OUT function is active.	1- Check PCOM terminal: it must be connected to the battery voltage (after the main contactor). 2- Set the nominal PCOM voltage in parameter SET POSITIVE PEB in ADJUSTMENTS list.
218		SENS MOT TEMP KO	The output of the motor thermal sensor is out of range.	1- Check if the resistance of the sensor is what expected measuring its resistance. 2- Check the wiring. 3- If the problem is not solved, replace the logic board.
219		PEB-PEVP NOT OK	Only for AC3 and ACE3, the PEB and PEV voltage is not match the parameter setting	1- Check PCOM terminal: it must be connected to the battery voltage (after the main contactor). 2- Set the nominal PCOM voltage in parameter SET POSITIVE PEB in ADJUSTMENTS list.
220		VKEY OFF SHORTED	At key-on, the logic board measures a voltage value of the KEY input that is constantly out of range, below the minimum allowed value.	1- Check that the battery has the same nominal voltage of the inverter. 2- Check the battery voltage, if it is out of range replace the battery. 3- If the battery voltage is ok, replace the logic board.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
221		HANDBRAKE	Handbrake input is active.	<ul style="list-style-type: none"> 1- Check that handbrake is not active by mistake. 2- Check the SR/HB input state through the TESTER function. 3- Check the wirings. 4- Check if there are failures in the microswitches. 5- If the problem is not solved, replace the logic board.
222		SEAT MISMATCH	This alarm can appear only in a Traction + Pump configuration or in a multimotor one. There is an input mismatch between the traction controller and the pump controller relatively to the TILLER/SEAT input (A1): the two values recorded by the two controllers are different.	<ul style="list-style-type: none"> 1- Check if there are wrong connections in the external wiring. 2- Using the TESTER function, verify that the seat inputs are in accordance with the actual state of the external switch. 3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
223		COIL SHOR. MC (FOR COMBI AC0/ COMBI ACX AND ACE4) MC-EF COIL SHOR.(FOR ACE2, ACE3)	This alarm occurs when an overload of the MC driver	<ul style="list-style-type: none"> 1- Check the connections between the controller outputs and the loads. 2- Collect information about characteristics of the coil connected to the driver and ask for assistance to a EP technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded. 3- In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
224		WAITING FOR NODE	The controller receives from the CAN bus the message that another controller in the net is in fault condition; as a consequence the controller itself cannot enter into an operative status, but it has to wait until the other node comes out from the fault status.	Check if any other device on the CAN bus is in fault condition.
225		CURRENT SENS. KO	the current sensor of the controller can not be driven or always 0	This type of fault is related to internal components. Replace the logic board.
226		VACC OUT RANGE	<ul style="list-style-type: none"> 1- The CPOT input read by the microcontroller is not within the MIN VACC ÷ MAX VACC range, programmed through the PROGRAMM VACC function . 2- The acquired values MIN VACC and MAX VACC are inconsistent. 	<ul style="list-style-type: none"> 1- Acquire the maximum and minimum potentiometer values through the PROGRAM VACC function. If the alarm is still present, check the mechanical calibration and the functionality of the accelerator potentiometer. 2- If the problem is not solved, replace the logic board.
227		HW FAULT	At start-up, some hardware circuit intended to enable and disable the power bridge or the LC driver (output A12) is found to be faulty. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	This type of fault is related to internal components. Replace the logic board.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
228		TILLER OPEN	Tiller/seat input has been inactive for more than 120 seconds.	1- Activate the tiller/seat input. 2- Check the tiller/seat input state through the TESTER function. 3- Check the wirings. 4- Check if there are failures in the microswitches. 5- If the problem is not solved, replace the logic board.
229		HW FAULT EB.	At start-up, the hardware circuit dedicated to enable and disable the EB driver (output A4) is found to be faulty. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	This type of fault is not related to external components. Replace the logic board.
230		LC COIL OPEN	This fault appears when no load is connected between the NMC output A12 and the positive voltage (for example the KEY voltage).	1- Check the wiring, in order to verify if LC coil is connected to the right connector pin and if it is not interrupted. 2- If the alarm is still present, than the problem is inside the logic board; replace it.
232		CONT. DRV. EV	AUX valve driver is not able to drive the load.	The device or its driving circuit is damaged. Replace the controller.
233		POWERMOS SHORTED	The DC-link voltage drops to zero when a high-side or low-side MOSFET is turned on.	1- Check that motor phases are correctly connected. 2- Check that there is no dispersion to ground for every motor phases. 3- In case the problem is not solved, replace the controller.
234		DRV. SHOR. EV	AUX valve driver is shorted.	1- Check if there is a short circuit or a low impedance path between the negative terminal of the coils and -B. 2- If the problem is not solved, replace the logic board.
235		CTRAP THRESHOLD	it is a controller internal check fault	Check the parameter DUTY PWM CTRAP is correct. If the alarm is still, Ask for assistance to a EP technician
236		CURRENT GAIN	The maximum current gain parameters are at the default values, which means that the maximum current adjustment procedure has not been carried out yet.	Ask for assistance to a EP technician in order to do the adjustment procedure of the current gain parameters.
237		ANALOG INPUT	This alarm occurs when the A/D conversion of the analog inputs returns frozen values, on all the converted signals, for more than 400 ms. The goal of this diagnosis is to detect a failure in the A/D converter or a problem in the code flow that skips the refresh of the analog signal conversion.	If the problem occurs permanently it is necessary to replace the logic board.

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
238		HW FAULT EV.	At start-up, the hardware circuit dedicated to enable and disable the EV drivers is found to be faulty. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	This type of fault is not related to external components. Replace the logic board.
239		CONTROLLER MISM.	The software is not compatible with the hardware. Each controller produced is "signed" at the end of line test with a specific code mark saved in EEPROM according to the customized part number. According with this "sign", only the customized firmware can be uploaded.	1- Upload the correct firmware. 2- Ask for assistance to a EP technician in order to verify that the firmware is correct.
240		EVP DRIVER OPEN	The EVP driver is not able to drive the EVP coil. The device itself or its driving circuit is damaged.	This fault is not related to external components. Replace the logic board.
241		COIL SHOR. EVAUX	This alarm occurs when an overload of the EV drivers occurs.	1- Check the connections between the controller outputs and the loads. 2- Collect information about characteristics of the coils connected to the drivers and ask for assistance to a EP technician in order to verify that the maximum current that can be supplied by the hardware is not exceeded. In case no failures/problems have been found, the problem is in the controller, which has to be replaced.
242		OPEN COIL EV.	This fault appears when no load is connected between one or more EV outputs and the positive terminal PEV (pin A3). For the meaning of code "XX", refer to paragraph 10.5 EVP1=BIT 0 EV1=BIT 1 EV2=BIT 2 EV3=BIT 3 EVP2=BIT 4 EV4=BIT 5 EV5=BIT 7 HORN=BIT 6	1- Check the coils. 2- Check the wiring. 3- If the problem is not solved, replace the logic board.
243		THROTTLE PROG.	A wrong profile has been set in the throttle profile.	Set properly the throttle-related parameters
244		WARNING SLAVE	Warning on supervisor uC.	Connect the Console to the supervisor uC and check which alarm is present.
245		IQ MISMATCHED	The error between the Iq (q-axis current) setpoint and the estimated Iq is out of range.	Ask for assistance to a EP technician in order to do the correct adjustment of the motor parameters.
246		EB. DRIV.OPEN	The EB coil driver is not able to drive the load. The device itself or its driving circuit is damaged.	This type of fault is not related to external components. Replace the logic board.
247		DATA ACQUISITION	Controller in calibration state.	The alarm ends when the acquisition is done.
248		NO CAN MSG.	CANbus communication does not work properly. The hexadecimal value "XX" identifies the faulty node.	1- Verify the CANbus network (external issue). 2- Replace the logic board (internal issue).

Table 4-3 Troubleshooting Chart (Drive / Lift Controller) - Continued

CAN CODE		ALARM	EXPLANATION	TROUBLESHOOTING
249		CHECK UP NEEDED	This is a warning to point out that it is time for the programmed maintenance.	Turn on the CHECK UP DONE option after that the maintenance service.
250		THERMIC SENS. KO	The output of the controller thermal sensor is out of range.	This kind of fault is not related to external components. Replace the controller.
251		WRONG SET BAT.	At start-up, the controller checks the battery voltage (measured at the KEY input A10) and it verifies that it is within a range of $\pm 20\%$ around the nominal value.	1- Check that the SET BATTERY parameter inside the ADJUSTMENTS list matches with the battery nominal voltage. 2- If the battery nominal voltage is not available for the SET BATTERY parameter inside the ADJUSTMENTS list, record the value stored as HARDWARE BATTERY RANGE parameter in the SPECIAL ADJUST. list and contact a EP technician. 3- Through the TESTER function, check that the KEY VOLTAGE reading shows the same value as the key voltage measured with a voltmeter on pin A10. If it does not match, then modify the ADJUST BATTERY parameter according to the value read by the voltmeter. 4- Replace the battery.
253		FIELD ORIENT. KO	The error between the Id (d-axis current) setpoint and the estimated Id is out of range.	Ask for assistance to a EP technician in order to do the correct adjustment of the motor parameters.
254		EB. DRIV.SHRT.	1- The EB driver is shorted. 2- The microcontroller detects a mismatch between the valve setpoint and the feedback at the EB output.	1- Check if there is a short or a low impedance path between the negative coil terminal and -B. 2- Check if the voltage applied is in accordance with the parameters settings 3- If the problem is not solved, replace the controller.

Table 4-4 Troubleshooting Chart (Steering Controller)

CAN CODE	ALARM	EXPLANATION	TROUBLESHOOTING
17	LOGIC FAILURE #3	A hardware problem in the logic board due to high currents (overload). An overcurrent condition is triggered even if the power bridge is not driven.	The failure lies in the controller hardware. Replace the controller
19	LOGIC FAILURE #1	This fault is displayed when the controller detects an undervoltage condition at the KEY input. Undervoltage threshold depends on the nominal voltage of the controller.	1- Fault can be caused by a key input signal characterized by pulses below the undervoltage threshold, possibly due to external loads like DC/DC converters starting-up, relays or contactors during switching periods, solenoids energizing or de-energizing. Consider to remove such loads. 2- If no voltage transient is detected on the supply line and the alarm is present every time the key switches on, the failure probably lies in the controller hardware. Replace the logic board. 3- If the alarm occurs during motor acceleration or when there is a hydraulic-related request, check the battery charge, the battery health and power-cable connections.
195	WRONG CONFIG	Wrong set of controller type and model type.	1- Check the parameter controller type in "special adjustment" menu 2- Check the parameter model type in "special adjustment" menu
196	NO CAN TILL EP	The controller lost the communication with EP tiller at least once, when the truck is using.	1- Check the wiring of can cable 2- Try to replace the EP tiller 3- Replace the controller
197	NO CAN DISP EP	When the truck is running, if the DISPLAY TYPE=5, but the controller lose the communication with EP DISPLAY, this alarm occurs	1- Check the communication wiring between EP DISPLAY and controller 2- Check if the EP DISPLAY is broken
200	STEER SENSOR KO	The voltage read by the microcontroller at the steering-sensor input is not within the STEER RIGHT VOLT + STEER LEFT VOLT range, programmed through the STEER ACQUIRING function	1- Acquire the maximum and minimum values coming from the steering potentiometer through the STEER ACQUIRING function. If the alarm is still present, check the mechanical calibration and the functionality of the potentiometer. 2- If the problem is not solved, replace the logic board.
201	WRONG ENC SET	Mismatch between parameters ENCODER PULSES 1 and ENCODER PULSES 2	Set the two parameters with the same value, according to the adopted encoder.
202	VDC LINK OVERV.	This fault is displayed when the controller detects an overvoltage condition. Overvoltage threshold depends on the nominal voltage of the controller. Nominal voltage 24V 36/48V 72/80V 96V Overvoltage threshold 35V 65V 115V 130V As soon as the fault occurs, power bridge and MC are opened. The condition is triggered using the same HW interrupt used for undervoltage detection, uC discerns between the two evaluating the voltage present across DC-link capacitors: - High voltage Overvoltage condition - Low/normal voltage Undervoltage condition	If the alarm happens during the brake release, check the line contactor contact and the battery power- cable connection.

Table 4-4 Troubleshooting Chart (Steering Controller) - Continued

CAN CODE	ALARM	EXPLANATION	TROUBLESHOOTING
208	EEPROM KO	The connection of the EEPROM is not ok	This type of fault is related to internal components. Replace the logic board.
209	PARAM RESTORE	The controller has restored the default settings. If a CLEAR EEPROM has been made before the last key re-cycle, this warning informs you that EEPROM was correctly cleared.	1- A travel demand or a pump request does cancel the alarm. 2- If the alarm appears at key-on without any CLEAR EEPROM performed, replace the controller.
210	WRONG RAM MEM.	The algorithm implemented to check the main RAM registers finds wrong contents: the register is "dirty". This alarm inhibits the machine operations.	Try to switch the key off and then on again, if the alarm is still present replace the logic board.
212	W.SET. TG-EB XX	The slave controller find the status of the main contactor is different between hardware and CAN-BUS	This type of fault is related to internal components. Replace the logic board.
213	INPUT MISMATCH	The slave controller find the status of the input is different between hardware and CAN-BUS	This type of fault is related to internal components. Replace the logic board.
227	OUT MISMATCH XX	The slave controller find the status of the output is different between hardware and CAN-BUS	This type of fault is related to internal components. Replace the logic board.
229	NO CAN WR MSG.XX	CAN-bus communication does not work properly. The hexadecimal value "XX" identifies the faulty node.	1- Verify the CANbus network (external issue). 2- Replace the logic board (internal issue).
230	SOFTWARE ERROR	It means the software of the slave controller is wrong	This type of fault is related to internal components. Replace the logic board.
237	ANALOG INPUT	This alarm occurs when the A/D conversion of the analog inputs returns frozen values, on all the converted signals, for more than 400 ms. The goal of this diagnosis is to detect a failure in the A/D converter or a problem in the code flow that skips the refresh of the analog signal conversion.	If the problem occurs permanently it is necessary to replace the logic board.
239	CONTROLLER MISM.	The software is not compatible with the hardware. Each controller produced is "signed" at the end of line test with a specific code mark saved in EEPROM according to the customized part number. According with this "sign", only the customized firmware can be uploaded.	1- Upload the correct firmware. 2- Ask for assistance to a EP technician in order to verify that the firmware is correct.
240	OUT MISMATCH PU	This is a safety related test. Supervisor µC has detected that master µC is driving the pump motor in a wrong way (not corresponding to the operator request).	1- Checks the matching of the parameters between Master and Supervisor. 2- Ask for assistance to a EP technician. 3- If the problem is not solved, replace the logic board.

Table 4-4 Troubleshooting Chart (Steering Controller) - Continued

CAN CODE	ALARM	EXPLANATION	TROUBLESHOOTING
241	SP MISMATCH PUMP	This is a safety related test. The supervisor µC has detected a mismatch in the DC-pump speed setpoint with respect to the master µC.	1- Check the matching of the parameters between master and supervisor. 2- Ask for assistance to a EP technician. 3- If the problem is not solved, replace the logic board.
242	SP MISMATCH XX	This is a safety related test. The supervisor µC has detected a mismatch in the speed setpoint with respect to the master µC. The hexadecimal value "XX" facilitates EP technicians debugging the problem.	1- Check the matching of the parameters between master and supervisor. 2- Ask for assistance to a EP technician. 3- If the problem is not solved, replace the logic board.
248	NO CAN MSG. XX	CANbus communication does not work properly. The hexadecimal value "XX" identifies the faulty node.	1- Verify the CANbus network (external issue). 2- Replace the logic board (internal issue).

SECTION 5 STEERING SYSTEM

5-1. STEERING COLUMN

5-1.1. Steering Column Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the three screws (1, Figure 5-1) and remove the steering column lower cover (2) from the front plate.
3. Remove the six screws (3) and remove the steering column right cover (4) and left cover (5).
4. Disconnect the connection between the turn signal switch and main wiring harness, then remove the turn signal switch (6) from the steering column left cover (5).
5. Pry up the steering wheel cap (7) and loosen the nut (8) to remove the steering wheel (9) from the steering column (10).
6. Remove the four screws (11) and loosen the lock screw on the bottom of the gimbal (12), then remove the stepper motor (13) from the steering column (10).

7. Loosen the lock screw on the top of the gimbal (12) to remove the gimbal (12).
8. Unscrew the two screws (14) and remove the damper (15) from the steering column (10).
9. Remove the two snap rings (16) and knock out the two bearings (17) and the steering shaft (18).
10. Unscrew the adjusting handle (19) to remove the nut (20).
11. Remove the two snap rings (21) and knock out the shaft (22) from the side to separate the steering column (10) from the bracket (23).
12. Unscrew the three bolt (24) with a wrench to remove the bracket (23) from the front plate.

5-1.2. Steering Column Installation

1. Install the steering column by reversing the steps 2-12 in paragraph 5-1.1.
2. Turn on the key switch and disengage the emergency disconnect switch.

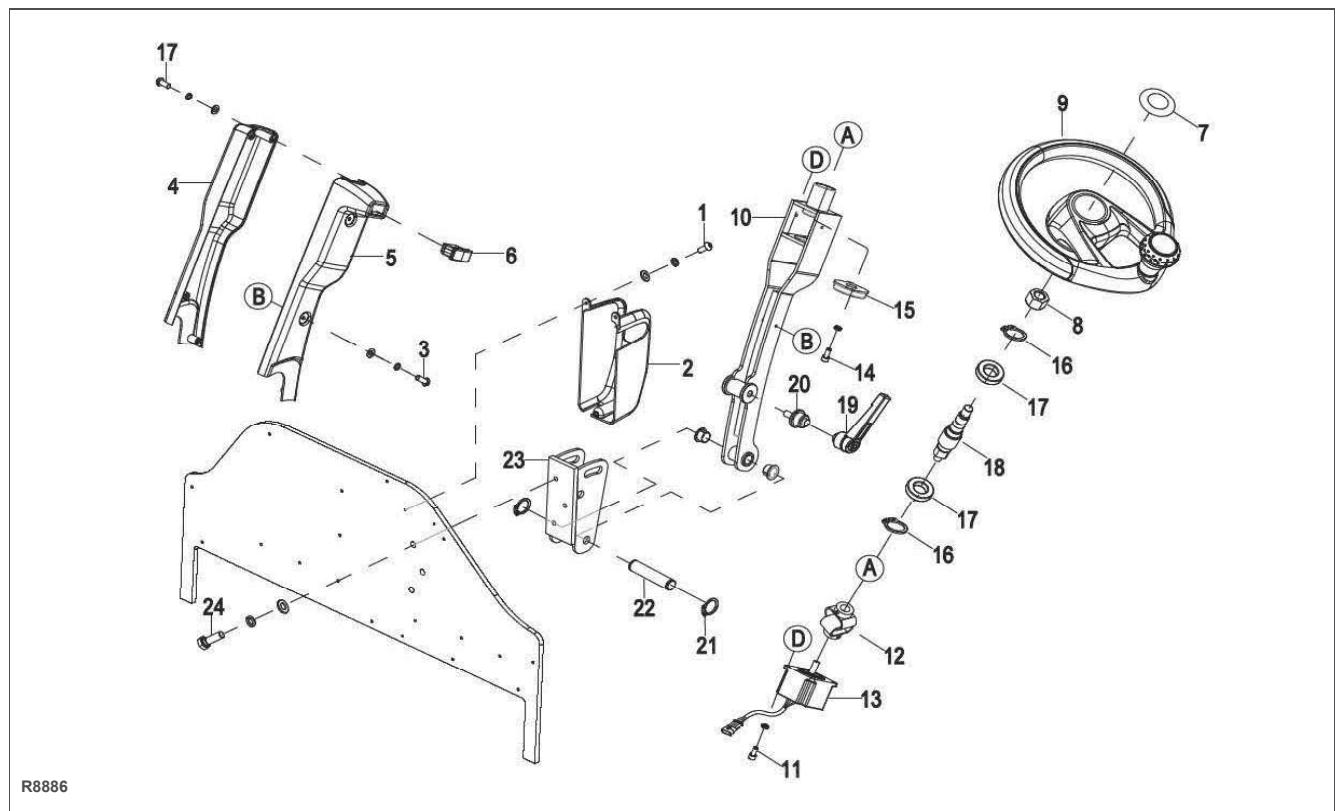


Figure 5-1 Steering System

5-2. REAR STEERING WHEEL ASSEMBLIES

5-2.1. Rear Steering wheel assemblies removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the front wheels to prevent movement.
3. Raise the rear of the truck off the ground to provide clearance for wheel removal. Block the truck to prevent accidental lowering.
4. Remove the five nut protectors (1, Figure 5-2).
5. Remove the five nuts (2) from the rear steering wheel assemblies (3)
6. Remove the steering wheel assembly (3) from the steering bridge (4).

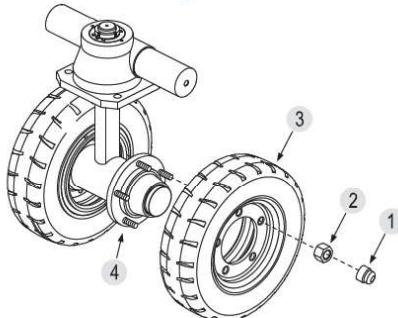


Figure 5-2 Rear Steering Wheels

5-2.2. Rear Steering wheel assemblies installation

1. Install the rear steering assemblies by reversing the steps 2-6 in paragraph 5-2.1.
2. Turn on the key switch and disengage the emergency disconnect switch.

5-3. COUNTERWEIGHT

5-3.1. Counterweight removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the front wheels to prevent movement.
3. Raise the rear of the truck off the ground to provide clearance for wheel removal. Block the truck to prevent accidental lowering.

NOTE: Using a hoist or another forklift please secure the counterweight with chains, straps or other suitable equipment that can securely handle the weight of the counterweight.

4. Remove the three bolts that secures the counterweight (1) to the chassis.

5. Slowly lift the counterweight away from the chassis of the truck.

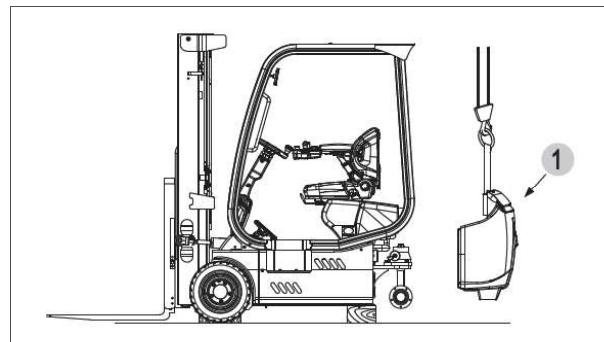


Figure 5-3 Counterweight

5-3.2. Counterweight installation

1. Install the counterweight by reversing the steps 2-5 in paragraph 5-3.1.
2. Turn on the key switch and disengage the emergency disconnect switch.

5-4. REAR STEERING AXLE

5-4.1. Rear Steering axle removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the front wheels to prevent movement.
3. Raise the rear of the truck off the ground to provide clearance for wheel removal. Block the truck to prevent accidental lowering.
4. Remove the counterweight according to paragraph 5-3.1.
5. Remove the rear steering wheel assemblies according to paragraph 5-2.1.

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting.

6. Remove the hoses (1, Figure 5-4) from steering axle.

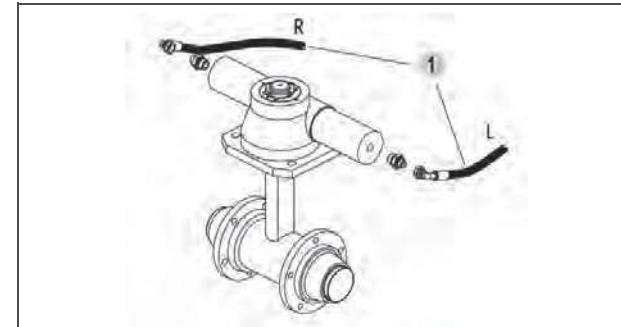


Figure 5-4 Rear Steering Axle Hoses

7. Remove the steering potentiometer according to paragraph 5-5.1.
8. Remove the five bolts (1, [Figure 5-5](#)).
9. The rear steering axle (2) is heavy so make sure to secure it so that it doesn't fall when you remove it from the chassis.

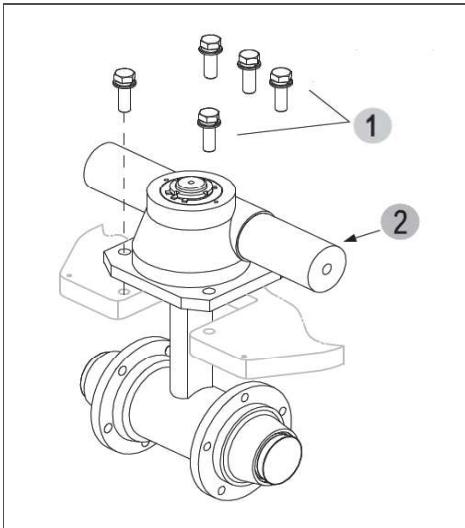


Figure 5-5 Rear Steering Axle Mounting

5-4.2. Rear Steering axle Installation

1. Install rear steering axle by reversing the steps 8-9 in paragraph 5-4.1.
2. Install the steering potentiometer according to paragraph [Figure 5-6](#)
3. Install the hoses (1, [Figure 5-4](#)) on the steering axle.
4. Install the rear steering wheel assemblies according to paragraph 5-2.2.
5. Install the counterweight according to paragraph 5-3.2.
6. Reverse the steps 2-3 in paragraph 5-4.1.
7. Turn on the key switch and disengage the emergency disconnect switch.
8. Turn the steering wheel back and forth to refill steering axle and lines with hydraulic oil.

Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

5-5. STEERING POTENTIOMETER

5-5.1. Steering Potentiometer Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the front wheels to prevent movement.
3. Raise the rear of the truck off the ground to provide clearance for wheel removal. Block the truck to prevent accidental lowering.

4. Remove the counterweight according to paragraph 5-3.1.
5. Remove the main wire harness from steering potentiometer (1, [Figure 5-6](#))
6. Remove the rubber shield (2).
7. Remove the two mounting screws (3).
8. Remove the remove the steering potentiometer (1) from the mounting bracket (4).
9. Remove the two mounting screws (5).
10. Remove the mounting bracket (4) from the rear steering axle.
11. Remove the bolt (6) and washer (7) from the rear steering axle.

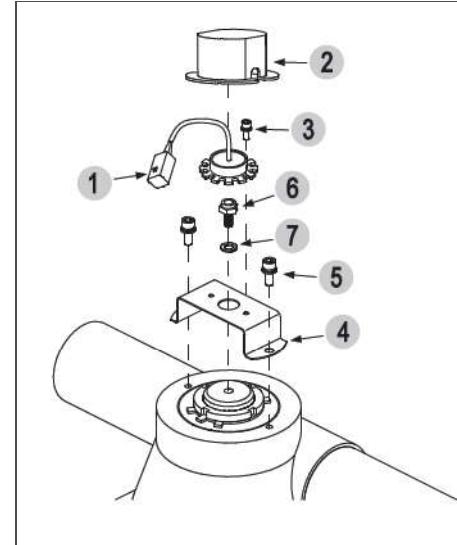


Figure 5-6 Steering Potentiometer

5-5.2. Steering Potentiometer Installation

1. Install rear steering axle by reversing the steps 5-11in paragraph 5-5.1.
2. Install the counterweight according to paragraph 5-3.2.
3. Reverse the steps 2-3 in paragraph 5-5.1.
4. Turn on the key switch and disengage the emergency disconnect switch.

5-6. STEERING PUMP AND MOTOR ASSEMBLY

5-6.1. Steering Pump and Motor Assy. Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the front wheels to prevent movement.
3. Remove the back cover according to paragraph 5-8.1.
4. Remove the cables (1, [Figure 5-7](#)) from the pump contactor and pump motor.
5. Loosen the two connectors (2) and remove the hoses (3) from the pump body.

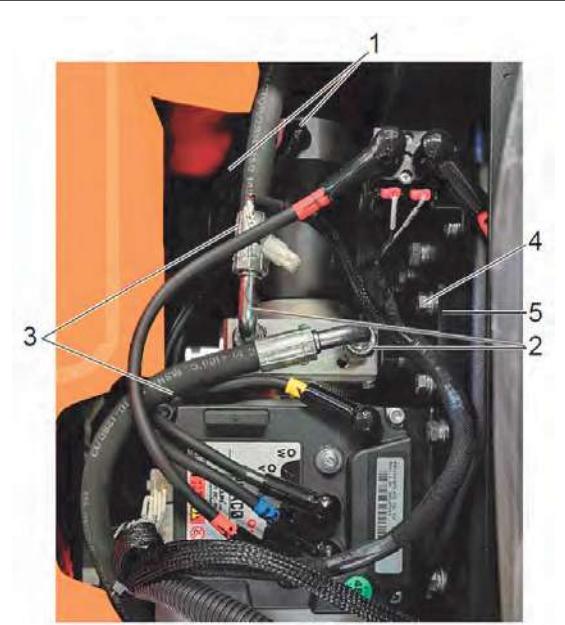


Figure 5-7 Steering Pump and Motor Assembly

6. Remove the counterweight according to paragraph 5-3.1.
7. Remove the two bolts (4) and remove the bracket (5)

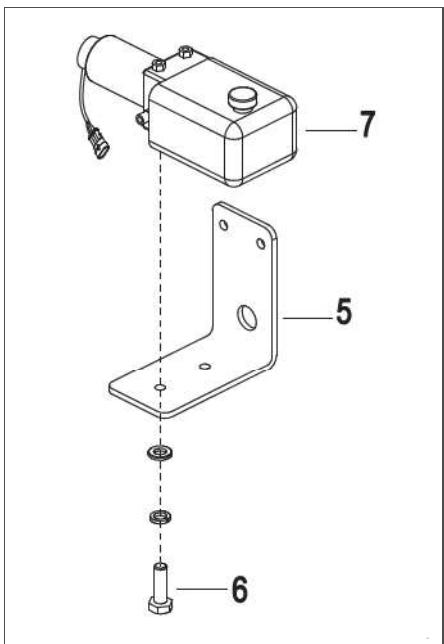


Figure 5-8 Steering Pump & Motor Assy. Mounting

8. Remove the two bolts (6, Figure 5-8) and remove the steering pump and motor assembly (7) from the bracket (5).

5-6.2. Steering Pump and Motor Assy. Installation

1. Install steering pump and motor assembly by reversing the steps 7-8in paragraph 5-6.1.
2. Install the counterweight according to paragraph 5-3.2.
3. Reverse the steps 4-5 in paragraph 5-6.1.
4. Install the back cover according to paragraph 5-8.2.
5. Remove the blocks from the front wheels.
6. Turn on the key switch and disengage the emergency disconnect switch.

5-7. STEERING PUMP MOTOR

5-7.1. Steering Pump Motor Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the steering pump and motor assembly according to paragraph 5-6.1.
3. Remove the two screws (9) on the motor base and remove the pump motor (1, Figure 5-9) from the valve body.
4. Remove the steering encoder (8) from the end of the pump motor.

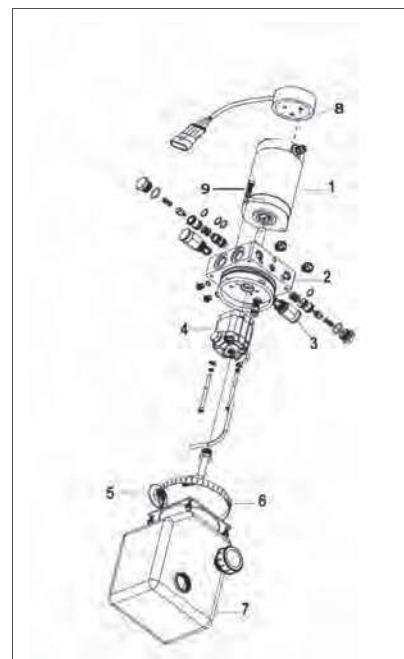


Figure 5-9 Steering Pump Motor

5-7.2. Steering Pump Motor Installation

1. Install steering pump motor by reversing step 2-4 in paragraph 5-7.1.
2. Turn on the key switch and disengage the emergency disconnect switch.

5-8. RIGHT AND BACK COVERS

5-8.1. Right and Back Covers Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the four screws (1, Figure 5-10).
3. Remove the right cover (2).
4. Remove the two screws (3).
5. Remove the back cover (4) from the bracket.

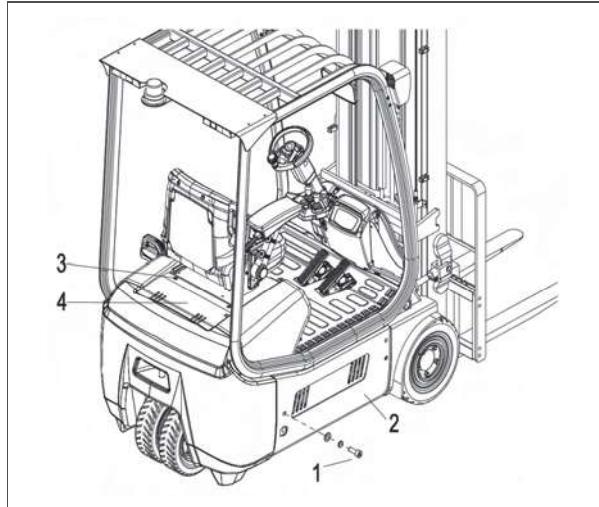


Figure 5-10 Right Cover

5-8.2. Right and Back Covers Installation

1. Install the right and back covers by reversing steps 2-5 in paragraph 5-8.1.
2. Turn on the key switch and disengage the emergency disconnect switch.

5-9. OPERATING HANDLE COVER

5-9.1. Operating Handle Cover Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the four screws (1, Figure 5-12) and remove the lower operating handle cover (2).
3. Remove the three screws (4) and remove the lower operating armrest cover (5) from the operating armrest (3).
4. Disconnect the connection between the operating handle and operating armrest harness (6).
5. Remove the operating armrest harness (6).
6. Remove the four screws (7) and remove the operating handle from the operating armrest (3).

7. Remove the eight screws (8), then remove the side shift lever (9) and the tilt/lift lever (10).
8. Remove the horn button (12) and the emergency stop switch (11).
9. Remove the three screws (14) and remove the upper operating handle cover (13), then remove the directional switch (15).

5-9.2. Operating Handle Cover Installation

1. Install the right and back covers by reversing steps 2-9 in paragraph 5-9.1.
2. Turn on the key switch and disengage the emergency disconnect switch.

5-9.3. Front Cover Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the two screws (1, Figure 5-11).
3. Remove two screws (2).
4. Remove the front cover (3).

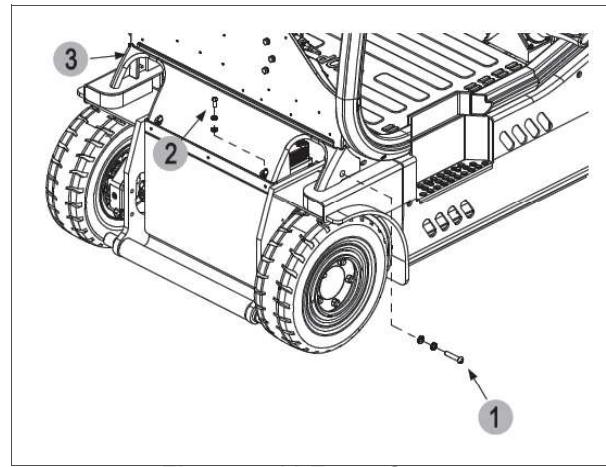


Figure 5-11 Front Cover

5-9.4. Front Cover Installation

1. Install the front cover by reversing steps 2-4 in paragraph 5-9.3.
2. Turn on the key switch and disengage the emergency disconnect switch.

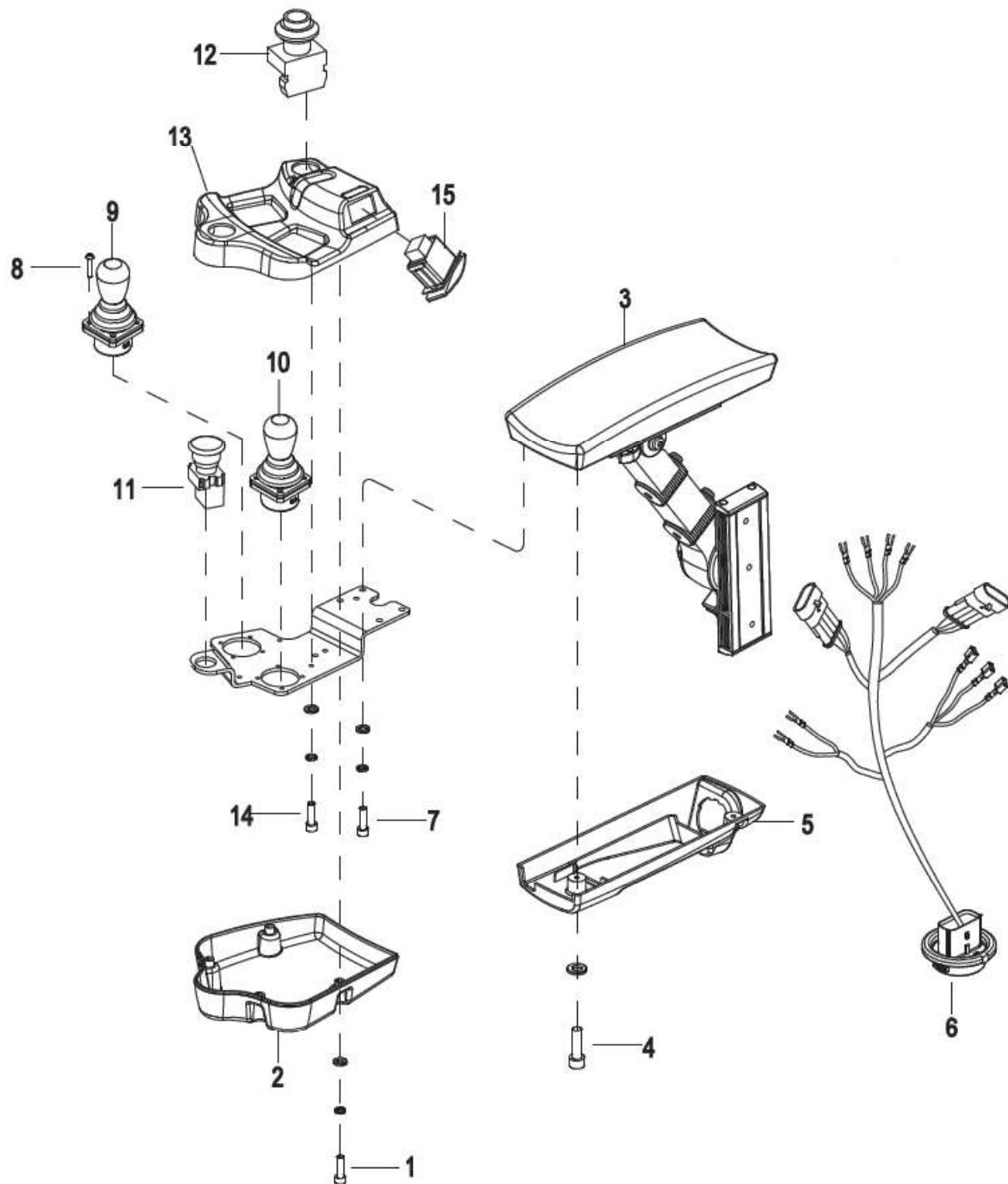


Figure 5-12 Operating Handle

SECTION 6

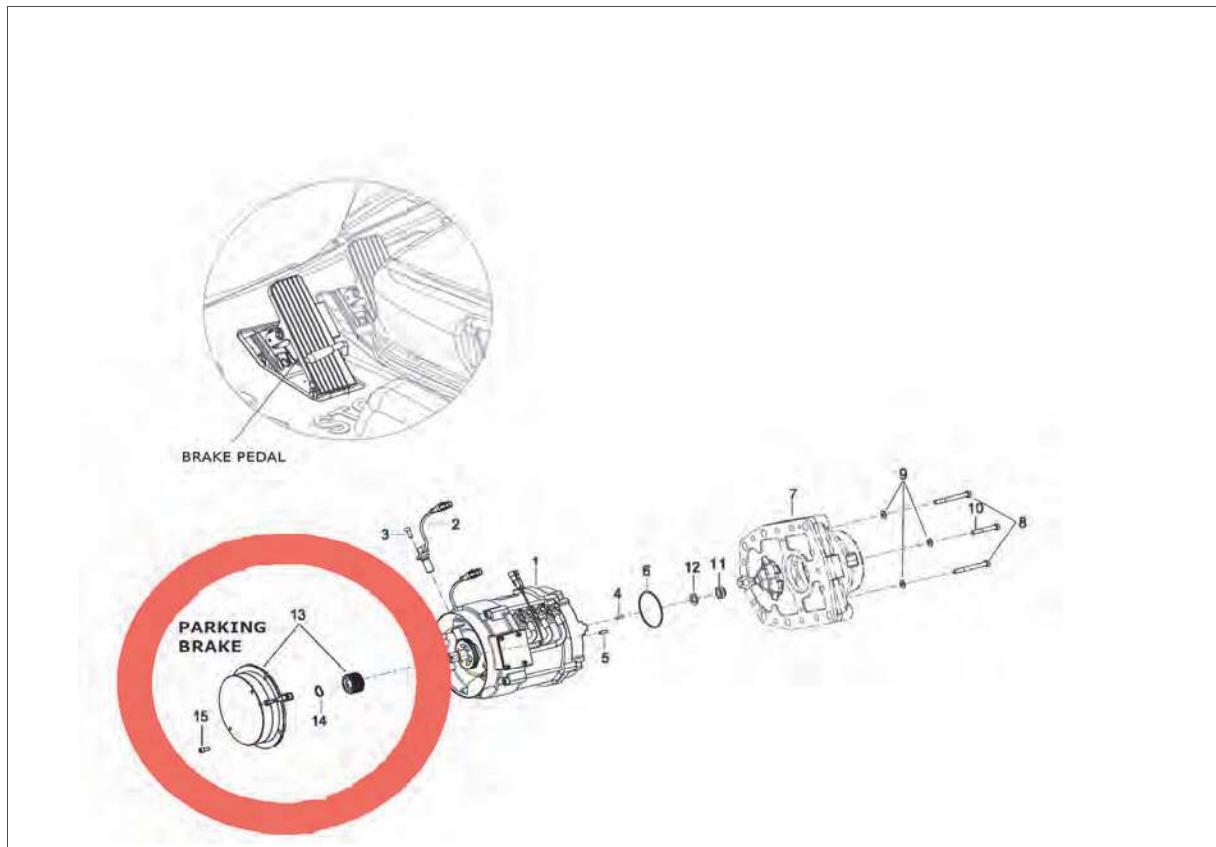
BRAKE SERVICING

6-1. BRAKES

There are two types of brakes: parking brake and foot brake. The parking brake is a mechanical brake that is spring applied and activates when you push the parking brake button on the dashboard.

The brake pedal controls the stopping distance by reversing the drive motor's magnetic field to stop the truck.

Braking distance can be adjusted through parameters in the controller.



NOTES

SECTION 7

DRIVE UNIT, DRIVE WHEELS

7-1. DRIVE WHEEL

7-1.1. Drive Wheel Assembly Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the rear wheels to prevent movement.
3. Raise the side of the truck off the ground to provide clearance for wheel removal. Block the truck to prevent accidental lowering.
4. Remove the 5 nut covers (4, Figure 7-1).
5. Remove the 5 nuts (2).
6. Carefully remove the drive wheel (3).

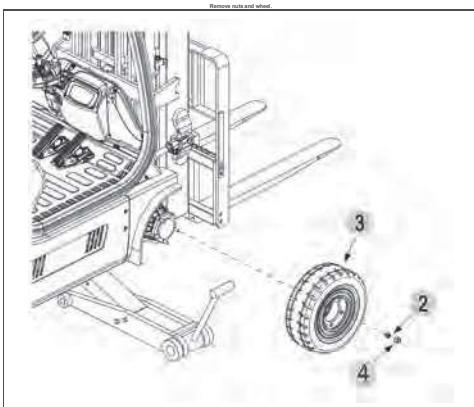


Figure 7-1 Drive Wheel Removal

7-1.2. Drive Wheel Assembly Installation

1. Install in reverse order of paragraph 7-1.1.
2. Torque nuts to 162 ft-lb (220 Nm).

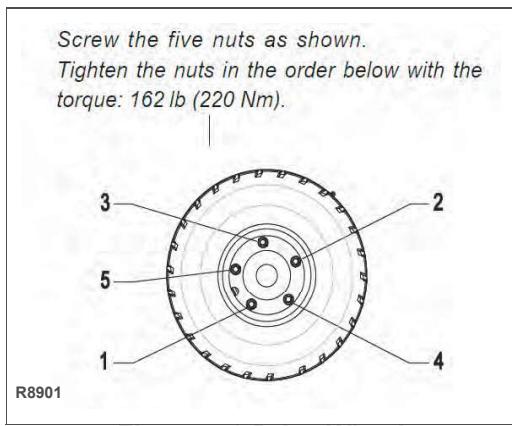


Figure 7-2 Drive Wheel

7-2. DRIVE MOTOR

7-2.1. Drive Motor Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the U, V and W cables (Figure 7-3) on the drive motor.
3. Remove the drive wheel as described in paragraph 7-1.1.
4. Disconnect the connection between the drive motor and the main wiring cables.
5. Disconnect the connection between the brake and the main wiring cables.
6. Remove the 6 bolts (3, Figure 7-3) and remove the 3 plates (4).
7. Remove the 7 bolts (5) and remove the gearbox (6) and the drive motor (8) from the chassis.
8. Remove the 3 bolts (7) and remove the drive motor (8) from the gearbox (6).
9. Remove the nut (9) and remove the motor gear (10 and O-ring (11) from the drive motor (8)

7-2.2. Drive Motor Installation

1. Install in reverse order of paragraph 7-2.1.

NOTE: When installing the motor gear onto the shaft of the motor make sure that woodruff key on the motor shaft is fully seated on the motor gear.

Motor gear should fully engage with the gear within the gearbox, rotate the gearbox without blocking and then secure it with four screws.

For torque requirements see (Figure 7-3).

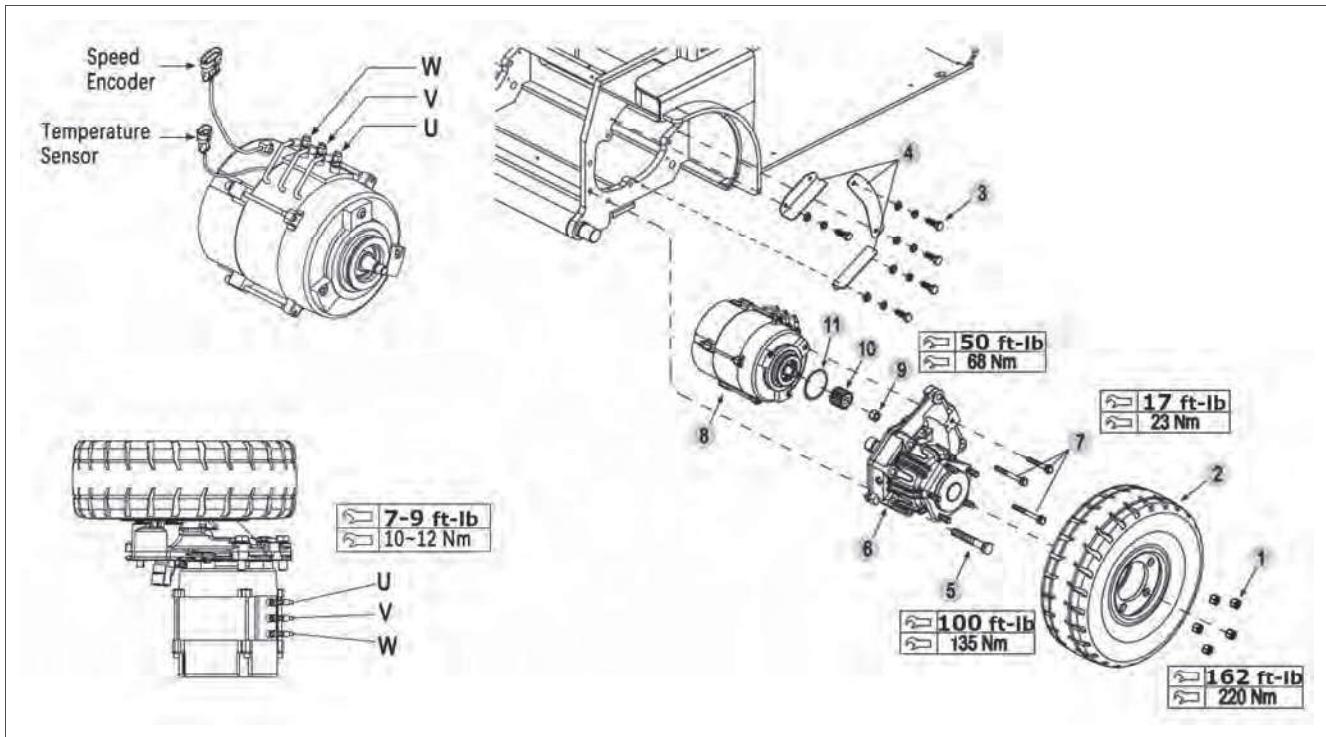


Figure 7-3 Drive Motor

7-3. SPEED ENCODER

7-3.1. Speed Encoder Removal

Turn off the key switch and engage the emergency disconnect switch.

2. Disconnect the plug on the speed encoder (3, [Figure 7-4](#)).
3. Remove the screw (1) that secures the speed encoder to the drive motor and remove the speed encoder.

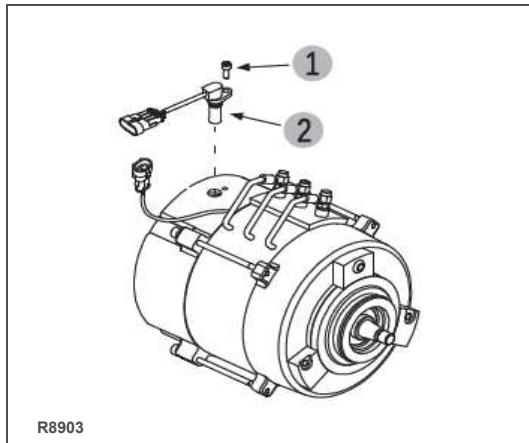


Figure 7-4 Speed Encoder

SECTION 8

ELEVATION SYSTEM SERVICING

8-1. GENERAL

The elevation system includes the outer mast, inner mast, lift linkage, lift chains, lift cylinder and ram head.

8-2. LIFT CHAIN WEAR INSPECTION

The lift chain should be replaced when it is worn enough to increase its length by 3% or more. To make this determination proceed as follows.

Using a section of chain that sees the most frequent operation over the chain sheaves, isolate a vertical portion under tension from the weight of carriage and forks.

If measured distance between pin center on 20 vertical links is 12.88" or more, the chain should be replaced.

New chain anchor pins should be installed when chains are replaced. Never replace a partial section of chain and never repair chain. Refer to paragraph 8-4. when installing new chain.

8-3. LIFT CHAIN LENGTH ADJUSTMENT

1. Fully lower the lift carriage.
2. Turn off the key switch and engage the emergency disconnect switch.
3. **WARNING:** Before attempting any adjustment, make certain power is disconnected.
4. Loosen the lower of the two jam nuts (2, Figure 8-1) on chain anchor (1) to allow for adjustment of the top jam nut (2).
5. Break the lower jam nut (2) free from the top jam nut (2).
6. Take up slack in both lift chain with the top jam nut (2) by screwing it upward.
7. Align chain anchor (1) so the cotter pins (7) are parallel to the mast.
8. **CAUTION:** At least 3 full threads must be present below lower nut after adjustment.
9. Tighten jam nuts (2) securely while maintaining alignment of cotter pins (7).
10. Turn on the key switch and disengage the emergency disconnect switch.
11. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

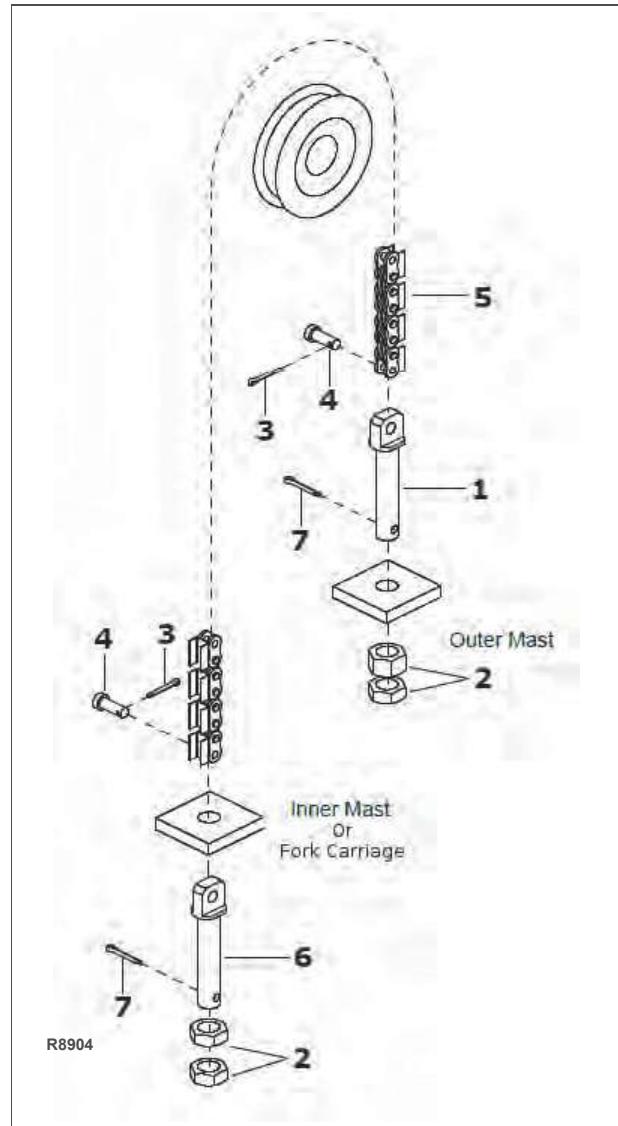


Figure 8-1 Chain Assembly

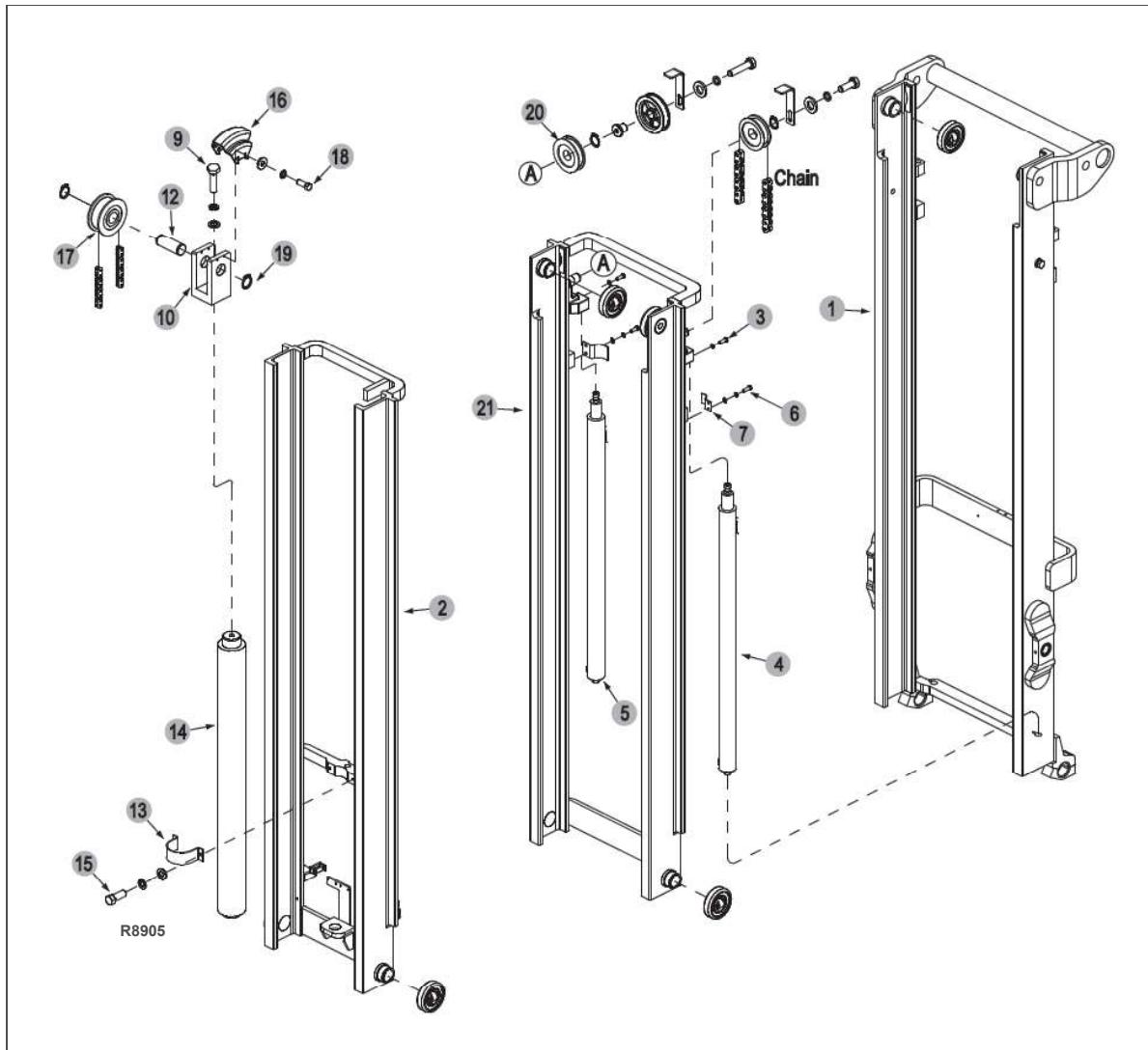


Figure 8-2 Mast System

8-4. LIFT CHAIN REPLACEMENT

8-4.1. Mast Chain Replacement

1. With the lift truck wheels securely blocked, raise the forks approximately two feet from floor and position blocks or strong supports under the lift carriage.
 2. Lower lift carriage onto the support. Check that arrangement is secure before proceeding.
 3. Turn off the key switch and engage the emergency disconnect switch.
- WARNING:** Before attempting any replacement, make certain power is disconnected.
4. Remove the cotter pin (7, [Figure 8-1](#)) and remove the two jam nuts (2) from the chain anchor (1) and chain anchor (6).

5. Remove the chain assembly from the chain sprocket (20, [Figure 8-2](#)).
6. Remove the cotter pin (3, [Figure 8-1](#)), pull out the pin shaft (4) and separate the chains (5) from the chain anchor (1) and chain anchor (6).
7. Replace with new chains and hang the new chain assembly onto the chain sprocket.
8. Put the chain anchor (6) through the inner mast (2, [Figure 8-2](#)) chain anchor brackets hole, secure with the jam nuts (2, [Figure 8-1](#)).
9. Put the chain anchor (1) through the outer mast (1, [Figure 8-2](#)) chain anchor bracket hole, secure with the jam nuts (2, [Figure 8-1](#)).
10. Adjust the chains according to paragraph 8-3.
11. Turn on the key switch and disengage the emergency disconnect switch.

8-4.2. Fork Carriage Chains Replacement

1. With the lift truck wheels securely blocked, raise the forks approximately two feet from floor and position blocks or strong supports under the lift carriage.
2. Lower lift carriage onto the support. Check that arrangement is secure before proceeding.
3. Turn off the key switch and engage the emergency disconnect switch.

WARNING: Before attempting any replacement, make certain power is disconnected.

4. Remove the cotter pin (7, [Figure 8-1](#)) and remove the two jam nuts (2) from the chain anchor (1) and chain anchor (6).
5. Remove the chain assembly from the chain sprocket (17, [Figure 8-2](#)).
6. Remove the cotter pin (3, [Figure 8-1](#)), pull out the pin shaft (4) and separate the chains (5) from the chain anchor (1) and chain anchor (6).
7. Replace with new chains and hang the new chain assembly onto the chain sprocket.
8. Put the chain connector (6) through the fork carriage chain anchor brackets hole, secure with the jam nuts (2).
9. Put the chain anchor (1) through the middle mast (21, [Figure 8-2](#)) chain anchor bracket hole, secure with the jam nuts (2, [Figure 8-1](#)).
10. Adjust the chains according to paragraph [8-3](#).
11. Turn on the key switch and disengage the emergency disconnect switch.

8-5. LIFT CYLINDERS

NOTE: Removal and repair of lift cylinders are covered in [SECTION 9](#).

8-6. MAST

8-6.1. Mast Removal

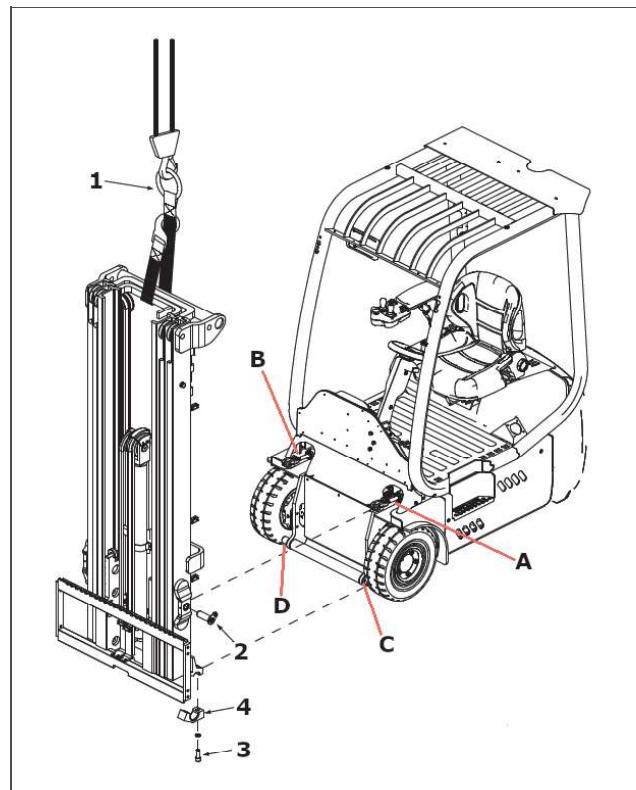


Figure 8-3 Mast Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the truck to prevent movement.
3. Put a container under the mast to collect the hydraulic oil when disconnecting the hoses.
4. Disconnect all the hoses that connects to the mast.

NOTE: Make sure that the crane or other equipment you are using can handle the weight of the mast.

5. Wrap a sling (1, [Figure 8-3](#)) around the upper beam of inner and outer masts and slowly lift the sling with a crane. Just lift it enough to put tension on the sling;
6. Remove the shafts (2) between the outer mast and tilt cylinders (A and B).
7. Remove the bolts (3) and remove the mounting blocks (4) between the outer mast and chassis (C and D)
8. Remove the mast from the truck.

8-6.2. Mast Installation

1. Install in reverse order of paragraph 8-6.1.

NOTES

SECTION 9

HYDRAULIC SYSTEM SERVICING

9-1. LINES AND FITTINGS

WARNING: When forks are raised, pressure exists in the hydraulic system lines and fittings. To ensure release of pressure, forks must be fully lowered and the battery disconnected before performing any maintenance on the hydraulic system.

NOTE: Leaking hydraulic fittings may be remedied by simply tightening fittings. If this does not remedy the leak, the fittings or line must be replaced.

9-2. PUMP AND MOTOR ASSEMBLY

9-2.1. Pump and Motor Assembly

1. Lower forks fully.
2. Turn off the key switch and engage the emergency disconnect switch.
3. Remove the right cover (refer to paragraph 5-8.1. for instructions).

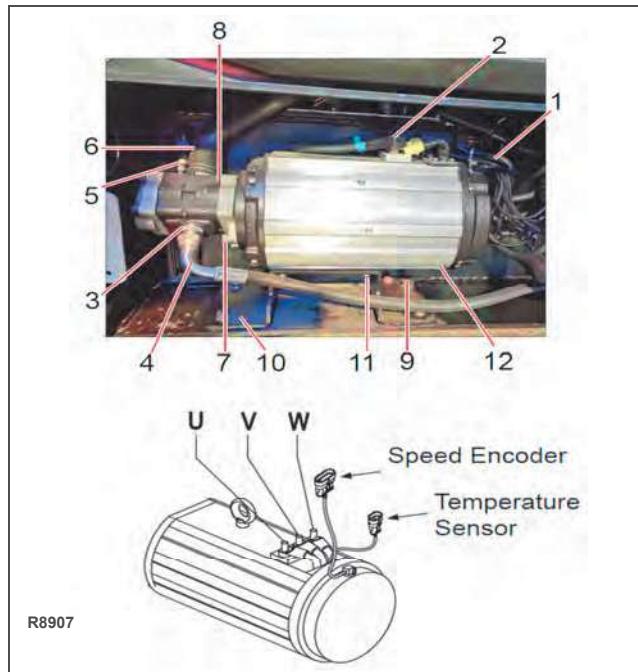


Figure 9-1 Pump and Motor Assembly

4. Disconnect the speed encoder and temperature sensor (1, Figure 9-1) on the pump motor (12) and remove the cables U, V and W (2) from the motor (12).

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container

under the line or fitting before disconnecting

5. Loosen hose connector (3) and remove the hose (4).
6. Remove the hose clamp (5) from the inlet hose (6).
7. Remove the two mounting bolts (7) and remove the gear pump (8) from the motor (12).
8. Remove the four bolts (9) and remove the bracket (10) from the chassis.
9. Remove the four bolts (11) and remove the motor (12) from the bracket (10).

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting

10. Install in the reverse order from 9 to 3.

9-3. PUMP MOTOR SPEED ENCODER

9-3.1. Pump Motor Speed Encoder Removal

1. Turn off the key switch and engage the emergency disconnect switch.

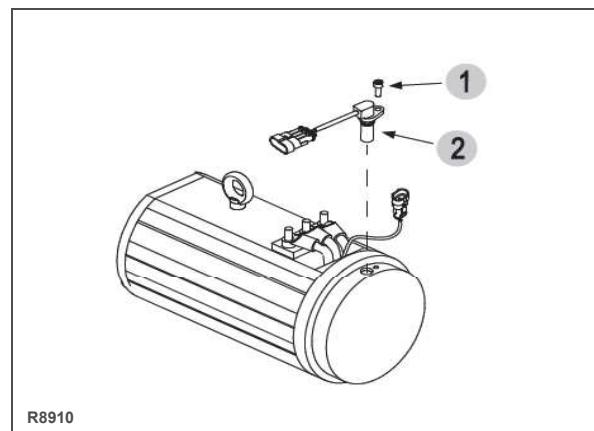


Figure 9-2 Pump Motor Speed Encoder

2. Remove the right cover (refer to paragraph 5-8.1. for instructions).
3. Disconnect the AMP connector on the speed encoder(2, Figure 9-2).
4. Remove the screw (1) from the drive motor and remove the speed encoder.

9-3.2. Pump Motor Speed Encoder Installation

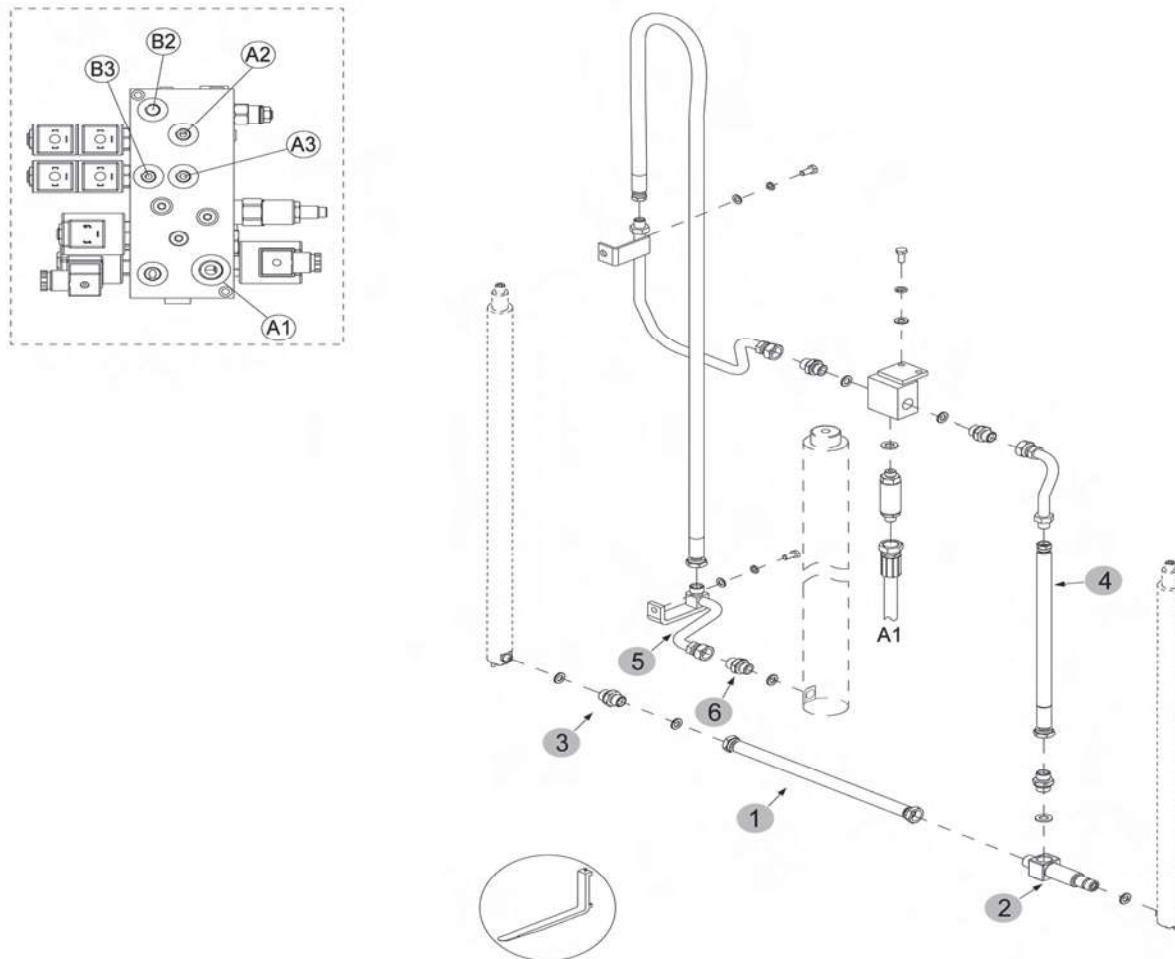
1. Install in reverse order of paragraph 9-3.1.

9-4. HYDRAULIC LINES

1. Turn off the key switch and engage the emergency disconnect switch.
2. Refer to [Figure 9-3](#) and remove leaking line or fitting and replace it with a new line or fitting.
3. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

4. Turn on the key switch and disengage the emergency disconnect switch.
5. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.
6. Turn the steering wheel back and forth to refill steering axle and lines with hydraulic oil.
7. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

Code	Description
A1	Lifting / Lowering Mast Tubing



R8911

Figure 9-3 Hydraulic Lines - Mast

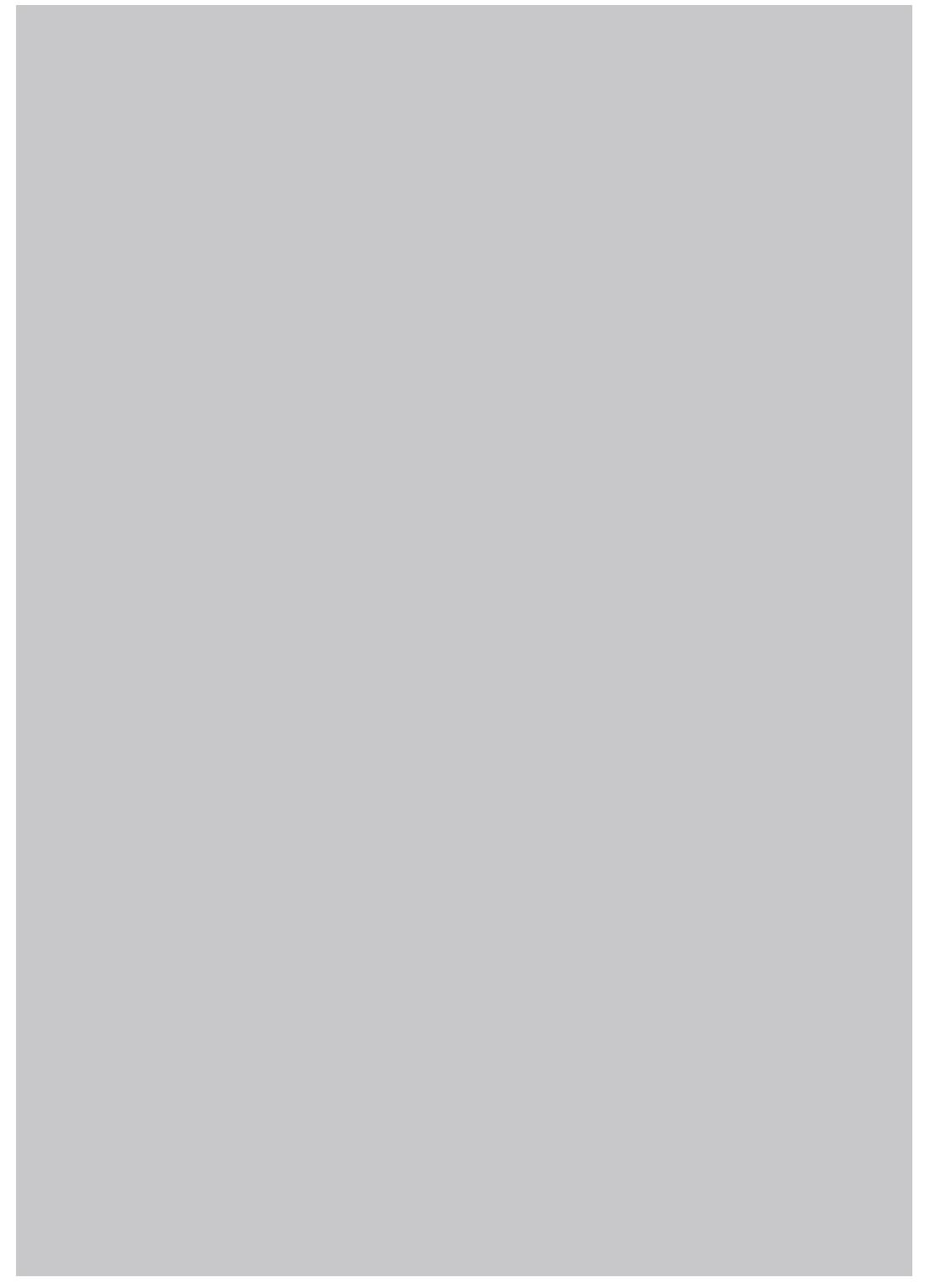


Figure 9-4 Hydraulic Lines - Side Shift

9-5. CONTROL VALVE

9-5.1. Control Valve Removal

WARNING: When forks are raised, pressure exists in the hydraulic system lines and fittings. To ensure release of pressure, forks must be fully lowered and the battery disconnected before performing any maintenance on the hydraulic system.

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting.

1. Lower forks fully.
2. Turn off the key switch and engage the emergency disconnect switch.

3. Remove the right cover (refer to paragraph 5-8.1. for instructions).
4. Remove the hoses from the control valve and the wiring harness.
5. Remove the two screws (1, [Figure 9-5](#)) and remove the control valve.

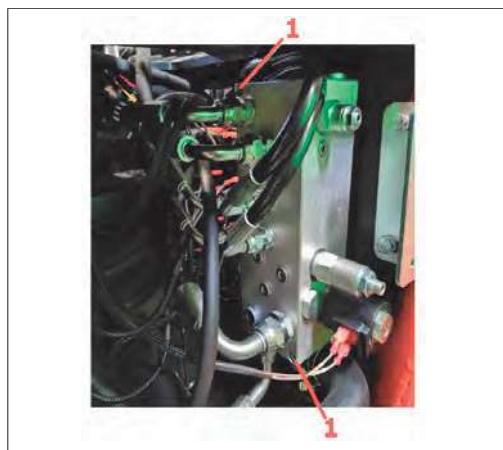
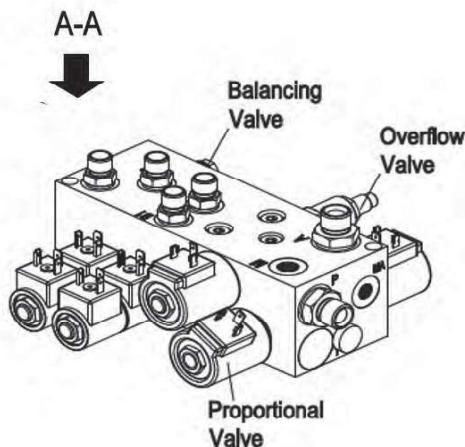


Figure 9-5 Control Valve Mounting

9-5.2. Control Valve Installation

1. Install in reverse order of paragraph 9-5.1..
2. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
3. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.

Symbol	Interface Function	Connection Terminals	Interface Size
A1	Lifting, lifting / lowering solenoid valve controls	Lift Cylinder	G1/2
A2	Backward tilting, backward tilting solenoid valve controls	Tilt Cylinder	G1/4
B2	Forward tilting, forward tilting solenoid valve controls	Tilt Cylinder	G1/4
A3	Left shifting, left shifting solenoid valve controls	Side-Shift Cylinder	G1/4
B3	Right shifting, right shifting solenoid valve controls	Side-Shift Cylinder	G1/4



A-A

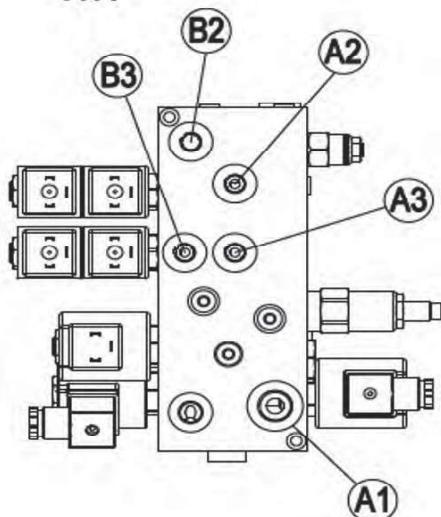


Figure 9-6 Control Valve

9-6. TILT CYLINDER

9-6.1. Tilt Cylinder Removal

WARNING: When forks are raised, pressure exists in the hydraulic system lines and fittings. To ensure release of pressure, forks must be fully lowered and the battery disconnected before performing any maintenance on the hydraulic system.

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting.

WARNING: Mast must be supported by a hoist before removing tilt cylinders.

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the wheels to prevent movement.
3. Secure mast with a hoist.
4. Lift up on floor board and disconnect harness from accelerator and move the floor board out of the way.
5. Tag and disconnect hoses (6, Figure 9-8) from the tilt cylinder (3).
6. Remove the anchor bolt (1) from the outer mast and pull out the shaft (2).
7. Support the cylinder and remove the anchor bolt (4) from the chassis and pull out the shaft (5).
8. Remove the tilt cylinder (3).

NOTE: Leaking hydraulic fittings may be remedied by simply tightening fittings. If this does not remedy the leak, the fittings or line must be replaced.

9-6.2. Repair of Tilt Cylinder

WARNING: To prevent cylinder damage, use proper pipe vise. The cylinder will be distorted if the vise is tightened too much.

1. Secure the cylinder assembly in a vise.
2. Remove nut (3, Figure 9-7), lock washer (4), bolt (2) and rod end (1) from piston rod (5).
3. Using spanner wrench, remove gland nut (11) from cylinder body (6).
4. Remove dust seal (7), shaft sleeve (8), cover plate (9), seal (10), O-ring (12) and O-ring (13) from gland nut (11).

5. Pull piston rod (5) from cylinder body (6).
6. Remove seal (14) and support ring (15) from the piston.

NOTE: Before reassembling the cylinder, it is recommended that packing kit items be replaced.

7. Reassemble the cylinder in reverse order for disassembly.

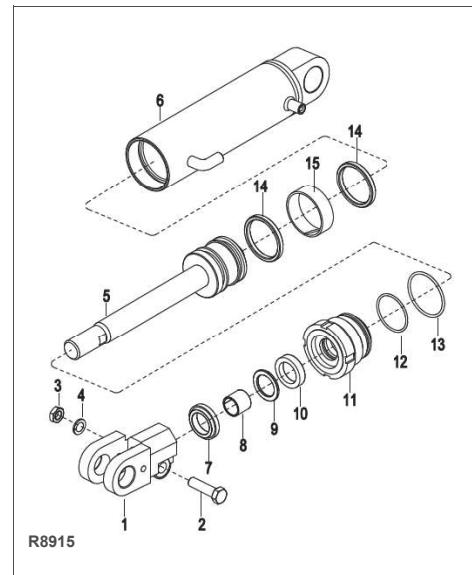


Figure 9-7 Tilt Cylinder

9-6.3. Tilt Cylinder Installation

1. Install in reverse order of paragraph 9-6.1..
2. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
3. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.
4. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

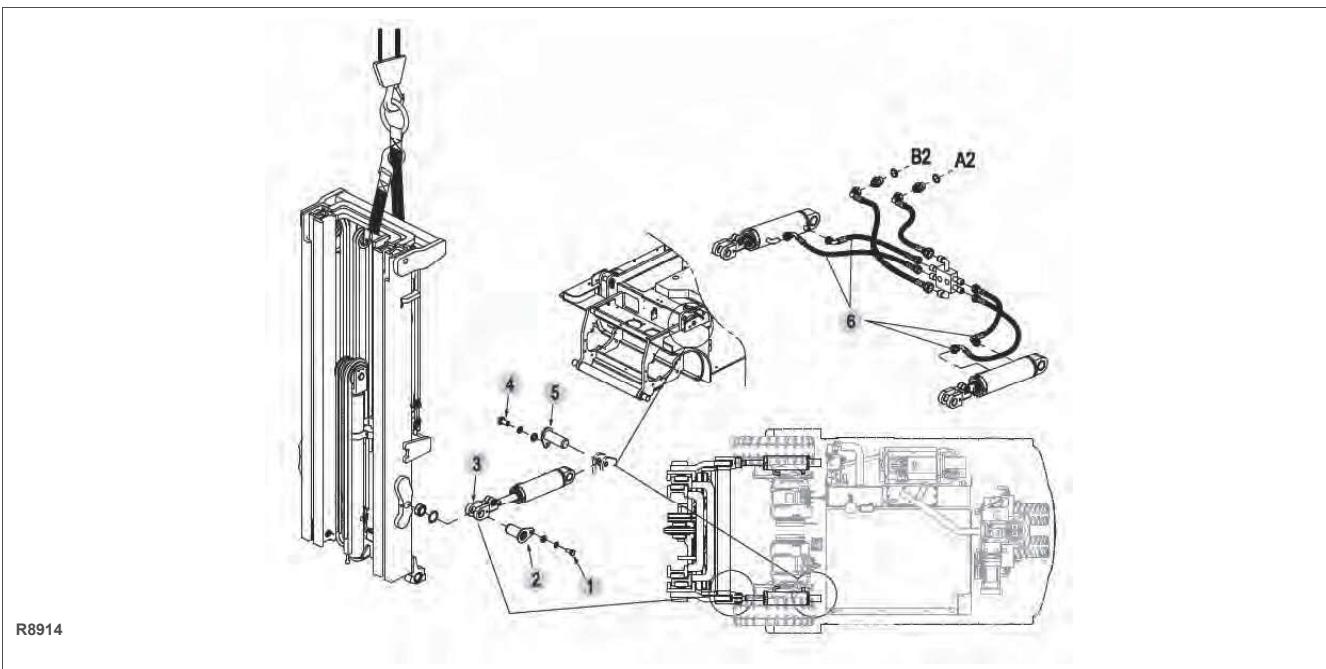


Figure 9-8 Hydraulic Tilt

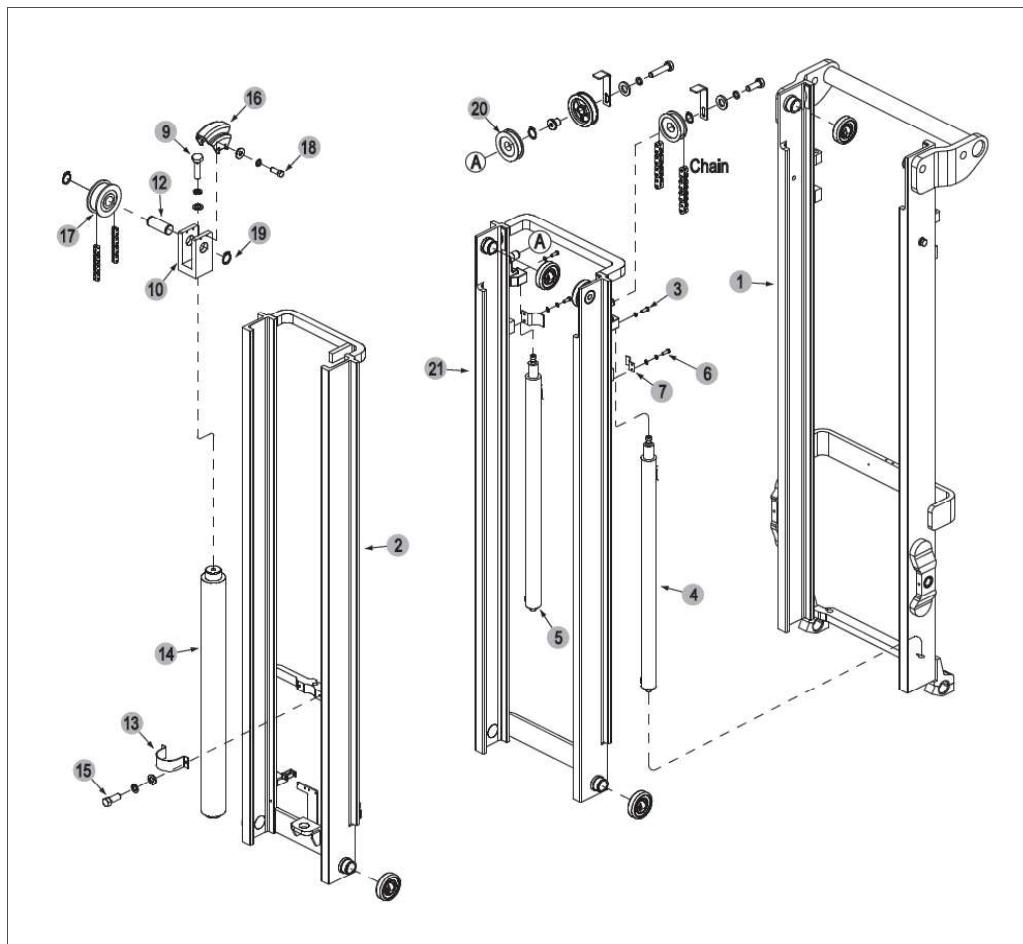


Figure 9-9 Mast System

9-7. LIFT CYLINDER (TRIMAST)

9-7.1. Free Lift Cylinder Removal

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under the lift carriage.
2. Lower lift carriage onto the support. Check that arrangement is secure before proceeding.
3. Turn off the key switch and engage the emergency disconnect switch.

WARNING: Before attempting any replacement, make certain power is disconnected

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting relieve the hydraulic pressure

4. Remove the fitting (6, [Figure 9-3](#)) separating the pipe from the free lift cylinder.
5. Remove the bolts (3, [Figure 9-4](#)) and remove the bracket (4).
6. Remove the hoses (1).
7. Remove the fork carriage chains as described in paragraph [8-4.2](#).
8. Remove bolt (18, [Figure 9-9](#)) and remove the free lift cylinder chain pulley guard (16).
9. Remove the snap ring (19) and remove the shaft (12).
10. Remove the chain pulley (17).
11. Remove the bolt (9) and then remove the chain pulley bracket (10) from the free lift cylinder (14).
12. Remove the bolt (15) and remove the clamp (13).
13. Separate the free lift cylinder (14) from the inner mast (2).
14. Raise the free lift cylinder (14) up and out of truck.

9-7.2. Repair of Free Lift Cylinder

WARNING: To prevent cylinder damage, use proper pipe vise. The cylinder will be distorted if the vise is tightened too much.

1. Secure the cylinder assembly in a vise.
2. Using spanner wrench, remove gland nut (1, [Figure 9-10](#)) from cylinder tube (14).
3. Remove dust ring (2), retainer ring (3), seal (4), bushing (6), O-ring (5) and O-ring (7) from gland nut (1).
4. Pull out the piston rod (8) from the cylinder tube (19).
5. Remove the piston (9) from the piston rod (8).

6. Remove the bushing (11), retaining ring (12) and seal (13) from the piston rod(9).
7. Remove the snap ring (14) then remove the valve seat (15).
8. Remove the retaining ring (17) and remove the spring (18).

NOTE: Before reassembling the cylinder, it is recommended that packing kit items be replaced.

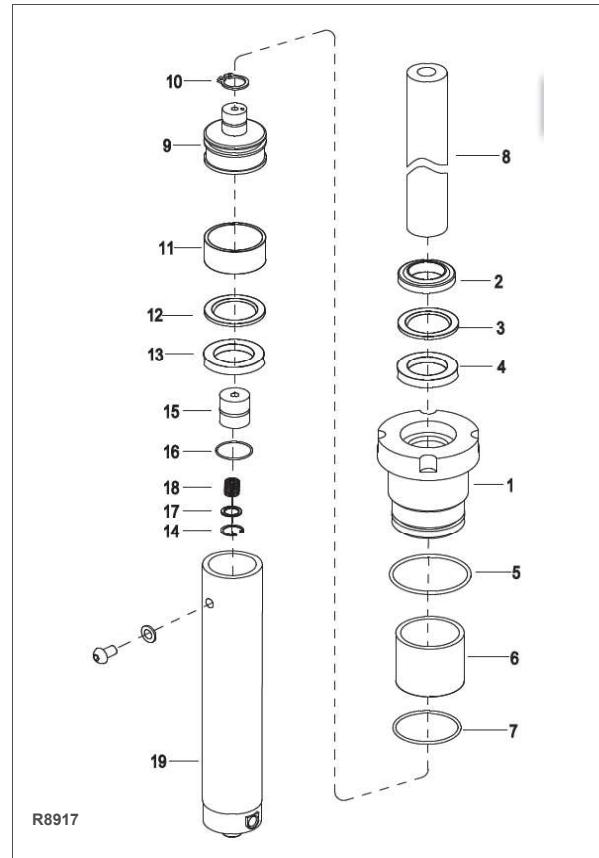


Figure 9-10 Free Lift Cylinder

9. Reassemble in reverse order of disassembly.
10. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
11. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.
12. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

9-7.3. Free Lift Cylinder Installation

1. Install in reverse order of paragraph 9-7.1.
2. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
3. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.

9-7.4. Secondary Lift Cylinder Removal

1. Turn off the key switch and engage the emergency disconnect switch.

WARNING: Before attempting any replacement, make certain power is disconnected.

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting.

1. Remove the mast according to paragraph 8-6.1.
2. Lower the mast making sure that the front of the mast is facing down. Check that arrangement is secure before proceeding.
3. Remove lift chain as described in paragraph 8-4.
4. **Left Cylinder:** Disconnect the hose (1, [Figure 9-3](#)) from three way fitting (2). Remove three way fitting (2) from lift cylinder.

Right Cylinder: Disconnect the hose from lift cylinder. Remove nipple.

WARNING: Support lift cylinder before performing the following steps to prevent cylinder from falling.

5. Remove the bolt (6, [Figure 9-9](#)) and remove the cylinder clamp (7).
6. Remove bolt (3, [Figure 9-9](#)), lock washer and flat washer from the top of the cylinder being removed.
7. Raise the lift cylinder out of truck.

9-7.5. Repair of Secondary Lift Cylinder

WARNING: To prevent cylinder damage, use proper pipe vise. The cylinder will be distorted if the vise is tightened too much.

1. Secure the cylinder assembly in a vise.
2. Using spanner wrench, remove gland nut (1, [Figure 9-10](#)) from cylinder tube (14).
3. Remove dust ring (2), O-ring (3 and bushing (4), from gland nut (1).
4. Pull out the piston rod (5) from the cylinder tube (14).
5. Remove the bushing (6) and the piston (8) from the piston rod (5).
6. Remove the O-ring (7), bushing (9), retaining ring (10) and seal (11) from the piston.
7. Remove the O-ring (12) and bushing (13) from the piston (8).

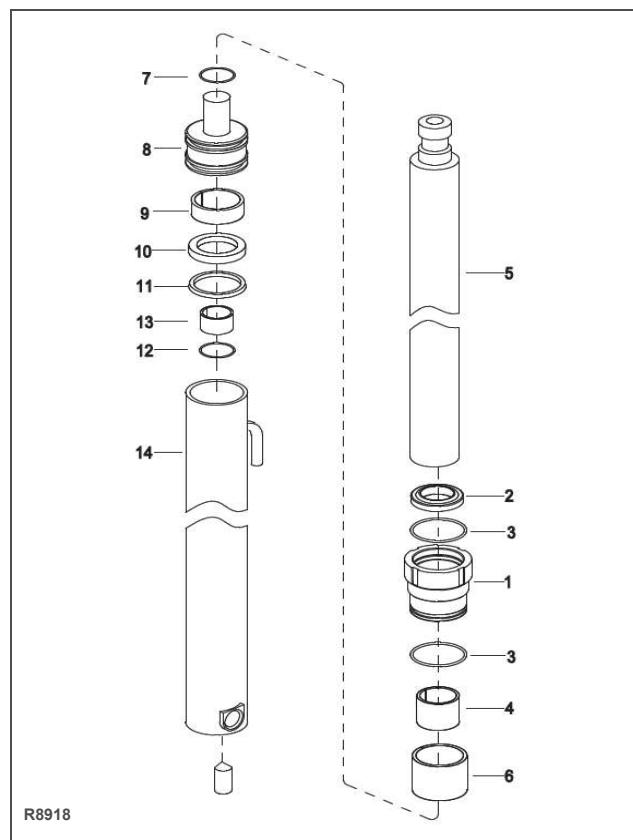


Figure 9-11 Secondary Lift Cylinder

NOTE: Before reassembling the cylinder, it is recommended that packing kit items be replaced.

8. Reassemble in reverse order of disassembly.
9. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
10. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.
11. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

9-7.6. Secondary Lift Cylinder Installation

1. Install in reverse order of paragraph 9-7.4.
2. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
3. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.
4. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#)

9-8. BUILT IN SIDE SHIFT

CAUTION: Hydraulic oil can damage parts. Wipe off any oil immediately. Provide a container under the line or fitting before disconnecting relieve the hydraulic pressure

9-8.1. Built In Side Shift Removal

1. With the lift truck wheels securely blocked, lower the forks to the floor.
2. Turn off the key switch and engage the emergency disconnect switch.
3. Remove the four bolts (3, [Figure 9-12](#)) and remove the load backrest (1) from the side shifter (2).
4. Remove the side shift hoses (1, [Figure 9-4](#)) from the side shift cylinder.
5. Remove the chain assembly and remove the built in side shifter (2, [Figure 9-12](#)) from the inner mast.

9-8.2. Built In Side Shift Installation

1. Install in reverse order of paragraph [9-8.1](#).
2. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
3. Operate all hydraulic levers to refill the cylinders and lines with hydraulic oil.
4. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

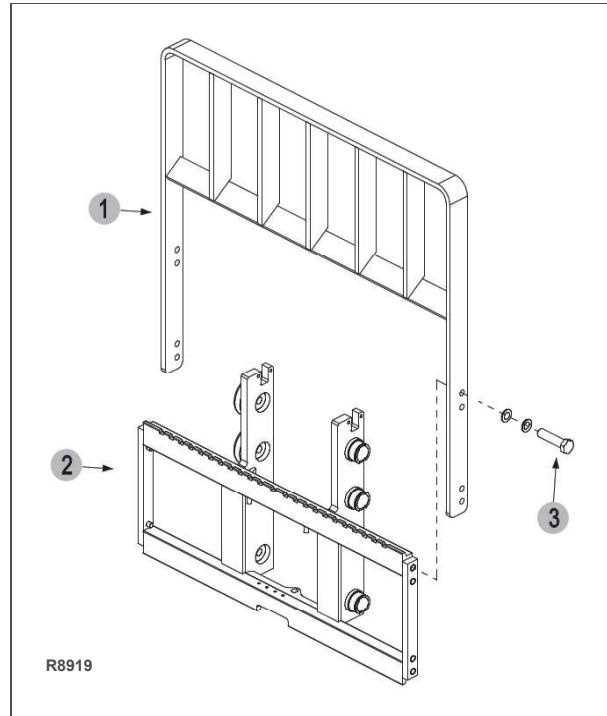


Figure 9-12 Built In Side Shifter

NOTES

SECTION 10 ELECTRICAL COMPONENTS

10-1.DASH BOARD

10-1.1.Dash Board Removal

1. Remove the five screws (, Figure 10-1), remove the control panel cover (2) from the font plate.
2. Disconnect the components on the control panel cover from the main wiring harness.

3. Remove the headlight switch (3), warning light switch (4), blue light switch (5) and other components such as key switch (6) and display unit (7).

10-1.2.Dash Board Installation

1. Install in reverse order of paragraph 10-1.1.

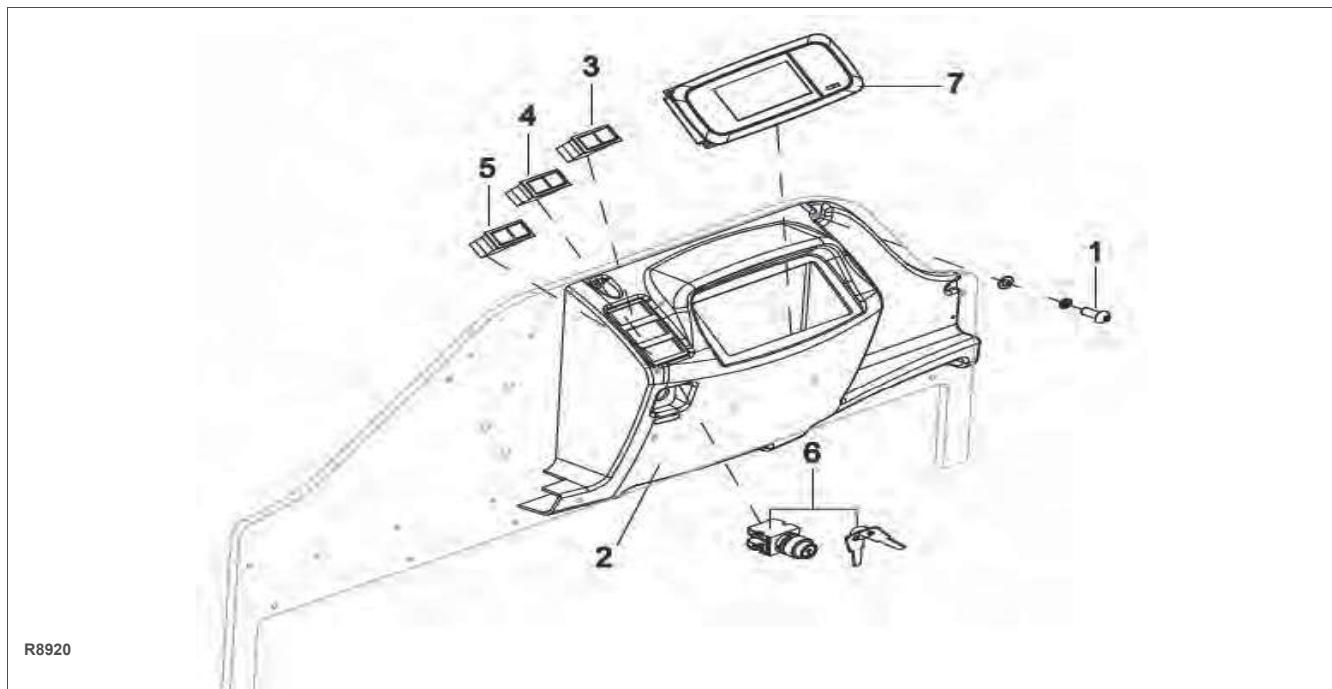


Figure 10-1 Operator Compartment

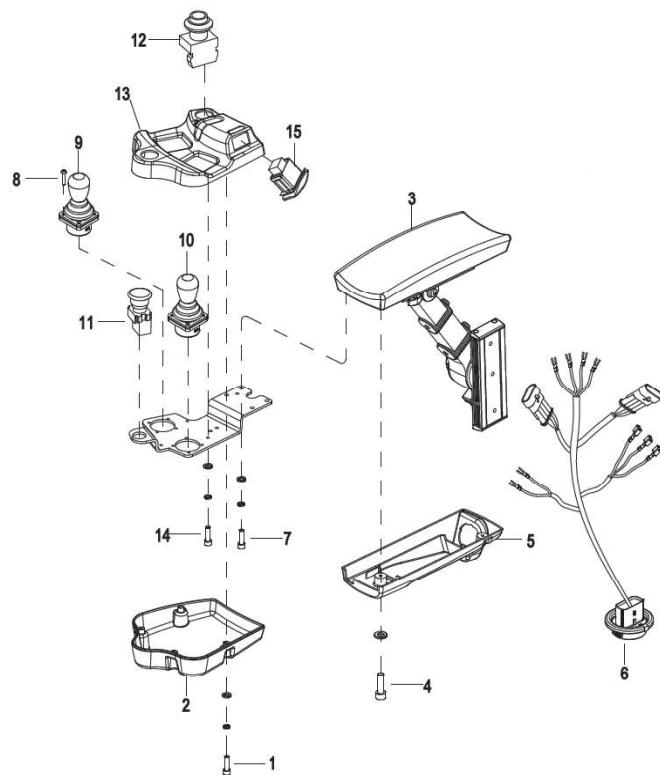


Figure 10-2 Operating Handle

10-2.PARKING BRAKE SWITCH

10-2.1.Parking Brake Switch Removal

1. Remove the dash as described in paragraph 10-1.1.
2. Disconnect the parking brake switch from the main harness and remove from cover (2).

10-2.2.Parking Brake Switch Installation

1. Install in reverse order of paragraph 10-2.1.
2. Install the dash as described in paragraph 10-1.2.

10-3.WARNING LIGHT SWITCH

10-3.1.Warning Light Switch Removal

1. Remove the dash as described in paragraph 10-1.1.
2. Disconnect the warning light switch (4, Figure 10-1) from the main harness and remove from cover (2).

10-3.2.Warning Light Switch Installation

1. Install in reverse order of paragraph 10-3.1.
2. Install the dash as described in paragraph 10-1.2.

10-4.EMERGENCY DISCONNECT SWITCH

10-4.1.Emergency Disconnect Switch Removal

1. Remove as described in paragraph 5-9.1.

10-4.2.Emergency Disconnect Switch Installation

1. Install in reverse order of paragraph 5-9.1.

10-5.DISPLAY UNIT

10-5.1. Display Unit Removal

1. Remove the dash as described in paragraph 10-1.1.
2. Disconnect the display unit (7, Figure 10-1) from the main harness and remove from cover (2).

10-5.2.Display Unit Installation

1. Install in reverse order of paragraph 10-5.1.
2. Install the dash as described in paragraph 10-1.2.

10-6.DIRECTIONAL SWITCH

10-6.1. Directional Switch Removal

1. Remove as described in paragraph 5-9.1.

10-6.2.Directionial Switch Installation

1. Install in reverse order of paragraph 5-9.1.

10-7.KEY SWITCH

10-7.1.Key Switch Removal

1. Remove the dash as described in paragraph 10-1.1.
2. Disconnect the key switch (6) from the main harness and remove from cover (2).

10-7.2.Key Switch Installation

1. Install in reverse order of paragraph 10-7.1.

10-8.ACCELERATOR PEDAL

10-8.1.Accelerator Pedal Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the floor mat.
3. Disconnect the accelerator pedal wiring (1, Figure 10-3) from the main wiring harness.
4. Remove the two bolts (2) and remove the accelerator pedal from the chassis.

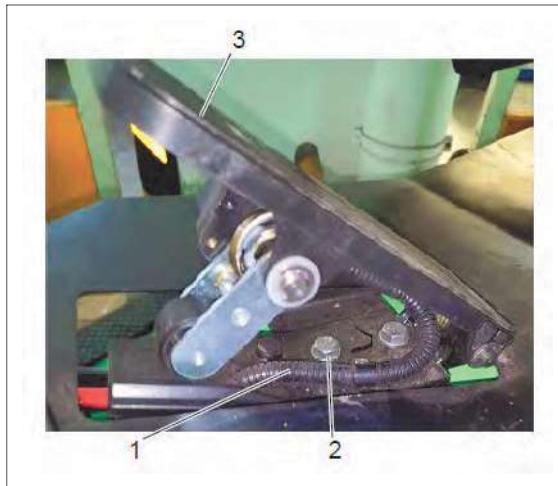


Figure 10-3 Accelerator Pedal

10-8.2.Accelerator Pedal Installation

1. Install in reverse order of paragraph 10-8.1.

10-9.ELECTRICAL CONTROL PANEL

NOTE: Erratic operation of the truck may be caused by defective controller components. Before removing the electrical panel, perform troubleshooting procedures per SECTION 4, to determine corrective action to be taken

10-9.1.Combi Controller Removal

1. Remove the mast according to paragraph 8-6.1.
2. Remove the two screws (2, [Figure 10-4](#)) and remove the cover (3) from the chassis.
3. Tag all cables, wiring harnesses and copper strips and remove them from the controller.
4. Remove screws (1, [Figure 10-5](#)) and remove the traction controllers (2) and one pump controller (3).

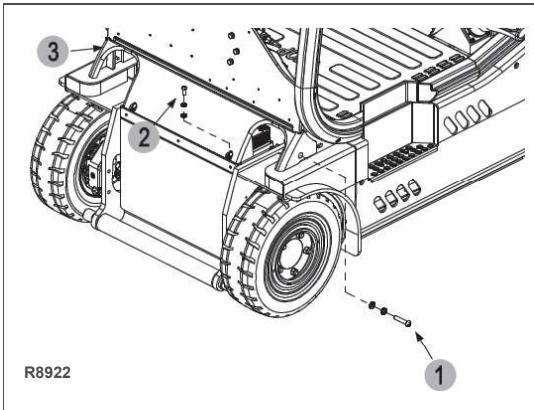


Figure 10-4 Front Cover

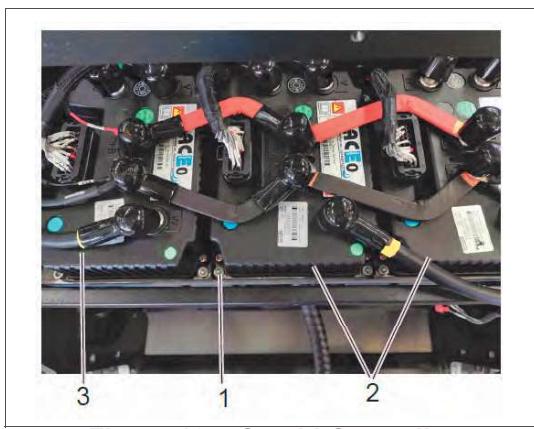


Figure 10-5 Combi Controller

10-9.2.Combi Controller Installation

1. Apply appropriate amount of thermal grease on the back of controller and place the controller on the electrical mounting plate.
2. Follow the steps in reverse order of paragraph 10-9.1.

10-9.3. EPS Controller Removal

1. Remove the back cover according to paragraph 5-8.1.
2. Tag all cables, wiring harnesses and copper strips and remove them from the controller (2, [Figure 10-6](#)).
3. Remove the four screws (1) and remove the steering controller (2) from the electrical mounting plate (3).

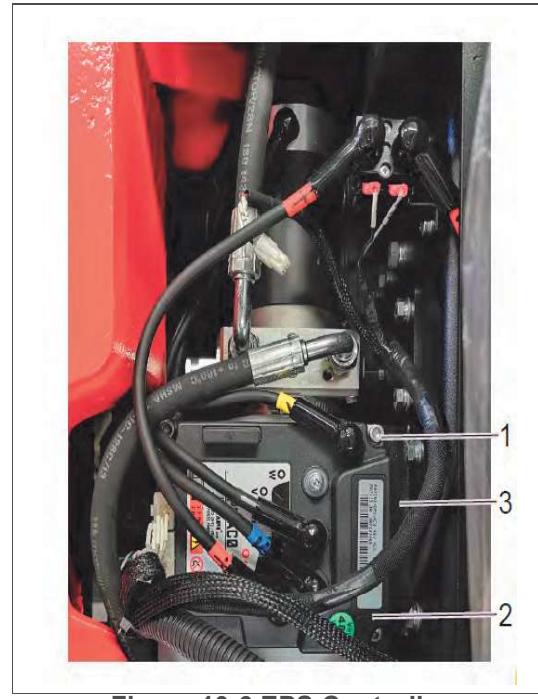


Figure 10-6 EPS Controller

10-9.4. EPS Combi Controller Installation

1. Apply appropriate amount of thermal grease on the back of controller and place the controller on the electrical mounting plate.
2. Follow the steps in reverse order of paragraph 10-9.3.

10-9.5. DC-DC Accessory Converter Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Securely block the truck to prevent movement.
3. Remove the three bolts and remove the counterweight (1, [Figure 10-7](#)) from the chassis.
4. Disconnect harness from DC-DC accessory converter (3, [Figure 10-8](#)).
5. Remove the four screws (2).
6. Remove the DC-DC accessory converter (3).

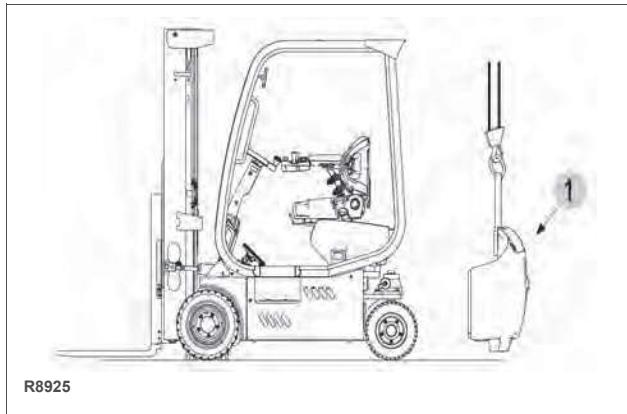


Figure 10-7 Counterweight

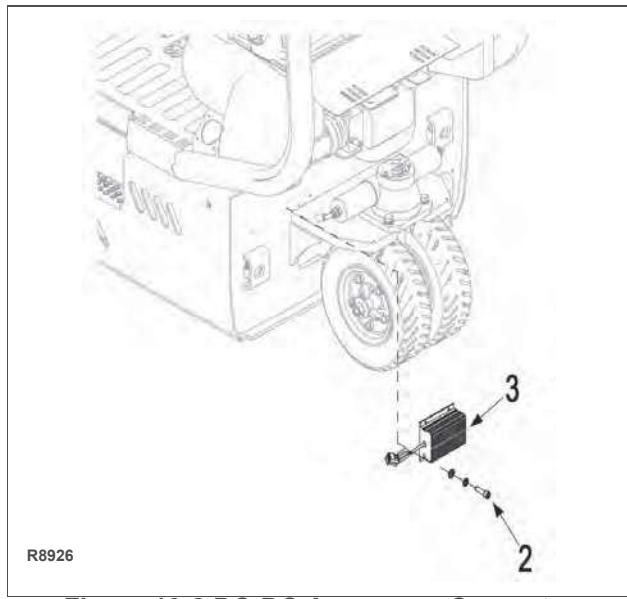


Figure 10-8 DC-DC Accessory Converter

10-9.6. DC-DC Accessory Converter Installation

1. Install in reverse order of paragraph [10-9.5](#).

10-9.7. DC-DC System Converter Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the floor mat and then remove the six screws (1, [Figure 10-9](#)).
3. Remove the front floor plate (3) and back floor plate (2).
4. Disconnect harness from DC-DC system converter (5, [Figure 10-10](#)).
5. Remove the two screws (4).
6. Remove the DC-DC system converter (3).

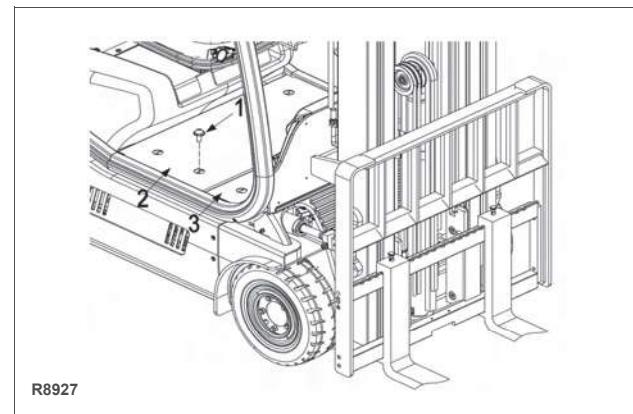


Figure 10-9 Floor Plate

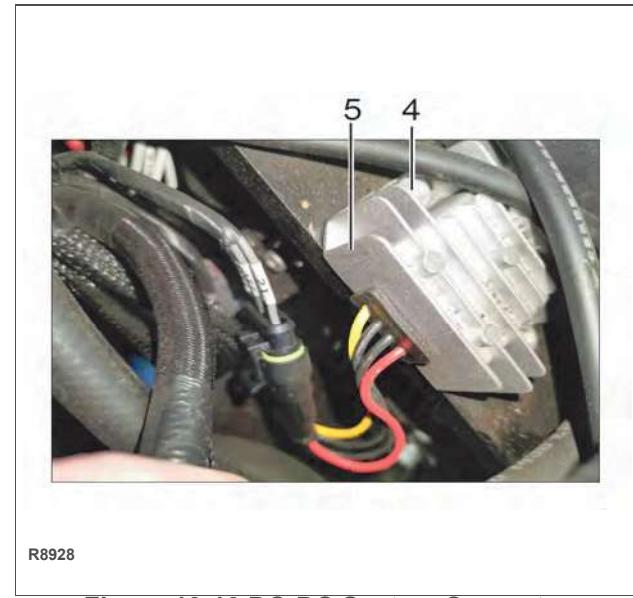


Figure 10-10 DC-DC System Converter

10-9.8. DC-DC System Converter Installation

1. Install in reverse order of paragraph [10-9.7](#).

10-9.9.Main Contactor Removal

1. Turn off the key switch and engage the emergency disconnect switch.
2. Remove the front cover according to paragraph 5-9.3.
3. Disconnect the cables on the main contactor, [Figure 10-11](#).
4. Remove the four screws (3, [Figure 10-12](#)).
5. Remove the main contactor (2) from the mounting plate (3).

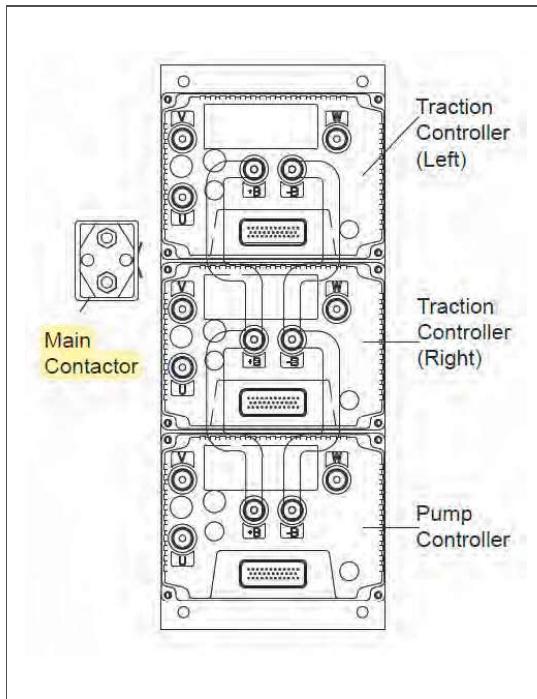


Figure 10-11 Main Contactor

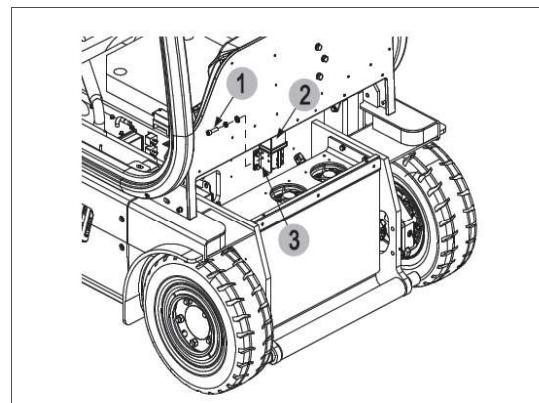


Figure 10-12 Main Contactor Removal

10-9.10.Main Contactor Installation

1. Install in reverse order of paragraph 10-9.9.

10-10.FUSES

For fuse information please see [Figure 10-13](#).

Main fuse: Installed on the electrical mounting plate.

Fuse 1-5: Installed in fuse box.

Fuse 6-7: Installed in battery box.

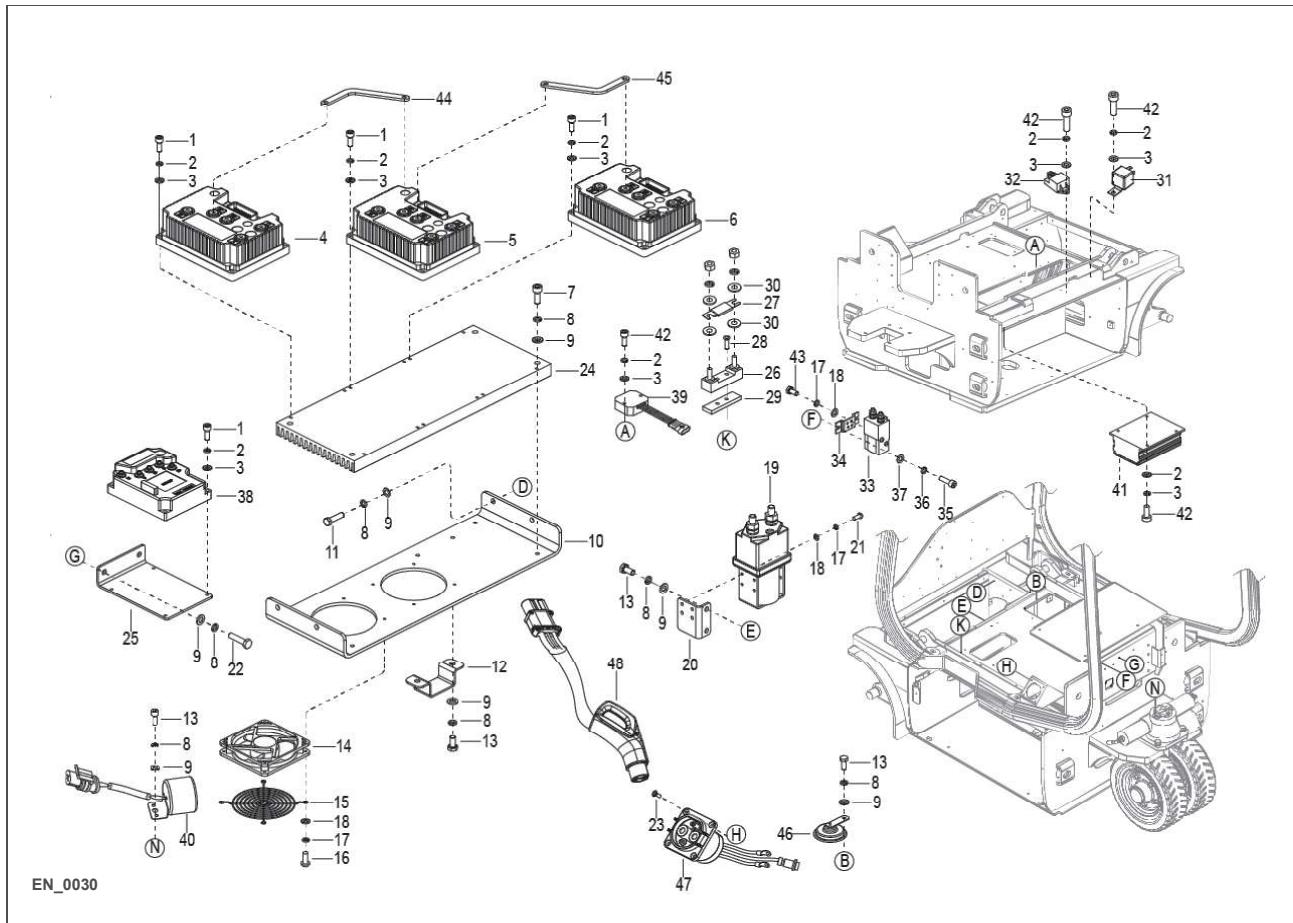
The entire vehicle is installed with eight fuses altogether. When there is fuse failure, the truck may not be able to run properly due to that.

Function	Status							
	Main Fuse	Fuse 1	Fuse 2	Fuse 3	Fuse 4	Fuse 5	Fuse 6	Fuse 7
MAIN Fuse 500A	×	O	O	O	O	O	O	O
Fuse 1 5A	O	×	O	O	O	O	O	O
Fuse 2 5A	O	O	×	O	O	O	O	O
Fuse 3 5A	O	O	O	×	O	O	O	O
Fuse 4 10A	O	O	O	O	×	O	O	O
Fuse 5 5-10A	O	O	O	O	O	×	O	O
Fuse 6 400A	O	O	O	O	O	O	×	O
Fuse 7 15A	O	O	O	O	O	O	O	×
1 Drive	×	O	O	O	O	O	×	×
2 Hydraulic Action	×	O	O	O	×	O	×	×
3 Steering	×	O	O	O	O	O	×	×
4 Instrument	×	O	O	O	O	O	×	×
5 Turn Signal/Warning Light	×	O	×	O	O	O	×	×
6 Horn/Brake Light	×	×	O	O	O	O	×	×
7 Headlight	×	O	O	×	O	O	×	×
8 Reversing Light and Buzzer	×	×	O	O	O	O	×	×

× : Failure

O : Normal

Figure 10-13 Fuses



SECTION 11 REFERENCE SECTION

11-1.BOLT CLASSES

Below you can find a table that shows the different bolt classes and specifications.

Performance Level		Material	Specification (mm)
	5.8 grade	Low carbon steel	M6 ~ M48
	8.8 grade	Quenched and tempered medium carbon steel	M6 ~ M48
	10.9 grade	Quenched and tempered medium carbon alloy steel	M6 ~ M48
	12.9 grade	Quenched and tempered medium carbon alloy steel	M6 ~ M48

Table 11-1 Bolt Classes

11-2. BOLT TORQUES

Below you can find the a table that shows the different Torque specifications for different bolt sizes and classes.

Metric Screws/Bolts Tightening Torque Table (n·m)				
Nominal Diameter (mm)	Performance Level			
	5.8	8.8	10.9	12.9
	Proof Stress (MPa)			
	380	600	830	970
M6	7~8	10~12	14~17	17~20
M8	16~18	25~30	34~41	41~48
M8×1	17~20	27~32	37~43	43~52
M10	31~36	49~59	68~81	81~96
M10×1	35~41	55~66	76~90	90~106
M12	55~64	86~103	119~141	141~167
M12×1.5	57~67	90~108	124~147	147~174
M14	87~103	137~164	189~224	224~265
M14×1.5	144~170	149~179	206~243	243~289
M16	136~160	214~256	295~350	350~414
M16×1.5	144~170	228~273	314~372	372~441
M18	186~219	294~353	406~481	481~570
M18×1.5	210~247	331~397	457~541	541~641
M20	264~312	417~500	576~683	683~808
M20×1.5	294~345	463~555	640~758	758~897
M22	360~431	568~680	786~941	918~1099
M22×1.5	395~473	624~747	803~1034	1009~1208
M24	457~547	722~864	998~1195	1167~1397
M24×2	497~595	785~940	1086~1300	1269~1520
M27	669~801	1056~1264	1461~1749	1707~2044
M27×2	723~865	1141~1366	1578~1890	1845~2208
M30	908~1087	1437~1717	1984~2375	2318~2775
M30×2	1005~1203	1587~1900	2196~2629	2566~3072
M36	1587~1900	2506~3000	3466~4150	4051~4850
M36×3	1680~2011	2653~3176	3670~4394	4289~5135
M42	2538~3039	4088~4798	5544~6637	6479~7757
M42×3	2731~3269	4312~5162	5965~7141	6921~8345
M48	3813~4564	6020~7207	8327~9969	9732~11651
M48×3	4152~4970	6556~7848	9069~10857	10598~12688

Table 11-2 Bolt Torque

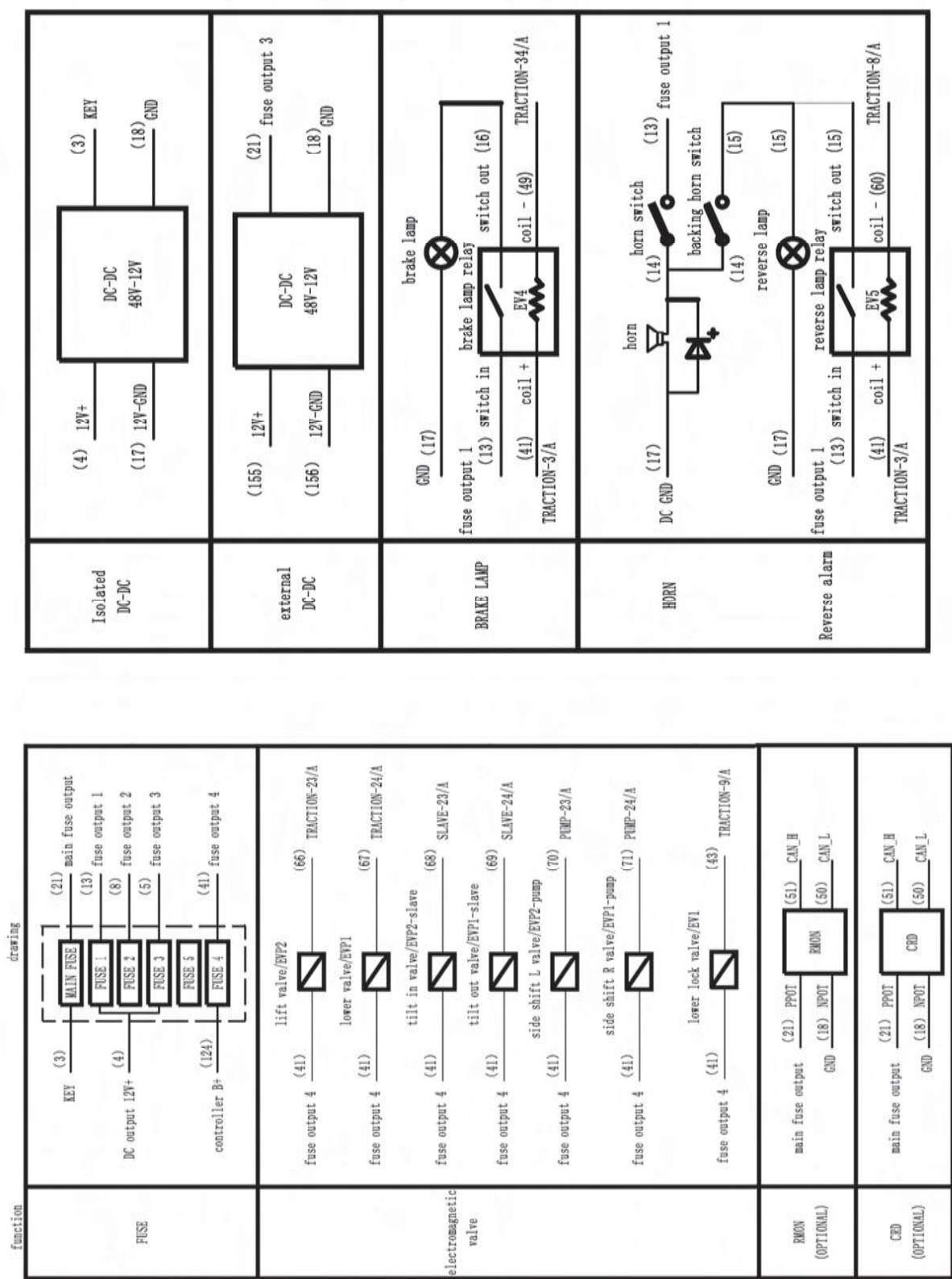


Figure 11-1 Electrical Wiring Diagram

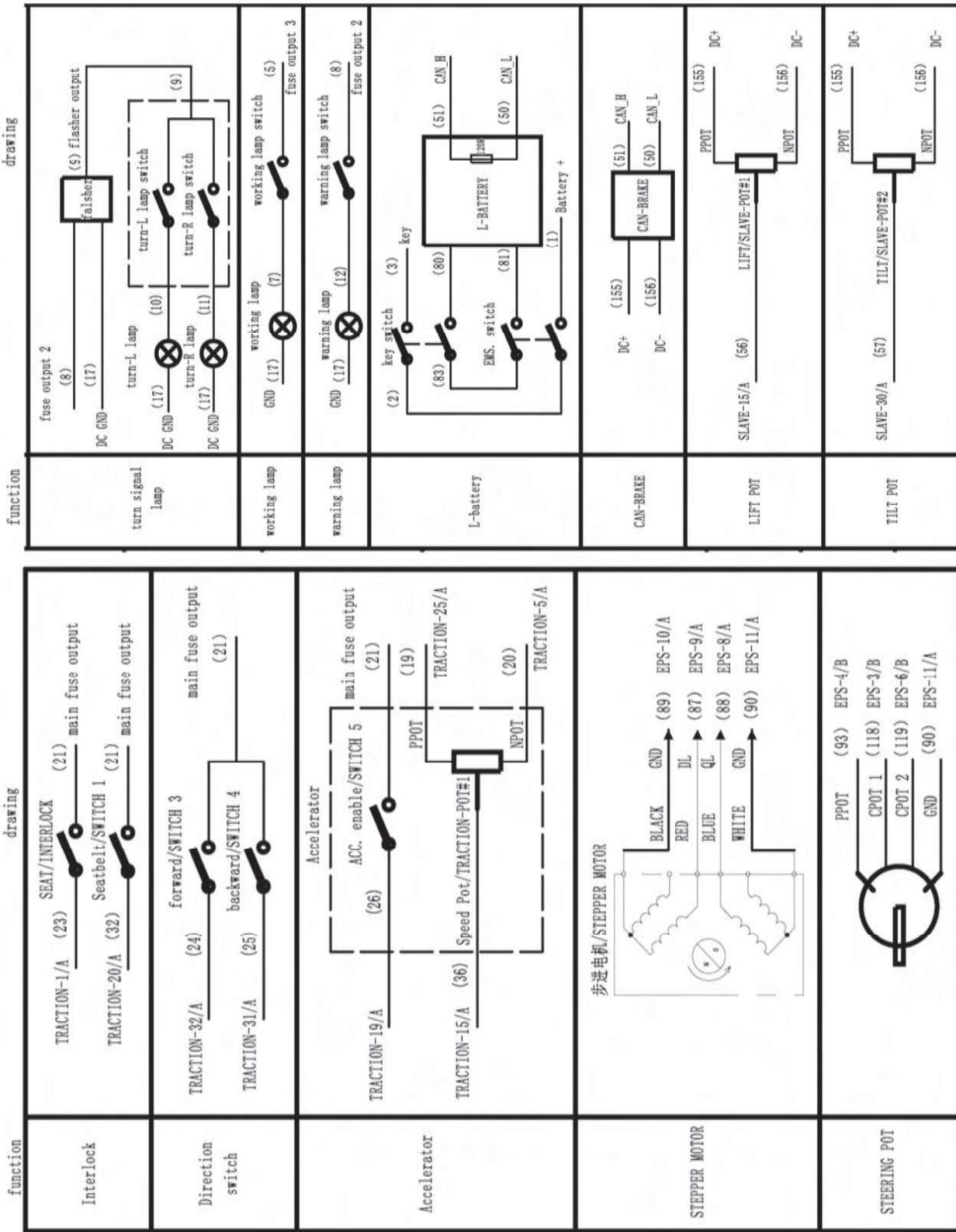


Figure 11-1 Electrical Wiring Diagram - Continued

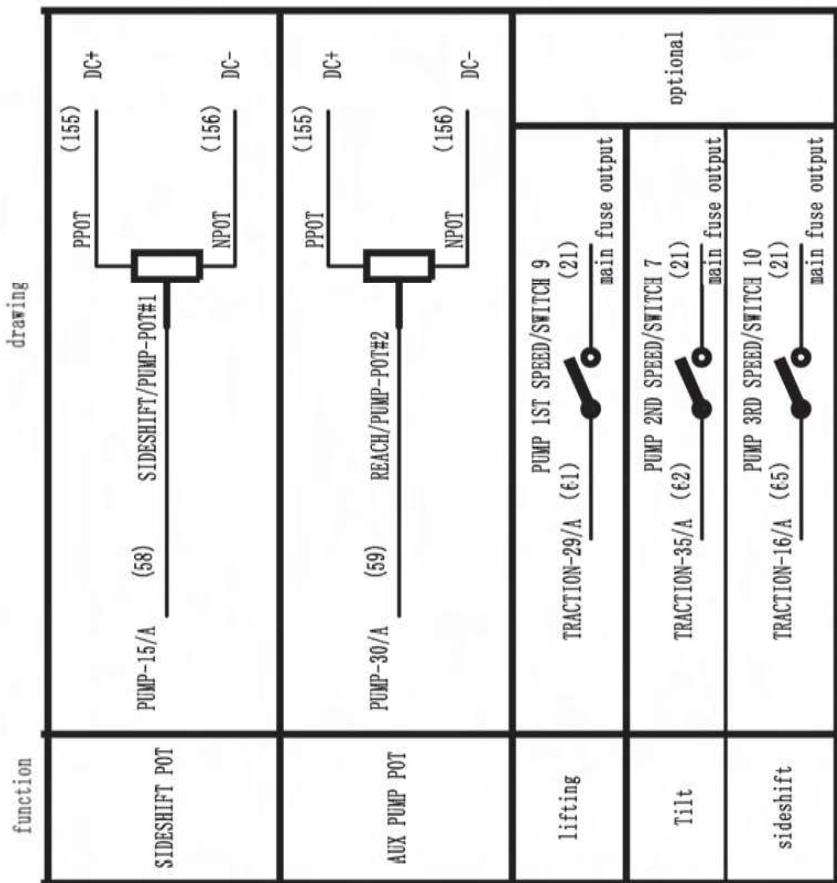


Figure 11-1 Electrical Wiring Diagram - Continued

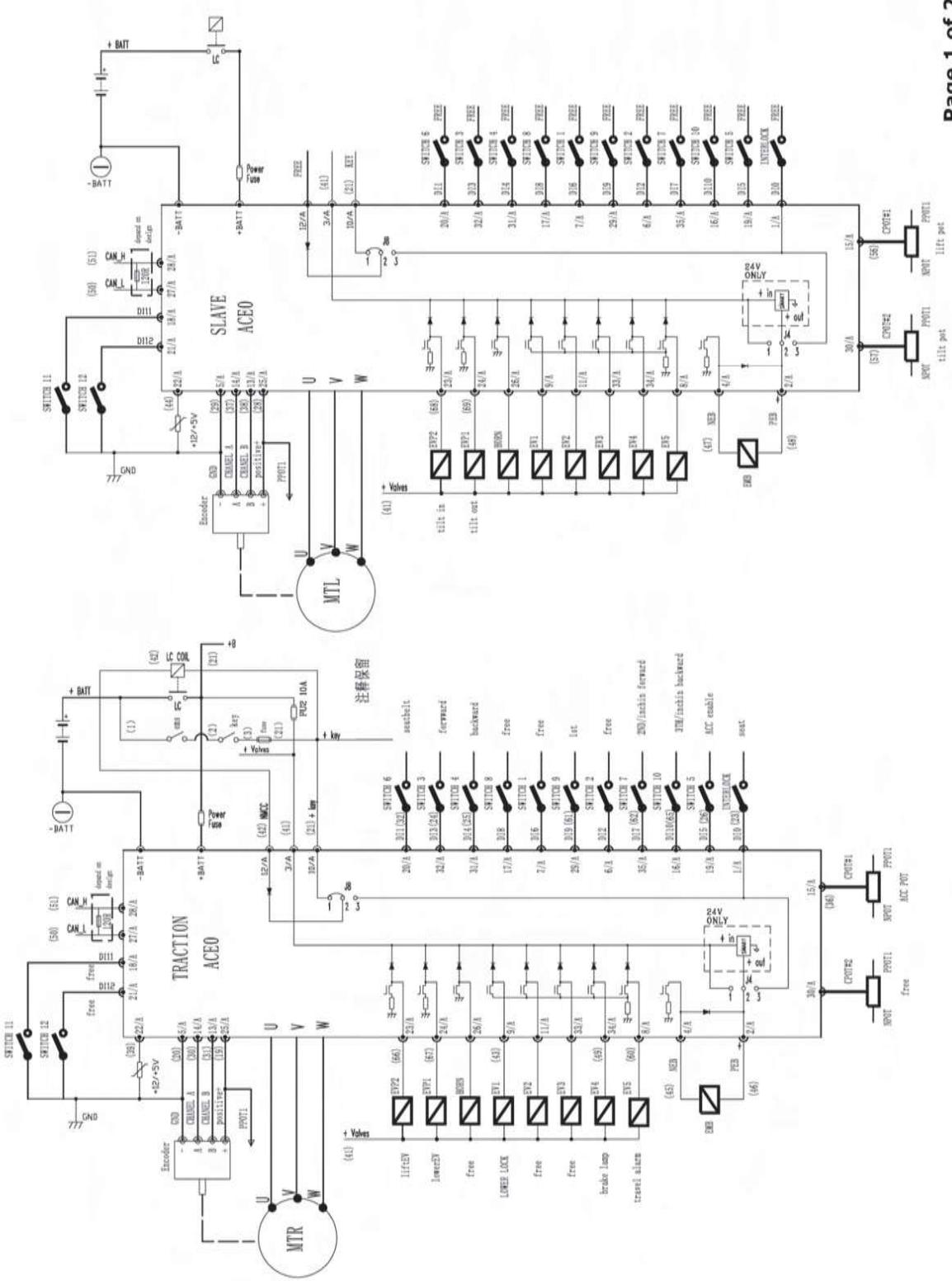


Figure 11-1 Electrical Wiring Diagram - Continued

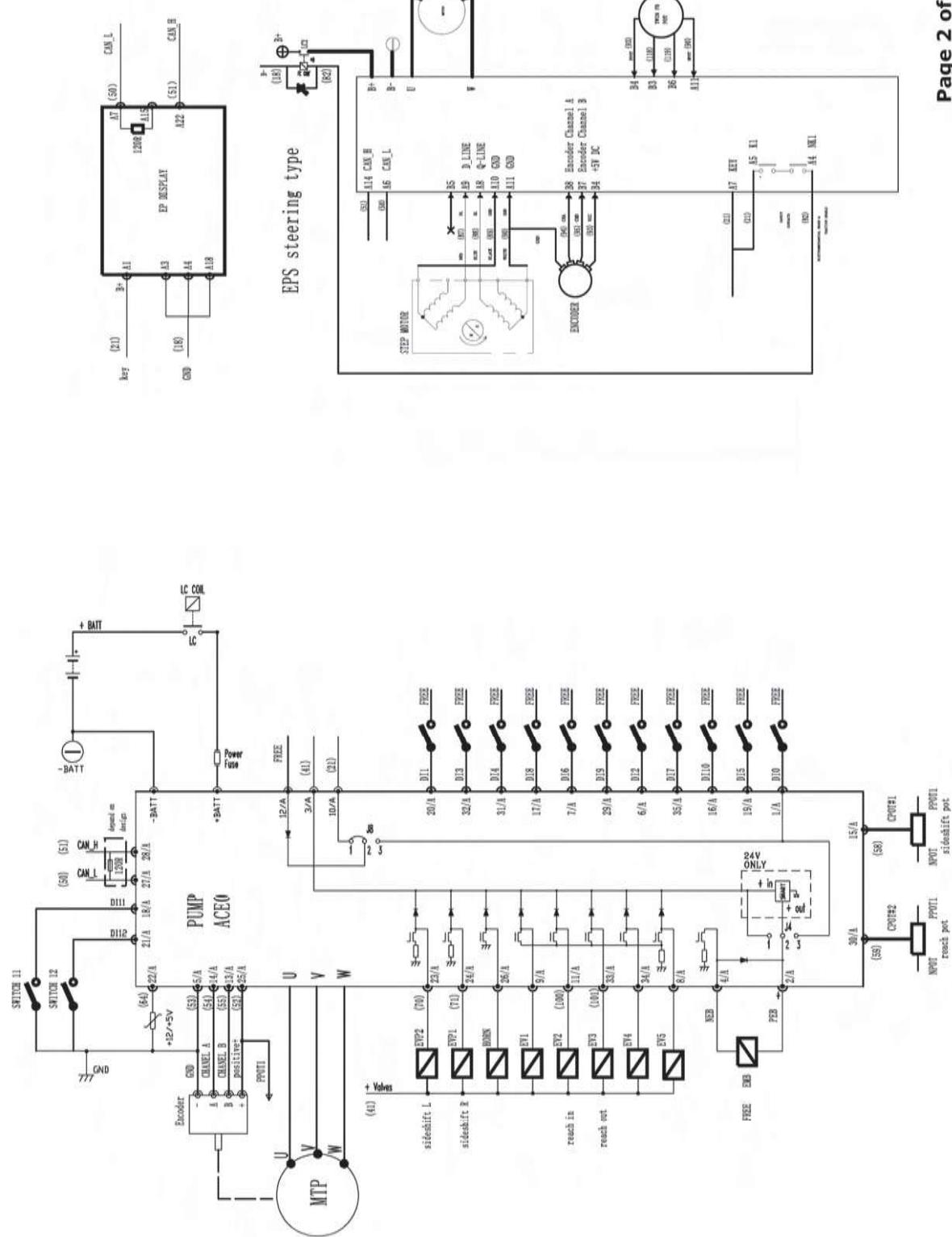


Figure 11-1 Electrical Wiring Diagram - Continued

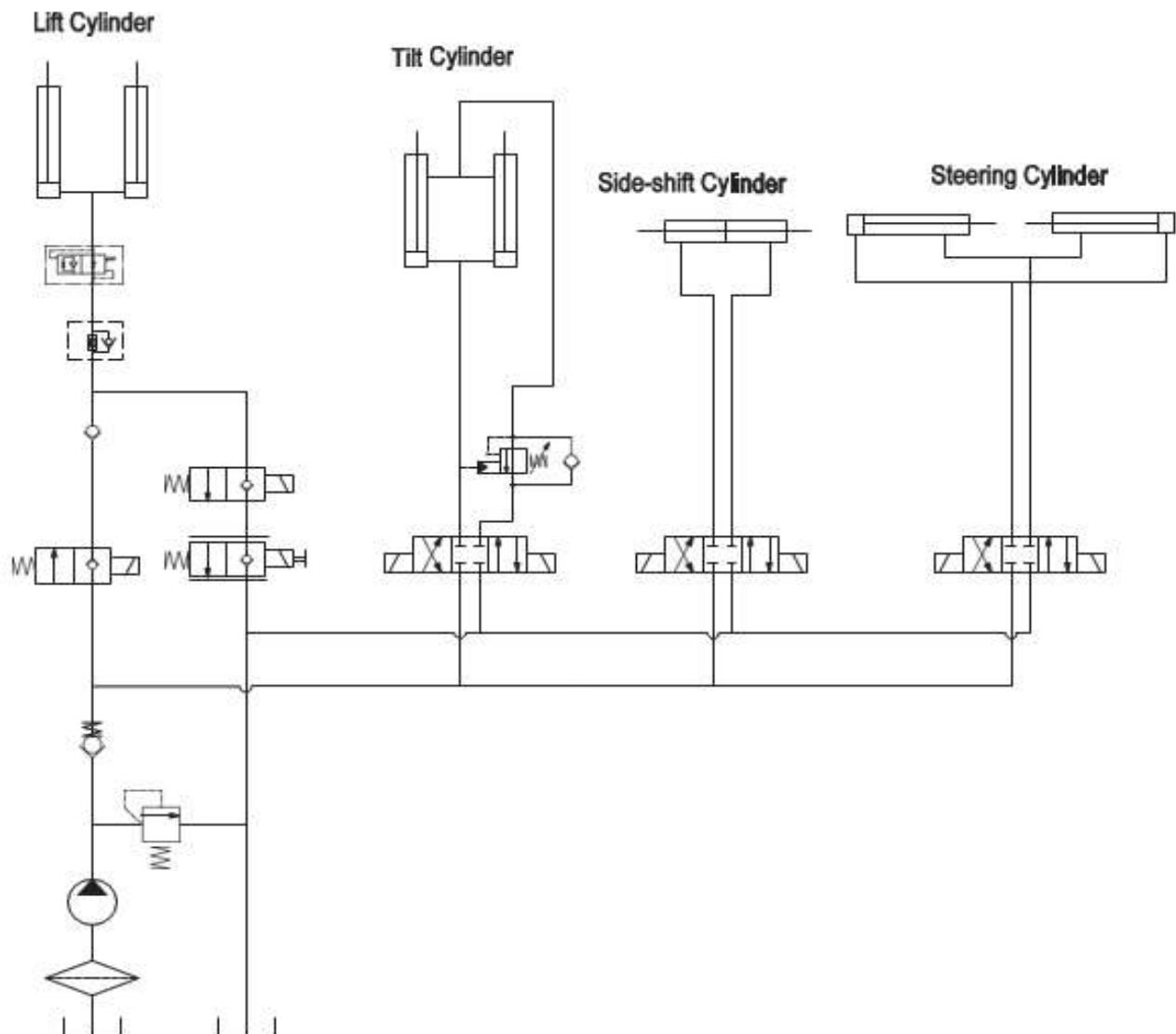


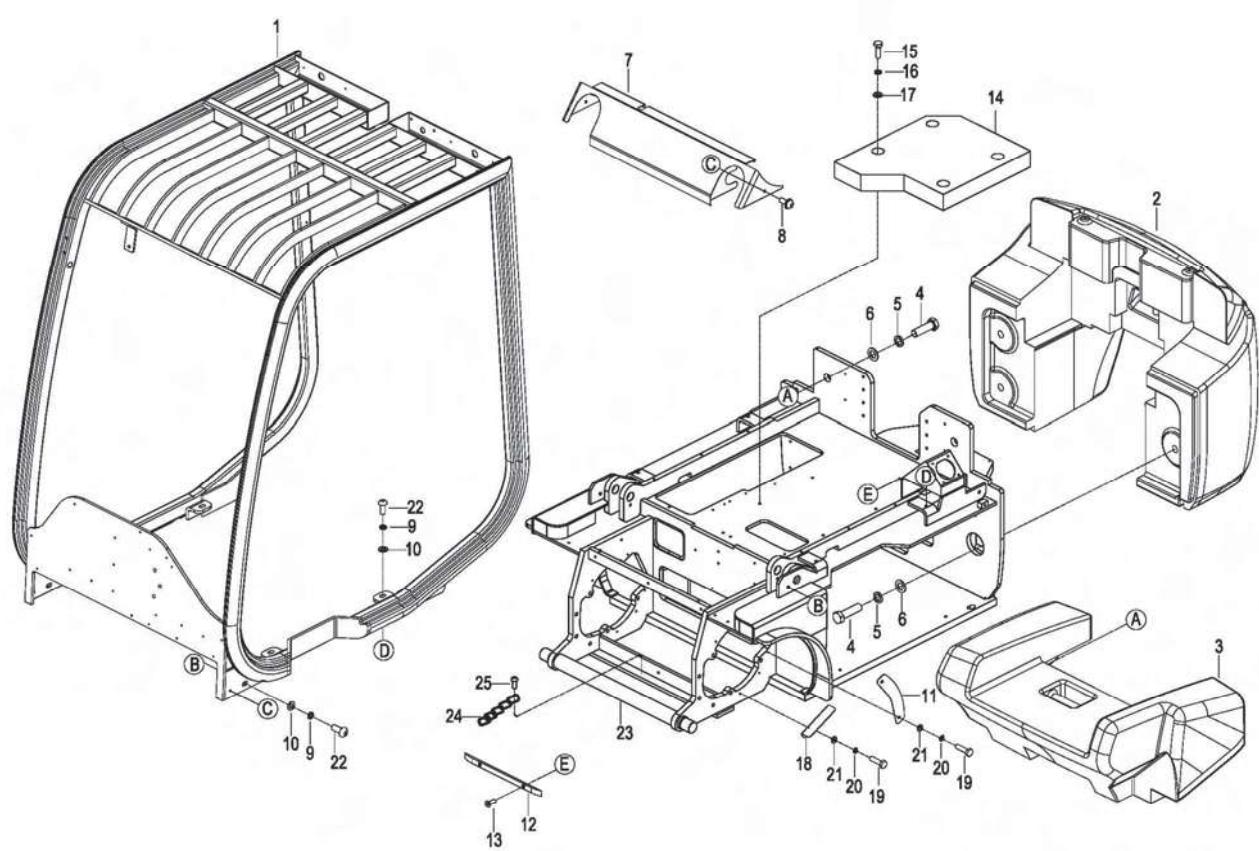
Figure 11-2 Hydraulic Diagram

NOTES

SECTION 12

ILLUSTRATED PARTS BREAKDOWN

Following is an illustrated parts breakdown of assemblies and parts associated with the LVE40 Lift Truck.

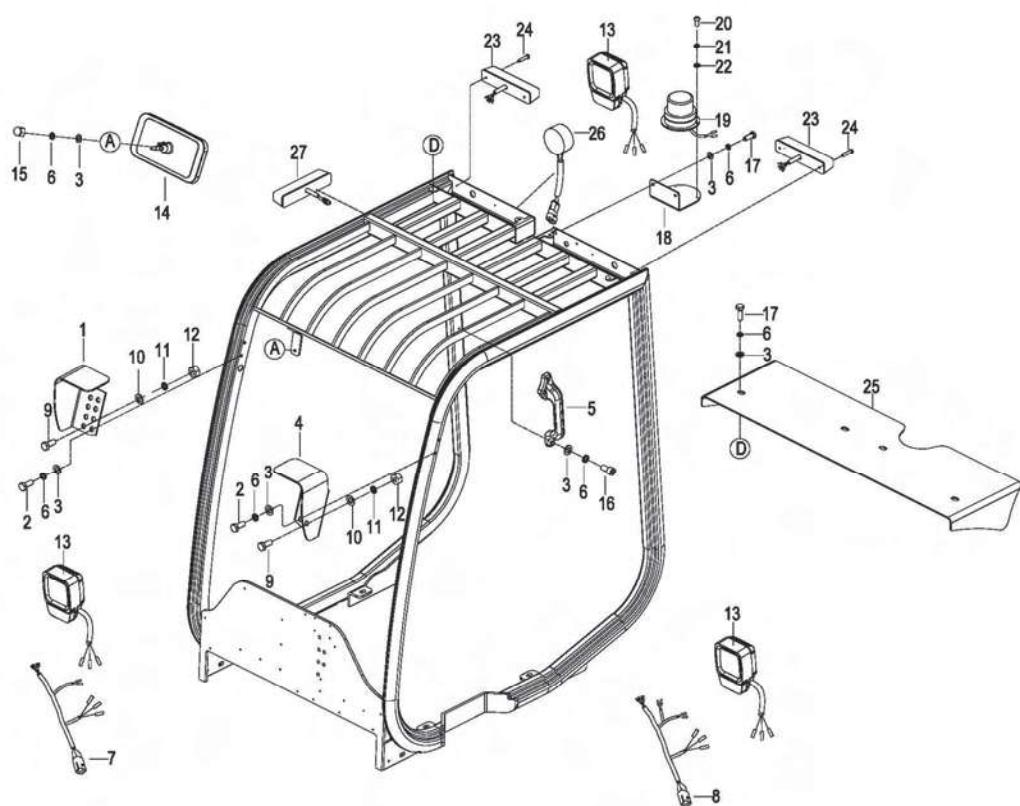


EN_0001

Figure 12-1 Frame and Counterweight

FRAME AND COUNTERWEIGHT

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-112000-00	OVERHEAD GUARD	1	
2	3231-130001-10-CK	COUNTERWEIGHT	1	Without Logo, Green
2a	3231-130001-10-BJ	COUNTERWEIGHT	1	Without Logo, Yellow
3	3231-130002-00	COUNTERWEIGHT	1	
4	3010-020000-69	BOLT M24×70	5	
5	0000-000250-00	LOCK WASHER Φ24	5	
6	0000-000489-00	FLAT WASHER Φ24	5	
7	3231-210000-00	FRONT COVER	1	
8	3020-000001-89	SCREW M8×16	2	
9	0000-000060-00	LOCK WASHER Φ12	8	
10	0000-000175-00	FLAT WASHER Φ12	8	
11	3218-100003-00	SAFETY GUARD II	2	
12	3625-100003-00	FRICTIONAL STRIP	4	
13	0000-000326-00	SCREW M6×12	8	
14	3231-100013-00	COUNTERWEIGHT	1	
15	0000-000251-00	BOLT M10×25	4	
16	0000-000063-00	LOCK WASHER Φ10	4	
17	0000-000007-00	FLAT WASHER Φ10	4	
18	3218-100002-00	SAFETY GUARD I	4	
19	0000-000259-00	BOLT M6×16	12	
20	0000-000056-00	LOCK WASHER Φ6	12	
21	0000-000380-00	FLAT WASHER Φ6	12	
22	3010-000001-05	BOLT M12×30	8	
23	3231-111000-0A-CK	FRAME WELDS	1	Green
23a	3231-111000-0A-BJ	FRAME WELDS	1	Yellow
24	3112-100033-00	ELECTROSTATIC CHAIN	1	
25	3020-000000-49	SCREW M4X10	1	

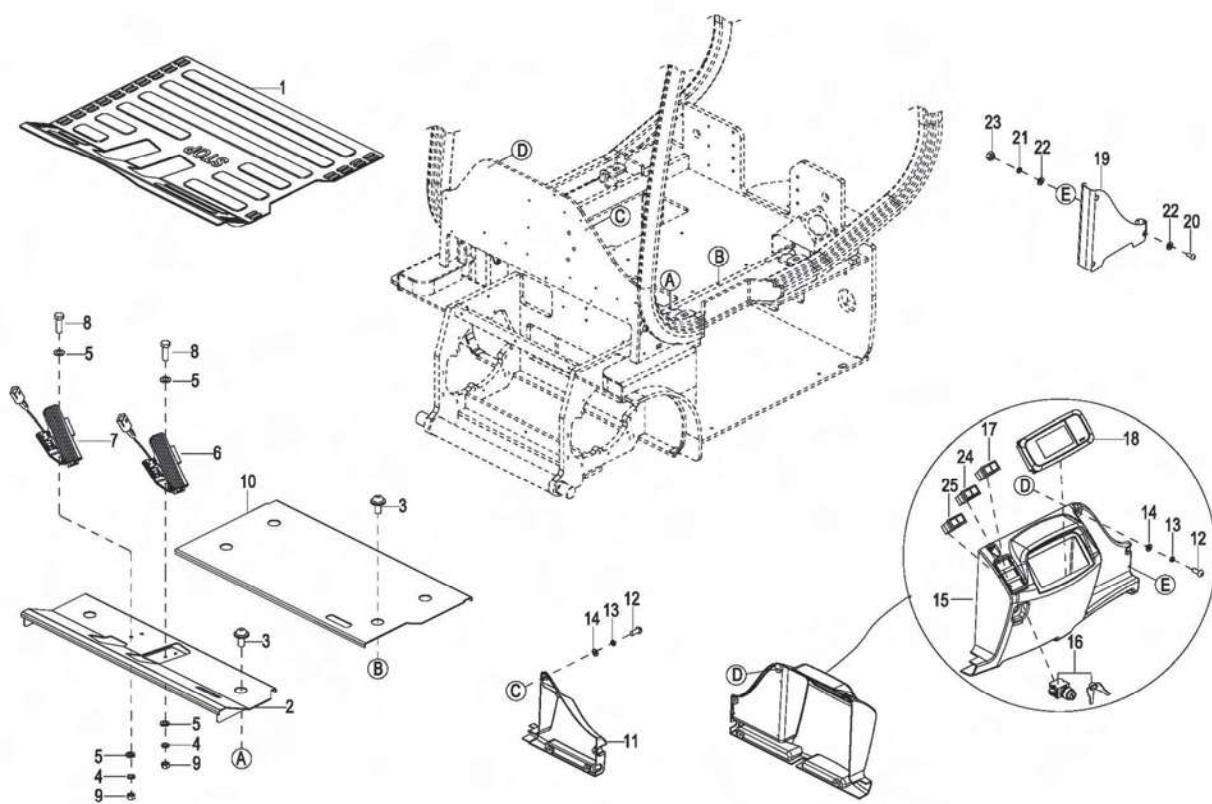


EN_0002

Figure 12-2 Overhead Guard

OVERHEAD GUARD

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-100010-00-CK	RIGHT LAMP HOLDER	1	Green
1a	3231-100010-00-BJ	RIGHT LAMP HOLDER	1	Yellow
2	3010-160000-01	BOLT M8×16	4	
3	0000-000176-00	FLAT WASHER Φ8	13	
4	3231-100009-00-CK	LEFT LAMP HOLDER	1	Green
4a	3231-100009-00-BJ	LEFT LAMP HOLDER	1	Yellow
5	3218-600009-00	HAND	1	
6	0000-000159-00	LOCK WASHER Φ8	13	
7	3231-620003-00	LAMP HARNESS R	1	
8	3231-620002-00	LAMP HARNESS L	1	
9	0000-000270-00	BOLT M10×20	2	
10	0000-000007-00	FLAT WASHER Φ10	2	
11	0000-000063-00	LOCK WASHER Φ10	2	
12	0000-000553-00	NUT M10	2	
13	3231-680100-00	HEAD LAMP	3	
14	3218-122000-10	REAR VIEW MIRROR	1	
15	3030-130000-03	NUT M8	1	
16	0000-000109-00	SCREW M8×16	2	
17	0000-000242-00	BOLT M8×16	6	
18	3112-100019-00	BRACKET	1	
19	3218-600400-10	CAUTION SWITCH	1	
20	0000-001350-00	SCREW M4×12	3	
21	0000-000122-00	LOCK WASHER Φ4	3	
22	0000-000702-00	FLAT WASHER Φ4	3	
23	3130-680200-10	REAR LAMP UNIT	2	
24	0000-000852-00	SCREW M5×65	4	
25	3231-100008-00-CK	COVER	1	Green
25a	3231-100008-00-BJ	COVER	1	Yellow
26	3218-680300-10	BLUE LIGHT	1	Optional
27	1601-100004-10	RED LIGHT	2	

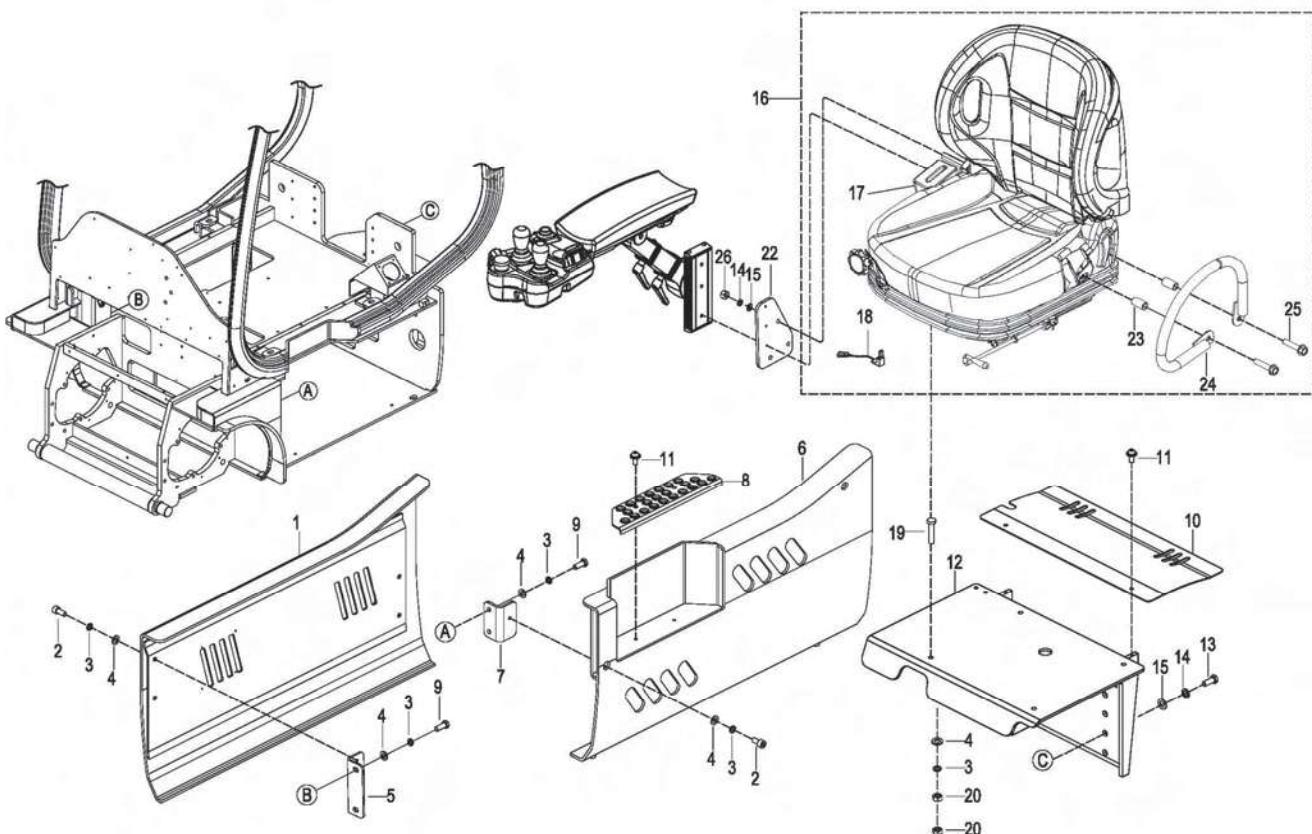


EN_0003

Figure 12-3 Operators Compartment

OPERATORS COMPARTMENT

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-200003-00	CUSHION	1	
2	3231-271000-00	FRONT FLOOR	1	
3	3020-000001-89	SCREW M8×16	6	
4	0000-000159-00	LOCK WASHER Φ8	2	
5	0000-000176-00	FLAT WASHER Φ8	4	
6	3112-600300-00	PEDAL BRAKE	1	
7	3218-680000-00	ACCELERATOR	1	
8	0000-000277-00	BOLT M8×25	4	
9	0000-000550-00	NUT M8	4	
10	3231-230000-00	BACK FLOOR	1	
11	3231-300001-00	DASHBOARD LEFT	1	
12	0000-000371-00	SCREW M6×16	8	
13	0000-000056-00	LOCK WASHER Φ6	8	
14	0000-000380-00	FLAT WASHER Φ6	8	
15	3231-300002-00	DASHBOARD RIGHT	1	
16	3112-603000-00	KEY LOCK	1	
17	3231-600900-00	WARNING LIGHT SWITCH	1	
18	3218-600007-30	CONTROLLER METER	1	
19	3231-300003-00	FILE BOX	1	
20	0000-001506-00	SCREW M4×16	3	
21	0000-000122-00	LOCK WASHER Φ4	3	
22	0000-000702-00	FLAT WASHER Φ4	6	
23	0000-000139-00	NUT M4	3	
24	3231-600700-00	HEADLIGHT SWITCH	1	
25	3231-600910-00	COVER	1	
25a	3231-600800-00	BLUE LIGHT SWITCH	1	Optional

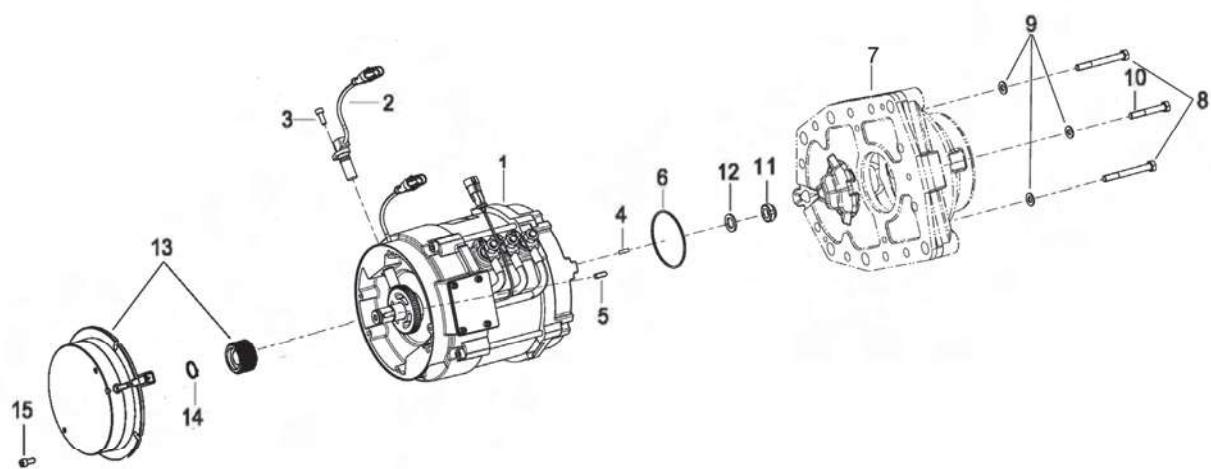


EN_0004

Figure 12-4 Back Cover

BACK COVER

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-240000-00-CK	RIGHT COVER	1	Green
1a	3231-240000-00-BJ	RIGHT COVER	1	Yellow
2	0000-000109-00	SCREW M8×16	6	
3	0000-000159-00	LOCK WASHER Φ8	14	
4	0000-000176-00	FLAT WASHER Φ8	14	
5	3231-100006-00	BRACKET	2	
6	3231-260000-00-CK	LEFT COVER	1	Green
6a	3231-260000-00-BJ	LEFT COVER	1	Yellow
7	3231-100007-00	BRACKET	1	
8	3231-200001-00	PEDAL	1	
9	0000-000242-00	BOLT M8×16	4	
10	3231-100004-00	BACK COVER	1	
11	3020-000001-89	SCREW M8×16	4	
12	3231-113000-00	BRACKET	1	
13	0000-000282-00	BOLT M10×30	7	
14	0000-000063-00	LOCK WASHER Φ10	10	
15	0000-000007-00	FLAT WASHER Φ10	10	
16	3218-212000-30-01	SEAT	1	With Bracket
17	3218-212001-00	SEAT BELT	1	
18	3215-600200-10	SEAT SWITCH	1	
19	0000-000278-00	BOLT M8×30	4	
20	0000-000550-00	NUT M8	8	
21	3231-252000-00	OPERATING ARMREST ASSEMBLY	1	
22	3231-251001-00	BRACKET	1	
23	3218-212001-60	PIPE BOX	2	
24	3218-212002-60	SEAT ARMREST	1	
25	3010-000004-21	M12*60	2	
26	3030-000000-24	NUT M10	3	

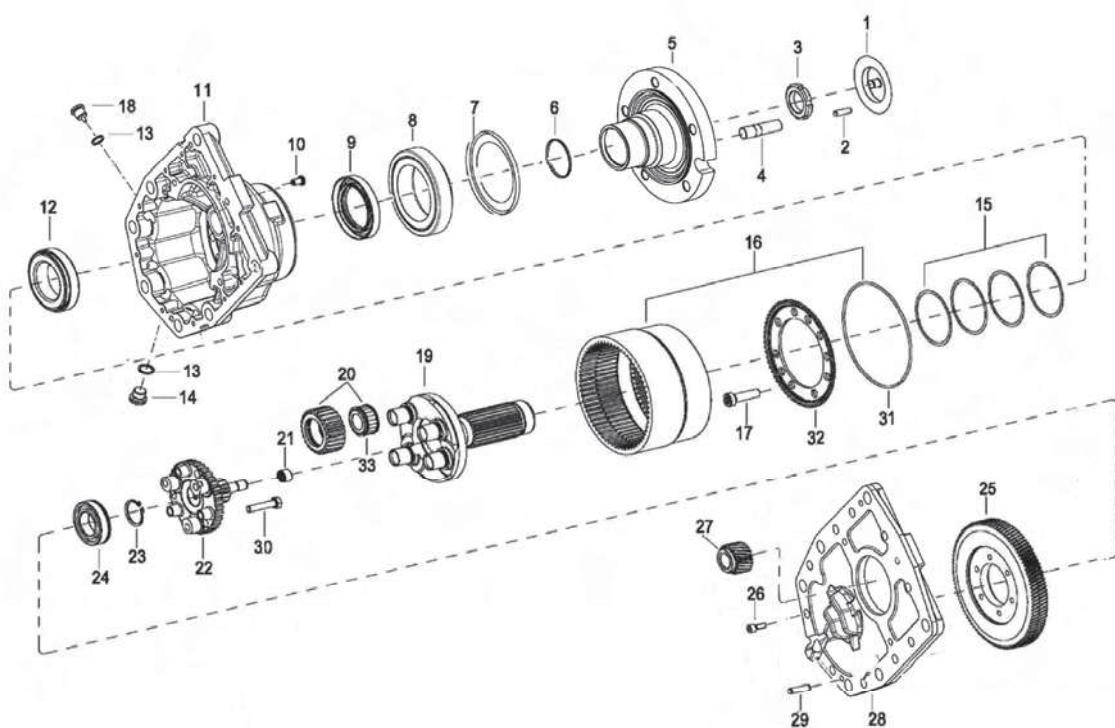


EN_0005

Figure 12-5 Drive Unit

DRIVE UNIT

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-430000-10	DRIVE UNIT ASSEMBLY - L	1	Used from serial number 2301001008
--	3231-430000-20	DRIVE UNIT ASSEMBLY - R	1	Used from serial number 2301001008
1	3231-43017X-00	TRACTION MOTOR	1	
2	3231-43018X-00	SENSOR	1	
3	3231-43019X-00	SCREW M6*16	1	
4	3231-43020X-00	WOODRUFF KEY 4*6,5	1	
5	3231-43021X-00	FITTED KEY 6*6*18	1	
6	3218-410001-00	O-RING 76*2,5	1	
7	3231-43001X-00	GEARBOX ASSEMBLY	2	Used up to serial number 2301001007
7a	3231-43001X-10	GEARBOX ASSEMBLY-L	1	Used from serial number 2301001008
7b	3231-43001X-20	GEARBOX ASSEMBLY -R	1	Used from serial number 2301001008
8	3231-43023X-00	SCREW M8*75	2	
9	3218-410045-00	WASHER	3	
10	3231-43024X-00	SCREW M8*55	1	
11	3231-43025X-00	SLOTTED NUT	1	
12	3231-43026X-00	WASHER	1	
13	3231-43027X-00	BRAKE	1	
14	3231-43028X-00	RETAINING RING	1	
15	3231-43029X-00	CAP SCREW	4	

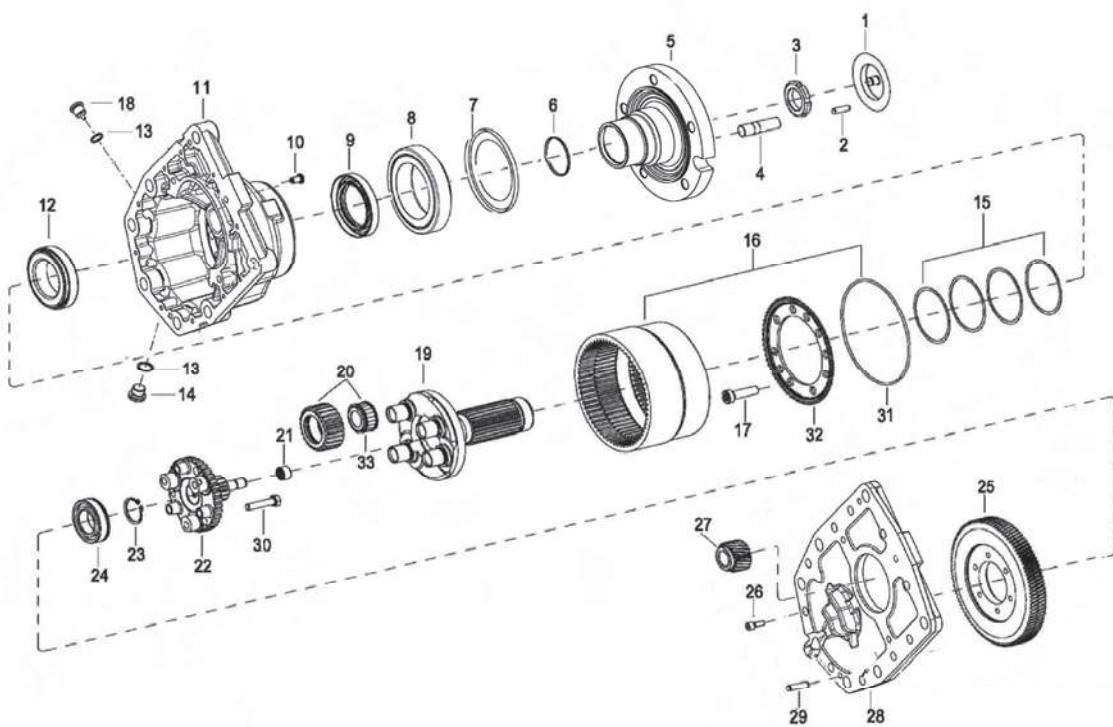


EN_0006

Figure 12-6 Transmission

TRANSMISSION

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3625-42001X-00	PROTECTION CAP	1	
2	3625-42002X-00	SLOTTED PIN	8	
3	3625-42003X-00	SLOTTED NUT	1	
4	3625-42004X-00	WHEEL STUD	1	
5	3231-43033X-00	WHEEL SHAFT	1	
6	3625-42015X-00	O-RING	1	
7	3231-43003X-00	NILOS-RING	1	
8	3231-43004X-00	TAPERED ROLLER BEARING	1	
9	3625-42009X-00	SEELING RING	1	
10	3231-43005X-00	BREATHER	1	
11	3231-43030X-00	HOUSING	2	Used up to serial number 2301001007
11a	3231-43006X-00	HOUSING-R	1	Used from serial number 2301001008
11b	3231-43030X-10	HOUSING-L	1	Used from serial number 2301001008
12	3231-43007X-00	TAPERED ROLLER BEARING	1	
13	3218-410024-00	SESLING RING	4	
14	3218-410025-00	SCREW PLUG	2	
15	3625-42013X-00	SET OF SHIMS	1	
16	3231-43031X-00	RING GEAR	1	Used up to serial number 2301001007
16a	3625-42014X-00	RING GEAR	1	Used from serial number 2301001008
17	3231-43008X-00	TORX-SCREW	1	
18	3231-43009X-00	SCREW PLUG	2	
19	3625-42016X-00	PLANET CARRIER	2	
20	3625-42017X-00	REPAIR KIT	1	
21	3218-410033-00	NEEDLE SLEEVE	1	
22	3625-42018X-00	INNER DISC CARRIER	1	
23	3231-43010X-00	RETAINING RING	1	
24	3231-43011X-00	NILOS-RING	1	
25	3625-42025X-00	SEELING RING	1	
26	3218-410010-00	NEEDLE SLEEVE	10	
27	3625-42026X-00	GEAR SHAFT	1	

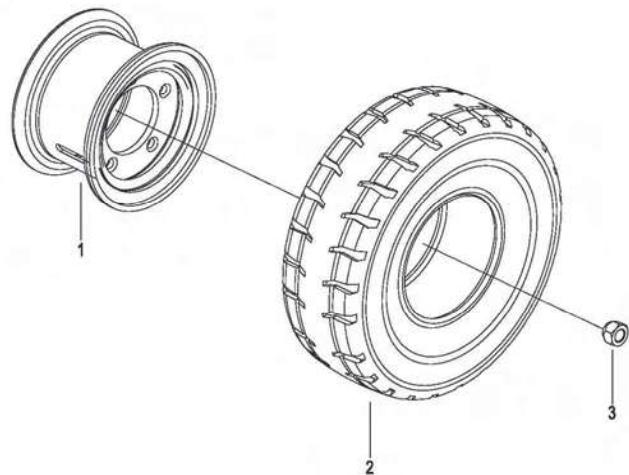


EN_0006

Figure 12-6 Transmission - Continued

TRANSMISSION - CONTINUED

Pos.	Part Number	Description	Qty. Reqd.	Notes
28	3231-43032X-00	HOUSING COVER	2	Used up to serial number 2301001007
28a	3231-43012X-00	HOUSING COVER	2	Used from serial number 2301001008
29	3231-43013X-00	CYLINDRICAL PIN	2	
30	3218-410023-00	TORX-SCREW	6	
31	3231-43014X-00	RING	1	
32	3231-43015X-00	TOOTHED DISC	1	
33	3231-43016X-00	CYLINDER ROLLER BEARING	4	

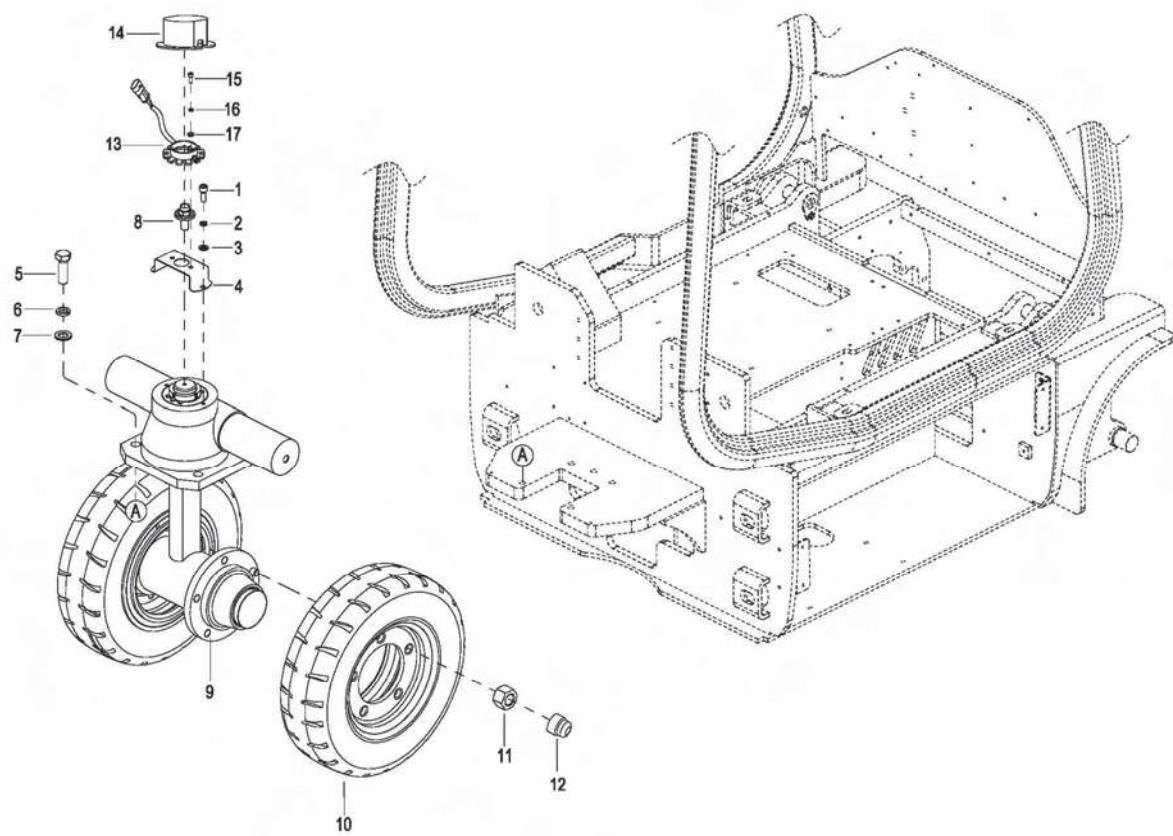


EN_0007

Figure 12-7 Drive Wheel Assembly

DRIVE WHEEL ASSEMBLY

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3220-420000-10	DRIVE WHEEL	2	Includes pos. # 1 and 2
--	3220-420000-30	DRIVE WHEEL	2	Tires Without Trace
1	3220-421000-00	RIM SET	1	
2	3220-420001-10	FRONT TIRE 200×50-10	1	
2a	3220-420001-30	FRONT TIRE 200×50-10	1	Without trace
3	3218-400002-00	NUT	10	

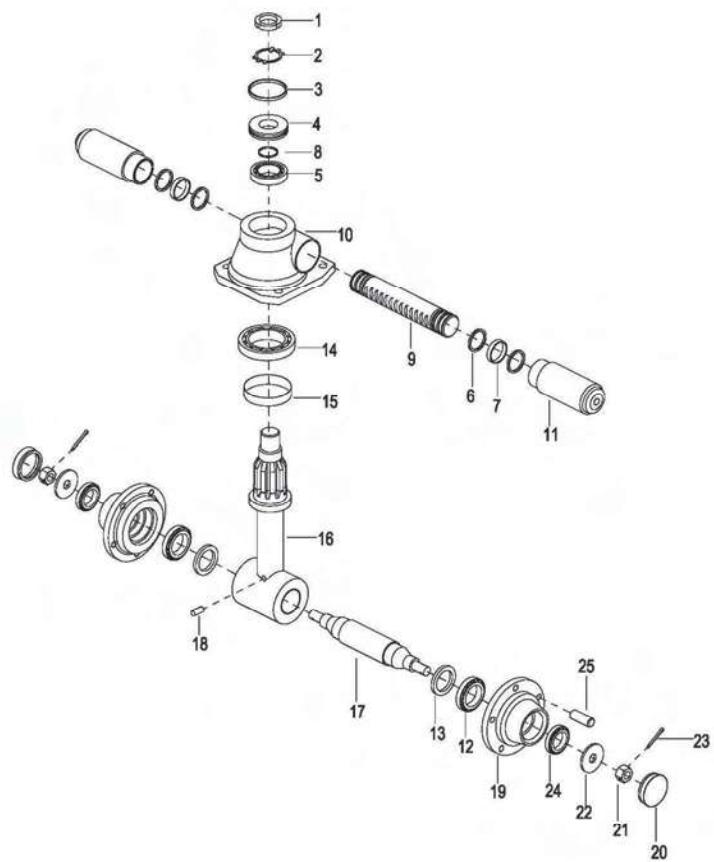


EN_0008

Figure 12-8 Rear Steering

REAR STEERING

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000055-00	SCREW M6×16	2	
2	0000-000056-00	LOCK WASHER Φ6	2	
3	0000-000380-00	FLAT WASHER Φ6	2	
4	3218-500001-0A	POTENTIOMETER HOLDER	1	
5	0000-000446-00	BOLT M16×50	4	
6	0000-000191-00	LOCK WASHER Φ16	4	
7	0000-000190-00	FLAT WASHER Φ16	4	
8	3218-500002-10	COPPER BOLT	1	
9	3218-520000-10	STEERING AXLE	1	Without tires
10	3218-510000-10	BACK TIRE ASSEMBLY	2	
10a	3218-510000-30	BACK TIRE ASSEMBLY	2	Smooth
11	3218-500003-00	NUT	10	
12	3218-500005-0A	NUT COVER	10	
13	2YL0-122228-82	POTENTIOMETER	1	
14	3218-500006-00	SHIELD RUBBER	1	
15	0000-000028-00	SCREW M4×10	2	
16	0000-000122-00	LOCK WASHER Φ4	2	
17	0000-000702-00	FLAT WASHER Φ4	2	

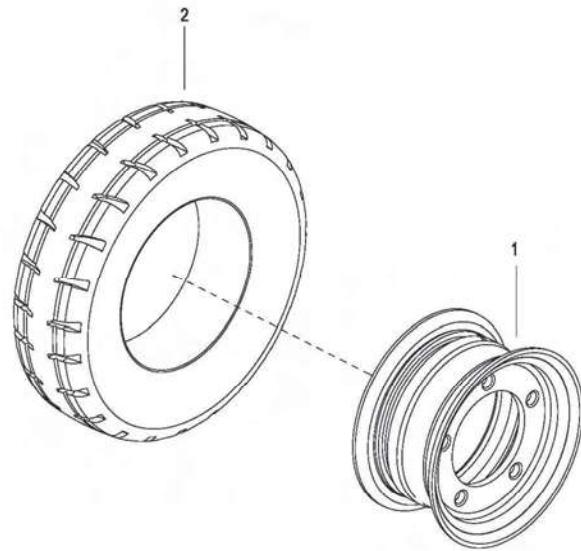


EN_0009

Figure 12-9 Steering Axle

STEERING AXLE

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3218-520001-00	NUT M39×1.5	1	
2	3218-520002-00	THRUST WASHER	1	
3	3218-520003-00	O-RING D82×2.65	1	
4	3218-520004-00	BUSHING	1	
5	3218-520005-00	BEARING	1	
6	3218-520006-00	U- RING 40×50×6	4	
7	3218-520007-00	RING 45×50×12	2	
8	3218-520029-00	O-RING	1	
9	3218-520009-00	CYLINDER SHAFT	1	
10	3218-520010-00	ROTARY BEARINGS	1	
11	3218-520011-00	CYLINDER	2	
12	3218-520026-00	BEARING	2	
13	3218-520027-00	SEAL 65×90×12	2	
14	3218-520014-00	BEARING	1	
15	3218-520015-00	SEAL 90×115×12	1	
16	3218-520016-00	GEAR AXLE	1	
17	3218-520017-00	SHAFT	1	
18	3218-520018-00	PIN A10×24	1	
19	3218-520025-00	HUB	2	
20	3218-520020-00	COVER	2	
21	3218-520021-00	NUT M24×2	2	
22	3218-520022-00	WASHER 24	2	
23	3218-520023-00	PIN 5×45	2	
24	3218-520024-00	BEARING	2	
25	3218-500004-00	STUD	10	

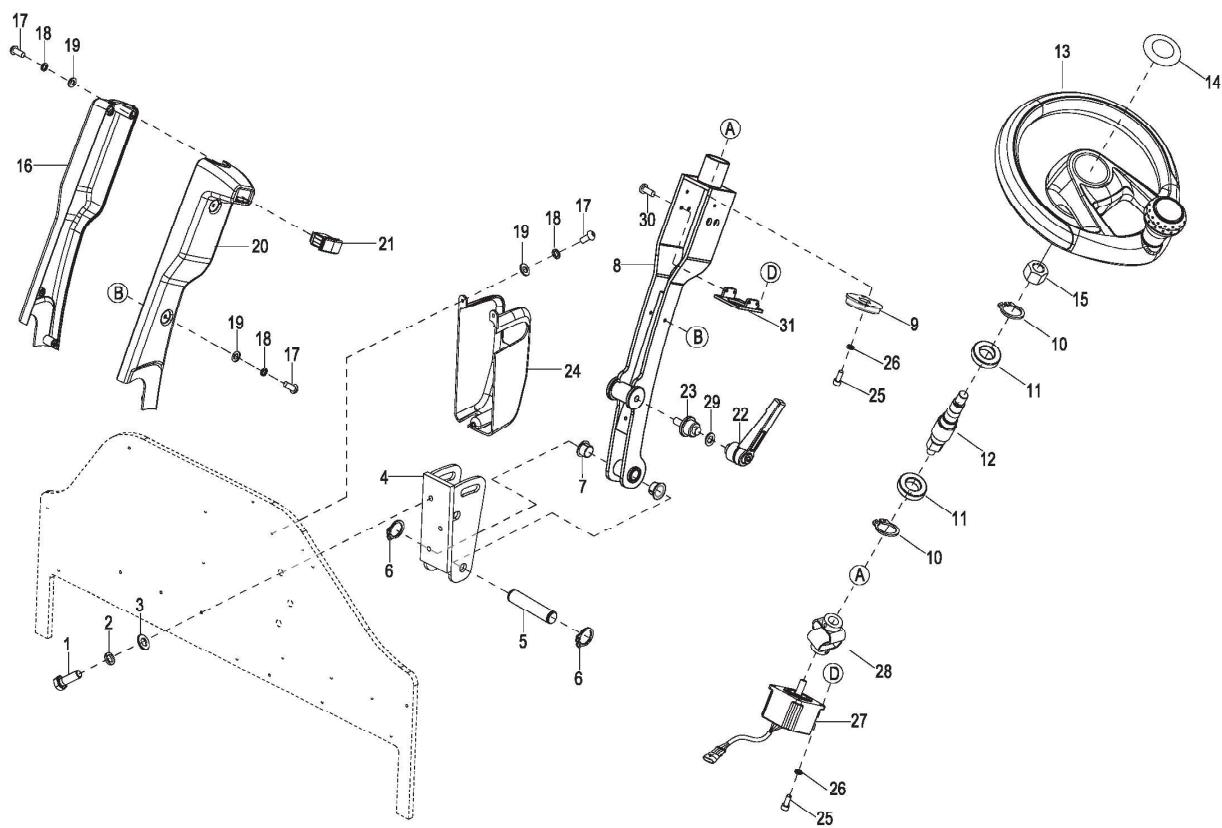


EN_0010

Figure 12-10 Rear Wheel Assembly

REAR WHEEL ASSEMBLY

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3218-511000-00	RIM SET	1	
2	3218-510001-10	REAR TIRE	1	
2a	3218-510001-30	REAR TIRE	1	Smooth

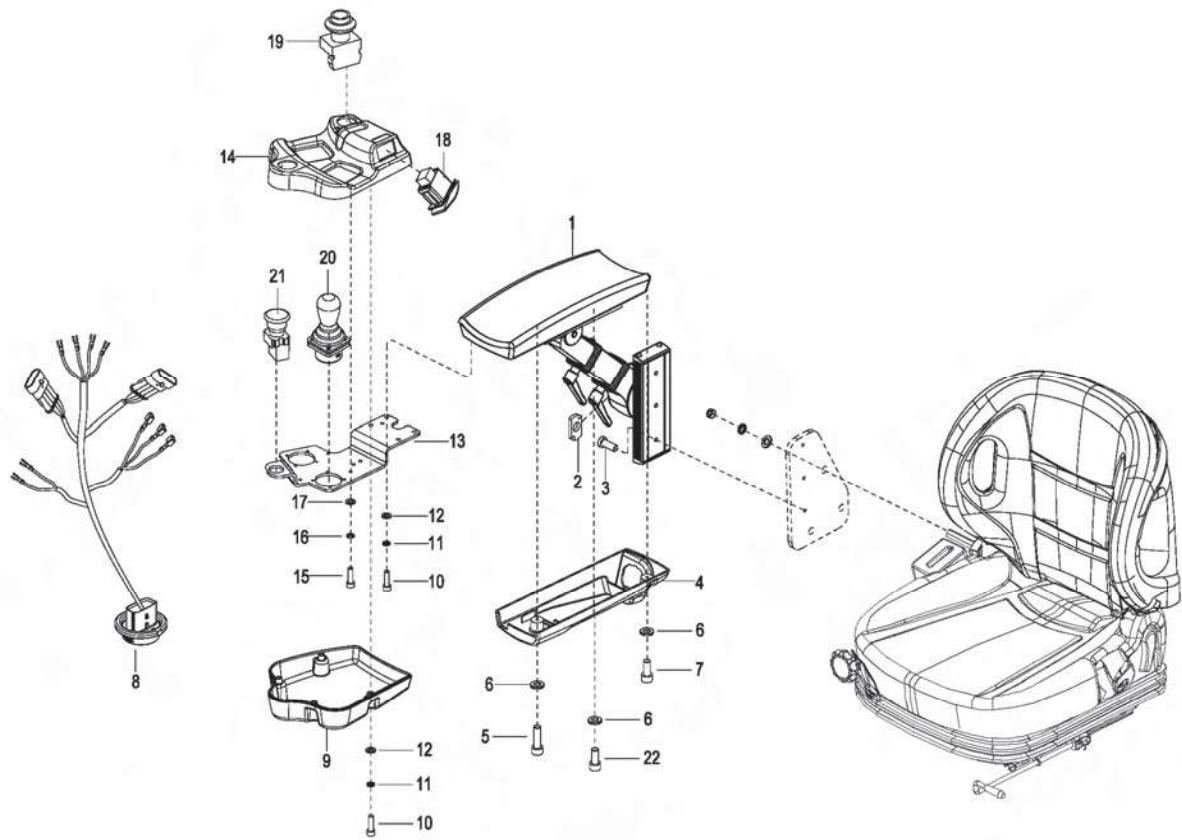


EN_0011

Figure 12-11 Steering Control System

STEERING CONTROL SYSTEM

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000251-00	BOLT M10×25	3	
2	0000-000063-00	LOCK WASHER Φ10	3	
3	0000-000007-00	FLAT WASHER Φ10	3	
4	3231-311000-00	STEERING BRACKET	1	
5	3231-310003-00	SHAFT	1	
6	0000-000589-00	SHAFT SNAP RING Φ16	2	
7	2028-019000-44	AXLE SLEEVE 1618F	2	
8	3231-312000-0A	STEERING COLUMN	1	
9	3231-310004-00	DAMPER 19×14	1	
10	0000-000293-00	SHAFT SNAP RING Φ20	2	
11	0000-000643-00	BEARING	2	
12	3231-310001-00	STEERING SHAFT	1	
13	3231-320000-00	STEERING WHEEL	1	
14	3231-32000X-01	HORN BUTTON COVER	1	
15	0000-000583-00	NUT M12×1.5	1	
16	3231-300005-00	RIGHT COVER	1	
17	0000-000371-00	SCREW M6×16	6	
18	0000-000056-00	LOCK WASHER Φ6	6	
19	0000-000380-00	FLAT WASHER Φ6	6	
20	3231-300004-00	LEFT COVER	1	
21	3231-600400-10	SWITCH	1	
22	3218-320008-10	HANDLE R	1	
23	3231-310002-00	SHAFT M12×1	1	
24	3231-300006-00	LOWER COVER	1	
25	3020-010000-53	SCREW M5×12	6	
26	0000-000206-00	LOCK WASHER Φ5	6	
27	CK11-560002-00	STEPPING MOTOR	1	
28	3113-333000-00	GIMBAL	1	
29	3040-000001-20	WASHER Φ12	1	
30	3020-010000-53	SCREW M5×12	4	
31	3231-313000-00	MOUNTING BRACKET	1	

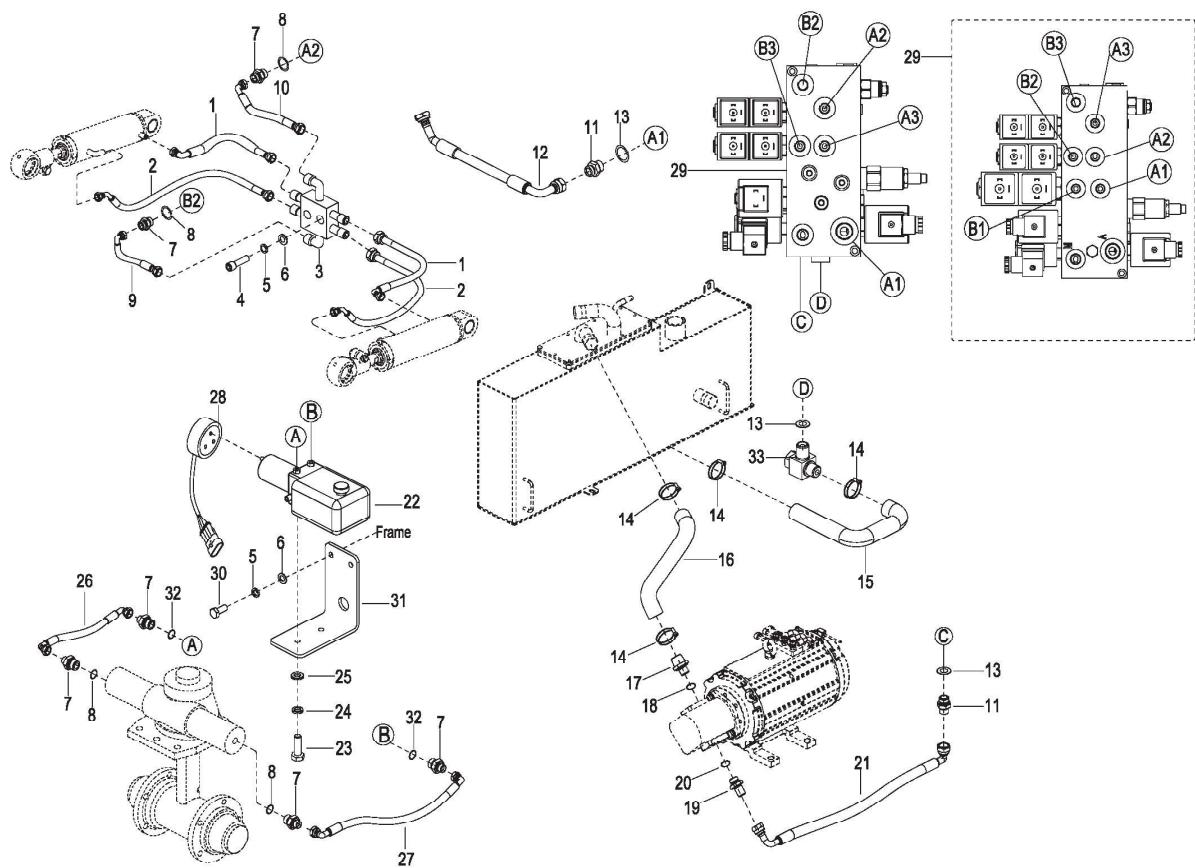


EN_0012

Figure 12-12 Operating Arm Assembly

OPERATING ARM ASSEMBLY

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-252000-00	OPERATING ARMREST ASSEMBLY	1	
1	3231-252200-10	ARMREST	1	
2	3231-252102-00	LIMIT BLOCK	1	
3	3020-030000-12	SCREW M6×12	3	
4	3231-252201-00	COVER	1	
5	0000-001239-00	SCREW M5×30	1	
6	0000-000390-00	FLAT WASHER Φ 5	3	
7	0000-000323-00	SCREW M5×16	1	
8	3231-620005-00	OPERATING ARMREST HARNESS	1	
9	3231-252104-00	COVER	1	
10	0000-000055-00	SCREW M6×16	4	
11	0000-000056-00	LOCK WASHER Φ 6	4	
12	0000-000380-00	FLAT WASHER Φ 6	4	
13	3231-252101-00	BRACKET	1	
14	3231-252103-00	COVER	1	
15	0000-001024-00	SCREW M3×10	3	
16	0000-000995-00	LOCK WASHER Φ 3	3	
17	0000-000991-00	FLAT WASHER Φ 3	3	
18	3231-600500-00	SWITCH	1	
19	3712-401000-00	HORN	1	
20	3231-252400-00	FOUR ROCKER SWITCH	2	
21	3218-604000-00	EMERGENCY STOP SWITCH	1	
22	3231-252202-00	BOLT M5×30	1	

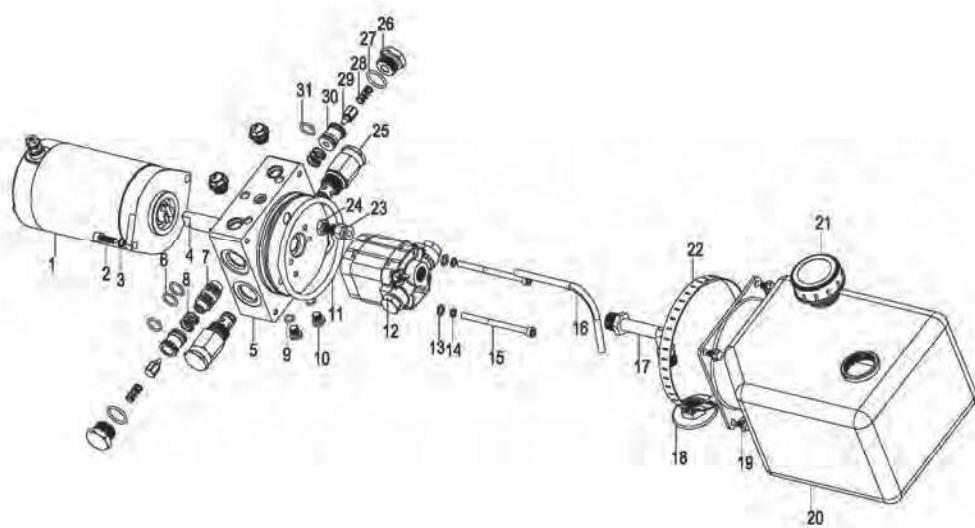


EN_0013

Figure 12-13 Hydraulic System

HYDRAULIC SYSTEM

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-728000-00	FORWARD HOSE	2	
2	3231-729000-00	BACKWARD HOSE	2	
3	3218-710500-0A	THREE-WAY VALVE	1	
4	0000-000109-00	SCREW M8×16	2	
5	0000-000159-00	LOCK WASHER Φ8	2	
6	0000-000210-00	FLAT WASHER Φ8	2	
7	2702-141600-00	CONNECTOR G1/4-M16×1.5	6	
8	0000-000044-00	WASHER Φ14	4	
9	3231-723000-00	FORWARD HOSE	1	
10	3231-724000-00	BACKWARD HOSE	1	
11	2702-122000-00	CONNECTOR G1/2-M20×1.5	3	
12	3231-722000-30	LIFTING HOSE ASSEMBLY	1	
13	0000-000366-00	WASHER Φ22	3	
14	0000-000471-00	CLIP Φ32-40	4	
15	3231-700006-00	RETURN HOSE	1	
16	3231-700005-00	OIL SUCTION PIPE	1	
17	2713-333200-00	CONNECTOR M33×2-Φ32	1	
18	0000-000640-00	O-RING 21.2×2.65	1	
19	2701-222000-00	CONNECTOR M22×1.5-M20×1.5	1	
20	0000-000639-00	O-RING 19×2.65	1	
21	3231-721000-00	HOSE	1	Pump to Solenoid Valve
22	3231-740000-0B	HYDRAULIC PUMP ASSEMBLY	1	
23	0000-000270-00	BOLT M10×20	2	
24	0000-000063-00	LOCK WASHER Φ10	2	
25	0000-000547-00	FLAT WASHER Φ10	2	
26	3231-726000-00	STEERING HOSE I	1	
27	3231-727000-00	STEERING HOSE II	1	
28	3712-403000-00	ENCODER	1	
29	3231-750000-00	SOLENOID VALVE ASSEMBLY	1	3-Way Valve Assembly
29a	3231-750000-10	SOLENOID VALVE ASSEMBLY	1	4-Way Valve Assembly
30	0000-000242-00	BOLT M8×16	2	
31	3231-100005-00	BRACKET	1	
32	0000-000637-00	O-RING 13×2.65	2	
33	2720-123200-00	CONNECTOR G1/2-Φ32	1	

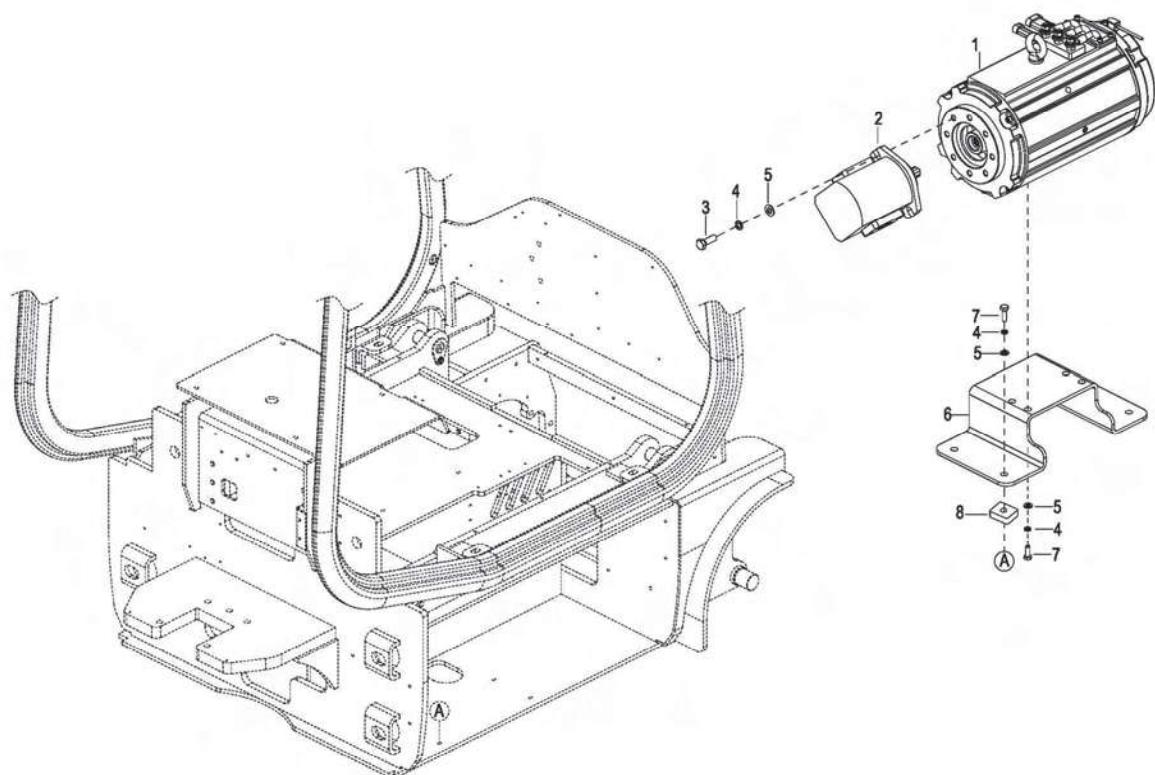


EN_0014

Figure 12-14 Power Steering Pump and Motor Assembly

POWER STEERING PUMP AND MOTOR ASSEMBLY

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-74001X-00	DC MOTOR	1	
2	3231-74002X-00	SCREW M6X16	2	
3	1114-43002X-10	LOCK WASHER Φ 6	2	
4	3231-74004X-00	CONNECTOR 40MM	1	
5	3231-74005X-00	PUMP BASE	1	
6	3231-74006X-00	O-RING 11.6×1.8	2	
7	3231-74007X-00	PISTON	1	
8	3231-74008X-00	SPRING	2	
9	3231-74009X-00	O-RING 6.5X1.5	2	
10	3231-74010X-00	PLUG DRAIN	2	
11	3231-74011X-00	O-RING 85X5.3	1	
12	3231-74012X-00	GEAR PUMPS	1	Used up to serial number 2292000172
12a	3231-74001X-0A	GEAR PUMPS	1	Used between serial number 2292000173 - 2301300263
12b	3231-74001X-0B	GEAR PUMPS	1	Used from serial number 2301300264
13	3231-74013X-00	FLAT WASHER Φ 5	2	
14	1114-43013X-10	LOCK WASHER Φ 5	2	
15	3231-74015X-00	SCREW M5X75	2	
16	3231-74016X-00	RETURN HOSE	1	
17	3231-74017X-00	INLET TUBE	1	
18	3231-74018X-00	FILTER	1	
19	3231-74019X-00	BOLT M5X8	4	
20	3231-74020X-00	TANK	1	
21	3231-74021X-00	TANK TOP	1	
22	3231-74022X-00	CLAMP	1	
23	3231-74023X-00	CONNECTOR ZG1/8- Φ 6	1	
24	3231-74024X-00	NUT	1	
25	3231-74025X-00	RELIEF VALVE	2	
26	3231-74026X-00	DRAIN PLUG	2	
27	3231-74027X-00	O-RING 16.36X2.21	2	
28	3231-74028X-00	SPRING	2	
29	3231-74029X-00	CONE SPOOL ASSEMBLY	2	
30	3231-74030X-00	VALVE BUSH	2	
31	3231-74031X-00	O-RING 12.8X1.8	2	

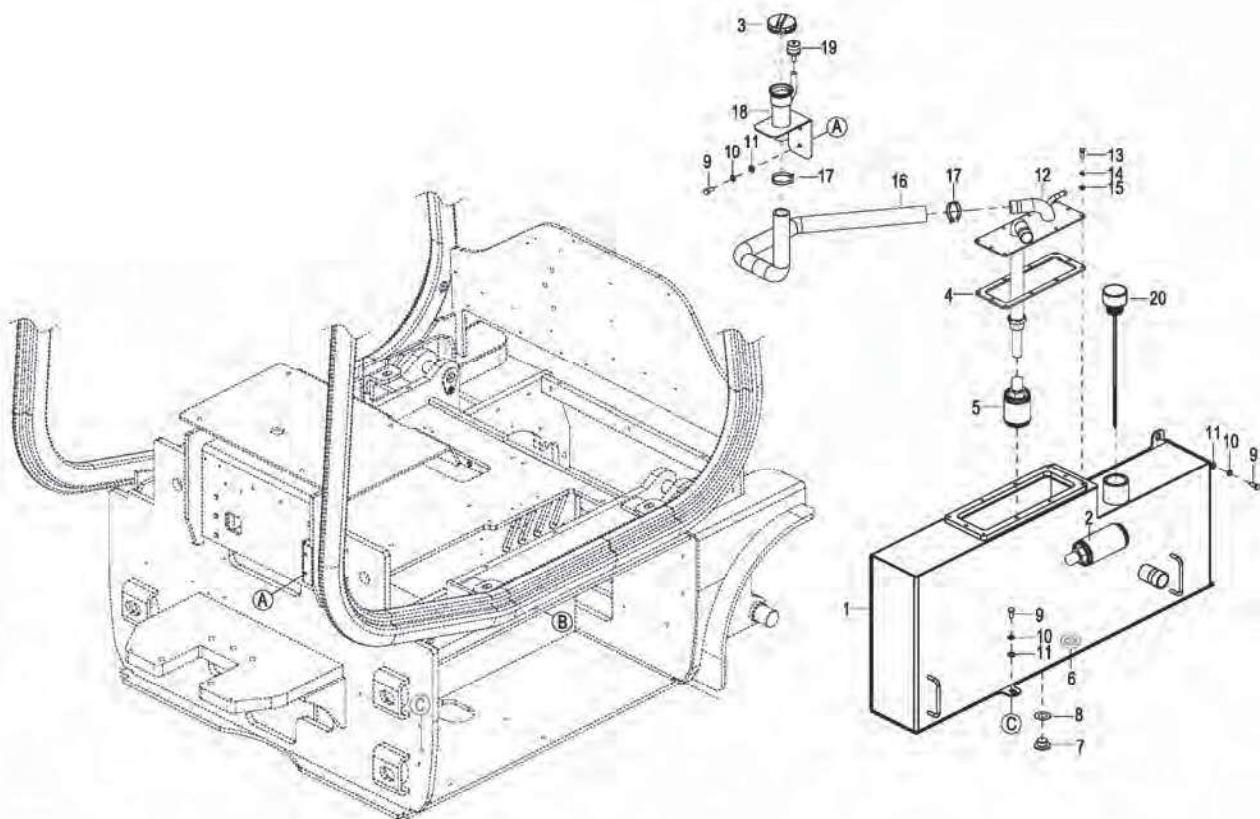


EN_0015

Figure 12-15 Main Pump and Motor Assembly

MAIN PUMP AND MOTOR ASSEMBLY

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3218-660000-00	PUMP MOTOR	1	
2	3115-750000-00	GEAR PUMP	1	
3	3010-030000-42	BOLT M10×1.25×30	2	
4	0000-000063-00	LOCK WASHER Φ10	10	
5	0000-000007-00	FLAT WASHER Φ10	10	
6	3231-700002-00	BRACKET	1	
7	0000-000244-00	BOLT M10×30	8	
8	3218-600006-00	SHOCK ABSORBER	4	

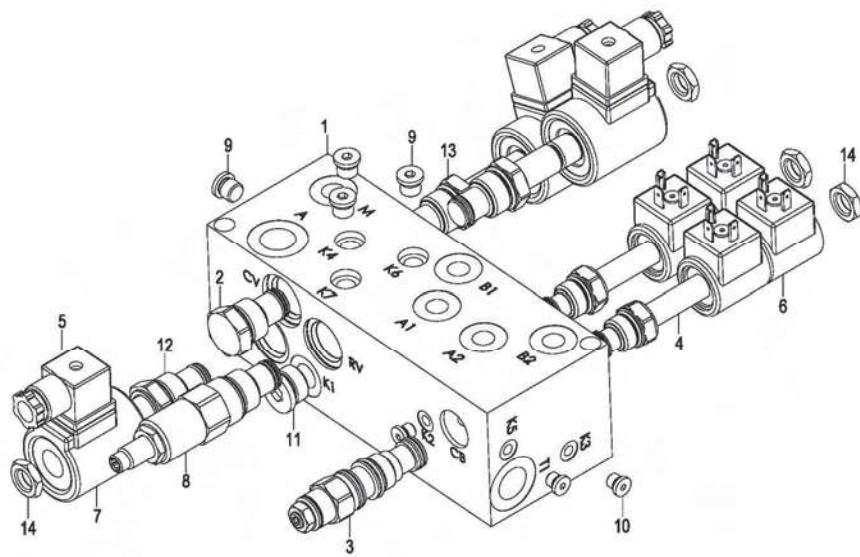


EN_0016

Figure 12-16 Hydraulic Reservoir

HYDRAULIC RESERVOIR

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-710000-0A	OIL TANK	1	
2	3231-700008-00	FILTER	1	
3	3218-112002-00	CAP	1	
4	3218-112001-00	GASKET	1	
5	3218-110008-00	FILTER	1	
6	3218-110010-00	MAGNET	1	
7	3218-110001-00	PLUG DRAIN M18×1.5	1	
8	0000-000634-00	WASHER Φ18	1	
9	0000-000242-00	BOLT M8×16	4	
10	0000-000159-00	LOCK WASHER Φ8	4	
11	0000-000176-00	FLAT WASHER Φ8	4	
12	3231-720000-00	OIL TANK COVER	1	
13	3010-020000-04	BOLT M6×16	10	
14	0000-000056-00	LOCK WASHER Φ6	10	
15	0000-000380-00	FLAT WASHER Φ6	10	
16	3231-700004-00	PIPE	1	
17	0000-000471-00	CLIP Φ32-40	2	
18	3231-730000-00	OILING PORT	1	
19	3125-713000-00	BREATHER	1	
20	3231-700004-01	OIL INTAKE CAP	1	

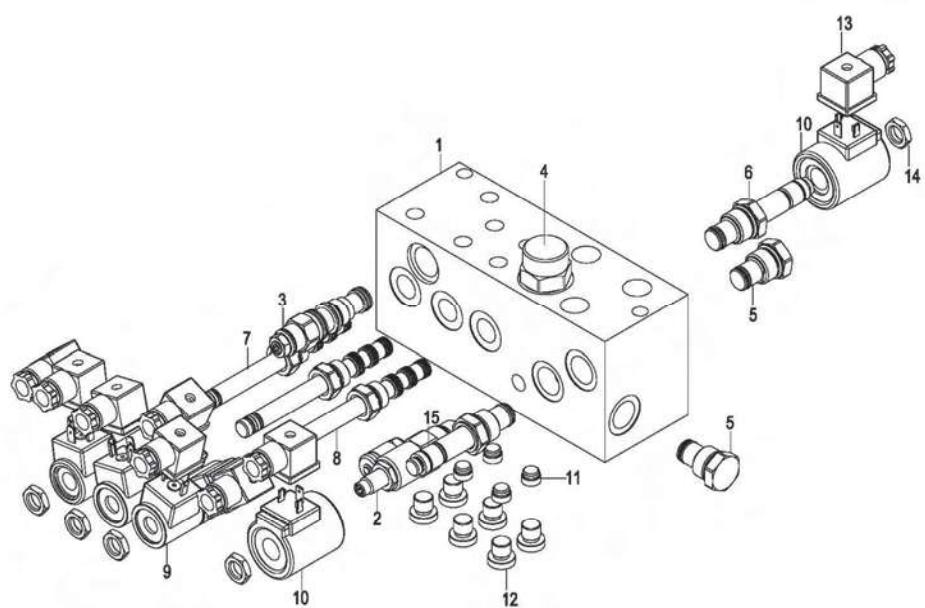


EN_0017

Figure 12-17 Solenoid Valve Assembly - 3 Valve

SOLENOID VALVE ASSEMBLY - 3 VALVE

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-75001X-00	VALVE BLOCK	1	
2	3231-75002X-00	CHECK VALVE	1	
3	3218-33003X-AD	BALANCE VALVE	1	
4	3218-33008X-AD	ELECTROMAGNETIC VALVE	2	
5	3218-33013X-AD	PLUG	3	
6	3218-33009X-AD	COIL	4	
7	3218-33010X-AD	COIL	3	
8	3231-75008X-00	OVERFLOW VALVE	1	
9	3231-75009X-00	PLUG	4	
10	3231-75010X-00	PLUG	3	
11	3231-75011X-00	PLUG	1	
12	3218-33015X-AD	ELECTROMAGNETIC VALVE	2	
13	3218-33006X-AD	PROPORTIONAL VALVE	1	
14	3231-75014X-00	NUT	5	

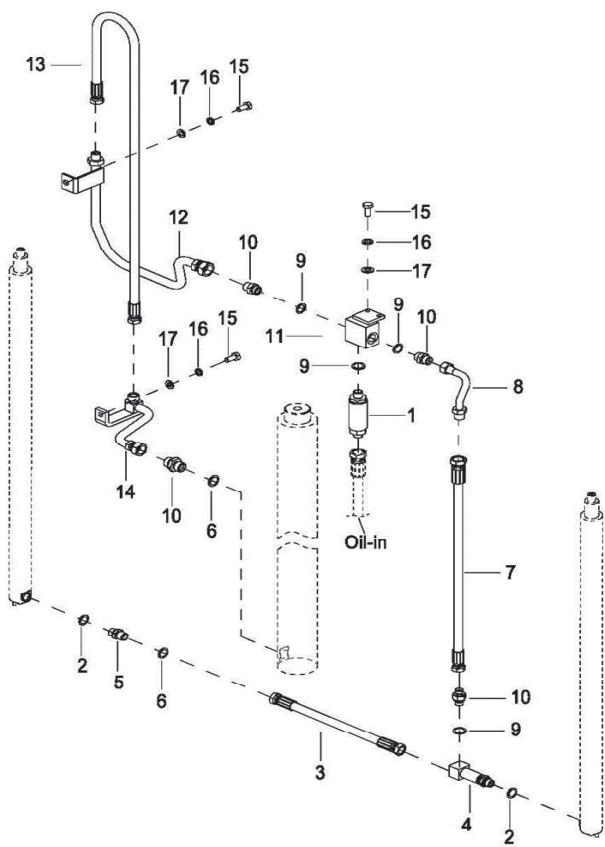


EN_0018

Figure 12-18 Solenoid Valve Assembly - 4 Valve

SOLENOID VALVE ASSEMBLY - 4 VALVE

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-75001X-10	VALVE BLOCK	1	
2	3218-33002X-AD	CHECK VALVE	1	
3	3218-33003X-AD	BALANCE VALVE	1	
4	3218-33004X-AD	OVERFLOW VALVE	1	
5	3218-33005X-AD	CHECK VALVE	2	
6	3218-33006X-AD	PROPORTIONAL VALVE	1	
7	3218-33007X-AD	PROPORTIONAL VALVE	1	
8	3218-33008X-AD	ELECTROMAGNETIC VALVE	2	
9	3231-75009X-10	COIL	6	
10	3231-75010X-10	COIL	2	
11	3218-33011X-AD	PLUG	7	
12	3218-33012X-AD	PLUG	7	
13	3218-33013X-AD	PLUG	8	
14	3231-75014X-10	NUT	5	
15	3218-33015X-AD	ELECTROMAGNETIC VALVE	1	

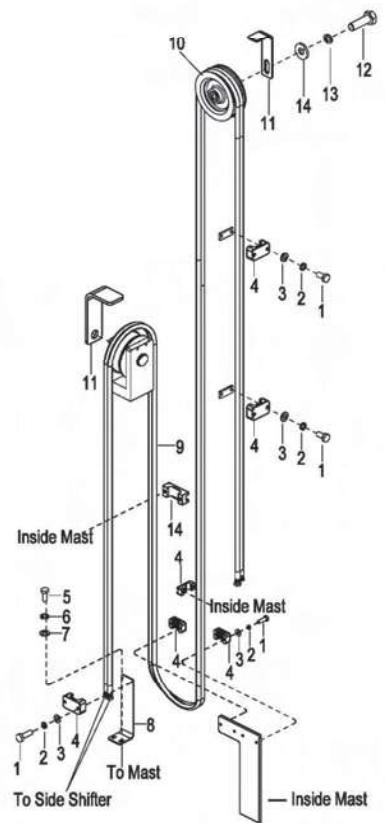


EN_0019

Figure 12-19 Three Stage Mast Hydraulic Lines - Standard

THREE STAGE MAST HYDRAULIC LINES - STANDARD

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3215-860400-10	FLOW REGULATOR	1	
2	0000-000638-00	O-RING 17X2.65	2	
3	3231-865000-00	OIL PIPE II	1	
4	3215-860600-30	THREE WAY	1	
5	2701-202200-00	CONNECTOR M20×1.5-M22×1.5	1	
6	0000-000639-00	O-RING 19×2.65	2	
7	3231-864000-30	OIL PIPE I	1	
8	3231-863000-00	STEEL PIPE II	1	
9	0000-000366-00	WASHER Φ22	4	
10	2701-222200-00	CONNECTOR M22×1.5-M22×1.5	4	
11	3625-854000-30	THREE WAY	1	
12	3231-862000-00	STEEL PIPE I	1	
13	3231-868000-00-05	OIL PIPE	1	Lift Height 189" (4800mm)
13a	3231-868000-00-06	OIL PIPE	1	Lift Height 197" (5000mm)
14	3231-861000-00	STEEL PIPE	1	
15	0000-000242-00	BOLT M8×16	4	
16	0000-000159-00	LOCK WASHER Φ8	4	
17	0000-000176-00	FLAT WASHER Φ8	4	

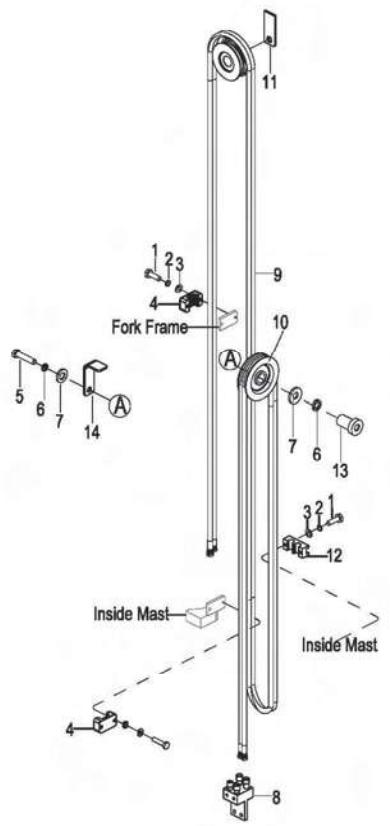


EN_0020

Figure 12-20 Three Stage Mast Hydraulic Lines - 3 Valve - Built in Side Shift

THREE STAGE MAST - HYDRAULIC LINES - 3 VALVE - BUILT IN SIDE SHIFT

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000902-00	SCREW M6×25	12	
2	3040-000000-54	LOCK WASHER Φ6	12	
3	3040-000000-36	FLAT WASHER Φ8	12	
4	3231-800015-0A	PLATE	6	
5	0000-000242-00	BOLT M8×16	2	
6	0000-000159-00	LOCK WASHER Φ8	2	
7	0000-000176-00	FLAT WASHER Φ8	2	
8	3231-800003-00	FIXED PLATE	1	
9	3231-866000-0A-05	OIL PIPE	2	Lift Height 189" (4800mm)
9a	3231-866000-0A-06	OIL PIPE	2	Lift Height 197" (5000mm)
10	0000-000438-00	FLAT WASHER Φ10	1	
11	3231-800011-00	PLATE	2	
12	3010-020000-26	BOLT M10×20	1	
13	0000-000060-00	LOCK WASHER Φ10	1	
14	3231-800015-00	PLATE	1	

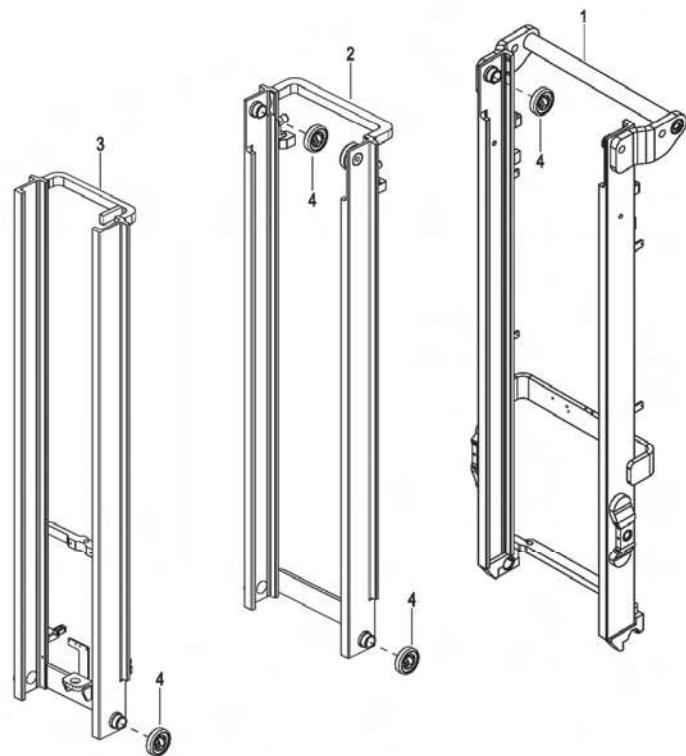


EN_0021

Figure 12-21 Three Stage Mast - Hydraulic Lines - 4 Valve - Attachment

THREE STAGE MAST - HYDRAULIC LINES - 4 VALVE - ATTACHMENT

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000902-00	SCREW M6×25	6	
2	3040-000000-50	LOCK WASHER Φ6	6	
3	3040-000000-36	FLAT WASHER Φ6	6	
4	3231-800015-0A	PLATE	2	
5	0000-000286-00	BOLT M12×60	1	
6	3040-000000-51	LOCK WASHER Φ12	2	
7	3040-000000-41	FLAT WASHER Φ12	2	
8	3231-950100-00	FOUR-WAY ASSEMBLY	1	
9	3231-869000-00-05	OIL PIPE	2	Lift Height 189" (4800mm)
9a	3231-869000-00-06	OIL PIPE	2	Lift Height 197" (5000mm)
10	3215-800003-10	TUBE ROUND	1	
11	3231-800011-00	BRACKET	1	
12	3215-860001-60	BRACKET	1	
13	3231-800008-00	SLEEVE	1	
14	3231-800013-00	FLAT WASHER Φ12	1	

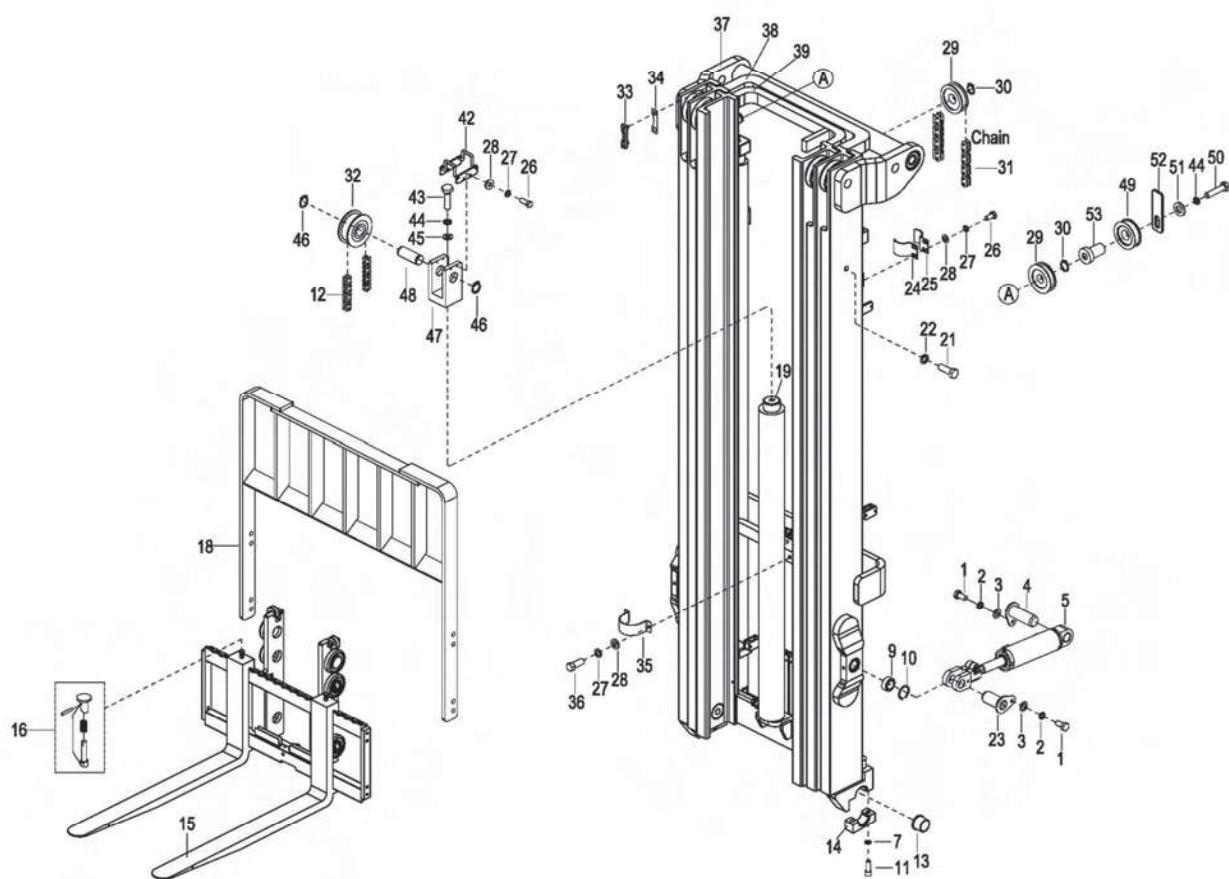


EN_0026

Figure 12-22 Three Stage Mast

THREE STAGE MAST

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-810000-0A-05	OUTSIDE MAST	1	Lift Height 189" (4800mm)
1a	3231-810000-0A-06	OUTSIDE MAST	1	Lift Height 197" (5000mm)
2	3231-820000-0A-05	MIDDLE MAST	1	Lift Height 189" (4800mm)
2a	3231-820000-0A-06	MIDDLE MAST	1	Lift Height 197" (5000mm)
3	3231-830000-0A-05	OUTSIDE MAST	1	Lift Height 189" (4800mm)
3a	3231-830000-0A-06	OUTSIDE MAST	1	Lift Height 197" (5000mm)
4	2415-612000-1B	ROLLER I	8	

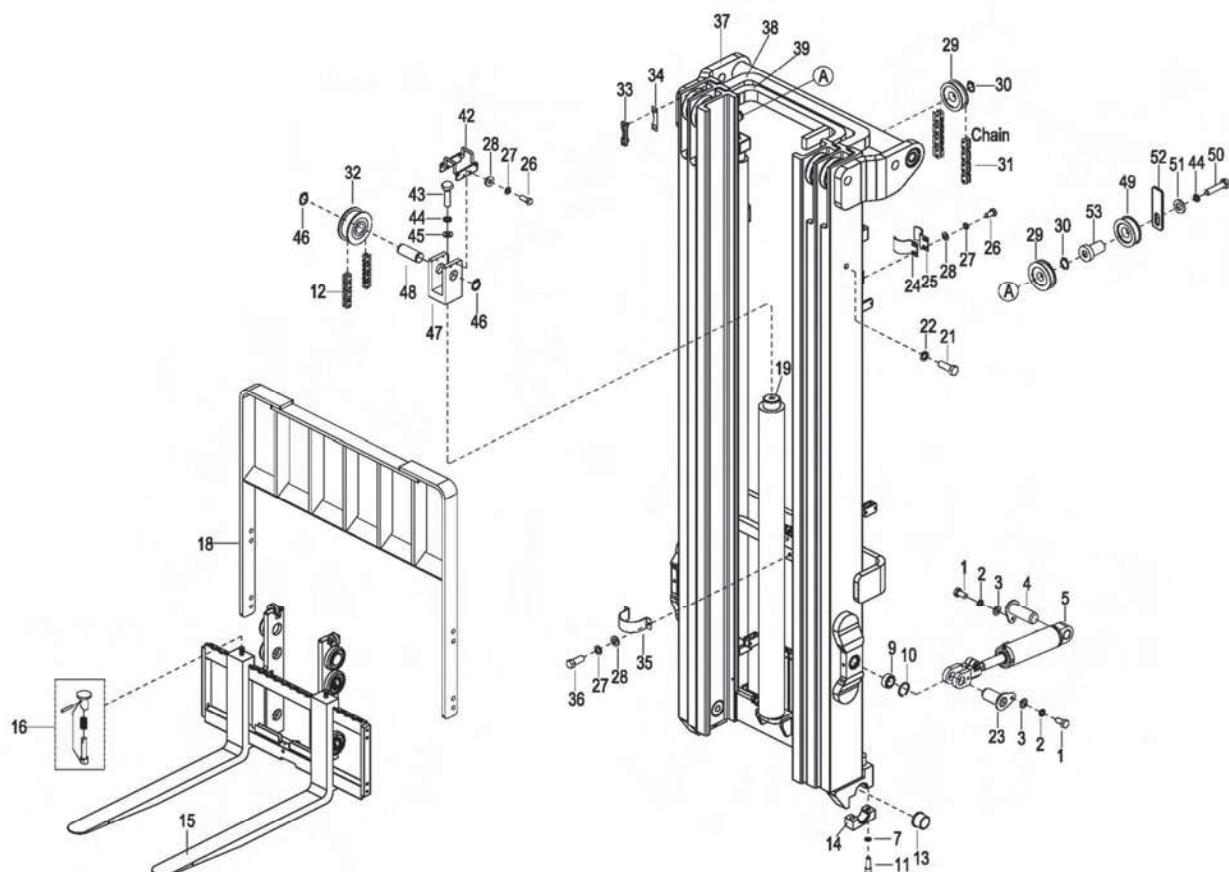


EN_0025

Figure 12-23 Three Stage Mast - Elevation System - Overview

THREE STAGE MAST - ELEVATION SYSTEM - OVERVIEW

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000305-00	BOLT M10×1.25×20	4	
2	0000-000063-00	LOCK WASHER φ10	4	
3	3040-000000-35	FLAT WASHER φ10	4	
4	3218-114000-0A	SHAFT	2	
5	3231-860000-00	TILT CYLINDER	2	
6	3010-020000-49	BOLT M14×40	8	
7	0000-000233-00	LOCK WASHER φ14	12	
8	0000-000379-00	FLAT WASHER φ14	8	
9	0000-001012-00	BEARING	2	
10	0000-000849-00	SEAL φ47	4	
11	3020-000004-64	SCREW M14×60	4	
12	3231-800300-00-05	FREE LIFT CHAIN ASSEMBLY	1	Lift Height 189" (4800mm) 75 Pitch
12a	3231-800300-00-06	FREE LIFT CHAIN ASSEMBLY	1	Lift Height 197" (5000mm) 77 Pitch
13	3231-800001-00	COPPER SLEEVE	2	
14	3231-810013-0A	FIXED PLATE	2	
15	3125-800001-00-05	FORK	2	4.8"x1.57"x42" (122*40*1070mm)
15a	3125-800001-00-08	FORK	2	4.8"x1.57"x47.2" (122*40*1200mm)
15b	3125-800001-00-11	FORK	2	4.8"x1.57"x53.9" (122*40*1370mm)
15c	3125-800001-00-13	FORK	2	4.8"x1.57"x29" (122*40*1500mm)
16	2125-630001-10	PIN ASSEMBLY	2	
17	--	FORK FRAME	1	See Fork Carriage section
18	3112-721000-B0	BAFFLE	1	
19	3231-420000-30-05	FREE LIFT CYLINDER	1	Lift Height 189" (4800mm)
19a	3231-420000-30-06	FREE LIFT CYLINDER	1	Lift Height 197" (5000mm)
20	3231-410000-30-05	MAST LIFT CYLINDER	2	Lift Height 189" (4800mm)
20a	3231-410000-30-06	MAST LIFT CYLINDER	2	Lift Height 197" (5000mm)
21	0000-000375-00	BOLT M16×35	2	
22	0000-000191-00	LOCK WASHER φ16	2	
23	3112-130000-00	SHAFT	2	
24	3231-800006-30	CYLINDER HOOP	2	

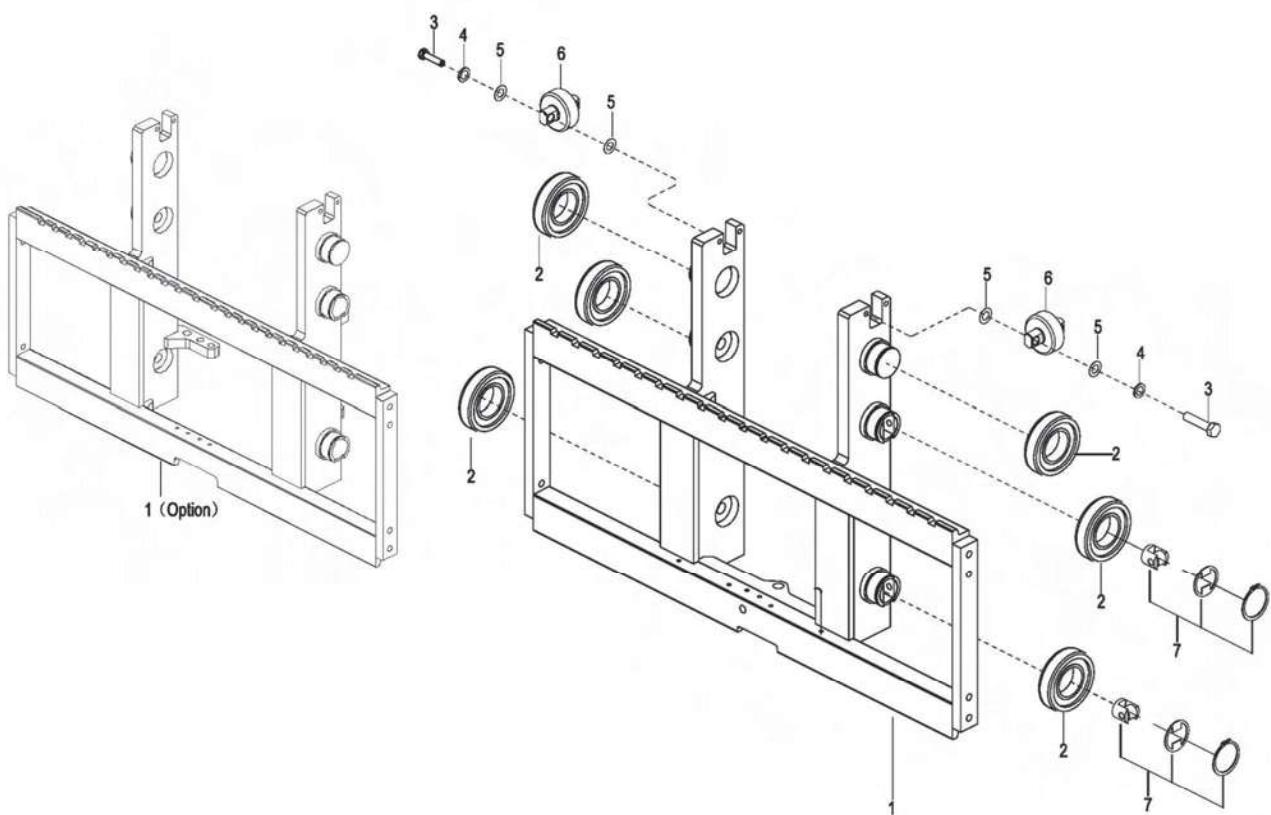


EN_0025

Figure 12-23 Three Stage Mast - Elevation System - Overview - Continued

THREE STAGE MAST - ELEVATION SYSTEM OVERVIEW - CONTINUED

Pos.	Part Number	Description	Qty. Reqd.	Notes
25	3231-800007-30	CYLINDER HOOP	2	
26	3010-020000-14	BOLT M8×20	6	
27	3040-000000-52	LOCK WASHER $\Phi 8$	6	
28	3040-000000-40	FLAT WASHER $\Phi 8$	6	
29	3231-800002-00	CHAIN PULLEY	2	
30	0000-000183-00	COLLAR $\Phi 35$	2	
31	3231-800200-0A-05	CHAIN ASSEMBLY	2	Lift Height 189" (4800mm)
31a	3231-800200-0A-06	CHAIN ASSEMBLY	2	Lift Height 197" (5000mm)
32	3231-800010-00	SHEAVE	1	
33	3120-600001-00	GUIDE PLATE	2	
34	3625-800006-30	WASHER	2	
35	3231-800008-30	FIXED PLATE	1	
36	0000-000242-00	BOLT M8×16	2	
37	--	OUTSIDE MAST	1	See Three Stage Mast section
38	--	MIDDLE MAST	1	See Three Stage Mast section
39	--	INSIDE MAST	1	See Three Stage Mast section
40	0000-000283-00	BOLT M10×35	2	
41	0000-000553-00	NUT M10	2	
42	3231-800400-00	COVER	1	
43	3010-120000-02	BOLT M16×40	1	
44	3040-000000-55	LOCK WASHER $\Phi 16$	2	
45	3040-000000-44	WASHER $\Phi 16$	1	
46	3231-800006-00	COLLAR Φ	2	
47	3231-800100-00	CHAIN PULLEY SEAT	1	
48	3231-800005-00	CHAIN SHAFT	1	
49	2125-600002-30	TUBING ROLLER	1	
50	0000-000613-00	BOLT M12×50	1	
51	0000-000438-00	WASHER $\Phi 12$	1	
52	3231-800011-00	PLATE	1	
53	3231-800007-00	SLEEVE	1	

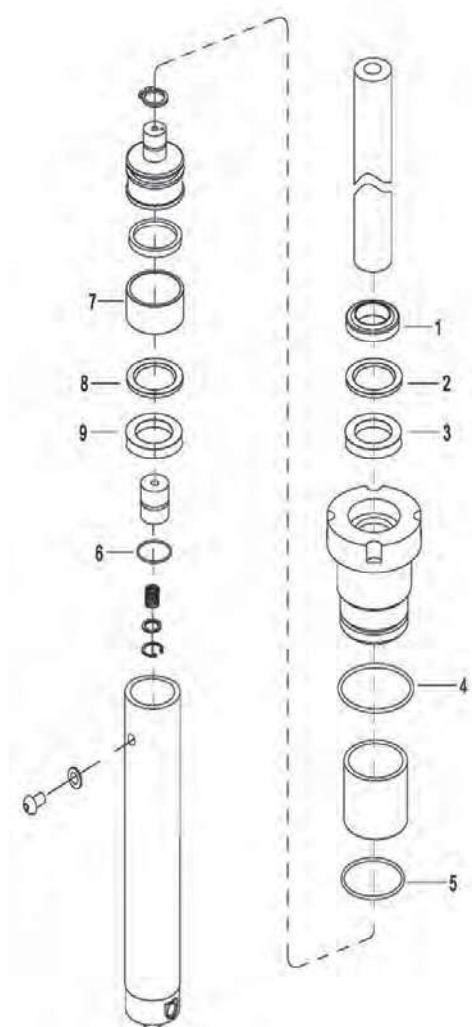


EN_0027

Figure 12-24 Three Stage Mast Fork Carriage

THREE STAGE MAST FORK CARRIAGE

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-841000-5A	SIDE SHIFT	1	For a breakdown see Built-In Side Shift Section
1a	3231-841000-0A	FORK CARRIAGE	1	Optional
2	2415-612000-1B-01	ROLLER	6	
3	0000-000913-00	BOLT M10×40	4	
4	0000-000063-00	LOCK WASHER Φ10	4	
5	0000-000007-00	FLAT WASHER Φ10	A.R.	As Required
6	3625-843000-30	SIDE ROLLER	2	
7	3316-512000-20-01	SIDE ROLLER	4	

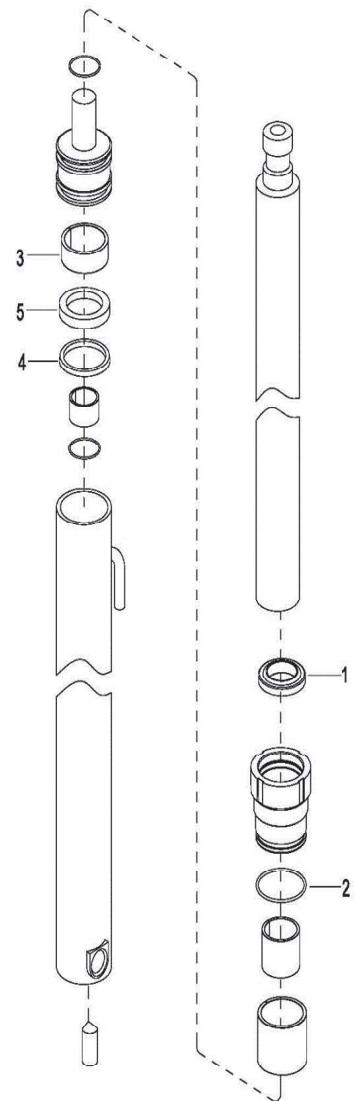


EN_0022

Figure 12-25 Three Stage Mast - Free Lift Cylinder

THREE STAGE MAST - FREE LIFT CYLINDER

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-420000-30-05	FREE LIFT CYLINDER	1	Lift Height 189" (4800mm)
--	3231-420000-30-06	FREE LIFT CYLINDER	1	Lift Height 197" (5000mm)
KIT	3231-3ZG	SEAL KIT FOR CYLINDER	1	Incl. pos. # 1,2,3,4,5,6,7,8 & 9
1	/	LBI DUST RING 55×63×5/6.5	1	
2	/	SNAP RING 55×65×3	1	
3	/	RING 55×65×6	1	
4	/	O-RING 75×3.1	1	
5	/	O-RING 70×3.1	1	
6	/	O-RING 20×2.4	1	
7	/	WEARING 70×65×20	1	
8	/	RING 70×60×6	1	
9	/	SNAP RING 70×60×2	1	

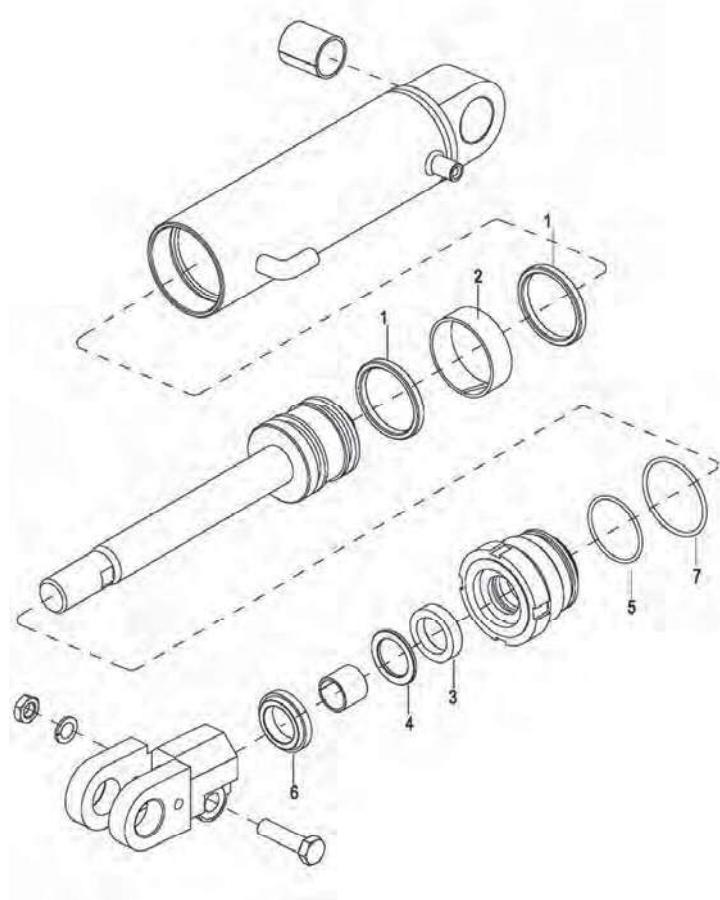


EN_0023

Figure 12-26 Three Stage Mast - Mast Lift Cylinder

THREE STAGE MAST - MAST LIFT CYLINDER

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-410000-30-05	LIFT CYLINDER	2	Lift Height 189" (4800mm), Two cylinders per truck.(Qty. for parts below are per cylinder)
--	3231-410000-30-06	LIFT CYLINDER	2	Lift Height 197" (5000mm), Two cylinders per truck.(Qty. for parts below are per cylinder)
KIT	3231-3BG	SEAL KIT FOR CYLINDER	1	Includes pos # 1,2,3,4,5 & 6
1	/	LBI DUST RING 35×43×5/6.5	1	
2	/	O-RING 50×2.4	1	
3	/	SUPPORT RING 45×40×15	1	
4	/	SNAP RING 45×35×2	1	
5	/	SEAL RING 45×35×2	1	

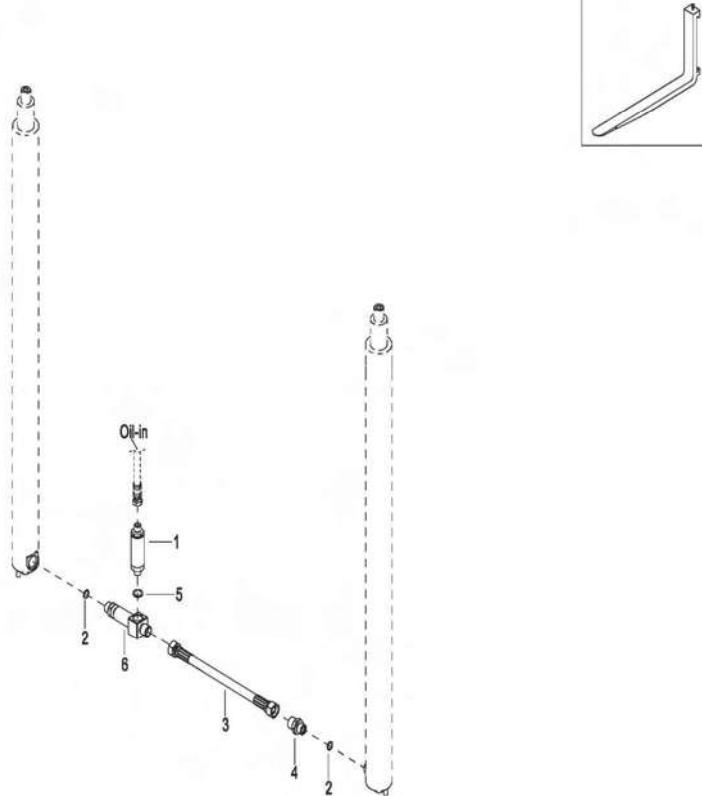


EN_0024

Figure 12-27 Three Stage Mast - Tilt Cylinder

THREE STAGE MAST - TILT CYLINDER

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-860000-00	TILT CYLINDER	1	
KIT	3231-QXG	SEAL KIT FOR CYLINDER	1	Includes pos. # 1,2,3,4,5,7,8 & 9
1	/	SEAL 63×53×6	2	
2	/	WEAR RING 63×58×20	1	
3	/	SEAL 30×40×6	1	
4	/	SEAL 30×40×3A	1	
5	/	O-RING 63×3.1	1	
6	/	DUST SEAL 30×38×5.8/8	1	
7	/	O-RING 65×2.65	1	

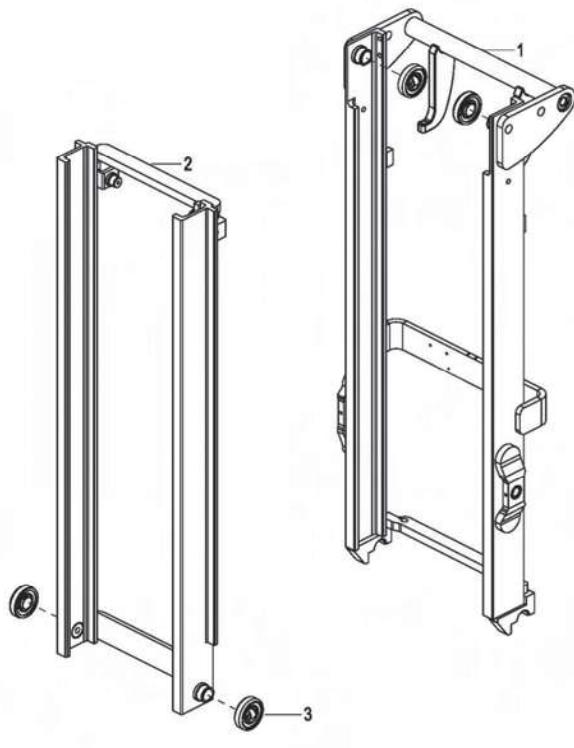


EN_0033

Figure 12-28 Telescopic Mast Hydraulic Lines

TELESCOPIC MAST HYDRAULIC LINES

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3215-860400-10	FLOW REGULATOR	1	
2	3060-020000-21	O-RING 17×2.65	2	
3	3215-861300-30	OIL PIPE II	1	
4	2701-202000-00	CONNECTOR M20×1.5-M20×1.5	1	
5	0000-000366-00	WASHER Φ22	1	
6	3215-860600-30	THREE WAY	1	

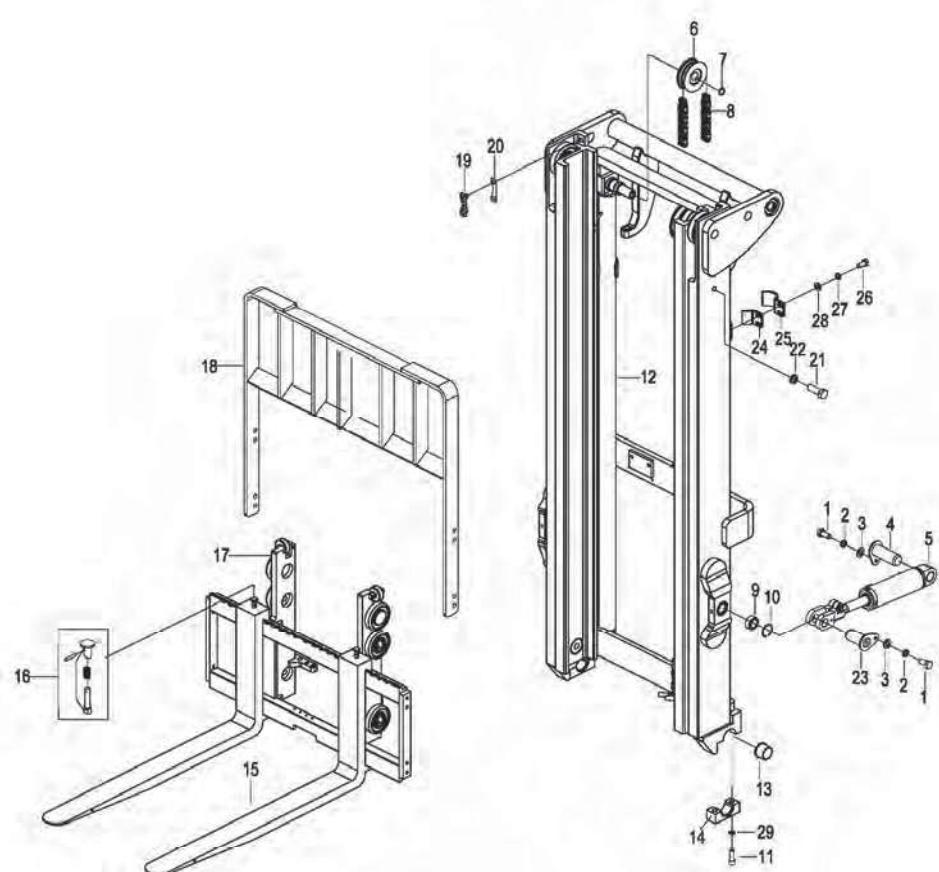


EN_0035

Figure 12-29 Telescopic Mast

TELESCOPIC MAST

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-810000-10-05	OUTSIDE MAST	1	H=130" (3300mm)
2	3231-820000-10-05	INSIDE MAST	1	H=130" (3300mm)
3	2415-612000-1B	ROLLER	4	

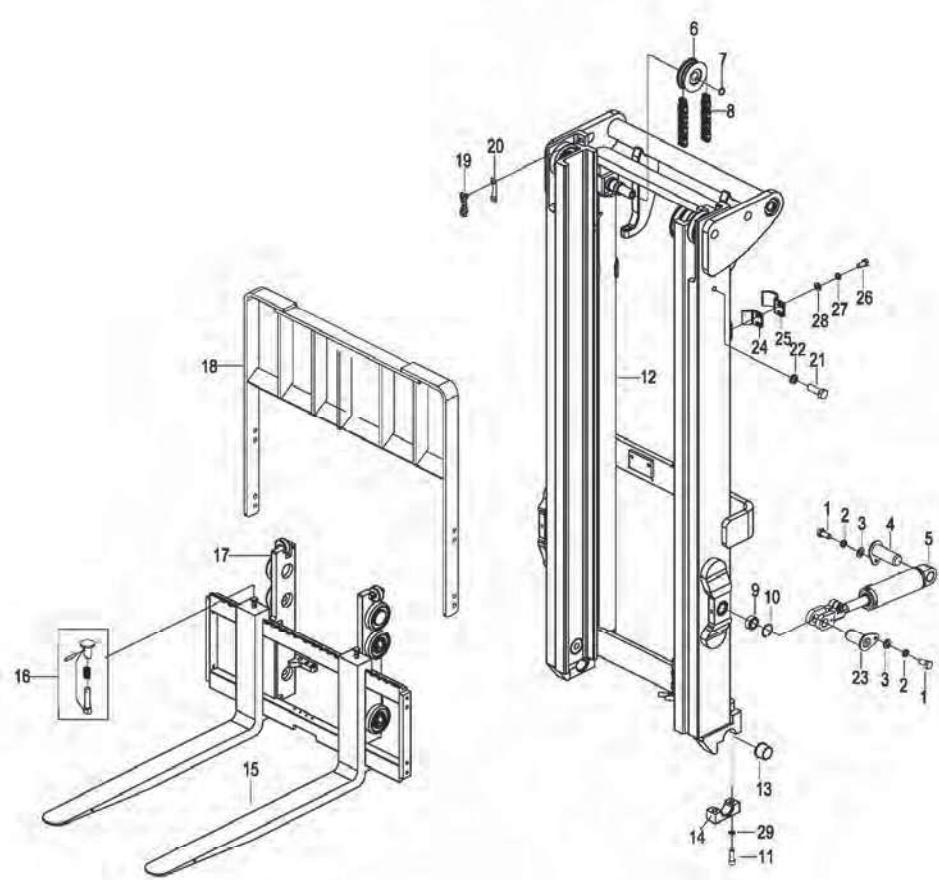


EN_0036

Figure 12-30 Telescopic Mast - Elevation System - Overview

TELESCOPIC MAST - ELEVATION SYSTEM - OVERVIEW

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000305-00	BOLT M10×1.25×20	4	
2	0000-000063-00	LOCK WASHER Φ10	4	
3	0000-000547-00	FLAT WASHER Φ10	4	
4	3218-114000-0A	SHAFT	2	
5	3231-850000-00	TILT CYLINDER	2	
6	3112-800019-10	CHAIN PULLEY	2	
7	0000-000183-00	COLLAR Ø35	2	
8	3231-800100-1A-05	CHAIN ASSEMBLY	2	H=130" (3300mm) 109 Pitch
9	0000-001012-00	BEARING	2	
10	0000-000849-00	SEAL Φ47	2	
11	3020-000004-64	SCREW M14×60	4	
12	3231-410000-10-05	LIFT CYLINDER	2	H=130" (3300mm)
13	3231-800001-00	COPPER SLEEVE	2	
14	3231-810013-0A	FIXED PLATE	2	
15	3125-800001-00-05	FORK	2	122*40*1070mm
15a	3125-800001-00-08	FORK	2	122*40*1200mm
15b	3125-800001-00-11	FORK	2	122*40*1370mm
15c	3125-800001-00-13	FORK	2	122*40*1500mm
16	2125-630001-10	PIN ASSEMBLY	2	
17	--	FORK FRAME	1	See Telescopic Fork Carriage Section
18	3112-721000-B0	BAFFLE	1	42in
18a	3112-721000-B0-02	BAFFLE	1	48in
18b	3112-721000-B0-03	BAFFLE	1	60in
19	3120-600001-00	GUIDE PLATE	2	
20	3625-800006-30	WASHER	2	
21	0000-000375-00	BOLT M16×35	2	
22	0000-000191-00	LOCK WASHER Φ16	2	

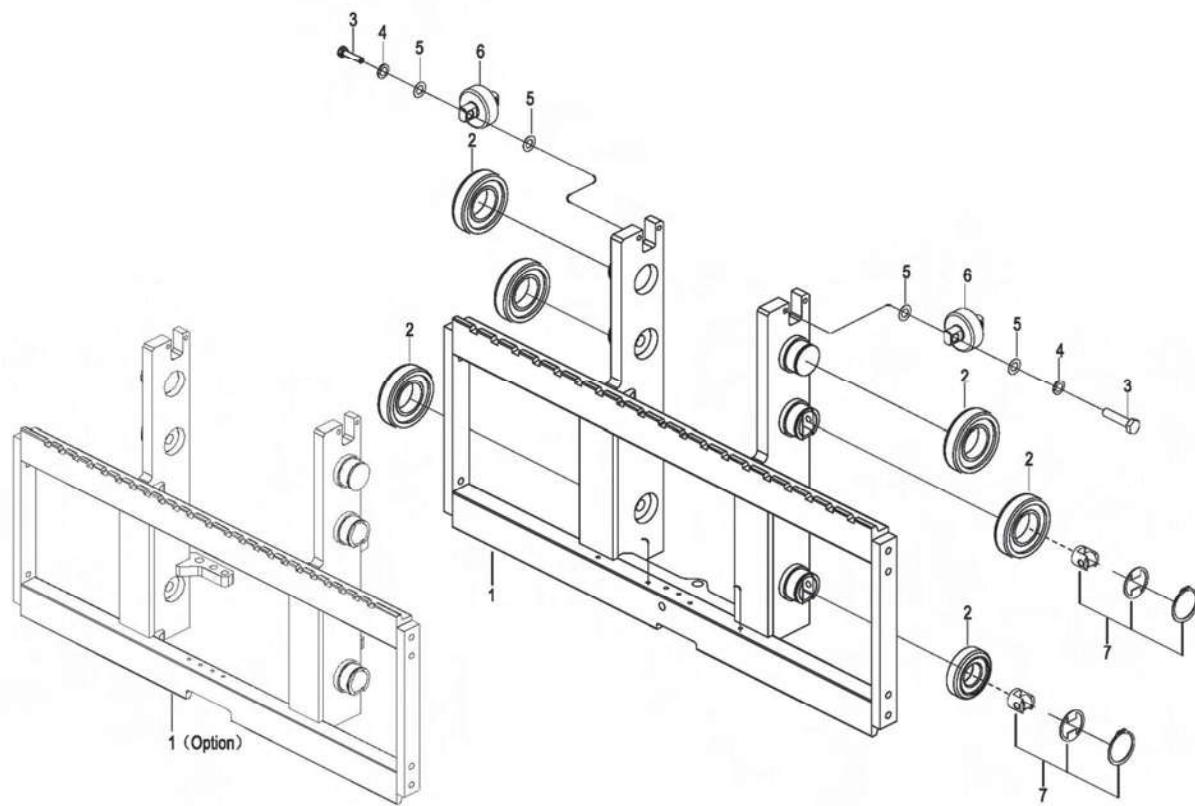


EN_0036

Figure 12-30 Telescopic Mast - Elevation System - Overview - Continued

TELESCOPIC MAST - ELEVATION SYSTEM - OVERVIEW - CONTINUED

Pos.	Part Number	Description	Qty. Reqd.	Notes
23	3112-130000-00	SHAFT	2	
24	3231-800006-30	CYLINDER HOOP	2	
25	3231-800007-30	CYLINDER HOOP	2	
26	3010-020000-14	BOLT M8×20	4	
27	3040-000000-52	LOCK WASHER Φ8	4	
28	3040-000000-40	FLAT WASHER Φ8	4	
29	3040-000000-54	LOCK WASHER Φ14	4	

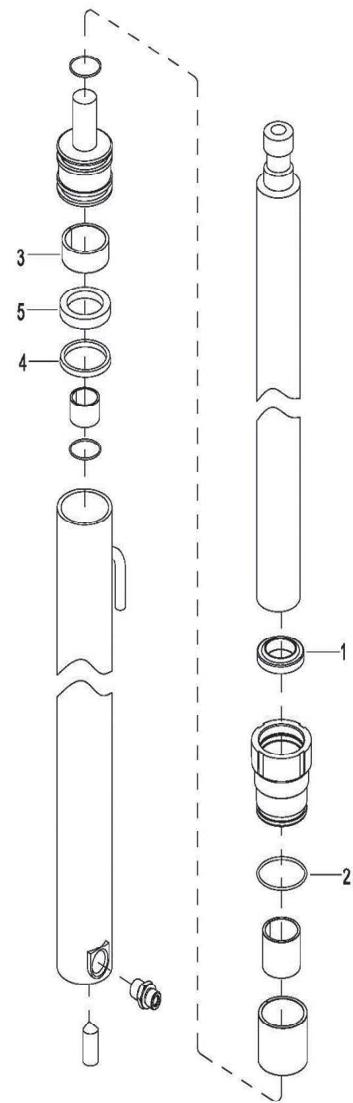


EN_0038

Figure 12-31 Telescopic Mast - Fork Carriage

TELESCOPIC MAST - FORK CARRIAGE

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-841000-6A	SIDE SHIFT	1	For a breakdown see Built-In Side Shift Section
1a	3231-841000-1A	FORK CARRIAGE	1	Option
2	2415-612000-1B-01	ROLLER	6	
3	0000-000913-00	BOLT M10×40	4	
4	0000-000063-00	LOCK WASHER Φ10	4	
5	0000-000007-00	FLAT WASHER Φ10	A.R.	As Required
6	3625-843000-30	SIDE ROLLER	2	
7	3316-512000-20-01	SIDE ROLLER	4	

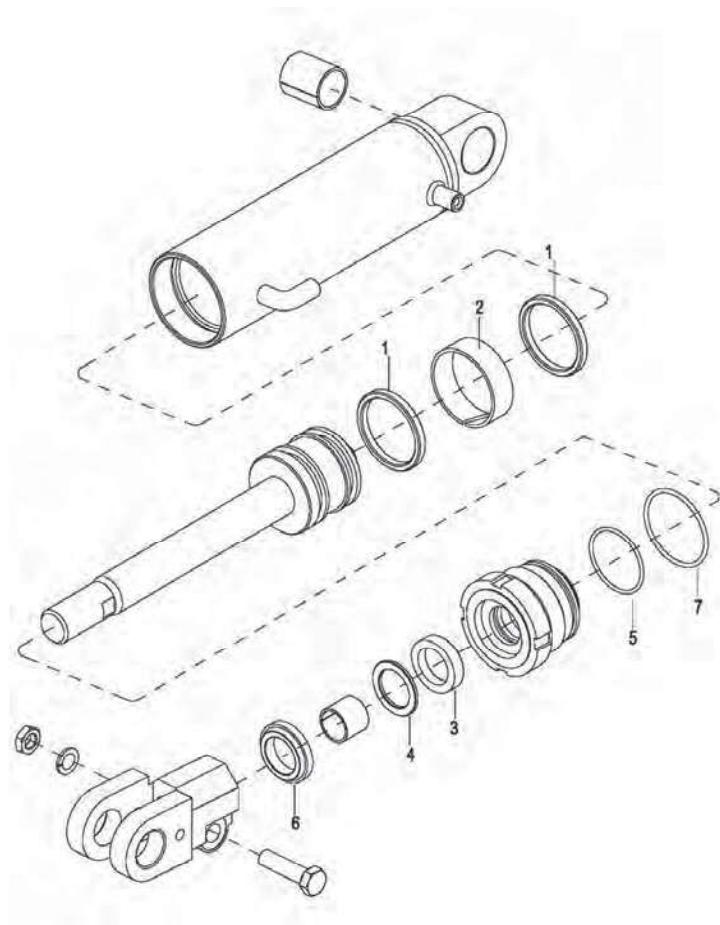


EN_0034

Figure 12-32 Telescopic - Mast Lift Cylinder

TELESCOPIC - MAST LIFT CYLINDER

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-410000-10-05	LIFT CYLINDER ASSEMBLY	2	Lift Height 130" (3300mm)Two cylinders per truck.(Qty. below are per cylinder)
KIT	3231-2BG2	SEAL KIT FOR CYLINDER	1	Includes Pos. # 1,2,3,4 & 5
1	/	DUST SEAL D35×43×5/6.5	1	
2	/	O-RING D50×2.4	1	
3	/	WEARING 45×40×15	1	
4	/	SEAL D45×35×6	1	
5	/	SNAP RING 45×35×2	1	

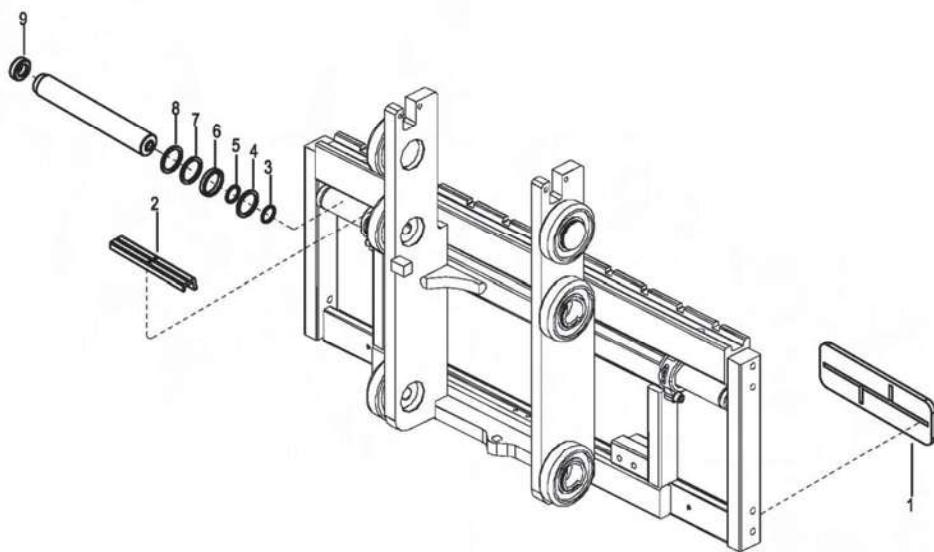


EN_0039

Figure 12-33 Telescopic Mast - Tilt Cylinder

TELESCOPIC MAST - TILT CYLINDER

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-850000-00	TILT CYLINDER	2	Two cylinders per truck.(Qty. below are per cylinder)
KIT	3231-QXG	SEAL KIT FOR CYLINDER	1	Includes pos. # 1,2,3,4,5,7,8 & 9
1	/	SEAL 63×53×6	2	
2	/	WEAR RING 63×58×20	1	
3	/	SEAL 30×40×6	1	
4	/	SEAL 30×40×3A	1	
5	/	O-RING 63×3.1	1	
6	/	DUST SEAL 30×38×5.8/8	1	
7	/	O-RING 65×2.65	1	

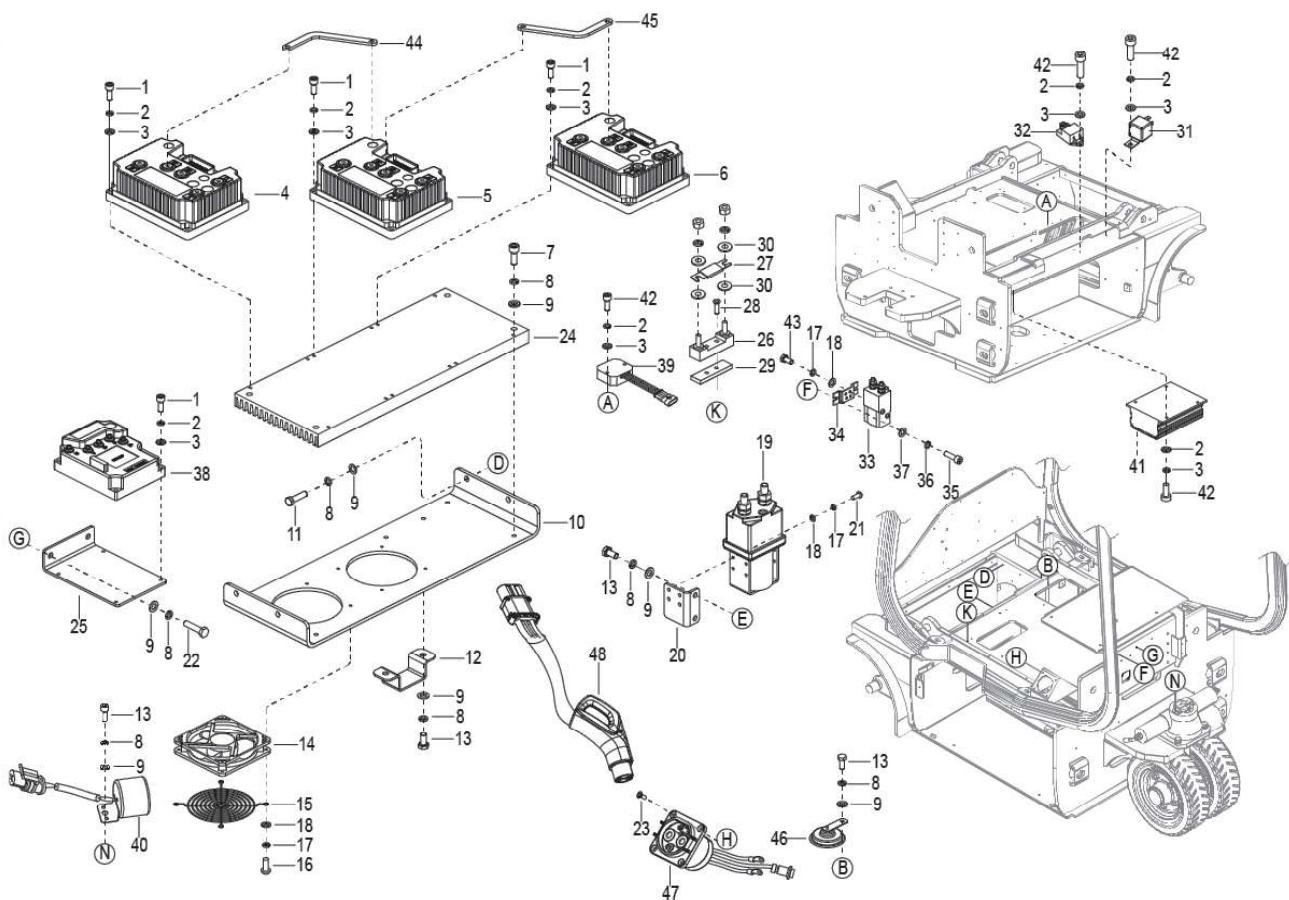


EN_0037

Figure 12-34 Built-In Side Shift

BUILT-IN SIDE SHIFT

Pos.	Part Number	Description	Qty. Reqd.	Notes
--	3231-841000-6A	FORK FRAME	1	Used on Telescopic Mast
--	3231-841000-5A	FORK FRAME	1	Used on Three Stage Mast
1	/	BLOCK DOWN	2	
2	/	BLOCK	2	
3	/	GASKET RING 44.4X3.1	2	
4	/	BEAD FLANGE	2	
5	/	O-RING 52.6X2.4	2	
6	/	GASKET RING 40X50X8	2	
7	/	COLLAR	2	
8	/	BUSH RING 40X48X5/6.5	2	
9	/	SHOCK ABSORBER SLEEVE	2	
10	3231-KNHK-2A	KIT FOR SLIDER	1	Includes pos. # 1-9

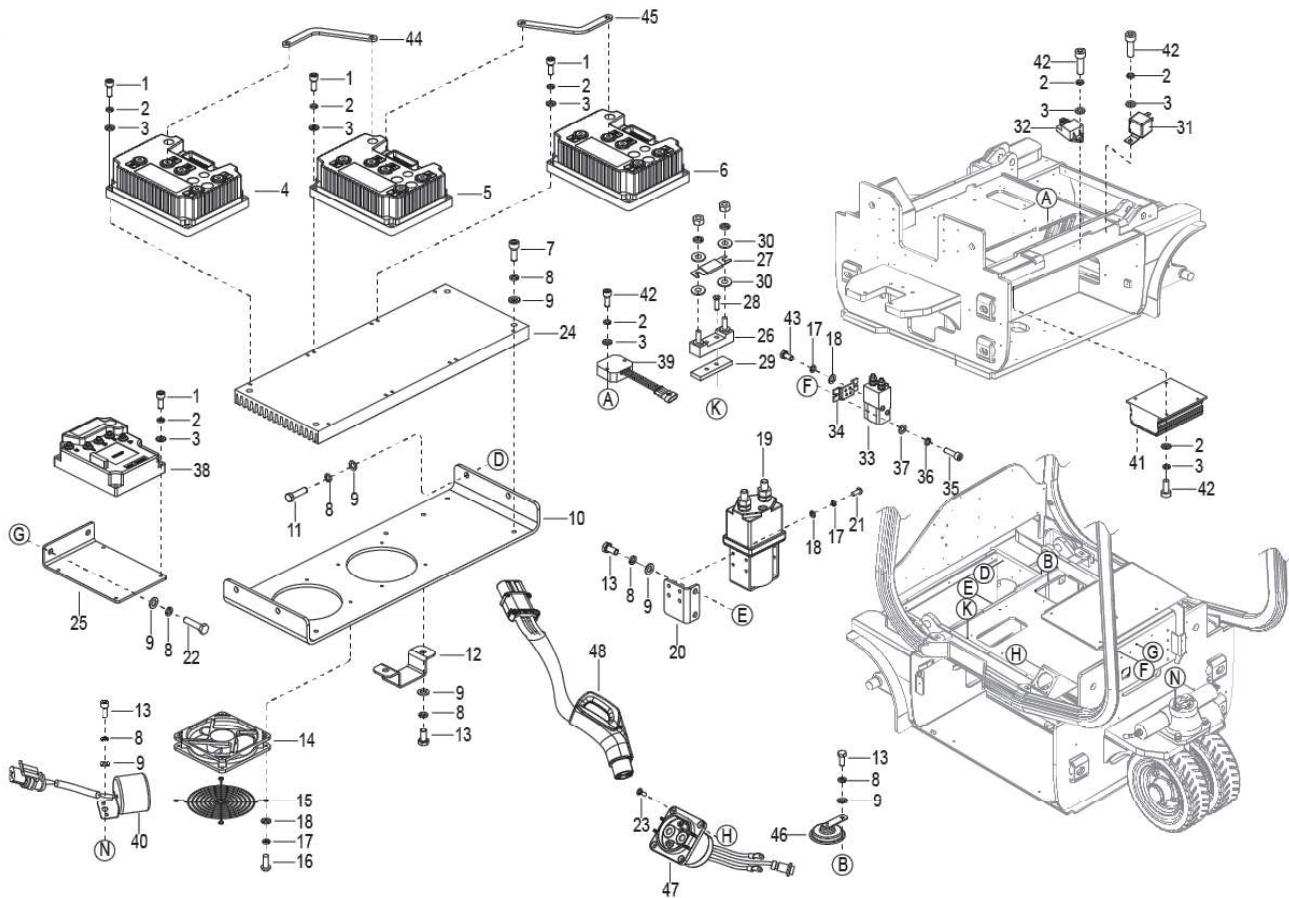


EN_0030

Figure 12-35 Electrical Components

ELECTRICAL COMPONENTS

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000006-00	SCREW M6×30	16	
2	0000-000056-00	LOCK WASHER Φ6	24	
3	0000-000123-00	FLAT WASHER Φ6	24	
4	3218-600100-26-80	PUMP MOTOR CONTROLLER	1	
5	3218-600100-26-60	TRACTION MOTOR CONTROLLER L	1	
6	3218-600100-26-40	TRACTION MOTOR CONTROLLER R	1	
7	0000-000026-00	SCREW M8×30	4	
8	0000-000159-00	LOCK WASHER Φ8	16	
9	0000-000210-00	FLAT WASHER Φ8	16	
10	3231-100001-00	CONTROL BRACKET	1	
11	0000-000277-00	BOLT M8×25	4	
12	3231-100003-00	BOARD	1	
13	0000-000242-00	BOLT M8×16	6	
14	3630-500001-00	FAN	2	
15	1220-500004-00	GUARD	2	
16	0000-001144-00	SCREW M4×35	8	
17	0000-000122-00	LOCK WASHER Φ4	12	
18	0000-000702-00	FLAT WASHER Φ4	12	
19	3218-634000-00	CONTACTOR	1	
20	4103-610001-00	BRACKET	1	
21	0000-000646-00	SCREW M4×10	4	
22	0000-000255-00	BOLT M8×20	2	
23	0000-000126-00	SCREW M6×16	4	
24	3231-630001-00	CONTROLLER PLATE	1	
25	3231-100002-00	BRACKET	1	
26	1120-540001-00	FUSE BOX	1	
27	3218-630002-00	FUSE 500A	1	
28	0000-000618-00	SCREW M6×12	2	
29	LB00-300047-0A	RESIN	1	
30	3218-630006-00	WASHER Φ8	4	
31	3525-684000-10	LIGHT RELAY	2	
32	3218-600600-00	FLASHER	1	
33	3231-600003-00	CONTACTOR 48V80A	1	
34	3231-630002-00	BRACKET	1	



EN_0030

Figure 12-35 Electrical Components -Continued

ELECTRICAL COMPONENTS - CONTINUED

Pos.	Part Number	Description	Qty. Reqd.	Notes
35	3010-020001-02	SCREW M5×10	2	
36	0000-000206-00	LOCK WASHER Φ5	2	
37	0000-000390-00	FLAT WASHER Φ5	2	
38	3316-721000-00-80	CONTROLLER	1	
39	3231-600002-00	DC CONVERTER	1	
40	3218-600700-00	ALARM BUZZER	1	
41	3218-602000-00	DCDC CONVERTER	1	
42	0000-000077-00	SCREW M6×12	8	
43	0000-001010-00	SCREW M4×8	2	
44	3231-630003-00	+ COPPER BAR	2	
45	3231-630004-00	- COPPER BAR	2	
46	3218-600500-00	HORN	1	
47	3231-610100-00	RECHARGEABLE BOX	1	
48	3231-610200-00	CHARGE GUN TRANSFER LINE	1	

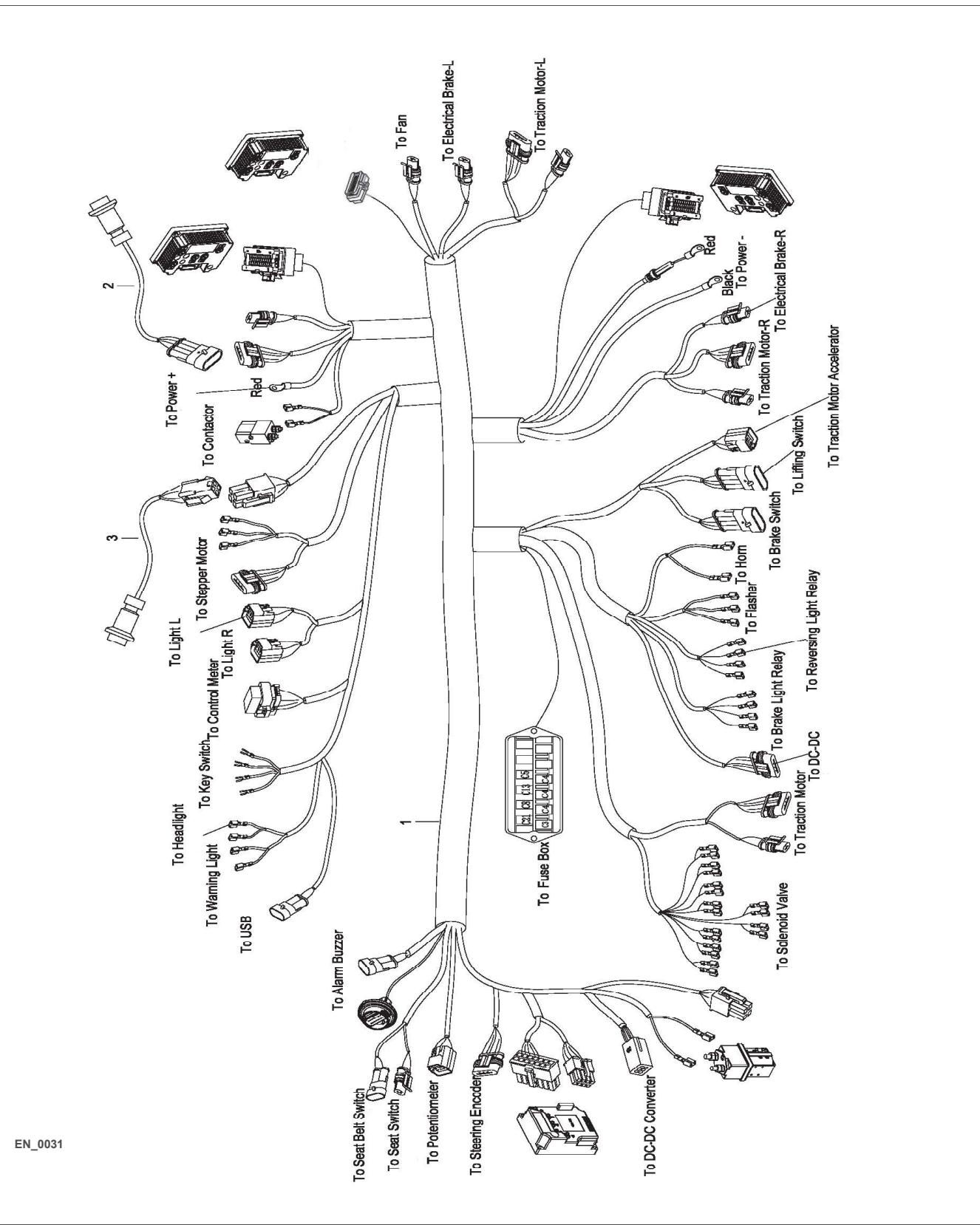
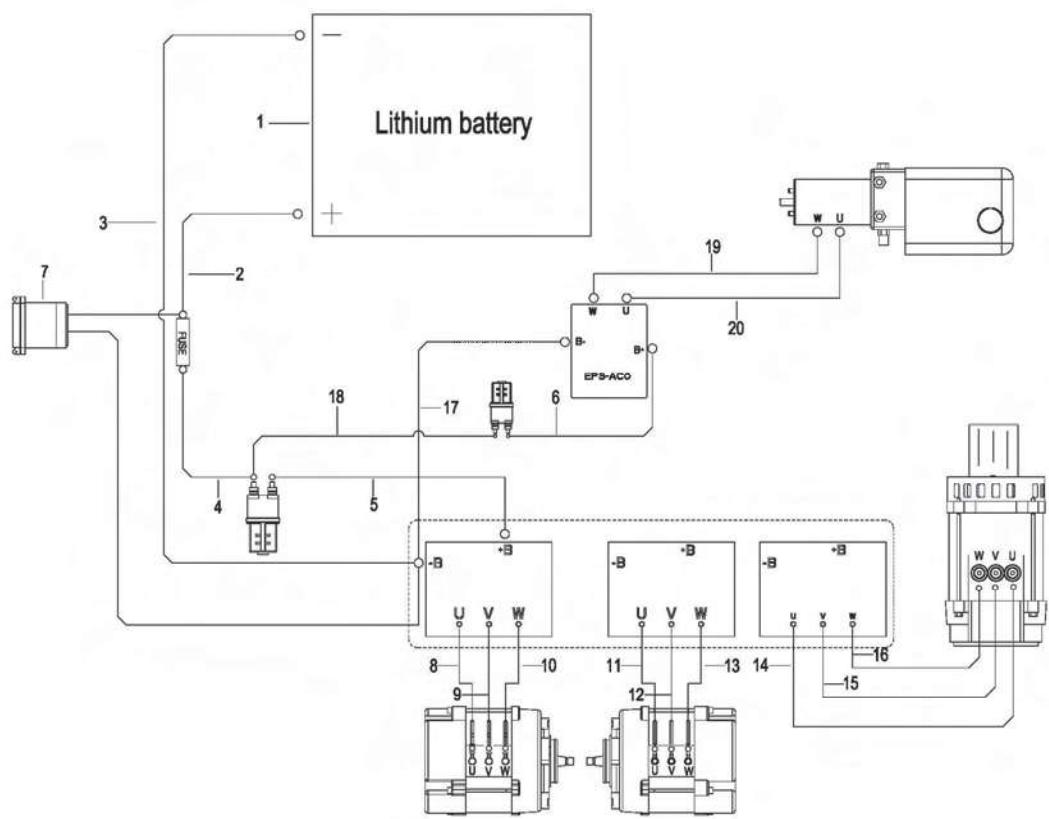


Figure 12-36 Wiring Harness

WIRING HARNESS

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	3231-620001-20	MASTER WIRE HARNESS	1	
2	3231-620006-00	COMMUNICATION CABLE	1	Used up to serial number 2292000008
2a	3231-620006-10	COMMUNICATION CABLE	1	Used from serial number 2292000009
3	3231-620009-00	DEBUG INTERFACE HARNESS	1	



EN_0032

Figure 12-37 Wiring Cables

WIRING CABLES

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	LB52-00000Z-01-01	BATTERY BOX	1	Used up to serial number 2292000008
1a	LB52-00000Z-07	BATTERY BOX	1	Used from serial number 2292000009
1b	LB52-00000Z-04	BATTERY BOX	1	Used from serial number 2292000009 - With remote connection
2	3231-610010-00	POWER CABLE +	1	
3	3231-610011-00	POWER CABLE -	1	
4	3231-610012-00	CONTACTOR CABLE+	1	
5	3218-610003-10	LT+ CABLE	1	
6	3231-610017-00	STEERING CONTACTOR CABLE+	1	
7	3231-610100-00	CHARGING RECEPTACLE	1	
8	3231-610001-00	L-DRIVE MOTOR CABLE U	1	
9	3231-610002-00	L-DRIVE MOTOR CABLE V	1	
10	3231-610003-00	L-DRIVE MOTOR CABLE W	1	
11	3231-610004-00	R-DRIVE MOTOR CABLE U	1	
12	3231-610005-00	R-DRIVE MOTOR CABLE V	1	
13	3231-610006-00	R-DRIVE MOTOR CABLE W	1	
14	3231-610007-00	PUMP MOTOR CABLE U	1	
15	3231-610008-00	PUMP MOTOR CABLE V	1	
16	3231-610009-00	PUMP MOTOR CABLE W	1	
17	3231-610013-00	STEERING CABLE +	1	
18	3231-610014-00	STEERING CABLE -	1	
19	3231-610016-00	STEERING MOTOR CABLE W	1	
20	3231-610015-00	STEERING MOTOR CABLE U	1	



Big Lift LLC