

OWNER'S MANUAL

OPERATION MAINTENANCE PARTS LIST

TOTAL
WAREHOUSE

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WARNING

DO NOT INSTALL, OPERATE OR SERVICE THIS PRODUCT UNLESS YOU HAVE READ AND FULLY UNDERSTAND THE ENTIRE CONTENTS OF THIS MANUAL. FAILURE TO DO SO MAY RESULT IN PROPERTY DAMAGE, BODILY INJURY OR DEATH.

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, brakes, steering mechanism, guards and safety devices.

Operate truck only from designated operating position. 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.

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 load downhill.

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

When leaving 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 24 volt transistor WPT 45 lift truck distributed by Big Joe. 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 WPT 45 lift truck.

1-2. GENERAL DESCRIPTION.

The self-propelled WPT 45 truck, Figure 1-2, lifts and transports payloads up to 4500 pounds on rigid forks.

The forward and reverse motion is controlled by either of two controller levers mounted on the control head. Stopping and turning is controlled by the steering arm. Lift and Lower is controlled by pushbuttons on the control head. The battery powered lift truck is quiet and without exhaust fumes.

The reversible AC motor propels the lift truck in forward or reverse direction throughout the available speed range. The WPT 45 lift truck can be driven with

forks raised or lowered. The lift truck must be protected from the elements.

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 and controls.

MODEL NO.		SERIAL NO.	
MAX CAP LB/ KG	LOAD CTR IN/ MM	LIFT HGT IN/ MM	
ALT CAP LB/ KG	LOAD CTR IN/ MM	LIFT HGT IN/ MM	
TRUCK WT LESS BATTERY LB/ KG	BATTERY MIN WT LB/ KG		
TRUCK WT WITH BATTERY LB/ KG	BATTERY MAX WT LB/ KG		
TRUCK TYPE	BATTERY TYPE	CERTIFIED	VOLTAGE
COMPLIES WITH THE APPLICABLE REQUIREMENTS OF ANSI B56.1 AND OSHA STANDARDS			
U.S. PATENT NO. 4,444,284			
AUSTRALIAN PATENT NO. 537,987			
BIG LIFT LLC			
WISCONSIN DELLS, WISCONSIN 53985			

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Figure 1-1 Name Plate

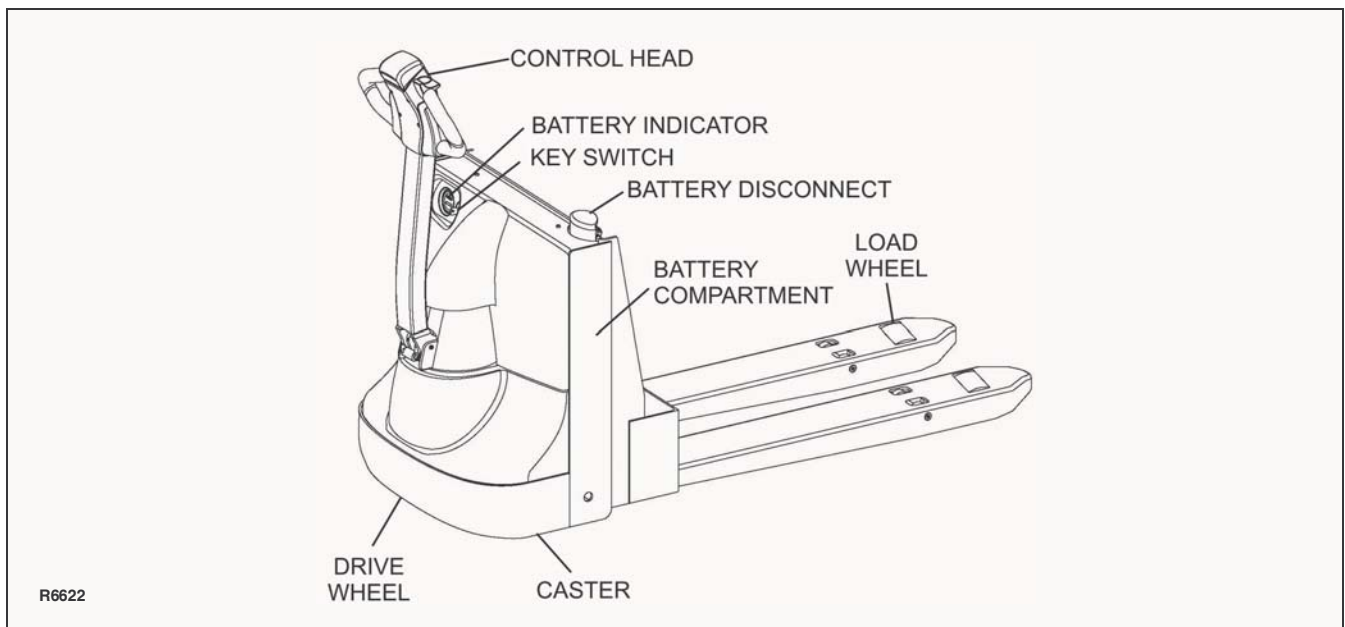


Figure 1-2 . WPT 45 Lift Truck

1-3. SAFETY FEATURES.

The WPT 45 is designed and engineered to provide maximum safety for operator and payload. Some of the safety features incorporated into the design are:

- Dead-man brake to apply the brake and cut off drive power when the steering arm is released.
- Belly-button switch to reverse truck should the operator accidentally pin himself against a wall or obstruction when backing up in slow speed.
- All control functions automatically return to "OFF" when released.
- Externally accessible quick-disconnect battery plug within operator's reach.
- Separately fused control circuits and power circuits.
- Readily accessible horn button.
- Handle to provide a firm hand hold for operator.
- Flow control valve regulates maximum lowering speed within prescribed limits.
- Relief valve maintains hydraulic pressure within prescribed limits.
- High visibility color scheme of truck provides visual alert of truck's presence.
- Battery Indicator
- Casters

SECTION 2 OPERATION

2-1. GENERAL.

This section gives detailed operating instructions for the WPT 45 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 WPT 45 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 and have read all warnings and instructions in this manual and on the truck.
- All warnings and instructions must be read and understood before using the equipment.
- Equipment must be inspected by a qualified person on a regular basis.
- Do not operate this truck until you have checked its condition. Give special attention to Tires, Horn, Batteries, Controller, Lift System, Brakes, Steering Mechanism, Guards and Safety Devices
- Operate truck only from designated operation position. Wear foot protection. Do not carry passengers.
- 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.
- Always look in direction of travel. Keep a clear view, and when load interferes with visibility, travel with load or lifting mechanism trailing.

- Do not overload truck. Check nameplate for load weight and load center information.
- 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 loads which are higher than the load backrest unless load is secured so that no part of it could fall backward.
- When leaving truck, neutralize travel control. Fully lower lifting mechanism and set brake. When leaving truck unattended, turn off key switch and disconnect switch, remove key and disconnect battery.

2-3. BEFORE OPERATION

Table 2-1 covers important inspection points on the WPT 45 lift truck which should be checked prior to operation. Depending on use, some trucks may require additional checks.

Figure 2-1 shows a sample format for an Operator Checklist, which can be modified as necessary to fit your operation.

WARNING: Periodic maintenance of this truck by a QUALIFIED 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 maintenance technician.

Table 2-1 Operator Checks

ITEM	PROCEDURE
Transmission and hydraulic systems.	Check for signs of fluid leakage.
Forks	Check for cracks and damage.
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 in steering arm when steering.
Travel controls	Check that speed controls on control head operate in all speed ranges in forward and reverse and that belly button switch functions.

ITEM	PROCEDURE
Wheels	Check drive wheel for cracks or damage. Move truck to check load for freedom of rotation.
Hydraulic controls	Check operation of lift and lower to their maximum positions.
Brakes	Check that brakes actuate when steering arm is raised to upright position, and when lowered to horizontal position.
Deadman/ Parking brake	Check that steering arm raises to upright position when released and brake applies.
Battery disconnect	Check that battery can be disconnected and reconnected. Check for connector damage.
Battery charge	Check the battery indicator.



Electric Truck Daily Operator Check-Off List

Date _____ Operator _____

Truck No. _____ Model No. _____

Dept. _____ Shift _____

Hour Meter
Reading—Drive _____ Hoist _____

Check	O.K. (✓)	Need Maintenance
Tires		
Load Wheels		
Horn		
Lift—Lower Control		
Attachment Operation		
Forward & Reverse Controls		
Steering		
Brakes		
Hydraulic Leaks, Cylinders, Valves, Hoses, Etc.		

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Figure 2-1 Sample of Operator Check List

2-4. GENERAL CONTROL OPERATION.

The speed control (See [Figure 2-2](#)) located on each side of the control head provides fingertip control for driving the truck. Rotate the control in the direction you want to travel. The farther you rotate the control from the neutral position, the faster the truck will travel.

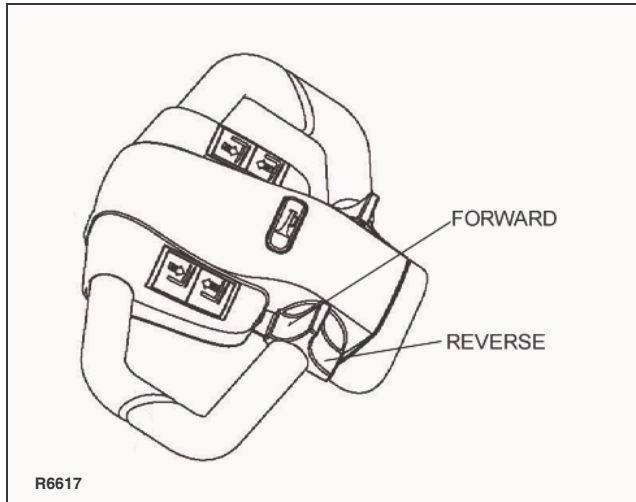


Figure 2-2 Forward/Reverse Control

The pushbutton switches (See [Figure 2-3](#)), located on the front of the control head activate the lift-lower controls and the horn.

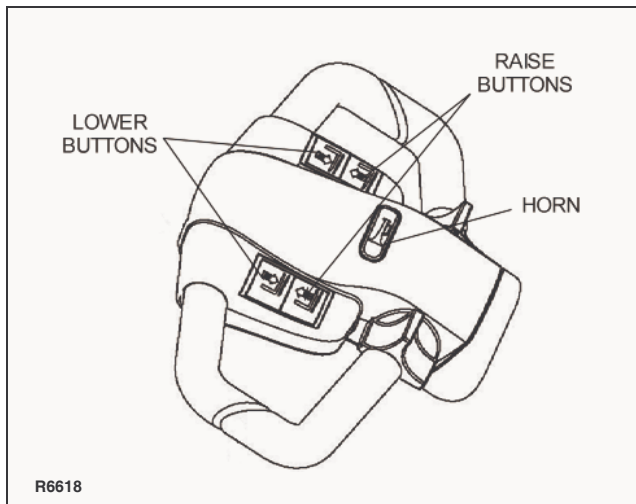


Figure 2-3 Pushbutton Switches

The brake is fully applied by lowering or raising the steering arm. (See [Figure 2-4](#)) All traction control power is shut off when the brake is engaged. When the steering arm is in the upright position, the brake acts as a parking brake. Deadman braking occurs when the handle is released and spring action raises steering arm to the upright position.

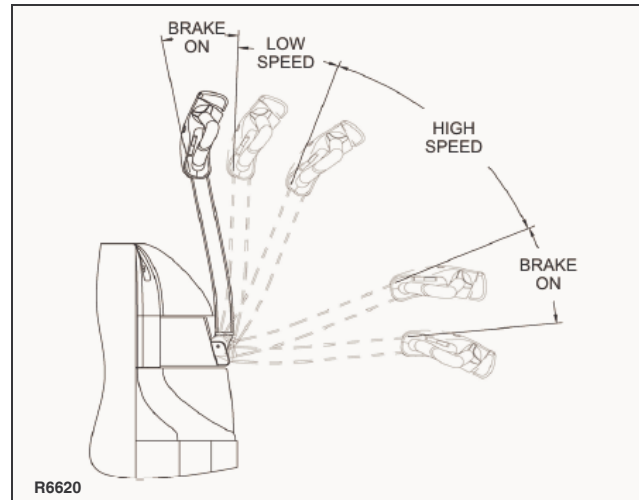


Figure 2-4 Brake Actuation

2-5. DRIVING AND STOPPING PROCEDURES.

1. Connect the batteries and turn on the key switch. Grasp the grips of the steering head so that the speed control can be comfortably operated by either thumb.
2. Lower the steering arm to a comfortable position above horizontal to disengage the brake and to energize the electrical circuits. If the truck is not moved, the electrical circuits will time out and will deenergize. See [Figure 2-4](#).
3. To move forward (with load in front), slowly press the speed control forward. See [Figure 2-2](#). Press the forward speed control farther to increase speed.
4. To slow down or stop, release the speed control and lower or raise the steering arm to the horizontal or vertical position. See [Figure 2-4](#). In those positions, the brake engages, slowing or stopping the truck.
5. Procedures for movement in reverse are the same as in the forward direction except slowly press the speed control backward. See [Figure 2-2](#).

2-6. BELLY-BUTTON SWITCH.

The belly-button switch ([Figure 2-5](#)) minimizes the possibility of the driver being pinned by the steering arm while driving the lift truck in slow speed. If the switch presses against the operator while the lift truck is being driven toward the operator, the switch changes the direction of the lift truck.

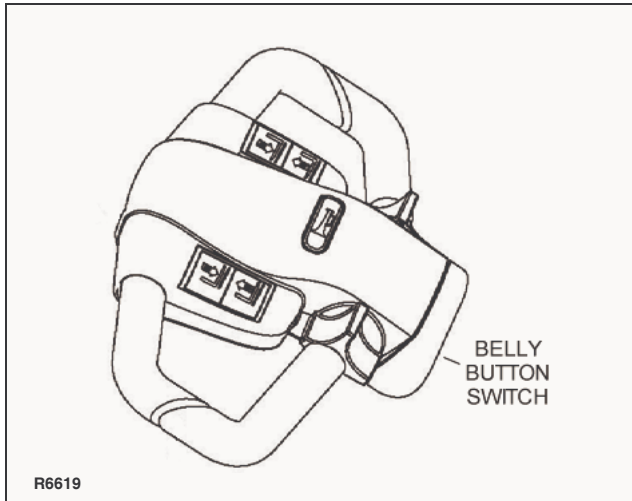


Figure 2-5 Belly-Button Switch

2-7. STEERING ARM GAS SPRING.

The steering arm gas spring automatically raises the steering arm to the upright position when the steering arm is released. If the steering arm does not return fully, the steering arm gas spring requires replacement. Return truck to maintenance for repair.

2-8. LIFT AND LOWER CONTROLS.

Lift/Lower Control buttons are located on the steering control head. (Figure 2-3)

To lift forks, push in either LIFT button and hold until forks reach desired height. To lower forks, push in either LOWER button and hold until forks descend to desired height.

2-9. LOADING AND UNLOADING.

1. Move truck to location where load is to be picked up.
2. Move the truck into position so forks are within pallet or skid, and the load is centered over the forks and as far back as possible.
3. Raise forks to lift load.
4. Drive to area where load is to be placed.
5. Move truck to align load with its new position.
6. Lower the load until it rests squarely in place and the forks are free.
7. Slowly move the truck out from under the load.

2-10. PARKING.

When finished with moving loads, return the truck to its maintenance or storage area. Turn off the key switch and disconnect the batteries. Charge batteries as necessary. Refer to battery care instructions, [SECTION 3](#).

NOTES

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 qualified maintenance 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 qualified service technician or your Big Joe Service Representative.

3-3. BATTERY CARE.

3-3.1. General

The WPT 45 may be equipped with maintenance free or industrial wet cell batteries.

The care and maintenance of the battery is very important to obtain efficient truck operation and maximum battery life.

CAUTION: Gases produced by a battery can be explosive. Do not smoke, use an open flame, create an arc or sparks in the vicinity of the battery. Ventilate an enclosed area well when charging.

CAUTION: Batteries contain sulfuric acid which may cause severe burns. Avoid contact with eyes, skin or clothing. In case of contact, flush immediately and thoroughly with clean water. Obtain medical attention when eyes are affected. A baking soda solution (one pound to one gallon of water) applied to spilled acid until bubbling stops, neutralizes the acid for safe handling and disposal.

Leakage voltage 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, leakage voltage will not normally affect truck operation unless a short circuit or breakdown of circuit wire insulation to truck frame occurs.

A voltage check from battery connector terminal to battery case should indicate near zero volts. Typically, however, the sum of the voltages at both terminals will equal battery volts. This leakage voltage will discharge the battery. As battery cleanliness deteriorates, the usable charge of the battery decreases due to this self discharge.

Table 3-1 Monthly and Quarterly Inspection and Service Chart

VISUAL CHECKS	
INTERVAL	INSPECTION OR SERVICE
Monthly	Check mechanical brake for proper operation.
Monthly	Check load wheels for wear. A poly load wheel must be replaced if worn to within 1/16 inch of hub. Check for separation from hub.
Monthly	Check drive wheel for wear. A poly drive wheel must be replaced if worn to within 3/4 inch of hub. Check for separation from hub.
Monthly	Inspect wiring for loose connections and damaged insulation.
Monthly	Inspect contactors for proper operation.
Monthly	Check deadman brake switch for proper operation.
Quarterly	Check lift cylinder for leakage.
Quarterly	Check for excessive jerking of steering arm when stopping or starting.

Although a leakage voltage 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.

3-3.2. Safety Rules

- Wear protective clothing, such as rubber apron, gloves, boots and goggles when performing any maintenance on batteries. Do not allow electrolyte to come in contact with eyes, skin, clothing or floor. If electrolyte comes in contact with eyes, flush immediately and thoroughly with clean water. Obtain medical attention immediately. Should electrolyte be spilled on skin, rinse promptly with clean water and wash with soap. A baking soda solution (one pound to one gallon of water) will neutralize acid spilled on clothing, floor or any other surface. Apply solution until bubbling stops and rinse with clean water.
- If truck is equipped with wet cell batteries, keep vent plugs firmly in place at all times except when adding water or taking hydrometer readings. Do not allow dirt, cleaning solution or other foreign material to enter cells. Impurities in electrolyte has a neutralizing effect reducing available charge.
- Do not bring any type of flame, spark, etc., near the battery. Gas formed while the battery is charging, is highly explosive. This gas remains in cell long after charging has stopped.
- 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. Gas formed during charging is highly explosive and can cause serious injury.

1. Charge the battery only in areas designated for that use.
2. Make certain the charger being used matches the voltage and amperage of the truck battery.
3. Before disconnecting or connecting batteries to a charger, make sure the charger is "OFF". If an attempt is made to do this while the charger is "ON", serious injury to you, the battery and the charger could result.
4. Before connecting the battery cable to the trucks receptacle, make sure the key switch is off. The battery cable must be fully connected before the truck is used. If the plug is not making good contact, heat will weld the two parts of the battery connector together, making it difficult to remove and necessary to replace.
5. Battery terminals should be checked and cleaned of corrosion regularly. Good battery terminal contact is essential not only for operation, but also for proper charging of the battery.
6. The charging requirements will vary depending on the use of the truck. The battery should be given as equalizing charge on a weekly basis. This charge should normally be an additional three hours at the finish rate.
7. Make certain battery used meets weight and size requirements of truck. NEVER operate truck with an undersized battery.

3-3.4. Battery Cleaning

Always keep vent plugs tightly in place when cleaning battery. When properly watered and charged, the battery will remain clean and dry. All that is necessary is to brush or blow off any dust or dirt that may accumulate on them. However, if electrolyte is spilled or overflows from a cell, it should be neutralized with a solution of baking soda and water, brushing the soda solution beneath the connectors and removing grime from the covers. Then rinse the battery with cool water from a low pressure supply to remove the soda and loosen dirt. If batteries stay wet consistently, they may be either overcharged or over filled. This condition should be investigated and corrected.

3-3.5. MAINTENANCE FREE BATTERIES

Some trucks may be equipped with maintenance free batteries. These batteries are completely sealed, will not require any watering and have a full 80% discharge available.

Sealed Maintenance Free batteries contain a pressure release valve and under normal operating conditions do not require any special ventilation.

CAUTION: Do not try to open this battery or remove the pressure release valve.



Only under severe overcharging, such as connected to an improperly sized charger, will any significant amount of gasses be released from the battery. Also, being a valve regulated battery, it never requires watering.

3-4. CHARGING BATTERIES

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. Check the condition of the AC cord, the battery connector and battery cables. If there are any cuts in the cable, any exposed wires, loose plugs or connectors, **DO NOT** attempt to charge the batteries. Contact appropriate personnel for repairs to be made.
3. Disconnect the batteries from the truck and connect the batteries to the charger. Make sure connectors are mated properly.
4. Connect the charger to the appropriate power supply.
5. Follow the instructions for the charger being used.

<p>BATTERY HAZARD</p> 	<p> DANGER</p> <p>EXPLOSIVE/POISON/CAUSTIC NO SPARKS, FLAMES, SMOKING BATTERY ACID can cause blindness and severe burns SHIELD EYES, AVOID SKIN CONTACT IF SPLASHED flush immediately with water, get medical help fast.</p> <p>Do not service battery while on charge. Do not connect or disconnect battery from charger while charger is on. Only qualified and experienced personnel should perform maintenance and repair on batteries. Use caution while servicing or removing battery. (Refer to Battery Safety Sheet).</p>
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3-5. LUBRICATION.

Refer to Table 3-2 for the recommended types of grease and oil. Table 3-3 in conjunction with Figure 3-1 identifies the items requiring lubrication.

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

No. 1	Transmission oil—EP SAE 80W-90 Transmission oil—EP SAE 10W-30 (Note)
No. 2	Grease—Lithium base, general purpose.
No. 3	Hydraulic oil-Heavy duty with a viscosity of 150 SUS foam suppressing agent and rust and oxidation inhibitors Hydraulic oil-Heavy duty with a viscosity of 100 SUS foam suppressing agent and rust and oxidation inhibitors (Note)
No. 4	SAE 30 or 40 Engine lubricating oil

NOTE: USED ON COLD CONDITIONED TRUCKS

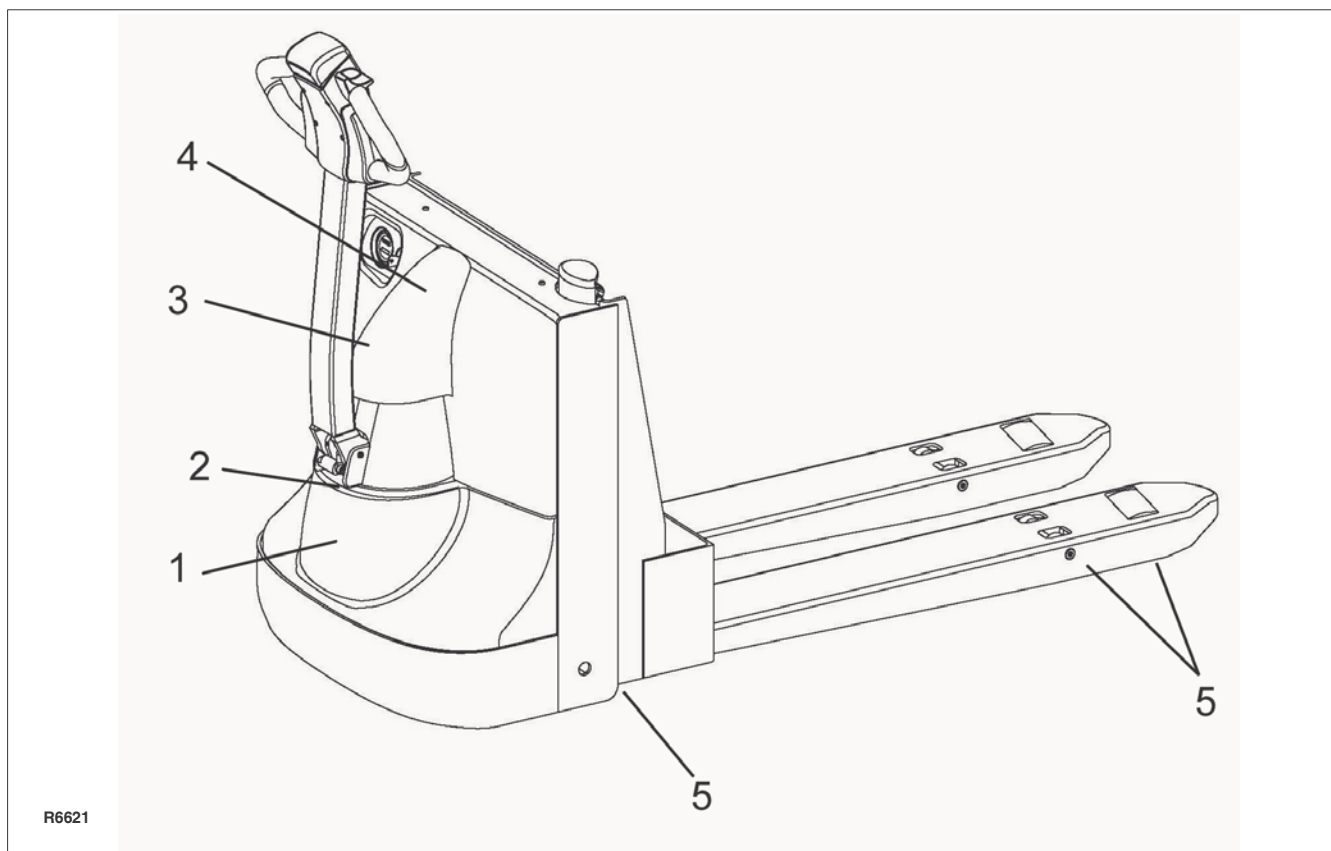


Figure 3-1 Lubrication Diagram

Table 3-3 Lubrication Chart

FIG 3-2 INDEX NO.	LOCATION	METHOD OF APPLICATION	TYPE (Table 3-3)	APPLICATION OF LUBRICANT
1	Transmission Capacity 2 pints	Can	No. 1	Fill to level plug opening
2	Pivot Tube Fitting	Gun	No. 2	Pressure lubricate
3	Hydraulic Reservoir Capacity-1 quarts	Can	No. 3	With lift carriage fully lowered, fill reservoir with hydraulic oil to 1 inch below opening
4	Lift Linkage Fittings	Gun	No. 2	Pressure lubricate.
5	Lift Linkage Fittings*	Gun	No. 2	Pressure lubricate.

* Raise lift carriage to gain access to grease fittings.

NOTES

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: Truck and Hydraulic System Will Not

Operate: Truck Does Not Operate Forward or Reverse: Trouble With Braking: Trouble With Lifting Or Lowering, and Miscellaneous malfunctions.

Table 4-1 Troubleshooting Chart

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
TRUCK AND HYDRAULIC SYSTEM WILL NOT OPERATE Truck will not travel nor will lift system operate.	a. Fuse (15, Figure 12-20) blown. b. Battery dead or disconnected. c. Keyswitch (7, Figure 12-19) defective. d. Defective wiring.	Check fuse and replace if necessary. Check battery quick-disconnect plug and check battery voltage. Bypass keyswitch to determine if it is malfunctioning. Check for open circuit. Repair as required.
TRUCK DOES NOT OPERATE FORWARD OR REVERSE Truck does not travel forward or reverse. All other functions operate normally. Truck travels forward but not in reverse. Truck travels reverse but not in forward. Truck travels forward and in reverse at lower speeds; will not travel at high speed.	a. Check all wiring. A loose connection may be the cause of malfunction. b. Defective deadman switch (19, Figure 12-2). c. Defective main contactor (12, Figure 12-20). d. Defective potentiometer (2, Figure 12-3). Defective potentiometer (2, Figure 12-3) in control head. Defective potentiometer (2, Figure 12-3) in control head. Defective potentiometer (2, Figure 12-3) in control head.	Tighten all loose connections before further troubleshooting. Check and replace switch if defective. Check for proper operation and replace if necessary. Check and replace potentiometer if defective. Check and replace potentiometer if defective. Check and replace potentiometer if defective.
TROUBLE WITH BRAKING Truck does not slow with brake, or brake does not engage. Brake will not release.	a. Defective deadman switch (19, Figure 12-2). b. Defective electric brake (2, Figure 12-9). a. Air gap more than 0.01 in (0.25mm). b. Brake temperature above 281° F (140° C). c. Open brake circuitry or wiring.	Check deadman switch for continuity. If none found when the control arm is in the brake position, replace switch. Adjust or replace brake. Adjust. Allow to cool and check air gap. Make voltage checks.

Table 4-1 Troubleshooting Chart - Continued

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
TROUBLE WITH BRAKING - Continued Brake drags. Brake grabs. Abnormal noise and chatter when brake is applied.	a. Air gap less than 0.01 in (0.25mm). b. Defective electric brake (2, Figure 12-9). a. Incorrect stopping distance adjustment. b. Defective electric brake (2, Figure 12-9). Defective electric brake (2, Figure 12-9).	Adjust. Replace. Adjust. Replace. Replace.
TROUBLE WITH LIFTING OR LOWERING Oil sprays or flows from the top of the lift cylinder. Squealing sounds when lifting forks. Forks do not lift to top. Weak, slow or uneven action of hydraulic system. Forks do not lift, pump motor does not run.	. Defective packing in lift cylinder a. Oil level too low. b. Lift linkage binding. Oil level too low. a. Defective pump or relief valve. b. Worn lift cylinder. c. Load larger than capacity. d. Defective lift motor solenoid. e. Battery charge low. a. Battery is dead or disconnected. b. Defective wiring. c. Defect in electrical system for operating pump motor.	Repair lift cylinder. Identify oil leak. Apply grease. Add oil to reservoir. Check pressure. Adjust as necessary. Replace cylinder. Refer to I.D.plate for capacity. Replace solenoid (17, Figure 12-17) on electrical panel. Charge battery. Check and recharge if required. Check and repair as required. Check lift switch in control head, as well as the solenoid (17, Figure 12-17).
Forks do not lift, motor runs. Forks lift, but will not go down. Load will not hold	Defect in hydraulic system. Defect in hydraulic system a. Oil bypassing internally in control valve b. Worn lift cylinder or packing.	Check the oil level in the reservoir and the oil lines to the lift cylinder, and repair as required. If normal, check the hydraulic pump, and relief valve. Repair, or adjust. Check lowering control switch in control head and lowering solenoid on valve assembly (11, Figure 12-17). Replace as required. Replace valve assembly (1, Figure 12-17). Repack cylinder.

Table 4-1 Troubleshooting Chart - Continued

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
TROUBLE WITH LIFTING OR LOWERING - Continued Platform does not lift to top. Pump motor runs. Forks creep downward under load when in a raised position.	a. Oil level too low. b. Load larger than capacity. c. Batteries need charging. Leak in hydraulic system, lift cylinder or lowering valve.	Add oil to reservoir. Refer to nameplate on side of mast for maximum load capacity. Change batteries. Check for leaking fitting in hydraulic line and repair as required. Repack lift cylinder or replace valve assembly (1, Figure 12-17).
MISCELLANEOUS Steering arm does not return to the upright position. Truck moves forward when arm is pulled down. Steering arm jerks excessively starting or stopping the truck. Drive motor is jerky.	a. Weak return spring. b. Binding. a. Belly-button switch defective. b. Short in control head. Drive wheel worn. Motor internally damaged or worn.	Replace spring. Check and free the binding item. Verify that the cable has not been damaged. Repair or replace as needed. Check for short, and repair or replace as necessary. Check wiring and repair as required. Replace drive wheel if worn to within 3/4 inch of hub. Replace motor.

4-2. CONTROLLER TROUBLESHOOTING

4-2.1. Zapi Handset

A Zapi Handset is available that is designed specifically for use with the Zapi controller. It serves multiple functions of reading diagnostic data, testing truck operation, setting options, adjustments and parameter changes of the controller. The Zapi Handset is available through your Big Joe dealer. If you require dealer location information, contact Big Joe

Remove the rubber plug from the CNC connector of the controller and plug in the Zapi Handset connector as shown in Figure 4-1.



Figure 4-1 Connecting the Handset

4-2.2. Fault Detection.

4-2.2.1. General

The controller provides diagnostics information to assist technicians in troubleshooting problems. When a fault is detected, an alarm is recorded in the logbook. It has a FIFO (First Input First Output) structure that means the oldest alarm is lost when the database is full and a new alarm occurs. The logbook is composed of alarms with the following information:

- The alarm code
- The number of times that each alarm occurs consecutively

- The Hour Meter reading (value) when the latest event of every alarm occurred
- The invert temperature when the latest event of every alarm occurred.

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

4-2.2.2. Logbook Access

To view the alarm logbook proceed as follows:

1. Connect the Zapi Handset, refer to paragraph 4-2.1.
2. Press the ROLL down button (1, Figure 4-2) and the ENTER button (3) at the same time to enter the MAIN MENU.
3. Press the ROLL down button (2) or the ROLL up button (1) to find the ALARMS display.
4. Press the ENTER button (3) to view the alarms.
5. Press the OUT button (6) to exit the alarms.

NOTE: Refer to bigjoesupport.com for the Zapi supplement containing detailed information of alarm codes. There are two versions shown. The PDS uses the Standard version which lists the error by: Alarm Name, Repetitions, Temperature and Hour Meter reading.

4-2.3. Testing Truck Operation.

The Zapi Handset can be used to test certain truck operations as follows:

1. Connect the Zapi Handset, refer to paragraph 4-2.1.
2. Press the ROLL down button (1, Figure 4-2) and the ENTER button (3) at the same time to enter the MAIN MENU.
3. Press the ROLL down button (2) or the ROLL up button (1) to find the TESTER display.
4. Press the ENTER button (3) to view the tests.
5. To verify various switch functions, locate the switch on the display and then operate that function to verify operation
6. Press the OUT button (6) to exit the tests.

4-2.4. Settings and Adjustments

4-2.4.1. Set Options

To set options proceed as follows and refer to [Table 4-2](#):

1. Connect the Zapi Handset, refer to paragraph 4-2.1.
2. Press the ROLL up button (1, [Figure 4-2](#)) and the SET up button (5) at the same time to enter the CONFIG MENU.
3. Press the ROLL down button (1) or the ROLL up button (2) to find the SET OPTIONS display.
4. Press the ENTER button (3) to view the options.
5. Press the ROLL down (2) or the ROLL up button (1) to find the option to be changed.
6. Press the SET up button (5) or the SET down button (6) until the desired value setting is reached. The option is now set at the desired value.
7. Press the OUT button (4) to exit the options.

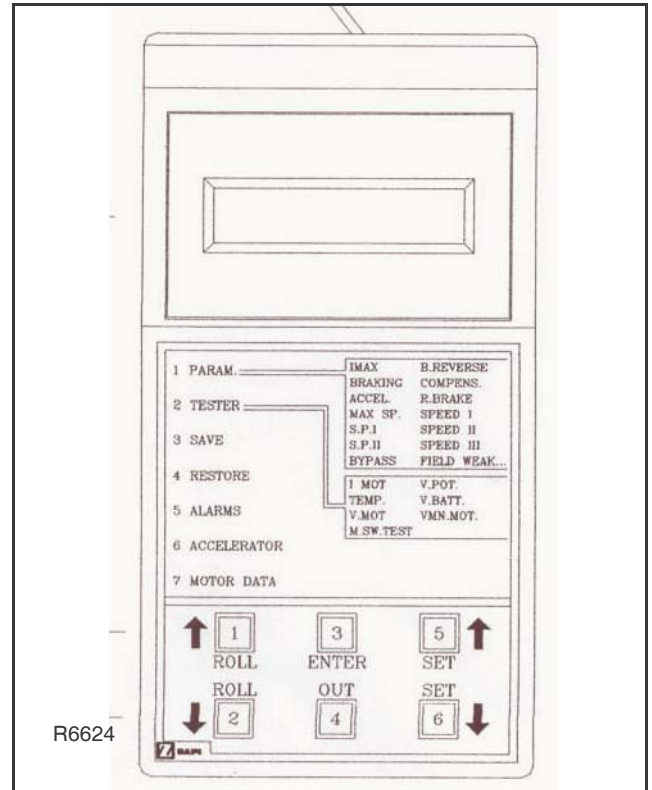


Figure 4-2 Zapi Handset

Table 4-2 Set Options

Parameter	Factory Setting	Description
TILLER switch	HANDLE	This option handles the input CNB#3 (Table 4-5). This input opens when the operator leaves the truck (released). It is connected to a Keyswitch controlled voltage when the operator is present.
SET INPUT #1	OPTION #1	<p>(Standard Version only). This option handles the digital input CNA#15. It can be set as:</p> <ul style="list-style-type: none"> • OPTION #1: CNA is managed as a cutback speed input (SR#1). • OPTION #2: CNA is managed as a digital handbrake input. • OPTION #3: CNA is managed as an inching backward. <p>The input CNA#15 (Table 4-5) can only be used as Aux Lowering request when the MDIPRC is PRESENT.</p> <p>This input must be connected to a Keyswitch controlled voltage. The SR#1 becomes active when CNA#15 (Table 4-5) is open. The inching backward becomes active when the CNA#15 (Table 4-5) is closed to a Keyswitch controlled voltage.</p>

Table 4-2 Set Options - Continued

Parameter	Factory Setting	Description
SET INPUT #2	PRESENT	<p>It can be can be set as:</p> <ul style="list-style-type: none"> • PRESENT: CNA#14 (Table 4-5) is managed as a cutback speed input (SR#2). • OPTION #1: CNA#14 (Table 4-5) is managed as an inching backward. <p>The input CNA#14 (Table 4-5) can only be used as Aux Lifting request when the MDIPRC is PRESENT.</p> <p>This input must be connected to a Keyswitch controlled voltage.</p> <p>The SR#2 becomes active when CNA#14 (Table 4-5) is open.</p> <p>The inching backward becomes active when the CNA#14 (Table 4-5) is closed to a Keyswitch controlled voltage.</p>
SET INPUT #4	OPTION #1	<p>This option handles the digital input CNB#7 (Table 4-5). It can be can be set as:</p> <ul style="list-style-type: none"> • BELLY CNB#7 (Table 4-5) is managed as a Belly Switch input. • BRAKE CNB#7 (Table 4-5) is managed as service brake input. <p>This information can be used also to recognize when the operator is driving with a pressed pedal braking.</p> <ul style="list-style-type: none"> • EX.HYDRO: CNB#7 (Table 4-5) is managed as Exclusive Hydro. <p>This input must be connected to a Keyswitch controlled voltage.</p> <p>The Belly switch active level is specified on the QUICK INV LOGIC below.</p> <p>The service brake of the exclusive hydro becomes active when CNB#7 is opened.</p>
HOUR COUNTER	RUNNING	<p>This option specifies the hour counter mode. It can be set as:</p> <ul style="list-style-type: none"> • RUNNING: The counter registers travel time only. • key on: The counter registers when the keyswitch is closed.
BATTERY CHECK	Level = 1	<p>This option specifies the handling of the low battery charge detection. It can be set as:</p> <ul style="list-style-type: none"> • Level 0: Nothing happens, the battery charge level is ignored. • Level 1: A BATTERY LOW alarm is raised when the battery level is calculated being less than 10% of the full charge. A BATTERY LOW alarm inhibits the Lifting function. • Level 2: A BATTERY LOW alarm is raised when the battery level is calculated being less than 10% of the full charge. A BATTERY LOW alarm reduces the maximum truck speed down to 24% of the full truck speed then, if the MDI-PRC is absent, inhibits the Lifting function. • Level 3 Equivalent to Level 1; a BATTERY LOW alarm is raised when the battery level is calculated being less than 10% of the full charge. A BATTERY LOW alarm inhibits the Lifting function.
HYDRO KEY ON	OFF	<p>ON/OFF: If this options is programmed ON the traction Inverter manages a hydraulic steering function when the keyswitch is switched ON (only if the AUX OUTPUT #1 option is programmed as HYDRO CONTACT or as WXCLUSIVE HYDRO).</p>
STOP ON RAMP	OFF	<p>Not used.</p>

Table 4-2 Set Options - Continued

Parameter	Factory Setting	Description
AUX OUTPUT #1	BRAKE	<p>This option handles output CNA#3 (Table 4-5). It can be used as:</p> <ul style="list-style-type: none"> • BRAKE: CNA#3 (Table 4-5) drives an electromechanical Brake. • HYDROCOMNT: CNA#3 (Table 4-5) drives the contractor for a hydraulic steering function when the direction input or brake pedal input are active or a movement of the truck is detected. • EX.HYDRO: CNA#3 (Table 4-5) drives the contractor for a hydraulic steering function when the exclusive hydro input is active. • FREE: CNA#3 (Table 4-5) is not used. <p>The current this output can sink is up to 3Adc.</p>
PEDAL BRAKING	NONE	<p>The analog input CNA#18 (Table 4-5) has one of two functions:</p> <ul style="list-style-type: none"> • Pedal Braking input. • Command input for lifting/lowering proportional valves in MDI-PRC version. <p>To turn from the first to the second function is just enough to set PEDAL BRAKING to HNONE.</p> <p>This option handles the analog input CNA#18 (Table 4-5) when used as pedal braking input:</p> <ul style="list-style-type: none"> • ANALOG: With this setting it is possible to modulate the strength of the braking when the accelerator is released. The strength of the braking is proportional to the brake pedal potentiometer connected to this input. When the pedal potentiometer voltage is equal/less than the SET POT BRK MIN, the minimum release braking strength is applied (following the RELEASE BRAKING setting). <p>When the pedal potentiometer voltage is equal/higher than the SET POT BRK MAX, the maximum release braking strength is applied (following the PEDAL BRAKING setting). In the intermediate position, the electrical braking strength is a linear function between the minimum (RELEASED BRAKING) and maximum (PEDAL BRAKING) intensity. When there is also a switch connected to the pedal braking (i.e. SET INPUT #4 to level BRAKE), it must be closed, otherwise the release braking is stuck to the minimum strength disregarding the pedal potentiometer position.</p> <ul style="list-style-type: none"> • DIGITAL: No pedal potentiometer is expected. Only when both the SET INPUT #4 is Level BRAKE and the brake switch connected to CNB#4 (Table 4-5) is closed, the release electrical braking follows the PEDAL BRAKING setting (maximum strength); in all of the other conditions the release electrical braking follows the RELEASE BRAKING setting (minimum strength). • NONE: The analog input CNA#18 (Table 4-5) is not used for the release braking modulation.
QUICK INVERSION	BELLY	<p>This option specifies the quick inversion mode when the SET INPUT #4 is set BELLY. It can be set as:</p> <ul style="list-style-type: none"> • NONE: The quick inversion function is not managed (no effect when CNB#7 (Table 4-5) switches over). • TIMED: The quick inversion function is timed. • BELLY: The quick inversion function is managed but not timed.

Table 4-2 Set Options - Continued

Parameter	Factory Setting	Description
AUX VOLTAGE #1	100%	This option specifies the percentage of the keyswitch controlled voltage to be applied to the loads on CNA#1 (Table 4-5) (main contactor coil) and CNA#3 (Table 4-5) (electromechanical brake). The voltage modulation is set with a PWM at 1 kHz frequency. After an initial delay of about 1 sec in which the entire keyswitch controlled voltage is applied to the loads, the PWM reduces the voltage at the loads down to the specified percentage.
PERFORMANCE	OPTION #1	This option can be set <ul style="list-style-type: none"> • OPTION#1 • OPTION#2
QUICK INV. LOGIC	OPTION #1	This option specifies the active level for the Belly switch input (CNB#7) <ul style="list-style-type: none"> • OPTION#1: The quick inversion is executed when CNB#7 (Table 4-5) is closed to a Keyswitch controlled voltage. • OPTION#2: The quick inversion is executed when CNB#7 (Table 4-5) is opened from a Keyswitch controlled voltage.
MDI-PRC	ABSENT	This option specifies: <ul style="list-style-type: none"> • PRESENT: The MDI-PRC is connected to the ACO via the CAN Bus: the handling of the Hydraulics is specified on the TRUCK TYPE setting. • ABSENT: The MDI-PRC is not connected to the ACO: the TRUCK TYPE disappears from the SET OPTIONS function list.
MOT SET-UP LOCK	OFF	Not used.

4-2.4.2. Adjustments

To change an adjustment proceed as follows and refer to Table 4-3:

1. Connect the Zapi Handset, refer to paragraph 4-2.1.
2. Press the ROLL up button (1, Figure 4-3) and the SET up button (5) at the same time to enter the CONFIG MENU.
3. Press the ROLL down button (1) or the ROLL up button (2) to find the ADJUSTMENTS display.
4. Press the ENTER button (3) to view the adjustments.
5. Press the ROLL down button (2) or the ROLL up button (1) to find the adjustment to be changed.
6. Press the SET up button (5) or the SET down button (6) until the desired value setting is reached. The adjustment is now set at the desired value.
7. Press the OUT button (4) to exit the adjustments.

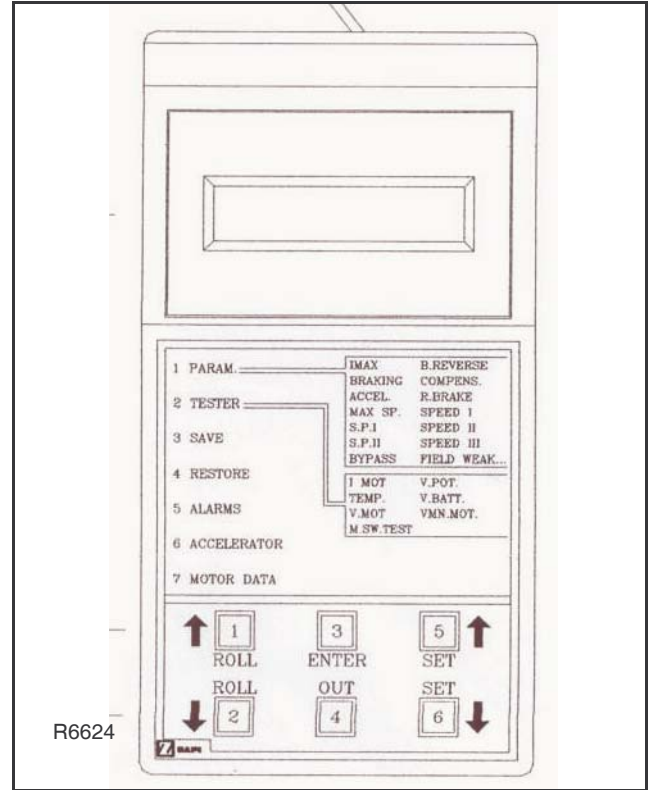


Figure 4-3 Zapi Handset

Table 4-3 Adjustments

Parameter	Factory Setting	Description
SET POT BRK MIN	0.5 V	This setting records the minimum value of braking pedal potentiometer when the braking pedal switch is closed; the procedure is similar to the PROGRAM VACC function. This procedure must be carried out only if the PEDAL BRAKING option is programmed as ANALOG. No adjustment is necessary when PEDAL BRAKING options is programmed as NONE.
SET POT BRK MAX	4.5 V	This setting records the maximum value of braking pedal potentiometer when the braking pedal is fully pressed; the procedure is similar to the PROGRAM VACC function. This procedure must be carried out only if the PEDAL BRAKING option is programmed as ANALOG. No adjustment is necessary when PEDAL BRAKING options is programmed as NONE.
SET BATTERY TYPE	24V	Selects the nominal battery voltage.
ADJUST BATTERY	XX V	Do not modify - Factory adjusted (Fine adjustment of the battery voltage measured by the controller.)
THROTTLE 0 ZONE	9%	Establishes a deadband in the accelerator input curve.

Table 4-3 Adjustments - Continued

Parameter	Factory Setting	Description
THROTTLE X POINT	45%	This parameter together with the THROTTLE Y POINT, changes the characteristic of the accelerator input curve: when the accelerator is de-pressed to X point percent, the corresponding truck speed is Y point percent of the Maximum truck speed. The relationship between the accelerator position and the truck speed is linear between the THROTTLE 0 ZONE and the X point and also between the X point and the maximum accelerator position but with two different slopes (Figure 4-4).
THROTTLE Y POINT	68%	This parameter together with the THROTTLE X POINT, changes the characteristic of the accelerator input curve: when the accelerator is de-pressed to X point percent, the corresponding truck speed is Y point percent of the Maximum truck speed. The relationship between the accelerator position and the truck speed is linear between the THROTTLE 0 ZONE and the X point and also between the X point and the maximum accelerator position but with two different slopes (Figure 4-4).
ADJUSTMENT #01	LEVEL = 5	Adjust the upper level of the battery charge table (Level 0 to 9).
ADJUSTMENT #02	LEVEL = 5	Adjust the lower level of the battery charge table (Level 0 to 9).
LOAD HM FROM MDI	OFF	When set On, the Hourmeter of the Controller is transferred and recorded on the Hourmeter of the Standard MDI (connected on the Serial Link).
CHECK UP DONE	OFF	Turn it On when asked Maintenance service has been executed to cancel the CHECK UP NEEDED warning.
CHECK UP TYPE	NONE	It specifies the handling of the CHECK UP NEEDED warning: <ul style="list-style-type: none"> • NONE: No CHECK UP NEEDED warning. • OPTION#1: CHECK UP NEEDED warning on the handset and MDIPRC after 300 hours. • OPTION#2: Equal to OPTION#1 but Speed reduction after 340 hours. • OPTION#3: Equal to OPTION#2 but the truck definitively stops after 380 hours.

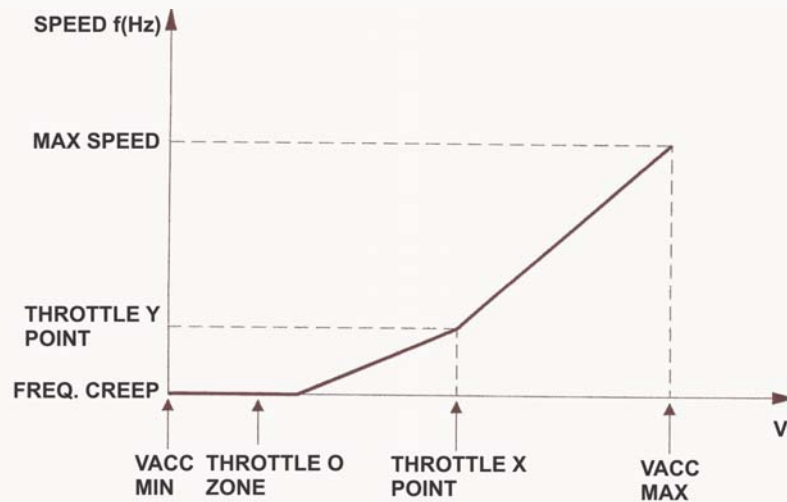


Figure 4-4 Throttle Regulation

4-2.4.3. Parameter Change

To change a parameter proceed as follows and refer to Table 4-4:

1. Connect the Zapi Handset, refer to paragraph 4-2.1.
2. Press the ROLL down button (1, Figure 4-5) and the ENTER button (3) at the same time to enter the MAIN MENU.
3. Press the ROLL down button (1) or the ROLL up button (2) to find the PARAMETER CHANGE display.
4. Press the ENTER button (3) to view the parameters.
5. Press the ROLL down button (2) or the ROLL up button (1) to find the parameter to be changed.
6. Press the SET up button (5) or the SET down button (6) until the desired value setting is reached. The parameter is now set at the desired value.
7. Press the OUT button (4) to exit the parameters.

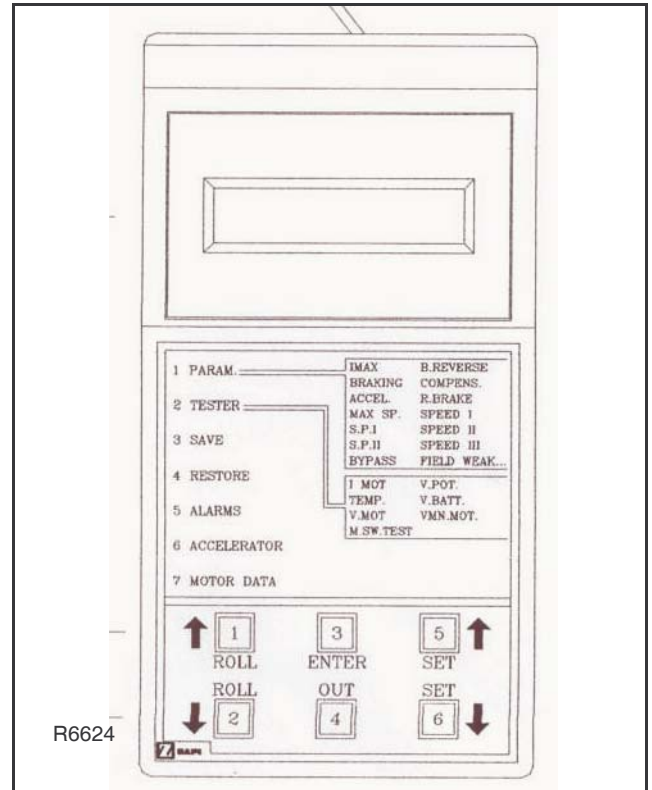


Figure 4-5 Zapi Handset

Table 4-4 Parameter Adjustments

Parameter	Factory Setting	Description
ACCELER. DELAY	LEVEL = 8	Level 0 to 9. It determines the acceleration ramp. At Level 9 the truck takes a long time to accelerate.
RELEASE BRAKING	LEVEL = 5	Level 0 to 9. It controls the deceleration ramp when the travel request is released. At Level 9 the truck brakes abruptly.
INVERS. BRAKING	LEVEL = 4	Level 0 to 9. It controls the deceleration ramp when the direction switch is inverted during travel. At Level 9 the truck brakes abruptly.
PEDAL BRAKING	LEVEL = 9	Level 0 to 9. It controls the deceleration ramp when the travel request is released and the brake pedal switch is pressed to its maximum. At Level 9 the truck brakes abruptly.
SPEED LIMIT BRK	LEVEL = 1	Level 0 to 9. It controls the deceleration ramp when the accelerator has turned down but not completely released. At Level 9 the truck decelerates abruptly.
BRAKE CUTBACK	LEVEL = 5	Level 0 to 9. It controls the deceleration ramp when the a speed reduction input becomes active and the motor slows down. At Level 9 the truck decelerates abruptly.
MAX SPEED FORW	100 Hz	Typically from 90 Hz to 160 Hz. It determines the maximum speed in forward direction.
MAX SPEED BACK	100 Hz	Typically from 90 Hz to 160 Hz. It determines the maximum speed in backward direction.

Table 4-4 Parameter Adjustments - Continued

Parameter	Factory Setting	Description
CUTBACK SPEED	100%	Typically from 10% to 100%. It determines the percentage of the max speed applied when the cutback switch 1 (SR#1 on CNA#15 (Table 4-5) is active. When set to 100% the speed reduction is ineffective.
CUTBACK SPEED 2	37%	Typically from 10% to 100%. It determines the percentage of the max speed applied when the cutback switch 2 (SR#2 on CNA#14 (Table 4-5) is active. When set to 100% the speed reduction is ineffective.
HS CUTBACK	100%	Typically from 10% to 100%. It determine the percentage of the max speed applied when the Hard & Soft function (H&S switch on CNB#4 (Table 4-5) is active. When set to 100% the speed reduction is ineffective.
FREQUENCY CREEP	5.00 Hz	Hz value. This is the minimum speed applied when the forward or reverse switch is closed, but the accelerator at its minimum. In the ACO sense Coils this setting is higher equal than 5 Hz.
RPM CREEP	100%	A Percentage value. Set to 100% and not Used.
MAXIMUM CURRENT	96%	It specifies the percentage of the absolute current (150A) at which the current will be limited. Normally MAXIMUM CURRENT is 100%. DO NOT CHANGE.
INCHING SPEED	0 Hz	Hz value. It determines the speed when the “Inching function” is active.
INCHING TIME	LEVEL = 0	Level 0 to 9. It determines the duration time when the “Inching function” is active.
AUXILIARY TIME	1	Time units value (seconds). For the encoder version, it determines the time duration (in seconds) in which the the frequency was arrived to zero.
ANTIROLLBACK	80%	A Percentage of the Maximum Current. This setting increases the phase current when low frequency during starting operation. It is used to push up, in feedforward way, the torque when it is not possible to control the flux, in feedback way, because of the low frequency.

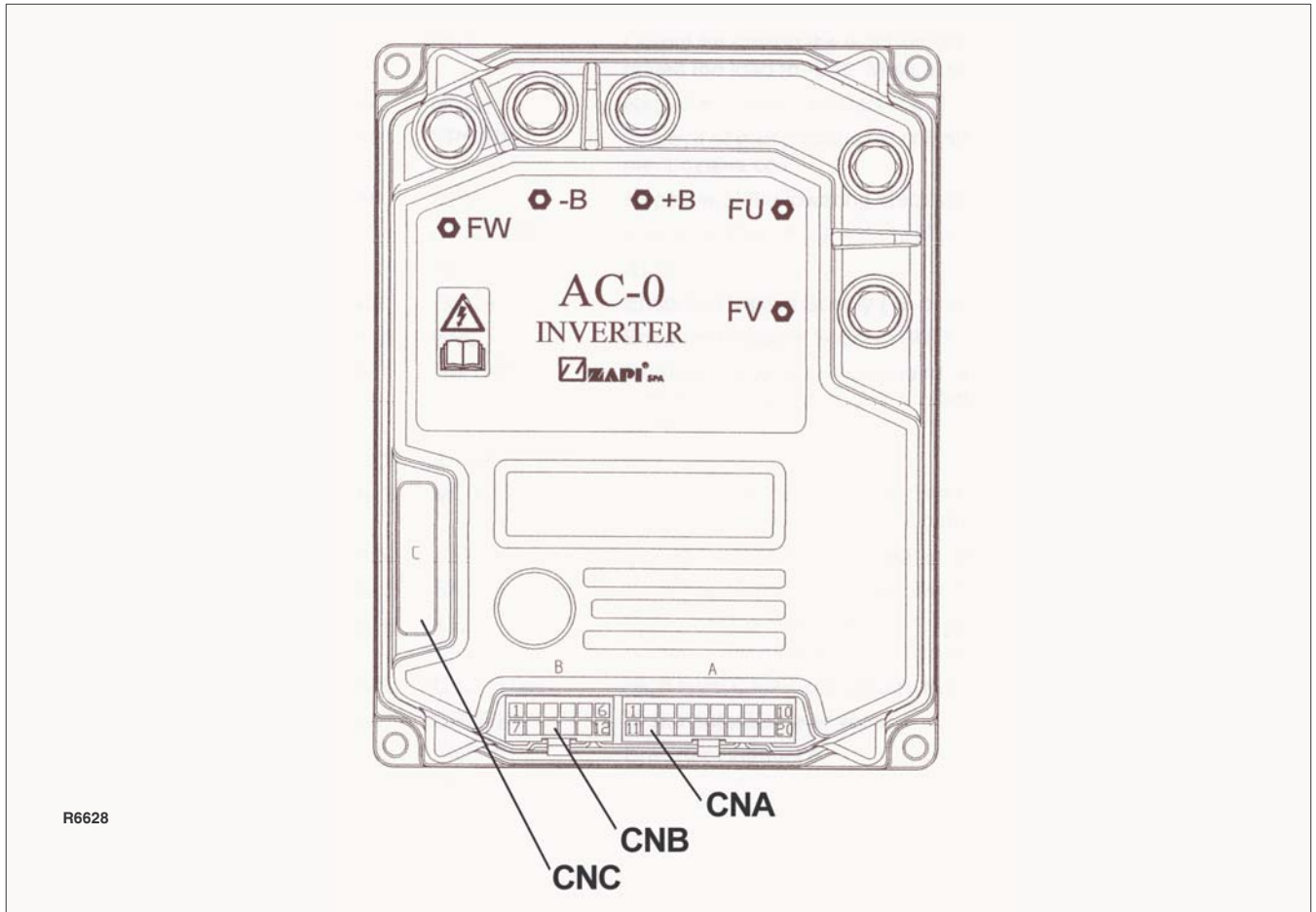


Figure 4-6 Zapi Controller Connections

Table 4-5 Zapi Controller Connector Pins

CNA Connector		
PIN	ABBREVIATION	DESCRIPTION
CNA#1	NMC	Negative of main contactor coil.
CNA#2	PMC	Positive of main contactor coil.
CNA#3	NEB	Output for driving the electromechanical brake coil; drives the load to -Batt. Maximum current: 3 A.
CNA#4	NPC	Negative of pump contactor soil.
CNA#5	PPC/PEV	Positive of pump contactor coil and lowering electrovalve coil.
CNA#6	NEV	Negative of the lowering electrovalve coil.
CNA#7	CAN LOW	Low level CAN-BUS voltage I/O.
CNA#8	-BAT	-Bat.
CNA#9	ENC+	Encoder Positive Supply (+5 or +12 Vdc)
CNA#10	ENC-	Encoder Negative Supply (GND to minus battery)
CNA#11	HM(+B)	Output for driving an hourmeter; when the hourmeter is active this output provides a +Batt signal; 3 maximum current.

Table 4-5 Zapi Controller Connector Pins - Continued**CNA Connector - Continued**

PIN	ABBREVIATION	DESCRIPTION
CNA#12	-BATT	-Batt.
CNA#13	MOT TH	Motor thermal sensor input. The internal pull-up is a fixed 2mA (Max 5V) source current.
CNA#14	SR2	Speed reduction 2 input. Active low (switch opened).
CNA#15	SR1	Speed reduction 1 input. Active low (switch opened).
CNA#16	+12V	This output provides a +12V signal for the MDI PRC, it present; mA maximum current.
CNA#17	CAN HIGH	High level CAN-BUS voltage I/O.
CNA#18	CPOTB	Brake potentiometer wiper.
CNA#19	ENC A	Encoder Channel A.
CNA#20	ENC B	Encoder Channel B.

CNB Connector

CONNECTOR PIN	ABBREVIATION	DESCRIPTION
CNB#1	KEY SW	Connected to the power supply through a microswitch (KEY) with a 6.3-10 A fuse in series (this could be mounted on the AC-0 cover).
CNB#2	CM	Common for FW/BW/SR1/SR2/TILLER/H&S/BELLY/LIFTING/ LOWERING microswitches. This connection supplies a keyswitch voltage level.
CNB#3	TILLER SW	Tiller request input. Must be connected to the tiller microswitch, active high.
CNB#4	H&S SW	Hard & Soft request input. Must be connected to the Hard & Soft microswitch, active high.
CNB#5	BACKWARD SW	Backward direction request input. Must be connected to the backward direction microswitch, active high.
CNB#6	FORWARD SW	Forward direction request input. Must be connected to the forward direction microswitch, active high.
CNB#7	BELLY SW	Quick inversion function input; must be connected to the Belly microswitch; it is active high.
CNB#8	LOWERING SW	Lowering request input, active high.
CNB#9	LIFTING SW	Lifting request input, active high.
CNB#10	CPOT	Lifting request input, active high.
CNB#11	NPOT	Negative of accelerator unit, tested for wire disconnection diagnosis.
CNB#12	PPOT	Potentiometer positive: 10V output; keep load >1kΩ.

Table 4-5 Zapi Controller Connector Pins - Continued		
CNC Connector		
CONNECTOR PIN	ABBREVIATION	DESCRIPTION
CNC#1	PCLRxD	Positive serial reception.
CNC#2	NCLRxD	Negative serial reception.
CNC#3	PCLTxD	Positive serial transmission.
CNC#4	NCLTxD	Negative serial transmission.
CNC#5	GND	Negative console power supply.
CNC#6	+12V	Positive console power supply.
CNC#7	FLASH	Must be connected to C8 for the Flash memory programming (if used).
CNC#8	FLASH	Must be connected to C7 for the Flash memory programming (if used).

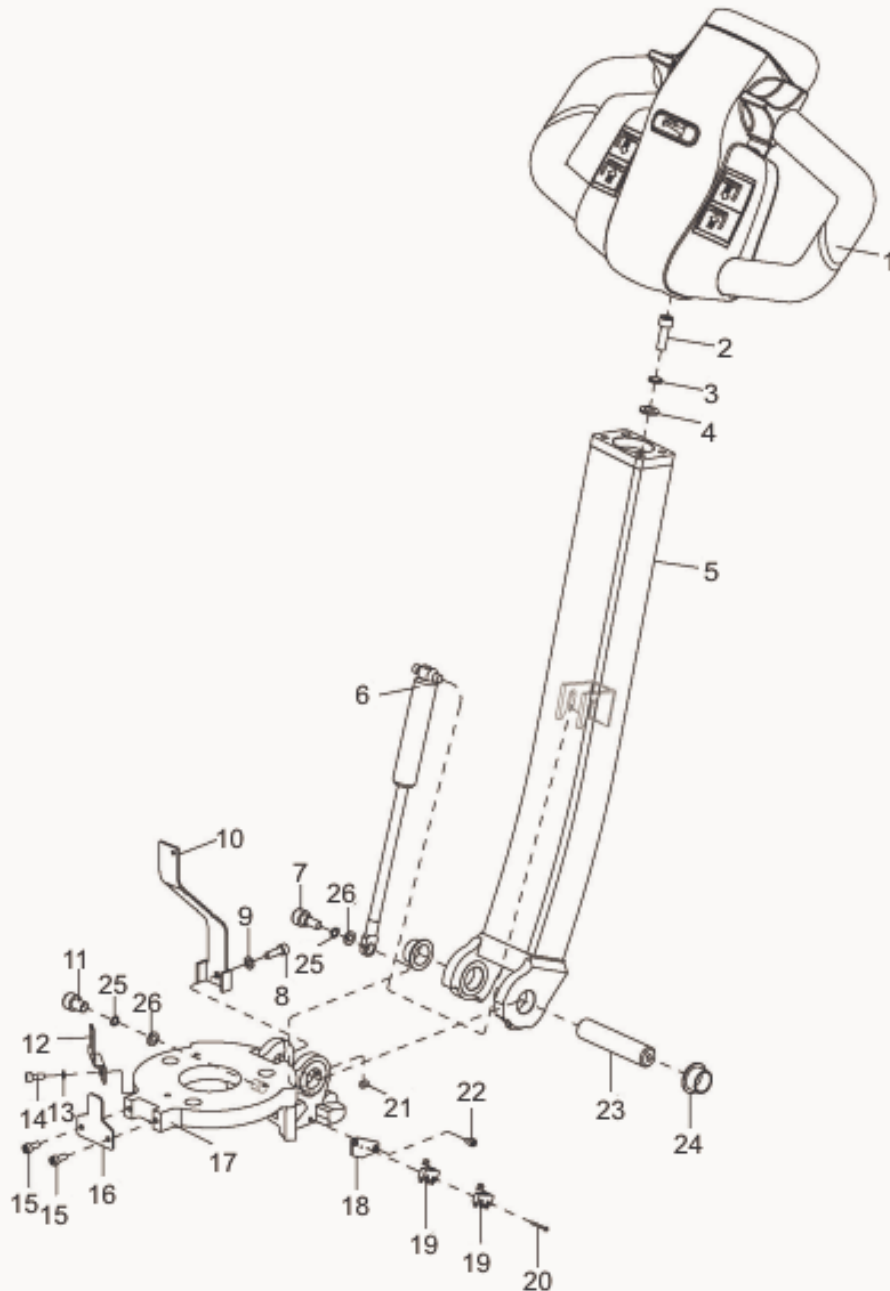
SECTION 5

STEERING ARM, CONTROL HEAD AND COMPARTMENT

5-1. CONTROL HEAD

5-1.1. Control Head Removal

1. Turn off the key switch (7, Figure 12-19) and disconnect the batteries.
1. Remove the cap assembly as described in paragraph 5-1.3.
2. Remove two screws (2, Figure 5-1), two washers (3) and two flat washers (4).



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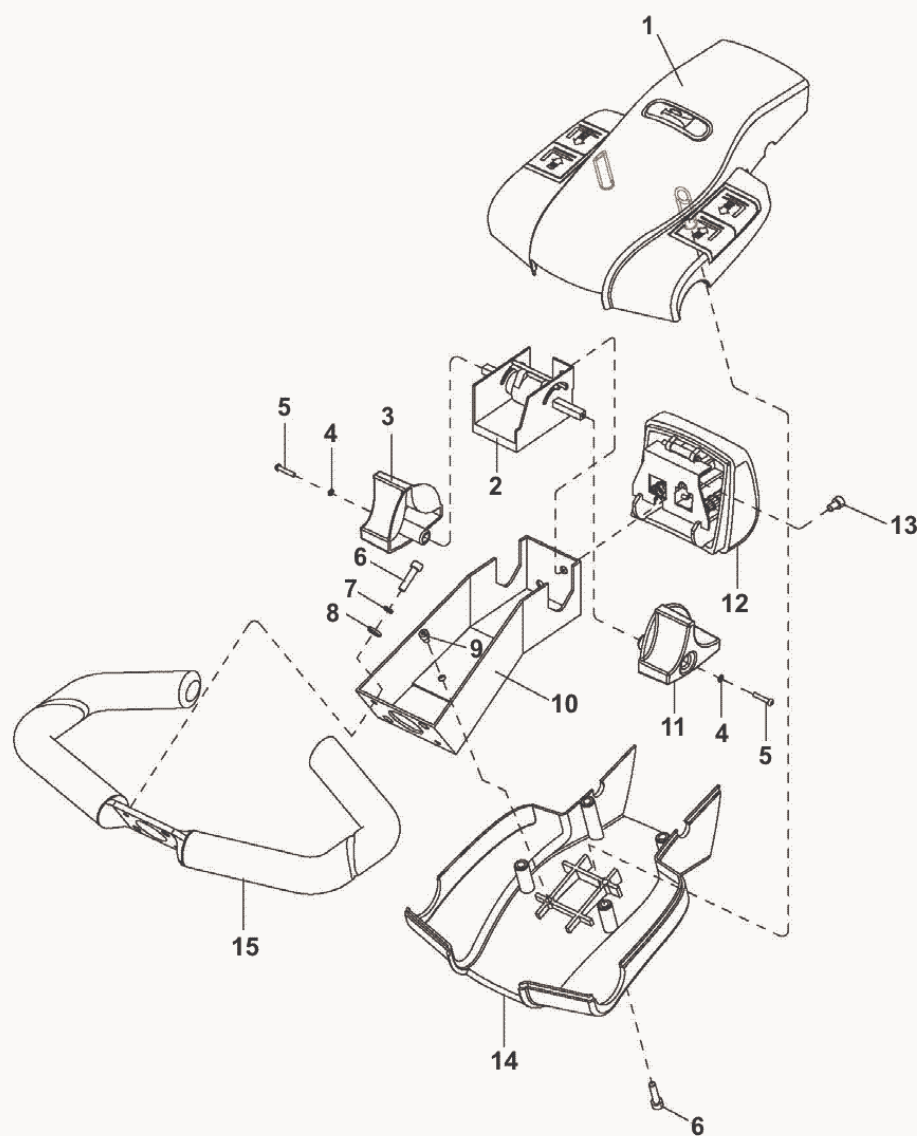
Figure 5-1 Steering Arm

WARNING: When removing the control head in the following steps, be sure to hold it in place until the control harness is disconnected.

3. Remove two screws (6, Figure 5-2), two washers (7) and two flat washers (8).
4. Disconnect harness (10, Figure 12-21) from harness (13) and remove the control head and handle (15, Figure 5-2).

5-1.2. Control Head Installation

1. Hold control head in place and connect harness (10, Figure 12-21) to harness (13).
2. Secure control head and handle (15, Figure 5-2) with two screws (6), two washers (7) and two flat washers (8).
3. Install two screws (2, Figure 5-1), two washers (3) and two flat washers (4).
4. Install the cap assembly as described in paragraph 5-1.4.
5. Reconnect the batteries and turn on the key switch (7, Figure 12-19).



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Figure 5-2 Control Head

5-1.3. Cap Assembly Removal.

1. Turn off the key switch (7, Figure 12-19) and disconnect the batteries.
2. Remove four screws (6, Figure 5-2) and lift up cap assembly (1) and disconnect harness (10, Figure 12-21) from harness (9).

5-1.4. Cap Assembly Installation.

1. Hold cap assembly (1, Figure 5-2) in place and connect harness (10, Figure 12-21) to harness (9).
2. Position cap assembly (1, Figure 5-3) on control head and secure with four screws (6).
3. Reconnect the batteries and turn on the key switch (7, Figure 12-19).

5-1.5. Belly-Button Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.3.
2. Disconnect harness (8, Figure 12-21) from harness (10).
3. Remove two screws (13, Figure 5-2) and remove switch assembly (12) from bracket (10).
4. Remove pin (6, Figure 5-3), bracket (5), and spring (3) from button (1).
5. Remove two pins (4) and switch (2) from bracket (5).
6. Disconnect harness (8, Figure 12-21) from switch (2, Figure 5-3) and connect it to the new switch.
7. Position the new switch (2, Figure 5-3) in bracket (5) and secure with two pins (4).

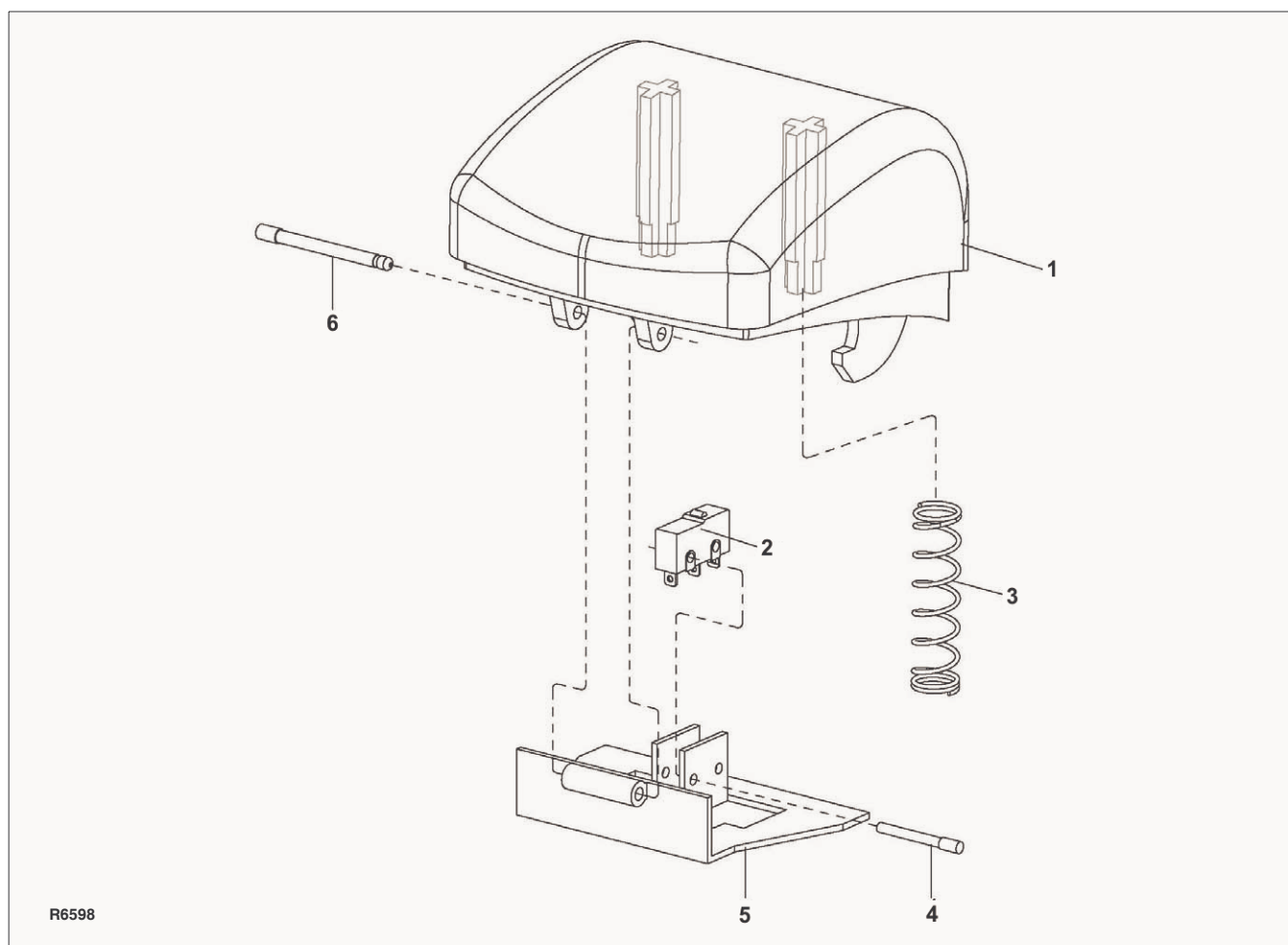


Figure 5-3 Emergency Reverse Switch Assembly

8. Position bracket (5) in button (1) and install pin (6).
9. Position switch assembly (12, [Figure 5-2](#)) on bracket (10) and secure with two screws (13).
10. Connect harness (8, [Figure 12-21](#)) to harness (10).
11. Install the cap assembly as described in paragraph [5-1.4](#).

5-1.6. Horn Switch Replacement.

1. Remove the cap assembly as described in paragraph [5-1.3](#).

2. Remove three screws (8, [Figure 5-4](#)), bracket (7) and spring (9).
3. Remove two pins (10) and switch (6) from bracket (7).
4. Disconnect harness (9, [Figure 12-21](#)) from switch (6, [Figure 5-2](#)) and connect it to the new switch.
5. Position the new switch (6) in bracket (7) and secure with two pins (10).
6. Position bracket (7) in cover (1) and secure with three screws (8).
7. Install the cap assembly as described in paragraph [5-1.4](#).

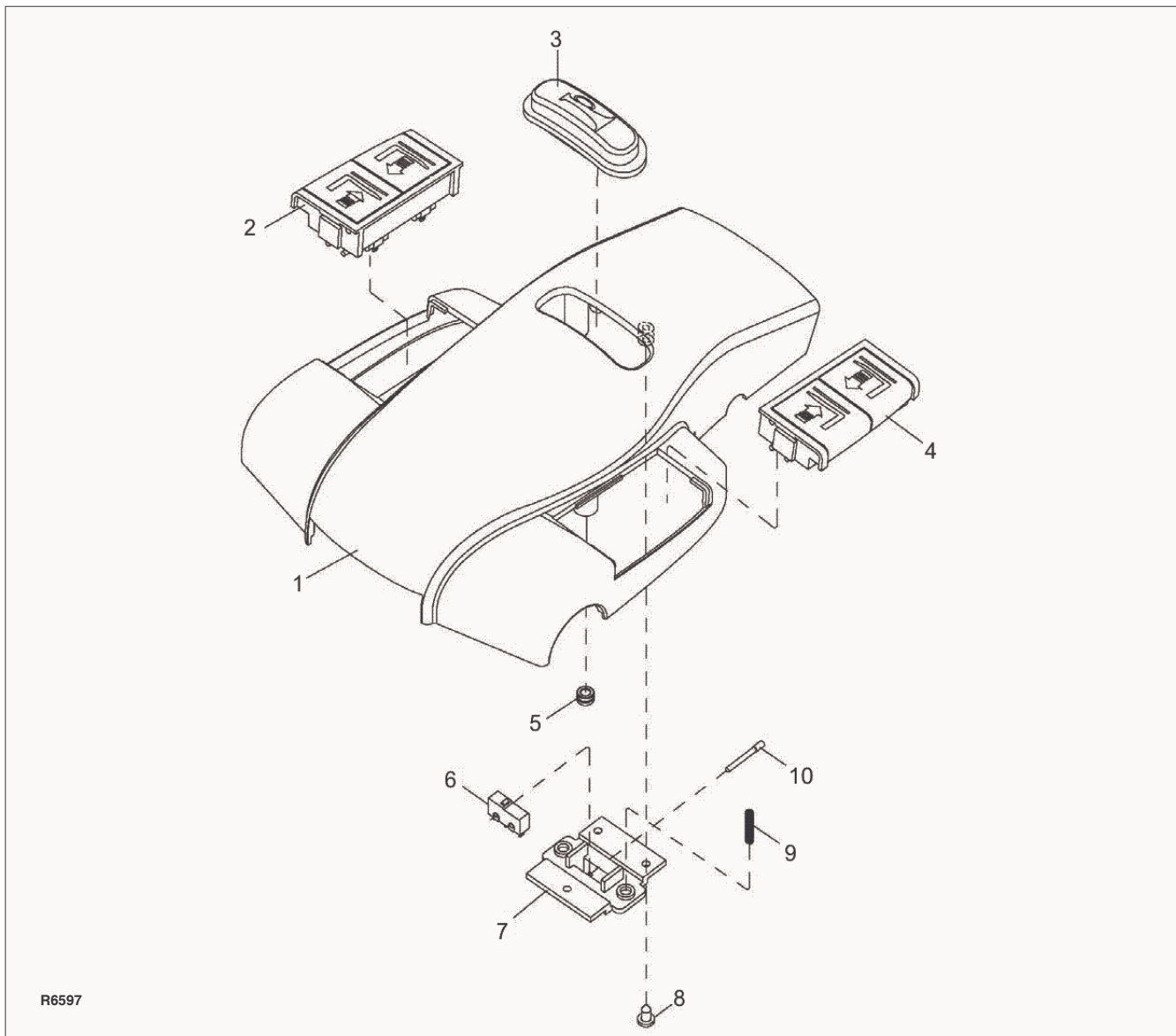


Figure 5-4 Cap Assembly

5-1.7. Lift and Lower Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.3.
2. Disconnect harness (9, Figure 12-21) from switch assembly (2 or 4, Figure 5-4).
3. Remove pin (3, Figure 5-5) and switch assembly (2 or 4, Figure 5-4) from the cap (1)
4. Remove two pins (3, Figure 5-5), two switches (2) and four springs (5) from bracket (4).
5. Position the new switches (2) and four springs (5) in bracket (4) and secure with two pins (3).
6. Position switch assembly (2 or 4, Figure 5-4) in cover (1) and secure with pin (3, Figure 5-5).
7. Connect harness (9, Figure 12-21) to switch (2 or 4, Figure 5-4).
8. Install the cap assembly as described in paragraph 5-1.4.

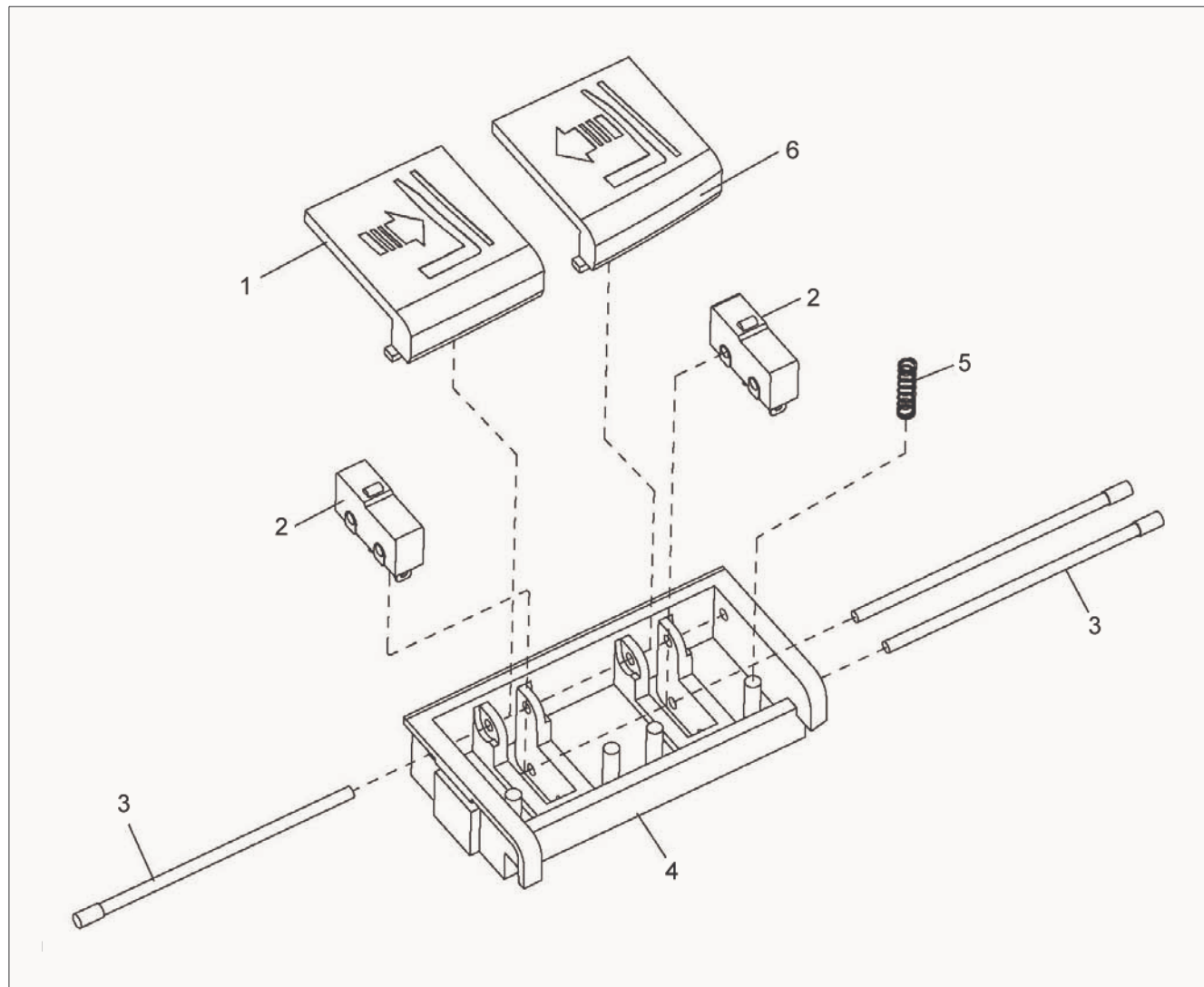


Figure 5-5 Left Lift/Lower Switch Assy (Right Similar)

5-1.8. Speed Potentiometer Replacement.

1. Remove the cap assembly as described in paragraph 5-1.3.
2. Disconnect harness (10, Figure 12-21) from potentiometer (2, Figure 5-2).
3. Remove screw (5), washer (4) and control knob (3) from potentiometer (2).
4. Remove screw (5), washer (4) and control knob (11) from other side of potentiometer (2).
5. Remove two screws (13) and remove potentiometer (2) from bracket (10).
6. Position new potentiometer (2) in bracket (10) and secure with two screws (13).
7. Install control knob (3) on potentiometer (2) and secure with screw (5), and washer (4).
8. Install control knob (11) on the other side of potentiometer (2) and secure with screw (5), and washer (4).
9. Connect harness (10, Figure 12-21) to potentiometer (2, Figure 5-2).
10. Install the cap assembly as described in paragraph 5-1.4.

5-2. STEERING ARM

5-2.1. Return Spring Replacement.

The steering arm gas return spring (6, Figure 5-1) is replaced while the steering arm (5) is in the upright position.

1. Remove the compartment covers as described in paragraph 5-3.
2. Secure the steering arm (5, Figure 5-1) in the upright position.
3. Remove screw (7), flat washer (25), washer (26) and free the gas return spring (6) from brake plate (16).
4. Pull downward on the gas return spring (6) to free it from its seat inside steering arm (5).
5. Position the new gas return spring (6) inside the steering arm being sure it fully engages its seat.
6. Position the opposite end of the gas return spring (6) on brake plate (16) and install screw (7), flat washer (25), washer (26).
7. Install the compartment covers as described in paragraph 5-3.

5-2.2. Steering Arm Removal.

1. Remove the compartment covers as described in paragraph 5-3.
2. Remove the brake as described in paragraph 6-1.3.
3. Disconnect harness (6, Figure 12-21) and harness (10) from harness (13).
4. Attach a hoist to steering arm (1, Figure 12-1).
5. Remove the three screws (4), three washers (5) and the steering arm (1).

5-2.3. Steering Arm Installation.

1. Position steering arm (1, Figure 12-1) over the drive motor and secure with three screws (4), three washers (5).
2. Connect harness (6, Figure 12-21) and harness (10) to harness (13).
3. Install the brake as described in paragraph 6-1.3.
4. Install the compartment covers as described in paragraph 5-3.

5-3. COMPARTMENT COVERS

5-3.1. Removal.

1. Turn off the key switch and disconnect the batteries
2. Remove two screws (10, Figure 12-11) and upper cover (9).
3. Remove two screws (3, Figure 12-1).
4. Remove middle cover (8).
5. Pull the lower cover (7) up and out.

5-3.2. Installation.

1. Position the lower cover (7, Figure 12-11) on the frame.
2. Place middle cover (8) around the brake and secure with two screws (3, Figure 12-1).
3. Install upper cover (9, Figure 12-11) and secure with two screws (10).
4. Reconnect the batteries and turn on the key-switch.

SECTION 6 BRAKE SERVICING

6-1. BRAKES.

The brake system consists of a drive motor mounted brake. This brake is spring applied and electrically released. Should it become necessary to move a dead truck, the brake is equipped with an adjusting nut (Figure 6-1) that may be manually loosened to release the brake.

WARNING: Before returning the truck to operation, be sure to return the brake adjusting nut to its original position and check for proper braking function. Failure to return adjusting nut to its original position results in truck having no braking ability.

6-1.1. Air Gap Adjustment.

The "air gap" is the distance between the magnet body and the rotor plate with the brake applied. As the brake pads and rotor wear normally, the air gap will increase and should be readjusted when it measures more than 0.25 mm.

NOTE: If the air gap measures more than 0.25 mm, the brake may not release properly. Air gap adjustment can be performed as long as the brake pads and rotor function properly or until the adjustable spacer threads are fully engaged (adjustment limit reached).

1. Block load wheels.
2. Remove the compartment covers as described in paragraph 5-3.
3. Using low pressure air, remove any dirt between armatures and magnet body.
4. Using standard feeler gauges, check the gap between the magnet body and the rotor plate. The gap should be 0.25 mm.
5. If necessary, refer to Figure 6-1 and adjust the gap as follows:
 - a. Loosen the three mounting screws by half a turn.
 - f. The threaded air gap adjusting nuts can then be screwed into Magnet Body by turning counterclockwise.
 - g. Turn the three mounting screws clockwise until the gap measures 0.012" (0.25 mm).

- h. The threaded air gap adjusting nuts are then screwed clockwise until they bottom.
 - i. Finally tighten the three mounting screws to 52 in-lb (6 Nm).
 - j. Recheck the gap.
11. Remove load wheel blocks and check operation.
 12. Install the compartment covers as described in paragraph 5-3.

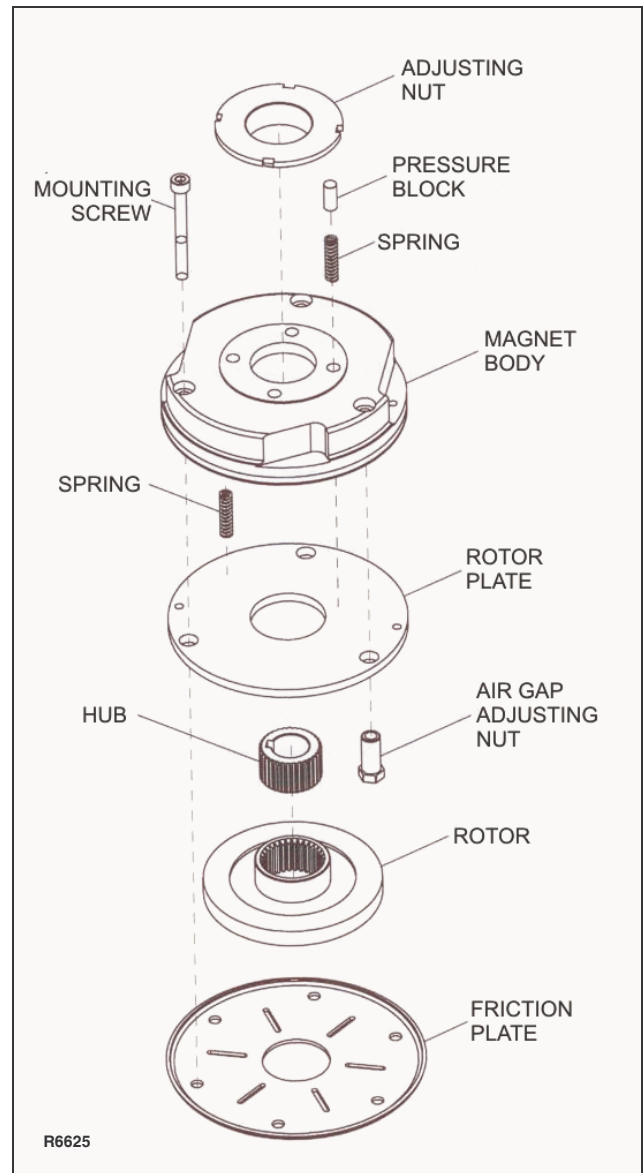


Figure 6-1 Brake Assembly

6-1.2. Stopping Distance Adjustment.

The stopping distance of the truck should require minimal adjustment. However, this distance should be checked with each planned maintenance.

Using an unloaded truck, run truck to its top speed on an even dry concrete surface. Move control handle into the lower braking position. Measure length of braking path from the actuation point of the brakes until the truck has stopped. The actual length of the braking path should be between approximately 1.5 - 2.5 ft (0.5-0.7 m).

To adjust stopping distance, proceed as follows:

1. Block load wheels.
2. Remove the compartment covers as described in paragraph 5-3.
3. Rotate the adjusting nut (Figure 6-1) clockwise to SHORTEN the stopping distance or counterclockwise to LENGTHEN the stopping distance.
4. Remove load wheel blocks and check operation.
5. Install the compartment covers as described in paragraph 5-3.

6-1.3. Brake Assembly Replacement

1. Block load wheels.
2. Remove the compartment covers as described in paragraph 5-3.
3. Disconnect electric brake (12, Figure 12-21) from harness (13).
4. Remove the three mounting screws (Figure 6-1) and the brake.
5. Place the new brake into position and secure with the three mounting screws.
6. Finally tighten the three mounting screws to 52 in-lb (6 Nm).
7. Reconnect electric brake (12, Figure 12-21) from harness (13).
8. Remove load wheel blocks and check operation.
9. Install the compartment covers as described in paragraph 5-3.

SECTION 7

TRANSMISSION, DRIVE WHEEL, LOAD WHEEL

7-1. Drive Wheel.

1. Turn off the key switch (7, Figure 12-19) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph 5-3.
3. Loosen but do not remove the five nuts (15, Figure 7-1).
4. Jack up the truck so the drive wheel is off the ground; then securely block the truck to prevent movement.
5. Remove the five nuts (15) five washers (14) and drive wheel (13) from the transmission (12).
6. Install new drive wheel in reverse order of removal.
7. Install the compartment covers as described in paragraph 5-3.
8. Reconnect the batteries and turn on the keyswitch (7, Figure 12-19).

7-2. Transmission.

1. Turn off the key switch (7, Figure 12-19) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph 5-3.
3. Remove the brake (2, Figure 7-1) as described in paragraph 6-1.3.
4. Remove the steering arm as described in paragraph 5-2.2.
5. Disconnect harness (13, Figure 12-21) from drive motor (11).
6. Remove the drive motor (4) as described in paragraph 10-4.1.
7. Remove the drive wheel (13) as described in paragraph 7-1.
8. Support the transmission (12) and remove the six screws (6, Figure 12-1), six washers (4) and six flat washers (3).

9. Slowly lower the transmission out the bottom of the frame.
10. Install new transmission by reversing the steps above.

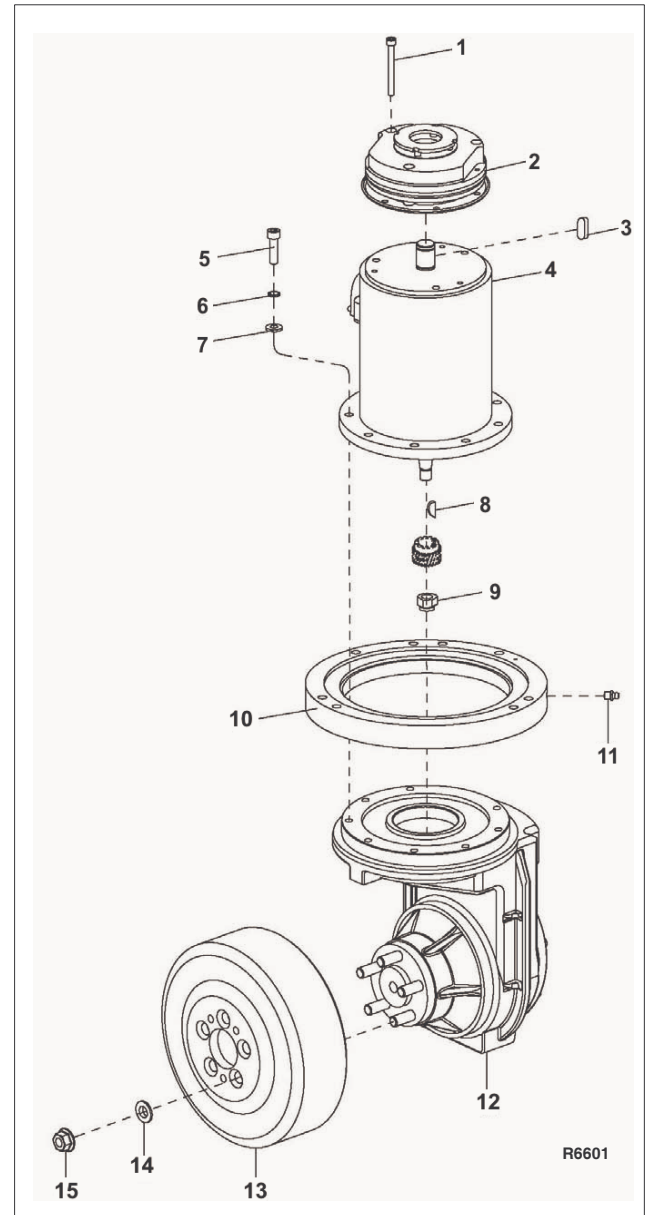


Figure 7-1 Transmission, Motor, Brake Assembly

7-3. Load Wheel.

7-3.1. Removal

1. Raise forks.
2. Turn off the key switch (7, Figure 12-19) and disconnect the batteries.
3. Block the drive wheel to prevent the truck from rolling.
4. Jack up the forks to raise the load wheels off the floor. Securely block the forks in the raised position by positioning supports under both fork tips.

NOTE: When shaft (10, Figure 12-14) is removed, load wheel assembly (11) will drop free.

5. Remove screw (4) securing pin (10) and remove pin (10) and load wheel assembly (11).

NOTE: Inspect the load wheel assembly. If the load wheel is worn within 1/8" of the metal sleeve, or is cracked or damaged, replace the entire load wheel and bearing assembly. Big Joe by recommends that both load wheel assemblies be replaced at the same time. This ensures level and safe operation of the lift truck.

7-3.2. Repair

6. Remove bearings (1, Figure 7-2) from wheels (2).
7. Inspect bearings (1) and replace if necessary.
8. Reassemble bearings (1) in wheels (2).

7-3.3. Load Wheel Installation

1. Position load wheel assembly (11, Figure 12-14) in wheel bracket (12).
2. Install pin (10) and secure with screw (4).
3. Remove blocking from under the truck.
4. Lower the forks.
5. Reconnect the batteries and turn on the keyswitch (9, Figure 12-19).

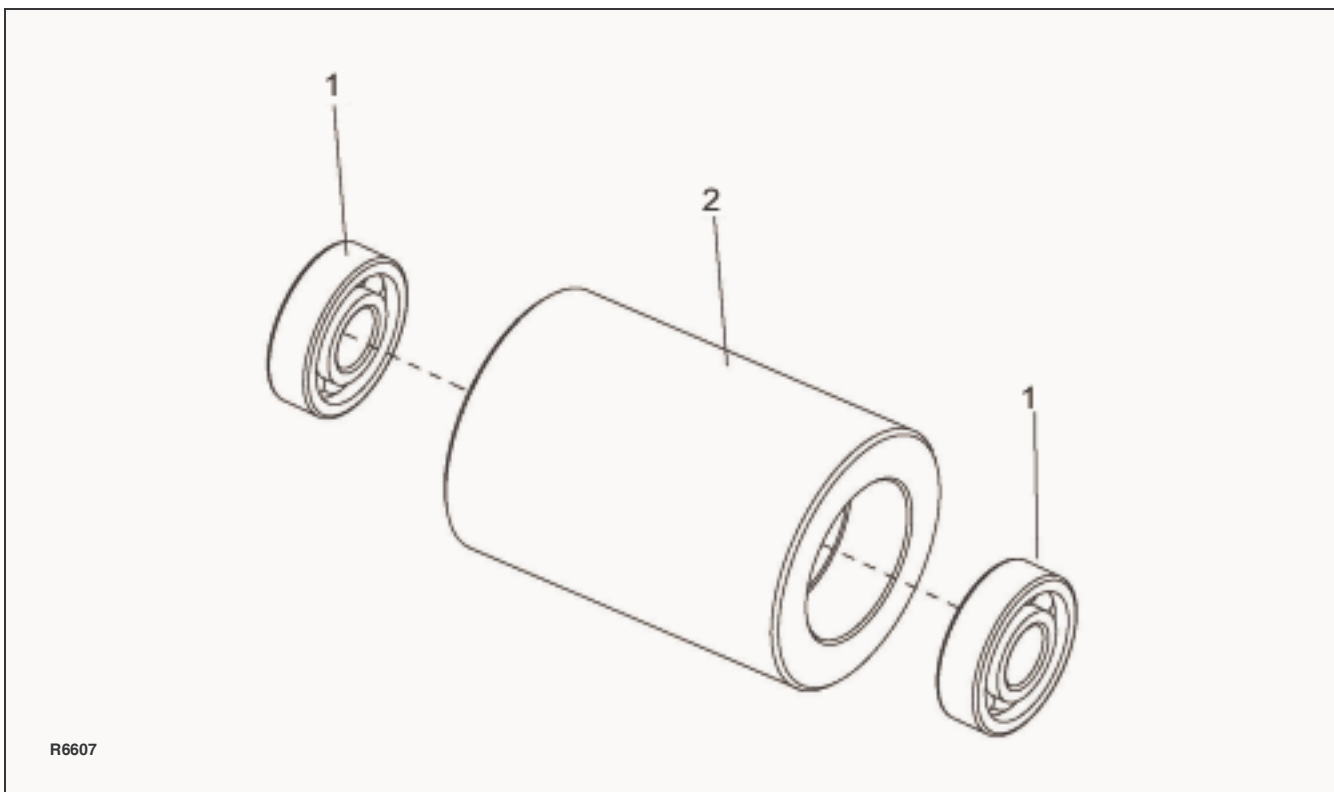


Figure 7-2 Wheel Assembly

SECTION 8 ELEVATION SYSTEM SERVICING

8-1. GENERAL.

The elevation system includes the lift linkage, power section and fork section.

8-2. LIFT LINKAGE

8-2.1. Removal

1. Lift complete truck to height sufficient to permit access to lift linkage under forks. Provide blocking under frame (3, [Figure 8-1](#)), the rear of fork section (1) and at tips of the forks.
2. Turn off the key switch (7, [Figure 12-19](#)) and disconnect the batteries.
3. Remove screw (9, [Figure 8-1](#)) from each side of frame (3). Support tension rod (14, [Figure 8-2](#)) and remove pin (2) from each side of link (5). Lower link (5) to the floor.
4. Support both tension rods (14) and remove pins (9).
5. Remove tension rods (14) with attached parts from under the fork.

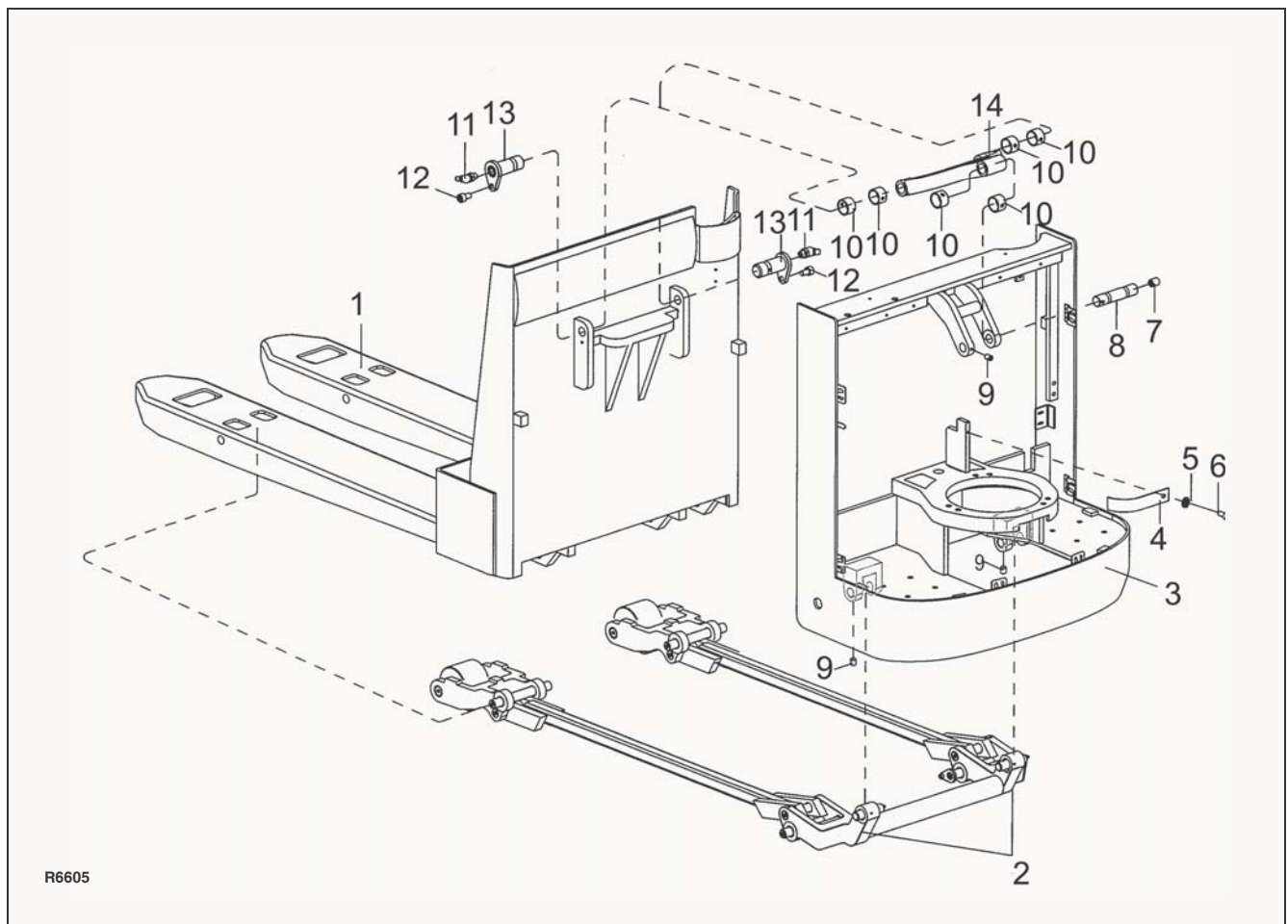


Figure 8-1 Frame

8-2.2. Installation

1. Position tension rods (14, [Figure 8-2](#)) with attached parts under the fork.
2. Position bracket (12) in the fork and install pin (9).
3. Raise each tension rod (14) into position and install pin (2) through the frame. Secure Pin (2) with screw (9, [Figure 8-1](#)).
4. Remove blocking and lower the truck to the ground.
5. Reconnect the batteries and turn on the key-switch.
6. Reconnect the batteries and turn on the keyswitch (7, [Figure 12-19](#)).

8-3. Power Section and Fork Section

8-3.1. Separating Power Section and Fork Section.

1. Support entire truck on blocking, providing separate blocks so that fork section (1, [Figure 8-1](#)) can be fully supported when frame (3) is removed.
2. Turn off the key switch (7, [Figure 12-19](#)) and disconnect the batteries.
3. Remove the compartment covers as described in paragraph 5-3.
4. Remove the lift cylinder as described in paragraph 9-2.4.
5. Remove the brake as described in paragraph 6-1.3.
6. Remove the steering arm as described in paragraph 5-2.2.
7. Remove the transmission as described in paragraph 7-2.
8. Attach a suitable hoist to frame (3, [Figure 8-1](#)).
9. Remove screw (9) and shaft (8) from frame (3).
10. Remove screw (9). Support link (5, [Figure 8-2](#)) and remove pins (2). Lower link (5) to the floor.

11. Remove frame (3) from fork section (1).

8-3.2. Fork Frame Repair.

1. Removal of components mounted on the frame (1) may be necessary to effect repairs/welding.
2. Inspect fork section (1) for broken welds and weld as necessary.
3. Replace fork section (1) if forks have been bent severely.

8-3.3. Carrier Frame Repair.

1. Removal of components mounted on the frame (3) may be necessary to effect repairs/welding.
2. Inspect frame (3) for broken welds and weld as necessary.

8-3.4. Mating Power Section and Fork Section.

1. With suitable hoist, carefully move frame (3, [Figure 8-1](#)) into position.
2. Move link (14) into position on carrier frame (3) and install shaft (8). Secure shaft with screw (9).
3. Raise link (5, [Figure 8-2](#)) and install pins (2) and secure with screws (9, [Figure 8-2](#)).
4. Remove hoist from carrier frame (3).
5. Install the transmission as described in paragraph 7-2.
6. Install the steering arm as described in paragraph 5-2.3.
7. Install the brake as described in paragraph 6-1.
8. Install the lift cylinder as described in paragraph 9-2.4.
9. Install the compartment covers as described in paragraph 5-3.
10. Reconnect the batteries and turn on the keyswitch (9, [Figure 12-19](#)).
11. Remove the blocking from under the truck.

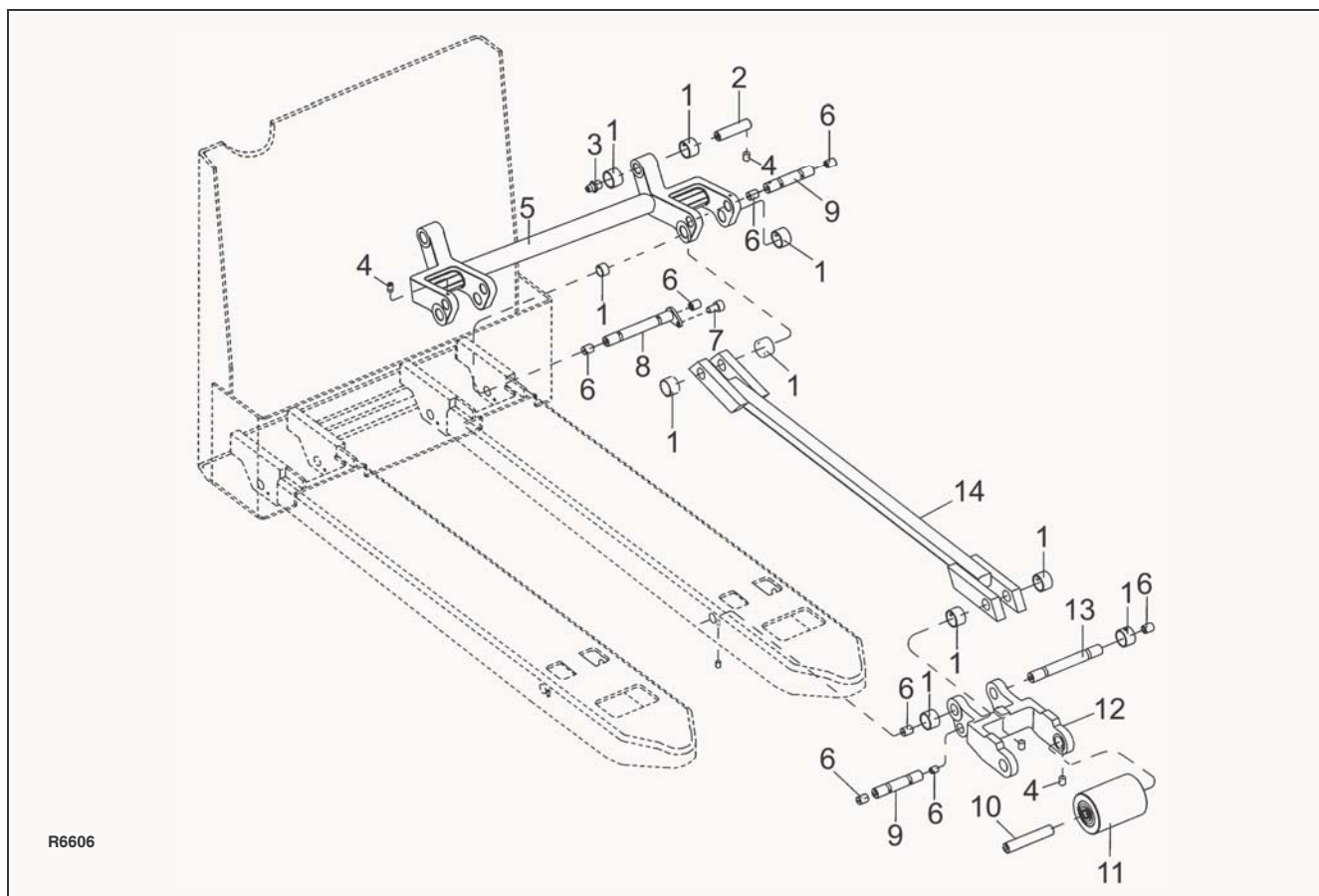


Figure 8-2 Lift Linkage Assembly

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 batteries 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.

1. Lower forks fully.

2. Turn off the key switch (7, [Figure 12-19](#)) and disconnect the batteries.

3. Remove the compartment covers as described in [paragraph 5-3](#).

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

4. Refer to [Figure 9-1](#) and remove leaking line or fitting and replace it with a new line or fitting.

5. Check level of hydraulic oil. Hydraulic oil must be between the two level marks on the reservoir. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).

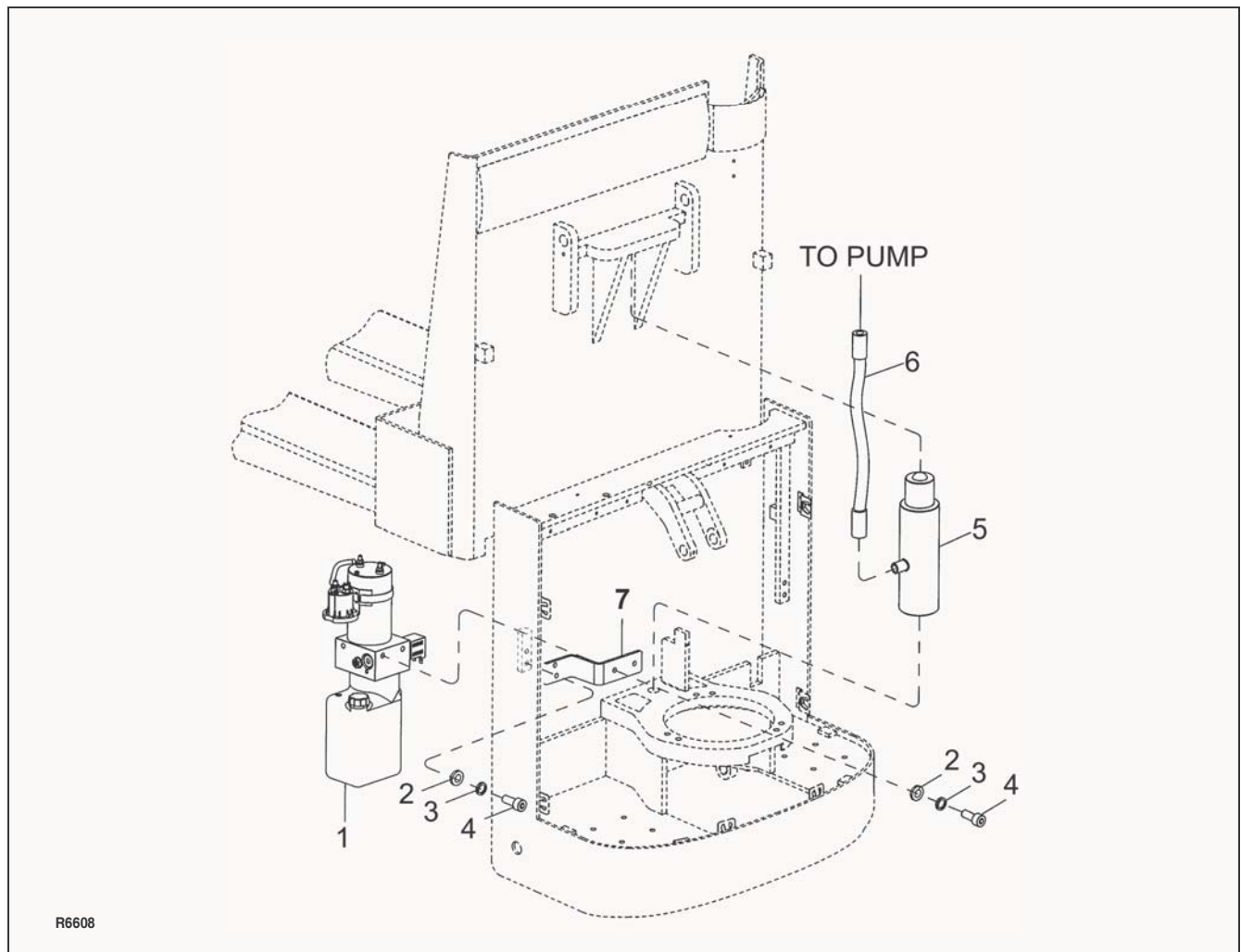


Figure 9-1 Hydraulic System

6. Reconnect the batteries and turn on the keyswitch (7, [Figure 12-19](#)).
7. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
8. Check level of hydraulic oil. Hydraulic oil must be between the two level marks on the reservoir. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
9. Install the compartment covers as described in paragraph 5-3.

9-2. HYDRAULIC PUMP, MOTOR, AND RESERVOIR ASSY

The hydraulic pump/motor assembly can be disassembled and repaired. However, a defective pump, valve or motor requires replacement of that component.

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 batteries disconnected before performing any maintenance on the hydraulic system.

9-2.1. Removal

1. Lower forks fully.
2. Turn off the key switch (7, [Figure 12-19](#)) and disconnect the batteries.
3. Remove the compartment covers as described in paragraph 5-3.
4. Tag and disconnect electrical leads from motor (2, [Figure 9-2](#)) and solenoid (17).

NOTE: The reservoir and hose will be filled with hydraulic oil. Place a container under the pump assembly to catch any hydraulic oil.

5. Disconnect hose (6, [Figure 9-1](#)) from pump/motor assembly (1).

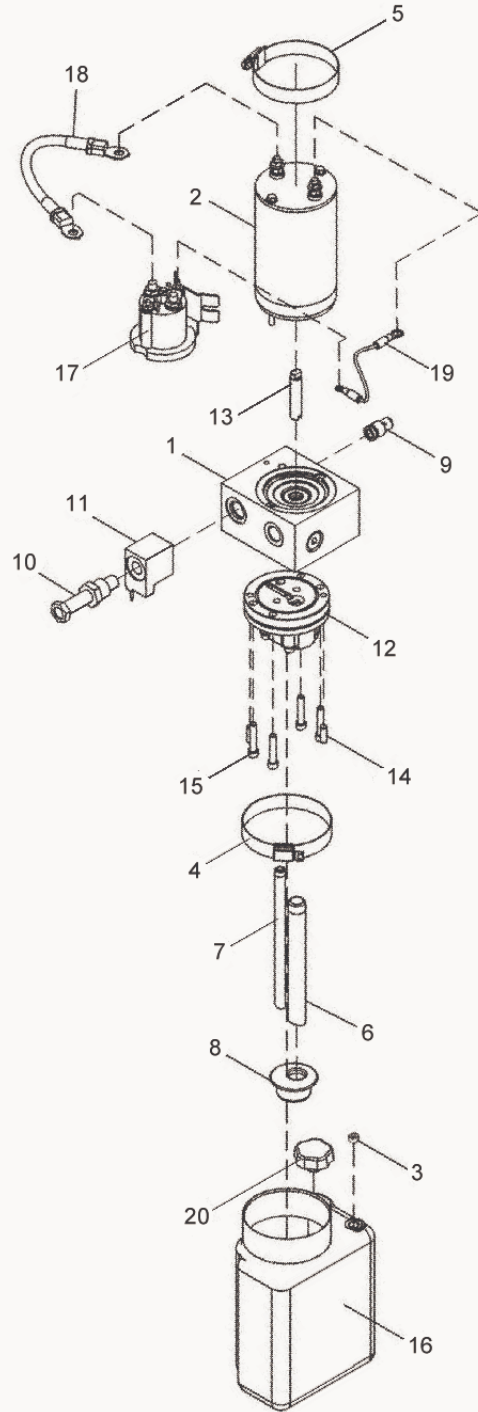
6. While supporting the pump/motor assembly (1), remove two screws (4), two washers (3) and two flat washers (2).
7. Remove the pump/motor assembly (1) with bracket (7).
8. Remove two screws (4), two washers (3) and two flat washers (2) and bracket (7) from pump/motor assembly (1).

9-2.2. Disassembly and Reassembly

1. Remove the hydraulic pump/motor assembly as described in paragraph 9-2.1.
2. Refer to [Figure 9-2](#) for disassembly and reassembly.

9-2.3. Installation

1. Position bracket (7, [Figure 9-1](#)) on pump/motor assembly (1) and secure with two screws (4), two washers (3) and two flat washers (2).
2. While supporting the pump/motor assembly (1), install two screws (4), two washers (3) and two flat washers (2).
3. Reconnect hose (6, [Figure 9-1](#)) to pump/motor assembly (1).
4. Connect electrical leads to motor (2, [Figure 9-2](#)) and solenoid (17).
5. Fill the hydraulic reservoir. Hydraulic oil must be between the two level marks on the reservoir. Use hydraulic oil listed in [Table 3-2](#).
6. Reconnect the batteries and turn on the keyswitch (7, [Figure 12-19](#)).
7. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
8. Check level of hydraulic oil. Hydraulic oil must be between the two level marks on the reservoir. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
9. Install the compartment covers as described in paragraph 5-3.



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Figure 9-2 Pump and Motor Assembly

9-2.4. Lift Cylinder

9-2.4.1. Removal

1. Lower forks fully.
2. Turn off the key switch (7, [Figure 12-1](#)) and disconnect the batteries.
3. Remove the compartment covers as described in paragraph 5-3.
4. Ensure that hydraulic pressure has been relieved from the lift circuit. Disconnect the hydraulic line from the lift cylinder.
5. Disconnect hose (6, [Figure 9-1](#)) from cylinder (5).
6. Remove screw (6, [Figure 12-13](#)), washer (5) and spring plate (4) securing the cylinder to frame (3).

WARNING: Frame is heavy. Use care while securing and lifting in order to prevent injury.

7. With suitable hoist, carefully raise frame (1) slightly so the cylinder can be removed.

9-2.4.2. Repair

1. Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
2. Withdraw the cylinder rod (5) from the cylinder.

NOTE: If the cylinder tube (1) or piston rod (5) are damaged, the entire lift cylinder must be replaced.

3. Replace guide rings (2), seal ring (3) and wiper ring (4).
4. Coat all parts with hydraulic oil ([Table 3-2](#)).
5. Insert piston rod (5), with attached parts, into cylinder tube (1).

9-2.4.3. Installation

1. Position the cylinder on frame (3, [Figure 12-13](#)). Then lower the frame (1) onto the cylinder.
2. Reconnect the hose (3, [Figure 9-1](#)) to cylinder (1) with new O-ring (2).
3. Fill the hydraulic reservoir. Hydraulic oil must be between the two level marks on the reservoir. Use hydraulic oil listed in [Table 3-2](#).
4. Reconnect the batteries and turn on the keyswitch (7, [Figure 12-19](#)).
5. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
6. Check level of hydraulic oil. Hydraulic oil must be between the two level marks on the reservoir. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
7. Install the compartment covers as described in paragraph 5-3.

SECTION 10

ELECTRICAL COMPONENTS

10-1.ELECTRICAL CONTROL PANEL

10-1.1.Maintenance

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.

There are no user-serviceable parts inside the controller. No attempt should be made to open the controller. Opening the controller may damage it and will void the warranty.

The controller is programmed at the factory specifically for the truck model on which it is equipped. It is important to replace the controller with the correct pre-programmed unit to assure proper performance settings intended for that particular truck. See [Figure 12-20](#) for the preprogrammed controller number.

It is recommended that the controller exterior be cleaned periodically, and if a Zapi Handset is available, this periodic cleaning provides a good opportunity to check the controller's diagnostic history file. It is also recommended that the controller's fault detection circuitry be checked whenever the vehicle is serviced.

10-1.2.Cleaning

1. Turn off the key switch (7, [Figure 12-19](#)) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph 5-3.
3. Remove any dirt or corrosion from the bus bar area. The controller should be wiped clean with a moist rag. Allow it to dry before reconnecting the battery.

4. Make sure the connections to the buss bars are tight. Use two well insulated wrenches for this task in order to avoid steering the buss bars.

10-1.3.Panel Removal.

1. Turn off the key switch (7, [Figure 12-19](#)) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect all electrical cables which connect to the control panel (1, [Figure 10-1](#)).
4. Remove two screws (4), two washers (3), two flat washers (2) and control panel (1).

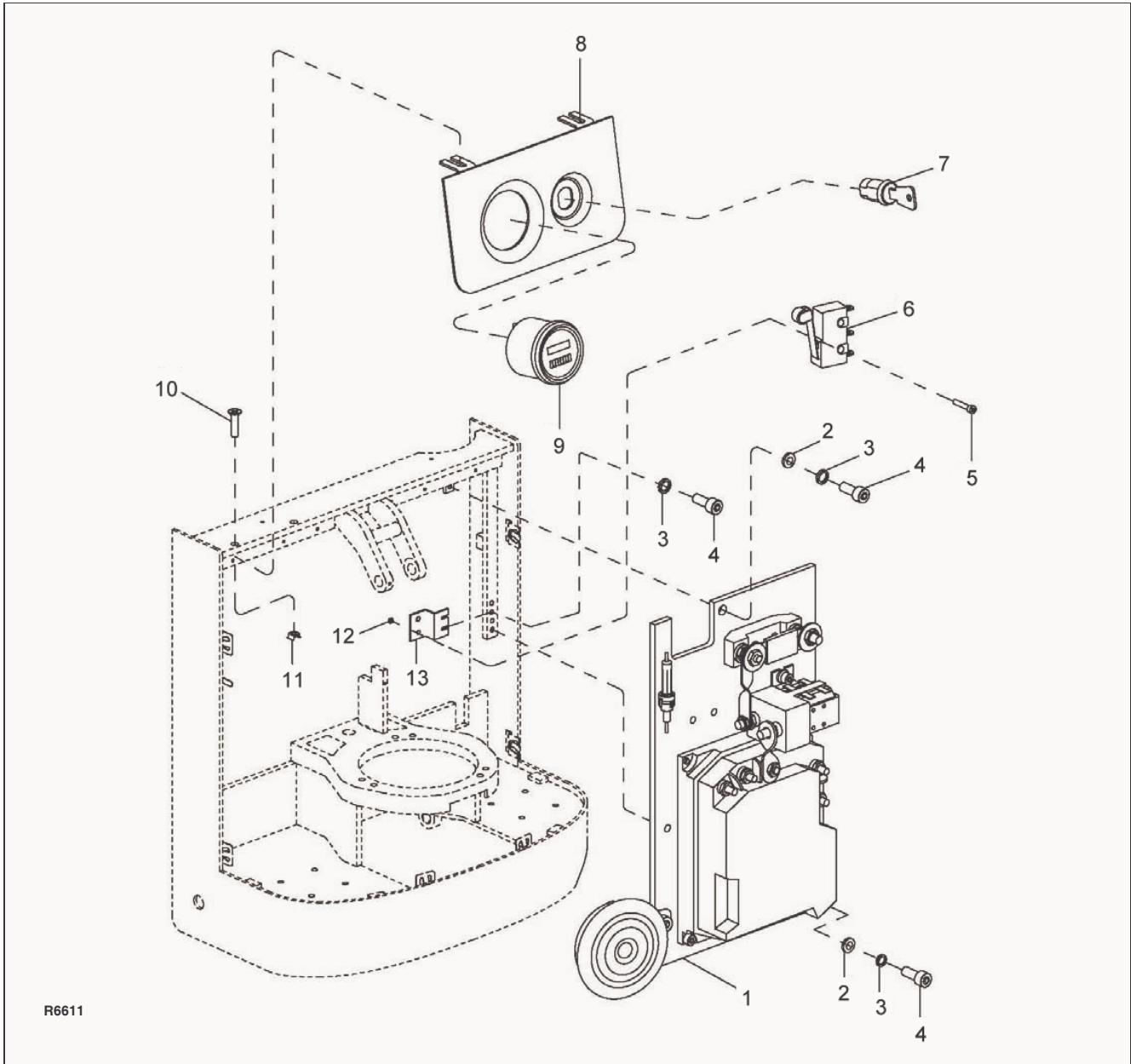
10-1.4.Panel Disassembly.

Refer to [Figure 10-2](#) for location and identity of the major replacement components mounted on the panel and remove defective parts.

NOTE: Contactor (12) is not repairable and must be replaced if defective.

10-1.5.Panel Installation.

1. Install the control panel (1, [Figure 10-1](#)) and secure with two screws (4), two washers (3), two flat washers (2).
2. Refer to [Figure 12-22](#) and connect all electrical cables to the control panel as noted during removal.
3. Install the compartment covers as described in paragraph 5-3.
4. Reconnect the batteries and turn on the keyswitch (7, [Figure 12-19](#)).



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Figure 10-1 Electrical System

10-2.HORN REPLACEMENT

1. Turn off the key switch (7, Figure 12-19) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect all electrical connections from horn (19, Figure 10-1).
4. Remove screw (7), washer (8), flat washer (9), and horn (19).
5. Install horn (19) and secure with screw (7), washer (8), flat washer (9).
6. Install the compartment covers as described in paragraph 5-3.
7. Reconnect the batteries and turn on the keyswitch (7, Figure 12-19).

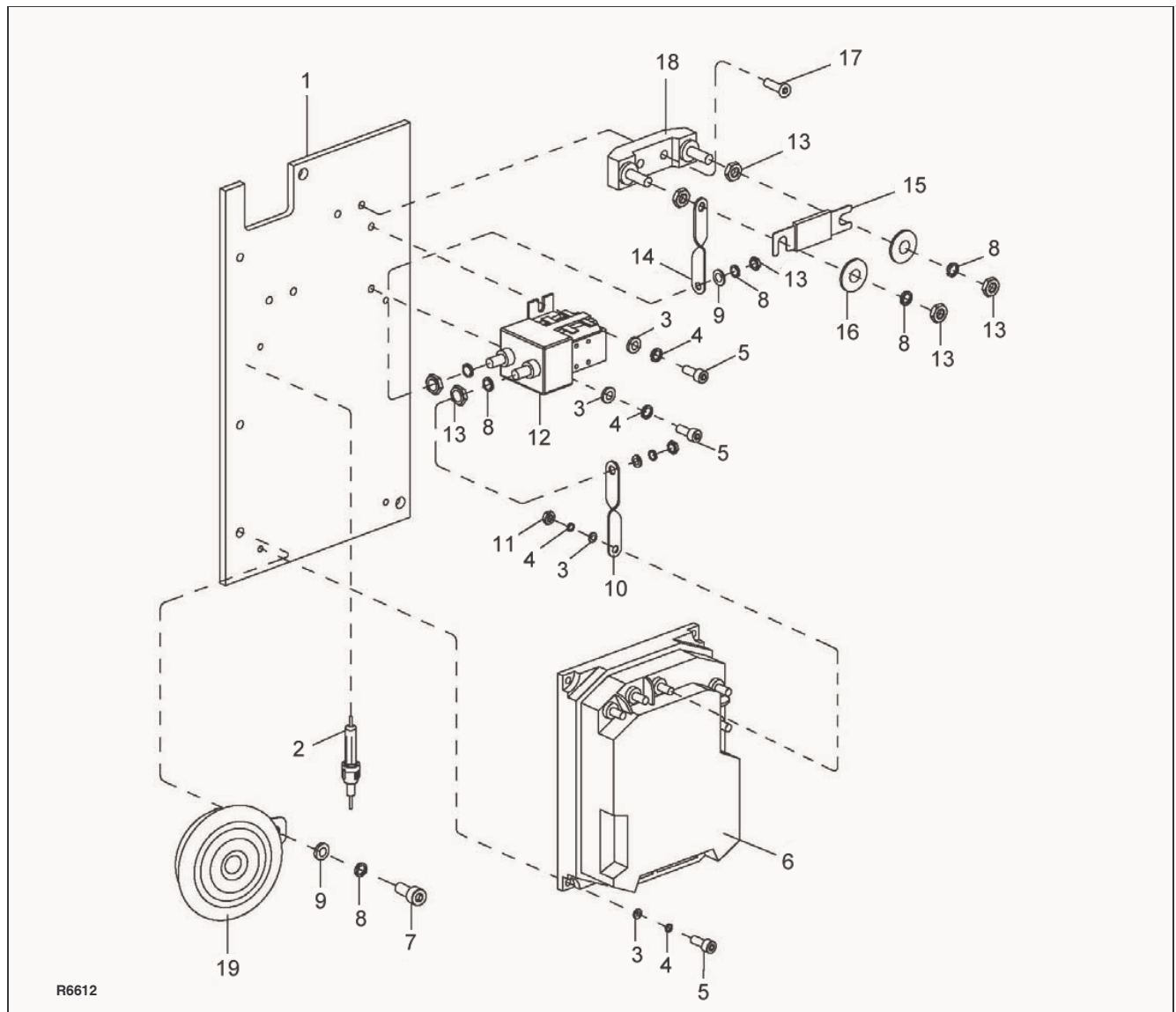


Figure 10-2 Electrical Panel

10-3.PUMP MOTOR.

The pump motor is replaceable but not repairable. Refer to paragraph 9-2.

10-4.DRIVE MOTOR.

The drive motor exposed surfaces should be cleaned at least once a month to assure proper cooling of motor. Use an air hose to blow dust off of motor surfaces.

10-4.1.Motor Removal

1. Remove the brake as described in paragraph 6-1.3.
2. Note routing of cables to ensure proper installation.
3. Tag the cables connected to the drive motor; then disconnect these cables from the drive motor.
4. Remove the eight screws (5, Figure 10-3), eight washers (6) and eight flat washers (7).
5. Lift motor (4) from transmission (12).
6. Remove nut (9), gear, and key (8) from the motor (4).

10-4.2.Motor Installation

1. Position key (8, Figure 10-3) and gear on the shaft of motor (4) and secure with nut (9).
2. Install drive motor onto transmission. Make sure to align gear (11) with the gear inside the transmission.
3. Reinstall the eight screws (5), eight washers (6) and eight flat washers (7). to secure the motor to the transmission.
4. Position cables as noted in removal and reconnect cables to the drive motor. Make sure to match the cable label to the terminal.
5. Reinstall the brake as described in paragraph 6-1.3.

10-5.LIFT LIMIT SWITCH

10-5.1.Replacement

1. Disconnect wiring from the lift limit switch (6, Figure 10-1).
2. Remove the two screws (4), two washers (3), mounting plate (13) and switch (6).

3. Remove the two screws (5), two nuts (12) and mounting plate (13) from switch (6).
4. Position the new switch (6) on mounting plate (13) and secure with two screws (5) and two nuts (12).
5. Position bracket (13) on the frame and secure with two screws (4) and two washers (3).
6. Adjust the switch as described in paragraph 10-5.2.

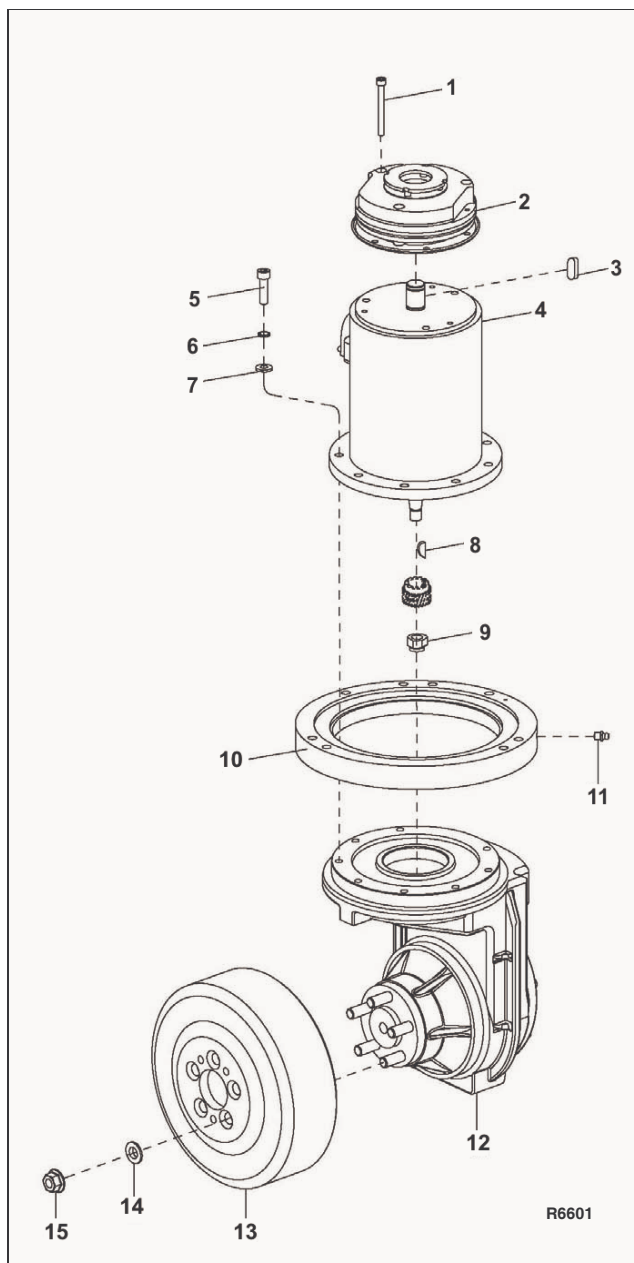


Figure 10-3 Transmission, Motor, Brake Assembly

10-5.2.Adjustment

1. Raise the forks until switch (6, [Figure 10-1](#)) is aligned with the detent on the frame.
2. The detent should trigger the lift limit switch and stop the hydraulic pump and motor.
3. If necessary, loosen screws (4) and adjust mounting plate (13).
4. Tighten screws (4) and recheck.

10-6.DEADMAN SWITCH

10-6.1.Replacement

1. Disconnect wiring from the deadman switch (19, [Figure 12-2](#)).
2. Remove the two screws (20), and switches (19) from bracket (18).
3. Position the new switches (19) on bracket (18) and secure with the two screws (20).

NOTES

SECTION 11

OPTIONAL EQUIPMENT

11-1.LOAD BACKREST.

A load backrest is available for addition to the lift truck to allow handling of high loads.

11-2.CASTERS

Casters provide for additional stability. Installation of the casters is shown in [Figure 12-11](#) and repair parts as shown in [Figure 12-12](#).

NOTES

SECTION 12

ILLUSTRATED PARTS BREAKDOWN

Following is an illustrated parts breakdown of assemblies and parts associated with the WPT 45 Lift Truck.

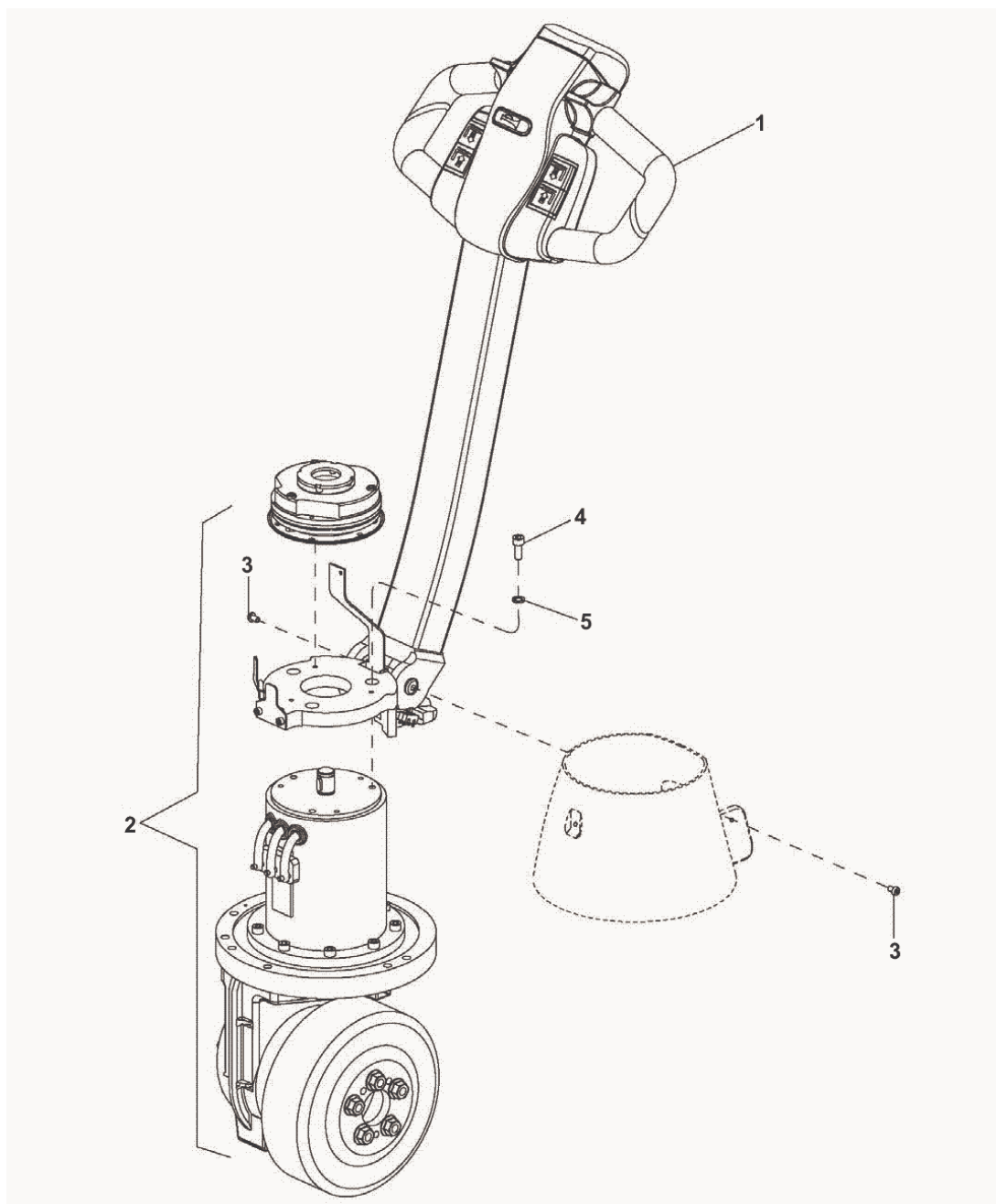


Figure 12-1 Steering System

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	STEERING ARM (FIGURE 12-2)	REF
2	—	TRANSMISSION, MOTOR, BRAKE ASSY (FIGURE 12-8)	REF

INDEX NO.	PART NO.	PART NAME	NO. REQD.
3	0000-000090-00	SCREW	2
4	0000-000322-00	SCREW	3
5	0000-000159-00	WASHER	3

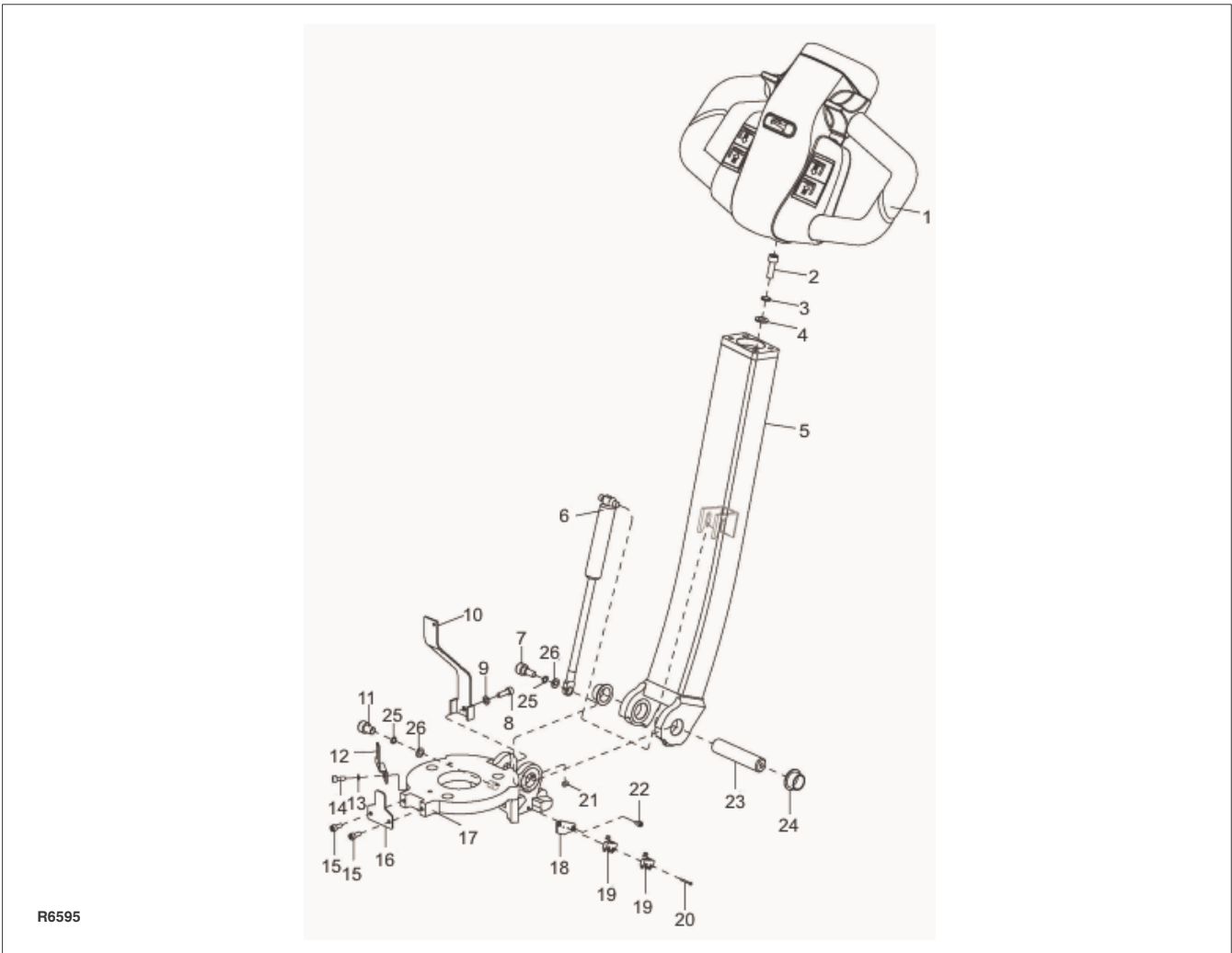
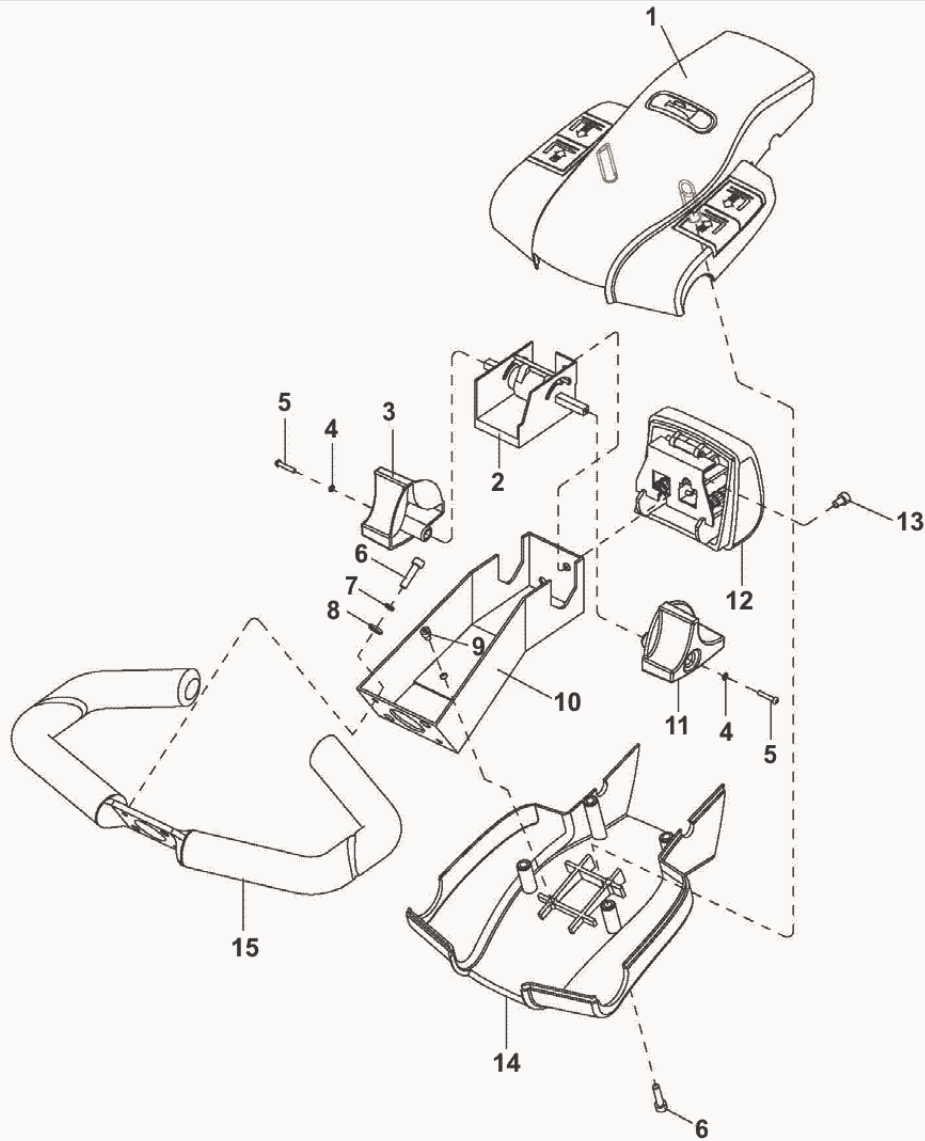


Figure 12-2 Steering Arm

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	CONTROL HEAD (FIGURE 12-3)	REF
2	0000-000322-00	SCREW	2
3	0000-000159-00	WASHER	2
4	0000-000194-00	FLAT WASHER	2
5	1120-330000-00	CONTROL ARM	1
6	1120-320000-00	GAS SPRING	1
7	1120-300002-00	SCREW	1
8	0000-000033-00	SCREW	1
9	0000-000056-00	WASHER	1
10	1120-300005-00	BRACKET	1
11	0000-000030-00	SCREW	1
12	—	BRACKET	1
13	0000-000206-00	WASHER	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
14	0000-000117-00	SCREW	1
15	0000-000031-00	SCREW	2
16	1120-300004-00	FIXED PLATE	1
17	1120-300001-0A	BRAKE PLATE	1
18	1120-300006-00	BRACKET	1
19	1120-310002-00	DEADMAN SWITCH	2
20	0000-000207-00	SCREW	2
21	0000-000016-00	SCREW	1
22	0000-000028-00	SCREW	2
23	1120-300003-00	SHAFT	1
24	0000-000029-00	BUSHING	2
25	0000-000071-00	FLATWASHER	2
26	0000-000063-00	WASHER	2



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Figure 12-3 Control Head

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-340000-00	CONTROL HEAD	1
1	—	• CAP ASSEMBLY (FIGURE 12-4)	REF
2	1120-340004-00	• POTENTIOMETER	1
3	1120-340005-00	• CONTROL KNOB	1
4	0000-000038-00	• WASHER	2
5	0000-000037-00	• SCREW	2
6	0000-000035-00	• SCREW	6
7	0000-000206-00	• WASHER	2
8	0000-000128-00	• FLAT WASHER	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	0000-000036-00	• SCREW	2
10	1120-340001-00	• CONNECTOR BRACKET	1
11	1120-340003-00	• CONTROL KNOB	1
12	—	• EMERGENCY REVERSE SWITCH ASSY (FIGURE 12-7)	REF
13	0000-000152-00	• SCREW	2
14	1120-340002-00	• COVER	1
15	1120-341000-00	• HANDLE	1

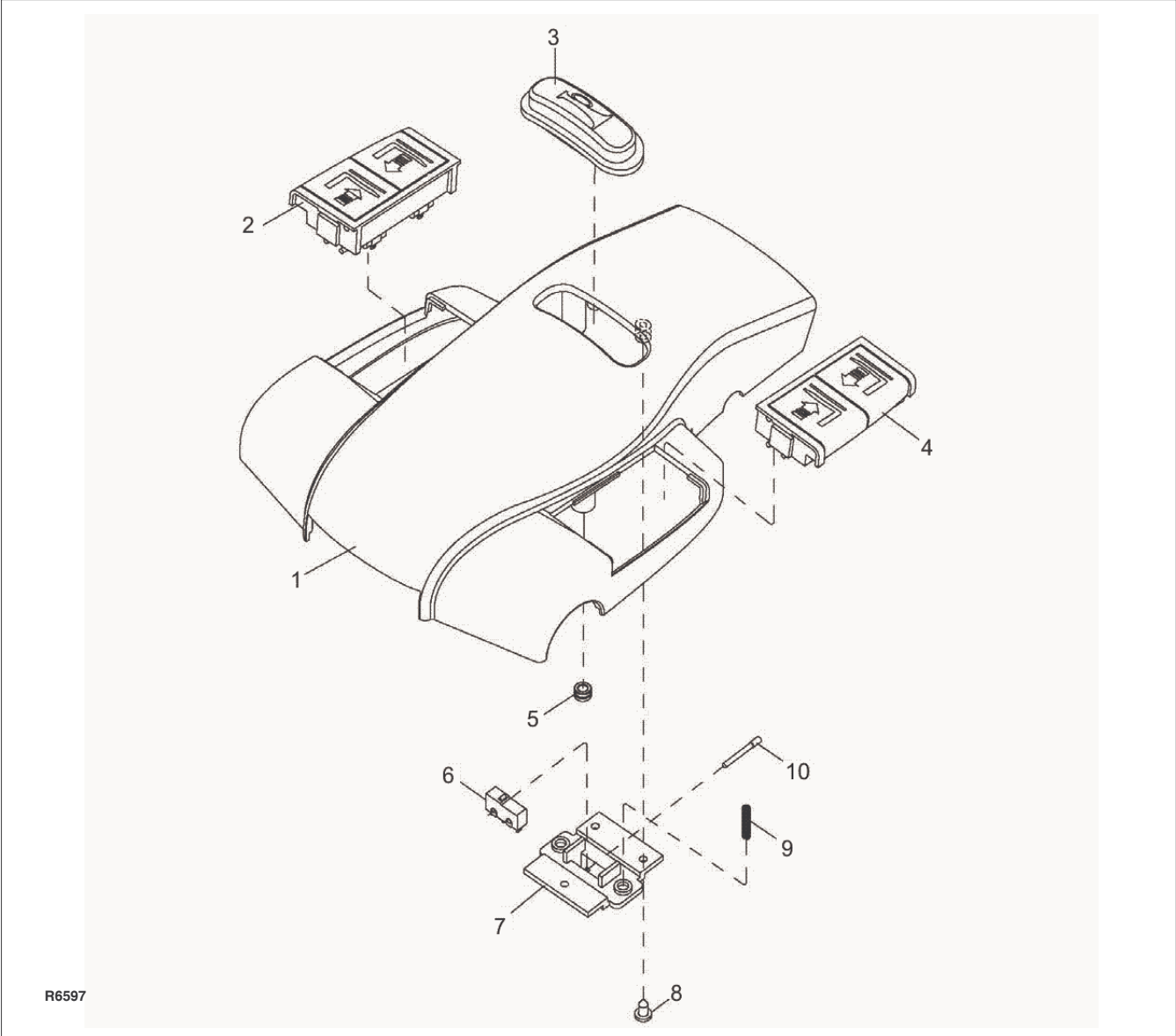


Figure 12-4 Cap Assembly

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-342000-00	CAP ASSEMBLY	1
1	1120-342001-00	• COVER	1
2	1120-342200-00	• LIFT/LOWERING SWITCH ASSY, RIGHT	1
3	1120-342002-00	• HORN BUTTON	1
4	1120-342100-00	• LIFT/LOWERING SWITCH ASSY, LEFT	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
5	0000-000040-00	• NUT	4
6	1120-310001-00	• HORN SWITCH	1
7	1120-342004-00	• HORN SWITCH BRACKET	1
8	0000-000039-00	• SCREW	3
9	1120-342003-00	• SPRING	2
10	1120-342005-00	• PIN	2

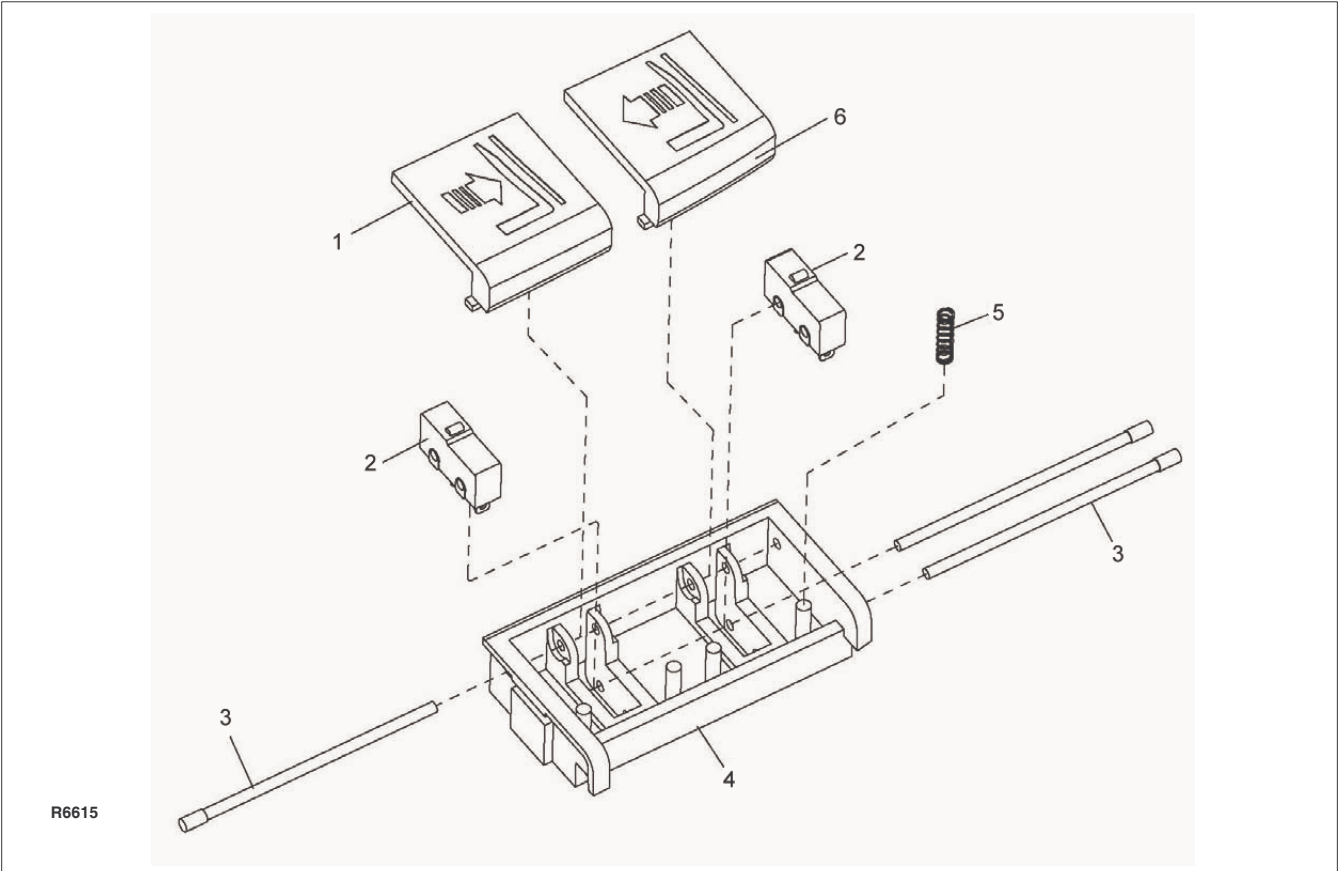


Figure 12-5 Lift/Lowering Switch Assy, Left

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-342100-00	LIFT/LOWERING SWITCH ASSY, LEFT	1
1	1120-342103-00	• BUTTON, LOWERING	1
2	1120-310001-00	• SWITCH	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
3	1120-342105-00	• PIN	3
4	1120-342101-00	• BUTTON BRACKET, LEFT	1
5	1120-342102-00	• SPRING	4
6	1120-342104-00	• BUTTON, LIFT	1

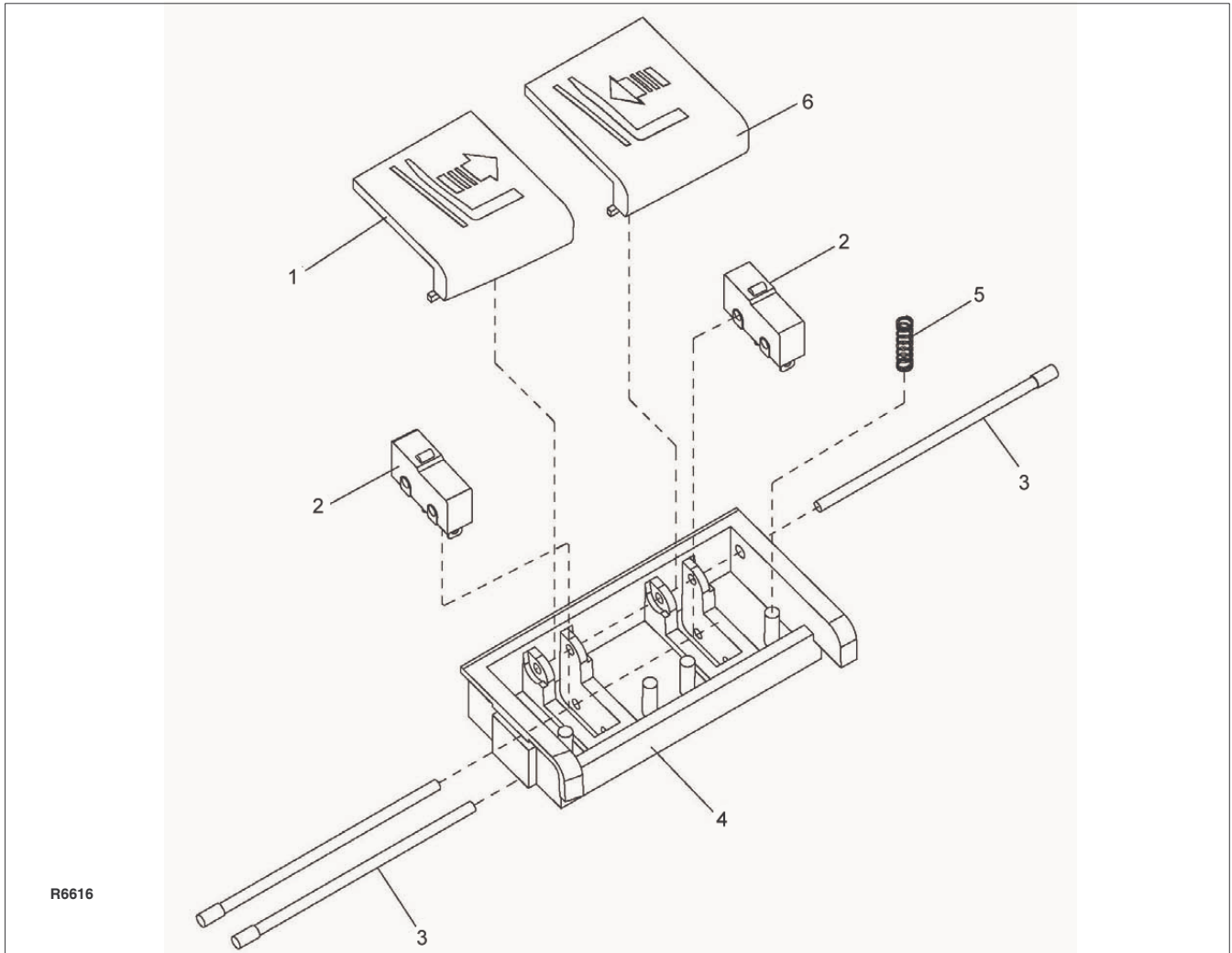


Figure 12-6 Lift/Lowering Switch Assy, Right

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-342200-00	LIFT/LOWERING SWITCH ASSY, RIGHT	1
1	1120-342203-00	• BUTTON, LIFT	1
2	1120-310001-00	• SWITCH	2
3	1120-342105-00	• PIN	3

INDEX NO.	PART NO.	PART NAME	NO. REQD.
4	1120-342201-00	• BUTTON BRACKET, RIGHT	1
5	1120-342102-00	• SPRING	4
6	1120-342202-00	• BUTTON, LOWERING	1

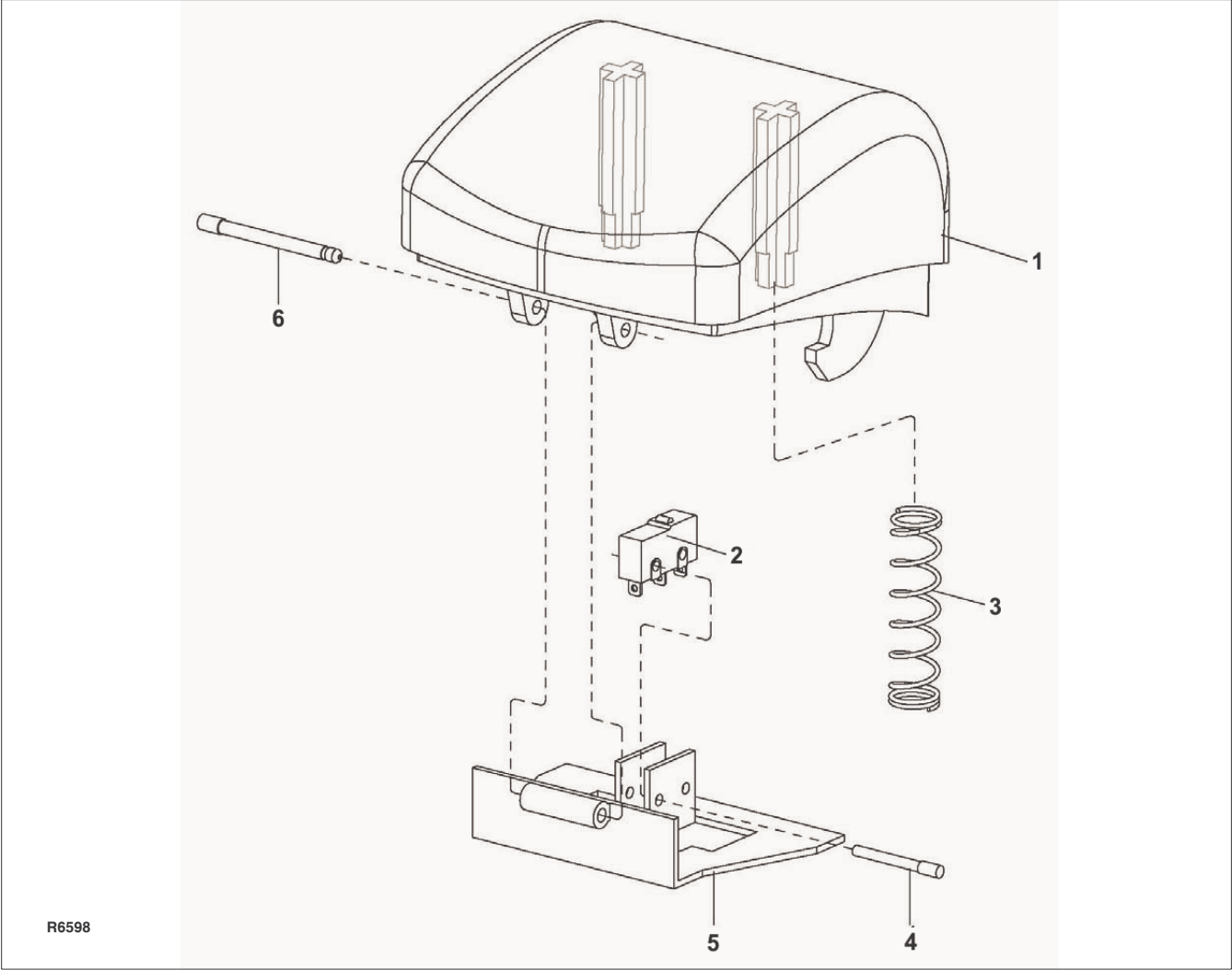


Figure 12-7 Emergency Reverse Switch Assembly

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-343000-00	EMERGENCY REVERSE SWITCH ASSY	1
1	1120-343002-00	• EMERGENCY REVERSE BUTTON	1
2	1120-310001-00	• SWITCH	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
3	1120-343003-00	• SPRING	2
4	1120-342005-00	• PIN	2
5	1120-343001-00	• BRACKET	1
6	1120-343004-00	• PIN	1

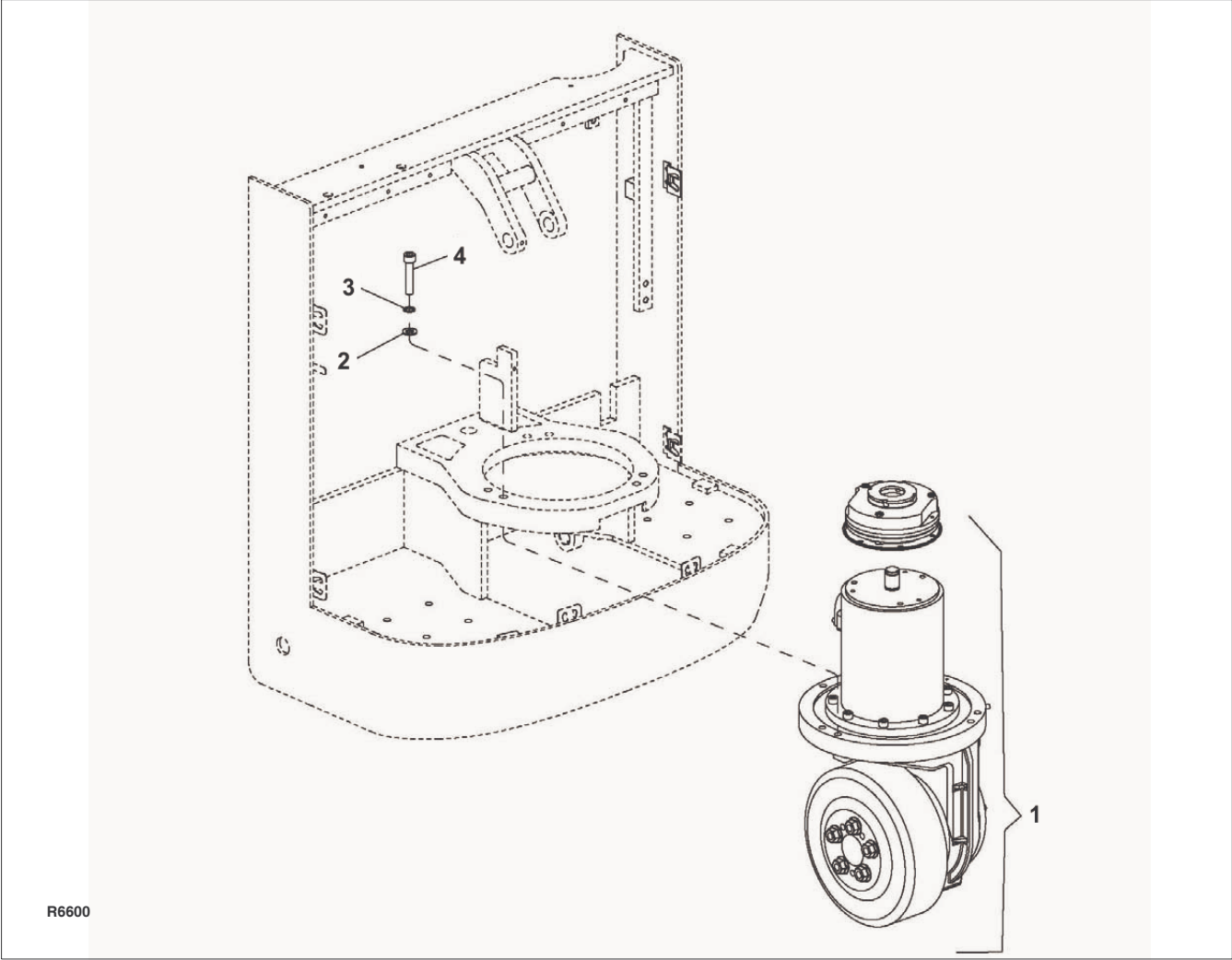
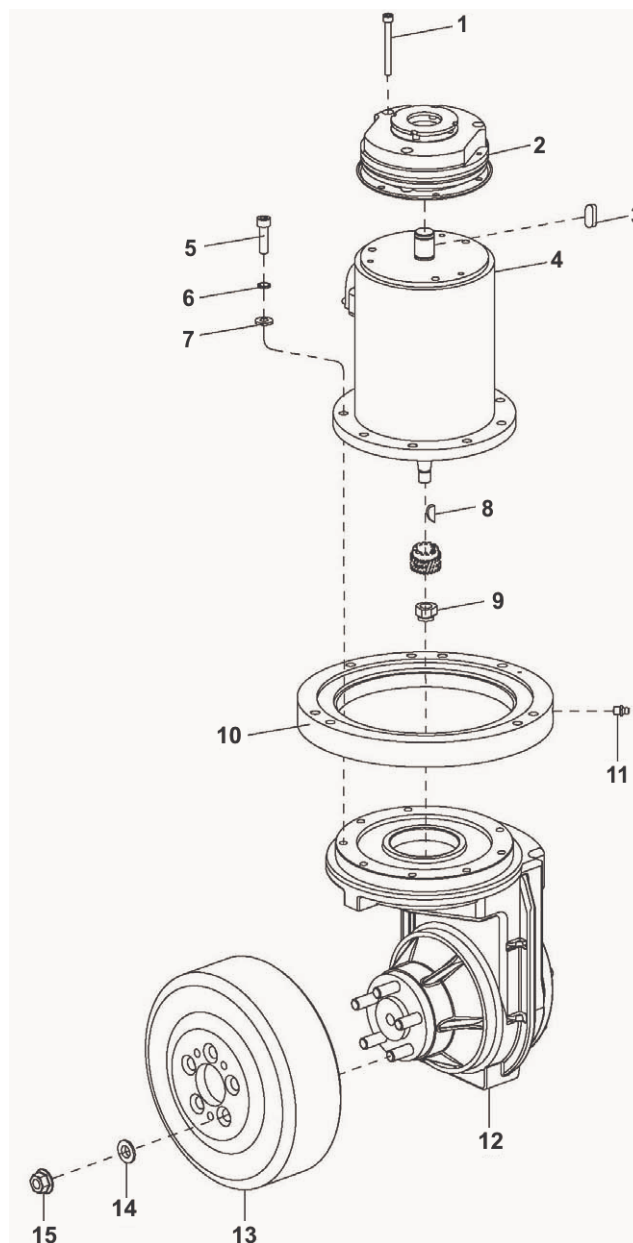


Figure 12-8 Transmission, Motor, Brake Mounting

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	TRANSMISSION, MOTOR, BRAKE ASSEMBLY (FIGURE 12-9)	REF

INDEX NO.	PART NO.	PART NAME	NO. REQD.
2	0000-000071-00	FLAT WASHER	6
3	0000-000063-00	WASHER	6
4	0000-000205-00	SCREW	6



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Figure 12-9 Transmission, Motor, Brake Assembly

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-200000-00	TRANSMISSION, MOTOR, BRAKE ASSEMBLY	1
1	0000-000027-00	• SCREW	3
2	1120-210000-00	• BRAKE	1
3	0000-000202-00	• FLAT KEY	1
4	1120-220000-00	• DRIVE MOTOR	1
5	0000-000323-00	• SCREW	8
6	0000-000159-00	• WASHER	8
7	0000-000194-00	• FLAT WASHER	8

INDEX NO.	PART NO.	PART NAME	NO. REQD.
8	0000-000204-00	• KEY	1
9	0000-000203-00	• NUT	1
10	1120-230000-00	• BEARING	1
11	0000-000013-00	• GREASE FITTING	1
12	—	• TRANSMISSION (FIGURE 12-10)	REF
13	1120-200001-00	• DRIVE WHEEL	1
14	0000-000025-00	• WASHER	5
15	0000-000157-00	• NUT	5

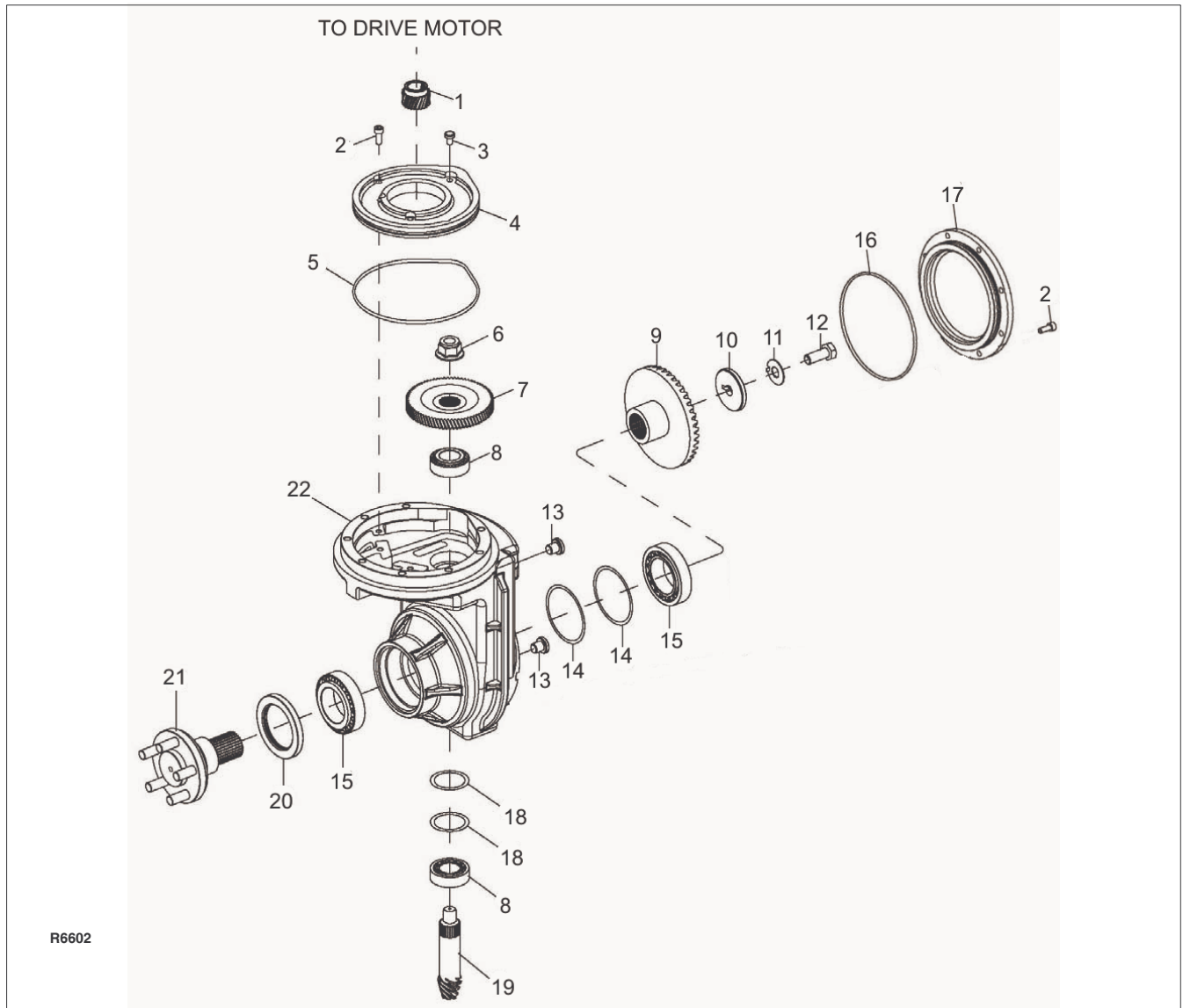
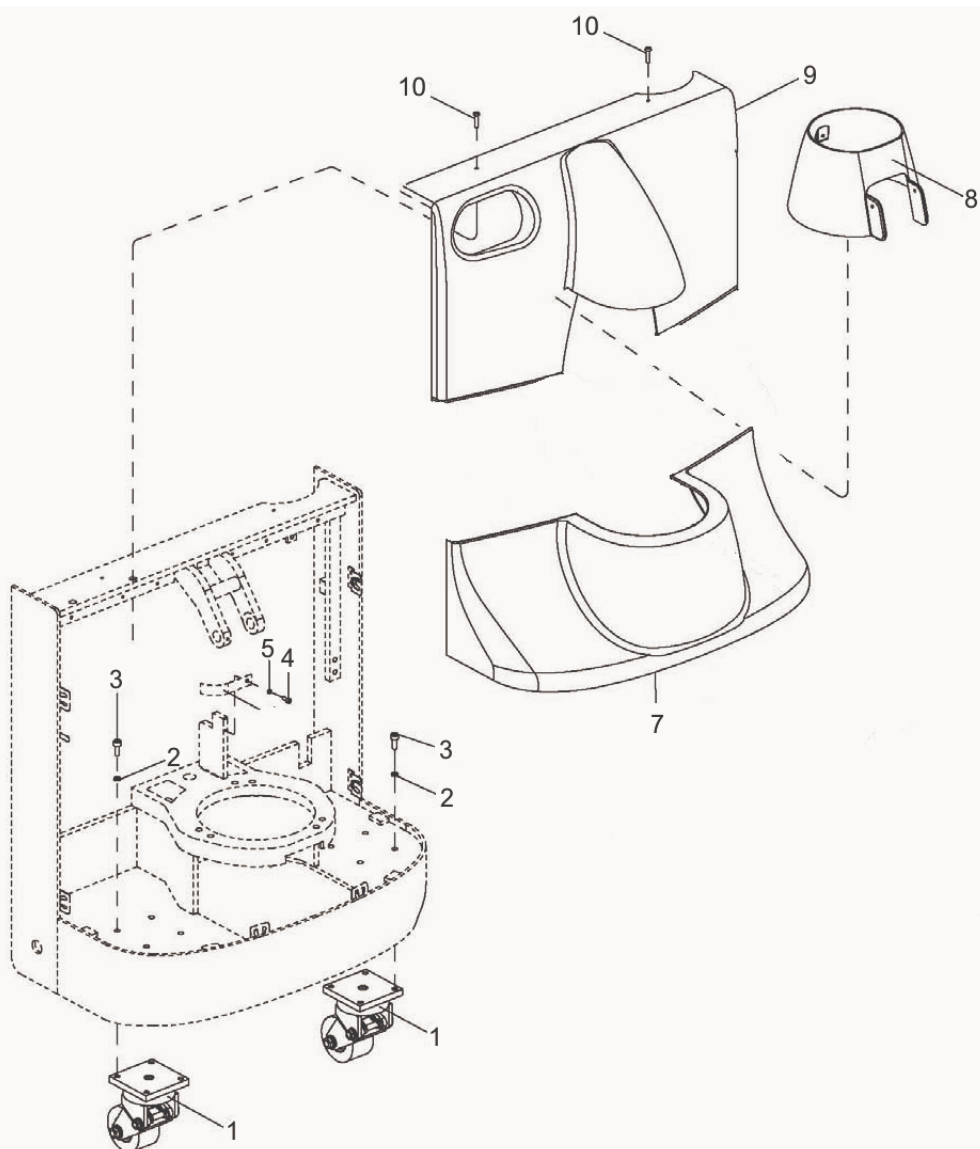


Figure 12-10 Transmission, Motor Brake Assembly

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-240000-00	TRANSMISSION	1
1	1120-240014-00	• GEAR	1
2	0000-000079-00	• SCREW	12
3	1120-240013-00	• BREATHER	1
4	1120-240001-00	• TOP COVER	1
5	0000-000211-00	• O-RING	1
6	0000-000212-00	• NUT	1
7	1120-240002-00	• GEAR	1
8	0000-000213-00	• BEARING	2
9	1120-240003-00	• GEAR	1
10	1120-240004-00	• WASHER	1
11	1120-240005-00	• WASHER	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
12	0000-000147-00	• BOLT	1
13	1120-240006-00	• BOLT	2
14	1120-240007-00	• WASHER	2
15	0000-000148-00	• BEARING	2
16	0000-000214-00	• O-RING	1
17	1120-240008-00	• SIDE COVER	1
18	1120-240009-00	• WASHER	2
19	1120-240010-00	• GEAR	1
20	0000-000215-00	• SEAL WASHER	1
21	1120-240011-00	• SPLINE SHAFT	1
22	1120-240012-00	• HOUSING	1



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Figure 12-11 Compartment

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	CASTER WHEEL (OPTIONAL) (FIGURE 12-12)	REF
2	0000-000002-00	WASHER	8
3	0000-000321-00	SCREW	8
4	0000-000004-00	SCREW	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
5	0000-000005-00	WASHER	1
6	1120-100001-00	SPRING PLATE	1
7	1120-150003-00	LOWER COVER	1
8	1120-150002-00	MIDDLE COVER	1
9	1120-150001-00	UPPER COVER	1
10	0000-000170-00	SCREW	2

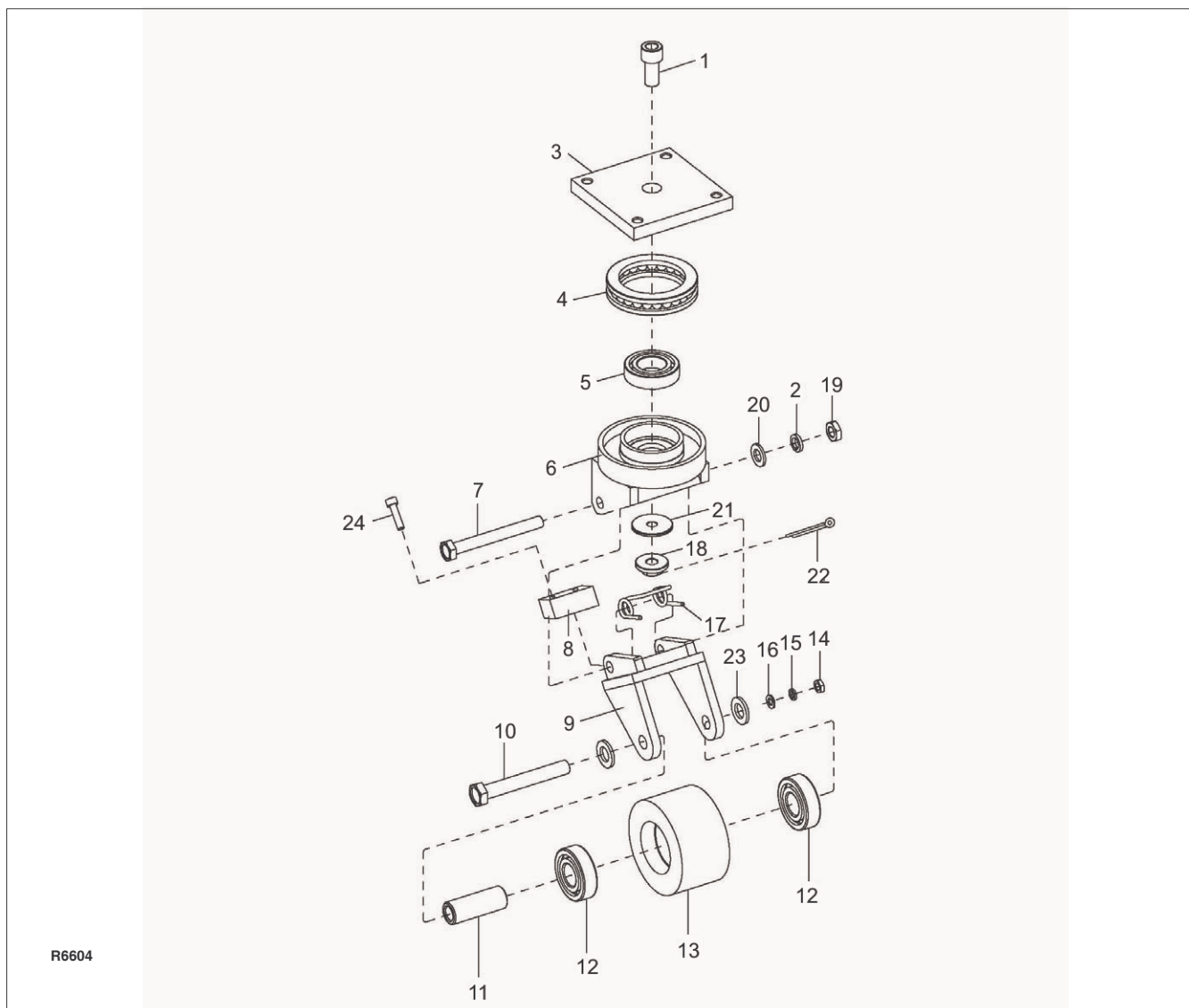
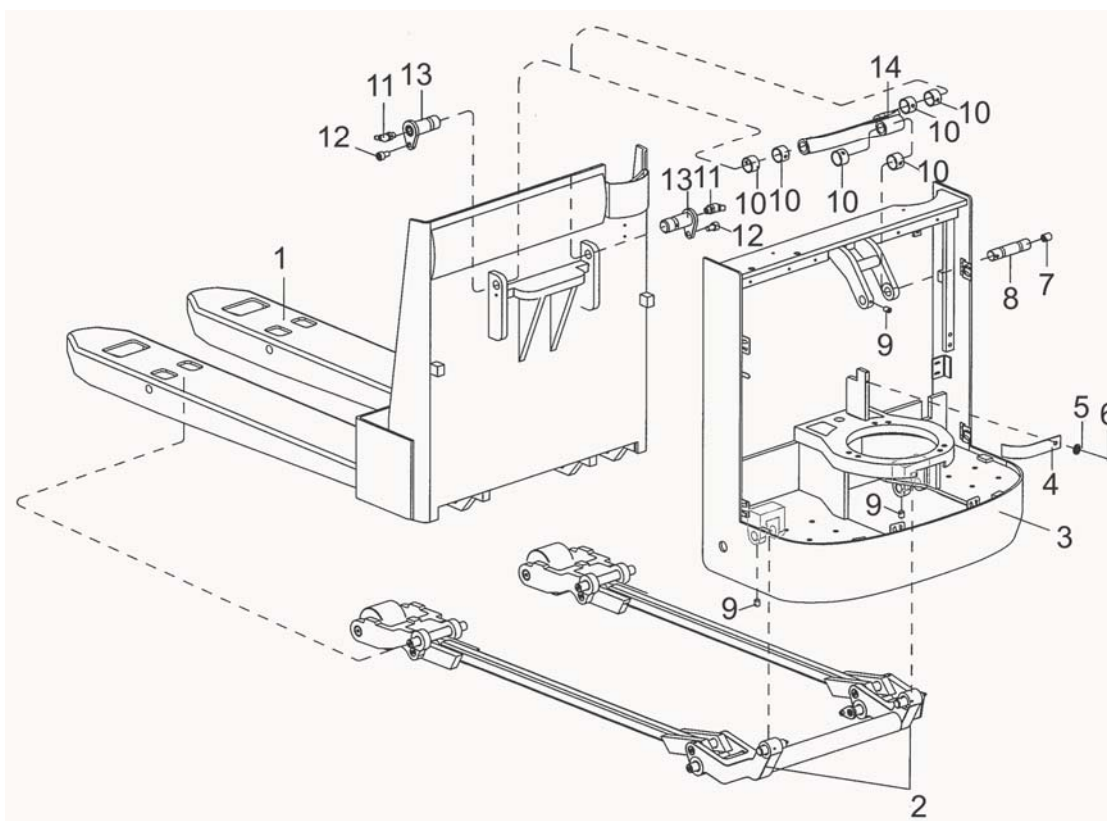


Figure 12-12 Caster Wheel (Optional)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-140000-00	CASTER WHEEL	2
1	1120-140002-00	• SCREW	1
2	0000-000023-00	• WASHER	1
3	1120-140001-00	• HOUSING	1
4	0000-000164-00	• BEARING	1
5	0000-000130-00	• BEARING	1
6	1120-141000-00	• WHEEL HOUSING	1
7	0000-000168-00	• SCREW	1
8	1120-140003-00	• BUMPER	1
9	1120-142000-00	• WHEEL BRACKET	1
10	0000-000167-00	• SCREW	1
11	1120-143001-00	• SHAFT	1
12	0000-000020-00	• BEARING	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
13	1120-143003-00	• WHEEL	1
14	0000-000165-00	• NUT	1
15	0000-000199-00	• WASHER	1
16	0000-000222-00	• FLAT WASHER	1
17	1120-140004-00	• SPRING	1
18	0000-000174-00	• NUT	1
19	0000-000054-00	• NUT	1
20	0000-000071-00	• FLAT WASHER	1
21	0000-000175-00	• FLAT WASHER	1
22	0000-000296-00	• RETAINER PIN	1
23	0000-000172-00	• FLAT WASHER	2
24	0000-000004-00	• SCREW	1



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Figure 12-13 Frame

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	FORK FRAME (FIGURE 12-23)	REF
2	—	LIFT LINK ASSEMBLY (FIGURE 12-14)	REF
3	1120-120000-00	FRAME	1
4	1120-100001-00	SPRING PLATE	1
5	0000-000005-00	WASHER	1
6	0000-000004-00	SCREW	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
7	0000-000012-00	GREASE FITTING	1
8	1120-130002-00	SHAFT	1
9	0000-000016-00	SCREW	3
10	0000-000011-00	BUSHING	6
11	0000-000014-00	GREASE FITTING	2
12	0000-000015-00	SCREW	2
13	1120-134000-00	SHAFT	2
14	1120-130001-00	UPPER LINK	1

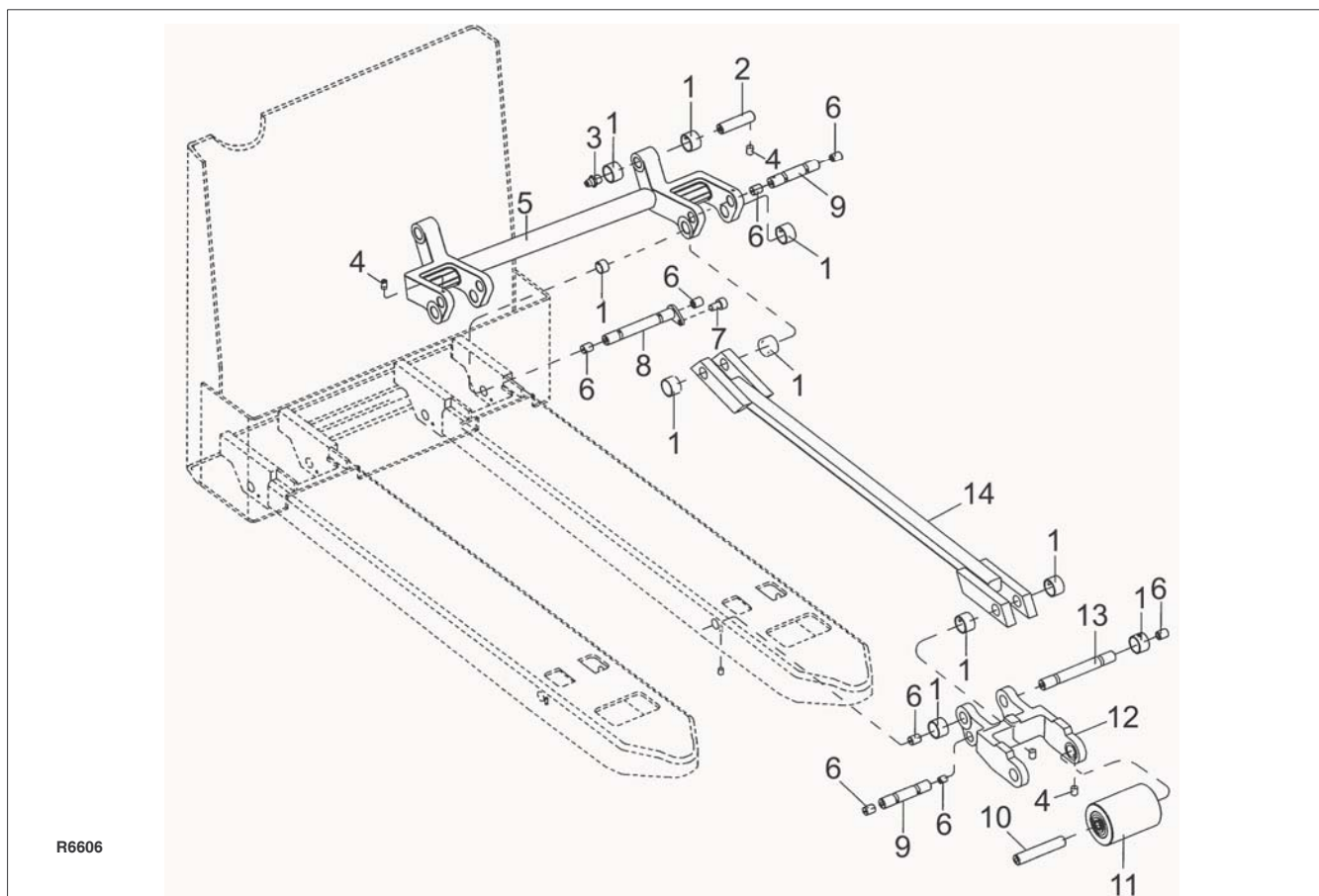
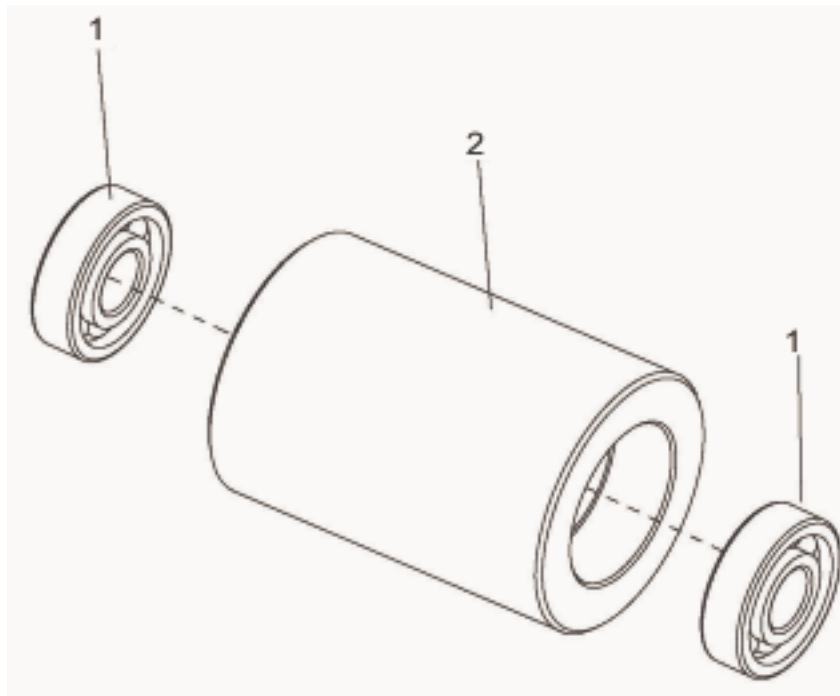


Figure 12-14 Lift Link Assembly

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-130000-10	LIFT LINK ASSEMBLY	1
1	0000-000011-00	• BUSHING	20
2	1120-130004-00	• SHAFT	2
3	0000-000013-00	• GREASE FITTING	2
4	0000-000016-00	• SCREW	6
5	1220-133000-10	• LOWER LINK	1
6	0000-000012-00	• BUSHING	16
7	0000-000015-00	• SCREW	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
8	1120-131000-00	• SHAFT	2
9	1120-130006-00	• SHAFT	4
10	1120-130010-10	• SHAFT	2
11	—	• LOAD WHEEL (FIGURE 12-15)	REF
12	1120-130008-00	• WHEEL BRACKET	2
13	1120-130007-00	• SHAFT	2
14	1120-132000-1A	• TENSION BAR	2

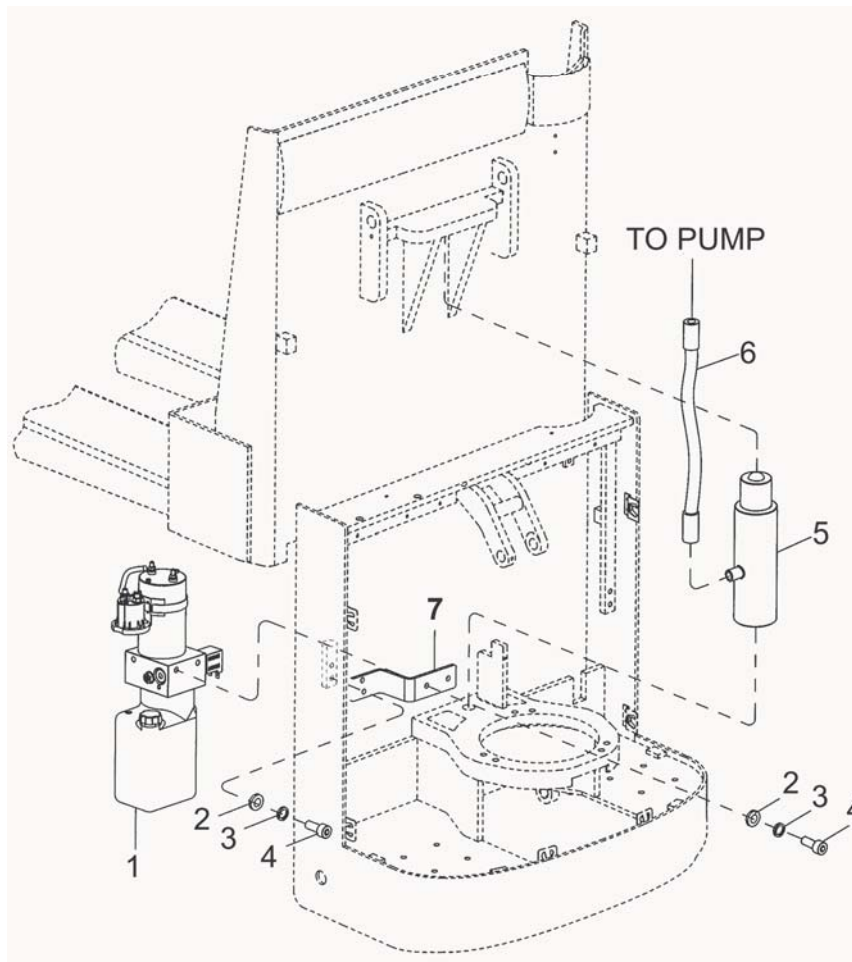


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Figure 12-15 Load Wheel

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-133000-10	LOAD WHEEL	2
1	0000-000100-00	• BEARING	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
4	1120-133003-10	• LOAD WHEEL	1



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Figure 12-16 Hydraulic System

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	PUMP & MOTOR ASSY (FIGURE 12-17)	REF
2	0000-000176-00	WASHER, LOCK	4
3	0000-000002-00	WASHER	4

INDEX NO.	PART NO.	PART NAME	NO. REQD.
4	0000-000321-00	SCREW	4
5	—	CYLINDER (FIGURE 12-18)	REF
6	1120-400001-00	HOSE	1
7	1120-400002-00	BRACKET	1

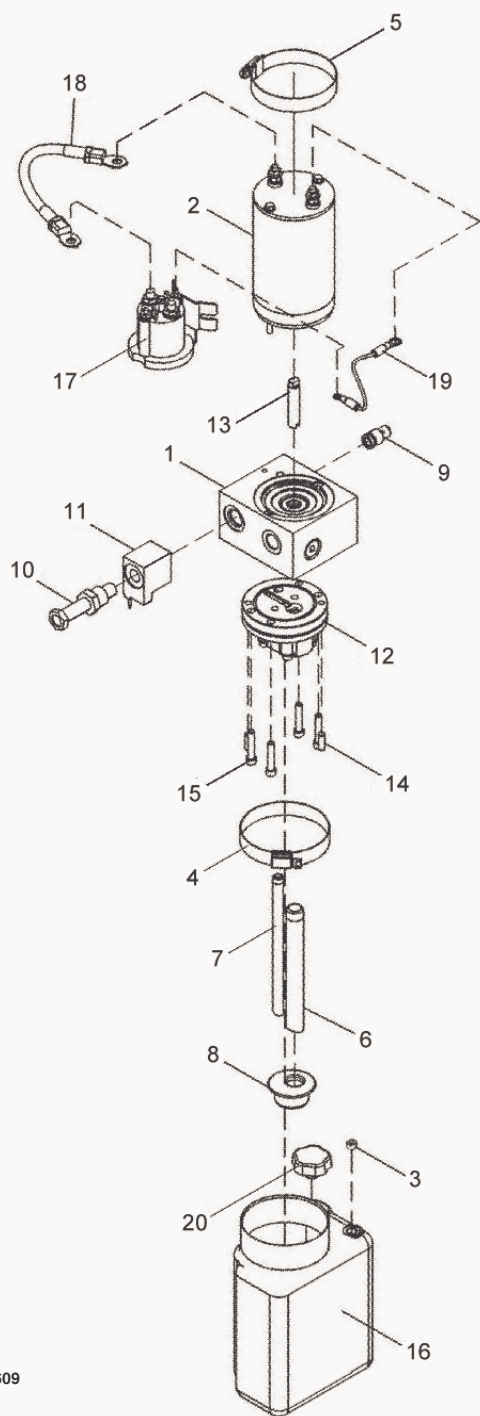


Figure 12-17 Pump & Motor Assy

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-420000-00	PUMP & MOTOR ASSY	1
1	1120-420001-00	• VALVE ASSEMBLY	1
2	1120-420002-00	• MOTOR	1
3	1120-420003-00	• PLUG	1
4	1120-420004-00	• CLAMP	1
5	1120-420005-00	• CLAMP	1
6	1120-420006-00	• TUBE	1
7	1120-420007-00	• TUBE	1
8	1120-420008-00	• FILTER	1
9	1120-420009-00	• RELIEF VALVE	1
10	1120-420010-00	• CARTRIDGE	1
11	1120-420011-00	• SOLENOID VALVE LOWERING	1
12	1120-420012-00	• PUMP	1
13	1120-420013-00	• SHAFT	1
14	1120-420014-00	• PIN	2
15	1120-420015-00	• SCREW	4
16	1120-420016-00	• RESERVOIR	1
17	1120-420017-00	• CONTACTOR	1
18	1120-420018-00	• CABLE	1
19	1120-420019-00	• WIRE ASSEMBLY	1
20	1120-420020-00	• PLUG	1

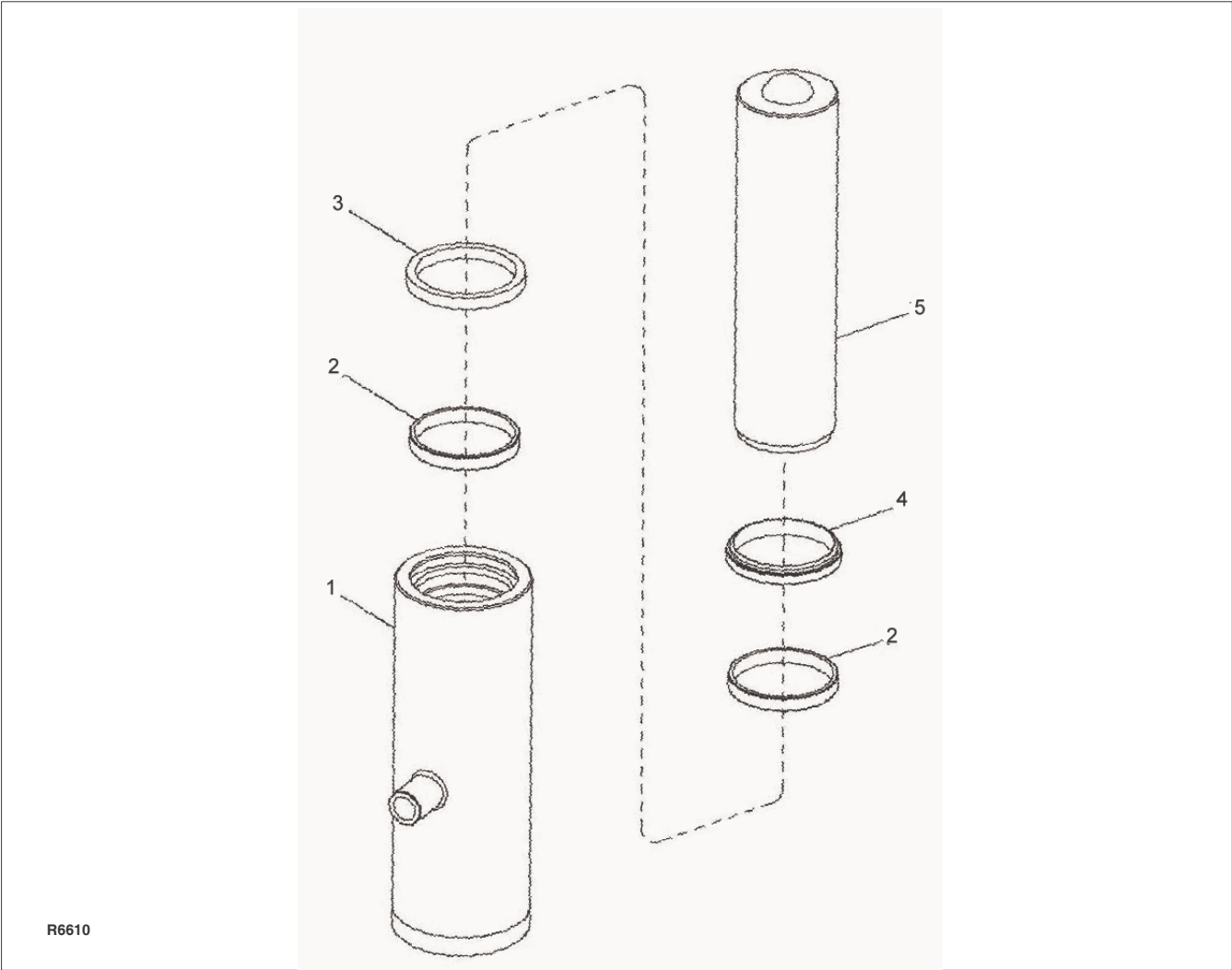
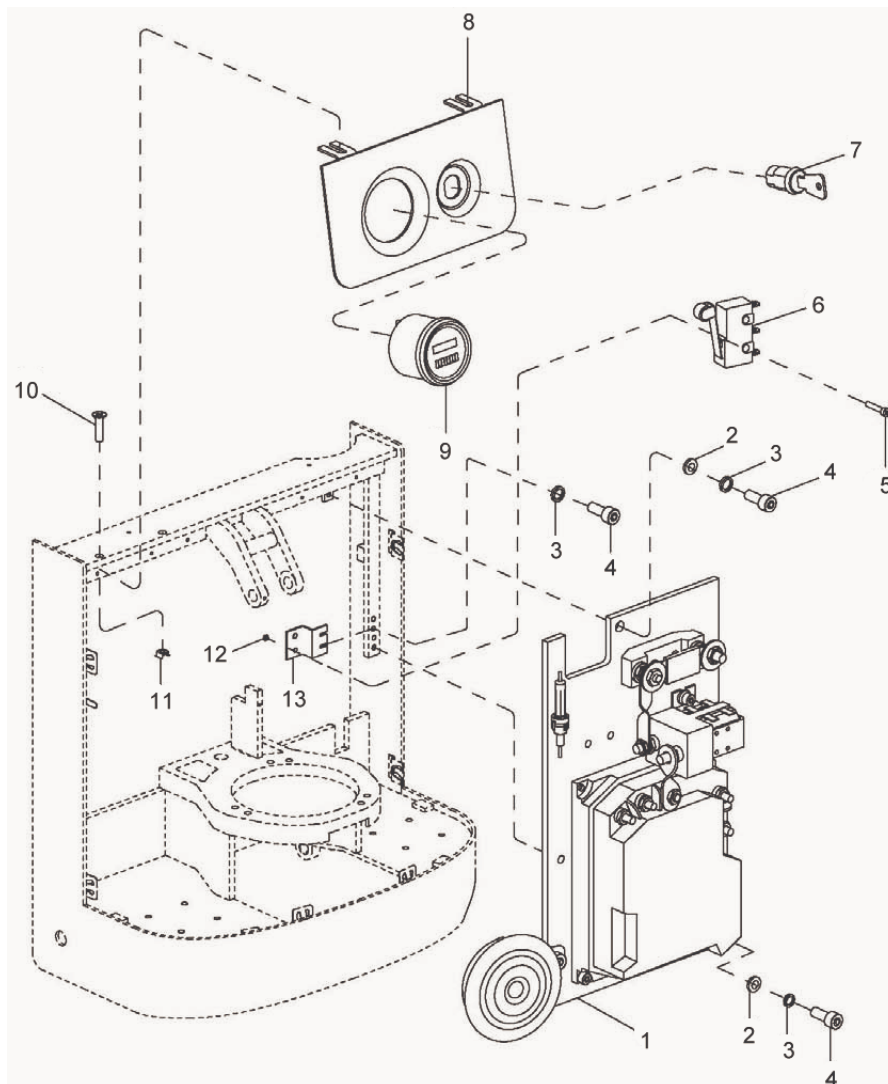


Figure 12-18 Lift Cylinder

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-410000-00	LIFT CYLINDER	1
1	1120-411000-00	• CYLINDER TUBE	1
2	1120-410002-00	• GUIDE RING	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
3	0000-000046-00	• SEAL RING	1
4	0000-000045-00	• WIPER RING	1
5	1120-410001-00	• PISTON ROD	1



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Figure 12-19 Electrical System

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	ELECTRICAL PANEL (FIGURE 12-20)	1
2	0000-000194-00	FLAT WASHER	2
3	0000-000159-00	WASHER	4
4	0000-000321-00	SCREW	4
5	0000-000208-00	SCREW	2
6	1120-500006-00	SWITCH, LIFTING LIMIT	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
7	1120-500011-00	KEY SWITCH	1
—	1120-500016-00	• KEY	1
8	1120-500002-00	BRACKET	1
9	1120-500007-00	BATTERY INDICATOR	1
10	0000-000074-00	SCREW	2
11	1120-500013-00	NUT	2
12	0000-000209-00	NUT	2
13	1120-500008-00	MOUNTING PLATE	1

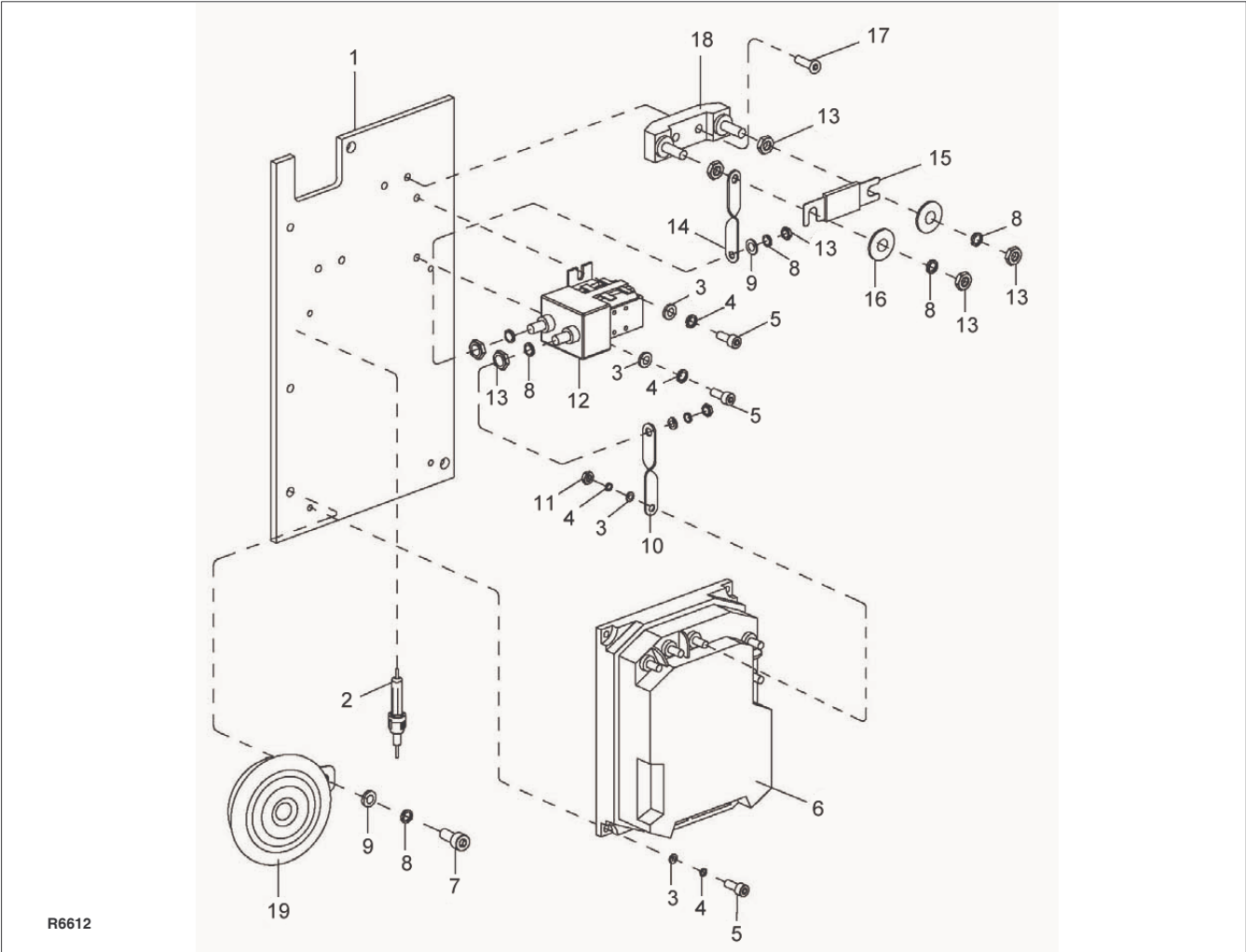
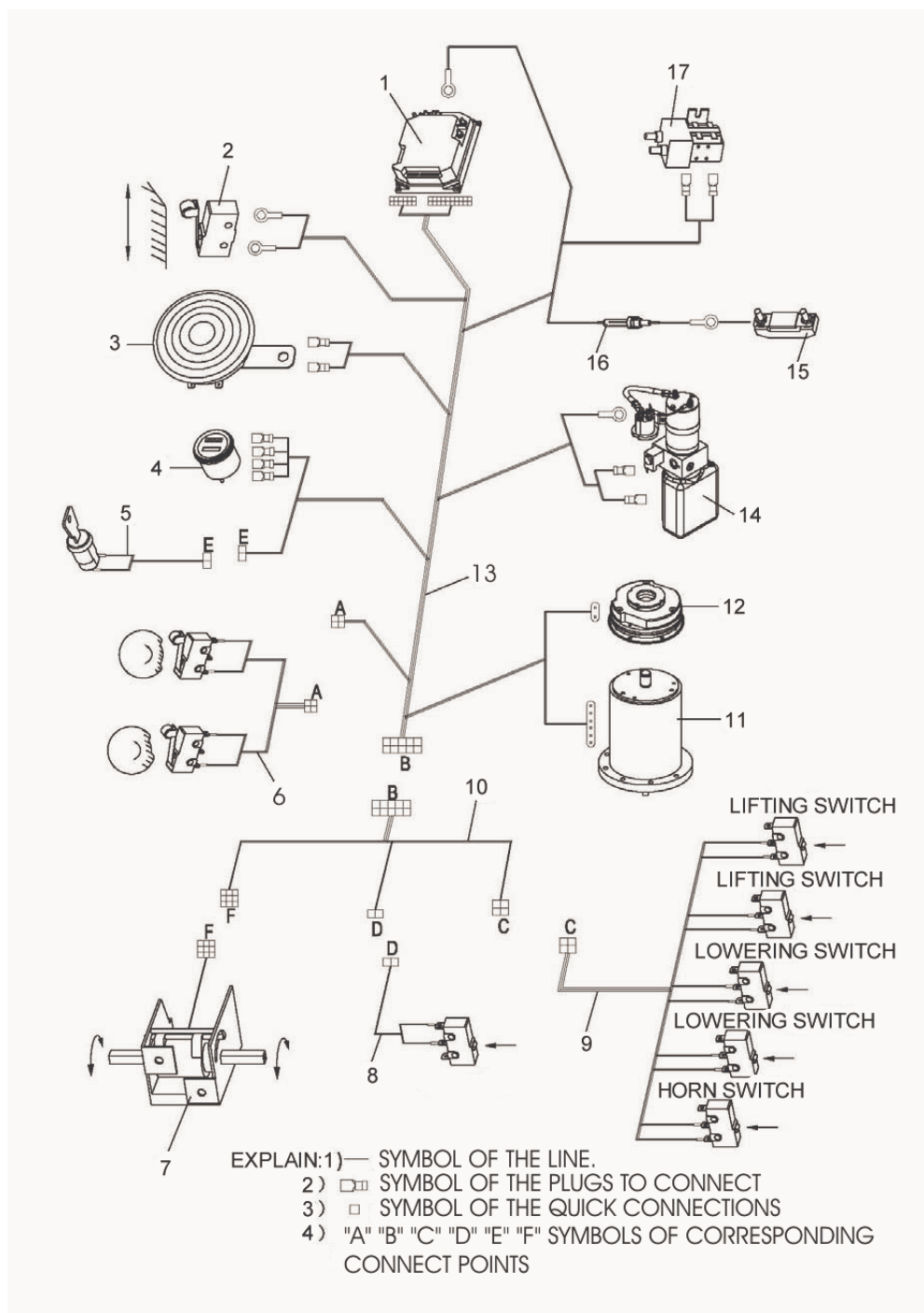


Figure 12-20 Electrical Panel

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	—	ELECTRICAL PANEL	1
1	1120-500001-00	• BOARD	1
2	1120-500010-00	• FUSE (15A)	1
3	0000-000123-00	• FLAT WASHER	7
4	0000-000056-00	• WASHER	7
5	0000-000015-00	• SCREW	6
6	1120-500004-00	• CONTROLLER	1
7	0000-000321-00	• SCREW	1
8	0000-000159-00	• WASHER	7
9	0000-000194-00	• FLAT WASHER	3

INDEX NO.	PART NO.	PART NAME	NO. REQD.
10	1120-530007-00	• BUSS BAR	1
11	0000-000166-00	• NUT	5
12	1120-500005-00	• CONTACTOR	1
13	0000-000196-00	• NUT	8
14	1120-530006-00	• BUSS BAR	1
15	1120-540002-00	• FUSE	2
16	0000-000210-00	• FLAT WASHER	2
17	0000-000074-00	• SCREW	2
18	1120-540001-00	• STAND (200A)	1
19	1120-500003-00	• HORN	1

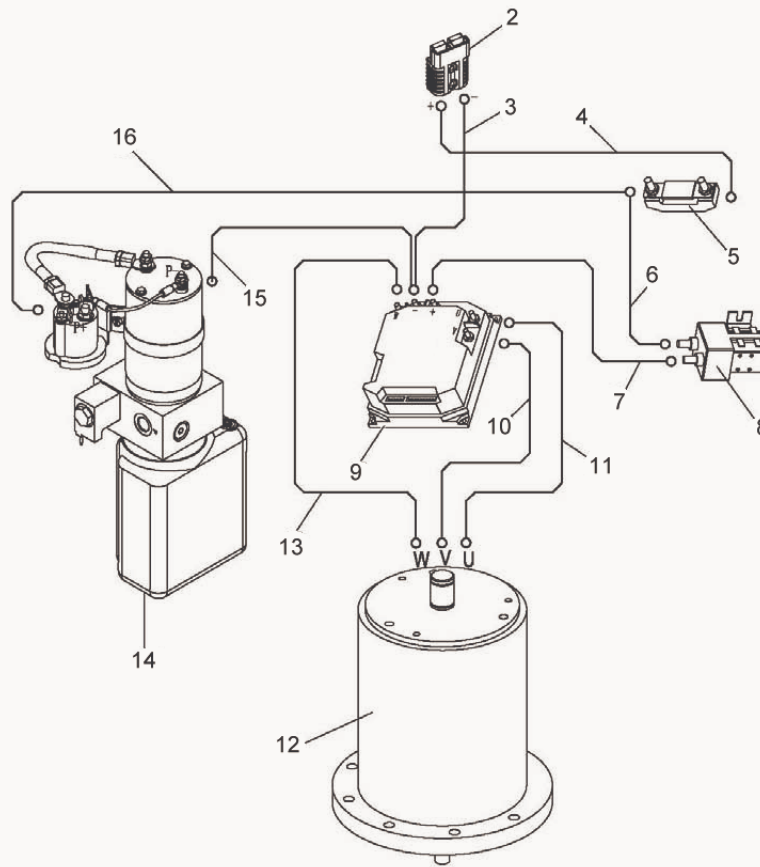


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Figure 12-21 Wiring Harness

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	CONTROLLER (FIGURE 12-20)	REF
2	—	SWITCH (FIGURE 12-19)	REF
3	—	HORN (FIGURE 12-20)	REF
4	—	BATTERY INDICATOR (FIGURE 12-19)	REF
5	1120-520002-00	WIRING HARNESS, KEY SWITCH	1
6	1120-520003-00	WIRING HARNESS, DEADMAN SWITCH	1
7	—	POTENTIOMETER (FIGURE 12-3)	REF
8	1120-520005-00	WIRING HARNESS, EMER- GENCY REVERSE SWITCH	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	1120-520006-00	WIRING HARNESS, SWITCH	1
10	1120-520004-00	WIRING HARNESS, CON- TROL HEAD	1
11	—	DRIVE MOTOR (FIGURE 12-9)	REF
12	—	BRAKE (FIGURE 12-9)	REF
13	1120-520001-00	WIRING HARNESS, MAIN	1
14	—	PUMP (FIGURE 12-17)	REF
15	1120-540000-00	FUSE ASSEMBLY	1
16	—	FUSE (FIGURE 12-20)	REF
17	—	CONTACTOR (FIGURE 12-20)	REF



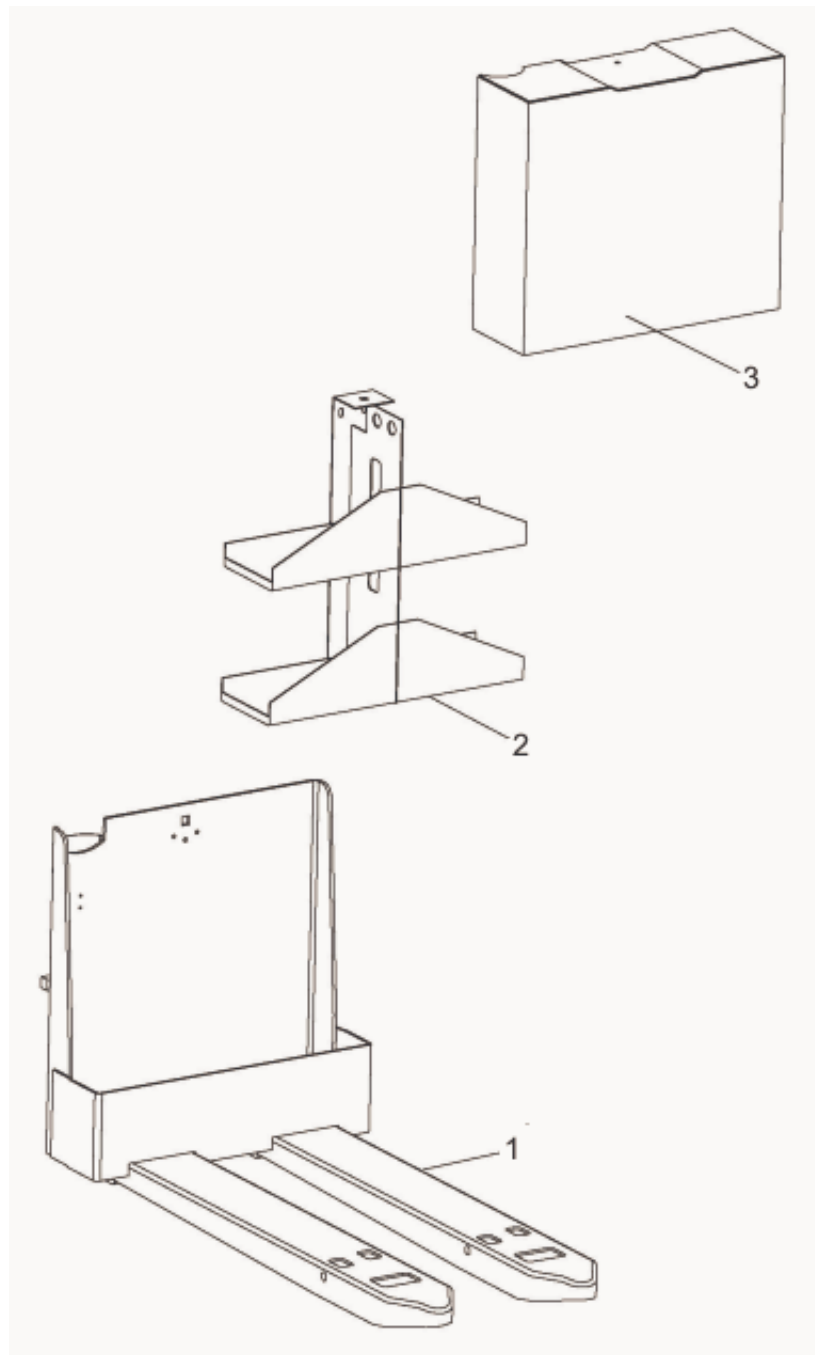
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EXPLAIN: 1) — SYMBOL OF THE CABLE
2) ○ SYMBOL OF THE JOINTS CONNECTING PARTS

Figure 12-22 Wiring Cables

INDEX NO.	PART NO.	PART NAME	NO. REQD.
2	1120-500009-00	CONNECTOR BATTERY GRAY	1
3	1120-530002-00	POWER CABLE -	1
4	1120-530001-00	POWER CABLE +	1
5	—	FUSE ASSEMBLY (15 & 18, FIGURE 12-20)	REF
6	—	BUSS BAR (14, FIGURE 12-20)	REF
7	—	BUSS BAR (10, FIGURE 12-20)	REF
8	—	CONTACTOR (FIGURE 12-20)	REF

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	—	CONTROLLER (FIGURE 12-20)	REF
10	1120-530003-00	MOTOR CABLE V	1
11	1120-530004-00	MOTOR CABLE U	1
12	—	DRIVE MOTOR (FIGURE 12-9)	REF
13	1120-530005-00	MOTOR CABLE W	1
14	—	PUMP (FIGURE 12-17)	REF
15	1120-530008-00	PUMP POWER CABLE -	1
16	1120-530009-00	PUMP POWER CABLE +	1



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Figure 12-23 Battery Compartment

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	1145-110000-00	FORK FRAME	1
2	1145-511000-00	BATTERY FRAME	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
3	1145-512000-00	BATTERY COVER	1

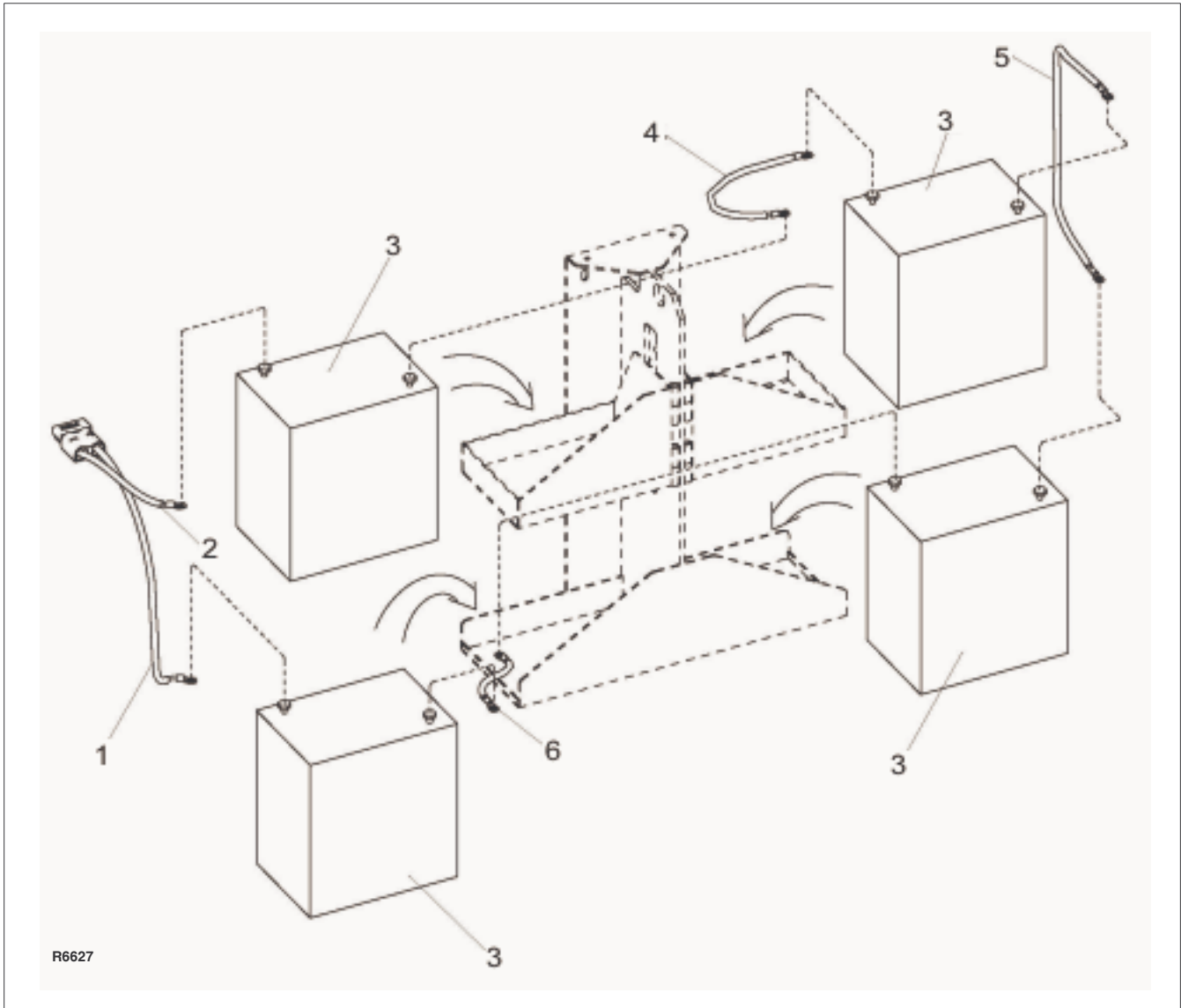


Figure 12-24 Batteries

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	1145-530001-00	POWER CABLE +	REF
2	1145-530002-00	POWER CABLE -	REF
3	1145-530006-00	BATTERY	4

INDEX NO.	PART NO.	PART NAME	NO. REQD.
4	1145-530003-00	CABLE I	1
5	1145-530004-00	CABLE II	1
6	1145-530005-00	CABLE III	1



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