

# OWNER'S MANUAL

## BGL-33 WALKIE COUNTERBALANCED STACKER



### WARNING

Do not 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.

**BLUE GIANT**<sup>®</sup>

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## WARNING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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 CB33 lift truck manufactured by Big Lift LLC. Included are operating instructions, planned maintenance instructions, lubrication procedures, corrective maintenance procedures and a complete parts list with part location illustrations.

Users shall comply with all requirements indicated in applicable OSHA standards and current edition of A.N.S.I. B56.1 Part II. By following these requirements and the recommendations contained in this manual, you will receive many years of dependable service from your CB33 lift truck.

### 1-2. GENERAL DESCRIPTION.

The self-propelled CB33 truck, [Figure 1-2](#), lifts and transports payloads up to 3300 pounds on adjustable forks.

The forward and reverse motion is controlled by either of two thumb controlled levers mounted on the control head. Stopping and turning is controlled by the control arm. Lift, Lower and Tilt are 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 CB33 lift truck can be driven with forks raised or lowered; however, the speed is restricted when the platform is raised above a preset limit.

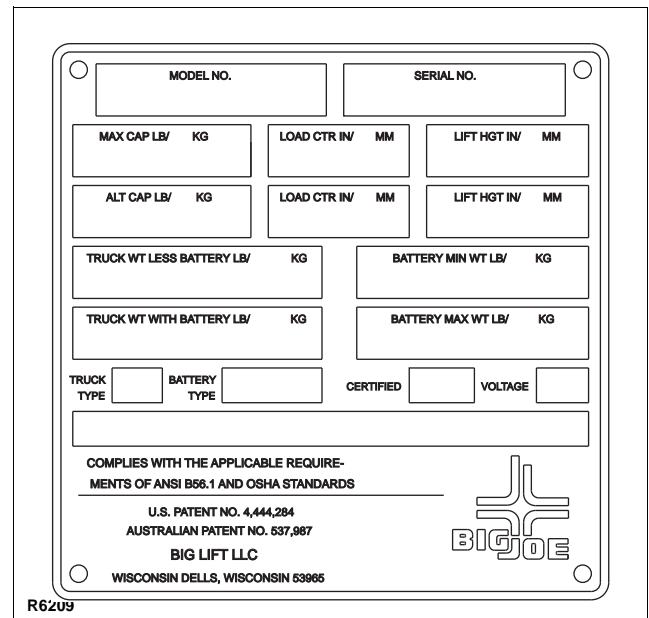
On demand power steering makes the lift truck highly maneuverable.

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.

### 1-3. SAFETY FEATURES.

The CB33 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 control arm is released.



**Figure 1-1 Name Plate**

- Belly-button switch to reverse truck should the operator accidentally pin himself against a wall or obstruction when backing up in slow speed.
- High speed limit switch to restrict speed when lift carriage is raised above the preset limit.
- 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.
- Lift carriage backrest to help stabilize the load.
- 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.

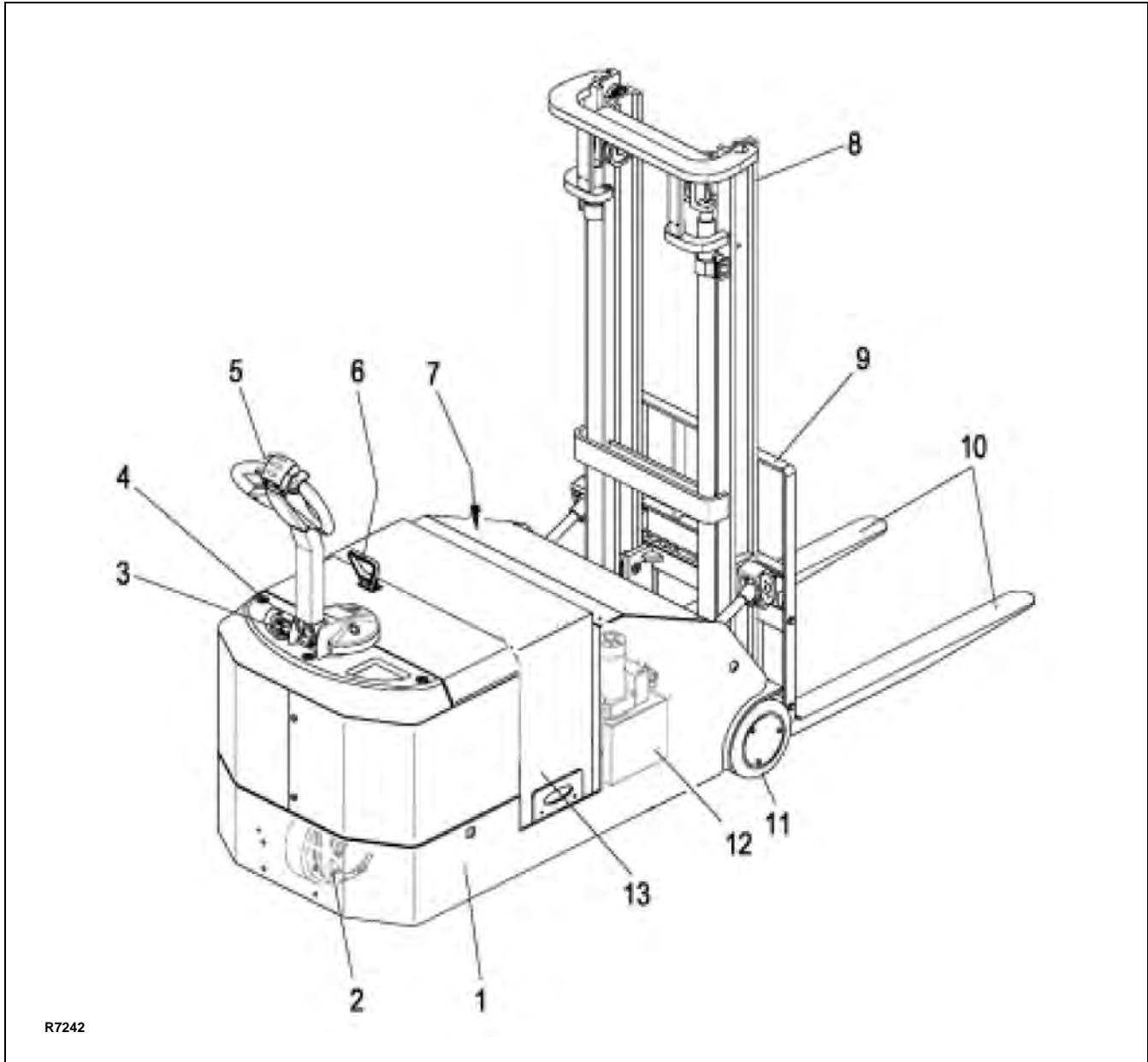


Figure 1-2. CB33 Lift Truck

ITEM	COMPONENT
1	Chassis
2	Drive wheel
3	Battery Discharge Indicator
4	Key Switch
5	Control Handle
6	Battery Disconnect
7	Controller

ITEM	COMPONENT
8	Mast
9	Back Rest
10	Forks
11	Load Wheel
12	Hydraulic pump
13	Battery

## SECTION 2 OPERATION

### 2-1. GENERAL.

This section gives detailed operating instructions for the CB33 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 CB33 lift truck.

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

- Do not operate this truck unless you have been trained and authorized to do so.
- All warnings and instructions must be read and understood before using the equipment.
- Equipment must not be altered in any way.
- Equipment must be inspected by a qualified person on a regular basis.
- Do not exceed the rated capacity. Overloading may result in damage to the hydraulic system and structural components.
- Be certain that the lifting mechanism is operating smoothly throughout its entire height, both empty and loaded.
- Be sure that mast is vertical - do not operate on a slope.
- Be sure the truck has a firm and level footing.
- Avoid overhead wires and obstructions.
- Check for obstructions when raising or lowering the lift carriage.
- Do not handle unstable or loosely stacked loads. Use special care when handling long, high, or wide loads to avoid tipping, loss of load, or striking bystanders.
- Center and carry the load as far back as possible toward the lift carriage back rest. The center-of-gravity of the load must not exceed the load center listed on the nameplate. See [Figure 2-1](#) for load center limitations.
- Pick up loads on both forks. Do not pick up on only one fork.
- When traveling, always lower the load as far as possible.

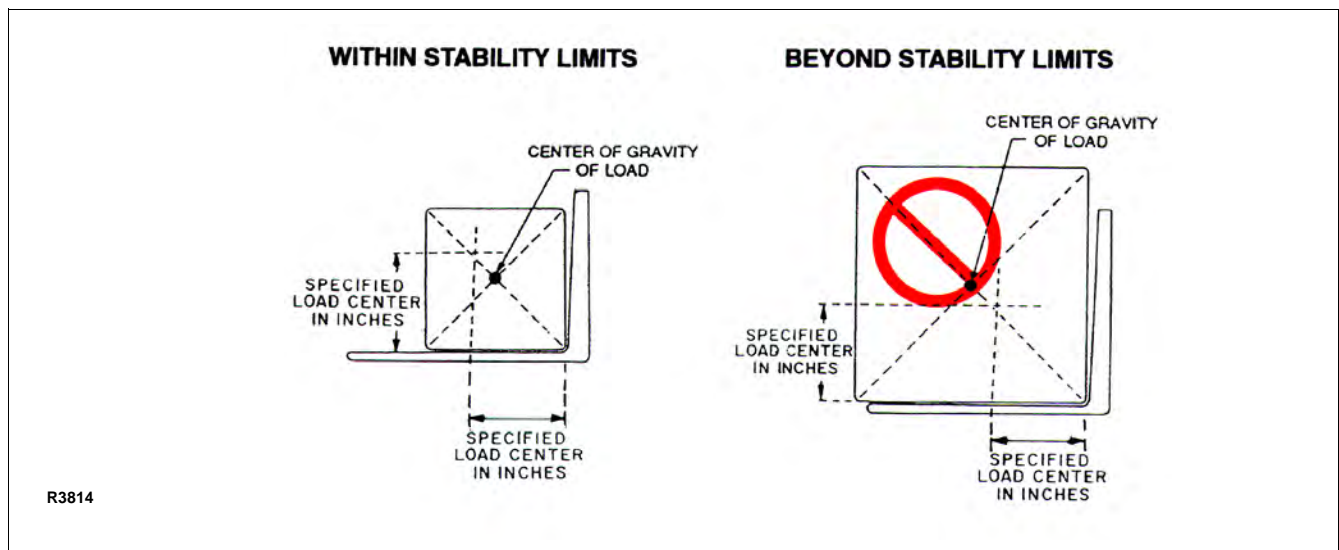


Figure 2-1 Load Center

- When stacking pallets in racks and it is necessary to move the load in a raised position, use caution. Operate truck smoothly.
- Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.
- Operate truck only from designated operation position. Never place any part of your body between the mast uprights. Do not carry passengers.
- Do not allow anyone to stand or pass under load or lifting mechanism.
- When leaving truck, neutralize travel control. Fully lower lifting mechanism and set brake. When leaving truck unattended, turn off key switch, remove key and disconnect battery.

### 2-3. BEFORE OPERATION

Table 2-1 covers important inspection points on the CB33 lift truck which should be checked prior to operation. Depending on use, some trucks may require additional checks.

**Table 2-1 Operator Checks**

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

Figure 2-2 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.

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, lower and tilt to their maximum positions.
Brakes	Check that brakes actuate when control arm is raised to upright position, and when lowered to horizontal position.
Deadman/ Parking brake	Check that control 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.
High speed limit switch	Allow for enough space to operate truck in high speed. Elevate forks approximately two feet, then test drive truck to check if high speed is cut out.





## 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 2-2 Sample of Operator Check List**

## 2-4. GENERAL CONTROL OPERATION.

### 2-4.1. Control Arm

The control arm is used to steer and to control speed and braking of the truck.

**Slow Speed:** Move the control arm down to the slow speed range and move the travel lever to forward or reverse. See [Figure 2-3](#). Press the travel lever farther to increase speed available in the slow speed range.

**High Speed:** Move the control arm down to the high speed range and move the travel lever to forward or reverse. See [Figure 2-3](#). Press the travel lever farther to increase speed available in the high speed range.

**Braking:** Move the control arm to the lower braking range or release it to the upper braking range. See [Figure 2-3](#).

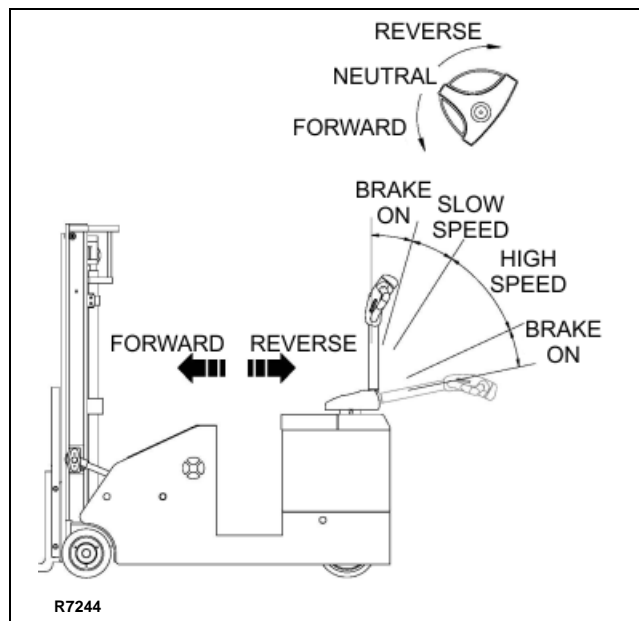


Figure 2-3 Control Arm

### 2-4.2. Control Head

**Lift:** Pushbutton switch (1, [Figure 2-4](#)) activates lower and pushbutton switch (2) activates lift.

**Tilt:** Pushbutton switch (6) activates tilt back, and pushbutton switch (7) activates tilt forward.

**Horn:** Pushbutton switch (4) activates the horn.

**Belly-button:** Switch (5) minimizes the possibility of the driver being pinned by the control 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.

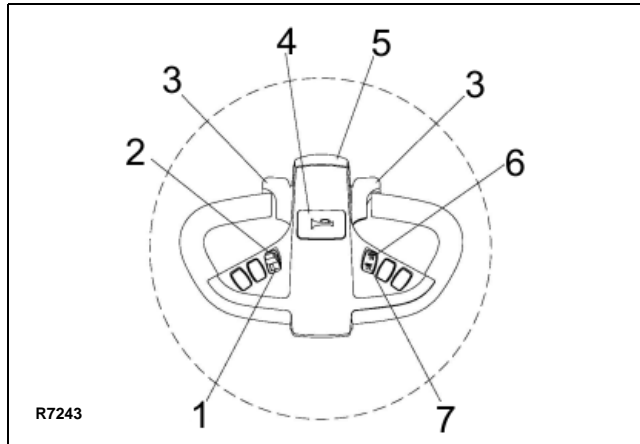


Figure 2-4 Control Head

## 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 control 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 de-energize. See [Figure 2-3](#).
3. To move forward (with load in front), slowly press the travel control (3, [Figure 2-4](#)) forward. Press the travel speed control farther to increase speed.
4. To slow down or stop, release the travel control and lower or raise the control arm to the horizontal or vertical position. See [Figure 2-3](#). 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 travel control (3, [Figure 2-4](#)) to reverse.

### 2-5.1. Stopping

The brake pattern of the truck depends on the ground conditions. The driver must take this into account when operating the truck.

The driver must be looking ahead when traveling. If there is no hazard, brake moderately to avoid moving the load.

There are four different ways to stop the truck:

1. **Plugging:** This electrical braking function consists of rotating the travel control (3, [Figure 2-4](#)) in the opposite direction of travel and then releasing it when the truck stops. Plugging is a convenient

way to slow down the truck during normal operation. If the control is not released, the truck will accelerate in the opposite direction.

2. **Control arm (See Figure 2-3):** The brake is fully applied by lowering or raising the control arm. All traction control power is shut off when the brake is engaged. When the control arm is in the upright position, the brake acts as a parking brake. Dead-man braking occurs when the handle is released and spring action raises control arm to the upright position.
3. **Regenerative braking:** If the travel control (3, Figure 2-4) is released, the truck automatically brakes regeneratively.

#### **2-6. CONTROL ARM GAS SPRING.**

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

#### **2-7. 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. Tilt the forks to level the load.
5. Drive to area where load is to be placed.
6. Move truck to align load with its new position.
7. Lower the load and tilt until it rests squarely in place and the forks are free.
8. Slowly move the truck out from under the load.

#### **2-8. 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 Lift LLC Service Representative.

### 3-3. BATTERY CARE.

#### 3-3.1. General

The CB33 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 electrical 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.
Monthly	Check lift chain tension, lubrication & operation (see paragraph <a href="#">3-6</a> .)
Quarterly	Check lift and tilt cylinders for leakage.
Quarterly	Check for excessive jerking of control arm when stopping or starting.
Semi-annually	Inspect for chain wear (See <a href="#">SECTION 8</a> )

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 the cells 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 an 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.



**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.

**3-6. LIFT CHAIN MAINTENANCE.**

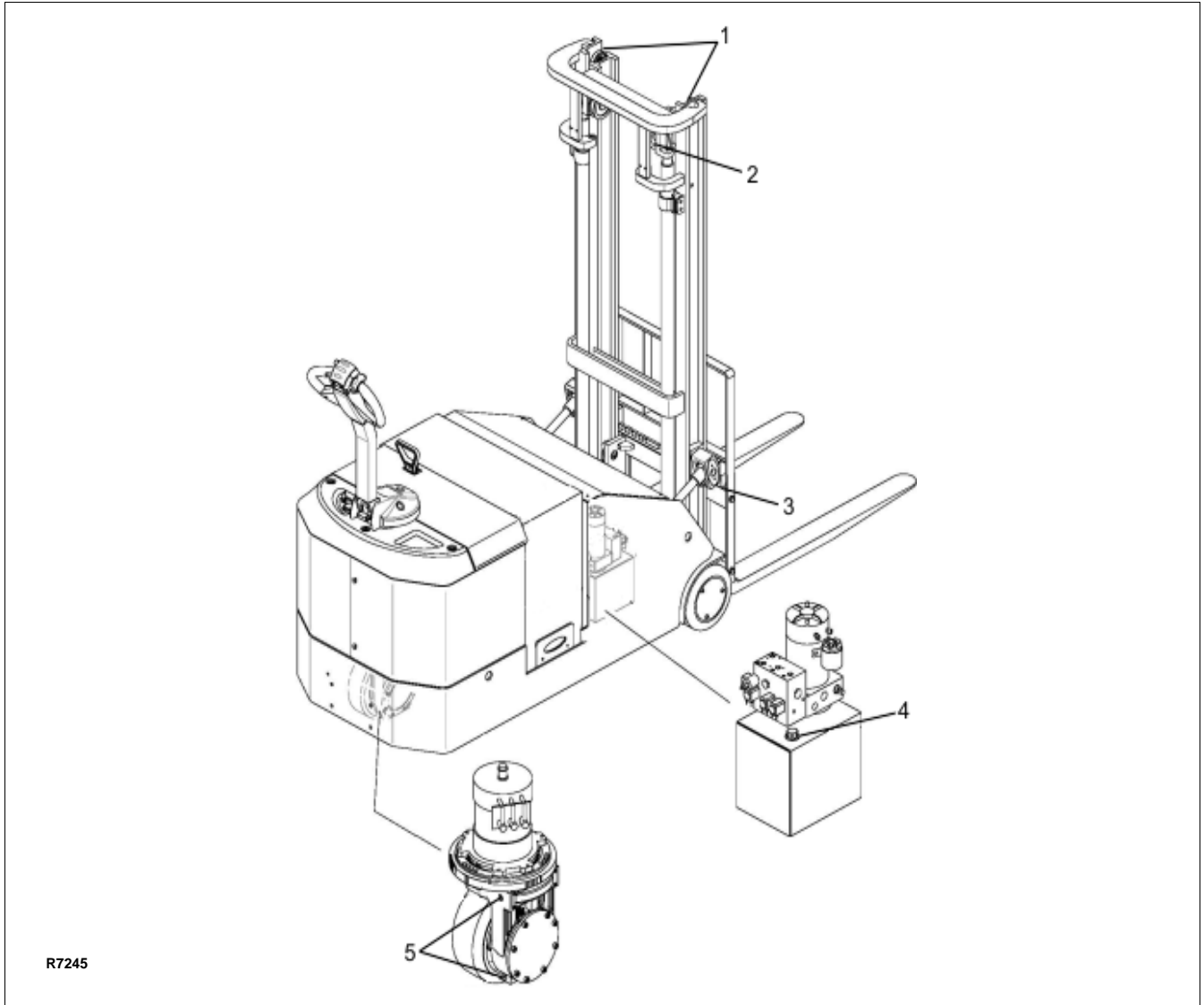
Fully raise and lower lift carriage while observing chains as they move over chain sheaves. Ensure chain is aligned and tracking properly and all links are pivoting freely. With lift carriage fully lowered, spray or brush on a film of SAE 30 or 40 engine oil.

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

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





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**Figure 3-1 Lubrication Diagram**

**Table 3-3 Lubrication Chart**

<b>FIG 3-1 INDEX NO.</b>	<b>LOCATION</b>	<b>METHOD OF APPLICATION</b>	<b>TYPE (Table 3-3)</b>	<b>APPLICATION OF LUBRICANT</b>
1	Inner & Outer Mast	Brush	No. 2	Full length of channel where rollers operate.
2	Lift Chain	Brush or Spray	No. 4	See Paragraph 3-6.
3	Lift Carriage	Brush	No. 2	Light coating where forks slide
4	Hydraulic Reservoir Capacity-1 quarts	Can	No. 3	With lift carriage fully lowered, fill reservoir with hydraulic oil to 1 inch below opening
5	Transmission Capacity 2 pints	Can	No. 1	Fill to level plug opening

## 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 Oper-

ate: 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
<p><b>TRUCK AND HYDRAULIC SYSTEM WILL NOT OPERATE</b></p> <p>Truck will not travel nor will lift system operate.</p>	<p>a. Fuse (7, <a href="#">Figure 12-23</a>) blown.</p> <p>b. Battery dead or disconnected.</p> <p>c. Keyswitch (5, <a href="#">Figure 12-22</a>) defective.</p> <p>d. Defective wiring.</p>	<p>Check fuse and replace if necessary.</p> <p>Check battery quick-disconnect plug and check battery voltage.</p> <p>Bypass keyswitch to determine if it is malfunctioning.</p> <p>Check for open circuit. Repair as required.</p>
<p><b>TRUCK DOES NOT OPERATE FORWARD OR REVERSE</b></p> <p>Truck does not travel forward or reverse. All other functions operate normally.</p> <p>Truck travels forward but not in reverse.</p> <p>Truck travels reverse but not in forward.</p> <p>Truck travels forward and in reverse at lower speeds; will not travel at high speed.</p>	<p>a. Check all wiring. A loose connection may be the cause of malfunction.</p> <p>b. Defective deadman switch (40, <a href="#">Figure 12-1</a>).</p> <p>c. Defective main contactor (15, <a href="#">Figure 12-23</a>).</p> <p>d. Defective potentiometer (11, <a href="#">Figure 12-2</a>).</p> <p>Defective potentiometer (11, <a href="#">Figure 12-2</a>) in control head.</p> <p>Defective potentiometer (11, <a href="#">Figure 12-2</a>) in control head.</p> <p>Defective potentiometer (11, <a href="#">Figure 12-2</a>) in control head.</p>	<p>Tighten all loose connections before further troubleshooting.</p> <p>Check and replace switch if defective.</p> <p>Check for proper operation and replace if necessary.</p> <p>Check and replace potentiometer if defective.</p> <p>Check and replace potentiometer if defective.</p> <p>Check and replace potentiometer if defective.</p> <p>Check and replace potentiometer if defective.</p>
<p><b>TROUBLE WITH BRAKING</b></p> <p>Truck does not slow with brake, or brake does not engage.</p>	<p>a. Defective deadman switch (40, <a href="#">Figure 12-1</a>).</p> <p>b. Defective electric brake (2, <a href="#">Figure 12-4</a>).</p>	<p>Check deadman switch for continuity. If none found when the control arm is in the brake position, replace switch.</p> <p>Replace brake.</p>

**Table 4-1 Troubleshooting Chart - Continued**

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
<p><b>TROUBLE WITH BRAKING - Continued</b></p> <p>Brake will not release.</p> <p>Brake drags.</p> <p>Brake grabs.</p> <p>Abnormal noise and chatter when brake is applied.</p>	<p>a. Defective electric brake (2, <a href="#">Figure 12-4</a>).</p> <p>b. Brake temperature above 281° F (140° C).</p> <p>c. Open brake circuitry or wiring.</p> <p>Defective electric brake (2, <a href="#">Figure 12-4</a>).</p> <p>Defective electric brake (2, <a href="#">Figure 12-4</a>).</p> <p>Defective electric brake (2, <a href="#">Figure 12-4</a>).</p>	<p>Replace brake.</p> <p>Allow to cool.</p> <p>Make voltage checks.</p> <p>Replace.</p> <p>Replace.</p> <p>Replace.</p>
<p><b>TROUBLE WITH LIFTING OR LOWERING</b></p> <p>Oil sprays or flows from the top of the lift cylinder.</p> <p>Squealing sounds when lifting forks.</p> <p>Forks do not lift to top.</p> <p>Weak, slow or uneven action of hydraulic system.</p> <p>Forks do not lift, pump motor does not run.</p> <p>Forks do not lift, motor runs.</p>	<p>Defective packing in lift cylinder</p> <p>a. Oil level too low.</p> <p>b. Dry channels in mast.</p> <p>c. Defective mast or carriage rollers</p> <p>a. Oil level too low.</p> <p>b. Load larger than capacity.</p> <p>a. Defective pump or relief valve.</p> <p>b. Worn lift cylinder.</p> <p>c. Load larger than capacity.</p> <p>d. Defective lift motor solenoid.</p> <p>e. Battery charge low.</p> <p>a. Battery is dead or disconnected.</p> <p>b. Defective wiring.</p> <p>c. Defect in electrical system for operating pump motor.</p> <p>Defect in hydraulic system.</p>	<p>Repair lift cylinder.</p> <p>Identify oil leak.</p> <p>Apply grease.</p> <p>Replace rollers</p> <p>Add oil to reservoir.</p> <p>Refer to I.D.plate for capacity.</p> <p>Check pressure. Adjust as necessary.</p> <p>Replace cylinder.</p> <p>Refer to I.D.plate for capacity.</p> <p>Replace coil (2, <a href="#">Figure 12-21</a>).</p> <p>Charge battery.</p> <p>Check and recharge if required.</p> <p>Check and repair as required.</p> <p>Check lift switch in control head, as well as the coil (2, <a href="#">Figure 12-21</a>).</p> <p>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.</p>

**Table 4-1 Troubleshooting Chart - Continued**

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
<p><b>TROUBLE WITH LIFTING OR LOWERING - Continued</b></p> <p>Forks lift, but will not go down.</p> <p>Load will not hold</p>	<p>Defect in hydraulic system</p> <p>a. Oil bypassing internally in control valve</p> <p>b. Worn lift cylinder.</p>	<p>Check lowering control switch in control head, &amp; lowering solenoid (4, <a href="#">Figure 12-21</a>). Replace as required.</p> <p>Replace pump &amp; motor assembly (<a href="#">Figure 12-21</a>).</p> <p>Replace cylinder.</p>
<p>Forks does not lift to top. Pump motor runs.</p> <p>Forks creep downward under load when in a raised position.</p> <p>Truck moves forward when arm is pulled down.</p> <p>Control arm jerks excessively starting or stopping the truck.</p> <p>Drive motor is jerky.</p>	<p>a. Oil level too low.</p> <p>b. Load larger than capacity.</p> <p>c. Batteries need charging.</p> <p>Leak in hydraulic system, lift cylinder or lowering valve.</p> <p>a. Belly-button switch defective.</p> <p>b. Short in control head.</p> <p>Drive wheel worn.</p> <p>Motor internally damaged or worn.</p>	<p>Add oil to reservoir.</p> <p>Refer to nameplate on side of mast for maximum load capacity.</p> <p>Charge batteries.</p> <p>Check for leaking fitting in hydraulic line and repair as required. Repack lift cylinder or replace or pump &amp; motor assembly (<a href="#">Figure 12-21</a>).</p> <p>Check for short, and repair or replace as necessary.</p> <p>Check wiring and repair as required.</p> <p>Replace drive wheel if worn to within 3/8 inch of hub.</p> <p>Replace motor.</p>
<p><b>TRUPOUBLE WITH STEERING</b></p>	<p>a. Faulty fuse.</p> <p>b. Check all wiring. A loose connection may be the cause of malfunction.</p> <p>c. Defective potentiometer (33, <a href="#">Figure 12-1</a>).</p> <p>d. Defective controller (9, <a href="#">Figure 12-23</a>).</p> <p>d. Defective steering motor (16, <a href="#">Figure 12-4</a>).</p>	<p>Test fuses.</p> <p>Tighten all loose connections before further troubleshooting.</p> <p>Check and replace potentiometer if defective.</p> <p>Check operation and replace if necessary.</p> <p>Check wiring and repair as required.</p>

### 4-1.1. CONTROLLER TROUBLESHOOTING

The controllers provide diagnostics information to assist technicians in troubleshooting problems. Refer to [Table 4-2](#) for the traction controller error messages. Refer to [Table 4-3](#) for the steering controller error messages.

### 4-1.2. 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 Lift LLC dealer. If you require dealer location information, contact Big Lift LLC.

Remove the rubber plug from the CNC connector of the controller and plug in the Zapi Handset connector.

### 4-1.3. Fault Detection.

#### 4-1.3.1. 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 times that each alarm occurs consecutively
- The Hour Meter 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.

#### 4-1.3.2. Logbook Access

To view the alarm logbook proceed as follows:

1. Connect the Zapi Handset, refer to paragraph [4-1.2](#).
2. Press the ROLL down button (1, [Figure 4-1](#)) 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. When finished, press the OUT button (6). The display will ask: "ARE YOU SURE?". Press ENTER BUTTON (3) for yes, or OUT for NO.
6. Press the OUT button (6) to exit the ALARMS display.

NOTE: Refer to [bigjoesupport.com](http://bigjoesupport.com) for the Zapi supplement containing detailed information on alarm codes. There are two versions shown. The CB33 uses the Standard version which lists the error by: Alarm Name, Repetitions, Temperature and Hour Meter reading.

### 4-1.4. Testing Truck Operation.

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

1. Connect the Zapi Handset, refer to paragraph [4-1.2](#).
2. Press the ROLL down button (1, [Figure 4-1](#)) 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.

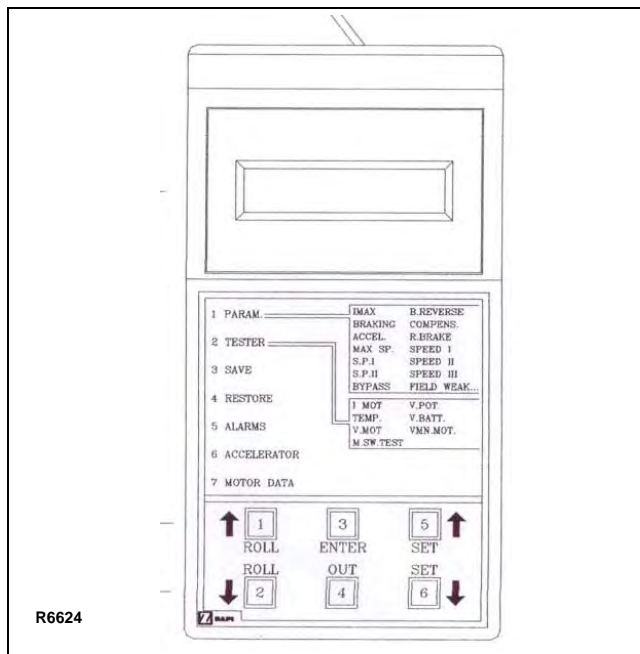


Figure 4-1 Zapi Handset

## **4-1.5. Settings and Adjustments**

### **4-1.5.1. Set Options**

To set options proceed as follows:

1. Connect the Zapi Handset, refer to paragraph 4-1.2.
2. Press the ROLL up button (1, [Figure 4-1](#)) 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.

### **4-1.5.2. Adjustments**

To change an adjustment proceed as follows:

1. Connect the Zapi Handset, refer to paragraph 4-1.2.
2. Press the ROLL up button (1, [Figure 4-1](#)) 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.

### **4-1.5.3. Parameter Change**

To change a parameter proceed as follows:

1. Connect the Zapi Handset, refer to paragraph 4-1.2.
2. Press the ROLL down button (1, [Figure 4-1](#)) 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.

**Table 4-2 TRACTION CONTROLLER**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
99	SLIP PROFILE	This is an error on the choice of the parameters of the slip profile.	Check the value of the parameters in the hardware setting menu.
80	FORW+BACK	This alarm occurs when both the travel (Fwd and Bwd) are active at the same time.	Check the wiring of the Fwd and Rev travel demand inputs (use the readings in the TESTER to facilitate the troubleshooting). Check the microswitches for failures. A failure in the logic is possible too. So, when you have verified the travel demand switches and wiring are correct, it is necessary to replace the controller.
79	INCORRECT START	This is a warning for an incorrect starting sequence.	The possible reasons for this alarm are (use the readings in the TESTER to facilitate the troubleshooting): <ul style="list-style-type: none"> <li>• A travel demand was active at key-on.</li> <li>• Presence man sensor was active at key-on.</li> </ul> Check the wiring. Check the micro-switches. It could also be an error sequence made by the operator. A failure in the logic is possible too; so when all of the above are checked and nothing was found, replace the controller.
78	VACC NOT OK	The test is made at key-on and after 20 sec that both the travel demands have been turned off. This alarm occurs if the ACCELERATOR reading in the TESTER menu is 1.0V higher than PROGRAM VACC min acquisition when the accelerator is released.	Check the mechanical calibration and the functionality of the potentiometer.
62	HIGH TEMPERATURE	This alarm occurs when the temperature of the base plate is higher than 85°. Then the maximum current decreases proportionally with the temperature increases from 85° to 105°. At 105° the Current is limited to 0 Amps.	Improve the air cooling of the controller. If the alarm is signalled when the controller is cold, the possible reasons are a thermal sensor failure or a failure in the logic card. In this case, it is necessary to replace the controller.



**Table 4-2 TRACTION CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
65	BATTERY LOW	This occurs when the battery charge is calculated being less than or equal to 10% of the full charge and the BATTERY CHECK setting is other than 0 (refer to SET OPTION menu).	Charge the battery. If charging does not help, using a voltmeter, measure the battery voltage and compare the reading with the value in the BATTERY VOLTAGE parameter. If they are different, adjust the value of the ADJUST BATTERY function.
71	EEPROM KO	This is due to a HW or SW defect of the non-volatile embedded memory supporting the controller parameters. This alarm does not inhibit the machine operations, but the truck will work with the default values.	Try to execute a CLEAR EEPROM operation (refer to CONSOLE manual). Switch the key off and on to check the result. If the alarm occurs permanently, it is necessary to replace the controller. If the alarm disappears, the previously stored parameters will have been replaced by the default parameters. with the temperature increases from 85° to 105°
65	MOTOR TEMPERATURE	This warning occurs when the temperature sensor is opened (If digital) or has overtaken the threshold of 150°C (if analog).	Check the thermal sensor inside the motor (use the MOTOR TEMPERATURE reading in the TESTER menu); check the sensor ohmic value and sensor wiring. If the sensor is OK, improve the air cooling of the motor. If the warning is present when the motor is cool, then the problem is inside the controller.
61	THERMIC SENSOR KO	The output of the controller thermal sensor is out of range.	This type of fault is not related to external components; replace the controller.
	CHECK UP NEEDED	This is just a warning to call for the time programmed maintenance	It is just enough to turn the CHECK UP DONE option to level ON after the maintenance is executed.
	DATA ACQUISITION	Acquisition of the current gains.	The alarm ends when the acquisition is done.

**Table 4-2 TRACTION CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
86	PEDAL WIRE KO	The SW continuously checks for the connection of the two supply ends of the potentiometer in the accelerator. The test consists of reading the voltage drop on a sense diode, connected between NPOT (CNA#30) and GND and cascaded with the potentiometer: if the potentiometer gets disconnected on PPOT (NNA#25) or NPOT, no current flows in the sense diode and the voltage on the NPOT connection collapses down. When the NPOT voltage is less than 0.3V this alarm occurs. This alarm also occurs when the NPOT voltage is higher than 2Vdc (to detect the condition of a broken sense diode).	Check the Voltage on NPOT and the potentiometer connections.
51	TILLER OPEN	Warning: When the tiller is released, after a fixed period of time of standby (30 seconds) the main contactor open.	At the next travel request, the warning will disappear.
92	CURRENT GAIN	The Maximum current gain parameter are at the default values, which means the maximum current adjustment procedure has not been carried out yet.	Ask the assistance of a Zapi technician to do the correct adjustment procedure of the current gain parameters.
68	WAITING FOR NODE	The controller receives from the CAN the message that another controller in the net is in fault condition; as a consequence the ACOE controller itself cannot enter an operative status, but has to WAIT for the other controller coming out from the fault status.	

**Table 4-2 TRACTION CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
98	DEAD MAN ABSENT	This warning (present only in trucks with "Dead Man" switch) appears when the "Dead Man" switch is open.	At the next travel request with dead man switch closed, the warning disappears.
76	VALVE COIL SHORTED	This alarm occurs when there is a short circuit on an on/off valve coil.	<ul style="list-style-type: none"> <li>• If the fault is present at start up, it is very likely that the hw overcurrent protection circuit is damaged, it is necessary to replace the controller.</li> <li>• If the fault is present when the controller drives the outputs, the problem is located in the harness and in the coils.</li> </ul>
74	EV1/5 DRIVER SHORTED	Electrovalve EV1 or EV2 driver is shorted	Check if there is a short or a low impedance between the negative of one of these coils and -BAT. Otherwise the driver circuit is damaged and the controller must be replaced.
74	EV2 DRIVER SHORTED	Electrovalve EV2 driver is shorted	Check if there is a short or a low impedance between the negative of this coil and -BAT. This warning also occurs if the external load is not present and the parameter EV2 in the "Set Options" menu is set "PRESENT", in this case the warning disappears setting the EV2 parameter "ADBSSENT". Otherwise the driver circuit is damaged and the controller must be replaced.
74	EV3 DRIVER SHORTED	Electrovalve EV3 driver is shorted	Check if there is a short or a low impedance between the negative of this coil and -BAT. This warning also occurs if the external load is not present and the parameter EV3 in the "Set Options" menu is set "PRESENT", in this case the warning disappears setting the EV3 parameter "ADBSSENT". Otherwise the driver circuit is damaged and the controller must be replaced.
74	EV4 DRIVER SHORTED	Electrovalve EV4 driver is shorted	Check if there is a short or a low impedance between the negative of this coil and -BAT. This warning also occurs if the external load is not present and the parameter EV4 in the "Set Options" menu is set "PRESENT", in this case the warning disappears setting the EV4 parameter "ADBSSENT". Otherwise the driver circuit is damaged and the controller must be replaced.

**Table 4-2 TRACTION CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
48	EVP DRIVER KO	The EVP valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller.
47	EVP2 DRIVER KO	The EVP2 valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller.
56	PUMP I NO ZERO	In staNdbY condition (pump motor not driven), the feedback coming from the current sensor in the pump chopper gives a value out of a permitted range.	This type of fault is not related to external components; replace the controller.
52	PUMP I=0 EVER	This test is carried out when the pump motor is running, and it verifies that the current feedback sensor is not constantly stuck to 0.	This type of fault is not related to external components; replace the controller.
49	LIFT + LOWER	This alarm occurs when both fork movement requests (Lift + Lower) are active at the same time.	Check the wiring of the lift and lower inputs (use the readings in the TEST to facilitate the troubleshooting). Check the microswitches for failures. A failure in the logic is possible too. So, when you have verified the travel demand switches are working fine and the wiring is right, it is necessary to replace the controller.
75	CONT. DRV. EV1	The EV1 valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller
75	CONT. DRV. EV2	The EV2 valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller
75	CONT. DRV. EV3	The EV3 valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller
75	CONT. DRV. EV4	The EV4 valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller
75	CONT. DRV. EV5	The EV5 valve driver is not able to drive the load (cannot close).	The device or its driving circuit is damaged, replace the controller

**Table 4-2 TRACTION CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
89	PUMP VACC NOT OK	The minimum of the lift potentiometer is not correctly set.	It is suggested to repeat a "PROGRAM VACC" procedure.
67	SENS. MOT. TEMP. KO	<ul style="list-style-type: none"> <li>• The motor temperature sensor is not correctly connected to A22.</li> <li>• The motor temperature sensor is damaged.</li> </ul>	<ul style="list-style-type: none"> <li>- Check the correct connection of the motor temperature sensor.</li> <li>- If the current sensor is correctly connected, replace it.</li> <li>- If the problem persists, replace the controller.</li> </ul>

**Table 4-3 STEERING CONTROLLER**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
6	SERIAL ERR #1	Main uC and slave uC communicate via a local serial interface. This alarm occurs when the slave uC does not receive the communication from the main uC through this serial interface.	It is necessary to replace the controller.
13	EEPROM KO	<p>It occurs if a test to write and read one location in EEPROM fails. The SW expects to read the written value.</p> <p>It also occurs when the hour meter gives different values between the three redundant locations in which it is recorded.</p> <p>It also occurs when the busy bit of the EEPROM does not rise within 12 msec.</p>	It is necessary to replace the controller.
16	LOGIC FAILURE #4	This alarm occurs in the rest state if the output of the voltage amplifier of the phase Vw-Vv have a drift larger than $\pm 0.25$ V.	It is necessary to replace the controller
17	LOGIC FAILURE #3	This alarm occurs in the rest state if the output of the voltage amplifier of the phase Vu-Vw have a drift larger than $\pm 0.25$ V.	It is necessary to replace the controller
18	LOGIC FAILURE #2	This alarm occurs when the real voltage between phases W and V of the motor is different from the desired voltage.	It is necessary to replace the controller

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
19	LOGIC FAILURE #1	This alarm occurs when the real voltage between phases W and U of the motor is different from the desired voltage.	It is necessary to replace the controller.
32	VMN NOT OK	This alarm occurs in the initial rest state after key-on if the inputs of motor voltage amplifiers are not in the window from 2.2 to 2.8 Vdc.	It is necessary to replace the controller.
48	MAIN CONT. OPEN	This alarm occurs only when the setting CAN BUS is PRESENT. Then the EPS-AC0 waits for a via CAN information that the traction controller has closed the main contactor. If this information lacks more than about 1.5 secs, this alarm occurs.	Find, on the traction controller, the reason for keeping the main contactor open.
53	STBY I HIGH	This alarm occurs two ways:  1) In the initial rest state after key-on, if the outputs of the current amplifiers are not comprised in the window 2.2 to 2.8 Vdc.  2) After the initial diagnosis this alarm occurs when the outputs of the current amplifiers at rest have a drift larger than $\pm 0.15V$ .	It is necessary to replace the controller.
61	HIGH TEMPERATURE	This alarm occurs if the temperature of the controller base plate overtakes 75 degrees.	Improve the cooling of the controller; otherwise it is necessary to replace the controller.
65	MOTOR TEMPERAT	This alarm occurs only when DIA MOTOR TEMP is on and the thermal sensor inside the motor measures a temperature higher than 150 degrees. It also occurs when trying to acquire the motor resistance with a temperature in the motor higher than 150 degree (still with DIAG MOTOR TEMP to ON).	Check that the thermal sensor in the motor is working correctly. If it is, improve the cooling of the motor.

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
70	HIGH CURRENT	This alarm occurs if the circuit to limit via hardware the current in the motor is either always active at key-on or repeatedly active when the motor is turning.	Check the motor is suited to work with the EPS-AC0 (not oversized). Otherwise it is necessary to replace the controller.
71	POWER FAILURE #3	This alarm occurs when the current in the phase V of the motor is zero and the motor is commanded for moving.	Check the power fuse is OK. Check the battery positive arrives to the controller. Check the continuity of the wire in the phase V of the motor. Otherwise it is necessary to replace the controller.
72	POWER FAILURE #2	This alarm occurs when the current in the phase U of the motor is zero and the motor is commanded for moving.	Check the power fuse is OK. Check the battery positive arrives to the controller. Check the continuity of the wire in the phase U of the motor. Otherwise it is necessary to replace the controller.
73	POWER FAILURE #1	This alarm occurs when the current in the phase W of the motor is zero and the motor is commanded for moving.	Check the power fuse is OK. Check the battery positive arrives to the controller. Check the continuity of the wire in the phase W of the motor. Otherwise it is necessary to replace the controller.
83	BAD ENCODER SIGN	It occurs in applications with toggle switches when the applied frequency (FREQUENCY) and motor speed (ENC SPEED) have opposite sign.	Swap in between two encoder channels (CNB#7 with CNB#8).
84	STEER SENSOR KO	This alarm occurs if the command potentiometer (CPOC1 on CNA#9 or CPOC2 on CNA#8) changes with a jerk larger than MAX SP SLOPE. This alarm is used to catch a discontinuity in the voltages of the command potentiometer.	Change the steer pot.
85	STEER HAZARD	This is just a warning to inform that the steering controller is limiting the angle in the steering direction. No speed reduction occurs on the traction.	

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
218	CLOCK PAL NOT OK	The main uC sends an analog signal towards the slave uC to reset the slave uC on demand. When the slave uC detects the analog signal external to a window from 2.2 to 2.8 and not in the range to generate the reset on demand, the slave uC raises this alarm.	It is necessary to replace the controller.
99	INPUT ERROR #1	It occurs when the voltage on CNA#4 (NK1: Lower Potential Terminal of the Safety Contacts) is higher than 12 V before to turn the safety contacts closed.	When the safety contacts are open, the voltage on CNA#4 is expected to be close to 0 Vdc and this is independent from whether the safety contacts are connected to a plus battery or to a minus battery. In the first case (safety contacts connected to a plus battery), when the safety contacts are open, CNA#4 is connected to a minus battery through a load. Only a harness mistake may connect NK1 to a higher than 12 voltage.
212	MICRO SLAVE #8	It occurs when the encoder counting of the main uC is not matched with the encoder counting the slave uC.	It is necessary to replace the controller.
219	STEPPER MOTOR MISM	This alarm occurs if the frequency and the amplitude of the voltages from the stepper motor lines are mismatched in between. In normal condition when the amplitude of the stepper motor lines increases, the frequency of the stepper motor lines must increase too.	It is necessary to replace the controller.
220	MOTOR LOCKED	This alarm occurs if the current in the steering motor stays close to the maximum current longer than 1 sec.	Search for a mechanical problem locking the motor. To help in the fault finding, set DEBUG OUTPUT to level 11.



**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
221	MICRO SLAVE #4	<p>It occurs in one or the following conditions:</p> <p>(Open loop application only) If the slave uC detects the stator voltage phasor rotates in the opposite direction respect to the sign of the stepper motor speed.</p> <p>(Closed loop application only) If the slave uC detects the stator voltage phasor rotates in the opposite direction respect to the commanded position.</p>	It is necessary to replace the controller.
222	FB POT LOCKED	<p>In application with a feedback potentiometer, this alarm occurs if the feedback potentiometer (CPOT on CNB#6) does not change (or changes in the opposite direction) its value even if commanded to change.</p> <p>In application with toggle switches with ENCODER CONTROL to off, this alarm occurs if the feedback encoder counting does not change its value even if commanded to change.</p>	In application with the feedback potentiometer, verify potentiometer is not mechanically loosened. Check there is not a mechanical block of the steered wheel. Be sure the wiper has not reached its own electrical limit because of too much angle of the steered wheel. Besides, this alarm may occur at the installation when the motor rotates in the wrong direction turning away from the desired direction.
223	JERKING FB POT	This alarm occurs if the feedback potentiometer (CPOT on CNB#6) changes with a jerk larger than 0.3V in 16 msec. This alarm is used to catch a discontinuity in the voltages of the feedback potentiometer	Change the feedback potentiometer.
225	CURRENT GAIN	This alarm occurs when the parameter to compensate for the gain of the current amplifiers (ADJUSTMENT #03 and ADJUSTMENT #04) have the default values.	It is necessary to send the controller to Zapi to perform, the maximum current regulation.

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
226	NO SYNC	Every 16msec, inside the code cycle, the main uC rises and then lowers an input for the slave uC (SYNC). When the slave uC detects no edge for more than 100 msec on this input, this alarm occurs. This is just a watch dog function: when the main uC does not execute the code cycle it does not update the SYNC signal and the slave uC cuts off the steer and traction.	It is necessary to replace the controller.
227	SLAVE COM. ERROR	Main uC and Slave uC communicate via a local serial interface. This alarm occurs when the main uC does not receive the communication from the slave uC through this serial interface.	It is necessary to replace the controller.
237	WAITING DATA	This warning occurs only if CAN BUS is PRESENT. At key-on the EPS-AC0 asks the traction controller to send a list of parameters via CAN BUS. From the request until the parameter are correctly received, this warning occurs. The steer is not activated yet, and the safety relays remain open when this warning is present.	
228	POSITION ERROR	This alarm occurs for a error in the redundant test of the feedback sensors.	Check the potentiometer connected to CNB#6 is working correctly. If toggle switches are connected to CNA#2 and CNA#3, verify they are working correctly and the setting AUX FUNCTION 11 is correct. Verify that sensor bearing in the motor (encoder) has not slipped (the sensor bearing has two rings: one is connected to the rotor shaft; the other is connected to the motor frame. Check these two rings are securely connected to their structure without slippage.

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
238	EPS NOT ALIGNED	This is a real alarm that cuts off the traction. It occurs at the initial alignment if the straight-ahead condition is not matched within 6 sec. Throughout the 6 sec delay, steering is not activated, the safety relays are open and the traction is stopped.	
239	WAITING FOR TRAC	At key-on the EPS-AC0 needs an assent from the traction controller to close the safety contacts and to turn on the operational mode. Until this happens, this warning occurs. The steer is not activated and the safety relays remain open when this warning is present.	
241	ENCODER ERROR	It occurs when ENCODER CONTROL is set ON and the real frequency does not pursuit the commanded frequency.	This condition is several times due to either, a mismatching between the Encoder resolution used in the SW and the real encoder resolution, or a wrong connection between the two encoder channels. In this latest case, exchange the connections.
242	Q LINE SENSOR KO	This alarm occurs when the mean voltage of the Quadrature line of the stepper motor (connection CNA#8) is not null: the voltage on every stepper motor line is a sine wave with null mean voltage.	Check the continuity of the stepper motor connections. In particular the resistance between CNA#8 and the negative battery (with the stepper motor at rest) is expected to be very low (close to 30 ohms).
243	D LINE SENSOR KO	This alarm occurs when the mean voltage of the Direct line of the stepper motor (connection CNA#9) is not null: the voltage on every stepper motor line is a sine wave with null mean voltage.	Check the continuity of the stepper motor connections. In particular the resistance between CNA#9 and the negative battery (with the stepper motor at rest) is expected to be very low (close to 30 ohms).
245	DATA ACQUISITION	This alarm occurs when acquiring the motor resistance or when adjusting the parameters to compensate for the gain of the current amplifiers (maximum current factory adjusted).	Recycle the key.

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
244	GAIN EEPROM KO	The parameters to compensate for the gain of the current amplifiers (ADJUSTMENT #03 and ADJUSTMENT #04 are recorded in a not volatile memory (eeprom) with a redundant handling. In fact every adjustment is recorded in three eeprom locations. If the values in these three location are different, this alarm occurs.	It is necessary to send the controller to Zapi to execute the maximum current regulation.
246	MICRO SLAVE KO	In stepper motor application, this alarm occurs if the main uC is detecting a direction of the stepper motor not matched with the one that the slave uC is detecting.  In closed loop application, this alarm occurs if the main uC is detecting a direction of the steering error not matched with the one that the slave uC is detecting.  Furthermore, this alarm occurs if the main uC is detecting no steering limitation meanwhile the slave uC is detecting a steering limitation.	It is necessary to replace the controller.
247	CAN BUS KO	This alarm occurs only when the setting CAN BUS is PRESENT. Then the EPS-AC0 must receive the event messages from the traction controller. If these messages lack more than about 1 sec, this alarm occurs.	Check the CAN Bus communication system and analyse the frames from the traction controller to the steer controllers.
248	S.P OUT OF RANGE	This alarm occurs for a fault on the command potentiometer (CPOC2on CNA#8). When a single command pot is chosen, the alarm occurs if the wiper (CPOC1) exits the range from 0.8 Vdc to 4.2 Vdc. When the twin pot is chosen, the alarm occurs if the sum of the two wiper voltages (CPOC1 + CPOC2) exists the range from 4.5 Vdc to 5.5 Vdc.	Check the connections of the potentiometer. This alarm occurs when one connection of the command potentiometer is broken.

**Table 4-3 STEERING CONTROLLER - Continued**

Error Message		Possible Cause	Fault Elimination
Code	Error Text		
249	F.B OUT OF RANGE	This alarm occurs for a fault on the feedback potentiometer (CPOT on CNB#6). This alarm occurs in CPOT exits the range from 0.3 Vdc to 4.7 Vdc.	Check the connections of the feedback potentiometer. This alarm occurs when one connection of the feedback potentiometer is broken.
250	MICRO SLAVE	It occurs when the information on the status bus between the main uC and the slave uC is frozen to the OFF value (the slave uC does not update the status bus configuration).	It is necessary to replace the controller.
251	KM OPEN	This alarm occurs if the slave uC detects the safety contact, of the main uC, open when expected being closed.	It is necessary to replace the controller.
252	KS OPEN	This alarm occurs if the slave uC detects the safety contact, of the main uC, open when expected being closed.	It is necessary to replace the controller.
253	KM CLOSED	This alarm occurs at key-on if the slave uC detects the safety contact, of the main uC, closed prior to being commanded.	This alarm occurs if the connection CNA#5 (K1) is around a voltage of 12 Vdc when switching on the key. In fact, when the safety contacts are open, K1 is expected to be plus battery voltage (not 12 V). Search for a harness problem or replace the controller.
254	KS CLOSED	This alarm occurs if the main uC detects the safety contact, of the slave uC, closed prior to being commanded.	This alarm occurs if the connection CNA#4 (NK1) is around a voltage of 12 Vdc when switching on the key. In fact, when the safety contacts are open, NK1 is expected to be a minus battery voltage (not 12 V). Search for a harness problem or replace the controller.

## NOTES

## SECTION 5 STEERING SYSTEM, CONTROL HEAD AND COMPARTMENT

### 5-1. CONTROL HEAD

#### 5-1.1. Cap Assembly Removal.

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove two screws (17, [Figure 5-2](#)) and two screws (20). As cap (2) is removed, cover (6) and spring (16) can be removed.
3. Lift up cap (2), tag and disconnect harness (34, [Figure 5-1](#)) from harnesses (8, 9, 12, [Figure 5-2](#)).
4. Remove cap (2).

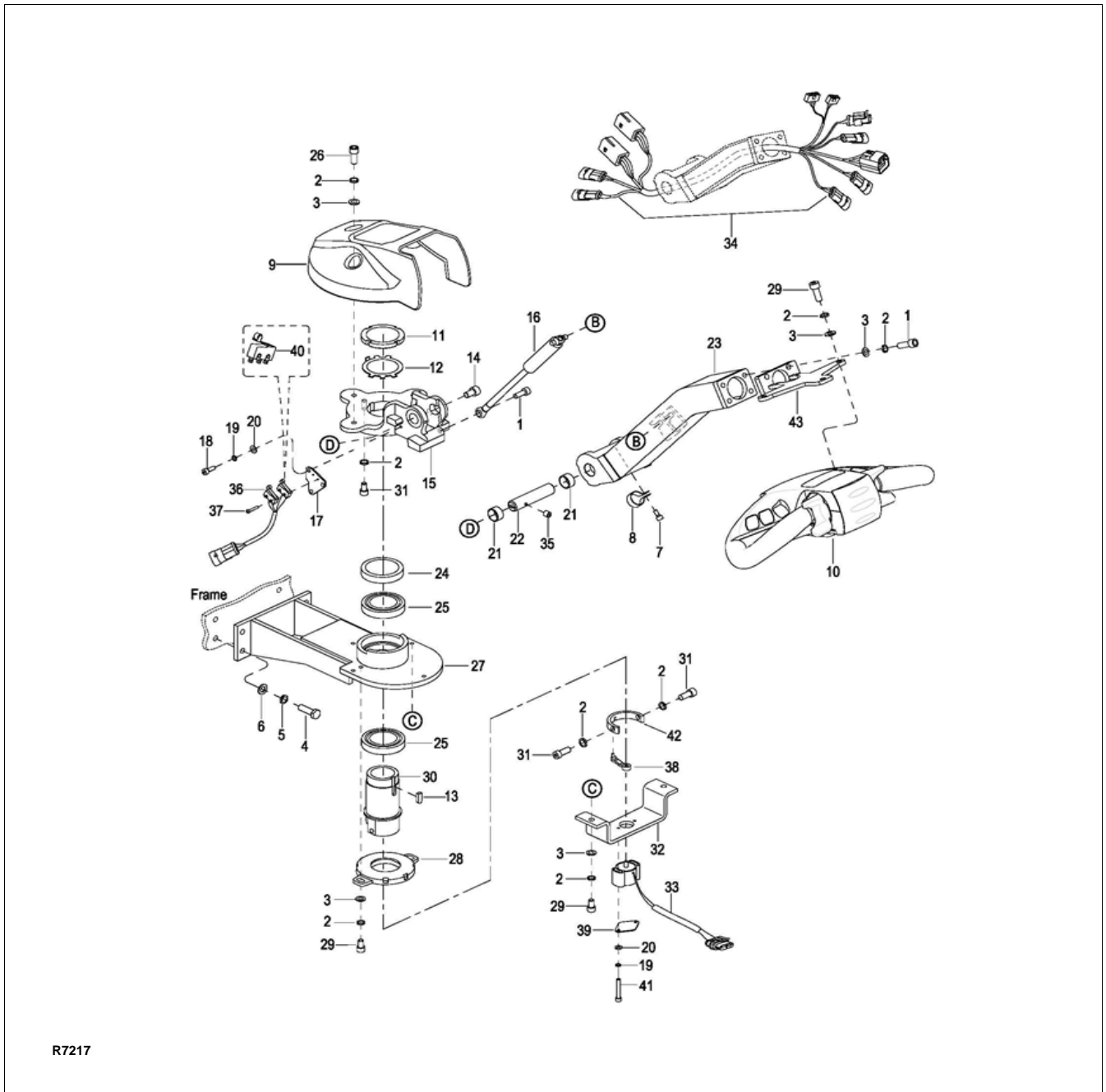
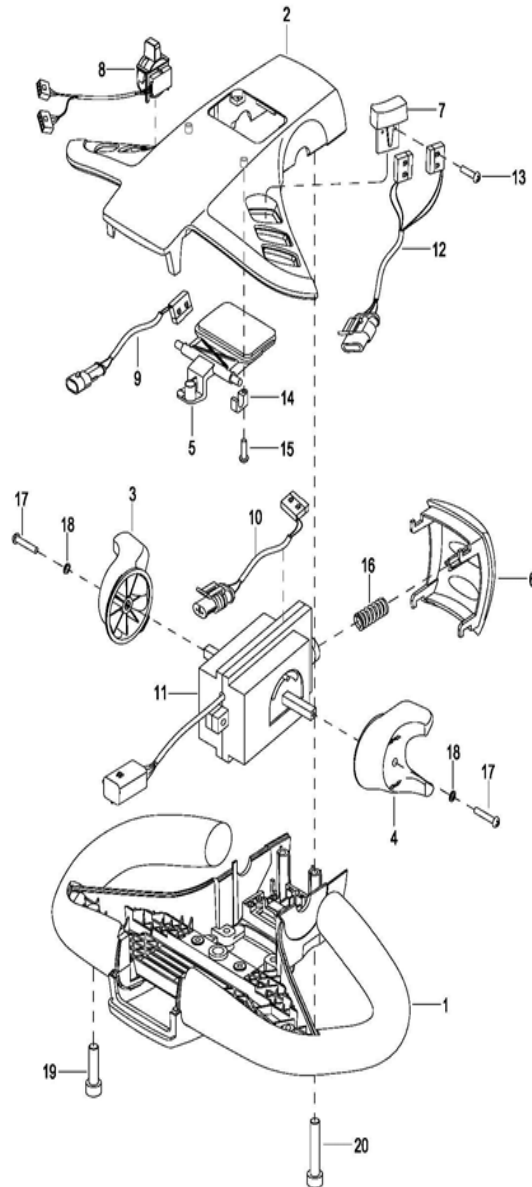


Figure 5-1 Control Arm

### 5-1.2. Cap Assembly Installation.

1. Hold cap (2, [Figure 5-2](#)) in place and reconnect harness (34, [Figure 5-1](#)) to harnesses (8, 9, 12, [Figure 5-2](#)).
2. As cap (2) is installed, install cover (6) and spring (16). Secure cap (2) with two screws (17) and two screws (20).
3. Reconnect the batteries and turn on the key switch (5, [Figure 12-22](#)).



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Figure 5-2 Control Head



### 5-1.3. Control Head Removal.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Tag and disconnect harness (34, [Figure 5-1](#)) from switch (10, [Figure 5-2](#)) and potentiometer (11).
3. Hold control head (2, [Figure 5-1](#)) in place and remove three screws (29), lock washers (2) and flat washers (3). Remove control head (2) from bracket (43).

### 5-1.4. Control Head Installation.

1. Hold control head (2, [Figure 5-1](#)) in place and secure to bracket (43) with three screws (29), lock washers (2) and flat washers (3).
2. Reconnect harness (34) to switch (10, [Figure 5-2](#)) and potentiometer (11).
3. Install the cap assembly as described in paragraph 5-1.2.

### 5-1.5. Speed Potentiometer Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Disconnect harness (34, [Figure 5-1](#)) from potentiometer (11, [Figure 5-2](#)).
3. Remove screw (18), washer (17) and travel control (3) from potentiometer (11).
4. Remove screw (18), washer (17) and travel control (4) from other side of potentiometer (11).
5. Remove potentiometer (11) from cover (1).
6. Position new potentiometer (11) in cover (1).
7. Install travel control (4) on potentiometer (11) and secure with screw (18), and washer (17).
8. Install travel control (3) on the other side of potentiometer (11) and secure with screw (18), and washer (17).
9. Connect harness (34, [Figure 5-1](#)) to potentiometer (11, [Figure 5-2](#)).
10. Install the cap assembly as described in paragraph 5-1.2.

### 5-1.6. Belly-Button Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Disconnect harness (34, [Figure 5-1](#)) from switch (10, [Figure 5-2](#)).
3. Remove and replace switch (10).

4. Reconnect harness (34, [Figure 5-1](#)) to switch (10, [Figure 5-2](#)).
5. Install the cap assembly as described in paragraph 5-1.2.

### 5-1.7. Horn Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Remove two screws (15, [Figure 5-2](#)), two mounts (14) and horn button (5).
3. Remove switch (9) from cap (2).
4. Position the new switch in cap (2).
5. Position horn button (5) in cap (2) and secure with two mounts (14) and two screws (15).
6. Install the cap assembly as described in paragraph 5-1.2.

### 5-1.8. Lift and Lower Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Remove switch assembly (8, [Figure 5-2](#)) from cap (3).
3. Install new switch assembly (8) in cap (3).
4. Install the cap assembly as described in paragraph 5-1.2.

### 5-1.9. Tilt Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Remove two screws (13, [Figure 5-2](#)) and switch assembly (12) from button (7).
3. Secure new switch assembly (12) to button (7) with two screws (13).
4. Install the cap assembly as described in paragraph 5-1.2.

## 5-2. CONTROL ARM

### 5-2.1. Gas Return Spring Replacement.

The control arm gas return spring (16, [Figure 5-1](#)) is replaced while the control arm (23) is in the upright position.

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove three screws (4, [Figure 5-1](#)), lock washers (2), flat washers (3) and cover (9).
3. Secure the control arm (23) in the upright position.

4. Remove screw (1) and free the gas return spring (16) from bracket (15).
5. Pull downward on the gas return spring (16) to free it from its seat inside control arm (23).
6. Position the new gas return spring (16) inside the control arm being sure it fully engages its seat.
7. Position the opposite end of the gas return spring (16) on bracket (15) and install screw (1).
8. Install cover (9) and secure with three screws (4), lock washers (2), flat washers (3).
9. Reconnect the batteries and turn on the key switch (5, [Figure 12-22](#)).

#### 5-2.2. Control Arm Removal.

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove the gas return spring (16) as described in paragraph [5-2.1](#).
3. Disconnect harness (34) from harness (1, [Figure 12-25](#)).
4. Attach a hoist to control arm (23, [Figure 5-1](#)).
5. Remove screw (14), screw (35), shaft (2) and the control arm (23).

#### 5-2.3. Control Arm Installation.

1. Position control arm (23, [Figure 5-1](#)) on bracket (15) and secure with shaft (2), screw (35) and screw (14).
2. Reconnect harness (34) to harness (1, [Figure 12-25](#)).
3. Install the gas return spring (16) as described in paragraph [5-2.1](#).
4. Reconnect the batteries and turn on the key switch (5, [Figure 12-22](#)).

### 5-3. COMPARTMENT COVERS

#### 5-3.1. Removal.

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove two screws (3, [Figure 12-5](#)), washers (14) and swing covers (7 & 8) open. Covers may be lifted off hinges (6).
3. Remove three screws (1), lock washers (11), flat washers (12) and cover (2).
4. Remove two screws (3), washers (14) and upper cover (4).

5. Remove screw (8, [Figure 12-6](#)), lock washer (9), flat washer (10), two screws (11), lock washers (9) and cover (2).
6. Remove four screws (6) washers (7) and cover (1).

#### 5-3.2. Installation.

1. Install cover (1, [Figure 12-6](#)) and secure with four screws (6) and washers (7).
2. Install cover (2) and secure with screw (8), lock washer (9), flat washer (10), two screws (11), and lock washers (9).
3. Install upper cover (4, [Figure 12-5](#)) and secure with two screws (3) and washers (14).
4. Install cover (2), three screws (1), lock washers (11) and flat washers (12).
5. Position covers (7 & 8) on hinges (6). Close the covers and secure with two screws (3) and washers (14).
6. Reconnect the batteries and turn on the key switch (5, [Figure 12-22](#)).

### 5-4. STEERING CONTROL

#### 5-4.1. Removal.

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph [5-3](#).
3. Disconnect potentiometer (33, [Figure 5-1](#)) from harness (1, [Figure 12-25](#)).
4. Remove two screws (29, [Figure 5-1](#)), lock washers (2), flat washers (3) and remove mounting plate (32) from bracket (27).
5. Remove rocker (38) from shaft of potentiometer (33).
6. Remove two screws (41), lock washers (19), flat washers (20), plate (39) and potentiometer (33) from mounting plate (32).
7. Remove two screws (31), lock washers (2) and cam (42).
8. Remove two screws (29), lock washers (2), flat washers (3) and damper (28).

#### 5-4.2. Installation.

1. Install damper (28, [Figure 5-1](#)) and secure with two screws (29), lock washers (2) and flat washers (3).

2. Install cam (42) and secure with two screws (31), lock washers (2).
  3. Position potentiometer (33) on mounting plate (32) and secure with plate (39), two screws (41), lock washers (19), and flat washers (20).
  4. Position rocker (38) on shaft of potentiometer (33).
  5. Install mounting plate (32) on bracket (27) and secure with two screws (29), lock washers (2), flat washers (3).
  6. Reconnect potentiometer (33) to harness (1, [Figure 12-25](#)).
  7. Install the compartment covers as described in paragraph [5-3](#).
  8. Reconnect the batteries and turn on the key switch (5, [Figure 12-22](#)).
3. Disconnect position switch (2, [Figure 12-3](#)) from harness (1, [Figure 12-25](#)).
  4. Remove position switch from the frame.
  5. Disconnect harness (1) from steering motor (16, [Figure 12-4](#)).
  6. Remove screw (19), lock washer (20), washer (21) and gear (17) from steering motor (16).
  7. Remove four screws (18) and lift steering motor (16) from the frame.

## 5-5. STEERING MOTOR

### 5-5.1. Removal.

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph [5-3](#).

### 5-5.2. Installation.

1. Position steering motor (16, [Figure 12-4](#)) on the frame and secure with four screws (18).
2. Install gear (17) on steering motor (16) and secure with screw (19), lock washer (20) and washer (21).
3. Reconnect harness (1, [Figure 12-25](#)) to steering motor (16, [Figure 12-4](#)).
4. Install position switch on the frame.
5. Reconnect harness (1, [Figure 12-25](#)) to position switch (2, [Figure 12-3](#)).
6. Install the compartment covers as described in paragraph [5-3](#).
7. Reconnect the batteries and turn on the key switch (5, [Figure 12-22](#)).

## NOTES

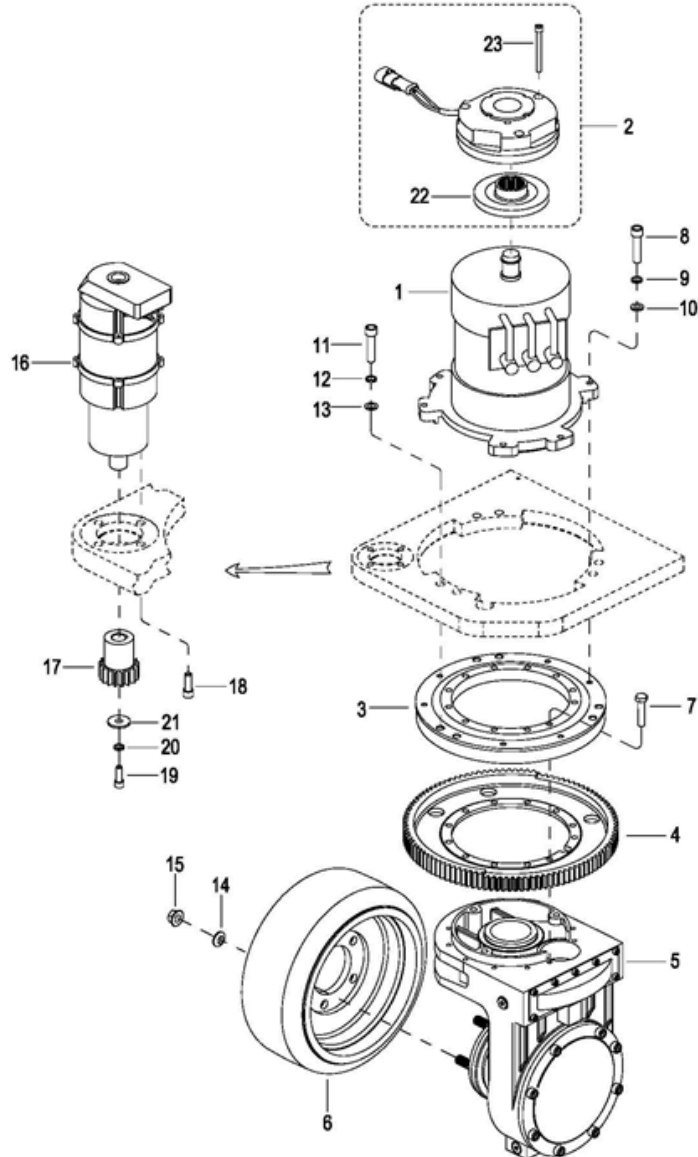
## SECTION 6 BRAKE SERVICING

### 6-1. BRAKES.

The brake system consists of a drive motor mounted brake. This brake is spring applied and electrically released.

#### 6-1.1. Brake Assembly Replacement

1. Block load wheels.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
3. Remove the compartment covers as described in paragraph [5-3](#).
4. Disconnect electric brake (2, [Figure 6-1](#)) from the harness (1, [Figure 12-25](#)).
5. Remove three screws (23, [Figure 6-1](#)) and remove brake (2).
6. Place the new brake into position and secure with the three screws (23).
7. Reconnect electric brake (2) to the harness (1, [Figure 12-25](#)).
8. Install the compartment covers as described in paragraph [5-3](#).
9. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).



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Figure 6-1 Drive Assembly

## SECTION 7

### TRANSMISSION, DRIVE WHEEL, LOAD WHEEL

#### 7-1. Drive Wheel.

1. Turn off the key switch (5, [Figure 12-22](#)) 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 (6) from the transmission (5).
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 (5, [Figure 12-22](#)).

#### 7-2. Transmission.

1. Remove the drive wheel (6) as described in paragraph [7-1](#).
2. Remove the brake (1, [Figure 7-1](#)) as described in paragraph [6-1.1](#).
3. Remove the steering motor as described in paragraph [5-5](#).
4. Support the transmission (5, [Figure 7-1](#)) and remove the six screws (11), six lock washers (12) and six flat washers (13).
5. Slowly lower the transmission out the bottom of the frame.
6. Remove the twelve screws (7), bearing (3) and gear (4) from transmission (5)
7. Install new transmission by reversing the steps above.

#### 7-3. Load Wheel.

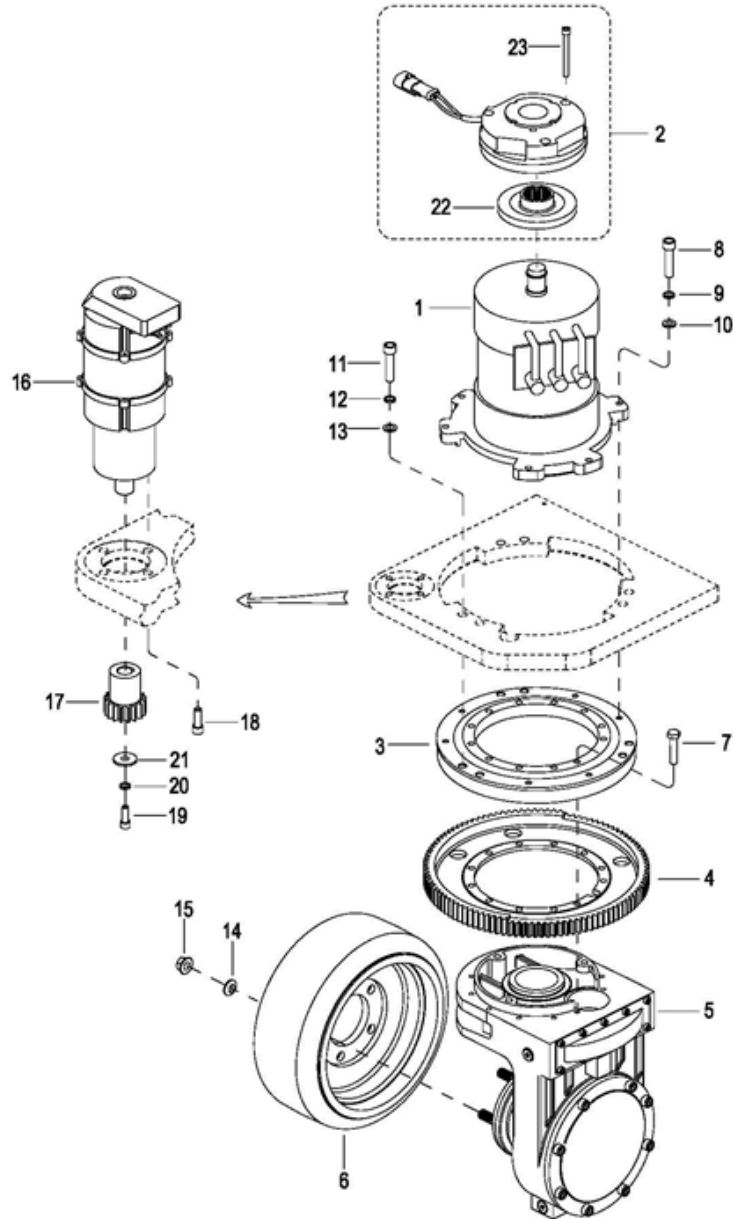
##### 7-3.1. Removal

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Block the drive wheel to prevent the truck from rolling.
3. Jack up the truck to raise the load wheel off the floor. Securely block the truck in the raised position.
4. Remove three screws (1, [Figure 7-2](#)) and cover (2).
5. Remove two screws (3), two lock washers (4), two flat washers (5) and retainer (6).
6. Remove load wheel (7).
7. Remove bearings (13) from load wheel (7).

**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 Lift LLC 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. Load Wheel Installation

1. Install bearings (13, [Figure 7-2](#)) in load wheel (7).
2. Position load wheel (7) on spindle.
3. Remove retainer (6) and secure with two screws (3), two lock washers (4) and two flat washers (5).
4. Install cover (2) and secure with three screws (1).
5. Remove blocking from under the truck and lower to the ground.
6. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).



R7220

Figure 7-1 Drive Assembly



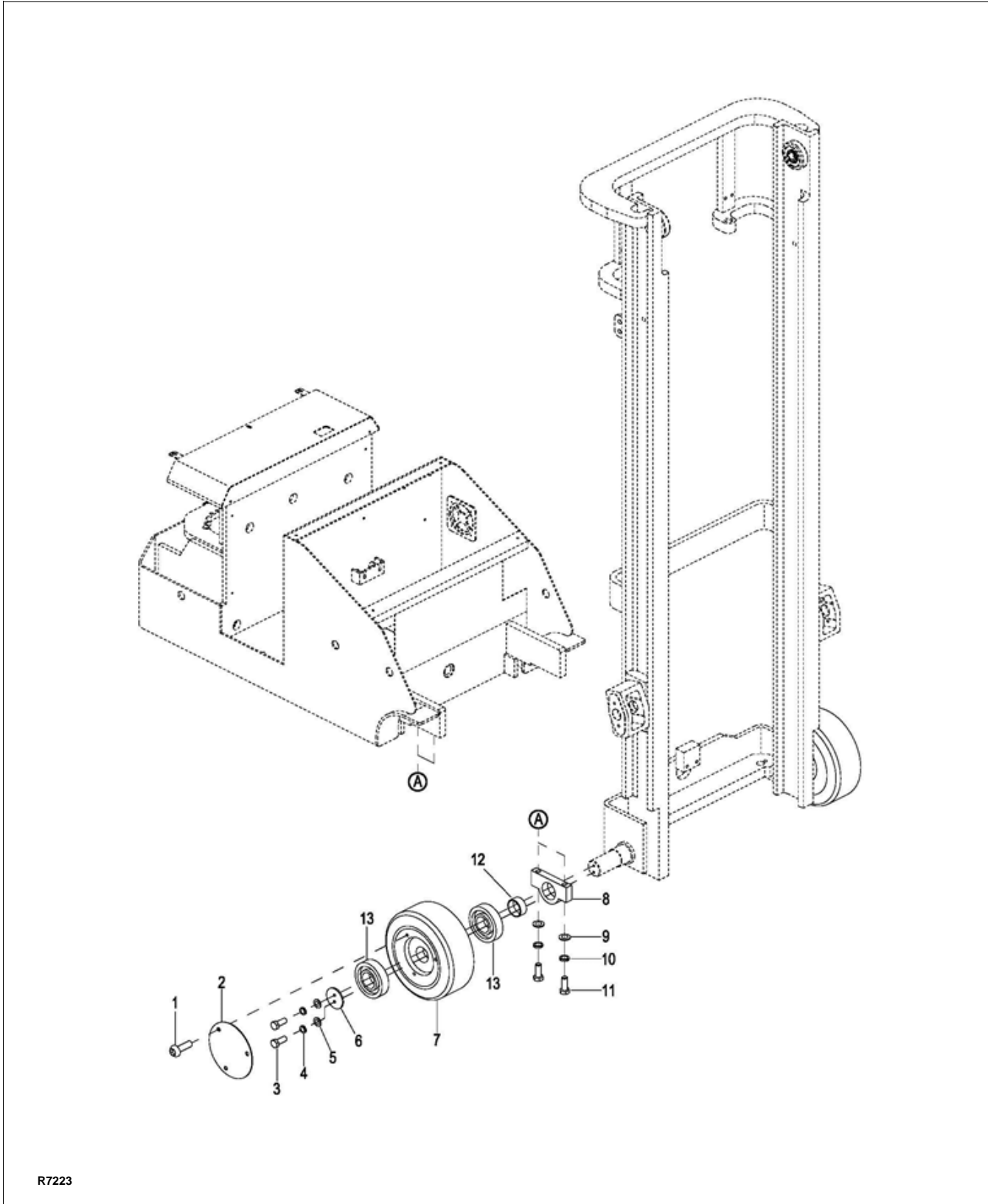


Figure 7-2 Load Wheels

## NOTES

## SECTION 8 ELEVATION SYSTEM SERVICING

### 8-1. GENERAL.

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

### 8-2. LIFT CHAIN LENGTH ADJUSTMENT.

#### 8-2.1. Telescopic

1. Fully lower the lift carriage.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

3. Loosen upper jam nuts (2, [Figure 8-1](#)), located above the mounts on outer mast (17, [Figure 8-2](#)), to allow for adjustment of middle jam nuts.
4. Break the lower jam nuts (2, [Figure 8-1](#)), located below the mounts on outer mast free from the middle jam nuts (2).
5. Take up slack in both lift chains with middle jam nut (2). Strive for equal tension on both chains.
6. Align adjusting bolts (1) so each clevis pin (4) is parallel to the mast.

**CAUTION:** At least 3 full threads must be present below lower nuts (2) after adjustment.

7. Tighten jam nuts securely while maintaining alignment of clevis pins (4).
8. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
9. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

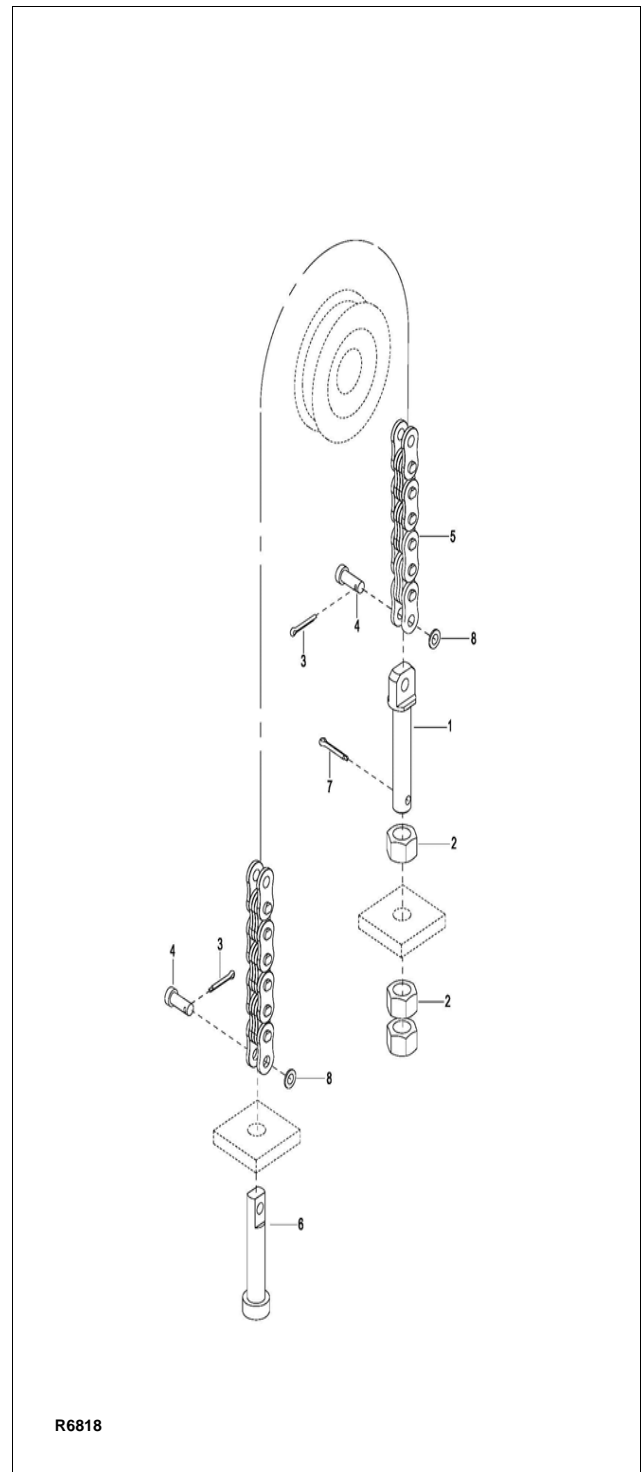
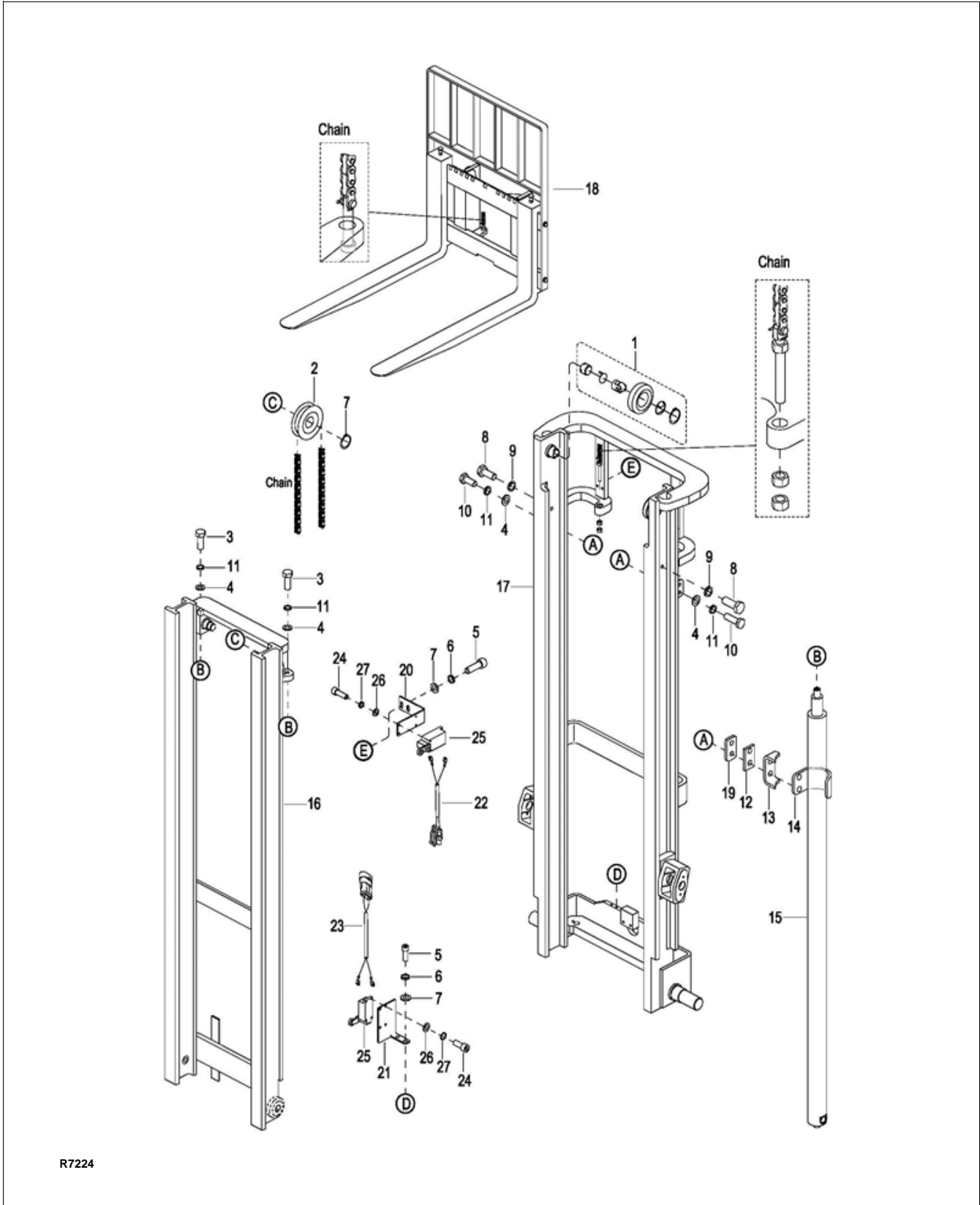


Figure 8-1 Chain Assembly



R7224

Figure 8-2 Elevation System (Telescopic)

### 8-2.2. Three Stage Mast Free Lift Chain

1. Fully lower the lift carriage.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

3. Loosen lower jam nuts (2, [Figure 8-1](#)), located above the mounts of cylinder (9, [Figure 8-3](#)), to allow for adjustment of middle jam nuts.
4. Break the lower jam nuts (2, [Figure 8-1](#)), located below the mounts of the cylinder, free from the middle jam nuts (2).
5. Take up slack in both lift chains with middle jam nut (2, [Figure 8-1](#)). Strive for equal tension on both chains.
6. Align anchors (1) so each clevis pin (4) is parallel to the mast.

**CAUTION:** At least 3 full threads must be present below lower nut (2) after adjustment.

7. Tighten jam nuts securely while maintaining alignment of clevis pins (4).
8. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
9. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

### 8-2.3. Three Stage Mast Secondary Lift Chain

1. Fully lower the lift carriage.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

3. Loosen jam nuts (2, [Figure 8-1](#)), the mount of outer mast (1, [Figure 8-3](#)), to allow for adjustment of middle jam nut.
4. Break the lower jam nuts (2, [Figure 8-1](#)), located below the mount of outer mast free from the middle jam nuts.
5. Take up slack in both lift chains with middle jam nut (2). Strive for equal tension on both chains.
6. Align anchors (1) so each clevis pin (4) is parallel to the outer mast (1, [Figure 8-3](#)).

**CAUTION:** At least 3 full threads must be present below lower nut (2, [Figure 8-1](#)) after adjustment.

7. Tighten jam nuts securely while maintaining alignment of clevis pins (4).
8. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
9. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

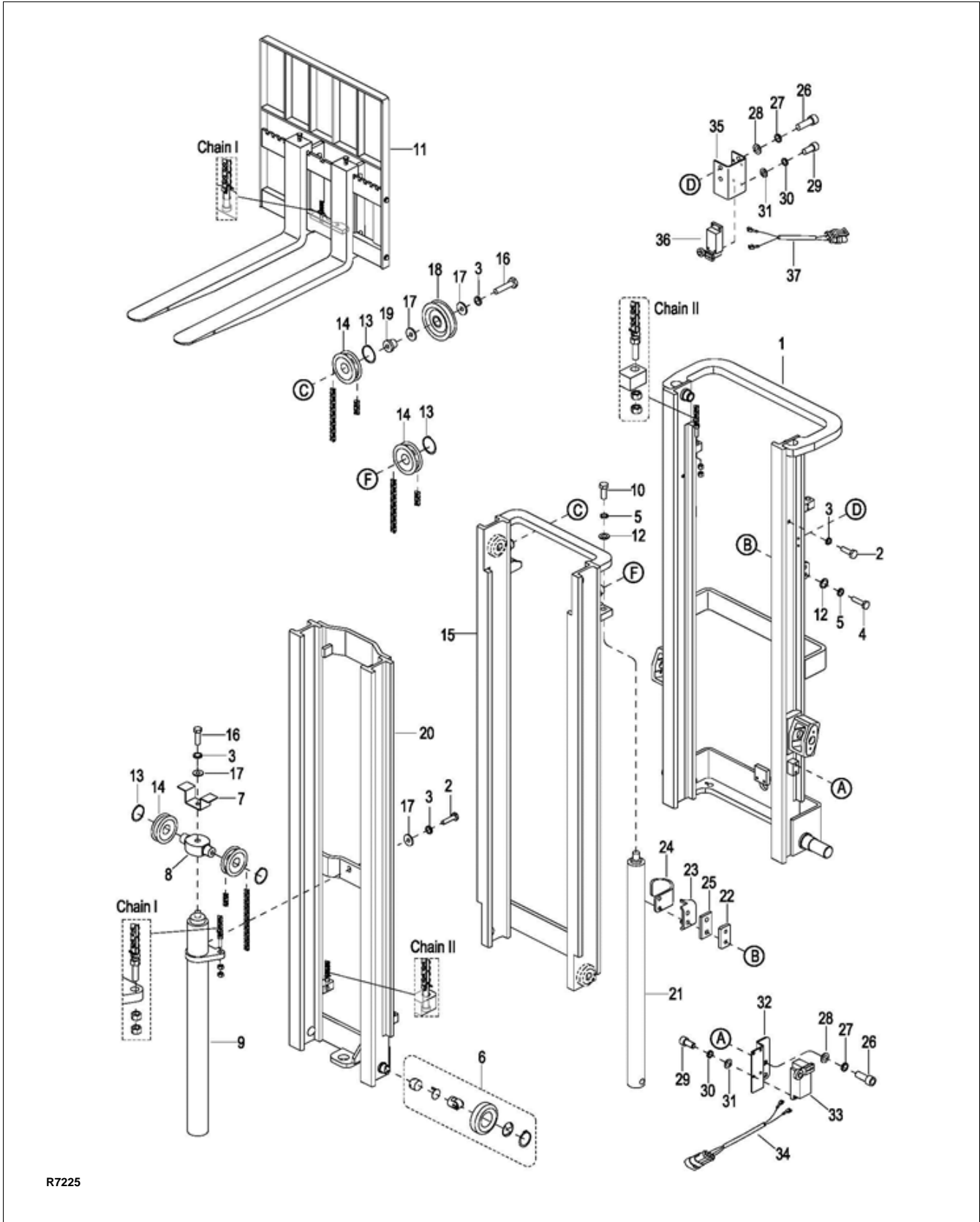
### 8-3. LIFT CHAIN WEAR INSPECTION.

Both lift chains should be replaced when either chain is worn enough to increase it's length by 3% or more. To make this determination proceed as follows.

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

Measure the distance between pin centers on 20 vertical links. If the section measures 12.88" or more, the chain should be replaced.

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



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Figure 8-3 Mast (Three Stage Mast)

## 8-4. LIFT CHAIN REPLACEMENT.

### 8-4.1. Telescopic

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under inner mast (16, [Figure 8-2](#)).
2. Lower inner mast onto the support. Check that arrangement is secure before proceeding.
3. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

4. Remove cotter pin (3, [Figure 8-1](#)) and clevis pin (4) connecting chain (5) to chain anchor (6) at the lift carriage.
5. Remove cotter pin (3) and clevis pin (4) connecting chain (5) to chain anchor (1) at the outer mast (17, [Figure 8-2](#)).
6. Remove chain from sheave (2).
7. Position new chain on sheave (2).
8. Secure chain to chain anchor (1, [Figure 8-2](#)) at the outer mast with clevis pin (4) and cotter pin (3).
9. Connect the opposite end of chain to chain anchor (6) at the lift carriage with clevis pin (4) and cotter pin (3).
10. Adjust the chains according to paragraph [8-2](#).
11. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).

### 8-4.2. Three Stage Mast Free Lift Chain

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under the lift carriage.
2. Lower the lift carriage onto the support. Check that arrangement is secure before proceeding.
3. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

4. Remove cotter pin (3, [Figure 8-1](#)) and clevis pin (4) connecting chain (5) to chain anchor (6) at the lift carriage.

5. Remove cotter pin (3) and clevis pin (4) connecting chain (5) to chain anchor (1) at free lift cylinder (9, [Figure 8-3](#)).
6. Remove chain from sheave (14).
7. Position new chain on sheave (14).
8. Secure chain to chain anchor (1) at free lift cylinder (9) with clevis pin (4) and cotter pin (3).
9. Connect the opposite end of chain to chain anchor (6) at the lift carriage with clevis pin (4) and cotter pin (3).
10. Adjust the chains according to paragraph [8-2](#).
11. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).

### 8-4.3. Three Stage Mast Secondary Lift Chain

1. With the lift truck wheels securely blocked, raise the forks approximately five feet from floor and position blocks or strong supports under masts (15 and 20, [Figure 8-3](#)).
2. Lower the masts onto the support. Check that arrangement is secure before proceeding.
3. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

4. Remove cotter pin (3, [Figure 8-1](#)) and clevis pin (4) connecting chain (5) to chain anchor (6) at inner mast (20, [Figure 8-3](#)).
5. Remove cotter pin (3, [Figure 8-1](#)) and clevis pin (4) connecting chain (5) to chain anchor (1) at outer mast (1, [Figure 8-3](#)).
6. Remove chain from sheave (14).
7. Position new chain on sheave (14).
8. Secure chain to chain anchor (1) at outer mast (1, [Figure 8-3](#)) with clevis pin (4, [Figure 8-1](#)) and cotter pin (3).
9. Connect the opposite end of chain to chain anchor (6) at inner mast (20, [Figure 8-3](#)) with clevis pin (4, [Figure 8-1](#)) and cotter pin (3).
10. Adjust the chains according to paragraph [8-2](#).
11. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).

## 8-5. LIFT CYLINDERS.

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

## 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 (5, [Figure 12-22](#)) and disconnect the batteries.
3. Remove the front 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](#), [Figure 9-2](#) and [Figure 9-5](#) and remove leaking line or fitting and replace it with a new line or fitting.
5. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
6. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
7. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
8. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
9. Install the front compartment covers as described in paragraph [5-3](#).

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

**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

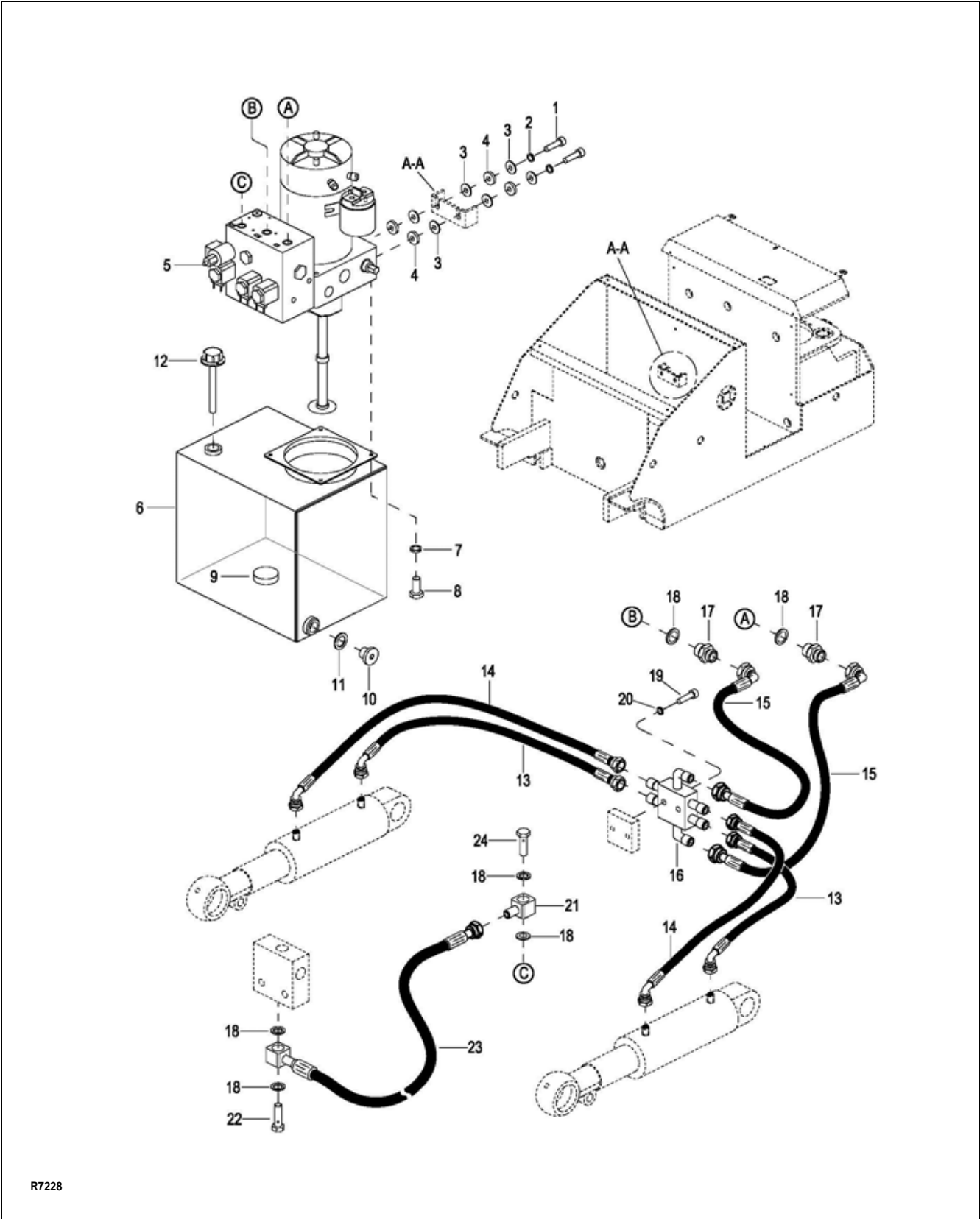
1. Lower forks fully.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
3. Remove the front compartment covers as described in paragraph [5-3](#).
4. Tag and disconnect electrical leads from pump and motor (5, [Figure 9-1](#)).

**NOTE:** Place a container under the pump assembly to catch any hydraulic oil.

5. Tag and disconnect two hoses (15) and hose (23) from pump and motor (5).
6. Remove two screws (1), two lock washers (2) four washers (4) and six washers (3).
7. Remove the pump and motor assembly (5) with reservoir (6).
8. Remove four bolts (8), four lock washers (7) and reservoir (6) from pump and motor assembly (5).
9. Refer to [Figure 12-21](#) for disassembly and reassembly of the pump and motor.

#### 9-2.2. Installation

1. Install pump and motor assy (5, [Figure 9-1](#)) on reservoir (6) and secure with four bolts (8) and four lock washers (7).
2. Position pump and motor assy (5) on mounting bracket and secure with two screws (1), two lock washers (2) four washers (4) and six washers (3).
3. Reconnect two hoses (15) and hose (23) to pump and motor (5).
4. Connect electrical leads to pump and motor (5).
5. Fill the hydraulic reservoir. Use hydraulic oil listed in [Table 3-2](#).
6. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
7. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
8. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
9. Install the front compartment covers as described in paragraph [5-3](#).



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Figure 9-1 Hydraulic System

### 9-3. Lift Cylinder (Telescopic)

#### 9-3.1. Removal

1. Fully lower the lift carriage.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

3. Remove screw (3, [Figure 9-3](#)), lock washer (11) and flat washer (4) securing the top of cylinder (15) to mast (16).

4. Using another lift truck or suitable jack, raise mast (16) far enough to remove pressure on the lift cylinder (15).

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

5. Disconnect the tube (3, [Figure 9-5](#)) from the bottom of lift cylinder.
6. Support cylinder (15) and remove two bolts (10), two lock washers (11), two flat washers (4), shims (12), bracket (13), clip (14) and block (19).
7. Raise lift cylinder assembly up and out of truck.

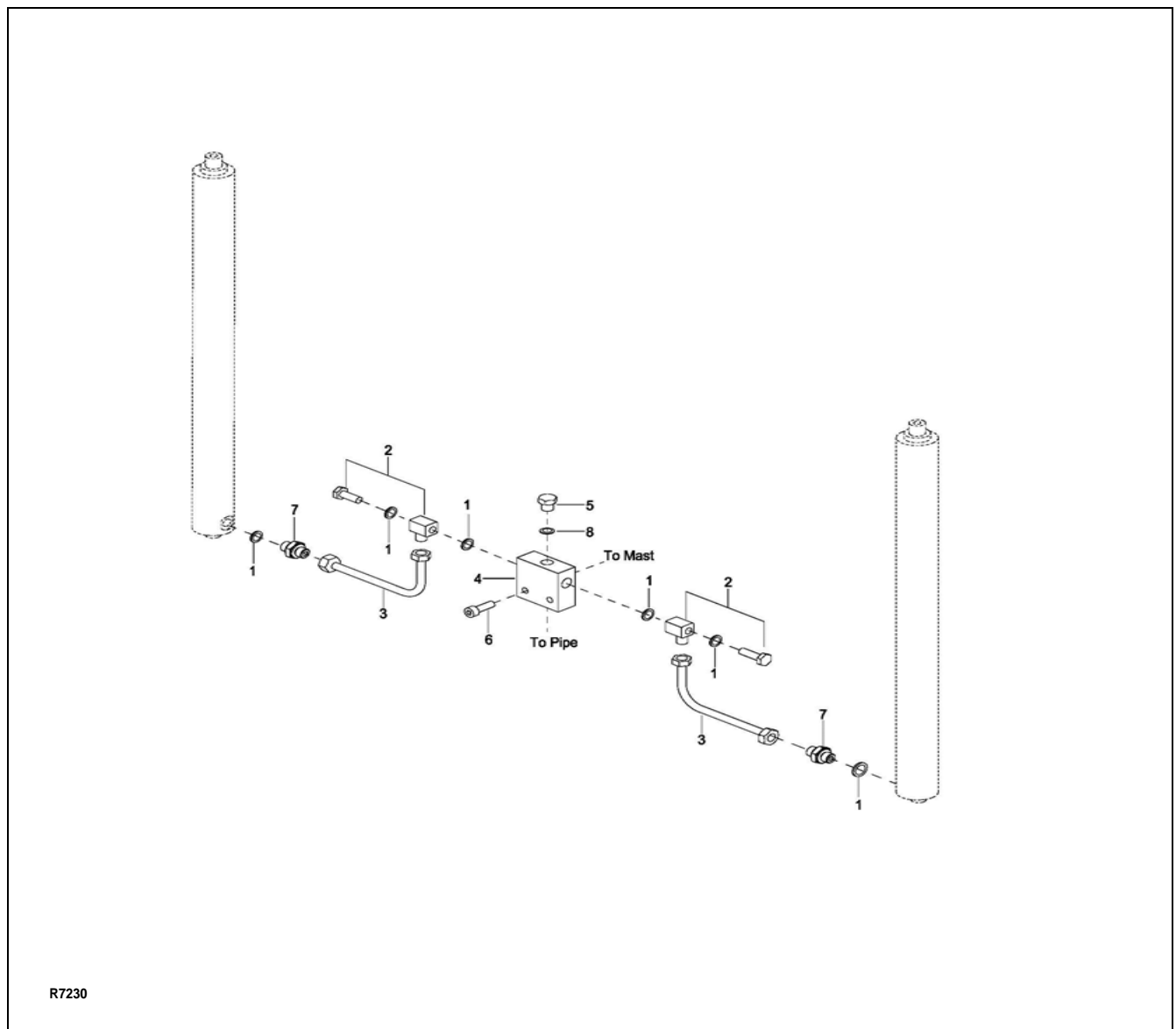
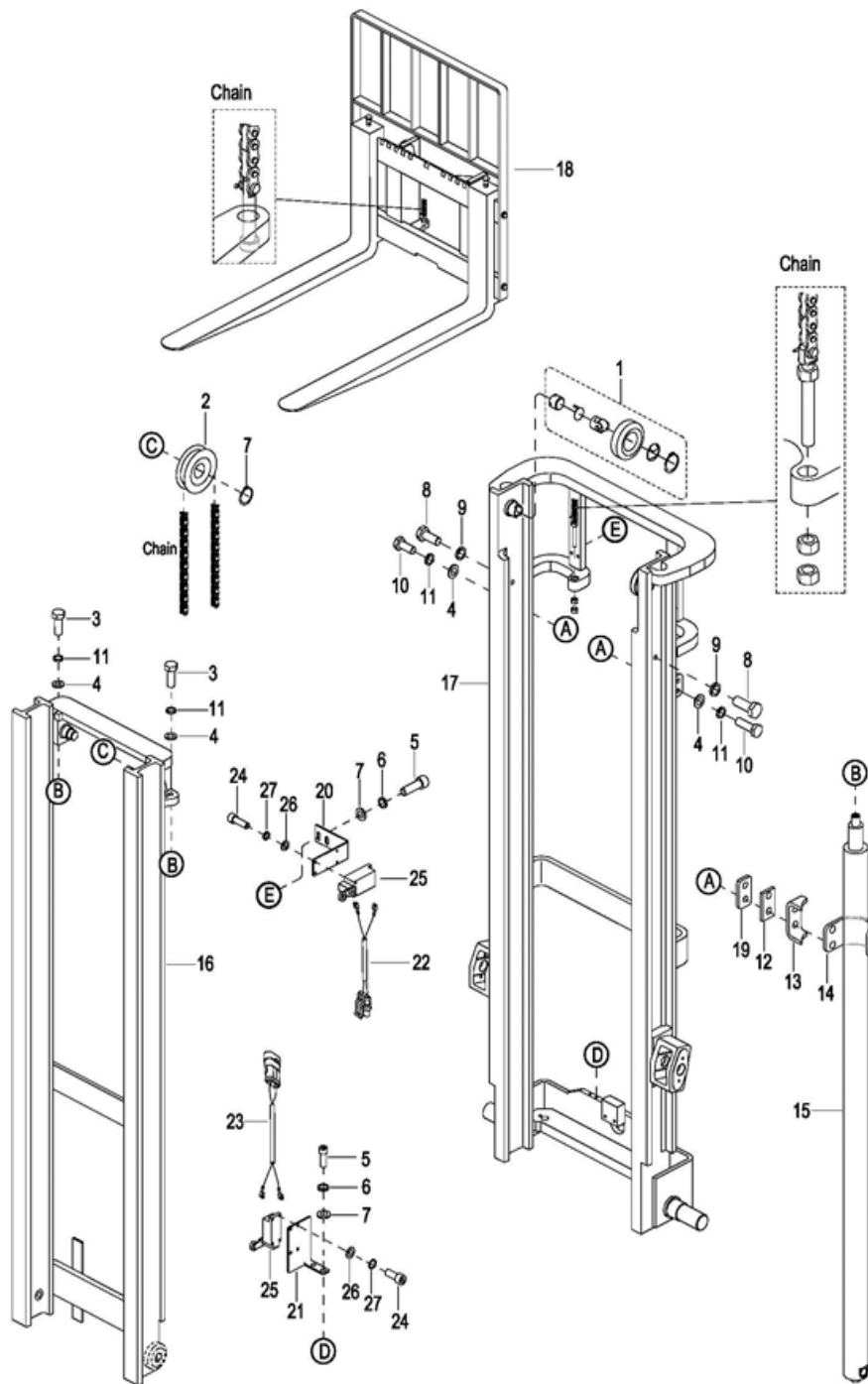


Figure 9-2 Lift System (Telescopic)



R7224

Figure 9-3 Elevation System (Telescopic)

### 9-3.2. Repair

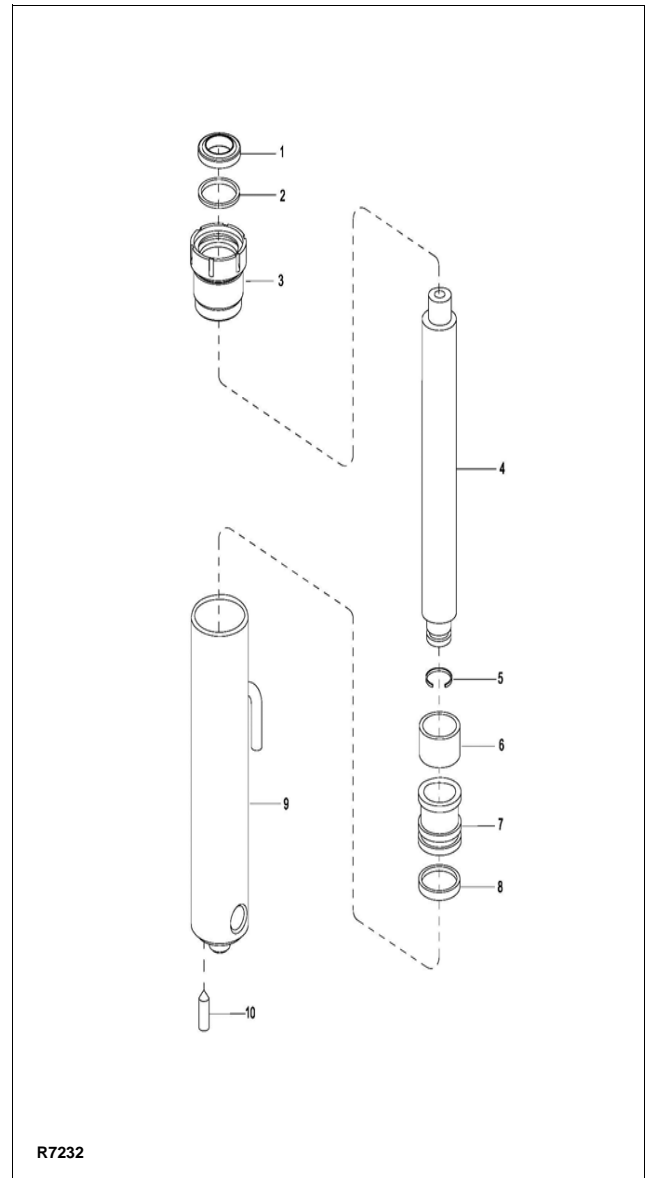
**CAUTION:** To prevent damage, use proper pipe clamp vise. The cylinder will be distorted if the vise is tightened too much.

1. Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
2. Remove gland nut (3, [Figure 9-4](#)).
3. Remove wiper ring (1) and O-ring (2) from gland nut (3).
4. Pull out piston rod (4).
5. Remove collar (5) and piston (7) from piston rod (4).
6. Remove packing (8) and back up ring (6) from piston (7).
7. Coat all parts with hydraulic oil ([Table 3-2](#)).
8. Install packing (8) and back up ring (6) on piston (7).
9. Remove piston (7) and collar (5) on piston rod (4).
10. Insert rod (4) in cylinder tube (9).
11. Install wiper ring (1) and O-ring (2) on gland nut (3).
12. Install gland nut (3) in cylinder tube (9).

### 9-3.3. Installation

1. Using another lift truck or suitable jack, raise mast (16, [Figure 9-3](#)) far enough to allow installation of the lift cylinder (15).
2. Slowly lower mast (16) while aligning cylinder (15) with the tap on mast (16).
3. Secure the top of cylinder (30) with flat washer (4), lock washer (11) and screw (3)
4. Install clip (14), bracket (13), shims (12), two flat washers (4), two lock washers (11), two screws (10) and block (19).
5. Reconnect the tube (3, [Figure 9-2](#)) to the bottom of the lift cylinder.
6. Fill the hydraulic reservoir. Use hydraulic oil listed in [Table 3-2](#).
7. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).

8. Operate the lift and lower buttons to refill the cylinders and lines with hydraulic oil.
9. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
10. Install the compartment covers as described in paragraph [5-3](#).



**Figure 9-4 Lift Cylinder (Telescopic)**

## 9-4. Lift Cylinder (Three Stage Mast Free Lift)

### 9-4.1. Removal

1. Fully lower the lift carriage.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

3. Using another lift truck or suitable jack, raise lift carriage far enough to remove pressure on the free lift cylinder
4. Remove cotter pin and clevis pin connecting the lift chain to the anchor at cylinder (9, [Figure 9-6](#)).
5. Remove screw (16), lock washer (3), flat washer (17), bracket (7) and ram head (8) from cylinder (9)

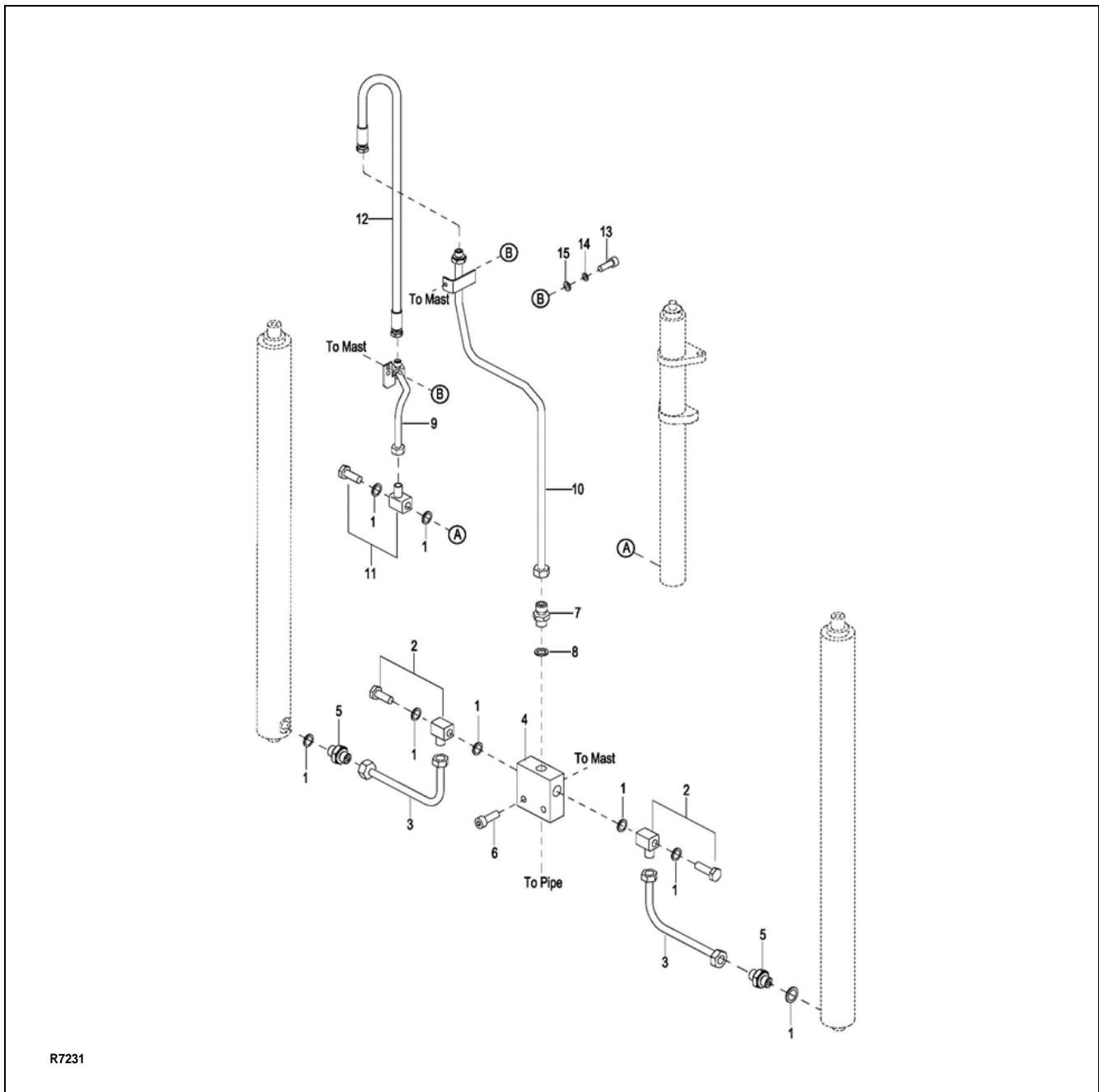
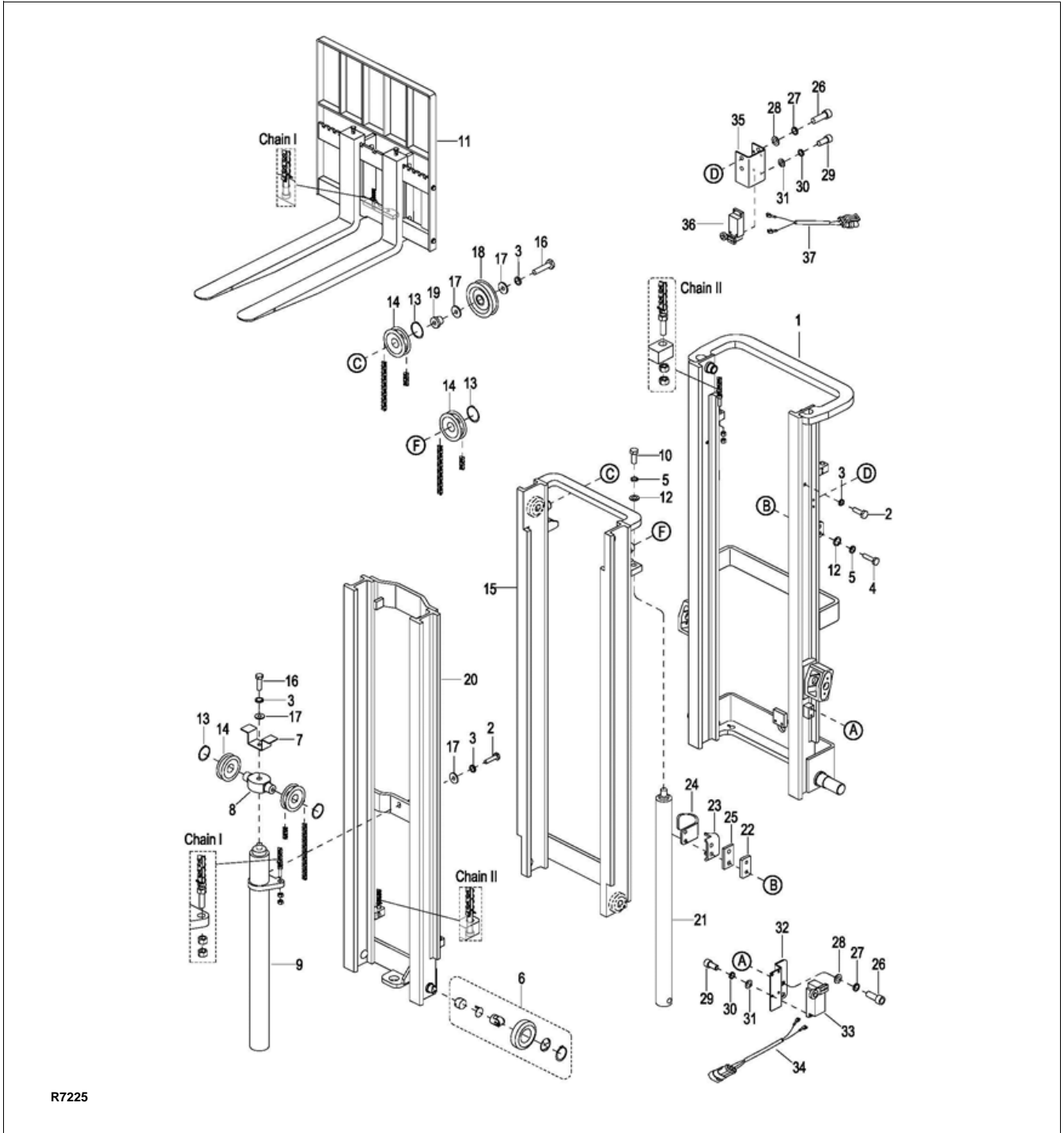


Figure 9-5 Lift System (Three Stage Mast)

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

6. Remove chains from sheaves (14).
7. Disconnect the tube (9, [Figure 9-5](#)) from the bottom of lift cylinder.
8. Support cylinder (9, [Figure 9-6](#)) and remove two screws (2), two lock washers (3) and two flat washers (17).
9. Raise lift cylinder assembly up and out of truck.



**Figure 9-6 Elevation System (Three Stage Mast)**

### 9-4.2. Repair

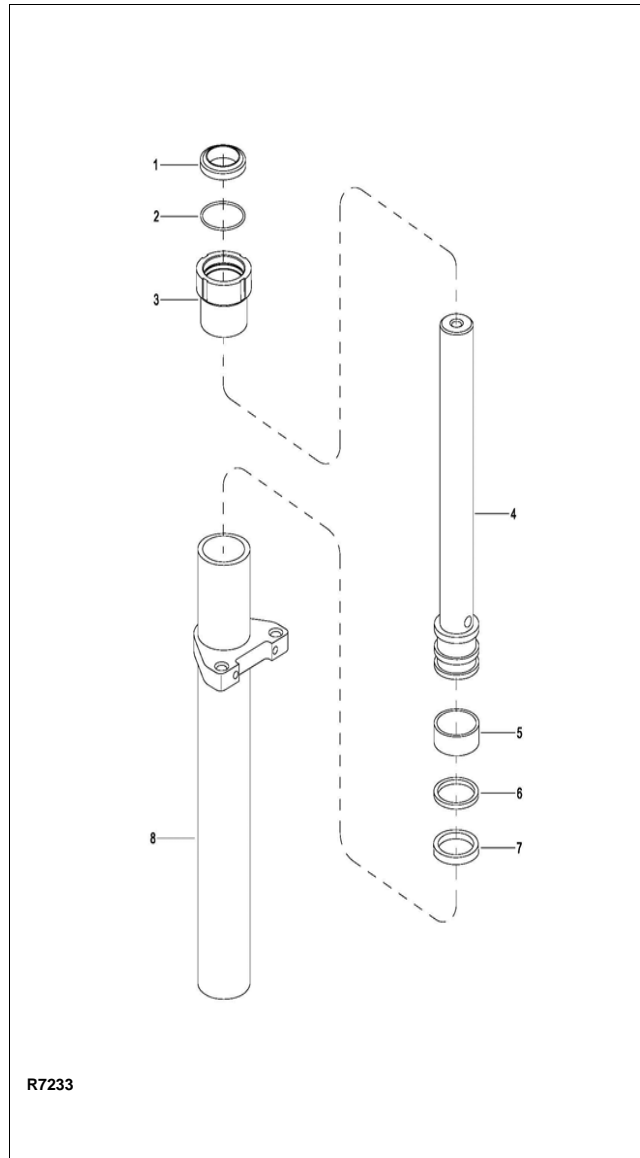
**CAUTION:** To prevent damage, use proper pipe clamp vise. The cylinder will be distorted if the vise is tightened too much.

1. Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
2. Remove gland nut (3, [Figure 9-7](#)).
3. Remove wiper (1) and O-ring (2) from gland nut (3).
4. Pull out piston rod (4).
5. Remove packing (7), ring (6) and backup ring (5) from piston rod (4).
6. Coat all parts with hydraulic oil ([Table 3-2](#)).
7. Install backup ring (5), ring (6) and packing (7) on piston rod (4).
8. Insert rod (4) in cylinder tube (8).
9. Install O-ring (2) and wiper (1) on gland nut (3).
10. Install gland nut (3) in cylinder tube (8).

### 9-4.3. Installation

1. Position cylinder (9, [Figure 9-6](#)) on inner mast (20) and secure with two screws (2), two lock washers (3) and two flat washers (17).
2. Reconnect the tube (3, [Figure 9-5](#)) to the bottom of the cylinder.
3. Position ram head (8, [Figure 9-6](#)) and bracket (7) and on cylinder (9) and secure with screw (16), lock washer (3), and washer (17).
4. Position lift chains over sheave, (14) and secure lift chain to the anchor at cylinder (9) with clevis pin and cotter pin.
5. Adjust the chains according to paragraph [8-2](#).
6. Fill the hydraulic reservoir. Use hydraulic oil listed in [Table 3-2](#).
7. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).

8. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
9. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).



**Figure 9-7 Free Lift Cylinder (Three Stage Mast)**



## 9-5. Lift Cylinder (Three Stage Mast Secondary)

### 9-5.1. Removal

1. Fully lower the lift carriage.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

3. Remove screw (10, [Figure 9-6](#)), lock washer (5) and flat washer (12) securing the top of cylinder (21) to mast (15).
4. Using another lift truck or suitable jack, raise middle mast (15) far enough to remove pressure on the secondary lift cylinder (21).

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

5. Disconnect the tube (3 [Figure 9-5](#)) from the bottom of lift cylinder.
6. Support cylinder (21, [Figure 9-6](#)) and remove two bolts (4), two lock washers (5), two flat washers (12), shims (22), bracket (23), clip (24) and block (25).
7. Raise lift cylinder assembly up and out of truck.

### 9-5.2. Repair

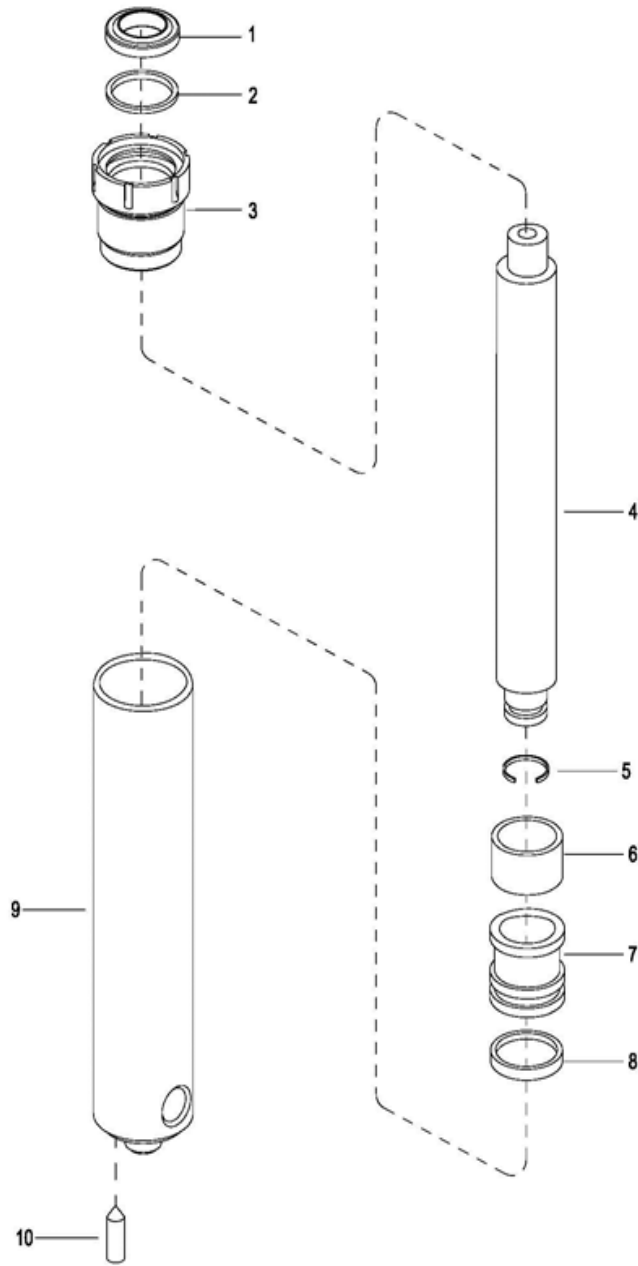
**CAUTION:** To prevent damage, use proper pipe clamp vise. The cylinder will be distorted if the vise is tightened too much.

1. Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
2. Remove gland nut (3, [Figure 9-8](#)).
3. Remove wiper (1) and O-ring (2) from gland nut (3).
4. Pull out piston rod (4).
5. Remove collar (5) and piston (7) from piston rod (4).

6. Remove backup ring (6) and packing (8) from piston rod (4).
7. Coat all parts with hydraulic oil ([Table 3-2](#)).
8. Install packing (8) and backup ring (6) on piston (7).
9. Remove piston (7) and collar (5) on piston rod (4).
10. Insert rod (4) in cylinder tube (9).
11. Install wiper (1) and O-ring (2) on gland nut (3).
12. Install gland nut (3) in cylinder tube (9).

### 9-5.3. Installation

1. Using another lift truck or suitable jack, raise middle mast (15, [Figure 9-6](#)) far enough to allow installation of the secondary lift cylinder (21).
2. Slowly lower mast (15) while aligning cylinder (21) with the tap on mast (1).
3. Secure the top of cylinder (21) with flat washer (12), lock washer (5) and screw (10)
4. Install clip (24), bracket (23), shims (22), two flat washers (12), two lock washers (5), two bolts (4) and block (25).
5. Reconnect the tube (3, [Figure 9-5](#)) to the bottom of the lift cylinder.
6. Fill the hydraulic reservoir. Use hydraulic oil listed in [Table 3-2](#).
7. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
8. Operate the lift and lower buttons to refill the cylinders and lines with hydraulic oil.
9. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
10. Install the compartment covers as described in paragraph [5-3](#).



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Figure 9-8 Secondary Lift Cylinder (Three Stage Mast)

## 9-5.4. Tilt Cylinders

### 9-5.4.1. Removal

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

1. Secure mast with a hoist and safety chains and blocking under the mast.
2. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.

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

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

under the line or fitting before disconnecting.

3. Remove the front compartment covers as described in paragraph 5-3.
4. Support the mast in an upright position.
5. Disconnect hoses (13 & 14, [Figure 9-1](#)) from the tilt cylinder.
6. Remove bolt (6, [Figure 9-9](#)), lock washer (2), flat washer (3) and shaft (7) from the cylinder.
7. Support the tilt cylinder and remove bolt (1, [Figure 9-9](#)), lock washer (2), flat washer (3) and shaft (4) from the cylinder.
8. Carefully raise tilt cylinder from the truck.

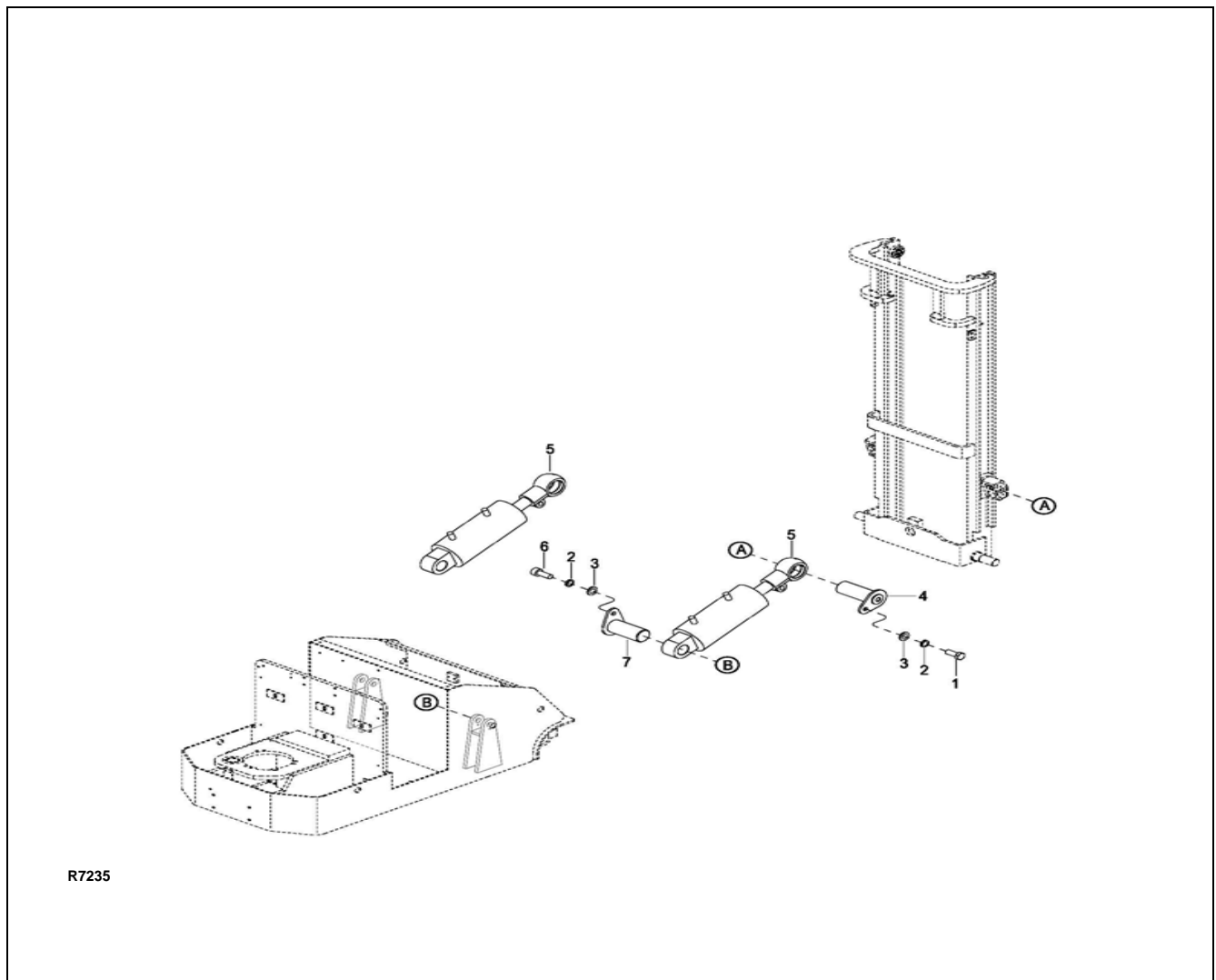


Figure 9-9 Tilt Cylinder Mounting

### 9-5.4.2.Repair

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

1. Remove nut (6, [Figure 9-10](#)), lock washer (5) and bolt (4).
2. Remove clevis (1) from piston rod (11).
3. In necessary, remove retaining ring (3) and bearing (2) from clevis (1).
4. Remove gland nut (9) from tube (14).
5. Remove dust seal (7), seal (8) and O-ring (10) from gland nut (9).
6. Pull piston rod (11) out of tube (14).
7. Remove seals (12) and wear ring (13) from piston rod (11).
8. If necessary, remove bearing (15) from tube (14).
9. Coat all parts with hydraulic oil ([Table 3-2](#)).
10. Install bearing (15) in tube (14).
11. Install seals (12) and wear ring (13) on piston rod (11).
12. Install piston rod (11) in cylinder body (14).
13. Install dust seal (7), seal (8) and O-ring (10) in gland nut (9).
14. Install gland nut (9) in tube (14).

15. Install bearing (2) and retaining rings (3) in clevis (1).
16. Install clevis (1) on piston rod (11) and secure with bolt (4), lock washer (5) and nut (6).

### 9-5.4.3.Installation

1. Position the cylinder between the outer mast and the truck frame.
2. Support the tilt cylinder and install shaft (4, [Figure 9-9](#)), flat washer (3), lock washer (2) and bolt (1).
3. Install shaft (7) flat washer (3), lock washer (2) and bolt (6).
4. Reconnect hoses (13 & 14, [Figure 9-1](#)) to the tilt cylinders.
5. Fill the hydraulic reservoir. Use hydraulic oil listed in [Table 3-2](#).
6. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).
7. Operate the tilt buttons to refill the cylinder and lines with hydraulic oil.
8. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in [Table 3-2](#).
9. Install the front compartment covers as described in paragraph [5-3](#).

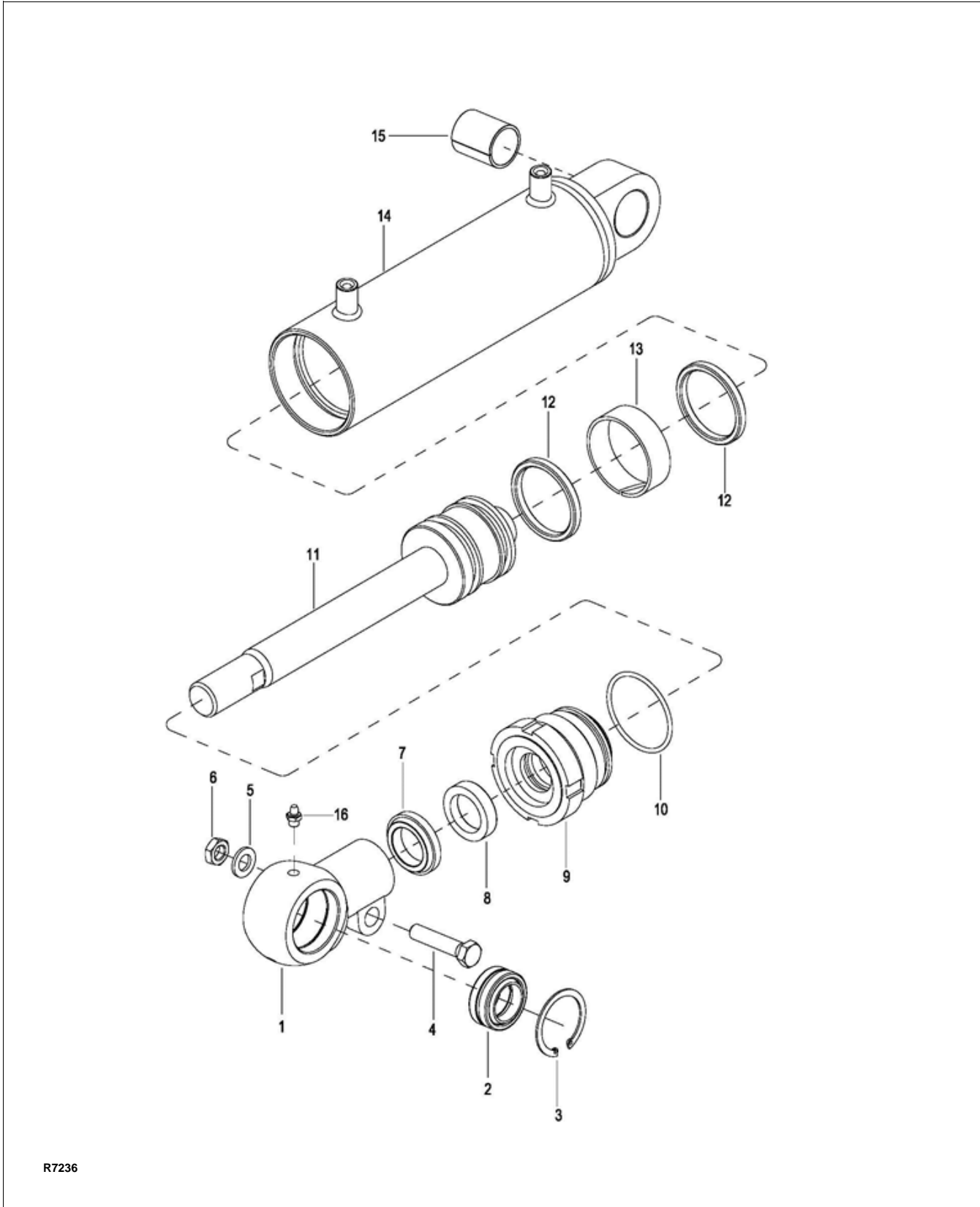


Figure 9-10 Tilt Cylinder

## NOTES

## 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. 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 either controller. No attempt should be made to open the controllers. Opening the controllers may damage them and will void the warranty.

The controllers are programmed at the factory specifically for the truck model on which it is equipped. It is important to replace the controllers with the correct preprogrammed unit to assure proper performance settings intended for that particular truck. See [Figure 12-23](#) for the preprogrammed controller number.

It is recommended that the controller exterior be cleaned periodically.

#### 10-1.2.Cleaning

1. Turn off the key switch (5, [Figure 12-22](#)) 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 bending the buss bars.

#### 10-1.3.Panel Removal.

1. Turn off the key switch (5, [Figure 12-22](#)) 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 (4, [Figure 10-1](#)).
4. Remove four screws (1), four lock washers (2), four flat washers (3) and control panel (4).

#### 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.

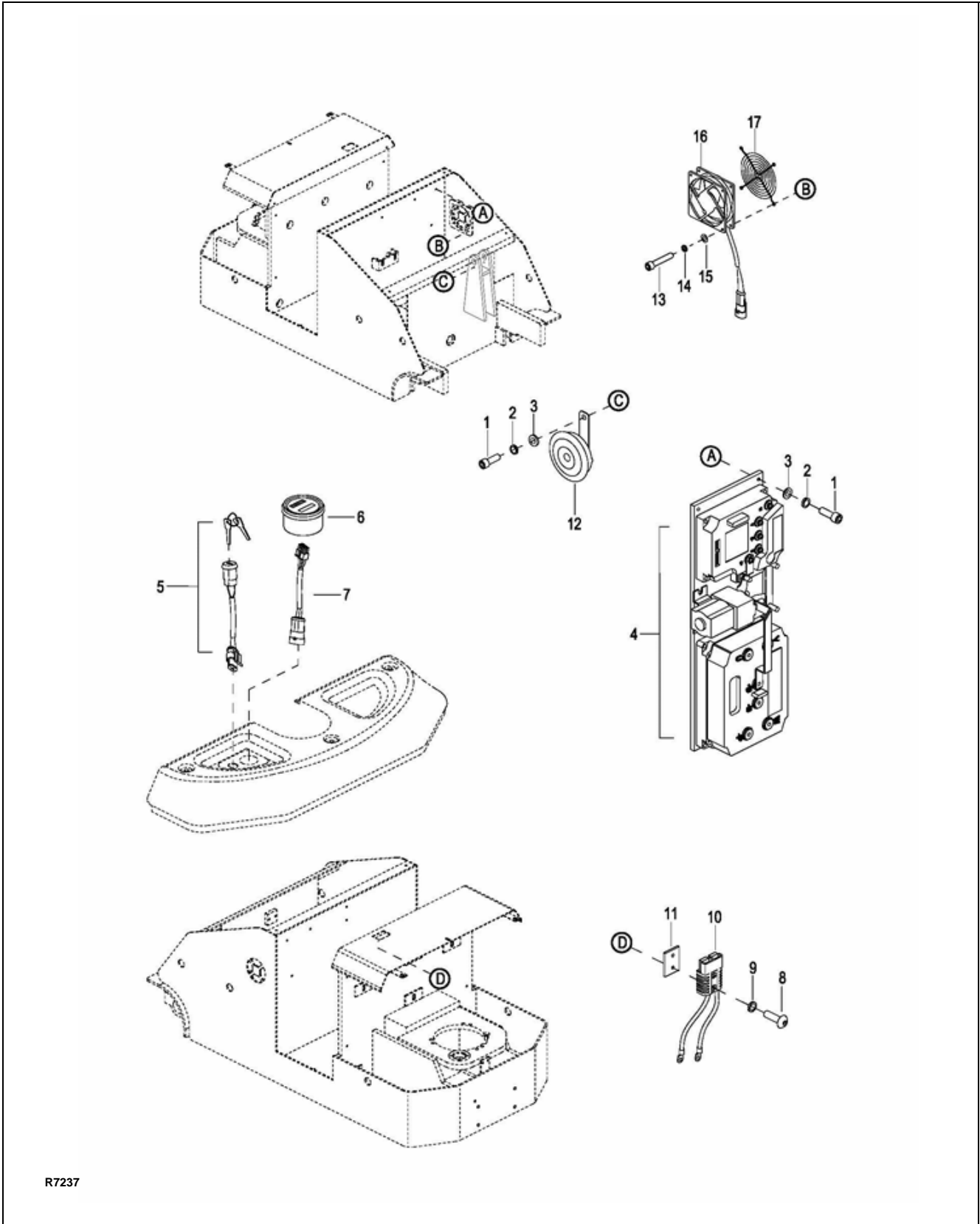
**NOTE:** Contactor (15) is not repairable and must be replaced if defective.

#### 10-1.5.Panel Installation.

1. Install the control panel (4, [Figure 10-1](#)) and secure with two screws (1), two lock washers (2) and two flat washers (3).
2. 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 (5, [Figure 12-22](#)).

### 10-2.HORN REPLACEMENT

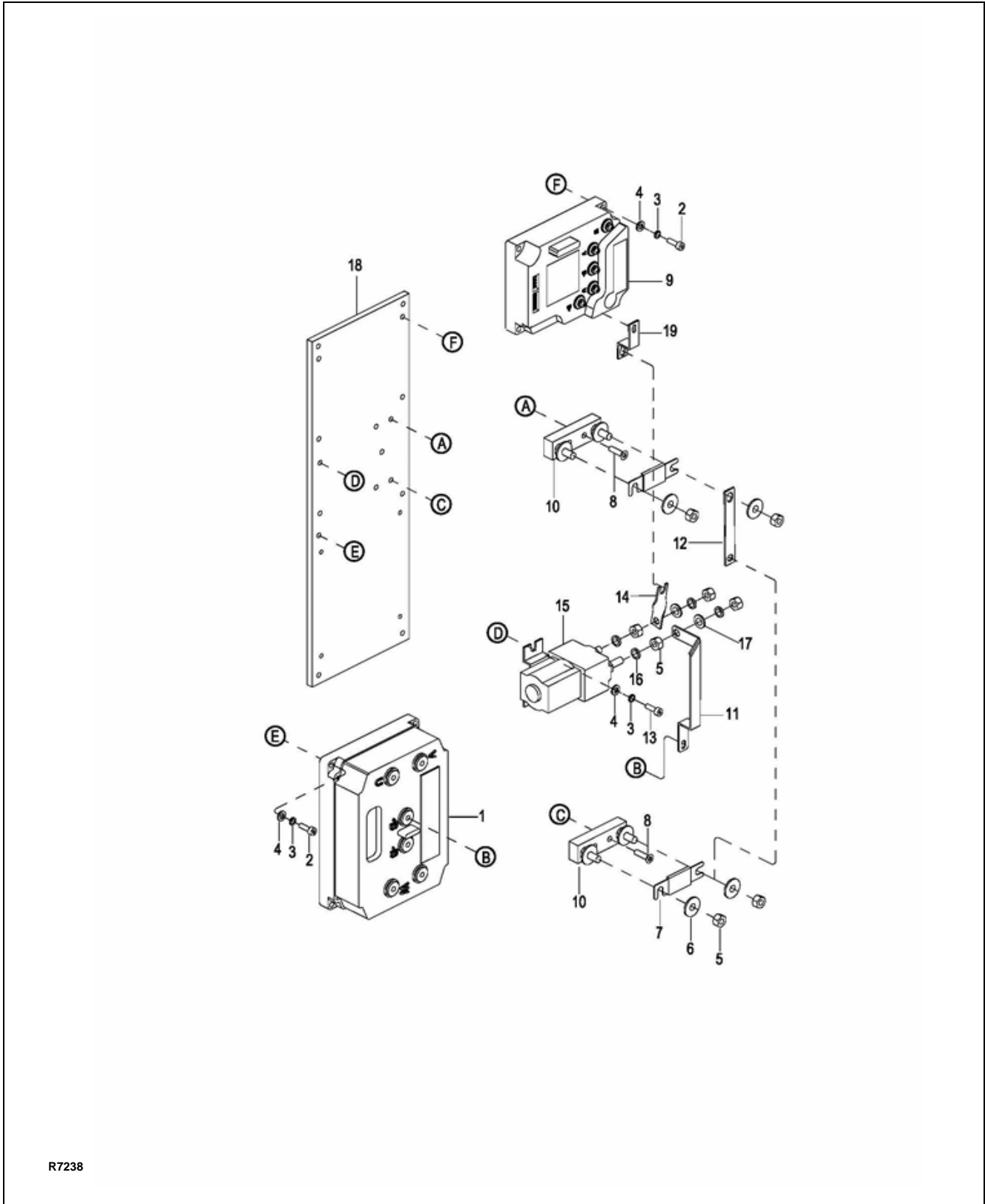
1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect all electrical connections from horn (12, [Figure 10-1](#)).
4. Remove screw (1), lock washer (2), flat washer (3) and horn (12).
5. Install horn and secure with screw (1), lock washer (2), flat washer (3).
6. Install the compartment covers as described in paragraph 5-3.
7. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).



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Figure 10-1 Electrical System





R7238

Figure 10-2 Electrical Panel

### 10-3.PUMP MOTOR.

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 compressed air to blow dust off of motor surfaces.

#### 10-4.1.Motor Removal

1. Remove the drive wheel (6, [Figure 10-3](#)) as described in paragraph 7-1.
2. Remove the brake (2) as described in paragraph 6-1.1.
3. Note routing of cables to ensure proper installation.
4. Tag the cables connected to the drive motor; then disconnect these cables from the drive motor.
5. Remove six screws (8), six lock washers (9) and six flat washers (10).
6. Remove drive motor (1) from bearing (3).

#### 10-4.2.Motor Installation

1. Install drive motor (1, [Figure 10-3](#)) onto bearing (3).
2. Remove six screws (8), six lock washers (9) and six flat washers (10) to secure the motor to the bearing.

3. Position cables as noted in removal and reconnect cables to the drive motor.
4. Reinstall the brake as described in paragraph 6-1.1.
5. Reinstall the drive wheel (6) as described in paragraph 7-1.
6. Install the rear compartment covers as described in paragraph 5-3.

### 10-5.DEADMAN SWITCH

#### 10-5.1.Replacement

1. Turn off the key switch (5, [Figure 12-22](#)) and disconnect the batteries.
2. Remove three screws (26, [Figure 12-1](#)), lock washers (2), flat washers (3) and cover (9).
3. Disconnect the harness from switch (36, [Figure 12-1](#)).
4. Remove two screws (37) and switch (36).
5. Install new switch (36) and secure with two screws (37).
6. Reconnect the deadman switch wiring.
7. Check for proper operation.
8. Install cover (9) and secure with three screws (26), flat washers (3) and lock washers (2).
9. Reconnect the batteries and turn on the keyswitch (5, [Figure 12-22](#)).

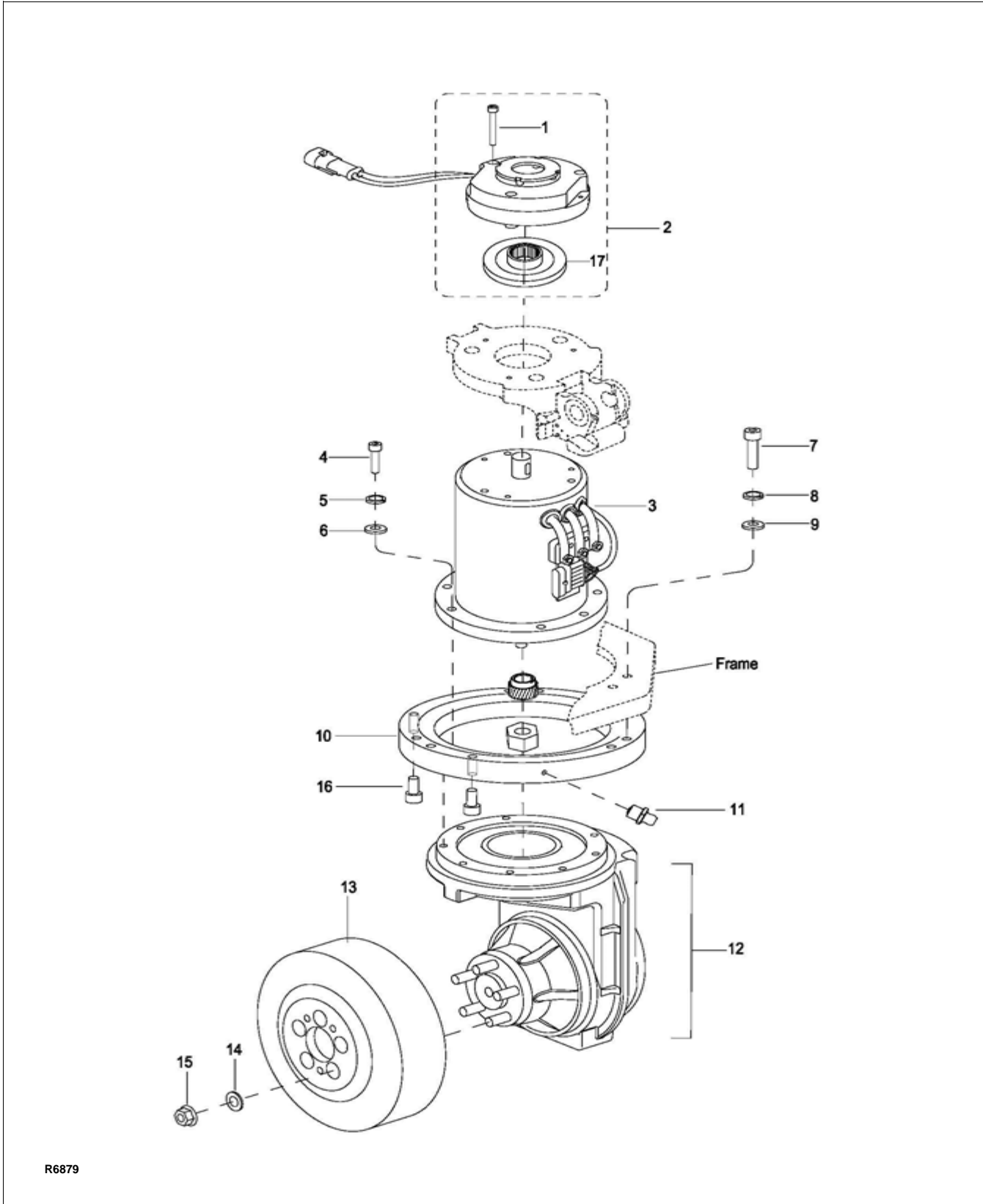


Figure 10-3 Transmission, Motor, Brake Assembly

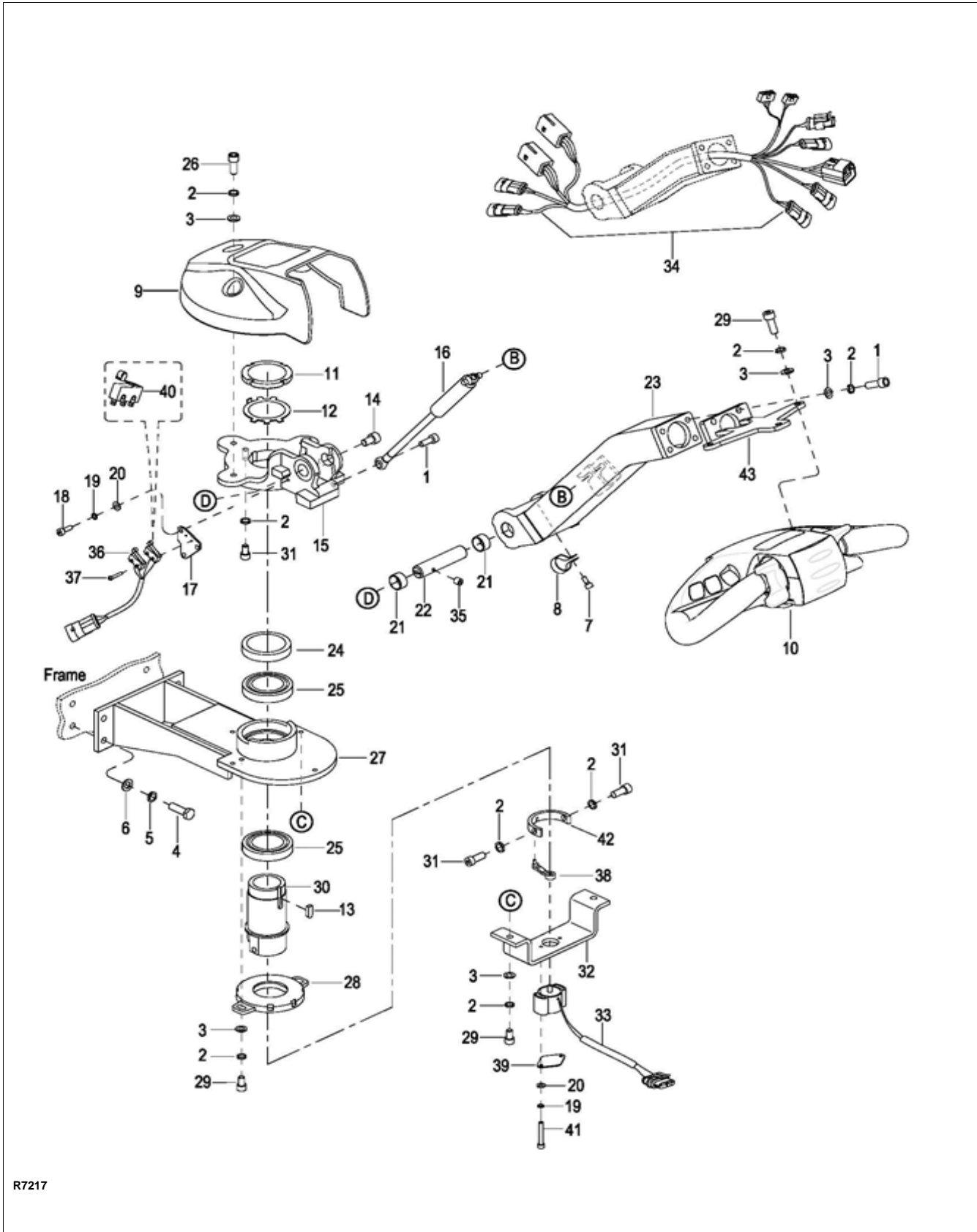
## NOTES

**SECTION 11  
OPTIONAL EQUIPMENT**

## NOTES

**SECTION 12**  
**ILLUSTRATED PARTS BREAKDOWN**

Following is an illustrated parts breakdown of assemblies and parts associated with the CB33 Lift Truck.



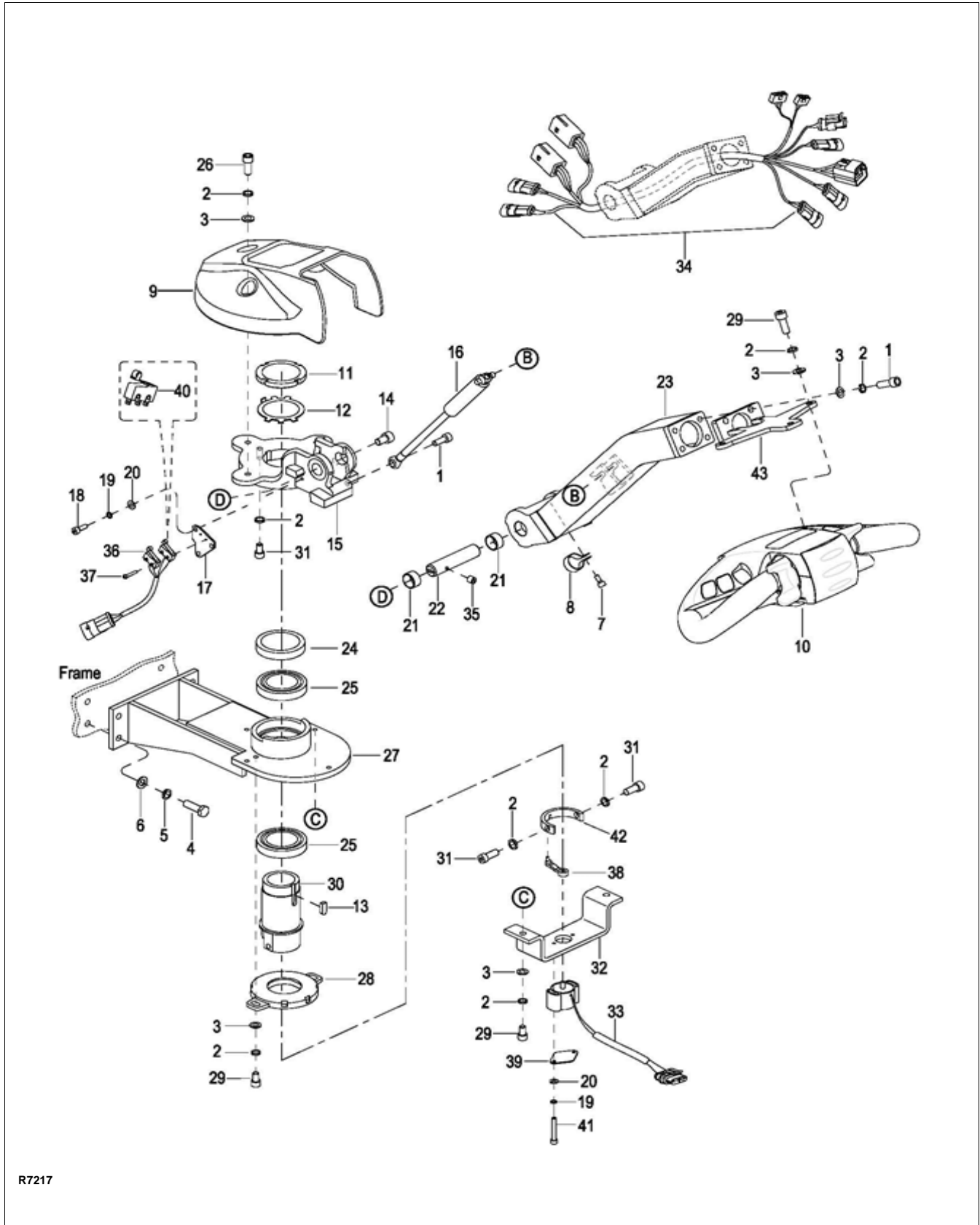
R7217

Figure 12-1 Control Arm



**CONTROL ARM**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000322-00	SCREW, M8 X 25	5	
2	0000-000159-00	WASHER, LOCK, M8	19	
3	0000-000176-00	WASHER, FLAT, M8	16	
4	0000-000283-00	BOLT, M10 X 35	4	
5	0000-000063-00	WASHER, LOCK, M10	4	
6	0000-000007-00	WASHER, FLAT, M10	4	
7	0000-000004-00	SCREW, M5 X 12	1	
8	0000-000491-00	CLAMP	1	
9	1280-300005-00	REVOLVING COVER	1	
10	2333-340000-00-B	CONTROL HEAD	1	
11	0000-000114-00	NUT, M53 X 1.5	1	
12	0000-000143-00	WASHER, LOCK, M52	1	
13	0000-000681-00	KEY, C8 X 7 X 14	1	
14	0000-000030-00	SCREW, M10 X 16	1	
15	2130-300001-00	TURNING BRACKET	1	
16	2130-350000-00	GAS SPRING	1	
17	1120-300006-00	SPACER	1	
18	0000-000028-00	SCREW, M4 X 10	2	
19	0000-000122-00	WASHER, LOCK, M4	2	
20	0000-000702-00	WASHER, FLAT, M4	2	
21	0000-000011-00	BEARING	2	
22	1120-300003-00	SHAFT	1	

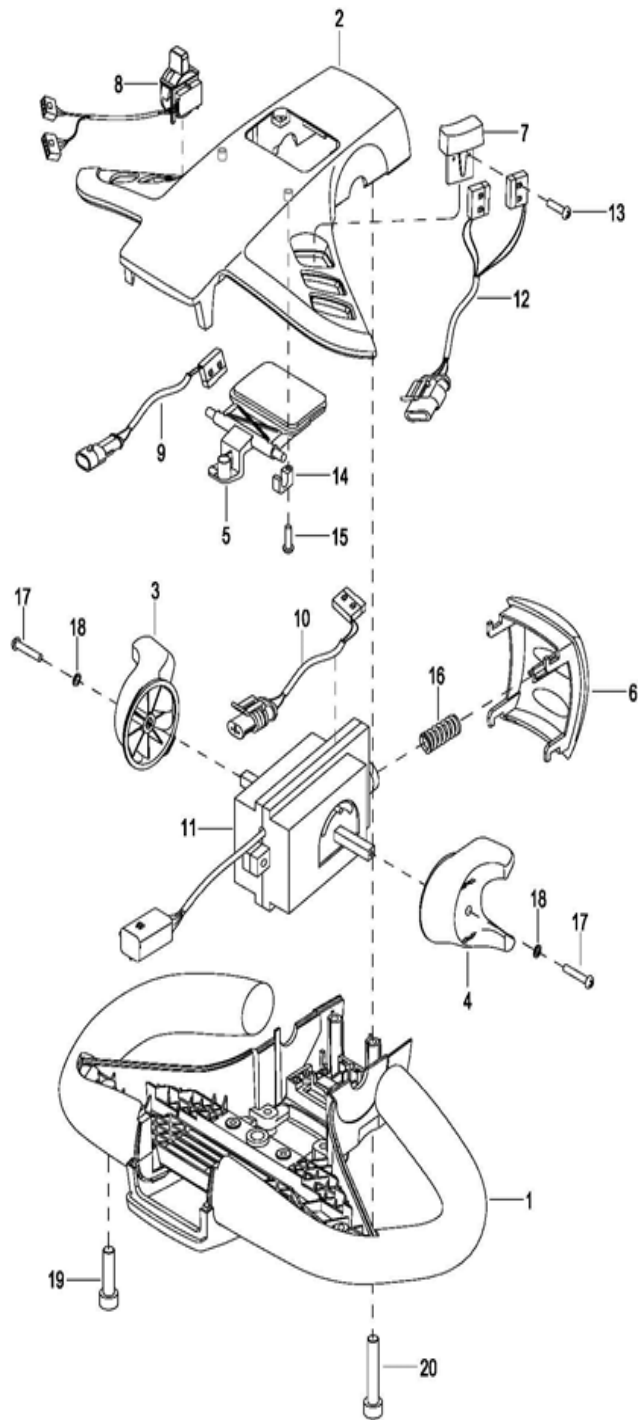


R7217

Figure 12-1 Control Arm - Continued

**CONTROL ARM - CONTINUED**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
23	2333-330000-10	CONTROL ARM	1	
24	2322-300002-00	SLEEVE	1	
25	0000-000142-00	BEARING 6011-2Z	2	
26	0000-000321-00	SCREW, M8 X 20	3	
27	2333-310000-00	HANDLE BRACKET	1	
28	1280-370000-10	DAMPING STEERING BOX	1	
29	0000-000321-00	SCREW, M8 X 20	7	
30	2322-300001-00	SUPPORT	1	
31	0000-000109-00	SCREW, M8 X 16	3	
32	1221-300002-00	MOUNTING PLATE	1	
33	1221-520007-0A	POTENTIOMETER WITH WIRE HARNESS	1	
34	2333-520002-10	WIRE HARNESS	1	
35	0000-000429-00	SCREW, M5 X 8	1	
36	2130-520004-00	SWITCH WIRE HARNESS	1	
37	0000-000377-00	SCREW, M2 X 20	2	
38	1221-300003-00	ROCKER POTENTIOMETER	1	
39	1221-300004-00	PLATE	1	
40	1220-560001-00	SWITCH	2	
41	0000-000121-00	SCREW, M4 X 35	2	
42	1221-300001-00	CAM	1	
43	2333-320000-10	CONTROL HANDLE BRACKET	1	

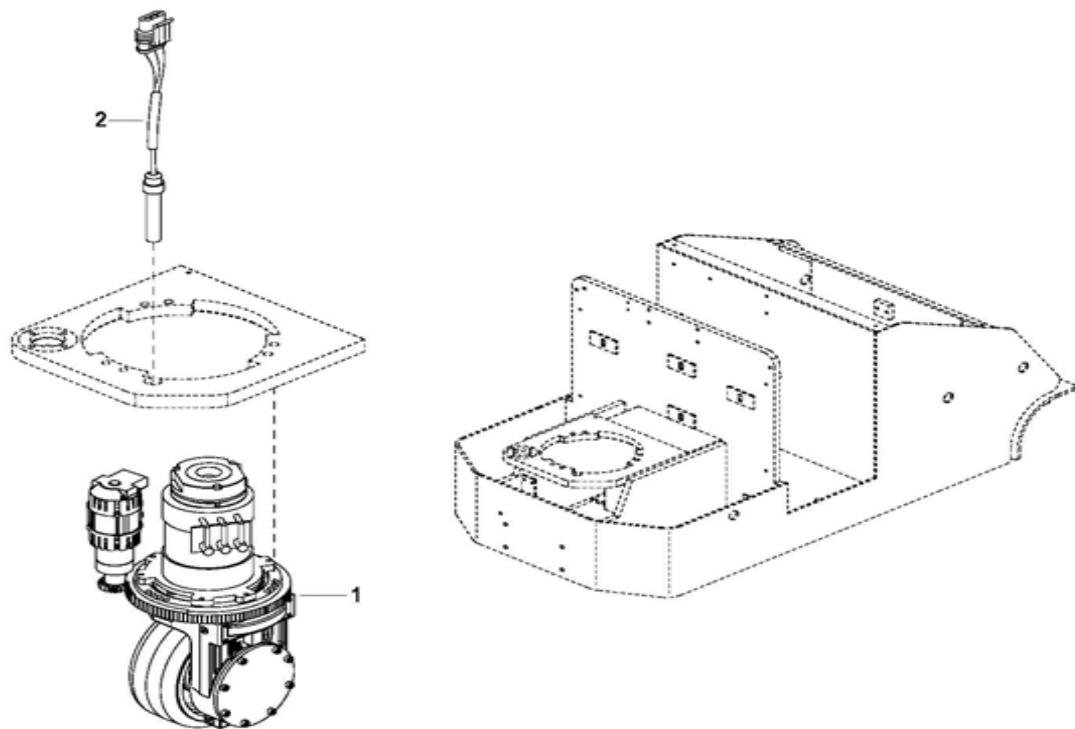


R7218

Figure 12-2 Control Head

**CONTROL HEAD**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2333-340000-00-B	CONTROL HEAD ASSEMBLY	1	
1	2333-340001-00	COVER	1	
2	2333-340002-00	CAP	1	
3	2333-340003-00	TRAVEL LEVER R	1	
4	2333-340004-00	TRAVEL LEVER L	1	
5	2333-340005-00	HORN BUTTON	1	
6	2333-340006-00	BELLY BUTTON COVER	1	
7	2333-340007-00	TILT BUTTON	1	
8	2333-340008-00	LIFT LOWER SWITCH	1	
9	2333-520005-10	HORN WIRE HARNESS	1	
10	2333-520004-10	BELLY BUTTON SWITCH HARNESS	1	
11	2333-520003-10	POTENTIOMETER	1	
12	2333-520006-10	TILT SWITCH HARNESS	1	
13	2333-340011-00	SCREW, ST2.9 X 9.5	2	
14	2333-340009-00	MOUNT SEAT	2	
15	2333-340012-00	SCREW, ST2.9 X 13	2	
16	2333-340010-00	SPRING	1	
17	0000-000037-00	SCREW, M3 X 12	2	
18	0000-000038-00	WASHER, LOCK, M3	2	
19	2333-340013-00	SCREW, M5 X 30	2	
20	2333-340014-00	SCREW, M5 X 55	2	

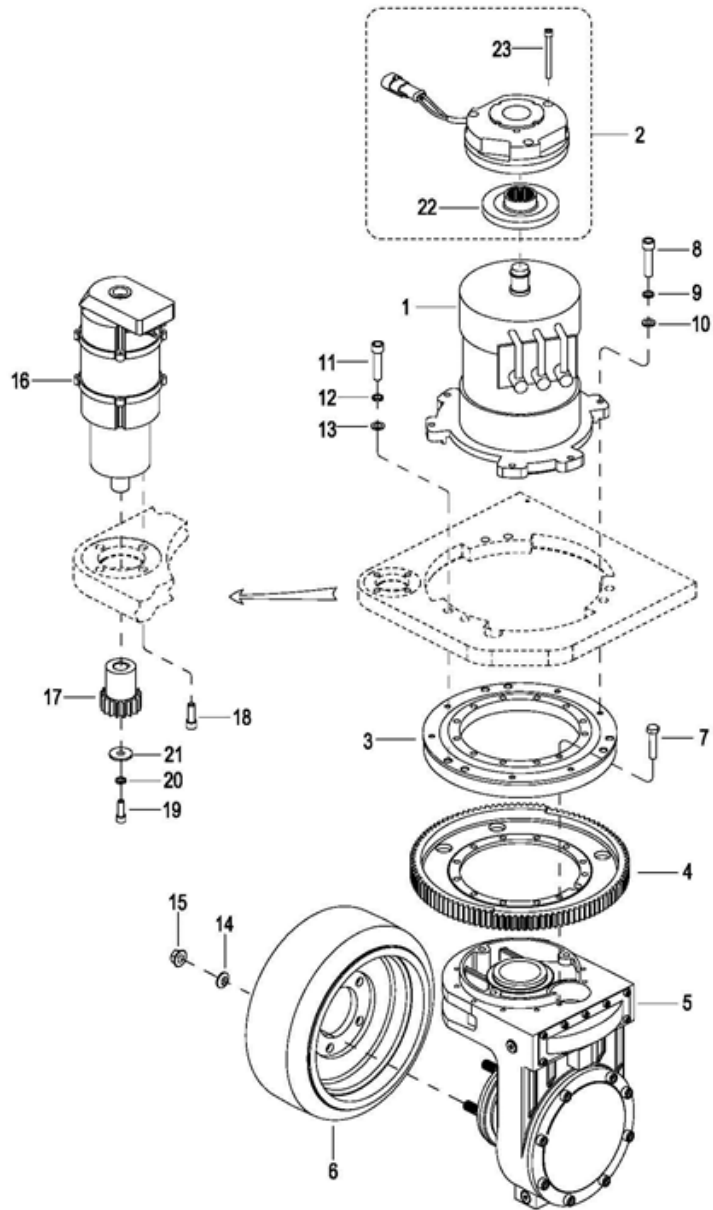


R7219

Figure 12-3 Drive System

**DRIVE SYSTEM**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2333-200000-10	DRIVE ASSEMBLY	1	
2	1280-520009-10	POSITION SWITCH WIRE HARNESS	1	



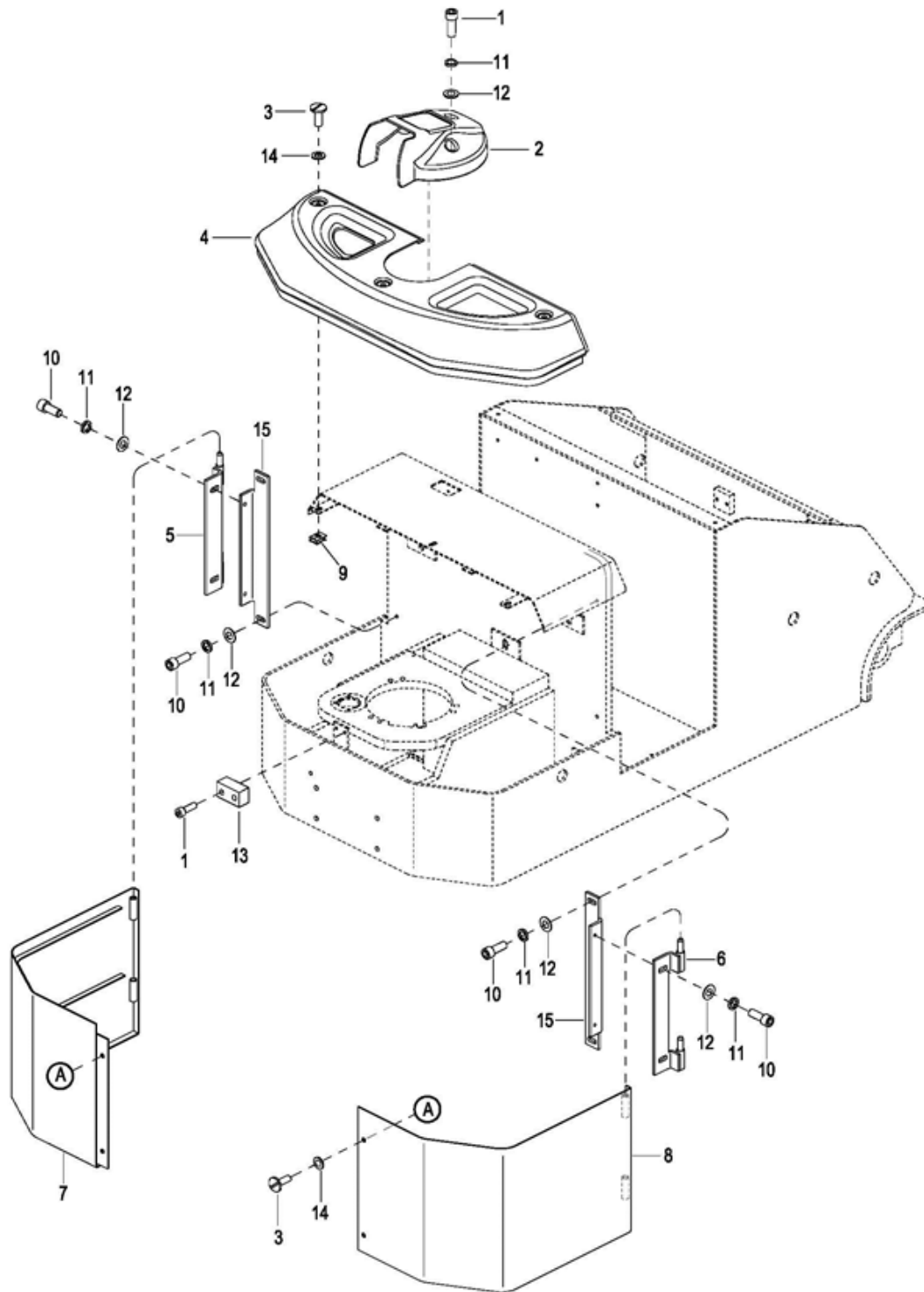
R7220

Figure 12-4 Drive Assembly



**DRIVE SYSTEM**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2333-200000-00	DRIVE ASSEMBLY	1	
1	2333-240000-10	DRIVE MOTOR	1	
2	2333-210000-00	BRAKE ASSEMBLY	1	
3	2333-200002-10	BEARING	1	
4	2333-200003-10	GEAR	1	
5	2333-220000-10	TRANSMISSION	1	
6	2333-230000-10	DRIVE WHEEL	1	
7	0000-000869-00	BOLT, M8 X 40	12	
8	0000-000154-00	SCREW, M8 X 35	6	
9	0000-000159-00	WASHER, LOCK, M8	6	
10	0000-000176-00	WASHER, FLAT, M8	6	
11	0000-000516-00	SCREW, M12 X 40	6	
12	0000-000060-00	WASHER, LOCK, M12	6	
13	0000-000373-00	WASHER, FLAT, M12	6	
14	0000-001268-10	WASHER, LOCK, M14	5	
15	0000-001269-10	NUT, M14 X 1.5	5	
16	2333-270000-10	STEERING MOTOR	1	
17	2333-200004-00	GEAR	1	
18	0000-000321-00	SCREW, M8 X 20	4	
19	0000-000386-00	SCREW, M6 X 20	1	
20	0000-000056-00	WASHER, LOCK, M6	1	
21	2333-200001-10	WASHER	1	
22	2333-210001-10	BRAKE LINING	1	
23	0000-001287-10	SCREW, M6 X 70	3	

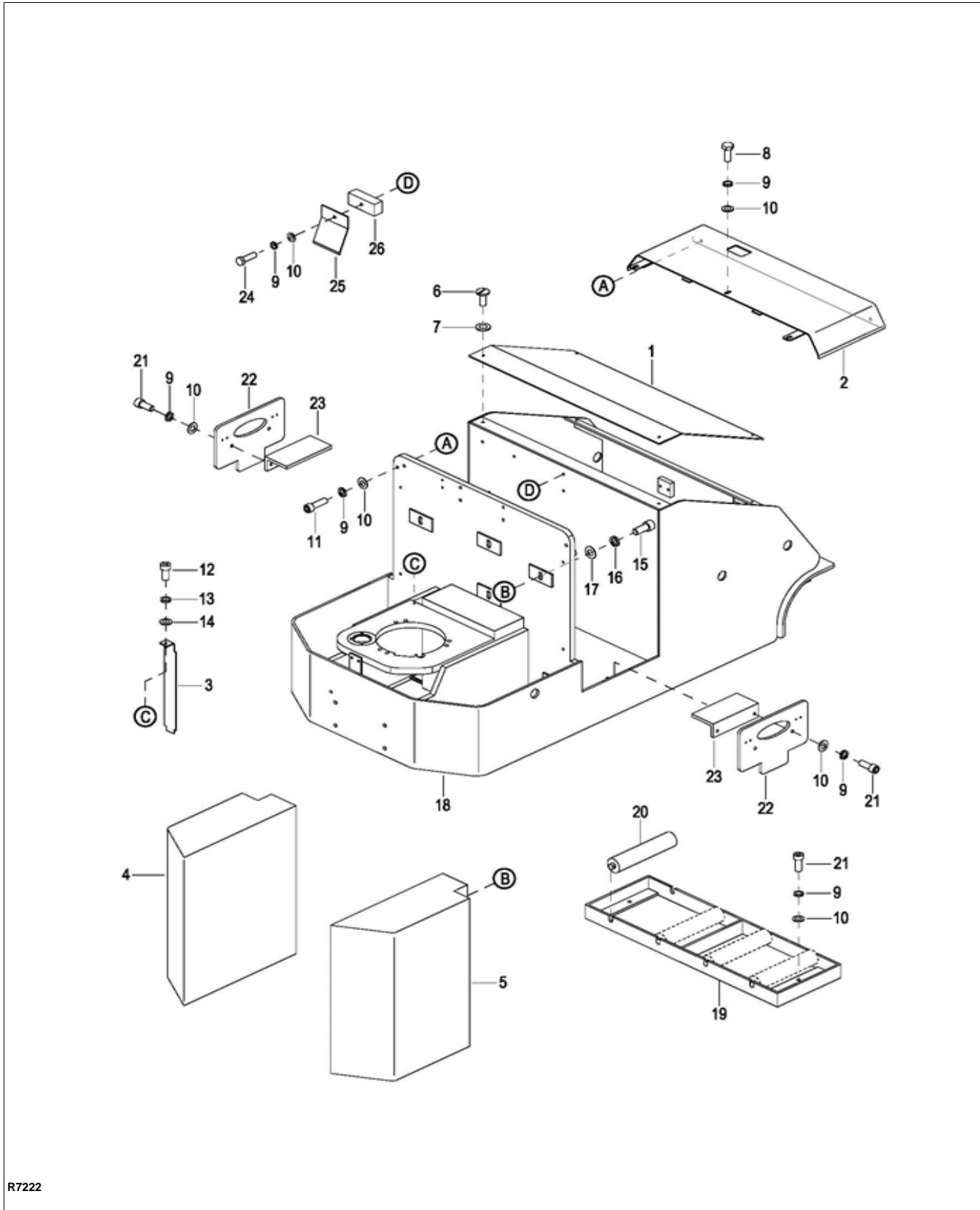


R7221

Figure 12-5 Compartment

**COMPARTMENT**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000433-00	SCREW, M8 X 12	5	
2	2130-190002-00	MIDDLE COVER	1	
3	0000-000649-00	SCREW, M8 X 20	5	
4	2130-190001-00	UPPER COVER	1	
5	2130-172000-00	HINGE BLOCK L	1	
6	2130-182000-00	HINGE BLOCK R	1	
7	2333-131000-00	COVER ASSEMBLY L	1	
8	2333-141000-00	COVER ASSEMBLY R	1	
9	1220-150005-00	NUT, M8	2	
10	0000-000109-00	SCREW, M8 X 16	8	
11	0000-000159-00	WASHER, LOCK, M8	11	
12	0000-000194-00	WASHER, FLAT, M8	11	
13	2125-600005-00	BUFFER BLOCK	1	
14	2214-150002-00	WASHER	5	
15	2333-130001-00	MOUNTING PLATE	2	

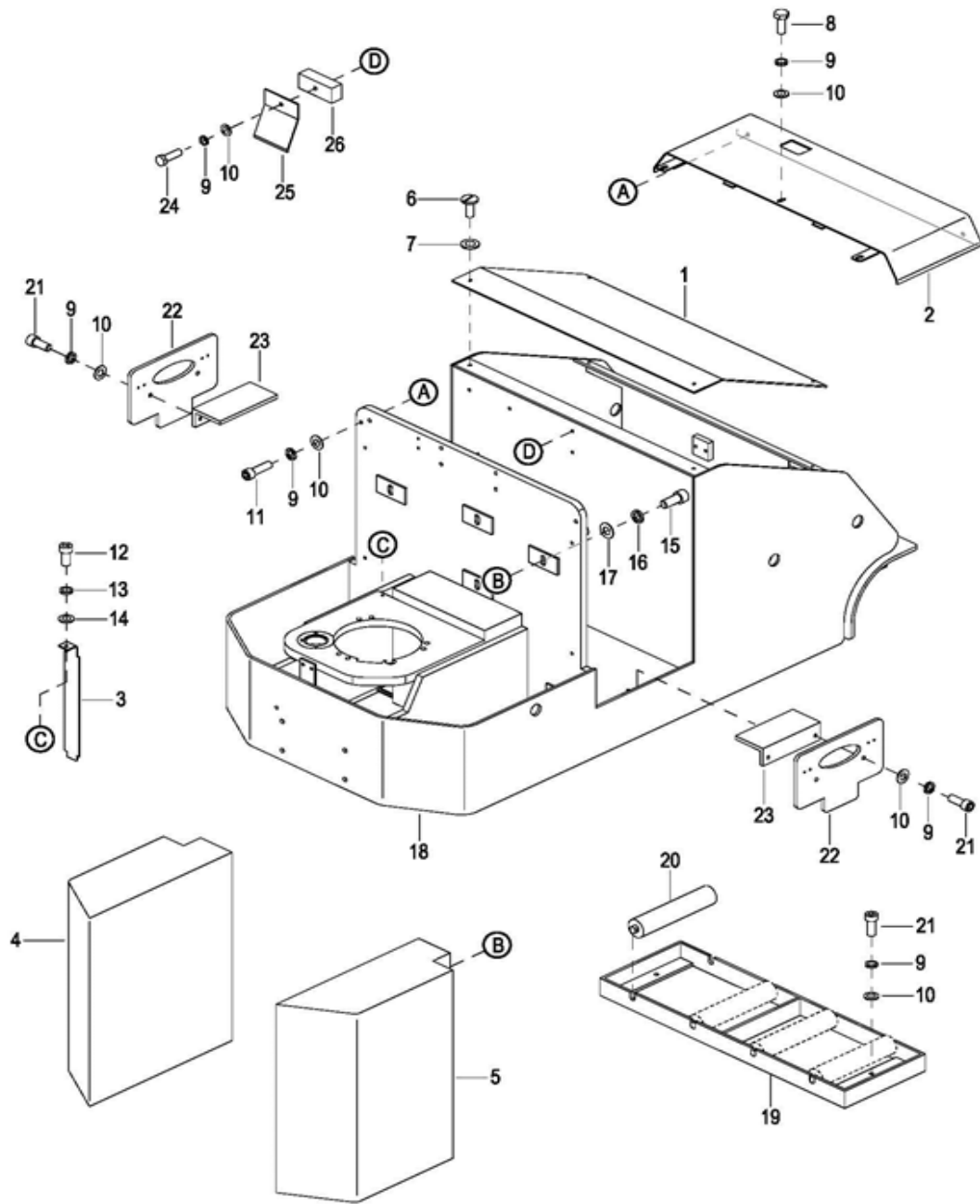


R7222

Figure 12-6 Frame

**FRAME**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2333-100002-00	COVER	1	
2	2333-120000-00	BATTERY COVER	1	
3	2333-100001-10	CABLE BAFFLE	1	
4	2333-150000-00	COUNTER WEIGHT L	1	
5	2333-160000-00	COUNTER WEIGHT R	1	
6	0000-000368-00	SCREW, M8 X 12	4	
7	2214-150002-00	WASHER	4	
8	0000-000242-00	BOLT, M8 X 16	1	
9	0000-000159-00	WASHER, LOCK, M8	10	
10	0000-000176-00	WASHER, FLAT, M8	10	
11	0000-000026-00	SCREW, M8 X 30	2	
12	0000-000015-00	SCREW, M6 X 10	1	
13	0000-000056-00	WASHER, LOCK, M6	1	
14	0000-000380-00	WASHER, FLAT, M6	1	
15	0000-000087-00	SCREW, M12 X 25	4	
16	0000-000060-00	WASHER, LOCK, M12	4	
17	0000-000373-00	WASHER, FLAT, M12	4	
18	2333-110000-10	FRAME	1	
19	1280-161000-00	ROLLER FRAME	1	
20	1280-160001-00	ROLLER	4	
21	0000-000322-00	SCREW, M8 X 25	6	
22	1280-180002-00	BAFFLE	1	

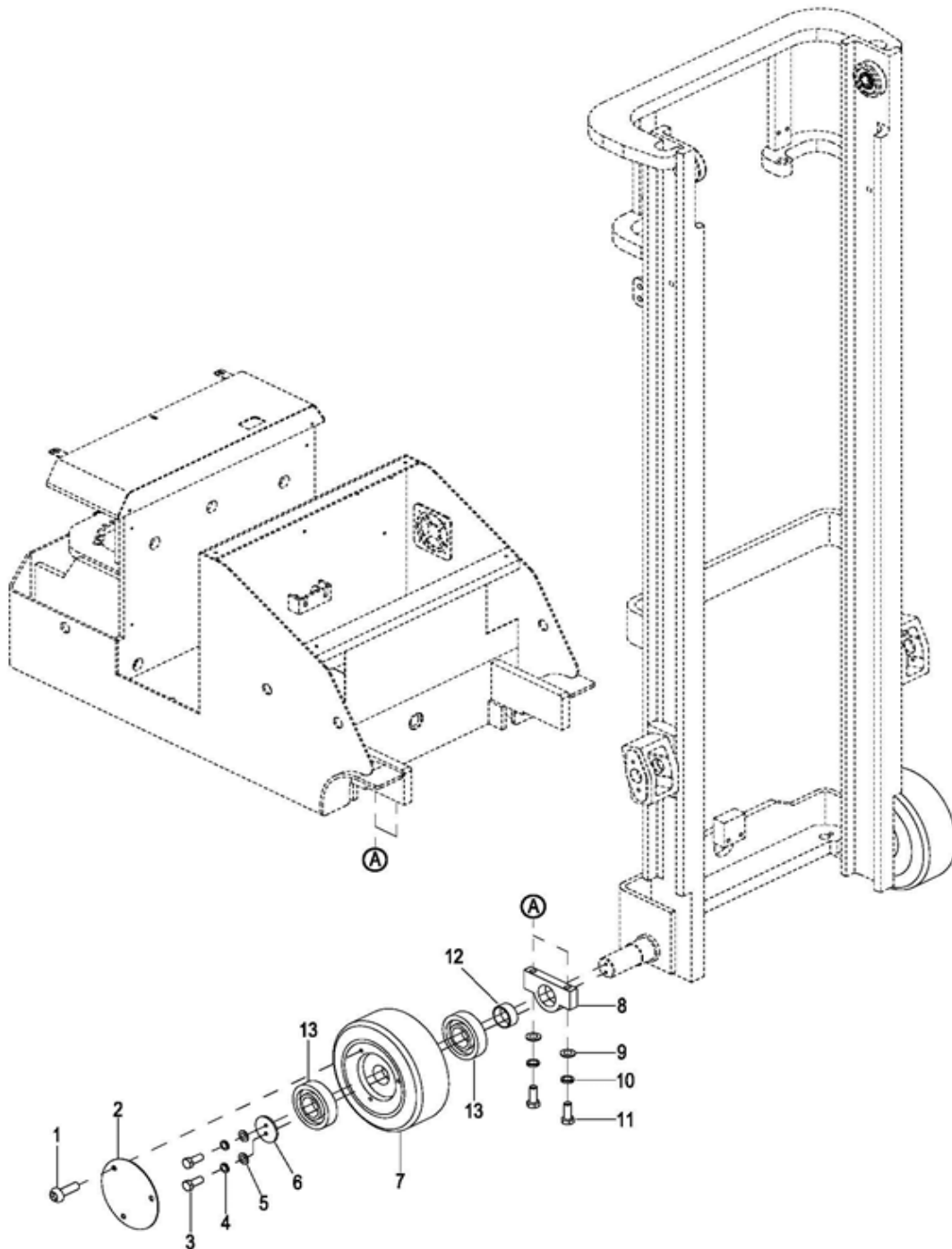


R7222

Figure 12-6 Frame - Continued

FRAME - CONTINUED

Pos.	Part Number	Description	Qty. Reqd.	Notes
23	1280-180001-0A	BLOCK	1	
24	0000-000279-00	BOLT, M8 X 35	1	
25	2125-100002-00	BATTERY CLIP	1	
26	2140-100001-00	BATTERY BLOCK	1	



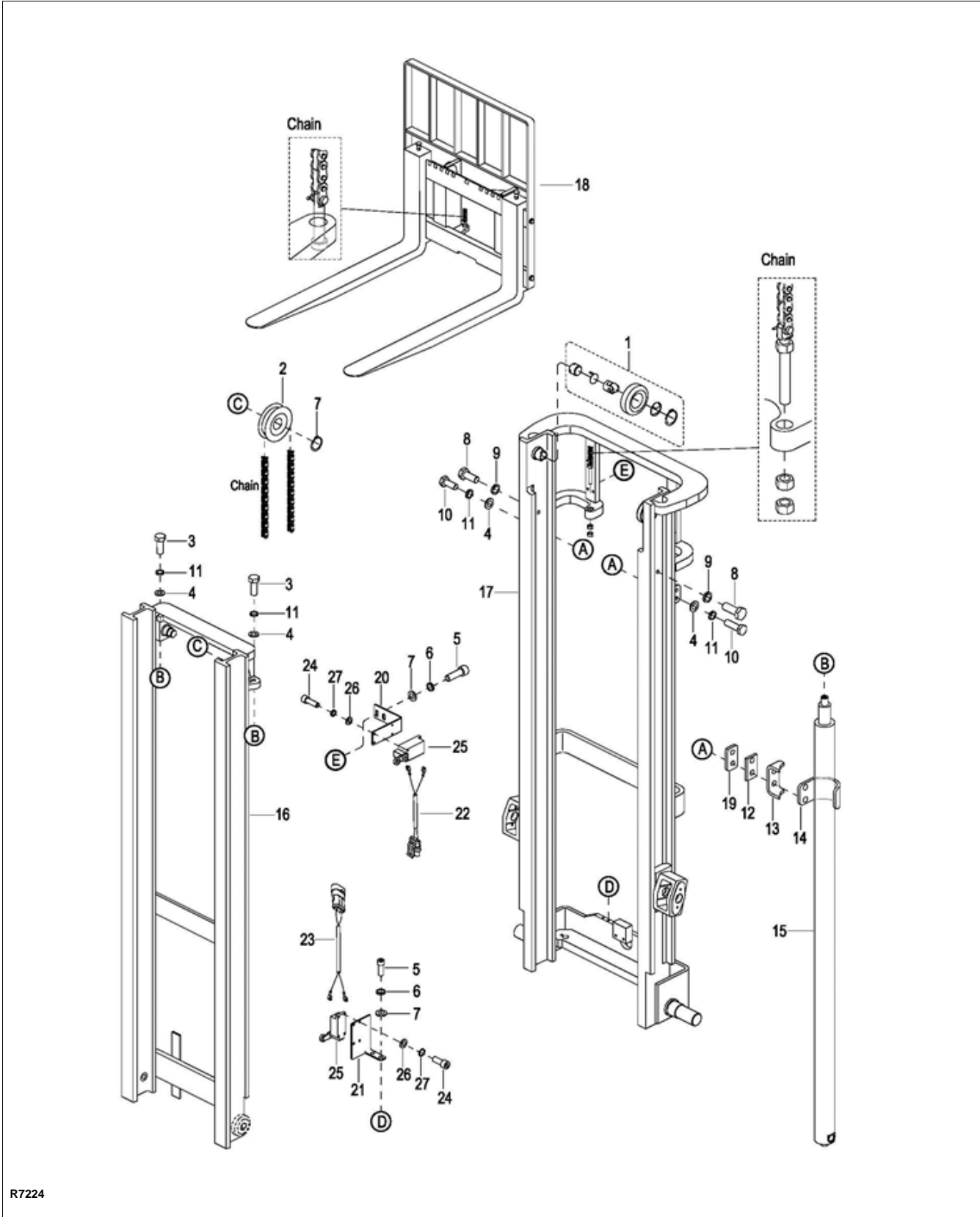
R7223

Figure 12-7 Load Wheels



**LOAD WHEELS**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000700-00	SCREW, M8 X 16	3	
2	2320-600003-00	COVER	1	
3	0000-000620-00	BOLT, M6 X 16	2	
4	0000-000056-00	WASHER, LOCK, M6	2	
5	0000-000380-00	WASHER, FLAT, M6	2	
6	2320-600002-00	RETAINER	1	
7	2320-601100-00	LOAD WHEEL	1	
8	2320-600001-00	MOUNTING BASE	1	
9	0000-000379-00	WASHER, FLAT, M14	2	
10	0000-000233-00	WASHER, LOCK, M14	2	
11	0000-001028-00	BOLT, M14 X 90	2	
12	0000-000858-00	BUSHING, 50 X 60 X 30	1	
13	0000-000857-00	BEARING	2	

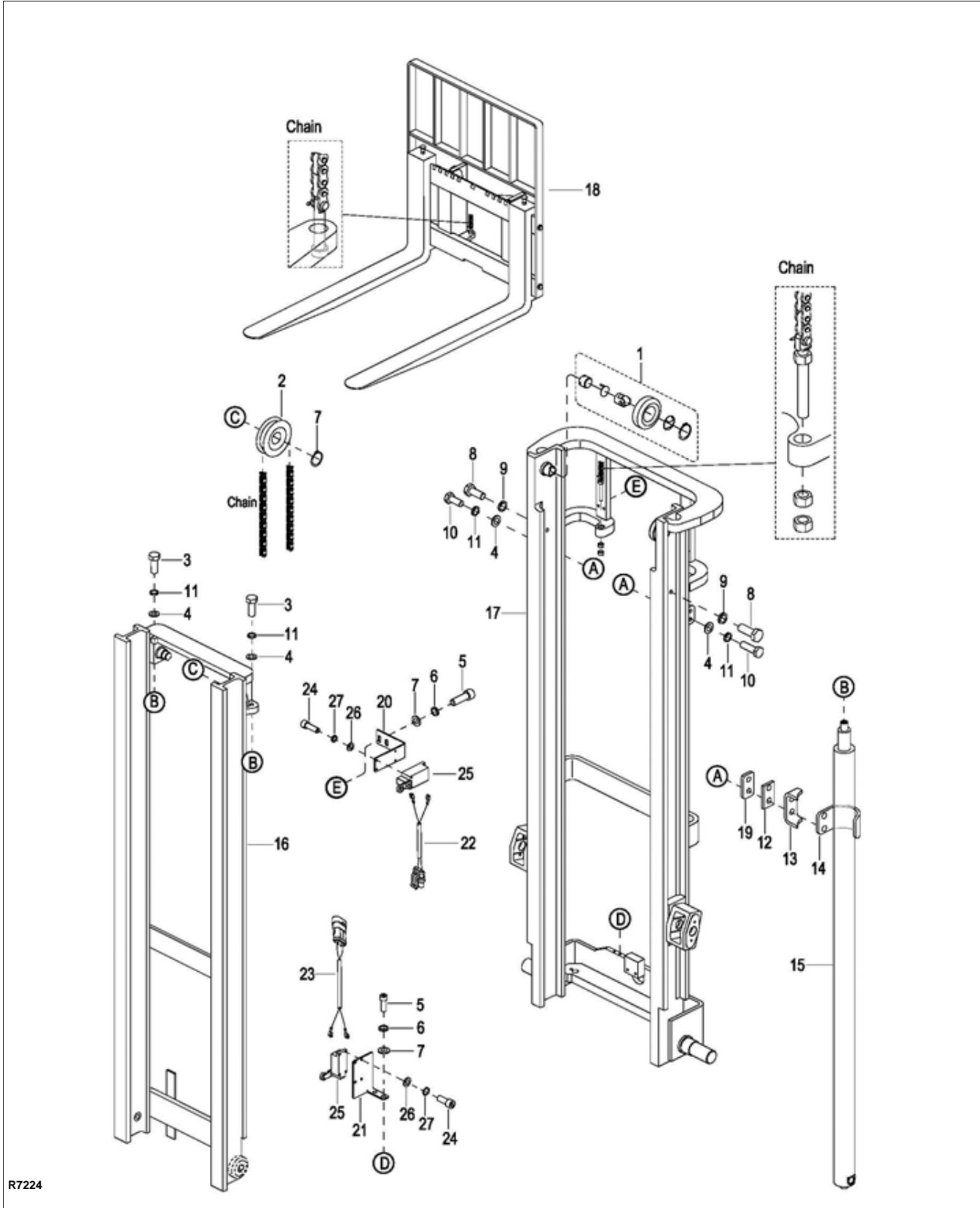


R7224

Figure 12-8 Elevation System (Telescopic)

**ELEVATION SYSTEM (TELESCOPIC)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2125-612000-00	ROLLER ASSEMBLY	4	
2	2214-600001-00	CHAIN ROLLER	2	
3	0000-000244-00	BOLT, M10 X 30	2	
4	0000-000071-00	WASHER, FLAT, M10	6	
5	0000-000109-00	SCREW, M8 X 16	4	
6	0000-000159-00	WASHER, LOCK, M8	4	
7	0000-000176-00	WASHER, FLAT, M8	4	
8	0000-000285-00	BOLT, M12 X 35	2	
9	0000-000060-00	WASHER, LOCK, M12	2	
10	0000-000283-00	BOLT, M10 X 35	4	
11	0000-000063-00	WASHER, LOCK, M10	6	
12	2214-600005-00	SHIM	A.R.	As Required
13	2214-600004-0A	CYLINDER BRACKET	2	
14	2214-600003-0A	CLINDER CLIP	2	
15	2130-410000-00-01	CYLINDER	2	Used for Lift Height 104"
15a	2130-410000-00-02	CYLINDER	2	Used for Lift Height 126"
16	2333-620000-00-01	INNER MAST	1	Used for Lift Height 104" Lift Height 104"
16a	2333-620000-00-03	INNER MAST	1	Used for Lift Height 126"

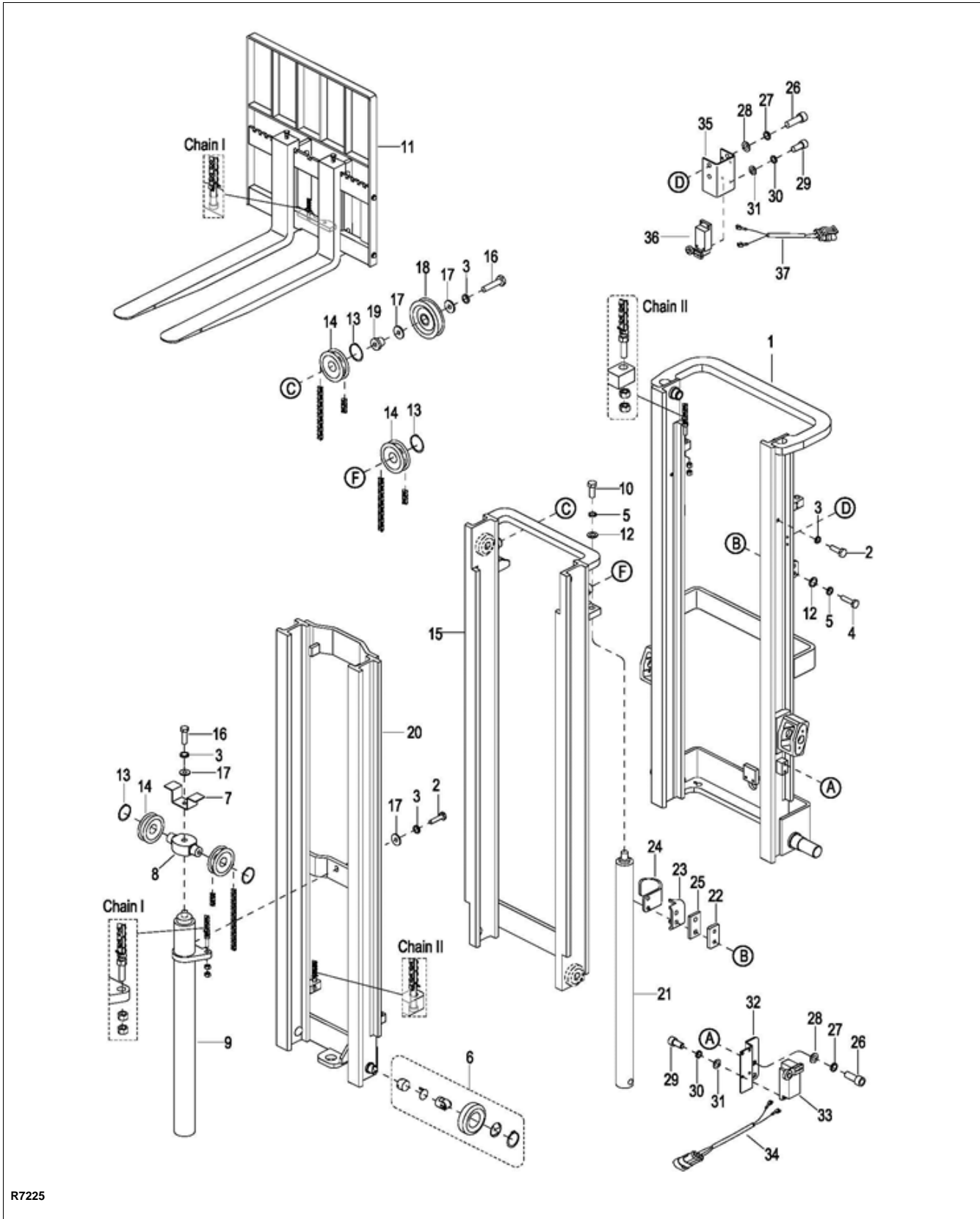


R7224

Figure 12-8 Elevation System (Telescopic) - Continued

**ELEVATION SYSTEM (TELESCOPIC) - CONTINUED**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
17	2333-610000-00-01	OUTER MAST	1	Used for Lift Height 104"
17a	2333-610000-00-03	OUTER MAST	1	Used for Lift Height 126"
18	—	LIFT CARRIAGE	2	See Lift Carriage Section
19	2214-600007-00	CUSHION BLOCK II	2	
20	2130-500002-0A	SENSOR BRACKET	1	
21	2130-500001-0A	SENSOR BRACKET	1	
22	2125-520009-26	PROXIMITY SWITCH HARNESS	1	Used for Lift Height 104"
22a	2125-520009-29	PROXIMITY SWITCH HARNESS		Used for Lift Height 126"
23	2130-520003-0A	PROXIMITY SWITCH HARNESS	1	
24	0000-000004-00	SCREW, M5 X 12	8	
25	2125-500003-00	PROXIMITY SWITCH 8108	2	
26	0000-000390-00	WASHER, FLAT, M5	8	
27	0000-000206-00	WASHER, LOCK, M5	8	

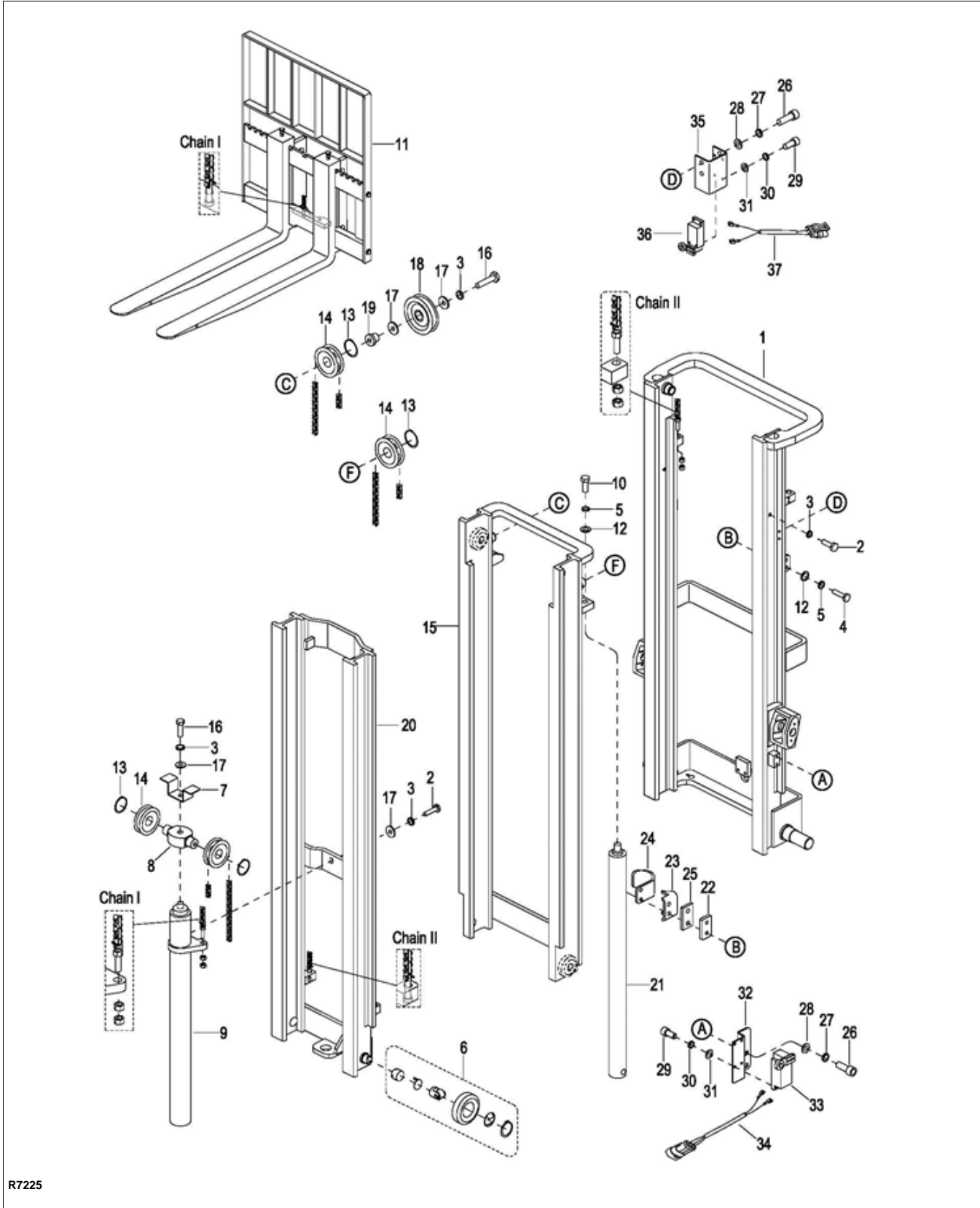


R7225

Figure 12-9 Elevation System (Three Stage Mast)

**ELEVATION SYSTEM (THREE STAGE MAST)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2333-610000-30-01	OUTER MAST	1	Used for Lift Height 157"
1a	2333-610000-30-02	OUTER MAST	1	Used for Lift Height 177"
2	0000-000285-00	BOLT, M12 X 35	1	
3	0000-000060-00	WASHER, LOCK, M12	6	
4	0000-000283-00	BOLT, M10 X 35	4	
5	0000-000063-00	WASHER, LOCK, M10	6	
6	2125-612000-00	ROLLER ASSEMBLY	8	
7	2125-600007-30	BRACKET	1	
8	2125-600001-30	ROLLER BRACKET	1	
9	2333-420000-30-01	CYLINDER, FREE LIFT	1	Used for Lift Height 157"
9a	2333-420000-30-02	CYLINDER, FREE LIFT	1	Used for Lift Height 177"
10	0000-000244-00	BOLT, M10 X 30	2	
11	—	LIFT CARRIAGE	2	See Lift Carriage Section
12	0000-000071-00	WASHER, FLAT, M10	6	
13	0000-000183-00	RETAINER RING, M35	4	
14	2214-600001-00	CHAIR ROLLER	4	
15	2125-620000-30-01	MIDDLE MAST	1	Used for Lift Height 157"
15a	2125-620000-30-02	MIDDLE MAST	1	Used for Lift Height 177"
16	0000-000613-00	BOLT, M12 X 50	2	



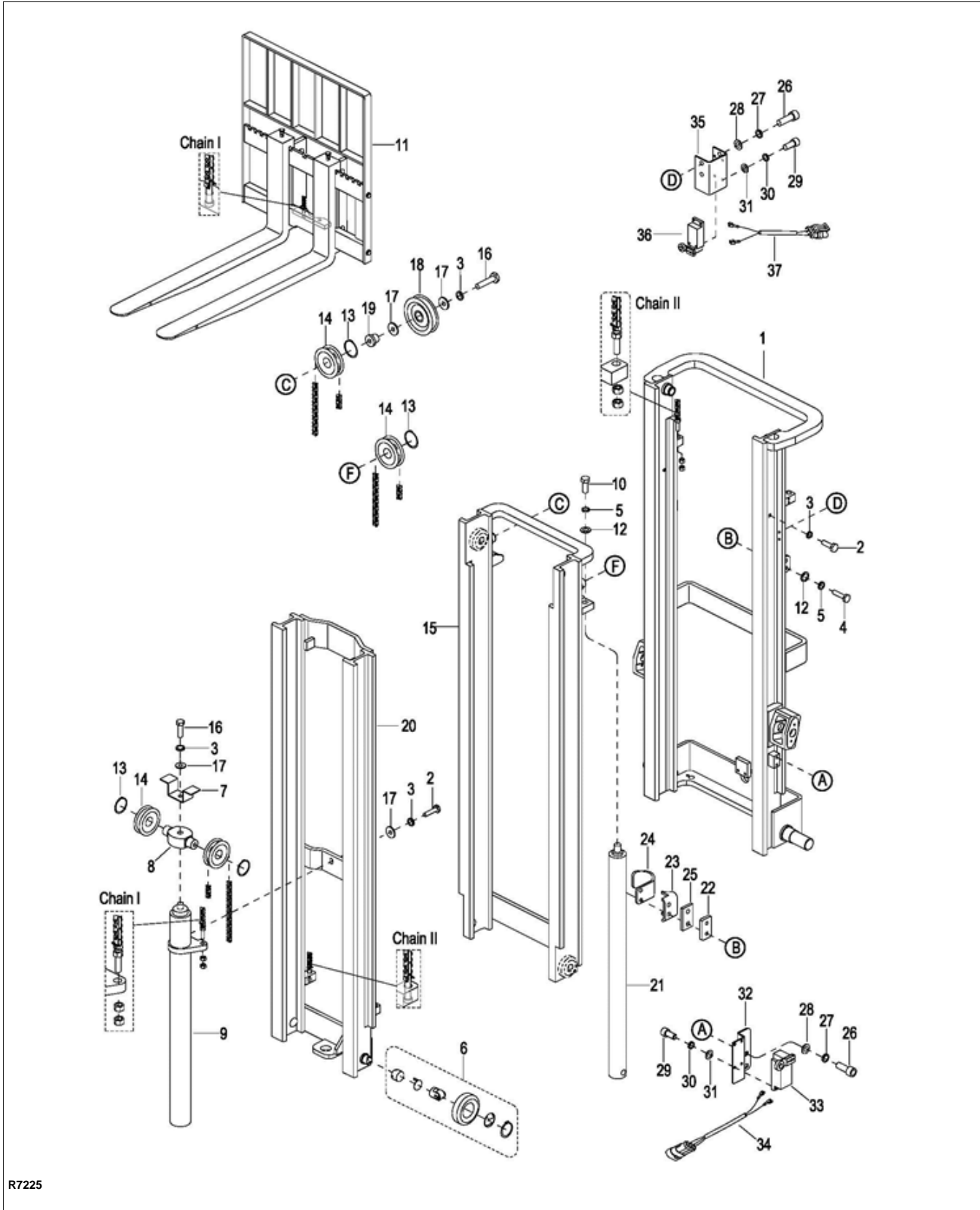
R7225

Figure 12-9 Elevation System (Three Stage Mast) - Continued



**ELEVATION SYSTEM (THREE STAGE MAST) - CONTINUED**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
17	0000-000222-00	WASHER, FLAT, M12	2	
18	2125-600002-30	HOSE ROLLER	1	
19	2125-600003-00	BUSHING	1	
20	2333-630000-30-01	INNER MAST	1	Used for Lift Height 157"
20a	2333-630000-30-02	INNER MAST	1	Used for Lift Height 177"
21	2130-410000-30-01	CYLINDER, SECONDARY LIFT	2	Used for Lift Height 157"
21a	2130-410000-30-02	CYLINDER, SECONDARY LIFT	2	Used for Lift Height 177"
22	2214-600005-00	SHIM	A.R.	As Required
23	2125-600006-30	CYLINDER BRACKET	2	
24	2125-600005-30	CLIP	2	
25	2214-600007-00	CUSHION BLOCK	2	
26	0000-000109-00	SCREW, M8 X 16	4	
27	0000-000159-00	WASHER, LOCK, M8	4	
28	0000-000176-00	WASHER, FLAT, M8	4	
29	0000-000004-00	SCREW, M5 X 12	8	
30	0000-000206-00	WASHER, LOCK, M5	8	
31	0000-000390-00	WASHER, FLAT, M5	8	
32	2125-500001-3A	SENSOR BRACKET	1	
33	2125-500003-00	PROXIMITY SWITCH, 8108	1	
34	2130-520003-0A	PROXIMITY SWITCH HARNESS	1	
35	2125-500002-3A	SENSOR BRACKET	1	

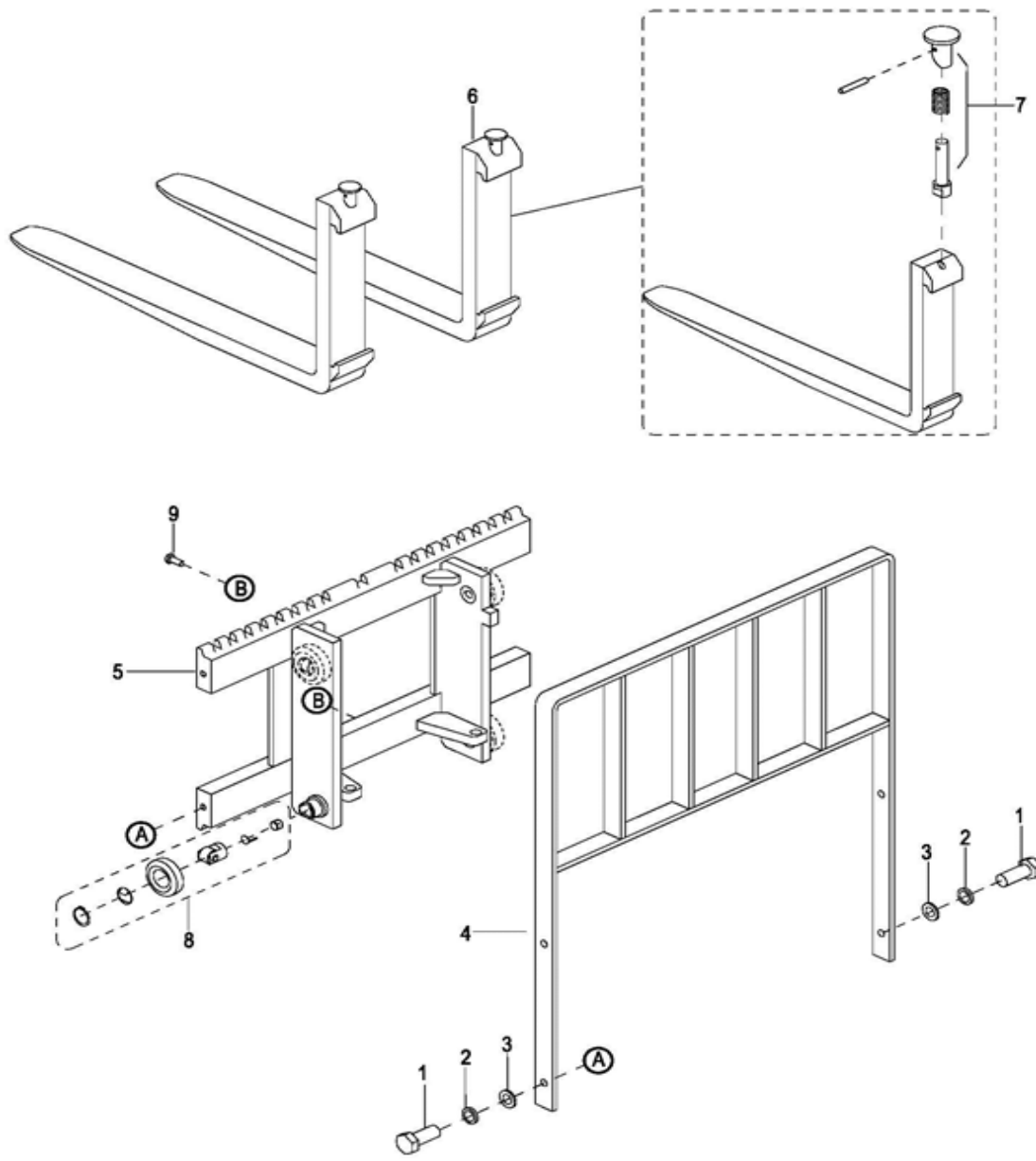


R7225

Figure 12-9 Elevation System (Three Stage Mast) - Continued

**ELEVATION SYSTEM (THREE STAGE MAST) - CONTINUED**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
36	2125-500002-00	PROXIMITY SWITCH, 8104	1	Used for Lift Height 157"
36a	2125-500003-00	PROXIMITY SWITCH, 8104	1	Used for Lift Height 177"
37	2125-520009-22	PROXIMITY SWITCH HARNESS	1	Used for Lift Height 157"
37a	2125-520009-24	PROXIMITY SWITCH HARNESS	1	Used for Lift Height 177"

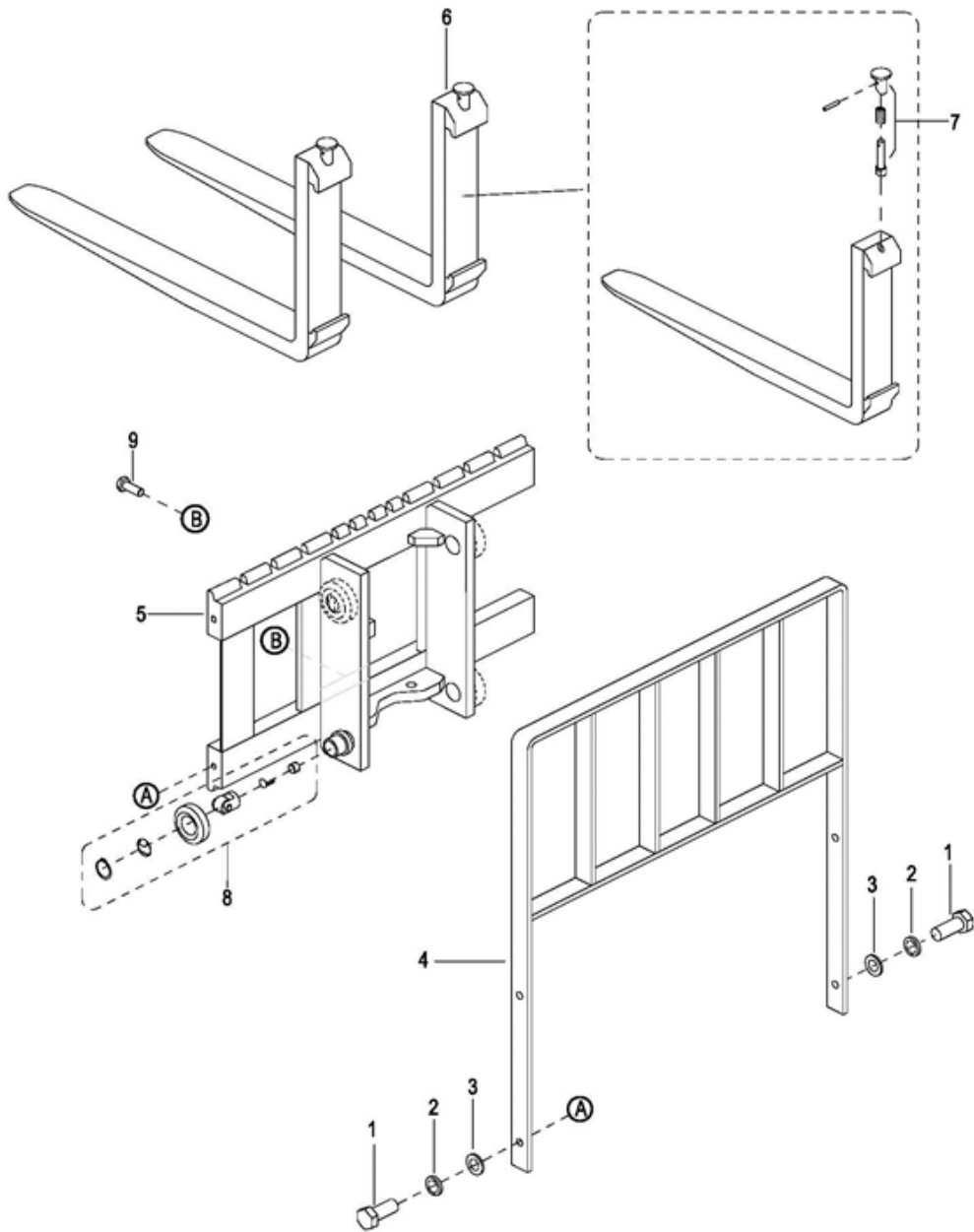


R7226

Figure 12-10 Lift Carriage (Telescopic)

LIFT CARRIAGE (TELESCOPIC)

Pos.	Part Number	Description	Qty. Reqd.	Notes
1	0000-000284-00	BOLT, M12 X 30	4	
2	0000-000060-00	WASHER, LOCK, M12	4	
3	0000-000373-00	WASHER, FLAT, M12	4	
4	2320-631000-00	BACKREST	1	
5	2130-631000-00	LIFT CARRIAGE	1	
6	2125-630001-00	FORK	2	
7	2125-630001-10	PIN ASSEMBLY	2	
8	2125-612000-00	ROLLER ASSEMBLY	4	
9	0000-000030-00	SCREW, M10 X 16	1	

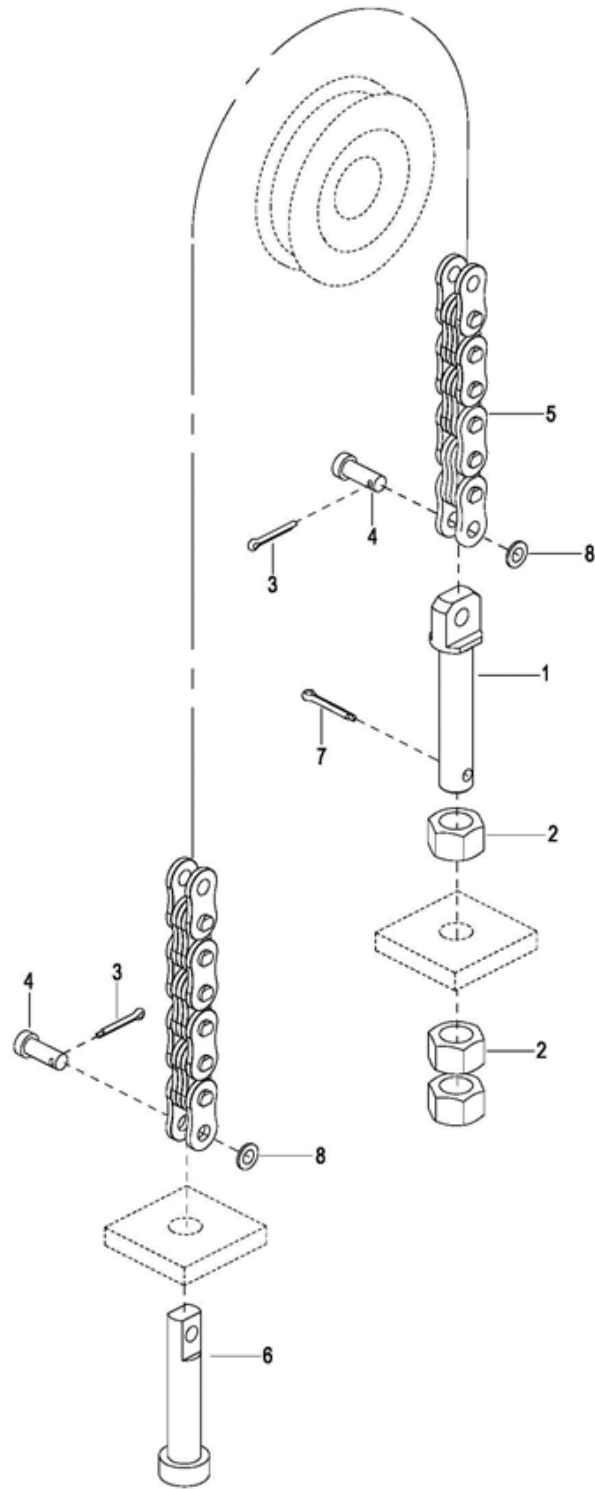


R7227

Figure 12-11 Lift Carriage (Three Stage Mast)

**LIFT CARRIAGE (Three Stage Mast)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000221-00	BOLT, M12 X 30	4	
2	0000-000060-00	WASHER, LOCK, M12	4	
3	0000-000373-00	WASHER, FLAT, M12	4	
4	2320-631000-00	BACKREST	1	
5	2125-641000-30	LIFT CARRIAGE	1	
6	2125-630001-00	FORK	2	
7	2125-630001-10	PIN ASSEMBLY	2	
8	2125-612000-00	ROLLER ASSEMBLY	4	
9	0000-000030-00	SCREW, M10 X 16	1	



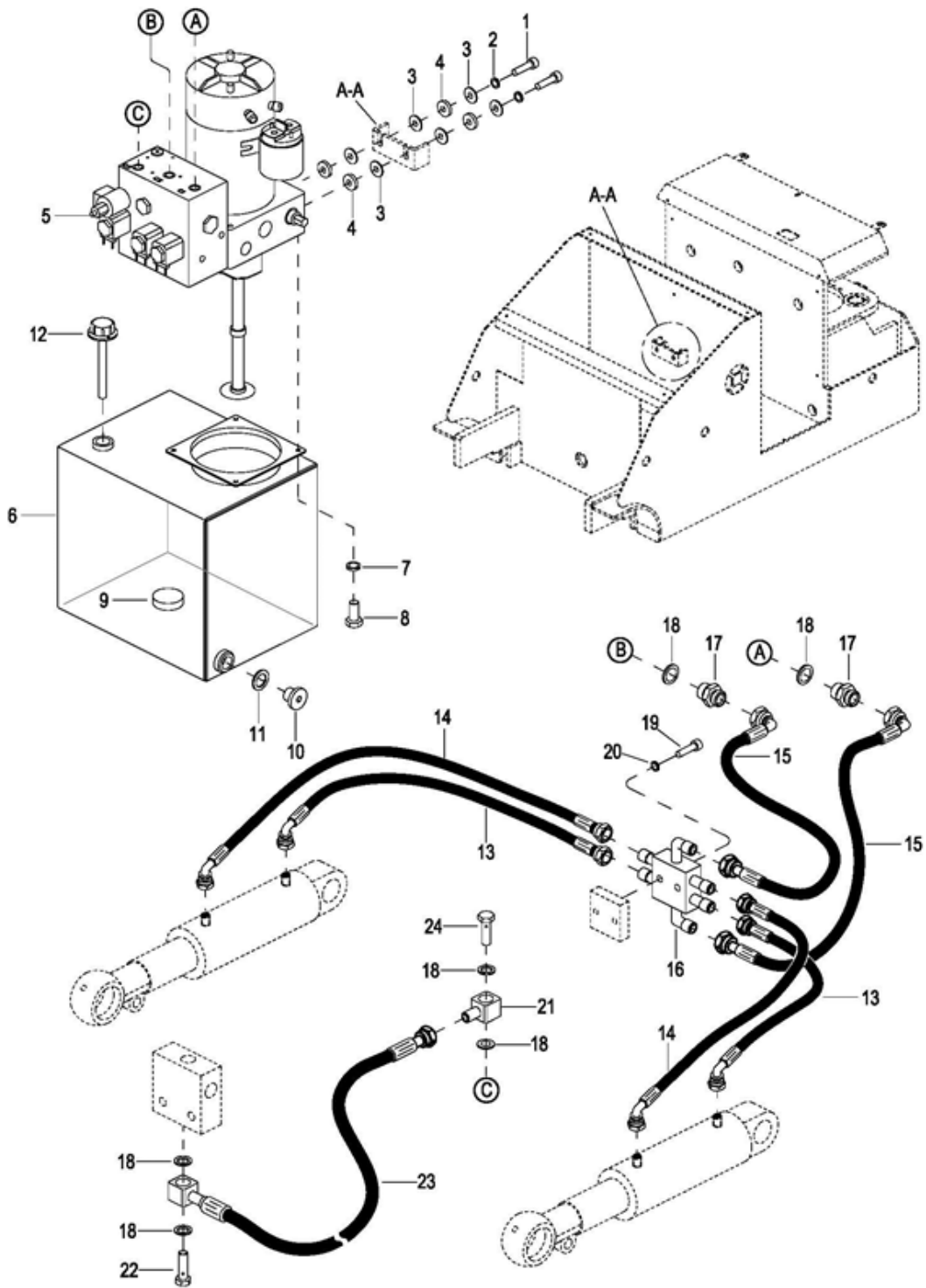
R6818

Figure 12-12 Chain Assembly



**CHAIN ASSEMBLY**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2125-640001-00	ADJUSTING BOLT	1	
2	0000-000187-00	NUT, M16 X 1.5	3	
3	0000-000188-00	COTTER PIN, M3.2 X 20	2	
4	2125-640002-00	PIN	2	
5	2125-640000-00-02	CHAIN I (MOUNTS TO FREE LIFT CYL)	1	Used for Lift Height 104", Telescopic Mast
5a	2125-640000-00-04	CHAIN I (MOUNTS TO FREE LIFT CYL)	1	Used for Lift Height 126", Telescopic Mast
5b	2125-651000-30-01	CHAIN I (MOUNTS TO FREE LIFT CYL)	1	Used for Lift Height 157", Three Stage Mast
5c	2125-651000-30-02	CHAIN I (MOUNTS TO FREE LIFT CYL)	1	Used for Lift Height 177", Three Stage Mast
5c	2125-652000-30-01	CHAIN II (MOUNTS TO INNER MAST)	1	Used for Lift Height 157", Three Stage Mast
5c	2125-652000-30-02	CHAIN II (MOUNTS TO INNER MAST)	1	Used for Lift Height 177", Three Stage Mast
6	2125-640003-00	CHAIN ANCHOR	1	
7	0000-000686-00	COTTER PIN, M3.2 X 32	1	
8	0000-000176-00	WASHER, FLAT, M8	2	

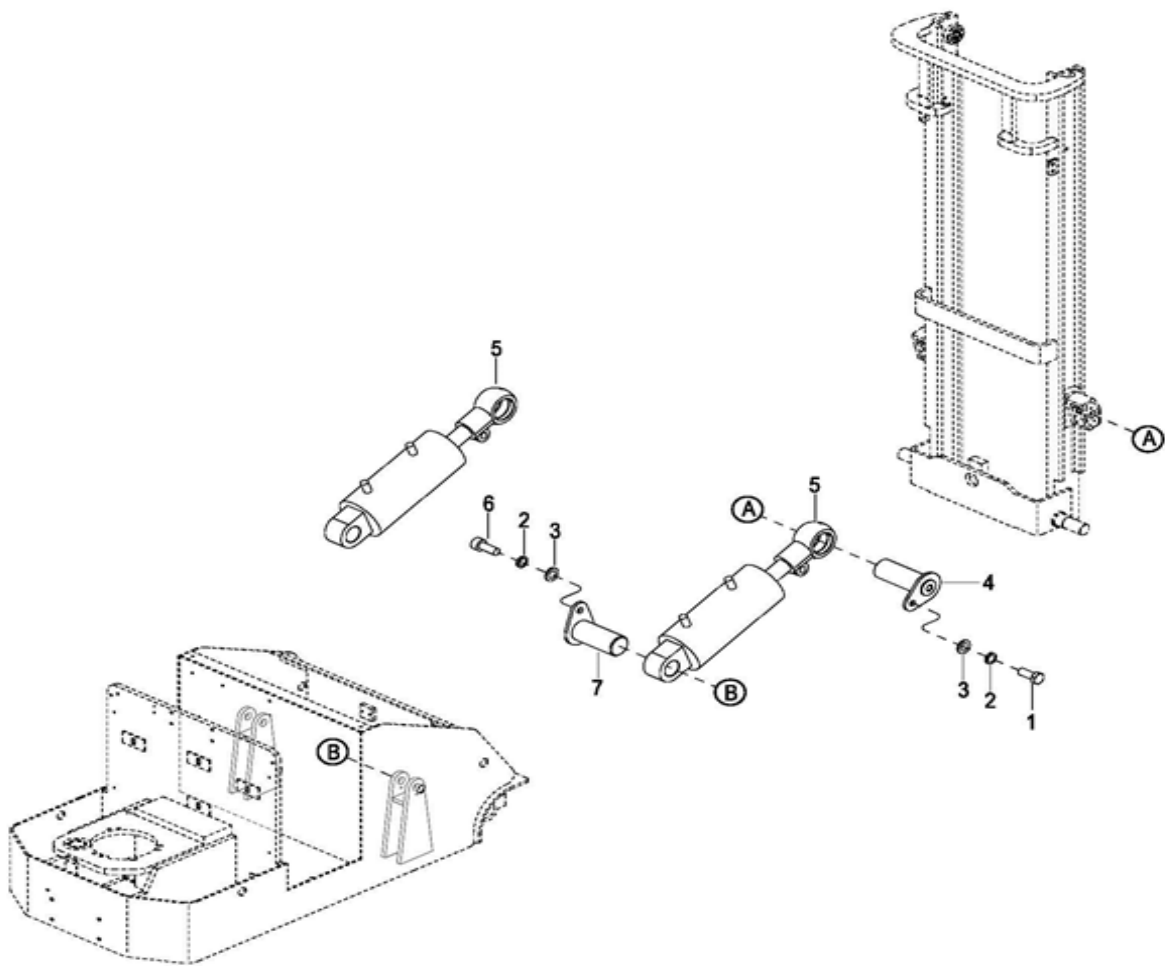


R7228

Figure 12-13 Hydraulic System

**HYDRAULIC SYSTEM**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000155-00	SCREW, M10 X 40	2	
2	0000-000063-00	WASHER, LOCK, M10	2	
3	0000-000007-00	WASHER, FLAT, M10	6	
4	2112-410004-00	WASHER	4	
5	2333-460000-10	PUMP AND MOTOR ASSEMBLY	1	
6	2333-411000-00	RESERVOIR	1	
7	0000-000056-00	WASHER, LOCK, M6	4	
8	0000-000620-00	BOLT, M6 X 16	4	
9	2125-420001-00	MAGNET	1	
10	0000-000635-00	PLUG, M18 X 1.5	1	
11	0000-000510-00	WASHER, M20	1	
12	2130-423000-00	FILTER	1	
13	2333-420000-00	HOSE	2	
14	2333-430000-00	HOSE	2	
15	3218-711000-00	HOSE, TILT	2	
16	3218-710500-00	MANIFOLD	1	
17	2702-141600-00	CONNECTOR, G1/4-M16 X 1.5	2	
18	0000-000044-00	SEAL, M14	6	
19	0000-000322-00	SCRREW, M8 X 25	2	
20	0000-000159-00	WASHER, LOCK, M8	2	
21	2707-141400-00	CONNECTOR, G1/4-M14 X 1.5	1	
22	2402-143500-00	BOLT, G1/4 X 35	1	
23	2333-450000-00	HOSE	1	
24	2402-143700-00	BOLT, G1/4 X 37	1	



R7235

Figure 12-14 Tilt System

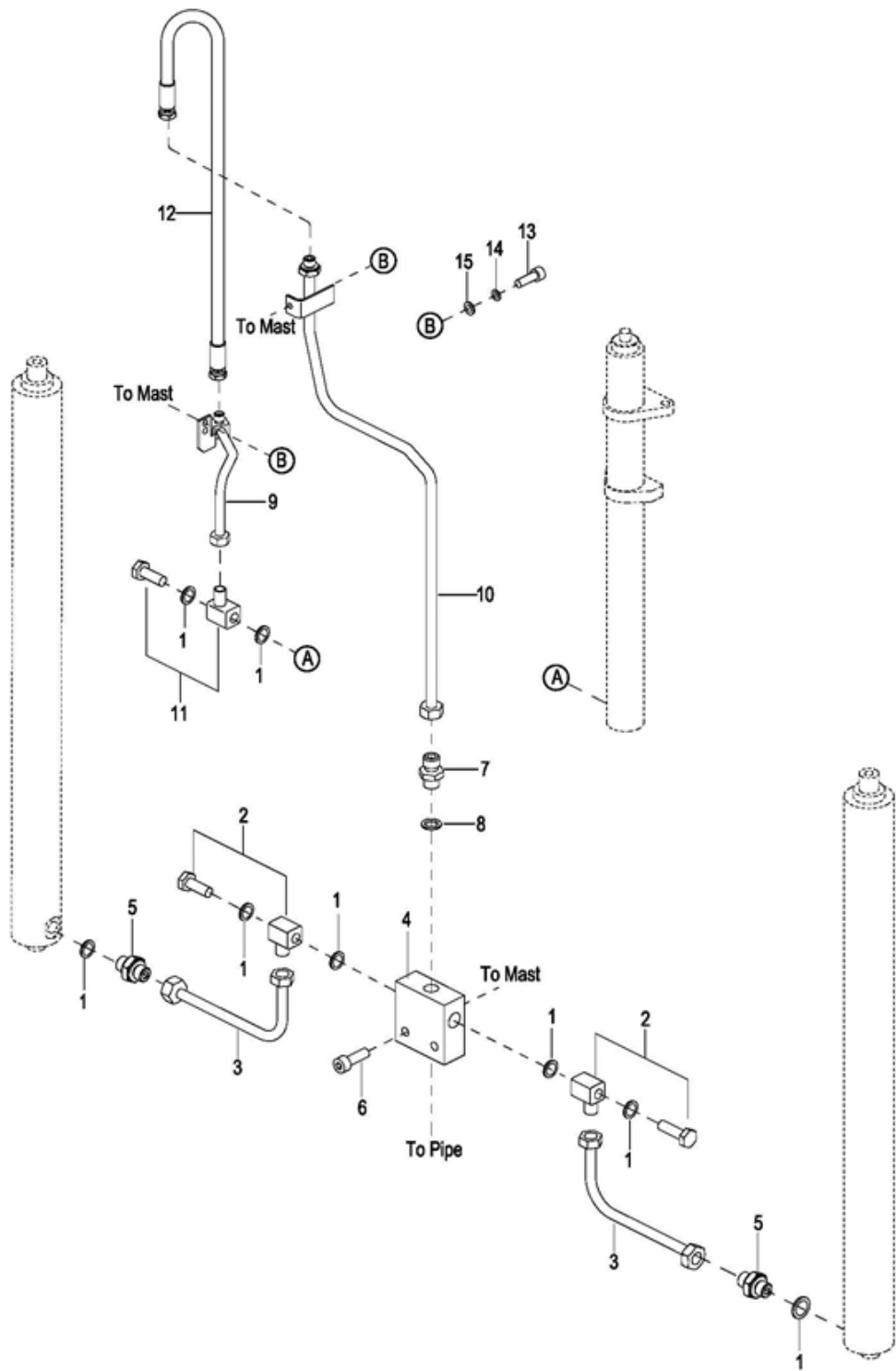
**TILT SYSTEM**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000255-00	BOLT, M8 X 20	2	
2	0000-000159-00	WASHER, LOCK, M8	4	
3	0000-000176-00	WASHER, FLAT, M8	4	
4	2333-400001-00	SHAFT	2	
5	2333-440000-00	TILT CYLINDER	2	
6	0000-000321-00	SCREW, M8 X 20	2	
7	3218-840000-00	SHAFT	2	



**LIFT SYSTEM (TELESCOPIC)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000069-00	SEAL, M16	6	
2	2706-161600-00	CONNECTOR, M16 x 1.5 x M16 x 1.5	2	
3	2130-470000-00	TUBE ASEMBLY	2	
4	2125-400002-3A	MANIFOLD	1	
5	2712-141300-00	PLUG, G1/4	1	
6	0000-000169-00	SCREW, M8 X 30	2	
7	2701-161600-00	CONECTOR, M16 X 1.5 X M16 X 1.5	2	
8	0000-000044-00	SEAL, M14	1	



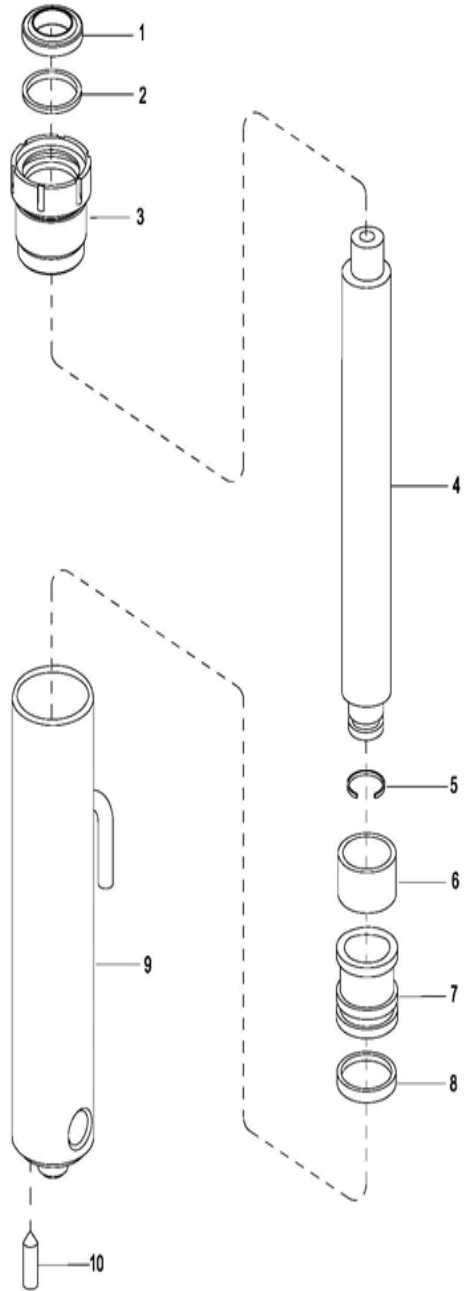
R7231

Figure 12-16 Lift System (Three Stage Mast)



**LIFT SYSTEM (Three Stage Mast)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000069-00	SEAL, M16	8	
2	2706-161600-00	CONNECTOR, M16 x 1.5 x M16 x 1.5	2	
3	2130-430000-30	TUBE ASEMBLY	2	
4	2125-400002-30	MANIFOLD	1	
5	2701-161600-00	CONECTOR, M16 X 1.5 X M16 X 1.5	2	
6	0000-000169-00	SCREW, M8 X 30	2	
7	2702-142000-00	CONNECTOR, G1/4 X M20 X 1.5	1	
8	0000-000044-00	SEAL, M14	1	
9	2125-430000-3B	TUBE ASSEMBLY	1	
10	2125-450000-3A	TUBE ASSEMBLY	1	
11	2706-162000-10	CONNECTOR, M16 X 1.5 X M20 X 1.5	1	
12	2125-440000-3A-01	HOSE ASSEMBLY	1	Used for Lift Height 157", Three Stage Mast
12a	2125-440000-3A-02	HOSE ASSEMBLY	1	Used for Lift Height 177", Three Stage Mast
13	0000-000109-00	SCREW, M8 X 16	3	
14	0000-000159-00	WASHER, LOCK, M8	3	
15	0000-000176-00	WASHER, FLAT, M8	3	

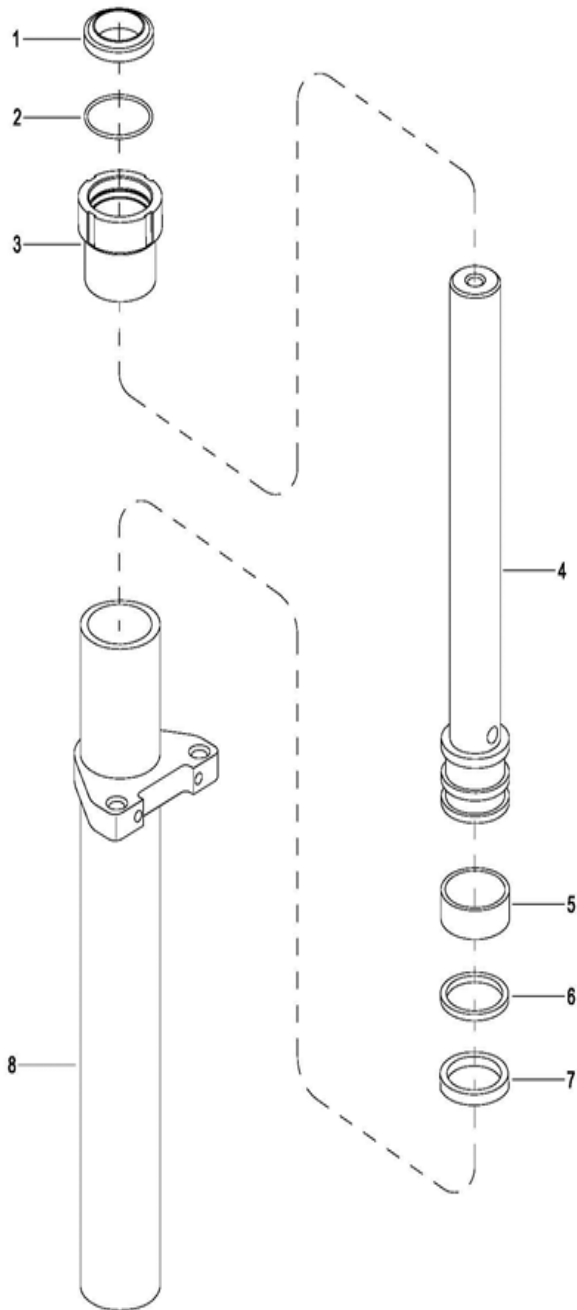


R7232

Figure 12-17 Lift Cylinder (Telescopic)

**LIFT CYLINDER (TELESCOPIC)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2130-410000-00-01	LIFT CYLINDER	1	Used for Lift Height 104", Telescopic Mast
—	2130-410000-00-02	LIFT CYLINDER	1	Used for Lift Height 126", Telescopic Mast
—	2130-2BG	SEAL KIT	1	Includes 1,2,8
1	0000-000084-00	RING, WIPER, 35 X 43 X 5-6.5	1	
2	0000-000370-00	O-RING, 40 X 3.1	1	
3	1220-420001-0A	GLAND NUT	1	
4	2130-410001-00-01	PISTON ROD	1	
4a	2130-410001-00-02	PISTON ROD		
5	2130-410003-00	COLLAR	1	
6	2130-410004-00	RING, BACK UP	1	
7	2130-410002-00	PISTON	1	
8	0000-000132-00	ROD PACKING, 30 X 40 X 6	1	
9	2130-411000-00-01	CYLINDER TUBE	1	Used for Lift Height 104", Telescopic Mast
9a	2130-411000-00-02	CYLINDER TUBE		Used for Lift Height 126", Telescopic Mast
10	2125-410006-30	PIN	1	

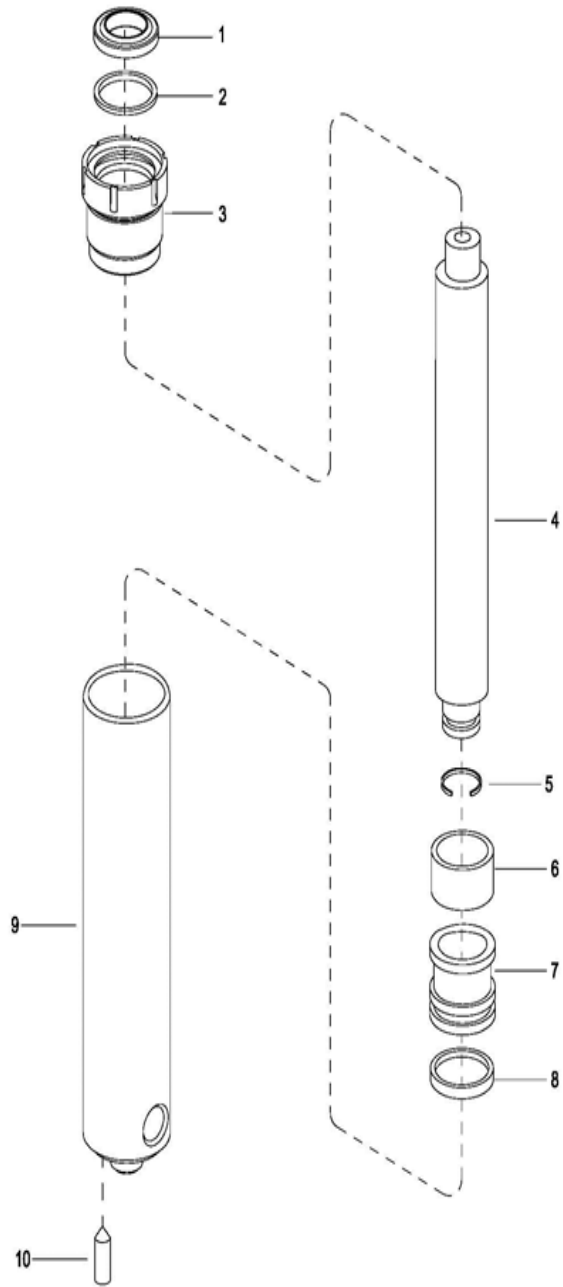


R7233

Figure 12-18 Free Lift Cylinder (Three Stage Mast)

**FREE LIFT CYLINDER (Three Stage Mast)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2333-420000-30-01	FREE LIFT CYLINDER	1	Used for Lift Height 157", Three Stage Mast
—	2333-420000-30-02	FREE LIFT CYLINDER	1	Used for Lift Height 177", Three Stage Mast
—	2333-ZZG-3A	SEAL KIT	1	Includes 1,2,7
1	0000-000045-00	RING, WIPER, 35 X 43 X 5-6.5	1	
2	0000-000690-00	O-RING, 60 X 3.1	1	
3	2130-420002-30	GLAND NUT	1	
4	2130-420001-30-01	PISTON ROD	1	Used for Lift Height 157", Three Stage Mast
4a	2130-420001-30-02	PISTON ROD	1	Used for Lift Height 177", Three Stage Mast
5	2130-420003-30	RING, BACK UP, 70 x 65 x 20	1	
6	0000-000698-00	SNAP RING, 53 x 63 x 2		
7	0000-000699-00	ROD PACKING, 53 X 63 X 6	1	
8	2333-421000-30-01	CYLINDER TUBE	1	Used for Lift Height 157", Three Stage Mast
8a	2333-421000-30-02	CYLINDER TUBE	1	Used for Lift Height 177", Three Stage Mast

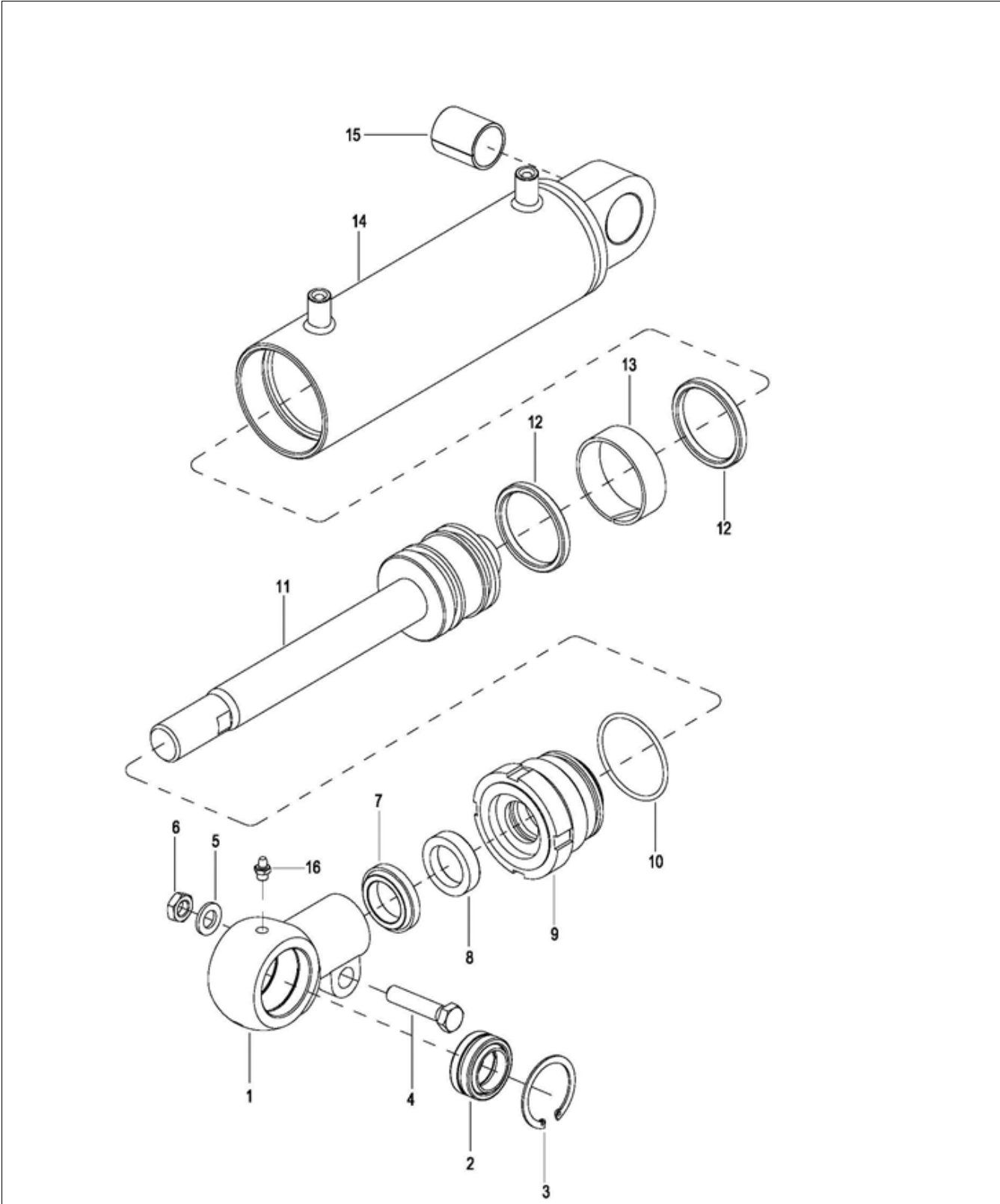


R7234

Figure 12-19 Secondary Lift Cylinder (Three Stage Mast)

**SECONDARY LIFT CYLINDER (Three Stage Mast)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2130-410000-30-01	SECONDARY LIFT CYLINDER	1	Used for Lift Height 157", Three Stage Mast
—	2130-410000-30-02	SECONDARY LIFT CYLINDER	1	Used for Lift Height 177", Three Stage Mast
—	2130-2BG	SEAL KIT	1	Includes 1,2,3
1	0000-000084-00	RING, WIPER, 35 X 43 X 5-6.5	1	
2	0000-000370-00	O-RING, 40 X 3.1	1	
3	1220-420001-0A	GLAND NUT	1	
4	2130-410001-30-01	PISTON ROD	1	Used for Lift Height 157", Three Stage Mast
4a	2130-410001-30-02	PISTON ROD	1	Used for Lift Height 177", Three Stage Mast
5	2130-410003-30	COLLAR	1	
6	2130-410004-30	RING, BACK UP	1	
7	2130-410002-30	PISTON	1	
8	0000-000132-00	ROD PACKING, 30 X 40 X 6	1	
9	2130-411000-30-01	CYLINDER TUBE	1	Used for Lift Height 157", Three Stage Mast
9a	2130-411000-30-02	CYLINDER TUBE	1	Used for Lift Height 177", Three Stage Mast
10	2125-410006-30	PIN	1	



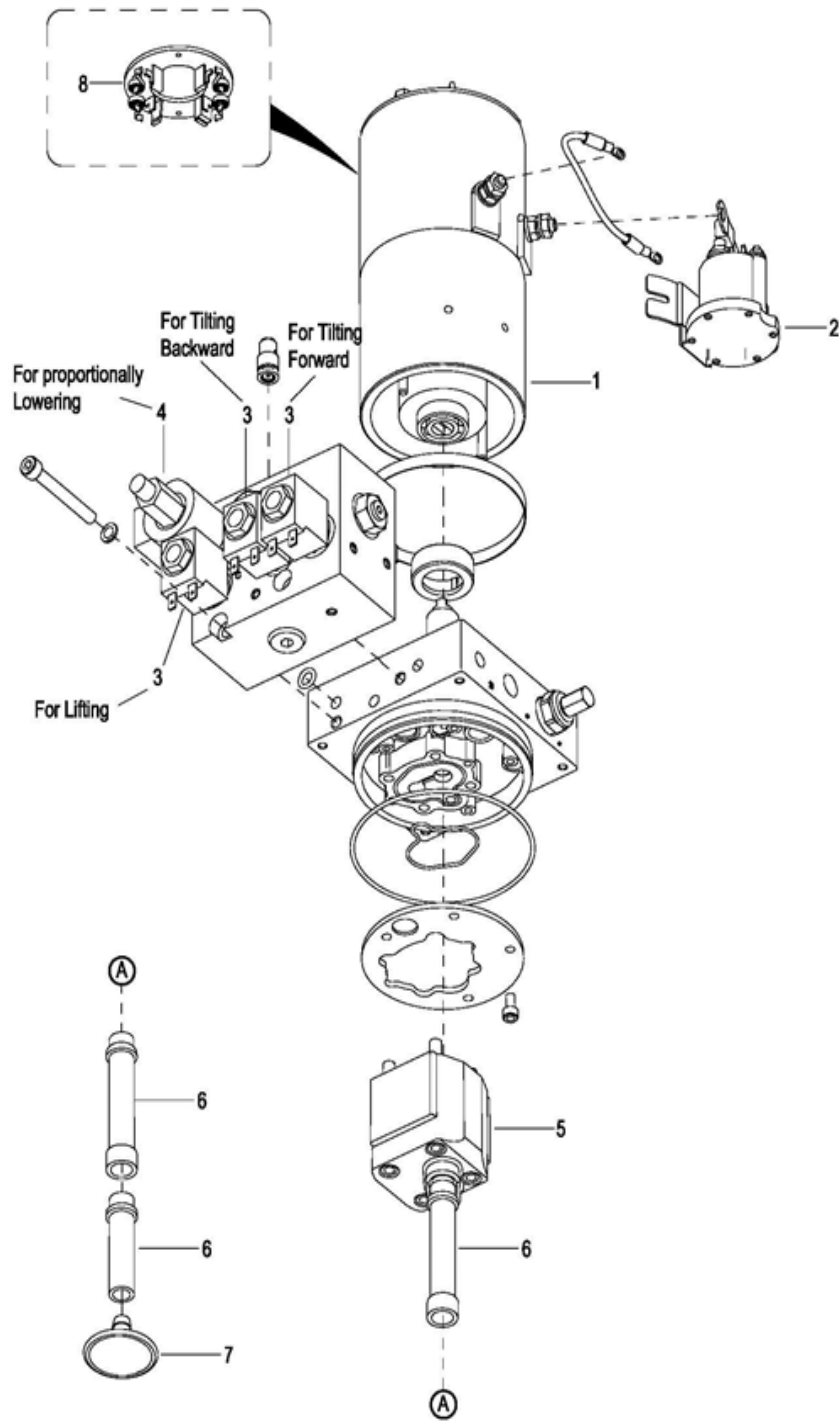
R7236

Figure 12-20 Tilt Cylinder



**TILT CYLINDER**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2333-440000-00	TILT CYLINDER	1	
—	2320-QXG-0A	SEAL KIT	1	Includes 7,8,9,10
1	2333-440001-00	CLEVIS	1	
2	0000-001012-00	BEARING, GE30ES	1	
3	0000-000849-00	SEAL, M47	1	
4	0000-001013-00	BOLT, M14 X 55	1	
5	0000-000233-00	WASHER, LOCK, M14	1	
6	0000-001014-00	NUT, M14	1	
7	0000-001017-00	DUST SEAL, LYO 30 X 47 X 10	1	
8	0000-001016-00	SEAL, 30 X 43 X 7	1	
9	2320-440001-00	GUIDE RING	1	
10	0000-000967-00	O-RING, 80 X 3.1	1	
11	2320-442000-00	PISTON ROD	1	
12	0000-001015-00	SEAL, YX70 X 80 X 6	2	
13	2320-440003-00	WEAR RING, 20 X 2.5	1	
14	2333-441000-00	CYLINDER BODY	1	
15	3218-810007-00	BUSHING, 3040	1	
16	0000-000588-00	GREASE FITTING	1	



R7229

Figure 12-21 Pump and Motor

**PUMP AND MOTOR**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
—	2333-460000-10	PUMP & MOTOR ASSEMBLY	1	
1	2130-470002-40	MOTOR	1	
2	2320-421008-00	PUMP SOLENOID	1	
3	2320-421016-00	SOLENOID VALVE	3	Lift & Tilt
4	2333-460001-10	PROPORTIONAL SOLENOID VALVE	1	Lower
5	2320-421002-00	PUMP	1	
6	2320-421012-00	PLASTIC TUBE	3	
7	2320-421013-00	FILTER, STEEL	1	
8	2130-470003-40	BRUSH	1	

R7237

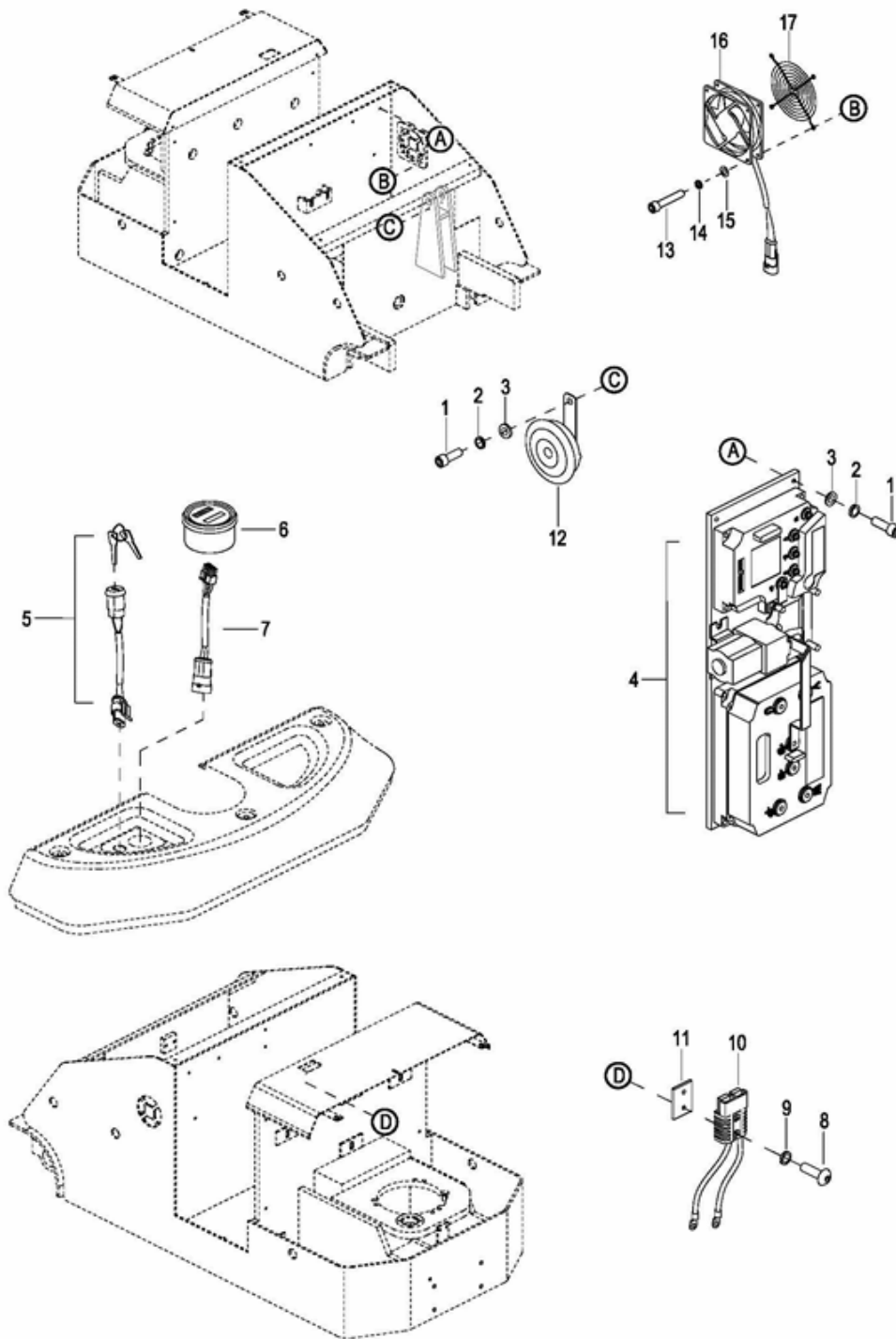
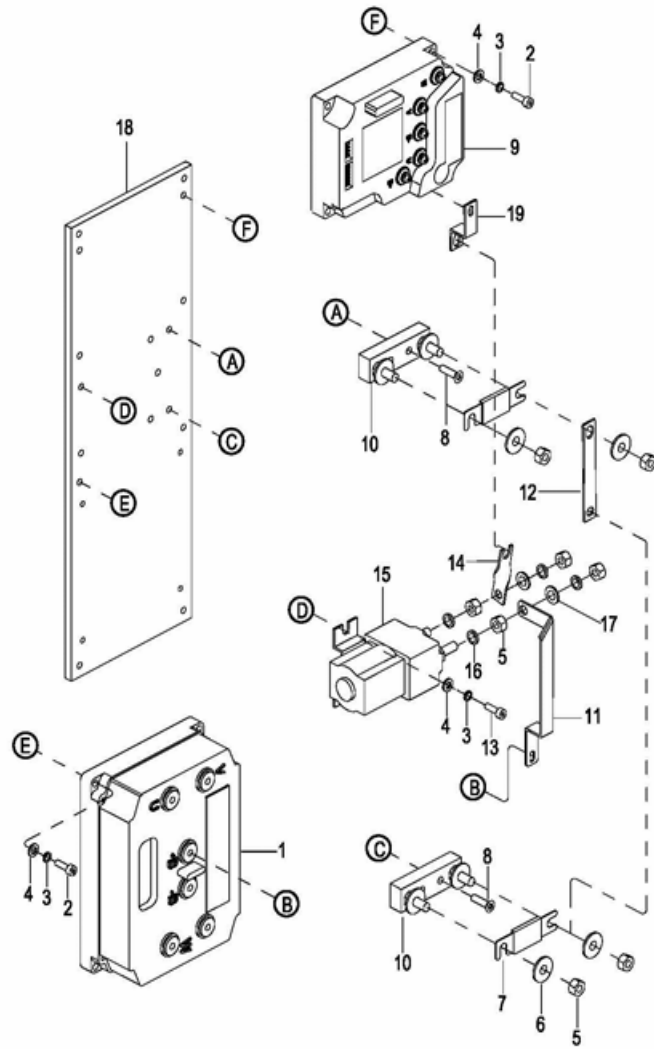


Figure 12-22 Electrical System

**ELECTRICAL SYSTEM**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000321-00	SCREW, M8 X 20	4	
2	0000-000159-00	WASHER, LOCK, M8	4	
3	0000-000194-00	WASHER, FLAT, M8	4	
4	—	ELECTRICAL PANEL	1	See Electrical Panel Section
5	1220-520002-1C	KEY SWITCH	1	
6	1115-510006-20	HOUR METER	1	
7	1220-520007-0D	METER WIRING HARNESS	1	
8	0000-000170-00	SCREW, M6 X 30	2	
9	0000-000056-00	WASHER, LOCK, M6	3	
10	2333-531000-00	BATTERY CONNECTOR	1	
11	1120-112008-00	SPACER	1	
12	1120-500003-00	HORN	1	
13	0000-000121-00	SCREW, M4 X 35	4	
14	0000-000122-00	WASHER, LOCK, M4	4	
15	0000-000702-00	WASHER, FLAT, M4	4	
16	1220-520010-0C	FAN	1	
17	1220-500004-00	FAN GUARD	1	

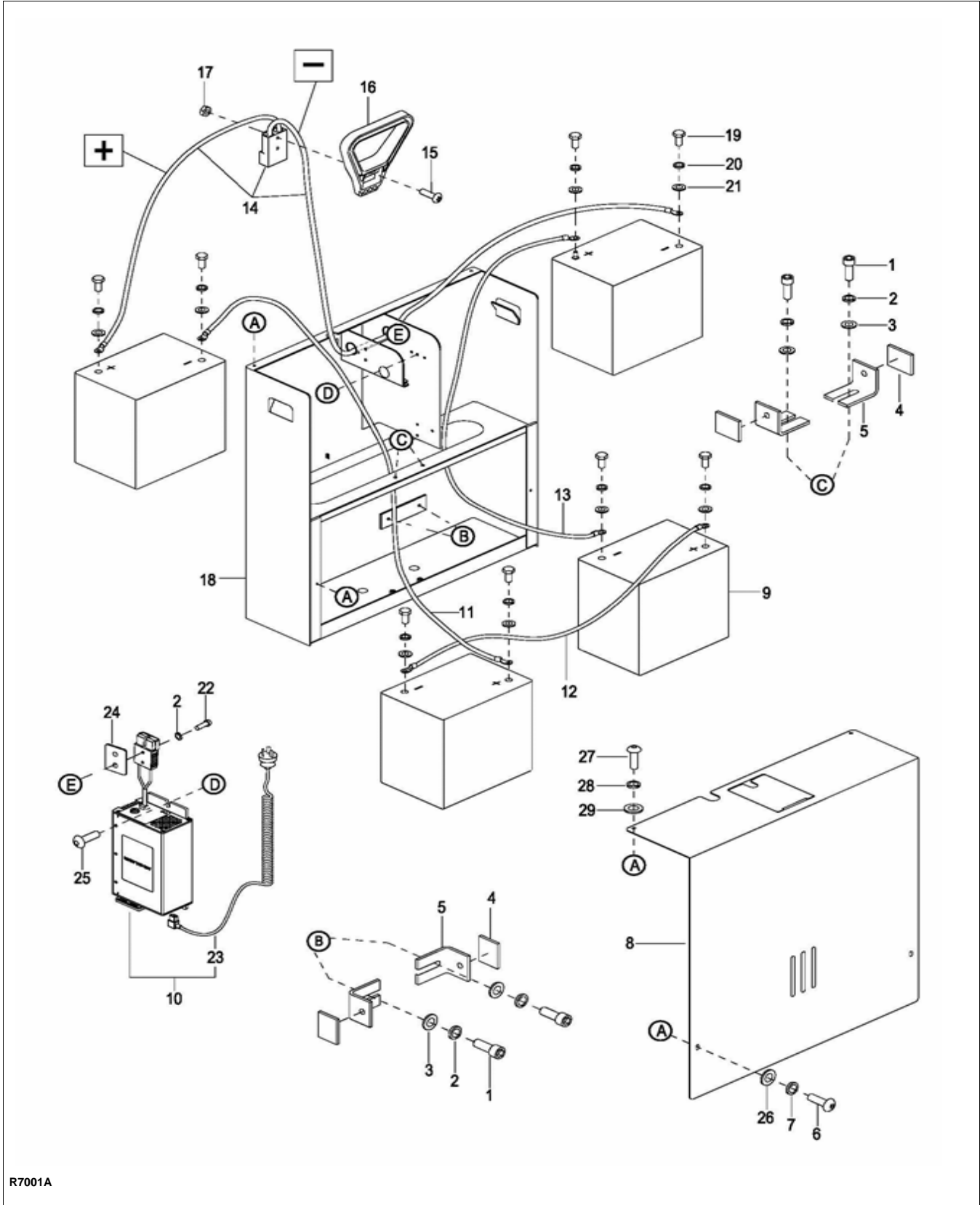


R7238

Figure 12-23 Electrical Panel

**ELECTRICAL PANEL**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2333-510001-00	CONTROLLER	1	
2	0000-000074-00	SCREW, M6 X 20	8	
3	0000-000056-00	WASHER, LOCK, M6	14	
4	0000-000380-00	WASHER, FLAT, M6	14	
5	0000-000196-00	NUT, M8	8	
6	0000-000210-00	WASHER, FLAT, M8	4	
7	1120-540002-00	FUSE, 200A	2	
8	0000-000126-00	SCREW, M6 X 16	4	
9	1280-560002-00	CONTROLLER, AC	1	
10	1120-540001-00-B	FUSE BLOCK	2	
11	1280-510002-00	BUSS BAR	1	
12	1280-510001-00	BUSS BAR	1	
13	0000-000015-00	SCREW, M6 X 10	2	
14	1120-530006-00	BUSS BAR	1	
15	1280-560003-00	CONTACTOR	1	
16	0000-000159-00	WASHER, LOCK, M8	4	
17	0000-000176-00	WASHER, FLAT, M8	2	
18	1280-510000-10	PANEL	1	
19	1280-510002-10	BUSS BAR	1	



R7001A

Figure 12-24 Battery Assembly (Optional)



**BATTERY ASSEMBLY (OPTIONAL)**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	0000-000055-00	SCREW M6×16	6	
2	0000-000056-00	LOCK WASHER Ø6	6	
3	0000-000023-00	FLAT WASHER Ø6	4	
4	1145-550003-20	WASHER RUBBER	4	
5	1145-550001-20	BLOCK	4	
6	0000-000119-00	SCREW M5×8	4	
7	0000-000206-00	LOCK WASHER Ø5	4	
8	1145-552000-2D	BATTERY COVER	1	
9	003232	BATTERY	4	
10	1120-560000-00	CHARGER	1	
11	1145-553002-2L	M2 CABLE	1	
12	1145-553001-20	M1 CABLE	1	
13	1145-533003-2L	M3 CABLE	1	
14	1145-553100-20	GREY BATT. CONNECTOR ASSY.	1	
15	0000-000102-00	SCREW M6×45	2	
16	005450	HANDLE UPPER	1	
17	0000-000166-00	NUT M6	2	
18	1145-551000-2D	BATTERY FRAME	1	
19	0000-000242-00	BOLT M8 x 16	8	
20	0000-000159-00	LOCK WASHER Ø8	8	
21	0000-000176-00	FLAT WASHER Ø8	8	
22	0000-000170-00	SCREW M6 x 30	2	
23	1120-560001-00	CHARGER CABLE	2	For 110V USA
24	1120-112008-00	PLATE	1	
25	0000-000851-00	SCREW M8 x 12	2	
26	0000-000390-00	FLAT WASHER Ø5	2	
27	0000-000700-00	SCREW M8 x 16	2	
28	0000-000159-00	LOCK WASHER Ø8	2	
29	0000-000176-00	FLAT WASHER Ø8	2	

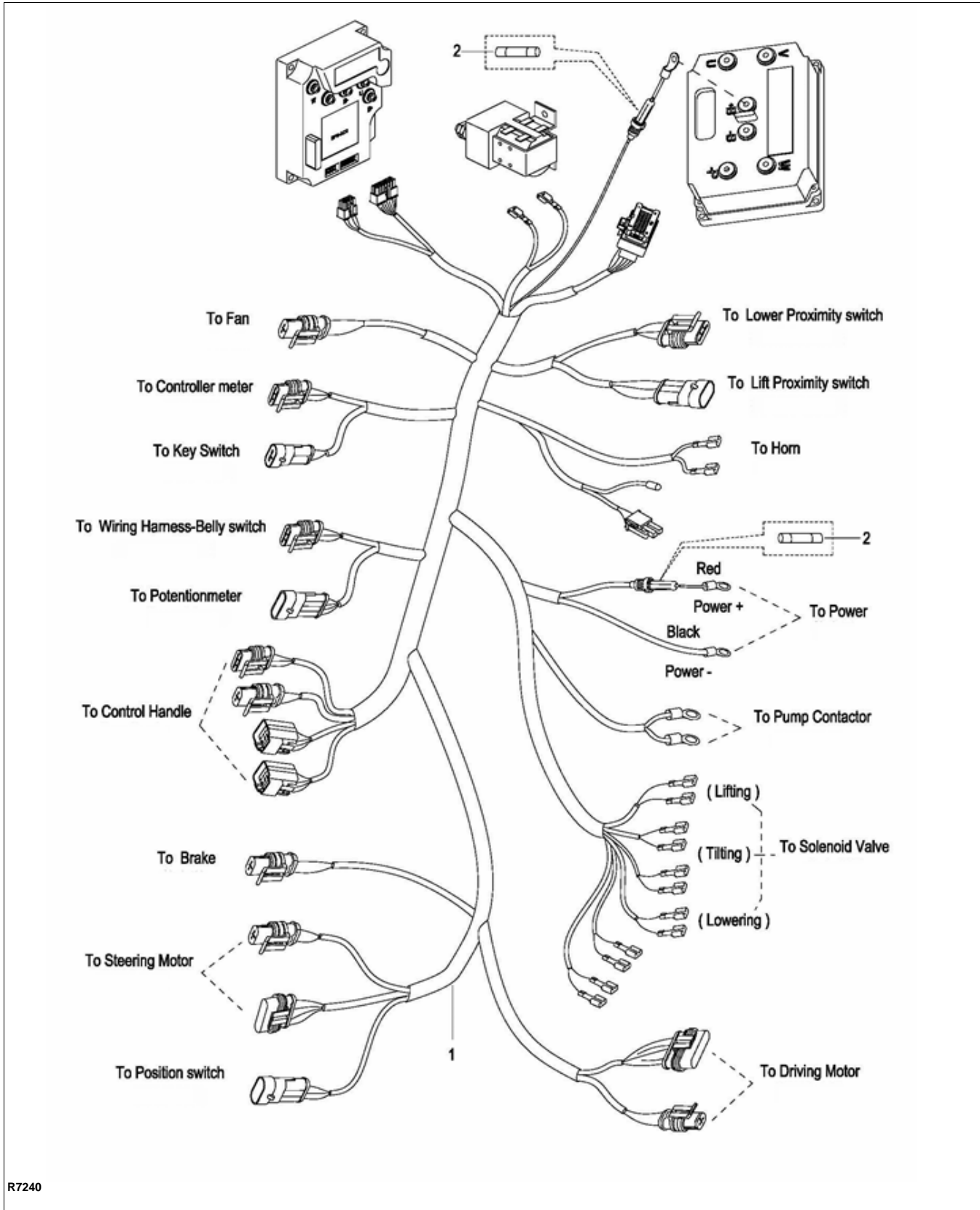
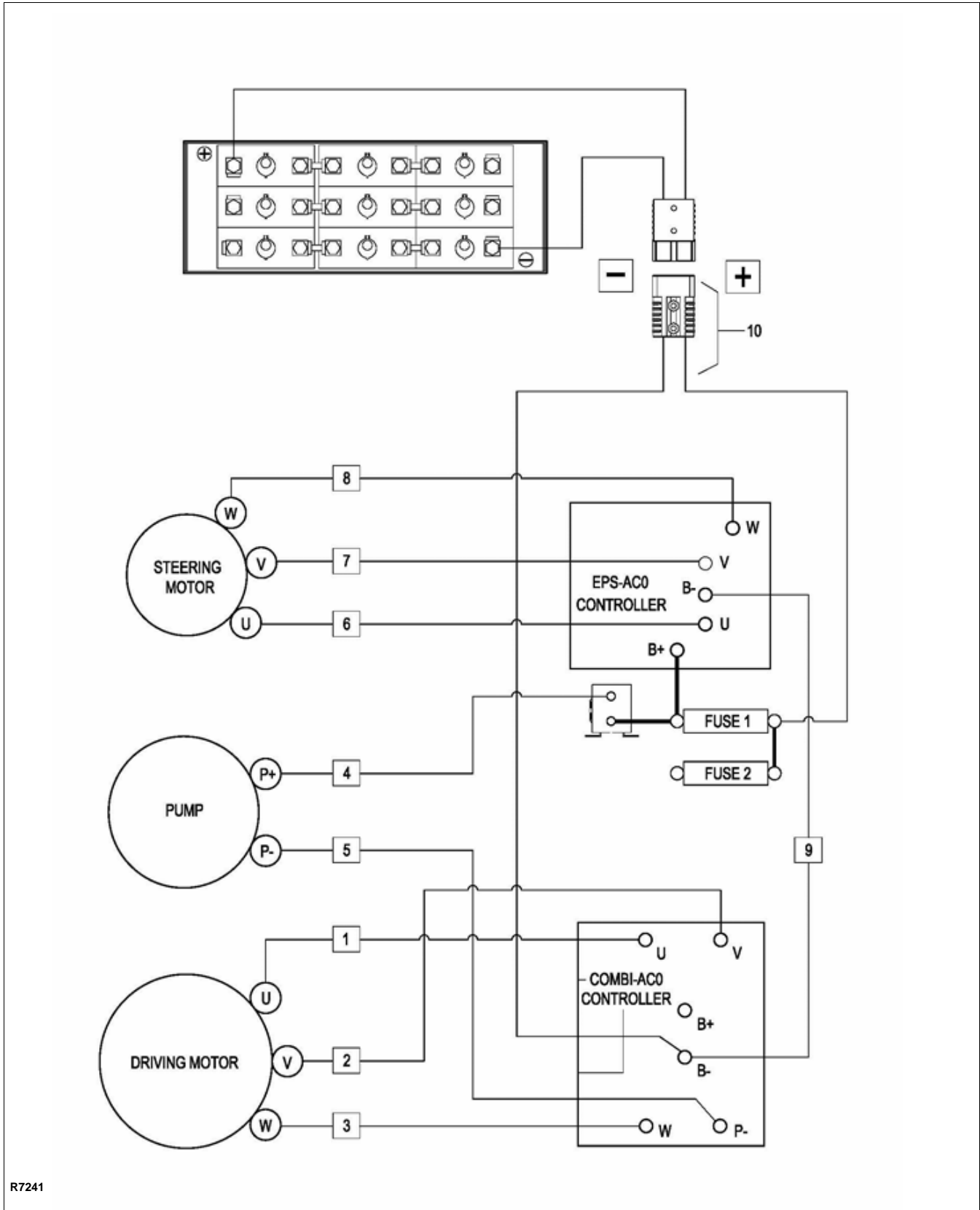


Figure 12-25 Wire Harness

**WIRE HARNESS**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2333-520001-00	WIRE HARNESS	1	
2	1120-500010-00	FUSE, 10A	2	



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Figure 12-26 Wiring Cables

**WIRE CABLES**

<b>Pos.</b>	<b>Part Number</b>	<b>Description</b>	<b>Qty. Reqd.</b>	<b>Notes</b>
1	2333-530001-00	DRIVE MOTOR CABLE U	1	
2	2333-530002-00	DRIVE MOTOR CABLE V	1	
3	2333-530003-00	DRIVE MOTOR CABLE W	1	
4	2333-530004-00	PUMP MOTOR CABLE +	1	
5	2333-530005-00	PUMP MOTOR CABLE -	1	
6	2333-530006-10	STREEING MOTOR CABLE U	1	
7	2333-530007-10	STREEING MOTOR CABLE V	1	
8	2333-530008-10	STREEING MOTOR CABLE W	1	
9	2333-530009-00	B- CABLE, CONTROLLER	1	
10	2333-531000-00	BATTERY CONNECTOR	1	

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