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SELF-PROPELLED,
STRADDLE PALLET LIFT TRUCK

S22 SERIES

OWNER'S MANUAL

OPERATION
MAINTENANCE
PARTS LIST

⚠ WARNING

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

S22 SERIES Self-Propelled, Straddle Pallet Lift Truck. Issue Date: August 17, 2012. Rev.0 (Manual# BG-S22-0812)

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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 transistor S22 lift truck distributed by Big Lift LLC. Included are operating instructions, planned maintenance instructions, lubrication procedures, corrective maintenance procedures and a complete parts list with part location illustrations.

Users shall comply with all requirements indicated in applicable OSHA standards and current edition of A.N.S.I. B56.1 Part II. By following these requirements and the recommendations contained in this manual, you will receive many years of dependable service from your S22 lift truck.

1-2. GENERAL DESCRIPTION.

The self-propelled S22 truck, Figure 1-2, lifts and transports payloads up to 2200 pounds on adjustable forks.

The S22 Mono truck has a 62 inch lift. The S22 Telescopic truck has either a 96 or 116 inch lift.

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

The reversible AC motor propels the lift truck in forward or reverse direction throughout the available speed range. The S22 lift truck can be driven with forks raised or lowered; however, the speed is restricted when the platform is raised above a preset limit.

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

1-3. SAFETY FEATURES.

The S22 is designed engineered to provide maximum safety for operator and payload. Some of the safety features incorporated into the design are:

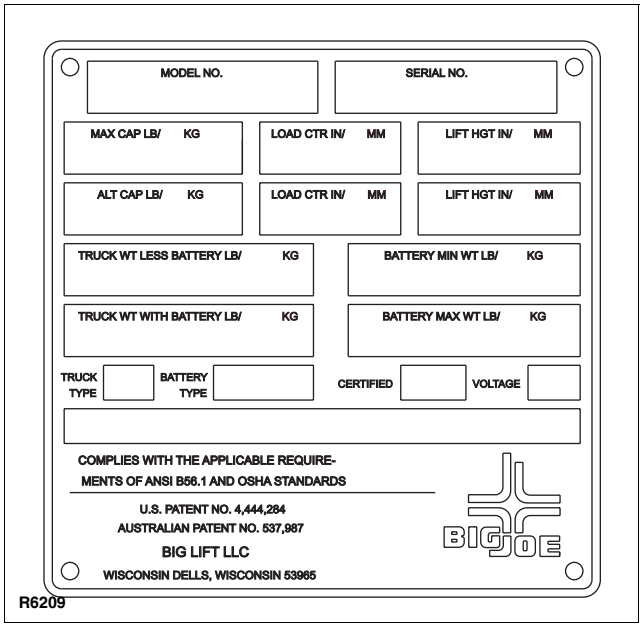

Figure 1-1 Name Plate

- Dead-man brake to apply the brake and cut off drive power when the steering arm is released.
- Emergency brake switch to apply the brake and cut off drive power when depressed.
- 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 emergency stop switch 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
- Caster.

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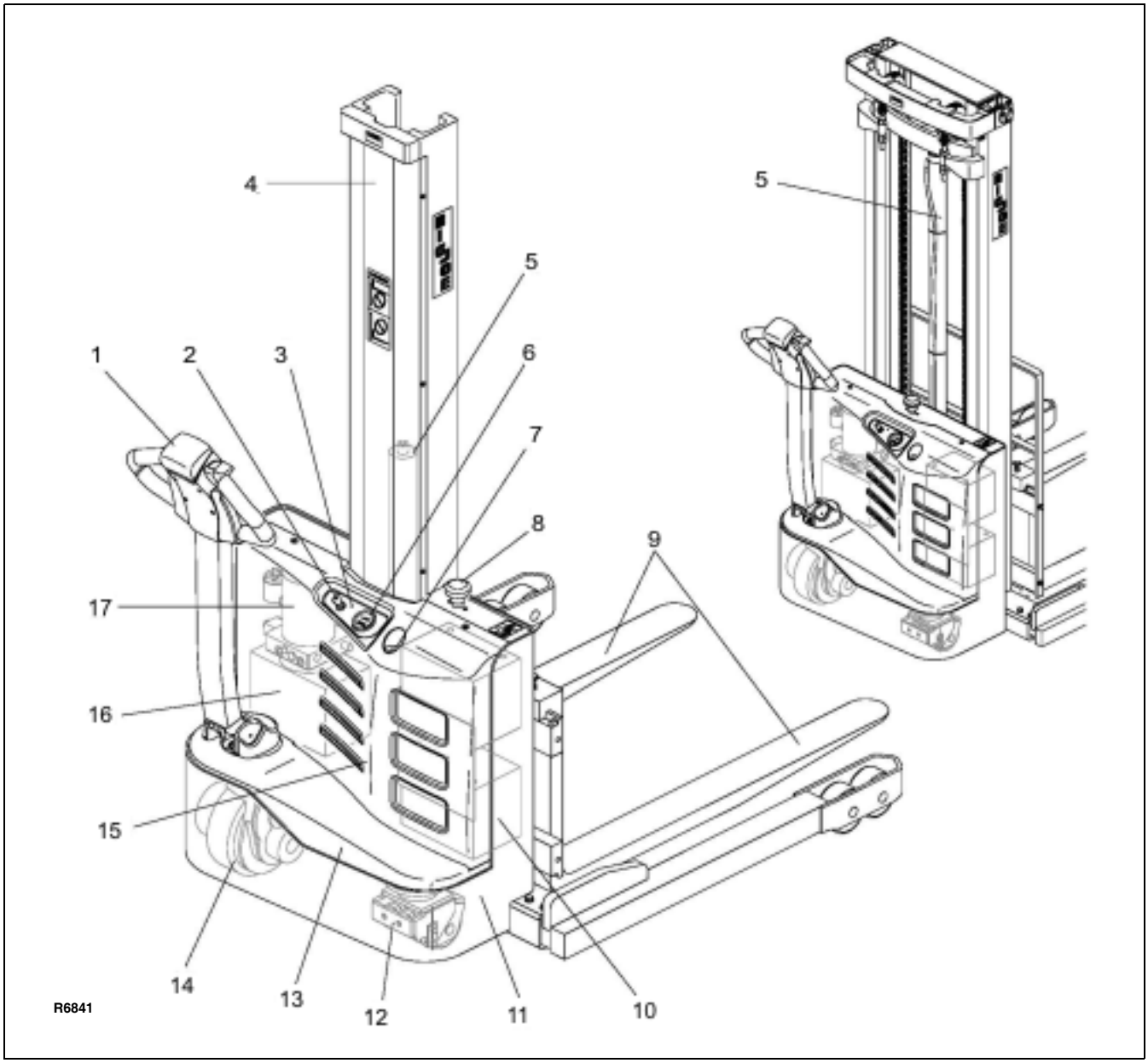

Figure 1-2 S22 Lift Truck

ITEM	COMPONENT
1	Control handle.
2	Key switch
3	LED indicator
4	Mast cover
5	Lift cylinder
6	Battery indicator
7	Battery charger connector
8	Emergency brake switch
9	Forks

ITEM	COMPONENT
10	Battery
11	Chassis
12	Caster
13	Cover
14	Drive wheel
15	Cover
16	Hydraulic reservoir
17	Hydraulic pump

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SECTION 2
OPERATION

2-1. GENERAL.

This section gives detailed operating instructions for the S22 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 S22 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 side slope.
- Be sure the truck has a firm and level footing.
- Avoid overhead wires and obstructions.
- Check for obstructions when raising or lowering the lift carriage.
- Do not handle unstable or loosely stacked loads. Use special care when handling long, high, or wide loads to avoid tipping, loss of load, or striking bystanders.
- Center and carry the load as far back as possible toward the lift carriage back rest. The center-of-gravity of the load must not exceed the load center listed on the 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.

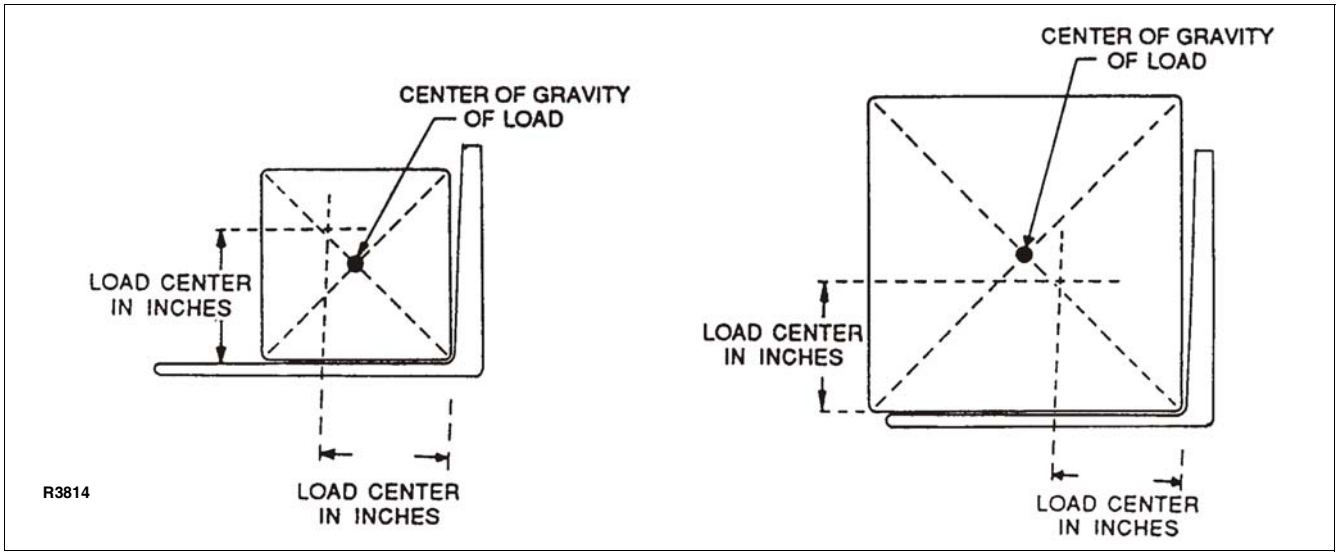

Figure 2-1 Load Center

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- 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 disengage the emergency stop switch.

2-3. BEFORE OPERATION

Table 2-1 covers important inspection points on the S22 lift truck which should be checked prior to operation. Depending on use, some trucks may require additional checks.

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

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

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

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

Table 2-1 Operator Checks

ITEM	PROCEDURE
Transmission and hydraulic systems.	Check for signs of fluid leakage.
Forks	Check for cracks and damage; 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 steering arm when steering.
Travel controls	Check that speed controls on control head operate in all speed ranges in forward and reverse and that belly button switch functions.
Wheels	Check drive wheel for cracks or damage. Move truck to check load for freedom of rotation.
Hydraulic controls	Check operation of lift and lower to their maximum positions.
Brakes	Check that brakes actuate when steering arm is raised to upright position, and when lowered to horizontal position.
Deadman/ Parking brake	Check that steering arm raises to upright position when released and brake applies.
Emergency Stop Switch	Check that emergency stop switch can be disengaged and reengaged.
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.

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BIG JOE

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

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2-4. GENERAL CONTROL OPERATION.

The speed control (See Figure 2-3) located on each side of the control head provides fingertip control for driving the truck. Rotate the control in the direction you want to travel. The farther you rotate the control from the neutral position, the faster the truck will travel.

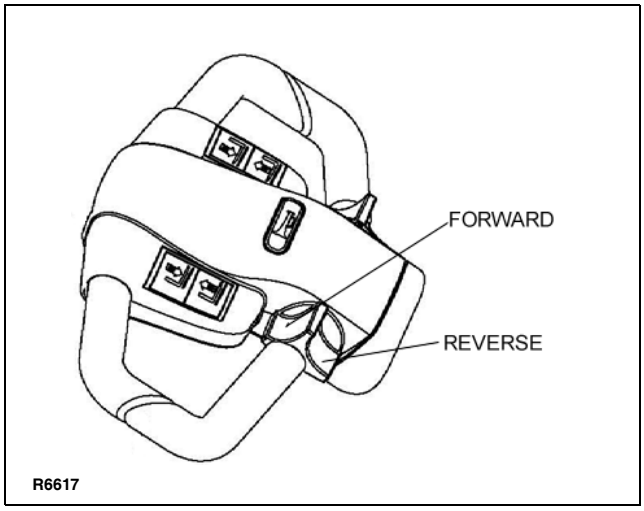

Figure 2-3 Forward/Reverse Control

The pushbutton switches (See Figure 2-4), located on the front of the control head activate the lift-lower controls and the horn.

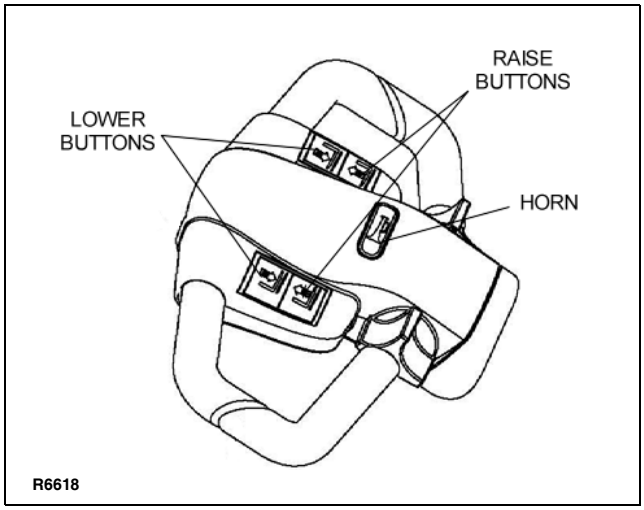

Figure 2-4 Pushbutton Switches

2-5. DRIVING AND STOPPING PROCEDURES.

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

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 speed control lever in the opposite direction of travel and then releasing it when the truck stops. Plugging is a convenient way to stop the truck during normal operation. If the control is not released, the truck will accelerate in the opposite direction.
2. **Steering arm (See Figure 2-5)**: The brake is fully applied by lowering or raising the steering arm. (See Figure 2-5) All traction control power is shut off when the brake is engaged. When the steering arm is in the upright position, the brake acts as a parking brake. Deadman braking occurs when the handle is released and spring action raises steering arm to the upright position.
3. **Emergency braking**: Press the emergency brake switch, all electrical functions are cut out and the truck automatically brakes.
4. **Regenerative braking**: If the speed control lever is released, the truck automatically brakes regeneratively. When the speed is below.5 MPH, the brake applies.

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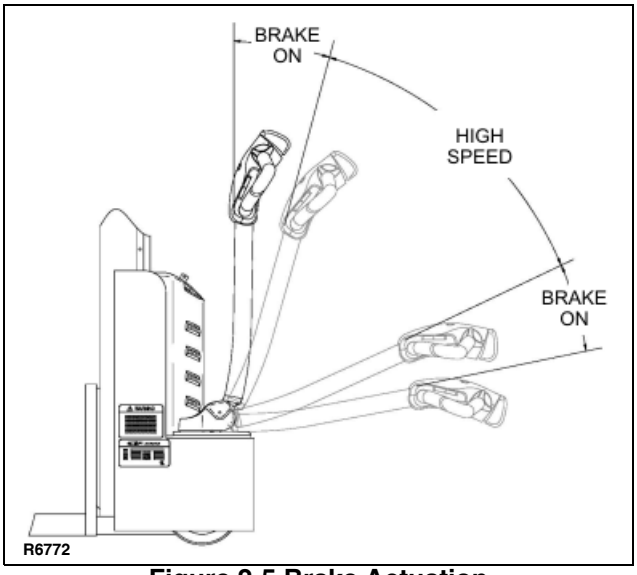

Figure 2-5 Brake Actuation

2-6. BELLY-BUTTON SWITCH.

The belly-button switch (Figure 2-6) minimizes the possibility of the driver being pinned by the steering arm while driving the lift truck in slow speed. If the switch presses against the operator while the lift truck is being driven toward the operator, the switch changes the direction of the lift truck.

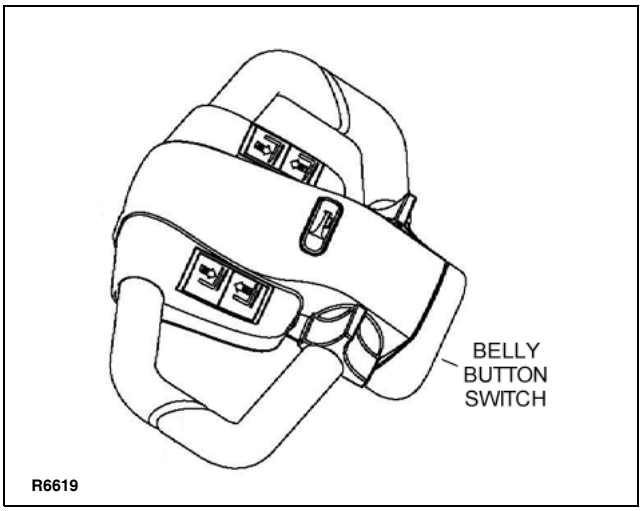

Figure 2-6 Belly-Button Switch

2-7. STEERING ARM GAS SPRING.

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

2-8. LIFT AND LOWER CONTROLS.

Lift/Lower Control buttons are located on the steering control head. (Figure 2-4)

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

2-9. LOADING AND UNLOADING.

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

2-10.PARKING.

When finished with moving loads, return the truck to its maintenance or storage area. Turn off the key switch and engage the emergency stop switch. Charge batteries as necessary. Refer to battery care instructions, SECTION 3.

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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 S22 may be equipped with maintenance free 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 handing 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	Check deadman brake switch for proper operation.
Monthly	Check lift chain tension, lubrication & operation (see paragraph 3-7.)
Quarterly	Check lift cylinder for leakage.
Quarterly	Check for excessive jerking of steering arm when stopping or starting.
Semi-annually	Inspect for chain wear (See SECTION 8)

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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 bubbing stops and rinse with clean water.
- Do not bring any type of flame, spark, etc., near the battery. Gas formed while the battery is charging, is highly explosive. This gas remains in cell long after charging has stopped.
- Do not lay metallic or conductive objects on battery. Arcing will result.
- Do not touch non-insulated parts of DC output connector or battery terminals to avoid possible electrical shock.
- De-energize all AC and DC power connections before servicing battery.
- Do not charge a frozen battery.
- Do not use charger if it has been dropped or otherwise damaged.

3-3.3. Battery Care and Charging

CAUTION: Never smoke or bring open flame near the battery. Gas formed during charging is highly explosive and can cause serious injury.

1. Charge the battery only in areas designated for that use.
2. 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.
3. The charging requirements will vary depending on the use of the truck. The battery should be given as equalizing charge on a weekly basis. This charge should normally be an additional three hours at the finish rate.
4. 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.

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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 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. Pull the charger cord out of the cover (1, Figure 3-1) and connect to the appropriate power supply,
4. The LED (2) flashes red to indicate that the charger is connected.
5. Charge the batteries until the LED (2) produces a permanent green light.
6. Disconnect the charger cord and insert it in its receptacle on the truck.

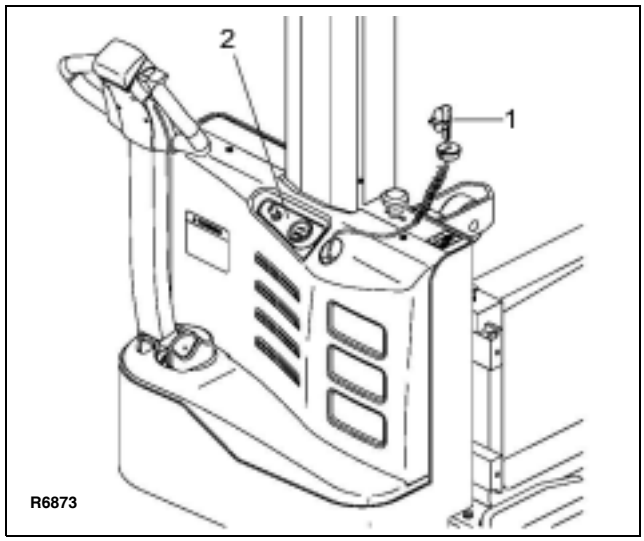
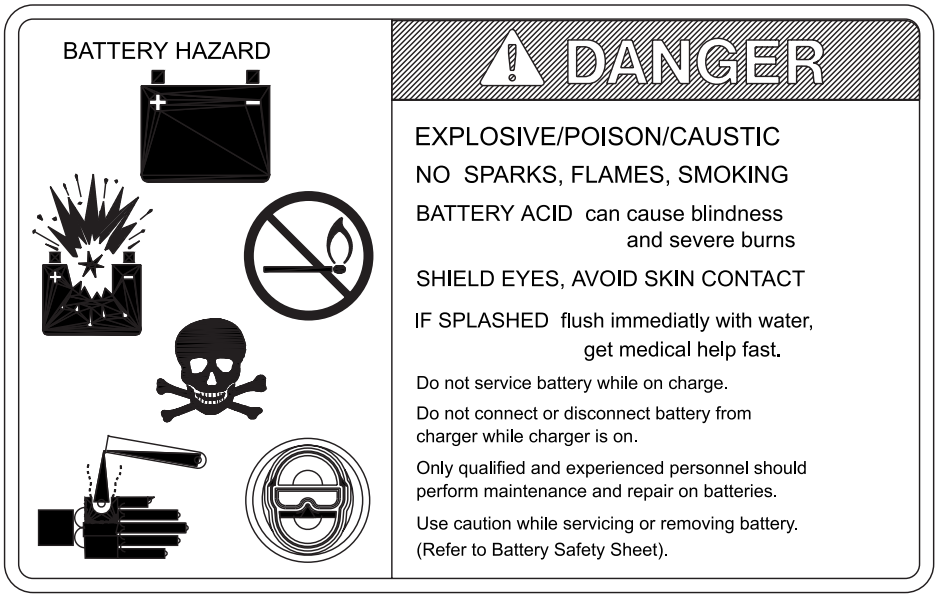


Figure 3-1 Battery Charging

3-5. CHARGING BATTERIES

1. Park truck at charging station with carriage lowered and turn the key switch off and engage the emergency stop switch.
2. Remove two screws (1, Figure 3-2) and remove cover (2).



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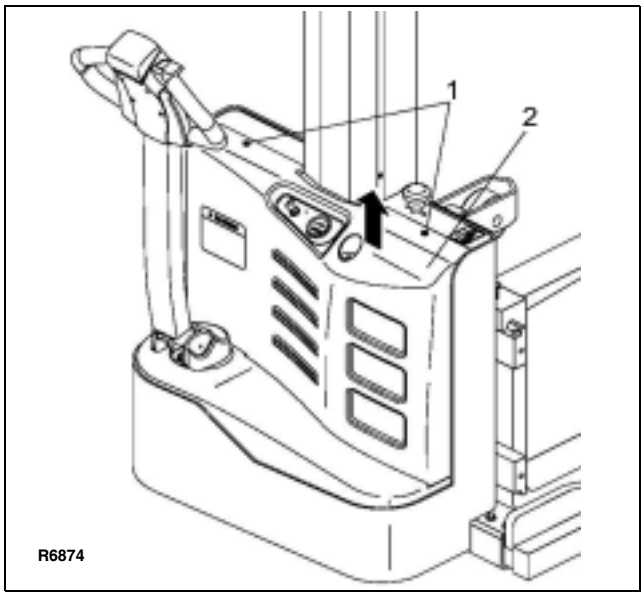

Figure 3-2 Battery Charging

3. Remove two screw (1, Figure 3-3) and remove bracket (2).

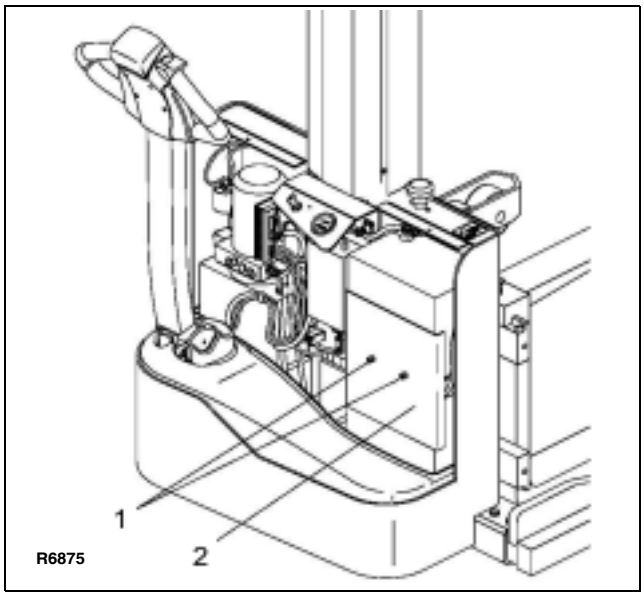

Figure 3-3 Battery Charging

4. Tag and disconnect the three cables from the batteries and replace the batteries.
5. Install in the reverse order of removal.

3-6. LUBRICATION.

Refer to Table 3-2 for the recommended types of grease and oil. Table 3-3 in conjunction with Figure 3-4 identifies the items requiring lubrication.

3-7. LIFT CHAIN MAINTENANCE.

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

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

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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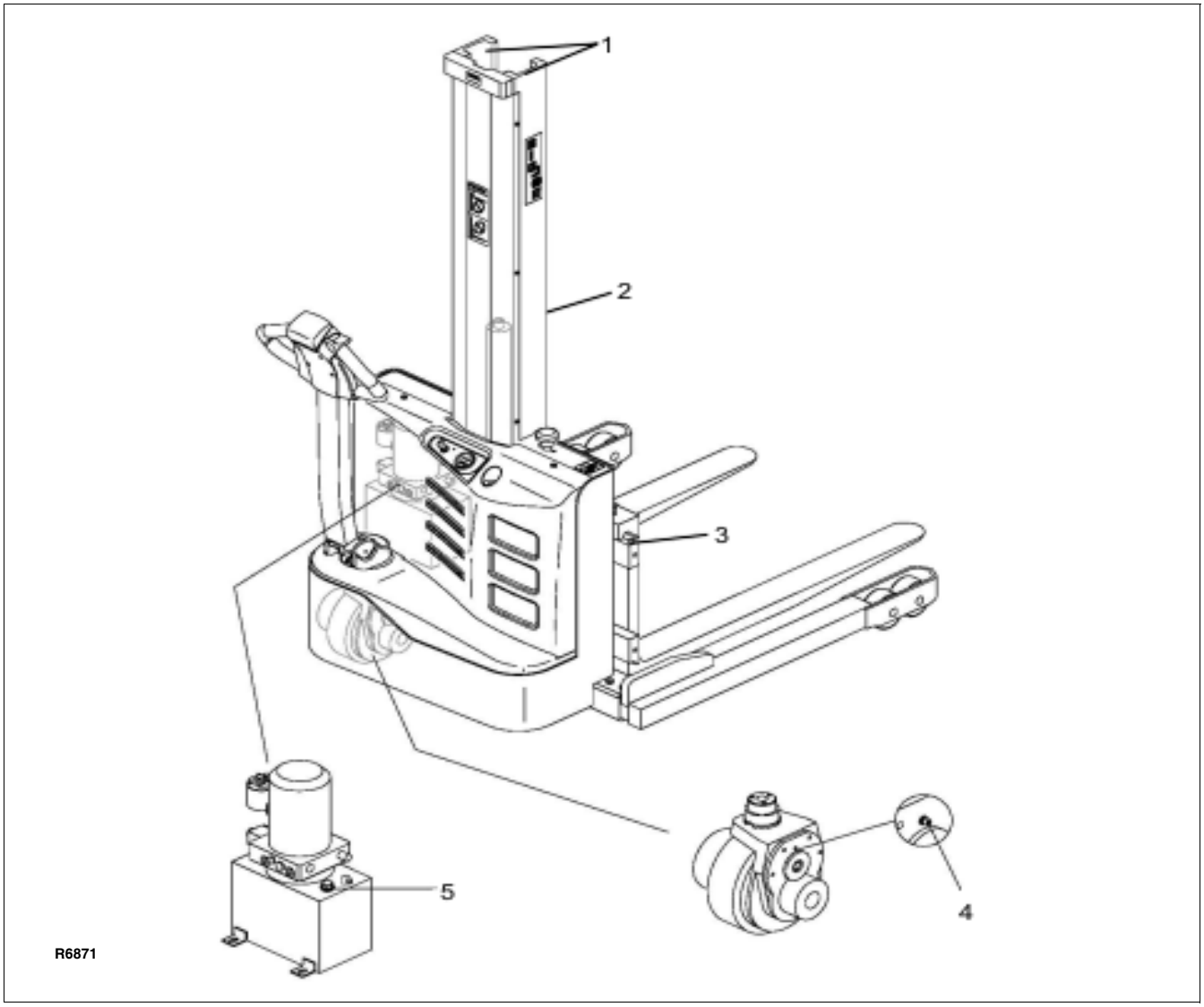

Figure 3-4 Lubrication Diagram

Table 3-3 Lubrication Chart

FIG 3-2 INDEX NO.	LOCATION	METHOD OF APPLICATION	TYPE (Table 3-3)	APPLICATION OF LUBRICANT
1	Inner & Outer Mast	Brush	No. 2	Full length of channel where rollers operate.
2	Lift Chain	Brush or Spray	No. 4	See Paragraph 3-7.
3	Lift Carriage	Brush	No. 2	Light coating where forks slide.
4	Transmission Capacity 2 pints	Can	No. 1	Fill to level plug.
5	Hydraulic Reservoir Capacity-1 quarts	Can	No. 3	With lift carriage fully lowered, fill reservoir with hydraulic oil to level on breather dip stick.

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SECTION 4
TROUBLESHOOTING

4-1. GENERAL

Use Table 4-1 as a guide to determine possible causes of trouble. The table is divided into five main categories: Truck and Hydraulic System Will Not Operate: Truck Does Not Operate Forward or Reverse: Trouble With Braking: Trouble With Lifting Or Lowering, and Miscellaneous malfunctions.

Table 4-1 Troubleshooting Chart

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
TRUCK AND HYDRAULIC SYSTEM WILL NOT OPERATE		
Truck will not travel not will lift system operate.	a. Fuse (2, Figure 12-24 or Figure 12-24) blown.	Check fuse and replace if necessary.
	b. Fuse (28, Figure 12-22 or 17, Figure 12-23) blown.	Check fuse and replace if necessary.
	c. Battery dead or disconnected.	Check battery connections and check battery voltage.
	d. Keyswitch (4, Figure 12-22 or 3, Figure 12-23) defective.	Bypass keyswitch to determine if it is malfunctioning.
	e. Emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) defective.	Bypass keyswitch to determine if it is malfunctioning.
	f. Defective wiring.	Check for open circuit. Repair as required.
TRUCK DOES NOT OPERATE FORWARD OR REVERSE		
Truck does not travel forward or reverse. All other functions operate normally.	a. Check all wiring. A loose connection may be the cause of malfunction.	Tighten all loose connections before further troubleshooting.
	b. Defective deadman switch (16, Figure 12-1).	Check and replace switch if defective.
	c. Defective controller (13, Figure 12-22 or 9, Figure 12-23).	Check for proper operation and replace if necessary.
	d. Defective potentiometer (15, Figure 12-2).	Check and replace potentiometer if defective.
Truck travels forward but not in reverse.	Defective potentiometer (15, Figure 12-2) in control head.	Check and replace potentiometer if defective.
Truck travels reverse but not in forward.	Defective potentiometer (15, Figure 12-2) in control head.	Check and replace potentiometer if defective.
Truck travels forward and in reverse at lower speeds; will not travel at high speed.	Defective potentiometer (15, Figure 12-2) in control head.	Check and replace potentiometer if defective.

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Table 4-1 Troubleshooting Chart - Continued

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
TROUBLE WITH BRAKING		
Truck does not slow with brake, or brake does not engage.	a. Defective deadman switch (16, Figure 12-1).	Check deadman switch for continuity. If none found when the control arm is in the brake position, replace switch.
	b. Defective electric brake (1, Figure 12-5).	Adjust or replace brake.
Brake will not release.	a. Air gap more than 0.01 in (0.25mm).	Adjust.
	b. Brake temperature above 281° F (140° C).	Allow to cool and check air gap.
	c. Open brake circuitry or wiring.	Make voltage checks.
Brake drags.	Defective electric brake (1, Figure 12-5).	Replace.
Brake grabs.	a. Incorrect stopping distance adjustment.	Adjust.
	b. Defective electric brake (1, Figure 12-5).	Replace.
Abnormal noise and chatter when brake is applied.	Defective electric brake (1, Figure 12-5).	Replace.
TROUBLE WITH LIFTING OR LOWERING		
Oil sprays or flows from the top of the lift cylinder.	Defective packing in lift cylinder	Repair lift cylinder.
Squealing sounds when lifting forks.	a. Oil level too low.	Identify oil leak and fill reservoir.
	b. Dry channels in mast.	Apply grease.
	c. Defective mast or carriage rollers	Replace rollers.
Forks do not lift to top.	a. Oil level too low.	Add oil to reservoir.
	b. Load larger than capacity.	Refer to I.D.plate for capacity.
Weak, slow or uneven action of hydraulic system.	a. Defective pump or relief valve.	Check pressure. Adjust as necessary.
	b. Worn lift cylinder.	Replace cylinder.
	c. Load larger than capacity.	Refer to I.D.platefor capacity.
	d. Defective lift motor solenoid.	Replace solenoid (2, Figure 12-19) on pump motor.
	e. Battery charge low.	Charge battery.
Forks do not lift, pump motor does not run.	a. Battery is dead or disconnected.	Check and recharge if required.
	b. Defective wiring.	Check and repair as required.
	c. Defect in electrical system for operating pump motor.	Check lift switch in control head, as well as the solenoid (2, Figure 12-19).

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Table 4-1 Troubleshooting Chart - Continued

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
TROUBLE WITH LIFTING OR LOWERING - Continued		
Forks do not lift, motor runs.	Defect in hydraulic system.	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.
Forks lift, but will not go down.	Defect in hydraulic system	Check lowering control switch in control head and lowering solenoid on valve assembly. Replace as required.
Load will not hold	a. Oil bypassing internally in control valve	Replace valve assembly (Figure 12-19).
	b. Worn lift cylinder or packing.	Repack cylinder.
Platform does not lift to top. Pump motor runs.	a. Oil level too low.	Add oil to reservoir.
	b. Load larger than capacity.	Refer to nameplate on side of mast for maximum load capacity.
	c. Batteries need charging.	Change batteries.
Forks creep downward under load when in a raised position.	Leak in hydraulic system, lift cylinder or lowering valve.	Check for leaking fitting in hydraulic line and repair as required. Repack lift cylinder or replace valve assembly (Figure 12-19).
MISCELLANEOUS		
Steering arm does not return to the upright position.	a. Week return spring.	Replace spring.
	b. Binding.	Check and free the binding item. Verify that the cable has not been damaged. Repair or replace as needed.
Truck moves forward when arm is pulled down.	a. Belly-button switch defective.	Check for short, and repair or replace as necessary.
	b. Short in control head.	Check wiring and repair as required.
Steering arm jerks excessively starting or stopping the truck.	Drive wheel worn.	Replace drive wheel if worn to within 3/4 inch of hub.
Drive motor is jerky.	Motor internally damaged or worn.	Replace motor.

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4-2. CONTROLLER TROUBLESHOOTING

4-2.1. Fault Detection.

The controller provides diagnostics information to assist technicians in troubleshooting drive system problems. When a fault is detected, the appropriate fault code is signaled via the panel mounted LED.

4-2.2. Hand Held Programmer (Optional)

The hand held programmer is available that is designed specifically for use with the controller. The programmer is available through your Big Lift LLC dealer.

4-2.3. Fault Recording.

Fault events are recorded in the controller's memory. However, multiple occurrences of the same fault are recorded as one occurrence.

The fault event list can be loaded into the programmer for readout. The Special Diagnostics mode provides access to the controller's diagnostic history file. The history file contains the entire fault event list created since the diagnostic history file was last cleared. The standard Diagnostics mode provides information about only the currently active faults.

4-2.4. General Checkout.

Carefully complete the following checkout procedure. If you find a problem during the checkout, refer to paragraph 4-2.8. for further information.

The checkout can be conducted with or without the handheld programmer (See Paragraph 4-2.2.). However, the checkout procedure is easier with a programmer. To evaluate the system without a programmer, observe the LED and note the flashing pattern and refer to Table 4-3 for the code description.

CAUTION: Put the vehicle up on blocks to get the drive wheel off the ground before beginning these tests.

Turn the keyswitch off and make sure the brake is applied, the throttle is in neutral, and the forward/reverse switches are open.

Do not stand, or allow anyone else to stand directly in front of or behind the vehicle during the tests.

1. Disconnect the battery charger and connect the programmer to the 4-pin connector (Figure 4-1) on the controller.

Figure 4-1 Controller Terminals

2. Turn the lift truck key switch to the ON position. The programmer should "power up" with an initial display (2, Figure 4-2), and the controllers Status LED should begin steadily blinking a single flash. If neither happens, check for continuity in the key switch circuit and controller ground.

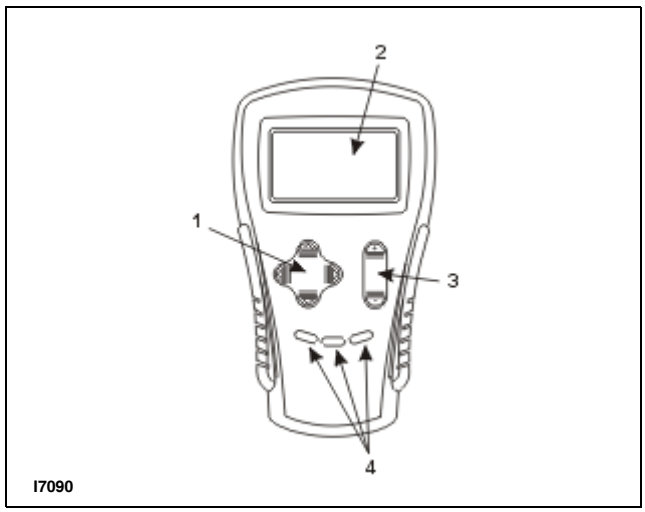

Figure 4-2 Hand Held Programmer

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3. Put the controller into the diagnostic mode by pressing the "Menu Navigation Key" (1, Figure 4-2). Using the Navigation key, select the Faults menu. Display the Faults menu by pressing the Right side of the Navigation key. Press the Right side of the Navigation key again to display the list of System Faults. The display should indicate "No Known Faults."

   Release the brake by pulling down the steering arm into the operating position. The controllers LED should continue blinking a single flash and the programmer should continue to indicate no faults. If there is a problem, the LED will flash a diagnostic code and the programmer will display a diagnostic message. If you are conducting the checkout without a programmer, look up the LED diagnostic code in Table 4-3.

   When the problem has been corrected, it may be necessary to cycle the brake in order to clear the fault code.

4. With the brake released, select a direction and operate the throttle. The motor should begin to turn in the selected direction. If it does not, verify the wiring to the forward/reverse switches and motor. The motor should run proportionally faster with increasing throttle. If not, refer to Paragraph 4-2.8.

5. Put the controller into the test mode by using the Navigation key (1) to select the "Monitor" menu. Select the Monitor mode by pressing the "Right" arrow on the Navigation key. Press the Navigation key "Down" arrow to scroll down to observe the status of the forward, reverse, brake, emergency reverse, and mode switches. Cycle each switch in turn, observing the programmer. Each input should show the correct state on the programmer.

6. Check the controller's fault detection circuitry as described in Paragraph 4-2.5.

7. Take the vehicle off the blocks and drive it in a clear area. It should have smooth acceleration and good top speed.

8. Test the plug braking of the vehicle. The vehicle should smoothly slow to a stop and reverse direction, with the audible plugging tone.

9. Verify that all options, such as high pedal disable (HPD), static return to off (SRO), and anti-tie-down, are as desired.

10. Check to see whether the emergency reverse (belly button) feature is working correctly. Verify that the circuit is operational by momentarily disconnecting one of the emergency reverse wires. The vehicle should be disabled and a fault indicated.

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4-2.5. Diagnostic History

The handheld programmer can be used to access the controller's diagnostic history file. When the programmer is connected to the unit, the error log file is automatically uploaded into the handheld programmer.

To see the present status of the unit, use the Menu Navigation Key (1, Figure 4-2) to select:

Faults->System Faults.

To access this log, use the Menu Navigation Key to select:

Faults->Fault History

The faults are shown as a code and descriptive text. If there are multiple faults, you have to scroll through the list using the Up and Down Buttons on the Menu Navigation Key

The faults may be intermittent faults, faults caused by loose wires, or faults caused by operator errors. Faults such as HPD or over-temperature may be caused by operator habits or by overloading.

After a problem has been diagnosed and corrected, clearing the diagnostic history file is recommended. This allows the controller to accumulate a new file of faults. By checking the new diagnostic history file at a later date, you can quickly determine whether the problem has been completely fixed.

To clear the diagnostic history file, select:

Faults->Clear Fault History.

You will be asked to confirm your actions. Use the "plus" arrow (+) for yes to clear the menu and the "minus" arrow (-) (3) to cancel your selection and not clear the Fault History.

4-2.6. Test the Fault Detection Circuitry

1. Put the vehicle up on blocks to get the drive wheel off the ground.
2. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
3. Using an inline fuse holder fitted with a 10 amp fuse and alligator clips, connect the controller's M and B- terminals.
4. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
5. Leave the key switch on and remove the in-line fuse wire. The vehicle status should continue to remain off.
6. Cycle the key switch off and on. Release the brake and apply the throttle. The vehicle should now operate normally.

4-2.7. Programmable Parameters

The controller has a number of parameters that can be programmed using the handheld programmer. These programmable parameters allow the vehicle's performance characteristics to be customized to fit the needs of individual vehicles or vehicle applications.

The OEM can specify the default value for each parameter and can also designate whether a parameter will have User or OEM access rights. Accordingly, programmers are available in User and OEM versions. The User programmer can adjust only those parameter with User access rights, whereas the OEM programmer can adjust all the parameters.

The programmable parameters are grouped hierarchically into menus, as shown in Table 4-2.

The MultiMode^{TM} feature of the controller allows operation in two distinct modes: Mode 1 and M2. These modes can be programmed to provide four different sets of operating characteristics, which can be useful for operating in different conditions. Mode 1 could be programmed such that the vehicle moves slowly for precise, indoor maneuvering, and Mode 2 programmed for higher speed, long distance travel outdoors.

The controller is in Mode 2 when the mode switch is in the On position (input connected to B+). Leaving the mode input floating or actively switching it Off (pulling it to B-) puts the controller in Mode 1.

The Speed menu allows the maximum speed in forward and reverse to be set independently in Mode 1 and Mode 2. The position of the speed limit pot determines whether the programmed Max Speed or Min Speed - or a speed between thee two programmed speeds - is in effect. Speed is varied linearl.y over the range between the two speeds in each mode, in forward and reverse

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Table 4-2 Programmable Parameters

Parameter	Factory Setting	Description
DRIVE MENU		
Accel Max Speed	5	Sets the rate (in seconds) at which the speed command increases when throttle is applied with the speed limit pot is in its maximum speed position, and the vehicle is traveling forward. Larger values represent slower response. Note: Allowable range is restricted by the Accel Min Speed setting.
Accel Min Speed	8	Sets the rate (in seconds) at which the speed command increases when throttle is applied while the speed limit pot is in its minimum speed position, and the vehicle is traveling forward. Larger values represent slower response Note: Allowable range is restricted by the Accel Max Speed setting.
Decel High Speed	1.5	Sets the rate (in seconds) that is used to slow down the vehicle when it is traveling forward at high speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by the Decel Low Speed setting.
Decel Low Speed	8	Sets the rate (in seconds) that is used to slow down the vehicle when it s traveling forward at low speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by the Decel High Speed setting.
Rev Accel Max Speed	1.5	Sets the rate (in seconds) at which the speed command increases when throttle is applied while the speed limit pot is in its maximum speed position, and the vehicle is traveling in reverse. Larger values represent slower response. Note: Allowable range is restricted by Rev Accel Min Speed setting.
Rev Accel Min Speed	8	Sets the rate (in seconds) at which the speed command increases when throttle is applied while the speed limit pot is in its minimum speed position, and the vehicle is traveling in reverse. Larger values represent slower response. Note: Allowable range is restricted by Rev Accel Max Speed setting.
Rev Decel High Speed	1.1	Sets the rate (in seconds) that is used to slow down the vehicle when it is traveling in reverse at high speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by Rev Decel Low Speed setting.

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
DRIVE MENU - Continued		
Rev Decel Low Speed	8	Sets the rate (in seconds) that is used to slow down the vehicle when it is traveling in reverse at low speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by Rev Decel High Speed setting.
Key Off Decel	4	Sets the rate (in seconds) that is used to slow down the vehicle at key-off or in the event of a major fault.
E Stop Decel	4	Sets the rate (in seconds) that is used to slow down the vehicle during emergency reverse, i.e., when a throttle command >80% in the reverse direction is given while the vehicle is moving forward. This gives the operator a way to stop more quickly when unexpected conditions arise.
E Stop Pause	1	Sets a pause before reversing direction after an emergency reverse stop. This gives the operator time to return the throttle to neutral without moving backwards
Soft Start	100%	This parameter can be used to soften the bump associated with gear slack in the transaxle when throttle is applied from the neutral state. Larger values provide a softer slack take-up.
Gear Soften	100%	This parameter is intended to soften the bump associated with gear slack in the transaxle when throttle is released and then reapplied while the vehicle is still moving. Larger values provide a softer slack take-up.
Creep Speed	10%	Creep Speed helps to prevent vehicle rollback on inclines when the brake is released with very little throttle applied. It is activated when the throttle request exceeds the throttle deadband threshold.
Push Max Speed	50%	Sets the maximum speed at which the vehicle can be pushed. When the vehicle is powered on and in neutral, it enters the push mode when the push button is activated. The electromagnetic brake is released, driving is inhibited, and speed is limited to Push Max Speed. When the vehicle is not powered on and the brake is mechanically released to enable pushing, Push Max Speed still applies. Once sufficient voltage is generated by the motor, speed will be limited by the controller
Soft Stop Speed	30%	Sets the speed at which a gentler deceleration is initiated when the throttle is released to neutral; larger values start the soft stop deceleration sooner.

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
SPEED MENU		
M1/M2 Max Speed	100%	During forward operation, defines the requested speed at full throttle when the speed limit pot is in its maximum speed position. Note: Allowable range is restricted by the M1/M2 Min Speed setting.
M1/M2 Min Speed	100%	During forward operation, defines the requested speed command at full throttle when the speed limit pot is in its minimum speed position. Min Speed cannot be set higher than the programmed Max Speed. Note: Allowable range is restricted by the M1/M2 Max Speed setting. Note: For this parameter to apply, a speed limit pot must be installed in parallel with the throttle and the Speed Limit Pot parameter must be programmed On (see Throttle menu).
M1/M2 Rev Max Speed	100%	During reverse operation, defines the requested speed at full throttle when he speed limit pot is in its maximum speed position. Note: Allowable range is restricted by M1/M2 Rev Min Speed setting.
M1/M2 Rev Min Speed	M1 = 100% M2 = 60%	During reverse operation, defines the requested speed command at full throttle when the speed limit pot is in its minimum speed position. Rev Min Speed cannot be set higher than the programmed Rev Max Speed. Note: Allowable range is restricted by M1/M2 Rev Max Speed setting. Note: For this parameter to apply, a speed limit pot must be installed in parallel with the throttle and the Speed Limit Pot parameter must be programmed On (see Throttle menu).

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
THROTTLE MENU		
Type	9	The 1212 controller can accept inputs from both 5kΩ, 3-wire pot throttles and voltage throttles. Set the throttle type parameter to match the throttle used in your application. *5kΩ, 3-wire pot throttles* 0 = wigwag 1 = inverted wigwag 2 = single-ended; neutral when wiper at PotLow 3 = inverted single-ended; neutral when wiper at PotHigh 4 = unipolar. Voltage throttles 5 = wigwag 6 = inverted wigwag 7 = single-ended; neutral when wiper . PotLow 8 = inverted single-ended voltage; neutral when wiper ≥ PotHigh 9 = unipolar
PotHigh	5	Sets the maximum voltage for voltage throttles (Types 5–9). For 5kΩ, 3-wire pot throttles, PotHigh is determined by the throttle itself.)
PotLow	2	Sets the maximum voltage for voltage throttles (Types 5–9). For 5kΩ, 3-wire pot throttles, PotLow is determined by the throttle itself.)
Neutral Deadband	30%	Sets the throttle range the controller interprets as neutral. Increasing the parameter setting increases the neutral range. This parameter allows the neutral deadband to be defined wide enough to ensure the controller goes into neutral when the throttle is released.
Throttle Max	100%	Sets the pot wiper voltage required to produce 100% controller output. Increasing the Throttle Max setting reduces the wiper voltage required, and therefore reduces the stroke necessary to produce full output. This feature allows reduced-range throttle assemblies to be used.
HPD	ON	When programmed On, vehicle drive is inhibited if a throttle command outside the neutral deadband is issued before the controller is powered up. Drive will continue to be inhibited until the throttle is returned to within the neutral deadband. If the HPD fault is not cleared within 10 seconds, a wiring fault is declared and a power cycle is required.
Speed Limit Pot	OFF	This parameter is used to enable/disable the speed limit pot. If no speed limit pot is used, set Speed Limit Pot to Off.

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
THROTTLE MENU - Continued		
Throttle Map	80%	The throttle map parameter adjusts the static throttle map. The parameter setting corresponds to the throttle command at half throttle. A setting of 50% provides linear response. Values below 50% reduce the throttle command at low throttle positions, providing enhanced slow speed maneuverability. Values above 50% give the vehicle a faster, more responsive feel at low throttle positions.
Tremor Suppression	100%	This parameter can be used to limit the controller's response to sharp throttle movements, such as movements resulting from hand tremors. Larger values will provide a steadier ride, but they also result in more sluggish response to throttle request. There is thus a trade-off between crispness of response (low Tremor Suppression settings) and steady speed in the presence of tremors (high settings).
Calibration	OFF	Wigwag and unipolar throttle pots should be centered. Setting this parameter to On inhibits driving and puts the controller into throttle autocalibration mode. Setting the parameter Off returns the controller to normal operation.
CURRENT MENU		
Main Current Limit	70	Sets the maximum current the controller will supply to the motor during normal driving. By limiting the current supplied, this parameter can be used to protect the motor from potentially damaging currents or to reduce the maximum torque applied to the drive system.
Braking Current Limit	70	Sets the maximum current the controller will supply to the motor during braking. By limiting the current supplied, this parameter can be used to protect the motor from potentially damaging currents or to reduce the maximum braking torque applied to the drive system.
Boost Current	80	Boost current gives a brief boost of current that greatly improves performance with transient loads, such as starting on a hill, crossing a threshold, climbing obstacles, etc. When the controller recognizes that the motor needs more current to respond to a drive request, it provides a current boost of a set amount for a set time. The Boost Current parameter defines the motor current limit during the boost period
Boost Time	10	This parameter sets the maximum time that the boost current is allowed.

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
INHIBIT MENU		
Type	5	The flexible speed input at J1 Pin 6 can be used to limit or to inhibit speed under certain conditions. For example, a switch could be installed under the seat so that if the operator drives the scooter while they are standing the max speed will be limited. The Inhibit Type parameter is used to select how the inhibit function will be implemented. Depending on how the inhibit switch is wired into the system, set this parameter to: 0 = B- active 1 = B+ active 2 = Open circuit active 3 = B- inactive 4 = B+ inactive 5 = Open circuit inactive.
Speed	100%	This parameter limits the maximum speed allowed during speed inhibit mode. A setting of 0 prevents drive during inhibit mode.
BRAKE MENU		
Delay	1	Sets the length of delay between when zero speed is commanded and the electromagnetic brake is engaged.
Fault Check	OFF	Enables/disables the fault detection on the EM brake.
Hold Voltage	24	A high initial voltage is applied to the brake coil when the brake is first released. After approximately 1 second, this peak voltage drops to the programmed Hold Voltage. The parameter should be set high enough to hold the brake released under all the shock and vibration conditions the vehicle will be subjected to.
Brake Light	OFF	When set to On, the horn output (J1 Pin 3) will act as a brake light driver. The brake light must be driven by a relay. The brake light will be turned on when the throttle is returned to neutral and will remain on for about 2 seconds after the EM brake is engaged.
HORN MENU		
Fault Beep	OFF	When programmed On, the horn will be used to provide audible fault codes whenever faults are present. These are the same fault codes that are flashed by the status LED. If a fault should occur while the vehicle is driving in reverse with the reverse beep active, the fault signal will take precedence. If this audible fault alarm is not wanted, set Fault Beep to Off.
Reverse Beep	ON	When programmed On, the horn will sound whenever the vehicle is being driven in reverse. On vehicles with reverse switches, the horn will sound when the reverse switch is activated.

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
HORN MENU - Continued		
Beep Constant	OFF	Sets the reverse beep to be a constant tone (when programmed On) or a 1Hz pulse (when programmed Off).
MOTOR MENU		
System Resistance	800	Sets the system resistance (motor + brushes + wiring + connections) used for load compensation and speed estimation. Control system performance depends on this parameter being set correctly; it must be set to the actual cold motor resistance.
Resistance Auto Comp	OFF	Resistance is automatically measured under a preset low current before the brake is released. The measured motor resistance plays an important role in IR compensation. The Resistance Auto Comp parameter enables/disables this automatic function.
Auto Comp Current Limit	50	Sets the current limit used for automatic resistance testing, as a percentage of the Main Current Limit (see Current menu).
Speed Scaler	27	The Speed Scaler parameter sets the maximum voltage that can be applied to the motor. It can be used to eliminate variations in maximum speed that would otherwise result when driving with a fully charged battery vs. a partially discharged battery. If Speed Scaler is set to 23 volts, for example, the maximum vehicle speed will be the same whether the actual battery voltage is 27 volts or 23 volts or any value in between.
Current Rating	70	This parameter should be set to the current rating provided by the motor 0–70 A manufacturer.
Max Current Time	120	Sets the maximum amount of time the motor is allowed to run at the main current limit.
Cutback Gain	100	When the motor overheats, the drive current is cut back until it reaches the programmed Current Rating. The Cutback Gain determines how quickly this cutback will occur, once the programmed Max Current Time has expired.
BDI MENU		
Full Voltage	24.9	Voltage when the battery is fully charged. Note: Allowable range is restricted by the Empty Voltage, Start Charge Voltage, and Reset Voltage settings.
Empty Voltage	24.3	Voltage when the battery is fully discharged. Note: Allowable range is restricted by the Full Voltage setting.
Full Charge Voltage	36	Voltage, when a charger is connected, above which the battery is considered finished charging. Note: Allowable range is restricted by the Start Charge setting.

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Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting	Description
BDI MENU - Continued		
Start Charger Voltage	28.1	Voltage above which the battery is considered to start charging. Note: Allowable range is restricted by the Full Voltage and Full Charge Voltage settings.
Reset Voltage	36	Voltage at which the BDI calculator will be reset to 100%, after the charger is disconnected and the controller is powered up. Note: Allowable range is restricted by the Full Voltage setting.
Discharge Factor	10	Discharge rate of the battery. Larger values are for larger batteries, which discharge more slowly.
Charge Factor	10	Charge rate of the battery. Larger values are for larger batteries, which charge more slowly.
Low BDI Level	100%	Sets the battery charge level at which maximum vehicle speed will be limited in order to protect the battery from deep discharge. Setting Low BDI Level to zero disables this function and allows the battery to discharge completely.
Low BDI Max Speed	100%	Sets the maximum allowed vehicle speed when the battery charge falls below the programmed Low BDI Level.
COMPENSATION MENU		
IR Comp	90%	Sets the motor load compensation. Higher values provide stronger disturbance rejection, while lower values provide smoother operation. Note: Allowable range is restricted by the Anti-Rollback Comp setting.
Anti-Rollback Comp	125%	Sets the motor load compensation after the throttle is released to neutral and the speed is estimated to be near zero. Higher values provide more hill-holding force. Note: Allowable range is restricted by the IR Comp setting.
MISCELLANEOUS MENU		
Sleep	60	Sets the delay time between the last throttle request or serial communication and when the controller goes into sleep mode. Setting the delay to zero disables the sleep function
Fault Code Type	2	This parameter selects which set of fault identification codes (Type 0,1, or 2) will be flashed by the status LED.
Reset Drive Time	OFF	The controller's hourmeter logs the total drive time since the last reset; this record is accessible through the Monitor menu. Setting this parameter ON zeroes the hourmeter and starts a new log; this is typically done when the vehicle is serviced. Reset Drive Time is automatically set to Off after the hourmeter is reset.

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4-2.8. Diagnostics and Troubleshooting.

The motor controller provides diagnostics information to assist in troubleshooting drive system problems. The diagnostics information can be obtained in two ways:

- Reading the appropriate display on the programmer
- Observing the fault codes issued by the panel mounted Status LED.

4-2.8.1. LED Diagnostics

During normal operation with no faults present, the Status LED is steady on. If the controller detects a fault the Status LED flashes a fault identification code continuously until the fault is corrected.

NOTE: The Status LED can only indicate one fault at a time. If multiple faults are detected, the highest priority fault code flashes until it is cleared.

With Fault Code Type parameter is set to 0, the status LED uses the fault codes listed in Table 4-3. Six single-digit codes are used: 2, 3, 5, 6, 7, and 9.

For suggestions about possible causes of the various faults, refer to Table 4-4 Troubleshooting Chart.

4-2.9. Programmer Diagnostics

With a programmer, diagnostics and troubleshooting is more direct than with the LED alone. The programmer presents complete diagnostic information in plain language - no code to decipher. Faults are displayed in the Diagnostic Menu, and the status of the controller inputs/outputs is displayed in the Test Menu.

The following 4-step process is generally used for diagnosing and troubleshooting an inoperative vehicle using the programmer:

1. Visually inspect the vehicle for obvious problems:
2. Diagnose the problem:
3. Test the circuitry with the programmer:
4. Correct the problem.

   Repeat the last three steps as necessary until the vehicle is operational.

   Refer to the Table 4-4 for suggestions covering a wide range of possible faults.

Table 4-3 LED Codes

LED Code		Explanation
LED Off	Not illuminated	No power or defective controller
Solid On	Always on	Controller operational, no faults
2	00	Undervoltage Fault
3	000	Overvoltage Fault
5	00000	Brake ON Fault
6	000000	HPD Fault Wiring Fault *
7	0000000	Speed Pot Fault Throttle Fault
9	000000000	Battery Disconnect Fault* Brake OFF Fault Current Sense Fault* EE Checker Fault† Hardware Failsafe* Main Fault* Main OFF Fault Main ON Fault Precharge Fault*

* = Must cycle keyswitch to clear

† = Must use programmer to clear, as follows: select Program menu, alter data value of any parameter, cycle keyswitch.

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Table 4-4 Troubleshooting Chart

LED CODE	PROGRAMMER LCD DISPLAY	POSSIBLE CAUSE	FAULT CLEARANCE
9	Battery Disconnect Fault	Battery disconnected	1. Battery not connected. 2. Poor connection to battery terminals.
9	Battery OFF Fault	Brake OFF Fault	1. Electromagnetic brake driver open. 2. Electromagnetic brake coil shorted.
5	Brake ON Fault	Brake ON fault	1. Electromagnetic brake driver shorted. 2. Electromagnetic brake coil open.
9	Current Sense Fault	Current sense out of range	1. Short in motor on in motor willing. 2. Controller failure. *
9	EEPROM Checksum Fault	EEPROM fault	EEPROM failure or fault
9	Hardware Failsafe	Motor voltage out of range	1. Motor voltage does not correspond to throttle request. 2. Short in motor or in motor wiring. 3. Controller failure.*
6	HPD Fault	HPD (High Pedal Disable)	1. Improper sequence of throttle and KSI, push or inhibit pot. 2. Misadjusted throttle pot.
9	Main Fault	Main contactor fault	1. Main contractor welded or stuck open. 2. Main contactor driver fault.
9	Main OFF Fault	Main contactor driver Off fault	Main contactor driver failed open.
9	Main ON Fault	Main contactor driver On fault	Main contactor driver failed closed.
3	Overvoltage Fault	Battery voltage too high	1. Battery voltage >31 volts. 2. Vehicle operating with charger attached. 3. Intermittent battery connection.
9	Precharge Fault	Precharge fault	1. Brake driver shorted. 2. Precharge circuit damaged. 3. MOSFET failure.
7	Speed POT Fault	Speed limit pot wiper out of range	1. Speed limit pot wire(s) broken or shoted. 2. Broken speed limit pot.

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Table 4-4 Programmable Parameters - Continued

LED CODE	PROGRAMMER LCD DISPLAY	POSSIBLE CAUSE	FAULT CLEARANCE
7	Throttle Fault	PotLow and /or PotWiper out of range	1. Throttle input wire open or shorted. 2. Throttle pot defective. 3. Wrong throttle type selected.
2	Undervoltage Fault	Battery voltage too low	1. Battery voltage <17 volts. 2. Bad connection at battery or controller.
6	Wiring Fault	HPD fault present >10 sec.	1. Misadjusted throttle. 2. Broken throttle pot or throttle mechanism.

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SECTION 5
STEERING ARM, CONTROL HEAD AND COMPARTMENT

5-1. CONTROL HEAD

5-1.1. Cap Assembly Removal.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove four screws (17, Figure 5-1), lift up cap assembly (21) and disconnect harness (23) from harness (15, Figure 5-2).

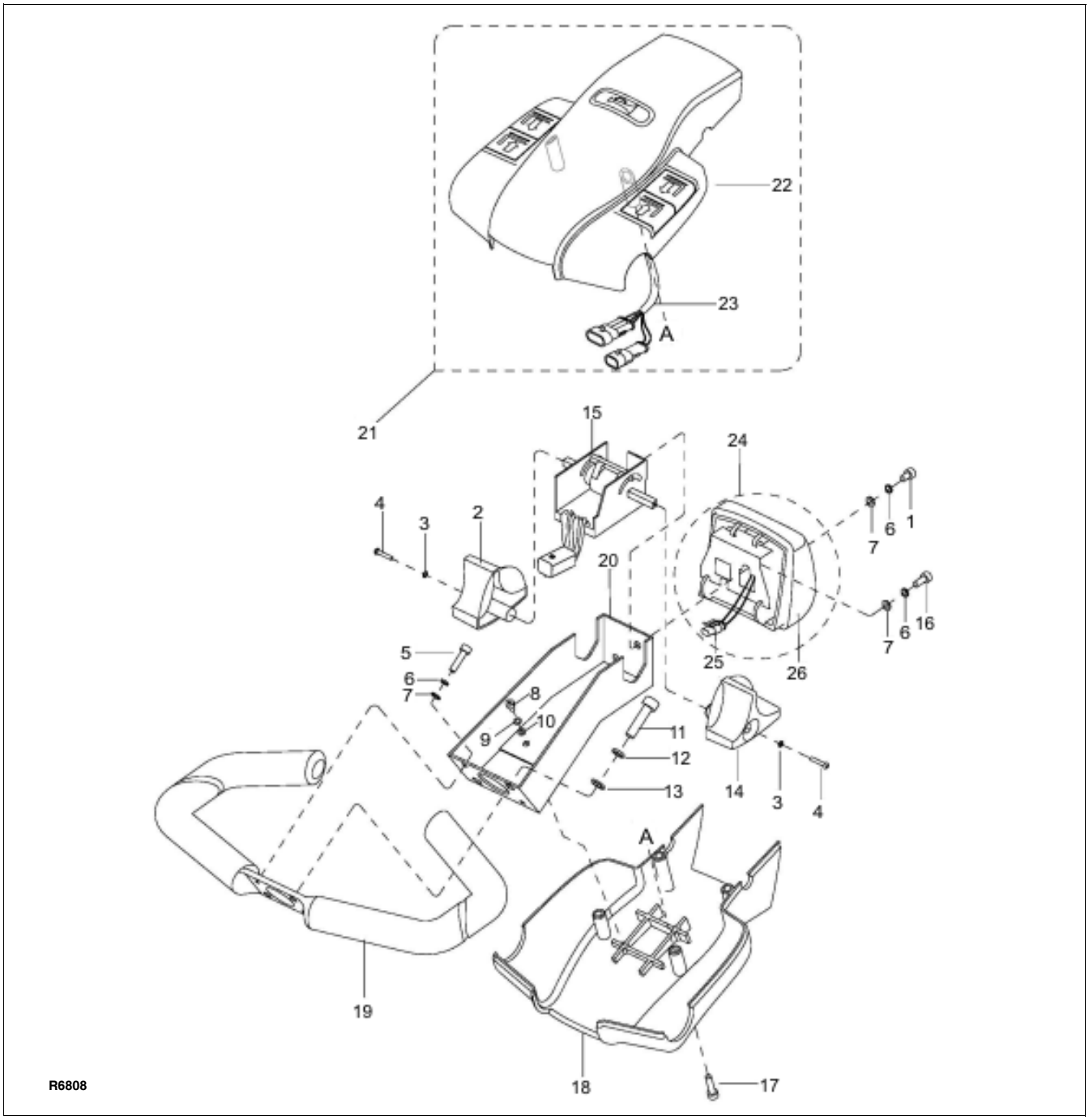

Figure 5-1 Control Head

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5-1.2. Cap Assembly Installation.

1. Hold cap assembly (21, Figure 5-1) in place and connect harness (23) to harness (15, Figure 5-2).
2. Position cap assembly (21, Figure 5-1) on control head and secure with four screws (17).
1. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).

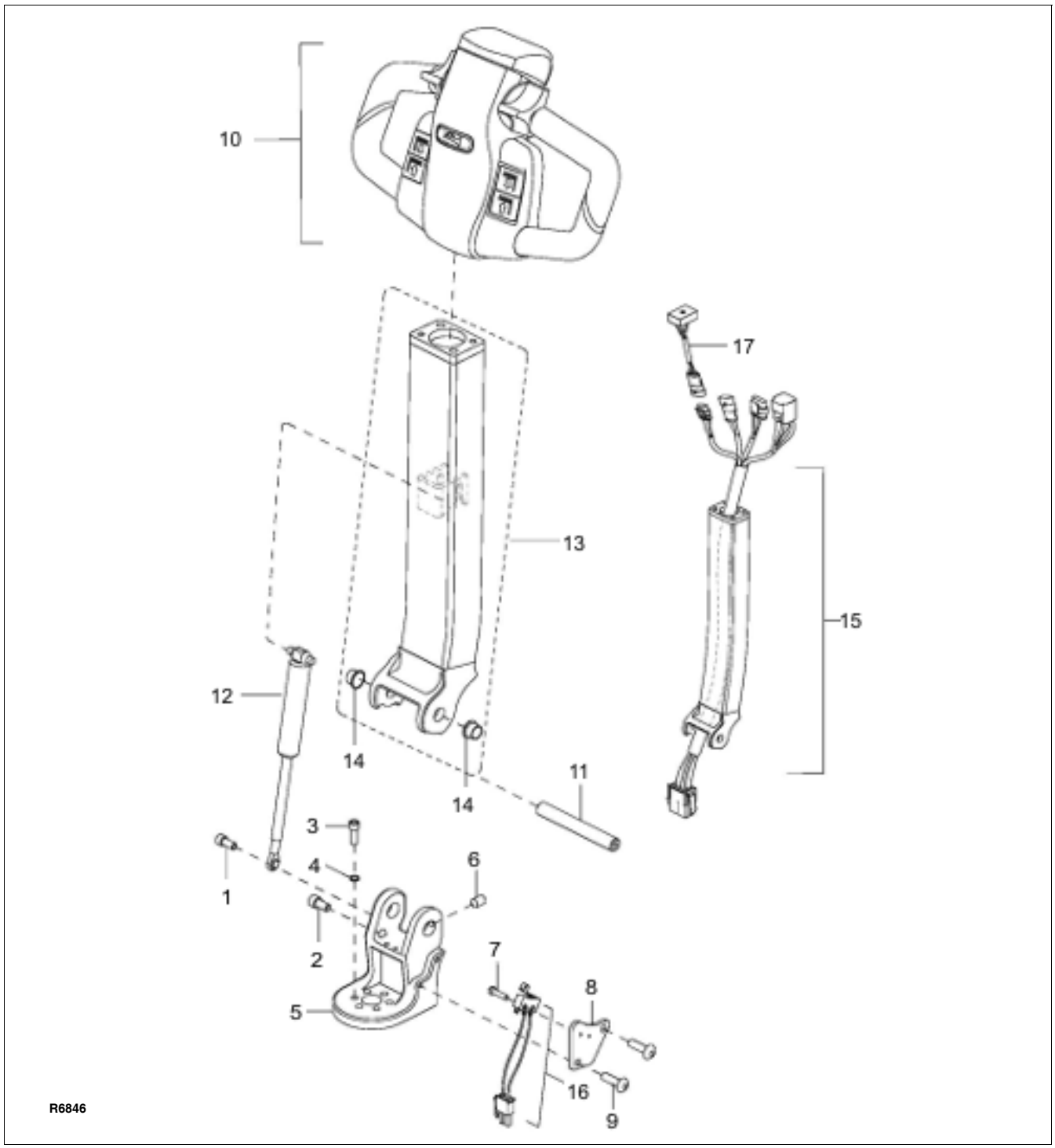

Figure 5-2 Steering Arm

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5-1.3. Control Head Removal

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Disconnect harness (15, Figure 5-2) from potentiometer (15, Figure 5-1) and reversing switch (25).
3. Remove two screws (11), two lock washers (12) and two flat washers (13).

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

4. Remove two screws (5), two washers (6) and two flat washers (7).
5. Remove the control head and handle (19).

5-1.4. Control Head Installation

1. Hold control head and handle (19, Figure 5-1) in place and install two screws (5), two washers (6) and two flat washers (7).
2. Install two screws (11), two lock washers (12) and two flat washers (13).
3. Reconnect harness (15, Figure 5-2) to potentiometer (15, Figure 5-1) and reversing switch (25).
4. 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 (15, Figure 5-2) from potentiometer (15, Figure 5-1).
3. Remove screw (4), washer (3) and control knob (2) from potentiometer (15).
4. Remove screw (4), washer (3) and control knob (14) from other side of potentiometer (15).
5. Remove screw (1), lock washer (6) and flat washer (7).
6. Remove screw (16), lock washer (6) and flat washer (7) and remove potentiometer (15) from bracket (20).
7. Position new potentiometer (15) in bracket (20) and secure with screw (16), lock washer (6) and flat washer (7).
8. Install screw (1), lock washer (6) and flat washer (7).
9. Install control knob (14) on potentiometer (15) and secure with screw (4), and washer (3).
10. Install control knob (2) on the other side of potentiometer (15) and secure with screw (4), and washer (3).
11. Connect harness (15, Figure 5-2) to potentiometer (15, Figure 5-1).
12. 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 (15, Figure 5-2) from reversing switch (25, Figure 5-1).
3. Remove screw (1), lock washer (6) and flat washer (7).
4. Remove screw (16), lock washer (6) and flat washer (7) and remove switch assembly (24) from bracket (20).
5. Remove pin (5, Figure 5-3), bracket (4), and spring (2) from button (1).
6. Remove two pins (3) and switch assembly (25, Figure 5-1) from bracket (4, Figure 5-3).
7. Position the new switch assembly (25, Figure 5-1) in bracket (4, Figure 5-3) and secure with two pins (3).
8. Position bracket (4) in button (1) and install pin (5).
9. Position switch assembly (24, Figure 5-1) on bracket (10) and secure with two screws (13).
10. Reconnect harness (15, Figure 5-2) to reversing switch (25, Figure 5-1).
11. Install the cap assembly as described in paragraph 5-1.2.

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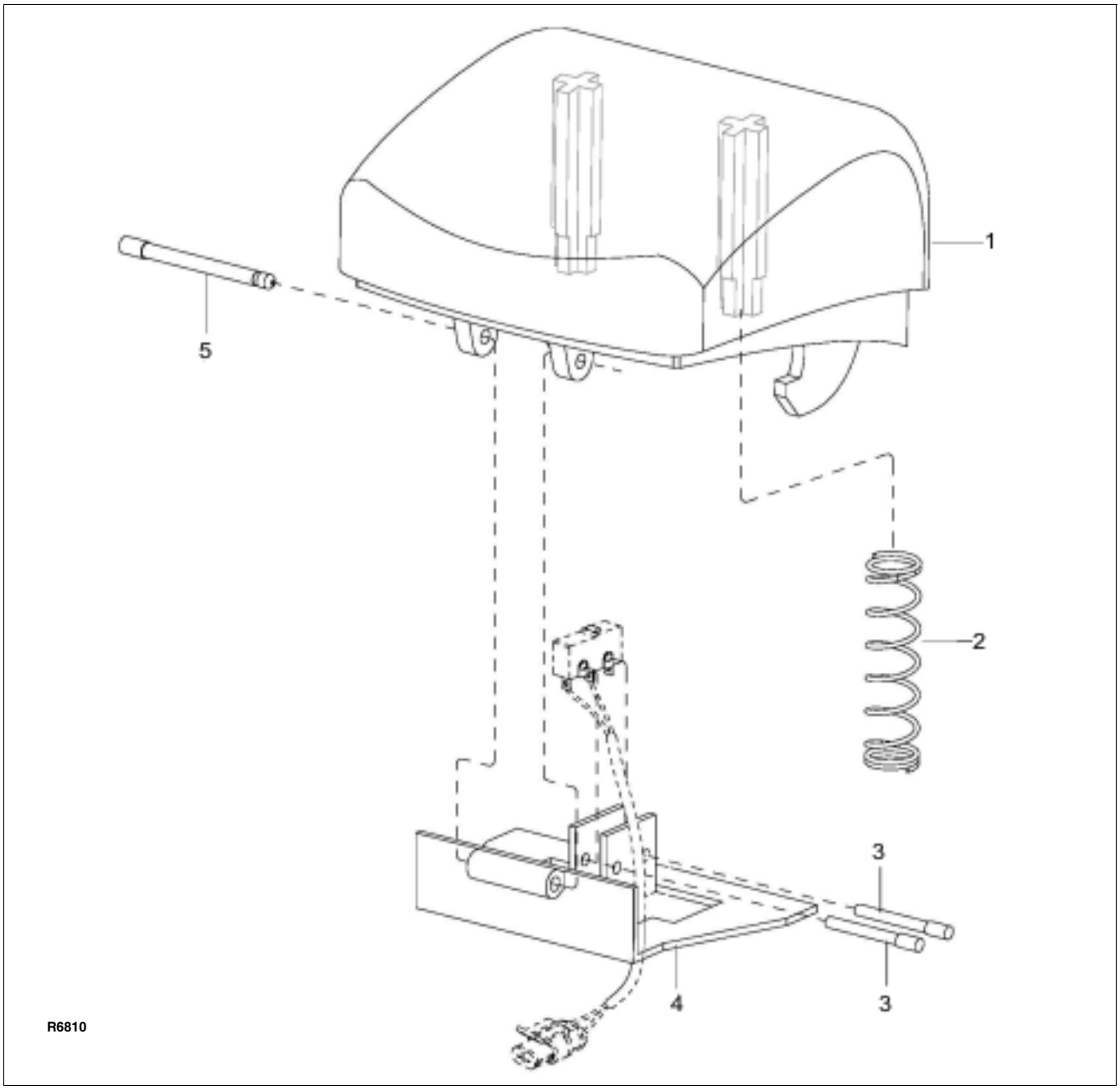

Figure 5-3 Emergency Reverse Switch Assembly

5-1.7. Horn Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Remove three screws (11, Figure 5-4), bracket (14) and springs (13).
3. Remove two pins (12) and defective switch from bracket (14).
4. Unsolder harness from defective switch and connect it to the new switch.
5. Position the new switch in bracket (14) and secure with two pins (12).
6. Position bracket (14) in cover (17) and secure with three screws (11).
7. Install the cap assembly as described in paragraph 5-1.2.

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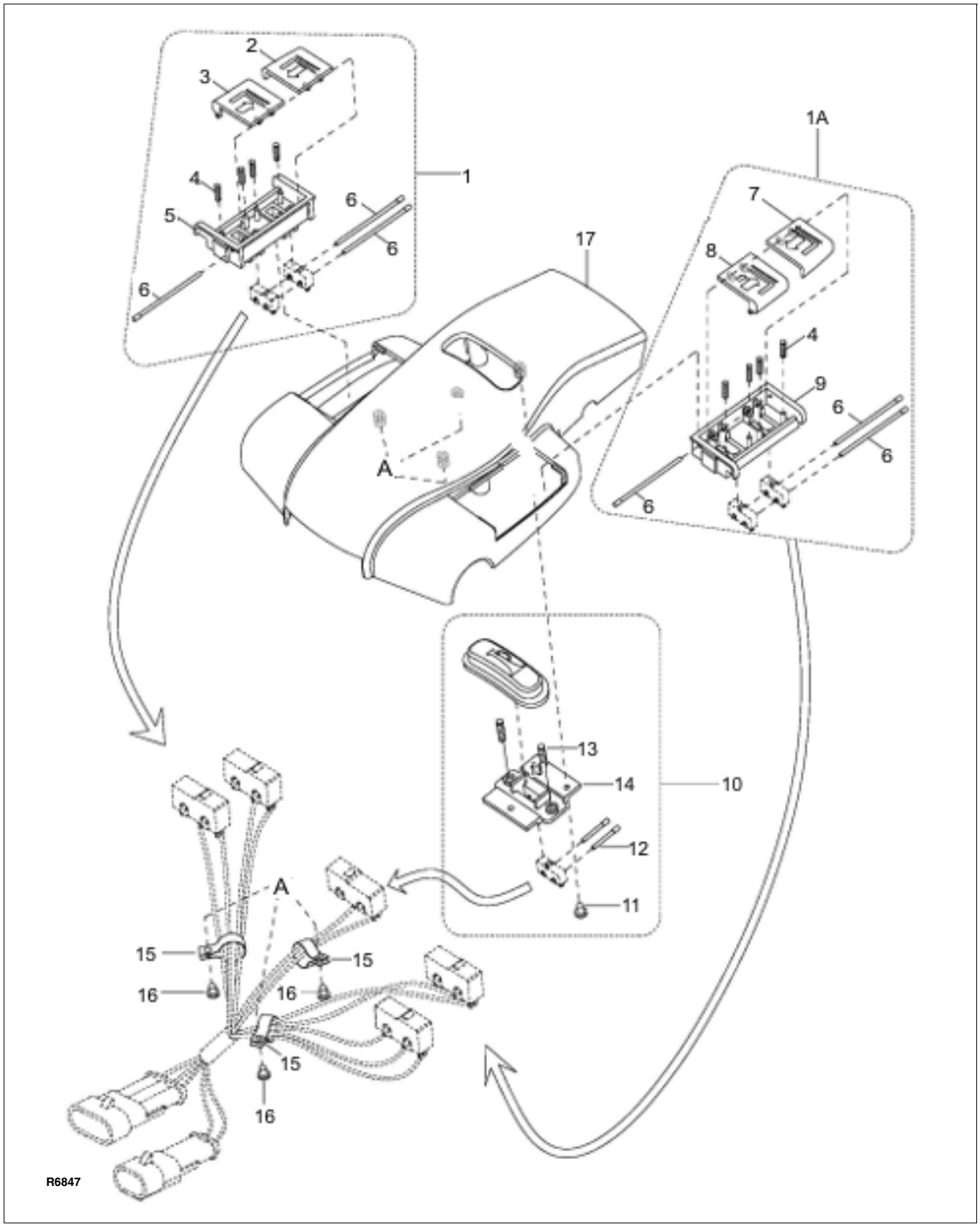

Figure 5-4 Cap Assembly

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5-1.8. Lift and Lower Switch Replacement.

1. Remove the cap assembly as described in paragraph 5-1.1.
2. Remove switch assembly (1 or 1A, Figure 5-4) form cap (17).
3. Remove pin (6) securing buttons (2 and 3 or 7 and 8) and remove the buttons.
4. Remove two pins (6), two switches and four springs (4) from bracket (5 or 9).
5. Unsolder harness from defective switch.
6. Solder the harness to new switch.
7. Position the new switches and four springs (4) in bracket (5 or 9) and secure with two pins (6).
8. Position switch assembly (1 or 1A) in cover (17) and secure with pin (6).
9. Install the cap assembly as described in paragraph 5-1.2.

5-2. STEERING ARM

5-2.1. Return Spring Replacement.

The steering arm gas return spring (12, Figure 5-2) is replaced while the steering arm (13) is in the upright position.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove three screws (5, Figure 12-6) and rotation cover (6).
3. Secure the steering arm (13, Figure 5-2) in the upright position.
4. Remove screw (1) and free the gas return spring (12) from bracket (5).
5. Pull downward on the gas return spring (12) to free it from its seat inside steering arm (13).
6. Position the new gas return spring (12) inside the steering arm being sure it fully engages its seat.
7. Position the opposite end of the gas return spring (12) on bracket (5) and install screw (1).
8. Install rotating cover (6, Figure 12-6) and secure with three screws (5).
9. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).

5-2.2. Steering Arm Removal.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove the return spring as described in paragraph 5-2.1.
3. Disconnect harness (15, Figure 5-2) from harness (1, Figure 12-24 or Figure 12-25).
4. Attach a hoist to steering arm (13, Figure 5-2).
5. Remove screw (6), shaft (11) and the steering arm (13).

5-2.3. Steering Arm Installation.

1. Position steering arm (13, Figure 5-2) in bracket (5) and secure with shaft (11) and screw (6).
2. Install the return spring as described in paragraph 5-2.1.
3. Reconnect harness (15) from harness (1, Figure 12-24 or Figure 12-25).
4. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).

5-3. COMPARTMENT COVERS

5-3.1. Removal.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove two screws (1, Figure 12-6) and two washers (2) and remove cover (4).

5-3.2. Installation.

1. Install cover (4, Figure 12-6) and secure with two screws (1) and two washers (2).
2. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23

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5-4. MONO MAST COVER

5-4.1. Removal.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove six screws (1, Figure 12-6) and six washers (2) and remove cover (3).

5-4.2. Installation.

3. Install cover (3, Figure 12-6) and secure with six screws (1) and six washers (2).
4. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23.

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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. Jack up the truck to gain access to the brake; then securely block the truck to prevent movement.
3. Disconnect electric brake from harness (1, Figure 12-24 or Figure 12-25).
4. Remove the two mounting screws (2, Figure 6-1) and the brake.
5. Place the new brake into position and secure with the two mounting screws.
6. Reconnect electric brake to harness (1, Figure 12-24 or Figure 12-25).
7. Remove the blocking and lower the truck to the ground.
8. Remove load wheel blocks and check operation.

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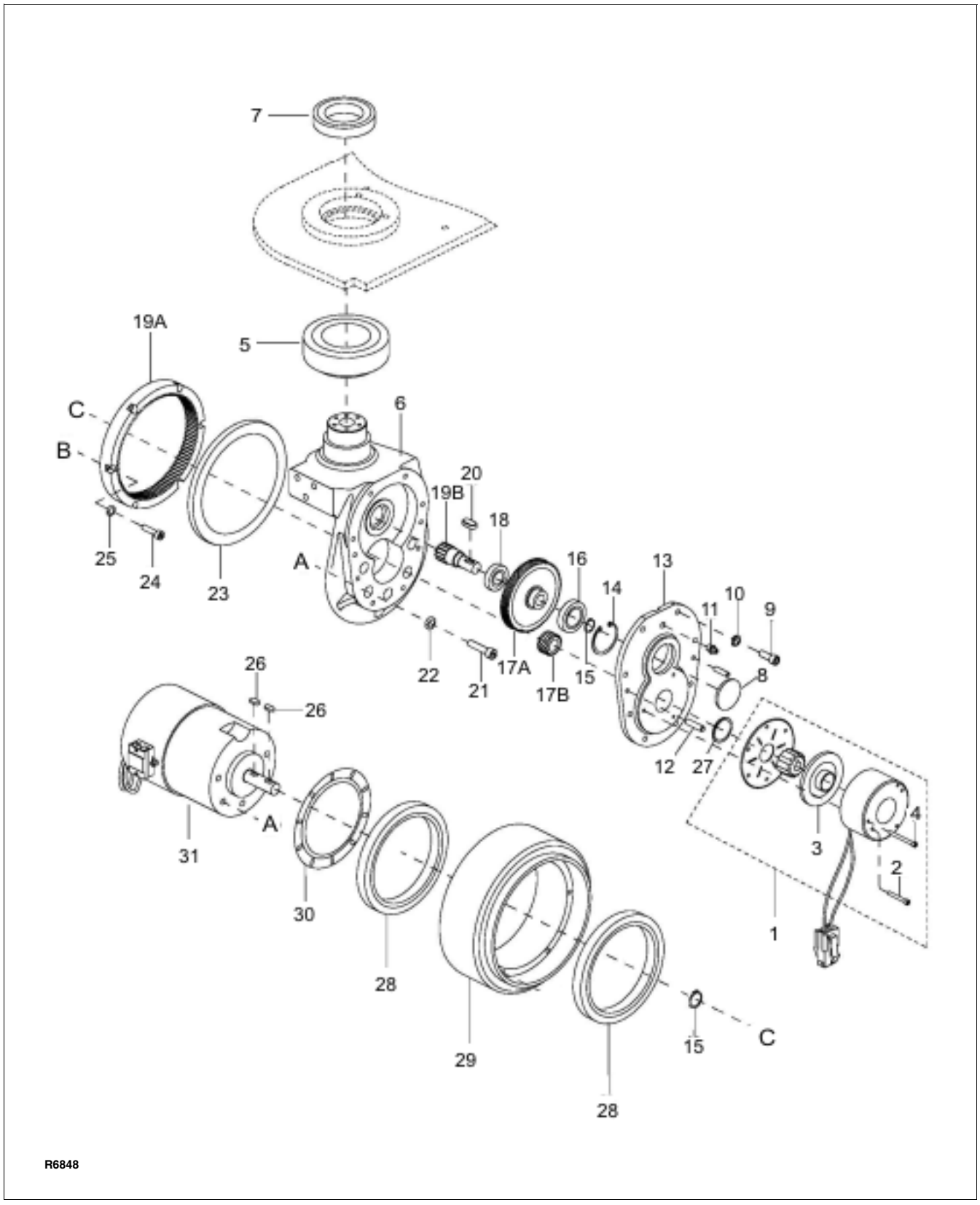

Figure 6-1 Transmission, Motor, Brake Assembly

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SECTION 7
TRANSMISSION, DRIVE WHEEL, LOAD WHEEL

7-1. Drive Wheel.

1. Remove the transmission as described in paragraph 7-2.
2. Remove the two mounting screws (2, Figure 7-1) and brake (1).
3. Remove eight screws (9), eight lock washers (10) and cover (13).
4. Remove five screws (21, Figure 7-1), lock washers (22), and free motor (31) with drive wheel (19) from housing (6).
5. Remove the six screws (24), six lock washers (25), gear (19) and baffle (30).
6. Remove bearings (28) from wheel (29).
7. Install new drive wheel in reverse order of removal.

7-2. Transmission.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove the compartment covers as described in paragraph 5-3.
3. Remove the steering arm as described in paragraph 5-2.
4. Raise the truck off the ground to provide clearance for transmission out the bottom. Securely block the truck to prevent movement.
5. Remove two screws (5, Figure 12-6) and bracket (7).
6. Disconnect electric brake (1, Figure 7-1) from harness (1, Figure 12-24 or Figure 12-25).
7. Disconnect cables (8 and 9, Figure 12-26 or Figure 12-27) from drive motor.
8. Disconnect deadman switch (16, Figure 12-1) from harness (1, Figure 12-24 or Figure 12-25).
9. Support the transmission and remove six screws (3, Figure 12-1), six washers (4) and bracket (5).
10. Lower the transmission out the bottom of the truck.
11. Install new transmission by reversing the steps above.

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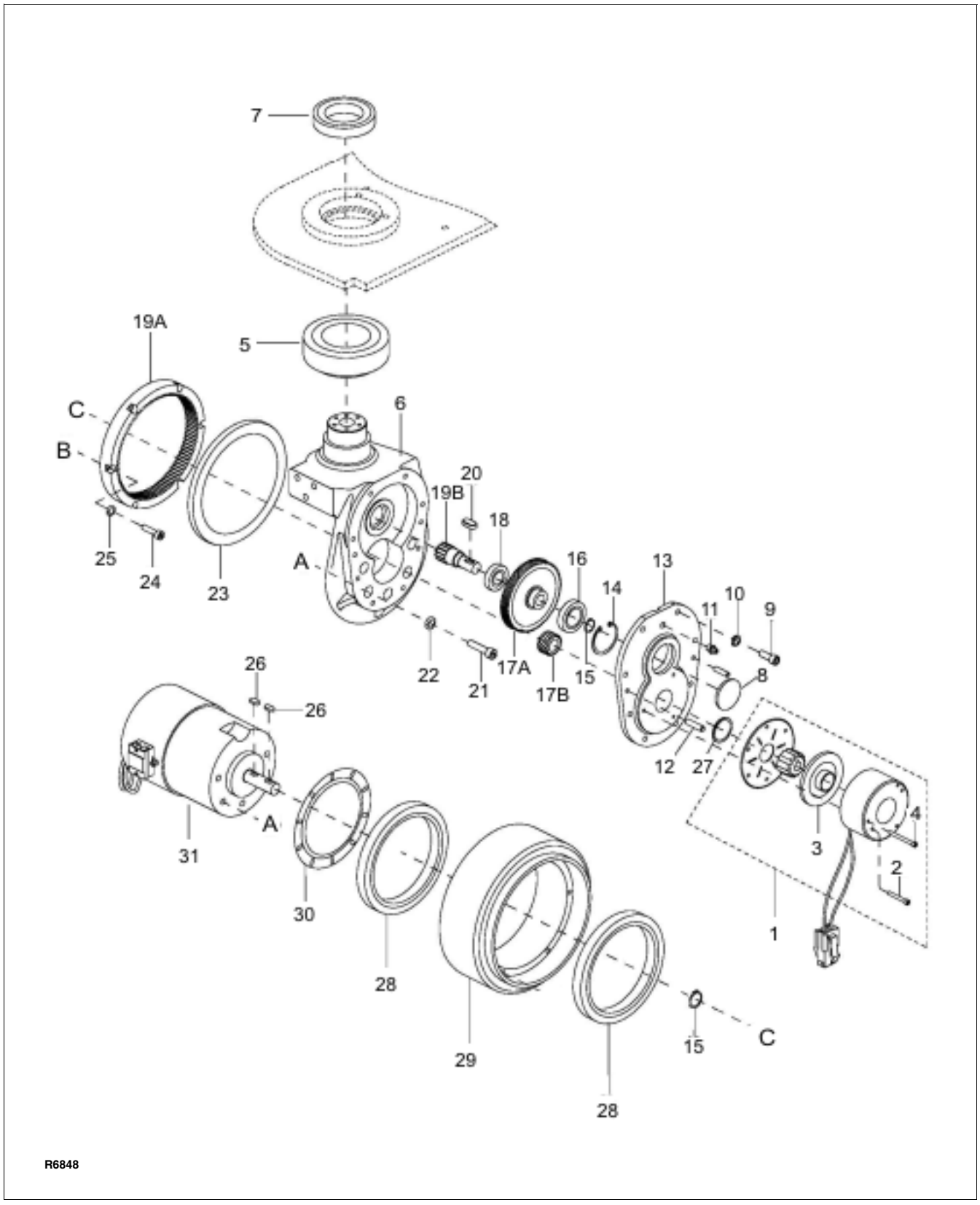

Figure 7-1 Transmission, Motor, Brake Mounting

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7-3. Load Wheel.

7-3.1. Removal

1. Raise forks.

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Block the drive wheel to prevent the truck from rolling.
3. Jack up the forks to raise the load wheels off the floor. Securely block the forks in the raised position by positioning supports under both fork tips.

NOTE: When shaft (10, Figure 12-8 or Figure 12-9) is removed, load wheel assembly (9) will drop free.

4. Remove screw (6) securing shaft (10) and remove shaft (10), washers (7) and load wheel assembly (9).

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. Repair

1. Remove bearings (8, Figure 12-8 or Figure 12-9) from wheels (9).
2. Inspect bearings (8) and replace if necessary.
3. Reassemble bearings (8) in wheels (9).

7-3.3. Load Wheel Installation

1. Position load wheel (9, Figure 12-8 or Figure 12-9) in the straddle.
2. Install shaft (10) and secure with screw (6).
3. Remove blocking from under the truck.
4. Lower the forks.
5. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).

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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. Mono

1. Fully lower the lift carriage.
2. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).

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

3. Loosen jam nut (3, Figure 8-1), located the above either the frame or the lift carriage to allow for adjustment of middle jam nut.
4. Break the lower jam nut (3) free from the middle jam nut (3).
5. Take up slack in the lift chain with middle jam nut (3).
6. Align anchor (2) so the clevis pin (4) is parallel to the mast.

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

7. Tighten jam nuts securely while maintaining alignment of clevis pin (4).
1. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

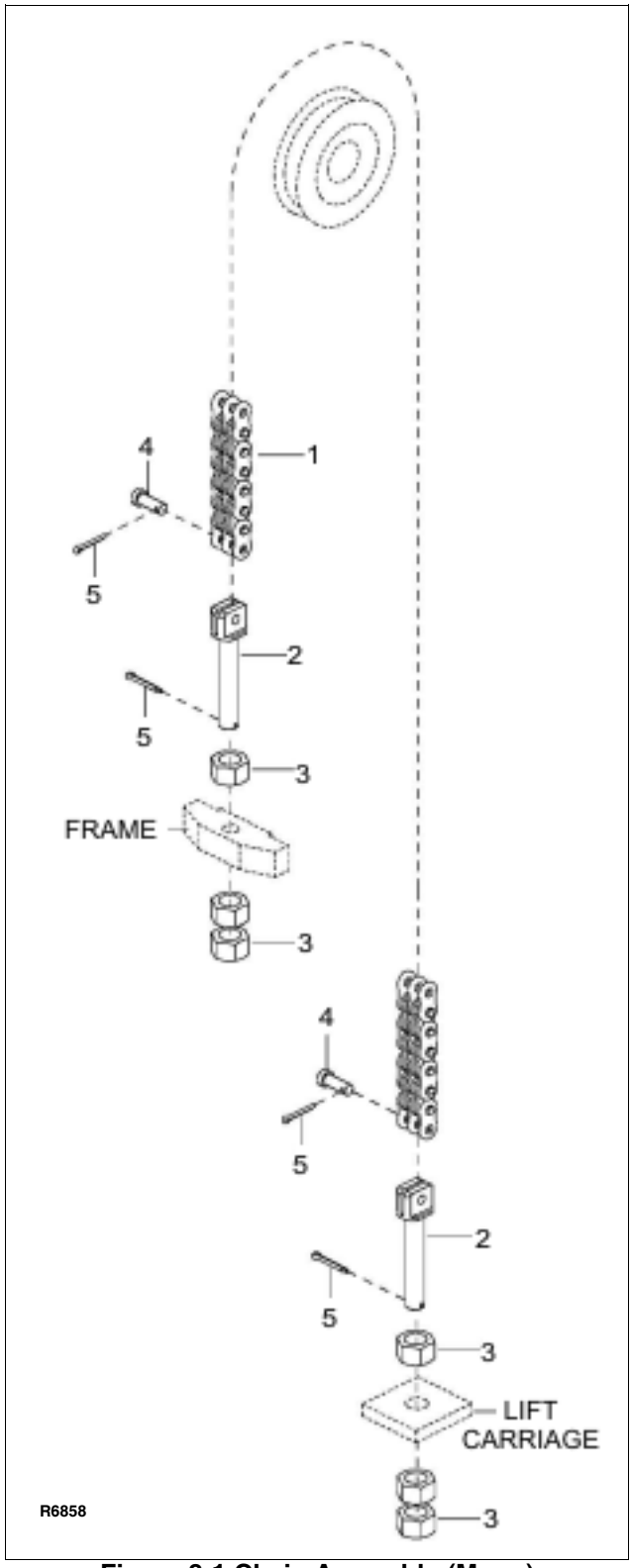

Figure 8-1 Chain Assembly (Mono)

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8-2.2. Telescopic

1. Fully lower the lift carriage.
2. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).

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

3. Loosen jam nut (3, Figure 8-2), located the above either the frame or the lift carriage to allow for adjustment of middle jam nut.
4. Break the lower jam nut (3) free from the middle jam nut (3).
5. Take up slack in the lift chain with middle jam nut (3).
6. Align anchor (2) so the clevis pin (4) is parallel to the mast.

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

7. Tighten jam nuts securely while maintaining alignment of clevis pin (4).
8. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
9. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

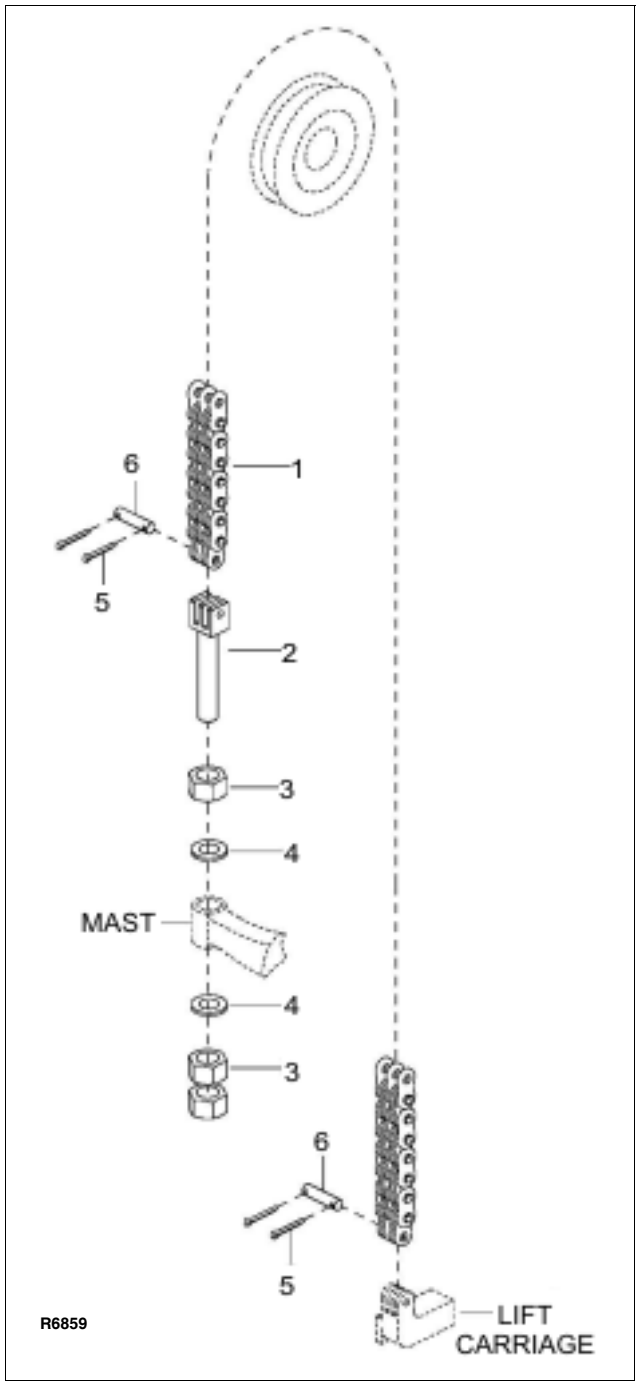

Figure 8-2 Chain Assembly (Telescopic)

8-3. LIFT CHAIN WEAR INSPECTION.

The lift chain should be replaced when it is worn enough to increase it's length by 3% or more. On Telecospic trucks, Both chains should be replaced at the same time. 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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8-4. LIFT CHAIN REPLACEMENT.

8-4.1. Mono

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under the lift carriage.
2. Lower lift carriage onto the support. Check that arrangement is secure before proceeding.
3. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).

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

4. Remove cotter pin (5, Figure 8-1) and clevis pin (4) connecting chain (1) to adjusting screw (2) at the lift carriage.
5. Remove cotter pin (5) and clevis pin (4) connecting chain (1) to adjusting screw (2) at the frame.
6. Remove chain from sheave (4, Figure 12-11).
7. Position new chain on sheave (4).
8. Secure chain to adjusting screw (2, Figure 8-1) at the frame with clevis pin (4) and cotter pin (5).
9. Connect the opposite end of chain to adjusting screw (2) at the lift carriage with clevis pin (4) and cotter pin (5).
10. Adjust the chains according to paragraph 8-2.
11. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).

8-4.2. Telescopic

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under the inner mast.
2. Lower inner mast onto the support. Check that arrangement is secure before proceeding.
3. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).

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

4. Remove one of the cotter pins (5, Figure 8-2) and pin (6) connecting chain (1) to the lift carriage.
5. Remove one of the cotter pins (5) and clevis pin (4) connecting chain (1) to adjusting screw (2) at the outer mast.
6. Remove chain from sheave (6, Figure 12-12).
7. Position new chain on sheave (6).
8. Secure chain to adjusting screw (2, Figure 8-2) at the outer mast with pin (6) and cotter pins (5).
9. Connect the opposite end of chain to the lift carriage with pin (6) and cotter pins (5).
10. Adjust the chains according to paragraph 8-2.
11. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).

8-5. LIFT CYLINDERS.

NOTE: Removal and repair of lift cylinders are covered in SECTION 9.

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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. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
3. Remove the compartment covers as described in paragraph 5-3.
4. Remove the mono mast cover 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.

5. **Mono Trucks**: Refer to Figure 9-1 and remove leaking line or fitting and replace it with a new line or fitting.

   Telescopic Trucks: Refer to Figure 9-2 and remove leaking line or fitting and replace it with a new line or fitting.

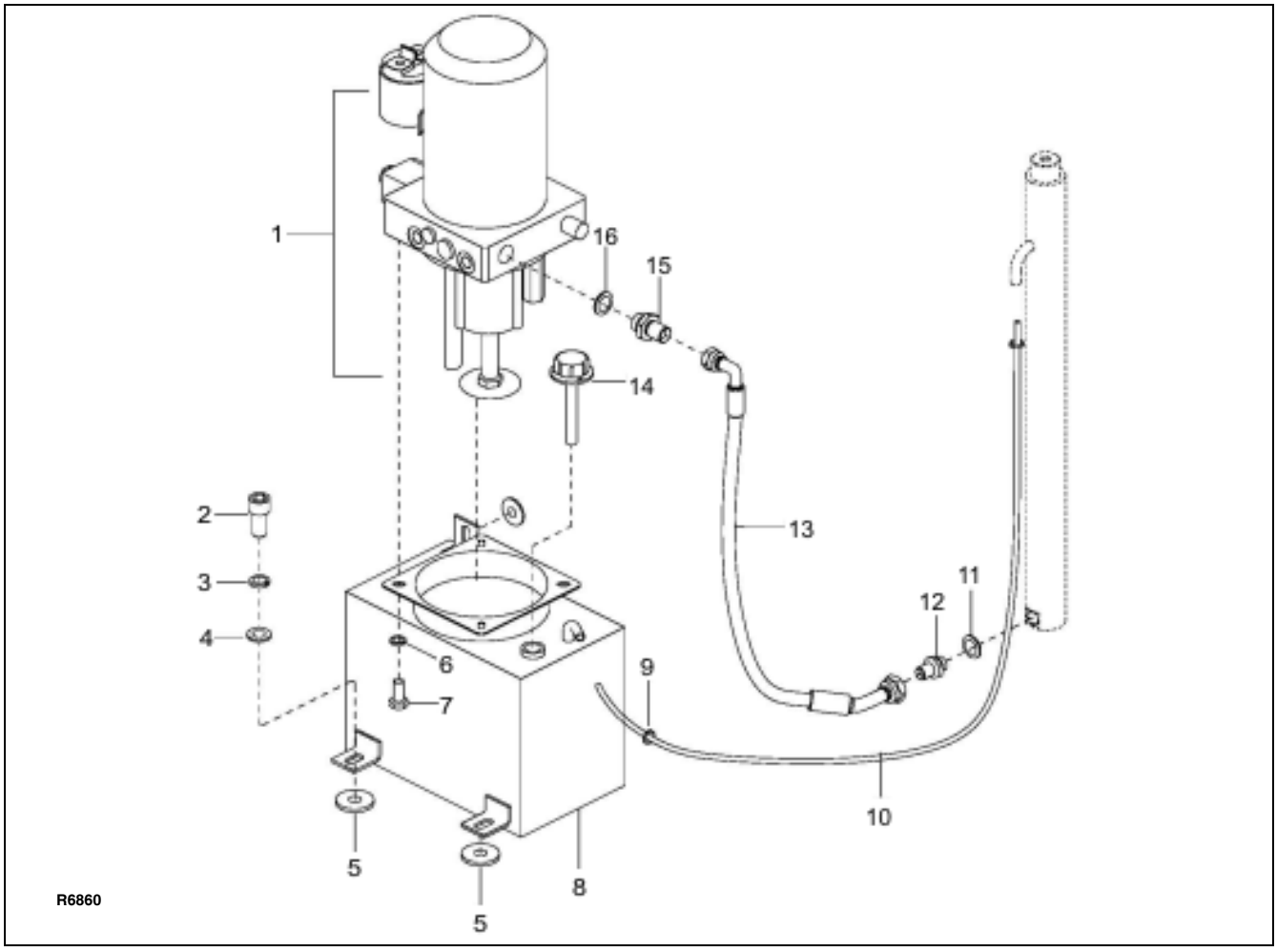

Figure 9-1 Hydraulic System (Mono)

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6. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
7. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
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.
10. Install the compartment covers as described in paragraph 5-3.
11. Install the mono mast cover as described in paragraph 5-3.

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

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

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

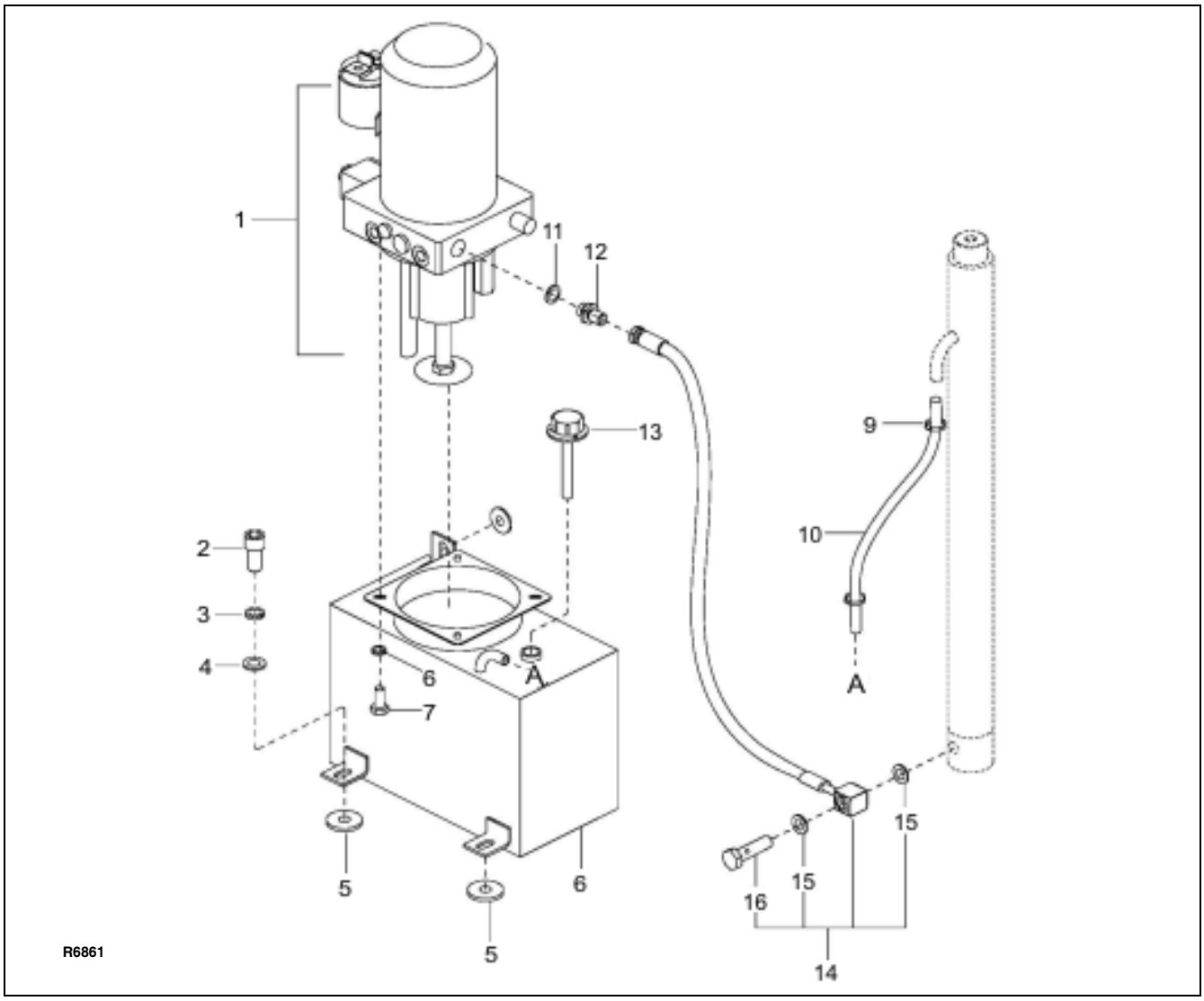

Figure 9-2 Hydraulic System (Telescopic)

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9-2.1. Removal

1. Lower forks fully.
2. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
3. Remove the compartment covers as described in paragraph 5-3.
4. Tag and disconnect electrical leads from motor and solenoid of pump/motor assembly (1, Figure 9-1 or Figure 9-2).

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

5. Disconnect hose (13, Figure 9-1 or 14, Figure 9-2) from pump/motor assembly (1).
6. While supporting pump/motor assembly (1), remove four screws (7) and four lock washers (6).
7. Remove the pump/motor assembly (1).

9-2.2. Disassembly and Reassembly

1. Remove the hydraulic pump/motor assembly as described in paragraph 9-2.1.
2. Refer to Figure 12-19 for disassembly and reassembly.

9-2.3. Installation

1. While supporting the pump/motor assembly (1, Figure 9-1 or Figure 9-2), install four screws (7) and four lock washers (6).
2. Reconnect hose (13, Figure 9-1 or 14, Figure 9-2) to pump/motor assembly (1).
3. Connect electrical leads to motor and solenoid of pump/motor assembly (1, Figure 9-1 or Figure 9-2).
4. Fill the hydraulic reservoir. Use hydraulic oil listed in Table 3-2.
5. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
6. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
7. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
8. Install the compartment covers as described in paragraph 5-3.

9-3. Lift Cylinder (Mono)

9-3.1. Removal

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under the lift carriage.
2. Lower lift carriage onto the support. Check that arrangement is secure before proceeding.
3. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).

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.

4. Remove the compartment covers as described in paragraph 5-3.
5. Remove the mono mast cover as described in paragraph 5-3.
6. Remove the lift chain as described in paragraph 8-4.
7. Disconnect the hose (10, Figure 9-1) from the top of lift cylinder.
8. Disconnect the hose (13) from the bottom of lift cylinder and remove connector (12) and seal (11).
9. Manually push the cylinder rod down as far as possible.
10. Remove screw (6), lock washer (7), flat washer (8) and ram head (5, Figure 9-3) from cylinder (11).

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

11. Remove two bolts (9), two lock washers (12), two flat washers (13) and clip (10).
12. Raise lift cylinder assembly (11) up and out of truck.

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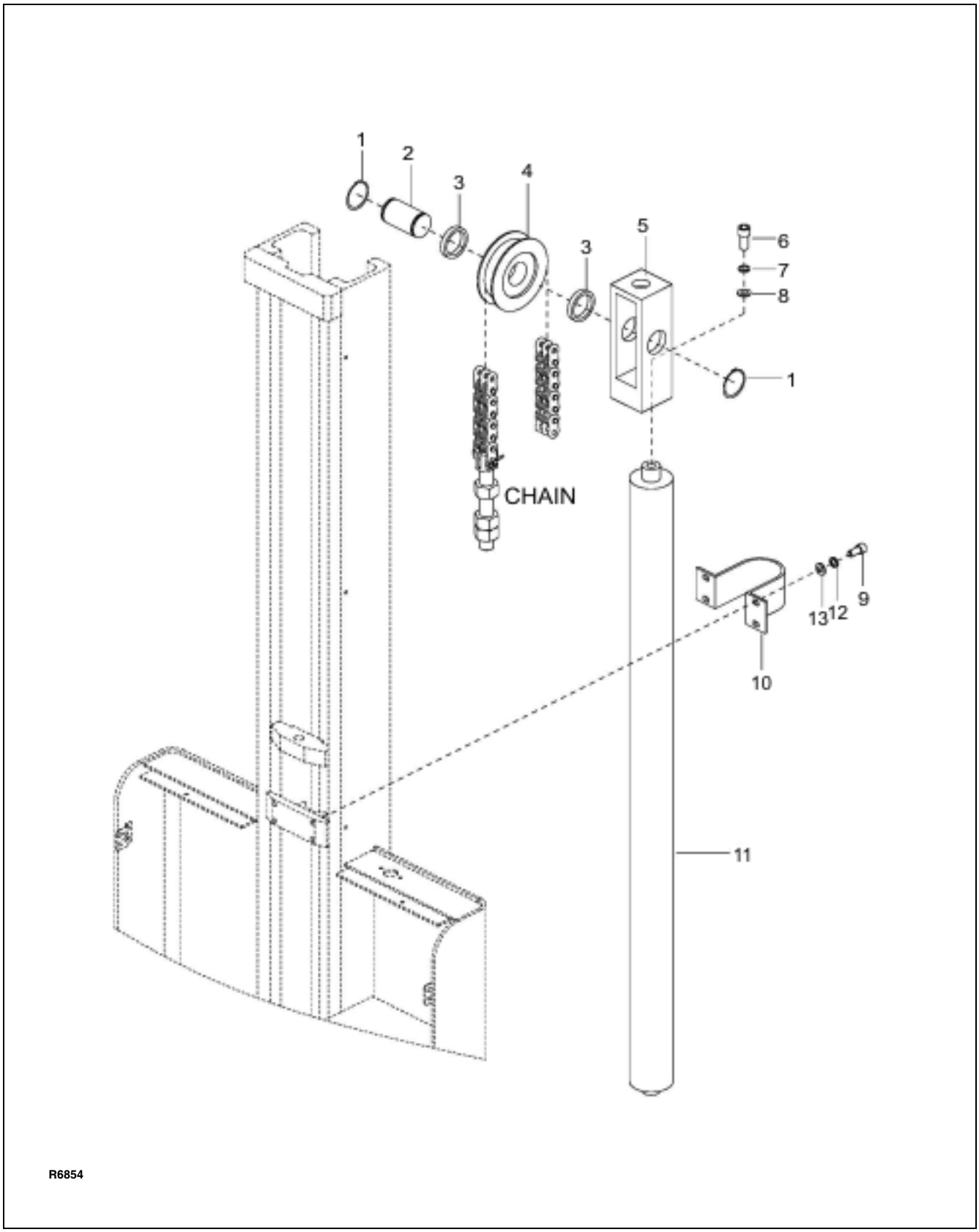

Figure 9-3 Elevation System (Mono)

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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 (7, Figure 9-4).
3. Remove wiper ring (8) and O-ring (9) from gland nut (7).
4. Pull out piston rod (1).
5. Remove bearing (5) and bushing (4).
6. Remove piston (2) and O-ring (3) from rod (1).
7. Remove guide ring (10) and seal (11) from piston (2).
8. Coat all parts with hydraulic oil (Table 3-2).
9. Install guide ring (10) and new seal (11) on piston (2).
10. Install new O-ring (3) on rod (1).
11. Install piston (2) on rod (1).
12. Install bearing (5) and bushing (4).
13. Insert rod (1) in cylinder tube (6).
14. Install wiper ring (8) and O-ring (9) on gland nut (7).
15. Install gland nut (7) in cylinder tube (6).

9-3.3. Installation

1. Position the cylinder in the mast.
2. Install clip (10, Figure 9-3) and secure with two bolts (9), two lock washers (12), two flat washers (13).
3. Install ram head (5) on top of cylinder (11) and secure with screw (6, lock washer (7) and flat washer (8).
4. Install the lift chain as described in paragraph 8-4.
5. Install connector (12, Figure 9-1) and seal (11).
6. Reconnect the hose (13) to the bottom of lift cylinder.
7. Reconnect the hose (10) to the top of lift cylinder.
8. Fill the hydraulic reservoir. Use hydraulic oil listed in Table 3-2.
9. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
10. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
11. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
12. Adjust the chains according to paragraph 8-2.
13. Install the compartment covers as described in paragraph 5-3.
14. Install the mono mast cover as described in paragraph 5-3.

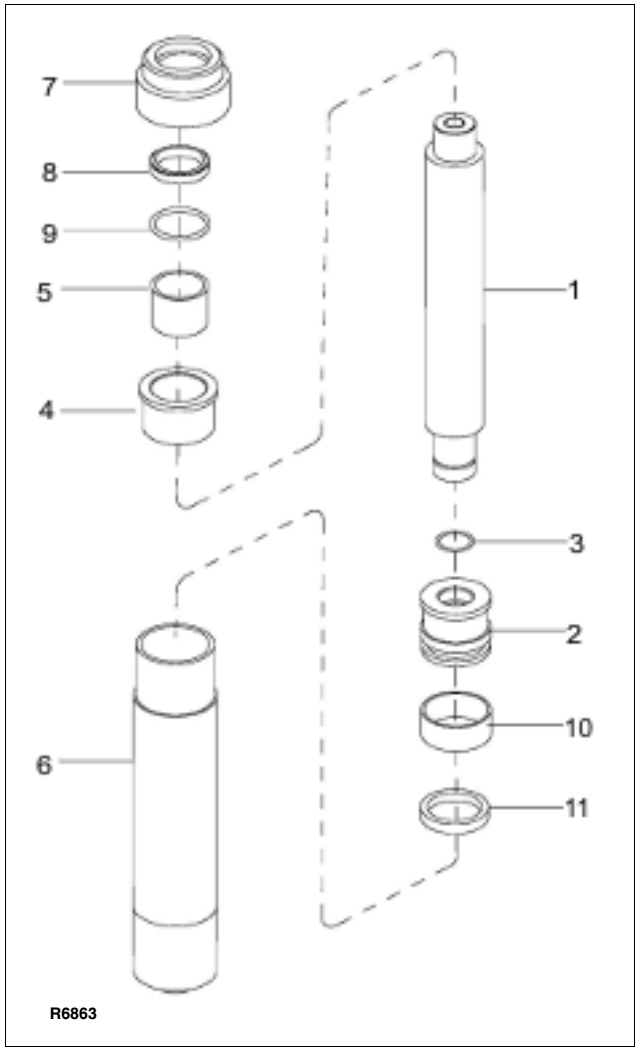

Figure 9-4 Lift Cylinder (Mono)

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9-4. Lift Cylinder (Telescopic)

9-4.1. Removal

1. With the lift truck wheels securely blocked, raise the forks approximately three feet from floor and position blocks or strong supports under the inner mast.
2. Lower inner mast onto the support. Check that arrangement is secure before proceeding.
3. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).

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.

4. Remove the compartment covers as described in paragraph 5-3.
5. Disconnect the hose (10, Figure 9-2) from the top of lift cylinder.
6. Disconnect the hose (14) from the bottom of lift cylinder.

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

7. Remove screw (10), lock washer (11) and flat washer (12) securing the top of the cylinder.
8. Remove screw (32), lock washer (11) and flat washer (12) securing the bottom of the cylinder.
9. Manually push the cylinder rod down as far as possible.
10. Raise lift cylinder assembly (15) up and out of truck.

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 (7, Figure 9-5).
3. Remove wiper ring (8) and O-ring (9) from gland nut (7).
4. Pull out piston rod (1).
5. Remove bearing (5) and bushing (4).
6. Remove piston (2) and O-ring (3) from rod (1).
7. Remove guide ring (10) and seal (11) from piston (2).
8. Coat all parts with hydraulic oil (Table 3-2).
9. Install guide ring (10) and new seal (11) on piston (2).
10. Install new O-ring (3) on rod (1).
11. Install piston (2) on rod (1).
12. Install bearing (5) and bushing (4).
13. Insert rod (1) in cylinder tube (6).
14. Install wiper ring (8) and O-ring (9) on gland nut (7).
15. Install gland nut (7) in cylinder tube (6).

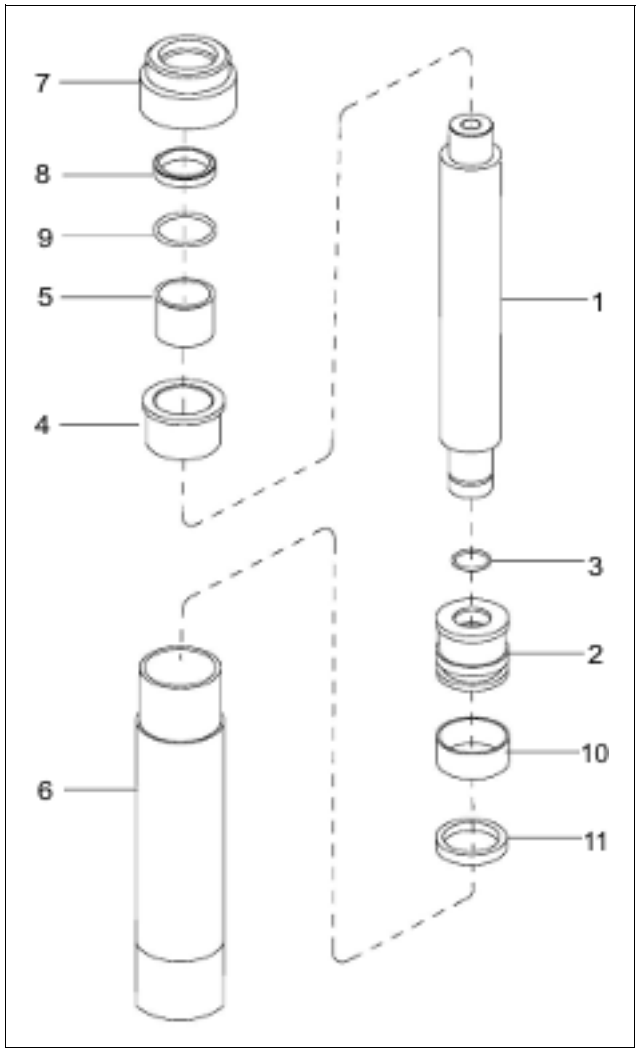

Figure 9-5 Lift Cylinder (Telescopic)

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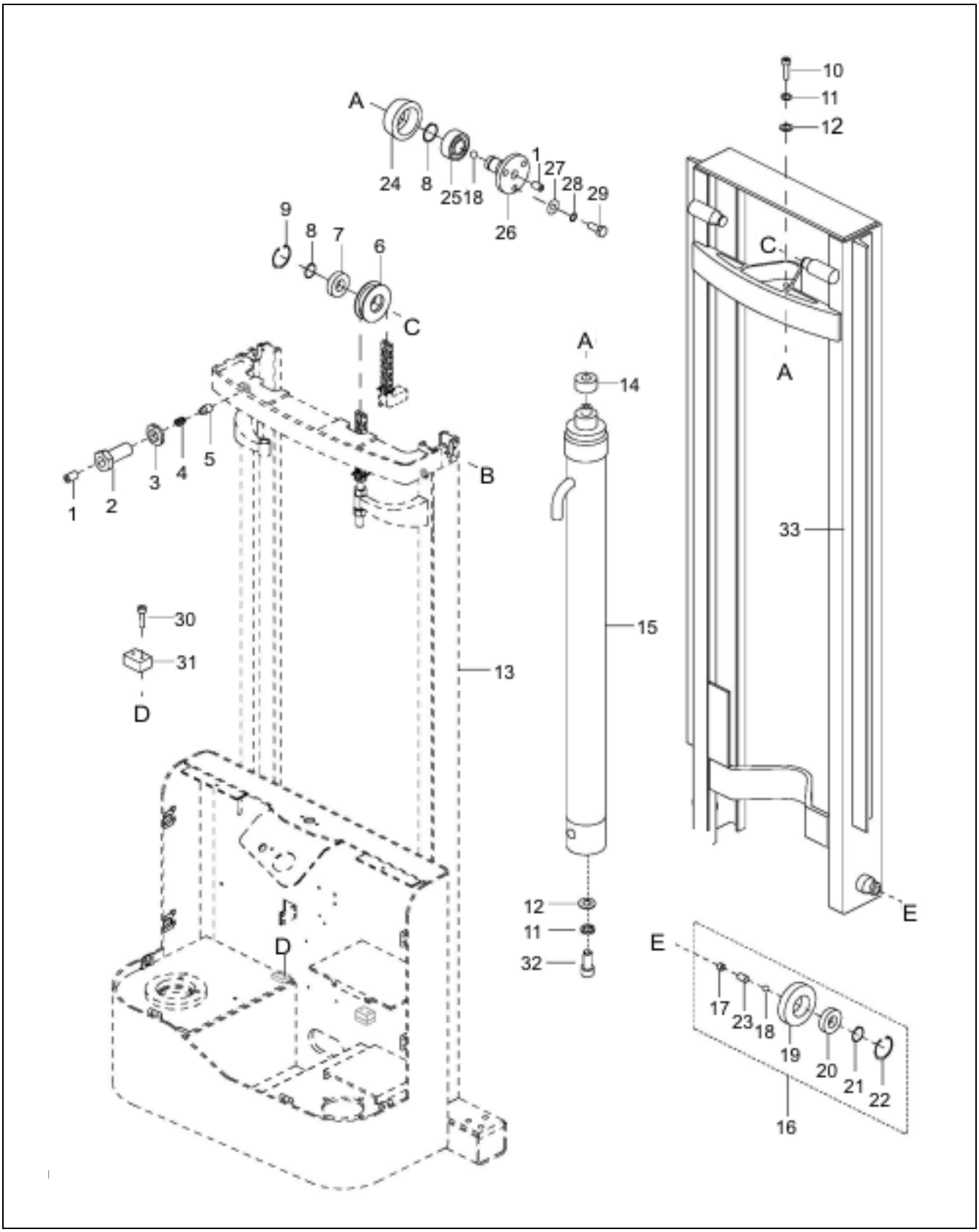

Figure 9-6 Elevation System (Telescopic)

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9-4.3. Installation

1. Position the cylinder in the mast.
2. Install screw (32, Figure 9-6), lock washer (11) and flat washer (12) to secure the bottom of the cylinder.
3. Install screw (10), lock washer (11) and flat washer (12) to secure the top of the cylinder.
4. Reconnect the hose (14) to the bottom of lift cylinder.
5. Reconnect the hose (10) to the top of lift cylinder.
6. Fill the hydraulic reservoir. Use hydraulic oil listed in Table 3-2.
7. Disengage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn on key switch (4, Figure 12-22 or 3, Figure 12-23).
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.
10. Install the compartment covers as described in paragraph 5-3.

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SECTION 10
ELECTRICAL COMPONENTS

10-1. ELECTRICAL CONTROL PANEL

10-1.1. Maintenance

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

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

The controller is programmed at the factory specifically for the truck model on which it is equipped. It is important to replace the controller with the correct preprogrammed unit to assure proper performance settings intended for that particular truck. See Figure 12-22 or Figure 12-23 for the preprogrammed controller number.

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

10-1.2. Cleaning

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
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.

10-1.3. Controller Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from controller (13, Figure 10-1 or 9, Figure 10-2).
4. Tag and disconnect remaining leads from the controller. Refer to Figure 12-26 or Figure 12-27).
5. Remove mounting screws, lock washers and remove controller (13, Figure 10-1 or 9, Figure 10-2) and heat sink.

10-1.4. Controller Installation.

1. Position controller (3, Figure 10-1 or 9, Figure 10-2) and heat sink on bracket and secure with original screws and two lock washers.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) to controller (13, Figure 10-1 or 9, Figure 10-2).
3. Reconnect remaining leads from the controller. Refer to Figure 12-26 or Figure 12-27).
4. Install compartment covers as described in paragraph 5-3.
5. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.5. Charger Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from charger (25, Figure 10-1 or 26, Figure 10-2).
4. Tag and disconnect charger cable (35, Figure 10-1 or 30, Figure 10-2) from the charger.
5. Tag and disconnect remaining two charger leads.
6. Remove mounting screws and four lock washers and remove charger (25, Figure 10-1 or 26, Figure 10-2).

10-1.6. Charger Installation.

1. Position charger (25, Figure 10-1 or 26, Figure 10-2) on the bracket and secure with original screws and lock washers.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) to charger (25, Figure 10-1 or 26, Figure 10-2).
3. Reconnect charger cable (35, Figure 10-1 or 30, Figure 10-2) to the charger.

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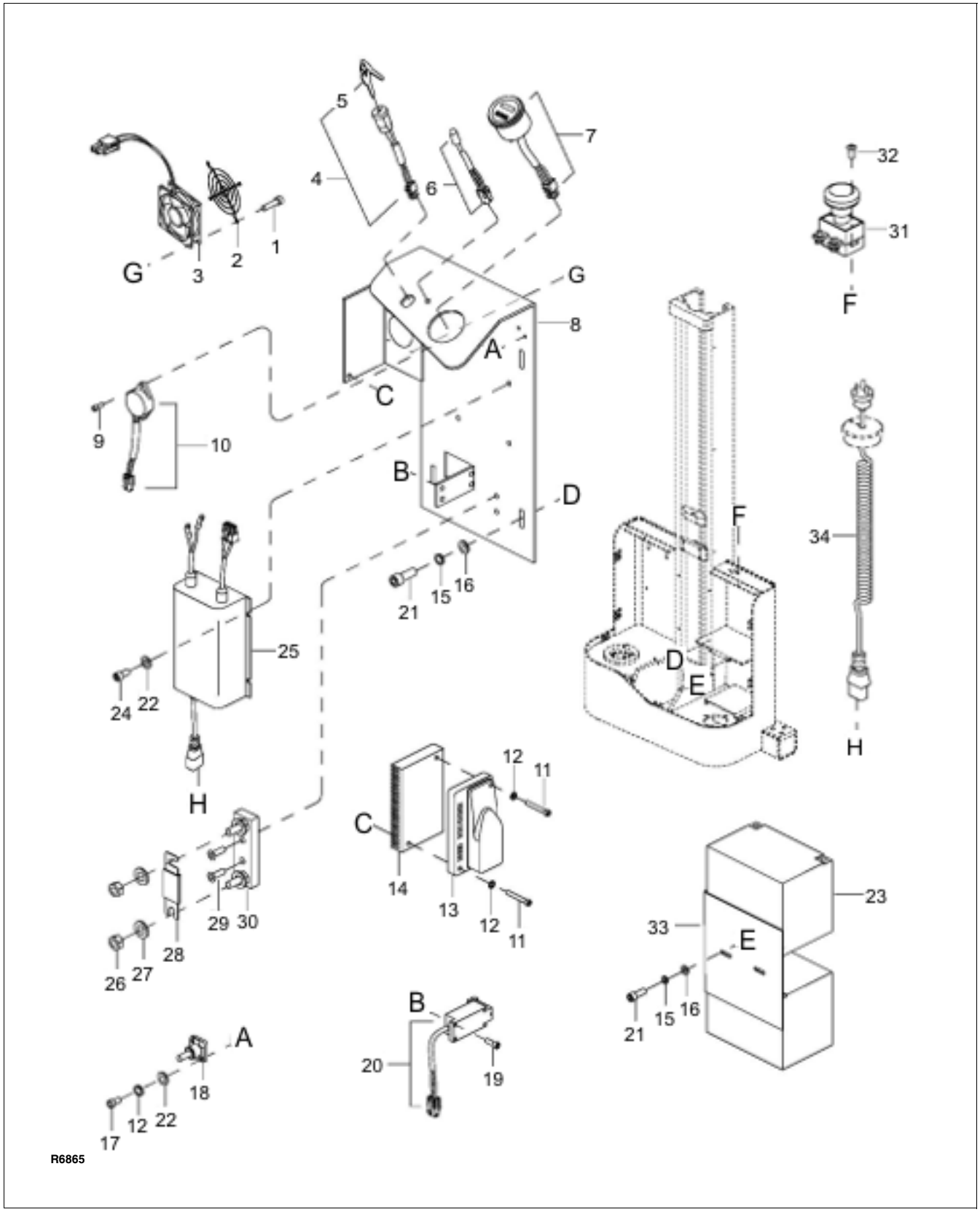

Figure 10-1 Electrical System (Mono)

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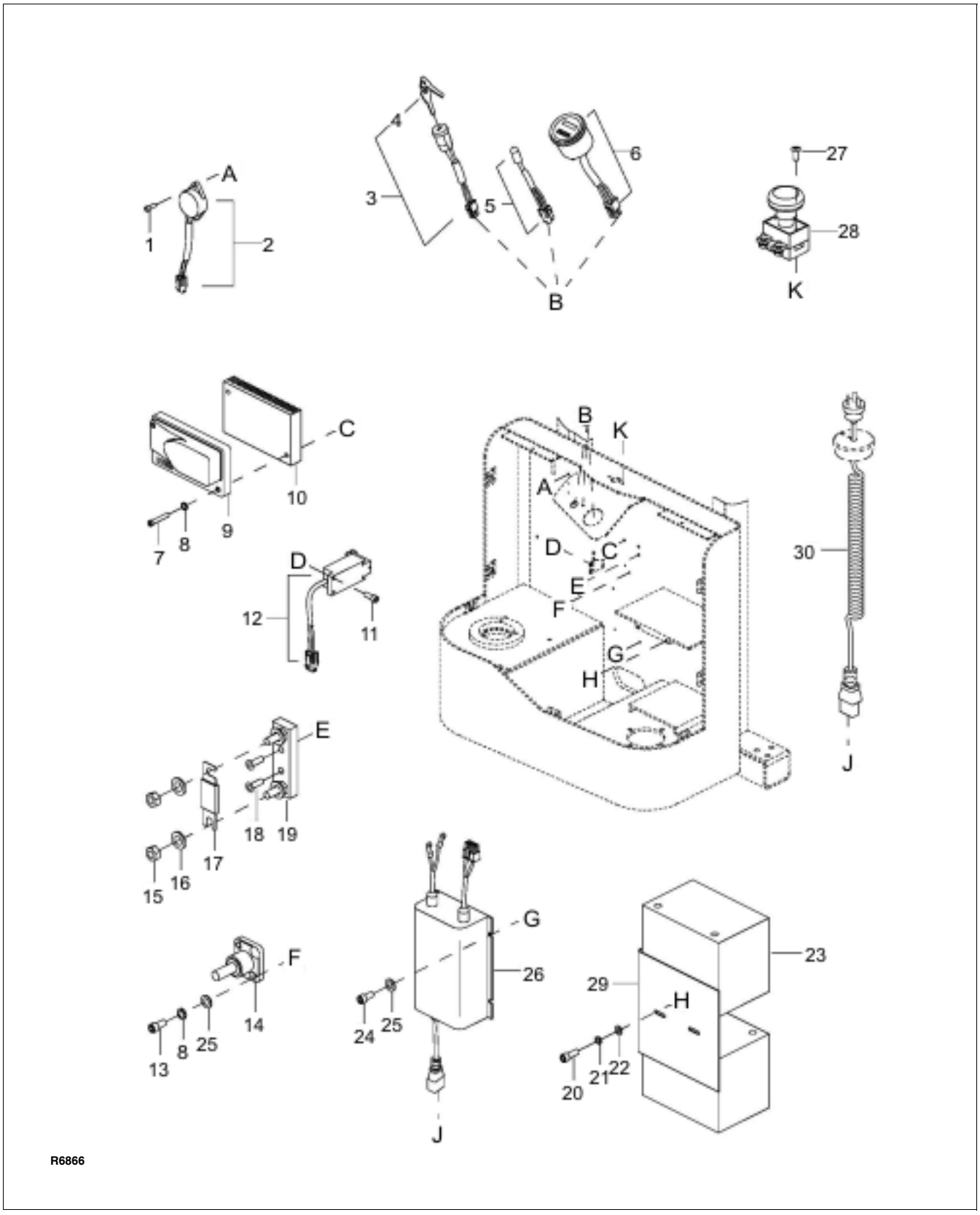

Figure 10-2 Electrical System (Telescopic)

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4. Reconnect remaining two charger leads.
5. Install compartment covers as described in paragraph 5-3.
6. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.7. Cooling Fan Removal (Mono).

1. Engage the emergency stop switch (31, Figure 12-22 or 28, Figure 12-23) and turn off key switch (4, Figure 12-22 or 3, Figure 12-23).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from fan (3, Figure 10-1).
4. Remove four screws (1), guard (2) and cooling fan (3).

10-1.8. Cooling Fan Installation (Mono).

1. Position cooling fan (3, Figure 10-1) and guard (2) on the bracket and secure with four screws (1).
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) from fan (3, Figure 10-1).
3. Install compartment covers as described in paragraph 5-3.
4. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.9. Buzzer Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from buzzer (10, Figure 10-1 or 2, Figure 10-2).
4. Remove two screws and buzzer from the bracket.

10-1.10. Buzzer Installation.

1. Position buzzer (10, Figure 10-1 or 2, Figure 10-2) on the bracket and secure with the original hardware.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) to buzzer (10, Figure 10-1 or 2, Figure 10-2).
3. Install upper compartment covers as described in paragraph 5-3.
4. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.11. Key Switch Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from key switch (4, Figure 12-22 or 3, Figure 12-23).
4. Remove mounting nut and key switch from the bracket.

10-1.12. Key Switch Installation.

1. Position key switch (4, Figure 12-22 or 3, Figure 12-23) on the bracket and secure with its mounting nut.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) to key switch (4, Figure 12-22 or 3, Figure 12-23).
3. Install compartment covers as described in paragraph 5-3.
4. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.13. Battery Indicator Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from battery indicator (7, Figure 10-1 or 6, Figure 10-2).
4. Remove mounting nuts and bracket and remove battery indicator from the bracket.

10-1.14. Battery Indicator Installation.

1. Position battery indicator (7, Figure 10-1 or 6, Figure 10-2) on the bracket and secure with its mounting bracket and nuts.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) from battery indicator (7, Figure 10-1 or 6, Figure 10-2).

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3. Install upper compartment covers as described in paragraph 5-3.
4. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.15.LED Indicator Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from LED indicator (6, Figure 10-1 or 5, Figure 10-2).
4. Cut the glue holding the LED indicator in place and remove the indicator.

10-1.16.LED Indicator Installation.

1. Position LED indicator (6, Figure 10-1 or 5, Figure 10-2) on the bracket and glue it in place.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) from LED indicator (6, Figure 10-1 or 5, Figure 10-2).
3. Install upper compartment covers as described in paragraph 5-3.
4. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.17.Emergency Disconnect Removal.

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Tag and disconnect cables (3 and 4, Figure 12-26 or Figure 12-27) from emergency disconnect (31, Figure 10-1 or 28, Figure 10-2).
4. Insert a tool through the shaft of emergency disconnect (31, Figure 10-1 or 28, Figure 10-2) and then unscrew the knob from the shaft.
5. Remove the two screws and remove the emergency disconnect from the bracket.

10-1.18.Emergency Disconnect Installation.

1. Position emergency disconnect (31, Figure 10-1 or 28, Figure 10-2) on the bracket and secure with two screws.
2. Install the knob on the emergency disconnect.
3. Reconnect cables (3 and 4, Figure 12-26 or Figure 12-27) to emergency disconnect (31, Figure 10-1 or 28, Figure 10-2).
4. Install compartment covers as described in paragraph 5-3.
5. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-1.19.Lift Limit Switch Removal.

1. Lower forks fully.
2. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
3. Remove the compartment covers as described in paragraph 5-3.
4. Tag and disconnect harness (1, Figure 12-24 or Figure 12-25) from limit switch (20, Figure 10-1 or 12, Figure 10-2).
5. Remove four screws and limit switch (20, Figure 10-1 or 12, Figure 10-2) from the bracket.

10-1.20.Lift Limit Switch Installation.

1. Position limit switch (20, Figure 10-1 or 12, Figure 10-2) on the bracket and secure with the four screws.
2. Reconnect harness (1, Figure 12-24 or Figure 12-25) to limit switch (20, Figure 10-1 or 12, Figure 10-2).
3. Install compartment covers as described in paragraph 5-3.
4. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

10-2.PUMP MOTOR.

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

10-3.DRIVE MOTOR.

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

The drive motor is replaceable but not repairable. Refer to paragraph 7-2.

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10-4.DEADMAN SWITCH

1. Engage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn off key switch (4, Figure 10-1 or 3, Figure 10-2).
2. Remove the compartment covers as described in paragraph 5-3.
3. Disconnect wiring from the deadman switch (16, Figure 12-1).
4. Remove the two screws (9), and bracket (8) from bracket (5).
5. Remove two screws (7) and switch (16) from bracket (8).
6. Position the new switch (16) on bracket (8) and secure with the two screws (7).
7. Position bracket (8) on bracket (5) and secure with two screws (9).
8. Install compartment covers as described in paragraph 5-3.
9. Disengage the emergency stop switch (31, Figure 10-1 or 28, Figure 10-2) and turn on key switch (4, Figure 10-1 or 3, Figure 10-2).

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SECTION 11
OPTIONAL EQUIPMENT

11-1.LOAD BACKREST

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

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SECTION 12
ILLUSTRATED PARTS BREAKDOWN

Following is an illustrated parts breakdown of assemblies and parts associated with the S22 Lift Truck.

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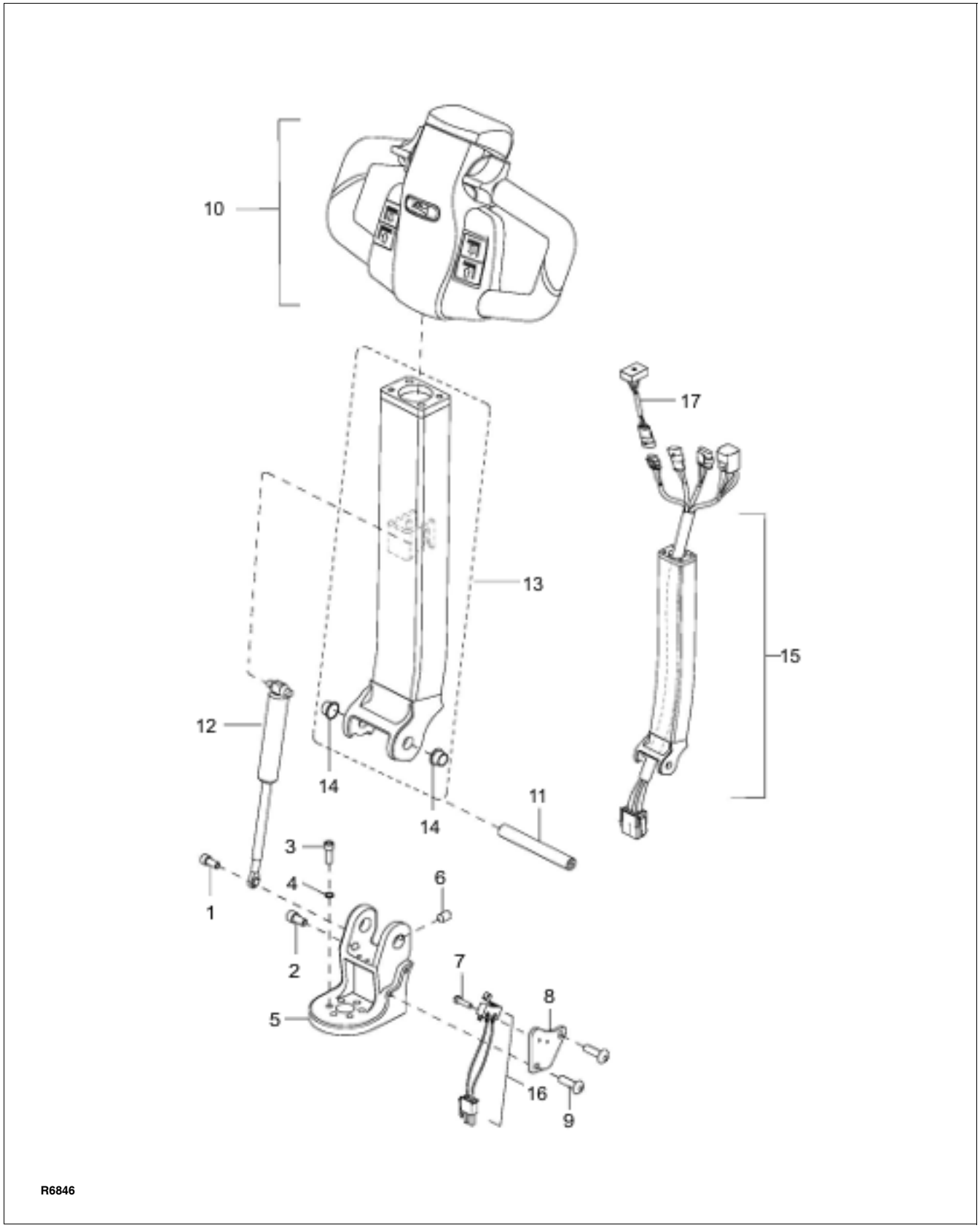

Figure 12-1 Steering System

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	0000-000322-00	SCREW, M8 x 25	1
2	0000-000030-00	SCREW, M10 x 16	1
3	0000-000386-00	SCREW, M6 x 20	6
4	0000-000056-00	WASHER, LOCK, M6	6
5	2108-300001-00	BRACKET	1
6	0000-000016-00	SCREW, M5 x 8	1
7	0000-000120-00	SCREW, M2 x 8	2
8	1115-500001-00	BRACKET	1
9	0000-000651-00	SCREW, M4 x 8	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
10	—	CONTROL HEAD (FIGURE 12-2)	REF
11	2108-300002-00	SHAFT	1
12	1120-320000-00	GAS SPRING	1
13	1115-310000-00	STEERING ARM	1
14	0000-000677-00	• BUSHING, 1610	2
15	1115-520010-00	WIRING HARNESS	1
16	1115-520009-0A	DEADMAN SWITCH	1
17	1115-520017-00	POTENTIOMETER WIRING HARNESS	1

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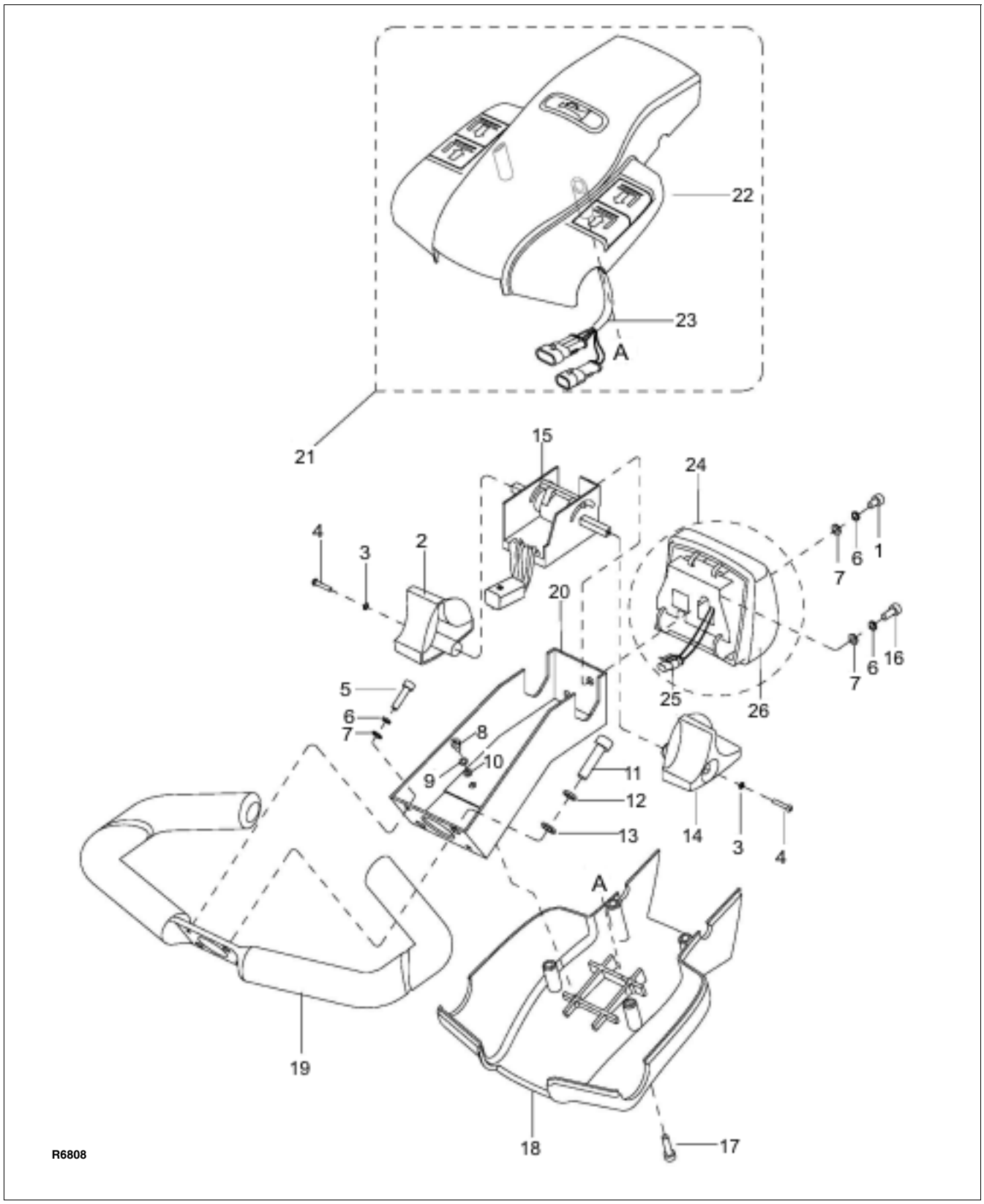

Figure 12-2 Control Head

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-340000-00	CONTROL HEAD	1
1	0000-000010-00	• SCREW, M5 X 6	1
2	1120-340005-00	• CONTROL KNOB	1
3	0000-000038-00	• WASHER, LOCK, M3	2
4	0000-000037-00	• SCREW, M3 X 12	2
5	0000-000004-00	• SCREW, M5 X 12	2
6	0000-000206-00	• WASHER, LOCK, M5	4
7	0000-000390-00	• WASHER, FLAT, M5	4
8	0000-000088-00	• SCREW, M4 X 8	2
9	0000-000122-00	• WASHER, LOCK, M4	2
10	0000-000702-00	• WASHER, FLAT, M4	2
11	0000-000322-00	• SCREW, M8 X 25	2
12	0000-000159-00	• WASHER, LOCK, M8	2
13	0000-000176-00	• WASHER, FLAT, M8	2
14	1120-340003-00	• CONTROL KNOB	1
15	1220-520008-00	• POTENTIOMETER	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
16	0000-000004-00	• SCREW, M5 X 12	1
17	0000-000035-00	• SCREW, M5 X 20	4
18	1120-340002-00	• COVER	1
19	1120-341000-00	• HANDLE	1
20	1120-340001-00	• CONNECTOR BRACKET	1
21	2125-342000-00-B	• CAP ASSEMBLY, 2 SPEED LOWERING	1
22	—	• • CAP ASSEMBLY (FIGURE 12-3)	REF
23	1220-520006-0C	• HARNESS, SWITCH	1
24	1120-343000-00-B	• EMERGENCY REVERSE SWITCH ASSY	1
25	1115-520004-0A	• REVERSING SWITCH	1
26	—	• EMERGENCY REVERSE SWITCH ASSY (FIGURE 12-4)	REF

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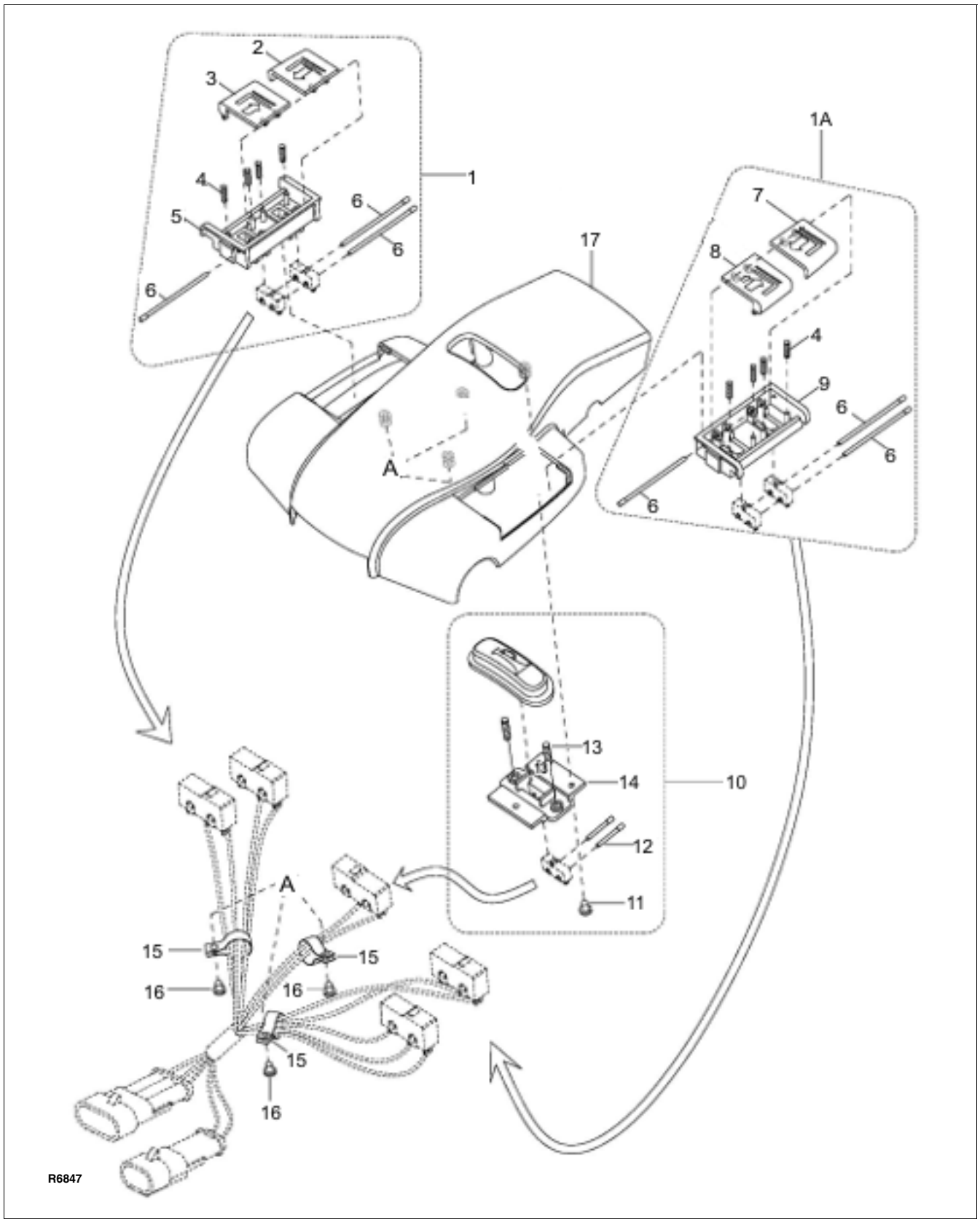

Figure 12-3 Cap Assembly

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-342000-00	CAP ASSEMBLY	1
1	1120-342200-00	• LIFT/LOWERING SWITCH ASSY, RIGHT	1
1A	1120-342100-00	• LIFT/LOWERING SWITCH ASSY, LEFT	1
2	1120-342203-00	• • BUTTON, LOWERING, RIGHT	1
3	1120-342202-00	• • BUTTON, LIFTING, RIGHT	1
4	1120-342102-00	• • SPRING	8
5	1120-342201-00	• • BUTTON BRACKET, RIGHT	1
6	1120-342105-00	• • PIN	6
7	1120-342104-00	• • BUTTON, LIFT, LEFT	1
8	1120-342103-00	• • BUTTON, LOWERING, LEFT, TWO SPEED	1
9	1120-342101-00	• • BUTTON BRACKET, LEFT	1
10	1120-342002-00	• HORN BUTTON	1
11	0000-000039-00	• • SCREW	3
12	1120-342005-00	• • PIN	2
13	1120-342003-00	• • SPRING	2
14	1120-342004-00	• • HORN SWITCH BRACKET	1
15	0000-000490-00	• CLAMP	3
16	0000-000039-00	• SCREW	3
17	1120-342001-00	• COVER	1

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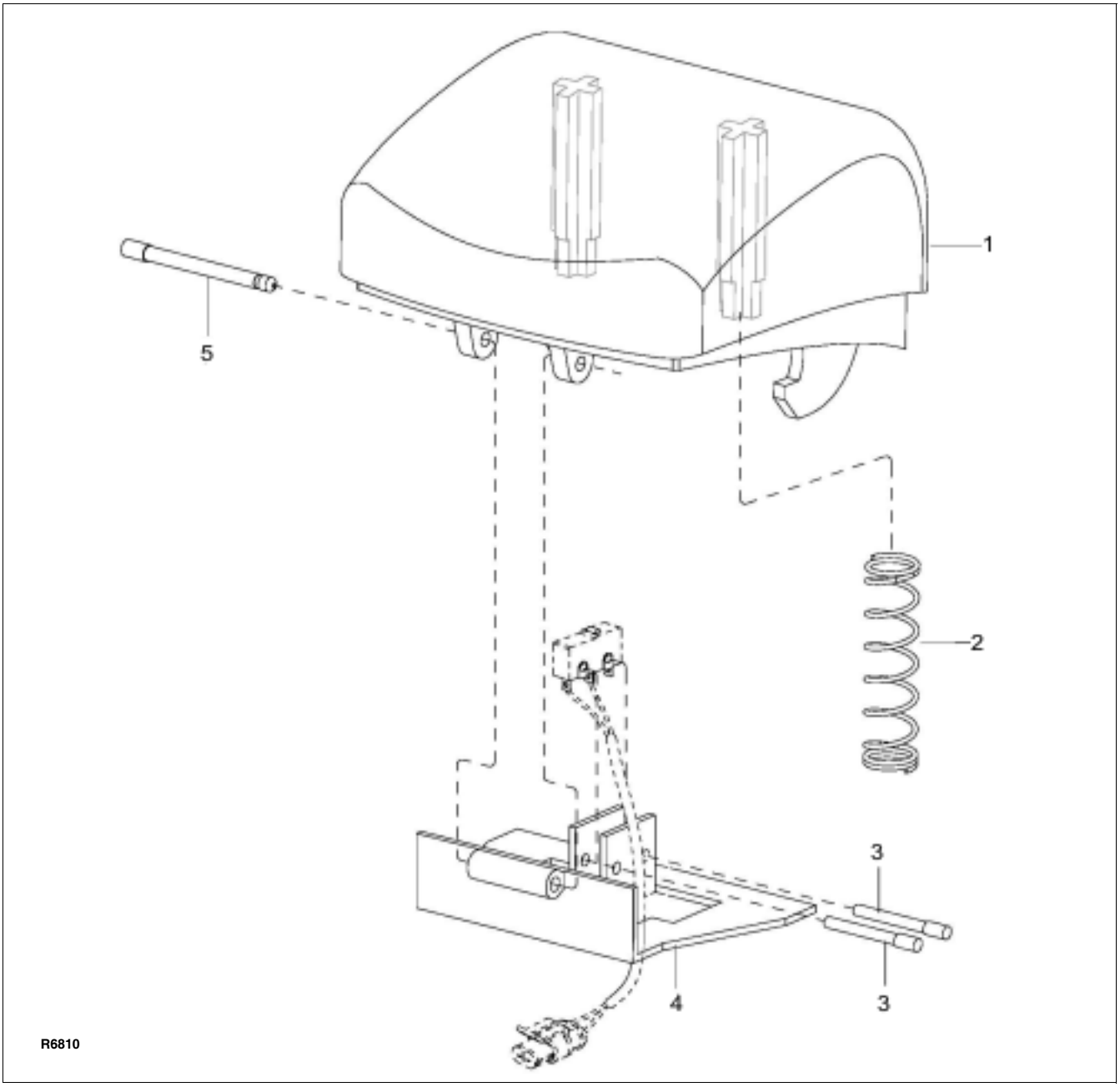

Figure 12-4 Emergency Reverse Switch Assembly

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	1120-343000-00	EMERGENCY REVERSE SWITCH ASSY	1
1	1120-343002-00	• EMERGENCY REVERSE BUTTON	1
2	1120-343003-00	• SPRING	2

INDEX NO.	PART NO.	PART NAME	NO. REQD.
3	1120-342005-00	• PIN	2
4	1120-343001-0A	• BRACKET	1
5	1120-343004-00	• PIN	1

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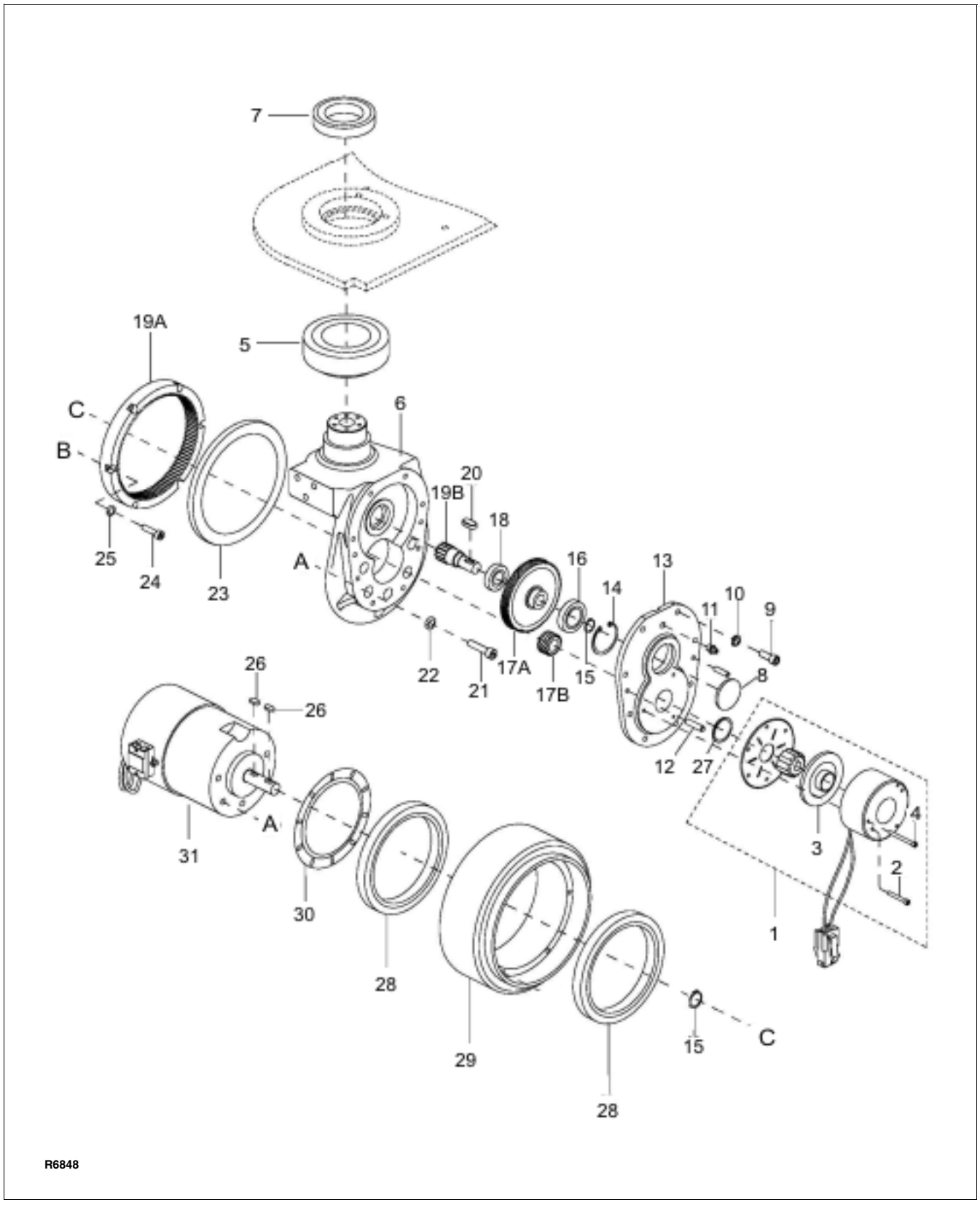

Figure 12-5 Transmission, Motor, Brake Assembly

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	1115-520012-00	BRAKE	1
2	0000-000121-00	• SCREW, M4 X 35	2
3	1115-240001-00	• FRICTION PLATE	1
4	0000-000665-00	• SCREW, M4 X 45	3
5	0000-000668-00	BEARING, 30212	1
6	2108-210001-00	HOUSING	1
7	0000-000657-00	BEARING, 6010-Z	1
8	1115-200007-00	CAP	2
9	0000-000386-00	SCREW, M6 X 20	8
10	0000-000056-00	WASHER, LOCK, M6	8
11	0000-000013-00	GREASE FITTING	1
12	0000-000704-00	PIN, M6 X 20	2
13	1115-200001-00	COVER	1
14	0000-000658-00	CLIP, M42	1
15	0000-000659-00	CLIP, M15	2
16	0000-000667-00	BEARING, 61905Z	1
17	—	GEAR SET (REPLACE BOTH)	1
17A	1115-200004-00	GEAR	1
17B	1115-200005-00	GEAR	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
18	0000-000680-00	BEARING, 16003Z	1
19	—	GEAR SET (REPLACE BOTH)	1
19A	1115-200002-00	GEAR, LOOP	1
19B	1115-200003-00	GEAR	1
20	0000-000660-00	KEY, 5 X 5 X 18	1
21	0000-000154-00	SCREW, M8 X 35	5
22	0000-000159-00	WASHER, LOCK, M8	5
23	0000-000670-00	SEAL, M155 X 172 X 10	1
24	0000-000661-00	SCREW, M5 X 20	6
25	0000-000206-00	WASHER, LOCK, M5	6
26	0000-000662-00	KEY, 5 X 5 X 12	2
27	0000-000671-00	SEAL, M16 X 28 X 7	1
28	0000-000663-00	BEARING, 61824-2RS	2
29	1115-220000-00	DRIVE WHEEL	1
30	1115-200010-00	BAFFLE	1
31	1115-230000-00	MOTOR	1

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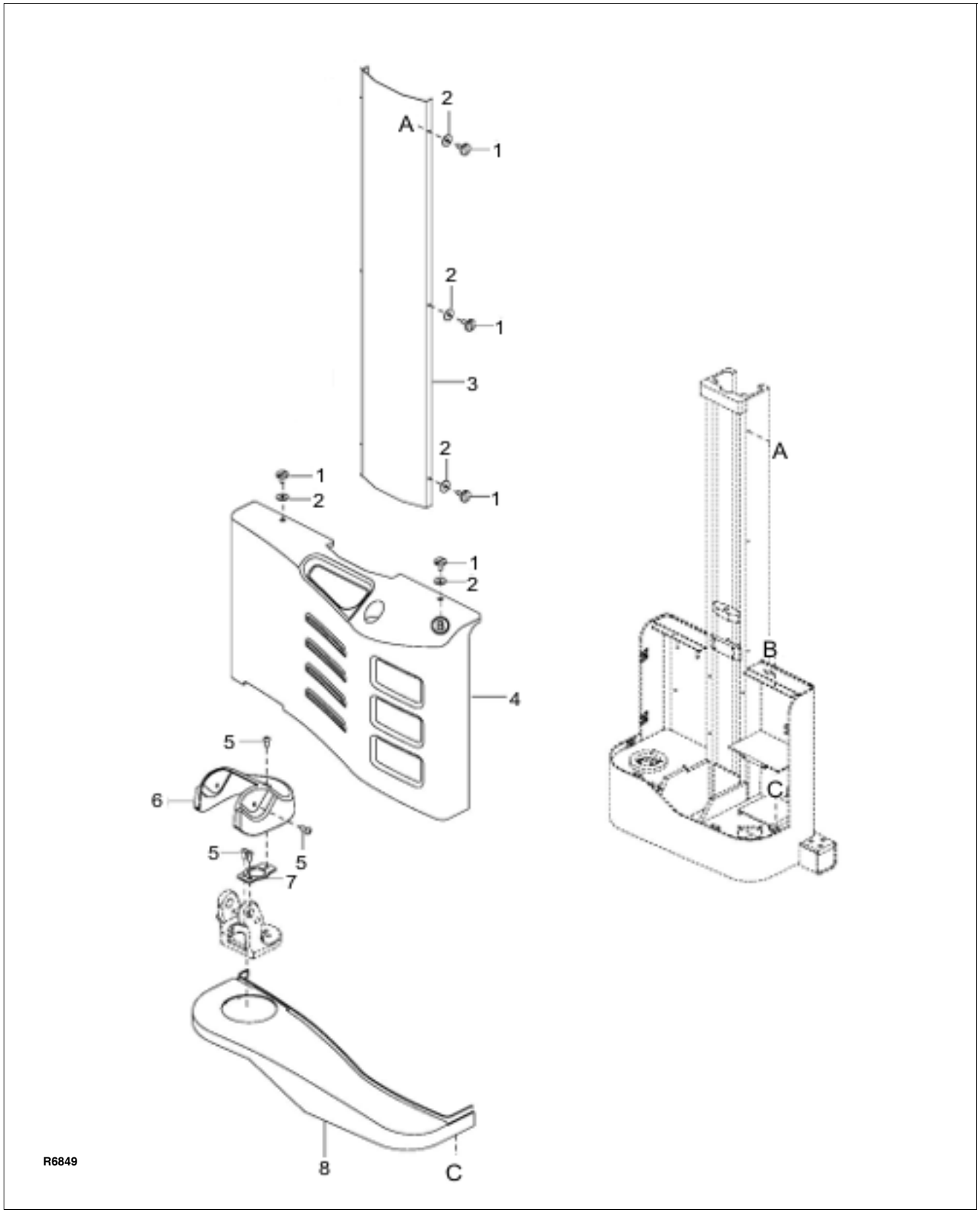

Figure 12-6 Compartment, Mono

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-100006-00	SCREW, M6 X 10	8
2	2214-150002-00	WASHER, M6	8
3	2108-100001-00-01	COVER	1
4	2108-100002-00	COVER	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
5	0000-000179-00	SCREW, M6 X 10	5
6	2108-100004-00	ROTATION COVER	1
7	2108-100005-00	BRACKET	1
8	2108-100003-00	COVER	1

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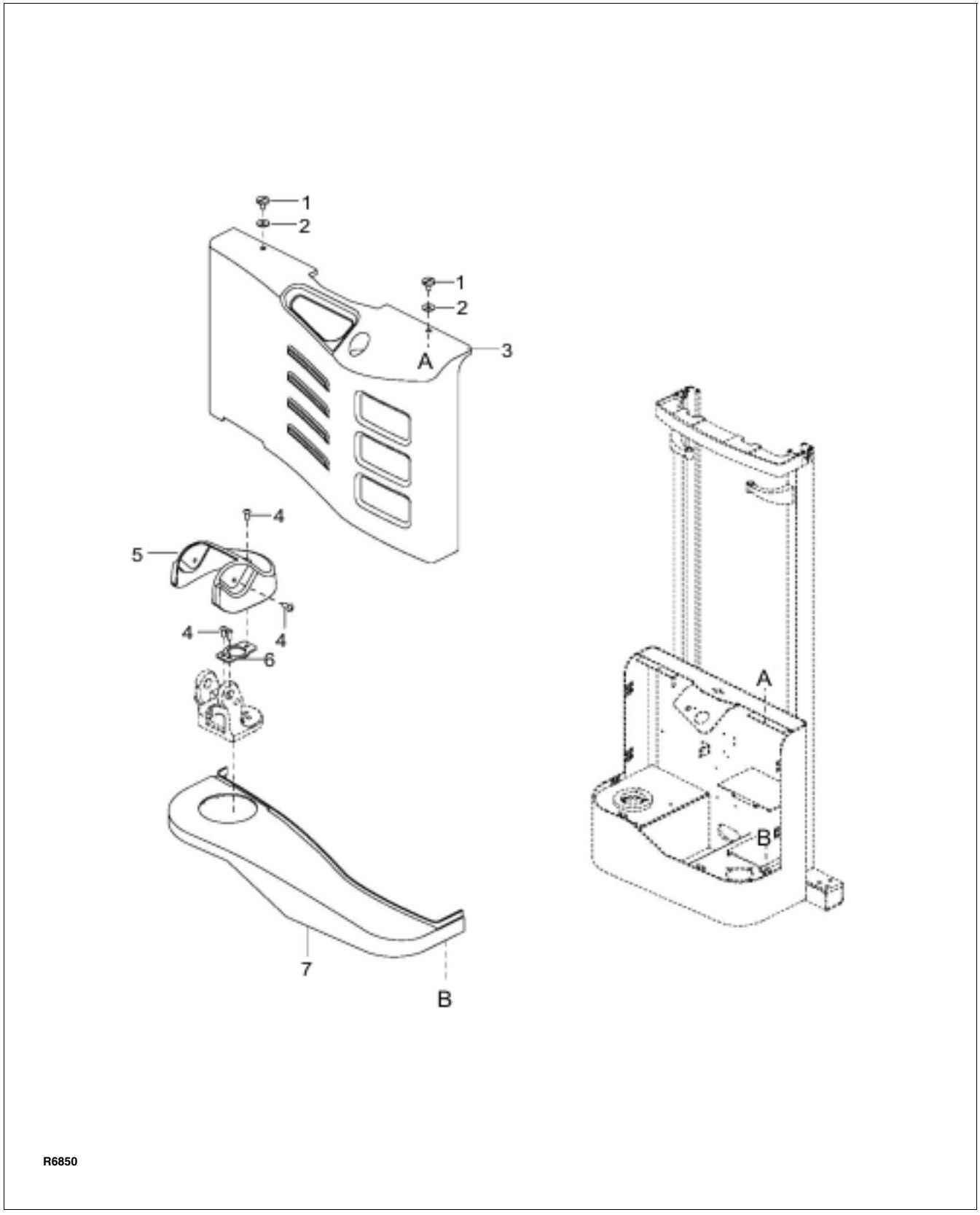

Figure 12-7 Compartment, Telescopic

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-100006-00	SCREW, M6 X 10	8
2	2214-150002-00	WASHER, M6	8
3	2108-100002-00	COVER	1
4	0000-000179-00	SCREW, M6 X 10	5

INDEX NO.	PART NO.	PART NAME	NO. REQD.
5	2108-100004-00	ROTATION COVER	1
6	2108-100005-00	BRACKET	1
7	2108-100003-00	COVER	1

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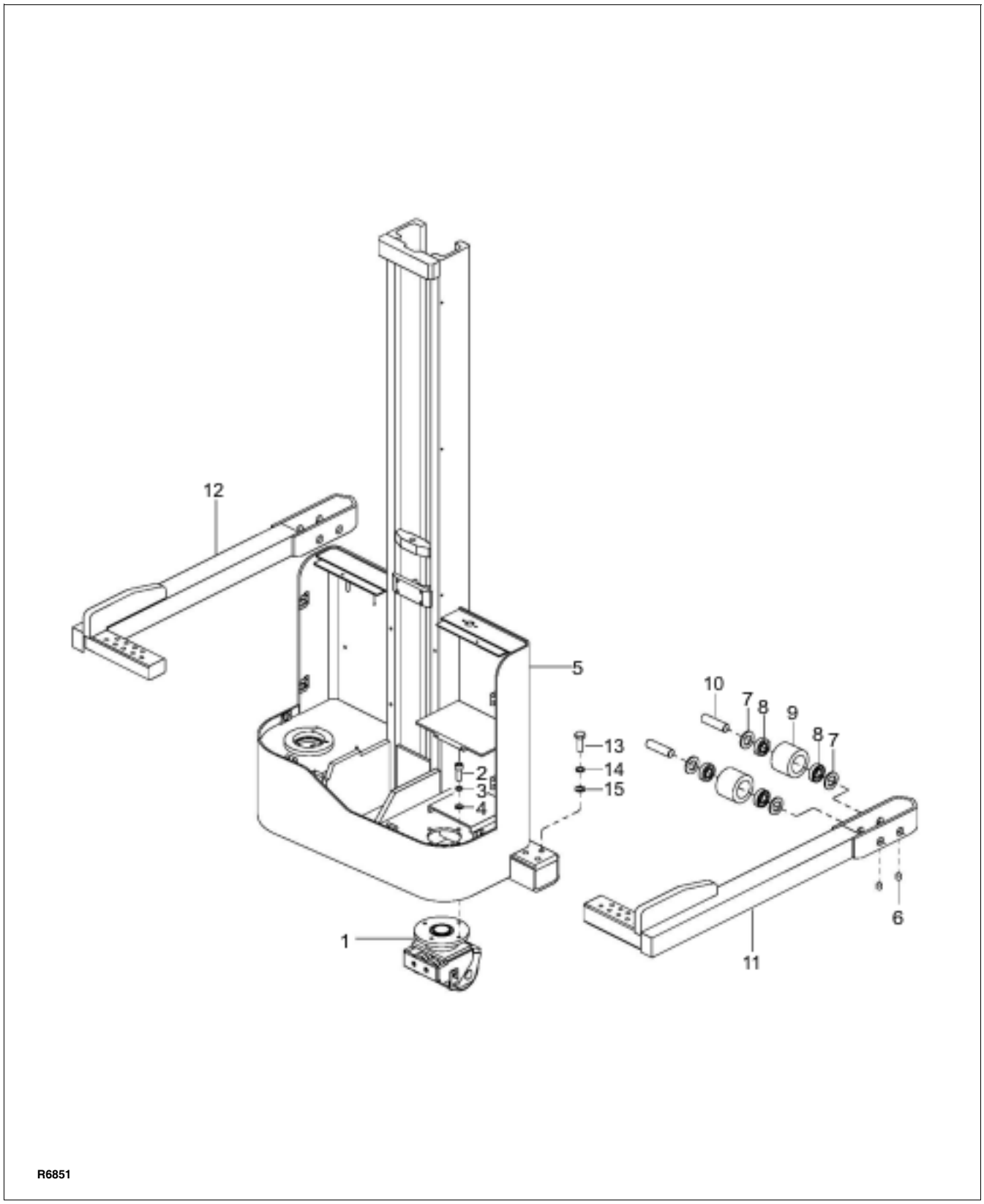

Figure 12-8 Adjustable Straddle, Mono

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	CASTER ASSEMBLY (FIGURE 12-10)	REF
2	0000-000322-00	SCREW, M8 X 25	4
3	0000-000159-00	WASHER, LOCK, M8	10
4	0000-000194-00	WASHER, FLAT, M8	10
5	2130-110000-00	FRAME	1
6	0000-000218-00	SCREW, M6 X 16	4
7	2125-101003-00	WASHER	8

INDEX NO.	PART NO.	PART NAME	NO. REQD.
8	0000-000424-00	BEARING, 6205-2Z	8
9	2125-101001-00	LOAD WHEEL	4
10	2125-101002-00	SHAFT	4
11	2108-130000-10	STRADDLE, RIGHT	1
12	2108-120000-10	STRADDLE, LEFT	1
13	0000-000703-00	SCREW, M16 X 45	6
14	0000-000191-00	WASHER, LOCK, M16	6
15	0000-000541-00	WASHER, FLAT, M16	6

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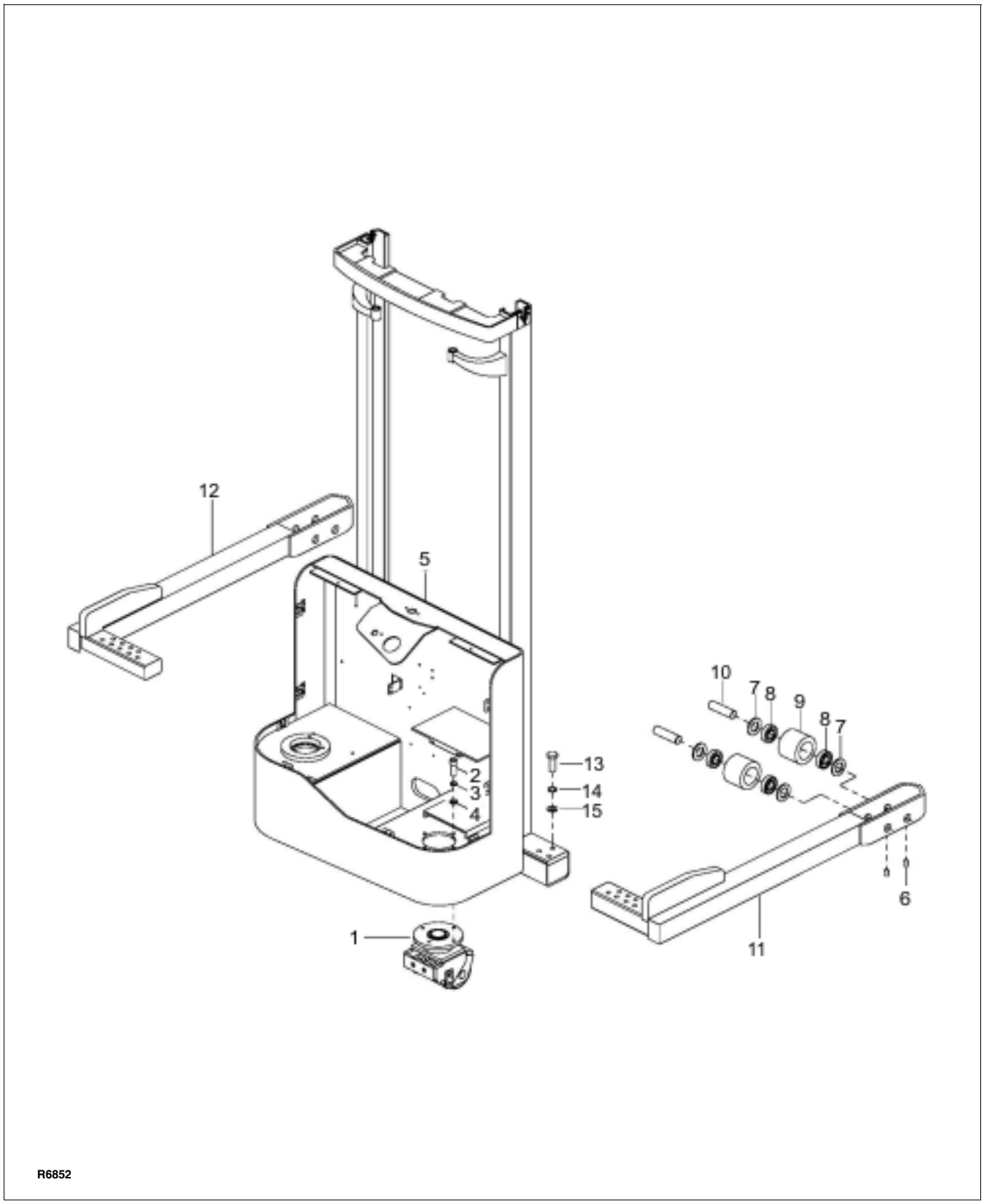

Figure 12-9 Adjustable Straddle, Telescopic

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	CASTER ASSEMBLY (FIGURE 12-10)	REF
2	0000-000322-00	SCREW, M8 X 25	4
3	0000-000159-00	WASHER, LOCK, M8	10
4	0000-000194-00	WASHER, FLAT, M8	10
5	2108-110000-60	FRAME	1
6	0000-000218-00	SCREW, M6 X 16	4
7	2125-101003-00	WASHER	8

INDEX NO.	PART NO.	PART NAME	NO. REQD.
8	0000-000424-00	BEARING, 6205-2Z	8
9	2125-101001-00	LOAD WHEEL	4
10	2125-101002-00	SHAFT	4
11	2108-130000-10	STRADDLE, RIGHT	1
12	2108-120000-10	STRADDLE, LEFT	1
13	0000-000703-00	SCREW, M16 X 45	6
14	0000-000191-00	WASHER, LOCK, M16	6
15	0000-000541-00	WASHER, FLAT, M16	6

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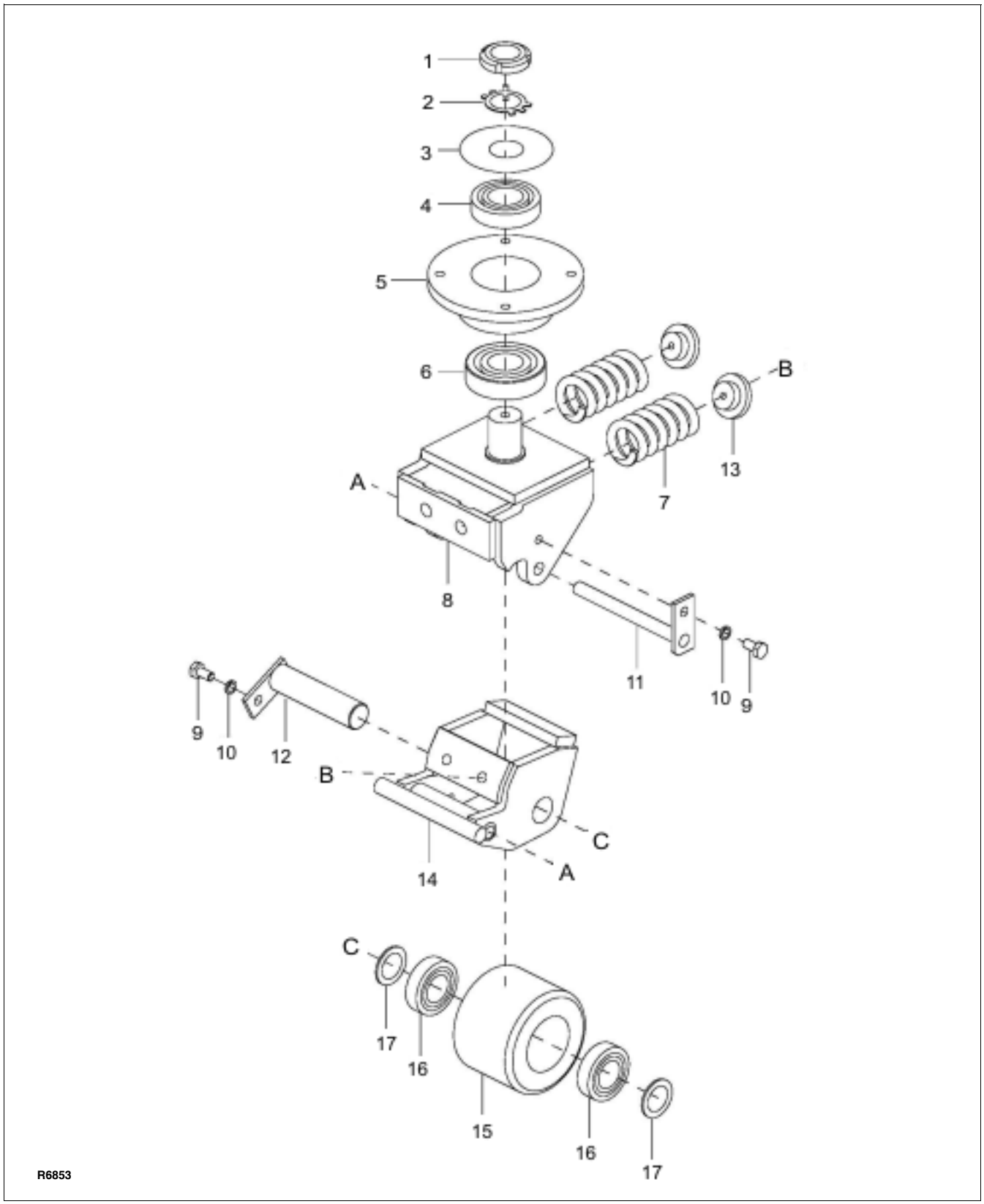

Figure 12-10 Caster

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	2108-140000-10	CASTER ASSEMBLY	1
1	0000-000093-00	• NUT, M27 X 1.5	1
2	0000-000094-00	• WASHER	1
3	1220-140001-00	• WASHER	1
4	0000-000420-00	• BEARING, 6206-2RZ	1
5	2140-140002-00	• BEARING BLOCK	1
6	0000-000421-00	• BEARING, 6306-2RZ	1
7	2108-140001-10	• SPRING	2
8	2140-141000-00	• HOUSING	1
9	0000-000242-00	• SCREW, M8 X 16	2
10	0000-000159-00	• WASHER, LOCK, M8	2
11	2140-142000-00	• HINGE PIN	1
12	2140-145000-00	• SHAFT	1
13	2140-140003-00	• SHAFT	2
14	2140-143000-00	• CASTER HOUSING	1
15	2140-144002-00	• CASTER WHEEL	1
16	0000-000424-00	• BEARING, 6205-2Z	2
17	0000-000249-00	• WASHER, FLAT, M24	2

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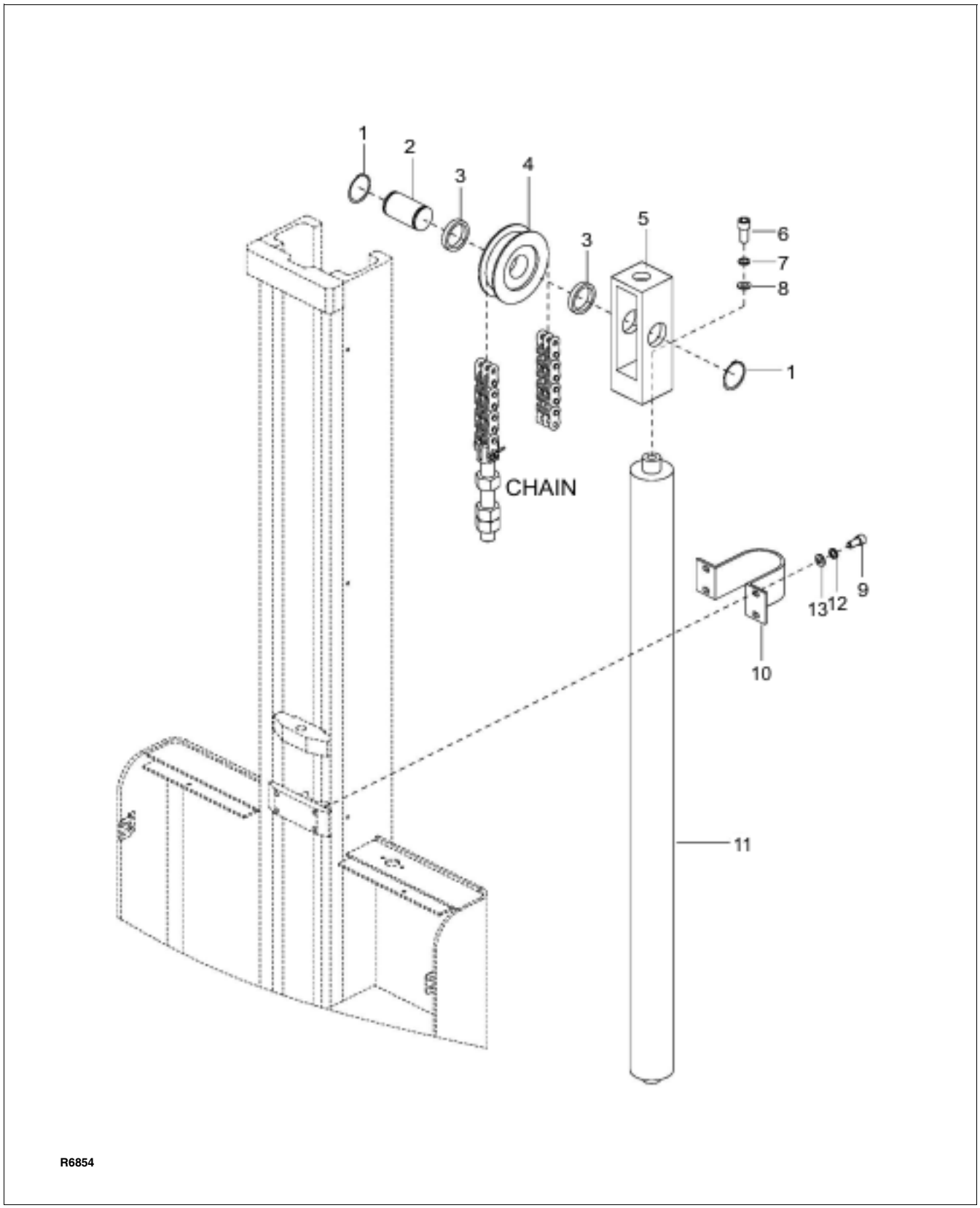

Figure 12-11 Elevation System (Mono)

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	0000-000756-00	RETAINER RIN	2
2	2108-600001-00	SHAFT	1
3	2108-600003-00	WASHER	2
4	2108-600002-00	CHAIN SHEAVES	1
5	2108-620000-00	RAM HEAD	1
6	0000-000374-00	SCREW, M12 X 30	1
7	0000-000060-00	WASHER, LOCK, M12	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
8	0000-000373-00	WASHER, FLAT, M12	1
9	0000-000321-00	SCREW, M8 X 20	4
10	2108-600004-00	CLIP, CYLINDER	1
11	—	LIFT CYLINDER (FIGURE 12-20)	REF
12	0000-000159-00	WASHER, LOCK, M8	4
13	0000-000176-00	WASHER, FLAT, M8	4

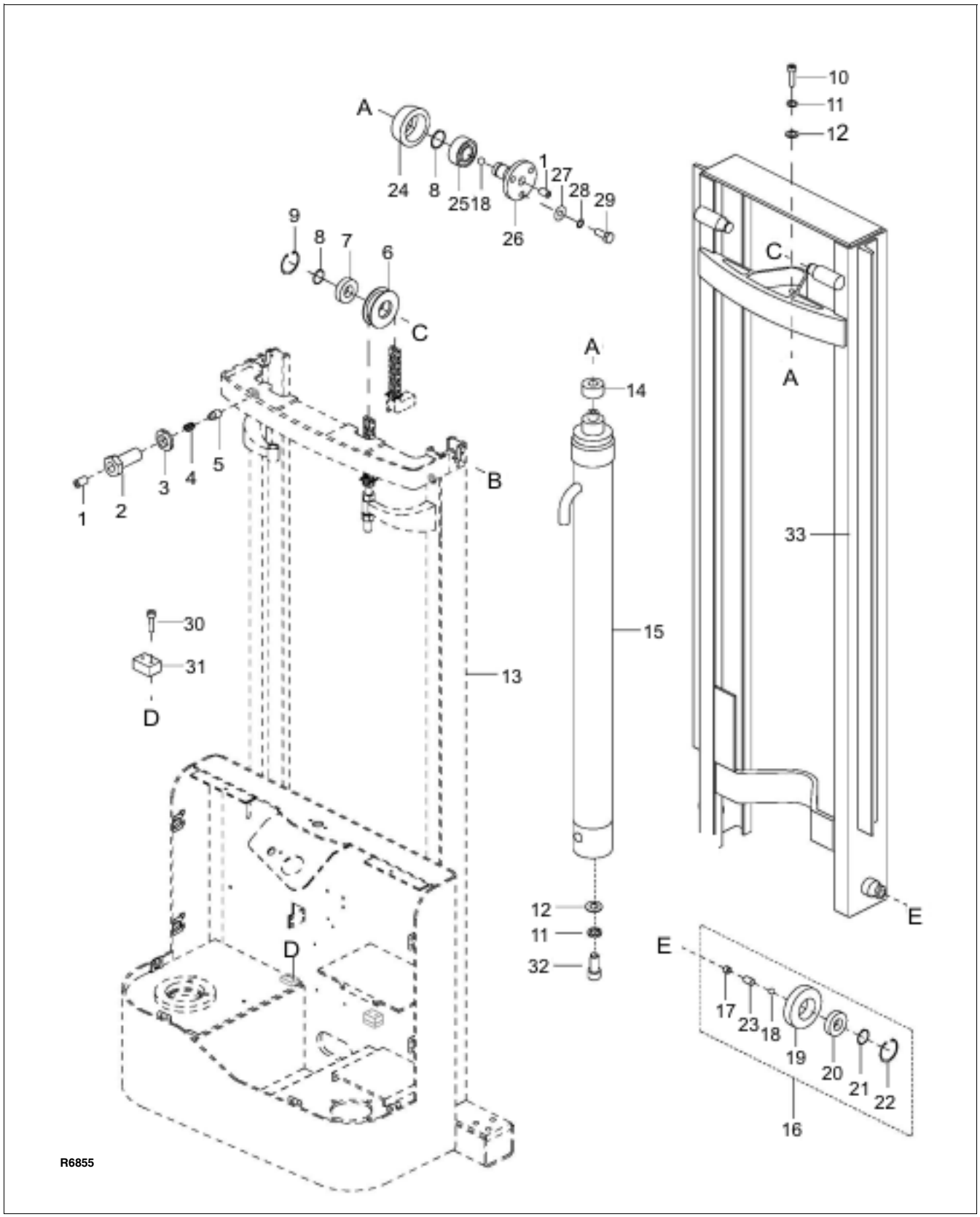

Figure 12-12 Elevation System (Telescopic)

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	0000-000761-00	SCREW, M5 X 6	4
2	2108-600002-00	BOLT	2
3	0000-000757-00	NUT, M20 X 1.5	2
4	2108-600003-60	SPRING	2
5	2108-600004-60	POSITIONING ROD	2
6	2108-600005-60	SHEAVES	2
7	0000-000100-00	BEARING, 6205	2
8	0000-000294-00	RETAINER RING	4
9	0000-000758-00	SNAP RING	2
10	0000-000374-00	SCREW, M12 X 30	1
11	0000-000060-00	WASHER, LOCK, M12	2
12	0000-000373-00	WASHER, FLAT, M12	2
13	2108-610000-60-01	OUTER MAST (96 IN LIFT)	1
13	2108-610000-60-02	OUTER MAST (116 IN LIFT)	1
14	2108-600001-60	BUSHING	1
15	—	LIFT CYLINDER (FIGURE 12-21)	REF
16	2108-632000-60	ROLLER ASSEMBLY	8

INDEX NO.	PART NO.	PART NAME	NO. REQD.
17	2108-600006-60	• COLUMN	2
18	0000-000777-00	• STEEL BALL	4
19	2108-600007-60	• ROLLER	2
20	0000-000420-00	• BEARING, 6206	2
21	0000-000434-00	• RETAINING RING	2
22	0000-000762-00	• SNAP RING	8
23	0000-000761-00	• SCREW, M12 X 20	2
24	2108-600008-60	ROLLER	2
25	0000-000759-00	BEARING, 3205	2
26	2108-600009-60	BEARING BLOCK	2
27	0000-000007-00	WASHER, FLAT, M10	6
28	0000-000063-00	WASHER, LOCK, M10	6
29	0000-000760-00	BOLT, M10 X 30	6
30	0000-000055-00	SCREW, M6 X 16	4
31	2125-600005-00	BUFFER BLOCK	2
32	0000-000325-00	SCREW, M12 X 20	4
33	2108-630000-60-01	INNER MAST (96 IN LIFT)	1
33	2108-630000-60-02	INNER MAST (116 IN LIFT)	1

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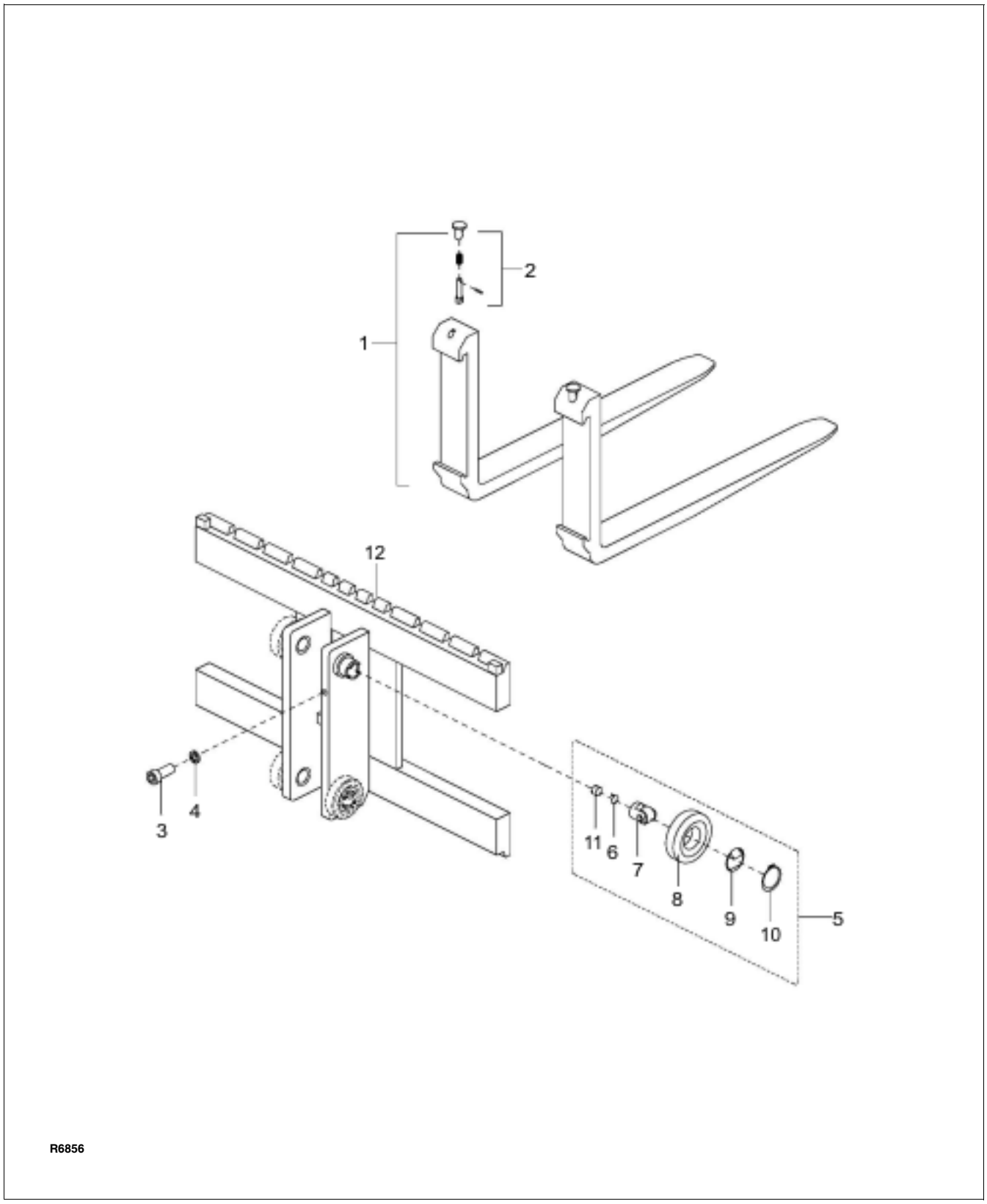

Figure 12-13 Lift Carriage (Mono)

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2125-630001-00	FORK	2
2	2125-630001-10	LOCK	2
3	0000-000008-00	SCREW, M10 X 20	1
4	0000-000063-00	WASHER, LOCK, M10	1
5	2125-631100-00	ROLLER ASSEMBLY	4
6	2125-612007-00	• SNAP RING	4
7	2125-612002-00	• BRACKET	4
8	2125-612001-00	• ROLLER	4
9	2125-612005-00	• DUST SEAL	4
10	0000-000183-00	• RETAINING RING, M35	4
11	2125-631104-00	• SCREW	4
12	2108-631000-10	CARRIAGE	1

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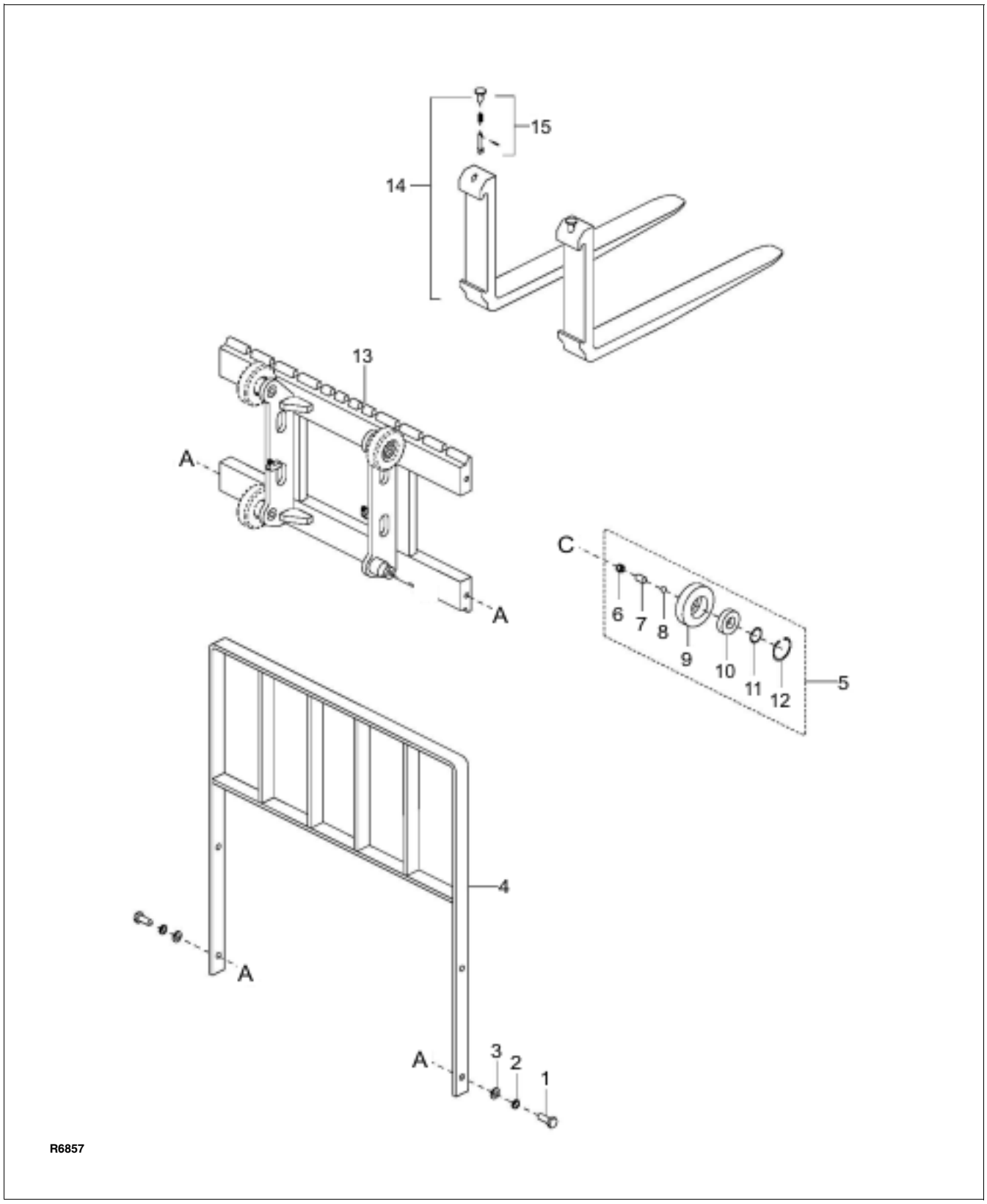

Figure 12-14 Lift Carriage (Telescopic)

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	0000-000284-00	BOLT, M12 X30	4
2	0000-000060-00	WASHER, LOCK, M12	4
3	0000-000373-00	WASHER, FLAT, M12	4
4	2125-632000-00	BACK SUPPORT	1
5	2108-632000-60	ROLLER ASSEMBLY	4
6	2108-600006-60	• COLUMN	4
7	0000-000761-00	• SCREW, M12 X 20	4
8	0000-000777-00	• STEEL BALL	4

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	2108-600007-60	• ROLLER	2
10	0000-000420-00	• BEARING, 6206	2
11	0000-000434-00	• RETAINING RING	2
12	0000-000762-00	• SNAP RING	8
13	2108-631000-60	CARRIAGE	1
14	2125-630001-00	FORK	2
15	2125-630001-10	LOCK	2

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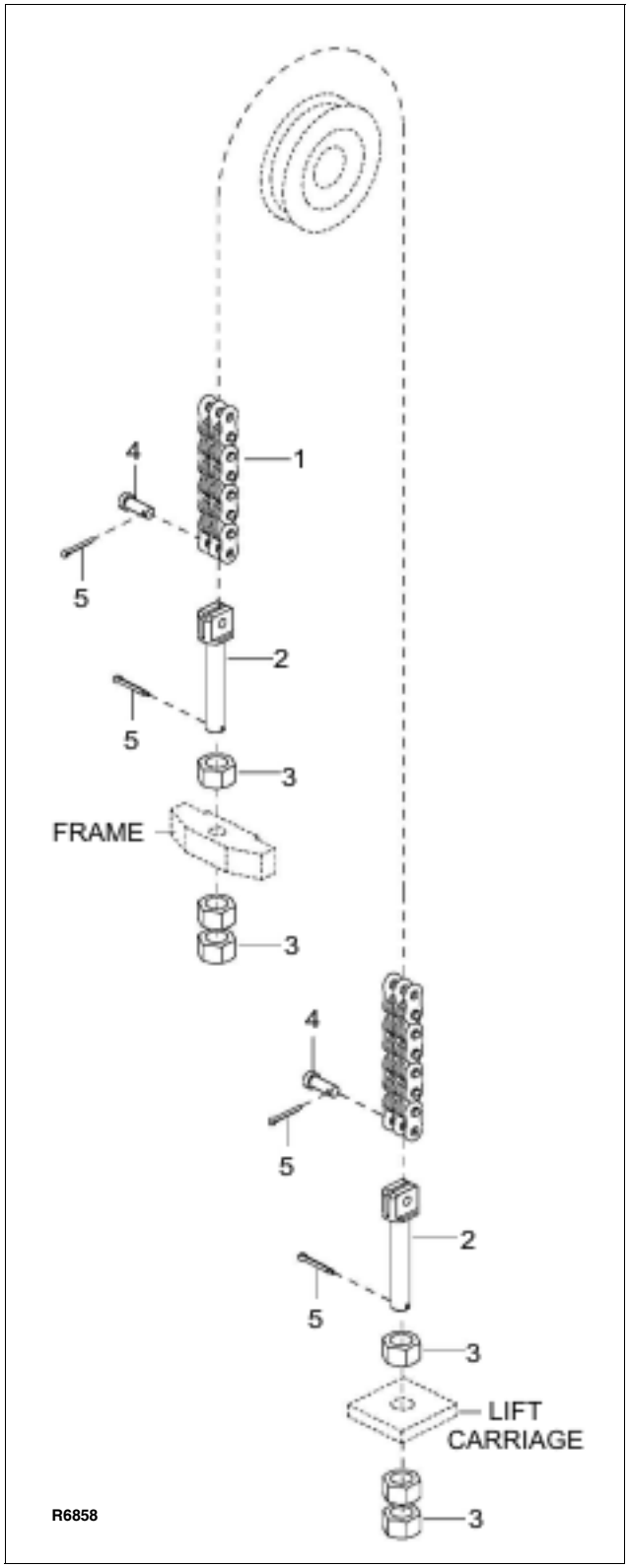

Figure 12-15 Chain Assembly (Mono)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-640000-00-01	CHAIN (63 LINKS)	1
2	2108-640001-00	ADJUSTING SCREW	2
3	0000-000237-00	NUT, M16 X 1.5	6
4	2108-640002-00	PIN	2
5	0000-000188-00	PIN, COTTER	4

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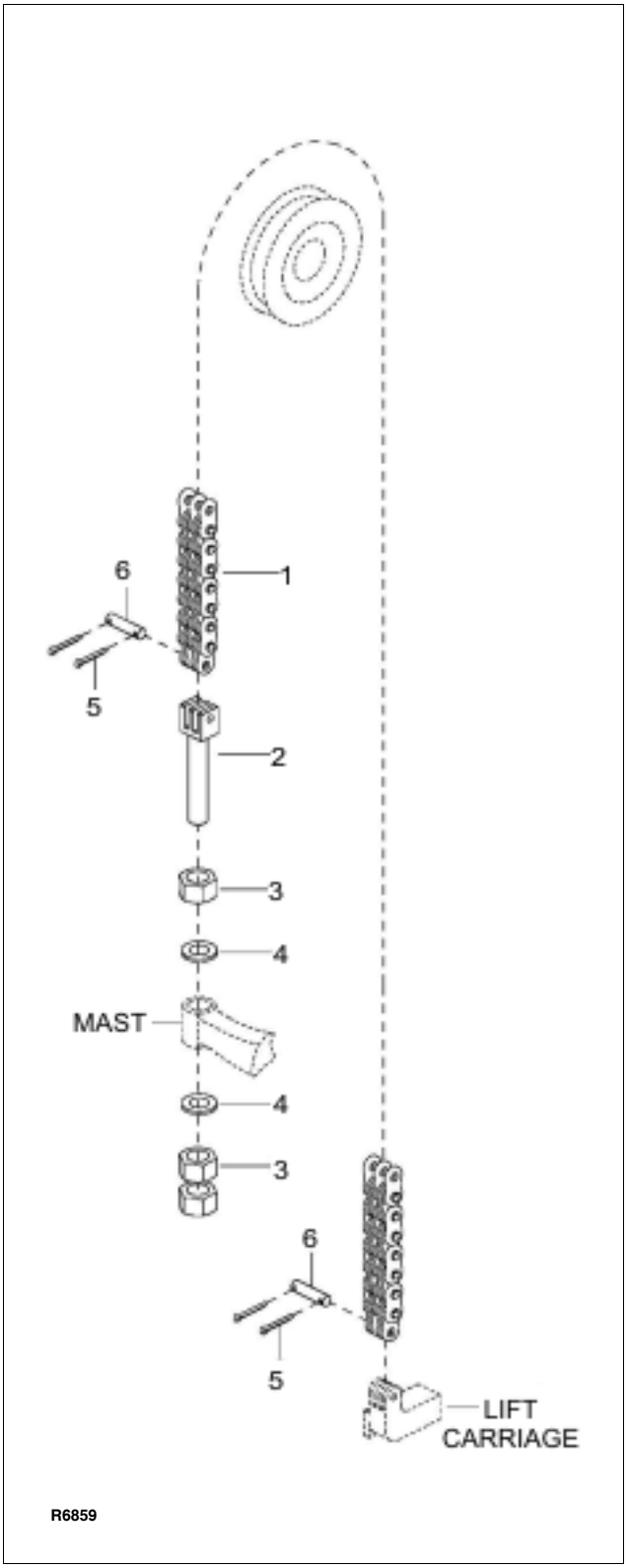

Figure 12-16 Chain Assembly (Telescopic)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2125-640001-60-01	CHAIN (96 IN LIFT) (131 LINKS)	2
1	2125-640001-60-02	CHAIN (116 IN LIFT) (143 LINKS)	2
2	2108-640002-60	ADJUSTING SCREW	2
3	0000-000237-00	NUT, M16 X 1.5	6
4	0000-000220-00	WASHER, M16	4
5	0000-000188-00	PIN, COTTER	8
6	0000-000779-00	PIN	4

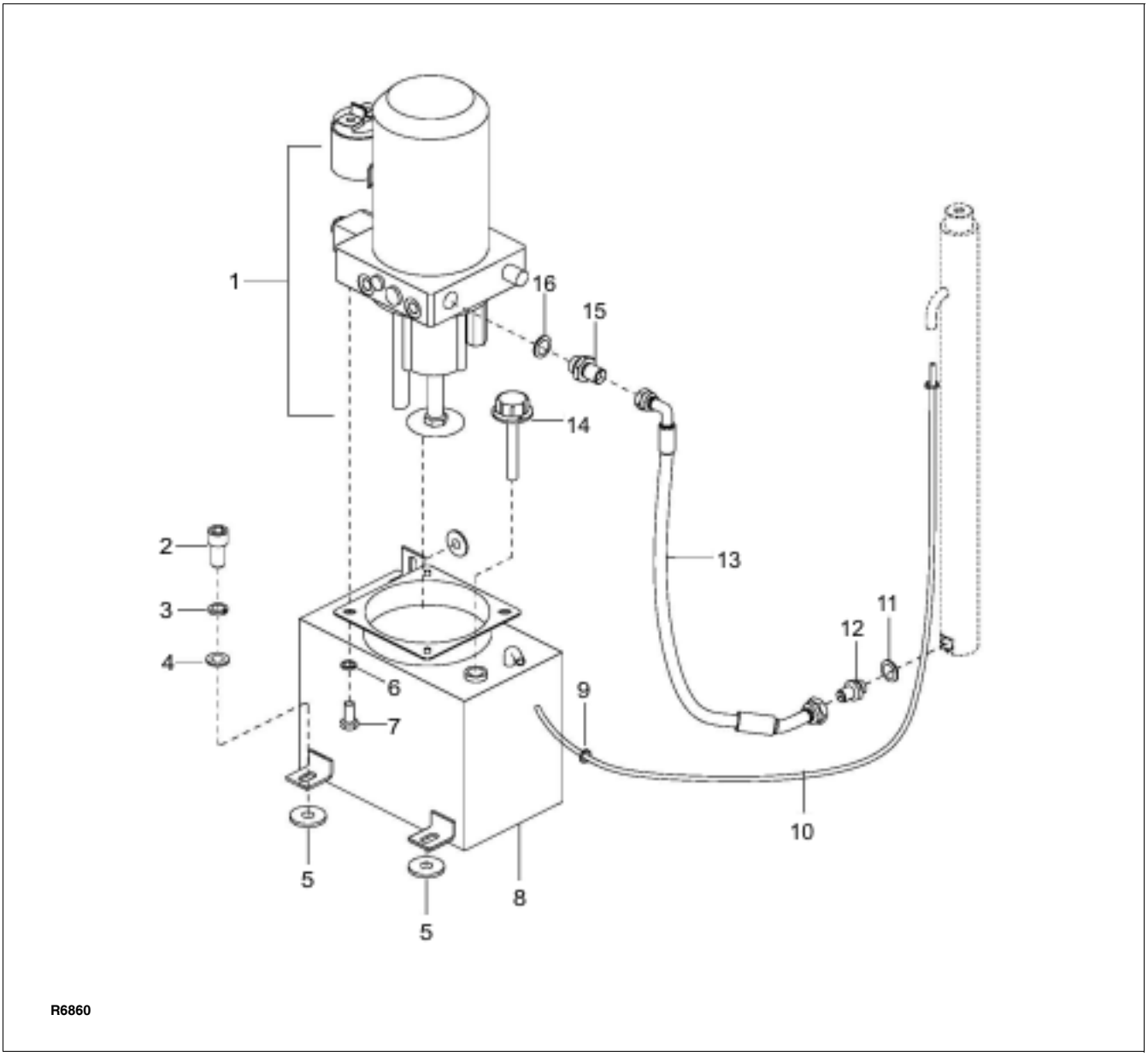

Figure 12-17 Hydraulic System (Mono)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	PUMP & MOTOR ASSY (FIGURE 12-19)	REF
2	0000-000109-00	SCREW, M8 X 16	3
3	0000-000159-00	WASHER, LOCK, M8	3
4	0000-000176-00	WASHER, FLAT, M8	3
5	2112-410004-00	SPACER	3
6	0000-000056-00	WASHER, LOCK, M6	4
7	0000-000259-00	SCREW, M6 X 16	4
8	2108-411000-00	OIL RESERVOIR	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	0000-000472-00	CLAMP	2
10	2108-400002-00-01	HOSE	1
11	0000-000069-00	SEAL	1
12	2701-161600-00	CONNECTOR	1
13	2108-400001-00	HOSE	1
14	2112-410002-00	BREATHER	1
15	2702-381600-00	CONNECTOR	1
16	0000-000634-00	SEAL	1

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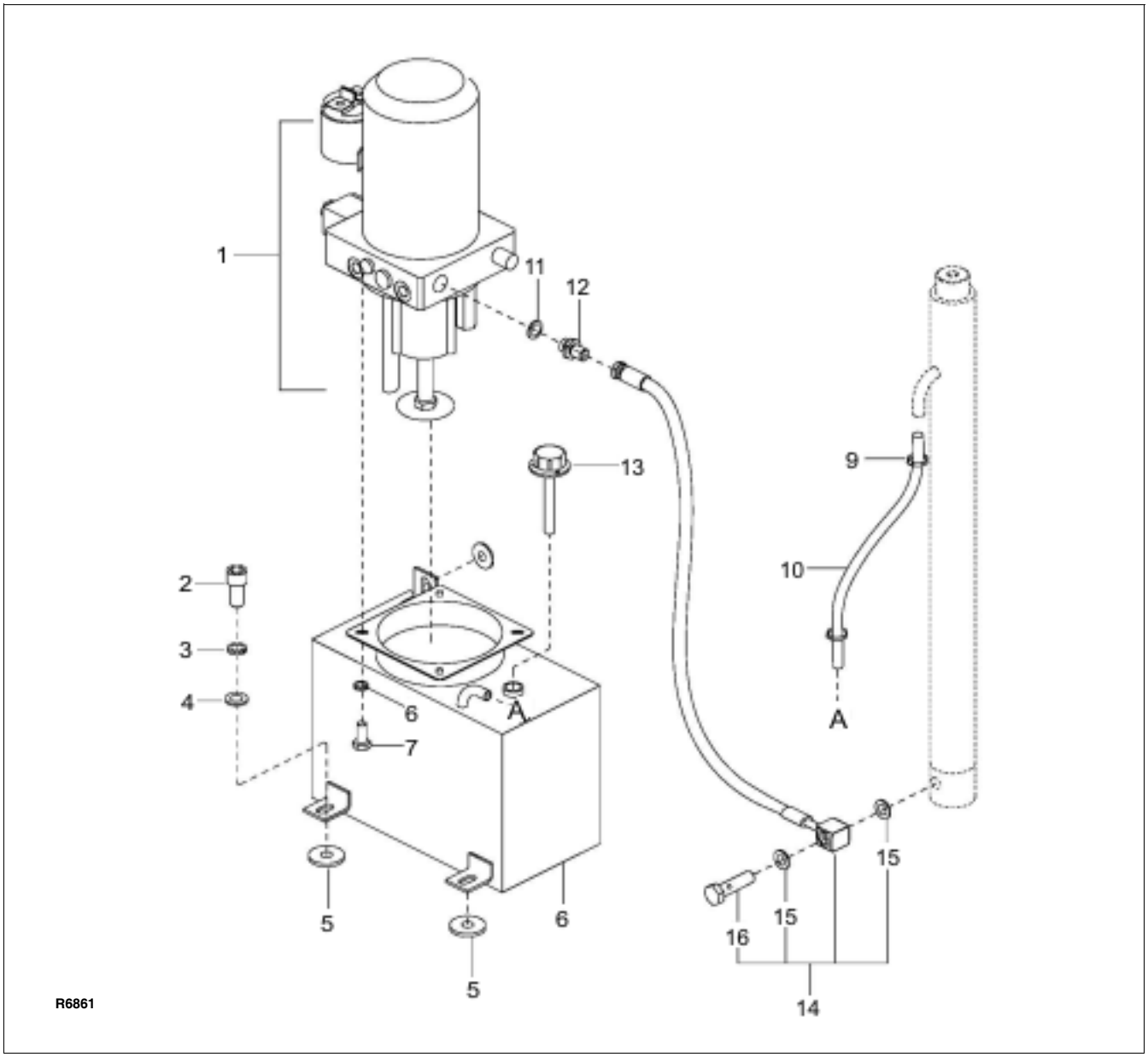

Figure 12-18 Hydraulic System (Telescopic)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	—	PUMP & MOTOR ASSY (FIGURE 12-19)	REF
2	0000-000109-00	SCREW, M8 X 16	3
3	0000-000159-00	WASHER, LOCK, M8	3
4	0000-000176-00	WASHER, FLAT, M8	3
5	2112-410004-00	SPACER	3
6	0000-000056-00	WASHER, LOCK, M6	4
7	0000-000259-00	SCREW, M6 X 16	4
8	2108-411000-60	OIL RESERVOIR	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	0000-000472-00	CLAMP	2
10	2108-400002-00-03	HOSE (96 IN LIFT)	1
10	2108-400002-00-04	HOSE (116 IN LIFT)	1
11	0000-000634-00	SEAL	1
12	2702-381400-00	CONNECTOR	1
13	2112-410002-00	BREATHER	1
14	2108-400001-60	HOSE	1
15	0000-000069-00	• SEAL	1
16	2108-400001-60	• CONNECTOR	1

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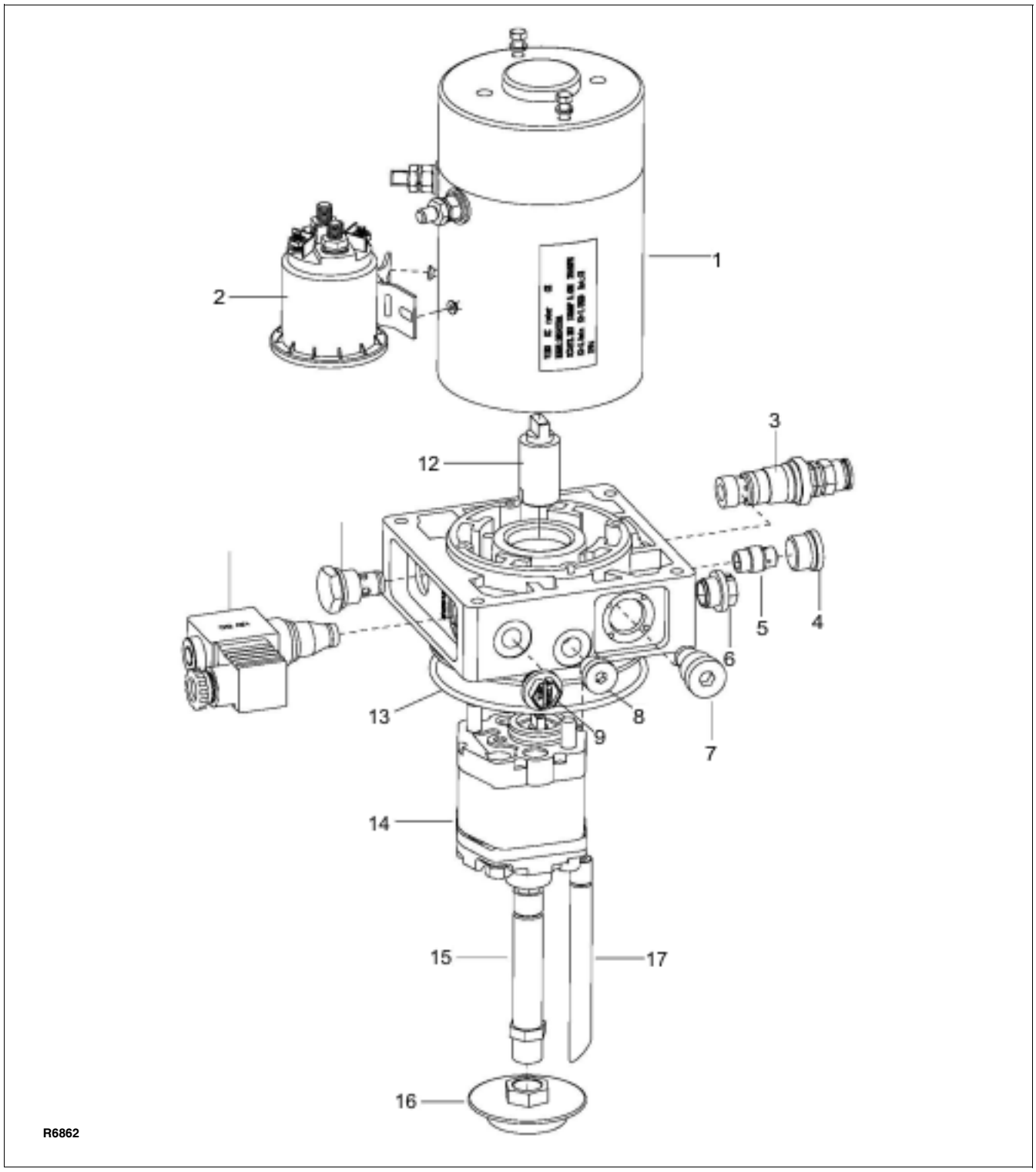

Figure 12-19 Pump & Motor Assy

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	2108-422000-00	PUMP & MOTOR ASSY	1
1	2108-422001-00	• MOTOR	1
2	2108-422002-00	• SOLENOID	1
3	2108-422003-00	• RELIEF VALVE	1
4	2108-422004-00	• PLUG	1
5	2108-422005-00	• VALVE	1
6	2108-422006-00	• PLUG, PLASTIC	1
7	2108-422007-00	• PLUG, CHECK VALVE	1
8	2108-422008-00	• PLUG	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
9	2108-422009-00	• PLUG, PLASTIC	1
10	2108-422010-00	• SOLENOID VALVE	1
11	2108-422011-00	• CHECK VALVE	1
12	2108-422012-00	• CONNECTOR	1
13	0000-000763-00	• O-RING	1
14	2108-422013-00	• PUMP, GEAR	1
15	2108-422014	• SUCTION HOSE	1
16	2108-422015-00	• SUCTION FILTER	1
17	2108-422016-00	• ESCAPE VALVE	1

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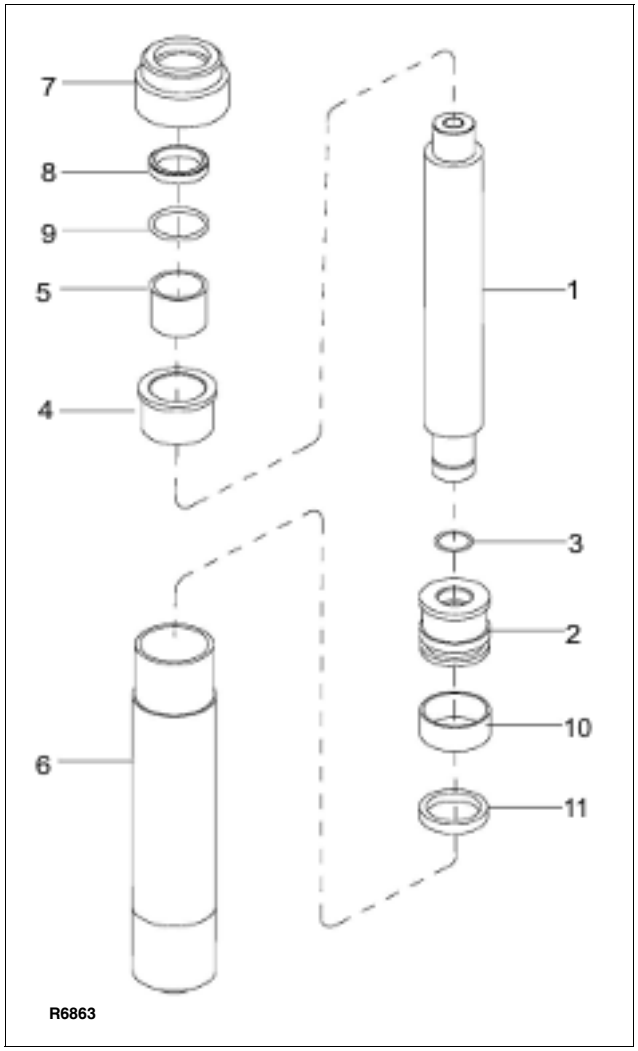

Figure 12-20 Lift Cylinder (Mono)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	2110-410000-00-01	LIFT CYLINDER	1
1	—	• PISTON ROD	1
2	2125-410002-00	• PISTON	1
3	2125-410003-00	• O-RING	1
4	2125-410006-00	• BUSHING	1
5	0000-000711-00	• BEARING, 3530	1
6	—	• CYLINDER TUBE	1
7	2125-410004-0A	• GLAND NUT	1
8	0000-000084-00	• WIPER RING	1
9	0000-000370-00	• O-RING	1
10	2125-410005-00	• GUIDE RING	2
11	0000-000512-00	• SEAL	1
—	2110-2Bg	SEAL KIT (INCLUDES 3,4,9)	

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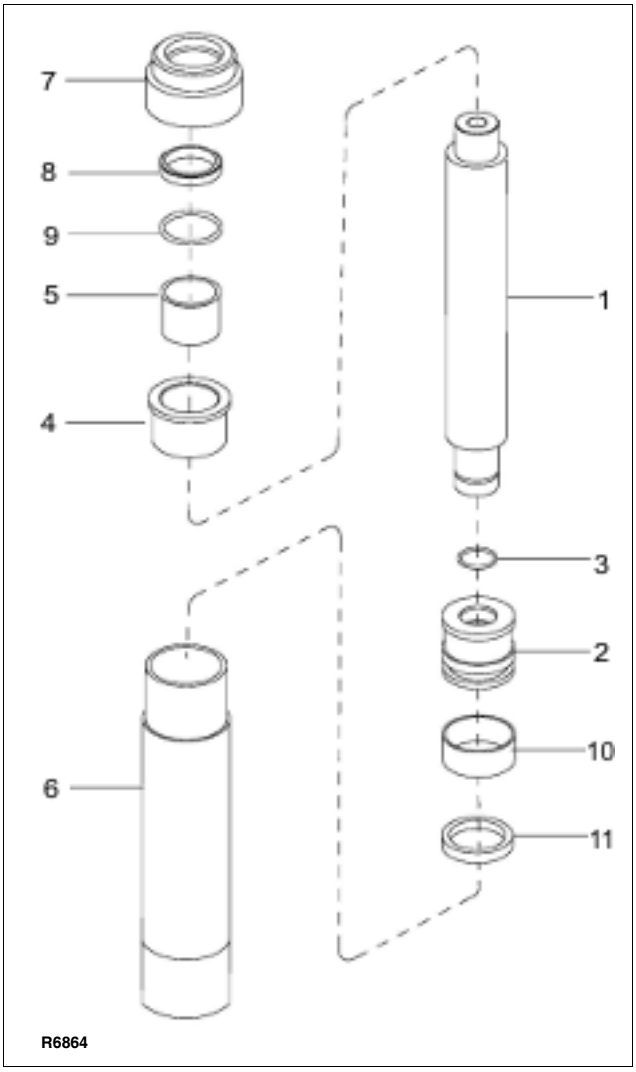

Figure 12-21 Lift Cylinder (Telescopic)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
—	2108-410000-60-01	LIFT CYLINDER (96 IN LIFT)	1
—	2108-410000-60-02	LIFT CYLINDER (116 IN LIFT)	1
1	—	• PISTON ROD	1
2	2125-410002-00	• PISTON	1
3	2125-410003-00	• O-RING	1
4	2125-410006-00	• BUSHING	1
5	0000-000711-00	• bearing, 3530	1
6	—	• CYLINDER TUBE	1
7	2125-410004-0A	• GLAND NUT	1
8	0000-000084-00	• WIPER RING	1
9	0000-000370-00	• O-RING	1
10	2125-410005-00	• GUIDE RING	2
11	0000-000512-00	• SEAL	1
—	2110-2Bg	SEAL KIT (INCLUDES 3,4,9)	

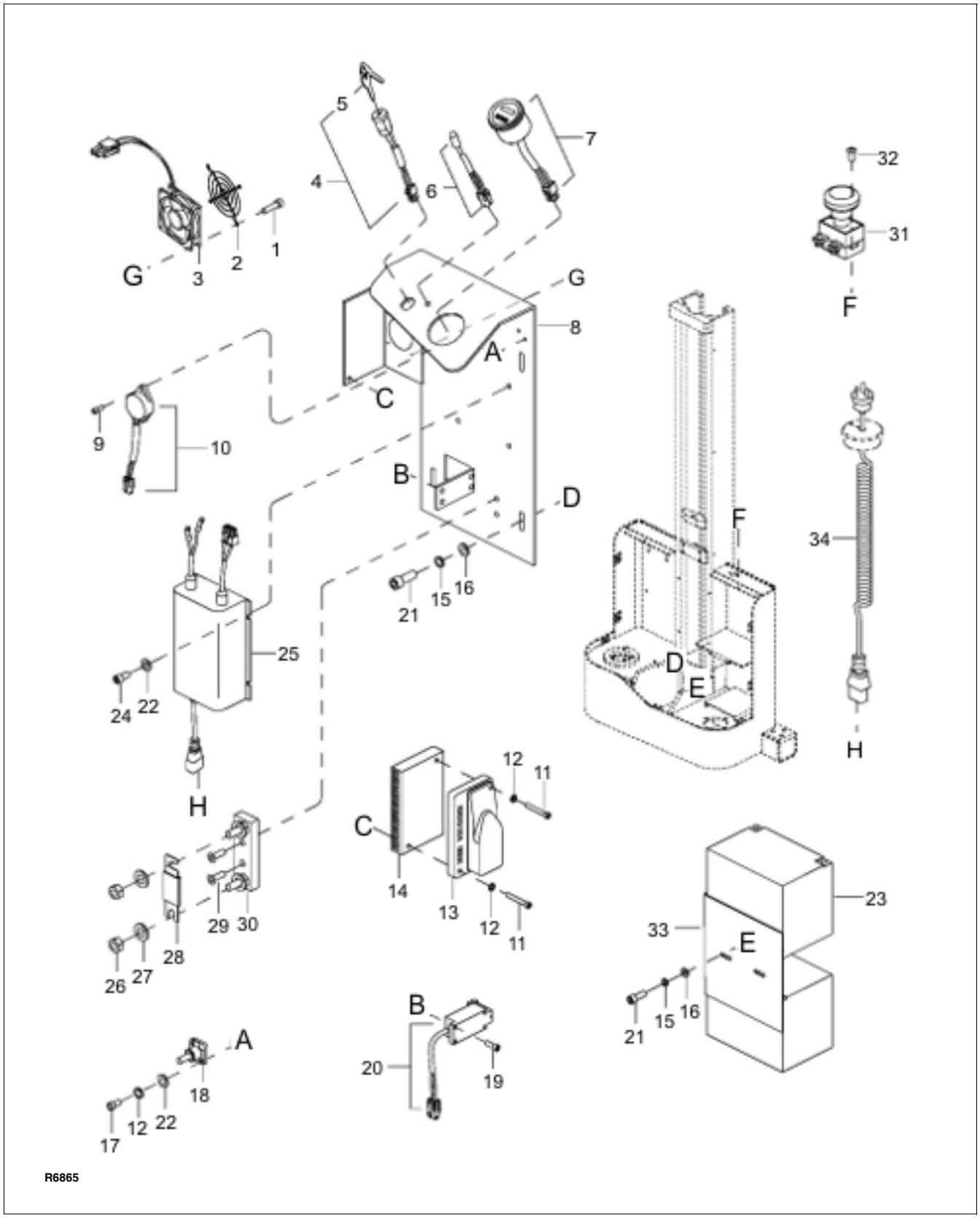

Figure 12-22 Electrical System (Mono)

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	0000-000121-00	SCREW, M4 X 35	4
2	1115-500007-00	GUARD	1
3	1115-520007-00	FAN	1
4	1115-520003-00	KEY SWITCH	1
5	1120-500016-00	• KEY	1
6	1115-520013-00	LED INDICATOR	1
7	1115-520005-00	BATTERY INDICATOR (WITHOUT HOURMETER)	1
	1115-520005-20	HARNESS, INDICATOR (WITHOUT HOURMETER)	1
7	1115-520005-30	BATTERY INDICATOR (WITH HOURMETER)	1
8	2108-510000-00	BRACKET	1
9	0000-000666-00	SCREW, M3 X 8	2
10	1115-520015-00	BUZZER	1
11	0000-000664-00	SCREW, M4 X 40	2
12	0000-000122-00	WASHER, LOCK, M4	4
13	1115-510004-00	CONTROLLER	1
14	1115-510005-00	HEATSINK	1
15	0000-000159-00	WASHER, LOCK, M8	6

INDEX NO.	PART NO.	PART NAME	NO. REQD.
16	0000-000176-00	WASHER, FLAT, M8	6
17	0000-000378-00	SCREW, M4 X 16	2
18	1120-500005-00	TERMINAL	1
19	0000-000010-00	SCREW, M5 X 6	4
20	2108-520006-00	SWITCH, LIMIT	1
21	0000-000109-00	SCREW, M8 X 16	6
22	0000-000702-00	WASHER, FLAT, M4	6
23	—	BATTERY	2
24	0000-000088-00	SCREW, M4 X 8	4
25	2108-520014-00	CHARGER ASSEMBLY	1
26	0000-000196-00	NUT, M8	2
27	0000-000194-00	WASHER, FLAT, M8	2
28	1115-510003-00	FUSE, 100A	1
29	0000-000126-00	SCREW, M6 X 16	2
30	1120-540001-00	FUSE HOLDER	1
31	1115-510008-00	EMERGENCY STOP SWITCH	1
32	0000-000616-00	SCREW, M5 X 10	2
33	2108-540000-00	BRACKET	1
34	1115-500006-10	CHARGER CABLE	1

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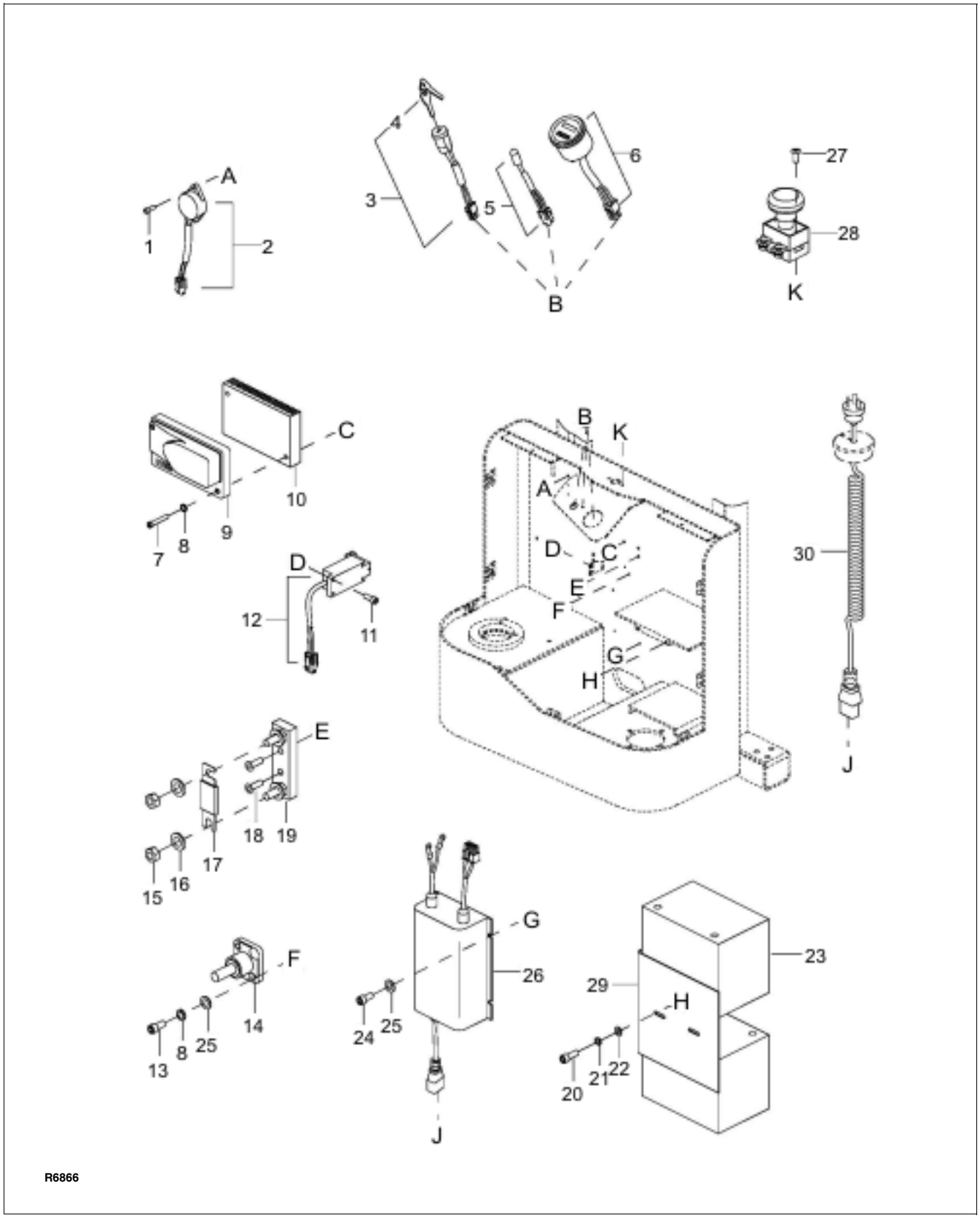

Figure 12-23 Electrical System (Telescopic)

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INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	0000-000666-00	SCREW, M3 X 8	2
2	1115-520015-00	BUZZER	1
3	1115-520003-00	KEY SWITCH	1
4	1120-500016-00	• KEY	1
5	1115-520013-00	LED INDICATOR	1
6	1115-520005-00	BATTERY INDICATOR (WITHOUT HOURMETER)	1
	1115-520005-20	HARNESS, INDICATOR (WITHOUT HOURMETER)	1
6	1115-520005-30	BATTERY INDICATOR (WITH HOURMETER)	1
7	0000-000664-00	SCREW, M4 X 40	2
8	0000-000122-00	WASHER, LOCK, M4	4
9	1115-510004-00	CONTROLLER	1
10	1115-510005-00	HEATSINK	1
11	0000-000010-00	SCREW, M5 X 6	4
12	2108-520006-00	SWITCH, LIMIT	1
13	0000-000378-00	SCREW, M4 X 16	2
14	1120-500005-00	TERMINAL	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
15	0000-000196-00	NUT, M8	2
16	0000-000194-00	WASHER, FLAT, M8	2
17	1115-510003-00	FUSE, 100A	1
18	0000-000126-00	SCREW, M6 X 16	2
19	1120-540001-00	FUSE HOLDER	1
20	0000-000109-00	SCREW, M8 X 16	6
21	0000-000159-00	WASHER, LOCK, M8	6
22	0000-000176-00	WASHER, FLAT, M8	6
23	—	BATTERY	2
24	0000-000088-00	SCREW, M4 X 8	4
25	0000-000702-00	WASHER, FLAT, M4	6
26	2108-520014-00	CHARGER ASSEMBLY	1
27	0000-000616-00	SCREW, M5 X 10	2
28	1115-510008-00	EMERGENCY STOP SWITCH	1
29	2108-540000-00	BRACKET	1
30	1115-500006-10	CHARGER CABLE	1

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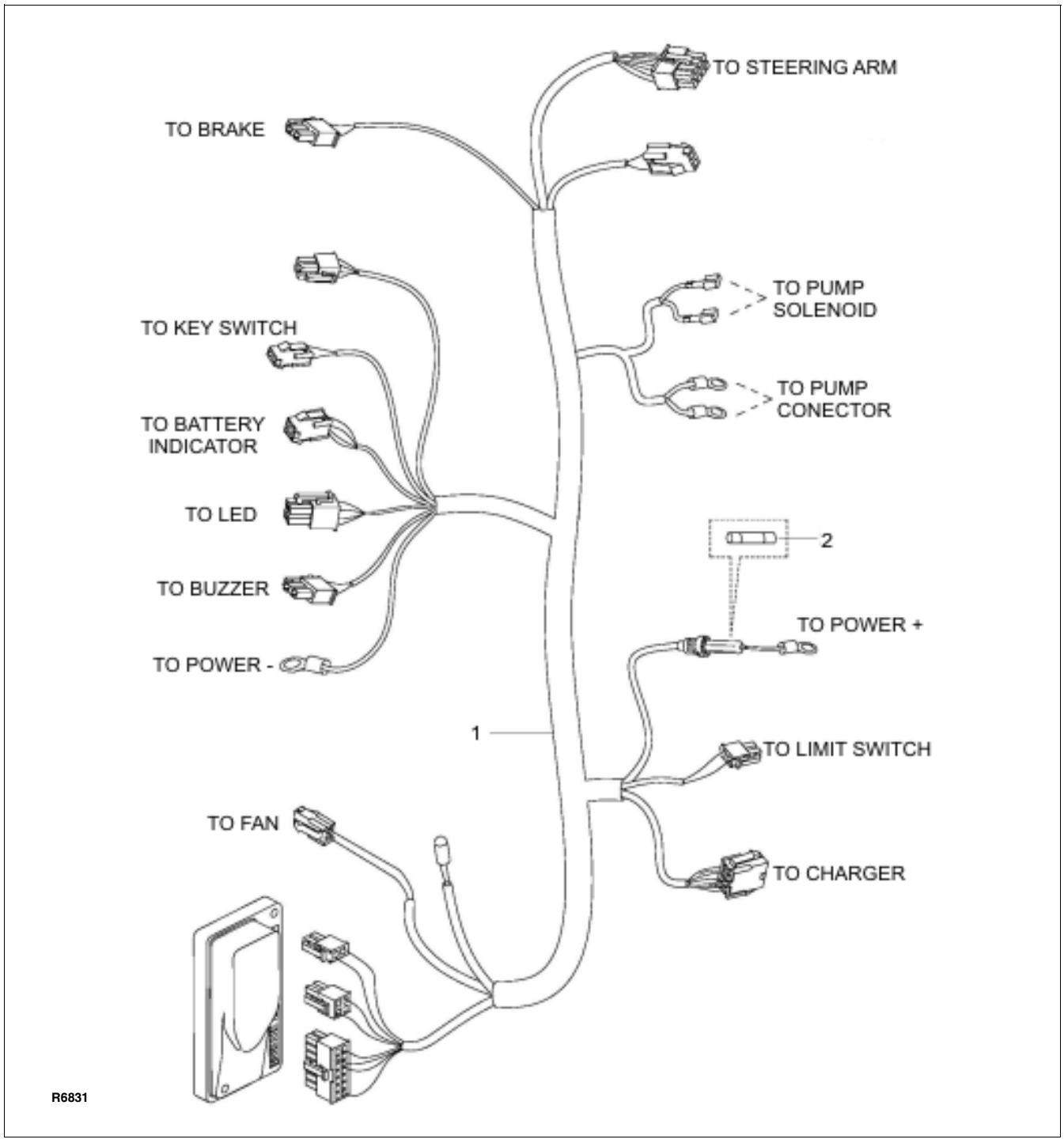

Figure 12-24 Wiring Harness (Mono)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-520001-00	HARNESS, MAIN	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
2	1120-500010-00	FUSE, 10A	

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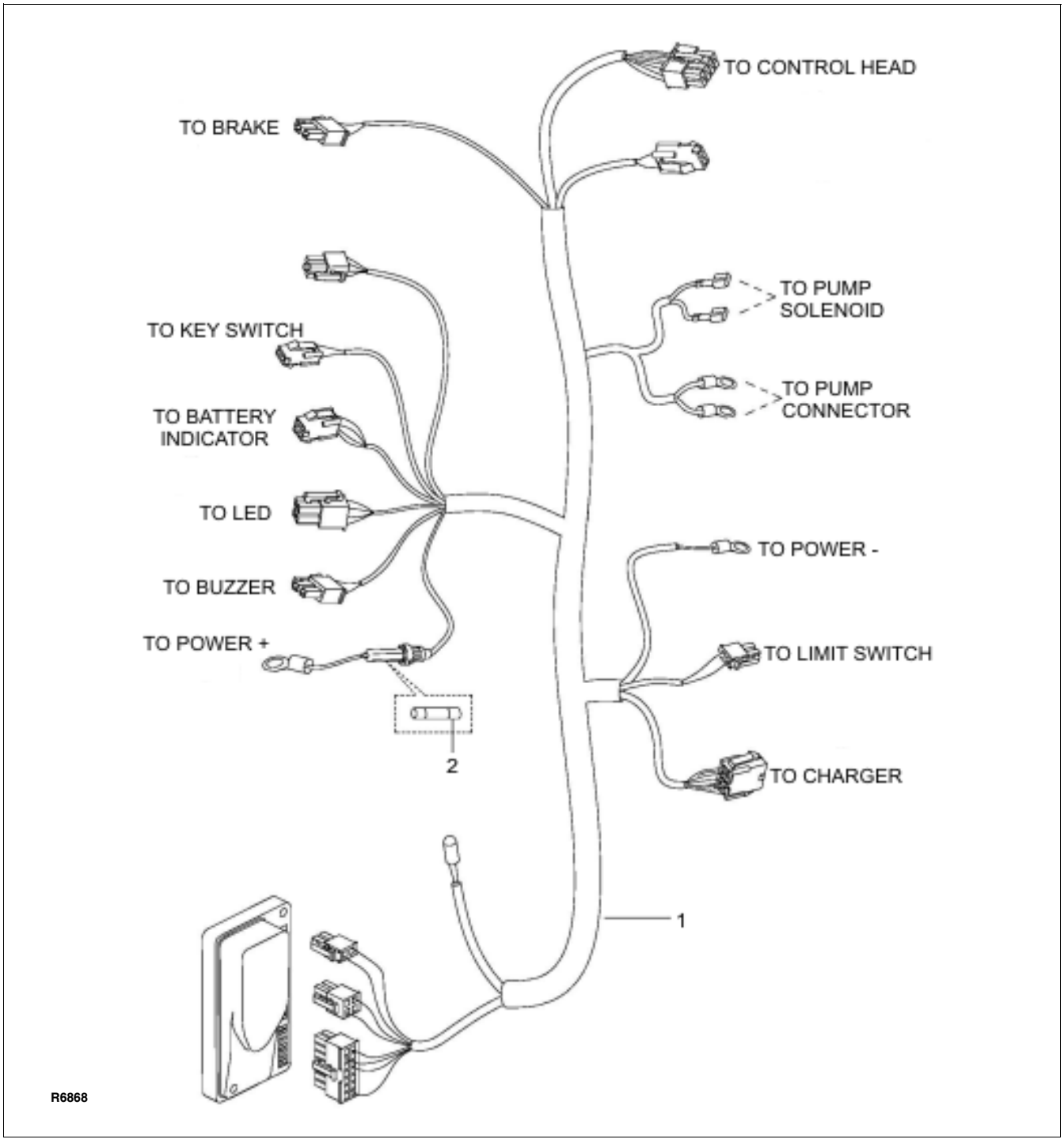

Figure 12-25 Wiring Harness (Telescopic)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-520001-60	HARNESS, MAIN	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
2	1120-500010-00	FUSE, 10A	

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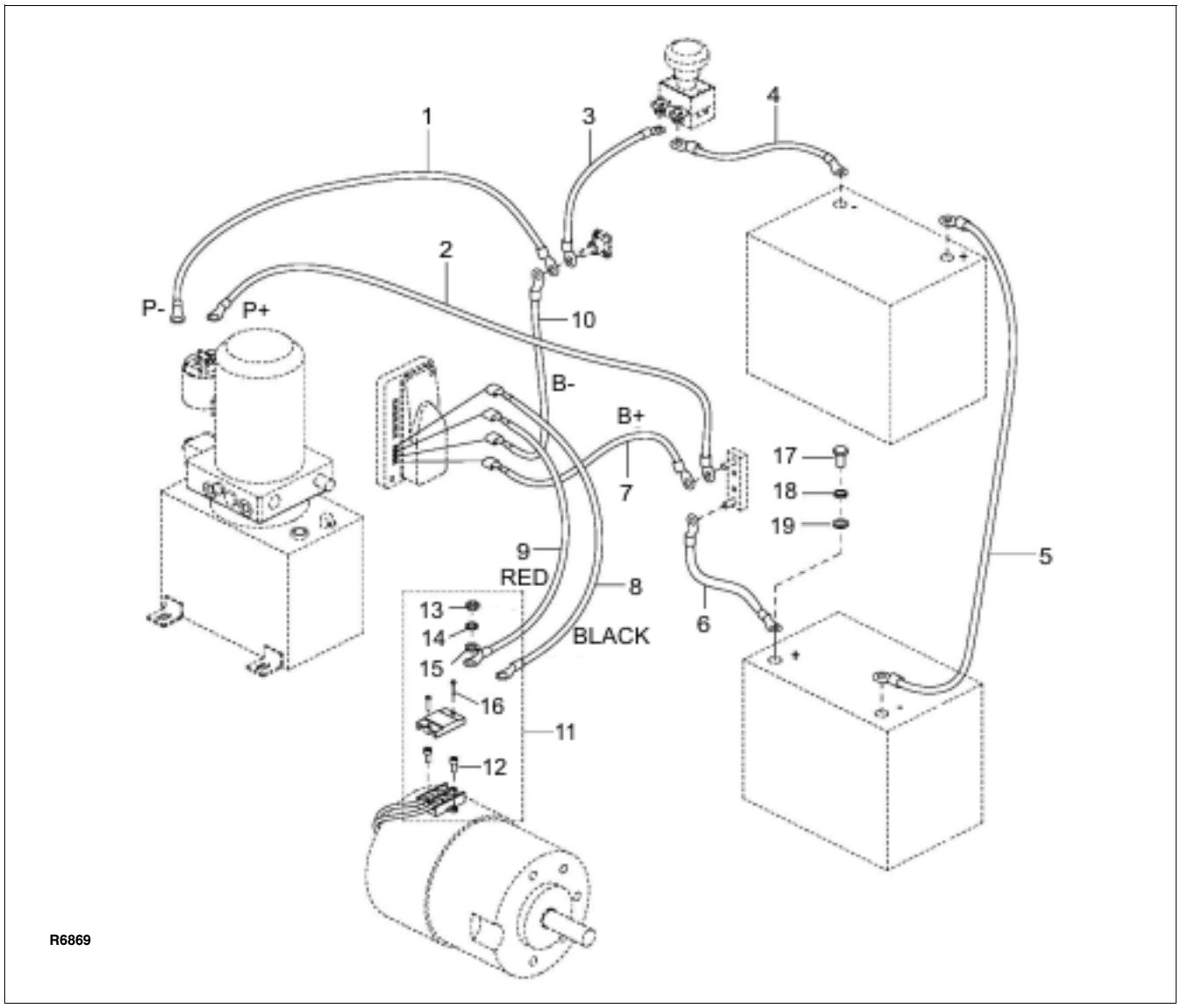

Figure 12-26 Wiring Cables (Mono)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-530006-00	CABLE P-	1
2	2108-530005-00	CABLE P+	1
3	2108-530009-00	CABLE C3	1
4	2108-530010-00	CABLE C4	1
5	2108-530008-00	CABLE C2	1
6	2108-530007-00	CABLE C1	1
7	2108-530001-00	CABLE B+	1
8	2108-530004-00	CABLE M2	1
9	2108-530003-00	CABLE M1	1
10	2108-530002-00	CABLE B-	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
11	1115-231000-00	BRACKET	1
12	0000-000004-00	• SCREW, M5 X 12	2
13	0000-000108-00	• NUT, M6	2
14	0000-000056-00	• WASHER, LOCK, M6	2
15	0000-000380-00	• WASHER, FLAT, M6	2
16	0000-000646-00	• SCREW, M4 X 10	2
17	0000-000277-00	BOLT, M8 X 25	4
18	0000-000159-00	WASHER, LOCK, M8	4
19	0000-000176-00	WASHER, FLAT, M8	4

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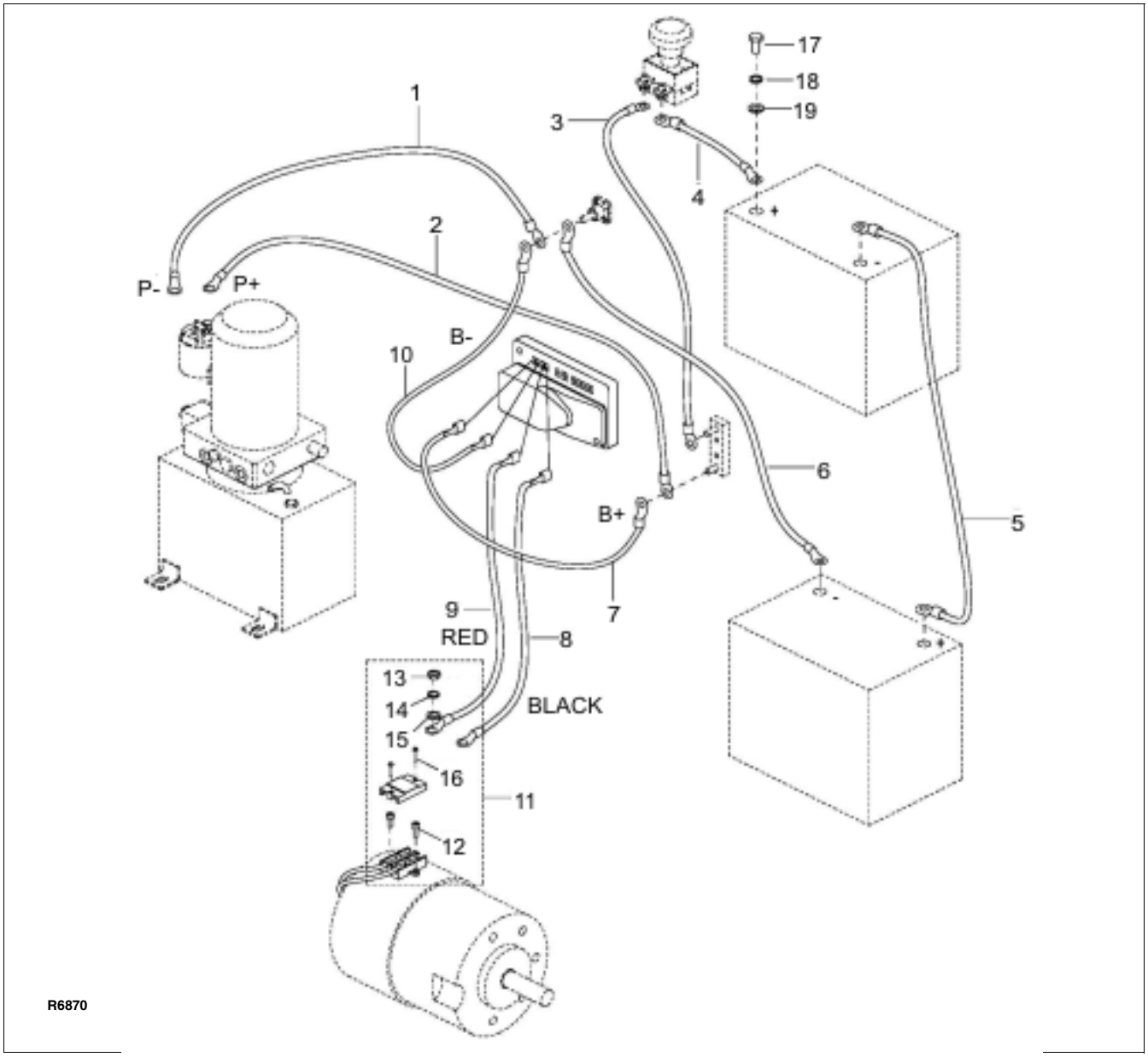

Figure 12-27 Wiring Cables (Telescopic)

INDEX NO.	PART NO.	PART NAME	NO. REQD.
1	2108-530006-60	CABLE P-	1
2	2108-530005-60	CABLE P+	1
3	2108-530009-60	CABLE C3	1
4	2108-530010-60	CABLE C4	1
5	2108-530008-00	CABLE C2	1
6	2108-530007-60	CABLE C1	1
7	2108-530001-60	CABLE B+	1
8	2108-530004-60	CABLE M2	1
9	2108-530003-60	CABLE M1	1
10	2108-530002-60	CABLE B-	1

INDEX NO.	PART NO.	PART NAME	NO. REQD.
11	1115-231000-00	BRACKET	1
12	0000-000004-00	• SCREW, M5 X 12	2
13	0000-000108-00	• NUT, M6	2
14	0000-000056-00	• WASHER, LOCK, M6	2
15	0000-000380-00	• WASHER, FLAT, M6	2
16	0000-000646-00	• SCREW, M4 X 10	2
17	0000-000277-00	BOLT, M8 X 25	4
18	0000-000159-00	WASHER, LOCK, M8	4
19	0000-000176-00	WASHER, FLAT, M8	4

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