

OWNER'S MANUAL

EPS-30 POWERED DRIVE STRADDLE TRUCK



ACTUAL PRODUCT MAY NOT APPEAR EXACTLY AS SHOWN



WARNING

Do not operate or service this product unless you have read and fully understand the entire contents of this manual. Failure to do so may result in property damage, bodily injury or death.

BLUE GIANT[®]

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1.0 OWNER'S PURCHASE RECORD

OWNER'S PURCHASE RECORD	
Please record information for future inquiries and to validate warranty. (See Section 2.1 for warranty validation)	
Dealer:	Date in Service:
	Number of Units:
Owner's Name:	Order Number:
Serial Number:	Year of Construction:

The manufacturer offers a full line of dock levelers, dock safety equipment, accessories, ergonomic and scissor lift equipment, seals and shelters, and industrial trucks. Concurrent with a continuing product improvement program, specifications are subject to change without notice (see section 2.2 of this manual). Please contact the manufacturer for latest information. Some features illustrated may be optional in certain market areas.

1.1 SAFETY PROCEDURES

1. 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.
2. 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.
3. 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.
4. Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.
5. 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.
6. 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.
7. Use special care when operating on ramps travel slowly, and do not angle or turn. Travel with load downhill.
8. Do not overload truck. Check nameplate for capacity and load center information.
9. 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.
10. 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.
11. 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.
12. Elevate forks or other lifting mechanism only to pick up or stack a load. Watch out for obstructions, especially overhead.
13. 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.
14. Do not allow anyone to stand or pass under load or lifting mechanism.
15. When leaving truck, neutralize travel control, fully lower lifting mechanism and set brake. When leaving truck unattended, also shut off power.

2.0 INTRODUCTION

The following is a quick reference to important procedures that must be followed while using the dock equipment. It is not intended to cover, or suggest that it does cover, all procedures necessary to ensure safe operation. All operators should be aware of and abide by all workplace safety regulations applicable to the operation of the dock equipment. These laws and regulations include but are not limited to:

- The Occupational Safety and Health Act (USA)
- Occupational Safety and Health Acts for Individual States (USA)
- Canadian Material Handling Regulations

For additional information on these regulations as well as industry standards that may apply to this product, please contact:

American National Standards Institute (ANSI)



1430 Broadway
New York, NY 10018
Telephone: (212) 642-4900

Also a member of:



Loading Dock Equipment Manufacturers
A Product Section of Material Handling Industry of America
A Division of Material Handling Industry
8720 Red Oak Blvd, Suite 201
Charlotte, NC, 28217-3992
Telephone: (704) 676-1190

2.1 WARRANTY INFORMATION

Thank you for purchasing Blue Giant products. We appreciate your business, and are confident that our product will serve you for many years to come. In the event that you experience a problem with our product, our Warranty Center is here to support the Blue Giant product(s) that you have purchased.

To validate warranty on recently purchased equipment, please complete and submit your information with our online Warranty Registration at www.bluegiant.com.

DEALER INFORMATION

Name:

Contact:

Telephone:

For more information about Blue Giant Warranty Support, please contact your local Blue Giant Equipment dealer, representative or authorized partner near you. You may also visit www.bluegiant.com or phone 1.905.457.3900.

* Note that failure to validate warranty at the time of receipt can seriously affect the outcome of any claim.

2.2 EXCLUSION OF LIABILITY

The manufacturer assumes no liability for damage or injury to persons or property which occur as a result of defects or faults in or incorrect use of dock equipment. The manufacturer also assumes no liability for lost profits, operating downtimes, or similar indirect losses incurred by the purchaser. Injury to third parties, irrespective of its nature, is not subject to compensation.

The manufacturer reserves the right to make changes at any time to the modules, components, and accessories, concurrent with its continuing product development program. Specifications, operating instructions, and illustrations included in this manual are subject to change without notice. Please contact manufacturer for the latest information.

2.3 MANUFACTURER'S NOTE

This industrial truck has been carefully inspected and tested at the manufacturer's plant prior to shipment, but should be checked upon receipt for transport damage. Any observed transport damage is to be listed on the signed copy of the freight document. Notify the freight forwarder of any damage WITHIN 48 HOURS.

3.0 WARNING

1. 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.
2. 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.
3. 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.
4. Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.
5. 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.
6. Travel with lifting mechanism as low as possible.
7. Always look in direction of travel. Keep a clear view, and when load interferes with visibility, travel with load trailing.
8. Use special care when operating on ramps travel slowly, and do not angle or turn. Travel with load downhill.
9. Do not overload truck. Check nameplate for capacity and load center information.
10. 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.
11. Do not handle unstable or loosely stacked loads.
12. Use special care when handling long, high or wide loads, to avoid losing the load, striking bystanders, or tipping the truck.
13. 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.
14. Elevate forks or other lifting mechanism only to pick up or stack a load. Watch out for obstructions, especially overhead.
15. 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.
16. Do not allow anyone to stand or pass under load or lifting mechanism.
17. When leaving truck, neutralize travel control, full lower lifting mechanism and set brake. When leaving truck unattended, also shut off power.

4.0 DESCRIPTION

4.1 INTRODUCTION

This publication describes the 24 volt lift truck distributed by Blue Giant Equipment Corporation. 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 EPS-30 lift truck.

4.2 GENERAL DESCRIPTION

The self-propelled truck, **Figure 1-2**, lifts and transports payloads up to 3000 pounds on rigid forks. The forward and reverse motion is controlled by either of two controller levers mounted on the control head. Stopping and turning is controlled by the steering arm. Lift and Lower is controlled by pushbuttons on the control head. The battery powered lift truck is quiet and without exhaust fumes.

The reversible AC motor propels the lift truck in forward or reverse direction throughout the available speed range.

The EPS-30 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.

4.3 SAFETY FEATURES

The EPS-30 is designed engineered to provide maximum safety for operator and payload. Some of the safety features incorporated into the design are:

- Dead-man brake to apply the brake and cut off drive power when the steering arm is released.
- Belly button switch to reverse truck should the operator accidentally pin himself against a wall or obstruction when backing up in slow speed.
- Emergency brake switch to apply the brake and cut off drive power when depressed.
- 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 battery disconnect 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.

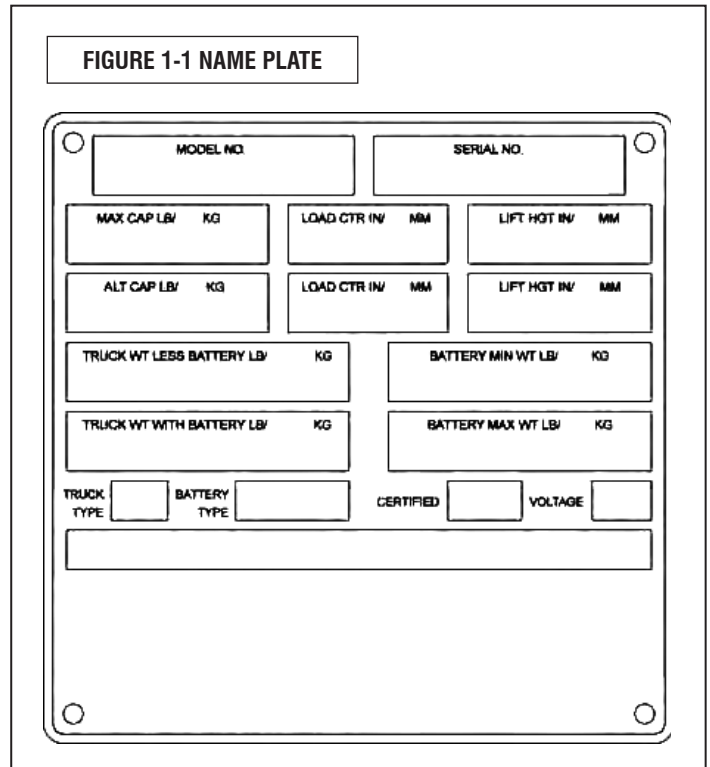
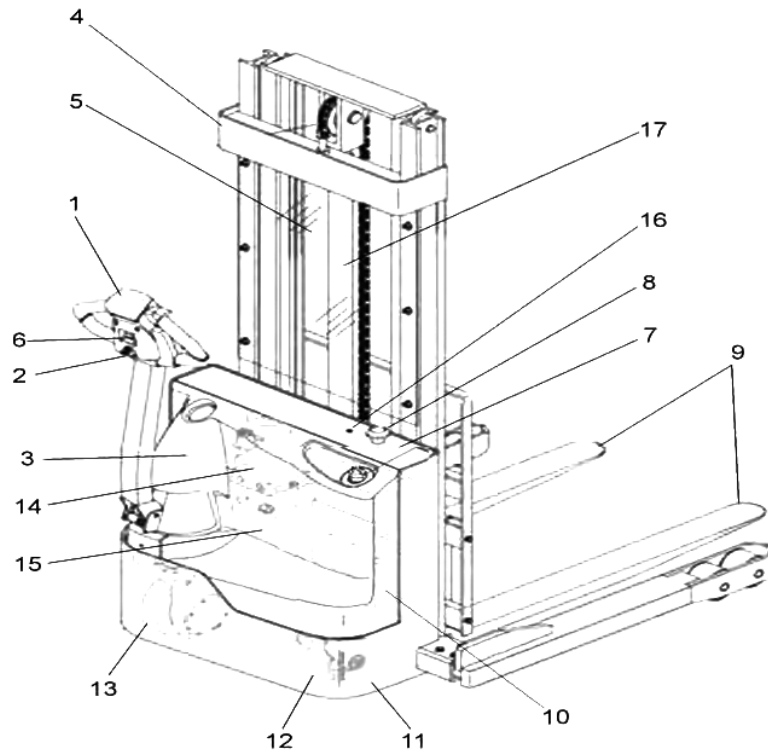


FIGURE 1-2 EPS-30 LIFT TRUCK



ITEM	COMPONENT
1	Control handle
2	Key switch
3	Cover
4	Mast
5	Windshield
6	Battery indicator
7	Battery charger connector
8	Emergency disconnect switch
9	Forks
10	Battery
11	Chassis
12	Caster
13	Drive wheel
14	Pump motor
15	Tank
16	LED indicator
17	Lift cylinder

5.0 OPERATION

5.1 GENERAL

This section gives detailed operating instructions for the 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.

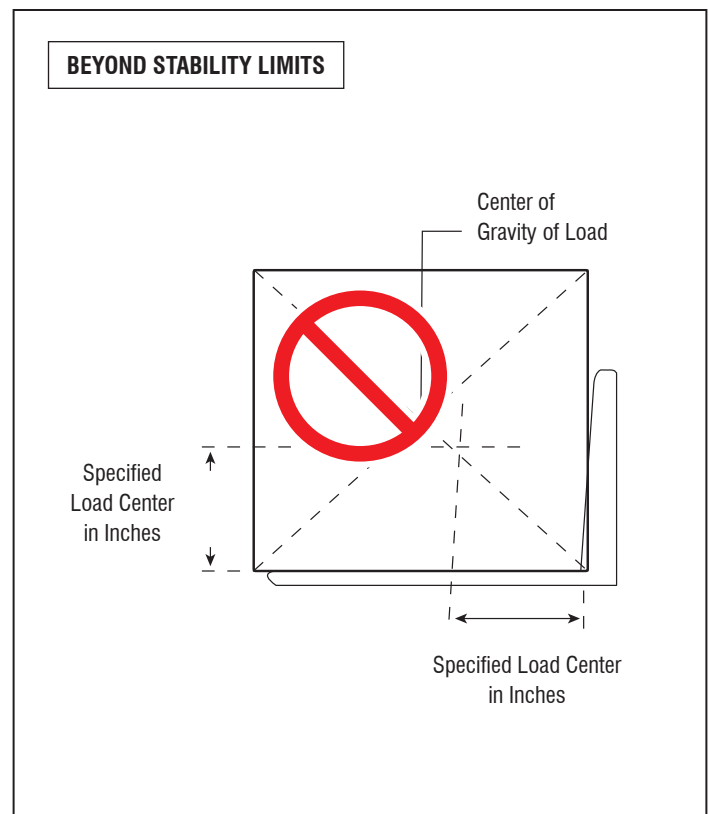
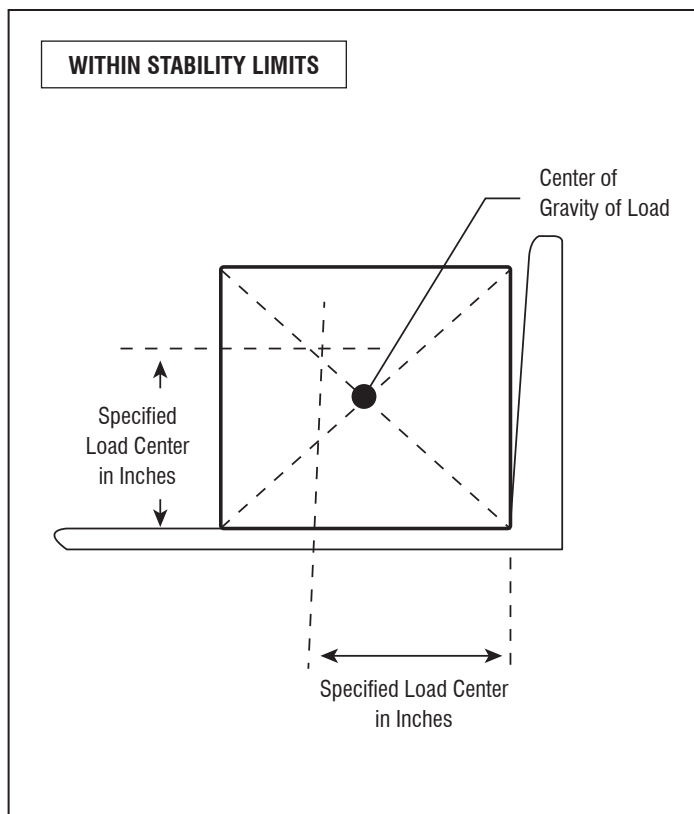
5.2 OPERATING PRECAUTIONS

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 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.
- 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.



5.3 BEFORE OPERATION

Table 2-1 covers important inspection points on the 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
<p>Periodic maintenance of this truck by a QUALIFIED SERVICE TECHNICIAN is required.</p>

 CAUTION
<p>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 6.</p>


 WARNING
<p>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.</p>

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.

FIGURE 2-2 SAMPLE OF OPERATOR CHECK LIST



**Stacker
Daily Operator Check List**

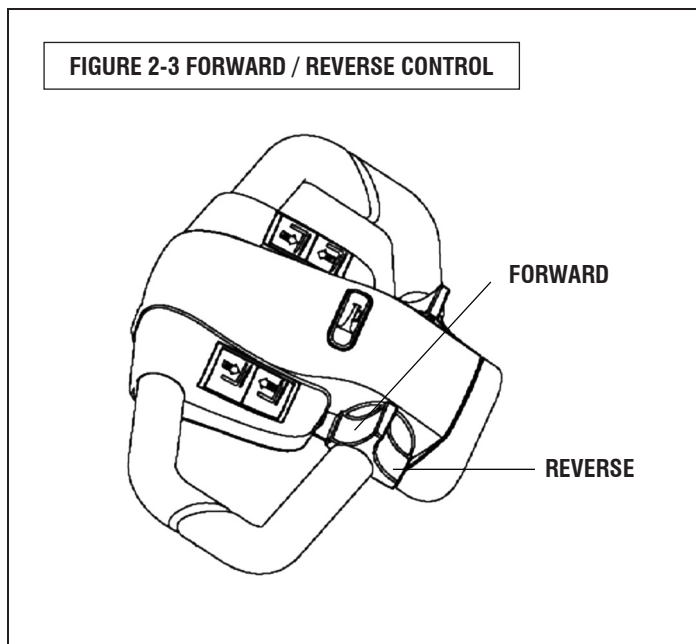
DATE: _____ OPERATOR: _____
 VEHICLE NUMBER: _____ MODEL NUMBER: _____
 DEPARTMENT: _____ SHIFT: _____
 HOUR METER READING - DRIVE: _____ HOIST: _____

CHECK	O.K. ✓	NEED MAINTENANCE
Tires		
Load Wheels		
Horn		
Lift / Lower Control		
Attachment Operation		
Forward and Reverse Controls		
Steering		
Electrical Brakes		
Hydraulic Leaks, Cylinders, Valves, Hoses, etc.		

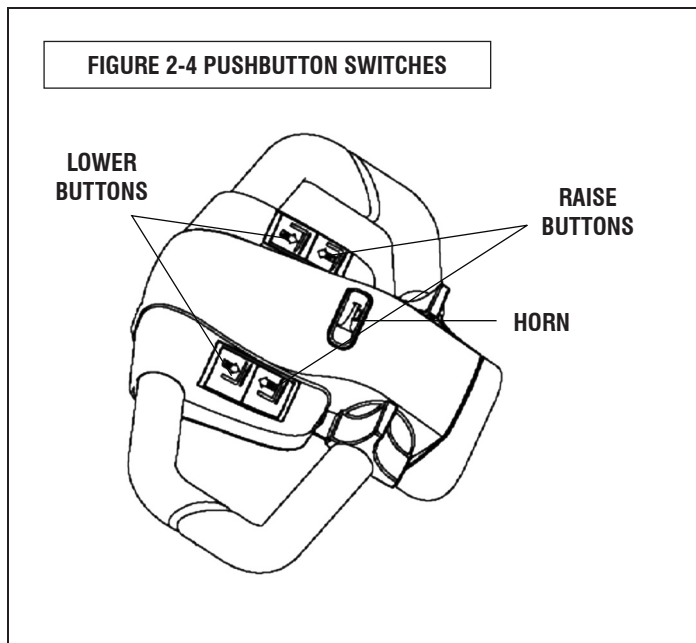
July 31, 2017

5.4 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.



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



5.5 DRIVING AND STOPPING PROCEDURES

1. Engage The Emergency Disconnect 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**.

5.5.1 STOPPING

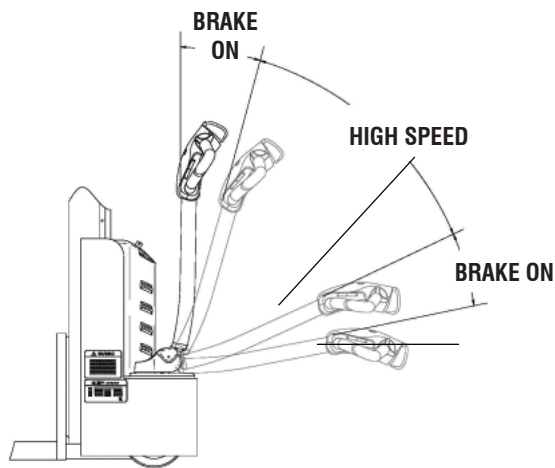
The stopping distance of the truck depends on the ground conditions. The driver must take this into account when operating the truck.

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 slow down 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 2-4**) All traction control power is shut off when the brake is engaged. When the steering arm is in the upright position, the brake acts as a parking brake. Deadman braking occurs when the handle is released and spring action raises steering arm to the upright position.
3. **Emergency braking:** Press the Emergency Disconnect 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.

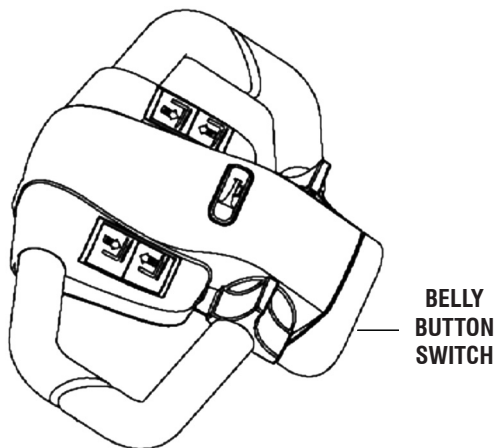
FIGURE 2-5 BRAKE ACTIVATION



5.6 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



5.7 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.

5.8 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.

5.9 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.

5.10 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 battery as necessary. Refer to battery care instructions, SECTION 6.

6.0 PLANNED MAINTENANCE

6.1 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 5, and refers any required servicing to a qualified maintenance technician who performs the scheduled maintenance and any required servicing.

6.2 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 Blue Giant Equipment Corporation Service Representative.

6.3 BATTERY CARE

6.3.1 GENERAL

The EPS-30 is 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 handling and disposal.

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

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

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.

TABLE 3-1 MONTHLY AND QUARTERLY INSPECTION AND SERVICE CHART

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" 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" of hub. Check for separation from hub.
Monthly	Inspect wiring for loose connections and damaged insulation.
Monthly	Inspect contactors for proper operation.
Monthly	Check deadman brake switch for proper operation.
Monthly	Check lift chain tension, lubrication and operation (see paragraph 6-7).
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 11)

6.3.2 SAFETY RULES

- Wear protective clothing, such as rubber apron, gloves, boots and goggles when performing any maintenance on batteries. Do not allow electrolyte to come in contact with eyes, skin, clothing or floor. If electrolyte comes in contact with eyes, flush immediately and thoroughly with clean water. Obtain medical attention immediately. Should electrolyte be spilled on skin, rinse promptly with clean water and wash with soap. A baking soda solution (one pound to one gallon of water) will neutralize acid spilled on clothing, floor or any other surface. Apply solution until bubbling stops and rinse with clean water.
- If truck is equipped with wet cell batteries, keep vent plugs firmly in place at all times except when adding water or taking hydrometer readings. Do not allow dirt, cleaning solution or other foreign material to enter cells. Impurities in electrolyte has a neutralizing effect reducing available charge.
- Do not bring any type of flame, spark, etc., near the battery. Gas formed while the battery is charging, is highly explosive. This gas remains in cell long after charging has stopped.
- Do not lay metallic or conductive objects on battery. Arcing will result.
- Do not touch non-insulated parts of DC output connector or battery terminals to avoid possible electrical shock.
- De-energize all AC and DC power connections before servicing battery.
- Do not charge a frozen battery.
- Do not use charger if it has been dropped or otherwise damaged.

6.3.3 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.

6.3.4 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 gases be released from the battery. Also, being a valve regulated battery, it never requires watering.

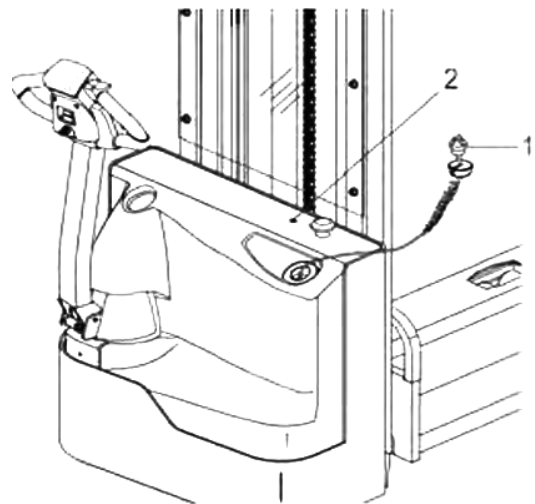
6.4 CHARGING BATTERIES

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

Proceed as follows:

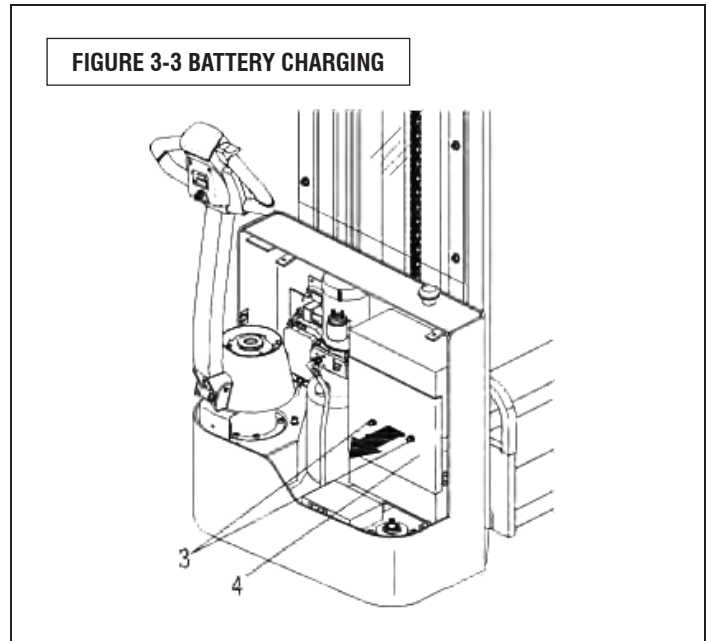
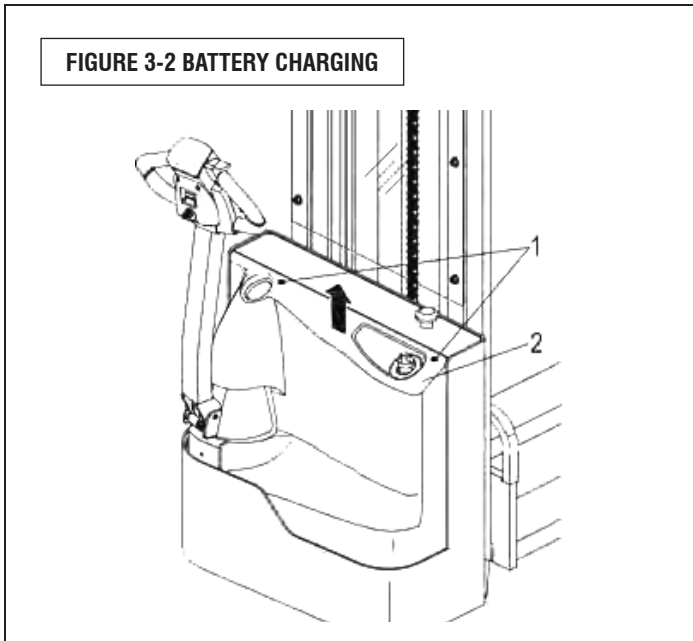
1. Park truck at charging station with carriage lowered and turn the key switch off.
2. Check the condition of the AC cord and battery cables. If there are any cuts in the cable, any exposed wires, loose plugs or connectors, DO NOT attempt to charge the batteries. Contact appropriate personnel for repairs 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) produces a permanent red light 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



6.5 BATTERIES REPLACEMENT

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).
3. Remove two nuts (3, **Figure 3-3**) and remove bracket (4).
4. Tag and disconnect the three cables from the batteries and replace the batteries.
5. Install in the reverse order of removal.



6.6 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.

6.7 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

FIGURE 3-4 LUBRICATION DIAGRAM

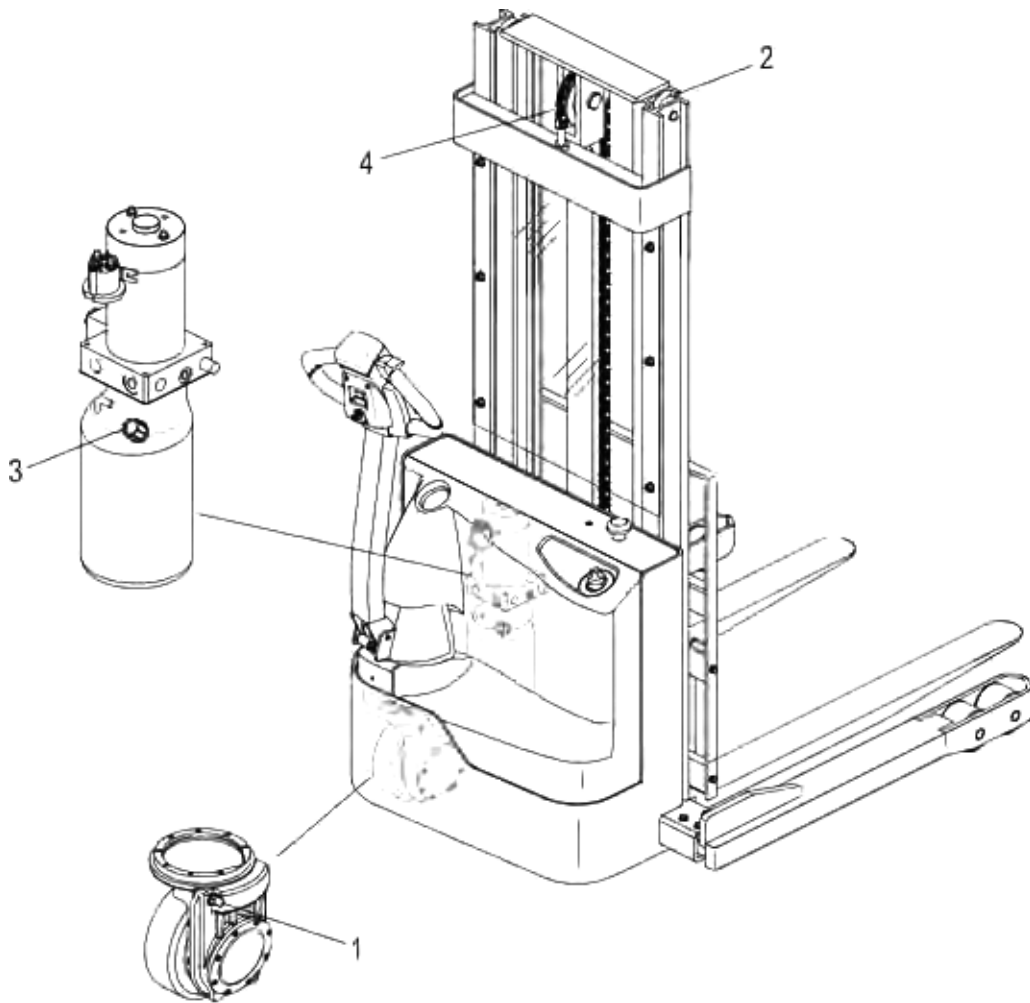


TABLE 3-3 LUBRICATION CHART

FIG 3-2 INDEX NO.	LOCATION	METHOD OF APPLICATION	TYPE (Table 3-3)	APPLICATION OF LUBRICANT
1	Transmission, Capacity - 3 Pints	Can	No. 1	Fill to level plug opening.
2	Inner and Outer Mast	Brush	No. 2	Full length of channel where rollers operate.
3	Hydraulic Reservoir, Capacity 5 quarts	Can	No. 3	With lift carriage fully lowered, fill reservoir with hydraulic oil to 1" below opening.
4	Lift Chain	Brush or Spray	No. 4	See Paragraph 6-7.

7.0 TROUBLESHOOTING

7.1 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. In conjunction with **Figure 3-4** identifies the items requiring lubrication.

TABLE 4-1 TROUBLESHOOTING CHART

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
<p>TRUCK AND HYDRAULIC SYSTEM WILL NOT OPERATE</p> <ul style="list-style-type: none"> Truck will not travel not will lift system operate. 	<ul style="list-style-type: none"> a. Fuse blown. Check fuse and replace if necessary. b. Fuse blown. Check fuse and replace if necessary. c. Battery dead or disconnected. Check battery connections and check battery voltage. d. Keyswitch defective. Bypass keyswitch to determine if it is malfunctioning. e. Emergency stop switch defective. f. Defective wiring. Check for open circuit. Repair as required. 	<p>Repair lift cylinder</p>
<p>TRUCK DOES NOT OPERATE FORWARD OR REVERSE</p> <ul style="list-style-type: none"> Truck does not travel forward or reverse. All other functions operate normally. Truck travels forward but not in reverse. Truck travels reverse but not in forward. Truck travels forward and in reverse at lower speeds; will not travel at high speed. 	<ul style="list-style-type: none"> a. Check all wiring. A loose connection may be the cause of malfunction. b. Defective deadman switch. c. Defective main controller. d. Defective potentiometer. <p>Defective potentiometer in control head.</p> <p>Defective potentiometer in control head.</p> <p>Defective potentiometer in control head.</p>	<ul style="list-style-type: none"> a. Tighten all loose connections before further troubleshooting. b. Check and replace switch if defective. c. Check for proper operation and replace if necessary. d. Check and replace potentiometer if defective. <p>Check and replace potentiometer if defective.</p> <p>Check and replace potentiometer if defective.</p> <p>Check and replace potentiometer if defective.</p>
<p>TROUBLE WITH BRAKING</p> <ul style="list-style-type: none"> Truck does not slow with brake, or brake does not engage. Brake will not release. Brake drags. Brake grabs. Abnormal noise and chatter when brake is applied. 	<ul style="list-style-type: none"> a. Defective deadman switch. b. Defective electric brake. <ul style="list-style-type: none"> a. Defective electric brake. b. Brake temperature above 281°F (140°C). c. Open brake circuitry or wiring. <p>Defective electric brake.</p> <ul style="list-style-type: none"> a. Incorrect stopping distance adjustment. b. Defective electric brake. <p>Defective electric brake.</p>	<ul style="list-style-type: none"> a. Check deadman switch for continuity. If none found when the control arm is in the brake position, replace switch. b. Adjust or replace brake. <ul style="list-style-type: none"> a. Replace. b. Allow to cool. c. Make voltage checks. <p>Replace.</p> <ul style="list-style-type: none"> a. Adjust. b. Replace. <p>Replace.</p>

TABLE 4-1 TROUBLESHOOTING CHART (continued)

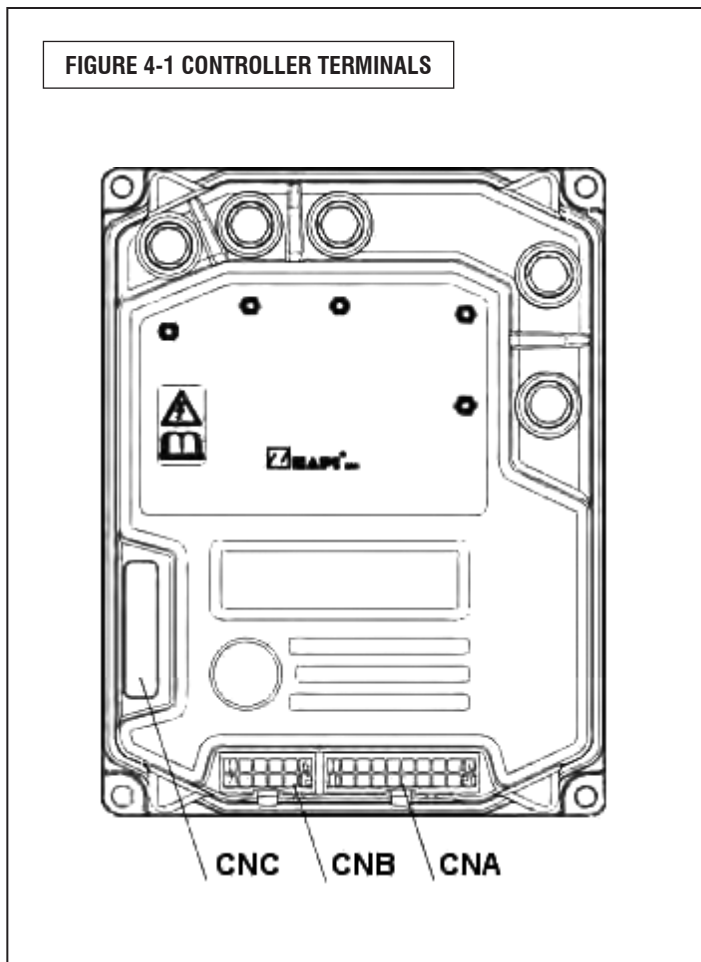
MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
<p>TROUBLE WITH LIFTING OR LOWERING</p> <ul style="list-style-type: none"> • Oil sprays or flows from the top of the lift cylinder. • Squealing sounds when lifting forks. • Forks do not lift to top. • Weak, slow or uneven action of hydraulic system. • Forks do not lift, pump motor does not run. • Forks do not lift, motor runs. • Forks lift, but will not go down. • Load will not hold • Forks do not lift to top. Pump motor runs. • Forks creep downward under load when in a raised position. 	<p>Defective packing in lift cylinder.</p> <ul style="list-style-type: none"> a. Oil level too low. b. Dry channels in mast. c. Defective mast or carriage rollers. <p>a. Oil level too low. b. Load larger than capacity.</p> <ul style="list-style-type: none"> a. Defective pump or relief valve. b. Worn lift cylinder. c. Load larger than capacity. d. Defective lift motor solenoid. e. Battery charge low. <ul style="list-style-type: none"> a. Battery is dead or disconnected. b. Defective wiring. c. Defect in electrical system for operating pump motor. <p>Defect in hydraulic system.</p> <p>Defect in hydraulic system.</p> <ul style="list-style-type: none"> a. Oil bypassing internally in control valve. b. Worn lift cylinder or packing. <ul style="list-style-type: none"> a. Oil level too low. b. Load larger than capacity. c. Batteries need charging. <p>Leak in hydraulic system, lift cylinder or lowering valve.</p>	<p>Repair lift cylinder.</p> <ul style="list-style-type: none"> a. Identify oil leak and fill reservoir. b. Apply grease. c. Replace rollers. <ul style="list-style-type: none"> a. Add oil to reservoir. b. Refer to I.D.plate for capacity. <ul style="list-style-type: none"> a. Check pressure. Adjust as necessary. b. Replace cylinder. c. Refer to I.D.platefor capacity. d. Replace solenoid on pump motor. e. Charge battery. <ul style="list-style-type: none"> a. Check and recharge if required. b. Check and repair as required. c. Check lift switch in control head, as well as the solenoid. <p>Check the oil level in the reservoir and the oil lines to the lift cylinder, and repair as required. If normal, check the hydraulic pump, and relief valve. Repair, or adjust.</p> <p>Check lowering control switch in control head and lowering solenoid on valve assembly. Replace as required.</p> <ul style="list-style-type: none"> a. Replace valve assembly. b. Repack cylinder. <ul style="list-style-type: none"> a. Add oil to reservoir. b. Refer to nameplate on side of mast for maximum load capacity. c. Change batteries. <p>Check for leaking fitting in hydraulic line and repair as required. Repack lift cylinder or replace valve assembly.</p>
<p>MISCELLANEOUS</p> <ul style="list-style-type: none"> • Steering arm does not return to the upright position. • Truck moves forward when arm is pulled down. • Steering arm jerks excessively starting or stopping the truck. • Drive motor is jerky. 	<ul style="list-style-type: none"> a. Weak return spring. b. Binding. <ul style="list-style-type: none"> a. Belly button switch defective. b. Short in control head. <p>Drive wheel worn.</p> <p>Motor internally damaged or worn.</p>	<ul style="list-style-type: none"> a. Replace spring. b. Check and free the binding item. Verify that the cable has not been damaged. Repair orreplace as needed. <ul style="list-style-type: none"> a. Check for short, and repair or replace as necessary. b. Check wiring and repair as required. orreplace as needed. <p>Replace drive wheel if worn to within 3/4" of hub.</p> <p>Replace motor.</p>

7.2 CONTROLLER TROUBLESHOOTING

7.2.1 ZAPI HANDSET

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

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



7.2.2 FAULT DETECTION

7.2.2.1 GENERAL

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

- The alarm code.
- The number of times that each alarm occurs consecutively.
- The Hour Meter reading (value) when the latest event of every alarm occurred.
- The invert temperature when the latest event of every alarm occurred.

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

7.2.2.2 LOGBOOK ACCESS

To view the alarm logbook proceed as follows:

1. Connect the Zapi Handset, refer to paragraph 7-2.1.
2. Press the OK button 2x (**1, Figure 4-2**) (3) MAIN MENU.
3. Press the ROLL down button or the ROLL up button to find the ALARMS display.
4. Press the OK button to view the alarms.
5. Press the ESC button to exit the alarms.

NOTE: Refer to bluegiant.com for the Zapi supplement containing detailed information of alarm codes. There are two versions shown. The EPS-30 uses the Standard version which lists the error by: Alarm Name, Repetitions, Temperature and Hour Meter reading.

7.2.3 TESTING TRUCK OPERATION

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

1. Connect the Zapi Handset, refer to paragraph 7-2.1.
2. Press the OK button (**1, Figure 4-2**).
3. Press the ROLL down button or the ROLL up button to find the TESTER display.
4. Press the OK button to view the tests.
5. To verify various switch functions, locate the switch on the display and then operate that function to verify operation.
6. Press the ESC button to exit the tests.

7.2.4 SETTINGS AND ADJUSTMENTS

7.2.4.1 SET OPTIONS

To set options proceed as follows and refer to **Table 4-2**:

1. Connect the Zapi Handset, refer to paragraph 7-2.1.
2. Press the OK button 2x (1, **Figure 4-2**) and Scroll to the CONFIG MENU, then Enter.
3. Press the ROLL down button or the ROLL up button to find the SET OPTIONS display.
4. Press the OK button to view the options.
5. Press the ROLL down or the ROLL up button to find the option to be changed.
6. Press the Left or Right Arrow button until the desired value setting is reached. The option is now set at the desired value.
7. Press the ESC button (4) to exit the options.



TABLE 4-2 SET OPTIONS

PARAMETER	FACTORY SETTING	DESCRIPTION
TILLER switch	HANDLE	This option handles the input CNB#3 (Table 4-5). This input opens when the operator leaves the truck (released). It is connected to a Keyswitch controlled voltage when the operator is present.
SET INPUT #1	LEVEL = 0 (OPTION #1)	(Standard Version only). This option handles the digital input CNA#15. It can be set as: OPTION #1: CNA is managed as a cutback speed input (SR#1). OPTION #2: CNA is managed as a digital handbrake input. OPTION #3: CNA is managed as an inching backward. The input CNA#15 (Table 4-5) can only be used as Aux Lowering request when the MDIPRC is PRESENT. This input must be connected to a Keyswitch controlled voltage. The SR#1 becomes active when CNA#15 (Table 4-5) is open. The inching backward becomes active when the CNA#15 (Table 4-5) is closed to a Keyswitch controlled voltage.

TABLE 4-2 SET OPTIONS (continued)

PARAMETER	FACTORY SETTING	DESCRIPTION
SET INPUT #2	PRESENT	<p>It can be can be set as:</p> <p>PRESENT: CNA#14 (Table 4-5) is managed as a cutback speed input (SR#2). OPTION #1: CNA#14 (Table 4-5) is managed as an inching backward. The input CNA#14 (Table 4-5) can only be used as Aux Lifting request when the MDIPRC is PRESENT. This input must be connected to a Keyswitch controlled voltage. The SR#2 becomes active when CNA#14 (Table 4-5) is open. The inching backward becomes active when the CNA#14 (Table 4-5) is closed to a Keyswitch controlled voltage.</p>
SET INPUT #4	BELLY (OPTION #1)	<p>This option handles the digital input CNB#7 (Table 4-5). It can be set as: BELLY CNB#7 (Table 4-5) is managed as a Belly Switch input. BRAKE CNB#7 (Table 4-5) is managed as service brake input. This information can be used also to recognize when the operator is driving with a pressed pedal braking. EX.HYDRO: CNB#7 (Table 4-5) is managed as Exclusive Hydro. This input must be connected to a Keyswitch controlled voltage. The Belly switch active level is specified on the QUICK INV LOGIC below. The service brake of the exclusive hydro becomes active when CNB#7 is opened.</p>
HOUR COUNTER	RUNNING	<p>This option specifies the hour counter mode. It can be set as:</p> <p>RUNNING: The counter registers travel time only. KEY ON: The counter registers when the keyswitch is closed.</p>
BATTERY CHECK	Level = 1	<p>This option specifies the handling of the low battery charge detection. It can be set as:</p> <p>Level 0: Nothing happens, the battery charge level is ignored. Level 1: A BATTERY LOW alarm is raised when the battery level is calculated being less than 10% of the full charge. A BATTERY LOW alarm inhibits the Lifting function. Level 2: A BATTERY LOW alarm is raised when the battery level is calculated being less than 10% of the full charge. A BATTERY LOW alarm reduces the maximum truck speed down to 24% of the full truck speed then, if the MDI-PRC is absent, inhibits the Lifting function. Level 3 Equivalent to Level 1; a BATTERY LOW alarm is raised when the battery level is calculated being less than 10% of the full charge. A BATTERY LOW alarm inhibits the Lifting function.</p>

TABLE 4-2 SET OPTIONS (continued)

PARAMETER	FACTORY SETTING	DESCRIPTION
HYDRO KEY ON	OFF	ON / OFF: If this options is programmed ON the traction Inverter manages a hydraulic steering function when the keyswitch is switched ON (only if the AUX OUTPUT #1 option is programmed as HYDRO CONTACT or as WXCLUSIVE HYDRO).
STOP ON RAMP	OFF	Not used.
AUX OUTPUT #1	BRAKE	<p>This option handles output CNA#3 (Table 4-5). It can be used as:</p> <ul style="list-style-type: none"> • BRAKE: CNA#3 (Table 4-5) drives an electromechanical Brake. • HYDROCOMNT: CNA#3 (Table 4-5) drives the contractor for a hydraulic steering function when the direction input or brake pedal input are active or a movement of the truck is detected. • EX.HYDRO: CNA#3 (Table 4-5) drives the contractor for a hydraulic steering function when the exclusive hydro input is active. • FREE: CNA#3 (Table 4-5) is not used.
PEDAL BRAKING	NONE	<p>The analog input CNA#18 (Table 4-5) has one of two functions:</p> <ul style="list-style-type: none"> • Pedal Braking input. • Command input for lifting / lowering proportional valves in MDIPRC version. To turn from the first to the second function is just enough to set PEDAL BRAKING to HNONE. This option handles the analog input CNA#18 (Table 4-5) when used as pedal braking input: • ANALOG: With this setting it is possible to modulate the strength of the braking when the accelerator is released. The strength of the braking is proportional to the brake pedal potentiometer connected to this input. When the pedal potentiometer voltage is equal / less than the SET POT BRK MIN, the minimum release braking strength is applied (following the RELEASE BRAKING setting). • When the pedal potentiometer voltage is equal / higher than the SET POT BRK MAX, the maximum release braking strength is applied (following the PEDAL BRAKING setting). In the intermediat position, the electrical braking strength is a linear function between the minimum (RELEASED BRAKING) and maximum (PEDAL BRAKING) intensity. When there is also a switch connected to the pedal braking (i.e. SET INPUT #4 to level BRAKE), it must be closed, otherwise the release braking is stuck to the minimum strength disregarding the pedal potentiometer position. • DIGITAL: No pedal potentiometer is expected. Only when both the SET INPUT #4 is Level BRAKE and the brake switch connected to CNB#4 (Table 4-5) is closed, the release electrical braking follows the PEDAL BRAKING setting (maximum strength); in all of the other conditions the release electrical braking follows the RELEASE BRAKING setting (minimum strength).

TABLE 4-2 SET OPTIONS (continued)

PARAMETER	FACTORY SETTING	DESCRIPTION
QUICK INVERSION	BELLY	<p>This option specifies the quick inversion mode when the SET INPUT #4 is set BELLY. It can be set as:</p> <ul style="list-style-type: none"> NONE: The quick inversion function is not managed (no effect when CNB#7 (Table 4-5) switches over). TIMED: The quick inversion function is timed. BELLY: The quick inversion function is managed but not timed.
AUX VOLTAGE #1	100%	<p>This option specifies the percentage of the keyswitch controlled voltage to be applied to the loads on CNA#1 (Table 4-5) (main contactor coil) and CNA#3 (Table 4-5) (electromechanical brake).</p> <p>The voltage modulation is set with a PWM at 1 kHz frequency. After an initial delay of about 1 sec in which the entire keyswitch controlled voltage is applied to the loads, the PWM reduces the voltage at the loads down to the specified percentage.</p>
PERFORMANCE	OPTION #1	<p>This option can be set:</p> <ul style="list-style-type: none"> OPTION#1 OPTION#2
QUICK INV. LOGIC	OPTION #1	<p>This option specifies the active level for the Belly switch input (CNB#7):</p> <ul style="list-style-type: none"> OPTION#1: The quick inversion is executed when CNB#7 (Table 4-5) is closed to a Keyswitch controlled voltage. OPTION#2: The quick inversion is executed when CNB#7 (Table 4-5) is opened from a Keyswitch controlled voltage.
MDI-PRC	ABSENT	<p>This option specifies:</p> <ul style="list-style-type: none"> PRESENT: The MDI-PRC is connected to the ACO via the CAN Bus: the handling of the Hydraulics is specified on the TRUCK TYPE setting. ABSENT: The MDI-PRC is not connected to the ACO: the TRUCK TYPE disappears from the SET OPTIONS function list.
MOT SET-UP LOCK	OFF	Not used.

7.2.4.2 ADJUSTMENTS

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

1. Connect the Zapi Handset, refer to paragraph 7-2.1.
2. Press the OK button to enter the CONFIG MENU.
3. Press the ROLL down button or the ROLL up button to find the ADJUSTMENTS display.
4. Press the ok button to view the adjustments.
5. Press the ROLL down or the ROLL up button to find the adjustment to be changed.
6. Press the Left or Right Arrow button to set the desired value setting is reached. The adjustment is now set at the desired value.
7. Press the ESC button to exit the adjustments.



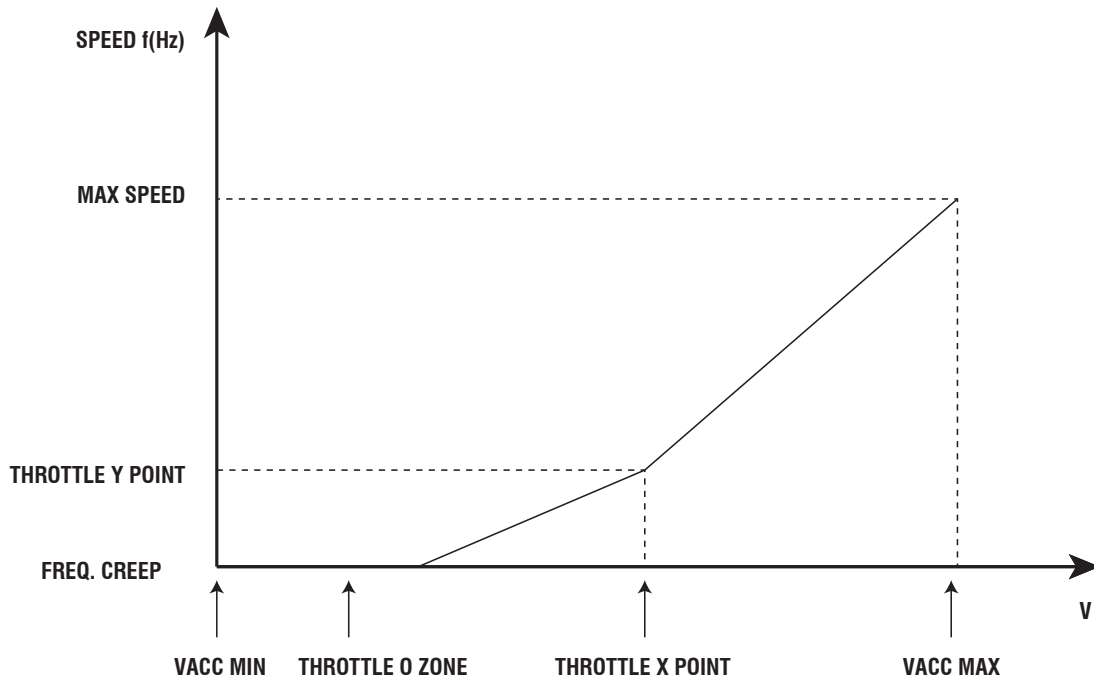
TABLE 4-3 ADJUSTMENTS

PARAMETER	FACTORY SETTING	DESCRIPTION
SET POT BRK MIN	0 V	This setting records the minimum value of braking pedal potentiometer when the braking pedal switch is closed; the procedure is similar to the PROGRAM VACC function. This procedure must be carried out only if the PEDAL BRAING option is programmed as ANALOG. No adjustment is necessary when PEDAL BRAKING options is programmed as NONE.
SET POT BRK MAX	2 V	This setting records the maximum value of braking pedal potentiometer when the braking pedal is fully pressed; the procedure is similar to the PROGRAM VACC function. This procedure must be carried out only if the PEDAL BRAKING option is programmed as ANALOG. No adjustment is necessary when PEDAL BRAKING options is programmed as NONE.
SET BATTERY TYPE	24V	Selects the nominal battery voltage.
ADJUST BATTERY	XX V	Do not modify - Factory adjusted (Fine adjustment of the battery voltage measured by the controller).
THROTTLE 0 ZONE	9%	Establishes a deadband in the accelerator input curve.

TABLE 4-3 ADJUSTMENTS (continued)

PARAMETER	FACTORY SETTING	DESCRIPTION
THROTTLE X POINT	54%	This parameter together with the THROTTLE Y POINT, changes the characteristic of the accelerator input curve: when the accelerator is depressed to X point percent, the corresponding truck speed is Y point percent of the Maximum truck speed. The relationship between the accelerator position and the truck speed is linear between the THROTTLE 0 ZONE and the X point and also between the X point and the maximum accelerator position but with two different slopes (Figure 4-4).
THROTTLE Y POINT	25%	This parameter together with the THROTTLE X POINT, changes the characteristic of the accelerator input curve: when the accelerator is depressed to X point percent, the corresponding truck speed is Y point percent of the Maximum truck speed. The relationship between the accelerator position and the truck speed is linear between the THROTTLE 0 ZONE and the X point and also between the X point and the maximum accelerator position but with two different slopes (Figure 4-4).
ADJUSTMENT #01	LEVEL = 5	Adjust the upper level of the battery charge table (Level 0 to 9).
ADJUSTMENT #02	LEVEL = 5	Adjust the lower level of the battery charge table (Level 0 to 9).
LOAD HM FROM MDI	OFF	When set On, the Hourmeter of the Controller is transferred and recorded on the Hourmeter of the Standard MDI (connected on the Serial Link).
CHECK UP DONE	OFF	Turn it On when asked Maintenance service has been executed to cancel the CHECK UP NEEDED warning.
CHECK UP TYPE	NONE	It specifies the handling of the CHECK UP NEEDED warning: <ul style="list-style-type: none"> • NONE: No CHECK UP NEEDED warning. • OPTION#1: CHECK UP NEEDED warning on the handset and MDIPRC after 300 hours. • OPTION#2: Equal to OPTION#1 but Speed reduction after 340 hours. • OPTION#3: Equal to OPTION#2 but the truck definitively stops

FIGURE 4-4 THROTTLE REGULATION



7.2.4.3 PARAMETER CHANGE

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

1. Connect the Zapi Handset, refer to paragraph 7-2.1.
2. Press the OK button to enter the MAIN MENU.
3. Press the ROLL down button or the ROLL up button to find the PARAMETER CHANGE display.
4. Press the OK button to view the parameters.
5. Press the ROLL down or the ROLL up button to find the parameter to be changed.
6. Press the Lefty or Right Arrow down button until the desired value setting is reached. The parameter is now set at the desired value.
7. Press the ESC button to exit the parameters.

FIGURE 4-5 HAND HELD PROGRAMMER

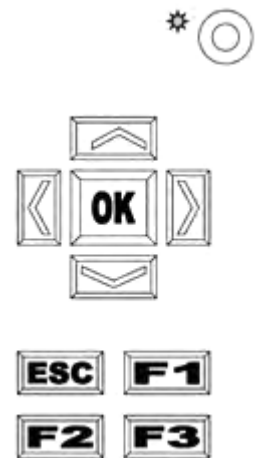


TABLE 4-4 PARAMETER ADJUSTMENTS

PARAMETER	FACTORY SETTING	DESCRIPTION
ACCELER. DELAY	LEVEL = 0	Level 0 to 9. It determines the acceleration ramp. At Level 9 the truck takes a long time to accelerate.
RELEASE BRAKING	LEVEL = 9	Level 0 to 9. It controls the deceleration ramp when the travel request is released. At Level 9 the truck brakes abruptly.
INVERS. BRAKING	LEVEL = 8	Level 0 to 9. It controls the deceleration ramp when the direction switch is inverted during travel. At Level 9 the truck brakes abruptly.
PEDAL BRAKING	LEVEL = 9	Level 0 to 9. It controls the deceleration ramp when the travel request is released and the brake pedal switch is pressed to its maximum. At Level 9 the truck brakes abruptly.
SPEED LIMIT BRK	LEVEL = 9	Level 0 to 9. It controls the deceleration ramp when the accelerator has turned down but not completely released. At Level 9 the truck decelerates abruptly.
BRAKE CUTBACK	LEVEL = 1	Level 0 to 9. It controls the deceleration ramp when the a speed reduction input becomes active and the motor slows down. At Level 9 the truck decelerates abruptly.
MAX SPEED FORW	120 Hz	Typically from 90 Hz to 160 Hz. It determines the maximum speed in forward direction.
MAX SPEED BACK	120 Hz	Typically from 90 Hz to 160 Hz. It determines the maximum speed in backward direction.
CUTBACK SPEED	100%	Typically from 10% to 100%. It determines the percentage of the max speed applied when the cutback switch 1 (SR#1 on CNA#15 (Table 4-5) is active. When set to 100% the speed reduction is ineffective.
CUTBACK SPEED 2	49%	Typically from 10% to 100%. It determines the percentage of the max speed applied when the cutback switch 2 (SR#2 on CNA#14 (Table 4-5) is active. When set to w100% the speed reduction is ineffective.
HS CUTBACK	4%	Typically from 10% to 100%. It determine the percentage of the max speed applied when the Hard and Soft function (H&S switch on CNB#4 (Table 4-5) is active. When set to 100% the speed reduction is ineffective.
FREQUENCY CREEP	1.00 Hz	Hz value. This is the minimum speed applied when the forward or reverse switch is closed, but the accelerator at its minimum. In the ACO sense Coils this setting is higher equal than 5 Hz.

TABLE 4-4 PARAMETER ADJUSTMENTS (continued)

PARAMETER	FACTORY SETTING	DESCRIPTION
RPM CREEP	100%	A Percentage value. Set to 100% and not Used.
MAXIMUM CURRENT	LEVEL = 9	Level 0 to 9.It specifies the percentage of the absolute current at which the current will be limited. Normally MAXIMUM CURRENT is 100%. DO NOT CHANGE.
INCHING SPEED	0 Hz	It determines the speed when the “Inching function” is active.
INCHING TIME	LEVEL = 0	Level 0 to 9. It determines the duration time when the “Inching function” is active.
AUXILIARY TIME	0	Time units value (seconds). For the encoder version, it determines the time duration (in seconds) in which the frequency was arrived to zero.
ANTIROLLBACK	80%	A Percentage of the Maximum Current. This setting increases the phase current when low frequency during starting operation. It is used to push up, in feedforward way, the torque when it is not possible to control the flux, in feedback way, because of the low frequency.

TABLE 4-5 ZAPI CONTROLLER CONNECTOR PINS

PARAMETER	ABBREVIATION	DESCRIPTION
CNA CONNECTOR		
CNA#1	NMC	Negative of main contactor coil.
CNA#2	PMC	Positive of main contactor coil.
CNA#3	NEB	Output for driving the electromechanical brake coil; drives the load to -Batt. Maximum current: 3 A.
CNA#4	NPC	Negative of pump contactor soil.
CNA#5	PPC / PEV	Positive of pump contactor coil and lowering electrovalve coil.
CNA#6	NEV	Negative of the lowering electrovalve coil.
CNA#7	CAN LOW	Low level CAN-BUS voltage I/O.
CNA#8	-BAT	-Bat.

TABLE 4-5 ZAPI CONTROLLER CONNECTOR PINS (continued)

PARAMETER	ABBREVIATION	DESCRIPTION
CNA CONNECTOR		
CNA#9	ENC +	Encoder Positive Supply (+5 or +12 Vdc).
CNA#10	ENC-	Encoder Negative Supply (GND to minus battery).
CNA#11	HM(+B)	Output for driving an hourmeter; when the hourmeter is active this output provides a +Batt signal; 3 maximum current.
CNA#12	-BATT	-Batt.
CNA#13	MOT TH	Motor thermal sensor input. The internal pull-up is a fixed 2mA (Max 5V) source current.
CNA#14	SR2	Speed reduction 2 input. Active low (switch opened).
CNA#15	SR1	Speed reduction 1 input. Active low (switch opened).
CNA#16	+12V	This output provides a +12V signal for the MDI PRC, it present; mA maximum current.
CNA#17	CAN HIGH	High level CAN-BUS voltage I/O.
CNA#18	CPOTB	Brake potentiometer wiper.
CNA#19	ENC A	Encoder Channel A.
CNA#20	ENC B	Encoder Channel B.
CNB Connector		
CNB#1	KEY SW	Connected to the power supply through a microswitch (KEY) with a 6.3-10 A fuse in series (this could be mounted on the AC-0 cover).
CNB#2	CM	CM Common for FW/BW/SR1/SR2/TILLER/H&S/BELLY/LIFTING/LOWERING microswitches. This connection supplies a keyswitch voltage level.
CNB#3	TILLER SW	Tiller request input. Must be connected to the tiller microswitch, active high.
CNB#4	H&S SW	Hard and Soft request input. Must be connected to the Hard and Soft microswitch, active high.
CNB#5	BACKWARD SW	Backward direction request input. Must be connected to the backward direction microswitch, active high.
CNB#6	FORWARD SW	Forward direction request input. Must be connected to the forward direction microswitch, active high.
CNB#7	BELLY SW	Quick inversion function input; must be connected to the Belly microswitch; it is active high.

TABLE 4-5 ZAPI CONTROLLER CONNECTOR PINS (continued)

PARAMETER	ABBREVIATION	DESCRIPTION
CNB Connector		
CNB#8	LOWERING SW	Lowering request input, active high.
CNB#9	LIFTING SW	Lifting request input, active high.
CNB#10	CPOT	Lifting request input, active high.
CNB#11	NPOT	Negative of accelerator unit, tested for wire disconnection diagnosis.
CNB12	PPOT	Potentiometer positive: 10V output; keep load >1k Ω .
CNC Connector		
CNC#1	PCLRxD	Positive serial reception.
CNC#2	NCLRxD	Negative serial reception.
CNC#3	PCLTXD	Positive serial transmission.
CNC#4	NCLTXD	Negative serial transmission.
CNC#5	GND	Negative console power supply.
CNC#6	+12V	Positive console power supply.
CNC#7	FLASH	Must be connected to C8 for the Flash memory programming (if used).
CNC#8	FLASH	Must be connected to C7 for the Flash memory programming (if used).

7.2.5 TROUBLESHOOTING

The controllers provide diagnostics information to assist technicians in troubleshooting problems. Refer to **Table 4-6** for the traction controller error messages. Refer to **Table 4-7** for the steering controller error messages.

TABLE 4-6 TRACTION CONTROLLER

ERROR MESSAGE		POSSIBLE CAUSE	FAULT ELIMINATION
CODE	ERROR TEXT		
1	WRONG CONFIG	It occurs the first time a controller is switched on when the non volatile EEPROM memory is not initialized yet.	When this alarm appears, please contact a Zapi technician for assistance.
8	WATCH DOG	It occurs when the embedded WATCH DOG protection is not able either to cut off the power stage when not triggered or it is not able to activate the power stage when triggered.	Verify the motor is connected and the continuity of the three motor phases. If the alarm occurs permanently, it is necessary to replace the controller.
16	AUX OUTPUT KO	This alarm occurs when the feedforward PWM generated by the controller to supply the Electromechanical Brake and the actual feedback voltage on the Electromechanical Brake are not matched in between. The diagnosis is made only when the Tiller Switch is active.	Probably it is necessary to replace the controller because the driver of the Electromechanical Brake has a failure.
13	EEPROM KO	It occurs due to a HW or SW defect of the non-volatile embedded memory supporting the controller regulations.	Try to execute a CLEAR EEPROM operation. This consists of Entering the ALARMS item in the MAIN MENU. Push at the same time the two right side buttons to enter the hidden ZAPI MENU. Roll up and Down until the CLEAR EEPROM appears on the hand set display. Push Twice the Enter Button. Switch the key off and on to check the result. If the alarm occurs permanently, it is necessary to replace the controller.
17	LOGIC FAILURE #3	It occurs when the circuit to limit via HW the current peak in the controller is active.	It is probably a power failure or a logic failure. If it occurs permanently it is necessary to replace the controller.
18	LOGIC FAILURE #2	It occurs when the circuit, to compensate for the dead times of the sine waves, is failed.	It is necessary to replace the controller.
19	LOGIC FAILURE #1	This alarm signals that an overvoltage / undervoltage protection operation has occurred.	Normally the overvoltage occurs due to the regenerative braking energy increasing the battery voltage; the undervoltage of the logic supply, can be due to a depletion in the key voltage. So first of all check for your failure mode then contact the Zapi technician to look for a countermeasure. As a matter of fact this alarm may occurs also for a HW failure and, in this case, it is necessary to replace the controller.
30	VMN LOW	Before to switch the main contactor on, the SW turns on sequence the Top side Power Mosfets and expects the phase V voltage increases toward the rail capacitor value. If the phase V does not increases this alarm occurs. This alarm may occur also when the initial diagnosis is overcome, and so the Main Contactor is expected to be closed.	If the problem occurs before the Main Contactor closes, probably a Power failure (e.g.a Bottom side Power Mosfet short circuited or a Top side Power Mosfet broken) or a Logic Failure occurred in the controller. If the problem occurs when the operator turns the truck moving the problem is the Battery positive is not connected to the +Batt terminal of the controller(check the continuity of the main contactor). If the problem occurs permanently it is necessary to replace the controller.

TABLE 4-6 TRACTION CONTROLLER (continued)

ERROR MESSAGE		POSSIBLE CAUSE	FAULT ELIMINATION
CODE	ERROR TEXT		
31	VMN HIGH	Before to switch the main contactor on, the SW turns on sequence the Bottom side Power Mosfets and expects the phase V voltage falls to GND value. If the phase V remains high level this alarm occurs.	Two possibilities: <ul style="list-style-type: none"> At least a motor phase is not connected to the controller or broken. A Power Failure (e.g. a Bottom side Power Mosfet opened) or a Logic Failure occurred in the controller. In this case it is necessary to replace the controller.
37	CONTACTOR CLOSED	The controller checks if the MC contact is closed when the coil isn't driven, trying to discharge the capacitor bank. If they don't discharge, the fault condition is entered.	It is suggested to check the contactor contact, if it is mechanically stuck or pasted.
38	CONTACTOR OPEN	The main contactor coil has been driven by the logic board, but the contactor does not close.	Two possible reasons: the wires to the coil are interrupted or not well connected or the contact of the contactor is not properly working.
49	I=0 EVER	This test is carried out when the motor is running, and it verifies that the current feedback sensor is not constantly stuck to 0.	If everything is ok for what it concerns the motor, the problem could be in the current sensor or in the related circuit.
55	PROGRAM LIFT LEVER	<p>The SW continuously matches the potentiometer connected to CNA#18 with the Main Lifting / Lowering pair request (CNB#9 and CNB#8). When the TRUCK TYPE is set 2, the alarms occurs in the following conditions:</p> <ul style="list-style-type: none"> If both the Main Lifting and Main Lowering request are disactive and the potentiometer voltage is higher than 60 mV over either the MIN LIFT or the MIN LOWER setting. If the Main Lifting request is active and the potentiometer voltage is higher than 200 mV over the MAX LIFT setting. If the Main Lowering request is active and the potentiometer voltage is higher than 200 mV over the MAX LOWER setting. If the MIN LIFT setting is higher than the MAX LIFT setting. If the MIN LOWER setting is higher than the MAX LOWER setting. <p>When the TRUCK TYPE is set 3, the alarms occurs in the following conditions:</p> <ul style="list-style-type: none"> If the Main Lowering request is disactive and the potentiometer voltage is higher than the MIN LOWER. 	Check the Main Lifting / Lowering pair (CNB#8 and CNB#9) and the voltage on the potentiometer connected to CNA#18. (Use the readings LIFTING SWITCH, DESCENT SWITCH and LIFTING CONTROL in the TESTER to facilitate the troubleshooting).

TABLE 4-6 TRACTION CONTROLLER (continued)

ERROR MESSAGE		POSSIBLE CAUSE	FAULT ELIMINATION
CODE	ERROR TEXT		
53	STBY I HIGH	This diagnosis is executed only when the main contactor is opened and asked to be closed (e.g. at key on or when the main contactor is opened and a new motion request turns active). Then the outputs of the Current amplifiers must be in a narrow window close to 2.5 Vdc (from 2.26 V to 2.74 V). Otherwise this STBY I HIGH alarm occurs.	If the alarm occurs permanently, it is necessary to replace the controller.
60	CAPACITOR CHARGE	In working condition, a resistance connected between the key and the Rail Capacitors, keeps the Rail Capacitors charged before the Main Contactor closes. When the voltage on the Rail Capacitors (measured on the phase V) is low and does not increase when the main contactor is opened this alarm occurs.	Three possibilities: <ul style="list-style-type: none"> • Another device, connected in parallel with the Rail Capacitors, has a failure • At least a motor phase is not connected to the controller or broken. • A Power failure or a Logic Failure occurred in the controller. In this case it is necessary to replace the controller.
61	HIGH TEMPERATURE	This alarm occurs when the temperature of the base plate is higher than 78 °C. Then the maximum current decreases proportionally with the temperature increases from 78 °C up to 100 °C. At 100 °C the current is limited to 0 Amps.	Improve the air cooling of the controller.
65	MOTOR TEMPERAT	This is just a warning with no effect on the truck performance. It occurs when the temperature of the motor winding overtakes the MOTOR OVERTEMP setting.	Check the thermal sensor inside the motor (use the MOTOR TEMPERATURE reading in the TESTER menu). If the sensor is OK, improve the air cooling of the motor.
67	CAN BUS KO	It occurs if the controller does not receive any message from the CAN Bus line.	First of all, check the wiring. If it is OK, try to disconnect one to one the module connected to the CAN Bus and check if this alarm disappears. When you are quite sure the problem is in the present module, it is necessary to replace the controller.
70	ENCODER ERROR	Two consecutive readings of the encoder speed are too much different in between: because of the inertiality of the system it is not possible the encoder changes its speed a lot in a short period. Probably an encoder failure has occurred (e.g. one or two channels of the encoder are corrupted).	Check both the electric and the mechanical encoder functionality. Frequently we experienced one of the two Sensor bearing's ring, slips inside its seat raising this alarm condition. Also the electromagnetic noise on the sensor bearing can be a cause for the alarm.
71	HANDBRAKE	This alarm occurs when the operator try to travel with the handbrake active.	Check the handbrake switch and its wiring to CNA#13. The handbrake switch must be connected between CAN#13 and GND voltage. When it is closed to GND the handbrake is considered active. A failure in the logic is possible too. In this case it is necessary to replace the controller.

TABLE 4-6 TRACTION CONTROLLER (continued)

ERROR MESSAGE		POSSIBLE CAUSE	FAULT ELIMINATION
CODE	ERROR TEXT		
73	THERMIC SENS KO	When the output of the thermal sensor on the base plate is higher than 4.95 V or lower than 0.1 V, the sensor is assumed failed and this alarm occurs.	It is necessary to replace the controller.
74	DRIVER SHORTED	This alarm occurs when the voltage on the Main Contactor is higher than expected: this means that the Main Contactor Coil has a high voltage although it is not supplied.	Probably it is necessary to replace the controller because the driver of the Main Contactor is short circuited.
75	CONTACTOR DRIVER	This alarm occurs when the voltage on the Main Contactor is smaller than expected: this means that the Main Contactor Coil has a null voltage when supplied.	Check the coils of the Main Contactor (CNA#1) is not short circuited. If it isn't, probably it is necessary to replace the controller because the driver of the Main Contactor is broken.
76	COIL SHORTED	This alarm occurs when there is an overload on one of the following connections: CNA#1, CNA#3, CNA#4 and CNA#6. Typically the problem is due to a short circuit of one of the coils connected to these outputs. After the overload has removed, the alarm exits automatically by releasing and then enabling a travel demand.	Check the coils of the main contactor (CNA#1), of the electromechanical brake (CNA#3), of the pump contactor (CNA#4), of the Aux valve (CNA#6).
78	VACC NOT OK	The test is made at key-on and after 20 sec that both the travel demands have turned disactive. This alarm occurs if the ACCELERATOR reading in the TESTER menu is higher than 1.0 V (it means the wiper of the potentiometer is higher than 2 Vdc) when the accelerator is released.	Check the mechanical calibration and the functionality of the potentiometer.
79	INCORRECT START	This is just a warning for an incorrect starting sequence.	The possible reasons for this alarm are (use the readings in the TESTER to facilitate the troubleshooting): <ol style="list-style-type: none"> a. A travel demand active at key on b. The tiller switch active at key-on c. The H&S input active at key-on d. The Quick inversion active at key-on e. A failure in the logic is possible too. When all f. of the above conditions were checked and ...

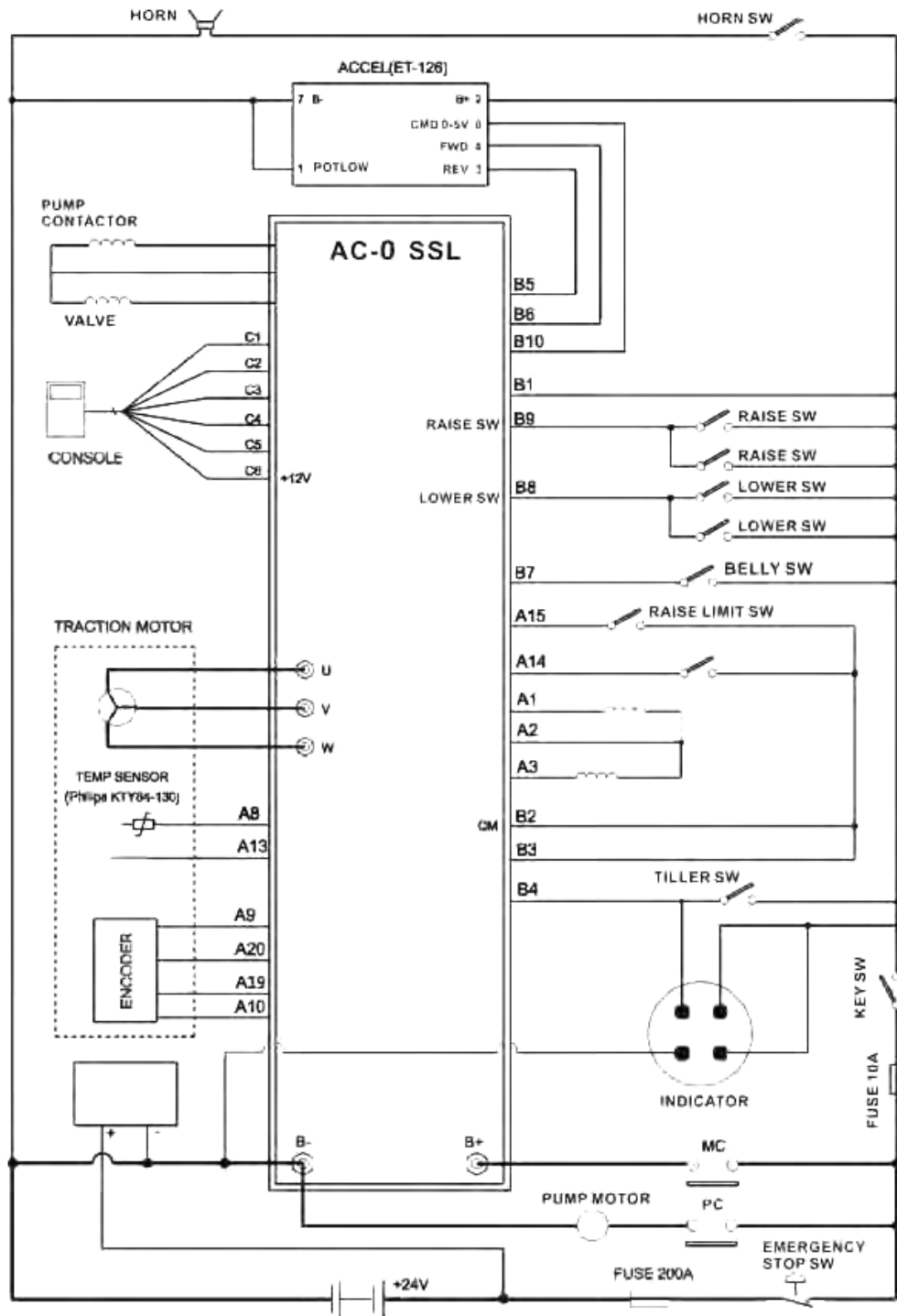
TABLE 4-6 TRACTION CONTROLLER (continued)

ERROR MESSAGE		POSSIBLE CAUSE	FAULT ELIMINATION
CODE	ERROR TEXT		
80	FORW+BACK	This alarm occurs when both the travel demands (Fwd and Bwd) are active at the same time.	Check the wiring of the Fwd and Bwd travel demand inputs (use the readings in the TESTER to facilitate the troubleshooting). A failure in the logic is possible too. When you have verified the travel demand switches are fine working and the wiring is right, it is necessary to replace the controller.
86	PEDAL WIRE KO	The SW continuously checks for the connection of the two supply ends of the potentiometer in the accelerator. The test consists of reading the voltage drop on a sense diode, connected between NPOT (CNB#11) and GND and cascaded with the potentiometer: if the potentiometer gets disconnected on PPOT or NPOT, no current flow in this sense diode and the voltage on the NPOT connection collapses down. When the NPOT voltage is less than 0.3 V this alarm occurs. This alarm occurs also when the NPOT voltage is higher than 2 Vdc (to detect also the condition	Check the voltage on NPOT (CNB#11) and the potentiometer connections.
91	LIFT LOW ACTIVE	This is just a warning when a Lifting / Lowering request is active at key-on.	<p>The possible reasons for this alarm are (use the readings in the TESTER to facilitate the troubleshooting):</p> <ul style="list-style-type: none"> • When MDI-PRC is absent: at least one between LIFTING SWITCH (CNB#9) or DESCENT SWITCH (CNB#8) active at key-on. • When TRUCK TYPE is Level=1: at least one between LIFTING SWITCH (CNB#9), DESCENT SWITCH (CNB#8), DIGITAL INPUT#1 (CNA#14) or DIGITAL INPUT#2 (CNA#15) active at key-on. • When TRUCK TYPE is Level=2: at least one between LIFTING SWITCH (CNB#9) or DESCENT SWITCH (CNB#8) active at key-on. • When TRUCK TYPE is Level=3: at least one between LIFTING SWITCH (CNB#9) or DESCENT SWITCH (CNB#8) active at key-on. <p>A failure in the logic is possible too. When all of the above conditions were checked</p>

TABLE 4-6 TRACTION CONTROLLER (continued)

ERROR MESSAGE		POSSIBLE CAUSE	Fault Elimination
CODE	ERROR TEXT		
90	LIFT / LOWER	This alarm occurs when both a Lifting request and a Lowering request are active at the same time.	<p>If the MDI-PRC is absent, check only the wiring of the main Lifting / Lowering pair (CNB#8 and CNB#9); if the MDI-PRC is present check also the wiring of the Aux Lifting / Lowering pair (CNA#14 and CNA#15). (Use the readings in the TESTER to facilitate the troubleshooting).</p> <p>A failure in the logic is possible too. When you have verified the Lifting / Lowering switches are fine working and the wiring is right, it is necessary to replace the controller.</p>
93	WRONG SET BATT.	When the key is turned ON, the controller check the battery voltage and verifies it is within a window around the nominal value.	Replace the battery with a correct battery.
94	CURRENT SENS KO	This alarm occurs when the procedure for the maximum current set-up is in progress.	The maximum current set-up is factory adjusted and so this alarm never should happen when the controller is on the field. So ask for the assistance of a Zapi technicians when this alarm occurs.
97	INPUT ERROR #1	This alarm occurs when the PLD device has a failure. The PLD device is used for both, the Passive Emergency Cell and a Multiplexer on the Main Lifting / Lowering requests. This Multiplexer exits the Lifting and the Not Lifting level on two distinct addresses. When the Lifting and the Not Lifting outputs have the same Logic Level the PLD device has failed and this alarm.	It is necessary to replace the controller.
99	CHECK UP NEEDED	This is just a warning to call for the time programmed maintenance.	It is just enough to turn the CHECK UP DONE option to level ON after the maintenance is executed.

FIGURE 4-6 WIRING DIAGRAM



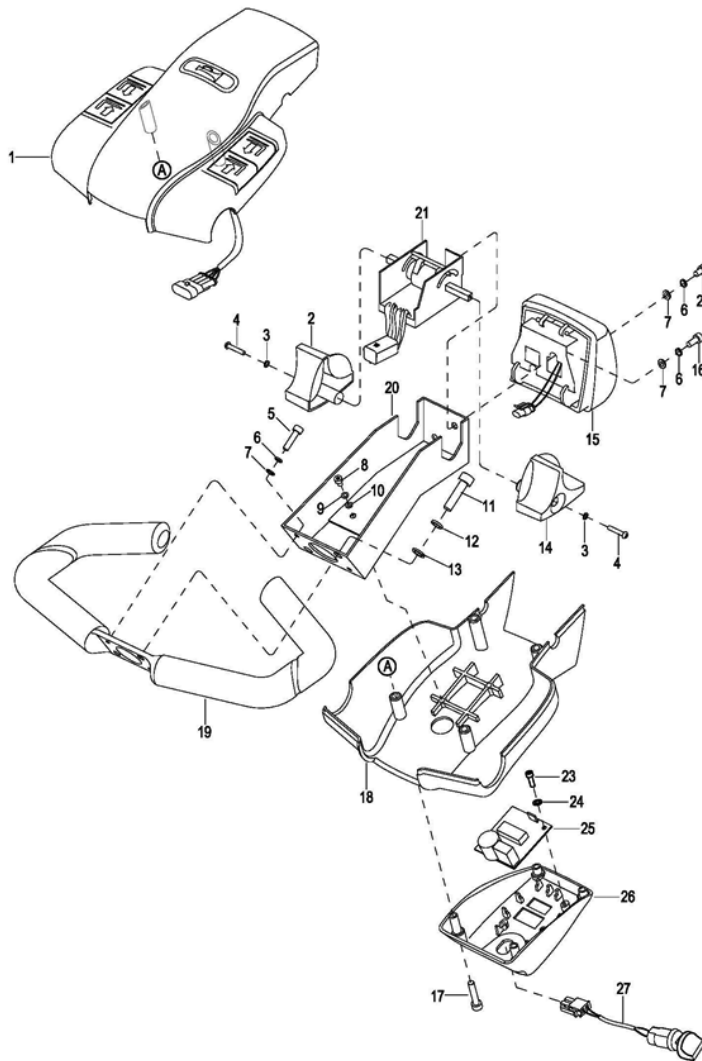
8.0 STEERING ARM, CONTROL HEAD AND COMPARTMENT

8.1 CONTROL HEAD

8.1.1 CAP ASSEMBLY REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove four screws, lift up cap assembly and disconnect from harnesses.

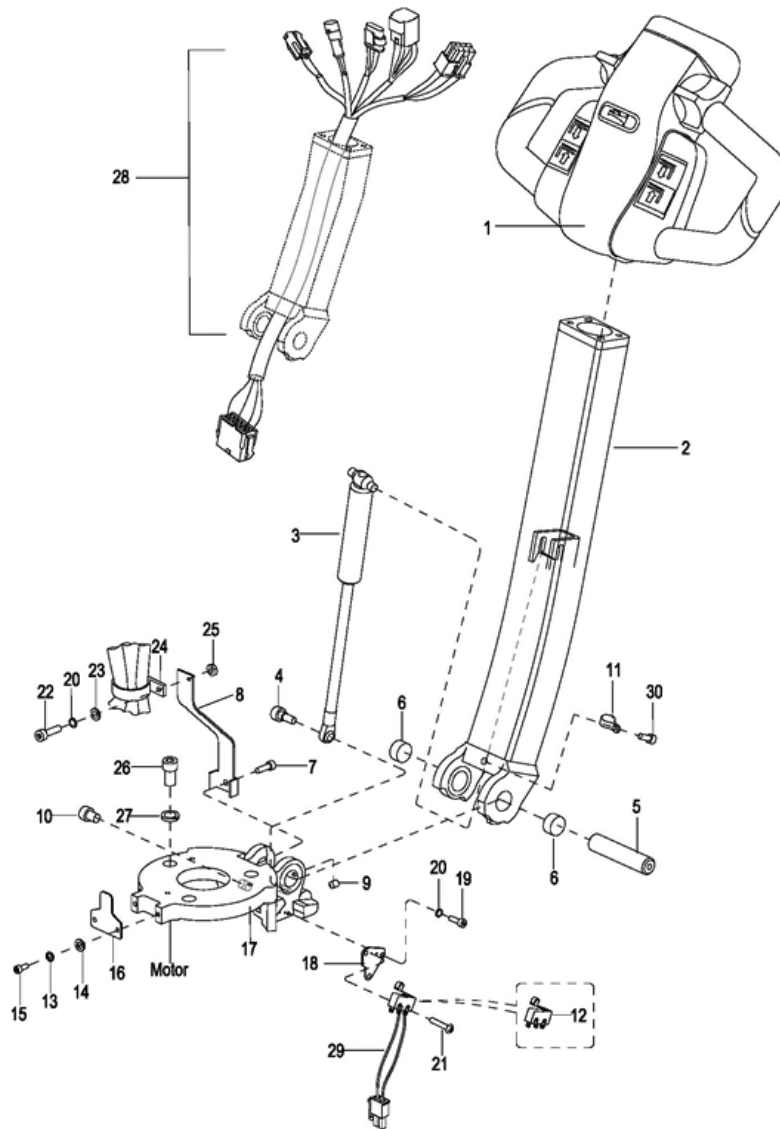
FIGURE 5-1 CONTROL HEAD



8.1.2 CAP ASSEMBLY INSTALLATION

1. Hold cap assembly in place and connect harnesses.
2. Position cap assembly on control head and secure with four screws.
3. Disengage the emergency stop switch and turn on key switch.

FIGURE 5-2 STEERING ARM



8.1.3 CONTROL HEAD REMOVAL

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Disconnect harness from potentiometer and reversing switch.
3. Remove two screws, two lock washers and two flat washers.



4. Remove two screws, two washers and two flat washers.
5. Remove the control head and handle.

8.1.4 CONTROL HEAD INSTALLATION

1. Hold control head and handle in place and install two screws, two washers and two flat washers.
2. Install two screws, two lock washers and two flat washers.
3. Reconnect harness to potentiometer and switch assembly.
4. Install the cap assembly as described in paragraph 8-1.2.

8.1.5 POTENTIOMETER REPLACEMENT

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Disconnect harness from potentiometer.
3. Remove screw, washer and control knob from potentiometer.
4. Remove screw, washer and control knob from other side of potentiometer.
5. Remove screw, lock washer and flat washer.
6. Remove screw, lock washer and flat washer and remove potentiometer from bracket.
7. Position new potentiometer in bracket and secure with screw, lock washer and flat washer.
8. Install screw, lock washer and flat washer.
9. Install control knob on potentiometer and secure with screw, and washer.
10. Install control knob on the other side of potentiometer and secure with screw, and washer.
11. Connect harness to potentiometer.
12. Install the cap assembly as described in paragraph 8-1.2.

8.1.6 BELLY BUTTON SWITCH REPLACEMENT

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Disconnect harness from switch assembly.
3. Remove screw, lock washer and flat washer.
4. Remove screw, lock washer and flat washer and remove switch assembly from bracket.
5. Remove pin, bracket, and spring from button.
6. Remove two pins and reversing switch from bracket.
7. Position the new reversing switch in bracket and secure with two pins.
8. Position bracket in button and install pin.
9. Position switch assembly on bracket and secure with two screws.
10. Reconnect harness to switch assembly.
11. Install the cap assembly as described in paragraph 8-1.2.

8.1.7 HORN SWITCH REPLACEMENT

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Remove three screws, bracket and springs.
3. Remove two pins and defective switch from bracket.
4. Position the new switch in bracket and secure with two pins.
5. Position horn switch assembly in cover and secure with three screws.
6. Install the cap assembly as described in paragraph 8-1.2.

FIGURE 5-3 EMERGENCY REVERSE SWITCH ASSEMBLY

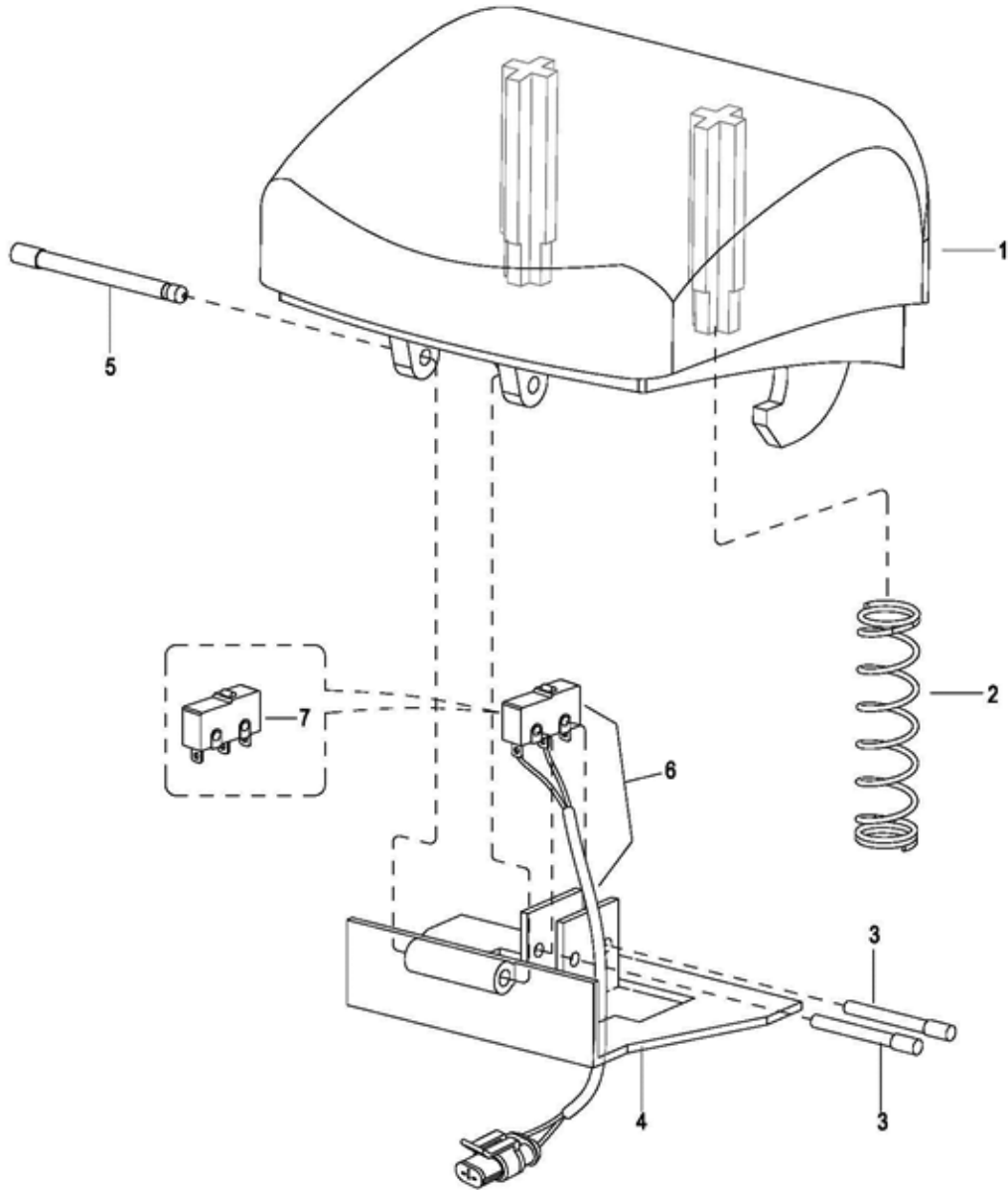
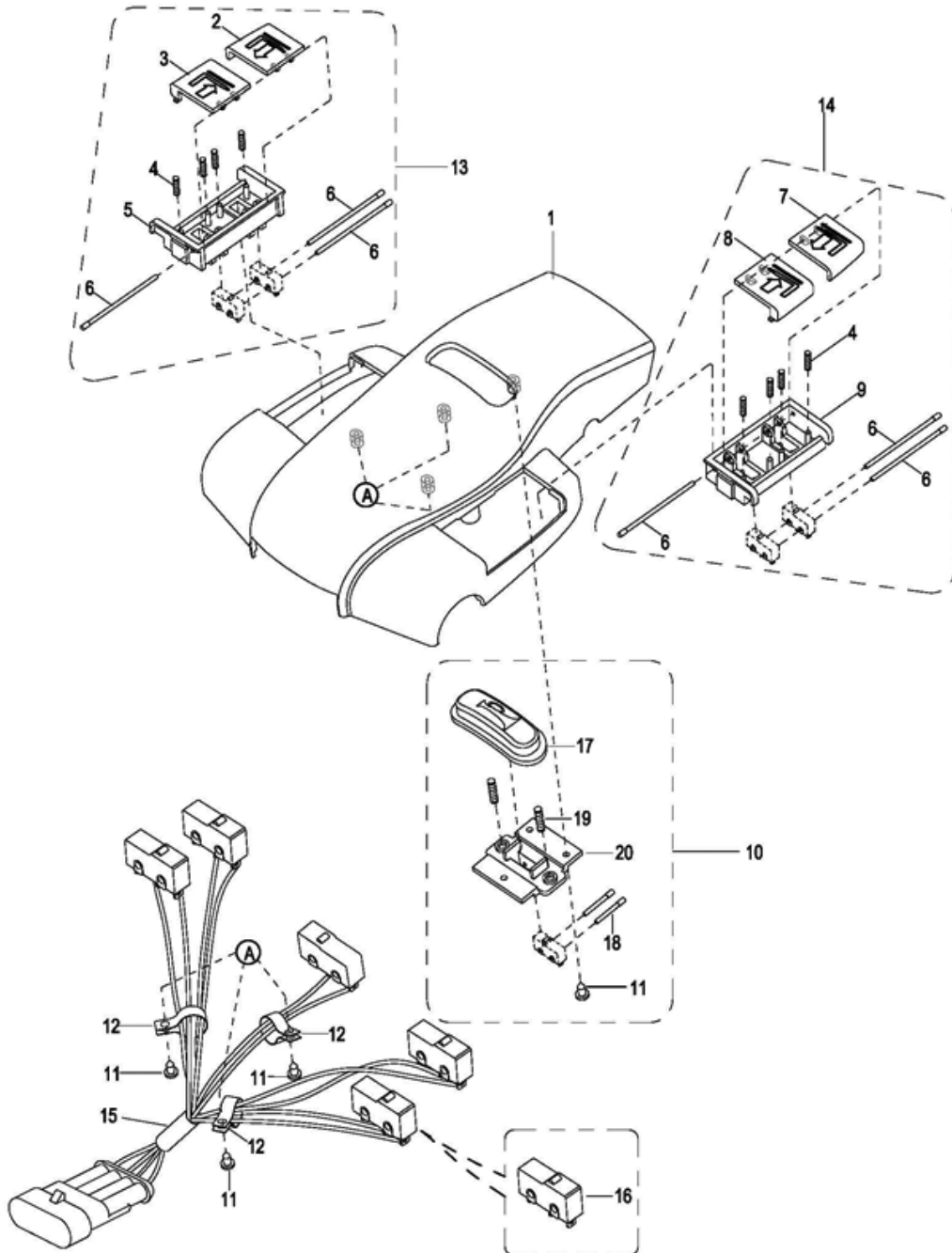


FIGURE 5-4 CAP ASSEMBLY



8.1.8 LIFT AND LOWER SWITCH REPLACEMENT

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Remove switch assembly from cap.
3. Remove pin securing buttons and remove the buttons.
4. Remove two pins, two switches and four springs from bracket.
5. Position the new switches and four springs in bracket and secure with two pins.
6. Position switch assembly in cover and secure with pin.
7. Install the cap assembly as described in paragraph 8-1.2.

8.1.9 KEY SWITCH REPLACEMENT

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Disconnect harness from key switch.
3. Remove key switch from bottom cover.
4. Position the new key switch into the bottom cover.
5. Install the cap assembly as described in paragraph 8-1.2.

8.1.10 POWER MODULE REPLACEMENT

1. Remove the cap assembly as described in paragraph 8-1.1.
2. Disconnect harness from power module.
3. Remove two screws, two washers and power module from bottom cover.
4. Position the new power module on the bottom cover and secure with two screws and two washers.
5. Install the cap assembly as described in paragraph 8-1.2.

8.2 COMPARTMENT COVERS**8.2.1 REMOVAL**

1. Engage the emergency stop switch and turn off key switch.
2. Remove the screw, the washer and the small cover.
3. Remove two screws, two washers and upper cover.
4. Remove two screws and middle cover.

8.2.2 INSTALLATION

1. Install middle cover and secure with two screws.
2. Position upper cover on the frame and secure with two screws and washers.
3. Install small cover and secure with the screw and washer.
4. Disengage the emergency stop switch and turn on key switch.

8.3 STEERING ARM**8.3.1 RETURN SPRING REPLACEMENT**

The steering arm gas return spring (**3, Figure 5-2**) is replaced while the steering arm (2) is in the upright position.

1. Engage the emergency stop switch (and turn off key switch).
2. Secure the steering arm in the upright position.
3. Remove screw and free the gas return spring from bracket.
4. Pull downward on the gas return spring to free it from its seat inside steering arm.
5. Position the new gas return spring inside the steering arm being sure it fully engages its seat.
6. Position the opposite end of the gas return spring on bracket and install screw.
7. Disengage the emergency stop switch and turn on key switch.
8. two pins.
9. Position switch assembly in cover and secure with pin.
10. Install the cap assembly as described in paragraph 8-1.2.

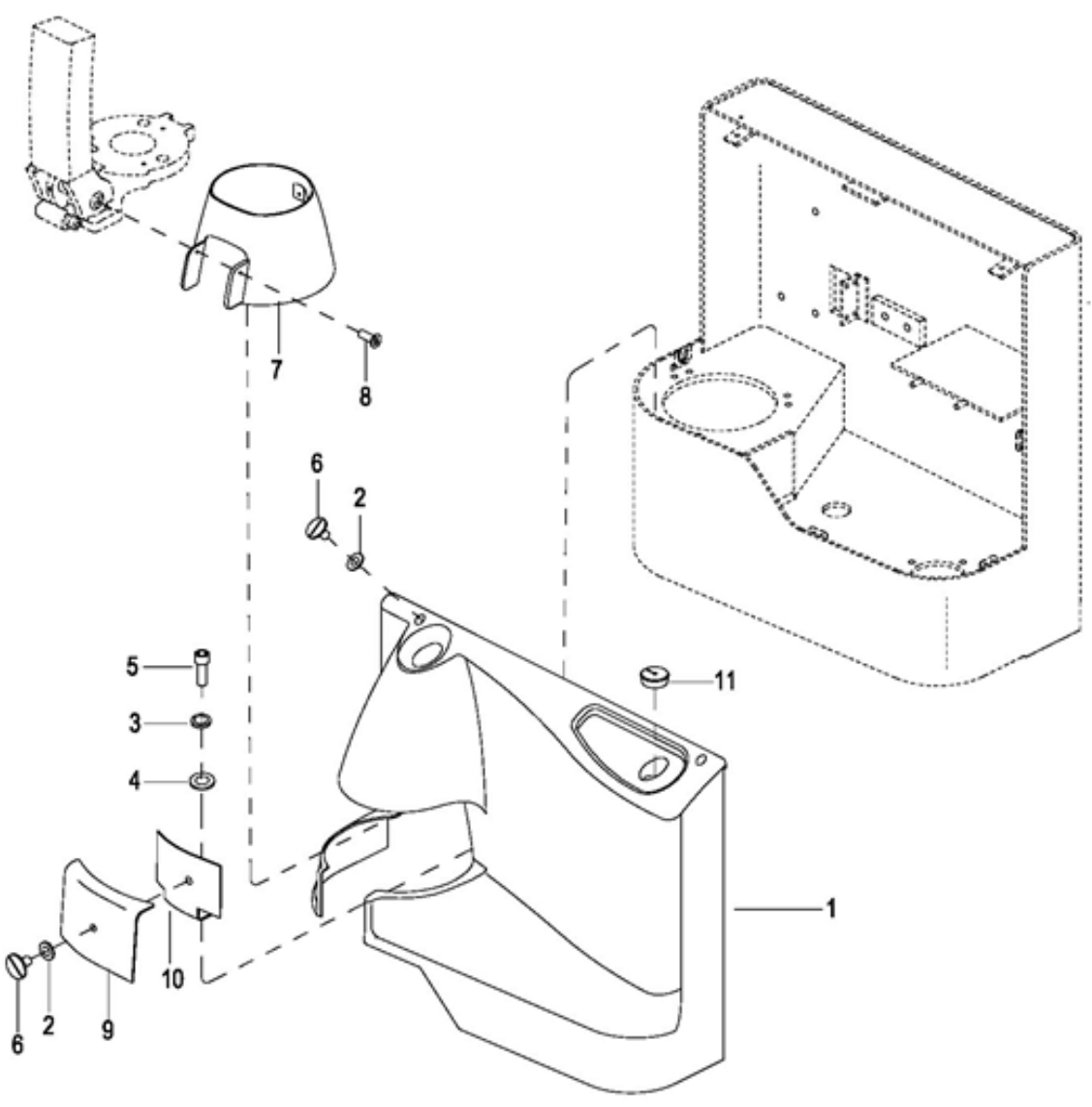
8.3.2 STEERING ARM REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the return spring as described in paragraph 8-3.1.
3. Disconnect harness from main harness.
4. Attach a hoist to steering arm.
5. Remove shaft and the steering arm.

8.3.3 STEERING ARM INSTALLATION

1. Position steering arm in bracket and secure with shaft and screw.
2. Install the return spring as described in paragraph 8-2.1.
3. Reconnect harness to main harness.
4. Disengage the emergency stop switch and turn on key switch.

FIGURE 5-5 COMPARTMENT COVER



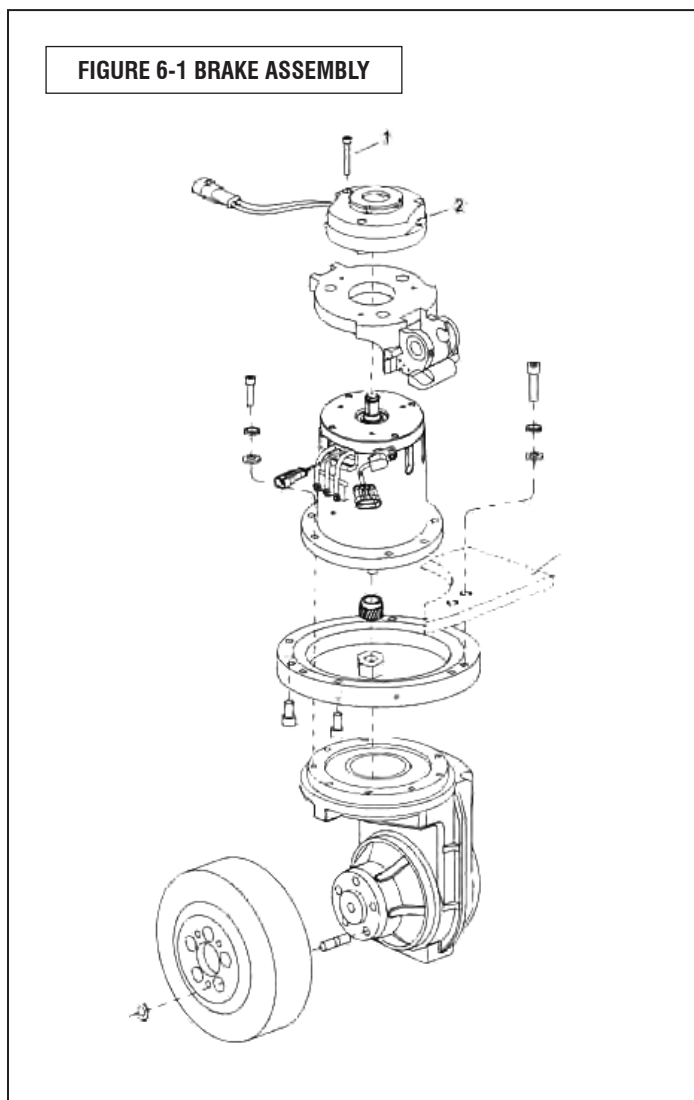
9.0 BRAKE SERVICING

9.1 BRAKES

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

9.1.1 BRAKE ASSEMBLY REPLACEMENT

1. Block load wheels.
2. Remove the compartment covers as described in paragraph 8-2.
3. Disconnect electric brake from wiring harness.
4. Remove the three mounting screws and the brake.
5. Place the new brake into position and secure with the three mounting screws.
6. Reconnect electric brake to driving harness.
7. Remove load wheel blocks and check operation.
8. Install the compartment covers as described in paragraph 8-2.



10.0 TRANSMISSION, DRIVE WHEEL, LOAD WHEEL

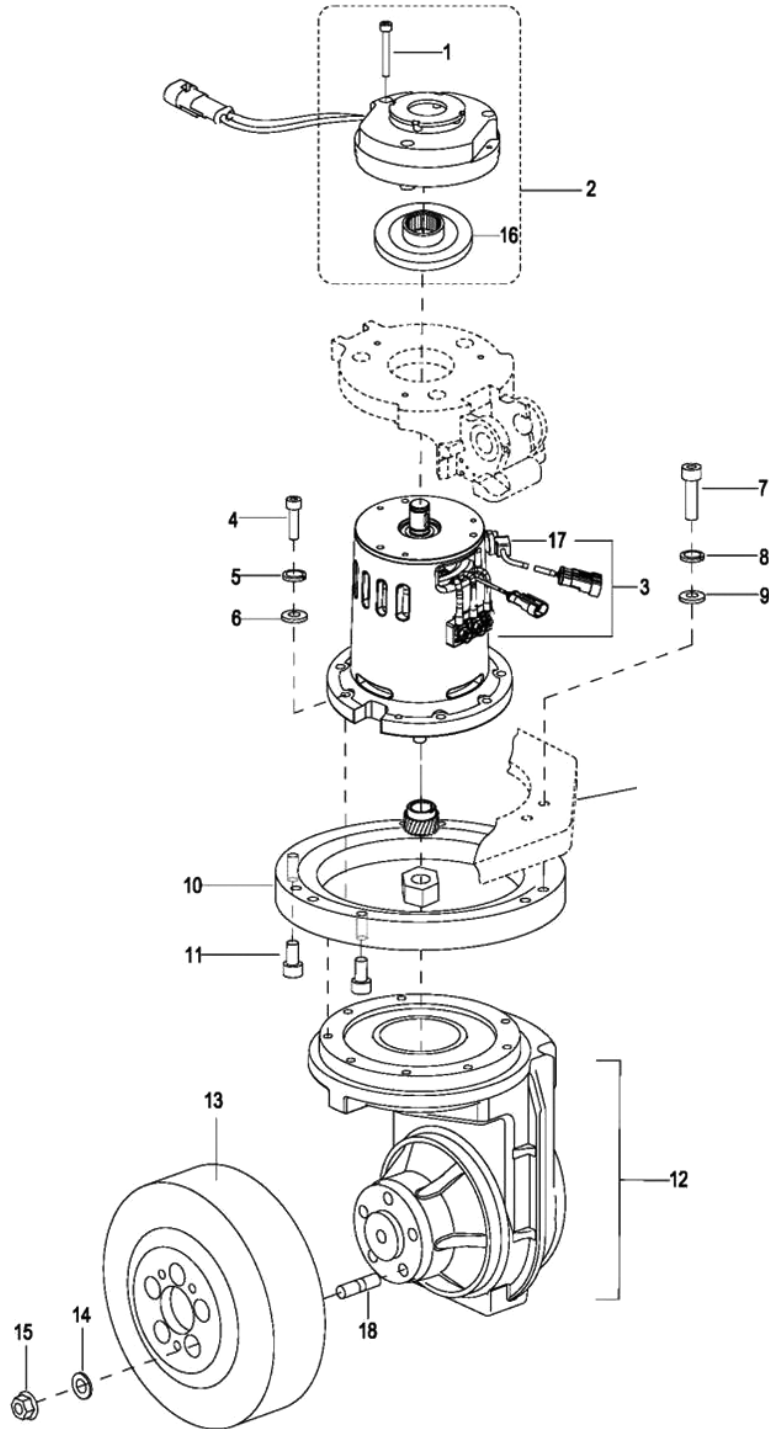
10.1 DRIVE WHEEL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Loosen but do not remove the five nuts.
4. Jack up the truck so the drive wheel is off the ground; then securely block the truck to prevent movement.
5. Remove five nuts, five washers, and drive wheel from transmission.
6. Install new drive wheel in reverse order of removal.
7. Install the compartment covers as described in paragraph 8-2.
8. Disengage the emergency stop switch and turn on key switch.

10.2 TRANSMISSION

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Remove the brake as described in paragraph 9-1.1.
4. Disconnect harness and cables from drive motor.
5. Remove the steering arm as described in paragraph 8-3.2.
6. Remove eight screws, eight lock washers, flat washers and motor from transmission.
7. Slowly lower the transmission out the bottom of the frame.
8. Remove drive wheel as described in paragraph 10-1.
9. Remove the six screws, six lock washers and six flat washers and lower the bearing out the bottom of the frame.
10. Install new transmission by reversing the steps above.

FIGURE 7-1 TRANSMISSION, MOTOR, BRAKE MOUNTING



10.3 LOAD WHEEL

10.3.1 REMOVAL

1. Raise forks.
2. Engage the emergency stop switch and turn off key switch.
3. Block the drive wheel to prevent the truck from rolling.
4. Jack up the forks to raise the load wheels off the floor. Securely block the forks in the raised position by positioning supports under both fork tips.

NOTE: When shaft is removed, load wheel will drop free.

5. Remove the snap ring and pins securing shaft and remove shaft, washers and load wheel assembly.

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. We recommend that both load wheel assemblies be replaced at the same time. This ensures level and safe operation of the lift truck.

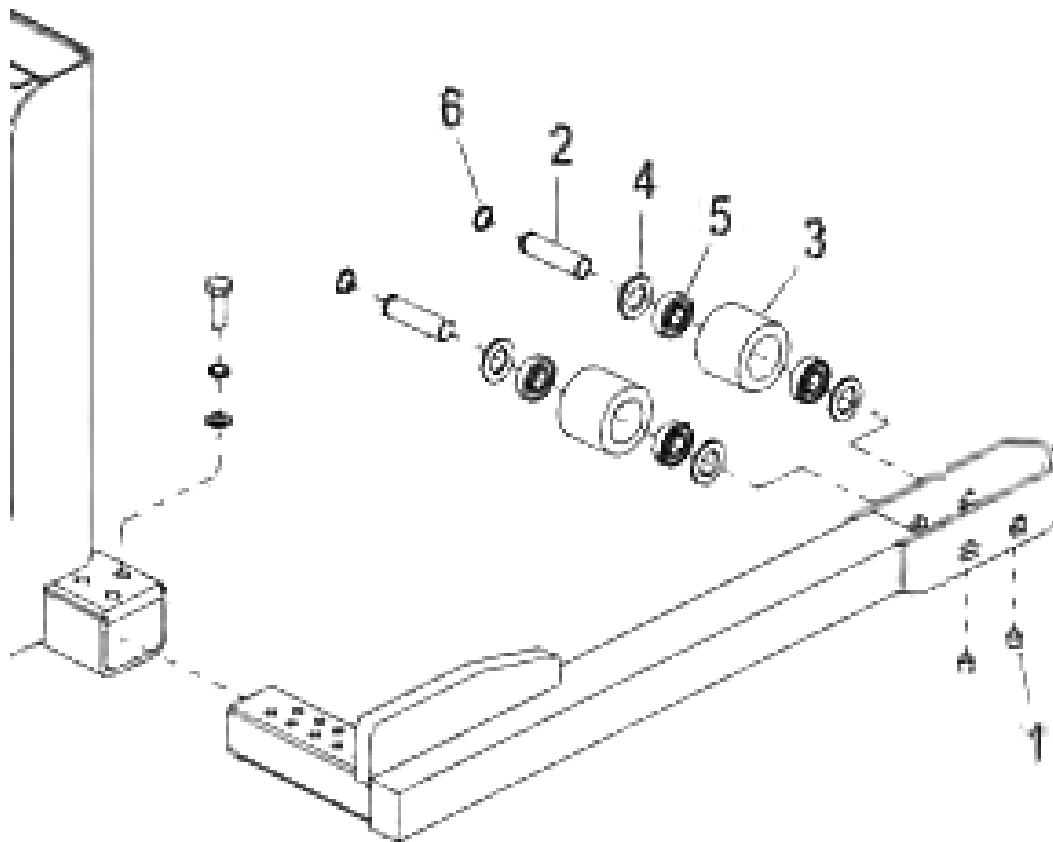
10.3.2 REPAIR

1. Remove bearings from wheel.
2. Inspect bearings and replace if necessary.
3. Reassemble bearings in wheel.
4. Jack up the forks to raise the load wheels off the floor. Securely block the forks in the raised position by positioning supports under both fork tips.

10.3.3 LOAD WHEEL INSTALLATION

1. Position load wheel and two washers in the straddle.
2. Install shaft and secure with pin and snap ring.
3. Remove blocking from under the truck.
4. Lower the forks.
5. Disengage the emergency stop switch and turn on key switch.

FIGURE 7-2 LOAD WHEEL



11.0 ELEVATION SYSTEM SERVICING

11.1 GENERAL

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

11.2 LIFT CHAIN LENGTH ADJUSTMENT

NOTE: The Telescopic trucks have two lift chains that are adjusted at the cross member of the outer mast Fully lower the lift carriage.

1. Fully lower the lift carriage.
2. Engage the emergency stop switch and turn off key switch.
3. Loosen both upper jam nuts to allow for adjustment of middle jam nuts.



WARNING

Before attempting any adjustment, make certain power is disconnected.

4. Break both lower jam nuts free from the middle jam nuts.
5. Take up slack in both lift chains with middle jam nuts. Strive for equal tension on both chains.
6. Align anchor so the clevis pins is parallel to the masts.
7. Tighten jam nuts securely while maintaining alignment of clevis pins.

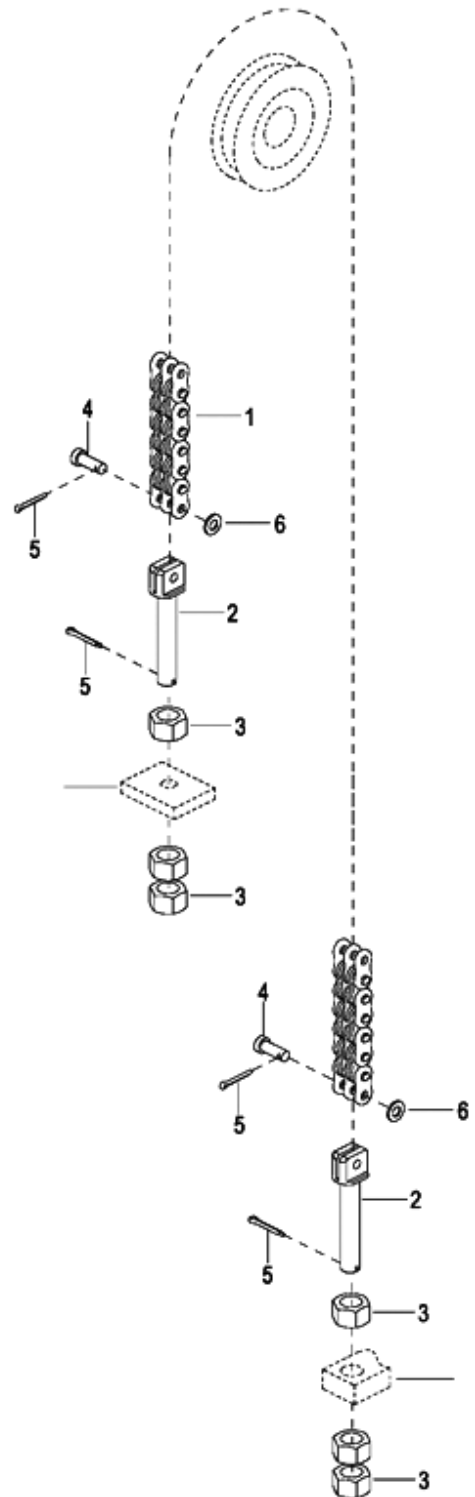


CAUTION

At least 3 full threads must be present below lower nut after adjustment.

8. Disengage the emergency stop switch and turn on key switch.
9. Test chain by operating carriage. If slack is still apparent, repeat above procedure.

FIGURE 8-1 CHAIN ASSEMBLY



11.3 LIFT CHAIN WEAR INSPECTION

Both lift chains should be replaced when either chain is worn enough to increase its length by 3% or more.

To make this determination proceed as follows.

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

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, clevis pins and cotter pins should be installed when chains are replaced. Never replace a partial section of chain and never repair chain. Refer to paragraph 11-4 when installing new chain.

11.4 LIFT CHAIN REPLACEMENT

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 and turn off key switch.
4. Remove cotter pin and clevis pin connecting chain to chain anchor at the lift carriage.
5. Remove cotter pin and clevis pin connecting chain to chain anchor at the outer mast.



WARNING

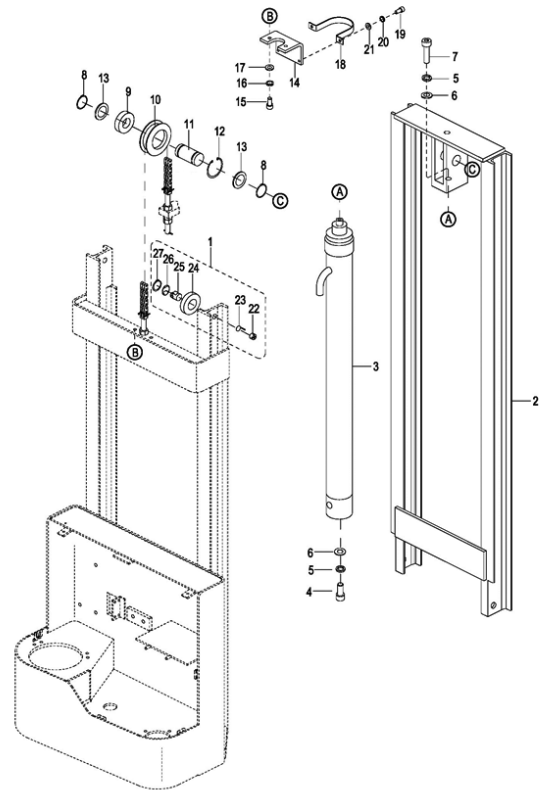
Before attempting any adjustment, make certain power is disconnected.

6. Remove chain from sheave.
7. Position new chain on sheave.
8. Secure new chain to new chain anchor at the outer mast with new clevis pin and new cotter pin.
9. Connect the opposite end of new chain to new chain anchor at the lift carriage with new clevis pin and new cotter pin.
10. Adjust the chains according to paragraph 11-2.
11. Disengage the emergency stop switch and turn on key switch.

11.5 LIFT CYLINDERS

NOTE: Removal and repair of lift cylinders are covered in SECTION 12.

FIGURE 8-2 MAST ASSEMBLY



12.0 HYDRAULIC SYSTEM SERVICING

12.1 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 and turn off key switch.
3. Remove the compartment covers as described in paragraph 8-2.



CAUTION

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

4. Telescopic Trucks: Refer to **Figure 9-1** and remove leaking line or fitting and replace it with a new line or fitting.
5. Check level of hydraulic oil. With lift carriage fully lowered, fill reservoir with hydraulic oil to 1" below opening. Use hydraulic oil listed in **Table 3-2**.
6. Disengage the emergency stop switch and turn on key switch.
7. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
8. Check level of hydraulic oil. Hydraulic oil must be 1" below opening. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in **Table 3-2**.
9. Install the compartment covers as described in paragraph 8-2.
10. Refer to paragraph 11-4 when installing new chain.

12.2 HYDRAULIC PUMP, MOTOR AND RESERVOIR ASSEMBLY

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

12.2.1 REMOVAL

1. Lower forks fully.
2. Engage the emergency stop switch and turn off key switch.
3. Remove the compartment covers as described in paragraph 8-2.

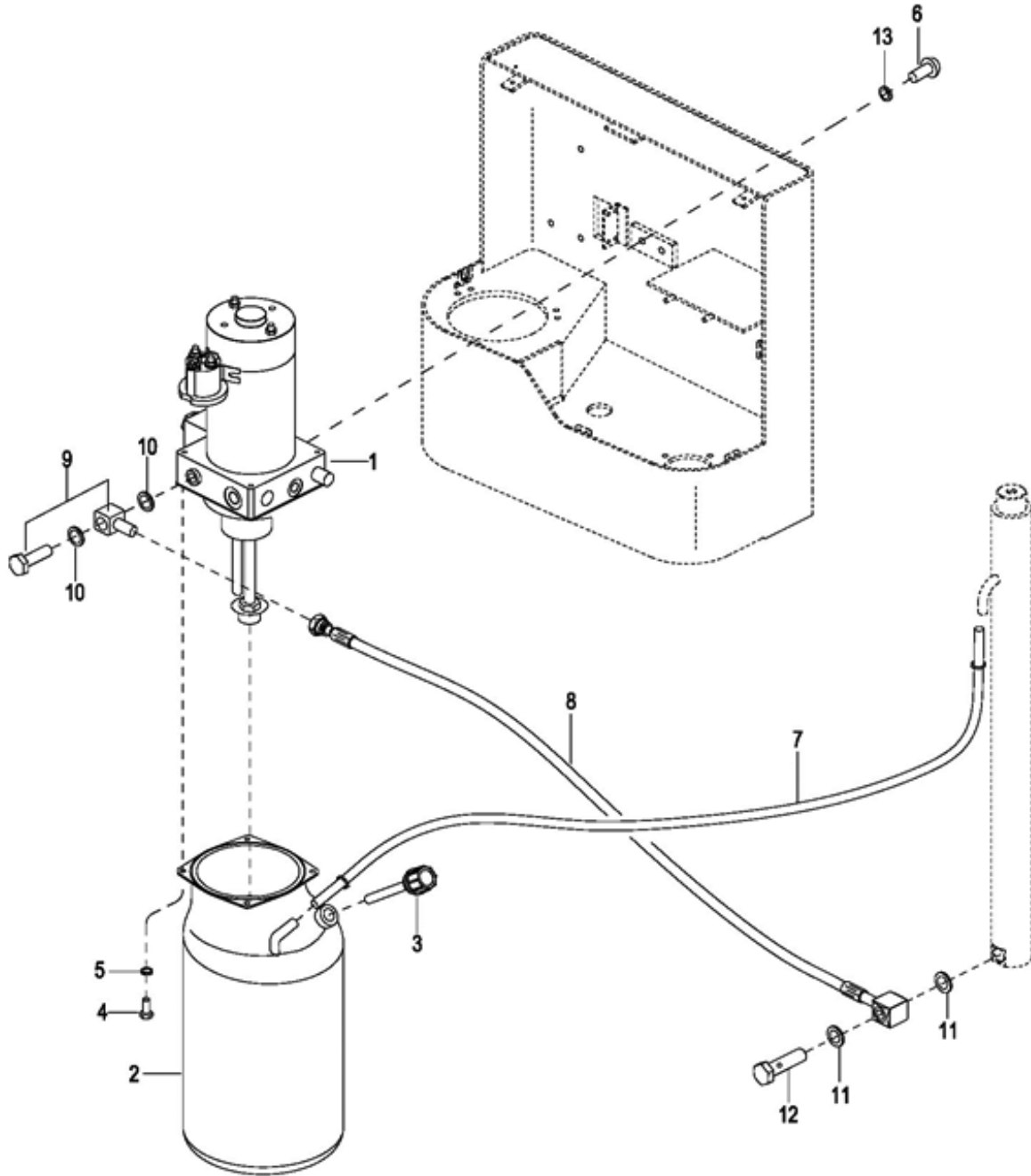
NOTE: The reservoir and hose will be filled with hydraulic oil. Place a container under the pump assembly to catch any hydraulic oil.

4. Tag and disconnect electrical leads from motor and solenoid. Refer to **Figure 10-4**.
5. Disconnect hose from pump and motor assembly.
6. While supporting the pump and motor assembly, remove four screws and four lock washers.
7. Remove the pump and motor assembly.

12.2.2 DISASSEMBLY AND REASSEMBLY

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

FIGURE 9-1 HYDRAULIC SYSTEM



12.2.3 INSTALLATION

1. While supporting the pump and motor assembly, secure with four screws and four lock washers.
2. Connect hose to pump and motor assembly.
3. Connect electrical leads to motor and solenoid.
4. Fill the hydraulic reservoir. Use hydraulic oil listed in **Table 3-2**.
5. Disengage the emergency stop switch and turn on key switch.
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 8-2.

12.3 LIFT CYLINDER

12.3.1 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 inner mast.
2. Lower inner mast onto the support. Check that Channel is secure before proceeding.



WARNING

Before attempting any replacement, make certain power is disconnected.



CAUTION

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

3. Engage the emergency stop switch and turn off key switch.
4. Remove the compartment covers as described in paragraph 8-3.
5. Disconnect the air hose from the top of lift cylinder.
6. Disconnect the hose from the bottom of lift cylinder.
7. Remove screw, lock washer, flat washer securing the top of the cylinder.
8. Remove screw, lock washer, flat washer securing the bottom of the cylinder.



WARNING

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

9. Support cylinder and remove two bolts, two lock washers, two flat washers and clamp from the plate.
10. Manually push the cylinder rod down as far as possible.
11. Raise lift cylinder assembly up and out of truck.

12.3.2 REPAIR

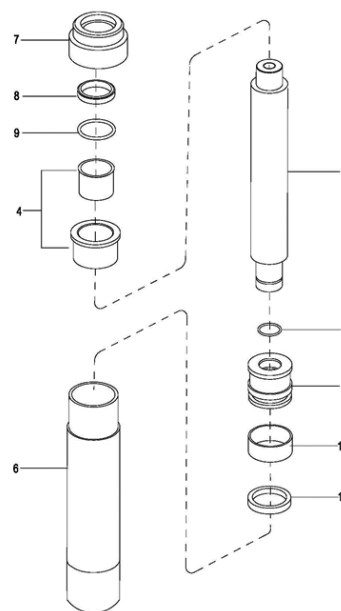


CAUTION

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

1. Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
2. Remove gland nut.
3. Remove wiper ring and o-ring from gland nut.
4. Pull out piston rod.
5. Remove bushing.
6. Remove guide ring and seal from piston rod.
7. Coat all parts with hydraulic oil (**Table 3-2**).
8. Install guide ring and new seal on piston rod.
9. Install bushing.
10. Insert rod in cylinder tube.
11. Install wiper ring and o-ring on gland nut.
12. Install gland nut in cylinder tube.

FIGURE 9-2 LIFT CYLINDER



12.3.3 INSTALLATION

1. Position the cylinder in the mast.
2. Install screw, lock washer, flat washer to secure the bottom of the cylinder.
3. Install screw, lock washer, flat washer to secure the top of the cylinder.
4. Install two bolts, two lock washers, two flat washers and clamp onto the plate.
5. Reconnect the hose to the bottom of lift cylinder.
6. Reconnect the air hose to the top of lift cylinder.
7. Fill the hydraulic reservoir. Use hydraulic oil listed in **Table 3-2**.
8. Disengage the emergency stop switch and turn on key switch.
9. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
10. Check level of hydraulic oil. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in **Table 3-2**.
11. Install the compartment covers as described in paragraph 8-2.

13.0 ELECTRICAL COMPONENTS

13.1 ELECTRICAL CONTROL PANEL

13.1.1 MAINTENANCE

NOTE: Erratic operation of the truck may be caused by defective controller components. Before removing the electrical panel, perform troubleshooting procedures per SECTION 7, 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 10-2** 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.

13.1.2 CLEANING

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Remove any dirt or corrosion from the bus bar area. The controller should be wiped clean with a moist rag. Allow it to dry before reconnecting the battery.
4. Make sure the connections to the buss bars are tight. Use two well insulated wrenches for this task in order to avoid steering the buss bars.

13.1.3 PANEL REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Tag and disconnect all electrical cables which connect to the control panel.
4. Remove three screws, three lock washers, three flat washers, horn and control panel.

13.1.4 PANEL DISASSEMBLY

Refer to **Figure 10-2** for location and identity of the major replacement components mounted on the panel and remove defective parts.

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

13.1.5 PANEL INSTALLATION

1. Install the control panel and secure with three screws, three lock washers, three flat washers and horn.
2. Refer to **Figure 10-3** and **Figure 10-4** and connect all electrical cables to the control panel as noted during removal.
3. Install the compartment covers as described in paragraph 8-2.
4. Disengage the emergency stop switch and turn on key switch.

13.1.6 CONTROLLER REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Tag and disconnect main harness from controller.
4. Tag and disconnect remaining leads from the controller. Refer to **Figure 10-4**.
5. Unscrew mounting screws and remove controller from control panel.

13.1.7 CONTROLLER INSTALLATION

1. Position controller on control panel and secure with four screws.
2. Reconnect main harness to controller.
3. Reconnect remaining leads to the controller. Refer to **Figure 10-4**.
4. Install compartment covers as described in paragraph 8-2.
5. Disengage the emergency stop switch (**19, Figure 10-1**) and turn on key switch (**27, Figure 5-1**).

FIGURE 10-1 ELECTRICAL SYSTEM

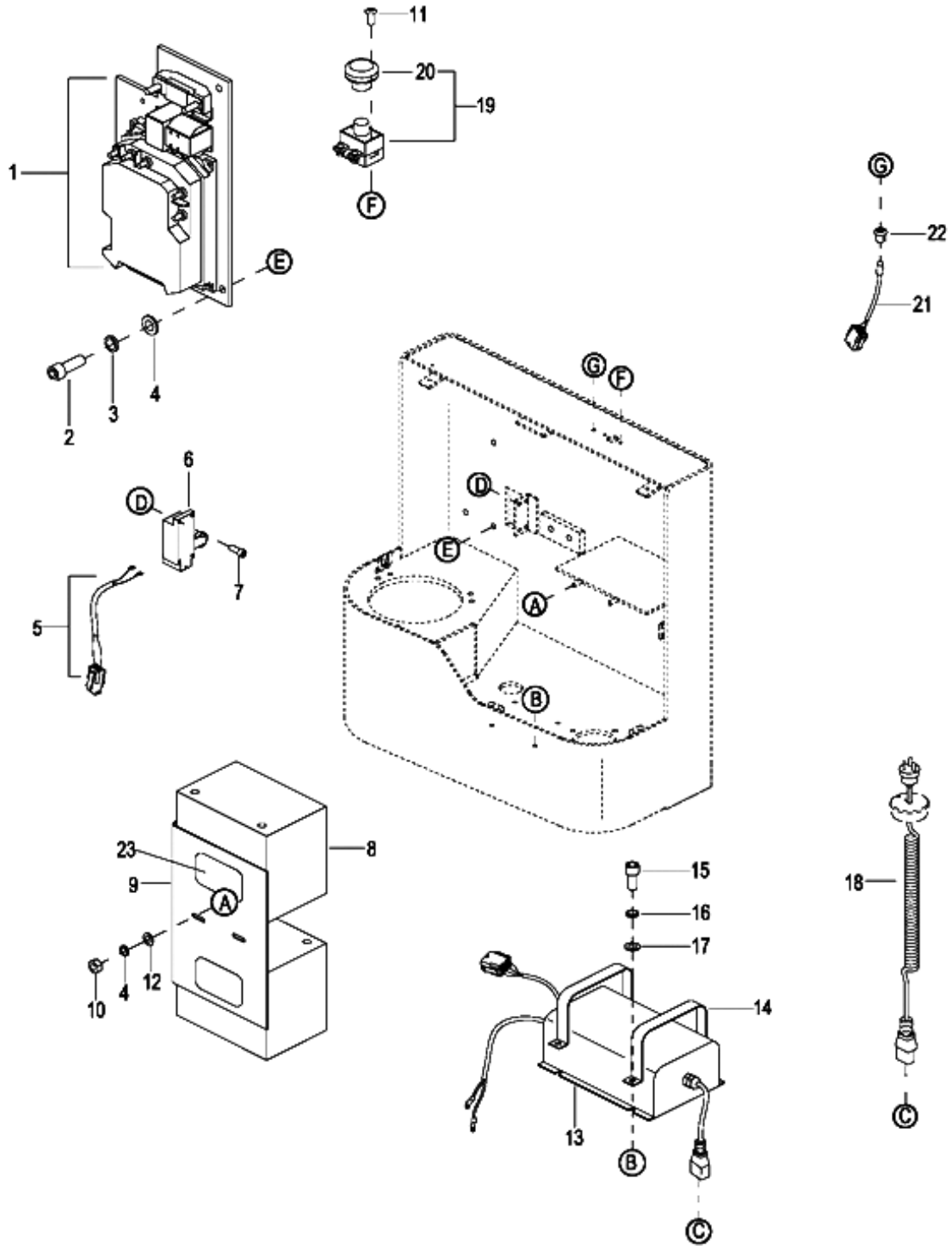
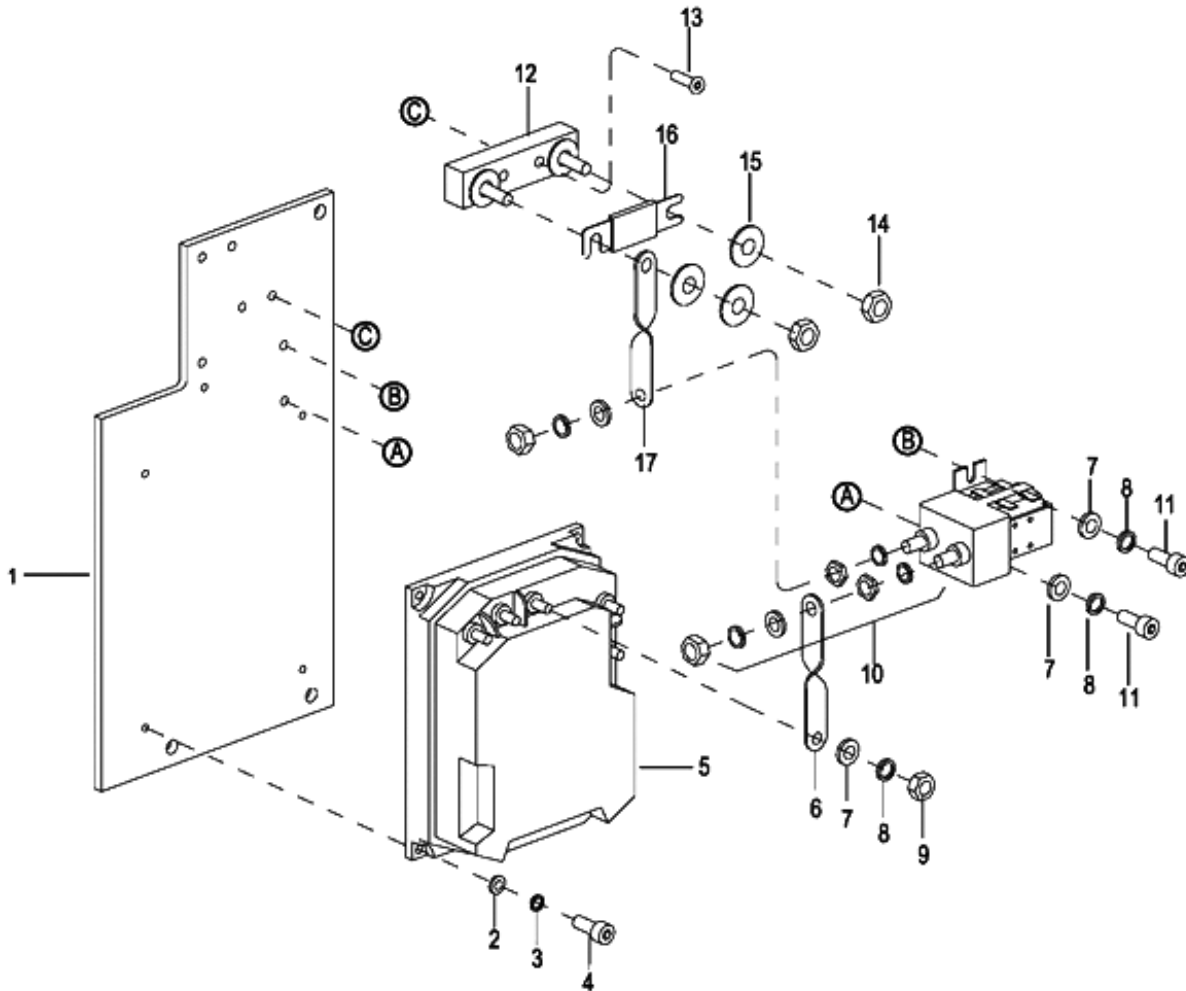


FIGURE 10-2 ELECTRICAL SYSTEM PANEL



13.1.8 CHARGER REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Tag and disconnect LED indicator from charger.
4. Tag and disconnect charger cable from the charger.
5. Tag and disconnect remaining two charger leads.
6. Remove four mounting screws and two hoops and remove charger. Remove four screws, guard and cooling fan.

13.1.9 CHARGER INSTALLATION

1. Position charger on the frame and secure with original screws and hoops.
2. Reconnect LED indicator to charger.
3. Reconnect charger cable to the charger.
4. Reconnect remaining two charger leads.
5. Install compartment covers as described in paragraph 8-2.
6. Disengage the emergency stop switch and turn on key switch.

FIGURE 10-3 WIRING HARNESS

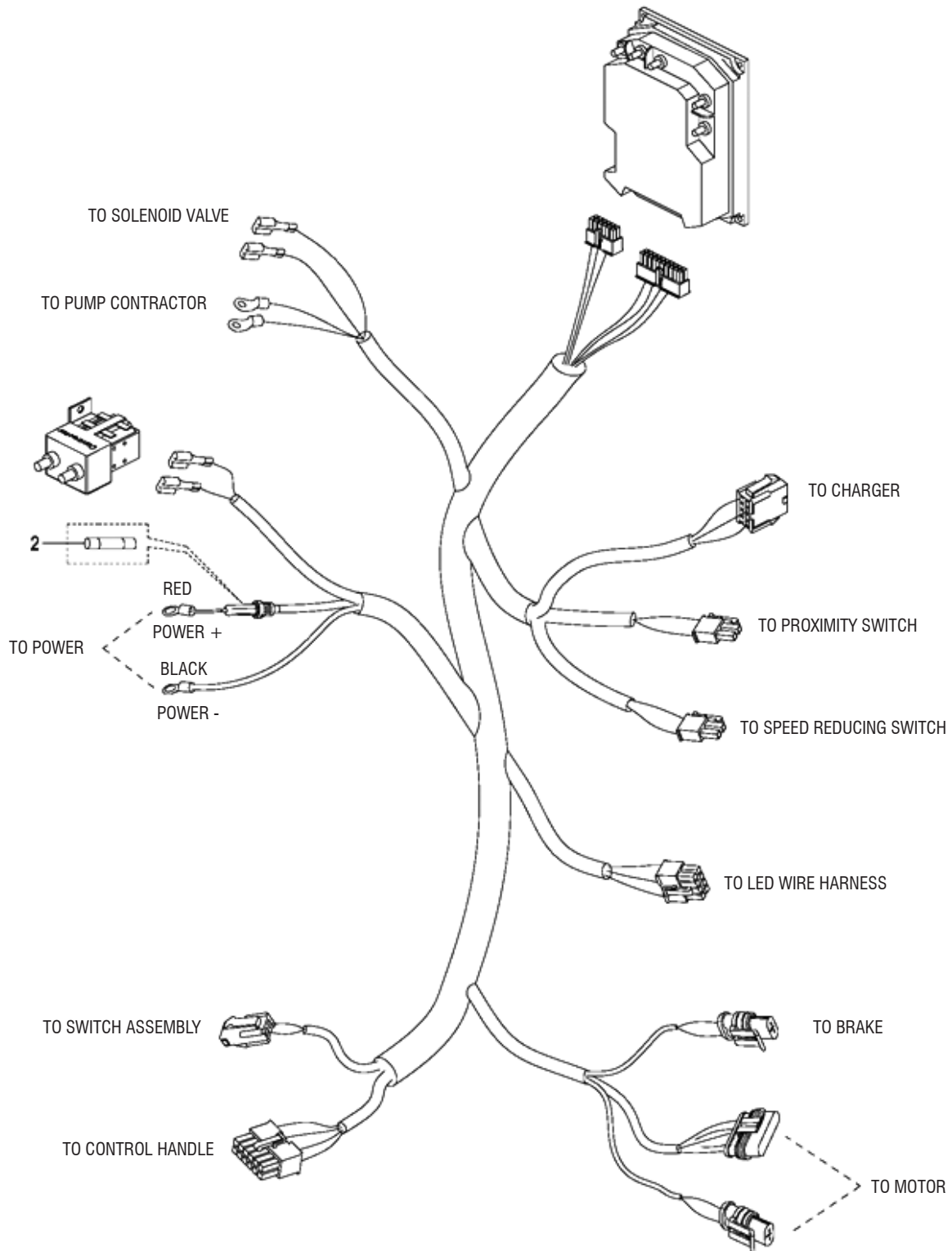
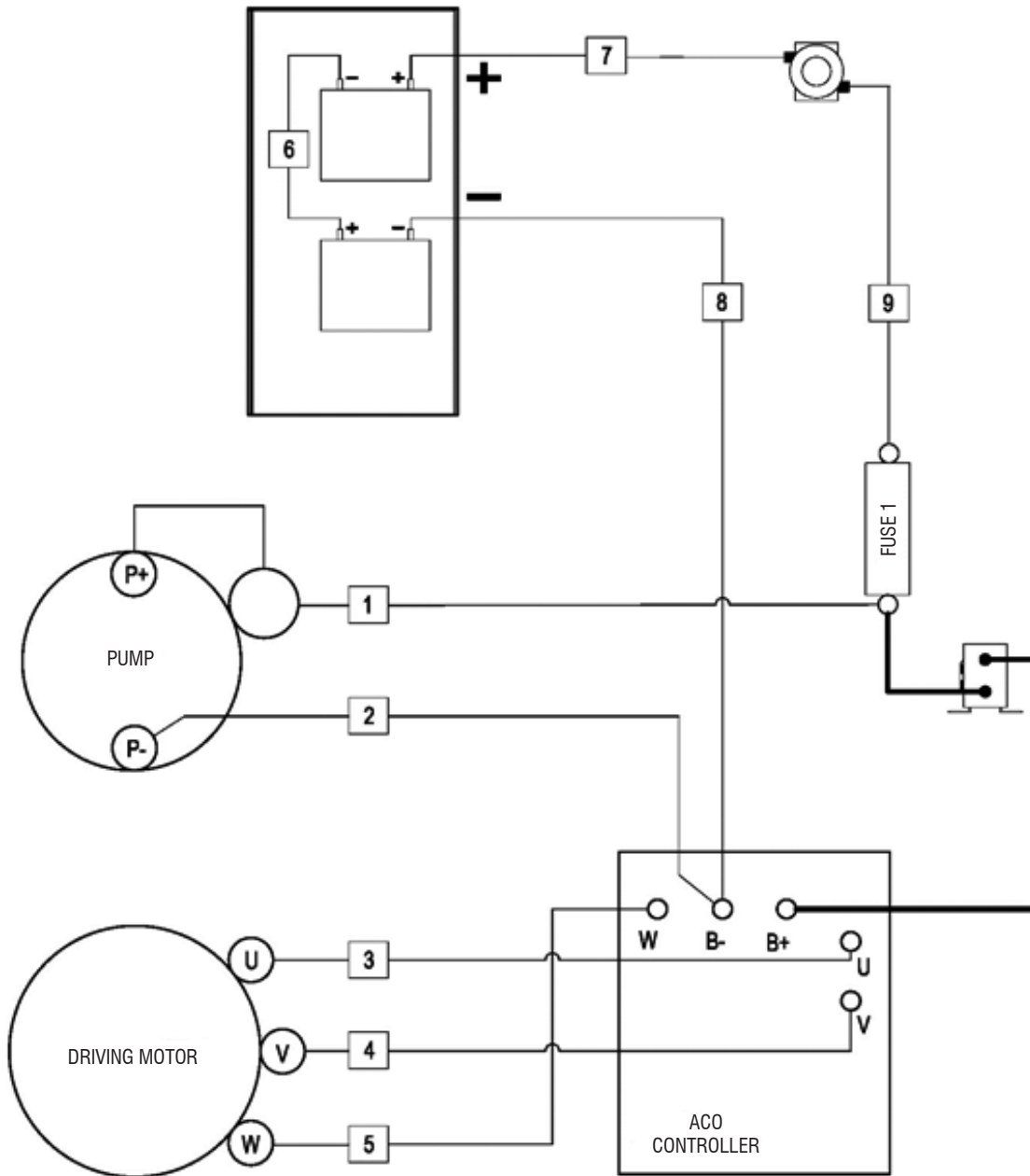


FIGURE 10-4 WIRING CABLES



13.1.10 LED INDICATOR REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Tag and disconnect LED indicator from charger.
4. Cut the glue holding the LED indicator in place and remove the indicator.

13.1.11 LED INDICATOR INSTALLATION

1. Position LED indicator on the bracket and glue it in place.
2. Reconnect charger to LED indicator.
3. Install upper compartment covers as described in paragraph 8-2.
4. Disengage the emergency stop switch and turn on key switch.

13.1.12 EMERGENCY STOP SWITCH REMOVAL

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Tag and disconnect cables from emergency stop switch.
4. Insert a tool through the shaft of emergency stop switch and then unscrew the knob from the shaft.
5. Remove the two screws and remove the emergency stop switch from the frame.

13.1.13 EMERGENCY STOP SWITCH INSTALLATION

1. Position emergency stop switch on the frame and secure with two screws.
2. Install the knob on the emergency stop switch.
3. Reconnect cables to emergency stop switch.
4. Install compartment covers as described in paragraph 8-2.
5. Disengage the emergency stop switch and turn on key switch.

13.1.14 LIFT LIMIT SWITCH REMOVAL

1. Lower forks fully.
2. Engage the emergency stop switch and turn off key switch.
3. Remove the compartment covers as described in paragraph 8-2.
4. Tag and disconnect main harness from limit switch.
5. Remove four screws and limit switch from the frame.

13.1.15 LIFT LIMIT SWITCH INSTALLATION

1. Position limit switch on the frame and secure with the four screws.
2. Reconnect main harness to limit switch.
3. Install compartment covers as described in paragraph 8-2.
4. Disengage the emergency stop switch and turn on key switch.

13.2 HORN REPLACEMENT

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Tag and disconnect all electrical connections from horn.
4. Remove screw, lock washer, flat washer and horn.
5. Install new horn and secure with screw, lock washer, flat washer.
6. Install the compartment covers as described in paragraph 8-2.
7. Disengage the emergency stop switch and turn on key switch.

13.3 PUMP MOTOR

The pump motor is replaceable but not repairable. Refer to paragraph 12-1.

13.4 DRIVE MOTOR

The drive motor exposed surfaces should be cleaned at least once a month to assure proper cooling of motor. Use an air hose to blow dust off of motor surfaces. The drive motor is replaceable but not repairable. Refer to paragraph 10-1.

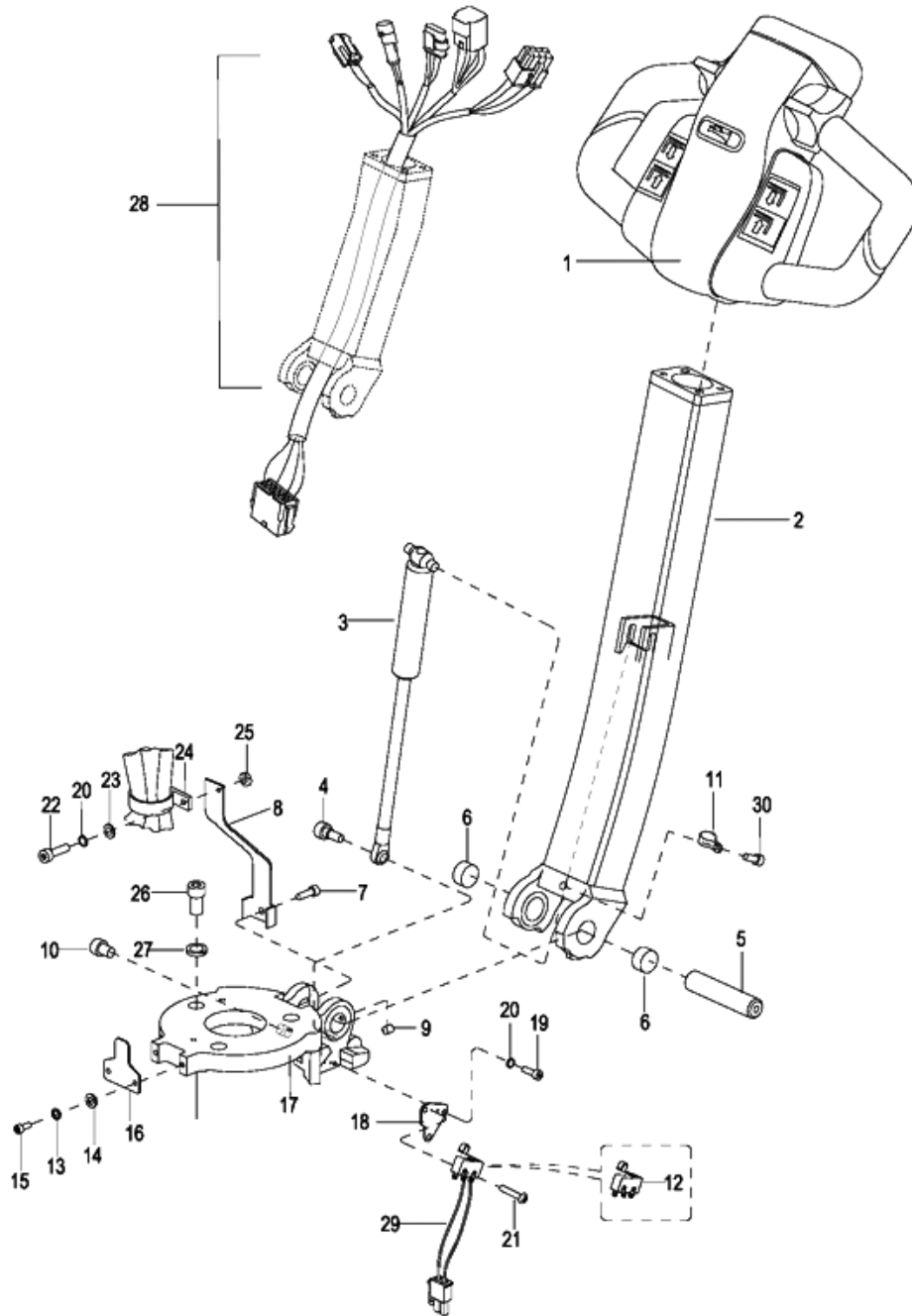
13.5 DEADMAN SWITCH

1. Engage the emergency stop switch and turn off key switch.
2. Remove the compartment covers as described in paragraph 8-2.
3. Disconnect main harness from the deadman switch.
4. Remove the two screws and bracket from the brake base.
5. Remove two screws and switch from bracket.
6. Position the new switch on bracket and secure with the two screws.
7. Position bracket on brake base and secure with two screws.
8. Install compartment covers as described in paragraph 5-2.
9. Disengage the emergency stop switch and turn on key switch.

14.0 ILLUSTRATED PARTS BREAKDOWN

Following is an illustrated parts breakdown of assemblies and parts associated with the EPS-30 Lift Truck.

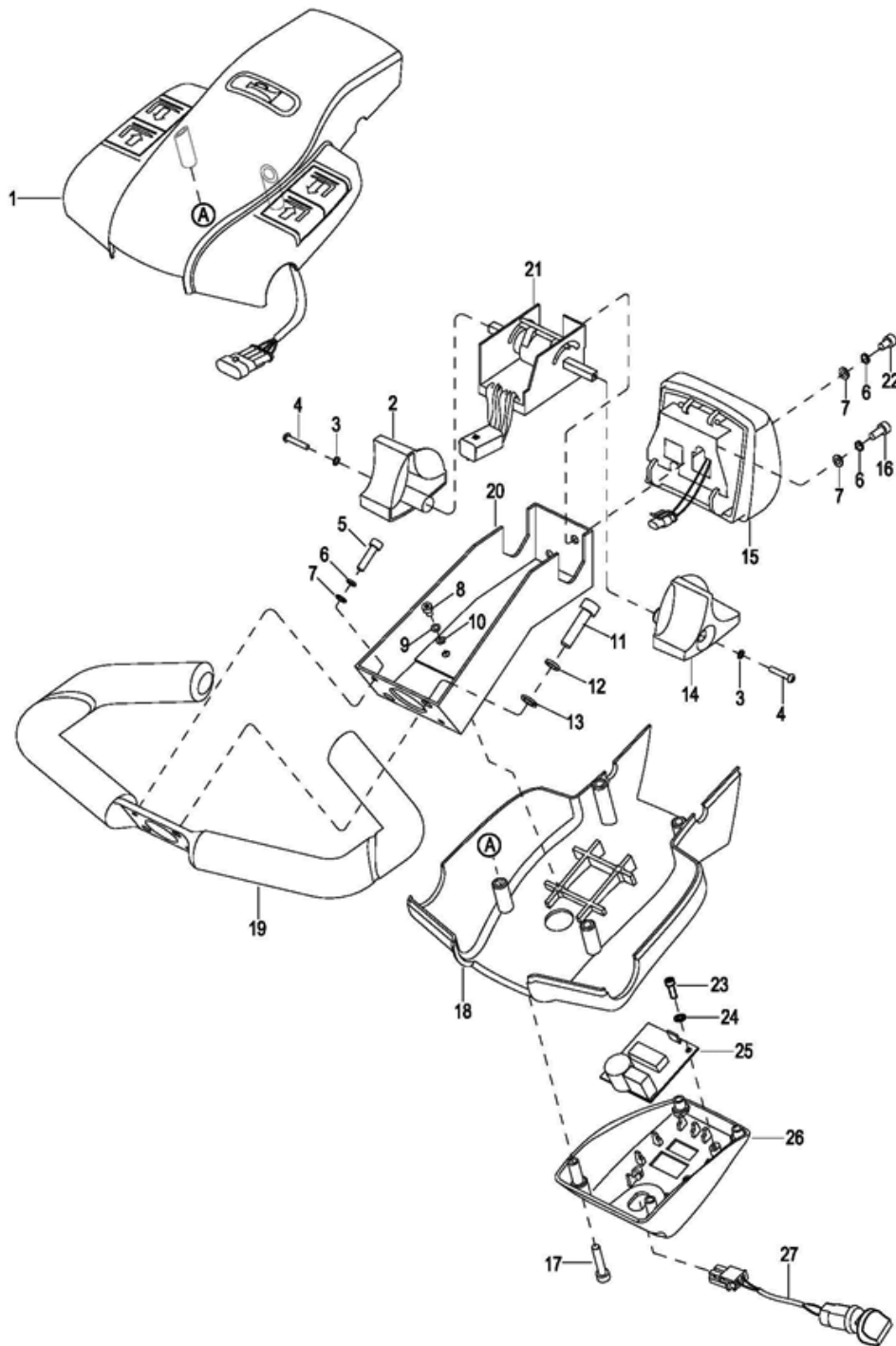
FIGURE 12-1 STEERING SYSTEM



STEERING ARM

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	114-340000-00-B	CONTROL POD ASSEMBLY	1	
2	1120-330000-0A	STEER ARM	1	
3	1120-320000-00	GAS SPRING	1	
4	0000-000322-00	SCREW M8 x 25	1	
5	1120-300003-00	SHAFT	1	
6	0000-000011-00	BUSHING	2	
7	0000-000032-00	SCREW M6 x 25	1	
8	1120-300005-00	BRACKET	1	
9	0000-000429-00	SCREW M5 x 8	1	
10	0000-000030-00	SCREW M10 x 16	1	
11	0000-000490-00	HARNESS CLAMP	1	
12	1220-560001-00	INCHING SWITCH I	2	
13	0000-000206-00	LOCK WASHER Ø5	2	
14	0000-000390-00	FLAT WASHER Ø5	2	
15	0000-000004-00	SCREW M5 x 12	2	
16	1120-300004-00	FIXED PLATE	1	
17	1120-300001-0A	BRAKE BASE	1	
18	1120-300006-00	SPACER	1	
19	0000-000088-00	SCREW M4 x 8	2	
20	0000-000122-00	LOCK WASHER Ø4	3	
21	0000-000120-00	SCREW M2 x 8	2	
22	0000-000378-00	SCREW M4 x 16	1	
23	0000-000702-00	FLAT WASHER Ø4	1	
24	0000-000491-00	PLASTIC RING	1	
25	0000-000209-00	NUT M4	1	
26	0000-000109-00	SCREW M8 x 16	3	
27	0000-000159-00	LOCK WASHER Ø8	3	
28	2105-520002-00	WIRE HARNESS	1	
29	1115-520009-0A	SWITCH ASSEMBLY	1	
30	0000-000010-00	SCREW M5 x 6	1	

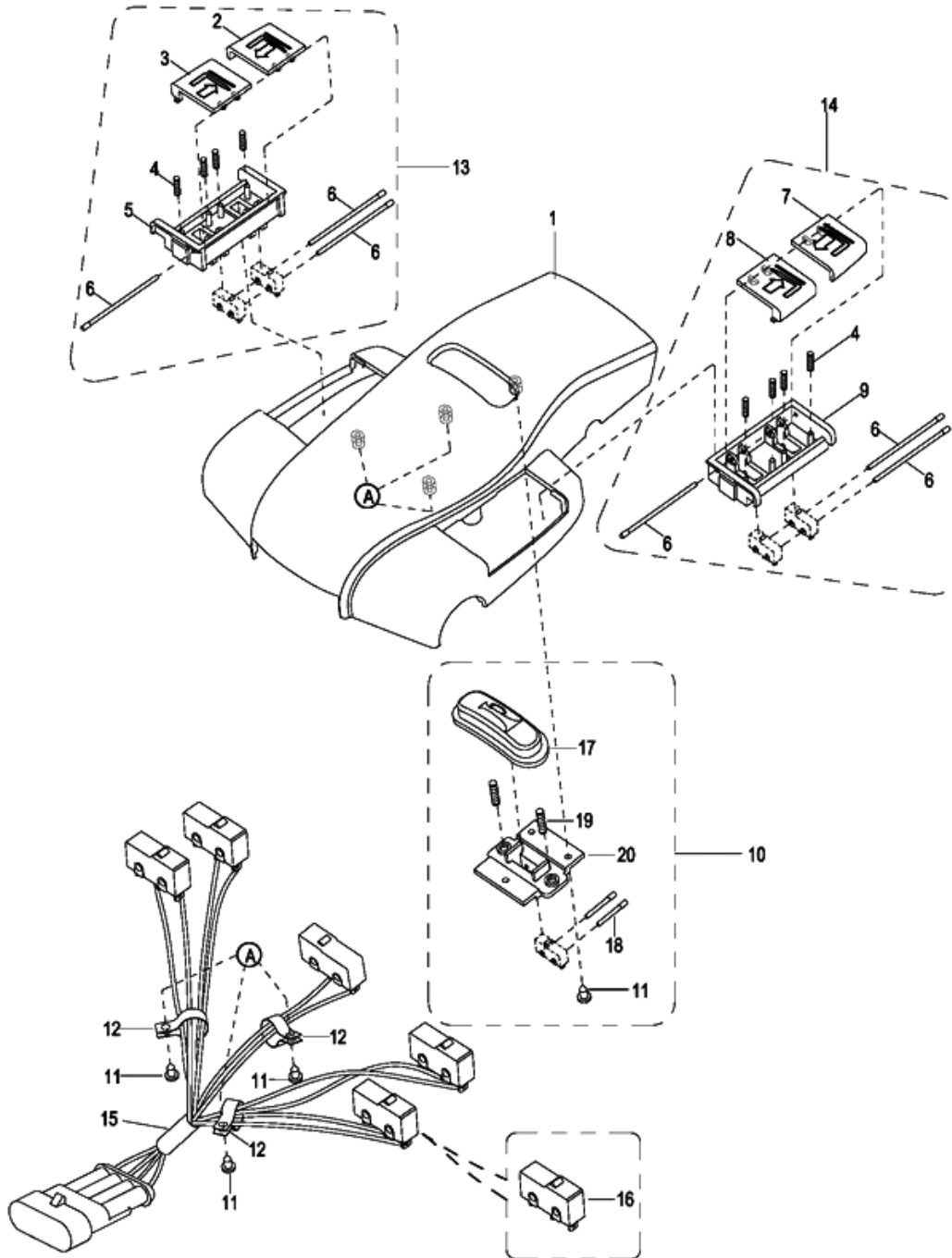
FIGURE 12-2 CONTROL HEAD



CONTROL HEAD

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	1120-342000-00-B	CONTROL HEAD COVER ASSEMBLY	1	WITH WIRE
2	1120-340005-00	CONTROL KNOB RIGHT SIDE	1	
3	0000-000038-00	LOCK WASHER Ø3	2	
4	0000-000037-00	SCREW M3 x 12	2	
5	0000-000004-00	SCREW M5 x 12	2	
6	0000-000206-00	LOCK WASHER Ø5	4	
7	0000-000390-00	FLAT WASHER Ø5	4	
8	0000-000088-00	SCREW M4 x 8	2	
9	0000-000122-00	LOCK WASHER Ø4	2	
10	0000-000702-00	FLAT WASHER Ø4	2	
11	0000-000322-00	SCREW M8 x 25	2	
12	0000-000159-00	LOCK WASHER Ø8	2	
13	0000-000176-00	FLAT WASHER Ø8	2	
14	1120-340003-00	CONTROL KNOB LEFT SIDE	1	
15	1120-343000-00-B	BELLY BUTTON COVER ASSEMBLY	1	WITH WIRE HARNESS
16	0000-000004-00	SCREW M5 x 12	1	
17	0000-001322-00	SCREW M5 x 50	4	
18	1114-310002-00	COVER	1	
19	1120-341000-00	HANDLE GRIP	1	
20	1120-340001-00	CONNECTOR BRACKET	1	
21	1220-520008-0C	ACCELERATOR ASSEMBLY	1	
22	0000-000010-00	SCREW M5 x 6	1	
23	0000-000666-00	SCREW M3 x 8	2	
24	0000-000991-00	FLAT WASHER Ø3	2	
25	1114-500007-00	CIRCUIT BOARD	1	
26	1114-310001-10	BOTTOM COVER	1	
27	1115-520019-0A	2-WAY KEY SWITCH ASSEMBLY	1	

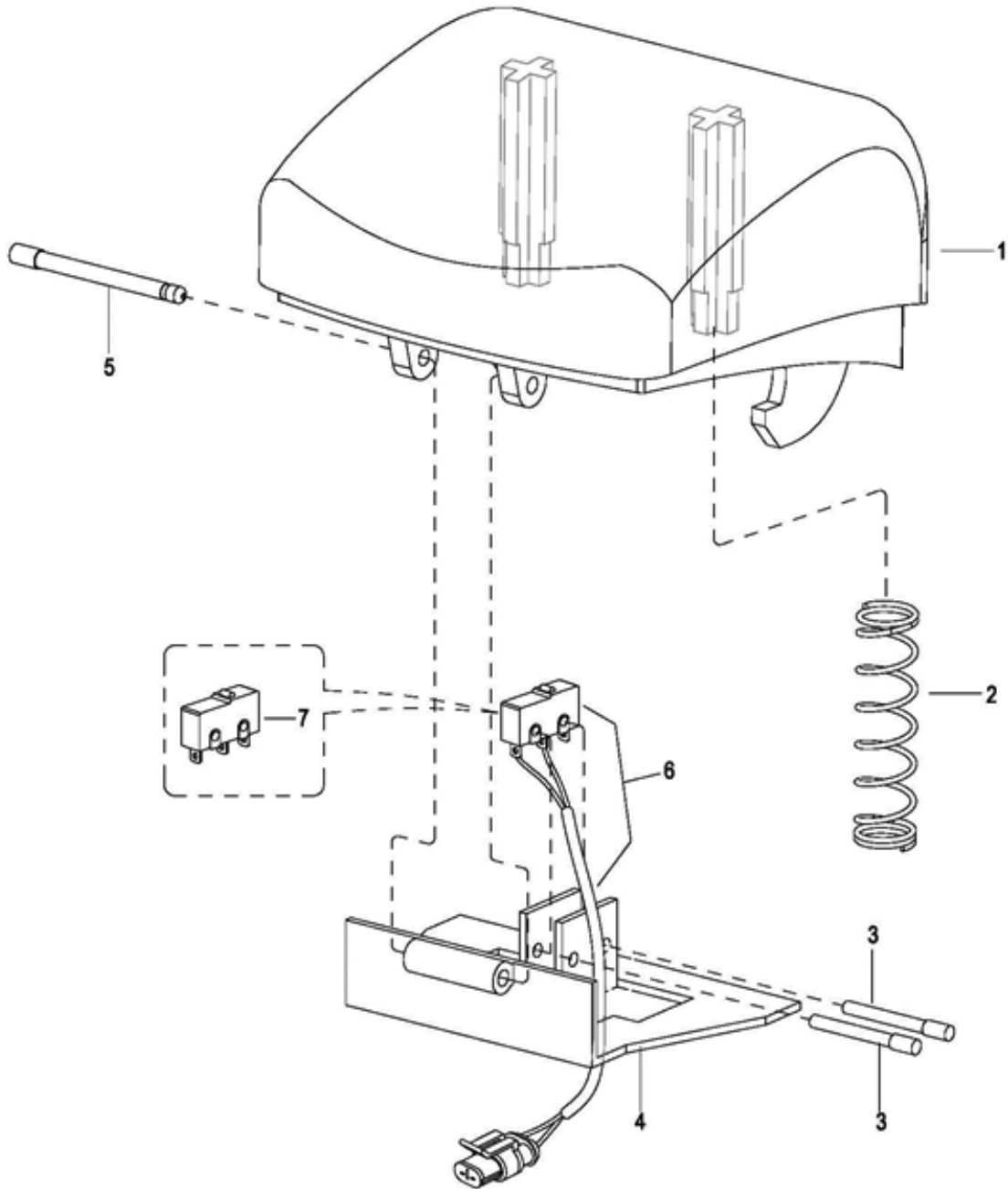
FIGURE 12-3 CAP ASSEMBLY



CAP ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	1120-342001-00	UPPER COVER	1	
2	1120-342203-00	LIFT BUTTON (R)	1	
3	1120-342202-00	LOWERING BUTTON (R)	1	
4	1120-342102-00	SPRING	8	
5	1120-342201-00	BUTTON BRACKET (R)	1	
6	1120-342105-00	PIN	6	
7	1120-342104-00	LIFT BUTTON (L)	1	
8	1120-342103-00	LOWERING BUTTON (L)	1	
9	1120-342101-00	BUTTON BRACKET (L)	1	
10	1120-342300-00	HORN BUTTON ASSEMBLY	1	
11	0000-000039-00	SCREW ST3.5 x 9.5	6	
12	0000-000490-00	LINE CLAMP	3	
13	1120-342200-00	LIFT AND LOWER BOX ASSEMBLY (R)	1	
14	1120-342100-00	LIFT AND LOWER BOX ASSEMBLY (L)	1	
15	1220-520006-0C	CONTROL HEAD HARNESS ASSEMBLY	1	WITH SWITCHES
16	1220-560002-00	INCHING SWITCH II	5	
17	1120-342002-00	HORN BUTTON	1	
18	1120-342005-00	PIN	2	
19	1120-342003-00	SPRING	2	
20	1120-342004-00	BUTTON BRACKET	1	

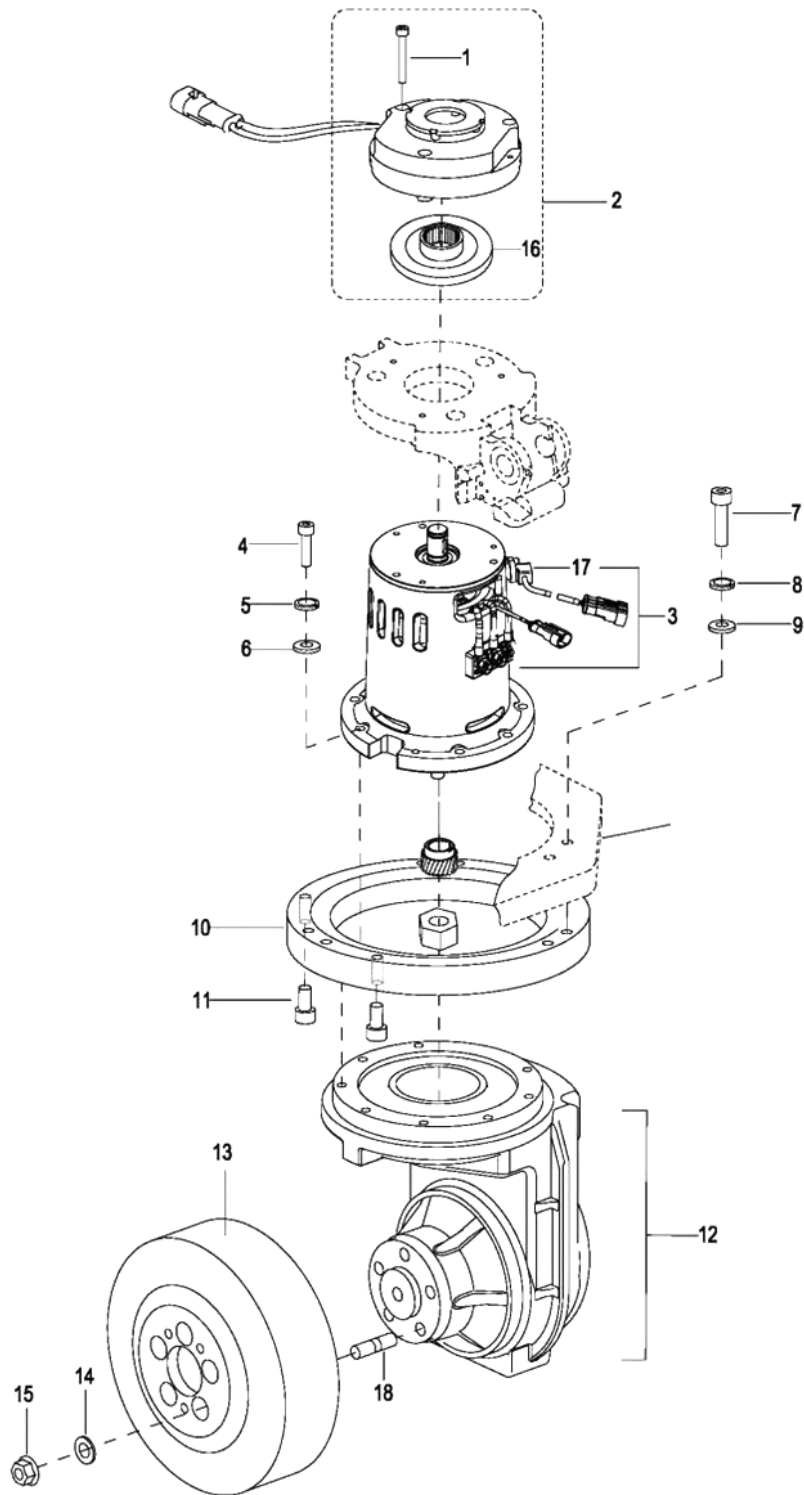
FIGURE 12-4 EMERGENCY REVERSE SWITCH ASSEMBLY



EMERGENCY REVERSE SWITCH ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	1120-343002-00	EMERGENCY REVERSE BUTTON	1	
2	1120-343003-00	SPRING	2	
3	1120-342005-00	PIN	2	
4	1120-343001-0A	BRACKET	1	
5	1120-343004-00	PIN	1	
6	1220-520005-0C	WIRE HARNESS REVERSING SWITCH	1	
7	1220-560002-00	INCHING SWITCH II	1	

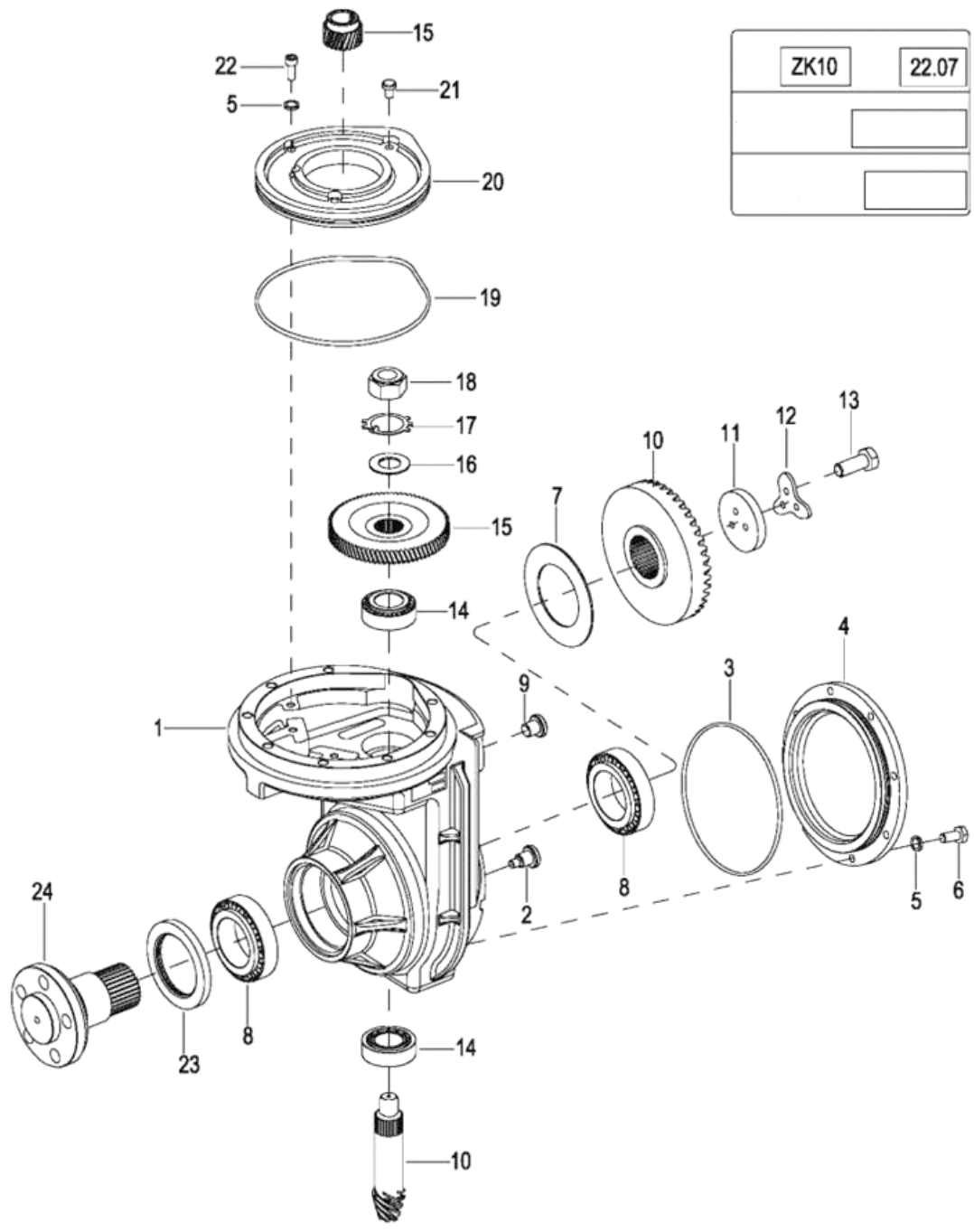
FIGURE 12-5 TRANSMISSION, MOTOR, BRAKE ASSEMBLY



TRANSMISSION, MOTOR, BRAKE ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	0000-000027-00	SCREW M6 x 55	3	
2	2125-210000-00	BRAKE ASSEMBLY	1	
3	2121-220000-00	MOTOR ASSEMBLY	1	
4	0000-000154-00	SCREW M8 x 35	8	
5	0000-000159-00	LOCK WASHER Ø8	8	
6	0000-000176-00	FLAT WASHER Ø8	8	
7	0000-000155-00	SCREW M10 x 40	6	
8	0000-000063-00	LOCK WASHER Ø10	6	
9	0000-000007-00	FLAT WASHER Ø10	6	
10	1120-230000-00	BEARING	1	
11	0000-000070-00	SCREW M10 x 25	2	
12	1120-240000-30	GEAR CASE ASSEMBLY	1	
13	1120-200001-00	DRIVE WHEEL POLY	1	
13	1120-200001-10	DRIVE WHEEL RUBBER	1	
13	1120-200001-20	TRACTION DRIVE TIRE	1	
14	0000-000025-00	LOCK WASHER Ø12	5	
15	0000-000157-00	NUT M12	5	
16	2125-210002-00	BRAKE LINING	1	
17	2121-220001-00	ENCODER	1	
18	1120-240014-30	STUDS	5	

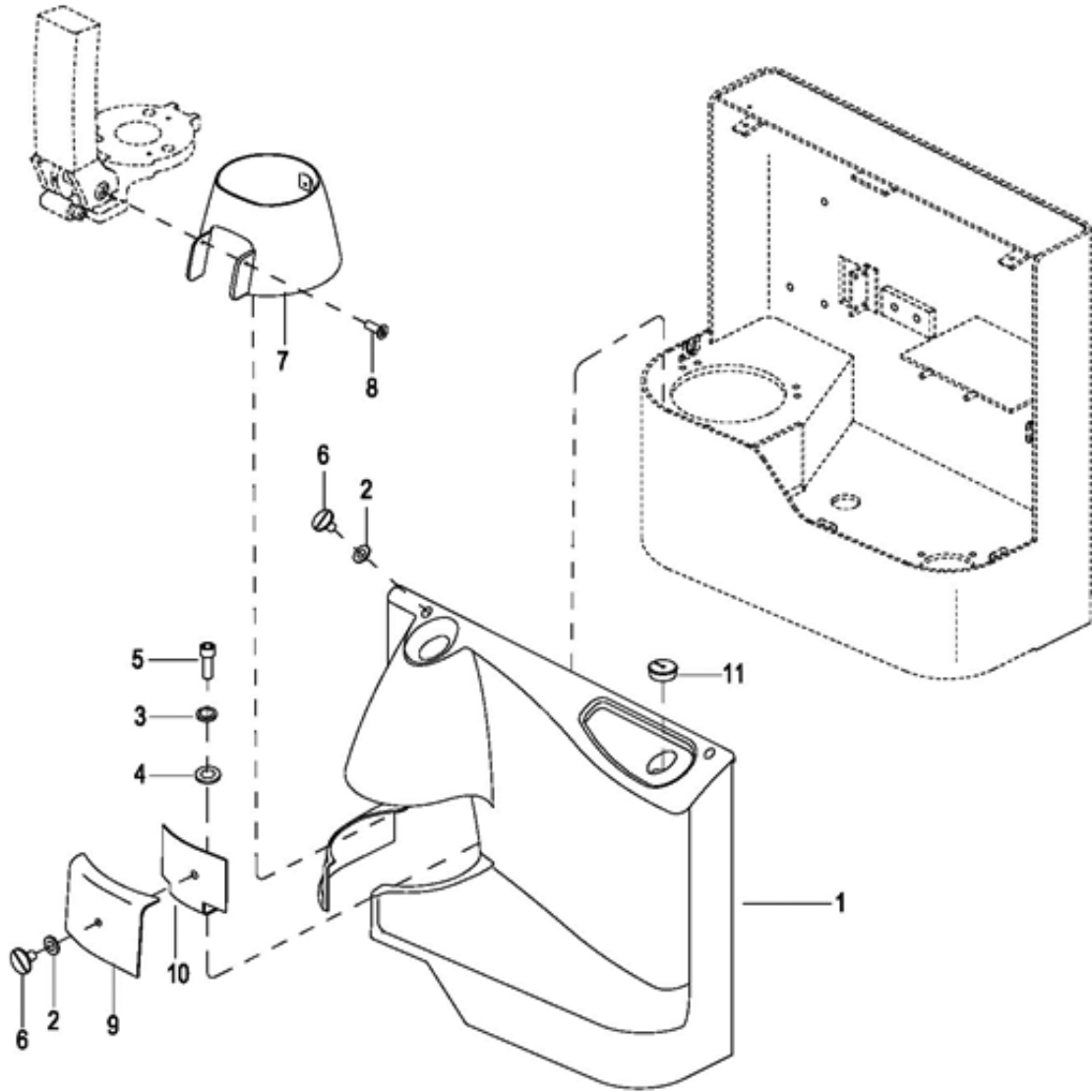
FIGURE 12-6 TRANSMISSION



TRANSMISSION

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	1120-240001-30	GEAR CASE	1	
2	1120-240002-30	PLUG	1	
3	0000-000214-00	O-RING 135 x 3.1	1	
4	1120-240003-30	COVER	1	
5	0000-000056-00	LOCK WASHER Ø6	12	
6	0000-000259-00	BOLT M6 x 16	8	
7	1120-240019-30	WASHER	A.R.	AS REQUIRED
8	0000-000961-00	BEARING	2	
9	1120-240005-30	PLUG	1	
10	1120-GB30-10	GEAR SET	1	INCLUDES 2 GEARS
11	1120-240007-30	WASHER	1	
12	1120-240008-30	LOCKING PLATE	1	
13	0000-000277-00	BOLT M8 x 25	3	
14	0000-001054-00	BEARING	2	
15	1120-GB30-00	GEAR SET	2	INCLUDES 2 GEARS
16	0000-000379-00	FLAT WASHER Ø14	1	
17	0000-001055-00	WASHER Ø14	1	
18	0000-001056-00	NUT M14 x 1.5	1	
19	0000-000211-00	O-RING 150 x 3.1	1	
20	1120-240010-30	COVER	1	
21	1120-240011-30	GAS PLUG	1	
22	0000-000055-00	SCREW M6 x 16	4	
23	1120-240017-30	SEAL WASHER TC80 x 65 x 8	1	
24	1120-240013-30	OUTPUT SHAFT	1	

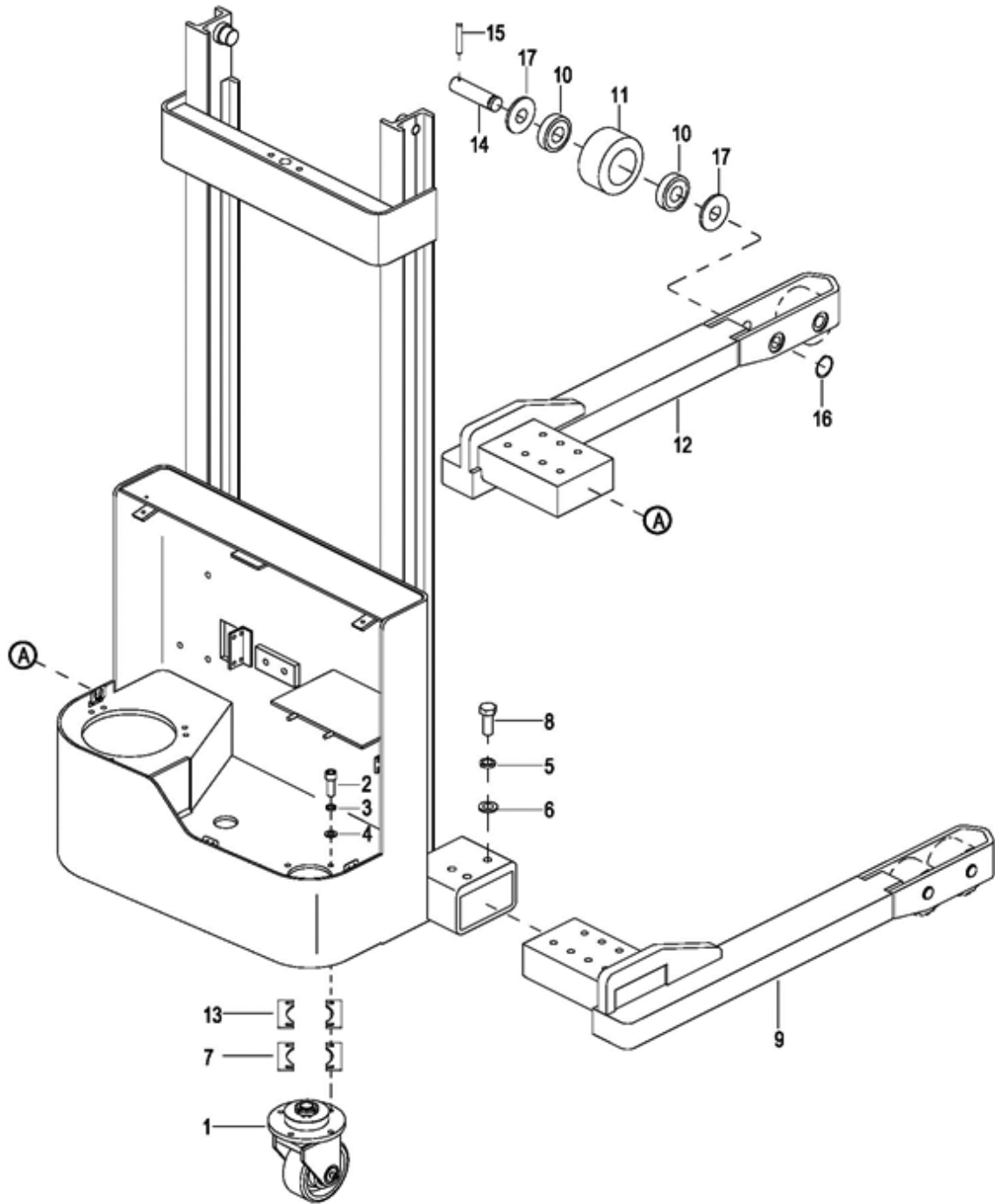
FIGURE 12-7 COMPARTMENT COVERS



COMPARTMENT COVERS

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2105-100001-00	COVER	1	
2	2214-150003-00	WASHER Ø6	3	
3	0000-000056-00	LOCK WASHER Ø6	1	
4	0000-000123-00	FLAT WASHER Ø6	1	
5	0000-000077-00	SCREW M6 x 12	1	
6	1120-150004-00	SCREW M6 x 2	3	
7	1120-150002-00	MIDDLE COVER	1	
8	0000-000126-00	SCREW M6 x 16	2	
9	2112-150001-00	SMALL COVER	1	
10	2112-150002-00	COVER BRACKET	1	
11	1118-100005-00	CHARGER CAP	1	

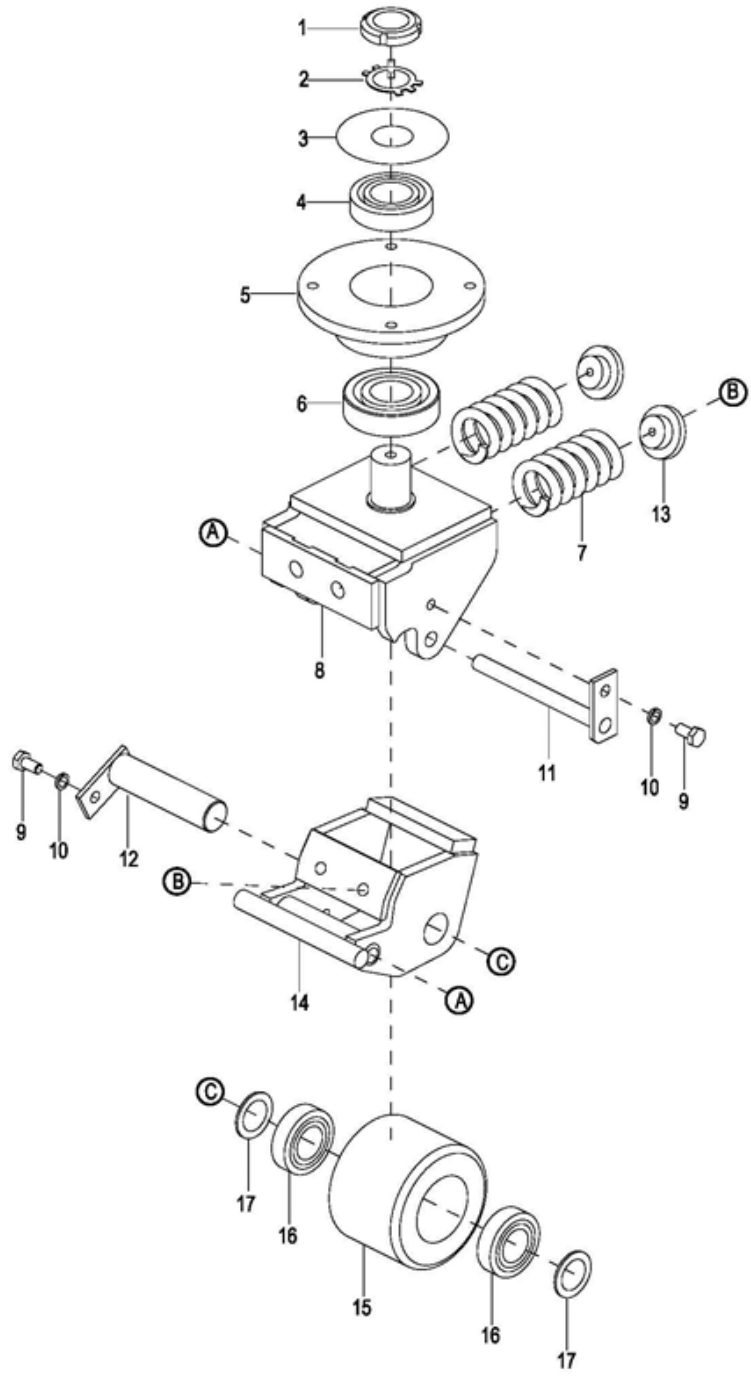
FIGURE 12-8 ADJUSTABLE STRADDLE



ADJUSTABLE STRADDLE

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2108-140000-1A	CASTER ASSEMBLY II	1	
2	0000-000322-00	SCREW M8 x 25	4	
3	0000-000159-00	LOCK WASHER Ø8	4	
4	0000-000194-00	FLAT WASHER Ø8	4	
5	0000-000191-00	LOCK WASHER Ø16	6	
6	0000-000220-00	FLAT WASHER Ø16 6	6	
7	2108-100001-10-01	WASHER	A.R.	AS REQUIRED - THK=1MM
8	0000-000963-00	BOLT M16 x 60	6	
9	2105-150000-70	END FRAME (R)	1	
10	0000-000100-00	BEARING	8	
11	2130-140001-00	LOAD WHEEL	4	
12	2105-140000-70	END FRAME (L)	1	
13	2108-100001-10-03	WASHER	A.R.	AS REQUIRED - THK=3MM
14	2130-140002-0A	SHAFT	4	
15	0000-000654-00	ROLL PIN 4 x 45	4	
16	0000-000294-00	RETAINING RING Ø25	4	
17	2130-140003-00	WASHER	8	
18	2105-100000-70-04	FRAME	1	

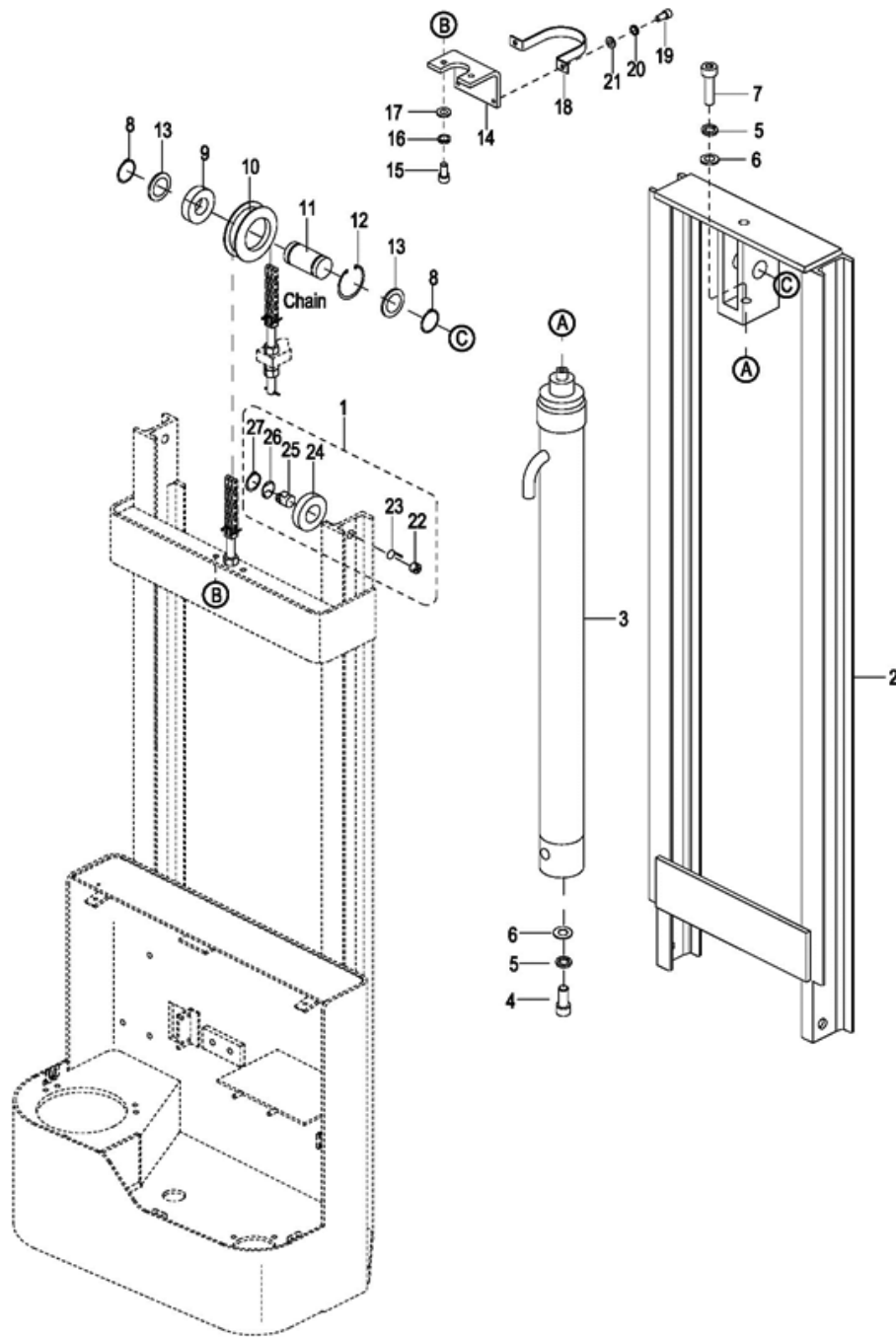
FIGURE 12-9 CASTER ASSEMBLY



CASTER ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
--	2108-140000-1A	CASTER ASSEMBLY	1	
1	0000-000093-00	NUT M27 x 1.5	1	
2	0000-000094-00	WASHER Ø27	1	
3	1220-140001-00	SNAP RING	1	
4	0000-000420-00	BEARING	1	
5	2140-140002-00	BEARING BLOCK	1	
6	0000-000421-00	BEARING	1	
7	2140-140004-00	SPRING	2	
8	2140-141000-00	YOKE	1	
9	0000-000242-00	BOLT M8 x 16	2	
10	0000-000159-00	LOCK WASHER Ø8	2	
11	2140-142000-00	HINGE PIN	1	
12	2140-145000-00	SHAFT	1	
13	2140-140003-00	SHAFT	2	
14	2140-143000-00	YOKE	1	
15	2125-101001-00	PU WHEEL	1	
16	0000-000424-00	BEARING	2	
17	0000-000249-00	FLAT WASHER Ø24	2	

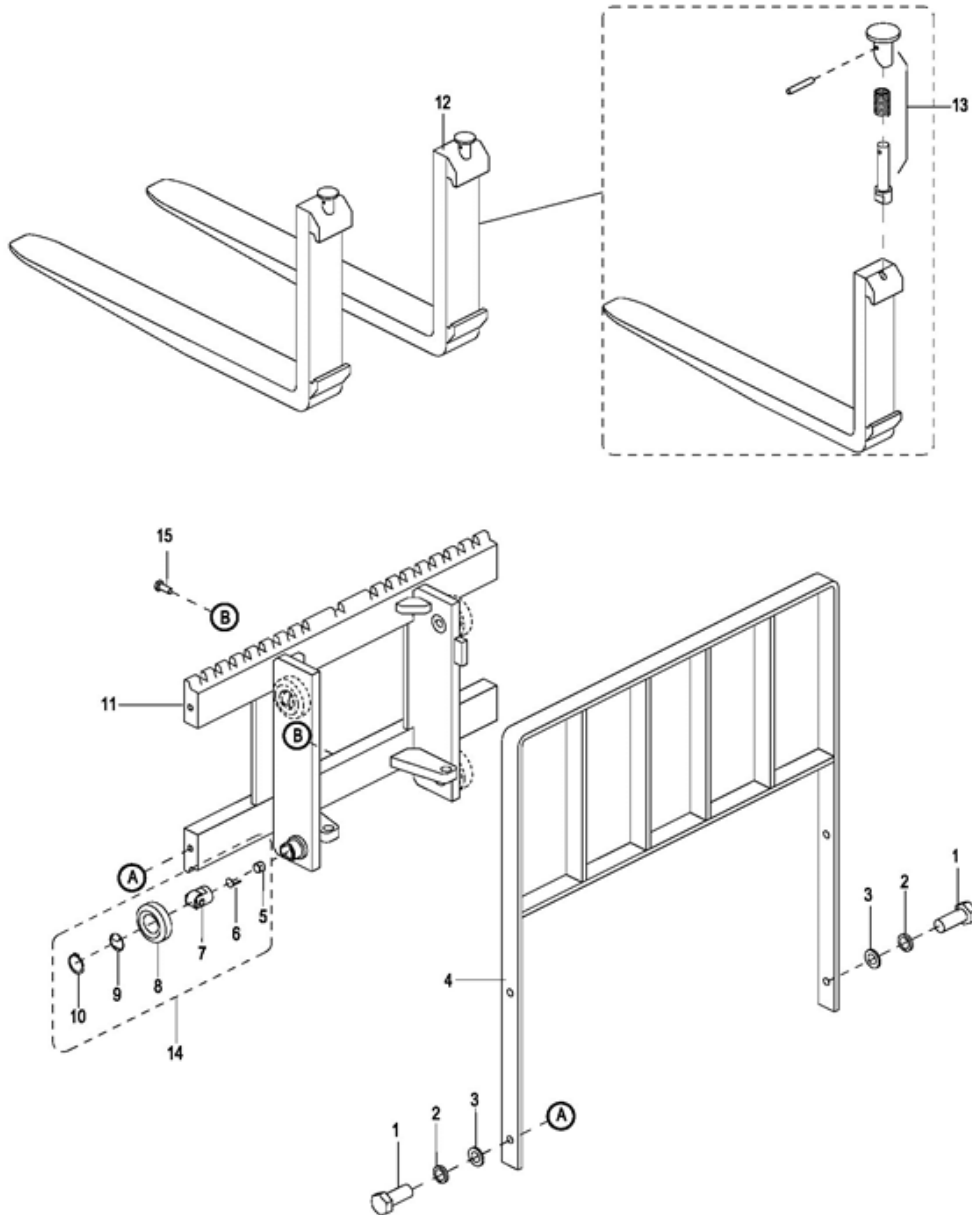
FIGURE 12-10 ELEVATION SYSTEM



Elevation System

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2125-612000-00	ROLLER ASSEMBLY	4	
2	2105-620000-00-04	INNER MAST	1	
3	2108-410000-60-03	LIFTING CYLINDER	1	
4	0000-000325-00	SCREW M12 x 20	1	
5	0000-000060-00	LOCK WASHER Ø12	2	
6	0000-000373-00	FLAT WASHER Ø12	2	
7	0000-000374-00	SCREW M12 x 30	1	
8	0000-000756-00	RETAINER RING Ø40	2	
9	0000-001387-10	BEARING	1	
10	2105-600001-00	CHAIN ROLLER	1	
11	2105-600003-00	CHAIN SHAFT	1	
12	0000-000987-00	ELASTIC COLLAR □80	1	
13	2105-600002-00	FLAT WASHER	2	
14	2105-600005-00	PLATE	1	
15	0000-000109-00	SCREW M8 x 16	2	
16	0000-000159-00	LOCK WASHER Ø8	2	
17	0000-000176-00	FLAT WASHER Ø8	2	
18	2105-600004-00	CYLINDER BRACKET	1	
19	0000-000055-00	SCREW M6 x 16	2	
20	0000-000056-00	LOCK WASHER Ø6	2	
21	0000-000380-00	FLAT WASHER Ø6	2	
22	2125-612004-00	SCREW	4	
23	2125-612007-00	SNAP RING	4	
24	2125-612001-00	MAIN ROLLER ASSEMBLY	4	
25	2125-612002-00	ASSISTANT ROLLER	4	
26	2125-612005-00	DUST SNAP	4	
27	0000-000183-00	RETAINER RING Ø35	4	

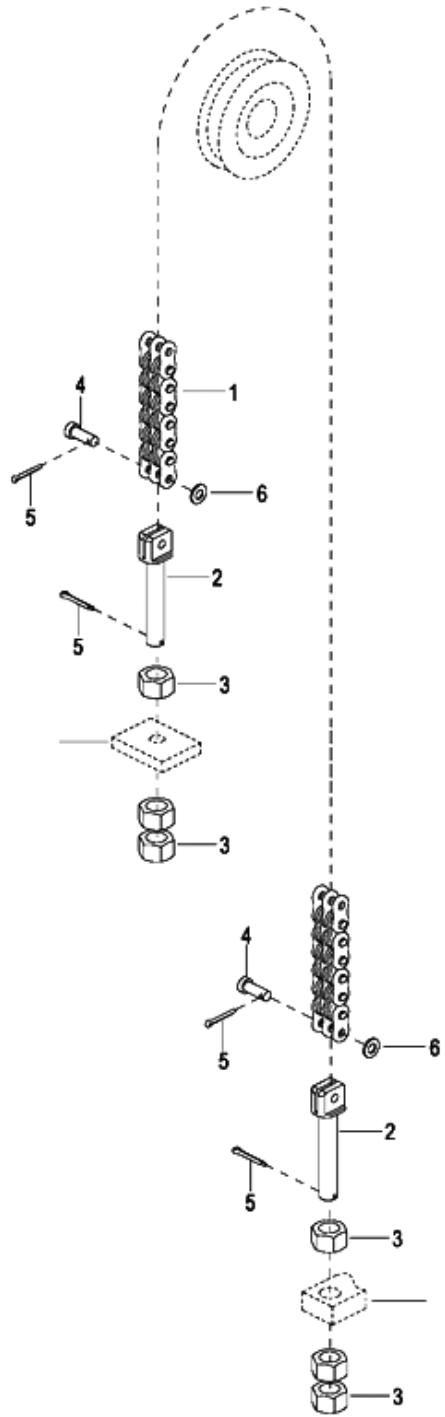
FIGURE 12-11 LIFT CARRIAGE



LIFT CARRIAGE

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	0000-000221-00	BOLT M12 x 30	4	
2	0000-000060-00	LOCK WASHER Ø12	4	
3	0000-000373-00	FLAT WASHER Ø12	4	
4	2125-632000-00	BLOCKING SHELF	1	
5	2125-631104-00	SCREW	4	
6	2125-612007-00	SNAP RING	4	
7	2125-612002-00	ASSISTANT ROLLER	4	
8	2125-612001-00	MAIN ROLLER ASSEMBLY	4	
9	2125-612005-00	DUST SNAP	4	
10	0000-000183-00	RETAINER RING Ø35	4	
11	2105-631000-70	FORK FRAME	1	
12	2125-630001-00	FORK	2	
13	2125-630001-10	PIN ASSEMBLY	2	
14	2125-631100-00	ROLLER ASSEMBLY	1	
15	0000-000030-00	SCREW M10 x 16	1	

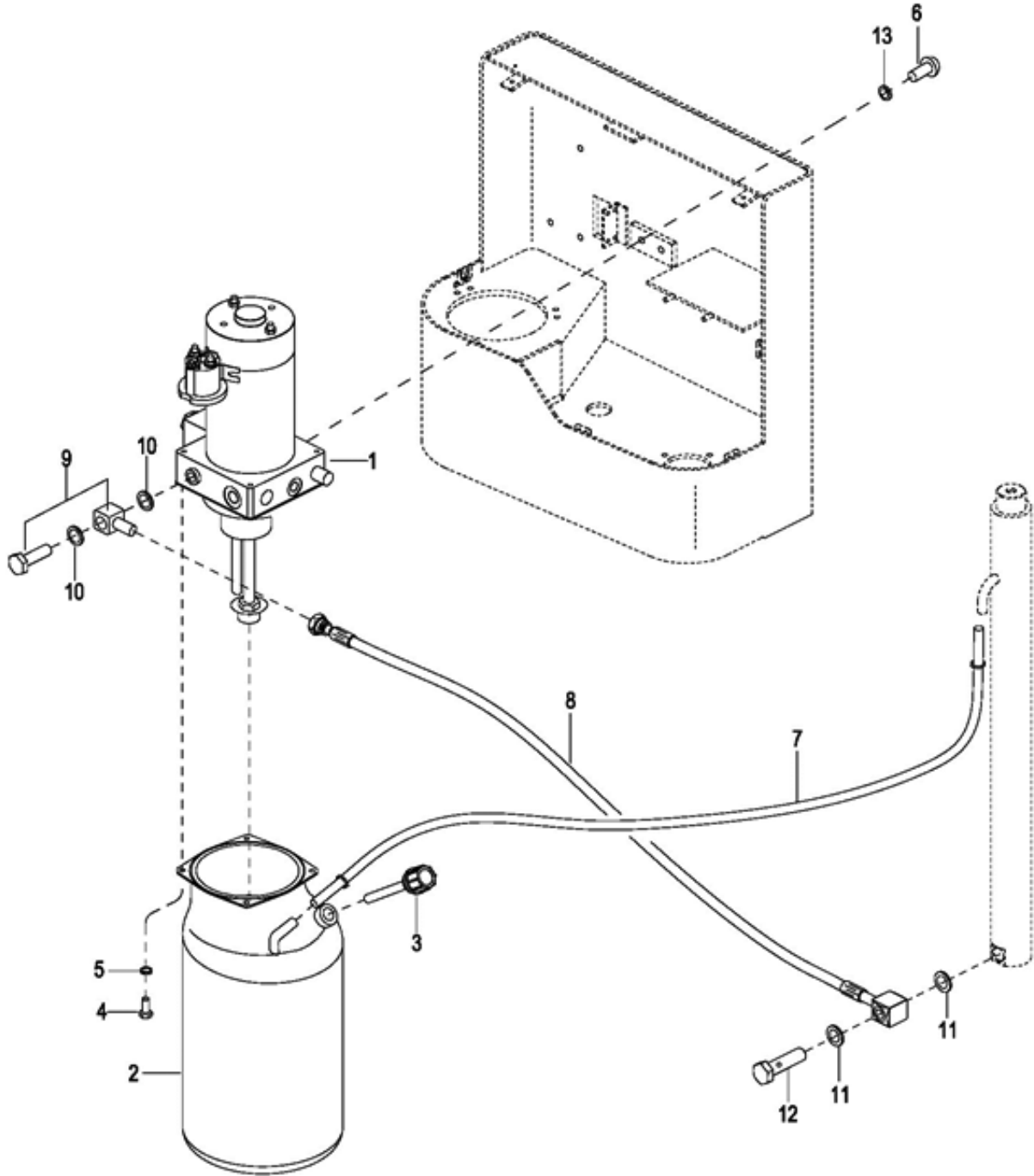
FIGURE 12-12 CHAIN ASSEMBLY



CHAIN ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2105-640003-00-04	CHAIN LH1244	1	
2	2105-640001-00	BOLT	2	
3	0000-000237-00	NUT M16 x 1.5	6	
4	2105-640002-00	PIN SHAFT	2	
5	0000-000188-00	PIN 3.2 x 20	4	
6	0000-000176-00	FLAT WASHER Ø8	2	

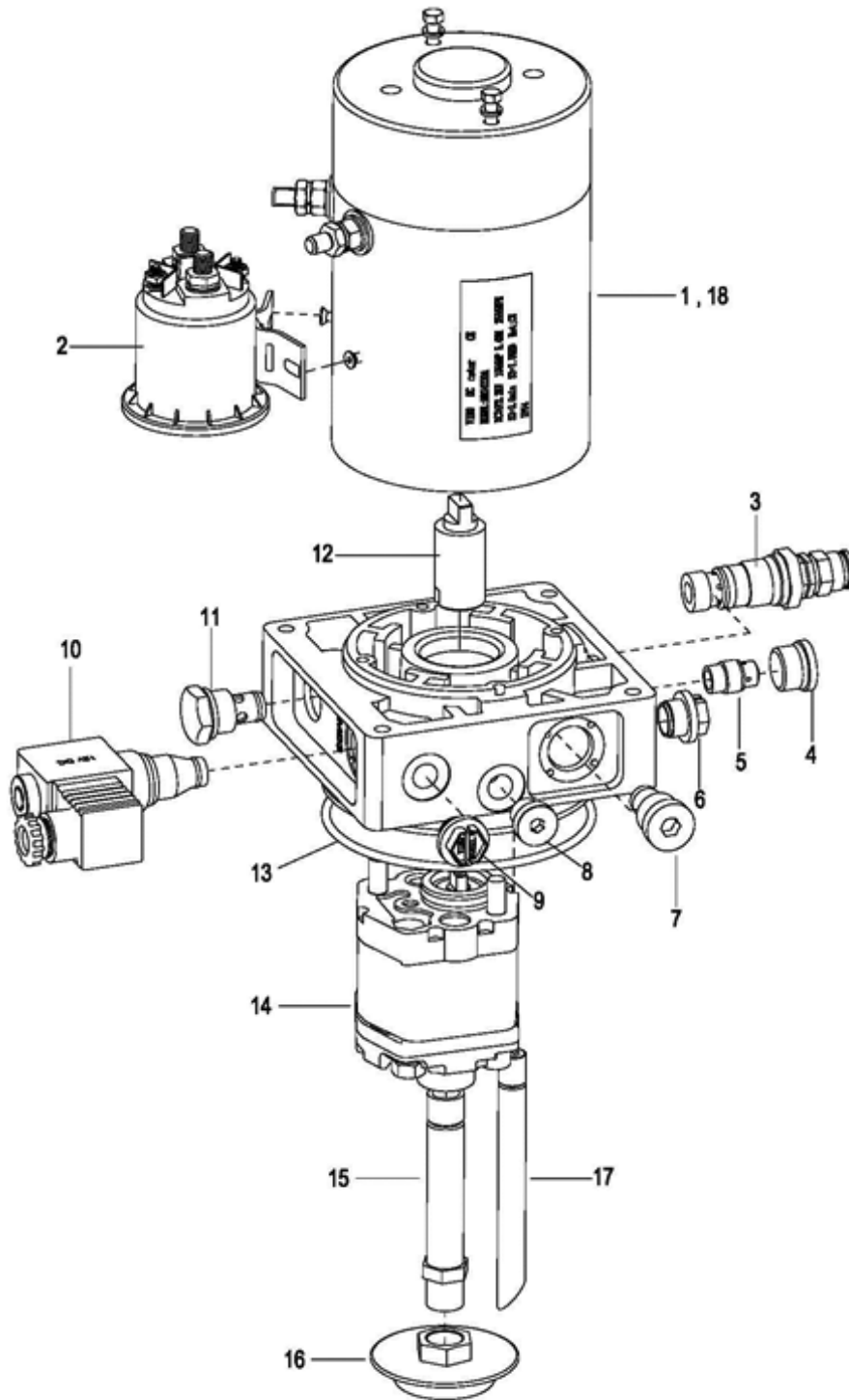
FIGURE 12-13 HYDRAULIC SYSTEM



HYDRAULIC SYSTEM

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2212-413000-00	PUMP AND MOTOR ASSEMBLY	1	
2	2105-411000-00	OIL TANK	1	
3	2125-423000-00	AIR FILTER	1	
4	0000-000264-00	BOLT M6 x 12	4	
5	0000-000056-00	LOCK WASHER Ø6	4	
6	0000-000712-00	SCREW M8 x 20	2	
7	2108-400002-00	OIL RETURN PIPE	1	
8	2108-400001-5A	OIL PIPE	1	
9	2707-381400-00	CONNECTOR G3/8-M14 x 1.5	1	
10	0000-000634-00	WASHER Ø18	2	
11	0000-000069-00	WASHER Ø16	2	
12	2401-163500-00	BOLT M16 x 35	1	
13	0000-000159-00	LOCK WASHER Ø8	2	

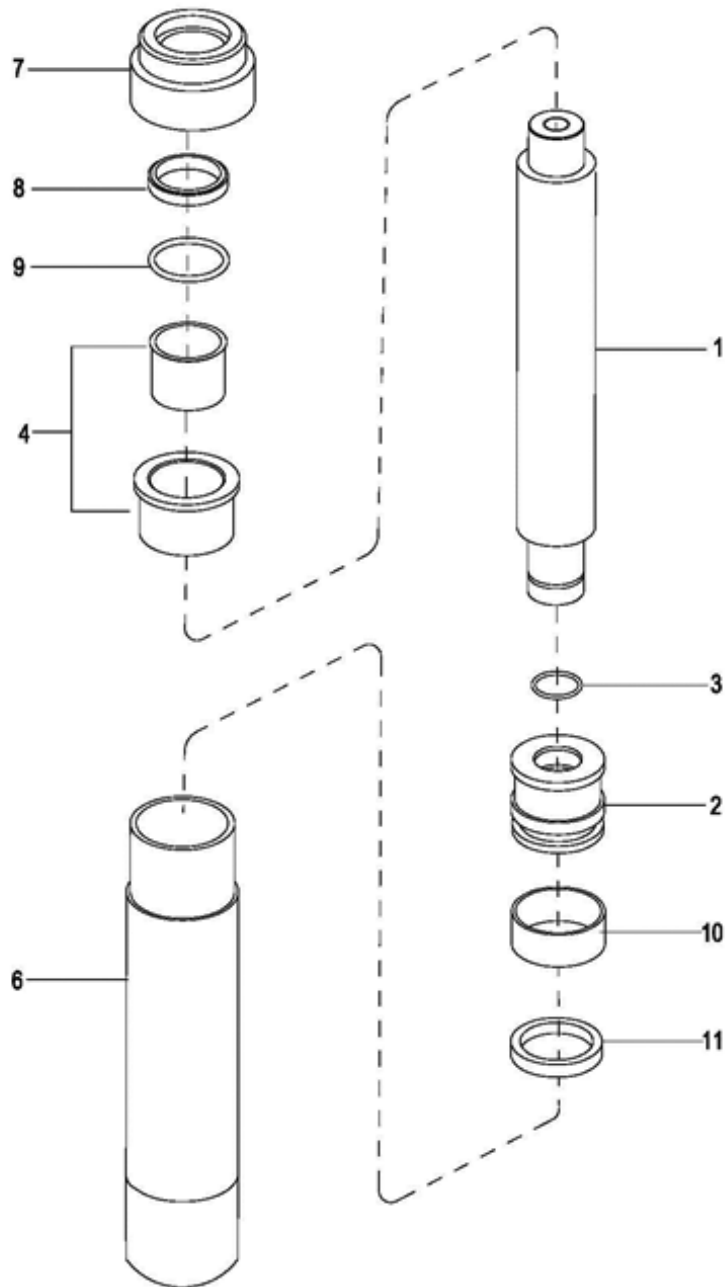
FIGURE 12-14 PUMP AND MOTOR ASSEMBLY



PUMP AND MOTOR ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2212-413001-00	MOTOR, 3.0KW	1	
2	2108-422002-00	RELAY STARTER	1	
3	2108-422003-00	RELIEF VALVE	1	
4	2108-422004-00	SCREW PLUG	1	
5	2212-413002-00	VALVE	1	
6	2108-422009-00	PLASTIC VALVE PLUG	1	
7	2108-422007-00	CHECK VALVE PLUG	1	
8	2108-422008-00	SCREW PLUG	1	
9	2108-422006-00	PLASTIC VALVE PLUG	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	1	
15	2212-413003-00	SUCTION OIL HOSE	1	
16	2108-422015-00	SUCTION FILER	1	
17	2212-413004-00	ESCAPE OIL VALVE	1	
18	2108-422017-00	BRUSH	1	

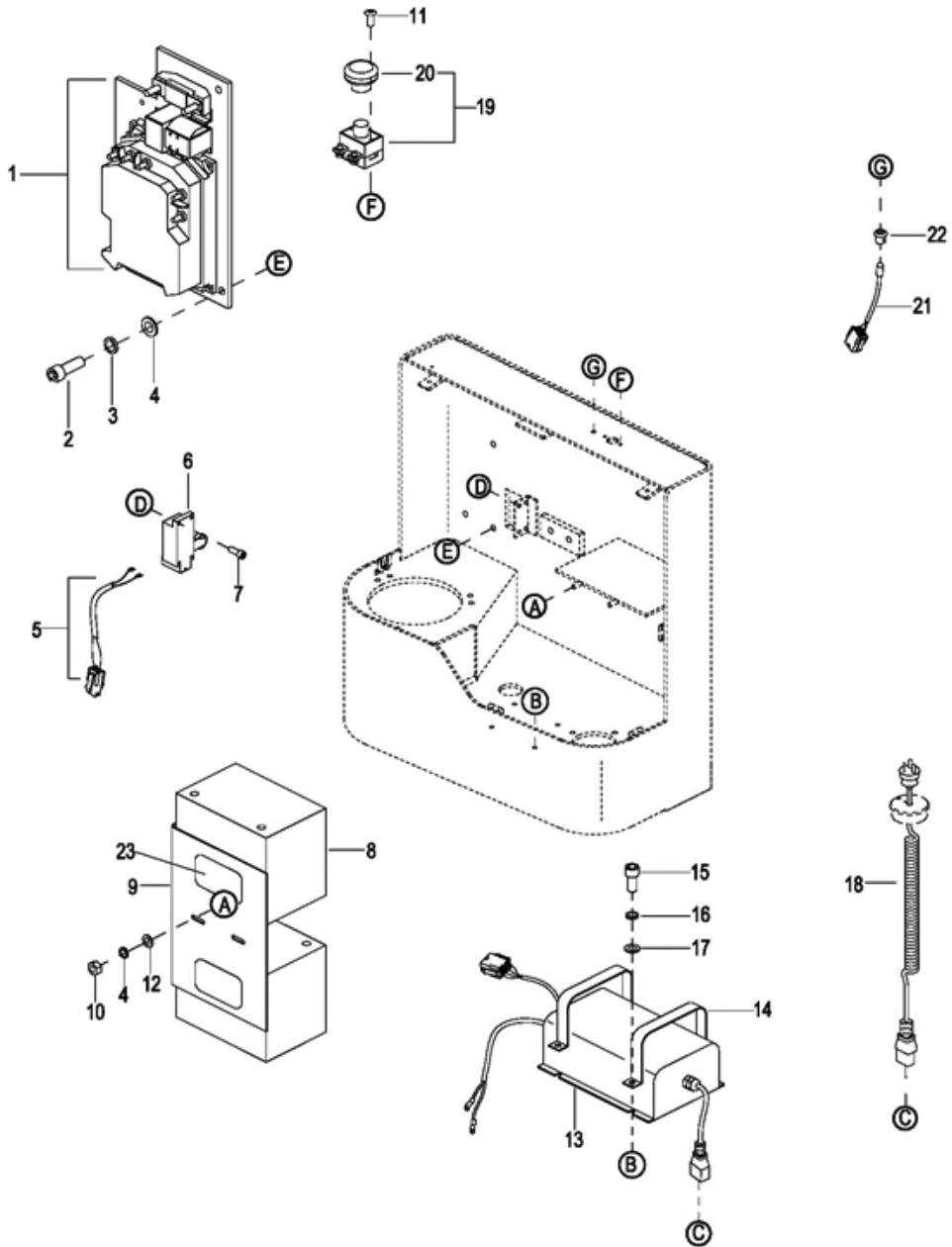
FIGURE 12-15 LIFT CYLINDER



LIFT CYLINDER

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
--	2108-410000-60-03	CYLINDER ASSEMBLY	1	
KIT	2110-2BG	SEAL KIT FOR CYLINDER	1	Includes Items 8, 9 AND 11
1	2125-410001-00-04	PISTON ROD	1	
2	2125-410002-00	PISTON	1	
3	2125-410003-00	COLLAR	1	
4	2125-410006-00	BUSHING	1	
6	2108-411000-60-03	CYLINDER TUBE	1	
7	2125-410004-0A	CAP	1	
8	0000-000084-00	RING WIPER 35 x 43 x 5-6.5	1	
9	0000-000370-00	O-RING 40 x 3.1	1	
10	2125-410005-00	RING BACK UP 50 x 20 x 2.5	1	
11	0000-000512-00	ROD PACKING 40 x 50 x 6	1	

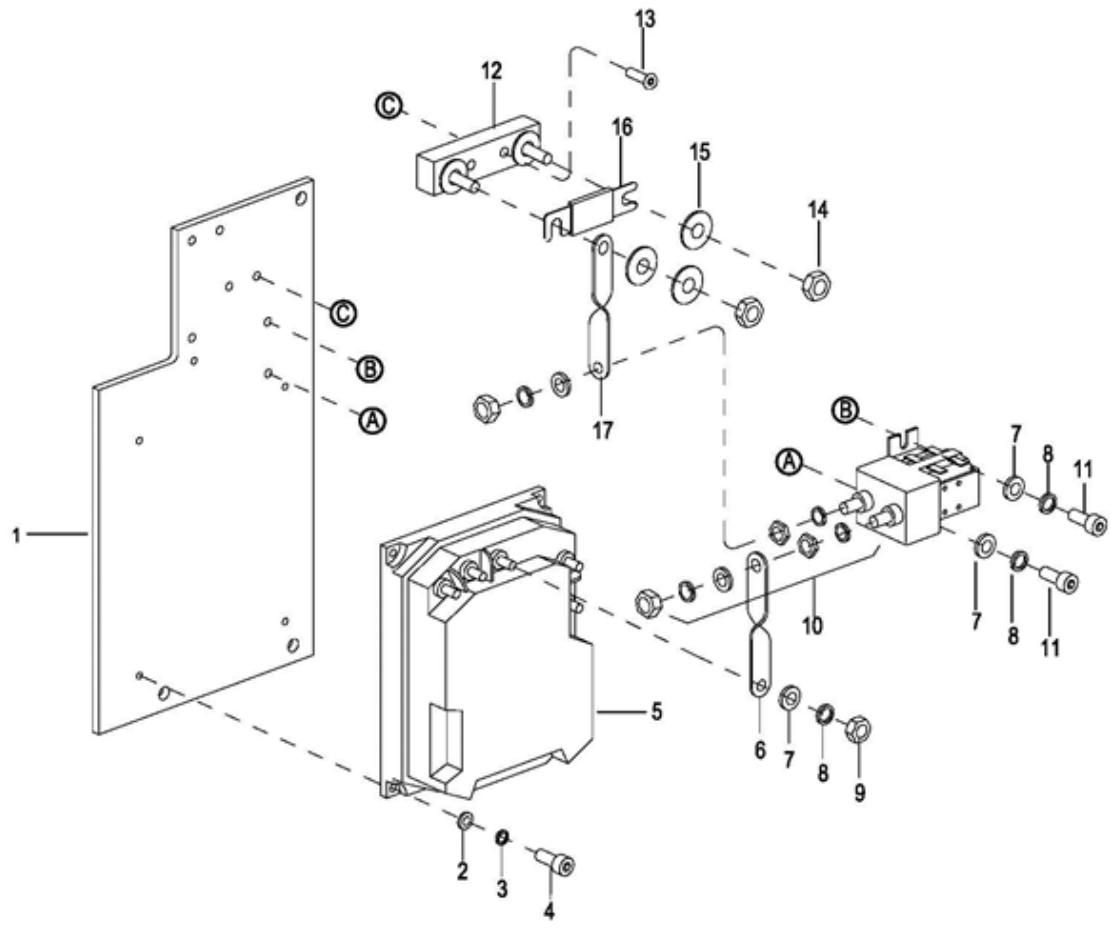
FIGURE 12-16 ELECTRICAL SYSTEM



ELECTRICAL SYSTEM

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	--	CONTROLLER BOARD ASSEMBLY	1	See Control Panel Assembly Section
2	0000-000433-00	SCREW M8 x 12	3	
3	0000-000194-00	FLAT WASHER Ø8	3	
4	0000-000159-00	LOCK WASHER Ø8	5	
5	2108-520006-00	HALF SPEED SWITCH HARNESS	1	
6	2125-500003-00	HALF SPEED SWITCH	1	
7	0000-000010-00	SCREW M5 x 6	4	
8	1118-560007-00	BATTERY	2	100Ah / 12V
9	2108-540001-00	BRACKET	1	
10	0000-000196-00	NUT M8	2	
11	0000-000616-00	SCREW M5 x 10	2	
12	0000-000176-00	FLAT WASHER Ø8	2	
13	2108-520015-00	CHARGE ASSEMBLY	1	
14	1115-500009-00	CHARGER HOOP	2	
15	0000-000088-00	SCREW M4 x 8	4	
16	0000-000122-00	LOCK WASHER Ø4	4	
17	0000-000702-00	FLAT WASHER Ø4	4	
18	1115-500006-10	CHARGER CABLE USA	1	
19	1115-510008-00	EMERGENCY STOP SWITCH	1	
20	1115-510008-10	BUTTON	1	
21	1115-520013-Z0	LED WIRE HARNESS	1	
22	1115-510009-00	LAMP HOLDER	1	
23	2112-410005-00	RUBBER CUSHION	2	

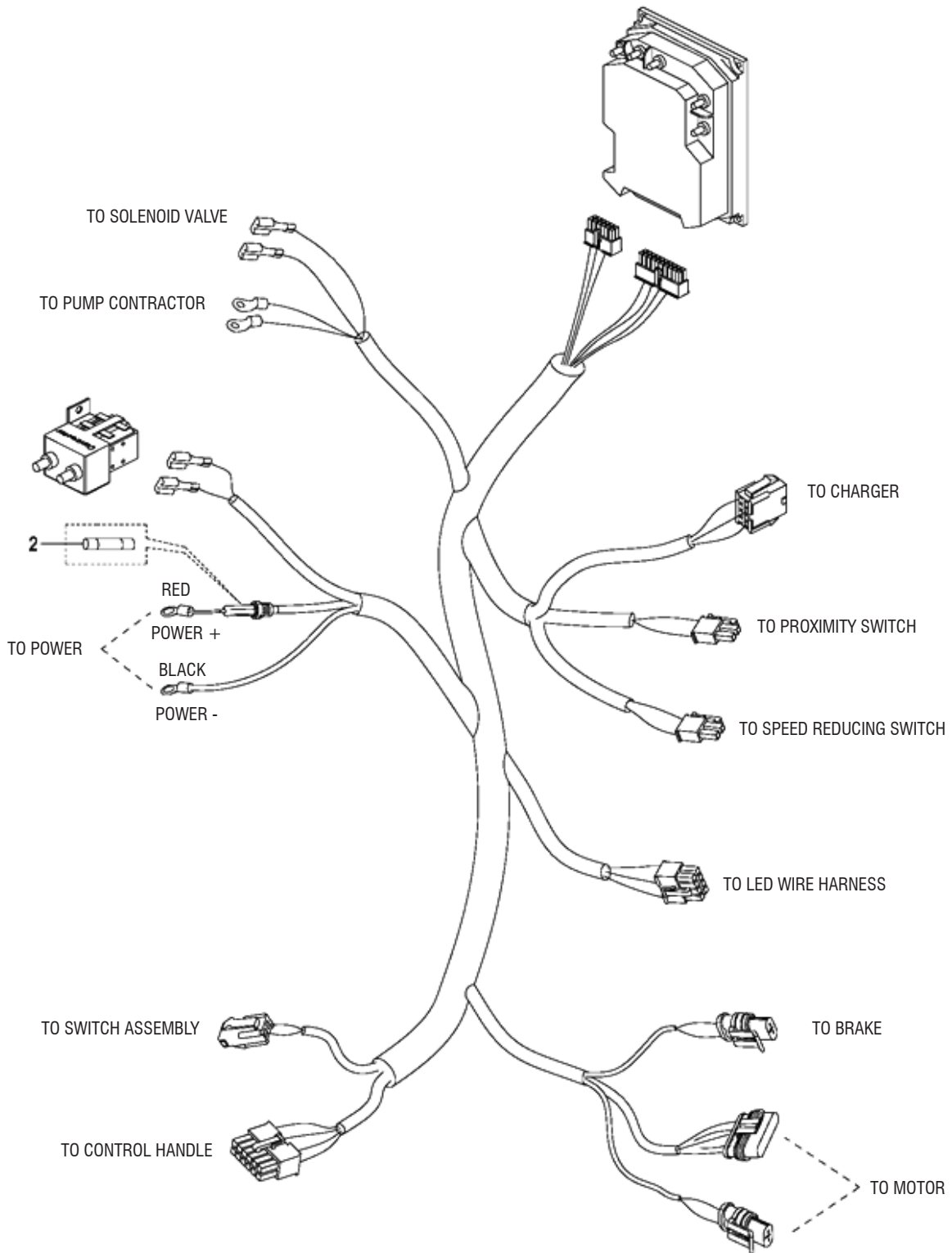
FIGURE 12-17 CONTROL PANEL ASSEMBLY



CONTROL PANEL ASSEMBLY

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	1420-510001-00	SETTING BOARD	1	
2	0000-000128-00	FLAT WASHER Ø5	4	
3	0000-000206-00	LOCK WASHER Ø5	4	
4	0000-000004-00	SCREW M5 x 12	4	
5	4230-560002-00	CONTROLLER	1	
6	1120-530007-00	COPPER CONDUCTOR	1	
7	0000-000123-00	FLAT WASHER Ø6	7	
8	0000-000056-00	LOCK WASHER Ø6	7	
9	0000-000166-00	NUT M6	5	
10	1120-500005-00	CONTACTOR	1	
11	0000-000077-00	SCREW M6 x 12	2	
12	1120-540001-00-B	STAND	1	
13	0000-000074-00	SCREW M6 x 20	2	
14	0000-000196-00	NUT M8	2	
15	0000-000210-00	FLAT WASHER Ø8	3	
16	1120-540002-00	FUSE 200A	1	
17	1120-530006-00	COPPER CONDUCTOR	1	

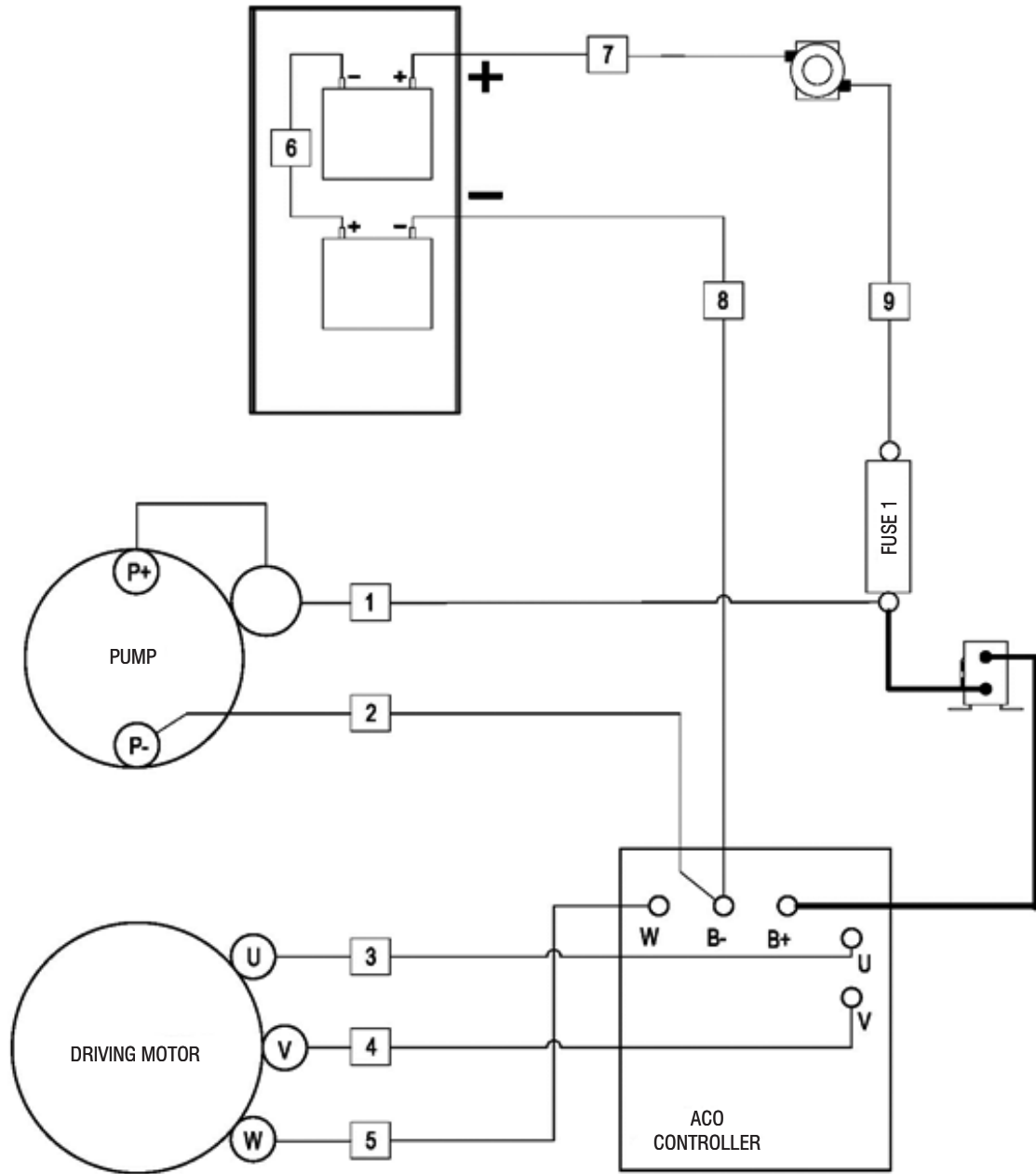
FIGURE 12-18 WIRING HARNESS



WIRING HARNESS

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	2105-520001-00	MASTER WIRING HARNESS	1	
2	1120-500010-00	FUSE 10A	1	

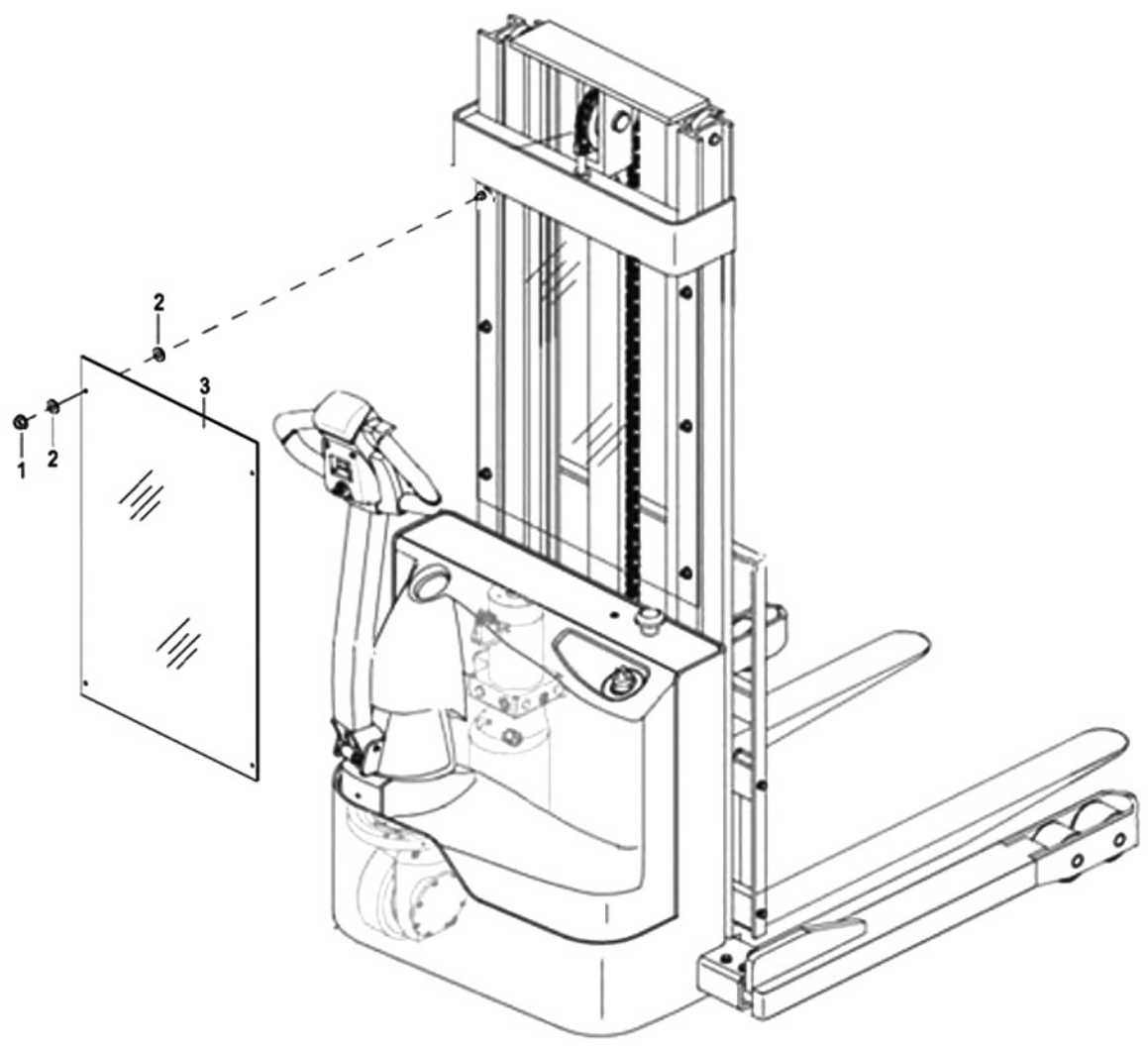
FIGURE 12-19 WIRING CABLES



WIRING CABLES

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
X	2105-530004-00	PUMP POWER LINE +	1	
X	2105-530005-00	PUMP POWER LINE -	1	
X	2105-530008-00	MOTOR LINE U	1	
X	2105-530007-00	MOTOR LINE V	1	
X	2105-530006-00	MOTOR LINE W	1	
X	2105-530009-00	BATTERY CABLE	1	
X	2105-530001-00	POWER+ CABLE	1	
X	2105-530002-00	POWER- CABLE	1	
X	2105-530003-00	EMERGENCY STOP SWITCH CABLE	1	

FIGURE 12-20 WINDSHIELD



WINDSHIELD

INDEX NO.	PART NO.	PART NAME	NO. REQ.	NOTES
1	0000-001176-00	NUT M8	6	
2	2214-150002-00	WASHER	12	
3	2111-110004-00-09	WINDSHIELD	1	

NOTES

NOTES

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