Assembly Instructions	Instrucciones de Ensamblaje	Directives d'assemblage
Customer Service US: 1-800-645-2986	Servicio de atención al Cliente US: 1-800-645-2986	Service à la clientèle Canada: 888-645-2986

MODEL 988993
POWERED PALLET TRUCK

Operation

Maintenance

Repair Parts List

Global Industrial
globalindustrial.com

MANUAL NO. BL-GL33-0618 - 07-16-2019

WARNING

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

Do not operate this truck until you have checked its condition. Give special attention to wheels, horn, battery, controller, lift system, brakes, steering mechanism, guards and safety devices.

Operate truck only from designated operating position. Do not carry passengers. Keep feet clear of truck and wear foot protection.

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

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

Always look in direction of travel. Keep a clear view, and when load interferes with visibility, travel with load trailing.

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

Do not handle loads which are higher than the chassis unless load is secured so that no part of it could fall backward. Before lifting, be sure load is centered, forks are completely under the chassis backrest.

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

PROPOSITION 65

WARNING

In accordance to
California Health & Safety Code Sections 25249.5 et. seq.
this warning is to let you know that this product can expose you to chemicals known to the state of California to cause cancer, birth defects and other reproductive harm.
For more information visit: www.p65warnings.ca.gov

TABLE OF CONTENTS

TABLE OF CONTENTS - CONTINUED

SECTION 1
DESCRIPTION

1-1. INTRODUCTION.

This publication describes the 24 volt 988993 lift truck distributed by Global Industrial. 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 988993 lift truck.

1-2. GENERAL DESCRIPTION.

The self-propelled 988993 truck, Figure 1-2, lifts and transports payloads up to 3300 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 DC motor propels the lift truck in forward or reverse direction throughout the available speed range. The 988993 lift truck can be driven with forks raised or lowered. The lift truck must be protected from the elements.

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

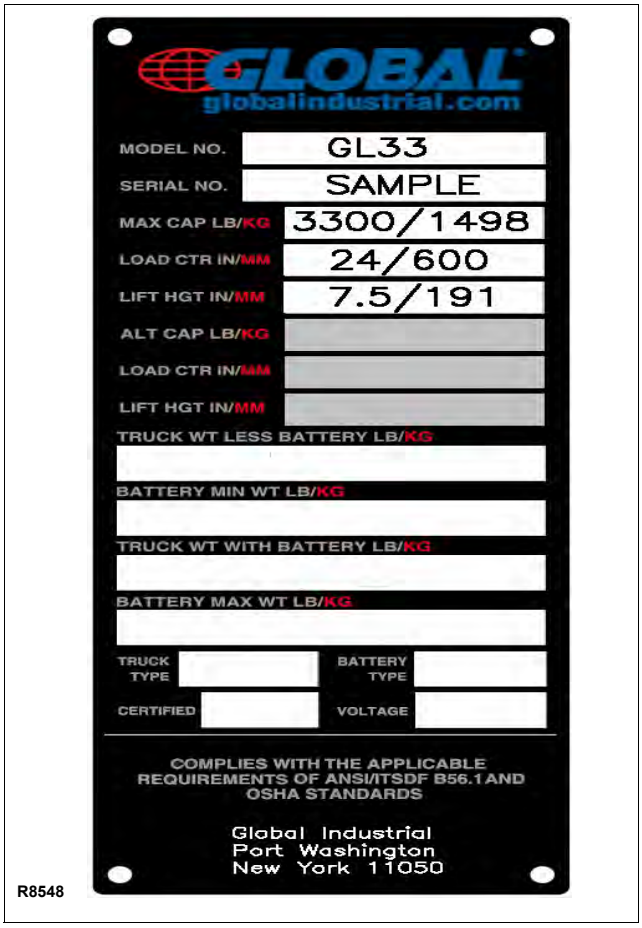
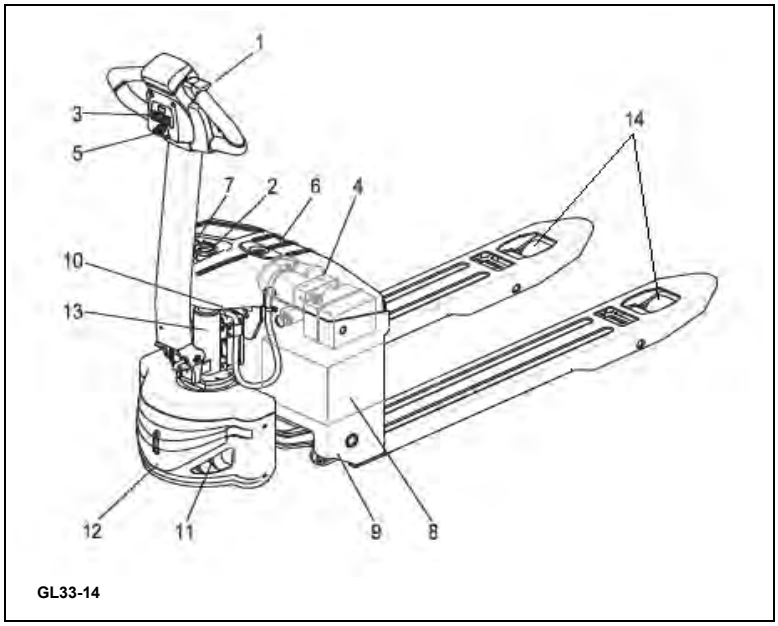


Figure 1-1 Name Plate



No.	Name
1	Control Lever
2	Emergency Stop Switch
3	Code lock
4	Pump and motor assembly
5	Key Switch
6	Upper Cover
7	Charging Plug
8	Battery
9	Chassis
10	Controller
11	Drive Wheel
12	Lower Cover
13	Lift Cylinder
14	Load Wheel

Figure 1-2 Lift Truck

1-3. SAFETY FEATURES.

The 988993 is designed and engineered to provide maximum safety for operator and payload. Some of the safety features incorporated into the design are:

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

SECTION 2
OPERATION

2-1. GENERAL.

This section gives detailed operating instructions for the 988993 lift truck. The instructions are divided into the various phases of operations, such as operating lift, driving, and stopping. Routine precautions are included for safe operation.

2-2. OPERATING PRECAUTIONS.

WARNING: Improper operation of the lift truck may result in operator injury, or load and/or lift truck damage. Observe the following precautions when operating the 988993 lift truck.

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

- Do not operate this truck unless you have been trained and authorized to do so and have read all warnings and instructions in this manual and on the truck.
- All warnings and instructions must be read and understood before using the equipment.
- Equipment must be inspected by a qualified person on a regular basis.
- Do not operate this truck until you have checked its condition. Give special attention to Wheels, Horn, Batteries, Controller, Lift System, Brakes, Steering Mechanism, Guards and Safety Devices
- Operate truck only from designated operation position. Wear foot protection. Do not carry passengers.
- Observe applicable traffic regulations. Yield right of way to pedestrians. Slow down and sound horn at cross aisles and wherever vision is obstructed.
- Start, stop, travel, steer and brake smoothly. Slow down for turns and on uneven or slippery surfaces that could cause truck to slide or overturn. Use special care when traveling without load as the risk of overturn may be greater.
- Always look in direction of travel. Keep a clear view, and when load interferes with visibility, travel with load or lifting mechanism trailing.
- Do not overload truck. Check nameplate for load weight and load center information.
- Before lifting, be sure load is centered, forks are completely under load, and load is as far back as possible against the chassis.
- Do not handle loads which are higher than the chassis unless load is secured so that no part of it could fall backward.
- When leaving truck, neutralize travel control. Fully lower lifting mechanism and set brake. When leaving truck unattended, turn off key switch and disconnect switch, and remove key.

2-3. BEFORE OPERATION

Table 2-1 covers important inspection points on the 988993 lift truck which should be checked prior to operation. Depending on use, some trucks may require additional checks.

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

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

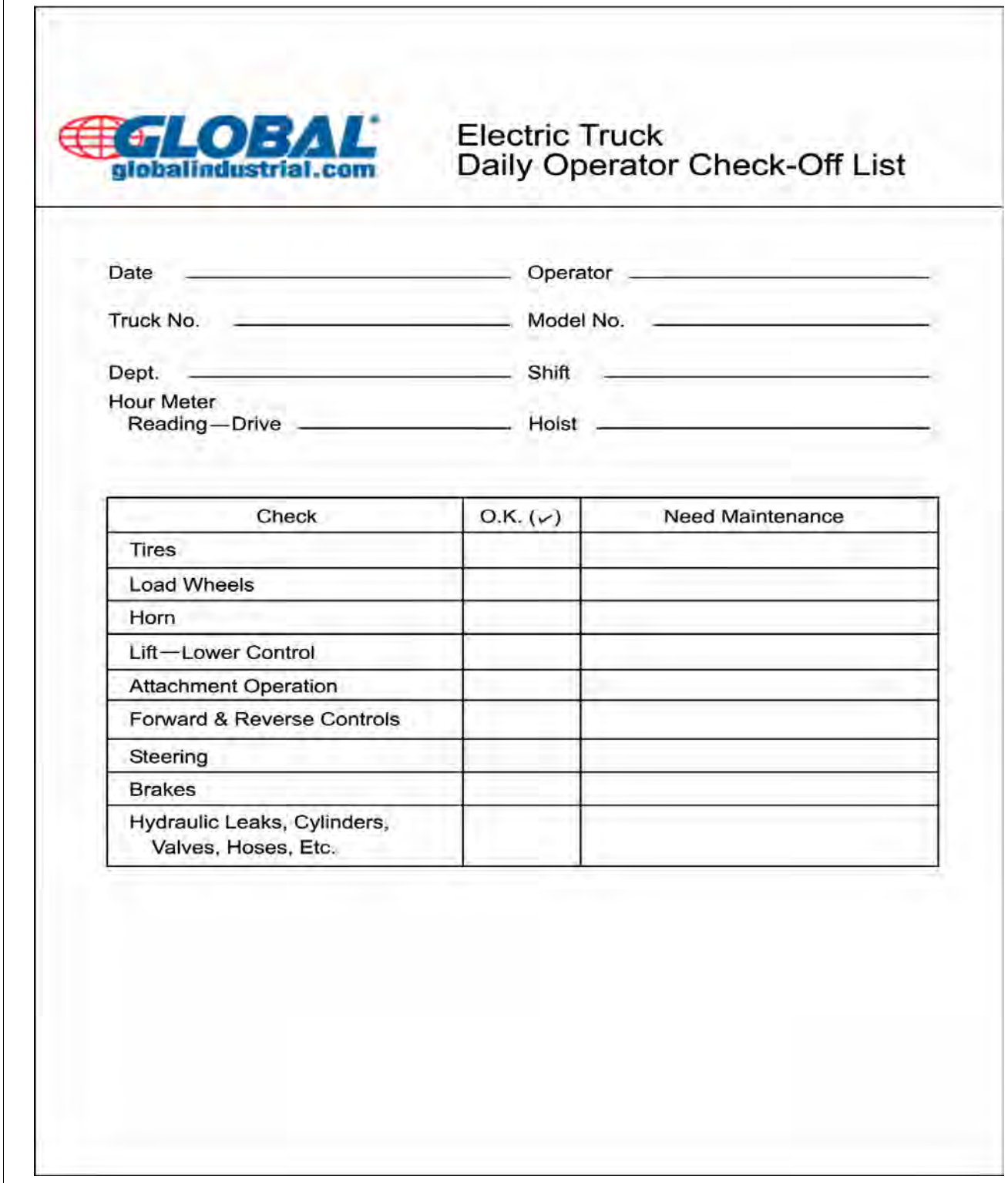
CAUTION: A QUALIFIED SERVICE TECHNICIAN should check the truck monthly for proper lubrication, proper fluid levels, brake operation, motor maintenance and other areas specified in the SECTION 3.

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

Table 2-1 Operator Checks

ITEM	PROCEDURE
Transmission and hydraulic systems.	Check for signs of fluid leakage.
Forks	Check for cracks and damage.
Safety signs	Check that warning labels, nameplate, etc., are in good condition and legible.
Horn	Check that horn sounds when operated.
Steering	Check for binding or looseness in steering arm when steering.
Travel controls	Check that speed controls on control head operate in all speed ranges in forward and reverse and that belly button switch functions.

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



GLOBAL
globalindustrial.com

Electric Truck
Daily Operator Check-Off List

Date _____ Operator _____

Truck No. _____ Model No. _____

Dept. _____ Shift _____

Hour Meter
Reading—Drive _____ Hoist _____

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

R8549

Figure 2-1 Sample of Operator Check List

2-4. GENERAL CONTROL OPERATION.

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

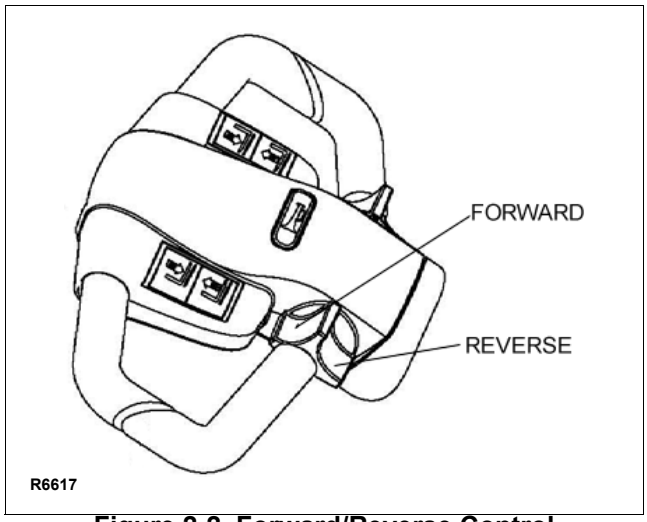


Figure 2-2 Forward/Reverse Control

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

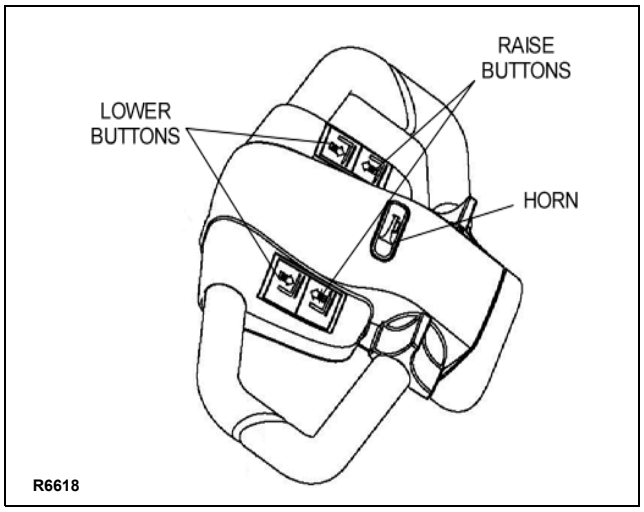


Figure 2-3 Pushbutton Switches

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

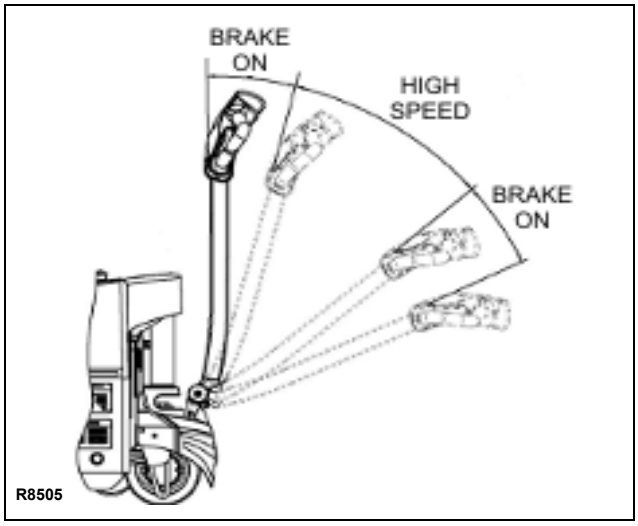


Figure 2-4 Brake Actuation

2-5. DRIVING AND STOPPING PROCEDURES.

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

2-6. BELLY-BUTTON SWITCH.

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

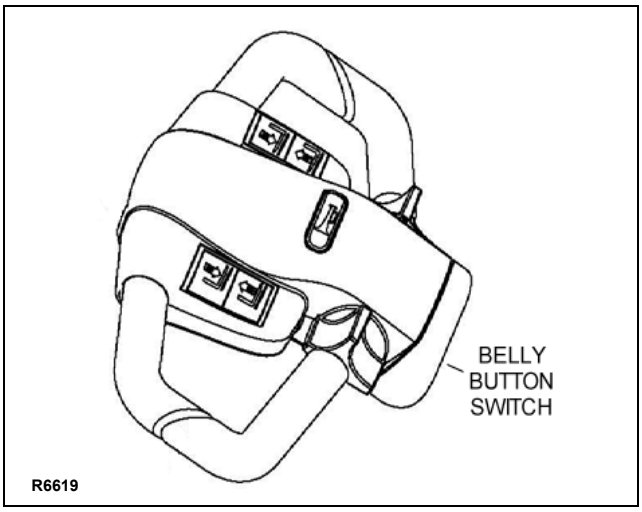


Figure 2-5 Belly-Button Switch

2-7. STEERING ARM GAS SPRING.

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

2-8. LIFT AND LOWER CONTROLS.

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

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

2-9. LOADING AND UNLOADING.

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

2-10.PARKING.

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

NOTES

SECTION 3
PLANNED MAINTENANCE

3-1. GENERAL.

Planned maintenance consists of periodic visual and operational checks, parts inspection, lubrication, and scheduled maintenance designed to prevent or discover malfunctions and defective parts. The operator performs the checks in SECTION 3, and refers any required servicing to a qualified maintenance technician who performs the scheduled maintenance and any required servicing.

3-2. MONTHLY AND QUARTERLY CHECKS.

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

3-3. BATTERY CARE.

3-3.1. General

The 988993 may be equipped with maintenance free batteries.

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

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

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

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

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

Table 3-1 Monthly and Quarterly Inspection and Service Chart

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

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

3-3.2. Safety Rules

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

3-3.3. Battery Care and Charging

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

1. Charge the battery only in areas designated for that use.
2. Battery terminals should be checked and cleaned of corrosion regularly. Good battery terminal contact is essential not only for operation, but also for proper charging of the battery.
3. The charging requirements will vary depending on the use of the truck. The battery should be given as equalizing charge on a weekly basis. This charge should normally be an additional three hours at the finish rate.
4. Make certain battery used meets weight and size requirements of truck. NEVER operate truck with an undersized battery.

3-3.4. Battery Cleaning

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

3-3.5. MAINTENANCE FREE BATTERIES

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

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

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

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

3-4. CHARGING BATTERIES

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

Proceed as follows:

1. Park truck at charging station with forks 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 top cover (Figure 3-1) and connect to the appropriate power supply.

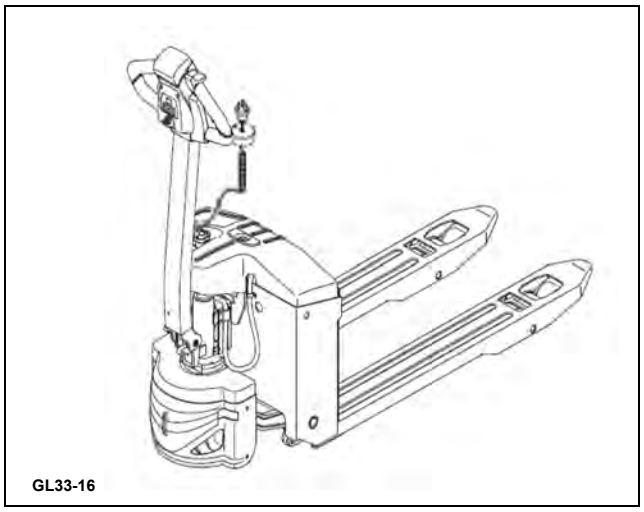


Figure 3-1 Battery Charging

R6115

3-5. BATTERY REPLACEMENT

Access to the batteries requires removing the cover. Charging requirements will vary depending on depth of discharge and temperature. Follow safety rules when placing a battery on charge.

Proceed as follows:

a. Remove top cover screws (1, Figure 3-2) and remove the upper compartment cover (2).

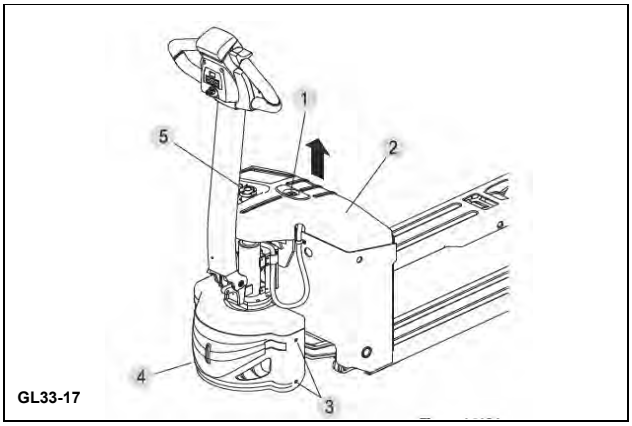


Figure 3-2 Cover Removal

b. Remove four and front cover, this will expose the 2 batteries. (Figure 3-3).

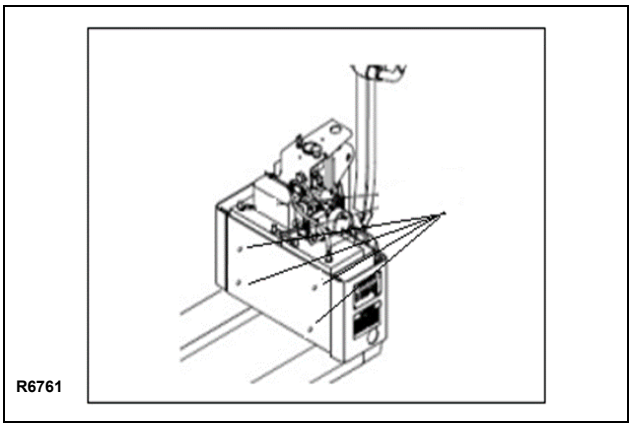


Figure 3-3 Screw Removal

c. Tag and disconnect the three battery cables (Figure 3-4).

d. To remove the batteries pull each one out individually as required.

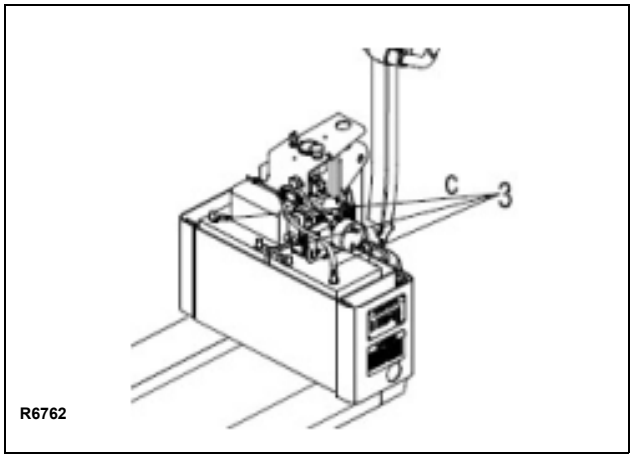


Figure 3-4 Disconnect Battery Cables

e. Install in the reverse order of remove.

3-6. LUBRICATION.

Refer to Table 3-2 for the recommended types of grease and oil. Table 3-3 in conjunction with Figure 3-5 identifies the items requiring lubrication.

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

No. 1	Grease—Lithium base, general purpose
No. 2	(Note) Grease—Lithium base
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

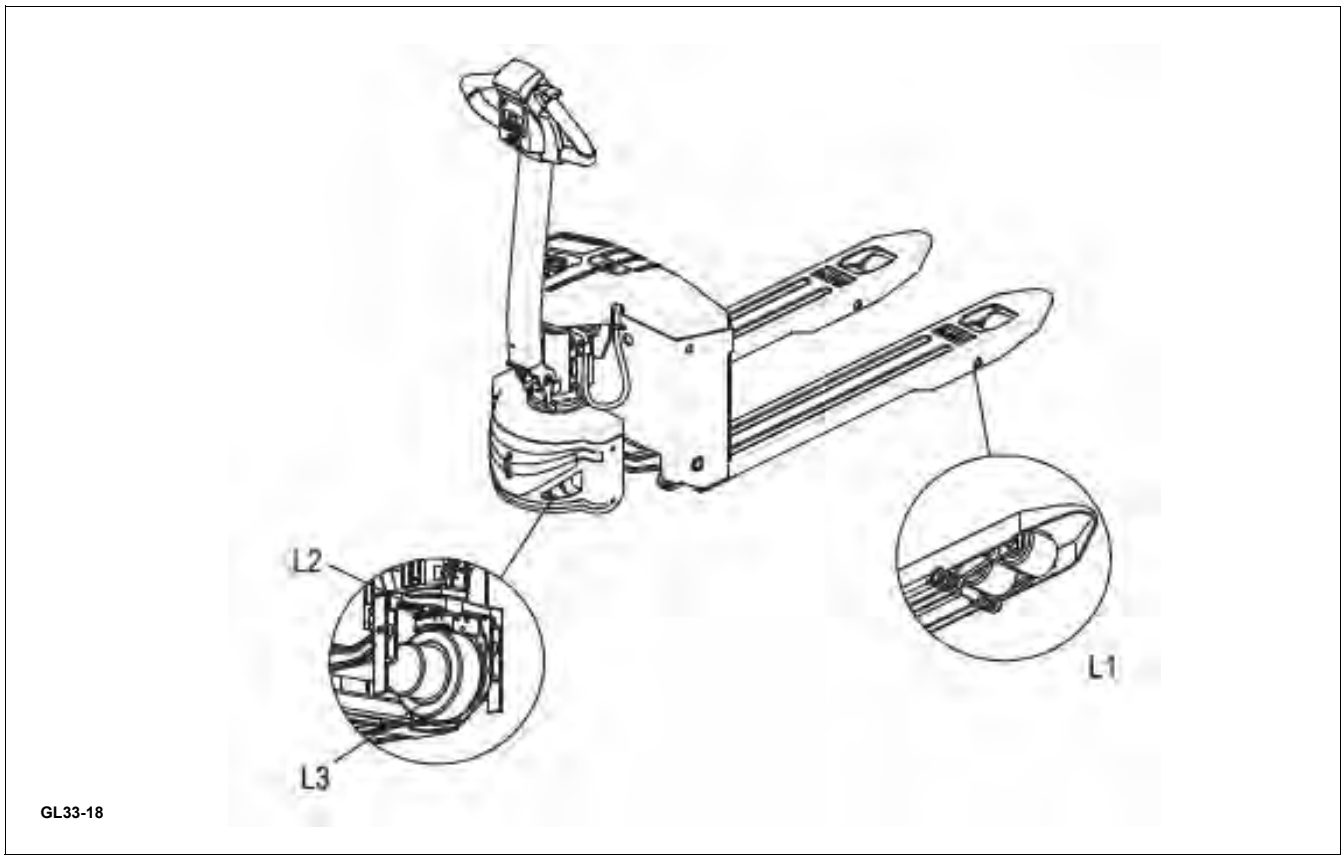


Figure 3-5 Lubrication Diagram

Table 3-3 Lubrication Chart

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

* Raise lift carriage to gain access to grease fittings.

SECTION 4
TROUBLESHOOTING

4-1. GENERAL

Use Table 4-1 and Figure 4-3 as a guide to determine possible causes of trouble. The table is divided into five main categories: Truck and Hydraulic System Will Not Operate: Truck Does Not Operate Forward or Reverse: Trouble With Braking: Trouble With Lifting Or Lowering, and Miscellaneous malfunctions.

Table 4-1 Troubleshooting Chart

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

Table 4-1 Troubleshooting Chart - Continued

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

Table 4-1 Troubleshooting Chart - Continued

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

4-2. CONTROLLER TROUBLESHOOTING

4-2.1. Fault Detection.

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

4-2.2. Hand Held Programmer (Optional)

The hand held programmer is available that is designed specifically for use with the controller. The programmer is available through your Global Industrial dealer.

4-2.3. Fault Recording.

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

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

4-2.4. General Checkout.

Carefully complete the following checkout procedure. If you find a problem during the checkout, refer to paragraph 4-2.7. for further information.

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

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

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

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

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

Figure 4-1. Controller Terminals

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

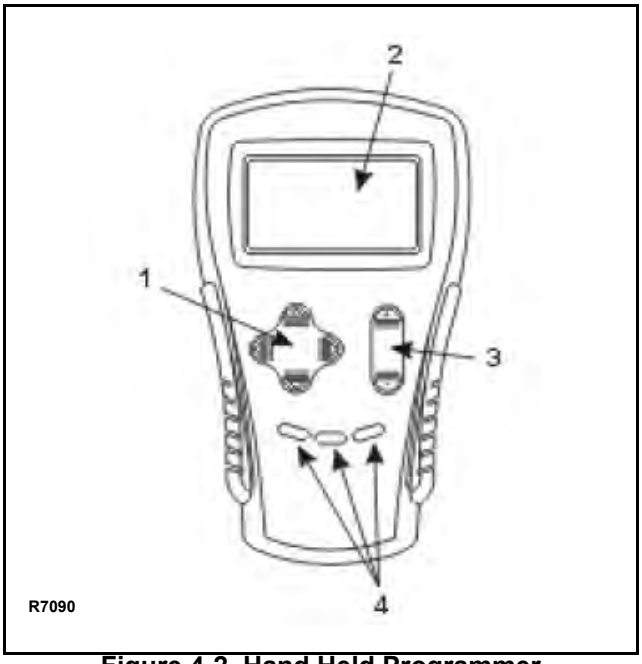


Figure 4-2. Hand Held Programmer

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

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

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

4. With the brake released, select a direction and operate the throttle. The motor should begin to turn in the selected direction. If it does not, verify the wiring to the forward/reverse switches and motor. The motor should run proportionally faster with increasing throttle. If not, refer to Paragraph 4-2.7.

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

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

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

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

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

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

4-2.5. Diagnostic History

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

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

Faults->System Faults.

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

Faults->Fault History

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

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

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

To clear the diagnostic history file, select:

Faults->Clear Fault History.

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

4-2.6. Test the Fault Detection Circuitry

1. Put the vehicle up on blocks to get the drive wheel off the ground.

1. Turn off the key switch and emergency disconnect.
2. Using an inline fuse holder fitted with a 10 amp fuse and alligator clips, connect the controller's M and B- terminals.
3. Turn on the emergency disconnect (17) the key switch (20). Release the brake and apply the throttle. The motor should not operate.
4. Leave the key switch on and remove the in-line fuse wire. The vehicle status should continue to remain off.
5. Cycle the key switch off and on. Release the brake and apply the throttle. The vehicle should now operate normally.

4-2.7. Diagnostics and Troubleshooting.

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

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

4-2.7.1. LED Diagnostics

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

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

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

For suggestions about possible causes of the various faults, refer to Table 4-3 Troubleshooting Chart.

Table 4-2 Programmable Parameters

Parameter	Factory Setting		Description
DRIVE MENU		**90A**	
Accel Max Speed		1.5 sec.	Sets the rate (in seconds) at which the speed command increases when throttle is applied with the speed limit pot is in its maximum speed position, and the vehicle is traveling forward. Larger values represent slower response. Note: Allowable range is restricted by the Accel Min Speed setting.
Accel Min Speed		5.0 sec.	Sets the rate (in seconds) at which the speed command increases when throttle is applied while the speed limit pot is in its minimum speed position, and the vehicle is traveling forward. Larger values represent slower response Note: Allowable range is restricted by the Accel Max Speed setting.
Decel High Speed		0.6 sec.	Sets the rate (in seconds) that is used to slow down the vehicle when it is traveling forward at high speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by the Decel Low Speed setting.
Decel Low Speed		1.5 sec.	Sets the rate (in seconds) that is used to slow down the vehicle when it s traveling forward at low speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by the Decel High Speed setting.
Rev Accel Max Speed		1.5sec.	Sets the rate (in seconds) at which the speed command increases when throttle is applied while the speed limit pot is in its maximum speed position, and the vehicle is traveling in reverse. Larger values represent slower response. Note: Allowable range is restricted by Rev Accel Min Speed setting.
Rev Accel Min Speed		5.0 sec.	Sets the rate (in seconds) at which the speed command increases when throttle is applied while the speed limit pot is in its minimum speed position, and the vehicle is traveling in reverse. Larger values represent slower response. Note: Allowable range is restricted by Rev Accel Max Speed setting.
Rev Decel High Speed		0.5 sec.	Sets the rate (in seconds) that is used to slow down the vehicle when it is traveling in reverse at high speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by Rev Decel Low Speed setting.

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
DRIVE MENU Cont.		**90A**	
Rev Decel Low Speed		1.5 sec.	Sets the rate (in seconds) that is used to slow down the vehicle when it is traveling in reverse at low speed and throttle is reduced. Larger values represent slower response. Note: Allowable range is restricted by Rev Decel High Speed setting.
Key Off Decel		0.7 sec.	Sets the rate (in seconds) that is used to slow down the vehicle at key-off or in the event of a major fault.
E Stop Decel		0.6 sec.	Sets the rate (in seconds) that is used to slow down the vehicle during emergency reverse, i.e., when a throttle command >80% in the reverse direction is given while the vehicle is moving forward. This gives the operator a way to stop more quickly when unexpected conditions arise.
E Stop Pause		0.5 sec.	Sets a pause before reversing direction after an emergency reverse stop. This gives the operator time to return the throttle to neutral without moving backwards
Soft Start		25%	This parameter can be used to soften the bump associated with gear slack in the transaxle when throttle is applied from the neutral state. Larger values provide a softer slack take-up.
Gear Soften		15%	This parameter is intended to soften the bump associated with gear slack in the transaxle when throttle is released and then reapplied while the vehicle is still moving. Larger values provide a softer slack take-up.
Creep Speed		7%	Creep Speed helps to prevent vehicle rollback on inclines when the brake is released with very little throttle applied. It is activated when the throttle request exceeds the throttle deadband threshold.
Push Max Speed		N/A	Sets the maximum speed at which the vehicle can be pushed. When the vehicle is powered on and in neutral, it enters the push mode when the push button is activated. The electromagnetic brake is released, driving is inhibited, and speed is limited to Push Max Speed. When the vehicle is not powered on and the brake is mechanically released to enable pushing, Push Max Speed still applies. Once sufficient voltage is generated by the motor, speed will be limited by the controller
Soft Stop Speed		13%	Sets the speed at which a gentler deceleration is initiated when the throttle is released to neutral; larger values start the soft stop deceleration sooner.

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
SPEED MENU		**90A**	
Max Speed Mode 1 Mode 2		 100% 30%	During forward operation, defines the requested speed at full throttle when the speed limit pot is in its maximum speed position. Note: Allowable range is restricted by the M1/M2 Min Speed setting.
Min Speed Mode 1 Mode 2		 20% 20%	During forward operation, defines the requested speed command at full throttle when the speed limit pot is in its minimum speed position. Min Speed cannot be set higher than the programmed Max Speed. Note: Allowable range is restricted by the M1/M2 Max Speed setting. Note: For this parameter to apply, a speed limit pot must be installed in parallel with the throttle and the Speed Limit Pot parameter must be programmed On (see Throttle menu).
Rev Max Speed Mode 1 Mode 2		 100% 30%	During reverse operation, defines the requested speed at full throttle when he speed limit pot is in its maximum speed position. Note: Allowable range is restricted by M1/M2 Rev Min Speed setting.
Rev Min Speed Mode 1 Mode 2		 10% 10%	During reverse operation, defines the requested speed command at full throttle when the speed limit pot is in its minimum speed position. Rev Min Speed cannot be set higher than the programmed Rev Max Speed. Note: Allowable range is restricted by M1/M2 Rev Max Speed setting. Note: For this parameter to apply, a speed limit pot must be installed in parallel with the throttle and the Speed Limit Pot parameter must be programmed On (see Throttle menu).

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
THROTTLE MENU		**90A**	
Type		7	The 1212 controller can accept inputs from both 5kΩ, 3-wire pot throttles and voltage throttles. Set the throttle type parameter to match the throttle used in your application. *5kΩ, 3-wire pot throttles* 0 = wigwag 1 = inverted wigwag 2 = single-ended; neutral when wiper at PotLow 3 = inverted single-ended; neutral when wiper at PotHigh 4 = unipolar. Voltage throttles 5 = wigwag 6 = inverted wigwag 7 = single-ended; neutral when wiper . PotLow 8 = inverted single-ended voltage; neutral when wiper ≥ PotHigh 9 = unipolar
PotHigh		5V	Sets the maximum voltage for voltage throttles (Types 5–9). For 5kΩ, 3-wire pot throttles, PotHigh is determined by the throttle itself.)
PotLow		0V	Sets the maximum voltage for voltage throttles (Types 5–9). For 5kΩ, 3-wire pot throttles, PotLow is determined by the throttle itself.)
Neutral Deadband		5%	Sets the throttle range the controller interprets as neutral. Increasing the parameter setting increases the neutral range. This parameter allows the neutral deadband to be defined wide enough to ensure the controller goes into neutral when the throttle is released.
Throttle Max		90%	Sets the pot wiper voltage required to produce 100% controller output. Increasing the Throttle Max setting reduces the wiper voltage required, and therefore reduces the stroke necessary to produce full output. This feature allows reduced-range throttle assemblies to be used.
HPD		ON	When programmed On, vehicle drive is inhibited if a throttle command outside the neutral deadband is issued before the controller is powered up. Drive will continue to be inhibited until the throttle is returned to within the neutral deadband. If the HPD fault is not cleared within 10 seconds, a wiring fault is declared and a power cycle is required.
Speed Limit Pot		OFF	This parameter is used to enable/disable the speed limit pot. If no speed limit pot is used, set Speed Limit Pot to Off.

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
THROTTLE MENU - Continued		**90A**	
Throttle Map		50%	The throttle map parameter adjusts the static throttle map. The parameter setting corresponds to the throttle command at half throttle. A setting of 50% provides linear response. Values below 50% reduce the throttle command at low throttle positions, providing enhanced slow speed maneuverability. Values above 50% give the vehicle a faster, more responsive feel at low throttle positions.
Tremor Suppression		50%	This parameter can be used to limit the controller's response to sharp throttle movements, such as movements resulting from hand tremors. Larger values will provide a steadier ride, but they also result in more sluggish response to throttle request. There is thus a trade-off between crispness of response (low Tremor Suppression settings) and steady speed in the presence of tremors (high settings).
Calibration		OFF	Wigwag and unipolar throttle pots should be centered. Setting this parameter to On inhibits driving and puts the controller into throttle autocalibration mode. Setting the parameter Off returns the controller to normal operation.
CURRENT MENU			
Main Current Limit		90A	Sets the maximum current the controller will supply to the motor during normal driving. By limiting the current supplied, this parameter can be used to protect the motor from potentially damaging currents or to reduce the maximum torque applied to the drive system.
Braking Current Limit		90A	Sets the maximum current the controller will supply to the motor during braking. By limiting the current supplied, this parameter can be used to protect the motor from potentially damaging currents or to reduce the maximum braking torque applied to the drive system.
Boost Current		90A	Boost current gives a brief boost of current that greatly improves performance with transient loads, such as starting on a hill, crossing a threshold, climbing obstacles, etc. When the controller recognizes that the motor needs more current to respond to a drive request, it provides a current boost of a set amount for a set time. The Boost Current parameter defines the motor current limit during the boost period
Boost Time		0.0 sec.	This parameter sets the maximum time that the boost current is allowed.

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
INHIBIT MENU		**90A**	
Type		2	The flexible speed input at J1 Pin 6 can be used to limit or to inhibit speed under certain conditions. For example, a switch could be installed under the seat so that if the operator drives the scooter while they are standing the max speed will be limited. The Inhibit Type parameter is used to select how the inhibit function will be implemented. Depending on how the inhibit switch is wired into the system, set this parameter to: 0 = B- active 1 = B+ active 2 = Open circuit active 3 = B- inactive 4 = B+ inactive 5 = Open circuit inactive.
Speed		0%	This parameter limits the maximum speed allowed during speed inhibit mode. A setting of 0 prevents drive during inhibit mode.
BRAKE MENU			
Delay		0.3 sec	Sets the length of delay between when zero speed is commanded and the electromagnetic brake is engaged.
Fault Check		ON	Enables/disables the fault detection on the EM brake.
Hold Voltage		18V	A high initial voltage is applied to the brake coil when the brake is first released. After approximately 1 second, this peak voltage drops to the programmed Hold Voltage. The parameter should be set high enough to hold the brake released under all the shock and vibration conditions the vehicle will be subjected to.
Brake Light		OFF	When set to On, the horn output (J1 Pin 3) will act as a brake light driver. The brake light must be driven by a relay. The brake light will be turned on when the throttle is returned to neutral and will remain on for about 2 seconds after the EM brake is engaged.
HORN MENU			
Fault Beep		N/A	When programmed On, the horn will be used to provide audible fault codes whenever faults are present. These are the same fault codes that are flashed by the status LED. If a fault should occur while the vehicle is driving in reverse with the reverse beep active, the fault signal will take precedence. If this audible fault alarm is not wanted, set Fault Beep to Off.
Reverse Beep		ON	When programmed On, the horn will sound whenever the vehicle is being driven in reverse. On vehicles with reverse switches, the horn will sound when the reverse switch is activated.
Beep Constant		OFF	Sets the reverse beep to be a constant tone (when programmed On) or a 1Hz pulse (when programmed Off).

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
MOTOR MENU		**90A**	
System Resistance		80 mΩ 73 mΩ	Sets the system resistance (motor + brushes + wiring + connections) used for load compensation and speed estimation. Control system performance depends on this parameter being set correctly; it must be set to the actual cold motor resistance.
Resistance Auto Comp		ON	Resistance is automatically measured under a preset low current before the brake is released. The measured motor resistance plays an important role in IR compensation. The Resistance Auto Comp parameter enables/disables this automatic function.
Auto Comp Current Limit		20%	Sets the current limit used for automatic resistance testing, as a percentage of the Main Current Limit (see Current menu).
Speed Scaler		27V	The Speed Scaler parameter sets the maximum voltage that can be applied to the motor. It can be used to eliminate variations in maximum speed that would otherwise result when driving with a fully charged battery vs. a partially discharged battery. If Speed Scaler is set to 23 volts, for example, the maximum vehicle speed will be the same whether the actual battery voltage is 27 volts or 23 volts or any value in between.
Current Rating		25A	This parameter should be set to the current rating provided by the motor 0–70 A manufacturer.
Max Current Time		120 sec.	Sets the maximum amount of time the motor is allowed to run at the main current limit.
Cutback Gain		0%	When the motor overheats, the drive current is cut back until it reaches the programmed Current Rating. The Cutback Gain determines how quickly this cutback will occur, once the programmed Max Current Time has expired.
BDI MENU			
Full Voltage		24.4V	Voltage when the battery is fully charged. Note: Allowable range is restricted by the Empty Voltage, Start Charge Voltage, and Reset Voltage settings.
Empty Voltage		20.8V	Voltage when the battery is fully discharged. Note: Allowable range is restricted by the Full Voltage setting.
Full Charge Voltage		28.2V	Voltage, when a charger is connected, above which the battery is considered finished charging. Note: Allowable range is restricted by the Start Charge setting.

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
BDI MENU - Cont.		**90A**	
Start Charger Voltage		25.2V	Voltage above which the battery is considered to start charging. Note: Allowable range is restricted by the Full Voltage and Full Charge Voltage settings.
Reset Voltage		25.0V	Voltage at which the BDI calculator will be reset to 100%, after the charger is disconnected and the controller is powered up. Note: Allowable range is restricted by the Full Voltage setting.
Discharge Factor		2.0	Discharge rate of the battery. Larger values are for larger batteries, which discharge more slowly.
Charge Factor		2.0	Charge rate of the battery. Larger values are for larger batteries, which charge more slowly.
Low BDI Level		40%	Sets the battery charge level at which maximum vehicle speed will be limited in order to protect the battery from deep discharge. Setting Low BDI Level to zero disables this function and allows the battery to discharge completely.
Low BDI Max Speed		15%	Sets the maximum allowed vehicle speed when the battery charge falls below the programmed Low BDI Level.
COMPENSATION MENU			
IR Comp		70%	Sets the motor load compensation. Higher values provide stronger disturbance rejection, while lower values provide smoother operation. Note: Allowable range is restricted by the Anti-Rollback Comp setting.
Anti-Rollback Comp		90%	Sets the motor load compensation after the throttle is released to neutral and the speed is estimated to be near zero. Higher values provide more hill-holding force. Note: Allowable range is restricted by the IR Comp setting.

Table 4-2 Programmable Parameters - Continued

Parameter	Factory Setting		Description
EMERGENCY REVERSE MENU		**90A**	
Speed (90A Only)		30%	Defines the maximum reverse speed of the motor when emergency reverse is active.
Time Limit (90A Only)		3 sec.	Defines how long emergency reverse is allowed to be active after the vehicle is moving in reverse direction. Setting this parameter to zero means there is no time limit.
Decel Rate (90A Only)		0.6 sec.	Sets the rate at which the vehicle brakes to a stop when emergency reverse is activated and the vehicle is moving forward. If the vehicle is already moving in the reverse direction above the programmed EMR speed, it will be brought down to the EMR speed.
Accel Rate (90A Only)		1.5 sec.	Sets the rate at which the vehicle accelerates in the reverse direction when emergency reverse is activated. speed.
Max Braking Current (90A Only)		90A	Defines the maximum allowed motor current when the vehicle brakes to a stop when emergency reverse is activated.
Switch Normally Closed (90A Only)		OFF	Defines the emergency reverse switch (belly button switch) type. On = BB switch is normally closed when it is not pressed. Off = BB switch is normally open when it is not pressed.
MISCELLANEOUS MENU			
Sleep		0	Sets the delay time between the last throttle request or serial communication and when the controller goes into sleep mode. Setting the delay to zero disables the sleep function
Fault Code Type		0	This parameter selects which set of fault identification codes (Type 0,1, or 2) will be flashed by the status LED.
Reset Drive Time		OFF	The controller's hourmeter logs the total drive time since the last reset; this record is accessible through the Monitor menu. Setting this parameter ON zeroes the hourmeter and starts a new log; this is typically done when the vehicle is serviced. Reset Drive Time is automatically set to Off after the hourmeter is reset.
Emergency Stop (90A Only)		ON	Defines how the vehicle will respond when the emergency stop button is pressed. On =The EM brake will be engaged rapidly when the emergency stop button is pressed; the battery is disconnected and the vehicle will stop abruptly. Off =When the emergency stop button is pressed, the battery is disconnected and the vehicle will decelerate for a short distance before it fully stops.

4-2.8. Programmer Diagnostics

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

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

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

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

   Refer to the Table 4-3 for suggestions covering a wide range of possible faults.

Table 3 TROUBLESHOOTING CHART

LED CODE	PROGRAMMER LCD DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,1	THERMAL FAULT	over-/under-temperature cutback	1. Temperature >80°C or < -10°C. 2. Excessive load on vehicle. 3. Operation in extreme environments. 4. Electromagnetic brake not releasing.
1,2	THROTTLE FAULT	PotLow and/or PotWiper out of range	1. Throttle input wire open or shorted. 2. Throttle pot defective. 3. Wrong throttle type selected.
1,3	SPEED POT FAULT	speed limit pot wiper out of range	1. Speed limit pot wire(s) broken or shorted. 2. Broken speed limit pot.
1,4	UNDERVOLTAGE FAULT	battery voltage too low	1. Battery voltage <17 volts. 2. Bad connection at battery or controller.
1,5	OVERVOLTAGE FAULT	battery voltage too high	1. Battery voltage >31 volts. 2. Vehicle operating with charger attached. 3. Intermittent battery connection.
2,1	MAIN OFF FAULT	main contactor driver Off fault	1. Main contactor driver failed open.
2,2	EMR SEQUENCING FAULT *[1212P]*	improper sequencing	1. Emerg. Rev. switch pressed before KSI on.
	MOTOR STALLED *[1212]*	motor stall fault	1. Motor is stalled.
2,3	MAIN FAULT	main contactor fault	1. Main contactor welded or stuck open. 2. Main contactor driver fault.
2,4	MAIN ON FAULT	main contactor driver On fault	1. Main contactor driver failed closed.
2,5	PUMP SRO FAULT *[1212P]*	improper sequencing	1. Pump switches pressed before KSI on.
3,1	WIRING FAULT	HPD fault present >10 sec.	1. Misadjusted throttle. 2. Broken throttle pot or throttle mechanism.
3,2	BRAKE ON FAULT	brake On fault	1. Electromagnetic brake driver shorted. 2. Electromagnetic brake coil open.
3,3	PRECHARGE FAULT	precharge fault	1. Brake driver shorted. 2. Precharge circuit damaged. 3. MOSFET failure.
3,4	BRAKE OFF FAULT	brake Off fault	1. Electromagnetic brake driver open. 2. Electromagnetic brake coil shorted.
3,5	HPD FAULT	HPD (High Pedal Disable)	1. Improper sequence of throttle and KSI, push, or inhibit inputs. 2. Misadjusted throttle pot.
4,1	CURRENT SENSE FAULT	current sense out of range	1. Short in motor or in motor wiring. 2. Controller failure. *
4,2	HARDWARE FAILSAFE	motor voltage out of range	1. Motor voltage does not correspond to throttle request. 2. Short in motor or in motor wiring. 3. Controller failure. *
4,3	EEPROM CHECKSUM FAULT	EEPROM fault	1. EEPROM failure or fault.
4,4	MOTOR OPEN *[1212]*	motor open fault	1. Motor wiring is open.
4,5	BATTERY DISCONNECT FAULT	battery disconnected	1. Battery not connected. 2. Poor connection to battery terminals.

* Jack up vehicle and retest to confirm diagnosis. Clean connections, inspect system wiring, and retest.

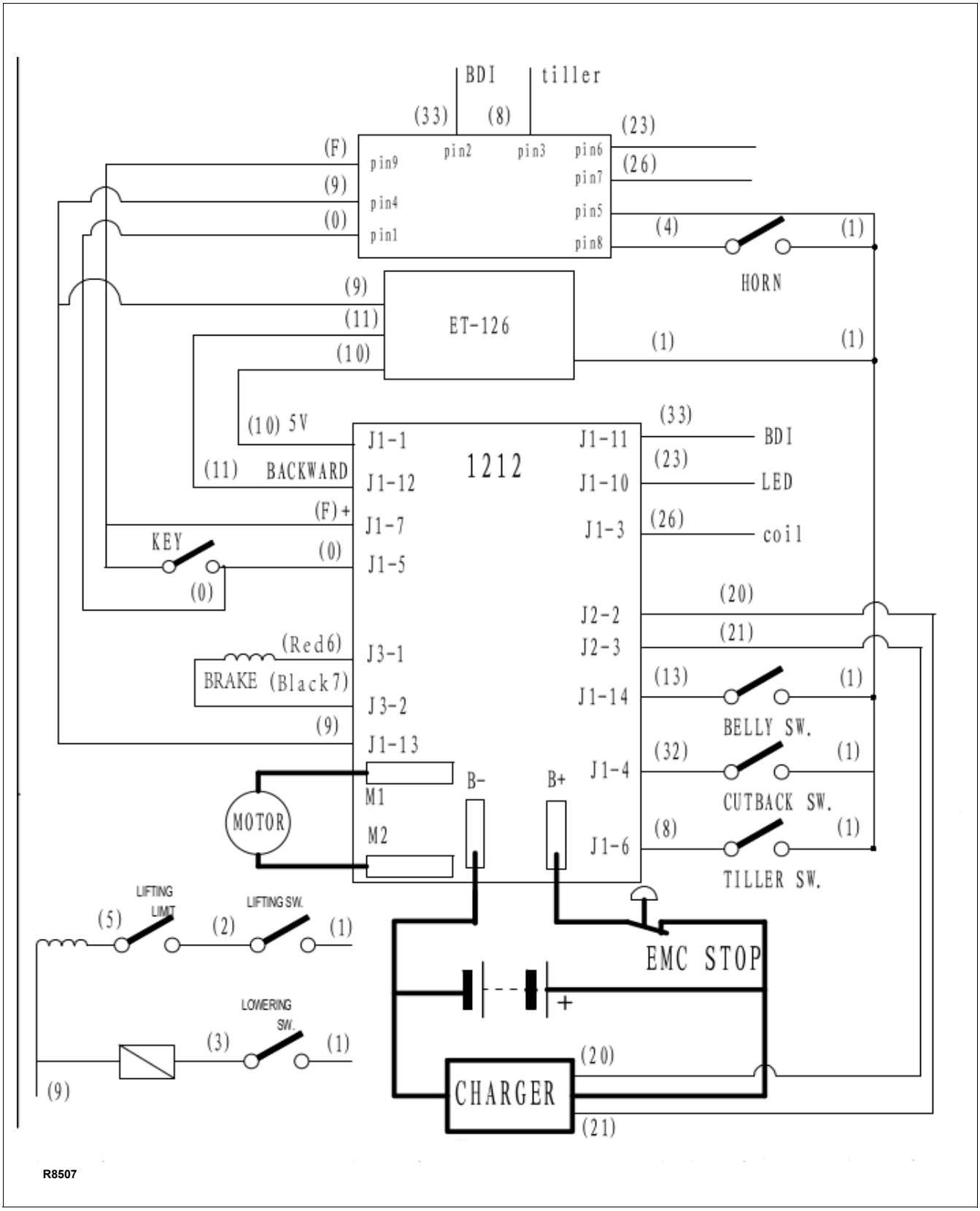


Figure 4-3 Wiring Diagram

SECTION 5
STEERING ARM, CONTROL HEAD AND COMPARTMENT

5-1. CONTROL HEAD

5-1.1. Control Head Removal

1. Turn off the key switch and emergency disconnect.
2. Remove the control head Covers as described in paragraph 5-1.3.
3. Disconnect harness from potentiometer.

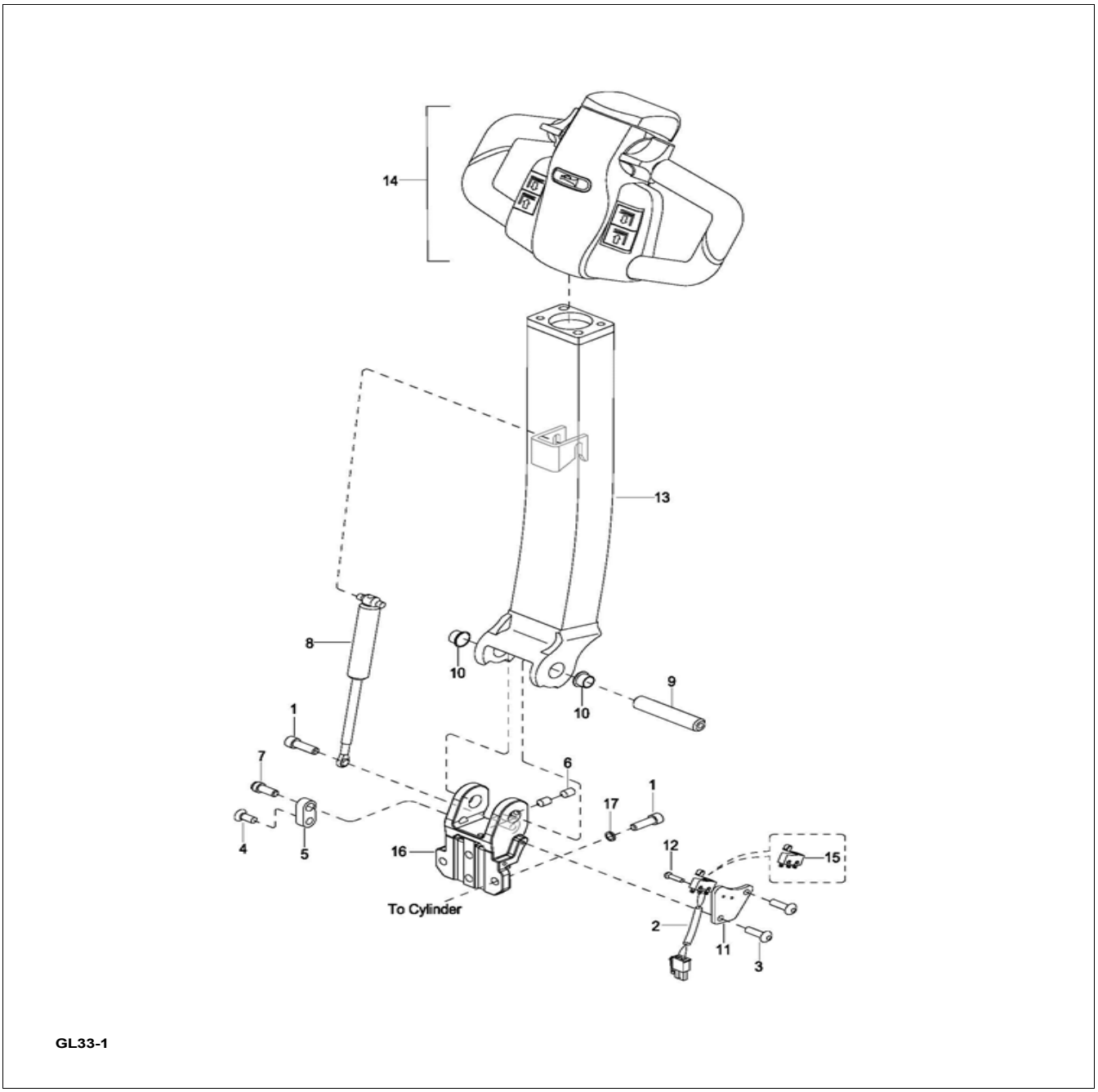


Figure 5-1 Steering Arm

4. Disconnect harness from emergency reverse switch.
5. Remove two screws, two washers and two flat washers.

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

6. Remove two screws, two washers and two flat washers.
7. Remove the control head and handle.

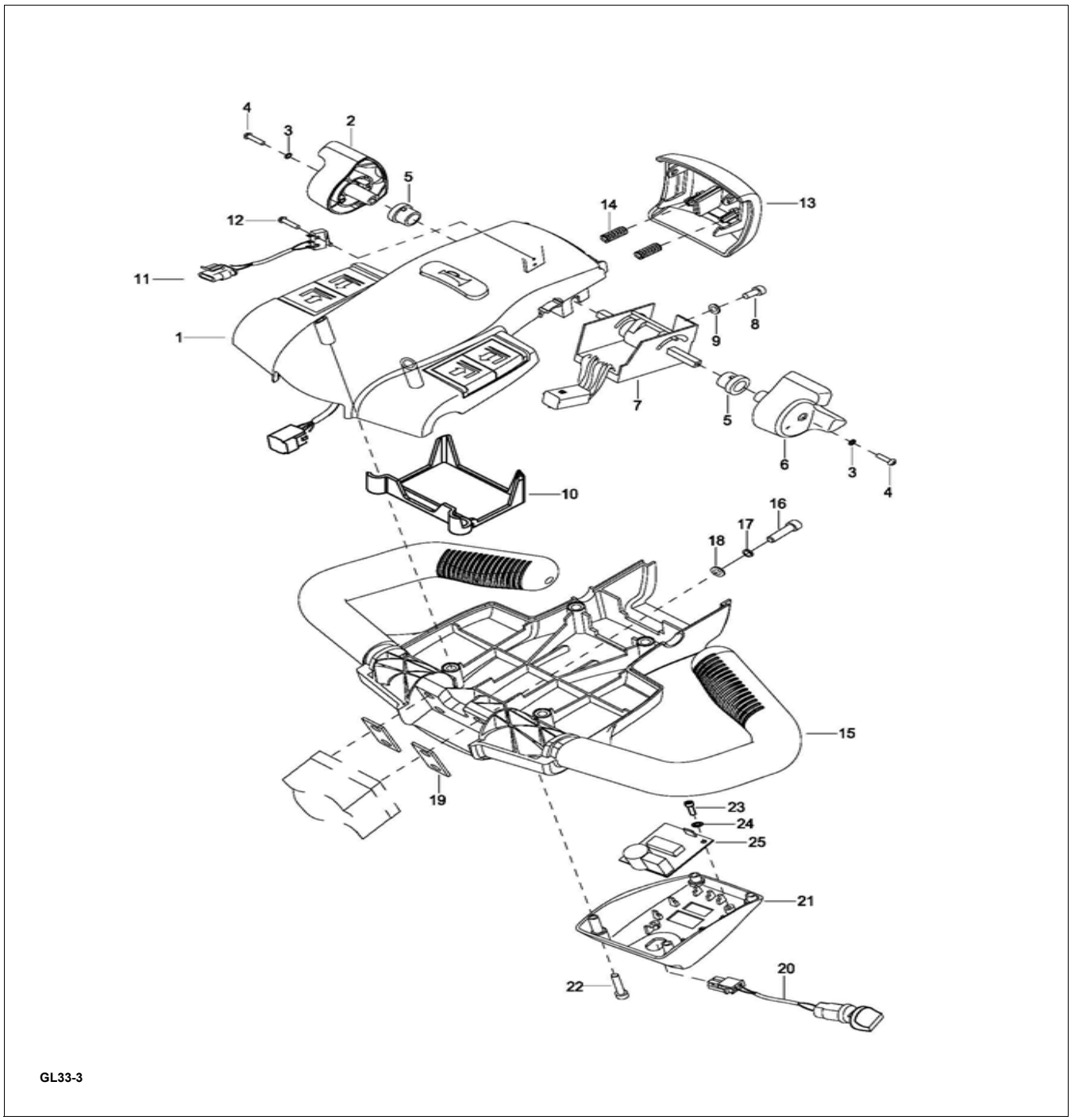


Figure 5-2 Control Head

5-1.2. Control Head Installation

1. Secure control head and handle with two screws, two washers and two flat washers.
2. Install two screws, two washers and two flat washers.
3. Reconnect harness to emergency reverse switch.
4. Reconnect harness to potentiometer.
5. Install the control Head Covers as described in paragraph 5-1.4.
6. Turn on the key switch and emergency disconnect.

5-1.3. Control Head Covers Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove four screws and lift up control head Covers.
3. Disconnect harnesses from each other and remove control head Covers.

5-1.4. Control Head Covers Installation.

1. Hold control head Covers in place and connect harnesses together.
2. Position control Head Covers on control head and secure with four screws.
3. Turn on the key switch and emergency disconnect.

5-1.5. Speed Potentiometer Replacement.

1. Remove the control Head Covers as described in paragraph 5-1.3.
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 screws, two lock washers and two flat washers and remove potentiometer and switch assembly from bracket.
6. Position new potentiometer and switch assembly in bracket and secure with screw, screw, two lock washers and two flat washers.
7. Install control knob on potentiometer and secure with screw, and washer.
8. Install control knob on the other side of potentiometer and secure with screw, and washer.
9. Reconnect harness to potentiometer.
10. Install the control Head Covers as described in paragraph 5-1.4.

5-1.6. Belly-Button Switch Replacement.

1. Remove the control Head Covers as described in paragraph 5-1.3.
2. Disconnect harness from emergency disconnect switch.
3. Remove screws, two lock washers and two flat washers and remove potentiometer and switch assembly from bracket.
4. Remove pin, bracket, and spring from button.
5. Remove two pins and switch assembly from bracket.
6. Position the new switch assembly in bracket and secure with two pins.
7. Position bracket and springs in button and install pin.
8. Position potentiometer and switch assembly in bracket and secure with screws, two lock washers and two flat washers.
9. Reconnect harness to emergency reverse switch.
10. Install the control head Covers as described in paragraph 5-1.4.

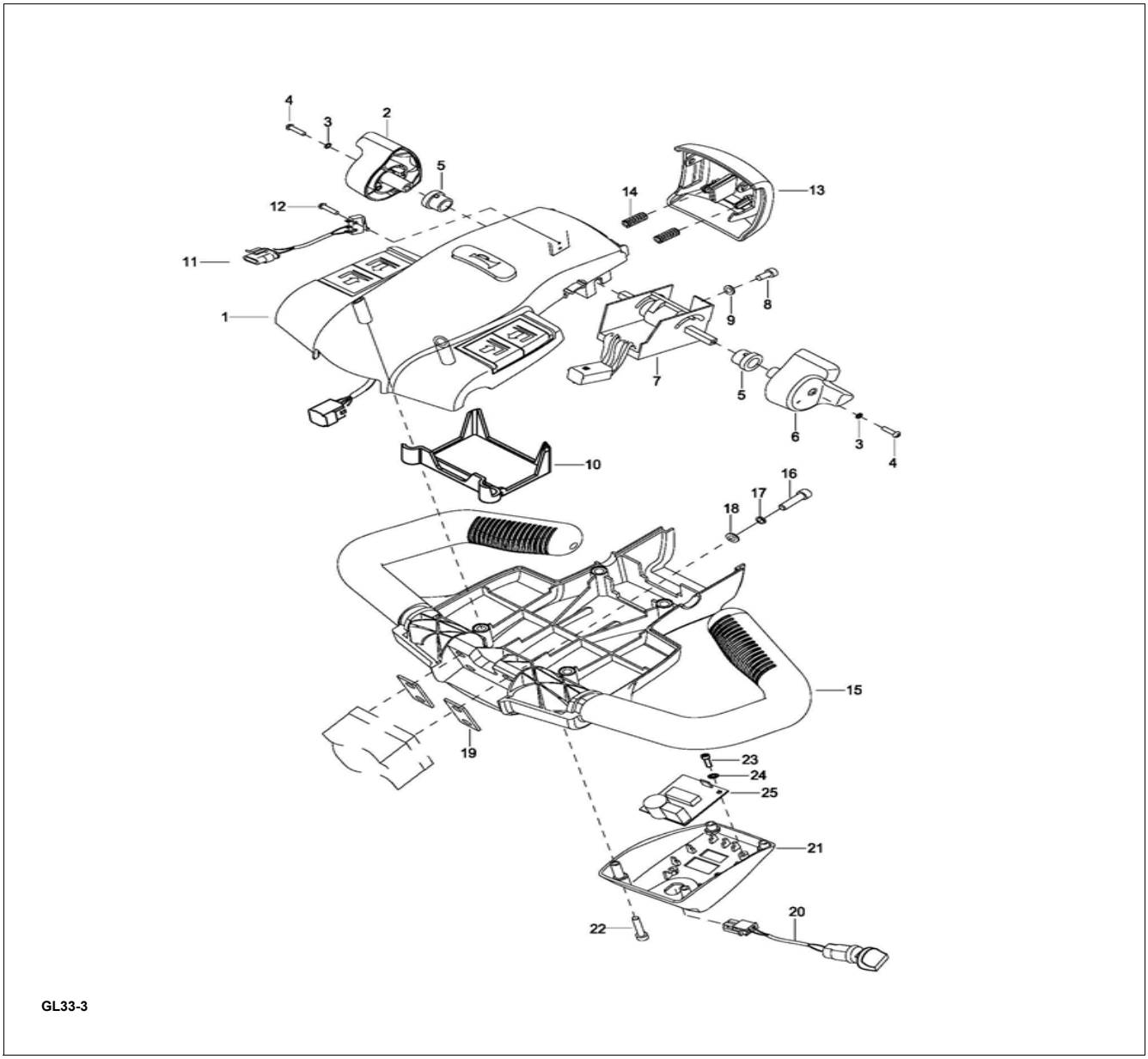


Figure 5-3 Emergency Reverse Switch Assembly

5-1.7. Horn Switch Replacement.

1. Remove the control head Covers as described in paragraph 5-1.3.
2. Remove three screws, bracket and two springs.
3. Remove two pins and switch from bracket.
4. Position new switch in bracket and secure with two pins.
5. Position bracket with two springs in cover and secure with three screws.
6. Install the control head Covers as described in paragraph 5-1.4.

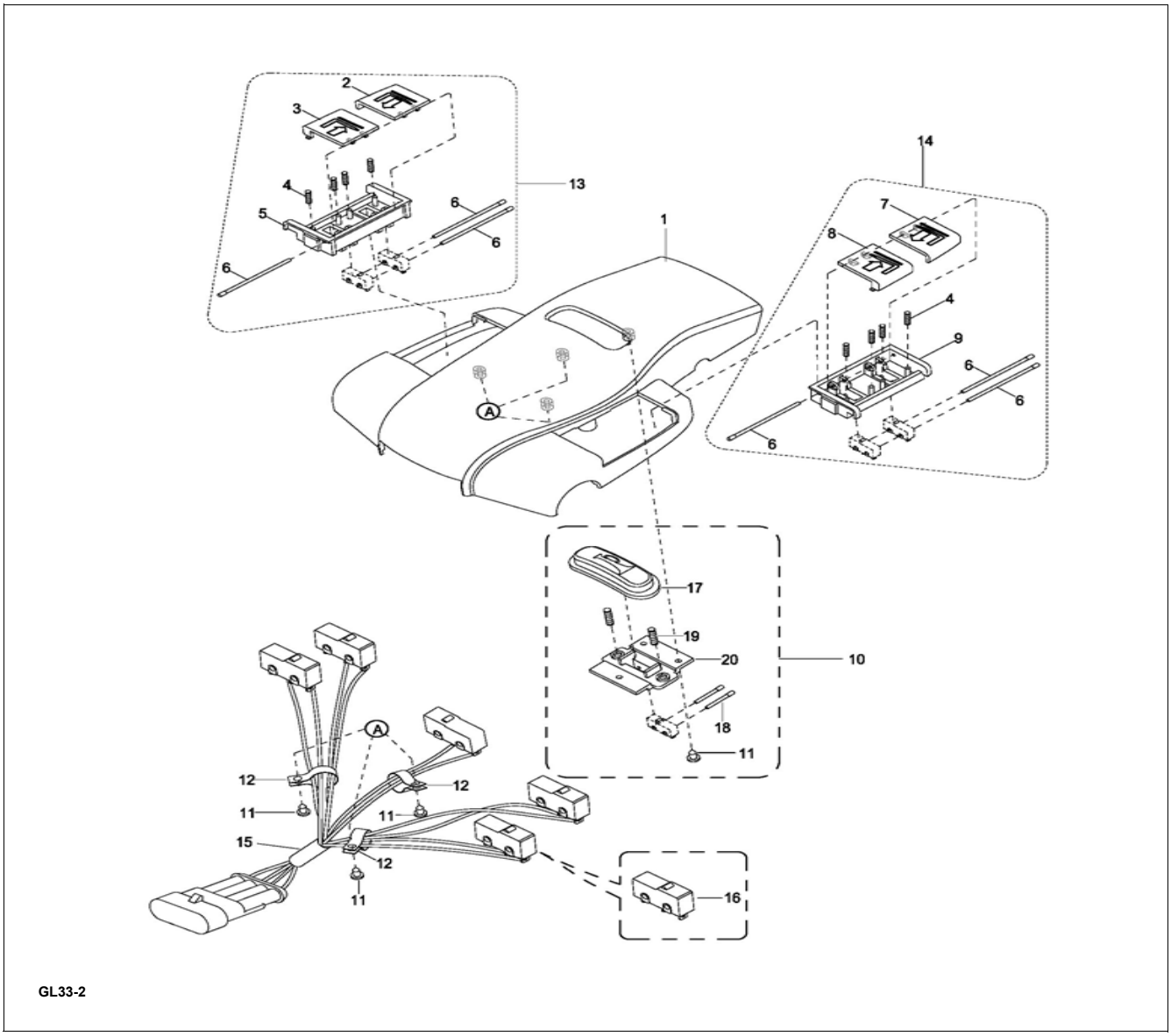


Figure 5-4 Control Head Covers

5-1.8. Lift and Lower Switch Replacement.

1. Remove the control Head Covers as described in paragraph 5-1.3.
2. Remove switch assembly from the cap
3. Remove pin securing buttons to bracket and remove the buttons.
4. Remove two pins, two switches and four springs from bracket.
5. Position switches and four springs in bracket and secure with two pins.
6. Position switch assembly in cover and secure with pin.
7. Install the control head Covers as described in paragraph 5-1.4.

5-2. UPPER COMPARTMENT COVERS

5-2.1. Removal.

1. Turn off the key switch and emergency disconnect.
2. Pull cable up and remove cap from the cable. Let cable back down into cover.
3. Remove two screws and cover.
4. Disconnect cable from the battery charger.

5-2.2. Installation.

1. Reconnect cable to the battery charger.
2. Feed cable through cover and position cover on frame. Secure with two screws.
3. Install cap on cable and position the cap on cover.
4. Turn on the key switch and emergency disconnect.

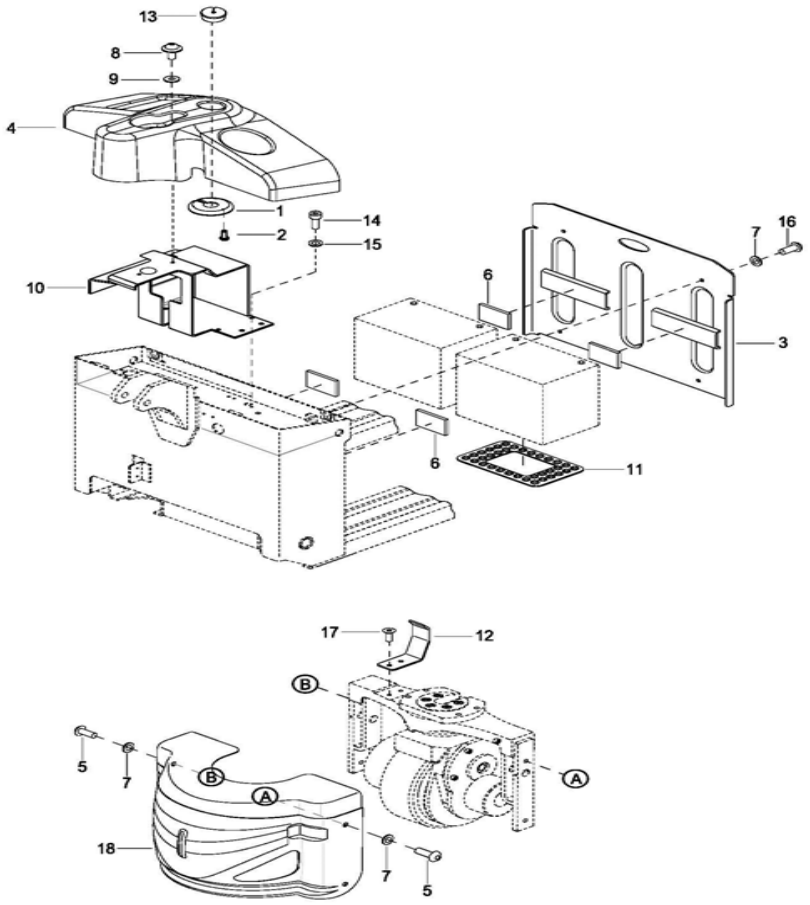


Figure 5-5 Compartment Cover

5-3. LOWER COMPARTMENT COVERS

5-3.1. Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove four screws and washers from lower cover.
3. Remove lower cover from back frame.

5-3.2. Installation.

1. Position lower cover on back frame and secure with four screws and washers.
2. Turn on the key switch and emergency disconnect.

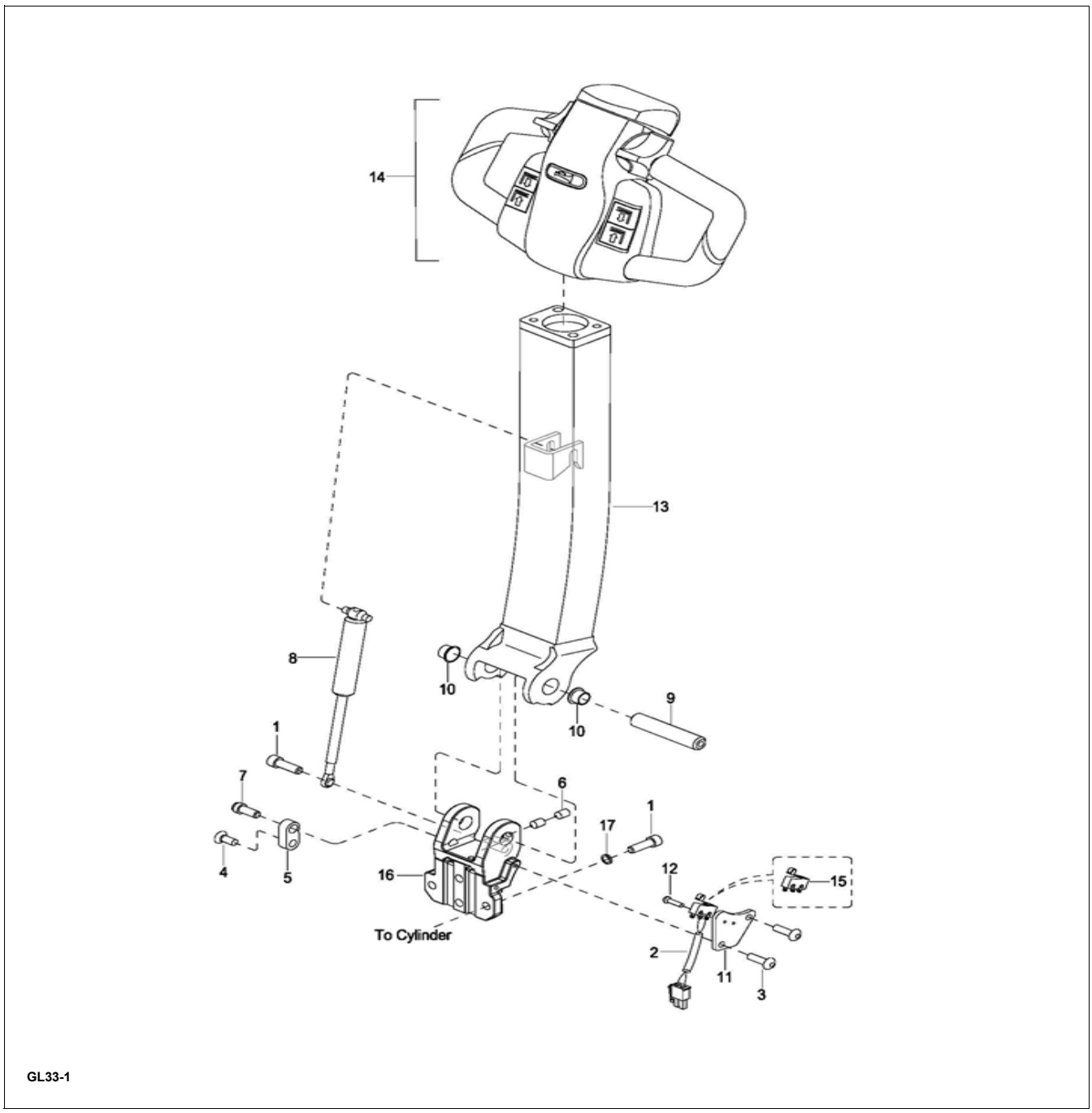


Figure 5-6 Steering Arm

5-4. STEERING ARM

5-4.1. Return Spring Replacement.

The steering arm gas return spring is replaced while the steering arm is in the upright position.

1. Secure the steering arm in the upright position.
2. Remove screw and free the gas return spring from bracket.
3. Pull downward on the gas return spring to free it from its seat inside steering arm.
4. Position the new gas return spring inside the steering arm being sure it fully engages its seat.
5. Position the opposite end of the gas return spring on bracket and install screw.

5-4.2. Steering Arm Removal.

1. Remove steering arm gas return spring as described in paragraph 5-4.1.
2. Disconnect the harnesses from each other.
3. Attach a hoist to steering arm.
4. Remove shaft and the steering arm.

5-4.3. Steering Arm Installation.

1. Position steering arm over bracket and secure with shaft.
2. Reconnect harnesses to each other.
3. Install steering arm gas return spring as described in paragraph 5-4.1.

SECTION 6
BRAKE SERVICING

6-1. BRAKES.

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

6-1.1. Brake Assembly Replacement

1. Block load wheels.
2. Remove the lower compartment covers as described in paragraph 5-3.
3. Disconnect electric brake from 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 harness.
7. Remove load wheel blocks and check operation.
8. Install the lower compartment covers as described in paragraph 5-3.

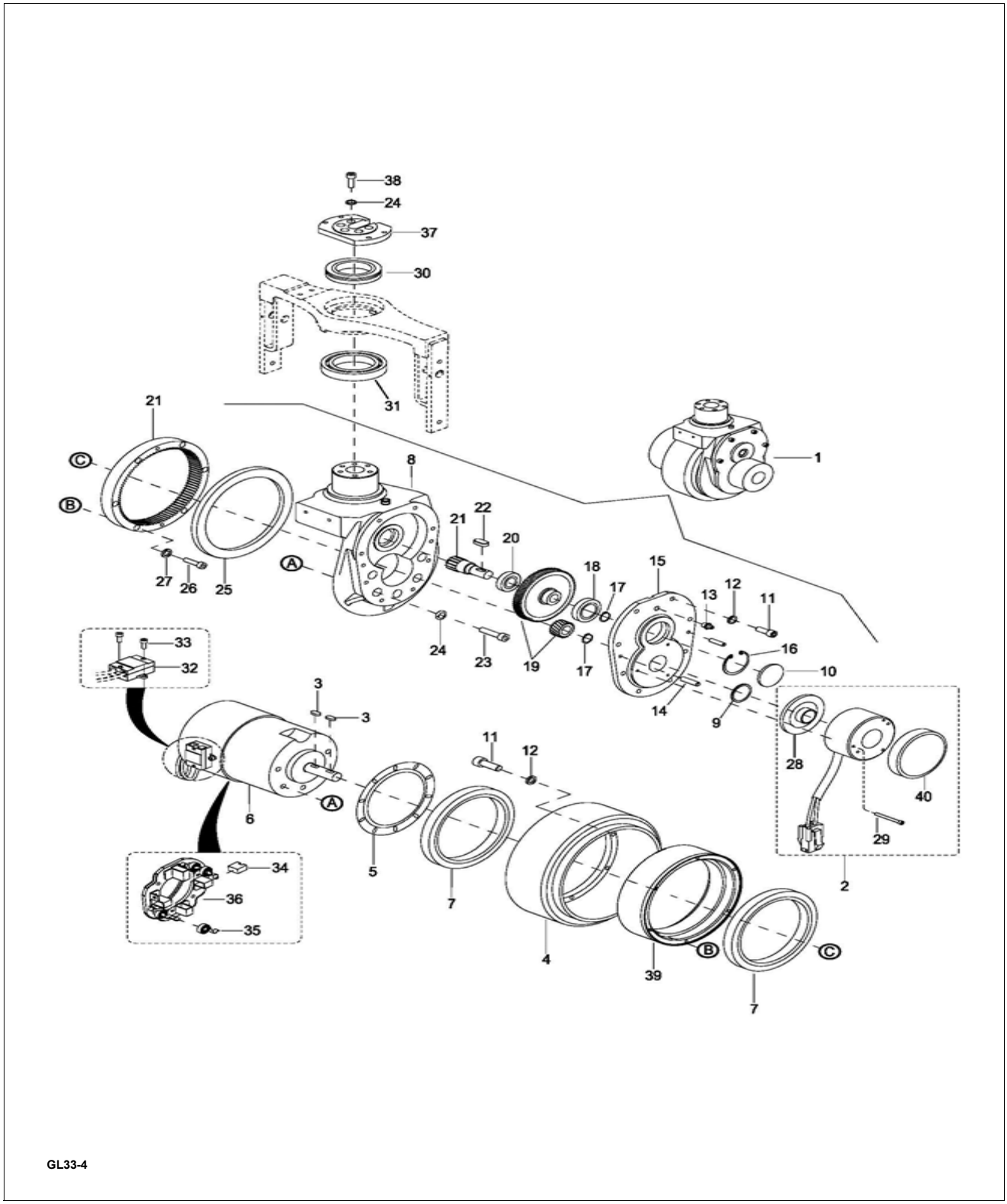


Figure 6-1 Transmission, Motor, Brake Mounting

SECTION 7
TRANSMISSION, DRIVE WHEEL, LOAD WHEEL

7-1. DRIVE WHEEL.

1. Turn off the key switch and emergency disconnect.
2. Remove the lower compartment covers as described in paragraph 5-3.
3. Jack up the truck so the drive wheel is off the ground; then securely block the truck to prevent movement.
4. Disconnect cables from drive motor.
5. Remove screws, lock washers, and free motor with drive wheel from housing.
6. Remove the screws, lock washers and gear.
7. Remove drive wheel from motor.
8. Remove bearing from wheel.
9. Install new drive wheel in reverse order of removal.
10. Install the lower compartment covers as described in paragraph 5-3.
11. Turn on the key switch and emergency disconnect.

7-2. TRANSMISSION.

1. Turn off the key switch and emergency disconnect.
2. Remove the lower compartment covers as described in paragraph 5-3.
3. Remove the brake as described in paragraph 6-1.1.
4. Remove the steering arm as described in paragraph 5-4.2.
5. Remove two screws and plate.
6. Remove five screws, five lock washers that holds the transmission to the back frame.
7. Remove the transmission.
8. Install new transmission by reversing the steps above.

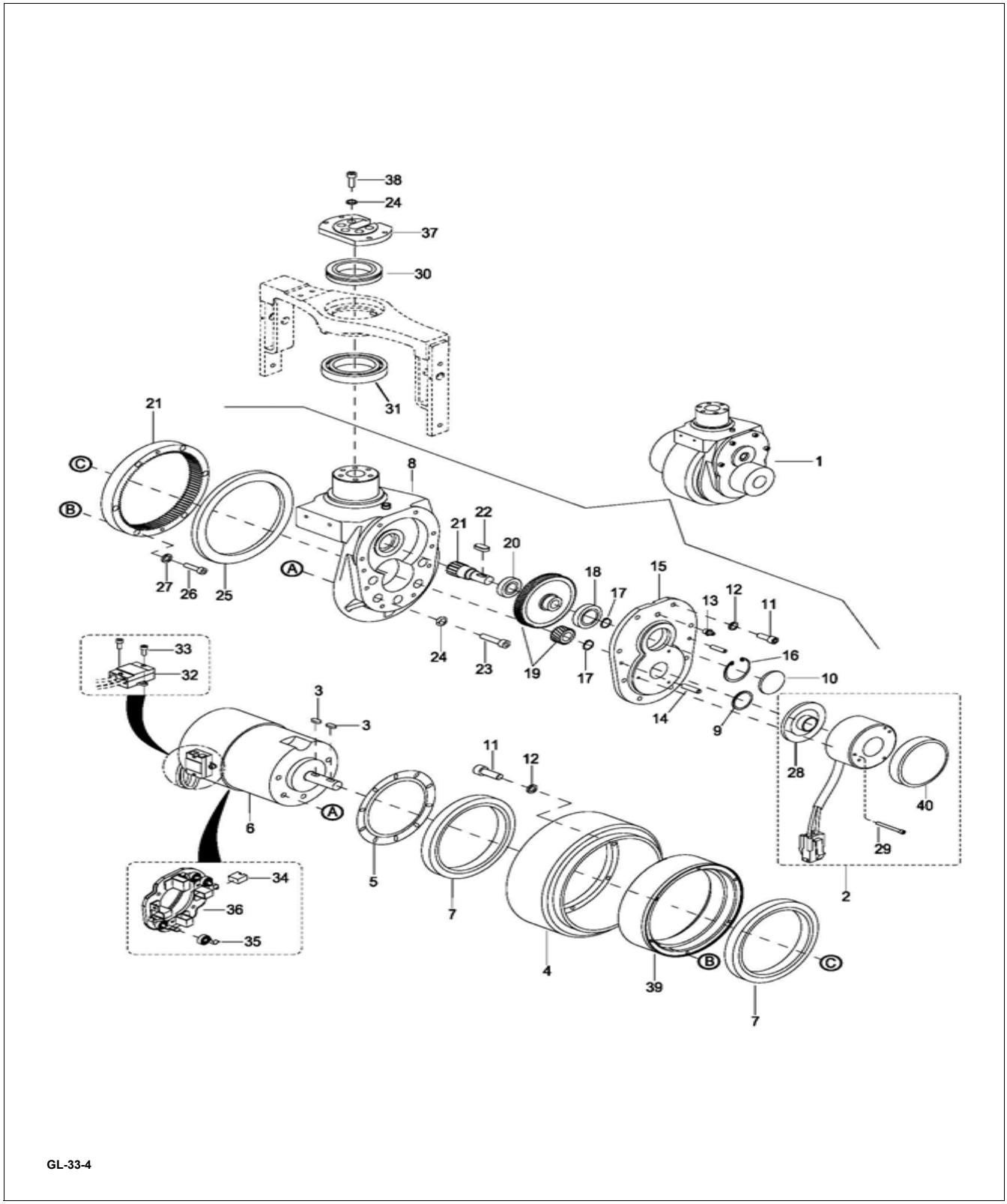


Figure 7-1 Transmission, Motor, Brake Mounting

7-3. LOAD WHEEL.

7-3.1. Removal

1. Raise forks.
2. Turn off the key switch and emergency disconnect.
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 assembly will drop free.

5. Remove pin securing shaft and remove shaft 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. Global Industrial recommends that both load wheel assemblies be replaced at the same time. This ensures level and safe operation of the lift truck.

7-3.2. Repair

1. Remove bearings from wheels.
2. Inspect bearings and replace if necessary.
3. Reassemble bearings in wheels.

7-3.3. Load Wheel Installation

1. Position load wheel assembly in wheel bracket.
2. Install shaft and secure with pin.
3. Remove blocking from under the truck.
4. Lower the forks.
5. Turn on the key switch and emergency disconnect.

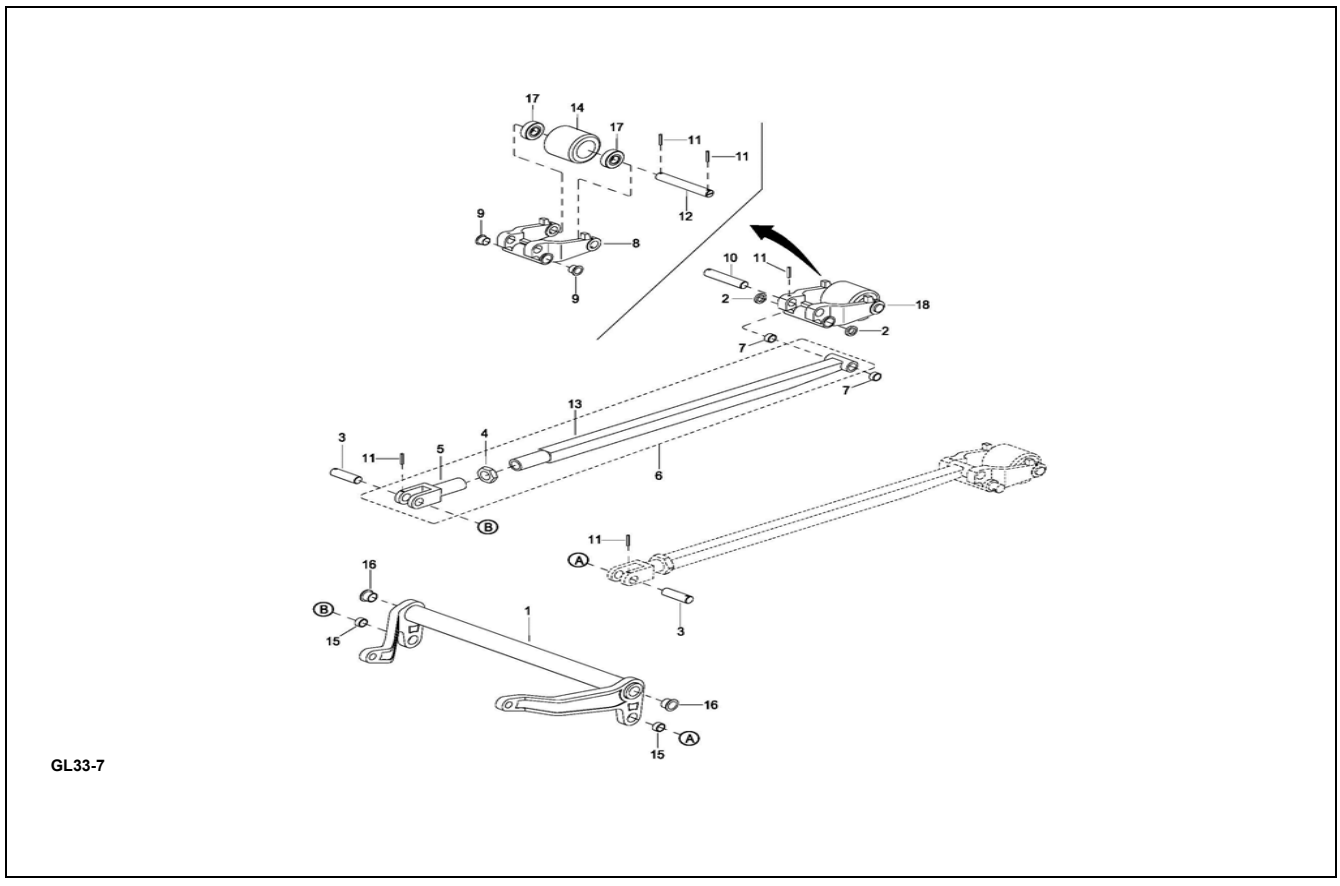


Figure 7-2 Wheel Assembly

NOTES

SECTION 8
ELEVATION SYSTEM SERVICING

8-1. LIFT LINKAGE

8-1.1. Removal

1. Lift complete truck to height sufficient to permit access to lift linkage under forks. Provide blocking under frame and at tips of the forks.
2. Turn off the key switch and emergency disconnect.
3. Remove all pins and remove all shafts and Support link assembly and remove long shaft.
4. Lower link assembly to the floor.

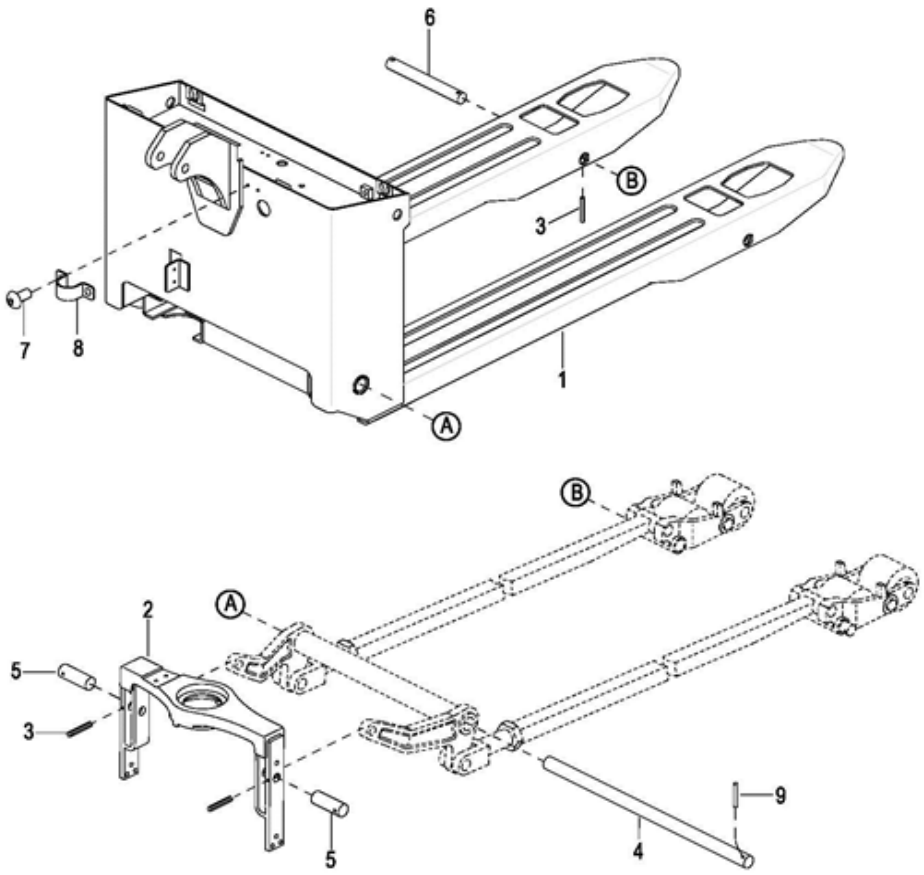


Figure 8-1 Frame

8-1.2. Repair

1. Remove pins, shafts and load wheel from wheel brackets.
2. Remove pins and shafts. Free brackets from tension bars.
3. Remove bushings from brackets if replacement is necessary,
4. Remove clips from link and free tension bars from link.
5. Loosen nuts and remove clevises from tension bars.
6. Remove bushings from clevises if replacement is necessary.
7. Install reassemble by reversing the steps above.

8-1.3. Installation

1. Position link assembly under frame.
2. Raise each link assembly into position and install shaft through frame. Secure shaft with clips.
3. Position wheel brackets in frame and install shafts. Secure shafts with pins.
4. Position link assembly and install shafts. Secure shafts with pins,
5. Remove blocking and lower the truck to the ground.
6. Turn on the key switch and emergency disconnect.

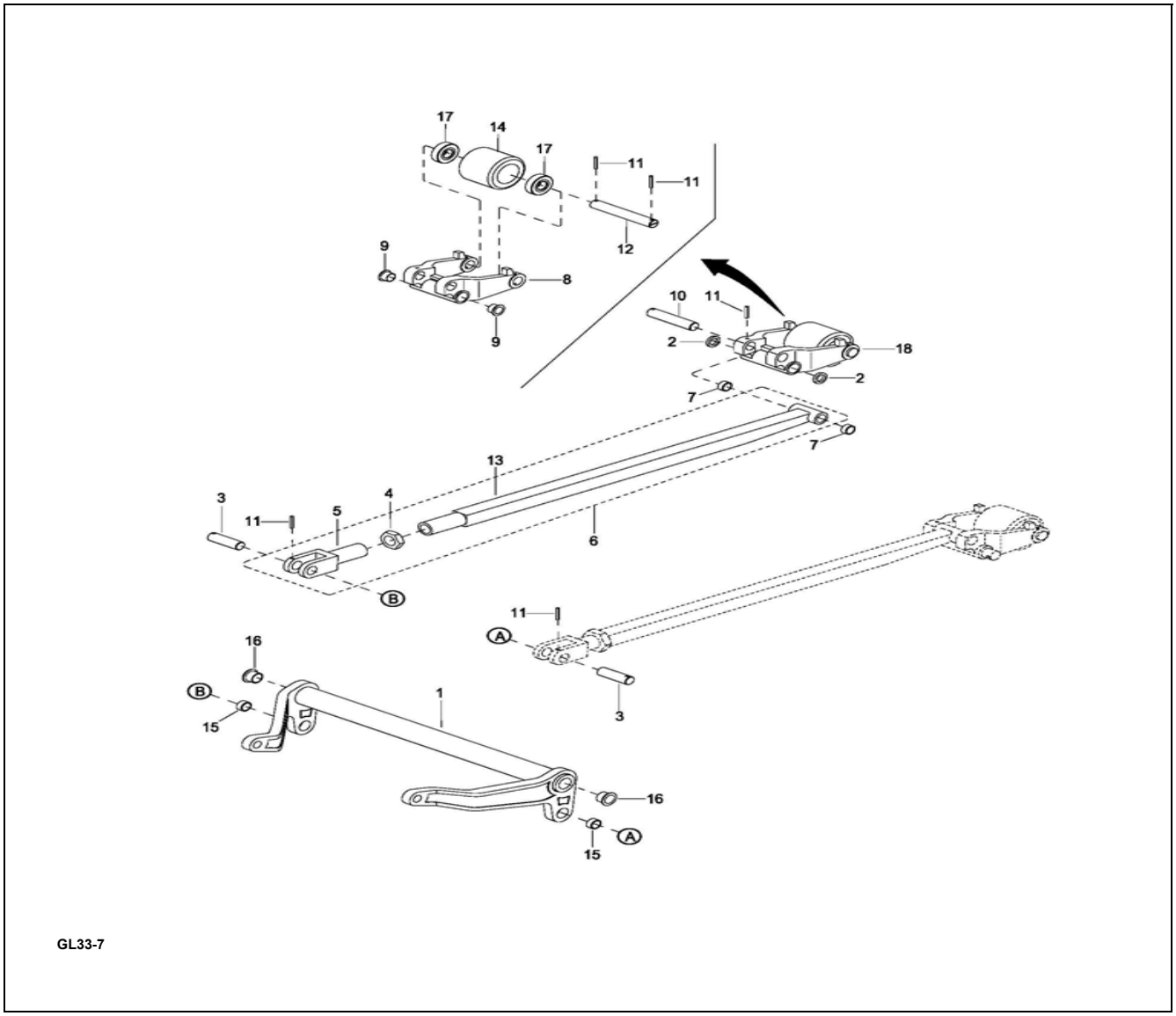


Figure 8-2 Lift Linkage Assembly

SECTION 9
HYDRAULIC SYSTEM SERVICING

9-1. LINES AND FITTINGS

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

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

1. Lower forks fully.
2. Turn off the key switch and emergency disconnect.
3. Remove the upper compartment cover as described in paragraph 5-2.

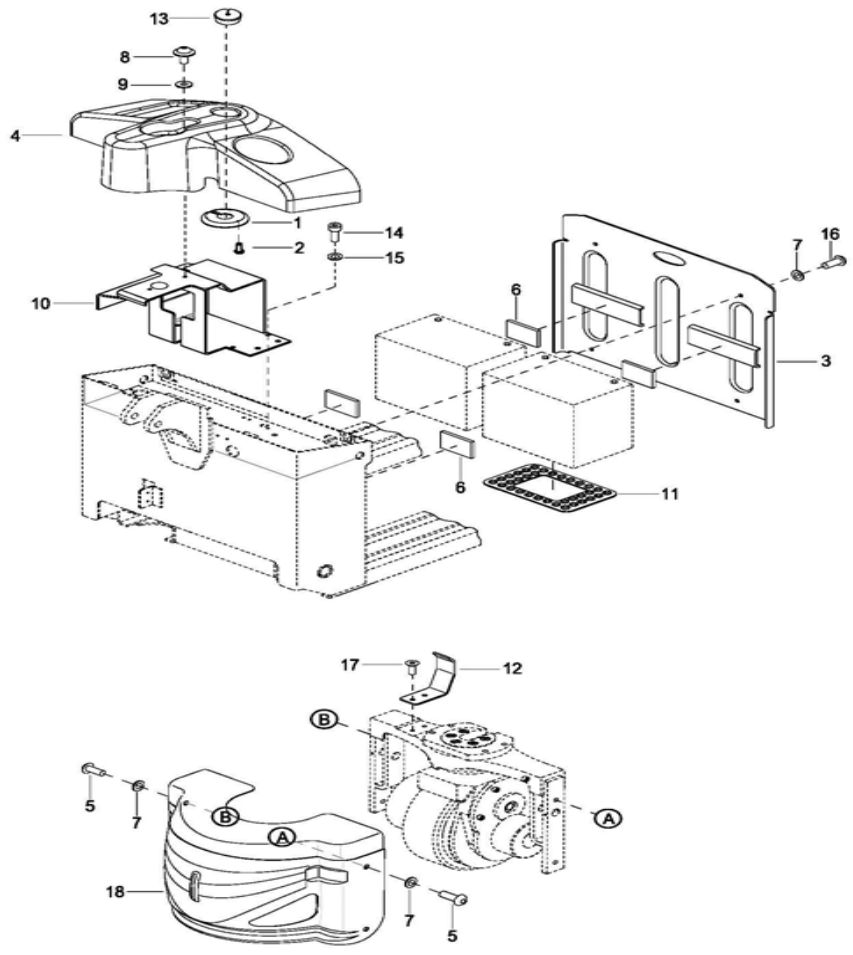


Figure 9-1 Compartment Cover

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

4. Refer to Figure 9-2 and remove leaking line or fitting and replace it with a new line or fitting. Check level of hydraulic oil. With lift carriage fully lowered, fill reservoir with hydraulic oil to 1 inch below opening. Use hydraulic oil listed in Table 3-2.
5. Turn on the key switch and emergency disconnect.
6. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
7. Check level of hydraulic oil. Hydraulic oil must be 1 inch below opening. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
8. Install the upper compartment cover as described in paragraph 5-2.

9-2. HYDRAULIC AND ELECTRICAL ASSEMBLY REMOVAL

The hydraulic system and electrical system can be removed as an assembly to provide additional clearance for various maintenance procedures.

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

9-2.1. Removal

1. Lower forks fully.
2. Turn off the key switch and emergency disconnect.
3. Remove the upper compartment cover as described in paragraph 5-2.
4. Remove the hydraulic line from the pump assembly.
5. Disconnect the wires and cables from the charger, and hydraulic system.
6. Remove the 4 (5mm) screws and washers to lift assembly away from frame.

9-2.2. Installation

1. Position assembly on frame and secure with screws and washers.
2. Assemble in reverse order.
3. Turn on the key switch and emergency disconnect.
4. Install the upper compartment cover as described in paragraph 5-2.

9-3. HYDRAULIC PUMP, MOTOR, AND RESERVOIR ASSY

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

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

9-3.1. Removal

1. Lower forks fully.
2. Turn off the key switch and emergency disconnect.
3. Remove the hydraulic and electrical assembly as described in paragraph 9-2.1.
4. Tag and disconnect electrical leads from solenoid and motor.

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

5. Disconnect hose from the pump and motor assembly.
6. Remove two screws and washers then remove the pump and motor assembly.

9-3.2. Disassembly and Reassembly

1. Remove the hydraulic pump/motor assembly as described in paragraph 9-3.1.
2. Refer to Figure 9-3 for disassembly and reassembly.

9-3.3. Installation

1. Position pump and motor on bracket and secure with two screws and washers.
2. Connect electrical leads to motor and solenoid.
3. Reconnect hose to the pump and motor assembly with two washers and bolt.

4. Fill the hydraulic reservoir. Hydraulic oil must be 1 inch below opening. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
5. Turn on the key switch and emergency disconnect.
6. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
7. Check level of hydraulic oil. Hydraulic oil must be 1 inch below opening. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2
8. Install the compartment cover as described in paragraph 5-2.

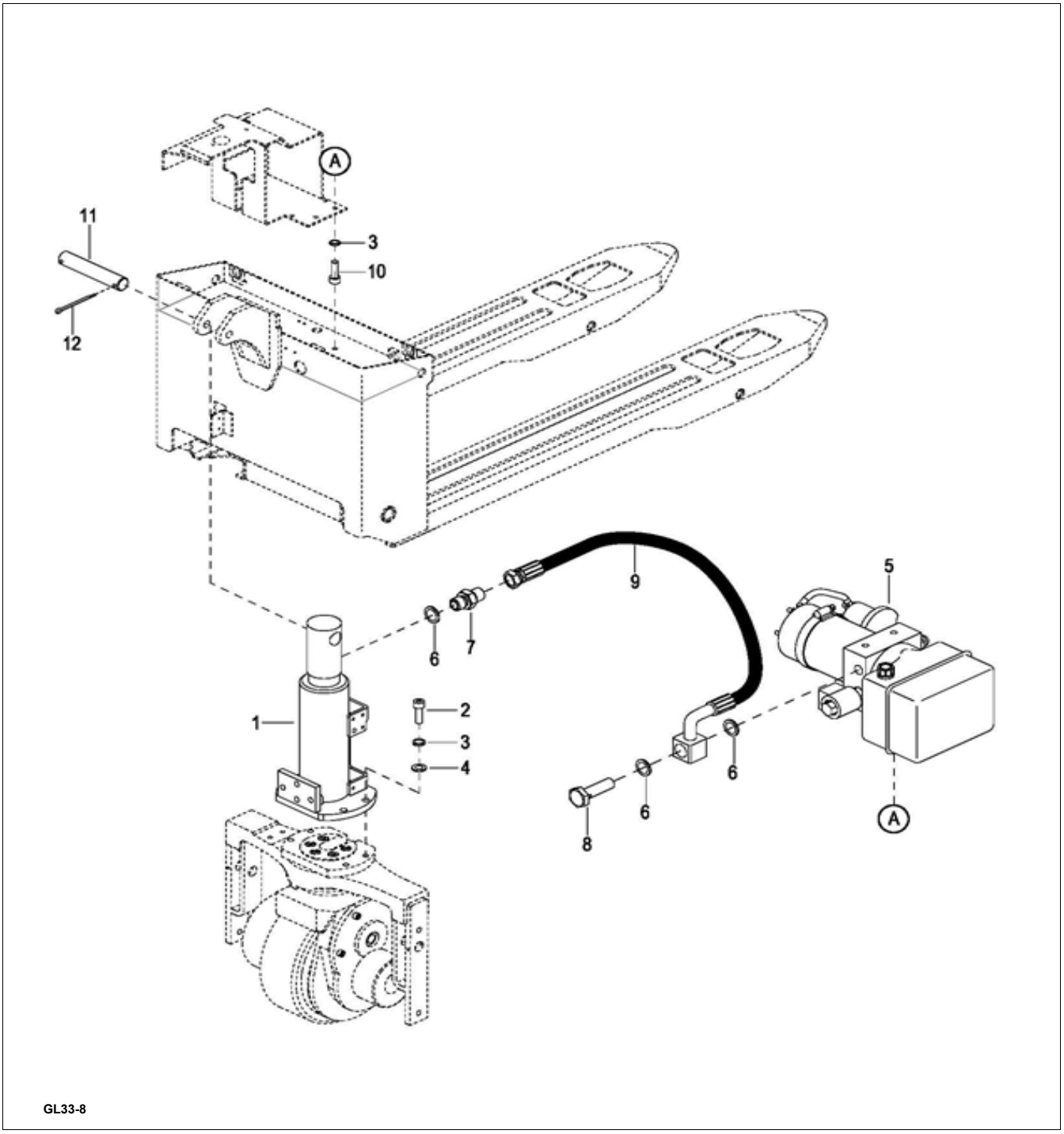


Figure 9-2 Hydraulic System

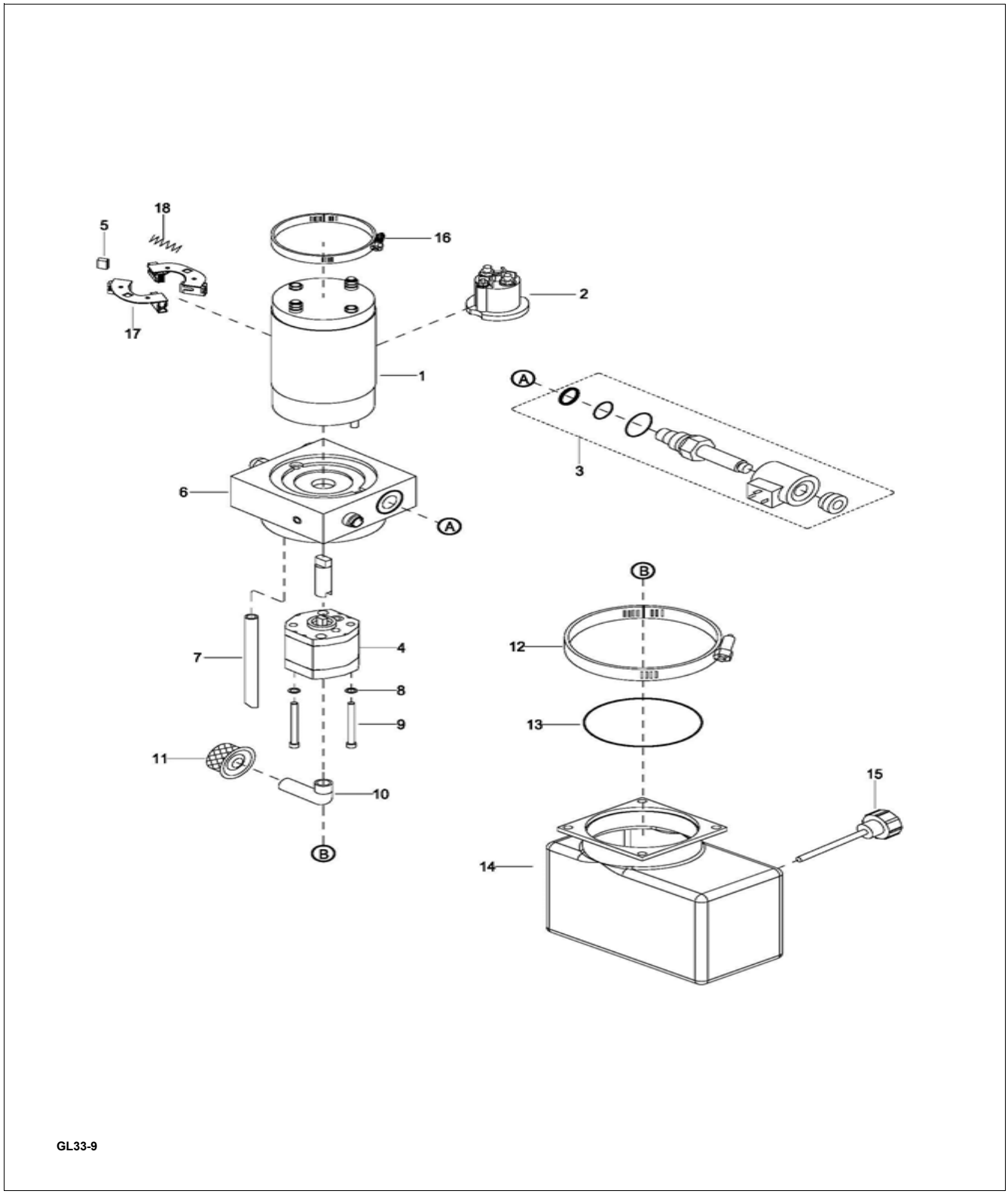


Figure 9-3 Pump & Motor Assy

9-4. LIFT CYLINDER

9-4.1. Removal

1. Lower forks fully.
2. Turn off the key switch and emergency disconnect.
3. Remove the upper compartment covers as described in paragraph 5-2.
4. Ensure that hydraulic pressure has been relieved from the lift circuit. Disconnect the hydraulic line from the lift cylinder.
5. Remove the 4 screws that secure the Aluminum housing to the cylinder.
6. Remove the handle assembly by removing the 3 mounting screws at the base of the handle and remove the handle.
7. Remove the shaft and pin and disconnect hose from cylinder.
8. Remove screws and washers securing the cylinder to frame.

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

9. With suitable hoist, carefully raise frame slightly so the cylinder can be removed.

9-4.2. Repair

1. Secure the lift cylinder in a vise, clamping lightly at the base of the cylinder.
2. Remove wiper and O-ring from gland nut.
3. Withdraw the cylinder rod from body.
4. Remove guide ring and seal ring from rod.

NOTE: If the cylinder body or piston rod are damaged, the entire lift cylinder must be replaced.

5. Replace guide ring, seal ring, wiper ring and O-ring.
6. Coat all parts with hydraulic oil (Table 3-2).
7. Install new guide ring and seal ring on rod.
8. Insert piston rod into body.

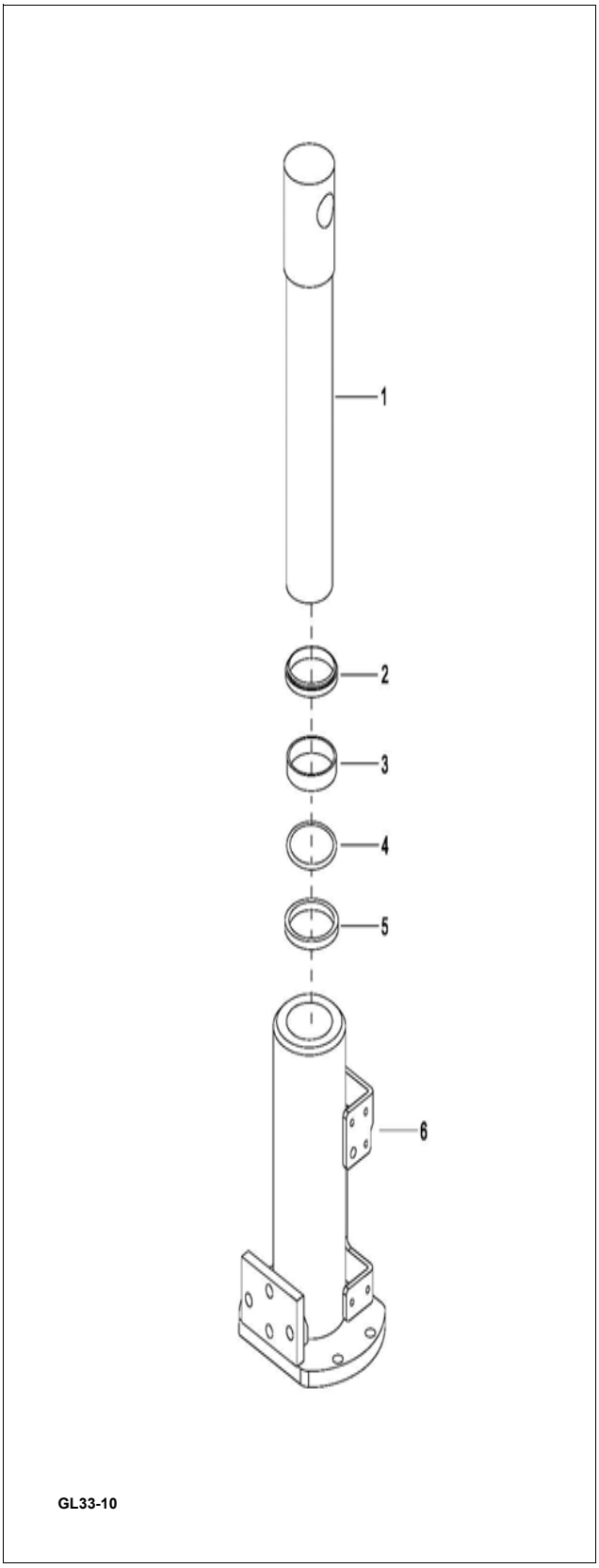


Figure 9-4 Lift Cylinder

9-4.3. Installation

1. Position the cylinder on frame and secure with screws and washers. Then lower the frame onto the cylinder.
2. Reconnect the hose to cylinder.
3. Fill the hydraulic reservoir. Hydraulic oil must be 1 inch below opening. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
4. Turn on the key switch and emergency disconnect.
5. Operate the lift and lower buttons to refill the cylinder and lines with hydraulic oil.
6. Check level of hydraulic oil. Hydraulic oil must be 1 inch below opening. If required, add hydraulic oil to bring to proper level. Use hydraulic oil listed in Table 3-2.
7. Install the compartment cover as described in paragraph 5-2.

SECTION 10
ELECTRICAL COMPONENTS

10-1. ELECTRICAL CONTROL PANEL

10-1.1. Maintenance

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

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

The controller is programmed at the factory specifically for the truck model on which it is equipped. It is important to replace the controller with the correct preprogrammed unit to assure proper performance settings intended for that particular truck. See the Electrical System in the parts section for the preprogrammed controller part number.

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

10-1.2. Cleaning

1. Turn off the key switch and emergency disconnect.
2. Remove the upper compartment covers as described in paragraph 5-2.
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.

10-1.3. Controller Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove the upper compartment covers as described in paragraph 5-2.
3. Tag and disconnect harness from controller.
4. Remove two screws, two lock washers and remove controller and heat sink from bracket.

10-1.4. Controller Installation.

1. Position controller and heat sink on bracket and secure with two screws and two lock washers.
2. Reconnect harness to controller.
3. Install upper compartment covers as described in paragraph 5-2.
4. Turn on the key switch and emergency disconnect.

10-1.5. Charger Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove the upper compartment covers as described in paragraph 5-2.
3. Tag and disconnect harness from charger.
4. Tag and disconnect remaining two charger leads from the pump motor and the fuse. Refer to Figure 10-3.
5. Remove four screws and four lock washers. Remove charger from bracket.

10-1.6. Charger Installation.

1. Position charger on bracket and secure with four screws and four lock washers.
2. Reconnect the two charger leads to the pump motor and the fuse. Refer to Figure 10-3.
3. Reconnect harness to charger.
4. Install upper compartment covers as described in paragraph 5-2.
5. Turn on the key switch and emergency disconnect.

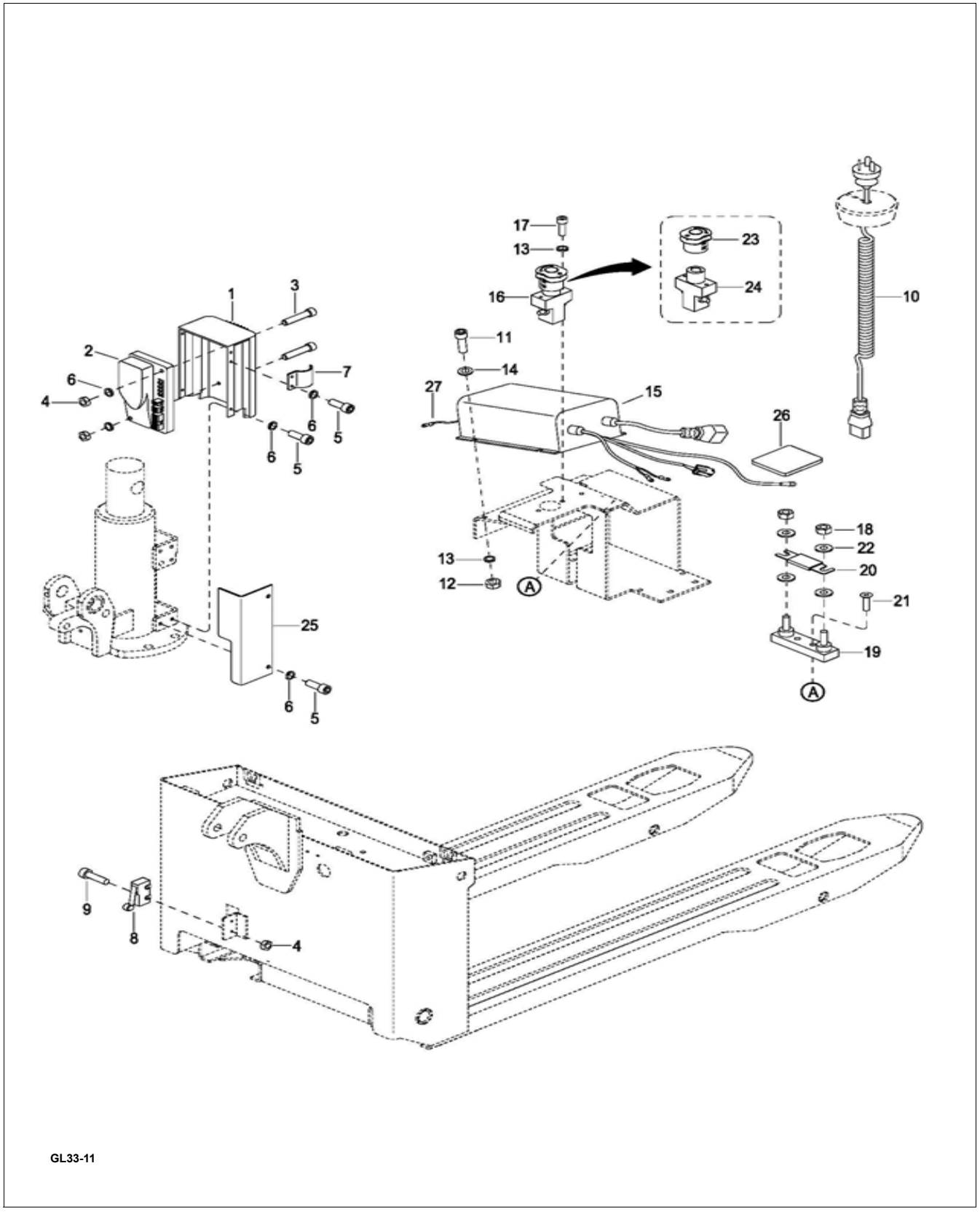


Figure 10-1 Electrical System

10-1.7. Buzzer Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove the upper rear cover from the back of the handle, and remove the Power Module / buzzer.

10-1.8. Buzzer Installation.

1. Position buzzer on bracket and secure with one screw.
2. Reconnect harness to buzzer.
3. Reassemble the upper compartment covers.
4. Turn on the key switch and emergency disconnect.

10-1.9. Key Switch Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove the upper rear cover from the back of the handle, and remove the Power Module / buzzer
3. Remove mounting nut and key switch from bracket.

10-1.10. Key Switch Installation.

1. Position key switch on bracket and secure with its mounting nut.
2. Reconnect harness to key switch.
3. Reassemble the upper compartment covers as needed.
4. Turn on the key switch and emergency disconnect.

10-1.11. Battery Indicator Removal.

1. Turn off the key switch and emergency disconnect.
2. Remove the upper compartment covers.
3. Tag and disconnect harness from battery indicator.
4. Remove the upper rear cover from the back of the handle, and remove the Power Module / buzzer.

10-1.12. Battery Indicator Installation.

1. Position the Power Module / buzzer on bracket (6) and secure with its mounting bracket and nuts.
2. Reconnect harness to battery indicator.
3. Install upper compartment cover as required.
4. Turn on the key switch and emergency disconnect.

10-1.13. Emergency Disconnect Removal.

1. Turn off the key switch, Push Down on the Emergency Stop Button and twist it Counter Clockwise while pushing down, then lift the knob off.
2. Tag and disconnect the cables harness from emergency disconnect.
3. Remove two screws and remove emergency disconnect from bracket.
4. Assemble in reverse order.

10-1.14.Emergency Disconnect Installation.

1. Position emergency disconnect on bracket and secure with two screws and washers.
2. Install the knob on the emergency disconnect.
3. Reconnect harness to emergency disconnect.
4. Install upper compartment covers as described in paragraph 5-2.
5. Turn on the key switch and emergency disconnect.

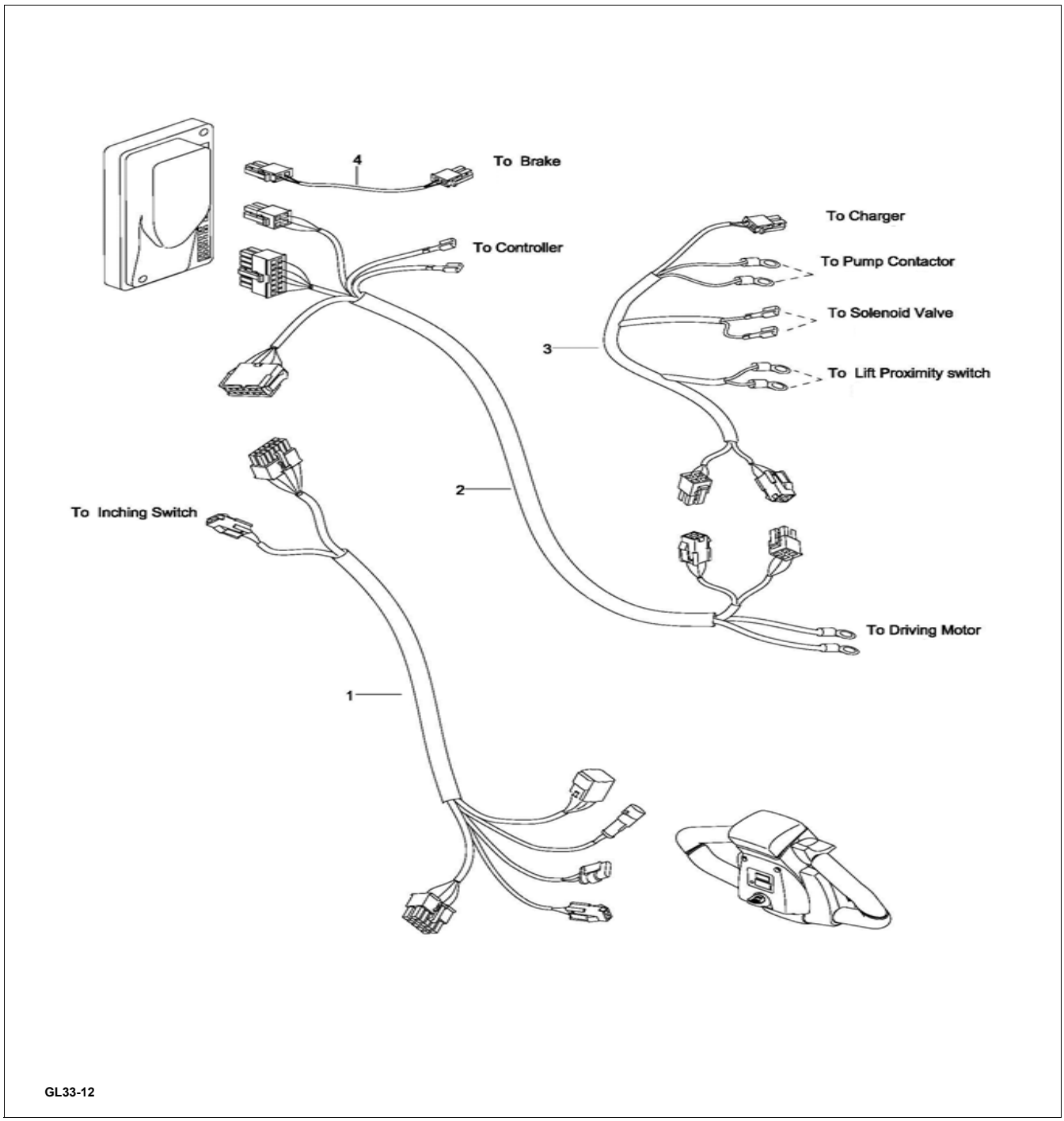


Figure 10-2 Wiring Harness

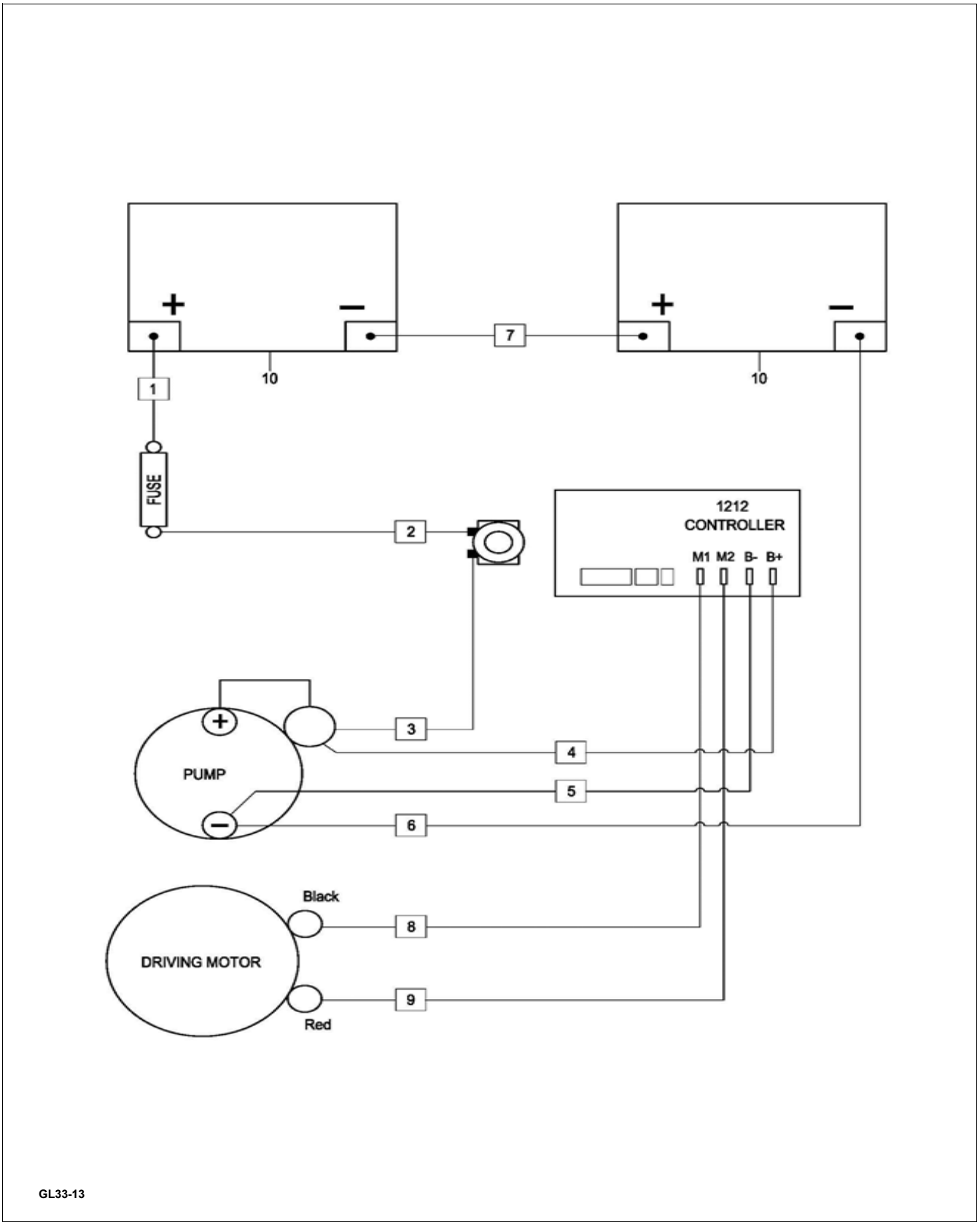


Figure 10-3 Wiring Cables

10-1.15.Lift Limit Switch Removal.

1. Lower forks fully.
2. Turn off the key switch and emergency disconnect.
3. Tag and disconnect harness from limit switch.
4. Remove two screws and limit switch from bracket.

10-1.16.Lift Limit Switch Installation.

1. Position limit switch on bracket and secure with two screws.
2. Reconnect harness to limit switch.
3. Turn on the key switch and emergency disconnect.

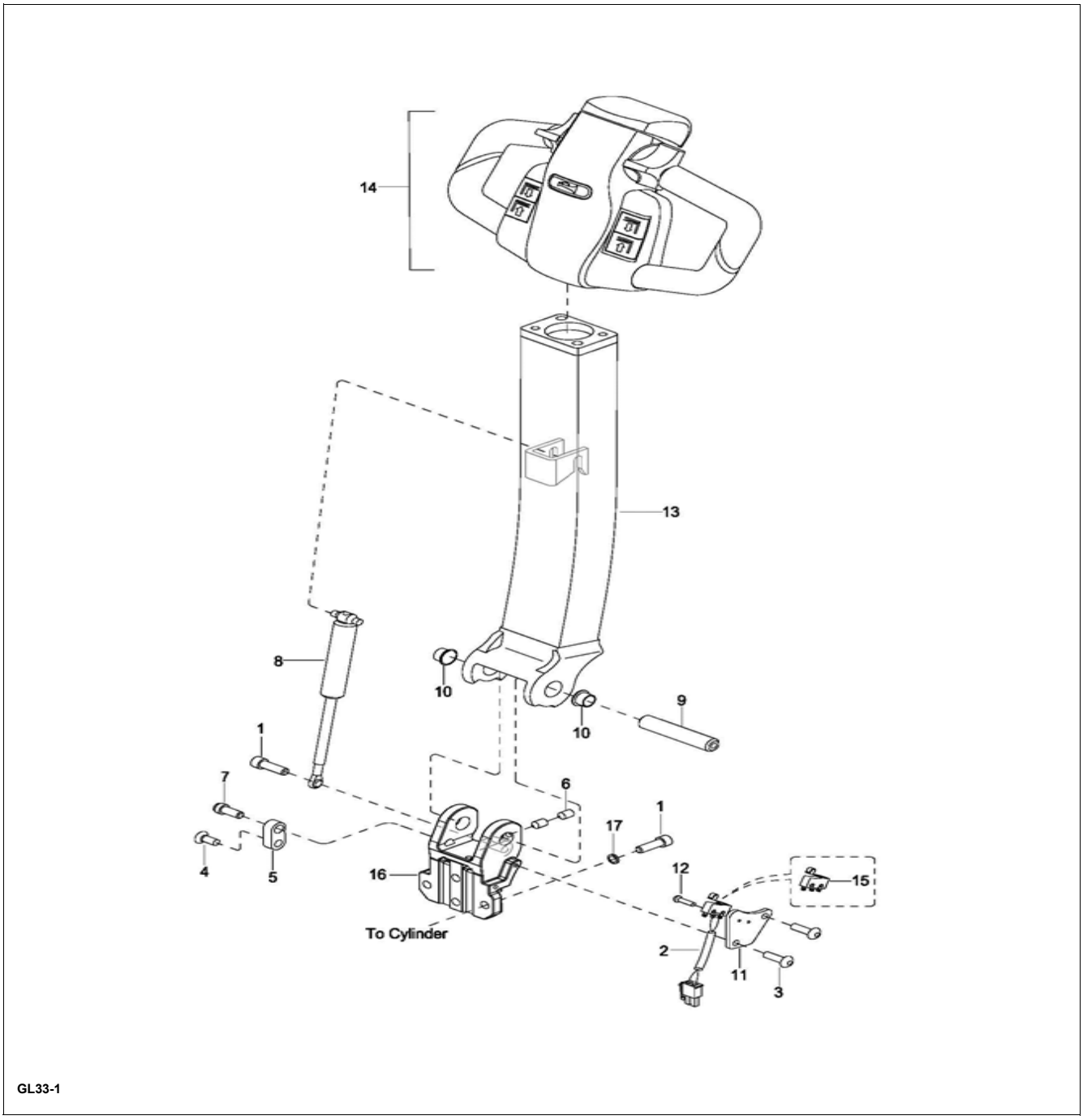


Figure 10-4 Steering Arm

10-2.PUMP MOTOR.

The pump motor is replaceable but not repairable. Refer to paragraph 9-3.

10-3.DRIVE MOTOR.

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

The drive motor is replaceable but not repairable.

10-4.DEADMAN SWITCH

10-4.1.Replacement

1. Turn off the key switch and emergency disconnect.
2. Remove the upper compartment covers as described in paragraph 5-2.
1. Disconnect wiring from the deadman switch.
2. Remove the two screws, and bracket from bracket.
3. Remove two screws and switch from bracket.
4. Position the new switch on bracket and secure with the two screws.
5. Position bracket on bracket and secure with two screws.
6. Install upper compartment covers as described in paragraph 5-2.
7. Turn on the key switch and emergency disconnect.

NOTES

SECTION 11
OPTIONAL EQUIPMENT

NOTES

SECTION 12
ILLUSTRATED PARTS BREAKDOWN

Following is an illustrated parts breakdown of assemblies and parts associated with the 988993 Lift Truck.

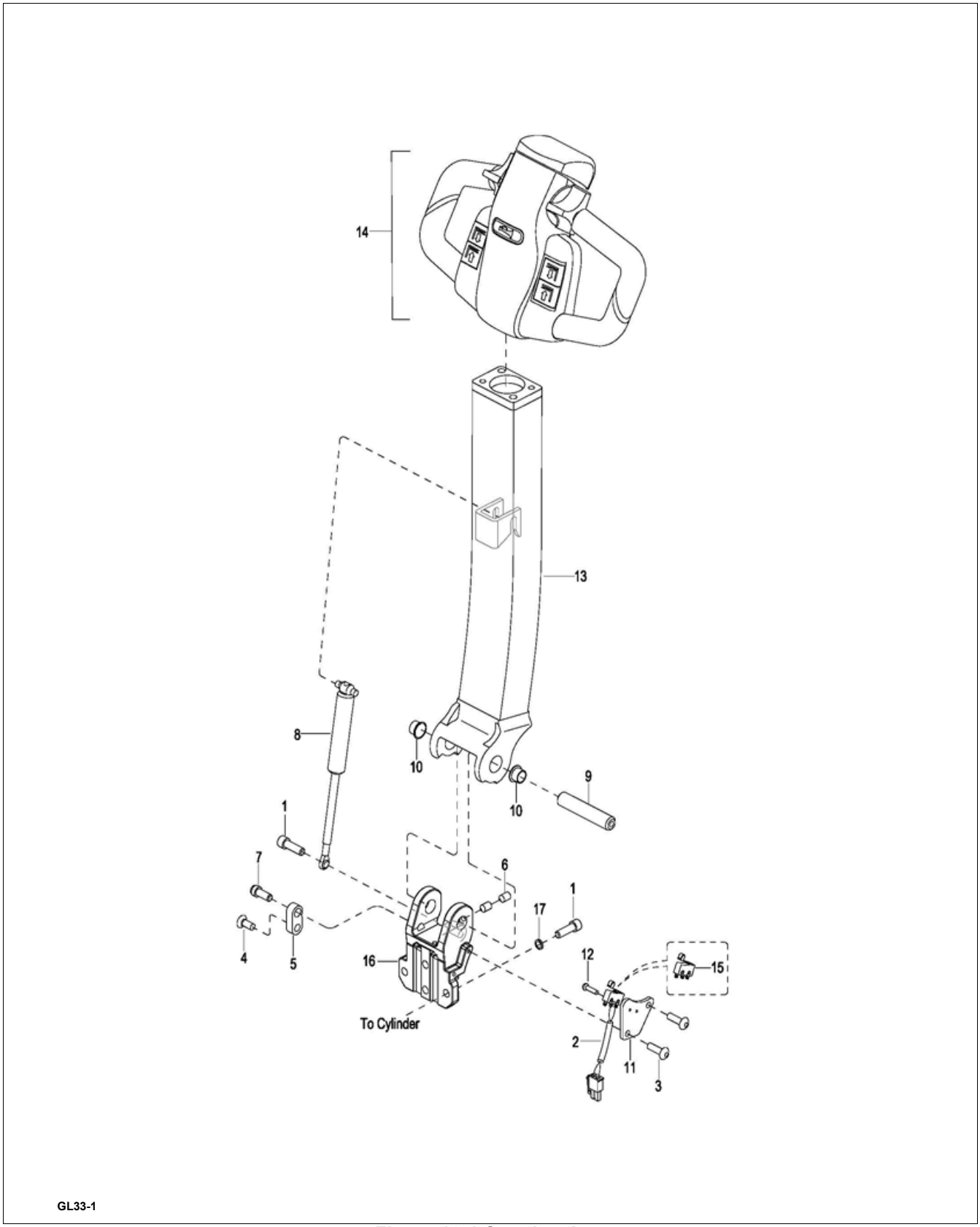


Figure 12-1 Steering Arm

Steering Arm

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	0000-000322-00	SCREW M8×25	5	
2	1115-520009-0A	INCHING SWITCH ASSEMBLY	1	
3	0000-000088-00	SCREW M4×8	2	
4	0000-001101-00	SCREW M8×20	1	
5	1115-300003-00	PROXIMITY BLOCK	1	
6	0000-001019-00	SCREW M6×6	2	
7	1115-300004-00	SCREW	1	
8	1120-320000-00	GAS SPRING	1	
9	1115-300002-00	SHAFT	1	
10	0000-000677-00	BUSHING	2	
11	1115-500001-00	SPACER	1	
12	0000-000989-00	SCREW M2×12	2	
13	1115-310000-00	CONTROL HANDLE	1	
14	1115-340000-10-40	CONTROL POD ASSEMBLY	1	With wire
15	1220-560001-00	INCHING SWITCH I	1	
16	1114-300001-00	BRACKET	1	
17	0000-000159-00	LOCK WASHER Ø8	4	

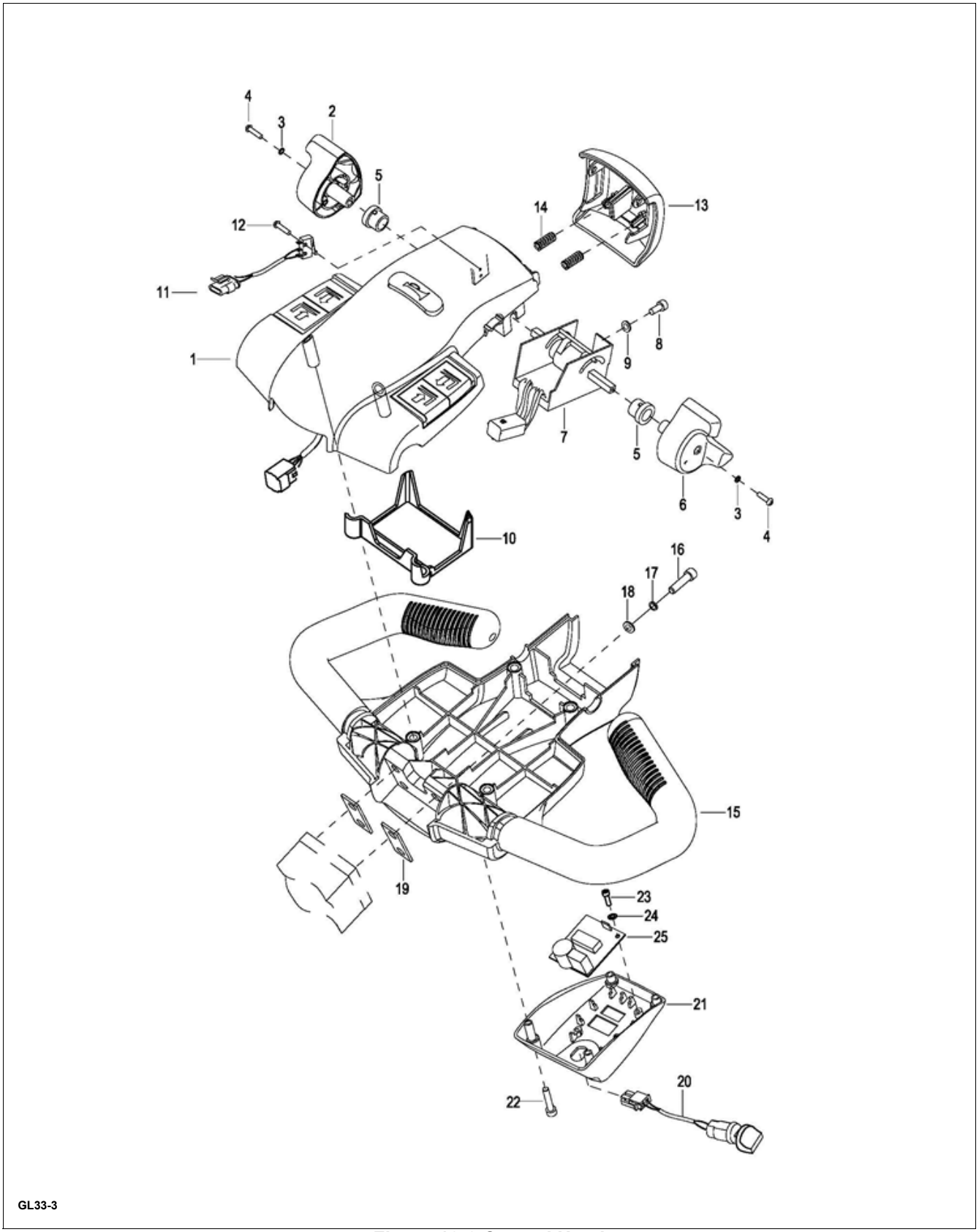


Figure 12-2 Control Head

Control Head

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1115-341000-00-10	CAP ASSEMBLY	1	With Wire
2	1115-340005-00	CONTROL KNOB R	1	
3	0000-000038-00	LOCK WASHER Ø3	2	
4	0000-000037-00	SCREW M3×12	2	
5	1115-340006-00	SEAT	2	
6	1115-340004-00	CONTROL KNOB L	1	
7	1220-520008-0C	ACCELERATOR ASSEMBLY	1	
8	0000-000323-00	SCREW M5×16	1	
9	0000-000390-00	FLAT WASHER Ø5	1	
10	1115-340007-00	WIRE HARNESS COVER	1	
11	1120-520009-00	REVERSING SWITCH WIRE	1	
12	0000-000989-00	SCREW M2×12	2	
13	1115-340003-00	COVER	1	
14	1121-310004-00	SPRING	2	
15	1115-340002-10	COVER	1	
16	0000-000322-00	SCREW M8×25	4	
17	0000-000159-00	LOCK WASHER Ø8	4	
18	0000-000176-00	FLAT WASHER Ø8	4	
19	1115-340001-00	WASHER	2	
20	1115-520019-0A	KEY SWITCH ASSEMBLY	1	
21	1114-310001-00	BOTTOM COVER	1	
22	0000-001322-00	SCREW M5×50	4	
23	0000-000666-00	SCREW M3×8	2	
24	0000-000991-00	FLAT WASHER Ø3	2	
25	1114-500007-00	POWER MODULE	1	

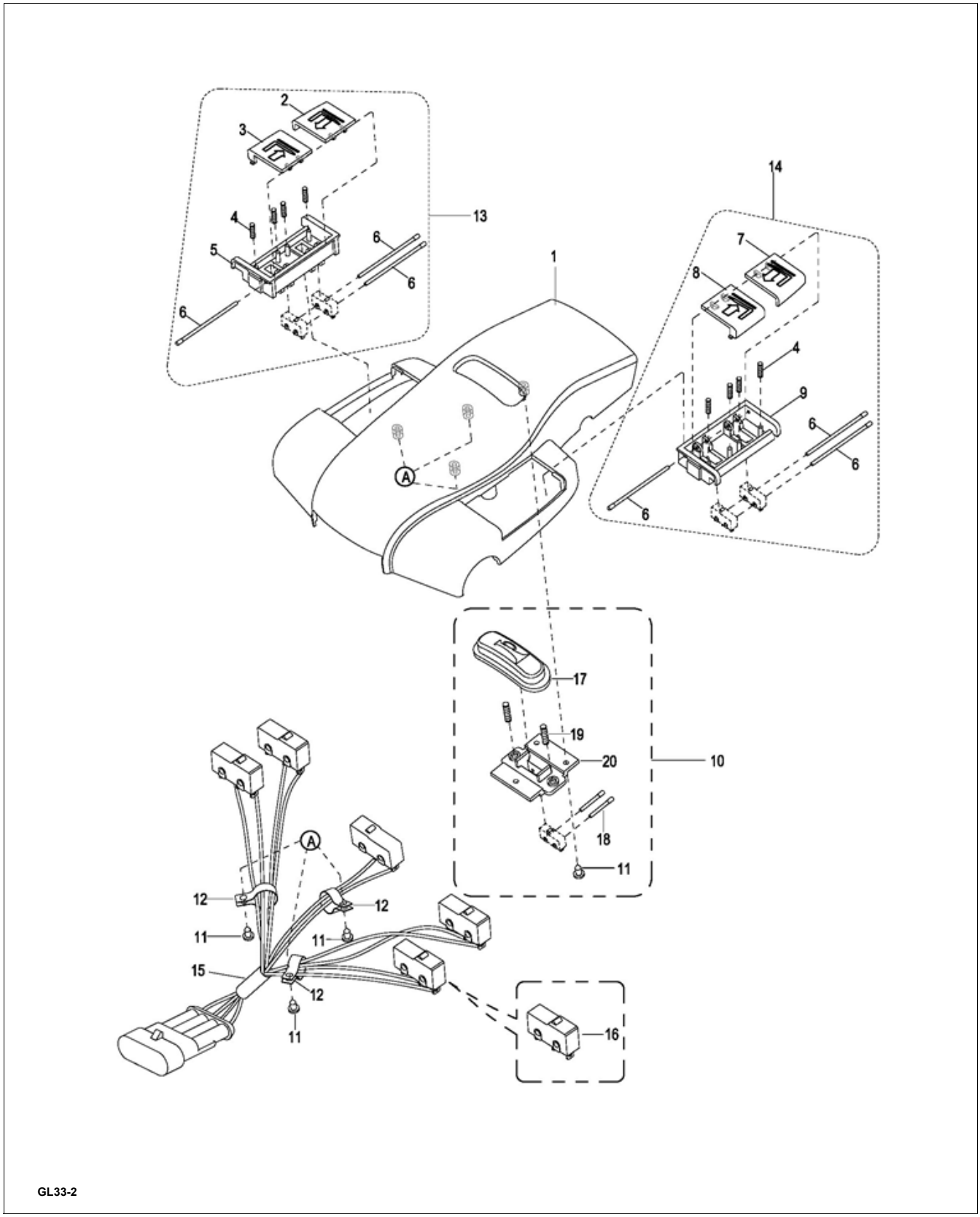


Figure 12-3 Control Head Covers

Control Head Covers

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1115-341001-00	UPPER COVER	1	
2	1120-342203-00	BUTTON FOR LIFTING (R)	1	
3	1120-342202-00	BUTTON FOR LOWERING (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	BUTTON FOR LIFTING (L)	1	
8	1120-342103-00	BUTTON FOR LOWERING (L)	1	
9	1120-342101-00	BUTTON BRACKET (L)	1	
10	1120-342300-00	HORN BUTTON ASSEMBLY	1	
11	0000-000039-00	SCREW ST3.5×9.5	6	
12	0000-000490-00	HARNESS CLAMP	3	
13	1120-342200-00	LIFT AND LOWER BOX (R) ASSY.	1	
14	1120-342100-00	LIFT AND LOWER BOX (L) ASSY.	1	
15	1220-520006-0C	HARNESS ASSEMBLY	1	With Switches
16	1220-560002-00	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	

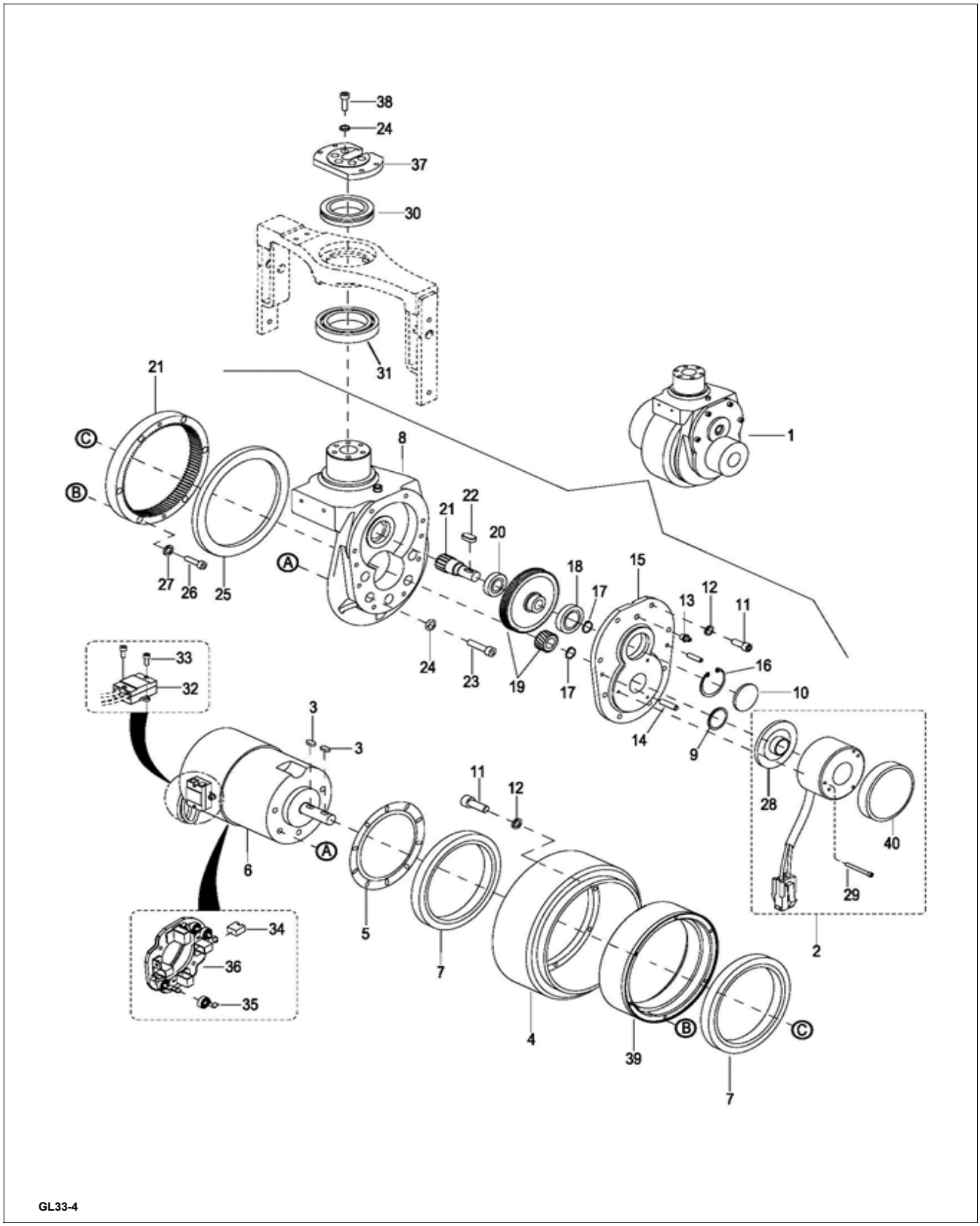


Figure 12-4 Transmission, Motor & Brake Assembly

Transmission, Motor & Brake Assembly

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1121-200000-A0	DRIVING ASSEMBLY	1	Used up to Serial # 427202925, (Incl. Pos. # 2—27)
1a	1121-200000-03	DRIVING ASSEMBLY	1	Used from Serial # 427202926, (Incl. Pos. # 2—27)
2	1115-520012-0A	BRAKE ASSEMBLY	1	Used up to Serial # 427190826
2a	1115-520012-10	BRAKE ASSEMBLY	1	Used from Serial # 427190827
3	0000-000662-00	FLAT KEY 5×5×12	2	
4	1115-220000-A0	DRIVING WHEEL	1	
5	1115-200010-00	BEARING BAFFLE	1	
6	1115-250000-00	MOTOR	1	
7	0000-000663-00	BEARING	2	
8	1121-210001-00	GEAR CASE	1	Used up to Serial # 427202925
8a	1121-210001-0E	GEAR CASE	1	Used from Serial # 427202926
9	0000-000671-00	OIL SEAL Ø16×28×7	1	
10	1115-200007-00	CAP	1	
11	0000-000386-00	SCREW M6×20	14	
12	0000-000056-00	LOCK WASHER Ø6	14	
13	0000-000013-00	GREASE FITTING M8	1	
14	0000-000704-00	PIN Ø6×20	2	
15	1115-200001-00	GEAR COVER	1	
16	0000-000658-00	SNAP RING FOR HOLE Ø42	1	
17	0000-000659-00	SNAP RING Ø15	2	
18	0000-000667-00	BEARING	1	
19	1115-GSX-10	GEAR KIT	1	Used up to Serial # 427202925 - The kit includes 2 gears (Pos.19)
19a	1121-GB03-00	GEAR KIT	1	Used from Serial # 427202926 - The kit includes 2 gears (Pos.19)
20	0000-000680-00	BEARING	1	Used up to Serial # 427202925
20a	3090-010000-42	BEARING	1	Used from Serial # 427202926

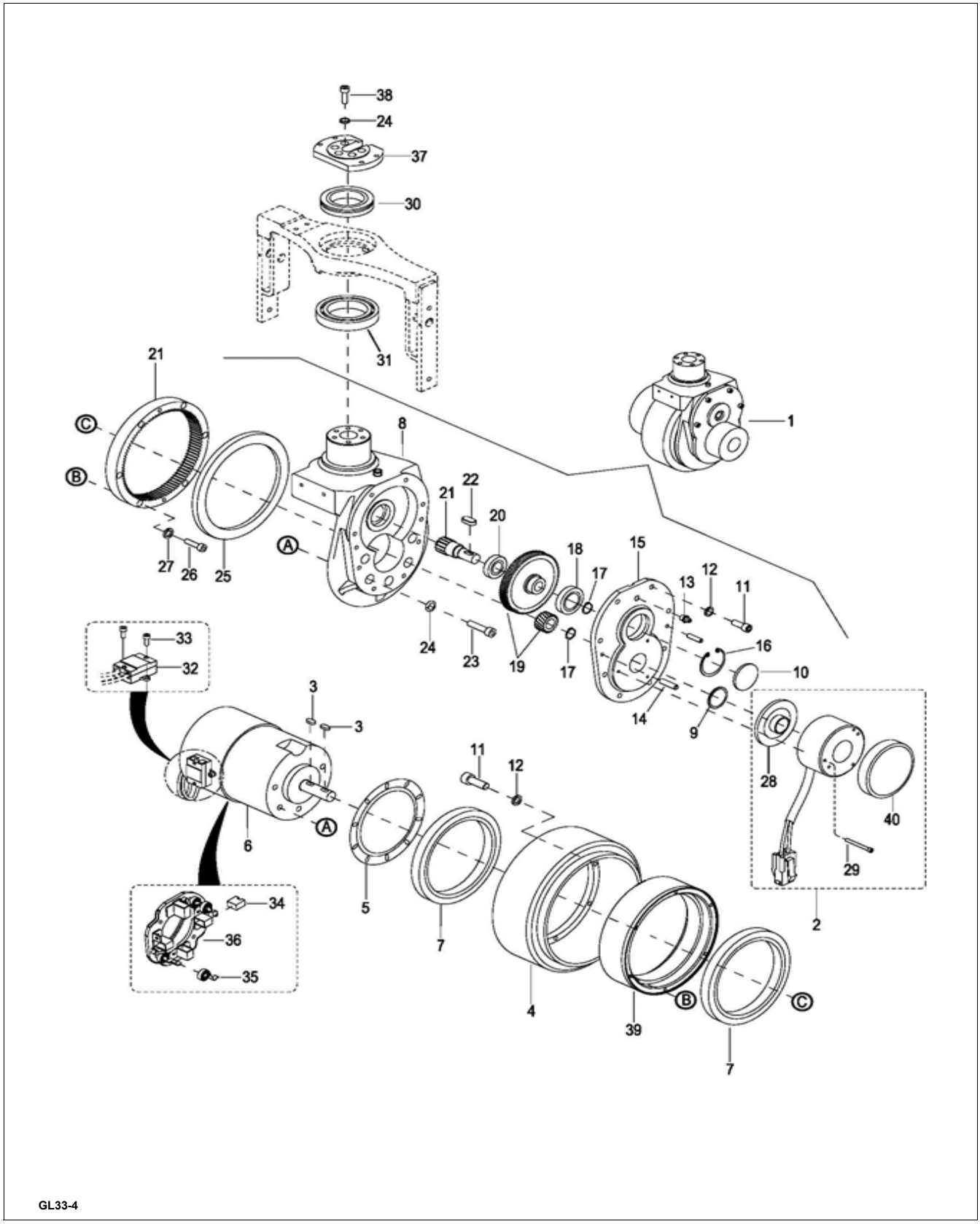


Figure 12-5 Transmission, Motor & Brake Assembly - Continued

Transmission, Motor & Brake Assembly - Continued

Pos. #	Part Number	Description	Qty. Reqd.	Notes
21	1115-GSX-20	GEAR KIT	1	Used up to Serial # 427202925 - The kit includes 2 gears (Pos.19)
21a	1121-GB03-10	GEAR KIT	1	Used from Serial # 427202926 - The kit includes 2 gears (Pos.19)
22	0000-000660-00	KEY 5×5×18	1	
23	0000-000026-00	SCREW M8×30	5	
24	0000-000159-00	LOCK WASHER Ø8	10	
25	0000-001788-00	OIL SEAL Ø155×173×10	1	
26	3020-010000-91	SCREW M5×25	6	
27	0000-000206-00	LOCK WASHER Ø5	6	
28	1115-240001-00	BRAKE LINING	1	
29	1115-240003-0A	SCREW M4×40	3	
30	0000-001230-00	BEARING	1	
31	0000-001231-00	BEARING 6013-Z	1	
32	1115-231000-00	BRACKET	1	
33	0000-000004-00	SCREW M5×12	2	
34	1115-250001-00	BRUSH	4	
35	1115-250002-00	BRUSH SPRING	4	
36	1115-250003-00	HOLDER BRUSH	1	
37	1121-200001-00	CONNECTING PLATE	1	
38	0000-000151-00	SCREW M8×25	5	
39	1115-200001-A0	INNER RIM	1	
40	1115-240002-0A	SCRAPER SEAL	1	
41	1115-200020-00	PLATE	1	Used from Serial # 427190827

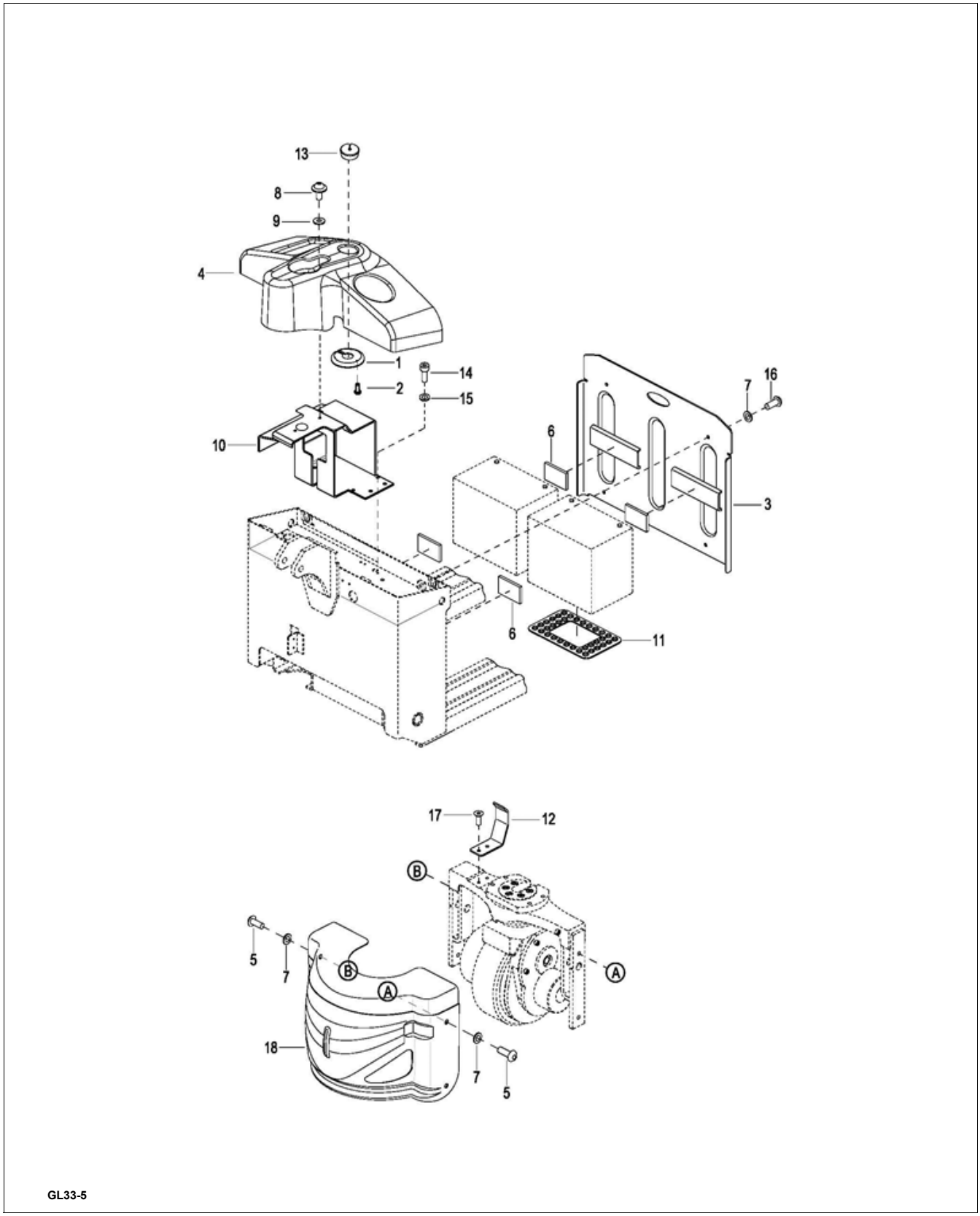


Figure 12-6 Compartment Cover

Compartment Cover

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1114-120003-A0	COVER	1	
2	3020-090000-01	SCREW ST3.9X9.5	3	
3	1114-141000-00	FRONT COVER	1	
4	1114-120001-A0	COVER	1	
5	0000-000712-00	SCREW M8×20	4	
6	1115-100003-F0	RUBBER CUSHION	4	
7	0000-000176-00	FLAT WASHER Ø8	8	
8	1115-150004-0B	SCREW M6×25	1	
9	2214-150002-00	WASHER	1	
10	1114AM-550000-00	HOLDER	1	
11	1115-100005-00	RUBBER CUSHION	2	
12	1114-500001-00	BAFFLE	1	
13	1115-120002-00	CHARGER CAP	1	
14	0000-000055-00	SCREW M6×16	4	
15	0000-000380-00	FLAT WASHER Ø6	4	
16	0000-000712-00	SCREW M8×20	4	
17	0000-000126-00	SCREW M6×16	2	
18	1121-143000-00	COVER	1	

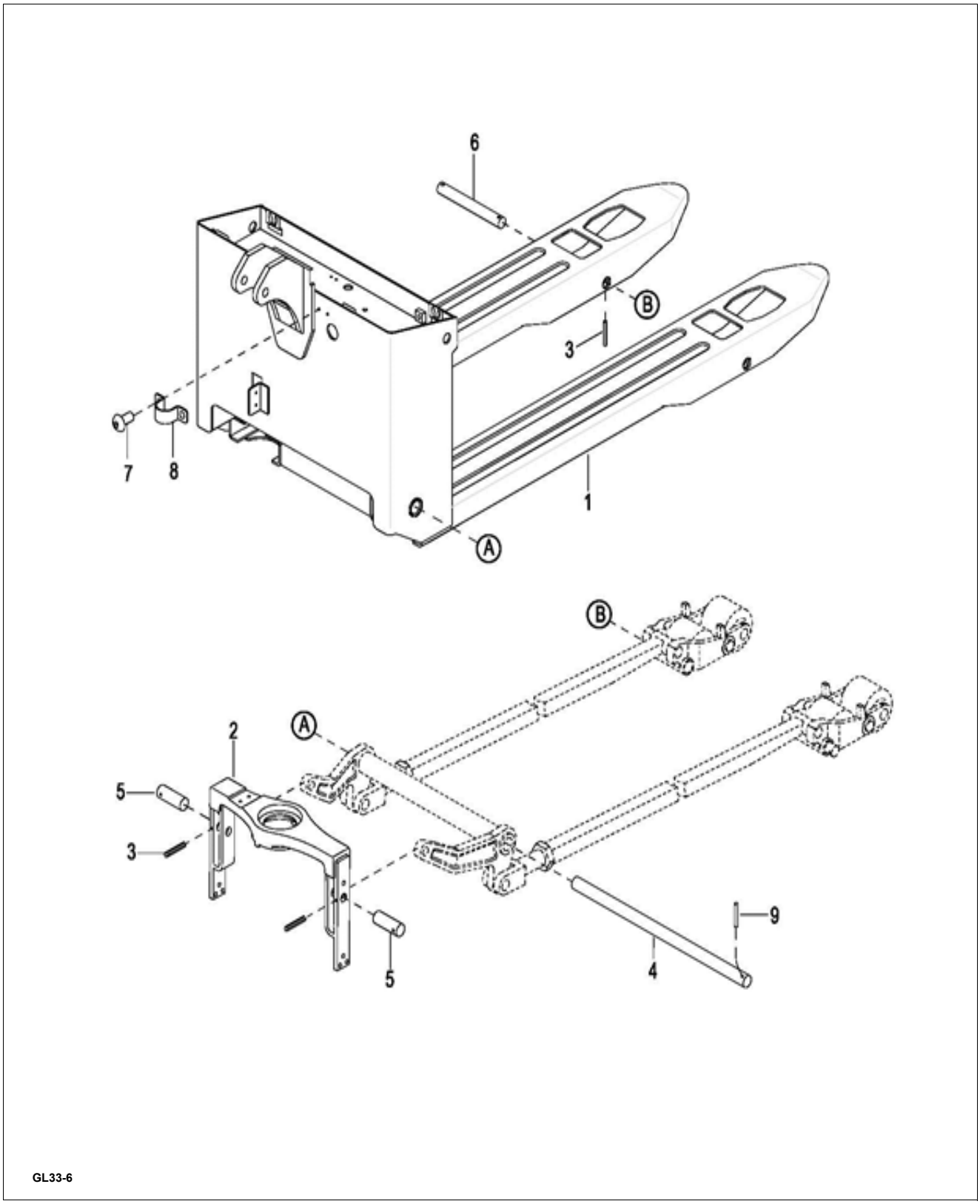


Figure 12-7 Frame

Frame

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1114AP-110000-0A-01-GL	FRONT FRAME	1	Width over forks 27” Fork Length 45”
2	1121-120000-00	BACK FRAME	1	
3	0000-001456-00	ROUND PIN Ø5×35	4	
4	1114-130001-10	LONG SHAFT	1	
5	1121-130002-00	SHORT SHAFT	2	
6	1114-130002-00	SHAFT	2	
7	0000-000088-00	SCREW M4×8	2	
8	1115-500002-00	HARNESS CLAMP	1	
9	0000-000410-00	ROUND PIN Ø6×40	1	

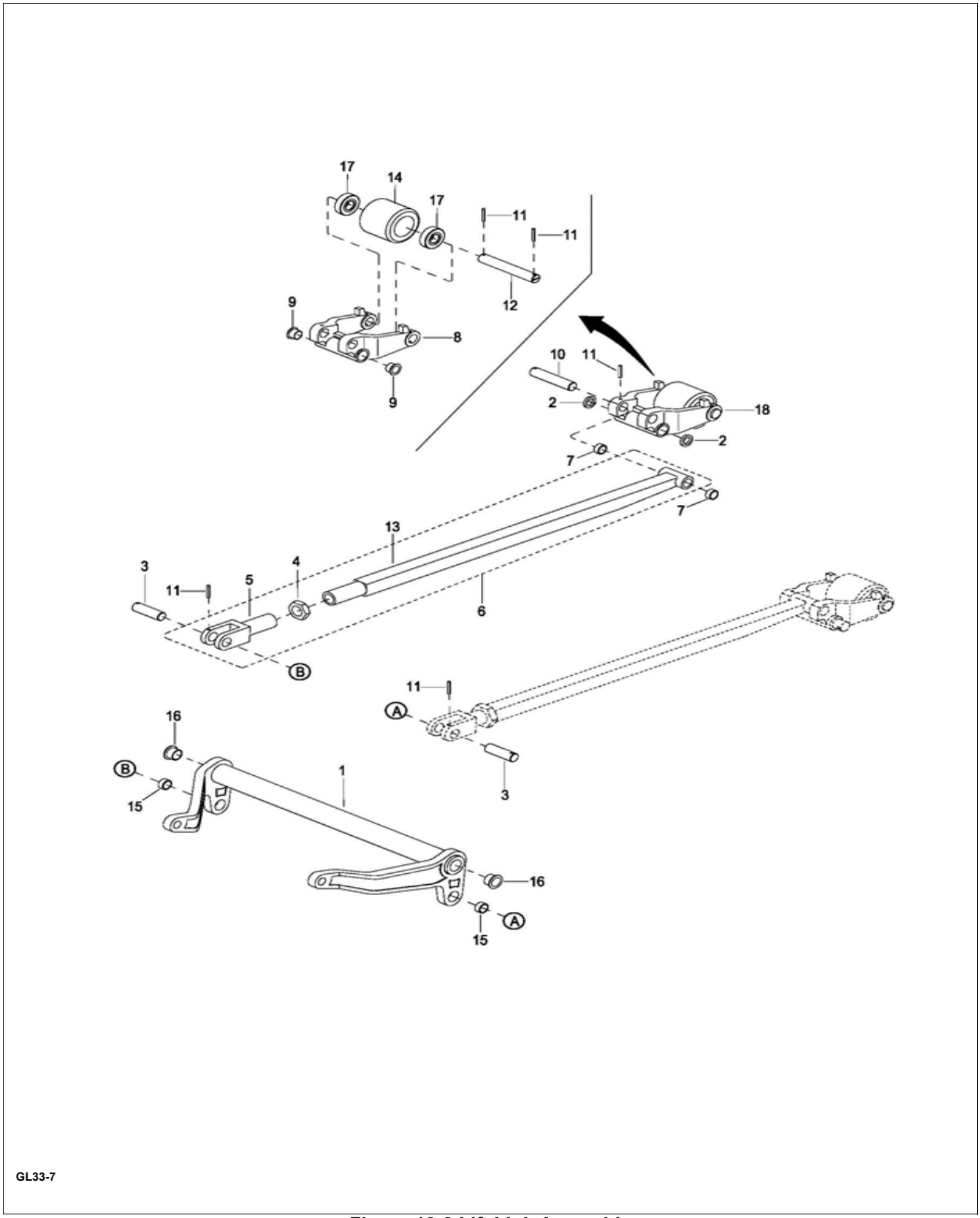


Figure 12-8 Lift Link Assembly

Lift Link Assembly

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1121-131000-10	DOWN LINK	1	
2	1115-130008-00	WASHER	4	
3	1121-130003-00	SHAFT	2	
4	0000-000101-00	NUT M22×1.5	2	
5	1121-132001-00	CONNECTOR	2	
6	1114-131000-00-01	LONG LINK	2	
7	0000-000907-00	BUSHING	4	
8	1115-130005-4A	WHEEL BRACKET	2	
9	0000-000908-00	BUSHING	4	
10	1115-130003-00	SHAFT	2	
11	0000-001456-00	ROUND PIN Ø5×35	4	
12	1115-130007-40	SHAFT	2	
13	1114-131100-0A-01	LONG ROD	2	
14	1114-133001-10	LOAD WHEEL	2	
15	0000-000011-00	BUSHING	2	
16	0000-001241-00	BUSHING	2	
17	0000-000020-00	BEARING	4	Used up to Serial # 427171688
17a	3090-000000-04	BEARING	4	Used from Serial # 427171689
18	1114-130005-10-B	WHEEL BRACKET ASSEMBLY	2	

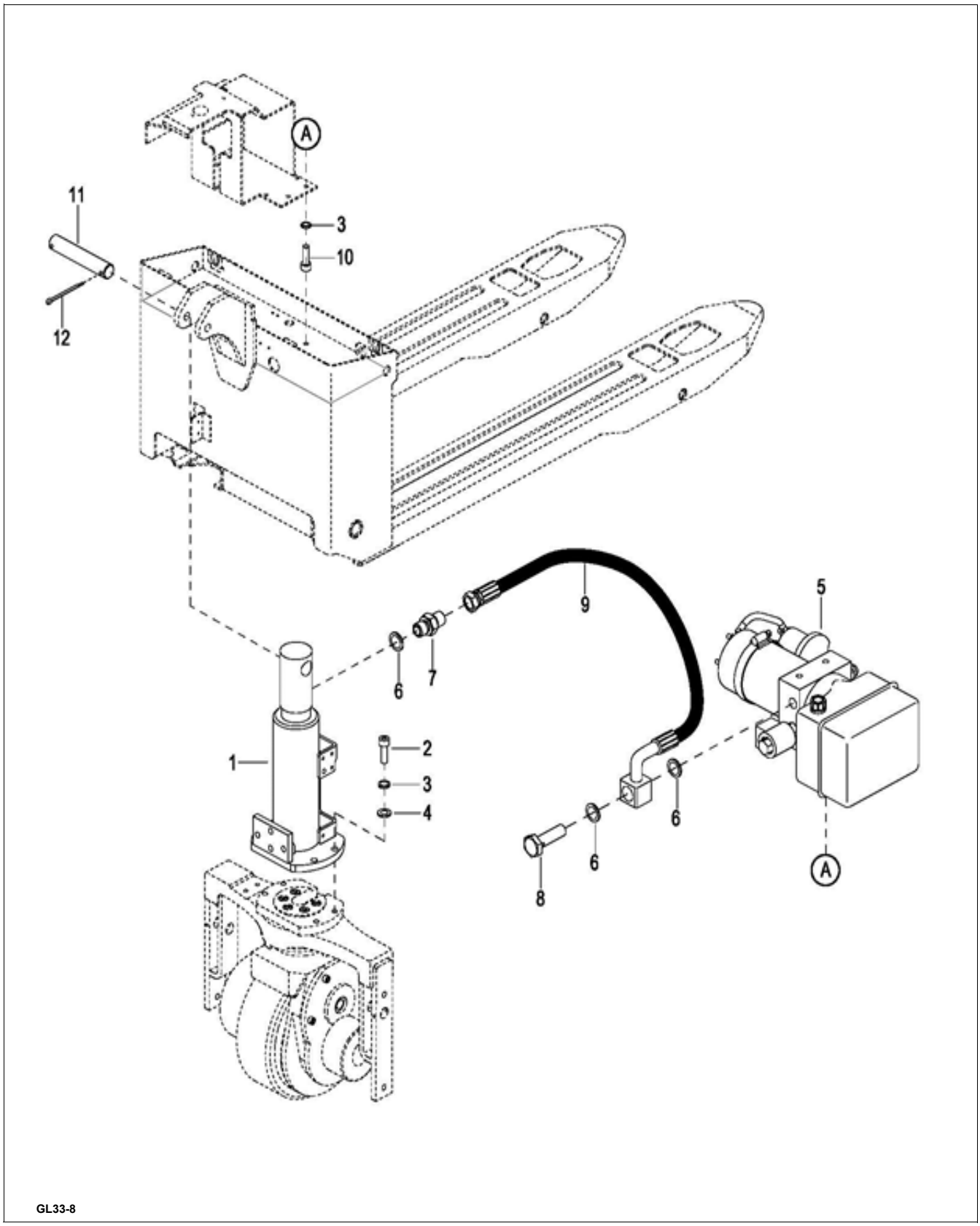


Figure 12-9 Hydraulic System

Hydraulic System

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1114-410000-0B	LIFTING CYLINDER	1	
2	0000-000321-00	SCREW M8×20	4	
3	0000-000159-00	LOCK WASHER Ø8	6	
4	0000-000194-00	FLAT WASHER Ø8	4	
5	1114-420000-0A	PUMP & MOTOR ASSEMBLY	1	
6	0000-000044-00	WASHER Ø14	3	
7	2701-141400-00	CONNECTOR M14×1.5- M14×1.5	1	
8	2401-143500-00	BOLT M14×35	1	
9	1114-430000-00	HOSE	1	
10	0000-000109-00	SCREW M8×16	2	
11	1114-400001-0C	PIN	1	
12	0000-001340-00	COTTER PIN 4×30	2	

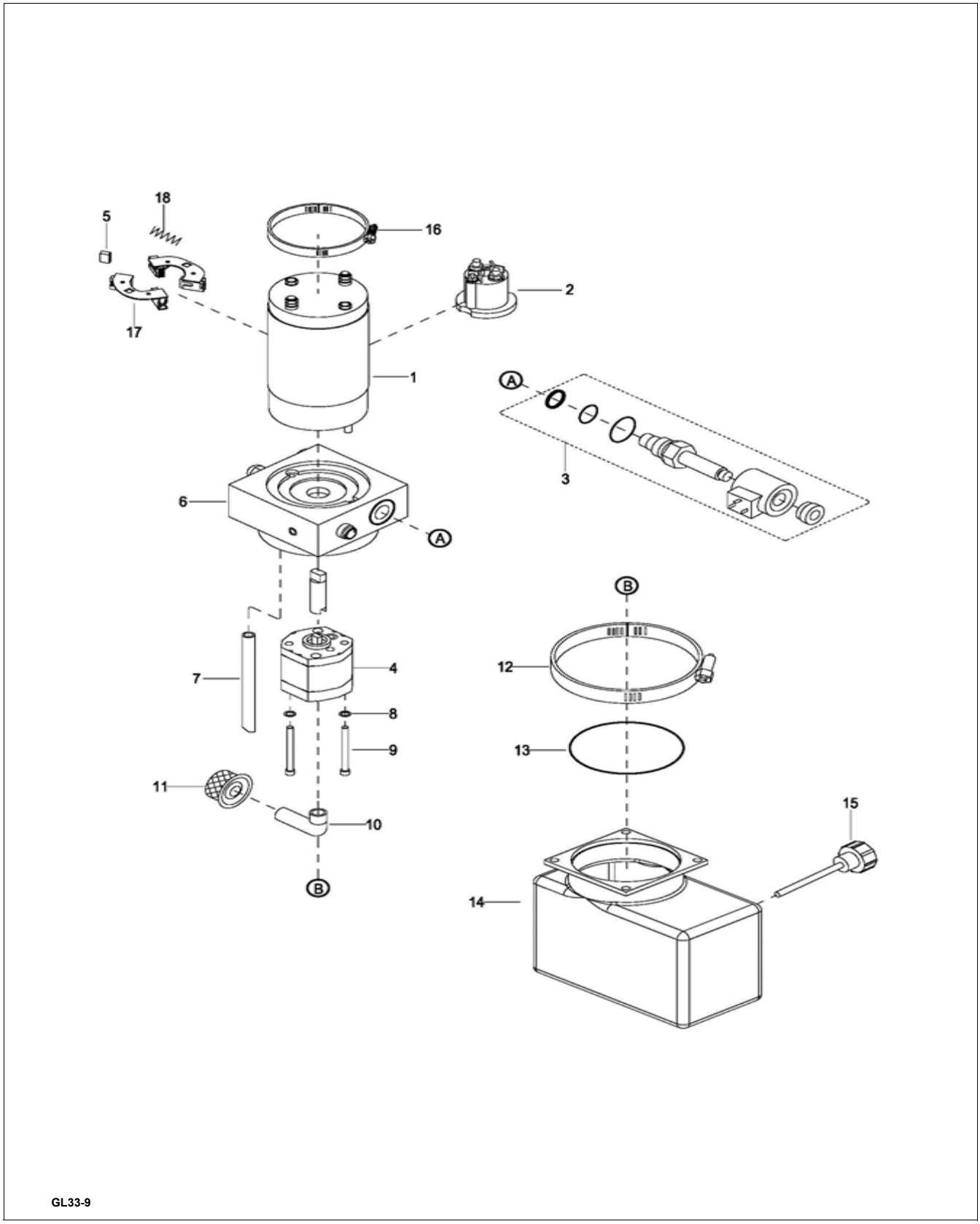
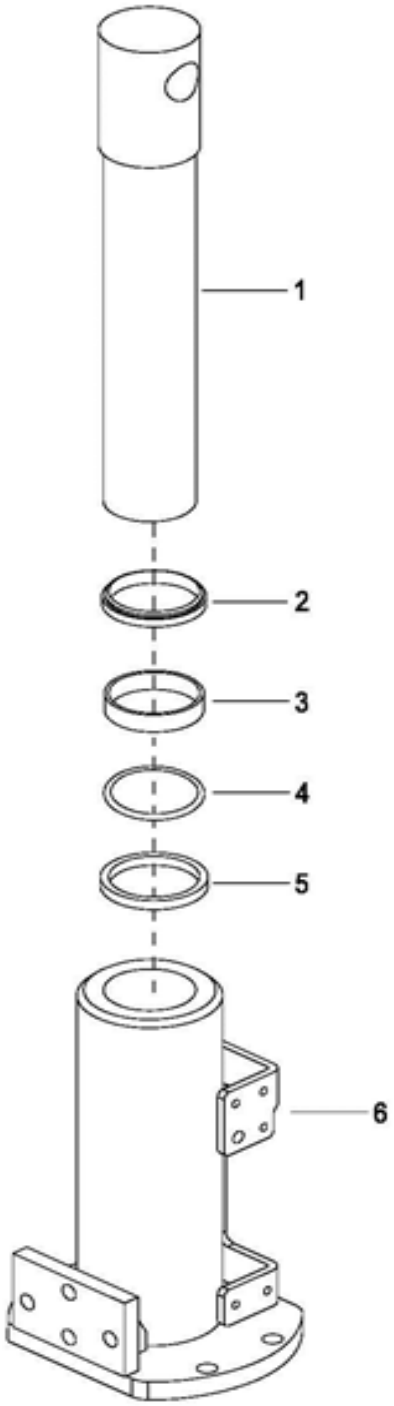


Figure 12-10 Pump & Motor Assy

Pump & Motor Assy

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1115-560003-00	MOTOR	1	
2	1115-560002-00	CONTACTOR	1	
3	1115-560017-00	SOLENOID VALVE	1	
4	1115-560011-00	PUMP	1	
5	1115-561001-0A	BRUSH	4	
6	1114-420002-00	ADAPTER	1	
7	1115-560009-00	RETURN PIPE	1	
8	1115-560012-00	WASHER Ø5	2	
9	1115-560013-00	SCREW M5×70	2	
10	1115-560014-00	SUCTION PIPE	1	
11	1115-560015-00	OIL FILTER	1	
12	1115-560018-00	CLAMP Ø100	1	
13	1115-560019-00	O-RING Ø85×3.0	1	
14	1114-420001-0A	TANK	1	
15	1115-560024-00	AIR CLEANER	1	
16	1115-560001-00	CLAMP	1	
17	1115-561002-00	HOLDER BRUSH	2	
18	1115-561003-00	SPRING	4	



GL33-10

Figure 12-11 Lift Cylinder

Lift Cylinder

Pos. #	Part Number	Description	Qty. Reqd.	Notes
--	1114-410000-0B	LIFT CYLINDER ASSEMBLY	1	
KIT	1114-ZZG-0A	SEAL KIT FOR LIFT CYLINDER	1	Includes pos. 2, 4, 5
1	1114-412000-0B	ROD PISTON	1	
2	0000-000672-00	RING WIPER 40×48×5-6.5	1	
3	1114-410001-00	RING BACK UP 40×50×9.7	2	
4	0000-000673-00	O-RING 45×3.1	1	
5	0000-000512-00	ROD PACKING 40×50×6	1	
6	1114-411000-0B	CYLINDER	1	

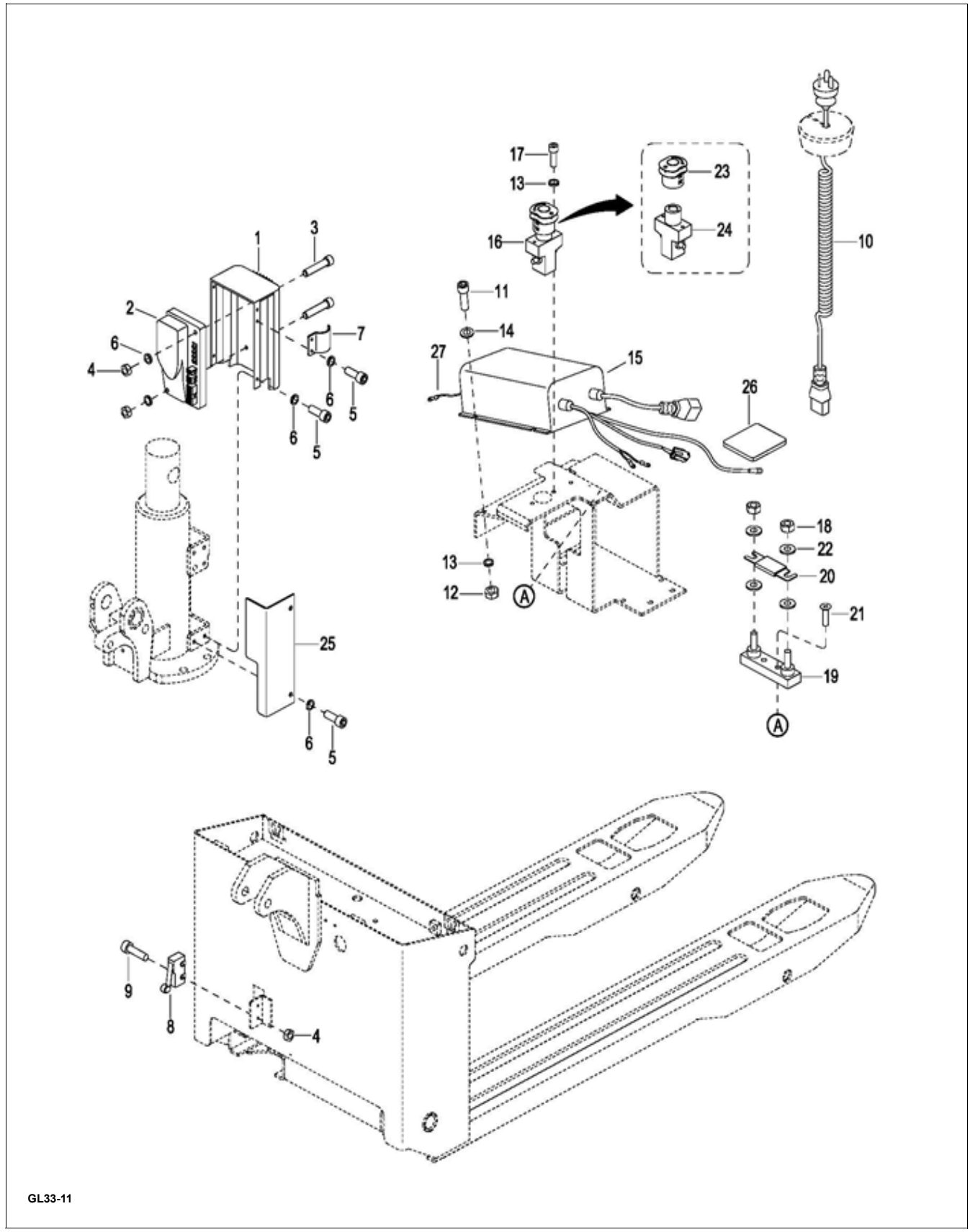

1
2
3
4
5
6
7
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
A
A
9
8
4
GL33-11

Figure 12-12 Electrical System

Electrical System

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1121-142000-0A	CONTROLLER COVER	1	
2	1115-510004-00-A0	CONTROLLER	1	
3	0000-000121-00	SCREW M4×35	2	
4	0000-000139-00	NUT M4	4	
5	0000-000028-00	SCREW M4×10	7	
6	0000-000122-00	LOCK WASHER Ø4	9	
7	1121-500002-00	PLATE	1	
8	1120-500006-00	LIFT LIMIT SWITCH	1	
9	0000-000208-00	SCREW M4×25	2	
10	1115-500006-10	CHARGER CABLE USA	1	
11	0000-000004-00	SCREW M5×12	4	
12	0000-000546-00	NUT M5	4	
13	0000-000206-00	LOCK WASHER Ø5	6	
14	0000-000390-00	FLAT WASHER Ø5	4	
15	1114-520007-0A	CHARGER	1	
16	1114-540000-00	EMERGENCY STOP SWITCH	1	
17	0000-000004-00	SCREW M5×12	2	
18	0000-000196-00	NUT M8	2	
19	1120-540001-00-B	FUSE STAND	1	
20	1115-510003-00	FUSE 100A	1	
21	0000-000126-00	SCREW M 6×16	2	
22	0000-000176-00	FLAT WASHER Ø8	4	
23	1114-540001-00	EMERGENCY SWITCH BUTTON	1	
24	1114-540002-00	EMERGENCY STOP SWITCH	1	
25	1114-140002-00	SIDE COVER	1	
26	1115-520020-00	3M PATCH	1	
27	1115-520021-00	GROUND WIRE	1	

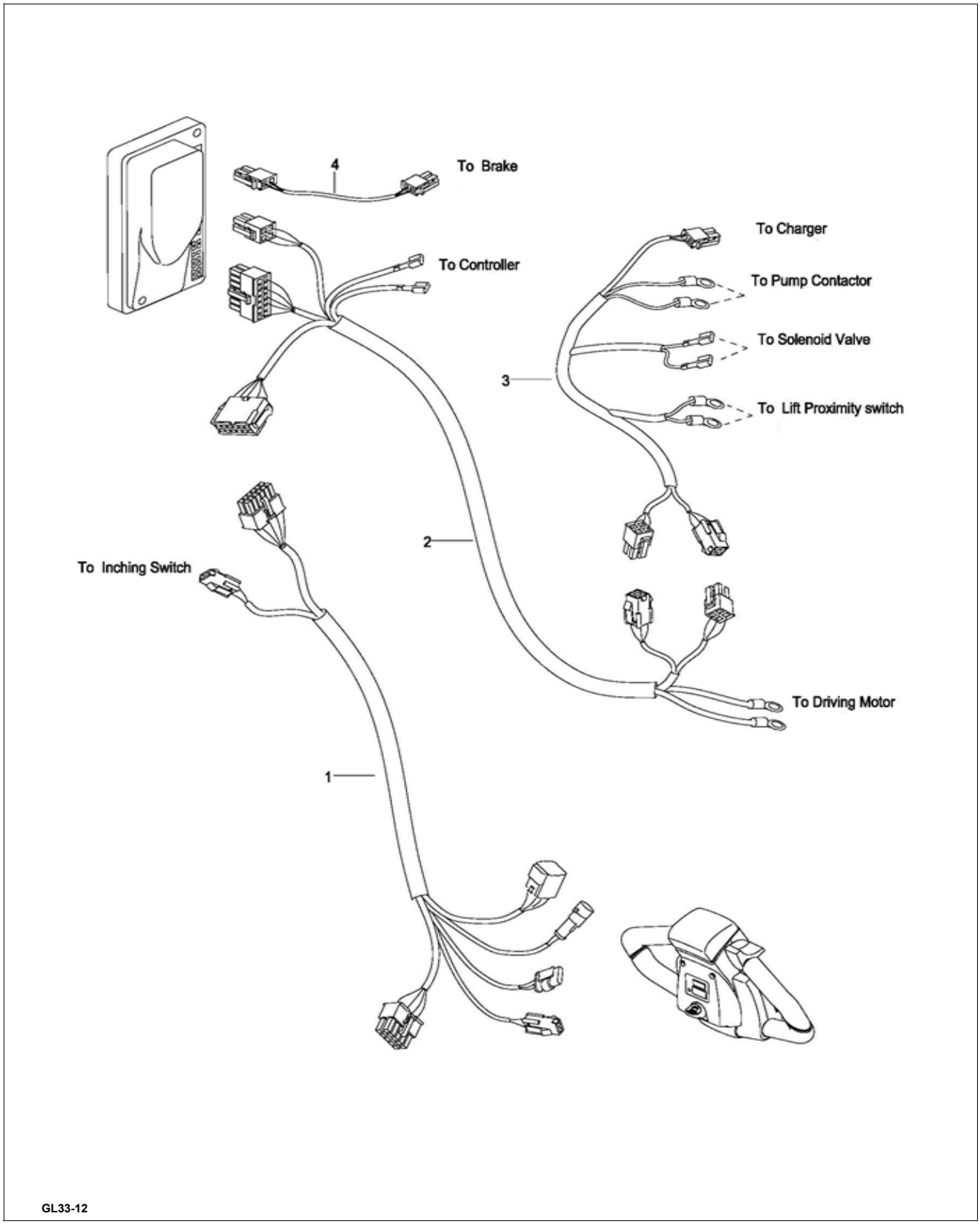


Figure 12-13 Wiring Harness

Wiring Harness

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1114-520008-00	MASTER WIRE HARNESS	1	
2	1114-520009-00	CONTROLLER WIRE HARNESS	1	
3	1114-520010-00	HYDRAULIC WIRE HARNESS	1	
4	1121-520006-0A	BRAKE WIRE HARNESS	1	Used up to Serial # 427190826
4a	1121-520006-0D	BRAKE WIRE HARNESS	1	Used from Serial # 427190827

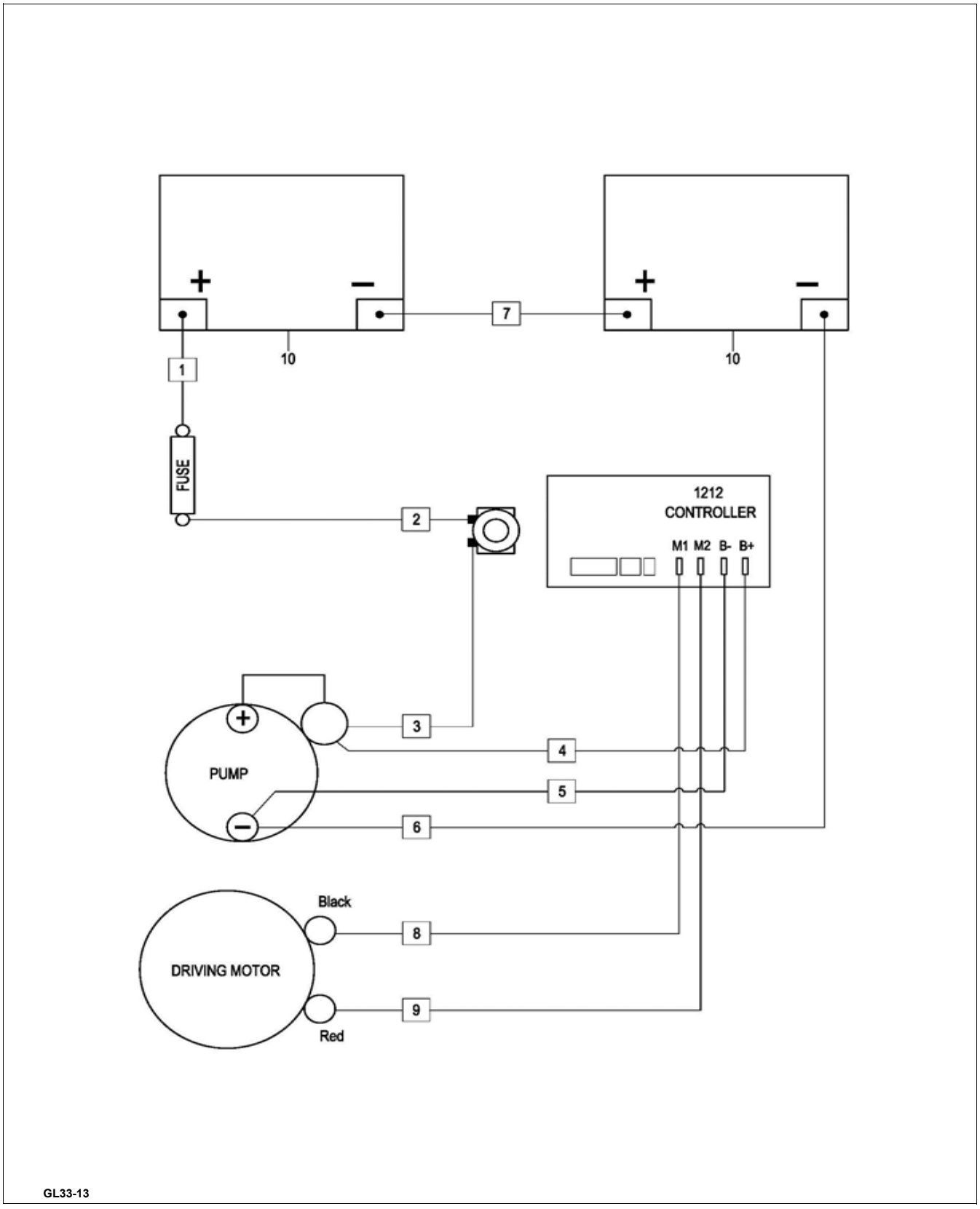


Figure 12-14 Wiring Cables

Wiring Cables

Pos. #	Part Number	Description	Qty. Reqd.	Notes
1	1114-530008-00	FUSE-BATTERY CABLE	1	
2	1115-530005-00	FUSE-SWITCH CABLE	1	
3	1114-530003-00	P+ CABLE	1	
4	1114-530004-00	B+ CABLE	1	
5	1114-530005-00	B- CABLE	1	
6	1114-530009-00	P- CABLE	1	
7	1114-530010-00	BATTERY CONNECTOR CABLE	1	
8	1121-530003-00	M1 CABLE	1	
9	1121-530004-00	M2 CABLE	1	
10	1114-500003-0A	BATTERY	2	


GLOBAL
globalindustrial.com