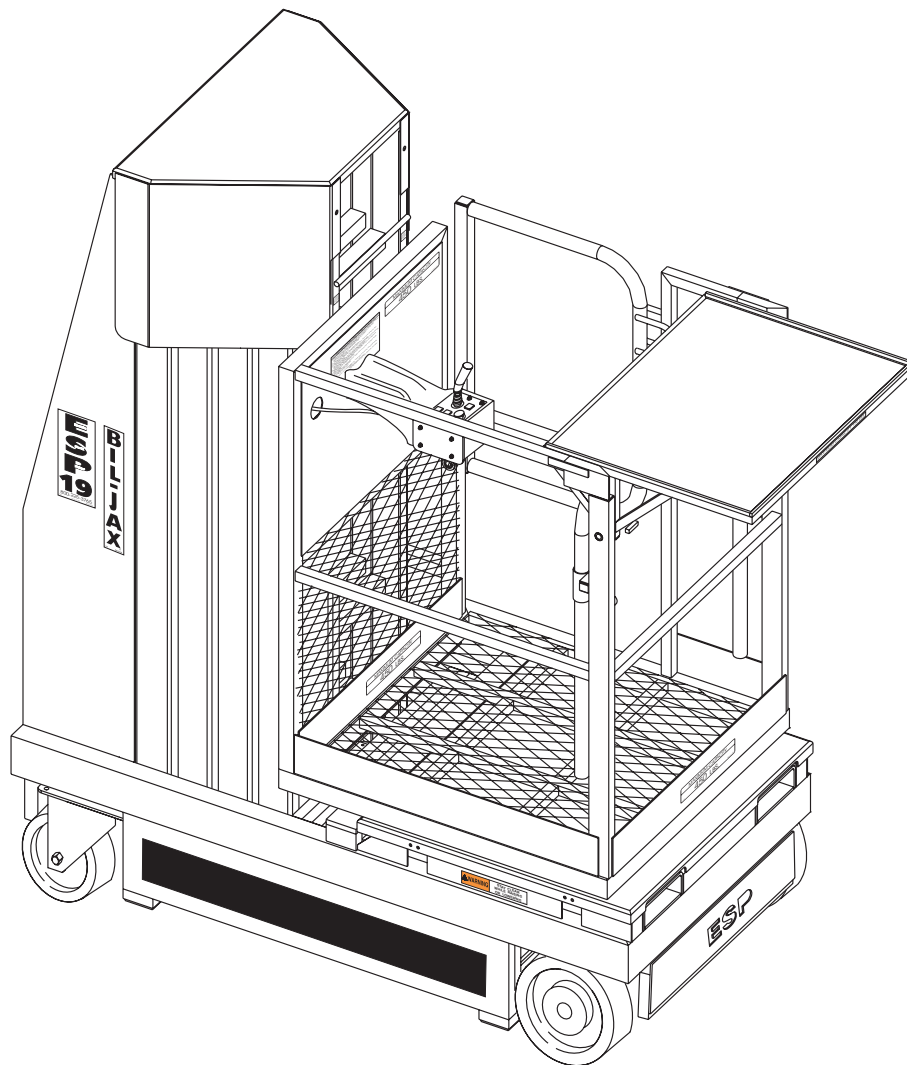


# ESP 19

Electric Stock Picker



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## **TELESCOPIC PERSONNEL LIFT**

**This equipment is designed and manufactured in compliance with the duties, responsibilities, and standards set forth for manufacturers in the ANSI 92.6 standard in effect at the time of manufacture.**

**This equipment will meet or exceed applicable OSHA codes and ANSI A92.6 standards when used in accordance with sections 5, 6, 7, 8, 9, 10, and 11 of ANSI A92.6 and all other manufacturer's recommendations.**

**It is the responsibility of the user of this equipment to follow all applicable ANSI, OSHA, Federal, State, and local codes and regulations that govern the safe operation of this equipment.**

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# 1

## Safety

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### 1-1 INTRODUCTION

Familiarity and proper training are required for the safe operation of mechanical equipment. Equipment operated improperly or by untrained personnel can be dangerous. Read the operating instructions in this manual and become familiar with the location and proper use of all controls. Inexperienced operators should receive instruction from persons who are familiar with the equipment before operating the machine. The use of intelligence and common sense in the operation of mechanical equipment is the best practice in any safety policy. Be professional and always observe the safety procedures set forth in this manual.

All OSHA, ANSI, state and local codes and regulations pertaining to this equipment should be obtained, read, and thoroughly understood before attempting to operate this equipment. Persons under the influence of drugs, alcohol, or prescription medication should not be on or near this equipment. Common sense should be implemented at all times during the use of this equipment. Do not operate this equipment in areas where equipment or user may come in contact with live power source.

The information contained herein is not to be considered as legal advice and is intended for informational purposes only. This information is offered to alert Bil-Jax customers to procedures that may be of concern to them.

This information is not intended to be all-inclusive and is to be followed in the use of Bil-Jax equipment only.

For any questions concerning the safe use of this equipment, call 800-537-0540 before operating.

### **Safety Notes**

This manual contains DANGERS, WARNINGS, CAUTIONS, and NOTES that must be followed to prevent the possibility of improper service, damage to the equipment, or personal injury.



#### **DANGER**

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**Dangers warn of equipment operation near electrical power lines that could lead to personal injury or death.**

---



#### **WARNING**

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**Warnings describe conditions or practices that could lead to personal injury or death.**

---



#### **CAUTION**

---

**Cautions provide information important to prevent errors that could damage machine or components.**

---

**NOTE:** Notes contain additional information important to a procedure.



## 1-2 BEFORE OPERATION

Read and observe the following general safety precautions before operating the ESP 19.

- ALWAYS survey the usage area for potential hazards such as untampered earth fills, unlevel surfaces, overhead obstructions, and electrically charged conductors or wires. Be aware of any potential hazards and always consider what could happen. Watch for moving vehicles in the operating area.
- ALWAYS read, understand, and follow the procedures in this manual before attempting to operate equipment.
- ALWAYS inspect the equipment for damaged or worn parts. Check for cracked welds, hydraulic leaks, damaged wiring, loose wire connectors, damaged casters, and damaged pothole guards. Also check for any improper operation. NEVER operate equipment if damaged in any way. Improperly operating equipment must be repaired before using.
- ALWAYS wear proper clothing for the job. Wear protective equipment as required by federal, state, or local regulations.
- ALWAYS locate, read, and follow all directions and warnings displayed on the equipment.
- ALWAYS inspect the equipment for “DO NOT USE” tags installed by maintenance personnel. NEVER use tagged equipment until repairs are made and all tags are removed by authorized maintenance personnel.
- ALWAYS make sure the platform is free of mud, grease, or other foreign material. This will reduce the possibility of slipping.
- NEVER allow improperly trained personnel to operate this equipment. Only trained and authorized personnel shall be allowed to operate this equipment.
- NEVER operate this equipment if you are under the influence of alcohol or drugs or if you feel ill, dizzy, or unsteady in any way. Operators must be physically fit, thoroughly trained, and not easily excitable.
- NEVER modify, alter, or change the equipment in any way that would affect its original design or operation in any way.
- NEVER operate this equipment in ways for which it is not intended.

## 1-3 DURING OPERATION

Read and observe the following general safety precautions at all times during operation of the ESP 19.

### DANGER

**This machine is not insulated for use near electrical power lines and DOES NOT provide protection from contact with or close proximity to any electrically charged conductor. Operator must maintain safe clearances at all times (10 feet minimum) and always allow for platform movement such as wind induced sway. Always contact the power company before performing work near power lines. Assume every line is hot. Remember, power lines can be blown by the wind.**

Refer to Table 1-1 for minimum safe approach distances between machine and electrical power lines.

**Table 1-1. Minimum Safe Approach Distances**

Voltage Range (Phase to Phase)	Minimum Safe Approach Distance	
	(Feet)	(Meters)
0 to 300V	Avoid Contact	
Over 300V to 50KV	10	3.05
Over 50KV to 200KV	15	4.60
Over 200KV to 350KV	20	6.10
Over 350KV to 500KV	25	7.62
Over 500KV to 750KV	35	10.67
Over 750KV to 1000KV	45	13.72

- ALWAYS position lift far enough away from power sources to ensure that no part of the lift can accidentally reach into an unsafe area.
- ALWAYS operate only on a firm and level surface. NEVER use on surfaces that do not support the weight of the equipment and its rated load capacity.
- ALWAYS keep yourself and all personnel away from potential pinch or shear points.
- ALWAYS report any misuse of equipment to the proper authorities. Horseplay is prohibited.
- ALWAYS maintain good footing on the platform. NEVER wear slippery soled shoes.
- ALWAYS make certain all personnel are clear and there are no obstructions before repositioning platform.
- ALWAYS cordon off area around the base to keep personnel and other equipment away from it while in use.
- ALWAYS stay clear of wires, cables, and other overhead obstructions.
- ALWAYS disconnect power at the batteries when not in use to guard against unauthorized use.

- NEVER allow electrode contact with any part of the platform if welding is being performed from the platform.
- NEVER override or by-pass manufacturer's safety devices.
- NEVER release the travel brake or tow the lift vehicle while a person or materials are on board.
- NEVER stand or sit on guard rails. Work only within the platform guard rail area and do not lean out over guard rails to perform work.
- NEVER attempt to increase working height with boxes, ladders, or other means.
- NEVER operate this equipment when exposed to high winds, thunderstorms, ice, or any other weather conditions that would compromise the safety of the operator.
- NEVER climb up or down masts.
- NEVER allow ropes, electric cords, hoses, etc. to become entangled in the equipment when the platform is being raised or lowered.
- NEVER exceed manufacturer's platform load limits and make sure all materials are evenly distributed over the entire platform.
- NEVER exceed platform load ratings by transferring loads to platform at elevated heights.
- NEVER use guard rails to carry materials and never allow overhang of materials when raising or lowering platform.

## 1-4 MAINTENANCE SAFETY

Read and observe the following general safety precautions when performing maintenance on the ESP 19.

- ALWAYS perform maintenance procedures according to manufacturer's requirements. NEVER short change maintenance procedures.
- ALWAYS check hydraulic system. Make sure all lines, connectors, and fittings are tight and in good condition.
- ALWAYS keep all mechanisms properly adjusted and lubricated according to maintenance schedule and manufacturers specifications.
- ALWAYS perform a function check of operating controls before each use and after repairs have been made.
- ALWAYS locate and protect against possible pinch points prior to performing maintenance and repairs.
- ALWAYS use only factory-approved parts to repair or maintain this equipment. If this equipment is rebuilt, retesting is required in accordance with factory instructions.
- NEVER add unauthorized fluids to the hydraulic system or battery. Check manufacturers specifications.
- NEVER exceed the manufacturer's recommended relief valve settings.
- NEVER attempt repairs you do not understand. Consult manufacturer if you have any questions regarding proper maintenance, specifications, or repair.

### Battery Maintenance

Read and observe the following general safety precautions when performing battery maintenance on the ESP 19.

- Check battery charge indicator for proper state of charge on maintenance free batteries before using lift.
- ALWAYS wear safety glasses when working near battery.
- ALWAYS avoid contact with battery acid. Battery acid causes serious burns. Avoid contact with skin or eyes. If accidental contact occurs, flush with water and consult a physician immediately.
- ALWAYS disconnect ground cable first when removing battery.
- ALWAYS connect ground cable last when installing battery.
- ALWAYS charge batteries in open, well-ventilated areas.
- NEVER smoke when servicing battery.
- NEVER allow batteries to overcharge and boil.
- NEVER short across battery posts to check for current. NEVER break a live circuit at battery.
- NEVER jump start other vehicles using lift battery.

## 1-5 DAMAGED EQUIPMENT POLICY

### **Safety Statement**

At Bil-Jax, we are dedicated to the safety of all users of our products. Therefore, all Bil-Jax lifts are designed, manufactured, and tested to comply with current applicable Federal OSHA and ANSI codes and regulations.

### **Damage Policy**

There may be occasions when a Bil-Jax lift is involved in an incident that results in structural damage to the lift. This can seriously compromise the ability of the lift to perform in a safe manner. Therefore, whenever a Bil-Jax lift is damaged structurally or when there is the possibility of structural damage (this damage may be internal and is not always visible to the naked eye), Bil-Jax requires that the lift be returned to our facility at 125 Taylor Parkway, Archbold, Ohio, for reconditioning. If you have any questions concerning what constitutes structural damage, please call the Bil-Jax Service Department at 800-537-0540.

### **Damage Repair Notice**

There may be occasions when a Bil-Jax lift is involved in an incident resulting in non-structural damage. When this occurs and repairs are made by the owner or area distributor, please notify Bil-Jax of these non-maintenance repairs and request a repair form to be filled out and returned to Bil-Jax.



# 2

## Introduction

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### 2-1 GENERAL DESCRIPTION

The ESP 19 hydraulic lift is designed and manufactured for use as a warehouse stocking and order picking vehicle. Its guard rail design permits the operator to ride on the platform with the load, while transferring parts to and from multiple overhead storage locations. The maximum platform load is limited to 450 lbs.

All ESP 19 operations are powered by a 24-Volt DC battery package. A 40-amp battery charger and plug-in receptacle are included in the system for recharging the batteries at the end of each work period. A charge level indicator displays the battery charge status.

The platform lift function is hydraulic, including a hydraulic cylinder, reservoir, and pump. The hydraulic pump motor is driven by a 24-Volt DC electric motor. Elevation is by a 1-3/4 inch linear-displacement hydraulic cylinder and four telescoping mast sections. The lower mast section is raised by hydraulic cylinder. The upper mast sections are raised mechanically by connecting sets of chains and sheaves (pulleys). The lift platform rises four inches for each inch of hydraulic cylinder extension.

Other electrically powered functions include a two-wheel drive transaxle for floor travel and pushbutton steering. The maximum travel speed is enabled only when the lift platform is down. When the platform is raised, the travel speed is limited. The transaxle includes an electric brake that locks the drive wheels whenever forward or reverse travel is halted. The electric brake is normally applied; the brake disengages when forward or reverse travel is enabled with the joystick. In case of a loss of battery power, a manual free wheel lever can be used to disengage the electric brake, allowing the lift vehicle to be towed.

Floor travel and platform lift functions are controlled from an upper control box located on the lift platform. Floor travel is by joystick control with pushbutton steering. Lift functions are by pushbutton control. Platform lift can also be controlled from a lower control box mounted on the vehicle base. An electronic level sensor disables all lift and travel functions except platform lowering if the lift vehicle base is more than one degree out of level. While out of level, travel can be resumed after the lift platform is fully lowered.

With equipment power on or off, turning an emergency lowering valve knob lowers the lift platform at a controlled, safe speed. The lowering valve knob is visible and readily accessible from floor level.

Proper lift vehicle operation and safety are assured by performing the scheduled inspection and maintenance procedures set forth in this manual. The risk of platform free-fall is eliminated by proper maintenance of the chains, sheaves and sheave pins, a properly installed flow restrictor valve, and a clean mast. The restrictor valve (non-adjustable) fixes the maximum rate of platform descent to approximately 0.6 feet per second, whether the platform is empty or fully loaded. With the restrictor valve properly installed, a hydraulic hose failure will result in the same maximum rate of descent.

Carefully read and understand all of the safety instructions in Section 1 and all operating instructions in Section 3 of this manual before operating the lift vehicle.

## 2-2 SPECIFICATIONS

### ESP 19 Electric Hydraulic Lift Platform

Model Number ESP 19

Serial Number \_\_\_\_\_

Manufactured by: Bil-Jax, Inc.  
 125 Taylor Parkway  
 Archbold, Ohio 43502  
 800-537-0540

**Table 2-1. Specifications**

Rated Platform Load	450 lbs (204 kg) total including operator [1 person + materials not to exceed 450 lbs (204 kg)]
Extended Platform Height	19 ft 3 in (5.9 m)
Retracted Platform Height	20 in. (50.8 cm)
Platform Dimensions	30 in. W x 30 in. L x 42 in. H (0.76 m x 0.76 m x 1.07 m)
Base Dimensions	30-1/2 in. W x 63 in. L x 80 in. H (0.77 m x 1.60 m x 2.03 m)
Gross Shipping Weight	2150 lbs (975 kg)
Platform Lift Time	20 seconds empty, 32 seconds loaded
Platform Retraction Time	22 seconds empty, 22 seconds loaded
Platform Lift Rate	Lift platform empty: 0.66 ft (0.3 m)/sec. Lift platform loaded: 0.42 ft (0.19 m)/sec.
Hydraulic System Pressure	1200 psi empty, 2100 psi loaded
Travel Speeds (Maximum)	Lift platform lowered: 2.5 mph Lift platform raised: 0.5 mph
Power Source	DC – two in-series 12 volt maintenance-free batteries

## 2-3 WARRANTY

Bil-Jax warrants its telescopic lifts for one year from the date of delivery against all defects of material and workmanship, provided the unit is operated and maintained in compliance with Bil-Jax's operating and maintenance instructions; structural components are warranted for three years. Bil-Jax will, at its option, repair or replace any unit or component part which fails to function properly in normal use.

This warranty does not apply if the lift and/or its component parts have been altered, changed, or repaired without the consent of Bil-Jax or by anyone other than Bil-Jax or its factory trained personnel, nor if the lift and/or its components have been subjected to misuse, negligence, accident or any conditions deemed other than those considered as occurring during normal use.

Components not manufactured by Bil-Jax are covered by their respective manufacturer's warranties. A list of those components and their warranties is available upon written request to Bil-Jax.

Bil-Jax shall not in any event be liable for the cost of any special, indirect, or consequential damages to anyone, product, or thing. This warranty is in lieu of all other warranties expressed or implied. We neither assume nor authorize any representative, or other person, to assume for us any other liability in connection with the sale, rental, or use of this product.



# 3

## Operation

---

### 3-1 OPERATOR CONTROLS

Most of the operator controls for the ESP 19 are located on the upper and lower control boxes. Other operator controls include the BATTERY ON/OFF switch and the emergency lowering valve. The BATTERY ON/OFF switch, located on the left side of the lift base, is the main power disconnect switch for the lift vehicle. The location and operation of the emergency lowering valve is described in paragraph 3-3.

#### Lower Control Box

The lower control box, Figure 3-1, is located on the lift base and contains three controls: UP/DOWN, EMERGENCY STOP, and UPPER CONTROL/OFF/LOWER CONTROL. The lower control box enables lift operations from floor level.

The UPPER CONTROL/OFF/LOWER CONTROL key switch selects the active (upper or lower) control location. To enable an UP or DOWN lift motion from the floor, turn and hold the key switch in the LOWER CONTROL position. To enable lift vehicle travel or platform elevation from the upper control box, turn the key switch to the UPPER CONTROL position. To disable lift vehicle operations, turn the key switch to the OFF position and remove the key.

Turn the UP/DOWN selector switch to the UP position to raise the lift platform or to the DOWN position to lower the platform. (The key switch must be held in the LOWER CONTROL position to enable the UP/DOWN selector switch).

Press the EMERGENCY STOP button to stop all equipment motion. If the lift vehicle is moving forward or back, pressing the EMERGENCY STOP button engages the travel brake causing travel to stop quickly. To resume lift vehicle operation, turn the EMERGENCY STOP button clockwise.

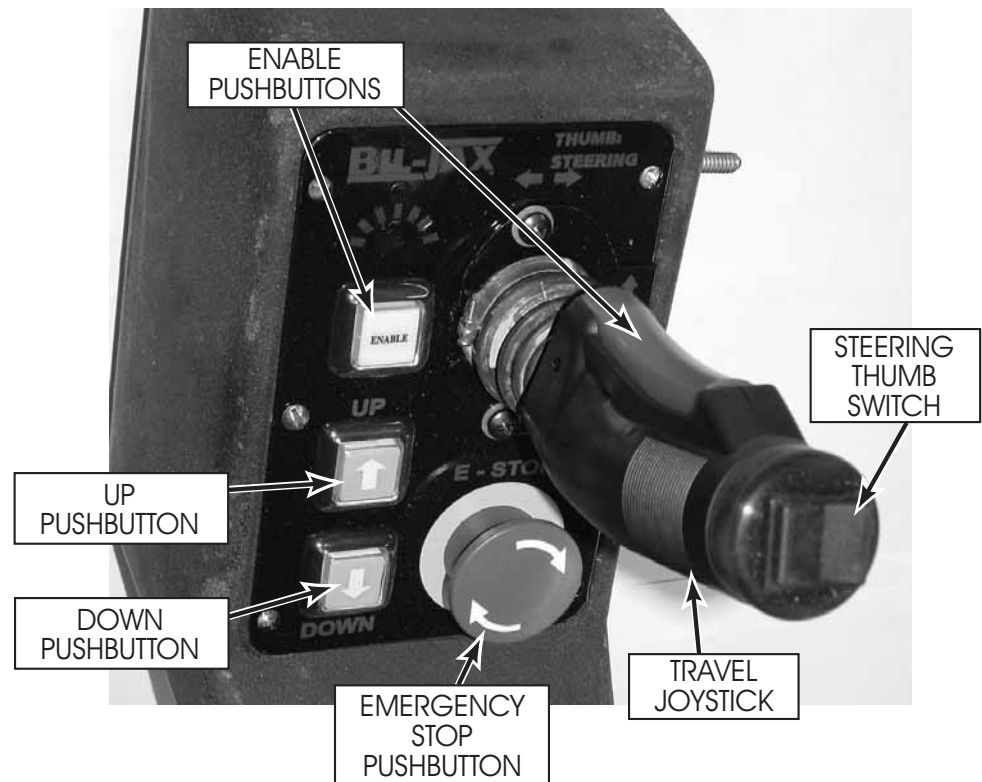


Figure 3-1. Lower Control Box

## Upper Control Box

The upper control box, Figure 3-2, is in the lift cage. The upper control box enables lift and travel operations whenever the BATTERY ON/OFF switch is in the ON position and the lower control box key switch is in the UPPER CONTROL position.

Upper control box controls include four pushbuttons and a forward/reverse floor-travel joystick with thumb-switch steering.



**Figure 3-2. Upper Control Box**

Press and hold either one of the ENABLE pushbuttons to enable a control function. An ENABLE pushbutton must be pressed to enable the lift, steering, and travel functions. The ENABLE pushbutton must be held down to continue the equipment function.

With one of the ENABLE pushbuttons depressed, press the UP [↑] pushbutton to raise the platform or press the DOWN [↓] pushbutton to lower the platform.

With one of the ENABLE pushbuttons depressed, move the travel joystick forward or back to move the lift vehicle in the forward or reverse direction. For slow speeds, move the joystick forward or back just a little. For faster speeds, move the joystick more.

With one of the ENABLE pushbuttons depressed, press the left or right side of the thumb switch to steer the rear wheels to the left or right. The steering can be adjusted before or during floor travel.

Press the EMERGENCY STOP button to stop all equipment motion. If the lift vehicle is moving forward or back, a travel brake is applied causing travel to stop. To resume lift vehicle operations, turn EMERGENCY STOP button clockwise.

## 3-2 NORMAL OPERATING PROCEDURE

Perform the following procedures to operate the ESP 19 platform lift vehicle.

1. Read and follow all safety precautions contained in Section 1 and all responsibilities outlined in the ANSI A92.3 reprint in Section 7 of this manual.
2. Check the lift vehicle for damage or worn parts. If damage or part wear is found, do not operate the vehicle until the problem is corrected.
3. Make sure battery charger cord is disconnected from wall outlet. Place cord back into its box and close and latch lid. **LIFT WILL NOT OPERATE IF LID IS NOT CLOSED SECURELY.**
4. Turn the BATTERY ON/OFF switch, Figure 3-3, to the ON position.
5. Observe the battery charge level indicator. Verify that the battery charge level is 3/4 or more.

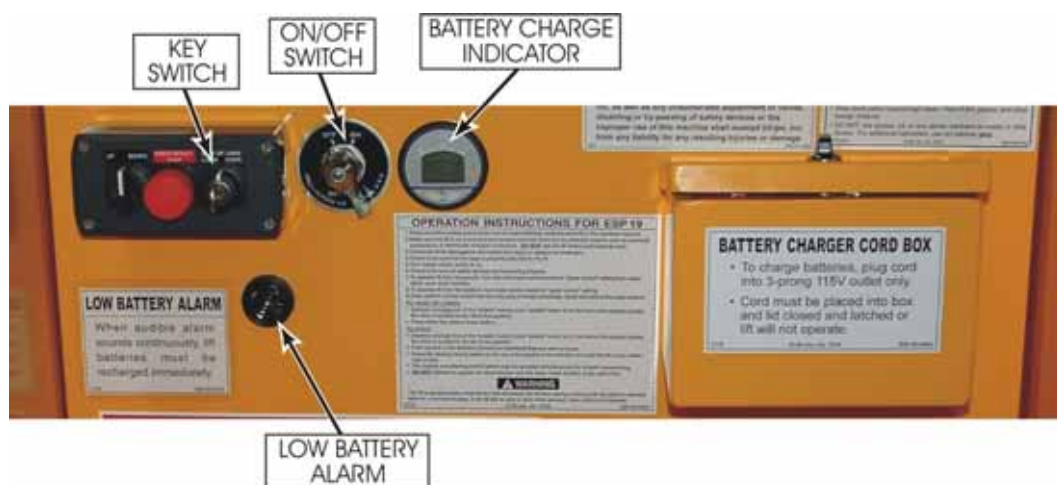


Figure 3-3. Battery On/Off Switch

6. Turn the UPPER CONTROL/OFF/LOWER CONTROL key switch, Figures 3-1 & 3-3, to the UPPER CONTROL position.
7. Enter the platform cage and close the entry gate. **LIFT WILL NOT OPERATE IF THE GATE IS NOT CLOSED COMPLETELY.**
8. Use the upper control box controls to operate the lift vehicle.
9. Position the lift vehicle at the work area. Make sure the vehicle is on a firm and level surface and that there are no potential hazards such as speed bumps, open floor drains, potholes, overhead obstructions or electrically charged conductors. Do not operate the lift vehicle if such hazards exist in the immediate area.

**NOTE:** The lift vehicle is equipped with a level sensor. When the vehicle is on a slope greater than 1 degree, the level sensor disables all functions other than platform lowering and sounds an alarm beeper. Once the platform is lowered, floor travel is again enabled to allow travel to a level area.

10. During floor travel and lift operations, the alarm beeper should sound. If the alarm beeper does not work properly, do not operate the lift vehicle.
11. During lift platform descent, the amber caution light should blink on and off. If the caution light does not blink on and off, do not use the lift vehicle.
12. If any equipment motion continues after the pushbutton, joystick, or selector switch is released, press the EMERGENCY STOP pushbutton, Figure 3-2. All equipment motion should stop immediately.
13. At the end of each workday and whenever a low battery alarm sounds, transport the lift vehicle to the recharge site and plug in the charge cord. Verify that the ON-CHARGING indicator lights up on the battery charger.

**NOTE:** For more information on battery charging operations, refer to the battery charging procedure in paragraph 4-4.

14. To shut down the equipment, turn the UPPER CONTROL/OFF/LOWER CONTROL key switch and the BATTERY ON/OFF switch to OFF. Remove the key to prevent unauthorized equipment operation.

### 3-3 EMERGENCY LOWERING PROCEDURES

In an emergency, a person at floor level can lower the platform by holding the UPPER CONTROL/OFF/LOWER CONTROL key switch in the LOWER CONTROL position and turning the UP/DOWN selector switch to the DOWN position. (If the upper control box emergency stop pushbutton is depressed, the platform will not lower.)

An emergency lowering valve is shown in Figure 3-4. In case of a total loss of battery power, a person at floor level can safely lower the platform by opening the emergency lowering valve.

#### WARNING

**Do not climb out of the lift cage while the lift platform is elevated. The lift mast cannot be climbed safely. An elevated lift platform has a high center of gravity and can be tipped easily. Standing on or leaning out from the outside of a cage rail may cause the lift vehicle to tip over. Tipping the lift vehicle over can cause severe injury or death and equipment damage.**

If you lose power while elevated in the cage, instruct someone on ground level to open the emergency lowering valve. **Do not** leave the cage to climb down the lift mast or storage shelves.

To lower the platform, pull and hold the red valve knob until the platform starts to descend. When the platform is fully lowered, release the knob to close the valve.

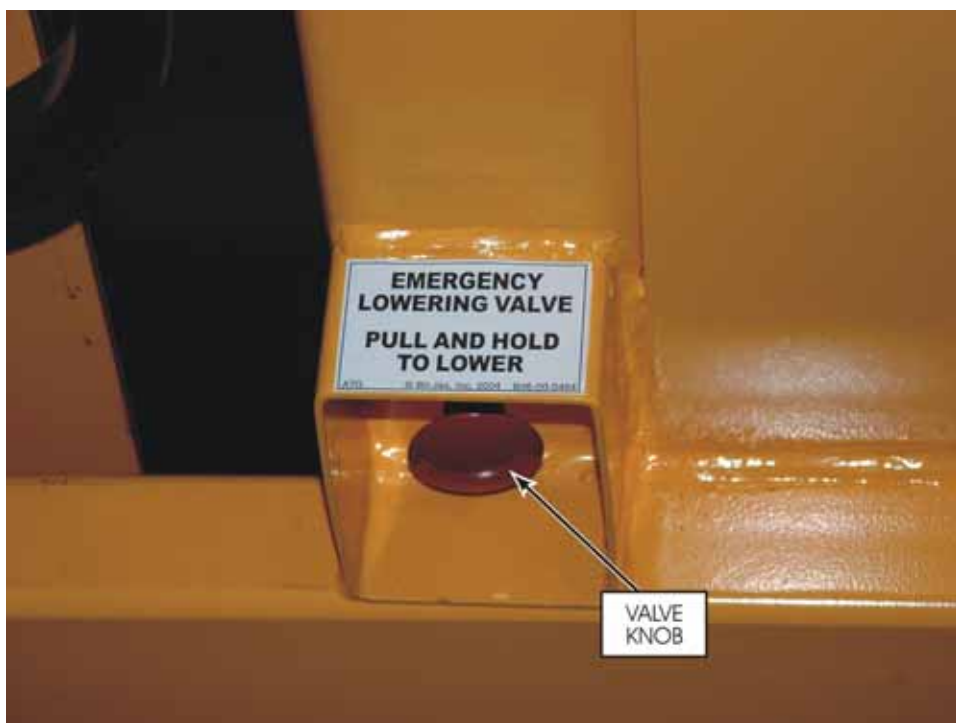


Figure 3-4. Emergency Lowering Valve

### 3-4 LIFT VEHICLE TRANSPORT

The platform vehicle is equipped with lifting and tow features, Figure 3-5. Read the following instructions before using these features to lift or tow the vehicle.



Figure 3-5. Lifting Pockets

#### CAUTION

**Do not attempt to push the lift vehicle or use the lift vehicle to pull another vehicle or object. Pushing the lift vehicle or using the vehicle for towing may cause serious equipment damage.**

The forks of a lift truck (2-ton minimum capacity) can be used to raise the ESP 19 for loading onto a trailer or for blocking up the lift vehicle for maintenance. Forks must be inserted a minimum of 32 inches before raising the ESP 19.

Before towing the ESP 19 lift vehicle, you must manually disengage the travel brake and disconnect the steering cylinder from the steering linkage. Refer to the illustrations in Figure 3-6.



Figure 3-6. Travel Brake and Steering Linkage

# 4

## Maintenance

---

### 4-1 SCHEDULED SERVICE CHECKS

#### Daily/Weekly Service Checks

Perform the daily and weekly service checks listed in Table 4-1.

Table 4-1. Daily/Weekly Service Checks

Service Check	Daily before use	Weekly
Check that all upper and lower control box controls work properly.	✓	
Check for hydraulic oil leaks.	✓	
Check for loose or missing parts.	✓	
Check for and retighten loose nuts and bolts.	✓	
Check that cage gate is secure.	✓	
Ensure Operation Manual is in manual tube.	✓	
Verify that underguard shuts down operation when weight is applied.		✓

## 6 Month/Yearly Service Checks

Perform the service checks in Table 4-2 every 6 months or every 12 months, as indicated.

**Table 4-2. 6 Month/Yearly Service Checks**

Service Check	Every 6 months	Every 12 months
Check chain assemblies for split leaves, loose pins, excessive wear, or elongation.	✓	
Verify that cage is securely bolted to lift mast.	✓	
Check that slide blocks and their paths are clean and lightly lubricated with a dry silicone lubricant.	✓	
Verify that all safety decals are present and legible.	✓	
Check for wear on chain sheaves, sheave axles, and bearings.	✓	
Check caster axle and swivel bolts for wear.	✓	
Check casters for cracks or excessive wear.	✓	
Lubricate lift chains with 40-weight oil.	✓	
Check hydraulic UP and DOWN valves operation.	✓	
Clean battery terminals.	✓	
Check operation of emergency lowering valve.	✓	
Grease rear caster swivel bolts, axles and wheels.	✓	
Grease steering linkage pivot bolts.	✓	
Grease front caster pillow blocks.	✓	
Check battery cables and wiring for loose connections and damaged wires.	✓	
Replace hydraulic oil.		✓
Check slide blocks for wear.		✓
Check for mast sway.		✓
Load test with 450 pounds.		✓



## 4-2 UNDERGUARD SERVICE CHECK

The underguard is a safety device located under the cage/platform that shuts down operation of the lift when weight is applied. Perform the following procedure weekly to verify the underguard is working properly.

1. Turn power to lift ON and raise cage/platform using the lower control box a minimum of 3 feet above the underguard.
2. Place a weight of at least 15 lbs. on the underguard. Refer to Figure 4-1.

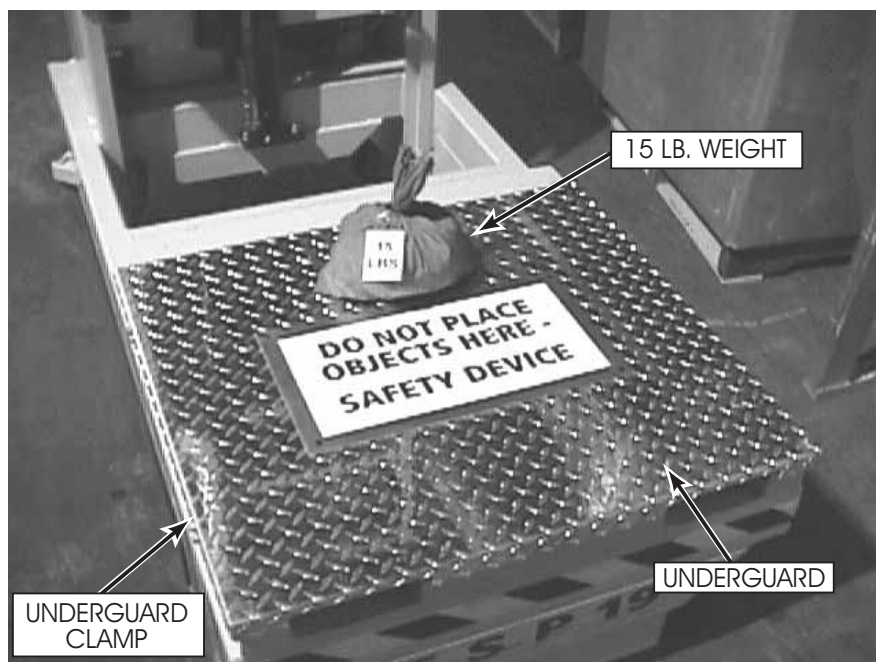


Figure 4-1. Underguard

3. **BEFORE ATTEMPTING TO LOWER THE LIFT, MAKE SURE AREA UNDERNEATH AND AROUND THE CAGE/PLATFORM IS CLEAR OF PERSONNEL OR OTHER OBJECTS.** Using the lower control box with power ON, attempt to lower lift. A warning beeper should sound and the lift should not lower. The lift should still be able to raise. With someone in the cage, switch to upper controls and attempt to drive. A warning beeper should sound and the lift should not drive.
4. If the lift lowers or drives, the switches below the underguard may need to be adjusted or replaced. To adjust or replace underguard switches, shut power OFF to lift, then remove two of the underguard clamps from one side of the lift. The switches below the underguard can be adjusted by loosening the screws or removed for replacement.
5. Retest whenever underguard is removed and switches are adjusted or replaced.

## 4-3 LUBRICATION

Lubrication makes operation of the ESP 19 more efficient and extends the life of the lift vehicle. Perform the following lubrication procedures.

1. Lubricate lift chains with clean 40-weight oil. Refer to Figure 4-2.

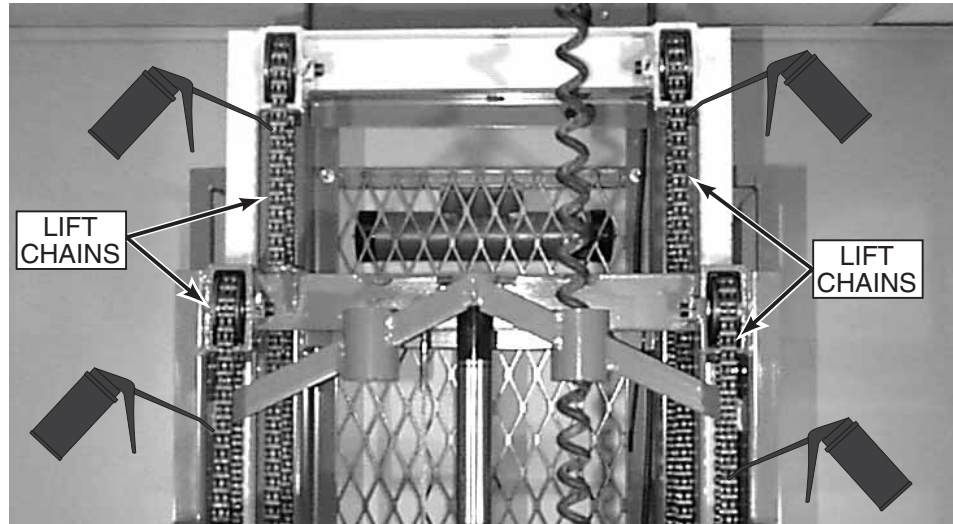


Figure 4-2. Lift Chains Lubrication

2. Clean the mast slide ways, Figure 4-3, and lightly spray the slide ways with a dry silicone lubricant.

**NOTE:** The slide blocks have a high level of lubricity and need only be kept clean. To reduce wear and extend service life, the slide ways should be cleaned and lightly lubricated with a dry type silicon lubricant.

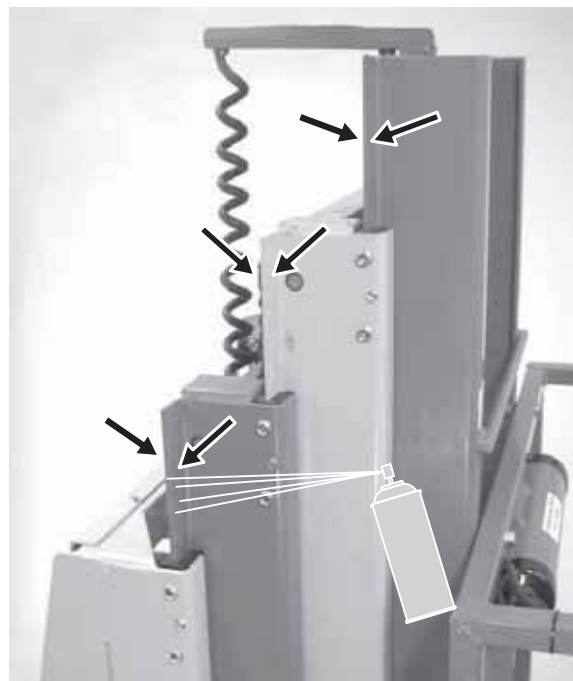
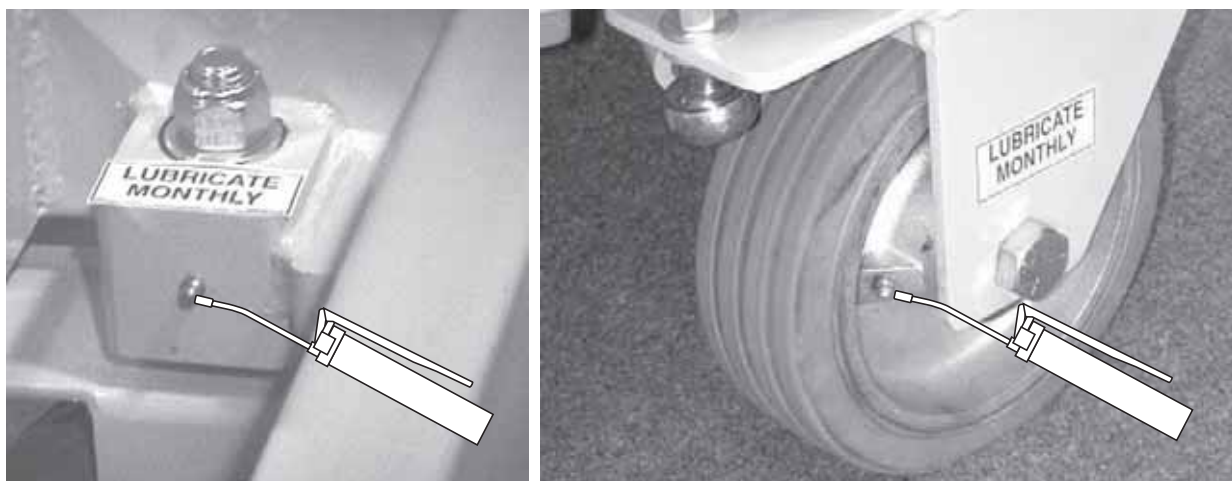
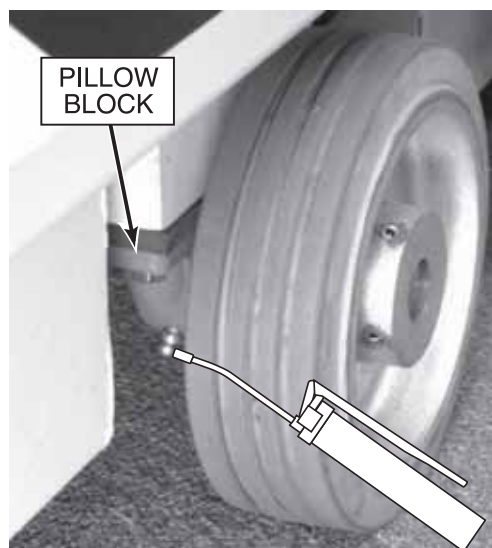


Figure 4-3. Mast Slide Ways Lubrication



**Figure 4-4. Rear Casters Lubrication**

3. See Figure 4-4. Grease rear caster axles and swivel bolts at the grease fittings provided. Add about 1/2 ounce of clean #2 NGLI grease to each fitting.
4. Remove, clean, and lubricate steering linkage with wheel bearing grease.
5. Apply about 1/2 ounce of clean #2 NGLI grease to the fitting on each front wheel pillow block, Figure 4-5. Do not over-grease the pillow block bearings.



**Figure 4-5. Front Caster Pillow Blocks Lubrication**

## 4-4 HYDRAULIC SYSTEM

Hydraulic system maintenance varies by the amount of use and the environment in which the lift vehicle is used. Keeping the hydraulic oil clean and the reservoir properly filled will help prevent possible damage to the system.

### Hydraulic System Inspection

Check all hydraulic hoses and fittings for leaks and damage daily. Tighten or replace as necessary to prevent hydraulic oil loss.

### Fluid Check and Replacement

With the platform in its lowest position, the hydraulic oil level should be at the MAXIMUM level mark (1-1/2 in. from top of reservoir).

The reservoir is initially filled with Energol HLP-HD46 (BP Oil); a high grade, non-foaming hydraulic oil. This oil is recommended for use in climatic temperatures as low as -20°F/-29°C. Dextron Automatic Transmission Fluid Type A is recommended for use in temperatures as low as -40°F/-40°C.

If either of these oils is not available, a good grade SAE 10W hydraulic oil may be used where the minimum climatic temperature is above 32°F/0°C. An SAE 5W hydraulic oil may be used where temperatures are as low as 0°F/-18°C.

Do not mix different hydraulic oils. Clean the reservoir and sump strainer and replace the hydraulic oil at least once a year. Clean the reservoir and sump strainer and replace the oil whenever contamination is suspected.

### Hydraulic System Air Bleeding Procedure

Delayed response or uneven movement of the hydraulic cylinder may indicate trapped air in the hydraulic oil.

**NOTE: Whenever the upper control box emergency stop pushbutton is engaged, lift operation remains enabled at the lower control box. However, the UP or DOWN lift motion will be intermittent. Intermittent lift motion should not be mistaken as trapped air in the hydraulic system.**

Perform the following procedure to bleed trapped air from the hydraulic system.

1. Fill the reservoir to the MAXIMUM level with the proper hydraulic fluid.
2. Fully raise the lift platform.
3. Lower the lift platform to allow oil with entrapped air to return to the reservoir. Be careful not to overflow the hydraulic reservoir.
4. Leave the lift platform down and the lift vehicle at rest for 10 to 15 minutes while air escapes the hydraulic oil.
5. Repeat steps 2 through 4 as needed. Each time the platform is lowered, refill the reservoir to prevent pumping more air into the hydraulic cylinder.

## Pressure Relief Valve Adjustment

Perform the following procedure to adjust the pressure relief valve. Refer to Figure 4-6.

1. Move the ESP 19 lift platform to the fully DOWN position.
2. Center 450 pounds of weight on the lift platform.
3. Loosen the jam nut. The pressure relief valve is on the back side of the pump.
4. Turn the pressure relief valve adjust screw 1/8<sup>th</sup> turn counterclockwise. This will adjust the relief valve bypass pressure setting for less than 450 pounds of lift.
5. Place the key switch in the LOWER CONTROL position and press the UP pushbutton. The pump should run, bypassing oil to the hydraulic reservoir.



### CAUTION

**Do not adjust the pressure relief valve for a bypass pressure higher than needed to raise the 450 pound load. Hydraulic system overload may occur at a higher bypass pressure, causing hydraulic failures or damage to the equipment.**

6. With the platform lift function enabled (pump running), turn the pressure relief valve adjust screw clockwise just enough to smoothly raise the platform without bypassing oil to the hydraulic reservoir.
7. Retighten the jam nut.



Figure 4-6. Pressure Relief Valve Adjustment

## Flow Restrictor Valve Replacement

### **⚠ WARNING**

Closely read and adhere to the following instructions whenever you remove and install the flow restrictor valve. Failure to properly install the flow restrictor valve can result in serious injury or death to personnel or damage to the equipment.

The flow restrictor valve, Figure 4-7, is located inside the base of the hydraulic lift cylinder. If the flow restrictor valve needs to be removed or replaced, it is important that it be properly reinstalled.

1. Raise the platform and masts high enough to access the fitting. Support the raised platform using a forklift or hoist to prevent it from lowering.

### **⚠ WARNING**

Never work under the lift while it is raised unless the platform is fully supported to prevent it from lowering. Failure to properly support a raised platform can result in serious crushing injury or death.

2. Remove the hydraulic line from the fitting. Then, remove the fitting.
3. Remove the flow restrictor valve using a 3/16" allen wrench.
4. When reinstalling the flow restrictor valve, make sure it is tightened in all the way against the bottom.
5. When reinstalling the fitting, do not tighten it against the flow restrictor. If the fitting is turned in too far, it can reduce or stop the oil flow to the cylinder.
6. Finally, reconnect the hydraulic line to the fitting. Make sure the o-ring seal on the face of the fitting is not cut or tore.

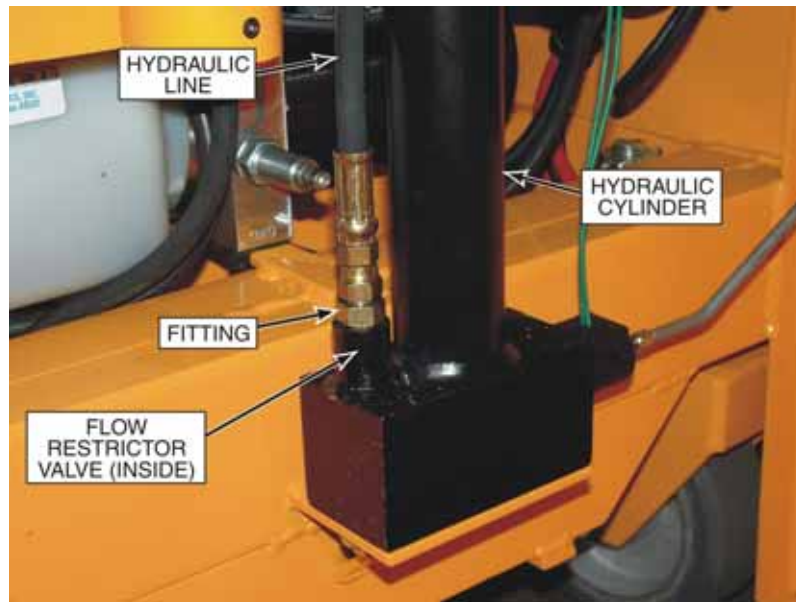


Figure 4-7. Flow Restrictor Valve

## Valve Operation

Refer to Figure 4-8 for valve locations and the hydraulic diagram in Figure 4-15. The valves are labeled on the valve manifold as A, B, C, FA and FB. The platform down valve is located at the base of the lift cylinder.

**Steering Valve Right (A):** Pressing the ENABLE and the thumb steering switch to the right energizes the steering valve, causing the steering cylinder to extend and execute a right turn.

**Steering Valve Left (B):** Pressing the ENABLE and the thumb steering switch to the left energizes the steering valve, causing the steering cylinder to retract and execute a right turn.

**Lift Valve (C):** Pressing the ENABLE and UP pushbuttons energizes the platform lift valve, causing the lift cylinder to extend.

**Down Valve (D):** Pressing the ENABLE and DOWN pushbuttons energizes the platform down valve. Oil flows back into the reservoir, causing the lift cylinder to retract.

**Steering Speed Adjust Valve (FA):** Adjust to control left turn – steering cylinder retraction rate.

**Steering Speed Adjust Valve (FB):** Adjust to control right turn – steering cylinder extension rate.



Figure 4-8. Valve Operation

## Hydraulic Cylinder Repair



### CAUTION

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**Hydraulic cylinder removal requires extensive disassembly of the ESP 19 lift vehicle. Contact Bil-Jax for assistance before removing the hydraulic cylinder.**

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### *Hydraulic Cylinder Removal*

It is recommended that Bil-Jax be contacted for assistance before removing the hydraulic cylinder.

1. Make sure hydraulic cylinder is completely retracted and pressure is released from the system. Place a pan underneath the cylinder to catch the hydraulic oil.
2. Disconnect the hydraulic hose from the flow restrictor valve and drain the hydraulic oil from the cylinder. Remove the two bolts, washers, and nuts securing the hydraulic cylinder to the base.
3. Remove the plexiglass cover from the base.
4. Remove the mounting bolt, washer, and nut securing hydraulic cylinder to the lower mast.
5. Disconnect the two lift chains from the base mast.
6. Using a crane with at least one ton of lifting capacity, lift the lower mast section high enough to remove the clamp securing the cylinder to the base. Remove the clamp and cylinder from the unit.
7. After hydraulic cylinder maintenance is completed, reinstall the cylinder in the reverse order of removal.



### Hydraulic Cylinder Repair Procedure

Perform the following procedure to repair the hydraulic lift cylinder. Refer to Figure 4-9.

1. Remove gland nut (1) from cylinder jacket (2). If worn, replace gland nut (1), o-ring (3), packing ring (4), and rod wiper (5) with a new gland nut assembly.
2. Remove piston rod (6) and wear ring (7).
3. Inspect piston rod (6) and wear ring (7) for gouges, scratches, and wear. Replace worn or damaged components.
4. Thoroughly clean the inside surface of cylinder jacket (2).
5. Lubricate wear ring (7) with clean hydraulic oil or petrolatum. Slide piston rod (6) with wear ring (7) into cylinder jacket (2).
6. Lubricate o-ring (3), packing ring (4), and rod wiper (5) with clean hydraulic oil or petrolatum.
7. Slide gland nut (1) onto piston rod (6). Fully thread the gland nut into cylinder jacket (2).
8. Reinstall the hydraulic cylinder in the lift vehicle and reconnect the hydraulic hose.
9. Refill the hydraulic reservoir.
10. Stroke the cylinder to seat and align packing ring (4) and wear ring (7).
11. Bleed all trapped air from the hydraulic system.

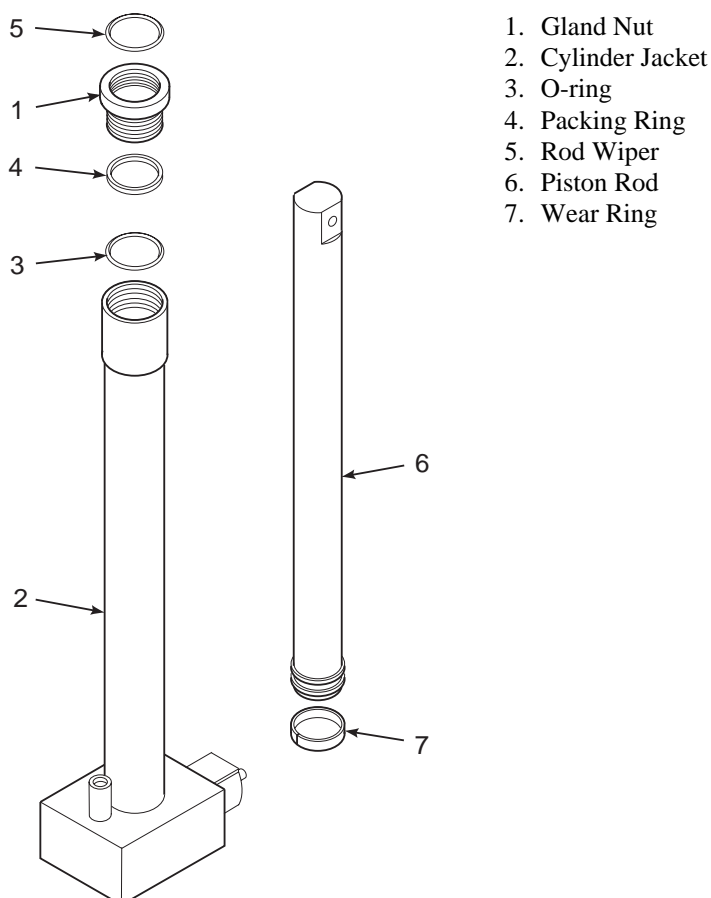


Figure 4-9. Hydraulic Cylinder Disassembly

## 4-5 ELECTRICAL SYSTEM

Regular maintenance is necessary to keep the electrical system in proper working order. Check daily all electrical wires for cuts, broken wires, potential short circuits, and any other damage.

### Battery Care and Charging

The electric system is designed to provide power for a normal work shift. However, the charge life of the battery pack depends on machine usage. Plan your work to prevent unnecessary use of electrical power.

Since the power source for the machine is a battery pack, proper battery care is important. Recharge the batteries after each work shift. When the machine is not being used, the batteries should be charged at least once a week. Normal battery charging time should be 10 to 12 hours. If the battery is extremely low, charging time may be as long as 24 hours.

Clean the battery terminals every 6 months. Remove the cables from the battery posts, clean the battery posts and cable ends to shiny metal, and replace the cables. Always connect the insulated cable from the starter solenoid to the most positive post. Lubricate the outside of the battery post connections with petroleum jelly or grease.

### Battery Charging Procedure

1. Remove the battery charger cord from its box and plug into a 3-prong 115V outlet, Figure 4-10.



Figure 4-10. Battery Charger Cord

2. When there is power to the battery charger, a red “ON-CHARGING” LED on the charger will be lit and the ammeter will display the rate of charge.

3. Once the battery voltage reaches a predetermined level programmed in the electronic control, the yellow “80% CHARGE” LED will illuminate.
4. The charge will be completed 3-1/2 hours after the yellow “80% CHARGE” LED is lit. The charger and all LED’s will automatically shut off. The battery charge level indicator should indicate at least 3/4 charge.

**NOTE:** If the battery voltage does not reach the 80% level within 14 hours, the charger will shut off and the “CHECK BATTERY” LED will light up.

### CAUTION

Before making or breaking connections between charger and battery, always remove the power cord from the 115 volt outlet. For more information, refer to the instructions supplied with the battery charger.

5. After the charge cycle is completed, disconnect the battery charger cord from the wall outlet, place it back into its box, and close and latch the lid. **LIFT WILL NOT OPERATE IF THE LID IS NOT CLOSED SECURELY.**

## 4-6 LIFT CHAINS AND SLIDE BLOCKS

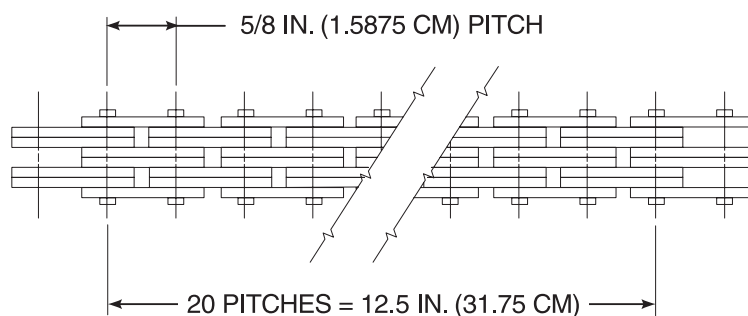
### WARNING

Do not operate a unit on which any chain assembly is damaged or in need of replacement. Operating a unit with a damaged chain can cause severe injury or death to personnel and damage to equipment.

Inspect all lift chains every 6 months. Inspect for signs of wear, split leaves, loose pins, clevis damage, and elongation. Replace any chain that is damaged in any way. Chain assemblies may be ordered from your dealer or direct from the factory. Do not operate a unit on which any chain assembly is damaged and in need of replacement.

### Chain Elongation Inspection

Refer to Figure 4-11. Measure 20 pitches of chain. Twenty pitches of new chain should measure 12.5 in. (31.75 cm). Replace the chain if a 20-pitch length measures over 12.75 in. (32.385 cm).



REPLACE CHAIN IF 20 PITCHES  
MEASURES OVER 12.75 IN (32.385 CM)

**Figure 4-11. Chain Elongation Inspection**

## Lift Chain Adjustment

1. Raise the platform to the maximum height. Then, lower the platform while someone verifies that all sheaves (pulleys) are turning and that the chains are not visibly damaged or worn.
2. Remove the plexiglass cover from the base.
3. When the platform is fully lowered, the lift chains should be equally tight. Check each lift chain at mid-span. The lift chains should flex about 1/2 to 3/4 inch (12 to 19 mm), but there should be no loose play.
4. If a lift chain is loose, tighten the related clevis, Figure 4-12. Tighten the clevis lock nut until the lift chain just becomes snug. Do not over-tighten any lift chain. (An over-tightened lift chain will raise the platform from its rest position at the bottom of the base slide ways).
5. After making a lift chain adjustment, verify that at least 1/8 in. (3 mm) of the threaded clevis rod extends beyond the lock nut. Also recheck the slack of all lift chains at mid-span; verify that all lift chains are equally snug.
6. If a single lift chain requires frequent adjustment, the clevis lock nut is probably worn. Replace any clevis lock nut that does not hold position during use.
7. Replace the plexiglass cover.

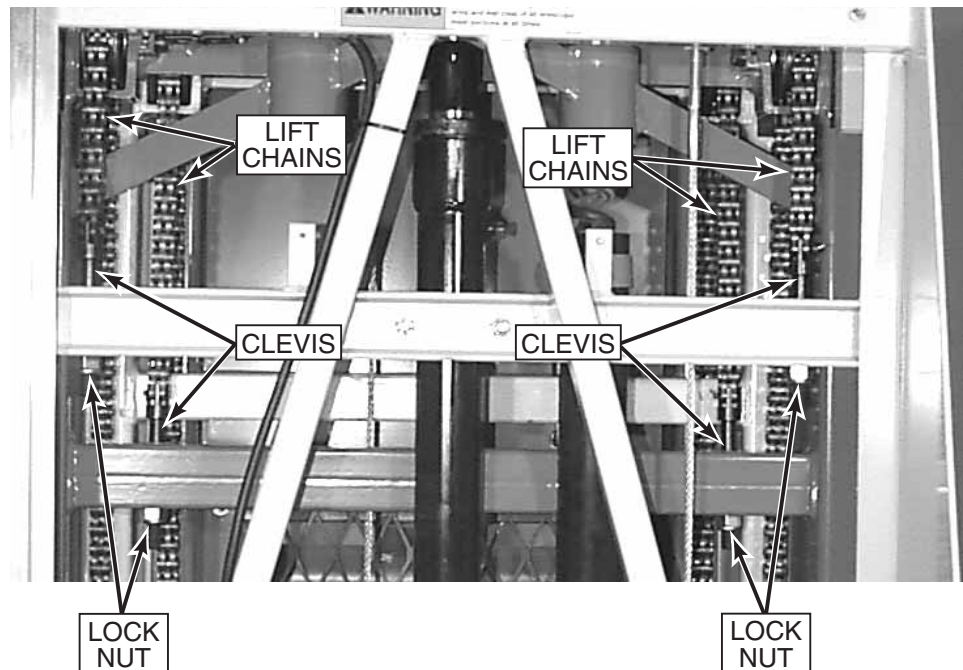


Figure 4-12. Lift Chains Adjustment

## Slide Block Adjustment

Annually check for wear on the slide blocks and replace or retighten as necessary. If the lift exhibits excessive mast sway, it is probable that the slide blocks need adjustment. The slide blocks should be adjusted so that there is no air gap between the slide block and the mast the slide block is moving against. There are 16 slide blocks, - 8 upper and 8 lower. Three upper slide blocks are shown in Figure 4-13.

Start with the slide blocks on one side of the inner mast. Adjust the upper and lower slide blocks on one side, followed by the upper and lower slide blocks on the opposite side. Repeat the adjustments for the center mast slide blocks, followed by the outer mast slide blocks. The adjustment procedure is the same for all slide blocks:

1. Loosen, but do not remove the slotted hex screw securing the slide block.
2. Use an Allen wrench to turn the set screws clockwise. This will push the block in against the next mast. Do not overtighten. Tighten the slotted hex head screw to secure the slide block in position.
3. After all adjustments are made, fully extend the lift. If the platform can be raised and lowered without hesitation or stopping, the blocks are properly adjusted.

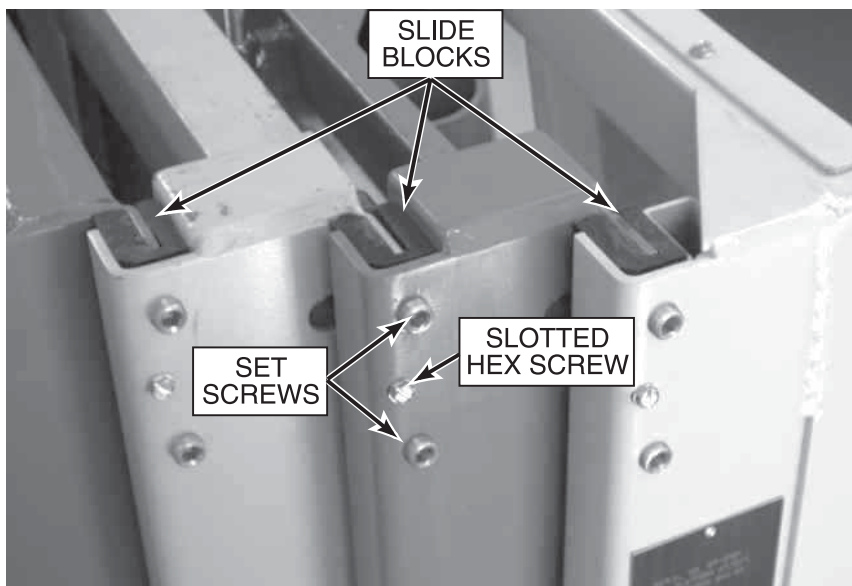


Figure 4-13. Slide Blocks Adjustment

**NOTE:** The plastic slide blocks in the mast are made of a bearing material which has a high degree of lubricity and need only be kept clean. However, precautions should be taken to ensure that the paths along which the blocks move are kept clean and lightly lubricated with a dry type silicon lubricant.

## 4-7 TROUBLESHOOTING

Table 4-3. Troubleshooting Chart

Problem	Cause	Correction
1. Lift vehicle controls do not work at upper or lower control box.	<ul style="list-style-type: none"> <li>a. Master power switch turned off.</li> <li>b. Low battery power or faulty battery circuit.</li> <li>c. Emergency stop button engaged (pushed in).</li> <li>d. Battery ground or in-series battery cable loose.</li> <li>e. Circuit breaker tripped.</li> <li>f. Battery cable or equipment ground lead loose or corroded.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn on master power switch.</li> <li>b. Recharge batteries per paragraph 4-4. Check for faulty battery or cables if red battery charger LED is lit.</li> <li>c. Rotate emergency stop buttons clockwise to disengage.</li> <li>d. Check for and repair loose battery connections or ground fault.</li> <li>e. Reset breaker. If breaker trips again, locate and correct short to ground in power circuit wiring.</li> <li>f. Clean and reconnect loose or corroded battery cable or ground lead.</li> </ul>
2. Lift vehicle controls do not work at upper control box, but do work at lower control box.	<ul style="list-style-type: none"> <li>a. Emergency stop button engaged (pushed in) on upper control box.</li> <li>b. Upper control box cable connectors unplugged.</li> <li>c. Upper control box cable connectors plugged into wrong receptacles.</li> <li>d. Enable pushbutton switch or wiring faulty.</li> </ul>	<ul style="list-style-type: none"> <li>a. Rotate emergency stop buttons clockwise to disengage.</li> <li>b. Plug in cable connectors at front of upper control box.</li> <li>c. Plug in cable connectors in opposite receptacles at upper control box.</li> <li>d. Repair wire break or replace faulty switch.</li> </ul>
3. When UP function is selected, pump motor runs but will not raise the platform.	<ul style="list-style-type: none"> <li>a. Hydraulic oil level low in reservoir.</li> <li>b. More than 450 lbs. on lift platform.</li> <li>c. Emergency lowering valve open.</li> <li>d. Up valve solenoid or solenoid wiring faulty.</li> <li>e. Down valve sticking open or leaking.</li> <li>f. UP switch or UP switch wiring faulty.</li> <li>g. Mast sections dirty; slide blocks binding.</li> <li>h. Internal leakage in hydraulic cylinder.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check reservoir level. If low, check for oil system leakage. Refill reservoir and bleed air from hydraulic system per instructions in paragraph 4-3.</li> <li>b. Ensure load is 450 lbs. or less.</li> <li>c. Close emergency lowering valve.</li> <li>d. Check voltage at up valve solenoid. If no voltage, check wiring. If voltage, exchange solenoids and recheck function; replace solenoid if faulty.</li> <li>e. Repair or replace down valve.</li> <li>f. Check for lighted UP LED when up switch is engaged. If LED does not light, signal is not reaching main controller; repair wire break or replace faulty switch.</li> <li>g. Clean and lubricate masts with dry silicone. If needed, adjust slide blocks per paragraph 4-5.</li> <li>h. Check cylinder housing for heat buildup due to leakage. If leakage is indicated, repair or replace hydraulic cylinder.</li> </ul>

Table 4-3. Troubleshooting Chart (Continued)

Problem	Cause	Correction
4. ENABLE pushbutton blinks when pressed.	<ul style="list-style-type: none"> <li>a. ENABLE pushbutton has been pressed down for longer than 5 seconds without a function being selected.</li> <li>b. Joystick potentiometer out of adjustment (will not return to center).</li> <li>c. Did not press ENABLE pushbutton first before moving joystick to forward or reverse drive.</li> <li>d. Tried to drive forward or reverse and raise or lower the platform at the same time.</li> </ul>	<ul style="list-style-type: none"> <li>a. Release ENABLE pushbutton and press again.</li> <li>b. Adjust joystick forward/reverse travel potentiometer for null drive signal with joystick at center.</li> <li>c. Release ENABLE pushbutton and press again before moving joystick.</li> <li>d. Release ENABLE pushbutton and run only one function (drive or lift) at a time.</li> </ul>
5. When DOWN function is selected, lift platform will not descend.	<ul style="list-style-type: none"> <li>a. Down valve solenoid or solenoid wiring faulty.</li> <li>b. Down valve sticking; does not open.</li> <li>c. DOWN switch or DOWN switch wiring faulty.</li> <li>d. Underguard switches activated</li> </ul>	<ul style="list-style-type: none"> <li>a. Check voltage at down valve solenoid. If no voltage, check wiring. If voltage, exchange solenoids and recheck function; replace solenoid if faulty.</li> <li>b. Repair or replace down valve.</li> <li>c. Check for lighted DOWN LED when down switch is engaged. If LED does not light, signal is not reaching main controller; repair wire break or replace faulty switch.</li> <li>d. Remove object from underguard or readjust/replace switches.</li> </ul>
6. Alarm is sounding; lift UP and travel functions stopped working.	<ul style="list-style-type: none"> <li>a. Lift vehicle more than 1 degree out of level.</li> </ul>	<ul style="list-style-type: none"> <li>a. Lower lift platform and drive lift vehicle to level area.</li> </ul>
7. When joystick is moved, lift vehicle will not travel.	<ul style="list-style-type: none"> <li>a. Wheels blocked.</li> <li>b. Free wheel lever in free wheel (tow) position.</li> <li>c. Joystick or joystick wiring faulty.</li> <li>d. Main controller or main controller signal wiring faulty.</li> <li>e. Motor controller 24-volt power cable disconnected.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check wheels for blocking; remove travel obstacle.</li> <li>b. Move free wheel lever back to drive position.</li> <li>c. Check for lighted travel LED when joystick is engaged. If travel LED does not light, travel signal is not reaching main controller; repair wire break or replace faulty joystick.</li> <li>d. Check for output voltage to motor controller when joystick is engaged. If travel signal is not present at main controller, contact Bil-Jax for assistance. If travel signal is not present at motor controller, repair wire break.</li> <li>e. Check connection of 24-volt power cable to motor controller; repair faulty power cable connection.</li> </ul>

Table 4-3. Troubleshooting Chart (Continued)

Problem	Cause	Correction
7. When joystick is moved, lift vehicle will not travel. (cont)	f. Motor controller, motor controller output wiring, or transaxle drive motor faulty.  g. Transaxle drive train damaged.	f. Check for output voltage to drive motor when joystick is engaged. If drive voltage is not present at motor controller, replace motor controller. If drive voltage does not reach drive motor, repair wire break. If drive voltage is present at drive motor, replace drive motor.  g. If transaxle drive motor runs, inspect drive train components for damage. Repair or replace transaxle gearhouse, if damaged.
8. When steering thumb switch is pressed, steering wheels do not swivel.	a. Wheels turned to steering limit. b. 10 Amp Motors fuse burned out on main controller board. c. Internal steering actuator fuse. d. Thumb switch or thumb switch wiring faulty.  e. Actuator or actuator wiring faulty.  f. Steering linkage failed.  g. Main controller faulty.	a. Turn wheels in opposite direction. b. Replace 10 Amp Motors fuse.  c. Replace steering actuator fuse. d. Check for lighted steering LED when thumb switch is engaged. If LED does not light, signal is not reaching main controller; repair wire break or replace faulty joystick.  e. Check actuator wiring for operating voltage. If voltage is present, replace faulty actuator. If voltage is not present, check actuator wiring for continuity; repair wire breaks.  f. Check steering linkage for damage; replace damaged parts.  g. Contact Bil-Jax for assistance.
9. When BATTERY ON/OFF switch is turned ON, hydraulic pump starts up.	a. Motor start relay failure; relay contacts fused shut.	a. Replace motor start relay.



### Troubleshooting Aids

See Table 4-4 for interpreting LED indicators located on the main controller board shown in Figure 4-14. Hydraulic and PC logic diagrams are shown in Figures 4-15 and 4-16. An electrical wiring diagram is shown in Figure 4-17.

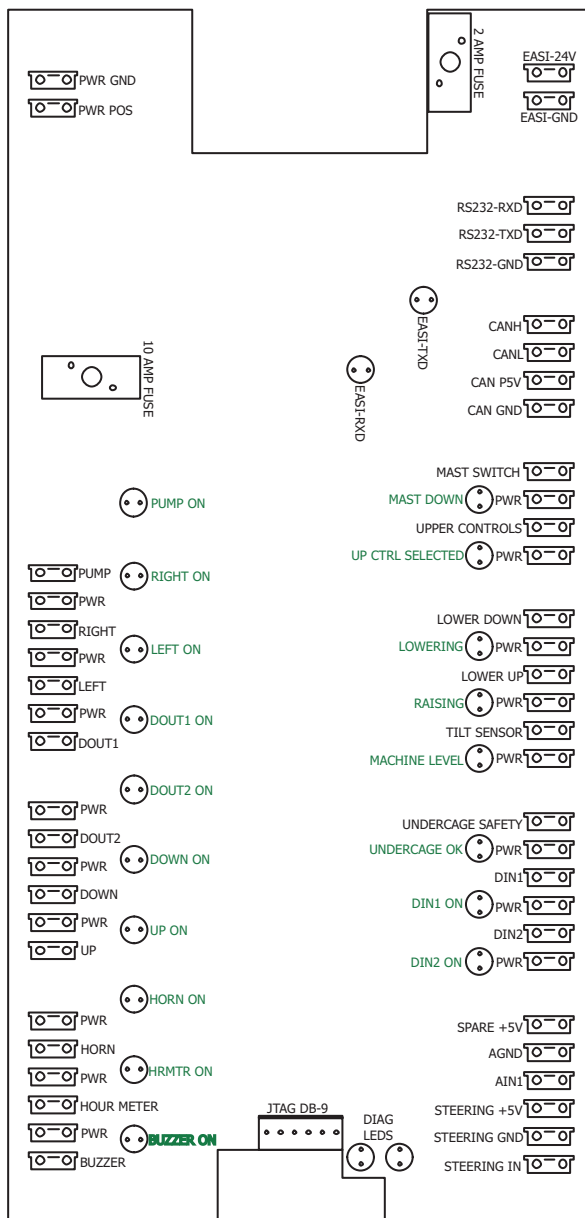


Figure 4-14. Main Controller Board

**Table 4-4. Main Controller LED Indicators**

<b>Indicator</b>	<b>Function</b>	<b>Color</b>
Main Controller Diagnostics	Error Codes Flashes 1: Main Controller OK Flashes 2: Short or open at hydraulic pump output Flashes 3: Short circuit on the Up, Down, Horn, Buzzer, or Hour Meter outputs Flashes 4: Short circuit on one of the Steering outputs Flashes 5: Error reading/writing NVM-using default values	Red
System Diagnostics	Error Codes Flashes 1: System OK Flashes 2: Tilt limit exceeded Flashes 3: Transaxle brake error Flashes 4: Unable to Communicate with Motor Controller Flashes 5: Unable to Communicate with Joystick	Green
EASI-TXD	Upper Control Transmitting	Green
EASI-RXD	Upper Control Receiving	Green
Mast Down	Mast Down Switch Output	Green
Lower Down	Lower Mast Down Output	Green
Lower Raise	Lower Mast Up Output	Green
Upper Controls	Upper Controls Activated	Green
Steer Left	Steer Left Output	Green
Steer Right	Steer Right Output	Green
Down Valve	Platform Down Output	Green
Up Valve	Platform Up Output	Green
Horn ON	Horn Output	Green
Hour Meter	Hour Meter On Output	Green
Pump ON	Pump Motor Running Output	Green
	IN-4, IN-5, IN-6, IN-7 (Spare Inputs)	Green

**NOTE: If a short is detected on either Up, Down, Horn, or Buzzer, none of the outputs will function. If any of the error codes listed above are detected, see the following pages to further troubleshoot the problem.**

---

## **Main Controller Troubleshooting**

### **Lower Control Mode**

- **Up Command Does Not Work**

1. Check if the LED “UP CTRL SEL” on the main controller is OFF. If it’s ON, check the Upper/Lower selector switch and make sure it’s set to Lower Control.
2. While holding “UP” command switch ON,
  - a. Check LED labeled “RISING” on the main controller. It should be ON, indicating the UP command switch is OK. If the LED is OFF, the UP/DOWN command switch on the machine or the wiring may be faulty.
  - b. LED’s labeled “PUMP ON” and “UP ON” should be ON. If LED “RISING” is ON, but LED’s “PUMP ON” or “UP ON” are OFF, the main controller may be faulty.

- **Down Command Does Not Work**

1. Check if the LED “UP CTRL SEL” on the main controller is OFF. If it’s ON, check the Upper/Lower selector switch and make sure it’s set to Lower Control.
2. While holding “DOWN” command switch ON,
  - a. Check LED labeled “LOWERING” on the main controller. It should be ON, indicating the DOWN command switch is OK. If the LED is OFF, the UP/DOWN command switch on the machine or the wiring may be faulty.
  - b. LED labeled “DOWN ON” should be ON. If LED “LOWERING” is ON, but LED “DOWN ON” is OFF, the main controller may be faulty.

## **Upper Control Mode**

- **No Power To The Joystick: No Communication**

-There is power on the main controller, but not on the joystick.

1. When in Upper Control Mode, LED "UP CTRL SEL" should be ON. If it's OFF, check the Upper/Lower selector switch and make sure it's set to Upper Control.
2. Make sure the joystick is connected to EASI POS and EASI NEG terminals of the main controller.
3. Make sure E-STOP switch on the joystick is OFF.
4. Make sure LED's EASI-TXD and RXD on the main controller are blinking at high frequency. If not, Check Fuse F1 located on the main controller. If all of the above are O.K, the joystick may be faulty.

- **Joystick Does Not Drive The Motor**

-Moving the joystick forward or reverse does not drive the machine.

1. Check if there is communication between the main controller and the joystick. If L1 and L2 LED's on the joystick are not blinking rapidly, there is no communication. Refer to the previous step to troubleshoot "No Communication".
2. L1 and L2 on the joystick are blinking rapidly, but unit still does not drive, then:
  - a. Press "ENABLE" on the joystick, move the joystick forward, Check if LED "HRMTR ON" turns on. If not on, the main controller may be faulty. Check fuse F2 on the main controller.
  - b. If the LED turns on, but unit still doesn't drive, the motor controller may be faulty. Refer to the Motor Controller Troubleshooting section.

- **UP/DOWN, LEFT/RIGHT Commands Do Not Work**

-When pressing UP, DOWN, LEFT, or RIGHT switches on the joystick, the machine does not respond.

1. Check if there is communication between the main controller and the joystick. If L1 and L2 LED's on the joystick are not blinking rapidly, there is no communication. Refer to the previous step to troubleshoot "No Communication".
2. For faulty UP command:
  - a. Hold "UP" switch on the joystick, make sure it lights up. If it doesn't, the internal bulb may be blown or the switch may be faulty.
  - b. Press "UP" and "ENABLE" on the joystick. Make sure that LED's "PUMP ON", "UP ON" and "HRMTR ON" turn ON. If not, the main controller may be faulty.
3. For faulty DOWN command:

- a. Hold "DOWN" switch on the joystick, make sure it lights up. If it doesn't, the internal bulb may be blown or the switch may be faulty.
  - b. Press "DOWN" and "ENABLE" on the Joystick. Make sure LED's "DOWN ON" and "HRMTR ON" turn ON. If not, the main controller may be faulty.
4. For faulty LEFT/RIGHT command:
    - a. Hold "ENABLE" & "LEFT" switch on the joystick, check LED's "PUMP ON" & "LEFT ON" turn ON. If not, the "LEFT" switch on the joystick or the main controller may be faulty.
    - b. Hold "ENABLE" & "RIGHT" switch on the joystick, check LED's "PUMP ON" & "RIGHT ON" turn ON. If not, the "RIGHT" switch on the joystick or the main controller may be faulty.

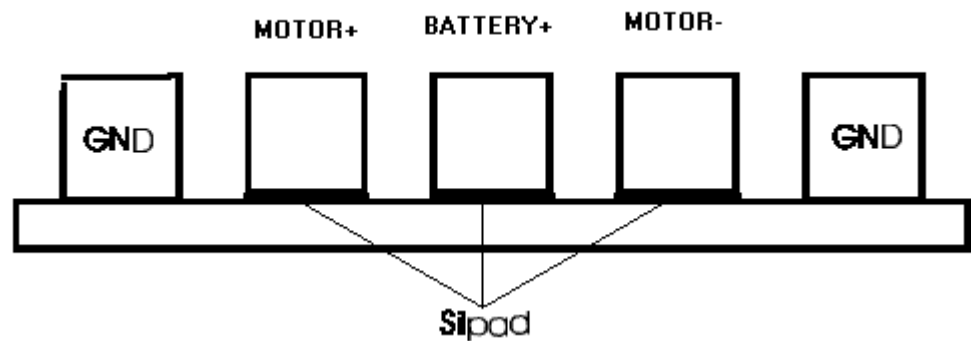
- **Joystick Switches Work But Do Not Light Up**

-"ENABLE", "UP", "DOWN", steering LED's do not light up, but the functionality is fine.

1. "ENABLE", "UP", "DOWN" switches work but the bulbs inside the switches won't turn ON possibly because of internal bulbs being blown or the wiring to the bulb may be loose.
2. Steering angle LED display won't turn ON due to possible following reasons:
  - a. Blown LED's (very unlikely that all LED's are blown), if none turn ON, the joystick may not be providing proper signal.
  - b. Faulty wiring between the LED board and the joystick board or a loose connection.
  - c. The wiring between the steering angle sensor to the main controller (Steering IN) may be faulty.

## Motor Controller Troubleshooting

1. Make sure there is Power present on the Motor Controller unit. L2 should be ON, if not ON, check to see if the power cable is properly connected to the unit. If still no power to the unit, please check resistances between the following terminals. If any resistance fails, the motor controller is faulty.
  - a. GND and POWER Very High ~ M ohms
  - b. GND and MOTOR + Very High
  - c. GND and MOTOR - Very High
  - d. POWER and MOTOR + Very High
  - e. POWER and MOTOR - Very High



2. Make sure the unit is communicating with the main controller (refer to the Blink Codes). L7 and LED1 on the motor controller should be blinking at high frequency. If not, check wiring between J12 of the motor controller to the main controller. Check fuse on the motor controller.
3. Make sure the brake is ok.
  - a. L5 on the Motor Controller is ON and L6 is OFF. If L5 is OFF, it means that the brake's manual override system is activated. In such case, the motor controller will not drive the motor. Manual override lever situated on the brake should be disengaged in order for the motor controller to drive the motor.
4. L6 should only turn ON when the joystick is moved either forward or reverse. If L6 remains ON or OFF regardless of the position of the joystick, the motor controller may be faulty.

## Beeper Codes

The audible alarm beeper can be used to troubleshoot conditional problems with the ESP as opposed to the electrical errors listed on the previous pages. The following beeper codes are listed by the length of time the audible alarm sounds.

BEEPER CODES	CONDITION
Beeeeeep____Beeeeeep____Beeeeeep____ (long beep, long pause, long beep, long pause...)	Normal Motion Indicator – Machine operating properly.
Be__Be__Be__Be__ (short beep, pause, short beep, pause...)	Machine Out of Level With Platform Down – Platform will not raise.
B__B__Be__B__B__Be__ (very short beep, short pause, very short beep, short pause, short beep, short pause...)	Machine Out of Level With Platform Raised – Platform will not raise and machine will not drive.
B__Beeeeeep__B__Beeeeeep__B__Beeeeeep__ (very short beep, short pause, very long beep, short pause, very short beep, short pause...)	Object On Underguard – Platform will not lower and machine will not drive.
Beeeeeep (continuous beep)	Low Battery Warning – Immediately drive machine to recharging area and plug-in to wall outlet.

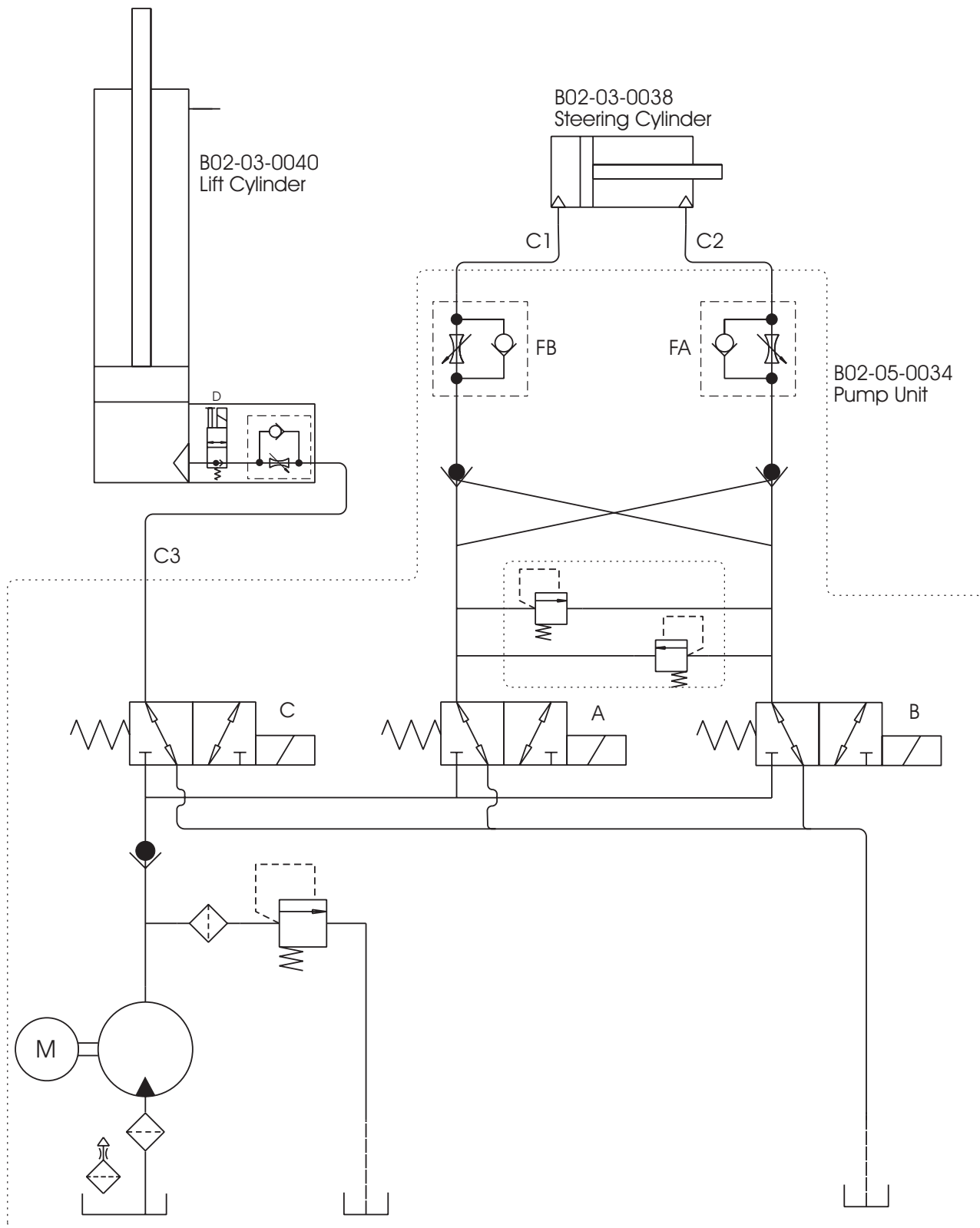


Figure 4-15. Hydraulic Diagram



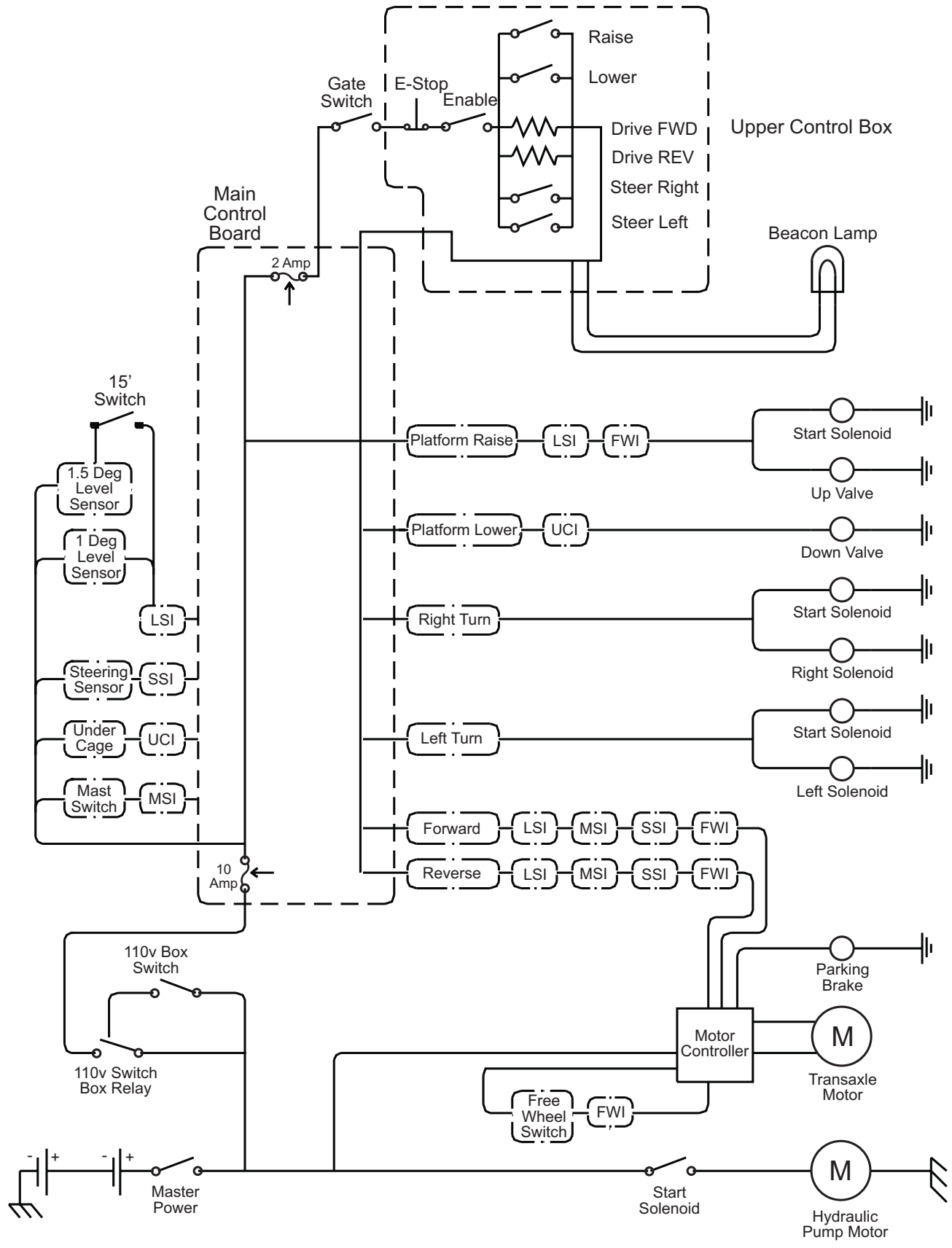


Figure 4-16. PC Logic Diagram

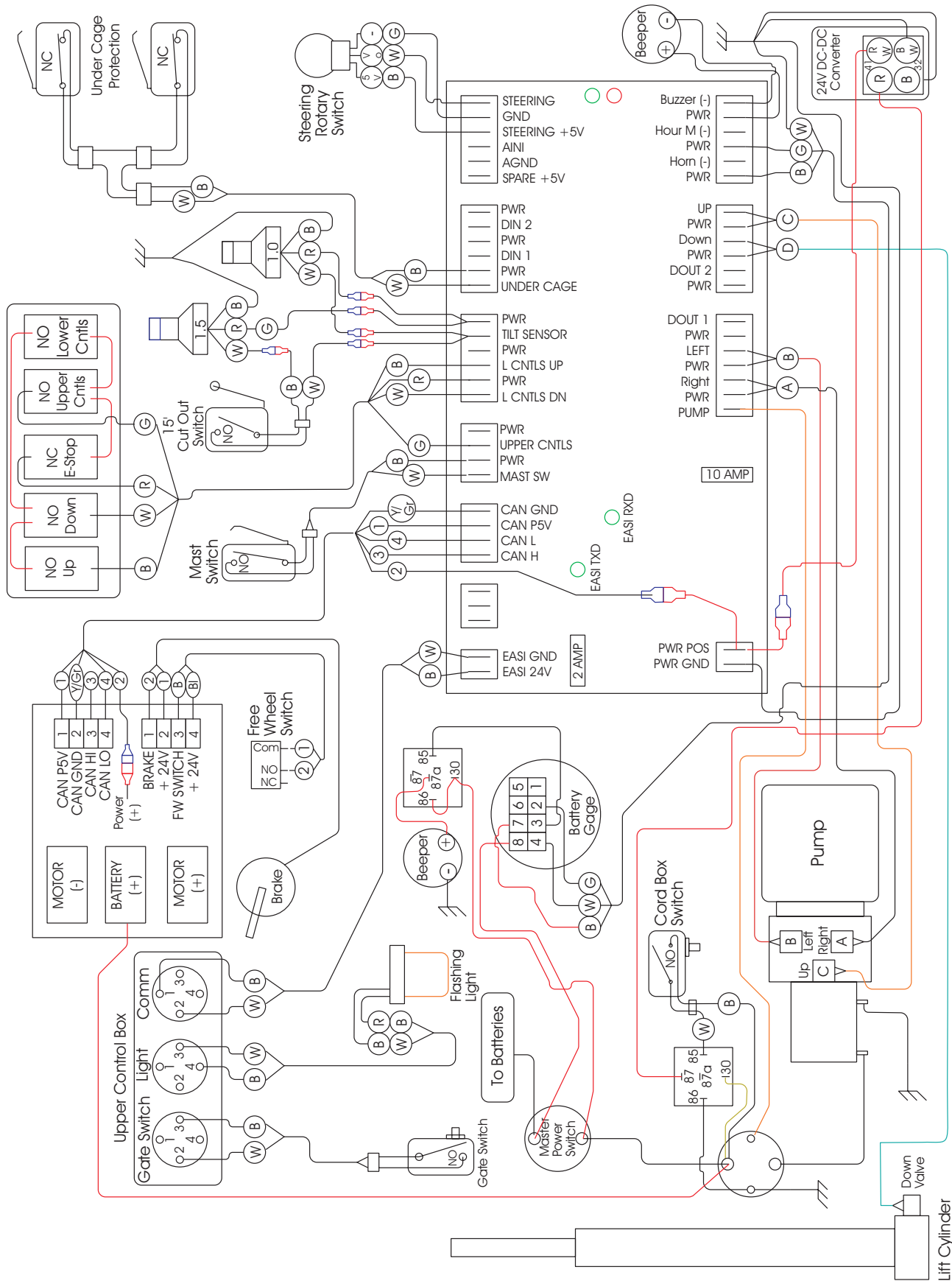


Figure 4-17. Electrical Layout

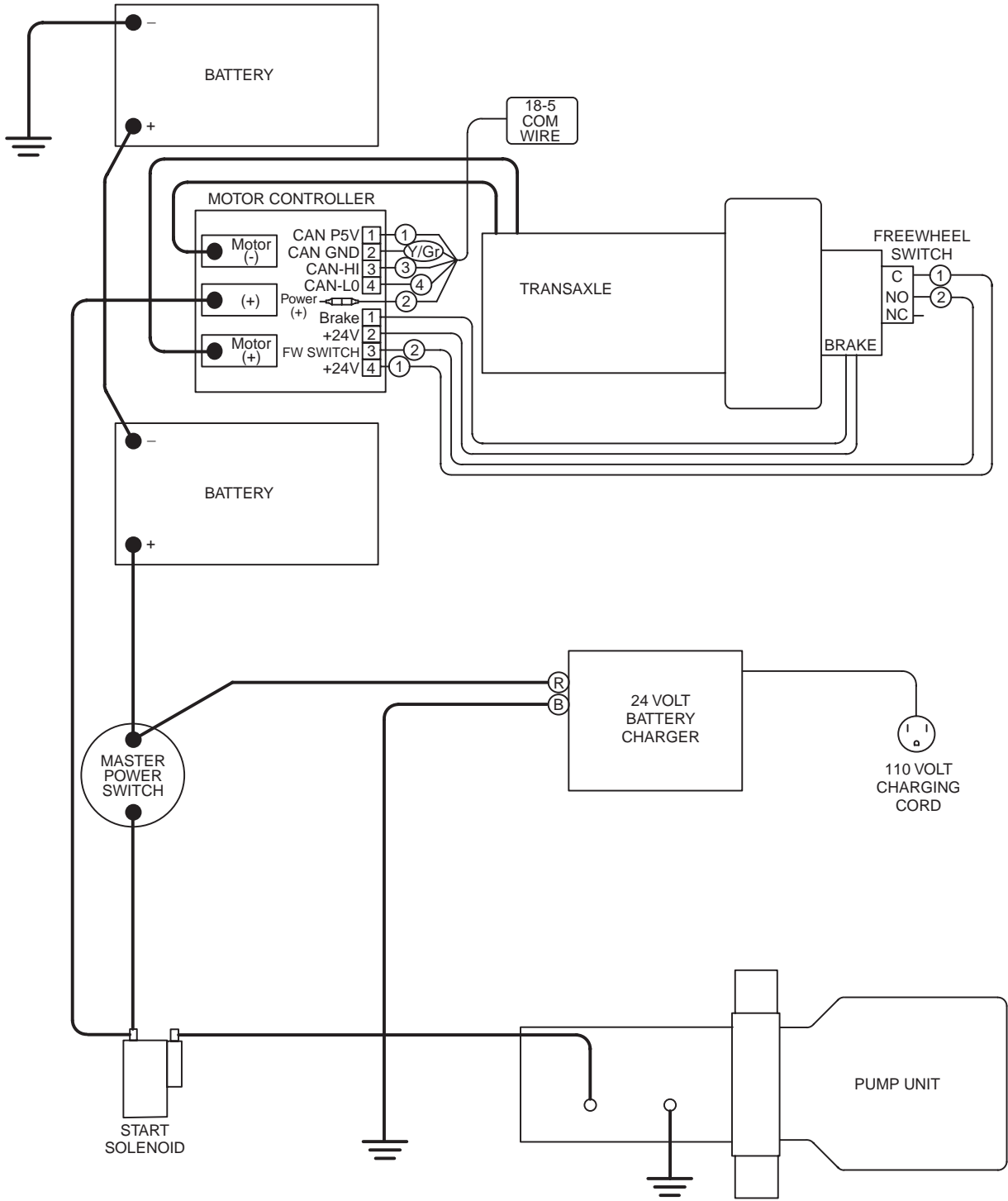


Figure 4-18. Drive Wiring Diagram

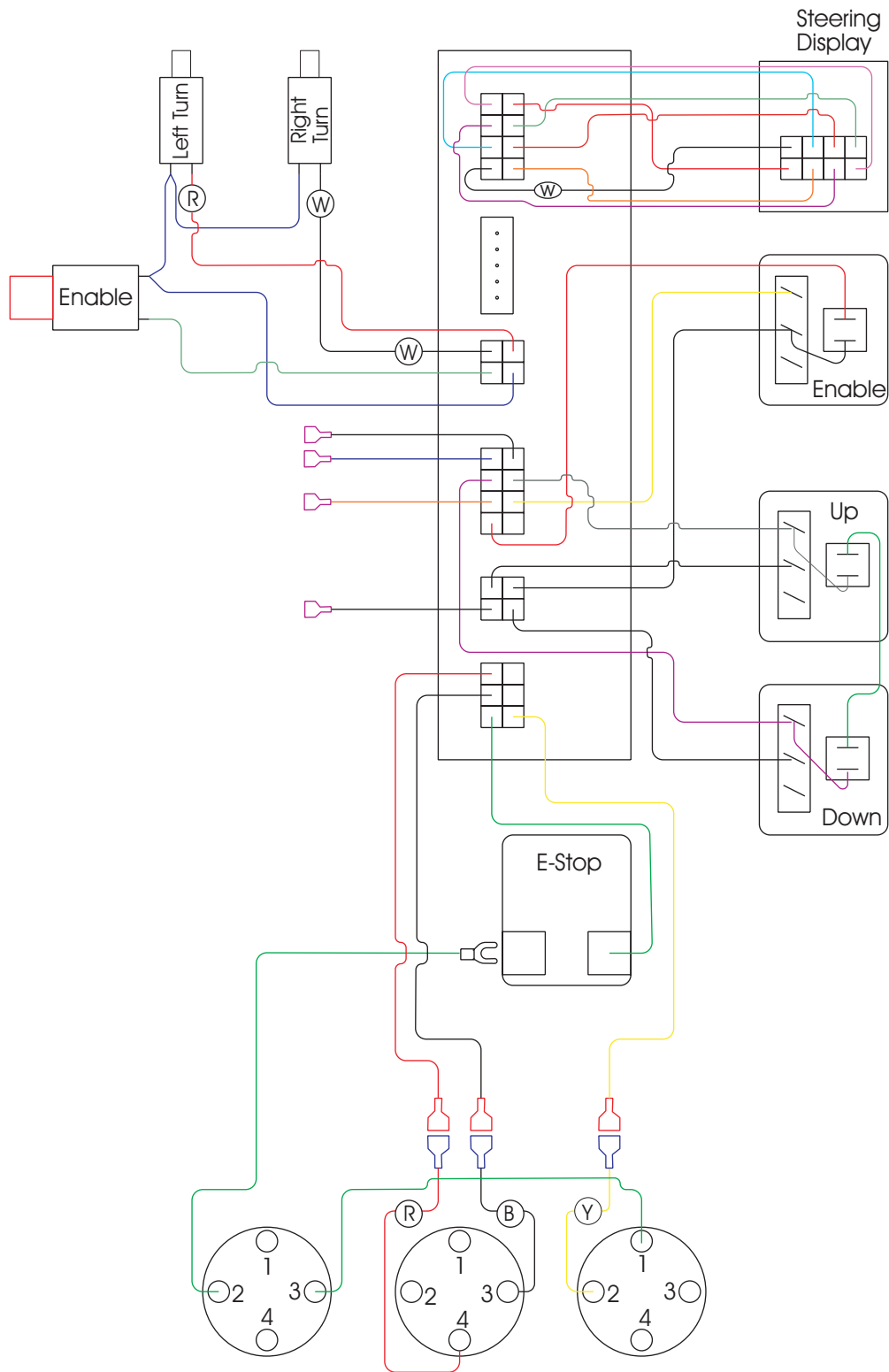


Figure 4-19. Upper Control Wiring Diagram

# 5

## Replacement Decals

Refer to Table 5-1, and Figures 5-1, 5-2, and 5-3 for descriptions and locations of decals on the ESP 19.

**Table 5-1. Replacement Decals**

Decal No.	Description of Decal	Qty	Decal No.	Description of Decal	Qty
B06-00-0009	Warning...Moving telescopic masts will create...	2	B06-00-0383	Danger...Failure To Comply With The Following...	1
B06-00-0034	Danger...During charging, explosive oxyhydrogen gas...	1	B06-00-0390	Trans Axle Instruction	2
B06-00-0037	Lubricate Semi-Annually	4	B06-00-0453	ESP 19 Horizontal Logo	1
B06-00-0066	Insert Forks Minimum 32"...	2	B06-00-0454	ESP 19 Vertical Logo	2
B06-00-0068	SAE 10W Hydraulic Oil	1	B06-00-0455	Bil-Jax (Vertical transfer type decal)	2
B06-00-0138	Warning...(Maintenance decal)	1	B06-00-0456	800-225-3765 For Service	1
B06-00-0146	Danger...(High voltage line warning)	1	B06-00-0457	Warning...Stay clear while work platform is raised	1
B06-00-0173	Safety harness lanyard attachment point	2	B06-00-0458	Maximum Capacity 150 lbs.	2
B06-00-0192	Operation and service manual inside	1	B06-00-0459	For Bicycles Only	2
B06-00-0225	Warning...Stay clear when raising or lowering	2	B06-00-0460	Caution (Black on Yellow)	2
B06-00-0289	Check level with cage fully down	1	B06-00-0461	Operation Instructions for ESP 19	4
B06-00-0297	Forklift Pockets	1	B06-00-0462	Battery Charger Cord Box	1
B06-00-0339	Warning...Full Body Harness and Lanyard...(Not used on lifts with fully enclosed platform)	1	B06-00-0463	Do Not Pick Machine Up From This End	1
B06-00-0349	Operation Instructions for Battery Charger	1	B06-00-0464	Emergency Lowering	1
B06-00-0359	Serial Number Tag (Not available as replacement part)	1	B06-00-0469	Warning...This is not a work platform or a shelf	1
B06-00-0382	Caution...This machine designed and manufactured...	1	B06-00-0470	Low battery alarm	1
			B06-00-0492	Turn Master Power Switch Off...	1
			B06-00-0500	Maximum Capacity...450 lb.	4
			B06-00-0501	Tip Over Hazard	2
			B06-00-0509	Wheel Loading	2
			B06-00-0532	Slope Warning	2

### OPERATION INSTRUCTIONS FOR ESP 19

1. Read and follow safety precautions and all responsibilities sections set forth in the operators manual
2. Make sure the lift is on a firm and level surface and that there are no potential hazards such as overhead obstructions or electrically charged conductors. **DO NOT** use the lift where such hazards exist.
3. Check the lift for damaged or worn parts and **repair or replace** as necessary.
4. Check to be sure that the cage is properly attached to the lift.
5. Turn master power switch to on.
6. Check to be sure all safety devices are functioning properly.
7. To operate lift from the ground turn and hold lower control switch to "lower control" setting then select either up or down function.
8. To operate lift from the platform, turn lower control switch to "upper control" setting.
9. Make sure battery charger cord is disconnected from outlet, placed back into its box and lid is closed and latched. **LIFT WILL NOT OPERATE IF LID IS NOT CLOSED SECURELY.**
10. Enter platform and be certain that the entry gate is closed completely. **LIFT WILL NOT OPERATE IF ENTRY GATE IS NOT CLOSED COMPLETELY.**

**TO RAISE OR LOWER:**

- Depress and hold one of the "enable" buttons (one "enable" button is on the front of the joystick handle, the other is located to the left of the joystick).
- Press either the raise or lower button.

**TO DRIVE:**

- Depress and hold one of the "enable" buttons (one "enable" button is on the front of the joystick handle, the other is located to the left of the joystick).
- Push joystick in the direction (forward or backward) that you wish to travel.
- Press the steering thumb switch on the top of the joystick in the direction you wish the lift to turn (either right or left).
- The joystick and steering thumb switch may be operated simultaneously for smooth maneuvering.
- **DO NOT** attempt to operate the drive function and the raise/lower function at the same time.

**⚠ WARNING**

This lift is equipped with a level sensor that will prevent the lift from raising or driving with platform elevated while on an unlevel surface. If the lift fails to raise or drive while elevated, lower platform immediately.

806-00-0461

B06-00-0461

**E.S.P. 19**  
SERIAL NO. ESP  
MAX. PLATFORM HT. 19'6"  
POWER SOURCE: 24V DC  
Patents Pending

**bil-jax**  
125 PALMER PARKWAY  
ARCHBOLD, OH 43002 U.S.A.  
800-527-5333

B06-00-0359

**Electric**  
**Stock**  
**Picker**  
**ESP 19**  
800-225-3765  
CTG      © Bil-Jax, Inc. 2004      806-00-0454

B06-00-0454

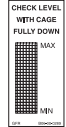
**⚠ DANGER**

**FAILURE TO COMPLY WITH THE FOLLOWING INSTRUCTIONS OR ANY OTHER IMPROPER USE OR MAINTENANCE OF THIS EQUIPMENT WILL RESULT IN INJURY OR DEATH.**

- Risk of Electric Shock  
**DO NOT** expose charger to rain, power wash detergents or spray - **DO NOT** use frayed or damaged electric cords when charging.
- During charging, explosive oxyhydrogen gas is generated. **DO NOT** smoke or allow open fire, sparks, or embers near battery when charging.
- Connect input cord only to properly grounded three wire outlet with specified voltage and frequency.
- **Always** wear safety goggles and face shield when working on or near battery.
- Check battery acid level at the start of each day. If acid does not cover the plates, add only enough distilled or demineralized water to completely cover the plates.
- Keep terminals and terminal connections clean.
- Consult Operation and Maintenance Manual for additional information on battery maintenance.

806-00-0034

B06-00-0034



B06-00-0289

**Operation Instructions for Battery Charger**

Since batteries are the power source for the machine, proper battery care cannot be overemphasized. Recharge batteries after each work shift. When the machine is not being used, batteries should be charged at least once a week.

The normal charging time should be 10 to 12 hours. If batteries are extremely low, charging time may be as long as 24 hours. Charge batteries as follows:

- Connect an extension cord from a 110V AC 60 Hz outlet to the flush mount receptacle. The extension cord to be used should be as short and large as possible. A small, long cord will decrease the output of the charger due to the voltage drop in the line; this will increase the charge back time.
- If there is power in the line the "on-charging" red LED light will indicate charge current is flowing, and the ammeter will show the rate of charge.
- Once the battery voltage reaches a predetermined level programmed in the electronic control, the "80% Charge" yellow LED will turn on.
- 3-1/2 hours after the yellow light goes on the charge will be completed and the charger will automatically shut-off. At this time, all the LED's will turn off.

**NOTE:** If the battery does not reach the 80% level in 14 hours, the charger will shut off and the "check battery" red LED light will turn on. This is to avoid prolonged charging of a defective battery that will not properly charge.

806-00-0349

B06-00-0349

**⚠ DANGER**

**FAILURE TO COMPLY WITH THE FOLLOWING SAFETY INSTRUCTIONS OR ANY OTHER IMPROPER USE OF THIS EQUIPMENT WILL RESULT IN SERIOUS INJURY OR DEATH.**

**BEFORE USE:**

- This equipment to be used by competent, fully trained, and authorized personnel only. Operator must read and understand owner's manual and all decals before operating. It is the operator's responsibility to comply with all warnings and instructions.
- NEVER TAKE CHANCES - DO NOT operate this lift if you are under the influence of drugs or alcohol, or if you feel dizzy, ill or unsteady in any way.
- ALWAYS survey the job site and identify all potential hazards.
- DO NOT override or alter any safety devices or make any modifications that would affect the original design of the lift.
- Inspect unit for damaged or worn parts. DO NOT use unit until such parts are replaced. DO NOT use if lift is not working properly.
- DO NOT use when exposed to wind, rain, snow or ice.
- Check all safety devices for proper function prior to each use.
- DO NOT use without entry gate in the closed position unless operator is wearing a full body harness and lanyard and with the required attached to factory provided attachment point.

**DURING USE:**

- DO NOT raise platform while on uneven, soft, or sloped surfaces.
- DO NOT DRIVE lift onto uneven, soft, or sloped surfaces while elevated.
- DO NOT climb up or down mast.

**OWNERS & OPERATORS ARE RESPONSIBLE FOR INSPECTION, MAINTENANCE, TRAINING, AND OPERATION AS REQUIRED BY THE OWNERS MANUAL AND THE ANSI A92.6 STANDARD (IN EFFECT AT DATE OF MANUFACTURE).**

**WORKFORCE**  
AERIAL WORK PLATFORMS

806-00-0383

B06-00-0383

**⚠ CAUTION**

This machine is designed and manufactured in compliance with the ANSI A92.6 standard in force on the date of manufacture. Dealers, owners, users, operators, lessors, and lessees are responsible for inspection, maintenance, training, and operation as required by A92.6 and the owners manual.

Alterations, modifications, or changes to this machine without the written authorization of bil-jax, inc. as well as any unauthorized adjustment of valves, disabling or by-passing of safety devices or the improper use of this machine shall exempt bil-jax, inc. from any liability for any resulting injuries or damage.

806-00-0382

B06-00-0382

**OPERATION AND SERVICE MANUAL INSIDE**

806-00-0192

B06-00-0192

**⚠ WARNING**

**FAILURE TO COMPLY WITH THE FOLLOWING MAINTENANCE REQUIREMENTS COULD RESULT IN SERIOUS INJURY OR DEATH**

- Follow complete maintenance schedule outlined in Owner's Manual and Section 6 of the ANSI standard reproduced in the Owner's Manual.
- Inspect all chain assemblies, fasteners, pins, and related parts daily for wear, damage, proper tightness, and function. Replace according to Owner's Manual recommendations.
- Do not overtighten slide blocks.
- Slide block paths must be kept clean - free of dirt, grease, and other foreign material.
- DO NOT use grease, oil, or any similar lubricant on masts or slide blocks. For additional lubrication, use dry silicone only.

806-00-0138

B06-00-0138

**Electric Stock Picker**  
**ESP 19**  
CTG      © Bil-Jax, Inc. 2004      806-00-0453

B06-00-0453

**LUBRICATE SEMI-ANNUALLY**  
CTG      © Bil-Jax, Inc. 2003      806-00-0037

B06-00-0037

**⚠ DANGER**

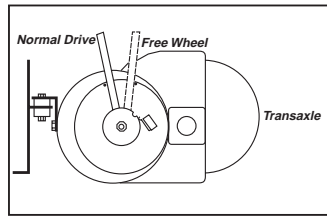
**IT IS UNLAWFUL TO OPERATE THIS EQUIPMENT WITHIN 10 FEET OF HIGH VOLTAGE LINES OF 50,000 VOLTS OR LESS.**

For safe clearance of lines in excess of 50,000 volts, see owners manual.

This machine is **NOT** insulated. Do not use within 10 ft. of power lines or other electrically charged sources. This machine **DOES NOT** provide protection for personnel from contact with or close proximity to any live electrical power source and should be considered energized by all personnel coming in contact with machine.

806-00-0146

B06-00-0146



B06-00-0390

**⚠ WARNING**

Moving telescopic masts will create pinch points. Keep fingers, hands, arms and feet clear of all telescopic mast sections at all times.

806-00-0009

B06-00-0009

**⚠ WARNING**

**STAY CLEAR WHILE RAISING OR LOWERING**

806-00-0225

B06-00-0225

Figure 5-1. Replacement Decals

**B  
I  
L  
J  
A  
X**

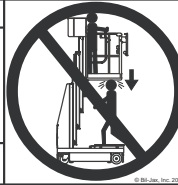
B06-00-0455

**WARNING**

**STAY CLEAR WHILE WORK PLATFORM IS RAISED**

- DO NOT work, stand, sit or place any part of your body under the work platform while platform is raised.
- DO NOT allow children to stand, sit or play on this lift.
- DO NOT place any objects on the base of the lift while the platform is raised.

**FAILURE TO COMPLY WITH THESE INSTRUCTIONS MAY RESULT IN SERIOUS CRUSHING INJURY OR DEATH.**



B06-00-0457

**BATTERY CHARGER CORD BOX**

- To charge batteries, plug cord into 3-prong 115V outlet only.
- Cord must be placed into box and lid closed and latched or lift will not operate.

B06-00-0462

**MAXIMUM CAPACITY 150 LBS.**

B06-00-0458

**800-225-3765 FOR SERVICE**      **FOR BICYCLES ONLY**

B06-00-0456

B06-00-0459

**CAUTION**

B06-00-0460

THE HYDRAULIC SYSTEM OF THIS MACHINE IS DESIGNED TO USE SAE TOW, LOW FOAMING HYDRAULIC OIL

B06-00-0068

INSERT FORKS MINIMUM 32" FOR TRANSPORT ONLY

B06-00-0066

**WARNING** **Rated Number of Occupants: One (1)**

**Tip Over Hazard**  
DO NOT exceed rated capacity. DO NOT exert horizontal side force to the platform while elevated. Failure to comply with the preceding instructions may result in the machine tipping over causing serious injury or death to the operator.

**Maximum Capacity: 450 lbs. / 204 kg**

Tool Tray (150 lb. max) + Platform (300 lb. max)	Or	Bike Rack (50 lb. max) + Platform (400 lb. max)
450 lbs. / 204 kg		450 lbs. / 204 kg

**Rated Horizontal Side Force: 0 lbs.**

B06-00-0500

**Forklift Pockets**



B06-00-0297

**WARNING**

This machine must not be operated on any slope greater than 5 degrees. Failure to follow these instructions will result in serious injury or death.

B06-00-0532

**EMERGENCY LOWERING VALVE**

**PULL AND HOLD TO LOWER**

B06-00-0464

**LOW BATTERY ALARM**

When audible alarm sounds continuously, lift batteries must be recharged immediately.

B06-00-0470

**DO NOT PICK MACHINE UP FROM THIS END**

B06-00-0463

**WARNING**

**THIS IS NOT A WORK PLATFORM OR A SHELF**

- DO NOT stand or sit on this mast cover.
- DO NOT use this mast cover as a work platform.
- DO NOT use this mast cover as a shelf or workbench by placing tools, equipment, merchandise or any other objects on it.

**FAILURE TO COMPLY WITH THESE INSTRUCTIONS MAY CAUSE THE MAST COVER TO FAIL AND RESULT IN SERIOUS INJURY OR DEATH.**

B06-00-0469

**NOTICE**

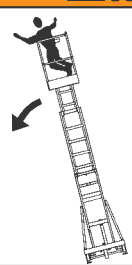
- Turn master power switch off when not in use. Failure to turn power off will drain batteries.
- Turn control box off before turning master power switch on.

B06-00-0492

**WARNING**

**Tip Over Hazard**

Battery weight is critical for lift stability. This lift must be equipped with two batteries having a total combined minimum weight of 165 lbs. DO NOT replace with batteries of lesser weight. Use only Bil-Jax authorized replacement parts.

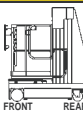


B06-00-0501

**CAUTION**

**MAXIMUM WHEEL LOADING**


Front 950 lbs (431 kg) per wheel  
Rear 900 lbs (408 kg) per wheel



B06-00-0509

**WARNING**

Full Body Harness and Lanyard must be used at all times during operation. Failure to wear Full Body Harness and Lanyard may allow operator to fall from platform resulting in serious injury or death.



B06-00-0339

Figure 5-1. Replacement Decals

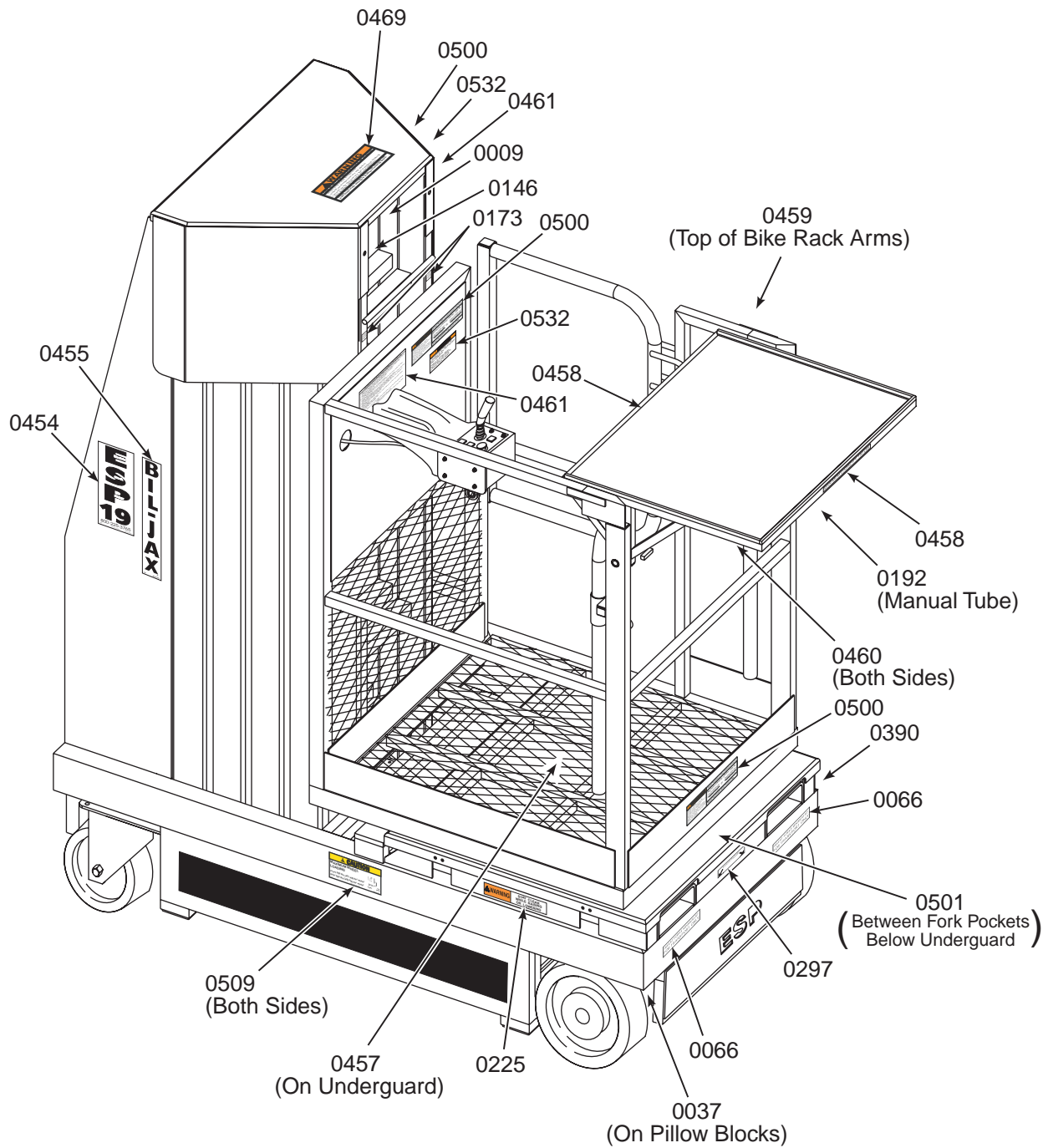


Figure 5-2. Decal Locations, Side View



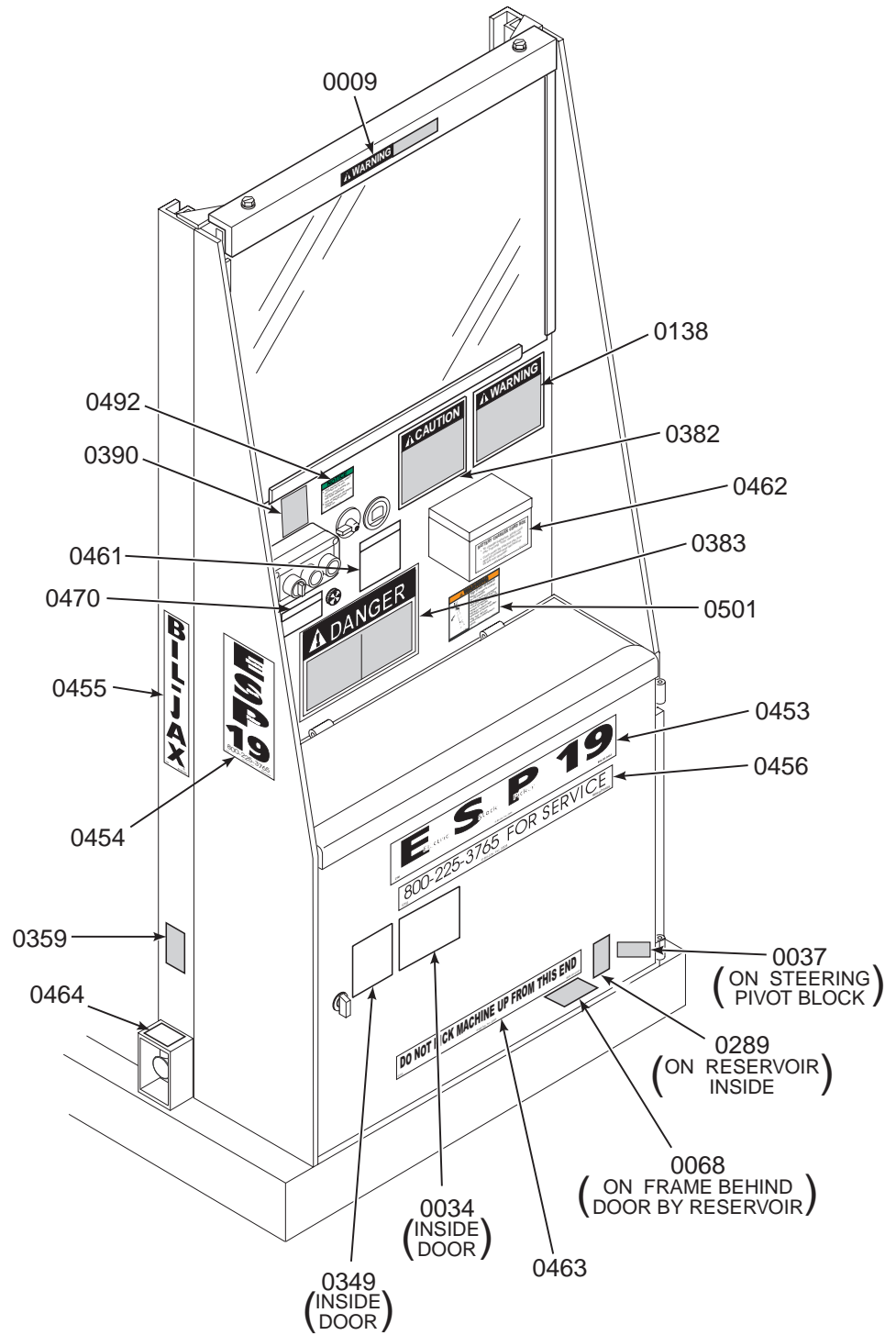


Figure 5-3. Decal Locations, Rear View



# 6

## Parts List

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## 6-1 FIRST MOVING MAST PARTS LIST

Refer to Table 6-1 for the parts list for the first moving mast.

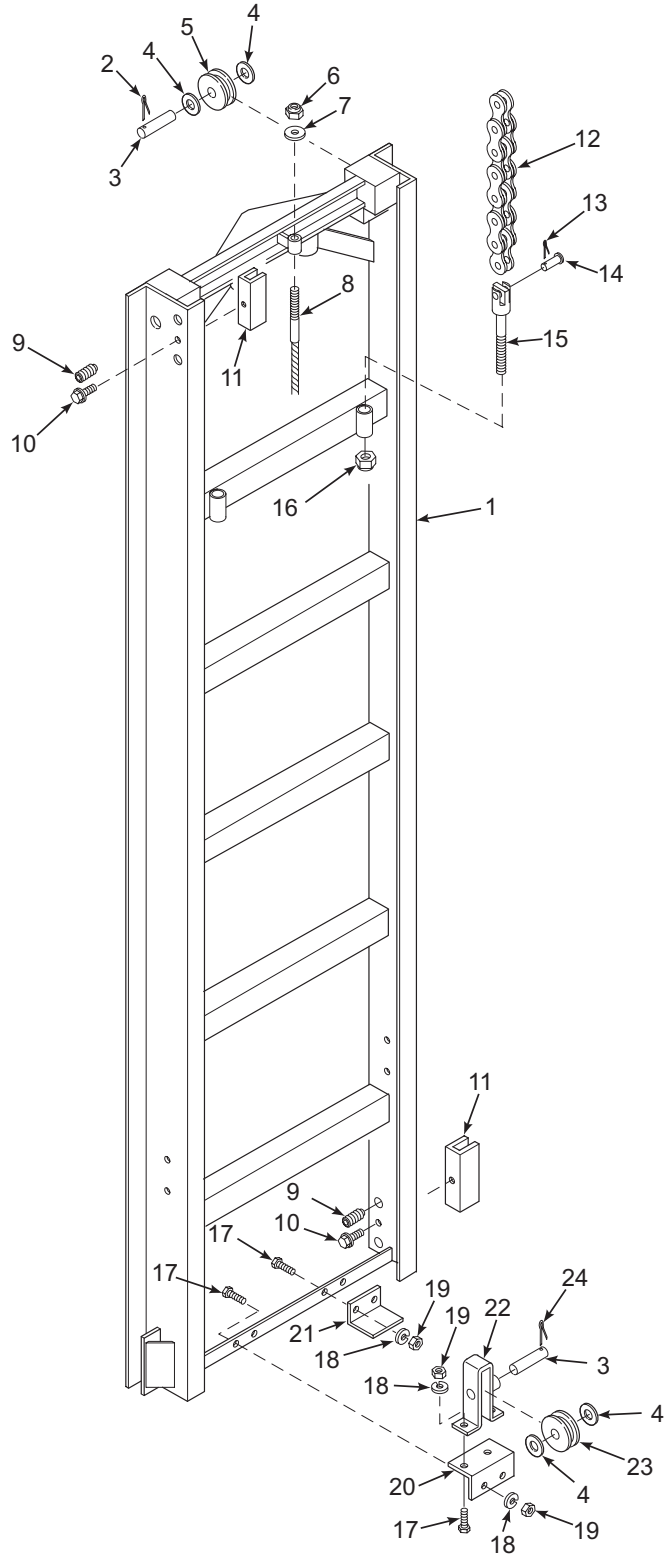


Figure 6-1. First Moving Mast

**Table 6-1. First Moving Mast Parts List**

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Qty</b>
1	B16-01-0044	First Moving Mast Weldment	1
2	0090-0770	Pin, Cotter 3/16 x 1-1/2 in.	2
3	B36-01-0002	Axle, Sheave	3
4	0090-0425	Washer, Flat, 5/8 in.	6
5	B26-00-0009	Sheave Assembly, Chain	2
6	0090-0188	Nut, Nylon Lock, 3/8-16	1
7	0090-0422	Washer, Flat, 3/8 in.	1
8	B40-00-0003	Cable, Steel, 3/16 in.	1
9	0090-0389	Screw, Set, 1/2-20 x 1/2 in.	8
10	0090-0403	Screw, Sheet Metal, #10 x 1	4
11	B31-00-0001	Slide Block, Plastic	4
12	B40-01-0008	Chain, Lift	2
13	0090-0860	Pin, Cotter	2
14	B04-07-0078	Pin, Clevis	2
15	B04-07-0088	Clevis, Upper	2
16	0090-0192	Nut, Nylon Lock, 1/2-13	2
17	0090-0042	Screw, Cap, 3/8-16 x 1 in.	6
18	0090-0210	Washer, Lock, Split, 3/8 in.	6
19	0090-0162	Nut, Hex, 3/8-16	6
20	B24-01-0008	Mounting Bracket	1
21	B29-00-0033	Mast Stop	1
22	B29-00-0078	Bracket, Weldment	1
23	B26-00-0001	Sheave, Cable	1
24	0090-0147	Pin, Cotter	1
*	B03-00-0009	Chain Assy, includes items 12, 13, 14, 15, 16 and Lower Clevis (shown on next page)	1

\*NOTE: It is recommended that chain parts be purchased as an assembly.

## 6-2 SECOND MOVING MAST PARTS LIST

Refer to Table 6-2 for the parts list for the second moving mast.

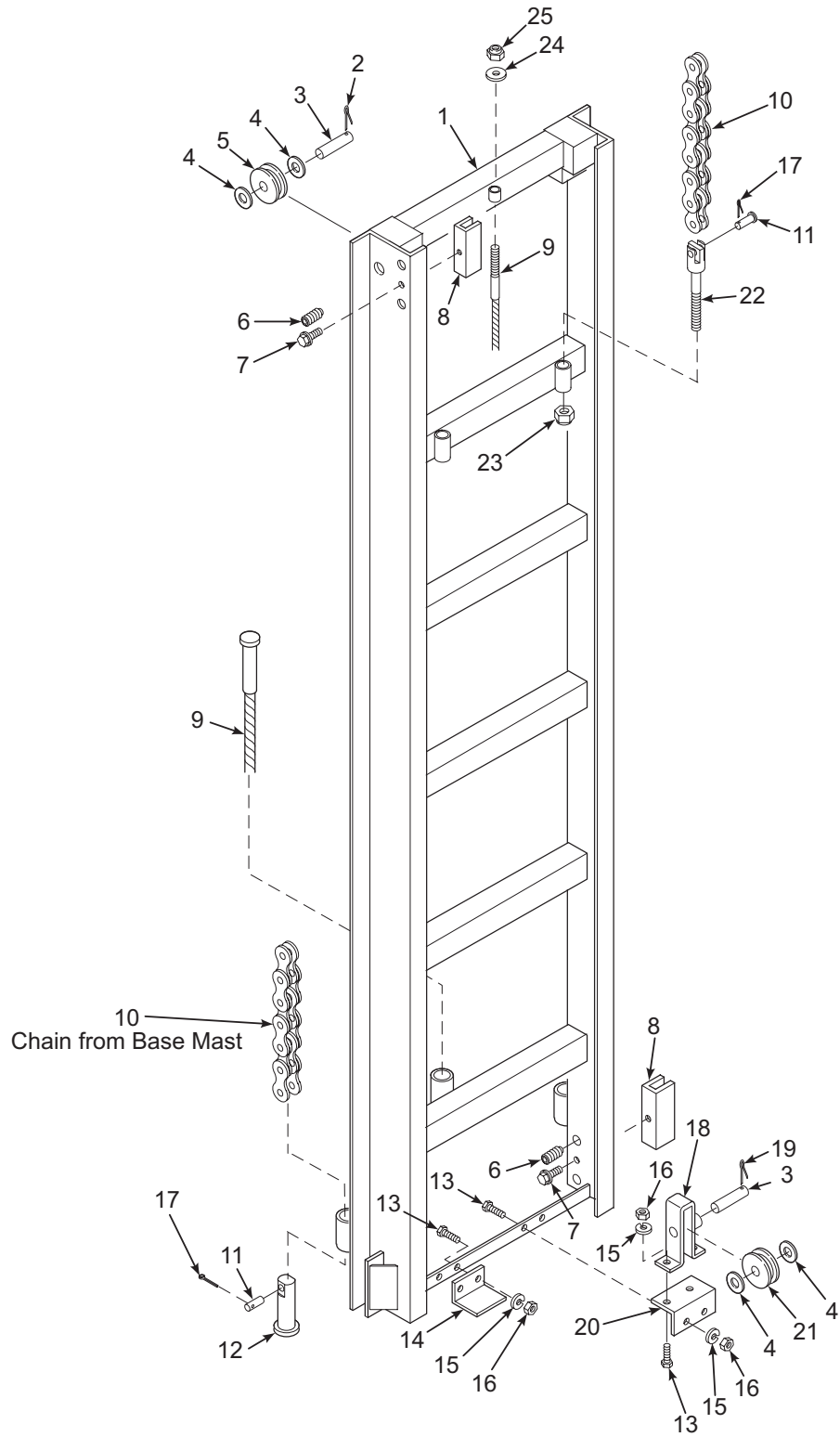


Figure 6-2. Second Moving Mast

Table 6-2. Second Moving Mast Parts List

Item No.	Part No.	Description	Qty
1	B16-01-0040	Second Moving Mast Weldment	1
2	0090-0770	Pin, Cotter, 3/16 x 1-1/2 in.	2
3	B36-01-0002	Axle, Sheave	3
4	0090-0425	Washer, Flat, 5/8 in.	6
5	B26-00-0009	Sheave Assembly, Chain	2
6	0090-0389	Screw, Set, 1/2-20 x 1/2 in.	8
7	0090-0403	Screw, Sheet Metal, #10 x 1 in.	4
8	B31-00-0001	Slide Block, Plastic	4
9	B40-00-0003	Cable, Steel, 3/16 in.	1
10	B40-01-0008	Chain, Lift	4
11	B04-07-0078	Pin, Clevis	4
12	B04-07-0087	Clevis, Lower	2
13	0090-0042	Screw, Cap, 3/8-16 x 1 in.	6
14	B29-00-0033	Mast Stop	1
15	0090-0210	Washer, Lock, Split, 3/8 in.	6
16	0090-0162	Nut, Hex, 3/8-16	6
17	0090-0860	Pin, Cotter	4
18	B29-00-0078	Bracket, Weldment	1
19	0090-0147	Pin, Cotter, 1/8 x 1-1/4 in.	1
20	B24-01-0008	Mounting Bracket	1
21	B26-00-0001	Sheave, Cable	1
22	B04-07-0088	Clevis, Upper	2
23	0090-0192	Nut, Nylon Lock, 1/2-13	2
24	0090-0422	Washer, Flat, 3/8 in.	1
25	0090-0188	Nut, Nylon Lock, 3/8-16	1
*	B03-00-0009	Chain Assy, includes items 10, 11, 12, 17, 22 and 23	1

\*NOTE: It is recommended that chain parts be purchased as an assembly.

### 6-3 THIRD MOVING MAST PARTS LIST

Refer to Table 6-3 for the parts list for the third moving mast.

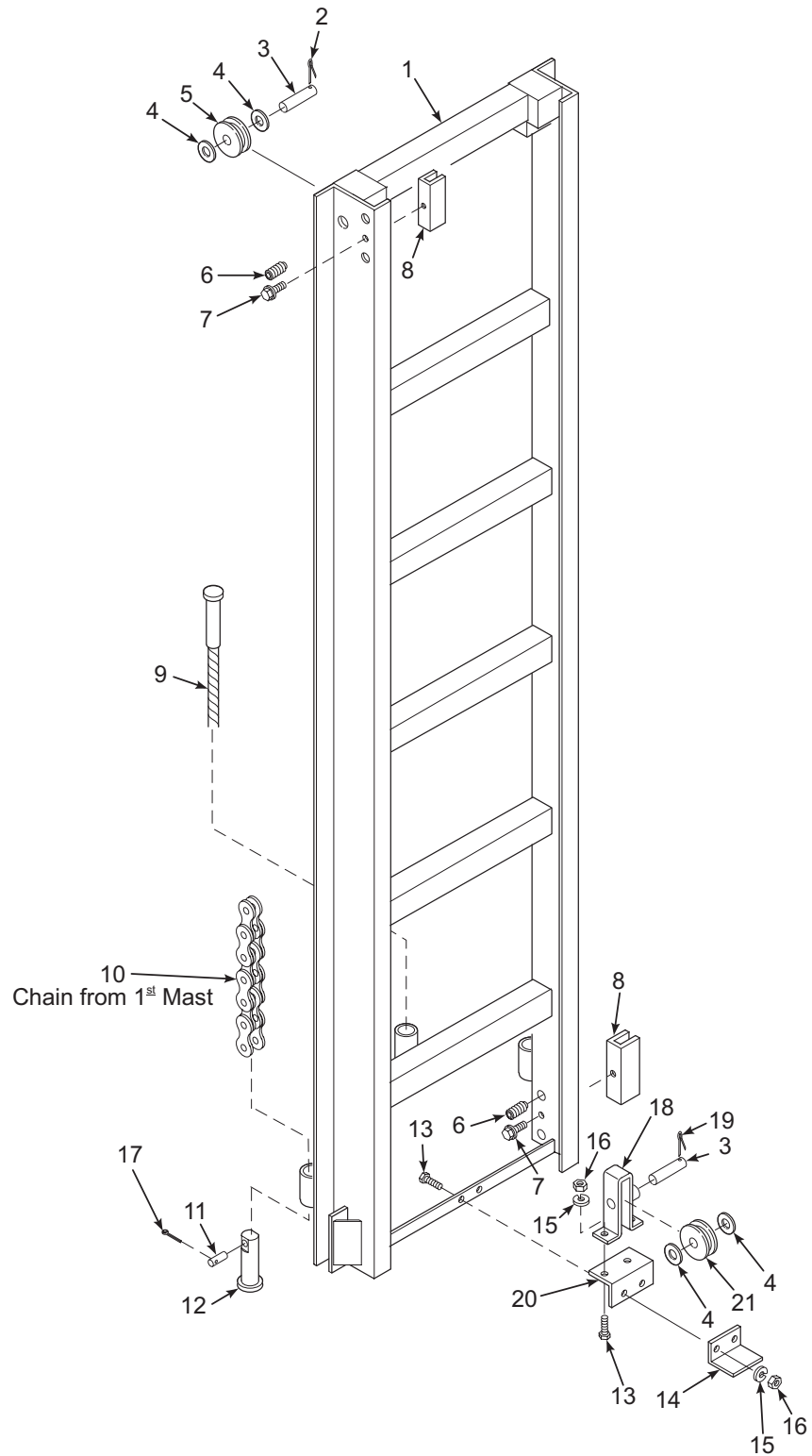


Figure 6-3. Third Moving Mast



Table 6-3. Third Moving Mast Parts List

Item No.	Part No.	Description	Qty
1	B16-01-0041	Third Moving Mast Weldment	1
2	0090-0770	Pin, Cotter, 3/16 x 1-1/2 in.	2
3	B36-01-0002	Axle, Sheave	3
4	0090-0425	Washer, Flat, 5/8 in.	6
5	B26-00-0009	Sheave Assembly, Chain	2
6	0090-0389	Screw, Set, 1/2-20 x 1/2 in.	8
7	0090-0403	Screw, Sheet Metal, #10 x 1 in.	4
8	B31-00-0001	Slide Block, Plastic	4
9	B40-00-0003	Cable, Steel, 3/16 in.	1
10	B40-01-0008	Chain, Lift	2
11	B04-07-0078	Pin, Clevis	2
12	B04-07-0087	Clevis, Lower	2
13	0090-0042	Screw, Cap, 3/8-16 x 1 in.	6
14	B29-00-0033	Mast Stop	1
15	0090-0210	Washer, Lock, Split, 3/8 in.	6
16	0090-0162	Nut, Hex, 3/8-16	6
17	0090-0860	Pin, Cotter	2
18	B29-00-0078	Bracket, Weldment	1
19	0090-0147	Pin, Cotter, 1/8 x 1-1/4 in.	1
20	B24-01-0008	Mounting Bracket	1
21	B26-00-0001	Sheave, Cable	1
*	B03-00-0009	Chain Assy, includes items 10, 11, 12, 17 and Upper Clevis & Lock Nut (shown on page 6-4)	1

\*NOTE: It is recommended that chain parts be purchased as an assembly.

## 6-4 FOURTH MOVING (PLATFORM) MAST PARTS LIST

Refer to Table 6-4 for the parts list for the forth moving (platform) mast.

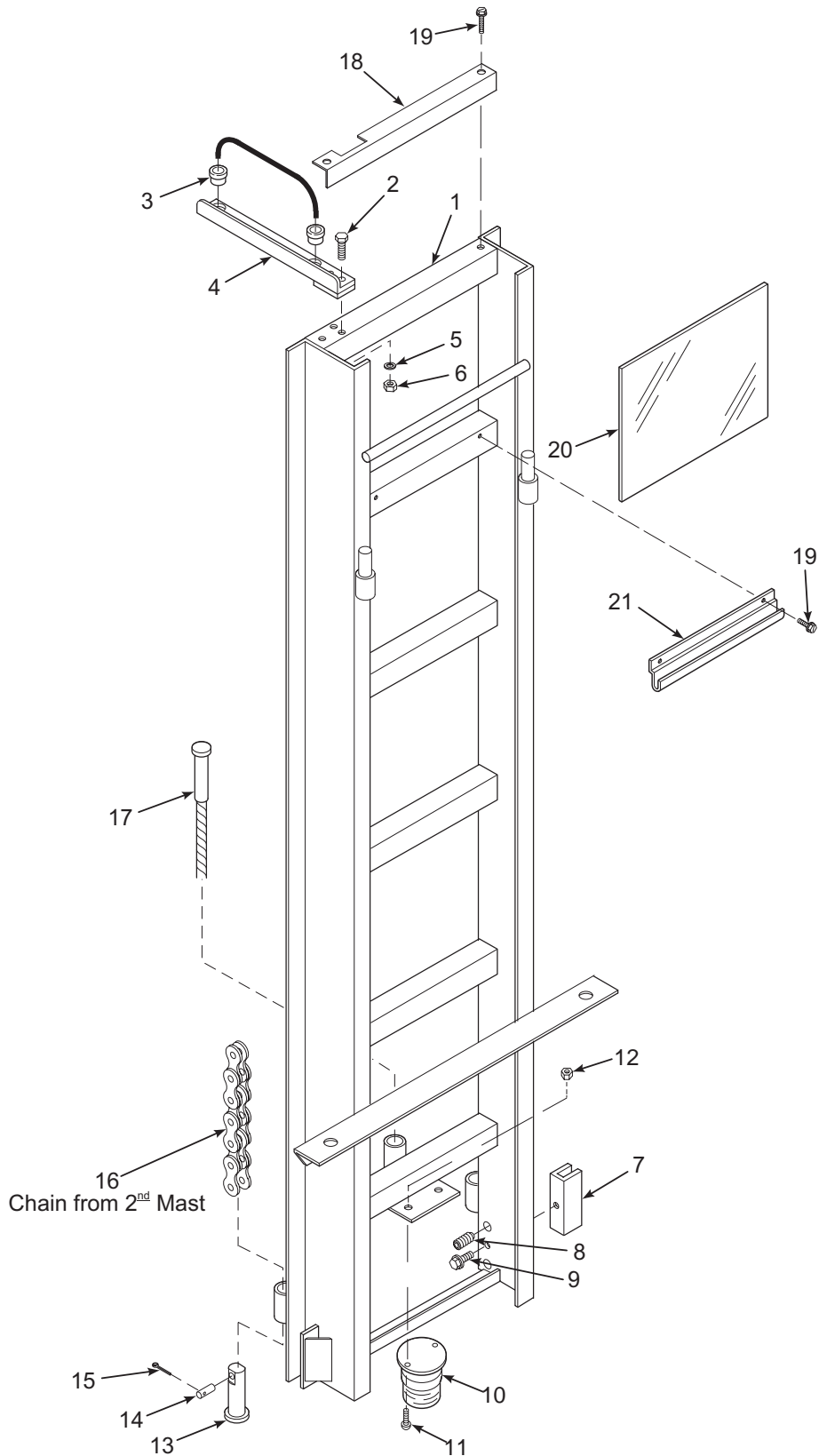


Figure 6-4. Fourth Moving (Platform) Mast

Table 6-4. Fourth Moving (Platform) Mast Parts List

Item No.	Part No.	Description	Qty
1	B16-01-0042	Fourth Moving (Platform) Mast Weldment	1
2	0090-0014	Screw, Cap, 1/4-20 x 2-1/4 in.	2
3	B01-09-0026	Grommet, Plastic	2
4	B29-00-0160	Bracket, Outreach	1
5	0090-0206	Washer, Lock, Split, 1/4 in.	2
6	0090-0159	Nut, Hex, 1/4-20	2
7	B31-00-0001	Slide Block, Plastic	2
8	0090-0389	Screw, Set, 1/2-20 x 1/2 in.	4
9	0090-0403	Screw, Sheet Metal, #10 x 1 in.	2
10	B01-10-0275	Light, Caution	1
11	0090-0802	Screw, Machine, #10-24 x 7/8 in.	2
12	0090-0182	Nut, Nylon Lock, #10-24	2
13	B04-07-0087	Clevis, Lower	2
14	B04-07-0078	Pin, Clevis	2
15	0090-0860	Pin, Cotter	2
16	B40-01-0008	Chain, Lift	2
17	B40-00-0003	Cable, Steel, 3/16 in.	1
18	B07-01-2033	Edge, Top Cover	1
19	0090-0344	Screw, Threadcutting, #10-24 x 1/2 in.	4
20	B18-00-0178	Plexiglass, 1/8 in.	1
21	B24-00-0011	Frame, Aluminum, 11-1/2 in	1
*	B03-00-0009	Chain Assy, includes items 13, 14, 15, 16 and Upper Clevis & Lock Nut (shown on page 6-4)	1

\*NOTE: It is recommended that chain parts be purchased as an assembly.

## 6-5 BATTERY COMPARTMENT PARTS LIST

Refer to Table 6-5 for the parts list for the battery compartment.

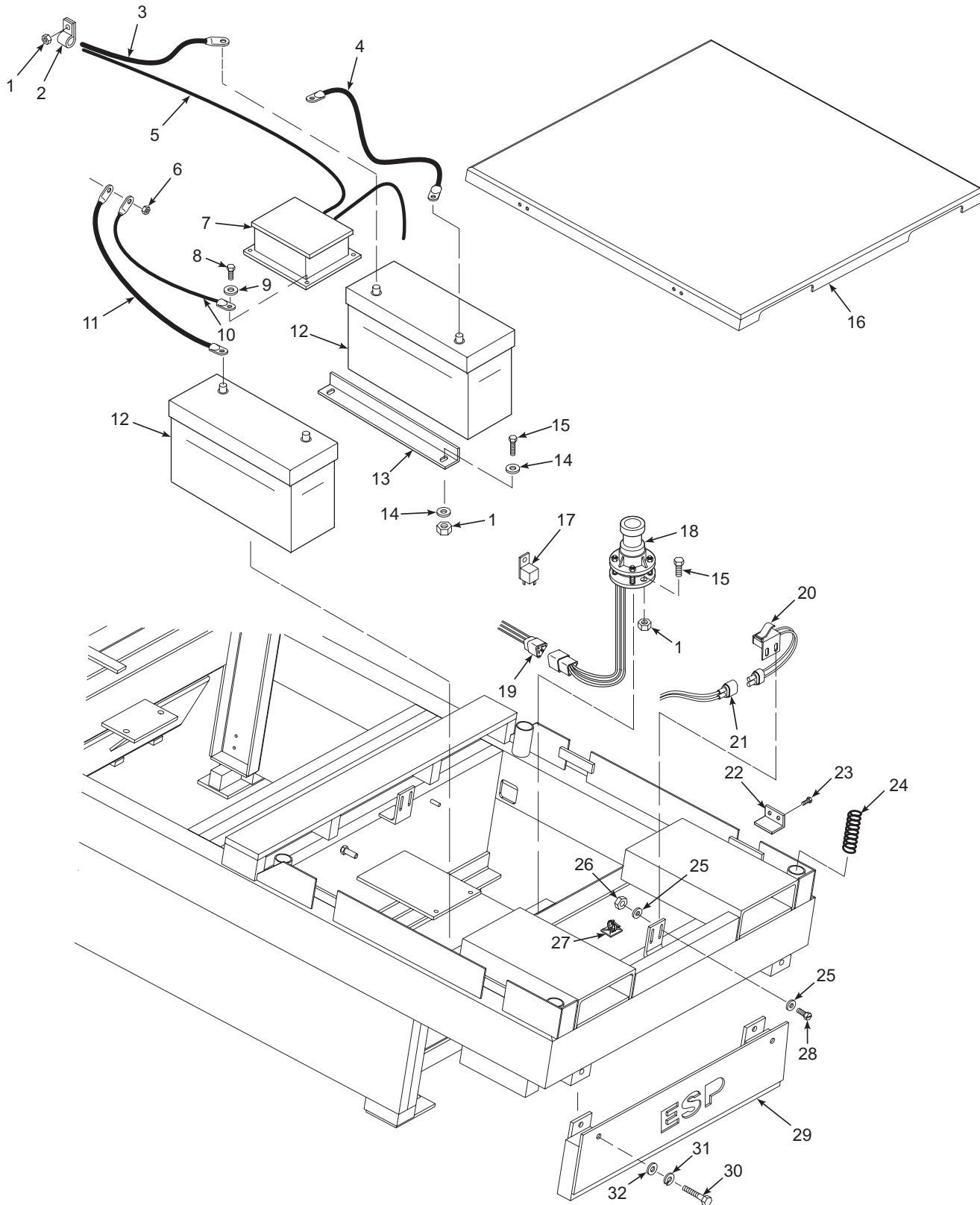


Figure 6-5. Battery Compartment

Table 6-5. Battery Compartment Parts List

Item No.	Part No.	Description	Qty
1	0090-0183	Nut, Nylon Lock, 1/4-20	7
2	B04-07-0036	Clamp, Cable/Hose, DG 16	1
3	B01-01-0144	Cable, Battery, 2 Ga. x 104 in.	1
4	B01-01-0027	Cable, Battery, 2 Ga. x 19 in.	1
5	B01-01-0130	Cable, Battery, 4 Ga. x 68 in.	1
6	0090-0188	Nut, Nylon Lock, 3/8-16	1
7	B01-10-0282	Controller, Motor	1
8	0090-0028	Screw, Cap, 5/16-18 x 3/4 in.	2
9	0090-0208	Washer, Lock, 5/16 in.	2
10	B01-01-0131	Cable, Battery, 8 Ga. x 16 in	1
11	B01-01-0014	Cable, Battery, 2 Ga. x 8 in.	1
12	B01-04-0015	Battery, Maintenance-Free, 12 Volt	2
13	B07-01-1144	Bracket, Battery Clamp	2
14	0090-0419	Washer, Flat, 1/4 in.	8
15	0090-0005	Screw, Cap, 1/4-20 x 3/4 in.	6
16	B18-00-0179	Underguard	1
17	B01-06-0053	Relay, 24 Volt DC, 20 Amp	1
18	B01-10-0135	Sensor, Level, 1.5 Degree	1
19	B01-01-0113	Plug, Level Sensor	1
20	B01-03-0061	Switch, Limit, Underguard	2
21	B01-01-0122	Cable Assembly, Underguard Switch	2
22	B07-06-5953	Clamp, Underguard	4
23	0090-0001	Screw, Cap, 1/4-20 x 1/2 in.	8
24	B39-00-0049	Spring	4
25	0090-0415	Washer, Flat, #10	8
26	0090-0182	Nut, Nylon Lock, #10-24	4
27	B04-07-0015	Clamp, Cable	1
28	0090-0232	Screw, Machine, #10-24 x 5/8 in.	4
29	B11-01-0148	Front Guard	1
30	0090-0048	Screw, Cap, 3/8-16 x 2 in.	2
31	0090-0210	Washer, Lock, Split, 3/8 in.	2
32	0090-0422	Washer, Flat, 3/8 in.	2

## 6-6 HYDRAULIC PUMP COMPARTMENT PARTS LIST

Refer to Table 6-6 for the parts list for the hydraulic pump compartment.

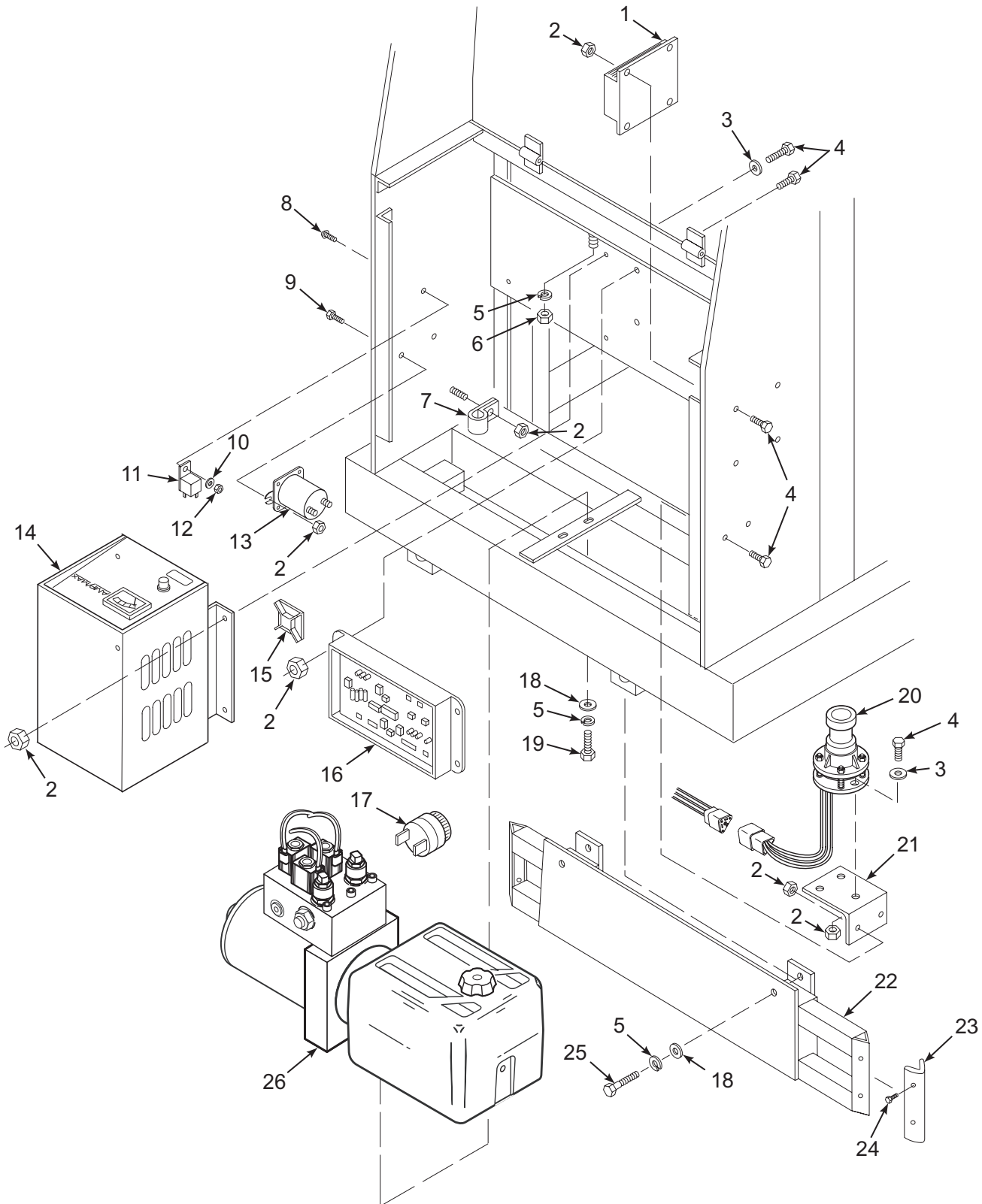


Figure 6-6. Hydraulic Pump Compartment

**Table 6-6. Hydraulic Pump Compartment Parts List**

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Qty</b>
1	B01-10-0291	Converter, 24 Volt DC-DC	1
2	0090-0183	Nut, Nylon Lock, 1/4-20	22
3	0090-0419	Washer, Flat, 1/4 in.	6
4	0090-0005	Screw, Cap, 1/4-20 x 3/4 in.	16
5	0090-0210	Washer, Lock, Split, 3/8 in.	5
6	0090-0162	Nut, Hex, 3/8-16	1
7	B04-07-0036	Clamp, Cable/Hose, DG 16	4
8	0090-0232	Screw, Machine, #10-24 x 5/8 in.	1
9	0090-0001	Screw, Cap, 1/4-20 x 1/2 in.	2
10	0090-0415	Washer, Flat, #10	1
11	B01-06-0053	Relay, 24 Volt DC, 20 Amp	1
12	0090-0182	Nut, Nylon Lock, #10-24	1
13	B02-15-0425	Solenoid, Start, 24VDC	1
14	B01-05-0056	Charger, Battery, 40 Amp, 110 Volt AC, 60	1
15	B04-07-0015	Clamp, Tie Wrap	3
16	B01-10-0280	Control Board, Main	1
17	B01-10-0194	Alarm, Audible	1
18	0090-0422	Washer, Flat, 3/8 in.	4
19	0090-0040	Screw, Cap, 3/8-16 x 3/4 in.	2
20	B01-10-0247	Sensor, Level, 1.0 Degree	1
21	B29-00-0021	Bracket, Level Sensor Mount	1
22	B11-01-0147	Rear Guard	1
23	B30-00-0061	Bumper, Corner	2
24	0090-0344	Screw, Threadcutting, #10-24 x 1/2 in.	8
25	0090-0048	Screw, Cap, 3/8-16 x 2 in.	2
26	B02-05-0034	Pump, Hydraulic (see pages 6-26 & 6-27 for component parts listing)	1

## 6-7 BASE PARTS LIST

Refer to Table 6-7 for the parts list for the base.

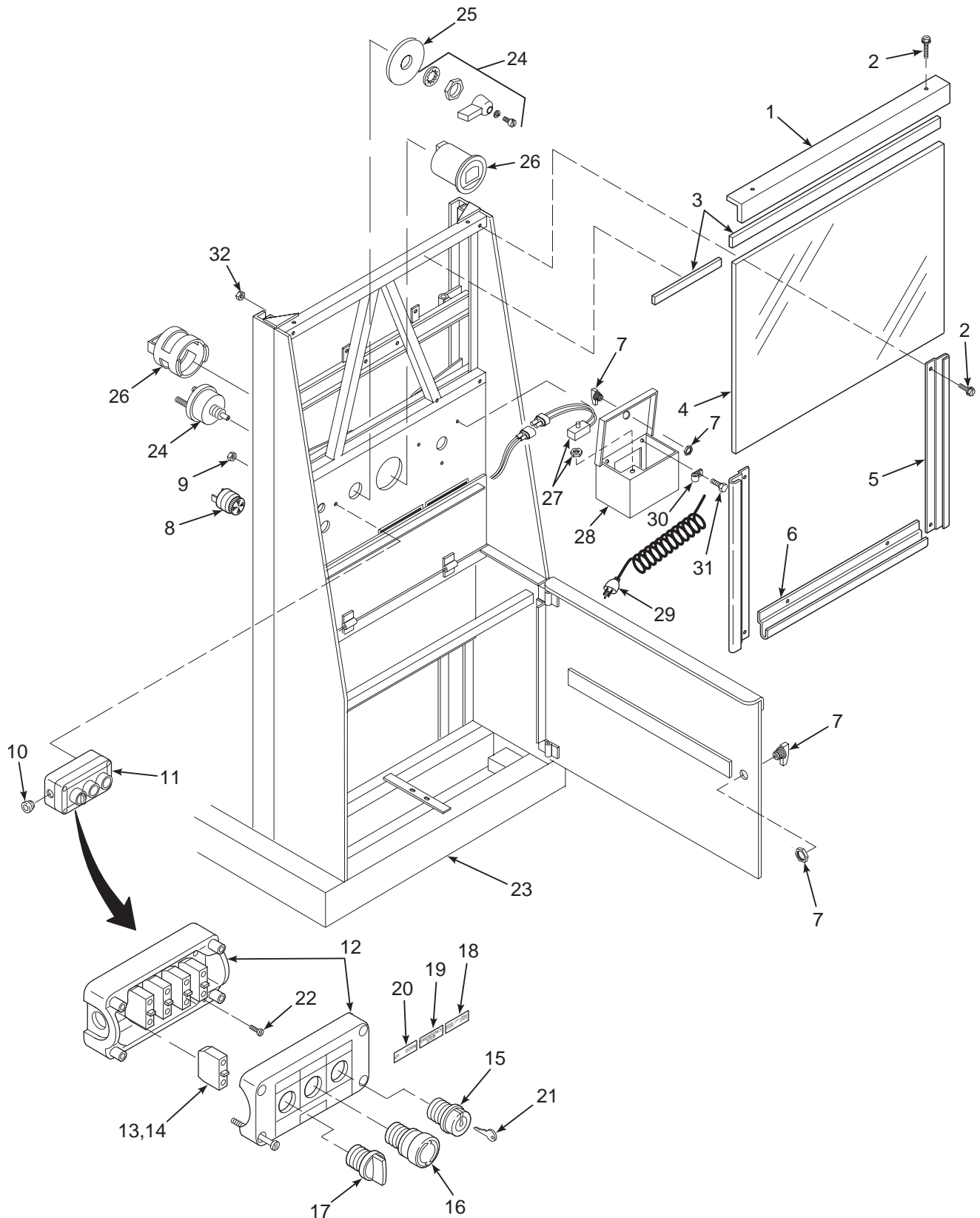


Figure 6-7. Base



Table 6-7. Base Parts List

Item No.	Part No.	Description	Qty
1	B07-01-2003	Edge, Top Cover	1
2	0090-0344	Screw, Threadcutting, #10-24 x 1/2 in.	8
3	B05-00-0005	Tape, Foam Adhesive	32 in.
4	B18-00-0177	Plexiglass, 1/8 in.	1
5	B24-01-0013	Frame, Aluminum, 18-1/4 in.	2
6	B24-01-0009	Frame, Aluminum, 20 in.	1
7	B37-00-0006	Lock Assembly, Utility	2
8	B01-10-0194	Alarm, Audible	1
9	0090-0182	Nut, Nylon Lock, #10-24	2
10	B01-09-0003	Strain Relief, Cable	1
11	B01-02-0076	Control Box Assembly, Lower	1
12	B19-00-0040	Box, Switch, 3 Position	1
13	B01-02-0078	Contacts, Switch, Normally Open	4
14	B01-02-0079	Contacts, Switch, Normally Closed	1
15	B01-02-0082	Switch, Selector, Keyed	1
16	B01-02-0081	Switch, Pushbutton, Emergency Stop	1
17	B01-02-0080	Switch, Selector, Up/Down	1
18	B00-00-0131	Legend Plate, Upper/Off/Lower	1
19	B00-00-0130	Legend Plate, Emergency Stop	1
20	B00-00-0129	Legend Plate, Up/Down	1
21	B38-00-0001	Key, Replacement	1
22	0090-0232	Screw, Machine, #10-24 x 5/8 in.	2
23	B11-01-0146	Weldment, Base and Mast	1
24	B01-02-0060	Switch, Master Power	1
25	B00-00-0112	Faceplate, Master Power Switch	1
26	B01-10-0294	Battery Gauge/Hour Meter	1
27	B01-03-0065	Switch, Battery Charger Cord Box	1
28	B19-00-0045	Box, Battery Charger Cord	1
29	B01-01-0143	Cord, Retractable, 16-3	1
30	B04-07-0032	Clamp, Cord, DG-6	1
31	0090-0005	Screw, Cap, 1/4-20 x 3/4 in.	3
32	0090-0183	Nut, Nylon Lock, 1/4-20	3

## 6-8 BASE MAST PARTS LIST

Refer to Table 6-8 for the parts list for the base mast.

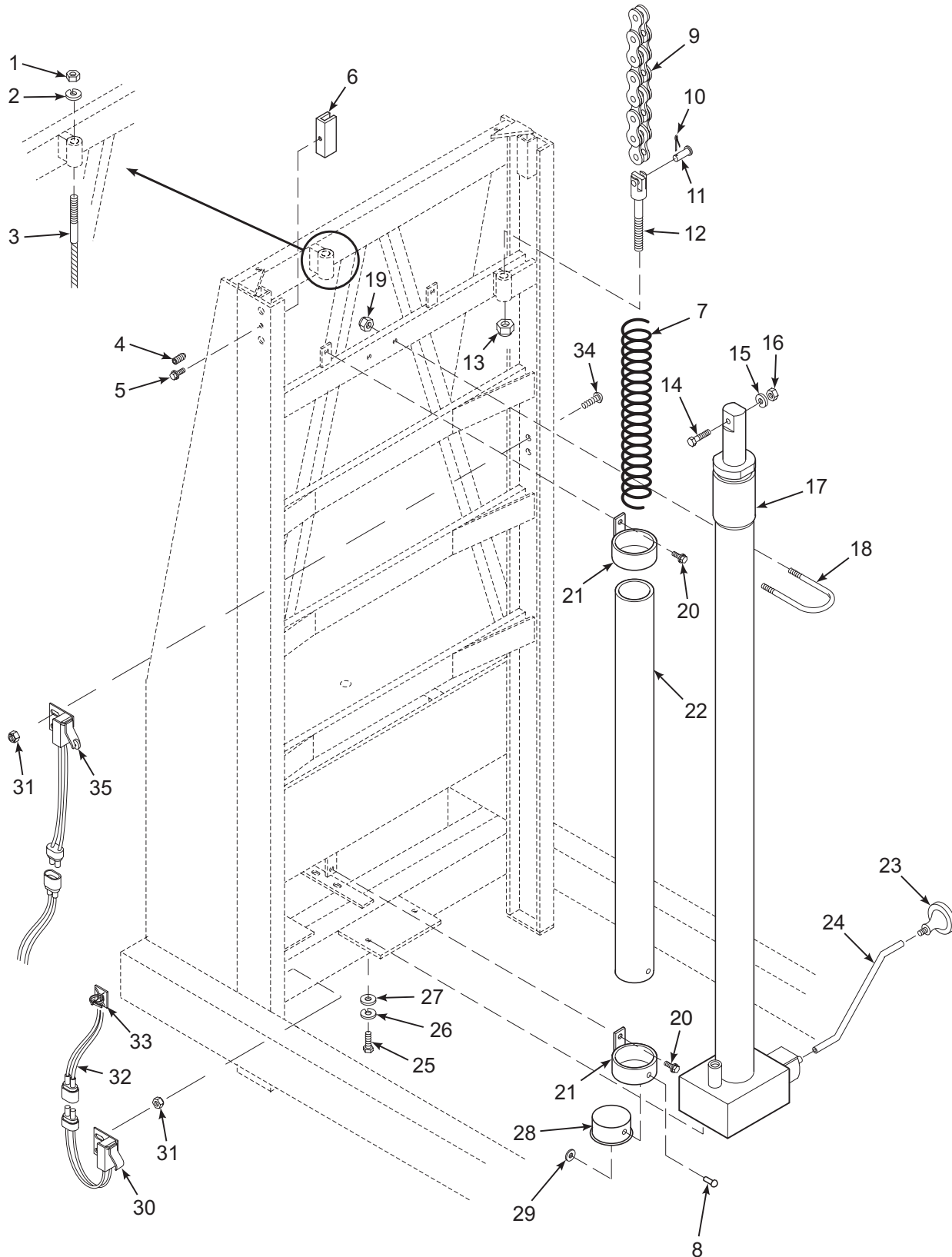


Figure 6-8. Base Mast

Table 6-8. Base Mast Parts List

Item No.	Part No.	Description	Qty
1	0090-0188	Nut, Nylon Lock, 3/8-16	1
2	0090-0422	Washer, Flat, 3/8 in.	1
3	B40-00-0003	Cable, Steel, 3/16 in.	1
4	0090-0389	Screw, Set, 1/2-20 x 1/2 in.	4
5	0090-0403	Screw, Sheet Metal, #10-24 x 1 in.	2
6	B31-00-0001	Slide Block, Plastic	2
7	B01-01-0142	Cord, Coiled, 16-2	1
8	0090-0684	Rivet, Pop, 3/16 x 1/2 in.	2
9	B40-01-0008	Chain, Lift	2
10	0090-0860	Pin, Cotter, 1.6 mm	2
11	B04-07-0078	Pin, Clevis	2
12	B04-07-0088	Clevis, Upper	2
13	0090-0192	Nut, Nylon Lock, 1/2-13	2
14	0090-0071	Screw, Cap, 1/2-13 x 2-1/2 in.	1
15	0090-0212	Washer, Lock, Split, 1/2 in.	1
16	0090-0166	Nut, Hex, 1/2-13	1
17	B02-03-0040	Cylinder, Hydraulic Lift, 1.75 in. Diameter	1
18	0090-0654	Clamp, U-bolt, 5/16-18 x 2-1/2 x 2-5/8 in.	1
19	0090-0185	Nut, Nylon Lock, 5/16-18	2
20	0090-0344	Screw, Thread Cutting, #10-24 x 1/2 in.	2
21	B29-00-0049	Retainer, Tube	2
22	B00-00-0007	Tube, Plastic	1
23	B46-00-0031	Knob, Manual Lowering Valve	1
24	B07-06-1060	Extension Rod, Manual Lowering Valve	1
25	0090-0042	Screw, Cap, 3/8-16 x 1 in.	2
26	0090-0210	Washer, Lock, Split, 3/8 in.	2
27	0090-0422	Washer, Flat, 3/8 in.	2
28	B00-00-0008	Plug, Plastic	1
29	0090-0498	Washer, Flat, 3/16 in.	2
30	B01-03-0040	Switch, Limit, Mast	1
31	0090-0182	Nut, Nylon Lock, #10-24	4
32	B01-01-0129	Cable Assembly, Mast Limit Switch	1
33	B04-07-0015	Clamp, Cable	2
34	0090-0231	Screw, Machine, #10-24 x 1/2	2
35	B01-03-0066	Switch, Limit, Level Sensor	1
*	B03-00-0009	Chain Assy, includes items 9, 10, 11, 12, 13, and Lower Clevis (shown on page 6-4)	1

\*NOTE: It is recommended that chain parts be purchased as an assembly.

## 6-9 DRIVE AXLE PARTS LIST

Refer to Table 6-9 for the parts list for the drive axle components.

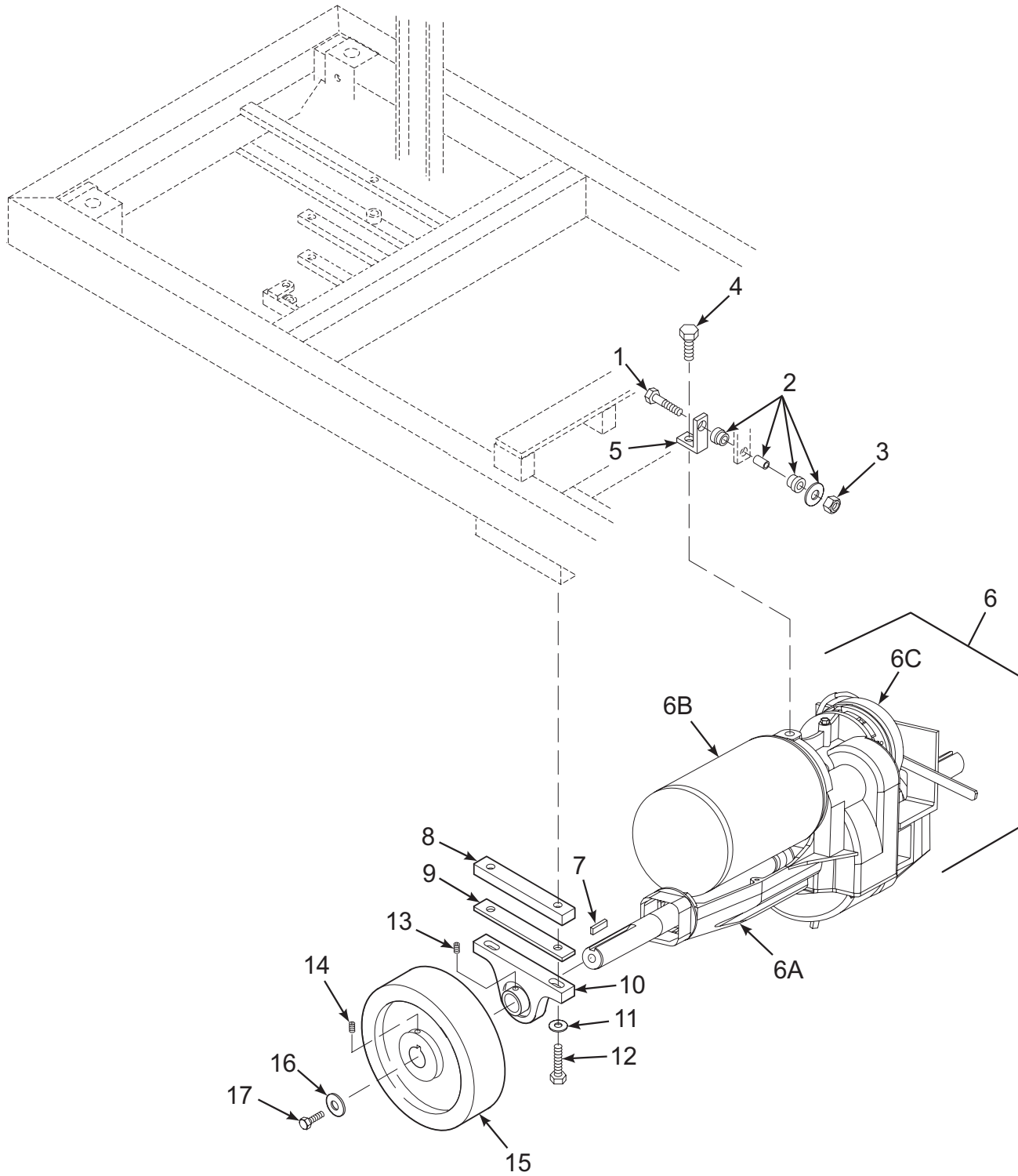


Figure 6-9. Drive Axle

**Table 6-9. Drive Axle**

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Qty</b>
1	0090-0049	Screw, Cap, 3/8-16 x 2-1/4 in.	1
2	B30-00-0050	Pad Assembly, Torsion	1
3	0090-0188	Nut, Nylon Lock, 3/8-16	2
4	0090-0065	Screw, Cap, 1/2-13 x 1 in.	1
5	B07-06-5995	Bracket, Torsion	1
6	B01-07-0015	Transaxle Assembly	1
6A	B01-07-0012	Transaxle Subassembly	1
6B	B01-07-0011	Motor Subassembly	1
6C	B01-07-0013	Brake Subassembly, Electric	1
7	B07-07-5022	Key, Square, 1/4 x 2-1/4 in.	2
8	B30-00-0049	Mount, Rubber	2
9	B07-06-5946	Plate, Transaxle Clamp	2
10	B25-00-0073	Pillow Block	2
11	0090-0422	Washer, Flat, 3/8 in.	4
12	0090-1096	Screw, Cap, 3/8-16 x 2 in. – Grade 8	4
13	0090-0367	Screw, Set, 1/4-28 x 1/4 in.	4
14	0090-1071	Screw, Set, 5/16-18 x 5/8 in.	4
15	B08-02-0015	Caster, 10 in. Drive	2
16	0090-0776	Washer, Flat, 7/16 in.	2
17	0090-0617	Screw, Cap, 7/16-14 x 1 in.	2

## 6-10 STEERING PARTS LIST

Refer to Table 6-10 for the parts list for the steering components.

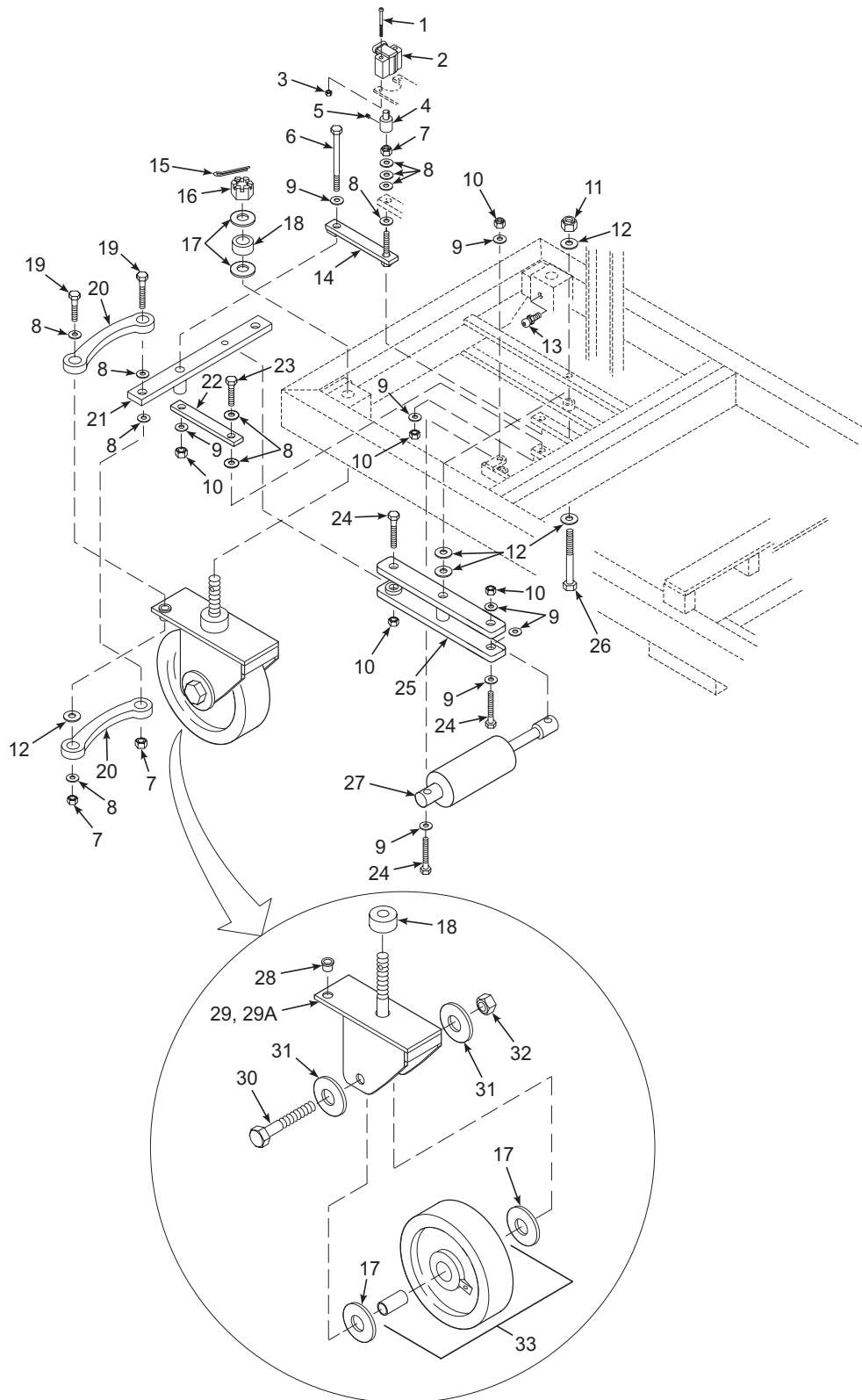


Figure 6-10. Steering

Table 6-10. Steering Parts List

Item No.	Part No.	Description	Qty
1	0090-0239	Screw, Machine, #10-24 x 1-1/2 in.	2
2	B01-02-0105	Switch, Rotary, Steering Indicator	1
3	0090-0182	Nut, Nylon Lock, #10-24	2
4	B24-01-0015	Adapter Shaft, Rotary Switch	1
5	0090-0824	Screw, Set, #10-32 x 3/16 in.	1
6	0090-0035	Screw, Cap, 5/16-18 x 3 in.	1
7	0090-0188	Nut, Nylon Lock, 3/8-16	6
8	0090-0422	Washer, Flat, 3/8 in.	15
9	0090-0420	Washer, Flat, 5/16 in.	7
10	0090-0185	Nut, Nylon Lock, 5/16-18	4
11	0090-0192	Nut, Nylon Lock, 1/2-13	1
12	0090-0574	Washer, Flat, 1/2 in.	6
13	B00-00-0009	Fitting, Zerk, Drive-In	2
14	B11-01-0149	Support Arm, Tie Rod	1
15	0090-0881	Pin, Cotter, 5/32 x 2 in.	2
16	0090-1072	Nut, Castle, 1-8	2
17	0090-0429	Washer, Flat, 1 in.	8
18	B25-00-0096	Bearing, Thrust	4
19	0090-0046	Screw, Cap, 3/8-16 x 1-3/4 in.	4
20	B07-08-0037	Knuckle, Tie Rod	4
21	B11-01-0138	Tie Rod	1
22	B07-06-5826	Support Linkage, Tie Rod	1
23	0090-0045	Screw, Cap, 3/8-16 x 1-1/2 in.	1
24	0090-1061	Screw, Cap, 5/16-18 x 2 in. – Grade 8	3
25	B11-01-0100	Linkage, Steering	1
26	0090-0080	Screw, Cap, 1/2-13 x 4-1/2 in.	1
27	B02-03-0038	Cylinder, Hydraulic Steering, 1.5 in. Bore x 4 in. Stroke	1
28	0063-0492	Bushing	2
29	B11-01-0137	Bracket, Wheel, Right	1
29A	B11-01-0105	Bracket, Wheel, Left	1
30	0090-0112	Bolt, Steering Axle, 3/4-10 x 5 in.	2
31	0090-0428	Washer, Flat, 3/4 in.	4
32	0090-0195	Nut, Nylon Lock, 3/4-10	2
33	B08-02-0011	Caster, Steering	2

## 6-11 PLATFORM PARTS LIST

Refer to Table 6-11 for the parts list for the platform.

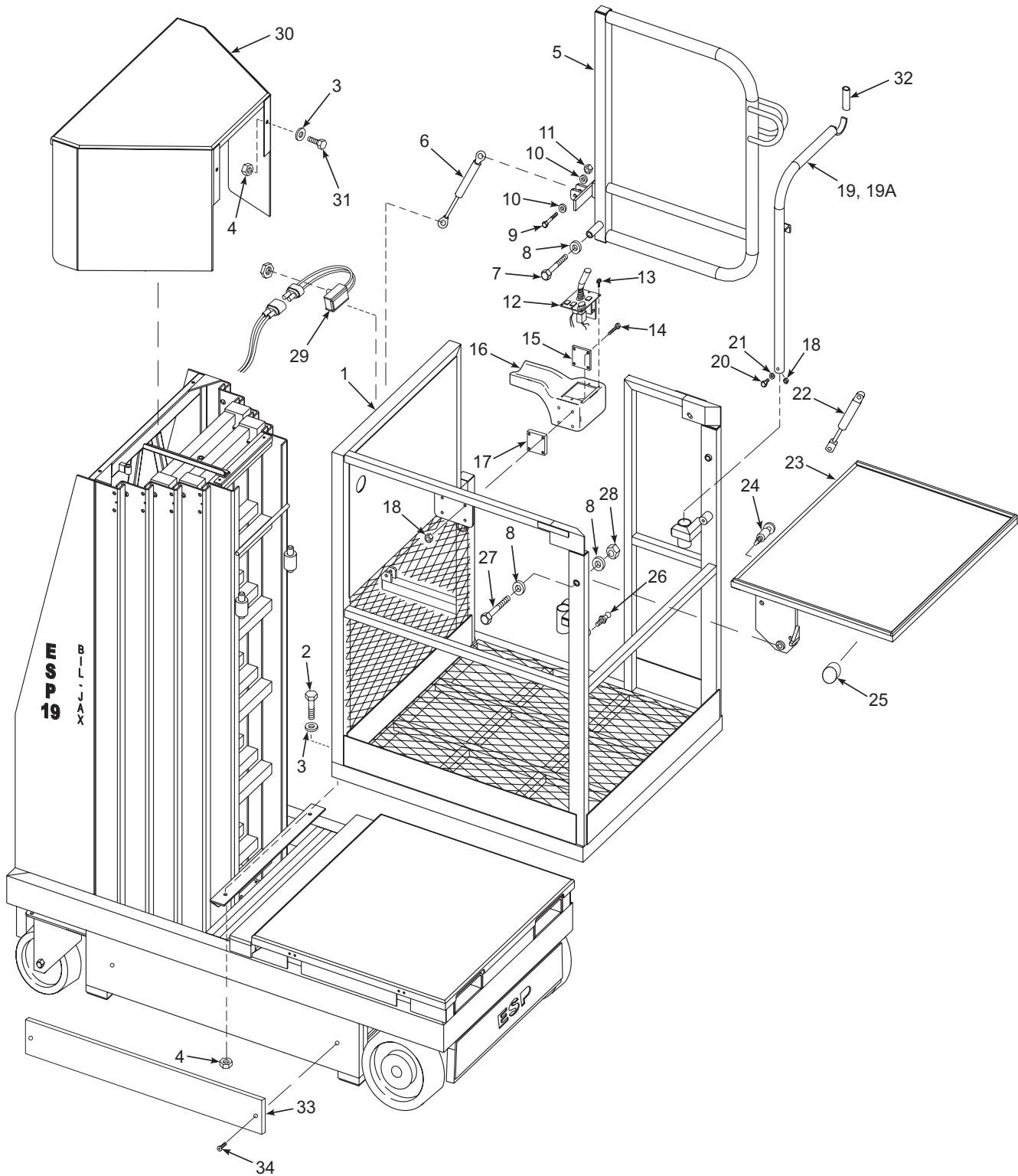


Figure 6-11. Platform



Table 6-11. Platform Parts List

Item No.	Part No.	Description	Qty
1	B17-00-0137	Weldment, Platform	1
2	0090-0053	Screw, Cap, 3/8-16 x 3 in.	2
3	0090-0422	Washer, Flat, 3/8 in.	4
4	0090-0188	Nut, Nylon Lock, 3/8-16	4
5	B17-00-0138	Gate	1
6	B39-00-0048	Gas Shock, Gate	1
7	0090-0076	Screw, Cap, 1/2-13 x 3-1/2 in.	1
8	0090-0574	Washer, Flat, 1/2 in.	5
9	0090-0033	Screw, Cap, 5/16-18 x 1-3/4 in.	2
10	0090-0420	Washer, Flat, 5/16 in	4
11	0090-0185	Nut, Nylon Lock, 5/16-18	2
12	B01-10-0281	Joystick Switch Plate Assembly, Includes Circuit Board	1
13	0090-0224	Screw, Machine, #8-32 x 3/8 in.	6
14	0090-0007	Screw, Cap, 1/4-20 x 1-1/4 in.	4
15	B07-06-5549	Plate, Clamp, Upper Control Box	1
16	B18-00-0144	Control Box, Upper Enclosure	1
17	B07-06-5552	Plate, Threaded, Control Box	1
18	0090-0183	Nut, Nylon Lock, 1/4-20	6
19	B11-00-0052-1	Bike Rack Arm, Left	1
19A	B11-00-0052-2	Bike Rack Arm, Right	1
20	0090-0001	Screw, Cap, 1/4-20 x 1/2 in.	2
21	0090-0419	Washer, Flat, 1/4 in.	4
22	B39-00-0034	Gas Shock, Shelf	1
23	B17-00-0139	Shelf, Cage	1
24	B36-00-0038	Pin, Spring Plunger, Shelf	2
25	B00-00-0014	Cap, Manual Tube	2
26	0090-0920	Ball, Swivel	2
27	0090-0074	Screw, Cap, 1/2-13 x 3 in.	2
28	0090-0191	Nut, Jam, Nylon Lock, 1/2-13	2
29	B01-03-0065	Switch, Gate	1
30	B18-00-0183	Mast Cover	1
31	0090-0042	Screw, Cap, 3/8-16 x 1 in.	2
32	B00-00-0154	Sleeve, Heat Shrink, 1/2 x 5 in.	2
33	B00-00-0144	Bumper	2
34	0090-1052	Screw, Machine, #10-24 x 3/4 in.	4

## 6-12 UPPER CONTROL BOX PARTS LIST

Refer to Table 6-12 for the parts list for the upper control box.

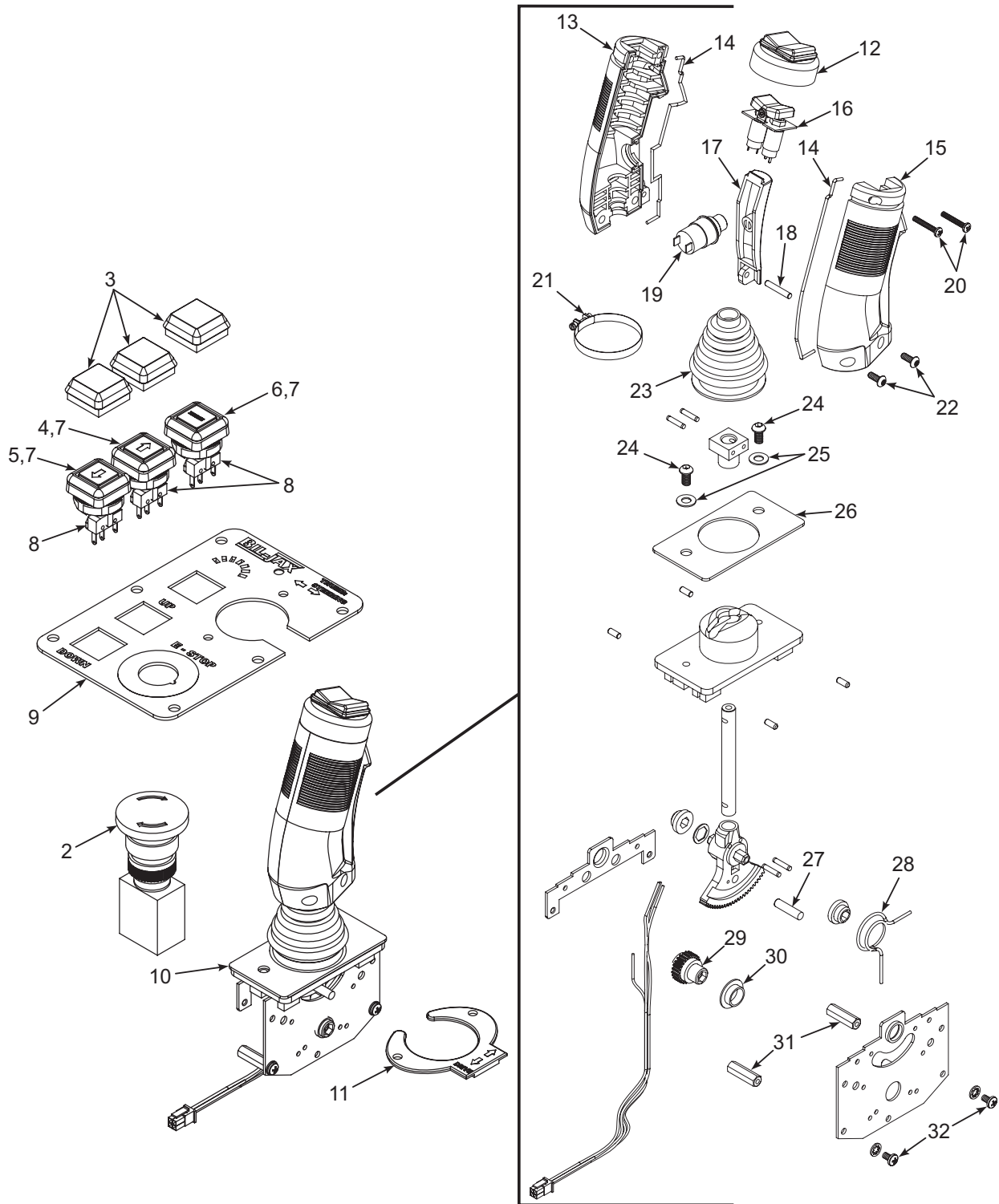


Figure 6-12. Upper Control Box

Table 6-12. Upper Control Box Parts List

Item No.	Part No.	Description	Qty
	B01-10-0273	Joystick Assembly	1
1	B01-10-0198	Circuit Board, Joystick (Not Shown)	1
2	B01-10-0201	Stop Switch, Emergency	1
3	B01-10-0205	Protection Skin, Push Button	3
4	B01-10-0202	Push Button, Arrow Up	1
5	B01-10-0203	Push Button, Arrow Down	1
6	B01-10-0204	Push Button, Enable	1
7	B01-10-0207	Mini Lamp, 6.3 volt	3
8	B01-10-0206	Switch, Cherry, Water/Dust Proof	3
9	B01-10-0317	Plate, Top Control	1
10	B01-10-0264	Joystick	1
11	B01-10-0318	Plate, Drive Direction	1
12	B01-10-0311	Rubber Cup, Thumb Switch	1
13	B01-10-0312-1	Handle, Joystick, Left Half	1
14	B01-10-0313	Rubber Cord	2
15	B01-10-0312-2	Handle, Joystick, Right Half	1
16	B01-10-0315	Switch, Thumb Actuator	1
17	B01-10-0314	Lever, Enable Switch	1
18	B01-10-0305	Pin, Dowel, 1/8 x 3/4 in.	1
19	B01-10-0316	Pushbutton, Enable Switch	1
20	0090-0500	Screw, Machine, #4-40 x 3/4 in.	2
21	B01-10-0218	Clamp	1
22	B01-10-0217	Screw, Machine, Torx, #6-32 x 3/8 in.	2
23	B01-10-0210	Boot, Rubber	1
24	0090-0243	Screw, Machine, #10-32 x 1/2 in.	2
25	B01-10-0209	Washer, Plastic	2
26	B01-10-0208	Gasket, Foam	1
27	B01-10-0306	Pin, Dowel, 3/16 x 3/4 in.	1
28	B01-10-0308	Spring, Torsion	1
29	B01-10-0307	Gear, 24 Tooth, Switch Activation	1
30	B01-10-0310	Bushing, Flanged	1
31	B01-10-0309	Standoff, Hex	2
32	0090-1087	Screw, Machine, Panhead, #6-32 x 1/4 in.	2

### 6-13 HYDRAULIC UNIT PARTS LIST

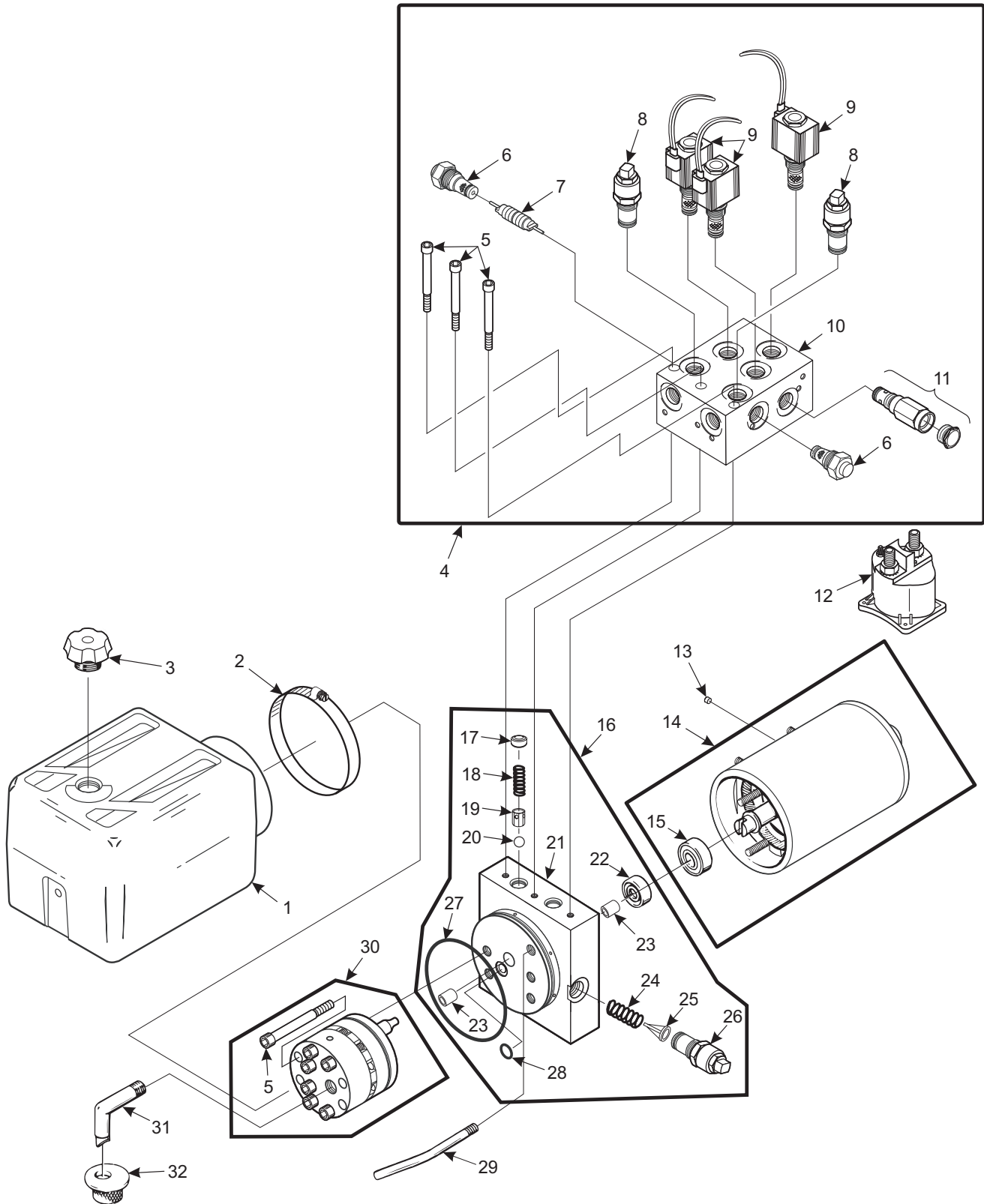


Figure 6-13. Hydraulic Unit Assembly

Table 6-13. Hydraulic Unit Parts List

Item No.	Part No.	Description	Qty
	B02-05-0034	Pump Unit Complete	1
1	B02-15-0423	Reservoir, Plastic	1
2	B02-15-0412	Clamp, Reservoir	1
3	B02-15-0418	Breather Cap	1
4	B02-15-0438	Valve Assembly, 24VDC	1
5	0090-1060	Screw, Socket Head Cap, 1/4-20 x 2-3/4 in.	7
6	B02-15-0444	Cap, Cartridge Valve	2
7	B02-15-0440	Valve, Pilot Operated Check	1
8	B02-15-0441	Valve, Flow Control	2
9	B02-15-0442	Valve, Cartridge, 3 Way-2 Position	3
10	B02-15-0439	Valve Manifold	1
11	B02-15-0443	Valve, Cartridge Relief	1
12	B02-15-0425	Solenoid, Start, 24VDC	1
13	B02-15-0490	Plug, Nylon, Motor	2
14	B02-15-0424	Motor, Electric, 12VDC	1
15	B02-15-0491	Bearing, Motor	1
16	B02-15-0420	Base Assembly, Pump	1
17	B02-15-0433	Screw, Spring Retainer, 9/16-18	1
18	B02-15-0432	Spring, Check Valve	1
19	B02-15-0431	Poppet, Ball Retainer	1
20	B02-15-0430	Ball, 5/16 in. Diameter	1
21	B02-15-0426	Base, End Head	1
22	B02-15-0429	Seal, Shaft	1
23	B02-15-0427	Bearing, Needle	2
24	B02-15-0434	Spring, Retaining, Port Filter	1
25	B02-15-0435	Filter, Screen	1
26	B02-15-0436	Valve, Cartridge Relief	1
27	B02-15-0437	Seal, O-Ring, 3-7/8 x 1/8 in.	1
28	B02-15-0428	Seal, O-Ring, 5/8 x 1/16 in.	1
29	B02-15-0401	Tube, Return, 1/8 NPT, 90°	1
30	B02-15-0421	Pump Assembly	1
31	B02-15-0403	Tube, Return, 3/8 NPT, 90°	1
32	B02-15-0404	Filter, Screen (Suction)	1

## 6-14 HYDRAULIC CYLINDER, FITTINGS, AND HOSES PARTS LIST

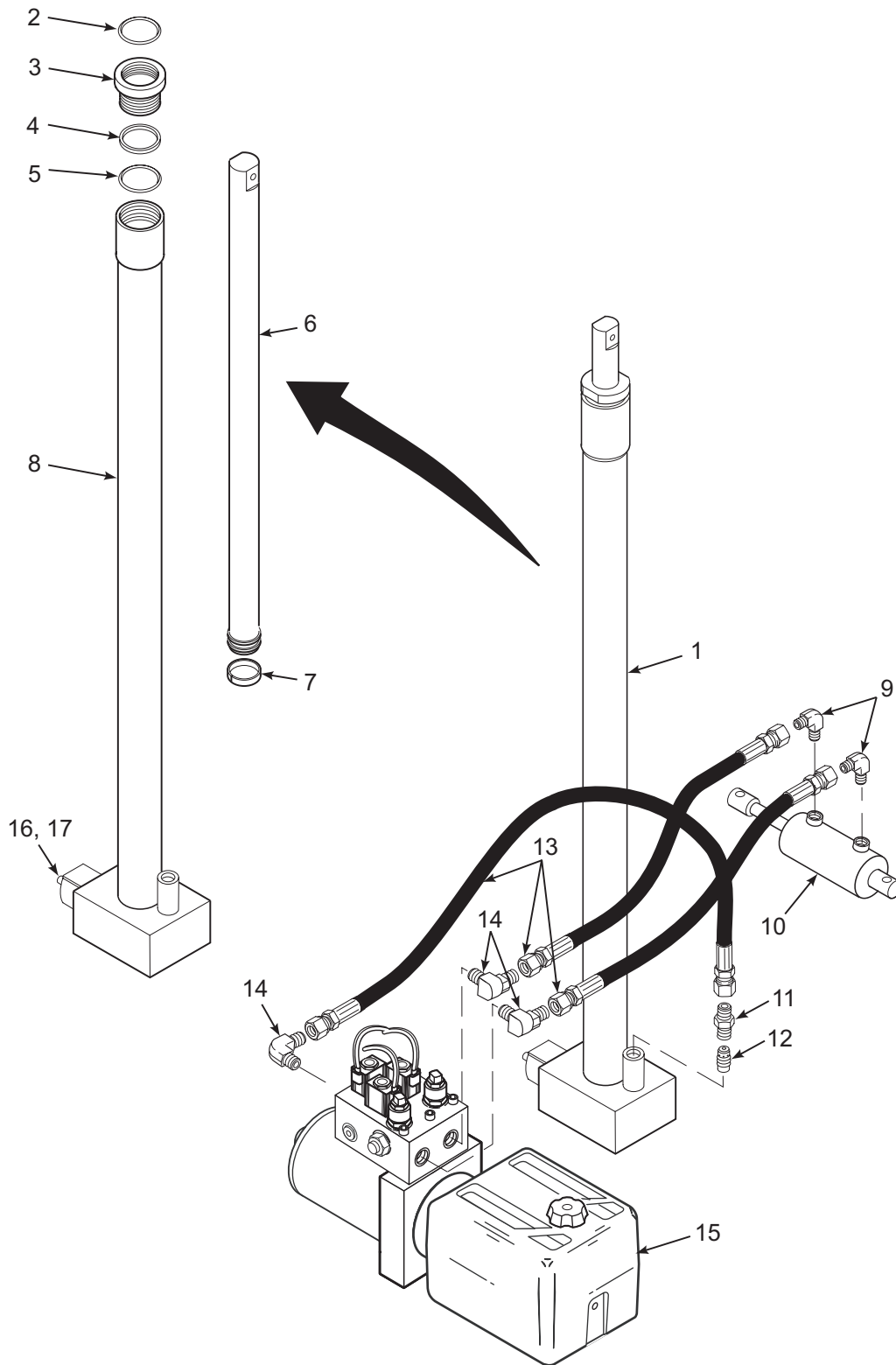


Figure 6-14. Hydraulic Cylinder, Fittings, and Hoses

**Table 6-14. Hydraulic Cylinder, Fittings, and Hoses Parts List**

<b>Item No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Qty</b>
1	B02-03-0040	Cylinder, Hydraulic Lift, 1.75 in. Bore x 54 in. Stroke	1
2		Wiper, Rod	1
3	B02-13-0096	Nut, Gland	1
4		Packing	1
5		O-Ring	1
6	NSS	Piston Rod	1
7		Ring, Wear	1
8	NSS	Jacket, Cylinder	1
9	B02-02-0230	Fitting, 4MFS-4ORM 90°	2
10	B02-03-0038	Cylinder, Hydraulic Steering, 1.5 in. Bore x 4 in. Stroke	1
12	B02-04-0094	Valve, Flow Control, 1.25 gpm	1
11	B02-02-0237	Fitting, Straight, 4ORFS-6ORB	1
13	B02-01-0186	Hose, Hydraulic, #4 x 22 in. w/2 - #4FMFS fittings	3
14	B02-02-0229	Fitting, 4MFS-6ORM 90°	3
15	B02-05-0034	Pump, Hydraulic	1
16	B02-15-0445	Valve	1
17	B01-08-0018	Coil	1
*	B02-13-0097	Seal Kit (Includes items 2, 4, 5, and 7	

NSS – Not Sold Separately





# 7

## ANSI Reprint

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The following sections are reprinted from the ANSI A92.6-1999 code in effect at the time of manufacture. Permission to reprint has been granted by the Scaffold Industry Association.

### 5. Responsibilities of Dealers

**5.1 Basic Principles.** Sound principles of safety, training, inspection, maintenance, application, and operation consistent with all data available regarding the parameters intended use and expected environment shall be applied in the training of operators, in maintenance, application, safety provisions and operation of the aerial platform with due consideration of the knowledge that the aerial platform will be carrying personnel.

### 5.2 Manuals.

**5.2.1 Machine manual(s).** Dealers shall keep and maintain copy(s) of the (1) Operating manual. (2) Maintenance manual. (3) Parts manual. (4) Repair manual. The operating manual and maintenance manual shall be provided with each rental, lease or sale delivery and shall be stored in the weather resistant storage compartment on the aerial platform. Manual(s) are considered an integral part of the aerial platform and are vital to communicate necessary safety information to owners, users and operators. In addition, repair and parts manuals should be provided with each sale delivery.

**5.2.2 Manual of responsibilities.** The ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms shall be provided and stored in the weather resistant storage compartment.

**5.3 Pre-delivery Preparation.** Aerial platforms shall be inspected, serviced, and adjusted to manufacturer's requirements prior to each delivery by sale, lease, or rental.

### 5.4 Maintenance, Inspection And Repair.

**5.4.1 Maintenance.** When a dealer accomplishes preventative maintenance on the aerial platform, it shall be in accordance with the manufacturer's recommendations and based on the environment and severity of use.

**5.4.2 Inspection.** When the dealer accomplishes frequent and annual inspections, they shall be accomplished in accordance with the manufacturer's manuals.

**5.4.3 Repairs.** Repairs accomplished to correct malfunctions and problems shall be in accordance with the manufacturer's manuals and instructions.

**5.5 Maintenance Safety Precautions.** Before adjustments and repairs are started on an aerial platform, the following precautions shall be taken as applicable: (1) Powerplant stopped and starting means rendered inoperative; (2) All controls in the "Off" position and all operating features secured from inadvertent motion by brakes, blocks, or other means; (3) Elevating assembly and platform lowered down to the full down position, if possible, or otherwise secured by blocking or cribbing to prevent dropping; (4) Hydraulic oil pressure relieved from all hydraulic circuits before loosening or removing hydraulic components; (5) Safety props or latches installed where applicable as prescribed by the manufacturer.

**5.6 Replacement Parts.** When parts or components are replaced, they shall be identical or equivalent to original aerial platform parts or components

**5.7 Training.** The dealer shall offer appropriate training to facilitate owners, users, and operators to comply with requirements set forth in this standard regarding the inspection, maintenance, use, application, and operation of the aerial platform.

**5.8 Familiarization On Delivery.** Upon delivery by sale, lease, rental or any form of use, the dealer shall have the responsibility with the person designated by the receiving entity for accepting the aerial platform to: 1) Identify the weather resistant compartment (for manual storage). 2) Confirm the manuals, as specified by the manufacturer, are on the aerial platform. 3) Review control functions. 4) Review safety devices specific to the model aerial platform being delivered.

**5.9 Dealer As User.** Whenever a dealer directs personnel to operate an aerial platform (loading, unloading, inspecting, sales demonstrations, or any form of use), the dealer shall assume the responsibilities of users as specified in Section 7 of this standard. All personnel authorized to operate the aerial platform shall have been: (1) Trained. (2) Familiarized with the aerial platform to be operated. (3) Made aware of the responsibilities of the operators as outlined in Section 8 of this standard.

**5.10 Assistance To Owners And Users.** If a dealer is unable to answer an owner's or user's question(s) relating to rated capacity, intended use, maintenance, repair, inspection, or operation of the aerial platform, the dealer shall obtain the proper information from the manufacturer or a qualified person if the manufacturer is no longer in business and provide that information to the owner or user.

**5.11 Record Retention And Dissemination.**

**5.11.1 Record retention.** The dealer shall retain the following records for at least 4 years: (1) Name and address of the purchaser of each aerial platform by serial number and the date of delivery. (2) Records of the pre-delivery preparation performed prior to each delivery. (3) Records of frequent and annual machine inspections accomplished. (4) Records of repairs accomplished to correct malfunctions and problems. (5) Name of the person(s) trained. (6) Name of the person(s) providing the training. (7) Date of training. (8) Name of person(s) receiving familiarization with the aerial platform upon each delivery unless this individual has been provided with familiarization on the same model, or one having characteristics consistent with the one being delivered, within the prior 90 days.

**5.11.2 Proof of training.** The dealer should provide trainees who successfully complete training a means to evidence they are trained. The dealer shall provide such proof if requested by the trainee. The document evidencing the training shall include the following information: (1) Name of entity providing training or retraining. (2) Name of trainer(s). (3) Clear identification that training covered Self-Propelled Elevating Work Platforms. (4) Date of training.

**5.11.3 Record dissemination.** Upon request, the dealer shall provide the following information: (1) To the owner of the aerial platform, a copy of frequent or annual inspections performed. (2) To the owner of the aerial platform, a copy of repairs accomplished. (3) To a user, proof of training for an operator, including name of trainer and date of training. (4) To a user, the name of the person(s) receiving familiarization upon delivery of the aerial platform.

**5.12 Modifications.** Modification, alteration or remanufacture of an aerial platform shall be made only with prior written permission of the manufacturer.

**5.13 Manufacturer's Safety Bulletins.** The dealer shall comply with safety-related bulletins as received from the manufacturer.

**5.14 Responsibilities Upon Sale.** When the aerial platform is sold, the dealer: (1) Shall, upon delivery, ensure the operating and maintenance manuals are conveyed to the owner. (2) Shall, upon delivery, provide a copy of the ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms. (3) Should, within 60 days of sale, provide repair and parts manuals. (4) Shall, within 60 days of the sale, notify the manufacturer or its successor (if existing) of the sale, providing the full name and address of the purchaser. (5) Should, if the aerial platform is used, accomplish an annual machine inspection prior to delivery and provide a copy to the purchaser within 60 days of the sale. (6) Shall, upon delivery, familiarize the person designated by the receiving entity with the aerial platform being acquired.

## 6. Responsibilities of Owners

**6.1 Basic Principles.** Sound principles of safety, training, inspection, maintenance, application, and operation consistent with all data available regarding the parameters of intended use and expected environment shall be applied in the performance of the responsibilities of owners with due consideration of knowledge that the aerial platform will be carrying personnel.

**6.2 Responsibilities Upon Purchase.** Upon purchase of the aerial platform, the buyer: (1) Shall ensure the operating and maintenance manuals have been received. (2) Should acquire repair and parts manuals within 60 days of acquisition. (3) Shall within 60 days of acquisition of the aerial platform provide the manufacturer with the full name and address of the buyer along with the model and serial number of the aerial platform acquired. (4) Shall, if the aerial platform is used, perform either a frequent inspection, or an annual inspection, prior to placing the unit in service. (5) Shall become familiar with and conform with the responsibilities of owners as set forth in the ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms.

### 6.3 Manuals.

**6.3.1 Machine manual(s).** Owners shall provide a copy(s) of the operating and maintenance manual(s) with each rental, lease, or sales delivery by ensuring they are properly stored in the weatherproof compartment that is a part of the aerial platform. The manual(s) is considered an integral part of the aerial platform and is vital to communicate necessary safety information to owners, users and operators. In addition, repair and parts manuals should be provided with each sale delivery.

**6.3.2 Manual of responsibilities.** The ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms shall be provided and stored in the weather resistant storage compartment.

### 6.4 Maintenance, Inspection And Repair.

**6.4.1 Maintenance.** The owner of an aerial platform shall arrange that the maintenance specified in this standard be properly performed on a timely basis. The owner shall establish a preventive maintenance program in accordance with the manufacturer's recommendations and based on the environment and severity of use of the aerial platform.

**6.4.2 Inspection.** The owner shall arrange for frequent and annual inspections to be performed as specified by the manufacturer. All malfunctions and problems identified in the inspection shall be corrected before the aerial platform is returned to service.

**6.4.3 Repairs.** When the aerial platform is damaged or in need of repair, all malfunctions and problems identified shall be corrected before the aerial platform is returned to service.

**6.5 Pre-delivery Preparation.** Aerial platforms shall be inspected, serviced, and adjusted to manufacturer's requirements prior to each delivery by sale, lease or rental.

**6.6 Frequent Inspection.** The owner of an aerial platform shall ensure that a frequent inspection is performed in accordance with the manufacturer's instructions on an aerial platform: (1) That has been in service for 3 months or 150 hours, whichever occurs first; (2) That has been out of service for a period longer than 3 months; (3) That was purchased used. This inspection shall be accomplished prior to the aerial platform being placed in service.

The inspection shall be made by a person qualified as a mechanic on the specific make and model of the aerial platform. The inspection shall include all items specified by the manufacturer for a frequent inspection and shall include, but not be limited to, the following: (1) All functions and their controls for speed(s), smoothness, and limits of motion; (2) Lower controls including the provisions for overriding of upper controls; (3) All chain and cable mechanisms for adjustment and worn or damaged parts; (4) All

emergency and safety devices; (5) Lubrication of all moving parts, inspection of filter element(s), hydraulic oil, engine oil, and coolant, as specified by the manufacturer; (6) Visual inspection of structural components and other critical components such as fasteners, pins, shafts, and locking devices; (7) Placard, warnings, and control markings; (8) Additional Items specified by the manufacturer.

The owner shall not place the aerial platform into service until all malfunctions and problems have been corrected.

**6.7 Annual Inspection.** The owner of an aerial platform shall ensure that an annual inspection is performed on the aerial platform no later than 13 months from the date of the prior annual inspection. The inspection shall be performed by a person(s) qualified as a mechanic on the specific make and model of the aerial platform. The inspection shall include all items specified by the manufacturer for an annual inspection.

**6.8 Maintenance Safety Precautions.** Before adjustments and repairs are started on an aerial platform, the following precautions shall be taken as applicable: (1) Powerplant stopped and starting means rendered inoperative; (2) All controls in the "off" position and all operating systems secured from inadvertent motion by brakes, blocks, or other means; (3) Elevating assembly and platform lowered to the full down position, if possible, or otherwise secured by blocking or cribbing to prevent dropping; (4) Hydraulic oil pressure relieved from all hydraulic circuits before loosening or removing hydraulic components; (5) Safety props or latches installed where applicable as prescribed by the manufacturer.

**6.9 Replacement Parts.** When parts or components are replaced, they shall be identical or equivalent to original aerial platform parts or components.

**6.10 Maintenance And Inspection Training.** The owners shall train their maintenance personnel in inspection and maintenance of the aerial platform in accordance with the manufacturer's recommendations and sections 6.2-6.11 of this standard.

**6.11 Training.**

**6.11.1 Operator training.** Whenever an owner directs or authorizes an employee to operate an aerial platform (loading, unloading, inspecting or any form of use) the owner shall assume the responsibilities of the user as specified in Section 7 of this standard and shall ensure that the person has been: (1) Trained. (2) Familiarized with the aerial platform to be operated. (3) Made aware of the responsibilities of operators as outlined in Section 8 of this standard.

**6.11.2 Assistance to user.** Upon request of the user, when an owner sells, leases, rents or provides an aerial platform for any form of beneficial use, the owner at that time shall offer to do training or advise the user where training may be reasonably secured.

**6.12 Familiarization Upon Delivery.** Upon delivery for lease, rental or any form of beneficial use, the owner shall have the responsibility with the person designated by the receiving entity for accepting the aerial platform to: 1) Identify the weather resistant compartment (for manual storage). 2) Confirm the manuals, as specified by the manufacturer, are on the aerial platform. 3) Review control functions with the operator or person(s) designated by the user. 4) Review safety devices specific to the model aerial platform being delivered.

**6.13 Operation.** When an owner operates an aerial platform, the owner shall have the responsibilities of users as specified in Section 7 of this standard, and the operating personnel shall have responsibilities of operators as specified in Section 8 of this standard.

**6.14 Assistance To Users And Operators.** If an owner is unable to answer a user's or operator's question(s) relating to rated capacity, intended use, maintenance, repair, inspection, or operation of the aerial platform, the owner shall obtain the proper information from the dealer or manufacturer and provide that information to user or operator.

## **6.15 Record Retention And Dissemination.**

**6.15.1 Record retention.** The owner shall retain the following records for at least 4 years: (1) Name and address of the purchaser of each aerial platform by serial number and date of delivery. (2) Written records of the frequent and annual inspections and repairs performed. The record shall include deficiencies found, corrective action accomplished and identification of the person(s) performing the inspection and repairs. (3) Written records of repairs accomplished on the aerial platform. The records shall include corrective action accomplished and identification of the person(s) performing the repairs. (4) Predelivery preparation performed prior to each delivery. (5) Name of the person(s) trained. (6) Name of the person(s) providing training. (7) Name of the person(s) provided with familiarization upon delivery unless this individual has been provided with familiarization on the same model, or one having characteristics consistent with the one being delivered, within the prior 90 days. (8) Name of person(s) providing familiarization upon delivery.

**6.15.2 Proof of training.** Owners providing training should provide successful trainees a means to evidence their training and shall provide such proof if requested by the trainee. The document evidencing the training shall include the following information: (1) Name of entity providing training or retraining. (2) Name of trainer(s). (3) Clear identification that training covered Self-Propelled Elevating Work Platforms. (4) Date of training.

**6.15.3 Record dissemination.** Upon request, an owner accomplishing training and/or familiarization shall provide the following: (1) To a user, proof of training for an operator, including name of trainer and date of training; (2) To a user, the name of the person(s) receiving familiarization upon delivery of the aerial platform.

**6.16 Modifications.** Modification, alteration or remanufacture of an aerial platform shall be made only with prior written permission of the manufacturer.

**6.17 Manufacturer's Safety Bulletins.** The owner shall comply with safety-related bulletins as received from the manufacturer or the dealer.

**6.18 Responsibilities Upon Sale.** When the aerial platform is sold, the seller: (1) Shall, upon delivery, ensure the operating and maintenance manuals are conveyed to the new owner. (2) Shall, upon delivery, provide a copy of the ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms. (3) Should provide repair and parts manuals to the new owner. (4) Shall, upon the request of the new owner, offer to do training or advise where training may reasonably be obtained.

## **7. Responsibilities of Users.**

**7.1 Basic Principles.** The information in this standard must be supplemented by good job management, safety control, and the application of sound principles of safety, training, inspection, maintenance, application, and operation consistent with all data available regarding the parameters of intended use and expected environment. Since the user has direct control over the application and operation of aerial platforms, conformance with good safety practices in this area is the responsibility of the user and the operating personnel, including the operator. Decisions on the use and operation of the aerial platform must always be made with due consideration for the fact that the aerial platform will be carrying personnel whose safety is dependent on those decisions.

### **7.2 Manuals.**

**7.2.1 Machine manuals.** Users shall keep and maintain a copy(s) of the operating and maintenance manual(s) in the weather resistant storage compartment provided by the manufacturer. The manual(s) is considered an integral part of the aerial platform and is vital to communicate necessary safety information to users and operators.

**7.2.2 Manual of responsibilities.** The ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and

Brokers of Self-Propelled Elevating Work Platforms shall be provided and stored in the weather resistant storage compartment.

**7.3 Inspection And Maintenance.** Users shall inspect and maintain the aerial platform as required to ensure proper operation. The frequency of inspection and maintenance shall be determined by the manufacturer's recommendations and be compatible with operating conditions and the severity of the operating environment. Aerial platforms that are not in proper operating condition shall be immediately removed from service until repaired. Repairs shall be made by a qualified person and the repairs shall be in conformance with the manufacturer's recommendations.

**7.3.1 Frequent Inspection.** Users of an aerial platform shall ensure that frequent inspections are conducted as outlined in section 6.6 of this standard.

**7.3.2 Annual Inspection.** Users of an aerial platform shall ensure that annual inspections are conducted as outlined in section 6.7 of this standard.

**7.3.3 Pre-start Inspection.** Before use each day or at the beginning of each shift, the aerial platform shall be given a visual inspection and functional test including but not limited to the following: (1) Operating and emergency controls. (2) Safety devices. (3) Personal protective devices. (4) Air, hydraulic and fuel system leaks. (5) Cables and wiring harness. (6) Loose or missing parts. (7) Tires and wheels. (8) Placards, warnings, control markings, and operating manual(s). (9) Outriggers, stabilizers, and other structures. (10) Guardrail system. (11) Items specified by the manufacturer.

**7.3.4 Maintenance Safety Precautions.** Before adjustments and repairs are started on an aerial platform, the following precautions shall be taken as applicable: (1) Powerplant stopped and starting means rendered inoperative; (2) All controls in the "Off" position and all operating systems secured from inadvertent motion by brakes, blocks, or other means; (3) Elevating assembly and platform lowered to the full down position, if possible, or otherwise secured by blocking or cribbing to prevent dropping; (4) Hydraulic oil pressure relieved from all hydraulic circuits before loosening or removing hydraulic components; (5) Safety props or latches installed where applicable as prescribed by the manufacturer.

**7.4 Replacement Parts.** When parts or components are replaced, they shall be identical or equivalent to original aerial platform parts or components.

**7.5 Maintenance Training.** The user shall insure only qualified personnel inspect and maintain the aerial platform in accordance with the manufacturer's recommendations and sections 7.3 and 7.4 of this standard.

**7.6 Operator Training And Retraining.** Whenever a user directs or authorizes an individual to operate an aerial platform the user shall ensure the person has been: (1) Trained before being assigned to operate the aerial platform. (2) Familiarized with the aerial platform to be operated. (3) Made aware of responsibilities of operators as outlined in Section 8 of this standard. (4) Retrained, if necessary, based on the user's observation and evaluation of the operator.

**7.6.1 Trainee records.** A record of the trainee's aerial platform instruction shall be maintained by the user for at least 4 years.

**7.7 Familiarization Before Use.** The user shall permit only properly trained personnel to operate an aerial platform. The user shall ensure that before use the operator is familiar with the model of the aerial platform to be operated, and specifically: (1) Knows where the weather resistant compartment for manual storage is located. (2) Knows the operating and maintenance manuals supplied by the manufacturer are stored in the weather resistant compartment and is familiar with the operating and safety manuals. (3) Understands all control functions, placards and warnings. (4) Is aware of and understands all safety devices specific to the model aerial platform being used.

**7.8 Workplace Inspection.** Before the aerial platform is used and during use, the user shall check the area in which the aerial platform is to be used for possible hazards such as, but not limited to: (1) Drop-offs or holes. (2) Slope(s). (3) Bumps and floor obstructions. (4) Debris. (5) Overhead obstructions and high voltage conductors. (6) Hazardous locations and atmospheres (reference ANSI/NFPA 505-1996). (7) Inadequate surface and support to withstand all load forces imposed by the aerial platform in all operating configurations. (8) Wind and weather conditions. (9) Presence of unauthorized persons. (10) Other possible unsafe conditions.

**7.9 Determination Of Hazardous Locations.** It shall be the responsibility of the user to determine the hazard classification (potential presence of flammable or explosive gases or particles) of the intended location of operation. Aerial platforms operated in hazardous locations shall be approved in accordance with, and of the type required, by ANSI/NFPA 505-1996.

**7.10 Operator Warnings And Instructions.** The user shall direct personnel operating the aerial platform to be in compliance with the provisions set forth in this standard. The user shall monitor their performance and supervise their work to ensure the use, application and operation of the aerial platform is in conformance with the provisions set forth in this standard, warn personnel of potential hazards, provide means to protect against identified hazards, and explain the potential consequences of not following proper operating guidelines. Instructions and guidelines regarding proper operation shall include, but not necessarily be limited to, the following issues and subjects: (1) Fall protection. The guardrail system of the aerial platform provides fall protection. If worksite rules require an occupant(s) of the platform to wear restraint or body positioning devices, occupants shall comply with instructions provided by the aerial platform manufacturer regarding anchorage(s). (2) Slope and grade. The aerial platform shall not be operated in any manner on grades, side slopes or ramps exceeding those for which the aerial platform is rated by the manufacturer. (3) Deployment of stability enhancing means. Outriggers, stabilizers, extendible axles, oscillating axles or other stability enhancing means shall be deployed and locked into place as required by the manufacturer. (4) Guardrail system. Guardrails shall be installed and positioned, and access gates or openings shall be closed per the manufacturer's instructions. (5) Distribution of load. The load and its distribution on the platform and any platform extension(s) shall be in accordance with manufacturer's rated capacity for that specific configuration. (6) Maintaining overhead clearance. The operator shall be instructed to ensure that adequate clearance is maintained from overhead obstructions and energized electrical conductors and parts. (7) Electrocution hazard. The user shall direct the operator to maintain, and provide the means to maintain the minimum safe approach distance (MSAD) from energized power lines and parts, as listed in Table 7-1 on pages 7-14 & 7-15. Electrical equipment and lines shall be considered energized until determined to be de-energized by tests or other appropriate methods or means and properly grounded. If energized power lines or parts are within the area in which the aerial platform is to be used, the user shall define and explain to the operator specific means to maintain the minimum safe approach distance required. (8) Personal protective equipment. The user shall direct the operator to ensure all personnel on the platform wear personal protective equipment as required. (9) Personnel footing. Personnel shall maintain a firm footing on the platform floor while working thereon. Climbing by occupants on the midrail or toprail of the aerial platform is prohibited. The use of planks, ladders, or any other device on the aerial platform for achieving additional height or

reach is prohibited. (10) Precaution for other moving equipment. When other moving equipment and vehicles are present, special precautions shall be taken to comply with local ordinances or safety standards established for the workplace. Warnings such as, but not limited to, flags, roped-off areas, flashing lights, and barricades shall be used as appropriate. (11) Reporting problems or malfunctions. The user shall direct the operator to immediately report to a supervisor any problem(s) or malfunction(s) that become evident during operation. The user shall ensure all problems and malfunctions that affect the safety of operations are repaired prior to continued use. (12) Reporting potentially hazardous locations. The user shall direct the operator to immediately report to a supervisor any potentially hazardous location(s) (one having potentially flammable or explosive gases or particles) that become evident during operation. (13) Hazardous location operation. Operation of aerial platforms not approved and marked for operation in a hazardous location (one having potentially flammable or explosive gases or particles) shall be prohibited. (14) Entanglement. Care shall be taken to prevent rope, electric cords, and hoses, etc., from becoming entangled in the aerial platform. (15) Capacity limitations. Rated capacities shall not be exceeded when loads are transferred to the platform at any height. (16) Work area. The operator shall ensure the area surrounding the aerial platform is clear of personnel and equipment before lowering the platform. (17) Fueling. The engine (if applicable) shall be shut down while fuel tanks are being filled. Fueling shall be done in a well-ventilated area free of flame, sparks, or other hazards that may cause fire or explosion. (18) Battery charging. Batteries shall only be charged in a well-ventilated area free of flame, sparks, or other hazards that may cause fire or explosion. (19) Improper platform stabilization. The aerial platform shall not be positioned against another object to steady the platform. (20) Misuse as a crane. The aerial platform shall not be used as a crane. (21) Unusual operating support conditions. The aerial platform shall not be operated from a position on trucks, trailers, railway cars, floating vessels, scaffolds, or similar equipment unless the application is approved in writing by the manufacturer or a qualified person. (22) Travel speeds. The operator shall limit travel speed according to conditions, including the condition of the support surface, congestion, visibility, slope, location of personnel, and other factors leading to hazards which may cause collision(s) or result in potential injury(s) to personnel. (23) Elevated driving requirements. Before and during driving while the platform is elevated, the operator shall: (a) Maintain a clear view of the support surface and route of travel. (b) Ensure personnel in the worksite area that may be affected are aware of the movement, communicating and maneuvering the aerial platform as required to protect against personal injury. (c) Maintain a safe distance from obstacles, debris, drop-offs, holes, depressions, ramps, and other hazards to ensure safe travel. (d) Maintain a safe distance from overhead obstacles. (24) Stunt driving. Stunt driving and horseplay are prohibited. (25) Securing the aerial platform. The user shall direct the operator to implement means provided to protect against use by unauthorized person(s). (26) Altering safety devices. Interlocks or other safety devices shall not be altered or disabled. (27) Snagged platform. If the platform/basket or supporting assembly becomes caught, snagged, or otherwise prevented from normal motion by adjacent structures or other obstacles such that control reversal does not free the platform, all personnel shall be removed from the platform/basket before attempts are made to free the platform using lower controls. (28) Vacating (or entering) an elevated aerial platform. If permitted by the manufacturer, personnel shall only vacate or enter a raised aerial platform by following the guidelines and instructions provided by the manufacturer. (29) Modifications. Modification or alteration of an aerial platform or the fabrication and attaching of frameworks, or the mounting of attachments for holding tools or materials onto the platform or the guardrail system shall only be accomplished with the prior written permission of the manufacturer. (30) Assistance to the operator. If an operator encounters any suspected malfunction of the aerial platform, or any hazard or potentially unsafe condition relating to capacity, intended use or safe operation of the aerial platform, the operator shall cease operation of the aerial platform and request further information from the employer. (31) Problems or malfunctions. Any problem(s) or malfunction(s) that affect the safety of operations shall be repaired prior to use of the aerial platform. (32) Carrying materials (larger than the platform). The user shall ensure



that only tools and materials, which are evenly distributed and can be safely handled by a person(s) working from the platform, are transported. (33) Rated horizontal force. The user shall direct the operator not to exceed the manufacturer's rated horizontal force. (34) Bridge cranes. When an aerial platform is to operate within the area of travel of a bridge crane or similar equipment, steps shall be taken to prevent a collision with the aerial platform. (35) Adequate support requirements. The user shall insure the support surface is adequate for the aerial platform and the load carried. (36) Leveling the aerial platform. Outriggers and leveling devices supplied by the manufacturer shall be utilized to level the aerial platform when provided. (37) Protecting against unauthorized use. The user shall direct the operator not to use, rent, lease, or provide the aerial platform for any form of beneficial use unless so authorized.

**7.11 User As Operator.** If a user is also the operator of an aerial platform, the user shall have the responsibilities of operators specified in Section 8 of this standard as well as responsibilities of users as specified in Section 7 of this standard.

**7.12 Shutdown Of Aerial Platform.** The user shall authorize and direct the operating personnel to cease operation of the aerial platform in case of any suspected malfunctions of the aerial platform, or any hazard or potentially unsafe condition that may be encountered, and to request further information as to safe operation from the owner, dealer, or manufacturer before further operation of the aerial platform.

**7.13 Record Retention And Dissemination.**

**7.13.1 Record retention.** The user shall retain the following records for at least 4 years: (1) Names of the operator(s) trained and retrained. (2) Names of operator(s) provided familiarization. (3) The owner (or entity designated by the owner) is responsible to ensure frequent and annual inspections are conducted and written records are maintained. The records shall include the date of the inspection, any deficiencies found, the corrective action recommended and identification of the person(s) performing the inspection. (4) When employees of the user accomplish repairs on the aerial platform, the user shall maintain written records. The record shall include the date of repair, a description of the work accomplished, and identification of the person(s) performing the repair.

**7.13.2 Record dissemination.** (1) When the user directs personnel to accomplish frequent or annual inspections, not later than 60 days after the inspections, the appropriate records shall be provided to the owner of the aerial platform. (2) When the user directs personnel to accomplish repairs on the aerial platform, not later than 60 days after the repairs are accomplished, the appropriate records shall be provided to the owner.

**7.13.3 Proof of training.** Users providing training should provide successful trainees a means to evidence their training and shall provide such proof if requested by the trainee. The document evidencing the training shall include the following information: (1) Name of entity providing training or retraining. (2) Name of trainer(s). (3) Clear identification that training covered Self-Propelled Elevating Work Platforms. (4) Date of training.

**7.14 Modifications.** Modification, alteration or remanufacture of an aerial platform shall be made only with prior written permission of the manufacturer.

**7.15 Manufacturer's Safety Bulletins.** The user shall comply with safety related bulletins as received from the manufacturer, dealer, or owner.

**8. Responsibilities Of Operators**

**8.1 Basic Principles.** The information in this standard shall be supplemented by good judgment, safety control, and caution in evaluating each situation. Since the operator is in direct control of the aerial platform, conformance with good safety practices in this area is the responsibility of the operator. The operator shall make decisions on the use and operation of the aerial platform with due consideration for the fact that his or her own safety as well as the safety of others is dependent on those decisions.

## **8.2 Manuals.**

**8.2.1 Machine manuals.** The operator shall ensure the operating and maintenance manuals are stored in the weather resistant storage compartment on the aerial platform. The manual(s) is considered an integral part of the aerial platform and is vital to communicate necessary safety information to the operator. The operator shall be familiar with the manuals and reference them as required.

**8.2.2 Manual of responsibilities.** The ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms shall be provided and stored in the weather resistant storage compartment.

**8.3 Pre-start Inspection.** Before use each day or at the beginning of each shift, the aerial platform shall be given a visual inspection and functional test including but not limited to the following: (1) Operating and emergency controls. (2) Safety devices. (3) Personal protective devices. (4) Air, hydraulic, and fuel system leaks. (5) Cables and wiring harness. (6) Loose or missing parts. (7) Tires and wheels. (8) Placards, warnings, control markings, and operating manuals. (9) Outriggers, stabilizers, and other structures. (10) Guardrail system. (11) Items specified by the manufacturer.

**8.4 Problems Or Malfunctions.** Any problems or malfunctions that affect the safety of operations shall be repaired prior to the use of the aerial platform.

## **8.5 Training, Retraining, And Familiarization.**

**8.5.1 General training.** Only personnel who have received general instructions regarding the inspection, application and operation of aerial platforms, including recognition and avoidance of hazards associated with their operation, shall operate an aerial platform. Such items covered shall include, but not necessarily limited to, the following issues and requirements: (1) The purpose and use of manuals. (2) That operating manuals are an integral part of the aerial platform and must be stored properly in the weather resistant compartment when not in use. (3) A pre-start inspection. (4) Responsibilities associated with problems or malfunctions affecting the operation of the aerial platform. (5) Factors affecting stability. (6) The purpose of placards and decals. (7) Workplace inspection. (8) Safety rules and regulations. (9) Authorization to operate. (10) Operator warnings and instructions. (11) Actual operation of the aerial platform. Under the direction of a qualified person, the trainee shall operate the aerial platform for a sufficient period of time to demonstrate proficiency in the actual operation of the aerial platform.

**8.5.2 Retraining.** The operator shall be retrained, when so directed by the user, based on the user's observation and evaluation of the operator.

**8.5.3 Familiarization.** When an operator is directed to operate an aerial platform he/she is not familiar with, the operator shall receive instructions regarding the following items: (1) The location of the weather resistant compartment (for manual storage). (2) The purpose and function of all controls. (3) Safety devices and operating characteristics specific to the aerial platform.

**8.6 Before Operation.** Before operation, the operator shall: (1) Read and understand the manufacturer's operating instruction(s) and user's safety rules or have them explained. (2) Understand all labels, warnings, and instructions displayed on the aerial platform or have them explained. (3) Ensure all occupants of the aerial platform wear appropriate personal safety equipment for the conditions, including the environment in which the aerial platform will be operated.

**8.7 Workplace Inspection.** Before the aerial platform is used and during use, the operator shall check the area in which the aerial platform is to be used for possible hazards such as, but not limited to: (1) Drop-offs or holes. (2) Slope(s). (3) Bumps and floor obstructions. (4) Debris. (5) Overhead obstructions and electrical conductors. (6) Hazardous locations. (7) Inadequate surface and support to withstand all load forces imposed by the aerial platform in all operating configurations. (8) Wind and weather conditions. (9) Other possible unsafe conditions.

**8.8 Prior To Each Elevation.** Before each elevation of the platform, the operator shall ensure: (1) Outriggers, stabilizers, extendable axles, or other stability enhancing means are used as required by the manufacturer. (2) Guardrails are installed and access gates or openings are closed per manufacturer's instructions. (3) The load and its distribution on the platform and any platform extension(s) are in accordance with the manufacturer's rated capacity for that specific configuration. (4) All personnel on the aerial platform have appropriate safety gear for the work and environment envisioned.

**8.9 Understanding Of Hazardous Locations.** It shall be the responsibility of the operator to understand the hazard classification (potential presence of flammable or explosive gases or particles) of the intended location of operation according to ANSI/NFPA-1996.

**8.10 Operator Warnings And Instructions.** The operator shall ensure the operation of the aerial platform is in compliance with the following: (1) Fall protection. The guardrail system of the aerial platform provides fall protection. If worksite rules require an occupant(s) of the platform to wear restraint or body positioning devices, occupants shall comply with instructions provided by the aerial platform manufacturer regarding anchorage(s). (2) Slope and grade. The aerial platform shall not be operated in any manner on grades, side slopes or ramps exceeding those for which the aerial platform is rated by the manufacturer. (3) Deployment of stability enhancing means. Outriggers, stabilizers, extendable axles, oscillating axles or other stability enhancing means shall be deployed and locked into place as required by the manufacturer. (4) Guardrail system. Guardrails shall be installed and positioned, and access gates or openings shall be closed per the manufacturer's instructions. (5) Distribution of load. The load and its distribution on the platform and any platform extension(s) shall be in accordance with manufacturer's rated capacity for that specific configuration. (6) Maintaining overhead clearance. The operator shall ensure adequate clearance is maintained from overhead obstructions and energized electrical conductors and parts. (7) Electrocution hazard. The operator shall maintain the minimum safe approach distance (MSAD) from energized power lines and parts, as listed in Table 7-1 on pages 7-14 & 7-15. Electrical equipment and lines shall be considered energized until determined to be de-energized by tests or other appropriate methods or means and properly grounded. If energized power lines or parts are within the area in which the aerial platform is to be used, the operator shall maintain the minimum safe approach distance required. (8) Personal protective equipment. The user operator shall ensure all occupants of the platform wear personal protective equipment as required. (9) Personnel footing. Personnel shall maintain firm footing on the platform floor while working thereon. Climbing by occupants on the midrail or top rail of the aerial platform is prohibited. The use of planks, ladders, or any other device on the aerial platform for achieving additional height or reach is prohibited. (10) Precaution for other moving equipment. When other moving equipment and vehicles are present, special precautions shall be taken to comply with local ordinances or safety standards established for the workplace. Warnings such as, but not limited to, flags, roped-off areas, flashing lights, and barricades shall be used as appropriate. (11) Reporting problems or malfunctions. The operator shall immediately report to a supervisor any problem(s) or malfunction(s) that become evident during operation. The operator shall ensure all problems and malfunctions that affect the safety of operations are repaired prior to continued use. (12) Reporting potentially hazardous locations. The operator shall immediately report to a supervisor any potentially hazardous location(s) (one having potentially flammable or explosive gases or particles) that become evident during operation. (13) Hazardous location operation. Operation of aerial platforms not approved and marked for operation in a hazardous location (one having potentially flammable or explosive gases or particles) shall be prohibited. (14) Entanglement. Care shall be taken to prevent rope, electric cords, and hoses, etc., from becoming entangled in the aerial platform. (15) Capacity limitations. Rated capacities shall not be exceeded when loads are transferred to the platform at any height. (16) Work area. The operator shall ensure the area surrounding the aerial platform is clear of personnel and equipment before lowering the platform. (17) Fueling. The engine (if applicable) shall be shut down while fuel tanks are being filled. Fueling shall be done in a well-ventilated area

free of flame, sparks, or other hazards that may cause fire or explosion. (18) Battery charging. Batteries shall only be charged in a well-ventilated area free of flame, sparks, or other hazards that may cause fire or explosion. (19) Improper platform stabilization. The aerial platform shall not be positioned against another object to steady the platform. (20) Misuse as a crane. The aerial platform shall not be used as a crane. (21) Unusual operating support conditions. The aerial platform shall not be operated from a position on trucks, trailers, railway cars, floating vessels, scaffolds, or similar equipment unless the application is approved in writing by the manufacturer or a qualified person. (22) Travel speeds. The operator shall limit travel speed according to conditions, including the condition of the support surface, congestion, visibility, slope, location of personnel, and other factors leading to hazards which may cause collision(s) or result in potential injury(s) to personnel. (23) Elevated driving requirements. Before and during driving while the platform is elevated, the operator shall: (a) Maintain a clear view of the support surface and route of travel. (b) Ensure personnel in the worksite area that may be affected are aware of the movement, communicating and maneuvering the aerial platform as required to protect against personal injury. (c) Maintain a safe distance from obstacles, debris, drop-offs, holes, depressions, ramps, and other hazards to ensure safe travel. (d) Maintain a safe distance from overhead obstacles. (24) Stunt driving. Stunt driving and horseplay are prohibited. (25) Securing the aerial platform. The operator shall implement means provided to protect against use by unauthorized person(s). (26) Altering safety devices. Interlocks or other safety devices shall not be altered or disabled. (27) Snagged platform. If the platform/basket or supporting assembly becomes caught, snagged, or otherwise prevented from normal motion by adjacent structures or other obstacles such that control reversal does not free the platform, all personnel shall be removed from the platform/basket before attempts are made to free the platform using lower controls. (28) Vacating (or entering) an elevated aerial platform. If permitted by the manufacturer, personnel shall only vacate or enter a raised aerial platform by following the guidelines and instructions provided by the manufacturer. (29) Modifications. Modification or alteration of an aerial platform or the fabrication and attaching of frameworks, or the mounting of attachments for holding tools or materials onto the platform or the guardrail system shall only be accomplished with the prior written permission of the manufacturer. (30) Assistance to the operator. If an operator encounters any suspected malfunction of the aerial platform, or any hazard or potentially unsafe condition relating to capacity, intended use or safe operation of the aerial platform, the operator shall cease operation of the aerial platform and request further information from the employer. (31) Problem(s) or malfunction(s). Any problems or malfunctions that affect the safety of operations shall be repaired prior to use of the aerial platform. (32) Carrying materials (larger than the platform). The operator shall ensure that only tools and materials, which are evenly distributed and can be safely handled by a person(s) working from the platform, are transported. (33) Rated horizontal force. The operator shall not permit personnel on the platform to exceed the manufacturer's horizontal force. (34) Bridge cranes. When an aerial platform is to operate within the area of travel of a bridge crane or similar equipment, steps shall be taken to prevent a collision with the aerial platform. (35) Adequate support requirements. The operator shall insure the support surface is adequate for the aerial platform and the load carried. (36) Leveling the aerial platform. Outriggers and leveling devices supplied by the manufacturer shall be utilized to level the aerial platform when provided. (37) Protecting against unauthorized use. The operator shall not use, rent, lease, or provide the aerial platform for any form of beneficial use to another entity without the authorization of the user.

**8.11 Record Of Training.** When provided or when obtained upon the operator's request, proof of training provided by the training entity should be retained by the operator. Records shall contain the following information: (1) Name of entity providing training or retraining. (2) Name of trainer(s). (3) Clear identification that training covered Self-Propelled Elevating Work Platforms. (4) Date of training.

## 9. Responsibilities Of Lessors

**9.1 Basic Principles.** Sound principles of safety, training, inspections, maintenance, application, and operation consistent with all data available regarding the parameters of intended use and expected environment shall be applied in the performance of responsibilities of lessors with due consideration of the knowledge that the aerial platform will be carrying personnel.

**9.2 Lessor As A Dealer.** When a lessor uses the aerial platform as a dealer, the lessor shall have the responsibilities of dealers as specified in Section 5 of this standard.

**9.3 Lessor As An Owner.** When a lessor uses the aerial platform as an owner, the lessor shall have responsibilities of owners as specified in Section 6 of this standard.

**9.4 Lessor As A User.** When a lessor uses the aerial platform as a user, the lessor shall have the responsibilities of users as specified in Section 7 of this standard.

**9.5 Lessor As An Operator.** When a lessor uses the aerial platform as an operator, he shall have the responsibilities of operators as specified in Section 8 of this standard.

## 10. Responsibilities Of Lessees

**10.1 Basic Principles.** Sound principles of safety, training, inspections, maintenance, application, and operation consistent with all data available regarding the parameters of intended use and expected environment shall be applied in the performance of responsibilities of lessees with due consideration of the knowledge that the aerial platform will be carrying personnel.

**10.2 Lessee As A Dealer.** When a lessee uses the aerial platform as a dealer, he shall have the responsibilities of dealers as specified in Section 5 of this standard.

**10.3 Lessee As An Owner.** When a lessee uses the aerial platform as an owner, the lessee shall have the responsibilities of owners as specified in Section 6 of this standard.

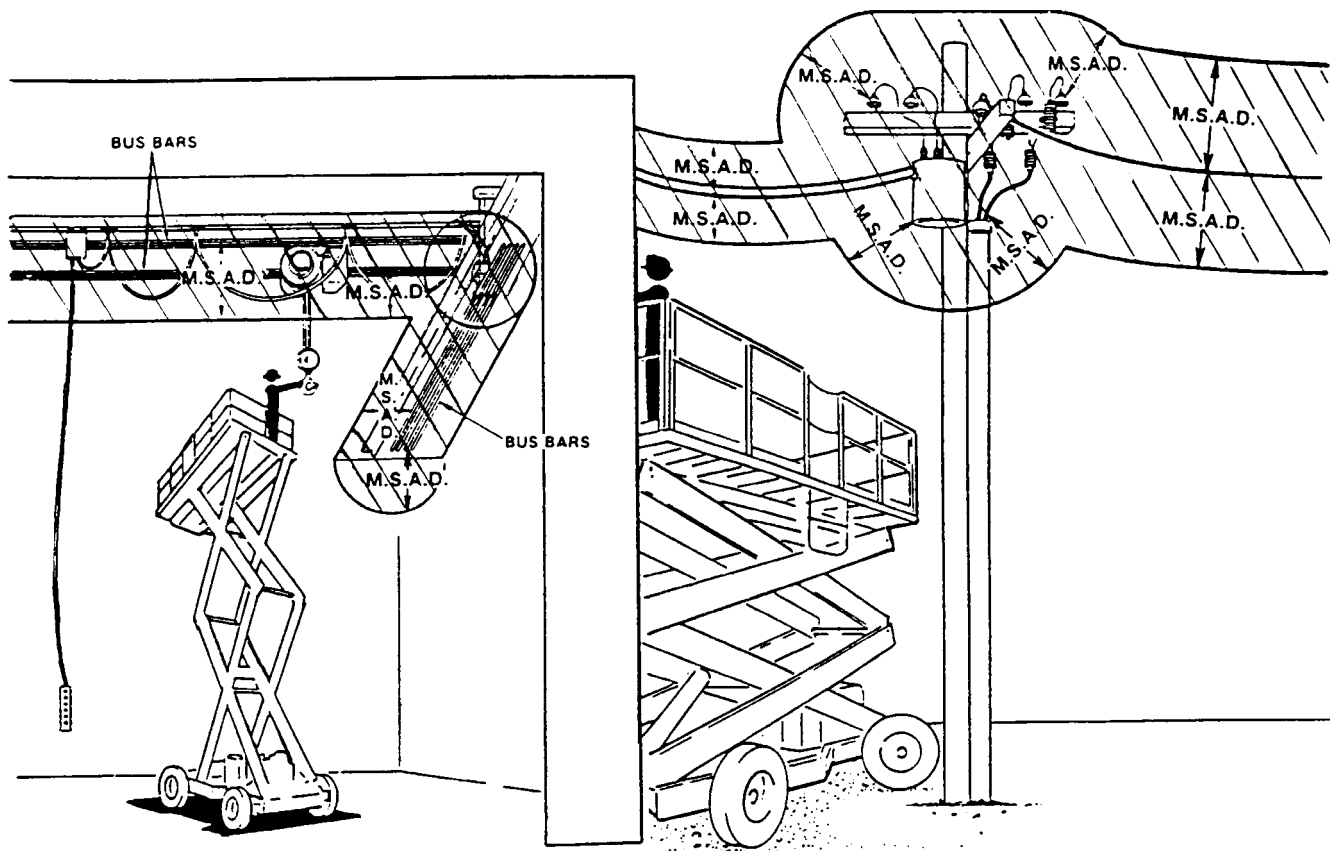
**10.4 Lessee As A User.** When a lessee uses the aerial platform as a user, the lessee shall have the responsibilities of users as specified in Section 7 of this standard.

**10.5 Lessee As An Operator.** When a lessee uses the aerial platform as an operator, the lessee shall have the responsibilities of operators as specified in Section 8 of this standard.

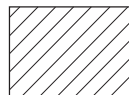
## 11. Responsibilities Of Brokers

**11.1 Responsibilities Upon Sale.** The broker shall: (1) Upon delivery, ensure the operating and maintenance manuals are provided to the new owner. (2) Upon delivery, provide a copy of the ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms. (3) Maintain records of the sale for a minimum of 4 years.

**11.2 Responsibilities With Re-rents, Leases, Or Any Other Form Of Beneficial Use.** When compensation is received as a result of a re-rent, lease or any form of beneficial use of an aerial platform, the broker shall: (1) Upon delivery, ensure the operating and maintenance manuals are provided to the user. (2) Upon delivery, provide a copy of the ANSI/SIA A92.6-1999 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees, and Brokers of Self-Propelled Elevating Work Platforms. (3) Ensure operating personnel are familiarized with the aerial platform prior to use. (4) Retain records of the transaction for a minimum of 4 years.



M.S.A.D. = Minimum Safe Approach Distance (See Table 7-1).



DENOTES PROHIBITED ZONE

**⚡ DANGER**

- Do not allow machine, personnel, or conductive materials inside prohibited zone.
- Maintain M.S.A.D. from all energized lines and parts as well as those shown.
- Assume all electrical parts and wires are energized unless known otherwise.

**⚠ CAUTION**

Diagrams shown are only for purposes of illustrating M.S.A.D. work positions, not all work positions.

**Table 7-1. Minimum Safe Approach Distance (M.S.A.D.) to energized  
(exposed or insulated) power lines and parts**

<b>Voltage Range (Phase to Phase)</b>	<b>Minimum Safe Approach Distance</b>	
	<b>(Feet)</b>	<b>(Meters)</b>
0 to 300V	Avoid Contact	
Over 300V to 50KV	10	3.05
Over 50KV to 200KV	15	4.60
Over 200KV to 350KV	20	6.10
Over 350KV to 500KV	25	7.62
Over 500KV to 750KV	35	10.67
Over 750KV to 1000KV	45	13.72









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