

UpRight

SL-20

SERVICE & PARTS MANUAL

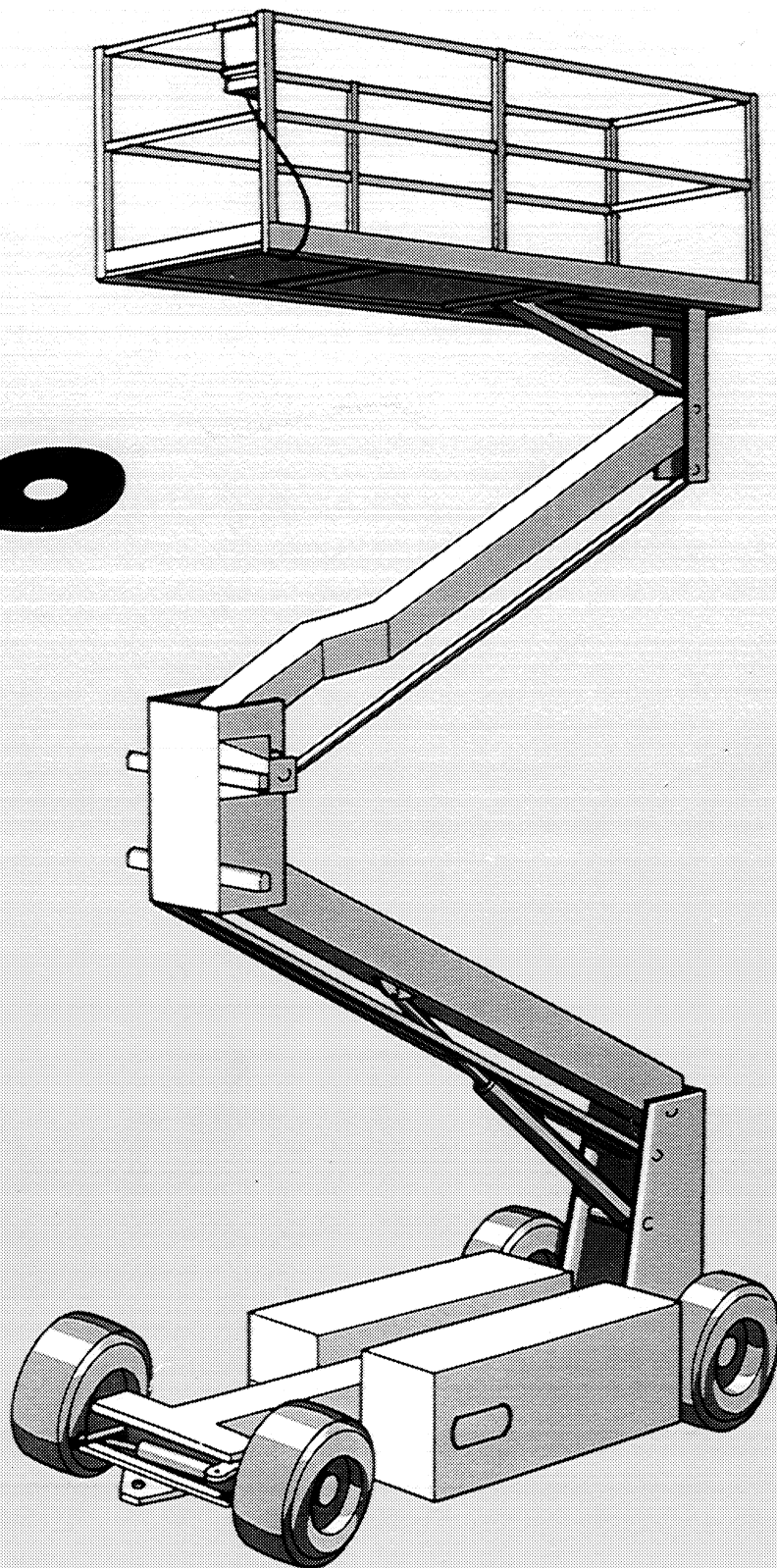


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INTRODUCTION AND GENERAL INFORMATION

1-1 INTRODUCTION.

1-2 PURPOSE. This manual provides illustrations and instructions for the operation and maintenance of the UPRIGHT SL-20 Work Platform manufactured by UpRight, Inc. Selma Operations, of Selma, California. (See Figure 1-1).

1-3 SCOPE. The operating instructions include both operation and maintenance responsibilities concerning the SL-20 Work Platform's readiness. The functions cover scheduled maintenance, troubleshooting, repair, adjustment and replacement.

1-4 GENERAL INFORMATION.

1-5 ITEM DESCRIPTION. The UPRIGHT SL-20 Work Platform is a self-propelled lift designed to be used as a means of elevating maintenance personnel and equipment

and to provide a mobile work platform. It is designed to provide mobility with the platform in a raised or lowered position. Travel with the platform raised more than one foot is limited to the low speed range.

1-6 PURPOSE AND LIMITATIONS. The objective of the SL-20 Work Platform is to provide a quickly deployable, self-propelled, variable height work platform. The elevating function shall only be used when the work platform is on a level paved or reinforced work area. The work platform is intended to be self-propelled when in relatively close proximity to the work area.

1-7 SPECIFICATIONS. Refer to Table 1-1.

Table 1-1. Specifications

ITEM	DESCRIPTION
Platform Size	30 In. x 96 In.
Maximum Platform Capacity	
Standard	750 lbs.
With Optional Cage	550 lbs. Total Capacity 250 lbs. In Cage
Working Height	26 Ft.
Maximum Platform Height	20 Ft.
Minimum Platform Height	47 In.
Energy Source	24 Volt Battery Pack 4 H.P. D.C. Electric Motor Four 220 Ampere-hour Batteries
Battery Charger	25 AMP Battery Charger
Battery Duty Cycle	25% for 8 Hours
Lift System	Single Lifting Cylinder
Driveable Height	20' Standard
Surface Speed	
Platform Lowered	0 to 2 MPH
Platform Raised	0 to .6 MPH
Hydraulic Tank Capacity	4 Gallons
Hydraulic Fluid	Mobil 423

ITEM	DESCRIPTION
Dimensions	
Weight	2,830 lb.
Overall Width	32-1/2 In.
Overall Height	89 In.
Overall Length	96 In.
Control System	2 Speed - Forward and Reverse
Drive Control	Toggle Switches for all Functions
Horizontal Drive	Dual Wheel Hydraulic Motors
Wheels	16 In. Diameter, Solid Rubber
Braking	Spring Applied, Hydraulic Release Parking Brake
Toeboard	4 In. High
Guardrails	42 in. High
Turning Radius	125 In. Outside
Gradability	20%
Wheel Base	73 In.

Specifications subject to change without notice.

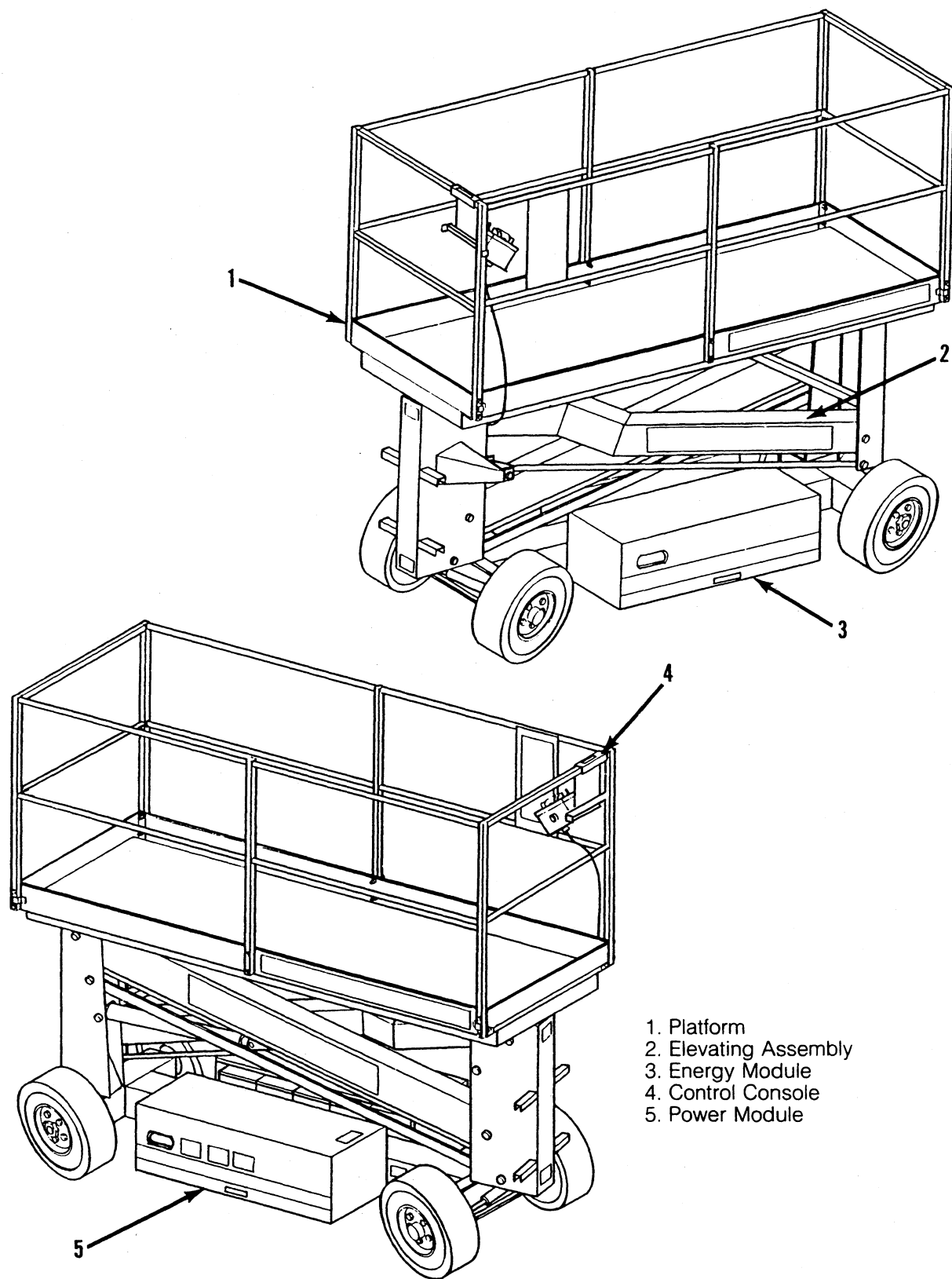


Figure 1-1. SL-20 Work Platform

INSTRUCTION MANUAL

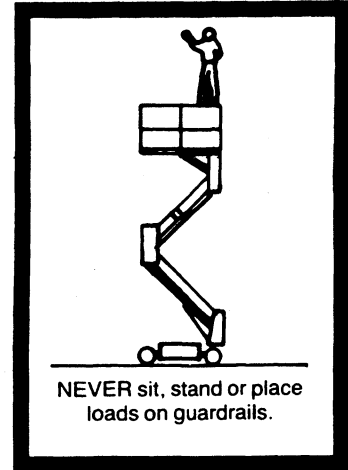
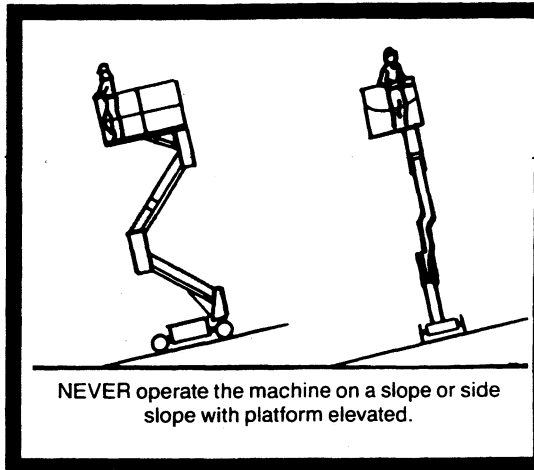
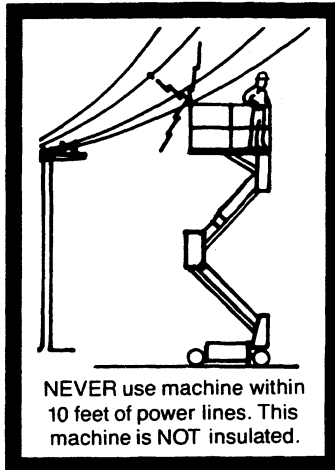
UpRight

SL-20

SECTION II

SERIAL NO. 3045 TO 3800
FOR OTHER SERIAL NUMBERS REFER TO INSTRUCTION
MANUAL ON THE MACHINE OR CONTACT THE FACTORY

SAFETY RULES & OPERATING INSTRUCTIONS



SAFETY RULES

BEFORE USING THE UpRight SL-20:

- Thoroughly **INSPECT** the work platform for cracked welds, loose hardware, hydraulic leaks, damaged control cable, loose wire connections and tire damage.
- **CHECK** that all guardrails are properly in place and secured with all fasteners in place.
- **DISTRIBUTE** all loads evenly on the platform. See back cover for maximum platform load.
- **SURVEY** the work area for surface hazards such as holes, drop-offs, bumps and debris before operating machine.
- **LOOK** up, down and around for overhead obstructions and electrical conductors.
- **LATCH** gate at entrance after mounting platform.
- **NEVER** use damaged equipment. (Contact UPRIGHT for instructions. See toll free number on back cover.)
- **NEVER** change operating or safety systems.
- **NEVER** operate the work platform within ten feet of power lines. **THIS MACHINE IS NOT INSULATED.**
- **NEVER** elevate the platform or drive the work platform while elevated unless the work platform is on firm level surface.
- **NEVER** attach overhanging loads or increase platform size.
- **NEVER** use ladders or scaffolding on the platform.
- **NEVER** sit, stand or climb on guardrail or midrail.
- **NEVER** climb down elevating assembly with the platform elevated.
- **NEVER** recharge batteries near sparks or open flame; batteries that are being charged emit highly explosive hydrogen gas.
- **NEVER** perform service on work platform while platform is elevated without blocking the elevating assembly.
- **AFTER USE** secure the work platform against unauthorized use by turning key switch off and removing key from key switch.
- **CHECK** that parking brake release valve is open for normal operation.

PRE-OPERATIONAL & SAFETY INSPECTION INSTRUCTIONS

*Read and fully understand all safety rules
and then follow these steps each day before use.*

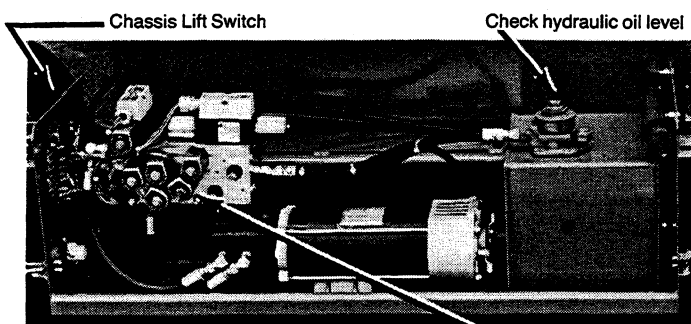


Figure 1. Power Module

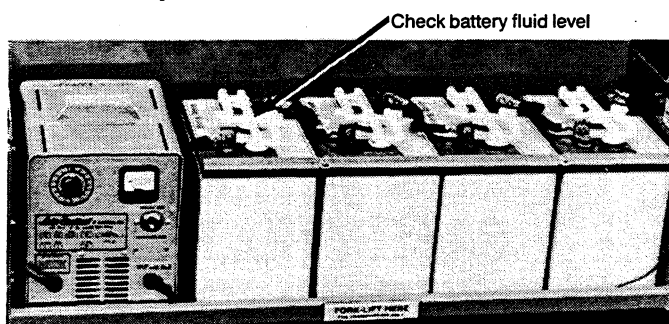


Figure 2. Energy Module

1. Visually inspect for any damage or missing parts.
2. Remove module covers.
3. Check hydraulic oil level with platform fully lowered. Unscrew LARGE hex portion of cap. Oil should be visible in filter (Figure 1). Use Mobile DTE 25 or equivalent.
4. Check battery fluid level (Figure 2).
5. Check state of battery charge (see Maintenance).
6. Check that AC extension cord has been disconnected from charger.

— WARNING —

PERFORM FOLLOWING CHECKS FROM THE GROUND

7. Check that emergency stop switch on control console is in "ON" position. When switch guard is closed, emergency stop switch will automatically go to "OFF" position.
8. Turn key switch to "DRIVE" position.
9. Depress foot switch (located on platform floor).
10. Push drive switch to "FORWARD" position then "REVERSE" position to check for speed and directional control.
11. Move steering switch right and then left to check steering control.
12. Move machine, if necessary, to unobstructed area to allow for full elevation.
13. Turn key switch to "LIFT" position.
14. Push chassis lift switch to "UP" position and fully elevate platform (Figure 1).
15. While platform is elevated, visually inspect from outside of elevating assembly area, gears, lift cylinder, cables and hoses for any damage or erratic operation.

NOTE: Step 10 should be done with drive range selector in "LOW" and "HIGH".

— WARNING —

DO NOT ENTER ELEVATING ASSEMBLY AREA WHILE ELEVATED

16. Check for missing or loose parts and fasteners.
17. Lower platform part way by pushing chassis lift switch to "DOWN" (Figure 1).
18. Check for audible down alarm function while lowering.
19. Finish lowering platform by opening emergency lowering valve to check for proper valve operation (see "Emergency Lowering").
20. Close emergency lowering valve (Figure 1).
21. After all the preceeding checks have been completed, replace module covers.

PREPARATION FOR USE

Ensure that pre-operation and safety inspection has been completed and any deficiencies have been corrected.

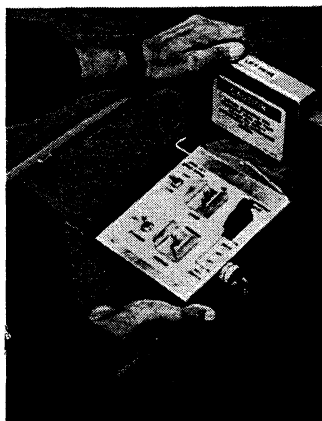


Figure 3.

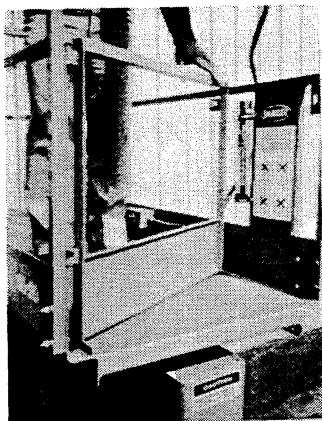


Figure 4.

1. Hang control console on guardrail (Figure 3).
2. After mounting platform, insure gate is closed and latched. (Figure 4).

OPERATING INSTRUCTIONS

Understand all functions of all controls before operating machine.

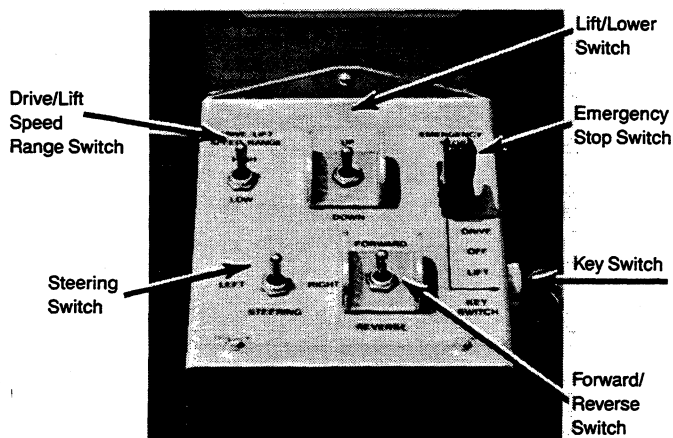


Figure 5. Control Console

— WARNING —

Before operating always check that route is clear of persons, obstructions, holes and dropoffs, above, below and to the sides of platform.

— WARNING —

Before traveling in reverse, double check that route is clear.

TRAVEL WITH PLATFORM LOWERED

NOTE: Always check that route is clear of obstructions, holes and drop-offs, and is capable of supporting the wheel loads.

1. Turn key switch to "DRIVE" position.
2. Set drive range selector to "HIGH" for travel on level surfaces, to "LOW" for climbing grades or traveling in confined areas.
3. Set the drive/lift speed range to "LOW".
4. Depress foot switch.
5. Push drive switch "FORWARD" or "BACKWARD" to travel desired direction.
6. While moving, push drive/lift speed range switch to "HIGH" if faster speed is desired.

STEERING

1. Turn key switch to "DRIVE" position.
2. Depress foot switch.
3. Push steering switch right or left to turn wheels.

NOTE: Steering is not self-centering. Wheels must be returned to straight ahead position by operating switch.

ELEVATING PLATFORM

1. Turn key switch to "LIFT" position.
2. Set drive/lift speed range switch to "HIGH".
3. Depress foot switch.
4. Push lift/lower switch to "UP" position to elevate platform.

NOTE: Setting drive/lift speed range switch to "LOW" will allow slow elevation speed.

TRAVEL WITH PLATFORM ELEVATED

NOTE: Machine will travel at a reduced speed when platform is elevated.

1. Travel with platform elevated only on a hard level surface.
2. Turn key switch to "DRIVE" position.
3. Depress foot switch.
4. Push drive switch FORWARD or BACKWARD to change direction.

LOWERING PLATFORM

1. Turn key switch to "LIFT" position.
2. Depress foot switch.
3. Push lift/lower switch to "DOWN".

EMERGENCY LOWERING

— WARNING —

If platform should fail to lower, never climb down elevating assembly. This could result in serious bodily injury.

1. Ask person on ground to open emergency lowering valve to lower platform. This valve is located on the left hand side of chassis through cut out in power module cover.
2. Open valve by turning knob counterclockwise (Figure 1).
3. Once platform is fully lowered, be certain that emergency lowering valve is closed again. The platform will not elevate if the emergency lowering valve has not been closed.

AFTER USE EACH DAY

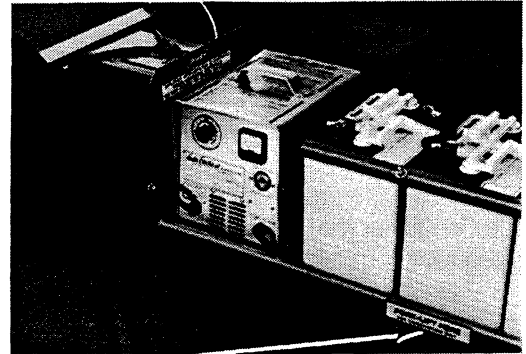
1. Ensure that platform is fully lowered.
2. Park work platform on level ground, preferably under cover.
3. Secure against vandals, children or unauthorized operation.
4. Turn key switch to "OFF" position and remove key to prevent unauthorized operation.

FORKLIFTING OF WORK PLATFORM

NOTE: Forklifting is for transporting only.

1. Forklift from side by lifting under modules (Figure 6).

NOTE: See specifications for weight of work platform and be certain that forklift is of adequate capacity to lift work platform.



Forklift from side

Figure 6. Forklifting

SECURING TO TRUCK FOR TRANSPORT

1. Always block under work platform to keep weight off front wheels while being transported.

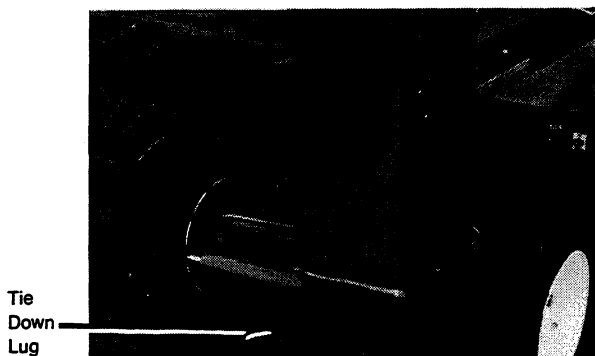


Figure 7. Tie Down Lugs

2. Use tie down lugs (located center front and center rear of chassis) to secure the work platform for transport (Figure 7).

— CAUTION —

Tie down lugs are not to be used for lifting work platform.

3. Use chains or straps of adequate load capacity.

— CAUTION —

Over-tightening may result in damage to work platform.

4. Always chock wheels on truck bed.

GUARDRAIL LOWERING INSTRUCTIONS

This procedure is solely for the purpose of passing through doorways. Guardrails must be returned to proper position before using the SL-20.

FOLD DOWN PROCEDURE

1. Remove control console from front guardrail and lay it on the deck.
2. Lift up on top front guardrail until slots disengage from pins and then fold guardrail back.
3. Remove retaining pin at the right side of top rear guardrail, rotate it to position along left top guardrail and pin in place.

4. Lift up on on left top guardrail until slots disengage with pins and fold guardrail in.
5. Lift up on right top guardrail until slots disengage with pins and fold guardrail in.

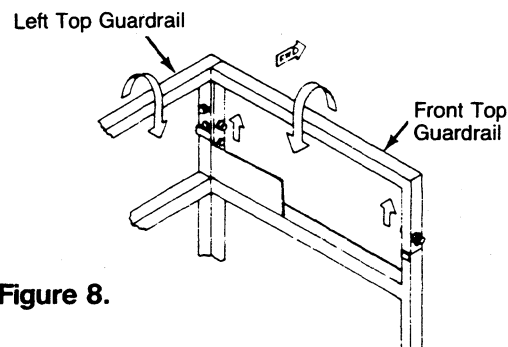
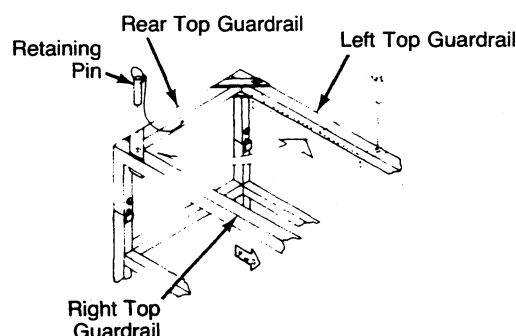


Figure 8.



GUARDRAIL ERECTION PROCEDURE

1. Raise the right top guardrail and then push down to engage pins with slots.
2. Raise the left top guardrail and then push down to engage pins with slots.
3. Remove retaining pin from rear top guardrail (attached to left top guardrail), swing it into place across rear of machine and pin to right top guardrail.
4. Raise front top guardrail and push down to engage pins with the slots.
5. Hook control console over front guardrail.

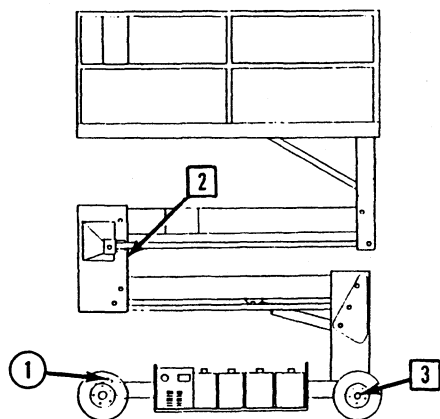
BATTERY CHARGING

1. Check battery fluid level.
2. Check battery charge indicator in power module to see state of charge in batteries.
3. The plug for the battery charger is located at the rear of the power module. Connect plug to properly grounded 115 volt, 60 HZ outlet.
4. Operation of the charger is automatic. The green light on the side cover of charger is on when batteries are charging. The light will blink when batteries are fully charged.

— CAUTION —

Use charger only on battery systems specified on battery nameplate. Connect only to properly grounded outlets. Disconnect only when supply cord is disconnected as arcing and burning may result. Surface of charger is very hot while charging and can cause burns. Avoid contact while charging. Keep charger dry.

MAINTENANCE AND ROUTINE SERVICE



LUBRICATION POINTS

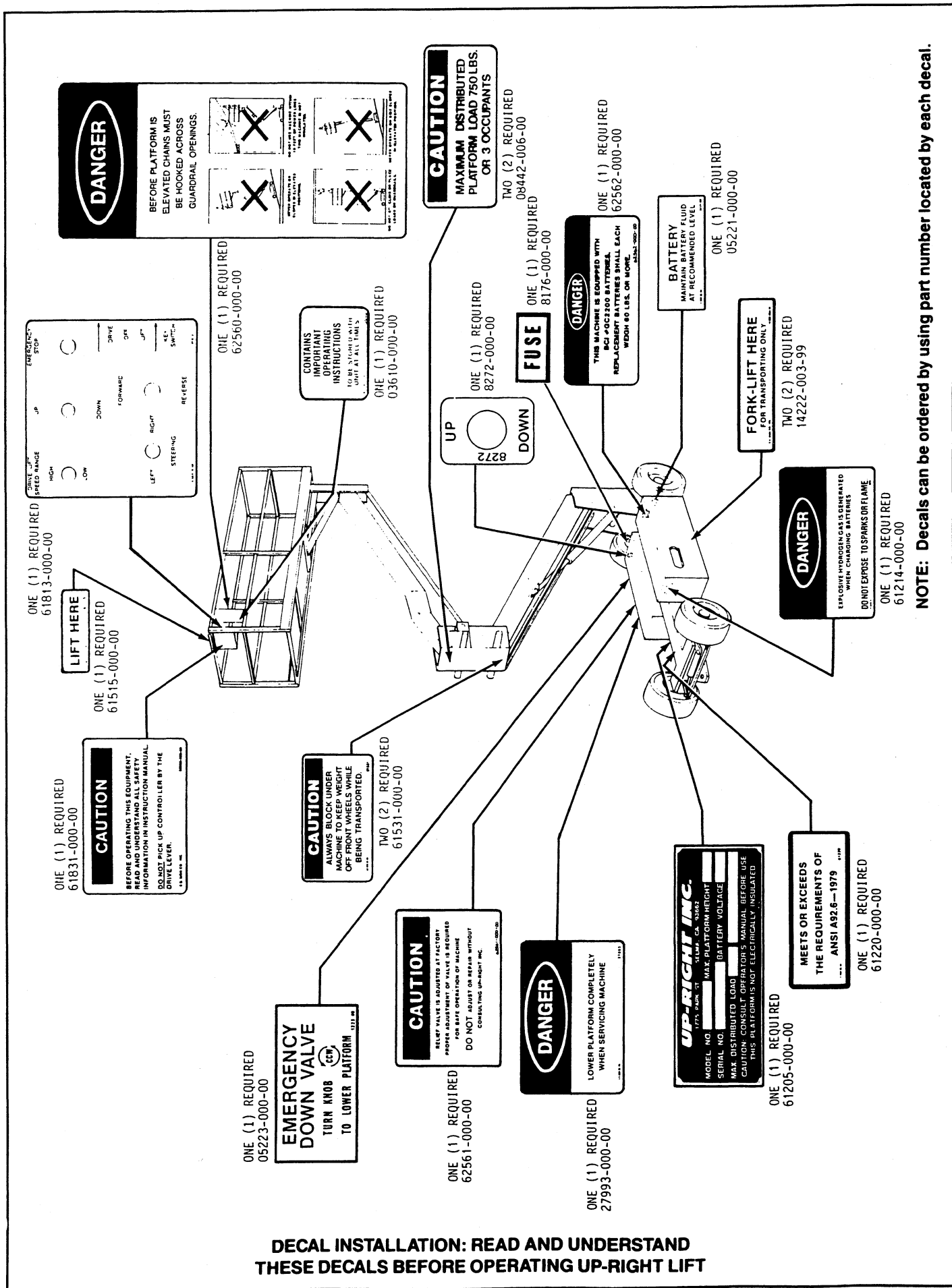
1. King Pins (Weekly)
2. Gears (Weekly)
3. Wheel Bearings (Yearly)

☐ Grease
☐ Oil

— CAUTION —

Never perform service work on work platform while platform is elevated.

Figure 9. Lubrication Points



NOTE: Decals can be ordered by using part number located by each decal.

SPECIFICATIONS		
ITEM	AMERICAN STANDARD	METRIC
PLATFORM SIZE	30 in. x 96 in.	0.76 m x 2.44 m
MAXIMUM PLATFORM CAPACITY Standard With Fold-Down Extension Deck With Optional Cage	750 lbs. 650 lbs. 550 lbs. total capacity/250 lbs. in cage	340 kg. 295 kg. 250 kg. total capacity/110 kg. in cage
WORKING HEIGHT	26 ft.	7.92 m
MAXIMUM PLATFORM HEIGHT	20 ft.	6.10 m
MINIMUM PLATFORM HEIGHT	47 in.	1.19 m
ENERGY SOURCE	24 volt battery pack 4 HP/DC electric motor Four 220 ampre-hour batteries	24 volt battery 3 kW DC Motor Four 220 ampres-hour batteries
BATTERY CHARGER	25 AMP Battery Charger	
BATTERY DUTY CYCLE	25% for 8 hours	
LIFT SYSTEM	Single Lifting Cylinder	
DRIVEABLE HEIGHT	20 ft.	6.10 m
SURFACE SPEED Platform Lowered Platform Raised	0 to 2.0 MPH 0 to .6 MPH	0.89 m/s 0.27 m/s
HYDRAULIC TANK CAPACITY	4 gallons	15
DIMENSIONS Weight Overall Width Overall Height Overall Height, Guardrails Lowered* Overall Length	2830 lbs. 32.5 in. 89 in. 79.5 in. 96 in.	1284 kg. 0.83 m 2.26 m 2.02 m 2.44 m
CONTROL SYSTEM	2 speeds — forward and reverse	
DRIVE CONTROL	Toggle switches for all functions	
HORIZONTAL DRIVE	Dual wheel; hydraulic motors	
WHEELS	16 in. diameter solid rubber	0.41 m diameter solid rubber
BRAKING	Spring applied, hydraulic release parking brake	
TOEBOARD	6 in. high	0.15 m high
GUARDRAILS	43.5 in. high	1.10 m high
TURNING RADIUS	114 in. outside, 88 in. inside	2.90 m outside, 2.24 m inside
GRADEABILITY	20%	20%
WHEEL BASE	73 in.	1.85 m
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE		

Required Maintenance Service

SERVICE OPERATION	SERVICE INTERVAL					
	Daily	Weekly	Monthly or 50 Hrs.	6 Mos. or 250 Hrs.	1 Yr. or 500 Hrs.	2 Yrs. or 1000 Hrs.
Check battery fluid level	X					
Charge batteries	X					
Check hydraulic fluid level	X					
Check lug nuts	X					
Lubricate king pins		X				
Grease gears		X				
Grease wheel bearings					X	
Change hydraulic filter				X		
Change hydraulic fluid						X
Check electric motor brushes			X			

Meets or exceeds all applicable requirements of OSHA and ANSI A92.6-1979

NOTE: FOR PROPER SERVICE PROCEDURES REFER TO UPRIGHT SL-20 SERVICE MANUAL.

SALES • RENTAL • SERVICE

UpRight

UpRight, Inc.
1775 Park Street
Selma, California 93662
TEL: 209/896-5150
FAX: 209/896-9012

Call Toll Free

1-800-926-LIFT

603099-001

Canada
108 Industrial Drive
Whitby, Ontario, Canada L1N5Z8
TEL: 416/668-7701

PREPARATION FOR USE, SHIPMENT AND STORAGE

3-1. PREPARATION FOR USE.

WARNING

STAND CLEAR when cutting the metal banding to avoid being cut when the banding snaps back.

- a. Remove the metal banding from the module covers and elevating assembly.
- b. Remove the banding from the control console.
- c. Lift the front of SL-20 and remove banding and blocks from rear wheels.
- d. Lower work platform.
- e. Close the emergency lowering valve.
- f. Connect the negative battery lead terminal (1, Figure 3-1).

3-2. PREPARATION FOR SHIPMENT.

- a. Fully lower the platform.
- b. Disconnect the battery negative (-) lead from the battery terminal (1, Figure 3-1).
- c. Band the control console to the front guardrail.
- d. Band the elevating assembly to the frame just behind the front wheels and at the rear wheels.
- e. For sea shipment, perform preservation per extended storage paragraph 3-4/a.

3-3. TRANSPORT.

- a. Maneuver the SL-20 into transport position and chock wheels.

NOTE

If forklifting is required, lift from side of the work platform.

- b. Place blocks under the rear axle.
- c. Secure the work platform to the transport vehicle with chains or straps of adequate load capacity attached to the chassis tie down lugs.
- d. Open emergency lowering valve.

3-4. STORAGE. No preparation for storage is required for normal usage. Regular maintenance per Table 5-1 and Figure 5-1 should be performed. If the work platform is to be placed in long term storage (dead storage) use the following preservation procedure.

a. **Preservation.**

- (1) Clean painted surfaces. If the paint surface is damaged, repaint.

NOTE

This hydraulic system is filled to the sight glass with approved fluid required for operation. Do not drain.

- (2) Fill the hydraulic tank to operating level.
- (3) Coat exposed portions of extended cylinder rods with an approved preservative and wrap with barrier material.
- (4) Coat all exposed unpainted metal surfaces with preservative.

b. **Batteries.**

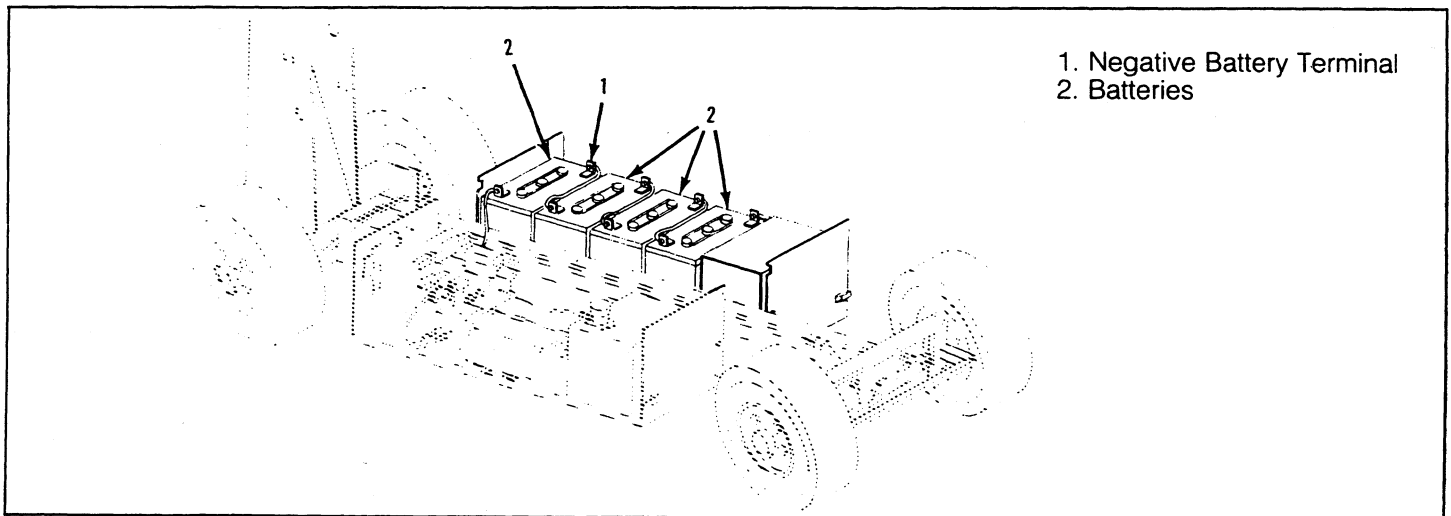
- (1) Disconnect all the battery leads and secure to the chassis. Tape the connectors on the ends of the leads to the chassis.
- (2) Remove the batteries and place in alternate service.

c. **Rear Axle.**

CAUTION

SL-20 must be blocked under rear axle to prevent damage to motor seals.

- (1) Jack up rear of work platform.
- (2) Place blocks under rear axles. The blocks must be high enough to prevent rear tires from touching the ground.
- (3) Lower work platform onto the blocks.



1. Negative Battery Terminal
2. Batteries

Figure 3-1. Batteries

OPERATION INSTRUCTIONS

4-1. THEORY OF OPERATION.

4-2. GENERAL FUNCTIONING. The battery powered electric motor directly drives a two section hydraulic pump. This pump supplies oil under pressure to operate all the work platform functions. The oil flow is directed to the different functions by electrically activated solenoid valves.

4-3. DRIVING (Figures 6-1 & 6-2). With the Emergency Stop Switch (S1) on and the Key (Mode) Switch (S2) in drive the work platform will drive and steer in direction you wish to travel. Driving Forward or Reverse will energize the Drive Coils (L3 or L5), the Steering Bypass Coil (L4) and the Motor Relays (CR1 and CR2) to start the Electric Motor. Oil will now flow through the Drive Valve (V4) to the Brake Cylinder (CYL2) and the Hydraulic Motor(s) (MOT1). Driving in High Speed will also energize the High Speed Coil (L9). This allows oil to combine from both sections of the Hydraulic Pump (ASSY1) and flow through Hydraulic Motor(s) (MOT1) to increase speed. Steering Left or Right will energize the Steering Valve Coils (L1 or L2) and the Motor Relays (CR1 and CR2). This allows oil to flow through the Steering Valve (V1) to the Steering Cylinder (CYL1).

Driving in High Speed with platform elevated is the same, except oil pressure on (CV4) opens the check valve and allows oil from one section of the pump to flow back to tank. This limits the machine to Low Speed.

4-4. RAISING AND LOWERING PLATFORM. With the Emergency Stop Switch (S1) on and the Key (Mode) Switch (S2) in Lift, the platform will raise and lower. Raising the platform energizes the Lift Bypass Coil (L7), Steering Bypass Coil (L4), UP Coil (L6) and Motor Relays (CR1 and CR2) to start Electric Motor. Oil will now flow through the Lift Valve (V7) to the Lift Cylinder (CYL3). Lifting in HIGH Speed will also energize the High Speed Coil (L9). This allows oil to combine from both sections of Hydraulic Pump (ASSY1) and flow to the Lift Cylinder (CYL3), increasing the speed in which the platform will raise. Lowering the platform electrically energizes the Down Alarm (HN) and the Down Coil (L8). This allows the oil to flow out of the Lift Cylinder through an orifice, which controls the rate of descent, then back to tank. Lowering the platform manually with Emergency Lowering Valve (V10) allows the oil to flow out of Lift Cylinder in same manner.

4-5. SAFETY DESIGN. The SL-20 has the following features to ensure safe operation.

- a. The drive speed is limited to CREEP speed when operating the work platform while platform is elevated.
- b. The platform descent rate is controlled by an orifice. The lift cylinder is equipped with a velocity fuse to prevent descent should a hose fail.
- c. A holding brake is automatically engaged when the drive toggle switch is released.
- d. The control box is equipped with a guarded emergency-stop switch.
- e. Controls are guarded to prevent inadvertent operating.
- f. An alarm is provided to signal when the platform is lowering.
- g. A lift switch is located in the module on the chassis for lifting and lowering work platform from ground level.
- h. A foot switch must be depressed for all power functions.

4-6. CONTROLS AND INDICATORS. The controls and indicators for operation of the SL-20 Work Platform are shown in Figure 4-1. The name and function of each control and indicator are listed in Table 4-1. The index numbers in the figure correspond to the index numbers in the table. The operator should know the location of each control and indicator and have a thorough knowledge of the function and operation of each before attempting to operate the unit.

4-7. OPERATING PROCEDURES.

4-8. PRE-OPERATION CHECKOUT.

WARNING

DO NOT perform service on work platform with the platform elevated unless it is properly blocked.

- a. Remove module covers and inspect for damage and missing parts.
- b. Check the level of the oil with the platform fully lowered. Oil should be visible at the sight gauge. Use Mobil 423 or equivalent.
- c. Check the fluid level in the batteries (See Section V, Paragraph 5-7).
- d. Check state of battery charge (See Section V, Paragraph 5-7/b).
- e. Check that A.C. extension cord has been disconnected from charger.
- f. Carefully inspect the entire work platform for damage such as cracked welds or structural members, loose or missing parts, oil leaks, damaged cables or hoses, loose connections and tire damage.

WARNING

Perform the following checks from the ground.

WARNING

STAND CLEAR of the platform while performing checks.

NOTE

Unhook control console from front guardrail and hold while performing the following tests.

- g. Before operating the work platform survey the work area for surface hazards such as holes, drop-offs, bumps and debris.
- h. Check in **ALL** directions for obstructions and electrical conductors.
- i. Lift the Emergency Stop Switch cover and position toggle to the **ON** position. (When switch guard is closed, Emergency Stop Switch will automatically go to **OFF** position).

CAUTION

Protect control console cable from possible damage while performing checks.

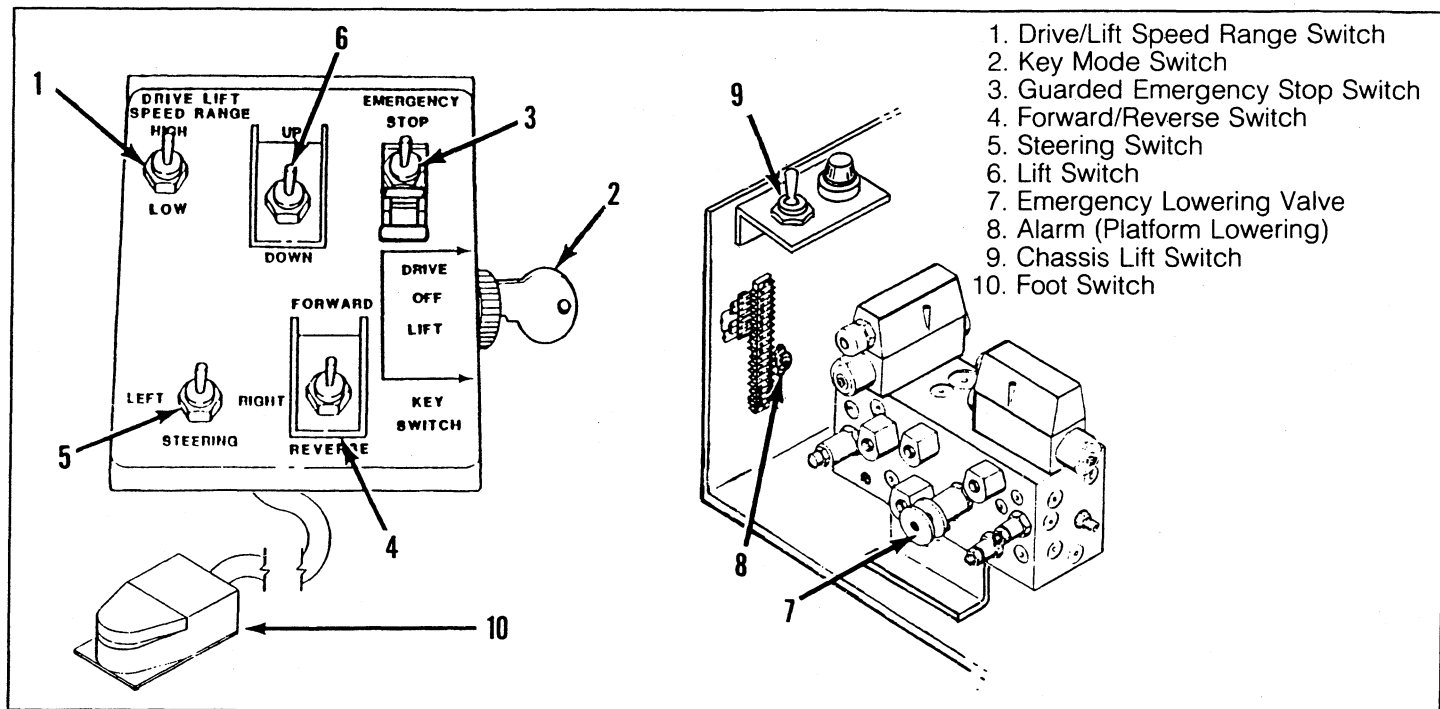


Figure 4-1. Controls and Indicators

j. Turn Mode Switch to **DRIVE** position.

NOTE

Step I. should be performed with Speed Range Switch first in **LOW** and then **HIGH**.

NOTE

Foot switch must be depressed for all power functions.

k. Push Drive Switch to **FORWARD** position then **REVERSE** position to check for speed and direction control.

l. Move Steering Switch **RIGHT**. Then **LEFT** to check for steering control.

m. Rehook control console to front guardrail and turn Mode Switch to **LIFT**.

WARNING

LOOK up and around for obstructions prior to operating the lift function.

DO NOT operate the work platform within 10 feet of any electrical power lines. **THIS WORK PLATFORM IS NOT INSULATED.**

DO NOT elevate the platform unless the work platform is on firm level ground.

DO NOT enter the elevating assembly while the platform is elevated.

n. Push Chassis Lift Switch to **UP** position, check **LOW** and **HIGH** speeds and fully elevate platform.

o. Visually inspect the elevating assembly, rollers, lift cylinder, cables and hoses for damage or erratic operation. Check for missing or loose parts.

p. Lower the platform partially by pushing Chassis Lift Switch to **DOWN**, and check operation of the audible lowering alarm.

Table 4-1. Controls and Indicators

INDEX NUMBER	NAME	FUNCTION
1	Drive/Lift Speed Range Switch	Provides a High and Low Speed.
2	Key Mode Switch	Provides power to Drive Switches or Lift Switch.
3	Guarded Emergency Stop Switch	Cuts off power to all circuits.
4	Forward-Reverse Switch	Provides power to drive Valves.
5	Steering Switch	Provides power to Steering Valves. Although the switch is self-centering, the steering system is not. The wheels must be steered back to straight. Observe the tires while maneuvering the work platform to ensure proper direction.
6	Lift Switch	Provides power to Lift and Down Valves.
7	Emergency Lowering Valve	When Knob is turned counterclockwise and pulled out. Platform will lower. Push knob in and turn clockwise to close valve. The platform will not raise until the valve is closed.
8	Alarm (Platform Lowering)	Sounds an audible signal while platform is lowering when lift switch is used to lower the platform. If the Emergency Lowering Valve (7) is used the alarm does not sound.
9	Chassis Lift Switch	Provides power for lifting and lowering platform at the ground level.
10	Foot Switch	Provides redundant electrical control switch

q. Open the Emergency Lowering Valve manually to check for proper operation. Once the platform is fully lowered, close the valve.

r. Replace module covers.

s. Turn Mode Switch to **OFF** and close Emergency Stop Switch Cover.

4-9. OPERATION.

4-10. TRAVEL WITH PLATFORM LOWERED (Figure 4-1).

- a. After entering platform latch gate across entrance. Also check that rail at middle of rear guardrail is pinned in position.
- b. Check that route is clear of obstructions, holes and drop-offs and is capable of supporting wheel loads.
- c. Check clearances above, below and to the sides of platform.
- d. Turn the Guarded Emergency Stop Switch (3) on the control console to the **ON** position.
- e. Turn Key Mode Switch (2) to **DRIVE**.
- f. Depress foot switch.
- g. Set the Drive/Lift Speed Range Switch (1) to **LOW** or **HIGH** depending on area in which you are traveling.
- h. Push Forward/Reverse (4) to **FORWARD** position or **REVERSE** position to travel in desired direction.
- i. Move the Steering Switch (5) to **RIGHT** or **LEFT** to turn work platform.

NOTE

Steering is not self-centering. Wheels must be returned to straight ahead position by operating Steering Switch.

4-11. LIFTING PLATFORM.

WARNING

LOOK up and around for obstructions before performing the **LIFT** function.

DO NOT elevate the platform unless work platform is level.

DO NOT operate work platform within 10 feet of any electrical power lines. **THIS WORK PLATFORM IS NOT INSULATED.**

DO NOT perform service on work platform with the platform elevated, unless properly blocked.

- a. Turn Key Mode Switch (2) to **LIFT** position.
- b. Depress foot switch.
- c. Push the Lift Switch (6) to **UP** position and hold to elevate the platform.

WARNING

NEVER enter the elevating assembly while the platform is elevated.

- d. When the work task is completed, lower the platform by holding the Lift Switch (6) in the **DOWN** position until the platform is fully lowered.

4-12. TRAVEL WITH PLATFORM ELEVATED (Figure 4-1).

NOTE

Work platform will travel at reduced speed when platform is elevated.

- a. Check that route is clear of persons, obstructions, holes and drop-offs and is capable of supporting the wheel loads.
- b. Check clearances above, below and to the sides of platform.
- c. Travel with platform elevated on hard level surface only.
- d. Turn Mode Switch to **DRIVE** position.

WARNING

BEFORE traveling in **REVERSE**, check that route is clear.

- e. Push Forward/Reverse (4) to **FORWARD** or **REVERSE** for desired direction of travel.

MAINTENANCE INSTRUCTIONS

5-1. SCOPE. This section contains instructions for the maintenance of the SL-20. Procedures for the operational checkout, adjustment, scheduled maintenance, troubleshooting, and repair/removal are included.

5-2. LOCATION OF COMPONENTS. Figure 5-1 shows components on complete work platform. Figure 5-2 shows components mounted directly to chassis and located in the control valve.

5-3. SCHEDULED INSPECTION AND MAINTENANCE.

5-4. GENERAL. The complete inspection consists of periodic visual and operational checks, together with all necessary minor adjustments to assure proper performance. Refer to Table 5-1.

5-5. BLOCKING ELEVATING ASSEMBLY (Figure 5-3).

WARNING

BEFORE performing maintenance service on work platform while platform is elevated ensure that elevating arms are properly blocked.

NOTE

A 4x4 of firm wood with a length of 36 inches shall be used to block the elevating assembly.

a. Installation.

- (1) Park the work platform on firm, level ground.
- (2) Open Guarded Emergency Stop Switch Cover on control console and position toggle in the **ON** position.
- (3) Turn Key Mode Switch on control console to **LIFT** position.

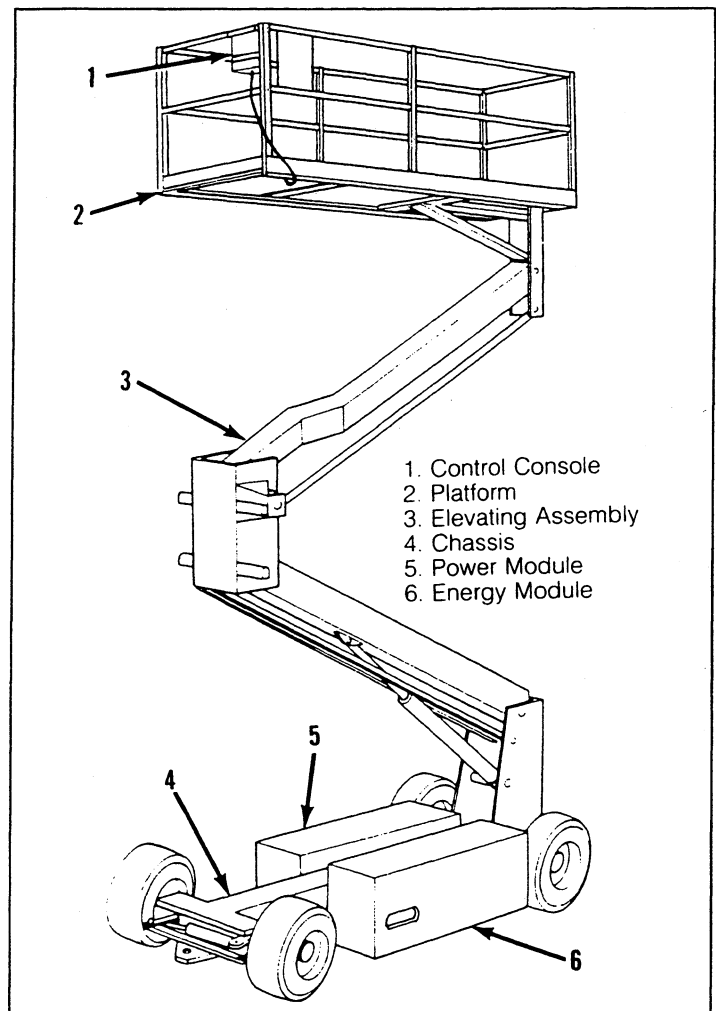


Figure 5-1. Location of Components

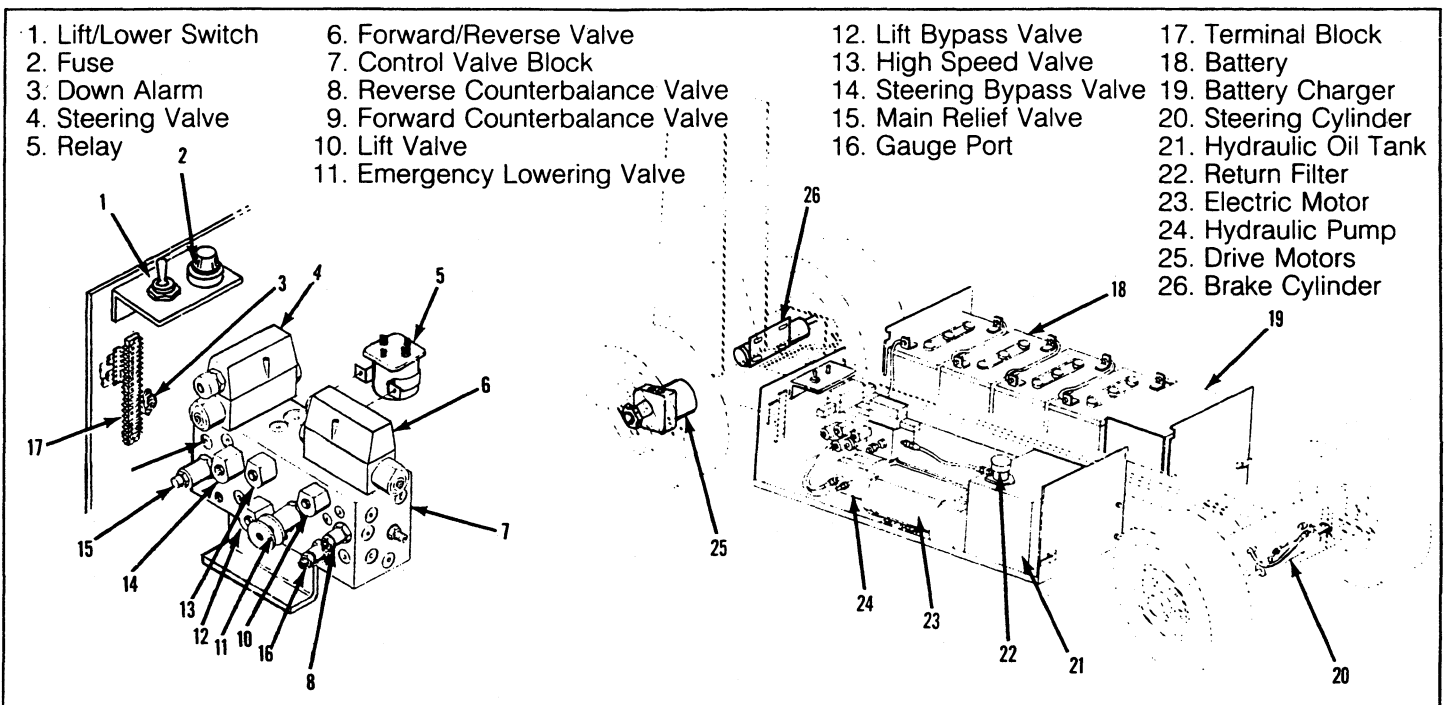


Figure 5-2. Location of Components, Chassis

Table 5-1. Inspection, Checks and Services

INTERVAL	COMPONENT/LOCATION	INSPECTION/CHECK/SERVICES
Each Shift	Battery System/Chassis	Check electrolyte level. Check specific gravity. Clean exterior. Check cable condition. Charge batteries per paragraph 5-7/b.
	Hydraulic Oil Tank/Chassis	Check oil level and fill if necessary.
	Tires/Chassis	Check for damage.
	Control Linkage Cable/Scissors	Check the exterior of the cable for pinching, binding or wear.
	Deck and Guardrails/Platform	Check fasteners for proper torque. Check welds for cracks. Check condition of deck.
	Arms/Elevating Assembly	Inspect for structural bends and weld cracking.
125 Hours	Control Valves/Hydraulic System	Check for leaks at valve bases. Check valve hose connections.
	Hoses/Hydraulic System	Check hose connections for serviceability. Check hoses for wear.
	Emergency Hydraulic System/Chassis Module	Manually open emergency lowering valve and check for serviceability.
	Hydraulic Pump/Chassis	Check for leaks at mating surfaces. Check for hose fitting leaks. Check mounting bolts for proper torque.
	Drive Motors/Chassis	Check for operation and leaks.
	Steering System/Chassis	Check hardware for proper torque
	Steering Cylinders/Chassis	Check rods for gouges. Check Seals for leakage. Check hoses for damage. Check fittings for proper torque.
	Wheel Bearings/Chassis	Check wheel assembly for play.
	Pivot Pin Retainer/Scissors	Check bolts for proper torque.
	Lift Cylinder/Hydraulic System	Check rod for wear. Check mounting pivot pins for wear. Check seals for leaks. Check hoses for damage. Check fittings for proper torque. Check snaprings.
	Control Console/Platform	Check switch operation. Check cable for wear.
	Work Platform, Complete	Perform pre-operational checkout per paragraph 4-8.
	Work Platform, Complete	Lubricate per paragraph 5-8

INTERVAL	COMPONENT/LOCATION	INSPECTION/CHECK/SERVICES
250 Hours	Batteries/Chassis	Clean terminals per paragraph 5-7a.
	Hydraulic Oil Filter/Chassis	Change filter per paragraph 5-9
	Hydraulic Pump/Chassis	Wipe clean.
	Steering System/Chassis	Check hardware.
	Pivot Points/Elevating Assembly	Check for wear. Check for wear and deformation.
	Elevating Arms	Check for bending and weld cracks.
	Entire Work Platform	Check component mountings for proper torque. Check all fasteners for tightness. Check welds for cracks. Check hoses for damage. Check for and repair collision damage.
	Linkage Gear/Elevating Assembly	Inspect for wear
500 Hours	Entire Work Platform	Check for corrosion, remove and repaint.
1000 Hours	Hydraulic Oil/Chassis	Drain hydraulic tank and replace oil per paragraph 5-8.
2000 Hours	Wheel Bearings/Chassis	Repack wheel bearings per seals per paragraph 5-20

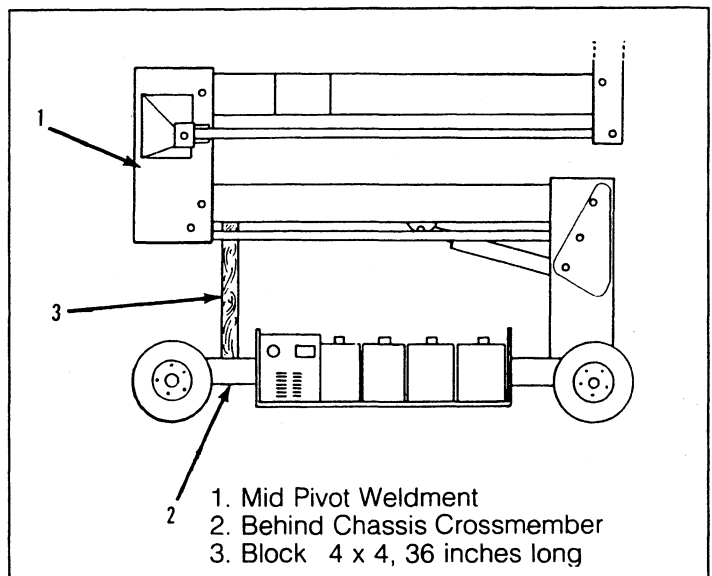


Figure 5-3. Blocking The Elevating Assembly

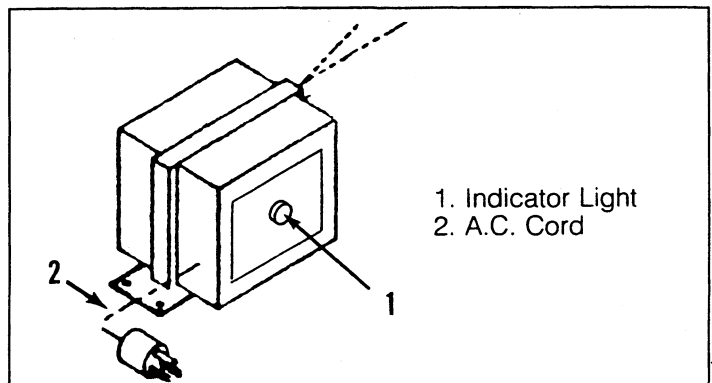


Figure 5-4. Battery Charger

- (4) Push Chassis Lift Switch (located in hydraulic module) to **UP** position and elevate platform approximately four feet.

WARNING

DO NOT stand in elevating assembly area while performing steps 5 and 6.

- (5) Place 4x4 between mid pivot weldment (1) and chassis crossmember (2).
- (6) Push Chassis Lift Switch to **DOWN** position and gradually lower elevating assembly until 4x4 is secured tightly between mid pivot weldment and chassis crossmember.

b. Removal.

WARNING

DO NOT stand in elevating assembly area while removing block.

- (1) Push Chassis Lift Switch to **UP** position and gradually raise platform.
- (2) Remove 4x4 block.
- (3) Push Chassis Lift Switch to **DOWN** position and completely lower platform.
- (4) Turn Key Mode Switch to the **OFF** position and close Guarded Emergency Stop Switch Cover.

5-6. MAINTENANCE-DETAIL INSTRUCTIONS.

5-7. BATTERY MAINTENANCE. Electrical energy for the motor is supplied by four six volt batteries wired in series for 24 volts DC. Proper care and maintenance of the batteries and motor will ensure maximum performance from the work platform.

a. Battery Inspection and Cleaning.

- (1) Check battery fluid level daily, especially if work platform is being used in a warm, dry climate.

CAUTION

If battery water level is not maintained, batteries are not capable of full charge therefore creating a low discharge rate which will damage motor/pump unit and void warranty.

- (2) Batteries and cables should be inspected periodically for signs of cracks in the cases, electrolyte leakage and corrosion of the terminals. Inspect cables for worn spots or breaks in the insulation and for broken cable terminals.
- (3) Clean batteries which show signs of corrosion at the terminals, or onto which electrolyte has overflowed during charging. Use a baking soda or ammonia solution to clean the batteries, taking care not to get the solution inside the cells. Rinse thoroughly with clear water. Clean battery and cable contact surfaces to a bright metal finish whenever a cable is removed.

b. Battery Charging (See Figure 5-4).

- (1) Charge batteries at end of each work shift or sooner if batteries have been discharged.

CAUTION

Do not charge batteries when the work platform is in a hazardous area.

CAUTION

Permanent damage to batteries will result if batteries are not immediately recharged after discharging.

- (2) Do not charge unused vehicles regularly except during winter storage on a monthly basis.
- (3) When night air temperatures fall below 65 degrees F batteries charged in unheated areas should be placed on charge as soon after use as possible.
- (4) Connect A.C. Cord (2) to a properly grounded 115 volt, 60Hz power supply.
- (5) Indicator light glows to indicate battery being charged.
- (6) Indicator light blinks when batteries are at full charge.

c. Battery Cell Equalization.

- (1) Once a month, the specific gravity of all cells should be checked with a hydrometer. The temperature corrected specific gravity in this state should be 1.260. If any corrected readings are below 1.230, the batteries containing such cells should be replaced. If a wide variation exists, this is an indication for need of battery replacement.
- (2) Do not check the specific gravity in a cell to which water has just been added. If there is not enough electrolyte in a fully charged cell to obtain a sample for the hydrometer, add water and continue charging for one to two hours to adequately mix the water and electrolyte.

5-8. LUBRICATION. Refer to Figure 5-5 for location of items that require lubrication service.

WARNING

NEVER perform service on work platform while platform is elevated without blocking the elevating assembly.

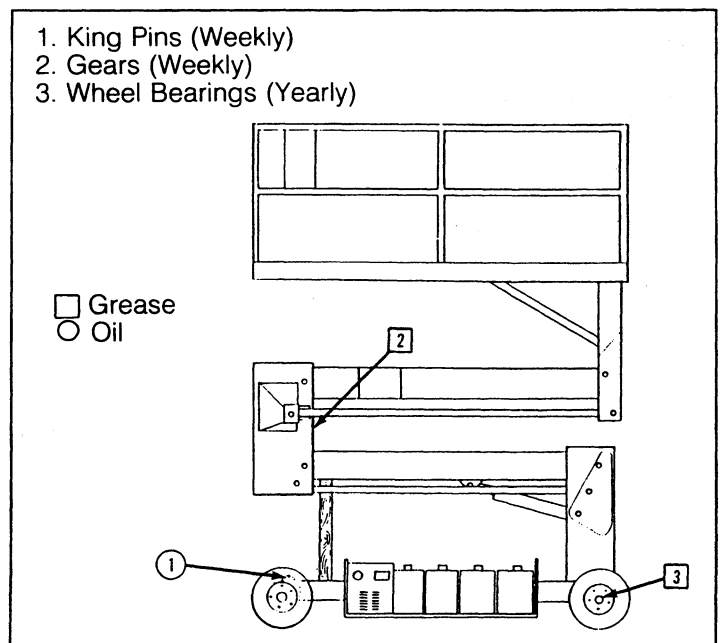


Figure 5-5. Lubrication Points

5-9. HYDRAULIC OIL TANK AND FILTER (Figure 5-6).

- Operate the work platform to bring the hydraulic oil up to normal operating temperature.
- Provide a suitable container to catch the drained oil. Hydraulic tank has a 4 gallon capacity.

WARNING

The hydraulic oil may be of sufficient temperature to cause burns. Wear safety gloves and safety glasses when handling hot oil.

- Remove the drain plug (3) and allow all oil to drain.
- Reinstall the drain plug (3).
- Unscrew the filter top (2) from the filter body.
- Lift the filter element from the filter body.
- Drop the replacement filter element into the filter body and press into position.
- Fill the hydraulic oil tank to the sight gauge with Mobile 423 hydraulic oil or equivalent by pouring the oil into the top of the filter. Since the oil is being filtered as it is going into the tank, it will take a while to fill the tank completely. Hydraulic tank has a 4 gallon capacity.

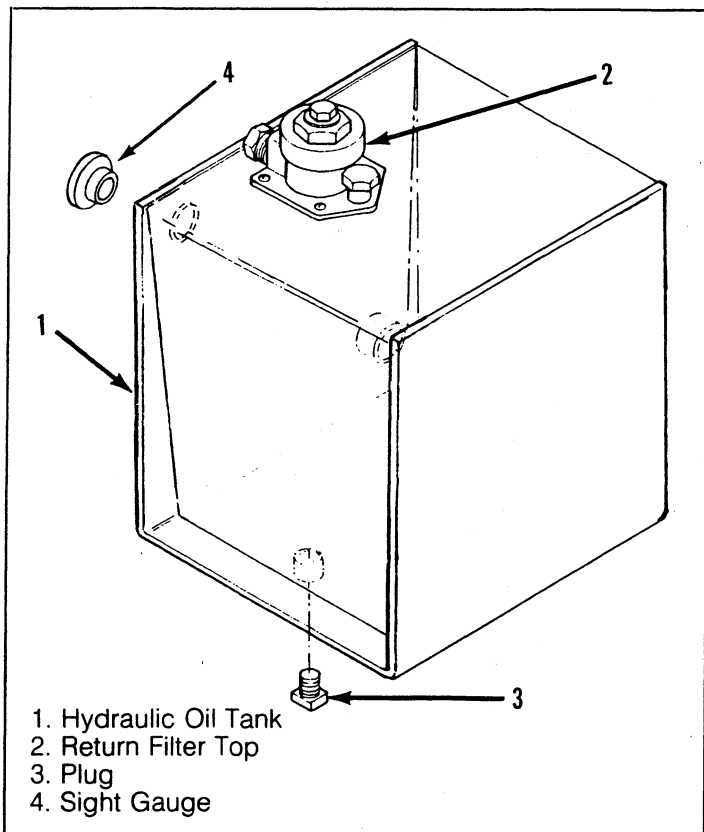


Figure 5-6. Hydraulic Oil Tank and Filter

5-10. TROUBLESHOOTING.

5-11. SCOPE. Table 5-2 provides a logical sequence of tests that are designed to isolate problems with the SL-20. This table includes a list of probable causes and remedies.

5-12. SAFETY.

WARNING

When troubleshooting, ensure that the work platform is resting on a firm, level surface. When performing any service which requires the platform to be raised, the elevating assembly must be blocked per paragraph 5-5. Disconnect the battery ground cable when replacing or testing the continuity of any electrical component.

5-13. GENERAL PROCEDURE. In general, troubleshooting should be carried out by first thoroughly looking at the electrical circuits and components that could cause the problem. Loose terminal connections and short circuits are always a potential probable cause when troubleshooting. Only when electrical circuits and components have been found fault-free, should the hydraulic system be examined. Refer to Tables 6-1 and 6-2 for Reference Designations used in Table 5-2.

Table 5-2. Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
All functions inoperable, electric motor does not start.	1. Blown control circuit fuse.	Check 15 amp Control Circuit Fuse (F1). Replace if blown.
	2. Faulty battery charger.	Check the voltage output of the battery charger. If less than 24 VDC, repair or replace.
	3. Faulty battery (ies).	After completely charging the batteries, test each battery (BT). Replace as required.
	4. Faulty electric motor.	While operating the steering function, check voltage across the Electric Motor (B) terminals. If 24 VDC is present, replace the Motor (B).
	5. Faulty motor relay.	While operating the steering, check voltage across the coil terminals of Motor Relay (CR1). If no voltage is present, proceed with step 6. If 20 VDC or more, check continuity across the contact terminals of Motor Relay (CR1) while still operating the steering function. If there is no continuity, replace the defective Motor Relay (CR1).
	6. Guarded emergency stop failed open.	With the Guarded Emergency Stop Switch (S1) in the ON position, check continuity across the contacts. If none, replace.

Table 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
All functions inoperable. Electric motor starts when actuated.	1. Hydraulic oil tank low.	Check hydraulic oil level, top off as required.
	2. Damaged coupling.	Remove Pump (ASSY1) from Motor (B) and check coupling.
	3. Faulty hydraulic pump.	Check pressure and delivery of the Hydraulic Pump (ASSY1). Replace if required.
Electric Motor starts but no functions in low speed.	CV2	Check CV2 for contaminants and reset check ball in valve block.
Electric Motor continues to run after controls are returned to the OFF position.	Motor relay contacts fused together.	With 0 voltage at the coil terminals of the Motor Relay (CR1) check continuity across the contact terminals. If there is continuity, replace the Motor Relay (CR1).
Work platform will not drive or steer. Platform Up/Down functions properly.	Faulty key mode switch	With the Key Mode Switch (S2) in the DRIVE position, check continuity. Replace if faulty.
Steering inoperable or functions sluggishly.	1. Faulty steering switch.	Test Steering Switch (S4) for continuity. Replace if faulty.
	2. Faulty key mode switch.	Test Key Mode Switch (S2) for continuity. Replace if faulty.
	3. Faulty Diode (D3).	Check diode (D3) replace if faulty.
	4. Mechanical damage.	Inspect all steering components. Replace damaged parts.
	5. Steering valve stuck.	Inspect Steering Valve (V1). If spool is sticking, replace.
	6. Steering Cylinder piston seal leaking.	Check Steering Cylinder (CYL3) for leakage from one port to another. Repair as required.
Work platform will not steer right.	1. Faulty steering switch.	Test Steering Switch (S4) for continuity. Replace if faulty.
	2. Faulty diode.	Test Diodes (D1, D2). Replace if faulty.
	3. Faulty steer right solenoid.	Test Steer Right Solenoid (L1). If the proper voltage is present and the Coil is not magnetic, replace.

Table 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Work platform will not steer left.	1. Faulty steering switch.	Test Steering Switch (S4) for continuity. Replace if faulty.
	2. Faulty diode.	Test Diodes (D1, D2) Replace if defective.
	3. Faulty steer left solenoid.	Test Steer Left Solenoid (L2). If the proper voltage is present and the Coil is not magnetic, replace.
Work platform will not drive forward or reverse. Lift function operable.	1. Faulty drive switch.	Check continuity of Drive Switch (S5).
	2. Faulty key mode switch.	Check continuity of Key Mode Switch (S2).
	3. Faulty diode.	Check Diode (D3) replace if faulty.
	4. Forward/reverse valve faulty.	Check the Forward/Reverse Valve (V4). If the spool is not shifting, replace the valve.
	5. Shuttle valve not seating.	Check for contaminants and reseal ball to valve block.
	6. Mechanical failure.	Inspect drive motor shafts, hubs, and keys.
	7. Worn drive motors.	Check hydraulic pressure being delivered to the Drive Motors (MOT1, MOT2). If sufficient, replace Drive Motors.
No drive in HIGH speed.	1. Lift cylinder has pressure on it.	Check to make sure platform is completely lowered.
	2. Faulty speed range switch.	Test Speed Range Switch (S6) for continuity. Replace if faulty.
	3. Faulty high speed coil.	Test High Speed Coil (L9). If proper voltage is present and coil is not magnetized, replace.
	4. Faulty high speed valve.	Replace High Speed Valve (V8).
	5. CV4	Check CV4 for contaminants and reseal in valve block.
No drive FWD but drives in REV.	1. Faulty drive switch.	Test Drive Switch (S5) for continuity. Replace if faulty.
	2. Faulty diode.	Test Diodes (D4,D5). Replace if faulty.
	3. Faulty FWD coil.	Test FWD Coil (L3) if proper voltage is present and coil is not magnetized, replace.

Table 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
No drive FWD but drives in REV . Continued	4. Faulty drive valve.	Inspect Drive Valve (V4) if spool is sticking replace.
	5. Faulty counter-balance valves.	Check pressure of Counter-balance Valves (V2,V3). Replace or reset valves as required.
	6. Shuttle valve.	Check for contaminants and reseal ball in Valve Block.
No drive REV but drives in FWD .	1. Faulty drive switch.	Test Drive Switch (S5) for continuity. Replace if faulty.
	2. Faulty diode.	Test Diodes (D4,D5). Replace if faulty.
	3. Faulty REV coil.	Test REV Coil (L5) if proper voltage is present and coil is not magnetized, replace.
	4. Faulty drive valve.	Inspect Drive Valve (V4) if spool is sticking replace.
	5. Faulty counter-balance valves.	Check pressure of Counter-balance Valves (V2,V3). Replace or reset valves as required.
	6. Shuttle valve.	Check for contaminants and reset ball in Valve Block.
Platform will not elevate or elevates slowly in LOW and HIGH speeds.	1. Emergency lowering valve (V10) actuated to OPEN position.	Push knob in and turn clockwise to close Emergency Lowering Valve (V10).
	2. Platform overload.	Observe maximum load rating (See Table 1-1).
	3. Faulty diode.	Test Diode (D6), replace if faulty.
	4. Faulty up valve coil.	Test UP Valve Coil (L6). If proper voltage is present and the coil is not magnetized, replace.
	5. Height limit switch malfunction.	Test Height Limit Switch (S8) for continuity. Replace if required.
	6. Faulty lift switch.	While holding the Lift Switch (S3) in the LIFT position, check continuity. Replace if faulty.
	7. Faulty key mode switch.	Test Key Mode Switch (S2) for continuity. Replace if defective.
	8. Relief valve out of adjustment or faulty.	Adjust the Main Relief Valve (RV1). If not adjustable, replace.
	9. Lift valve sticking.	Replace the Lift Valve (V7).
	10. Lowering valve stuck in the OPEN position.	Replace the Lowering Valve (V11).

Table 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
No drive or lift in LOW speed but steering OK.	1. Faulty steering bypass coil.	Test Steering Bypass Coil (L4). If proper voltage is present and coil is not energized replace.
	2. Faulty Steering bypass valve.	Replace Steering Bypass Valve (V6).
No HIGH speed lift.	1. Faulty speed range switch.	Test Speed Range Switch (S6) for continuity. Replace if faulty.
	2. Faulty High speed coil.	Test High Speed Coil (L9) if proper voltage is present and the coil is not magnetized, replace.
	3. Faulty Lift Bypass Coil.	Test Lift Bypass Coil (L7) if proper voltage is present and the coil is not magnetized, replace.
	4. Faulty High speed valve.	Replace High Speed Valve.
	5. Faulty lift bypass valve.	Replace Lift Bypass Valve.
Platform drifts down after being elevated.	1. Emergency lowering valve partly open or faulty.	Ensure that the Emergency Lowering Valve (V10) is completely closed. If the platform still drifts down, replace the Emergency Lowering Valve (V10).
	2. Check valve leaking.	Check for contamination under Ball (CV3). Clean and reseal Ball in block.
	3. Faulty Valve O-rings.	Check and replace O-Rings on Lowering Valve (V11) and High Speed Cutout Piston.
Work platform drives while lifting.	Faulty diode.	Test Diode (D4,D5). Replace if faulty.
Work platform lifts while driving.	Faulty diode.	Test Diode (D6). Replace if faulty.
Platform will not lower.	1. Faulty lowering valve coil.	Test Lowering Valve Coil (L8). If proper voltage is present and Coil is not magnetized, replace.
	2. Faulty key mode selector switch.	With the Key Mode Selector Switch (S2) in the LIFT position, check continuity. Replace if defective.
	3. Faulty lift switch.	While holding the Lift Switch (S3) in the DOWN position, check continuity. Replace if defective.
	4. Lowering valve stuck.	Replace the Lowering Valve (V11).
	5. Plugged lowering speed orifice.	Replace and clean Orifice (ORF2).
	6. Velocity fuse valve sticking.	Replace the Velocity Fuse Valve (V5).

Table 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Down alarm horn does not sound.	Faulty down alarm horn.	Check voltage to Down Alarm Horn. If proper voltage is present, replace the Down Alarm Horn (HN).
Brake will not release.	Faulty brake cylinder.	Check and replace Seals in Brake Cylinder (CYL2).
Brake will not lock wheel.	1. Orifice plugged.	Remove and clean Brake Orifice (ORF1).
	2. Faulty brake cylinder.	Check and replace Seals in Brake Cylinder (CYL2).
	3. Broken brake cylinder spring.	Check and replace Brake Cylinder Spring.

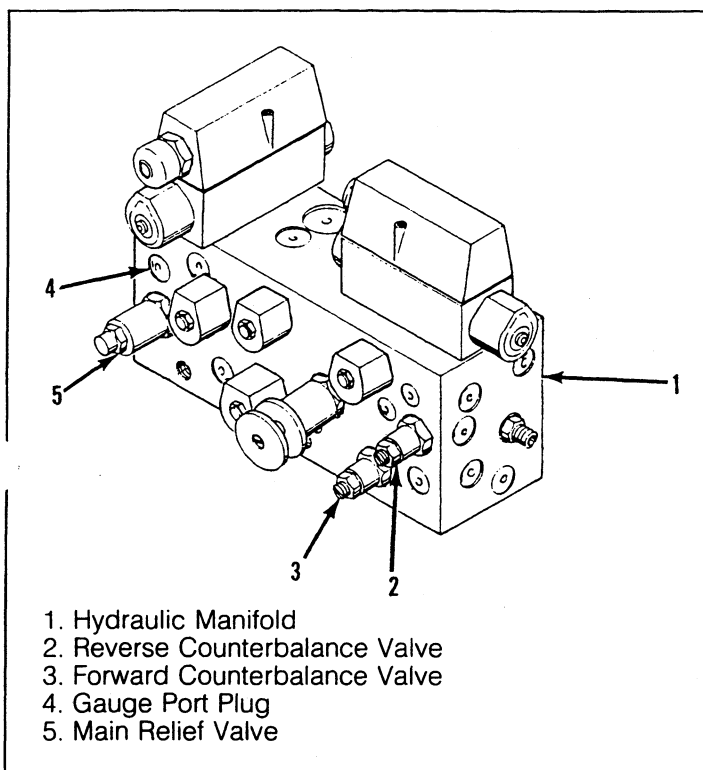


Figure 5-7. Hydraulic Pressure Adjustment

5-14. ADJUSTMENTS.

5-15. SETTING HYDRAULIC PRESSURE (Figure 5-7).

NOTE

Check the hydraulic pressure whenever the manifold or relief valve has been serviced or replaced.

a. Main Relief Valve (5).

- (1) Operate the hydraulic system 10-15 minutes to warm the oil.
- (2) Remove the Gauge Port plug (4) and install a 0-3000 psi pressure gauge. Note: Check ball and spring are in this port. Take care not to lose them.
- (3) Loosen the locknut on the Main Relief Valve (5).
- (4) Position the Steering Toggle Switch to either left or right and hold until system bypasses.

(5) Slowly screw the adjusting screw in to increase the pressure to raise the rated platform load, then tighten the locknut.

(6) Remove pressure gauge and install plug (4). Be certain that spring and ball are in the proper position.

b. Counterbalance Valve (2,3).

- (1) Remove Gauge Port Plug (4) and install an 0-1000 psi pressure gauge. Note: Check ball and spring are in this port. Take care not to lose them.
- (2) Lift work platform and block rear wheels off ground.
- (3) Operate the hydraulic system 10 to 15 minutes to warm the hydraulic oil.
- (4) Position the Key Mode Switch to **DRIVE**.
- (5) Position Speed Range Switch to **LOW**.
- (6) Position the Drive Switch to **FORWARD**.
- (7) Adjust the **REVERSE** Counterbalance Valve (2) by turning the adjustment screw **IN** until the pressure gauge indicates 400 psi, then slowly turn the screw **OUT** until the gauge indicates 350 psi. Lock adjustment with locknut.
- (8) Position the Drive Switch to **REVERSE**.
- (9) Adjust the **FORWARD** Counterbalance Valve (3) by turning the adjustment screw **IN** to achieve 400 psi, then slowly turning the screw **OUT** to reach 350 psi. Lock the adjustment with the locknut.
- (10) Actuate **FORWARD**, actuate **REVERSE** checking gauge to ensure pressures are 350 psi. Readjust as needed.
- (11) Remove blocks and lower work platform to ground.
- (12) Remove the gauge from the gauge port and reinstall plug. Be certain that spring and ball are in their proper position.
- (13) Operate the drive system and check proper speeds and braking.

5-16. REPAIR. The following procedures are to handle replacement of components that are damaged or worn beyond acceptable performance specifications.

5-17. HYDRAULIC MANIFOLD (Figure 5-8).

a. **General.** It is not necessary to remove the manifold to perform all maintenance procedures. A determination should be made prior to beginning as to whether or not the manifold should be removed.

b. Removal.

- (1) Tag and disconnect the solenoid valve leads from the terminal strip.
- (2) Tag, disconnect and plug hydraulic hoses.
- (3) Remove the ESNA nuts (15), jam nut (16) and bolts (23) that hold the manifold (1) to the mounting bracket (27).
- (4) Remove manifold block (1).

c. Disassembly.

NOTE

Mark all components as they are removed so as not to confuse their location during assembly.

(1) Remove coils from solenoid valves (5,6,7,8).

(2) Remove fitting (18).

(3) Remove spool valve covers (13) and spool valves (10,33).

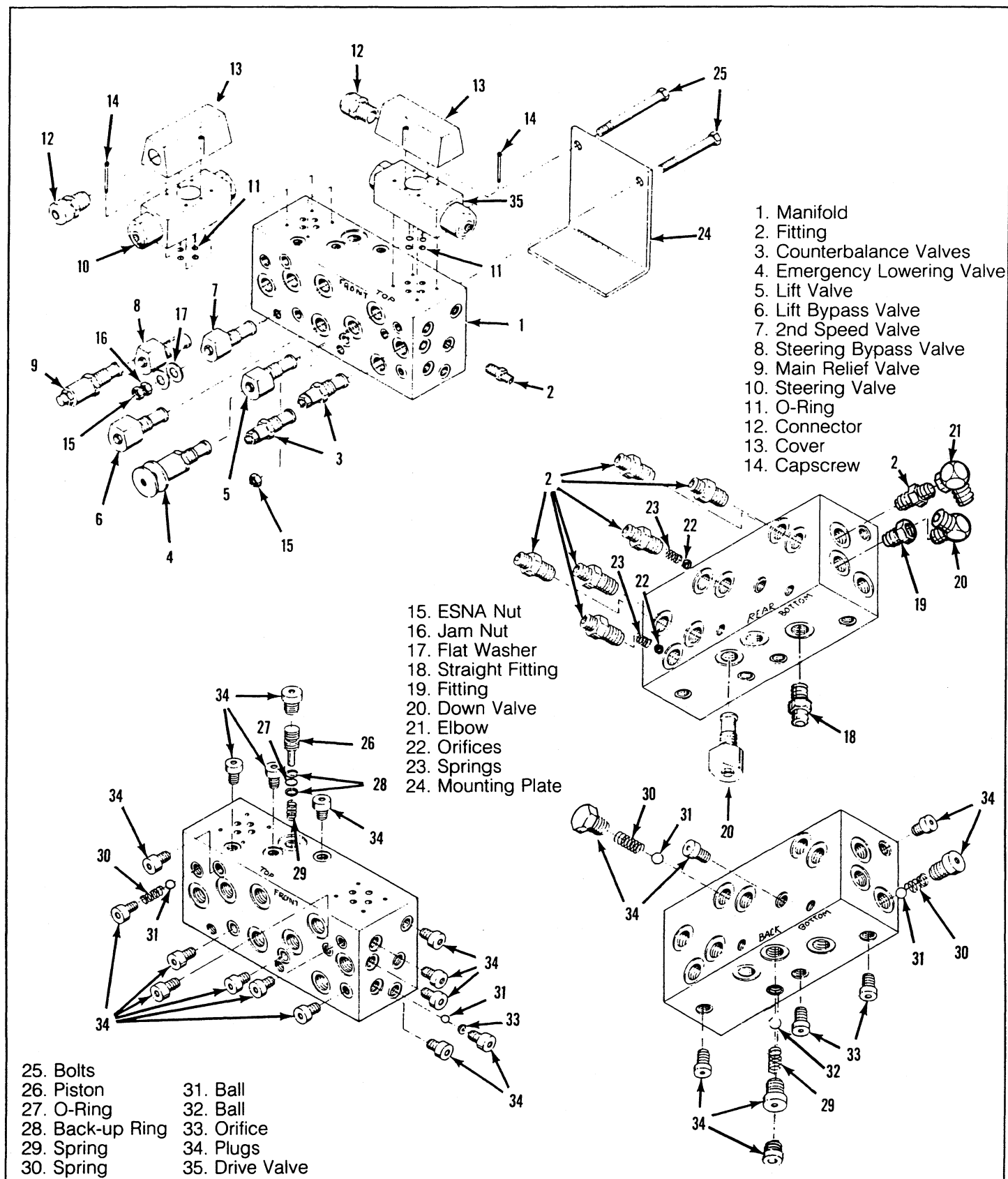


Figure 5-8. Hydraulic Manifold (List Included)

- (4) Remove solenoid valves (5,6,7,8), main relief valve (9), counterbalance valves (3) and emergency down valve (4).
- (5) Remove fittings (2), springs (21) and orifices (20).
- (6) Remove plugs (32), spring (28) and ball (29) from back side of manifold block.
- (7) Remove plugs (32), spring (28) and ball (29) from left side of manifold block.
- (8) Remove plugs (32), spring (27) and ball (30) from bottom of manifold block.
- (9) Remove plugs (32), spring (28) and ball (29) from front of manifold block.
- (10) Remove plugs (32), orifice (31) and ball (29) from right side of manifold block.
- (11) Remove plugs (32), piston (24) and spring (27) from top of manifold block.

d. Cleaning and Inspection.

- (1) Wash the manifold in cleaning solvent to remove built up contaminants and then blow out all passages with clean compressed air.
- (2) Inspect the manifold for cracks, thread damage and scorings where O-rings seal against internal and external surfaces.
- (3) Wash and dry each component and check for thread damage, torn or cracked O-rings and proper operation.
- (4) Replace parts and O-rings found not serviceable.

e. Assembly.

NOTE

Lubricate all O-rings before installation to prevent damage to O-rings. Seat all balls in manifold block.

- (1) Install spring (27), piston (24) and plugs (32) in top of manifold block.
- (2) Install ball (29), orifice (31) (use one drop of locktite #242) and plugs (32) to right side of manifold block.
- (3) Install ball (29), spring (28) and plugs (32) to front side of manifold block.
- (4) Install ball (30), spring (27) and plugs (32) to bottom of manifold block.
- (5) Install ball (29), spring (28) and plugs (32) to back of manifold block.
- (6) Install ball (29), spring (28) and plugs (32) to left side of manifold block.
- (7) Install orifices (20, spring (21) and fittings (2) to back and right side of manifold block.
- (8) Install emergency lowering valve (4), counterbalance valves (3), main relief valve (9) and solenoid valves (5,6,7,8) to front side of manifold block.
- (9) Install spool valves (10,33) to top of manifold block.
- (10) Install fitting (18).
- (11) Install coils to solenoid valves (4,5,6,7,8,).

f. Installation.

- (1) Attach manifold assembly to mounting plate (22) with bolts (23), jam nut (17) and ESNA nut (15).

NOTE

Longer bolt and jam nut go in hole nearest the front of the module. Then attach all solenoid ground wires with ESNA nut (15).

- (2) Connect Solenoid leads to terminal strip (as previously tagged).
- (3) Connect hydraulic hoses. Be certain to tighten hoses to manifold.
- (4) Operate each hydraulic function and check for proper function and leaks.

5-18. HYDRAULIC PUMP (Figure 5-9).

a. Removal (Figure 5-9).

NOTE

If the hydraulic tank has not been drained, suitable means for plugging the hoses should be provided to prevent excessive fluid loss.

- (1) Mark, disconnect and plug the hose assemblies (1,2,3).
- (2) Loosen the capscrews (4) and remove the pump assembly (5) from the motor (6).

NOTE

Capscrews hold pump together as well as holding it to the motor. Care must be taken to keep pump sections together.

b. Installation.

- (1) Lubricate the pump (5) with general purpose grease and attach the pump to the motor (6) with the capscrews (4).
- (2) Use a criss cross pattern and torque each capscrew a little at a time until all 4 capscrews are torqued to 20 ft. lbs.
- (3) Unplug and reconnect the hydraulic hoses.
- (4) Check the oil level in the hydraulic tank before operating the work platform.

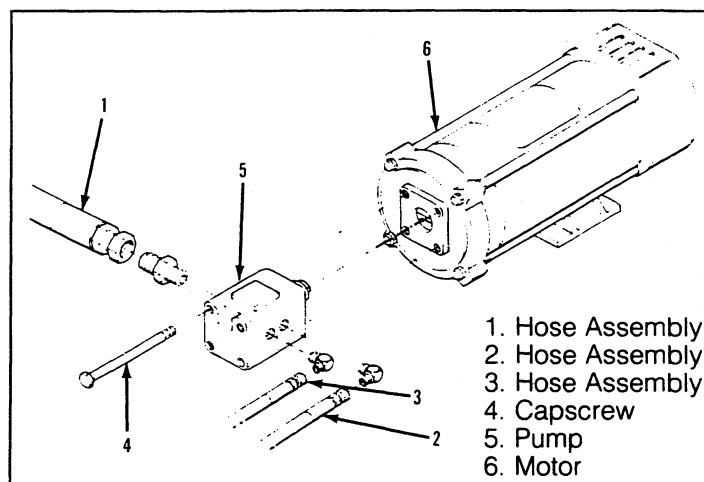


Figure 5-9. Hydraulic Pump Removal

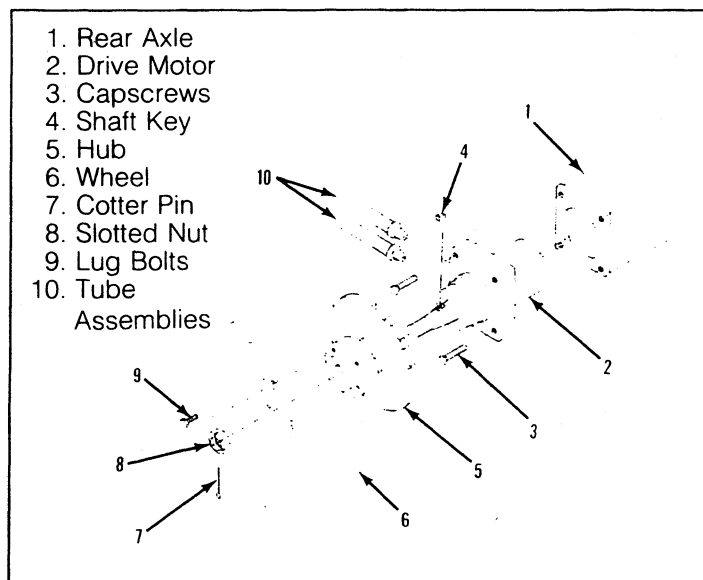


Figure 5-10. Drive Motor Removal

5-19. HYDRAULIC DRIVE MOTORS AND HUBS (Figure 5-10).

a. Removal.

- (1) Park the work platform on firm level ground then block the wheels to prevent the work platform from rolling.
- (2) Loosen the wheel lug bolts (9) on the motor to be removed.
- (3) Use a 1.5 ton capacity jack to raise the rear of the work platform.

WARNING

Position blocks under the raised rear axle to prevent the work platform from falling if the jack fails.

- (4) Remove the wheel lug bolts (9) and wheel (6).
- (5) Remove the cotter pin (7), slotted nut (8), hub (5) and the shaft key (4).

NOTE

Before disconnecting tube assemblies thoroughly clean off all outside dirt around fittings. (After disconnecting tube assemblies and before removing from vehicle, **IMMEDIATELY** plug port holes.)

- (6) Tag, disconnect and plug the hose assemblies (10) to prevent foreign material from entering.
- (7) Remove the capscrews (3) and drive motor (2) from the rear axle (1).

b. Installation.

- (1) Position the drive motor (2) in the rear axle (1) and secure with capscrews (3).
- (2) Remove the plugs from the tube assemblies (10) and connect to the drive motor (2).
- (3) Install the shaft key (4), hub (5) and slotted nut (8). Torque the locknut to 350 to 400 ft. lb. Install the cotter pin (7).

- (4) Install the wheel (6) with lugbolts (9) onto the hub (5). Torque to 40 ft. lb.
- (5) Lower the jack and remove. Operate the drive system and check for leaks.

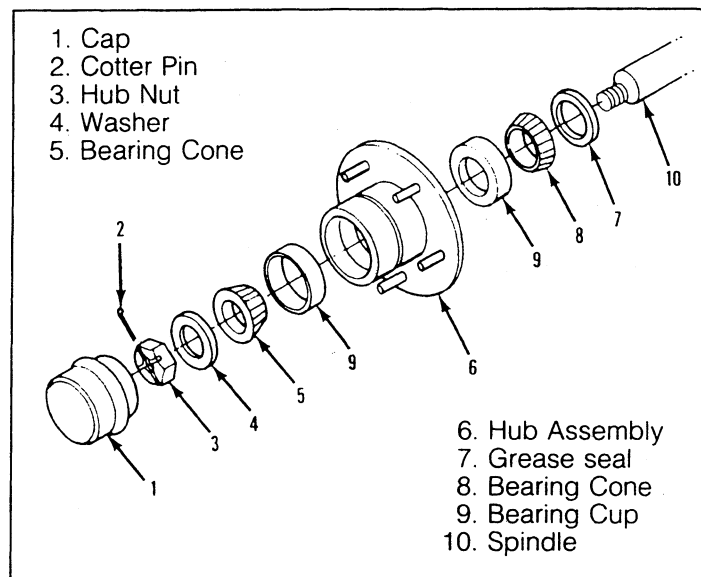


Figure 5-11. Wheel Bearings

5-20. WHEEL BEARINGS (Figure 5-11).

a. Removal.

- (1) Loosen the wheel lug nuts then raise the front axle of the work platform until the tire to be worked on is off the ground.
- (2) Install support blocks to prevent the work platform from falling if the jack fails.
- (3) Remove the wheel lug nuts and the wheel.
- (4) Remove the cap (1).
- (5) Straighten the cotter pin (2) then withdraw it from the spindle (10) and hub nut (3).
- (6) Remove the hub nut (3) and washer (4).
- (7) Slide the entire hub assembly (6) from the spindle (10) and place on clean surface.
- (8) Remove the bearing cone (5) and place on clean surface.
- (9) Remove the grease seal (7) thus allowing the bearing cone (8) to be removed.

NOTE

At this point, examine the bearing cups (9). If they are smooth, shiny and free of pits or any surface irregularities, **DO NOT** remove them.

- (10) If the bearing cups (9) need replacement, remove them by tapping around the circumference of the inside surface of the bearing cups from the opposite side using a long drift.

b. Installation.

- (1) Position the replacement bearing cup (9) over the opening in the hub assembly (6) then position the worn bearing cup over the replacement so that the

bearing surfaces face each other. Use the old bearing cup as a drift to work the replacement into position by tapping evenly around the circumference.

- (2) Apply a liberal coating of multi purpose grease to the bearing surface of each cup.
- (3) Pack the bearing cone (8) with multi purpose grease and position it within the rear bearing cup (9) in the hub assembly (6) install the new grease seal (7) again using the worn bearing cup as a drift.
- (4) Apply a thin coating of multi purpose grease to the spindle (10) to protect the grease seal (7) then slide the hub assembly (6) onto the spindle (10).
- (5) Pack the bearing cone (5) with multi purpose grease and slide it onto the spindle (10) until it seats in the outer bearing cup (9).
- (6) Install the washer (4) and hub nut (3). Tighten the hub nut (3), while rotating the assembly (6), until the hub drags then back the nut to the first slot that aligns with the cotter pin hole in the spindle (10).
- (7) Install the cotter pin (2) and bend the end up over the hub nut (3) and the spindle (10).
- (8) Install the cap (1) and wheel/tire assemblies. Torque the lug nuts to 40 ft. lbs.
- (9) Remove blocks and lower work platform to the ground.

5-21. BRAKE CYLINDER (Figure 5-12).

NOTE

To remove the brake cylinder, the left drive motor **MUST** be removed.

a. Removal.

- (1) Back up rear axle and block the wheels to prevent the work platform from rolling when the brake is removed.
- (2) Disconnect motor tube assemblies (10, Figure 5-10) and plug.
- (3) Remove the capscrews (3, Figure 5-10) and remove motor, hub and wheel assembly as a unit from rear axle.
- (4) Disconnect the tube assemblies (1, 17) and cap the openings to prevent foreign material from entering.
- (5) Remove the capscrews (2), flatwasher (3) and locknuts (11) to remove the cylinder (4) from the rear axle.

b. Disassembly.

NOTE

Prepare a clean work area on which to service the internal parts.

- (1) Remove the snap ring (5) and withdraw the shaft (11) and all attached components from the cylinder barrel (4).
- (2) Remove the head cap (6) from the shaft (11) then remove the wiper (9), shaft seal (10) and seals (7, 8) from the head cap (6).

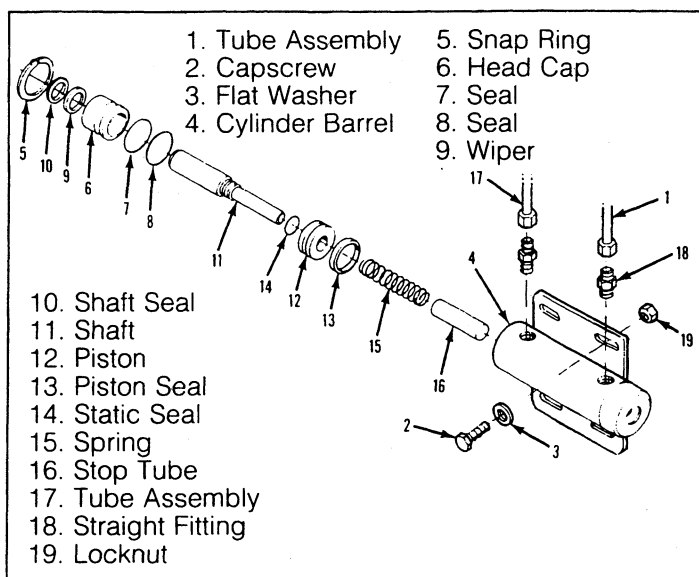


Figure 5-12. Brake Cylinder

- (3) Unscrew the piston (12) from the shaft (11) and remove the static seal (14). Remove the piston seal (13) from the piston (12).

- (4) Remove the spring (15) and stop tube (16) from the cylinder barrel (4).

c. Cleaning and Inspection.

- (1) Clean all metal parts in solvent and blow dry with filtered compressed air.
- (2) Check all thread parts for stripped or damaged threads.
- (3) Check the bearing surfaces inside of the head cap (6), outer edge surface of the piston (12), inside of the cylinder barrel (4) and the shaft (11) for signs of scoring or excessive wear.
- (4) Check the spring for cracks.
- (5) Replace any parts found not serviceable.
- (6) Replace all seals.

d. Assembly and Installation.

- (1) Install the piston seal (13) on the piston (12) then assemble the static seal (14), shaft (11) and piston (12).
- (2) Position the spring (15) and stop tube (16) on the shaft assembly.
- (3) Lubricate the piston seal (13) with clean hydraulic fluid, then install the shaft assembly in the cylinder barrel (4).
- (4) Lubricate the seals (7, 8) with clean hydraulic fluid and install on the head cap (6).
- (5) Install the shaft seal (10) and wiper (9) within the head cap (6).
- (6) Lubricate entire assembly's seals (7, 8) and the shaft seal and wiper (10, 9) with clean hydraulic fluid then install the head cap (6) onto the shaft (11) and into the cylinder barrel (4).
- (7) Secure with snap ring (5).

- (8) Position the brake cylinder assembly on the rear axle so that the shaft (11) will fully engages the brake disc, however the shaft must clear the brake disc once retracted. Secure with capscrews (2), flatwashers (3) and locknuts (18).
- (9) Connect the tube assemblies (1,17).
- (10) Place wheel hub and motor assembly in axle and attach with capscrews (3, Figure 5-10).
- (11) Connect motor tube assemblies (10, Figure 5-10).
- (12) Operate the brake retract circuit and check that the shaft clears the brake disc. Check for leaks.

5-22. STEERING CYLINDER (Figure 5-13).

a. Removal.

- (1) Mark and disconnect the tube assemblies from the fittings and immediately cap the openings to prevent foreign material from entering.
- (2) Remove the locknuts (9) and capscrews (10) to remove the cylinder assembly.

b. Disassembly.

- (1) Place cylinder barrel (8) in a vice.
- (2) Unscrew the headcap (2) from the cylinder barrel (8).
- (3) Withdraw the piston and shaft assembly from cylinder barrel (8).
- (4) Secure the piston and shaft assembly and remove piston nut (7), piston (5) and head cap (2).
- (5) Remove the rod wiper (12), rod seal (11) and static seal (3) from the headcap (2).
- (6) Discard all the seals.
- (7) Remove the piston seal (6) and piston rod seal (4) from the piston (5).
- (8) Discard the piston rod seal (4) and piston seal (6).

c. Cleaning and Inspection.

- (1) Wash all the metal parts in cleaning solvent and blow dry with filtered compressed air.
- (2) Inspect all the threaded components for stripped or damaged threads.
- (3) Check the inside surface of the cylinder barrel (8) for scoring or excessive wear.
- (4) Check the piston (5) and head cap (2) for scoring or excessive wear.
- (5) Inspect the surface of the shaft (1) for scoring or excessive wear.
- (6) Replace all seals and O-rings.

d. Assembly and Installation.

- (1) Lubricate and install replacement rod seal (11) and static seal (3) on the headcap (2).
- (2) Lubricate and install replacement rod wiper (12) in the headcap (2).
- (3) Install the headcap (2) on the shaft (1). Note: Head cap should be installed on the piston end. Sliding over the pivot hole could damage seals.

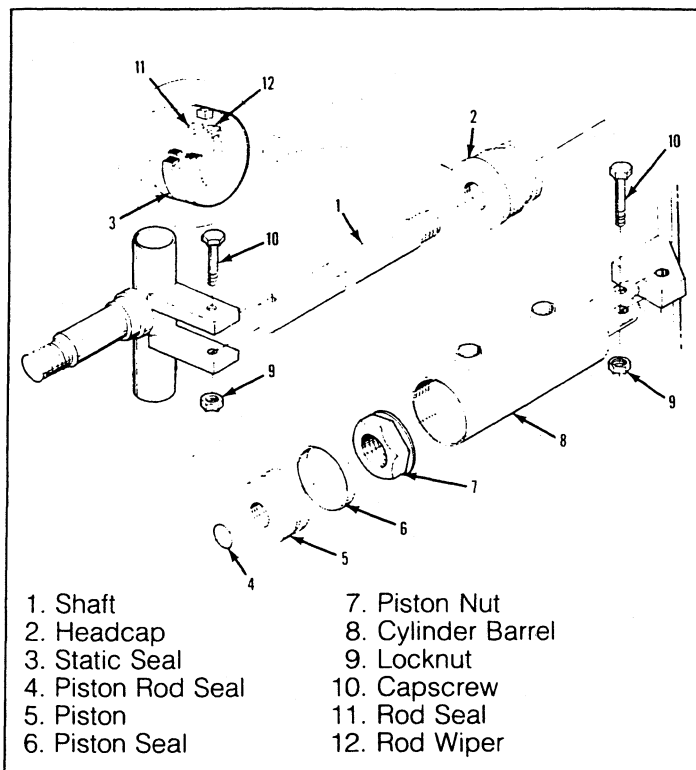


Figure 5-13. Steering Cylinder

- (4) Install a replacement piston seal (6) and piston rod seal (4) on the piston (5).
- (5) Install the piston seal (6), piston (5) and piston nut (7) on the shaft (1). Torque nut to 150 in. lbs.
- (6) Lubricate the piston seal (6) and install the shaft assembly in the cylinder barrel (8).
- (7) Screw head cap into the cylinder barrel. Hand tighten and then turn 1/4 turn further.
- (8) Position the cylinder assembly on the chassis and secure with capscrews (10) and locknuts (9).
- (9) Connect the tube assemblies to the fittings.
- (10) Operate the steering circuit several times throughout its entire range of travel to expel trapped air and check for leaks.

5-23. LIFT CYLINDER.

a. Removal (Figure 5-14).

- (1) Block elevating assembly per paragraph 5-5.
- (2) Remove hose assembly (1) and plug openings.
- (3) Remove retaining rings (2,3) from cylinder pins (4,5) and set screw (6) from end of cylinder rod.
- (4) Place a 2 foot long 2 x 4 across module covers.
- (5) Support rod end of cylinder and remove rod end cylinder pin (4) and let cylinder down to rest on 2 x 4.
- (6) Support barrel end of cylinder and remove barrel end cylinder pin (5).
- (7) Lift cylinder from work platform.

b. Disassembly (Figure 5-15).

- (1) Unscrew the head cap (11) from the cylinder barrel (1).

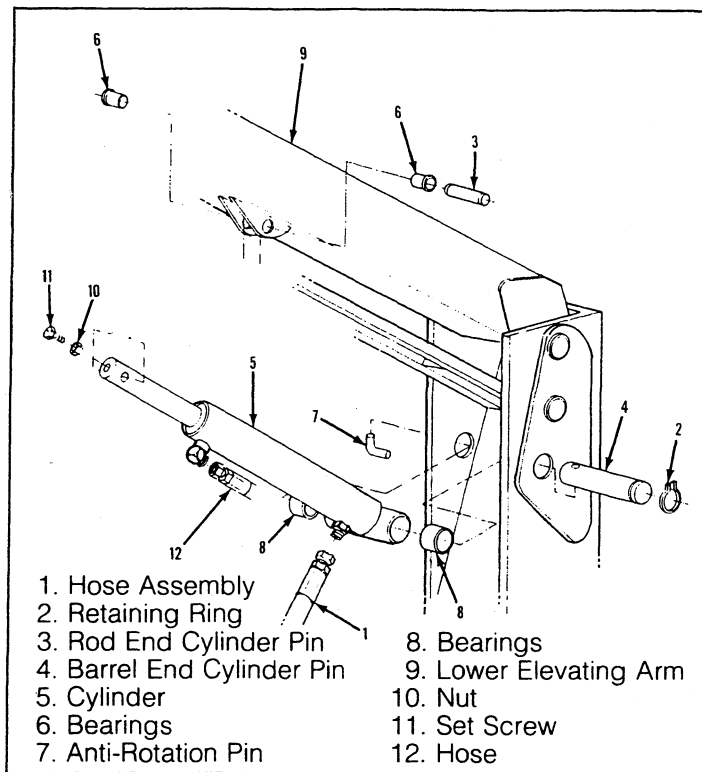


Figure 5-14. Lift Cylinder Removal

- (2) Remove the piston and rod assembly from the cylinder barrel.
- (3) Unscrew the piston nut (6) and remove piston (8) and head cap (11) from the piston rod (12).
- (4) Remove the piston static O-ring (9) from the cylinder rod (12) and discard.
- (5) Remove the piston seal (7) from the piston (8) and discard.
- (6) Remove the static O-ring (10), rod seal (15) and rod wiper (14).
- (7) Remove the rod end breather (5).
- (8) Do not remove the velocity fuse (2) unless replacement is necessary.

c. Cleaning and Inspection (Figure 5-15).

- (1) Clean all the metal parts in cleaning solvent and blow dry with filtered compressed air.
- (2) Check the working surfaces of the piston (8), head cap (11), cylinder barrel (1) and rod (12) for excessive wear or scoring.
- (3) Replace parts found to be unserviceable.
- (4) Replace all seals, O-rings and wipers.

d. Reassembly (Figure 5-15).

- (1) Lubricate the static O-ring (10), rod seal (15) and rod wiper (14) and then install in the head cap (11).
- (2) Install the piston seal (7) on the piston (8).
- (3) Install the head cap (11), piston static seal (9), piston (8) and piston nut (6) on the cylinder rod (12). Torque nut to 70 ft. lbs.

NOTE

The head cap (11) should be installed from the piston end of the cylinder rod. Sliding the head cap over

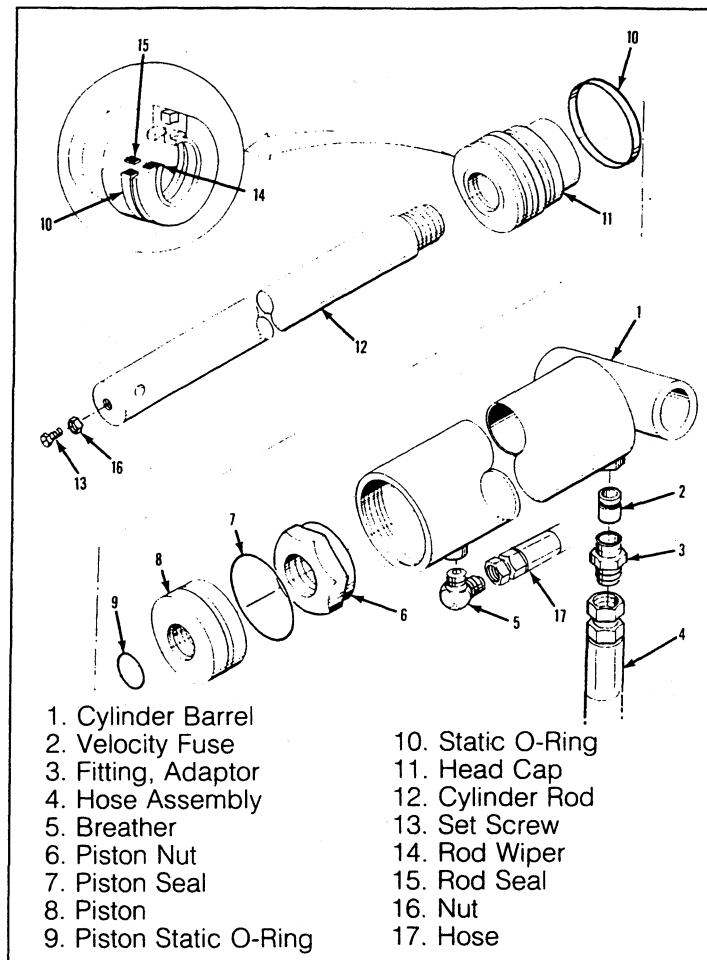


Figure 5-15. Lift Cylinder Disassembly/Assembly

the pivot pin hole may damage the rod seal (15) and rod wiper (14).

- (4) Lubricate and piston seal (7) and install the piston and rod assembly into the cylinder barrel (1).
- (5) Screw the head cap (11) into the cylinder barrel (1) hand tight and then turn 1/4 turn further.

e. Installation (Figure 5-14).

NOTE

BEFORE installing the lift cylinder check the cylinder pins (4,5) and bearings (7) for excessive wear or other damage. Replace if necessary.

- (1) Place two, 2-3 foot long 2 x 4s across the modules to support the cylinder and then lay the cylinder on them.
- (2) Lift the barrel end of the cylinder into place and push the pivot pin (4) in until approximately 1-1/2 inch is still exposed. Take care in aligning the holes so that the pin can be pushed in by hand. If holes are not properly aligned and the pin is forced in, the bearings will be damaged.
- (3) Install the anti-rotation pin (8) into cylinder pivot pin (5) and align with hole in chassis mast.
- (4) Push cylinder pivot pin completely in and install snap ring (3).
- (5) Install rod end bearings (7) in lower elevating arm (10) bracket (if removed).

- (6) Lift rod end into place and insert pin (4). Rotate pin (4) so that hole in center aligns with set screw hole in cylinder rod end.

- (7) Install snap rings (2) and set screw (6).

5-24. ELECTRIC MOTOR SERVICE (Figure 5-16). The permanent magnet motor differs from conventional D.C. motors in that the field winding has been replaced with ceramic magnet pole pieces. **Do not impact, drop, or squeeze the motors as this can cause damage to the ceramic pole pieces and will affect warranty considerations.** Care must be taken when the permanent magnet motor is disassembled, since the magnet pole pieces will attract ferrous metals. This fact dictates motors should be disassembled in an area free of ferrous metal chips.

a. Troubleshooting.

- (1) Read the nameplate to become familiar with the motor, especially the rated voltage.
- (2) Try to turn the shaft by hand. Keep motor leads separated while doing this. If the shaft turns freely go to item (3). If the shaft won't turn, proceed to item (2A).
- (2A) The shaft could be tight for a number of reasons. This check is to determine if the tightness is of a temporary nature only. Obtain a power to produce the nameplate voltage. **Do Not Make A Permanent Connection.** First touch the motor leads quickly to the power supply just long enough to observe if the shaft turns. If it does turn, then hold the motor leads on the power supply for a longer time. If the motor sounds normal, go to item (3). If the motor sounds noisy, it should be taken apart as described in this bulletin.
- (3) If the motor turned freely, connect an ammeter in the circuit as shown in Figure 5-16 A. With rated voltage applied and the shaft running free, the ammeter should read less than 20% of the nameplate full load current. If the motor meets the above conditions then it can be assumed the original problem is external to the motor.

b. Disassembly.

- (1) Remove thru bolts.
- (2) Remove pulley end cover.
- (3) Pull the armature out of the assembly in one swift motion. **It is important that the pulling motion on the Armature be continuous. Do not pull part way out and release.** If this is done, the magnets will pull the armature back into the stator and cause severe damage.
- (4) Remove commutator end cover.

NOTE

Do not place the stator ring in any mechanical holding device during the disassembly or assembly operation. Permanent distortion or other damage will result.

c. Troubleshooting. Once the motor has been disassembled, go through the following check list steps to determine where the problem lies.

- (1) Bearings - Should spin smoothly and easily and have ample lubrication and be free of corrosion.

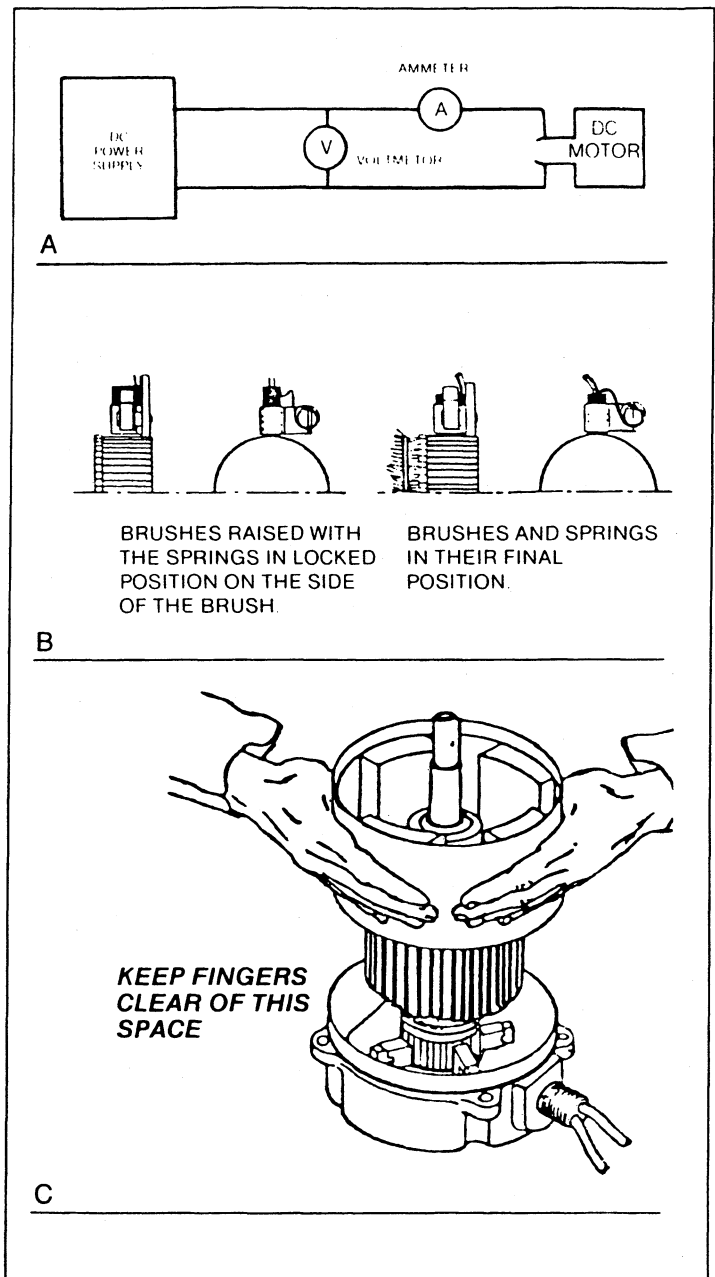


Figure 5-16. Electric Motor Service

- (2) Armature - Check for grounds and shorted turns. Refinish commutator surface if pitted or excessively worn.
- (3) Brushes - Check brushes for wear and to ensure that they are free in the brush holders.

NOTE

Observe how brushes are assembled in brush holders and position of brush lead. New brushes must be installed in same manner. Brushes should be removed as follows:

- Remove brush spring clip from its mounting on brush assembly.
- Lift brush assembly from brush holder.
- Disconnect brush assembly lead.
- New brush assembly to be installed by reversing above procedure.

- (4) Inspect wire harness and all connections for signs of damage due to overheating.
- (5) Stator - Check magnets to see if they are securely mounted.

d. Reassembly.

- (1) Install new brushes and be sure they are free in the holder. Install brush with the lead wires positioned as when received. Raise all brushes to the locked position. (See Figure 5-16 B and (3) in the Trouble Shooting segment).
- (2) Place commutator cover on a work bench with brush assembly facing upward.
- (3) Place the bearing spring into the bearing bore.
- (4) Take a complete armature assembly, including bearings, and insert commutator end bearing into the bearing bore.

NOTE

Do not re-use bearings which have been removed from armature shaft. Keep assembly in a vertical position. Use extreme care not to damage armature with bearing pullers. New bearings should be installed by pressing inner race of bearing onto proper position on armature shaft.

- (5) Set the brushes to final position as shown in Figure 5-16 B.
- (6) The next step is place the complete stator down over the vertical armature, and into position on the commutator cover.

CAUTION

Care must be exercised at this point. There is a strong magnetic attraction between the stator assembly and the armature, which tends to pull the stator assembly rapidly downward. It is important to have a firm grasp of the stator assembly and be sure fingers are free from the space between stator assembly and commutator cover (see Figure 5-16 C).

- (7) The stator assembly must be placed in a definite relationship with the commutator covers in order to obtain a neutral brush setting. There is a match-mark on both items. ***These two marks must line up exactly. Rotate until they do.***
- (8) Assemble the pulley end cover in the proper relationship. Insert mounting bolts and tighten alternately to ensure a good mechanical alignment.
- (9) Spin the shaft by hand to see if it is free. Be sure motor leads (if used) are not touching together. If the leads are touching, a generator action will give the effect of friction in the motor. A no-load test can now be performed. At rated voltage, observe the no-load current. It should be less than 20% of the nameplate full load current. Anything higher indicates:
 - Brushes are not on neutral setting (check match-marks for exact alignment).
 - Faulty armature.

DIAGRAMS

6-1. CONTENT. This section contains electrical diagrams, hydraulic power diagrams, and associated information for maintenance purposes.

6-2. USE. The diagrams are to be used in conjunction with Table 5-2 **TROUBLESHOOTING**. They allow understanding of the make-up and functions of the systems for checking, tracing, and fault-finding during trouble analysis.

Table 6-1. Electrical Diagram Legend.

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
B	Motor, Electric	Provides power to Drive Hydraulic Pump.	Center of right Module.
BT	Batteries 6 volts	To store energy to power work platform.	Left Module.
CR1	Motor Relay	Connects Batteries to Motor.	Rear of right Module, behind Valve Manifold.
D1	Diode	Provides power to Motor Relays when Steer Switch is activated RIGHT .	Between T1 and T2 on Fanning Strip.
D2	Diode	Provides power to Motor Relays when Steer Switch is activated LEFT .	Between T3 and T2 on Fanning Strip.
D3	Diode	Provides power to Motor Relay when Lift and Drive Switches are activated.	Between T2 and T5 on Fanning Strip.
D4	Diode	Provides power to Steering Bypass and Speed Range Switch when Drive Switch is activated FORWARD .	Between T4 and T5 on Fanning Strip.
D5	Diode	Provides power to Steering Bypass and Speed Range Switch when Drive Switch is activated REVERSE .	Between T6 and T5 on Fanning Strip.
D6	Diode	Provides power to Steering Bypass and Speed Range Switch when Lift Switch is activated UP .	Between T7 and T5 on Fanning Strip.

6-3. INDEX OF DIAGRAMS. The diagrams appear in the following order:

Figure 6-1. Electrical Diagram.

Figure 6-2. Hydraulic Diagram.

6-4. DIAGRAM LEGENDS. The components that comprise the electrical and hydraulic systems are given a reference designation and are explained as to location and function in the following tables:

Table 6-1. Electrical Diagram Legend.

Table 6-2. Hydraulic Diagram Legend.

Table 6-1. Electrical Diagram Legend - Continued.

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
F1	Fuse, 15 AMP	Provides over-load protection for the Control Circuit.	At rear of right Module.
HN	Alarm, Down	Provides warning sound when deck is lowering.	Rear wall of right Module.
L1	Solenoid (coil)	Shifts Steer Valve to RIGHT turn position.	Right end of Spool Valve mounted on left top of Manifold Block.
L2	Solenoid (coil)	Shifts Steer Valve to LEFT turn position.	Left end of Spool Valve mounted on left top of Manifold Block.
L3	Solenoid (coil)	Shifts Drive Valve to FORWARD position.	Left end of Spool Valve mounted on right top of Manifold Block.
L4	Solenoid (coil)	Closes Steering Bypass Valve.	Top left of front of Manifold Block.
L5	Solenoid (coil)	Shifts Drive Valve to REVERSE position.	Right end of Spool Valve mounted on right top of Valve Manifold.
L6	Solenoid (coil)	Opens Lift Valve.	Top right Coil on front of Manifold Block.
L7	Solenoid (coil)	Closes Lift Bypass Valve.	Bottom Center Coil on front of Manifold Block.
L8	Solenoid (coil)	Opens Down Valve.	Central bottom of Manifold Block.
L9	Solenoid	Closes High Speed Valve.	Top center Coil of front of Manifold Block.

Table 6-1. Electrical Diagram Legend - Continued.

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
S1	Switch, Guarded Emergency Stop.	Control Circuit shut off.	On Control Box right front.
S2	Switch, Key Mode	Supplies power to Lift, Drive and Steer switch.	On Control Box side.
S3	Switch, Lift	Supplies power to Lift or Lower Valve Solenoids.	On Control Box left center.
S4	Switch, Steer	Supplies power to Steer Valve Solenoids.	On Control Box left rear.

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
S5	Switch, Drive	Supplies power to Drive Valve right rear Solenoids.	On Control Box
S6	Switch, Speed Range	Supplies power to High Speed Valve Solenoids.	On Control Box left front.
S7	Switch, Chassis Lift	Supplies power to Lift or Lower Valve Solenoids.	Left front of Module.
S8	Switch, Platform Height Limit	Opens Lift Valve Solenoid Circuit when Deck is fully elevated.	Near left side Roller Track at center of work platform.

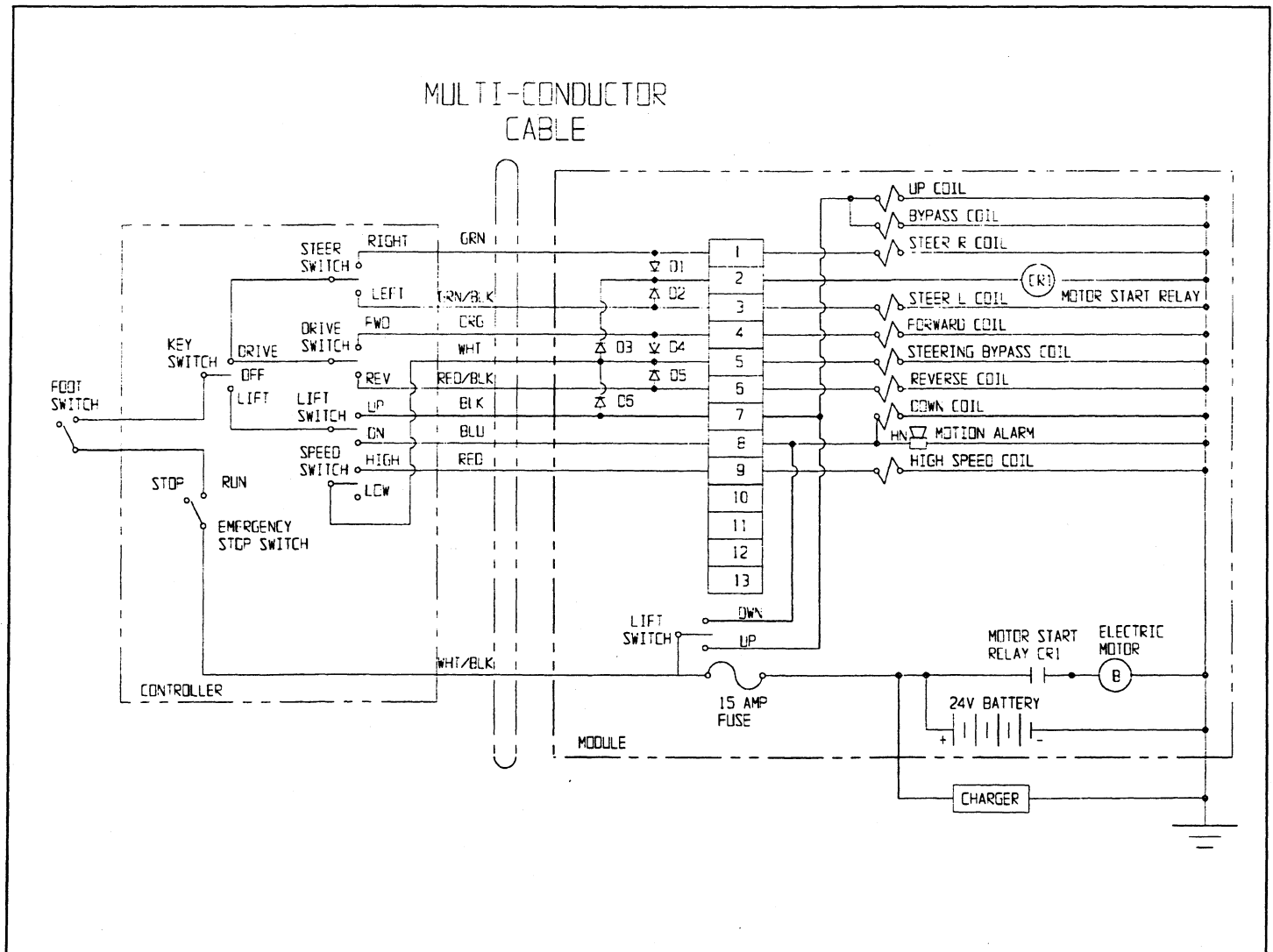


Figure 6-1. Electrical Diagram

Table 6-2. Hydraulic Diagram Legend

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
ASSY1	Duplex Pump	Supplies hydraulic oil flow for Lift, Drive, and Steer.	On Electric Motor center of right Module.
CV1	Check Valve	Prevents oil of both sections of Pump from combining.	Bottom front of left side of Manifold Block
CV2	Check Valve	Prevents oil of both sides of Pump from combining.	Top left of front of Manifold Block.
CV3	Check Valve	Prevents oil from flowing back through Lift Valve.	Top center of back of Manifold Block.
CV4	Check Valve	With platform down prevents oil from flowing to Tank in HIGH speed.	Back center of bottom of Manifold Block.
CYL1	Cylinder, Steering	Provides force to turn front Wheels.	Center front of Chassis.
CYL2	Cylinder, Brake	Stops Machine from moving while parked.	Left rear side of Chassis.
CYL3	Cylinder, Lift	Provides force to lift Platform.	Attaches to Chassis Mast and lower Lift Arm.
FL1	Filter	Filters oil returning to Tank.	In Oil Tank at front of right Module.
MOT1	Drive Motor	Provides tractive effort for work platform.	On left of rear Axle.
MOT2	Drive Motor (Optional)	Provides tractive effort for work platform.	On right rear Axle.
ORF1	Orifice, Brake	Delays the engagement of the Brake Cylinder Shaft.	Bottom right of back surface of Manifold Block.
ORF2	Orifice, Lift	Controls the platform rate of descent.	Center of back of Manifold Block.

Table 6-2. Hydraulic Diagram Legend - Continued

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
SV1	Valve, Shuttle	Provides oil to Brake Cylinder when either Drive FORWARD or REVERSE are actuated.	Bottom center of right side of Manifold Block.
V1	Valve, Steer	Provides directional control for Steering Cylinder.	Left top of Manifold Block.
V2	Valve, Counterbalance FORWARD	Prevents machine from running away on slopes and cushions stops.	Right top of front of Manifold Block.
V3	Valve, Counterbalance REVERSE	Prevents machine from running away on slopes and cushions stops.	Right bottom of front of Manifold Block.
V4	Valve, Drive	Provides directional control of oil for drive functions.	Right top of Manifold Block.
V5	Valve, Velocity Fuse	Locks Lift Cylinders if lines break.	Inside Lift Cylinder work port.
V6	Valve, Steering Bypass	Prevents oil from bypassing while driving and lifting.	Top left of Manifold Block.
V7	Valve, Lift	Provides oil flow to Lift Cylinders.	Top right Coil on front of Manifold Block.
V8	Valve, High Speed	Prevents oil from bypassing while driving and lifting.	Top center Coil on front of Manifold Block.
V9	Valve, Lift Bypass	Prevents oil from bypassing while lifting.	Bottom center Coil on front of Manifold Block.
V11	Valve, Down	Allows oil to flow out of Lift Cylinders to Tank.	Center of bottom of Manifold Block.
RV1	Valve, Main Relief	Provides over pressure protection to Pump.	Left front of Manifold Block.

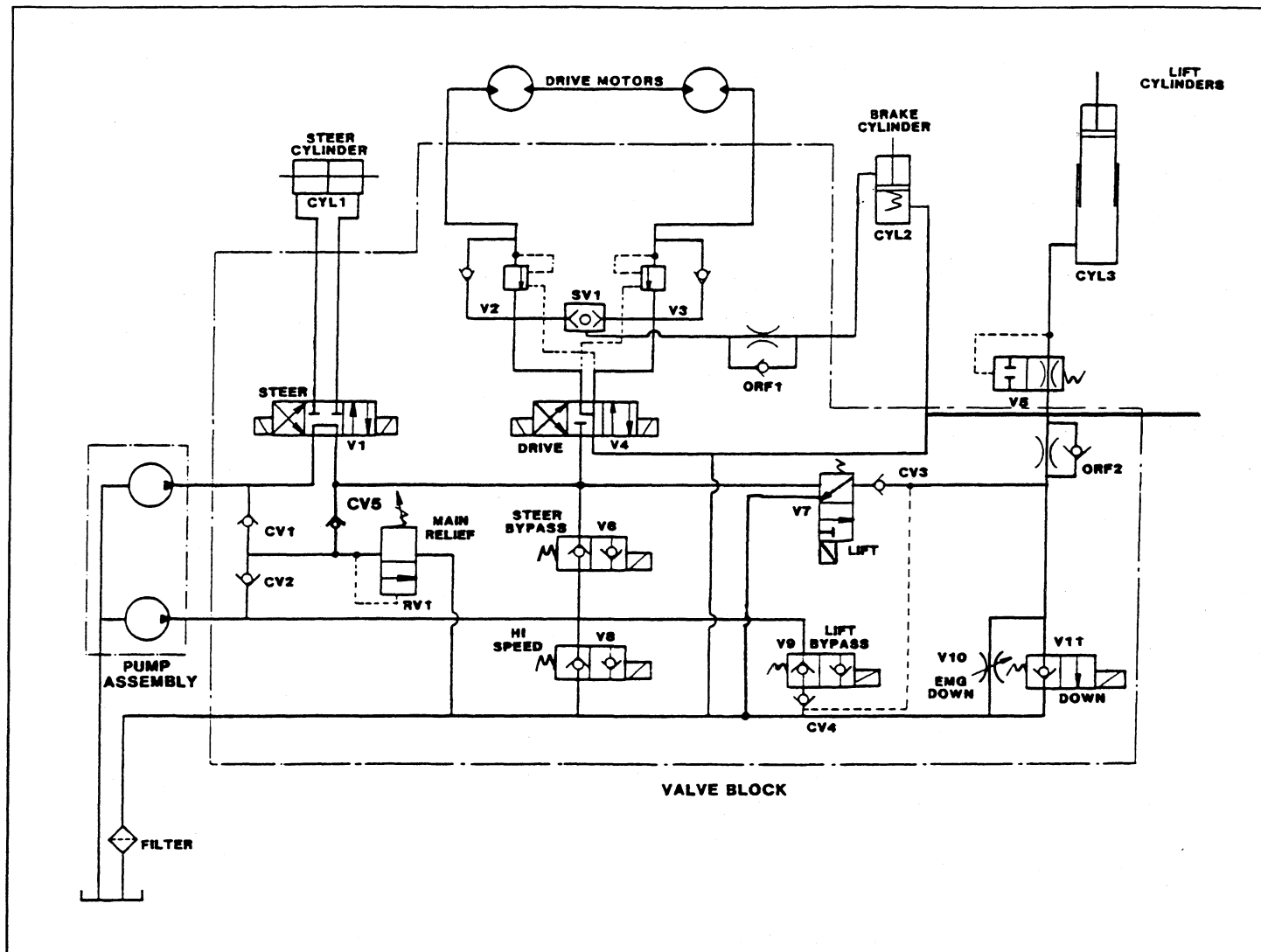


Figure 6-2. Hydraulic Diagram

SECTION VII

ILLUSTRATED PARTS BREAKDOWN

7-1. INTRODUCTION.

This section lists and illustrates the replaceable assemblies and parts of the SL-20 Work Platform, as manufactured by UPRIGHT INC., Selma, California, 93662. Each assembly is followed by its components parts indented to show their relationship to the assembly.

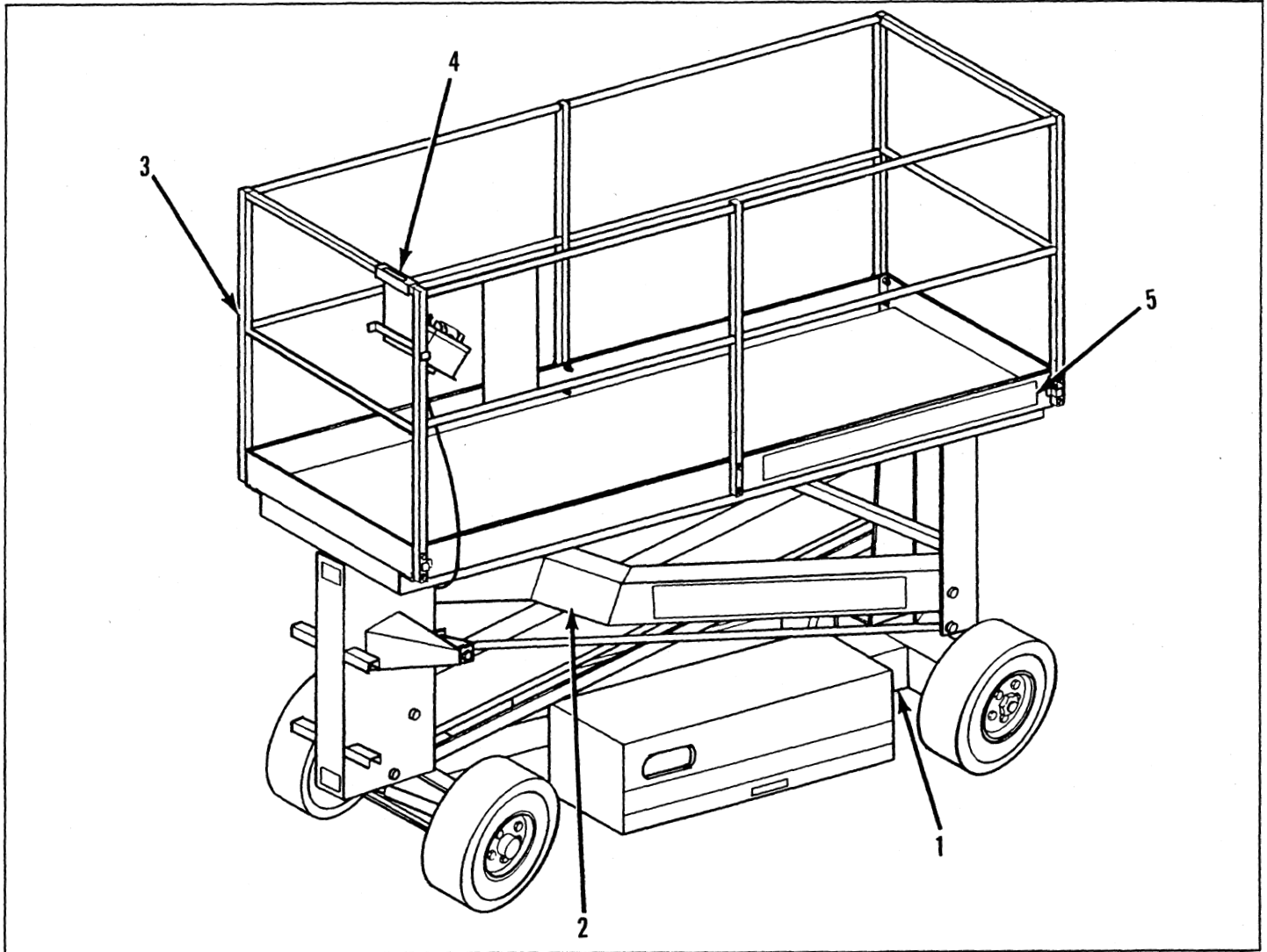


Figure 7-1. SL-20 Work Platform

Figure 7-1. SL-20 Work Platform

ITEM	PART	DESCRIPTION	QTY.
7-1	63400-000-00	SL-20 WORK PLATFORM	1
-1	63402-000-00	. CHASSIS ASSEMBLY. (See Figure 7-2)	1
-2	No Number	. ELEVATING ASSEMBLY (See Figures 7-11)	1
-3	No Number	. PLATFORM/GUARDRAIL ASSEMBLY(See Fig. 7-14)	1
-4	63404-000-00	. CONTROLLER ASSEMBLY (See Figure 7-15)	1
-5	63008-000-00	. DECAL KIT INSTALLATION (See Figure 7-16)	1

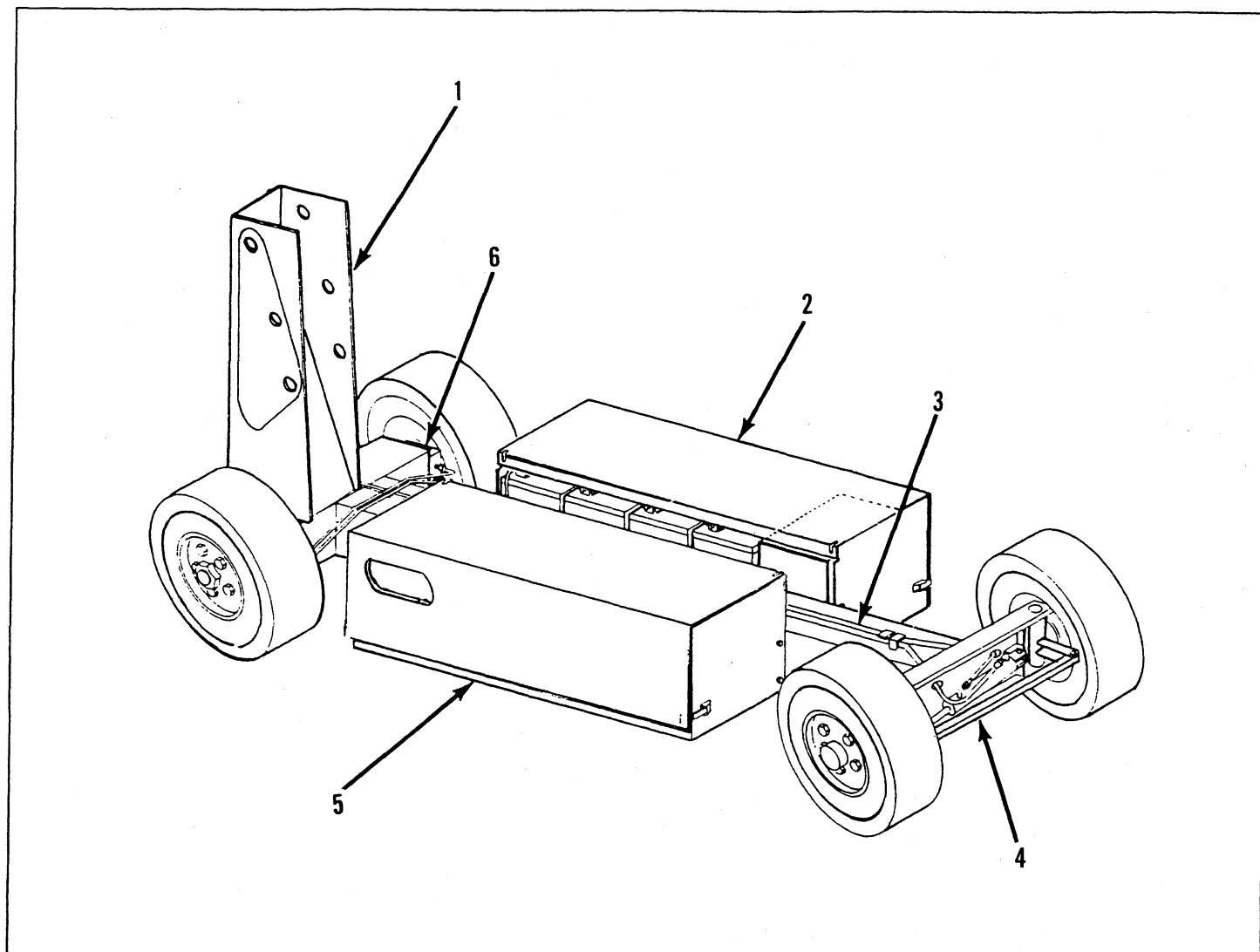


Figure 7-2. Chassis Assembly

Figure 7-2. Chassis Assembly

ITEM	PART	DESCRIPTION	QTY.
7-2	63402-000-00	CHASSIS ASSEMBLY	1
-1	63011-000-00	. CHASSIS FRAME WELDMENT	1
-2	No Number	. MODULE ASSEMBLY, Energy (See Figures 7-5)	1
-3	No Number	. HOSE AND TUBING KIT/ INSTALLATION (See Fig. 7-10)	1
-4	No Number	. FRONT STEERING AND HUB ASSEMBLY (See Figure 7-3)	1
-5	63403-000-00	. MODULE ASSEMBLY, Control (See Figure 7-6)	1
-6	No Number	. BRAKE CYLINDER AND DRIVE MOTOR (See Figure 7-4)	1

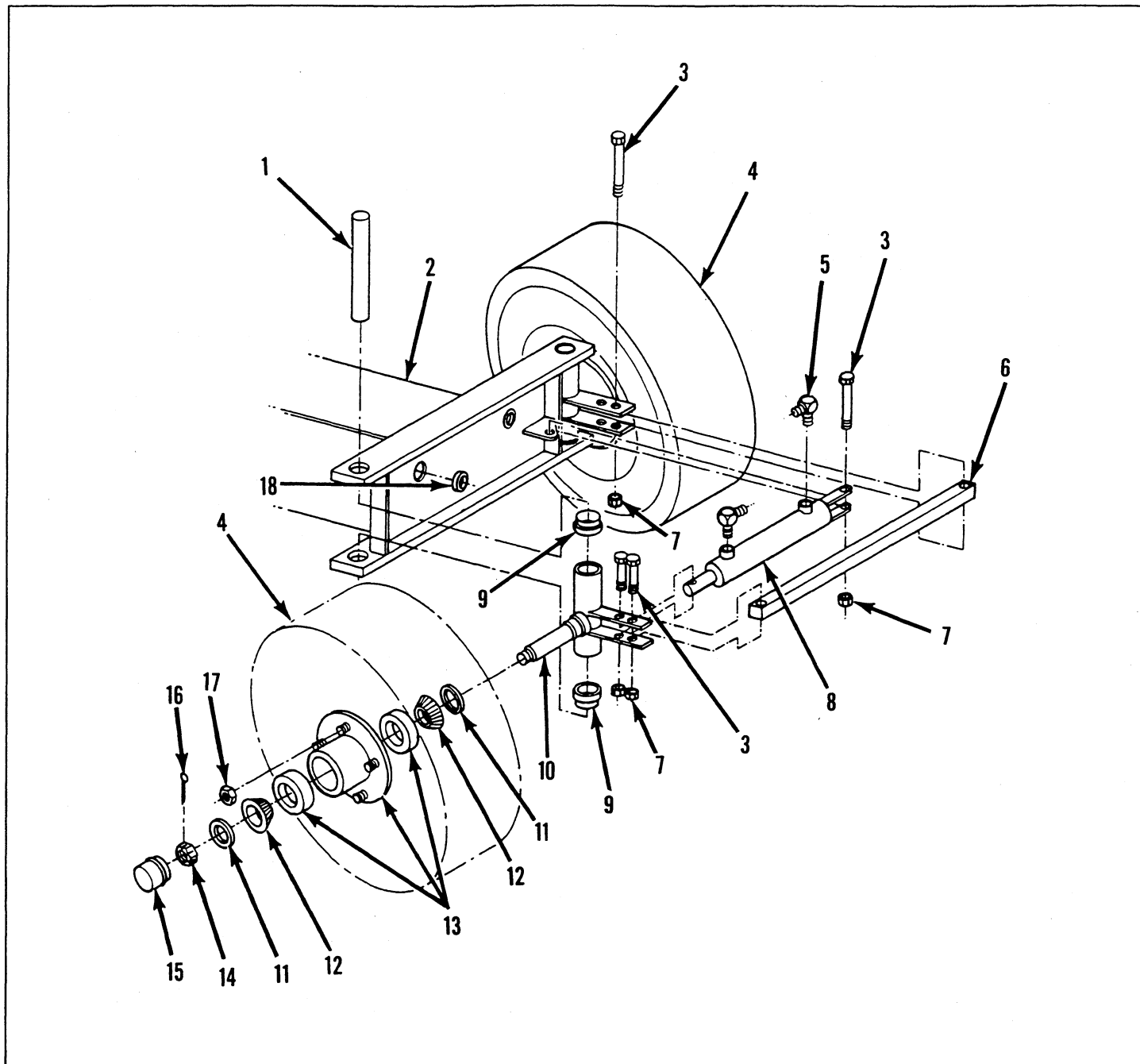


Figure 7-3. Front Steering and Hub Assembly

Figure 7-3. Front Steering and Hub Assembly

ITEM	PART	DESCRIPTION	QTY.
7-3	No Number	FRONT STEERING AND HUB ASSEMBLY (See Figure 7-2 for NHA)	REF
-1	63077-000-00	. PIN, King	2
-2	63011-000-00	. FRAME WELDMENT (See Figure 7-2)	REF
-3	11254-016-00	. SCREW, HEX 3/8-16 UNC x 2	4
-4	61826-000-00	. WHEEL ASSEMBLY	2
-5	11940-006-00	. FITTING, Elbow	2
-6	63089-000-00	. LINK, Drag	1
-7	11248-006-00	. LOCKNUT, HEX 3/8-16 UNC	4
-8	63097-000-00	. CYLINDER, Steering	1

ITEM	PART	DESCRIPTION	QTY.
-	63097-014-00	. SEAL KIT	1
-9	11781-014-00	. BEARING, Flange	4
-10	63078-000-00	. SPINDLE WELDMENT	2
-11	05104-000-00	. SEAL, Grease	2
-12	11775-011-00	. BEARING, Cone	4
-13	63102-000-00	. HUB ASSEMBLY	2
-14	11274-016-00	. NUT, Slotted HEX 1-14 UNF	2
-15	05078-000-00	. CAP, Dust	2
-16	11753-012-00	. PIN, Cotter	2
-17	05105-000-00	. NUT, Wheel	10
-18	12956-010-00	. GROMMET, 3/16	3

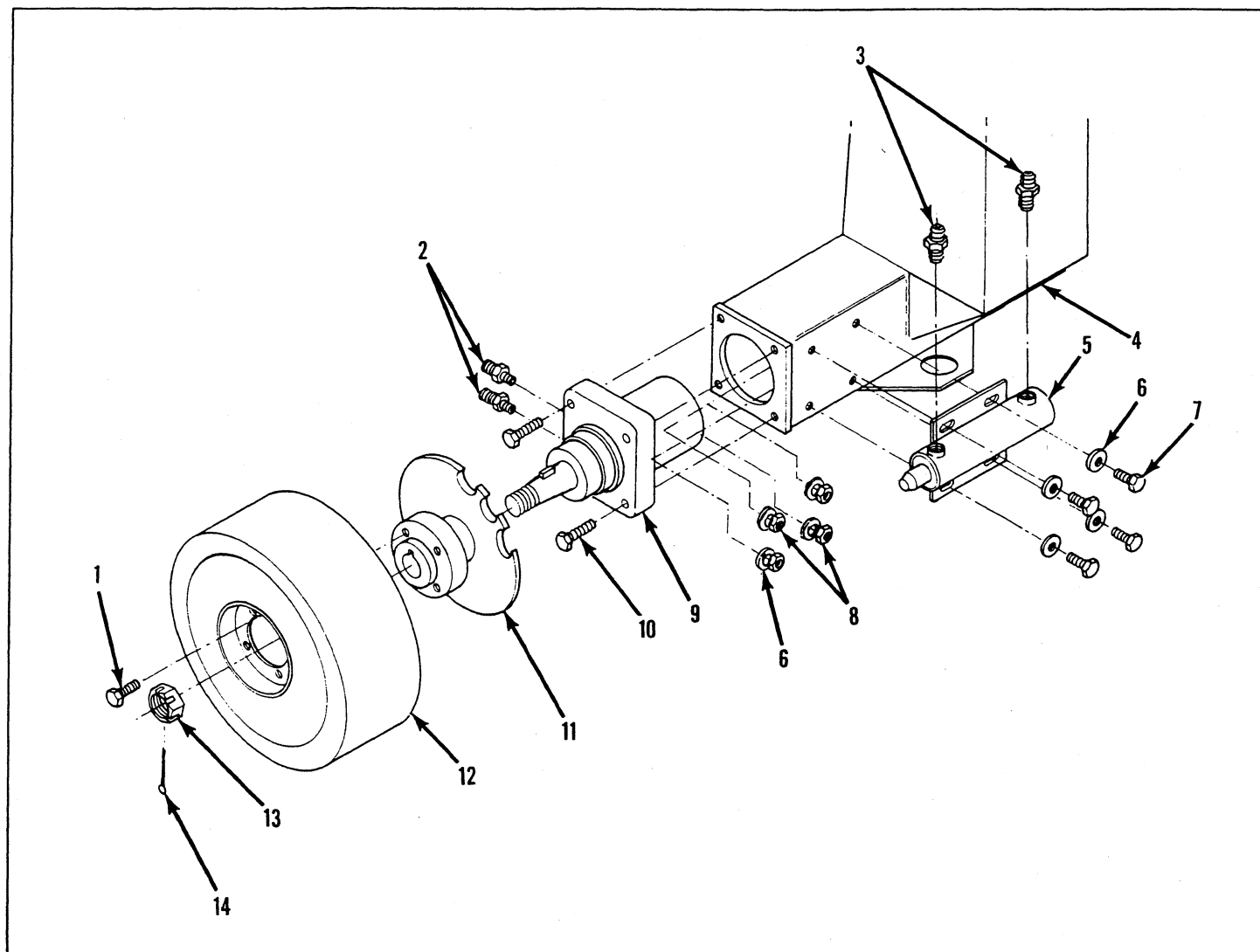


Figure 7-4. Brake Cylinder and Drive Motor Assembly

Figure 7-4. Brake Cylinder and Drive Motor Assembly

ITEM	PART	DESCRIPTION	QTY.
7-4	No Number	BRAKE CYLINDER & MOTOR (See Figure 7-2 for NHA)	REF
-1	14122-001-00	. BOLT, Wheel	10
-2	11941-013-00	. FITTING, Straight	4
-3	11939-010-00	. FITTING, Straight	2
-4	63011-000-00	. CHASSIS FRAME WELDMENT (See Figure 7-2)	REF
-5	60479-000-00	. CYLINDER, Brake	1
-	60211-014-00	. SEAL KIT	1
-6	11246-006-00	. WASHER, HEX 3/8-16 UNC	8
-7	11264-010-00	. SCREW, HEX 3/8-24 UNF x 1-1/4	4

ITEM	PART	DESCRIPTION	QTY.
-8	61817-011-00	. NUT, Spline 3/8-24 UNF	4
-9	61817-001-00	. MOTOR, Drive	2
-	61817-010-00	. SEAL KIT, Motor	REF
-10	11256-018-00	. SCREW, HEX 1/2-13 UNC x 2-1/4	8
-11	63075-000-00	. BRAKE HUB WELDMENT, LH	1
-12	61826-000-00	. WHEEL ASSEMBLY	2
-13	11274-016-00	. NUT, Slotted HEX 1-14 UNF	2
-14	11753-012-00	. PIN, Cotter	2
-15	60737-000-00	. HUB, RH (Not Shown)	1

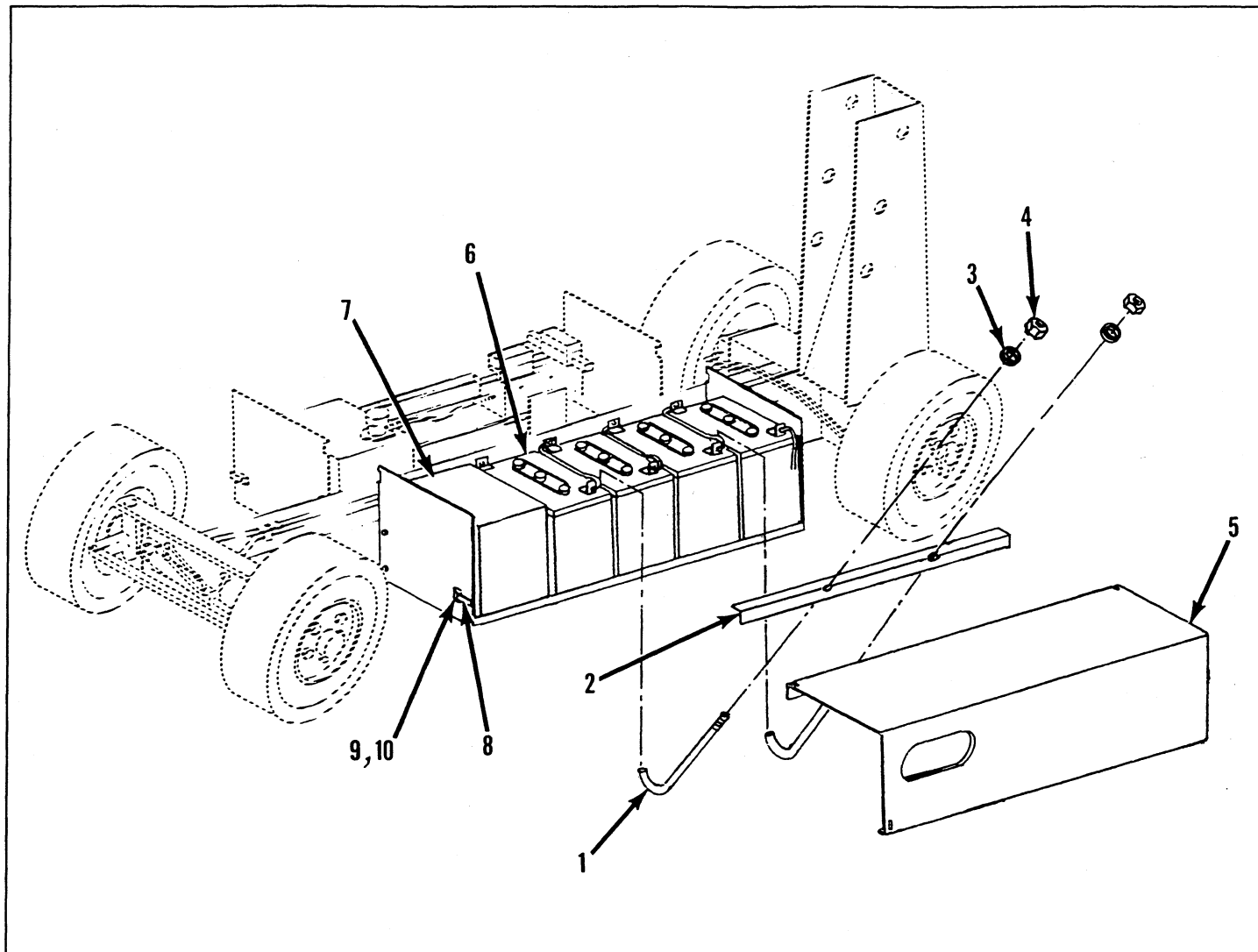


Figure 7-5. Energy Module Assembly

Figure 7-5. Front Energy Module Assembly

ITEM	PART	DESCRIPTION	QTY.
7-5	No Number	ENERGY MODULE ASSEMBLY (See Figure 7-2 for NHA)	REF
-1	63082-000-00	. BOLT	2
-2	63083-000-00	. ANGLE	1
-3	11239-004-00	. WASHER, 1/4 DIA	2
-4	11248-004-00	. LOCKNUT, 1/4-20 UNC	2

ITEM	PART	DESCRIPTION	QTY.
-5	63067-000-00	. COVER, Module	1
-6	15796-000-00	. BATTERY, 6V 220 AMP	4
-7	63944-001-00	. CHARGER, Battery	1
-8	11248-002-00	. NUT, HEX 8-32 UNC	4
-9	05299-000-00	. LATCH, Toggle	2
-10	11708-004-00	. SCREW, 8/37 UNC x 1/2	4

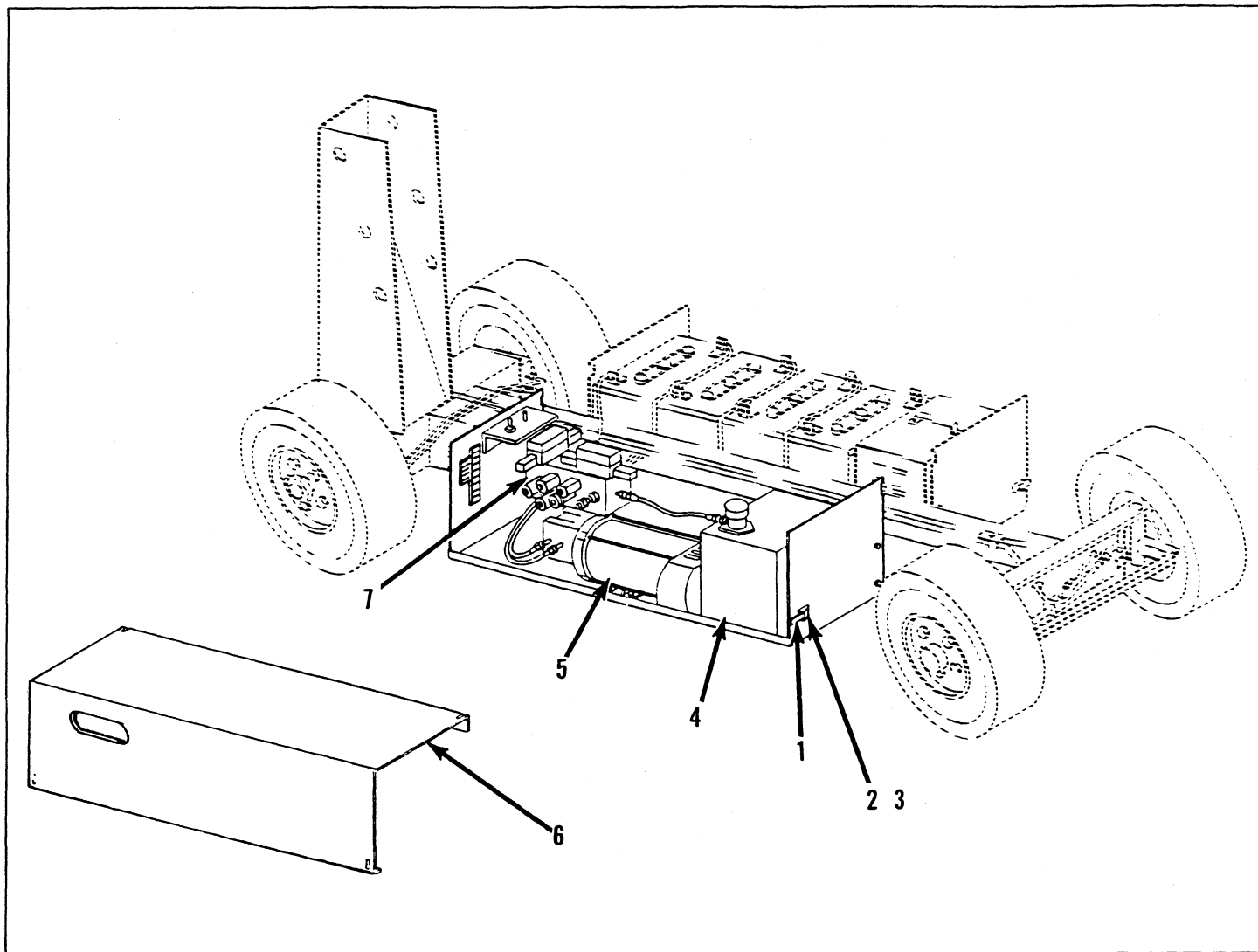


Figure 7-6. Control Module Assembly

Figure 7-6. Control Module Assembly

ITEM	PART	DESCRIPTION	QTY.
7-6	63403-000-00	CONTROL MODULE ASSEMBLY (See Figure 7-2 for NHA)	REF
-1	05299-000-00	LATCH, Toggle	2
-2	11708-004-00	SCREW, 8-32 UNC x 1/2	4
-3	11248-004-00	NUT, ESNA 1/4-20 UNC	2
-4	No Number	HYDRAULIC TANK INSTALLATION (See Figure 7-7)	1
-5	No Number	PUMP/MOTOR AND ELECTRICAL INSTALLATION, (See Figure 7-8)	1
-6	63067-000-00	COVER, Control Module	1
-7	63217-000-00	MANIFOLD, Hydraulic (See Figure 7-9)	1

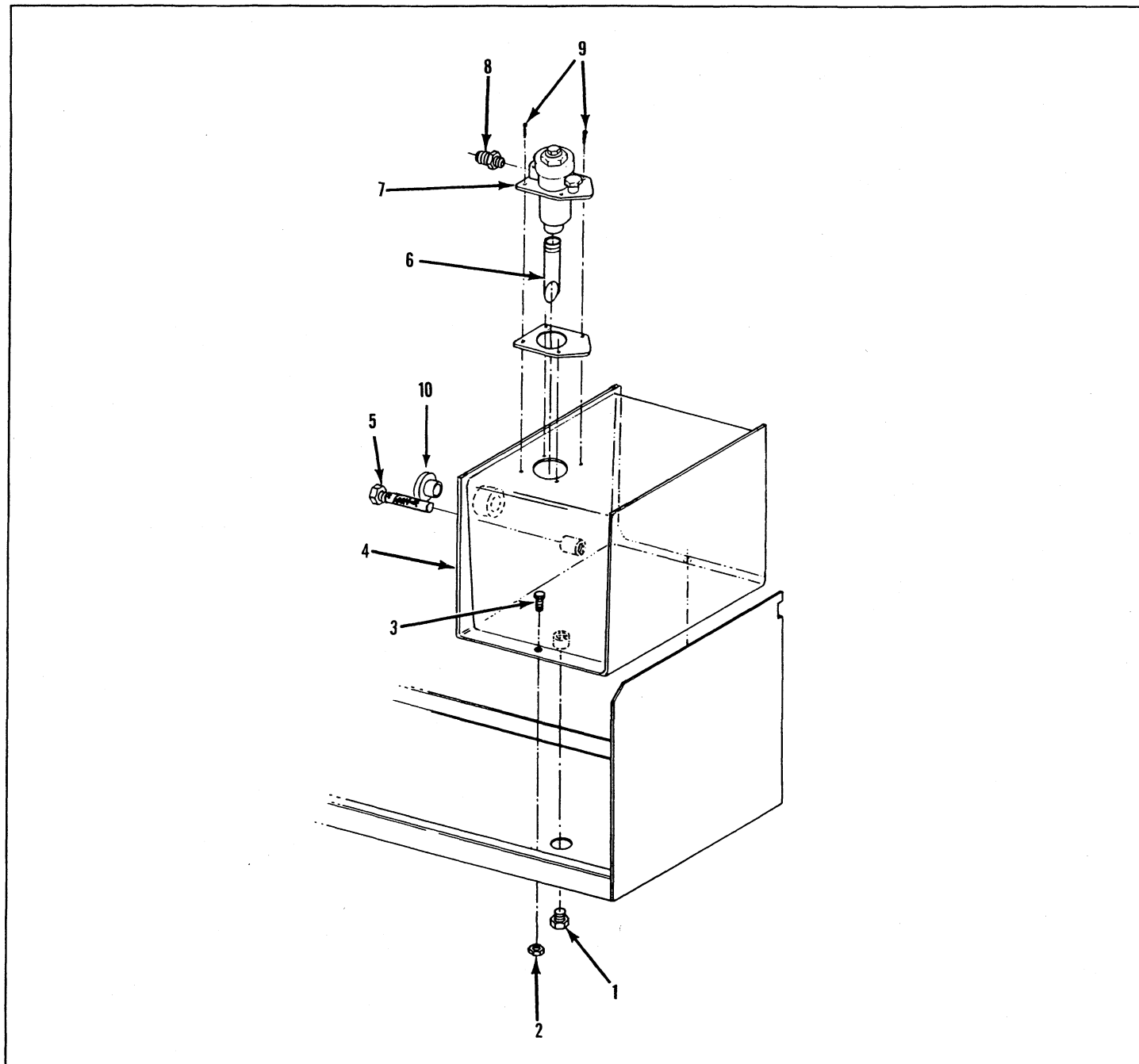


Figure 7-7. Hydraulic Tank Installation

Figure 7-7. Control Module Assembly

ITEM	PART	DESCRIPTION	QTY.
7-7	No Number	HYDRAULIC TANK INSTALLATION (See Figure 7-6 for NHA)	REF
-1	21305-006-00	. PLUG	1
-2	11248-006-00	. LOCKNUT, HEX 3/8-16	2
-3	11254-008-00	. SCREW, HEX 3/8-16 UNC x 3/4	2
-4	63063-000-00	. HYDRAULIC TANK WELDMENT	1
-5	61818-000-00	. FITTING, Suction Screen	1

ITEM	PART	DESCRIPTION	QTY.
-6	63126-099-00	. TUBE, Drain	1
-7	63100-001-00	. FILTER RETURN	1
-	63100-010-00	. . Element	1
-8	11939-014-00	. FITTING, Straight	1
-9	14073-006-00	. SCREW, RD HD 10-32 UNF x 3/4	4
-10	63979-006-00	. SIGHT GAUGE	1

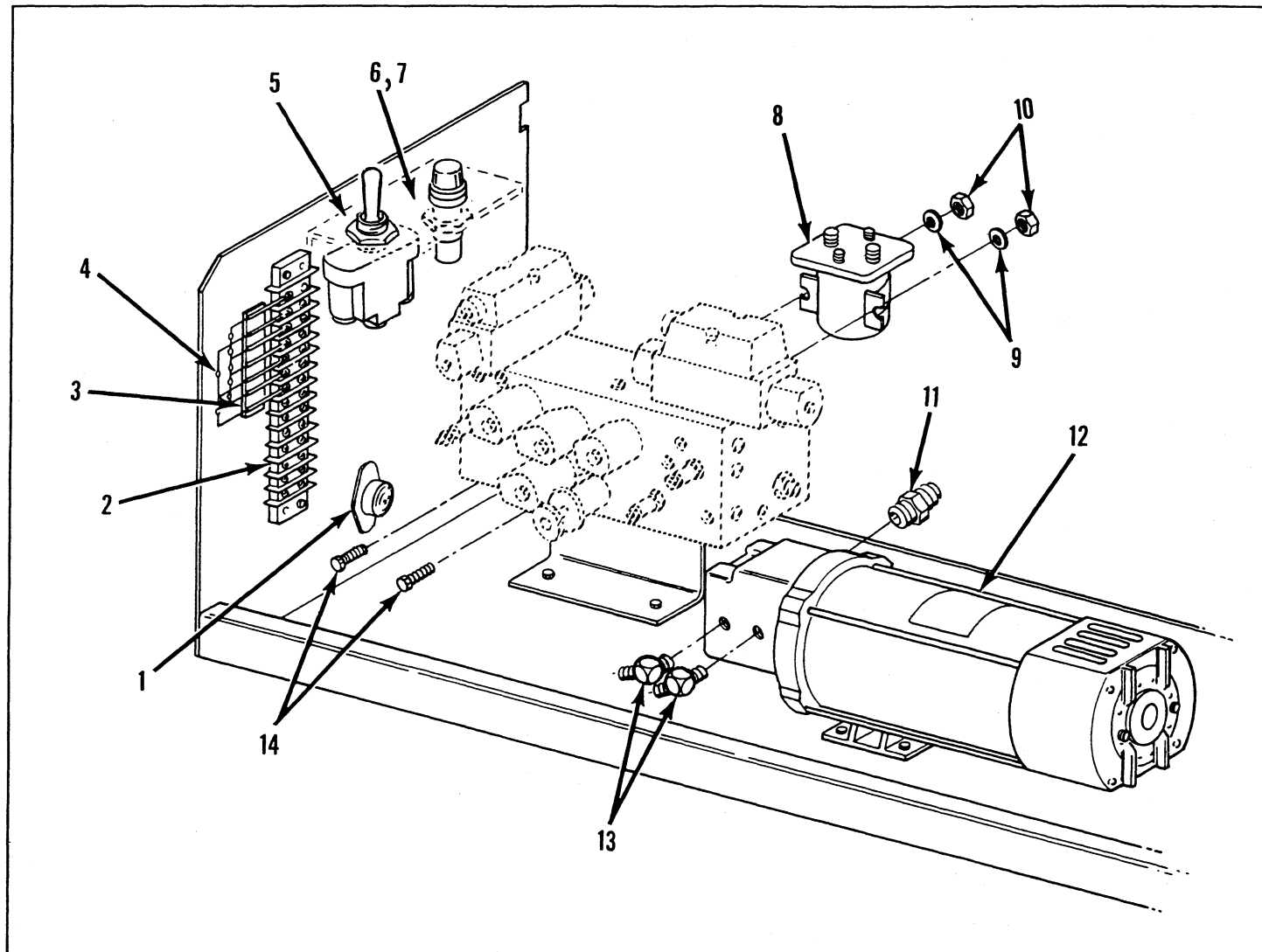


Figure 7-8. Pump/Motor and Electrical Components Installation

Figure 7-8. Pump/Electrical Components Installation

ITEM	PART	DESCRIPTION	QTY.
7-8	No Number	PUMP/MOTOR AND ELECTRICAL COMPONENTS INSTALLATION, (See Figure 7-6 for NHA)	REF
-1	15765-000-00	. BUZZER	1
-2	29928-004-00	. TERMINAL BLOCK	1
-3	61806-000-00	. STRIP, Fanning	1
-4	29825-002-00	. DIODE	7
-5	12798-000-00	. SWITCH	1
-6	29701-000-00	. HOLDER, Fuse	1
-7	29704-015-00	. FUSE, 15 AMP	1
-8	10122-000-00	. RELAY	1

ITEM	PART	DESCRIPTION	QTY.
-9	11240-004-00	. WASHER, Flat 1/4 DIA	2
-10	11248-004-00	. LOCKNUT, HEX 1/4-20 UNC	2
-11	11941-012-00	. FITTING, Straight	1
-12	15797-000-00	. POWER UNIT	1
	15797-001-00	. . PUMP	1
	15797-004-00	. . MOTOR	1
	10145-001-00	. . BRUSH SET, Ohio Motor	1
-13	11934-004-00	. FITTING, Elbow	2
-14	11252-006-00	. SCREW, HEX 1/4-20 UNC x 3/4	2

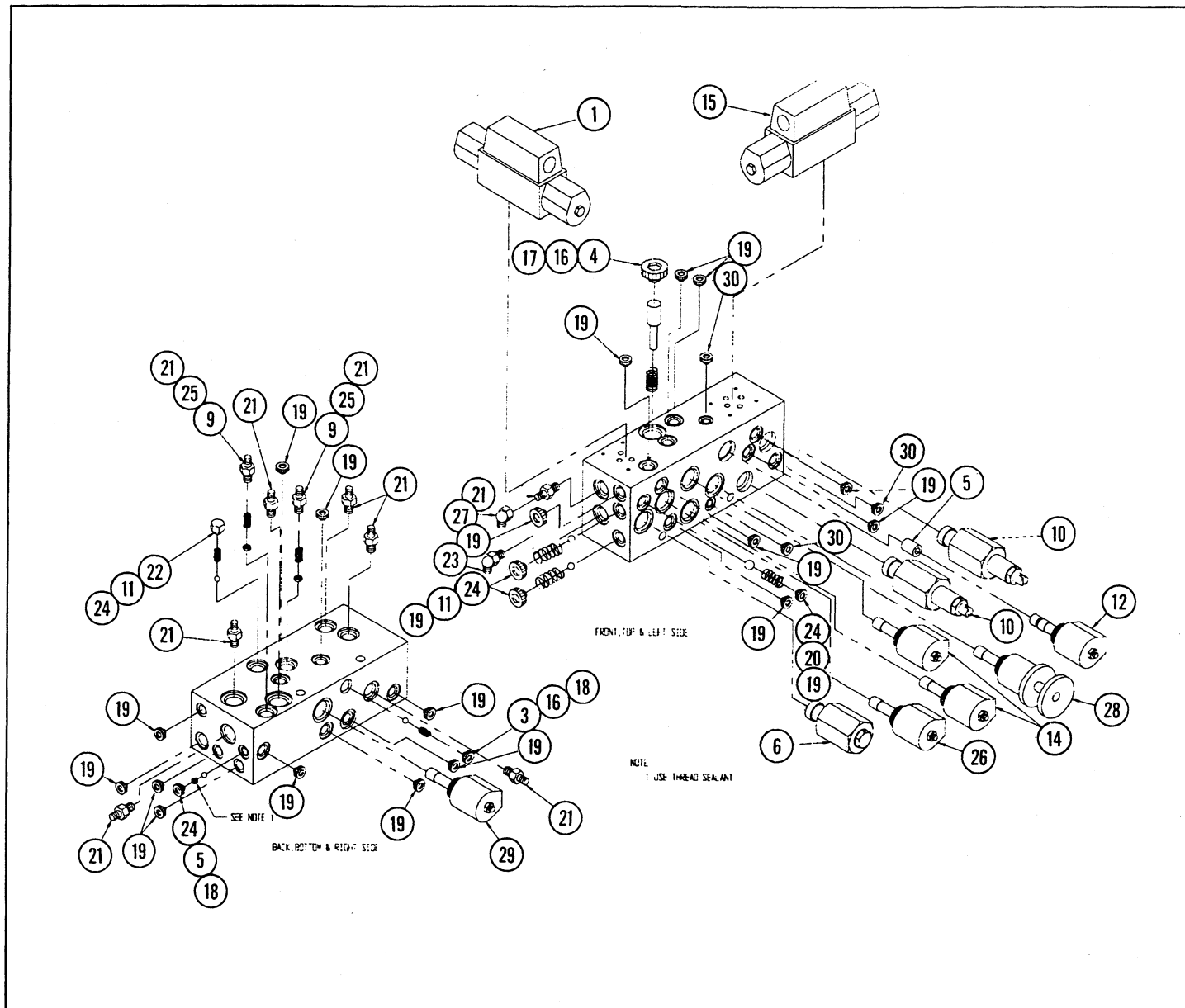


Figure 7-9. Hydraulic Manifold Assembly Serial Numbers 1000 to 1328

Figure 7-9. Hydraulic Manifold Assembly

ITEM	PART	DESCRIPTION	QTY.
7-9	63217-000-00	HYDRAULIC MANIFOLD ASSEMBLY, Serial Numbers 1329 to Current (See Figure 7-6 for NHA)	REF
-1	15763-000-00	. VALVE, Solenoid, Steering	1
-2	30576-005-00	. VALVE, Manifold	1
-3	61827-000-00	. BALL, Steel 7/16 DIA.	1
-4	61819-000-00	. PISTON ASSEMBLY	1
-5	61728-000-00	. ORIFICE	2
-6	60390-000-00	. VALVE, Relief	1
-8	29925-000-00	. CONNECTOR, Cable	2
-9	15919-000-00	. ORIFICE	2
-10	15900-000-00	. VALVE, Counterbalance	2
-11	15799-000-00	. SPRING, Compress	3
-12	61797-000-00	. VALVE, Solenoid, Lift	1
-14	15762-000-00	. VALVE, Solenoid, N.O. High Speed	2
-15	15760-000-00	. VALVE, Solenoid, Drive	1

ITEM	PART	DESCRIPTION	QTY.
-16	13987-005-00	. SPRING	2
-17	12004-008-00	. FITTING, Plug	1
-18	12004-006-00	. FITTING, Plug	2
-19	12004-004-00	. FITTING, Plug	21
-20	13987-006-00	. SPRING, Compress	1
-21	11941-005-00	. FITTING, Adaptor, Straight	9
-22	20021-006-00	. FITTING, Adaptor, Plug	1
-23	11934-004-00	. FITTING, Elbow	1
-24	05135-000-00	. BALL, Steel 5/16 DIA.	5
-25	05133-000-00	. SPRING, Valve	2
-26	63121-000-00	. VALVE, Solenoid, N.C. Steering Bypass	1
-27	11937-003-00	. FITTING, Elbow	1
-28	60388-000-00	. Valve, Cartridge, Emergency Down	1
-29	15764-000-00	. VALVE, Solenoid, N.C. -Down	1
-30	12004-002-00	. FITTING, Plug	3

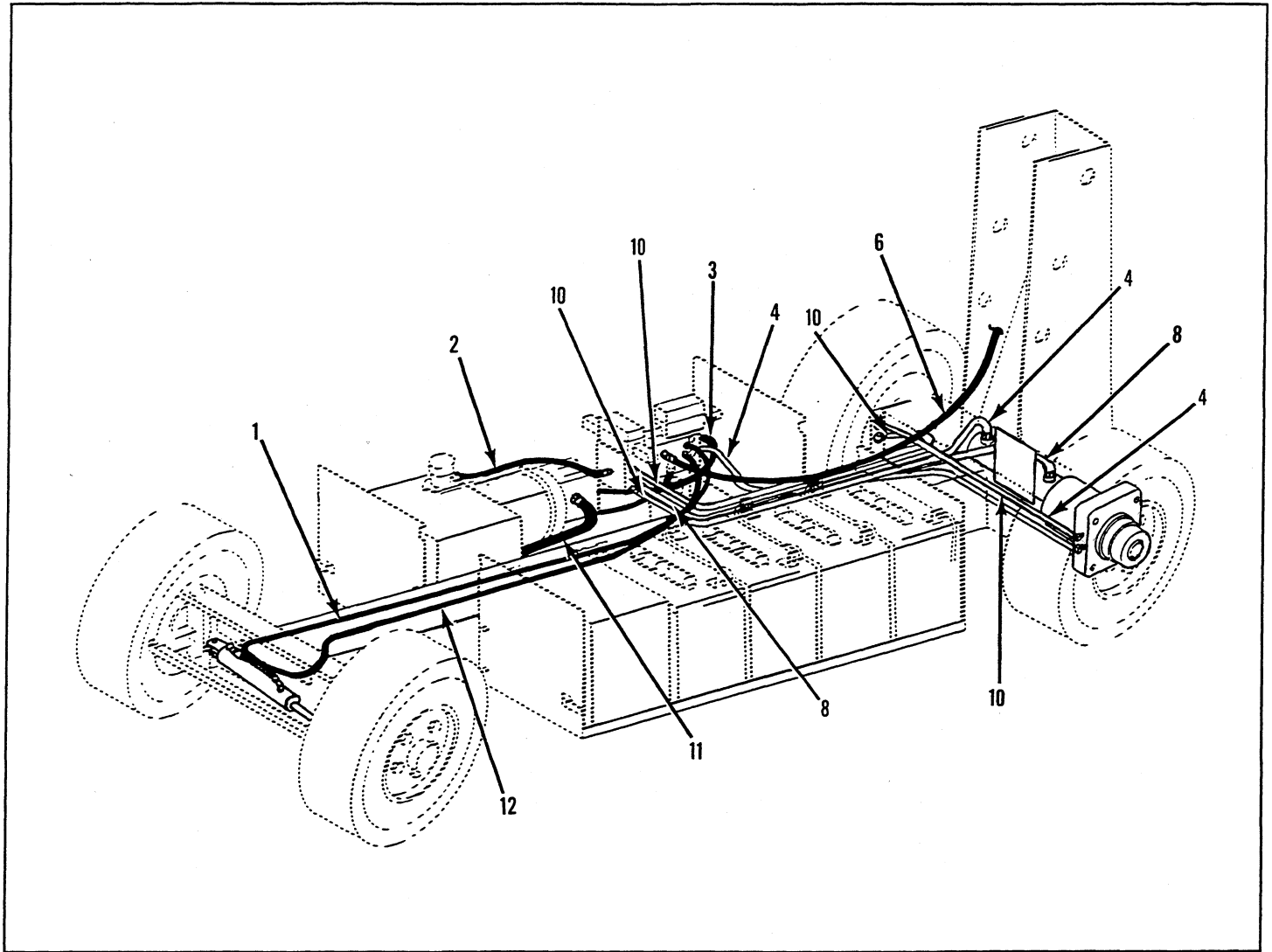


Figure 7-10. Hose and Tubing Kit Installation Chassis

Figure 7-10. Hose and Tubing Kit Installation Chassis

ITEM	PART	DESCRIPTION	QTY.
7-10	No Number	HOSE AND TUBING KIT INSTALLATION, Chassis	REF
-1	61131-004-00	. HOSE ASSEMBLY 1/4 x 70	1
-2	60861-029-00	. HOSE ASSEMBLY 3/8 x 19	1
-3	60861-013-00	. HOSE ASSEMBLY 3/8 x 15-1/2	2
-4	60861-008-00	. BRAKE HOSE ASSEMBLY	2
-6	60861-030-00	. HOSE ASSEMBLY 3/8 x 35	1

ITEM	PART	DESCRIPTION	QTY.
-7	60861-020-00	. BRAKE HOSE ASSEMBLY	1
-8	63107-000-00	. BRAKE HOSE ASSEMBLY	1
-10	60861-006-00	. DRIVE HOSE ASSEMBLY	2
-11	61789-002-00	. HOSE ASSEMBLY 3/4 x 20-1/2	1
-12	61131-002-00	. HOSE ASSEMBLY 1/4 x 74	1

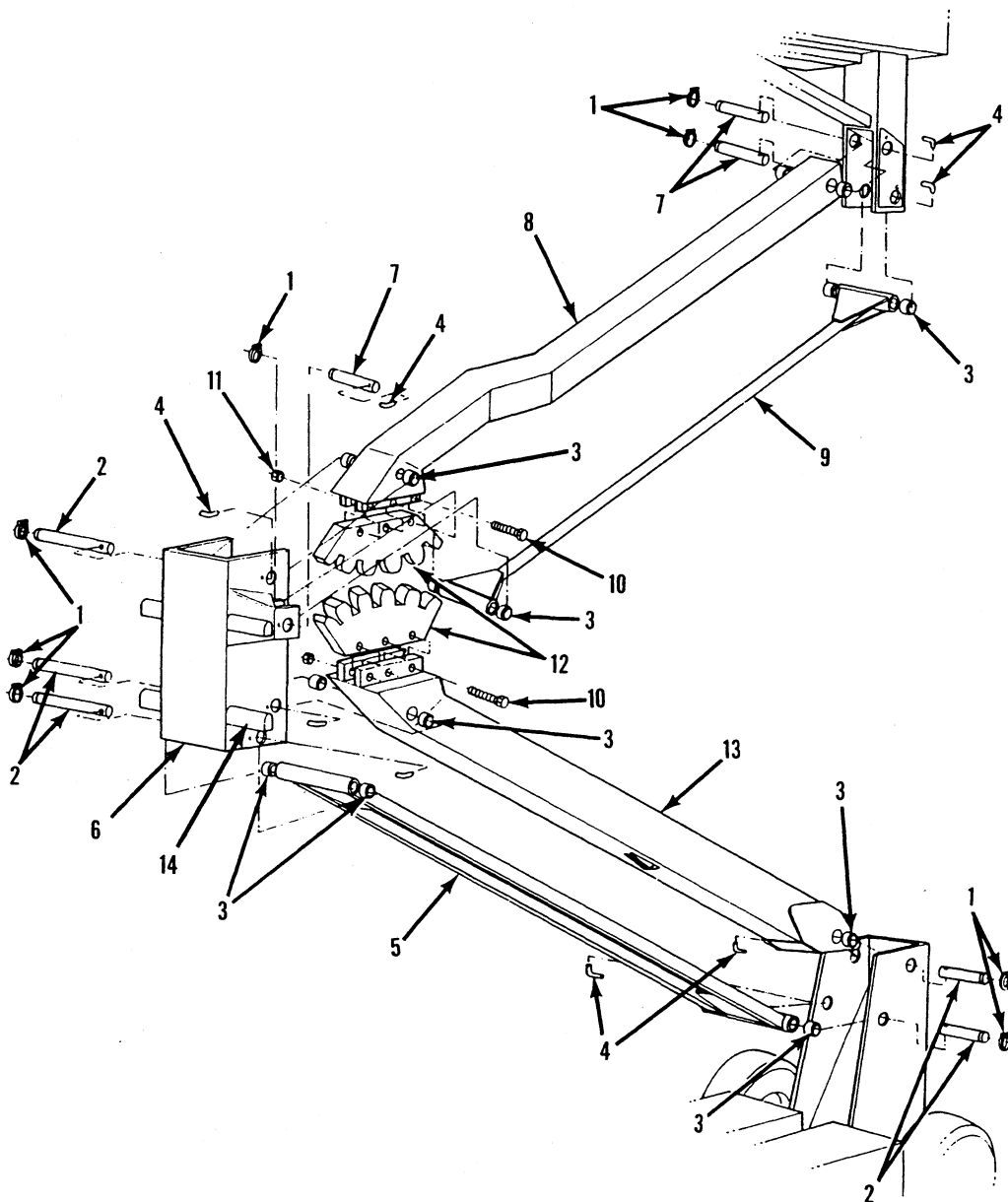


Figure 7-11. Elevating Assembly

Figure 7-11. Elevating Assembly

ITEM	PART	DESCRIPTION	QTY.
7-11	No Number	ELEVATING ASSEMBLY (See Figure 7-2 for NHA)	REF
-1	11764-023-00	. RING, Retaining	9
-2	63090-000-00	. PIN, Pivot, Long	5
-3	63095-001-00	. BEARING	18
-4	63087-000-00	. PIN, Locking	9
-5	63061-000-00	. TENSION ROD WELDMENT, Lower	1
-6	63035-000-00	. MID-LINKAGE PIVOT WELDMENT	1
-7	63091-000-00	. PIN, Pivot, Short	3

ITEM	PART	DESCRIPTION	QTY.
-8	63044-000-00	. LIFT ARM WELDMENT, Upper	1
-9	63059-000-00	. TENSION ARM WELDMENT, Upper	1
-10	14099-036-00	. SCREW, HHC 3/4-10 UNC x 4-1/2	6
-11	11248-012-00	. LOCKNUT, HEX 3/4-10 UNC	6
-12	63085-001-00	. GEAR, Linkage	2
-13	63052-000-00	. LIFT ARM WELDMENT, Lower	1
-14	63116-001-00	. STEP	4

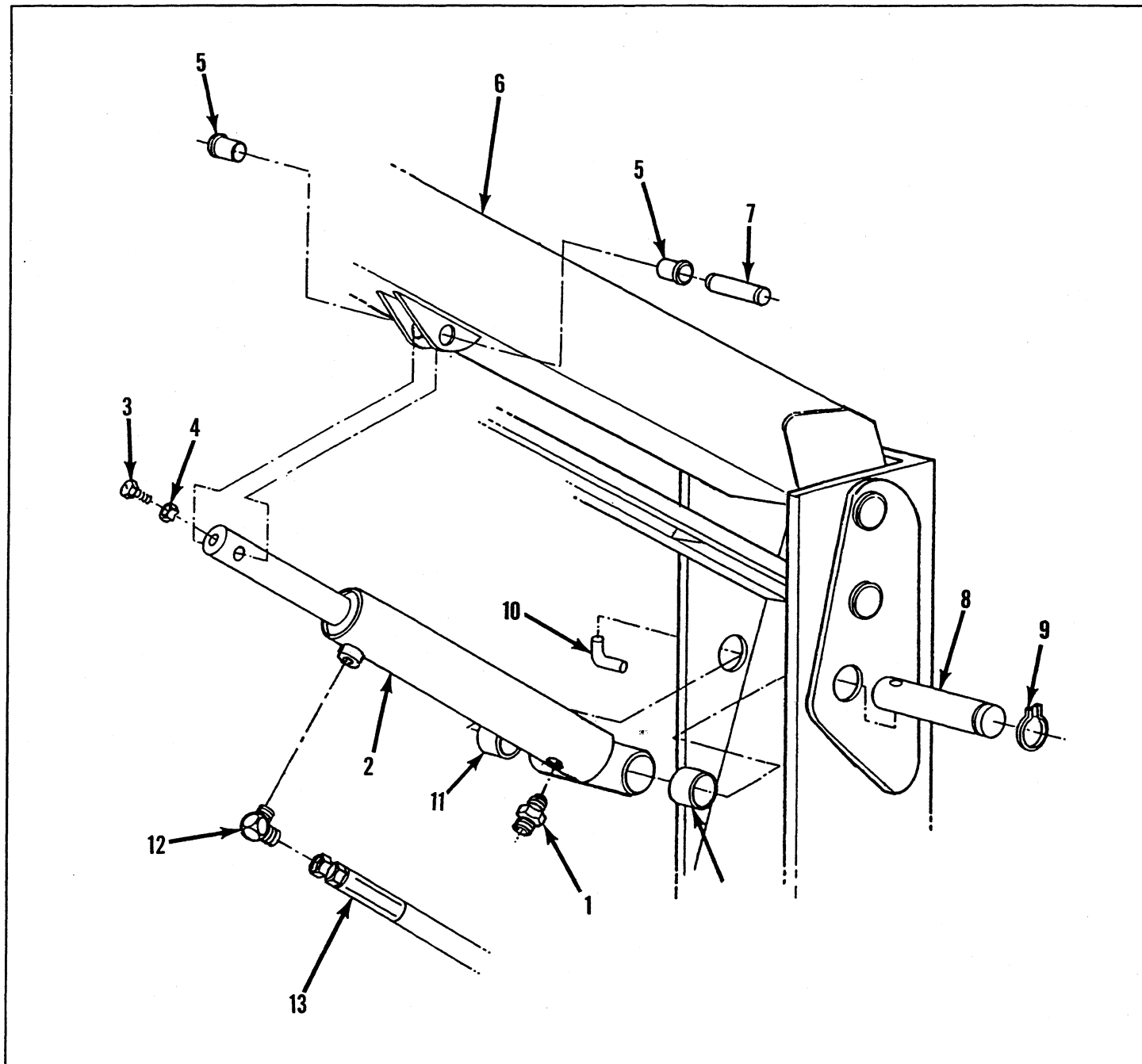


Figure 7-12. Lift Cylinder Installation

Figure 7-12. Lift Cylinder Installation

ITEM	PART	DESCRIPTION	QTY.
7-12	No Number	LIFT CYLINDER INSTALLATION (See Figure 7-11 for NHA)	REF
-1	11941-006-00	. FITTING, Straight	1
-2	63096-000-00	. LIFT CYLINDER	1
	63096-014-00	.. SEAL KIT	1
	63096-010-00	.. FUSE, Velocity	1
-3	11287-010-00	. SCREW, HHC 3/8-16 UNC x 1/4	1
-4	11273-006-00	. NUT, Jam 3/8-16 UNC	1
-5	62649-001-00	. BEARING	2

ITEM	PART	DESCRIPTION	QTY.
-7	63134-000-00	. PIN, Cylinder	1
-8	63090-000-00	. PIN, Pivot, Long	1
-9	11764-023-00	. RING, Retaining	1
-10	63087-000-00	. PIN	1
-11	63095-001-00	. BEARING	2
-12	11940-006-00	. FITTING	1
-13	61132-005-00	. HOSE ASSEMBLY, 1/4 x 61	1

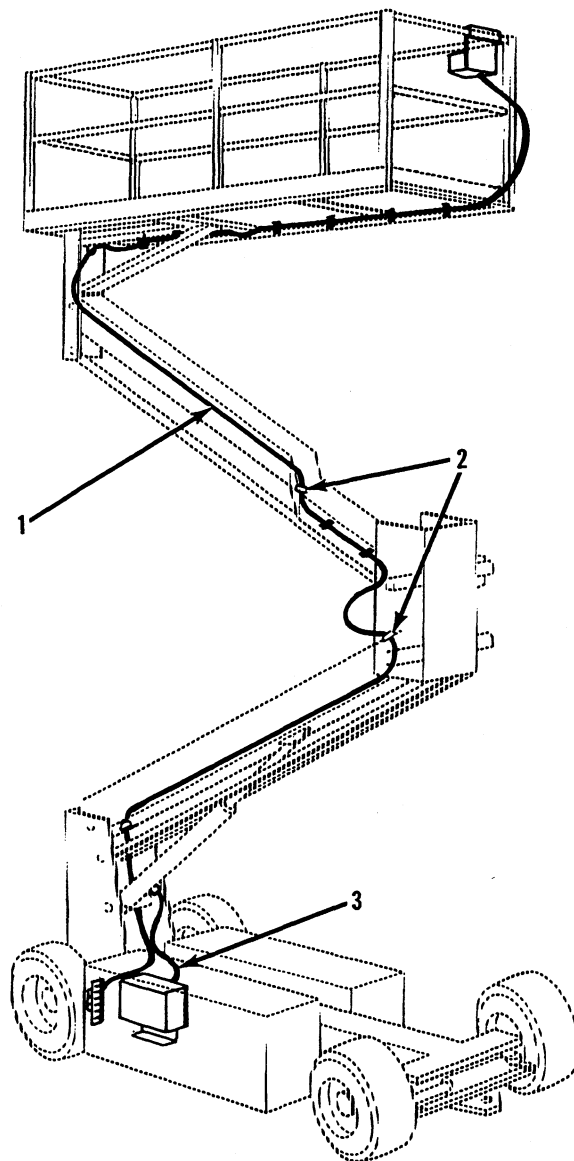


Figure 7-13. Hose and Cable Installation, Elevating Assembly/Platform

**Figure 7-13. Hose and Cable Installation,
Elevating Assembly/Platform**

ITEM	PART	DESCRIPTION	QTY.
7-13	No Number	HOSE AND CABLE INSTALLATION, Elevating Assembly/Platform (See Figure 7-11 for NHA)	REF
-1	63006-000-00	. CABLE, LINKAGE ASSEMBLY	1
-2	11868-014-00	. BUSHING, Strain Relief 7/8 DIA.	2
-3	60861-030-00	. HOSE, LIFT ASSEMBLY x 35	1

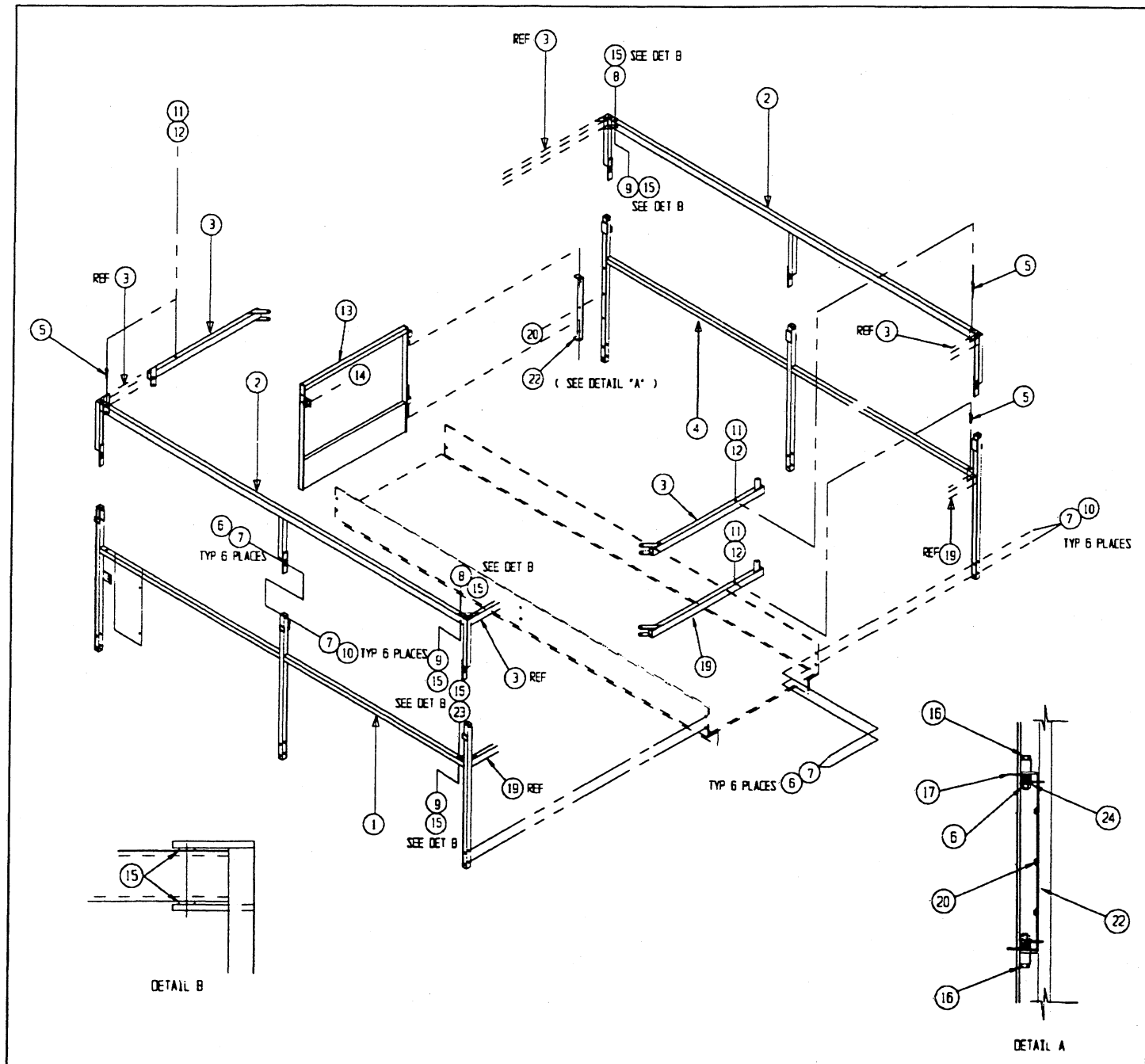


Figure 7-14. Platform/Guardrail Assembly

Figure 7-14. Fold-Down Rail Assembly Serial Number to Current

ITEM	PART	DESCRIPTION	QTY.
7-14	63220-003-00	FOLD-DOWN RAIL ASSEMBLY (See Figure 7-1 for NHA)	REF
-1	63221-001-00	. WELDMENT, Bottom Rail L/H	1
-2	63222-002-00	. WELDMENT, Top Rail 1.1M.(43 1/2)	2
-3	63223-001-00	. WELDMENT, End Rail	2
-4	63224-001-00	. WELDMENT, Bottom Rail R/H	1
-5	10414-000-00	. LOCKING PIN Assembly	3
-6	11248-006-00	. NUT, ESNA 3/8-16	20
-7	11240-006-00	. WASHER, Flat 3/8 DIA.	36
-8	11253-022-00	. SCREW, HEX HD Cap 5/16-18 x 2 3/4	2
-9	11248-005-00	. NUT, ESNA 5/16-18	3
-10	11254-006-00	. SCREW, HEX HD Cap 3/8-16 x 2	18
-11	26553-004-00	. POP RIVET, 3/16 DIA. x 3/8	3

ITEM	PART	DESCRIPTION	QTY.
-12	11240-003-00	. WASHER, Flat 3/16 DIA.	3
-13	63253-000-00	. WELDMENT, Gate	1
-14	03570-000-00	. RETAINING PIN Assembly	1
-15	11240-005-00	. WASHER, Flat 5/16 DIA.	6
-16	11254-022-00	. SCREW, HHC 3/8-16 x 2 3/4	2
-17	63270-000-00	. SPRING, Torsion	2
-19	63257-000-00	. WELDMENT, Rear Midrail	1
-20	26527-004-00	. SCREW, Self Tap 1/4-20 x 1/2 Long	1
-22	63312-000-00	. HINGE PLATE	1
-23	11253-016	. SCREW, HHC 5/16-18 x 2	1
-24	14996-006-00	. WASHER, Flat 3/8 SAE	2

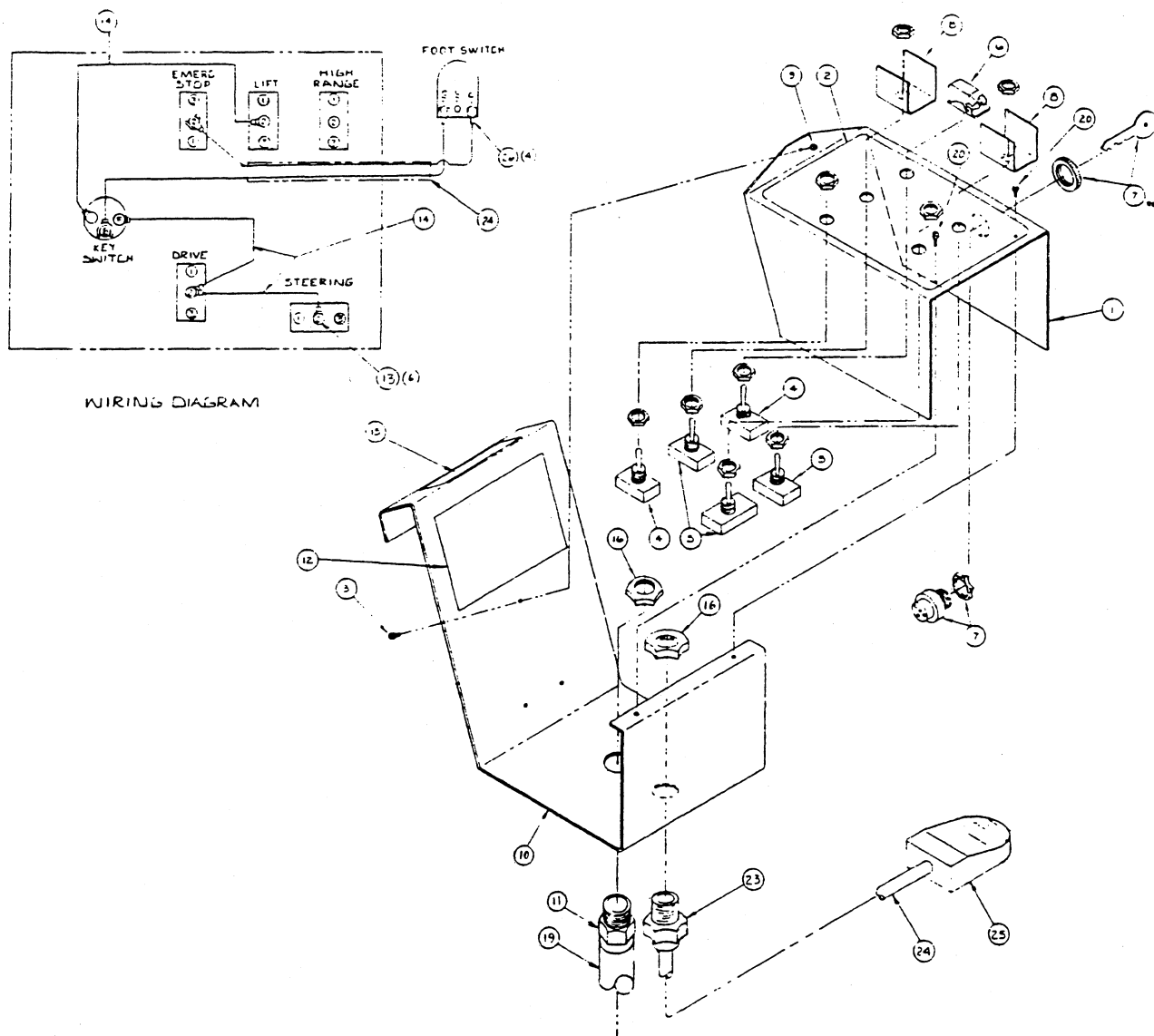
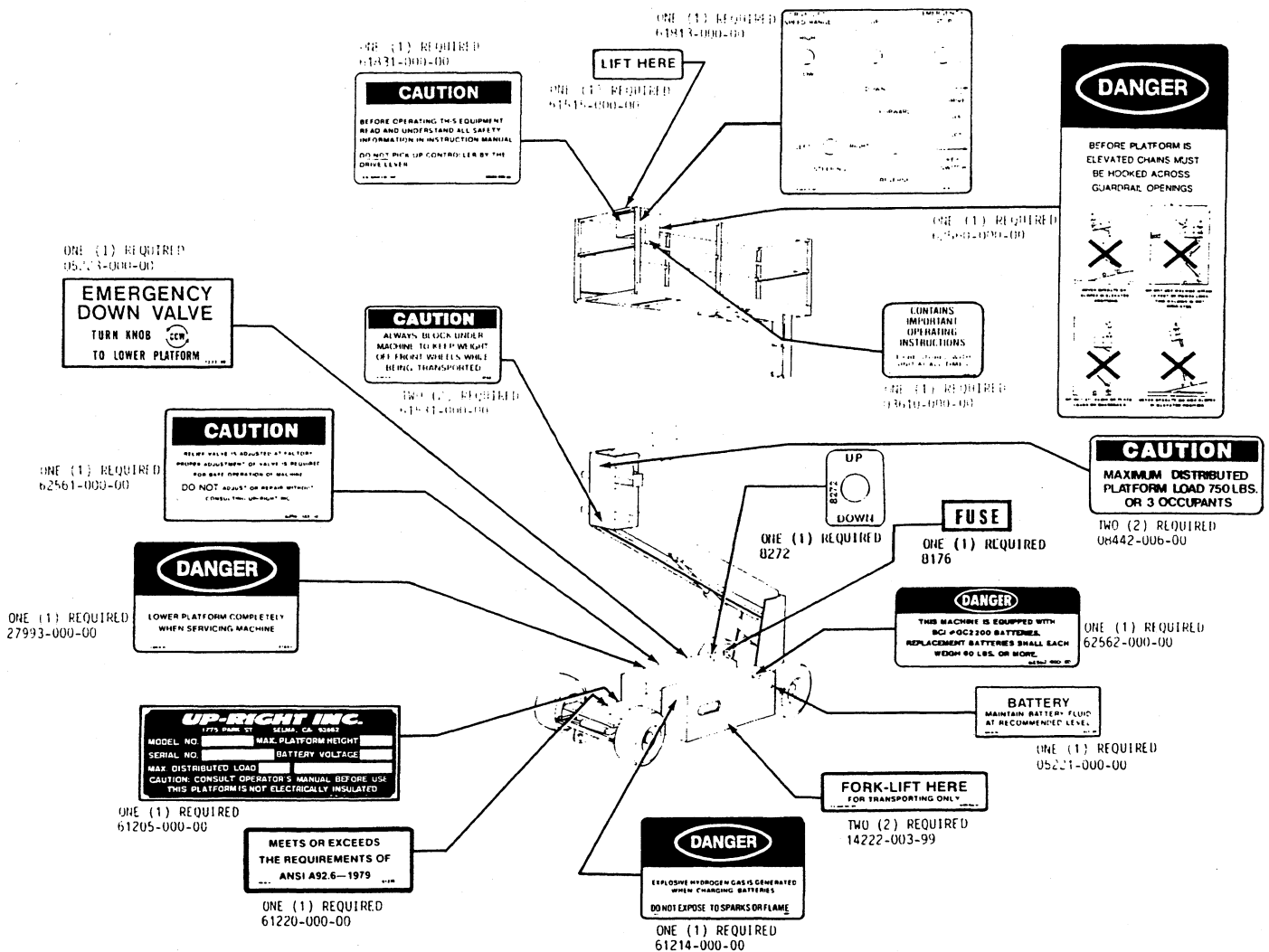


Figure 7-15. Controller Assembly

Figure 7-15. Controller Assembly Serial Number to Current

ITEM	PART	DESCRIPTION	QTY.
7-28	63404-000-00	CONTROLLER ASSEMBLY (See Figure 7-1 for NHA)	REF
-1	61809-000-00	CONSOLE, Controller	1
-2	61813-000-00	DECAL, Controller	1
-3	11708-000-00	SCREW, UNC RD HD 8-32 x 1 2	1
-4	12797-000-00	SWITCH, Toggle 82600	2
-5	12798-000-00	SWITCH, Toggle	3
-6	29936-006-00	GUARD, Switch Cutler-HM 8497K1	1
-7	15935-000-00	KEYSWITCH, Cole - 95593	1
-8	08271-000-00	GUARD, Toggle Switch	2
-9	11248-002-00	LOCKNUT, UNC HEX 8-32	1
-10	63452-000-00	HANGER, Controller	1

ITEM	PART No.	DESCRIPTION	QTY.
-11	29925-003-00	CONNECTOR, Cable TB 2524	1
-12	60865-000-00	DECAL, Before Operating	1
-14	29456-000-00	WIRE, 16 AWG THHN STRD COP YEL	38in.
-15	61515-000-00	DECAL, Lift Here	1
-16	29939-002-00	LOCKNUT, T&B - #141	2
-20	14073-006-00	SCREW, Self Tap UNC HEX 8-32 x 3/4	2
-21	63088-000-00	CONTROLLER, Channel	1
-22	26553-004-00	RIVET, Pop 3 16 Dia.	2
-23	29925-000-00	CONNECTOR	1
-24	29495-099-00	CABLE 14-3	6ft.
-25	63906-000-00	FOOT SWITCH	1
-26	29610-000-00	CONNECTOR, Fork Terminal 10-12	4



DECAL KIT	63008-000-00	1 REQUIRED
Does not include Controller Decals:	61515-000-00	Lift Here Decal -1 Req.
	61813-000-00	Controller Decal
	61831-000-00	Caution Decal

**NOTE: DECALS CAN BE ORDERED
BY USING PART NUMBER LOCATED
BY EACH DECAL.**

Figure 7-16. Safety Decal Kit Installation

UpRight

UpRight, Inc.
1775 Park Street
Selma, California 93662
TEL: 559/896-5150
FAX: 559/896-9012

Call Toll Free
1-800-926-LIFT

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108 Industrial Drive
Whitby, Ontario, Canada L1N5Z8
TEL: 416/668-7701

P/N63099-001
9901-25-MCP