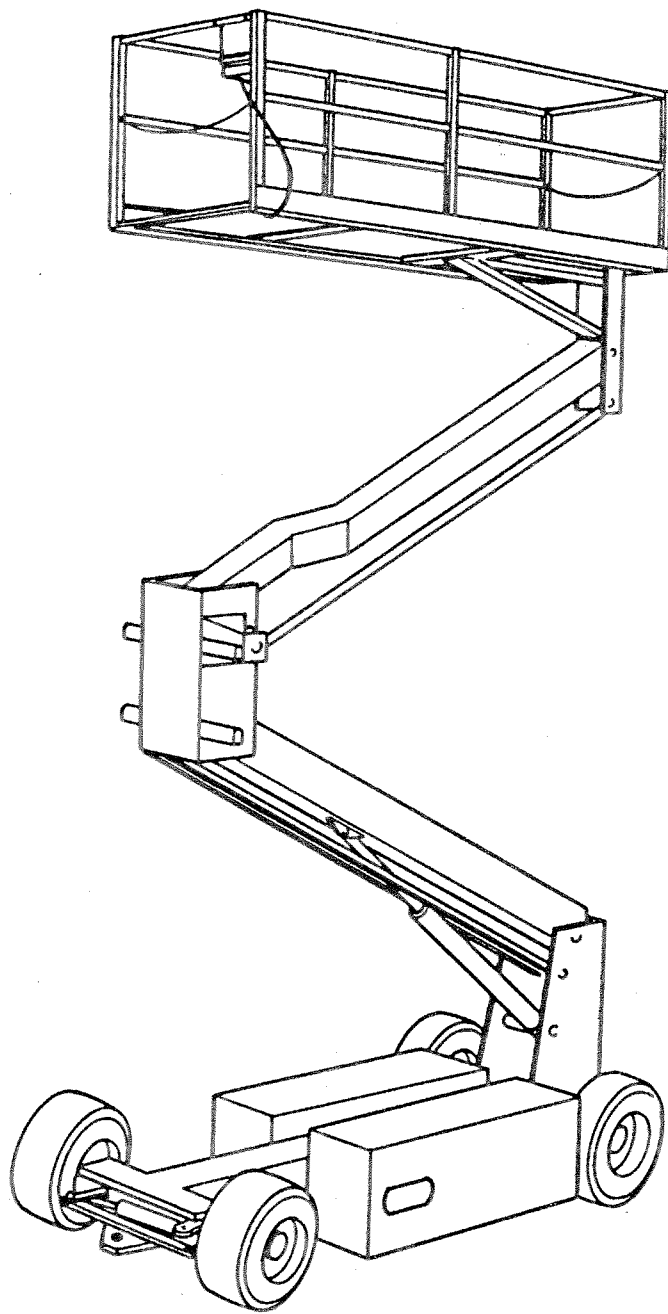


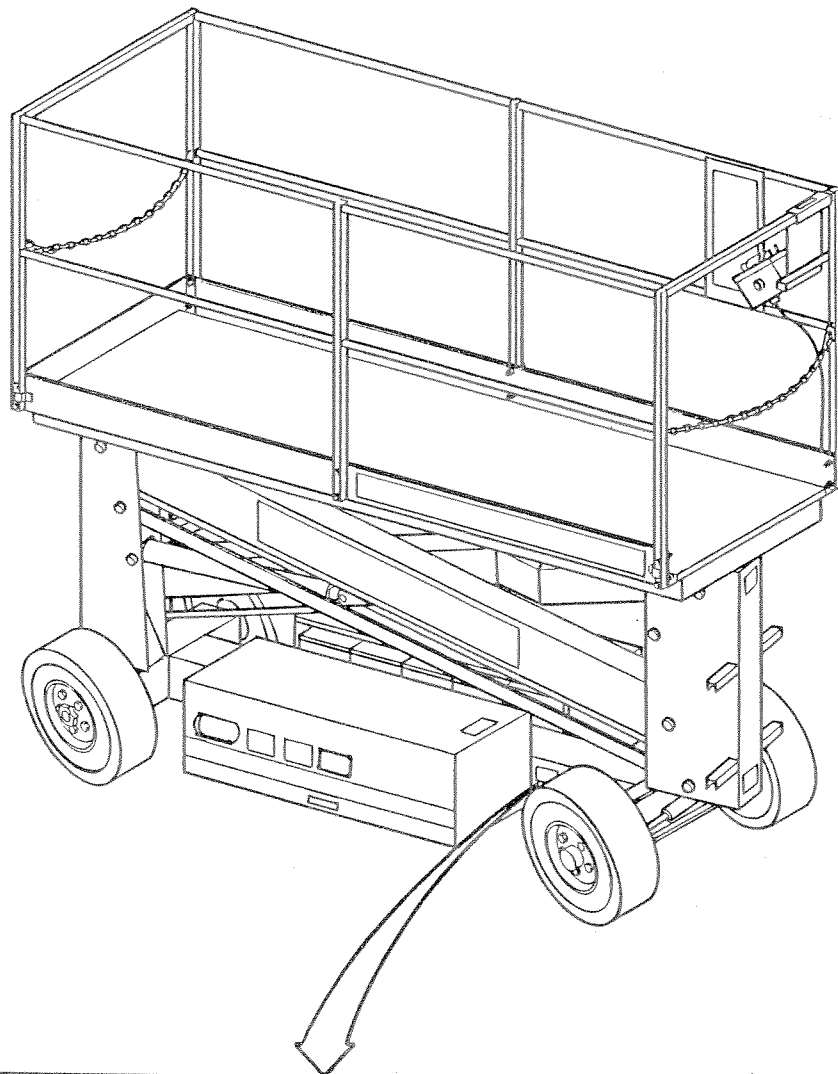
# UpRight

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**SL-20**

**Service and  
Parts Manual**



## **UP-RIGHT INC.**

1775 PARK ST. SELMA, CA 93662

MODEL NO.  MAX. PLATFORM HEIGHT

SERIAL NO.  BATTERY VOLTAGE

MAX. DISTRIBUTED LOAD

CAUTION: CONSULT OPERATOR'S MANUAL BEFORE USE.  
THIS PLATFORM IS NOT ELECTRICALLY INSULATED

P/N 61205-000-00

PART NUMBER

Identification Plate and Model Number

## TABLE OF CONTENTS

Section/Paragraph	Page
I. INTRODUCTION AND GENERAL INFORMATION . . . . .	1-1
1-1. Introduction . . . . .	1-1
1-2. Purpose. . . . .	1-1
1-3. Scope. . . . .	1-1
1-4. General Information. . . . .	1-1
1-5. Item Description . . . . .	1-1
1-6. Purpose and Limitations. . . . .	1-1
1-7. Specifications . . . . .	1-1
II. SAFETY . . . . .	2-1
2-1. Rules and Precautions. . . . .	2-1
III. PREPARATION FOR USE, SHIPMENT AND STORAGE. . . . .	3-1
3-1. Preparation for Use. . . . .	3-1
3-2. Preparation for Shipment . . . . .	3-2
3-3. Transport. . . . .	3-2
3-4. Storage. . . . .	3-2
IV. OPERATION INSTRUCTIONS . . . . .	4-1
4-1. Theory of Operation. . . . .	4-1
4-2. General Functioning. . . . .	4-1
4-3. Driving. . . . .	4-1
4-4. Raising and Lowering Platform. . . . .	4-1
4-5. Safety Design. . . . .	4-1
4-6. Controls and Indicators. . . . .	4-2
4-7. Operating Procedures . . . . .	4-4
4-8. Pre-Operation Checkout . . . . .	4-4
4-9. Operation. . . . .	4-6
4-10. Travel with Platform Lowered . . . . .	4-6
4-11. Lifting Platform . . . . .	4-6
4-12. Travel with Platform Elevated. . . . .	4-7
V. MAINTENANCE INSTRUCTIONS . . . . .	5-1
5-1. Scope. . . . .	5-1
5-2. Location of Components . . . . .	5-3
5-3. Scheduled Inspection and Maintenance . . . . .	5-3
5-4. General. . . . .	5-3
5-5. Blocking Scissors. . . . .	5-5
5-6. Maintenance-Detailed Instructions. . . . .	5-7
5-7. Battery Maintenance. . . . .	5-7
5-8. Lubrication. . . . .	5-9
5-9. Hydraulic Oil Tank and Filter. . . . .	5-10
5-10. Troubleshooting. . . . .	5-11
5-11. Scope. . . . .	5-11
5-12. Safety . . . . .	5-11
5-13. General Procedure. . . . .	5-11
5-14. Adjustments. . . . .	5-18
5-15. Setting Hydraulic Pressure . . . . .	5-18
5-16. Repair . . . . .	5-20

5-17.	Hydraulic Manifold . . . . .	5-20
5-18.	Hydraulic Pump . . . . .	5-24
5-19.	Hydraulic Drive Motors and Hubs. . . . .	5-25
5-20.	Wheel Bearings . . . . .	5-27
5-21.	Brake Cylinder . . . . .	5-29
5-22.	Steering Cylinder. . . . .	5-31
5-23.	Lift Cylinder Removal. . . . .	5-33
5-24.	Electric Motor . . . . .	5-37
VI.	DIAGRAMS . . . . .	6-1
6-1.	Content. . . . .	6-1
6-2.	Use. . . . .	6-1
6-3.	Index of Diagrams. . . . .	6-1
6-4.	Diagram Legends. . . . .	6-1
VII.	ILLUSTRATED PARTS BREAKDOWN. . . . .	7-1
7-1.	Introduction . . . . .	7-1
7-2.	Explanation of Columns in Illustrated. . . . .	7-1
	Parts Breakdown	
7-3.	Figure and Index Number Column . . . . .	7-1
7-4.	Part Number Column . . . . .	7-1
7-5.	Description Column . . . . .	7-1
7-6.	Quantity Required. . . . .	7-1
7-7.	Abbreviations. . . . .	7-1

## LIST OF ILLUSTRATIONS

Figure	Title	Page
1-1.	SL-20 Work Platform. . . . .	1-4
3-1.	Batteries. . . . .	3-1
4-1.	Controls and Indicators. . . . .	4-2
5-1.	Location of Components . . . . .	5-1
5-2.	Location of Components, Chassis. . . . .	5-2
5-3.	Blocking the Elevating Assembly. . . . .	5-6
5-4.	Battery Charger. . . . .	5-8
5-5.	Lubrication Points . . . . .	5-9
5-6.	Hydraulic Oil Tank and Filter. . . . .	5-10
5-7.	Hydraulic Pressure Adjustment. . . . .	5-19
5-8.	Hydraulic Manifold (Sheet 1 of 2). . . . .	5-21
	Hydraulic Manifold (Sheet 2 of 2). . . . .	5-22
5-9.	Hydraulic Pump Removal . . . . .	5-25
5-10.	Drive Motor Removal. . . . .	5-26
5-11.	Wheel Bearings . . . . .	5-27
5-12.	Brake Cylinder . . . . .	5-29
5-13.	Steering Cylinder. . . . .	5-32
5-14.	Lift Cylinder Removal. . . . .	5-34
5-15.	Lift Cylinder Disassembly. . . . .	5-35
5-16.	Electric Motor . . . . .	5-38
6-1.	Electrical Diagram . . . . .	6-8
6-2.	Hydraulic Diagram. . . . .	6-9



## LIST OF ILLUSTRATIONS - Continued

Figure	Title	Page
7-1.	SL-20 Work Platform. . . . .	7-3
7-2.	Chassis Assembly . . . . .	7-5
7-3.	Front Steering and Hub Assembly. . . . .	7-7
7-4.	Brake Cylinder and Drive Motor Assembly. . . . .	7-9
7-5.	Energy Module Assembly . . . . .	7-11
7-6.	Control Module Assembly. . . . .	7-13
7-7.	Hydraulic Tank Installation. . . . .	7-15
7-8.	Pump/Motor and Electrical Components Installation. . . . .	7-17
7-9.	Hydraulic Manifold Assembly, Serial No. 1000 . . . . .	7-19
	to 1328	
7-9A.	Hydraulic Manifold Assembly, Serial No. 1329 . . . . .	7-24
	to Current	
7-10.	Hose Kit Installation, Chassis . . . . .	7-28
7-11.	Elevating Assembly . . . . .	7-30
7-12.	Lift Cylinder Installation . . . . .	7-32
7-13.	Hose and Cable Installation, Elevating . . . . .	7-34
	Assembly/Platform	
7-14.	Platform/Guardrail Assembly. . . . .	7-36
7-15.	Controller Assembly with Key Lift/Drive Switch . . . . .	7-38
7-16.	Decal Kit Installation . . . . .	7-40

## LIST OF TABLES

Number	Title	Page
1-1.	Specifications . . . . .	1-1
	Legend for Figures 4-1 and 4-2 . . . . .	4-3
	Legend for Figures 4-3 and 4-4 . . . . .	4-3
4-1.	Controls and Indicators. . . . .	4-3
5-1.	Inspection, Checks and Services. . . . .	5-3
5-2.	Troubleshooting. . . . .	5-11
6-1.	Electrical Diagram Legend. . . . .	6-1
6-2.	Hydraulic Diagram Legend . . . . .	6-5

## SECTION I

### INTRODUCTION AND GENERAL INFORMATION

#### 1-1. INTRODUCTION.

1-2. **PURPOSE.** This manual provides illustrations and instructions for the operation and maintenance of the UP-RIGHT SL-20 Work Platform manufactured by Up-Right, 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 UP-RIGHT SL-20 Work Platform is a self-propelled scissor 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.

\*750 lb. load option, limited drive height 15 Ft.

Table 1-1. Specifications - Continued

ITEM	DESCRIPTION
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 Platform Raised	0 to 2 MPH 0 to .6 MPH
Hydraulic Tank Capacity	4 Gallons
Hydraulic Fluid	Mobil 423
Dimensions Weight Overall Width Overall Height Overall Length	2,830 lb. 32-1/2 In. 89 In. 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

Table 1-1. Specifications - Continued

ITEM	DESCRIPTION
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.

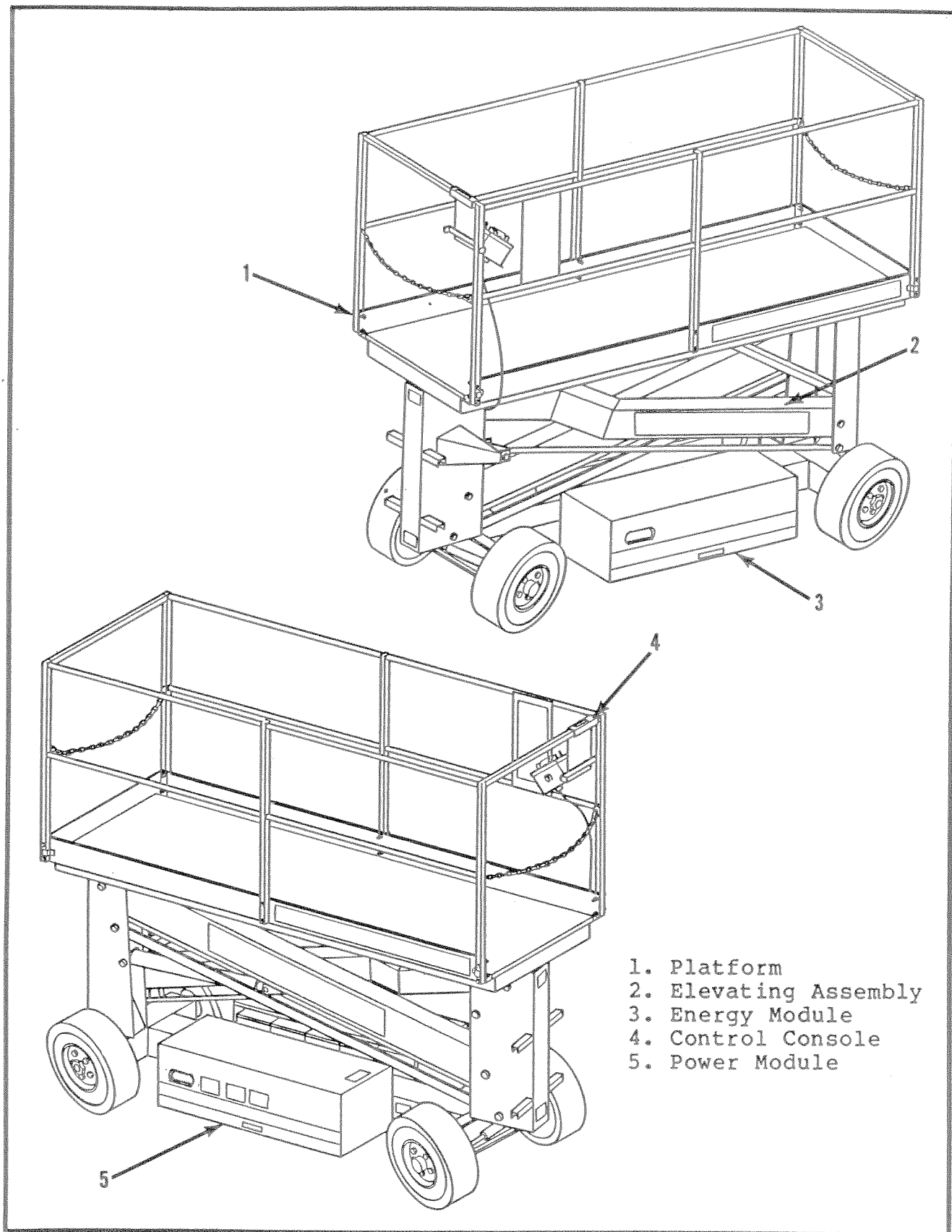


Figure 1-1. SL-20 Work Platform

## SECTION II

### SAFETY

2-1. RULES AND PRECAUTIONS. BEFORE USING THE UP-RIGHT SL-20. Read and then follow completely all Safety Rules and Precautions before operating the Up-Right SL-20.

- a. Thoroughly INSPECT the work platform for cracked welds, loose hardware, hydraulic leaks damaged control cable, loose wire connections and tire damage.
- b. DISTRIBUTE all loads evenly on the platform. Do not exceed maximum platform load specifications.
- c. SURVEY the work area for surface hazards such as holes, drop-offs, bumps and debris before operating work platform.
- d. LOOK up, down & around for overhead obstructions and electrical conductors.
- e. HOOK chain across entrance after mounting platform.
- f. DO NOT use damaged equipment. (Contact nearest UP-RIGHT Service Center for instructions. See toll free numbers on front cover.)
- g. DO NOT change operating or safety systems.
- h. DO NOT operate the work platform within ten feet of power lines. THIS WORK PLATFORM IS NOT INSULATED.
- i. DO NOT elevate the platform or drive the work platform while elevated unless on firm level surface.
- j. DO NOT attach overhanging loads or increase platform size.
- k. DO NOT use ladders or scaffolding on the platform.
- l. DO NOT sit, stand or climb on guardrail or midrail.
- m. DO NOT climb down elevating assembly with the platform elevated.
- n. DO NOT recharge batteries near sparks or open flame; batteries that are being charged emit highly explosive hydrogen gas.

- o. DO NOT perform service on work platform while platform is elevated without blocking the elevating system.
- p. AFTER USE secure the work platform against unauthorized use by turning off Key Switch and removing key.

### SECTION III.

#### 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).

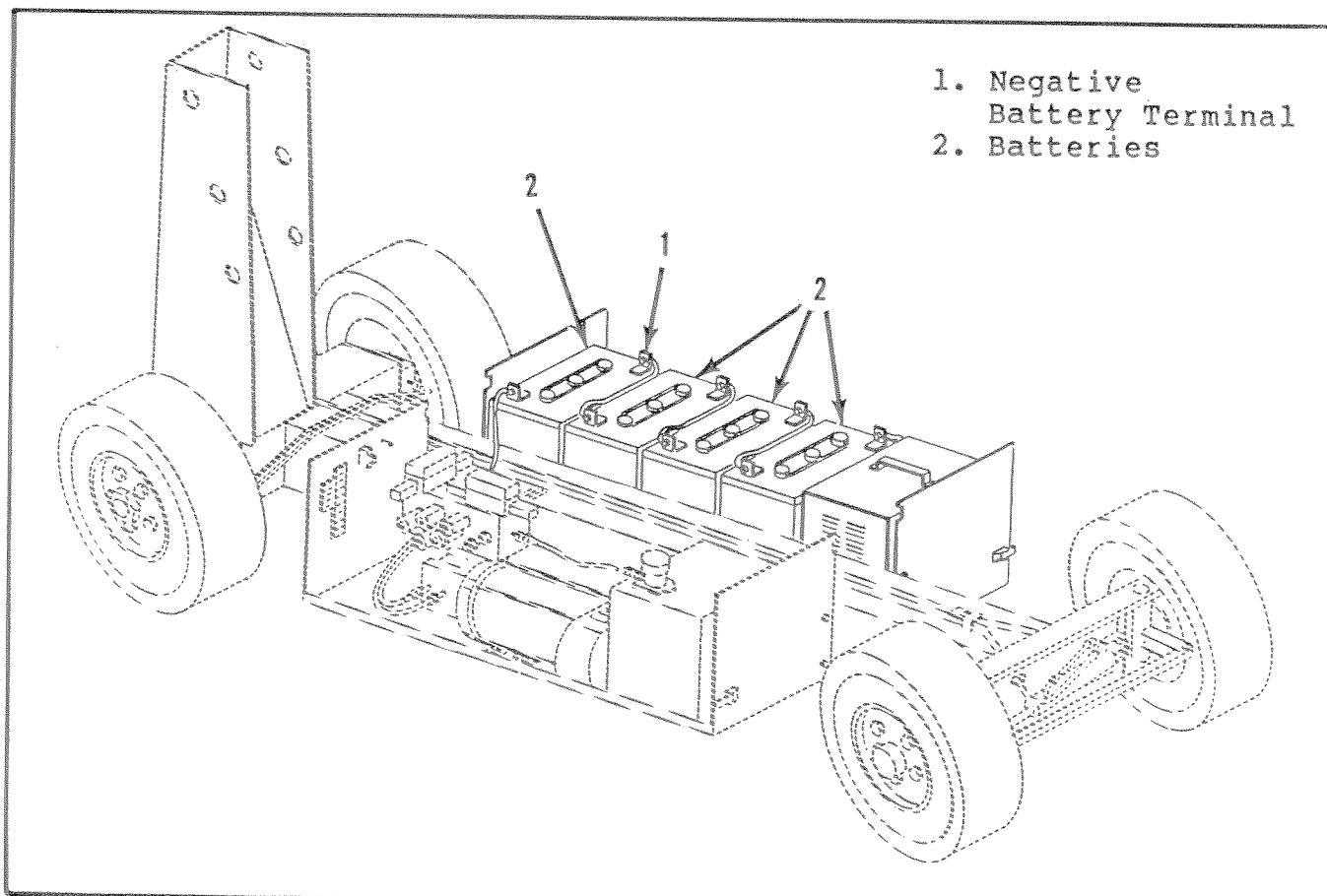


Figure 3-1. Batteries



### 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 operating level 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.

## SECTION IV

### 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 inadvertant 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.

**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.

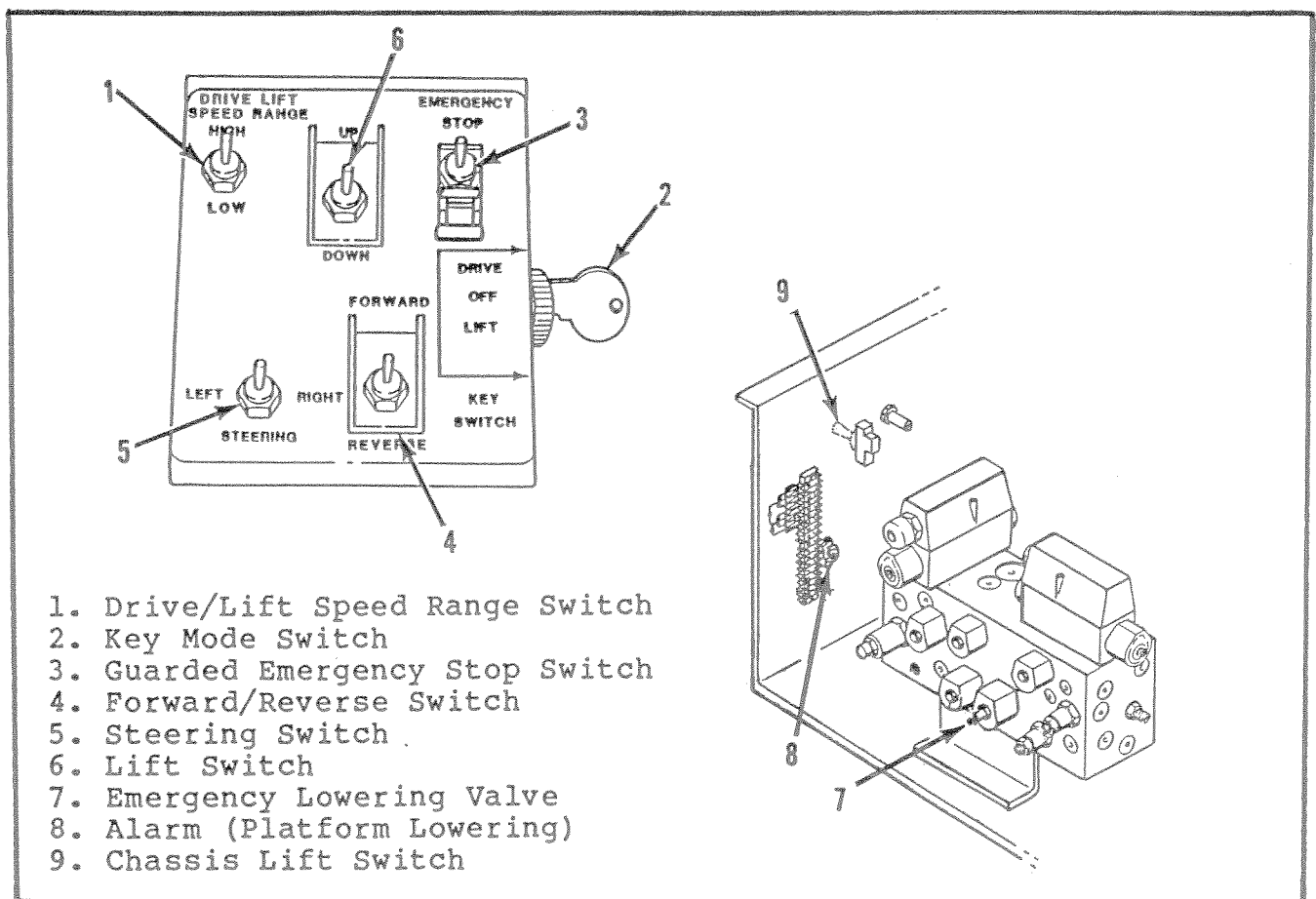


Figure 4-1. Controls and Indicators

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 counterclock- wise 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.

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. Remove the cap from the hydraulic filter and check the level of the oil with the platform fully lowered. Oil should be visible. 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 work 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.

- j. Turn Mode Switch to DRIVE position.

#### NOTE

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

- k. Push Drive Switch to FORWARD position then REVERSE position to check for speed and directional 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.
- 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 mounting platform hook chains across entrance. Also check that chain at middle of rear guardrail is hooked 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. Set the Drive/Lift Speed Range Switch (1) to LOW or HIGH depending on area in which you are traveling.
- g. Push Forward/Reverse (4) to FORWARD position or REVERSE position to travel in desired direction.
- h. 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. 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.

- c. 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.

## SECTION V

### 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.

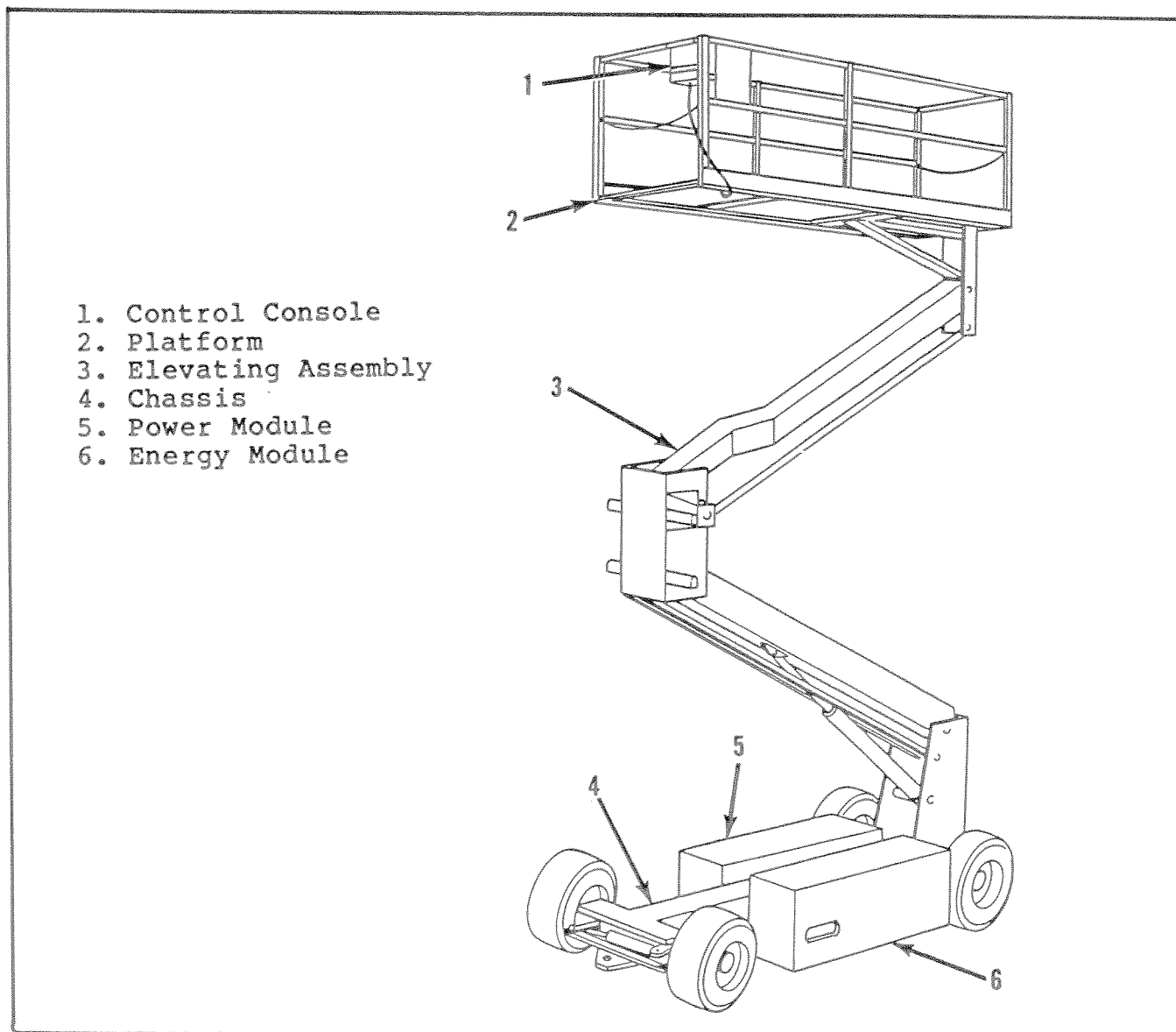
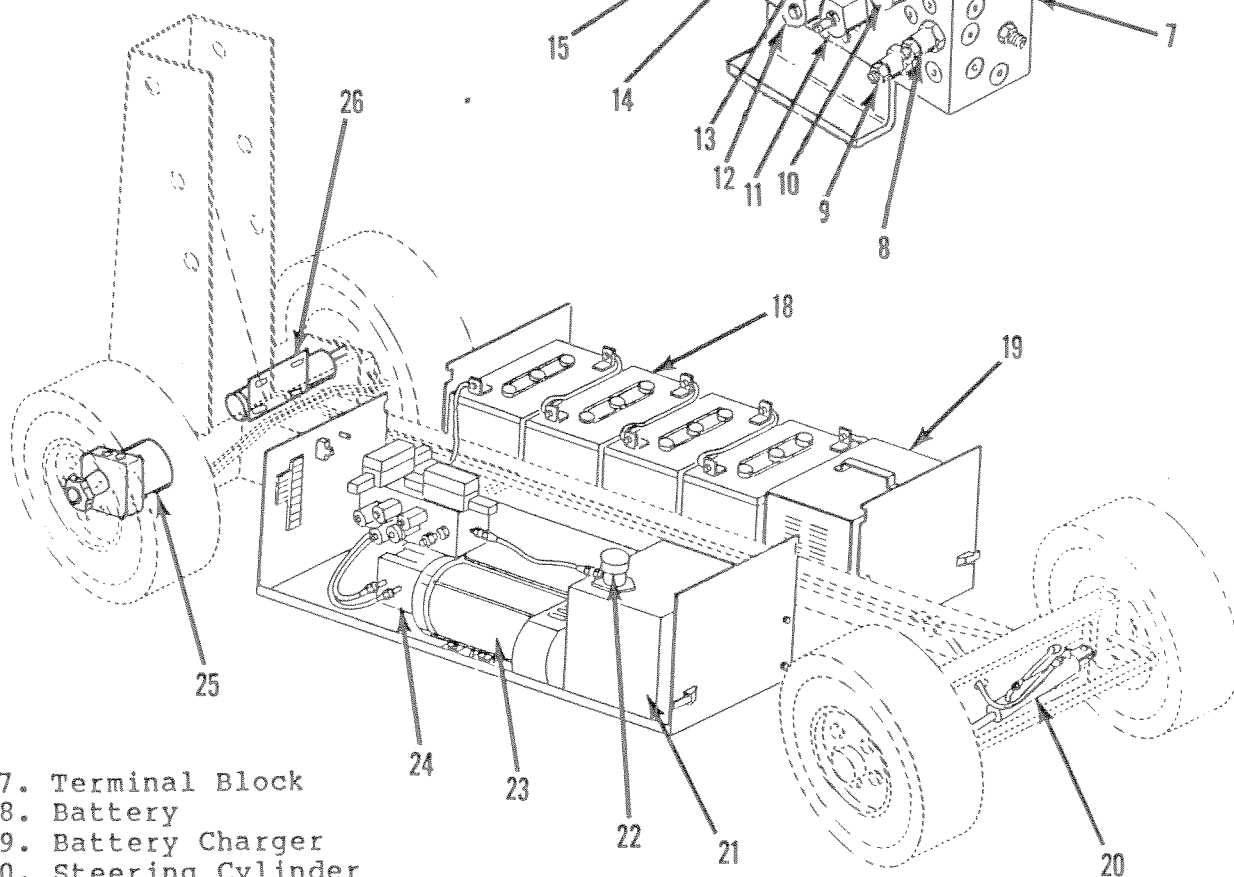
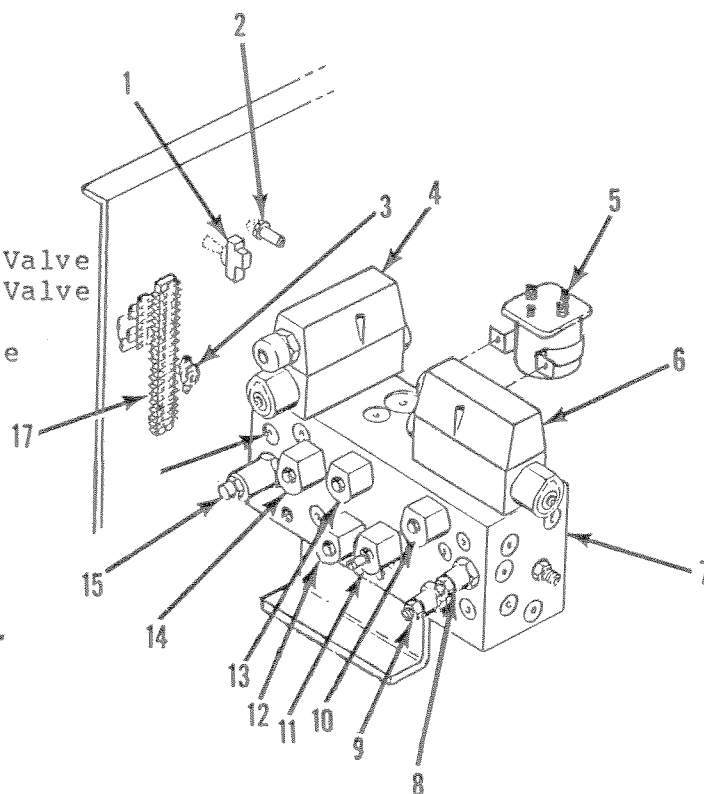


Figure 5-1. Location of Components

1. Lift/Lower Switch
2. Fuse
3. Down Alarm
4. Steering Valve
5. Relay
6. Forward/Reverse Valve
7. Control Valve Block
8. Reverse Counterbalance Valve
9. Forward Counterbalance Valve
10. Lift Valve
11. Emergency Lowering Valve
12. Lift Bypass Valve
13. High Speed Valve
14. Steering Bypass Valve
15. Main Relief Valve
16. Gauge Port



17. Terminal Block
18. Battery
19. Battery Charger
20. Steering Cylinder
21. Hydraulic Oil Tank
22. Return Filter
23. Electric Motor
24. Hydraulic Pump
25. Drive Motors
26. Brake Cylinder

Figure 5-2. Location of Components, Chassis

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.

Table 5-1. Inspection, Checks and Services

INTERVAL	COMPONENT/LOCATION	INSPECTION/CHECK/SERVICES
Each Shift      125 Hours	Battery System/Chassis	Check electrolyte level. Check specific gravity. Clean exterior. Check cable condition. Charge batteries
	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 tightness. Check welds for cracks. Check condition of deck.
	Arms/Elevating Assembly	Inspect for structural bends and weld cracking.
	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 tightness.

Table 5 1. Inspection, Checks and Services - Continued

INTERVAL	COMPONENT/LOCATION	INSPECTION/CHECK/SERVICE
125 Hours - Cont'd.	Drive Motors/Chassis	Check for operation and leaks.
	Steering System/ Chassis	Check hardware for tightness.
	Steering Cylinders/ Chassis	Check rods for gouges. Check Seals for leakage. Check hoses for serviceability. Check fittings for tightness.
	Wheel Bearings/ Chassis	Check wheel assembly for play.
	Pivot Pin Retainer/ Scissors	Check bolts for tightness.
	Lift Cylinder/ Hydraulic System	Check rod for gouges. Check mounting pivot pins for wear. Check seals for leaks. Check hoses for serviceability. Check fittings for tightness. Check snaprings.
	Control Console/ Platform	Check switches operation. Check cable for wear.
	Work Platform, Complete	Perform pre-operational checkout.
	Work Platform, Complete	Lubricate.
250 Hours	Batteries/Chassis	Clean terminals.
	Hydraulic Oil Filter/ Chassis	Change filter.
	Hydraulic Pump/Chassis	Wipe clean.
	Steering System/Chassis	Check hardware.

Table 5-1. Inspections, Checks and Services - Continued.

INTERVAL	COMPONENT/LOCATION	INSPECTION/CHECK/SERVICE
250 Hours - Cont'd.	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 tightness. Check all fasteners for tightness. Check welds for cracks. Check hoses for serviceability. 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.
	Wheel Bearings/ Chassis	Repack wheel bearings.
2000 Hours	Wheel Bearings/ Chassis	Replace wheel bearings and seals.

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 scissors.

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.

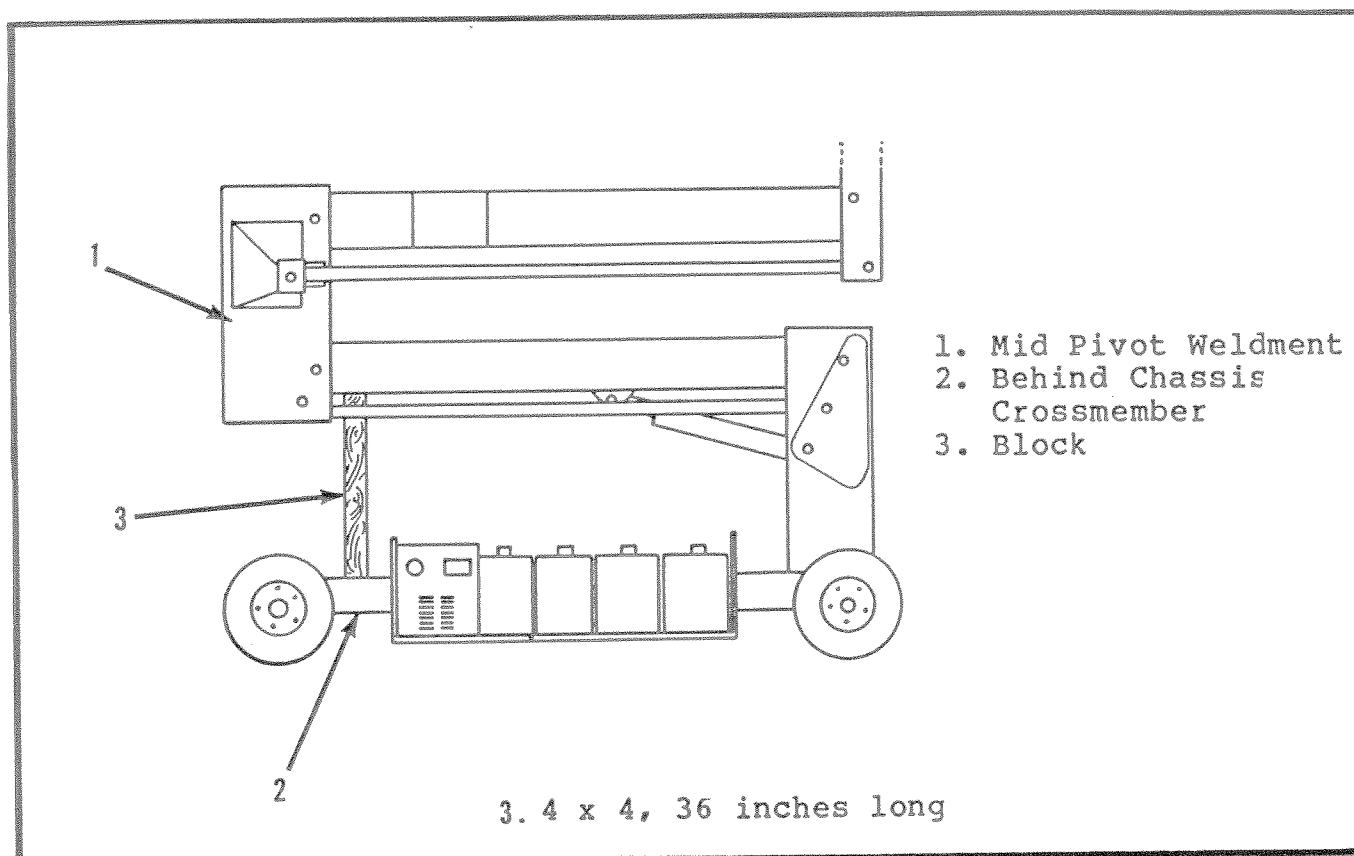


Figure 5-3. Blocking The Elevating Assembly

(3) Turn Key Mode Switch on control console to **LIFT** position.

(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.



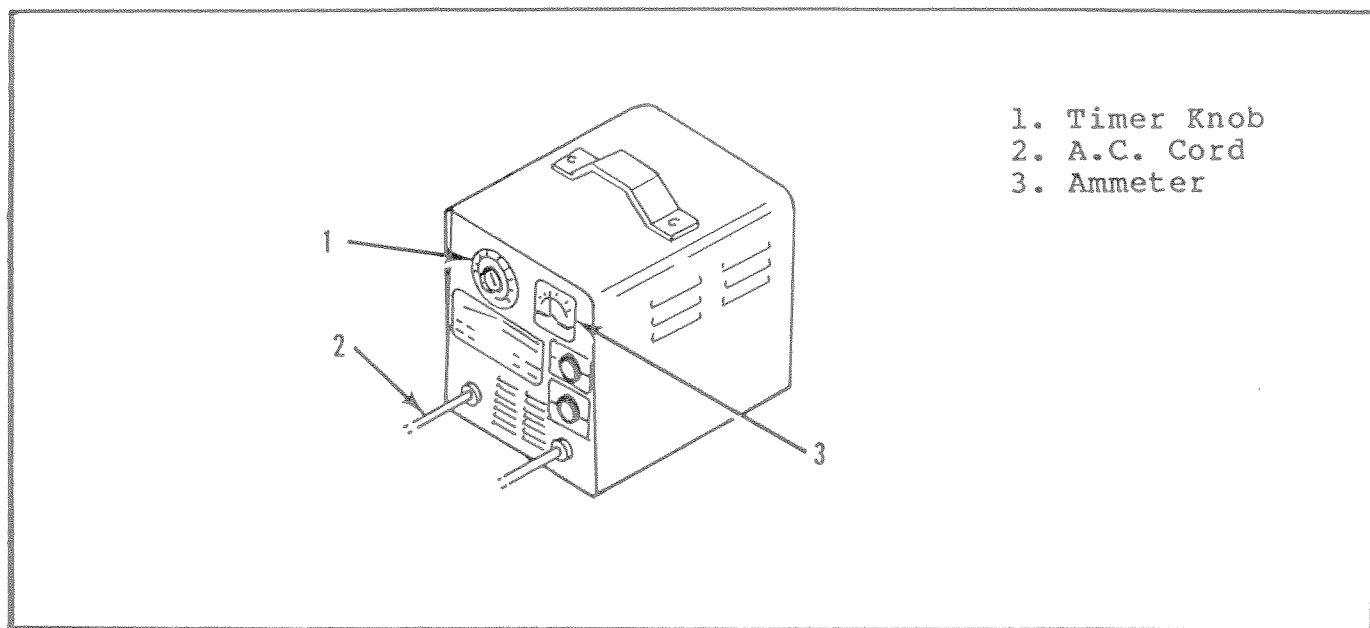


Figure 5-4. Battery Charger

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. Under such conditions a 4 hour equalize charge once a week in the early afternoon will improve state of charge and battery life.

(4) With Timer Knob (1) turned to OFF, connect A.C. Cord (2) to a properly grounded 115 volt, 60Hz power supply.

(5) Set Timer Knob (1) to 7 for lightly discharged batteries and to ON (16 hours) for well discharged batteries. Charger shuts off automatically at end of set period.

(6) Initial charge rate varies with state of discharge but finish rate should be in green area on Ammeter (3) when all cells are good.

(7) To determine approximate full charge at start of day's use, turn Timer Knob (1) to 1. Drop of Ammeter needle to green area in 15 minutes or less indicates full charge.

c. Battery Cell Equalization.

(1) The specific gravity of the electrolyte in the battery cells should be equalized monthly. To do this, charge batteries as outlined in Battery Charging. After this initial charge, check the electrolyte level in all cells and add water as necessary. Then, turn the charger on for additional eight hours. During this time, the charging current will be low (four amps) as cells are equalizing.

(2) After equalization, 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. At any rate, the specific gravity in all cells after equalization should not vary more than .010. If a wide variation exists, this is an indication for need of battery replacement.

(3) 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.

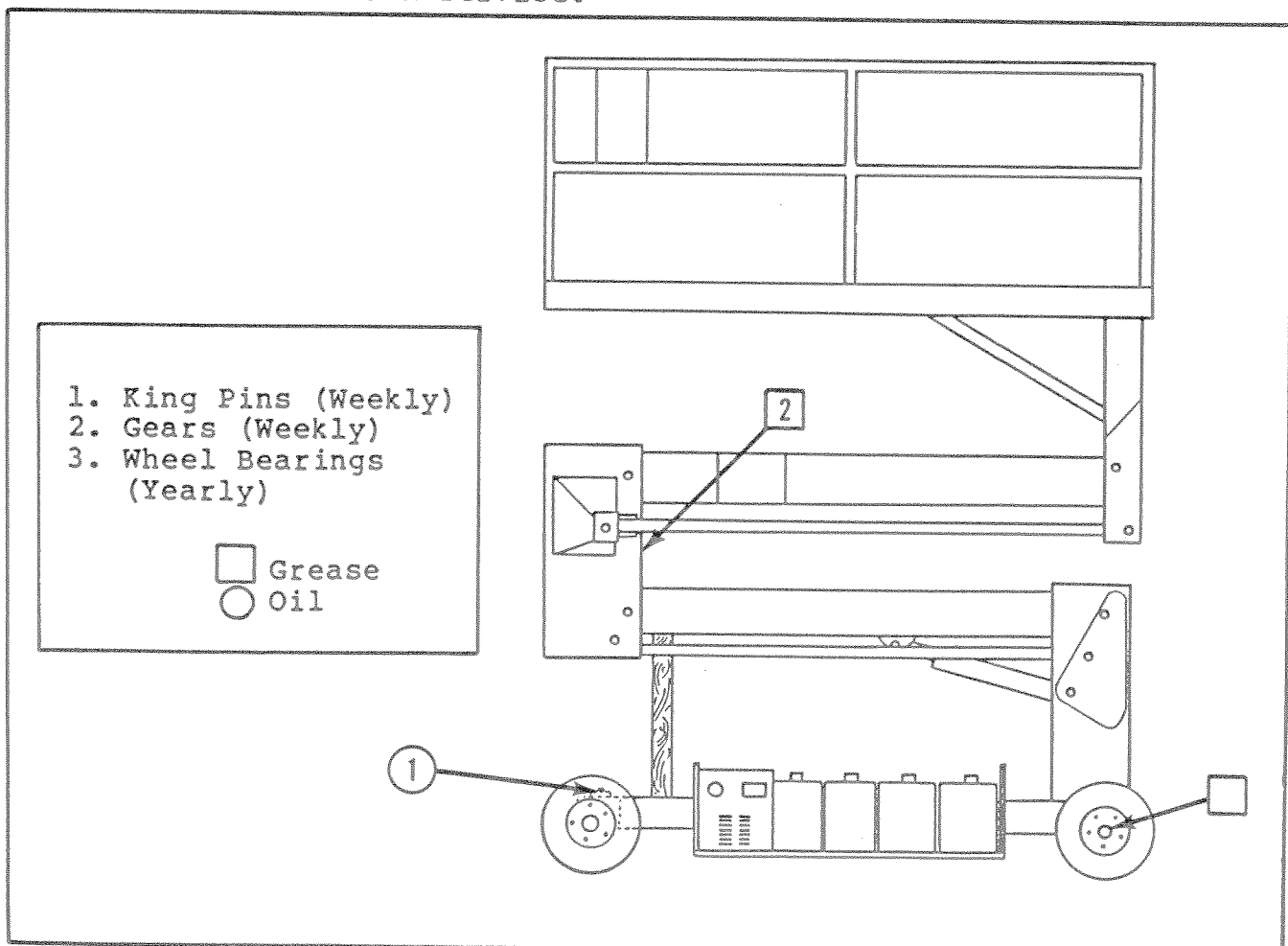


Figure 5-5. Lubrication Points

WARNING

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

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

- a. Operate the work platform to bring the hydraulic oil up to normal operating temperature.
- b. 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.

- c. Remove the drain plug (3) and allow all oil to drain.
- d. Reinstall the drain plug (3).
- e. Unscrew the filter top (2) from the filter body.
- f. Lift the filter element from the filter body.
- g. Drop the replacement filter element into the filter body and press into position.

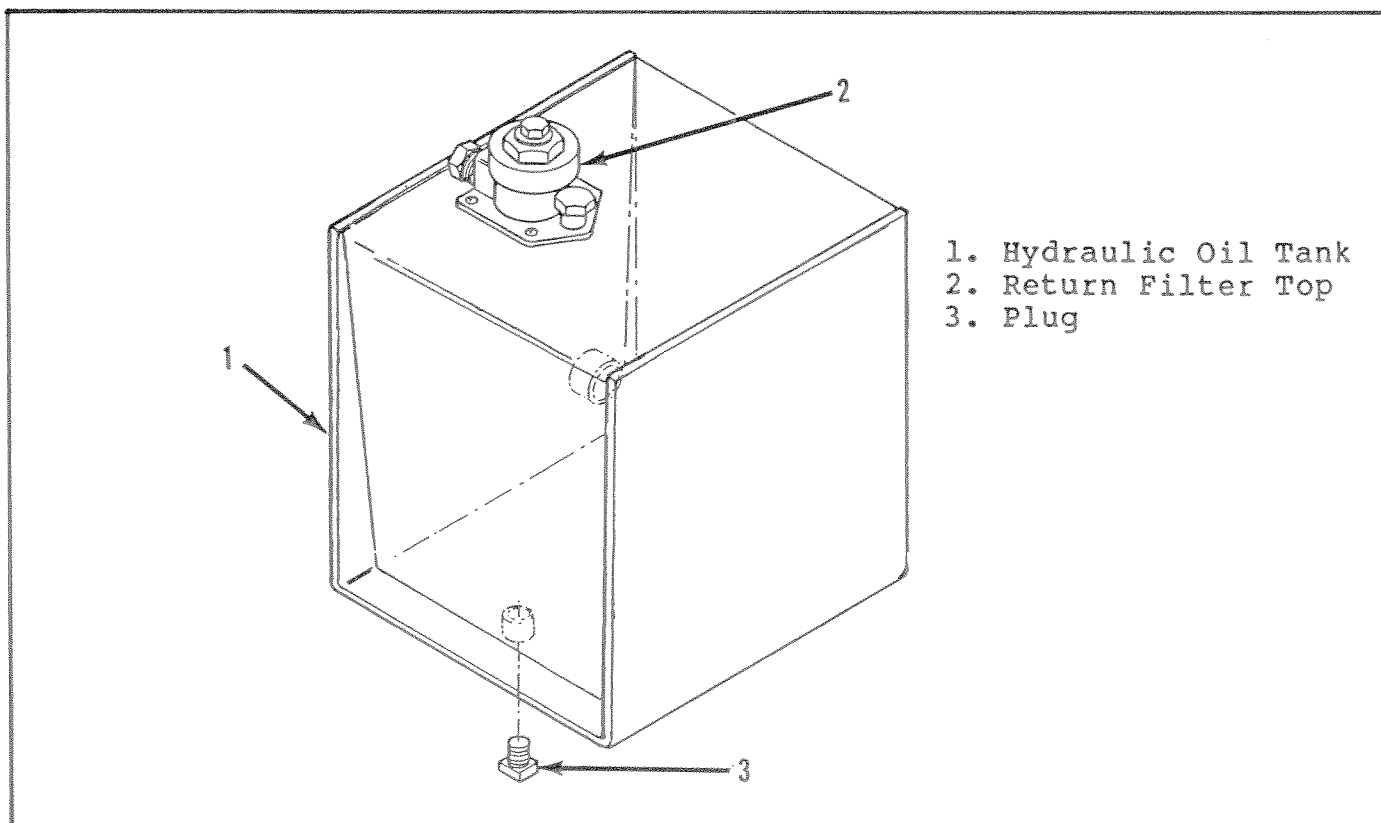


Figure 5-6. Hydraulic Oil Tank and Filter

h. Fill the hydraulic oil tank 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.

#### 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).

TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
All functions inoperable. Electric motor does not start - Cont'd.	5. Faulty motor relay.	While operating the steering, check voltage across the coil terminals of Motor Relay (CRL). If no voltage is present, proceed with step 6. If 20 VDC or more, check continuity across the contact terminals of Motor Relay (CRL) while still operating the steering function. If there is no continuity, replace the defective Motor Relay (CRL).
	5. Faulty motor relay (CRL) - Cont'd.	
	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.
All functions inoperable. Electric motor starts when control is 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 (CRL) check continuity across the contact terminals. If there is continuity, replace the Motor Relay (CRL).

TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
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.
Steering inoperable or functions sluggishly - Cont'd.	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.
Work platform will not steer left.	1. Faulty steering switch.	Test Steering Switch (S4) for continuity. Replace if faulty.

TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Work platform will not steer left - Cont'd.	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).

TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
No drive in HIGH speed - Cont'd.	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.
	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.



TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
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).
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).

TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
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.
No HIGH speed lift - Cont'd.	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.

TABLE 5-2. Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Platform will not lower - Cont'd.	2. Faulty key mode selector switch.	With the Key Mode Selector Switch (S2) in the LIFT position, check continuity. Replace if faulty.
	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.	Remove and clean Orifice (ORF2).
	6. Velocity fuse valve sticking.	Replace the Velocity Fuse Valve (V5).
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.

## 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.

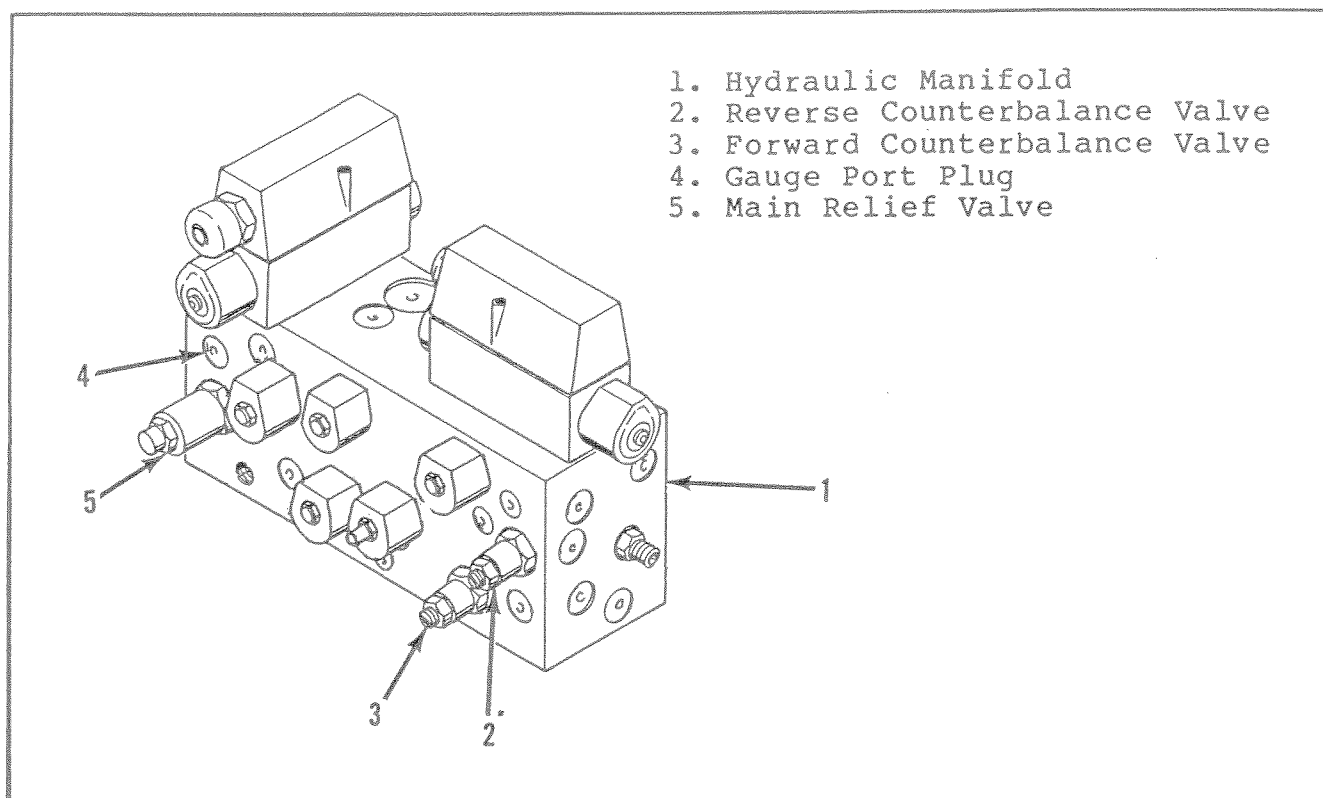


Figure 5-7. Hydraulic Pressure Adjustment

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 2000 psi, then tighten the locknut.

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

d. Counterbalance Valve (2,3).

(1) Remove Gauge Port Plug (4) and install an 0-3000 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 450 psi, then slowly turn the screw OUT until the gauge indicates 400 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 450 psi, then slowly turning the screw OUT to reach 400 psi. Lock the adjustment with the locknut.

(10) Actuate FORWARD, actuate REVERSE checking gauge to ensure pressures are 400 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.

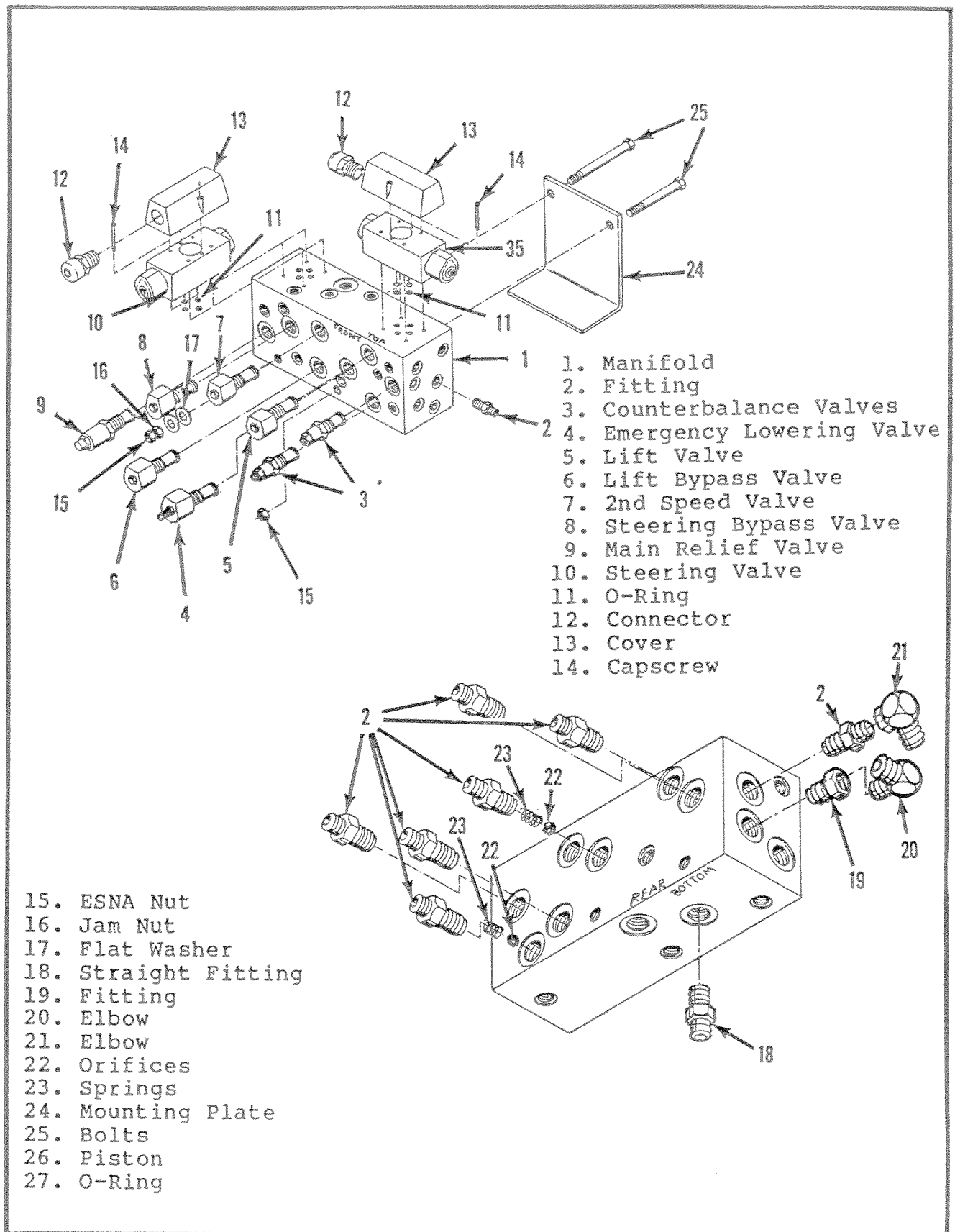
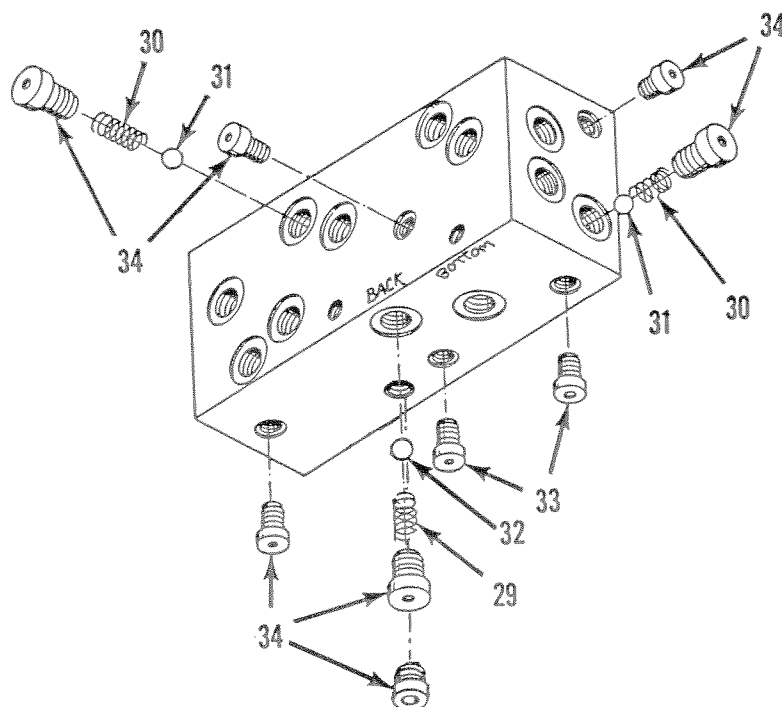
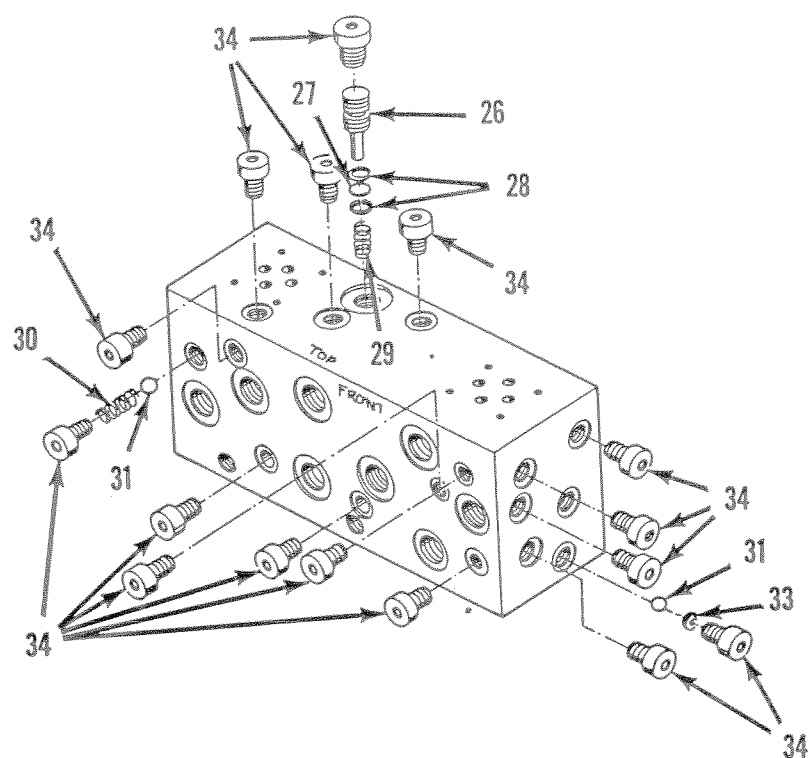


Figure 5-8. Hydraulic Manifold (Sheet 1 of 2)



- 28. Back-up Ring
  - 29. Spring
  - 30. Spring
  - 31. Ball
  - 32. Ball
  - 33. Orifice
  - 34. Plugs
  - 35. Drive Valve
- (See Sheet 1 of 2)

Figure 5-8. Hydraulic Manifold (Sheet 2 of 2)

- (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).
- (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). Ensure not to loose the shaft coupler (7). Note: Capscrews hold pump together as well as holding it to the motor. Care must be taken to keep pump sections together.

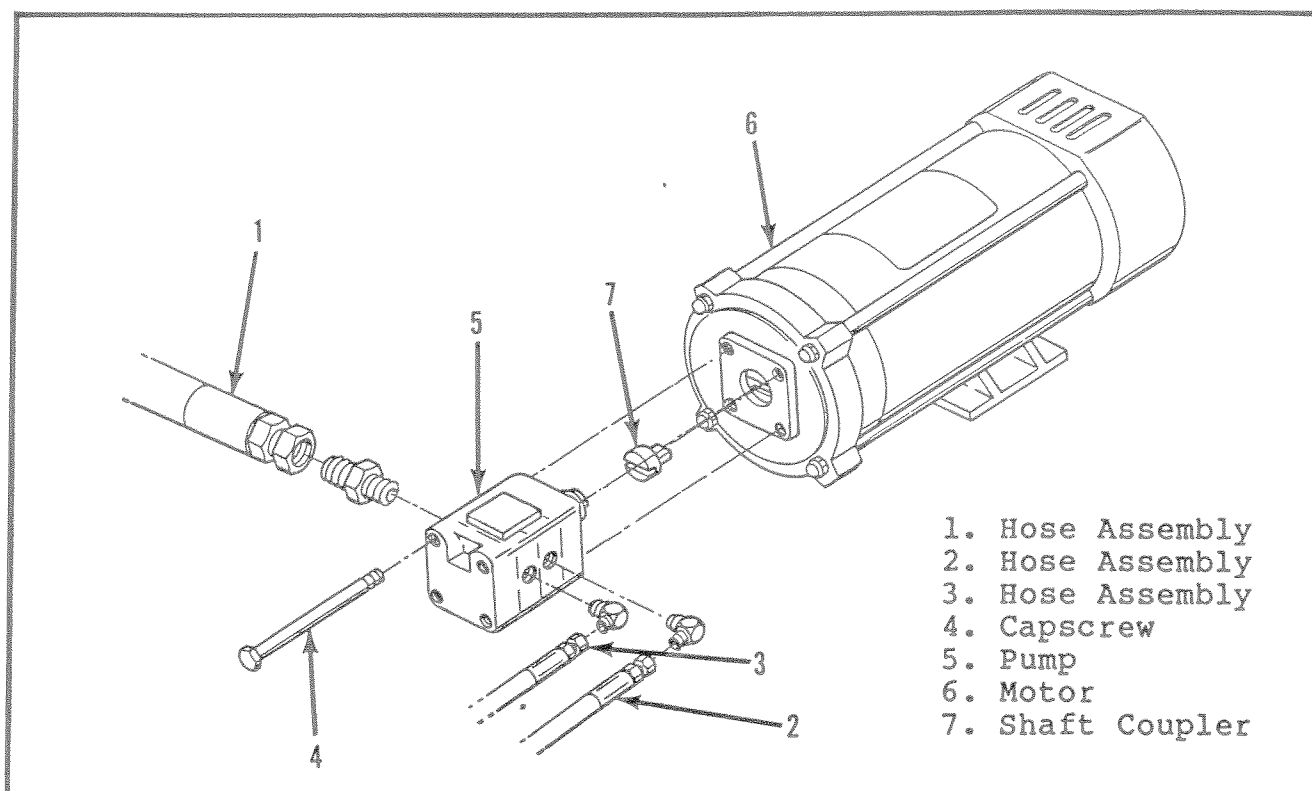


Figure 5-9. Hydraulic Pump Removal

b. Installation.

(1) Lubricate the pump (5) and shaft coupler (7) with general purpose grease and attach the pump and shaft coupler 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.

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.

1. Rear Axle
2. Drive Motor
3. Capscrews
4. Shaft Key
5. Hub
6. Wheel
7. Cotter Pin
8. Slotted Nut
9. Lug Bolts
10. Tube Assemblies

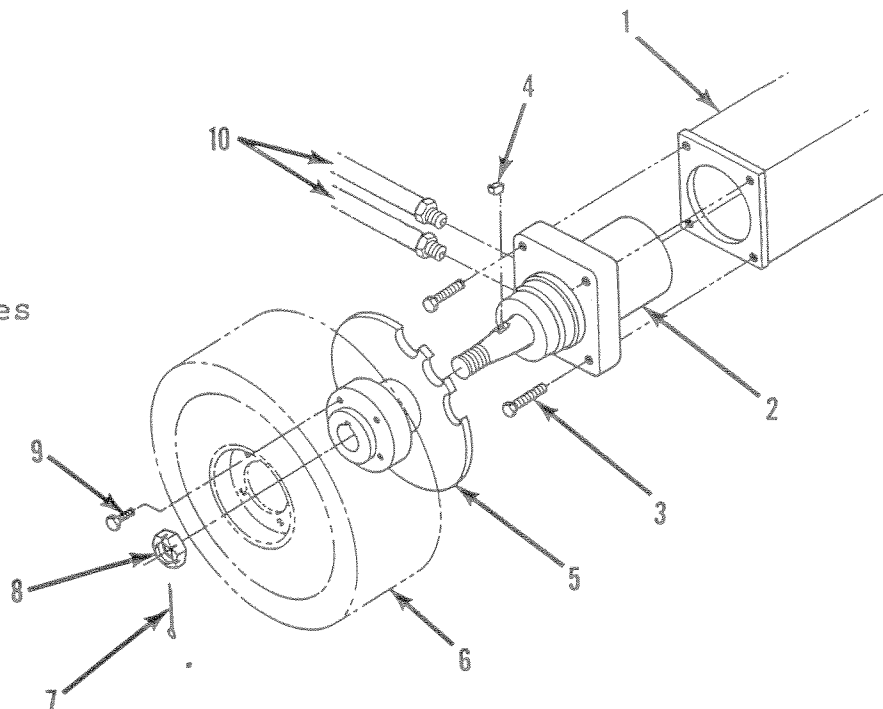


Figure 5-10. Drive Motor Removal

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 tube 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.

#### 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.

1. Cap
2. Cotter Pin
3. Hub Nut
4. Washer
5. Bearing Cone
6. Hub Assembly
7. Grease seal
8. Bearing Cone
9. Bearing Cup
10. Spindle

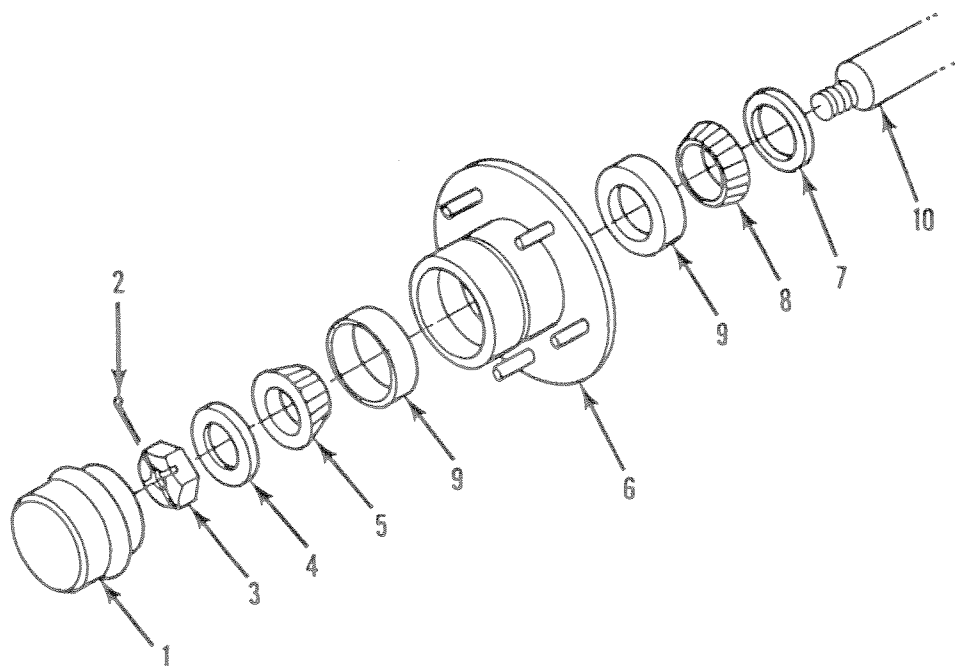


Figure 5-11. Wheel Bearings

(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.

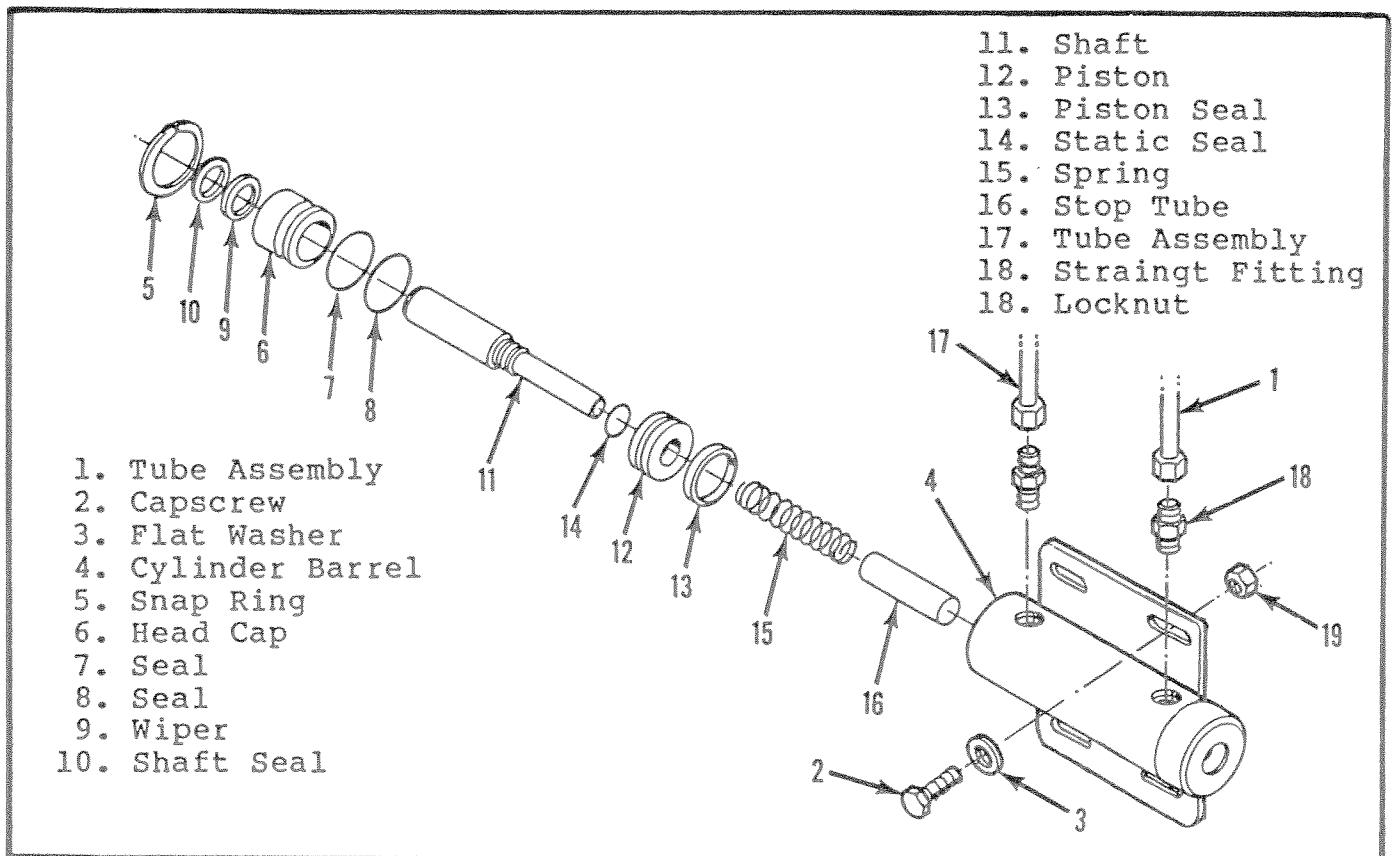


Figure 5-12. Brake Cylinder

(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).

(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.

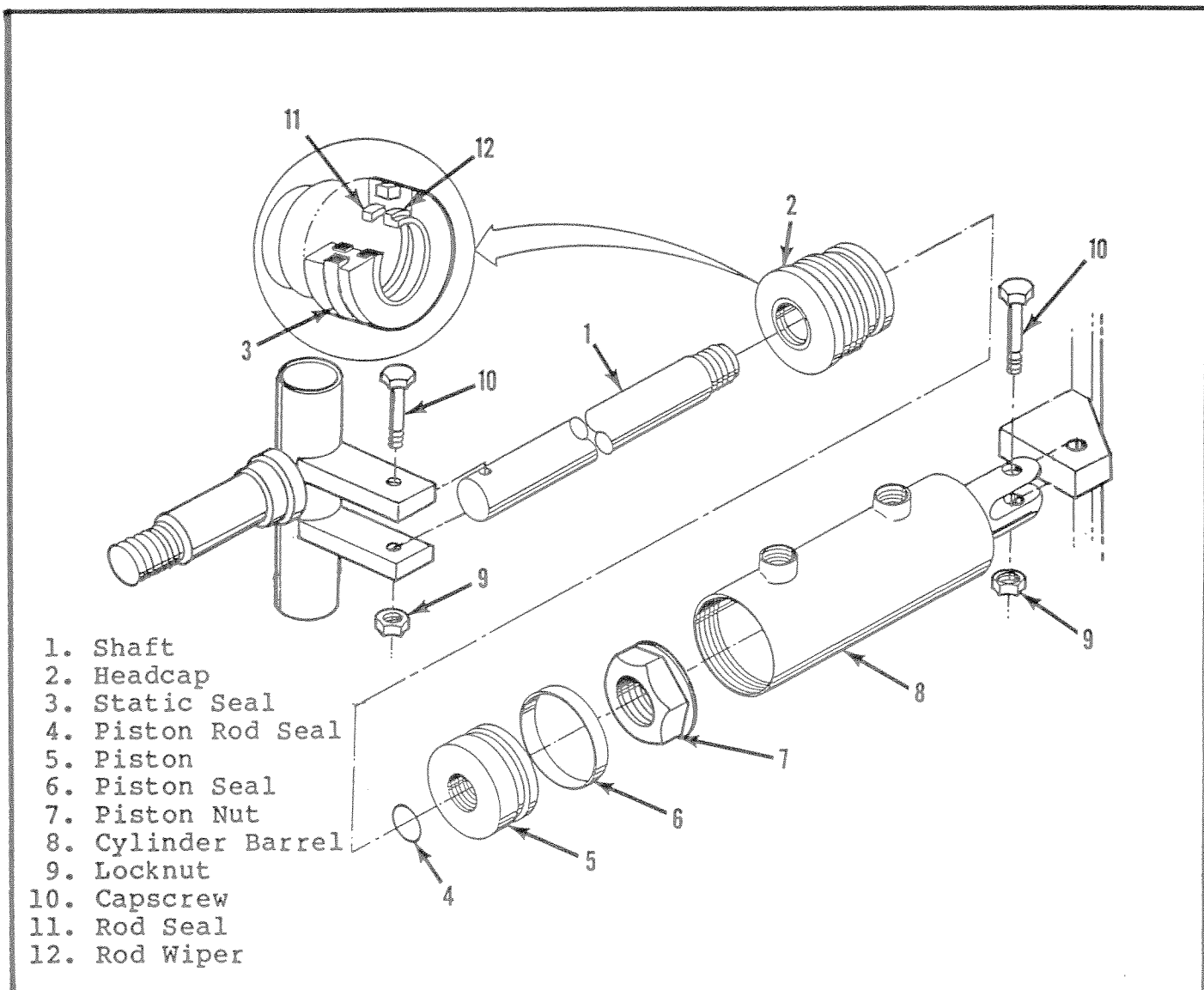


Figure 5-13. Steering Cylinder

(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).

(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).

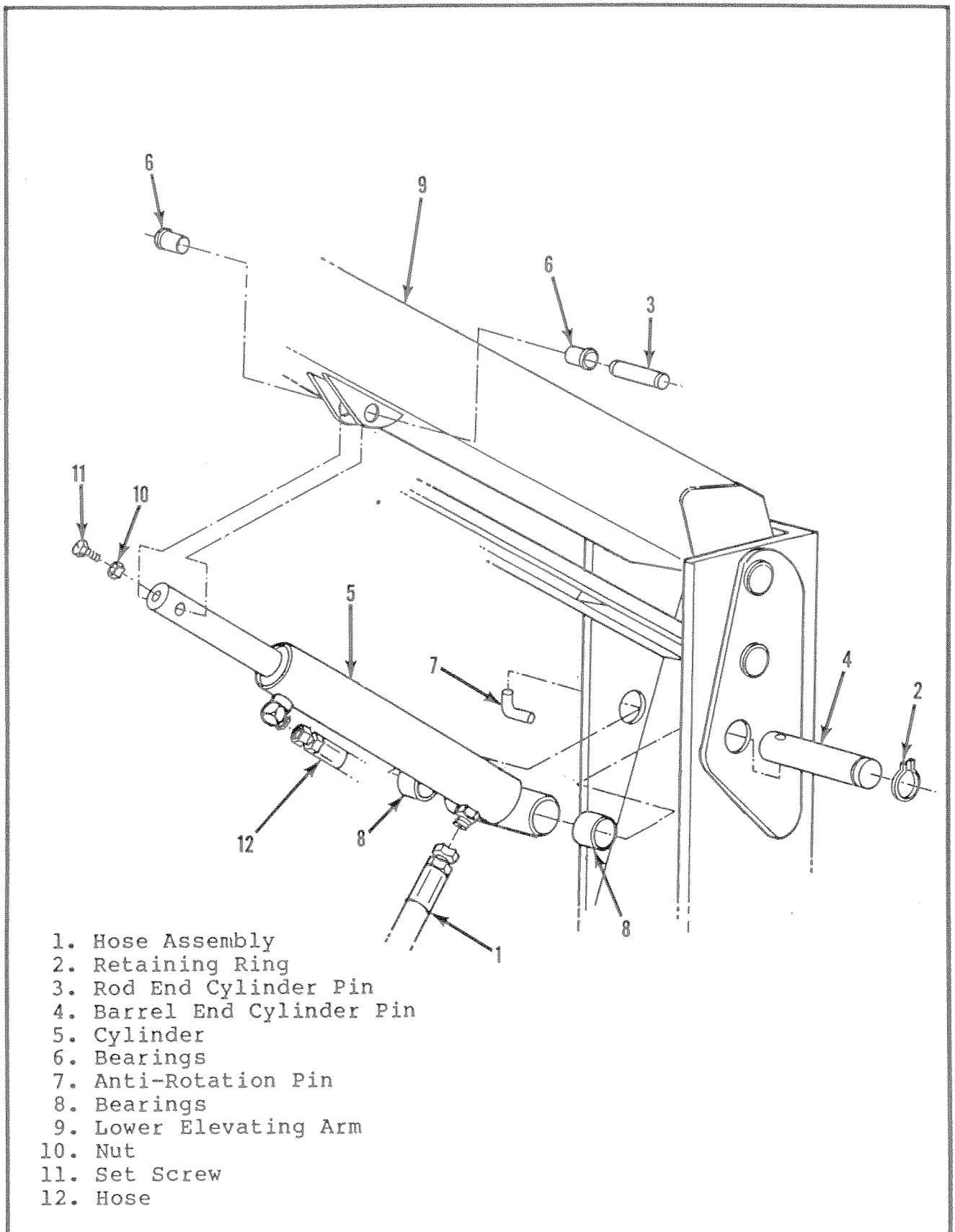


Figure 5-14. Lift Cylinder Removal

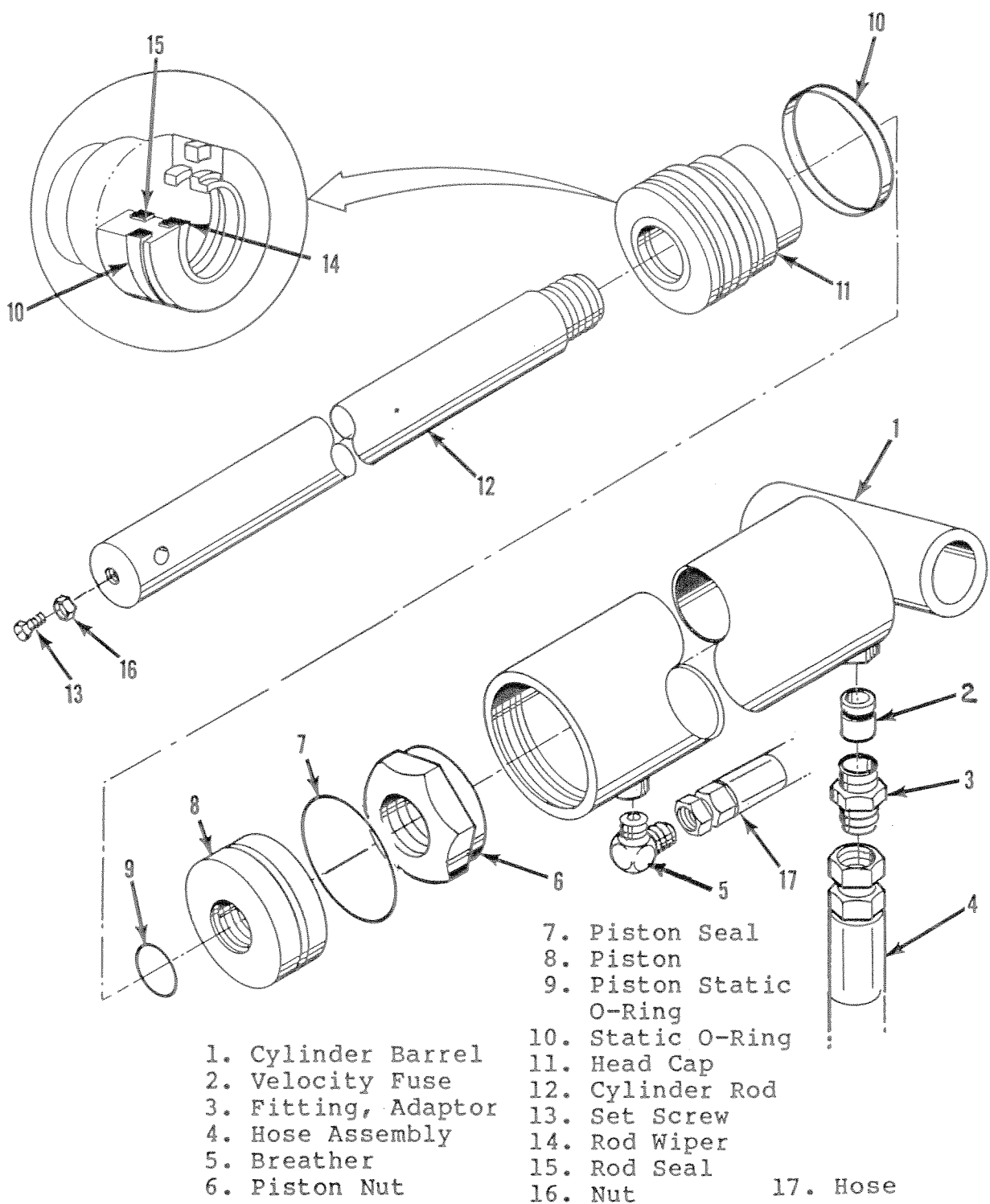


Figure 5-15. Lift Cylinder Disassembly/Assembly

(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).

##### NOTE

Brush replacement is necessary if the brushes are damaged or excessively worn. Replace when brush wears down to 5/16 inch. When replacement is needed, replace all brushes (4 sets).

##### a. Removal and Disassembly.

(1) Remove the acorn nuts (1) and lockwashers (2) from the motor tie-bolts (3).

(2) Tap gently on the brush housing (4) to separate the brush housing and brush plate (5) assembly from the motor housing and armature (14).

(3) Remove the brush plate (5) from the brush housing (4).

(4) Remove the brush screws (6) and locknuts (12). Remove the brushes (7).

##### NOTE

Ensure that the brush springs (8) and armature bearing spring (9) are not lost when disassembling the brush housing and brush plate assembly.

##### b. Reassembly.

(1) Attach the brushes (7) and tighten the brush screws (6) and nuts (12).

(2) Ensure that the brush springs (8) are in proper position.

(3) Slide the brushes completely into the brush guides (10). Retain brushes by sliding a round wooden toothpick or small dowel through the retainer holes (11) provided in the brush guides (10) and brush plate (5).

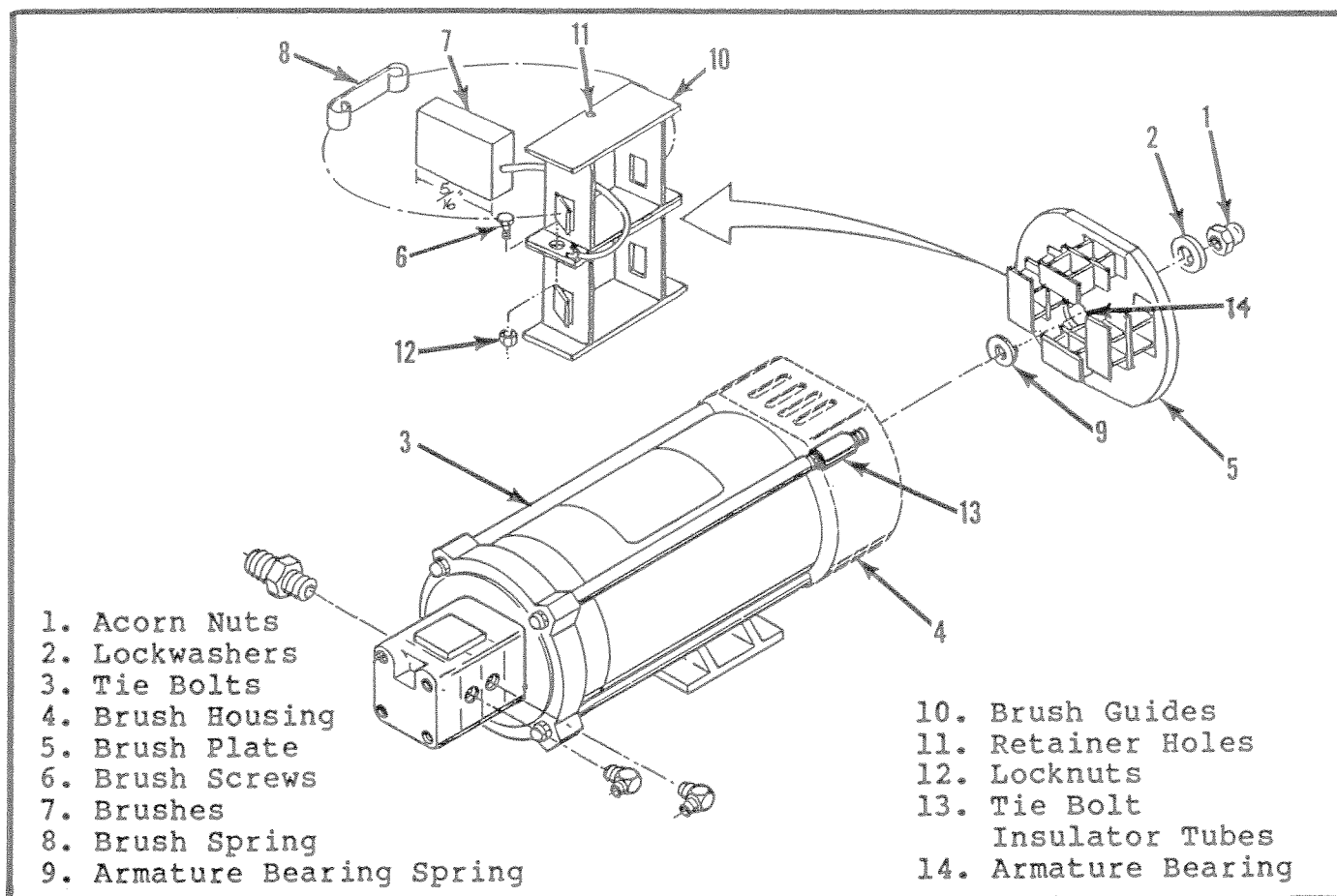


Figure 5-16. Electric Motor Service

c. Installation.

(1) Slide the brush housing (4) over the motor tie bolts (3) against the motor housing. Ensure that the key on the brush housing engages the slot in the motor housing.

(2) Position the tie bolt insulator tube (13) so the brush wires will not contact the motor tie rods.

NOTE

When performing step 3 ensure that armature bearing spring (9) is positioned properly in armature bearing (14).

(3) Slide the brush plate assembly (5) into the brush housing (4) and onto the armature bearing (14). Ensure that the brush plate aligning pin properly engages the aligning hole in the brush housing.

(4) Install the lockwashers (2) and acorn nuts (1).

(5) Pull out the brush retainers (toothpicks).

## SECTION VI

### 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.

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.

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.

TABLE 6-1. Electrical Diagram Legend - Continued

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
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.
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.



TABLE 6-1. Electrical Diagram Legend - Continued

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
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.	Lower right Coil on front of Manifold Block.
L9	Solenoid	Closes High Speed Valve.	Top center Coil of front of Manifold Block.
S1	Switch, Guarded Emergency Stop.	Control Circuit shut off.	On Control Box right front.

TABLE 6-1. Electrical Diagram Legend - Continued

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
S2	Switch, Key Mode	Supplies power to Lift, Drive and Steer switch.	On Control Box right 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.
S5	Switch, Drive	Supplies power to Drive Valve Solenoids.	On Control Box right rear.
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.

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.

TABLE 6-2. Hydraulic Diagram Legend - Continued

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
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.
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.

TABLE 6-2. HYDRAULIC DIAGRAM LEGEND

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
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.
V10	Valve, Down	Allows oil to flow out of Lift Cylinders to Tank.	Bottom center of front of Manifold Block.
RV1	Valve, Main Relief	Provides over pressure protection to Pump.	Left front of Manifold Block.

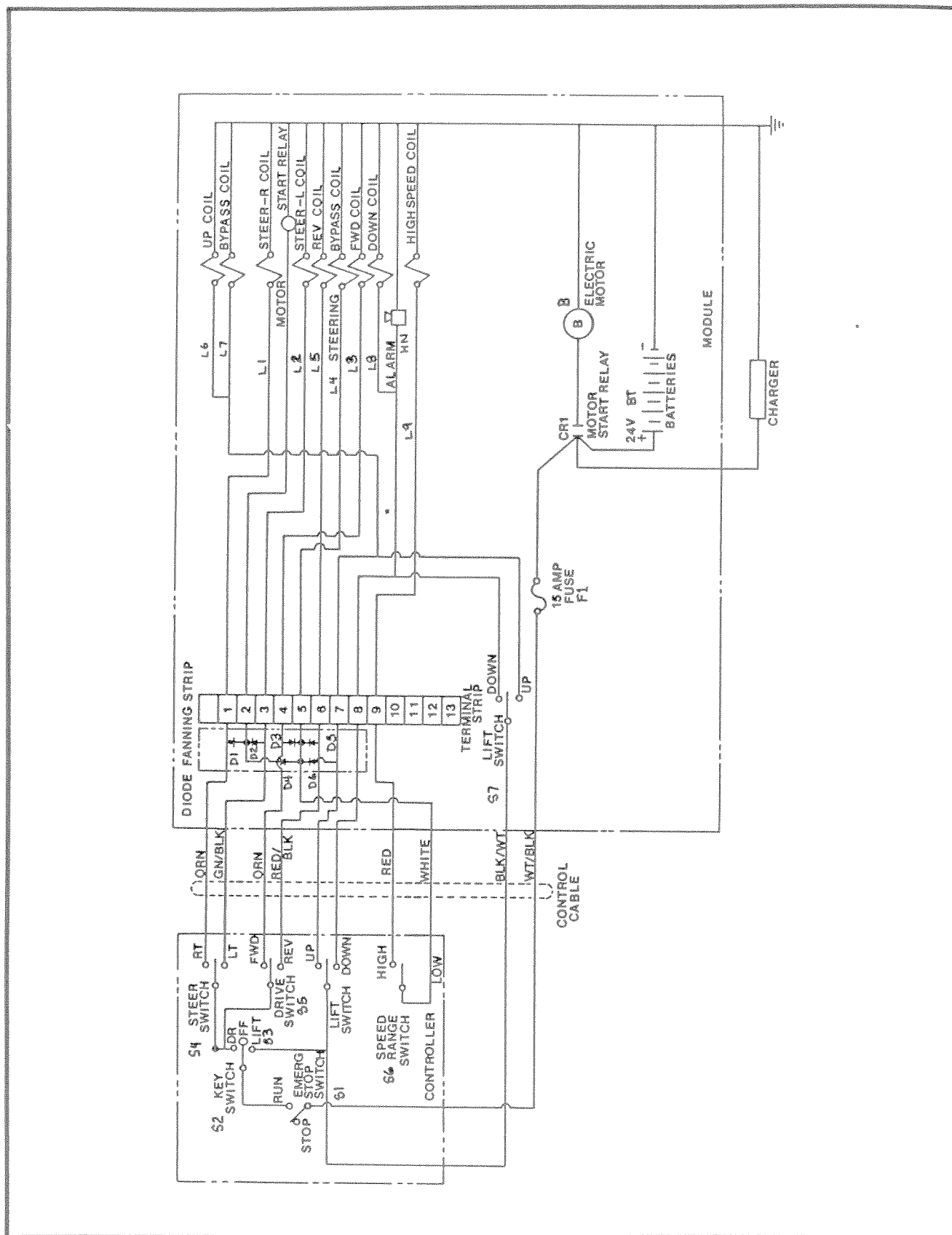


Figure 6-1. Electrical Diagram

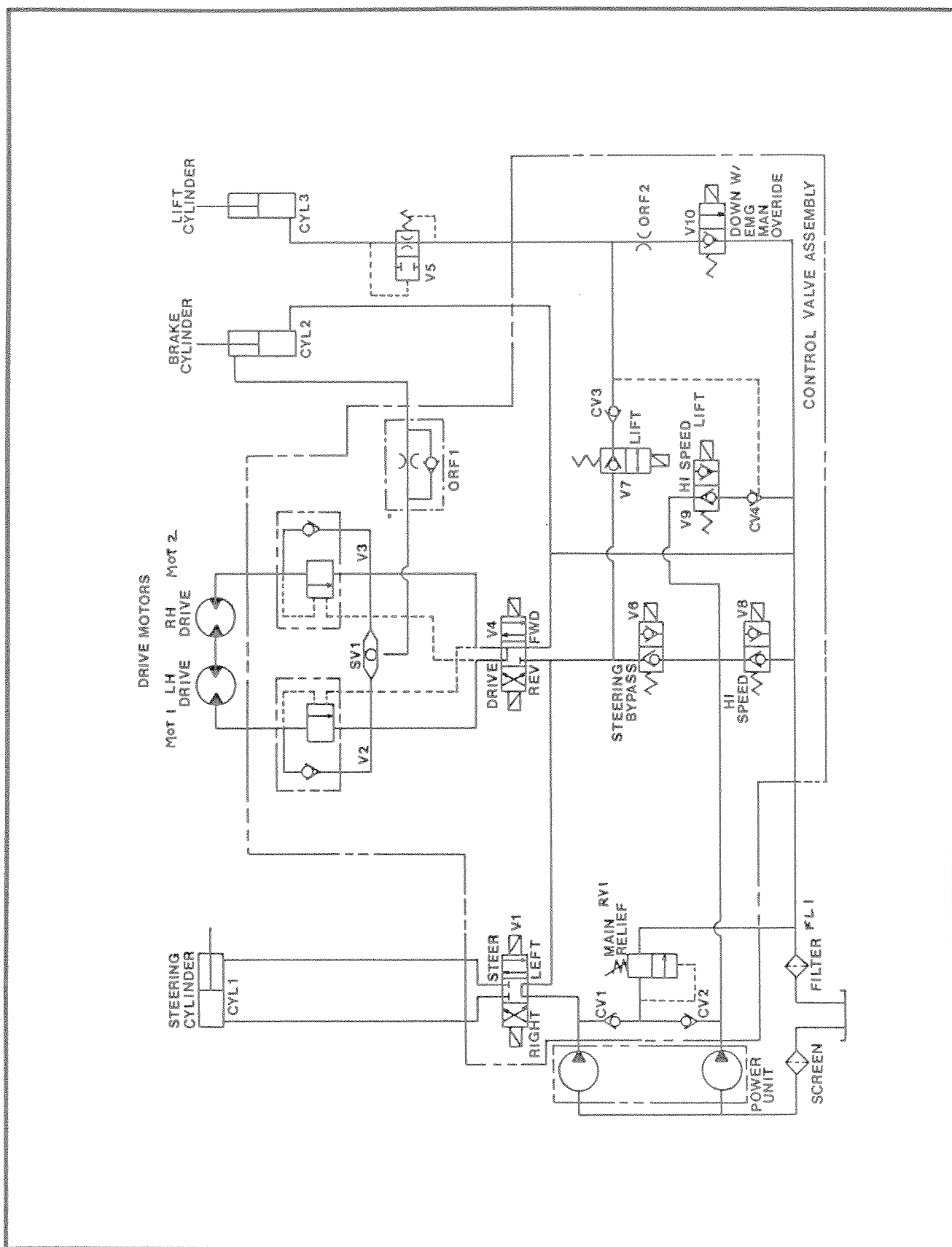


Figure 6-2. Hydraulic Diagram

## SECTION VII

### ILLUSTRATED PARTS BREAKDOWN

7-1. **INTRODUCTION.** This section lists and illustrates the replaceable assemblies and parts of the Up-Right SL-20, as manufactured by UP-RIGHT INC., Selma, California, 93662. Each assembly is followed by its components parts indented to show their relationship to the assembly.

7-2. **EXPLANATION OF COLUMNS IN ILLUSTRATED PARTS BREAKDOWN.**

7-3. **FIGURE AND INDEX NUMBER COLUMN.** The figure and index numbers correlate each parts list to its appropriate illustration. The first number in this column on each page of listings indicates the figure number of the associated illustration. The following numbers, preceded by a dash, correspond to the index numbers of each part on the illustration.

7-4. **PART NUMBER COLUMN.** This column contains the manufacturer's part number for each item listed.

7-5. **DESCRIPTION COLUMN.** This column contains the manufacturer's nomenclature for each assembly or part. Each part description is indented to show relationship. Reference to next higher assembly or detail parts breakdown follow the description where applicable.

7-6. **QUANTITY REQUIRED COLUMN.** This column contains the quantity required for each assembly in the higher assembly and for each detail part in an assembly.

7-7. **ABBREVIATIONS.** The following abbreviations are used in this Section.

AMP . . . . .	Ampere
ASSY. . . . .	Assembly
BUTT. . . . .	Button
DIA . . . . .	Diameter
FT. . . . .	Feet
GA. . . . .	Gauge
HD. . . . .	Head
HEX . . . . .	Hexagon
HH. . . . .	Hexagon Head
HHC . . . . .	Hexagon Head Cap
HP. . . . .	Horse Power
HWH . . . . .	Hexagon Washer Head
LBS . . . . .	Pounds
LG. . . . .	Long
LH. . . . .	Left Hand
MACH. . . . .	Machine



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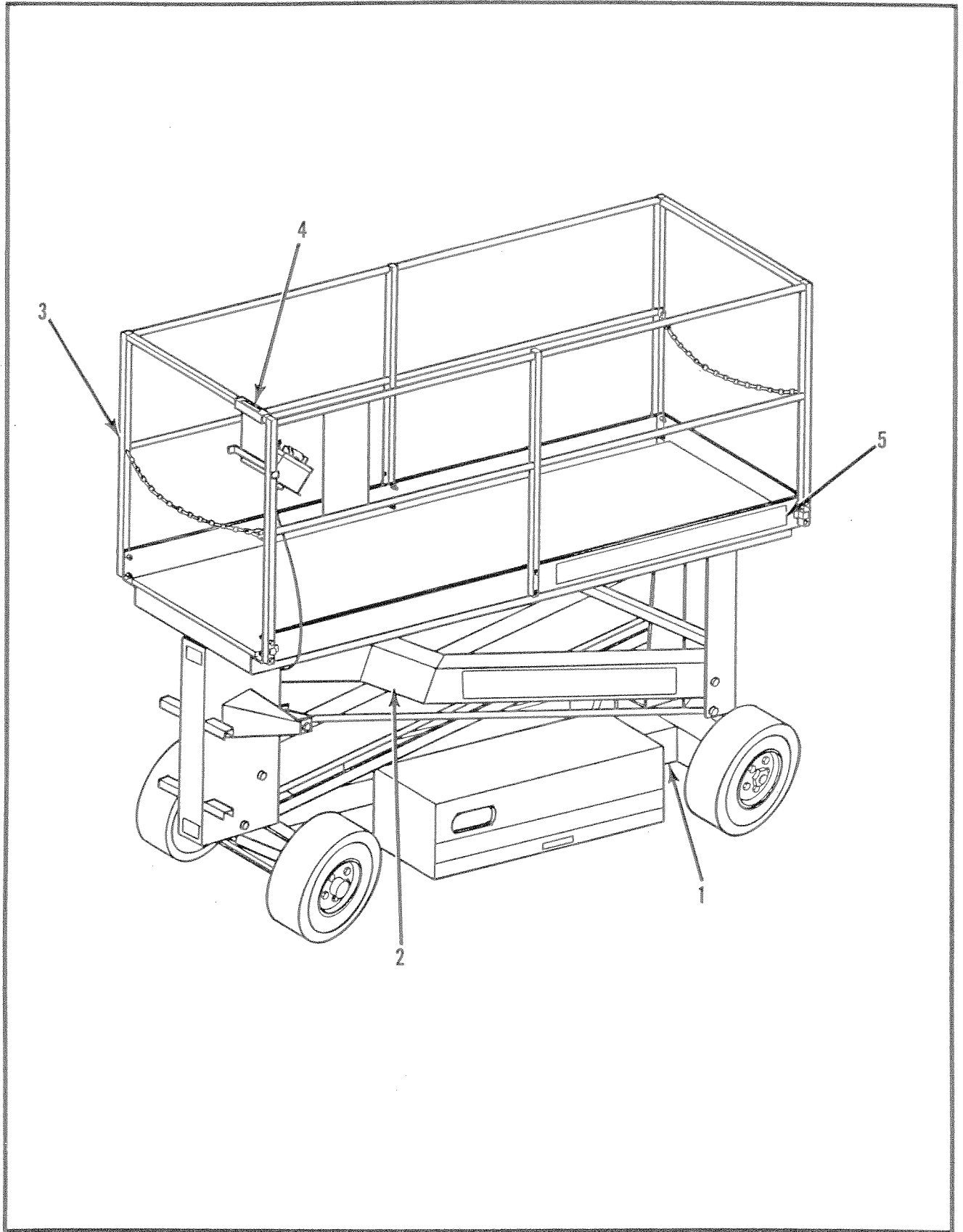


Figure 7-1. SL-20 Work Platform

ITEM	PART	DESCRIPTION	QTY
7-1	63000-000-00	SL-20 WORK PLATFORM. . . . .	1
-1	63001-000-00	. CHASSIS ASSEMBLY. . . . . (See Figure 7-2)	1
-2	No Number	. ELEVATING ASSEMBLY. . . . . (See Figures 7-10)	1
-3	No Number	. PLATFORM/GUARDRAIL ASSEMBLY . . . . . (See Figure 7-14)	1
-4	63007-000-00	. CONTROLLER ASSEMBLY . . . . . (See Figure 7-15)	1
-5	63008-000-00	. DECAL KIT INSTALLATION. . . . . (See Figure 7-16)	1
-6	63123-000-00	. REAR KICK RAIL. . . . . (See Figure 7-14)	1

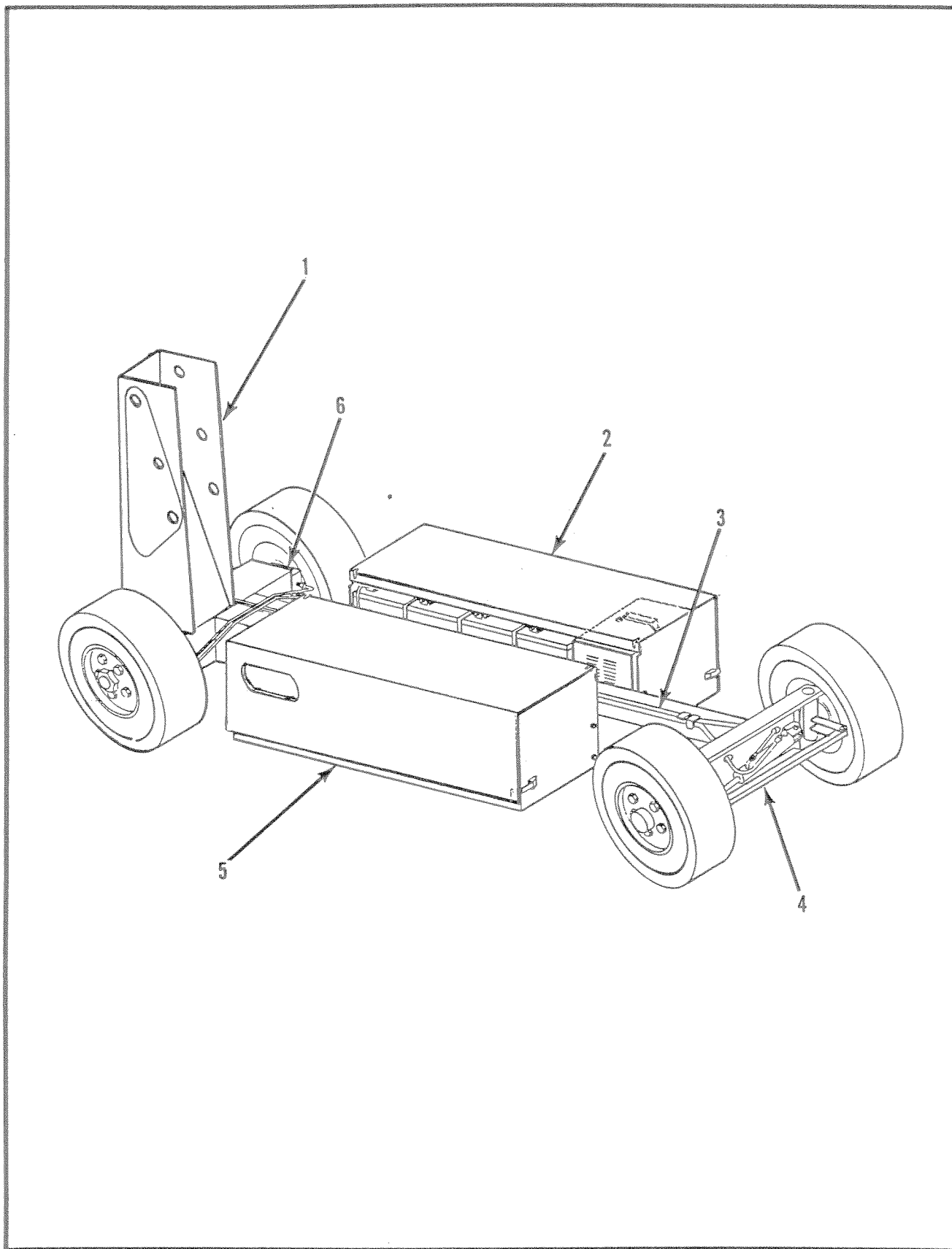


Figure 7-2. Chassis Assembly

ITEM	PART	DESCRIPTION	QTY
7-2	63001-000-00	CHASSIS ASSEMBLY. . . . .	REF
-1	63011-000-00	. CHASSIS FRAME WELDMENT. . . . .	1
-2	No Number	. MODULE ASSEMBLY, Energy . . . . . (See Figure 7-5)	1
-3	No Number	. HOSE AND TUBING KIT/INSTALLATION. . . . . (See Figure 7-10)	1
-4	No Number	. FRONT STEERING AND HUB ASSEMBLY . . . . . (See Figure 7-3)	1
-5	63004-000-00	. MODULE ASSEMBLY, Control. . . . . (See Figure 7-6)	1
-6	No Number	. BRAKE CYLINDER AND DRIVE MOTOR. . . . . ASSEMBLY (See Figure 7-4)	1

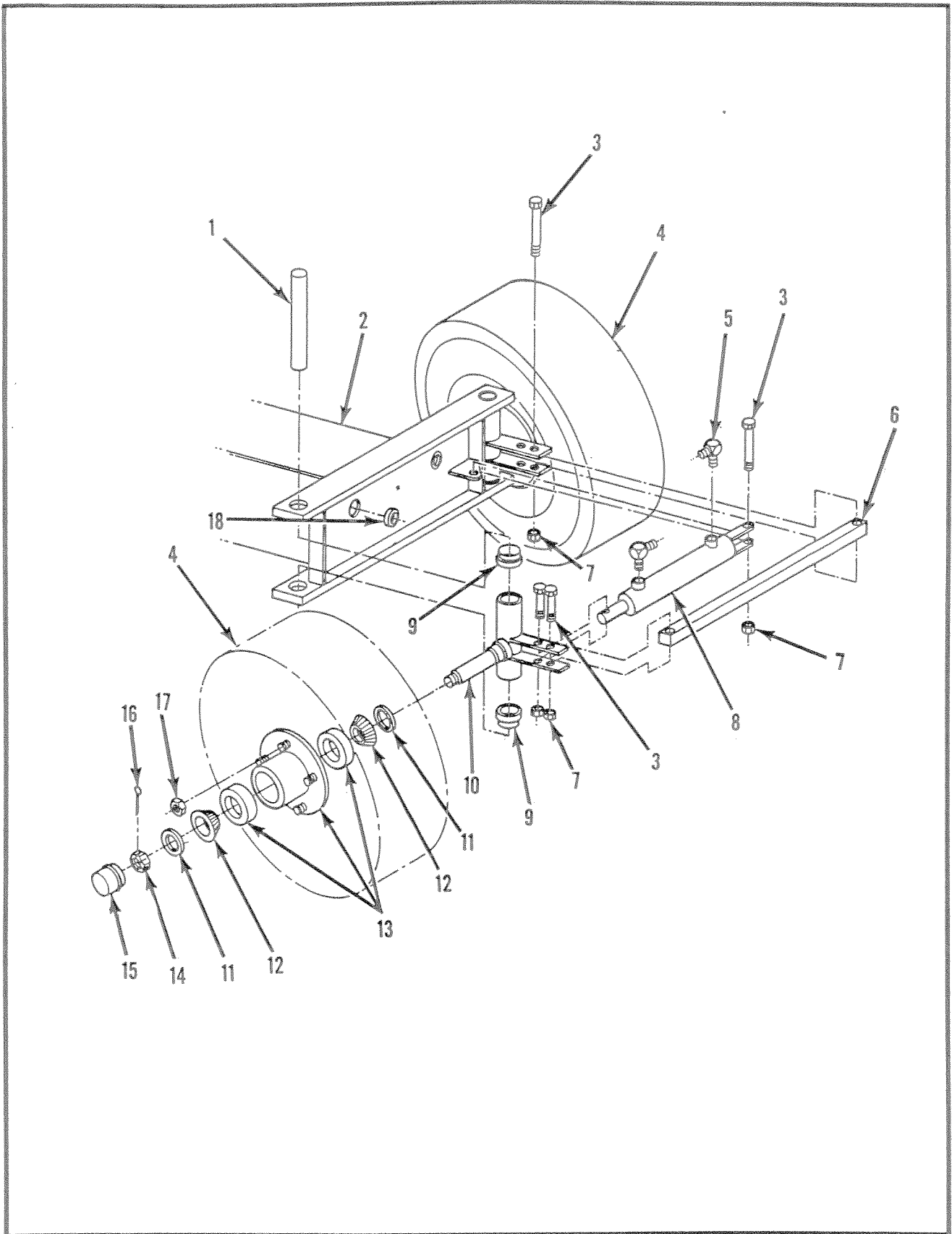


Figure 7-4. Brake Cylinder and Drive Motor Assembly

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
	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

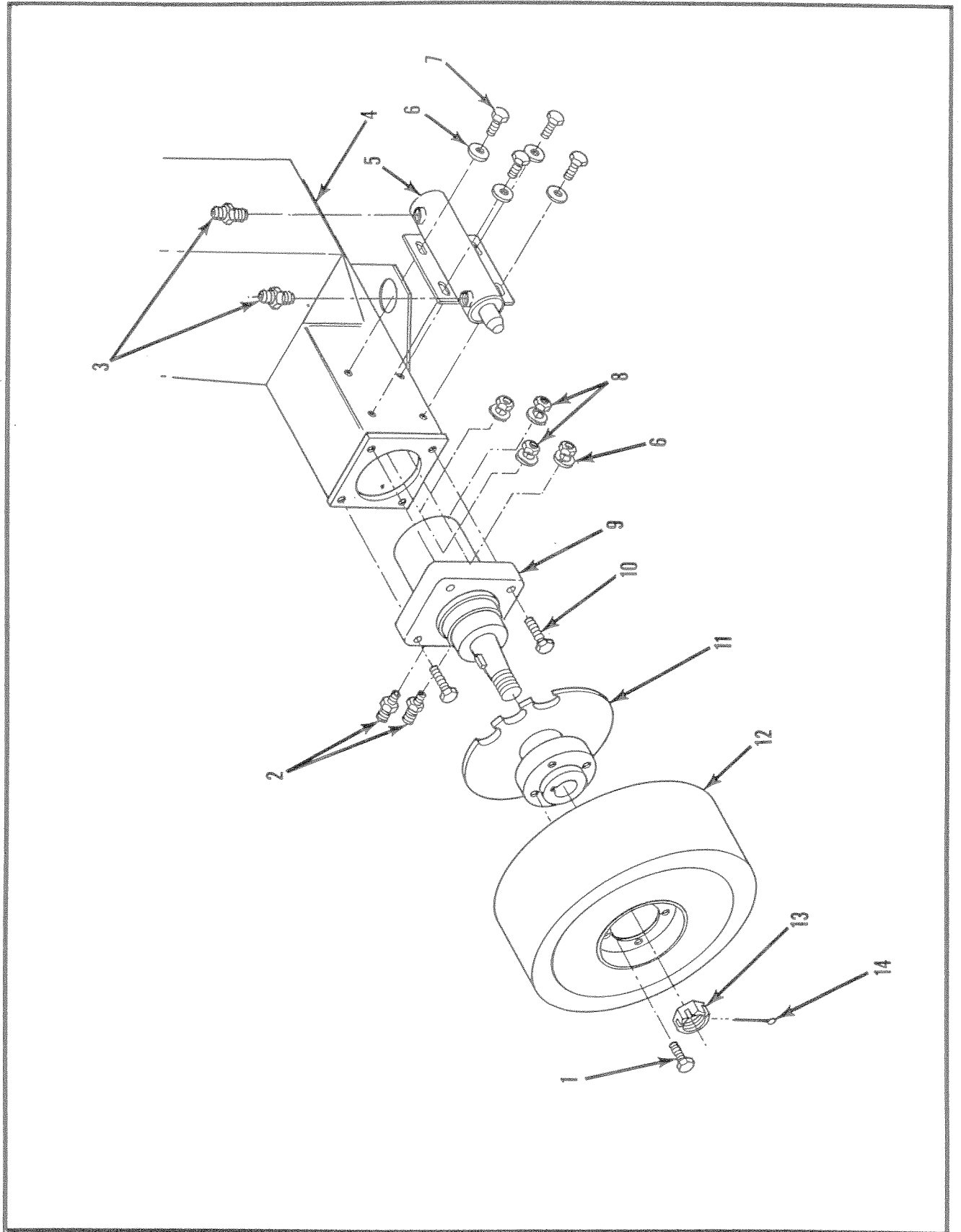


Figure 7-3. Front Steering and Hub Assembly



ITEM	PART	DESCRIPTION	QTY
7-4	No Number	BRAKE CYLINDER AND DRIVE MOTOR ASSY . . . (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
-8	12485-004-00	. NUT, Spline 3/8-24 UNF. . . . .	4
-9	61817-000-00	. MOTOR, Drive. . . . .	2
-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

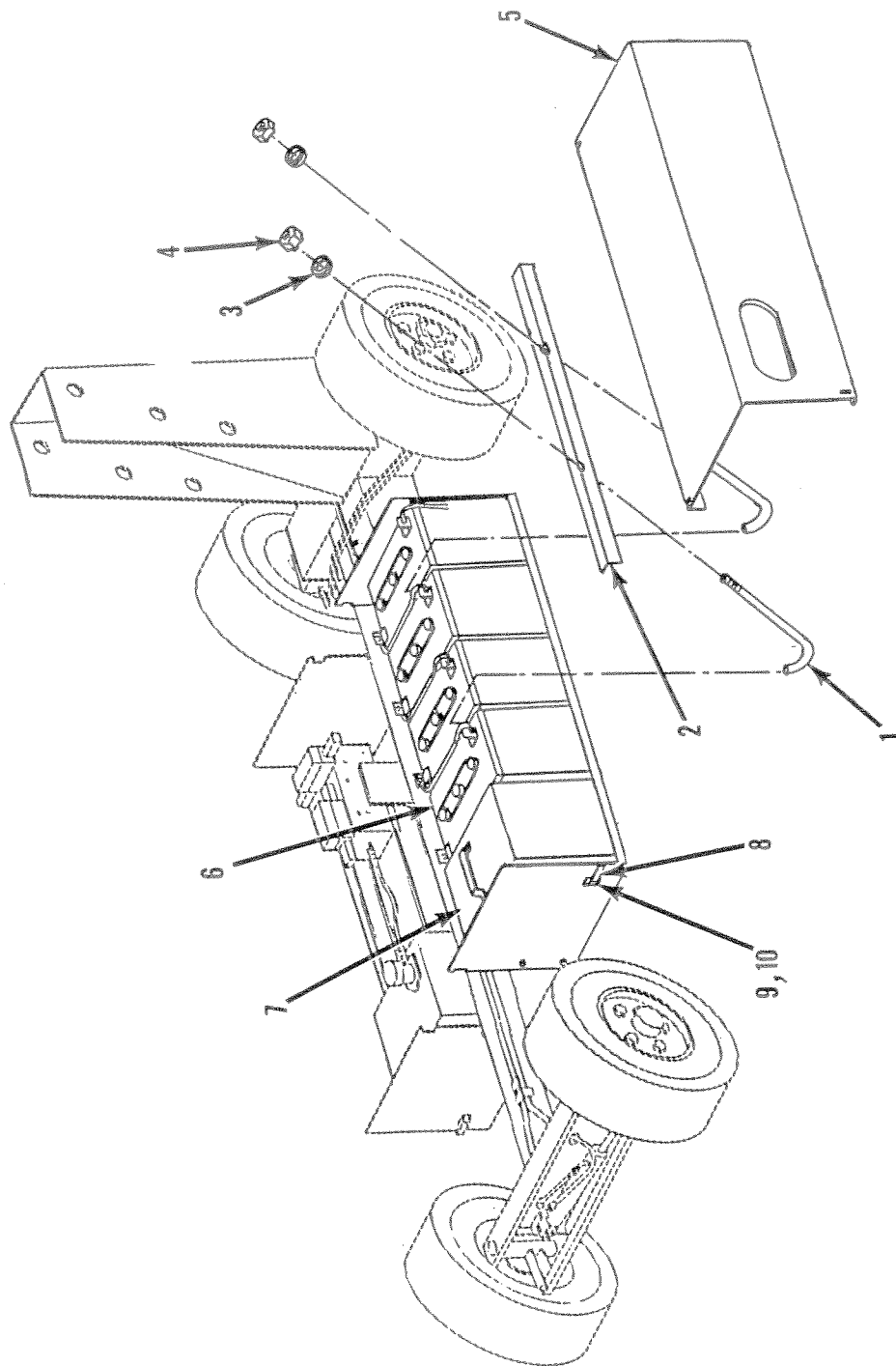


Figure 7-5. Energy Module Assembly

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
-5	63067-000-00	. COVER, Module . . . . .	1
-6	15796-000-00	. BATTERY, 6V 220 AMP . . . . .	4
-7	10112-000-00	. 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

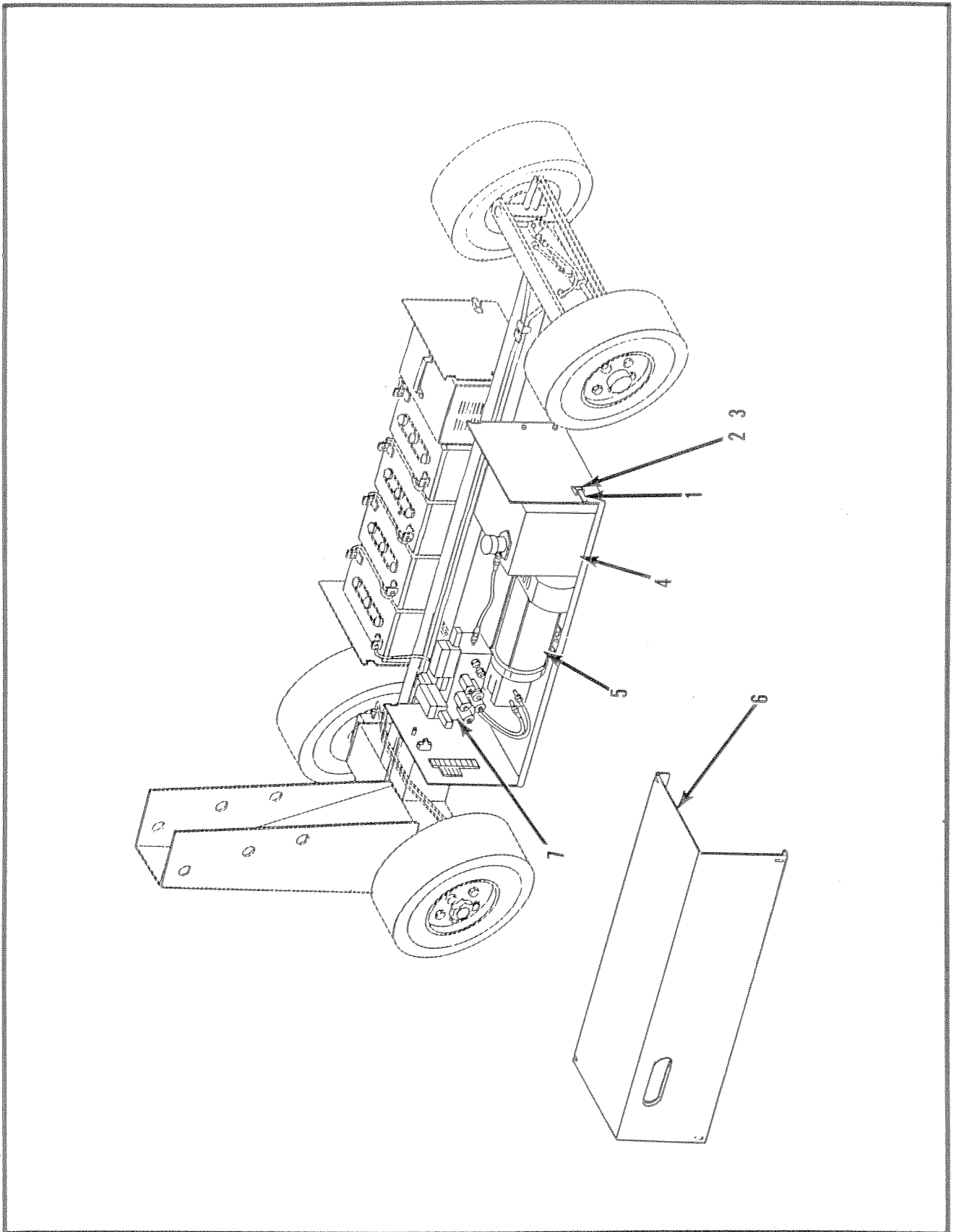


Figure 7-6. Control Module Assembly

ITEM	PART	DESCRIPTION	QTY
7-6	63004-000-00	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	63005-000-00	. MANIFOLD, Hydraulic . . . . . (See Figure 7-9)	1

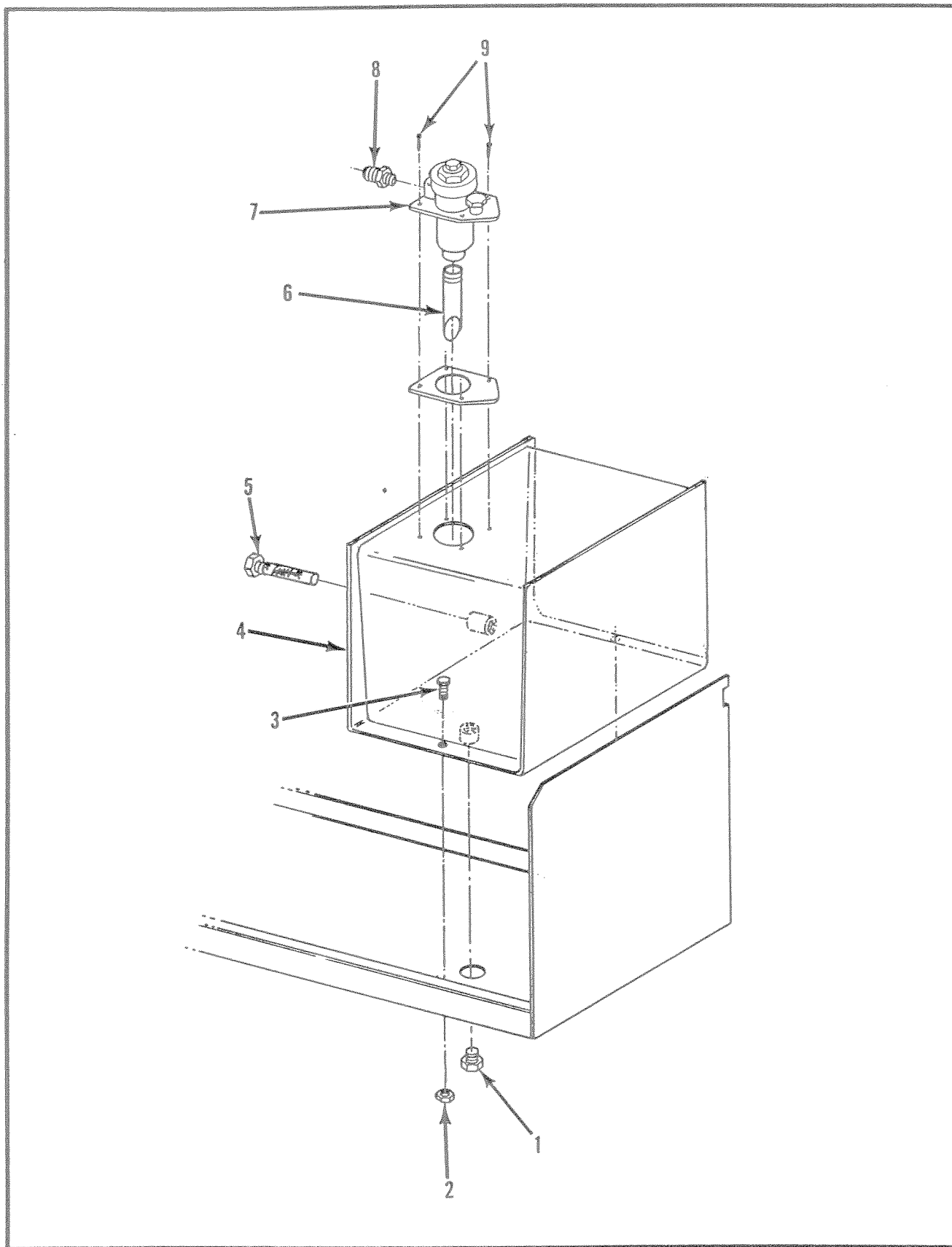


Figure 7-7. Hydraulic Tank Installation

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
-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

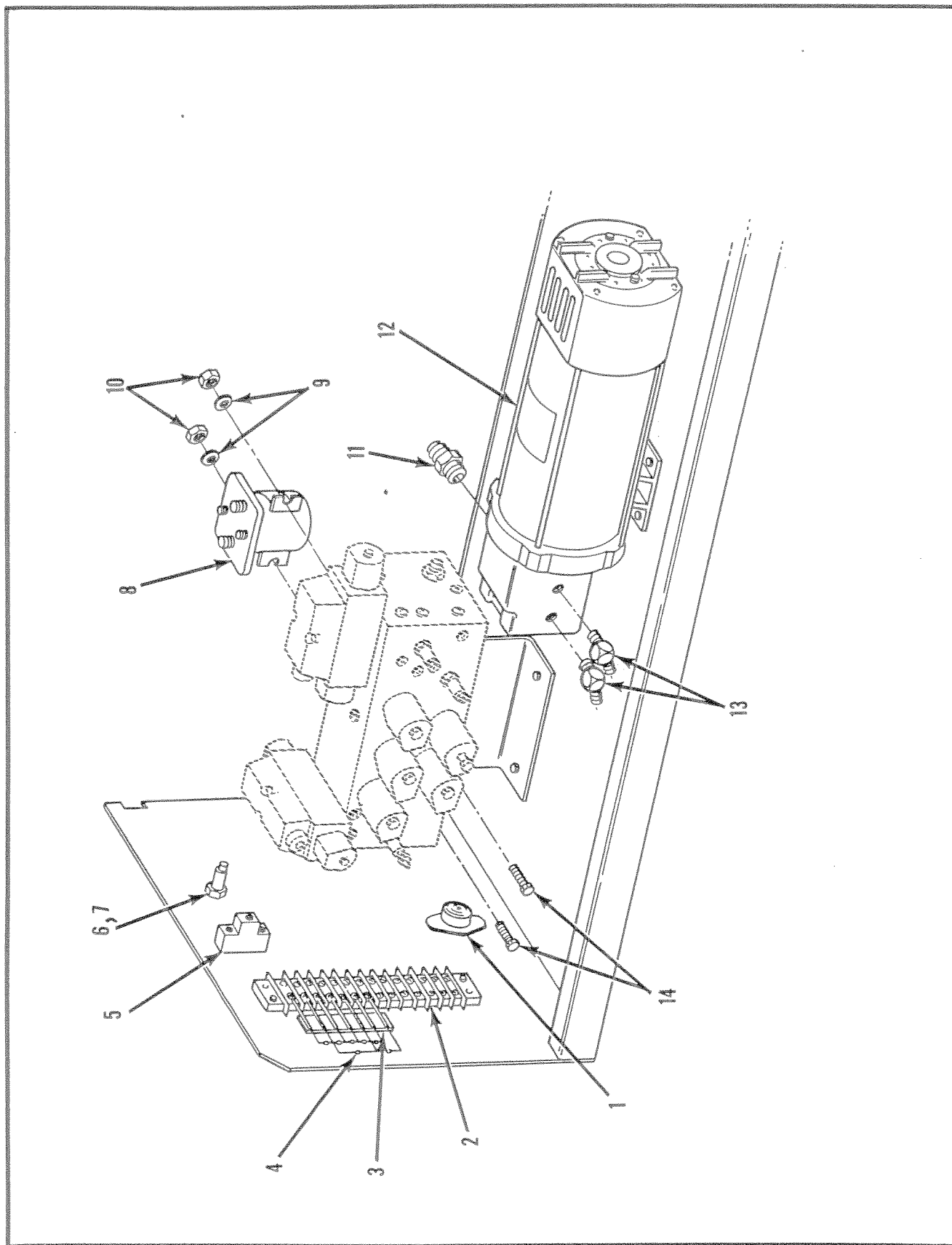


Figure 7-8. Pump/Motor and Electrical Components Installation



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
-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
	15797-002-00	. . COUPLER . . . . .	1
	15797-004-00	. . MOTOR . . . . .	1
	15797-005-00	. . . BRUSH SET . . . . .	1
-13	11934-004-00	. FITTING, Elbow. . . . .	2
-14	11252-006-00	. SCREW, HEX 1/4-20 UNC x 3/4 . . . . .	2

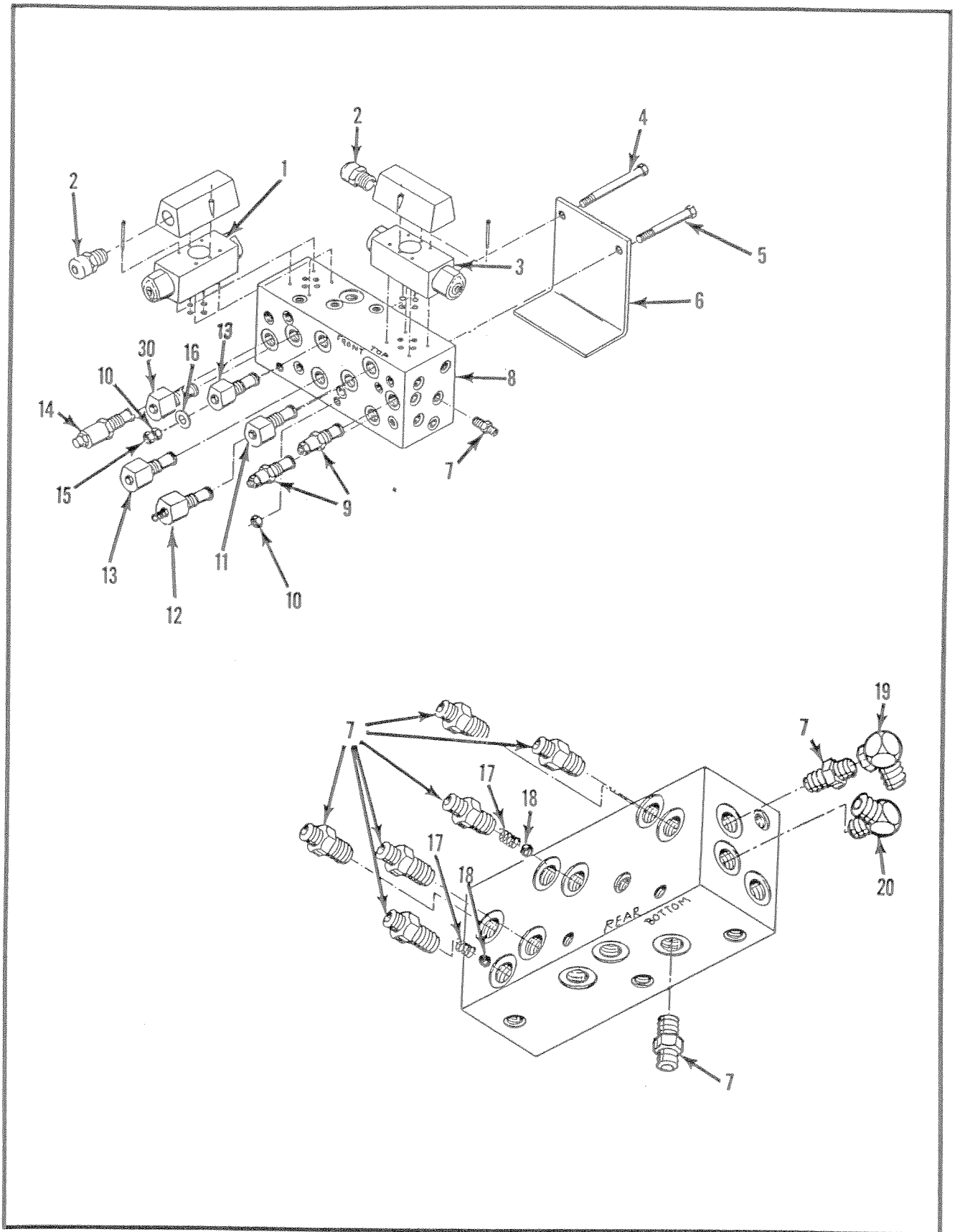


Figure 7-9. Hydraulic Manifold Assembly  
Serial Numbers 1000 to 1328  
(Sheet 1 of 2)

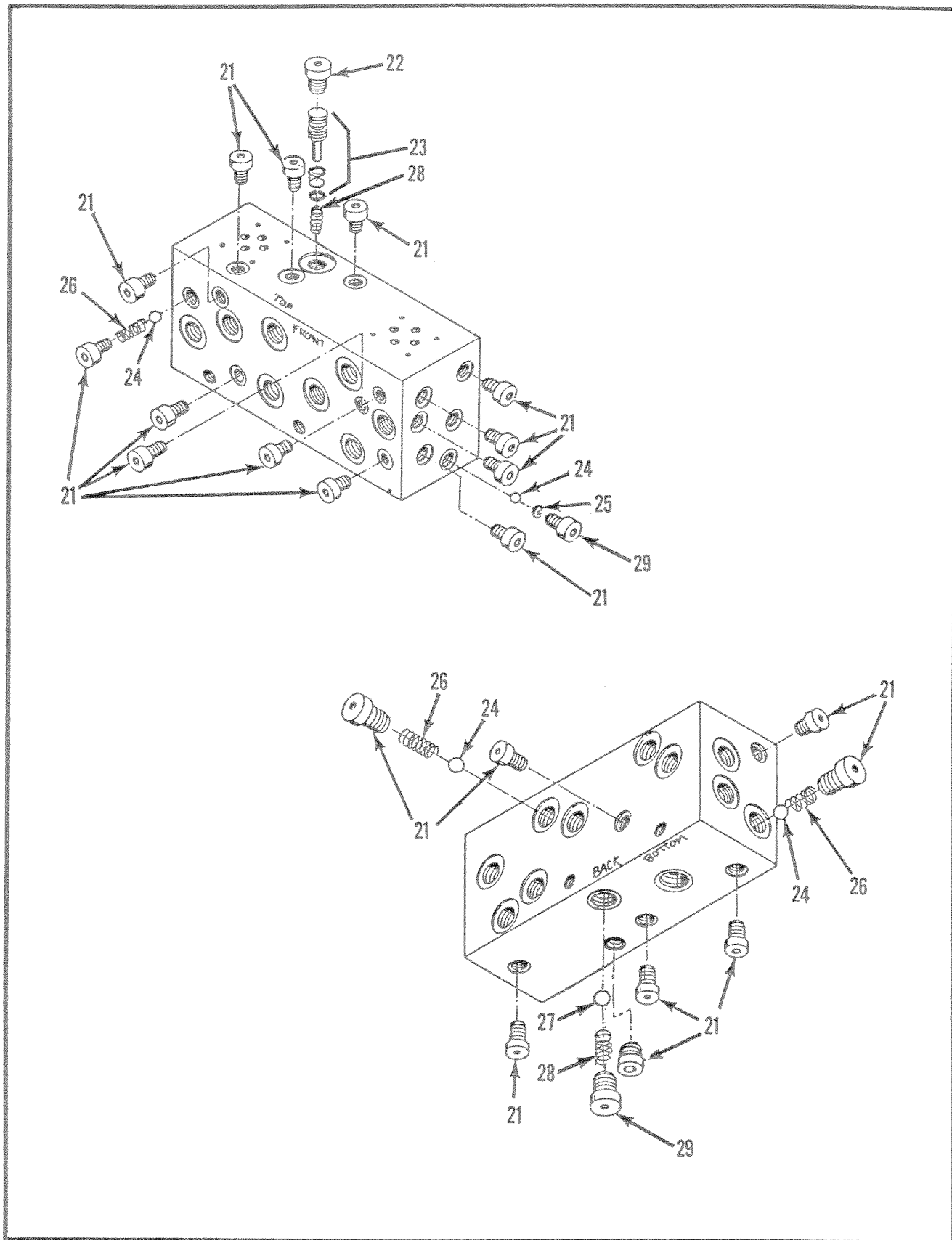


Figure 7-9. Hydraulic Manifold Assembly  
Serial Numbers 1000 to 1328  
(Sheet 2 of 2)

ITEM	PART	DESCRIPTION	QTY
7-9	63005-000-00	HYDRAULIC MANIFOLD ASSEMBLY, . . . . . Serial Numbers 1000 to 1328 (See Figure 7-6 for NHA)	REF
-1	15763-000-00	. VALVE, Solenoid, Steering . . . . .	1
	15760-001-00	. . COIL. . . . .	2
	13888-007-00	. . O-RING. . . . .	4
-2	29925-000-00	. CONNECTOR, Cable. . . . .	2
-3	15760-000-00	. VALVE, Solenoid, Drive. . . . .	1
	15760-001-00	. . COIL. . . . .	2
	13888-007-00	. . O-RING. . . . .	4
-4	11254-036-00	. SCREW, HHC 3/8-16 UNC x 4-1/2 . . . . .	1
-5	11254-032-00	. SCREW, HHC 3/8-16 UNC x 4 . . . . .	1
-6	63084-000-00	. BRACKET . . . . .	1
-7	11941-005-00	. FITTING, Straight . . . . .	9
-8	63103-000-00	. VALVE, Manifold . . . . .	1
-9	15900-000-00	. VALVE, Counterbalance . . . . .	2
	13888-059-00	. . O-RING, Small . . . . .	1
	13888-058-00	. . O-RING, Large . . . . .	1
-10	11248-006-00	. NUT, HEX 3/8-16 UNC . . . . .	2
-11	15764-000-00	. VALVE, Solenoid, N.C. . . . .	1
	15762-001-00	. . COIL. . . . .	1
	15764-002-00	. . POPPET, N.C.. . . . .	1
	13888-057-00	. . O-RING, Small . . . . .	1
	13888-056-00	. . O-RING, Large . . . . .	1
-12	63101-000-00	. VALVE, Cartridge, Emergency Down. . . . .	1
	13888-057-00	. . O-RING, Small . . . . .	1
	13888-056-00	. . O-RING, Large . . . . .	1

ITEM	PART	DESCRIPTION	QTY
7-9	63005-000-00	HYDRAULIC MANIFOLD ASSEMBLY (Cont'd) . . .	REF
-13	15762-000-00	. VALVE, Solenoid, N.O. . . . .	2
	15762-001-00	. . COIL. . . . .	1
	15762-002-00	. . POPPET, N.O.. . . . .	1
	13888-057-00	. . . O-RING, Small . . . . .	1
	13888-058-00	. . . O-RING, Large . . . . .	1
-14	60390-000-00	. VALVE, Cartridge, Relief. . . . .	1
	13888-057-00	. . O-RING, Small . . . . .	1
	13888-056-00	. . O-RING, Large . . . . .	1
-15	11273-006-00	. NUT, Jam 3/8-16 UNC . . . . .	1
-16	11240-006-00	. WASHER, Flat 3/8 DIA. . . . .	1
-17	05133-000-00	. SPRING. . . . .	2
-18	15919-000-00	. ORIFICE . . . . .	2
-19	11937-003-00	. FITTING, Elbow. . . . .	1
-20	11934-004-00	. FITTING, Straight . . . . .	1
-21	12004-004-00	. PLUG. . . . .	21
-22	12004-008-00	. PLUG. . . . .	1
-23	61819-000-00	. PISTON ASSEMBLY . . . . .	1
-24	05135-000-00	. BALL, Steel 5/16 DIA. . . . .	4
-25	61728-000-00	. ORIFICE . . . . .	1
-26	15799-000-00	. SPRING. . . . .	3
-27	61827-000-00	. BALL, Steel 5/16 DIA. . . . .	1
-28	13987-005-00	. SPRING. . . . .	2
-29	12004-006-00	. PLUG. . . . .	2

ITEM	PART	DESCRIPTION	QTY
7-9	63005-000-00	HYDRAULIC MANIFOLD ASSEMBLY (Cont'd) . . .	REF
-30	63121-000-00	. VALVE, Solenoid Spool Type. . . . .	1
	63121-002-00	. . CARTRIDGE . . . . .	1
	63121-003-00	. . COIL. . . . .	1

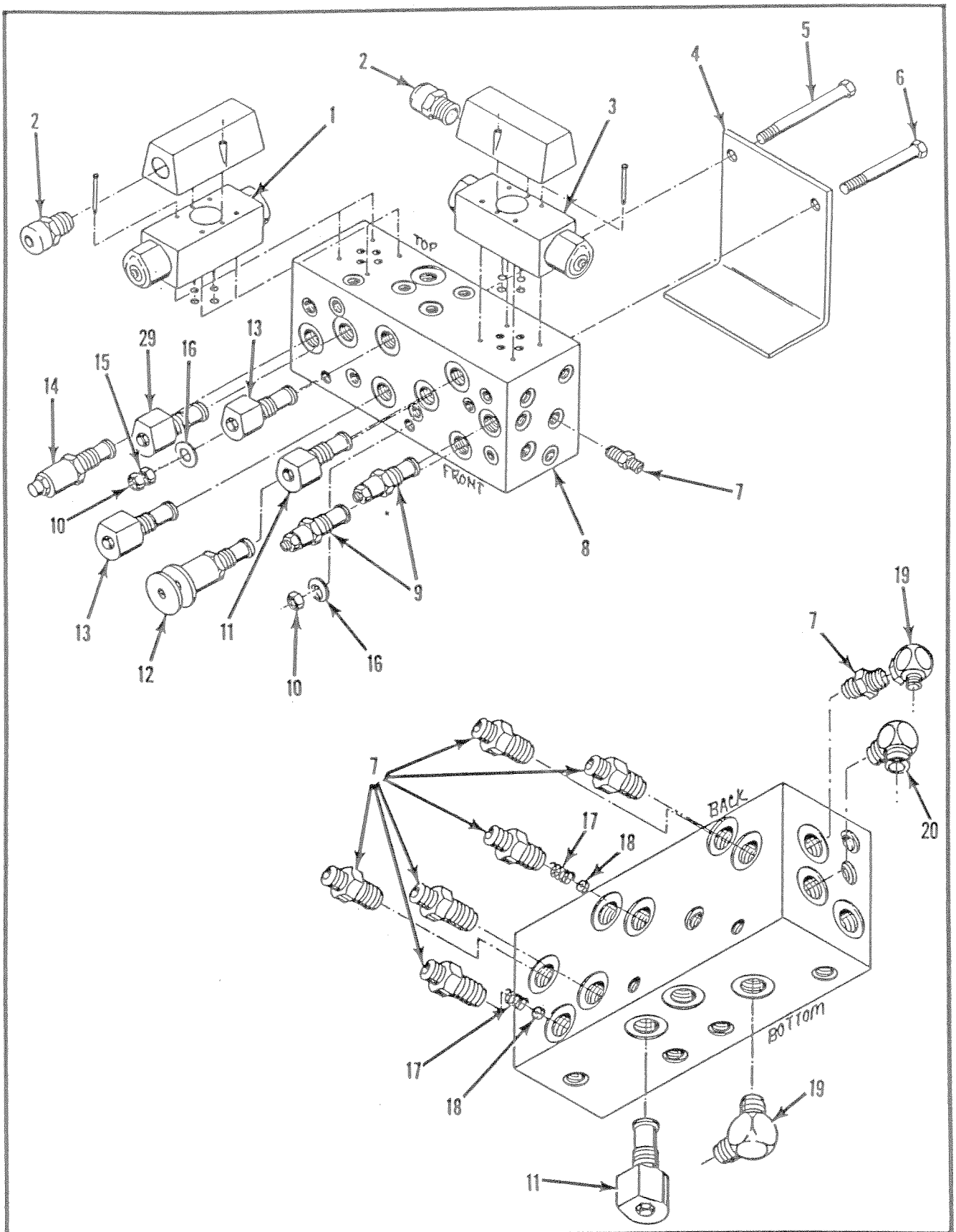


Figure 7-9A. Hydraulic Manifold Assembly  
Serial Numbers 1329 to Current  
(Sheet 1 of 2)

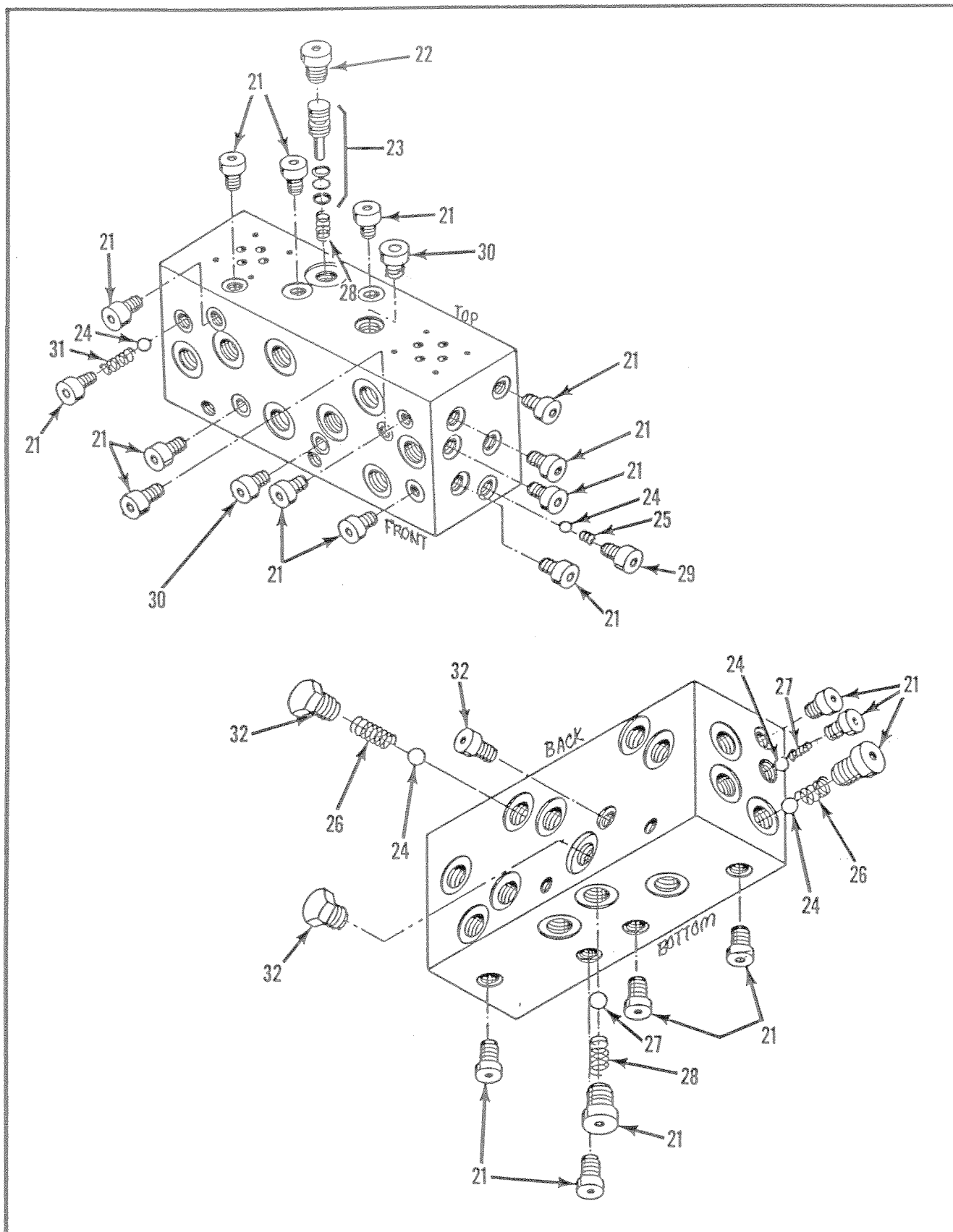


Figure 7-9A. Hydraulic Manifold Assembly  
Serial Numbers 1329 to Current  
(Sheet 2 of 2)



ITEM	PART	DESCRIPTION	QTY
7-9A	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
	15760-001-00	. . COIL. . . . .	2
-2	29925-000-00	. CONNECTOR, Cable. . . . .	2
-3	15760-000-00	. VALVE, Solenoid, Drive. . . . .	1
	15760-001-00	. . COIL. . . . .	2
-4	11254-036-00	. SCREW, HHC 3/8-16 UNC x 4-1/2 . . . . .	1
-5	11254-032-00	. SCREW, HHC 3/8-16 UNC x 4 . . . . .	1
-6	63084-000-00	. BRACKET . . . . .	1
-7	11941-005-00	. FITTING, Straight . . . . .	9
-8	63218-000-00	. VALVE, Manifold . . . . .	1
-9	15900-000-00	. VALVE, Counterbalance . . . . .	2
-10	11248-006-00	. NUT, HEX 3/8-16 UNC . . . . .	2
-11	61797-000-00	. VALVE, Solenoid, N.C. . . . .	1
		. . COIL. . . . .	1
-12	60388-000-00	. VALVE, Cartridge, Emergency Down. . . . .	1
-13	15762-000-00	. VALVE, Solenoid, N.O. . . . .	2
	15762-001-00	. . COIL. . . . .	1
-14	60390-000-00	. VALVE, Cartridge, Relief. . . . .	1
-15	11273-006-00	. NUT, Jam 3/8-16 UNC . . . . .	1
-16	11240-006-00	. WASHER, Flat 3/8 DIA. . . . .	1
-17	05133-000-00	. SPRING. . . . .	2
-18	15919-000-00	. ORIFICE . . . . .	2
-19	11937-003-00	. FITTING, Elbow. . . . .	1

ITEM	PART	DESCRIPTION	QTY
7-9A	63005-000-00	HYDRAULIC MANIFOLD ASSEMBLY (Cont'd) . . .	REF
-20	11934-004-00	. FITTING, Elbow. . . . .	1
-21	12004-004-00	. PLUG. . . . .	23
-22	12004-008-00	. PLUG. . . . .	1
-23	61819-000-00	. PISTON ASSEMBLY . . . . .	1
-24	05135-000-00	. BALL, Steel 5/16 DIA. . . . .	4
-25	61728-000-00	. ORIFICE . . . . .	1
-26	15799-000-00	. SPRING. . . . .	3
-27	61827-000-00	. BALL, Steel 5/16 DIA. . . . .	1
-28	13987-005-00	. SPRING. . . . .	2
-29	63121-000-00	. VALVE, Solenoid Spool Type. . . . .	1
	63121-002-00	. . CARTRIDGE . . . . .	1
	63121-003-00	. . COIL. . . . .	1
-30	12004-002-00	. FITTING, Plug . . . . .	2
-31	13987-006-00	. SPRING. . . . .	1
-32	20021-006-00	. FITTING, Plug . . . . .	1

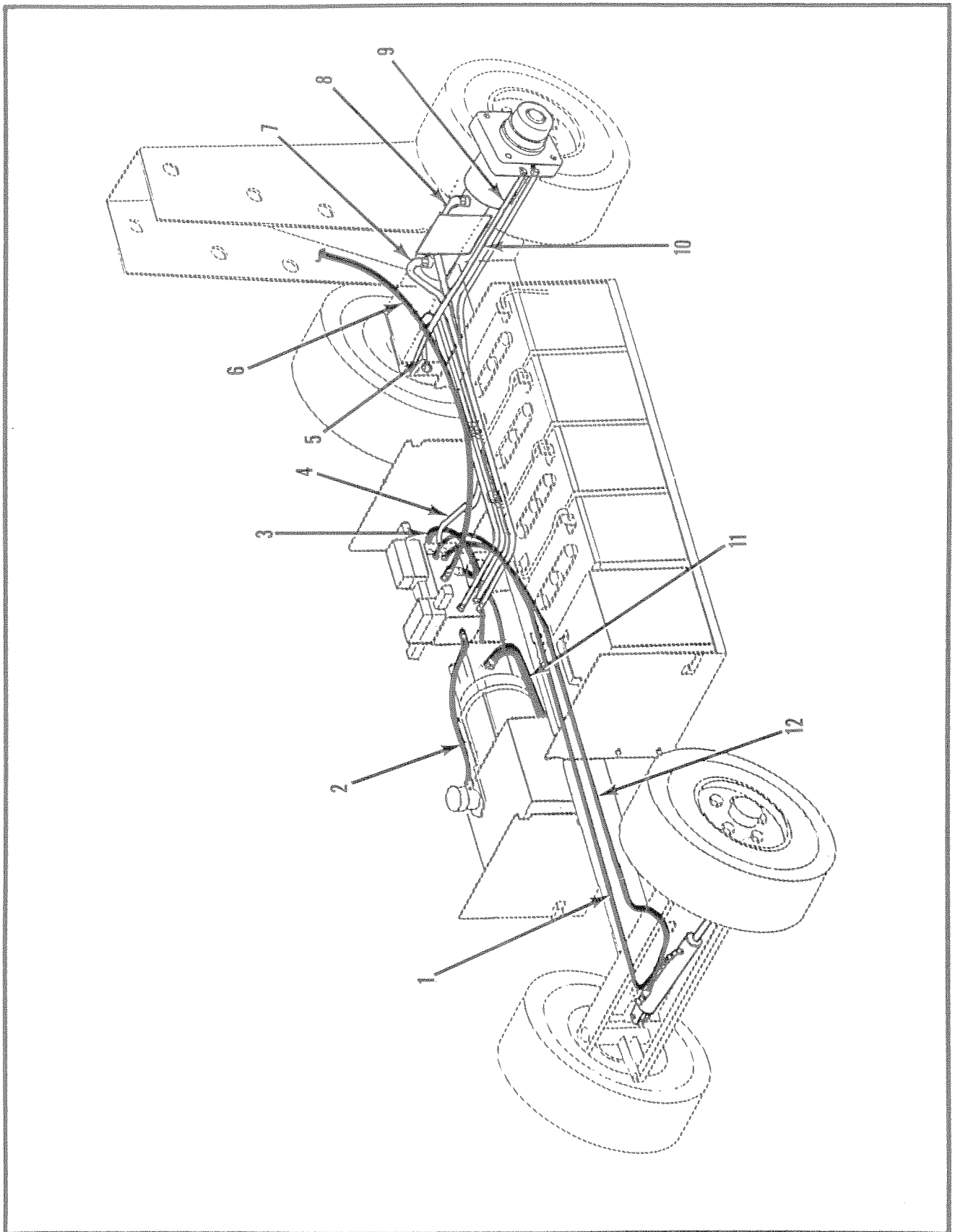


Figure 7-10. Hose and Tubing Kit Installation Chassis

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	63107-000-00	. BRAKE TUBE ASSEMBLY . . . . .	1
-5	63105-000-00	. DRIVE TUBING ASSEMBLY . . . . .	1
-6	60861-030-00	. HOSE ASSEMBLY 3/8 x 35. . . . .	1
-7	63108-000-00	. BRAKE TUBING ASSEMBLY . . . . .	1
-8	63107-000-00	. BRAKE TUBING ASSEMBLY . . . . .	1
-9	63106-000-00	. DRIVE TUBING ASSEMBLY . . . . .	1
-10	63104-000-00	. DRIVE TUBING ASSEMBLY . . . . .	1
-11	61789-002-00	. HOSE ASSEMBLY 3/4 x 20-1/2. . . . .	1
-12	61131-002-00	. HOSE ASSEMBLY 1/4 x 74. . . . .	1

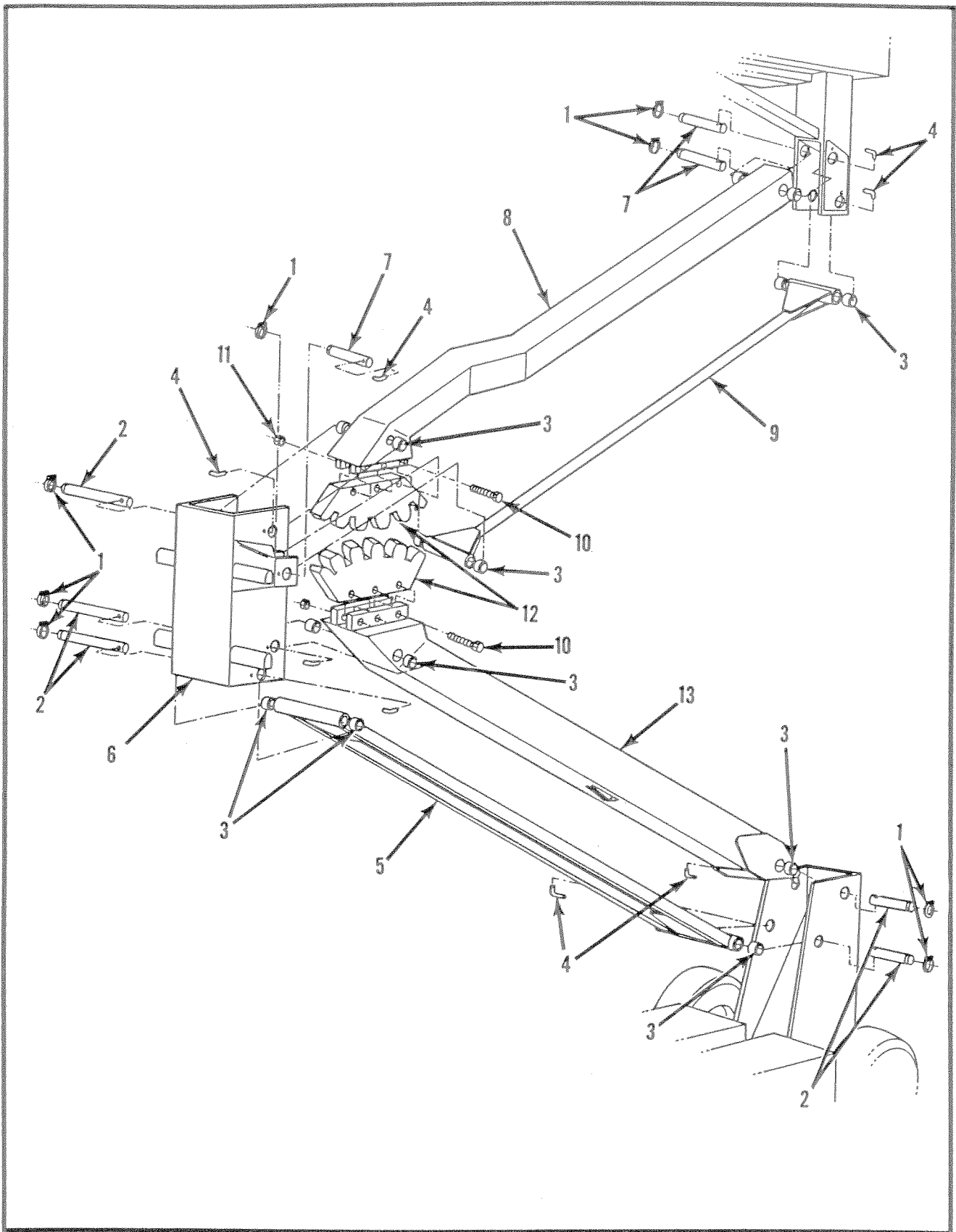


Figure 7-11. Elevating Assembly

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
-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	63085-000-00	. GEAR, Linkage . . . . .	2
-13	63052-000-00	. LIFT ARM WELDMENT, Lower. . . . .	1

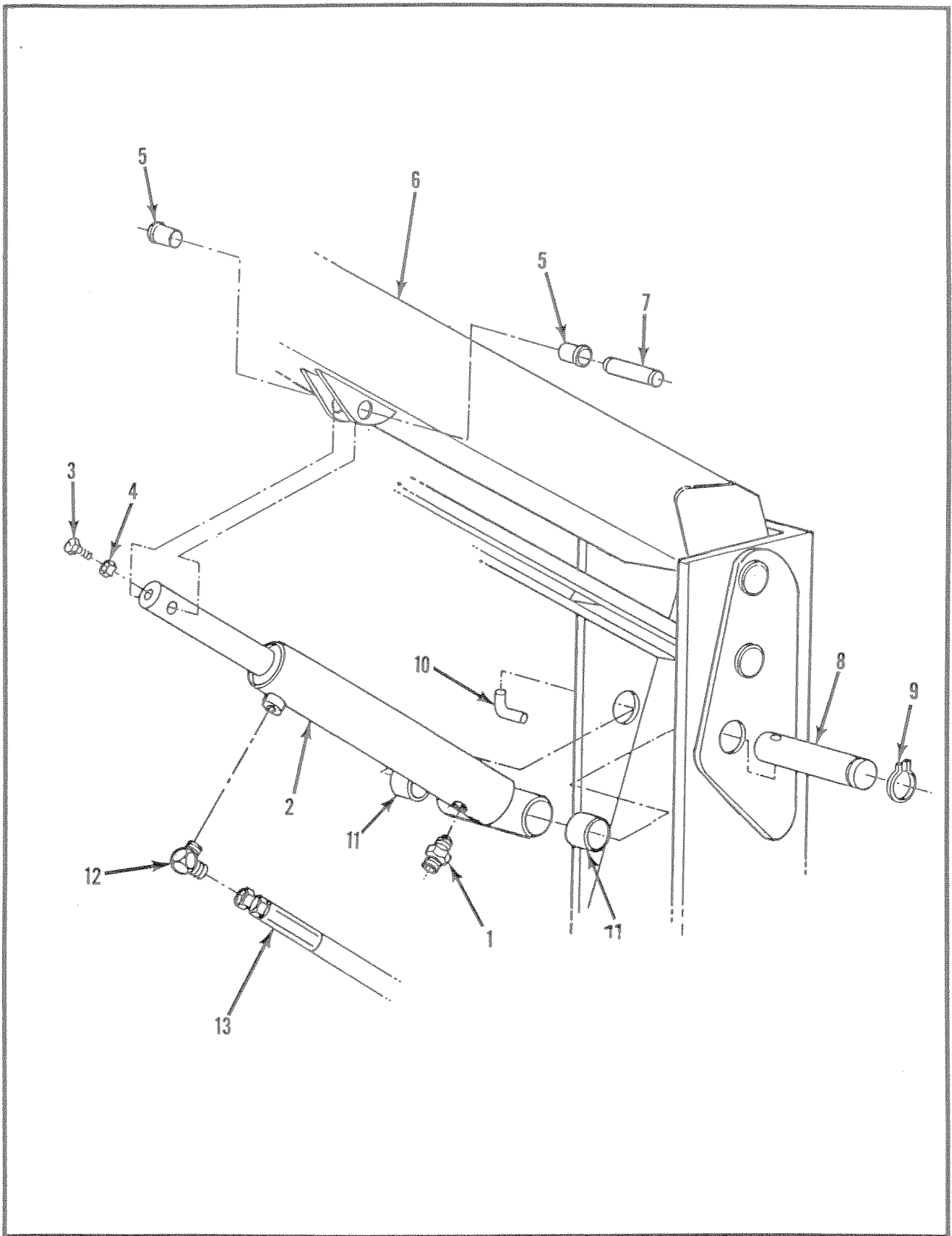


Figure 7-12. Lift Cylinder Installation

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
-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
-6	63052-000-00	. LIFT ARM, Lower . . . . .	1
-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



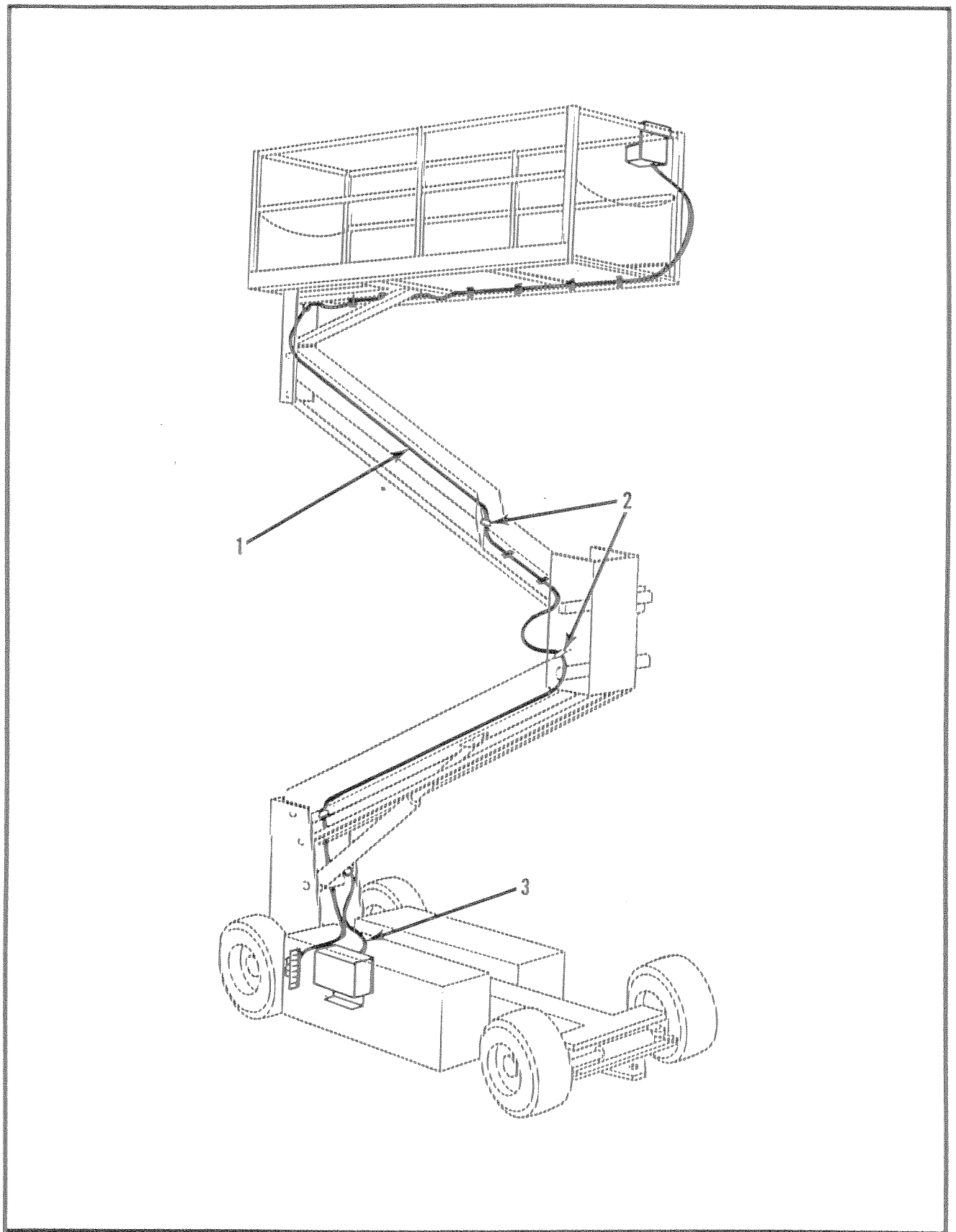


Figure 7-13. Hose and Cable Installation,  
Elevating Assembly/Platform

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

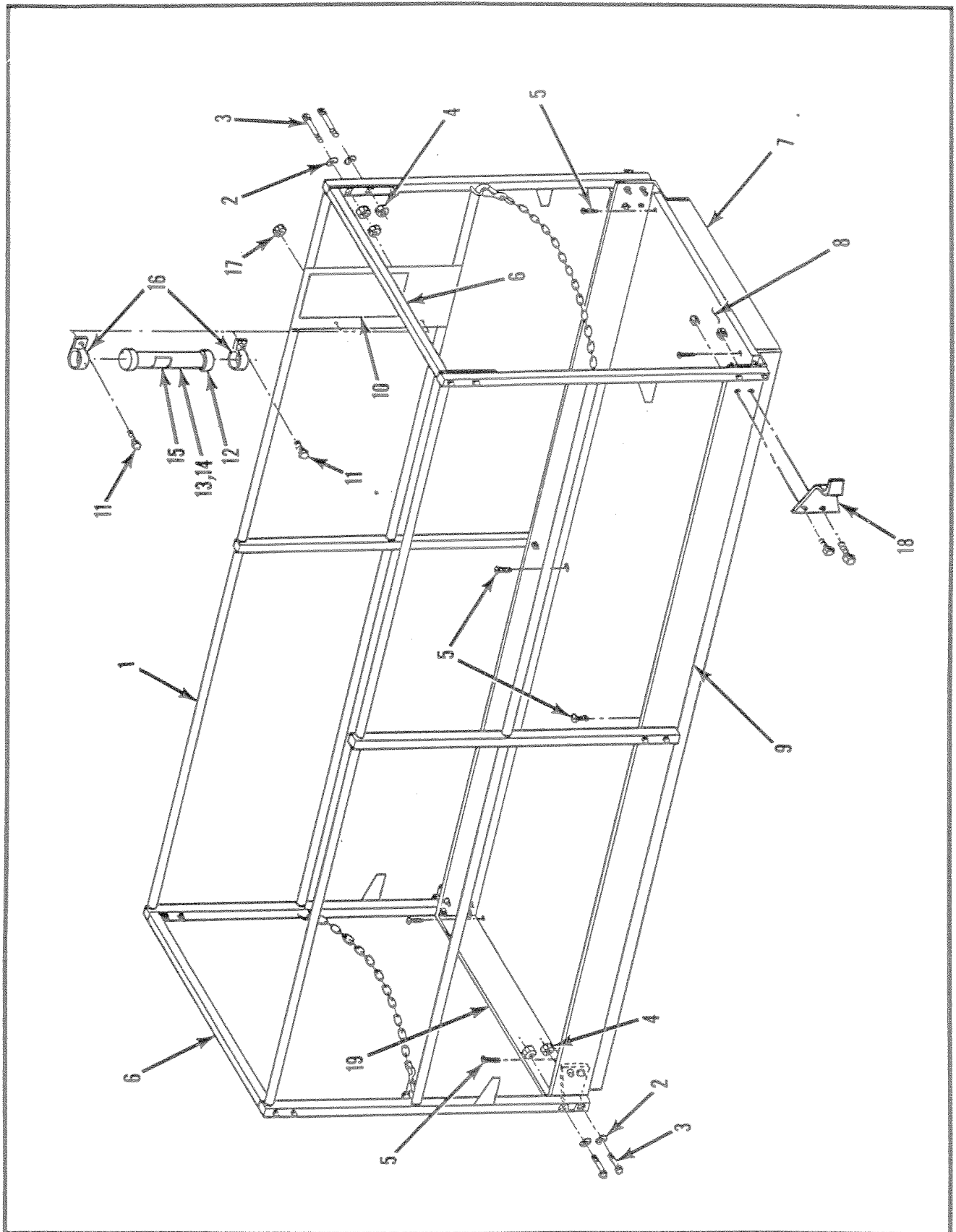


Figure 7-14. Platform/Guardrail Assembly

ITEM	PART	DESCRIPTION	QTY
7-14	No Number	PLATFORM/GUARDRAIL ASSEMBLY . . . . . (See Figure 7-1 for NHA)	REF
-1	63124-000-00	. GUARDRAIL, LH . . . . .	1
-2	11239-006-00	. WASHER, Flat 3/8 DIA. . . . .	20
-3	11254-016-00	. SCREW, HHC 3/8-16 UNC GR 5 x 2. . . . .	28
-4	11248-006-00	. LOCKNUT, HEX 3/8-16 . . . . .	28
-5	15794-008-00	. SCREW, Waferhead TEX 10-24 UNC x 1. . . . .	6
-6	63111-000-00	. TOP RAIL WELDMENT . . . . .	2
-7	63023-000-00	. PLATFORM WELDMENT . . . . .	1
-8	24611-002-00	. PLYWOOD . . . . .	1
-9	63092-000-00	. GUARDRAIL, RH . . . . .	1
-10	62560-000-00	. DECAL, Danger . . . . .	1
-11	11252-006-00	. SCREW, 1/4-20 UNC x 3/4 . . . . .	2
-12	03612-000-00	. CAP . . . . .	2
-13	03613-002-00	. TUBE. . . . .	1
-14	63098-000-00	. MANUAL, User's (Not Shown). . . . .	1
-15	03610-000-00	. DECAL, Contains Important Operating Instructions	1
-16	20398-012-00	. CLAMP . . . . .	2
-17	11248-002-00	. NUT, ESNA 8-32 UNC. . . . .	2
-18	63034-000-00	. BRACKET . . . . .	4
-19	63123-000-00	. REAR KICK RAIL. . . . .	1

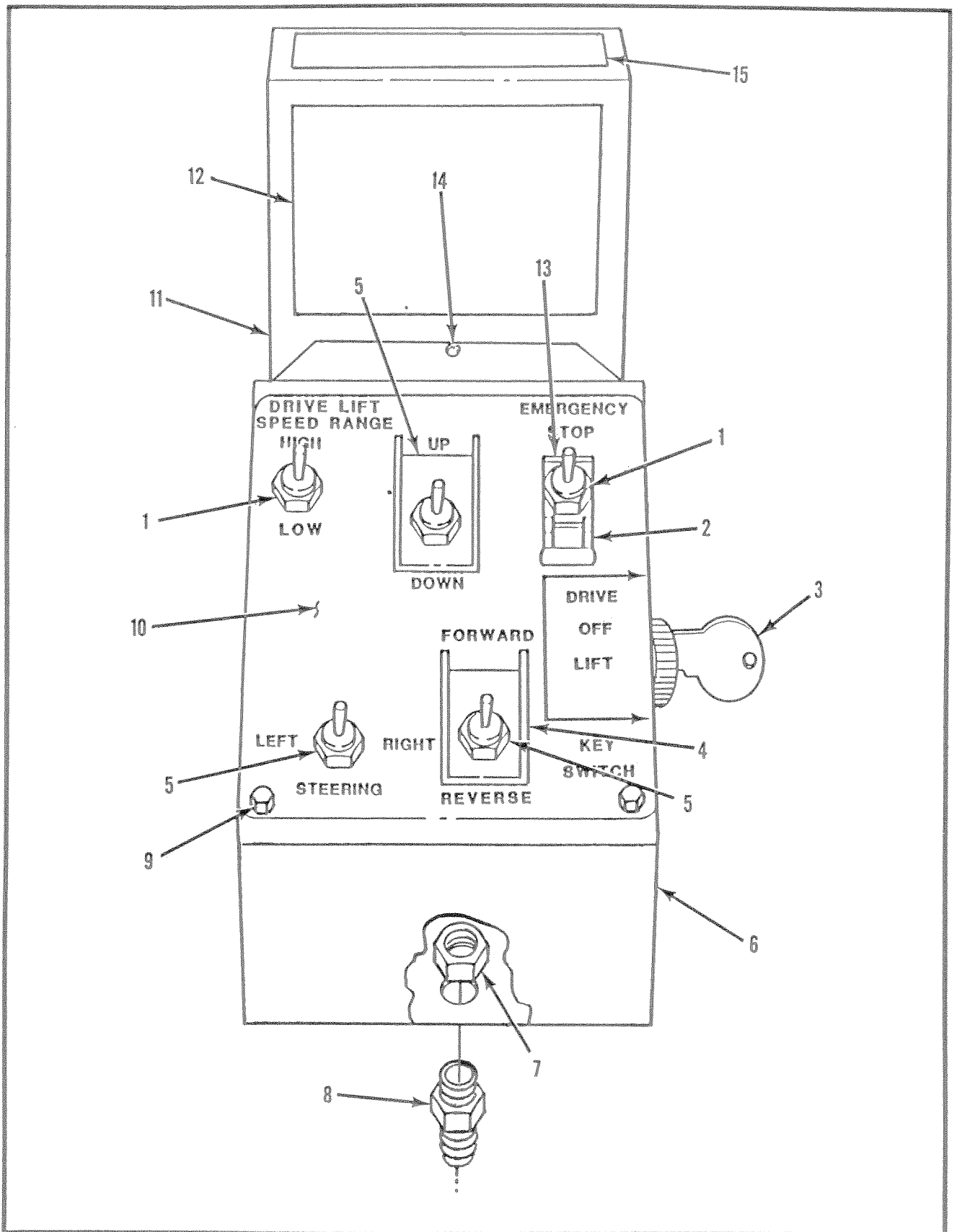
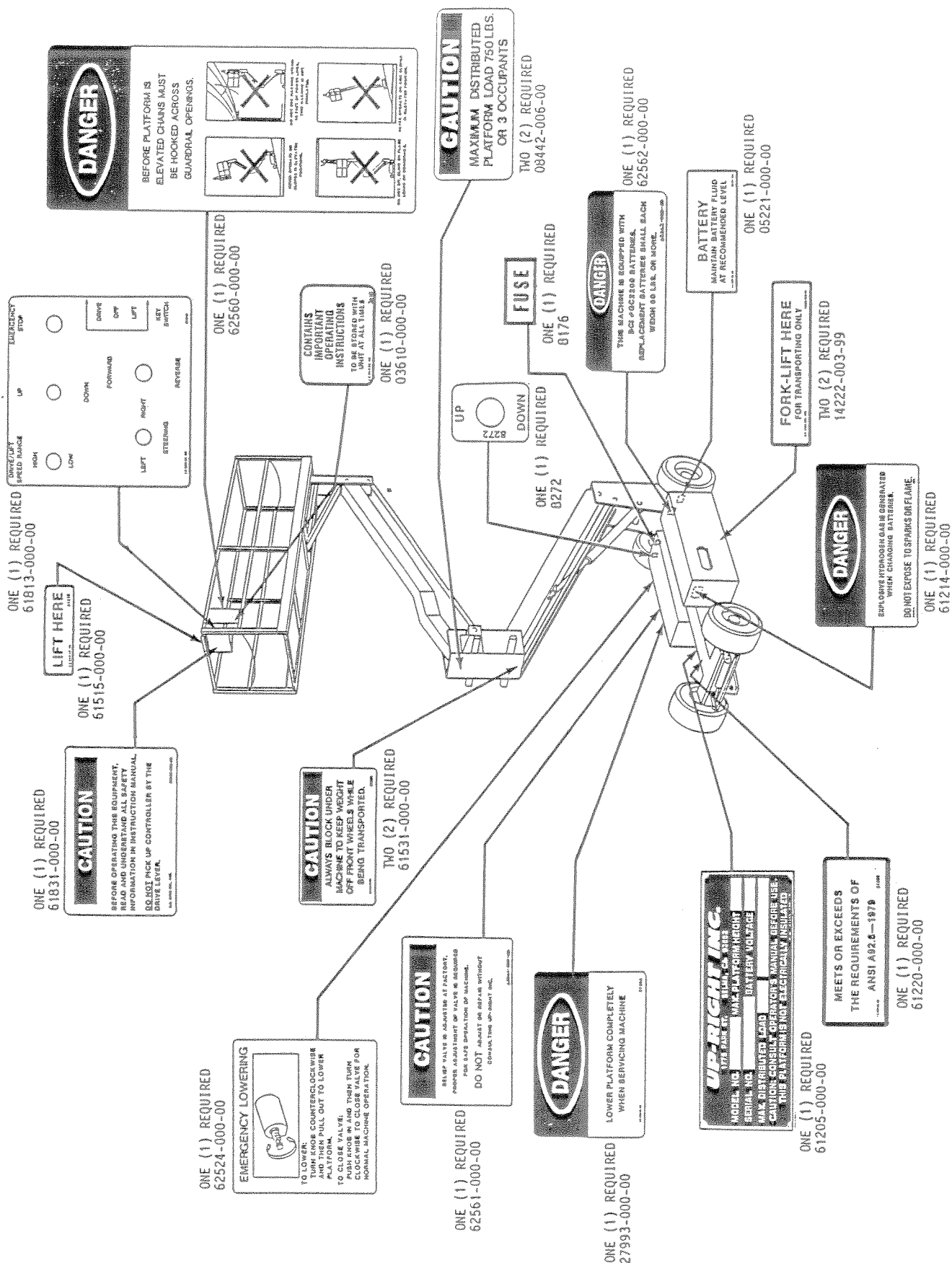


Figure 7-15. Controller Assembly

ITEM	PART	DESCRIPTION	QTY
7-15	63007-000-00	CONTROLLER ASSEMBLY . . . . . (See Figure 7-1 for NHA)	REF
-1	12797-000-00	. SWITCH, Toggle. . . . .	2
-2	29936-006-00	. GUARD, Switch . . . . .	1
-3	15935-000-00	. SWITCH, Key Mode. . . . .	1
-4	08271-000-00	. GUARD, Switch . . . . .	2
-5	12798-000-00	. SWITCH, Toggle. . . . .	3
-6	61809-000-00	. CONSOLE, Controller . . . . .	1
-7	29939-002-00	. LOCKNUT, HEX. . . . .	1
-8	29925-003-00	. CONNECTOR . . . . .	1
-9	14073-006-00	. SCREW, HHC 8-32 UNC 3/4 . . . . .	2
-10	61813-000-00	. DECAL, Controller . . . . .	1
-11	61811-000-00	. HANGER, Controller. . . . .	1
-12	60865-000-00	. DECAL, Caution. . . . .	1
-13	11708-004-00	. SCREW, 8-32 UNC x 1/2 . . . . .	1
-14	11248-002-00	. NUT, HEX 8-32 UNC . . . . .	1
-15	61515-000-00	. DECAL, Lift Here. . . . .	1



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

Figure 7-16. Safety Decal Kit Installation







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