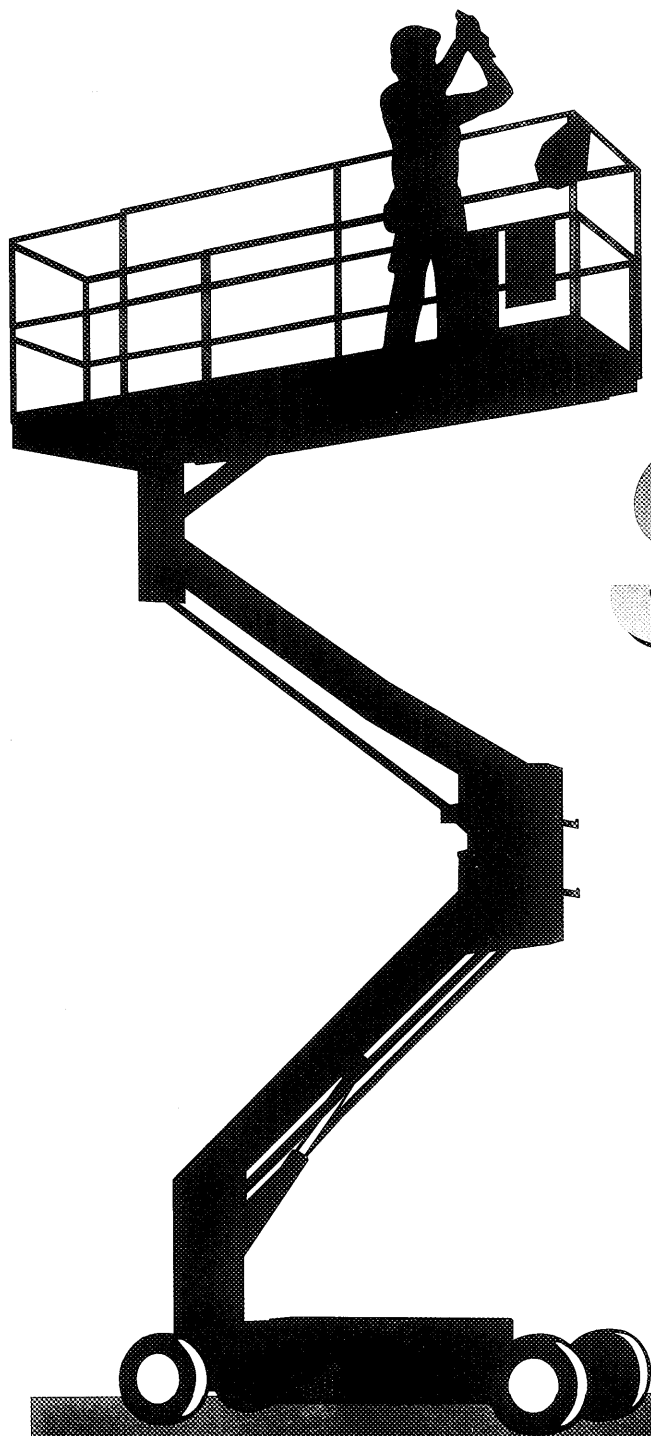


UpRight



SL-20D

Series

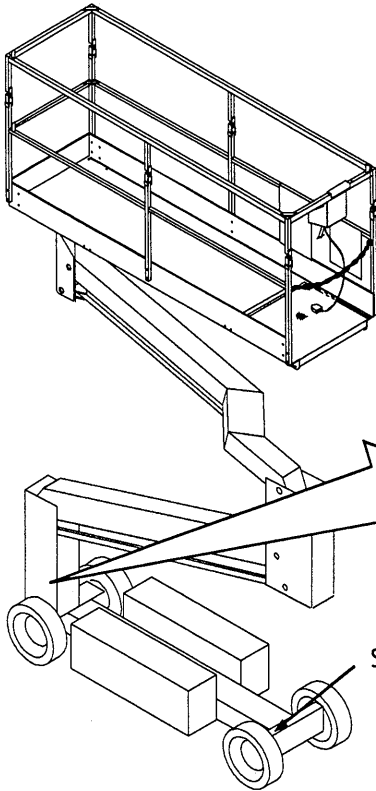
WORK PLATFORM

**Service &
Parts Manual**

SERVICE & PARTS MANUAL

SL-20D Series

Serial Numbers 4300 to current



When contacting UpRight for service or parts information, be sure to include the MODEL and SERIAL NUMBERS from the equipment nameplate. Should the nameplate be missing the SERIAL NUMBER is also stamped on the top right side of the front chassis cross member.

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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	
<small>P/N 61205-000-00</small>	

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5/95 D

Forward

Introduction

HOW TO USE THIS MANUAL

This manual is divided into 7 sections. The first page of each section is marked with a black tab that lines up with one of the thumb index tabs on the right side of this page. You can quickly find the first page of each section without looking through the table of contents which follows this page. The section number printed at the top corner of each page can also be used as a quick reference guide.

SPECIAL INFORMATION

NOTE: Gives helpful information.



DANGER



Indicates the hazard or unsafe practice *will* result in severe injury or death.



WARNING



Indicates the hazard or unsafe practice *could* result in severe injury or death.



CAUTION



Indicates the hazard or unsafe practice could result in *minor* injury or property damage.

WORKSHOP PROCEDURES

CAUTION: Detailed descriptions of standard workshop procedures, safety principles and service operations are not included. Please note that this manual does contain warnings and cautions against some specific service methods which could cause personal injury, or could damage a machine or make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by UpRight Inc., might be done, or of the possible hazardous consequences of each conceivable way, nor could UpRight Inc. investigate all such ways. Anyone using service procedures or tools, whether or not recommended by UpRight Inc., must satisfy themselves thoroughly that neither personal safety nor machine safety will be jeopardized.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at any time without notice. No part of this publication may be reproduced, stored in retrieval system, or transmitted, in any form by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher. This includes text, figures and tables.

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Machine Preparation

2.0

Information on preparation for use & shipment, forklifting, transporting and storage.

Operation

3.0

Operating instructions and safety rules.

Maintenance

4.0

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Troubleshooting

5.0

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Schematics and valve block diagram with description and location of components.

Illustrated Parts Breakdown

7.0

Complete parts lists with illustrations.

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1.0 Introduction

PURPOSE

This manual provides illustrations and instructions for the operation and maintenance of the SL-20D Series Work Platforms manufactured by Up-Right, Inc. Selma, California. (See Figure 1-1).

SCOPE

This manual includes both operation and maintenance responsibilities concerning the SL-20D Series Work Platform's readiness. The Maintenance Section covers scheduled maintenance, troubleshooting, repair, adjustment and replacement.

1.1 General Information

DESCRIPTION

The SL-20D Series Work Platform is a self-propelled aerial work platform designed to be used as a means of elevating personnel and equipment and to provide a mobile work platform. They are designed to provide mobility with the platform in a raised or lowered position. Travel with the platform elevated is automatically limited to the low speed range.

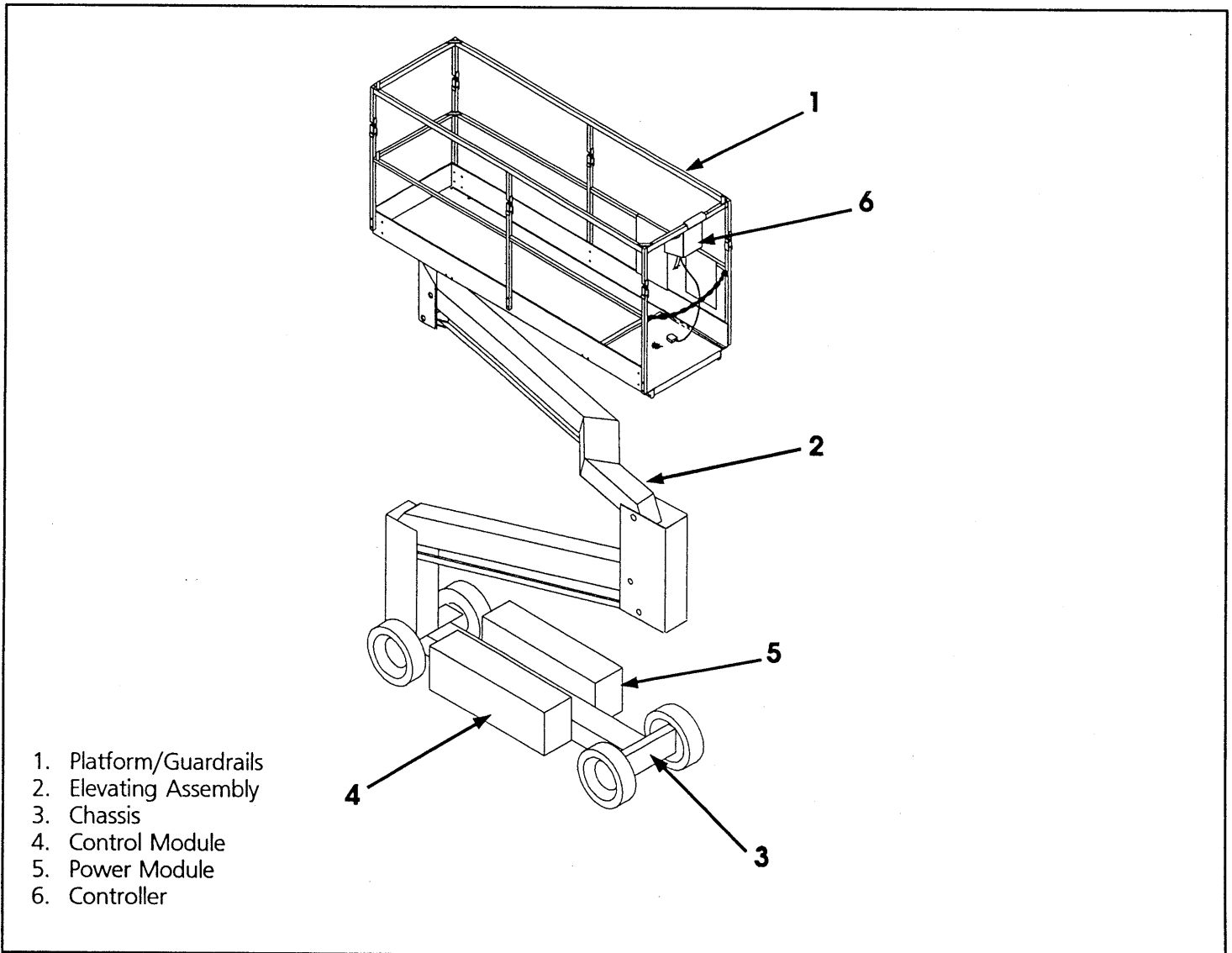


Figure 1-1: SL-20D Series Work Platform

Introduction & Specifications

PURPOSE AND LIMITATIONS

The objective of the SL-20D Series Work Platforms 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 firm level work area. The work platform is intended to be self-propelled when in relatively close proximity to the work area.

1.2 Specifications*

Refer to Table 1-1.

Table 1-1: Specifications

ITEM	SL-20D
Platform Size (inside Toeboards) Standard	30 in. x 98 in. (.76 m x 2.49 m)
Maximum Platform Capacities Standard, With Extension With Cantilever Cage On Extension or Cage	650 lb (294 kg) or two people 550 lb (250 kg) or two people 250 lb (110 kg) or one person
Height Working Height Max. Platform Height Min. Platform Height	26 ft. (7.92 m) 20 ft. (6.10 m) 47 in. (1.19 m)
Weight Standard, With Extension	3,205 lb (1,454 kg)
Dimensions Overall Width Overall Height Overall Length	32.5 in. (.83 m) 94 in. (2.38 m) 98 in. (2.49 m)
Driveable Height	20 ft. (6.10 m)
Surface Speed Platform Lowered Platform Raised	0 to 2.3 mph (0 to 3.70 km/h) 0 to .7 mph (1.13 km/h)
Energy Source	24V battery pack (4-220 ampere hour, 6 Volt batteries, min. wt. 62 lb ea. [28.12 kg]), 4 HP DC electric motor
Battery Charger	25 AMP, 60 Hz 110 VAC
Battery Duty Cycle	25% for 8 Hours
Hydraulic Tank Capacity	4 Gallons [15.2 l]
Lift System	One Single Stage Lift Cylinder
Drive Control	Proportional
Control System	Proportional Controller with Toggle Selector Switch, Red Mushroom Emergency Stop and Foot-Operated Interlock Switch
Horizontal Drive	Dual Rear Wheel
Tires	16 in. (41 cm) diameter Solid Rubber
Parking Brake	Spring Applied, Hydraulic Release Brake Cylinder
Turning Radius	55 in. (1.40 m) Inside
Gradeability	25% (14°)
Wheel Base	62.5 in. (1.59 m)
Guardrails	43.5 in. (1.10 m)
Toeboard	6 in. (150 mm)

*Specifications subject to change without notice.

Read and familiarize yourself with all operating instructions before attempting to operate machine.

2.1 Preparation for Use

WARNING

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

1. Remove the metal banding from the Module covers and Elevating Assembly.
2. Remove the banding from the Controller.
3. Lift the front of the machine and remove banding and blocks from front wheels.
4. Lower machine.
5. Close the Emergency Lowering Valve (Figure 2-1) by pushing in on the knob and turning $\frac{1}{4}$ turn clockwise until the detent engages.
6. Connect the negative battery lead terminal (Figure 2-2).

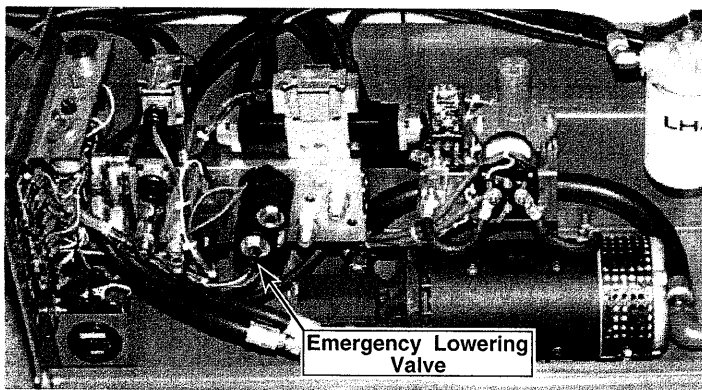


Figure 2-1: Control Module, Right Side

2.2 Preparation For Shipment

1. Lubricate machine per lubrication instructions in Section 4.0, Maintenance.
2. Fully lower the platform.
3. Disconnect the battery negative (-) lead from the battery terminal (Figure 2-2).
4. Band the Controller to the front guardrail.
5. Band the Elevating Assembly to the frame just behind the front wheels.
6. Open the Emergency Lowering Valve.

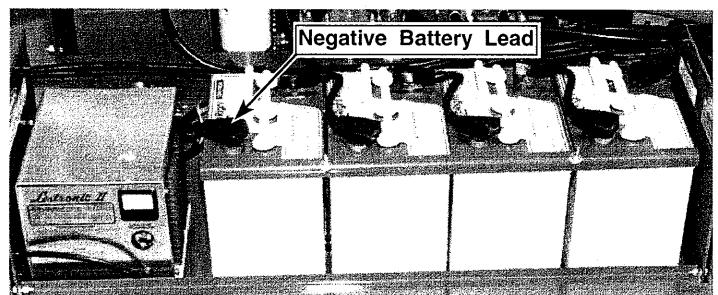


Figure 2-2: Power Module, Left Side

2.3 Forklifting Of Work Platform

NOTE: Forklifting is for transporting only.

CAUTION

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

Forklift from the side by lifting under the Chassis Modules (Figure 2-3).

2.4 Lifting Work Platform

Secure straps to Chassis Lifting Lugs **only** (Figure 2-3).

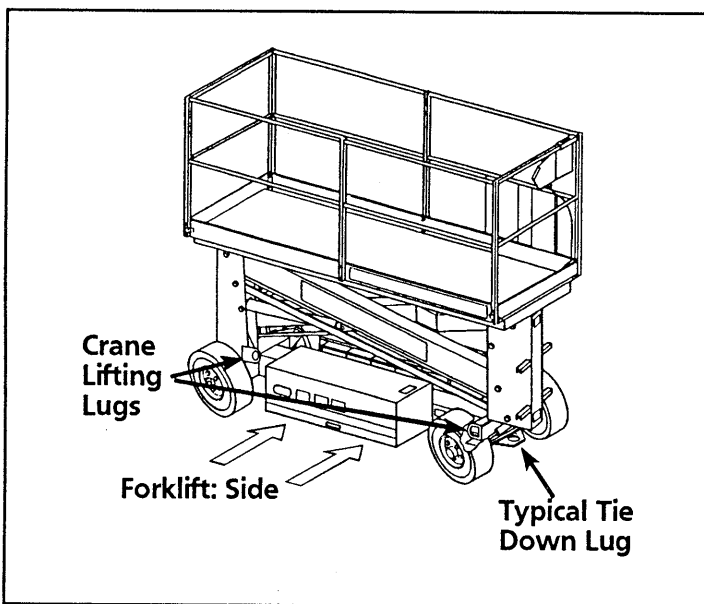


Figure 2-3: Forklift Sockets & Tie Down Brackets

2.5 Transport

1. Maneuver the work platform into transport position and chock wheels.
2. Secure the work platform to the transport vehicle with chains or straps of adequate load capacity attached to the chassis tie down lugs (Figure 2-3).

CAUTION

Tie down lugs are not to be used to lift work platform.

Over-tightening of chains or straps through tie down lugs may result in damage to work platform.

3. Open Emergency Lowering Valve by pushing in on the knob and turning $\frac{1}{4}$ turn counterclockwise.

2.6 Storage

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

PRESERVATION

1. Clean painted surfaces. If the paint surface is damaged, repaint.
2. Fill the hydraulic tank to operating level with the Platform fully lowered, fluid should be visible on the dipstick.
3. Coat exposed portion of extended cylinder rod with a preservative such as multi-purpose grease and wrap with barrier material.
4. Coat all exposed unpainted metal surfaces with preservative.

BATTERIES

1. Disconnect the Battery ground cable terminal and secure to the chassis.
2. Disconnect the remaining battery leads and secure to the chassis.
3. Remove the batteries and place in alternate service.

3.0 Introduction

GENERAL FUNCTIONING

The battery powered electric motor directly drives a two section hydraulic pump. The smaller section supplies oil under pressure to operate steering and joins the larger section flow to provide oil to the other work platform functions. The oil flow is directed to the different functions by electrically activated solenoid valves.

DRIVING

Refer to the Hydraulic and Electrical Schematics, Section 6.

With the Chassis Key Switch turned to **DECK**, both Chassis and Controller Emergency Stop Switches ON, the Drive/Lift Switch on **DRIVE**, and the Foot Switch depressed the machine will drive forward or reverse at a speed proportional to the angle the Control Lever is pushed or pulled.

Driving with the Platform Lowered

Moving the Control Lever to **FORWARD** with the Platform fully lowered will energize the Motor Start Relay, the Forward Coil, and the Proportional Coil to allow oil to flow into the Parking Brake and serially through the Hydraulic Motors. Moving the Control Lever to **REVERSE** is the same as forward except the Reverse Coil is energized causing the Motors to turn in the opposite direction. The Proportional Valve closes or opens in proportion to the movement of the Control Lever from center. As the Proportional Valve closes more oil is allowed to flow to the Forward or Reverse Valves increasing drive speed.

Driving with the Platform Elevated

Raising the Platform (see RAISING THE PLATFORM, below) opens the High Speed Platform Down Limit Switch and closes the Tilt Sensor Down Limit Switch providing power to the Tilt Alarm Relay contacts and to the Tilt Sensor. The Tilt Sensor now provides power to the Tilt Alarm Relay coil, holding the contacts open, as long as the machine is level. Should the machine become un-level while elevated the Tilt Sensor opens the circuit to the Tilt Alarm Relay and the contacts close, providing power to the Tilt Alarm. The High Speed Down Limit Switch limits the output from the Proportional Controller keeping the Proportional Coil from closing fully thus limiting drive speed. When raised driving will be limited to the low speed range.

Steering

At the top of the Control Lever is a momentary rocker switch for steering the machine left and right. With power to the Controller and the Foot Switch depressed, pressing the right or left side of the rocker switch will energize the Right or Left Steering Coil and allow oil to flow through the Steering Valve to the Steering Cylinder. Releasing the rocker switch de-energizes the Steering Coils and holds the Steering Cylinder in position. **The Steering Cylinder will not automatically return to center, the Steering Switch must be activated to change the wheels direction.**

RAISING AND LOWERING PLATFORM

With the Chassis Key Switch turned to **DECK**, both Chassis and Controller Emergency Stop Switches ON, the Drive/Lift Switch on **LIFT**, and the Foot Switch depressed the machine will elevate at a speed proportional to the angle the Control Lever is pushed forward.

Pushing forward on the Control Lever energizes the Proportional Coil, Motor Start Relay, and Up Coil. The greater the angle from center of the Control Lever the more the Proportional Valve closes. As the Proportional Valve closes more oil is allowed to flow through the Lift Valve to the Lift Cylinder increasing lift speed.

Lowering the platform electrically energizes the 60 Hz Motion Alarm and the Down Coil through the Cushion Down Limit Switch. When the Down Coil is energized the oil is allowed to flow out of the Lift Cylinder through the Down Orifice, which controls the rate of descent, then back to the tank. During the last 6-12 inches (153-305 mm) of Platform lowering the Cushion Down Limit Switch switches from the Down Coil to the Cushion Down Coil to slow the Platform even further (Cushion Speed) by diverting oil through a smaller orifice. Lowering the Platform manually with an Emergency Lowering Valve allows the oil to flow out of the Lift Cylinder in the same manner but there is no Down Alarm or Cushion Down.

SAFETY DESIGN

The SL-20D Series Work Platform has the following features to ensure safe operation:

- The drive speed is limited to Creep Speed when operating the work platform while the platform is elevated.
- The platform descent rate is controlled by an orifice (Fixed Speed). In the last 6-12 inches (153-305 mm) of platform lowering, the Cushion Valve is energized to slow the platform even further (Cushion Speed) by diverting oil through a smaller orifice. The lift cylinder is equipped with a velocity fuse to prevent descent should a hose rupture.
- Parking brake is automatically engaged when the Drive Switch is released and the machine comes to a full stop or if power is lost.
- The Chassis Controls and Controller are equipped with an Emergency Stop Switch for stopping all powered functions.
- The Foot Switch must be depressed for the Controller to function.
- The Controller is guarded to prevent inadvertent operation.
- An alarm is provided to signal when the platform is lowering.
- A Lift Switch is located in the Control Module on the right side of the Chassis for lifting and lowering the platform from ground level.
- The Tilt Alarm (600 Hz) is activated on slopes of 2 degrees side to side and fore and aft when the machine is elevated.

- An Emergency Lowering Valve is provided in the Control Module to lower the platform in the event electrical power is lost.
- A grate is provided at the front of the platform to allow viewing of the front wheels by the operator to aid steering.

3.1 Safety Rules and Precautions

Before using the SL-20D Series Work Platform:

NEVER operate the machine within ten feet of power lines. **THIS MACHINE IS NOT INSULATED.**

NEVER elevate the platform or drive the machine while elevated unless the machine is on a firm level surface.

NEVER sit, stand or climb on guardrail or midrail.

NEVER operate the machine without first surveying the work area for surface hazards such as holes, drop-offs, bumps and debris before operating machine.

NEVER operate the machine unless all guardrails are properly in place and secured with all fasteners in place.

SECURE chain across entrance after mounting platform.

NEVER use ladders or scaffolding on the platform.

NEVER attach overhanging loads or increase platform size.

LOOK up, down and around for overhead obstructions and electrical conductors.

DISTRIBUTE all loads evenly on the platform. See Table 1-1 for maximum platform load.

NEVER use damaged equipment. (Contact UpRight, Inc. for instructions.)

NEVER change or modify operating or safety systems.

INSPECT the machine thoroughly for cracked welds, loose hardware, hydraulic leaks, damaged control cable, loose wire connections and wheel bolts.

NEVER climb down elevating assembly with platform elevated.

NEVER perform service on or in the elevating assembly while the platform is elevated without first blocking the elevating assembly.

NEVER recharge batteries near sparks or open flame; batteries that are being charged emit highly explosive hydrogen gas.

SECURE the work platform against unauthorized use by turning key switch off and removing key from key switch.

NEVER replace any component or part with anything other than original replacement parts without manufacturers consent.

3.2 Controls and Indicators

The controls and indicators for operation of the SL-20D Series Work Platform is shown in Figure 3-1. The name and function of each control and indicator are listed in Table 3-1. 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.**

Table 3-1: Controls and Indicators

Platform/Controller

INDEX NO.	NAME	FUNCTION
1	FOOT SWITCH	Provides power to the Controller only when depressed, preventing accidental activation of the Controller.
2	EMERGENCY STOP SWITCH	Push red button to cut off power to all functions (OFF). Pull out to provide power (ON).
3	CONTROL LEVER	Move joy stick forward or backwards to proportionally control Drive Valves and Lift Valve or open Down Valve depending on position of Drive/ Lift Switch.
4	STEERING SWITCH	Moving the momentary rocker switch Right or Left steers the work platform in that direction. Although the Steering Switch is self centering the steering system is not. The wheels must be steered back to straight.
5	DRIVE/LIFT SWITCH	Selecting DRIVE allows the work platform to move forward or reverse. Selecting LIFT allows the platform to raise or lower.

Table 3-1: Controls and Indicators (cont'd.)

Chassis

INDEX NO.	NAME	FUNCTION
6	EMERGENCY STOP SWITCH	Push red button to cut off power to all functions(OFF). Pull out to provide power (ON).
7	CHASSIS LIFT SWITCH	Toggle switch to UP to lift the work platform and toggle switch to DOWN to lower the work platform.
8	KEY SWITCH	Turn Key clockwise to DECK to provide power to Controller and counterclockwise to CHASSIS to provide power to Chassis Controls.
9	VOLT/HOUR METER (OPTIONAL)	Indicates state of battery charge and hours machine has had power ON.
10	EMERGENCY LOWERING VALVE	Push in and turn knob counterclockwise to lower the Platform. To close, push in and turn knob ¼ turn clockwise until detent engages. The platform cannot be raised until this valve is closed.

INDEX NO.	NAME	FUNCTION
11*	DOWN ALARM (60 Hz)	Sounds an audible when the Platform is lowering during normal operation. If the Emergency Lowering Valve is used the alarm does not sound.
12*	TILT ALARM (600 Hz)	Sounds an audible signal when the platform is elevated and on a slope of 2° side to side or fore and aft.

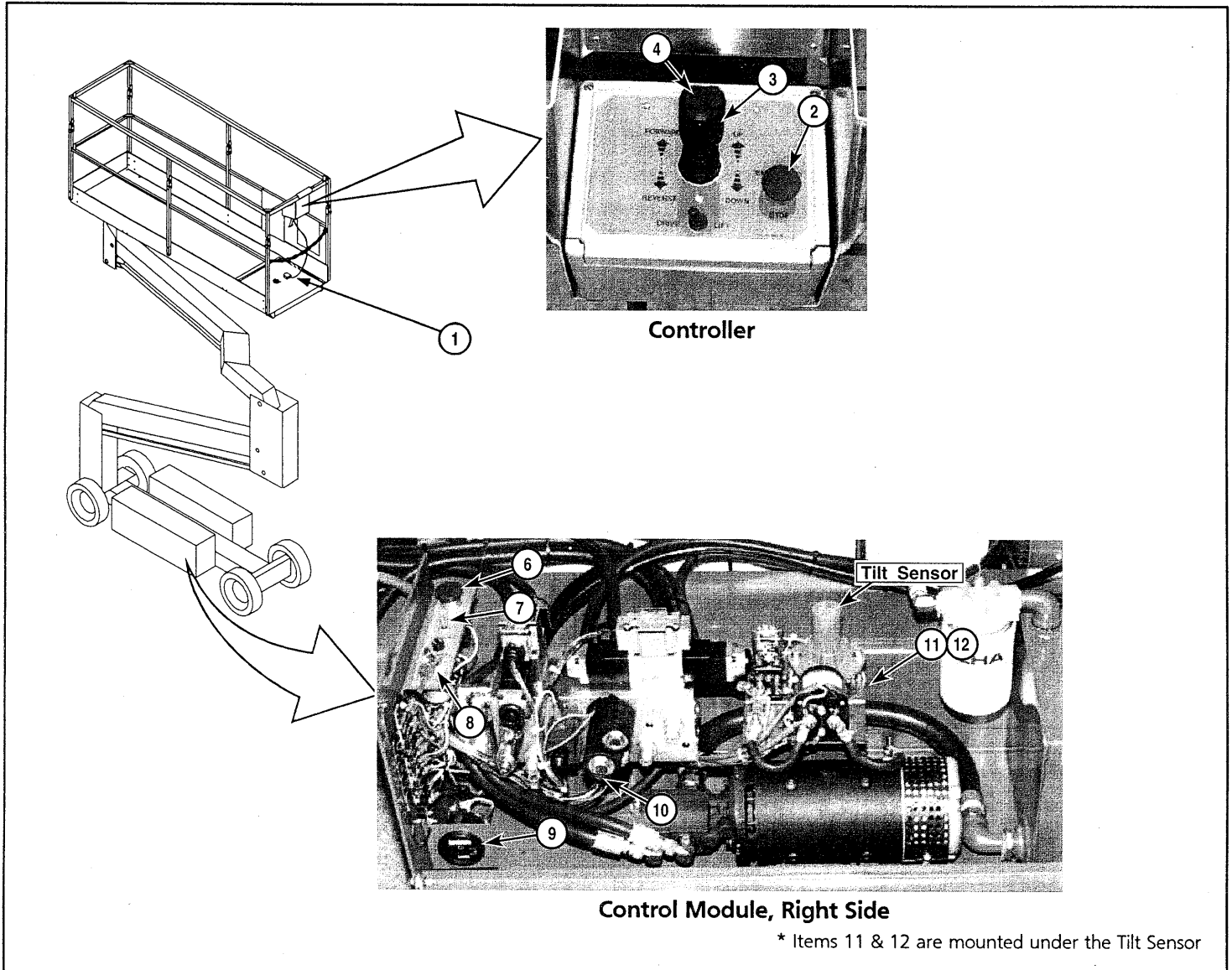


Figure 3-1: Controls and Indicators

3.3 Pre-Operation Inspection

NOTE: Carefully read, understand and follow all safety rules and operating instructions. Perform the following steps each day before use.



WARNING



DO NOT perform service on or in elevating assembly with the platform elevated unless the elevating assembly is properly blocked.

1. Open module covers and inspect for damage, oil leaks or missing parts.
2. Check the level of the hydraulic oil with the platform fully lowered. Oil should be visible on the dipstick (Section 4.4). Add ISO #46 hydraulic oil if necessary.
3. Check that fluid level in the batteries is correct (See *Battery Maintenance, Section 4.3*).
4. Verify batteries are charged.
5. Check that A.C. extension cord has been disconnected from charger.
6. Check that all guardrails are in place, the Slideout Deck Extension is secured with the pins and all fasteners are properly tightened.
7. 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.
8. Turn Chassis and Platform Emergency Stop Switches ON (Figure 3-1) by pulling the button out.
9. Verify that the Controller Power Switch is **ON**.
10. Move machine, if necessary, to unobstructed area to allow for full elevation.
11. Turn the Chassis Key Switch (Figure 3-1) to **CHASSIS**.
12. Push Chassis Lift Switch (Figure 3-1) to **UP** position and fully elevate platform.
13. Visually inspect the elevating assembly, lift cylinder, cables and hoses for damage or erratic operation. Check for missing or loose parts.
14. Check Level Sensor (Figure 3-1) operation by pushing the sensor off of level, the alarm should sound.
15. Partially lower the platform by pushing Chassis Lift Switch to **DOWN**, and check operation of the audible lowering alarm.

16. Open the Chassis Emergency Lowering Valve (Figure 3-1) to check for proper operation by pushing in on the knob and turning 1/4 turn counterclockwise. Once the platform is fully lowered, close the valve by pushing in on the knob and turning 1/4 turn clockwise until the detent engages.
17. Turn the Chassis Key Switch to **DECK**.
18. Close and secure module covers.
19. Check that route is clear of persons, obstructions, holes and drop-offs, is level and capable of supporting the wheel loads.
20. Unhook Controller from guardrail. Firmly grasp Controller hanger and Foot Switch together, in such a manner that the Foot Switch can be depressed, while performing the following checks from the ground.



WARNING



STAND CLEAR of the work platform while performing the following checks.
Protect control console cable from possible damage while performing checks.

21. Position Drive/Lift Switch to **DRIVE**.
22. While depressing Foot Switch, slowly position the Control Lever to **FORWARD** then **REVERSE** to check for speed and directional control. The farther you push or pull the Control Lever from center the faster the machine will travel.
23. Push Steering Switch **RIGHT** then **LEFT** to check for steering control.
24. Push the Emergency Stop Switch Button.
25. Rehook Controller on front guardrail and place Foot Switch on deck.

3.4 Operation

NOTE: Understand the functions of all the controls before operating the machine AND ensure that the Pre-Operation Inspection (Section 3.3) has been completed and any deficiencies corrected.

TRAVEL WITH PLATFORM LOWERED

1. Check that route is clear of people, obstructions, holes and drop-offs, is level and is capable of supporting wheel loads.
2. Verify Chassis Key Switch is turned to **DECK** and Chassis Emergency Stop Switch is **ON**, pull button out.
3. After mounting platform secure chain across entrance. Check that guardrails are properly assembled and in position with the Slideout Deck Extension secured with the pins. Hang Controller on front guardrail.
4. Check clearances above, below and to the sides of platform.
5. Pull Controller Emergency Stop Button out to ON position. When the button is pushed down Emergency Stop Switch will automatically go to OFF position.
6. Position Drive/Lift Switch to **DRIVE**.
7. While depressing Foot Switch, slowly push or pull the Control Lever to **FORWARD** or **REVERSE** position to travel in the desired direction. The farther you push or pull the Control Lever from center the faster the machine will travel.

STEERING

1. Position Drive/Lift Switch to **DRIVE**.
2. While depressing the Foot Switch, push the Steering Switch to **RIGHT** or **LEFT** to turn wheels in the desired direction. Observe the tires while maneuvering the work platform to ensure proper direction.

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

ELEVATING PLATFORM



WARNING



LOOK up and around for obstructions before performing the lift function.

DO NOT elevate the platform unless the work platform is on a firm and level surface.

DO NOT operate the work platform within 10 feet of any electrical lines.

THIS WORK PLATFORM IS NOT INSULATED.

NEVER enter the Elevating Assembly while the platform is elevated.

1. Position Drive/Lift Switch to **LIFT**.
2. While depressing Foot Switch, push Control Lever to **UP**, the farther you push the Control Lever the faster the Platform will elevate.

TRAVEL WITH PLATFORM ELEVATED



WARNING



Travel with platform elevated **ONLY** on firm and level surfaces.

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

1. Check that route is clear of people, obstructions, holes and drop-offs, is level and capable of supporting the wheel loads.
2. Check clearances above, below and to the sides of platform.
3. Position Drive/Lift Switch to **DRIVE**.
4. While depressing Foot Switch, slowly push or pull the Control Lever to **FORWARD** or **REVERSE** position to travel in the desired direction.

LOWERING PLATFORM

1. Position Drive/Lift Switch to **DRIVE**.
2. While depressing Foot Switch, pull Control Lever to **DOWN**.

EMERGENCY LOWERING

The Emergency Lowering Valve is located on the front of the Manifold Assembly on the right side of the machine in the Control Module (see Figure 3-1).

1. Open the Emergency Lowering Valve by pushing in on the knob and turning $\frac{1}{4}$ turn counterclockwise.

Note: the Down Alarm will not sound when using the Emergency Lowering Valve.

2. Once the platform is fully lowered, be certain that the Emergency Lowering Valve is closed again. The platform will not elevate if the Emergency Lowering Valve has not been closed.
3. To close the Emergency Lowering Valve, push in on the knob and turn $\frac{1}{4}$ turn clockwise until the detent engages.

AFTER USE EACH DAY

1. Ensure that the platform is fully lowered.
2. Park the machine on level ground, preferably under cover, secure against vandals, children or unauthorized operation.
3. Turn the Key Switch to **OFF** (center position) and remove the key to prevent unauthorized operation.

BRAKE RELEASE PUMP (OPTIONAL) (FIGURE 3-2)

Perform the following only when the machine will not operate under its own power and it is necessary to move the machine or when towing the machine up a grade or winching onto a trailer to transport.

1. Close the needle valve by turning the knob clockwise.
2. Pump the Brake Release Pump until the Parking Brake Cylinder Rod clears the wheel rotor.
3. The machine will now roll when pushed or pulled.
4. Be sure to open the needle valve and verify that the cylinder rod has extended before the machine is operated.



WARNING



Never operate work platform with the Parking Brake released. Serious injury or damage could result.

Never tow faster than 1 ft./sec. (.3 m/sec.).

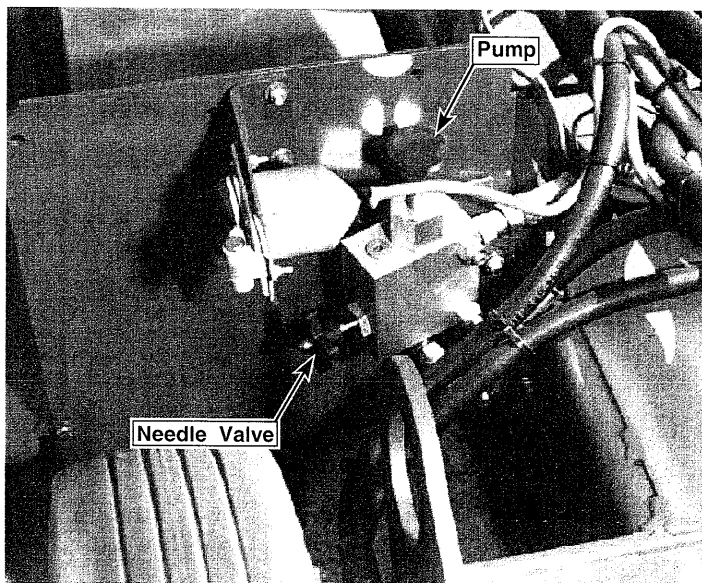


Figure 3-2: Optional Brake Release Pump

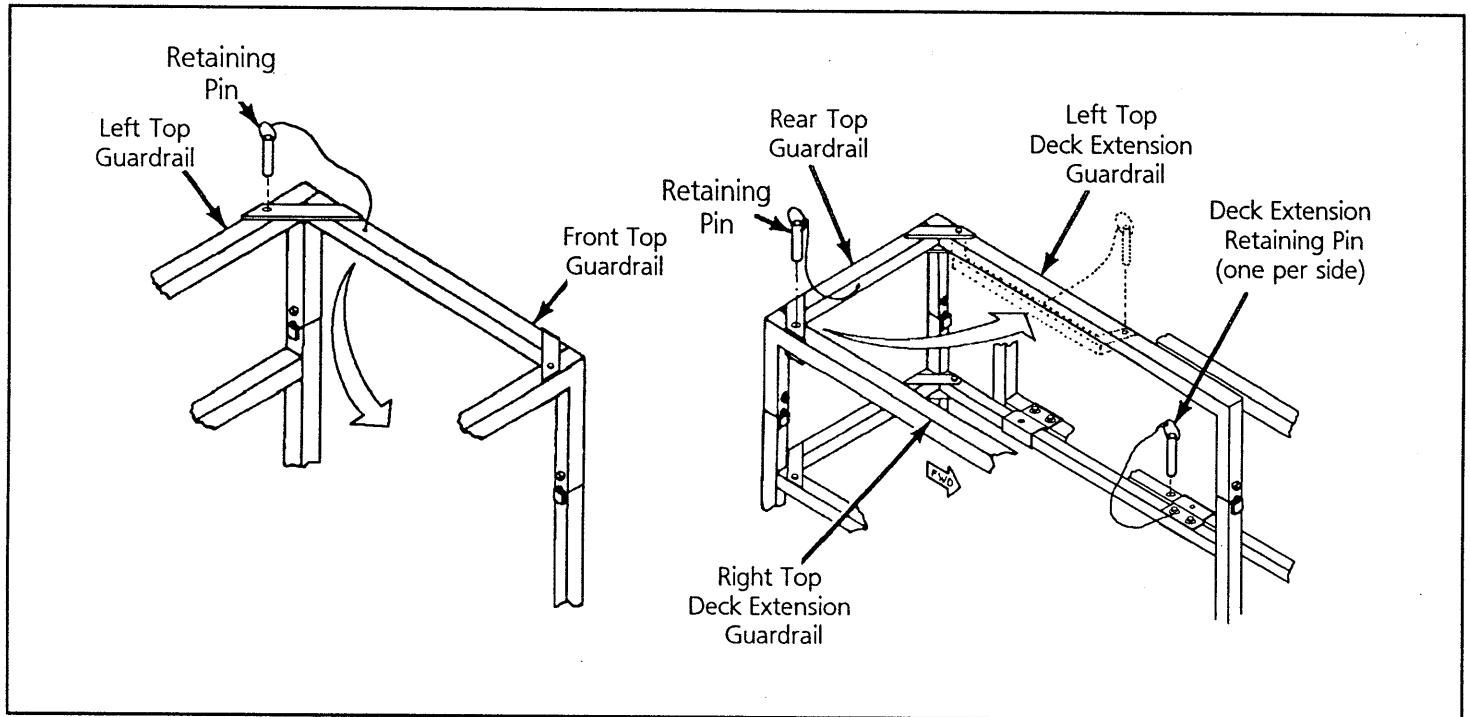


Figure 3-3: Fold Down Guardrails

FOLD DOWN GUARDRAILS (Figure 3-3)

This procedure is only for the purpose of passing through doorways. **Guardrails must be returned to proper position before using the work platform.**

Fold Down Procedure

1. Remove Controller from front guardrail and lay it on the platform deck.
2. Secure Deck Extension with pins.
3. Remove retaining pin at left side of front top guardrail and rotate guardrail into position along right top guardrail and pin in place.
4. Remove retaining pin at right side of rear top guardrail and rotate guardrail into position along left top guardrail and pin in place.
5. Lift up on left top deck extension guardrail until slots disengage from pins and fold guardrail in. Repeat for outer left guardrail.
6. Lift up on right top deck extension guardrail until slots disengage from pins and fold guardrail in. Repeat for outer right guardrail.

Erection Procedure

1. Raise the right top guardrail and push down to engage pins with slots. Repeat for deck extension guardrail.
2. Raise the left top guardrail and push down to engage pins with slots. Repeat for deck extension guardrail.
3. Remove retaining pin securing rear top guardrail to left top guardrail and swing rear top guardrail into place across rear of work platform and pin to right top guardrail.
4. Remove retaining pin securing front top guardrail to right top guardrail and swing front top guardrail into place across front of work platform and pin to left top guardrail.
5. Rehook Controller over top front guardrail.

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4.0

Introduction

This section contains instructions for the maintenance of the SL-20D Series Work Platform. Procedures for the operational checkout adjustment, scheduled maintenance, and repair/removal are included.

Referring to *Section 3.0* will aid in understanding the operation and function of the various components and systems of the SL-20D Series Work Platform and help in diagnosing and repair of the machine.

SPECIAL TOOLS

The following is a list of special tools that are required to perform certain maintenance procedures. These tools may be purchased from your dealer.

Description	Part Number
Tilt Sensor Adjusting Tool	30622-000-00
Inclinometer	10119-000-00
Gauge, 0-600 psi	14124-006-00
Gauge, 0-3000 psi	14124-030-00
Fitting, Quick Disconnect	63965-002-00

4.1 Preventative Maintenance (Table 4-1)

The complete inspection consists of periodic visual and operational checks, together with all necessary minor adjustments to assure proper performance. Complete descriptions of the procedures are in the text following the table.

⚠ WARNING ⚠
<p>Before performing preventative maintenance familiarize yourself with the operation of the machine and block Elevating Assembly whenever it is necessary to enter the Elevating Assembly when the platform is elevated.</p>

Table 4-1: Preventative Maintenance

PAGE NO.	COMPONENT	INSPECTION OR SERVICES	EA. SHIFT	INTERVAL			
				50 HRS. OR 30 DAYS	250 HRS. OR 6 MOS.	1000 HRS. OR 2 YRS.	
4-3	Battery System	Check electrolyte level Check specific gravity Clean exterior Check battery cable condition Charge batteries Clean terminals	X X X	X	X		
4-5	Hydraulic Oil	Check oil level Change filter Drain and replace oil (ISO #46)	X		X		X
	Hydraulic System	Check for leaks Check hose connections Check for exterior wear	X	X	X		
	Emergency Hydraulic System	Open the emergency lowering valve and check for serviceability	X				
	Controller	Check switch operation	X				
	Control Cable	Check the exterior of the cable for pinching, binding or wear	X				
	Platform Deck and Rails	Check fasteners for proper torque Check welds for cracks Check condition of deck	X X X				
	Tires/Wheels	Check for damage Torque wheel nuts/bolts	X X				
4-10	Hydraulic Pump	Wipe clean Check for leaks at mating surfaces Check for hose fitting leaks Check mounting bolts for proper torque	X	X X X			
4-10	Drive Motors	Check for operation and leaks	X				
4-13	Steering System	Check hardware & fittings for proper torque Oil pivot pins Oil king pins Check steering cylinder for leaks & mounting bolts for proper torque		X X X		X	
	Elevating Assembly	Inspect for cracks Check pivot points for wear Check pivot pin retaining rings Check Elevating Assembly for bending	X	X X		X	
4-5		Grease Linkage Gears		X			
	Chassis	Check hoses for pinch or rubbing points Check component mounting for proper torque Check welds for cracks	X X			X	
4-14	Lift Cylinder	Check the cylinder rod for wear Check pivot pin retaining rings Check seals for leaks Inspect pivot points for wear Check fittings for proper torque		X X X X X			
4-17	Entire Unit	Check for and repair collision damage Check fasteners for proper torque Check for corrosion-remove and repaint	X			X X	
4-5		Lubricate		X			
	Labels	Check for peeling or missing labels & replace	X				
4-11	Front Wheels	Repack wheel bearings					X

4.2 Blocking Elevating Assembly (Figure 4-1)

⚠ WARNING ⚠

BEFORE entering Elevating Assembly while performing maintenance on work platform, while elevated, ensure that Elevating Assembly is properly blocked.

DO NOT stand in Elevating Assembly area while installing or removing jack stand.

INSTALLATION

1. Park the work platform on firm level ground.
2. Verify Platform Emergency Stop Switch is ON.
3. Open the Control Panel cover on the Control Module.
4. Turn Chassis Key Switch to **CHASSIS**.
5. Position Chassis Lift/Lower Switch to **UP** and elevate platform approximately four feet (1.2 m).
6. Place a one ton jack stand between the Lower Boom and Chassis just behind the front crossmember. Be careful not to place it on a hydraulic hose.
7. Push Chassis Lift Switch to **DOWN** position and gradually lower platform until Lower Boom is supported by the jack stand.

REMOVAL

1. Push Chassis Lift Switch to **UP** position and gradually raise platform until jack stand can be removed.
2. Remove jack stand.
3. Push Chassis Lift Switch to **DOWN** position and completely lower platform.
4. Close Control Panel cover.

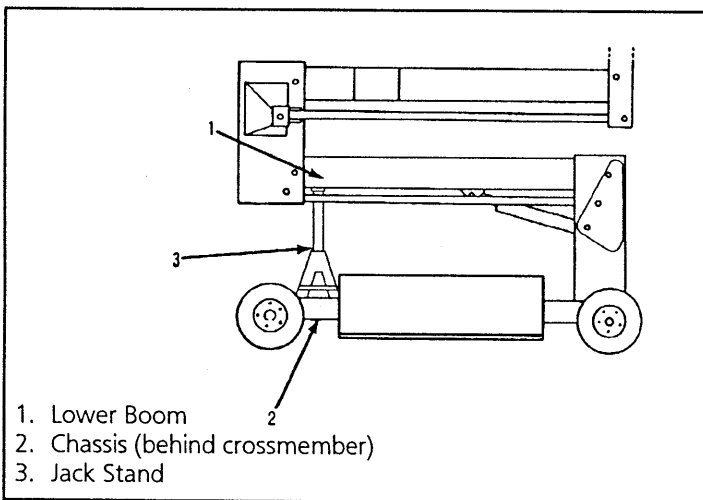


Figure 4-1: Blocking the Elevating Assembly

4.3 Battery Maintenance

Electrical energy for the motor is supplied by four 6 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.

⚠ WARNING ⚠

Hazard of explosive gas mixture. Keep sparks, flame and smoking materials away from batteries.

Always wear safety glasses when working with batteries.

Battery fluid is highly corrosive. Rinse away any spilled fluid thoroughly with clean water.

BATTERY INSPECTION AND CLEANING

Check battery fluid level daily, especially if work platform is being used in a warm, dry climate. If required add distilled water only, use of tap water with high mineral content will shorten battery life.

⚠ CAUTION ⚠

If battery water level is not maintained, batteries will not fully charge, creating a low discharge rate which will damage Motor/Pump unit and void warranty.

Batteries 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.

Clean batteries that show signs of corrosion at the terminals or onto which electrolyte has overflowed during charging. Use a baking soda 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.

BATTERY CHARGING (See Figure 4-2)

Charge batteries at end of each work shift or sooner if batteries have been discharged.

⚠ CAUTION ⚠

Charge batteries in a well ventilated area.

Do not charge batteries when the work platform is in an area containing sparks or flames.

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

Never leave charger operating unattended for more than two days.

Never disconnect cables from batteries when charger is operating.

Keep charger dry.

When night air temperatures fall below 65°F (18°C) batteries charged in unheated areas should be placed on charger 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.

1. Check battery fluid level. If electrolyte level is lower than $\frac{3}{8}$ in. (10 mm) above plates add distilled water only.
2. The plug for the battery charger is located at the left side of the Power Module. Connect plug to properly grounded outlet of proper voltage and frequency.
3. Charger turns on automatically after a short delay, the ammeter will indicate the rate of charge.
4. Charger turns off automatically when batteries are fully charged.

BATTERY CELL EQUALIZATION

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 distilled 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.

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.

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.

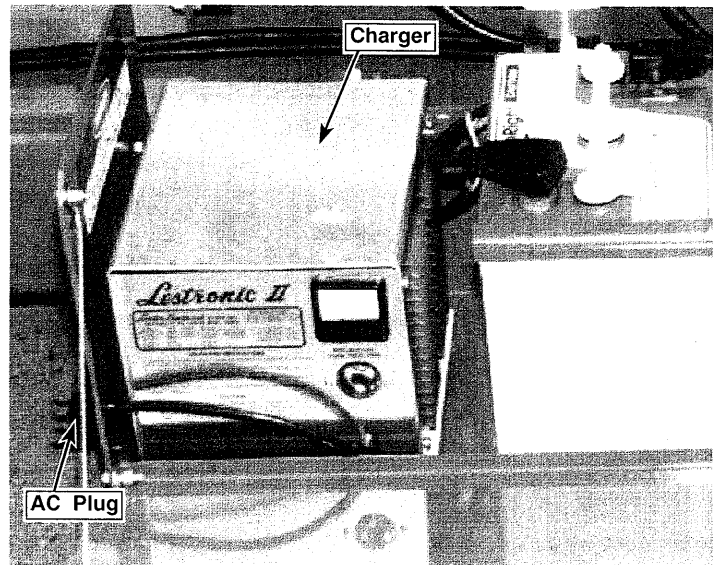


Figure 4-2: Battery Charger

4.4 Lubrication

Refer to Figure 4-3 for location of items that require lubrication service. Refer to the appropriate sections for lubrication information on the Hydraulic Oil Tank and Filter and Front Wheel Bearings.

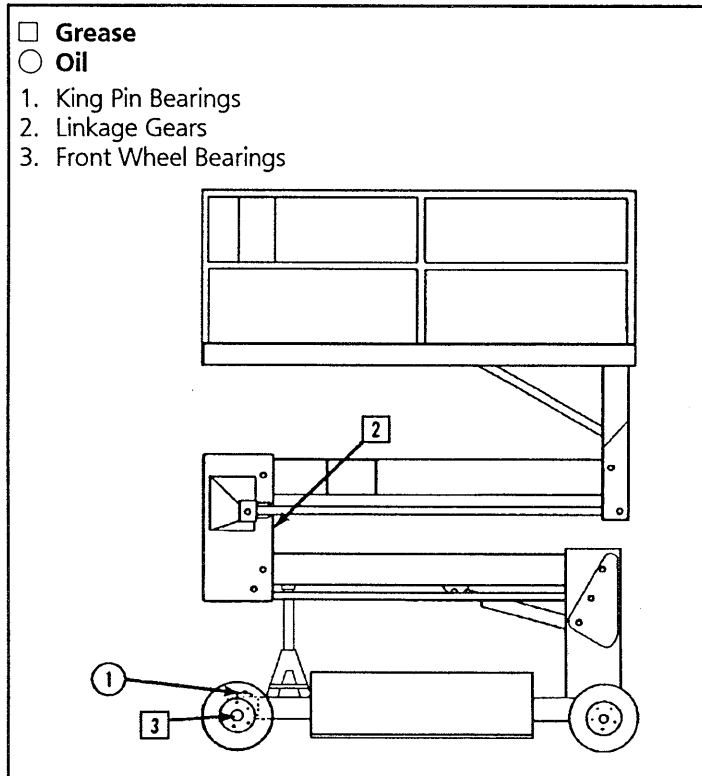
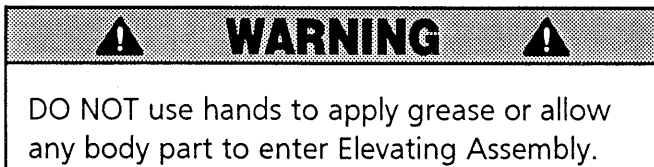


Figure 4-3: Lubrication Points

LINKAGE GEARS

1. Raise Platform fully.
2. Using another work platform or a free standing ladder get up high enough to comfortably reach gears.
3. Use a long handled brush to apply multi-purpose grease to the face of the gears.



4. Lower platform after greasing.

KING PINS

Apply one or two drops of motor oil to each king pin bearing.

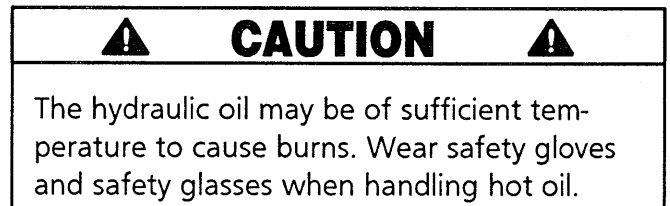
HYDRAULIC OIL TANK AND FILTER (Figure 4-4)

Fluid Level

With Platform fully lowered, oil should be visible on the Dipstick, if not fill the tank until oil registers on the Dipstick. **DO NOT** fill above the upper line or when the Platform is elevated.

Oil and Filter Replacement

1. Operate the work platform for 10-15 minutes to bring the hydraulic oil up to normal operating temperature.



2. Provide a suitable container to catch the drained oil. Hydraulic tank has a 4 gallon (15 l) capacity.
3. Remove the drain plug and allow all oil to drain.
4. Reinstall the drain plug.
5. Unthread the filter from the filter head.
6. Apply a thin film of clean hydraulic oil (ISO #46) to the gasket of the replacement filter.
7. Thread the replacement filter onto the filter head until the gasket makes contact then rotate the filter 3/4 of a turn further.
8. Fill the hydraulic tank with ISO #46 hydraulic oil. Hydraulic tank has a 4 gallon (15 l) capacity.
9. Recycle used oil through a reputable dealer.

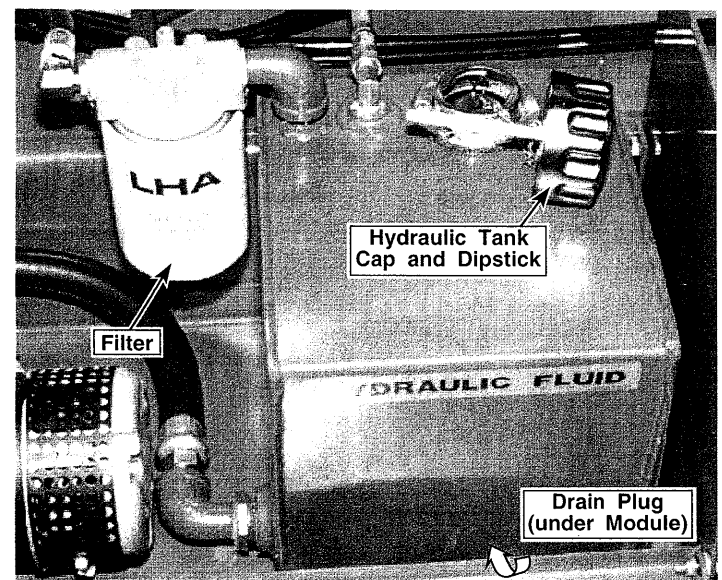


Figure 4-4: Hydraulic Oil Tank and Filter

4.5 Setting Hydraulic Pressures (Figure 4-5)

Check the hydraulic pressures whenever the pump, manifold or relief valve have been serviced or replaced.

WARNING

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

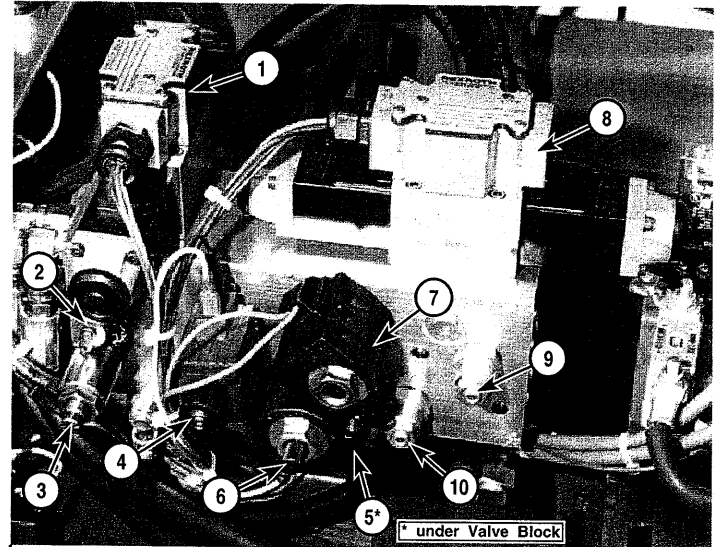
The oil in the hydraulic system is under very high pressure which can easily cause severe cuts. **Obtain medical assistance immediately if cut by hydraulic oil.**

MAIN RELIEF VALVE (Figure 4-5)

1. Operate the hydraulic system 10-15 minutes to warm the oil.
2. Loosen locknut or remove cover on the Main Relief Valve and turn adjusting screw counterclockwise two full turns.
3. Place the maximum rated load, see *Table 1-1*, on the platform.
4. Turn the Chassis Key Switch to **CHASSIS**. Position the Chassis Lift Switch to **UP** position and hold it there.
5. Slowly turn the Main Relief Valve adjusting screw clockwise to increase the pressure until the platform just begins to raise (approximately 2000 psi (138 bar)).
6. Release the Chassis Lift Switch. Tighten locknut or replace Main Relief Valve cover and torque to 6 Ft/Lbs (8 Nm).

COUNTERBALANCE VALVES (Figure 4-5)

1. Operate the work platform for 10-15 minutes to bring the hydraulic oil up to normal operating temperature.
2. Remove Gauge Port Cap and install the 0-600 psi (0-50 bar) pressure gauge assembly.
3. Remove the red Control Cable wire from terminal #9.
4. Lift work platform and block rear wheels off ground.
5. Loosen the locknuts on Counterbalance Valves.
6. With the Chassis Key Switch on **DECK** and the Drive/Lift Switch in **DRIVE** depress the Foot Switch and slowly pull the Control Lever to **REVERSE** to drive the wheels.



- | | |
|-----------------------|----------------------------------|
| 1. Steering Valve | 6. Down/Emergency Lowering Valve |
| 2. Gauge Port | 7. Lift Valve |
| 3. Main Relief | 8. Drive Valve |
| 4. Proportional Valve | 9. Forward Counterbalance Valve |
| 5. Cushion Down Valve | 10. Reverse Counterbalance Valve |

Figure 4-5: Hydraulic Manifold

7. Adjust the Forward Counterbalance Valve by turning the adjustment screw clockwise until the pressure gauge indicates 400 psi (27.58 bar), then slowly turn the screw counterclockwise until the gauge indicates 350 psi (24.13 bar).
8. Slowly push the Control Lever to **FORWARD** to drive the wheels.
9. Adjust the Reverse Counterbalance Valve by turning the adjustment screw clockwise until the pressure gauge indicates 400 psi (27.58 bar), then slowly turn the screw counterclockwise until the gauge indicates 350 psi (24.13 bar).
10. Check the settings by slowly moving the Control Lever **FORWARD**, then **REVERSE** checking the gauge to ensure pressures are properly set. Readjust as needed.
11. Tighten locknuts on valves to 6 Ft/Lbs (8 Nm). Remove blocks and lower work platform to ground.
12. Reconnect the red Control Cable wire to terminal #9.
13. Remove the gauge from the gauge port and reinstall cap.
14. Check for proper operation of the drive system and brake.

4.6 Switch Adjustments

TILT SENSOR (Figure 4-6)

1. Place machine on firm level surface $\pm 1/4^\circ$.
3. Use the Inclinometer (P/N: 10119-000-00) to ensure front and rear of Chassis is level $\pm 1/4^\circ$.
4. Open Control Module cover and place the Tilt Sensor Adjusting Tool (P/N: 30622-000-00) on the Tilt Sensor.
5. Adjust the three leveling screws until the bubble is centered in the circle.
6. Remove the Adjusting Tool and close the Module cover.

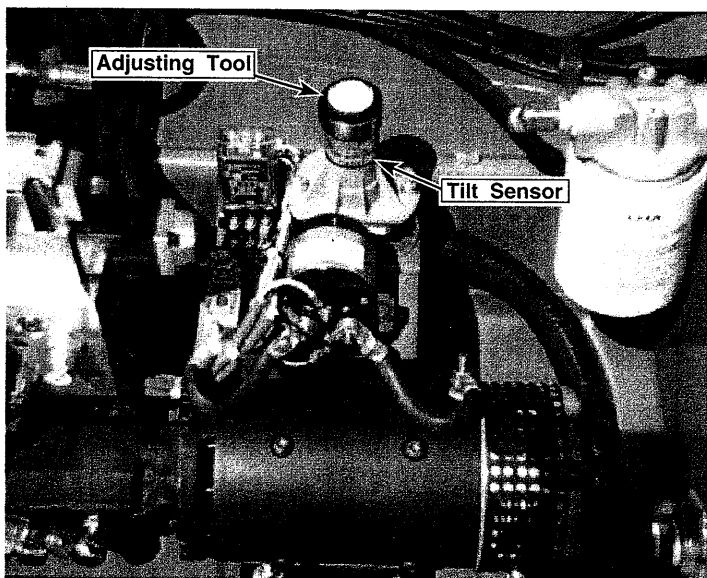


Figure 4-6: Tilt Sensor Adjustment

PROPORTIONAL CONTROL ADJUSTMENT (Figure 4-7)

To perform the adjustment the Controller (Control Box) must be opened by removing the two screws at the top corners of the Controller and rotating the top forward to expose the proportional controller.

1. Push Control Lever just far enough to illuminate the **PWM** LED indicator.
2. Set the Lo pot so the motor turns on when the LED lights up but the machine does not move.
3. Place an ammeter in series with the Proportional Coil (See Figure 4-7).
4. Verify Platform is fully lowered.
5. Select Drive with Drive/Lift Switch.
6. Push Control Lever fully to **FORWARD** or **REVERSE** and check that machine speed is 20 ft. (6.1 m) in 5-6 seconds.
7. Adjust **HI** trim pot if required, turning clockwise increases speed.
8. Select Lift with Drive/Lift Switch and elevate platform 12-18 inches (.30-.46 m).
9. Push Control Lever fully to **FORWARD** or **REVERSE** and check that machine speed is 20 ft. (6.1 m) in 18-22 seconds.
10. Adjust **MID** trim pot if required.

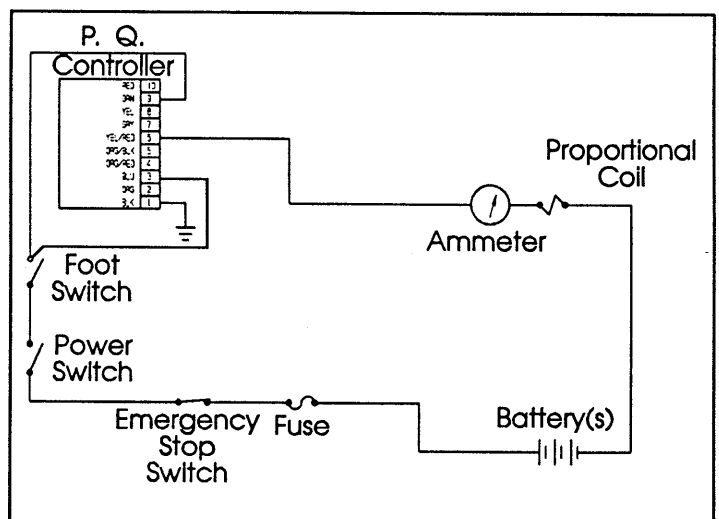


Figure 4-7: Proportional Control Test Circuit

4.7 Hydraulic Manifold (Figure 4-8)

Though it is not necessary to remove the manifold to perform all maintenance procedures, a determination should be made as to whether or not the manifold should be removed before maintenance procedures begin.

REMOVAL

1. Remove the battery ground cable.
2. Tag and disconnect the solenoid valve leads from the terminal strip.
3. Tag, disconnect and plug hydraulic hoses.
4. Remove the locknuts, jam nut and bolts that hold the manifold to the mounting bracket.
5. Remove manifold block.

DISASSEMBLY

NOTE: Mark all components as they are removed so as not to confuse their location during assembly. Refer to Figure 4-8 often to aid in disassembly and assembly.

1. Remove coils from solenoid valves.
2. Remove spool valve covers and spool valves.
3. Remove solenoid valves, Main Relief Valve and Counterbalance Valves.
4. Remove fittings, plugs, springs, balls and orifices.

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 scoring 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 unserviceable.

ASSEMBLY

Note: Lubricate all O-rings before installation to prevent damage to O-rings. Seat all balls in manifold block by lightly tapping on the ball with a brass drift.

1. Install fittings, plugs, springs, balls and orifices. Use one drop of Locktite #242 on each screw-in orifice.
2. Install Counterbalance Valves, Main Relief Valve, solenoid valves and spool valves.

Note: torque cartridge and spool valves to 25 ft. lbs. (34 Nm).

3. Install coils on solenoid valves.

Note: torque coil retaining nuts to 4-5 ft. lbs. (5.4-6.8 Nm).

INSTALLATION

1. Attach manifold assembly to mounting plate with bolts, jam nut and locknut.

Note: Longer bolt, washers and jam nut go in hole nearest the left end of the manifold. Secure all ground wires with locknut.

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. Adjust all hydraulic pressures according to instructions in Section 4.5.

Maintenance

1. Gage Connector
2. Valve Manifold
3. Cushion Orifice, .030
4. Down Orifice, .062
5. Orifice
6. Main Relief Cartridge
7. Proportional Valve Solenoid
8. 90° Elbow Fitting
9. Orifice
10. Counterbalance Valve
11. Spring
12. Lift Valve Solenoid
13. Steering Valve Solenoid
- 14.
15. Drive Valve Solenoid
- 16.
- 17.
18. Plug, #6
19. Plug, #4
20. Plug, #2
21. Adaptor Fitting
22. Fitting Plug
23. 90° Elbow Fitting
24. Ball, $\frac{5}{16}$ (8 mm)*
25. Spring
- 26.
- 27.
28. Down Valve Solenoid & Emergency Lowering Valve
29. Cushion Down Valve Solenoid
- 30.
31. 90° Elbow Fitting
- 32.
33. Spring*
34. Cap Screw (8)
35. Drive Plug

* One each added after machine serial number 4590.

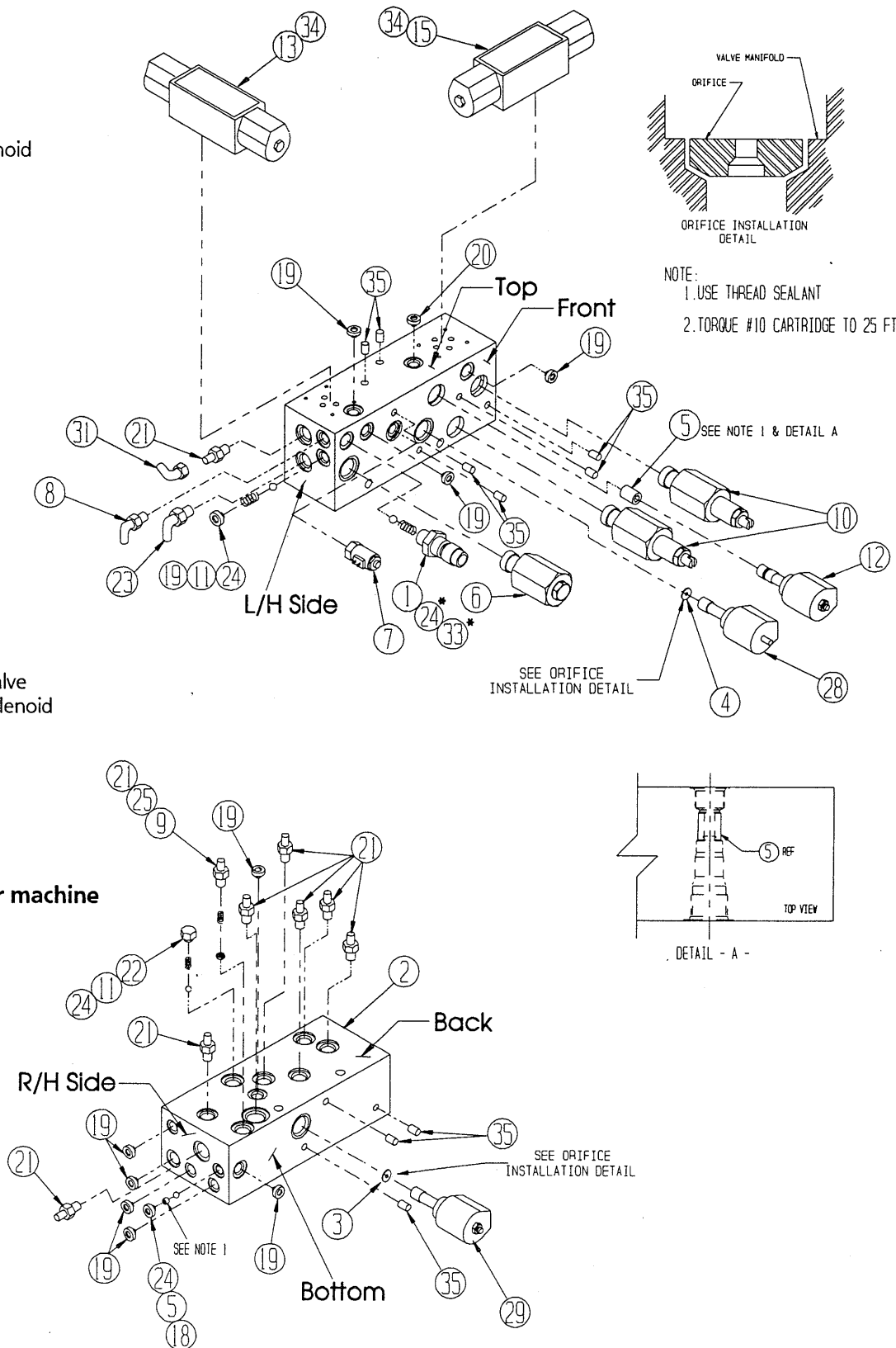


Figure 4-8: Hydraulic Manifold, Exploded View

4.8 Hydraulic Pump (Figure 4-9)

REMOVAL

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.
2. Loosen the capscrews and remove the pump assembly from the motor.

INSTALLATION

1. Lubricate the pump shaft with general purpose grease and attach the pump to the motor with the capscrews.
2. Using a criss-cross pattern torque each capscrew a little at a time until all capscrews are torqued to 20 Ft/Lbs (27 Nm).
3. Unplug and reconnect the hydraulic hoses.
4. Check the oil level in the hydraulic tank before operating the work platform.

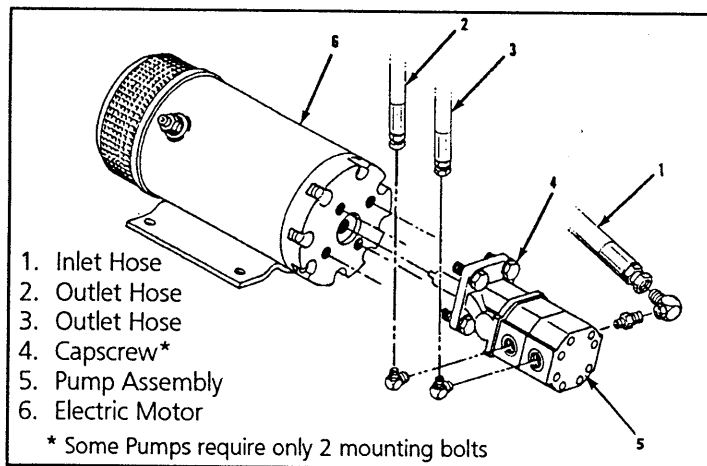


Figure 4-9: Hydraulic Pump

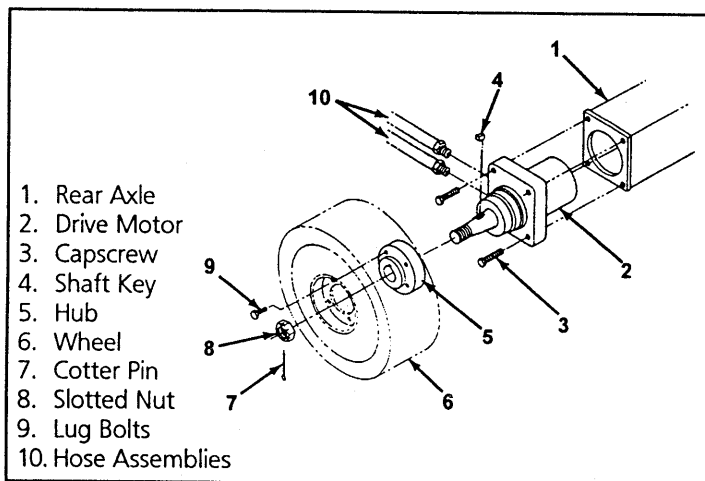


Figure 4-10: Drive Motor Installation

4.9 Hydraulic Drive Motors and Hubs (Figure 4-10)

REMOVAL

1. Park the work platform on firm level ground then block the front wheels to prevent the work platform from rolling.
 2. Loosen the wheel lug bolts on the appropriate wheel.
 3. Use a 1.5 ton capacity jack to raise the rear axle. Install support blocks or jackstand of adequate capacity to prevent the work platform from falling if the jack fails.
 4. Remove the wheel lug bolts and wheel.
 5. Remove the cotter pin, locknut, hub and the shaft key. If necessary use a wheel puller to remove hub.
- NOTE: Before disconnecting hoses, thoroughly clean off all outside dirt around fittings. (After disconnecting hoses and before removing from vehicle, IMMEDIATELY plug port holes.)**
6. Tag, disconnect and plug the hose assemblies to prevent foreign material from entering.
 7. Remove the capscrews and drive motor from the axle.

INSTALLATION

1. Referring to Figure 4-10, position the drive motor in the axle and secure with capscrews.
2. Remove the plugs from the hose assemblies and connect to the drive motor.
3. Install the shaft key, hub and slotted nut. Torque the slotted nut to 140 to 160 Ft/Lbs (190-217 Nm). Install a new cotter pin, **DO NOT** back-off the nut to install the cotter pin.
4. Install the wheel with lug bolts onto the hub. Torque to 80 Ft/Lbs (108 Nm).
5. Remove blocks, lower the jack and remove. Operate the drive system and check for leaks.
6. Drive machine for 20 minutes and retorque wheel lug bolts and check for leaks.

4.10 Wheel Bearings (Figure 4-11)

REMOVAL

1. Loosen the wheel lug nuts, then using a 1.5 ton capacity jack, raise the work platform until the axle is off the ground.
2. Install support blocks or jackstand of adequate capacity to prevent the work platform from falling if the jack fails.
3. Remove the wheel lug nuts and the wheel.
4. Remove the dust cap.
5. Remove the cotter pin.
6. Remove the hub nut and washer.
7. Slide the entire hub assembly from the spindle and place on clean surface.
8. Remove the outside bearing cone and place on clean surface.
9. Remove the grease seal and the inside bearing cone.

Examine the bearing cups. If they are smooth, shiny and free of pits or any surface irregularities, **DO NOT** remove them.

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

INSTALLATION

1. Position the replacement bearing cup over the opening in the hub assembly then position the worn cup over the replacement so that the bearing surfaces face each other. Use the old bearing cone 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 inside bearing cone with multi-purpose grease and position it within the rear bearing cup in the hub assembly. Install the new grease seal.
4. Apply a thin coating of multi-purpose grease to the spindle to protect the grease seal then slide the hub assembly onto the spindle.
5. Pack the outside bearing cone with multi-purpose grease and slide it onto the spindle until it seats in the outer bearing cup.
6. Install the washer and hub nut. Tighten the hub nut, while rotating the assembly, until the hub drags then back the nut to the first slot that aligns with the cotter pin hole in the spindle.
7. Install a new cotter pin and bend the end up over the hub nut and the spindle.
8. Install the cap and wheel/tire assembly. Torque the lug nuts to 80 Ft/Lbs (108 Nm).
9. Remove blocks and lower work platform to the ground.
10. Drive machine for 20 minutes and retorque wheel lug nuts and check for leaks.

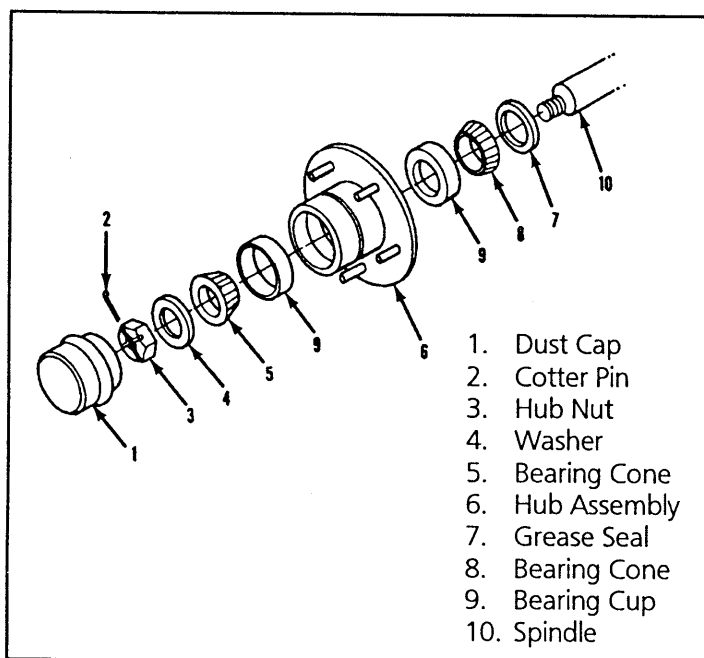


Figure 4-11: Wheel Bearings

4.11 Brake Cylinder (Figure 4-12)

REMOVAL

1. Block the wheels to prevent the work platform from rolling when the brake is removed.
2. Disconnect the hose assemblies and cap the openings to prevent foreign material from entering.
3. Remove the locknuts and washers that mount the cylinder to the chassis.

DISASSEMBLY

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

1. Remove fittings from cylinder barrel.
2. Remove the retainer and withdraw the shaft and all attached components from the cylinder barrel.
3. Remove the head cap from the shaft then remove the wiper, shaft seal and seals from the head cap.
4. Unscrew the piston from the shaft and remove the static seal. Remove the piston seal from the piston.
5. Remove the spring and stop tube from the cylinder barrel.

CLEANING AND INSPECTION

1. Clean all metal parts in solvent and blow dry with filtered compressed air.
2. Check all threaded parts for stripped or damaged threads.
3. Check the bearing surfaces inside of the head cap, outer edge surface of the piston, inside of the cylinder barrel and the shaft for signs of scoring or excessive wear.
4. Check the spring for cracks.

5. Replace any parts found unserviceable.

6. Discard all seals.

ASSEMBLY AND INSTALLATION

1. Install the piston seal on the piston then assemble the static seal, shaft and piston.
2. Position the spring and stop tube on the shaft assembly.
3. Lubricate the piston seal with clean hydraulic fluid, then install the shaft assembly in the cylinder barrel.
4. Lubricate the seals with clean hydraulic fluid and install on the head cap.
5. Install the shaft seal and wiper within the head cap.
6. Lubricate entire assembly's seals and the shaft seal and wiper with clean hydraulic fluid then install the head cap onto the shaft and into the cylinder barrel.
7. Secure with retainer.
8. Position the brake cylinder assembly on the chassis so that the shaft fully engages the brake disc, however the shaft must clear the brake disc once retracted. Secure with washers and locknuts.
9. Connect the hose assemblies.
10. Operate the drive circuit and check that the shaft retracts and clears the brake disc. Check for leaks.

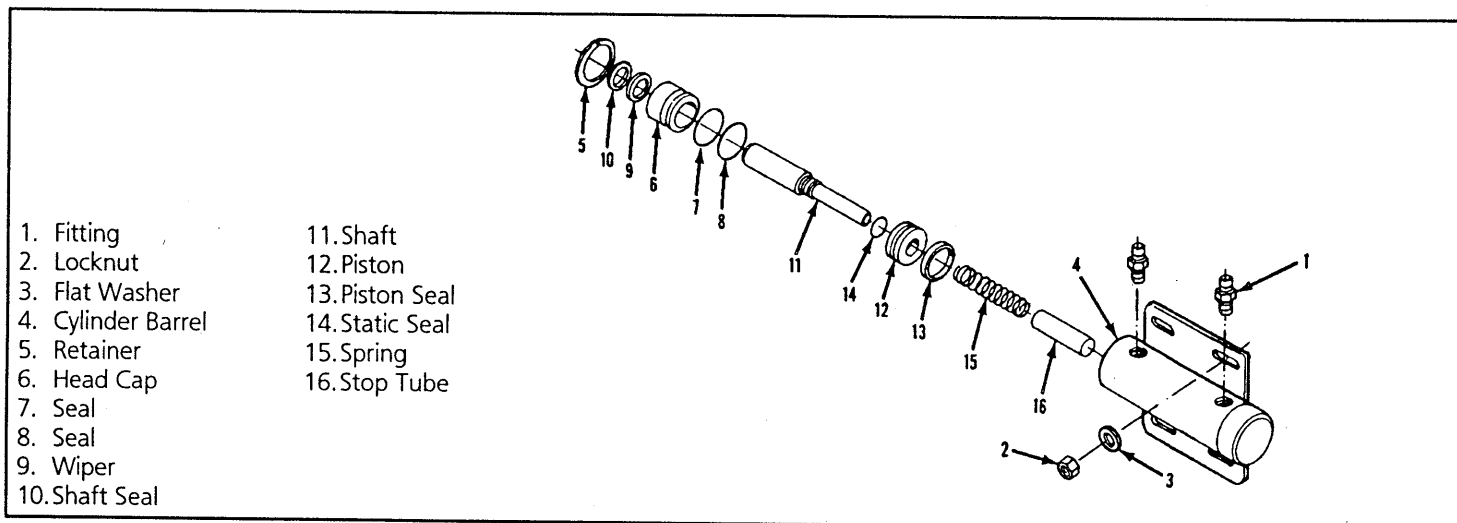


Figure 4-12: Brake Cylinder

4.12 Steering Cylinder (Figure 4-13)

REMOVAL

1. Mark and disconnect the hose assemblies from the fittings and immediately cap the openings to prevent foreign material from entering.
2. Remove the locknuts and capscrews that secure the cylinder assembly.

DISASSEMBLY

1. Remove the headcap from the barrel tube.
2. Withdraw the piston and shaft assembly from the barrel tube.
3. Remove the piston nut, piston and headcap.
4. Remove the rod wiper, rod seal, and static seal from the headcap and discard the seals.
5. Remove the piston seal and piston rod seal from the piston and discard.

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 for scoring or excessive wear.
4. Check the piston and headcap for scoring or excessive wear.
5. Inspect the surface of the shaft for scoring or excessive wear.

ASSEMBLY AND INSTALLATION

1. Lubricate and install new rod seal, rod wiper and static seal on the headcap.
2. Install the headcap onto the shaft from the piston end.

Note: installing the headcap over the pivot hole in the shaft could damage the seals.

3. Install a new piston seal and piston rod seal on the piston.
4. Install the piston on the shaft and secure with the piston nut, torque to 150 In/Lbs (16.95 Nm).
5. Lubricate the piston seal with clean hydraulic fluid and install the shaft assembly in the cylinder barrel.
6. Screw headcap into cylinder barrel hand tight then turn ¼ turn further.
7. Position the cylinder assembly on the chassis and secure with capscrews and locknuts.
8. Connect the hose assemblies to the fittings.
9. Operate the steering circuit several times throughout its entire range of travel to expel trapped air and check for leaks.

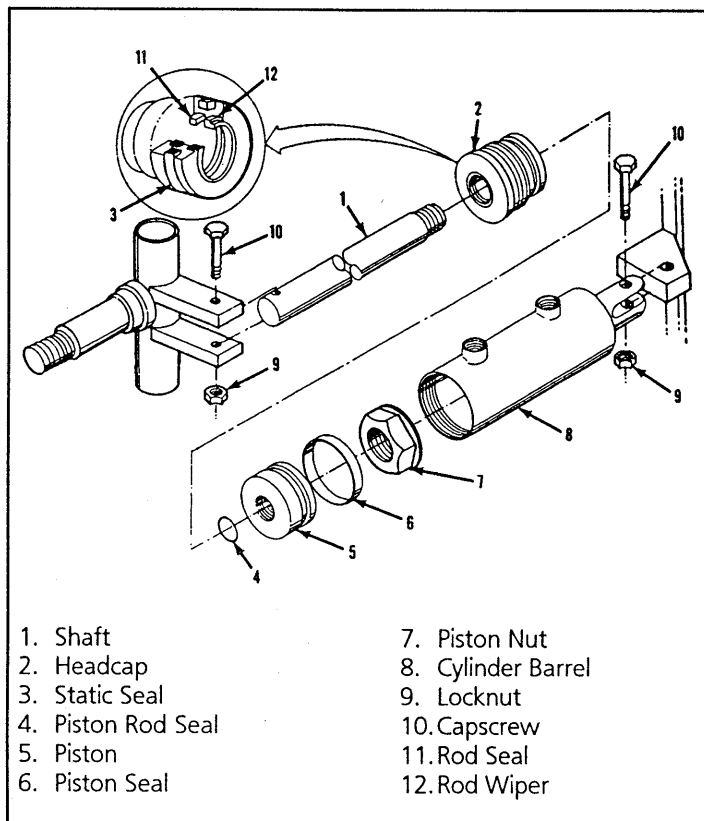


Figure 4-13: Steering Cylinder

4.13 Lift Cylinder (Figure 4-14)

REMOVAL

1. Block Elevating Assembly (Section 4.2).
2. Provide a suitable container to catch the hydraulic fluid, then disconnect the hydraulic hoses. Immediately plug hoses to prevent foreign material from entering.
3. Remove snap rings from cylinder pins and set screw from end of cylinder rod.
4. Place a 2 ft. (61 cm) long plank, at least one inch (25 mm) thick, across the top of the modules.
5. Support rod end of cylinder and remove rod end cylinder pin and let cylinder down to rest on the plank.
6. Attach a suitable hoisting device and sling to the cylinder.
7. Support the cylinder so the barrel end cylinder pin can be removed, then remove the cylinder from the machine with the hoisting device.
8. Move cylinder to a prepared work area.

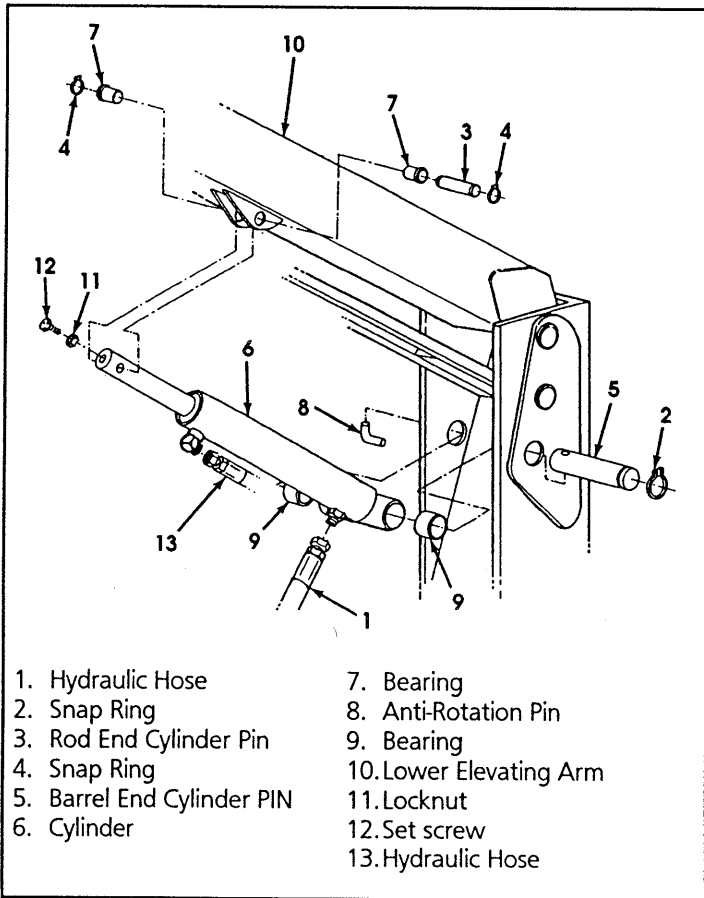


Figure 4-14: Lift Cylinder Installation

DISASSEMBLY (Figure 4-15)

1. Unscrew the headcap and withdraw the rod and piston assembly from the barrel tube.
2. Unscrew the piston nut and remove piston and headcap from the cylinder rod.
3. Remove the piston static o-ring from the cylinder rod.
4. Remove the piston seal from the piston.
5. Remove the rod seal, rod wiper and static seal from the headcap.
6. Remove the fittings from the cylinder barrel.
7. Do not remove the velocity fuse unless replacement is necessary.

CLEANING AND INSPECTION

1. Clean all metal parts in solvent and blow dry with filtered compressed air.
2. Check all threaded parts for stripped or damaged threads.

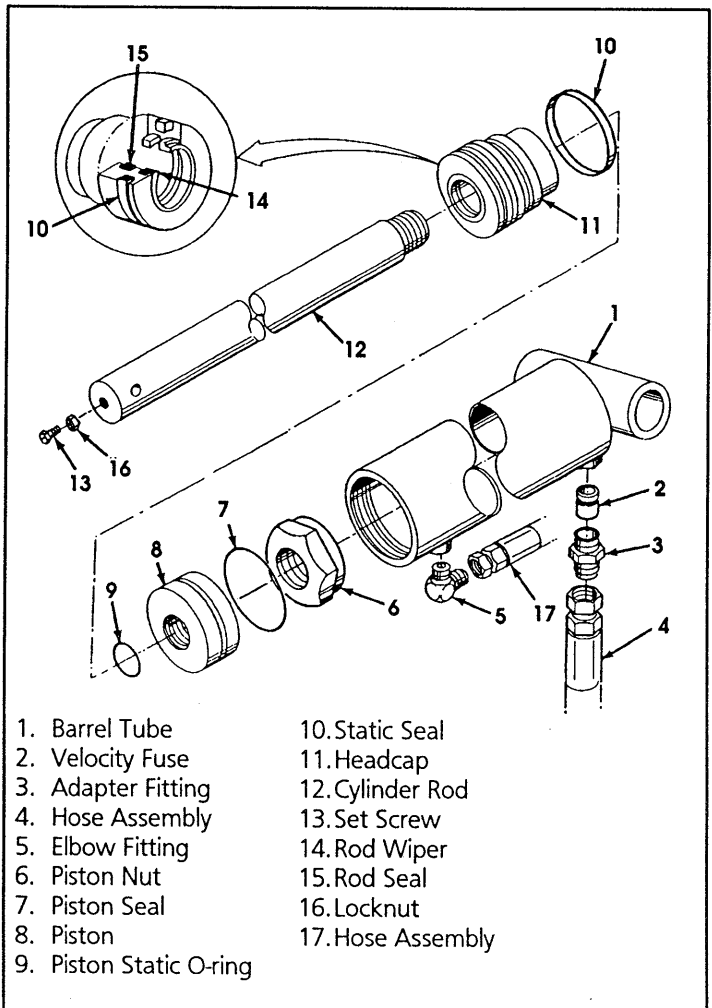


Figure 4-15: Lift Cylinder Assembly

3. Check the bearing surfaces inside of the headcap, outer edge surface of the piston, inside of the cylinder barrel and the shaft for signs of scoring or excessive wear.
4. Replace any parts found unserviceable.

REASSEMBLY (Figure 4-15)

1. Lubricate and install new rod seal, rod wiper and static seal on the headcap.

NOTE: Multi-purpose lubricant should be used.

2. Install a new piston seal on the piston.
3. Install the headcap on the cylinder rod from the piston end.

Note: installing the headcap over the pivot hole in the shaft could damage the seals.

4. Install a new piston static o-ring, the piston and piston nut on the cylinder rod. Torque nut to 70 Ft/Lbs (95 Nm).
5. Lubricate the piston seal and install the piston and rod assembly in the barrel tube.
6. Thread the headcap into the barrel tube and hand tighten, then turn $\frac{1}{4}$ turn further.
7. Install the velocity fuse (if removed).

INSTALLATION (Figure 4-14)

Note: before installing Lift Cylinder check cylinder pins and bearings for wear and replace if necessary.

1. Place two 2 ft. (61 cm) long planks, at least one inch (25 mm) thick, across the top of the modules.
2. Place the Lift Cylinder on the planks across the modules.
3. Lift the barrel end of the cylinder into place and push the cylinder pin in until approximately $1\frac{1}{2}$ in. (38 mm) is still exposed.

Note: take care in aligning the holes so that the pin can be pushed in by hand. If holes are not properly aligned and the pin is forced in, the bearings will be damaged.

4. Install anti-rotation pin into cylinder pin aligning with hole in the mast and push the cylinder pin completely in and secure with the snap ring.
5. Install rod end bearings in Lower Elevating Arm bracket (if removed).
6. Lift rod end of cylinder into place and insert pin. Rotate pin so hole in center aligns with set screw hole in cylinder rod end.
7. Install snap rings and set screw.
8. Test with weight at rated platform load to check system operation.

4.14 Electric Motor (Figure 4-16)

TROUBLESHOOTING

1. Read the nameplate to become familiar with the motor, especially the rated voltage.
2. Try to turn the shaft by hand. Keep motor leads separated while doing this. If the shaft turns freely go to step 3. If the shaft won't turn, proceed to step 2A.
- 2A. The shaft could be tight for a number of reasons, this check is to determine if the tightness is of a temporary nature only. Obtain power to produce the nameplate voltage. **Do Not Make A Permanent Connection.** First touch the motor leads quickly to the power supply just long enough to observe if the shaft runs. If it does turn, then hold the motor leads on the power supply for a longer time. If the motor sounds normal, go to step 3. If the motor sounds noisy, it should be taken apart as described in the disassembly section.
3. If the motor turned freely, connect an ammeter in the circuit as shown in Figure 4-16A. With rated voltage applied and the shaft running free, the ammeter should read less than 20% of the nameplate full load current. If the motor meets the above conditions then it can be assumed the original problem is external to the motor.

DISASSEMBLY

1. Remove thru bolts.
2. Remove pulley end cover.
3. Pull the armature out of the assembly in one swift motion.
4. Remove commutator end cover.

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

INSPECTION

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

1. Bearings should spin smoothly and easily and have ample lubrication and be free of corrosion.
2. Armature should be checked for grounds and shorted turns. Refinish commutator surface if pitted or excessively worn.
3. Brushes should be checked for wear and to ensure that they are free in the brush holders.

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

- Remove brush spring clip from its mounting on brush assembly.
 - Lift brush assembly from brush holder.
 - Disconnect brush assembly lead.
 - New brush assembly to be installed by reversing above procedure.
4. Inspect wire harness and all connections for signs of damage due to overheating.
 5. Check stator to see it is securely mounted.

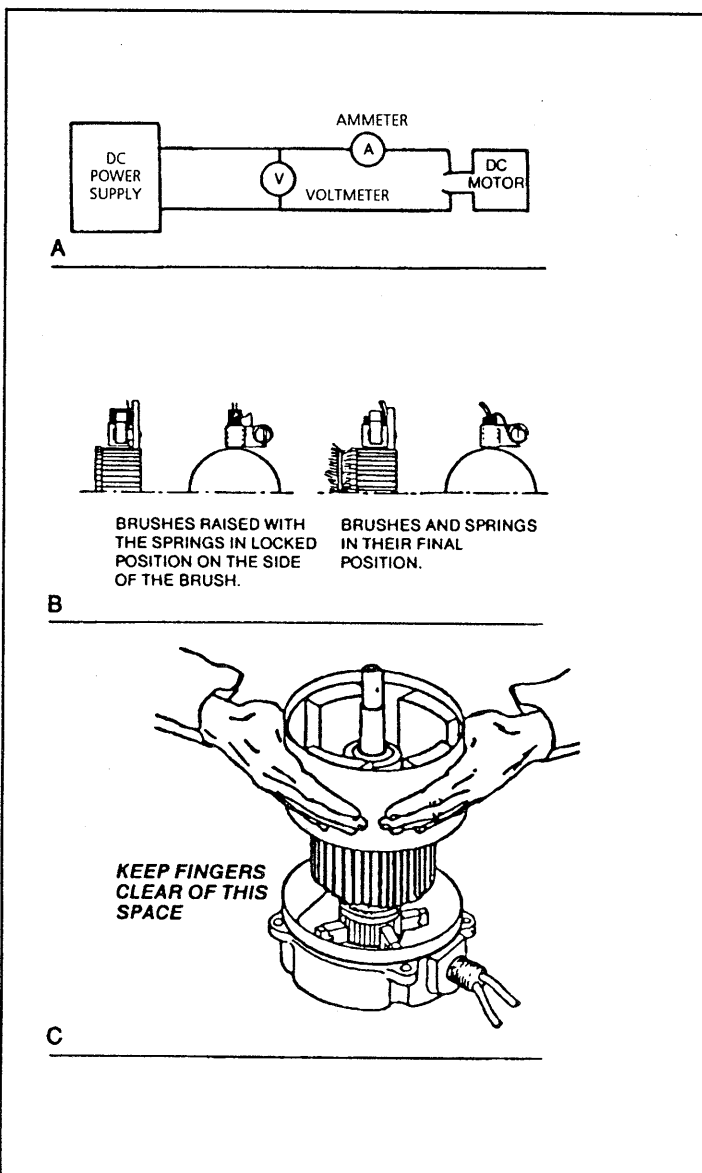


Figure 4-16: Electric Motor Service

REASSEMBLY

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

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

5. Set the brushes to final position as shown in Figure 4-16B.
6. Place the complete stator down over the vertical armature, and into position on the commutator cover.
7. The stator assembly must be placed in a definite relationship with the commutator covers in order to obtain a neutral brush setting. There is a match-mark on both items. **These two marks must line up exactly. Rotate until they do.**
8. Assemble the pulley end cover in the proper relationship. Insert mounting bolts and tighten alternately to ensure a good mechanical alignment.
9. Spin the shaft by hand to see if it is free. Be sure motor leads (if used) are not touching together. If the leads are touching, a generator action will give the effect of friction in the motor. A no-load test can now be performed. At rated voltage, observe the no-load current. It should be less than 20% of the nameplate full load current. Anything higher indicates:
 - Brushes are not on neutral setting (check matchmarks for exact alignment).
 - Faulty armature.

4.15 Recommended Bolt Torque (Table 4-2)

Use the following values to torque fasteners used on UpRight Work Platforms unless a specific torque value is called out for the part being installed.

Table 4-2: Bolt Torque

THREAD SIZE <small>American National Standard-UNF (fine)</small>	WIDTH ACROSS FLATS	TORQUE VALUE			
		ENGLISH		METRIC	
1/4	7/16	110	In/Lbs	12	Nm
5/16	1/2	190	In/Lbs	22	Nm
3/8	9/16	30	Ft/Lbs	41	Nm
7/16	5/8	50	Ft/Lbs	68	Nm
1/2	3/4	75	Ft/Lbs	102	Nm
5/8	15/16	150	Ft/Lbs	203	Nm
3/4	1 1/8	250	Ft/Lbs	339	Nm
7/8	1 5/16	400	Ft/Lbs	542	Nm
1	1 1/2	600	Ft/Lbs	813	Nm

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5.0 Introduction

Table 5-1 provides a logical sequence of tests that are designed to isolate problems with SL-20D Series machines. This table includes a list of probable causes and remedies. Referring to *Section 3.0* will aid in understanding the operation and function of the various components and systems of the SL-20D Series Work Platform and help in diagnosing and repair of the machine.



WARNING



When troubleshooting, ensure that the work platform is resting on a firm, level surface.

When performing any service on or in the Elevating Assembly area which requires the platform to be raised, the Elevating Assembly must be blocked.

Disconnect the batteries ground cable when replacing or testing the continuity of any electrical component.

GENERAL PROCEDURE

Troubleshooting should be carried out in two steps, first by 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. Secondly, the hydraulic system should be examined, but only after electrical circuits and components have been found fault free. Refer to Tables 6-1 and 6-2 for Reference Designations used in Table 5-1.

Troubleshooting

Table 5-1: Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
All functions inoperable, Electric Motor does not start.	1. Blown Control Circuit Fuse (FU2).	Check 15 amp Control Circuit Fuse. Replace if blown.
	2. Blown Electric Motor Fuse (FU1).	Check 175 amp Electric Motor Fuse. Replace if blown.
	3. Faulty Battery Charger.	Check the voltage output of the Battery Charger. If less than 24 VDC, repair or replace.
	4. Faulty Battery(ies) (BAT).	After completely charging Batteries, test each Battery. Replace as required.
	5. Faulty Electric Motor (MOT).	While operating the steering function, check voltage across the Electric Motor terminals. If 24 VDC is present, replace the Motor.
	6. Faulty Motor Relay (CR1).	While operating the steering, check voltage across the coil terminals of Motor Relay. If no voltage is present, proceed with step 7. If 20 VDC or more, check continuity across the contact terminals of Motor Relay while still operating the steering function. If there is no continuity, replace the defective Motor Relay.
	7. Emergency Stop Switch (SW1, SW3) failed open.	With the Emergency Stop Switch in the ON position, check continuity across the contacts. If none, replace.
	8. Faulty Key Switch (SW2).	Check continuity, replace if defective.
All functions inoperable. Electric motor starts when control is actuated.	1. Hydraulic Reservoir low.	Check hydraulic fluid level, top off as required.
	2. Faulty Hydraulic Pump (PMP1).	Check pressure and delivery of the Hydraulic Pump. Replace if required.
	3. Proportional Valve (V7).	Check operation. Replace if required.
	4. Faulty Controller (CONT).	Check operation. Adjust or replace if required.
Electric Motor continues to run after controls are returned to the OFF position.	Motor Relay (CR1) contacts fused together.	With 0 voltage at the coil terminals of the Motor Relay (CR1) check continuity across the contact terminals. If there is continuity, replace the Motor Relay.
Steering inoperable or functions sluggishly.	1. Faulty Steering Switch.	Test Steering Switch on Proportional Controller (CONT) for continuity. Replace if defective.
	2. Mechanical damage.	Inspect all steering components. Replace damaged parts.
	3. Steering Valve (V1) stuck.	Inspect Steering Valve. If spool is sticking, replace.
	4. Steering Cylinder (CYL1) piston seal leaking.	Check Steering Cylinder for leakage from one port to another. Repair as required.
	5. Steering Equalization Check Valve (CV3) leaking.	Check for contamination under ball. Clean and reseal ball in block.
Steering operates in opposite direction.	1. Low flow side of Pump (PMP1) defective.	Check pressure and delivery of the Hydraulic Pump. Replace if required.
	2. Faulty or missing Check Valve (CV3).	Reseat ball in seat or replace ball and spring (CV3).

TROUBLE	PROBABLE CAUSE	REMEDY
Work platform will not steer right.	1. Faulty Steering Switch.	Test Steering Switch on Proportional Controller (CONT) for continuity. Replace if defective.
	2. Faulty diode (DIO1).	Test diode. Replace if defective.
	3. Faulty Steer Right Solenoid (SOL1).	Test Steer Right Solenoid. If the proper voltage is present and the coil is not magnetized, replace.
Work platform will not steer left.	1. Faulty Steering Switch.	Test Steering Switch (CONT) for continuity. Replace if defective.
	2. Faulty diode (DIO2).	Test diode. Replace if defective.
	3. Faulty Steer Left Solenoid (SOL2).	Test Steer Left Solenoid. If the proper voltage is present and the coil is not magnetized, replace.
Work platform will not drive FORWARD or REVERSE. Lift function operable.	1. Faulty Drive/Lift Switch (SW5).	Check continuity of Drive/Lift Switch. Replace if defective.
	2. Faulty Drive Valve (V4).	Check the Drive Valve. If the spool is not shifting, replace the valve.
	3. Shuttle Valve (SV1) not seating.	Check for contaminants and reseal ball to valve block.
	4. Mechanical failure.	Inspect Drive Motor shafts, hubs, and keys.
	5. Worn Drive Motors (MOT1, MOT2).	Check hydraulic pressure being delivered to the Drive Motors. If sufficient, replace Drive Motors.
No high speed drive.	Faulty High Speed Down Limit Switch (LSW1b).	Check Switch for continuity. Replace if faulty.
No drive FWD but drives in REV. Lift function operable.	1. Faulty Drive/Lift Switch (SW5).	Test Drive/Lift Switch for continuity. Replace if faulty.
	2. Faulty diode (DIO4).	Test diode. Replace if faulty.
	3. Faulty Forward Coil (SOL3).	Test Forward Coil, if proper voltage is present and coil is not magnetized, replace.
	4. Faulty Drive Valve (V4).	Inspect Drive Valve, if spool is sticking replace.
	5. Faulty Counterbalance Valves (V2, V3).	Check pressure of Counterbalance Valves. Replace or reset valves as required.
	6. Shuttle Valve (SV1).	Check for contaminants and reseal ball in Valve Block.
No drive FWD but drives in REV. No lift function.	1. Faulty UP/FWD Relay (CR3).	Test UP/FWD Relay. Replace if required.
	2. Faulty Proportional Controller (CONT).	Check operation of Proportional Controller. Adjust as necessary. Replace if required.
No drive REV but drives in FWD. Lift function operable.	1. Faulty Drive/Lift Switch (SW5).	Test Drive/Lift Switch for continuity. Replace if faulty.
	2. Faulty diode (DIO5).	Test diode. Replace if faulty.
	3. Faulty REV Coil (SOL4).	Test REV Coil if proper voltage is present and coil is not magnetized, replace.
	4. Faulty Drive Valve (V4).	Inspect Drive Valve, if spool is sticking replace.

Troubleshooting

Table 5-1: Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
No drive REV but drives in FWD. Lift function operable. (cont'd.)	5. Faulty Counterbalance Valves (V2, V3).	Check pressure of Counterbalance Valves. Replace or reset valves as required.
	6. Shuttle Valve (SV1).	Check for contaminants and reseal ball in Valve Block.
No drive REV but drives in FWD. No lift function.	1. Faulty DN/REV Relay (CR4).	Check DN/REV Relay. Replace if faulty.
	2. Faulty Proportional Controller (CONT).	Adjust Proportional Controller. Replace if required.
Platform will not elevate or elevates slowly.	1. Emergency Down Valve (V8) open.	Close Emergency Down Valve.
	2. Platform overloaded.	Observe maximum load rating (See Table 1-1).
	3. Faulty diode (DIO6, DIO7).	Test diodes, replace if faulty.
	4. Faulty Lift Valve Coil (SOL5).	Test Lift Valve Coil. If proper voltage is present and coil is not magnetized, replace.
	5. Faulty Drive/Lift Switch (SW5).	Test Drive/Lift Switch for continuity. Replace if defective.
	6. Main Relief Valve (RV1) out of adjustment or faulty.	Adjust the Main Relief Valve. If not adjustable, replace.
	7. Lift Valve (V6) sticking.	Replace the Lift Valve.
	8. Down Valve (V8) stuck in the open position.	Replace the Down Valve.
	9. Faulty Proportional Valve (V7).	Check Proportional Valve operation, replace if faulty.
	10. Faulty Proportional Controller (CONT).	Check operation of Proportional Controller. Adjust as necessary. Replace if required.
Platform drifts down after being elevated.	1. Down/Emergency Lowering Valve (V8) partly open or faulty.	Ensure that the Emergency Lowering Knob is in closed position. Repair or replace the valve.
	2. Check Valve (CV2) leaking.	Check for contamination under ball. Clean and reseal ball in block.
	3. Leaky Cushion Down Valve (V9) cartridge.	Repair or replace the Cushion Down Valve.
	4. Lift Cylinder (CYL3) Piston Seals leaking.	Repair or replace Lift Cylinder.
Work platform drives while lifting.	Faulty diode (DIO3, DIO4, DIO5).	Test diodes. Replace if faulty.
Work platform lifts while driving.	Faulty diode (DIO6).	Test diode. Replace if faulty.

TROUBLE	PROBABLE CAUSE	REMEDY
Platform will not lower. Drive function operable.	1. Faulty Down Valve Coil (SOL6).	Test Down Valve Coil. If proper voltage is present and coil is not magnetized, replace.
	2. Faulty Drive/Lift Switch (SW5).	With the Drive/Lift Switch in the LIFT position, check continuity. Replace if defective.
	3. Faulty Proportional Controller (CONT).	Adjust Proportional Controller. Replace if required.
	4. Down Valve (V8) stuck.	Replace the Down Valve.
	5. Plugged Down Orifice (ORF2).	Remove and Clean Orifice.
	6. Velocity Fuse Valve (V5) sticking or frozen.	Repeat lifting and lowering platform to warm oil, if possible move machine out of cold environment, replace the Velocity Fuse Valve.
Down/Motion Alarm does not sound.	1. Faulty Down Alarm (ALM1).	Check voltage to Down Alarm . If proper voltage is present, replace the Alarm.
	2. Faulty diode (DIO8).	Test diode. Replace if faulty.
Brake will not release.	1. Brake Orifice (ORF1) plugged.	Remove and Clean Orifice.
	2. Faulty Brake Cylinder (CYL2).	Check and replace seals in Brake Cylinder.
	3. Brake Cylinder (CYL2) out of adjustment.	Adjust to engage Brake Disc when extended only.
Brake will not lock wheel.	1. Faulty Brake Cylinder (CYL2).	Check and replace seals in Brake Cylinder.
	2. Brake Cylinder (CYL2) out of adjustment.	Adjust to engage Brake Disc when extended.

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6.0 Introduction

This section contains electrical and hydraulic power schematics, and associated information for maintenance purposes.

The diagrams are to be used in conjunction with *Table 5-1: Troubleshooting*. They allow understanding of the make-up and functions of the systems for checking, tracing, and fault-finding during troubleshooting analysis.

The components that comprise the electrical and hydraulic systems are given a reference designation and are explained as to function and location in the following tables.

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Figure 6-3: Hydraulic Manifold	6-5

6.1 Electrical Schematic

Table 6-1: Electrical Schematic Legend

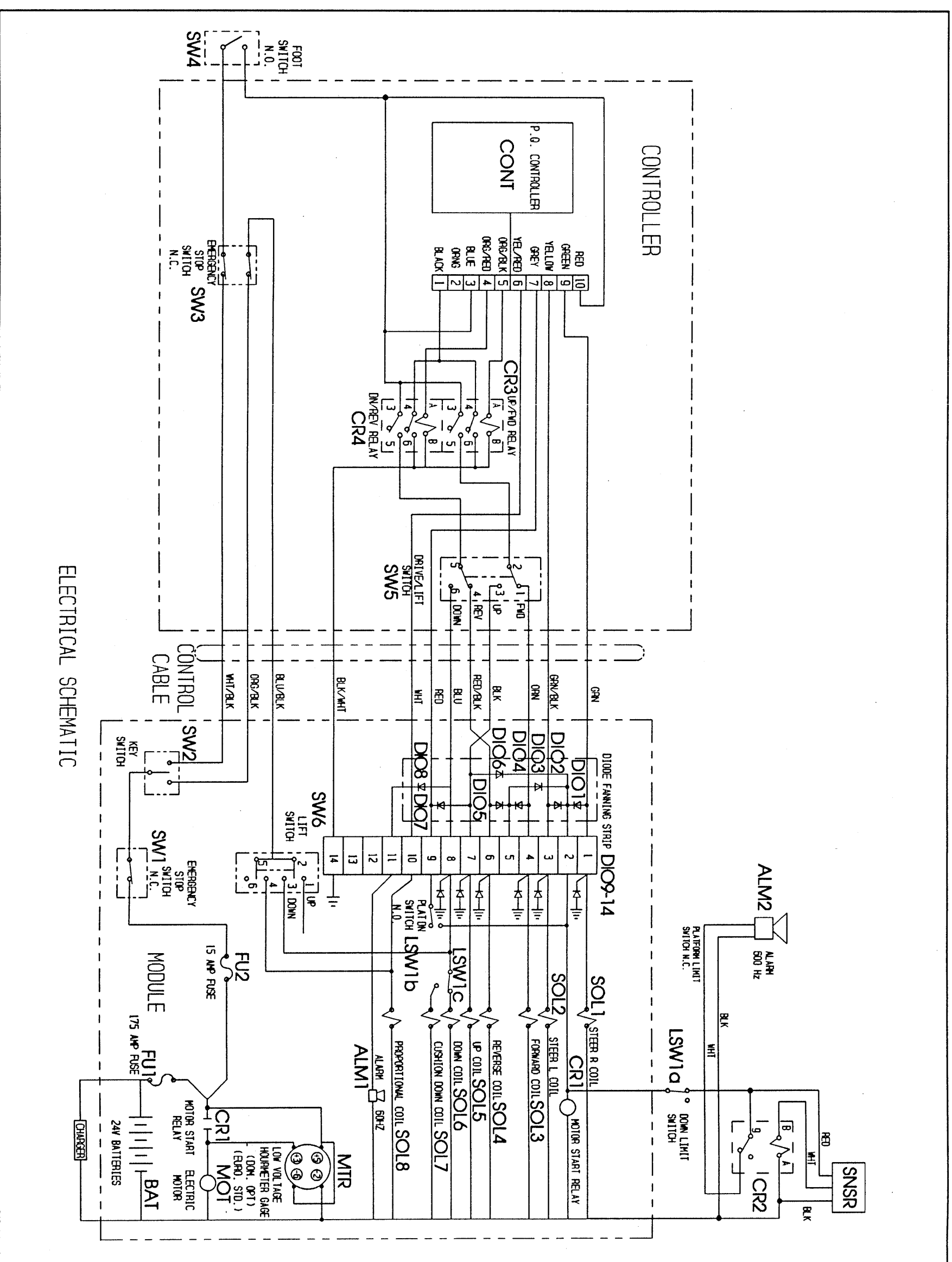
REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
ALM1	Alarm, Down	Provides warning sound (60Hz) when machine is lowering.	Center back of Control Module under Tilt Sensor (lower unit).
ALM2	Alarm, Platform Tilt	Provides warning sound (600Hz) when Platform is on slopes of 2° side to side and 2° fore and aft.	Center back of Control Module under Tilt Sensor (upper unit).
BAT	Batteries (4) 6 volts	To store energy	Chassis Power Module, left side.
CONT	Controller, Proportional & Switch, Steering	Supplies power to Proportional Coil and Up/Forward Relay or Down Reverse Relay. Supplies power to either Right or Left Steer Valve Solenoids.	Platform Controller center. Top of Controller joystick.
CR1	Relay, Motor	Connects Batteries to Motor.	Center of Control Module.
CR2	Relay, Drive/Lift Cutout	Energized by Tilt Sensor or Tilt Cutout Limit Switch, provides power to Tilt/Overload Alarm and completes Motor Relay circuit.	Center back of Control Module next to Tilt Sensor.
CR3	Relay, Up/Forward	Supplies power to Up/Forward contacts in Drive/Lift Switch.	Platform Controller.
CR4	Relay, Down/Reverse	Supplies power to Down/Reverse contacts in Drive/Lift Switch.	Platform Controller.
DIO1	Diode	Supplies power to Motor Relay when Steer Switch is activated RIGHT .	Between T1 and T2 on Fanning Strip.
DIO2	Diode	Supplies power to Motor Relay when Steer Switch is activated LEFT .	Between T3 and T2 on Fanning Strip.
DIO3	Diode	Supplies power to Motor Relay for FORWARD and REVERSE operation.	Between T5 and T2 on Fanning Strip.
DIO4	Diode	Supplies power to Motor Start Relay through DIO3 during FORWARD operation.	Between T4 and T5 on Fanning Strip.
DIO5	Diode	Supplies power to Motor Start Relay through DIO3 during REVERSE operation.	Between T6 and T5 on Fanning Strip.
DIO6	Diode	Supplies power to Motor Relay for LIFT operation.	Between T7 and T2 on Fanning Strip.
DIO7	Diode	Supplies power to Controller for High Speed Lift.	Between T7 and T9 on Fanning Strip.

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
DIO8	Diode	Supplies power to Down Alarm during Lowering.	Between T8 and T11 on Fanning Strip.
DIO9-14	Diodes	Protects Diodes 1-8 from voltage spikes.	On Fanning Strip.
FU1	Fuse, 175 AMP	Overload protection for the electric motor.	Center of Control Module next to Motor Start Relay.
FU2	Fuse, 15 AMP	Overload protection for the control circuit.	Top left of Control Module.
LSW1 a	Switch, Tilt Sensor Down Limit	Cuts power to Tilt Sensor when Platform is down.	Right side of Chassis Pedestal Weldment. Contacts 5 & 6.
LSW1 b	Switch, High Speed Down Limit	Cuts power to High Speed Drive when Platform is elevated.	Contacts 7 & 8.
LSW1 c	Switch, Cushion Down Limit	Switches power from Down Coil to Cushion Down Coil.	Contacts 1, 2, 3 & 4.
MOT	Motor, Electric	Provides power to Drive Hydraulic Pump.	Middle front of Control Module.
MTR	Meter, Volt/Hour (Option on Domestic, Standard On European)	Shows state of charge of batteries and hours machine has power on.	Left front of Control Module below Fanning Strip.
SNSR	Sensor, Tilt	Provides power to Tilt Alarm when Platform is on slopes of 2° side to side and 2° fore and aft.	Center back of Control Module.
SOL1	Solenoid, Right Steer (coil)	Shifts Steer Valve to RIGHT turn position.	Farthest end of Spool Valve mounted on left top of Manifold Block.
SOL2	Solenoid, Left Steer (coil)	Shifts Steer Valve to LEFT turn position.	Closest end of Spool Valve mounted on left top of Manifold Block.
SOL3	Solenoid, Forward (coil)	Shifts Drive Valve to FORWARD position.	Left end of Spool Valve mounted on right top of Manifold Block.
SOL4	Solenoid, Reverse (coil)	Shifts Drive Valve to REVERSE position.	Right end of Spool Valve mounted on right top of Manifold Block.
SOL5	Solenoid, Up (coil)	Opens Lift Valve.	Top right Coil on front of Manifold Block.
SOL6	Solenoid, Down (coil)	Opens Down Valve.	Center bottom front of Manifold Block.
SOL7	Solenoid, Down Cushion (coil)	Opens Down Cushion Valve.	Center of bottom of Manifold Block.
SOL8	Solenoid, Proportional (coil)	Opens Proportional Valve.	Upper center left on front of Manifold Block.
SW1	Switch, Chassis Emergency Stop Button.	Control Circuit shut off.	Top left of Control Module on Chassis Control Panel.
SW2	Switch, Key	Supplies power to Controller or Chassis Lift Switch.	Top left of Control Module on Chassis Control Panel.

Schematics

Table 6-1: (cont'd)

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
SW3	Switch, Controller Emergency Stop Button.	Control/Circuit shut off.	Platform Controller bottom left.
SW4	Switch, Foot	Supplies power to Controller Power Switch.	Platform deck.
SW5	Switch, Drive/Lift	Supplies power to Forward and Reverse or Up and Down Valve coils.	Controller bottom center.
SW6	Switch, Chassis Lift	Provides power to either Up or Down circuits.	Top left of Control Module on Chassis Control Panel.



ELECTRICAL SCHEMATIC

Figure 6-1: Electrical Schematic

6.2

Hydraulic Schematic

Table 6-2: Hydraulic Schematic Legend

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
CV1	Check Valve, Steering	Allows Steering Valve to function at a higher pressure than drive.	Front center of left side of Manifold Block.
CV2	Check Valve, Lift	Prevents oil from flowing back through Lift Valve.	Top center of back of Manifold Block.
CV3*	Check Valve, Steering Equalization	Balances pressure differential across the Steering Cylinder.	Behind Gauge Port fitting.
CY11	Cylinder, Steering	Provides force to turn front wheels.	Center front of Chassis.
CY12	Cylinder, Brake	Stops machine from moving while parked.	Left rear side of Chassis.
CY13	Cylinder, Lift	Provides force to lift Platform.	Between Chassis Pedestal weldment and Lower Arm Assy.
FL1	Filter	Filters oil returning to Tank.	Left side of Hydraulic Tank.
FL2	Suction Screen	Traps particles in Hydraulic Tank.	Inside Hydraulic Tank at outlet.
MOT1	Drive Motor	Provides tractive effort for work platform.	In left rear axle.
MOT2	Drive Motor	Provides tractive effort for work platform.	In right rear axle.
ORF1	Orifice, Brake	Delays the engagement of the Brake Cylinder.	Bottom right of back of Manifold Block.
ORF2	Orifice, Down	Controls the platform rate of descent.	Center front of Manifold Block.
ORF3	Orifice, Cushion Down	Controls Platform rate of descent in last 6-12" (152-304 mm).	Center bottom of Manifold Block.
PMP	Duplex Pump	Supplies hydraulic oil flow for all functions	On Electric Motor at center front of Control Module.
RV1	Valve, Main Relief	Provides over pressure protection to Pump.	Left front of Manifold Block.
SV1	Valve, Shuttle	Provides oil to Brake Cylinder when either Drive FORWARD or REVERSE are actuated.	Center bottom of right side of Manifold Block.
V1	Valve, Steering	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 center front of Manifold Block.
V3	Valve, Counterbalance REVERSE	Prevents machine from running away on slopes and cushions stops.	Right bottom 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 Cylinder if line breaks.	Inside Lift Cylinder Port.
V6	Valve, Lift	Provides oil flow to Lift Cylinder.	Top right Coil on front of Manifold Block.
V7	Valve, Proportional	Controls oil flow into Drive and Lift circuits by proportionally dumping oil back to tank.	Top center on front of Manifold Block.
V8	Valve, Down and Emergency Lowering	Allows oil to flow out of Lift Cylinders to Tank, manually operated for Emergency Lowering.	Bottom center on front of Manifold Block.
V9	Valve, Cushion Down	Provides slower rate of descent during last 6-12" (152-304 mm) of Platform travel.	Center rear on bottom of Manifold Block.

* Added after machine serial number 4590.

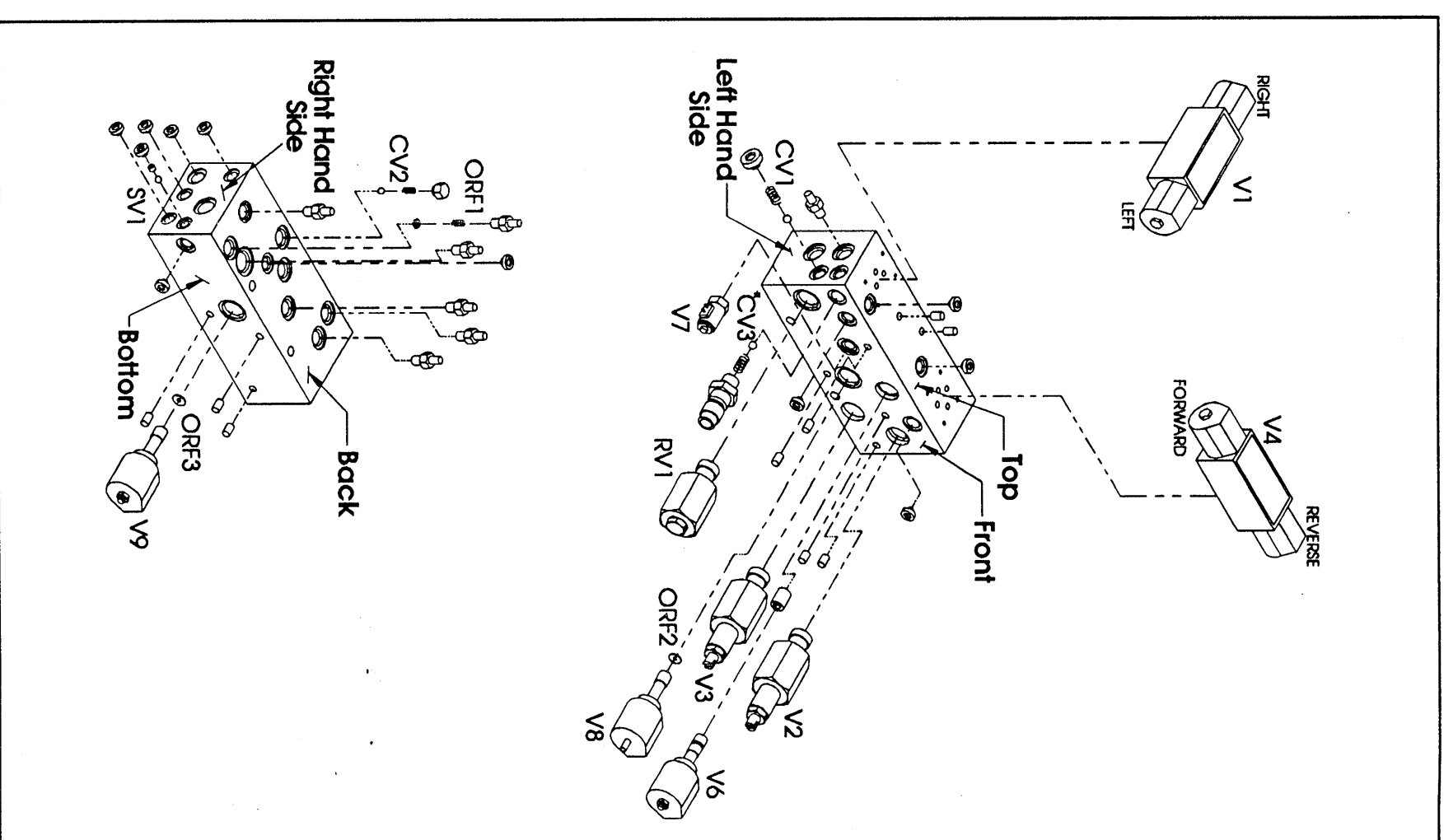
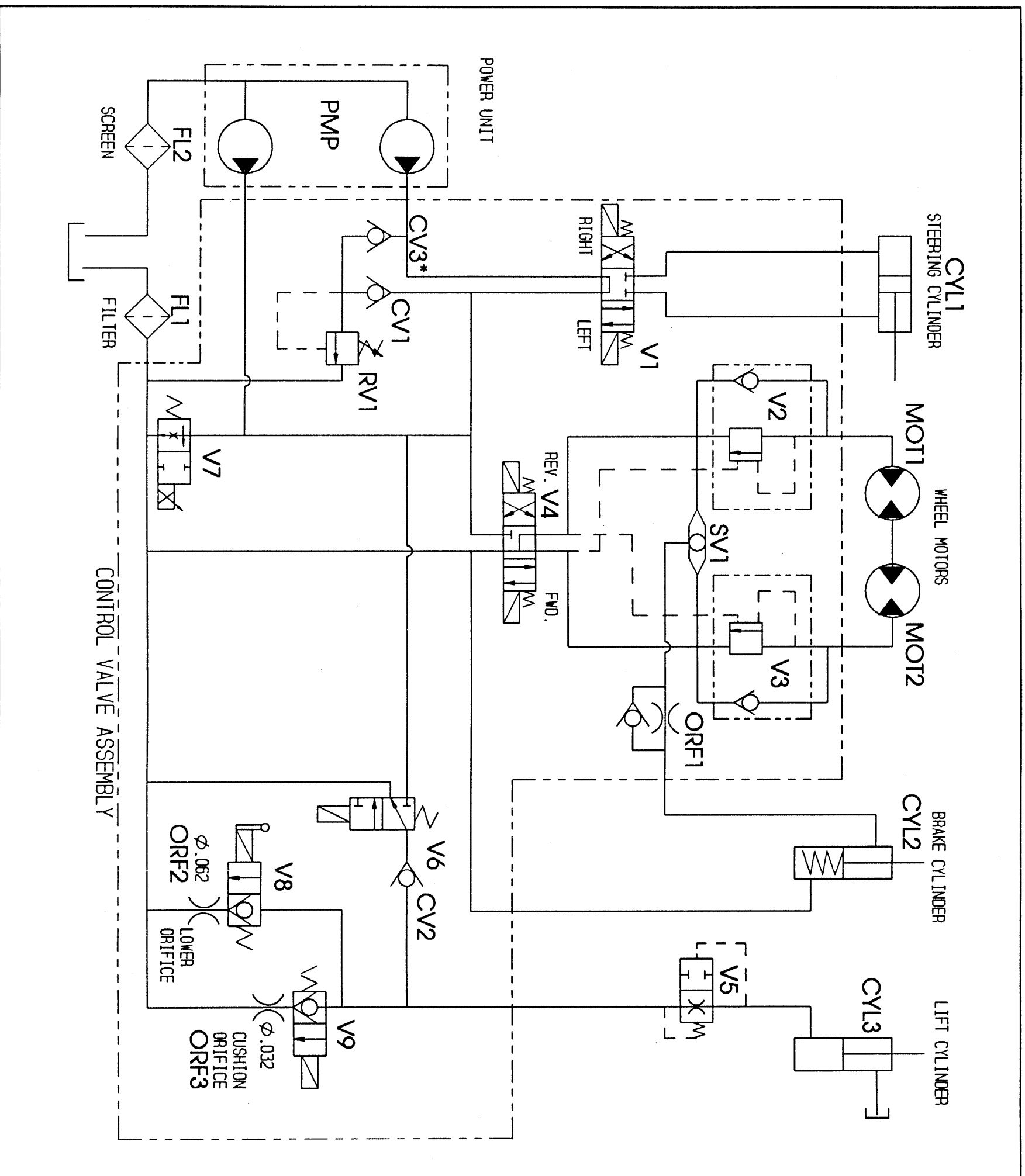


Figure 6-2: Hydraulic Schematic

Figure 6-3: Hydraulic Manifold

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7.0 Introduction

This section lists and illustrates the replaceable assemblies and parts of the SL-20D Series Work Platform, as manufactured by Upright, Inc.

Each parts list contains the component parts for that assembly indented to show relationship where applicable.

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7.2 Illustrated Parts

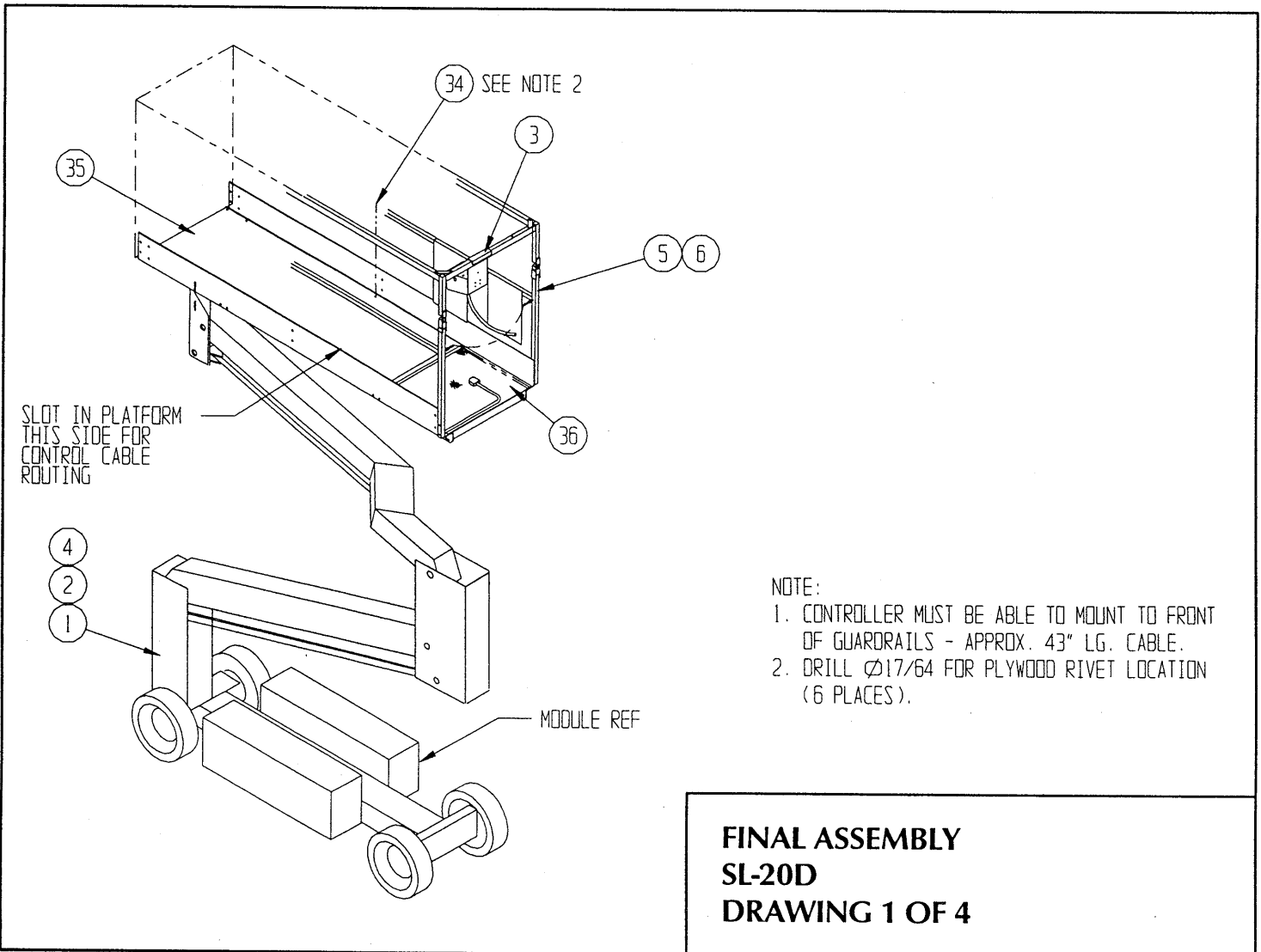
Next Page.

Illustrated Parts Breakdown

FINAL ASSEMBLY SL-20D

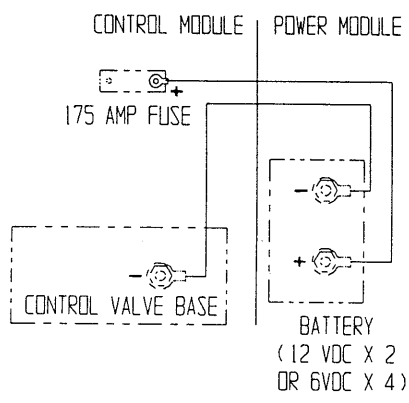
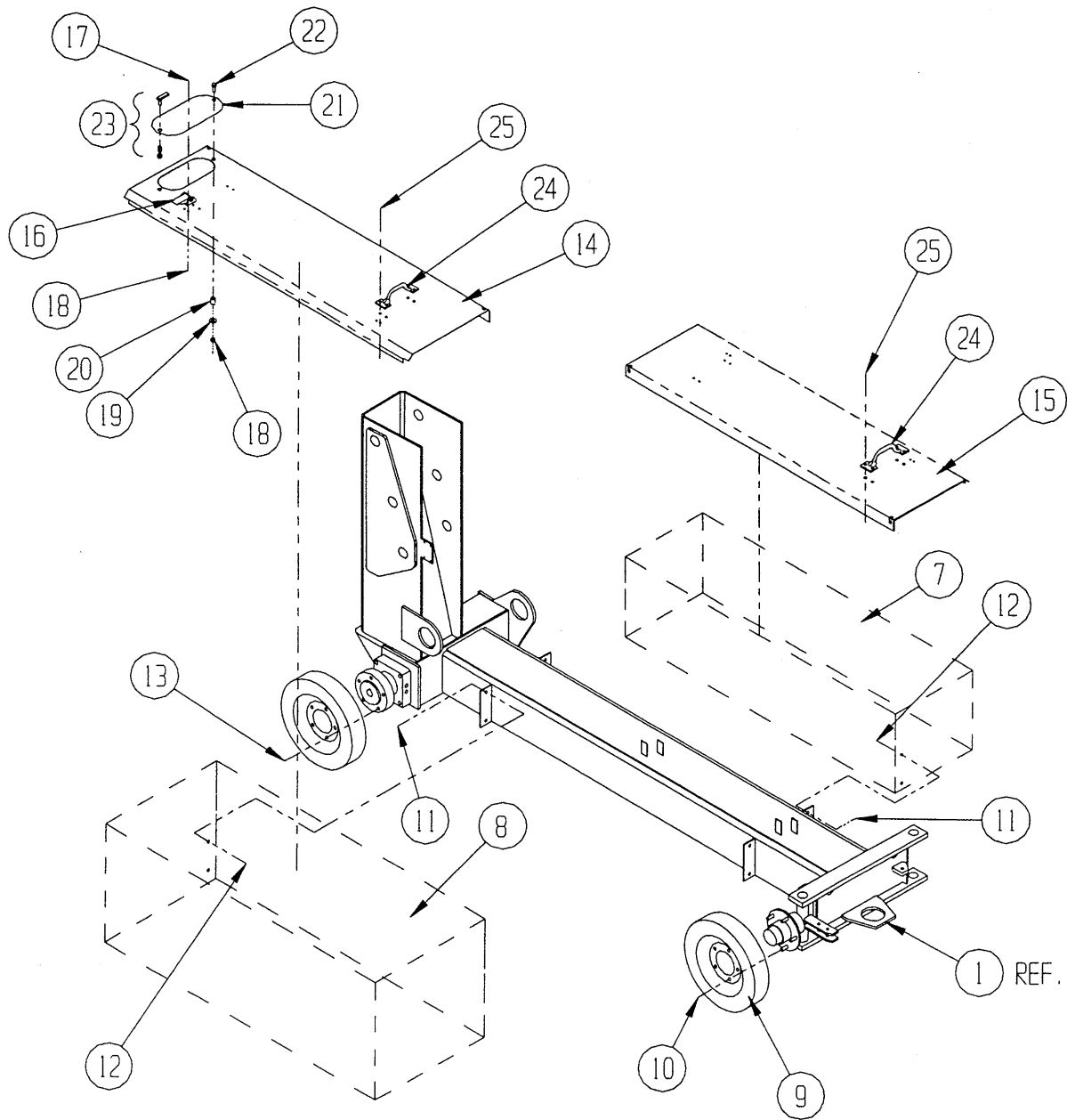
ITEM	PART	DESCRIPTION	QTY.
1	63401-000	BASIC ASSY	1
2	63003-003	HOSE KIT	1
3	63610-000	CONTROLLER	1
4	63008-004	LABEL KIT	1
5	63476-002	GUARDRAIL ASSY/INSL	1
6	63575-002	SLIDEOUT DECK ASSY/INSL	1
7	63453-001	POWER MODULE ASSY	1
8	63403-003	CONTROL MODULE ASSY	1
9	61826-000	WHEEL ASSY	4
10	05105-000	WHEEL NUT	10
11	11248-006	LOCKNUT, 3/8-16 UNC HEX	8
12	11254-008	SCREW, 3/8-16 UNC HHC X 1	8
13	14122-001	BOLT, WHEEL	10
14	63399-000	COVER, CONTROL MODULE	1
15	63397-000	COVER, POWER MODULE	1
16	05299-000	LATCH, TOGGLE	4
17	11708-004	SCREW, 8-32 UNC X 1/2	8
18	11248-002	LOCKNUT, 8-32 HEX	9
19	11240-002	WASHER, #8 FLAT	1
20	10098-001	TUBE, 3/8 OD NEOPRENE X 3/8	1
21	63359-000	ACCESS COVER	1

ITEM	PART	DESCRIPTION	QTY.
22	11708-006	SCREW, 8-32 UNC X 3/4	1
23	63360-001	SWELL LATCH	1
24	25427-002	HANDLE	4
25	26553-006	RIVET	16
26	15793-011	SWITCH, LIMIT	1
27	15793-013	SWITCH, LEVER	1
28	11728-004	SCREW, 10-32 UNC X 1/2	2
29	63468-001	CONTROL CABLE	1
30	29925-000	CONNECTOR	1
31	63557-000	HOSE SUPPORT	1
32	15963-099	TIE STRAP	.66 FT
33	15964-000	STRAP HEAD	1
34	26554-006	RIVET, POP 1/4 .75-.87 GRIP	6
35	63321-002	PLYWOOD DECK	1
36	65333-001	GRATE WELDMENT	1
37	29610-002	TERM, FORK 16-14 #8	4
38	29620-002	CONN, BUTT 14-16	1
39	29488-099	WIRE, 16 GA. 6 COND	4 FT
40	29931-003	CONN, PUSH FEM 14-16	2
41	14914-001	CONN, PUSH MALE 14-16	2
42	29454-099	WIRE, 16 GA. RED	2.5 FT



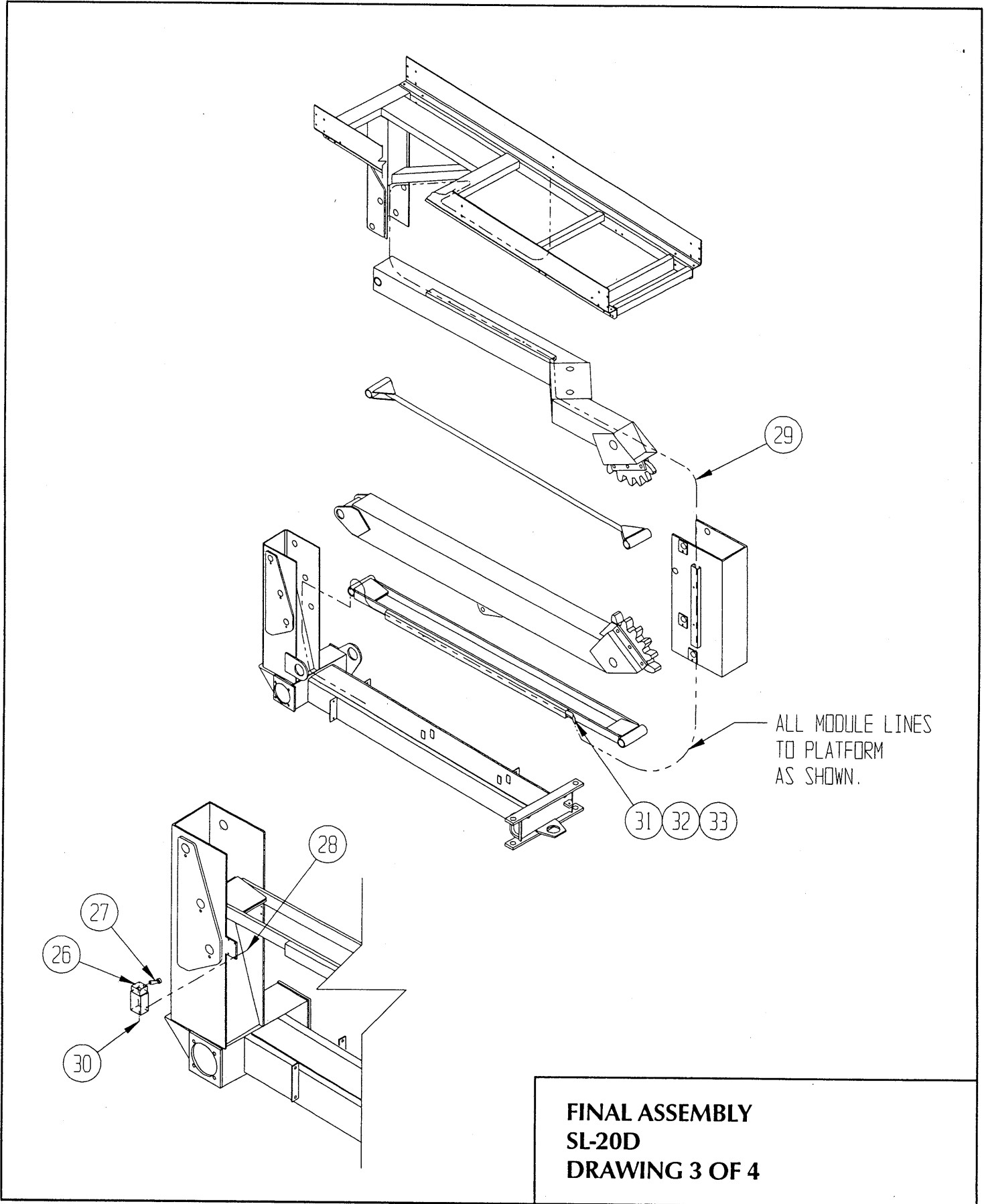
**FINAL ASSEMBLY
SL-20D
DRAWING 1 OF 4**

Illustrated Parts Breakdown

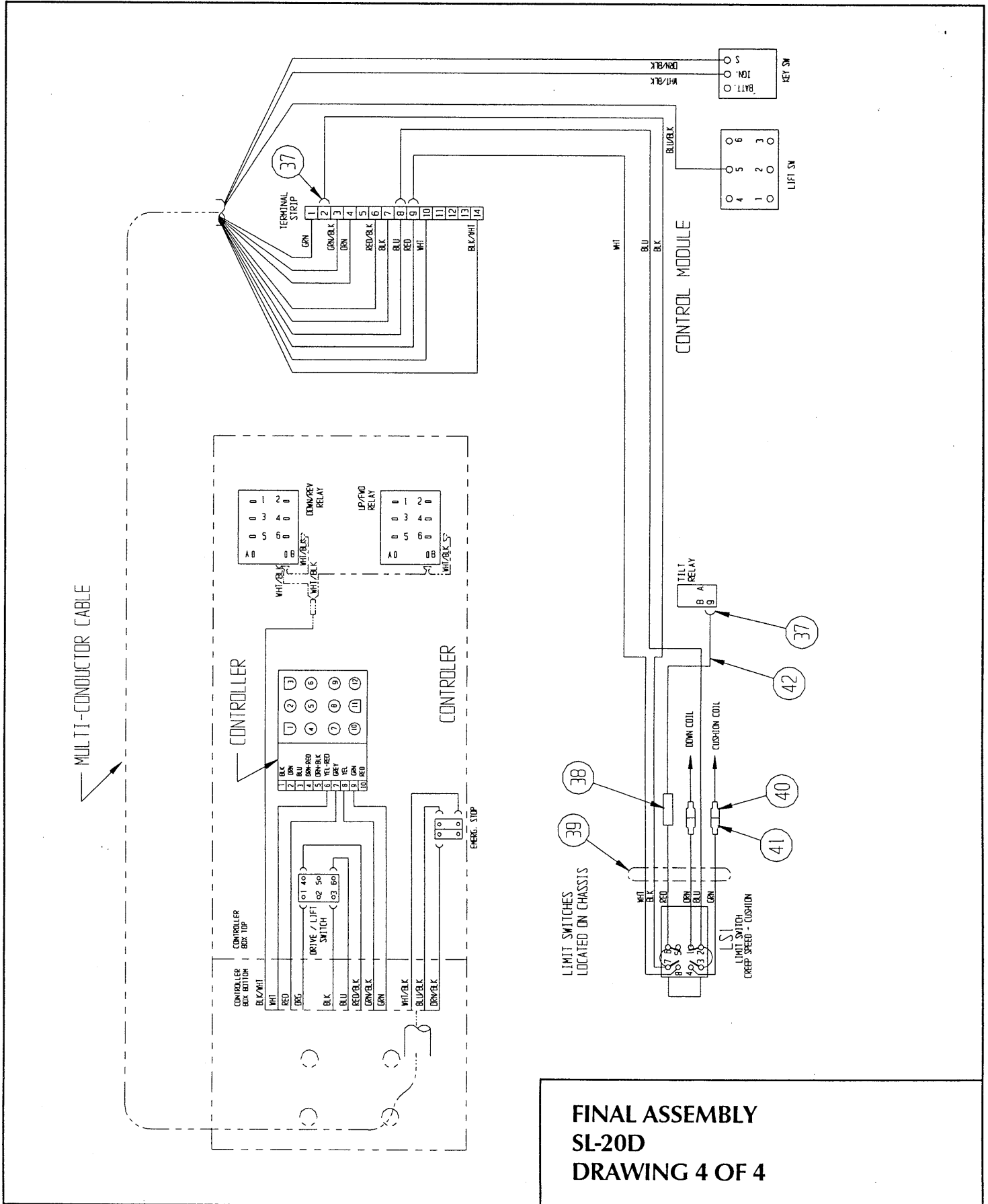


**FINAL ASSEMBLY
SL-20D
DRAWING 2 OF 4**

Illustrated Parts Breakdown



Illustrated Parts Breakdown



**FINAL ASSEMBLY
SL-20D
DRAWING 4 OF 4**

Illustrated Parts Breakdown

BASIC ASSEMBLY SL-20D

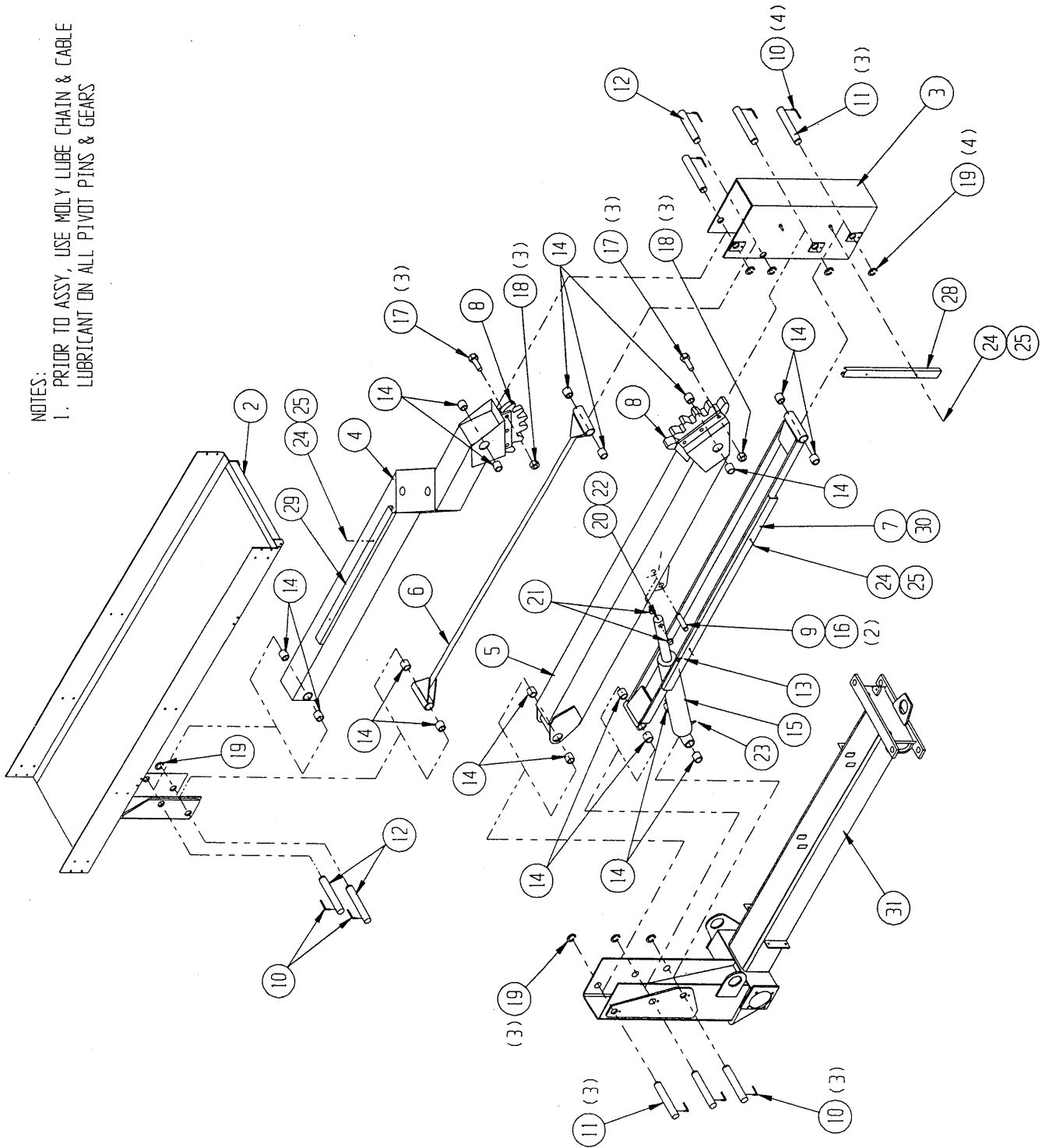
ITEM	PART	DESCRIPTION	QTY.
2	63474-001	WELDMENT, DECK	1
3	63035-002	WELDMENT, MIDLINK PIVOT	1
4	63044-002	WELDMENT, UPPER ARM	1
5	63052-001	WELDMENT, LOWER ARM	1
6	63059-000	WELDMENT, UPPER TENSION	1
7	63061-002	WELDMENT, LOWER TENSION	1
8	63085-001	GEAR, LINKAGE	2
9	63134-001	PIN, CYL. ROD	1
10	63087-000	LOCKING PIN	9
11	63090-000	PIVOT PIN, LONG	6
12	63091-000	PIVOT PIN, SHORT	3
13	11940-006	FITTING, ELBOW	1
14	63095-001	BEARING, PIVOT	18
15	63096-000	LIFT CYLINDER	1
*	63096-014	SEAL KIT, LIFT CYLINDER	1
*	63096-010	VELOCITY FUSE	1
16	11764-016	RETAINING RING	2
17	14099-036	SCREW, HHC 3/4-10 X 4 1/2 LG	6
18	11248-012	LOCKNUT, 3/4-10 HEX	6
19	11764-023	RETAINING RING	9
20	13925-016	SCREW, SET SCPT 3/8-16 X 1 LG	1
21	62649-001	FLANGED BEARING	2
22	11273-006	NUT, JAM 3/8-16	1
23	11941-009	FITTING, ADAPTOR	1
24	11240-004	WASHER, 1/4 DIA FLAT	6
25	11248-004	LOCKNUT, 1/4-20 UNC HEX	6
28	63666-001	WIRE CHANNEL X 24	1
29	63666-002	WIRE CHANNEL X 40	1
30	63666-003	WIRE CHANNEL X 57	1
31	63402-003	CHASSIS ASSY	1

*Not Shown

Illustrated Parts Breakdown

Section
7.2

NOTES:
1. PRIOR TO ASSY, USE MOLY LUBE CHAIN & CABLE
LUBRICANT ON ALL PIVOT PINS & GEARS



**BASIC ASSEMBLY
SL-20D**

Illustrated Parts Breakdown

CHASSIS ASSEMBLY SL-20D

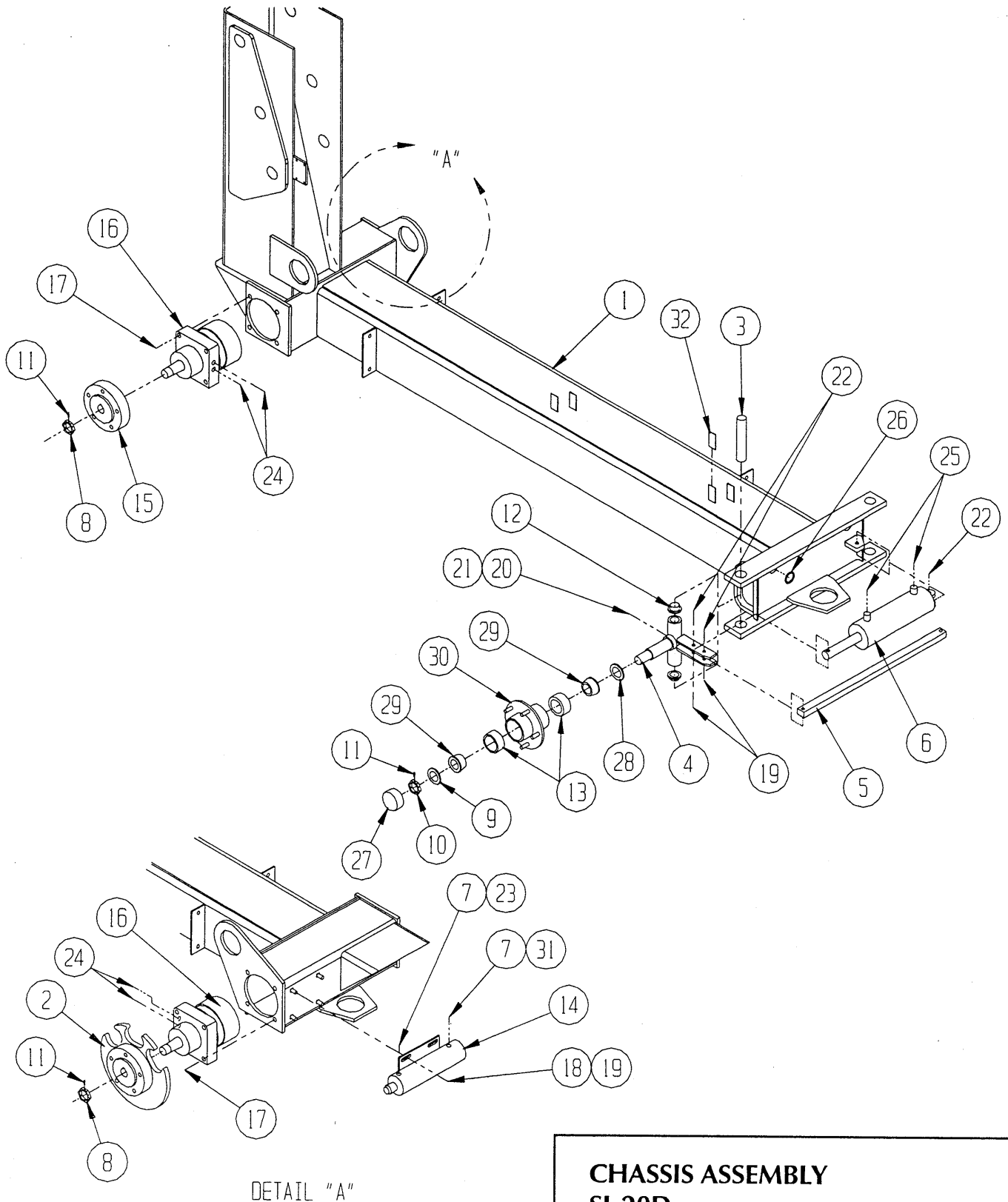
ITEM	PART	DESCRIPTION	QTY.
1	63011-002	CHASSIS WELDMENT	1
2	63075-000	BRAKE HUB WELDMENT	1
3	63077-000	KING PIN	2
4	63078-000	SPINDLE WELDMENT	2
5	63089-000	DRAG LINK	1
6	63097-000	STEERING CYLINDER	1
*	63097-014	SEAL KIT, STEERING CYLINDER	1
7	11939-010	FITTING STR	2
8	61817-011	NUT, SLOTTED 1-14 UNF	2
9	11239-016	WASHER, 1 DIA FLAT ASTM	2
10	11274-016	NUT, 1-14 UNF SLOTTED HEX	2
11	11753-012	PIN, COTTER 1/8 X 1 1/2	4
12	11781-014	BEARING, FLANGED	4
13	11776-004	BEARING CUP	4
14	60479-000	BRAKE CYLINDER	1
*	60211-014	SEAL KIT, BRAKE CYLINDER	1
15	60737-000	HUB	1

ITEM	PART	DESCRIPTION	QTY.
16	61817-001	MOTOR, HYD.	2
*	61817-010	SEAL KIT, HYD. MOTOR	1
17	11256-024	SCREW, 1/2-13 UNC HHC X 3	8
18	11240-006	WASHER, 3/8 DIA	4
19	11248-006	LOCKNUT, 3/8-16 UNC HEX	8
20	11273-006	NUT, 3/8-16 UNC HEX JAM	2
21	11254-010	SCREW, 3/8-16 UNC HHC X 1 1/4	2
22	11254-016	SCREW, 3/8-16 UNC HHC X 2	4
23	11937-003	FITTING, 90° EL	1
24	11941-013	FITTING, ST	4
25	11940-006	FITTING, 90° EL	2
26	12956-010	GROMMET	2
27	05078-000	CAP, DUST	2
28	05104-000	SEAL, GREASE	2
29	11775-011	CONE BEARING	4
30	63102-001	HUB ASSY	2
31	11932-003	FITTING, 45° EL	1
32	29940-099	TUBE, HEAT SHRINK 3/4 DIA	67 FT

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Illustrated Parts Breakdown

Section
7.2



**CHASSIS ASSEMBLY
SL-20D**

Illustrated Parts Breakdown

CONTROL MODULE ASSEMBLY SL-20D

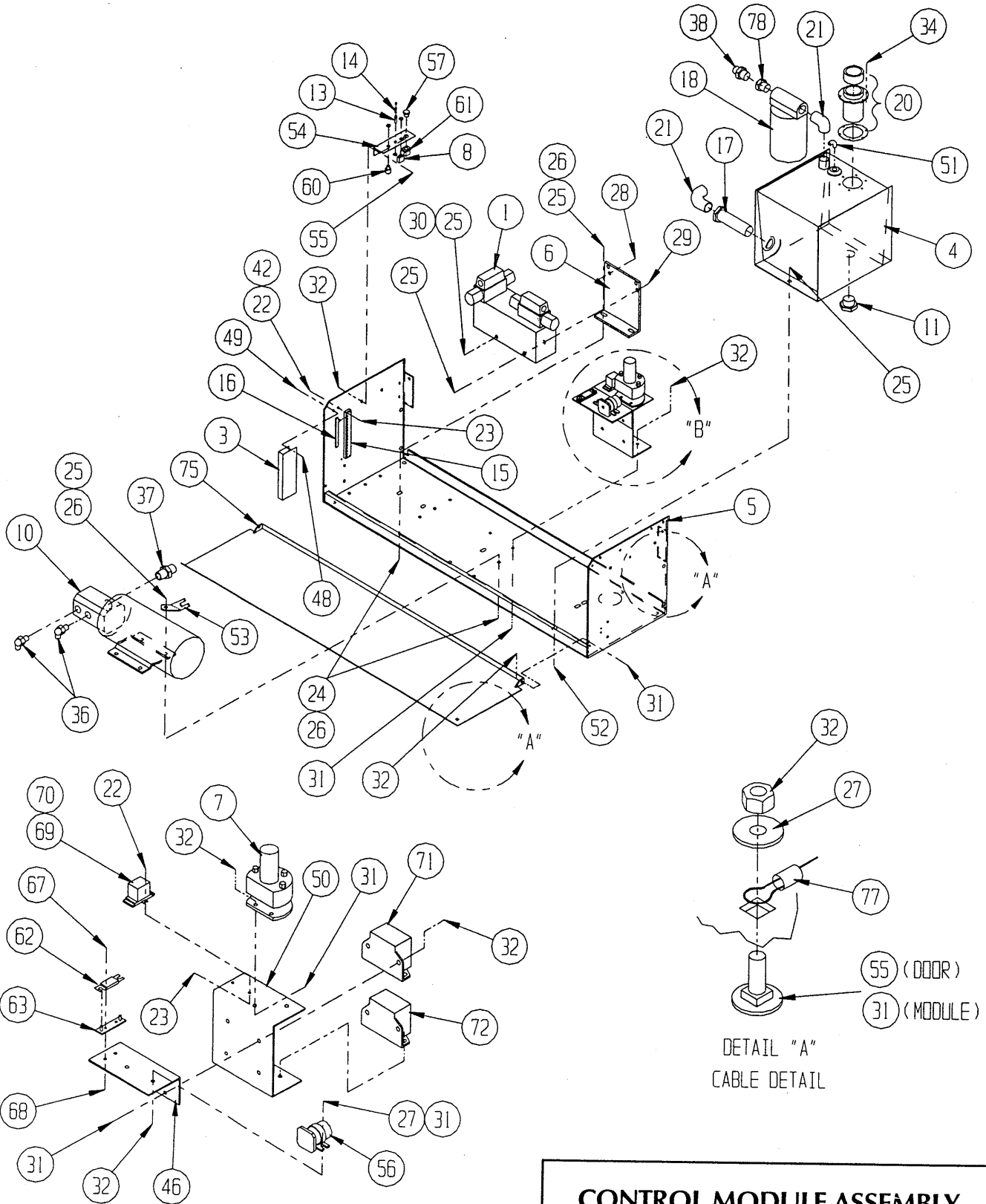
ITEM	PART	DESCRIPTION	QTY.
1	63217-002	CONTROL VALVE ASSEMBLY	1
*	30576-007	VALVE BLOCK, SERVICE	1
2	63468-001	CONTROL CABLE	1
3	63385-000	DIODE COVER	1
4	63063-001	HYD. TANK WELDMENT	1
5	63406-001	MODULE TRAY, CONTROL	1
6	63084-000	VALVE BRACKET	1
7	29945-006	TILT SENSOR	1
8	12798-001	TOGGLE SWITCH	1
9	64195-005	BATTERY CABLE X 5	2
10	15797-000	POWER UNIT	1
*	15797-010	PUMP	1
*	15797-011	MOTOR	1
*	10145-001	BRUSH SET, MOTOR	2
11	21305-006	PLUG, MAGNET	1
13	29701-000	FUSE HOLDER	1
14	29704-015	FUSE AGC 15 AMP	1
15	29928-004	TERMINAL BLOCK	1
16	63471-002	FANNING STRIP	1
*	29825-002	DIODE	15
17	61818-000	FITTING, SUCTION SCREEN	1
18	05154-001	FILTER ASSEMBLY, RETURN	1
*	05154-002	ELEMENT, FILTER	1
20	05963-001	FILLER BREATHER	1
21	63931-012	ELBOW, 3/4 NPT STREET	2
22	11715-006	SCREW, #6-32 X 3/4	4
23	11248-047	LOCKNUT, #6-32 HEX	4
24	11254-010	SCREW, HHC 3/8-16 X 1-1/4	6
25	11248-006	NUT, ESNA 3/8-16	10
26	11240-006	WASHER, FLAT 3/8 DIA	14
27	11240-004	WASHER, 1/4 FLAT	4
28	11254-036	SCREW, HHC 3/8-16 X 4 1/2	1
29	11254-032	SCREW, HHC 3/8-16 X 4	1
30	11273-006	NUT, JAM 3/8-16	1
31	11252-006	SCREW, HHC 1/4-20 X 3/4	11
32	11248-004	NUT, ESNA 1/4-20	14
34	11811-006	SCREW, SELF TAP 10-32 X 1/2	6
35	63574-099	WIRE, 16 AWG BLK/WHT	6 FT
36	11934-004	FITTING, 90° EL	2
37	11941-012	FITTING, STR	1
38	11939-010	FITTING, STR	1
39	29601-040	RING TERMINAL, 14-16 GA X 5/16	1
40	29496-099	WIRE, 16 GA 2-COND	2 FT
41	29616-001	CONN, PUSH TERM F 14-16 3/16	2
42	11240-001	WASHER, #6	2
43	29601-013	RING TERMINAL, 16-14 GA #10	12
45	29610-002	FORK TERM, 16-14 #8	32
46	63769-000	RELAY BRACKET	1
48	14996-003	WASHER, #10 SAE	1
49	26553-004	RIVET, 3/16 X .251-.375 GRIP	1
50	63438-001	BRACKET, TILT	1
51	11940-006	FITTING 90°	1
52	11254-008	SCREW, HHC 3/8-16 X 1	2
53	63029-000	BUSS BAR	1
54	63421-001	CONTROL BRACKET	1
55	11829-006	CARRIAGE BOLT, 1/4-20 X 3/4	3
56	10122-000	SOLENOID 24V	1

ITEM	PART	DESCRIPTION	QTY.
57	63667-001	PUSH BUTTON	1
58*	29451-099	WIRE, 16 GA WHT	8 FT
59*	29452-099	WIRE, 16 GA BLK	5 FT
60	10155-000	KEY SWITCH	1
*	10155-001	KEY	1
61	63667-002	CONTACT BLOCK N.C.	1
62	10148-001	FUSE, 175 AMP	1
63	10149-000	FUSE BLOCK	1
64	29931-003	TERM PUSH, F 14-16 X .25	12
66	29601-015	RING TERMINAL, 14-16 GA 3/8 DIA	9
67	11709-008	SCREW, RH 10-24 UNC X 1	2
68	11248-003	NUT, ESNA 10-24 UNC	2
69	27963-000	RELAY SOCKET	1
70	27962-001	RELAY	1
71	63779-001	HORN, 600 HZ	1
72	63779-002	HORN, 60 HZ	1
75	63394-000	DOOR, CONTROL SIDE	1
77	64466-015	CABLE, VINYL COVERED ASSY X 15	1
78	11661-006	REDUCER	1

*Not Shown

Illustrated Parts Breakdown

Section
7.2

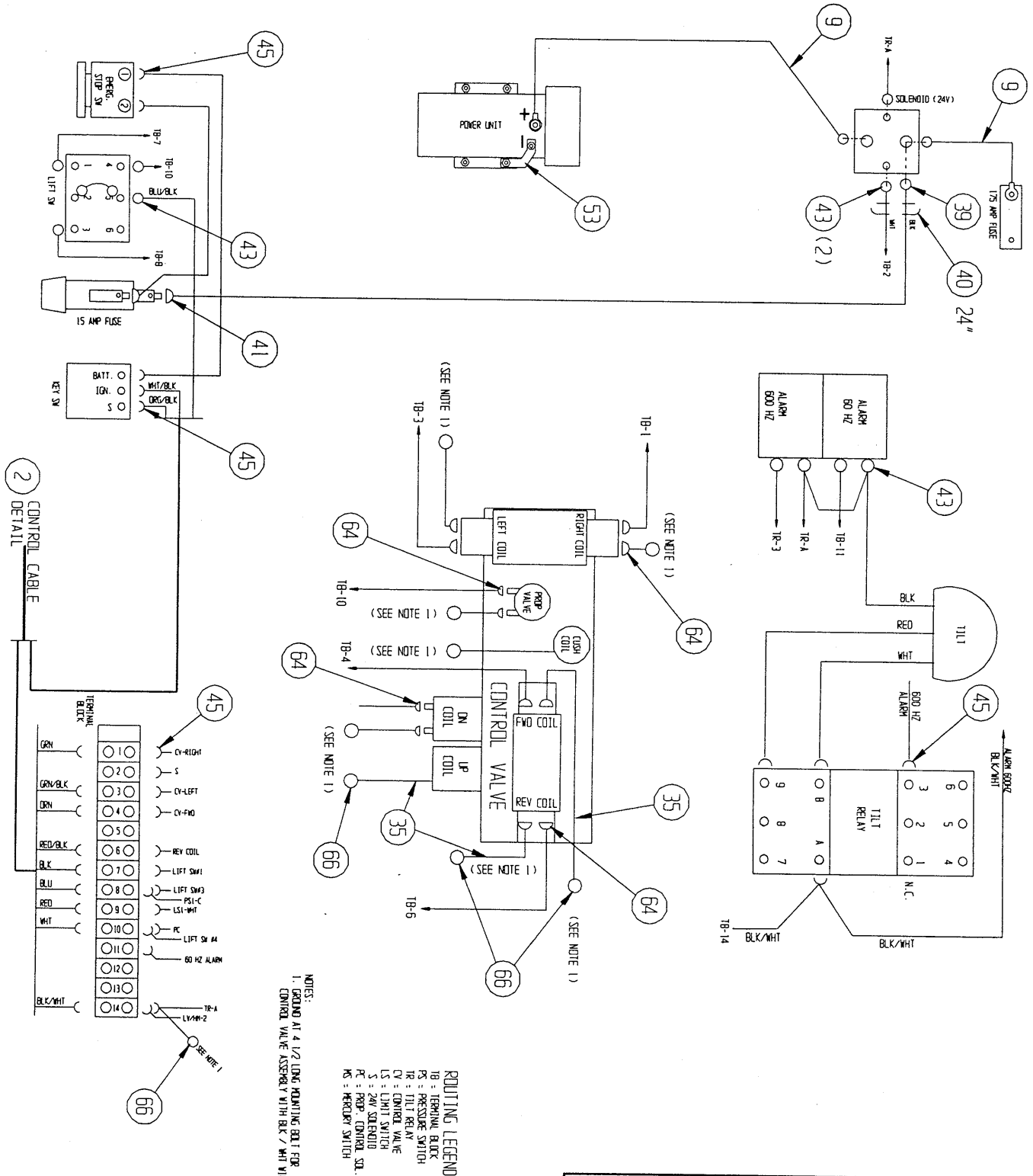


DETAIL "B"
TILT ALARM ASSEMBLY

DETAIL "A"
CABLE DETAIL

**CONTROL MODULE ASSEMBLY
SL-20D
DRAWING 1 OF 2**

Illustrated Parts Breakdown



**CONTROL MODULE ASSEMBLY
SL-20D
DRAWING 2 OF 2**

Illustrated Parts Breakdown

Section
7.2

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Illustrated Parts Breakdown

CONTROL VALVE ASSEMBLY SL-20D

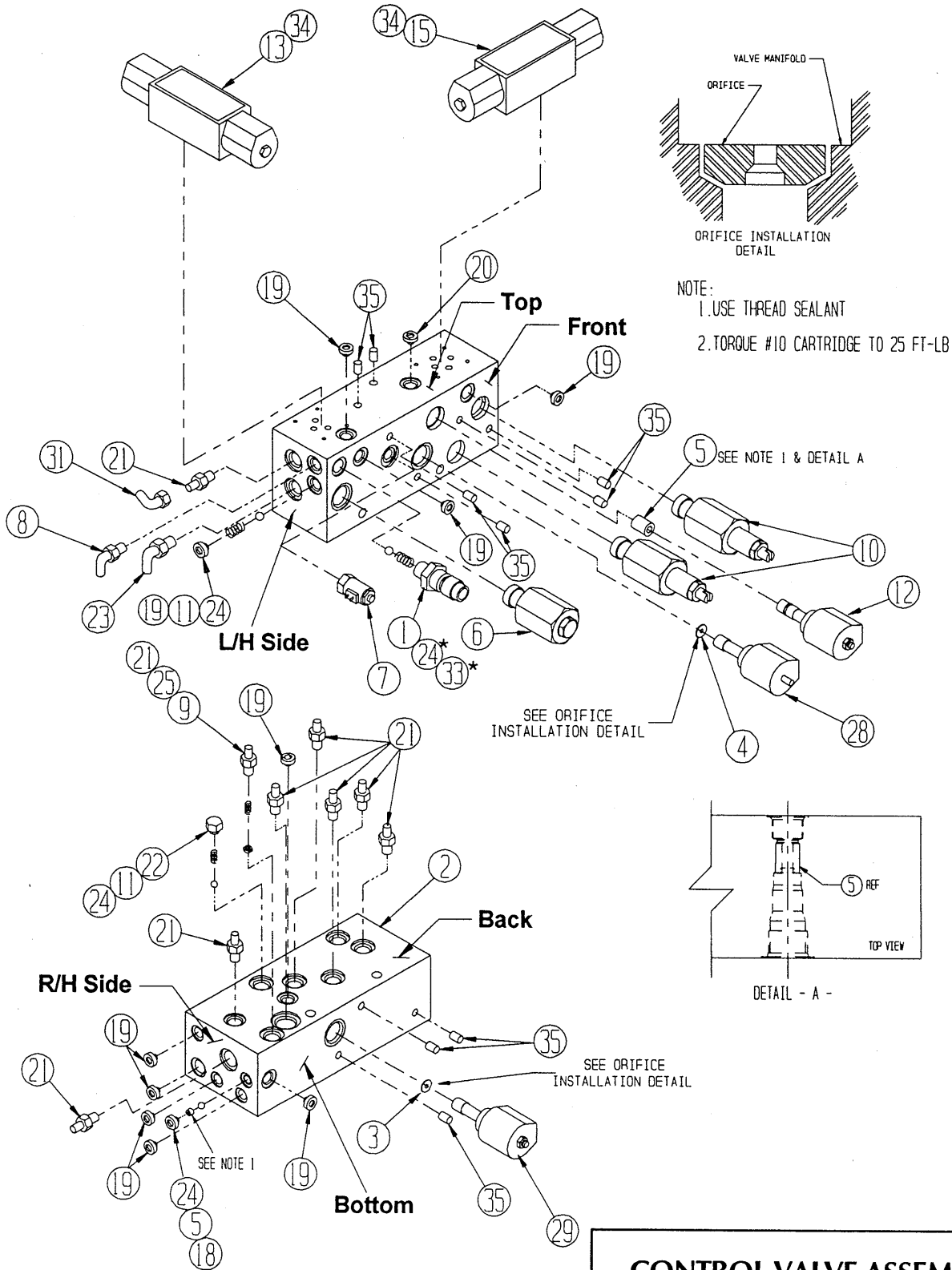
ITEM	PART	DESCRIPTION	QTY.
1	63965-001	CONNECTOR, GAUGE	1
2	63218-001	VALVE BLOCK, CONTROL	1
-	30576-007	VALVE BLOCK, SERVICE	1
3	63664-001	ORIFICE, .030 CUSHION	1
4	63664-002	ORIFICE, .062 DOWN	1
5	61728-000	ORIFICE	2
6	60390-000	VALVE, MAIN RELIEF	1
7	63986-002	VALVE, PROPORTIONAL SOLENOID	1
8	11934-026	FITTING, 90°	1
9	15919-000	ORIFICE	1
10	15900-000	VALVE, COUNTERBALANCE	2
11	15799-000	SPRING, COMP.	2
12	61797-000	VALVE, LIFT SOLENOID	1
13	15763-000	VALVE, STEERING SOLENOID	1
*	13888-007	O-RING	4
15	15760-000	VALVE, SOLENOID (DRIVE)	1
*	13888-007	O-RING	4
18	12004-006	FITTING, PLUG, #6	1
19	12004-004	FITTING, PLUG, #4	10
20	12004-002	FITTING, PLUG, #2	1
21	11941-005	FITTING, ADAPTER	7

ITEM	PART	DESCRIPTION	QTY.
22	20021-006	FITTING, PLUG, HEX	1
23	11934-004	FITTING, 90°	1
24+	05135-000	BALL, 5/16 DIA ATL	4
25	05133-000	SPRING, VALVE	1
28	63925-002	VALVE, DOWN & EMER. DOWN SOLENOID	1
29	15764-000	VALVE, CUSHION DOWN SOLENOID	1
31	11937-003	FITTING, 90°	1
33+	13987-006	SPRING	1
34	14412-016	SCREW, SOC HD CAP 10-24 X 2	8
35	63977-001	PLUG, DRIVE	9

+ One each added after machine serial number 4550.

*Not Shown

Illustrated Parts Breakdown



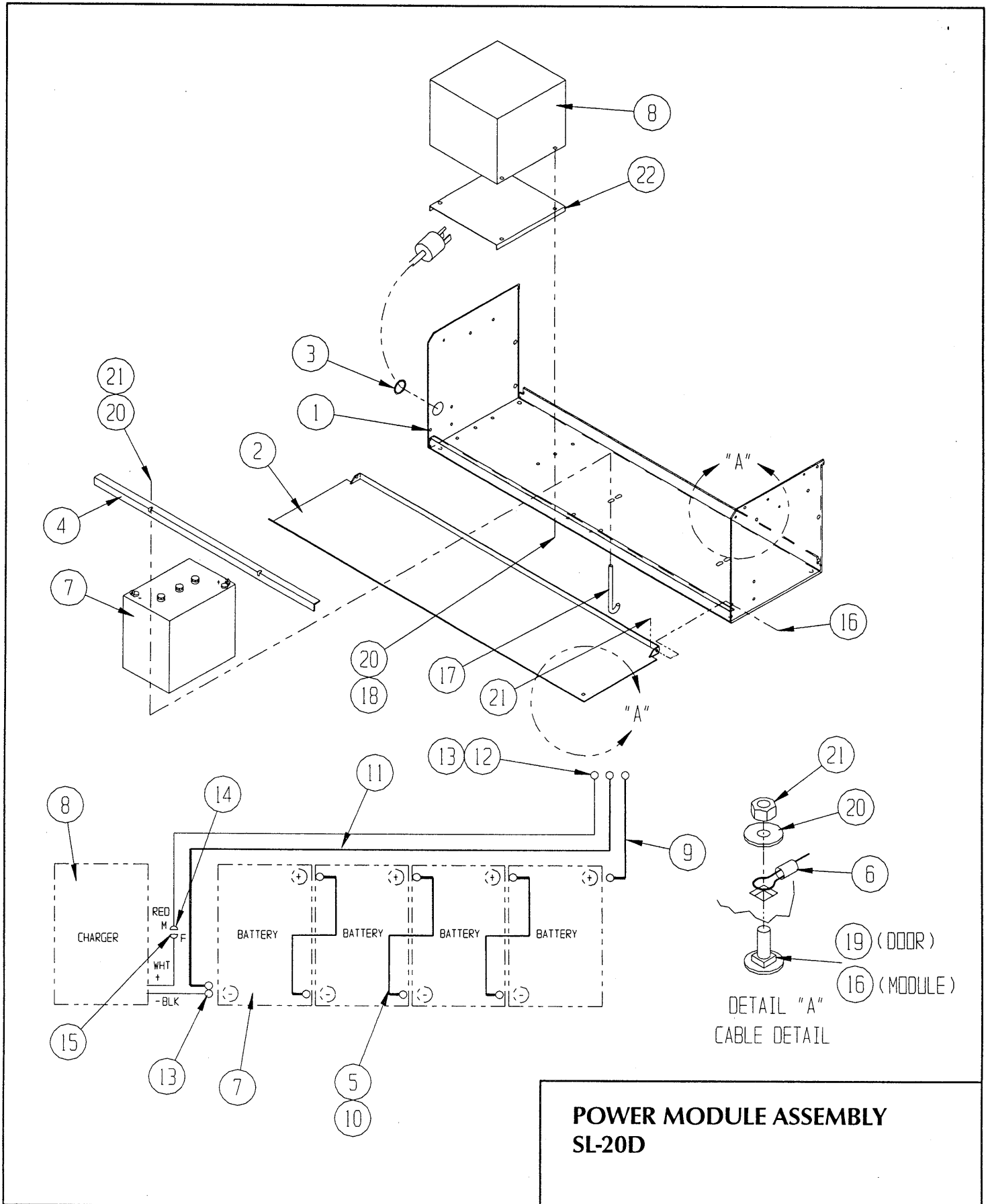
**CONTROL VALVE ASSEMBLY
SL-20D**

Illustrated Parts Breakdown

POWER MODULE ASSEMBLY SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	63552-000	MODULE TRAY	1
2	63395-000	DOOR, POWER MODULE	1
3	12956-010	GROMMET	1
4	63083-000	ANGLE, BATTERY HOLD DOWN	1
5	10154-000	TERMINAL COVER	8
6	64466-015	CABLE, VINYL COVERED ASSY	1
7	15796-000	BATTERY, 6 VDC	4
8	63944-011	CHARGER, BATTERY	1
9	62125-043	CABLE, ASSY X 43	1
10	62125-008	CABLE, ASSY X 8	3
11	64195-068	CABLE, ASSY X 68	1
12	29470-099	WIRE, 12 AWG RED	6 FT
13	29601-039	CONN RING, 12-10 X 5/16	2
14	14914-002	CONN, M PUSH X .25	1
15	29931-005	CONN, FM PUSH X .25	1
16	11252-006	SCREW, 1/4-20 UNC HHC X 3/4	3
17	63082-000	BOLT, J	2
18	11252-012	SCREW, 1/4-20 UNC X 1 1/2	2
19	11829-006	BOLT, CARR 1/4-20 UNC X 3/4	1
20	11240-004	WASHER, 1/4 DIA FLAT	6
21	11248-004	LOCKNUT, 1/4-20 HEX	6
22	63386-000	CHARGER, SPACER	1

Illustrated Parts Breakdown



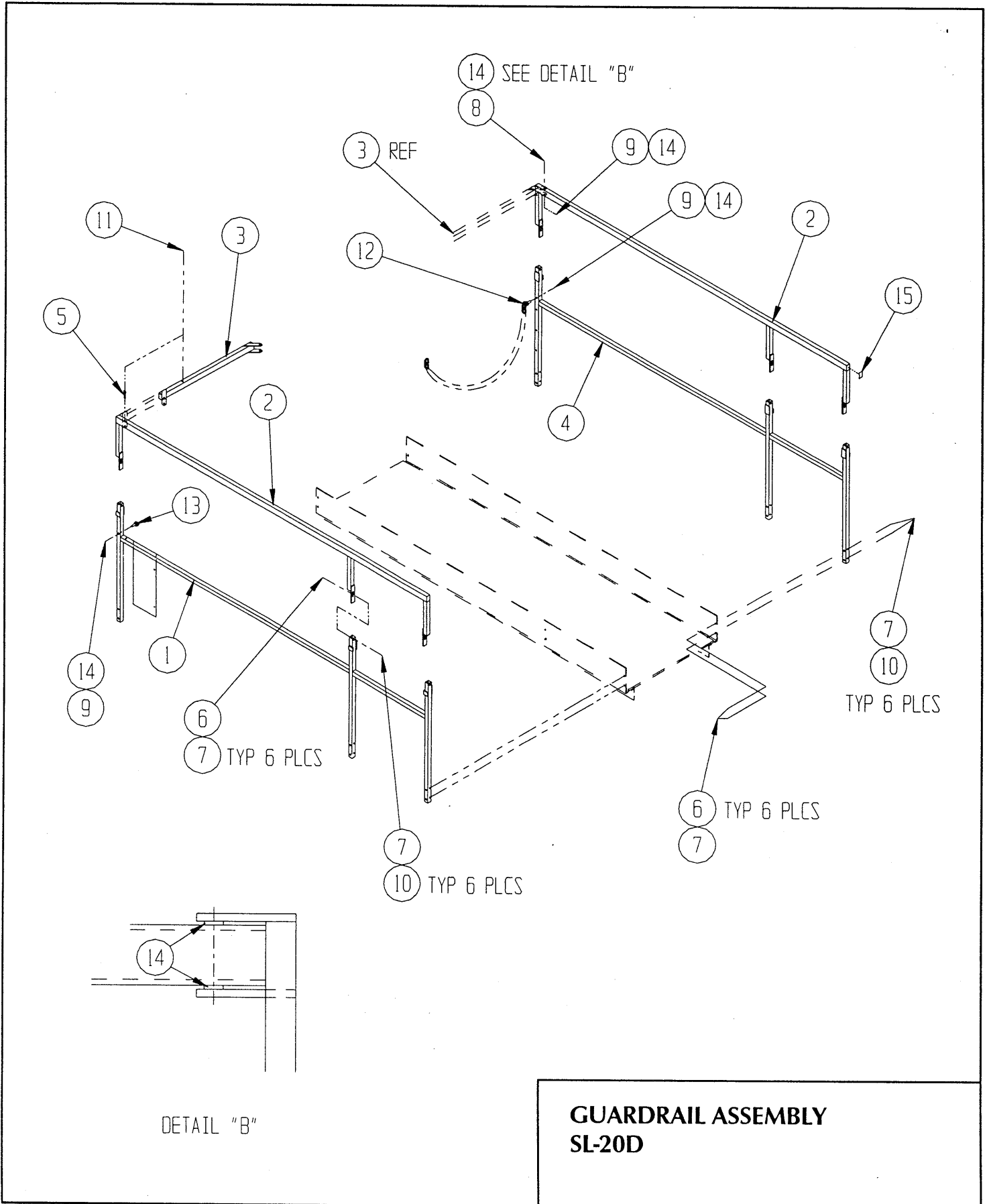
**POWER MODULE ASSEMBLY
SL-20D**

Illustrated Parts Breakdown

GUARDRAIL ASSEMBLY SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	63484-001	WELDMENT, BOTTOM RAILRH	1
2	63486-000	WELDMENT, TOP RAIL	2
3	63223-001	WELDMENT, END RAIL	1
4	63485-001	WELDMENT, BOTTOM RAIL LH	1
5	10414-000	LOCKING PIN ASSY	1
6	11248-006	NUT, ESNA 3/8-16	18
7	11240-006	WASHER, FLAT 3/8 DIA	36
8	11253-024	SCREW, HHC 5/16-18 X 3	1
9	11248-005	NUT, ESNA 5/16-18	3
10	11254-016	SCREW, HHC 3/8-16 X 2	18
11	26553-004	POP RIVET, 3/16 DIA X 3/8	1
12	63133-001	SAFETY CHAIN	1
13	14940-005	EYEBOLT	1
14	11240-005	WASHER, FLAT 5/16 DIA	4
15	63926-002	PLUG, 1 X 2 RECT	4

Illustrated Parts Breakdown

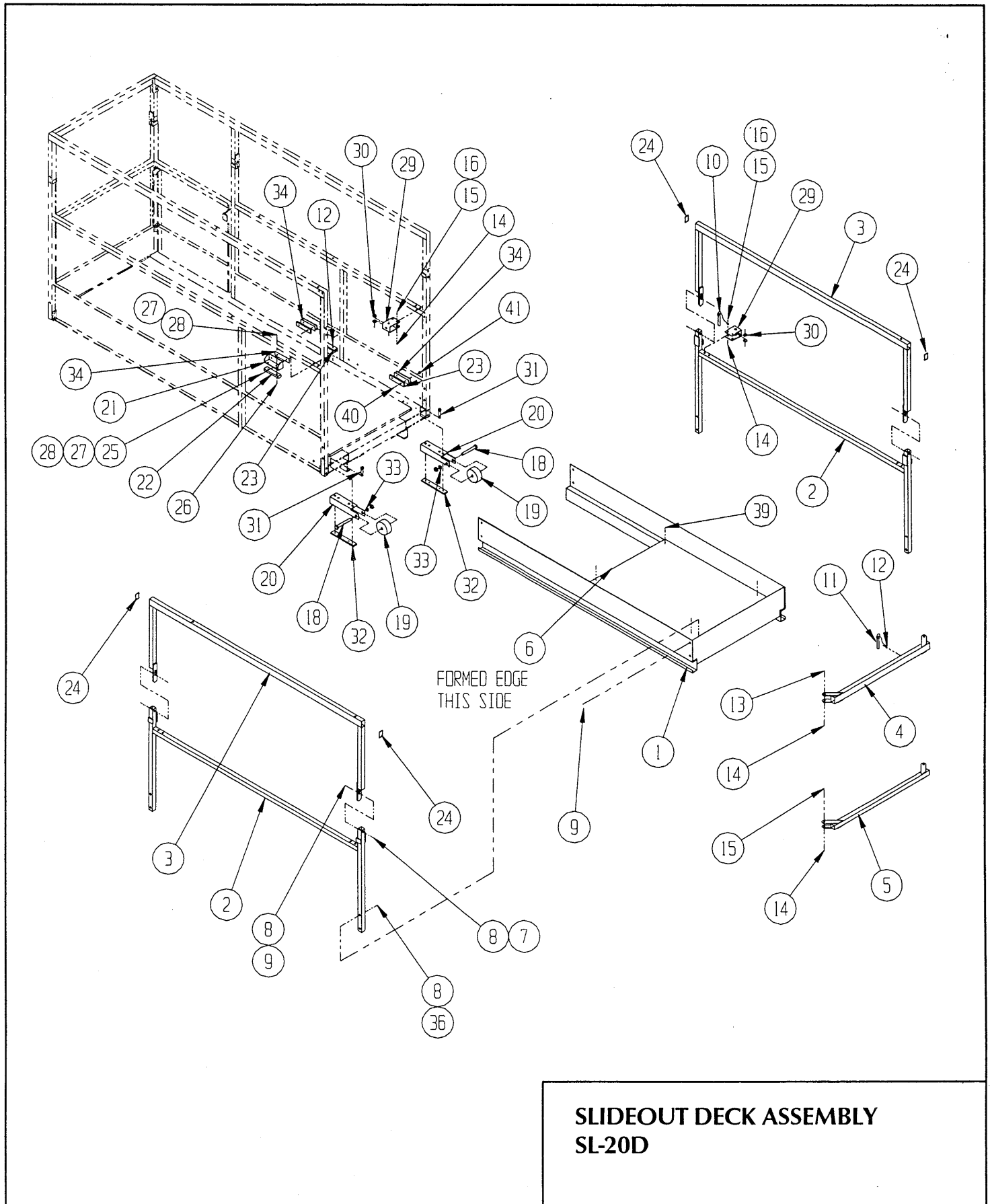


Illustrated Parts Breakdown

SLIDEOUT DECK ASSEMBLY SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	63478-000	DECK WELDMENT	1
2	63722-000	LOWER RAIL WELDMENT	2
3	63723-000	UPPER RAIL WELDMENT	2
4	63482-000	TOP RAIL	1
5	63483-000	MIDRAIL	1
6	63492-000	DIAMOND TREAD FLOOR	1
7	11254-016	SCREW, HEX HD CAP 3/8-16 X 2	4
8	11240-006	WASHER, FLAT 3/8	16
9	11248-006	ESNA NUT, 3/8-16	12
10	61786-000	LOCKING PIN ASSY	2
11	10414-000	LOCKING PIN ASSY	1
12	26553-004	POP RIVET, 3/16 X 3/8 GRIP	5
13	11253-022	SCREW, HHC 5/16-18 X 2-3/4	1
14	11248-005	ESNA NUT, 5/16-18	11
15	11253-016	SCREW, HEX HD CAP 5/16-18 X 2	10
16	11240-005	WASHER, FLAT 5/16	16
18	63990-001	AXLE	2
19	63989-001	WHEEL	2
20	63490-000	WHEEL MOUNTING BRACKET	2
21	63726-000	SLIDE BRACKET	2
22	63727-000	SLIDE BLOCK	2
23	63728-000	SLIDE BLOCK	8
24	63926-002	PLUG, TUBE	4
25	11252-006	SCREW, HEX HD CAP 1/4-20 X 3/4	4
26	12553-008	SCREW, SOCKET HD 1/4-20 X 1	4
27	11248-004	ESNA NUT, 1/4-20	11
28	11240-004	WASHER, FLAT 1/4	8
29	63729-000	GUARDRAIL CLIP	4
30	10080-006	TREE CLIP	12
31	11254-008	SCREW, HEX HD CAP 3/8-16 X 1	4
32	63578-000	RETAINING BLOCK	2
33	11240-008	WASHER FLAT 1/2	2
34	63571-000	SPACER	10
36	11254-014	SCREW, HHC 3/8-16 X 1 3/4	8
39	26553-007	POP RIVET, 3/16 X 1/2 GRIP	4
40	11709-006	SCREW, #10-24 UNC X 3/4	8
41	11248-003	LOCKNUT, #10-24 UNC HEX	8

Illustrated Parts Breakdown



**SLIDEOUT DECK ASSEMBLY
SL-20D**

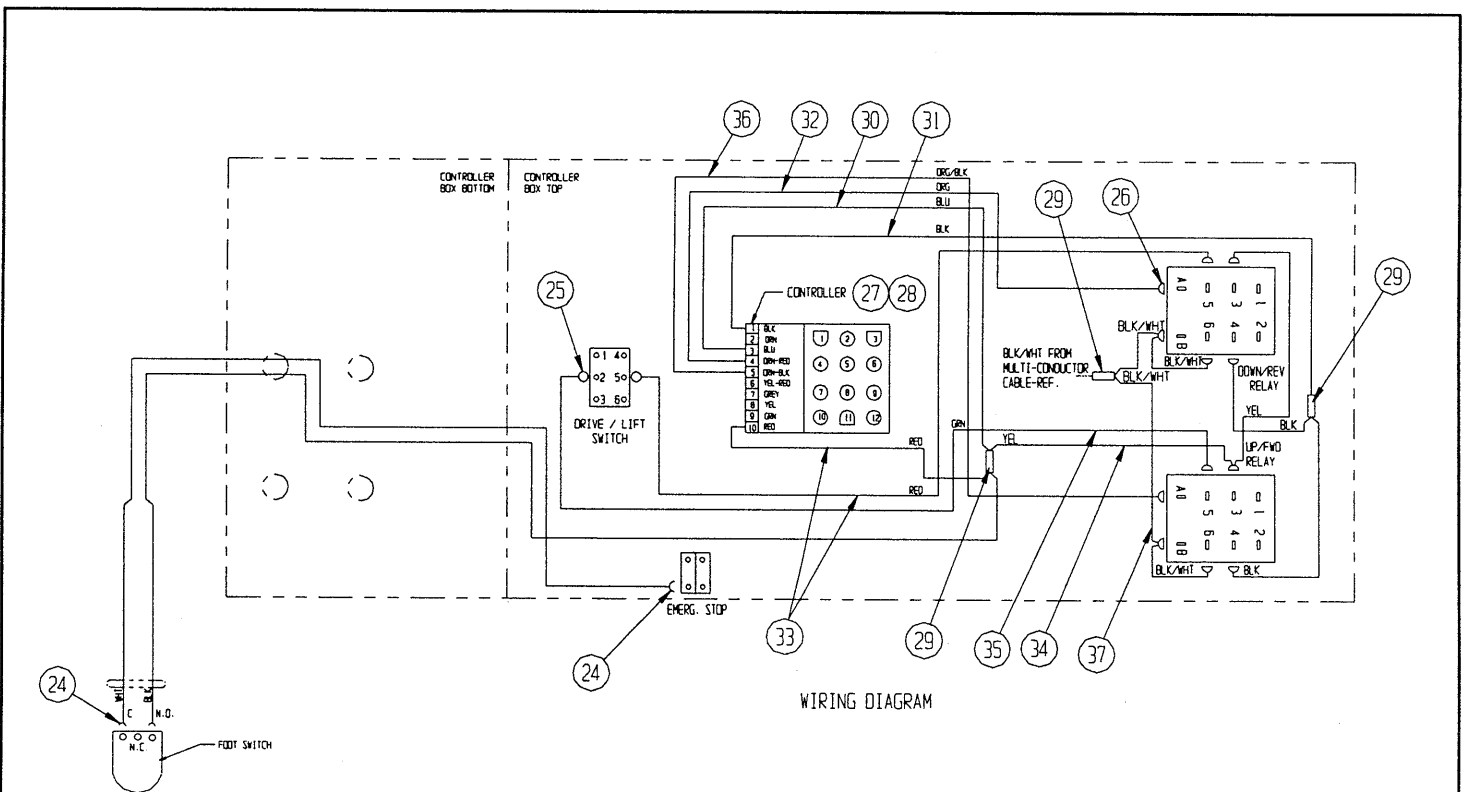
Illustrated Parts Breakdown

CONTROLLER ASSEMBLY SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	11248-047	LOCKNUT, 6-32 UNC	4
2	11715-004	SCREW, 6-32 UNC MACH RD HD X 1/2	4
3	11811-006	SCREW, 10-32 SLFTP X 3/4	2
4	11253-004	SCREW, 5/16 HH X 1/2	4
5	15941-001	SWITCH, DRIVE/LIFT	1
6	63368-000	BOX ENCLOSURE	1
7	29872-000	BOOT, SWITCH	1
8	29925-000	CONNECTOR	1
9	29939-002	LOCKNUT, CONDUIT	1
10	63906-000	SWITCH, FOOT	1
11	63951-002	RELAY	2
12	63975-000	CONTROLLER	1
*	66544-014	SWITCH, STEERING	2
*	63953-001	BOOT, UPPER CONTROLLER	1
*	63953-002	BOOT, LOWER CONTROLLER	1
*	63975-003	CIRCUIT BOARD, CONTROLLER	1
*	63975-004	GEAR/POT ASSY, CONTROLLER	1
13	63667-001	SWITCH, E-STOP	1
14	63611-000	CONTROLLER WING	1
15	63612-000	CONTROLLER WING	1
16	63613-000	CONTROLLER HANGER	1
17	26551-005	RIVET 1/8 DIA X 3/16-1/4 GRIP	6

ITEM	PART	DESCRIPTION	QTY.
18	29490-099	WIRE, 16 AWG 2 COND	6 FT
19	64462-009	CAPPLUGS, 1 1/16	1
20	63667-003	CONTACT BLOCK, 2 NC	1
21	29925-010	CONNECTOR	1
22	29939-003	LOCKNUT, 3/4 NPT	1
23	64462-007	CAPPLUGS, 7/8	1
24	29610-002	CONNECTOR, FORK TERM.	3
25	29601-013	CONNECTOR, RING TERM.	2
26	29616-001	CONNECTOR, SPADE TERM.	12
27	63956-003	PLUG, CONN	1
28	63956-002	PIN, CONN	5
29	29620-003	CONN. BUTT 12-10	3
30	29450-099	WIRE, 16 AWG BLU	1 FT
31	29452-099	WIRE, 16 AWG BLK	1 FT
32	29453-099	WIRE, 16 AWG ORG	1 FT
33	29454-099	WIRE, 16 AWG RED	1 FT
34	29456-099	WIRE, 16 AWG YEL	1 FT
35	29457-099	WIRE, 16 AWG GRN	1 FT
36	29477-099	WIRE, 16 AWG ORG/BLK	1 FT
37	63574-099	WIRE, 16 AWG BLK/WHIT	1 FT
38	11709-008	SCREW, RD HD MACH. 10-24 X 1	2

*Not Shown



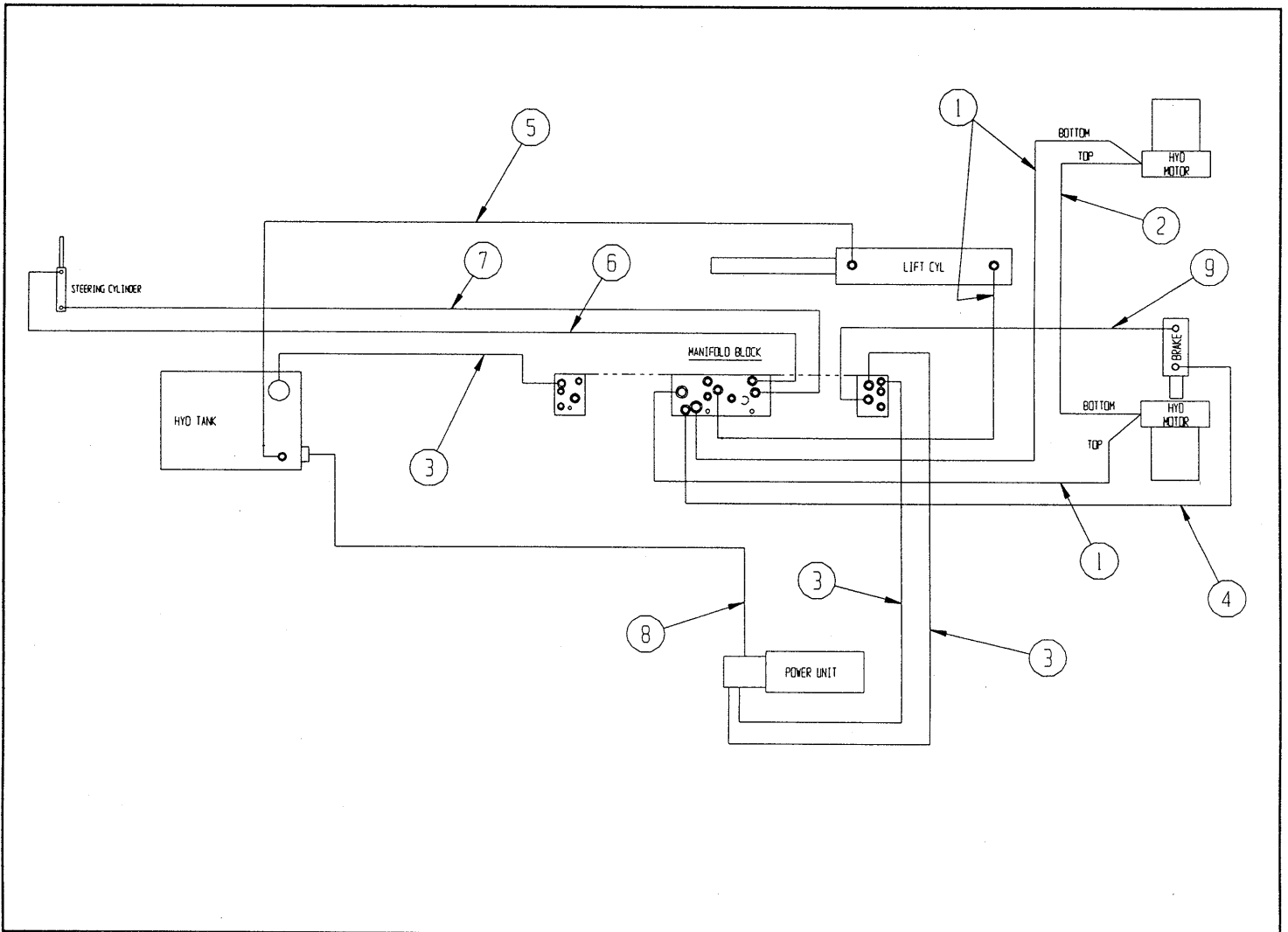
WIRING DIAGRAM

**CONTROLLER ASSEMBLY
SL-20D
DRAWING 1 OF 2**

Illustrated Parts Breakdown

HOSE KIT SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	60861-006	HOSE, ASSY 3/8 DIA X 38	3
2	60861-008	HOSE, ASSEMBLY 3/8 DIA X 29 1/2	1
3	60861-051	HOSE, ASSEMBLY 3/8 DIA X 13	3
4	60861-020	HOSE, ASSEMBLY 3/8 DIA X 44 1/2	1
5	61132-005	HOSE, ASSEMBLY 1/4 DIA X 79	1
6	61132-006	HOSE, ASSEMBLY 1/4 DIA X 70	1
7	61132-008	HOSE, ASSEMBLY 1/4 DIA X 74	1
8	61789-025	HOSE, ASSEMBLY 3/4 DIA X 25	1
9	60861-026	HOSE, ASSEMBLY 3/8 DIA X 31	1



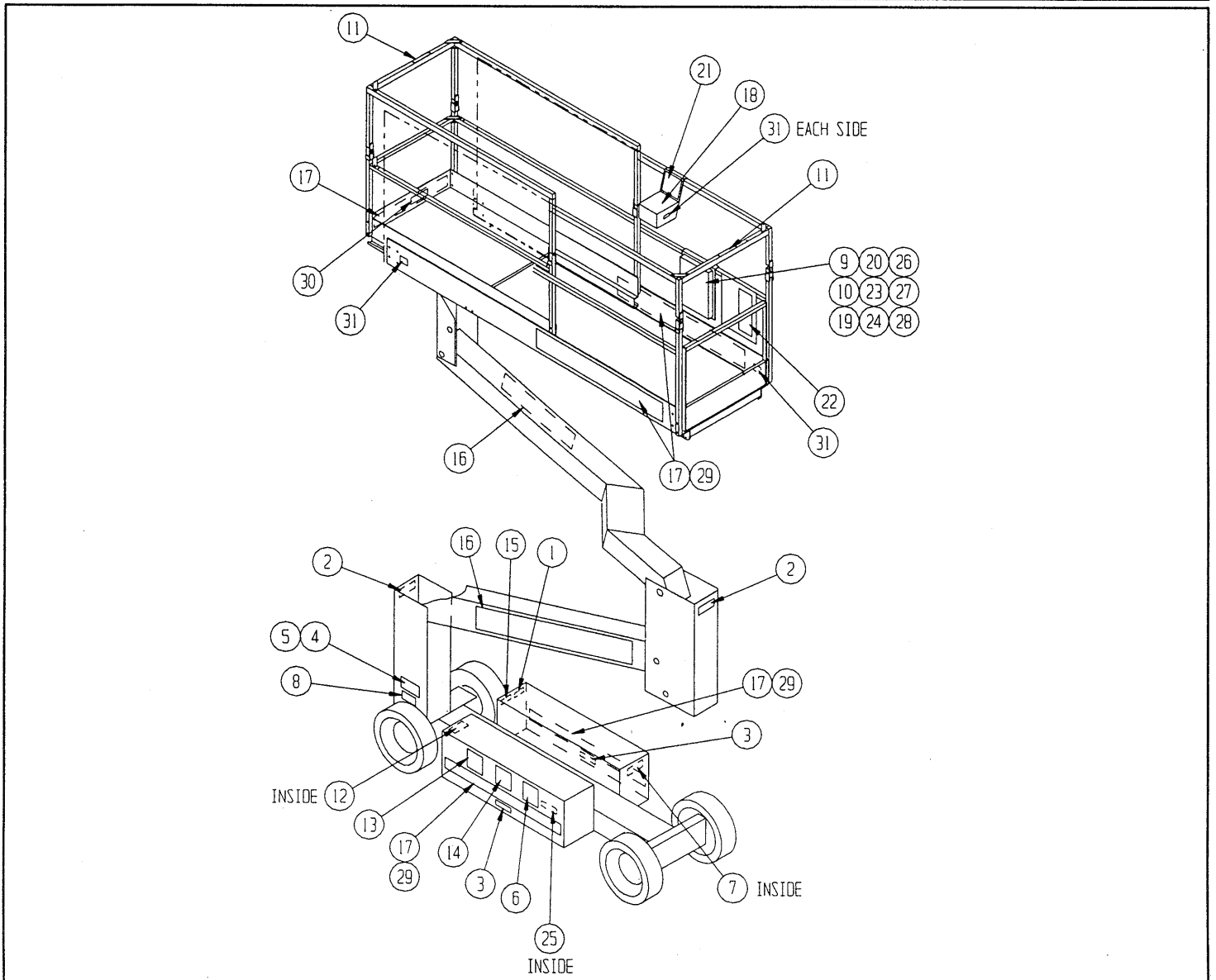
Illustrated Parts Breakdown

Section
7.2

LABEL KIT, 63008-004 SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	05221-000	LABEL, BATTERY FLUID	1
2	63213-000	LABEL, MAX LOAD 650 LB	2
3	14222-003-99	LABEL, FORK LIFT HERE	2
4	26551-005	RIVET, POP	4
5	61205-000	NAME PLATE	1
6	27993-000	LABEL, LOWER PLATFORM	1
7	61214-000	LABEL, DANGER HYDROGEN GAS	1
8	61220-001	LABEL, ANSI REQ.	1
9	10076-000	MANUAL CASE	1
10	10076-001	LABEL, ATTENTION	1
11	61787-000	LABEL, DANGER GUARDRAIL	2
12	63419-002	LABEL, CONTROLS	1
13	62524-001	LABEL, EMERGENCY LOWERING	1
14	62561-000	LABEL, CAUTION RELIEF VALVE	1
15	62562-000	LABEL, DANGER BATTERIES	1

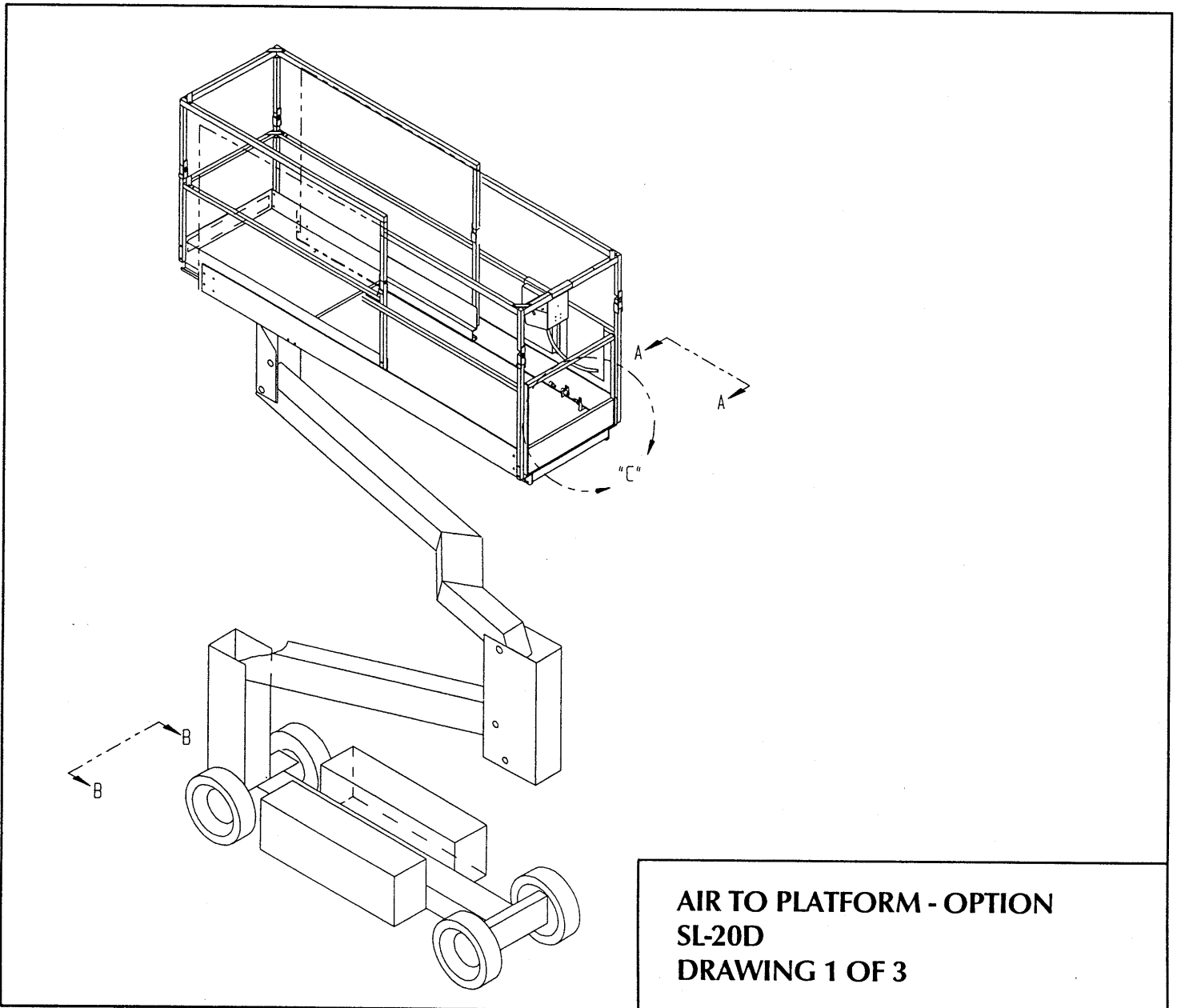
ITEM	PART	DESCRIPTION	QTY.
16	63130-001	LABEL, UPRIGHT SL-20D	2
17	61683-001	LABEL, UPRIGHT	5
18	63369-000	LABEL, CONTROLLER	1
19	11248-004	LOCKNUT, 1/4-20 UNC	4
20	11252-006	SCREW, 1/4-20 UNC HHC X 3/4	2
21	61831-000	LABEL, BEFORE OPERATING	1
22	62560-000	LABEL, DANGER INS.	1
23	60577-000	ANSI MANUAL	1
24	63098-004	USER MANUAL	1
25	60197-000	LABEL, HYDRAULIC FLUID	1
26	11240-004	WASHER, 1/4 STD FLAT	8
27	11252-016	SCREW, 1/4-20 UNC HHC X 2	2
28	61685-000	MANUAL CASE BRACKET	1
29	61684-001	LABEL, SL-20D	4
30	05652-000	LABEL, MAX LOAD 250 LB	1
31	64444-000	LABEL, USA	4



Illustrated Parts Breakdown

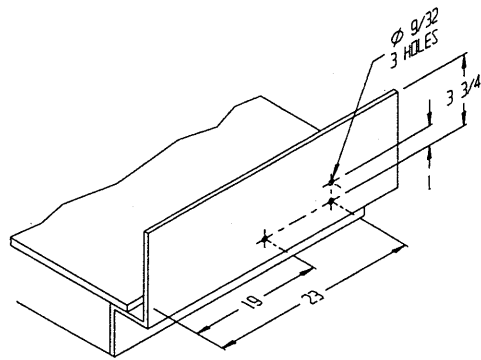
AIR TO PLATFORM - OPTION SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	11249-003	NUT, #10-32 ESNA LOCK	5
2	11826-008	SCREW, #10-32 RD HD MACH X 1 LG	5
3	12728-000	COUPLING, MALE	1
4	12729-003	COUPLING	1
5	15770-099	HOSE, 3/8	30 FT
6	64274-002	FITTING, HOSE	2
7	63191-000	BRACKET	2
8	13919-006	CLAMP	13
9	14418-005	WELD STUD	12
10	14251-003	FERRULE	12

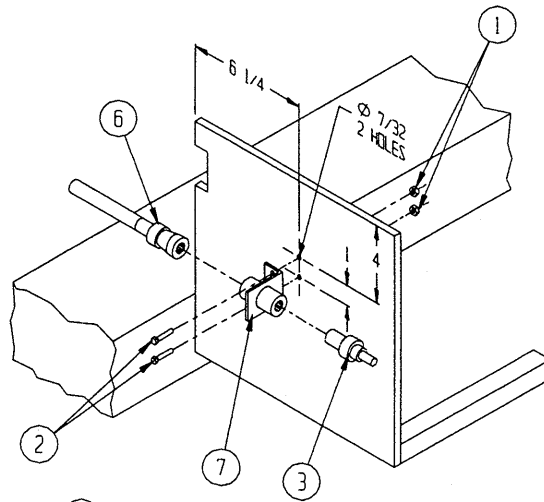


Illustrated Parts Breakdown

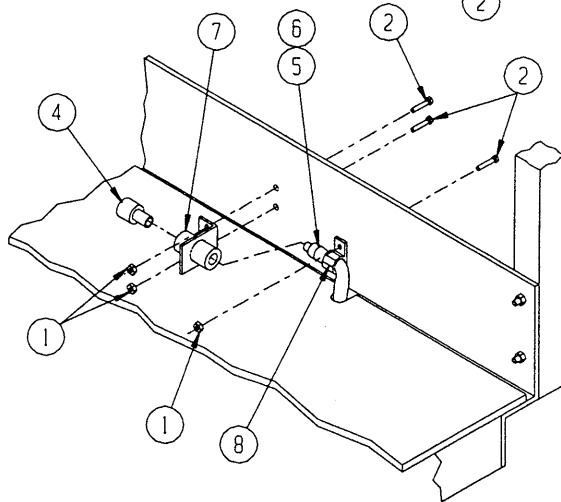
Section
7.2



VIEW A-A



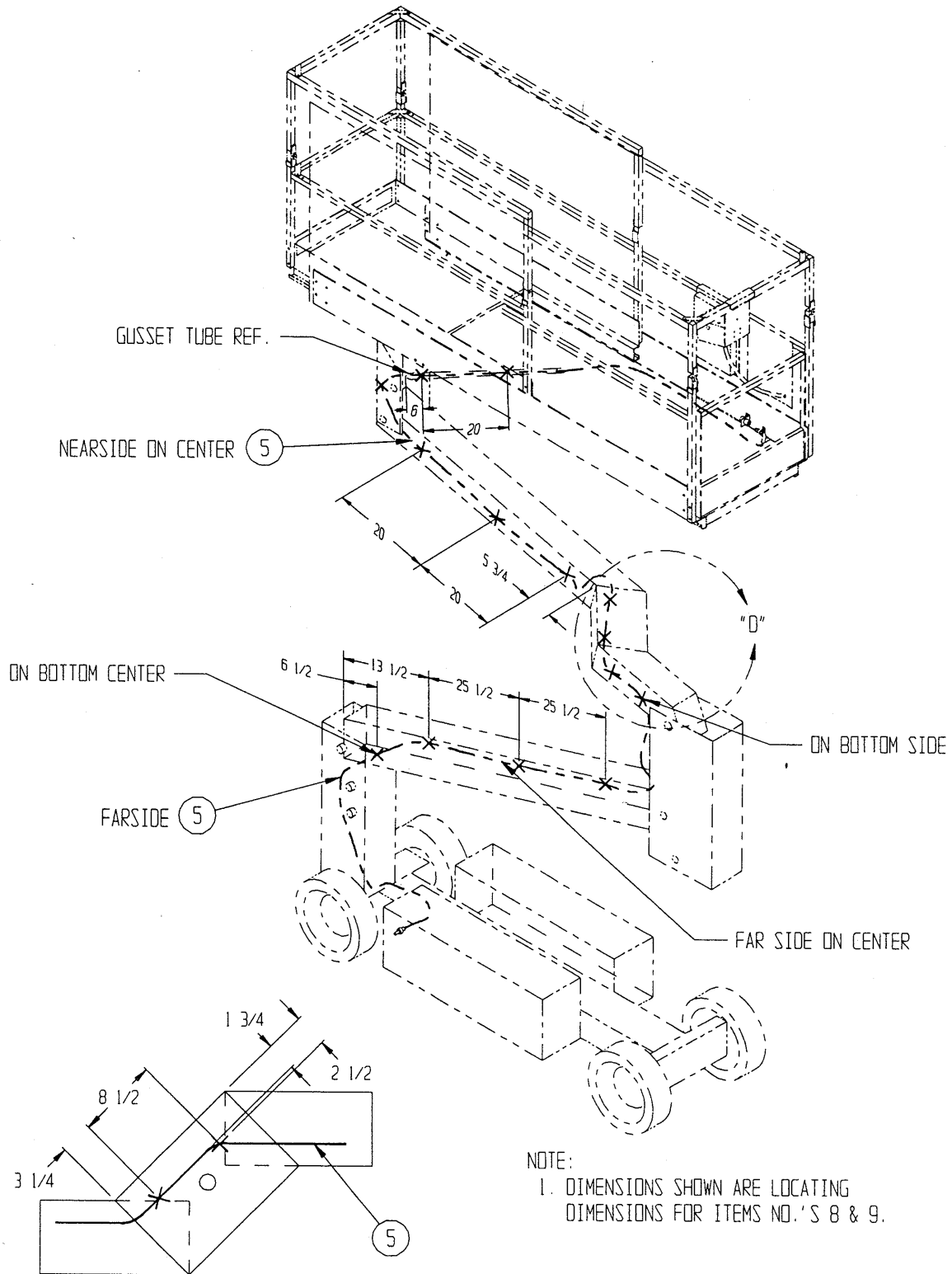
VIEW B-B



DETAIL "C"

AIR TO PLATFORM - OPTION
SL-20D
DRAWING 2 OF 3

Illustrated Parts Breakdown

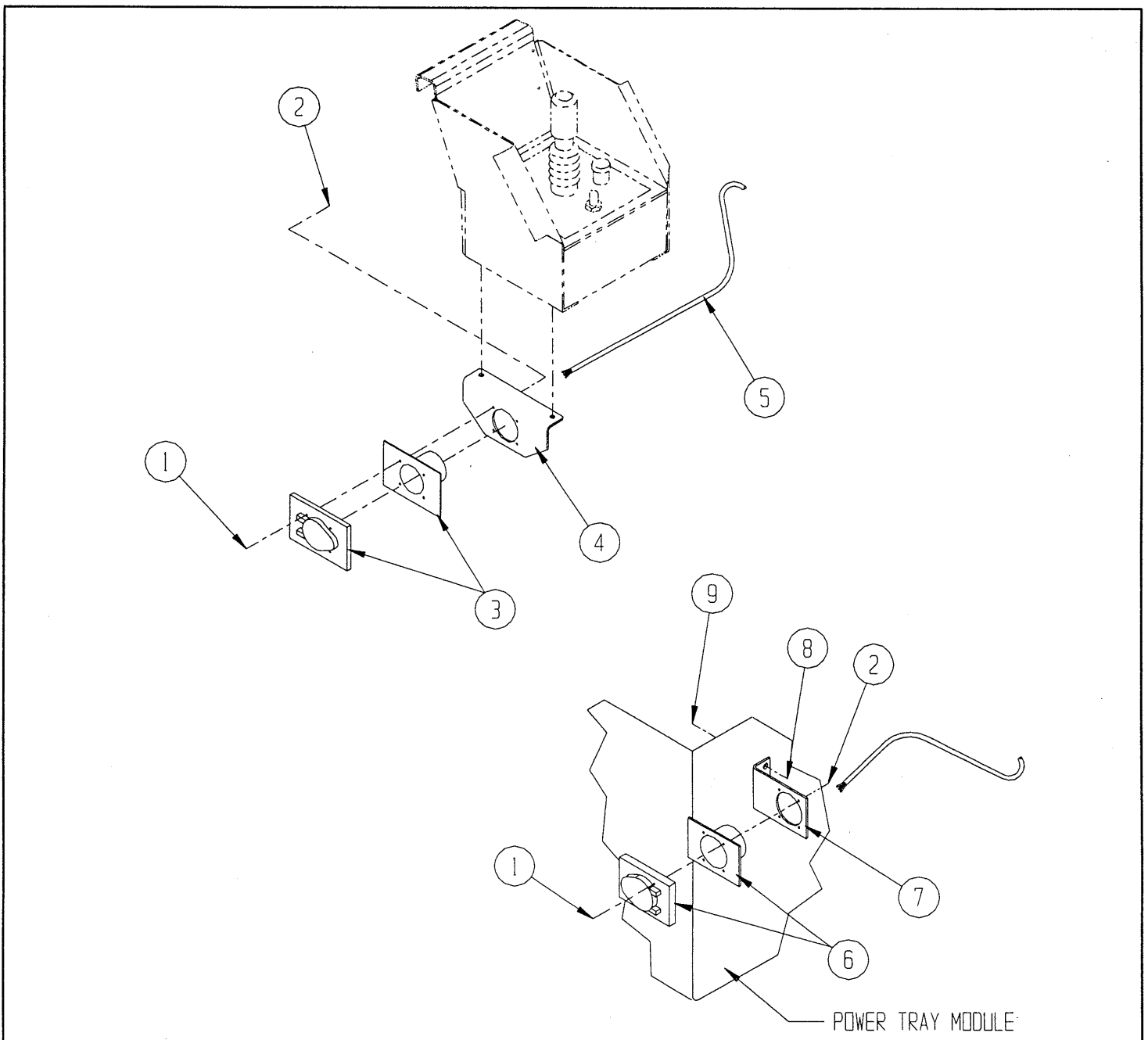


**AIR TO PLATFORM - OPTION
SL-20D
DRAWING 3 OF 3**

Illustrated Parts Breakdown

POWER TO PLATFORM - OPTION SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	11715-004	SCREW, RD. HD. #6-32 X 1/2 LG.	8
2	11248-047	NUT, ESNA #6-32	8
3	08942-001	OUTLET, FEMALE AC	1
4	64520-000	BRACKET	1
5	29495-099	WIRE, 14 GA 3 COND.	37 FT
6	08942-002	OUTLET, MALE AC	1
7	61914-001	BRACKET, BELL BOX MOUNT	1
8	11826-006	SCREW, RD. HD. #10-32 X 3/4 LG.	2
9	11249-003	NUT, ESNA #10-32	2

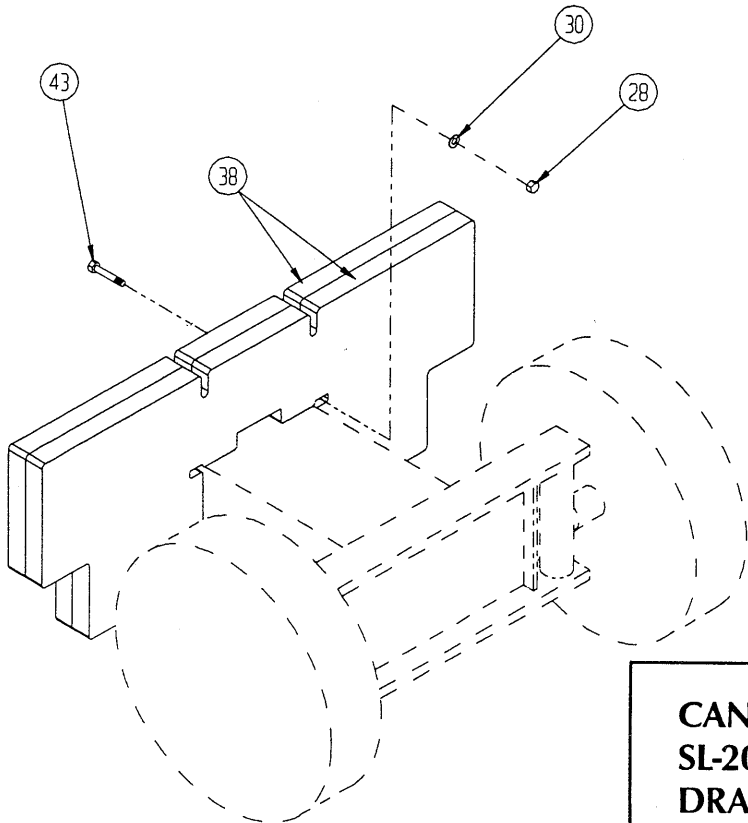


Illustrated Parts Breakdown

CANTILEVER CAGE - OPTION SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	63212-000	ROLLING FRAME ASSY	1
2	63211-002	CAGE ASSY	1
3	63210-002	VERTICAL CHAIN GUARD	1
4	63207-000	ROLLING FRAME SHAFT	1
5	63199-000	INNER BRACKET	2
6	63198-000	CHAIN GUARD	2
7	63196-000	OUTER BRACKET WELDMENT	2
8	61617-000	ROLLER	2
9	61615-000	PIN WELDMENT	2
10	11828-010	SCREW, 1/4-20 UNC FH X 1 1/4	2
11	61520-000	LABEL, MAX LOAD 550 LBS	2
12	61359-000	SPROCKET	2
13	61355-000	SAFETY WALK	1
14	60643-001	BEARING, SLIDE	6
15	27931-010	BEARING, BRNZ	4
16	19101-002	BAR, 3/16 SQ CFS X 1 1/4	1
17	17404-002	PIPE, 1/4 SCH 40 BLK STL X 1 1/4	4
18	10153-036	SPROCKET, 3/4 BORE	1
19	11884-003	LINK CON, 35 SNG STRD CLIP TYPE	5
20	11828-006	SCREW, 1/4-20 UNC FH X .75	2
21	11741-010	SCREW, 3/8-16 UNC FHS X 1 1/4	4
22	11735-020	ROLL PIN, 1/8 DIA X 1 1/4	2
23	11254-010	SCREW, HHC GR5 3/8-16 UNC X 1 1/4	8
24	11246-004	NUT, ESNA THIN 1/4-20 UNC	2
25	11252-030	SCREW, 1/4-20 UNC X 3 3/4	4
26	11252-014	SCREW, 1/4-20 UNC X 1 3/4	2
27	11252-008	SCREW, HHC GR5 1/4-20 UNC X 1	6
28	11248-006	NUT, HEX ESNA 3/8 16 UNC	12

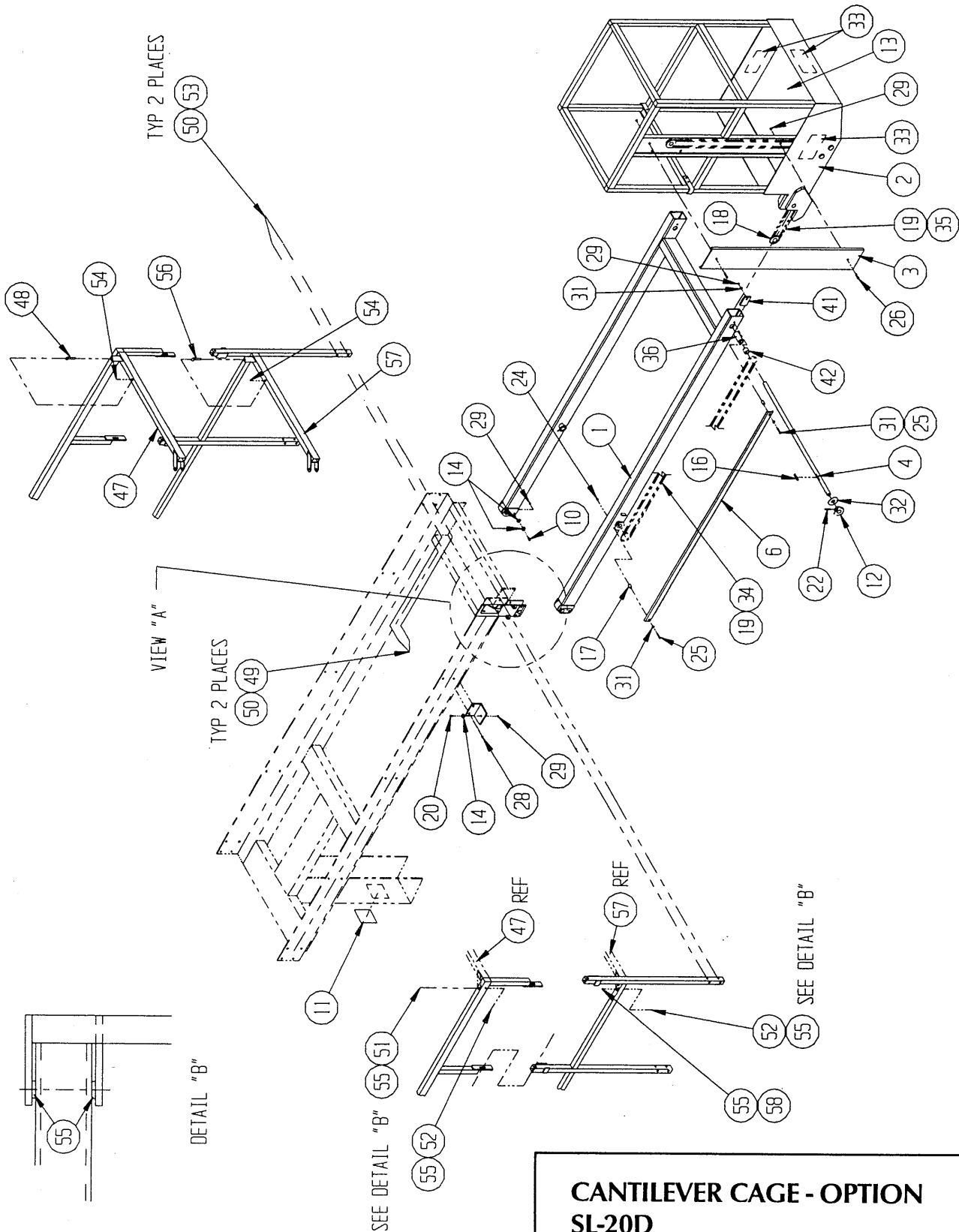
ITEM	PART	DESCRIPTION	QTY.
29	11248-004	NUT, HEX ESNA 1/4-20 UNC	14
30	11240-006	WASHER, FLAT STD 3/8	12
31	11240-004	WASHER, FLAT STD 1/4	4
32	06452-000	BEARING, THRUST	2
33	05652-000	LABEL, MAX LOAD 250 LBS	3
34	05641-016	CHAIN, ROLLER # 35 X 273 PITCHES	2
35	05641-011	CHAIN, ROLLER #35 X 291 PITCHES	1
36	61939-000	PIVOT BUSHING	2
38	63214-000	CHASSIS COUNTERWEIGHT	2
40	63209-000	SUPPORT ANGLE	2
41	61938-000	TAB	2
42	62642-010	BEARING	2
43	11254-030	SCREW, 3/8-16 UNC X 3 3/4	4
44	61322-000	CHAIN ADJUSTMENT SCREW	4
45	11250-004	NUT, 1/4-20 UNC HEX	4
46	11831-008	BOLT, 3/8-16 UNC CARRIAGE X 1	4
47	63223-001	WELDMENT, END RAIL	1
48	10414-000	LOCKING PIN ASSY	1
49	11248-006	NUT, ESNA 3/8-16	4
50	11240-006	WASHER, FLAT 3/8 DIA	8
51	11253-024	SCREW, HEX HD CAP 5/16-18 X 3	1
52	11248-005	NUT, ESNA 5/16-18	2
53	11254-016	SCREW, HEX HD CAP 3/8-16 X 2	4
54	26553-004	POP RIVET, 3/16 DIA X 3/8	2
55	11240-005	WASHER, FLAT 5/16 DIA	4
56	61786-000	LOCKING PIN ASSY	1
57	63267-000	WELDMENT, REAR MIDRAIL	1
58	11253-016	SCREW, HHC 5/16-18 X 2	1



**CANTILEVER CAGE - OPTION
SL-20D
DRAWING 1 OF 3**

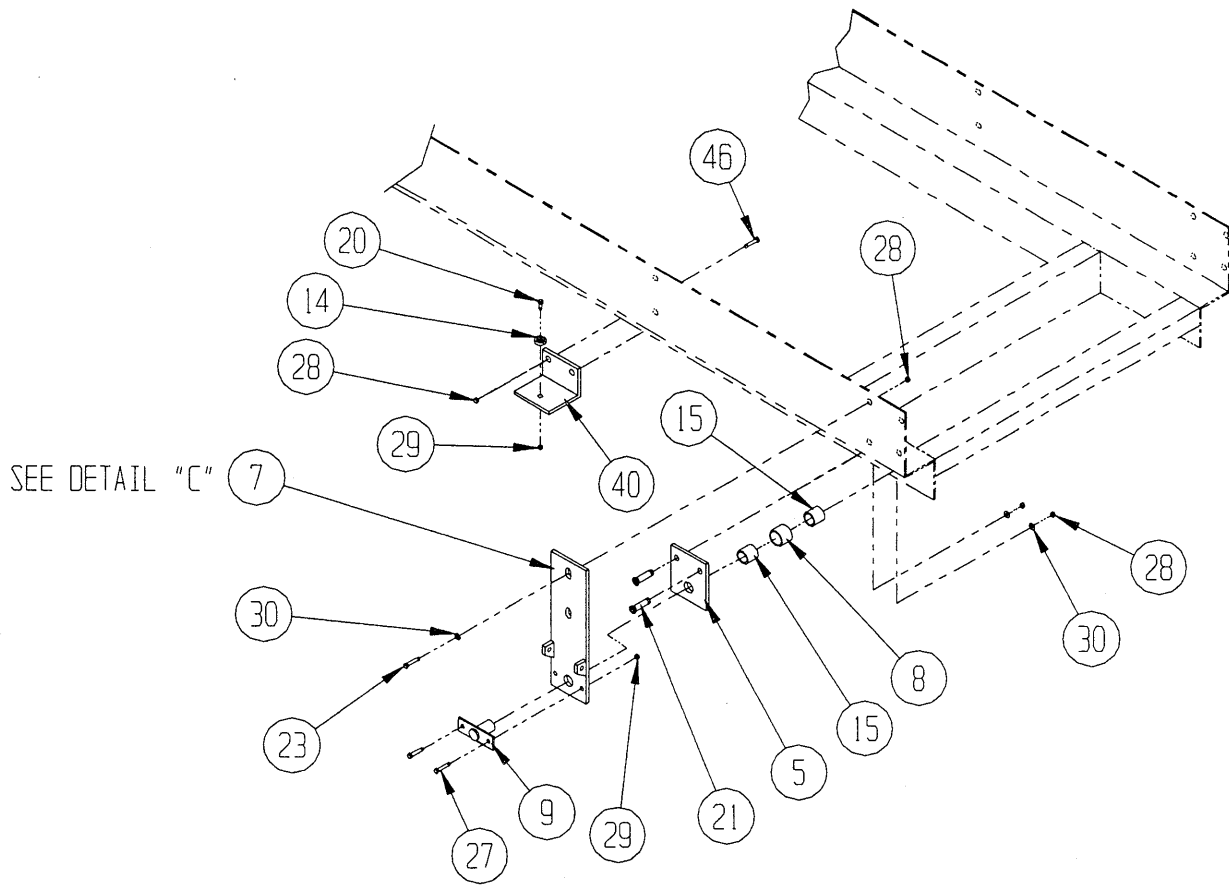
Illustrated Parts Breakdown

Section
7.2

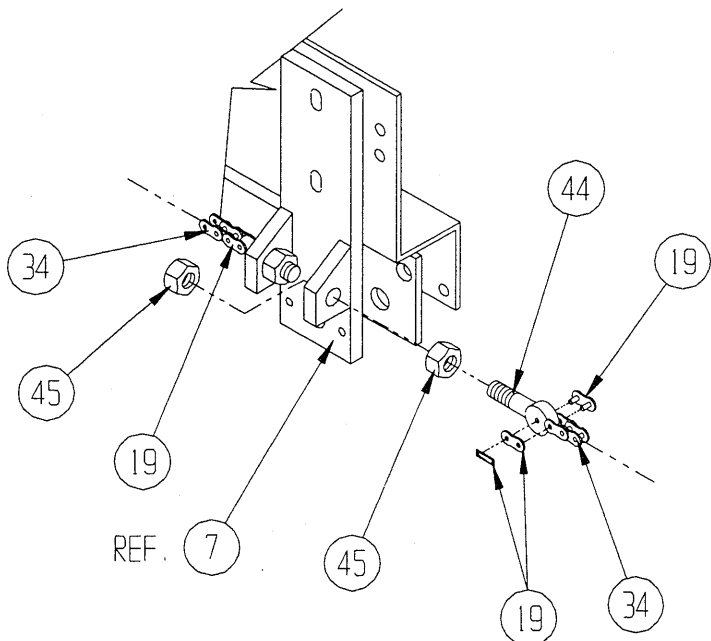


**CANTILEVER CAGE - OPTION
SL-20D
DRAWING 2 OF 3**

Illustrated Parts Breakdown



VIEW "A"



DETAIL "C"

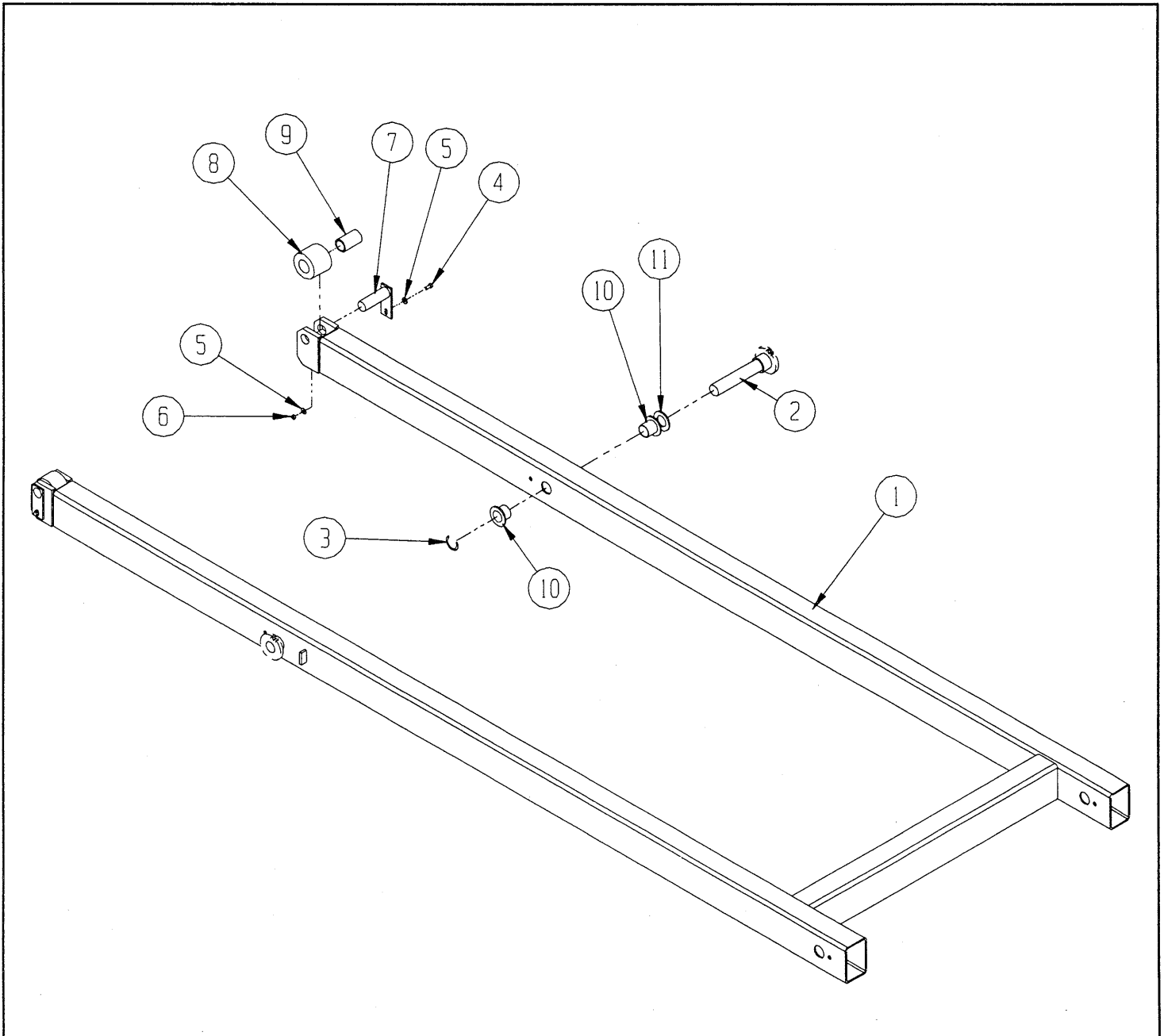
**CANTILEVER CAGE - OPTION
SL-20D
DRAWING 3 OF 3**

Illustrated Parts Breakdown

Section
7.2

ROLLING FRAME SUBASSEMBLY, CANTILEVER CAGE - OPTION SL-20D

ITEM	PART	DESCRIPTION	QTY.
1	63194-000	ROLLING FRAME	1
2	61310-000	SHAFT WELDMENT	2
3	11764-012	RING, RETAINING	2
4	11252-008	SCREW, 1/4-20 UNC HHC X 1	2
5	11240-004	WASHER, 1/4 DIA FLAT	4
6	11248-004	LOCKNUT, 1/4-20 UNC HEX	2
7	61304-000	PIN WELDMENT	2
8	61336-000	ROLLER	2
9	27931-010	BEARING	2
10	00173-000	BEARING, FLANGE	4
11	06452-000	BEARING, THRUST	2



UpRight

Call Toll Free in U.S.A.

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P/N 63099-002-00

5/95 D