

SERVICE & MAINTENANCE

Model 10VP 15VP 20VP

3120849

November 15, 2000



AUSTRALIAN OFFICE

JLG INDUSTRIES, INC.
P.O. Box 5119
11 Bolwarra Road
Port Macquarie, Australia
Telephone: 065 811111
Fax: 065 810122

EUROPEAN OFFICE

JLG INDUSTRIES (EUROPE)
Kilmartin Place,
Tannochside Park
Uddingston, Scotland, G71 5PH
Telephone: 01698 811005
Main Fax: 01698 811055
Parts Fax: 01698 811455

WORLD HEADQUARTERS

JLG INDUSTRIES, INC.
1 JLG Drive
McConnellsburg, PA.
17233-9533
USA
Telephone: (717) 485-5161
Fax: (717) 485-6417

FOREWORD

The purpose of this manual is to provide users with the operating procedures essential for the promotion of proper machine operation for its intended purpose. It is important to over-stress proper machine usage. All information in this manual should be **READ** and **UNDERSTOOD** before any attempt is made to operate the machine. **YOUR OPERATING MANUAL IS YOUR MOST IMPORTANT TOOL** - Keep it with the machine. **REMEMBER ANY EQUIPMENT IS ONLY AS SAFE AS THE OPERATOR.**

BECAUSE THE MANUFACTURER HAS NO DIRECT CONTROL OVER MACHINE APPLICATION AND OPERATION, PROPER SAFETY PRACTICES ARE THE RESPONSIBILITY OF THE USER AND HIS OPERATING PERSONNEL.

ALL INSTRUCTIONS IN THIS MANUAL ARE BASED ON THE USE OF THE MACHINE UNDER PROPER OPERATING CONDITIONS, WITH NO DEVIATIONS FROM THE ORIGINAL DESIGN. ALTERATION AND/OR MODIFICATION OF THE MACHINE IS STRICTLY FORBIDDEN, WITHOUT WRITTEN APPROVAL FROM JLG INDUSTRIES, PER OSHA REGULATIONS.



THIS "SAFETY ALERT SYMBOL" IS USED TO CALL ATTENTION TO POTENTIAL HAZARDS WHICH MAY LEAD TO SERIOUS INJURY OR DEATH IF IGNORED.

Safety of personnel and proper use of the machine are of primary concern, **DANGER, WARNING, CAUTION, IMPORTANT, INSTRUCTIONS** and **NOTE** are inserted throughout this manual to emphasize these areas. They are defined as follows:

DANGER

DANGER INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED WILL RESULT IN SERIOUS INJURY OR DEATH.

WARNING

WARNING INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED COULD RESULT IN SERIOUS INJURY OR DEATH.

CAUTION

CAUTION INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, MAY RESULT IN MINOR OR MODERATE INJURY. IT MAY ALSO BE USED TO ALERT AGAINST UNSAFE PRACTICES.

IMPORTANT

IMPORTANT OR INSTRUCTIONS PROCEDURES ESSENTIAL FOR SAFE OPERATION AND WHICH, IF NOT FOLLOWED MAY RESULT IN A MALFUNCTION OR DAMAGE TO THE MACHINE.

Also in this Manual "Notes:" are used to provide information of special interest.

IMPORTANT

JLG INDUSTRIES, INC. MAY HAVE ISSUED SAFETY RELATED BULLETINS FOR YOUR JLG PRODUCT. CONTACT JLG INDUSTRIES, INC. OR THE LOCAL AUTHORIZED JLG DISTRIBUTOR FOR INFORMATION CONCERNING SAFETY RELATED BULLETINS WHICH MAY HAVE BEEN ISSUED FOR YOUR JLG PRODUCT. ALL ITEMS REQUIRED BY THE SAFETY RELATED BULLETINS MUST BE COMPLETED ON THE AFFECTED JLG PRODUCT.

Due to the continuous product improvements, JLG Industries, Inc. reserves the right to make specification changes without prior notification. Contact JLG Industries, Inc. for updated information.

This page left intentionally blank.

INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A. GENERAL

This section contains the general safety precautions which must be observed during maintenance of the aerial platform. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others or damage to the equipment. A maintenance program must be established by a qualified person and must be followed to ensure that the machine is safe to operate.

WARNING

MODIFICATION OF THE MACHINE WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE MACHINE IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED IS A SAFETY VIOLATION.

The specific precautions to be observed during machine maintenance are inserted at the appropriate point in the manual. These precautions are, for the most part, those that apply when servicing hydraulic and larger machine component parts.

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of component weight and never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

WARNING

SINCE THE MACHINE MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA IS THE RESPONSIBILITY OF THE OWNER/OPERATOR.

B. HYDRAULIC SYSTEM SAFETY

1. It should be particularly noted that the machines hydraulic systems operate at extremely high and potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system.
2. Relieve system pressure by activating the lift DOWN control with the platform completely lowered to direct any line pressure back into the return line to the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.

C. MAINTENANCE

WARNING

FAILURE TO COMPLY WITH SAFETY PRECAUTIONS LISTED IN THIS SECTION COULD RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.

- REMOVE ALL RINGS, WATCHES, AND JEWELRY WHEN PERFORMING ANY MAINTENANCE.
- DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.
- OBSERVE AND OBEY ALL DANGER, WARNING, CAUTION AND OTHER INSTRUCTIONS ON MACHINE AND IN SERVICE MANUAL.
- KEEP STANDING SURFACES AND HAND HOLDS FREE OF OIL, GREASE, WATER, ETC.
- NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVER-HEAD SLING.
- BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.
- BATTERY SHOULD ALWAYS BE DISCONNECTED DURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

This page intentionally left blank.

EFFECTIVITY CHANGES

September 15, 1997 – Original Issue of Manual

January 10, 1998 – Change 1– Pages Affected: Revision Log - Page c
 Table of Contents - Page ii
 Section 3 - Pages 3-8 & 3-9

February 7, 2000 – Revised – Pages Affected: Section-1, Page 1-5, Table 1-5.
 Section-2, Page 2-18, Table 2-3.
 (remove lube check requirement for drive wheel gear box)

October 19, 2000 – Revised – Complete Manual

November 15, 2000 – Revised – Pages Affected: Section 1 - Page 1-2
 Section 2 - Page 2-33 & 2-34

This Page Left Intentionally Blank

SUBJECT - SECTION, PARAGRAPH	PAGE NO.
SECTION INTRODUCTION - - MAINTENANCE SAFETY PRECAUTIONS	
a GENERAL	a
b HYDRAULIC SYSTEM SAFETY	a
c MAINTENANCE	a
EFFECTIVITY CHANGES	c
 SECTION 1 - SPECIFICATIONS	
1.1 Capacities	1-1
1.2 Component Data	1-1
1.3 Performance Data	1-1
1.4 Torque Requirements	1-2
1.5 Lubrication	1-2
1.6 Hydraulic Pressure Adjustment	1-3
1.7 Cylinder Specifications	1-3
1.8 Serial Number Locations	1-3
 SECTION 2 - SERVICE PROCEDURES	
2.1 General	2-1
2.2 Servicing And Maintenance Guidelines	2-1
2.3 Lubrication Information	2-3
2.4 Positioning Lift For Access To Components Located Under The Base Frame	2-4
2.5 Drive Motor Component Service Procedures	2-5
2.6 Platform Control Box Service Procedures	2-15
2.7 Battery Charger Assembly And Disassembly	2-20
2.8 Mast Assembly And Disassembly Procedures	2-23
2.9 Mast To Base Frame Installation	2-32
2.10 Mast Chains/cables And Sequencing Cables Adjustment	2-33
2.11 Sequence Cable Replacement Kit	2-34
2.12 Preventive Maintenance And Inspection Schedule	2-36
 SECTION 3 - TROUBLESHOOTING	
3.1 General	3-1
3.2 Troubleshooting Information	3-1
3.3 Hydraulic Circuit Checks	3-1
3.4 Electrical Circuit Checks	3-1
3.5 Troubleshooting Section - Table Of Contents	3-15
3.6 Ohm Ratings For Various Components	3-16
3.7 Main Power Circuit Troubleshooting	3-17
3.8 Drive Train Troubleshooting	3-20
3.9 Mast Troubleshooting	3-30
3.10 Hydraulic Leak Troubleshooting	3-41
3.11 Base Frame Components Troubleshooting	3-42

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1-1.	Hydraulic Pressure Setting - Adjustment Screw Located At Base Of Pump Motor	1-3
1-2.	Hydraulic Pressure Gauge Installation.. . . .	1-3
1-3.	Torque Chart.	1-4
1-4.	Lubrication Chart.	1-5
2-1.	Accessing Machine Underside Components By Lifting With A Fork Truck.	2-4
2-2.	Check Torque Limit Clutch - Torque Setting.	2-5
2-3.	Torque Limit Clutch - Adjustment Components.	2-6
2-4.	Brake Assembly Components	2-6
2-5.	Brake Armature Plate & Brake Disk Adjustment.	2-7
2-6.	Manual Release Brake Cable Adjustment.	2-8
2-7.	Drive Motor Assembly Removal.	2-9
2-8.	Drive Motor Gear Box Assembly.	2-10
2-9.	Gear/pinion Shaft Assembly.	2-11
2-10.	Drive Shaft Assembly.	2-12
2-11.	Drive Motor Brush Location.	2-13
2-12.	Drive Motor Brush Installation.	2-13
2-13.	Correct/incorrect Brush Spring Bracket Positions.	2-14
2-14.	Platform Control Box Assembly (Exploded View).	2-15
2-15.	Platform Control - Circuit Board Component Wiring Connections.	2-17
2-16.	Mast Section - Assembly Reference.	2-23
2-17.	10VP Mast Assembly.	2-25
2-18.	15VP Mast Assembly.	2-26
2-19.	20VP Mast Assembly.	2-27
2-20.	Mast Chain/Cable/Sequence Cable Adjustment Components.	2-33
3-1.	Led Battery/fault Code Indicator Strip On Platform Controller Box.	3-2
3-2.	Overview Of Standard Electrical System. (Sheet 1 Of 2)	3-6
3-3.	VP Electrical Diagram. (VP Series - Standard)	3-8
3-4.	Hydraulic Diagram. (VP Series)	3-10

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1-1.	Machine GVW and Wheel Loads	1-1
1-2.	Hydraulic Oil Operating Range	1-2
1-3.	Lubrication Specifications.	1-2
1-4.	Machine Interlock Switch Operating Conditions.	1-2
1-5.	Cylinder Specifications	1-3
1-6.	Lubrication Intervals for Various Components	1-5
2-1.	Chain Stretch Tolerance	2-2
2-2.	VP Series Mast Component Features.	2-23
2-3.	Preventive Maintenance & Inspection Schedule.	2-37
3-1.	MC-1 WARNING CODES (Indicated by 3 beeps, then slow flashing LED's).	3-3
3-2.	MC-1 ERROR CODES (Indicated by rapid LED flashing and periodic beep)	3-4
3-3.	Ohm Ratings for Various Components.	3-16
3-4.	Unit will not Power Up From Ground Control.	3-17
3-5.	No Power At Platform Control.	3-18
3-6.	Won't Drive. (Platform Lowered or Elevated)	3-20
3-7.	Elevation Switch Circuit Check	3-20
3-8.	Brake Limit Switch Circuit Check	3-21
3-9.	Drive Motor/Circuit Check	3-21
3-10.	Brake Switch/Circuit Check.	3-21
3-11.	Won't Drive with Platform Elevated.	3-22
3-12.	Tilt Sensor Circuit Check.	3-22

3-13	PHP Limit Switch Circuit	3-23
3-14	Won't Climb Grade	3-24
3-15	Drives In Opposite Direction	3-25
3-16	Only Drives A Short Distance	3-26
3-17	E-Stop and Key Switch Circuit Check.	3-27
3-18	Won't Drive Straight.	3-28
3-19	Noise from Drive Assembly.	3-29
3-20	Platform Will Not Lift Up Using Platform Control.	3-30
3-21	Pump Circuit	3-31
3-22	Pump Valves Circuit	3-32
3-23	Platform Will Not Lower Using Platform Control.	3-33
3-24	Unit Will Not Lift Up From Ground Control Toggle Switch.	3-34
3-25	Unit Will Not Lower From Ground Control Toggle Switch.	3-35
3-26	Platform Will Not Lower Manually.	3-36
3-27	Platform Lift Up and Down Jerky.	3-37
3-28	Mast Noisy when Lifting and Lowering.	3-38
3-29	Platform (Mast) Won't Stay Elevated.	3-39
3-30	Platform (Mast) Descends Too Slowly.	3-40
3-31	Hydraulic Leak Troubleshooting	3-41
3-32	Caster Wheels Not Operating Freely.	3-42
3-33	Pot Hole Protection (PHP) Bars Will Not Set.	3-42

This page intentionally left blank.

SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

System Voltage

All VP Models – 24 Volt DC (2 - 12 volt DC batteries)

Hydraulic Oil Reservoir

All VP Models – 4.7 ltr. (5 qts. U.S.)

1.2 COMPONENT DATA

Hydraulic Pump/Pump Motor Assembly

Pump Motor - 24 Volt DC motor

Pump Displacement –

10 & 15VP – .098 cu. in./rev. (1.6cc/rev.)

20VP – .049 cu. in./rev. (0.8cc/rev.)

Pump Output (Max.) –

10 & 15VP - 1.20 gpm @ 2200 psi

20VP – 0.65 gpm @ 2200 psi

Hydraulic System Pressure Setting –

10 & 15VP - 68.95 bar (1000 psi)

20VP - 172.3 bar (2500 psi)

Rear Wheel Drive Motors

Drive Motors -

24 Volt DC w/perm. magnet

Right angle gear

Maintenance free sealed gear

Brake shaft and drive shaft, Integral to Motor

Parking Brake (must be released for pushing)

Batteries/Battery Charger

Batteries (2) – 12 Volt / 100 Amp Hour –

Deep Cycle Marine - RV

Battery Charger –

Euro - 240 VAC/50 Hz input

U.K. - 115/230 VAC/50-60 Hz input - (switchable)

AUST. - 250 VAC/50 Hz input

24 volt, 10 amp output - with 2 amp finish

Reset Circuit Breaker

Automatic Charge Circuit

Plug Interlock Circuit

1.3 PERFORMANCE DATA

Platform Capacity (All Platforms except Extendible)

10VP – 160 kg (350 lbs.)

15VP – 160 kg (350 lbs.)

20VP – 160 kg (350 lbs.)

Extendible Platform Capacity

Extendible Platform – 120 kg* (265 lb.)

* The extendible platform is rated to carry a maximum weight of 160 kg (350 lbs.), however a maximum of 120 kg (265 lb.) is allowed out on the platform extension.

Platform Size

Standard Platform – (66cm) x (66cm)
26 in. x 26 in.

Table 1-1.
Machine GVW and Wheel Loads

VP MODEL	CONFIG.	GVW (no load)	(1)DRIVE WHEEL (ea) w/rated load	(1)CASTER (ea) w/rated load	Kg/cm ² (Drive)	Kg/cm ² (Caster)
10VP	CE (Euro/UK/Aust.)	420 kg (930 lb.)	158 kg (350 lb.)	52 kg (115 lb.)	9.5 kg/cm ² (135 psi)	4.5 kg/cm ² (70 psi)
15VP	CE (Euro/UK/Aust.)	615 kg (1355 lb.)	240 kg (530 lb.)	68 kg (150 lb.)	13 kg/cm ² (185 psi)	6.4 kg/cm ² (91 psi)
20VP	CE (Euro/UK/Aust.)	940 kg (2072 lb.)	(2)336 kg (741 lb.)	(3)225 kg (496 lb.)	18.6 kg/cm ² (265 psi)	18.6 kg/cm ² (265 psi)

Note: (1.) Maximum wheel load in any configuration, with rated load.
(2.) Standard platform or with extended platform retracted.
(3.) Maximum with extended platform, extended.

SECTION 1 - SPECIFICATIONS

Machine Height (In Stowed Position)

Euro/UK/Aust. - 2.01m (79 in.) height

Base Footprint

VP Series - 0.81m (32 in.) width
1.42m (56 in.) length

Max. Platform Height (mast extended)

10VP – 3.1m (10 ft. 2 in.)
15VP – 4.36m (14 ft. 4 in.)
20VP – 5.82m (19 ft. 1 in.)

Platform Working Height (average)

10VP – 4.92m (16 ft. 2 in.)
15VP – 6.2m (20 ft. 4 in.)
20VP – 7.64m (25 ft. 1 in.)

Machine Drive Speed (max.)*

Platform Lowered - 3.22 kph (2 mph)
Platform Elevated - .81 kph (0.5 mph)
(reduced by limit switch)

* Variable to maximum with speed cut back.

Amperage Draw (average)

Lift - 12 amps.
Drive - 20 amps.

1.4 TORQUE REQUIREMENTS

When maintenance becomes necessary or a fastener has loosened, refer to the Torque Chart, Figure 1-2 to determine proper torque value.

1.5 LUBRICATION

Hydraulic Oil

Hydraulic oils must have anti-wear qualities at least to API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service. JLG Industries, recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152.

For cold weather applications, i.e. when temperatures remain consistently below -7°C (+20°F) JLG recommends using Mobil DTE 13 hydraulic oil.

Aside from JLG recommendations, it is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. If use of hydraulic oil other than Mobilfluid 424 is desired, contact JLG Industries for proper recommendations.

Table 1-2. Hydraulic Oil Operating Range

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE	SAE VISCOSITY GRADE
-18° C to -5° C (0° F to +23° F)	10W
-18° C to +99° C (0° F to +210° F)	10W-20, 10W-30
+10° C to +210° C (50° F to 210° F)	20W-20

Lubrication Specifications

Table 1-3. Lubrication Specifications

KEY	SPECIFICATIONS
MPG -	Multipurpose Grease having a minimum dripping point of 350° F. Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL -	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.
HO -	Hydraulic Oil. ISO-Vg grade 32, 46.

Table 1-4. Machine Interlock Switch Operating Conditions.

Mast Elevation	Drive Cutout (PHP System)	Tilt Status	Brake Status	Controller Response
mast retracted	bars raised	(not tilted)	engaged	Full Drive and Lift
mast retracted	bars raised	(not tilted)	disengaged	Drive and Lift Disabled
mast extended	bars lowered	(not tilted)	engaged	Drive 25% maximum
mast extended	bars raised (blocked)	(not tilted)	engaged	Drive Disabled
mast extended	bars lowered	(tilt)	engaged	Drive and Lift disabled
mast retracted	bars raised	(tilt)	engaged	Lift Disabled
mast retracted	bars raised/battery charger plugged-in	(not tilted)	engaged	Drive Disabled

1.6 HYDRAULIC PRESSURE ADJUSTMENT

Adjust system pressure so that platform will raise with rated capacity in platform.

The following are recommended factory pressure settings;

VP10,VP15 –1000 psi

VP20 – 2500 psi

Turning adjustment screw **clockwise increases system pressure**, turning screw **counterclockwise decreases system pressure**.

Make pressure adjustment with oil at normal operating temperature. If pressure is set when oil is cold, platform may not raise rated load after oil has warmed.

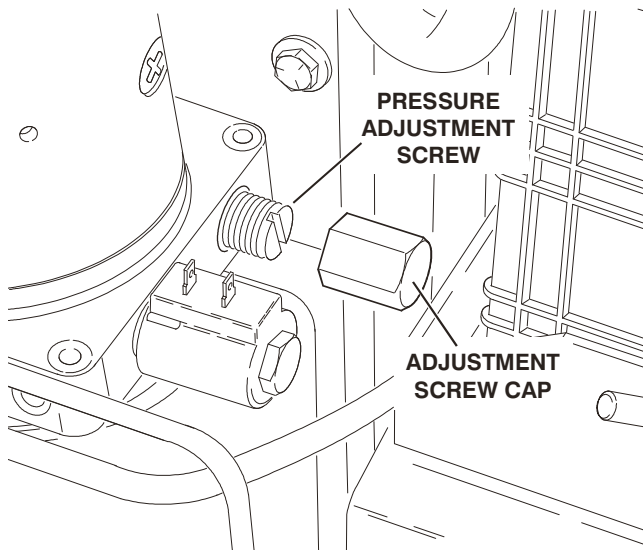


Figure 1-1. Hydraulic Pressure Setting - Adjustment Screw Located at Base of Pump Motor (Remove Hex Head Cap as Shown)

⚠ CAUTION

ONLY OPEN HYDRAULIC SYSTEM LINES WITH THE MAST LOWERED TO RELIEVE PRESSURE IN THE SYSTEM. CAREFULLY LOOSEN REQUIRED FITTINGS, WEAR SAFETY PROTECTION EQUIPMENT WHEN WORKING WITH HYDRAULIC SYSTEMS.

Connect pressure gauge as shown in Figure 1-2., Hydraulic Pressure Gauge Installation.

Select a T-Fitting to exactly match the thread size of the pump (.562 x 18 THD), pressure line (.562 x 18 THD) and gauge fitting as required.

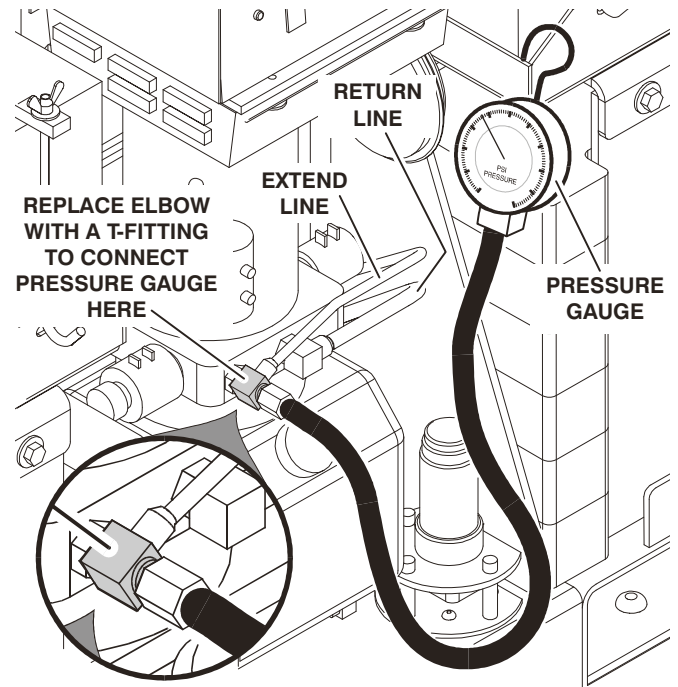


Figure 1-2. Hydraulic Pressure Gauge Installation.

1.7 CYLINDER SPECIFICATIONS

NOTE: All dimensions are given in centimeters cm, with the inches (in.) U.S. equivalent, given in parentheses.

Table 1-5. Cylinder Specifications

DESCRIPTION	BORE cm/(in.)	STROKE cm/(in.)	ROD DIA. cm/(in.)
Lift Cylinder - 10VP	3.81 (1.50)	138.43 (54.50)	2.86 (1.125)
Lift Cylinder - 15VP	3.81 (1.50)	138.43 (54.50)	2.86 (1.125)
Lift Cylinder - 20VP	3.81 (1.50)	138.43 (54.50)	2.86 (1.125)

1.8 SERIAL NUMBER LOCATIONS

For machine identification, a serial number plate is affixed to the machine. The plate is located on the back of the mast, just above the mast support bracket. In addition, should the serial number plate be damaged or missing, the machine serial is stamped on the mast and on the base frame.

VALUES FOR ZINC PLATED BOLTS ONLY														UNPLATED CAP SCREWS			
SIZE	THD	BOLT DIA. (CM)	THREAD STRESS AREA (SQ. CM)	SAE GRADE 5 BOLTS & GRADE 2 NUTS				SAE GRADE 8 BOLTS & GRADE 8 NUTS				UNBRAKO 1960 SERIES SOCKET HEAD CAP SCREW WITH LOC-WEL PATCH					
				TORQUE				TORQUE				TORQUE					
				(DRY OR LOC. 263) NM	(LUB.) NM	(LOCTITE 262) NM	(LOCTITE 242 OR 271) NM	(DRY OR LOC. 263) NM	(LUB.) NM	(LOCTITE 262) NM	(LOCTITE 242 OR 271) NM	(DRY OR LOC. 263) NM	(LUB.) NM	(LOCTITE 262) NM	(LOCTITE 242 OR 271) NM	CLAMP LOAD (KG)	CLAMP LOAD (KG)
4	40	0.2845	0.0153	172	1	1	—	—	—	245	2	1	—	—	—	—	—
	48	0.0168	0.0168	191	1	1	—	—	—	272	2	1	—	—	—	—	—
6	32	0.3505	0.0232	263	2	2	—	—	—	372	3	2	—	—	—	—	—
	40	0.0258	0.0258	277	2	2	—	—	—	417	3	2	—	—	—	—	—
8	32	0.4166	0.0356	408	4	3	—	—	—	572	5	4	—	—	—	—	—
	36	0.0374	0.0374	426	4	3	—	—	—	599	5	4	—	—	—	—	—
10	24	0.4826	0.0445	508	5	4	—	—	—	717	7	5	—	—	—	—	—
	32	0.0508	0.0508	583	6	4	—	—	—	817	8	6	—	—	—	—	—
1/4	20	0.6350	0.0808	916	11	9	—	—	12	1297	16	12	—	—	18	1442	18
	28	0.0925	0.0925	1052	14	10	—	—	16	1488	19	14	—	—	21	1651	19
5/16	18	0.7938	0.1331	1515	23	18	22	26	26	2141	34	25	30	41	2377	34	34
	24	0.1473	0.1473	1678	26	19	23	29	29	2821	34	27	34	41	2631	37	37
3/8	16	0.9525	0.1969	2241	41	31	38	48	31	3175	61	48	54	68	3493	61	61
	24	0.2230	0.2230	2540	48	34	43	54	34	3583	68	48	61	75	3983	68	68
7/16	14	1.1112	0.2700	3085	68	48	61	75	43	4332	95	75	85	109	4822	95	95
	20	0.3015	0.3015	3425	75	68	68	81	68	4854	109	81	95	122	5384	102	102
1/2	13	1.2700	0.3604	4105	102	75	92	115	75	5783	149	109	130	163	6437	149	149
	20	0.4061	0.4061	4854	122	88	108	136	88	6532	163	122	146	183	7253	156	156
9/16	12	1.4288	0.4623	5262	149	109	133	163	109	7539	204	149	188	224	8256	210	210
	18	0.5156	0.5156	5874	163	122	148	183	122	8278	231	176	209	258	9208	224	224
5/8	11	1.5875	0.5740	6532	204	149	183	224	149	9231	298	231	244	326	10251	285	285
	18	0.6502	0.6502	7394	231	176	207	258	176	10433	326	244	277	359	11612	298	298
3/4	10	1.9050	0.8484	9662	353	271	325	387	271	13653	515	380	408	570	15150	495	495
	16	0.9474	0.9474	10796	407	298	363	448	298	15241	570	434	456	631	16919	542	542
7/8	9	2.2225	1.1735	13336	583	434	523	644	434	18870	814	624	658	895	20956	793	793
	14	1.2929	1.2929	14697	637	475	576	705	475	20775	895	678	724	983	23088	861	861
1	8	2.5400	1.5392	17509	868	651	785	915	651	23360	1220	922	931	1342	27488	1173	1173
	12	1.6840	1.6840	19142	949	719	858	997	719	27080	1356	1003	1079	1492	30074	1241	1241
1-1/8	7	2.8575	1.9380	19187	1085	814	968	1139	814	31162	1736	1302	1396	1898	34610	1681	1681
	12	2.1742	2.1742	21546	1193	895	1087	1254	895	34927	1953	1464	1566	2136	38828	1871	1871
1-1/4	7	3.1750	2.4613	24404	1519	1139	1368	1593	1139	38554	2468	1844	1970	2712	43954	2373	2373
	12	2.7254	2.7254	27035	1681	1247	1516	1762	1247	43818	2712	2034	2183	2983	48671	2549	2549
1-1/2	6	3.4925	2.9337	29076	1980	1492	1792	2068	1492	47174	3227	2413	2586	3559	52391	3145	3145
	12	3.3401	3.3401	33113	2278	1708	2042	2373	1708	53570	3688	2766	2935	4068	59648	3308	3308
1-1/2	6	3.8100	3.5687	35381	2630	1980	2379	2746	1980	57380	4284	3200	3430	4712	63731	4122	4122
	12	4.0132	3.9781	39781	2983	2224	2676	3118	2224	142200	4827	3607	3856	5322	71669	4433	4433

Note: These torque values do not apply to cadmium plated fasteners.



SAE GRADE 5



SAE GRADE 8

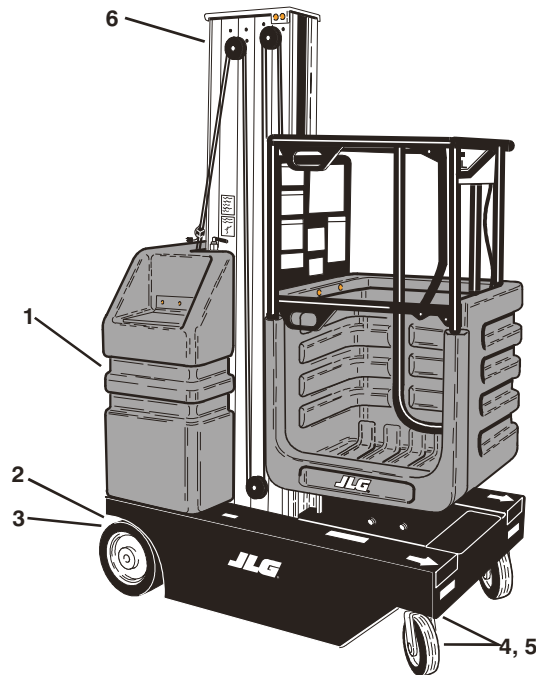


Figure 1-4. Lubrication Chart.

Table 1-6. Lubrication Intervals for Various Components

ITEM	COMPONENT	NO/TYPE LUBE POINTS	LUBE/METHOD	INTERVAL HOURS				COMMENTS
				3 MONTHS 150 Hrs.	6 MONTHS 300 Hrs.	1 YEAR 600 Hrs.	2 YEARS 1200 Hrs.	
1	Hydraulic Oil	Fill To Line on Reservoir 5 Qt. Reservoir	HO - Check Hyd. Oil Level HO - Change Hyd. Oil				✓	Check Hydraulic Oil every 10 hrs. Change Hydraulic Oil every 1200 hrs.
2	Drive Wheel Bearings	4 - Grease Fittings	MPG - Pressure Gun	✓				
3	Drive Wheel Gear Box	2 - Gear Box	Gear Oil					Change only when serviced requires 6 oz. (175 cc's) to fill.
4	Caster Axles	2 - Grease Fitting	MPG - Pressure Gun	✓				
5	Swivel Raceways	2 - Front Casters	MPG - Pressure Gun	✓				
6	Mast Chains *	2 - Per Section	Chain Lube - Brush or Spray	✓				Inspect, lubricate if dry or rusting.

* Applies Only to Mast Sections with Chains.

Key to Lubricants: MPG - Multipurpose Grease

HO - Hydraulic Oil - See Section 1.5, "Lubrication" in Service Manual.

GEAR OIL - Good Quality Worm Gear Oil - SAE 90 - AGMA#5 - EP Compounded

- Notes:
1. Be certain to lubricate like items on each side of the machine.
 2. Recommended lubricating intervals are based on normal use. If machine is subjected to severe operating conditions, such as a high number of cycles, location, corrosive/dirty environment, etc., user must adjust lubricating requirements accordingly.
 3. Prior to checking hydraulic oil level, operate machine through one complete cycle of lift function (full up and down). Failure to do so will result in incorrect oil level reading on the hydraulic reservoir.

This page left intentionally blank

SECTION 2. SERVICE PROCEDURES

2.1 GENERAL

This section provides general information to assist in the performance of maintenance on the personnel lift. Descriptions, techniques and specific procedures are designed to provide the safest and most efficient maintenance for use by personnel responsible for ensuring the correct installation and operation of machine components and systems.

⚠ CAUTION

WHEN AN ABNORMAL CONDITION IS NOTED AND PROCEDURES CONTAINED HEREIN DO NOT SPECIFICALLY RELATE TO THE NOTED IRREGULARITY, WORK SHOULD BE STOPPED AND TECHNICALLY QUALIFIED GUIDANCE OBTAINED BEFORE WORK IS RESUMED.

2.2 SERVICING AND MAINTENANCE GUIDELINES

General

The following information is provided to assist you in the use and application of servicing and maintenance procedures contained in this chapter.

Safety and Workmanship

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of component weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

⚠ WARNING

NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING.

Cleanliness

The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep the wheel bearings, mast sections and oil supply clean; however, these items must be maintained on a scheduled basis in order to function properly.

At any time when oil lines are disconnected, clear adjacent areas as well as the openings and fittings them-

selves. As soon as a line or component is disconnected, cap or cover all openings to prevent entry of foreign matter.

Clean and inspect all parts during servicing or maintenance, and assure that all passages and openings are unobstructed. Cover all parts to keep them clean. Be sure all parts are clean before they are installed. New parts should remain in their containers until they are ready to be used.

Components Removal and Installation

Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (*chains, cables, etc.*) should be parallel to each other and as near perpendicular as possible to top of part being lifted.

Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90 degrees.

If a part resists removal, check to see whether all nuts, bolts, cables, brackets, wiring, etc., have been removed and that no adjacent parts are interfering.

Component Disassembly and Reassembly

When disassembling or reassembling a component, complete the procedural steps in sequence. Do not partially disassemble or assemble one part, then start on another. Always recheck your work to assure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

Pressure-Fit Parts

When assembling pressure-fit parts, use an "anti-seize" or molybdenum disulfide base compound to lubricate the mating surface.

Bearings

When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.

Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.

If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.

Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore,

SECTION 2 - SERVICE PROCEDURES

apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

Gaskets

Check that holes in gaskets align with openings in the mating parts. If it becomes necessary to hand-fabricate a gasket, use gasket material or stock of equivalent material and thickness. Be sure to cut holes in the right location, as blank gaskets can cause serious system damage.

Bolt Usage and Torque Application

Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.

Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See Figure 1-1.)

Hydraulic Lines and Electrical Wiring

Clearly mark or tag hydraulic lines and electrical wiring, as well as their receptacles, when disconnecting or removing them from the unit. This will assure that they are correctly reinstalled.

Hydraulic System

Keep the system clean. If evidence of metal or rubber particles is found in the hydraulic system, drain and flush the entire system.

Disassemble and reassemble parts on clean work surface. Clean all metal parts with non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

Lubrication and Servicing

Components and assemblies requiring lubrication and servicing are shown in the Lubrication Chart, (See Figure 1-2.). Service applicable components with the amount, type, and grade of lubricant recommended in this manual, at the specified intervals. When recommended lubricants are not available, consult your local supplier for an equivalent that meets or exceeds the specifications listed.

Batteries

Clean batteries, using a non-metallic brush and a solution of baking soda and water. Rinse with clean water. After cleaning, thoroughly dry batteries and coat terminals with an anti-corrosion compound.

Mast Chain Inspection Procedure

WARNING

MAST CHAINS TO BE INSPECTED AND LUBRICATED EVERY THREE MONTHS.

Inspect mast chains for the following conditions:

Wear: Always inspect that segment of chain that operates over a sheave. As the chain flexes over the sheaves, joints and plate edges very gradually wear. Chain “stretch” can be measured using a manufacturers wear scale or steel tape. When chains have elongated 3% they must be removed and replaced. Refer to Table 2-1 for proper chain specifications and allowable stretch tolerances. Peening and wear of chain plate edges are caused by sliding over a chain worn contact face of a sheave, or unusually heavy loads. All of the above require replacement of the chain and correction of the cause. Chain side wear, noticeable when pin heads and outside plates show a definite wear pattern, is caused by misalignment of the sheave/chain anchors and must be corrected promptly. Do not repair chains; if a section of chain is damaged, replace the entire chain set.

Rust and Corrosion: Rust and corrosion will cause a major reduction in the load carrying capacity of the chain, because these are primary reasons for side plate cracking. The initial lubrication at the factory is applied in a hot dip tank to assure full penetration into the joint. Do not steam clean or degrease chains. At time of chain installation, factory lube must be supplemented by a maintenance program to provide a film of oil on the chains at all times. If chains are corroded, they must be inspected, especially the outside plates, for cracks in-line with the pins. If cracks are found, replace the chain; if no cracks are discovered, lubricate the chains by dipping in heated oil, and reinstall on the machine. Keep chains lubricated.

Table 2-1. Chain Stretch Tolerance

Chain Size	Pin to Pin Measurement	Allowable Stretch
.50" pitch	12" or 24 pitches	.24 in./12 in. span
.625 pitch	15" or 24 pitches	.30 in./15 in. span

Fatigue Cracks: Fatigue is a phenomenon that affects most metals, and is the most common cause of chain plate failures. Fatigue cracks are found through the link holes, perpendicular (90 degrees) from the pin in-line position. Inspect chains carefully after long time use and heavy loading for this type of crack. If any cracks are discovered, replace all chains, as seemingly sound plates are on the verge of cracking. Fatigue and ultimate strength failures on JLG Lifts are incurred as a result of severe abuse as design specs are well within the rated lifting capacity of these chains.

Tight Joints: All joints in the leaf chain should flex freely. On leaf chain, tight joints are usually caused by rust/corrosion, or the inside plates “walking” off the bushing. Limber up rusty/corroded chains (*after inspecting care fully*) with a heavy application of oil (*preferably a hot oil dip*). Tap inside “walking” plates inward; if “walking” persists, replace the chain. This type of problem is accelerated by poor lubrication maintenance practice, and most tight joint chains have been operated with little or no lubrication. Tight joints on leaf chain are generally caused by:

- a. Bent pins or plates.
- b. Rusty joints.
- c. Peened plate edges.

Oil rusty chains, and replace chains with bent or peened chain components. Keep chains lubricated.

Protruding or Turned Pins: Chains operating with inadequate lube generate tremendous friction between the pin and plates (pin and bushing on leaf chain). In extreme cases, this frictional torque can actually turn the pins in the outside press-fit plates. Inspect for turned pins, which can be easily spotted as the “V” flats on the pin heads are no longer in line. Replace all chains showing evidence of turned or protruding pins. Keep chains lubricated.

Chain Anchors and Sheaves: An inspection of the chain must include a close examination of chain anchors and sheaves. Check chain anchors for wear breakage and misalignment. Anchors with worn or broken fingers should be replaced. They should also be adjusted to eliminate twisting the chain for an even load distribution.

Inspect the sheaves, sheave bearings, sheave grooves and pins for extreme wear, replace as necessary. A worn sheave can mean several problems, as follows:

- a. Chains too tight.
- b. Sheave bearings/pin bad.
- c. Bent/misaligned chains.

Mast Cable Inspection Procedure

IMPORTANT

MAST CABLES ARE TO BE INSPECTED EVERY THREE MONTHS OR MORE FREQUENTLY AS DESCRIBED FOLLOWING.

CAUTION

WEAR PROTECTIVE GLOVES TO PROTECT HANDS WHEN HANDLING CABLE.

The periodic inspection shall cover the entire length of the cable. The inspection frequency shall be based on such factors as expected cable life as determined by experience on the particular application or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads.

Inspection should be more frequent as cables approach the end of their useful lives.

Only the surface wires of the cable require inspection, do not attempt to open the cable. Any deterioration resulting in any loss of original strength, such as described below, shall be noted, and then a determination made if further use would constitute a hazard.

Mast cables must be replaced after machine has been in service for five (5) years, regardless of cable condition, or sooner if conditions dictate.

Conditions such as the following shall be sufficient reason for questioning continual use of the [cable] or increasing the frequency of inspection:

1. In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay.
2. One outer wire broken at the point of contact with the core of the rope which has worked its way out of the rope structure and protrudes or loops out from the rope structure. Additional inspection of this section is required.
3. Wear of one-third the original diameter of outside individual wires.
4. Kinking, crushing, birdcaging or any other damage resulting in distortion of the rope structure.
5. Evidence of any heat damage from any cause.
6. Reductions from nominal diameter of more than;
 - a. 1/64th in. (0.4mm) for diameters up to and including 5/16th in. (8mm);

NOTE: *A good indicator of a stretched extend/retract cable is if the adjusting nuts are bottomed out. If no adjustment remains the cables have stretched and need replacement.*

Also check for cracked, bent, worn, severely corroded, or improperly installed cable ends.

Inspect sheaves, sheave grooves, and sheave pins for excessive wear, replace as necessary.

2.3 LUBRICATION INFORMATION

Hydraulic System

The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc., to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient system warm-up or leaks in the pump supply.

The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system

SECTION 2 - SERVICE PROCEDURES

can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage.

Cloudy oils indicate a high moisture content which permits organic growth, resulting in oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.

It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

NOTE: Metal particles may appear in the oil of new machines due to the wear-in of meshing components.

Hydraulic Oil

For best performance, JLG recommends the use of ISO-Vg grade 32, 46 oil with a viscosity range between 15-250 SUS at 100 degrees F (32-54 cST at 40 degrees C). Refer to Section 1-5 of this Service Manual for recommended hydraulic oils.

Changing Hydraulic Oil

Use of any of the recommended hydraulic oils eliminates the need for changing the oil on a regular basis. If it is necessary to change the oil, use only those oils meeting or exceeding the specifications appearing in this manual. If unable to obtain the same type of oil supplied with the machine, consult local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils. JLG Industries recommends changing the hydraulic oil annually.

Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the service container.

While the unit is shut down, a good preventive maintenance measure is to make a thorough inspection of all hydraulic components, lines, fittings, etc., as well as a functional check of each system, before placing the machine back in service.

Lubrication Specifications

Specified lubricants, as recommended by the component manufacturers, are always the best choice, however, multi-purpose greases usually have the qualities which meet a variety of single purpose grease requirements. Should any question arise regarding the use of greases in maintenance stock, consult your local supplier for evaluation. Refer to Table 1-3 in this Service Manual for an explanation of the lubricant key designations appearing in the Lubrication Chart.

2.4 POSITIONING LIFT FOR ACCESS TO COMPONENTS LOCATED UNDER THE BASE FRAME

Access to the underside of the VP lift can be obtained by lifting the machine with a fork lift truck, using the fork lift pockets in the base frame.

Lifting with a Fork Truck (See Figure 2-1.)

1. Choose a fork lift truck capable of safely handling the full weight of the machine.
2. Locate work area on a firm, level surface.

⚠ WARNING

KEEP MACHINE LEVEL OR SLIGHTLY TILTED TOWARD FORKLIFT TRUCK WHEN LIFTING TO PREVENT MACHINE FROM SLIDING OFF LIFTING TINES.

3. When lifting with a fork truck, lift only using the fork lift-truck pockets running the length of the machine's base frame from rear to front.
4. After lifting machine to desired work height, place support stands under the machine. The support stands must reach from the floor to the bottom of the machine and be capable of safely handling the weight of the machine.

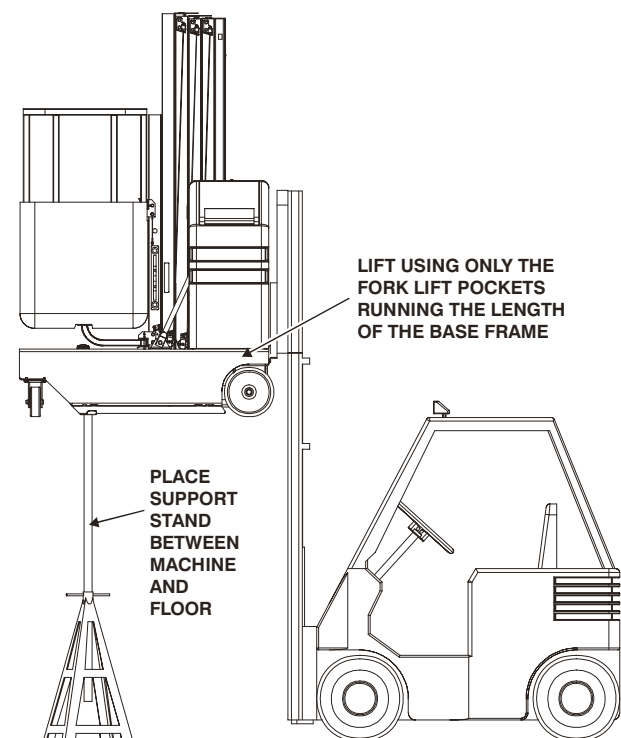


Figure 2-1. Accessing Machine Underside Components by Lifting with a Fork Truck.

2.5 DRIVE MOTOR COMPONENT SERVICE PROCEDURES

Torque Limiting Clutch Maintenance

VP Series machines are equipped with a torque limiting clutch coupling on each drive axle. The clutch is mounted inline on the drive axle between the drive wheel and the drive motor gear box. The clutch is designed to slip at a pre-set torque if the machines rear wheels are over-driven while the machine is being towed, pushed or forklifted, thus preventing damage to the drive gear box. Although factory pre-set, the clutch assembly and torque should be checked at the following interval:

- Every 3 months.

Visual Inspection and Limiting Torque Checking Procedure

1. Locate the machine on a firm level surface.

⚠ WARNING

KEEP MACHINE LEVEL OR SLIGHTLY TILTED TOWARD FORKLIFT TRUCK WHEN LIFTING TO PREVENT MACHINE FROM SLIDING OFF LIFTING TINES.

2. Carefully raise the lift to gain access to the underside of the base frame. Refer to Section 2.4, "Positioning Lift For Access to Components Located Under the Base Frame".
3. Locate the clutch assembly on each rear drive axle and check for the following;
 - a. Check the coupling chains for any loose or missing parts, i.e. pins, links, etc., replace if necessary.
 - b. Check that the allen-head set screws on the (large) clutch adjusting nut are in place and secure. Tighten or replace if necessary.
 - c. Check for any debris wedged in or wrapped around the clutch coupling chains and axle shafts. Remove debris and clean area if necessary.

Checking Clutch - Torque Setting (ft. lb.)

NOTE: Check that the machines brakes are engaged before applying torque to the rear drive wheels.

1. Remove the drive wheels from the drive axles.
2. Select a torque wrench capable of setting a torque of at least 185 ft. lb. Insert special tool (P/N-0080229) into a 3/4" socket on the torque wrench.
3. Slide the tool onto the end of the drive axle aligning the key on the axle shaft (install key on axle, if necessary), with key slot in the tool. (See Figure 2-2.)
4. Turn the torque wrench and note the torque setting when the torque limiting clutch releases. The torque (slip) setting should be set at 185 ft. lb. Check both rear drive axles.

NOTE: The allowable breaking torque for the torque limiting clutch can be set as much as 35 ft. lb. less than the factory setting of 185 ft. lb., but never more than the 185 ft. lb. factory setting.

5. If torque setting is OK, re-install the wheels and lower machine, IF NOT, see the following note.

NOTE: If torque setting is outside the allowable range of specifications, the torque limiting clutch will need adjustment. See Torque Limiting Clutch Adjustment following.

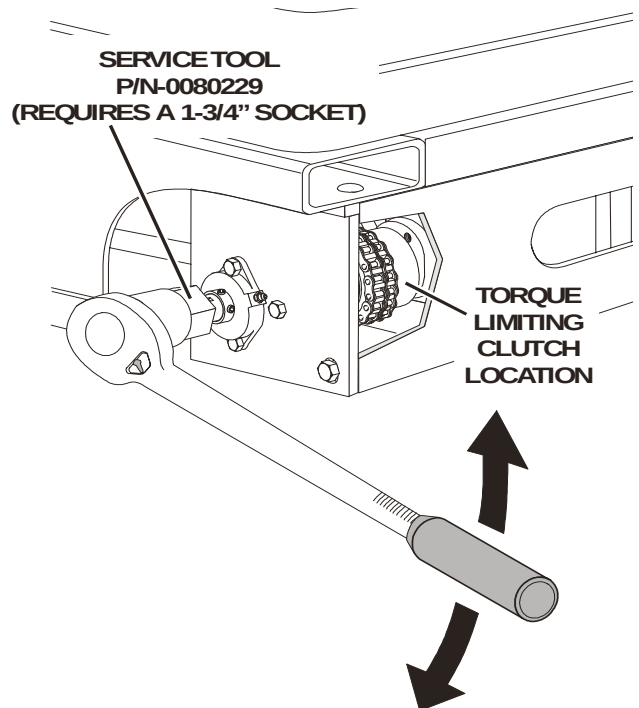


Figure 2-2. Check Torque Limit Clutch - Torque Setting.

Torque Limiting Clutch Adjustment

NOTE: The large adjusting nut on the side of the clutch assembly is a standard type thread.

If the torque (slip) setting of the clutch assembly is under spec (by more than 35 ft. lb.), the large adjusting nut must be (tightened) turned clockwise to increase the torque setting.

If the torque (slip) setting is over spec (over 185 ft. lb.) the large adjusting nut must be (loosened), turned counter-clockwise to decrease the torque setting.

1. Loosen the two (2) adjusting nut setscrews located on the large adjusting nut on the clutch assembly. (See Figure 2-3.)
2. Hold the drive axle steady using service tool (P/N-0080229) and the torque wrench used to check the torque setting.
3. Depending on how far off the original torque setting was (see note at beginning of this procedure), tighten or loosen the adjusting nut accordingly, then recheck the (slip) torque setting.
4. When proper torque setting is achieved, re-tighten the two (2) adjusting nut, setscrews.
5. Re-install the drive wheels, remove the jack stand and lower the machine to ground.

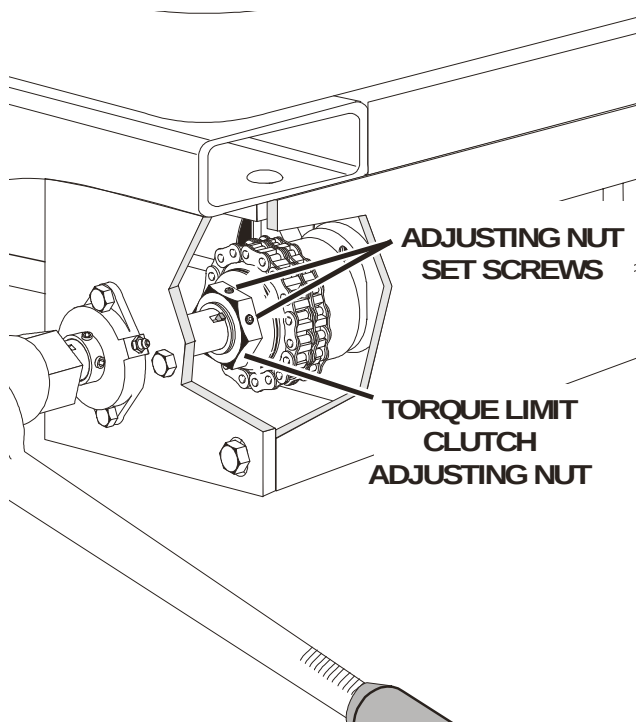


Figure 2-3. Torque Limit Clutch - Adjustment Components.

Drive Motor Brake Adjustment/Removal

(See Figure 2-4. & Figure 2-5.)

Mounted onto the front of each drive motor housing is a brake assembly. The brakes are normally ENGAGED (brakes on) when the machine is parked and are RELEASED electrically (brakes off) under normal driving conditions, when the joystick is enabled and pushed in any direction. The brakes can also be RELEASED manually using the manual brake release lever mounted on the side of the mast.

NOTE: The brakes are intended only as parking brakes to keep the machine from moving while at rest. The brakes are not used to stop the machine during driving operations, this braking is controlled by the drive motors themselves. Under normal driving conditions, once released the brakes are not engaged again until the machine comes to a complete stop.

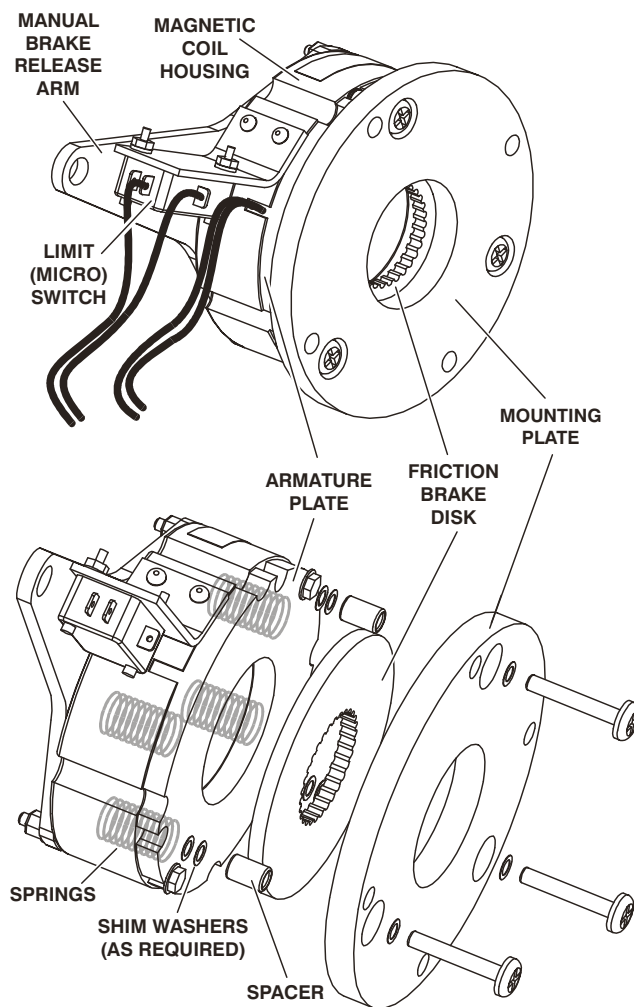


Figure 2-4. Brake Assembly Components

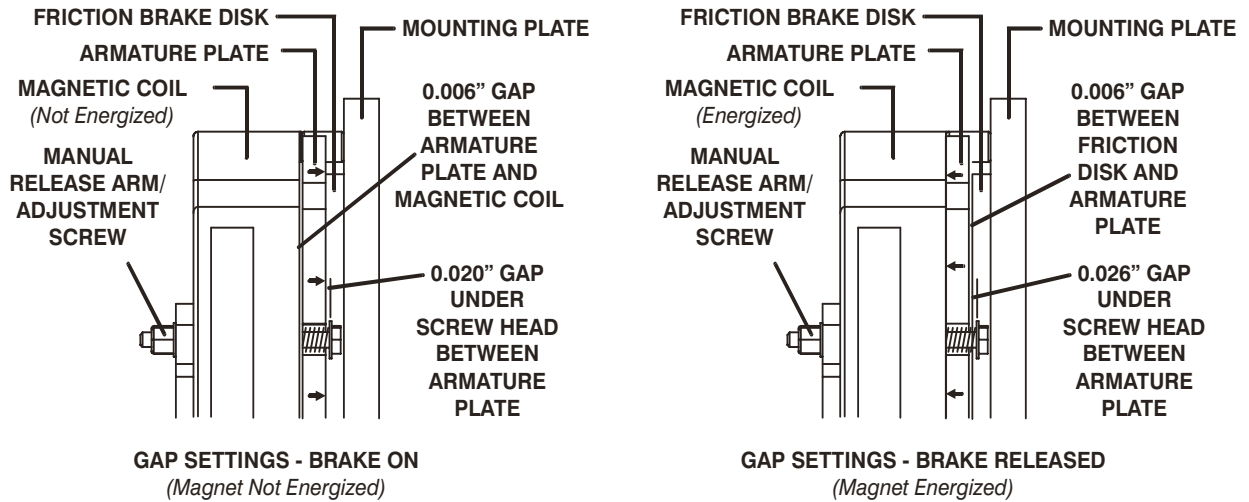


Figure 2-5. Brake Armature Plate & Brake Disk Adjustment.

Operation (See Figure 2-4. & Figure 2-5.)

When the magnetic coil is not energized (*brake on*), the armature plate is pushed away from the magnetic coil surface by heavy springs internally mounted in the magnetic coil housing. This pressure forces the armature plate against the friction brake disk holding it tight between the armature plate and the mounting plate. The brake is not released until either the magnetic coil is energized pulling the armature plate away from the friction brake disk or the brake is manually released using the manual brake release handle.

A correctly adjusted brake will ideally have a measurement of approximately .006" (*but will operate normally at .004" to .010"*) between the armature plate and magnetic coil housing surface when the brakes are ENGAGED (brakes on).

Never allow any type of lubricant (oil, grease, hydraulic fluid, etc.) to come in contact with the brake friction disk or it's contacting surfaces. Also if the brake becomes clogged with debris or dirt the brake may not release properly.

Checking/Adjusting Armature Plate Gap Setting

1. First inspect that all parts of the brake assembly are tight and secure. Tighten as necessary.
2. Inspect the brake for any debris which may be lodged in the air gap between the armature plate and magnetic coil when the brakes are ENGAGED (*brakes on*); on either side of the friction disk when the brake is RELEASED (*brakes off*); or any dirt or debris lodged between the manual release arm and the magnetic coil housing. Clean and remove debris as necessary.

3. With the brakes ENGAGED measure the air gap between the armature plate and the magnetic coil housing. The correct setting should be .006", however the brakes will operate properly if the measurement is a minimum of .004" and a maximum of .010". (See Figure 2-5.)
4. If the air gap falls outside the maximum allowable setting of .010" the friction disk has worn. To correct this replace the disk with a new one.
5. If the air gap is below the minimum allowable setting of .004", recheck the areas between the magnetic coil housing, armature plate, friction disk and mounting plate for debris. Clean as necessary. Also check that the manual release arm screws are not tightened to tight.

Manual Release Arm - Screw Adjustment

NOTE: Always check the armature plate gap setting is within spec before attempting to adjust the manual release arm screw adjustment.

1. With the brakes ENGAGED (*brakes on*) the air gap under the head of the manual release arm screw to the surface of the armature plate should be set at .020". Adjust using the locknut on the release arm end of the screw.
2. With the brakes electrically RELEASED (*brakes off*) the air gap under the screw head increases to approximately .026" due to the armature plate movement towards the magnetic coil, releasing the friction brake disk. When the brakes are RELEASED (*brakes off*) manually the screw head pulls in against the armature plate releasing the friction brake disk.

Brake Assembly Removal

1. Lift the machine to gain access to the underside (See Section 2-4., "Positioning Lift For Access To Components Located Under The Base Frame").
2. Disconnect the brake magnetic coil wiring connector and the brake limit (micro) switch wiring connector from their wiring harness connectors.
3. Disconnect the manual brake release cable from the manual brake release arm attached to the brake assembly.
4. Lower machine back down to ground level.

CAUTION

PLACE MACHINE ON A LEVEL SURFACE BEFORE REMOVING THE BRAKE ASSEMBLIES. MACHINE MAY ROLL AWAY IF NOT SETTING ON A LEVEL SURFACE.

5. Using the Ground Control Switch, raise the platform to gain access to the brake assemblies mounted on the end of the drive motors located at the base of the mast.

WARNING

NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING.

6. Remove the four (4) hex cap screws securing the brake assembly to the end of the drive motor and remove the brake assembly from the end of the drive motor.

Brake Assembly Installation

1. Guide the manual release lever, brake coil and brake limit switch wiring connectors through the opening in the drive motor cover and base frame while sliding the brake assembly onto the front of the drive motor. Engage the teeth of the disk brake with the teeth on the drive motor brake gear.
2. If necessary, manually release the brake disk using the manual release lever to allow the brake assembly to turn and align the four holes in the brake mounting plate with the mating holes in the drive motor end plate.
3. Secure the brake assembly to the drive motor using four (4) hex cap screws with washers. Torque evenly to 44 in. lbs.
4. Lift the machine to gain access to the underside (See Section 2-4., "Positioning Lift For Access To Components Located Under The Base Frame").
5. Reconnect the brake coil and brake limit switch wiring connectors to their respective wiring harness connectors.

6. Reconnect the manual release brake cable to the manual release lever (Y shaped lever) and adjust cable so brakes are released when manual release lever is in the down position. (See Figure 2-6.)

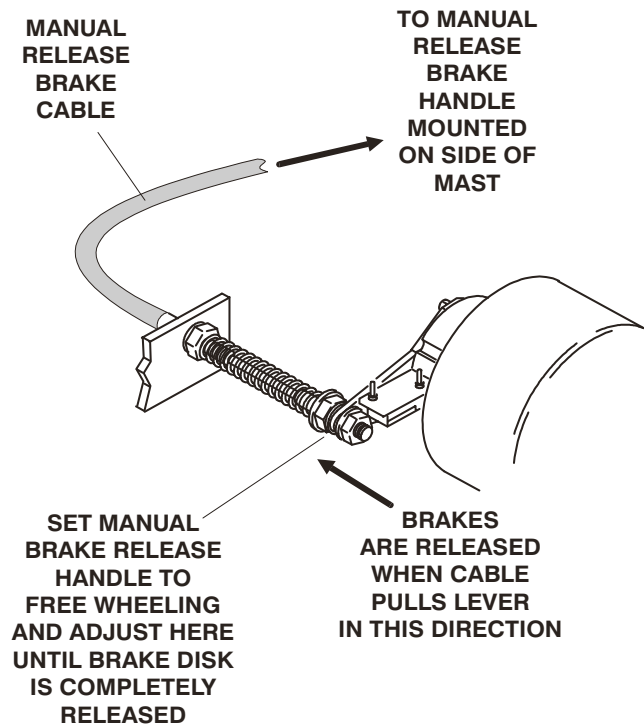


Figure 2-6. Manual Release Brake Cable Adjustment.

Drive Motor Removal

(See Figure 2-7.)

The VP drive motors consist of three sections, the gear box attached to the rear of the drive motor, the electric drive motor itself, and the brake assembly mounted at the front of the drive motor. Each drive motor is mounted independently of the other on a completely removable drive assembly weldment at the back of the machine.

1. Disconnect the positive battery terminal from the left side battery.
2. Remove the rear plate weldment from the machine, (plate with the tie down lug) and set aside. Three (3) bolts hold the top of the rear plate weldment to the base frame, four (4) bolts attach it to the motor cover weldment (located under machine) at the back and on the sides.
3. Carefully raise the lift to gain access to the underside of the base frame. Refer to Section 2.4, "Positioning Lift For Access to Components Located Under the Base Frame".
4. Remove the remaining two (2) bolts attaching the motor cover to the base frame and set it aside.

5. Disconnect the wiring connectors to the drive motor and the brake assembly on either or both sides, depending on which drive assembly(ies) is being removed.
6. Disconnect the manual release brake cable from the brake assembly arm on either or both drive motors if removing the complete drive assembly.

NOTE: If removing each drive motor separately continue to Step 7. If removing the complete drive assembly with both motors attached go to Step 11.

7. Remove the one (1) bolt, nut, and two (2) washers from the front of the drive motor mounting plate.
8. While holding the drive motor in place, remove the remaining two (2) bolts with washers holding the drive motor mounting plate to the drive motor assembly weldment.
9. Slide the drive motor and torque limiting clutch assembly towards the center of the machine, sliding the torque limiting clutch off the outer drive shaft.
10. Move drive motor assembly and torque limiting clutch to a suitable work bench for disassembly.

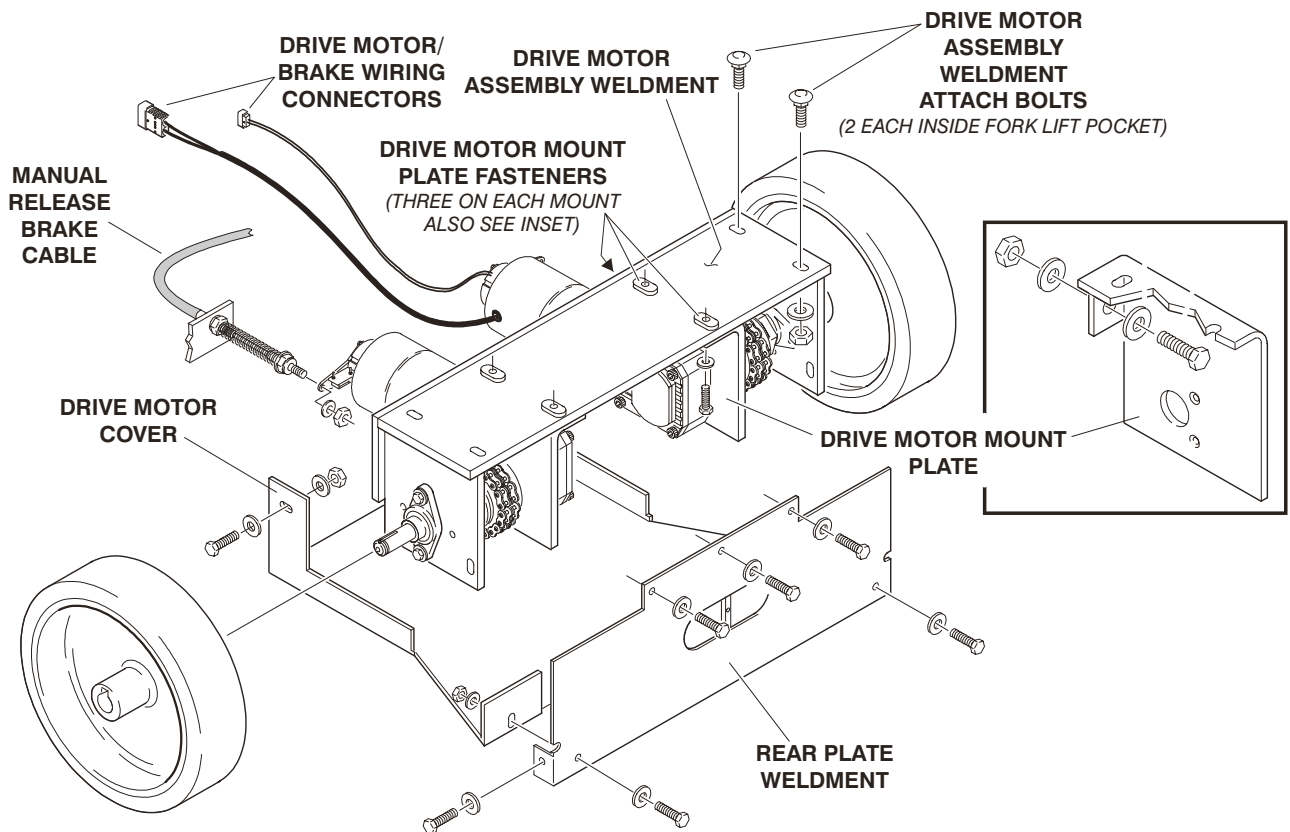


Figure 2-7. Drive Motor Assembly Removal.

CAUTION

IF REMOVING THE COMPLETE DRIVE ASSEMBLY, IT WEIGHS APPROXIMATELY XX LB. AND WILL REQUIRE ASSISTANCE TO LOWER. PREFERABLY USE A MOVABLE TRANSMISSION OR OTHER HYDRAULIC JACK TO CAREFULLY LOWER ASSEMBLY FROM UNDER MACHINE.

11. Carefully remove the four (4) nuts and washers (outer most holes on the drive assembly weldment) from the carriage bolts attaching the drive motor assembly to the base frame. *Be aware of the weight of the assembly before completely removing the fasteners, see the CAUTION above.*
12. Lower the drive assembly and place on a suitable work surface.

Gear Box Disassembly/Assembly

(See Figure 2-8.)

The drive motor gear box is mounted on the rear of each drive motor transferring power from the electric drive motor to the rear drive wheels. It is a right angle worm gear type box with a 50:1 reduction drive ratio. The internal gears and bearings of the gear box are lubricated by 175cc's of gear oil in an unvented aluminum alloy housing. Early VP machines included a oil drain plug on the rear surface of the gear box housing, later model machines do not. The following procedures disassemble and assemble the gear box housing internal components.

Gear Box Disassembly (See Figure 2-8.)

1. Remove the drive motor/gear box/brake assembly from the machine using the procedure outlined previously in this section of the manual.

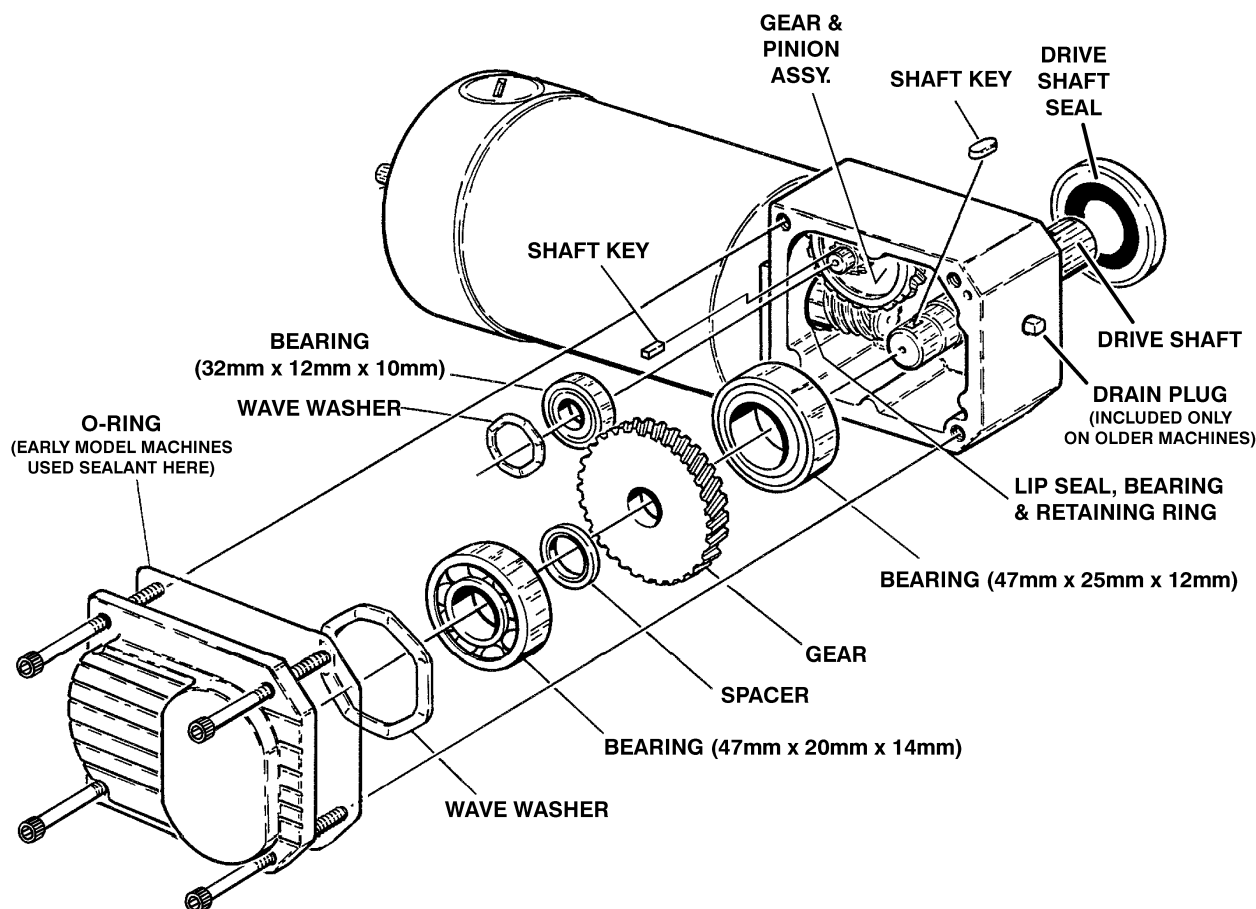


Figure 2-8. Drive Motor Gear Box Assembly.

NOTE: The gear oil can be drained out when the side cover is removed in the next step. Remove the side cover from the gear box with the drive shaft side pointing down, then tilt drive motor/gear box assembly to drain the oil into a suitable container.

2. Remove the four (4) hex cap screws securing the side cover to the gear box housing, and remove the side cover and rubber seal ring. (*Note: Early model machines did not have the rubber seal ring and were sealed with sealant only.*) Be careful not to scratch or gouge the mating surfaces between the cover and the gear box housing. This area is sealed by the rubber ring/sealant and may leak oil if damaged.
3. Remove the wave washers from atop the large and small bearings and lay inside their respective holes in the side cover.
4. Using a suitable catch container, drain the gear oil from the gear box housing.
5. Remove the drive shaft assembly from the housing. Place the drive motor/gear box assembly on a hydraulic press with the open side of the gear box housing facing down. Support the gear box housing surface but do not block the free travel of the drive gear and bearings, on the drive shaft or the pinion gear assembly.
6. With the open surface of the housing properly supported, carefully press the drive shaft down through until it is free of the housing. When the drive shaft assembly is free, slide it completely out of the housing.
7. To remove the large (47mm) (*cover side*) bearing and (*housing side*) bearing from the drive shaft, use a suitable hydraulic press and press the bearing(s) off the shaft. Keep the spacer from between the cover side bearing and the drive shaft gear for reuse during assembly.
8. To remove the small (32mm) bearing(s) from the gear (*brass*) and pinion assembly, use a suitable hydraulic press and press the bearing(s) off the gear and pinion shaft.
9. To remove the (*brass*) worm gear from the pinion assembly, use a suitable hydraulic press and press the gear off the pinion shaft. Keep the (*brass*) gear key for reuse during assembly.
10. Inspect the drive shaft seal for cuts, cracks and wear, or if showing signs of leakage. Replace if necessary.

Gear/Pinion Shaft Assembly (See Figure 2-9.)

1. Locate the pinion gear/shaft, place the key for the (*brass*) worm gear into the slot on the gear shaft.
2. Press the (*brass*) worm gear onto the pinion shaft and align the keyway in the (*brass*) worm gear with the key on the pinion shaft. Press the (*brass*) worm gear onto the shaft until it bottoms out against the pinion gear teeth.

NOTE: Press bearings onto the shaft pressing only against the bearing inner race. Do not press against the outer race or damage could occur to the bearing.

3. Press the small (32mm) bearings onto the ends of the pinion shaft. The inner race of the bearing on the pinion gear side can be bottomed out against the pinion gear. Do not press the bearing on the (*brass*) worm gear side of the shaft in tight against the (*brass*) worm gear. This bearing must be flush with the end of the shaft on the outside, yet have clearance from the (*brass*) worm gear on the inside, so it can rotate freely.

Drive Shaft Assembly (See Figure 2-10.)

1. Slide the (housing side), 42mm x 25mm x 12mm (*thinner*) bearing onto the long end of the drive shaft. Press the bearing inner race until it bottoms against the shaft shoulder between the drive gear and the bearing.
2. Slide the narrow spacer onto the drive gear end of the shaft and press the (*cover side*) 42mm x 20mm x 14mm (*wider*) bearing onto the drive shaft until it bottoms against the spacer. This bearing should be flush with the end of the drive shaft.

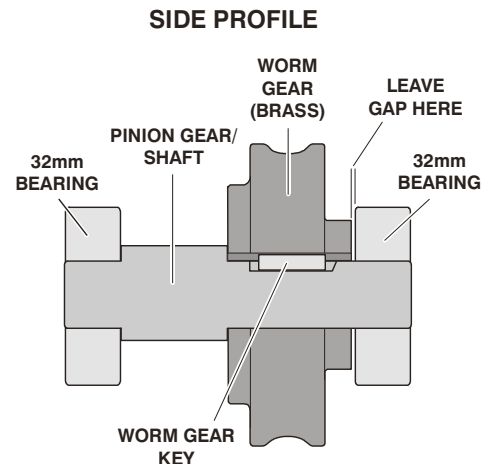


Figure 2-9. Gear/Pinion Shaft Assembly.

Final Gear Box Assembly

1. If necessary, install a new drive shaft lip seal into the drive shaft hole in the gear box housing before assembling the drive shaft gear set into the gear box. Install the seal so it is even with the bottom of the chamfer in the drive shaft hole on the outside of the housing and flush with the bearing seat on the inside of the housing.
2. Lube the drive shaft seal with a thin film of oil before sliding the drive shaft over the seal.
3. Position the gear box with open cover side up, allow space under the gear box for the drive shaft to extend through without obstruction.
4. Hold the gear and pinion, and drive shaft assemblies together with the pinion gear and the ring gear on the drive shaft meshing. Now carefully slide these assemblies into the gear box housing sliding the drive shaft through the drive shaft lip seal.

NOTE: While assembling the gear assemblies into the gear box housing, be careful with the drive shaft seal and the softer brass worm gear and brass drive worm gear from the drive motor.

5. Continue to drop the gear assemblies into the gear box, align the bearings with the bearing seats in the housing on both assemblies. Drop the gear and pinion (*smaller*) bearing into it's seat first, while wiggling

that gear set align the drive shaft bearing and wiggle it into it's seat. When both are seated continue to next step.

6. With the gear box still positioned with the open cover side up, fill the gear box with six (6) ounces (U.S.) (175cc's) of good quality worm gear oil (*Specification - SAE 90 weight - AGMA#5 - EP Compounded*). When pouring the gear oil, wet the gears and bearings with the oil.
7. Wet with gear oil and place the large wave washer on the end of the drive shaft bearing and the small wave washer on the end of the gear and pinion bearing.
8. Clean the mating surfaces of the side cover and the gear box and check that the cover dow guide pins are properly installed in the cover.
9. On older model gear boxes apply sealant to the cover mating surface on the gear box. On newer model gear boxes insert the rubber seal into the groove in the cover.
10. Using the cover dow guide pins, place the cover onto the gear box housing.
11. Secure using the four (4) hex cap screws, torque screws evenly to 90 in. lbs.
12. Install the drive motor back onto the machine.

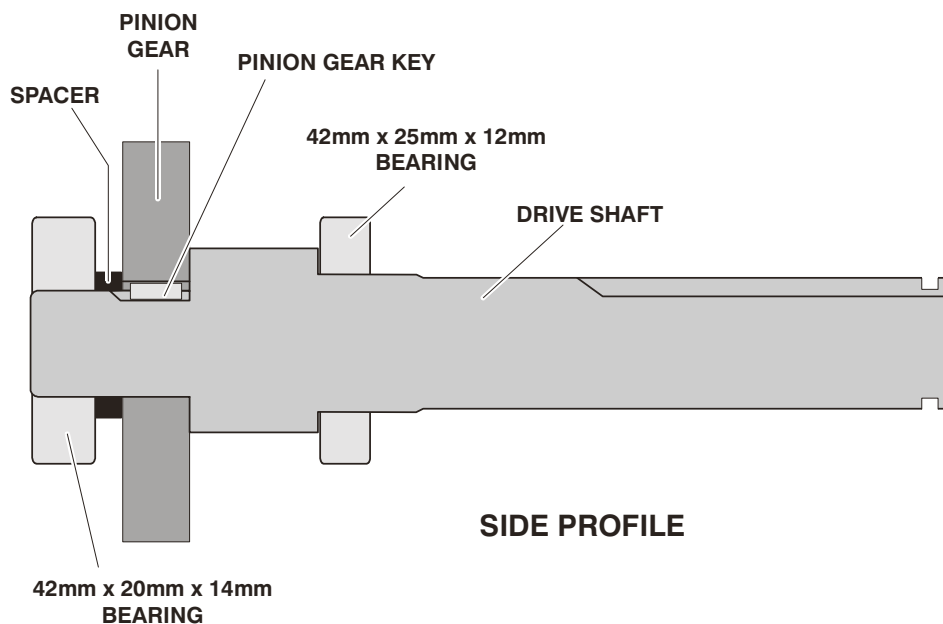


Figure 2-10. Drive Shaft Assembly.

Drive Motor Brush Replacement

Each drive motor contains two (2) brushes, the brushes are located under the two (2) large round slotted brush caps on the front end of each drive motor.

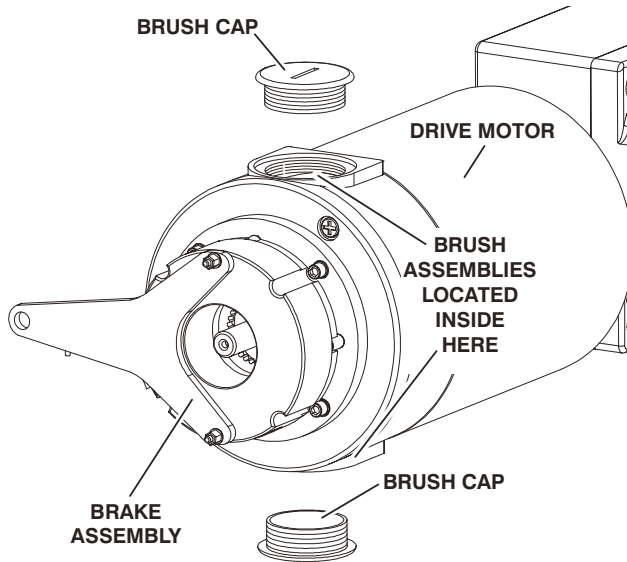


Figure 2-11. Drive Motor Brush Location.

⚠ WARNING

DISCONNECT THE POWER LEADS FROM THE POWER SOURCE BEFORE INSPECTING OR REPLACING BRUSHES.

Brush Cleaning and Inspection

Brush wear rate varies depending on the individual application's duty cycle, and should be inspected at frequent intervals to determine an appropriate inspection schedule. Brushes should be replaced before they are less than .375 in. (9.5mm) in length. Carbon dust accumulation should be removed periodically. If the end shield has been removed from the drive, a clean, dry, non-linting cloth can be used for cleaning. DO NOT use solvents as they may damage non-metallic parts and adversely affect subsequent brush commutation.

Brush Removal (See Figure 2-12.)

Removal of the brushes also requires the removal of the drive motor(s) from the machine, see procedure described earlier in this section for instructions to remove the drive motors. If not already done, disconnect the positive (+) battery cable from the left side battery before proceeding.

1. Unscrew the large round brush caps from each side of the drive motor, use as large a screw driver as possible.
2. The brushes are retained by constant-force, roll-type springs. To remove the springs, press inward on the end of the spring retaining bracket using the tip of a pair of long nose pliers or other appropriate tool. The brushes should pop out, if not, they can be removed by pulling outward on the spring brackets with a pair of long nose pliers after the inside ends are unhooked.
3. Now pull the brush out of the brush box by it's wire (pig-tail).

NOTE: If only inspecting the brushes, it is not necessary to remove the pig-tail terminal from it's connection to the brush box.

4. Loosen the the screw securing the pig-tail terminal end to the brush box and slide the terminal end out from under the screw completely removing the brush from the drive motor.

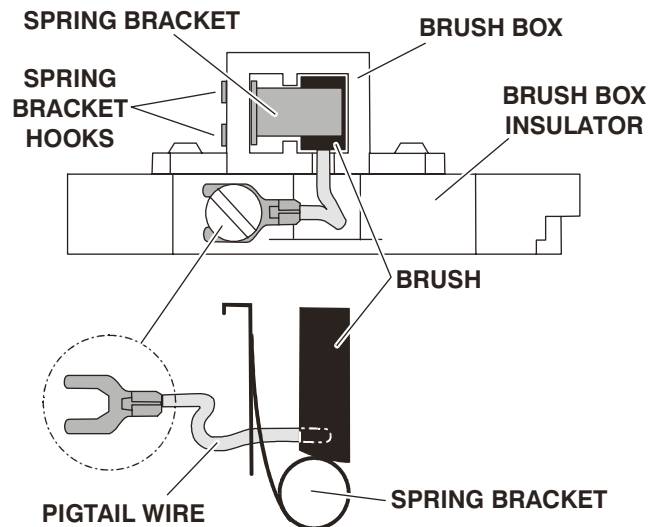


Figure 2-12. Drive Motor Brush Installation.

Brush Reassembly (See Figure 2-12.)

⚠ CAUTION

MAKE CERTAIN THAT THE GROUND WIRE IS SECURELY RECONNECTED TO THE GROUND TERMINAL IF REMOVED. LEADS, INTERNAL TO THE SHIELD, MUST BE ROUTED AWAY FROM THE ARMATURE, (E.G.: BE CLOSE TO THE INSIDE WALL OF THE ALUMINUM SHIELD) TO PREVENT A SAFETY HAZARD AND/OR DAMAGE TO THE MOTOR.

1. Install the brush (*pig-tail*) terminal end under the screw on the brush box in the same manner as the old brush that was removed and tighten the screw.
2. Slide the body of the brush into the brush box, be certain that the wire (*pig-tail*) is aligned with the slot in the base of the brush box so that it can "feed" into the brush box slot as the brush wears down.

NOTE: The *pig-tail* wire should be formed to rest against the nonmetallic insulator. It must be spaced from any metallic surfaces other than the brush box by a minimum of .125 in. (3mm).

3. Now install the brush retaining spring bracket. Grasp the tip of the spring bracket such that the roll-type spring will be on the "brush side" of the brush box, and resting on top of the brush when the brush spring is completely installed.
4. Push the spring bracket slowly into its slot while letting its two attaching hooks slide on the wall of the brush box.
5. Stop, but do not release the spring bracket when its hooks slip around the edge of the brush box.
6. While still grasping the spring bracket with the pliers, slowly bring the spring back out of the brush box until the hooks latch around the edge of the brush box.
7. Now release the spring bracket and check that it is lying flat against the brush box wall. If it is "cocked" it is improperly seated and will have to be reinstalled.

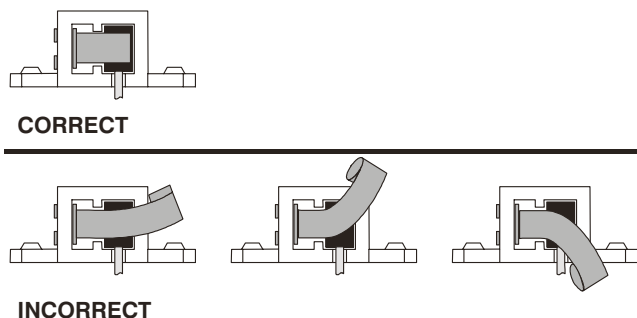


Figure 2-13. Correct/Incorrect Brush Spring Bracket Positions.

⚠ IMPORTANT

THE SPRING BRACKET MUST BE ALSO LIE COMPLETELY INSIDE THE BRUSH BOX AND NOT OUT OVER THE EDGE. THE ROLL END OF THE SPRING MUST BE CENTERED ON THE TOP OF THE BRUSH. (SEE FIGURE 2-13.)

8. Also apply slight pressure by pulling up on the spring bracket to be certain it is hooked securely around the brush box wall at the bottom of the brush box.
9. Screw the brush caps back into the end shield using the largest possible screwdriver.
10. Reinstall the drive motor(s) to the machine and reconnect the power source.

⚠ IMPORTANT

NEW BRUSHES MAY BE SEATED BY RUNNING THE DRIVE MOTOR AT NO LOAD. PROPER SEATING IS REQUIRED FOR LOWEST BRUSH NOISE LEVEL.

2.6 PLATFORM CONTROL BOX SERVICE PROCEDURES

Joystick Calibration Procedure

1. Turn off all power to the platform control.
2. Move the joystick to the maximum forward position and hold it there.

NOTE: Joystick will be held in the maximum forward position until asked to release it in Step 5.

3. Turn on power to the platform control, nine (9) LED's will flash rapidly on the platform control touch pad.
4. Depress the horn switch pad, the alarm will sound for about one (1) second, then release the horn pad.
5. Now release the joystick to the neutral position.
6. Turn off system power.

The joystick calibration is now complete.

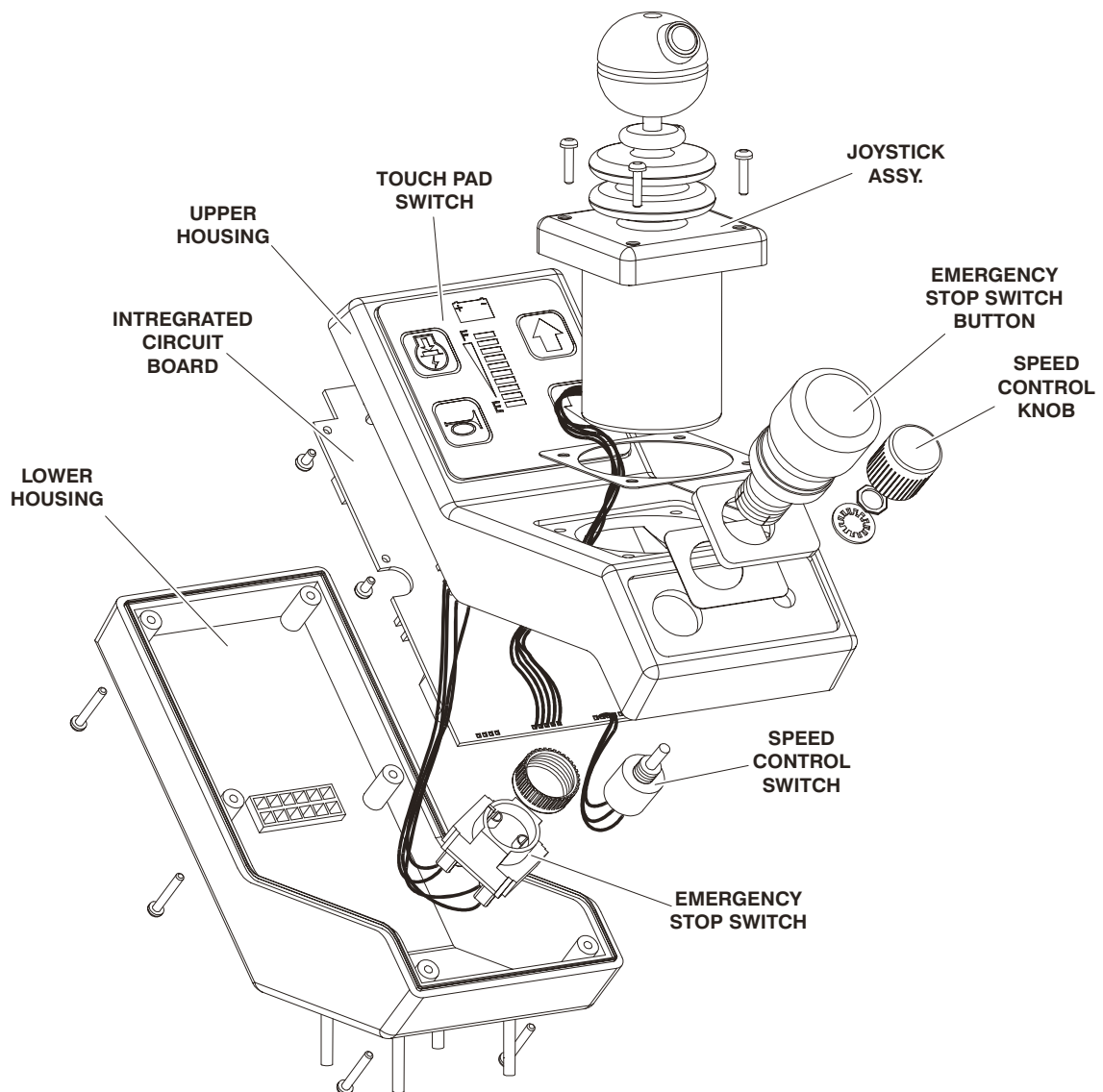


Figure 2-14. Platform Control Box Assembly (Exploded View)

Platform Control Box Disassembly

⚠ IMPORTANT

DO NOT ATTEMPT TO DISASSEMBLE THE PLATFORM CONTROL BOX IF MACHINE IS STILL UNDER WARRANTY. OPENING THE PLATFORM CONTROL BOX WHILE THE MACHINE IS UNDER WARRANTY WILL VOID THE WARRANTY. IF UNDER WARRANTY REQUEST A REPLACEMENT BOX FROM THE FACTORY.

The VP Series platform control box allows for replacement of five (5) components internal to the box.

- Controller Integrated Circuit Board
- Joystick Assembly
- Emergency Stop Switch
- Speed Control Switch
- Touch Pad Switch Assembly

Except for the touch pad switch assembly, which plugs into the circuit board, replacement of each component requires unsoldering, then soldering each replacement components' wiring to the controller's integrated circuit board. Due to the small contact area when connecting each wire to the circuit board this soldering requires precise temperatures and neatness of the soldered point itself so as not to destroy the circuit board or cross any of the circuit paths on the board.

⚠ IMPORTANT

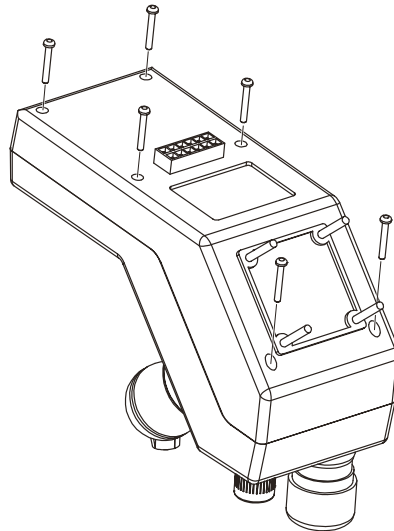
ELECTROSTATIC DISCHARGE CAN DAMAGE COMPONENTS ON THE INTEGRATED CIRCUIT BOARD. PLACE THE PLATFORM CONTROL BOX ON A NON-CONDUCTIVE SURFACE WHEN OPENING THE BOX AND WORKING DIRECTLY WITH THE CIRCUIT BOARD.

Removing Control Box From Platform

1. Turn off all power to the platform control box.
2. Unhook the wiring harness cable at the quick-disconnect coupling. (*Early VP models were not equipped with the quick-disconnect coupling, skip to Step 4.*)
3. Remove the platform control box and box mount to a suitable work surface.
4. Remove the control box from the control box mount by removing the four (4) nuts from the studs on the bottom of the control box.
5. Unplug the wiring harness cable connector on the back of the lower housing half.
6. Lay control box mount and wiring harness assembly aside.

Lower Half Of Housing Removal

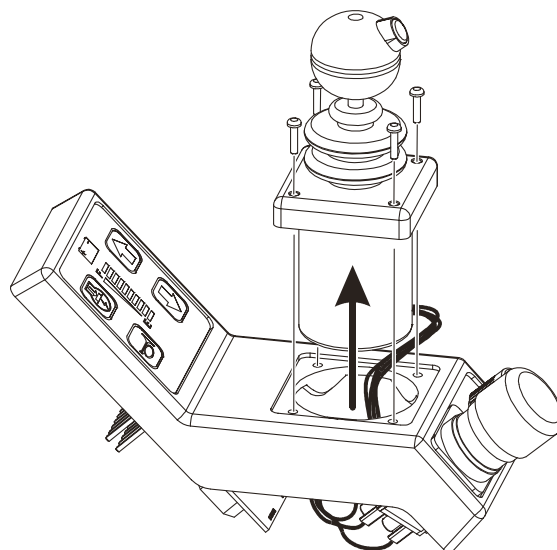
1. Position the control box upside down and remove the six (6) screws attaching the lower half of the housing to the upper half of the control box housing.
2. Lay screws and lower housing aside.



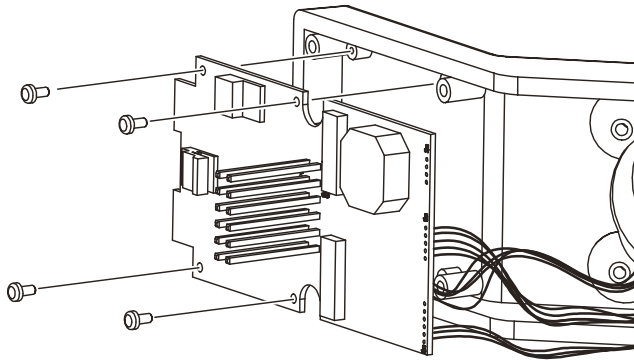
Joystick Assembly Removal

NOTE: To completely remove the joystick assembly, its wiring will need to be unsoldered from the integrated circuit board.

1. Remove the four (4) screws from the top of the bezel around the base of the joystick and slide the joystick assembly out of the upper housing.
2. Unplug the touchpad switch ribbon connector from the circuit board connector socket.



3. Remove the four (4) screws attaching the circuit board to the upper housing.



NOTE: If reusing the circuit board be careful when unsoldering component wires **DO NOT OVERHEAT BOARD.**

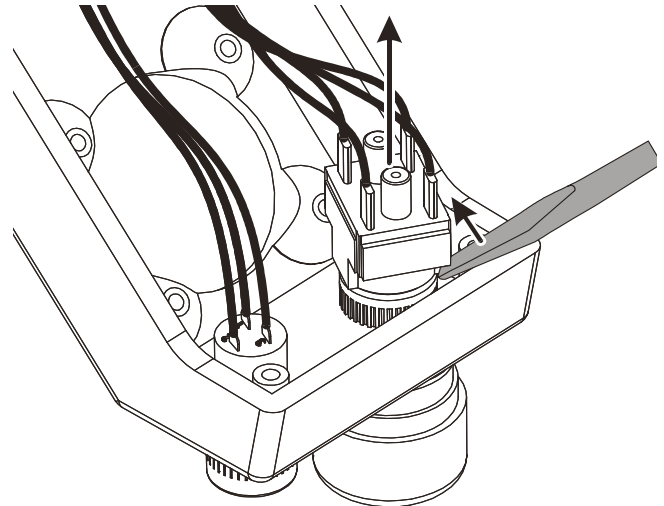
4. Position the circuit board and unsolder the wires from the joystick assembly at the J2, J3 and J7 locations on the circuit board. (See Figure 2-15.)

NOTE: (Early VP model joystick assemblies did not have the drive enable button on the joystick knob. Wires from this design were attached in the J3 location on the circuit board only.)

5. With all the joystick wiring unsoldered remove joystick assembly from the control box.

Emergency Stop Switch Removal

1. Remove the switch part of the emergency stop switch by carefully prying upward at the corner of the switch using a straight blade screwdriver. This will separate the switch from the reset button part of the emergency stop button assembly.



2. Position the circuit board and locate the emergency stop switch wires connected at locations J8, J9, J10 and J11. Unsolder the four (4) wires to the switch to remove the switch from the board. (See Figure 2-15.)

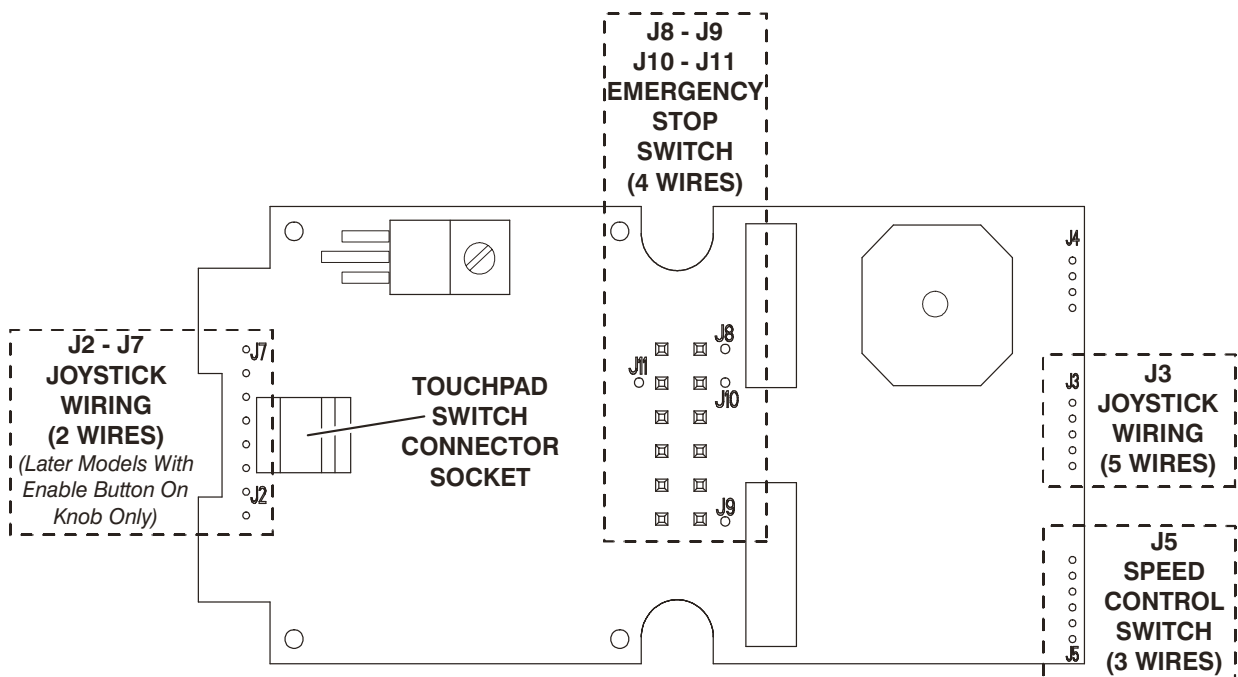
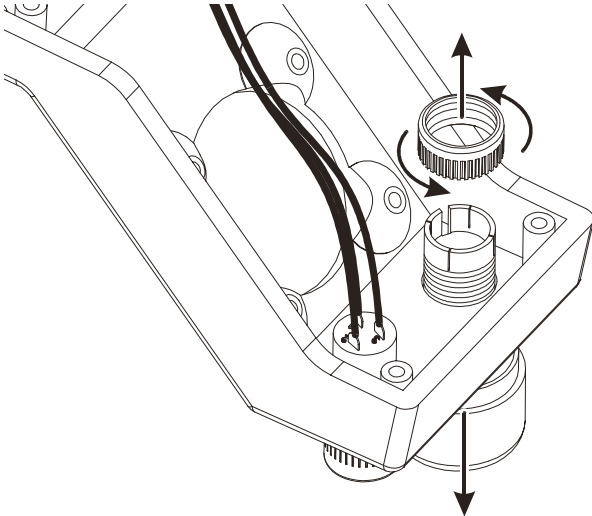


Figure 2-15. Platform Control - Circuit Board Component Wiring Connections.

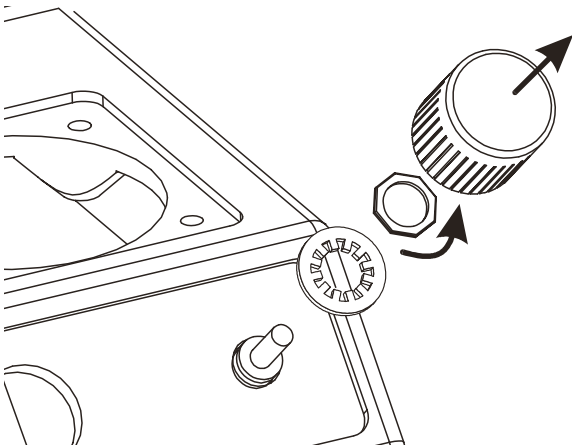
SECTION 2 - SERVICE PROCEDURES

3. Remove the reset button part of the emergency stop switch by unscrewing the collar on the inside end of the reset button assembly.



Speed Control Switch Removal

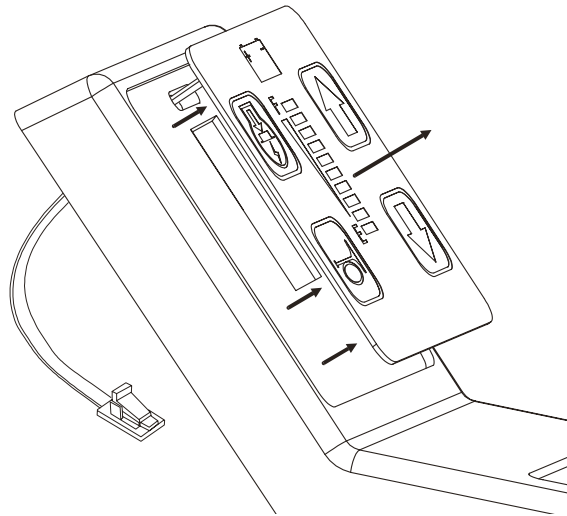
1. Remove the speed control knob by pulling up on the knob until it is free of the switch shaft.
2. Loosen and remove the retaining nut and lock washer from the switch collar and pull the switch out of the housing.



3. Position the circuit board and locate the speed control switch wires connected at location J5. (See Figure 2-15.) Unsolder the three (3) wires to the switch to remove the switch from the platform box.

Touch Pad Switch Removal

1. Unplug the touch pad ribbon cable connector from the circuit board connector socket. (See Figure 2-15.)
2. Using a thin tool, start by lifting an edge of the touch pad switch and slowly peel away it from the face of the upper housing until completely free.



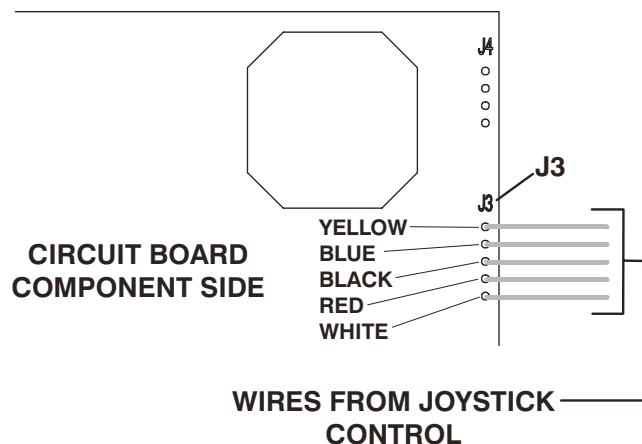
Platform Control Box Assembly

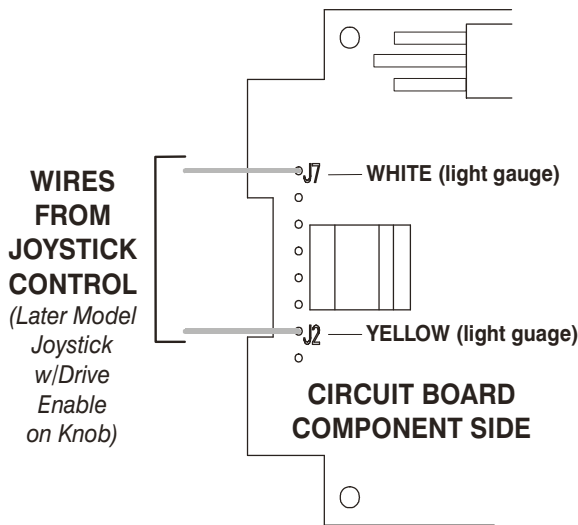
To assemble the components back into the control box follow the previously outlined disassembly procedure and reverse the steps for the component being installed. The following are additional guidelines for assembling each component.

NOTE: Be careful when soldering component wires to the circuit board DO NOT OVERHEAT BOARD.

Joystick Installation

1. Use the following illustrations to reattach the wires from the joystick to the circuit board.

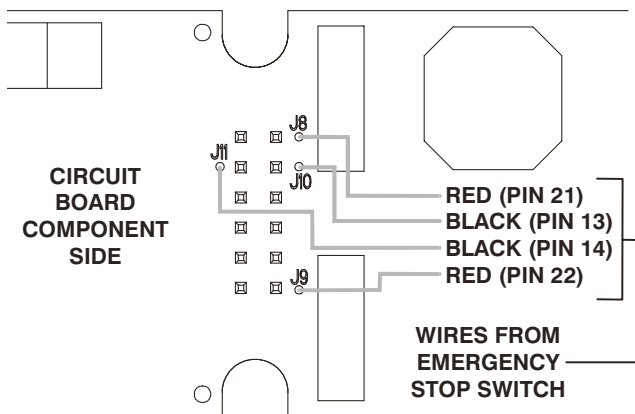




2. If damaged replace the gasket between upper housing surface and the joystick mounting surface before assembling.

Emergency Stop Switch Installation

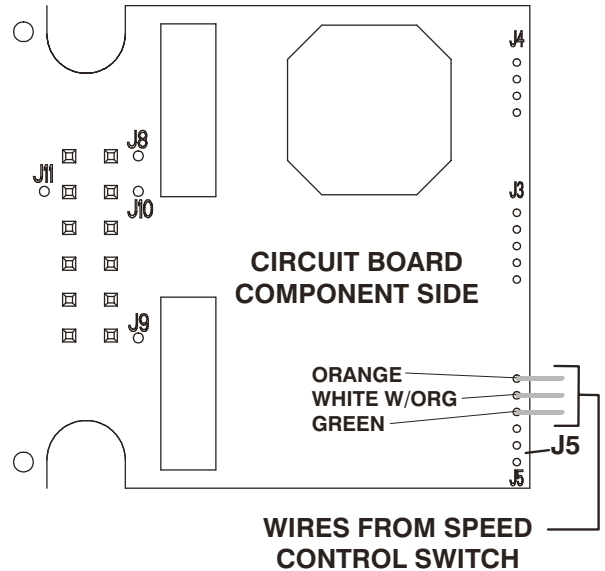
1. Use the following illustration to reattach the wires from the emergency stop switch to the circuit board.



2. If damaged replace the gasket between the stop switch base plate and the upper housing mounting surface.

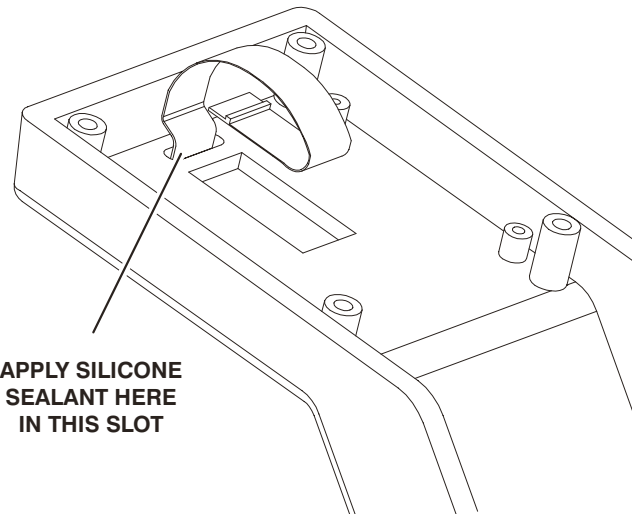
Speed Control Switch Installation

1. Use the following illustrations to reattach the wires from the speed control switch to the circuit board.



Touch Pad Switch Installation

1. Thoroughly clean the surface of the upper housing where the touch pad switch adheres to the upper housing.
2. Remove all traces of silicone sealant from around the slot where the ribbon cable connector passes through the housing.



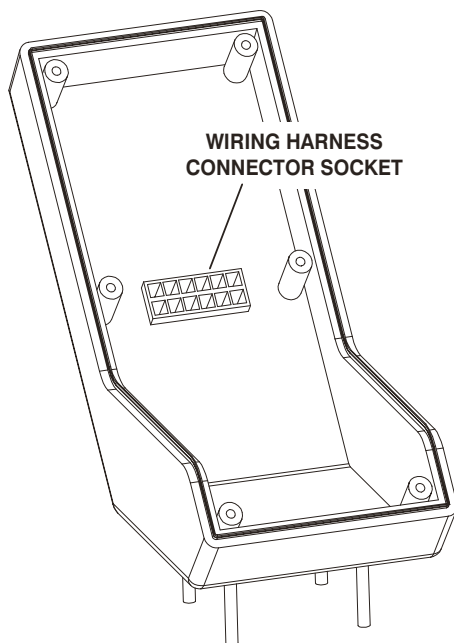
3. Remove the adhesive backing off the new touch pad switch, keep this surface clean and free of debris during assembly.
4. Assemble the new touch pad switch to the upper housing surface by first sliding the ribbon cable con-

necter from the touch pad switch through the slot at the top of the housing. Before pressing the touch pad adhesive side to the upper housing mounting surface, visually align the touch pad edges with the edges of the recess in the housing mounting surface.

5. Once the touch pad is installed, on the underside of the housing apply just enough silicone sealant to fill the small slot around the ribbon cable to help seal the slot and also strengthen the ribbon cable connection at the touch pad surface.
6. Re-install the circuit board and plug the ribbon cable connector into the circuit board cable socket.

Lower Half Housing Installation

1. Before installing the lower half housing apply a non-conductive grease to the square holes of the wiring harness connector socket on the inside of the housing socket. This will help keep out dirt and moisture.



2. Carefully slide the lower housing onto the upper half of the platform control box assembly until seated completely against the upper housing edges.
3. Secure lower half housing to the upper half housing using the six (6) screws removed during disassembly.

2.7 BATTERY CHARGER ASSEMBLY AND DISASSEMBLY

General Information

⚠ IMPORTANT

DO NOT ATTEMPT TO DISASSEMBLE THE BATTERY CHARGER IF MACHINE IS STILL UNDER WARRANTY. OPENING THE BATTERY CHARGER WHILE THE MACHINE IS UNDER WARRANTY WILL VOID THE CHARGER WARRANTY. IF UNDER WARRANTY REQUEST A REPLACEMENT CHARGER FROM THE FACTORY.

ALSO BEFORE REPLACING ANY COMPONENT, USE THE CHARGER MANUFACTURERS TROUBLESHOOTING GUIDE INCLUDED WITH THE MACHINE FOR CHECKING THE INTERNAL AC AND DC CIRCUITS TO DETERMINE WHICH COMPONENT HAS FAILED. COMPLETE WIRING DIAGRAMS PERTAINING TO YOUR MODEL CHARGER ARE ALSO INCLUDED IN THE MANUFACTURERS CHARGER MANUAL.

The VP Series battery charger allows for replacement of the following internal components. Consult your Illustrated Parts Manual for part numbers of these components which are available from the JLG Parts Department:

- Transformer
- Printed Circuit Board
- Shunt Assembly
- Interlock Relay
- SCR Rectifier
- AC Circuit Breaker
- DC Circuit Breaker

Replacement and troubleshooting of these components requires removal of the battery charger from its mounting position on the machine.

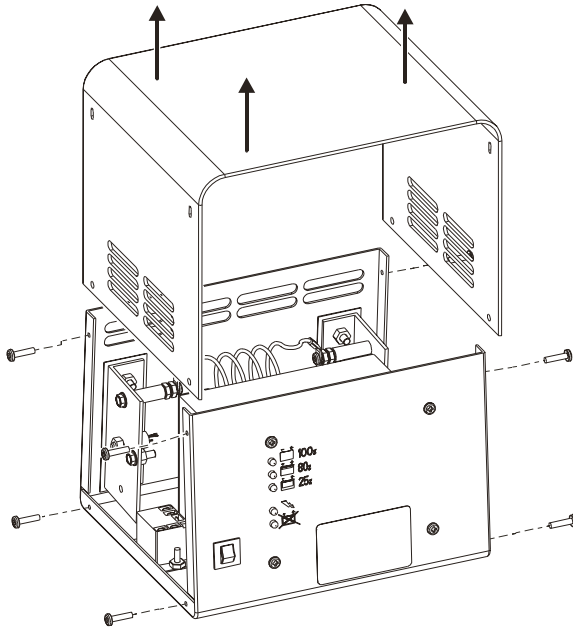
Battery Charger Removal

1. Remove the rear cover from the machine.
2. Unbolt and lower the MC-1 Controller Box.
3. Remove the four (4) capscrews securing the charger to its mounting plate.
4. Disconnect the DC wiring from the positive/negative battery terminals and interlock connector from the wiring harness.
5. Remove the charger from the machine.

Battery Charger Part Replacement

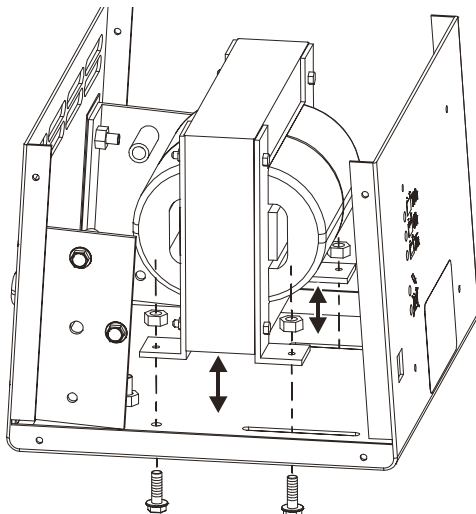
Cover Removal

1. Remove the eight (8) screws on the sides of the charger cover and remove cover.



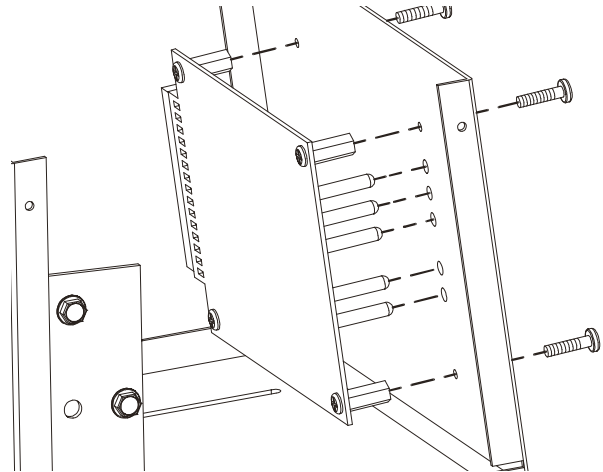
Transformer Replacement

1. Disconnect the wiring connecting the transformer to other components within the charger assembly.
2. Remove the four nuts from the cap screws securing the transformer brackets to the base of the charger chassis.
3. Remove transformer.



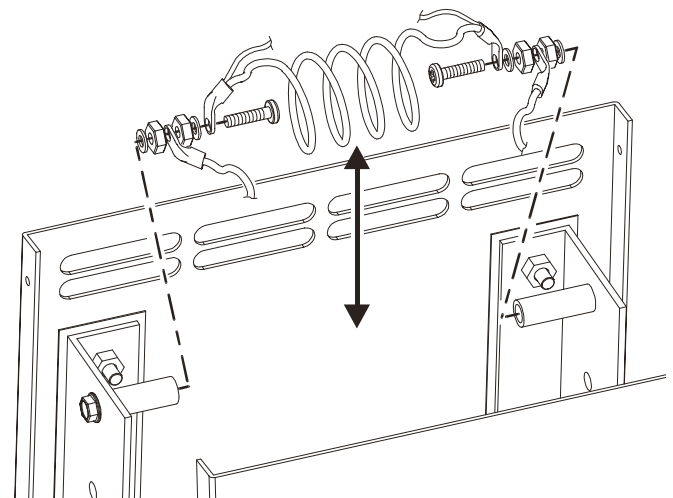
Printed Circuit Board Replacement

1. Disconnect the wide wiring connector from the end of the circuit board.
2. Remove the four (4) screw attaching the card to the front face of the charger chassis.
3. Remove the circuit board.



Shunt Assembly Replacement

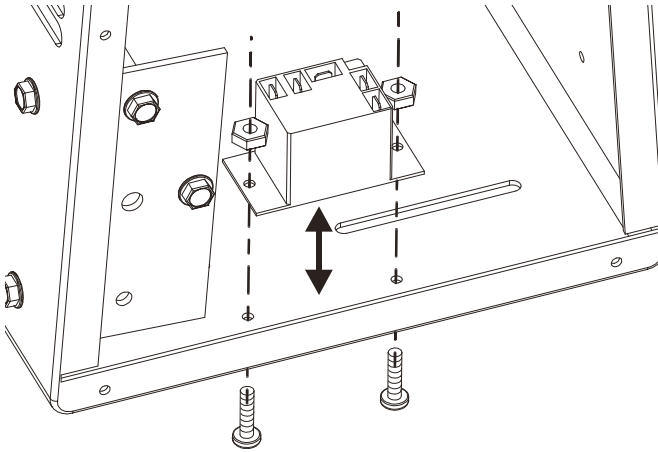
1. Carefully remove the screw from each end of the shunt assembly. The white insulator may need to be restrained to keep it from turning while removing the shunt assembly fasteners. Also make note of the position of each washer, nut and wire connector when removing for later assembly.



SECTION 2 - SERVICE PROCEDURES

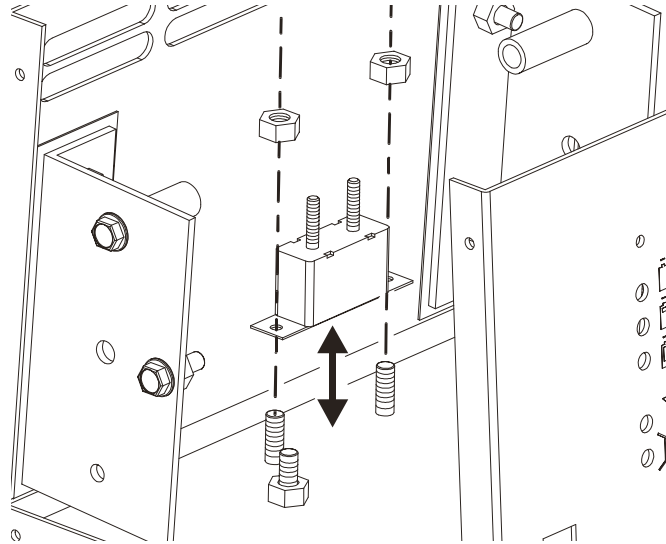
Interlock Relay Replacement

1. Disconnect the wiring connected to the relay.
2. Remove the two (2) nuts securing the interlock relay to the chassis base.
3. Remove the relay.



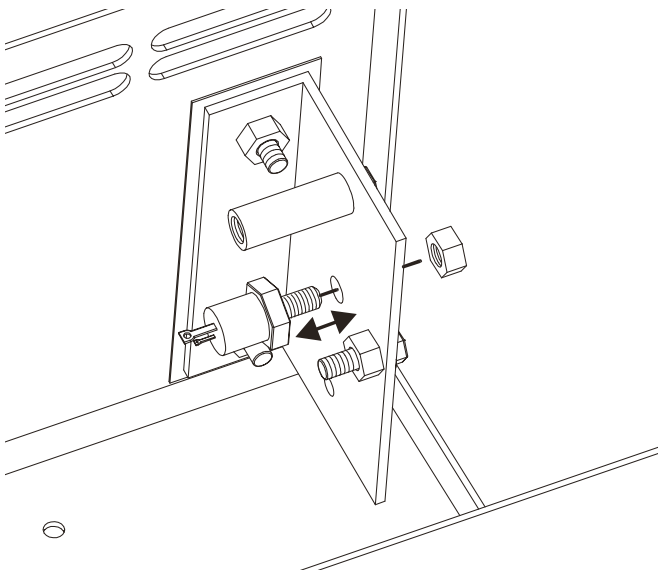
AC Circuit Breaker Replacement

1. Disconnect wiring connected to the breaker poles.
2. Remove the two (2) nuts securing the AC breaker to the chassis screws.
3. Remove the breaker from the chassis.



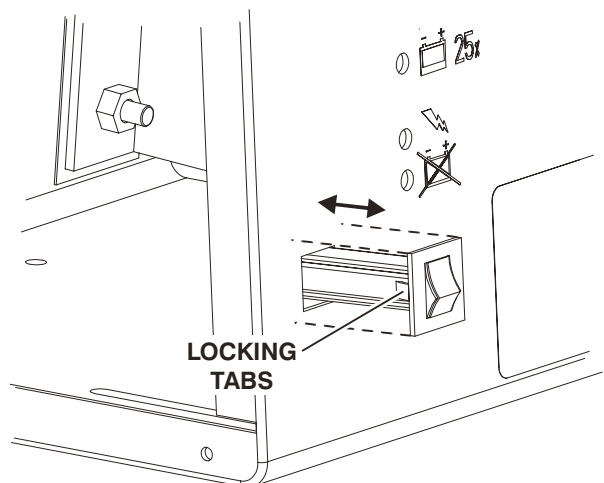
SCR Rectifier Replacement (Either Side)

1. Remove the wiring from the SCR Rectifier.
2. Remove the nut securing the rectifier to the insulated aluminum chassis bracket.
3. Remove the SCR Rectifier.



DC Circuit Breaker Replacement

1. Remove the wiring from the DC breaker terminals.
2. To remove the breaker from the front face of the charger, on the inside of the charger front face, push in on the tabs located on the sides of the breaker assembly and remove the breaker out the front of the charger.



2.8 MAST ASSEMBLY AND DISASSEMBLY PROCEDURES

The VP Series personnel lift mast sections are constructed of extruded aluminum, protected with an anodized surface finish. The mast sections are interlocked into each other when assembled, by internally mounted slide pads at the top and bottom of each mast section. These slide pads run up and down in slide pad channels on each side of the mast.

Each VP model mast assembly contains a different number of mast sections as shown following;

Table 2-2. VP Series Mast Component Features

Model	No. of Mast Sections	Extend/Retract Device
10VP	3	Chain
15VP	4	Chain
20VP	5	Chain

Assembly procedures for all mast sections is basically the same, carefully slide the mast sections together from bottom until mast ends are even. (When sliding the mast sections together, be careful not to scratch the anodized surface). Assemble the hardware to the bottom of mast section first, slide this section out the top of previous section and assemble hardware to the top of mast, (See Fig-

ure 2-1.). Always install slide pad shims with slide pads inserted into the slide pad channels, (ends of mast sections even). Applying silicone spray onto the slide pads and slide pad channels before assembly will help mast sections slide easier after slide pads have been properly shimmed.

Mast Disassembly Procedure

NOTE: Reference to mast sections-3/-4/-5 (platform mounting section) depends on which VP model lift you are working on.

1. After the mast assembly has been removed from the machine, lay the mast assembly down on a suitable work table with the platform mounting section on top, facing up.
2. Remove the sequencing cables and hardware from the sides of the mast assembly. Also remove the cover from the top of the mast assembly.
3. Remove chain adjust nuts from threaded ends of chain attached to the chain anchor plate on BOT-TOM end of mast section-3/-4/-5 (platform mounting section). Push threaded ends of chain through anchor plate.
4. At the TOP of mast section—3/-4/-5, pull chains out and allow to hang loose.

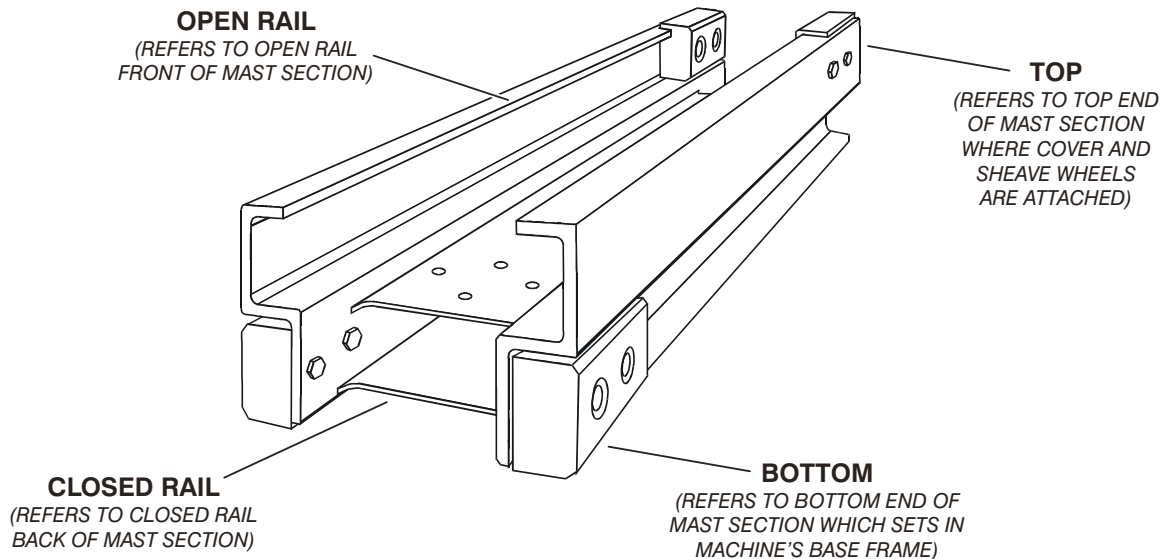


Figure 2-16. Mast Section - Assembly Reference.

SECTION 2 - SERVICE PROCEDURES

NOTE: When sliding mast sections apart, be careful not to scratch or score the anodized surface in the slide pad channels.

5. Carefully slide mast section-3/-4/-5 out BOTTOM of mast section-2/-3/-4 rails. Disassemble slide pads, shims and chain anchor plate from mast section-3/-4/-5, if necessary.

NOTE: Steps 6 through 10 apply to removal of mast section-4 on model 20VP lifts which have five (5) mast sections. If servicing a 15VP mast, go to step 11, or a 10VP go to step 17.

6. Remove chain adjust nuts from threaded ends of chains attached to the chain anchor plate on bottom end of mast section-4. Push threaded ends of chains through anchor plate.
7. At top of mast section-4, pull chains out and allow to hang loose.
8. Slide mast section-4 out the TOP of mast section-3 far enough to allow access to the chain sheave wheel assembly.
9. Remove countersunk-flathead screws securing chain sheave wheel assembly attach bars on both side rails at top of mast section-4 and remove sheave wheel assembly.

NOTE: When sliding mast sections apart, be careful not to scratch or score the anodized finish in the slide pad channels.

10. Carefully slide mast section-4 out BOTTOM of section-3. Remove slide pads, shims and chain anchor plate, if necessary.

NOTE: Steps 11 through 16 apply to removal of mast section-3 on 15VP (chain actuated) & 20VP (chain actuated) lifts. If servicing a 10VP mast, go to step 17.

11. Remove chain adjust nuts from threaded ends of chain attached to the chain anchor plate on BOTTOM end of mast section-3. Push threaded ends of chain through anchor plate.
12. At TOP of mast section-3, pull chains out and allow to hang loose, (be certain floor surface is clean and free of any metal chips or debris which may stick to lubricated chains).
13. Slide mast section-3 out TOP of mast section-2 far enough to allow access to the chain sheave wheel assembly.
14. Remove countersunk-flathead screws securing chain sheave wheel assembly attach bars on both side rails at TOP of mast section-3 and remove the sheave wheel assembly.

NOTE: Step 15 applies only to 20VP lift models which have five (5) mast sections. If servicing a 15VP mast, go to step 16.

15. While mast section-3 is still extended from section-2 remove the bolts attaching the two (2) chain assembly anchor eyelets to the TOP of mast section-3. Remove chains.

NOTE: When sliding mast sections apart, be careful not to scratch or score the anodized finish in the slide pad channels.

16. Carefully slide mast section-3 out BOTTOM of section-2. Remove slide pads, shims and chain anchor plate, if necessary.

NOTE: Removal of mast section-2 (cylinder attach section) is basically the same for all VP model lifts except where noted.

17. Slide mast section-2 out TOP of mast section-1 far enough to allow access to the chain assembly anchor block/sheave wheel assembly.
18. Remove countersunk-flathead screws securing chain anchor block/sheave wheel assembly attach bars on both side rails at TOP of mast section-2.
19. Slide the chain anchor block/sheave wheel assembly and hydraulic cylinder out the TOP of mast section-2 far enough to allow removal of the sheave wheel attach bars, sheave wheels and sheave pin from chain assembly anchor block.
20. Remove the setscrew holding the hydraulic cylinder rod into the chain assembly #444 anchor block. Lay chain assembly #444 to side.
21. Remove the hydraulic cylinder through BOTTOM of mast section-2, be careful not to nick or score cylinder rod surface while removing.

NOTE: When sliding mast sections apart, be careful not to scratch or score the anodized finish in the slide pad channels.

22. Carefully slide mast section-2 out BOTTOM of section-1. Remove slide pads and shims, if necessary.
 23. Slide the TOP of remaining mast section-1 out over edge of work surface and remove the bolts attaching the chain anchor blocks to mast section-1. Remove chain assemblies from mast and lay aside.
 24. Remove slide pads and shims from mast section-1.
- Mast disassembly should now be complete.

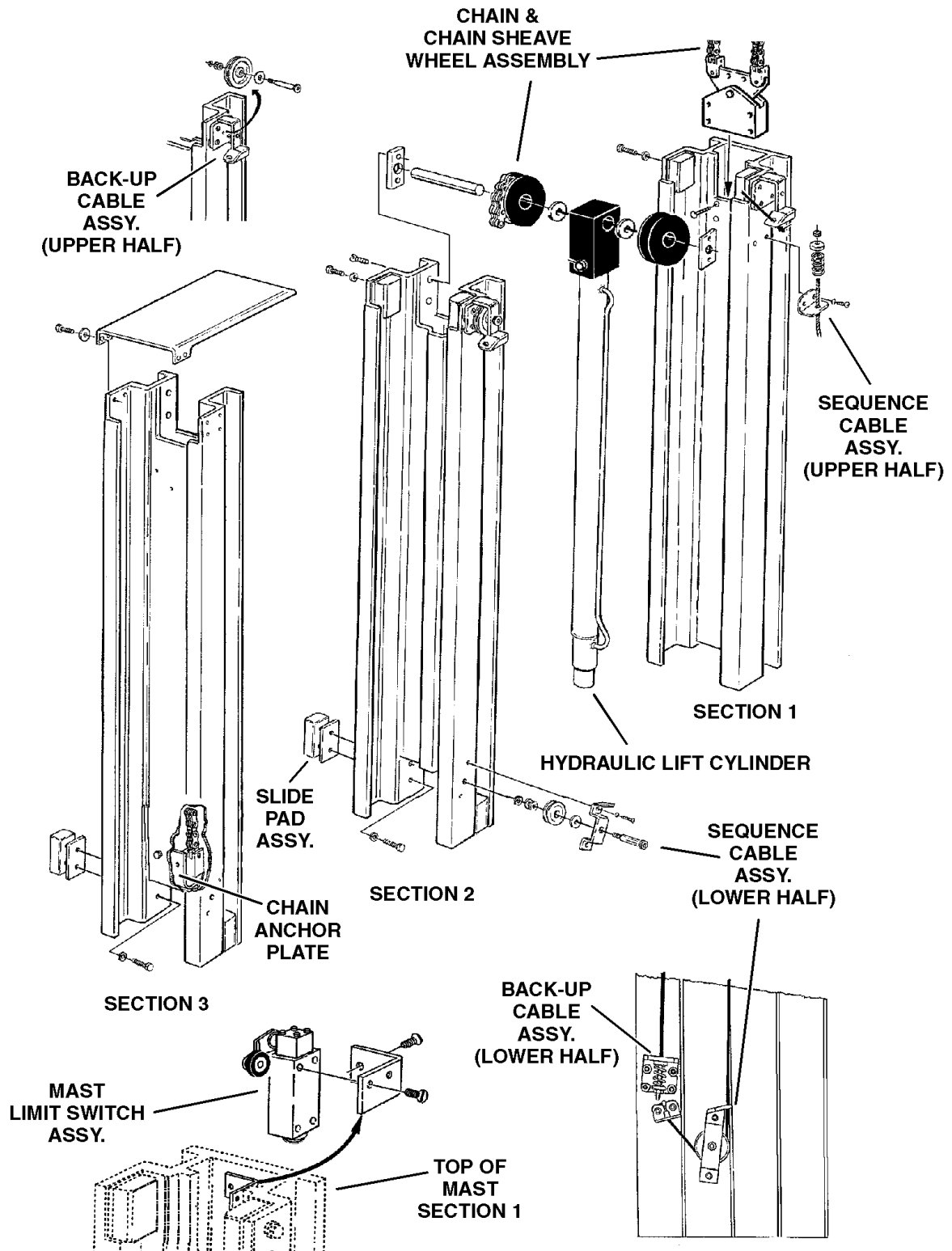


Figure 2-17. 10VP Mast Assembly.

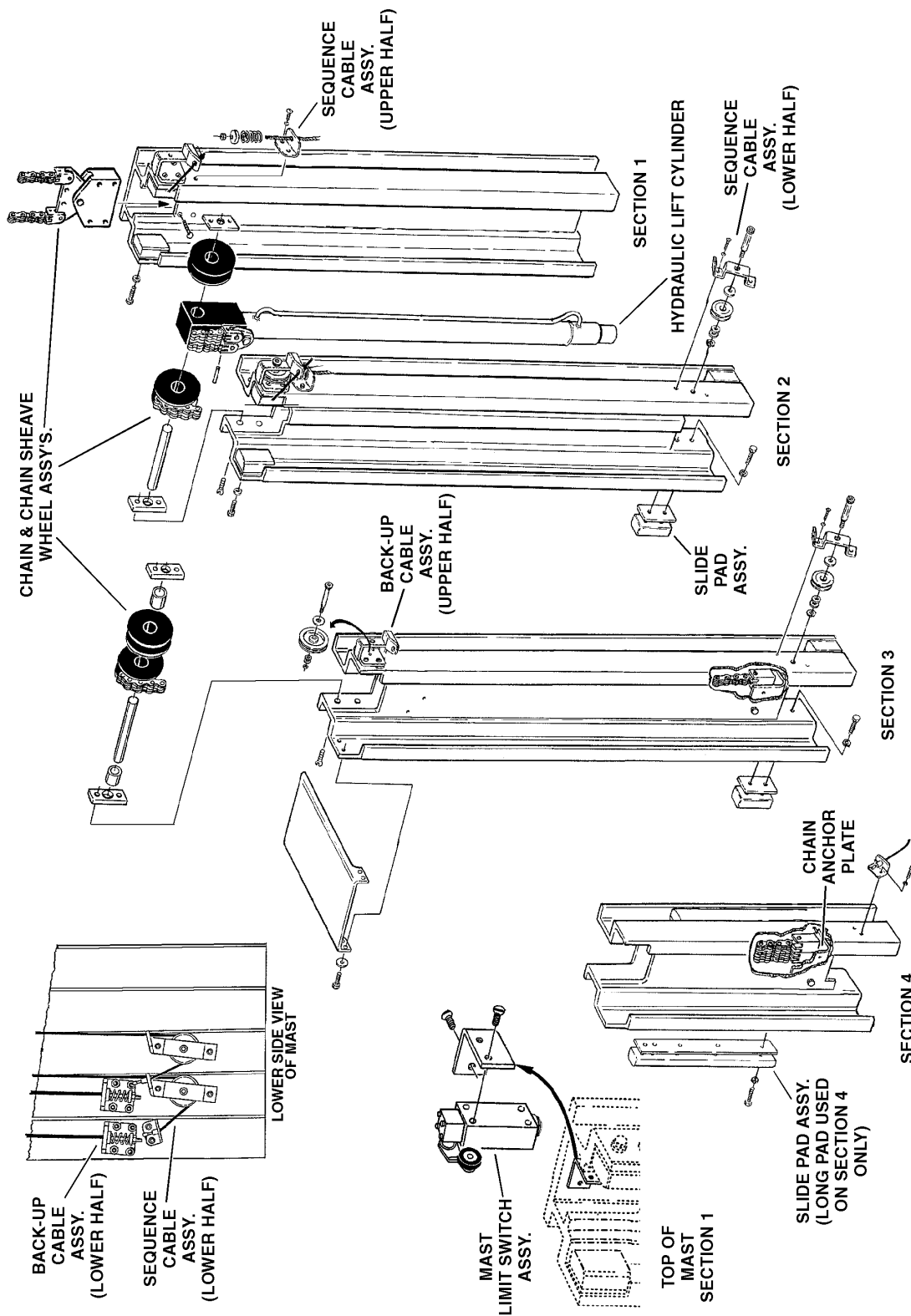


Figure 2-18. 15VP Mast Assembly.

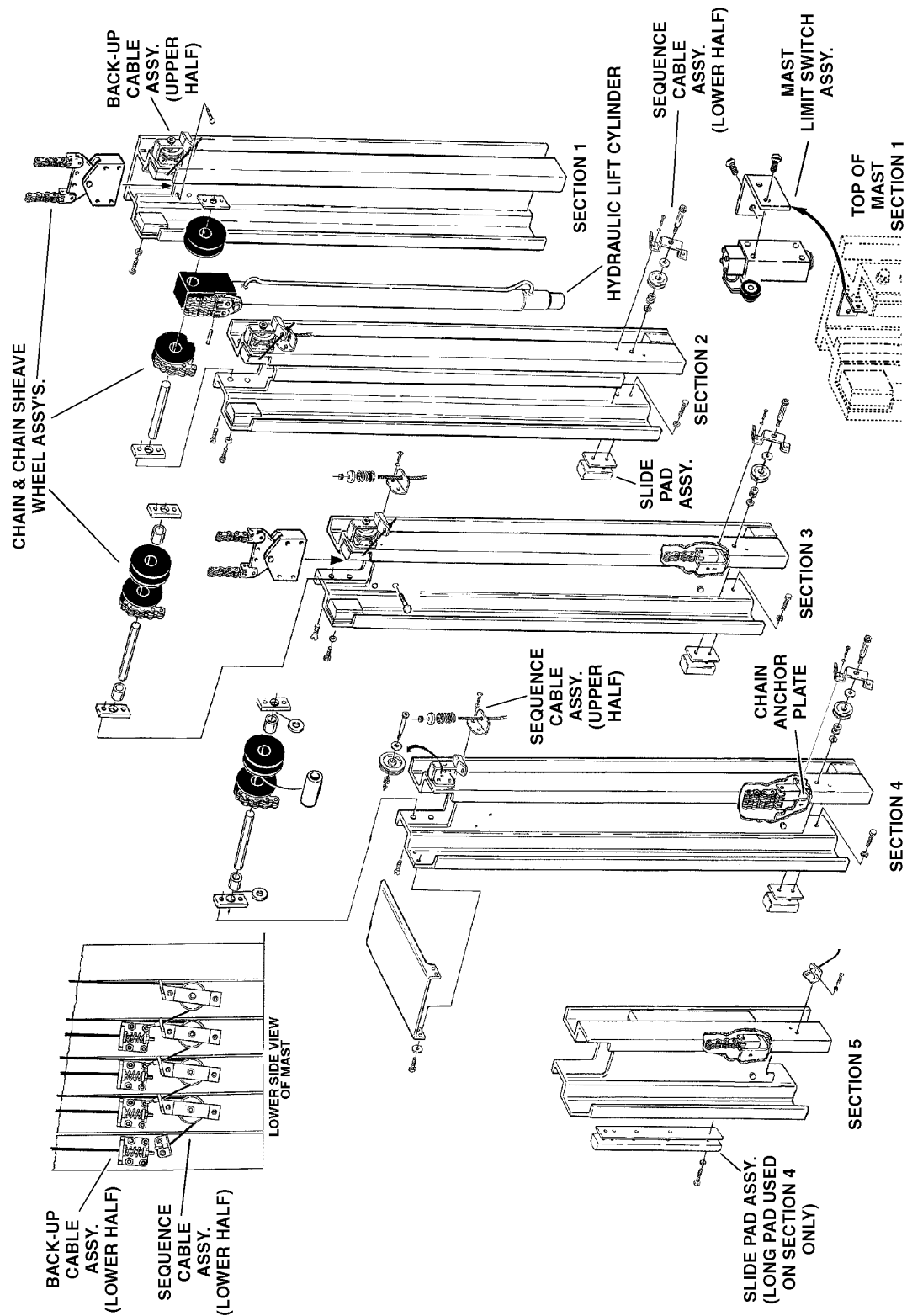


Figure 2-19. 20VP Mast Assembly.

SECTION 2 - SERVICE PROCEDURES

Mast Assembly

(See Figure 2-1, 2-2, 2-3 & 2-4.)

1. Place mast section-1, rail (open) side up on a clean, flat surface (preferably a table or work bench capable of supporting the weight of the entire mast assembly). Slide mast out over end of work surface far enough to allow access to the chain anchor attach holes at top of mast.
2. Locate the two (2) single chain assemblies. Lay out each chain assembly with anchor block end towards mast, and threaded end away from mast, (be certain floor surface is clean and free of any metal chips or debris which may stick to lubricated chains).
3. Insert the block anchor end into the top of mast section-1 and secure using two (2) 3/8"-16UNC x 2-1/2" (chain) long hex head bolts, flatwashers and nuts for each attach block. Place a flatwasher under bolt head and nut.

NOTE: When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad channels.

4. Locate mast section-2, carefully slide mast section-2 closed rail into section-1 open rail. Slide sections together until ends are even.

NOTE: Do not attach mast slide pads and shims to mast sections before assembling sections. If assembled in this manner, due to the tight fit of the slide pads in the slide pad channels, the anodized finish could be removed from the receiving mast's slide pad channels.

5. Insert slide pads into the slide pad channels at bottom end of mast between section-1 and -2, (one on each side of the mast), with beveled surface facing out towards section-1.
6. Thread slide pad attaching bolts, (two (2) 1/4"-20UNC x 3/8" long hex head bolts, place a flat washer under head of each bolt), through holes in mast section-2 inside rail, into the slide pad inserts. Thread in enough to hold pad in place.
7. Shim slide pads using the following steps:

NOTE: Always use the an even amount of shim material behind slide pads on both sides of the mast rails. This will keep mast sections centered in rail channels and prevent any distortion of the mast section.

- a. Use two shim pieces per slide pad, a thick one and a thin one.
- b. Start with a total thickness of approximately a .025" thick shim and a .055" thick shim.
- c. Slide shims into place between slide pad and mast rail. Tighten the slide pad mounting bolts, be sure there are no air gaps (on flat side of slide

pad) between shims, shim and mast or shim and slide pad when tightened.

- d. All mast sections are to be shimmed to provide a measurable gap between the slide pad (beveled side) and mast channel of 0.012" to 0.025" per side.
- e. When mast slide pads are shimmed properly, the mast sections should be able to slide in channel by hand.
8. Insert slide pads into the slide pad channels (top of mast) between section-1 and -2, (one on each side of the mast), with beveled surface facing in towards section-2.
9. Thread slide pad attaching bolts, (two (2) 1/4"-20UNC x 3/8" long hex head bolts, place a flat washer under head of each bolt), through holes in mast section-1 outside rail (top of mast) and into the slide pad inserts. Thread in enough to hold pad in place.
10. Shim per instructions in step 7.

NOTE: If hydraulic cylinder needs to be extended, the protective caps on the extend and return ports will need to be removed. Be careful not to nick or scour rod surface when extending, also catch any oil draining out of cylinder to avoid spillage onto work area.

11. Locate the hydraulic lift cylinder, slide the lift cylinder into the closed rail side of mast section-2 with rod end to top and port end to bottom of mast. Cylinder should extend out of mast on both ends. Return tube should be on right side when facing bottom of mast assembly.

NOTE: Top of cylinder assembly steps 12 and 13 applies to 20VP only. For 10VP & 15VP continue to step 14.

12. Locate chain assembly #444 (single anchor block with two narrow chains). Lay out chain assembly with anchor block end towards mast, (be certain floor surface is clean and free of any metal chip or debris which may stick to lubricated chains).
13. Insert hydraulic cylinder rod end into chain assembly #444, anchor block. Secure cylinder rod to anchor block with a 1/4"-28UNF x .50" long - Type C setscrew. Coat threads with blue Loctite # 242 before assembly.

NOTE: When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad rails.

14. Locate mast section-3, carefully slide section-3 closed rail into section-2 open rail. Slide sections together until ends are even.
15. Locate one (1) of the chain anchor plates (one with threaded holes horizontally aligned to outside of bracket). Attach using outer set of holes in bottom of

mast section-3 with two (2) 1/4"-20UNC x 3/4" long bolts, place a flatwasher under head of each bolt.

16. Slide mast section-3, approximately two feet out of the top of mast section-2.
17. Insert threaded ends of chain-assembly #466 (attached to top of mast section-1), through holes in anchor plate attached to bottom of mast section-3. Loosely thread two (2) 3/8"-16UNC nuts onto stud threads on each chain. Chains will be adjusted later in assembly.
18. Slide mast section-2 out of mast section-1 approximately one foot.

10VP Top of Cylinder Assembly

19. Assemble chain sheave wheels to cylinder rod end and attach to mast section-2 using following steps;
 - a. Attach chain mounting tube to top of hydraulic cylinder using one (1) 1/4"-28NF x 5/8" cap-screw.
 - b. Insert sheave pin through cylinder chain mounting tube on cylinder rod end.
 - c. Place a spacer tube on each side of mounting tube.
 - d. Next slide sheave wheels on onto sheave pin against spacer, on each side of mounting tube.
 - e. On outside of each sheave wheel, place another spacer tube.
 - f. On outside of spacer tubes place a sheave pin attach bar, (rectangular plate with threaded holes on each side of pin bore hole).
 - g. Slide the assembly with sheave pin, wheels and pin attach bars into top of mast section-2.
 - h. Attach to top of mast section-2 using two (2) 3/8"-16UNC x 1/2" long socket head-countersunk-flathead cap screws each side. Coat threads with Loctite #171 and tighten.

15VP Top of Cylinder Assembly

19. Assemble chain sheave wheels to cylinder rod end and attach to mast section-2 using following steps;
 - a. Attach chain mounting tube to top of hydraulic cylinder using one (1) 1/4"-28NF x 5/8" cap-screw.
 - b. Insert sheave pin through cylinder chain mounting tube on cylinder rod end.
 - c. Place a spacer tube on each side of mounting tube.
 - d. Next slide sheave wheels on onto sheave pin against spacer, on each side of mounting tube.
 - e. On outside of each sheave wheel, place another spacer tube.

- f. On outside of spacer tubes place a sheave pin attach bar, (rectangular plate with threaded holes on each side of pin bore hole).
- g. Before sliding this assembly into the top of mast section two, locate two (2) mast extension chain assemblies and lay their anchor ends into the slots of the chain mounting tube.
- h. Slide the assembly with sheave pin, wheels and pin attach bars into top of mast section-2.
- i. Attach to top of mast section-2 using two (2) 3/8"-16UNC x 1/2" long socket head-countersunk-flathead cap screws each side. Coat threads with Loctite #171 and tighten.

20VP Top of Cylinder Assembly

19. Assemble chain sheaves on chain assembly #444 anchor block (attached to cylinder rod end) and attach to mast section-2 using following steps;
 - a. Insert sheave pin through anchor block on cylinder rod end.
 - b. Place sheave wheels (for wide chain) on sheave pin, one each side of anchor block.
 - c. On outside of each sheave wheel, place a sheave pin attach bar, (rectangular plate with threaded holes on each side of pin bore hole).
 - d. Slide the whole anchor block assembly with sheave pin, wheels and pin attach bars into top of mast section-2. (Position anchor block with narrow chains facing mast section-3).
 - e. Attach to top of mast section-2 using two (2) 3/8"-16UNC x 1/2" long socket head-countersunk-flathead cap screws each side. Coat threads with Loctite #171 and tighten.
20. Slide mast section-2 back into section-1 until end are even.

NOTE: Step 23 and 24 applies to 20VP mast assembly only. 10VP and 15VP mast assembly continue at step 25.

21. Locate two mast extension chain assemblies. Attach the eyelet anchor end of each chain to the outside holes near top of mast section-3 using 3/8"-16UNC x 1-1/4" long hex head bolts, nuts and flatwashers. Place a flatwasher under bolt head and nut.

NOTE: When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad channels.

22. Carefully slide mast section-3 into section-2 until ends are even. Check to make sure chain assembly #466 (wide chains) are seating properly in chain #444 anchor block chain sheave wheels attached to mast section-2.

NOTE: Do not attach mast slide pads and shims to mast sections before assembling sections. If assembled in

SECTION 2 - SERVICE PROCEDURES

this manner, due to the tight fit of the slide pads in the slide pad channels, the anodized finish could be removed from the receiving mast's slide pad channels.

23. Insert slide pads into the top end mast rails between section-2 and -3, (one on each side of the mast), with beveled surface facing inward towards section-3.
24. Thread slide pad attaching bolts, (two (2) 1/4"-20UNC x 3/8" long hex head bolts, place a flat washer under head of each bolt), through holes in outside rail, on top of mast section-2 and into the slide pad inserts. Thread in enough to hold pad in place.
25. Shim per instructions in step 7.
26. Insert slide pads into the bottom end mast rails between section-2 and -3, (one on each side of the mast), with beveled surface facing out towards section-2.
27. Thread slide pad attaching bolts, (two (2) 1/4"-20UNC x 3/8" long hex head bolts, place a flat washer under head of each bolt), through holes on inside rail, on bottom end of mast section-3 and into the slide pad inserts. Thread in enough to hold pad in place.
28. Shim per instructions in step 7.

NOTE: *Assembly of 10VP mast should now be complete. To continue with 15VP assembly go to step 48. 20VP assembly continues following.*

NOTE: *When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad channels.*

29. Locate mast section-4, carefully slide section-4 closed rail into section-3 open rail. Slide sections together until ends are even.
30. Locate one (1) of the chain anchor plates (one with two threaded holes vertically aligned in center of bracket). Attach through inner (vertical) set of holes at bottom of mast section-4 using two (2) 1/4"-20UNC x 3/4" long bolts, place a flatwashers under head of each bolt.
31. Slide mast section-4 out the top of mast section-3 so the chain anchor plate on bottom of mast section-4 is easily accessible at top end of mast section-3. Rest the top end of mast section-4 on a support while performing next step.
32. Insert threaded ends of chain assembly (attached to anchor block on top mast section-2) through the chain anchor plate located on bottom of extended mast section-4. Loosely thread two (2) 3/8"-16UNC nuts onto stud threads on each chain. Chains will be adjusted later in assembly.

NOTE: *When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad channels.*

33. Slide mast section-4 back into mast section-3 except for about a foot or more. Allow enough slack in chains to mount sheave wheels to top of mast section-3.
34. Extend mast section-3 out far enough from section-2 mast to gain access to top of section-3.
35. Assemble chain sheaves to top of mast section-3 as follows;
 - a. Locate the two chain sheave wheels and slide onto sheave pin.
 - b. Slide two (2) short spacer tubes onto sheave pin, one each end of sheave pin to outside of sheave wheels.
 - c. Place two (2) sheave pin attach bars, one each end of sheave pin to outside of space tubes.
 - d. Holding complete sheave wheel assembly, slide assembly into top of mast section-3 and align threaded holes in sheave pin attach bars with holes in mast rails.
 - e. Attach to top of mast section-3 using two (2) 3/8"-16UNC x 1/2" long socket head-countersunk-flathead cap screws, each side. Coat threads with Loctite #171 and tighten.

NOTE: *When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad channels.*

36. Slide mast section-3 back into section-2 until ends are even. (Mast section-2 may need to be restrained to keep its slide pads from pushing out the bottom of mast section-1).
37. While mast section-4 is still extended from section-3; locate two chain assemblies. Attach the eyelet anchor end of each chain to the inside set of holes near top of mast section-4 using 3/8"-16UNC x 1-1/4" long hex head bolts, nuts and flatwashers. Place a flatwasher under bolt head and nut.
38. While mast section-4 is still extended from section-3, assemble chain sheaves to top of mast section-4 as follows;
 - a. Locate the wide tube spacer and slide onto sheave pin.
 - b. Slide two (2) chain sheave wheels onto sheave pin, one each end of sheave pin to outside of tube spacer.
 - c. Place two (2) large flat washers, one each end of sheave pin to outside of chain sheave wheels.
 - d. Place two (2) sheave pin attach bars, one each end of sheave pin to outside of large flatwashers.

- e. Holding complete chain sheave wheel assembly, slide assembly into top of mast section-4 and align threaded holes in sheave pin attach bars with holes in mast rails.
- f. Attach to top of mast section-4 using two (2) 3/8"-16UNC x 1/2" long socket head-countersunk-flathead cap screws, each side. Coat threads with Loctite #171 and tighten.

NOTE: *When sliding mast sections together, be careful not to scratch or score the anodized finish in the slide pad channels.*

- 39. Carefully slide mast section-4 back into section-3 until ends are even. Check to make sure chain assemblies are seating properly in chain sheave wheels attached to top of mast section-3.

NOTE: *Do not attach mast slide pads and shims to mast sections before assembling sections. If assembled in this manner, due to the tight fit of the slide pads in the slide pad rails, the anodized finish could be removed from the receiving mast's slide pad channels.*

- 40. Insert slide pads into the top end mast rails between section-3 and -4, (one on each side of the mast), with beveled surface facing inward towards section-4.
- 41. Thread slide pad attaching bolts, (two (2) 1/4"-20UNC x 3/8" long hex head bolts, place a flat washer under head of each bolt), through holes in outside rail, on top of mast section-3 and into the slide pad inserts. Thread in enough to hold pad in place.
- 42. Shim per instructions in step 7.
- 43. Insert slide pads into the bottom end mast rails between section-3 and -4, (one on each side of the mast), with beveled surface facing out towards section-3.
- 44. Thread slide pad attaching bolts, (two (2) 1/4"-20UNC x 3/8" long hex head bolts, place a flat washer under head of each bolt), through holes on inside rail, on bottom end of mast section-4 and into the slide pad inserts. Thread in enough to hold pad in place.
- 45. Shim per instructions in step 7.

NOTE: *The platform mounting section (section—4 on 15VP and section-5 20VP machines) slide pads, are assembled differently than the slide pads for the other mast sections. Mast section-4/-5 slide pads may need to be assembled/disassembled several times in order to determine the correct shim stock required for proper fit.*

- 46. Locate the remaining mast section-4/-5 (platform mounting- mast section). Lay mast section on flat stable surface.
- 47. Attach the remaining chain anchor plate (one with threaded holes vertically aligned in center of bracket). Attach through inner (vertical) set of holes in bottom of mast section-4/-5 with two (2) 1/4"-20UNC x 3/4" long bolts, place a flatwasher under head of each bolt.
- 48. Complete the following steps to determine shim stock thickness required for section-4/-5;

NOTE: *Always use the an even amount of shim material behind slide pads on both sides of the mast rails. This will keep mast sections centered in rail channels and prevent any distortion of the section.*

- a. Use two shim pieces per slide pad, a thick one and a thin one.
- b. Start with a total thickness of approximately .035" and .075" thick shim stock.

NOTE: *To protect the anodized finish when sliding the assembled mast section-4/-5 into section-3/-4, grind top and bottom edges of slide pads to approximately a 1/4" radius.*

- c. Attach shim stock and slide pads to both sides of mast section-4/-5 using five (5) 1/4"-20UNC x 1-1/4" long, hex head cap screws per side, with flatwasher under each bolt head. (Assemble shim stock and slide pad to mast section rail with shim stock against rail and slide pad with beveled side out).
- d. Carefully thread the slide pad mounting bolts with flatwashers through slide pads and shim stock into threads in mast section-4/-5. Be certain there are no air gaps between shims, shim and mast or shim and slide pad when tightened.

NOTE: *When sliding mast section-4/-5 into section-3/-4 note amount of force required to push sections together. Fit should be very snug but still be able to be pushed together by hand. If too tight, remove section-4/-5, disassemble slide pad from section-4/-5 and reduce thickness of shim stock. Open rails of section-3/-4 may be sprayed with silicone spray to help section-4/-5 slide easier.*

- e. Begin sliding top of mast section-4/-5 with closed rail down engaging the slide pads into slide pad channels at bottom of mast section-3/-4's open rail. Continue to push section-4/-5 into section-3/-4 until BOTTOM ends of mast sections are even.
- f. Check mast section for side play. If play exists use thicker shims dividing thickness equally between both sides of mast.

SECTION 2 - SERVICE PROCEDURES

- g. When mast slide pads are shimmed properly, there should be no side to side movement of slide pad in rail channel. Mast sections should be very snug in channels but still be able to slide in channel by hand.
49. Slide mast section-4/-5 to top of section-3/-4.
50. Insert threaded ends of chain assembly (attached to top of mast section—2/3) through the chain anchor plate located on bottom of extended mast section-4/-5. Loosely thread two (2) 3/8"-16UNC nuts onto stud threads on each chain. Chains will be adjusted later in assembly.
51. Slide mast section-4/-5 back into mast section-3/-4 until bottom ends of masts are even. Check to make sure chain set attached to top of section-2/-3 is seating properly in chain sheave wheels attached to top of mast section-3/-4. (Mast sections-2, -3 and -4 may need to be restrained to keep their slide pads from pushing out the bottom of mast sections-1, -2 and -3).
52. At bottom of mast assembly, thread all chain adjusting nuts on threaded ends until they are snug against the anchor plates and all slack is removed from chains. Check that chains are seated in their sheave wheels at top of mast assembly. Also, ends of mast sections should be even with each other.

Mast assembly should now be complete.

2.9 MAST TO BASE FRAME INSTALLATION

CAUTION

IF BATTERIES ARE STILL MOUNTED, REMOVE BATTERIES FROM THEIR TRAYS BEFORE LAYING THE BASE FRAME IN A HORIZONTAL POSITION.

4. Carefully position the mast into base frame assembly, (base frame and mast assembly must be held at 90° angle to each other).
5. Slide port end of hydraulic cylinder through hole in base frame cylinder mounting channel. (Return port (tube side) of cylinder must be on right side facing bottom of base and mast).
6. Align threaded hole in side of hydraulic cylinder head with hole in tab on bottom side of cylinder mounting channel. Secure hydraulic cylinder to cylinder mounting channel tab using a 5/16"-18UNC x 5/8" long hex head bolt and flat washer.
7. Carefully push mast assembly and base assembly together until the four (4) holes on bottom rear of mast align with holes in the base frame mast support crossmember.
8. Attach mast to base using four (4) 3/8"-16UNC x 1" long hex head bolts, locknuts and flatwashers, (place a flatwasher under bolt head and nut and mount with nuts on inside of frame).
9. Locate the two (2) mast support braces, attach to sides of base frame using a 3/8"-16UNC x 1" long hex head bolt, nut and flatwashers each brace, (place a flatwasher under bolt head and nut and mount with nuts on inside of frame. Use access hole in bottom of frame to attach nut inside frame).
10. Before setting machine upright on base, install a short 90° elbow fitting, flow control valve and another short 90° elbow fitting on the end of the flow control valve in the extend (left) port on bottom of hydraulic cylinder. Install a long 90° elbow fitting on return (right) port. Use sealant tape on fitting threads. Cap ports until hydraulic lines are installed.
11. Carefully set machine in an upright position on its base frame wheels.
12. Locate the mast support bracket. Attach mast support bracket to mounting holes halfway up back of mast using four (4) 3/8"-16UNC x 2-3/4" long hex head bolts, locknuts and flatwashers. (Place a flatwasher under bolt head and nut and mount with nuts on inside of frame).
13. Using a 4 ft. level, ensure mast is set to vertical (plumb) on the base frame.
14. When mast is vertical (plumb), attach support braces, (bolted to base), to the mast support bracket, (bolted to mast), using 3/8"-16UNC x 2-3/4" long hex head bolts, nuts and flatwashers. (Place a flatwasher under bolt head and nut and mount with nuts on inside of bracket).
15. After securing mast to base frame, using 4 ft. level again check that mast is vertical (plumb) on base frame.

16. Continue installing remaining components to mast assembly, (i.e. hydraulic pump/motor/reservoir, battery charger, etc.).

2.10 MAST CHAINS/CABLES AND SEQUENCING CABLES ADJUSTMENT

Mast Chain/Cable Adjustment

The intention of this procedure is to assure equal load distribution between the individual chains/cables of a mast section chain/cable set.

Adjust using the following procedure;

1. With mast retracted, step into the platform and bounce your weight up and down a few times to be certain platform is at the bottom of travel. Be certain all chain/cable sets are seated in their sheaves properly at the top of each mast section.
2. Then with no load in the platform check the side profile of the top of the mast for the amount of adjustment necessary to make the mast sections even for mast sections-3 and up. (See Figure 2-20.)

NOTE: Mast section-1 is fixed to the base and mast section-2 is attached to the lift cylinder, these sections require no adjustment.

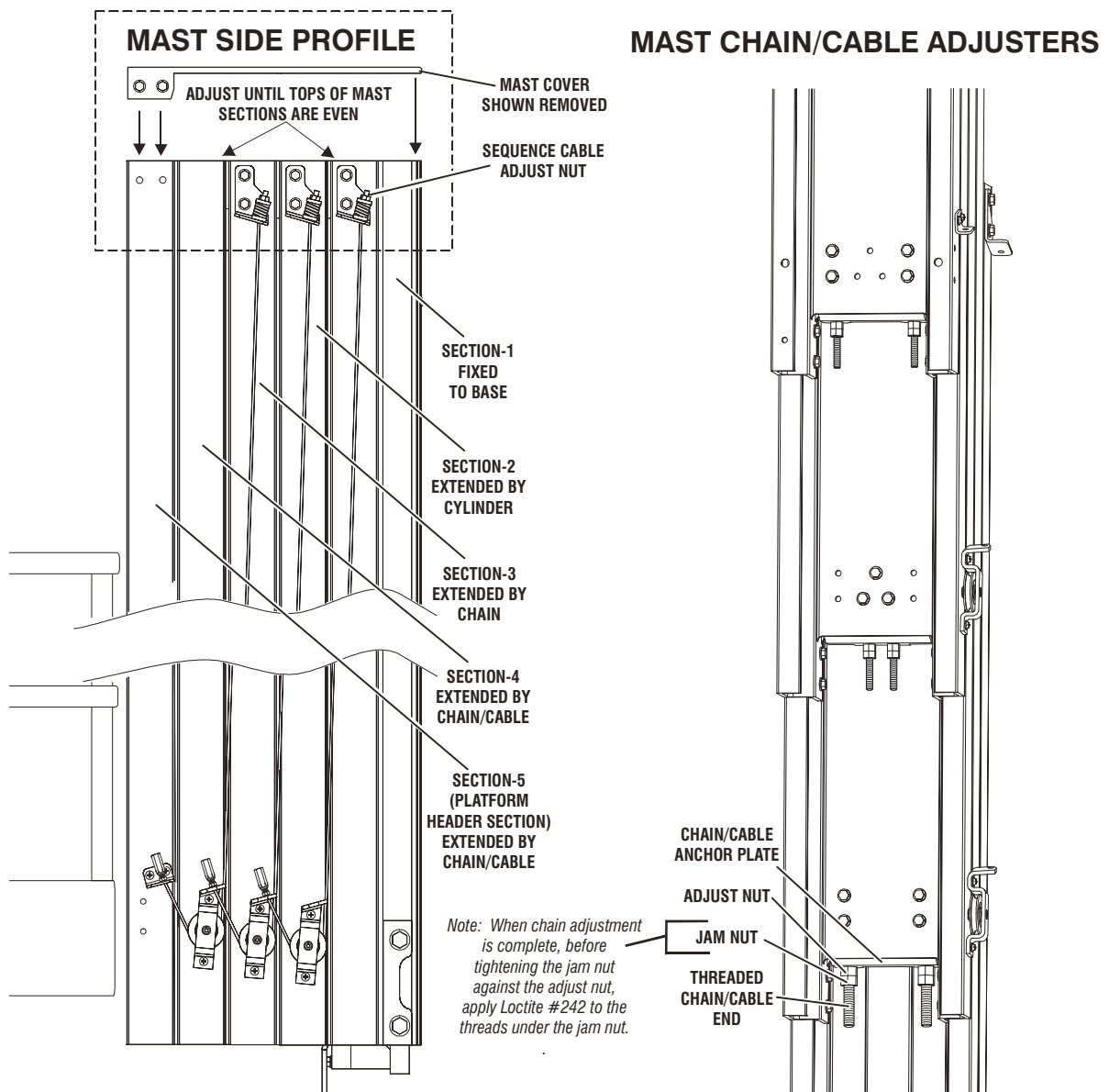


Figure 2-20. Mast Chain/Cable/Sequence Cable Adjustment Components.

SECTION 2 - SERVICE PROCEDURES

3. Adjust one mast section at a time starting from the back (*section-3, section-4, etc.*) of the mast and work forward. (*i.e.. if three is OK, then jump to four, etc.*)
4. Elevate the platform until the chain/cable anchor adjust nuts are accessible at the front and bottom of each mast section (*See Figure 2-20.*).

WARNING

NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING.

5. Start with the mast section which needs adjustment and loosen the bottom (*jam*) nut on each chain/cable.
6. **Tighten** (*to raise mast section*), **or loosen** (*to lower mast section*) **the adjusting nut** against the anchor plate on each chain/cable. Adjust the nut the amount required to raise or lower the top of the mast section so it is even with the previous mast section when the mast is retracted.

NOTE: *It is more important that the (threaded ends) studs protruding on the adjustments are equal side to side on a mast section, than it is that the tension in the chains is equal. The chain equalizers will always assure equal tension, but if the adjustment isn't equal as described, the chains may tend to pull to one side or the other.*
The threaded end of the chain/cable may need to be restrained while tightening the adjust nut to keep the chain/cable from twisting.

7. Retract the mast all the way and check if the top of the mast sections appear as shown in Figure 2-20.
8. Repeat steps (1) through (7) for remaining mast sections.
9. Once mast section adjustment is completed, apply loctite #242 to the threads under the (*jam*) nuts that were loosened. Then re-tighten the loosened (*jam*) nuts until tight against the top (*adjust*) nut. Chain/cable should have slight tension but should not be taut.

Sequencing Cable Adjustment

1. Retract mast completely, and check each sequencing cable on outside of masts for excessive slack. Adjust only to remove slack from cable.
2. Tighten nylock-nut just enough to remove excessive slack from sequencing cable. The springs should not be compressed more than 25% after adjusting.
3. Run mast through several cycles to verify cable/chain adjustments and ensure no interference exists between chain anchor brackets and mast.

2.11 SEQUENCE CABLE REPLACEMENT KIT

A sequence cable replacement kit is available from the JLG Parts Department to service broken or worn sequence cables. This kit consists of a replacement sequence cable with the threaded (top) end attached same as the top end of the factory cable. Also included is a clamp (drum/socket type) to secure the bottom end of the cable. Use the following procedure to install the replacement cable and clamp kit.

Remove Old Cable

1. Remove the locking nut from the threaded end of the cable at the top of the mast and then remove the spring cap, spring, and spacer washers if installed.
2. Slide the threaded top end out of the upper anchor bracket, then at the bottom end pull the cable out through the sheave pulley/anchor bracket until it is completely clear of the machine.

Replacement Cable Installation

1. Be certain the mast is completely retracted and at the bottom of travel. Check the mast "Side Profile" at the top of the mast as shown in Figure 2-20., adjust mast sections to proper height if necessary.
2. To determine where the clamp will be installed at the bottom of the replacement cable, temporarily assemble the new replacement cable to the top cable anchor bracket on the mast using the washers, spring, spring cap and lock nut previously disassembled. Thread the lock nut on until approximately 1/8 in. (3mm) of threads are exposed.
3. At the bottom of the mast, thread the loose end of the replacement cable through the proper sheave pulley and through the hole in the sheave pulley/anchor bracket on the mast section ahead of the sheave pulley.
4. Grasp the cable and pull on the cable until the spring at the top of the cable is slightly compressed. Use a black marker to mark the cable on the top side of the sheave pulley/anchor bracket. This will determine where the clamp (drum/socket) sleeve will be positioned on the cable.

IMPORTANT

DO NOT CUT THE CABLE AT THE MARKED POINT ON THE CABLE THIS IS ONLY USED AS A REFERENCE FOR POSITIONING THE CABLE SLEEVE WHICH WILL REST AGAINST THE ANCHOR BRACKET ONCE INSTALLED.

Clamp Installation (Drum/Socket Type)

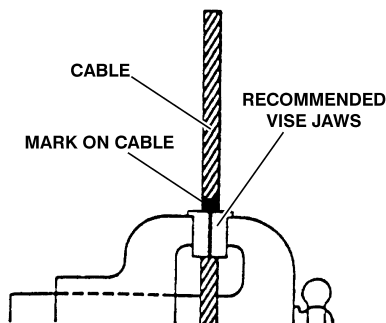
⚠ IMPORTANT

THE MANUFACTURER OF THE DRUM/SOCKET CLAMP RECOMMENDS THE USE OF THEIR CABLE CLAMP ASSEMBLY KIT (JLG P/N - 7023275) TO ASSEMBLE THE CLAMP TO THE WIRE ROPE. THE KIT CONSISTS OF VISE JAWS TO HOLD THE WIRE ROPE IN A VISE PROPERLY WITHOUT DAMAGING ANY ROPE STRANDS AND A PLUG DRIVER TO DRIVE THE PLUG INTO THE CENTER OF THE WIRE ROPE AND IS ALSO USED TO FORM THE STRANDS OF THE ROPE DURING ASSEMBLY.

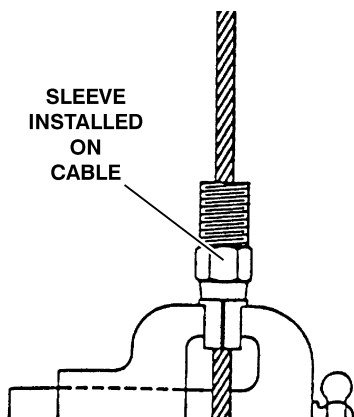
NOTE: The tools in the clamp assembly kit may be fabricated if necessary. The vise clamp consists of vise jaws with a hole drilled $\frac{1}{32}$ in. smaller than the diameter of the wire rope you are working with (i.e. $\frac{1}{8}$ in. rope - $\frac{3}{32}$ in. hole.)

The plug driver is a metal tube with a hole in the bottom to allow the strands of the wire rope to be shaped after the plug has been tapped into the center of the wire rope.

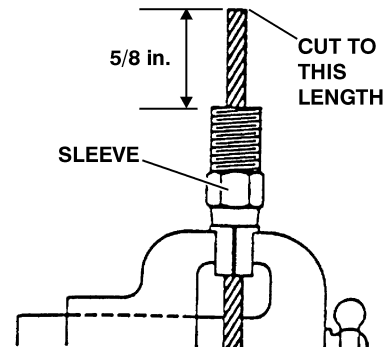
1. Using the recommended vise jaws, clamp the wire rope into a vise with the bottom edge of the black mark made on the wire rope resting just above the vise jaws.



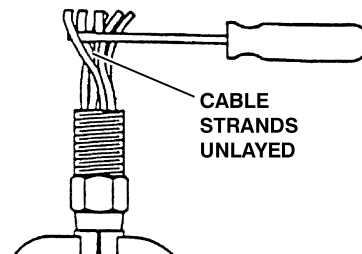
2. Twist the sleeve from the clamp kit onto the rope until it is flat against the vise jaws at the mark made on the wire rope.



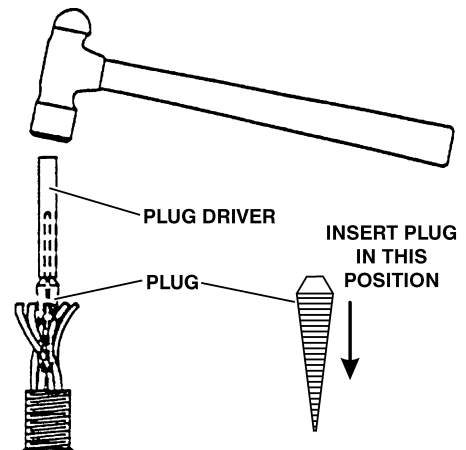
3. Use a suitable tool and cut the cable as shown in the illustration following. For $\frac{1}{8}$ in. cable the recommended length is $\frac{5}{8}$ in. past the end of the sleeve.



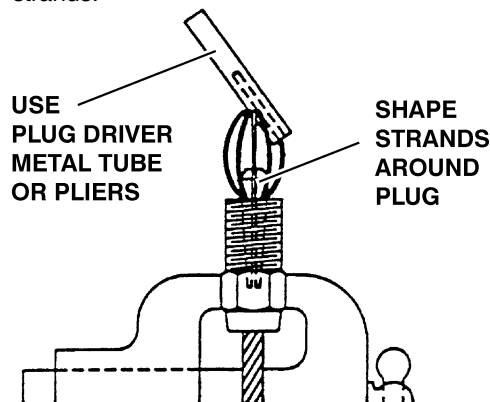
4. Unlay the cable strands by gently forcing a screwdriver between the outer strands to unlay the cable. When done properly the outer strands will form a symmetrical basket. Do not straighten out the spiral lay of the strands, unlay any wires that make up the strand, or allow the strands to cross each other inside the sleeve.



5. Install the plug supplied with the kit by placing the plug in the center of the strands starting with the small tapered end of the plug. Use a metal tube (plug driver) and hammer to drive the plug into the sleeve while assuring that the strands are spaced somewhat equally around the plug. Drive the plug until it is firmly seated and no more than $\frac{1}{3}$ of the plug is visible from above the sleeve.

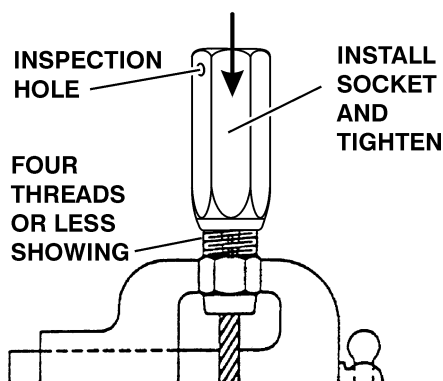


6. Reclamp the assembly in the vise on the flats of the sleeve. Using the plug driver, a metal tube or pliers, bend the outer strands toward the center strands enough that the socket can be slipped over all the strands.



NOTE: When assembling stainless steel parts all threads must be coated with a dry lubricant or an anti-seize lubricant to prevent seizing.

7. Coat the threads of the socket and sleeve with lubricant and install the socket by twisting it over the strands of the cable and engage the threads of the sleeve with the socket. Tighten until four threads or fewer are visible. If more than four threads are visible, proof load the cable and retighten the socket fitting. (There is no specific requirement for torque.)



8. Inspect for proper assembly prior to loading the cable. Strands visible through the inspection hole are your assurance of a proper assembly.

NOTE: The end of the rope may not be visible in the inspection hole after loading.

9. Install cable on machine and adjust per instructions shown previously in Section 2.10, MAST CHAINS/ CABLES AND SEQUENCING CABLES ADJUSTMENT.

2.12 PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE

(See Table 2-2.)

The preventive maintenance and inspection checks are listed and defined in the following table (See Table 2-2., this chapter). This table is divided into two basic parts, the "AREA" to be inspected and the "INTERVAL" at which the inspection is to take place. Under the "AREA" portion of the table, the various systems along with the components that make up that system are listed. The "INTERVAL" portion of the table is divided into five columns representing the various inspection time periods. The numbers listed within the interval column represent the applicable inspection code for which that component is to be checked.

The checks and services listed in this schedule are not intended to replace any local or regional regulations that may pertain to this type of equipment nor should the lists be considered as all inclusive. Variances in interval times may occur due to climate and/or conditions and depending on the location and use of the machine.

JLG Industries requires that a complete annual inspection be performed in accordance with the "Annual Machine Inspection Report" form. Forms are supplied with each new machine and are also available from JLG Customer Service. Form must be completed and returned to JLG Industries.

⚠ IMPORTANT

JLG INDUSTRIES REQUIRES THAT A COMPLETE ANNUAL INSPECTION BE PERFORMED IN ACCORDANCE WITH THE "ANNUAL MACHINE INSPECTION REPORT" FORM.

Table 2-3. Preventive Maintenance & Inspection Schedule.

AREA ON MACHINE	INTERVAL					
PLATFORM	(10 HRS.) DAILY	(50 HRS.) WEEKLY	(200 HRS.) MONTHLY	(500 HRS.) 3 MONTHS	(1000 HRS.) 6 MONTHS	(2000 HRS.) 1 YEAR
Platform Controller (all functions)	1,11					
Placards and Decals	1,2					
Control Tags	1,2					
Electrical Cables	1,8					
Handrail and Bar Gate	1,4					
MAST						
Mast Chains and all component parts	1,4,7,9			12		
Mast Sections	1,4,7					
Mast Sequencing Cables	1,4,7,9					
Speed/PHP Limit Switches	1,7,9					
BASE FRAME						
Batteries	1,3	5				
Battery Charge	1					
Power Cables To Platform	1,8					
Electric Motor/Hydraulic Pump Unit	1	5				
Hydraulic Hoses and Fittings	1	5				
Hydraulic Oil Reservoir *	3	5	4			
Hydraulic Oil Reservoir Breather		6,14				
Manual Descent Valve	1,7					
Lift Cylinder	1	5,6,13	4			
Placards and Decals	1,2					
Wheels and Casters	1	8,9		12		
Wheel Bearings			8	12		
Electric Drive Wheel Motors	1,7					
Electric Drive Wheel Gear Box **						
Torque Limiting Clutch				1,6,9		
Power Switch (Ground Control Box)	1,11					
Control Tags	1,2					
Hoses and Cables	1,8					
Bubble Level Indicator	1,2					

* Inspection and Maintenance Code 10 to be performed every two years.

** Maintenance Code 10 to be performed only when serviced, requires 171 cc's to fill.

Inspection and Maintenance Codes:

- | | |
|--|---|
| 1. Check for proper and secure installation. | 8. Check for excessive wear or damage. |
| 2. Check for visible damage and legibility. | 9. Check for proper tightness and adjustment. |
| 3. Check for proper fluid level. | 10. Drain, clean and refill. |
| 4. Check for any structural damage; cracked or broken welds; bent/warped surfaces; broken cable strands. | 11. Check for proper operation while pump/motor is running. |
| 5. Check for leakage. | 12. Check for proper lubrication. |
| 6. Check for presence of excessive dirt or foreign material. | 13. Check for evidence of scratches, nicks or rust and for straightness of rod. |
| 7. Check for proper operation and freedom of movement. | 14. Check for condition of element; replace as necessary. |

This page intentionally left blank.

SECTION 3. TROUBLESHOOTING

3.1 GENERAL

This section contains troubleshooting information to be used for locating and correcting most operating problems on a VP Series Personnel Lift. If a problem should develop which is not presented in this section or which is not corrected by listed corrective actions, technically qualified guidance should be obtained before proceeding with any maintenance.

3.2 TROUBLESHOOTING INFORMATION

Troubleshooting procedures applicable to the VP machine are listed and defined starting with Section 3.5, TROUBLESHOOTING SECTION - TABLE OF CONTENTS in this chapter of the manual.

Each malfunction within an individual group or system is followed by a listing of probable causes which will enable determination of the applicable remedial action. The probable causes and the remedial action should, where possible, be checked in the order listed in the tables.

It should be noted that there is no substitute for a thorough knowledge of the equipment and related systems.

It should be recognized that the majority of the problems arising in the machine will be centered in the hydraulic and electrical systems. For this reason, every effort has been made to ensure that all likely problems in these areas are given the fullest possible treatment. In the remaining machine groups, only those problems which are symptomatic of greater problems which have more than one probable cause and remedy are included. This means that problems for which the probable cause and remedy may be immediately obvious are not listed in this section.

The first rule for troubleshooting any circuit that is hydraulically operated and electrically controlled is to determine if the circuit is lacking hydraulic oil and electrical control power. This can be ascertained by overriding the bypass valve (mechanically or electrically) so that oil is available to the function valve, then overriding the function valve mechanically. If the function performs satisfactorily, the problem exists with the control circuit.

3.3 HYDRAULIC CIRCUIT CHECKS

(See Figure 3-4.)

The first reference for improper function of a hydraulic system, where the cause is not immediately apparent, should be the Hydraulic Diagram Circuit. The best place to begin the problem analysis is at the power source (pump). Once it is determined that the pump is serviceable, then a systematic check of the circuit components, would follow.

NOTE: For aid in troubleshooting, refer to Figure 3-4. for HYDRAULIC DIAGRAM circuit.

3.4 ELECTRICAL CIRCUIT CHECKS

General

The drive system on the VP series machine requires a microprocessor controlled electrical circuit to operate smoothly and accurately. All platform control functions are relayed to various machine components (i.e. platform up/down, drive functions, etc.) through the (MC-1) microprocessor box (mounted under the battery charger support bracket).

To help diagnose any problems with the components associated with the microprocessor, the MC-1 is designed with an internal fault messaging system which is displayed by LED flash sequences on the platform controller. When operating normally the LED panel on the platform controller (center LED strip) indicates the battery voltage status using ten (10) green LEDs. If a malfunction occurs to any of the drive components, the platform controller, or the MC-1 unit itself, these LEDs will flash a fault code (Warning or Error type) to help locate the problem area. The possible causes of fault codes are outlined in the following sub-sections of this chapter, see Table 3-1 and Table 3-2.

NOTE: For aid in troubleshooting electrical problem, refer to Figure 3-3. for an ELECTRICAL DIAGRAM of the various circuits. Also a pictorial overview of the Section, see Figure 3-2. "Pictorial Overview of VP Electrical System".

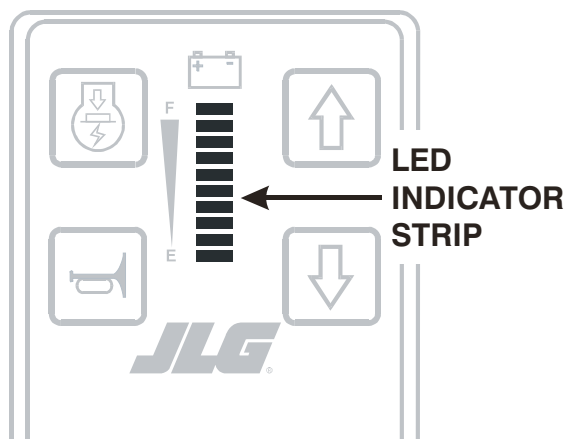


Figure 3-1. LED Battery/Fault Code Indicator Strip on Platform Controller Box.

LED Indicator Strip

When the machine is powered up, all function inputs should be open. If any function is active on power up, all functions will be made inoperative and a fault will be indicated at the platform controller box LED strip.

This strip has ten (10) green LEDs and is located on the platform controller box between the function touch pad buttons. See Figure 3-1.

Fault Code Reference Tables

There are two types of fault codes which can occur to indicate a problem with the machine, these are WARNING codes and ERROR codes.

The fault codes can occur either at machine power up or during operation of the machine.

WARNING Codes

(See Table 3-1.)

The WARNING will be indicated for 4 seconds and will be repeated every minute if the problem is not corrected. An audible three beeps indication is given at the beginning of each warning displayed. WHEN A WARNING CODE IS INDICATED THE MACHINE WILL USUALLY FUNCTION, however some machine functions may be disabled. See Table 3-1. for explanation of WARNING codes.

ERROR Codes

(See Table 3-2.)

An ERROR is indicated by an audible beep and continuously fast flashing LED bar. The number of fast (rapidly) flashing LEDs indicate the particular error message. AN ERROR CONDITION WILL DISABLE THE MACHINE until the problem is corrected. The ERROR message is only reset by turning off the system, however if the problem has not been corrected the ERROR will be indicated again at machine power-up. See Table 3-2. for explanation of ERROR codes.

NOTE: As shown in the following WARNING and ERROR code tables, a specific number of LEDs flashing can indicate more than one WARNING or ERROR code. These tables suggest specific areas to check as the probable cause for the fault code which has occurred. The fault code number is shown in the first column of the table and the number of LEDs flashing on the platform controller LED strip is shown in the second column of the table.

Table 3-1. MC-1 WARNING CODES
(Indicated by 3 beeps, then slow flashing LED's)

WARNING CODE	LED'S FLASHING	PROBABLE CAUSE	REMEDY
0	10	Enter Code - Security Code has been activated and must be entered before operation	Enter Code or deactivate using MC-1 configuration software.
1	8	Charger Connected	Unplug Charger
3	2	Brake Status Switch Open - Parking brake manually released	Reset Parking Brake
3	2	Brake manual release lever obstructed (located at drive motor brake)	Clear obstruction and reset lever
3	2	Defective parking brake status switch (located at drive motor brake)	Replace Switch
3	2	Defective pin 11 at X105 (BRN wire) connection or improper wiring	Properly attach wires or pin
3	2	Improper wiring at parking brake status switch	Properly attach wires
3	2	Improper wiring from parking brake status switch to ground	Properly attach wires
4	5	Configuration Lost - Drive Characteristic has changed	Reprogram using MC-1 software
5	6	Current Measurement faulty - Drive characteristic may have changed	Cycle on-off and reprogram if necessary
6	7	High Temperature in controller	Reduce power
7	7	Motor Stalled	Check drive wheels and motors
9	1	Battery Low (< 18v) and power reduced	Charge Batteries
12	9	Speed Control Potentiometer defective	Replace Joystick
13	4	Drive Cutout Input Open - PHP bar must be down to drive while elevated	Lower PHP
13	4	PHP bar is down, but drive is disabled - Defective wiring at D-connector	Properly attach wire (RED/BLU) or pin 12 of X105 connector
13	4	PHP bar is down, but drive is disabled - Defective ground wiring	Properly attach wires
14	3	PHP bar is down, but drive is disabled - Defective switch	Replace switch
14	3	Tilt Switch open - Slope greater than 2 degrees	Lower Platform and move to level ground
14	3	No Tilt Switch - open circuit at Pin 2 of X101 (WHT wire)	Properly attach pin or wire connections
14	3	No Tilt Switch - open circuit to ground	Check ground wire connections (BLK1 wire)
25	----	Joystick E. Stop Counter	Controller Log Only
26	----	Configuration Access Counter	Controller Log Only

SECTION 3 - TROUBLESHOOTING

Table 3-2. MC-1 ERROR CODES
(Indicated by rapid LED flashing and periodic beep)

ERROR CODE	LED'S FLASHING	PROBABLE CAUSE	REMEDY
0	8	System Overvoltage - Charger	Unplug Charger
0	8	System Overvoltage - Driving down long steep grade	Operate ground controls to reduce voltage
1	7	Controller Overtemperature	Turn unit off and allow to cool
2	8	Drive Motor Plug - Open Circuit - check connectors X103 & X104	Properly attach wires or pins A1 & A2
2	8	Drive Motor Plug - Open Circuit - check motor connections at motor	Properly attach wires or pins (WHT & BLK wires)
3	6	Brake Safety Relay	Replace Controller
4	2	Brake Short Circuit	Replace Brake
5	2	Brake Left Open Circuit - D-connectors to X103 & X104 switched	Switch D-connectors - Left Motor to X103; Right Motor to X104
5	2	Brake Left Open Circuit - Check pins 3 & 5 of X103 and brake wires	Properly attach wires or pins
5	2	Brake Left Open Circuit - Check brake wires or plug at drive motor	Properly attach wires or pins
6	2	Brake Right Open Circuit - Check pins 2 & 5 of X104 and brake wires	Properly attach wires or pins
6	2	Brake Right Open Circuit - Check brake wires or plug at drive motor	Properly attach wires or pins
7	2	Brake Open Circuit on one or both brakes	See above
8	9	Switch Short Circuit (Joystick)	Replace Joystick Box
9	6	Power Circuit Defect	Replace Controller
10	1	Battery Low (< 16.5 v)	Charge Battery
11	9	Check pins & wire connections at X102 & joystick box connector	Properly attach wires or pins
11	9	Joystick defective	Replace Joystick Box
12	8	Check pins & wire connections at X102 & joystick box connector	Properly attach wires or pins
12	8	Joystick Box	Replace Joystick Box
16	7	Current Limiting - Motor Short Circuit - Gearmotor defective	Replace Gearmotor
21	6	36v supply	Replace controller
24	5	Configuration Lost	Reprogram using MC-1 software, if error reoccurs then replace controller
25	6	RAM ROM	Replace controller

Table 3-2. MC-1 ERROR CODES
(Indicated by rapid LED flashing and periodic beep)

ERROR CODE	LED'S FLASHING	PROBABLE CAUSE	REMEDY
26	6	If voltage @ pin 5 (RED2) of X101 is 20v w/24v @ Battery or if ground controls and operating lift up clears error:	
		Defective main contactor	Replace main contactor
		Battery cables loose or corroded	Clean & tighten battery cables
26	6	If 0v @ pin 5 of X101, check connection @ pin 7 & 14 of X102	Properly attach wires or pins
26	6	Connection @ pin 5 of X101 bad	Properly attach wires or pins
26	6	Defective Power Relay	Replace Relay
26	6	Defective Power Relay ground wire	Properly attach wire
27	6	Safety Circuit - Joystick - check pin 6 @ X102 (Red Wire)	Properly attach wire or pin
27	6	Safety Circuit - Joystick - check pin 3 @ joystick connector (Red Wire)	Properly attach wire or pin
27	6	Defective Joystick - Normal voltage @ pin 6 of X102 (Red Wire): Joystick centered 5v, Joystick not centered 0v	Replace Joystick
27	6	Safety Circuit - Defective Controller	Replace Controller
28	6	Current Measurement	Replace Controller
29	6	Drive Circuit Left - Defective Controller	Replace Controller
31	6	Drive Circuit Right - Defective Controller	Replace Controller
32	1	Output driver defect - check for short in Hourmeter, Horn, Alarm or Power Relay	Replace defective component
32	1	Output Driver Defective - Defective Controller	Replace Controller
35	8	Communication Error - Check Pins 5 & 13 of X102 (Orange & Blue Wires)	Properly attach wires or pins
35	8	Communication Error - Check Pins 4 & 5 at Joystick (Orange & Blue Wires)	Properly attach wires or pins
35	8	Defective Joystick	Replace Joystick
35	8	Defective Controller	Replace Controller
36	6	Watch Dog	Replace Controller
38	6	EEPROM	Replace Controller
39	6	Software Error	Replace Controller

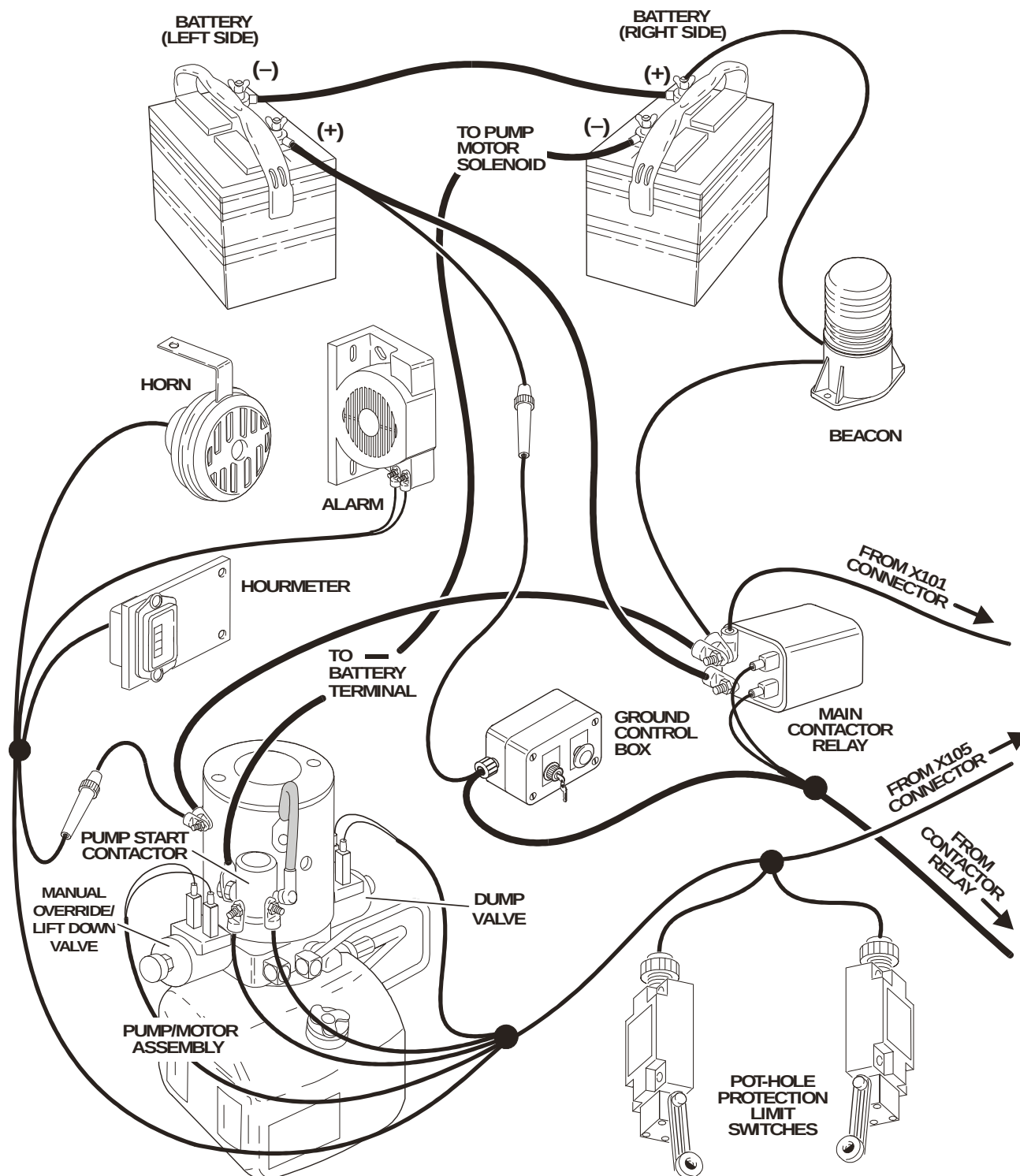


Figure 3-2. Overview of Standard Electrical System. (Sheet 1 of 2)

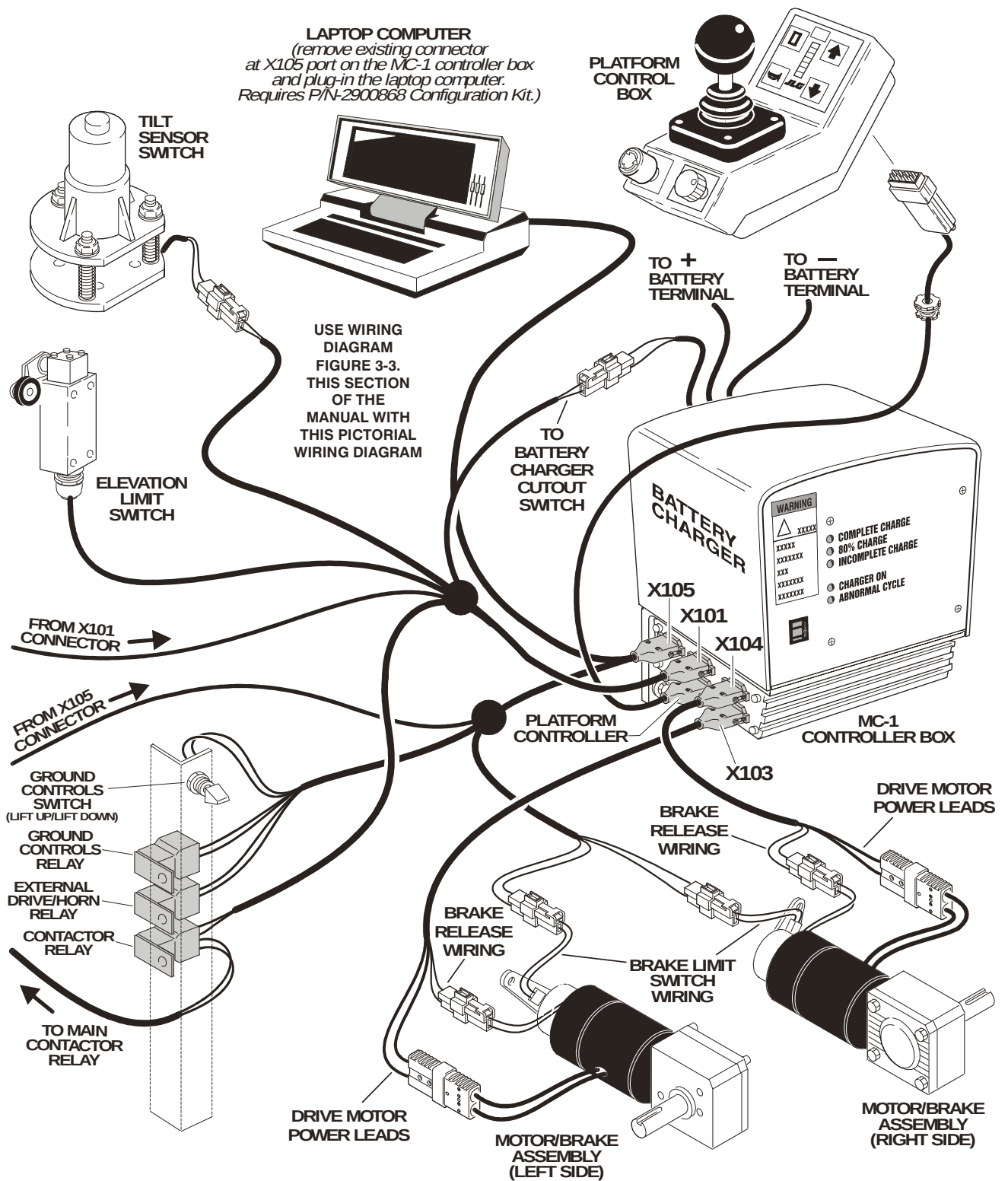


Figure 3-2. Overview of Standard Electrical System. (Sheet 2 of 2)

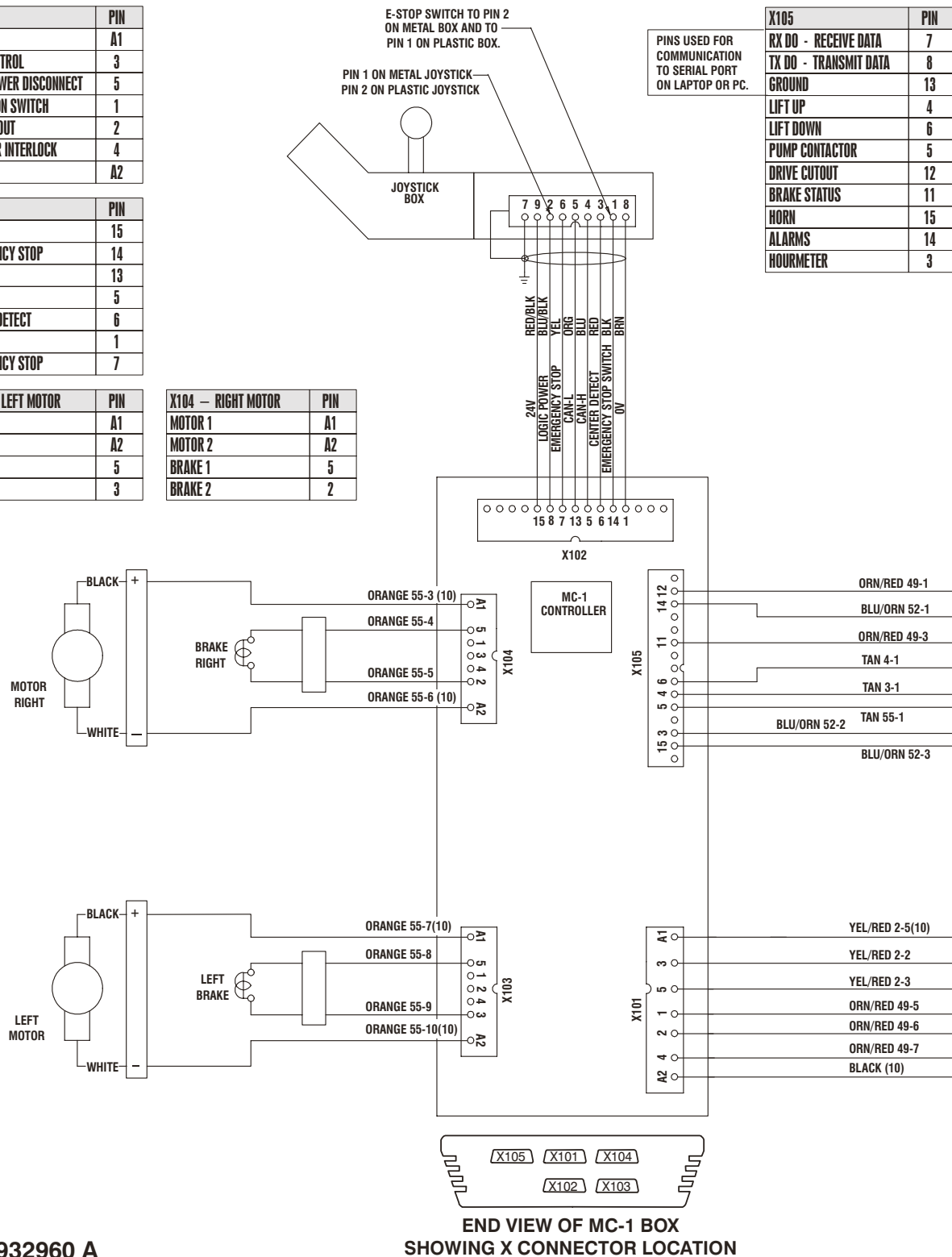
SECTION 3 - TROUBLESHOOTING

X101	PIN
B+	A1
B+ CONTROL	3
MAIN POWER DISCONNECT	5
ELEVATION SWITCH	1
TILT CUTOUT	2
CHARGER INTERLOCK	4
B-	A2

X102	PIN
B+	15
EMERGENCY STOP	14
CAN-LO	13
CAN-HI	5
CENTER DETECT	6
B-	1
EMERGENCY STOP	7

X103 - LEFT MOTOR	PIN
MOTOR 1	A1
MOTOR 2	A2
BRAKE 1	5
BRAKE2	3

X104 - RIGHT MOTOR	PIN
MOTOR 1	A1
MOTOR 2	A2
BRAKE 1	5
BRAKE 2	2



4932960 A

Figure 3-3. VP Electrical Diagram. (VP Series - Standard)

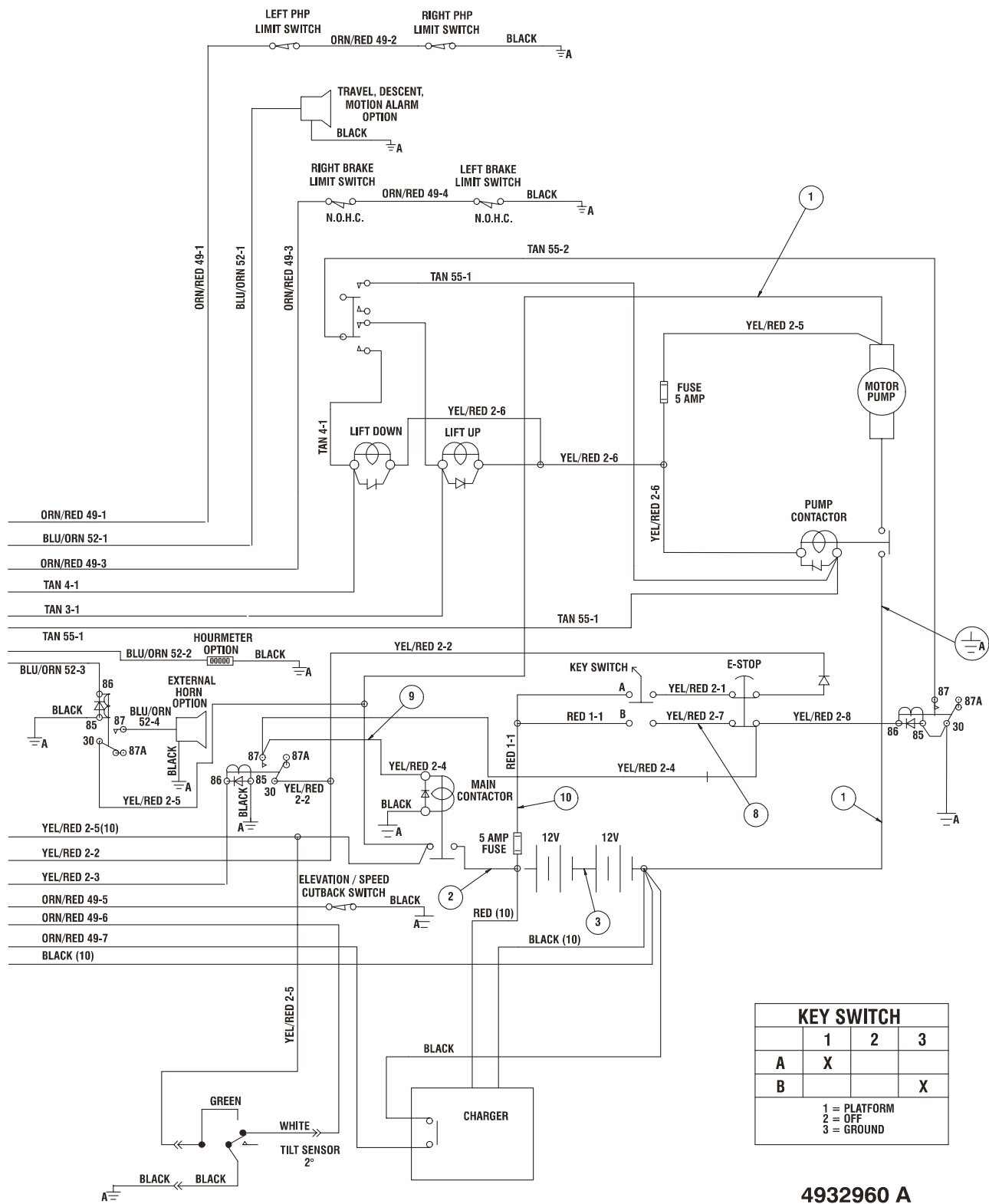
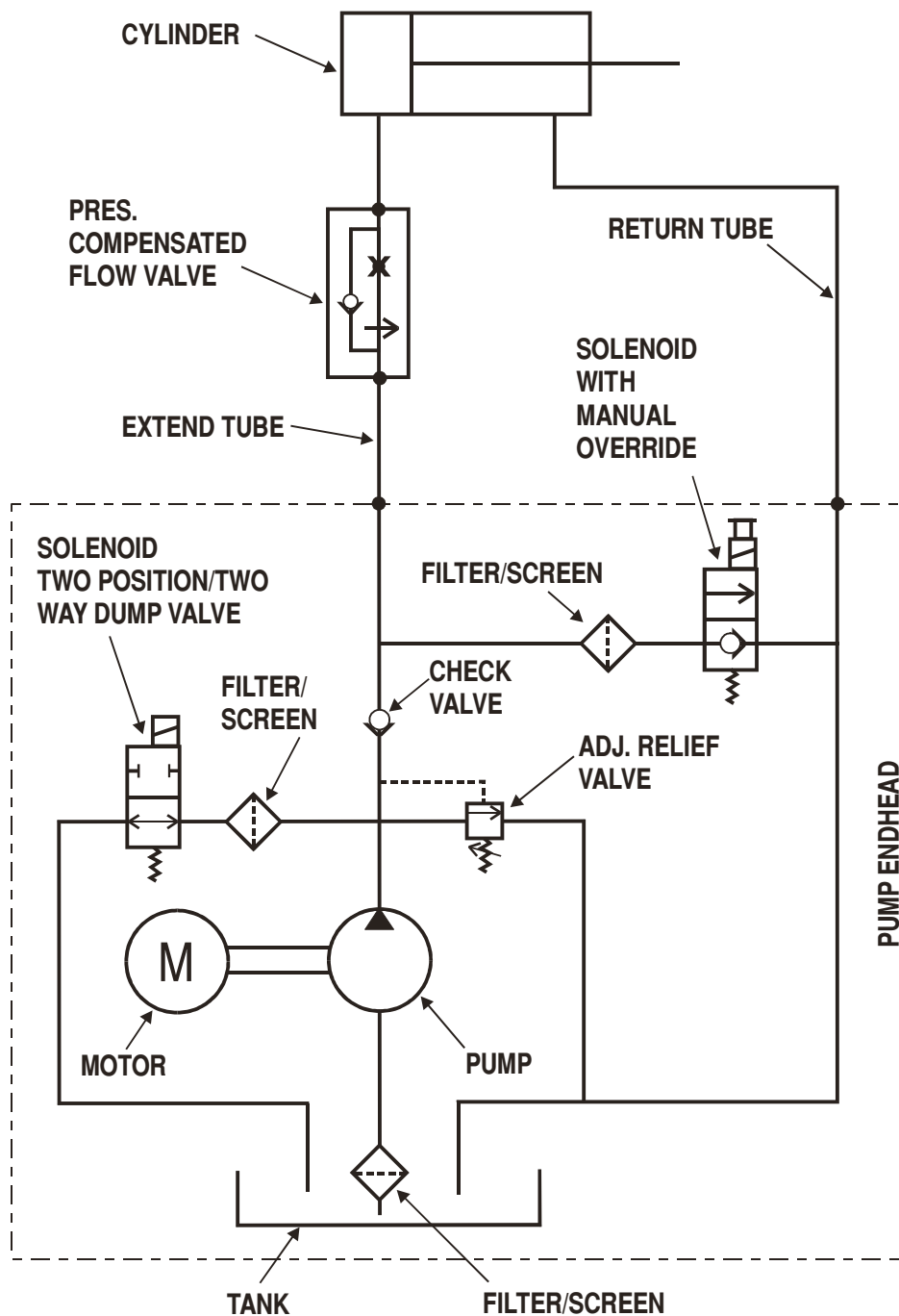


Figure 3-3. VP Electrical Diagram. (VP Series - Standard)



1282953

Figure 3-4. Hydraulic Diagram. (VP Series)

3.5 TROUBLESHOOTING SECTION - TABLE OF CONTENTS

OHM RATINGS FOR VARIOUS COMPONENTS	PAGE
---	-------------

Ohm Ratings for Various Components	3-12
--	------

MAIN POWER CIRCUIT TROUBLESHOOTING

Unit Will Not Power Up From Ground Control	3-13
No Power At Platform Control	3-14

DRIVE TRAIN TROUBLESHOOTING

Won't Drive (Platform Lowered Or Elevated)	3-16
Won't Drive (Platform Elevated Only)	3-18
Won't Climb Grade	3-20
Drives In Opposite Direction	3-21
Will Only Drive A Short Distance	3-22
Won't Drive Straight	3-24
Noise From Drive Assembly	3-25

MAST TROUBLESHOOTING

Platform Will Not Lift Up Using Platform Control	3-26
Platform Will Not Lower Using Platform Control	3-29
Platform Will Not Lift Up From Ground Control Toggle Switch	3-30
Platform Will Not Lower From Ground Control Toggle Switch	3-31
Platform Will Not Lower Manually	3-32
Platform Lift Up And Down Jerky	3-33
Mast Noisy When Lifting And Lowering	3-34
Platform (Mast) Won't Stay Elevated	3-35
Platform (Mast) Descends Too Slowly	3-36

HYDRAULIC LEAK TROUBLESHOOTING

Miscellaneous Hydraulic Leak Troubleshooting	3-37
--	------

BASE FRAME COMPONENTS TROUBLESHOOTING

Caster Wheels Not Operating Freely	3-38
Pot Hole Protection (PHP) Bars Will Not Set	3-38

3.6 OHM RATINGS FOR VARIOUS COMPONENTS

The following table contains ohm ratings for various VP Series machine components.

Table 3-3. Ohm Ratings for Various Components

COMPONENT	NOMINAL RESISTANCE @ TEMPERATURE	RESISTANCE RANGE POSSIBLE
Main Contactor	46.8ohm - 57.2ohm @ 68deg F	35.7ohm - 67.3ohm
Pump Motor	0.2ohm - 0.4ohm @ 77deg F	0.12ohm - 0.49ohm
Pump Relay	16.0ohm - 17.6ohm @ 77deg F	9.9ohm - 21.8ohm
Brake Coil	44.7ohm - 52ohm @ 68deg F	31.4ohm - 65.3ohm
Drive Motor (Bodine)	.1 to .3ohm (Can change depending on the rotation of the armature and temperature.)	N/A

3.7 MAIN POWER CIRCUIT TROUBLESHOOTING

Unit Will Not Power Up From Ground Control

Overview Of Procedure

The following procedure tests the circuits from the Battery (+) terminal through the Ground Control Box and to the Main Contactor Relay and Main Contactor for 24 volts or more. Also the Lift Up/Down Relay circuit is tested.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Battery connections clean and tight.
- Key switch positioned to Ground (GRND) control.
- Emergency stop switch pulled out. (Reset Position)

Table 3-4. Unit will not Power Up From Ground Control.

STEP	ACTION	SPEC	YES	NO
1.	Check the 5 amp inline fuse on the Red 1-1 wire from the battery (+) terminal to the ground control box, key switch. (Under pump/motor cover).	24 volts	OK, go to Step 2	Replace Fuse
Ground Control Box Assembly (Disassembled)				
2.	Is there 24 volts or more reading at the key switch, terminal B.	24 volts	Go to Step 3	Check Wiring from Battery to Terminal B. Repair or Replace
3.	Check for 24 volts or more on the Yel/Red, 2-7 wire from the key switch to the E-stop switch.	24 volts	Go to Step 4	Repair wiring or Replace Key Switch
4.	Check for 24 volts or more on the Yel/Red, 2-8 wire from the E-stop to the Ground Control Relay, terminal 86.	—	Go to Step 5	Repair wiring or Replace E-Stop Switch
5.	Check for 24 volts or more on the Yel/Red, 2-4 wire from the E-stop to the Main Contactor Relay, terminal 87.	—	Go to Step 6	Repair wiring or Replace E-Stop Switch
Main Contactor Circuit				
6.	Check for 24 volts or more on the Yel/Red, 2-4 wire from the Main Contactor Relay, terminal 87 to the Main Contactor.	—	Go to Step 7	Repair wiring or Replace Main Contactor Relay
7.	Did Main Contactor close?	—	Go to Step 9	Go to Step 8
8.	Is the Black ground wire connection from the Main Contactor to ground OK?	—	Replace Main Contactor	Repair Ground Wiring
9.	At this point, 24 volts should be present at the following terminal points; • Terminal 86 on the Ground Control Relay. • Main Contactor, Yel/Red, 2-4 wire.	—	—	—
10.	With Main Contactor engaged, 24 volts or more should be present at the following terminal points; • Pump Motor - 21' cable #1. • Yel/Red, 2-6 wire on the Pump Contactor. • Yel/Red, 2-6 wires on the Lift Up/Down Relay.	—	—	—

SECTION 3 - TROUBLESHOOTING

No Power At Platform Control

Overview Of Procedure

The following procedure checks voltage and ground starting from the power source (batteries) through the ground control station (key switch/E-stop) to the MC-1 box and finally to the platform control.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Keyswitch is turned to PLAT. (Platform)
- Both Emergency Stop Switches Reset (Ground/Platform). (Out)
- Connection of X102 Cable from MC-1 box to Platform Control, secure on both ends.

Table 3-5. No Power At Platform Control.

STEP	ACTION	SPEC	YES	NO
1.	Check if the inline 5 amp fuse is blown on the Red, 1-1 wire at the ground control station. (Ground control cover must be removed)	—	If OK, go to Step 2	Replace Fuse
2.	Check voltage to the Yel/Red, 2-2 wire at the MC-1 box, X101 connector, pin 3.	24 volts	Go to Step 3	Perform the E-Stop/Key Switch Circuit Check (Table 3-17)
3.	Check for Ground to the Black wire at the MC-1 box, X101 connector, pin A2.	Ground	Go to Step 4	Check connection/wiring between Battery and X101, Pin A2
4.	Check voltage to the Yel/Red, 2-3 wire at the MC-1 box, X101 connector, pin 5.	24 volts	Go to Step 5	Replace MC-1 Control Box
5.	Check voltage to the Yel/Red, 2-5 wire at the MC-1 box, X101 connector, pin A1.	24 volts	Go to Step 13	Go to Step 6
6.	Check voltage to the Yel/Red, 2-2 wire at the MC-1 box, X101 connector, pin 3, from the Power Relay pin 30.	24 volts	Go to Step 7	Check the wire between the Power Relay and Connection
7.	Check voltage to the Power Relay, pin 87.	24 volts	Go to Step 9	Go to Step 8
8.	Check for Ground to the Power Relay on the Black wire pin 85, to Ground.	Ground	Replace Relay	Check wiring to Ground Connection
9.	Check voltage to the Yel/Red, 2-4 wire at the Main Contactor from the Power Relay, pin 87.	24 volts	Go to Step 10	Check the Yel/Red, 2-4 Wiring
10.	Check for Ground, on the Black wire to the Main Contactor.	Ground	Go to Step 11	Check wiring to Ground Connection
11.	Check voltage at the Battery Cable from Battery to Main Contactor.	24 volts	Go to Step 12	Check Battery Cable
12.	Check voltage to the Yel/Red, 2-5 wire at the Main Contactor.	24 volts	Check Yel/Red 2-5 Wire	Replace Main Contactor

Table 3-5. No Power At Platform Control.

13.	Check voltage on the Red/Blk wire at the MC-1 box, X102 connector, pin 15, to the Platform Control.	24 volts	Go to Step 14	Replace MC-1 Box
14.	Check for Ground on the BRN wire at the MC-1 box, X102 connector, pin 1, to the Platform Control.	Ground	Go to Step 15	Replace MC-1 Box
15.	Check voltage on the Red/Blk wire, pin 9 on the Platform Control box.	24 volts	Go to Step 16	Replace Cable
16.	Check for Ground on the BRN wire, pin 8 on the Platform Control box.	Ground	Replace Platform Control	Replace Cable

3.8 DRIVE TRAIN TROUBLESHOOTING

Won't Drive (Platform Lowered Or Elevated)

IF MACHINE WON'T DRIVE ONLY WHEN PLATFORM IS ELEVATED, SEE SECTION 4.4

Overview Of Procedure

The following procedures check the components and circuits that feed data to the MC-1 Controller box assuring it is receiving the proper signals and conditions before engaging the machines' drive motors.

Check For These Obvious Conditions First:

- Joystick Powered On
- Unit will Lift & Lower Platform
- Machine is not Tilted - (3 LEDs flashing at joystick control)
- PHP Device is not Obstructed - (4 LEDs flashing at joystick control)
- Brakes are not Released - (2 LEDs flashing at joystick control)
- Charger is not Plugged In - (8 LEDs flashing at joystick control)

Table 3-6. Won't Drive. (Platform Lowered or Elevated)

STEP	ACTION	SPEC	YES	NO
1.	Check for ground from elevation limit switch in the X101 connector, pin 1 (49-5) at MC-1 box.	—	Go to Step 2	Check Elevation Limit Switch Circuit (Table 3-7)
2.	Check for ground from charger circuit wire in the X101 connector, pin 4 (49-7) at MC-1 box. (Perform this check with the charger unplugged)	—	Faulty Charger	Go to Step 3
3.	Check for ground from brake limit switches in the X105 connector, pin 11 at MC-1 box.	—	Go to Step 4	Check Brake Limit Switch Circuit (Table 3-8)
4.	Check that brakes are releasing, (2 LEDs) when joystick is enabled & moved forward.	—	Check Drive Motor Circuit (Table 3-9)	Check Brake Switch/Circuit (Table 3-10)

Table 3-7. Elevation Switch Circuit Check

• Perform these checks at the elevation switch which is located inside the top of mast section-1. • Check with mast lowered.				
STEP	ACTION	SPEC	YES	NO
1.	Check for ground into the switch from ground connection.	—	Go to Step 2	Repair Connection
2.	Check for ground out of switch to the 49-5 wire.	—	Go to Step 3	Adjust/Replace Switch
3.	Check for ground from switch to X101, Pin 1.	—	—	Repair Wire or Connection

Table 3-8. Brake Limit Switch Circuit Check

STEP	ACTION	SPEC	YES	NO
1.	Check for ground into the switch from the ground connection on the left brake limit switch.	—	Go to Step 2	Repair Connection
2.	Check for ground on the 49-4 wire coming out of left brake limit switch.	—	Go to Step 3	Adjust/Replace Switch
3.	Check for ground on the 49-4 wire going into the right brake limit switch.	—	Go to Step 4	Repair/Replace 49-4 wire
4.	Check for ground on the 49-3 side of the right brake limit switch.	—	Replace MC-1 box	Repair wire or Connection

Table 3-9. Drive Motor/Circuit Check

• Perform these checks with the joystick enabled and pushed to the full forward position.				
STEP	ACTION	SPEC	YES	NO
1.	Check for 24 volts at the drive motor on the 55-3 wire on the right motor and the 55-7 wire on the left drive motor. (Positive Side)	24 volts	Problem with Motor	Go the Step 2
2.	Check for 24 volts at the 55-3 wire at the X104 connector, pin A2 (for right motor) and the 55-7 wire at the X103 connector, pin A1 (for left motor).	24 volts	Check wiring and connections	Problem in MC-1 box or Joystick

Table 3-10. Brake Switch/Circuit Check

• Perform these checks with the joystick enabled and pushed to the full forward position.				
STEP	ACTION	SPEC	YES	NO
1.	Check for 24 volts at the wiring connectors on the 55-4 wire on the right drive motor brake unit and the 55-8 wire on the left drive motor brake unit.	24 volts	Clean, Gap or Replace Brake Unit	Go to Step 2
2.	Check for 24 volts at the 55-4 wire at the X104 connector, pin 5 (for right motor) and the 55-8 wire at the X103 connector, pin 5 (for left motor).	24 volts	Check wiring and connections	Problem in MC-1 box or Joystick

SECTION 3 - TROUBLESHOOTING

Won't Drive (Platform Elevated Only)

Overview Of Procedure

The following procedures check the components and circuits that feed data to the MC-1 Controller box assuring it is receiving the proper signals and conditions before engaging the machines' drive motors.

Check For These Obvious Conditions First:

- Joystick Powered On
- Unit will Lift & Lower Platform
- Machine is not Tilted - (3 LEDs flashing at joystick control)
- PHP Device is not Obstructed - (4 LEDs flashing at joystick control)
- Brakes are not Released - (2 LEDs flashing at joystick control)
- Charger is not Plugged In - (8 LEDs flashing at joystick control)

Table 3-11. Won't Drive with Platform Elevated

STEP	ACTION	SPEC	YES	NO
1.	Check for ground on tilt circuit at MC-1 box, X101 connector, pin 2, (O/R, 49-6 wire).	—	Go to Step 2	Check Tilt Sensor Circuit (Table 3-12)
2.	Check for ground on PHP circuit at MC-1 box, X105 connector, pin 12, (O/R, 49-1 wire).	—	Problem in MC-1 controller box	Check PHP Switch Circuit (Table 3-13)

Table 3-12. Tilt Sensor Circuit Check

• No ground at MC-1 box, X101 connector, pin 2, (O/R, 49-6 wire).				
STEP	ACTION	SPEC	YES	NO
1.	Is tilt sensor light on showing a tilt condition, even though machine is within tilt limit.	—	Adjust tilt sensor if necessary	Go to Step 2
2.	Check for ground on the Black wire (direct to ground) running into tilt sensor. (Continuity to B-)	—	Go to Step 3	Repair Connection
3.	Check for 24 volts at the Green to (Y/R, 2-5) wire from the main contactor relay.	—	Go to Step 4	Check Connection to Main Contactor Relay
4.	Check for ground on the White to (O/R, 49-6) wire at connector.	—	Repair connection at the X101 connector end/ broken wire O/R 49-6	Replace Tilt Sensor

Table 3-13. PHP Limit Switch Circuit

• No ground on PHP circuit at MC-1 box, X105 connector, pin 12, (O/R, 49-1 wire). • With PHP bars up.				
STEP	ACTION	SPEC	YES	NO
1.	Check for ground on Black wire (direct to ground) on the right side PHP limit switch. (Continuity to B –)	—	Go to Step 2	Repair Connection
2.	Check for ground on O/R, 49-2 wire to left PHP limit switch.	—	Go to Step 3	Adjust/Replace Right Switch
3.	Check for ground on O/R, 49-1 wire to MC-1 box, X105 connector, pin 12.	—	Repair connection at the X105 connector end	Adjust/Replace Left Switch

SECTION 3 - TROUBLESHOOTING

Won't Climb Grade

Overview Of Procedure

The following procedure checks the drive motor and attached components for component failure, misadjustment due to wear.

Check For These Obvious Conditions First:

- Batteries are Fully Charged (24 Volts)
- Speed Control is Set to Maximum
- Is Grade within the Maximum Allowable Specification of 15% Grade (8.5 degrees)
- Does the Travel Surface allow for Proper Drive Wheel Traction
- Is Platform Load within the Maximum Rated Capacity

Table 3-14. Won't Climb Grade

STEP	ACTION	SPEC	YES	NO
1.	Does machine drive straight on a level surface?	—	Go to Step 2	Refer to Machine Won't Drive Straight (Table 3-18)
2.	Are both the left and right drive motor, slip-clutches, located between the drive motor and the drive wheels, working properly?	—	Go to Step 3	Repair, Replace or Adjust Slip Clutch
3.	Do the left and right drive motor brakes release properly and allow the drive wheels to rotate freely ?	—	Go to Step 4	Dragging? Repair, Replace or Adjust Brakes
4.	Check the amperage output of the on the drive motor leads. They should not exceed 70 amps while pulling a grade.	—	Controller will Shut Drive Down and will flash a 7 LED Code	Go to Step 5
5.	Check the condition of the drive motor brushes.	—	OK, go to Step 6	Worn down, replace brushes or drive motor
6.	If all above is OK, Drive motors are working properly. Consult Factory.	—	—	—

Drives In Opposite Direction

Overview Of Procedure

The following procedure checks that both the drive motor power wire connections correctly installed and are secure and tight. Also that the joystick control assembly for proper installation at the platform control box.

Check For These Obvious Conditions First:

- If the Left Drive Motor (X103) connector is switched with the Right Drive Motor (X104) connector at the MC-1 box, you will immediately get an 2 LED flashing Error Code at the Platform Control when the machine is powered up.
- Check Joystick Calibration (See Procedure in Service Manual, Section-2).

Table 3-15. Drives In Opposite Direction

STEP	ACTION	SPEC	YES	NO
1.	Check the connection of the Orange, 55-3 wire to the right drive motor at both ends; • At the X104 connector on the MC-1 box, pin A1. • And the Black wire at the Drive Motor end.	—	Go to Step 2	* Repair or Replace Connection
2.	Check the connection of the Orange, 55-6 wire to the right drive motor at both ends; • At the X104 connector on the MC-1 box, pin A2. • And the White wire at the Drive Motor end.	—	Go to Step 3	* Repair or Replace Connection
3.	Check the connection of the Orange, 55-7 wire to the left drive motor at both ends; • At the X103 connector on the MC-1 box, pin A1. • And the Black wire at the Drive Motor end.	—	Go to Step 4	* Repair or Replace Connection
4.	Check the connection of the Orange, 55-10 wire to the left drive motor at both ends; • At the X103 connector on the MC-1 box, pin A2. • And the White wire at the Drive Motor end.	—	Go to Step 5	* Repair or Replace Connection
5.	Is platform control box under warranty? **	—	Order New One	Go to Step 6
6.	Internal to the platform control - check that the joystick assembly inside the platform control has not been installed backwards.	—	Re-install Correctly	Go to Step 7
7.	Internal to the platform control - check that the joystick assembly wiring to the platform control circuit card is not wired backwards.	—	Re-install Correctly	Consult Factory

* Note: If the Orange, 55-3 or 55-6 wires to the right drive motor in the X104 connector or the Orange, 55-7 or 55-10 wires to the left drive motor in the X103 connector at the MC-1 controller are crossed up that drive motor will run backwards.

** Note: If platform controller is not under warranty, the internal components of the platform controller are replaceable and can be ordered and replaced separately from the complete platform control box. See procedures in Section-2 of this Service Manual for Joystick Assembly/ Disassembly.

SECTION 3 - TROUBLESHOOTING

Will Only Drive A Short Distance

Overview Of Procedure

The following procedure will eliminate any problems found in the power circuit to the MC-1 controller box and also any objectionable environmental conditions.

Check For These Obvious Conditions First:

- Is Battery Voltage 24 Volts? (Fully Charge Batteries)

Table 3-16. Only Drives A Short Distance

STEP	ACTION	SPEC	YES	NO
1.	Is platform controller staying powered up when machine stops driving?	—	Go to Step 2	Check the E-Stop & Key Switch Circuit (Table 3-17)
2.	Check the voltage out of the X101 connector, pin 5, to the power relay pin 86. Check continuity at pin 85.	24 Volts	Go to Step 3	Repair or Replace Wires, or Problem with MC-1 Box
3.	Check the voltage from pin 87 on the power relay to the main contactor. (Main contactor should be closed at this point)	24 Volts	Go to Step 4	Repair or Replace Wires or Relay
4.	Check the voltage on the Yel/Red, 2-5 wire on the X101 connector, pin A1, from the main contactor.	24 Volts	Go to Step 5	Repair or Replace Wires or Main Contactor
5.	What type of surface is machine being operated on? Is surface soft, unstable or up a steep grade?	—	Machine will not perform well on a soft or unstable surface, if motor draw is over 70 amps, controller will shut the machine down. (7 LED Code)	Go to Step 6
6.	Are brakes releasing when trying to drive?	—	Go to Step 7	Repair/Replace or Adjust Drive Brakes (See Procedure in Service Manual)
7.	Is drive system running free? No noise or dragging.	—	Go to Step 8	Repair/Replace or Adjust Drive System (See Procedure in Service Manual)
8.	Is machine being operated in an environment with high static charge?	—	Machine may be building static charge in the MC-1 controller, which will make the drive system shut down.	—

Table 3-17. E-Stop and Key Switch Circuit Check

• Batteries Fully Charged. (24 Volts) • Ground Control Key Switch set to the Platform or on Ground position and the Emergency Stop Switch Reset to ON.				
STEP	ACTION	SPEC	YES	NO
1.	KEY SET TO PLATFORM: Check voltage on the Yel/Red, 2-2 wire from the emergency stop switch to MC-1 controller box, pin 3 in the X101 connector and pin 30 on the Power Relay.	24 Volts	Circuit is OK	Go to Step 2
2.	KEY SET TO GROUND: Check voltage on the Yel/Red, 2-4 wire coming out of the ground control box assembly to pin 87 on the power relay, and main contactor. Yel/Red 2-8 wire to pin 86 on the ground relay.	24 Volts	Circuit is OK	Go to Step 3
3.	Open the Ground Control Box Assembly (<i>housing with key switch and E-stop switch mounted inside</i>) and check the voltage on the Yel/Red, 2-1 wire leading into the emergency stop switch from the Key switch.	24 Volts	Repair connection to or replace E-Stop switch	Go to Step 3
4.	Check voltage on the Red, 1-1 wire leading into the Key switch.	24 Volts	Repair connection to or replace key switch	Go to Step 4
5.	Check voltage and continuity through the 5 amp fuse mounted inline outside of the ground control box assembly, on the Red, 1-1 wire.	24 Volts	Go to Step 6	Replace Fuse or Fuse Holder if damaged
6.	Check connection at battery.	24 Volts	Circuit OK	N/A

SECTION 3 - TROUBLESHOOTING

Won't Drive Straight

Overview Of Procedure

The following procedure examines the drive motor assembly weldments attaching the drive motors to the base frame. Also internal components of the the drive motors, gear box and a check of the components between the gear box and the drive wheels.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Nothing is lodged between one of the wheels and the base frame.
- A caster wheel on the front of the machine is seized up, creating resistance.
- Joystick properly calibrated per procedure in Section-2 of Service Manual.

Table 3-18. Won't Drive Straight.

STEP	ACTION	SPEC	YES	NO
1.	Check for the following on the drive assembly, drive attachment weldment; is bent, has broken welds, or loose hardware.	—	Repair/Replace/Tighten weldment	Go to Step 2
2.	Check for the following on the drive assembly, drive motor mounting plates; are bent, are square with drive weldments, or is hardware loose?	—	Repair/Replace/Tighten weldment	Go to Step 3
3.	Check for the following on the drive assembly, drive motor hardware; is hardware loose, flange bearing - bad/loose, slip clutch - check torque settings or adjustment.	—	Repair/Replace/Tighten component	Go to Step 4
4.	Check the left and right drive motor brakes for loose hardware & not releasing properly.	—	Tighten or Adjust per procedure in this Service Manual	Go to Step 5
5.	Inside the drive motor gear box check if; the drive shaft is excessively loose & condition of drive shaft bearings. Are any gears broken or gear teeth excessively worn.	—	Repair/Replace components per procedure in this Service Manual	Go to Step 6
6.	Is the electrical signal and amperage draw to the drive motors equal?	24 volts 15 amps	Recheck Steps 1 thru 5	Go to Step 7
7.	Check the drive motor brushes, do they need replaced?	—	Replace per procedure in this Service Manual	Go to Step 8
8.	Is the X102 wiring harness (from platform control box to MC-1 box) damaged, check wiring harness visually and individual wires with ohm meter.	—	Repair or Replace Harness as Required	Go to Step 9
9.	Is joystick control defective? If possible, swap out with another platform control.	—	Repair/Replace Platform control	Go to Step 10
10.	Is MC-1 control box defective or connections not tight? If possible, swap out with another MC-1 control box.	—	Tighten Connections or Replace MC-1 box	—

Noise From Drive Assembly

Overview Of Procedure

The following procedure examines the drive motor assembly weldments attaching the drive motors to the base frame. Also internal components of the the drive motors, gear box and a check of the components between the gear box and the drive wheels.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Nothing is lodged between one of the wheels and the base frame.
- A caster wheel on the front of the machine is seized up, creating resistance.

Table 3-19. Noise from Drive Assembly.

STEP	ACTION	SPEC	YES	NO
1.	Check for the following on the drive assembly, drive attachment weldment; is bent, has broken welds, or loose hardware.	—	Repair/Replace/ Tighten weldment	Go to Step 2
2.	Check for the following on the drive assembly, drive motor mounting plates; are bent, are square with drive weldments, or is hardware loose?	—	Repair/Replace/ Tighten weldment	Go to Step 3
3.	Check for the following on the drive assembly, drive motor hardware; is hardware loose, flange bearing - bad/loose, slip clutch - check torque settings or adjustment.	—	Repair/Replace/ Tighten Component	Go to Step 4
4.	Check the left and right drive motor brakes for loose hardware & not releasing properly.	—	Tighten or Adjust per procedure in this Service Manual	Go to Step 5
5.	Inside the drive motor gear box check if; the drive shaft is excessively loose & condition of drive shaft bearings. Are any gears broken or gear teeth excessively worn.	—	Repair/Replace components per procedure in this Service Manual	Go to Step 6
6.	Is the electrical signal and amperage draw to the drive motors equal?	24 volts 15 amps	Recheck Steps 1 thru 5	Go to Step 7
7.	Check the drive motor brushes, do they need replaced?	—	Replace per procedure in this Service Manual	—

3.9 MAST TROUBLESHOOTING

Platform Will Not Lift Up Using Platform Control

Overview Of Procedure

This procedure examines the complete pump motor, ground control and pump valves electrical circuits.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Platform loaded within maximum allowable capacity.
- Hydraulic oil is within it's specified operating temperature range.

Table 3-20. Platform Will Not Lift Up Using Platform Control.

STEP	ACTION	SPEC	YES	NO
1.	Will platform lift from ground control switch? Note: Key switch must be set to GRND to test this.	—	Go to Step 2	See (Figure 3-24)
2.	Does pump motor run?	—	Go to Step 3	See Pump Circuit Check (Table 3-21)
3.	Are the down and dump valves opening/closing properly? Note: If machine will not lift and hydraulic oil is visible flowing in the hydraulic tank, the dump valve is stuck in the open position.	—	Go to Step 4	See Pump Valves Circuit Check (Table 3-22)
4.	Is the pressure set properly on the pump?	—	Go to Step 5	Set to correct pressure specification per this Service Manual
5.	Is the lift cylinder OK?	—	Go to Step 6	Rebuild or Replace Lift Cyl.
6.	Are the mast sections operating freely?	—	Consult Factory	Check Mast, Rebuild if Necessary

Table 3-21. Pump Circuit

• Battery voltage 24 volts. (Fully charge batteries) • Key switch set to Platform .				
STEP	ACTION	SPEC	YES	NO
1.	At the pump motor, check for 24 volts at both ends of the battery cable running from the main contactor to the pump case stud. (left side)	24 volts	Go to Step 2	Tighten Connection or Replace Cable if Necessary
PUMP CONTACTOR RELAY CIRCUIT				
2.	Check the connection of the ground cable (attached to 5/16" stud, left side) to the pump contactor, is tight and connected on other end to B- at the right side battery.	Ground	Go to Step 3	Tighten Connection or Replace Cable if Necessary
3.	Check the connection of the ground cable (other side) is tight and connected to the pump case stud (center).	Ground	Go to Step 4	Tighten Connection or Replace Cable if Necessary
4.	Check the Yel/Red, 2-6 wire connected to the positive post on the pump case for tightness and 24 volt reading.	24 volts	Go to Step 5	Tighten/Repair Connection
5.	Check the Tan, 55-1 wire connected to both the Ground control switch and the MC-1 box, X105 connector, pin 5 through the pump contactor relay. Without any lift functions activated, it should show 24 volts, with a lift function activated it should show ground.	Ground	Go to Step 6	Tighten/Repair Connection
DUMP VALVE CIRCUIT				
6.	Check the Yel/Red, 2-6 wire connected to the positive (+) post on the pump case for 24 volts.	24 volts	Go to Step 7	Tighten/Repair Connection
7.	Check the Tan, 3-1 wire connected to both the Ground control switch and the MC-1 box, X105 connector, pin 4 through the lift up valve. Without any lift function activated, it should show 24 volts, with a lift function activated it should show ground.	24 volts	Go to Step 8	Tighten/Repair Connection
DOWN VALVE CIRCUIT				
8.	Check the Yel/Red, 2-6 wire connected to the positive (+) post on the pump case for 24 volts.	24 volts	Go to Step 9	Tighten/Repair Connection
9.	Check the Tan, 4-1 wire connected to both the Ground control switch and the MC-1 box, X105 connector, pin 6 through the lift down valve. Without any lift functions, it should show 24 volts, with a lift function it should show ground.	24 volts	Go to Step 10	Tighten/Repair Connection
MAIN CONTACTOR CIRCUIT				
10.	Check the battery cable from the B+ (left side) battery for 24 volts.	24 volts	Go to Step 11	Tighten/Repair Connection
11.	Check the battery cable going out to the pump case (left side) stud for 24 volts.	24 volts	Go to Step 12	Tighten/Repair Connection
12.	Check the Yel/Red, 2-5 (10 ga.) wire to the MC-1 box, X101 connector, pin A1 for 24 volts.	24 volts	Go to Step 13	Tighten/Repair Connection
13.	Check the Yel/Red, 2-4 wire to the Power Relay, pin #87 for 24 volts.	24 volts	Go to Step 14	Tighten/Repair Connection

SECTION 3 - TROUBLESHOOTING

Table 3-21. Pump Circuit

14.	Check the Black to ground on the pump contactor.	Ground	Go to Step 15	Tighten/Repair Connection
POWER RELAY CIRCUIT				
15.	Check the Yel/Red, 2-4 wire, #87 on the Power Relay to the main contactor, and to diode at E-Stop for 24 volts. Note: Power will stop at diode, silver line should be away from the E-Stop.	24 volts	Go to Step 16	Tighten/Repair Connection
16.	Check the Yel/Red, 2-2 wire, #30 on the Power Relay to the E-stop and to the MC-1 box, X101 connector pin 3, for 24 volts.	24 volts	Go to Step 17	Tighten/Repair Connection
17.	Check the Black, #85 pin on the Power Relay for connection to ground at pump contactor.	Ground	Go to Step	Tighten/Repair Connection
18.	Check the Yel/Red, 2-3 wire, #86 on the Power Relay to the MC-1 box, X101 connector pin 5, for 24 volts when the platform control is powered up.	—	Go to Step	Tighten/Repair Connection

Table 3-22. Pump Valves Circuit

• Battery voltage 24 volts. (Fully charge batteries) • Set key switch to Platform and set the Emergency Stop Button to the RESET position. • Down Valve should be normal (closed). • Dump Valve (up) should be normal (open). • If machine will not lift and hydraulic oil is visible flowing in the hydraulic tank, the dump valve is stuck open.				
STEP	ACTION	SPEC	YES	NO
LIFT UP - (CONDITIONS WHEN PUMP MOTOR IS RUNNING)				
1.	Pump Contactor Coil: Yel/Red, 2-6 wire - 24 volts Tan, 55-1 wire - Ground	—	—	—
2.	Lift Up Valve Coil: Yel/Red, 2-6 wire - 24 volts Tan, 3-1 wire - Ground	—	—	—
LIFT UP - (CHECK WHEN PUMP MOTOR IS NOT RUNNING)				
3.	Pump Contactor Coil: Yel/Red, 2-6 wire - 24 volts Tan, 55-1 wire - 24 volts	—	—	—
4.	Lift Up Valve Coil: Yel/Red, 2-6 wire - 24 volts Tan, 3-1 wire - 24 volts	—	—	—
LIFT DOWN - (CHECK WHEN DOWN AND ENABLE PADS ARE PUSHED ON THE PLATFORM CONTROL)				
5.	Lift Down Valve Coil: Yel/Red, 2-6 wire - 24 volts Tan, 4-1 wire - Ground	—	—	—
LIFT DOWN - (CHECK WHEN NO FUNCTION ARE ENABLED ON THE PLATFORM CONTROL)				
6.	Lift Down Valve Coil: Yel/Red, 2-6 wire - 24 volts Tan, 4-1 wire - 24 volts	—	—	—

Platform Will Not Lower Using Platform Control

Overview Of Procedure

This procedure tests for ground coming out of the MC-1 box to the dump valve circuit and through to the ground control toggle switch.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Hydraulic oil is within it's specified operating temperature range.

Table 3-23. Platform Will Not Lower Using Platform Control.

STEP	ACTION	SPEC	YES	NO
1.	Will machine lower manually, using the manual descent knob?	—	Go to Step 2	See (Table 3-26)
2.	Will machine lower from ground control switch? Note: Key switch must be set to GRND to check this.	—	Go to Step 3	See (Table 3-23)
3.	Check for ground on the Tan, 4-1 wire at the MC-1 box, X105 connector, pin 6.	—	Go to Step 4	Repair/Replace Joystick/MC-1 Box
4.	Check for ground on the Tan, 4-1 wire at the lift down coil.	—	Go to Step 5	Replace/Repair Wire or Connection
5.	Check complete pump motor circuit . (See Table 3-21)	—	—	—

Platform Will Not Lift Up From Ground Control Toggle Switch**Overview Of Procedure**

The following procedure examines the complete ground control circuit from the battery all the way to the pump motor for wiring or components which could be causing a failure of that circuit.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Battery connections clean and tight.
- Key switch positioned to Ground (GRND) control.
- Emergency stop switch pulled out. (Reset Position)
- Ground control power supply and wiring, OK (Table 3-4).
- Manual descent valve closed.
- 5 amp fuses on power and pump circuits, OK.
- Hydraulic oil level, OK.
- Weight in platform does not exceed machine maximum capacity.

Table 3-24. Unit Will Not Lift Up From Ground Control Toggle Switch.

STEP	ACTION	SPEC	YES	NO
1.	Does the pump motor run when lift up is selected at the ground control switch? Note: Steps 2 thru 9 are to be performed with LIFT UP selected at the ground control.	—	Go to Steps 5, 6 and 10	Check Ground Power Circuit (Table 3-4) Before Continuing to Step 3
2.	Check terminal 30 and 85 on the ground control relay for ground. Is ground contact OK?	Ground	Go to Step 3	Repair Wiring or Connection
3.	Check continuity across terminals 87 and 30 on the ground control relay. Is there continuity? (Relay must be energized)	—	Go to Step 4	Replace Relay
4.	Check the Black wire from terminal 87 on the ground control relay to the lift up/down ground control switch. Is there continuity with B—?	—	Go to Step 5	Repair Wiring or Connection
5.	Check for continuity across the terminals (Black to Tan 3-1 and Tan 55-1) of the lift up/down ground control toggle switch. Is there continuity?	—	Go to Step 6	Replace Lift Up/Down Ground Control Switch
6.	Check the Tan, 3-1 wire for continuity from the lift up/down ground switch to the lift up coil. Is there continuity?	—	Go to Step 7	Repair Wiring or Connection
7.	Check the Tan, 55-1 wire from the lift up/down ground switch to the pump contactor for continuity. Is there continuity?	—	Go to Step 8	Repair Wiring or Connection
8.	Check the Yel/Red, 2-6 wire from the pump motor to the pump contactor and lift-up coil for voltage. Is there voltage?	24 Volts	Go to Step 9	Repair Wiring or Connection
9.	Check the wire from the lift switch (Tan 55-1) pump contactor to the battery (-) terminal for continuity. Is there continuity?	—	—	Repair Wiring or Connection
10.	Check the pump motor pressure relief setting. Is it within specification per Service Manual?	—		Set as Required

Platform Will Not Lower From Ground Control Toggle Switch

Overview Of Procedure

The following procedure examines the complete ground control circuit from the battery all the way to the pump motor for wiring or components which could be causing a failure of that circuit.

Check For These Obvious Conditions First:

- Battery voltage 24 volts. (Fully charge batteries)
- Battery connections clean and tight.
- Key switch positioned to Ground (GRND) control.
- Emergency stop switch set to the Reset position)
- Ground control power supply and wiring, OK (Table 3-4).
- 5 amp fuses on power and pump circuits, OK.
- Hydraulic oil level, OK.

Table 3-25. Unit Will Not Lower From Ground Control Toggle Switch.

STEP	ACTION	SPEC	YES	NO
1.	Will machine lower manually?	—	Go to Step 3	Go to Step 2
2.	Check for obstructions in the mast, cylinder, hydraulic lines and lift down valve.	—	Repair, Replace or Adjust	Go to Step 3
3.	Check terminal 30 and 85 on the ground control relay for ground. Is ground contact OK? Continuity with B—.	Ground	Go to Step 4	Repair Wiring or Connection
4.	Check continuity across terminals 87 and 30 on the ground control relay. Is there continuity? (Relay must be energized)	Ground	Go to Step 5	Replace Relay
5.	Check the Black wire from terminal 87 on the ground control relay to the lift up/down ground control switch. Is there continuity with B—?	—	Go to Step 6	Repair Wiring or Connection
6.	Check for continuity across the terminals (Black to Tan, 4-1 wire) of the lift up/down ground control toggle switch. Is there continuity with the switch activated?	—	Go to Step 7	Replace Lift Up/Down Ground Control Switch
7.	Check the Tan, 4-1 wire for continuity from the lift up/down ground switch to the lift-down coil. Is there continuity?	—	Go to Step 7	Repair Wiring or Connection
8.	Check the Yel/Red, 2-6 wire from the pump motor to the lift-down coil for voltage. Is there voltage?	24 volts	—	Repair Wiring or Connection

SECTION 3 - TROUBLESHOOTING

Platform Will Not Lower Manually

Overview Of Procedure

The following procedure suggests components on the machine which might attribute to problems with the manual descent circuit.

Table 3-26. Platform Will Not Lower Manually.

STEP	ACTION	SPEC	YES	NO
1.	Check manual override solenoid with manual override (knob open).		Go to Step 2	Open
2.	Check Steps 1 thru 6 of (Table 3-30)		Repair	Go to Step 3
3.	Place the maximum capacity of weight in the Platform. Does it Lower?		—	Consult Factory

Platform Lift Up And Down Jerky

Overview Of Procedure

The following procedure suggests areas on the machine which might attribute to erratic movement of the platform during lift up and down.

Check For These Obvious Conditions First:

- If mast is not running smooth or has tight and rough spots, refer to the Mast Section Rebuild.
- Hydraulic oil level in reservoir tank at full level.
- Hydraulic oil no milky (presence of water), or not foamy (full of air).

Table 3-27. Platform Lift Up and Down Jerky.

STEP	ACTION	SPEC	YES	NO
CONTROLS (ELECTRICAL)				
1.	Is platform control, enable, up or down pad defective or worn out?	—	Replace pad	Go to Step 2
2.	Loose connections, ground and power.	—	Repair connection	Go to Step 3
3.	Valve coils or solenoids keep opening and closing.	—	Repair Connection or Replace Valve	Go to Step 4
4.	Problem internal to the MC-1 control box.	—	Replace box	Go to Step 5
HYDRAULIC				
5.	Are the hydraulic valves working properly.	—	Replace Valve	Go to Step 6
6.	Pump drive cavitates.	—	Replace Pump	Go to Step 7
7.	Lift cylinder	—	Rebuild or Replace Cylinder	—

SECTION 3 - TROUBLESHOOTING

Mast Noisy When Lifting And Lowering

Overview Of Procedure

This procedure examines components of the mast itself and as well as it's lifting components for dirt, debris, proper lubrication and operation.

Table 3-28. Mast Noisy when Lifting and Lowering.

STEP	ACTION	SPEC	YES	NO
1.	Do slide pads and slide pad channels need to be cleaned of dust, dirt, or other debris?	—	Clean Pads and Channels	Go to Step 2
2.	Do chain/cables need to be lubricated per JLG specification in the Service Manual?	—	Lubricate as Required	Go to Step 3
3.	Are the chain/cable sheave wheels dry and need lubrication? Note: Plastic wheels will howl on the sheave pin when they are dry. Sheave wheels may seize to the sheave pin and the pin may turn in the pin retainer blocks.	—	Lubricate or Replace Sheave Pins and Wheels	Go to Step 4
4.	Are the sequence cables (located on the side of mast) chattering when the springs are compressed? Note: This noise is normal at the sequence cable sheave wheels when the mast is completely lowered. However if the sequence cable chattering is happening no matter what position the mast is in, it could be a result of the mast being shimmed to tight or dirt and debris in the slide pad channels causing the mast to be tight.	—	Clean Slide Pads/ Channels or Re-shim Mast per Service Manual	Go to Step 5
5.	Is the bore of the lift cylinder dry?	—	Replace Packing or Lift Cylinder	Go to Step 6
6.	Are the bearings in the lift pump motor and pump drive worn?	—	Repair or Replace Pump	Go to Step 7
7.	Are the hydraulic lines vibrating together?	—	Adjust the Position of the Lines	Go to Step 8
8.	Check if the pump motor is loose to it's mounting plate.	—	Tighten pump mounting fasteners	Go to Step 9
9.	Hydraulic oil could be cavatating inside the pump.	—	Repair or Replace Pump	—

Platform (Mast) Won't Stay Elevated

Overview Of Procedure

The following procedure requests that the lift down, dump, and pump internal valves be checked to see if any are stuck open, it also examines the lift down and dump valve circuits. Also suggests that the lift cylinder packing could be leaking internally.

Check For These Obvious Conditions First:

- Manual descent valve is closed tight.

Table 3-29. Platform (Mast) Won't Stay Elevated.

STEP	ACTION	SPEC	YES	NO
1.	Is the lift down valve stuck open?	—	Repair or Clean Valve	Go to Step 2
2.	Check the valve inside the pump, it could be stuck open.	—	Replace Pump	Go to Step 3
3.	Lift down valves could be open due to incorrect electrical signal.	—	Check Pump Valve Electrical Circuit (Table 3-22)	Go to Step 4
4.	Dump valve could be open due to incorrect electrical signal.	—	Check Pump Valve Electrical Circuit (Table 3-22)	Go to Step 5
5.	Oil could be passing around the lift cylinder bore packing.	—	Replace or Rebuild the Lift Cylinder	—

SECTION 3 - TROUBLESHOOTING

Platform (Mast) Descends Too Slowly

Overview Of Procedure

The following procedure examines the mast some hydraulic components for obstructions and defects.

Table 3-30. Platform (Mast) Descends Too Slowly.

STEP	ACTION	SPEC	YES	NO
1.	Check mast slide pads shimmed to tight.	—	Reshim Mast	Go to Step 2
2.	Is there an obstruction in the mast?	—	Remove Obstruction	Go to Step 3
3.	The lift cylinder packing could be too tight in the bore of the cylinder barrel.	—	Rebuild or Replace Cylinder	Go to Step 4
4.	Check the flow valve on the extend hydraulic line for a restriction, i.e. dirt.	—	Clean or Replace Flow Valve	Go to Step 5
5.	Check if the lift down valve is opening completely.	—	Clean or Replace Valve	Go to Step 6
6.	Is there a restricted hydraulic line (smashed)?	—	Replace Hydraulic Line	—

3.10 HYDRAULIC LEAK TROUBLESHOOTING

Miscellaneous Hydraulic Leak Troubleshooting

Overview Of Procedure

This series of steps gives remedies for various areas of the machine where leaks could occur.

Table 3-31. Hydraulic Leak Troubleshooting

STEP	ACTION	SPEC	YES	NO
1.	Oil leaking around the lift cylinder rod.	—	Replace the Seal at the end of the Piston and Cylinder Barrel	—
2.	Oil leaking around the cylinder fitting/flow valve.	—	Tighten or Replace Fittings	—
3.	Oil leaking around the hydraulic lines.	—	Tighten or Replace Hydraulic Lines	—
4.	Oil leaking around the lift up valve.	—	Tight Cartridge in Pump Case	—
5.	Oil leaking around the lift down valve.	—	Tighten Cartridge in Pump Case	—
6.	Oil leaking around the (Red) manual descent valve.	—	Replace Lift Down Valve	—
Note: Do not overtighten the nut on the solenoid in steps 4, 5, and 6.				

3.11 BASE FRAME COMPONENTS TROUBLESHOOTING

Caster Wheels Not Operating Freely

Check For These Obvious Conditions First:

- Is machine operating on a smooth, level surface?

Table 3-32. Caster Wheels Not Operating Freely.

STEP	ACTION	SPEC	YES	NO
1.	Is the caster rotating freely?	—	Go to Step 2	Lubricate or Replace Caster Housing
2.	Is the wheel spinning freely?	—	Go to Step 3	Lubricate or Replace Wheel
3.	Is debris stuck in the plastic wheel?	—	Remove Debris or Replace Wheel	—

Pot Hole Protection (PHP) Bars Will Not Set

Check For These Obvious Conditions First:

- Obstruction under pot hole bar on either side of machine.
- Obstruction around the actuator assembly at the base of the mast.

Table 3-33. Pot Hole Protection (PHP) Bars Will Not Set.

STEP	ACTION	SPEC	YES	NO
1.	Check the actuator cables for adjustment or damage.	—	Adjust or Replace	Go to Step 2
2.	Check the PHP limit switch(s) at both sides of the machine for damage, adjustment and for continuity through switch to ground when bars are down.	—	Replace, Adjust or Repair Wiring	—



Corporate Office
JLG Industries, Inc.
1 JLG Drive
McConnellsburg PA. 17233-9533
USA
Phone: (717) 485-5161
Customer Support Toll Free: (877) 554-5438
Fax: (717) 485-6417

JLG Worldwide Locations

JLG Industries (Australia)
P.O. Box 5119
11 Bolwarra Road
Port Macquarie
N.S.W. 2444
Australia
Phone: (61) 2 65 811111
Fax: (61) 2 65 810122

JLG Industries (UK)
Unit 12, Southside
Bredbury Park Industrial Estate
Bredbury
Stockport
SK6 2sP
England
Phone: (44) 870 200 7700
Fax: (44) 870 200 7711

JLG Deutschland GmbH
Max Planck Strasse 21
D-27721 Ritterhude/Ihlpohl
Bei Bremen
Germany
Phone: (49) 421 693 500
Fax: (49) 421 693 5035

JLG Industries (Italia)
Via Po. 22
20010 Pregnana Milanese - MI
Italy
Phone: (39) 02 9359 5210
Fax: (39) 02 9359 5845

JLG Latino Americana Ltda.
Rua Eng. Carlos Stevenson,
80-Suite 71
13092-310 Campinas-SP
Brazil
Phone: (55) 19 3295 0407
Fax: (55) 19 3295 1025

JLG Europe B.V.
Jupiterstraat 234
2132 HJ Foofddorp
The Netherlands
Phone: (31) 23 565 5665
Fax: (31) 23 557 2493

JLG Industries (Norge AS)
Sofeimyrveien 12
N-1412 Sofienyr
Norway
Phone: (47) 6682 2000
Fax: (47) 6682 2001

JLG Polska
Ul. Krolewska
00-060 Warszawa
Poland
Phone: (48) 91 4320 245
Fax: (48) 91 4358 200

JLG Industries (Europe)
Kilmartin Place,
Tannochside Park
Uddingston G71 5PH
Scotland
Phone: (44) 1 698 811005
Fax: (44) 1 698 811055

JLG Industries (Pty) Ltd.
Unit 1, 24 Industrial Complex
Herman Street
Meadowdale
Germiston
South Africa
Phone: (27) 11 453 1334
Fax: (27) 11 453 1342

Plataformas Elevadoras
JLG Iberica, S.L.
Trapadella, 2
P.I. Castellbisbal Sur
08755Castellbisbal
Spain
Phone: (34) 93 77 24700
Fax: (34) 93 77 11762

JLG Industries (Sweden)
Enkopingsvagen 150
Box 704
SE - 175 27 Jarfalla
Sweden
Phone: (46) 8 506 59500
Fax: (46) 8 506 59534
