

SERVICE & MAINTENANCE

Model

20EL

25EL

30EL

36EL

41EL

3120782

October 31, 2003

CORPORATE OFFICE

JLG INDUSTRIES, INC.

1 JLG Drive

McConnellsburg, PA.

17233-9533

USA

Telephone: (717) 485-5161

Fax: (717) 485-6417

CALIFORNIAN PROPOSITION 65
BATTERY WARNING

**Battery posts,
terminals and related
accessories contain
lead and lead compounds,
chemical known to the
State of California
to cause cancer and
reproductive harm.**

**WASH HANDS
AFTER HANDLING!**

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

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 - OPERATION/SAFETY PRECAUTIONS

All procedures herein are based on the use of the machine under proper operating conditions, with no deviations from original design intent ... as per OSHA regulations.

READ & HEED!

The ownership, use, service, and/or maintenance of this machine is subject to various federal, state and local laws and regulations. It is the responsibility of the owner/user to be knowledgeable of these laws and regulations and to comply with them. The most prevalent regulations of this type are the Federal OSHA Safety Regulations*. Listed below, in abbreviated form are some of the requirements of Federal OSHA regulations in effect as of the date of publication of this handbook.

The listing of these requirements shall not relieve the owner/user of the responsibility and obligation to determine all applicable laws and regulations and their exact wording and requirements, and to comply with the requirements. Nor shall the listing of these requirements constitute an assumption of responsibility of liability on the part of JLG Industries, Inc.

1. Only trained and authorized operators shall be permitted to operate the aerial lift.
2. A malfunctioning lift shall be shut down until repaired.
3. The controls shall be plainly marked as to their function.
4. The controls shall be tested each day prior to use to determine that they are in safe operating condition.

5. Load limits specified by the manufacturer shall not be exceeded.
6. Instruction and warning placards must be legible.
7. Aerial lifts may be "field modified" for uses other than those intended by the manufacturer only if certified in writing by the manufacturer or an equivalent entity, such as a nationally recognized testing lab, to be in conformity to applicable OSHA safety regulations and to be at least as safe as it was prior to modification.
8. Aerial lifts shall not be used near electric power lines unless the lines have been deenergized or adequate clearance is maintained (see OSHA 29 CFR 1910.67 and 1926.400).
9. Employees using aerial lifts shall be instructed how to recognize and avoid unsafe conditions and hazards.
10. Ground controls shall not be operated unless permission has been obtained from personnel in the platform, except in case of an emergency.
11. Regular inspection of the job site and aerial lift shall be performed by competent persons.
12. Personnel shall always stand on the floor of the platform, not on boxes, planks, railing or other devices for a work position.

*Applicable Federal OSHA regulations, as of the date of publication of this manual include, but are not limited to, 29 CFR 1910.67, 29 CFR 1926.20, 29 CFR 1926.21, 29 CFR 1926.28, 29 CFR 1926.400 and 29 CFR 1926.453. Consult the current regulations for the exact wording and full text of the requirements and contact the closest Federal OSHA office for specific interpretations.

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.

EFFECTIVITY CHANGES

June 15, 1999 - Original Issue of Manual

November 21, 2000 - Revised - Pages Affected: Section 2 - Pages 2-11, 2-18 thru 2-21.

January 17, 2002 – Manual Revised

October 31, 2003 – Manual Revised

This Page Left Intentionally Blank

TABLE OF CONTENTS

SECTION - PARAGRAPH, SUBJECT	PAGE NO.
INTRODUCTION -- OPERATION/SAFETY PRECAUTIONS	A
INTRODUCTION -- MAINTENANCE SAFETY PRECAUTIONS.	A
A GENERAL	B
B HYDRAULIC SYSTEM SAFETY	B
C MAINTENANCE	B
EFFECTIVITY CHANGES	C
 SECTION 1 - SPECIFICATIONS	
1.1 CAPACITIES	1-1
Hydraulic Oil Reservoir	1-1
1.2 COMPONENT DATA	1-1
Hydraulic Pump/Electric Motor Assembly	1-1
Batteries (1) – DC Models.	1-1
Battery Charger – DC Models.	1-1
1.3 PERFORMANCE DATA	1-1
Platform Capacity	1-1
Machine Weight (with Standard Platform)	1-1
Machine Height (Platform Stowed)	1-1
Maximum Platform Height (Mast Extended)	1-1
Maximum Working Height (Average person)	1-2
Platform Cycle Performance	1-2
Outrigger Footprint	1-2
Machine Overall Width and Length (Base)	1-2
1.4 TORQUE REQUIREMENTS	1-2
1.5 LUBRICATION	1-2
Hydraulic Oil	1-2
Lubrication Specifications	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 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE	2-1
General.	2-1
Preparation, Inspection, and Maintenance	2-1
Pre-Start Inspection	2-1
Pre-Delivery Inspection and Frequent Inspection	2-1
Annual Machine Inspection	2-1
Preventative Maintenance	2-1
2.2 PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE	2-2
2.3 SERVICING AND MAINTENANCE GUIDELINES.	2-5
General.	2-5
Safety and Workmanship	2-5
Cleanliness.	2-5
Components Removal and Installation	2-5
Component Disassembly and Reassembly	2-5
Pressure-Fit Parts.	2-5

Bearings	2-5
Gaskets	2-5
Bolt Usage and Torque Application	2-6
Hydraulic Lines and Electrical Wiring	2-6
Hydraulic System	2-6
Lubrication and Servicing	2-6
Batteries	2-6
Mast Chain Inspection Procedure	2-6
Mast Cable Inspection Procedure	2-7
2.4 LUBRICATION INFORMATION	2-8
Hydraulic System	2-8
Hydraulic Oil	2-8
Changing Hydraulic Oil	2-8
Lubrication Specifications	2-8
2.5 BATTERY CHARGER - ASSEMBLY AND DISASSEMBLY	2-9
General Information	2-9
Battery Charger Removal	2-9
Cover Removal	2-9
Transformer Replacement	2-9
Printed Circuit Board Replacement	2-10
DC Circuit Breaker Replacement	2-10
AC Circuit Breaker and Voltage Selection Switch Replacement	2-10
Shunt Assembly, Varistor, and SCR Rectifier Replacement (See Illustration)	2-11
2.6 HYDRAULIC LIFT CYLINDER - REMOVAL, INSPECTION AND REBUILD	2-12
Disassembly	2-12
Cylinder Disassembly	2-12
Lift Cylinder Component Inspection	2-12
Cylinder Assembly	2-13
Installation	2-14
2.7 MAST ASSEMBLY AND DISASSEMBLY PROCEDURES	2-15
Mast Disassembly Procedure	2-15
Platform Section Removal (All Masts)	2-16
Mast Section 6 Removal (7 Section Mast)	2-16
Mast Section 5 Removal (6 & 7 Section Mast)	2-16
Mast Section 4 Removal (All Masts)	2-16
Mast Section 3 Removal (All Masts)	2-17
Mast Section 2 Removal (All Masts)	2-17
Mast Section 1 Disassembly (All Masts)	2-17
2.8 MAST ASSEMBLY	2-18
Mast Section 1 - Assembly (All Masts)	2-18
Mast Section 2 - Assembly (All Masts)	2-18
Mast Section 3 - Assembly (All Masts)	2-23
Mast Section 4 - Assembly (All Masts)	2-23
Mast Section 5 - Assembly (25/30/36/41 ft. Masts)	2-24
Mast Section 6 - Assembly (30/41 ft. Masts)	2-25
Platform Mounting Section - Assy. (All Masts)	2-26
2.9 MAST TO BASE FRAME INSTALLATION	2-28
2.10 MAST CHAINS/CABLES AND SEQUENCING CABLES ADJUSTMENT	2-29
Mast Chain/Cable Adjustment	2-29
Sequencing Cable Adjustment	2-30
2.11 SEQUENCE CABLE REPLACEMENT KIT	2-30
Remove Old Cable	2-30
Replacement Cable Installation	2-30
Clamp Installation (Drum/Socket Type)	2-31

SECTION 3 - TROUBLESHOOTING

3.1	GENERAL	3-1
3.2	TROUBLESHOOTING INFORMATION	3-1
3.3	HYDRAULIC CIRCUIT CHECKS	3-1
3.4	OUTRIGGER INTERLOCK CONTACTS	3-4
	Outrigger Socket and Outrigger Beam - Interlock Contacts	3-4
	Outrigger Socket - Contactor Screw Mounting Instructions	3-4
	Outrigger Beam - Interlock Contactor Plate Mounting Instructions	3-4
	Detent Screws	3-6

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.	Torque Chart	1-4
1-3.	Lubrication Locations (See Table below)	1-5
2-1.	Lift Cylinder Internal Component Assembly Cross-Section	2-13
2-2.	Mast Section - Assembly/Disassembly Reference	2-15
2-3.	20EL Mast Assembly Components. (5 - Section)	2-19
2-4.	25EL & 36EL Mast Assembly Components. (6 - Section)	2-20
2-5.	30EL & 41EL Mast Assembly Components. (7 - Section)	2-21
2-6.	Mast Chain/Cable Routing Diagram	2-22
2-7.	Mast Chain/Cable/Sequence Cable Adjustment Components. (Typical)	2-29
3-1.	Outrigger Socket Contactor Heads and Outrigger Beam - Contactor Plate Mounting Hardware (ORIGINAL AND 5/2001 - DESIGN)	3-5
3-2.	Hydraulic Schematic. (EL Series) (2792491_A)	3-7
3-3.	Electrical Diagram. (EL Series - 12V-DC)	3-8
3-4.	Electrical Diagram. (EL Series - 120V-AC)	3-10
3-5.	Electrical Diagram. (EL Series - 240V-AC)	3-12

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1-1.	Hydraulic Oil Operating Range	1-2
1-2.	Lubrication Specifications	1-2
1-3.	Cylinder Specifications	1-3
1-4.	Lubrication Intervals for Various Components	1-5
2-1	Inspection and Maintenance	2-2
2-2	EL Model - Preventive Maintenance & Inspection Schedule	2-3
2-3	Chain Stretch Tolerance	2-6
2-4	EL Series Mast Component Features	2-15
3-1	AC Unit - Troubleshooting	3-2
3-2	DC Unit - Troubleshooting	3-3

This page intentionally left blank.

SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

Hydraulic Oil Reservoir

AC Models – 5 qts. U.S. (4.7 ltr.)

DC Models – 5 qts. U.S. (4.7 ltr.)

1.2 COMPONENT DATA

Hydraulic Pump/Electric Motor Assembly

DC Models - 12 Volt DC motor/pump

Motor - 12v - DC Standard Duty

Pump Displacement – .049 cu. in./rev. (AFC 0.8 cc/rev.)

Pump Output – 0.43 GPM @ 3500 PSI @ 11.7v-DC @
150 AMPS @ 45 Centistrokes

Pressure Relief – Adjustable Range 1500 to 5000 PSI,
Set to 2800 PSI (193 bar) at factory

AC Models - 120 Volt AC motor/pump

Motor - 100/230v-AC, 1HP, 2850/3450 RPM, 50/60Hz

Pump Displacement – .049 in./rev. (0.8 cc/rev.)

Pump Output – 0.43 GPM @ 3500 PSI @ 16 AMPS @
115v-AC @ 45 Centistrokes

Pressure Relief – Adjustable Range 1500 to 5000 PSI,
Set to 2800 PSI (193 bar) at factory

AC Models - 240 Volt AC motor/pump

Motor - 100/230v-AC, 1HP, 2850/3450 RPM, 50/60Hz

Pump Displacement – .049 in./rev. (0.8 cc/rev.)

Pump Output – 0.43 GPM @ 3500 PSI @ 8 AMPS @
230v-AC @ 45 Centistrokes

Pressure Relief – Adjustable Range 1500 to 5000 PSI,
Set to 2800 PSI (193 bar) at factory

Batteries (1) – DC Models.

12 Volt – 165 Amp (min.) – Deep Cycle Marine - RV

Battery Charger – DC Models.

Input - 120/240 Volts AC – 50/60 Hz - Voltage Selectable

Output - 12 volt, 10 Amp - DC
w/Auto Charge Sensing Circuit.

1.3 PERFORMANCE DATA

Platform Capacity

MODEL	PLATFORM CAPACITY		
	ANSI (U.S.A.)	C.S.A. (Canada)	Brazil/ Japan
20EL AC & DC	350 lb. (160 kg)	300 lb. (135 kg)	160 kg (350 lb.)
25EL AC & DC	350 lb. (160 kg)	300 lb. (135 kg)	160 kg (350 lb.)
30EL AC & DC	350 lb. (160 kg)	250 lb. (113 kg)	135 kg (300 lb.)
36EL AC & DC	300 lb. (135 kg)	250 lb. (113 kg)	135 kg (300 lb.)
41EL AC & DC	300 lb. (135 kg)	250 lb. (113 kg)	135 kg (300 lb.)

Machine Weight (with Standard Platform)

20EL-AC - 740 lbs. (336kg)
 20EL-DC - 860 lbs. (390kg)
 25EL-AC - 825 lbs. (374kg)
 25EL-DC - 904 lbs. (411kg)
 30EL-AC - 890 lbs. (404kg)
 30EL-DC - 940 lbs. (427kg)
 36EL-AC - 1,060 lbs. (481kg)
 36EL-DC - 1,160 lbs. (526kg)
 41EL-AC - 1,100 lbs. (499kg)
 41EL-DC - 1,260 lbs. (572kg)

Machine Height (Platform Stowed)

20EL-AC & DC - 77.3 in. (2.0 m)
 25EL-AC & DC - 77.3 in. (2.0 m)
 30EL-AC & DC - 77.3 in. (2.0 m)
 36EL-AC & DC - 104.3 in. (2.64 m) *77 in. (2.0 m)
 41EL-AC & DC - 104.3 in. (2.64 m) *77 in. (2.0 m)
 * In tilt-back mode.

Maximum Platform Height (Mast Extended)

20EL-AC & DC - 20 ft. (6.09 m)
 25EL-AC & DC - 25 ft. (7.62 m)
 30EL-AC & DC - 30 ft. (9.14 m)
 36EL-AC & DC - 36 ft. (11 m)
 41EL-AC & DC - 41 in. (12.42 m)

SECTION 1 - SPECIFICATIONS

Maximum Working Height (Average person)

20EL-AC & DC - 26 ft. (7.92 m)
25EL-AC & DC - 31 ft. (9.45 m)
30EL-AC & DC - 36 ft. (11 m)
36EL-AC & DC - 42 ft. (12.80 m)
41EL-AC & DC - 47 ft. (14.33 m)

Platform Cycle Performance

Lift Up cycle time - from stowed to maximum platform height with maximum rated load.

Lift Down cycle time - from maximum platform height to stowed position with maximum rated load.

Maximum Platform Speeds: (in seconds)	20EL	25EL	30EL	36EL	41EL
Lift Up:	50	62	72	128	120
Lift Down:	32-42	32-42	32-42	47-57	45-55

Outrigger Footprint

20/25EL Models - 62 in. x 54 in. (1.57 m x 1.37 m)
30EL Models - 68 in. x 62 in. (1.72 m x 1.57 m)
36EL Models - 79 in. x 79 in. (2.0 m x 2.0 m)
41EL Models - 79 in. x 79 in. (2.0 m x 2.0 m)

Machine Overall Width and Length (Base)

20EL Models - 29 in.(W) x 47 in.(L) (74 cm x 1.19 m)
25EL Models - 29 in.(W) x 49 in.(L) (74 cm x 1.24 m)
30EL Models - 29 in.(W) x 52 in.(L) (74 cm x 1.32 m)
36EL Models - 29 in.(W) x 54.5 in.(L) (74 cm x 1.38 m)
41EL Models - 29 in.(W) x 57.5 in.(L) (74 cm x 1.46 m)

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, or as an alternate, Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and a viscosity index of 152. Mobilfluid 424 and Kendall Hyken 052 are fully compatible, and can be mixed as necessary.

When temperatures remain consistently below -20° F (-7° C) an amount of No. 2 diesel fuel, not to exceed 20% of system capacity, may be added to the hydraulic oil reservoir. This diesel fuel will "thin" the hydraulic oil for easier cold weather operation, and will almost completely dissipate from the hydraulic system over a several month period of time. When cold weather is past, it may be necessary to drain and refill the hydraulic system to rid the system of any remaining diesel fuel.

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 or Kendall Hyken 052 is desired, contact JLG Industries for proper recommendations.

Table 1-1. Hydraulic Oil Operating Range

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

Lubrication Specifications

Table 1-2. 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.

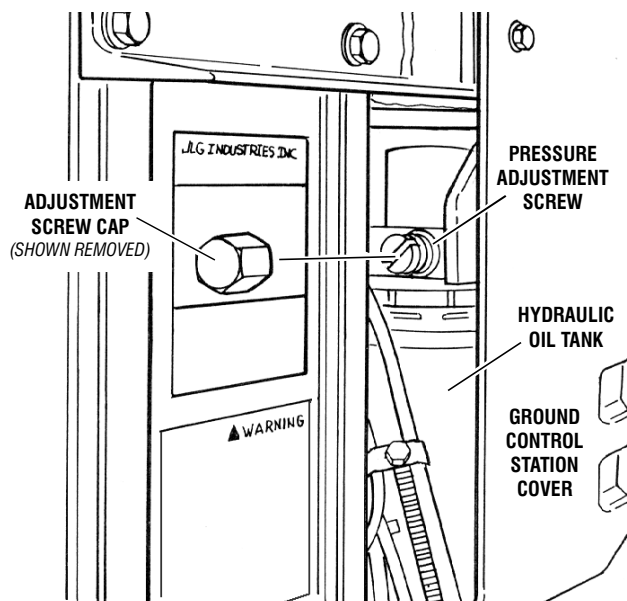
1.6 HYDRAULIC PRESSURE ADJUSTMENT

(See Figure 1-1.)

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

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

Do not adjust system pressure higher than required to raise the load. 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)**

1.7 CYLINDER SPECIFICATIONS

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

Table 1-3. Cylinder Specifications

DESCRIPTION	BORE in./(cm)	STROKE in./(cm)	ROD DIA. in./(cm)
Lift Cylinder - 20EL-AC & DC	1.63 (4.14)	56.50 (143.50)	1.38 (3.50)
Lift Cylinder - 25EL-AC & DC	1.63 (4.14)	56.50 (143.50)	1.38 (3.50)
Lift Cylinder - 30EL-AC & DC	1.63 (4.14)	56.50 (143.50)	1.38 (3.50)
Lift Cylinder - 36EL-AC & DC	1.63 (4.14)	83.25 (211.40)	1.38 (3.50)
Lift Cylinder - 41EL-AC & DC	1.63 (4.14)	78.25 (198.75)	1.38 (3.50)

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.

VALUES FOR ZINC PLATED BOLTS ONLY															UNPLATED CAP SCREWS	
SIZE	THD	BOLT DIA. (IN.)	THREAD STRESS AREA (SQ. IN.)	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				CLAMP LOAD (LB.)	TORQUE (as received) LB. FT.			
				(DRY OR LOC. 263) LB. IN.	(LUB.) LB. IN.	(LOCTITE 262) LB. IN.	(LOCTITE 242 OR 271) LB. IN.	(DRY OR LOC. 263) LB. IN.	(LUB.) LB. IN.	(LOCTITE 262) LB. IN.	(LOCTITE 242 OR 271) LB. IN.					
4	40	0.1120	0.00604	8	6	—	—	540	12	9	—	—	—	—		
	48	0.1120	0.00661	9	7	—	—	600	13	10	—	—	—	—		
6	32	0.1380	0.00909	580	16	12	—	820	23	17	—	—	—	—		
	40	0.1380	0.01015	610	18	13	—	920	25	19	—	—	—	—		
8	32	0.1640	0.01400	900	30	22	—	1260	41	31	—	—	—	—		
	36	0.1640	0.01474	940	31	23	—	1320	43	32	—	—	—	—		
10	24	0.1900	0.01750	1120	43	32	—	1580	60	45	—	—	—	—		
	32	0.1900	0.02000	1285	49	36	—	1800	68	51	—	—	—	—		
1/4	20	0.2500	0.0318	2020	96	75	—	2860	144	108	—	160	3180	13		
	28	0.2500	0.0364	2320	120	86	—	3280	168	120	—	185	3640	14		
5/16	18	0.3125	0.0524	3340	17	13	16	19	4720	25	18	22	30	5240	25	
	24	0.3125	0.0580	3700	19	14	17	21	5220	25	20	25	30	5800	27	
3/8	16	0.3750	0.0775	4940	30	23	28	35	7000	45	35	40	50	7750	45	
	24	0.3750	0.0878	5600	35	25	32	40	7900	50	35	45	55	8780	50	
7/16	14	0.4375	0.1063	6800	50	35	45	55	9550	70	55	63	80	10630	70	
	20	0.4375	0.1187	7550	55	40	50	60	10700	80	60	70	90	11870	75	
1/2	13	0.5000	0.1419	9050	75	55	68	85	12750	110	80	96	120	14190	110	
	20	0.5000	0.1599	10700	90	65	80	100	14400	120	90	108	135	15990	115	
9/16	12	0.5625	0.1820	11600	110	80	98	120	16400	150	110	139	165	18200	155	
	18	0.5625	0.2030	12950	120	90	109	135	18250	170	130	154	190	20300	165	
5/8	11	0.6250	0.2260	14400	150	110	135	165	20350	220	170	180	240	22600	210	
	18	0.6250	0.2560	16300	170	130	153	190	23000	240	180	204	265	25600	220	
3/4	10	0.7500	0.3340	21300	260	200	240	285	30100	380	280	301	420	33400	365	
	16	0.7500	0.3730	23800	300	220	268	330	33600	420	320	336	465	37300	400	
7/8	9	0.8750	0.4620	29400	430	320	386	475	41600	600	460	485	660	46200	585	
	14	0.8750	0.5090	32400	470	350	425	520	45800	660	500	534	725	50900	635	
1	8	1.000	0.6060	38600	640	480	579	675	51500	900	680	687	990	60600	865	
	12	1.000	0.6630	42200	700	530	633	735	59700	1000	740	796	1100	66300	915	
1-1/8	7	1.1250	0.7630	42300	800	600	714	840	68700	1280	960	1030	1400	76300	1240	
	12	1.1250	0.8560	47500	880	660	802	925	77000	1440	1080	1155	1575	85600	1380	
1-1/4	7	1.2500	0.9690	53800	1120	840	1009	1175	87200	1820	1360	1453	2000	96900	1750	
	12	1.2500	1.0730	59600	1240	920	1118	1300	96600	2000	1500	1610	2200	107300	1880	
1-1/2	6	1.500	1.1550	64100	1460	1100	1322	1525	104000	2380	1780	1907	2625	115500	2320	
	12	1.500	1.3150	73000	1680	1260	1506	1750	118100	2720	2040	2165	3000	131500	2440	
1-1/2	6	1.500	1.4050	78000	1940	1460	1755	2025	126500	3160	2360	2530	3475	140500	3040	
	12	1.500	1.5800	87700	2200	1640	1974	2300	142200	3560	2660	2844	3925	158000	3270	

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



SAE GRADE 5



SAE GRADE 8

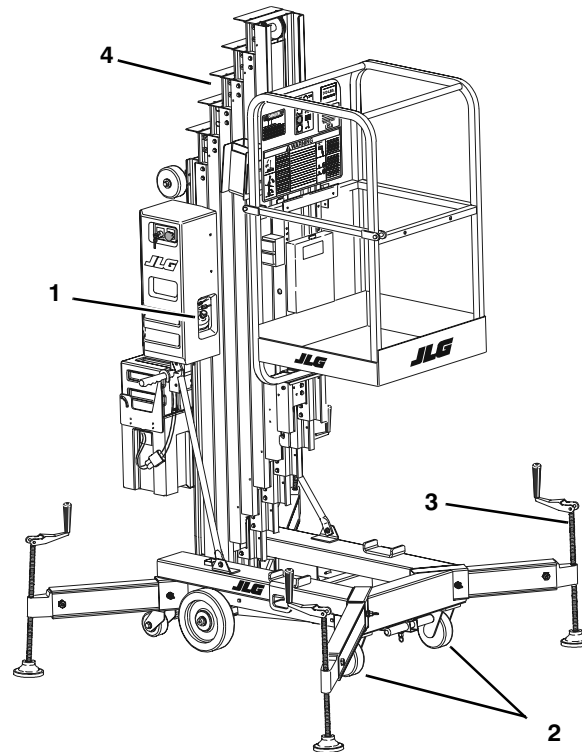


Figure 1-3. Lubrication Locations (See Table below).

Table 1-4. 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. (4.3 L) Reservoir	HO - Check Hyd. Oil Level HO - Change Hyd. Oil				✓	Check oil level every day. Change hydraulic oil every 2 years.
2	Swivel Raceways	2 - Front Casters	MPG - Pressure Gun		✓			
3	Leveling Jack Screws	4 - Jack Threads	MPG - Brush		✓			
4	Mast Chains *	2 - Per Section	Chain Lube - Brush or Spray		✓			Inspect, lubricate if drying or rusting.

* Applies Only to Mast Sections with Chains.

Key to Lubricants: MPG - Multipurpose Grease

HO - Hydraulic Oil - See Table 7-1 in Service Manual.

- 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. Lubricating intervals are calculated on 50 hours of machine operation a week.
 4. 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 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

General

This section provides the necessary information needed by those personnel that are responsible to place the machine in operation readiness and maintain its safe operating condition. For maximum service life and safe operation, ensure that all the necessary inspections and maintenance have been completed before placing the machine into service.

Preparation, Inspection, and Maintenance

It is important to establish and conform to a comprehensive inspection and preventive maintenance program. The following table outlines the periodic machine inspections and maintenance recommended by JLG Industries, Inc. Consult your national, regional, or local regulations for further requirements for aerial work platforms. The frequency of inspections and maintenance must be increased as environment, severity and frequency of usage requires.

Pre-Start Inspection

It is the User's or Operator's primary responsibility to perform a Pre-Start Inspection of the machine prior to use daily or at each change of operator. Reference the Operator's and Safety Manual for completion procedures for the Pre-Start Inspection. The Operator and Safety Manual must be read in its entirety and understood prior to performing the Pre-Start Inspection.

Pre-Delivery Inspection and Frequent Inspection

The Pre-Delivery Inspection and Frequent Inspection shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

The Pre-Delivery Inspection and Frequent Inspection procedures are performed in the same manner, but at different times. The Pre-Delivery Inspection shall be performed prior to each sale, lease, or rental delivery. The Frequent Inspection shall be accomplished for each machine in service for 3 months or 150 hours (whichever comes first); out of service for a period of more than 3 months; or when purchased used. The frequency of this inspection must be

increased as environment, severity and frequency of usage requires.

Reference the JLG Pre-Delivery and Frequent Inspection Form and the Inspection and Preventative Maintenance Schedule for items requiring inspection during the performance of these inspections. Reference the appropriate areas of this manual for servicing and maintenance procedures.

Annual Machine Inspection

The Annual Machine Inspection must be performed by a qualified JLG equipment mechanic on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who has successfully completed the JLG Service Training School for the subject JLG product model. Reference the machine Service and Maintenance Manual and appropriate JLG inspection form for performance of this inspection.

Reference the JLG Annual Machine Inspection Form and the Inspection and Preventative Maintenance Schedule for items requiring inspection during the performance of this inspection. Reference the appropriate areas of this manual for servicing and maintenance procedures.

For the purpose of receiving safety-related bulletins, it is important that JLG Industries, Inc. has updated ownership information for each machine. When performing each Annual Machine Inspection, notify JLG Industries, Inc. of the current machine ownership.

Preventative Maintenance

In conjunction with the specified inspections, maintenance shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

Reference Table 2-2, EL Model - Preventive Maintenance & Inspection Schedule., and the appropriate areas of this manual for servicing and maintenance procedures. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.

SECTION 2 - SERVICE PROCEDURES

Table 2-1. Inspection and Maintenance

Type	Frequency	Primary Responsibility	Service Qualification	Reference
Pre-Start Inspection	Prior to use each day; or At each Operator change.	User or Operator	User or Operator	Operator and Safety Manual
Pre-Delivery Inspection	Prior to each sale, lease, or rental delivery.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Frequent Inspection	In service for 3 months or 150 hours, whichever comes first; or Out of service for a period of more than 3 months; or Purchased used.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Annual Machine Inspection	Annually, no later than 13 months from the date of the prior inspection.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Preventative Maintenance	At intervals as specified in the Service and Maintenance Manual.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual

2.2 PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE

(See Table 2-2.)

The preventive maintenance and inspection checks are listed and defined in the following table. 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.

Table 2-2. EL Model - Preventive Maintenance & Inspection Schedule.

AREA ON MACHINE	INTERVAL				
	PRE-START (1) INSPECTION	WEEKLY PREVENTATIVE MAINTENANCE	3 MONTH PREVENTATIVE MAINTENANCE	PRE-DELIVERY (2) OR FREQUENT (3) INSPECTION	ANNUAL (4) (YEARLY) INSPECTION
MAST ASSEMBLY	1				
Mast Sections					2, 5
Chain Systems			14	3, 14	14, 25
Sequence Cable Systems				3	1, 2, 3
Support Bars					1, 2
Covers or Shields					1
Sheave Systems				1, 2	1, 2
Bearings					1, 2
Slide Pads					1, 2
PLATFORM ASSEMBLY	1				
Platform				1	1
Guard Rails				1, 2	2
Gate				1, 5	5
Floor					2
Extension Deck Assembly					1, 5
Lanyard Anchorage Point	1				
CHASSIS ASSEMBLY	1				
Outrigger Beams, Sockets, and Locking Pins				1, 2, 5, 7	1, 2, 5, 7
Outrigger Screw Jacks				5	1, 2, 5
Tires/Wheels/Caster Systems				1, 2	1, 2
Bubble Level				1, 2, 7	1, 2, 7
Cable Reel (LiftMaster Only)				5	5
Winch and Winch Brake (LiftMaster Only)					1, 2, 5
FUNCTIONS/CONTROLS	1				
Platform Controls				5	5, 6, 7
Ground Controls				5	5, 6, 24
Function Control Locks, Guards, or Detents				5	5
Function Enable System				5	
Emergency Stop Switches (Ground & Platform)				5	5
Function Limit or Cutout Switch Systems					
Manual Descent or Auxiliary Power				5	5
POWER SYSTEM					
Batteries	19	9			
Battery Fluid				11	11
Battery Charger					5
HYDRAULIC/ELECTRIC SYSTEM	1				
Hydraulic Pump		9		1, 2, 9	2, 5
Hydraulic Pump Cover					1
Hydraulic Cylinder		7, 9		2, 9	2, 9
Cylinder Attachment Pins and Pin Retainers				1, 2	
Hydraulic Hoses, Lines, and Fittings		9			1, 9
Hydraulic Reservoir, Cap, and Breather		5, 7		5, 7	5, 7
Hydraulic Filter					

SECTION 2 - SERVICE PROCEDURES

Table 2-2. EL Model - Preventive Maintenance & Inspection Schedule.

AREA ON MACHINE	INTERVAL				
	PRE-START (1) INSPECTION	WEEKLY PREVENTATIVE MAINTENANCE	3 MONTH PREVENTATIVE MAINTENANCE	PRE-DELIVERY (2) OR FREQUENT (3) INSPECTION	ANNUAL (4) (YEARLY) INSPECTION
Hydraulic Fluid *	11	11	11	11	11
Electrical Connections				20	20
Outrigger Interlock Systems				1, 2, 5	5
GENERAL					
Operator and Safety Manuals in Storage Box	21			21	21
ANSI and EMI Manuals/Handbooks Installed	21			21	21
Capacity Decals Installed, Secure, Legible	21			21	21
All Decals/Placards Installed, Secure, Legible	21			21	21
"Walk-Around" Inspection Performed	22				
Annual Machine Inspection Due				21	
No Unauthorized Modifications or Additions				21	21
All Relevant Safety Publications Incorporated				21	21, 22
General Structural Condition and Welds				2, 4	2, 4
All Fasteners, Pins, Shields, and Covers					1, 2
Grease and Lubricate to Specifications				22	22
Function Test of All Systems	22				
Paint and Appearance				7	7
Stamp Inspection Date on Frame					22
Notify JLG of Machine Ownership					22

Footnotes:

- (1) Prior to use each day; or at each Operator change
- (2) Prior to each sale, lease, or delivery
- (3) In service for 3 months or 150 hours; or Out of service for 3 months or more; or Purchased used
- (4) Annually, no later than 13 months from the date of the prior inspection

Inspection and Maintenance Codes:

1. Check for proper and secure installation.
2. Visual inspection for damage, cracks, distortion, or excessive wear.
3. Check for proper adjustment.
4. Check for cracked or broken welds.
5. Operates properly.
6. Returns to neutral or "off" position when released.
7. Clean and free of debris.
8. Interlocks function properly.
9. Check for signs of leakage.
10. Decals installed and legible.
11. Check for proper fluid level.
12. Check for chafing and proper routing.
13. Check for proper tolerances.
14. Properly lubricated.
15. Torqued to proper specification.
16. No gouges, excessive wear, or cords showing.
17. Properly inflated and seated around rim.
18. Proper and authorized components.
19. Fully charged.
20. No loose connections, corrosion, or abrasions.
21. Verify.
22. Perform.
23. Sealed properly.
24. Overrides Platform controls.
25. Inspected per Service and Maintenance Manual.

2.3 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.

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.

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 themselves. 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, 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 extend/retract 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 8-1 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 2-3. 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.

2.4 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 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 7 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 1-2. for an explanation of the lubricant key designations appearing in the Lubrication Chart.

2.5 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 (SCR) BATTERY CHARGER MANUAL 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 (SCR) BATTERY CHARGER MANUAL.

The EL Series dual AC input 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

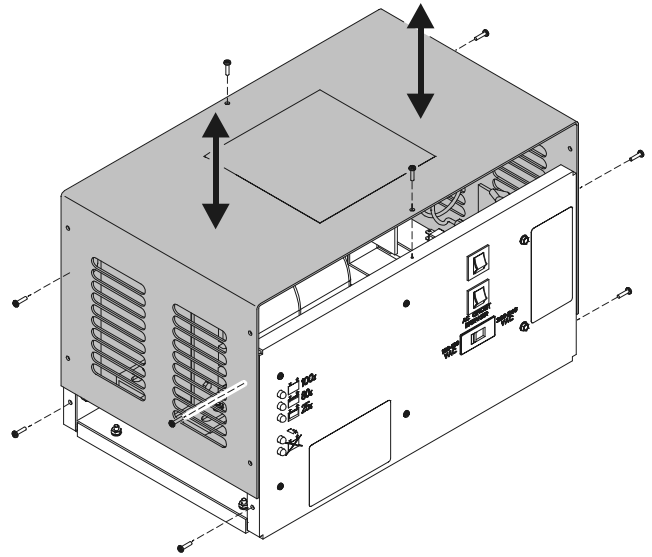
Replacement and troubleshooting of these components requires removal of the battery charger from it's mounting on the charger/battery box assembly.

Battery Charger Removal

1. If plugged in, unplug the AC voltage cord from AC receptacle and remove the charger/battery box unit from the machine.
2. Disconnect the + (RED) and - (BLACK) charging wires from the charger to the battery terminals in the lower battery compartment.
3. Remove the four (4) mounting bolts and washers located on the back of the upper battery box section, securing the charger into the upper section.
4. Remove the charger through the front opening while pulling the charging wires (RED/BLACK) through the hole on the bottom of the upper battery box section.

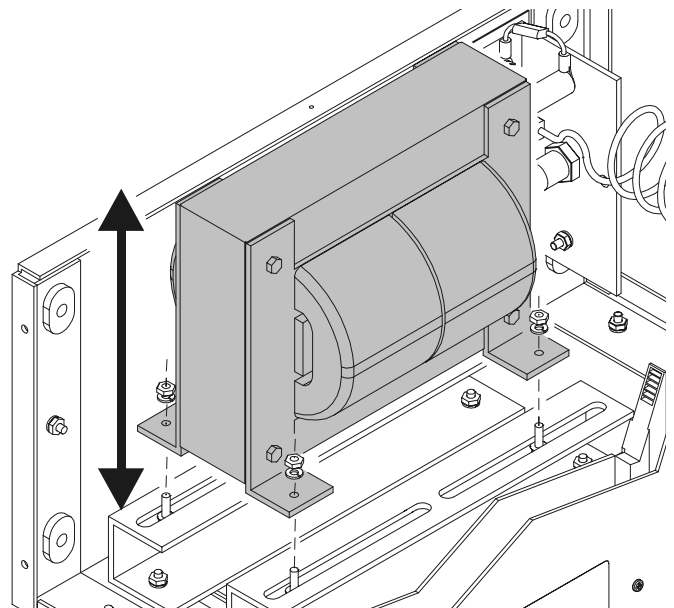
Cover Removal

5. Remove the ten (10) screws on the sides and top of the charger cover and remove cover.



Transformer Replacement

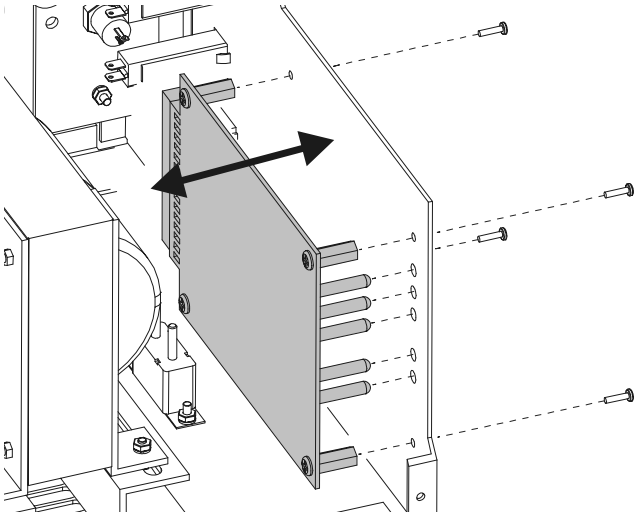
1. Disconnect the wiring connecting the transformer to other components within the charger assembly.
2. Remove the four nuts from the cap screws securing the transformer brackets to the base of the charger chassis.
3. Remove transformer.



SECTION 2 - SERVICE PROCEDURES

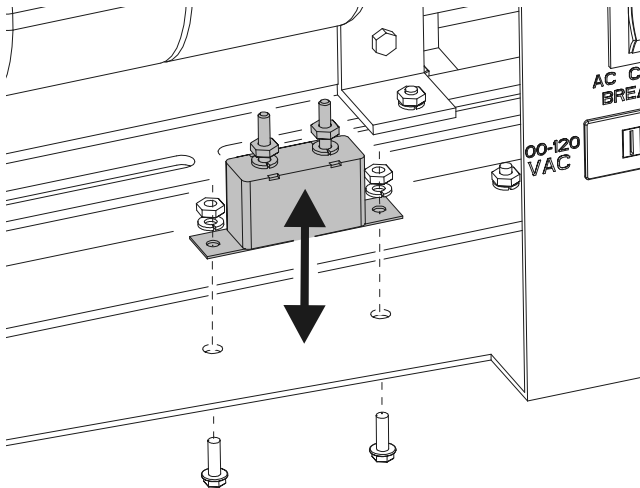
Printed Circuit Board Replacement

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.



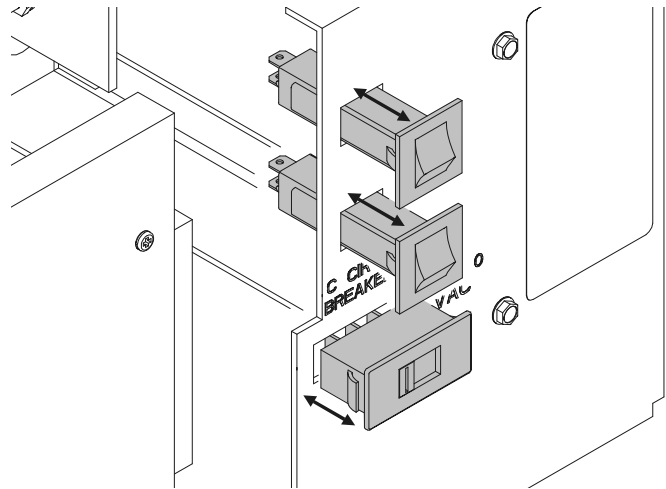
DC Circuit Breaker Replacement

1. Remove the wiring from the breaker terminals.
2. Remove the bolt, nut and washer from each side of the breaker, remove the breaker from the housing.



AC Circuit Breaker and Voltage Selection Switch Replacement

1. Remove the wiring from the AC breaker or Voltage Selection Switch terminals.
2. To remove the breaker or switch 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/switch assembly and remove the assembly out the front of the charger.



Shunt Assembly, Varistor, and SCR Rectifier Replacement (See Illustration)**Shunt Assembly (Item #1)**

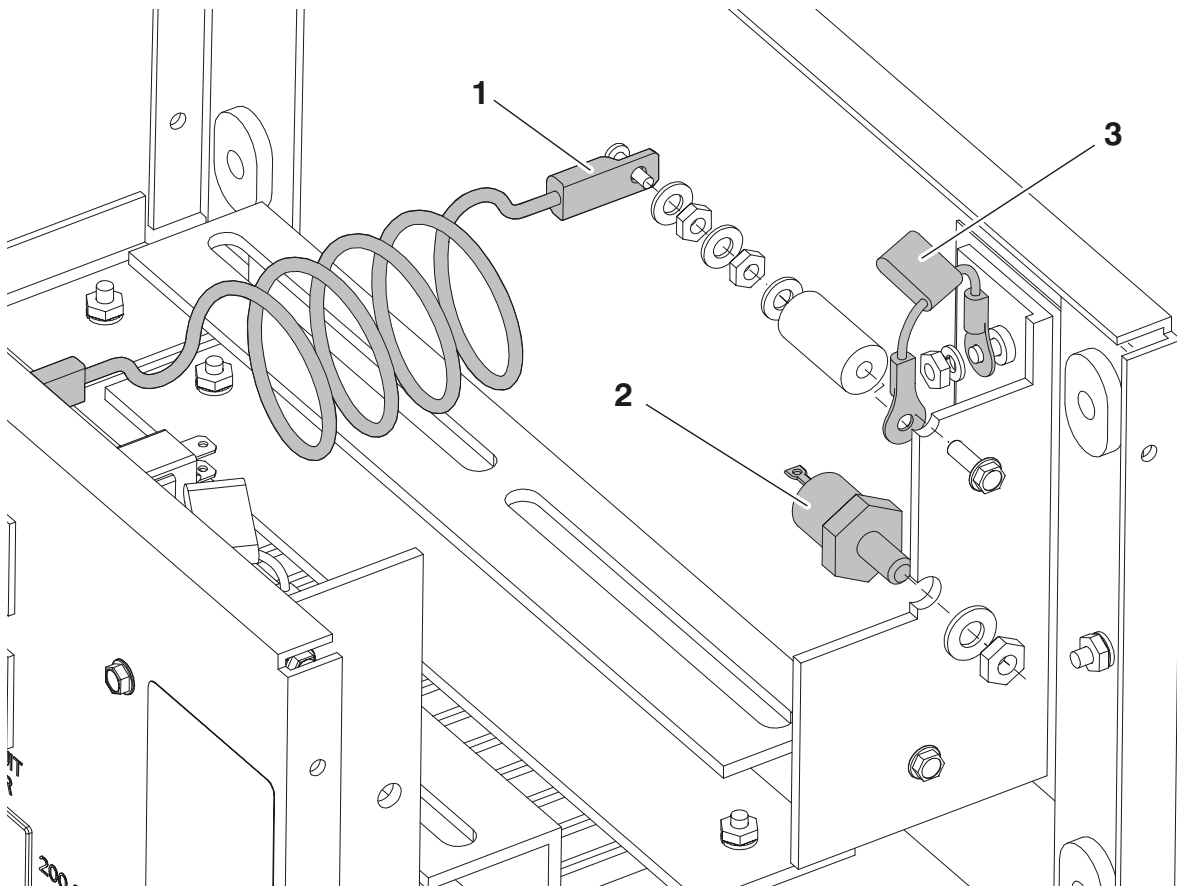
1. Carefully remove the screw from the end of the shunt assembly. The white insulator may need to be restrained to keep it from turning while removing the shunt assembly fasteners. Also make note of the position of each washer, nut and wire connector when removing for later assembly.

SCR Rectifier Replacement (Item #2)

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.

Varistor Replacement (Item #3)

1. Remove the fasteners securing the varistor to the aluminum angle bracket (see illustration below). One through the rear panel of the base with a short white spacer and one at the long white insulator attaching the shunt assembly to the bracket.
2. Remove the varistor from it's mount.



2.6 HYDRAULIC LIFT CYLINDER - REMOVAL, INSPECTION AND REBUILD

WARNING

HYDRAULIC CYLINDERS ARE DESIGNED TO HOLD HYDRAULIC FLUID UNDER HIGH PRESSURE. BE SURE ALL APPROPRIATE MEASURES ARE TAKEN TO RELIEVE RESIDUAL PRESSURE IN THE CYLINDER BEFORE DISCONNECTING LINES.

Disassembly

1. Disconnect power source. *(Remove the DC power pack/charger assembly from back of mast, if so equipped).*
2. Remove ground control (pump) cover.
3. Disconnect the hydraulic lines at the pump.
4. Using suitable lifting equipment, lay machine down horizontal onto the back of mast to allow access to the bottom of the machine. *(Preferably on an elevated work surface capable of supporting the full weight of the machine).*
5. Slide *(extend)* the mast out the top about 2 ft. to 3 ft. to allow access to the cylinder attach setscrew on the attach block at the top of mast section-2.
6. Remove the cylinder attach setscrew from the attach block on top of mast section-2. *(Lowest set of sheaves).*
7. Remove the protective mast cylinder/hydraulic line cover plate from the base frame under the mast.

NOTE: *(Use a container to catch the hydraulic oil from cylinder and hydraulic lines in next step, discard oil).*

8. Remove the hydraulic lines from the mast cylinder.
9. Remove the one (1) 5/16" bolt securing the cylinder to the cylinder mount and the four (4) 1/2" bolts securing the cylinder mount to the mast section-1 side rails.

NOTE: *In the following step the mast cylinder mount will be shimmed tight in the mast.*

10. Remove the cylinder mast mount from the mast.

NOTE: *In the following step the mast cylinder may be tight in the cylinder attach block at the top of the mast.*

11. Pull the mast cylinder out of the mast.

Cylinder Disassembly

12. Before disassembling the cylinder, clean away all dirt and foreign substances from openings, particularly the head area.

NOTE: *Always protect the chrome surface of the cylinder rod during assembly and disassembly. Any damage to this surface will require replacement of the rod.*

13. Extend the rod until the piston bottoms out against the cylinder head.
14. Compress the head retraining ring enough to allow the the cylinder head to be removed.
15. Carefully slide the head/rod/piston assembly out of the cylinder tube. A gentle tap on the head assembly may be required to remove the head from the cylinder tube.
16. Place the head/rod/piston assembly on a surface that will not damage the chrome.
17. Remove the piston locknut and separate the piston from the rod.
18. Slide the head off the rod from the piston end.

NOTE: *When removing the old seals use only blunt tools, be sure there are no sharp edges that may damage the seal grooves during removal. Scratching the groove may cause by-pass.*

19. Remove and discard all old seals.

Lift Cylinder Component Inspection

Cylinder Rod

There should be no scratches or pits deep enough to catch the fingernail. Pits that go to the base metal are unacceptable. Scratches that catch the fingernail but are not to the base metal, less than 0.5 inch long and primarily in the circumferential direction are acceptable provided they cannot cut the rod seal. Chrome should be present over the entire surface of the rod and the lack thereof is unacceptable. In the event that an unacceptable condition occurs, the rod should be repaired or replaced.

Cylinder Head

Visually inspect the inside bore for scratches or polishing. Deep scratches are unacceptable. Polishing indicates uneven loading and when this occurs, the bore should be checked for out-of-roundness. If out-of-roundness exceed 0.007", this is unacceptable. Check the condition of the dynamic seals (wiper, rod seals) looking particularly for metallic particles embedded in the seal surface. It is normal to cut the static seal on the retaining ring groove upon disassembly. Remove the rod seal, static o-ring and backup and rod wiper. Damage to the seal grooves, particularly on the sealing surfaces, is unacceptable. In the event that an unacceptable condition occurs, the head should be replaced.

Piston

Visually inspect the outside surface for scratches or polishing. Deep scratches are unacceptable. Polishing indi-

cates uneven loading and when this occurs, the diameter should be checked for out-of-roundness. If out-of-roundness exceeds 0.007", this is unacceptable. Check the condition of the dynamic seals and bearings looking particularly for metallic particles embedded in the bearing and in the piston seal surface. Remove the seals and bearings. Damage to the seal grooves, particularly on the sealing surfaces, is unacceptable. In the event that an unacceptable condition occurs, the piston should be replaced.

Tube Assembly

Visually inspect the inside bore for scratches and pits. There should be no scratches or pits deep enough to catch the fingernail. Scratches that catch the fingernail but are less than 0.5 inch long and primarily in the circumferential direction are acceptable provided they cannot cut the piston seal. The roughness of the bore should be between 10 and 20 μ inches RMS. Significant variation (greater than 8 μ inches difference) are unacceptable. In the event that an unacceptable condition occurs, the tube assembly should be repaired or replaced.

Cylinder Assembly

(See Figure 2-1.)

1. Rinse the inside of the tube with hydraulic fluid and allow to drain. A high-pressure rinse followed by a wipe with a lint-free rag is preferable. Clean all internal components of any foreign material.
2. Lubricate the head and all seals with hydraulic fluid prior to installation. Install the seal, wiper, o-ring, back-up ring, and retraining ring to the cylinder head.
3. Lubricate the piston and all components with hydraulic fluid. Install the seal and wear ring to the piston.

NOTE: Re-check that seals are not twisted or pinched and are properly seated.

4. Place the rod on a clean table. Install the static o-ring seal into the groove on the piston end of the rod.
5. Install the head followed by the piston onto the rod noting the proper orientation of each component. Torque the piston nut to 175-200 ft. lbs.

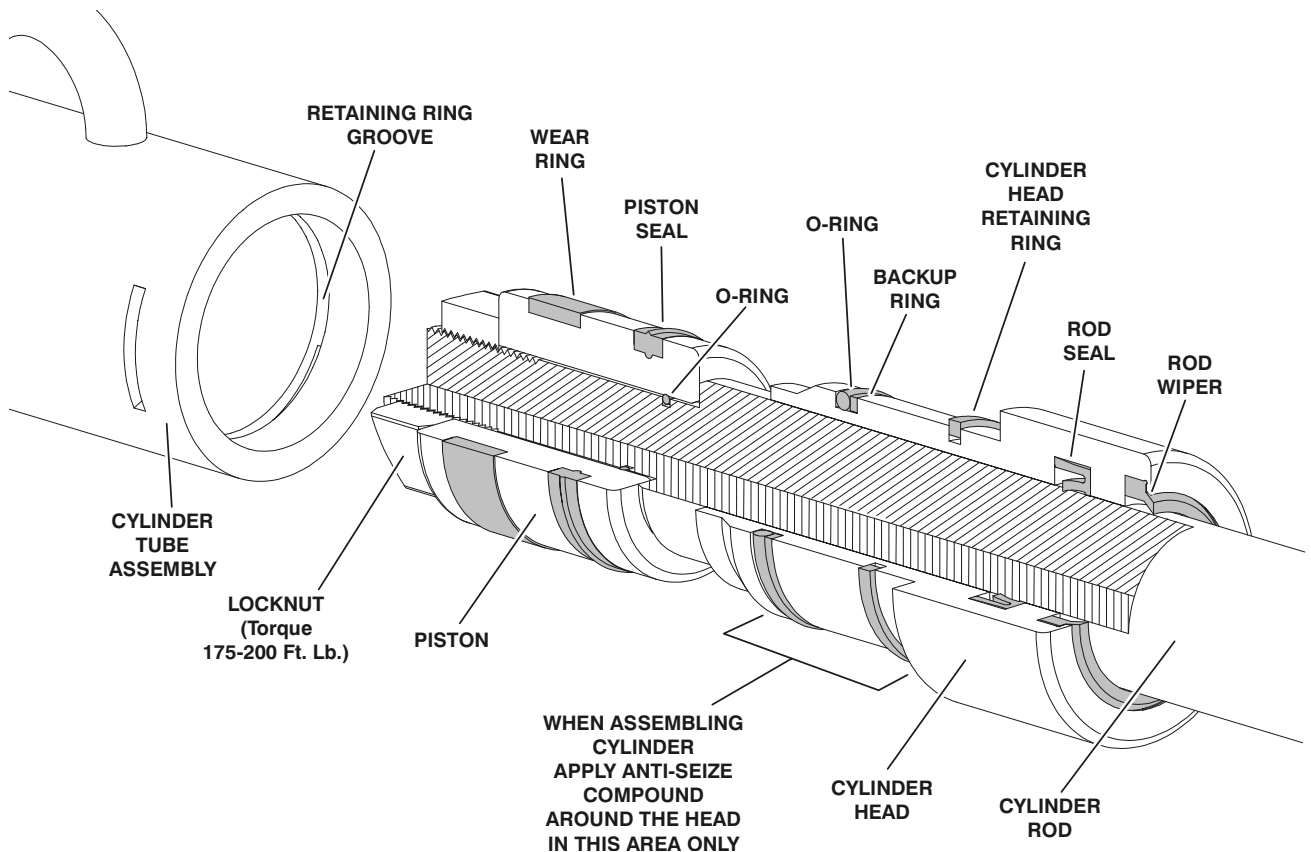


Figure 2-1. Lift Cylinder Internal Component Assembly Cross-Section.

SECTION 2 - SERVICE PROCEDURES

6. When the rod assembly is ready to be installed into the tube, liberally apply an anti-seize lubricant to the head outer surface, especially the static seal.
7. Next dip the entire rod assembly into hydraulic fluid and stuff this assembly into the tube. Watch the seals as they pass over the rod port (if visible) to be sure they are not nicked or cut.
8. Install the head until the retaining ring seats in it's groove.

Installation

1. Remove the plastic plugs from the cylinder.
2. Pull rod out of cylinder approximately 3 ft.

NOTE: *The following step is easier done with two people, one to slide the cylinder into the mast, the other to guide the rod into the cylinder block at the top of the mast.*

3. Slide the cylinder into the mast and install the rod into the cylinder attach block.
4. Apply Loctite #222 (purple) to the setscrew securing the lift cylinder rod to the sheave wheel anchor block at the top of mast section-2.
5. Install the setscrew in the cylinder attach block at the top of the mast, coat the threads of the setscrew with Loctite (RC/#640-blue) before tightening.

6. Install the cylinder mount at the bottom of the mast using the four (4) 1/2" bolts. Re-shim to eliminate any side clearance to prevent any strain on the sides of the mast when the bolts are tightened.
7. Install the one (1) 5/16" bolt, securing the mast cylinder to the cylinder mount.
8. Connect the hydraulic fittings and lines, (*new fittings should be used*).
9. Slide the mast together (*stowed position*) from the top of the mast.
10. Stand machine upright on it's base wheels.
11. Connect the hydraulic line fittings at the pump.
12. Check oil level in the hydraulic oil reservoir, add oil to fill line, if necessary.
13. Install the ground station (*pump*) cover.
14. Set-up machine for operation and cycle mast (*up and down*) approximately 3 ft. to 4 ft. a few times.
15. Check the hydraulic oil reservoir again, add oil to the fill line.

2.7 MAST ASSEMBLY AND DISASSEMBLY PROCEDURES

The EL Series personnel lift mast sections are constructed of extruded aluminum, protected with an anodized surface finish. The mast sections rails are interlocked into each other when assembled and are guided by slide pads mounted at the top and bottom of the rails on both sides of the mast section.

The current EL model line mast assemblies have been designed with either five (5), six (6) or seven (7) mast sections as shown following;

Table 2-4. EL Series Mast Component Features

Model	No. of Mast Sections	Extend Device
20EL	5	Chain & Cable
25EL / 36EL	6	Chain & Cable
30EL / 41EL	7	Chain & Cable

Assembly procedures for all mast assemblies is basically the same, carefully slide the mast sections together from bottom until mast ends are even, *(when sliding mast sections together be careful not to scratch the anodized surface in the slide pad channels)*. Assemble the hardware to

the bottom of mast section first, then slide this section out the top of previous section and assemble hardware to the top of mast, *(See Figure 2-2.)*. Always install slide pad shims with slide pads inserted into the slide pad channels, (ends of mast sections even).

Mast Disassembly Procedure

(See Figure 2-2.)

NOTE: Reference to mast sections-5/-6/-7 made following is dependent on which model machine you are servicing since the 20 ft. machines use five (5) mast sections, the 25 and 36 ft. models use six (6) mast sections, the 30 and 41 ft. models use seven (7) mast sections .

1. After the platform and other hardware have been removed from the mast, and mast has been removed from machine, lay mast assembly down with the shortest mast section-5/-6/-7 on top and facing up.
2. Remove sequencing retract cables from sides of mast assembly and the mini covers from the top of each mast section. Also, remove the latch bar assembly from BOTTOM of mast section-5/-6/-7.

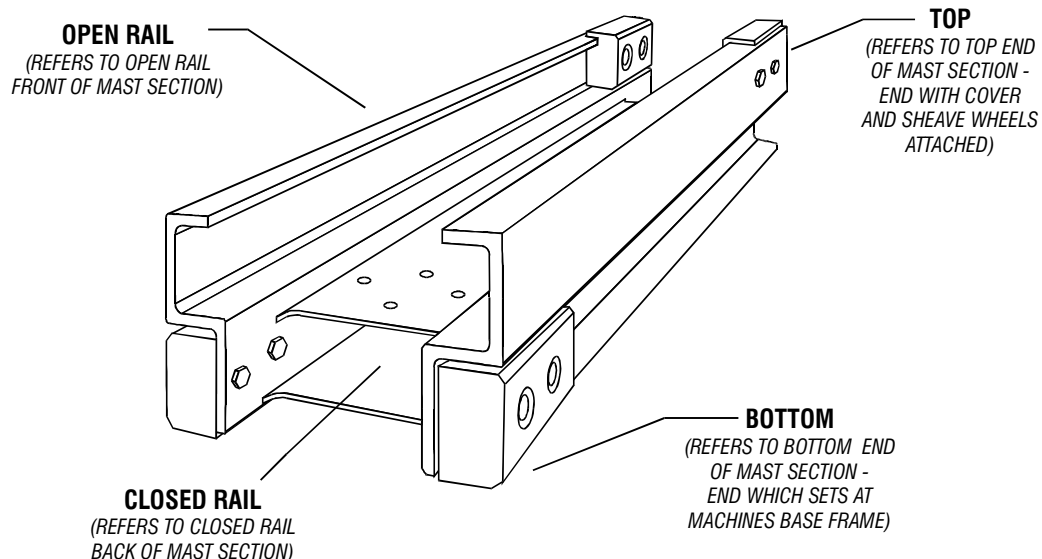


Figure 2-2. Mast Section - Assembly/Disassembly Reference.

SECTION 2 - SERVICE PROCEDURES

Platform Section Removal (All Masts)

3. Remove cable adjust nuts from threaded ends of cable attached to the cable anchor plate on BOTTOM end of mast section-5/-6/-7 (*short, platform mounting section*). Push threaded ends of cable through anchor plate
4. At TOP of mast section-5/-6/-7, pull cables out and allow to hang loose.

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

5. Carefully slide short mast section-5/-6/-7 out BOTTOM of mast section-4/-5/-6 rails. Disassemble slide pads, shims and cable anchor plate from mast section-5/-6/-7, if necessary.

Mast Section 6 Removal (7 Section Mast)

NOTE: Steps 6 through 10 apply to removal of mast section-6 used on 30 & 41 ft. models which have seven (7) mast sections. If disassembling a six (6) section 25 or 36 ft. mast, go to step 11, if disassembling a five (5) section 20 ft. mast continue to step 17.

6. Remove cable adjust nuts from threaded ends of cable attached to the cable anchor plate on bottom end of mast section-6. Push threaded ends of cable through anchor plate.
7. At top of mast section-6, pull cables out and allow to hang loose.
8. Slide mast section-6 out TOP of mast section-5 far enough to allow access to the cable sheave wheel assembly.
9. Remove countersunk-flathead screws securing cable sheave wheel assembly attach bars on both side rails at top of mast section-6 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-6 out BOTTOM of section-5. Remove slide pads, shims and cable anchor plate, if necessary.

Mast Section 5 Removal (6 & 7 Section Mast)

NOTE: Steps 11 through 15 apply to removal of mast section-5 used on 25, 30, 36 & 41 ft. models. If servicing a 20 ft. mast, go to step 17.

11. Remove cable adjust nuts from threaded ends of cable attached to the cable anchor plate on bottom

end of mast section-6. Push threaded ends of cable through anchor plate.

12. At top of mast section-5, pull cables out and allow to hang loose.
13. Slide mast section-5 out TOP of mast section-4 far enough to allow access to the cable sheave wheel assembly.
14. Remove countersunk-flathead screws securing cable sheave wheel assembly attach bars on both side rails at top of mast section-6 and remove sheave wheel assembly.

NOTE: Step 15 applies to removal of the cable assemblies used on mast section-5 of 30 & 41 ft. models. If servicing a 25 or 36 ft. mast, go to step 16.

15. While mast section-5 is still extended from section-4 remove the bolts attaching the two (2) cable assembly anchor eyelets to the TOP of mast section-5. Remove cables.

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-5 out BOTTOM of section-4. Remove slide pads, shims and cable anchor plate, if necessary.

Mast Section 4 Removal (All Masts)

17. Remove chain adjust nuts from threaded ends of chain attached to the chain anchor plate on BOTTOM end of mast section-4. Push threaded ends of cable through anchor plate.
18. At TOP of mast section-4, 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 or lay chains in a clean bucket*).
19. Slide mast section-4 out TOP of mast section-3 far enough to allow access to the cable sheave wheel assembly.
20. Remove countersunk-flathead screws securing cable sheave wheel assembly attach bars on both side rails at TOP of mast section-4 and remove sheave wheel assembly.
21. While mast section-4 is still extended from section-3 remove the bolts attaching the two (2) cable assembly anchor eyelets to the TOP of mast section-4. Remove cables.

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

Mast Section 3 Removal (All Masts)

23. 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 cable through anchor plate.
24. 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 or lay chains in a clean bucket).*
25. Slide mast section-3 out TOP of mast section-2 far enough to allow access to the chain sheave wheel assembly.
26. Remove countersunk flathead screws securing chain sheave wheel assembly attach bars on both side rails at TOP of mast section-3 and remove sheave wheel assembly.
27. While mast section-3 is still extended from section-2 remove the bolts attaching the two (2) chain assembly anchor blocks 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.*

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

Mast Section 2 Removal (All Masts)

29. Slide mast section-2 out TOP of mast section-1 far enough to allow access to the chain anchor block/sheave wheel assembly.
30. Remove countersunk-flathead screws securing chain anchor block/sheave wheel assembly attach bars on both side rails at TOP of mast section-2.
31. 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 the chain assembly anchor block.
32. Remove the setscrew holding the hydraulic cylinder rod into the chain assembly anchor block. Lay chain assembly to side.
33. Remove the hydraulic cylinder through the 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.*

34. Carefully slide mast section-2 out BOTTOM of section-1. Remove slide pads and shims, if necessary.

Mast Section 1 Disassembly (All Masts)

35. Slide the TOP of the remaining mast section-1 out over edge of work surface and remove the bolts attaching the anchor blocks of the two (2) chain assemblies to mast section-1. Remove chain assemblies from mast and lay aside.
36. Remove slide pads and shims from mast section-1, if necessary.

Mast disassembly should now be complete.

2.8 MAST ASSEMBLY

(See Figure 2-3., Figure 2-4. or Figure 2-5.)

Mast Section 1 - Assembly (All Masts)

1. Place mast section-1, rail (open) side up (See Figure 2-1.) 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 (*wide*) chain assemblies. Lay out each chain assembly with anchor block end towards mast, and notched end of block down, (*be certain floor surface is clean and free of any metal chips or debris which may stick to lubricated chains or lay chains in a clean bucket*).
3. Insert the block anchor end (with notched end on bottom) into the top of mast section-1 and secure using two (2) 3/8"-16UNC x 2-1/2" long hex head bolts, flatwashers and nuts for each attach block. Place a flatwasher under bolt head and nut.

Mast Section 2 - Assembly (All Masts)

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.
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. Start with a .036" thick shim and a .075" thick shim per side at each slide pad.
- b. Slide shims into place between slide pad and mast rail. Tighten the slide pad mounting bolts, be sure there are no air gaps between shims, shim and mast or shim and slide pad when tightened.

- c. Check mast section for side play. If play exists add .015" shims dividing the thickness equally between both sides of mast. Insert shims until the shims cannot be inserted halfway by hand with the mast pulled to the opposite side.
- d. 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 snug in channels but still 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.

NOTE: Before fastening and shimming the slide pad on the top left side of the mast, install a sequence cable bracket against the mast under the flatwasher.

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, Mast Section 2 - Assembly.

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.
12. Insert hydraulic cylinder rod end into chain assembly anchor block. Secure cylinder rod to anchor block with a 1/4"-28UNF x .50" long - Type C set-screw. Coat threads with blue Loctite # 242 before assembly.
13. Locate chain assembly (*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 or lay chains in a clean bucket*).
14. Slide mast section-2 out of mast section-1 approximately one foot.
15. Assemble chain sheaves on chain assembly anchor block (*attached to cylinder rod end*) and attach to mast section-2 using following steps;

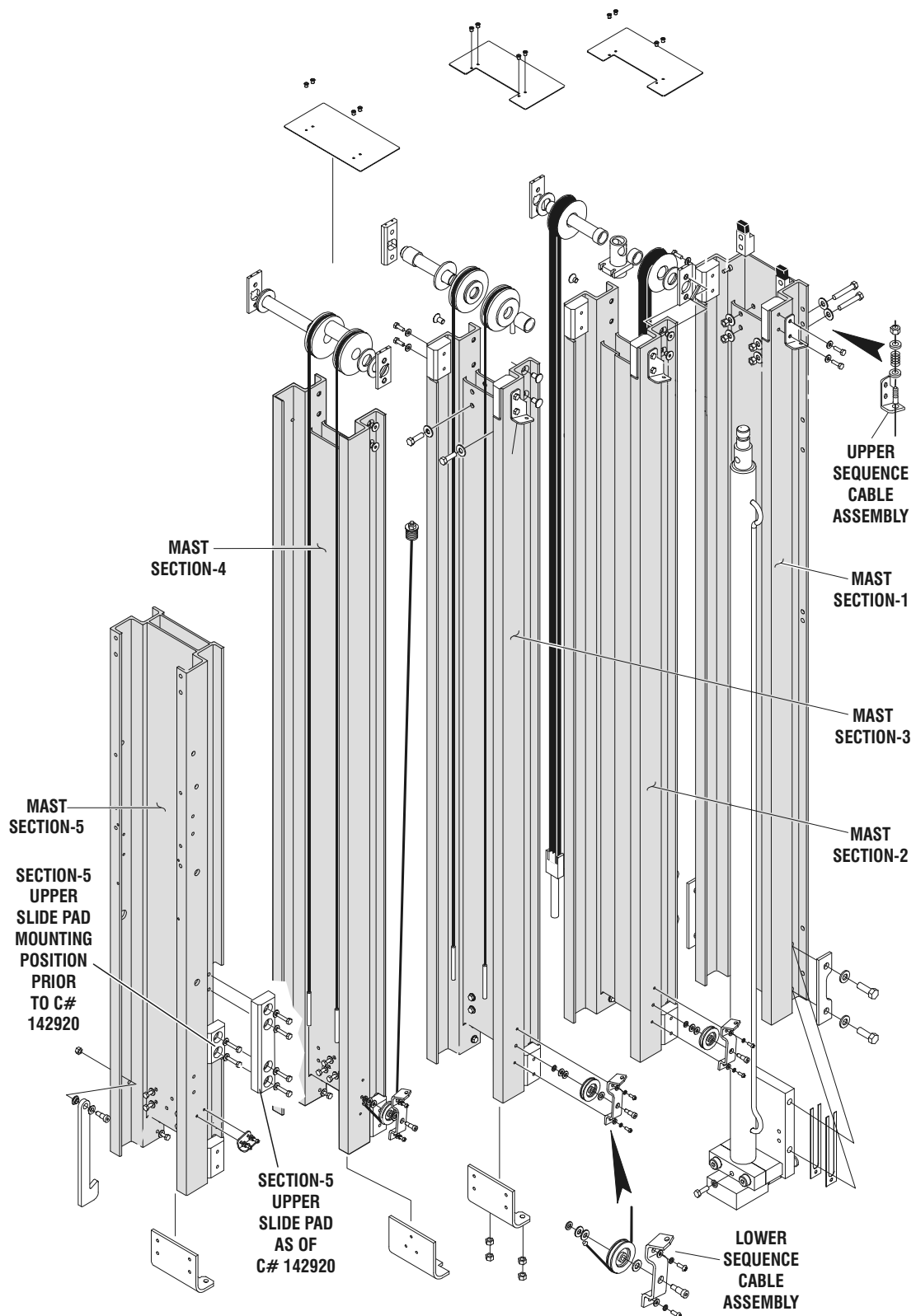


Figure 2-3. 20EL Mast Assembly Components. (5 - Section)

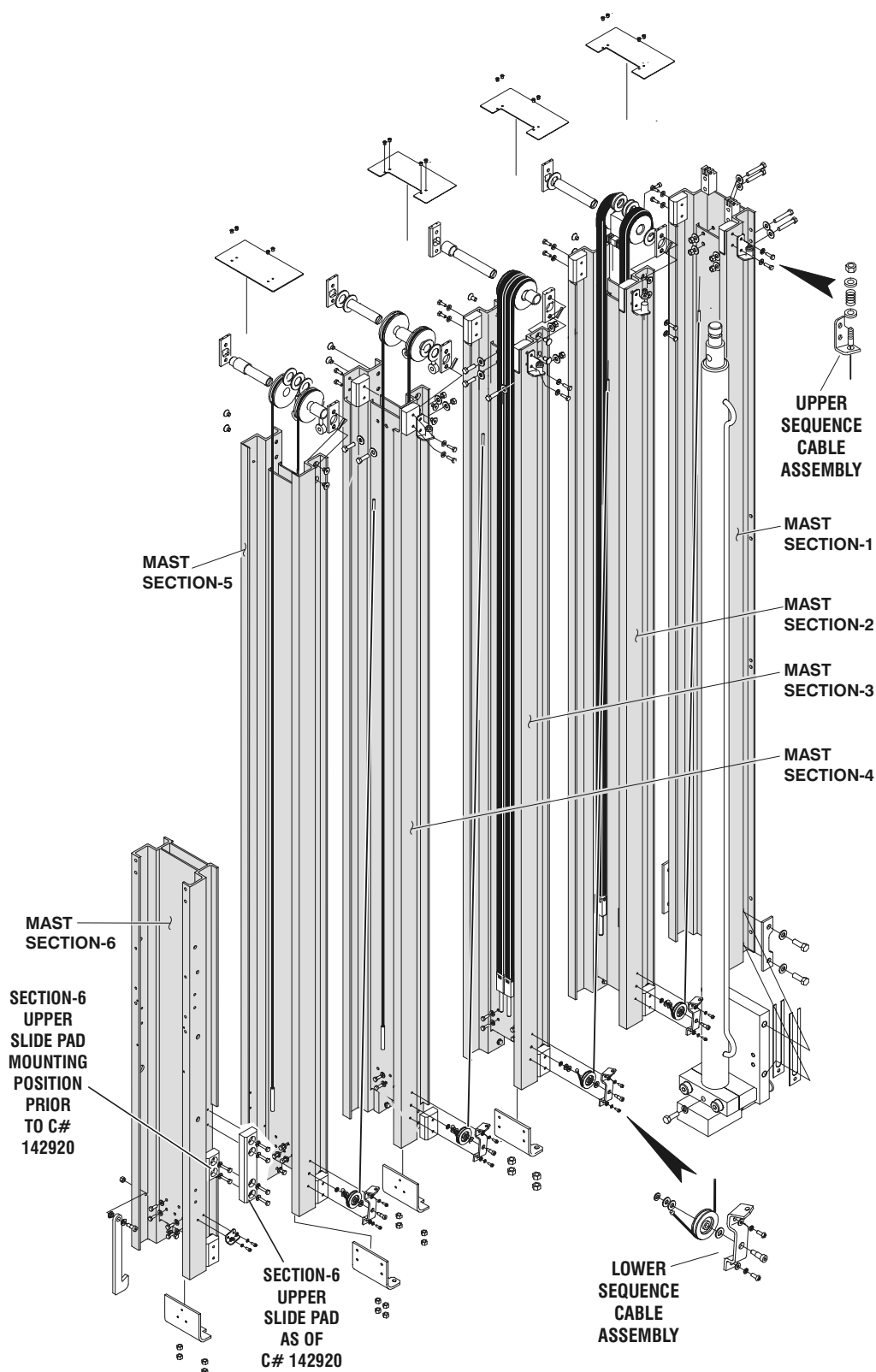


Figure 2-4. 25EL & 36EL Mast Assembly Components. (6 - Section)

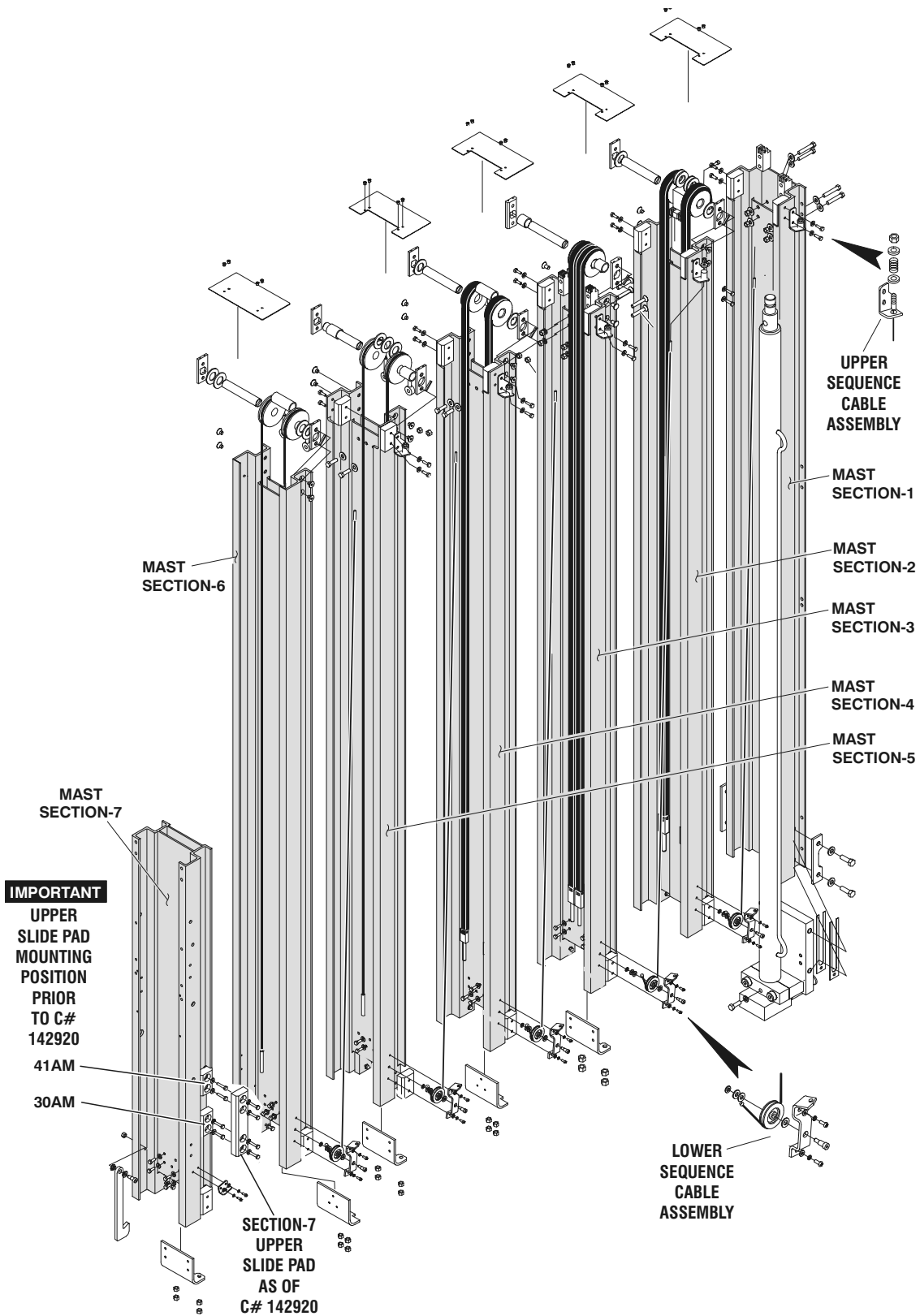


Figure 2-5. 30EL & 41EL Mast Assembly Components. (7 - Section)

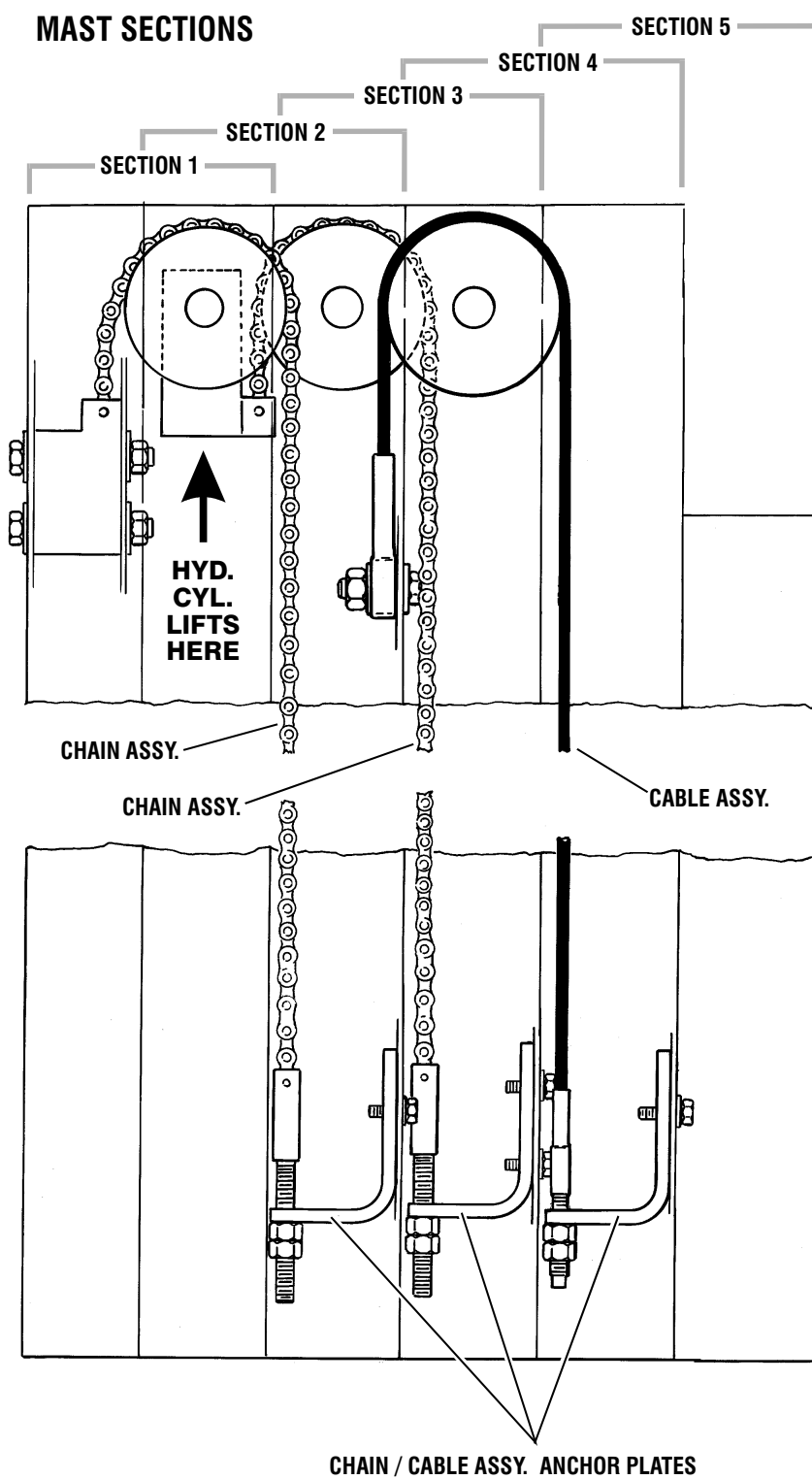


Figure 2-6. Mast Chain/Cable Routing Diagram.

- 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.
16. Slide mast section-2 back into section-1 until end are even.

Mast Section 3 - Assembly (All Masts)

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

- 17. Locate mast section-3, carefully slide section-3 closed rail into section-2 open rail. Slide sections together until ends are even.
 - 18. Locate one (1) of the chain/cable 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.
 - 19. Slide mast section-3, approximately two feet out of the top of mast section-2.
 - 20. Insert threaded ends of chain assembly (*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.
 - 21. Locate two cable assemblies. Attach the eyelet anchor end of each cable 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.
 - 22. Assemble chain sheaves (*for narrow chain assembly*) to top of mast section-3 as follows;
 - a. Locate the two (2) narrow 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.*
23. Carefully slide mast section-3 into section-2 until ends are even. Check to make sure chain assembly (*wide chains*) are seating properly in chain anchor block chain sheave wheels attached to mast section-2.
24. 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.
- NOTE:** *Before fastening and shimming the slide pad on the top left side of the mast, install a sequence cable bracket against the mast under the flatwasher.*
- 25. 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.
 - 26. Shim per instructions in step 7, Mast Section 2 - Assembly.
 - 27. 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.
 - 28. 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.
 - 29. Shim per instructions in step 7, Mast Section 2 - Assembly.

Mast Section 4 - Assembly (All Masts)

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

SECTION 2 - SERVICE PROCEDURES

30. Locate mast section-4, carefully slide section-4 closed rail into section-3 open rail. Slide sections together until ends are even.
31. Locate one (1) of the chain/cable 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.
32. Slide mast section-4 out the top of mast section-3 so the chain/cable 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.
33. Insert threaded ends of chain assembly (*attached to anchor block on top mast section-2*) through the chain/cable 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: Step 34 applies to 25 and 36 ft., six (6) section masts and 30 & 41 ft., seven (7) section masts only. For five (5) section 20 ft. masts skip to step 35.

34. While mast section-4 is still extended from section-3; locate two cable assemblies. Attach the eyelet anchor end of each cable 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.
35. While mast section-4 is still extended from section-3, assemble cable sheaves to top of mast section-4 as follows;
 - a. Locate the wide tube spacer and slide onto sheave pin.
 - b. Slide two (2) cable 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 cable sheave wheels.
 - d. Place two (2) sheave pin attach bars, one each end of sheave pin to outside of large flatwashers.
 - e. Holding complete cable 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.

36. Carefully slide mast section-4 back into section-3 until ends are even. Check to make sure chain assembly (*narrow chains*) are seating properly in chain sheave wheels attached to top of mast section-3.
37. 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.

NOTE: Before fastening and shimming the slide pad on the top left side of the mast, install a sequence cable bracket against the mast under the flatwasher.

38. 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.
39. Shim per instructions in step 7, Mast Section 2 - Assembly.
40. 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.
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 on inside rail, on bottom end of mast section-4 and into the slide pad inserts. Thread in enough to hold pad in place.
42. Shim per instructions in step 7, Mast Section 2 - Assembly.

Mast Section 5 - Assembly (25/30/36/41 ft. Masts)

NOTE: Steps 43 thru 56 apply to six (6) section 25 and 36 ft. and seven (7) section 30 and 41 ft. masts only. For five (5) section 20 ft. masts continue to step 70.

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

43. Locate mast section-5, carefully slide section-5 closed rail into section-4 open rail. Slide sections together until ends are even.
44. Locate one (1) of the chain/cable anchor plates (*one with threaded holes horizontally aligned to outside edges of bracket*). Attach through outer set of holes in bottom of mast section-5 with two (2) 1/4"-20UNC

x 3/4" long bolts, place a flatwasher under head of each bolt.

45. Slide mast section-5 out the top of mast section-4 so the chain/cable anchor plate on bottom of mast section-5 is easily accessible near top end of mast section-4. Rest the top end of mast section-5 on a support while performing next step.

46. Insert threaded ends of cable assembly (*attached to top of mast section-3*) through the chain/cable anchor plate located on bottom of extended mast section-5. 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.*

47. Slide mast section-5 back into section-4 except for a foot or two of length.

NOTE: *Steps 48 applies to seven (7) section 30 and 41 ft. masts only for six (6) section 25 and 36 ft. masts continue to step 49.*

48. Locate two cable assemblies. Attach the eyelet anchor end of each cable to the two inside holes near top of mast section-5 using 3/8"-16UNC x 1-1/4" long hex head bolts, nuts and flatwashers. Place a flatwasher under bolt head and nut.

49. While mast section-5 is still extended from section-4, assemble cable sheaves to top of mast section-5 as follows;

- a. Locate remaining sheave pin. Slide two (2) cable sheave wheels onto sheave pin and center.
- b. Place two (2) short spacer tubes on sheave pin, one on each end of sheave pin to outside of sheave wheels.
- c. Place two (2) sheave pin attach bars, one on each end of sheave pin to outside of short spacer tubes.
- d. Holding complete cable sheave wheel assembly, slide assembly into top of mast section-5 and align threaded holes in sheave pin attach bars with holes in mast rails.
- e. Attach to top of mast section-5 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.*

50. Carefully slide mast section-5 back into section-4 until ends are even. Check to make sure cable set from top of section-3 is seating properly in cable

sheave wheels attached to top of mast section-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*).

51. Insert slide pads into the top end mast rails between section-4 and -5, (*one on each side of the mast*), with beveled surface facing inward towards section-5.

NOTE: *Before fastening and shimming the slide pad on the top left side of the mast, install a sequence cable bracket against the mast under the flatwasher.*

52. 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-4 and into the slide pad inserts. Thread in enough to hold pad in place.

53. Shim per instructions in step 7, Mast Section 2 - Assembly.

54. Insert slide pads into the bottom end mast rails between section-4 and -5, (*one on each side of the mast*), with beveled surface facing out towards section-4.

55. 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.

56. Shim per instructions in step 7, Mast Section 2 - Assembly.

Mast Section 6 - Assembly (30/41 ft. Masts)

NOTE: *Steps 57 thru 69 install section-6 to a seven (7) section 30 and 41 ft. mast. If assembling a six (6) section 25 or 36 ft. mast, skip to step 70.*

57. Locate mast section-6, carefully slide section-6 closed rail into section-5 open rail. Slide sections together until ends are even.

58. Locate one (1) of the chain/cable anchor plates (*one with threaded holes horizontally aligned to outside edges of bracket*). Attach through outer set of holes in bottom of mast section-6 with two (2) 1/4"-20UNC x 3/4" long bolts, place a flatwasher under head of each bolt.

59. Slide mast section-6 out the top of mast section-5 so the chain/cable anchor plate on bottom of mast section-6 is easily accessible near top end of mast section-5. Rest the top end of mast section-6 on a support while performing next step.

SECTION 2 - SERVICE PROCEDURES

60. Insert threaded ends of cable assembly (*attached to top of mast section-4*) through the chain/cable anchor plate located on bottom of extended mast section-6. Loosely thread two (2) 3/8"-16UNC nuts onto stud threads on each chain. Chains will be adjusted later in assembly.
61. Slide mast section-6 back into section-5 except for a foot or two of length.
62. While mast section-6 is still extended from section-5, assemble cable sheaves to top of mast section-6 as follows;
 - a. Locate remaining sheave pin. Slide two (2) cable sheave wheels onto sheave pin and center.
 - b. Place two (2) short spacer tubes on sheave pin, one on each end of sheave pin to outside of sheave wheels.
 - c. Place two (2) sheave pin attach bars, one on each end of sheave pin to outside of short spacer tubes.
 - d. Holding complete cable sheave wheel assembly, slide assembly into top of mast section-6 and align threaded holes in sheave pin attach bars with holes in mast rails.
 - e. Attach to top of mast section-6 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.*

63. Carefully slide mast section-6 back into section-5 until ends are even. Check to make sure cable set from top of section-4 is seating properly in cable sheave wheels attached to top of mast section-5. (*Mast sections-3, -4 and -5 may need to be restrained to keep their slide pads from pushing out the bottom of mast sections-2, -3 and -4*).
64. Insert slide pads into the top end mast rails between section-5 and -6, (*one on each side of the mast*), with beveled surface facing inward towards section-6.

NOTE: *Before fastening and shimming the slide pad on the top left side of the mast, install a sequence cable bracket against the mast under the flatwasher.*

65. 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-5 and into the slide pad inserts. Thread in enough to hold pad in place.

66. Shim per instructions in step 7, Mast Section 2 - Assembly.
67. Insert slide pads into the bottom end mast rails between section-5 and -6, (*one on each side of the mast*), with beveled surface facing out towards section-5.
68. 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.
69. Shim per instructions in step 7, Mast Section 2 - Assembly.

Platform Mounting Section - Assy. (All Masts)

NOTE: *Reference to mast sections-5/-6/-7 made following is dependent on which model machine you are servicing since the 20 ft. machines use five (5) mast sections, the 25 and 36 ft. models use six (6) mast sections, the 30 and 41 ft. models use seven (7) mast sections.*

70. Locate the remaining mast section-5/-6/-7 (*platform mounting - mast section*). Lay mast section on flat stable surface.
71. Attach the remaining chain/cable anchor plate (*one with threaded holes vertically aligned in center of bracket*). Attach through inner (*vertical*) set of holes in bottom of mast section-5/-6/-7 with two (2) 1/4"-20UNC x 3/4" long bolts, place a flatwasher under head of each bolt.

NOTE: *The platform mounting section slide pads, are assembled differently than the slide pads for the other mast sections. Mast section-5/-6/-7 slide pads may need to be assembled/disassembled several times in order to determine the correct shim stock required for proper fit.*

72. Complete the following steps to determine shim stock thickness required for section-5/-6/-7;

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.
- c. Attach shim stock and slide pads to both sides of mast section-5/-6/-7 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).

⚠ IMPORTANT

PRIOR TO C# 142920 THE EL MAST INSTALLED TWO SHORT SLIDE PADS ON EACH SIDE OF THE PLATFORM MOUNTING MAST SECTION. AS OF C# 142920 A LONGER SINGLE PAD IS INSTALLED ON EACH SIDE.

ON MACHINES PRIOR TO C# 142920 THE 41EL MOUNTS THE (SHORT) UPPER SLIDE PAD IN THE UPPER SET OF SLIDE PAD MOUNTING HOLES. THE 20EL, 25EL, 30EL AND 36EL MACHINES MOUNT THE UPPER SLIDE PAD IN THE LOWER SET OF SLIDE PAD MOUNTING HOLES. (SEE FIGURE 2-5.)

- d. Carefully thread the slide pad mounting bolts with flatwashers through slide pads and shim stock into threads in mast section-5/-6/-7. Be certain there are no air gaps between shims, shim and mast or shim and slide pad when tightened.

NOTE: *Mast section-5/-6/-7 into section-4/-5/-6 fit should be very snug but still be able to be pushed together by hand. If too tight, remove section-5/-6/-7, disassemble slide pad and reduce thickness of shim stock.*

- e. Begin sliding top of mast section-5/-6/-7 with closed rail down engaging the slide pads into slide pad channels at bottom of mast section-4/-5/-6's open rail. Continue to push section-5/-6/-7 into section-4/-5/-6 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.
- 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.

- 73. Slide mast section-5/-6/-7 to top of section-4/-5/-6.
- 74. Insert threaded ends of cable assembly (*attached to top of mast section-3/-4/-5*) through the cable anchor plate located on bottom of extended mast section-5/-6/-7. Loosely thread two (2) 3/8"-16UNC nuts onto stud threads on each chain. Chains will be adjusted later in assembly.
- 75. Slide mast section-5/-6/-7 back into mast section-4/-5/-6 until bottom ends of masts are even. Check to make sure cable set attached to top of section-3/-4/-5 is seating properly in cable sheave wheels attached to top of mast section-4/-5/-6. (*Mast sections-2, -3, -4 and -5 may need to be restrained to keep their slide pads from pushing out the bottom of mast sections-1, -2, -3, -4 and -5*).
- 76. Adjust top and bottom ends of mast sections so they are all even with each other. At bottom of mast assembly, thread all chain/cable adjusting nuts on threaded ends until they are snug against the anchor plates and all slack is removed from chains and cables. Check that chains and cables are seated in their sheave wheels at top of mast assembly.
- 77. Assemble the latch bar to mast section-5/-6/-7, the mini covers to the top of each mast section and the sequencing cables and hardware to the side of the mast assembly.

Mast assembly should now be complete.

2.9 MAST TO BASE FRAME INSTALLATION

1. Using an overhead crane or suitable lifting device capable of supporting the weight of base frame, attach a sling strap or chain to the front crossmember of the base frame, raise base frame.
2. Extend hydraulic cylinder out from bottom of mast assembly approximately one (1) foot. *(Caps on extend and return ports will need to be removed to extend cylinder. Catch any hydraulic fluid expelled from return port in a container to prevent spillage onto work area).*
3. Bring base frame into position in front of mast assembly, *(base frame and mast assembly must be held at 90° angle to each other).*
4. 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).*
5. 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.
6. 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.
7. 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).*
8. 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).*
9. 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.
10. Carefully set machine in an upright position on its base frame wheels.
11. 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).*
12. Using a 4 ft. level, ensure mast is set to vertical (plumb) on the base frame.
13. 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).*
14. After securing mast to base frame, using 4 ft. level again check that mast is vertical (plumb) on base frame.

Mast installation should now be complete.

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. Also to step each front mast section up approximately 1/4 in. (6.5mm) from the section behind it to allow clearance for the individual mast section covers.

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 obtain the 1/4 in. (6.5mm) step for mast sections-3 and up. (See Figure 2-7.)

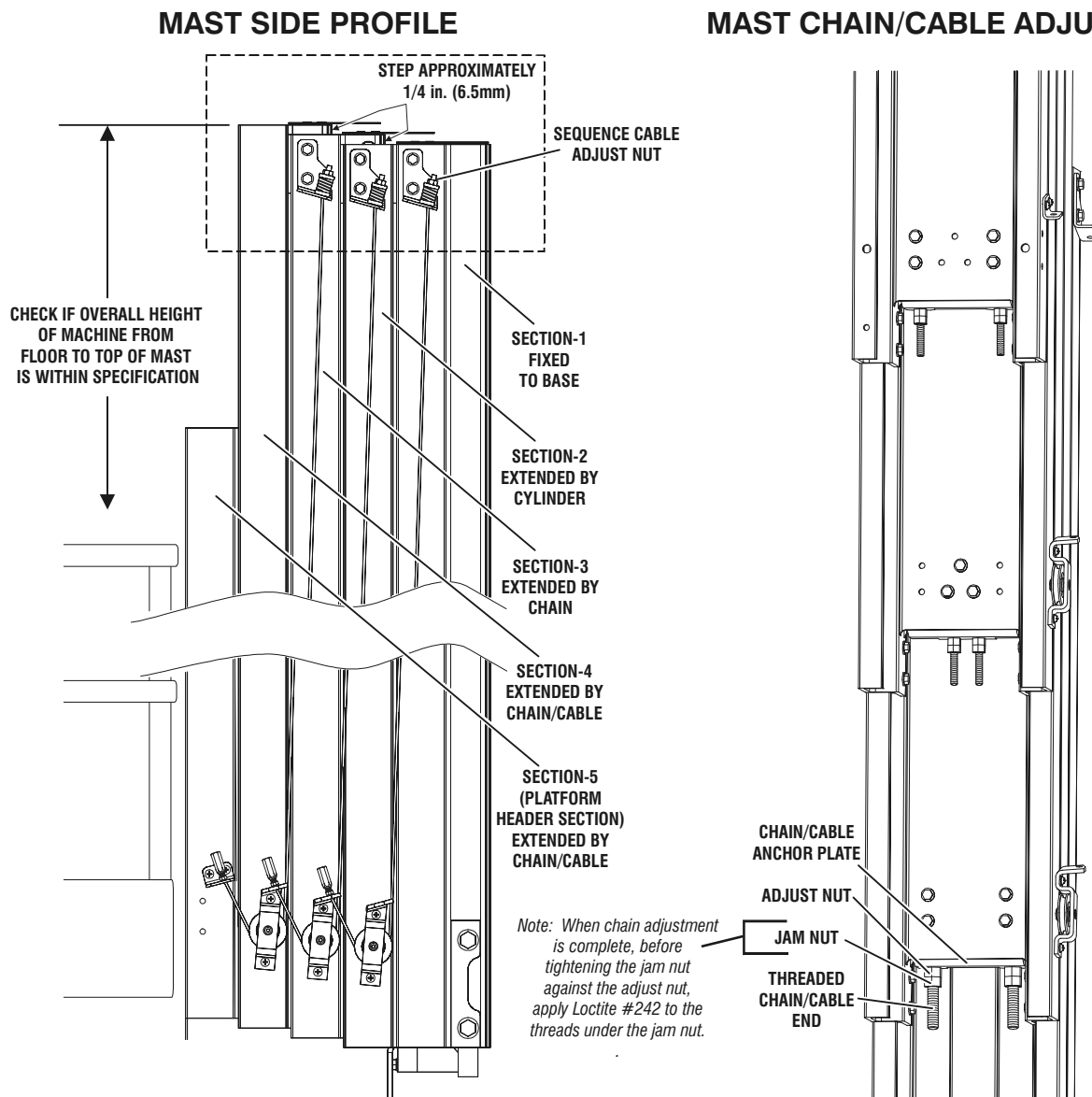


Figure 2-7. Mast Chain/Cable/Sequence Cable Adjustment Components. (Typical)

SECTION 2 - SERVICE PROCEDURES

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

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. To adjust, elevate the platform until the chain/cable anchor adjust nuts are accessible at the front and bottom of each mast section.

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 to match the side profile shown in Figure 2-7. when the mast is retracted. Be certain each chain/cable pair is adjusted to equal tension. (*The threaded end of the chain/cable will 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 2-7.
8. Repeat steps (1) through (7) for remaining mast sections. **ENSURE THAT ALL CHAIN/CABLE PAIRS HAVE EQUAL TENSION.**
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 2-7., 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)

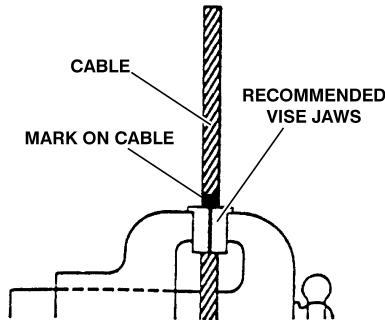
⚠ IMPORTANT

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.

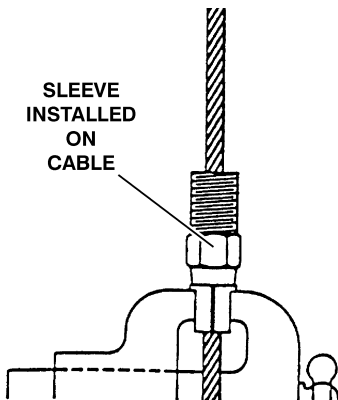
NOTE: The tools in the clamp assembly kit may be fabricated if necessary. The vise clamp consists of vise jaws with a hole drilled 1/32 in. smaller than the diameter of the wire rope you are working with (i.e. 1/8 in. rope - 3/32 in. hole.)

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.

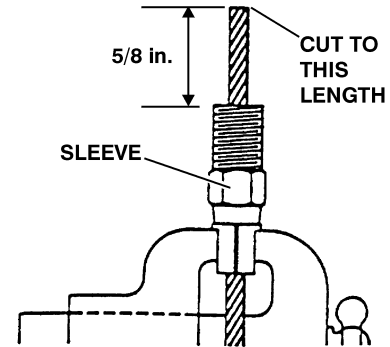
1. Using the recommended vise jaws, clamp the wire rope into a vise with the bottom edge of the black mark made on the wire rope resting just above the vise jaws.



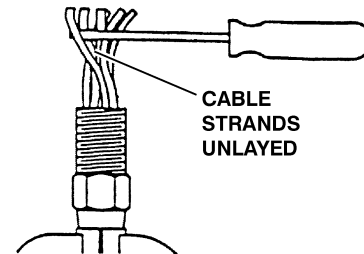
2. Twist the sleeve from the clamp kit onto the rope until it is flat against the vise jaws at the mark made on the wire rope.



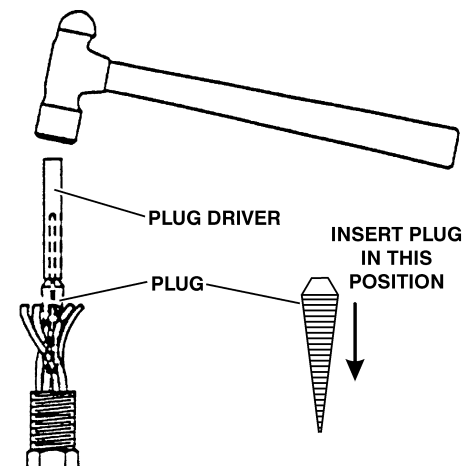
3. Use a suitable tool and cut the cable as shown in the illustration following. For 1/8 in. cable the recommended length is 5/8 in. past the end of the sleeve.



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.

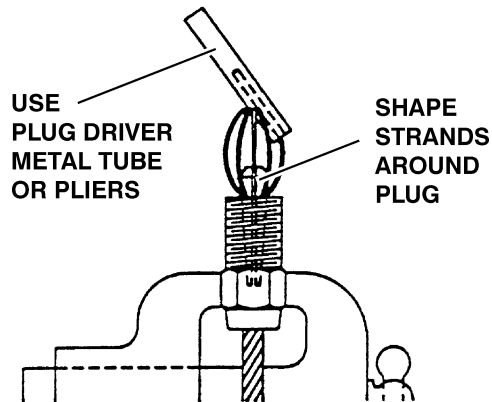


5. Install the plug supplied with the kit by placing the plug in the center of the strands starting with the small tapered end of the plug. Use a metal tube (plug driver) and hammer to drive the plug into the sleeve while assuring that the strands are spaced somewhat equally around the plug. Drive the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



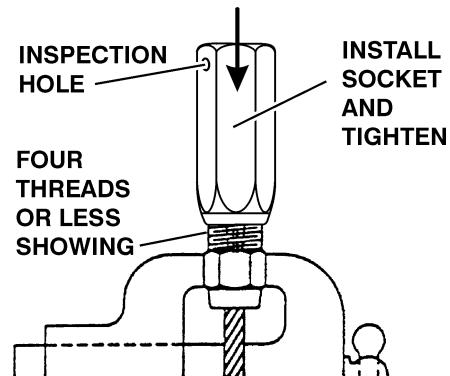
SECTION 2 - SERVICE PROCEDURES

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.

SECTION 3. TROUBLESHOOTING

3.1 GENERAL

This section contains troubleshooting information to be used for locating and correcting most of the operating problems which may develop in the aerial platform. 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

The troubleshooting procedures applicable to the aerial platform are listed and defined in Table 3-1, AC Unit - Troubleshooting and Table 3-2, DC Unit - Troubleshooting.

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 3-2.)

The first reference for improper function of a hydraulic system, where the cause is not immediately apparent, should be the Troubleshooting Chart. 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, beginning with the control, would follow.

NOTE: For aid in Hydraulic troubleshooting, refer to Figure 3-2. HYDRAULIC Schematic at the end of this section. For ELECTRICAL Diagrams refer to Figures 3-3, 3-4. & 3-5. also at the end of this chapter.

SECTION 3 - TROUBLESHOOTING

Table 3-1. AC Unit - Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Outrigger LED light does not turn on.		
	Outriggers are not properly inserted in outrigger sockets. Power source is OFF. Fuse(s) blown. Check for loose wire(s) on contactor screws under outrigger sockets (causing an open circuit). Contactor damaged. LED burnt out. Pull pin on outrigger socket is damaged.	Check all outriggers for proper installation in outrigger sockets Check power source. Check all insulating grommets on inter-lock contactors in base frame outrigger sockets and contactor plates on outrigger beams. Replace damaged grommet(s) and replace blown fuse. Properly reinstall wire to contactor screw per Figure 3-1. and instructions in Section 3.4, Outrigger Interlock Contacts. Replace contactor. Replace LED. Replace pull pin.
Platform does not rise when the four LED's are ON and motor does not start.		
	Red emergency stop button is engaged (PUSHED IN) on either ground control station or on platform. Control relay not functioning. Motor start relay not functioning. Unit wiring not properly grounded.	Disengage (TURN CLOCKWISE) red emergency button until it pops out. Replace control relay. Replace motor start relay. Check all grounds in the wiring.
Unit lowers by itself.		
	Manual descent valve open. Hydraulic hose and/or fittings loose causing a hydraulic pressure leak. Lift DOWN solenoid valve not functioning.	Close manual descent valve. Tighten hydraulic hose and/or fittings. Replace Lift DOWN solenoid valve.
Unit leaking hydraulic oil.		
	Hydraulic hose and/or fittings loose. Valve and/or plug loose. Breather cap on tank is saturated or clogged with oil. Hydraulic oil tank over-filled.	Tighten hydraulic hose and/or fittings. Tighten valve and/or plug. Replace breather cap on tank. Lower oil level to full mark on dipstick.
Unit lowers very slowly.		
	Flow control valve not functioning.	Replace flow control valve.

Table 3-2. DC Unit - Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Outrigger LED light does not turn on.		
	Outriggers are not properly inserted in outrigger sockets. Power source is OFF. Fuse(s) blown. Check for loose wire(s) on contactor screws under outrigger sockets (causing an open circuit). Contactor damaged. LED burnt out. Pull pin on outrigger socket is damaged.	Check all outriggers for proper installation in outrigger sockets Check power source. Check all insulating grommets on inter-lock contactors in base frame outrigger sockets and contactor plates on outrigger beams. Replace damaged grommet(s) and replace blown fuse. Properly reinstall wire to contactor screw per Figure 3-1. and instructions in Section 3.4, Outrigger Interlock Contacts." Replace contactor. Replace LED. Replace pull pin.
Platform does not rise when the four LED's are ON and motor does not start.		
	Red emergency button is engaged (PUSHED IN) on either ground control station or on platform. Control relay not functioning. Motor start relay not functioning. Unit wiring not properly grounded.	Disengage (TURN CLOCKWISE) red emergency button until it pops out. Replace control relay. Replace motor start relay. Check all grounds in the wiring.
Unit lowers by itself.		
	Manual descent valve open. Hydraulic hose and/or fittings loose causing a hydraulic pressure leak. Lift DOWN solenoid valve not functioning.	Close manual descent valve. Tighten hydraulic hose and/or fittings. Replace Lift DOWN solenoid valve.
Unit leaking hydraulic oil.		
	Hydraulic hose and/or fittings loose. Valve and/or plug loose. Breather cap on tank is saturated or clogged with oil. Hydraulic oil tank over-filled.	Tighten hydraulic hose and/or fittings. Tighten valve and/or plug. Replace breather cap on tank. Lower oil level to full mark on dipstick.
Unit lowers very slowly.		
	Flow control valve not functioning.	Replace flow control valve.

3.4 OUTRIGGER INTERLOCK CONTACTS

Outrigger Socket and Outrigger Beam - Interlock Contacts

It is very important that the outrigger interlock contacts located on the bottom surface inside the outrigger sockets of the base frame, and the contactor plate on the bottom of each outrigger beam are installed correctly. These parts when installed properly will be insulated from (–) negative ground. Read the following steps and see Figure 3-1. for correct installation. Also see Troubleshooting Tables 3-1 & 3-2. for any reference to possible problems with interlock contacts.

Outrigger Socket - Contactor Screw Mounting Instructions

(See Figure 3-1.)

ORIGINAL DESIGN

1. Install insulating grommets into holes (on the socket floor) inside of outrigger sockets in base frame.
2. Assemble two (2) #8-32UNC x 5/8" long contactor screws with two (2) #8 nylon washers under head and insert screw through insulating grommet as shown in Figure 9-1.
3. Install one (1) #8 nylon washer onto contactor screw threads against insulating grommet.
4. Apply Loctite #242 to screw threads.
5. Install one (1) standard #8 brass nut and thread in against nylon washer until insulating grommet just starts to compress. If necessary tighten nut further until top of contactor screw head measures 0.212" off floor of outrigger socket. (See Figure 3-1.)
6. Install wire end eyelet onto threaded end against previously installed brass nut.
7. Install second standard brass nut and thread tight against wire end eyelet.
8. While holding first brass nut, jam (tighten) second brass nut against wire end eyelet.

5/2001 - DESIGN

1. Install an insulating bushing into the holes (on the socket floor) inside of outrigger sockets in base frame.
2. Place one (1) #8-32UNC x 5/8" long contactor screw through each insulating grommet as shown in Figure 3-1.
3. Install two (2) #8 nylon washers onto contactor screw threads against insulating grommet, on the underside of the outrigger socket.

4. Apply Loctite #242 to screw threads.
5. Install one (1) standard #8 brass nut and thread in against nylon washer until insulating grommet just starts to compress.
6. Install wire end eyelet onto threaded end against previously installed brass nut.
7. Install second standard brass nut and thread tight against wire end eyelet.
8. While holding first brass nut, jam (tighten) second brass nut against wire end eyelet.

Outrigger Beam - Interlock Contactor Plate Mounting Instructions

ORIGINAL DESIGN

(See Figure 3-1.)

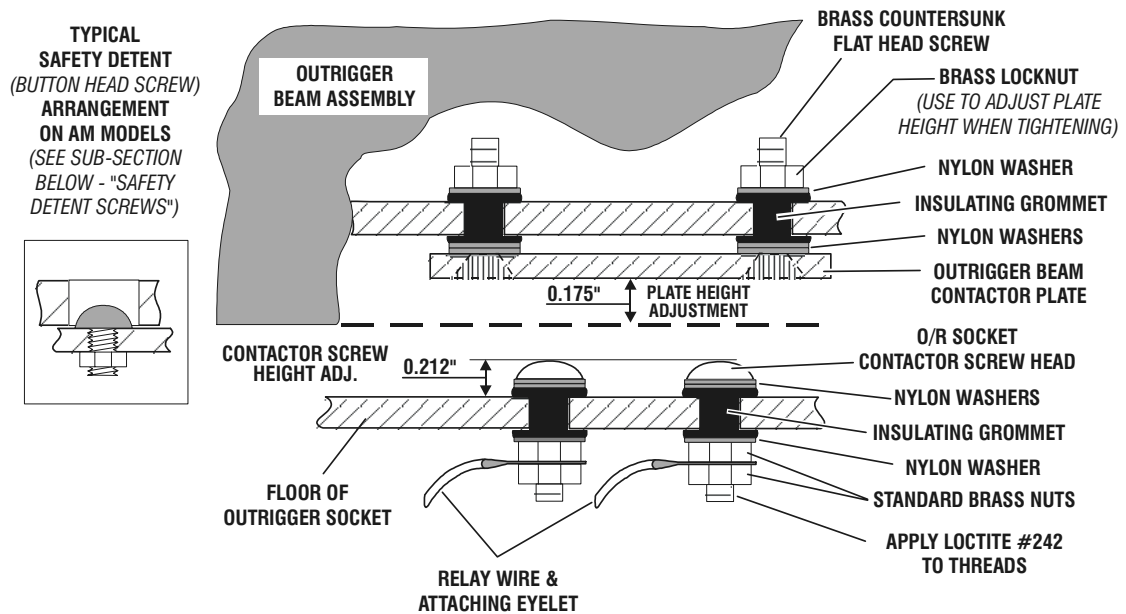
1. Assemble insulating grommets into the screw holes in outrigger beam.
2. Locate contactor plate and insert two (2) brass #8 - 32UNC x 3/4" long countersunk flathead screws through the contactor plate and install two (2) nylon washers on each screw against contactor plate.
3. On outside of outrigger beam slide threads of brass screws (of contactor plate assembly) through insulating grommets in outrigger beams until nylon washers rest against grommets and hold in place if necessary.
4. Install one (1) nylon washer on each screw inside of outrigger beam, against insulating grommet.
5. Thread a brass #8 - 32UNC locknut onto each screw inside outrigger beam, tighten screws until .175" height exists between bottom of plate and bottom most edge of outrigger beam. (See Figure 3-1.)

5/2001 - DESIGN

(See Figure 3-1.)

1. Assemble an insulating bushing into each of the screw holes in the floor of the outrigger beam.
2. Locate the contactor plate and insert two (2) brass #8 - 32UNC x 3/4" long countersunk flathead screws through the contactor plate.
3. Install one (1) o-ring on one screw and stack two (2) on the other screw, slide o-rings in against contactor plate.
4. On the bottom of the outrigger beam slide the threads of brass screws (with o-rings and contactor plate assembly) through the insulating bushings. Install the screw with two (2) o-rings towards jack end of outrigger beam. Hold in place if necessary.

ORIGINAL DESIGN



5/2001 - DESIGN

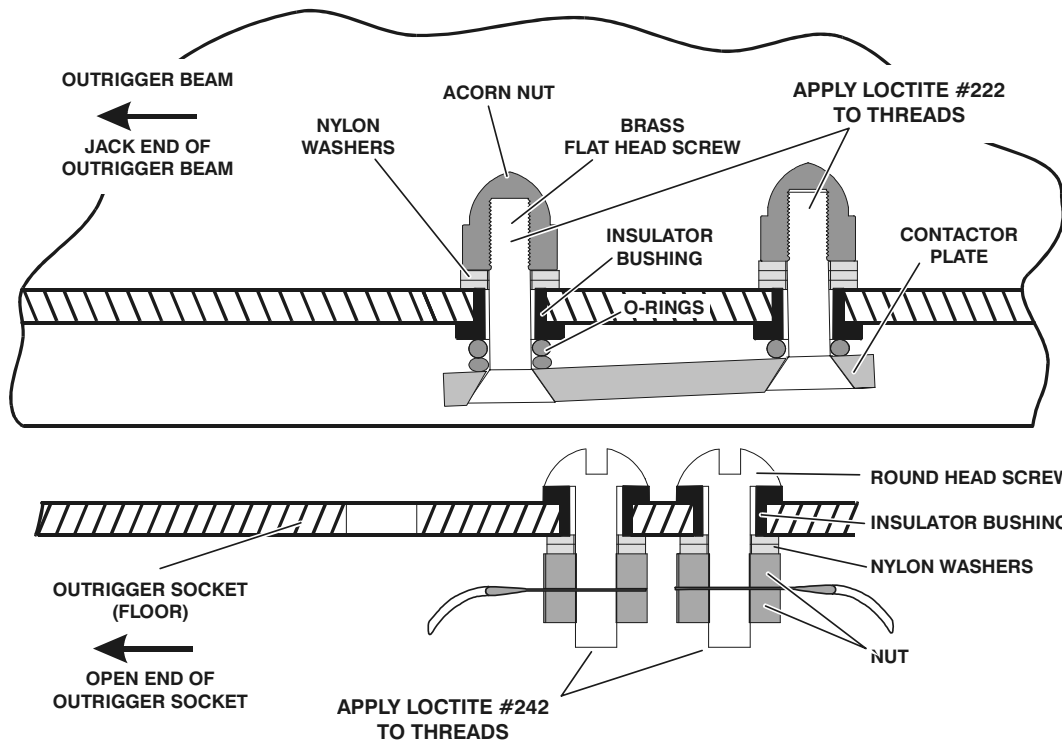


Figure 3-1. Outrigger Socket Contactor Heads and Outrigger Beam - Contactor Plate Mounting Hardware (ORIGINAL AND 5/2001 - DESIGN).

SECTION 3 - TROUBLESHOOTING

5. On the inside of the outrigger beam, install two nylon washers on the screw with the two (2) o-rings installed (*one towards jack end*) and three (3) nylon washers on the the other screw (*towards open end of beam*).
6. Coat the threads of the screws with Loctite #222 and thread the steel acorn nuts onto each screw. Hold the acorn nuts and tighten the screws using a cordless screw driver set at the #1 torque setting.

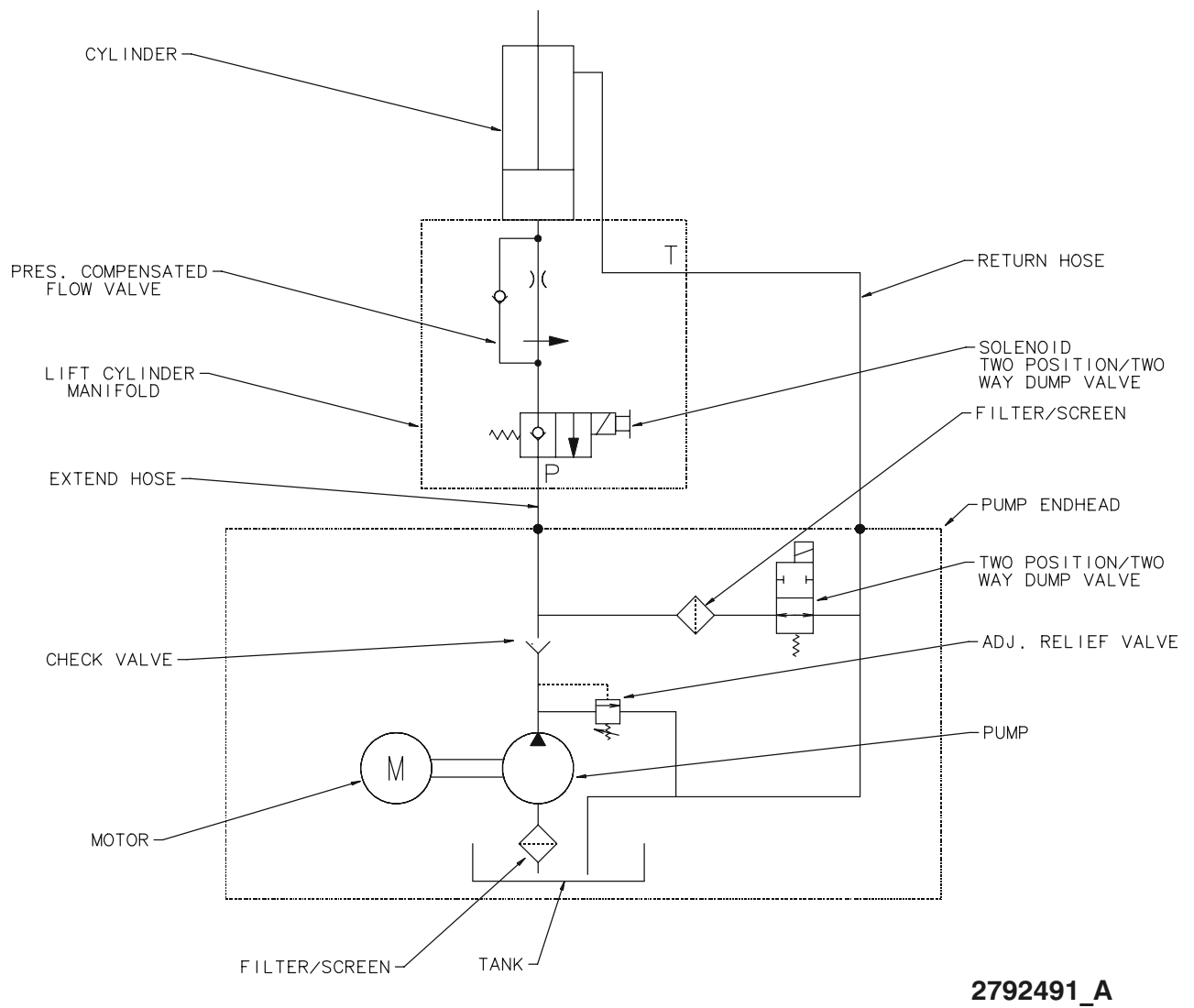
Detent Screws

(See Figure 3-1.)

OUTRIGGER BEAMS are manufactured with a series of holes drilled around the CONTACTOR PLATE assembly.

OUTRIGGER SOCKETS are equipped with button head screws (*detent screws*) mounted around the CONTACTOR SCREW HEADS on the floor of the outrigger socket. The detent screws must align with the holes in the outrigger socket before the contactor plate on the outrigger beam, and the contactor screw heads in the bottom of the outrigger socket can make contact to complete the interlock circuit.

The purpose of this design is to assure the proper size outrigger beams are used with their specific EL model to assure machine stability, i.e. the shorter outrigger beams of the 20EL, 25EL and 30EL models cannot be mistakenly used on higher reaching 36EL or 41EL models.



2792491_A

Figure 3-2. Hydraulic Schematic. (EL Series) (2792491_A)

SECTION 3 - TROUBLESHOOTING

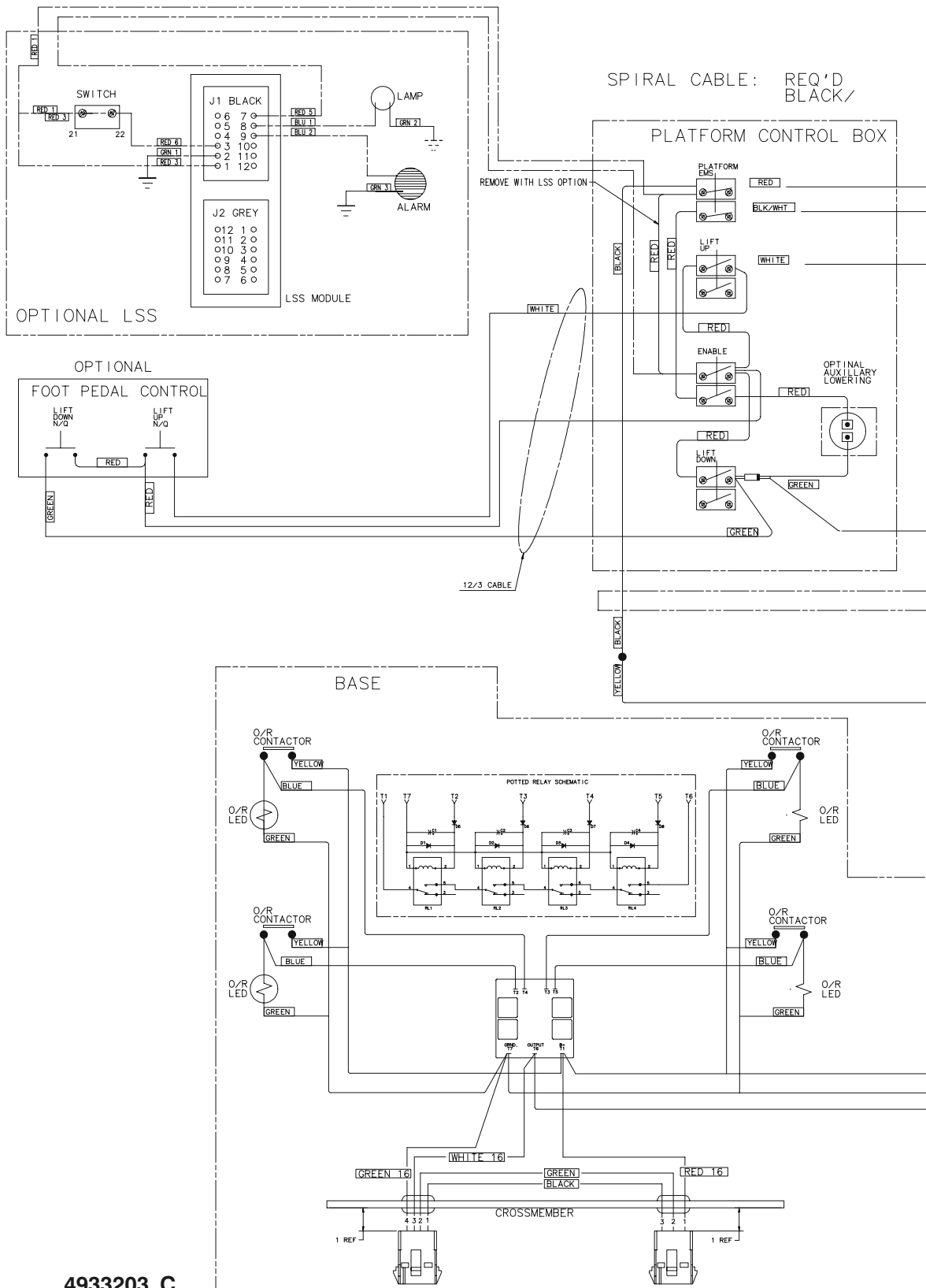
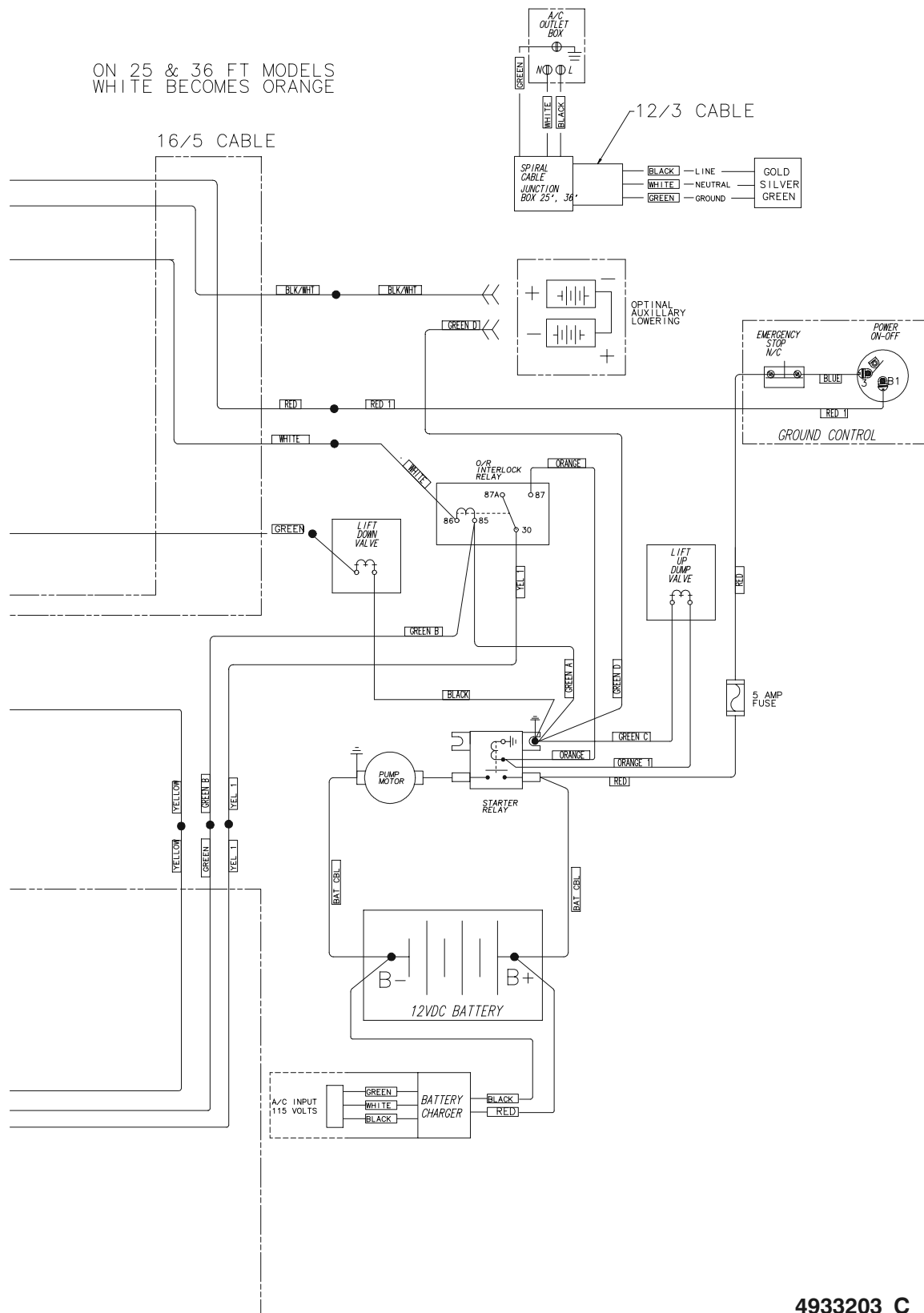


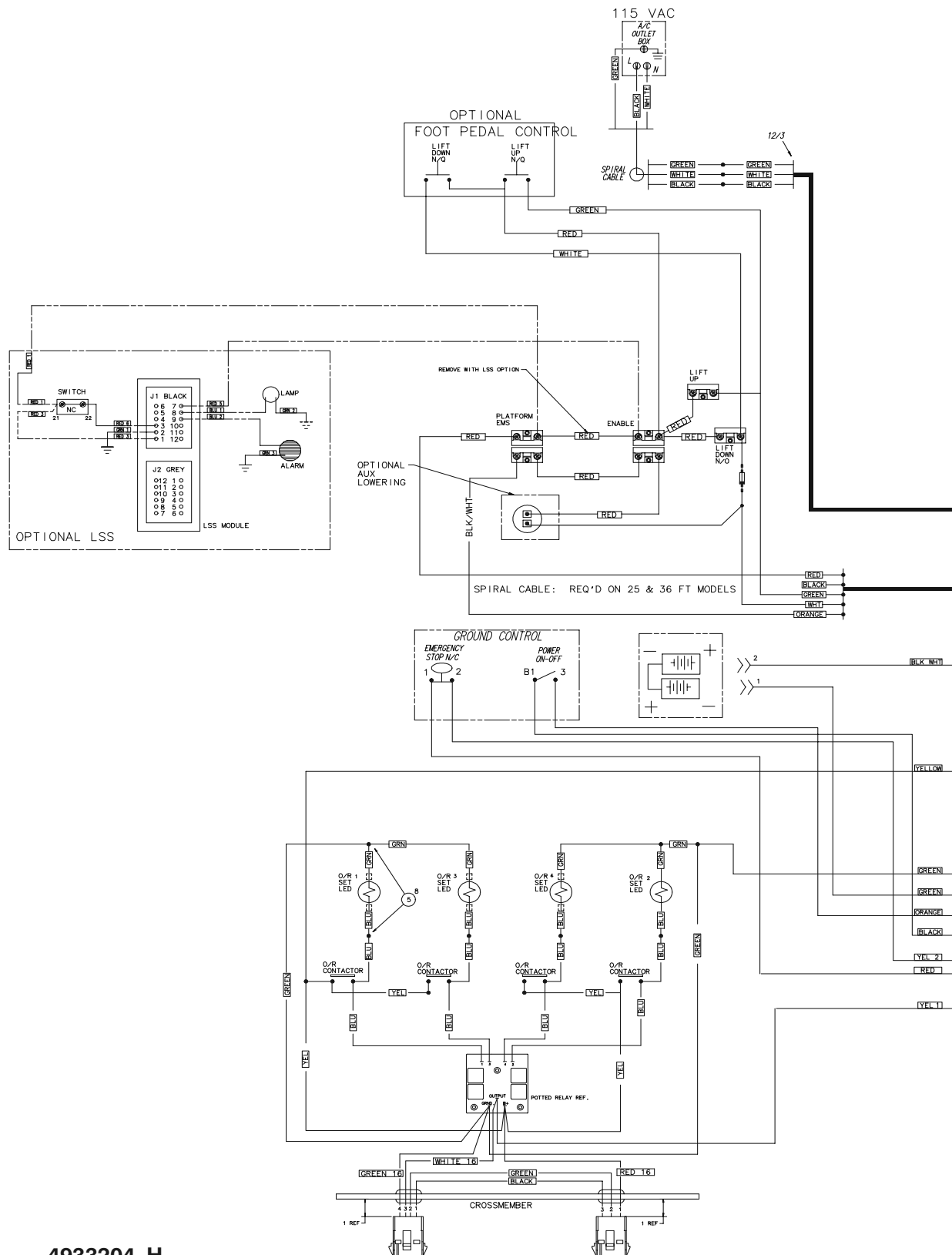
Figure 3-3. Electrical Diagram. (EL Series - 12v-DC)



4933203_C

Figure 3-3. Electrical Diagram. (EL Series - 12v-DC)

SECTION 3 - TROUBLESHOOTING



4933204_H

Figure 3-4. Electrical Diagram. (EL Series - 120V-AC)

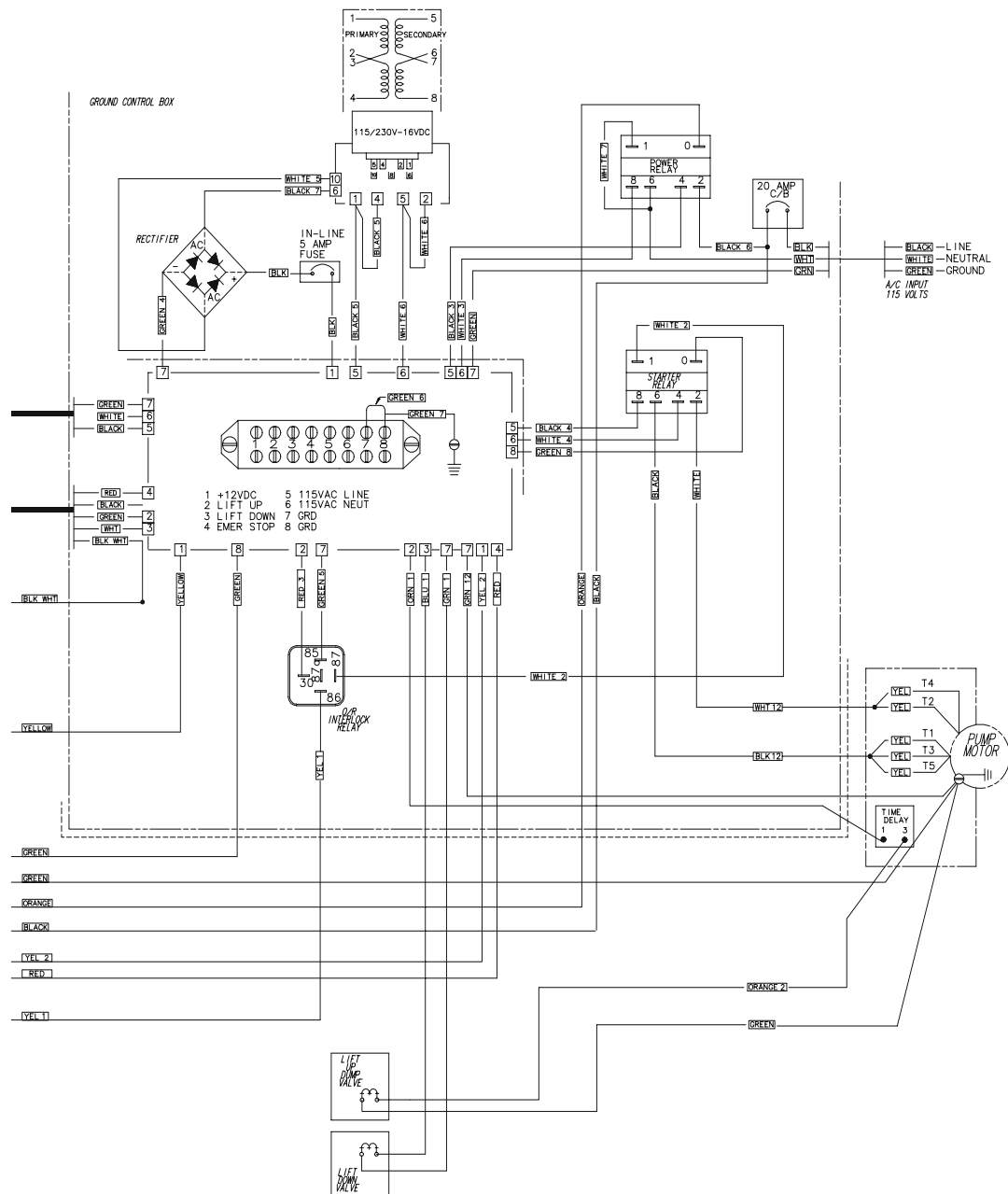
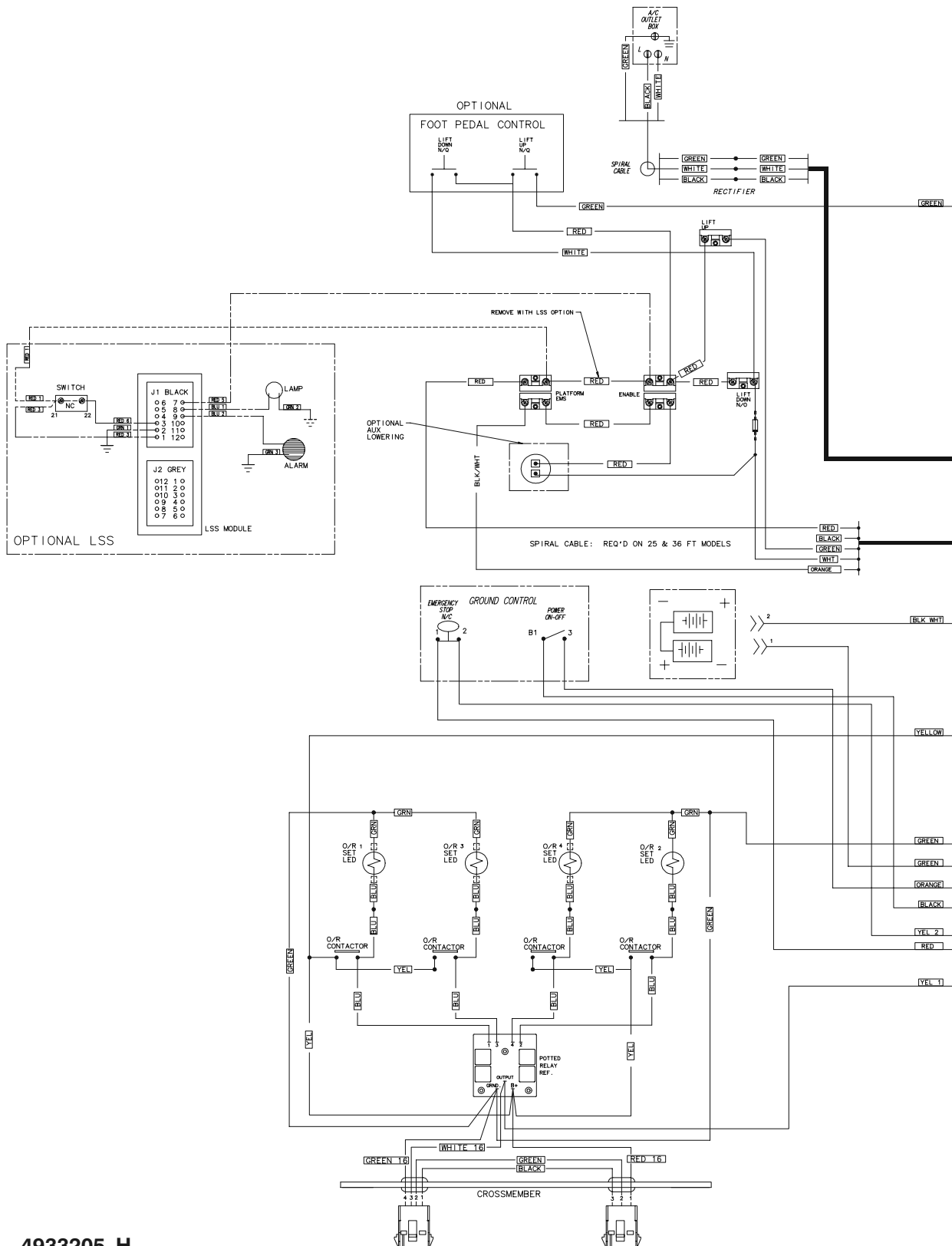


Figure 3-4. Electrical Diagram. (EL Series - 120V-AC)

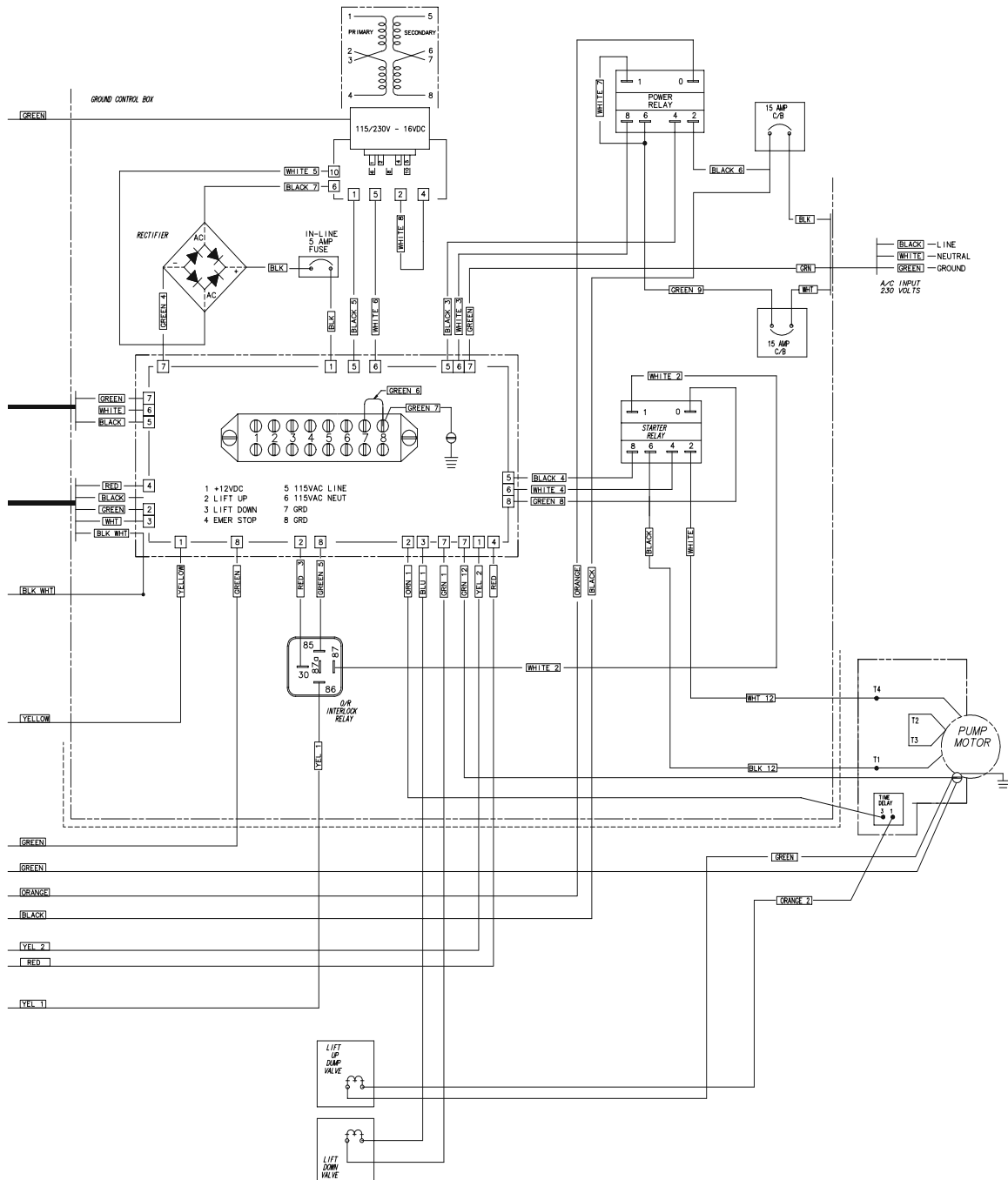
4933204_H

SECTION 3 - TROUBLESHOOTING



4933205_H

Figure 3-5. Electrical Diagram. (EL Series - 240V-AC)



4933205_H

Figure 3-5. Electrical Diagram. (EL Series - 240V-AC)

This page left intentionally blank.