Service and Maintenance Manual

Models
100SX
110SX
110SXJ
120SXJ

P/N - 3121105

July 29, 2004

ANSI

SECTION A. 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 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 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 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

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

B HYDRAULIC SYSTEM SAFETY

It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system.

Relieve system pressure by cycling the applicable control several times with the engine stopped and ignition on, to direct any line pressure back into 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 MAY RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.

- NO SMOKING IS MANDATORY. NEVER REFUEL DURING ELECTRICAL STORMS. ENSURE THAT FUEL CAP IS CLOSED AND SECURE AT ALL OTHER TIMES.
- 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 WARNINGS AND CAUTIONS ON MACHINE AND IN SERVICEMANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- USE CAUTION WHEN CHECKING A HOT, PRESSURIZED COOLANT SYSTEM.
- NEVER WORK UNDER AN ELEVATED BOOM UNTIL BOOM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR BOOM SAFETY PROP HAS BEEN ENGAGED.
- 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.

REVISON LOG

Original Issue	- April 1, 2000
Revised	- September 11, 2000
Revised	- June 8, 2001
Revised	- January 18, 2002
Revised	- June 11, 2002
Revised	- June 19, 2003
Revised	- July 29, 2004

TABLE OF CONTENTS

SUBJECT - SECTION, PARAGRAPH **PAGE NO.**

TABLE OF CONTENTS (continued)

SUBJECT - SECTION, PARAGRAPH **PAGE NO.**

TABLE OF CONTENTS (continued)

SUBJECT - SECTION, PARAGRAPH **PAGE NO.**

TABLE OF CONTENTS (continued)

SUBJECT - SECTION, PARAGRAPH **PAGE NO.**

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF TABLES

SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

Engine Crankcase
Deutz F4L912 w/Filter - 13.2 quarts (12.5 liters)

Fuel Tank
26 gallons (98 liters)

Hydraulic Tank
50 gallons (189 liters)

1.2 COMPONENT DATA

NOTE: *Tolerance on all engine rpm settings is plus or minus 10%.*

Engine - Deutz F4L912

Fuel - Diesel

Oil Capacity (crankcase only) - 12.7 quarts (12 liters)

Low (Mid) RPM - 1800

High RPM - 2400

Alternator - 55 Amp

Battery - 1000 cold cranking Amps, 210 minutes reserve capacity, 12 VDC

Fuel Consumption

Low RPM - 2.4 gph (9.1 lph)

High RPM - 3.8 gph (14.2 lph)

Horsepower - 70 @ 2400 RPM, no load

Torque Hub

Input Torque - 116 ft. lbs.

Input Speed - 2734 rpm

Output Torque - 10236 ft. lbs.

Output Speed - 31 rpm

Static Brake Torque - 147.5 ft. lbs.

Release Pressure - 261 psi

Max. Release Pressure - 725 psi

Drive Motor

Max. Displacement - 2.75 in^3 (45 cc)

Min. Displacement - 0.93 in^3 (15.2 cc)

Output Speed at Max. Displacement - 3000 rpm

Output speed at Min. Displacement - 4000 rpm

1.3 PERFORMANCE DATA - 100SX, 110SX & 110SXJ

Platform Height

100SX - 100ft. (30.5 m)
110SX & 110SXJ - 110 ft. (33.5 m)

Horizontal Outreach

60 ft. (18.3 m)

Below Ground Reach (110SX only)

12 ft. (3.6 m)

Swing

360° Continuous

Platform Capacity - Restricted (100SX & 110SX only)

1000 lbs. (450 kg)

Platform Capacity - Unrestricted

500 lbs. (230 kg)

Platform Rotator

180° Hydraulic

Jib Range of Articulation - 110SXJ

10 ft. (3.05 m) 95 degrees (+15, -80)

Overall Width - Axles Retracted

8 ft. 2 in. (2.49 m)

Overall Width - Axles Extended

10 ft. 10 in. (3.3 m)

Tailswing (Axles Extended)

2 ft. 10 in. (86 cm)

Stowed Height

10 ft. (3.0 m)

Stowed Length

100SX - 37ft. 10 in. (11.55 m)
110SX - 38 ft. 7 in. (11.76 m)
110SXJ - 44 ft. 2 in. (13.46 m)

Wheelbase

10 ft. (3.05 m)

Ground Clearance

12.5 in. (32 cm)

Gross Weight

100SX - 37,700 lbs. (17,136 kg)
110SX - 41,900 lbs. (19,006 kg)
110SXJ - 41,400 lbs. (18,779 kg)

Max. Ground Bearing Pressure

100SX & 110SXJ - 90 psi (6.3 kg/cm^2)
110SX - 100psi (7.0 kg/cm^2)

Drive Speed

3 mph (4.8 km/h)

Gradeability

40%

Turning Radius (Inside)

Axles Retracted - 14 ft. 8 in. (4.47 m)
Axles Extended - 12 ft. (3.66 m)

Turning Radius (Outside)

Axles Retracted - 22 ft. 2 in. (6.76 m)
Axles Extended - 24 ft. (7.32 m)

Tire Size/Type

385/65R22.5 Foam Filled

1.4 PERFORMANCE DATA - 120SXJ

Platform Height

120 ft. (36.58 m)

Horizontal Outreach

60 ft. (18.3 m)

Swing

360° Continuous

Platform Capacity

500 lbs. (230 kg)

Platform Rotator

180° Hydraulic

Jib Range of Articulation

11 ft. (3.35 m) 95 degrees (+15, -80)

Overall Width - Axles Retracted

8 ft. 2 in. (2.49 m)

Overall Width - Axles Extended

10 ft. 10 in. (3.3 m)

Tailswing (Axles Extended)

2 ft. 10 in. (86 cm)

Stowed Height

10 ft. (3.05 m)

Stowed Length (Working)

52 ft. 4 in. (15.95 m)

Stowed Length (Transport)

35 ft. 11 in. (10.95 m)

Wheelbase

10 ft. (3.05 m)

Ground Clearance

14.5 in. (37 cm)

Gross Weight

43,500 lbs. (19,732 kg)

Max. Ground Bearing Pressure

90 psi (6.3 kg/cm^2)

Drive Speed

3 mph (4.8 km/h)

Gradeability

40%

Turning Radius (Inside)

Axles Retracted - 12 ft. 10 in. (3.91 m)
Axles Extended - 10 ft. 7 in. (3.23 m)

Turning Radius (Outside)

Axles Retracted - 17 ft. 4 in. (5.28 m)
Axles Extended - 18 ft. 10 in. (5.74 m)

Tire Size/Type

445/65R22.5 Foam Filled

1.5 TORQUE REQUIREMENTS

Table 1-1.Torque Requirements

Description	Torque Value		Interval Hours
	Ft. Lbs.	Nm	
Bearing to Chassis	220	298	50/600*
Bearing to Turntable	220	298	50/600*
Wheel Lugs	180	245	100
Turntable Springs	75	102	200
Boom Chains	59	80	500
Rotator Bottom Bolt	480	672	A/R

* Check swing bearing bolts for security after first 50 hours of operation and every 600 hours thereafter.

NOTE: *See Procedure Section for tightening sequence of turntable bearing bolts.*

NOTE: *When maintenance becomes necessary or a fastener has loosened, refer to the Torque Chart to determine proper torque value.*

1.6 LUBRICATION

Deutz F4L912 Engine

Single Viscosity Oils (CD-SE, CD-SF)

When Outside Temp is Consistently	Use SAE Viscosity Number
-20° to +25° F (-29° to -4° C)	*10W
+15° to +50° F (-10° C to +10° C)	20W-20
+40° to +85° F (+4° to +30° C)	30
Above 75° F (+24° C)	40

Multi-Viscosity Oils (CD-SE, CD-SF)

When Outside Temp is Consistently	Use SAE Viscosity Number
-40° to +75° F(-40° to +24° C)	*5W-20 (Synthetic)
-5° to +70° F(-21° to +21° C)	10W-30
-5° to +85° F(-21° to +30° C)	10W-40
+15° to +75° F(-10° to +24° C)	15W-30
Above +15° F(-10° C)	15W-40

Table 1-2.Hydraulic Oil

Hydraulic System Operating Temperature Range	SAE Viscosity Grade
0° to +23° F(-18° to -5° C)	10W
0° to +210° F(-18° to +100° C)	10W-20, 10W-30
+50° to +210° F(+10° to +99° C)	20W-20

NOTE: *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 index of 152.*

NOTE: *When temperatures remain consistently below 20 degrees F (-7 degrees C.), JLG Industries recommends the use of Mobil DTE13.*

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

Table 1-3. Mobil EAL Envirosyn H 46 Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	46
Specific Gravity	.910
Pour Point, Max	-44°F (-44°C)
Flash Point, Min.	500°F (260°C)
Weight	**7.64 lb. per gal. (0.9 kg per liter)**
Viscosity	
at 104° F (40° C)	45 cSt
at 212° F (100° C)	8.0 cSt
Viscosity Index	153

Table 1-4. Mobil EAL 224 H Specs

Type	Biodegradable Vegetable Oil
ISO Viscosity Grade	32/46
Specific Gravity	.922
Pour Point, Max	-25°F (-32°C)
Flash Point, Min.	428°F (220°C)
Weight	7.64 lb. per gal. (0.9 kg per liter)
Viscosity	
at 104° F (40° C)	37 cSt
at 212° F (100° C)	8.4 cSt
Viscosity Index	213
Operating Temp	0-180° F (-17 - -162°C)
Note: Must be stored above 32° F (14° C)	

Table 1-5. Mobil DTE 13M Specs

Type	Petroleum Base
ISO Viscosity Grade	32
Specific Gravity	.877
Pour Point, Max	-40°F (-40°C)
Flash Point, Min.	330°F (166°C)
Viscosity	
at 104° F (40° C)	33 cSt
at 212° F (100° C)	6.5 cSt
Viscosity Index	140

Lubrication Specifications

Table 1-6.Lubrication Specifications

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350 degrees 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. API Service Classification GL-3, SAE 10W-20, Viscosity Index 152.
EO	Engine (crankcase) Oil. Gas - API SF/SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C.

Refer to Lubrication Chart for specific lubrication procedures.

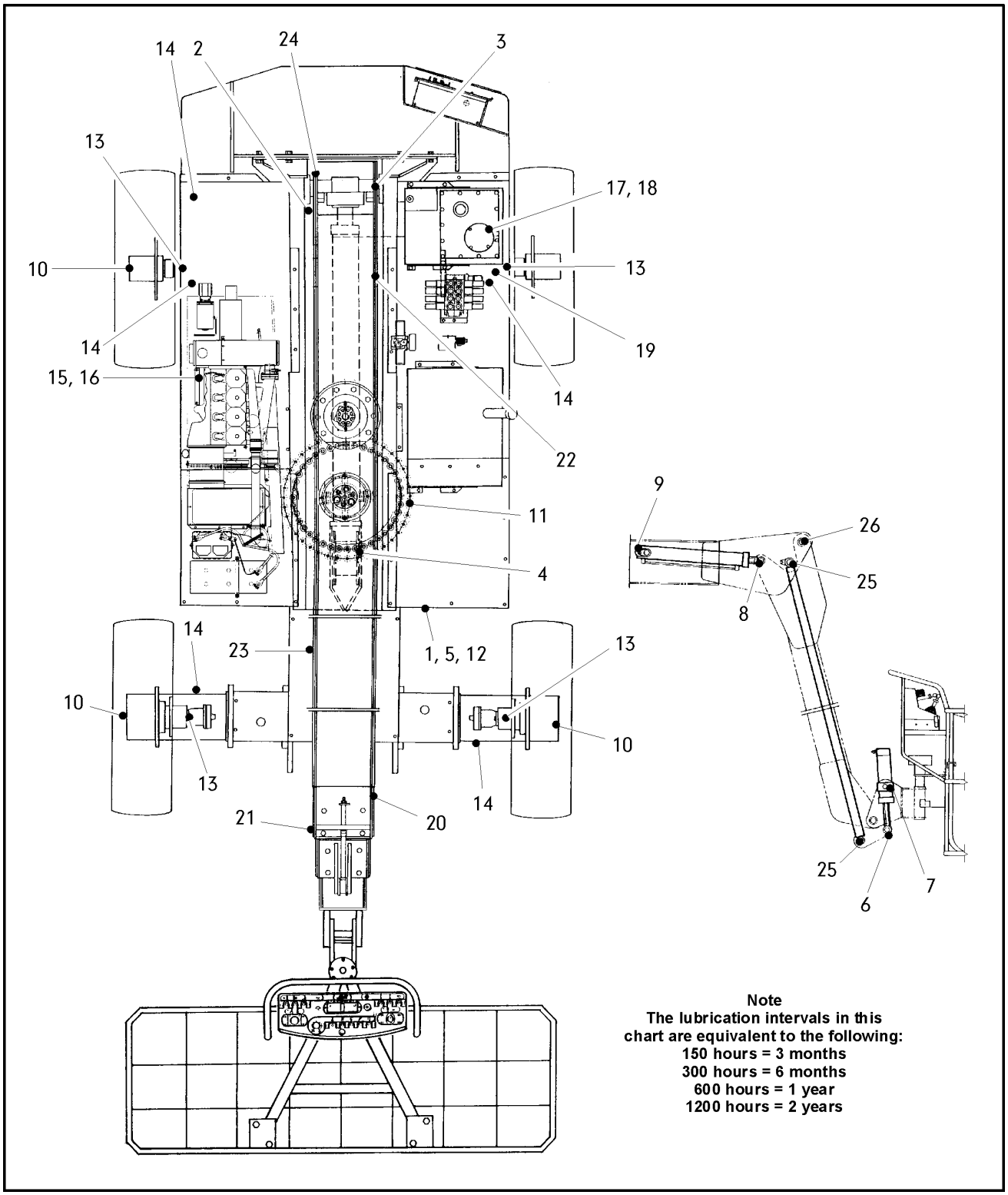


Figure 1-1. Lubrication Point Location

Table 1-7. Lubrication Chart

	Components	Number/Type Lube Points	Lube & Method	Interval Hours	Comments
1	Master Cylinder - Barrel End	1 Grease Fitting	MPG - Pressure Gun	150	Remote Access
2	Master Cylinder - Rod End	1 Grease Fitting	MPG - Pressure Gun	150	
3	Boom Pivot Bushings	2 Grease Fittings	MPG - Pressure Gun	150	
4	Lift Cylinder - Rod End	1 Grease Fitting	MPG - Pressure Gun	150	
5	Lift Cylinder - Barrel End	1 Grease Fitting	MPG - Pressure Gun	150	Remote Access
6	Slave Cylinder - Rod End	1 Grease Fitting	MPG - Pressure Gun	150	
7	Slave Cylinder - Barrel End	2 Grease Fitting	MPG - Pressure Gun	150	
8	Extend-A-Reach Cylinder - Rod End	1 Grease Fitting	MPG- Pressure Gun	150	
9	Extend-A-Reach Cylinder - Attach Pin	2 Grease Fittings	MPG - Pressure Gun	150	
10	Drive Hubs	Fill Plug	EPGL - SAE90	150/1200	Check every 150 hrs. /Change every 1200 hrs.
11	Swing Bearing Gear	N/A	MPG - Brush	150	
12	Swing Bearing	1 Grease Fitting	MPG - Pressure Gun	150	
13	Steer Spindles	2 Grease Fittings	MPG - Pressure Gun	150	
14	Extending Axle Beams	N/A	MPG - Brush	600	As needed
15	Engine Crankcase	Fill Cap	EO-SAE30	10/1000	Check daily/Change every 1000 hrs. or one year, whichever comes first. Adjust final level by mark on dipstick
16	Engine Oil Filter	N/A	Replaceable Cartridge	300	
17	Hydraulic Fluid	Fill Cap	HO	10/1200	Check daily/Change every 1200 hrs.
18	Hyd. Filter Element (Tank)	N/A	N/A	50/300	Replace filter after first 50 hrs. of operation, then every 300 hrs. thereafter
19	Hyd. Filter Element (Inline)	N/A	N/A	50/300	Replace filter after first 50 hrs. of operation, then every 300 hrs. thereafter
20	Telescope Cylinder Sheave	1 Grease Fitting	MPG - Pressure Gun	150	
21	Extend Chain Sheave	1 Grease Fitting	MPG - Pressure Gun	150	
22	Retract Chain Sheave	1 Grease Fitting	MPG - Pressure Gun	150	
23	Boom Chains	N/A	Chain Lube/Hot Oil Dip	1200	Includes extend and retract chains
24	Turntable Pivot Pin	2 Grease Fittings	MPG - Pressure Gun	150	
25	Extend-A-Reach Link Attach Pin	1 Grease Fitting	MPG - Pressure Gun	150	
26	Extend-A-Reach Pivot Pin	2 Grease Fittings	MPG - Pressure Gun	150	

NOTES:

Key to Lubricants:

EO	Engine Oil
EPGL	Extreme Pressure Gear Lube
HO	Hydraulic Fluid (Mobil #424 or equivalent)
MPGt	Multi-Purpose Grease

1.7 PRESSURE SETTINGS

Main Valve

Main - 3450 psi (238 bar)

Lift Down - 1500 psi (103 bar)

Jib (Up) - 3000 psi (207 bar)

Jib (Down) - 1400 psi (97 bar)

Swing - 1200 psi (83 bar)

Platform Level Up - 2500 psi (172 bar)

Platform Level Down - 2200 psi (152 bar)

Drive - 4500 psi (310 bar)

Steer - 2850 psi (197 bar)

Platform Rotate - 2500 psi (172 bar)

Extendable Axles In - 2500 psi (172 bar)

Extendable Axles Out - 2500 psi (172 bar)

NOTE: *Refer to Section 5 for pressure setting procedures.*

1.8 FUNCTION SPEEDS (IN SECONDS)

100SX

Lift Up - 100-85

Lift Down - 100-75

Swing Right & Left - 200-140

Telescope Out - 93-74

Platform Rotate Right & Left - 20-10

Drive (200ft.) - 57-47

Drive above Horizontal (50ft.) - 89-96

110SX

Lift Up - 100-85

Lift Down - 100-75

Swing Right & Left - 200-140

Telescope Out - 100-80

Platform Rotate Right & Left - 20-10

Drive (200ft.) - 57-47

Drive above Horizontal (50ft.) - 89-96

110SXJ

Lift Up - 100-85

Lift Down - 100-75

Swing Right & Left - 200-140

Telescope Out - 93-74

Platform Rotate Right & Left - 24-36

Articulated Jib Up - 15-20

Articulated Jib Down - 45-55

Drive (200ft.) - 56-46

Drive above Horizontal (50ft.) - 89-96

120SXJ

Lift Up - 100-85

Lift Down - 100-75

Swing Right & Left - 200-140

Telescope Out - 100-80

Platform Rotate Right & Left - 24-36

Articulated Jib Up - 15-20

Articulated Jib Down - 45-55

Drive (200ft.) - 56-46

Drive above Horizontal (50ft.) - 89-96

1.9 CYLINDER SPECIFICATIONS

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

Table 1-8.Cylinder Specifications

Cylinder	Bore	Stroke	Rod Dia.
Lift	9.0 (22.9)	43.375 (120.3)	4.0 (10.2)
Master Level (100SX, 110SX)	2.5 (6.4)	14.5 (36.8)	1.25 (3.2)
Master Level (110SXJ)	2.5 (6.4)	15.1 (38.4)	1.25 (3.2)
Slave Level (100SX, 110SX)	2.5 (6.4)	13.875 (35.2)	1.25 (3.2)
Slave Level (110SXJ)	3.5 (8.9)	6.94 (17.6)	1.75 (4.4)
Steer	3 (7.6)	10.31 (26.2)	1.5 (3.8)
Telescope (100SX, 110SXJ	5 (12.7)	247.81 (629.4)	3.5 (8.9)
Telescope (110HX)	5 (12.7)	266 (675.6)	3.5 (8.9)
Axle Extension	2.5 (6.4)	28.19 (71.6)	1.25 (3.2)
Extend-a-Reach (100HX+10)	3.5 (8.9	18.31 (46.5)	2.5 (6.4)

1.10 SERIAL NUMBER LOCATIONS

For machine identification, a serial number plate is affixed to the left side of the frame, below the battery compartment. If the serial number plate is damaged or missing, the machine serial number is stamped on the left side of the frame between the front and rear wheels, below the turntable bearing and on the right side of the turntable in the bottom of the valve compartment. In addition, the last five digits of the serial number are stamped on top of the fly end of the base boom section.

1.11 CRITICAL STABILITY WEIGHTS

⚠ WARNING

DO NOT REPLACE ITEMS CRITICAL TO STABILITY, SUCH AS THE COUNTERWEIGHT OR FOAM-FILLED TIRES, WITH ITEMS OF DIFFERENT WEIGHT OR SPECIFICATION. DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.

Table 1-9.Critical Stability Weights

Component	100SX	110SX	110SXJ	120SXJ
Counterweight (1.5:1)	6150 lbs. (2790 kg)	10,350 lbs. (4695 kg)	9,850 lbs. (4468 kg)	9,050 lbs. (4,105 kg)
Foam-Filled Tires (each)	700 lbs. (318 kg)	700 lbs. (318 kg)	700 lbs. (318 kg)	932 lbs. (423 kg)
Deutz Engine	837 lbs. (380 kg)	837 lbs. (380 kg)	837 lbs. (380 kg)	837 lbs. (380 kg)
36x72 Platform	205 lbs. 93 kg	205 lbs. 93 kg	205 lbs. 93 kg	205 lbs. 93 kg
36x96 Platform	238 lbs. (108 kg)	238 lbs. (108 kg)	238 lbs. (108 kg)	238 lbs. (108 kg)

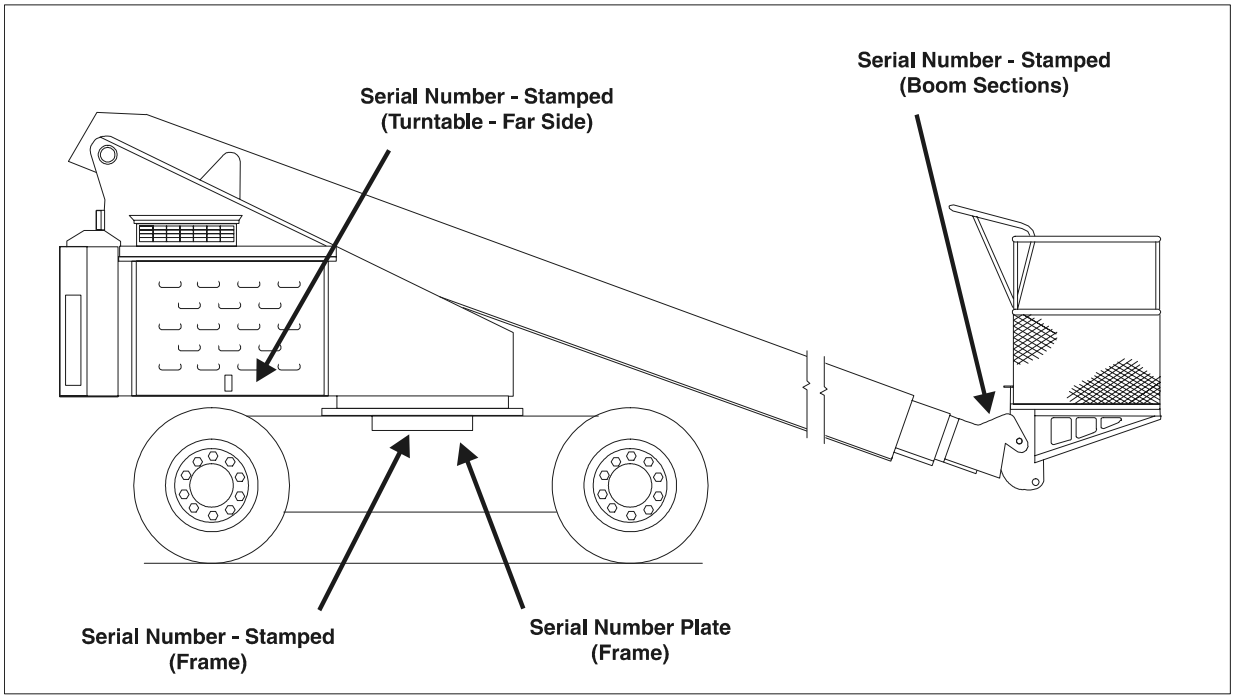


Figure 1-2. Serial Number Locations

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	
				CLAMP LOAD (LB.)	TORQUE				CLAMP LOAD (LB.)	TORQUE			CLAMP LOAD (LB.)	TORQUE (as received)
					(DRY OR LOC. 263)	(LUB.)	(LOCTITE 262)	(LOCTITE 242 OR 271)		(DRY OR LOC. 263)	(LUB.)	(LOCTITE 262)	(LOCTITE 242 OR 271)	
					LB. IN.	LB. IN.	LB. IN.	LB. IN.		LB. IN.	LB. IN.	LB. IN.	LB. IN.		LB. FT.
4	40	0.1120	0.00604	380	8	6	—	—	540	12	9	—	—	—	—
	48		0.00661	420	9	7	—	—	600	13	10	—	—	—	—
6	32	0.1380	0.00909	580	16	12	—	—	820	23	17	—	—	—	—
	40		0.01015	610	18	13	—	—	920	25	19	—	—	—	—
8	32	0.1640	0.01400	900	30	22	—	—	1260	41	31	—	—	—	—
	36		0.01474	940	31	23	—	—	1320	43	32	—	—	—	—
10	24	0.1900	0.01750	1120	43	32	—	—	1580	60	45	—	—	—	—
	32		0.02000	1285	49	36	—	—	1800	68	51	—	—	—	—
1/4	20	0.2500	0.0318	2020	96	75	—	105	2860	144	108	—	160	3180	13
	28		0.0364	2320	120	86	—	135	3280	168	120	—	185	3640	14
					LB. FT.	LB. FT.	LB. FT.	LB. FT.		LB. FT.	LB. FT.	LB. FT.	LB. FT.		
5/16	18	0.3125	0.0524	3340	17	13	16	19	4720	25	18	22	30	5240	25
	24		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		0.0878	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		0.1187	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		0.1599	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		0.2030	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		0.2560	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		0.3730	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		0.5090	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		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		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		1.0730	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		1.3150	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		1.5800	87700	2200	1640	1974	2300	142200	3560	2660	2844	3925	158000	3270

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

SAE GRADE 5

SAE GRADE 8

Figure 1-3. Torque Chart

SECTION 2. GENERAL

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 Factory-Certified Service Technician on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. JLG Industries, Inc. recognizes a Factory-Certified Service Technician 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 the Preventative Maintenance 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.

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	Factory-Certified Service Technician	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 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of 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

MAKE SURE THAT PERSONNEL ARE CLEAR OF CHASSIS AT ALL TIMES WHEN JACKS ARE EXTENDED.

⚠ WARNING

JACKS RETRACT AUTOMATICALLY, LOWERING THE CHASSIS.

⚠ WARNING

THE JACKS ARE TO BE USED FOR EXTENDING AND RETRACTING THE AXLES. THEY ARE NOT TO BE USED AS A MAINTENANCE TOOL.

The jacks (if equipped) provided for extending and retracting the axles are not to be used as a maintenance tool. When performing maintenance on the machine which requires lifting, use adequate hydraulic jacks for lifting the machine, not the axle jacks.

Cleanliness

1. 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 air, fuel, and oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.
2. At any time when air, fuel, or 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.
3. 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

1. 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.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eye-bolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90 degrees.
3. 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

1. 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.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. 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.
4. 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

1. 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.
2. 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 Torque Chart Section 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

1. Keep the system clean. If evidence of metal or rubber particles are found in the hydraulic system, drain and flush the entire system.
2. 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

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.

Battery

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

Lubrication and Servicing

Components and assemblies requiring lubrication and servicing are shown in the Lubrication Chart in Section 1.

2.3 LUBRICATION AND INFORMATION

Hydraulic System

1. 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 (suction) lines.

2. 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. Hydraulic system filters should be checked, cleaned, and/or replaced as necessary, at the specified intervals required in the Lubrication Chart in Section 1. Always examine filters for evidence of metal particles.

3. 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.

4. 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 or filters of new machines due to the wear-in of meshing components.*

Hydraulic Oil

1. Refer to Section 1 for recommendations for viscosity ranges.

2. JLG recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152.

NOTE: *Start-up of hydraulic system with oil temperatures below -15 degrees F (-26 degrees C) is not recommended. If it is necessary to start the system in a sub-zero environment, it will be necessary to heat the oil with a low density, 100VAC heater to a minimum temperature of -15 degrees F (-26 degrees C).*

3. The only exception to the above is to drain and fill the system with Mobil DTE 13 oil or its equivalent. This will allow start up at temperatures down to -20 degrees F (-29 degrees C). However, use of this oil will give poor performance at temperatures above 120 degrees F (49 degrees C). Systems using DTE 13 oil should not be operated at temperatures above 200 degrees F (94 degrees C) under any condition.

Changing Hydraulic Oil

1. Use of any of the recommended crankcase or hydraulic oils eliminates the need for changing the oil on a regular basis. However, filter elements must be changed after the first 50 hours of operation and every 300 hours thereafter. 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.

2. 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. Always clean the mesh element of the filter and replace the cartridge any time the system oil is changed.

3. 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 Section 1 for an explanation of the lubricant key designations appearing in the Lubrication Chart.

2.4 CYLINDER DRIFT TEST

Maximum acceptable cylinder drift is to be measured using the following methods.

Platform Drift

Measure the drift of the platform to the ground. Lower booms (if equipped) slightly elevated, upper boom fully extended with the rated load in the platform and power off. Maximum allowable drift is 2 inches (5 cm) in 10 minutes. If the machine does not pass this test, proceed with the following.

Cylinder Drift

Table 2-2. Cylinder Drift

Cylinder Bore Diameter		Max. Acceptable Drift in 10 Minutes	
inches	mm	inches	mm
3	76.2	0.026	0.66
3.5	89	0.019	0.48
4	101.6	0.015	0.38
5	127	0.009	0.22
6	152.4	0.006	0.15
7	177.8	0.005	0.13

Drift is to be measured at the cylinder rod with a calibrated dial indicator. The cylinder oil must be at ambient temperature and temperature stabilized.

The cylinder must have the normal load, which is the normal platform load applied.

If the cylinder passes this test, it is acceptable.

NOTE: *This information is based on 6 drops per minute cylinder leakage.*

2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

1. Pinned joints should be disassembled and inspected if the following occurs:
   a. Excessive sloppiness in joints.
   b. Noise originating from the joint during operation.
2. Filament wound bearings should be replaced if any of the following is observed:
   a. Frayed or separated fibers on the liner surface.
   b. Cracked or damaged liner backing.
   c. Bearings that have moved or spun in their housing.
   d. Debris embedded in liner surface.
3. Pins should be replaced if any of the following is observed (pin should be properly cleaned prior to inspection):
   a. Detectable wear in the bearing area.
   b. Flaking, pealing, scoring, or scratches on the pin surface.
   c. Rusting of the pin in the bearing area.
4. Re-assembly of pinned joints using filament wound bearings.
   a. Housing should be blown out to remove all dirt and debris...bearings and bearing housings must be free of all contamination.
   b. Bearing / pins should be cleaned with a solvent to remove all grease and oil...filament wound bearing are a dry joint and should not be lubricated.
   c. Pins should be inspected to ensure it is free of burrs, nicks, and scratches which would damage the bearing during installation and operation.

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL					
	Pre-Start[1] Inspection	Weekly Preventive Maintenance	Monthly Preventive Maintenance	Pre-Delivery[2] or Frequent[3] Inspection	Annual[4] (Yearly) Inspection	Every 2 Years
Boom Assembly	9					
Boom Weldments				1,2,4	1,2,4	
Hose/Cable Carrier Installations				1,2,9,12	1,2,9,12	
Pivot Pins and Pin Retainers				1,2	1,2	
Sheaves, Sheave Pins				1,2	1,2	
Bearings				1,2	1,2	
Wear Pads				1,2	1,2	
Covers or Shields				1,2	1,2	
Extend/Retract Chain or Cable Systems				1,2,3	1,2,3	
Platform Assembly	9					
Platform	1,2				1,2	
Railing	1,2			1	1,2	
Gate			5	1	1,5	
Floor	1,2			1	1,2	
Rotator		9,5				
Lanyard Anchorage Point	2			1,2,10	1,2,10	
Turntable Assembly	9					
Swing Bearing or Worm Gear				1,2,14	1,2,3,13,14	
Oil Coupling		9				
Swing Drive System						
Turntable Lock				1,2,5	1,2,5	
Hood, Hood Props, Hood Latches				5	1,2,5	
Chassis Assembly	9					
Tires	1	16,17		16,17,18	16,17,18	
Wheel Nuts/Bolts	1	15		15	15	
Wheel Bearings						14,24
Oscillating Axle/Lockout Cylinder Systems					5,8	
Outrigger or Extendable Axle Systems				5,8	5,8	
Steer Components						
Drive Motors						
Torque Hubs				11	11	
Functions/Controls	9					
Platform Controls	5	5		6	6	
Ground Controls	5	5		6	6	

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL					
	Pre-Start[1] Inspection	Weekly Preventive Maintenance	Monthly Preventive Maintenance	Pre-Delivery[2] or Frequent[3] Inspection	Annual[4] (Yearly) Inspection	Every 2 Years
Function Control Locks, Guards, or Detents	1,5	1,5		5	5	
Footswitch	1,5			5	5	
Emergency Stop Switches (Ground & Platform)	5			5	5	
Function Limit or Cutout Switch Systems				5	5	
Capacity Indicator					5	
Drive Brakes				5		
Swing Brakes				5		
Boom Synchronization/Sequencing Systems					5	
Manual Descent or Auxiliary Power				5	5	
Power System	9					
Engine Idle, Throttle, and RPM				3	3	
Engine Fluids (Oil, Coolant, Fuel)	11	9,11		11	11	
Air/Fuel Filter		1,7		7	7	
Exhaust System			1,9	9	9	
Batteries	5	1,9			19	
Battery Fluid		11		11	11	
Battery Charger		5			5	
Fuel Reservoir, Cap, and Breather	11,9		2	1,5	1,5	
Hydraulic/Electric System	9					
Hydraulic Pumps		1,9		1,2,9		
Hydraulic Cylinders		1,9,7	2	1,2,9	1,2,9	
Cylinder Attachment Pins and Pin Retainers		1,9		1,2	1,2	
Hydraulic Hoses, Lines, and Fittings		1,9	12	1,2,9,12	1,2,9,12	
Hydraulic Reservoir, Cap, and Breather	11	1,9	2	1,5	1,5	24
Hydraulic Filter		1,9		7	7	
Hydraulic Fluid	11			7,11	7,11	
Electrical Connections		1		20	20	
Instruments, Gauges, Switches, Lights, Horn		1			5,23	
General						
Operators and Safety Manuals in Storage Box	21			21	21	
ANSI and EMI Manuals/Handbooks Installed					21	
Capacity Decals Installed, Secure, Legible	21			21	21	
All Decals/Placards Installed, Secure, Legible	21			21	21	
Walk-Around Inspection Performed	21					

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL					
	Pre-Start[1] Inspection	Weekly Preventive Maintenance	Monthly Preventive Maintenance	Pre-Delivery[2] or Frequent[3] Inspection	Annual[4] (Yearly) Inspection	Every 2 Years
Annual Machine Inspection Due				21		
No Unauthorized Modifications or Additions				21	21	
All Relevant Safety Publications Incorporated				21	21	
General Structural Condition and Welds				2,4	2,4	
All Fasteners, Pins, Shields, and Covers				1,2	1,2	
Grease and Lubricate to Specifications				22	22	
Function Test of All Systems	21			21	21, 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

Performance 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 - Drain, Clean, Refill

SECTION 3. CHASSIS & TURNTABLE

3.1 DRIVE HUB

The final drive consists of two planetary stages with an integrated disconnect mechanism. Each stage incorporates a set of matched planetary gears, which provide an equal load distribution. All torque transmitting components are made of forged quenched and tempered high-alloy steels. External gears are carburized. Precision roller bearings support the sprocket or wheel loads. A shaft seal protects the unit against contamination.

Disassembly

1. Position drive so that one of the fill holes is at the bottom of the end cover and drain the oil.
2. Remove all bolts holding the motor and Remove motor from drive.
3. Compress the spring (55) using a simple fixture or other suitable device.
4. Remove snap ring (66) and release pressure on the spring (55) until loose.
5. Remove the spring (55).
6. Turn unit so that cover (8) is in the up position.
7. Remove the screw plugs (21) and seal rings (22).
8. Remove “o” ring (33).
9. Remove the first stage planetary assembly (7).
10. Remove hex bolts (23).
12. Remove ring gear (30) and “o” ring (19).
13. Remove snap rings (15).
14. Pull off planet gears (1) together with cylindrical roller bearings (11) from spindle (60).

NOTE: *Further disassembly of the hub is discouraged. reinstallation of the shaft nut (4) requires a special tool and a torque of 626 ft./ lbs. (876 Nm) for proper reassembly. These components Will Fail if not properly reassembled.*

15. Inspect the planetary stage assemblies as complete units. Thoroughly clean and check both the gearing and the bearings for damage and apply new oil. If the gears or bearings need replacing, they must be replaced as complete sets.
16. The first stage planetary gears (2) ***must*** *be changed in sets of three pieces.*
17. The first stage planetary gears (2) ***must*** be changed as a complete set of three and JLG recommends changing the sun gear shaft (43) along with this set of planets.
18. The second stage planetary bearings (11) ***must*** be replaced in sets of four pieces.
19. The second stage planetary gears (1) ***must*** be changed as a complete set of four and JLG recommends changing the sun gear (3) along with this set of planets.

Disassembly of Cover

Loosen and remove hex head bolts (53) to remove cover (51).

Disassembly of the First Stage Planetary Assembly (7)

1. Push sun gear shaft (43) out of the first stage.
2. Remove snap rings (14).
3. Press planet pins (5) out of the planet gears (2).
4. Pull cylindrical roller bearing (10) out of the planet gears (2).
5. Remove snap ring (16) from sun gear (3) and Remove planet carrier (7) from sun gear (3).

Disassembly of Second Stage Planet Gears (1)

Press cylindrical roller bearings out of planet gears (1).

Assembly of First Stage Planetary Assembly (7)

1. Pre-freeze planet pins (5) and install into planet carrier (7).
2. Install planet carrier (7) together with planet pins (5) on sun gear (3), and install snap ring (16).
3. Put sun gear shaft (43) into sun gear (3).
4. Pre-heat stay rings (17) and install onto planet pins (5).
5. Pre-heat cylindrical roller bearings (10) and install onto planet pins (5) and fix bearings with snap rings (14).

Assembly of End Cover Unit (8)

1. Install “o” ring (54) into groove of cover (8).
2. Install the cover (51) into cover (8) and fix cover (51) with hex bolts (53). Tighten bolts with torque wrench to 6.3 ft. lbs. (8.5 Nm).

Final Assembly

1. Install planet gears (1) onto planet pins which are part of spindle (60).
2. Install snap rings (15) on planet pins of spindle (60) in order to fix the planet gears (1).
3. Insert the first stage planetary assembly (7) into drive.
4. Install “o” ring (33) in groove of ring gear (30).
5. Install seal rings (22) and screw plugs (21).
6. Before installation of motor, CHECK THAT THERE IS 1-2 mm OF CLEARANCE BETWEEN THE MOTOR SPLINE SHAFT SHOULDER AND THE COUPLER (62).
7. Install the motor and reconnect hydraulic lines.
8. Roll motor so that one fill plug is at 12 o’clock position, and the other is at 3 o’clock. Fill to bottom of 3 o’ clock plug with gear oil. reinstall plugs.

Initial Start-up And After Repairs

Before operating the machine, make sure that the drive is filled with clean oil, approximately 0.2 US gallons(0.8 L). An accurate oil level is determined by the oil level plug, which should be removed before oil fill.

With the gear case filled to their proper levels, start the machine and allow sufficient time for run-in at moderate pressure and speed before running at full speed. After 4 hours of operation, recheck oil level.Maintenance

Daily: - Check for oil leakage

Weekly: - Check oil level

Monthly: - Check mounting bolt torque

Oil Change Interval-Gear Drive

1. Perform the first oil change after approximately 150 hours.
2. Subsequent changes, every 1500 hours or annually, whichever occurs first.

NOTE: *Flush the drive before filling with new oil.*

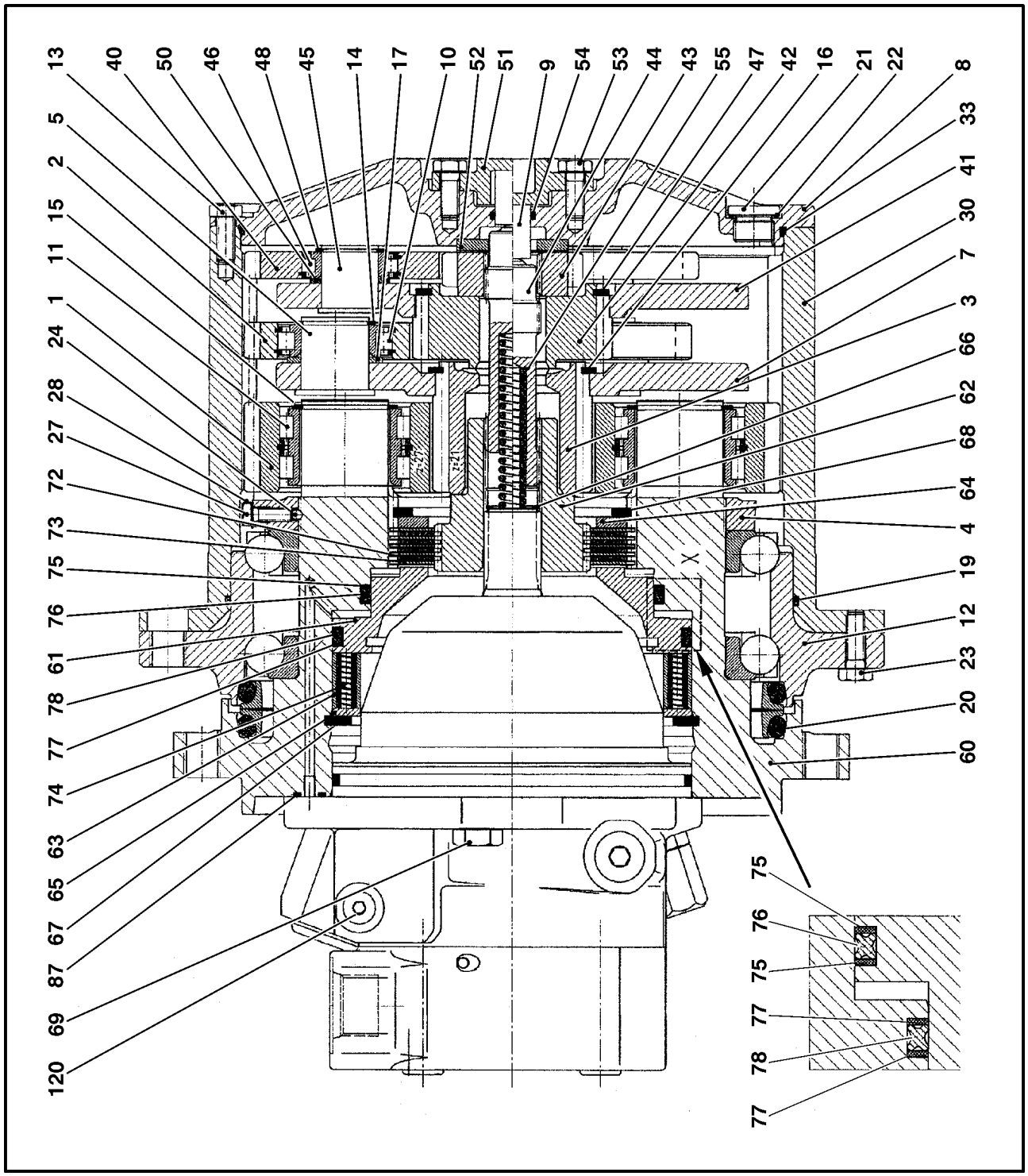


Figure 3-1. Drive Hub - Sheet 1 of 2)

1. Planet Gear
2. Planet Gear
3. Sun Gear
4. Shaft Nut
5. Planet Pin
7. Planet Carrier
8. Cover
9. Thrust Button
10. Roller Bearing
11. Roller Bearing
12. Ball Bearing
13. Hex Bolt
14. Snap Ring
15. Snap Ring
16. Snap Ring
17. Stay Rings
19. O-ring
20. Shaft Seal
21. Plug
22. Seal Ring
23. Bolt
24. Detent Ball
27. Bolt
28. Washer
30. Ring Gear
33. O-ring
41. Planet Carrier
42. Sun Gear
43. Sun Gear
45. Planet Pin
46. Roller Bearing
47. Retaining Ring
48. Retaining Ring
51. Cover
52. Thrust Washer
53. Bolt
54. O-ring
55. Spring
60. Spindle
61. Piston
62. Coupler
63. Ring Locator
64. Backup Plate
65. Backup Plate
66. Retaining Ring
67. Retaining Ring
68. Retaining Ring
69. Bolt
72. Brake Disc
73. Brake Disc
74. Spring
75. Backup Ring
76. Seal
77. Backup Ring
78. Seal
81. O-ring

Figure 3-2. Drive Hub - Sheet 2 of 2

3.2 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

NOTE: *This check is designed to replace the existing bearing bolt torque checks on JLG Lifts in service. This check must be performed after the first 50 hours of machine operation and every 600 hours of machine operation thereafter. If during this check any bolts are found to be missing or loose, replace missing or loose bolts with new bolts and torque to the value specified in the torque chart, after lubricating the bolt threads with loctite #271. After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.*

Check the frame to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to 70 degrees (full elevation).
2. At the positions indicated on Figure 3-3., Swing Bearing Bolt Feeler Gauge Check, try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
3. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
4. Swing the turntable 90 degrees, and check some selected bolts at the new position.
5. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

Check the turntable to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to 70 degrees (full elevation).
2. At the positions indicated on Figure 3-3., Swing Bearing Bolt Feeler Gauge Check, try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
3. Lower the boom to horizontal and fully extend the boom.
4. At the position indicated on Figure 3-3., Swing Bearing Bolt Feeler Gauge Check, try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

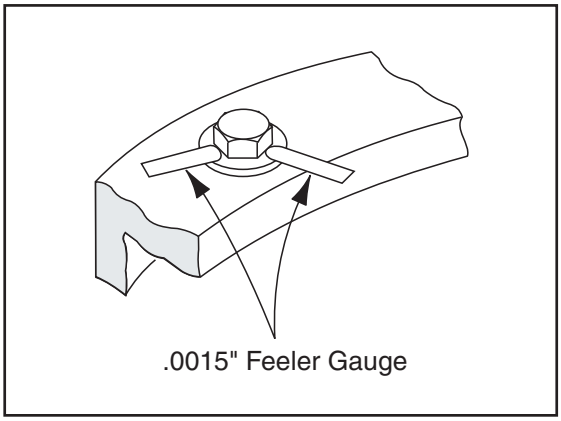


Figure 3-3. Swing Bearing Bolt Feeler Gauge Check

Bearing Wear Tolerance

1. From the underside of the machine, at rear center, with the boom fully elevated and fully retracted (Figure 3-4., Swing Bearing Tolerance Boom Placement), measure and record the distance between the swing bearing and the frame using a magnetic base dial indicator. (Figure 3-4., Swing Bearing Tolerance Boom Placement)
2. At the same point, with the boom at horizontal and extended until red marking band on mid section is exposed, measure and record the distance between the swing bearing and frame using a magnetic base dial indicator. (Figure 3-4., Swing Bearing Tolerance Boom Placement)
3. If a difference greater than 0.064 in. (1.625 mm) is determined, the swing bearing should be replaced.
4. If a difference less than 0.064 in. (1.625 mm) is determined, and any of the following conditions exist, the bearing should be removed, disassembled, and inspected for the following:
   a. Metal particles in the grease.
   b. Increased drive power required.
   c. Noise.
   d. Rough rotation.

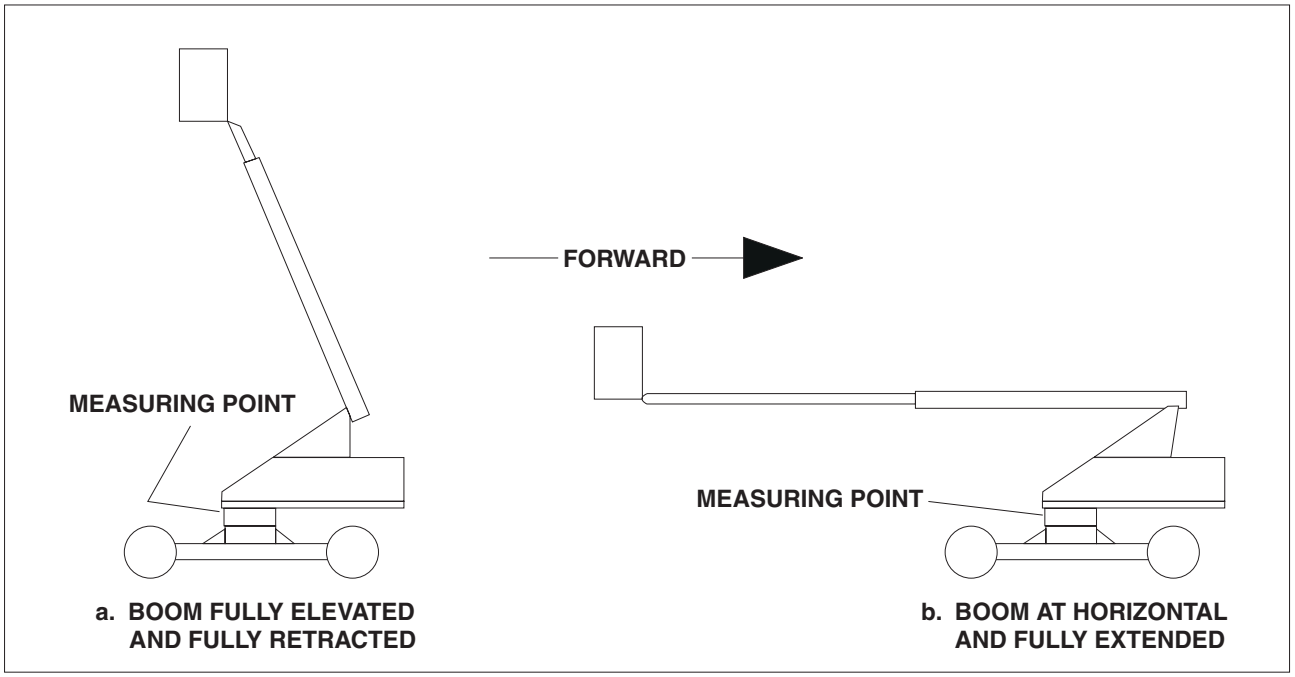


Figure 3-4. Swing Bearing Tolerance Boom Placement

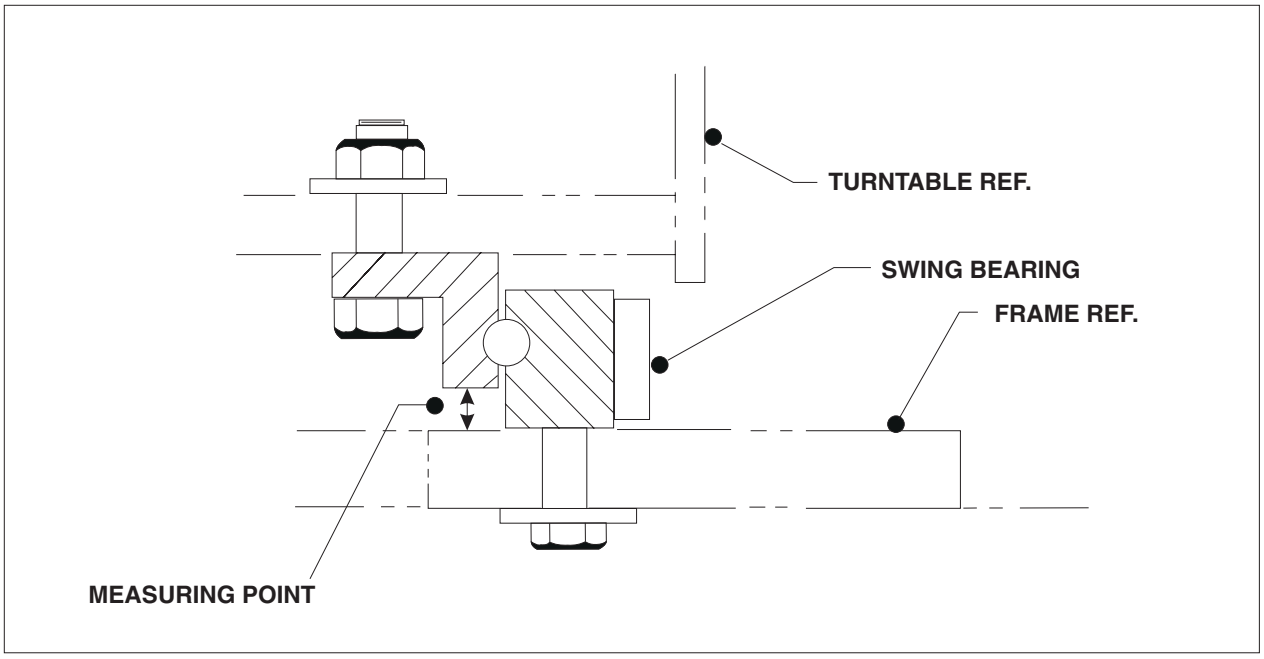


Figure 3-5. Swing Bearing Tolerance Measuring Point

5. If bearing inspection shows no defects, reassemble bearing and return to service.

⚠ IMPORTANT

THE SWING BEARING IS ONE OF THE MOST CRITICAL POINTS ON AN AERIAL LIFT. IT IS HERE THAT THE STRESSES OF LIFTING ARE CONCENTRATED, AT THE CENTER OF ROTATION. BECAUSE OF THIS, PROPER MAINTENANCE OF THE SWING BEARING BOLTS IS A MUST FOR SAFE OPERATION.

Bearing Replacement

1. Removal.
   a. From ground control station, operate the boom lift control and raise boom adequately to provide access to frame opening or, if equipped, to the rotary coupling.

⚠ WARNING

NEVER WORK BENEATH THE BOOM WITHOUT FIRST PROVIDING ADEQUATE OVERHEAD SLING SUPPORT AND/OR BLOCKING.

   b. Attach an adequate support sling to the boom and draw all slack from sling. Block the boom if feasible.

NOTE: *Steps c and d apply to those machines equipped with a rotary coupling.*

   c. From under side of machine frame, remove bolts and lockwashers which attach rotary coupling retaining yoke to coupling housing.

⚠ IMPORTANT

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID THE ENTRY OF CONTAMINANTS INTO THE SYSTEM.

   d. Tag and disconnect the hydraulic lines from the fittings on the top and sides of the rotary coupling. Use a suitable container to retain any residual hydraulic fluid. Immediately cap lines and ports.
   e. Attach suitable overhead lifting equipment to the base of the turntable weldment.
   f. Use a suitable tool to scribe a line on the inner race of the swing bearing and on the underside of the turntable. This line will aid in aligning the bearing upon installation. Remove the bolts, nuts and washers which attach the turntable to the bearing inner race. Discard the nuts and bolts.
   g. Use the lifting equipment to carefully lift the complete turntable assembly from the bearing. Ensure that no damage occurs to the turntable, bearing or frame mounted components.
   h. Carefully place the turntable on a suitably supported trestle.
   i. Use a suitable tool to scribe a line on the outer race of the swing bearing and the frame. This line will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the outer race of the bearing to the frame. Discard the bolts. Use suitable lifting equipment to remove the bearing from the frame; move the bearing to a clean suitably supported work area.
2. Installation.
   a. Position the bearing on the machine frame.
   b. Use suitable lifting equipment to carefully lower the swing bearing into position on the frame. Ensure that the scribed line of the outer race of the bearing aligns with the scribed mark on the frame (if a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft centerline of the frame).

⚠ CAUTION

JLG INDUSTRIES RECOMMENDS THAT ALL REMOVED BEARING NUTS AND BOLTS BE DISCARDED AND REPLACED WITH NEW NUTS AND BOLTS. SINCE THE SWING BEARING IS THE ONLY STRUCTURAL LINK BETWEEN THE FRAME AND TURNTABLE, IT IS IMPERATIVE THAT SUCH REPLACEMENT HARDWARE MEETS JLG SPECIFICATIONS. USE OF GENUINE JLG HARDWARE IS HIGHLY RECOMMENDED.

   c. Apply a light coating of Loctite #277 to the new bearing bolts, and loosely install the bolts and washers through the frame and outer race of bearing.

⚠ CAUTION

IF COMPRESSED AIR OR ELECTRICALLY-OPERATED IMPACT WRENCH IS USED FOR TIGHTENING THE BEARING ATTACHMENT BOLTS, THE TORQUE SETTING ACCURACY OF THE TOOL SHOULD BE CHECKED PRIOR TO USE.

   d. Following the Torque Sequence diagram shown in Figure 3-6., tighten the bolts to an initial torque of 180 ft. lbs. (244 Nm). Then following the same sequence tighten the bolts to a final torque of 240 ft. lbs. (325 Nm).
   e. Remove the lifting equipment from the bearing.
   f. Use suitable lifting equipment to carefully position the turntable assembly above the machine frame.

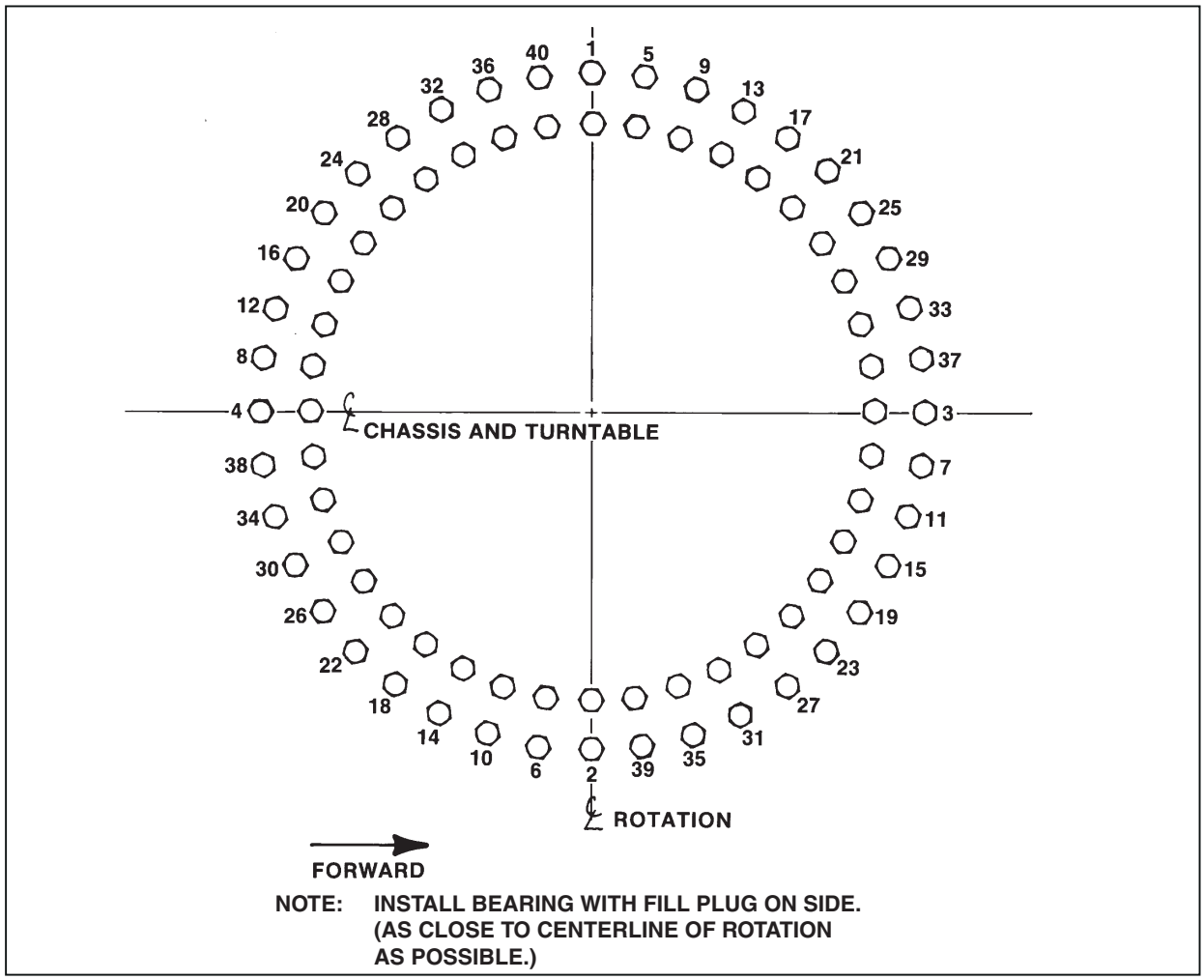


Figure 3-6. Swing Bearing Bolt Torquing Sequence

g. Carefully lower the turntable onto the swing bearing, ensuring that the turntable and bearing align as noted in step i above.

⚠ CAUTION

IF COMPRESSED AIR OR ELECTRICALLY-OPERATED IMPACT WRENCH IS USED FOR TIGHTENING THE BEARING ATTACHMENT BOLTS, THE TORQUE SETTING ACCURACY OF THE TOOL SHOULD BE CHECKED PRIOR TO USE.

h. Apply a light coating of Loctite #277 to the new bearing bolts, and install the bolts, washers and nuts through the turntable and inner race of the bearing.

i. Following the Torque Sequence diagram shown in Figure 3-6., Swing Bearing Bolt Torquing Sequence, tighten the bolts to an initial torque of 180 ft. lbs. (244 Nm). Then following the same sequence tighten the bolts to a final torque of 240 ft. lbs. (325 Nm).

j. Remove the lifting equipment.

k. Install the rotary coupling retaining yoke; apply a light coating of Loctite Sealant Number TL277-41 to the attaching bolts and secure the yoke to the rotary coupling with the bolts and lockwashers.

l. Connect the hydraulic lines to the rotary coupling as tagged prior to removal.

m. At ground control station, use boom lift control to lower boom to stowed position.

n. Using all applicable safety precautions, activate hydraulic system and functionally check swing system for proper and safe operation.

Swing Bearing Torque Values

1. Outer Race - 240 ft.lbs. (325 Nm) Loctite, 170 ft.lbs. (230 Nm) wet, 220 ft.lbs. (298 Nm) dry.
2. Inner Race - 240 ft.lbs. (325 Nm) Loctite, 170 ft.lbs. (230 Nm) wet, 220 ft.lbs. (298 Nm) dry.
3. Swing Bearing Torquing Sequence, Figure 3-6., Swing Bearing Bolt Torquing Sequence

⚠ WARNING

RETORQUE INNER AND OUTER SWING BEARING BOLTS TO 220 FT.LBS. (298 NM) AFTER FIRST 200 HOURS OF OPERATION AND EVERY 500 HOURS THEREAFTER.

3.3 SWING TORQUE HUB

Disassembly

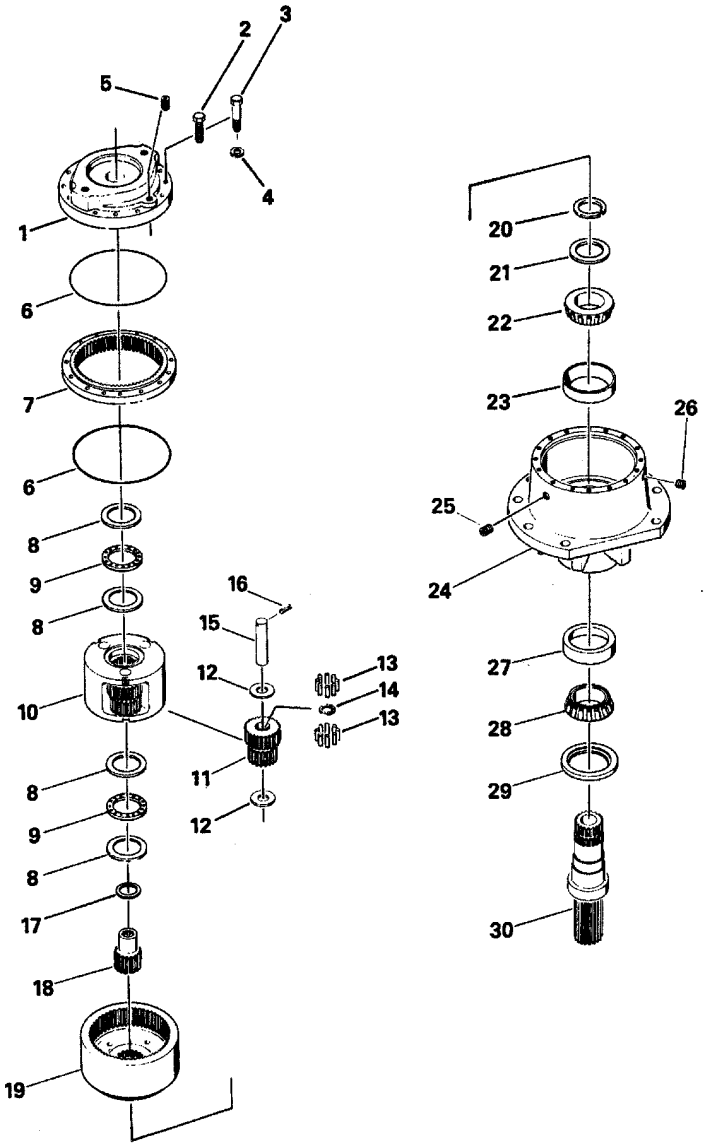
1. Remove oil plugs (25 and 26) and drain oil from unit into a suitable container. Replace drain plugs.

NOTE: *The screws, hub pinion gear, and retaining plate referenced in steps (2) and (3) are not shown in Figure 2-20, but are attached to the hub output shaft (item 30).*

2. Remove the two screws which attach the hub pinion gear retaining plate and remove plate.
3. Carefully remove pinion gear from splined hub output shaft.
4. Using suitable protection, clamp drive hub assembly in a vise or suitable holding fixture.
5. Remove four shoulder bolts (3) and lockwashers (4) from counterbored holes in cover of drive hub assembly.
6. Remove remaining eight bolts (2) which attach cover (1) to ring gear 7.
7. Carefully remove cover assembly (1) from input gear (18) together with outer thrust washers (8) and thrust bearing 9. Remove and discard outer o-ring (6).
8. Remove thrust washer (17) from small diameter of input gear (18).
9. Carefully withdraw input gear (18) from cluster gear (11) and output shaft (30).
10. Rotate ring gear (7) and check that each of the three cluster gears (11) incorporates a punched timing mark.
11. Carefully withdraw ring gear (7) from assembly.
12. Carefully withdraw carrier assembly (10) from internal gear (19).
13. Remove and discard inner o-ring (6).
14. Remove inner thrust washers (8) and thrust bearing (9) from counterbore in carrier assembly 10.
15. Carefully withdraw internal gear (19) from output shaft (30).
16. If necessary, disassemble planet carrier assembly (10) as follows:
    a. Remove three pins (16) by gently tapping a suitable punch against the roll pin until the pin is driven into planet shaft (15).
    b. Using a suitable drift, carefully and gently tap shafts (15) from carrier (10), ensuring that needle rollers (13) on each shaft are not damaged or lost.
    c. Lift cluster gears (11) from carrier (10) and remove thrust washers (12), needle rollers (13) and roller spacer (14).
    d. Drive roll pins (16) from shafts (15) and discard pins.
17. If necessary, disassemble hub and shaft assembly (24) as follows:
    a. Using suitable snap ring pliers, remove retaining ring (20) from groove in output shaft (30).
    b. Remove spacer shim (21) from output shaft.
    c. Place hub in a suitable hand-operated hydraulic press with external portion of shaft (30) down and with suitable block supporting hub (24).
    d. Using suitable protection between inner end of shaft (30) and press cylinder drift, operate press and carefully press shaft from inner bearing assembly (22 and 23).
    e. Remove seal (29) from shaft and discard seal.
    f. Remove bearing cone (22) from cup (23).
    g. Using press, remove bearing cups (23 and 27) from hub (24) and cone (28) from shaft (30).

Cleaning and Inspection

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect bearing components (22, 23, 27, 28) for damage, pitting, corrosion or excessive wear. Replace bearings as a complete set if necessary.
3. Inspect all thrust washers for scoring or excessive wear.
4. Inspect all geared or splined components for chipped or broken teeth and for excessive or uneven wear patterns.



1.Cover
2.Hex Head Bolt
3.Shoulder Bolt
4.Lockwasher
5.Plug
6.O-Ring
7.Ring Gear
8.Thrust Washer
9.Thrust Bearing
Planetary Carrier Assembly
10.Carrier Housing
11.Cluster Gear
12.Thrust Washer
13.Needle Roller
14.Spacer
15.Thrust Shaft
16.Roll Pin
17.Thrust Washer
18.Input Gear
19.Internal Gear
Hub Shaft Assembly
20.Retaining Ring
21.Spacer
22.Bearing Cone
23.Bearing Cup
24.Hub
25.Pipe Plug
26.Pipe Plug
27.Bearing Cup
28.Bearing Cone
29.Seal
30.Output Shaft

Figure 3-7. Swing Torque Hub

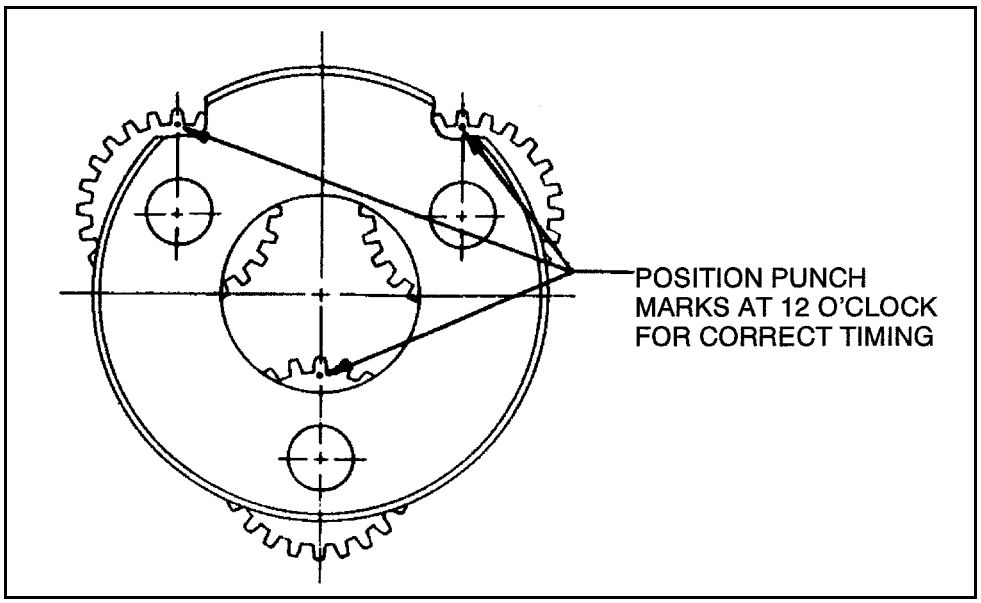


Figure 3-8. Torque Hub Carrier Timing

5. Inspect o-ring grooves in hub (24) and cover (1) for burrs or sharp edges. Dress applicable surfaces as necessary.
6. Inspect all thrust washer and bearing surfaces for damage. Repair or replace as necessary.
7. Inspect all threaded components for damage including stretching, thread deformation or twisting. Replace as necessary.
8. Inspect planet shafts (15) for scoring or other damage. Replace as necessary.

Assembly

1. If necessary, assemble hub and shaft assembly.
   a. Using a suitable hydraulic press, install bearing cups (23 and 27) into hub (24).
   b. Using the hydraulic press, install bearing cone (28) onto output shaft (30).
   c. Correctly position shaft (30) into hub (24) with cone (28) in cup (27).
   d. Using a suitable shaft support in the hydraulic press, install bearing cone (22) on shaft (30) until cone abuts bearing cup (23).
   e. Position spacer shim (21) on shaft (30) between retainer ring groove and bearing cone (22).
   f. Using suitable snap ring pliers, install retaining ring (20) on shaft (30).
   g. Using the hydraulic press, install a new seal (29) over shaft and into hub (24). Ensure that seal is installed squarely.
   h. Check that output shaft (30) rotates freely in the hub. The oil seal will create a small amount of drag. By tapping the outside of the shaft with a soft headed mallet, any excessive tightness will be reduced.
2. If necessary, assemble planet carrier assembly (10) as follows:
   a. Apply a light coating of petroleum jelly or multi-purpose grease to flanged surface of thrust washers (12).
   b. Position thrust washers (12) in carrier (10) with tang in appropriate carrier cutaway portion. Ensure that washers are flat against surface on both sides of carrier.
   c. Apply a liberal coating of petroleum or multi-purpose grease to inner diameter of cluster gear (11).
   d. Position spacer (14) at the approximate midpoint of the gear diameter.
   e. On each side of spacer (14), position needle rollers (13) in inner diameter of gear.
   f. Position assembled cluster gear (11) into carrier (10) between the two thrust washers (12). Ensure that larger gear is on the roll pin side of carrier.
   g. Position planet shaft (15) into carrier hole, with shaft roll pin hole on same side as carrier roll pin hole.
   h. Continue inserting shaft through thrust washers (12) and cluster gear 11. Ensure that needle rollers (13) are not displaced.

i. Align roll pin holes in both shaft (15) and carrier (10) with chamfered portion of shaft hole uppermost.

j. Position new roll pin (16) in hole in carrier (10) and drive pin into hole until end of pin is flush with carrier surface.

k. Repeat steps (a) through (j) for remaining two cluster gears.

3. Position internal gear (19) on inner end of output shaft (30).

4. Time carrier cluster gears as follows:

   a. Place carrier assembly on a flat surface, positioning two top gears at ten o'clock and two o'clock, and one bottom gear at six o'clock as shown in Figure 3-8., Torque Hub Carrier Timing.

   b. Find marked (punch mark) teeth on large gears. Rotate gears until punch mark is located in a straight up, 12 o'clock, position. Punch marks at ten o'clock and two o'clock will be located just under edge of carrier and not readily visible.

5. Place ring gear (7) over cluster gears (11), with raised shoulder of ring gear facing down.

6. While holding ring gear (7) in position, invert carrier assembly (10) so that ring gear and larger diameter of cluster gears (11) are facing down.

7. Apply a light coating of petroleum jelly or multi-purpose grease to inner thrust washer (8) and thrust bearing (9).

8. Position thrust washer (8), thrust bearing (9), and thrust washer (8) into applicable groove of carrier assembly (10).

9. Apply a light coating of petroleum jelly or multi-purpose grease to new inner o-ring (6).

10. Position o-ring (6) in groove in hub (24).

11. While holding ring gear (7) and carrier assembly (10), insert smaller diameter of cluster gears (11) into internal gear (19).

12. Rotate ring gear (7) until hole marked "X" is located over hub shaft assembly (24).

13. Insert input gear (18) into carrier assembly (10) so that input gear and larger diameter of cluster gears (11) are in mesh. Check that carrier assembly (10) rotates freely.

14. Position thrust washer (17) on shaft of input gear (18).

15. Apply a light coating of petroleum jelly or multi-purpose grease to new outer o-ring (6).

16. Position o-ring (6) into groove of cover (1).

17. Apply a light coating of petroleum jelly or multi-purpose grease to outer thrust washers (8) and thrust bearing (9).

18. Position outer thrust washer (8), thrust bearing (9) and thrust washer (8) in cover (1).

19. Position cover (1) on ring gear (7) with oil check plug (5) in cover located at 90° from oil fill plugs (25 and 26) in hub (24).

20. Install four shoulder bolts (3) and lockwashers (4) into appropriate counterbored holes in hub (24).

21. Install eight bolts (2) which attach cover (1) to ring gear (7) and hub (24) and tighten to a torque of 23-27 ft.lbs. (3.2-3.7 kgm).

22. Carefully install hub pinion gear on splined output shaft. If necessary, gently tap into position with a soft headed mallet.

23. Apply No. 2 Lift Grade Loctite to pinion gear retaining plate screws.

24. Position gear retaining plate and install attaching screws.

25. Remove oil fill plug (25 or 26) and fill hub assembly with approximately one quart of approved extreme pressure gear lubricant. Install fill plug.

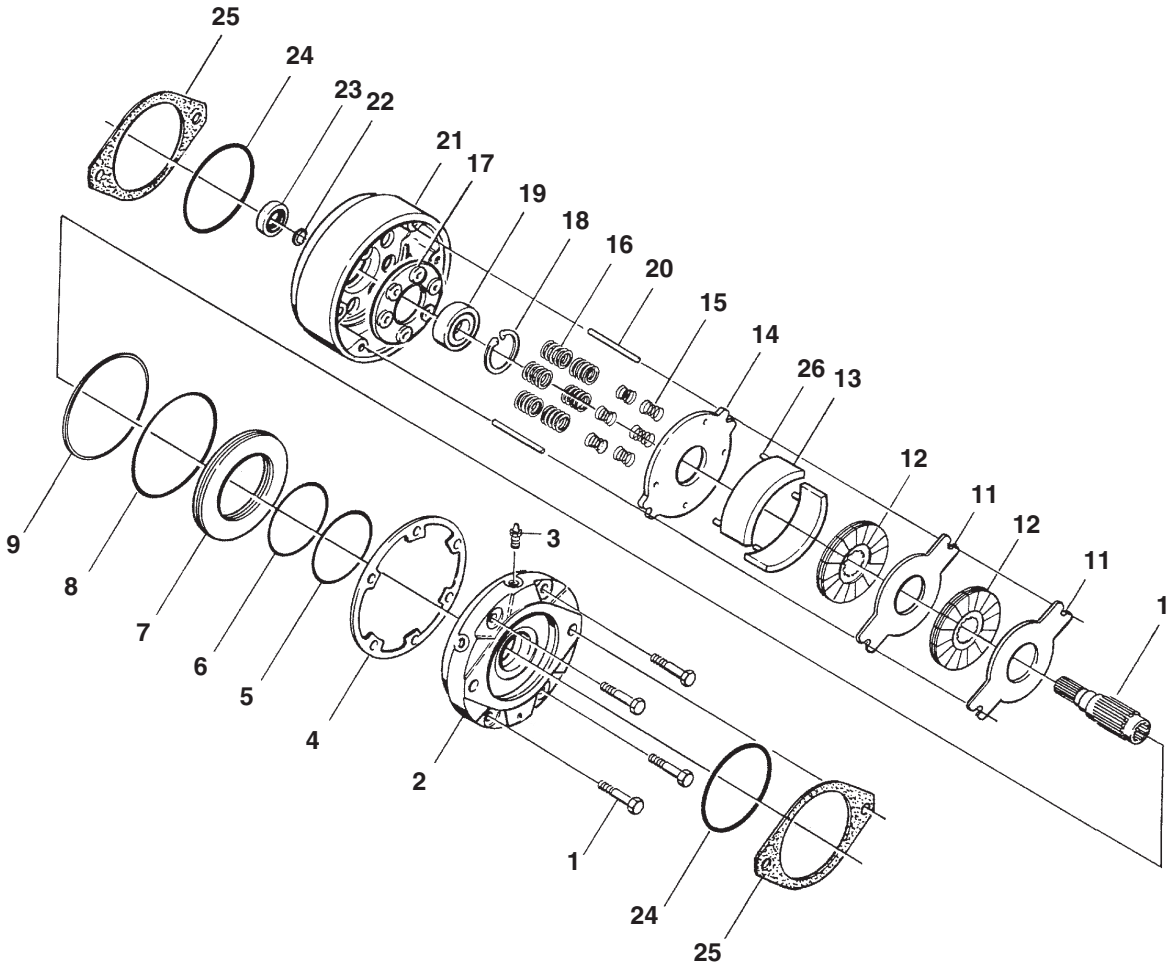
3.4 SWING BRAKE

1. Separate end cover (2) from housing (21) by removing capscrews (1).

⚠ CAUTION

END COVER IS UNDER SPRING TENSION OF APPROXIMATELY 907 KG. THE FOUR BOLTS SHOULD BE LOOSENED EVENLY TO RELIEVE THIS FORCE. IF A HYDRAULIC PRESS IS AVAILABLE (3,000 LB. [1,360 KG] MINIMUM), THE COVER CAN BE HELD IN POSITION WHILE REMOVING THE CAPSCREWS AND LOCKWASHERS.

2. Remove case seal (4) from the housing (21), then remove bleeder screw (3) from the end cover (2).



1. Capscrew
2. End Cover
3. Bleeder Screw
4. Case Seal
5. O-ring
6. Back-Up Ring
7. Piston
8. O-ring
9. Backup Ring
10. Shaft
11. Disc
12. Friction Disc
13. Separators
14. Return Plate
15. Spring
16. Spring
17. Spring Retainer
18. Retaining Ring
19. Bearing
20. Dowel Pin
21. Housing
22. Retaining Ring
23. Rotary Oil Seal
24. O-ring
25. Gasket
26. Pin

Figure 3-9. Swing Brake

3. Remove piston (7) from end cover (2).
4. Remove o-ring (5), back-up ring (6), o-ring (8) and back-up ring (9) from piston (7).
5. Remove separators (13) from housing (21).
6. Remove stack assembly, consisting of discs (11), return plate (14) and friction discs (12) from housing (21).

NOTE: *Not all models use the same number of springs or spring pattern. Record this information for assembly purposes. Spring retainer (17) was not used in earlier models.*

7. Remove dowel pins (20), springs (15 & 16) and spring retainer (17) from housing (21).
8. Remove retaining ring (18) from housing (21).
9. Remove shaft by pressing or using a soft mallet on male end of shaft (10).

NOTE: *Earlier models did not use retaining ring (22).*

10. Remove retaining ring (22) and bearing (19) from shaft (10).
11. Press Rotary oil seal (23) from housing (21).

Cleaning and Inspection

1. Clean all parts thoroughly.
2. Closely inspect all parts for excessive wear, cracks, and chips. Replace parts as necessary.
3. Discard seals and o-rings.
4. Closely inspect bearings and bearing contact surfaces. Replace as necessary.

NOTE: *Bearings may be reused if, after thorough inspection, they are found to be in good condition.*

Assembly

NOTE: *Lubricate all seals and o-rings with clean hydraulic oil prior to assembly.*

1. Clean all parts thoroughly before assembly.
2. Press new rotary oil seal (23) into housing (21). Note direction of the seal.

NOTE: *Earlier models did not use retaining ring (22).*

3. Install new bearing (19) and retaining ring (22) on shaft (10).
4. Insert shaft assembly and retaining ring (18) in housing (21).

NOTE: *Be sure to use the same number of springs and spring pattern as recorded during disassembly. Spring retainer (17) was not used in earlier models.*

5. Insert dowel pins (20), spring retainer (17) and springs (15 & 16) in housing (21).
6. Position new large diameter return plate (14) in housing with tabs guided by dowel pins (20) until disc rests on springs (15 & 16).

⚠ IMPORTANT

DISCS (11, 14) AND FRICTION DISCS (12) SHOULD REMAIN DRY DURING INSTALLATION. NO OIL RESIDUE SHOULD BE ALLOWED TO CONTAMINATE DISC SURFACES.

7. Place a new friction disc (12) on shaft (10) until it contacts return plate (14).
8. Add additional new discs (11) and new friction discs (12) as required to complete assembly.
9. Insert separators (13) in holes of return plate.
10. Install new o-ring (5), new backup ring (6), new o-ring (8) and new back-up ring (9) on piston (7). Note order of o-rings and back-up rings. Insert piston (7) into end cover (2) being careful not to shear o-rings or back-up rings.
11. Install new case seal (4) in housing (21) then install bleeder screw (3) in end cover (2).
12. Position end cover (2) on housing (21) aligning dowel pins (20) with holes in end cover.

NOTE: *If available, a hydraulic press will simplify installation of end cover on housing. Clamp cover in position while tightening capscrews.*

13. Press on inner ring of bearing (37) until it shoulders on shaft (45) to eliminate binding on bearings. Be certain to restrain opposite end of shaft to avoid excessive thrust loading on bearing (54).

⚠ IMPORTANT

IF HYDROSTATIC BENCH TESTING IS PERFORMED ON THE BRAKE ASSEMBLY, RELEASE PRESSURE SHOULD NOT EXCEED 138 BAR UNLESS TWO ADDITIONAL BOLTS ARE USED FOR SUPPLEMENTAL CLAMPING.

3.5 TILT ALARM SWITCH LEVELING

NOTE: *Each machine is equipped with a tilt alarm switch, factory set to activate at 5 degrees, which will illuminate a warning light, sound a warning horn and cut out 2 Speed Drive. Consult factory for tilt sensor adjustment. The only field adjustment necessary is leveling the switch on the spring loaded studs. There are two methods of adjustment, a manual adjustment and an adjustment using a voltmeter.*

⚠ CAUTION

PERFORM TILT ALARM SWITCH LEVELING PROCEDURE A MINIMUM OF EVERY SIX MONTHS TO ENSURE PROPER OPERATION AND ADJUSTMENT OF SWITCH.

Manual Adjustment

1. Park the machine on a flat, level surface. Ensure machine is level and tires are filled to rated pressure.

NOTE: *Ensure switch mounting bracket is level and securely attached.*

2. Level the base of the indicator by tightening the three flange nuts. Tighten each nut through approximately one half of it's spring's travel. DO NOT ADJUST THE "X" NUT DURING THE REMAINDER OF THE PROCEDURE.
3. With the electrical connections complete, slowly tighten one of the "Y" nuts until the circuit is closed and the light on the Platform Control Console illuminates.

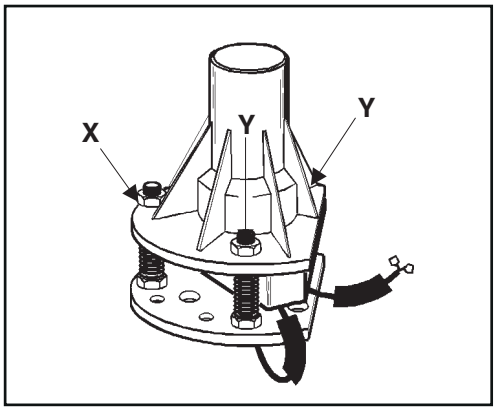


Figure 3-11. Tilt Switch Adjustment - Manual

4. Slowly back off the nut, counting the number of turns, until the circuit is again closed and the light again illuminates.
5. Divide the number of turns determined in step 4 in half. Tighten the nut this many turns. The line determined by this nut and the "X" nut is now parallel to the ground.
6. Repeat steps 3 through 5 for the remaining "Y" nut. The switch is now level.
7. Individually push down on one corner at a time; there should be enough travel to cause the switch to trip. If the switch does not trip in all three tests, the

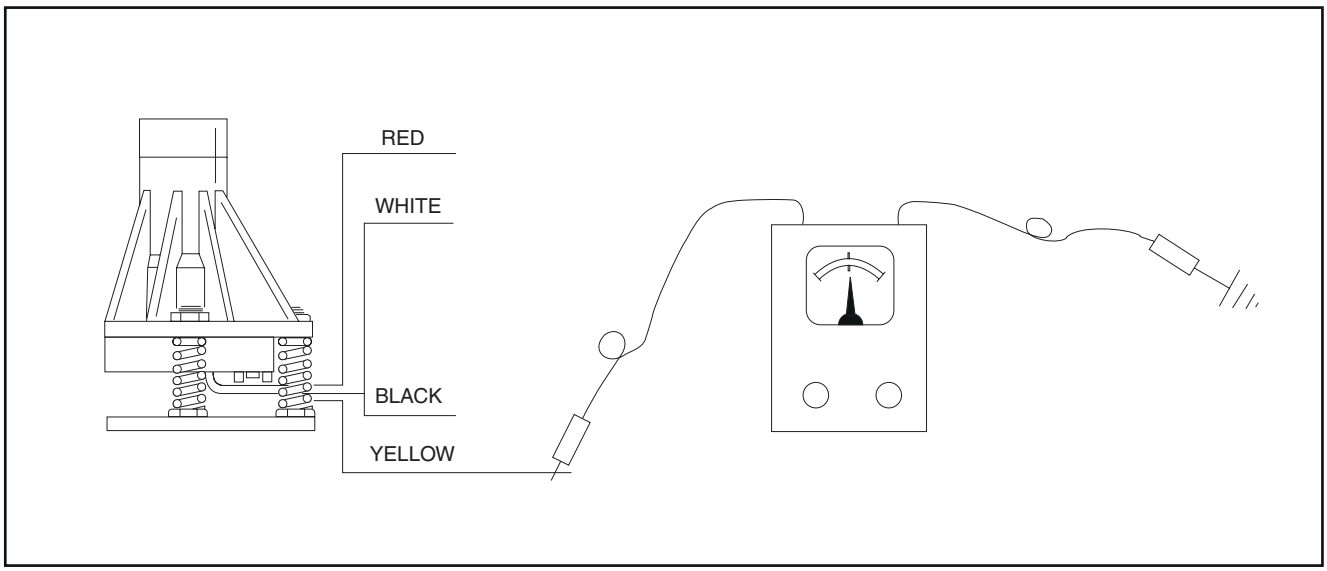


Figure 3-10. Tilt Switch Adjustment - Voltmeter

flange nuts have been tightened too far. Loosen the “X” nut and repeat steps 3 through 7.

Voltmeter Adjustment

1. Park machine on a flat, level surface. Ensure machine is level and tires are filled to rated pressure.
2. If engine is not running, turn ignition switch to ON.
3. Connect black lead of voltmeter to ground and red lead to yellow wire protruding from pot on bottom of sensor.
4. Adjust leveling nuts to obtain the highest possible voltage reading.
5. Check voltage at trip point in all four directions. If voltage reading is not symmetrical, repeat step 4 above.

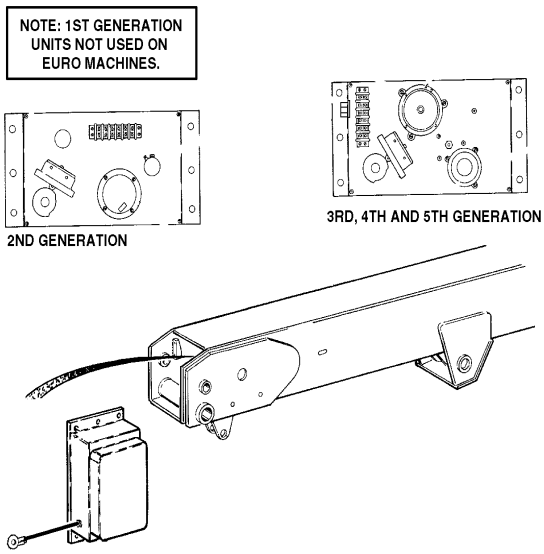
3.6 LOAD MANAGEMENT SYSTEM

The LMS (Load Management System) consists of three independent systems.

Platform Position Indication System

This system illuminates one of the two lamps in the platform position display located on both the platform console and ground control box. A blue light is used to indicate that the platform is within the permitted operating envelope and a red light is used to indicate when the platform is outside the permitted operating envelope. Either the blue or red light should be illuminated at all times.

The elevation angle is sensed by means of a pendulum potentiometer and the extension of the boom sensed by a multi-turn potentiometer driven by means of a cable attached to the telescoping part of the boom. Both of these sensors are situated at the rear of the base boom section and housed in a sealed steel box.



The signals from these sensors (elevation angle and extension distance) are fed into a load radius card which calculates the boom radius.

Boom Radius = Boom Length x Cos Boom Angle

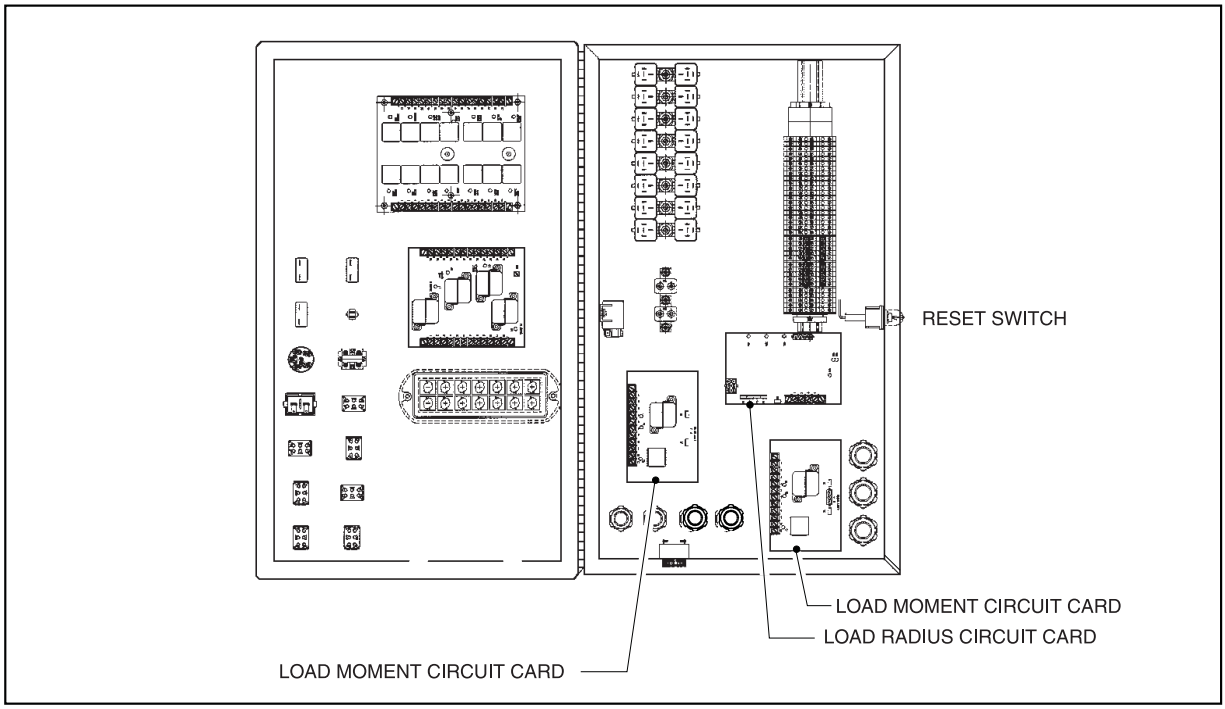


Figure 3-12. Control Box Components

This circuit card operates as follows:

A calibrated dc voltage representing the boom angle is sent from the boom angle sensor to the angle cosine circuit. This voltage is converted to the cosine of the angle and presented to the radius generator circuit.

A calibrated dc voltage representing the boom length is sent from the boom length sensor to the boom length circuit and presented to the radius generator circuit.

The length and cosine dc voltages are multiplied together in the radius generator circuit. The output dc voltage from this circuit is passed to a radius limiting circuit. This circuit is set to detect a specific boom radius dimension. The resultant output signal is sent to a logic network circuit which determines which of the indicator lamps (blue or red) should be energized.

There should be a signal from the sensors at all times, however, if the signal line from the angle, or the boom length sensor is cut a failure circuit detects this and activates an audible warning horn mounted in the console panels.

The boom length circuit also produces output dc voltage when the boom is within a predetermined critical boom length. This signal energizes a 12 volt dc solenoid flow control valve (via a relay in the overmoment control circuit card) to enable the descend function to operate at full speed. When this signal is removed, the descent function defaults to a creep speed.

Also, when an overmoment condition is sensed by the overmoment control circuit, a signal is sent to the logic circuit network. This causes either the red or blue lamp to flash indicating that an overmoment condition exists in that region. This condition also causes the audible warning to sound at the control consoles.

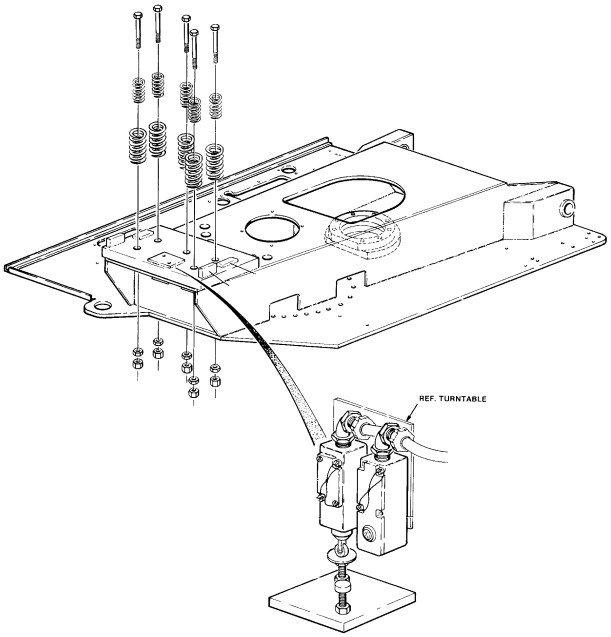
Overmoment Control System

The turntable is pivoted at the lower front area and compression springs, mounted towards the rear, provide a reaction force to the moment produced by boom extension. The force produced by the springs is adjusted to balance the moment produced when the boom is extended to the maximum permitted radius.

Immediately beyond this point of balance the turntable is permitted to pivot a maximum vertical distance of 3 mm. This movement is sensed by two independent switches which power two independent control circuit channels.

1. A positive break mechanical limit switch.

2. An inductive proximity switch.



Each circuit channel is arranged as follows:

The switch provides a 12 volt dc signal to a circuit card. The output from this card energizes a relay which permits the functional signals for boom extend and descend. When an input signal to a channel or an output signal from a circuit card is not present, the lift down and telescope out functions are interlocked.

There is also a warning horn signal present, at both the platform console and ground box, when either channel is not energized.

Load Management System Daily Check

At the beginning of each days' use, perform check with no load (persons or material) in platform from ground control station.

1. Extend all axles fully and insert lock pins (if applicable).
2. With boom fully retracted, raise boom to horizontal.
3. Position toggle switch located on the right side of the ground control station in the "P" position and hold.
4. Extend boom until it stops. Boom must stop on white tape on mid boom. Release toggle switch.
5. Retract boom until the telescope out will function. The system is now reset.
6. Position toggle switch located on the right side of the ground control station in the "M" position and hold.
7. Extend boom until it stops. Boom must stop on white tape on mid boom. Release toggle switch.
8. If boom does not stop at white tape or boom can be extended, system must be repaired by JLG authorized service personnel before machine can be used.

3.7 LOAD MANAGEMENT SYSTEM ADJUSTMENT

1. With boom retracted, limit switch and proximity switch are in neutral position.
2. Extend boom in horizontal position until white tape on inner mid boom is fully exposed, no load in platform.
3. Adjust proximity switch target until LED light comes on (switch is tripped), then secure locking nut.
4. Adjust actuator to trip switch, then secure locking nut.
5. To test cutoff switches, retract boom to reset position, then extend boom to test cutoff. Do not extend boom past white tape.
6. To test limit switch, retract boom to reset, then extend boom to cutoff while holding test bypass switch in “M” position. To test proximity switch, retract boom to reset, then extend boom to cutoff while holding test bypass switch in “P” position. When testing switches, do not extend boom past white tape on inner mid boom.

3.8 TURNTABLE SPRINGS

Removal

1. Fully retract boom.
2. Remove rear turntable cover.
3. Remove five (5) nuts and jam nuts from beneath turntable which attach to turntable spring bolts.
4. If necessary, remove bolts which secure load management switches to mounting bracket and allow switches to hang freely.

⚠ IMPORTANT

WRAP MASKING TAPE AROUND THE LOAD MANAGEMENT SWITCHES TO INSURE THAT THE SWITCHES WILL STILL BE OPERABLE.

5. Position boom to horizontal.
6. Remove five (5) bolts and turntable springs from turntable.

Installation

1. Position boom to horizontal.
2. Install five (5) bolts and turntable springs onto turntable.
3. Install five (5) nuts and jam nuts on turntable spring bolts.
4. Extend boom to cutoff (white tape) position then retract boom until turntable raises 1/4 in. (6.4 mm) from cutoff position, measured at spring area.
5. Snug jam nuts, then fully retract boom.
6. Torque jam nuts to 75 ft. lb. (10.4 kgm), then tighten nuts.
7. If removed, install load management switches on mounting brackets.
8. Position boom to horizontal. Adjust load management switches as required.

3.9 DRIVE AND STEER CONTROLLER

Controller Theory & Definitions

This controller is specifically designed and manufactured to provide a proportional output to a SUNDSTRAND Dual Coil electro-hydraulic valve. The controller you are about to calibrate has the following features:

PWM Output (Pulse \Width Modulation)
The SUNDSTRAND valve being driven by this controller requires an electrical current, between 20 and 130 milliamps in order to shift the valve spool from minimum to maximum flow. Because of the mass of the spool, shifting it a very small distance would be very difficult to do without overshooting the mark. This overshoot is called hysteresis and makes precise control of the function very difficult. PWM output provides a pulsed current to the spool which actually vibrates the spool so that it is never at rest and very easy to shift. This controller pulses the spool 100 times (cycles) per second and as you move the handle, the electronics change the time period the pulse is on within that cycle. As you move the handle away from center, the on time period or width of the cycle pulse will increase and as you move the handle back towards the center, the pulse will decrease. The percentage of on time to off time of the PWM signal is called the Duty Cycle, if it is on for 80% we call that an 80% duty cycle.

Current Regulated Output
This controller output is also current regulated. This controller was designed to output from 20 to 130 milliamps through a 17 Q coil using a 12 volt supply. Ohms Law dictates that the Current is always equal Voltage divided by Resistance. If the supply voltage or the coil resistance should change, Ohms Law dictates that the output current must also change which will affect the speed of the function accordingly. Because this controller is equipped with a current regulated output, it senses a change in voltage or resistance in the circuit and adjusts the duty cycle of the PWM signal so that the output current remains a constant current. Because the Current is constant and Resistance is machine dependent, the duty cycle will vary in an attempt to supply the required level of output. This feature ensures that the function speed the operator wishes to select always remains the same, within the limits of Ohms Law.

Dual Range
This controller is capable of providing two, independently adjustable, maximum output ranges with the same amount of handle travel. The Hi Range would normally be adjusted for full flow (maximum function speed) of the valve at full handle travel. The LO Range would provide some potion of the Hi Range setting, providing reduced oil flow to the valve, with the handle at full travel. LO Range provides the operator with excellent control of the proportional function with increased resolution for precise maneuverability.

Both outputs are linear between the Threshold setting and their respective setting. The controller is in the Hi Range mode when 12 volts is applied to the (R) terminal. As a fail safe, when system voltage is removed from the (R) terminal, the Lo Range feature is active.

I.R.S (Integrated Ramp System)
This controller is calibrated to provide a maximum ramp time of 2 seconds. This feature limits the rate of change of the output, eliminating a jerky response associated with sudden handle movements. Any change in handle position will result in a smooth change in function speed. The 2 seconds is measured between the Threshold and Hi or LO range setting.

R.T.O. (Ramp Thru Off)
This controller is configured with an enhanced ramp feature that allows the handle to released or moved from one handle extreme to the other without canceling the ramp duration. The RTO duration is factory set to 2 seconds.

3.10 CONTROLLER SETUP

NOTE: *Power needs turned on and footswitch depressed to set controls. See Table 3-1, Controller Settings for Milliamp Settings.*

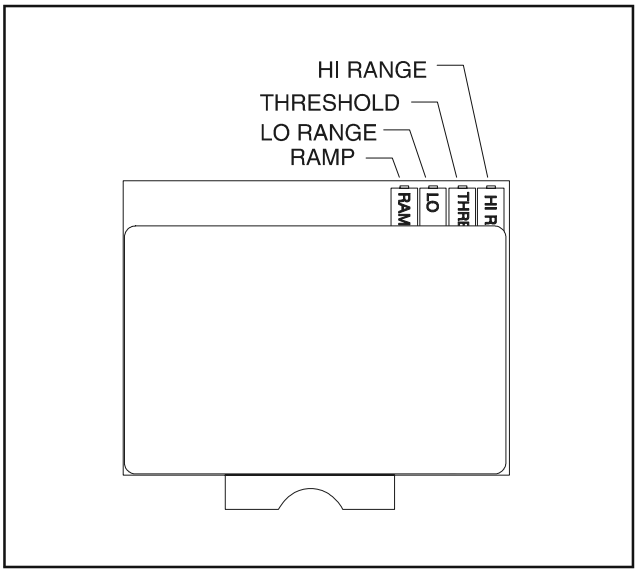


Figure 3-13. Typical Card Adjustments

Lift

1. Connect Amp Meter inline between the lift card plug pin #4 and tan 55-1 wire.
2. Operate Lift Controller just past the off position. Adjust the threshold trimpot.
3. Fully stroke controller and adjust HI range trimpot.
4. Turn function speed control CCW to snail position. Fully stroke controller and adjust LO trimpot.
5. Adjust RAMP trimpot to provide a smooth start and stop function.

Swing

1. Connect an amp meter inline between the swing card plug pin #4 and white 55-1 wire.
2. Operate swing controller just past the off position and adjust threshold trimpot.
3. Fully stroke controller and adjust HI range trimpot.
4. Turn function speed control CCW to snail position, fully stroke controller and adjust the LO trimpot.
5. Adjust RAMP trimpot to provide a smooth start and stop function.

Telescope, Level, Rotate, & Jib

1. Connect Amp Meter inline between the function card plug pin #4 and red/wht 50-1 wire.
2. Turn function control knob fully CCW (Do not go into snail mode). Operate telescope switch and adjust threshold trimpot.
3. Fully turn knob CW operate the telescope siwtch. Adjust HI range trimpot.
4. With the knob turned fully CW, operate the level switch. Adjust the LO trimpot.
5. Adjust ramp trimpot to provide a smooth start and stop function.

Drive

1. Connect Amp Meter inline between the drive controller plug pin #2 and orange 8-1 wire.
2. Operate the drive controller forward until the red LED glows. Adjust threshold trimpot.
3. Fully stroke controller. Adjust the HI range trimpot.
4. Turn function speed control CCW to snail position. Fully stroke controller and adjust the LO trimpot.
5. Adjust the ramp trimpot to provide a smooth start and stop function.

Table 3-1. Controller Settings

Function			
	HI	LO	THRES
Lift	900	200	100
Swing	500	180	140
Telescope, Rotate, Level, & Jib	900	230	150
Drive	140	70	12

3.11 FUNCTION CONTROL

Rotary Selector Controller Theory & Definitions

This Rotary Selector Controller is specifically designed and manufactured to provide a proportional output to a HYDRAFORCE flow control electro-hydraulic valve. The Rotary Selector Controller you are about to calibrate has the following features:

PWM Output (Pulse Width Modulation)
The HYDRAFORCE valve being driven by this Rotary Selector Controller requires an electrical current, between 360 and 1400 milliamps in order to shift the valve spool from minimum to maximum flow. Because of the mass of the spool, shifting it a very small distance would be very difficult to do without overshooting the mark. This overshoot is called hysteresis and makes precise control of the function very difficult. PWM output provides a pulsed current to the spool which actually vibrates the spool so that it is never at rest and very easy to shift. This Rotary Selector Controller pulses the spool 130 times (cycles) per second and as you turn the knob, the electronics change the time period the pulse is on within that cycle. As you move the knob away from the slow position, the on time period or width of the cycle pulse will increase and as you move the handle back towards the slow position, the pulse will decrease. The percentage of on time to off time of the PWM signal is called the Duty Cycle, if it is on for 80% we call that an 80% duty cycle.

Current Regulated Output
This Rotary Selector Controller output is also current regulated. This Rotary Selector Controller was designed to output from 360 to 1400 milliamps through a 4.7 ohm coil using a 12 volt supply. Ohms Law dictates that the Current is always equal to Voltage divided by Resistance. If the supply voltage or the coil resistance should change, Ohms Law dictates that the output current must also change which will affect the speed of the function accordingly. Because this Rotary Selector Controller is equipped with a current regulated output, it senses a change in voltage or resistance in the circuit and adjusts the duty cycle of the PWM signal so that the output current remains a constant current. Because the Current is constant and Resistance is machine dependent, the duty cycle will vary in an attempt to supply the required level of output. This feature ensures that the function speed the operator wishes to select always remains the same, within the limits of Ohms Law.

Dual Range
This Rotary Selector Controller is capable of providing two, independently adjustable, maximum output ranges with the same amount of knob travel. The Hi Range would normally be adjusted for full flow (maximum function speed) of the valve at full handle travel. The LO Range would provide some portion of the Hi Range setting, providing reduced oil flow to the valve, with the knob at full travel. LO Range provides the operator with excellent control of the proportional function with increased resolution for precise maneuverability. Both outputs are linear between the Threshold setting and their respective setting. The Rotary Selector Controller is in the Hi Range mode when 12 volts is applied to the (R) terminal. As a fail safe, when system voltage is removed from the (R) terminal, the Lo Range feature is active.

I.R.S (Integrated Ramp System)
This Rotary Selector Controller is calibrated to provide a maximum ramp time of 3 seconds. This feature limits the rate of change of the output, eliminating a jerky response associated with sudden knob movements. Any change in handle position will result in a smooth change in function speed. The 3 seconds is measured between the Threshold and Hi or LO range setting.

Adjustment Procedure

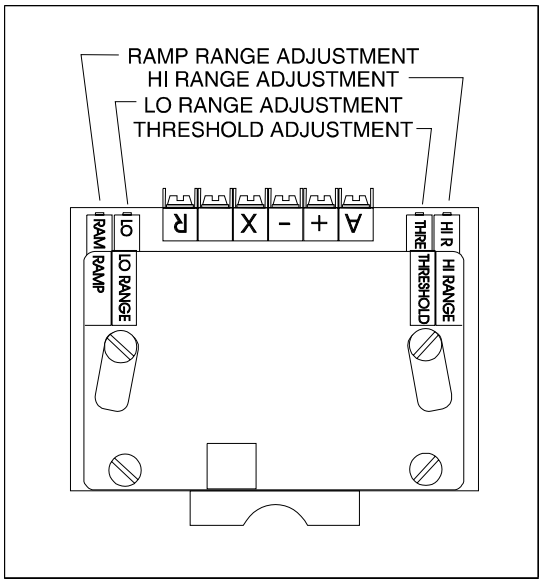


Figure 3-14. Function Control Card Adjustment

NOTE: *The trimpot adjustment screws are multi turn devices. No harm can come to the trimpot if it is turned too much. The trimpot will "click" when the wiper is at the end of the element. It may be necessary to turn the adjustment screw several turns to observe a change in the output.*

1. Disconnect the output wire from the card to terminal 4. Install a volt-ohmmeter in series in this wire and set the volt-ohmmeter to mA.
2. Turn on all power; engine does not need to be running.
3. With the function speed switch turned to the fully CCW position, activate the Telescope out switch and adjust Threshold to 84 mA.
4. With the function speed switch turned to the fully CW position, activate the Telescope out switch and adjust Hi Range to 900 mA.
5. With the function speed switch turned to the fully CW position, activate the Platform Rotate switch and adjust Lo Range to 300 mA.
6. Set Ramp about 10 turns CW from the fully CCW position. Adjust Threshold until Platform Rotate just starts to move when switch is in the "snail" position.

3.12 THROTTLE CHECKS AND ADJUSTMENTS - DEUTZ F4L-912 ENGINE

NOTE: *Never run fuel tank dry. Diesel engines cannot be restarted after running out of fuel until fuel system has been air-vented or "bled" of air. See Deutz instruction manual for procedure.*

1. Disconnect actuator cable from throttle lever. With the aid of an assistant, start the engine and allow it to come up to operating temperature. Adjust throttle lever stop until engine runs at 1800 RPM. Shut down engine. Reattach actuator cable to throttle lever, making sure that low (mid) engine setting remains the same. If necessary, adjust slide pin to contact low (mid) engine limit switch at 1800 RPM. Shut down engine.
2. Start the engine from ground controls and allow to come up to operating temperature. Inside the ground control terminal box, attach a "hot" wire from the 12 Volt power (red) wire at the PLATFORM/ GROUND SELECT switch to terminal 1 (brown/black wire) on the relay circuit card at the top of the ground control terminal box. This will cause the engine to run as if HIGH ENGINE and HIGH DRIVE are activated. Adjust slide pin to contact high engine limit switch at 2500 RPM. Remove "hot" wire from terminal 1 and from PLATFORM/GROUND SELECT switch. Shut down engine.

NOTE: *Actuator cable travel must stop slightly before lever makes contact with throttle lever stop. Failure to do so will burn out actuator.*

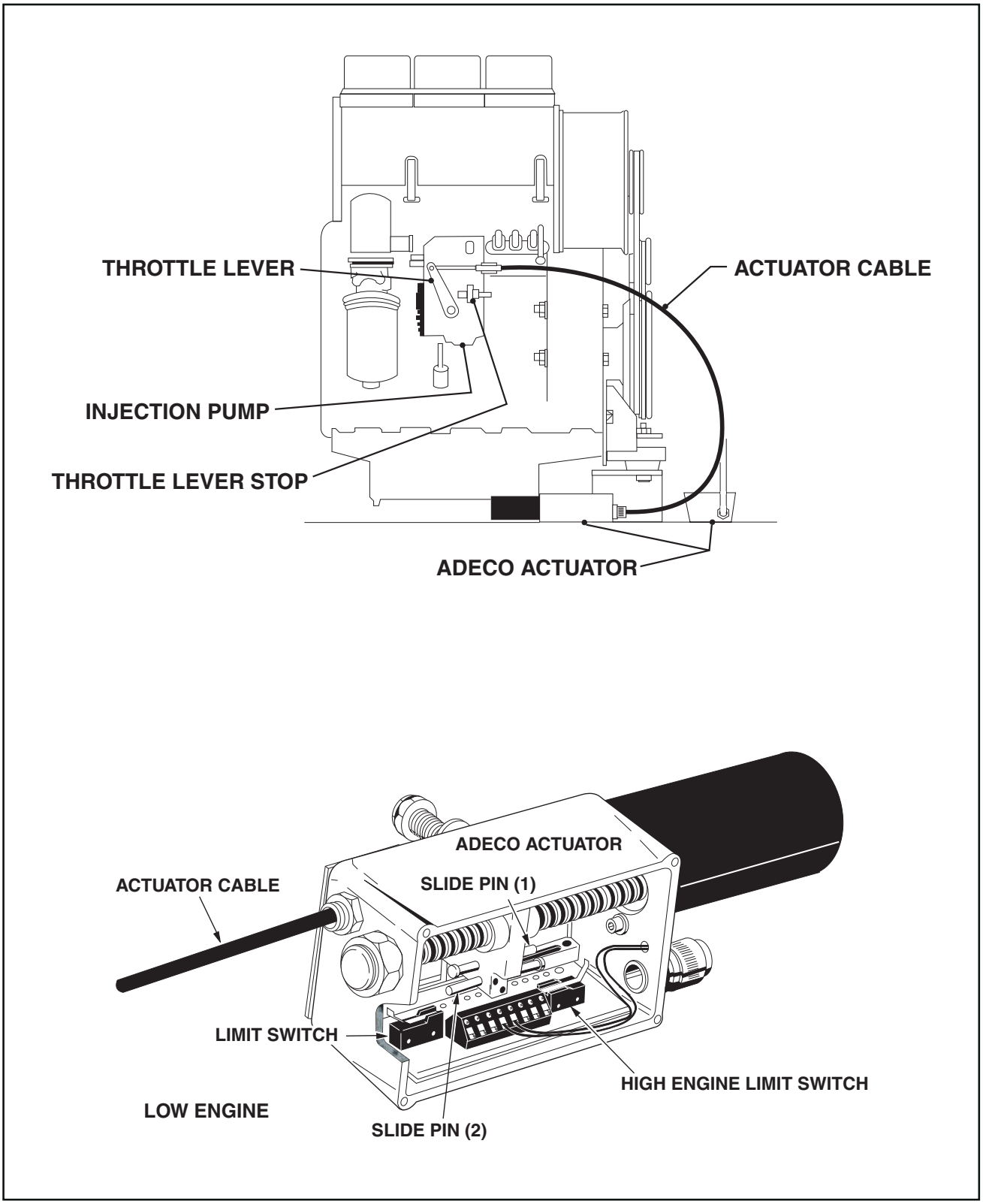


Figure 3-15. Throttle Checks and Adjustments - Deutz Engine

This page left blank intentionally.

SECTION 4. BOOM & PLATFORM

4.1 BOOM MAINTENANCE

Removal

1. Shut down machine systems.

NOTE: *Boom Assembly weighs approximately 10,000 (4536 kg).*

2. Using suitable lifting equipment, adequately support boom weight along entire length of retracted boom.

⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

3. Tag and disconnect hydraulic lines that run along the side of the boom.
4. Remove hardware attaching upper lift cylinder attach pin to boom.
5. Using a slide hammer or similar tool, and taking care not to damage pin, remove pin from boom.
6. Using all applicable safety precautions, and only if necessary, operate crane and fully retract lift cylinder.
7. Shut down machine systems.
8. Tag and disconnect all wiring to ground control box.
9. Remove boom length/angle indicator box.
10. Loosen and remove hardware securing boom pivot pin.
11. Ensuring that boom is adequately supported and using a suitable slide hammer, carefully remove pivot pin from boom and turntable structure. Ensure that boom and turntable structure are not damaged.
12. Carefully lift boom assembly clear of turntable and lower to ground or suitably supported work surface.

Disassembly

NOTE: *Left or right is determined facing the machine from the platform.*

1. Loosen the right side powertrack bracket and powertrack and lay on top of boom assembly.

⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

2. Tag and disconnect hydraulic lines to slave level cylinder and rotator motor.
3. Tag and disconnect wiring to platform control box.
4. Remove the left side powertrack.
5. Remove platform from boom assembly.
6. Remove cotter pins retaining telescope cylinder rod attach pin to base section.
7. Using a suitable brass drift, carefully drive telescope cylinder pin from base section.
8. Remove outer mid section extend chain adjust nut and locknut at upper aft end of base section.
9. Remove bolts, washers and lockwashers attaching outer mid section extend chain attach block to upper aft end of base section. Remove block.
10. Remove fly section extend chain adjust nut and locknut at lower front end of inner mid section.
11. Remove outer mid section retract chain adjust nut and locknut at lower front end of base section.
12. Remove fly section retract chain adjust nut and locknut at lower front end of inner mid section.

NOTE: *Note and record the number and thickness of any wear pad shims during wear pad removal.*

13. Remove bolts and lockwashers attaching side wear pads to front of base section. Remove pads and any shims.
14. Remove bolts, washers and lockwashers attaching lower front wear pads and mounting blocks to base section. While supporting assembled fly, outer mid and inner mid sections, remove wear pads, mounting blocks and shims.

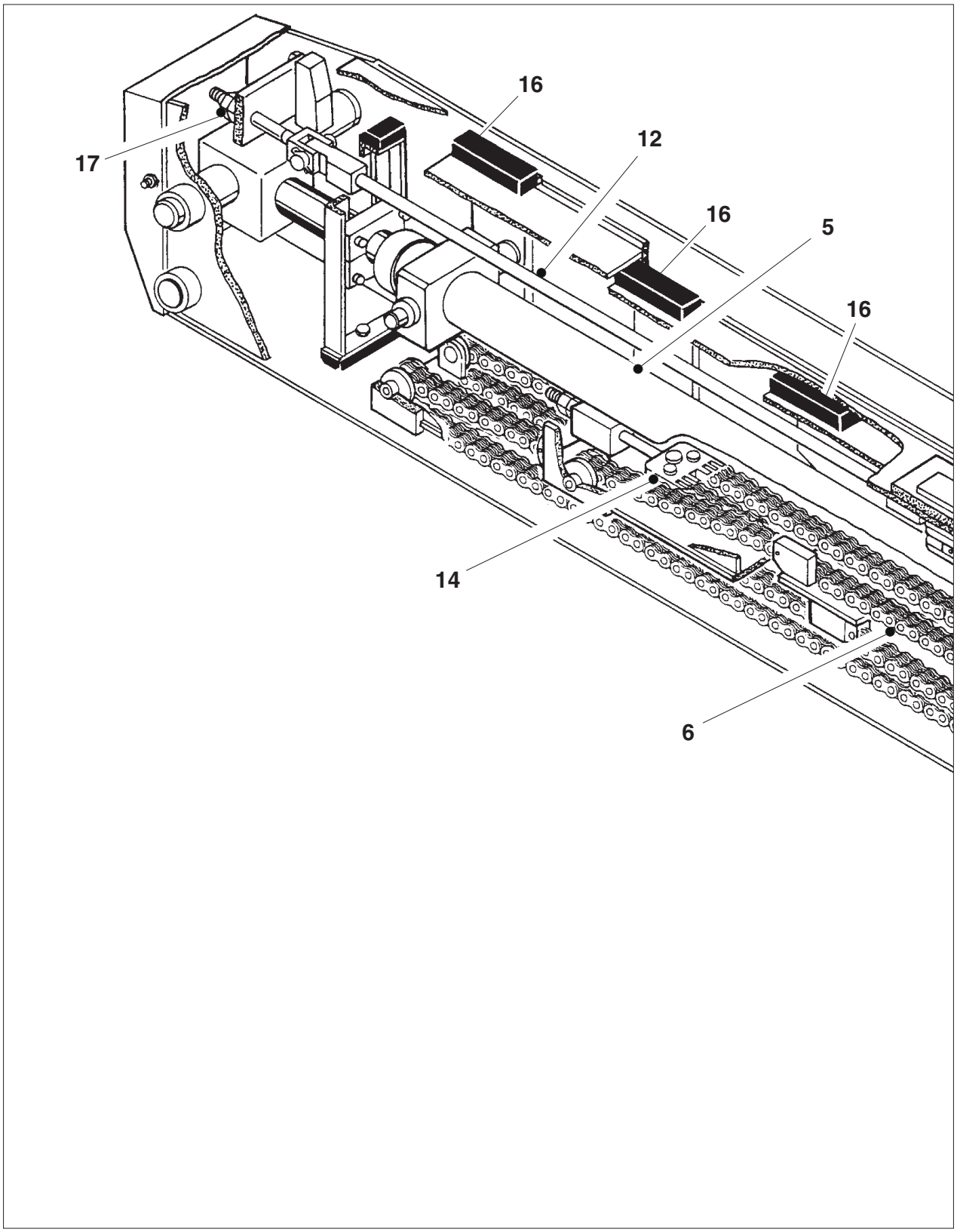


Figure 4-1. Boom Assembly - Sheet 1 of 2

1. Boom Base
2. Inner Mid Boom
3. Outer Mid Boom
4. Fly Boom
5. Telescope Cylinder
6. Outer Mid Extend Chain
7. Fly Extend Chain
8. Fly Retract Chain
9. Outer Mid Retract Chain
10. Tele Cylinder Sheave
11. Sheave
12. Chain Extend Rod
13. Chain Attach Pin
14. Chain Adjustment Assembly
15. Chain Adjustment Assembly
16. Upper Rear Wear Pad
17. Adjustment & Jam Nuts
18. Safety Chain

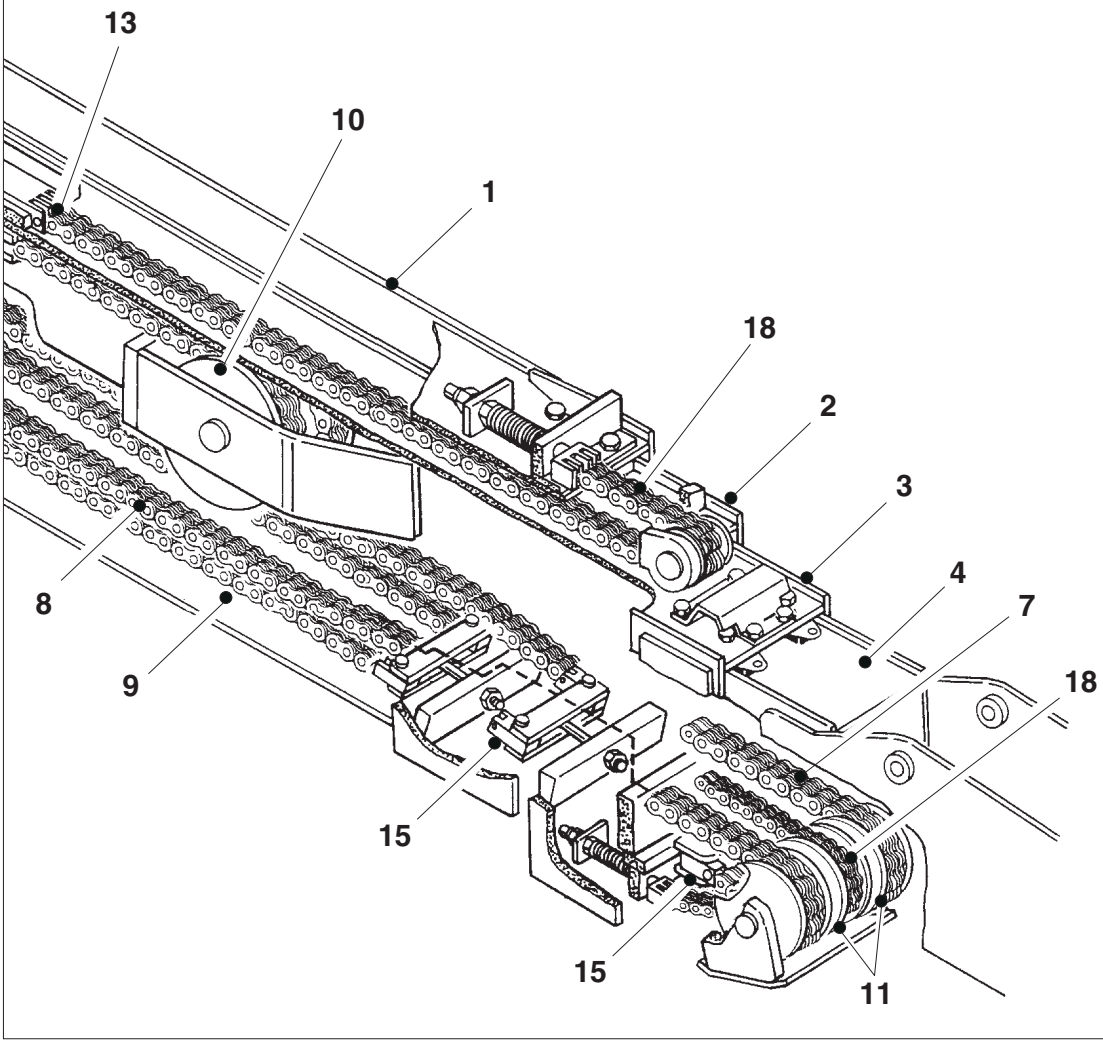


Figure 4-2. Boom Assembly - Sheet 2 of 2

15. Remove bolts and lockwashers attaching top front wear pad to base section. Remove pad and shims.
16. Using suitable lifting equipment, partially slide assembled inner mid, outer mid and fly sections out of base section.
17. Using suitable straps, tie off outer mid section retract chains to underside of inner mid section as inner mid, outer mid and fly sections are exiting base section.
18. Carefully lift inner mid, outer mid and fly sections clear of base section and lower to a suitably supported work area.
19. Using suitable lifting equipment, support telescope cylinder rod.
20. Remove setscrews securing trunnion pins that secure inner mid section to telescope cylinder.
21. Using a suitable tool, scribe a line on the outer end of each trunnion pin and boom structure as an aid to pin alignment during boom assembly.
22. Using a suitable slide hammer, remove trunnion pins attaching telescope cylinder to inner mid section.
23. Remove cotter pins and chain attach pins attaching outer mid section retract chains to lower aft end of outer mid section and remove chains.
24. Remove setscrews which attach chain sheave pins at lower aft end of inner mid section.
25. Using a suitable brass drift, carefully drive sheave pins from inner mid section and remove sheaves and thrust washers. If necessary, remove bushings from sheaves and replace. Ensure that pins, grease fittings and corresponding boom and sheave surfaces are not damaged.
26. Remove cotter pins and chain attach pins attaching fly section retract chains to lower aft end of fly section and remove chains.
27. Remove setscrews which attach chain sheave pins at lower aft end of outer mid section.
28. Using a suitable brass drift, carefully drive sheave pins from outer mid section and remove sheaves, seals, and thrustwashers. If necessary, remove bushings from sheaves and replace. Ensure that pins, grease fittings and corresponding boom and sheave surfaces are not damaged.
29. Pull boom sections out several feet to allow ample clearance for telescope cylinder removal.
30. Remove outer mid section extension chain adjust nut and locknut from clevis at lower aft end of outer mid section.
31. Using suitable lifting equipment, carefully slide telescope cylinder out of fly, outer mid, and inner mid sections, along with extension chain and bar.
32. When approximately one-half of the telescope cylinder is removed from the boom assembly, the extension bar attach to chain will become accessible. Remove cotter pins and clevis pin attaching extension bar to chain and remove bar.
33. Carefully lift telescope cylinder clear of boom assembly and lower to ground or suitably supported work area.
34. Remove bolts attaching outer mid section retract chain adjust block at lower front end of inner mid section and remove block.

NOTE: *Note and record number and thickness of any wear pad shims during wear pad removal.*

35. Remove bolts and lockwashers which attach upper aft inner mid section wear pads and remove pads and any shims.
36. Remove bolts, washers and lockwashers which attach bottom wear pads at front of inner mid section and remove pads and any shims.
37. Remove bolts and lockwashers which attach side wear pads at front of inner mid section and remove pads and any shims.
38. Remove bolts and lockwashers which attach top wear pad at front of inner mid section and remove pad and any shims.
39. Using suitable lifting equipment, carefully slide outer mid and fly sections clear of inner mid section and lower to ground or other suitably supported work area.
40. Remove bolts and lockwashers which attach upper aft outer mid section wear pads and remove pads and any shims.
41. Remove bolts and lockwashers which attach bottom wear pads at front of outer mid section and remove pads and any shims.

42. Remove bolts and lockwashers which attach side wear pads at front of outer mid section and remove pads and any shims.
43. Remove bolts and lockwashers which attach top wear pads to front of outer mid section and remove pads and any shims.
44. Remove bolt, washer and lockwasher attaching fly section right hand extend chain sheave attach pin to front of outer mid section.
45. Using a suitable brass drift, carefully drive each sheave pin from the boom section and remove the sheave assemblies. Inspect pins, lubrication fittings and sheave bearings for damage and dirt or foreign material. Replace components as necessary.
46. Repeat steps (42) and (43) for left hand sheave.
47. Using suitable lifting equipment, carefully slide fly section clear of outer mid section and lower to ground or suitably supported work area.

Inspection

1. Inspect all sheaves (extend chains, retract chains and telescope cylinder) for excessive groove wear, burrs or other damage. Replace sheaves as necessary.
2. Inspect extend chain and retract chain sheave bearings for wear, scoring, or other damage, and for ovality. Replace bearings as necessary, ensuring they are installed flush with sheave surface.
3. Inspect extend chain and retract chain sheave pins for scoring, tapering, ovality and evidence of correct lubrication. Replace pins as necessary.
4. Inspect telescope cylinder sheave pin for tapering, scoring, ovality and evidence of correct lubrication. Replace pin as necessary.
5. Inspect boom pivot pin for wear, scoring or other damage, and for tapering or ovality. Replace pin as necessary.
6. Inspect upper lift cylinder attach pin for tapering, ovality, scoring, wear, or other damage. Ensure pin surfaces are protected prior to installation. Replace pin as necessary.
7. Inspect telescope cylinder trunnion attach pin for tapering, ovality, scoring, wear, or other damage. Replace pin as necessary.
8. Inspect extend chain attach clevis pins for wear, scoring, or other damage. Replace pins as necessary.
9. Inspect telescope cylinder rod attach pin for scoring, wear, or other damage. Replace pin as necessary.
10. Inspect inner diameter of boom pivot bushing for scoring, distortion, wear, or other damage. Replace bushing as necessary.
11. Inspect all wear pads for excessive wear or damage. Replace pads when worn to within 1/8 in. (3.2 mm) of insert.
12. Inspect extend and retract chains and chain attach components for cracks, stretching, distortion, or other damage. Replace components as necessary.
13. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.
14. Inspect structural units of boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly

NOTE: *When installing fly section wear pads, install same number and thickness of shims as were removed during disassembly.*

1. Install upper aft fly section wear pads and shims, as required, using bolts and lockwashers.
2. Using suitable lifting equipment, carefully slide fly section into outer mid section.
3. Install fly section extend chain sheaves on front of outer mid section and install sheave pins. If necessary, tap pins into place using a soft headed mallet. Secure pins using bolts, washers and lockwashers.
4. Install lubrication fittings in ends of pins and lubricate sheaves with MPG.

NOTE: *When installing outer mid section wear pads, install same number and thickness of shims as were removed during disassembly.*

5. Install outer mid section top front wear pads and shims, as required, using bolts and lockwashers.
6. Install outer mid section side front wear pads and shims, as required, using bolts and lockwashers.

7. Install outer mid section bottom front wear pads and shims, as required, using bolts and lockwashers.
8. Install outer mid section upper aft wear pads and shims, as required, using bolts and lockwashers.
9. Using suitable lifting equipment, carefully slide assembled outer mid and fly sections into inner mid section.

NOTE: *When installing inner mid section wear pads, install same number and thickness of shims as were removed during disassembly.*

10. Install inner mid section top front wear pads and shims, as required, using bolts and lockwashers.
11. Install inner mid section side front wear pads and shims, as required, using bolts and lockwashers.
12. Install inner mid section bottom front wear pads and shims, as required, using bolts, washers and lockwashers.
13. Install inner mid section upper aft wear pads and shims, as required, using bolts and lockwashers.
14. Install fly section retract chain adjust block on lower front end of inner mid section and secure with bolts.
15. Place outer mid section extend chain assembly along telescope cylinder chain rest with chain adjust assembly hanging just below cylinder sheave.
16. Using lightweight motor oil (SAE 20W), adequately lubricate portion of chain occupying cylinder chain rest.
17. Using suitable lifting equipment, maneuver telescope cylinder and outer mid section extend chain assembly into position at aft end of assembled boom sections.
18. With a slight downward angle on the cylinder, insert sheave and chain adjust into boom sections until it is possible to insert chain adjust into attach block at rear of outer mid section. Temporarily install chain adjust and locknuts.
19. Carefully feed telescope cylinder approximately halfway into boom sections, lubricating chain with lightweight motor oil as it passes along chain rest. Attach extension bar to chain and continue inserting into boom sections.
20. Install fly section retract chain sheaves, seals and thrustwashers at aft end of outer mid section.
21. Install sheave pins and if necessary, tap pins into place using a soft headed mallet. Secure pins with setscrews.
22. Install lubrication fittings on ends of pins and lubricate sheaves with MPG.
23. Install fly section retract chains at lower aft end of fly section. Install chain attach pins and flatwashers and secure with cotter pins.
24. Carefully place fly section retract chains around chain sheaves at aft end of inner mid section and through bottom of inner mid section.
25. Install fly section retract chain clevis into attach block at lower front end of inner mid section. Install adjust nut and locknut on clevis.
26. Install outer mid section retract chain sheaves and thrust washers at aft end of inner mid section.
27. Install sheave pins and, if necessary, tap pins into place using a soft headed mallet. Secure pins with setscrews.
28. Install lubrication fittings on ends of pins and lubricate sheaves with MPG.
29. Install outer mid section retract chains at lower aft end of outer mid section. Install chain attach pins and flatwashers and secure with cotter pins.
30. Carefully place outer mid section retract chains around chain sheaves at aft end of inner mid section. Tie chains to underside of inner mid section using suitable straps.
31. Using suitable lifting equipment, carefully align holes in telescope cylinder trunnion and holes in aft end of inner mid section.
32. Install trunnion pins, ensuring that holes in pins align with holes in trunnion. If necessary, tap pins into place with a soft headed mallet. Secure pins with setscrews.
33. Using suitable lifting equipment, carefully slide assembled inner mid, outer mid, and fly sections into base section.
34. As sections are being installed, remove straps from outer mid section retract chains and feed attach clevis through holes in bottom of forward end of base section.

35. Install outer mid section retract chain clevis into attach block at lower front end of base boom section. Install adjust nut and locknut on clevis.

NOTE: *When installing base section wear pads, install same number and thickness of shims as were removed during disassembly.*

36. Install base section top front wear pads and shims, as required, using bolts and lockwashers.
37. Install base section lower front wear pads, mounting blocks, and shims, as required, using bolts, washers, and lockwashers.
38. Install base section side front wear pads and shims, as required, using bolts and lockwashers.
39. Carefully align telescope cylinder rod end with holes in aft end of base boom section and install attach pin. If necessary, tap pin into place using a soft headed mallet. Secure pin with cotter pins.
40. Install outer mid section extend chain attach block at aft end of base section and secure with bolts and lockwashers.
41. Install outer mid section extend chain clevis through hole in attach block and secure with adjust nut and locknut.
42. Attach platform to boom assembly.
43. Attach the left side powertrack to boom assembly.
44. Connect wiring to platform control box.
45. Connect hydraulic lines to slave level cylinder and rotator motor.
46. Attach the right side powertrack bracket and powertrack to boom assembly.

Installation

1. Using suitable lifting equipment, position assembled boom on turntable so that boom pivot holes in both boom and turntable are aligned.
2. Insert boom pivot pin, ensuring that locating slots in pin are aligned with setscrew locating holes in pin bushings.
3. If necessary, gently tap pin into position with a soft headed mallet. Secure pin with setscrews.
4. Connect all wiring to ground control box.
5. Using all applicable safety precautions, operate lifting equipment in order to position boom lift cylinder so that holes in cylinder rod end and boom structure are aligned. Insert lift cylinder pin.
6. If necessary, gently tap pin into position with a soft headed mallet, ensuring that pin plate holes are aligned with attach holes in boom structure. Install pin attaching bolts, washers and lockwashers.
7. Shut down machine systems.
8. Connect hydraulic lines running along side of boom.
9. Install boom length/angle sensor box. Adjust boom length/angle sensor box in accordance with paragraph 2-30.
10. Using all applicable safety precautions, operate machine systems and raise and extend boom fully, noting the performance of the extension cycle. If chattering is apparent, extend chain system requires adjustment.
11. Retract and lower boom, noting performance of retraction cycle. If chattering is apparent, retract chain system requires adjustment.
12. Shut down machine systems.
13. Adjust extend and retract chain systems as required and secure adjustment locknuts.
14. As necessary, lubricate all points requiring lubrication.

4.2 BOOM CHAINS

Adjusting Procedures

⚠ WARNING

ENSURE MACHINE IS ON A FIRM AND LEVEL SURFACE.

1. Position boom fully retracted at +5 degrees horizontal, no load in platform.
2. Torque outer mid section extend chain adjuster to 59 ft. lb. (80 Nm).
3. Torque outer mid section retract chain adjuster to 59 ft. lb. (80 Nm).
4. Torque fly section extend chain adjuster to 59 ft. lb. (80 Nm).
5. Torque fly section retract chain adjuster to 59 ft. lb. (80 Nm).
6. Cycle boom (extend at least 6 feet (2 meters), then retract fully).
7. Recheck outer mid section extend chain.

8. Recheck outer mid section retract chain.
9. Recheck fly section extend chain.
10. Recheck fly section retract chain.
11. Repeat steps (2) thru (10) if necessary.
12. Check for proper operation of boom.

JLG Industries, Inc. requires a complete boom disassembly, per the instructions outlined in Section 4.1, Boom Maintenance, every two years. All boom chains and related components (i.e., sheaves, pins, sprockets, wear pads, etc.) must also be inspected and replaced, as necessary, during this disassembly.

An immediate disassembly of the boom assembly and inspection of the boom chains and related components is required if any of the following conditions occur:

1. After machine is exposed to hostile environments or conditions (i.e., extreme cold, dust, sand, blasting grit, salt, chemicals, etc.) which could adversely affect boom operation.
2. Erratic boom operation or unusual noise exists. Refer to troubleshooting tables in Section 3.
3. Chain adjustment is required more often than specified in this Section or links need to be removed (chain shortened) to make adjustment.
4. Machine is idle for an extended period (6 months or longer).
5. Boom is overloaded or has sustained a shock load.

⚠ WARNING

FAILURE TO DISASSEMBLE THE BOOM ASSEMBLY AND PROPERLY INSPECT AND/OR REPLACE THE BOOM CHAINS AND RELATED COMPONENTS (I.E., SHEAVES, PINS, SPROCKETS, WEAR PADS, ETC.) COULD RESULT IN THE DAMAGE AND/OR BREAKAGE OF THE BOOM CHAINS AND/OR RELATED COMPONENTS. DAMAGE AND/OR BREAKAGE OF THESE ITEMS COULD RESULT IN UNCONTROLLED EXTENSION OR RETRACTION OF THE BOOM ASSEMBLY AND COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL OPERATING THE JLG BOOM LIFT.

Inspection Procedure

⚠ WARNING

BOOM CHAINS TO BE INSPECTED AT TIME OF NEXT BOOM OVERHAUL AND WHEN DEEMED NECESSARY BY MACHINE OWNER, BUT NOT TO EXCEED 2 YEARS OF MACHINE OPERATION.

1. Inspect boom chains for the following conditions:
   a. **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 2-1 for proper chain specifications and allowable stretch tolerances. Peening and wear of chain plate edges are caused by sliding over a chain worn contact face of a sheave, or unusually heavy loads. All of the above require replacement of the chain and correction of the cause. Chain side wear, noticeable when pin

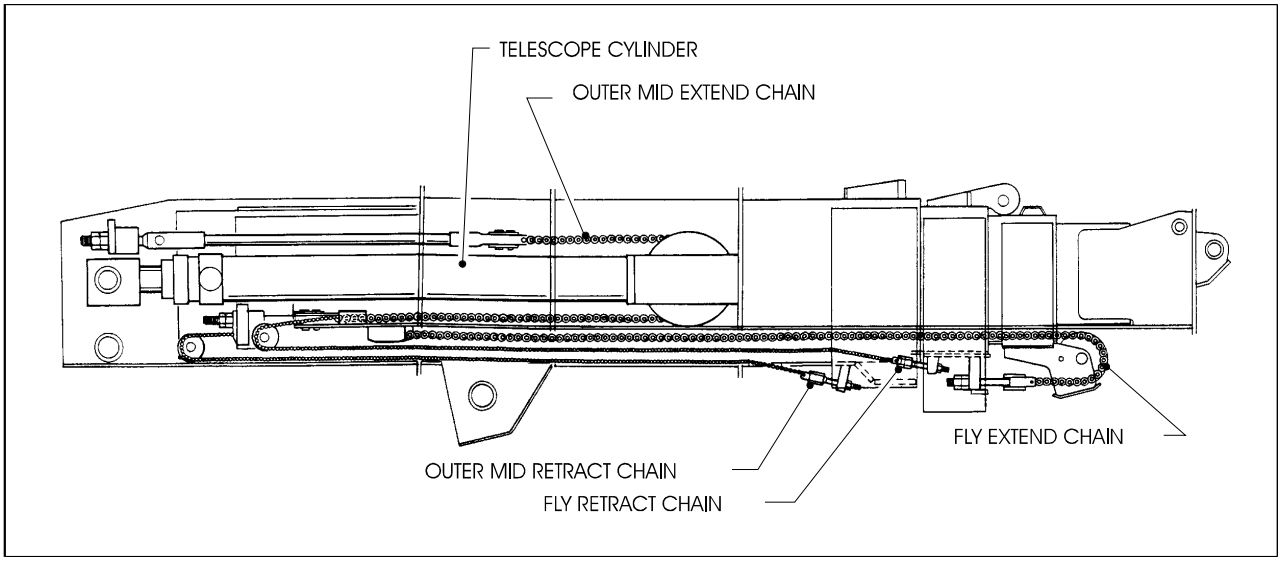


Figure 4-3. Typical Boom Assembly

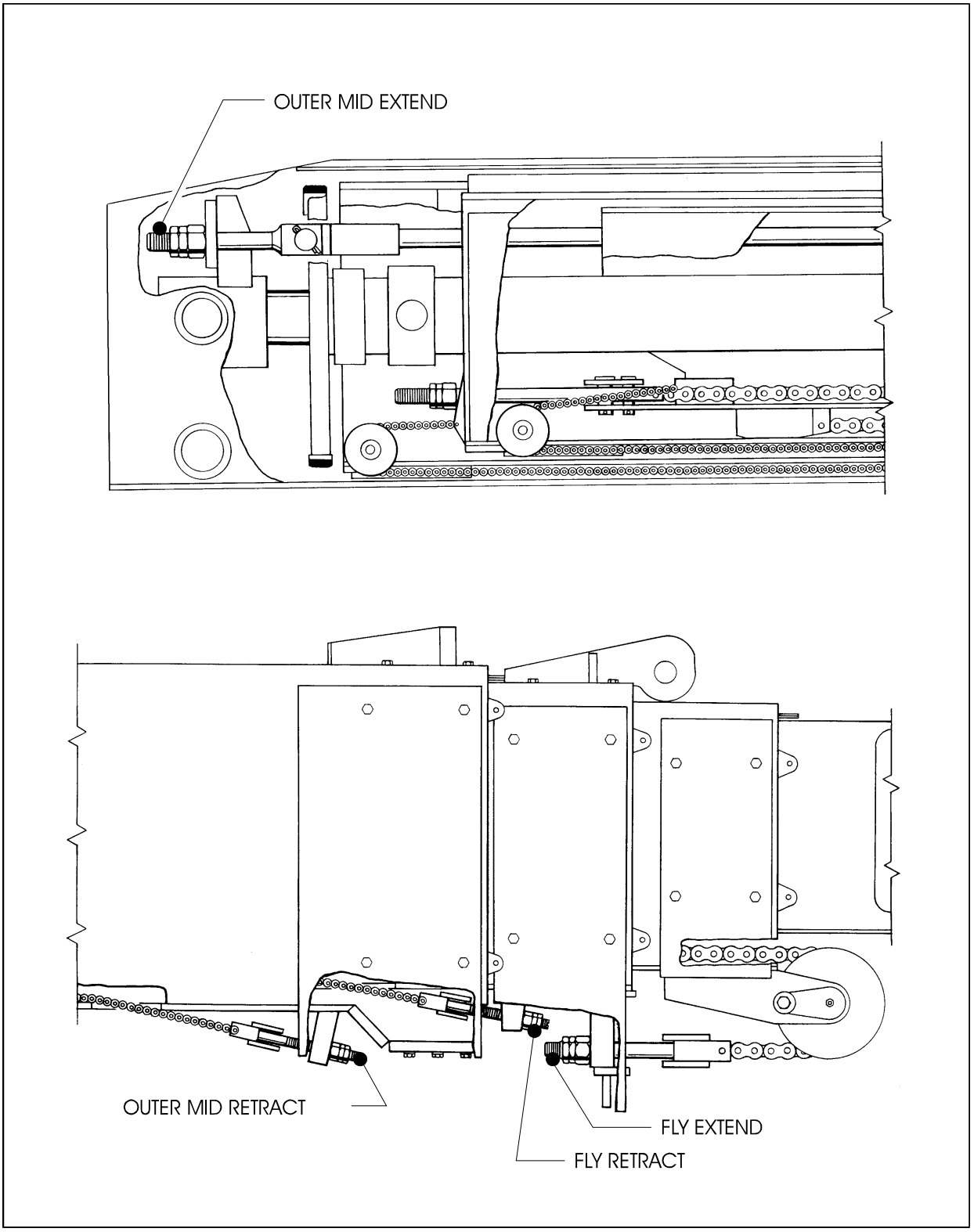
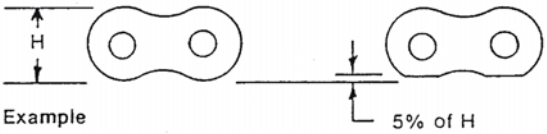


Figure 4-4. Boom Chain Adjustments

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.



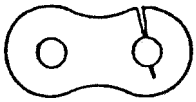
H for a 1" chain = 0.950"
Maximum wear = 5% of 0.950" = 0.047"
Minimum plate depth = 0.950" - 0.047" = 0.903"

b. Lubrication: One of the most important but often overlooked factors is adequate lubrication. In addition to reducing internal friction, maintaining a film of oil on all chain surfaces will inhibit rusting and corrosion. This is important as corrosion of highly stressed, hardened steel chain components can cause a major reduction in the load capacity of leaf chain and result in link plate cracking.

NOTE: *The need for lubrication can be determined by the presence of rust on the exposed portions of chain.*

c. 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 this lubricant of 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. A grade of SAE 30 or 40 weight, non-detergent motor oil should be used as a supplemental lubricant and a film of this oil should be constantly maintained on the surfaces and internal joints. 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.

d. **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.

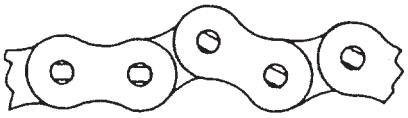


e. **Tight Joints:** All joints in the roller chain should flex freely. On roller chain, tight joints are usually caused by rust/corrosion, or the inside plates “walking” off the bushing. Limber up rusty/corroded chains (after inspecting carefully) with a heavy application of oil (preferably a hot oil 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:

1. Bent pins or plates.
2. Rusty joints.
3. Peened plate edges.

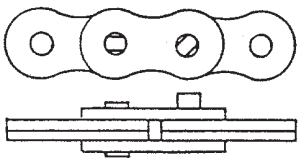
Oil rusty chains, and replace chains with bent or peened chain components. Keep chains lubricated.

TIGHT JOINTS



f. **Protruding or Turned Pins:** Chains operating with inadequate lube generate tremendous friction between the pin and plates (pin and bushing on roller 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.

ABNORMAL PROTRUSION OR TURNED PINS

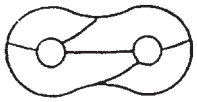


g. **Stress Corrosion Cracking:** The outside link plates, which are heavily press-fitted to the pins, are particularly susceptible to stress corrosion cracking. Like fatigue cracks, these initiate at the point of highest stress (aperture) but tend to extend in an arc-like path, often parallel to the

rolling grain of the material.

Also, more than one crack can often appear on a link plate. In addition to rusting, this condition can be caused by exposure to an acidic or caustic medium or atmosphere. Stress corrosion is an environmentally assisted failure. Two conditions must be present - corrosive agent and static stress. In the chain, static stress is present at the aperture due to the press fit pin. No cycle motion is required and the plates can crack during idle periods. The reactions of many chemical agents (such as battery acid fumes) with hardened metals liberate hydrogen which attacks and weakens the metal grain structure.

ARC-LIKE CRACKED PLATES
(STRESS CORROSION)



h. **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.

Sheaves should be inspected for worn flanges, which would indicate misalignment, and wear on the outside diameter of the sheave. A worn sheave can mean several problems, as follows:

1. Chains too tight.
2. Sheave bearings/pin bad.
3. Bent/misaligned chains.

Table 4-1. Chain Stretch Tolerance

CHAIN SIZE	PIN TO PIN MEASUREMENT	ALLOWABLE STRETCH 14 IN. SPAN
0.50 in. (1.27 cm) pitch	14 in. (36 cm) or 28 pitches	0.42 in. (1.07 cm)
0.625 in. (1.59 cm) pitch	15 in. (38 cm) or 24 pitches	0.45 in. (1.14 cm)
0.75 in. (1.91 cm) pitch	15 in. (38 cm) or 20 pitches	0.45 in. (1.14 cm)
1.00 in. (2.54 cm) pitch	14 in. (36 cm) or 14 pitches	0.42 in. (1.07 cm)
1.75 in. (4.45 cm) pitch	14 in. (36 cm) or 8 pitches	0.42 in. (1.07 cm)
2.00 in. (5.08 cm) pitch	14 in. (36 cm) or 7 pitches	0.42 in. (1.07 cm)

4.3 WEAR PADS

Shim up wear pads to within 1/16 in. (1.6 mm) tolerance between wear pad and adjacent surface.

Replace wear pads when worn within 1/8 in. (3.2 mm) of threaded insert.

4.4 LIMIT SWITCH ADJUSTMENTS

Boom Limit Switch

The boom limit switch is located on the left side of the base section of the boom. The switch will activate when the boom is extended past a set point with the axles retracted. When activated, the switch cuts out Telescope Out and Lift Up. Adjust the limit switch to trip at 10 feet (3 meters) of boom extension.

Horizontal Cut-Out Switch

The horizontal cut-out switch is located on the right side of the boom at the boom pivot pin. When activated, the switch cuts out the High Engine, High Drive and 2 Speed functions. Adjust the switch to activate when the boom reaches horizontal.

4.5 BOOM MARKING TAPE INSTALLATION

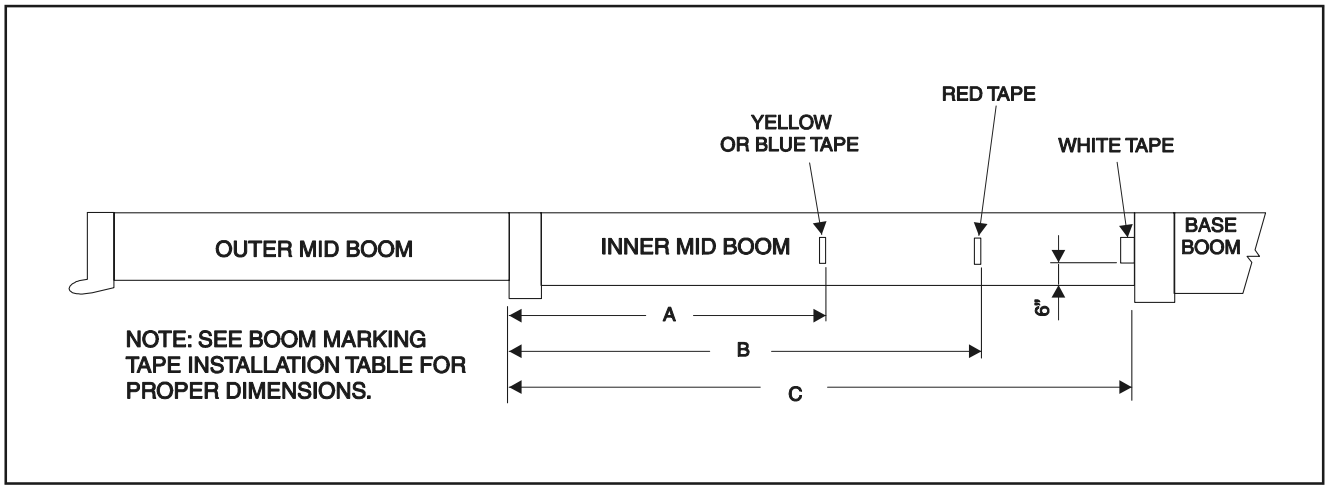


Figure 4-5. Boom Marking Tape Installation

Table 4-2.Boom Marking Tape Installation

w/o Boom Wipers			
Model	Dim. A	Dim. B	Dim.C
100SX Dual Capacity	51-1/4 in. (130.2 cm)	90 in. (228.6 cm)	123 in. (312.4 cm)
120SXJ Single Capacity	N/A	54-7/8 in. (139.4 cm)	90 in. (228.6 cm)
110SX Dual Capacity	85-1/2 in. (217.2 cm)	122-1/2 in. (311.2 cm)	160-1/2 in. (407.7 cm)
110SXJ Single Capacity	N/A	78-3/8 (199.1 cm)	129-3/8 in. (328.6 cm)
w/Boom Wipers			
Model	Dim. A	Dim. B	Dim. C
100SX Dual Capacity	49-1/8 in (124.8 cm)	87-7/8 in. (223.2 cm)	120-7/8 in. (307.8 cm)
120SXJ Single Capacity	N/A	52-7/8 in. (134.3 cm)	88 in. (223.5 cm)
110SX Dual Capacity	83-3/8 in. (211.8 cm)	120-3/8 in. (305.8 cm)	158-3/8 in. (402.3)
110SXJ Single Capacity	N/A	76-3/8 (193.9 cm)	127-3/8 in. (323.5 cm)

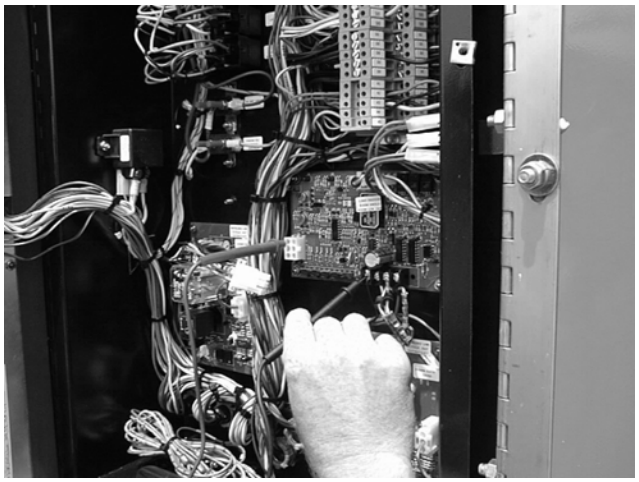
4.6 BOOM LOAD RADIUS SETUP PROCEDURES - 100SX DUAL CAPACITY

NOTE: *The boom length and angle sensor adjustments need to be made before the display lights are adjusted.*

The boom length and angle sensor is factory set and does not normally require adjusting unless it is removed from the base boom for maintenance.

Length Indicator Adjustment

1. Level the frame before beginning any adjustments.
2. Make all adjustments with the engine running unless otherwise noted.
3. Fully retract the boom.
4. On the Load Radius Circuit Card, measure TP10 and insure that 10 Volts DC (+0.1/-0 Volts DC) is present.
5. On the Load Radius Circuit Card, adjust P1 to 1.114 Volts DC while measuring TP1.
6. Make the following adjustment with the power off. On the Load Radius Circuit Card, disconnect connector J2 (the 6 pin connector on the printed circuit board). Measure between Pin (6) of the socket on the circuit board and ground (TB1-1), adjust potentiometer P5 to a value of 1.610 Ohms (+/- 0.005 Ohms). Reconnect J2 when adjustment is complete



7. Turn the power on and measure TP2. It should be 1.183 Volts DC. Re-adjust the 5K Ohm potentiometer in the boom cable reel if necessary. Adjust the 5K Ohm potentiometer by loosening the three screws holding it in place. Tighten the three (3) screws when adjustment is complete.

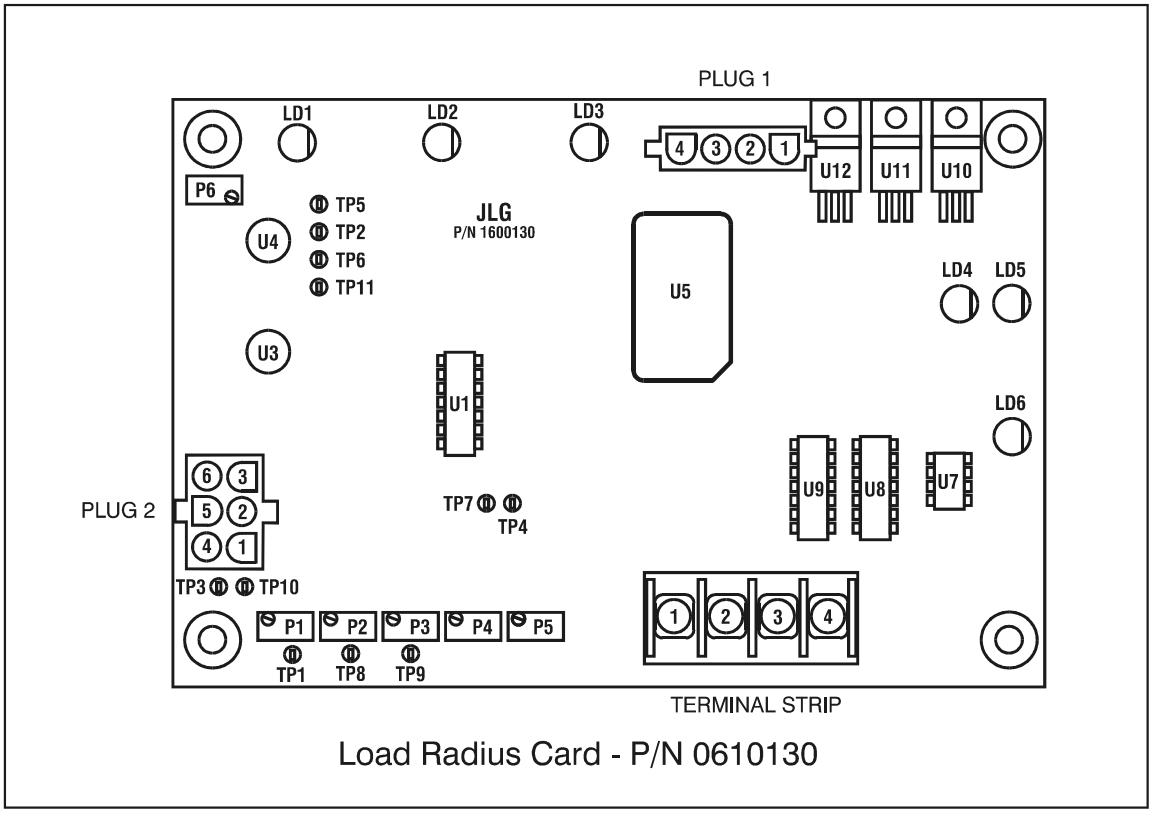
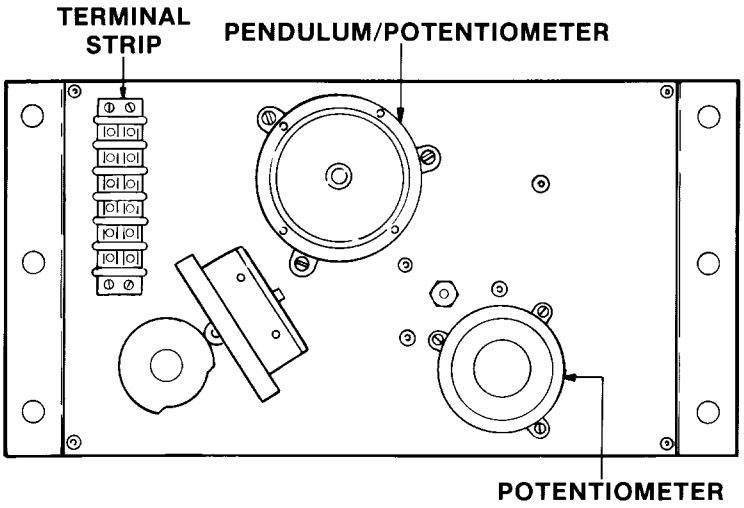


Figure 4-7. Load Radius Card



NOTE: *The boom length/angle sensor is factory set and normally does not require adjusting unless it is removed from the base boom for maintenance purposes, etc.*

Figure 4-6. Boom Length/Angle Sensor Configurations

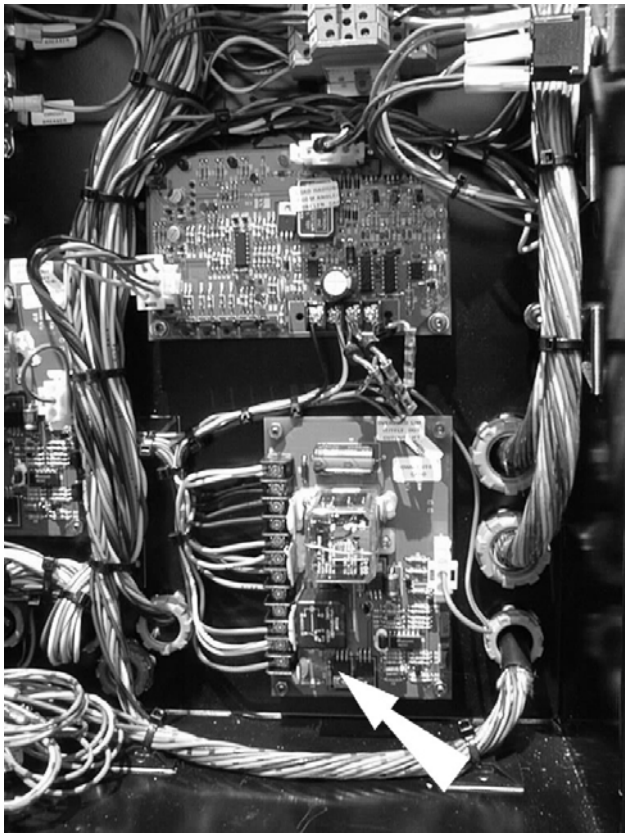
Boom Angle Sensor Adjustment

1. With the platform level, the boom fully retracted and at 45 (+/- 1) degrees elevation, measure the DC voltage at TP5 on the Load Radius Circuit Card.
2. Loosen the three screws securing the sensor to the box and rotate the sensor until 7.1 (+/- 0.1) Volts DC is measured at TP5. Tighten the screws on the sensor.
3. Return the boom to horizontal.

Radius Adjustment and Display Lights Setting Procedure

1. On the Load Radius Circuit Card, measure TP11 and adjust potentiometer P6 for a reading of 0.0 Volts DC.
2. On the Load Radius Circuit Card, measure TP8 and adjust potentiometer P2 for a reading of 1.585 Volts DC.
3. On the Load Radius Circuit Card, measure TP9 and adjust potentiometer P3 for a reading of 1.959 Volts DC.

4. Telescope the boom until the leading edge of the yellow marking tape is exposed from the mid boom. Adjust potentiometer P2 until the yellow light just turns on and the blue light turns off.
5. Telescope the boom until the leading edge of the red marking tape is exposed from the mid boom. Adjust potentiometer P3 until the red light just turns on and the yellow light turns off.



6. Extend the boom until the red tape is approximately 6 inches out of the base boom. Adjust P4 until the amber LED (DS2) on the Load Moment Circuit card goes out. This determines the length of the boom (critical length) where the lift down speed limiter is turned on.

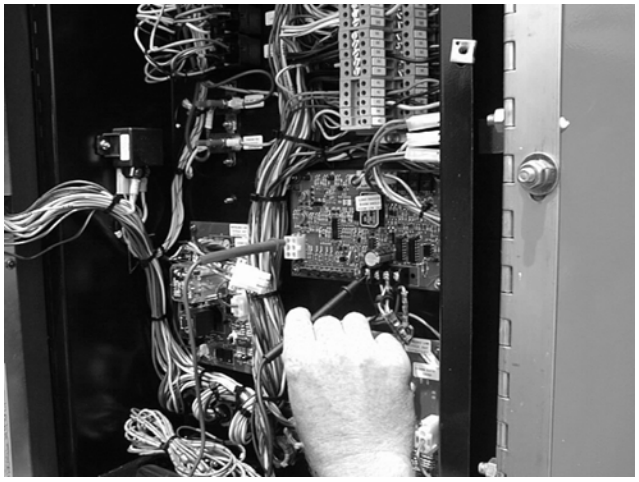
4.7 BOOM LOAD RADIUS SETUP PROCEDURES - 110SX SINGLE CAPACITY

NOTE: *The boom length and angle sensor adjustments need to be made before the display lights are adjusted.*

The boom length and angle sensor is factory set and does not normally require adjusting unless it is removed from the base boom for maintenance.

Length Indicator Adjustment

1. Level the frame before beginning any adjustments.
2. Make all adjustments with the engine running unless otherwise noted.
3. Fully retract the boom.
4. On the Load Radius Circuit Card, measure TP10 and insure that 10 (+0.1/-0) Volts DC is present.
5. On the Load Radius Circuit Card, adjust P1 to 1.151 Volts DC while measuring TP1.
6. Make the following adjustment with the power off. On the Load Radius Circuit Card, disconnect connector J2 (the 6 pin connector on the printed circuit board). Measure between Pin (6) of the socket on the circuit board and ground (TB1-1), adjust potentiometer P5 to a value of 1.340 (+/- 0.005) Ohms. Reconnect J2 when adjustment is complete.



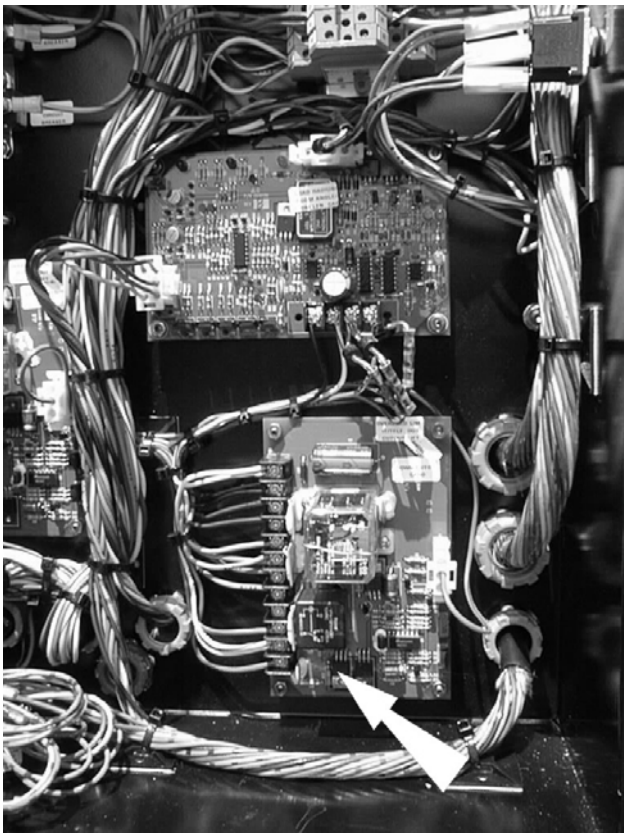
7. Turn the power on and measure TP2. It should be 1.237 Volts DC. Re-adjust the 5K Ohm potentiometer in the boom cable reel if necessary. Adjust the 5K Ohm potentiometer by loosening the three screws holding it in place. Tighten the three (3) screws when adjustment is complete.

Boom Angle Sensor Adjustment

1. With the platform level, the boom fully retracted and at 45 (+/- 1) degrees elevation, measure the DC voltage at TP5 on the Load Radius Circuit Card.
2. Loosen the three screws securing the sensor to the box and rotate the sensor until 7.1 (+/- 0.1) Volts DC is measured at TP5. Tighten the screws on the sensor.
3. Return the boom to horizontal.

Radius Adjustment and Display Lights Setting Procedure

1. On the Load Radius Circuit Card, measure TP11 and adjust potentiometer P6 for a reading of 0.0 Volts DC.
2. On the Load Radius Circuit Card, measure TP8 and adjust potentiometer P2 for a reading of 2.548 Volts DC.
3. On the Load Radius Circuit Card, measure TP9 and adjust potentiometer P3 for a reading of 5.0 Volts DC.
4. Telescope the boom until the leading edge of the red marking tape is exposed from the mid boom. Adjust potentiometer P2 until the red light just turns on and the blue light turns off.
5. Extend the boom until the red tape is approximately 6 inches out of the base boom. Adjust P4 until the amber LED (DS2) on the Load Moment Circuit card goes out. This determines the length of the boom (critical length) where the lift down speed limiter is turned on.



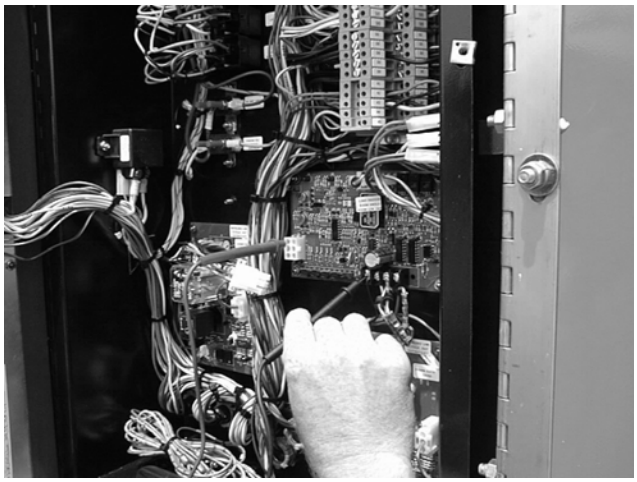
4.8 BOOM LOAD RADIUS SETUP PROCEDURES - 110SX DUAL CAPACITY

NOTE: *The boom length and angle sensor adjustments need to be made before the display lights are adjusted.*

The boom length and angle sensor is factory set and does not normally require adjusting unless it is removed from the base boom for maintenance.

Length Indicator Adjustment

1. Level the frame before beginning any adjustments.
2. Make all adjustments with the engine running unless otherwise noted.
3. Fully retract the boom.
4. On the Load Radius Circuit Card, measure TP10 and insure that 10 (+0.1/-0) Volts DC is present.
5. On the Load Radius Circuit Card, adjust P1 to 1.151 Volts DC while measuring TP1.
6. Make the following adjustment with the power off. On the Load Radius Circuit Card, disconnect connector J2 (the 6 pin connector on the printed circuit board). Measure between Pin (6) of the socket on the circuit board and ground (TB1-1), adjust potentiometer P5 to a value of 1.340 (+/- 0.005) Ohms. Reconnect J2 when adjustment is complete



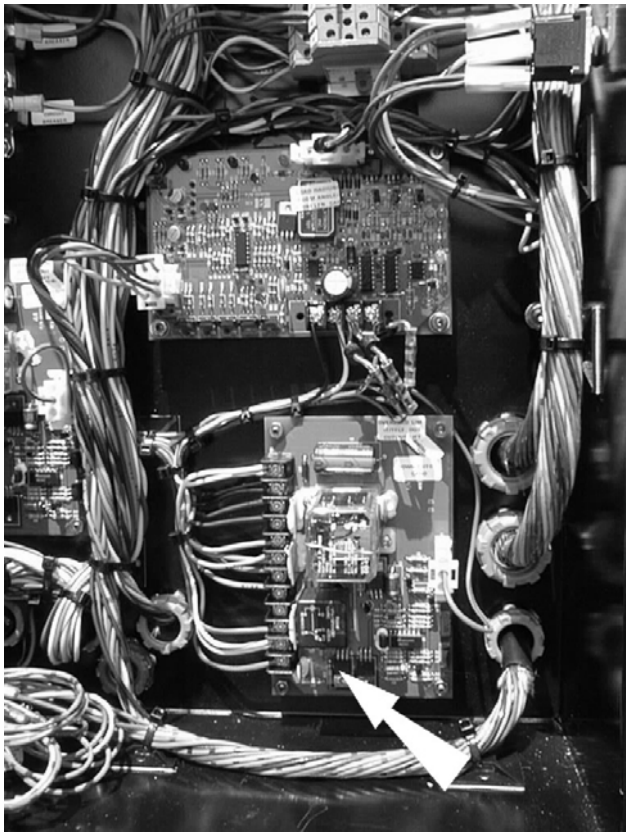
7. Turn the power on and measure TP2. It should be 1.237 Volts DC. Re-adjust the 5K Ohm potentiometer in the boom cable reel if necessary. Adjust the 5K Ohm potentiometer by loosening the three screws holding it in place. Tighten the three (3) screws when adjustment is complete.

Boom Angle Sensor Adjustment

1. With the platform level, the boom fully retracted and at 45 (+/- 1) degrees elevation, measure the DC voltage at TP5 on the Load Radius Circuit Card.
2. Loosen the three screws securing the sensor to the box and rotate the sensor until 7.1 (+/- 0.1) Volts DC is measured at TP5. Tighten the screws on the sensor.
3. Return the boom to horizontal.

Radius Adjustment and Display Lights Setting Procedure

1. On the Load Radius Circuit Card, measure TP11 and adjust potentiometer P6 for a reading of 0.0 Volts DC.
2. On the Load Radius Circuit Card, measure TP8 and adjust potentiometer P2 for a reading of 2.128 Volts DC.
3. On the Load Radius Circuit Card, measure TP9 and adjust potentiometer P3 for a reading of 2.548 Volts DC.
4. Telescope the boom until the leading edge of the yellow marking tape is exposed from the mid boom. Adjust potentiometer P2 until the yellow light just turns on and the blue light turns off.
5. Telescope the boom until the leading edge of the red marking tape is exposed from the mid boom. Adjust potentiometer P3 until the red light just turns on and the yellow light turns off.
6. Extend the boom until the red tape is approximately 6 inches out of the base boom. Adjust P4 until the amber LED (DS2) on the Load Moment Circuit card goes out. This determines the length of the boom (critical length) where the lift down speed limiter is turned on.



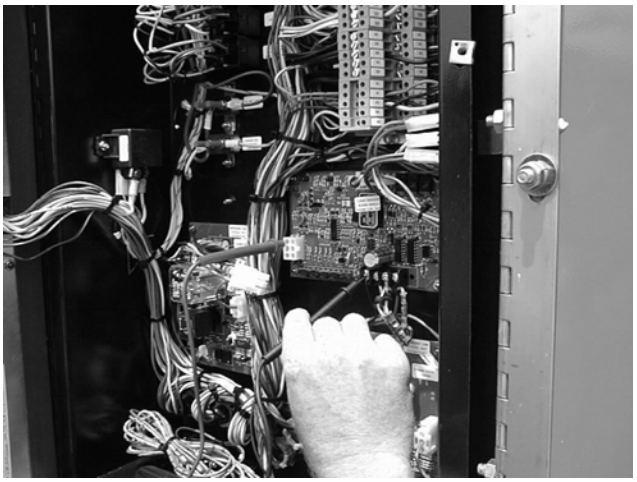
4.9 BOOM LOAD RADIUS SETUP PROCEDURES - 120SX

NOTE: *The boom length and angle sensor adjustments need to be made before the display lights are adjusted.*

The boom length and angle sensor is factory set and does not normally require adjusting unless it is removed from the base boom for maintenance.

Length Indicator Adjustment

1. Level the frame before beginning any adjustments.
2. Make all adjustments with the engine running unless otherwise noted.
3. Fully retract the boom.
4. On the Load Radius Circuit Card, measure TP10 and insure that 10 (+0.1/-0) Volts DC is present.
5. On the Load Radius Circuit Card, adjust P1 to 1.233 Volts DC while measuring TP1.
6. Make the following adjustment with the power off. On the Load Radius Circuit Card, disconnect connector J2 (the 6 pin connector on the printed circuit board). Measure between Pin (6) of the socket on the circuit board and ground (TB1-1), adjust potentiometer P5 to a value of 1.915 (+/- 0.005) Ohms. Reconnect J2 when adjustment is complete



7. Turn the power on and measure TP2. It should be 1.287 Volts DC. Re-adjust the 5K Ohm potentiometer in the boom cable reel if necessary. Adjust the 5K Ohm potentiometer by loosening the three screws holding it in place. Tighten the three (3) screws when adjustment is complete.

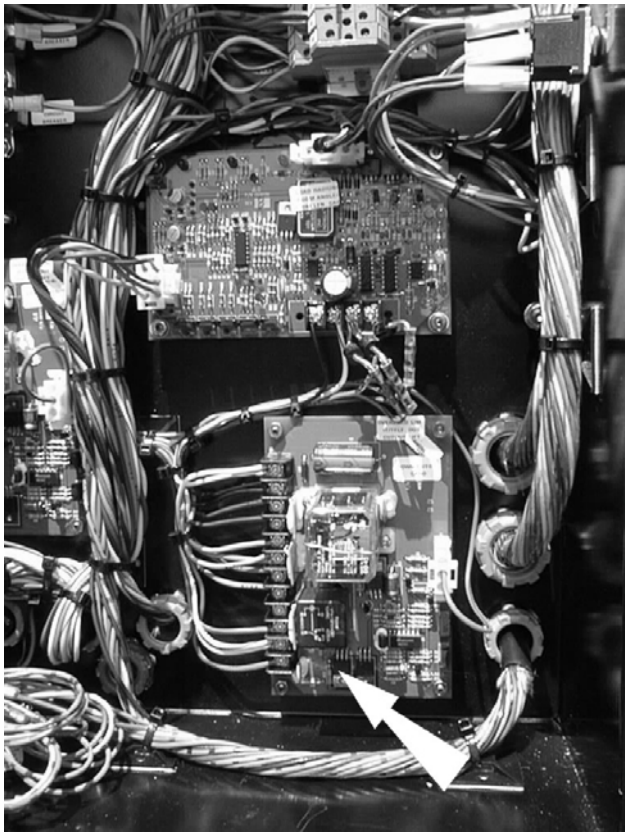
Boom Angle Sensor Adjustment

1. With the platform level, the boom fully retracted and at 45 (+/- 1) degrees elevation, measure the DC voltage at TP5 on the Load Radius Circuit Card.
2. Loosen the three screws securing the sensor to the box and rotate the sensor until 7.1 (+/- 0.1) Volts DC is measured at TP5. Tighten the screws on the sensor.
3. Return the boom to horizontal.

Radius Adjustment and Display Lights Setting Procedure

1. On the Load Radius Circuit Card, measure TP11 and adjust potentiometer P6 for a reading of 0.525 Volts DC.
2. On the Load Radius Circuit Card, measure TP8 and adjust potentiometer P2 for a reading of 2.223 Volts DC.
3. On the Load Radius Circuit Card, measure TP9 and adjust potentiometer P3 for a reading of 5.0 Volts DC.
4. Telescope the boom until the leading edge of the red marking tape is exposed from the mid boom. Adjust potentiometer P2 until the red light just turns on and the blue light turns off.

5. Extend the boom until the red tape is approximately 6 inches out of the base boom. Adjust P4 until the amber LED (DS2) on the Load Moment Circuit card goes out. This determines the length of the boom (critical length) where the lift down speed limiter is turned on.



This page intentionally left blank.

SECTION 5. HYDRAULICS

5.1 CYLINDERS - THEORY OF OPERATION

1. Cylinders are of the double acting type. Systems incorporating double acting cylinders are as follows: Lift, Telescope, Steer, Master Level, Slave Level, Axle Extend, Frame Lift (if equipped) and Extend-A-Reach (if equipped). A double acting cylinder is one that requires oil flow to operate the cylinder rod in both directions. Directing oil (by actuating the corresponding control valve to the piston side of the cylinder) forces the piston to travel toward the rod end of the barrel, extending the cylinder rod (piston attached to rod). When the oil flow is stopped, movement of the rod will stop. By directing oil to the rod side of the cylinder, the piston will be forced in the opposite direction and the cylinder rod will retract.
2. Holding valves are used in the Lift, Slave Level, Telescope, and Extend-A-Reach circuits to prevent retraction of the cylinder rod should a hydraulic line rupture or a leak develop between the cylinder and its related control valve.

5.2 CYLINDER CHECKING PROCEDURES

NOTE: *Cylinder checks must be performed any time a cylinder component is replaced or when improper system operation is suspected.*

Cylinder w/o Counterbalance Valves

Steer Cylinders, Master Level Cylinder, Frame Jack Cylinders.

⚠ IMPORTANT

OPERATE FUNCTIONS FROM GROUND CONTROL STATION ONLY.

1. Using all applicable safety precautions, activate engine and fully extend cylinder to be checked. Shut down engine.
2. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After the initial discharge, there should be no further leakage from the retract port.
3. Activate engine and activate cylinder extend function. Check retract port for leakage.
4. If cylinder leakage is 6-8 drops per minute or more, piston seals are defective and must be replaced. If cylinder retract port leakage is less than 6-8 drops per minute, carefully reconnect hose to retract port and retract cylinder.
5. With cylinder fully retracted, shut down engine and carefully disconnect hydraulic hose from cylinder extend port.
6. Activate engine and activate cylinder retract function. Check extend port for leakage.
7. If cylinder leakage is 6-8 drops per minute or more, piston seals are defective and must be replaced. If extend port leakage is less than 6-8 drops per minute, carefully reconnect hose to extend port, then activate cylinder through one complete cycle and check for leaks.

Cylinders w/Single Counterbalance Valves

Lift Cylinder, Telescope Cylinder, Extend-A-Reach Cylinder

⚠ IMPORTANT

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

1. Using all applicable safety precautions, activate hydraulic system.

⚠ WARNING

WHEN WORKING ON THE LIFT CYLINDER, RAISE THE BOOM TO HORIZONTAL AND SUPPORT THE BOOM USING A SUITABLE BOOM PROP OR OVERHEAD LIFTING DEVICE.

2. If working on the lift cylinder, raise boom to horizontal and place a suitable boom prop approximately 1 inch (2.5 cm) below the boom. If working on the telescope cylinder, raise the boom above horizontal and extend the fly boom approximately 1 foot (30.5 cm).
3. Shut down hydraulic system and allow machine to sit for 10-15 minutes. Turn ignition switch to ON, move control switch or lever for applicable cylinder in each direction, then turn ignition switch to OFF. This is done to relieve excess pressure in the hydraulic lines. Carefully remove hydraulic hoses from appropriate cylinder port block.
4. There will be initial weeping of hydraulic fluid, which can be caught in a suitable container. After the initial discharge, there should not be any further leakage from the ports. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repairs must be made. If the retract port is leaking, the piston seals are defective and must be replaced. If the extend port is leaking, the counterbalance valve is defective and must be replaced.

5. If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.
6. If used, remove boom prop or lifting device from boom, activate hydraulic system and run cylinder through one complete cycle to check for leaks.

Cylinders w/Dual Counterbalance Valve

Axle Extension Cylinders, Telescope Cylinder, Platform Slave Level Cylinder

⚠ IMPORTANT

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

1. Using all applicable safety precautions, activate hydraulic system.
2. If working on the telescope cylinder, raise the boom above horizontal and extend the fly boom approximately 1 foot (30.5 cm). If working on the platform slave level cylinder, stroke platform level cylinder forward until platform sits at a 45° angle.
3. Shut down hydraulic system and allow machine to sit for 10-15 minutes. Turn ignition switch to ON, move control switch or lever for applicable cylinder in each direction, then turn ignition switch to OFF. This is done to relieve pressure in the hydraulic lines. Carefully remove hydraulic hoses from appropriate cylinder port block.
4. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After the initial discharge, there should not be any further leakage from the ports. If leakage continues at a rate of 6-8 drops per minute or more, the counterbalance valve is defective and must be replaced.
5. To check piston seals, carefully remove the counterbalance valve from the retract port. After initial discharge, there should not be any further leakage from the ports. If leakage occurs at a rate of 6-8 drops per minute or more, the piston seals are defective and must be replaced.
6. If no repairs are necessary or when repairs have been made, replace counterbalance valve and carefully reconnect hydraulic hoses to cylinder port block.
7. Activate hydraulic system and run cylinder through one complete cycle to check for leaks.

5.3 CYLINDER REMOVAL AND INSTALLATION

Telescope Cylinder Removal

1. Place machine on a flat and level surface, with axles extended and the boom fully retracted and in the horizontal position.
2. Shut down engine. Support boom platform end with a prop or suitable overhead lifting device.
3. Remove boom end cover.
4. Remove boom length/angle indicator from boom assembly.

⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID THE ENTRY OF CONTAMINANTS INTO THE SYSTEM.

5. Tag and disconnect hydraulic lines to telescope cylinder. Use suitable containers to retain any residual hydraulic fluid. Cap hydraulic lines and ports.

⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID THE ENTRY OF CONTAMINANTS INTO THE SYSTEM.

6. Tag and disconnect hydraulic lines to telescope cylinder. Use suitable containers to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
7. Remove the two (2) cotter pins that retain the telescope rod attach pin to the base boom.
8. Using a suitable brass drift, carefully drive the telescope cylinder rod attach pin from the base boom.
9. Remove the telescope cylinder trunnion attach pin cover from each side of the base boom.
10. Remove the setscrews securing the telescope cylinder attach pin from each side of the telescope cylinder trunnion.
11. Using a suitable slide hammer, remove the half pins attaching the telescope cylinder to the inner mid boom section.
12. Attach a suitable sling to the telescope cylinder rod. Support with an overhead crane or other suitable lifting device.
13. Remove the rod support bracket at the aft end of the base boom.
14. Remove the two (2) extension chain adjusting nuts at the aft end of the base boom.

15. Remove the three (3) bolts, washers and lockwashers attaching the chain adjust bracket to the aft end of the base boom and remove bracket.
16. Pull boom sections apart several feet.
17. Using the lifting equipment, raise the cylinder to obtain sufficient clearance for removal of the cylinder.
18. Connect a suitable lifting device to the extension chain adjust rod on top of the telescope cylinder.
19. Using both lifting devices, carefully pull the cylinder from the boom assembly.

NOTE: *The extension rod will come out of the boom twice as far as the telescope cylinder proportionally.*

20. Continue sliding the cylinder and extension rod out of the boom until the rod can be separated from the extension chain by removing the chain clevis attach pin.
21. Using the lifting equipment, remove the extension chain bar.
22. Continue sliding the cylinder from the boom, laying the extension chain on top of the base boom as the cylinder is coming out.
23. Using another lifting device, support the sheave wheel end of the cylinder and remove the cylinder from the boom assembly.
24. Carefully lift the cylinder clear of the boom assembly and lower to the ground or suitably supported work area.

Telescope Cylinder Installation

1. Using suitable lifting equipment, carefully lower the cylinder to the boom assembly.
2. Using another lifting device, support the sheave wheel end of the cylinder and install the cylinder into the boom assembly.
3. Slide the extension cylinder into the boom, sliding the extension chain in place as the cylinder is moving in.
4. Using the lifting equipment, install the extension chain bar.
5. Continue sliding the cylinder and extension rod into the boom until the rod can be attached to the extension chain by installing the chain clevis attach pin.
6. Install the chain adjust bracket and install the three (3) bolts, washers and lockwashers which attach the bracket to the aft end of the base boom.
7. Install the two (2) extension chain adjusting nuts at the aft end of the base boom.
8. Install the rod support bracket at the aft end of the base boom.
9. Remove the sling attached to the telescope cylinder rod.
10. Pull boom sections back into the fully retracted position.
11. Using a suitable brass drift, if necessary, install the half pins attaching the telescope cylinder to the inner mid boom section.
12. Install setscrews that attach the telescope cylinder attach pins to each side of the telescope cylinder trunnions.
13. Install the telescope cylinder trunnion attach pin cover to each side of the base boom.
14. Carefully install the telescope cylinder rod attach pin into the base boom.
15. Install the two (2) cotter pins that retain the telescope rod attach pin to the base boom.
16. Remove applicable hydraulic line and port caps and correctly connect the hydraulic lines to the telescope cylinder. Ensure that all hoses are correctly routed.
17. Cycle telescope function several times to dissipate any air from cylinder and lines. Properly torque boom chains to 59 ft. lb. (80 Nm).
18. Install boom length/angle indicator on boom assembly.

NOTE: *Boom length/angle indicator will need to be adjusted as per the procedure listed in Section 4 of this manual.*

19. Using all applicable safety precautions, operate the boom functions. Check for correct operation and hydraulic leaks. Secure as necessary.
20. Install boom end cover.
21. Retract boom fully and place in stowed position.

Lift Cylinder Removal

1. Place the machine on a flat and level surface. Start the engine and place the boom in a horizontal position. Shut down the engine and attach a suitable support device to the boom.
2. Tag, disconnect and cap the lift cylinder hydraulic lines and ports.
3. Remove the bolt, flatwasher and lockwasher securing the cylinder rod attach pin retaining plate to the boom.
4. Remove the two bolts and two lockwashers securing the pin retaining plate to the pin. Using a suitable brass drift drive out the cylinder rod attach pin.
5. Using auxiliary power, retract the lift cylinder rod completely.
6. Remove the barrel end attach pin retaining plate and hardware. Using a suitable brass drift drive out the barrel end attach pin from the upright.
7. Remove the cylinder from the boom and place in a suitable work area.

Lift Cylinder Installation

1. Install lift cylinder in place using suitable slings or supports, aligning attach pin mounting holes on the upright.
2. Using a suitable drift, drive the barrel end attach pin through the mounting holes in the lift cylinder and the upright. Secure in place with the pin retaining plate and hardware.
3. Remove cylinder port plugs and hydraulic line caps and correctly attach lines to cylinder ports.
4. Using auxiliary power, extend the cylinder rod until the attach pin hole aligns with those in the boom. Using a suitable drift, drive the cylinder rod attach pin through the aligned holes, taking care to align the grooved pin holes. Secure the pin in place with the bolt, lockwasher and nut.
5. Place boom in the stowed position and shut down engine. Check hydraulic fluid level and adjust accordingly.

Master Level Cylinder Removal

1. With the main boom positioned to horizontal and properly supported, prepare to remove the upright level cylinder.
2. Remove the bolt, lockwasher and nut securing the level cylinder rod attach pin to the tower boom. Using an appropriate brass drift, drive out the level cylinder rod attach pin.
3. Tag, disconnect and cap hydraulic lines to level cylinder.

NOTE: *When disconnecting hydraulic lines, any residual hydraulic fluid should be drained into a suitable container.*

4. Make up two temporary hose assemblies (3/8 In. x 10 ft.) to carry power from the turntable swing motor supply hoses to the lift cylinder. Couple temporary hoses to swing motor supply hoses, using reducer fittings if necessary. Plug ports in swing motor.
5. After installing temporary hoses, activate swing function, using auxiliary power, to fully retract level cylinder rod.
6. Remove temporary hoses from level cylinder and cap them. Plug cylinder ports.
7. Using slings, restrain level cylinder.
8. Remove retaining plate and bolts from upright cylinder attach pin.
9. Using an appropriate brass drift, drive out the upright attach pin. Carefully remove restraining slings and remove level cylinder from boom.

Master Level Cylinder Installation

1. With the boom positioned at horizontal and properly supported, place the master level cylinder in position on the boom and secure in place using slings.
2. Align barrel end bushing with pin attach blocks in turntable upright and install upright attach pin using appropriate brass drift. Secure pin with retaining plate and retaining plate bolts.
3. Remove caps from temporary hydraulic lines and attach to level cylinder ports. Using auxiliary power, activate swing function and extend cylinder rod until rod bushing aligns with boom lift cylinder rod end attach bushing.
4. Using an appropriate brass drift drive the rod attach pin through the aligned bushings of the cylinder rod and boom lift cylinder rod end attach plate, taking care to align holes for bolt attachment. Secure rod end attach pin with bolt, lockwasher and nut.
5. Remove restraining slings from level cylinder.
6. Remove temporary hydraulic lines from cylinder ports and turntable swing motor hydraulic supply. Reattach hydraulic supply to swing motor.
7. Remove caps from cylinder hydraulic lines and correctly install lines to cylinder.
8. Remove boom support. Place boom in stowed position. Check hydraulic fluid level and adjust accordingly.

5.4 CYLINDER REPAIR

NOTE: *The following are general procedures that apply to all of the cylinders on this machine. Procedures that apply to a specific cylinder will be so noted.*

Disassembly

⚠ IMPORTANT

DISASSEMBLY OF THE CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to the cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source. Adequately support the cylinder rod, if applicable.

⚠ WARNING

FOR CYLINDERS WITH DOUBLE HOLDING VALVES, CRACK BLEEDERS TO RELEASE PRESSURE BEFORE REMOVING HOLDING VALVES.

3. If applicable, remove the cartridge-type holding valve and fittings from the cylinder port block. Discard o-rings.

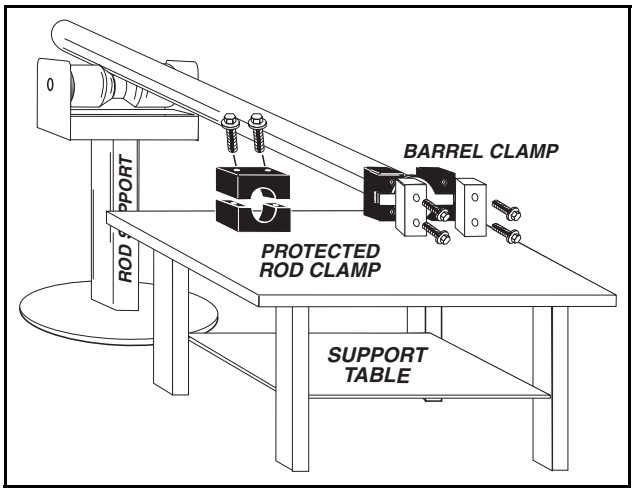


Figure 5-1. Cylinder Barrel Support

4. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to shatter loctite.
5. Using a suitable spanner wrench, loosen the cylinder head retainer, if applicable, and/or cylinder head gland, and remove from cylinder barrel.
6. Attach a suitable pulling device to the cylinder rod port block end or cylinder rod end, as applicable.

⚠ IMPORTANT

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

7. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.

⚠ CAUTION

ONCE THE HEAD GLAND HAS CLEARED THE CYLINDER CASE MOUTH, THE ROD MUST BE SUPPORTED CLOSE TO THE CYLINDER CASE PRIOR TO THE PISTON BEING PULLED PAST THE CYLINDER CASE THREADS. THIS IS DONE TO AVOID DAMAGE TO THE CYLINDER CASE THREADS, AND/OR THE PISTON AND PISTON SEALS.

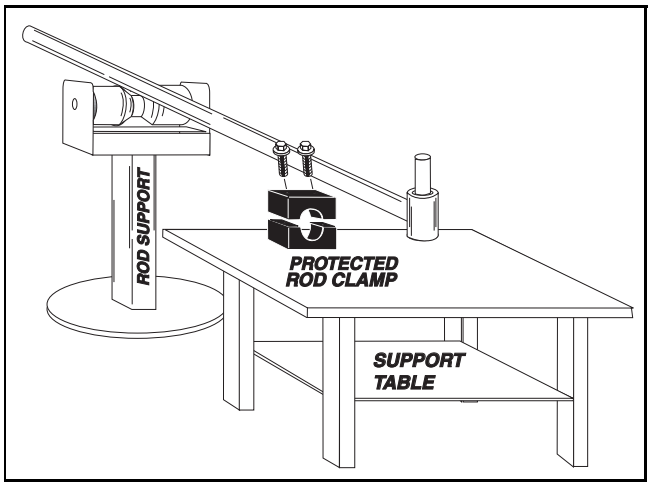


Figure 5-2. Cylinder Rod Support

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
9. Remove the set screw(s), if applicable, and nut which attach the piston to the rod, and remove the piston. Discard nylon point set screws.

10. Remove the piston rings.
11. Remove and discard the piston o-rings, seal rings, and backup rings.
12. Remove the set screw, if applicable, piston spacer, and wear ring, if applicable, from the rod.
13. Remove the rod from the holding fixture. Remove the cylinder head gland and retainer, if applicable. Discard the o-rings, back-up rings, rod seals, and wiper seals.

Cleaning and Inspection

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
8. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
9. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
10. If applicable, inspect cylinder head retainer or end cap for surface or thread damage. Repair or replace as necessary.
11. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
12. If applicable, inspect thread ring for scoring or other damage. Dress threads or applicable surfaces as necessary.
13. If applicable, inspect rod and barrel bushings for signs of correct lubrication and excessive wear. Replace as necessary.
14. Inspect travel limiting collar or spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
15. If applicable, inspect port block fittings and holding valve. Replace as necessary.
16. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
17. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

Assembly

NOTE: *Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. See your JLG Parts Manual.*

NOTE: *Apply a light film of hydraulic oil to all components prior to assembly.*

⚠ IMPORTANT

WHEN INSTALLING NEW "POLY-PAK" TYPE PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. REFER TO FIGURE 5-3. FOR CORRECT SEAL ORIENTATION. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

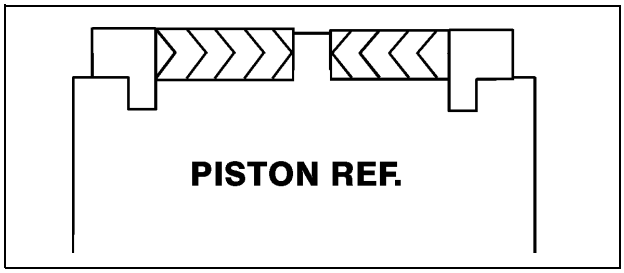


Figure 5-3. Poly-Pak Seal Installation

1. Place a new wiper seal and rod seal into the applicable cylinder head gland grooves.
2. Carefully install the head gland on the rod, ensuring that the wiper and rod seals are not damaged or dislodged. Push the head along the rod to the rod end, as applicable.

3. Carefully slide the piston spacer on the rod. If applicable, align the oil holes in the rod and the spacer. Secure the spacer, if applicable.
4. If applicable, correctly place a new o-ring and back-up rings in the inner piston diameter groove.
5. Carefully place the piston on the cylinder rod, ensuring that the o-ring and back-up rings are not damaged or dislodged.
6. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
7. Push the piston onto the rod until it abuts the spacer end and install the attaching nut.

⚠ WARNING

IF CYLINDER IS EQUIPPED WITH A PISTON NUT, APPLY "LOCQUIC PRIMER T" AND LOCTITE #242 TO PISTON NUT THREADS, THEN TIGHTEN NUT TO TORQUE SHOWN IN TABLE 5-1.

NOTE: *Self-locking setscrews used on piston nuts should be discarded and replaced whenever they are removed.*

Table 5-1. Cylinder Piston Nut Torque Specifications

Description	Nut Torque Value (w/Loctite)	Setscrew Torque Value (w/Loctite)
Axle Extension Cylinder	400 ft. lb. (542 Nm)	100 in. lb. (11 Nm)
Extend-a-Reach Cylinder	400 ft. lb. (542 Nm)	100 in. lb. (11 Nm)
Frame Jack Cylinder	400 ft. lb. (542 Nm)	100 in. lb. (11 Nm)
Level/Slave Cylinder	200 ft. lb. (271 Nm)	100 in. lb. (11 Nm)
Lift Cylinder	600 ft. lb. (813 Nm)	200 in. lb. (22 Nm)
Master Cylinder	80 ft. lb. (108 Nm)	100 in. lb. (11 Nm)
Steer Cylinder	80 ft. lb. (108 Nm)	100 in. lb. (11 Nm)
Telescope Cylinder	600 ft. lb. (813 Nm)	200 in. lb. (22 Nm)

8. If applicable, install the setscrew(s) which secure the piston attaching nut to the diameter groove.
9. Remove the cylinder rod from the holding fixture.
10. Place new o-rings and seals in the applicable outside diameter grooves of both the piston and the cylinder head.
11. Position the cylinder barrel in a suitable holding fixture.

⚠ IMPORTANT

EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

12. With barrel clamped securely, and while adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.
13. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder or, if applicable, until the cylinder head threads engage the threads of the barrel.
14. If applicable, secure the cylinder head retainer using a suitable spanner type wrench in the holes provided.
15. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any holding valve or valves.
16. If applicable, install the cartridge-type holding valve and fittings in the rod port block using new o-rings as applicable.

⚠ CAUTION

IF THE CYLINDER IS TO BE TESTED PRIOR TO INSTALLATION ON THE MACHINE, EXTREME CARE SHOULD BE USED TO INSURE THAT THE OUTER END OF THE ROD IS SUPPORTED. USE EITHER A TRAVELING OVERHEAD HOIST, FORKLIFT, OR OTHER MEANS TO SUPPORT THE OVERHANGING WEIGHT OF THE EXTENDING ROD.

Table 5-2. Holding Valve Torque Specifications

Description	Torque Value
Sun - 7/8 hex M20 x 1.5 thds	30-35 ft. lb. (41-48 Nm)
Sun - 1-1/8 hex 1-14 UNS thds	45-50 ft. lb. (61-68 Nm)
Sun - 1-1/4 hex M36 x 2 thds	150-160 ft. lb. (204-217 Nm)
Racine - 1-1/8 hex 1-1/16 - 12 thds	50-55 ft. lb. (68-75 Nm)
Racine - 1-3/8 hex 1-3/16 - 12 thds	75-80 ft. lb. (102-109 Nm)
Racine - 1-7/8 hex 1-5/8 - 12 thds	100-110 ft. lb. (136-149 Nm)

NOTE: *Steps (17) through (20) apply to the telescope cylinder.*

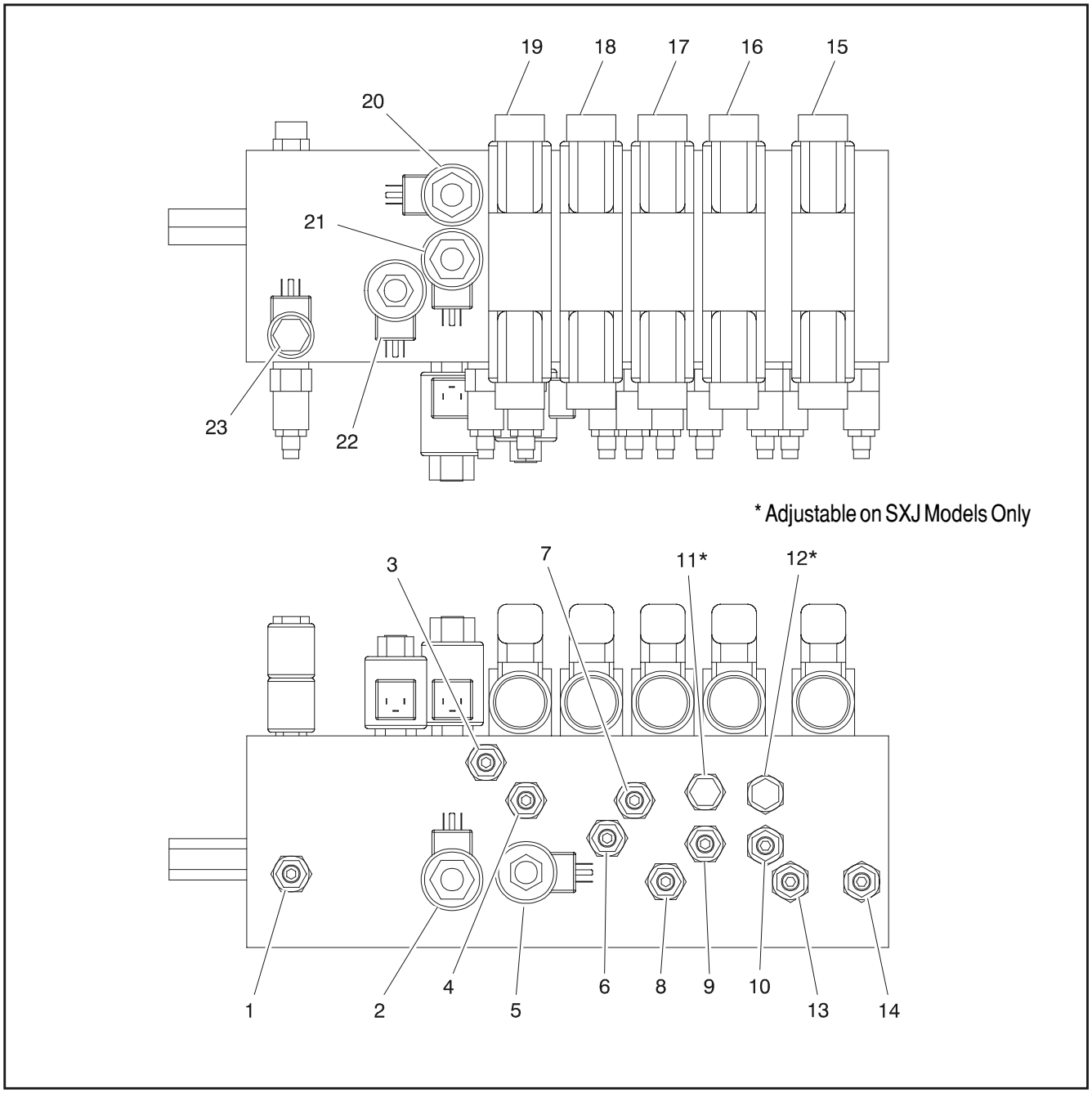
17. Elevate the barrel end of the cylinder to a work bench or other suitable device.
18. Plug the retract port and supply hydraulic power to the extend port.
19. Open the bleeder port plug (TP), venting all trapped air to atmosphere. Retighten the bleeder port plug. Disconnect the hydraulic power source and remove plug from retract port.
20. An alternative to steps (18) through (20) is to position the barrel horizontally in a suitable holding device, attach a hydraulic power source to both extend and retract ports, while supporting the cylinder rod, cycle the cylinder a minimum of 5 times with the bleeder port unplugged, venting all trapped air to atmosphere. A suitable hose may be attached to the bleeder port with the end in a container suitable to contain the hydraulic fluid. After all air is vented remove all attached hoses, and install the bleeder port plug. Also plug the extend and retract ports until cylinder is installed in boom.

5.5 PRESSURE SETTING PROCEDURES

Main Valve

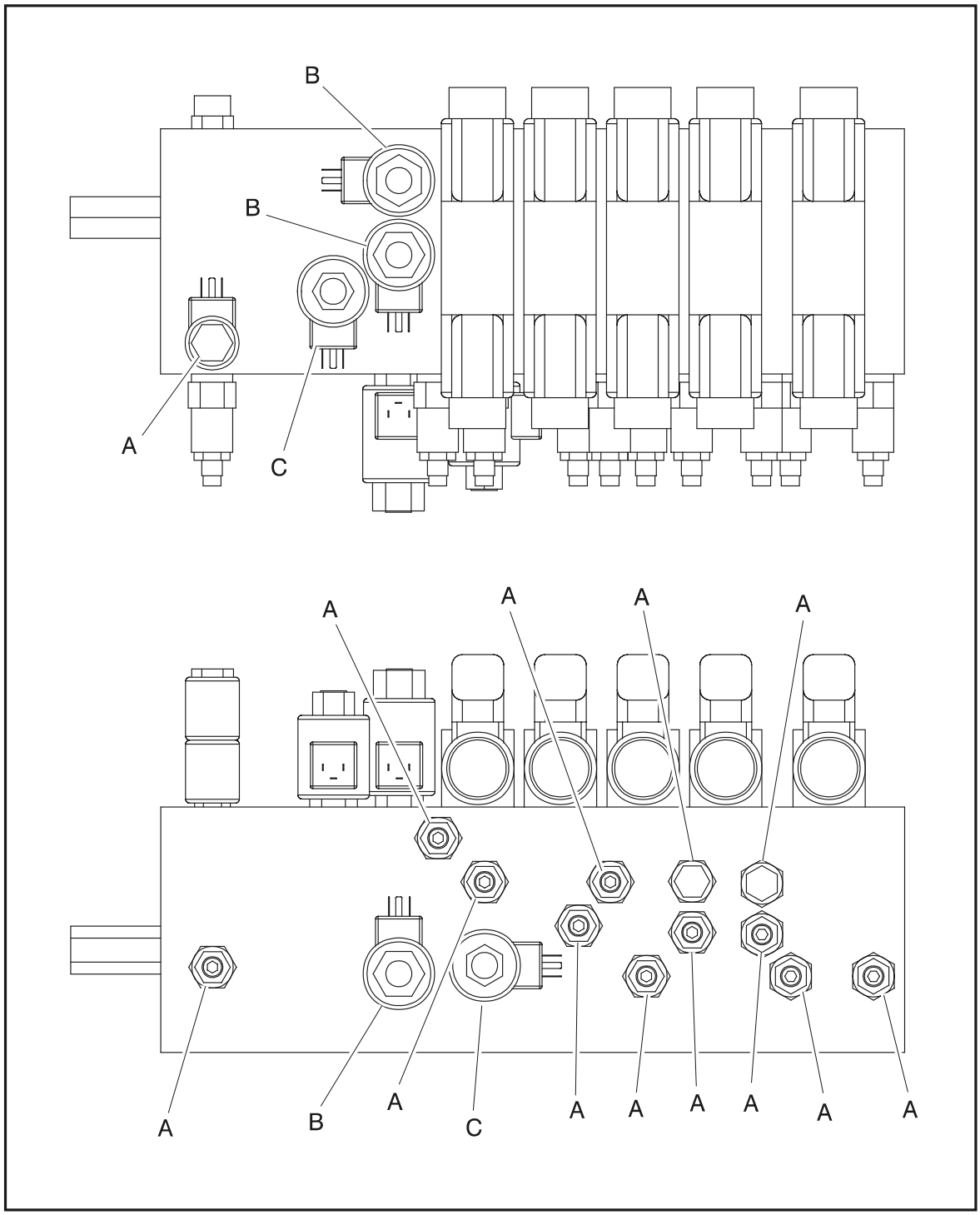
1. Main Relief.

   a. Plug pressure gauge into quick-connect (G port) on main valve. Monitor gauge.
   b. Bottom out Lift Up function.
   c. Loosen nut at main relief and adjust pressure to 3450 psi (238 bar) using an Allen wrench. Tighten nut.



1. Main Pressure Adjustment
2. Swing Flow Control
3. Lift Down Pressure
4. Lift Down Speed Control
5. Lift Down Slow Down
6. Swing Pressure
7. E.A.R. Pressure (Down)
8. E.A.R. Pressure (Up)
9. Rotate Pressure (Right)
10. Rotate Pressure (Left)
11. Rotate (Right) Flow Control
12. Rotate (Left) Flow Control
13. Level Up Pressure
14. Level Down Pressure
15. Level
16. Rotate
17. E.A.R.
18. Swing
19. Lift
20. Flow Control
21. Lift Flow Control
22. Main Dump
23. Telescope

Figure 5-4. Main Valve

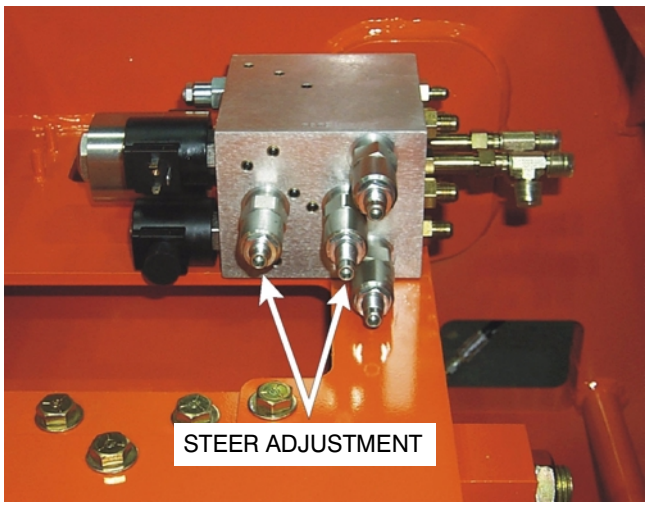


A. 18-20 ft.lbs. (24.5 - 27.2 Nm)
B. 33-37 ft.lbs. (44.9 - 50.3 Nm)
C. 25-27 ft. lbs. (34 - 36.7 Nm)

Figure 5-5. Main Valve Torque Values

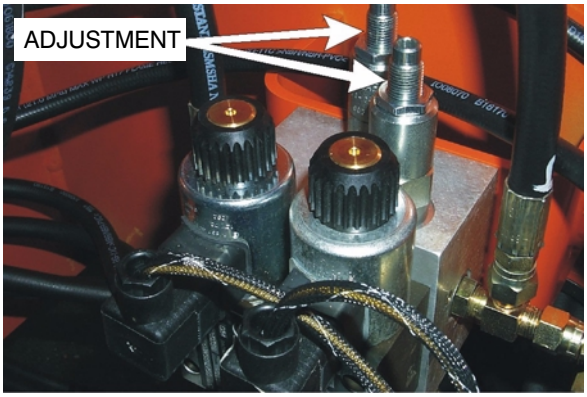
2. Lift Down Relief.
   a. Monitor pressure gauge at quick-connect (G port) on main valve.
   b. Bottom out Lift Down function.
   c. Loosen nut at lift down relief and adjust pressure to 1500 psi (103 bar) using an Allen wrench. Tighten nut.
3. Swing Relief.
   a. Monitor pressure gauge at quick-connect (G port) on main valve.
   b. Ensure turntable lock is engaged.
   c. Bottom out Swing Right function.
   d. Loosen nut at swing right relief and adjust pressure to 1200 psi (83 bar) using an Allen wrench. Tighten nut.
   e. Bottom out Swing Left function.
   f. Loosen nut at swing left relief and adjust pressure to 1200 psi (83 bar) using an Allen wrench. Tighten nut.
4. Extend-A-Reach Relief.
   a. Monitor pressure gauge at quick-connect on main valve at Port 8.
   b. Bottom out Extend-A-Reach Up function.
   c. Loosen nut at extend-a-reach up relief and adjust pressure to 3000 psi (207 bar) using an Allen wrench. Tighten nut.
   d. Monitor pressure gauge at quick-connect on main valve at Port 7.
   e. Bottom out Extend-A-Reach Down function.
   f. Loosen nut at extend-a-reach down relief and adjust pressure to 1400 psi (97 bar) using an Allen wrench. Tighten nut.
5. Platform Rotate Relief.
   a. Monitor pressure gauge at quick-connect on main valve.
   b. Bottom out Rotate Right function.
   c. Loosen nut on rotate right relief and adjust pressure to 2500 psi (172 bar). Tighten nut.
   d. Bottom out Rotate Left function.
   e. Loosen nut on rotate left relief and adjust pressure to 2500 psi (172 bar). Tighten nut.
6. Platform Level Relief.
   a. Monitor pressure gauge at quick-connect on main valve at Port 11.
   b. Bottom out Platform Level Down function.
   c. Loosen nut on platform level down relief and adjust to 2200 psi (152 bar).Tighten nut.
   d. Monitor pressure gauge at quick-connect on main valve at Port 12.
   e. Bottom out Platform Level Up function.
   f. Loosen nut on platform level up relief and adjust to 2500 psi (172 bar). Tighten nut.

Frame Mounted Valves



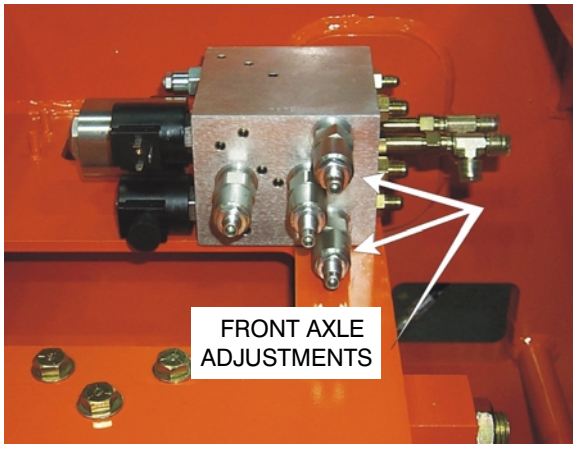
Back out steer adjustments to start setting pressures.

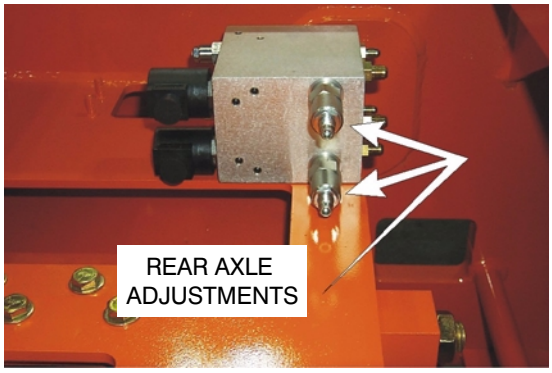
1. Rear Steer.



   a. Steer Select Switch should be in crab or compound steer.
   b. Operate steer switch right or left to set rear steer pressure.
   c. Pressure should be 2850 psi (197 bar).

2. Front Steer.
   a. Steer Select Switch should be in front steer.
   b. Operate steer switch right or left to set rear steer pressure.
   c. Pressure should be 2850 psi (197 bar).
3. Axles.





   a. Select Switch should be in Axle position, Steer Select switch should be in Front Wheel Steer position.
   b. Operate axles in and out.
   c. Pressure should be:
      Axles Out - 2500 psi (172 bar)
      Axles In - 2500 psi (172 bar).

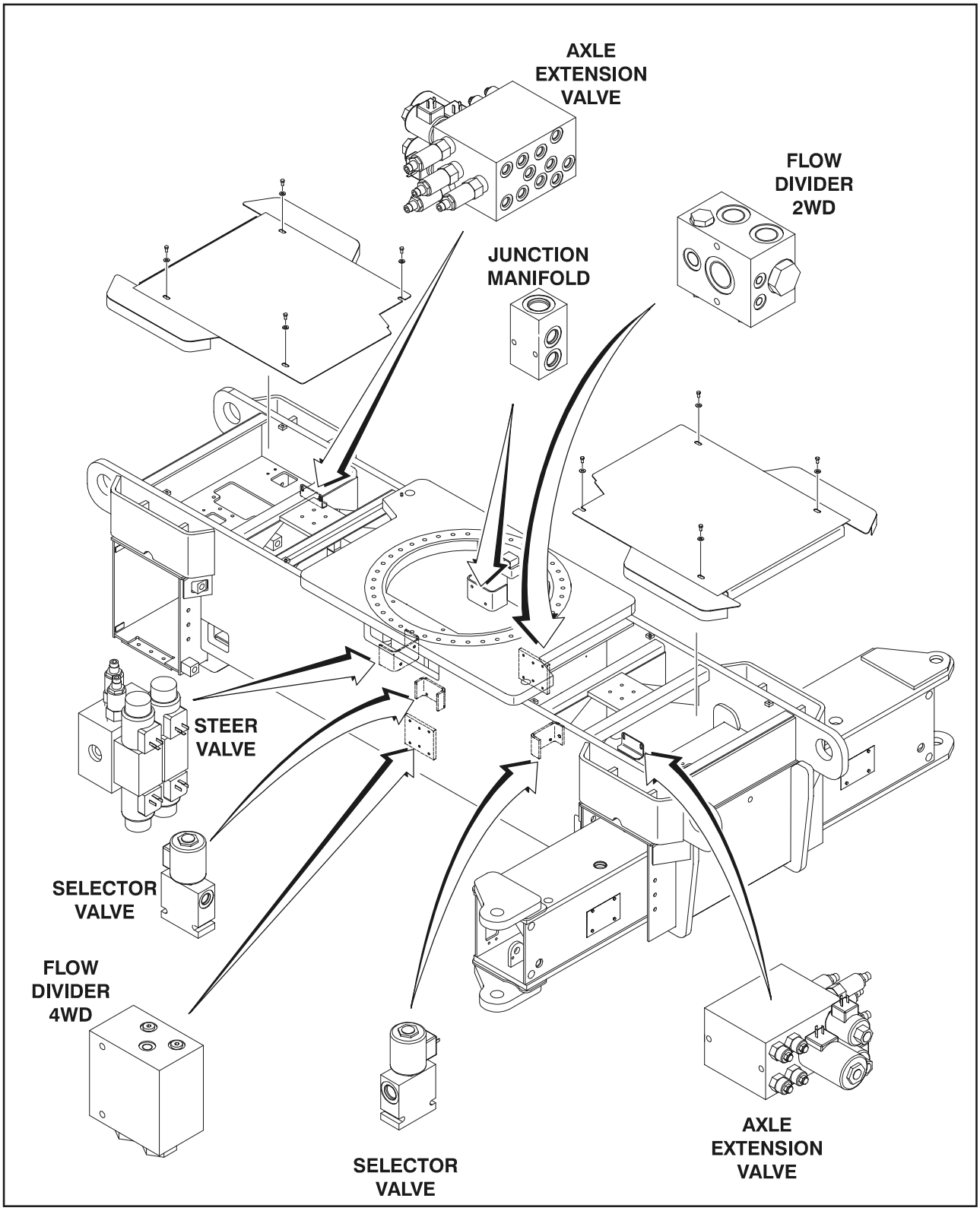


Figure 5-6. Chassis Valve Location

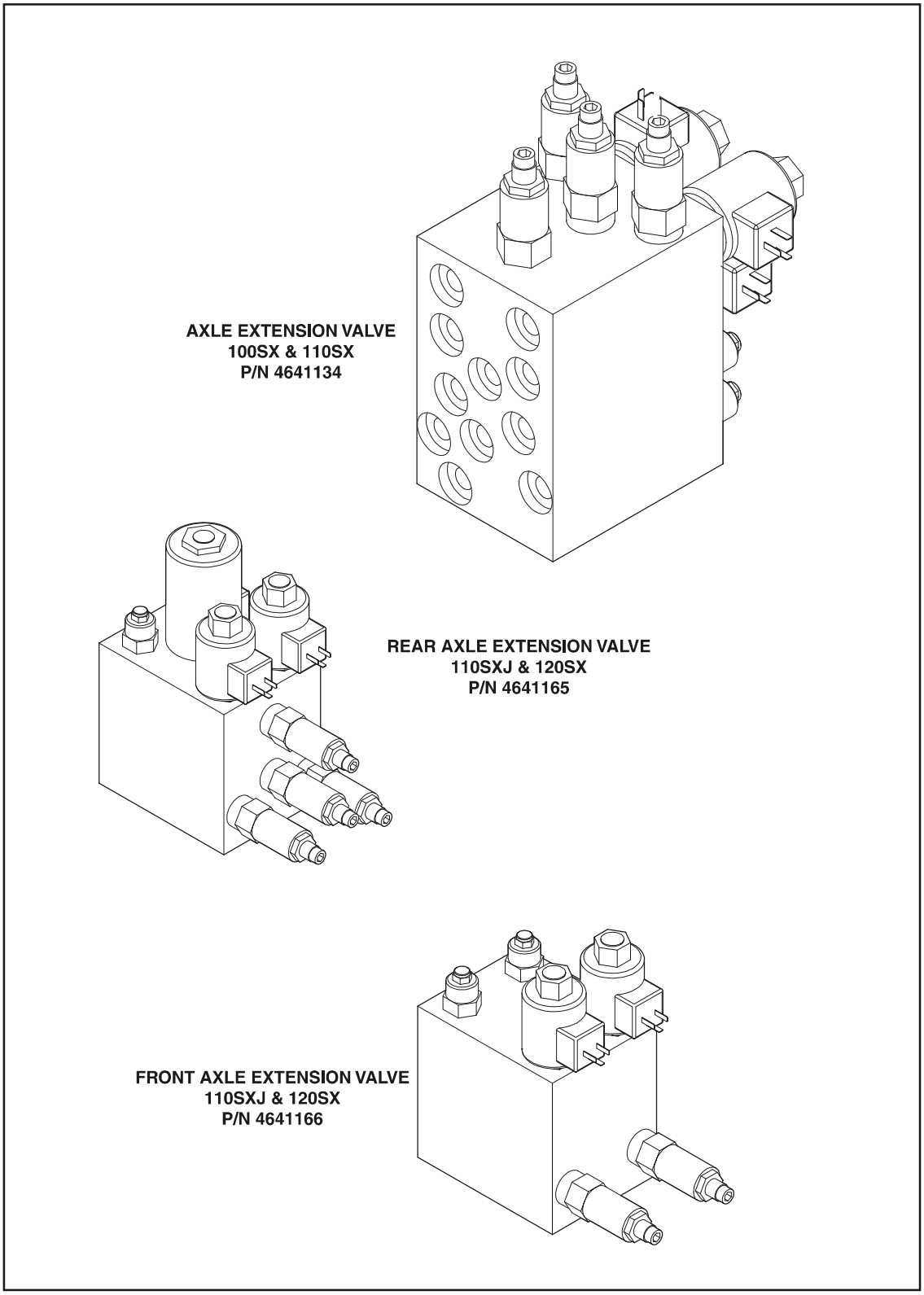
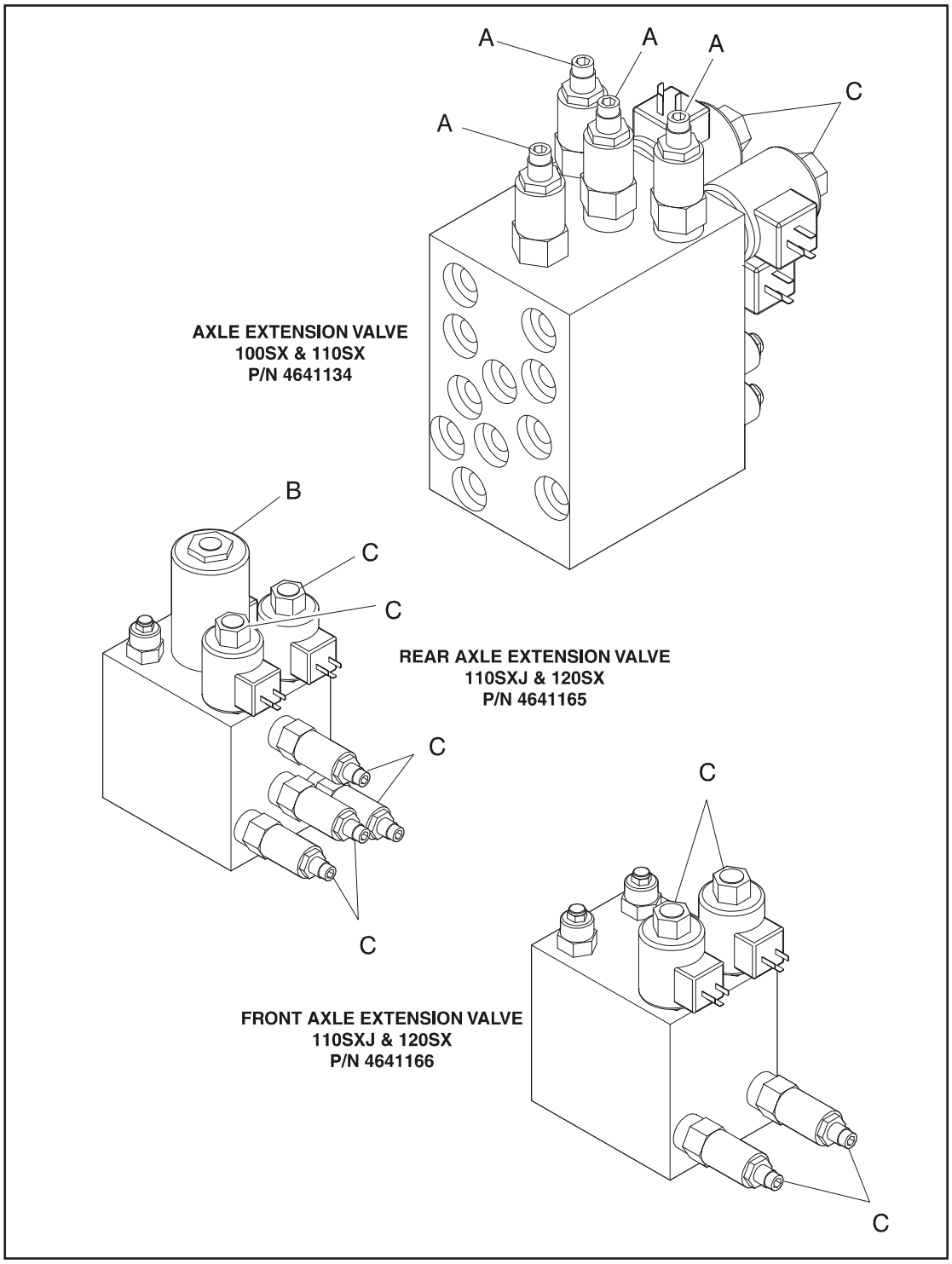


Figure 5-7. Axle Extension Valve



A. 18-20 ft.lbs. (24.5 - 27.2 Nm)
B. 52-60 ft.lbs. (70.7 - 81.6 Nm)
C. 25-27 ft. lbs. (34 - 36.7 Nm)

Figure 5-8. Axle Extension Valve Torque Values

This page left blank intentionally.

SECTION 6. SCHEMATICS

6.1 GENERAL

This section contains schematics to be used for locating and correcting most of the operating problems which may develop. 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.

6.2 TROUBLESHOOTING

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.

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.

6.3 HYDRAULIC CIRCUIT CHECKS

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. For aid in troubleshooting, refer to the Illustrated Parts Manual for hydraulic diagrams of the various circuits.

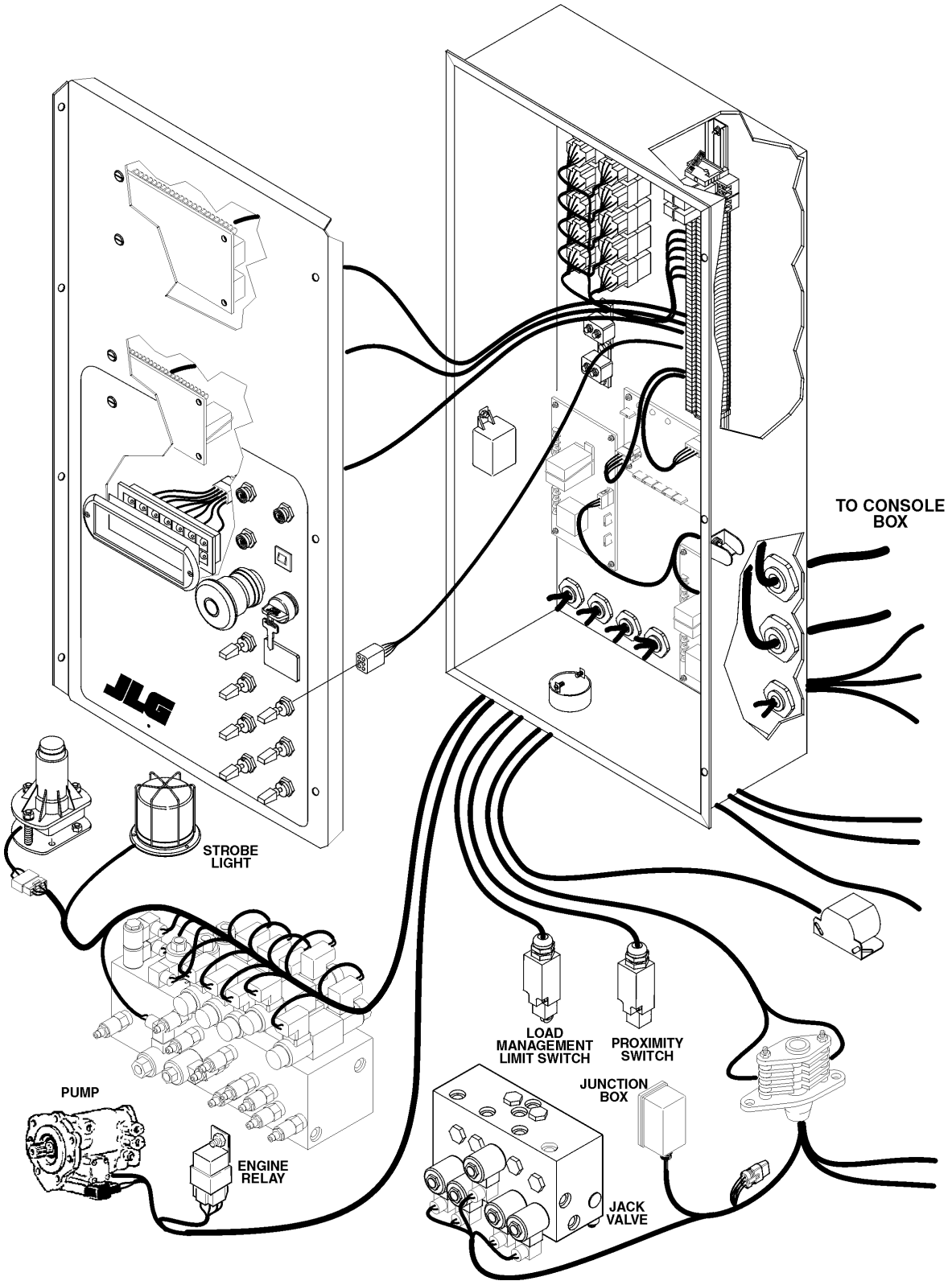


Figure 6-1. Electrical Components Installation - Sheet 1

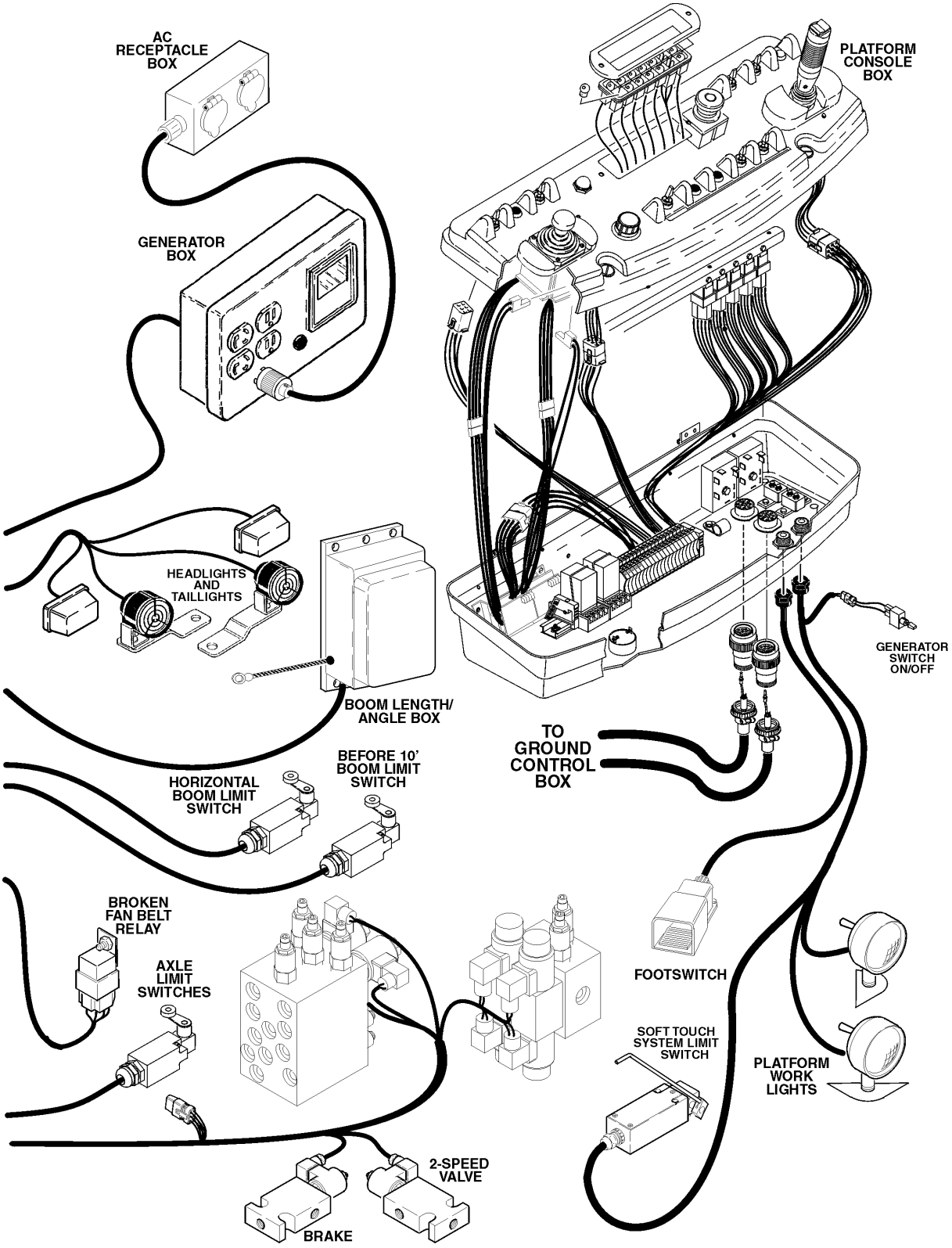


Figure 6-2. Electrical Components Installation - Sheet 2

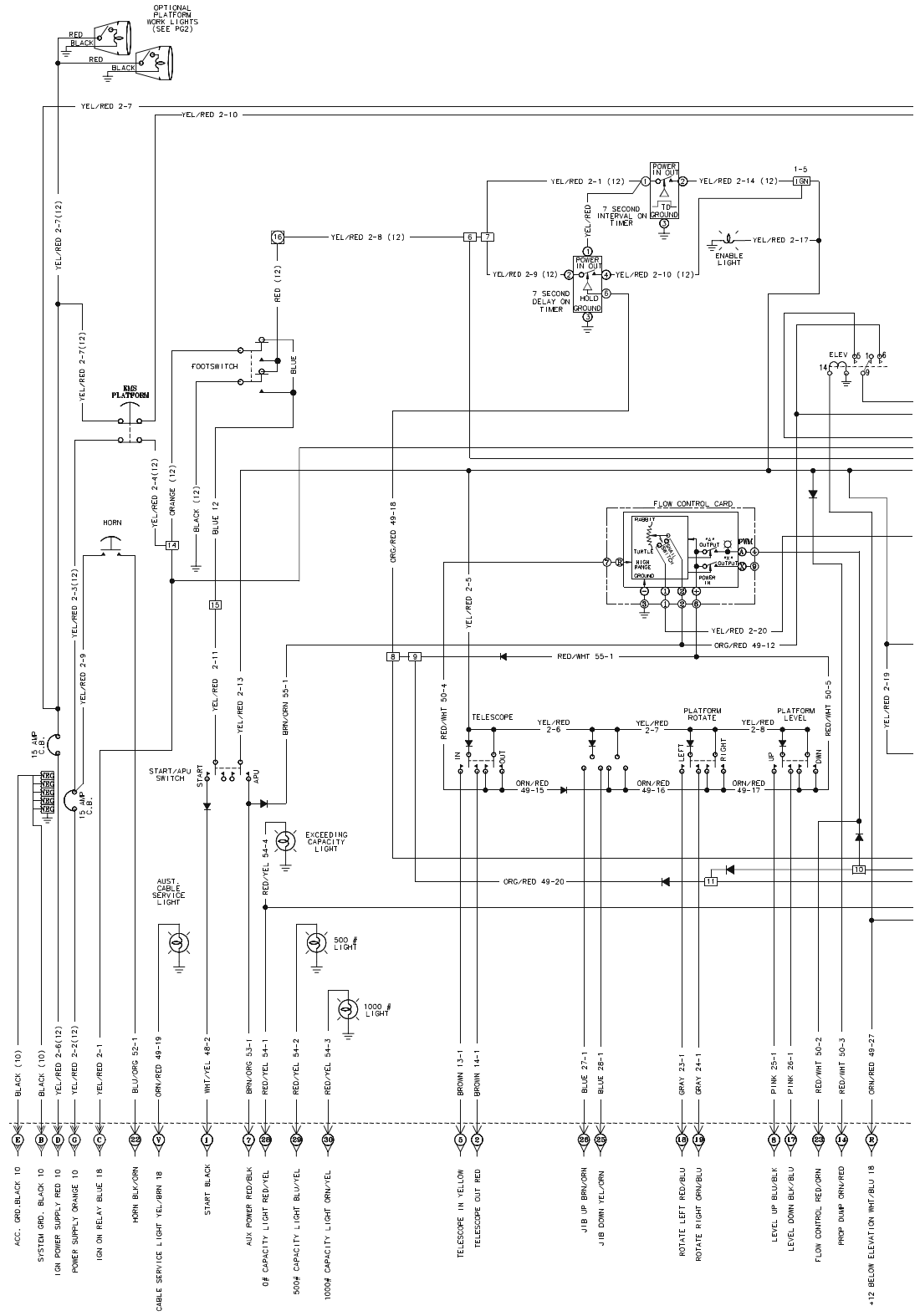
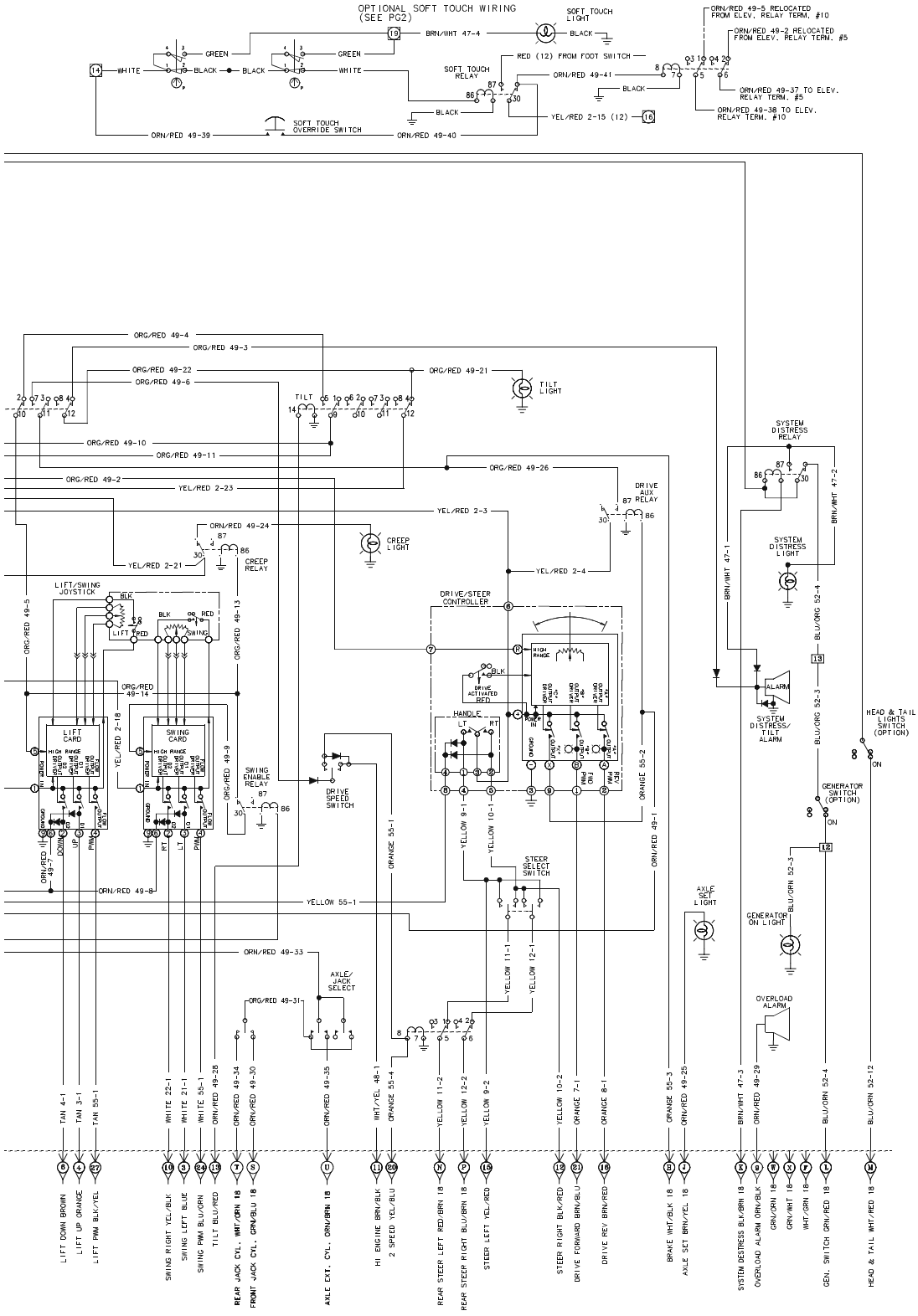


Figure 6-3. 100SX, 110SX Electrical Schematic - Platform - Sheet 1 of 2



1870122 E

Figure 6-4. 100SX, 110SX Electrical Schematic - Platform - Sheet 2 of 2

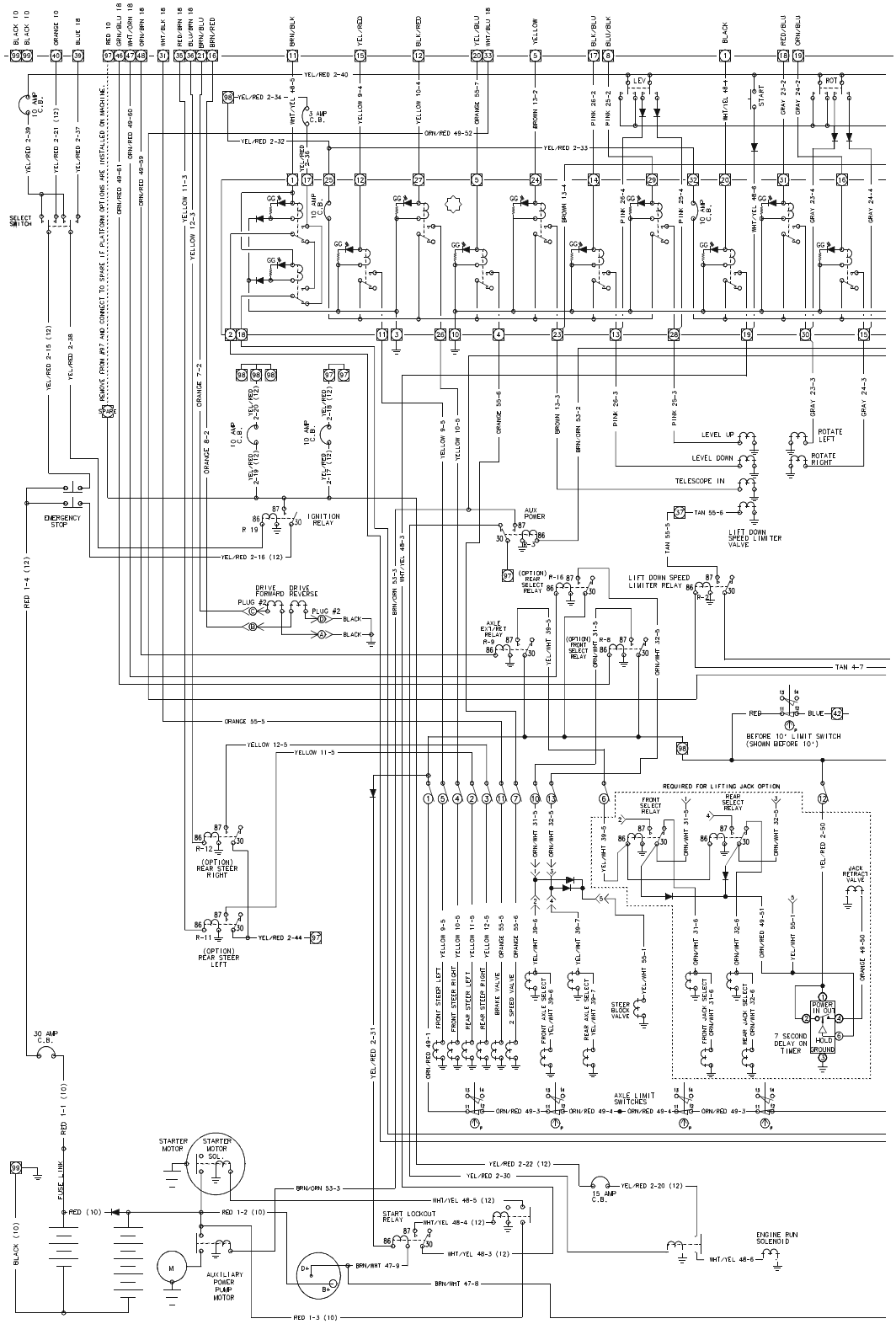
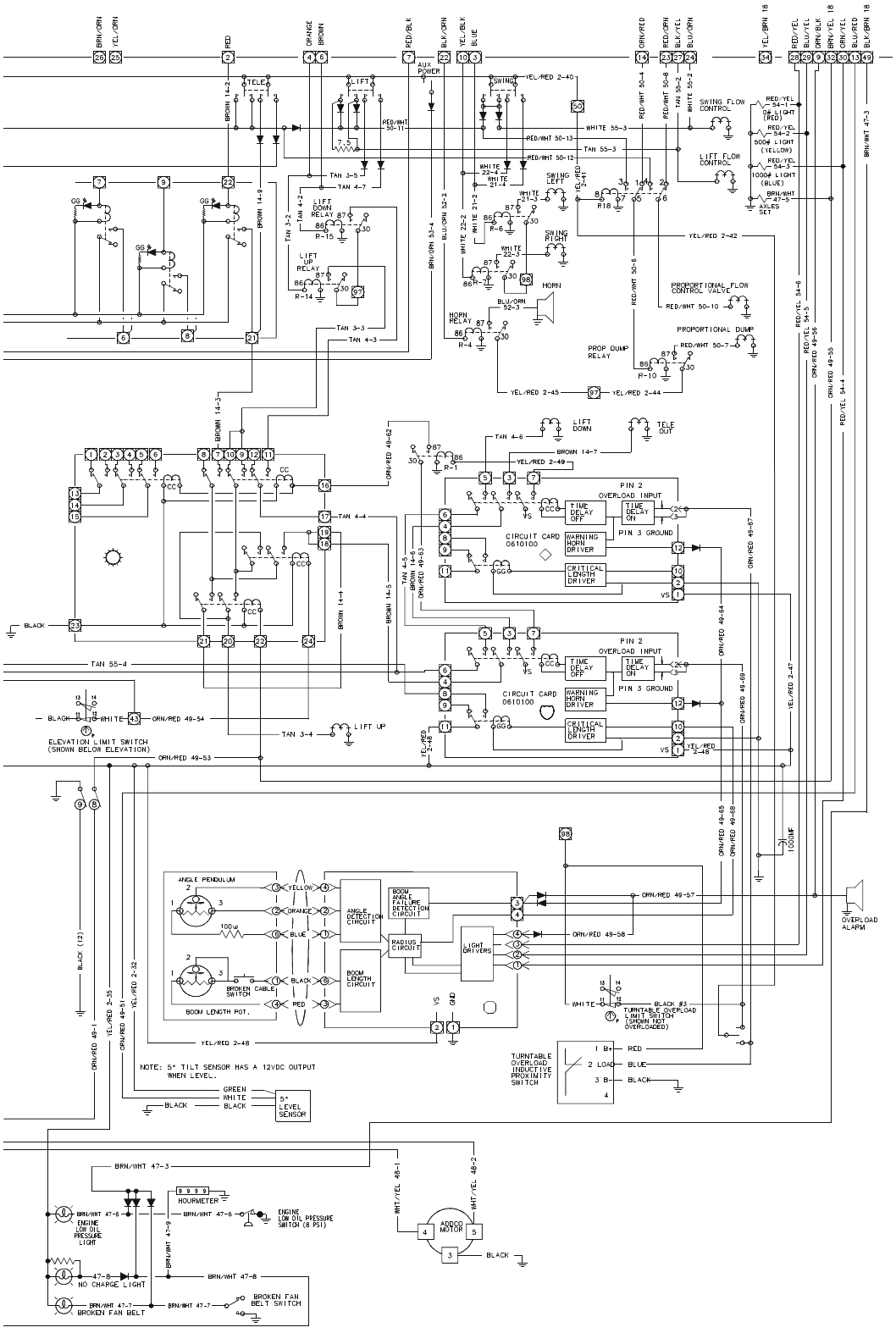


Figure 6-5. 100SX, 110SX Electrical Schematic - Boom, Turntable, Chassis - Sheet 1 of 2



1870122 E

Figure 6-6. 100SX, 110SX Electrical Schematic - Boom, Turntable, Chassis - Sheet 2 of 2

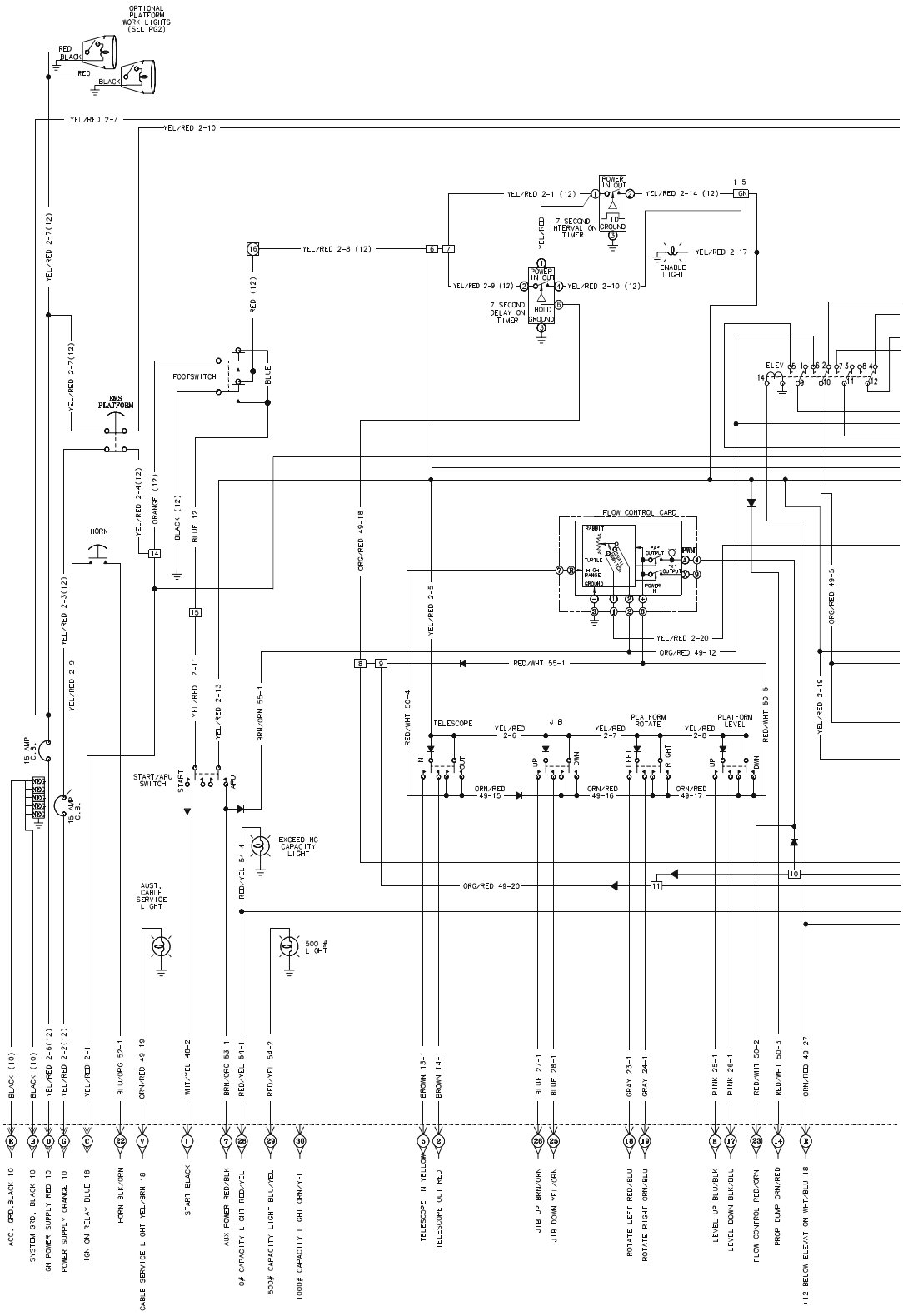
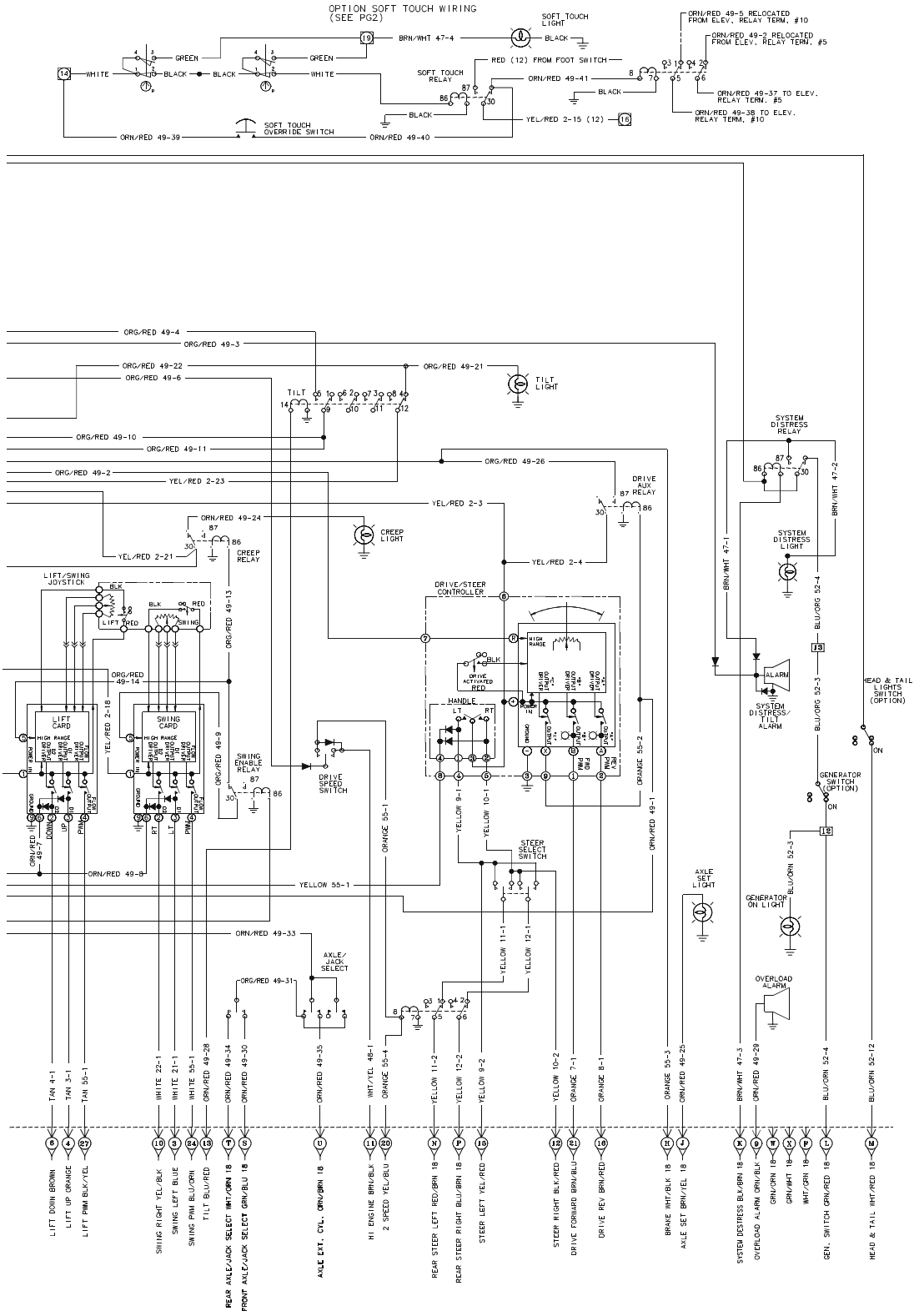


Figure 6-7. 110SXJ Electrical Schematic - Platform - Sheet 1 of 2



1870121 E

Figure 6-8. 110SXJ Electrical Schematic - Platform - Sheet 2 of 2

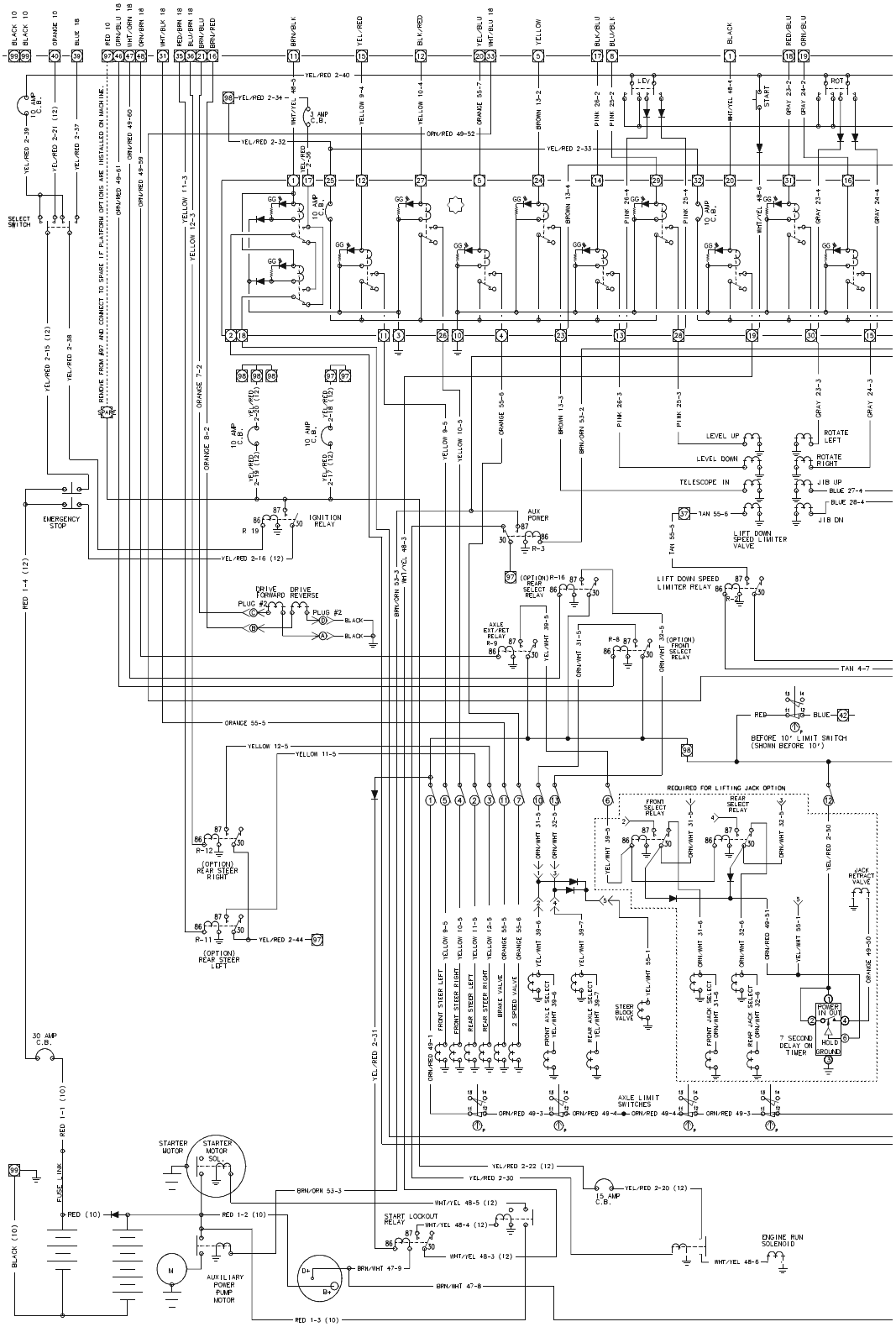
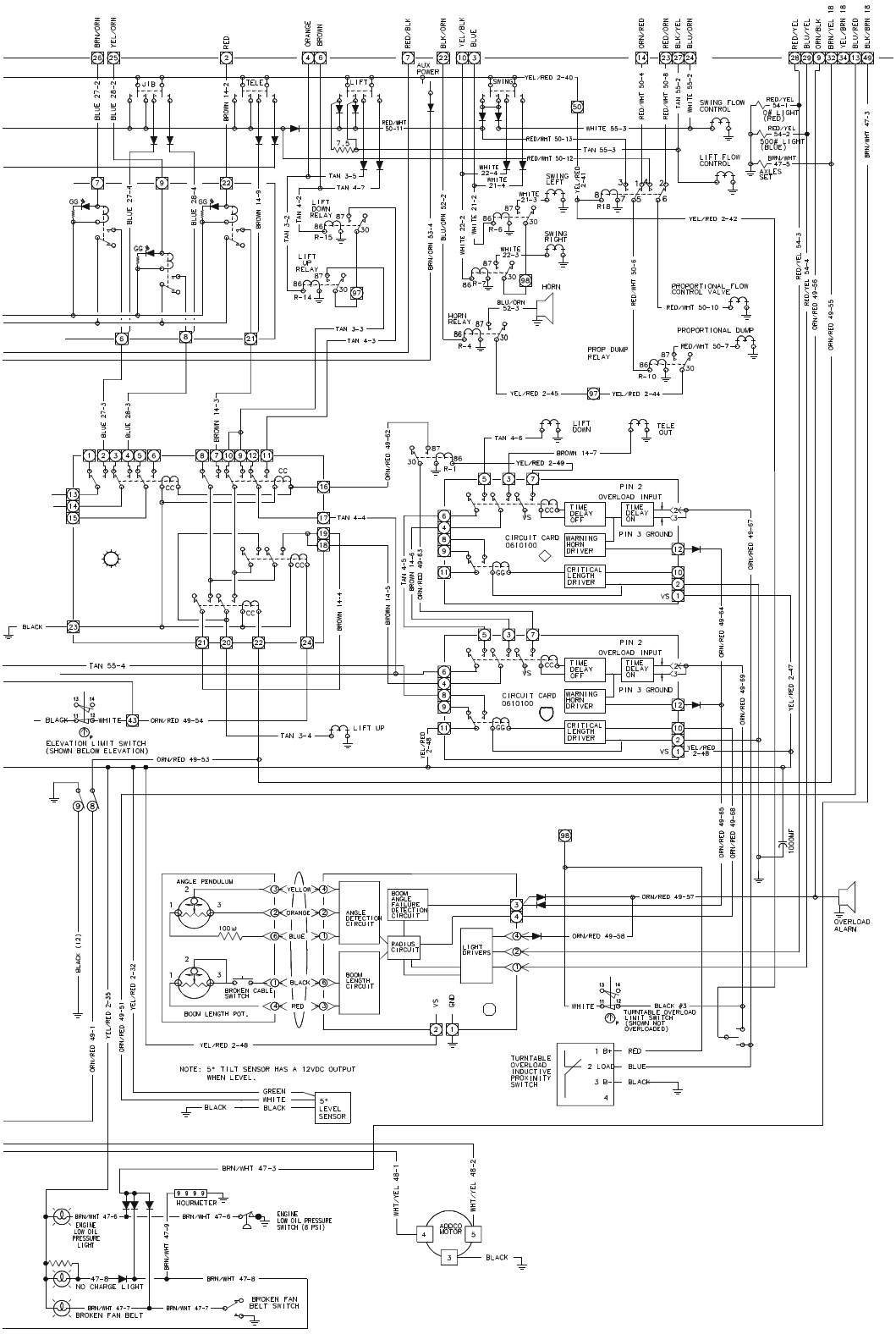


Figure 6-9. 110SXJ Electrical Schematic - Boom, Turntable, Chassis - Sheet 1 of 2



1870121 E

Figure 6-10. 110SXJ Electrical Schematic - Boom, Turntable, Chassis - Sheet 2 of 2

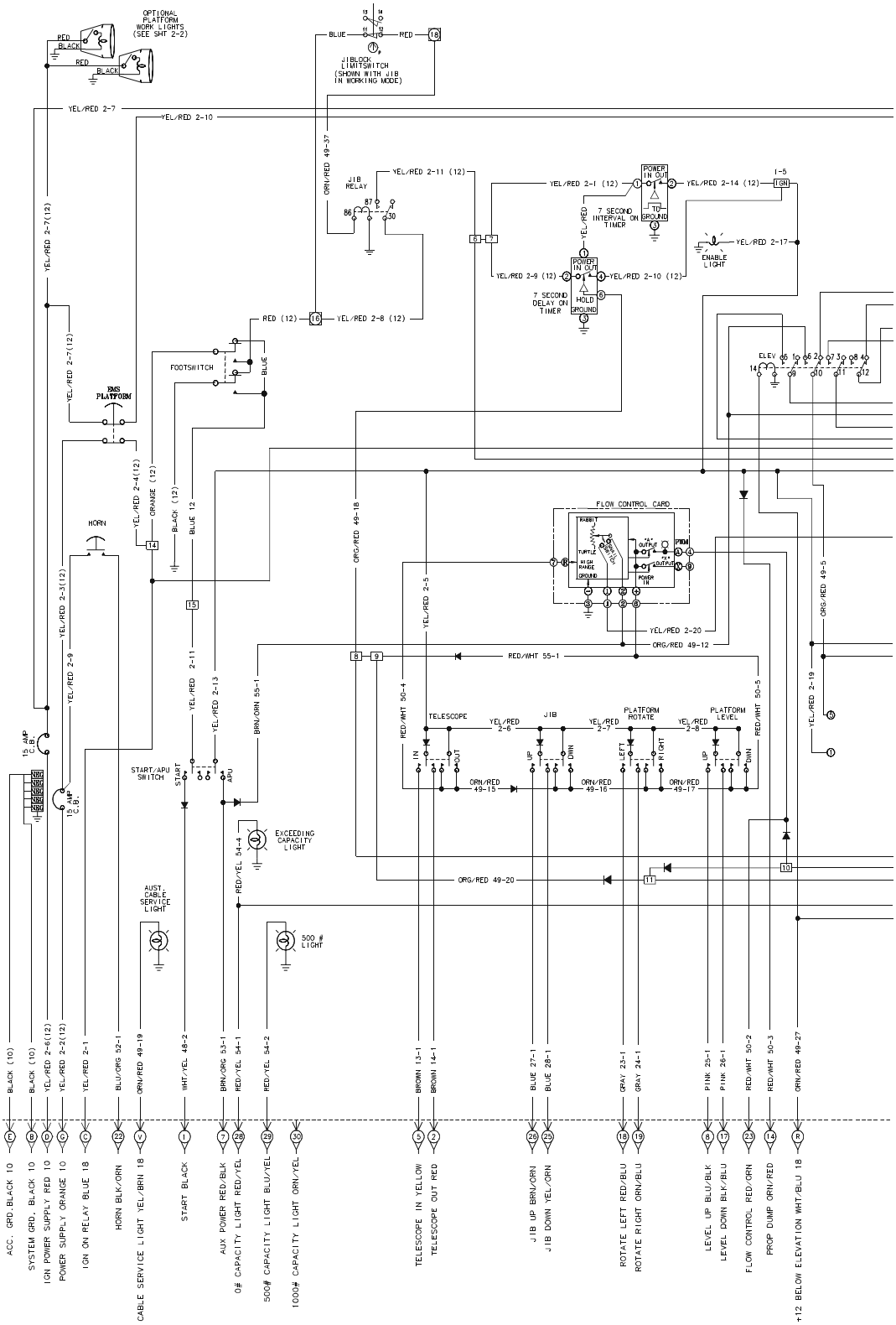
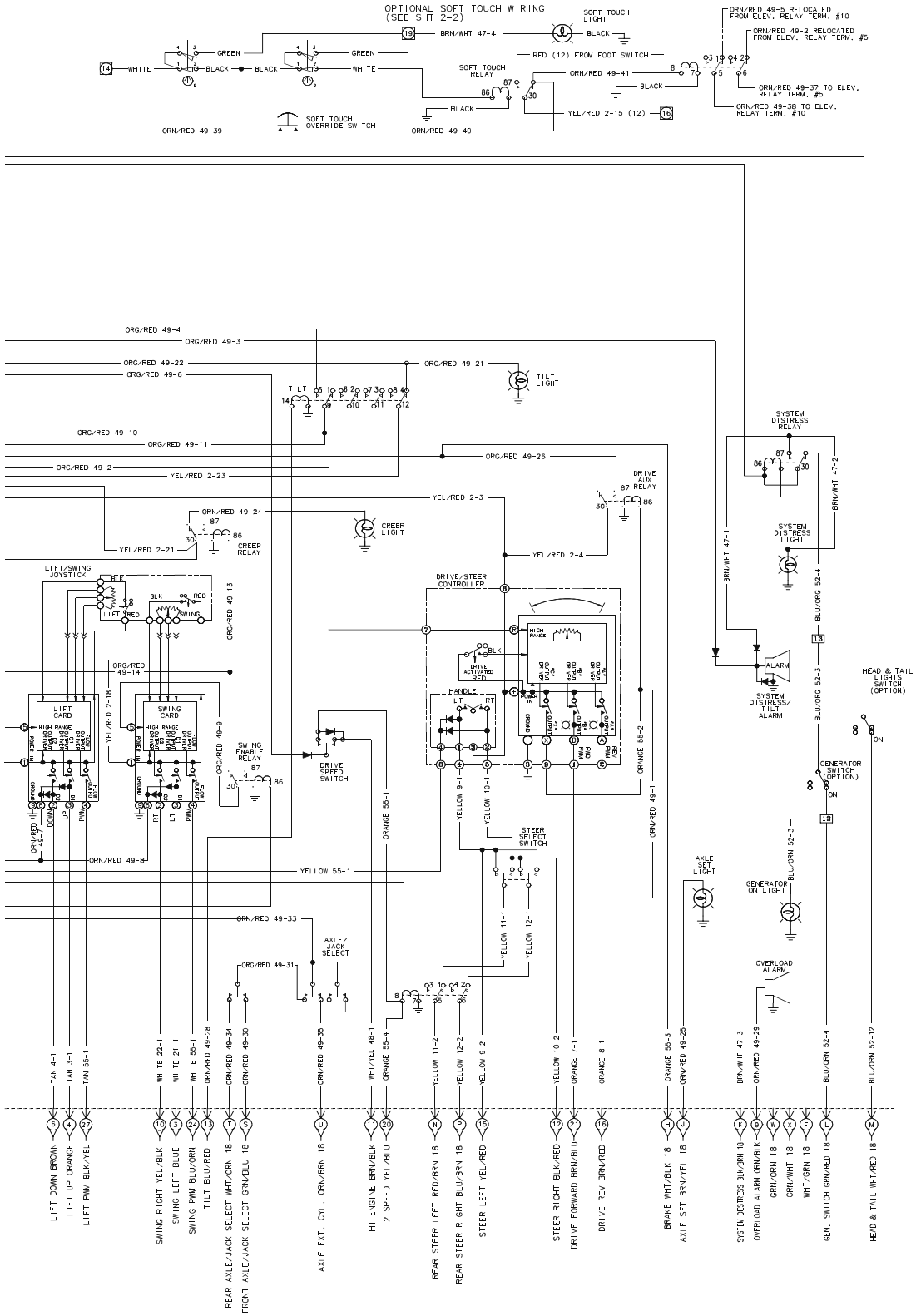


Figure 6-11. 120SXJ Electrical Schematic - Platform - Sheet 1 of 2



1870115 E

Figure 6-12. 120SXJ Electrical Schematic - Platform - Sheet 2 of 2

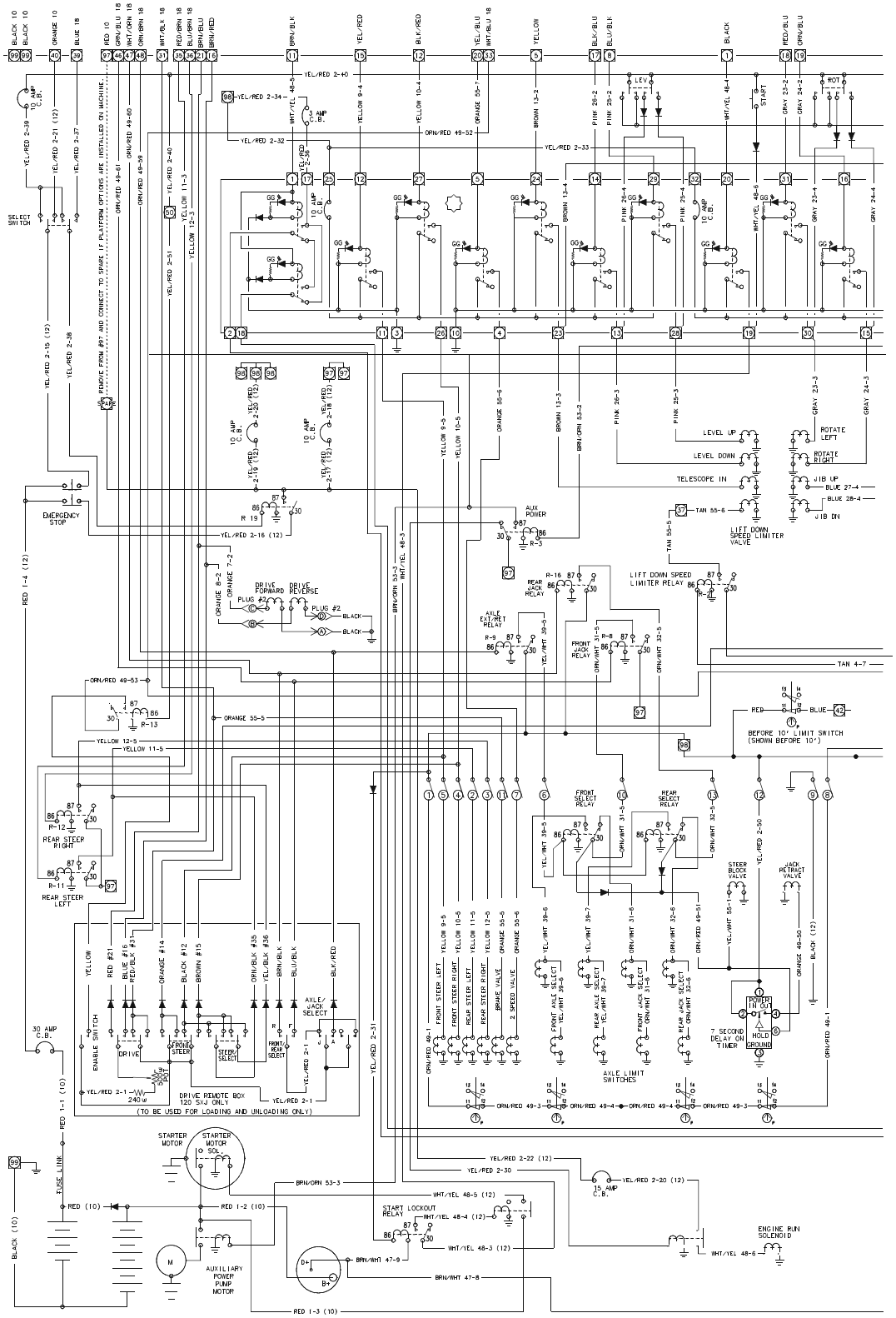


Figure 6-13. 120SXJ Electrical Schematic - Boom, Turntable, Chassis - Sheet 1 of 2

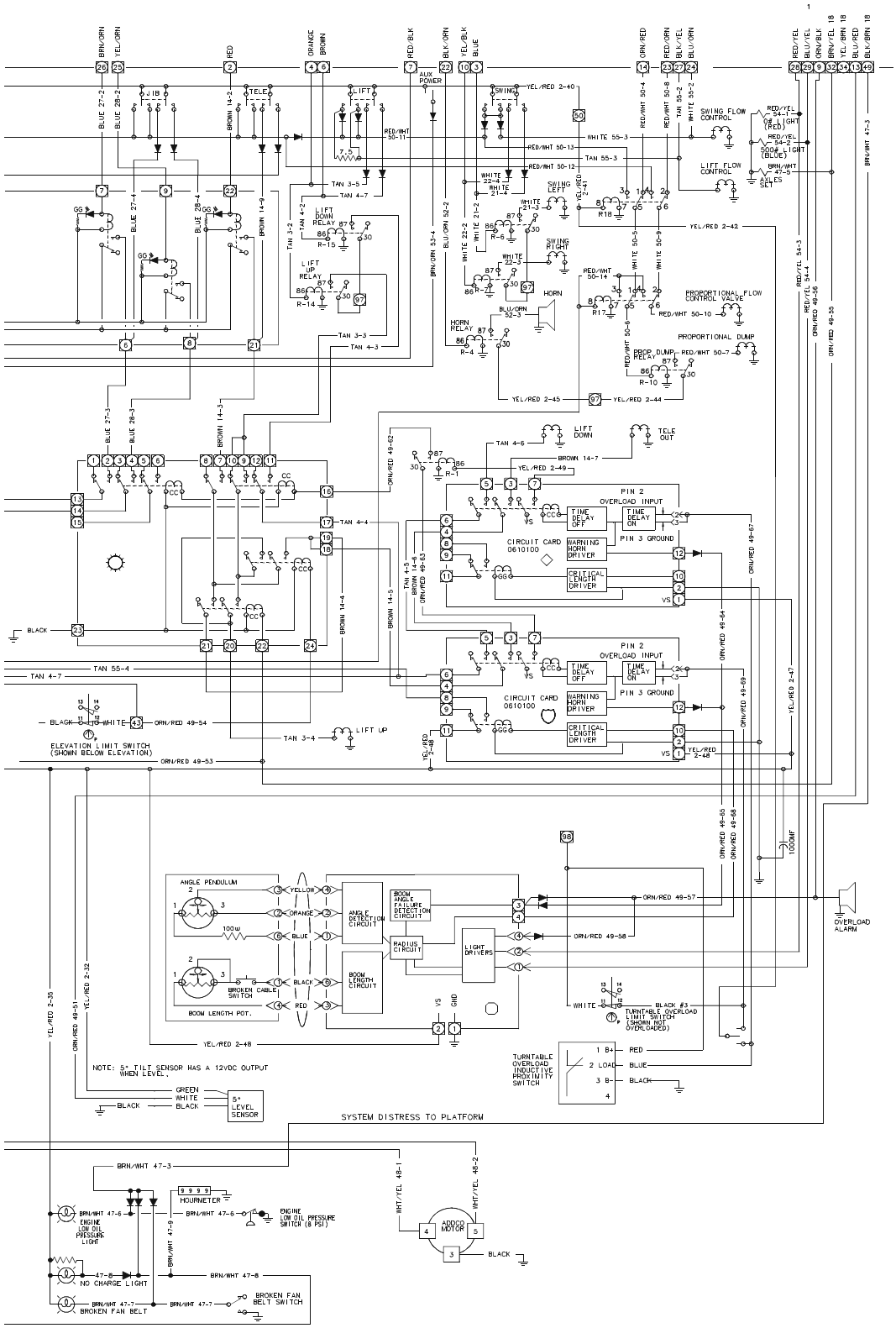


Figure 6-14. 120SXJ Electrical Schematic - Boom, Turntable, Chassis - Sheet 2 of 2

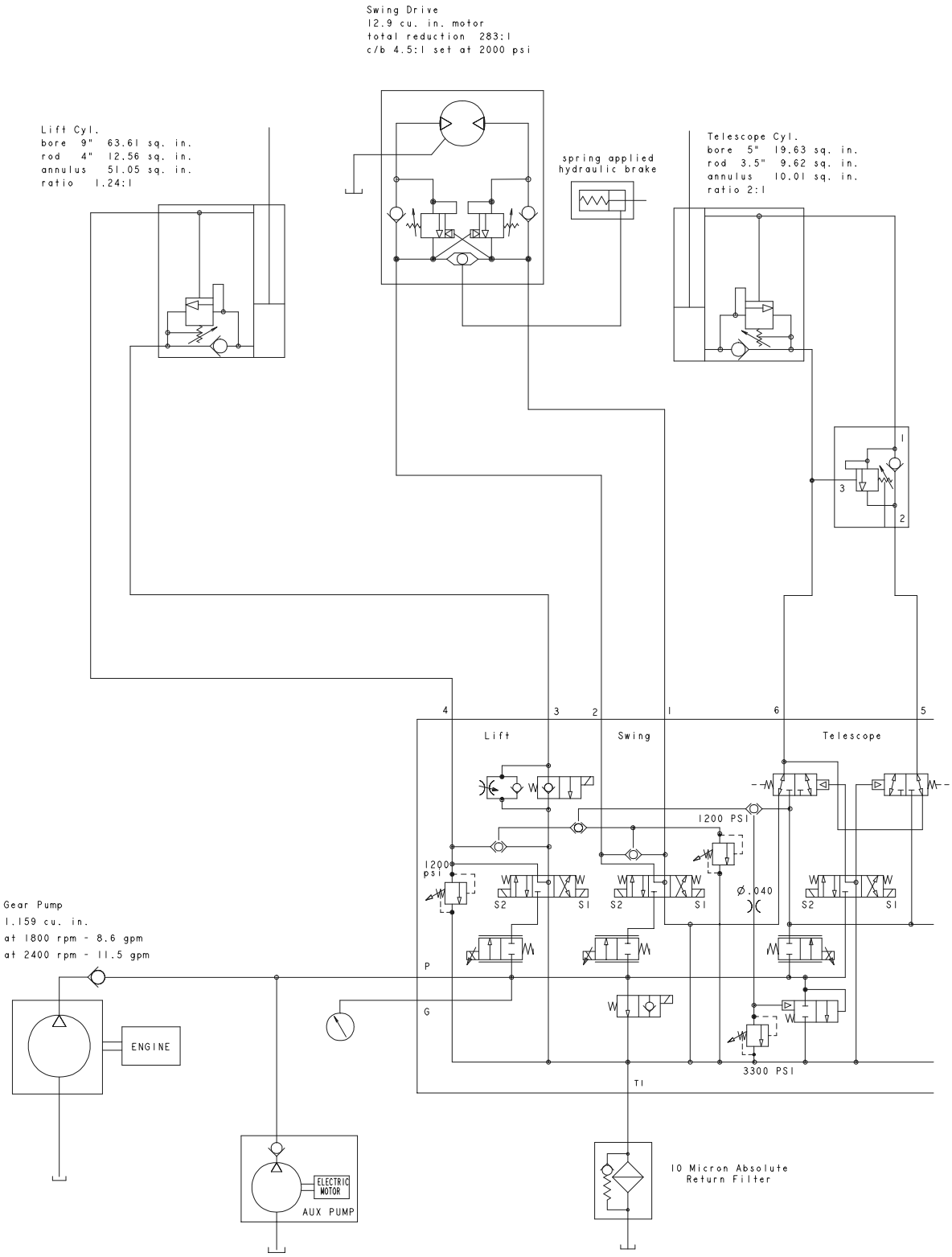
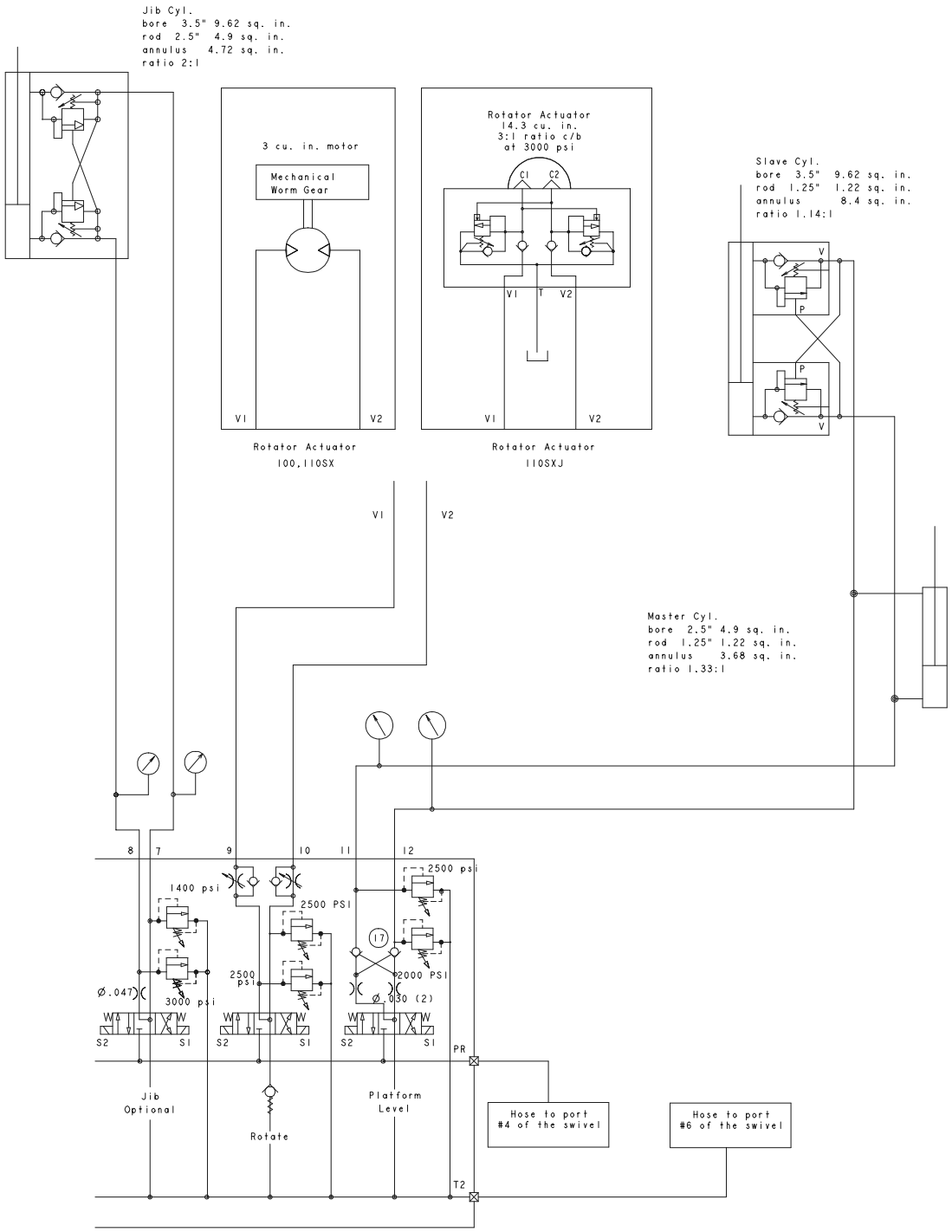


Figure 6-15. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 1 of 8



2792447 C

Figure 6-16. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 2 of 8

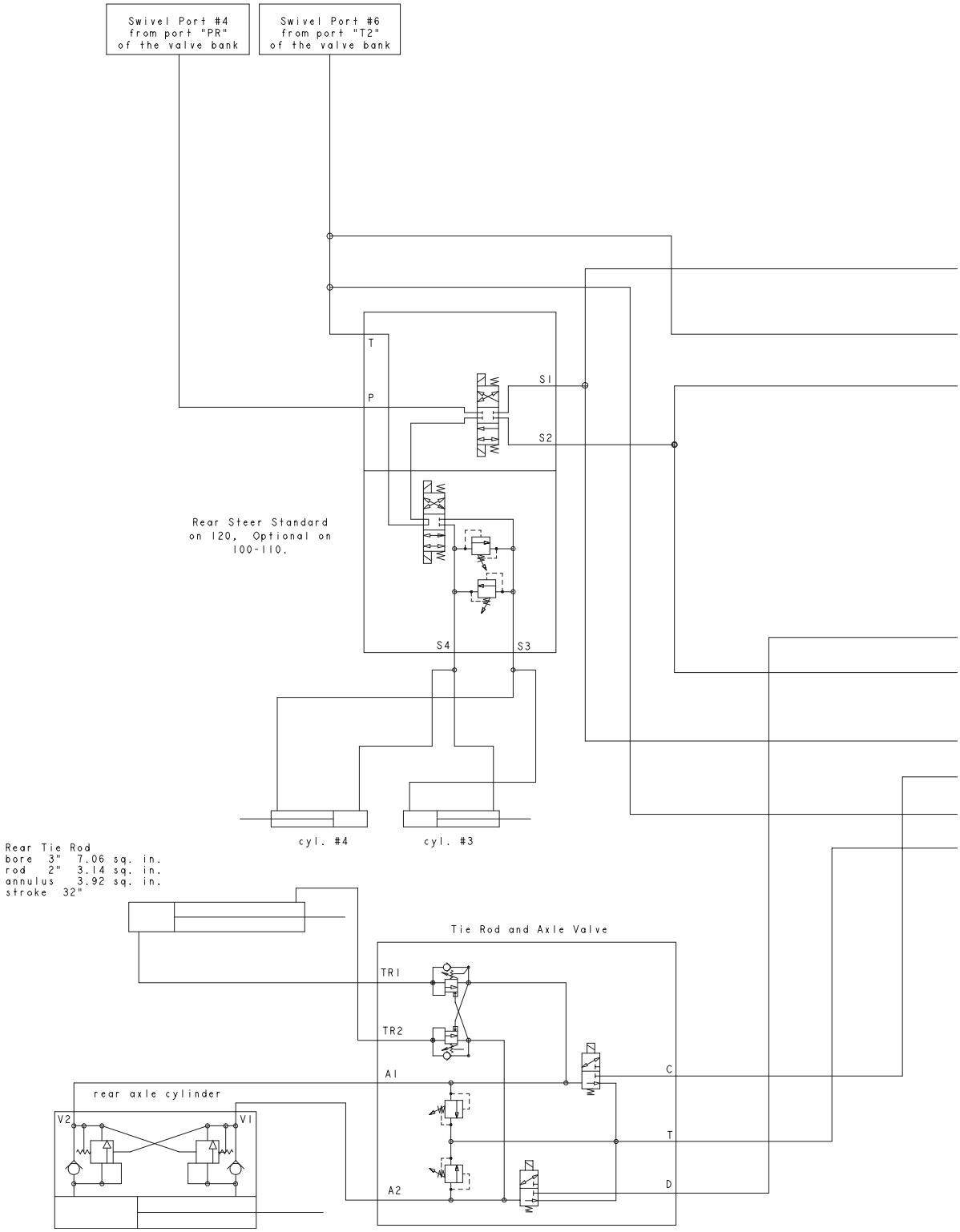
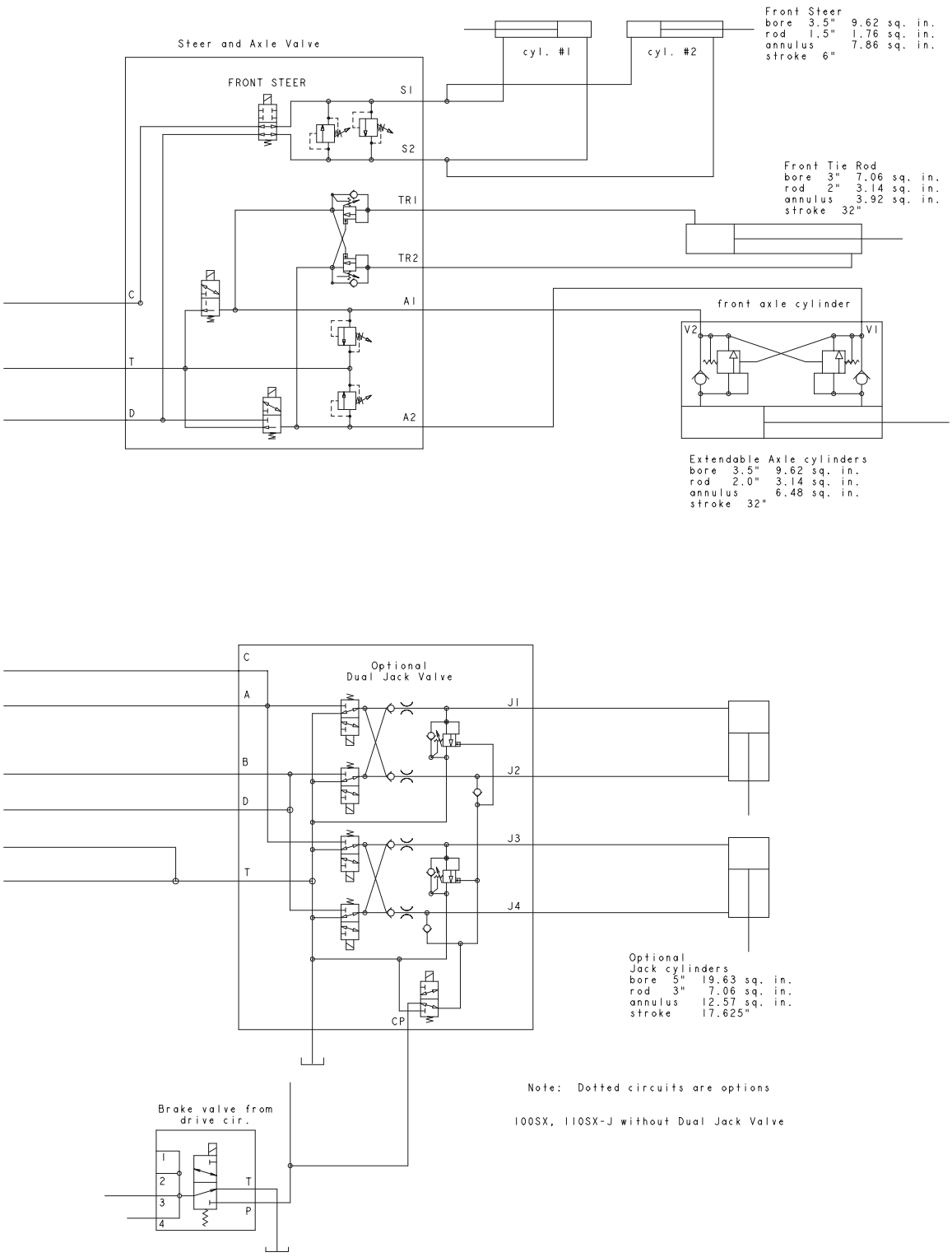


Figure 6-17. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 3 of 8



2792447 C

Figure 6-18. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 4 of 8

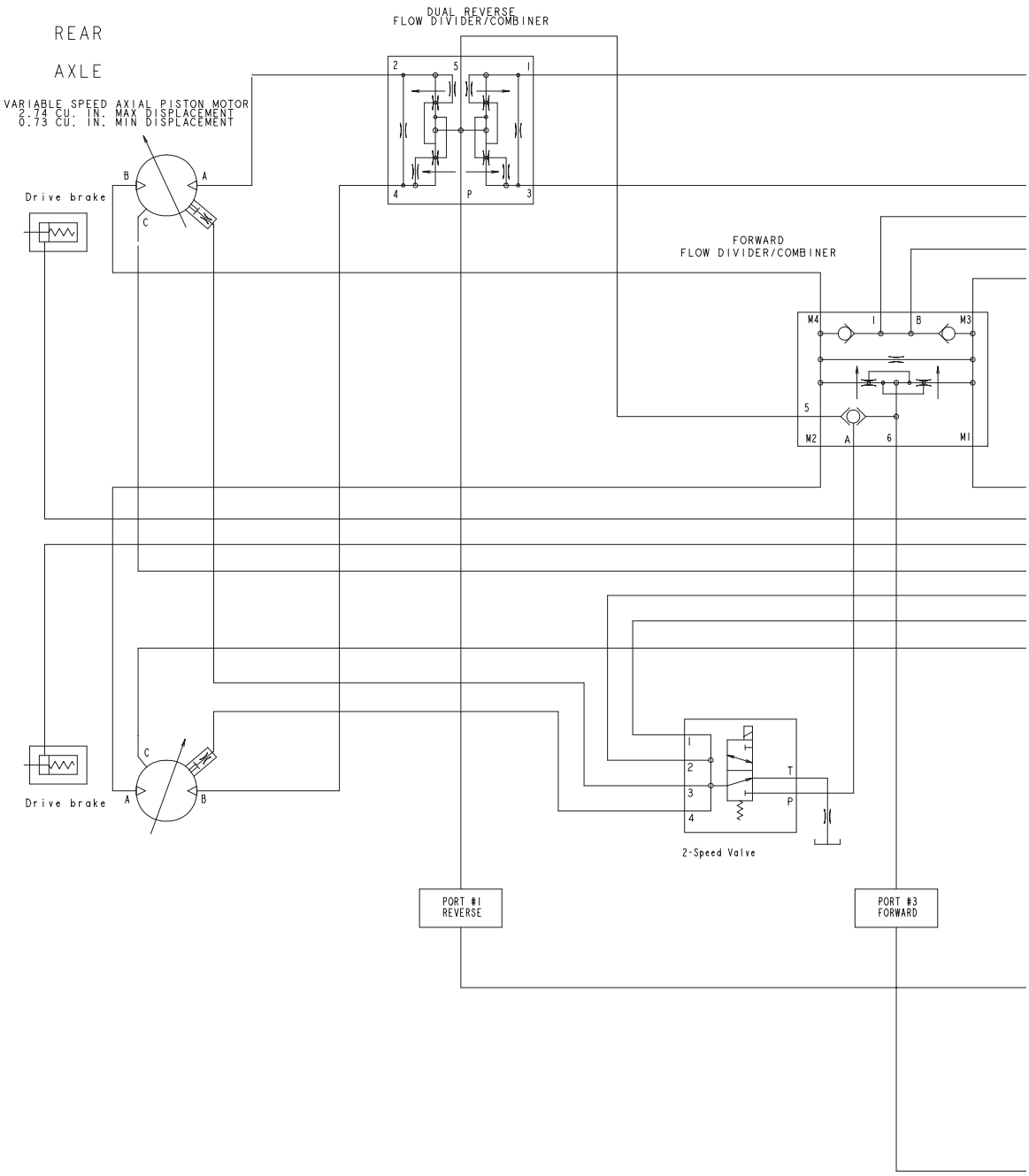
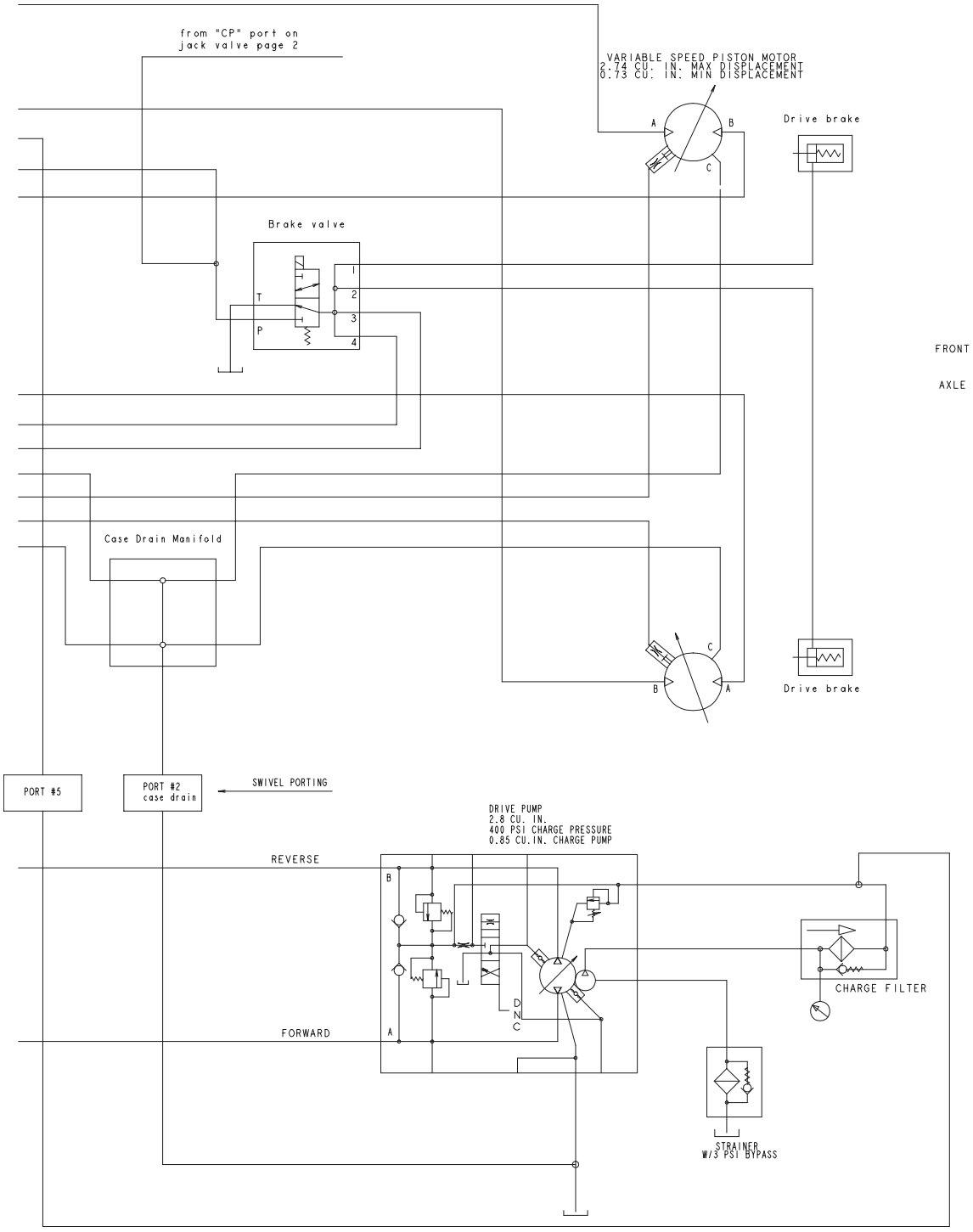


Figure 6-19. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 5 of 8



2792447 C

Figure 6-20. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 6 of 8

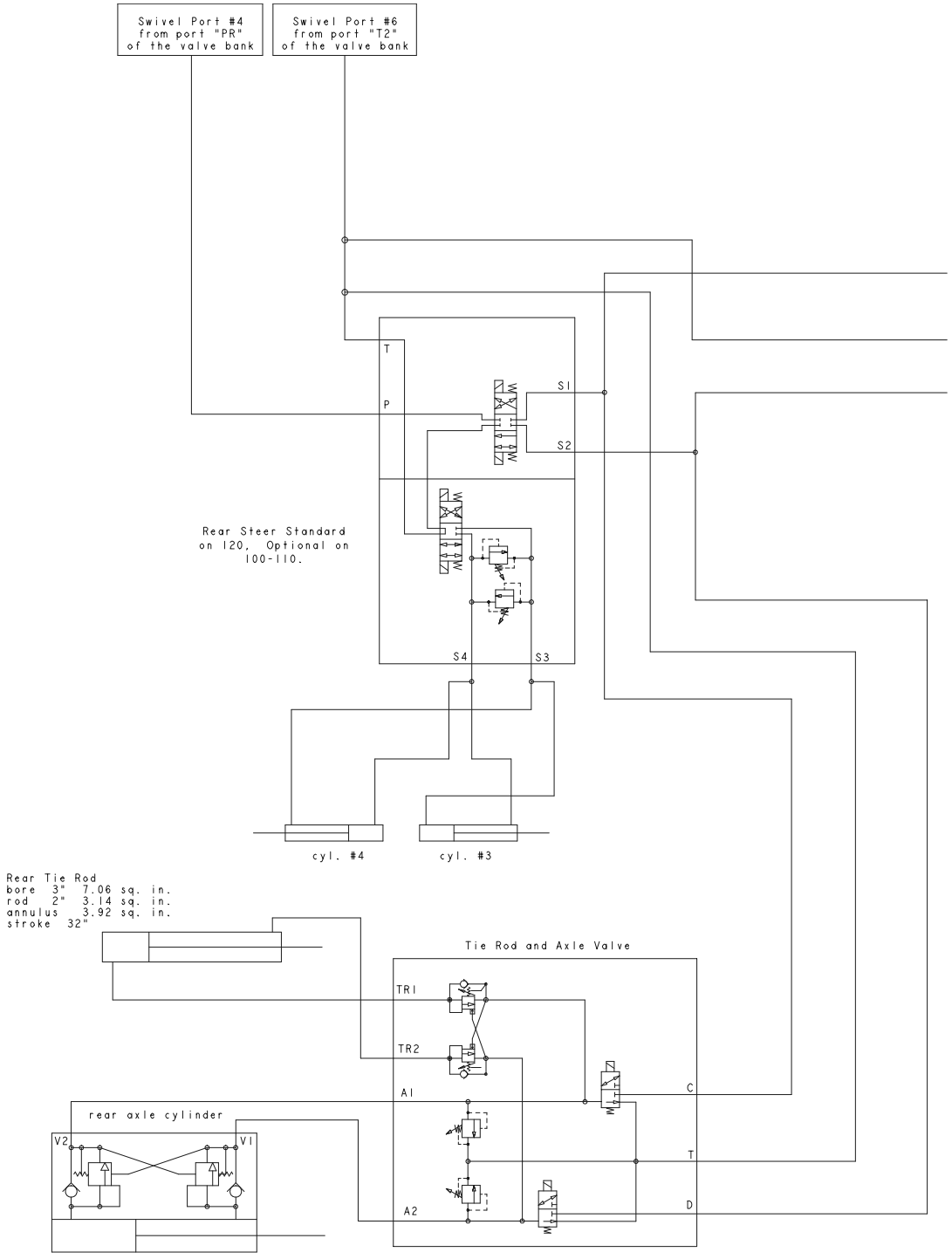
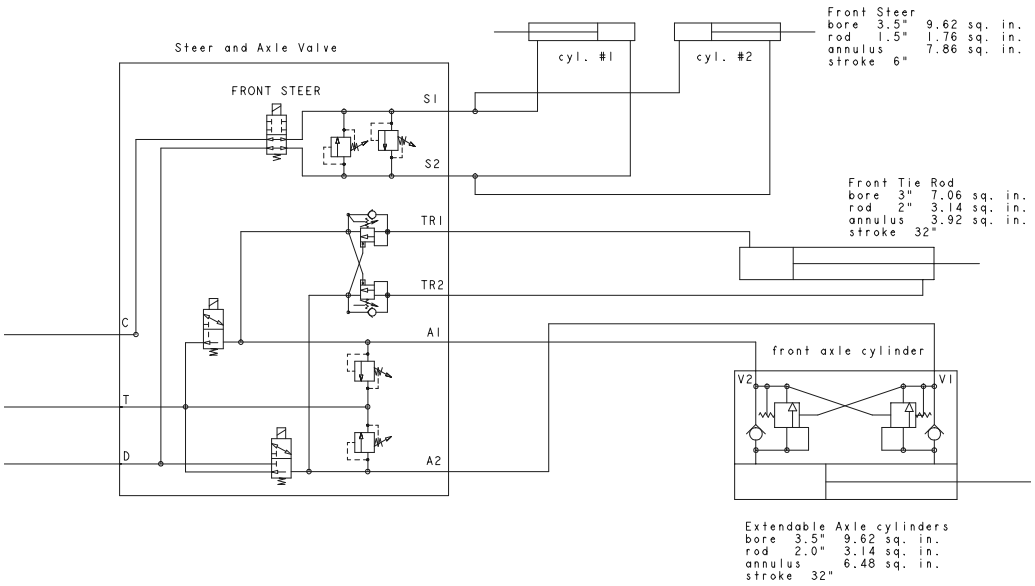


Figure 6-21. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 7 of 8



Note: Dotted circuits are options

100SX, 110SX-J without Dual Jack Valve

2792447 C

Figure 6-22. 100SX, 110SX, 110SXJ Hydraulic Schematic - Sheet 8 of 8

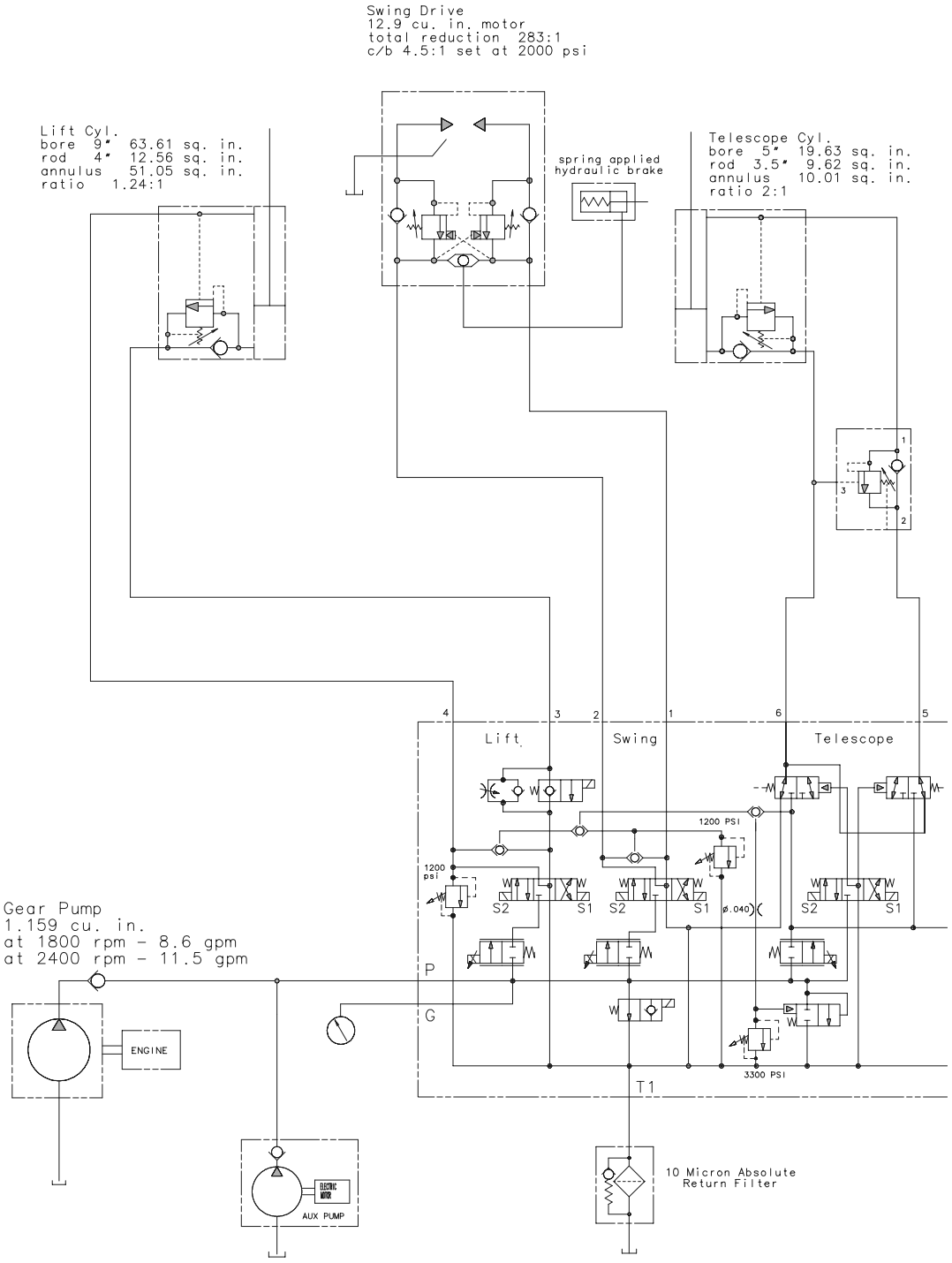
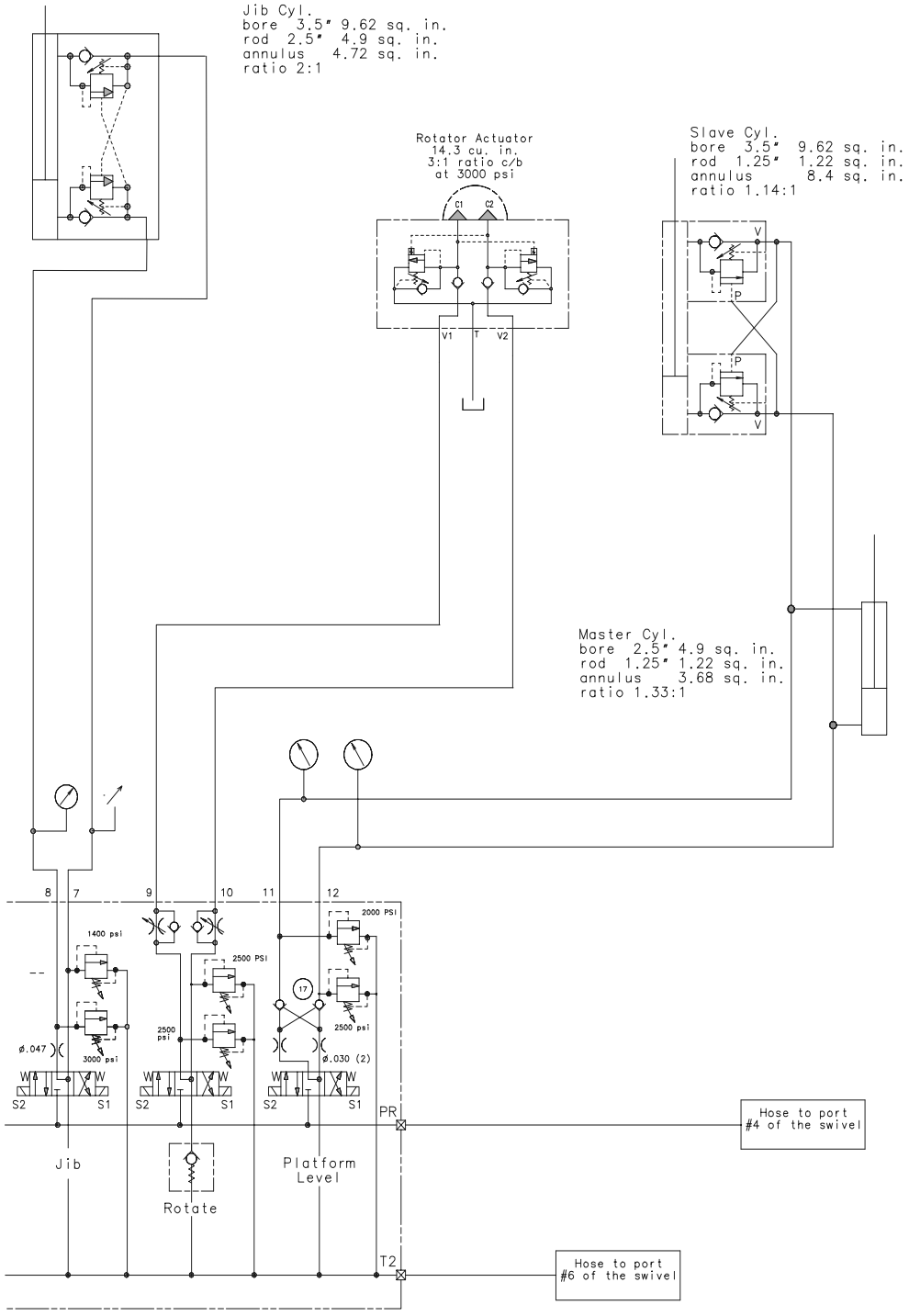


Figure 6-23. 120SXJ Hydraulic Schematic - Sheet 1 of 6



2792407 B

Figure 6-24. 120SXJ Hydraulic Schematic - Sheet 2 of 6

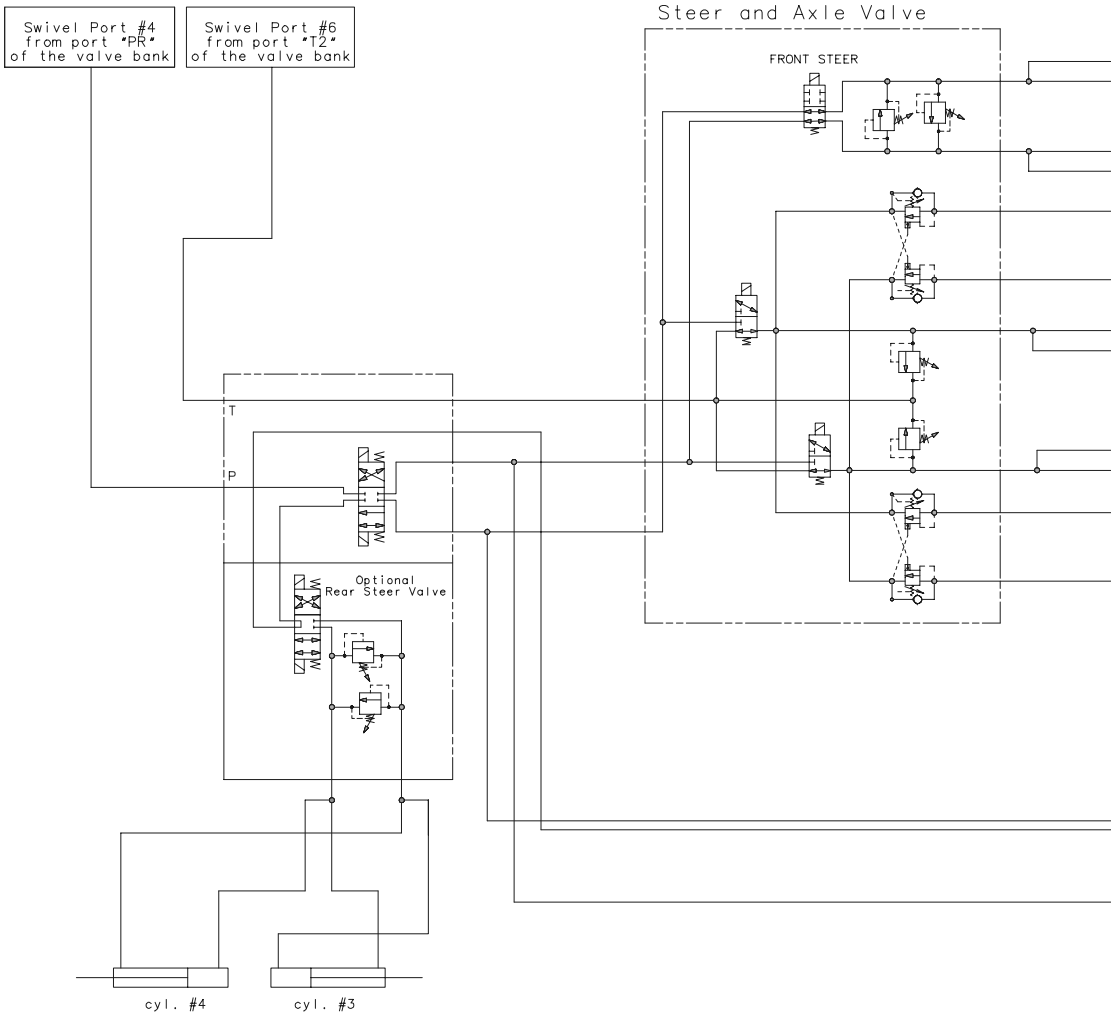
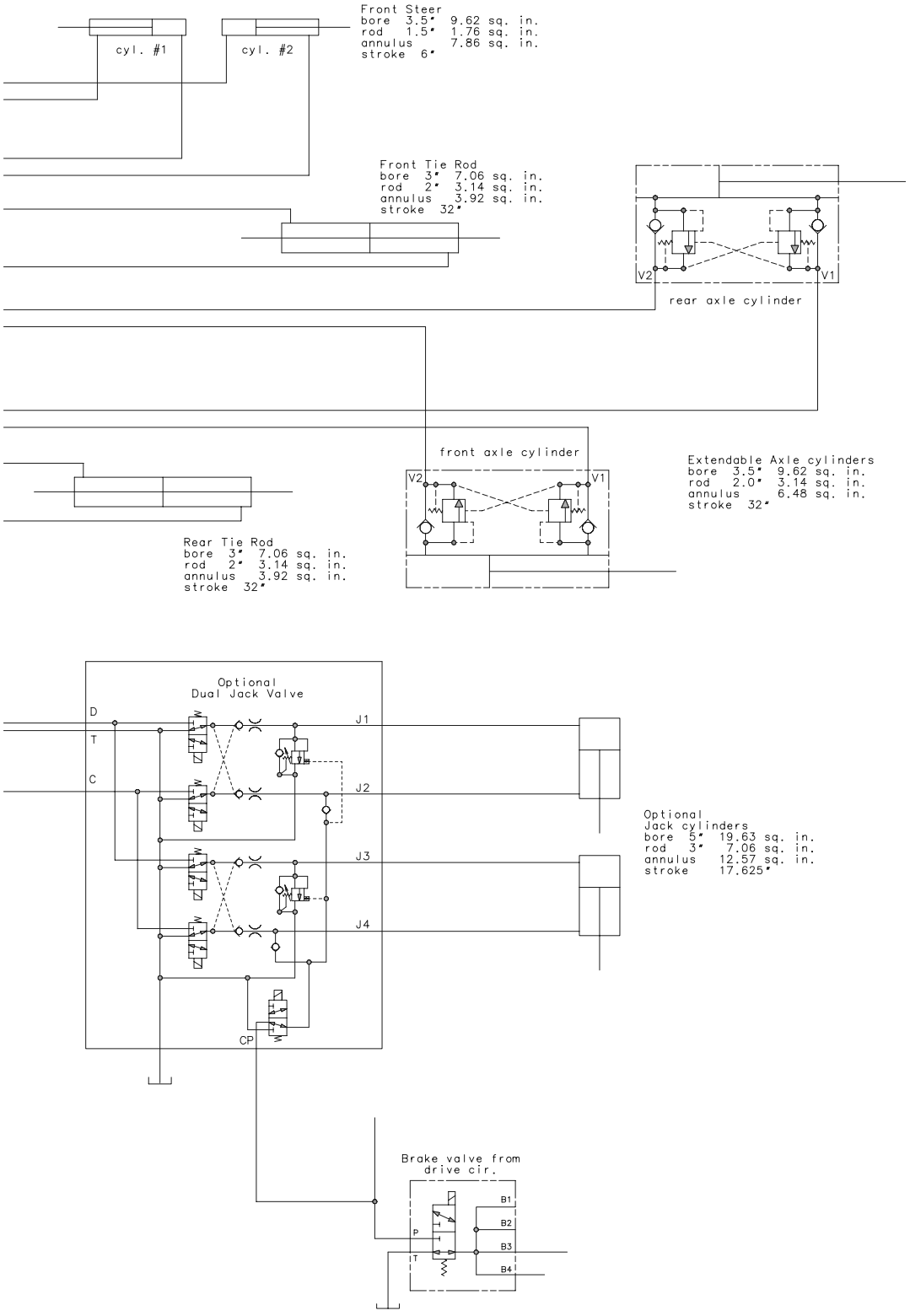


Figure 6-25. 120SXJ Hydraulic Schematic - Sheet 3 of 6



2792407 B

Figure 6-26. 120SXJ Hydraulic Schematic - Sheet 4 of 6

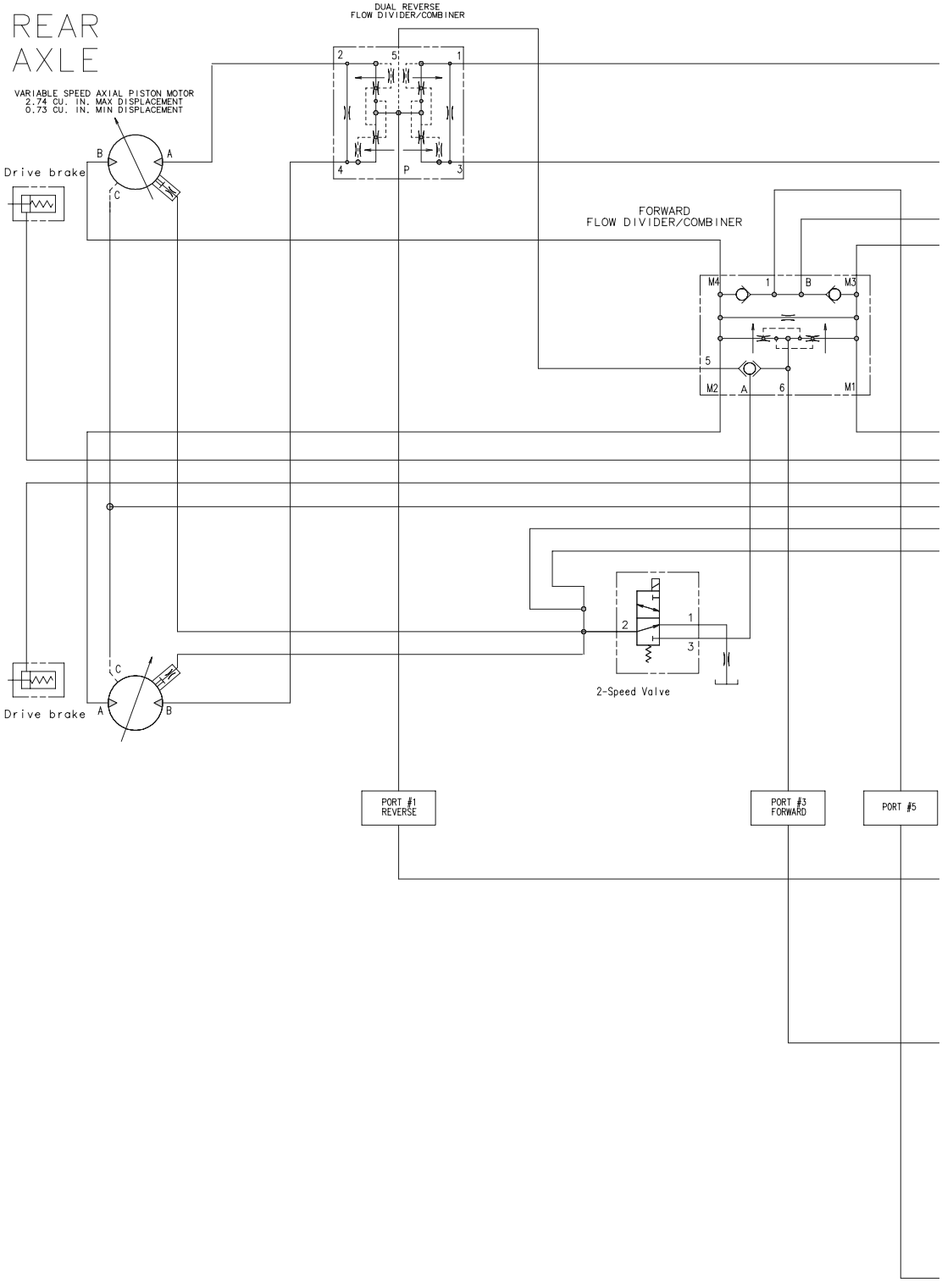
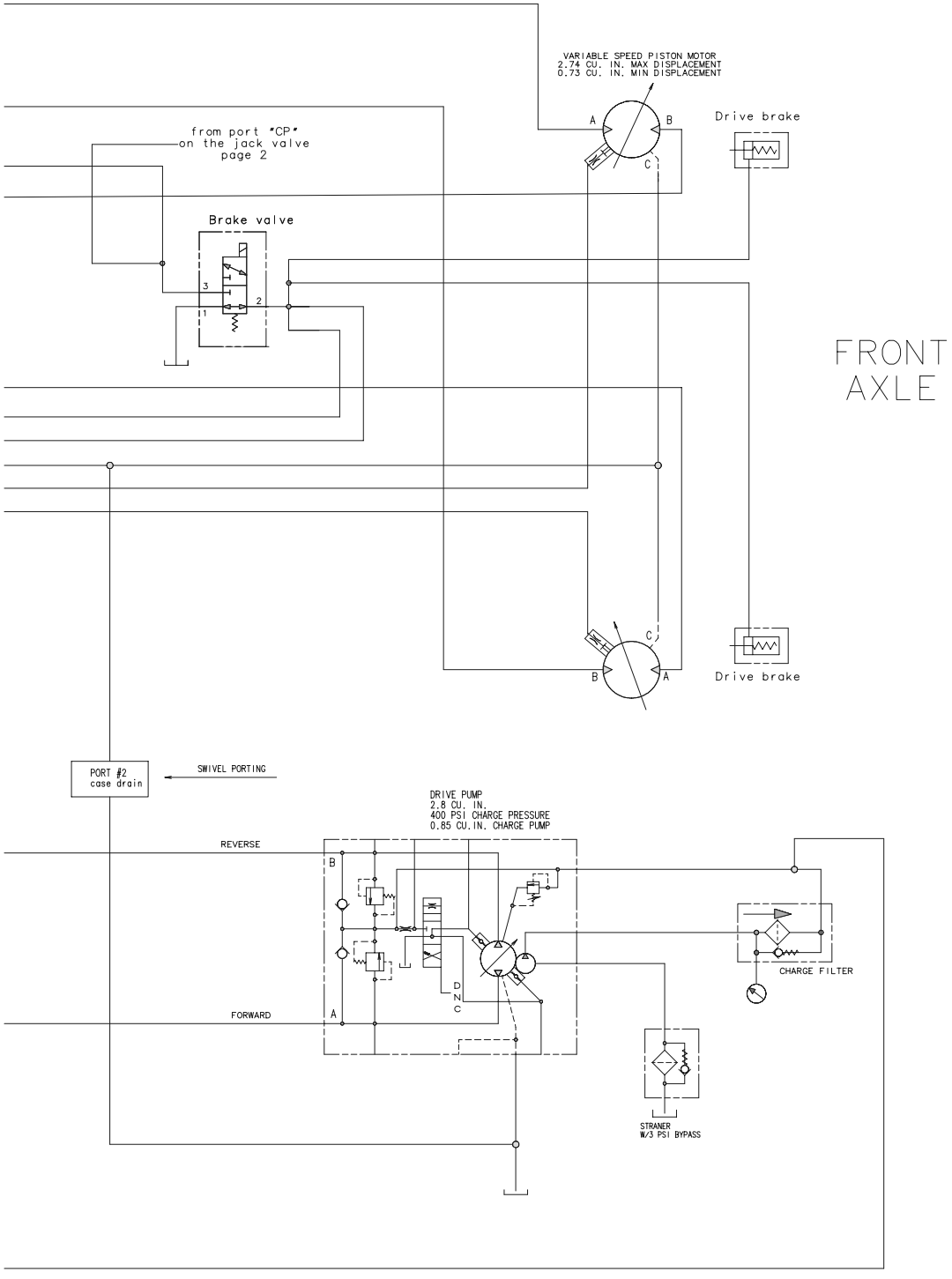


Figure 6-27. 120SXJ Hydraulic Schematic - Sheet 5 of 6



2792407 B

Figure 6-28. 120SXJ Hydraulic Schematic - Sheet 6 of 6

This page left blank intentionally.

PROPOSITION 65 WARNING

- **Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.**
- **Batteries also contain other chemicals known to the State of California to cause cancer.**
- **Wash hands after handling.**

⚠ WARNING: ⚠

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

1702961

Corporate Office
JLG Industries, Inc.
1 JLG Drive
McConnellsburg PA. 17233-9533
USA
Phone: (717) 485-5161
Fax: (717) 485-6417

JLG Worldwide Locations

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

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

JLG Deutschland GmbH
Max Planck Strasse 21
D-27721 Ritterhude/lhlpohl
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 Warsawa
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