

Service and Maintenance Manual

Model 1100S 1100SJP

P/N - 3121256

November 8, 2016





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.

A WARNING

MODIFICATION OR ALTERATION OF AN AERIAL WORK PLATFORM SHALL BE MADE ONLY WITH WRITTEN PERMISSION FROM THE MANUFACTURER.

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.

C MAINTENANCE

M WARNING

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

- ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- NO SMOKING IS MANDATORY. NEVER REFUEL DUR-ING 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 CAU-TIONS ON MACHINE AND IN SERVICEMANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- USE CAUTION WHEN CHECKING A HOT, PRESSUR-IZED 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 COMPO-NENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACH-MENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

REVISON LOG

Original Issue - April 15, 2009
Revised - February 12, 2010
Revised - January 8, 2013
Revised - November 8, 2016

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SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

Table 1-1. Capacities

Hydraulic Tank	55 gallons (208 liters)
Fuel Tank	53 gallons (200 liters)
Hydraulic System	66 gallons (250 liters)

1.2 TIRES

Table 1-2. Tire Specifications

Size	445/50D710
Load Range	J
Ply Rating	18
Load Rating	26,500 lbs. @ 100 psi (12020 kg @ 6.9 Bar)
Foam Fill	Poly urethane HD (55 Durometer) Foam
Max Tire Load	25,000 lbs. (11,340 kg)

1.3 ENGINE DATA

Table 1-3. Deutz TD2011L04O Specifications

Туре	Liquid Cooled
Number of Cylinders	4
Bore	3.7 in. (94 mm)
Stroke	4.4 in. (112 mm)
Total Displacement	190 cu. in. (3108 cm ³)
Compression Ratio	17.5
Firing Order	1-3-4-2
Output	75hp (56 kW)
Oil Capacity	
Cooling System	5 Quarts (4.5 L)
Engine w/Filter	11 Quarts (10.5 L)
Total Capacity	16 Quarts (15 L)
Average Fuel Consumption	1.1 gph (4.1 lph)
Idle Engine RPM	1200
Mid Engine RPM	1800
High Engine RPM	2475

1.4 SPECIFICATIONS AND PERFORMANCE DATA

Table 1-4. Operating Specifications

Maximum Work Load - 1100SJP (Capacity) Unrestricted Restricted	500 lb (230 kg) 1000 lb. (450 kg)
Maximum Work Load - 1100S (Capacity) Unrestricted	830 lb (365 kg)
Max.Vertical Platform Height	110 ft. (33.56 m)
Max.Horizontal Platform Reach (1100SJP)	75 ft. (22.9 m)
Max.Horizontal Platform Reach (1100S)	63 ft. 11 in. (19.5 m)
JibPLUS (1100SJP Only) Length Horizontal Motion Vertical Motion	8ft. (2.44m) 180° working, 244° stowed 130° (+75/-55)
Jib (1100S Only) Length Vertical Motion	7ft. 3.5 in. (2.22m) 130° (+75/-55)

Dimensional Data

Table 1-5. Dimensional Data

Overall Width Axles Retracted Axles Extended	8ft. 2in. (2.49 m) 12ft. 6in. (3.81 m)
Stowed Height	10ft. (3.05 m)
Stowed Length (1100SJP)	34ft. 11in. (10.64 m)
Stowed Length (1100S)	44ft. 1.5in. (13.45 m)
Wheelbase	12ft. 6in. (3.81 m)
Tailswing	5ft. 6 in. (1.6 m)
Ground Clearance (Axle)	12 in. (30.4 cm)
Ground Clearance (Chassis)	25.5 in. (64.7 cm)

Chassis

Table 1-6. Chassis Specifications

Maximum Travel Grade With boom in stowed position (Gradeability) (1100SJP)	45%
Maximum Travel Grade With boom in stowed position (Gradeability) (1100S)	30%
Maximum Travel Grade With boom in stowed position (Side Slope)	5°
Turning Radius - 1100SJP (Axles Retracted)	
Outside	22 ft. 6 in. (6.8 m)
Inside	14 ft. 5 in. (4.4 m)
Turning Radius - 1100SJP (Axles Extended)	
Inside	8 ft. (2.4 m)
Outside	19 ft. 4 in. (5.9 m)
Turning Radius - 1100S (Axles Retracted)	
Outside	35 ft. 6 in. (10.8 m)
Inside	25 ft. 3 in. (7.7 m)
Turning Radius - 1100S (Axles Extended)	
Inside	10 ft. 11 in. (3.33 m)
Outside	27 ft. (8.2 m)
Max Tire Load	25,000 lbs. (11,340 kg)
Max Ground Bearing Pressure (1100SJP)	100 psi (7.03 kg/cm ²)
Max Ground Bearing Pressure (1100S)	112 psi (7.87 kg/cm ²)
Maximum Drive Speed	3.25 mph (5.2 kph)
Max. Hydraulic System Pressure	4600 psi (317 Bar)
Maximum Wind Speed	28 mph (12.5 m/s)
Maximum Manual Force	400 N
Electrical System Voltage	12 Volts
Gross Machine Weight (1100SJP)	40,900 lb. (18,552 kg)
Gross Machine Weight (1100S)	39,800 lb. (18,053 kg)

1.5 TORQUE REQUIREMENTS

Table 1-7. Torque Requirements

Description	Torque Value (Dry)	Interval Hours
Wheel Bolts	180 ft. lbs. (252 Nm)	150
Swing Bearing Bolts	190 ft. lbs. (260 Nm)	50/600*
Tele Cylinder Regen Valve Mounting Bolts	13 ft. lbs. (18 Nm)	As required
Starter Solenoid Contacts Coil	95 in. lbs. (9.5 Nm) 40 in. lbs. (4 Nm)	As required

^{*}Check swing bearing bolts for security after first 50 hours of operation and every 600 hours thereafter. (See Swing Bearing in Section 3.)

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

Table 1-8. Engine Torque Requirements

Description	Torque Value Ft. Lb.s	Torque Value Nm
Cylinder Head Cover	6	8.5
Cylinder Head Cover	6	8.5
Rocker Arm Adjustment Screw	15	21
Intake Manifold	6	8.5
Air Intake Pipe	15	21
Exhaust Manifold	16	22
Oil Drain Plug	39	55
Oil Pan (sheet metal)	15	21
Oil Pan (cast)	22	31
Injection Line Attachment	21	30
Injection Valve Attachment	15	21
Lube Oil Filter Cartridge	19	27

1.6 HYDRAULIC OIL

Table 1-9. Hydraulic Oil Specifications

Hydraulic System Operating Temperature Range	S.A.E. Viscosity Grade
+0° to + 180° F (-18° to +83° C)	10W
+0° to + 210° F (-18° to +99° C)	10W-20, 10W30
+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.

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 1-10. Mobilfluid 424 Specs

SAE Grade	10W30		
Gravity, API	29.0		
Density, Lb/Gal. 60°F	7.35		
Pour Point, Max	-46°F (-43°C)		
Flash Point, Min.	442°F (228°C)		
Viscosity			
Brookfield, cP at -18°C	2700		
at 40° C	55 cSt		
at 100° C	9.3 cSt		
Viscosity Index	152		

Table 1-11. Mobil DTE 13M Specs

ISO Viscosity Grade	#32	
Specific Gravity	0.877	
Pour Point, Max	-40°F (-40°C)	
Flash Point, Min.	330°F (166°C)	
Viscosity		
at 40° C	33cSt	
at 100° C	6.6 cSt	
at 100° F	169 SUS	
at 210° F	48 SUS	
cp at -20° F	6,200	
Viscosity Index	140	

Table 1-12. UCon Hydrolube HP-5046

Туре	Synthetic Biodegradable			
Specific Gravity	1.082			
Pour Point, Max	-58°F (-50°C)			
pH	9.1			
Visc	osity			
at 0° C (32° F)	340 cSt (1600SUS)			
at 40° C (104° F)	46 cSt (215SUS)			
at 65° C (150° F)	22 cSt (106SUS)			
Viscosity Index	170			

Table 1-13. Mobil EAL H 46 Specs

Туре	Synthetic Biodegradable		
ISO Viscosity Grade	46		
Specific Gravity	.910		
Pour Point	-44°F (-42°C)		
Flash Point	500°F (260°C)		
Operating Temp.	0 to 180°F (-17 to 162°C)		
Weight	7.64 lb. per gal.		
	(0.9 kg per liter)		
Visco	osity		
at 40° C	45 cSt		
at 100° C	8.0 cSt		
Viscosity Index	153		

Table 1-14. Exxon Univis HVI 26 Specs

Specific Gravity	32.1						
Pour Point	-76°F (-60°C)						
Flash Point	217°F (103°C)						
Viscosity							
at 40° C	25.8 cSt						
at 100° C	9.3 cSt						
Viscosity Index	376						
NOTE: Mobil/Exxon recommends that this oil be checked on a yearly basis for viscosity.							

1.7 MAJOR COMPONENT WEIGHTS

Table 1-15. Component Weights

Component	Pounds	Kilograms
Tire & Wheel	867	393
Drive Hub & Motor	275.5	123
Swing Drive	290	132
Engine Assembly	1275	579
Boom (Complete)	11100	5035
Lift Cylinder	787	357
Tele Cylinder	1170	531
Jib Cylinder	69	31
Axle Oscillation Cylinder (1100SJP)	74	34
` '	0.2	10
Axle Extend Cylinder	92	42
Level Cylinder	89	40
Platform 36 x 96(1100SJP)	245	111
Platform 36 x 72 (1100SJP)	195	89
Platform 36 x 72 (1100S -	250	113
Shipyard Platform)		
Counterweight	5494	2492
Upperstructure	26000	11975

1.8 PRESSURE SETTINGS

Table 1-16. Pressure Settings

Circuit	PSI	Bar	
Function Pump, High	3400	234.4	
Function Pump, Low	300	20.6	
Drive, Pre-Set	5000	344.7	
Lift Up	2750	189.6	
Lift Down	1500	103.4	
Swing	1500	103.4	
Tele Out	3000	206.8	
Telescope In	3200	220.6	
Steer Right	2000	137.9	
SteerLeft	2500	172.3	
Platform Level Up	2500	172.3	
Platform Level Down	1500	103.4	
Jib Up	2750	189.6	
Jib Down	2750	189.6	
Extendable Axles	2500	172.3	

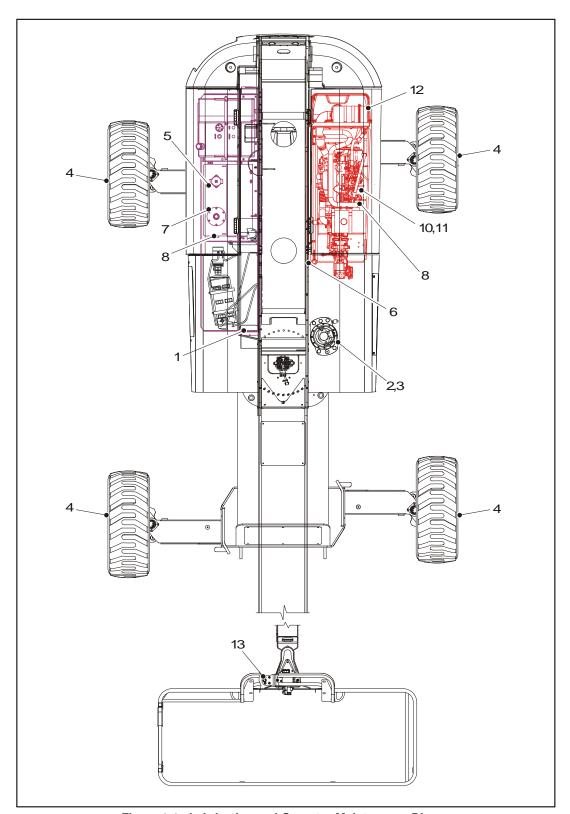


Figure 1-1. Lubrication and Operator Maintenance Diagram

1.9 LUBRICATION AND OPERATOR MAINTENANCE

NOTE: The following numbers correspond to those in Figure 1-1., Lubrication and Operator Maintenance Diagram.

Table 1-17. Lubrication Specifications

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350°F (177°C). 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
НО	Hydraulic Oil. API service classification GL-3, e.g. Mobilfluid 424.
EO	Engine (crankcase) Oil. Gas - API SF, SH, SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C.

NOTICE

LUBRICATION INTERVALS ARE BASED ON MACHINE OPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTISHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

NOTE: It is recommended as a good practice to replace all filters at the same time.

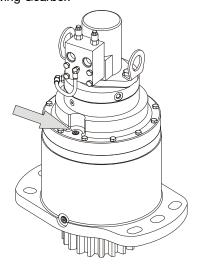
1. Swing Bearing - Remote Lube



Lube Point(s) - 2 Grease Fitting Capacity - A/R Lube - MPG

Interval - Every 3 months or 150 hours of operation

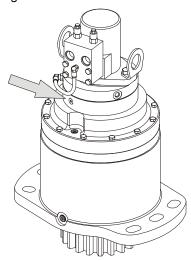
2. Swing Gearbox



Lube Point(s) - Fill Plug Capacity - 79 ounces (2.3 L) Lube - GL-5

Interval - Check level every 150 hrs/Change every 1200 hours of operation. Fill to cover ring gear.

3. Swing Brake



Lube Point(s) - Fill Plug Capacity - 2.7 ounces (80 ml)

Lube - DTE24

Interval - Check level every 150 hrs/Change every 1200 hours of operation.

4. Wheel Hub



Lube Point(s) - Level/Fill Plug Capacity - 0.5 quarts (0.5 liters) ± 10% Lube - EPGL

Interval - Change after first 150 hours then every 1200 hours of operation

Comments - Place Fill port at 12 o'clock position and Check port at 3 o'clock position. Pour lubricant into fill port until it just starts to flow out of check port.

5. Hydraulic Return Filter

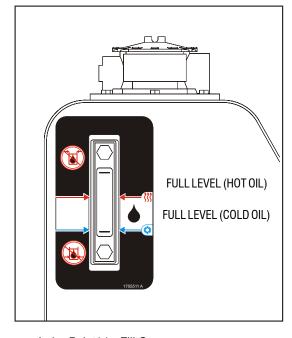


Lube Point(s) - Replaceable Element
Interval - Change after first 50 hours and every 300 hours thereafter or as indicated by condition indicator

6. Hydraulic Charge Filter

Lube Point(s) - Replaceable Element
Interval - Change after first 50 hours and every 300 hours thereafter or as indicated by condition indicator.

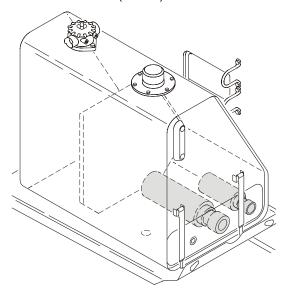
7. Hydraulic Oil



Lube Point(s) - Fill Cap Capacity - 55 gallons (208 liters) Tank Lube - HO Interval - Check level daily with boom of

Interval - Check level daily with boom down, axles retracted, cylinders retracted. Change every 2 years or 1200 hours of operation.

8. Suction Strainers (In Tank)



Lube Point(s) - 2

Interval - Every 2 years or 1200 hours of operation. Remove and clean at time of hydraulic oil change.

9. Oil Change w/Filter - Deutz



Lube Point(s) - Fill Cap/Spin-on Element Capacity -

5 Quarts (4.5 L) Cooling System 11 Quarts (10.5 L) Engine w/Filter

16 Quarts (15 L) Total Capacity

Lube - EO

Interval - Check level daily; change every 500 hours or six months, whichever comes first. Adjust final oil level by mark on dipstick. Refer to Figure 1-2., Deutz Engine Dipstick.

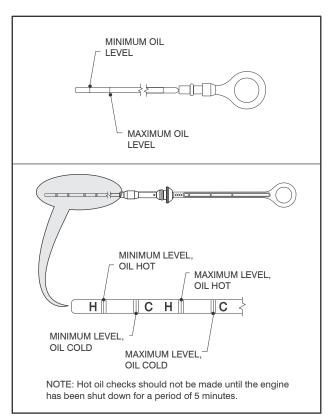
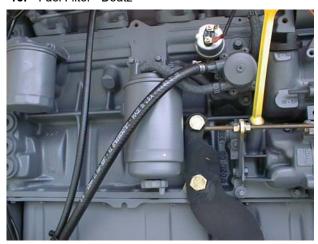


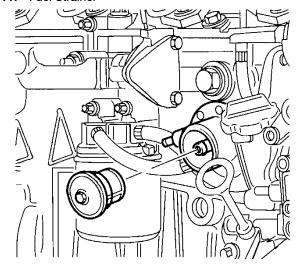
Figure 1-2. Deutz Engine Dipstick

10. Fuel Filter - Deutz



Lube Point(s) - Replaceable Element Interval - Every year or 600 hours of operation

11. Fuel Strainer



Lube Point(s) - Replaceable Element Interval - Every year or 600 hours of operation

12. Air Filter - Deutz



Lube Point(s) - Replaceable Element Interval - Every 6 months or 300 hours of operation or as indicated by the condition indicator

13. Platform Filter



Lube Point(s) - Replaceable Element Interval - Change after first 50 hours and then every year or 600 hours of operation thereafter

VALUES F	OR ZINC PI	_ATED / YELL(OW CHROMATE FAST	ENERS ONLY
SAE G	RADE 5	BOLTS	& GRADE 2	2 NUTS

SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	380	8 [.9]	6 [.7]		
	48	0.1120	0.00661	420	9 [1.0]	7 [.8]		
6	32	0.1380	0.00909	580	16 [1.8]	12 [1.4]		
	40	0.1380	0.01015	610	18 [2.0]	13 [1.5]		
8	32	0.1640	0.01400	900	30 [3.5]	22 [2.5]		
	36	0.1640	0.01474	940	31 [4]	23 [2.6]		
10	24	0.1900	0.01750	1120	43 [5]	32 [3,5]		
	32	0.1900	0.02000	1285	49 [5.5]	36 [4]		
1/4	20	0.2500	0.0318	2020	96 [11]	75 [9]		105 [12]
	28	0.2500	0.0364	2320	120 [14]	86 [10]		135 [15]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	3340	17 [23]	13 [18]	16 [22]	19 [26]
	24	0.3125	0.0580	3700	19 [26]	14 [19]	17 [23]	21 [29]
3/8	16	0.3750	0.0775	4940	30 [41]	23 [31]	28 [38]	35 [47]
	24	0.3750	0.0878	5600	35 [47]	25 [34]	32 [43]	40 [54]
7/16	14	0.4375	0.1063	6800	50 [68]	35 [47]	45 [61]	55 [75]
	20	0.4375	0.1187	7550	55 [75]	40 [54]	50 [68]	60 [81]
1/2	13	0.5000	0.1419	9050	75 [102]	55 [75]	68 [92]	85 [115]
	20	0.5000	0.1599	10700	90 [122]	65 [88]	80 [108]	100 [136]
9/16	12	0.5625	0.1820	11600	110 [149]	80 [108]	98 [133]	120 [163]
	18	0.5625	0.2030	12950	120 [163]	90 [122]	109 [148]	135 [183]
5/8	11	0.6250	0.2260	14400	150 [203]	110 [149]	135 [183]	165 [224]
	18	0.6250	0.2560	16300	170 [230]	130 [176]	153 [207]	190 [258]
3/4	10	0.7500	0.3340	21300	260 [353]	200 [271]	240 [325]	285 [386]
<u></u>	16	0.7500	0.3730	23800	300 [407]	220 [298]	268 [363]	330 [447]
7/8	9	0.8750	0.4620	29400	430 [583]	320 [434]	386 [523]	475 [644]
	14	0.8750	0.5090	32400	470 [637]	350 [475]	425 [576]	520 [705]
1	8	1.0000	0.6060	38600	640 [868]	480 [651]	579 [785]	675 [915]
	12	1.0000	0.6630	42200	700 [949]	530 [719]	633 [858]	735 [997]
1 1/8	7	1,1250	0.7630	42300	800 [1085]	600 [813]	714 [968]	840 [1139]
<u> </u>	12	1.1250	0.8560	47500	880 [1193]	660 [895]	802 [1087]	925 [1254]
1 1/4	7	1,2500	0.9690	53800	1120 [1518]	840 [1139]	1009 [1368]	1175 [1593]
<u> </u>	12	1.2500	1.0730	59600	1240 [1681]	920 [1247]	1118 [1516]	1300 [1763]
1 3/8	6	1.3750	1.1550	64100	1460 [1979]	1100 [1491]	1322 [1792]	1525 [2068]
	12	1.3750	1.3150	73000	1680 [2278]	1260 [1708]	1506 [2042]	1750 [2373]
1 1/2	6	1.5000	1.4050	78000	1940 [2630]	1460 [1979]	1755 [2379]	2025 [2746]
	12	1.5000	1.5800	87700	2200 [2983]	1640 [2224]	1974 [2676]	2300 [3118]

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

5000059_H





Figure 1-3. Torque Chart (SAE Fasteners - Sheet 1 of 3)

VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY

SAE GRADE 8 BOLTS & GRADE 8 NUTS, & SOCKET HEAD CAP SCREWS #6 THRU 1/4

SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	540	12 [1.4]	9 [1.0]		
	48	0.1120	0.00661	600	13 [1.5]	10 [1.1]		
6	32	0.1380	0.00909	820	23 [2.6]	17 [1.9]		
	40	0.1380	0.01015	920	25 [2.8]	19 [2.2]		
8	32	0.1640	0.01400	1260	41 [4.5]	31 [3.5]		
	36	0.1640	0.01474	1320	43 [5]	32 [4]		
10	24	0.1900	0.01750	1580	60 [7]	45 [5]		
	32	0.1900	0.02000	1800	68 [8]	51 [6]		
1/4	20	0.2500	0.0318	2860	144 [16]	108 [12]		160 [18]
	28	0.2500	0.0364	3280	168 [19]	120 [14]		185 [21]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	4720	25 [34]	18 [24]	22 [30]	30 [41]
	24	0.3125	0.0580	5220	25 [34]	20 [27]	25 [34]	30 [41]
3/8	16	0.3750	0.0775	7000	45 [61]	35 [47]	40 [54]	50 [68]
	24	0.3750	0.0878	7900	50 [68]	35 [47]	45 [61]	55 [75]
7/16	14	0.4375	0.1063	9550	70 [95]	55 [75]	63 [85]	80 [108]
	20	0.4375	0.1187	10700	80 [108]	60 [81]	70 [95]	90 [122]
1/2	13	0.5000	0.1419	12750	110 [149]	80 [108]	96 [130]	120 [163]
	20	0.5000	0.1599	14400	120 [163]	90 [122]	108 [146]	135 [183]
9/16	12	0.5625	0.1820	16400	150 [203]	110 [149]	139 [188]	165 [224]
	18	0.5625	0.2030	18250	170 [230]	130 [176]	154 [209]	190 [258]
5/8	11	0.6250	0.2260	20350	220 [298]	170 [230]	180 [244]	240 [325]
7.4	18	0.6250	0.2560	23000	240 [325]	180 [244]	204 [277]	265 [359]
3/4	10 16	0.7500 0.7500	0.3340	30100 33600	380 [515] 420 [569]	280 [380] 320 [434]	301 [408] 336 [456]	420 [569] 465 [630]
7/8	9	0.7500	0.3730	41600	420 [569] 600 [813]	320 [434] 460 [624]	485 [658]	465 [630] 660 [895]
1/0	14	0.8750	0.4620	45800	660 [895]	500 [678]	534 [724]	725 [983]
1	8	1.0000	0.6060	51500	900 [1220]	680 [922]	687 [931]	990 [1342]
- '- 	12	1,0000	0.6630	59700	1000 [1356]	740 [1003]	796 [1079]	1100 [1491]
1 1/8	7	1,1250	0.7630	68700	1280 [1735]	960 [1302]	1030 [1396]	1400 [1898]
","	12	1,1250	0.7550	77000	1440 [1952]	1080 [1464]	1155 [1607]	1575 [2135]
1 1/4	7	1.2500	0.9690	87200	1820 [2468]	1360 [1844]	1453 [1970]	2000 [2712]
F	12	1,2500	1.0730	96600	2000 [2712]	1500 [2034]	1610 [2183]	2200 [2983]
1 3/8	6	1,3750	1,1550	104000	2380 [3227]	1780 [2413]	1907 [2586]	2625 [3559]
	12	1.3750	1,3150	118100	2720 [3688]	2040 [2765]	2165 [2935]	3000 [4067]
1 1/2	6	1.5000	1.4050	126500	3160 [4284]	2360 [3200]	2530 [3430]	3475 [4711]
	12	1.5000	1.5800	142200	3560 [4827]	2660 [3606]	2844 [3856]	3925 [5322]
			•	•	•		-	

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

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SAE GRADE 5



SAE GRADE 8

Figure 1-4. Torque Chart (SAE Fasteners - Sheet 2 of 3)

				JLG SPECIFICATION #4150701- MAGNI 565						
				SC	CKET HEAD CAP S	CREWS 5/16 & AB	OVE			
SIZE	TPI	BOLT DIA	TENSILE	CLAMP		TORQUE	TORQUE			
			STRESS	LOAD	TORQUE	(LOCTITE 262)	(LOCTITE) (242 OR 271)			
			AINLA							
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]			
4	40	0,1120	0,00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474							
10	24	0.1900	0.01750							
	32	0.1900	0.02000							
1/4	20	0.2500	0.0318	2860	108 [12]		160 [18]			
	28	0.2500	0.0364	3280	120 [14]		185 [21]			
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]			
5/16	18	0.3125	0.0524	4720	18 [24]	22 [30]	30 [41]			
	24	0.3125	0.0580	5220	20 [27]	25 [34]	30 [41]			
3/8	16	0.3750	0.0775	7000	35 [47]	40 [54]	50 [68]			
	24	0.3750	0.0878	7900	35 [47]	45 [61]	55 [75]			
7/16	14	0.4375	0.1063	9550	55 [75]	63 [85]	80 [108]			
	20	0.4375	0.1187	10700	60 [81]	70 [95]	90 [122]			
1/2	13	0.5000	0.1419	12750	80 [108]	96 [130]	120 [163]			
	20	0.5000	0.1599	14400	90 [122]	108 [146]	135 [183]			
9/16	12	0.5625	0.1820	16400	110 [149]	139 [188]	165 [224]			
	18	0.5625	0.2030	18250	130 [176]	154 [209]	190 [258]			
5/8	11	0.6250	0.2260	20350	170 [230]	180 [244]	240 [325]			
7.4	18	0.6250	0.2560	23000	180 [244]	204 [277]	265 [359]			
3/4	10	0.7500	0.3340	30100	280 [380]	301 [408]	420 [569] 465 [630]			
7.0		0.7500	0.3730	33600	320 [434]	336 [456]				
7/8	9	0.8750 0.8750	0.4620 0.5090	41600 45800	460 [624] 500 [678]	485 [658] 534 [724]	660 [895] 725 [983]			
1	8	1,0000	0.5090	51500	680 [922]	687 [931]	990 [1342]			
 '- 	12	1.0000	0.6630	59700	740 [1003]	796 [1079]	1100 [1491]			
1 1/8	7	1,1250	0.7630	68700	960 [1302]	1030 [1396]	1400 [1898]			
'''	12	1,1250	0.7650	77000	1080 [1464]	1155 [1607]	1575 [2135]			
1 1/4	7	1,2500	0.9690	87200	1360 [1844]	1453 [1970]	2000 [2712]			
	12	1,2500	1.0730	96600	1500 [2034]	1610 [2183]	2200 [2983]			
1 3/8	6	1.3750	1.1550	104000	1780 [2413]	1907 [2586]	2625 [3559]			
	12	1.3750	1.3150	118100	2040 [2765]	2165 [2935]	3000 [4067]			
1 1/2	6	1.5000	1.4050	126500	2360 [3200]	2530 [3430]	3475 [4711]			
	12	1.5000	1.5800	142200	2660 [3606]	2844 [3856]	3925 [5322]			

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS





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SAE GRADE 5

SAE GRADE 8

Figure 1-5. Torque Chart (SAE Fasteners - Sheet 3 of 3)

VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY

CLASS 8.8 METRIC BOLTS CLASS 8 METRIC NUTS

SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m	N.m
3	.5	5.03	2.19	1.3	1.0	1.2	1.4
3.5	.6	6.78	2.95	2.1	1.6	1.9	2.3
4	.7	8.78	3.82	3.1	2.3	2.8	3.4
5	.8	14.2	6.18	6.2	4.6	5.6	6.8
6	1	20.1	8.74	11	7.9	9.4	12
7	1	28.9	12.6	18	13	16	19
8	1.25	36.6	15.9	25	19	23	28
10	1.5	58.0	25.2	50	38	45	55
12	1.75	84.3	36.7	88	66	79	97
14	2	115	50.0	140	105	126	154
16	2	157	68.3	219	164	197	241
18	2.5	192	83.5	301	226	271	331
20	2.5	245	106.5	426	320	383	469
22	2.5	303	132.0	581	436	523	639
24	3	353	153.5	737	553	663	811
27	3	459	199.5	1080	810	970	1130
30	3.5	561	244.0	1460	1100	1320	1530
33	3.5	694	302.0	1990	1490	1790	2090
36	4	817	355.5	2560	1920	2300	2690
42	4.5	1120	487.0	4090	3070	3680	4290

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

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METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-6. Torque Chart (METRIC Fasteners - Sheet 1 of 3)

VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY

CLASS 10.9 METRIC BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3-M5

SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m	N.m
3	.5	5.03	3.13	1.9	1.4	1.5	2.1
3.5	.6	6.78	4.22	3.0	2.2	2.4	3.3
4	.7	8.78	5.47	4.4	3.3	3.5	4.8
5	.8	14.2	8.85	8.9	6.6	7.1	9.7
6	1	20.1	12.5	15	11	12	17
7	1	28.9	18.0	25	19	20	28
8	1.25	36.6	22.8	37	27	29	40
10	1.5	58.0	36.1	72	54	58	79
12	1.75	84.3	52.5	126	95	101	139
14	2	115	71.6	200	150	160	220
16	2	157	97.8	313	235	250	344
18	2.5	192	119.5	430	323	344	473
20	2.5	245	152.5	610	458	488	671
22	2.5	303	189.0	832	624	665	915
24	3	353	220.0	1060	792	845	1170
27	3	459	286.0	1540	1160	1240	1690
30	3.5	561	349.5	2100	1570	1680	2310
33	3.5	694	432.5	2600	2140	2280	2860
36	4	817	509.0	3660	2750	2930	4020
42	4.5	1120	698.0	5860	4400	4690	6440

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

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8.8

METRIC CLASS 8.8 MET

METRIC CLASS 10.9

Figure 1-7. Torque Chart (METRIC Fasteners - Sheet 2 of 3)

JLG SPECIFICATION #4150701- MAGNI 565

CLASS 12.9 SOCKET HEAD CAP
SCREWS M6 AND ABOVE

SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m
3	.5	5.03			1.5	2.1
3.5	.6	6.78			2.4	3.3
4	.7	8.78			3.5	4.8
5	.8	14.2			7.1	9.7
6	1	20.1	12.5	11	12	17
7	1	28.9	18.0	19	20	28
8	1.25	36.6	22.8	27	29	40
10	1.5	58.0	36.1	54	58	79
12	1.75	84.3	52.5	95	101	139
14	2	115	71.6	150	160	220
16	2	157	97.8	235	250	344
18	2.5	192	119.5	323	344	473
20	2.5	245	152.5	458	488	671
22	2.5	303	189.0	624	665	915
24	3	353	220.0	792	845	1170
27	3	459	286.0	1160	1240	1690
30	3.5	561	349.5	1570	1680	2310
33	3.5	694	432.5	2140	2280	2860
36	4	817	509.0	2750	2930	4020
42	4.5	1120	698.0	4400	4690	6440

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

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METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-8. Torque Chart (METRIC Fasteners - Sheet 3 of 3)

∠ NOTES:	

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.

Туре	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 Man- ual
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 Techni- cian	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

Table 2-1. Inspection and Maintenance

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.

Cleanliness

 The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep 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

- 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 eyebolt 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.
- Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
- If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.
- 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

- Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
- Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See 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

- Keep the system clean. If evidence of metal or rubber particles are found in the hydraulic system, drain and flush the entire system.
- Disassemble and reassemble parts on clean work surface. Clean all metal parts with non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

Lubrication

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

- 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 speci-

fied intervals required in the Lubrication Chart in Section 1. Always examine filters for evidence of metal particles.

- 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

- Refer to Section 1 for recommendations for viscosity ranges.
- 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. Filter elements must be changed after the first 50 hours of operation and every 300 hours (unless specified otherwise) 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.
- 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, main 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	
8	203.2	0.0038	0.10	
9	228.6	0.0030	0.08	

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.
- 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.
 - 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 unless otherwise instructed (i.e. sheave pins).
 - c. Pins should be inspected to ensure it is free of burrs, nicks, and scratches which would damage the bearing during installation and operation.

2.6 WELDING ON JLG EQUIPMENT

NOTE: This instruction applies to repairs, or modifications to the machine and to welding performed from the machine on an external structure, or component,

Do the Following When Welding on JLG Equipment

- · Disconnect the battery.
- · Disconnect the moment pin connection (where fitted)
- Ground only to structure being welded.

Do NOT Do the Following When Welding on JLG Equipment

- Ground on frame and weld on any other area than the chassis.
- Ground on turntable and weld on any other area than the turntable.
- Ground on the platform/support and weld on any other area than the platform/support.
- Ground on a specific boom section and weld on any other area than that specific boom section.
- Allow pins, wear pads, wire ropes, bearings, gearing, seals, valves, electrical wiring, or hoses to be between the grounding position and the welded area.

NOTICE

FAILURE TO COMPLY WITH THE ABOVE REQUIREMENTS MAY RESULT IN COMPONENT DAMAGE (I.E. ELECTRONIC MODULES, SWING BEARING, COLLECTOR RING, BOOM WIRE ROPES ETC.)

Table 2-3. Inspection and Preventive Maintenance Schedule

	INTERVAL						
AREA	Pre-Start ¹ Inspection	Weekly Preventive Maintenanc e	Monthly Preventive Maintenanc e	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		15			
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				11	11		
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							
Drive Hubs				11	11		
Functions/Controls	9						

Table 2-3. Inspection and Preventive Maintenance Schedule

	INTERVAL						
AREA	Pre-Start ¹ Inspection	Weekly Preventive Maintenanc e	Monthly Preventive Maintenanc e	Pre- Delivery ² or Frequent ³ Inspection	Annual ⁴ (Yearly) Inspection	Every 2 Years	
Platform Controls	5	5		6	6		
Ground Controls	5	5		6	6		
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	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		

Table 2-3. Inspection and Preventive Maintenance Schedule

	INTERVAL						
AREA	Pre-Start ¹ Inspection	Weekly Preventive Maintenanc e	Monthly Preventive Maintenanc e	Pre- Delivery ² or Frequent ³ Inspection	Annual ⁴ (Yearly) Inspection	Every 2 Years	
Capacity Decals Installed, Secure, Legible	21			21	21		
All Decals/Placards Installed, Secure, Legible	21			21	21		
Walk-Around Inspection Performed	21						
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		

Table 2-3. Inspection and Preventive Maintenance Schedule

	INTERVAL					
AREA	Pre-Start ¹ Inspection	Weekly Preventive Maintenanc e	Monthly Preventive Maintenanc e	Pre- Delivery ² or Frequent ³ Inspection	Annual ⁴ (Yearly) Inspection	Every 2 Years

Footnotes:

Performance Codes:

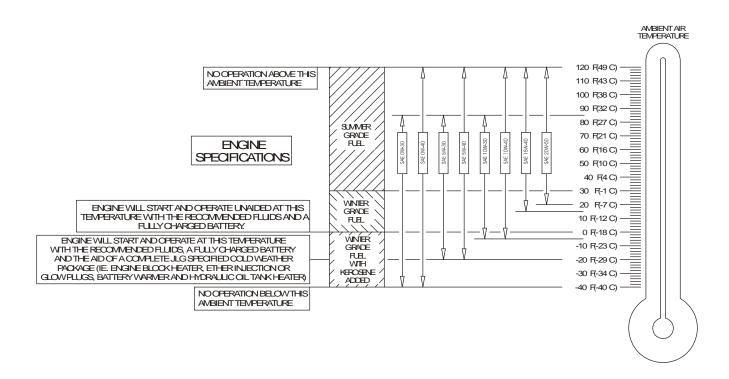
- 1 Check for proper and secure installation
- $2 Visual\ inspection\ for\ damage,\ cracks,\ distortion\ or\ excessive\ wear$
- $3-Check\ for\ proper\ adjustment$
- 4 Check for cracked or broken welds
- 5 Operates Properly
- 6 Returns to neutral or "off" position when released
- 7 Clean and free of debris
- 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

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

 $^{^4\,\}mathrm{Annually},$ no later than 13 months from the date of the prior inspection



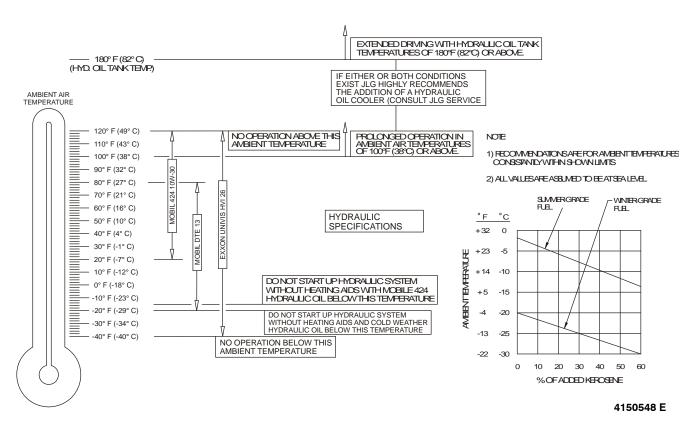


Figure 2-1. Engine Operating Temperature Specifications - Deutz

SECTION 3. CHASSIS & TURNTABLE

3.1 TIRES & WHEELS

Tire Inflation

The air pressure for pneumatic tires must be equal to the air pressure that is stenciled on the side of the JLG product or rim decal for safe and proper operational characteristics.

Tire Damage

For pneumatic tires, JLG Industries, Inc. recommends that when any cut, rip, or tear is discovered that exposes sidewall or tread area cords in the tire, measures must be taken to remove the JLG product from service immediately. Arrangements must be made for replacement of the tire or tire assembly.

For polyurethane foam filled tires, JLG Industries, Inc. recommends that when any of the following are discovered, measures must be taken to remove the JLG product from service immediately and arrangements must be made for replacement of the tire or tire assembly.

- a smooth, even cut through the cord plies which exceeds 3 inches (7.5 cm) in total length
- any tears or rips (ragged edges) in the cord plies which exceeds 1 inch (2.5 cm) in any direction
- any punctures which exceed 1 inch in diameter
- · any damage to the bead area cords of the tire

If a tire is damaged but is within the above noted criteria, the tire must be inspected on a daily basis to insure the damage hasn't propagated beyond the allowable criteria.

Wheel and Tire Replacement

The rims installed on each product model have been designed for stability requirements which consist of track width, tire pressure, and load capacity. Size changes such as rim width, center piece location, larger or smaller diameter, etc., without written factory recommendations, may result in an unsafe condition regarding stability.

Wheel Installation

It is extremely important to apply and maintain proper wheel mounting torque.

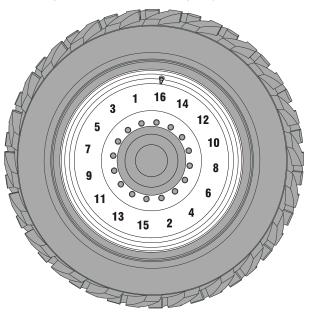
A WARNING

WHEEL NUTS MUST BE INSTALLED AND MAINTAINED AT THE PROPER TORQUE TO PREVENT LOOSE WHEELS, BROKEN STUDS, AND POSSIBLE DANGEROUS SEPARATION OF WHEEL FROM THE AXLE. BE SURE TO USE ONLY THE NUTS MATCHED TO THE CONE ANGLE OF THE WHEEL.

Tighten the lug nuts to the proper torque to prevent wheels from coming loose. Use a torque wrench to tighten the fasteners. If you do not have a torque wrench, tighten the fasteners with a lug wrench, then immediately have a service garage or dealer tighten the lug nuts to the proper torque. Over-tightening will result in breaking the studs or permanently deforming the mounting stud holes in the wheels.

The proper procedure for attaching wheels is as follows:

- Start all nuts by hand to prevent cross threading. DO NOT use a lubricant on threads or nuts.
- 2. Tighten nuts in the following sequence:



3. The tightening of the nuts should be done in stages. Following the recommended sequence, tighten nuts per wheel torque chart.

Table 3-1. Wheel Torque Chart

TORQUE SEQUENCE					
1st Stage	2nd Stage	3rd Stage			
45 ft. lbs. (60 Nm)	100 ft. lbs. (140 Nm)	180 ft. lbs. (252 Nm)			

4. Wheel nuts should be torqued before first road use and after each wheel removal. Check and torque every 3 months or 150 hours of operation.

3.2 EXTENDING AXLES

The Axle Extension System allows each of the four axles to be extended and retracted together while maintaining full steering control as the machine is driven. The system allows the axles to extend or retract only while the boom is in the transport position and in order to minimize wheel scrubbing during axle movement, a minimum drive speed must be attained before axle extension/retraction will be permitted. The system uses four limit switches (one at each axle) to sense when the axles are fully extended. If any of the switches are not made, the control system considers the axles retracted. To extend/retract the axles, the user engages the axle extend/retract switch on the platform console and the drive control at the same time. The axle set indicator will be off when the axles are not fully extended and the axle extend/retract switch is not engaged. It will flash while the axles are extending or retracting and will be on constantly when the axles are fully extended. With the axles not fully extended, the boom is restricted to operation within the transport position. If a signal from any axle extend sensing switch is lost when the boom beyond the transport position, the axle set indicator will flash and drive/steer functions will be disabled until the boom is brought back into the transport position. The steering angle will be automatically limited to +/- 25 degrees anytime the axles are not fully extended. If the wheel angle is more than +/- 25 degrees when the axle retract command is engaged, the control system will automatically reduce the wheel angle to 25 degrees during axle retraction.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.3 AXLE LIMIT SWITCH ADJUSTMENT PROCEDURE

- 1. Fully extend the axles.
- 2. Initially position the limit switch arm straight.
- 3. Select the mounting plate bolt pattern to position the switch roller within 0.125 inches (3.1 mm) from the edge of the axle cutout. It may be necessary to reposition the switch arm $\pm 10^{\circ}$ to accomplish this.
- Ensure the arm will clear the axle (without bottoming out to 70° stroke of the switch) in the retracted position.
- Check for proper operation. Axle set light is to deactivate when the axle is retracted 0.625 inches (16 mm) maximum from fully extended.

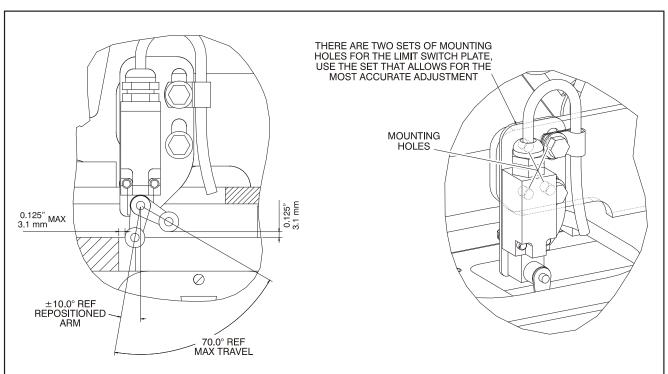


Figure 3-1. Axle Limit Switch Adjustment

3.4 DRIVE SYSTEM (1100SJP)

The drive system utilizes 2 traction pumps so each side is powered individually. This produces maximum tractive effort to wheels by minimizing flow divider losses. The maximum drive speed is modulated with the steered angle of the wheels to eliminate the whiplash effect of driving at full speed and maximum steering lock.

3.5 STEERING CONTROL SYSTEM

NOTE: The following description covers all modes of steering. The 1100S only utilizes the Conventional Two Wheel Steer Mode.

Each wheel is individually steered by means of a closed circuit control system utilizing a steer sensor on each wheel, 4 steer cylinders, and proportional valves.

The control system senses the wheel position in relation to the steering command (direction and steering mode) and automatically synchronizes the movement of all 4 wheels to the desired position.

There are three different modes of steering selectable by the position of the steer select switch on the platform control panel: conventional two wheel steering, crab and coordinated. These are shown below.

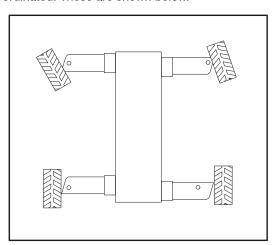


Figure 3-2. Conventional Two Wheel Steer Mode

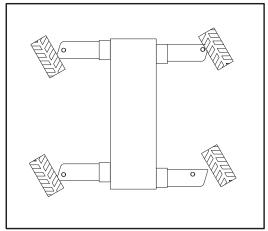


Figure 3-3. Crab Steer Mode - 1100SJP Only

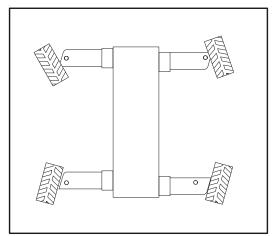


Figure 3-4. Coordinated Steer Mode - 1100SJP Only

Each wheel has its own steer cylinder, wheel angle sensor, and proportional valve, allowing the control system to position each wheel to the ideal angle for all steering modes and all steering commands. Changes in steering modes while the footswitch is depressed causes the wheels to automatically adjust to the appropriate angle for the selected steering mode based on the position of the inside front wheel. If the steer select switch is changed without the footswitch depressed or the EMS is off, the wheels will not move until the footswitch is depressed and a steering or drive command has been initiated. The steering angles are limited to +/- 25 degrees anytime the axles are not fully extended. If a wheel cannot achieve its commanded angle within a specified time, it is considered jammed. When a wheel is considered jammed during steering, a fault is reported and the remaining wheels will continue to their commanded position. The fault is cleared when the footswitch is cycled. If a wheel is iammed making it significantly out of position, with regard to the other wheels, the drive motors are restricted to their maximum displacement (slow speed). Wheel angle sensor failures will result in an approximated steering control logic that will allow the operator to move the machine until it can be repaired. The wheel at the failed sensor will be driven based on the information available from the other sensors. This wheel will not track perfectly and will become farther out of position over time. When the wheel becomes prohibitively out of position, the wheels can be re synchronized by fully steering against the mechanical stops.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.6 DRIVE/STEERING SPEED CONTROL

The Drive/Steering Speed Control system uses the steering sensors from the steering control system to increase operator control and comfort by reducing the effect of turning the chassis on the resulting lateral platform speed. The system proportionally varies the drive speed based on the predicted turning radius of the chassis for both coordinated and conventional two wheel steer modes. The tighter the turn the slower the allowable drive speed. As crab steer does not steer on a radius, full drive speed is maintained regardless of steer angle.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.7 TRACTION CONTROL SYSTEM

The traction control system uses the steering sensors from the steering control system to optimize the performance of the drive system. This is especially important due to the disparity of wheel speeds generated between the inside and outside wheels of the extended axle chassis with large steering angle capability. The steering sensors are used to predict the rolling path and therefore the required wheel speed of each wheel as the steering angles change and steering modes change. The control system can then command the ideal flow from each of the two drive pumps, one for the right side of the machine and one for he left side. On 1100SJP machines, two flow dividers, one for the right side front to back and one for the left side front to back absorb the variation in wheel speed front to back.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.8 DRIVE ORIENTATION SYSTEM

The Drive Orientation System (DOS) is intended to indicate to the operator conditions that could make the direction of movement of the chassis different than the direction of movement of the drive/steer control handle. The system indicates to the operator the need to match the black and white directional arrows on the platform control panel to the arrows on the chassis. The system uses a proximity switch mounted on the hydraulic swivel, an indicator light and an override switch on the platform display panel. The proximity switch trips when the turntable is swung +/- 45 degrees off center of the normal driving position. This occurs roughly when the boom is swung past a rear tire. When the turntable is in the normal drive position with the boom between the rear tires, no indications or interlocks are made. When the machine is actively driving when the turntable is swung past the switch point, the system is ignored until drive/steer is released. When drive is initiated with the boom swung past the switch point, the DOS indicator will flash and the drive/steer functions will be disabled. The operator must engage the DOS override switch to enable Drive/steer (high drive will remain disabled). When the DOS is enabled, the DOS indicator will be illuminated continuously and a 3-second enable timer will be started and will continue for 3 seconds after the end the last drive/steer command. If the timer expires, the DOS override switch must be reengaged to enable drive/steer.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

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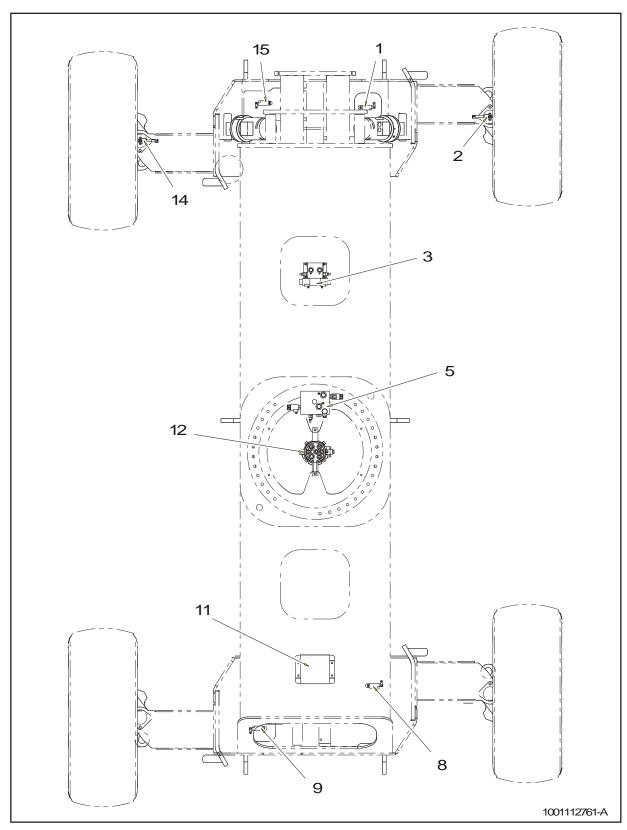


Figure 3-5. Chassis Component Location (1100S) - Sheet 1 of 2

- 1. Axle Limit Switch (Right Front)
- 2. Steer Angle Sensor (Right Front)
- 3. Steer Valve (Front)
- 4. Not Used
- 5. Traction Valve
- 6. Not Used
- 7. Not Used
- 8. Axle Limit Switch (Right Rear)
- 9. Axle Limit Switch (Left Rear)
- 10. Not Used
- 11. Chassis Module
- 12. Swivel/Collector Ring
- 13. Not Used
- 14. Steer Angle Sensor (Left Front)
- 15. Axle Limit Switch (Left Front)

Figure 3-6. Chassis Component Location (1100S) - Sheet 2 of 2

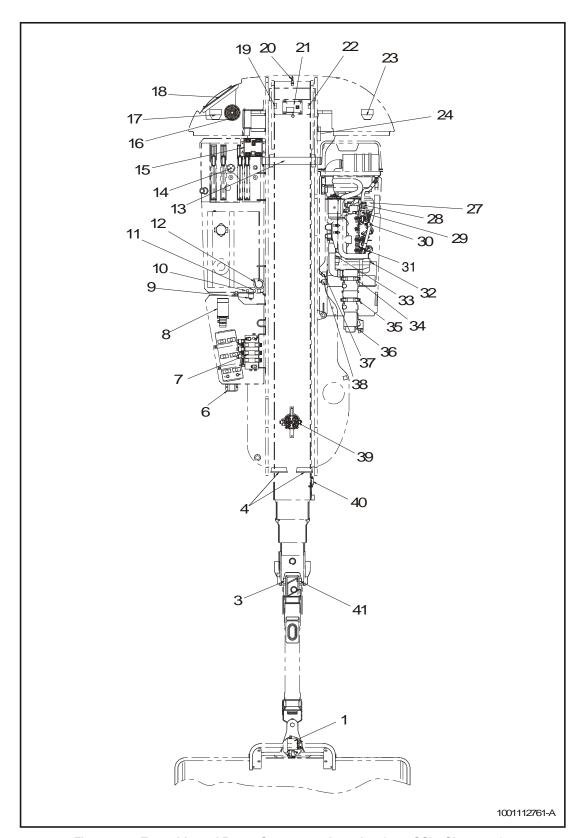


Figure 3-7. Turntable and Boom Component Location (1100SS) - Sheet 1 of 2

1. Platform Control Valve 22. Boom Angle Sensor (Right) 2. Not Used 23. Headlight 3. Platform Level Sensor (Secondary - Left) 24. Deutz EMR2 Module 4. Tail Lights 25. Not Used 5. Not Used 26. Not Used 6. Alarm 27. Alternator 7. Main Control Valve 28. Throttle Actuator 8. Auxiliary Power Pump 29. Oil Temperature Switch 9. Auxiliary Power Relay 30. Oil Pressure Switch 10. Chassis Power Distribution Relay 31. In Head Glow Plug 11. Headlight/Tail Light Relay 32. Engine Speed Sensor 12. Horn 33. Starter 13. Lift Cylinder Pivot Pin 34. Drive Pump (Right Side) 14. Fuel Level Sensor 35. Drive Pump (Left Side) 15. B.L.A.M. Module 36. Function Pump 16. Strobe Light 37. Starter Relay 17. Headlight 38. Glow Plug Relay 18. Ground Control Box 39. Swivel/Collector Ring 19. Boom Angle Sensor (Left) 40. Transport Limit Switch 20. Broken Cable Proximity Switch 41. Platform Level Sensor (Primary - Right)

Figure 3-8. Turntable and Boom Component Location (1100SS) - Sheet 2 of 2

42. Not Used

21. Boom Length Sensor

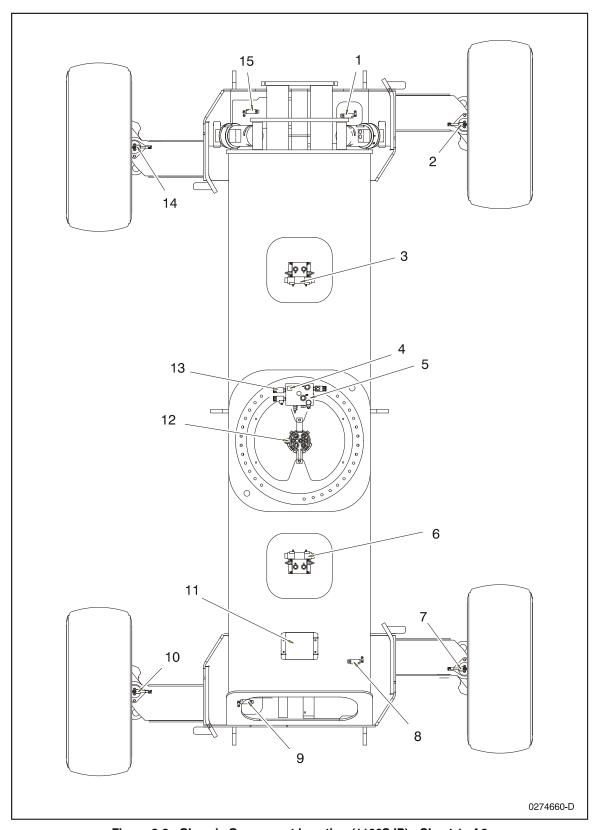


Figure 3-9. Chassis Component Location (1100SJP) - Sheet 1 of 2

- 1. Axle Limit Switch (Right Front)
- 2. Steer Angle Sensor (Right Front)
- 3. Steer Valve (Front)
- 4. Axle Lockout Valve
- 5. Traction Valve
- 6. Steer Valve (Rear)
- 7. Steer Angle Sensor (Right Rear)
- 8. Axle Limit Switch (Right Rear)
- 9. Axle Limit Switch (Left Rear)
- 10. Steer Angle Sensor (Left Rear)
- 11. Chassis Module
- 12. Swivel/Collector Ring
- 13. Axle Lockout Pressure Switch
- 14. Steer Angle Sensor (Left Front)
- 15. Axle Limit Switch (Left Front)

Figure 3-10. Chassis Component Location (1100SJP) - Sheet 2 of 2

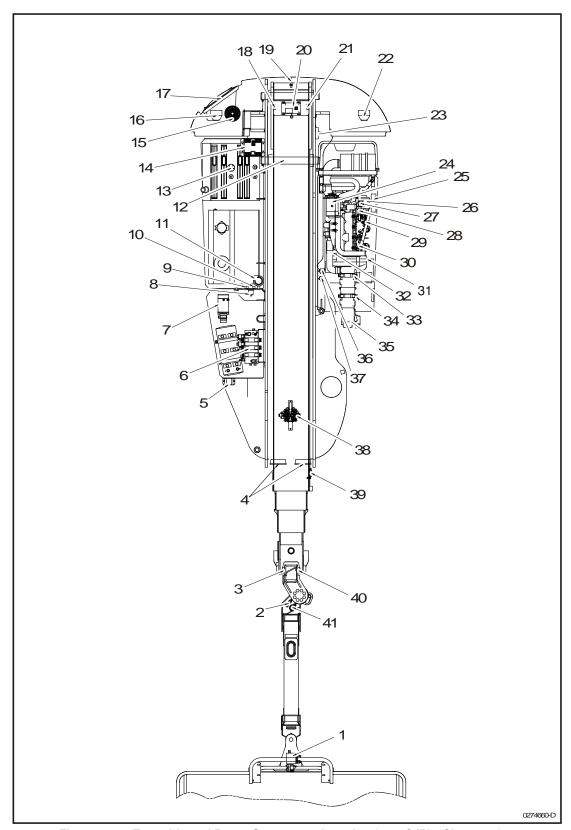


Figure 3-11. Turntable and Boom Component Location (1100SJP) - Sheet 1 of 2

- 1. Platform Control Valve
- 2. Jib Stow Switch
- 3. Platform Level Sensor (Secondary Left)
- 4. Tail Lights
- 5. Alarm
- 6. Main Control Valve
- 7. Auxiliary Power Pump
- 8. Auxiliary Power Relay
- 9. Chassis Power Distribution Relay
- 10. Headlight/Tail Light Relay
- 11. Horn
- 12. Lift Cylinder Pivot Pin
- 13. Fuel Level Sensor
- 14. B.L.A.M. Module
- 15. Strobe Light
- 16. Headlight
- 17. Ground Control Box
- 18. Boom Angle Sensor (Left)
- 19. Broken Cable Proximity Switch
- 20. Boom Length Sensor
- 21. Boom Angle Sensor (Right)

- 22. Headlight
- 23. Deutz EMR2 Module
- 24. 110V/220V Generator
- 25. Generator Control Box
- 26. Alternator
- 27. Throttle Actuator
- 28. Oil Temperature Switch
- 29. Oil Pressure Switch
- 30. In Head Glow Plug
- 31. Engine Speed Sensor
- 32. Starter
- 33. Drive Pump (Right Side)
- 34. Drive Pump (Left Side)
- 35. Function Pump
- 36. Starter Relay
- 37. Glow Plug Relay
- 38. Swivel/Collector Ring
- 39. Transport Limit Switch
- 40. Platform Level Sensor (Primary Right)
- 41. Dual Capacity Jib Position Switch

Figure 3-12. Turntable and Boom Component Location (1100SJP) - Sheet 2 of 2

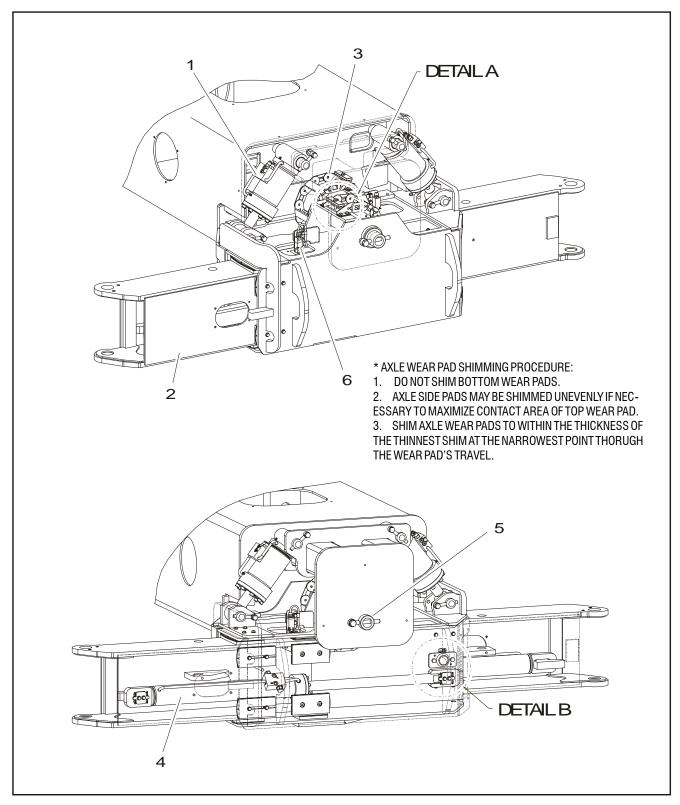
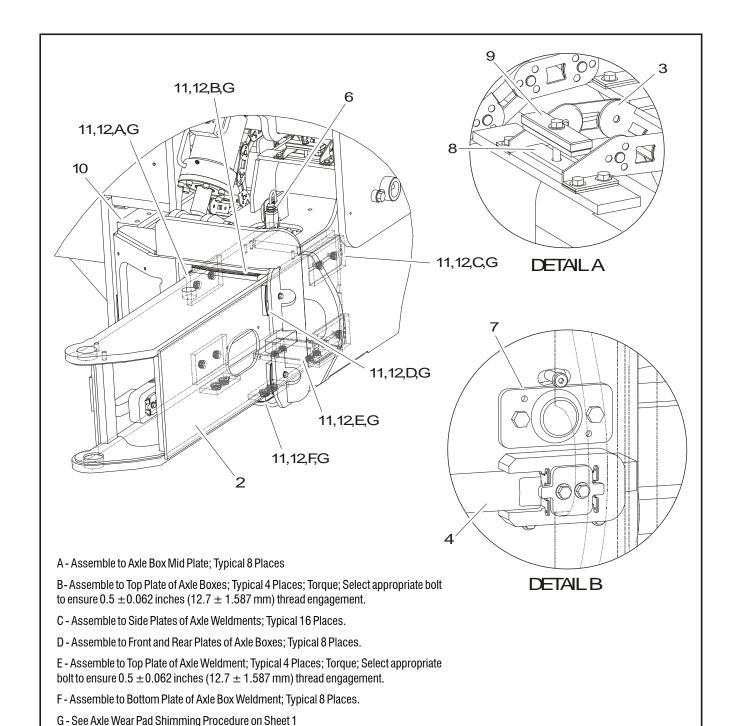


Figure 3-13. Oscillating Axle - Sheet 1 of 2



- 1. Axle Oscillation Cylinder
- 2. Axle
- 3. Axle Powertrack
- 4. Extension Cylinder
- 5. Axle Pivot Pin
- 9. Hose Clamp 10. Stop Block 6. Axle Limit Switch
- 7. Axle Stop Pin
- 8. Rubber Pad
- 11. Wear Pad
- 12. Shim

Figure 3-14. Oscillating Axle - Sheet 2 of 2

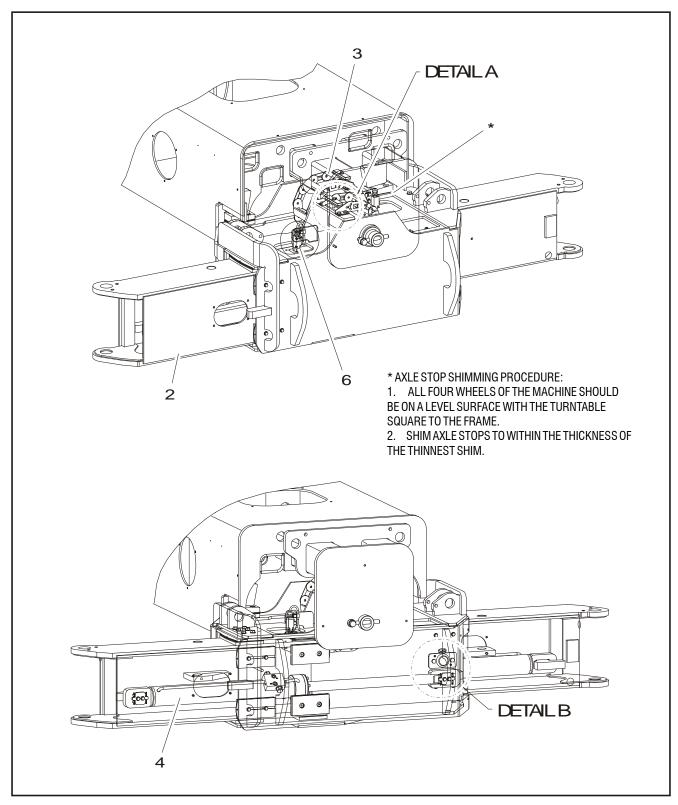
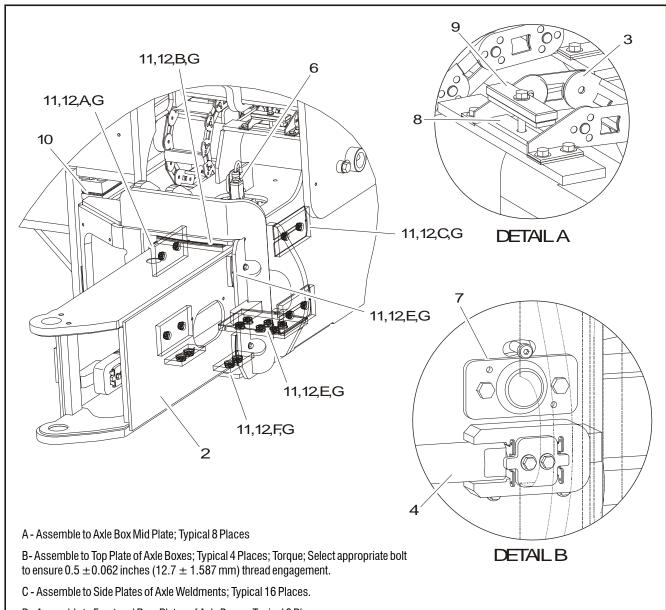


Figure 3-15. Fixed Axle - Sheet 1 of 2



- D Assemble to Front and Rear Plates of Axle Boxes; Typical 8 Places.
- E Assemble to Top Plate of Axle Weldment; Typical 4 Places; Torque; Select appropriate bolt to ensure 0.5 \pm 0.062 inches (12.7 \pm 1.587 mm) thread engagement.
- F Assemble to Bottom Plate of Axle Box Weldment; Typical 8 Places.
- ${\rm G}$ See Axle Stop Shimming Procedure on Sheet 1
 - 1. Not Used
 - 2. Axle
 - 3. Axle Powertrack
 - 4. Extension Cylinder
- 5. Not Used
- 6. Axle Limit Switch
- 7. Axle Stop Pin
- 8. Rubber Pad
- 9. Hose Clamp
- 10. Stop Block
- 11. Wear Pad
- 12. Shim

Figure 3-16. Fixed Axle - Sheet 2 of 2

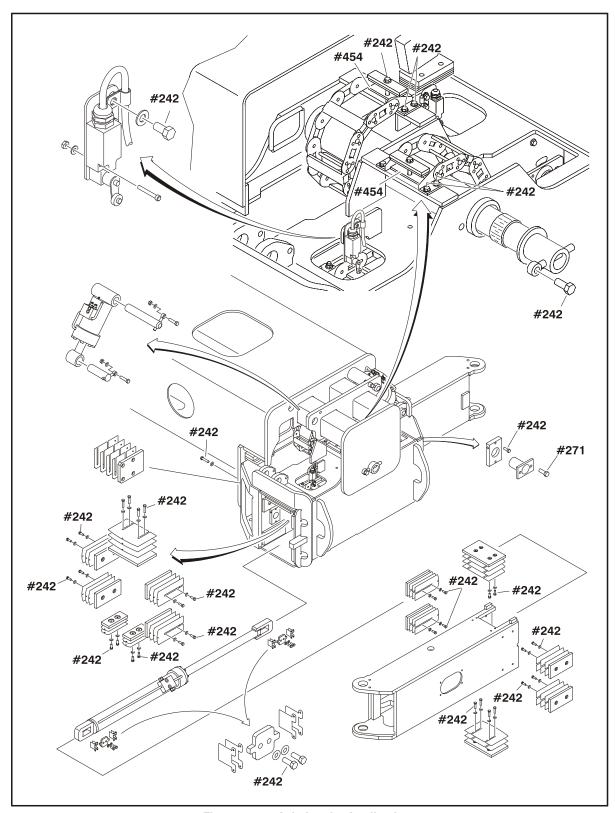


Figure 3-17. Axle Loctite Application

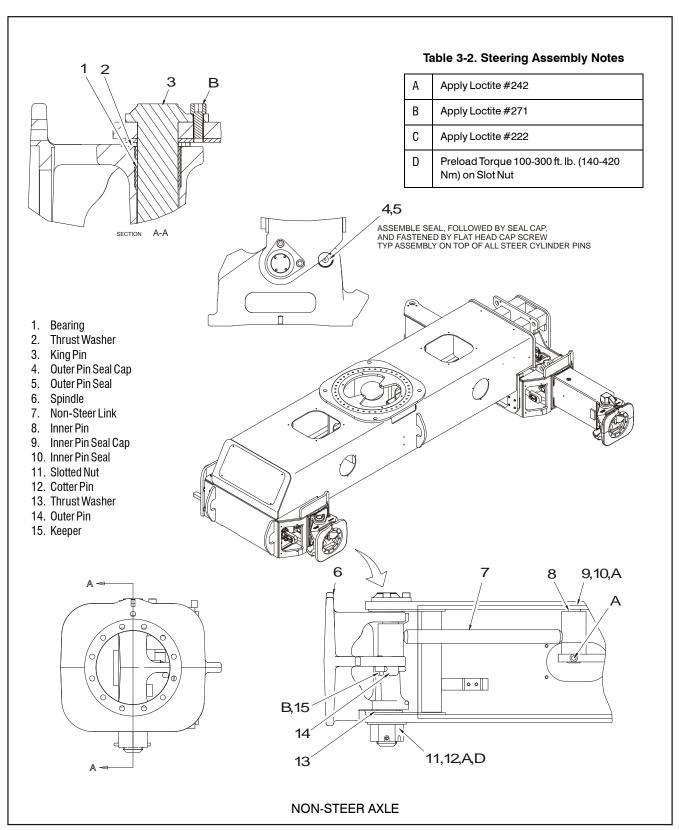


Figure 3-18. Steering Installation - Sheet 1 of 3

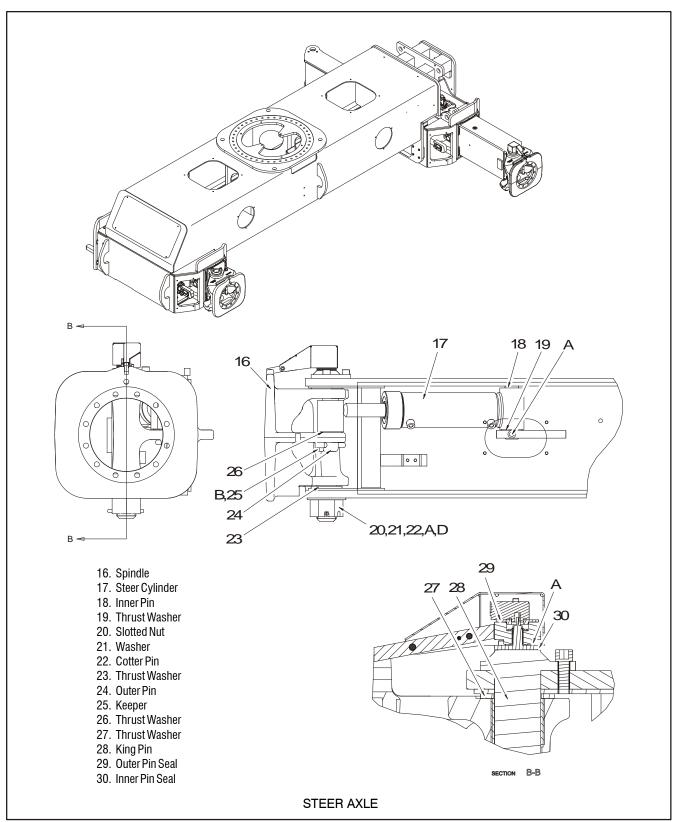


Figure 3-19. Steering Installation - Sheet 2 of 3

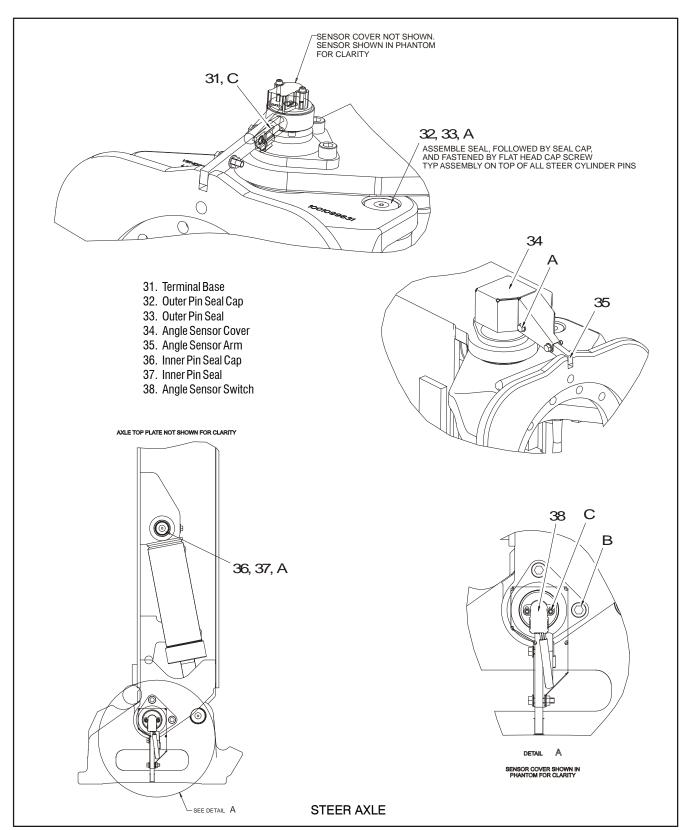


Figure 3-20. Steering Installation - Sheet 3 of 3

3.9 OSCILLATING AXLE SYSTEM (1100SJP)

The oscillating front axle is attached to the frame by a pivot pin, which allows all four wheels to remain on the ground when traveling on rough terrain. The oscillating axle also incorporates two lockout cylinders connected between the frame and the axle. The lockout cylinders permit axle oscillation when the boom is in the transport position and drive is commanded. The lockout cylinders will lock and hold the axle when drive is not commanded or when the boom is outside the transport position. The cylinders unlock when pilot pressure is applied to the holding valves mounted on the cylinders and lock when pilot pressure is removed. Pilot pressure is available from brake pressure and is controlled by a solenoid operated NC lockout valve mounted in the frame. To ensure the lockout valve is functioning correctly, a NO pressure switch is mounted between the lockout valve and the holding valves. The system is "healthy" when pressure trips the pressure switch when the lockout valve is commanded to be open and conversely is healthy when the lack of pressure resets the pressure switch when the lockout valve is commanded to be closed. Failures in the oscillating axle system will cause the control system to disallow lift up and telescope out when the boom is within the transport position and will disallow drive/steer, lift up and telescope out when the boom is beyond the transport position.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.10 OSCILLATING AXLE BLEEDING PROCEDURE AND LOCKOUT TEST (1100SJP)

Lockout Cylinder Bleeding

To start the test, the axle must be fully oscillated in one direction. Start with oscillating the axle so that the left lock-out cyl. is fully retracted (left front tire up), and the right lock-out cyl. Is fully extended (right front tire down).

NOTICE

ENSURE PLATFORM IS FULLY LOWERED AND BOOM IS CENTERED OVER REAR AXLE PRIOR TO BEGINNING BLEEDING PROCEDURE. MAKING SURE MACHINE IS ON A LEVEL SURFACE AND REAR WHEELS ARE BLOCKED, BRAKE WIRE IS DISCONNECTED.

- Making sure machine is on a level surface and rear wheels are blocked, machine is in transport mode.
- 2. Disengage the drive hubs.
- Use suitable container to catch any residual hydraulic fluid, place container under the lockout cylinder.
- 4. With the left lock-out cyl. retracted, open the bleeder on top of the cylinder, then have an operator from the platform (on high engine) feather drive. Activate drive fully.
- Close the bleeder when there is a steady stream of oil and not air.
- 6. With the axle in the same position, go to the right lock-out cyl. and open the bleeder at the rod end. Activate drive in the same manner and close when all air has been purged.
- Close the bleeder when there is a steady stream of oil and not air.
- 8. Oscillate the axle the other direction, left lock-out cyl. extended (tire down), right lock-out cyl. retracted (tire up). Use the same procedure for the bleeder in the rod end of the left lock-out cyl., Then the piston end of the right lock-out cyl. then close.
- Repeat this process one more time to ensure that all air has been purged from the system.
- 10. Perform oscillating axle lockout test.
- 11. If necessary, repeat steps 1 thru 9.

NOTE: Bleeding of the oscillating axles is an infrequent operation performed after hydraulic line failure and or lock-out cylinder repair.

Oscillating Axle Lockout Test

The front axles will oscillate when the boom is in the transport position (i.e. when the boom is less than 15° above horizontal and not extended beyond 24" [60.9 cm]) and drive is selected.

NOTICE

LOCKOUT SYSTEM TEST MUST BE PERFORMED QUARTERLY, ANY TIME A SYSTEM COMPONENT IS REPLACED, OR WHEN IMPROPER SYSTEM OPERATION IS SUSPECTED.

NOTE: Ensure boom is fully retracted, lowered, and centered between drive wheels prior to beginning lock-out cylinder test. The axles must also be fully extended.

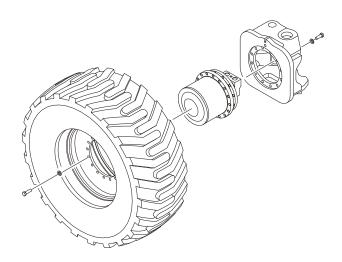
- 1. Place a 6 inch (15.2 cm) high block with ascension ramp in front of left front wheel.
- From platform control station, activate machine hydraulic system.
- Place FUNCTION SPEED CONTROL and DRIVE SPEED/TORQUE SELECT control switches to their respective LOW positions.
- Place DRIVE control lever to FORWARD position and carefully drive machine up ascension ramp until left front wheel is on top of block.
- **5.** Telescope the boom out of the transport position.
- Drive machine off of block and ramp back onto the level surface.
- Have an assistant check to see that left front wheel remains locked in position off of ground.
- 8. Retract the boom back in to the transport position.

 Activate drive and the lockout cylinders should release.
- **9.** Place the 6 inch (15.2 cm) high block with ascension ramp in front of right front wheel.
- Place DRIVE control lever to FORWARD and carefully drive machine up ascension ramp until right front wheel is on top of block.

- **11.** Telescope the boom out of the transport position.
- **12.** Drive machine off of block and ramp back onto the level surface.
- Have an assistant check to see that right front wheel remains locked in position off of ground.
- Retract the boom back in to the transport position. Activate drive and the lockout cylinders should release.
- **15.** If lockout cylinders do not function properly, have qualified personnel correct the malfunction prior to any further operation.

3.11 DRIVE HUB - REGGIANA RIDUTTORI

Removal



- 1. Place the machine on a firm, level surface.
- Place a jack adequate enough to support the load under the machine's frame at the hub that is to be removed. Jack up the machine until the tire is off of the ground.

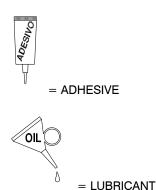
NOTE: The tire and wheel assembly weighs approximately 867 lbs. (393 kg).

- Remove the bolts and washers used to secure the tire and wheel assembly to the hub. Using an adequate lifting device, remove the tire and wheel assembly.
- 4. If the hub is a drive hub, tag and disconnect all hydraulic lines running to the drive motor. Cap or plug all openings to prevent dirt from entering the hydraulic system.

NOTE: The drive hub including drive motor weighs approximately 307 lbs. (139 kg). The non-drive hub weighs approximately 140 lbs. (63.5 kg).

- Use an adequate lifting device to support the weight of the drive hub.
- Remove the bolts and washers securing the drive hub to the spindle and remove the drive hub from the machine.

Symbol Nomenclature









Tools

Tools required for assembling and disassembling the wheel gear RRTD1701TB

- 1. Hammer;
- 2. Clamps for inner retention rings;
- 3. Clamps for outer retention rings;
- 4. Electric or pneumatic screwdriver;
- 5. Special spacer mounting;
- 6. Torque wrench;
- 7. Hydraulic press;
- 8. Wrench for M6, M8, M10 socket head screws and 1/4"G plug.
- 9. Socket wrench for M6 hexagonal screw.

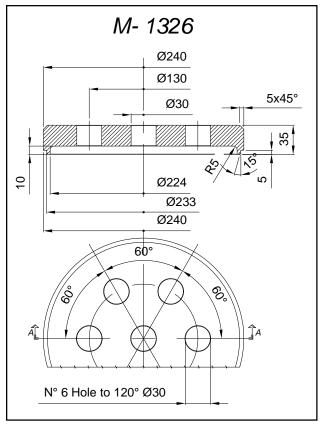


Figure 3-21. Bearing Track Spacer Mounting C016117

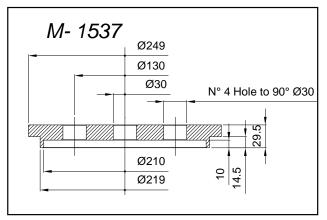


Figure 3-22. Oil Seal Spacer Mounting C125049

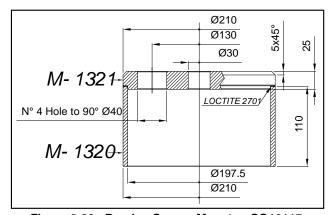


Figure 3-23. Bearing Spacer Mountng CO16117

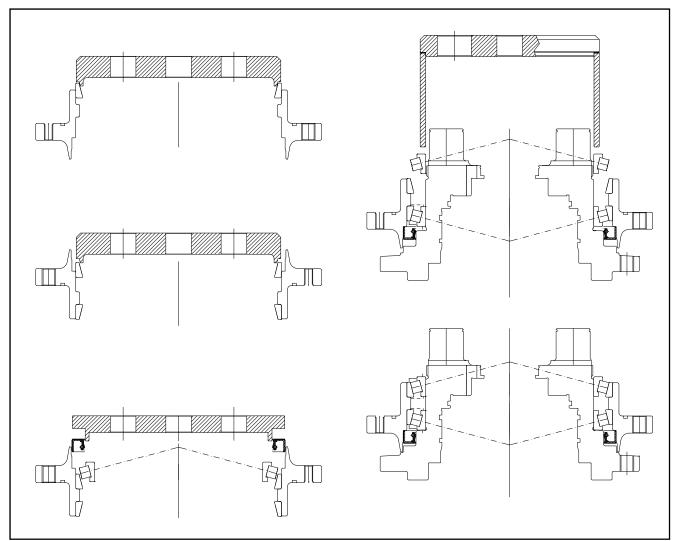


Figure 3-24. Assembly Diagram 1

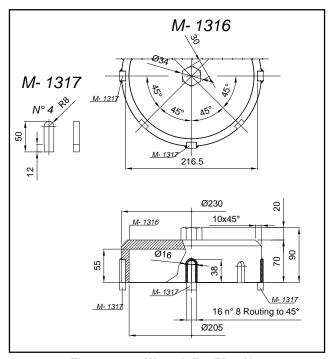


Figure 3-25. Wrench For Ring Nut

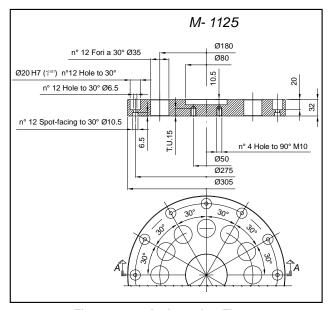


Figure 3-26. Anti-rotation Flange

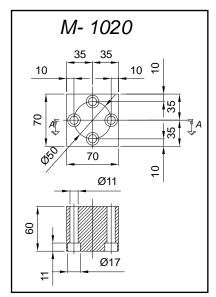


Figure 3-27. Anti-rotation Block

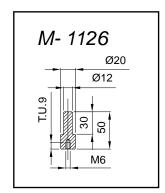


Figure 3-28. Anti-rotation Pin

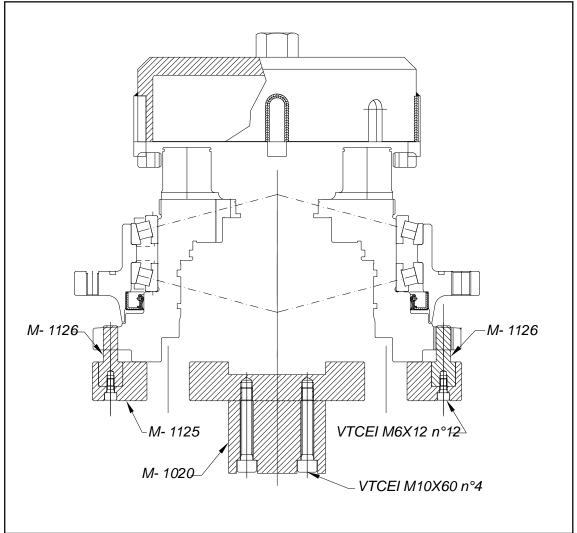


Figure 3-29. Assembly Diagram 2

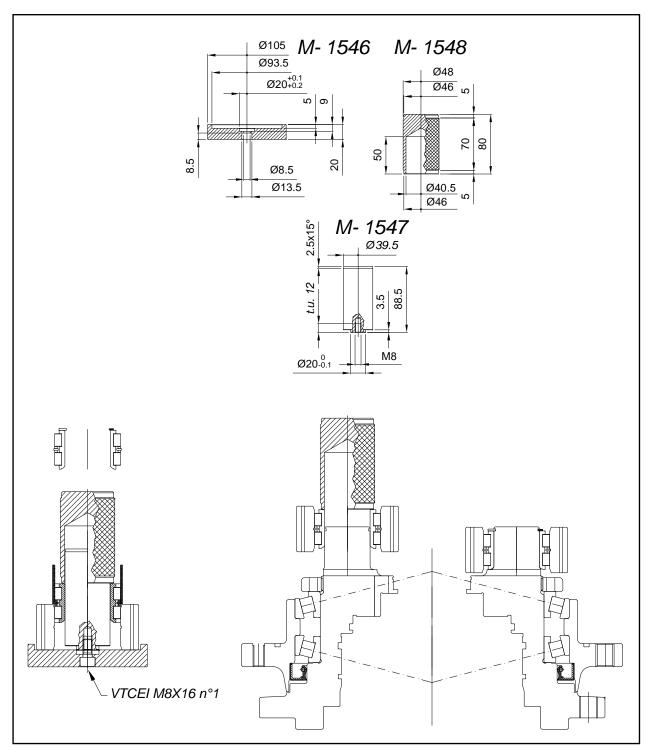
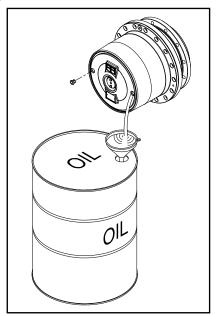


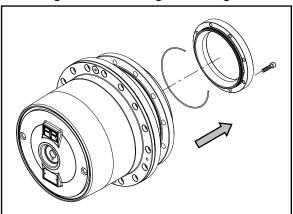
Figure 3-30. Tools For Assembling Bearing 3rd Stage Planetary Gear Assembly Diagram

Disassembly

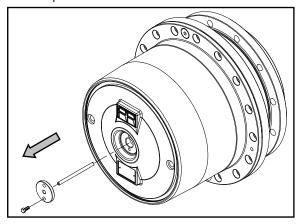
Remove the plugs and pour the lubricant in a container.



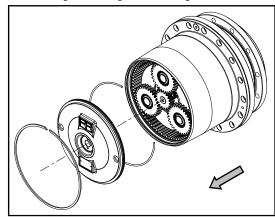
2. Release the screws to disassemble the motor flange taking care not to damage the O-Ring.



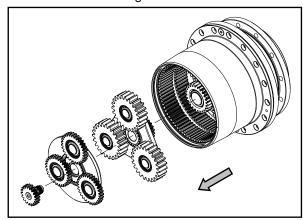
3. Release the screws from the release cover and pull the pin out.



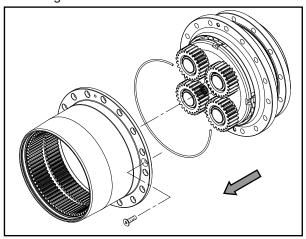
4. Remove the BR250 ring and pull the cover out avoiding to damage the O-Ring.



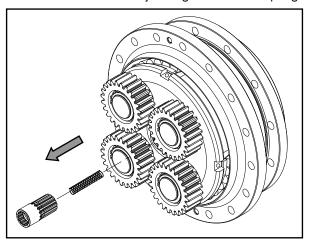
5. Pull the reduction gears out.



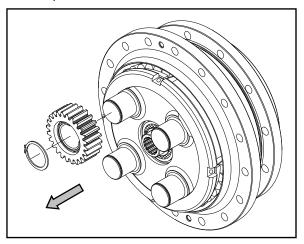
Loosen the M10x25 flathead socket screws and remove the planetary ring without damaging the O-Ring.



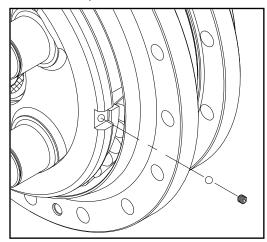
7. Remove the release joint together with the spring.



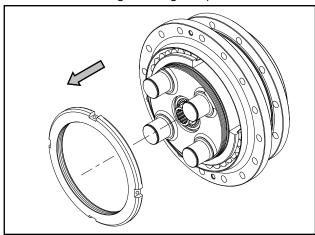
8. Disassemble the Ø40 outer snap rings and using an extractor remove the planetary gears from the spindle pins.



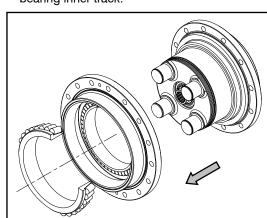
Loosen the M6x6 socket headless screws and also remove the 3/16" balls.



10. Loosen the ring nut using the special wrench.



11. Remove the hub support together with the roller bearing inner track.



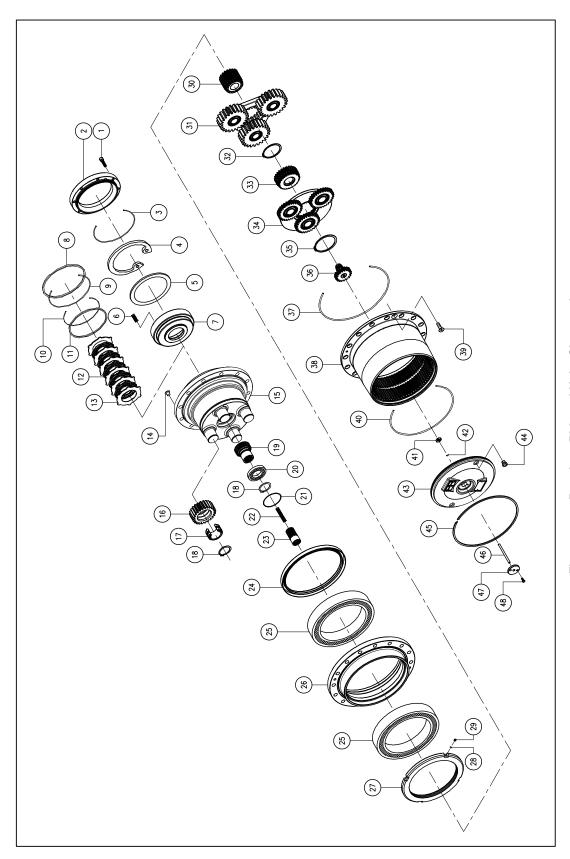
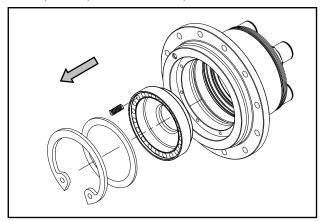


Figure 3-31. Reggiana Riduttori Hub - Sheet 1 of 2

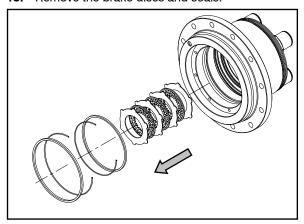
.	Screw	13. Iron Brake Disc	25. Tapered Roller Bearing	37. 0-ring
۲,	Motor Support	14. Plastic Plug	26. Bearing Support	38. Crown Gear
რ.	0-ring	15. Spindle	27. Ring Nut	39. Crown Gear Screw
4.	Inner Retention Ring	16. PlanetWheel	28. Sphere	40. O-ring
5.	Brake Spring Spacer	17. Bearing	29. Screw	41. Support Tablet
9	Brake Spring	18. Outer Retention Ring	30. Pinion	42. O-ring
7	Brake Piston	19. Input Shaft	31. Reduction Gears	43. Cover
∞.	8. Parbak	20. Input Shaft Bearing	32. Outer Retention Ring	44. Steel Plug
6	0-ring	21. Ring	33. Pinion	45. Cover Retaining Ring
10.	10. O-ring	22. Disengagement Spring	34. Reduction Gears	46. Disengagement Stud
Ξ	11. Parbak	23. Disengagement Shaft	35. Outer Retention Ring	47. Disengagement Cap
12.	12. Sintered Brake Disc	24. Spindle Oil Seal	36. Pinion	48. Disengagement Screw

Figure 3-32. Reggiana Riduttori Hub - Sheet 2 of 2

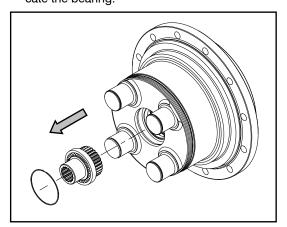
12. Disassemble the Ø160 inner snap ring and pull the spring holder spacer out. Remove the springs and using a compressed air jet in the brake control hole pull the piston out of the spindle.



13. Remove the brake discs and seals.

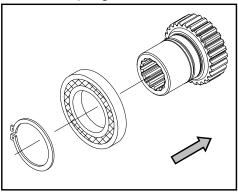


14. Fit the ball bearing into the input shaft and lock it with a Ø40 outer snap ring. Then mount the motor shaft in the spindle and lock with a BR68 ring. Lubricate the bearing.

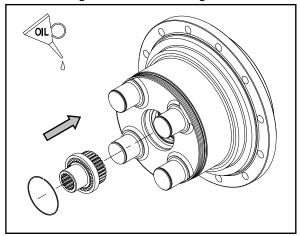


Assembly

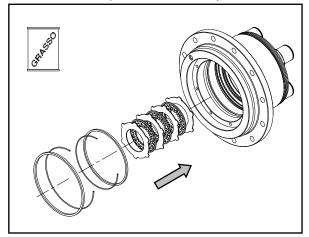
- Make sure all the component parts of the wheel gear are devoid of burrs, machining residues and that they are correctly washed.
- 2. Fit the ball bearing in the input shaft and lock with a Ø40 outer snap ring.



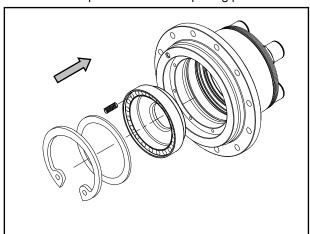
Mount the motor shaft in the spindle and lock with BR68 ring. Lubricate the bearing.



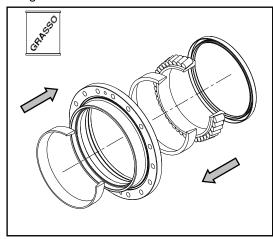
4. Fit the brake sealing rings O-Ring and PARBAK (lubricated with grease) in the respective spindle seats. Place the brake discs making sure to centre them on the spindle and on the input shaft.



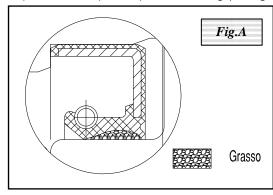
5. Insert the brake piston and place the springs into the piston holes. Close the brake fitting the spring holder plate, then lock with the Ø160 inner snap ring. Check the brake leakage, if any, as well as the static torque and minimum opening pressure.



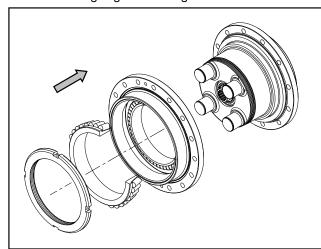
6. Prepare the hub support, mounting on it the two roller bearing outer tracks. Place the first roller bearing inner track.



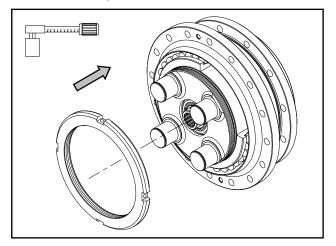
7. Fit the oil seal lubricated with grease onto the support with the special spacer mounting (see figure A).



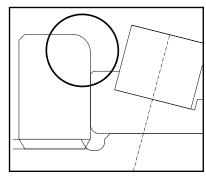
8. Place the hub support already assembled on the spindle making sure that the first roller bearing inner track goes correctly against it; then fit the second roller bearing inner track by means of the spacer mounting. Tighten the ring nut.



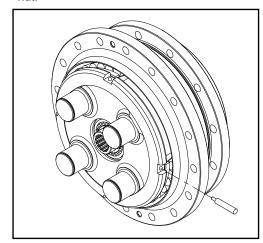
- **9.** Now check the unit roll torque and proceed in the following order:
- 10. By keeping the spindle locked, apply a setting preload by tightening the ring nut at 40daNm, turn completely the hub support twice using the special wrench to recover any bearing cage misalignments. Release and tighten the ring nut at the final torque of 30daNm (alternate tightening and some setting turns). Check the roll torque with seal which must be within 1÷1,5 daNm.



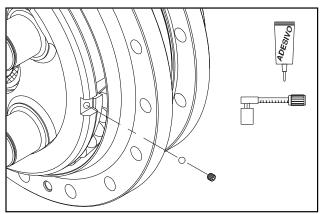
NOTE: Place the ring nut with its convex part facing the roller bearing as shown below.



 Using the special tool and hammer make four dents on the spindle thread by the M6 holes of the ring nut.

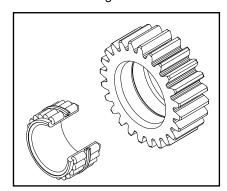


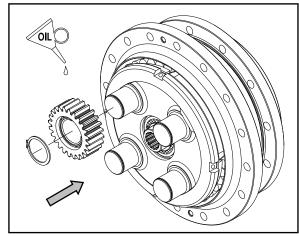
 Fit the 4 3/16" balls and tighten with LOCTITE 243 the 4 M6x6 socket headless screws at the torque of 1daNm.



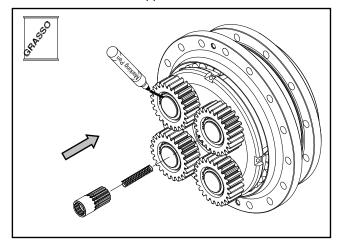
13. Fit the bearings onto the 3rd stage planetary gears and using a spacer mounting mount everything on

the spindle pins. Lock with a ÿ40 outer snap ring. Lubricate the bearings.

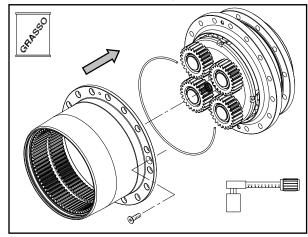




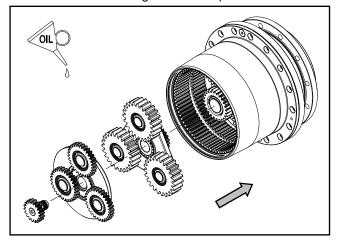
14. Using a marking pen, make a mark between the snap ring and the bearing. Fit the greased spring and the release joint. Use grease to fit the O-Ring 2-275 in the hub support seat.



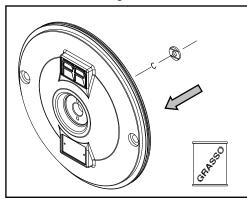
15. Place the hub onto the support making the two holes coincide for tightening the M10x25 flathead socket screws at the torque of 5daNm.



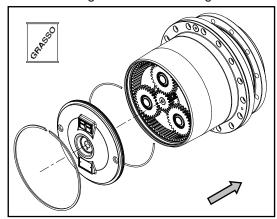
16. Fit the reduction gears and the pinion in the unit.



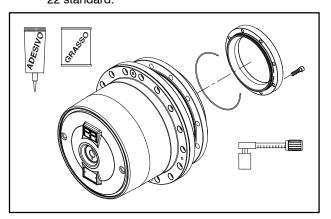
17. Prepare the closing cover fitting the O-ring 5-582 suitably greased and lock it with the shimming ring. Lubricate the bearings.



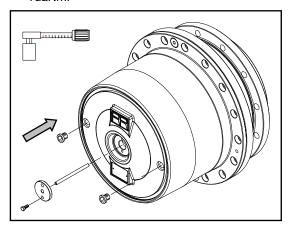
18. Fit the O-Ring 2-177 suitably greased, mount the cover locking it with the BR250 ring.



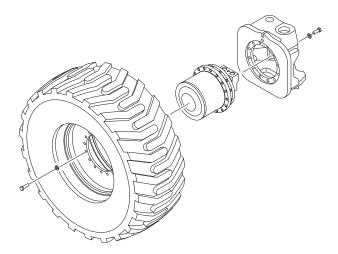
19. Fit the O-Ring 2-163 suitably greased, onto the motor coupling flange S-D LC/KC. Mount the flange on the spindle with 6 M8x25 socket cap screws at the torque of 2.4daNm with LOCTITE 243 Insert the pin and carry out the rotation test according to PGQ-22 standard.



20. Mount the release cover fastening it with 2 M6x20 hexagonal screws at the torque of 1daNm. Mount the 1/4"GAS plugs on the cover at the torque of 1daNm.



Installation



NOTE: The drive hub including drive motor weighs approximately 307 lbs. (139 kg). The non-drive hub weighs approximately 140 lbs. (63.5 kg).

- Use an adequate lifting device to support the weight of the hub.
- Align the hub assembly with the mounting holes in the spindle. Apply Loctite #271 to the bolts, and secure the hub to the spindle with the bolts and washers.
- Install the tire and wheel assembly. Refer to Section 3.1, Tires & Wheels.

3.12 SWING DRIVE

Roll and Leak Testing

Torque-Hub units should always be roll and leak tested before disassembly and after assembly to make sure that the unit's gears, bearings and seals are working properly. The following information briefly outlines what to look for when performing these tests.

NOTE: The brake must be released before performing the roll test. This can be accomplished by either pressure testing using the Brake Leak Test procedure below or by tightening the 12 bolts into the piston through the end plate (See Brake Disassembly Procedure)

NOTE: Bolts must be removed while performing brake release test

Roll Test

The purpose of the roll test is to determine if the unit's gears are rotating freely and properly. You should be able to rotate the gears in your unit by applying <u>constant</u> force to the roll checker. If you feel <u>more</u> drag in the gears only at certain points, then the gears are not rolling freely and should be examined for improper installation or defects. Some gear packages roll with more difficulty than others. Do not be concerned if the gears in your unit seem to roll hard as long as they roll with <u>consistency</u>.

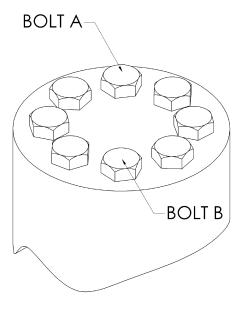
LEAK TEST (MAIN UNIT)

The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your air checker starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings or gaskets are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where the orings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, oring or gasket, the part must be replaced, and the unit rechecked. Leak test at 10 psi (0.7 bar) for 20 minutes.

Tightening and Torquing Bolts

If an air impact wrench is used to tighten bolts, extreme care should be taken to ensure that the bolts are not tightened beyond their specified torque.

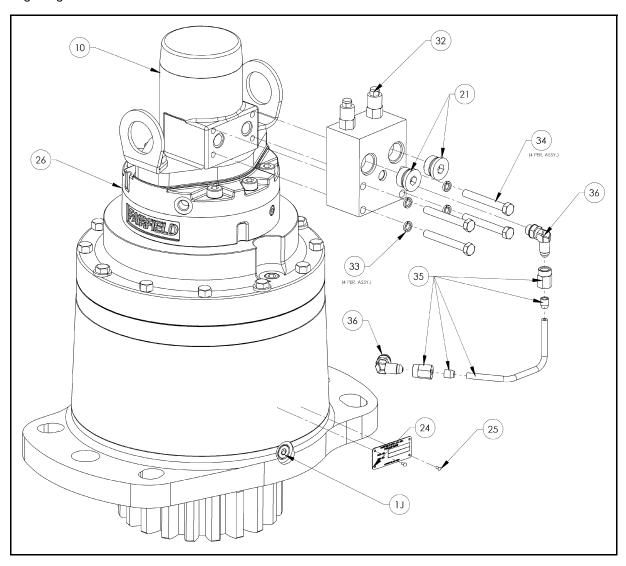
The following steps describe how to tighten and torque bolts or socket head cap screws in a bolt circle.



- 1. Tighten (but do not torque) bolt "A" until snug.
- Go to the opposite side of the bolt circle and tighten bolt "B" until equally snug.
- Crisscross around the bolt circle and tighten remaining bolts.
- Now use a torque wrench to apply the specified torque to bolt "A".
- Using the same sequence, crisscross around the bolt circle and apply an equal torque to the remaining bolts.

Motor Control Valve Disassembly

- 1. Place unit on bench with the motor end up.
- Remove O-ring Plug (1J) and drain the oil from the gearbox.
- **3.** Remove Hydraulic Tubing Assembly (35) by loosening fittings on both ends of tube with a wrench.
- **4.** Using a wrench, loosen jam nuts on Elbow Fittings (36) and remove fittings from Brake (26) and Motor Control Valve (32).
- Remove O-ring Plugs (21) from Motor Control Valve (32).
- **6.** Remove Motor Control Valve (32) from Motor (10) by removing the four Bolts (34) and washers (33).

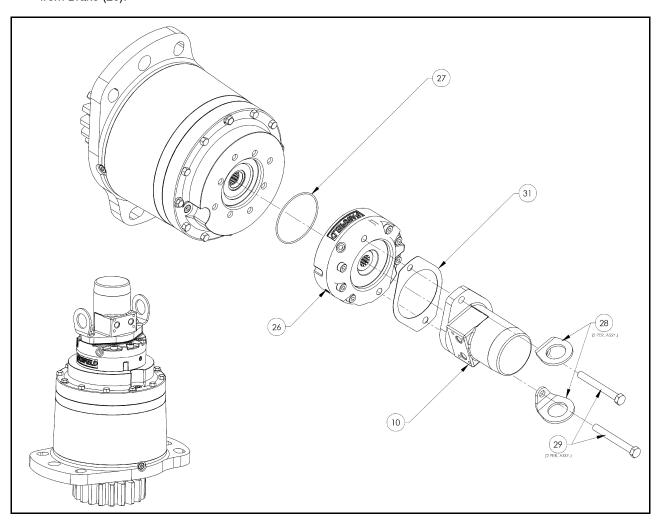


- 1J. O-Ring Plug
- 10. Hydraulic Motor
- 21. Plug
- 24. ID Plate
- 25. Drive Screw
- 26. Hydraulic Brake
- 32. Motor Control Valve
- 33. Lockwasher
- 34. Hex Bolt
- 35. Hydraulic Tubing
- 36. Elbow

Figure 3-33. Swing Drive - Motor Control Valve Disassembly

Motor and Brake Disassembly

- 1. With unit resting on bench with Motor (10) end up, loosen Hex Bolts (29) and remove Lift Lugs (28) from the Motor (10).
- 2. Pull Motor (10) straight up and remove Motor (10) from Brake (26).
- 3. Remove Gasket (31) from between Brake (26) and Motor (10).
- **4.** Remove Brake (26) from Main Torque-Hub Assembly and dump oil out of Brake (26).
- **5.** Remove O-ring (27) from between Motor (10) and Brake (26).



10. Hydraulic Motor

28. Lift Lug

26. Hydraulic Brake

29. Bolt

27. 0-Ring

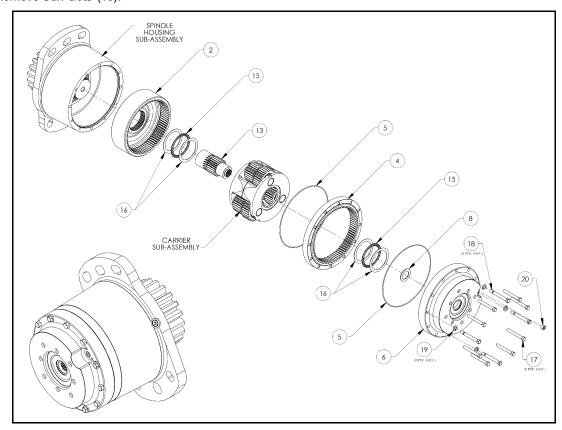
31. Gasket

Figure 3-34. Swing Drive - Motor and Brake Disassembly

Main Disassembly

- With the unit resting on the Output Shaft (Pinion) (1A), remove the eight Bolts (17), four Shoulder Bolts (18) and four Lock Washers (19) from the Input Cover (6).
- 2. Thread either 1/2-13 UNC eye bolts or motor mounting Bolts (29) into threaded holes in Input Cover (6) and pull Input Cover (6) off on the main assembly.
- Remove O-ring (5) from between Input Cover (6) and Ring Gear (4).
- Remove Thrust Washer (8) from end of Sun Gear (13).
- 5. Remove Sun Gear (13).

- Remove Thrust Washers (16) and Thrust Bearing (15) from between Input Cover (6) and Carrier (3A) Subassembly.
- 7. Remove Ring Gear (4) from Housing (1G).
- **8.** Remove O-ring (5) from between Ring Gear (4) and Housing (1G).
- 9. Remove Carrier (3A) Subassembly.
- Remove Thrust Washers (16) and Thrust Bearing (15) from between Carrier (3A) Subassembly and Internal Gear (2).
- 11. Remove Internal Gear (2).



- 2. Internal Gear
- 4. Ring Gear
- 5. O-Ring
- 6. Input Cover
- 8. Hex Bolt
- 13. Sun Gear
- 15. Thrust Bearing
- 16. Thrust Washer
- 17. Hex Bolt
- 18. Shoulder Bolt
- 19. Lockwasher
- 20. Pipe Plug

Figure 3-35. Swing Drive - Main Disassembly

Hub-Shaft Disassembly

 Using retaining ring pliers, remove Retaining Ring (1l) from groove in Output Shaft (1A) and discard.

A WARNING

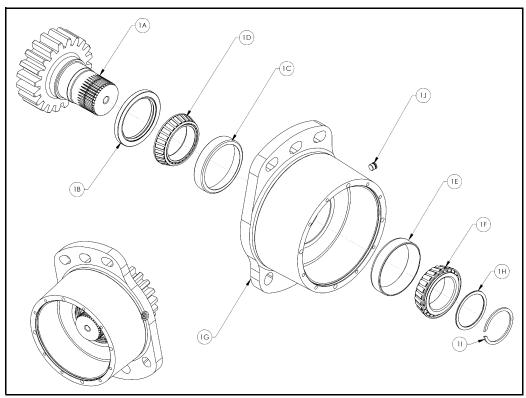
EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

- 2. Remove Thrust Washer (1H).
- 3. While supporting the Housing (1G) on the Output Shaft (1A) end, press the Output Shaft (1A) out of the Housing (1G).

NOTE: The Lip Seal (1B) may or may not be pressed out of the Housing (1G) by the Bearing Cone (1D) during this step.

- 4. Remove the Bearing Cone (1F) from the Housing (1G).
- Invert the Housing (1G) and remove the Lip Seal (1B) if not already removed when Output Shaft (1A) was pressed out of Housing (1G).
- 6. Remove the Bearing Cone (1D).
- 7. Bearing Cups (1C & 1E) will remain in Housing (1G).

NOTE: If bearing replacement is necessary, the Bearing Cups (1C & 1E) can be removed with a slide hammer puller or driven out with a punch.



- 1A. Output Shaft
- 1B. Lip Seal
- 1C. Tapered Bearing Cup
- 1D. Tapered Bearing Cone
- 1E. Tapered Bearing Cup
- 1F. Tapered Bearing Cone
- 1G. Housing
- 1H. Thrust Washer
- 11. Retaining Ring
- 1J. O-Ring Plug

Figure 3-36. Swing Drive - Hub Shaft Disassembly

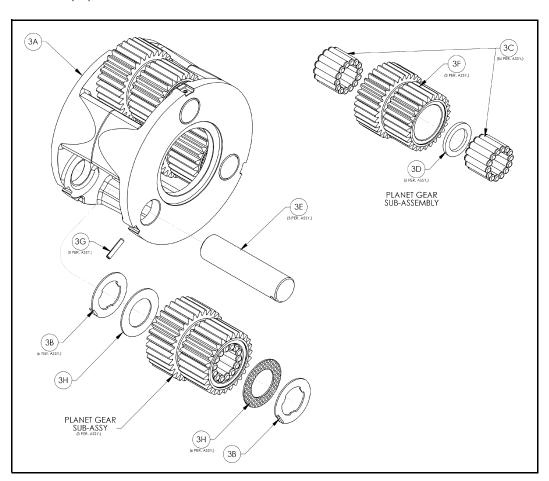
Carrier Disassembly

1. Using a 3/16" (5 mm) punch drive the Roll Pin (3G) which holds the Planet Shaft (3E) in the Carrier (3A) down into the Planet Shaft (3E) until it bottoms.

NOTE: Make sure that the Roll Pin has bottomed. Otherwise, damage to the carrier could occur when the Planet Shaft is removed.

2. Remove the Planet Shaft (3E) from the Carrier (3A). Use a small punch to remove the Roll Pin (3G) from the Planet Shaft (3E).

- 3. Slide the Planet Gear (3F), two Ball-Indented Thrust Washers (3H) and the two Thrust Washers (3B) out of the Carrier (3A).
- Remove both rows of Needle Bearings (3C) and the Spacer (3D) from the bore of the Planet Gear (3F).
- Repeat Steps 1 thru 4 for the remaining two Cluster Gears(3F).



- 3A. Carrier
- 3B. Tanged Thrust Washer
- 3C. Needle Bearing
- 3D. Thrust Washer
- 3E. Planet Shaft
- 3F. Cluster Gear
- 3G. Roll Pin
- 3H. Ball Indented Washer

Figure 3-37. Swing Drive - Carrier Disassembly

Hub-Shaft Sub-Assembly

- 1. Press Bearing Cone (1D) onto Shaft (1A).
- 2. Press Bearing Cup (1C) into Housing (1G), take care to insure cup starts square with bore of Hub (1G).
- 3. Place Bearing Cone (1D) in Bearing Cup (1C) in Housing 1G).
- 4. Press or tap Seal (1B) into the counterbore of Housing (1G) to the point where it becomes flush with the Housing (1G) face. Care should be taken to insure Seal (1B) is being correctly installed (smooth face up).
- 5. Invert Hub (1G) and press Bearing Cup (1E) into counterbore of Housing (1G).
- Carefully lower Housing (1G) onto the Output Shaft (1A).
- Start the Bearing Cone (1F) onto the Output Shaft (1A).

- Press or tap the Bearing Cone (1F) onto the Output Shaft (1A) until it is seated in the Bearing Cup (1E).
- Install Bearing Spacer (1H) onto Output Shaft (1A) and against Bearing Cone (1F).
- 10. Install Retaining Ring (1I) into the groove in the Output Shaft (1A). This Retaining Ring (1I) should never be reused in a repair or rebuild.

A WARNING

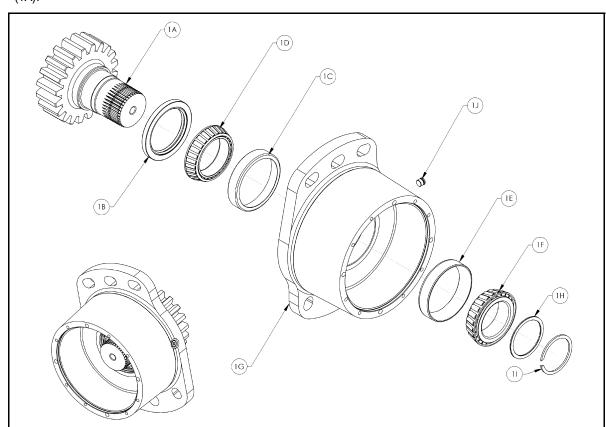
EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

11. Tap the Retaining Ring (1I) with a soft metal punch to ensure that the Retaining Ring (1I) is completely seated in the groove of the Output Shaft (1A).

▲ WARNING

EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

12. Install O-ring Plug (1J) and torque 23 to 24 ft-lbs.(32 - 33.5 Nm).



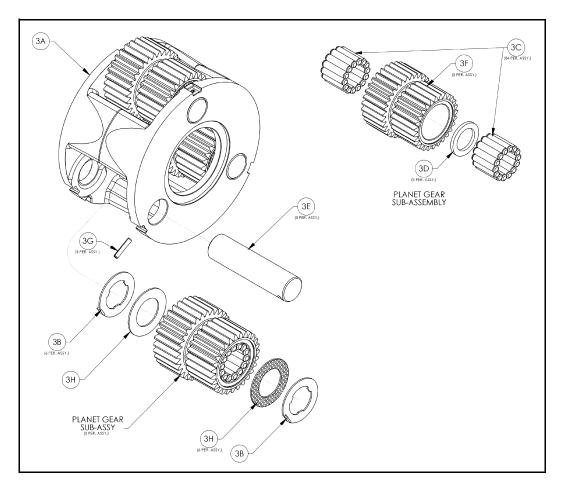
- 1A. Output Shaft
- 1B. Lip Seal
- 1C. Tapered Bearing Cup
- 1D. Tapered Bearing Cone
- 1E. Tapered Bearing Cup
- 1F. Tapered Bearing Cone
- 1G. Housing
- 1H. Thrust Washer
- 11. Retaining Ring
- 1J. 0-Ring Plug

Figure 3-38. Swing Drive - Hub Shaft Sub-Assembly

Carrier Sub-Assembly

- 1. Apply a liberal coat of grease to the bore of Cluster Gear (3F). This will enable the Needle Rollers (3C) to be held in place during assembly.
- 2. Install the first row of 14 Needle Rollers (3C) into the bore of Cluster Gear (3F).
- Insert Spacer (3D) into bore of Cluster Gear (3F) on top of the Needle Rollers (3C).
- Place second row of Needle Rollers (3C) into bore of Cluster Gear (3F) against Spacer (3D) and remove Planet Shaft (3E).
- Place Carrier (3A) into tool fixture so that one of the roll pin holes is straight up.
- 6. Start Planet Shaft (3E) through the hole in Carrier (3A). Using ample grease to hold it in position, slide one Thrust Washer (3B) over the Planet Shaft (3E) with the tang resting in the cast slot of the Carrier (3A). Place Ball-Indented Thrust Washer (3H) on the Planet Shaft (3E) with the indents against the first washer.
- 7. With large end of Cluster Gear (3F) facing the roll pin hole in the carrier, place the cluster gear into position in Carrier (3A) and push Planet Shaft (3E) through the Cluster Gear (3F) without going all the way through.

- 8. Slide the second Thrust Washer (3E) between the Cluster Gear (3F) and the Carrier (3A) with the tang of the washer located in the cast slot of the Carrier (3A). Slide ball-indented Thrust Washer (3H) onto the end of the Planet Shaft with the indents against the second thrust Washer. Finish sliding the Planet Shaft (3E) through the Thrust Washers (3H) & (3B) and into the Carrier (3A).
- Position the non-chamfered side on the Planet Shaft (3E) roll pin hole so that it is in line with the hole in the Carrier (3A) using a 1/8" (3 mm) diameter punch.
- 10. After using a 3/16" (5 mm) punch to align the two roll pin holes. Drive the Roll Pin (3G) through Carrier (3A) and into the Planet Shaft (3E) until the Roll Pin (3G) is flush with the bottom of the cast tang slot in the Carrier (3A). Use a 1/4" (6 mm) pin punch to make sure the Roll Pin (3G) is flush in the slot.
- Repeat Steps 1 thru 10 for the remaining two Cluster Gears(3F).



- 3A. Carrier
- 3B. Tanged Thrust Washer
- 3C. Needle Bearing
- 3D. Thrust Washer
- 3E. Planet Shaft 3F. Cluster Gear
- 3G. Roll Pin
- 3H. Ball Indented Washer

Figure 3-39. Swing Drive - Carrier Sub-Assembly

Main Assembly

- With the Hub Shaft Sub-Assembly resting on the Shaft (1A) install Internal Gear (2). The spline of the Internal Gear (2) bore will mesh with the spline of the Output Shaft (1A).
- Inspect the location of the Internal Gear (2) on the Output Shaft (1A). The portion of the Output Shaft (1A), which does not have full spline, should protrude through the Internal Gear (2) bore.
- Install two Thrust Washers (15) and one Thrust Bearing (16) on the portion of Output Shaft (1A) which protrudes through Internal Gear (2).
- Center the Input Gear (13) on the end of the Output Shaft (1A) opposite the gear with the large diameter down.
- Place O-ring (5) into Hub counter-bore. Use grease to hold O-ring in place.

A WARNING

BEWARE OF SHARP EDGES OF THE COUNTER BORE WHILE SEATING THIS O-RING.

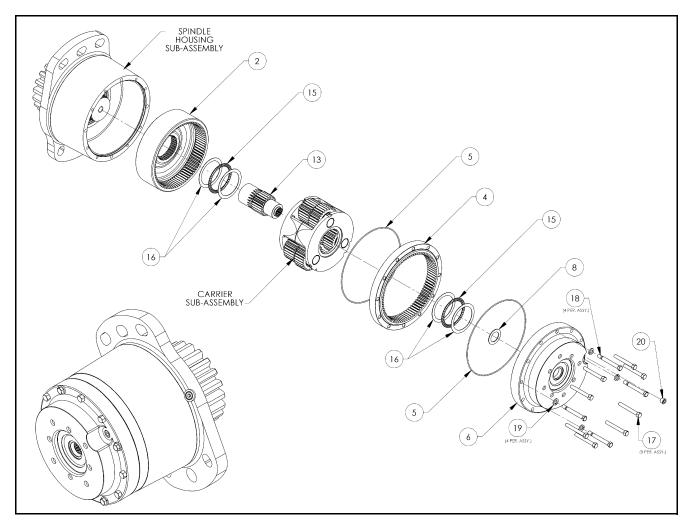
- 6. Also at this time locate and mark the four counter reamed holes in the face of the Hub (1G). This is for identification later in the assembly.
- 7. Place Carrier (3A) Subassembly on bench with the large end of Cluster Gears (3F) up with one at the 12 o clock position. Find the punch marked tooth on each gear at the large end and locate at 12 o'clock (straight up) from each planet pin. Marked tooth will be located just under the Carrier on upper two gears. Check the timing through the slots in the carrier.
- 8. With large shoulder side of Ring Gear (4) facing down, place Ring Gear (4) over (into mesh with) large end of gears. Be sure that punch marks remain in correct location during Ring Gear (4) installation. The side of the Ring Gear (4) with an "X" or punch mark stamped on it should be up.

- 9. While holding Ring Gear (4) and Cluster Gears (3F) in mesh, place small end of Cluster Gears (3F) into mesh with the Internal Gear (2) and Input Gear (13). On the Ring Gear (4) locate the hole marked "X", or punch marked, over one of the marked counterbored holes (Step 5) in Hub (1G). Check timing through the slots in the carrier. Rotate carrier in assembly to check for freedom of rotation.
- NOTE: NOTE: If gears do not mesh easily or Carrier Assembly does not rotate freely, then remove the Carrier and Ring Gear and check the Cluster Gear timing
 - 10. Install Thrust Washer (15)/Thrust Bearing (16) set into the counter-bore in the face of the carrier. Use grease to hold in place.
 - **11.** Place O-ring (5) into Cover (6) counter-bore. Use grease to hold O-Ring in place.

A WARNING

CAUTION: BEWARE OF SHARP EDGES OF THE COUNTER-BORE WHILE SEATING THIS O-RING.

- **12.** Using sufficient grease to hold in place, install Thrust Washer (8) into the counter-bore of the interface of the Cover (6).
- The Cover (6) is now installed, taking care to correctly align Pipe Plug hole (20) with those in the Hub (1J). Check timing sheet.
- 14. Locate the 4 counter-bored holes in Hub (1G) [marked in Step 5] and install 4 Shoulder Bolts (18) with Lockwashers (19). Start the shoulder bolts by hand
- **15.** Install Grade 8 Bolts (17) with Lockwashers (19) into remaining holes.
- 16. Torque Shoulder Bolts (18) 43 to 47 ft.-lbs. (60 to 65 Nm) and Grade 8 Bolts (17) to 43 to 47 ft.-lbs. (60 to 65 Nm). Roll and leak test the assembly.
- 17. With gearbox standing on the pinion end fill gearbox with GEAROIL 80W90, to bottom of plug hole in cover at Pipe Plug (20).
- **18.** Install Pipe Plug (20) into Cover (6) using thread sealant.

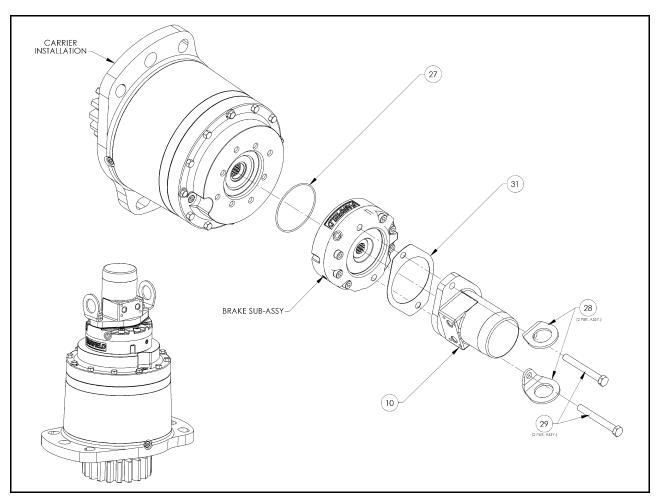


- 2. Internal Gear
- Ring Gear
- 5. O-Ring
- Input Cover
- 8. Hex Bolt 13. Sun Gear
- 15. Thrust Bearing16. Thrust Washer
- 17. Hex Bolt
- 18. Shoulder Bolt
- 19. Lockwasher
- 20. Pipe Plug

Figure 3-40. Swing Drive - Main Assembly

Motor and Brake Assembly

- 1. Place O-ring (27) onto end of Brake (26) and locate brake into pilot of cover.
- 2. Place Gasket (31) onto the brake face and line up the holes.
- 3. Place Motor (10) into Brake pilot against the Gasket (31).
- 4. Assemble Lift Lugs (28) onto Hex Bolts (29). Assemble Hex Bolts (29) with Lift Lugs through the Motor (10) and Brake (26) against the motor flange. Torque to 35 ft-lbs.
- Fill Brake (26) with 2.7 oz. (80cc) of BRAKOILVG32 (DTE24).



Hydraulic Motor
 Hydraulic Brake
 O-Ring
 Gasket

Figure 3-41. Swing Drive - Motor and Brake Assembly

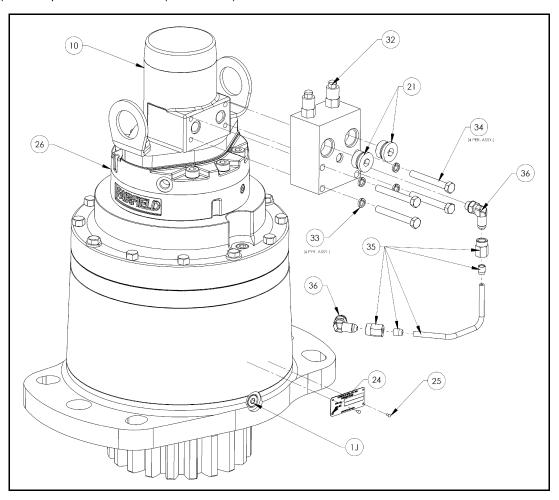
Motor Control Valve Assembly

 Lay assembly down with motor ports facing up. Remove the two plastic plugs in the motor ports, being careful not to loose the O-ring in each port. Assemble the Motor control Valve (32) onto the Motor (10) with Bolt (34) and Lock Washers (33). Torque Bolts (33) 23 to 27 ft-lbs. (32 to 38 Nm).

NOTE: Be sure to align the holes in the control valve with the motor ports.

- 2. Install Elbow Fittings (36) into Brake (26) and torque 13 to 15 ft-lbs. (18 to 21 Nm).
- 3. Install Elbow Fittings (36) into Motor Control Valve (32) and torque to 13 to 15 ft-lbs. (18 to 21 Nm).

- **4.** Assemble Tube (35) into Elbow Fittings (36) and torque 13 to 15 ft-lbs. (18 to 21 Nm).
- 5. Install O-ring Plugs (21) into Motor Control Valve (32) and torque 30 to 31 ft-lbs. (42 to 43 Nm).
- 6. Pressure test brake, tube and control valve connections by applying 3000 psi (207 bar) pressure to the brake bleed port and holding for 1 minute. Check for leaks at the control-valve-motor interface and the tube connections. Release pressure.
- 7. Place I.D. Plate (24) onto Housing (1G) with two Drive Screws (25). I.D. Plate (24) is to be inline with O-ring Plug (1J) as shown on assembly print.



- 1J. O-Ring Plug
- 10. Hydraulic Motor
- 21. Plug
- 24. ID Plate

- 25. Drive Screw
- 26. Hydraulic Brake
- 32. Motor Control Valve
- 33. Lockwasher
- 34. Hex Bolt
- 35. Hydraulic Tubing
- 36. Elbow

Figure 3-42. Swing Drive - Motor Control Valve Assembly

3.13 SWING BRAKE

Pre-Installation Checks

MECHANICAL

Check, That in the handling prior to assembly, the mounting features and other parts of the brake are undamaged. Ensure that the shaft to which the brake is mounted are clean and free from burrs and swellings.

HYDRAULIC/MECHANICAL

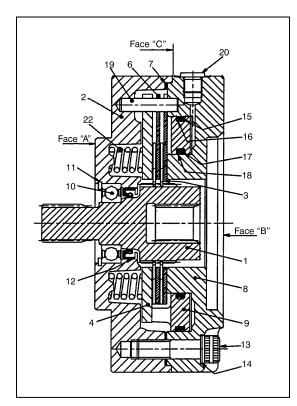
To check brake release, connect an appropriate hydraulic pressure supply set to the required level up to a maximum

of 3000 psi (200bar) and check that brake shaft (1) is free to rotate.

Remove hydraulic supply from brake, checking to ensure that the friction plates (3 & 6) have engaged thus preventing rotation of brake shaft (1)

NOTICE

RELEASE PRESSURE DURING BENCH TESTING SHOULD BE LIMITED TO 2000 PSI (138 BAR) UNLESS BRAKE IS FULLY INSTALLED USING 2-OFF 1/2" UNC MOUNTING BOLTS IN THE THROUGH (MOUNTING) HOLES.



- 1. Brake Shaft
- 2. Housing
- 3. Inner Friction

Plate

- 4. Pressure Plate
- 5. Gasket
- 6. Outer Plate
- 7. Gasket
- 8. Cylinder

- 9. Piston
- 10. Deep Groove Ball Bearing
- 11. Internal Retaining Ring
- 12. Rotary Shaft Seal
- 13. Socket Head Cap Screw
- 14. Shakeproof Washer
- 15. O-Ring
- 16. Backing Ring

- 17. O-Ring
- 18. Backing Ring
- 19. Dowel Pin
- 20. Hexagon Plug
- 21. Plastic Plug
- 21A. Socket Pressure
- Plug
- 22. Spring (Natural)
- 23. Spring (Blue)

Figure 3-43. Swing Brake

Installation

Position 1-off gasket (5) over male pilot on brake housing (4).

Locate brake shaft (1) and secure brake in position using 2-off 1/2" UNC mounting bolts in the through mounting (fixing) holes provided.

Connect hydraulic pressure supply to brake pressure inlet port. Ensure that the hydraulic pressure is set to the required level up to a maximum of 3000 psi (200 bar) and check that the brake disengages and re-engages correctly.

Maintenance

The brake is required to be kept in good working order and must be included in the planned maintenance program for the equipment to which the brake is installed. This must include torque testing together with inspection and replacement of the working parts such as friction plates (3 & 6) and, springs (22 & 23). The frequency of inspection depends on the duty demanded of the brake.

Disassembly

To remove brake from its installed position, reverse procedure previously described in the installation instructions. Place the complete brake assembly on a clean, dry work bench.

Remove external gasket (5) as necessary.

NOTE: Refer to Diagrams for the following.

- Supporting brake face "A", remove the six socket head cap screws and washers (items 13 & 14) in equal increments to ensure the spring pressure within the brake is reduced gradually and evenly. Alternatively, if press is available, the cylinder housing (8) can be restrained on face "B" while removing the six socket head cap screws and washers (13 & 14).
 - The brake assembly can now be fully dismantled and parts examined.
- 2. Remove cylinder housing (8) and piston (9) subassembly and dismantle if required, removing O-ring seals (15 & 17) and backing rings (16 & 18) as necessary.
- 3. Remove gasket (7) from housing (2).
- Remove friction plates (3 & 6) and pressure plate (4).
- 5. Remove 2-off dowel pins (19).
- 6. Remove springs (22 & 23).
- Should it be necessary to replace ball bearing (10) or shaft seal (12), reverse remainder of brake subassembly, supporting on face "c" of housing (2).

- 8. Remove internal retaining ring (11).
- Using arbor press or similar to break Loctite seal, remove brake shaft (1) from housing (2) and lay aside.
- Reverse housing (2) and press out ball bearing (10).
 Shaft seal (12) can also be removed if necessary.

Examination

All components can now be examined and inspected, paying particular attention to the following.

- 1. Inspect friction plates (3 & 6) and friction surface on pressure plate (4) for wear or damage.
- Examine friction plates (3) and brake shaft (1) for wear or damage to splines.
- 3. Examine input and output splines of brake shaft (1) for wear or damage.
- Examine compression springs (22 & 23) for damage or fatigue.
- 5. Check ball bearing (10) for axial float or wear.
- **6.** Examine O-ring seals (15 & 17) and backing rings (16 & 18) for damage.
- 7. Obtain replacement parts as required.

Assembly

Clean all parts thoroughly.

Reverse procedure previously outlined in Dismantling instructions taking particular care with.

- a. Assembly of shaft seal (12).
- b. Assembly of bearing (10).
- c. Quantity and orientation of springs (22 & 23).
- d. Assembly sequence of friction plates (3 & 6).
- Lightly lubricate rotary shaft seal (12) and assemble to housing (2) taking care not to damage seal lip.
- 2. Apply ring of Loctite 641 or equivalent adhesive to full circumference of housing (2) bearing recess adjacent to shoulder.

Apply complete coverage of Loctite 641 to outside diameter of bearing (10) and assemble fully in housing (2), retaining with internal retaining ring (11). Remove excess adhesive with clean cloth.

Press shaft (1) through bearing (10), ensuring bearing inner ring is adequately supported.

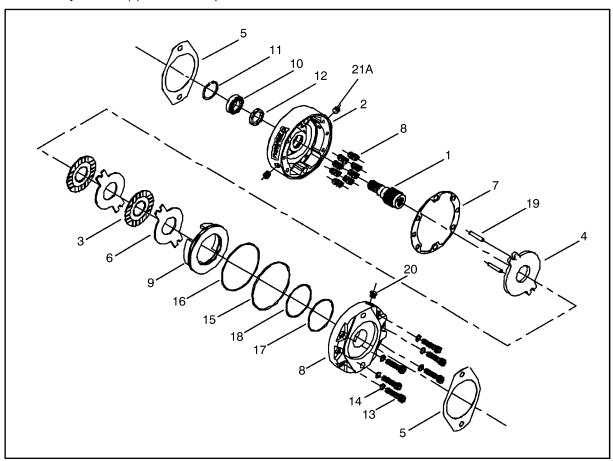
- Assemble correct quantity of springs (22 & 23) in orientation required.
- Lubricate O-ring seals (15 & 17) with Molykote 55M (or equivalent) silicone grease and assemble together with backing rings (16 & 18) to piston (9).

To ensure correct brake operation, it is important that the backing rings are assembled opposite ti the pressurized side of piston (9).

- 5. Correctly orientate piston (9) aligning spaces with the two dowel pin holes and, assemble into cylinder housing (8) taking care not to damage seals and carefully lay aside.
- **6.** Loctite 2-off pins (19) in housing (2) followed by pressure plate (4) and friction plates i.e. an inner (3) followed by an outer (6) in correct sequence.

- 7. Position gasket (7) in correct orientation.
- 8. Align two holes in cylinder with dowel pins (19) and assemble piston & cylinder sub-assembly to remainder of brake securing with 6-off socket head cap screws and washers (13 & 14). Torque to 55ft/lbs. (75 Nm).

NOTE: The use of a suitable press (hydraulic or arbor) Pressing down on cylinder end face "B" will ease assembly of the socket head cap screws (13).



- 1. Brake Shaft
- 2. Housing
- 3. Inner Friction

Plate

- 4. Pressure Plate
- 5. Gasket
- 6. Outer Plate
- 7. Gasket

- 8. Cylinder
- 9. Piston
- 10. Deep Groove Ball Bearing
- 11. Internal Retaining Ring
- 12. Rotary Shaft Seal
- 13. Socket Head Cap Screw
- 14. Shakeproof Washer
- 15. O-Ring
- 16. Backing Ring
- 17. O-Ring
- 18. Backing Ring
- 19. Dowel Pin
- 20. Hexagon Plug
- 21. Plastic Plug
- 21A. Socket Pressure

Plug

Figure 3-44. Swing Brake Assembly

3.14 SWING MOTOR

Disassembly and inspection

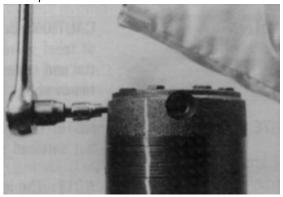
Place the Torqlink™ in a soft jawed vice, with coupling shaft (12) pointed down and the vise jaws clamping firmly on the sides of the housing (18) mounting flange or port bosses. Remove manifold port O-Rings (18A) if applicable.

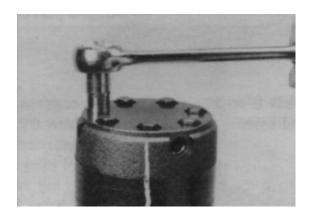


A WARNING

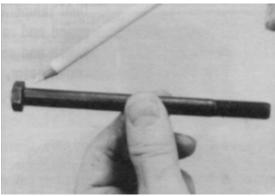
IFTHETORQLINK™ IS NOT FIRMLY HELD IN THE VISE, IT COULD BE DISLODGED DURINGTHE SERVICE PROCEDURES, CAUSING INJURY.

2. Scribe an alignment mark down and across the Torqlink™ components from end cover (2) to housing (18) to facilitate reassembly orientation where required. Loosen two shuttle or relief valve plugs (21) for disassembly later if included in end cover. 3/16 or 3/8 inch Allen wrench or 1 inch hex socket required.





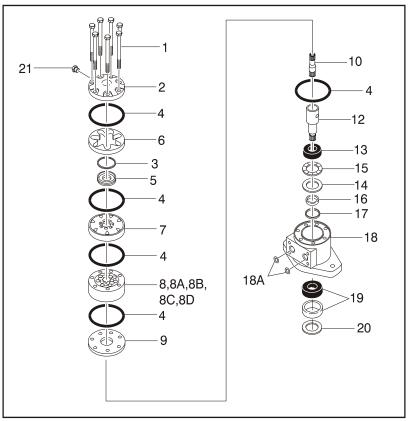
 Remove the five, six, or seven special ring head bolts (1) using an appropriate 1/2 or 9/16 inch size socket. Inspect bolts for damaged threads, or sealing rings, under the bolt head. Replace damaged bolts.



4. Remove end cover assembly (2) and seal ring (4). Discard seal ring.



NOTE: Refer to the appropriate "alternate cover construction" on the exploded view to determine the end cover construction being serviced.



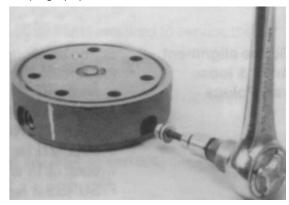
- 1. Special Bolts
- 2. End Cover
- 3. Seal Ring-Commutator
- 4. Seal Ring
- 5. Commutator Ring
- 6. Commutator Ring
- 7. Manifold
- 8. Rotor Set
- 8A. Rotor

- 8B. Stator or Stator Vane
- 8C. Vane
- 8D. Stator Half
- 9. Wear Plate
- 10. Drive Link
- 11. Not Used
- 12. Coupling Shaft
- 13. Bearing/Bushing,
- Inner
- 14. Thrust Washer

- 15. Thrust Bearing
- 16. Seal
- 17. Back-up Washer
- 18. Housing
- 18A. O-Ring
- 19. Bearing/Bushing,
- Outer
- 20. Dirt & Water Seal
- 21. Plug

Figure 3-45. Swing Drive Motor

5. If the end cover (2) is equipped with shuttle valve components, remove the two previously loosened plugs (21).

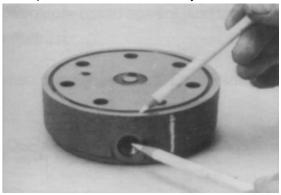


NOTICE

BE READY TO CATCH THE SHUTTLE VALVE OR RELIEF VALVE COMPONENTS THAT WILL FALL OUT OF THE END COVER VALVE CAVITY WHEN THE PLUGS ARE REMOVED.

NOTE: The insert and if included the orifice plug in the end cover (2) must not be removed as they are serviced as an integral part of the end cover.

6. Thoroughly wash end cover (2) in proper solvent and blow dry. Be sure the end cover valve apertures, including the internal orifice plug, are free of contamination. Inspect end cover for cracks and the bolt head recesses for good bolt head sealing surfaces. Replace end cover as necessary.



NOTE: A polished pattern (not scratches) on the cover from rotation of the commutator (5) is normal. Discoloration would indicate excess fluid temperature, thermal shock, or excess speed and require system investigation for cause and close inspection of end cover, commutator, manifold, and rotor set.

7. Remove commutator ring (6). Inspect commutator ring for cracks, or burrs.



8. Remove commutator (5) and seal ring (3) Remove seal ring from commutator, using an air hose to blow air into ring groove until seal ring is lifted out and discard seal ring. Inspect commutator for cracks or burrs, wear, scoring, spalling or brinelling. If any of these conditions exist, replace commutator and commutator ring as a matched set.





9. Remove manifold (7) and inspect for cracks surface scoring, brinelling or spalling. Replace manifold if any of these conditions exist. A polished pattern on the ground surface from commutator or rotor rotation is normal. Remove and discard the seal rings (4) that are on both sides of the manifold.



NOTE: The manifold is constructed of plates bonded together to form an integral component not subject to further disassembly for service. Compare configuration of both sides oft hem an if old to ensure that same surface is reassembled against the rotor set.

10. Remove rotor set (8) and warplane (9), together to retain the rotor set in its assembled form, maintaining the same rotor vane (8C) to stator (8B) contact surfaces. The drive link (10) may come away from the coupling shaft (12) with the rotor set, and wearplate. You may have to shift the rotor set on the warplane to work the drive link out of the rotor (8A) and warplane. Inspect the rotor set in its assembled form for nicks, scoring, or spalling on any surface and for broken or worn splines. If the rotor set component requires replacement, the complete rotor set must be replaced as it is a matched set. Inspect the warplane for cracks, brinelling, or scoring. Discard seal ring (4) that is between the rotor set and wearplate.



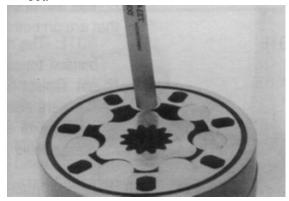
NOTE: The rotor set (8) components may become disassembled during service procedures. Marking the surface of the rotor and stator that is facing UP, with etching ink or grease pencil before removal from Torqlink™ will ensure correct reassembly of rotor into stator and rotor set intoTorqlink™.Marking all rotor components and mating spline components for exact repositioning at assembly will ensure maximum wear life and performance of rotor set andTorq-link™.



NOTE: Series TG Torqlinks[™] may have a rotor set with two stator halves (8B) with a seal ring (4) between them and two sets of seven vanes (8C). Discard seal ring only if stator halves become disassembled during the service procedures.

NOTE: A polished pattern on the wear plate from rotor rotation is normal.

11. Place rotor set (8) and wear plate (9) on a flat surface and center rotor (8A) in stator (8B) such that two rotor lobes (180 degrees apart) and a roller vane (8C) centerline are on the same stator centerline. Check the rotor lobe to roller vane clearance with a feeler gage at this common centerline. If there is more than 0.005 inches (0.13 mm) of clearance, replace rotor set.



NOTE: If rotor set (8) has two stator halves (8B & 8D) and two sets of seven vanes (8C & 8E) as shown in the alternate construction TG rotor set assembly view, check the rotor lobe to roller vane clearance at both ends of rotor.

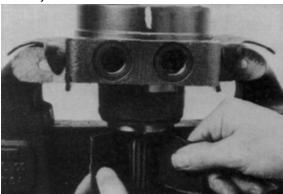
12. Remove drive link (10) from coupling shaft (12) if it was not removed with rotor set and wear plate. Inspect drive link for cracks and worn or damaged splines. No perceptible lash (play) should be noted between mating spline parts. Remove and discard seal ring (4) from housing (18).



13. Remove thrust bearing (11) from top of coupling shaft (12). Inspect for wear, brinelling, corrosion and a full complement of retained rollers.

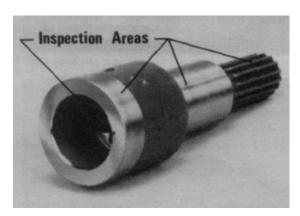


14. Check exposed portion of coupling shaft (12) to be sure you have removed all signs of rust and corrosion which might prevent its withdrawal through the seal and bearing. Crocus cloth or fine emery paper may be used.



15. Remove coupling shaft (12), by pushing on the output end of shaft. Inspect coupling shaft bearing and seal surfaces for spalling, nicks, grooves, severe wear or corrosion and discoloration. Inspect for damaged or worn internal and external splines or keyway. Replace coupling shaft if any of these conditions exist.





NOTE: Minor shaft wear in seal area is permissible. If wear exceeds 0.020 inches (0.51 mm) diametrically, replace coupling shaft.

NOTE: A slight "polish" is permissible in the shaft bearing areas. Anything more would require coupling shaft replacement.

16. 16. Remove and discard seal ring (4) from housing (18).

17. Remove thrust bearing (15) and thrust washer (14) Inspect for wear, brinelling, corrosion and a full complement of retained rollers.



18. Remove seal (16) and back up washer (17) from Small Frame, housing (18). Discard both.

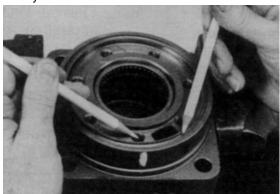




19. Remove housing (18) from vise, invert it and remove and discard seal (20). A blind hole bearing or seal puller is required.

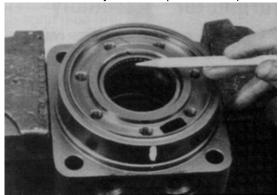


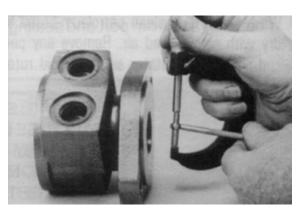
20. Inspect housing (18) assembly for cracks, the machined surfaces for nicks, burrs, brinelling or corrosion. Remove burrs that can be removed without changing dimensional characteristics. Inspect tapped holes for thread damage. If the housing is defective in these areas, discard the housing assembly.



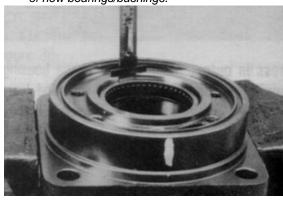
21. If the housing (18) assembly has passed inspection to this point, inspect the housing bearings/bushings (19) and (13) and if they are captured in the housing cavity the two thrust washers (14) and thrust bearing (15). The bearing rollers must be firmly retained in the bearing cages, but must rotate and orbit freely. All rollers and thrust washers must be free of brineling and corrosion. The bushing (19) or (13) to coupling shaft diameter clearance must not exceed 0.010 inch (0.025 mm). A bearing, bushing, or thrust washer that does not pass inspection must be

replaced. If the housing has passed this inspection the disassembly of the Torqlink $^{\text{TM}}$ is completed.

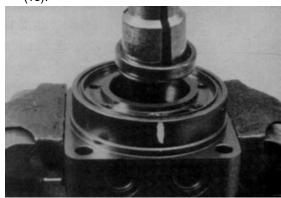


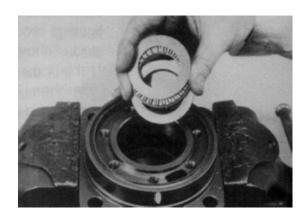


NOTE: The depth or location of bearing/bushing (13) in relation to the housing wear plate surface and the depth or location of bearing/bushing (19) in relation to the beginning of bearing/bushing counter bore should be measured and noted before removing the bearings/bushings. This will facilitate the correct reassembly of new bearings/bushings.



22. If the bearings, bushing or thrust washers must be replaced use a suitable size bearing puller to remove bearing/bushings (19) and (13) from housing (18) without damaging the housing. Remove thrust washers (14) and thrust bearing (15) if they were previously retained in the housing by bearing (13).





Assembly

Replace all seals and seal rings with new ones each time you reassemble the Torqlink™ unit. Lubricate all seals and seal rings with SAE 10W40 oil or clean grease before assembly.

NOTE: Individual seals and seal rings as well as a complete seal kit are available. The parts should be available through most OEM parts distributors or Parker approved Torqlink™ distributors. (Contact your local dealer for availability).

NOTE: Unless otherwise indicated, do not oil or grease parts before assembly.

Wash all parts in clean petroleum-based solvents before assembly. Blow them dry with compressed air. Remove any paint chips from mating surfaces of the end cover, commutator set, manifold rotor set, wear plate and housing and from port and sealing areas.

A DANGER

SINCE THEY ARE FLAMMABLE, BE EXTREMELY CAREFUL WHEN USING ANY SOLVENT. EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.

WARNING

WEAR EYE PROTECTION AND BE SURE TO COMPLY WITH OSHA OR OTHER MAXIMUM AIR PRESSURE REQUIREMENTS.

1. If the housing (18) bearing components were removed for replacement, thoroughly coat and pack a new outer bearing/bushing (19) with clean corrosion resistant grease recommended in the material section. Press the new bearing/bushing into the counterbore at the mounting flange end of the housing, using the appropriate sized bearing mandrel, which will control the bearing/ bushing depth.

Torqlink[™] housings require the use of bearing mandrel to press bearing/ bushing (19) into the housing to a required depth of 0.151/0.161 inches (3.84/4.09 mm) from the end of the bearing counterbore.





NOTE: Bearing mandrel must be pressed against the lettered end of bearing shell. Take care that the housing bore is square with the press base and the bearing/bushing is not cocked when pressing a bearing/bushing into the housing.

NOTICE

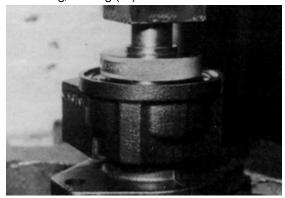
IF THE BEARING MANDREL SPECIFIED IN THE "TOOLS AND MATERIALS REQUIRED FOR SERVICING" SECTION IS NOT AVAILABLE AND ALTERNATE METHODS ARE USED TO PRESS IN BEARING/BUSHING (13) AND (19) THE BEARING/BUSHING DEPTHS SPECIFIED MUST BE ACHIEVED TO INSURE ADEQUATE BEARING SUPPORT AND CORRECT RELATIONSHIP TO ADJACENT COMPONENTS WHEN ASSEMBLED.

NOTICE

BECAUSE THE BEARING/BUSHINGS (13) AND (19) HAVE A PRESS FIT INTO THE HOUSING THEY MUST BE DISCARDED WHEN REMOVED. THEY MUST NOT BE REUSED.



2. The Torqlink™ inner housing bearing/bushing (13) can now be pressed into its counterbore in housing (18) flush to 0.03 inch (.76 mm) below the housing wear plate contact face. Use the opposite end of the bearing mandrel that was used to press in the outer bearing/bushing (19).



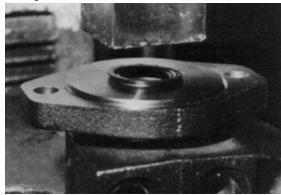


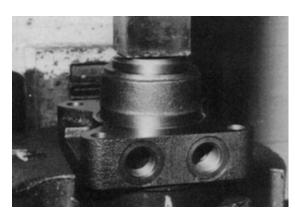




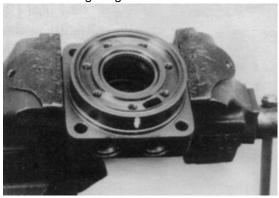
3. Press a **new** dirt and water seal (20) into the housing (18) outer bearing counterbore.

The Torqlink™ dirt and water seal (20) must be pressed in until its' flange is flush against the housing.





4. Place housing (18) assembly into a soft jawed vise with the coupling shaft bore down, clamping against the mounting flange.



5. On the Torqlinks™ assemble a new backup washer (17) and new seal (16) with the seal lip facing toward the inside of Torqlink™, into their respective counterbores in housing (18) if they were not assembled in procedure 2.





NOTICE

ORIGINAL DESIGN LARGE FRAME, TF & TG TORQLINKS™ THAT DO NOT HAVE BACKUP WASHER (25) WHEN DISASSEMBLED MUST BE ASSEMBLED WITH A NEW BACKUP WASHER (17), NEW BACKUP WASHER (25), AND NEW SEAL (16).

6. Assemble thrust washer (14) then thrust bearing (15) that was removed from the Torqlink[™].



NOTE: Torqlinks[™] require one thrust washer (14) with thrust bearing (15). The coupling shaft will be seated directly against the thrust

7. Apply masking tape around splines or keyway on shaft (12) to prevent damage to seal.



8. Be sure that a generous amount of clean corrosion resistant grease has been applied to the lower (outer) housing bearing/bushing (19). Install the coupling shaft (12) into housing (18), seating it against the thrust bearing (15) in the housings.



NOTICE

THE OUTER BEARING (19) IS NOT LUBRICATED BY THE SYSTEM'S HYDRAULIC FLUID. BE SURE IT IS THOROUGHLY PACKED WITH THE RECOMMENDED GREASE, PARKER GEAR GREASE SPECIFICATION #045236, E/M LUBRICANT #K-70M.

NOTE: Mobil Mobilith SHC ® 460

NOTE: A 102Tube (P/N 406010) is included in each seal kit.

NOTE: The coupling shaft (12) will be flush or just below the housing wear plate surface on TorqlinksTM when properly seated. The coupling shaft must rotate smoothly on the thrust bearing package.





9. Apply a small amount of clean grease to a **new** seal ring (4) and insert it into the housing (18) seal ring groove.



NOTE: One or two alignment studs screwed finger tight into housing (18) bolt holes, approximately 180 degrees apart, will facilitate the assembly and alignment of components as required in the following procedures. The studs can be made by cutting off the heads of either 3/8-24 UNF 2A or 5/16-24 UNF 2A bolts as required that are over 0.5 inch (12.7 mm) longer than the bolts (1) used in the TorqlinkTM.

10. Install drive link (10) the long splined end down into the coupling shaft (12) and engage the drive link splines into mesh with the coupling shaft splines.

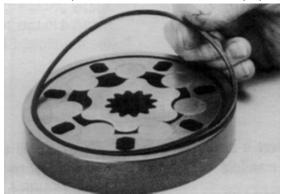


NOTE: Use any alignment marks put on the coupling shaft and drive link before disassembly to assemble the drive link splines in their original position in the mating coupling shaft splines.

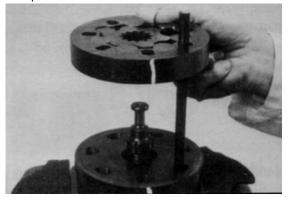
11. Assemble wear plate (9) over the drive link (10) and alignment studs onto the housing (18).



12. Apply a small amount of clean grease to a new seal ring (4) and assemble it into the seal ring groove on the wear plate side of the rotor set stator (8B).



13. Install the assembled rotor set (8) onto wear plate (9) with rotor (8A) counterbore and seal ring side down and the splines into mesh with the drive link splines.



NOTE: It may be necessary to turn one alignment stud out of the housing (18) temporarily to assemble rotor set (8) or manifold (7) over the drive link.

NOTE: If necessary, go to the appropriate, "Rotor Set Component Assembly Procedure."

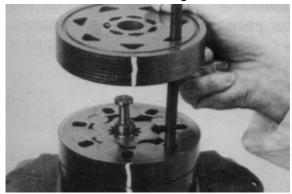
NOTE: The rotor set rotor counterbore side must be down against wear plate for drive link clearance and to maintain the original rotor-drive link spline contact. A rotor set without a counterbore and that was not etched before disassembly can be reinstalled using the drive link spline pattern on the rotor splines if apparent, to determine which side was down. The rotor set seal ring groove faces toward the wear plate (9).

14. Apply clean grease to a new seal ring (4) and assemble it in the seal ring groove in the rotor set contact side of manifold (7).

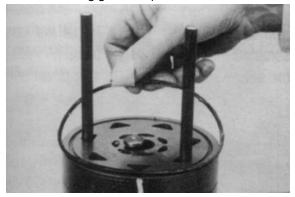


NOTE: The manifold (7) is made up of several plates bonded together permanently to form an integral component. The manifold surface that must contact the rotor set has it's series of irregular shaped cavities on the largest circumference or circle around the inside diameter. The polished impression left on the manifold by the rotor set is another indication of which surface must contact the rotor set.

15. Assemble the manifold (7) over the alignment studs and drive link (10) and onto the rotor set. Be sure the correct manifold surface is against the rotor set.



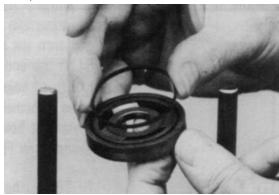
16. Apply grease to a **new** seal ring (4) and insert it in the seal ring groove exposed on the manifold.

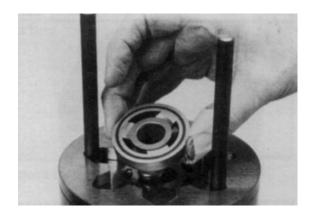


17. Assemble the commutator ring (6) over alignment studs onto the manifold.



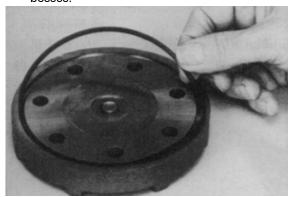
18. Assemble a **new** seal ring (3) flat side up, into commutator (5) and assemble commutator over the end of drive link (10) onto manifold (7) with seal ring side up.

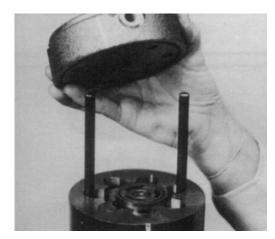


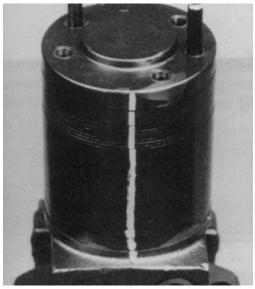


19. If shuttle valve components items #21, were removed from the end cover (2) turn a plug (21), loosely into one end of the valve cavity in the end cover. A 3/16 inch Allen wrench is required.

20. Assemble a new seal ring (4) into end cover (2) and assemble end cover over the alignment studs and onto the commutator set. If the end cover has only 5 bolt holes be sure the cover holes are aligned with the 5 threaded holes in housing (18). The correct 5 bolt end cover bolt hole relationship to housing port bosses.

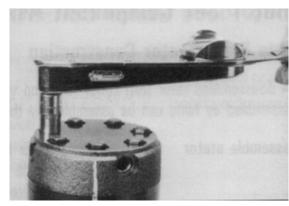


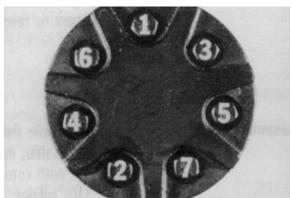




- **NOTE:** If the end cover has a valve (24) or has five bolt holes, use the line you previously scribed on the cover to radially align the end cover into its original position.
 - 21. Assemble the 5 or 7 special bolts (1) and screw in finger tight. Remove and replace the two alignment studs with bolts after the other bolts are in place. Alternately and progressively tighten the bolts to pull the end cover and other components into place with a final torque of 22-26 ft. lbs. 45-55 ft. lbs. (61-75 N m) for the seven 3/8-24 threaded bolts.



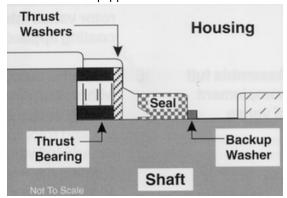




NOTE: The special bolts required for use with the relief or shuttle valve (24) end cover assembly (2) are longer than the bolts required with standard and cover assembly. Refer to the individual service parts lists or parts list charts for correct service part number if replacement is required.

22. Torque the two shuttle valve plug assemblies (21) in end cover assembly to 9-12 ft. lbs. (12-16 Nm) if cover is so equipped.

Torque the two relief valve plug assemblies (21) in end cover assembly to 45-55 ft. lbs.(61-75 Nm) if cover is so equipped.



One Piece Stator Construction

A disassembled rotor (8A) stator (8B) and vanes (8C) that cannot be readily assembled by hand can be assembled by the following procedures.

 Place stator (8B) onto wear plate (9) with seal ring (4) side down, after following Torqlink™ assembly procedures 1 through 13. Be sure the seal ring is in place.

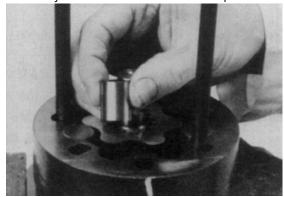


 If assembly alignment studs are not being utilized, align stator bolt holes with wear plate and housing bolt holes and turn two bolts (1) finger tight into bolt holes approximately 180 degrees apart to retain stator and wear plate stationary. **3.** Assemble the rotor (8A), counterbore down if applicable, into stator (8B), and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.



NOTE: If the manifold side of the rotor was etched during Torqlink disassembly, this side should be up. If the rotor is not etched and does not have a counterbore, use the drive link spline contact pattern apparent on the rotor splines to determine the rotor side that must be against the wear plate.

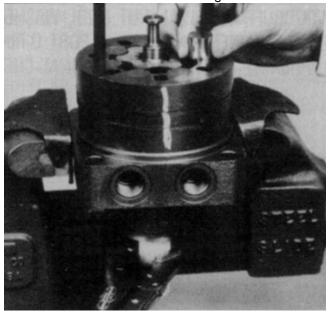
Assemble six vanes (8C), or as many vanes that will readily assemble into the stator vane pockets.



NOTICE

EXCESSIVE FORCE USED TO PUSH THE ROTOR VANES INTO PLACE COULD SHEAR OFF THE COATING APPLIED TO THE STATOR VANE POCKETS.

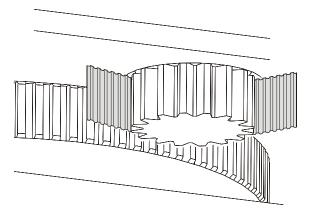
5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes (8C) into stator (8B), creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.



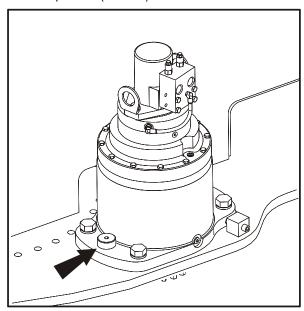
6. Remove the two assembled bolts (1) if used to retain stator and wear plate.

3.15 PROCEDURE FOR SETTING GEAR BACKLASH

- Set backlash to 0.010 to 0.015" using the following procedure.
- 2. Place shim (JLG p/n 4071041) between pinion and bearing on the bearing high spot. The bearing high spot should be stamped with an "X" on the surface below the teeth and marked with yellow paint in the tooth space.

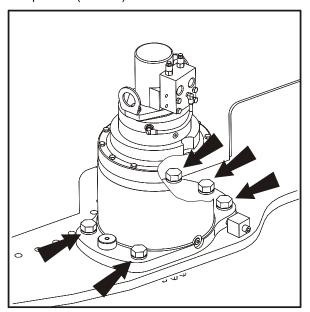


3. Torque the shoulder screw (shown below) to 660 foot-pounds (896 Nm) with Loctite #271.

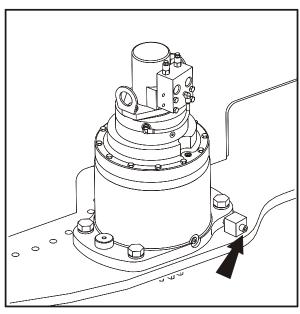


4. Remove the turntable lock pin.

5. Pre-torque the capscrews (shown below) to 90 footpounds (122 Nm) with Loctite #271.

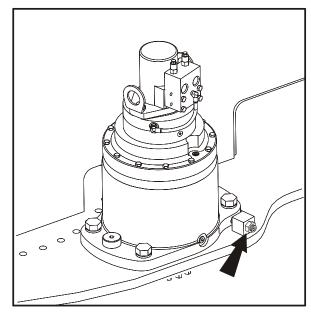


6. Tighten the setscrew (shown below) until the pinion is completely snug against the shim and bearing and then back off the setscrew.



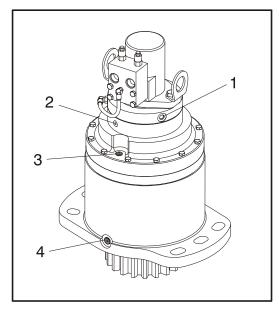
7. Torque the setscrew to 50 foot-pounds (68 Nm).

8. Tighten the jam nut (shown below) with Loctite #271.



- Torque the capscrews shown in step 5 to 660 footpounds (896 Nm).
- 10. Remove shim and discard.

3.16 SWING DRIVE LUBRICATION



- 1 Brake Bleed Port
- 2 Brake Fill Port
- 3 Gearbox Fill Port
- 4 Gearbox Drain Port

Figure 3-46. Swing Drive Ports

The Swing Gearbox is to be filled with 79 ounces (2.3 L) of API Service Classification GL-5 Extreme Pressure Gear Lube. Fill to cover the ring gear.

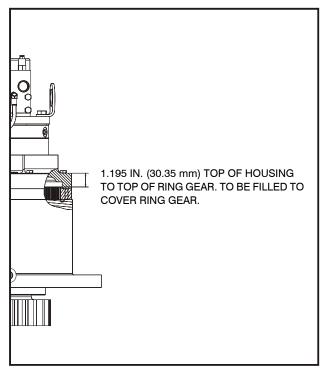


Figure 3-47. Swing Drive Lubrication

The Swing Brake is to be filled half full, 2.7 ounces (80 ml), with DTE24 oil.

3.17 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

NOTICE

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.

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 applying loctite #271 to the bolt threads. After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.

- 1. Check the frame to bearing attach bolts as follows:
 - a. Fully elevate the main boom. (See Figure 3-48.)
 - b. At the position indicated on Figure 3-48., try to insert a 0.0015 feeler gauge between the bolt and hardened washer at the arrow indicated position.

- c. Ensure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
- **d.** Swing the turntable 90 degrees, and check some selected bolts at the new position.
- e. 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:
 - Elevate the fully retracted main boom to full elevation.
 - b. At the position indicated on Figure 3-50. try to insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
 - c. Lower the boom to horizontal and fully extend the boom.
 - d. At the position indicated on Figure 3-49., try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

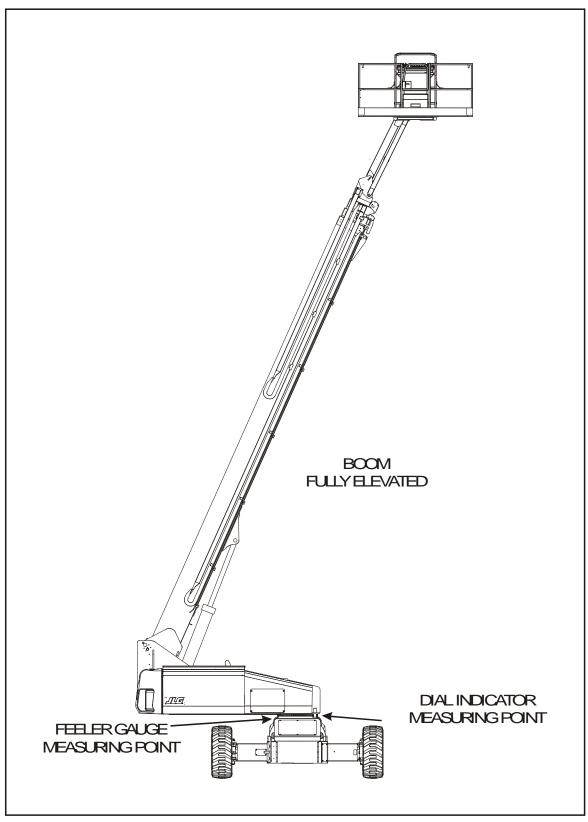


Figure 3-48. Swing Bearing Tolerance Boom Placement - Sheet 1 of 2

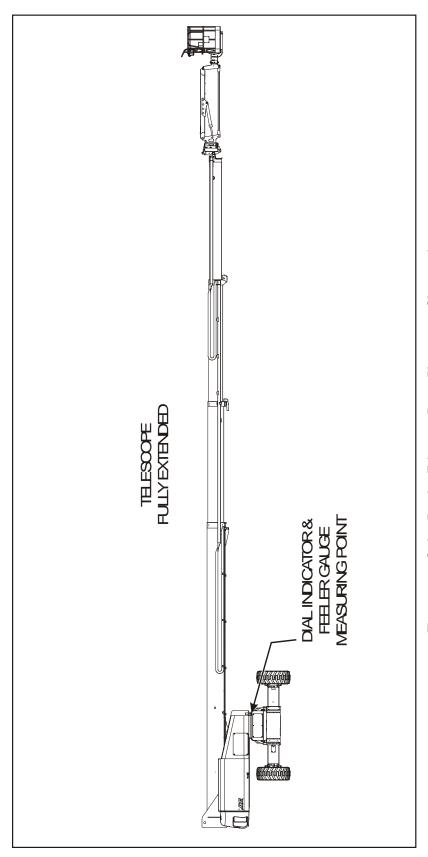


Figure 3-49. Swing Bearing Tolerance Boom Placement - Sheet 2 of 2

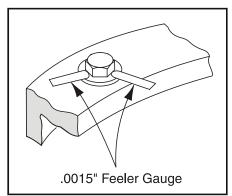


Figure 3-50. Swing Bolt Feeler Gauge Check

Wear Tolerance

 From the underside of the machine, at rear center, with the main boom fully elevated and fully retracted, as shown in Figure 3-48., Swing Bearing Tolerance Boom Placement - Sheet 1 of 2, set up a magnetic base dial indicator as shown below and set the indicator to 0 (zero).



 Next, position the main boom fully extended and horizontal as shown in Figure 3-49., Swing Bearing Tolerance Boom Placement - Sheet 2 of 2. Read the measurement recorded on the dial indicator gauge.

- **3.** If the measurement is greater than 0.094 in. (2.387 mm), the swing bearing should be replaced.
- 4. If the measurement is less than 0.094 in. (2.387 mm), 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.
- If bearing inspection shows no defects, reassemble and return to service.

Swing Bearing Removal

 From Ground Control station, operate the boom adequately to provide access to frame opening to rotary coupling.

A DANGER

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

Attach an adequate support sling to the boom and draw all slack from sling. Prop or block the boom if feasible.

NOTICE

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

Tag and disconnect the hydraulic lines from the fittings on the top of the rotary coupling. Use a suitable container to retain any residual hydraulic fluid. Immediately cap lines and ports.

NOTICE

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

4. From inside turntable, remove mounting hardware which attach rotary coupling retaining yoke brackets to turntable.

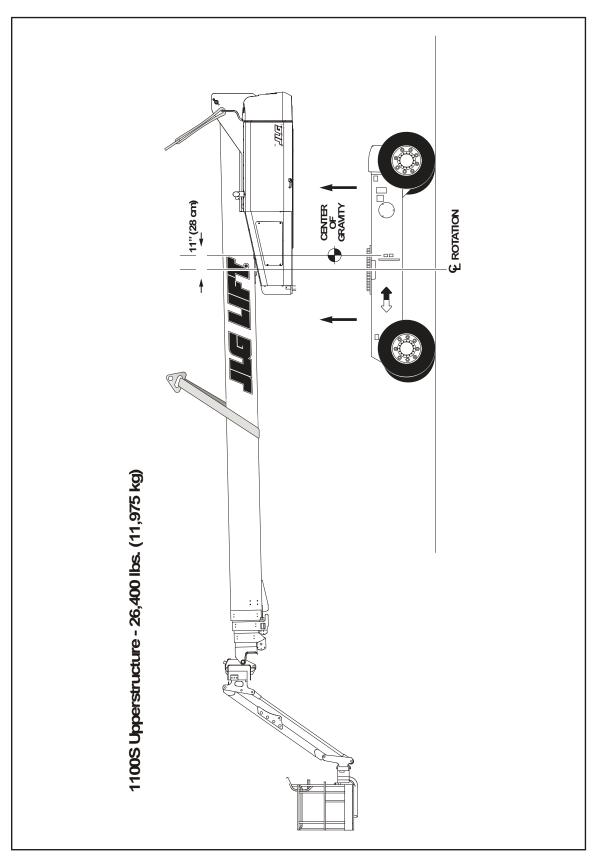
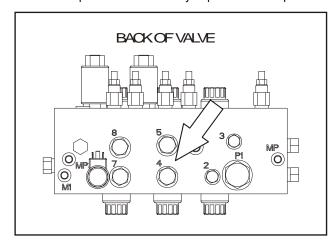


Figure 3-51. Swing Bearing Removal

5. At the rear of the main valve, remove the lift hose from port #4. Immediately cap the line and port.



- Attach suitable overhead lifting equipment to the machine. Refer to Figure 3-51., Swing Bearing Removal.
- 7. Use a suitable tool to scribe a line on the inner race of the swing bearing and on the underside of the turntable. This will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the turntable to the bearing inner race. Discard the bolts.
- 8. 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.
- Carefully place the turntable on a suitably supported trestle.

NOTE: The swing bearing weighs approximately 300 lbs. (136 kg).

10. 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, then move the bearing to a clean, suitably supported work area.

Swing Bearing Installation

NOTE: The swing bearing weighs approximately 300 lbs. (136 kg).

1. Using suitable lifting equipment, carefully lower the swing bearing into position on the frame. Ensure the scribed line of the outer race of the bearing aligns with the scribed line on the frame. If a new swing bearing is used, ensure that the spot with minimum gear backlash (marked with yellow paint) is towards the centerline of the swing drive (as close as the bolt pattern will allow).

NOTICE

JLG INDUSTRIES RECOMMENDS THAT ALL REMOVED BEARING BOLTS BE DISCARDED AND REPLACED WITH NEW 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.

Apply a light coating of Loctite #271 to the new bearing bolts, and loosely install the bolts and washers through the frame and outer race of bearing.

NOTICE

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.

- 3. Refer to the Torque Sequence diagram as shown in Figure 3-52., Swing Bearing Torque Sequence. Spray a light coat of Safety Solvent 13 on the new bearing bolts. Then apply a light coating of Loctite #271 to the new bearing bolts, and install the bolts and washers through the frame and outer race of the bearing. Tighten the bolts to an initial torque of 190 Ft. lbs. (260 Nm) w/Loctite.
- 4. Remove the lifting equipment from the bearing.
- 5. Using suitable lifting equipment, carefully position the turntable assembly above the machine frame.
- 6. Carefully lower the turntable onto the swing bearing, ensuring that the scribed line of the inner race of the bearing aligns with scribed line on the turntable. If a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft center line of the turntable.
- Spray a light coat of Safety Solvent 13 on the new bearing bolts. Then apply a light coating of Loctite #271 to the new bearing bolts, and install the bolts and washers through the turntable and inner race of the bearing.
- **8.** Following the Torque Sequence diagram shown in Figure 3-52., Swing Bearing Torque Sequence, tighten the bolts to a torque of 190 ft. lbs. (260 Nm) w/Loctite.

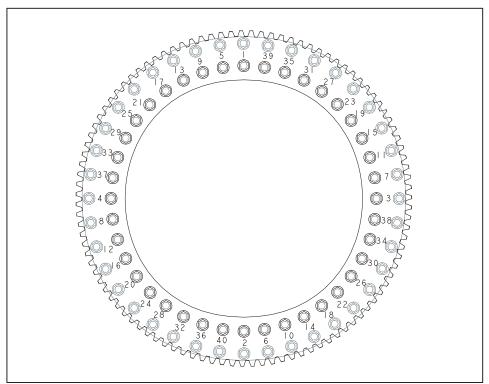
- **9.** Connect the hydraulic lines to the rotary coupling as tagged prior to removal.
- 10. Install the rotary coupling retaining yoke brackets, apply a light coating of Loctite #242 to the attaching bolts and secure the yoke to the turntable with the mounting hardware.
- Connect the hydraulic line disconnected during removal back to port #4 on the back of the main hydraulic valve.
- 12. Remove the lifting equipment.
- **13.** At ground control station, use boom lift control to lower boom to stowed position.
- 14. Using all applicable safety precautions, activate the hydraulic system and check the swing system for proper and safe operation.

Swing Bearing Torque Values

- 1. Outer Race 190 ft. lbs. (260 Nm) w/Loctite.
- 2. Inner Race 190 ft. lbs. (260 Nm) w/Loctite.
- 3. See Swing Bearing Torquing Sequence.

M WARNING

CHECK THE INNER AND OUTER SWING BEARING BOLTS FOR MISSING OR LOOSENESS AFTER FIRST 50 HOURS OF OPERATION, AND EVERY 600 HOURS THEREAFTER.



NOTE: Swing Bearing Torque Sequence is typical for both inner and outer races.

Figure 3-52. Swing Bearing Torque Sequence

3.18 SWING SPEED PROPORTIONING

Swing Speed Proportioning uses the boom length and angle sensors to improve the comfort, speed and control of the turntable swing function. Turntable swing speed is increased as the distance of the platform to the center of rotation is decreased. This results in approximately constant platform speeds regardless of boom position. Swing speed proportioning is disabled with any envelope sensors failure. Disabling of swing speed proportioning will default to the slowest swing speed setting.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.19 CHASSIS TILT INDICATOR SYSTEM

The Chassis Tilt Indicator System measures the turntable angle with respect to level ground. The tilt sensor (which is an integral part of the ground module) has two settings; 5.0 and 8.0 degrees. The smaller angle is used for the purpose of warning the operator by means of the chassis tilt light in the platform display panel. Additionally when used

in conjunction with the Beyond Transport - Drive Speed Cutback System, the tilt sensor will cause an alarm to sound, and automatically put all functions in the creep speed mode. With the exception of the speed cutback, this is a warning system only. The machine will continue to function. The operator is responsible to prevent the machine from attaining an unstable position. The 8.0 degree angle is used exclusively for the purpose of automatically shifting the drive motors to the maximum displacement position (slow speed). The control system responds to indicated angle readings 0.5 degrees smaller than the required angles to account for calibration and sensor variation.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

3.20 ROTARY COUPLING

Use the following procedure to for installing the seal kit.

- 1. Remove snap ring (7) from end.
- 2. Remove thrust ring (3) from same end.
- 3. Remove center body (1) from housing (3).
- 4. Cut off old seals (2,3,5).
- **5.** Assemble lip seals (2) in direction shown in Figure 3-53., Rotary Coupling Seal Installation.

- 6. Reassemble O-ring (4).
- 7. Heat cap seals (5) in hydraulic oil for 5 minutes at 300° F (149° C).
- 8. Assemble cap seals over O-rings
- **9.** Reinsert center body into housing (lube with hydraulic oil).
- 10. Replace thrust ring and snap ring.

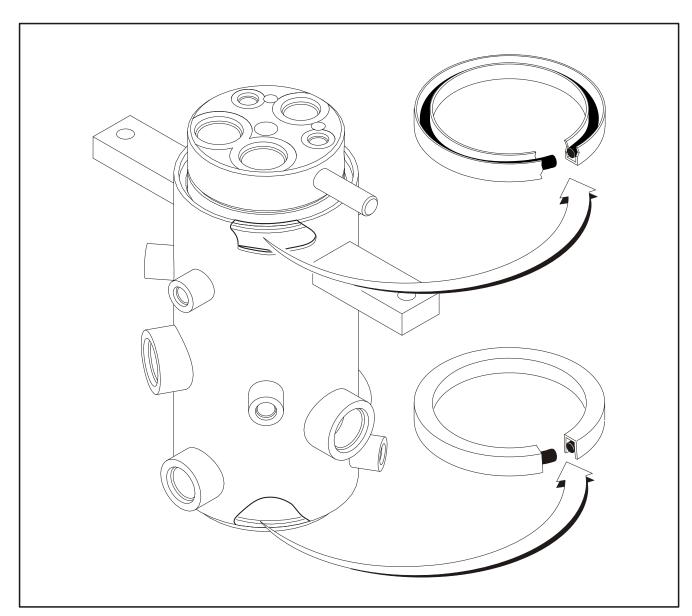
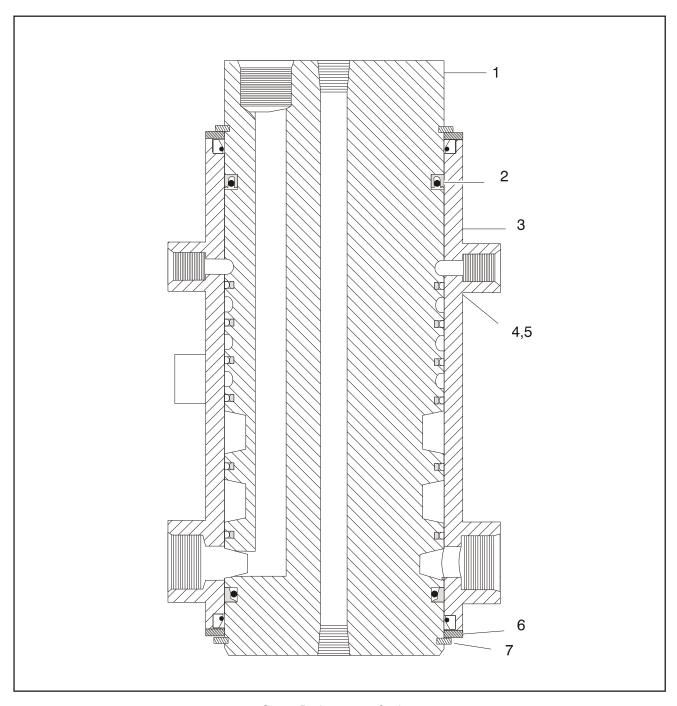


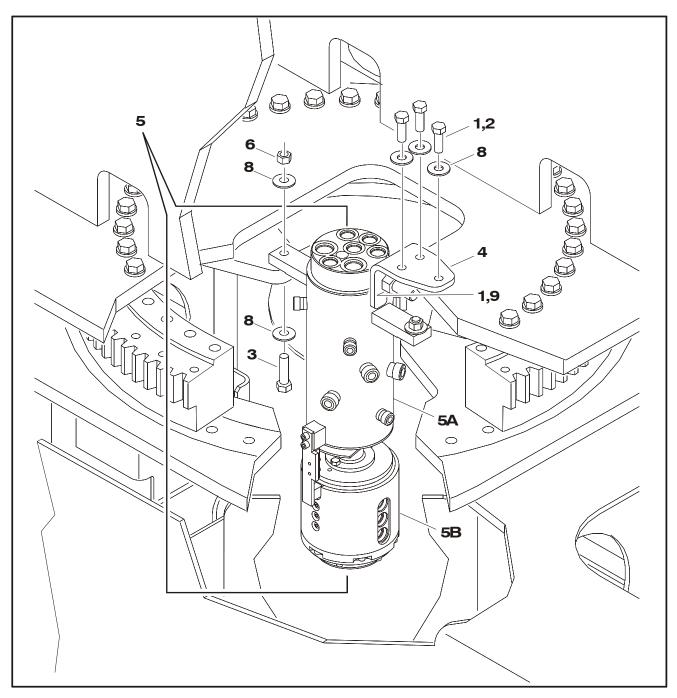
Figure 3-53. Rotary Coupling Seal Installation



- Center Body 1.
- Seal 5.
- Seal 2.
- Thrust Ring 6.
- 3. Housing
- O-ring

7. Snap Ring

Figure 3-54. Rotary Coupling Cutaway



- 1. Loctite #242
- 2. Bolt
- 3. Bolt
- 4. Swivel Bracket
- 5. Rotary Coupling & Collector Ring Assembly
- 5A. Rotary Coupling

- 5B. Rotary Circuit Contactor
- 6. Locknut
- 7. Not Used
- 8. Flatwasher
- 9. Nut

Figure 3-55. Rotary Coupling Installation

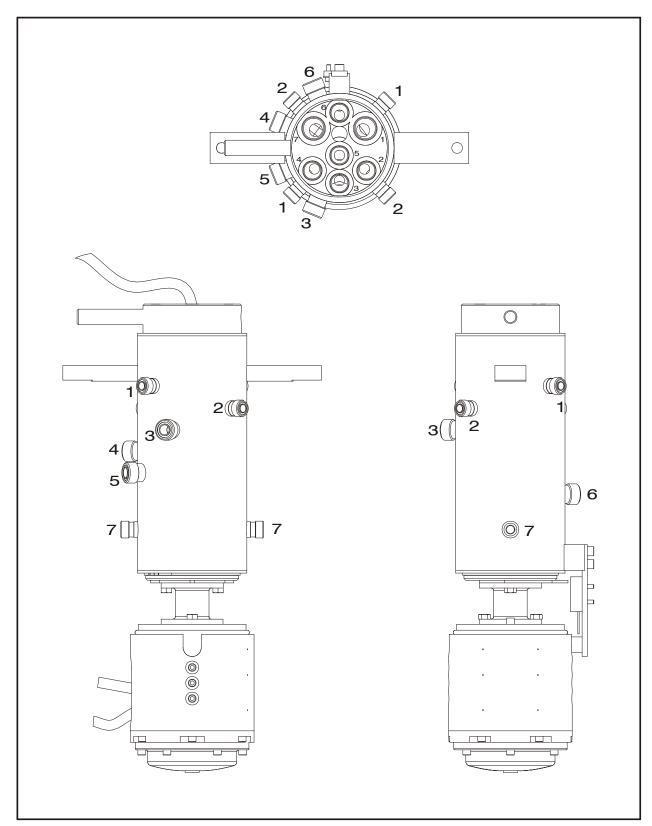


Figure 3-56. Rotary Coupling Port Location

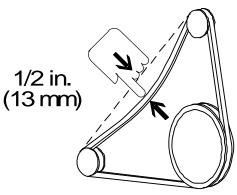
Table 3-2. Coupling Port Information Table

Por t No.	Outlet s	Port Size	Description	Operating Pressure PSI (Bar)	Proof Pressure PSI (Bar)
1	2	-12	Steer/Axle Extend (Tank)	250 (17)	375 (26)
2	2	-10	Steer/Axle Extend (Pressure)	3000 (207)	4500 (310)
3	1	-10	Drive A	3000 (207)	4500 (310)
4	1	-10	Drive B	3000 (207)	4500 (310)
5	1	-10	Drive A	3000 (207)	4500 (310)
6	1	-10	Drive B	3000 (207)	4500 (310)
7	2	-12	Case Drain	250 (17)	375 (26)

3.21 GENERATOR (SJP ONLY)

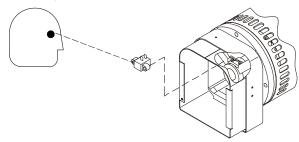
Every 250 hours

Every 250 hours of operation, check the drive belt for proper tension.

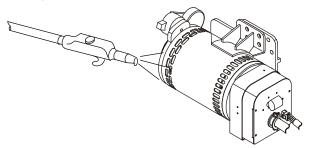


Every 500 hours

Every 500 hours of operation, service the generator brushes and slip rings. Hostile environments may require more frequent service.



Every 500 hours of service, blow out the inside of the generator. If operating in a hostile environment, clean monthly.

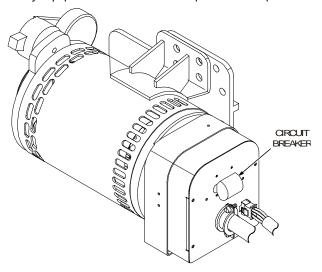


Overload Protection

▲ CAUTION

STOP THE ENGINE WHENEVER CHECKING OR INSPECTING THE CIRCUIT BREAKER.

The circuit breaker protects the generator windings from overload. If the circuit breaker opens, generator output stops. If the circuit breaker continues to open, check for faulty equipment connected to the platform receptacles.



Inspecting Brushes, Replacing Brushes, and Cleaning Slip Rings

Refer to Figure 3-57., Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings.

INSPECTING BRUSH POSITION

Inspect brush alignment with slip rings. View alignment through the air vents in the stator barrel. The brushes must ride completely on the slip rings.

INSPECTING BRUSHES

Remove the end panel. Inspect the wires. Remove the brush holder assembly. Pull the brushes from the holders.

Replace the brushes if damaged, or if the brush is at or near minimum length.

CLEANING SLIP RINGS

Visually inspect the slip rings. Under normal use, the rings turn dark brown.

If the slip rings are corroded or their surface is uneven, remove the belt to turn the shaft by hand for cleaning.

Clean the rings with 220 grit emery paper. Remove as little material as possible. If the rings are deeply pitted and do not clean up, consult generator factory service.

Reinstall the belt, brush holder assembly, and end panel.

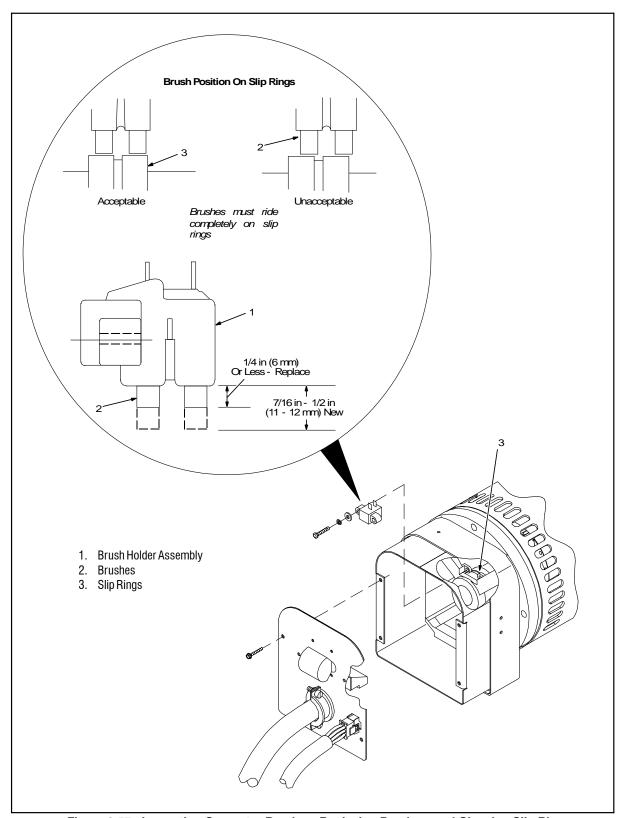
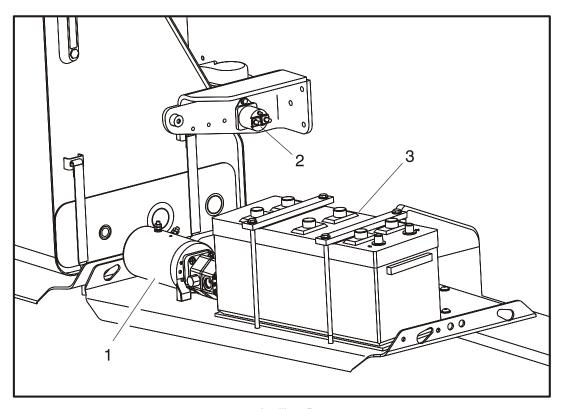


Figure 3-57. Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings

3.22 AUXILIARY POWER SYSTEM

The auxiliary power system is intended as a secondary means of moving the boom in the event of primary power loss. This system uses an electric motor/pump unit powered by a 12V battery capable of operating all functions except drive, controlled arc, controlled boom angle, and envelope tracking. During lift up or down functions, no other functions are permitted and during lift up functions, automatic platform leveling is not active. To reduce the demand on the battery and therefore extend the run time of the system, the auxiliary power functionality differs from the primary power functionality. The auxiliary power lift

down function supplies pilot pressure to the lift cylinder allowing gravity to lower the boom. The system redirects discharge oil from the lift cylinder to retract the telescope cylinder. When the boom is retracted to the transport length, the telescope in valve is dropped out and lift down is operated alone allowing the platform to reach the ground. This not only greatly reduces the power required for these functions but also lowers the boom within the envelope regardless of starting position. Envelope control and moment control remain active during the auxiliary power function.



- 1. Auxiliary Pump
- 2. Power Relay
- Battery

Figure 3-58. Auxiliary Pump Installation

3.23 ENGINE

NOTE: Refer to the engine manufacturer's manual for detailed operating and maintenance instructions.

Glow Plugs

If the glow plug option is enabled in the JLG Control System, the glow plug and indicator lamp will be energized when the Power/Emergency Stop switch is pulled on if the ambient air temperature is less than 50° F (10° C) and the engine coolant temperature is less than 140° F (60° C). This determination will occur one second after the Power/Emergency Stop switch has been pulled on. The lamp and glow plugs will remain energized for the period of time specified by the setting in the JLG Control System. Engine start shall be disabled during this period. On Deutz engines, the glow plugs will continue (post glow) after the engine has started for three times the machine digit setting.

Checking Oil Level

- 1. Switch the engine off before checking oil level.
- Make sure the machine and engine are level.
- 3. Remove the oil dipstick.
- 4. Wipe the dipstick with non-fibrous, clean cloth.
- 5. Insert the dipstick to the stop and remove again.



- 6. Check the oil level, and if necessary, top the oil level up to the MAX mark with an approved grade and type of oil as outlined in the engine manufacturer's operator's manual.
- Replace the dipstick making sure that it is fully seated in the dipstick tube to seal off the crankcase.

Changing Engine Oil

- Allow the engine to warm up. The engine oil should reach approximately 176° F (80° C).
- 2. Make sure the machine and engine are level.
- Switch off the engine.
- 4. Place an oil tray under the engine.
- 5. Open the oil drain valve.



▲ WARNING

WHEN DRAINING HOT ENGINE OIL THERE IS A RISK OF SCALD-ING.

NOTICE

DO NOT LET USED OIL RUN INTO THE SOIL; COLLECT THE USED OIL IN A CONTAINER SUITABLE FOR DISPOSAL OR RECYCLING. DISPOSE OF THE USED ENGINE OIL IN ACCORDANCE WITH ENVIRONMENTAL REGULATIONS.

- 6. Drain the oil.
- 7. Close the oil drain valve.

8. Pour in new engine oil. Refer to Section 1 for capacity and refer to Figure 3-59., Engine Oil Viscosity for the proper grade.

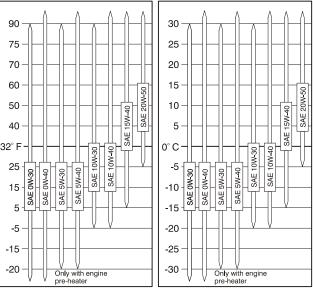
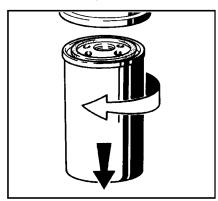


Figure 3-59. Engine Oil Viscosity

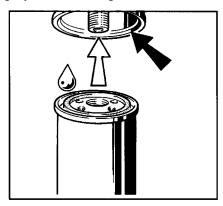
Changing the Oil Filter



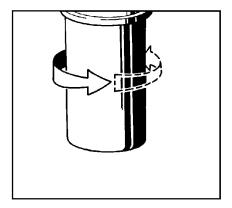
 Wipe the area around the filter to clean any dirt from the area. **2.** Using a suitable oil filter removal tool, loosen the lube oil filter cartridge and spin off.



- 3. Catch any escaping oil.
- 4. Clean any dirt from the filter carrier sealing surface.
- 5. Lightly oil the rubber gasket on the new oil filter.



Manually screw in the new filter until the gasket is flush.



- 7. Tighten the filter another half-turn.
- 8. Check the oil level.
- 9. Check the oil pressure.
- Check the oil filter cartridge and make sure there are no leaks.

Replacing the Fuel Filter

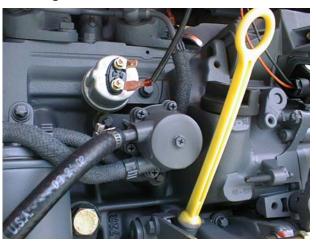


▲ WARNING

WHEN WORKING ON THE FUEL SYSTEM, MAKE SURE THERE ARE NO OPEN FLAMES OR SPARKS IN THE AREA. DO NOT SMOKE WHEN WORKING ON THE FUEL SYSTEM.

- Wipe the area around the filter to clean any dirt from the area.
- 2. Undo the fuel filter cartridge and spin off.
- 3. Catch any escaping fuel.
- 4. Clean any dirt from the filter carrier sealing surface.
- Apply a light film of oil or diesel fuel to the rubber gasket of the new filter cartridge.
- Manually screw in the new filter until the gasket is flush.
- 7. Tighten the fuel filter cartridge with a final half-turn.
- 8. Open the fuel shut-off valve.
- 9. Check for leaks.

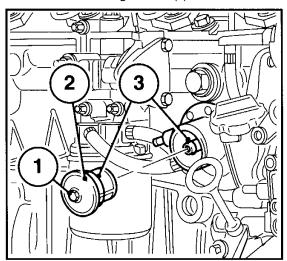
Cleaning the Fuel Strainer



A WARNING

WHEN WORKING ON THE FUEL SYSTEM, MAKE SURE THERE ARE NO OPEN FLAMES OR SPARKS IN THE AREA. DO NOT SMOKE WHEN WORKING ON THE FUEL SYSTEM.

1. Unscrew the hexagonal nut (1).



- 2. Remove the fuel strainer cover (2).
- **3.** Clean the fuel strainer with diesel fuel, replace if necessary.
- 4. Place the seal (3) in position.
- **5.** Install the fuel strainer cover (2) in position and tighten the hexagonal screw (1).
- 6. Check for leaks.

3.24 DEUTZ EMR 2

The EMR2 consists of the sensors, the control unit and the actuator. Engine-side controls as well as the JLG Control System are connected by means of separate cable harnesses to the EMR control unit.

The sensors attached to the engine provide the electronics in the control unit with all the relevant physical parameters In accordance with the information of the current condition of the engine and the preconditions (throttle position etc.), the EMR2 controls an actuator that operates the control rod of the injection pump and thus doses the fuel quantity in accordance with the performance requirements.

The exact position of the regulating rod is reported back and, if necessary, is corrected, by means of the control rod travel sensor, situated together with the rotation magnets in a housing of the actuator. The EMR2 is equipped with safety devices and measures in the hardware and software in order to ensure emergency running (Limp home) functions.

In order to switch the engine off, the EMR2 is switched in a de-energized fashion over the ignition switch. A strong spring in the actuator presses the control rod in the de-energized condition into the zero position. As a redundancy measure, an additional solenoid serves for switching off and this, independently of the actuator, also moves the control rod in the de-energized condition into the zero position.

After the programming, that is carried out over the ISO9141 interface, the EMR2 is possesses a motor-specific data set and this is then fixedly assigned to the engine. Included in this are the various application cases as well as the customer's wishes regarding a particular scope of function.

Each EMR2 module is matched by serial number to the engine. Modules cannot be swapped between engines.

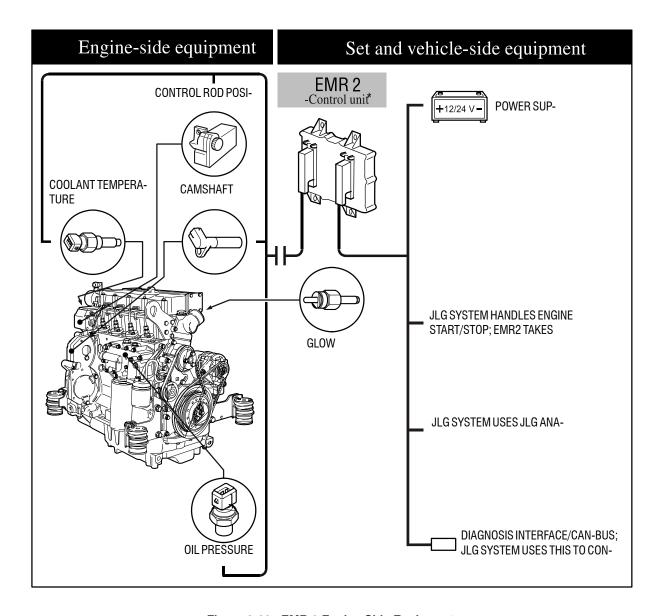


Figure 3-60. EMR 2 Engine Side Equipment

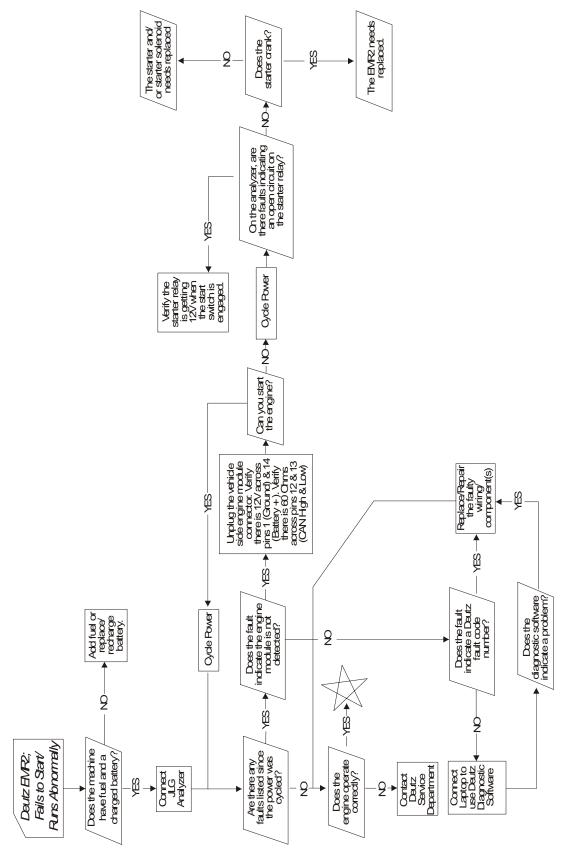
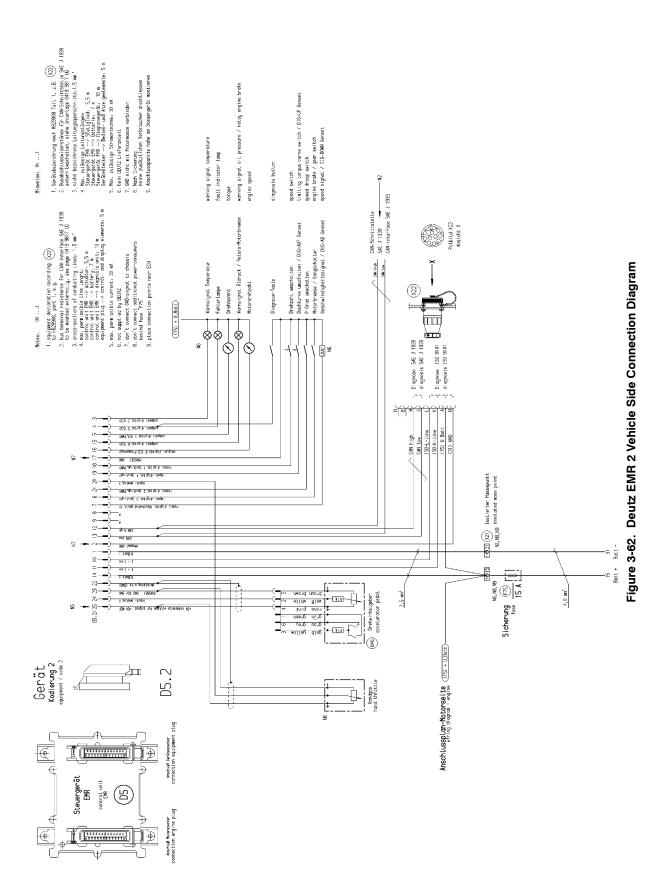


Figure 3-61. Deutz EMR 2 Troubleshooting Flow Chart



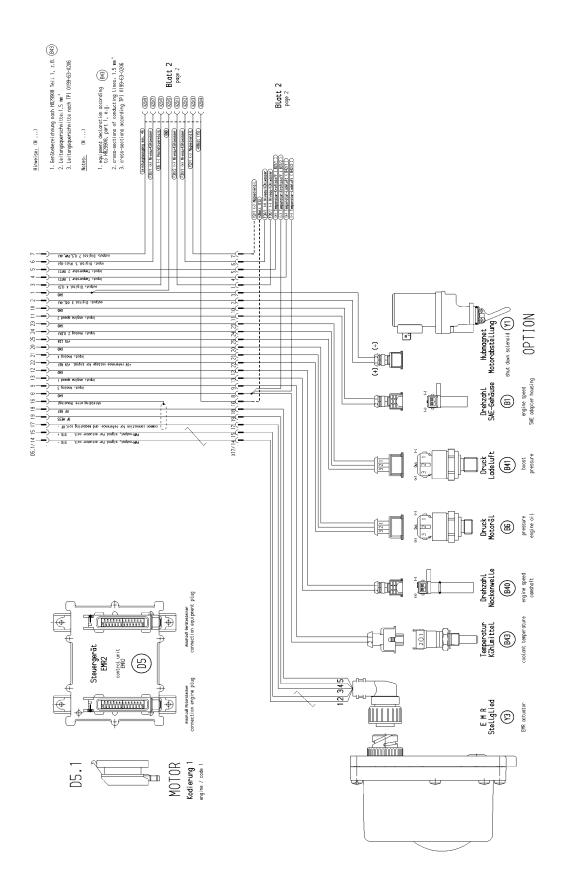


Figure 3-63. Deutz EMR 2 Engine Side Connection Diagram - Sheet 1 of 2

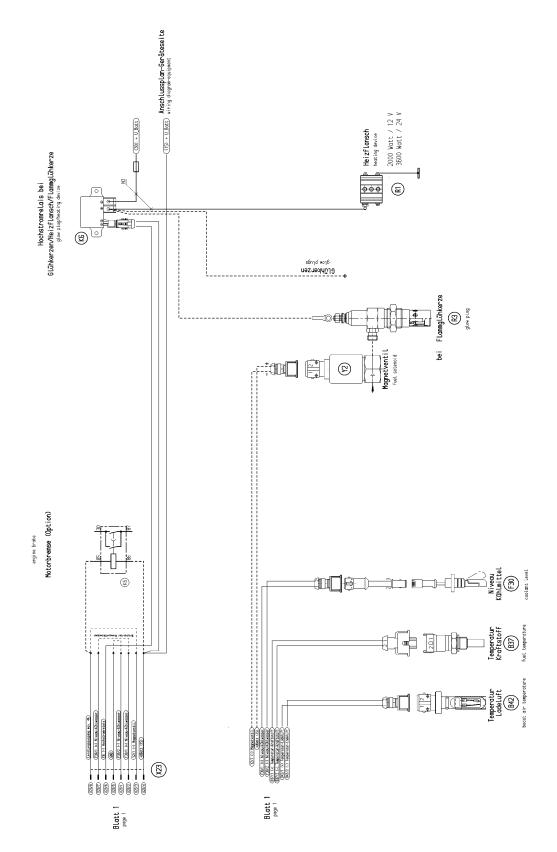
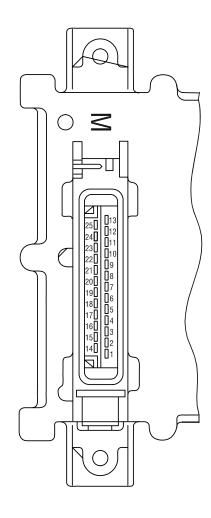


Figure 3-64. Deutz EMR 2 Engine Side Connection Diagram - Sheet 2 of 2

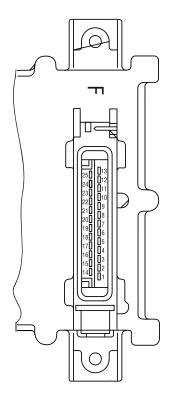


Pin No.	Designation	Description
1	Reserve	Reserve
2	Output: digital 3	Digital output for solenoid 1)
3	Output: digital 4	For heating flange (optional)/ glow plug (optional)
4	Input (optional) Temp 1	Fuel temperature ²⁾
5	Input (optional) Temp 2	Charge air temperature
6	Input (optional) DigIn 5	Coolant level / oil level
7	Output: PWM2/digital 6	
8	GND	Reference potential for analog signal at pin 9
9	Input: analog 7	Analog input for Coolant temperature sensor (NTC)
10	GND	Reference potential for analog signal at pin 11
11	Multi-function input: speed 2/DigIn 2	Digital input second engine speed (crankshaft) (optional) and speed signal (optional)
12	GND	Reference potential for analog signal at pin 13
13	Input: speed 1	Digital input first engine speed (camshaft)
14	STG -	PWM output, signal for actuator coil
15	STG +	PWM output, signal for actuator coil
16	Screen	Screening regulating rod travel sensor (for lines 17, 18, 19)
17	RF -	General connection for reference and measuring coil
18	RF REF	Analog input, reference signal of the reference coil
19	RF MESS	Analog input, measuring signal of the measuring coil
20	GND	Reference potential for signal at pin 21
21	Input: analog 4/digital 9	Analog input 4 (sensor signal oil pressure sensor) or digital input 9
22	+5 V REF	+5 V Reference voltage for signal at pin 21 (max. 15 mA)
23	GND	Reference potential for signal at pin 24
24	Input: analog 2/digital 7	Analog input 2 (sensor signal charge air) or digital input 7
25	+5 V LDA	+5 V Reference potential for signal at pin 24 (max. 15 mA)

¹⁾ For continuous power: < 4 A

Figure 3-65. EMR 2 Engine Plug Pin Identification

²⁾ Corresponds to special function"fuel temperature compensation at the EMR (0211 2571)



Pin-No.	Designation	Description
1	U Batt -	Negative pole at battery (clamp 31)
2	GND	Reference potential for signal
3	Output: digital 2	PWM or digital output, various functions
4	Input / output: DigInOut	Fault lamp and diagnostic button
5	Output: PWM 1/Dig 1	PWM or digital output, various functions
6	Multi-function input: DigIn 3	Genset applications/gear shift/motor brake
7	Input: digital 10/velocity	Speed signal (tacho input)
8	NC	Not occupied
9	NC	Not occupied
10	L-line	Serial ISO 9141 interface
11	K-line	Serial ISO 9141 interface
12	CAN high	Interface for CAN-Bus
13	CAN low	Interface for CAN-Bus
14	U Batt +	Positive pole for battery (clamp 15)
15	Output: digital 5	Digital output, various functions
16	Output: digital 7/Frequency	Frequency, PWM or digital output, various functions
17	Ground	Reference potential for signal at pins 18, 19 and 21
18	Input: digital 1 / PWM 1	PWM 1 or digital input 1, various functions
19	Multi-function input: Digln 4	Performance curve switching/genset applications
20	Multi-function input: digital 8 / analog 3	Hand hand throttle/genset applications, Digital (8) or analog input (3)
21	Input: digital 2 / PWM 2	PWM 2 or digital input 2, various functions
22	Screen	Screening (e.g. for lines hand throttle or PWG)
23	GND	Reference potential for signal at pin 24
24	Input: analog 1 / digital 6	Analog input 1 (pedal value sensor, PWG) or digital input 6
25	+5 V REF	+5 V Reference voltage for signal at pin 24

Figure 3-66. EMR 2 Vehicle Plug Pin Identification

Fault group	Fault no.	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Zero error display	1	No faults	524287	31	No active faults present		
	3	7	9		Sensor failure. Distance from gear	Governor in emergency operation (if sensor 2 available). Emergency switch-off (if sensor 2 not available or failed).	Check distance. Check cable
Revolutions	5	Speed sensor I	061	xo	co far, Additional adul impuises. Cable joint interrupted.	Governor in emergency operation (with sensor 1) Emergency switch-off (if sensor 1 not available or failed).	replace if required.
/ speed acquisition	03	Speed sensor	84	æ	Tacho failed. Additional fault impulses. Cable connection interrupted.	Governor in emergency operation.	Check cable connection and Tacho. Replace if required.
	3	Excess speed switch-	Ç	C	Speed was/is in excess of limit.e.	Engine stop.	Check parameter (21). Check speed settings.
	04	off .	08	D	Check PID setting. Check rods. Chech incorrect speed). Check No. of teeth.	Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator (impulse on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.	c cable to actuator (impulse on node.
	20	Charge air pressure	102	2			
	80	Oil pressure	100	2			
Sensors	60	Coolant temperature	110	N	Fault at corresponding sensor entry (e.g. short circuit or cable break).	With failure of the sensor the associated monitoring function is de-activated.	Check sensor cable. Check sensor and replace if required. Check fault limits for sensor.
	10	Charge air temperature	105	2			
	11	Fuel temperature	174	2			

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-67. EMR2 Fault Codes - Sheet 1 of 5

Fault group	Fault no.	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
	30	Oil pressure warning	100	-	Oil pressure below speed- dependent warning line characteristic	Fault message (disappears when oil pressure is again above recovery limit). After a delay time - fill limitation.	Check engine (oil level, oil pump). Check oil pressure sensor and cable. Check oil pressure warning line characteristic.
	31	Coolant temperature warning	110	0	Coolant temperature has exceeded warning level.	Fault message (disappears when coolant temperature again drops below recovery level). After a delay time - fill limitation.	Check coolant. Check coolant temperature sensor and cable.
Functional fault	32	Charge air temperature warning	105	0	Charge air temperature has exceeded warning level.	Fault message (disappears when charge air temperature gain drops below recovery level). After a delay time - fill limitation.	Check charge air Check charge air-temperature sensor and cable.
warning	34	Coolant level warning	111	-	Switch input "Low coolant level" is active.	Fault message.	Check coolant level. Check coolant level sensor and cable.
	35	Speed warning (with thrust mode	SID 190	4	revolutions was/is above (top) revolution speed limit. "Thrust mode" function is active.		Check parameters. Check speed settings.
		operation).			Check PID setting. Check rods. Check sensor (impulses on incorrect speed)	Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator Check speed sensor (impulses on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.	cable to actuator. Check speed for possible thrust mode.
	36	Fuel temperature warning	174	0	Fuel-temperature has exceeded warning level.	Fault message (disappears when fuel temperature again drops below recovery level).	Check fuel. Check fuel temperature sensor and cable.

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-68. EMR2 Fault Codes - Sheet 2 of 5

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Functional fault, switch-off	42	Charge air temperature switch- off	105	0	Charge air temperature has exceeded switch-off limit.	Emergency stop	Check charge air. Check charge air-temperature sensor and cable. Check switch-off limit.
	44	Coolant level switch- off	111	-	Switch input "Low coolant level" is active.	Emergency stop. Start lock.	Check coolant level. Check coolant level sensor and cable.
	20	Feedback	SID 24	12	Arkustor not connected. Esult in	Emarganov switch-off Artistor	Check actuator, replace if required. Check cable, check fault limits for "Confirmation".
	25	Reference feedback	SID 24	13	actuator confirmation.	cannot be operated.	Check actuator, replace if required. Check cable, check fault limits for "Rifeness confirmation".
Actuator	53	Control travel difference	SID 23	7	Injection pump/actuator jammed or not connected. Difference between nominal/actual control travel is > 10 % of the overall control path.	Fault message (disappears when difference is < 10 %).	Check actuator/actuator rods / injection pump, replace if required. Check actuator cable.
	29	Auto calibration BOSCH-EDC pumps faulty operation	SID 23	13	No automatic actuator equalization possible. Incorrect input of the actuator reference values.	Engine stop / start lock. Governor cannot be taken into use. EDC actuator calibration required.	Check actuator and replaced if required. Check feedback cable. Check fault limits and reference values of the feedback. Program the fault limits for feedback, save values. Switch ignition off and on again. Check again. If faulty, inform DEUTZ-Service and carry out automatic equalization again. Set fault limits again.

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-69. EMR2 Fault Codes - Sheet 3 of 5

Fault	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
	09	Digital output 3 (Switch-off solenoid, pin M 2)	SID 51	7	Fault (short circuit / cable break) at	Driver level is switched off.	Check cable of digital output frable heak or short circuit)
Hardware	62	Digital output 6, pin M 7	SID 60	2	indian milin	Fault message.	(10000000000000000000000000000000000000
outputs	63	Excess voltage switch-off solenoid	SID 51	9			
	29	Error Hand Setp1	91	11			
	89	Error CAN Setp1	868	2			
	02	CAN-Bus controller	SID 231	12	CAN-controller for CAN-bus is faulty. Fault removal despite reinitalising continuously not possible	Application-dependent.	Check CAN connection, terminating resistor (see Chapter
Communi- cation	71	CAN interface SAE J 1939	SID 231	6	Overflow in input buffer or a transmission cannot be placed on the bus.		12.4), Check control unit.
	74	Cable break, short circuit or bus-error	SID 231	14			Check CAN connection, cable connection. Check sensor and replace if required.
	92	Parameter programming (write EEPROM)	SID 253	12	Fault in parameter programming in the governor fixed value memory.		Switch ignition off and on again. Check again, If faulty inform
Memory	22	Cyclic program test	SID 240	12	Constant monitoring of program memory shows error (so-called "Flash-test").	Emergency switch-off. engine cannot be started.	DEUTZ Service
	78	Cyclic RAM test	SID 254	2	Constant monitoring of working memory shows error.		Note values of parameters (3895 and 3896). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-70. EMR2 Fault Codes - Sheet 4 of 5

Fault	Fault no. (in SERDIA)	Fault locality/	NPN	I ⊠	Cause	Remarks	Help
	80	Power supply (Actuator)	SID 254	7	Power supply for actuator not in the permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	83	Reference voltage 1	SID 254	2			Check voltage supply. Switch
: -	84	Reference voltage 2	SID 254	2	Reference voltage for actuator not in the permissible range.	Fault message (disappears when power again in the normal range). Auxiliary value 5 V	ignition off and on again. Check again. If faulty inform DEUTZ
Control unit hardware	85	Reference voltage 4	SID 254	2			Service.
	86	Internal temperature	171	12	Internal temperature for control unit not in permissible range.	Fault message (disappears when power again in the normal range).	Cuitab isortion off and an acain
	87	Atmospheric pressure	108	12	Atmospheric pressure not in permissible range.	Fault message (disappears when power again in normal range). Atmospheric pressure monitoring function de-activated.	which ignition on and on again. Check again, if faulty inform DEUTZ Service.
	06	Parameter fault (EEPROM retrieval or SID 253 checksum faulty).	SID 253	7	No data found or checksum of data is faulty (note: fault only occurs during setting of parameter / saving or reset.).	Engine cannot be started.	Check data for correct settings. Save parameters. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
Program logic	63	Stack overflow	SID 240	7	Internal calculation fault (so-called "Stack overflow" fault).	Emergency switch-off. Engine cannot be started.	Note parameters (3897 and 3898). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	94	Internal fault	SID 254	7			

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-71. EMR2 Fault Codes - Sheet 5 of 5

3.25 BIO FUEL IN DEUTZ ENGINES

General

Use of bio fuels is permitted for the compact engines made by DEUTZ.

Distillate fuels with residue oil percentages or mixed fuels may not be used in DEUTZ compact engines.

The DEUTZ vehicle engines are designed for diesel fuels in accordance with EN 590 with a cetane number of at least 51. DEUTZ engines for mobile machinery are designed for a cetane number of at least 45. When using fuels of a low cetane number, disturbing white smoke and ignition misfires are to be expected under some circumstances.

A cetane number of at least 40 is permissible for the US market, therefore special engine models have been developed to avoid starting difficulties, extreme white smoke or increased hydrocarbon emissions (EPA specification - US EPA REGULATIONS FOR LARGE NONROAD COMPRESSION-IGNITION ENGINES).

If the white smoke behavior is unacceptable when using a very low cetane number, the use of ignition improvers is to be recommended as a later remedial measure.

The certification measurements for compliance with the legal emission limits are carried out with the test fuels prescribed by law. These correspond to the diesel fuels in accordance with EN 590 and ASTM D 975. No emission values are guaranteed with the other fuels described. It is the obligation of the owner to check the permission for use of the fuels in accordance with regional regulations.

Bio Fuel

PERMITTED BIO-DIESEL FUELS

Originally only rape seed oil methylester (RME) was sold as a bio-diesel fuel in Europe but fatty acid methylester (FAME) based on other oils have come onto the market increasingly in recent years. However, with the latter there is a risk that the limit values of EN 14214 are not kept in the field. Anyone who uses bio-diesel fuel in DEUTZ engines must therefore choose his supplier very carefully and have him guarantee compliance with the EN 14214 limit values. Since experience has shown that rape seed oil methylester (RME) exceeds the limit values less often that other esters, it is expressly recommended to use only rape seed oil methyester. DEUTZ customers in Germany can additionally ensure the quality by buying bio-diesel fuel with an AGQM certificate (Arbeitsgemeinschaft Qualitäts-Management Biodiesel e.V.).

The use of US bio-diesel based on soy oil methylester is only permissible in mixtures with diesel fuel with a bio-diesel part of a max. 20 weight-%. The US bio-diesel used for the mixture must comply with the ASTM D6751-07a (B100) standard.

APPROVED ENGINES

The 912, 913, 914, 1011, 2011, 1012, 2012, 1013, 2013, 413 and 513 series are approved for bio-diesel from year of manufacture 1993 under compliance with the basic conditions specified below.

BASIC CONDITIONS TO BE OBSERVED

- A power loss of 5-9 % in relation to diesel fuel in accordance with EN 590 is possible due to the lower heating value. Blocking of the fuel injector is not allowed.
- The lubricating oil quality must correspond to TR 0199-99-3002. The lubricating oil change interval must be halved in relation to operation with diesel fuel in accordance with EN 590.
- Standstills of longer than 4 to 6 weeks must be avoided with bio-diesel. Otherwise the engine must be started and stopped with diesel fuel.
- Bio-diesels can be mixed with normal diesel fuel but the basic conditions described in this subsection apply for mixtures. Mixtures with up to 5 % (m/m) bio-diesel (B5) which have recently been on sale at European fuel stations are excepted. These fuels must be treated like normal diesel fuels because EN 590 expressly permits adding up to 5 % (m/m) bio-diesel in accordance with EN 14214.
- Approx. 30-50 hours after changing over from diesel fuel
 to bio-diesel, the fuel filter should be changed as a preventive measure to avoid a drop in performance due to
 clogged fuel filters. Deposited fuel ageing products are
 dissolved by bio-diesel and transported into the fuel filter. They should not be changed immediately but after
 approx. 30 to 50 hours because the dissolving of dirt
 takes a certain amount of time.

PLANT OIL

NOTICE

PURE PLANT OILS (E.G. RAPE SEED OIL, SOY OIL, PALM OIL) ARE NOT CLASSIFIED AS BIO-DIESEL AND EXHIBIT PROBLEMATICAL PROPERTIES FOR DIESEL ENGINE OPERATION (STRONG TENDENCY TO COKE, RISK OF PISTON SEIZURE, EXTREMELY HIGH VISCOSITY, POOR EVAPORATION BEHAVIOR.

The conversion of DEUTZ engines to rape seed oil fuel operation with conversion kits and modified tanks systems of various manufacturers is not allowed and leads to loss of warranty rights.

Biological Contamination In Fuels

SYMPTOMS

The following symptoms may indicate that a fuel tank is contaminated by micro-organisms:

- Internal tank corrosion,
- Filter blockage and the associated loss of power due to gel-like deposits on the fuel filter (especially after long standstills)

CAUSE

Micro-organisms (bacteria, yeasts, funguses) can form biosludge under unfavorable conditions (favoured particularly by heat and water).

Penetration by water is usually caused by condensation of the water in the air. Water does not dissolve in fuel so that the penetrating water collects at the bottom of the tank. The bacteria and funguses grow in the watery phase, at the phase boundary to the fuel phase, from which they draw their nutrition. There is an increased risk especially with biodiesel (FAME).

PREVENTIVE MEASURES

- Keep the storage tank clean, regular cleaning of the tank by specialist companies
- Installation of fuel pre-filters with water traps, especially in countries with frequently fluctuating fuel qualities and high percentage of water.

If the fuel system and storage tank have already been attacked by micro-organisms. The biocide must be dosed according to the manufacturer's specifications.

- · Avoid direct exposure of the storage tank to sunlight
- Use smaller storage tanks with corresponding low dwell times of the stored fuel

FUEL ADDITIVES

The use of fuel additives is not permitted. The flow improvers mentioned above are an exception. Use of unsuitable additives will result in loss of warranty.

SECTION 4. BOOM & PLATFORM

4.1 BOOM SYSTEMS

Broken Cable Indicator System

The boom on this model is a 4 section proportionally driven telescopic boom. The inner mid boom is driven directly by the telescope cylinder. The outer mid and fly booms are each driven by separate wire rope systems. Each rope system contains redundant ropes that are capable of allowing the operator to unknowingly continue use of the machine with a single rope failure. These kinds of failures with the extend ropes are self revealing to the operator so proper action can be taken. Failures within the fly extend ropes are self revealing as they are exposed on the exterior of the boom where a broken rope would be obvious. Failures within the outer mid ropes require the addition of the Broken Cable Indicator System in order to be self-revealing to the operator. This system uses a proximity sensor to detect excessive movement of the sensed rope as would be expected with a rope failure. A broken rope detection results in illuminating the Cable Break indicator on the platform control panel. No restrictions are made to the functionality of the control system. It is the responsibility of the operator to take the appropriate action.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Platform Control Enable System

The platform controls make use of a time dependent enable circuit to limit the time availability of "live" or enabled controls. When the footswitch is depressed, the controls are enabled and the operator has 7 seconds to operate any control. The controls will remain enabled as long as the operator continues to use any function and will remain enabled 7 seconds after the last function has been used. While the controls are "live", the enabled light will be illuminated in the platform display panel. When the time limit has been reached, the enabled light will turn off and the controls will be "dead" or disabled. To continue use of the machine the controls must be re-enabled to start the timer system over again. This is done by releasing all functions, then releasing and re-depressing the footswitch.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Transport Position Sensing System

The transport position sensing system uses the boom angle sensors and the boom length sensor mounted in the pivot end of the base boom in addition to the boom length switch mounted on the platform end of the base boom to sense when the boom is in the position associated with high speed travel. Above transport angle is recognized when one angle sensor reads more than 15° with respect to gravity and resets to within transport position when both angle sensors read less than 10° with respect to gravity. Transport length is recognized when both the length switch and length sensor read less than 2 ft extension. During failures of either the length switch or length sensor, the transport length will be determined by the remaining sensor or switch. The position of the articulated jib is not considered.

This system is used to control the following systems:

- Beyond Transport Drive Speed Cutback System
- Jib Stow System 1100SJP
- · Axle Extension System
- Oscillating Axle System 1100SJP

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Beyond Transport - Drive Speed Cutback System

When boom is positioned beyond the Transport Position, the drive motors are automatically restricted to their maximum displacement position (slow speed).

Jib Stow System (1100SJP Only)

This machine is equipped with a full function side swing rotator that is mechanically limited to 90 degree rotation to the left and electrically limited to 90 degrees to the right through the use of a positive action limit switch mounted on the rotator assembly. The machines stowed length can be reduced to facilitate transportation on standard trailers by swinging the jib further to the right using the hydraulic power of the side swing rotator. The control system will prevent swinging the jib past the 90 degree position unless the axles are retracted, the boom is in the transport position, and the jib stow override button on the platform control panel is held in combination with the jib swing function switch. When the jib is stowed, automatic platform leveling is disabled, the boom is restricted to the transport position, and axle extension is disabled. This system is functional only in the 500 lb. (230 kg) mode of the Dual Capacity System.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Envelope Tracking System

The Envelope Tracking System uses the envelope control sensors to enhance the control of the boom within the working envelope. Due to the shape of the working envelope, the maximum boom angle varies with telescope length. To maintain unrestricted operation of the boom, the lift down function is automatically introduced while telescoping in only when the boom is on the rearward edge of the envelope. This only occurs when telescoping in along the rearward edge and is not used elsewhere within the envelope or when telescoping out. Envelope tracking is disabled with any envelope or moment violations or failures. The envelope tracking functionality and be turned off using the manual position of the boom control select switch. Refer to Boom Control Select.

Moment Control System

The Moment Control System is the secondary means of controlling the stability of the machine. This system uses a load moment pin to attach the lift cylinder of the boom to the turntable. This pin is instrumented with gauges allowing the forces in the pin to be monitored. These forces are used to compare the actual boom moment (force at a distance) to a predetermined allowable boom moment. In controlling the boom moment, the position and load of the boom is controlled. The moment control system will detect moments larger than expected as well as those smaller than expected. This effectively controls the forward and rearward positions of the boom. The moment control system varies the maximum allowable moment based on ground slope. On level ground and with rated load in the platform, the allowable moments establish a working envelope slightly larger than the Envelope Control System's envelope to minimize interaction of the systems. With increasing ground slopes and rated load in the platform, the allowable moments may establish a working envelope smaller than the Envelope Control System's envelope and may result in moment violations at the extreme platform positions. Violations of the moment control systems allowable moment will result in reduced function speeds, BCS warning light illumination, restriction of functions, and sounding of the platform alarm and the flashing of the BCS light with attempts to operate restricted functions. The restricted functions due to moment system violations related to forward reach are disallowing jib functions, lift down, telescope out, swing, drive, and steer. The restricted functions due to moment system violations related to backward reach are disallowing jib functions, lift up, telescope in, swing, drive, and steer. Recognized failures within this system will result in control by the Envelope Control System, reduced function speeds, BCS warning light illumination. The boom will be restricted from leaving the transport position until the failure is resolved.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

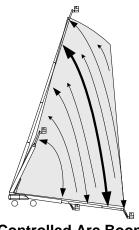
Boom Control System (BCS) Functional Check (Push to Test) System

The machine is equipped with a system for the operator to daily verify the proper functioning of the Boom Control System (Envelope Control System and the Moment Control System). The operator is instructed to position the boom in the position described by the instruction decal and to then verify the control system cut out the telescope movement at the correct length. When the operator pushes the push button mounted on the ground control panel, the control system compares the current moment reading in the moment system and compares it to the moment expected for this position. If the current moment is within allowable tolerance for the test position, the green BCS indicator will illuminate indicating the system is working properly. If the current moment is not within the allowable tolerance for the test position, the red BCS indicator will illuminate indicating the machine requires service by JLG authorized service personnel before the system is used. Failure of this test will not restrict the functionality of the machine and will not cause a system fault. It is the operators responsibility to take proper action. The machine can be in either capacity mode of the dual capacity system for this system check.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Controlled Arc System

The Controlled Arc System uses the envelope control sensors to enhance the control of the boom within the working envelope. The purpose of the controlled arc system is to minimize the interaction of lift functions with envelope edges and to increase user efficiency. This minimizes the effect of a long boom working in a comparatively narrow envelope. Because the boom is permitted to extend to longer lengths at high angles than at it is low angles, lift commands would normally cause the boom to violate the permitted envelope while lifting down or conversely require the operator to frequently command telescope out while lifting to high heights. The controlled arc system optimizes the envelope shape by automatically introducing telescope in or out during "lift only" commands. Telescope flow is regulated during lift commands to maintain a constant percentage of available boom length (0% is always fully retracted, 100% is variable as the permitted length changes when the boom is raised). The target percentage will be maintained throughout the lift command whether it is maintaining 0%, 100%, or any percentage in between. The target percentage is established at the start of lift command or end of manual telescope commands when using multiple functions with lift. The telescope command can be used independently or in combination with other functions. Manual introduction of telescope will override the controlled arc system and result in conventional control. Controlled arc will be disabled with any sensor failure, any moment violation, any envelope violation, or with auxiliary power functions. The controlled arc functionality and be turned off using the manual position of the boom control select switch. Refer to Boom Control Select.



Controlled Arc Boom Movement

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Controlled Boom Angle System

The Controlled Boom Angle System uses the envelope control sensors to enhance the control of the boom by minimizing the interaction of swing and drive functions with the envelope edges. This interaction is due to two factors. First, the envelope is controlled relative to gravity regardless of ground slope and second, the turntable/ boom mounting is effected by swing and drive functions when the ground slope varies. This can cause the boom position to vary within the envelope or even violate the envelope edges when swinging or driving without intentionally moving the boom. The controlled boom angle system minimizes this effect by automatically introducing lift up or down during swing and drive commands to maintain a constant boom angle relative to gravity for all boom angles greater than 9 degrees. Controlled boom angle is disabled with any envelope or moment violations or failures. The controlled boom angle functionality and be turned off using the manual position of the boom control select switch. Refer to Boom Control Select.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Envelope Tracking

The Envelope Tracking System uses the envelope control sensors to enhance the control of the boom within the working envelope. Due to the shape of the working envelope, the maximum boom angle varies with telescope length. To maintain unrestricted operation of the boom, the lift down function is automatically introduced while telescoping in only when the boom is on the rearward edge of the envelope. This only occurs when telescoping in along the rearward edge and is not used elsewhere within the envelope or when telescoping out. Envelope tracking is disabled with any envelope or moment violations or failures. The envelope tracking functionality and be turned off using the manual position of the boom control select switch. Refer to Boom Control Select.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Slow Down System

When the boom approaches the edges of the working envelope, all functions (except jib and platform functions, telescope in or out on the rearward edge and telescope in on the forward edge) are automatically slowed down by the control system to reduce the machine dynamics and improve operator control. The slow down starts within 4 feet of all edges and is at the fully reduced speeds 2 feet from all edges. The control system indicates to the operator this automatic introduction of slow down by flashing the creep light on the platform display panel. This feature applies to both platform and ground controls, however, no indication is made on the ground control panel.

Dual Capacity System (1100SJP Only)

The Dual Capacity System on this machine is a multiple envelope control system as opposed to an indication system. The control system changes the working envelope and moment limits to match the capacity select mode to either the 500 lb. (230 kg) mode or the 1000 lb. (450 kg) mode. It then displays the capacity mode on the platform and ground display panel and controls the positions of the boom within the allowable envelope for that mode. This mode is selectable by the operator with the dual capacity select switch on the platform control panel. The 500 lb. (230 kg) mode has the largest envelope and allows the use of the side swing jib. The 1000 lb. (450 kg) mode has a smaller envelope and requires the jib to be fixed in the centered position. To select the 1000 lb. (450 kg) mode the boom must already be in the smaller 1000 lb. (450 kg) envelope and the jib must be centered (+/-10 degrees) verified to the control system by the jib centered limit switch mounted on the side swing rotator. When the operator selects the 1000 lb. (450 kg) mode and these conditions are met, the capacity light changes from 500 lb. (230 kg) to 1000#, jib swing is disallowed, and the envelope and permitted moment values are changed accordingly. When the operator selects the 1000 lb. (450 kg) mode and these conditions are not met, both capacity lights will flash, the platform alarm will sound, and all functions except jib swing will be disabled until the capacity select switch is put back into the 500 lb. (230 kg) position. Operation of jib swing in this condition can be used to find the center position of the jib as the jib swing function will stop when the center position is reached.

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Electronic Platform Leveling

The electronic platform leveling system uses two tilt sensors (mounted on either side of the pivot weldment), a control valve (mounted to the platform support), a level cylinder, and the platform control module (mounted in the platform control box) to automatically measure and control the incline of the platform with respect to gravity. While in the automatic position of the boom control select platform leveling is active while operating drive, telescope, lift or swing and is not active while operating any other function (e.g. rotate, jib, or steer). While in the manual position of the boom control select, platform leveling is active while operating lift only. The system controls the platform angle relative to gravity using a set point established during power-up (cycling of the EMS) or at the conclusion of a manual platform level override by the operator using the platform level override switch from either the platform or the ground control. In other words the operator can chose a platform incline other than level with gravity and the system will maintain that incline automatically.

If a fault occurs in the platform leveling system the following will occur:

- Automatic platform leveling will stop (except when there is a fault in only one sensor)
- · The platform level fault indicator will flash
- · The platform alarm will sound
- All functions will default to creep speed if in platform mode and the boom is out of the transport position.
 Refer to Transport Position Sensing System.

To reset the fault the emergency stop switch should be recycled.

Boom Control Select

The boom control select is controlled from the platform by a switch mounted on the platform control panel. It allows the operator the ability to select between two different modes of boom control functionality: automatic and manual. While in either mode, the Envelope Control System and Moment Control System remains active.

When the boom control is selected to the automatic boom control position, lift and telescope movements are coordinated by the control system as described in the Controlled Arc, Controlled Boom Angle, and Envelope Tracking descriptions. These systems will remain active to automatically assist the operator in keeping the boom within the envelope boundaries.

When operating in the automatic mode, the following functionality characteristics should be noted.

- While operating Lift Up, the boom may also telescope out (Controlled Arc)
- While operating Lift Down, the boom may also telescope in (Controlled Arc)
- While operating Swing or Drive, the boom may lift up or lift down (Controlled Boom Angle)
- While operating Telescope In, the boom may lift down when at high boom angles and the creep light is flashing (Envelope Tracking)

In addition, when the boom control is selected to the automatic position, the automatic platform leveling feature is active during lift, telescope, swing, and drive movements as described in the Electronic Platform Leveling System description.

When the boom control is selected to the manual position, lift and telescope movements are controlled separately by the operator effectively turning off the controlled arc, controlled boom angle, and envelope tracking systems. Without these systems being active, the control system will stop the movements of the boom when the envelope boundaries are reached and the functions that could violate the envelope will be restricted. The platform alarm will sound and the BCS light will flash with attempts to operate a restricted function. In addition, when the boom control is selected to the manual position, the automatic platform leveling feature is active only during lift movements.

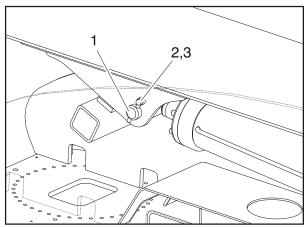
4.2 BOOM ASSEMBLY

Removal

- 1. Place machine on firm, level ground.
- 2. Slightly elevate the boom and support the fly boom with a crane or an adequate lifting device capable of handling 6 7 tons.



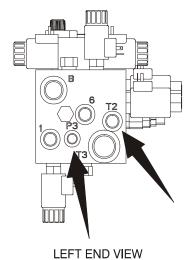
- 3. Place blocking under lift cylinder to hold it in place.
- **4.** Remove lift cylinder pin securing the lift cylinder rod to the boom.

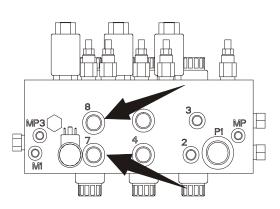


- 1. Pivot Pin
- 2. Bolt
- 3. Keeper Pin
- 5. Remove the boom end cover.

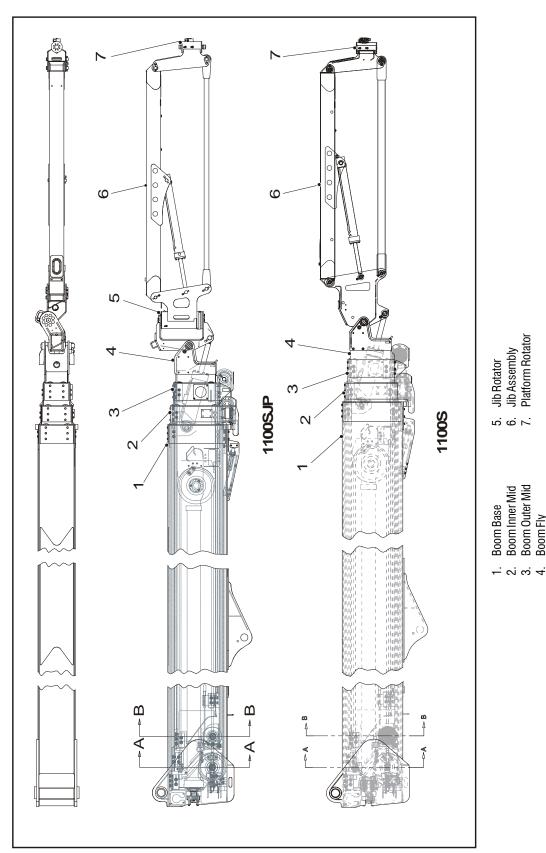
6. Tag and disconnect the telescope, tank, and pressure hoses as indicated below from the main valve and cap ends.







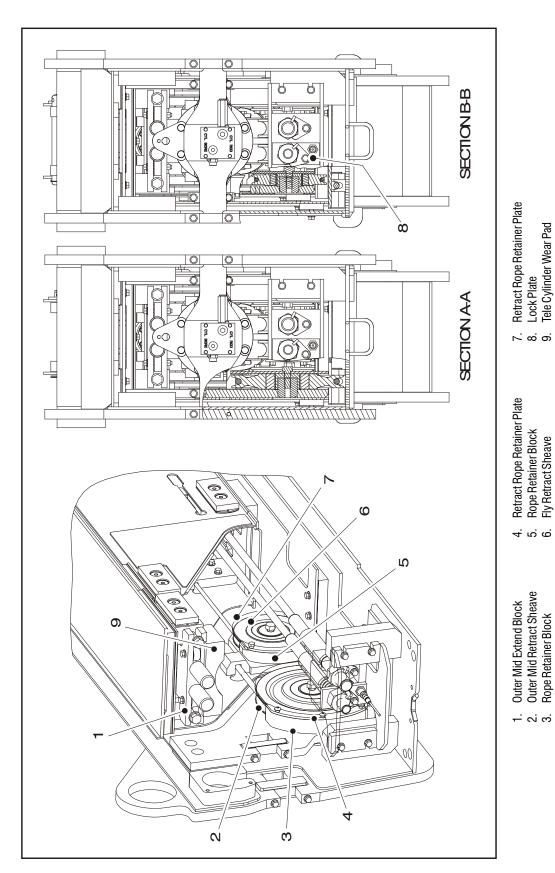
BOTTOM VIEW



Jib Rotator Jib Assembly Platform Rotator 5.

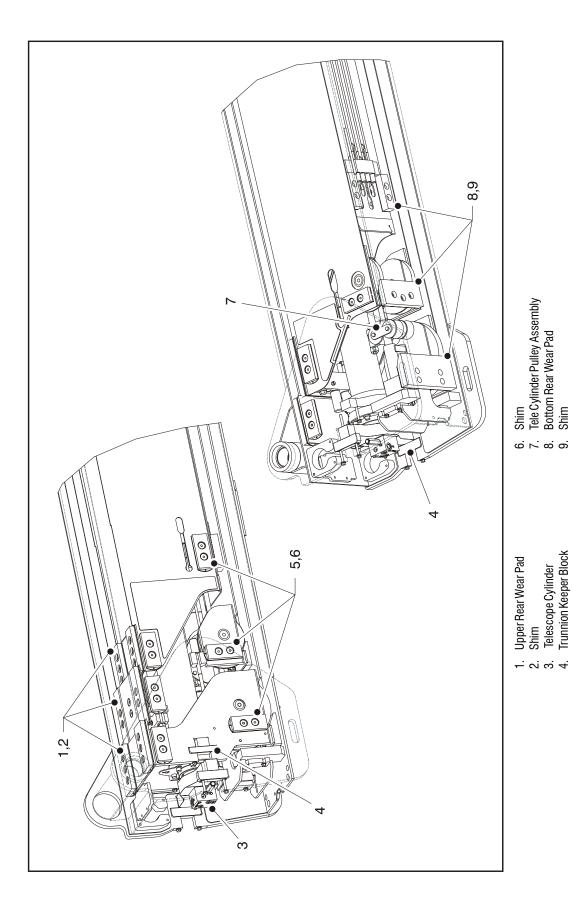
Boom Base Boom Inner Mid Boom Outer Mid Boom Fly

Figure 4-1. Boom Assembly - Sheet 1 of 9



- Retract Rope Retainer Plate Rope Retainer Block Fly Retract Sheave 4. 7. 9.
- Retract Rope Retainer Plate Lock Plate Tele Cylinder Wear Pad . 8 9. 9

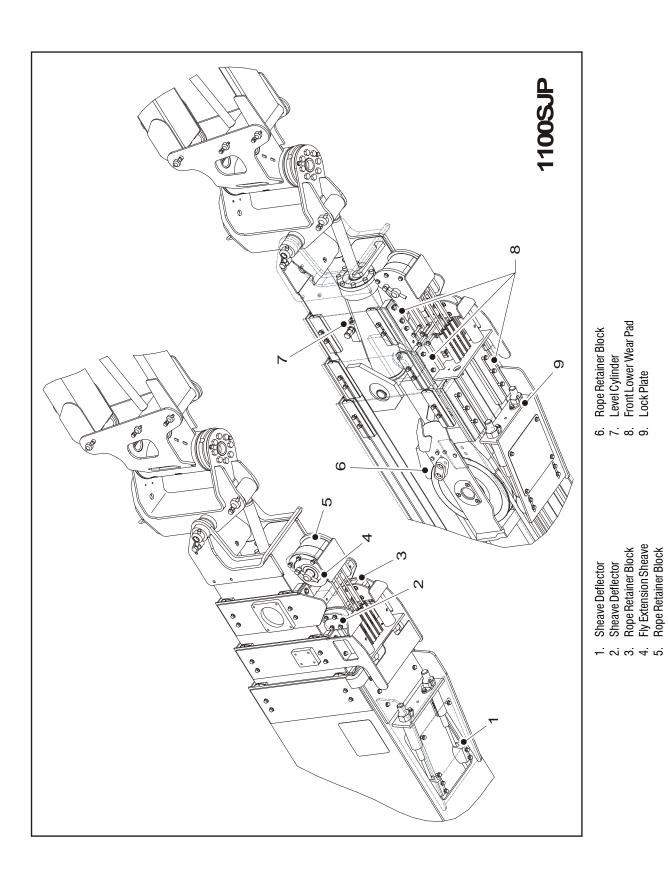
Figure 4-2. Boom Assembly - Sheet 2 of 9



9. % 6.

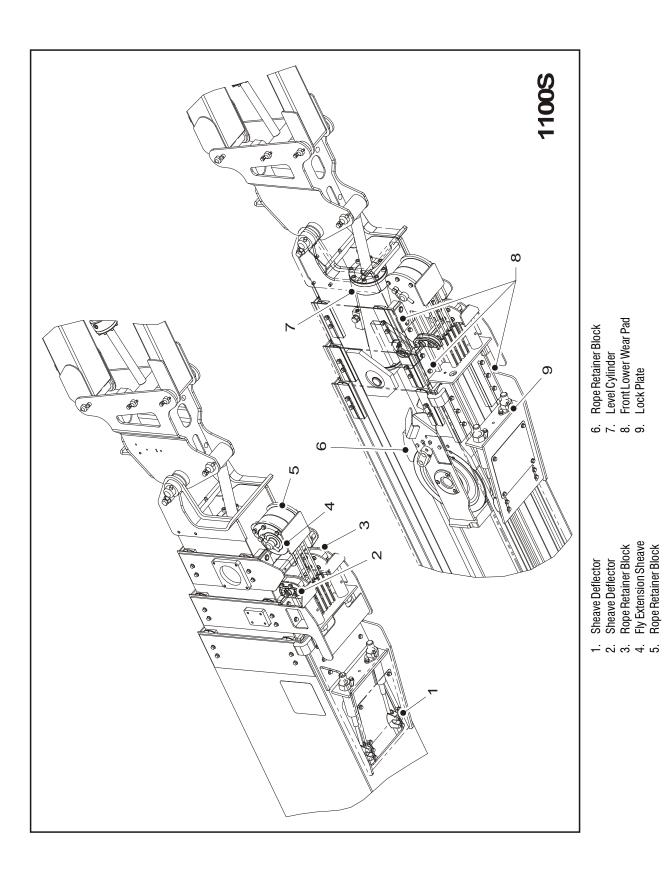
Upper Rear Wear Pad Shim Telescope Cylinder Trunnion Keeper Block Lower Rear Wear Pad - 2 8 4 6

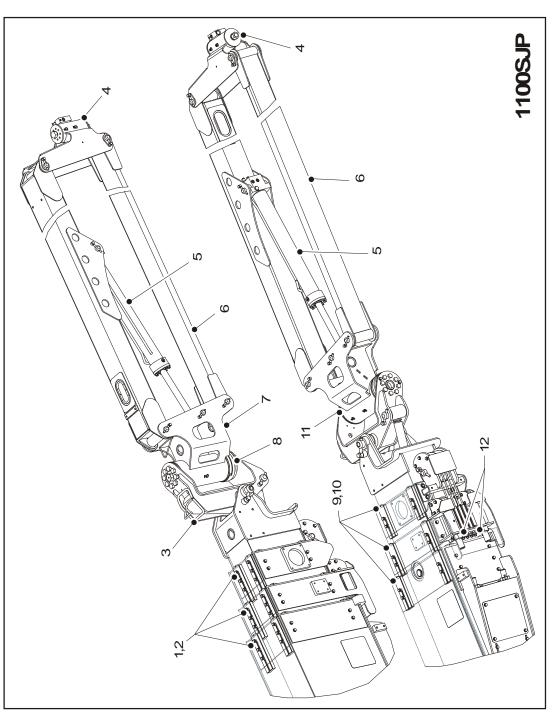
Figure 4-3. Boom Assembly - Sheet 3 of 9



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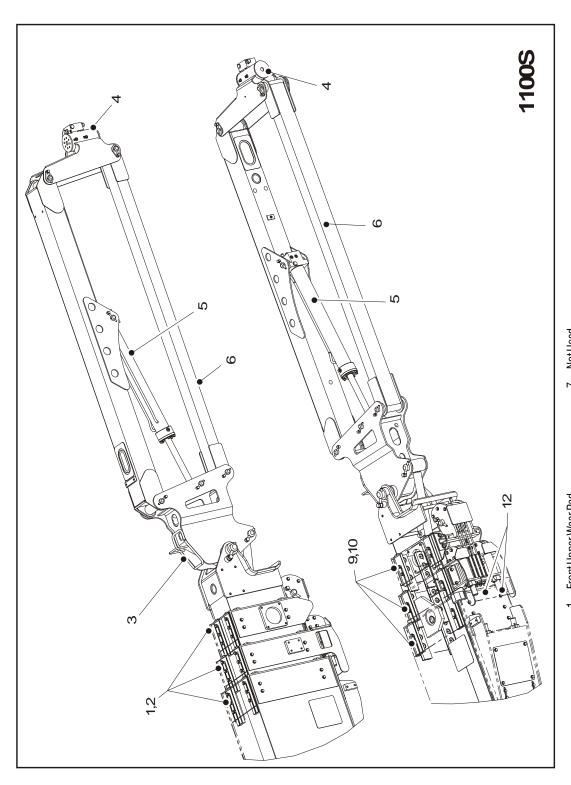
Figure 4-4. Boom Assembly - Sheet 4 of 9





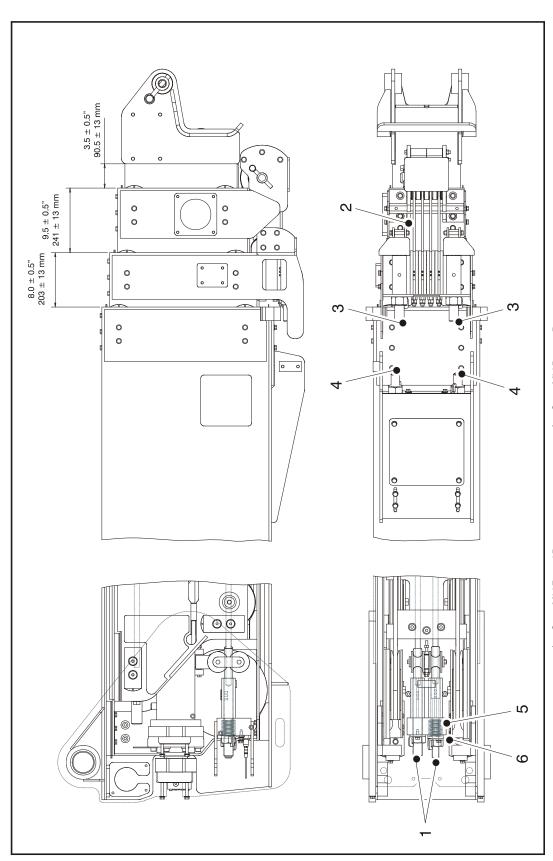
Front Upper Wear Pad
 Shim
 Shim
 Pivot Assembly
 Platform Rotator
 Jib Cylinder
 Lower Jib Link
 Tront Side Wear Pad
 Shim
 Jib Cylinder
 Lower Jib Link

Figure 4-6. Boom Assembly - Sheet 6 of 9



/ Not used	8. NotUsed	Front Side Wear Pad	10. Shim	11. Shim	12 Lock Plate
i. Fiolicoppei wear rad	. Shim	. Pivot Assembly	. Platform Rotator	. Jib Cylinder	I ower lib I ink
-	2	რ.	4.	5.	G

Figure 4-7. Boom Assembly - Sheet 7 of 9



Outer Mid Retract Rope Proximity Switch Spring Switch Adjustment Block 4. ... 6.

Figure 4-8. Boom Assembly - Sheet 8 of 9

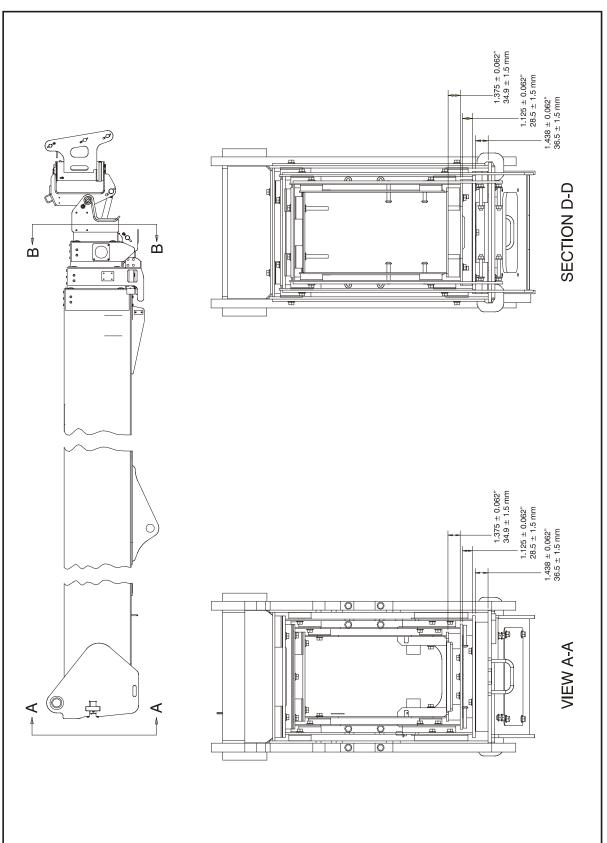


Figure 4-9. Boom Assembly - Sheet 9 of 9

7. Tag and disconnect the three electrical wires that run to the power track and the wire that goes to the proximity switch.

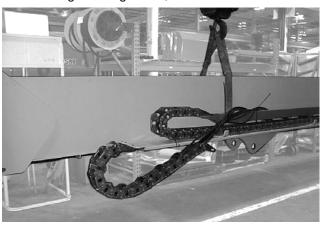


- 8. Unbolt the power track.
- **9.** Remove the bolt securing the keeper pin and remove the keeper pin from boom pivot pin.
- **10.** Using the lifting device, support the rear of the boom to remove the load from the pivot pin.



- 11. Remove the boom pivot pin.
- **12.** Move all of the hydraulic hoses and electrical wires so they are free from chassis.

13. Using the lifting device, remove boom from chassis.



14. Place boom on saw horses or other adequate supports.

Disassembly

NOTE: By dismounting the push tubes and push tube support brackets from the fly boom, outer mid boom, and inner mid boom, the powertrack assembly can remain attached to the base boom section. Straps (i.e. nylon ratchet straps) may be required to secure the upper portion of the powertrack assembly towards the base boom section.

NOTE: Prior to disassembling the boom, make sure the boom sections are extended about a foot to make it easier for component removal.

- 1. Use an adequate lifting device to support the jib.
- 2. Remove the leveling cylinder keepers and pins.



Tag and disconnect the two jib leveling cylinder hoses. Cap or plug all openings.

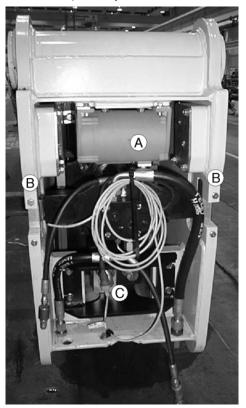


- **4.** Strap the power track to the base boom in several places for support.
- 5. Move the jib assembly away from the boom.
- 6. Remove the bolts that hold power track to boom.
- Count and mark all wear pads and shims to ensure proper boom section spacing during reassembly.
- 8. Remove the eight wear pads from the front of the boom base section.
- Remove the bronze deflector sheaves. Loosen the outer mid retract boom wire ropes.



- Remove the bolts securing the telescope cylinder trunnion blocks and remove the trunnion blocks.
- 11. Unbolt length sensor.
- **12.** Disconnect the cable running to the length sensor and remove the length sensor.

13. Remove the proximity sensor.



- A. Length Sensor
- B. Trunnion Bolts
- C. Proximity Sensor
- Loosen the four extend wire ropes at the front of the boom.
- **15.** Unbolt and remove the proximity sensor mounting block and spring.
- Unscrew the hydraulic hoses. Cap or plug all openings.
- 17. Remove trunnion keeper blocks.
- 18. Secure the base boom. Connect the extend and retract hoses to an external hydraulic power source and extend the telescope cylinder approximately 3 feet (1 m).
- **19.** Rotate the telescope cylinder end 90° so the ears on the end of the cylinder are vertical.
- Remove the boom length limit switch on the forward end of the base boom.

21. Extend the inner mid, outer mid and fly boom out approximately two feet (0.5 m).



Pull out the wire ropes between the base boom and mid boom.



NOTE: The telescope cylinder may remain attached to the fly, outer mid, and inner mid sections for step 23, or may be removed prior to complete boom disassembly as in steps 24 thru 27.

23. Pull the inner mid, outer mid, and fly boom sections out slowly along with wire ropes.



24. Remove trunnion keepers from the telescope cylinder barrel.

- **25.** Pull telescope cylinder and wire ropes out of the boom approximately 3/4 of the way.
- 26. Unbolt the extend rope block.
- **27.** Finish pulling the telescope cylinder and wire ropes out of the boom.
- **28.** Remove the wire rope retaining plates and blocks from the inner mid boom.
- 29. Remove the bearing cups and sheaves.

NOTE: A 3/4-16 UNF bolt can be used as a puller to remove the bearing cups.

- **30.** Remove the top and side wear pads from the forward end of the inner mid boom section.
- **31.** Unbolt the two retract wire ropes and four extend wire ropes. Remove the wire rope keepers.
- **32.** Pull the outer mid boom out approximately three feet (1 m).
- **33.** Remove the bottom wear pads.
- 34. Remove the bronze deflectors and retainer blocks.
- Pull the outer mid boom section and wire ropes out of the inner mid boom.
- **36.** Remove the wire rope ends from mid boom.
- Remove the retainer plates, bearing cups, rope retainer blocks, and sheaves from the outer mid section.
- **38.** Remove the wear pads from the outer mid boom top side.
- 39. Unbolt the keepers.
- 40. Unbolt the pin keeper.
- 41. Remove the sheave pin.
- 42. Remove the sheave.
- Pull the fly boom and wire ropes out of outer mid boom
- 44. Remove the wire rope ends from the fly boom.

Assembly

NOTE: Moderately apply Super Lube JLG Part No. 3020042 to all four inner surfaces of both ends of each boom section to a minimum depth of 3 to 4 feet (1 to 1.25 m). The fly boom section only needs Super Lube applied to the insertion end.

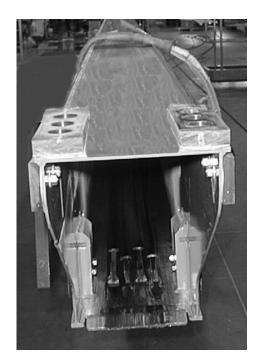
Super Lube is also to be moderately applied to all outer surfaces of interior wear pads after they are installed to the insertion end of boom sections. Care should be taken to avoid application on exposed painted surfaces of the fully extended boom.

NOTICE

WIRE ROPE NUTS ARE CLOSE IN SIZE AND CAN BE SWITCHED. BE CAREFUL. OUTER MID RETRACT NUTS, LOCATED ON BOTTOM OF BASE BOOM, WILL BE BLACK IN COLOR.

 Install the fly retract wire rope button ends into the slots in the side of the fly boom, coil the remaining lengths of wire rope and place them into the fly boom, tape the slots to keep the rope from jumping





2. Install the fly extend wire rope button ends into the slots on the bottom of the fly boom section. Place tape over the wire ends to keep them in place during assembly.



Manufacture a special fixture as shown below to keep four extend wire ropes from crossing over each other.



4. Insert the fly into outer mid boom keep it out far enough, about 2 feet (0.6 m, to enable access for installation of the level cylinder pivot pin. **5.** Install the front lower wear pads and shims to the outer mid boom as marked during disassembly.

NOTICE

DO NOT ALLOW THE FLY BOOM TO REST ON THE FOUR EXTEND WIRE ROPES WHILE INSERTING IT INTO THE OUTER MID BOOM.

- 6. Uncoil the fly retract wire ropes from the fly boom. Route the threaded ends of the wire ropes through the holes in the outer mid boom plates at the retract sheave locations.
- 7. Apply a thin coat of moly paste lubricant to the inside diameter of the sheave composite bearings. Install the fly retract sheaves and bushing cups while guiding the wire ropes from the previous step into their respective sheave grooves. Apply moly paste lubricant on the inside diameter of the sheave bushing cup. Ensure the sheaves move freely. A 3/4" 16UNF bolt may be used as a pulling tool to remove the bushing cup if required.

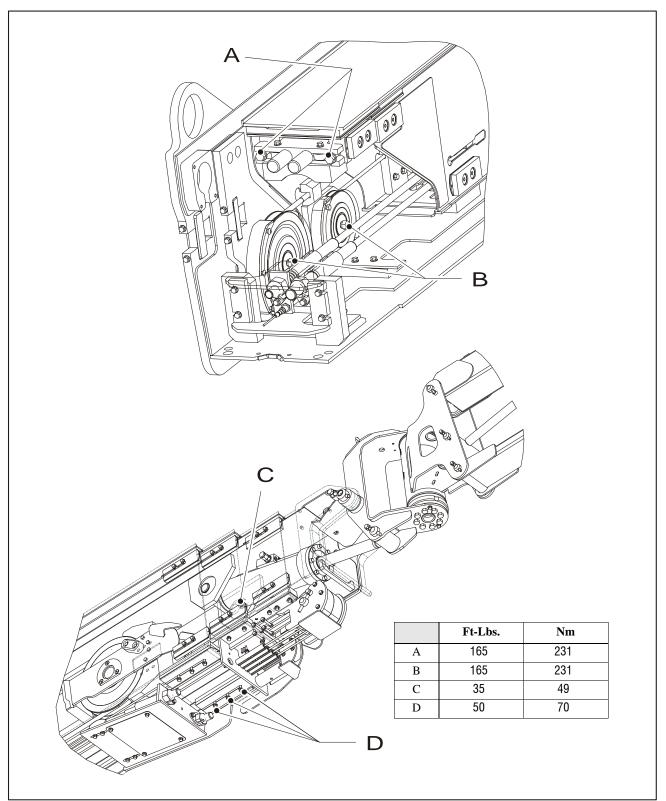


Figure 4-10. Boom Assembly Torque Values - Sheet 1 of 2

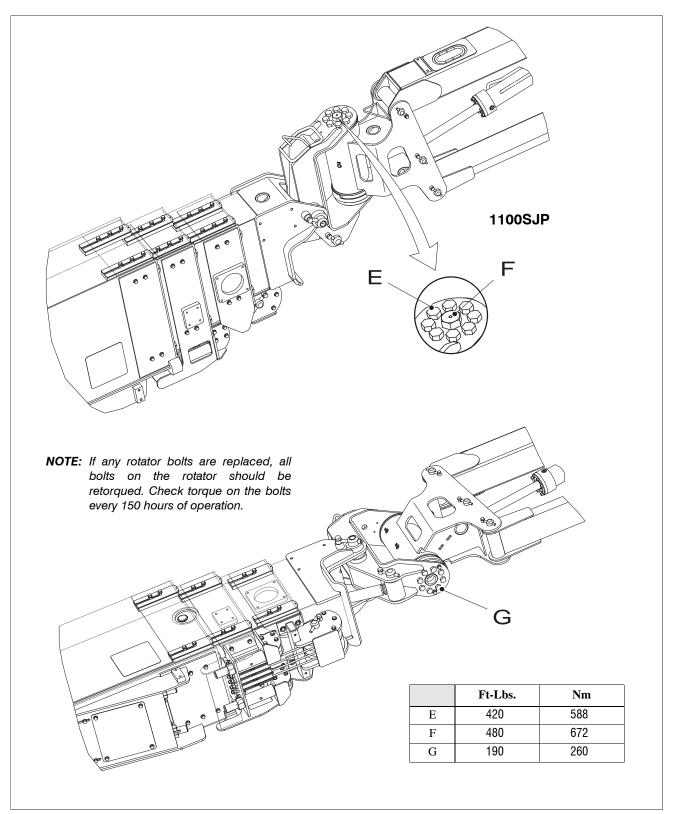


Figure 4-11. Boom Assembly Torque Values - Sheet 2 of 2

8. Install the wire rope retainer blocks, retainer plates, and bolts. Torque the main sheave bolts on the left and right sides to 165 ft. lbs. (231 Nm).





- Route the threaded ends of the four fly extend wire ropes through the extend sheave mount on outer mid boom.
- 10. Apply a thin coat of moly paste lubricant to the inside diameter of the sheave composite bearings. Install the fly extend sheave, pin, pin keeper, and wire rope retainer blocks and shims.

NOTE: Use shims to avoid pulling the sheave mount plates together. Ensure that the sheave moves freely.

- 11. Install the outer mid retract wire rope button ends into the slots on the rear side of the outer mid boom. Slide the remaining lengths of wire rope into the outer mid and fly boom subassembly for ease of remaining steps.
- **12.** Insert the outer mid and fly boom subassembly into the inner mid boom. Allow the subassembly to remain about two feet (0.6 m) partially extended.
- Install the lower wear pads and shims to the inner mid boom at the forward end of the boom assembly.

NOTE: Ensure that the fly retract wire ropes are located into their respective grooves in the wear pad.

14. Slide out the remaining outer mid retract wire ropes from the outer mid and fly boom subassembly. Route the threaded ends of the wire ropes through the holes in the inner mid bottom plate at the retract sheave locations.



- 15. Apply a thin coat of moly paste lubricant to the inside diameter of the sheave composite bearings. Install the outer mid retract sheaves and bushing cups while guiding the wire ropes from the previous step into their respective sheave grooves. Apply moly paste lube on the inside diameter of the sheave bushing cup. A 3/4" 16 UNF bolt may be used as a pulling tool to remove the bushing cup if required.
- **16.** Install the wire rope retainer blocks, retainer plates, and bolts. The main sheave bolts on the left and right are torqued to 165 ft. lbs.(231 Nm).

- 17. Route the threaded ends of the fly retract wire ropes through the inner mid wire rope adjustment holes at the forward end of the boom assembly. Engage the threaded fitting pins into the adjuster tube slots.
- **18.** Install the fly retract wire rope deflector sheaves, retainer blocks and loosely install the adjuster nuts onto the threaded fly retract wire rope fittings.

NOTE: The bolt heads of the deflector sheaves and retainer blocks should face outward.

- 19. Route the threaded ends of the fly extend wire ropes through the inner mid wire rope adjustment holes at the forward end of the boom assembly. Engage the threaded fitting pins into the adjuster tube slots.
- Loosely install the adjuster nuts onto the threaded fly extend wire rope fittings.

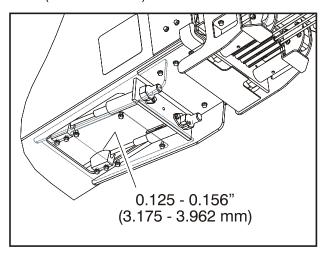
NOTE: Do not install the nylon collar lock nuts at this time.



- 21. Install the three section boom subassembly into the base boom. Allow the boom subassembly to remain about two feet (0.6 m) partially extended.
- **NOTE:** Do not allow the three boom subassembly to rest on the retract wire ropes while inserting it into the base boom.
 - 22. Route the threaded ends of the outer mid retract wire ropes into their respective tubes located in the adjuster box on the bottom of the base boom and loosely install adjuster nuts into the threaded retract wire rope fittings. Ensure that the threaded fitting pins are engaged into the adjuster tube slots.
- **NOTE:** The outer mid retract wire ropes adjuster nuts are plated black to distinguish them from the fly retract wire rope adjuster nuts, their thread sizes are similar but not interchangeable.



- 23. Install the lower wear pads, spacer blocks, and shims to the base boom at the forward end of the boom assembly.
- 24. Install the deflector sheaves into the outer mid wire rope adjuster box located on the bottom of the base boom at the forward end. Using their respective mounting slots, slide deflector sheaves into position until sheaves are approximately 0.125" -0.156" (3.175 3.962 mm) from the inner mid boom.



- 25. Apply a thin coat of moly paste lubricant to the inside diameter of the sheave composite bearings. Install the sheave and sheave pin to the end of the telescope cylinder. Ensure that the sheave moves freely.
- **26.** Route the outer mid extend wire ropes around the extend sheave on the telescope cylinder.

NOTE: The button ends of the wire ropes are to be positioned to the top of the assembly. The wire rope with the 1-12UNF threaded fitting is to be placed into the sheave groove on the side opposing the boom power track, while the wire rope with the 1 3/8-6UNC threaded fitting is to be placed into the sheave groove on the power track side of the boom assembly.

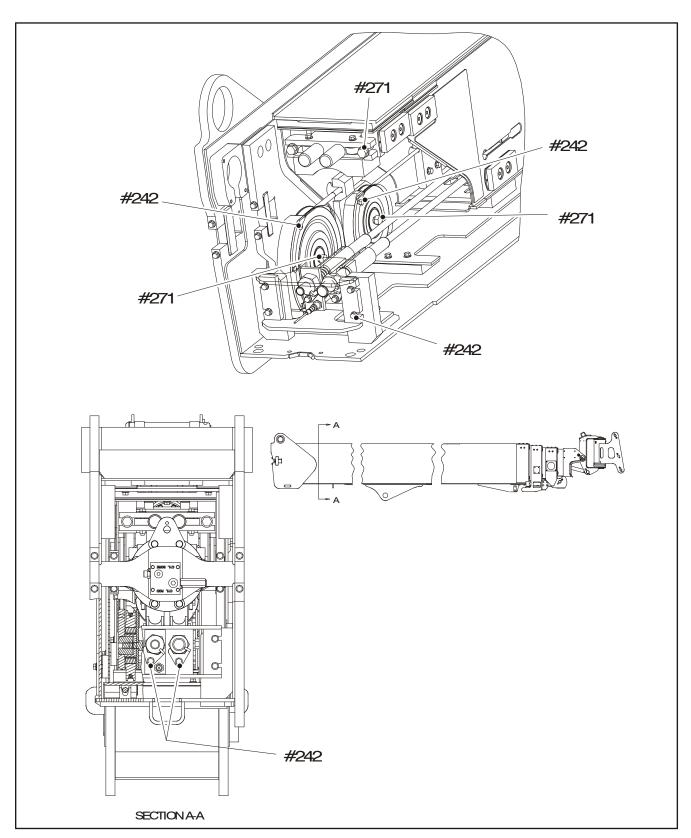


Figure 4-12. Locations for Loctite Application - Sheet 1 of 4

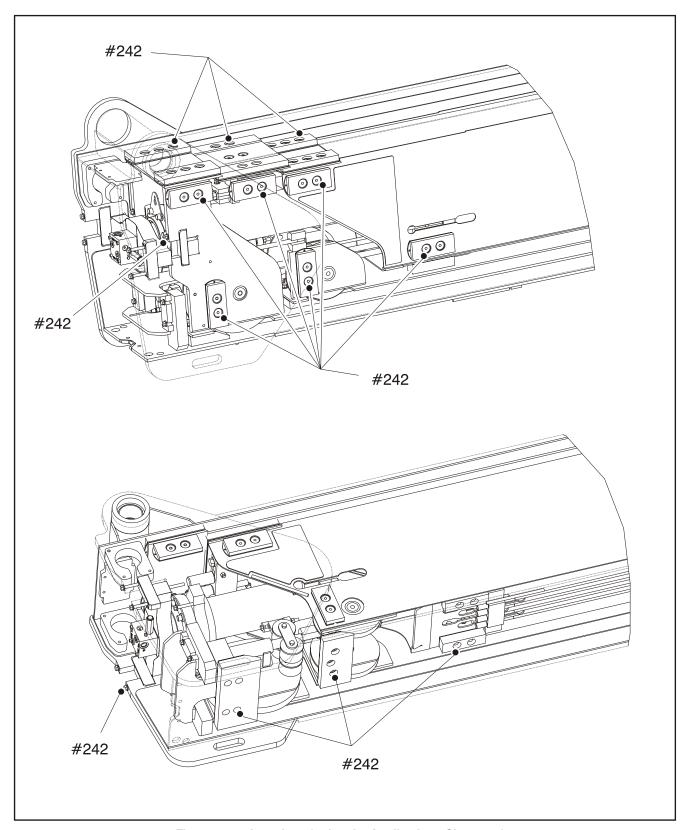


Figure 4-13. Locations for Loctite Application - Sheet 2 of 4

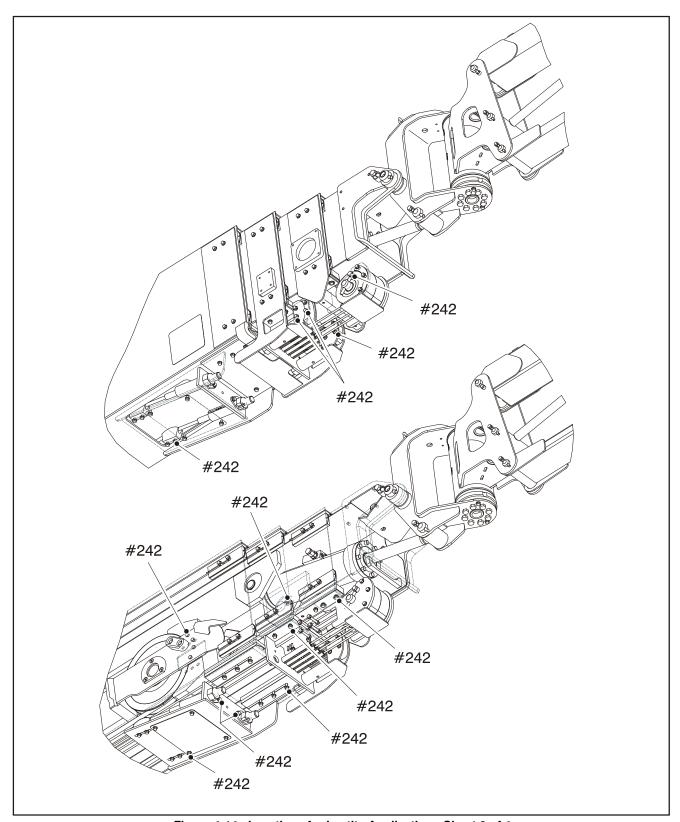


Figure 4-14. Locations for Loctite Application - Sheet 3 of 4

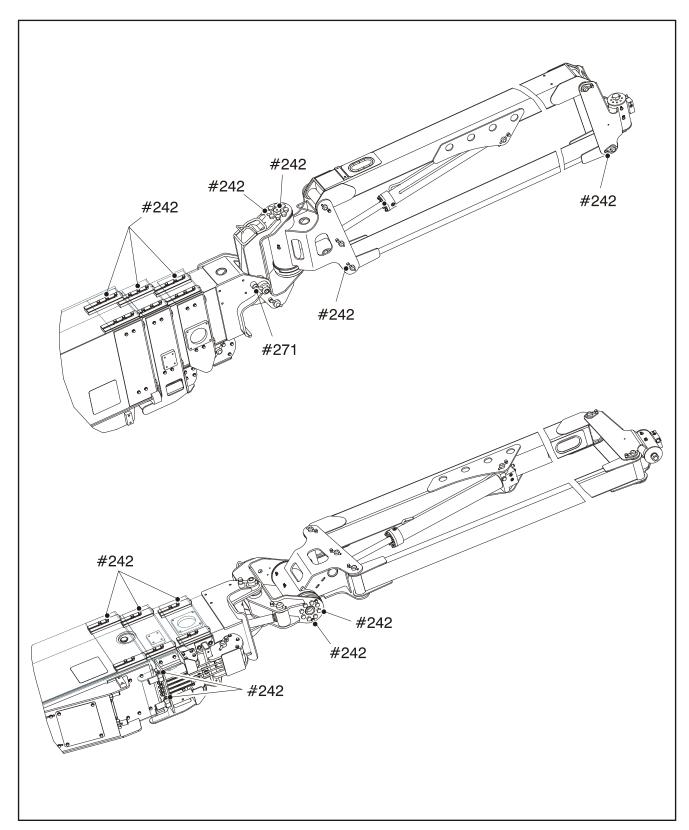


Figure 4-15. Locations for Loctite Application - Sheet 4 of 4

27. Install the wire rope retainer block to the end of the telescope cylinder.



- **28.** Install the outer mid extend block and guides to the button end of the extend wire ropes.
- 29. Insert the telescope cylinder into the boom assembly. Allow the cylinder assembly to remain partially extended from the boom assembly for the following steps.
- NOTE: The telescope cylinder rod is to be extended about three feet (1 m) for the following steps. Also, care must be taken to ensure that the telescope cylinder and its subassemblies avoid forcible impact with other boom assemblies.
 - 30. Install the outer mid extend block to the end of the outer mid boom; connecting the button ends of the outer mid extend wire ropes to the outer mid boom. Torque bolts to 165 ft.lbs. (231 Nm).
 - 31. Install the wire rope guide sheaves and assemble components to the bottom of the telescope cylinder while routing the extend wire ropes through the guide sheaves.
 - 32. Install the extend wire rope anchor weldment onto the extend wire rope threaded fittings while ensuring that the threaded fitting pins are engaged into the anchor weldment tube slots.
 - 33. Install the compression spring, proximity sensor mounting block and the adjuster nut to the 1-12UNF threaded fitting. The nut is to be installed loosely at this time. Do not install the proximity sensor at this time. This portion of the assembly is to be located on the side opposing the boom powertrack.



- **34.** Loosely install the 1 3/8-6UNC adjuster nut to the other threaded fitting. This portion of the assembly is to be located on the power track side of the boom assembly.
- 35. Continue to insert the telescope cylinder into the boom assembly until the cylinder barrel trunnion ears seat into their respective pockets in the inner mid boom.

NOTICE

CARE MUST BE TAKEN TO ENSURE THAT THE CYLINDER AND SUBASSEMBLIES AVOID FORCIBLE IMPACT WITH OTHER INTERNAL BOOM ASSEMBLIES.

- **36.** Use shims as required, install the telescope cylinder barrel trunnion keeper blocks and bolts.
- Locate the extend wire rope anchor weldment and install the mounting bolts.
- **38.** Retract the telescope cylinder rod and position the trunnion ears into their respective pockets in the base boom.
- **39.** Using shims as required, install the telescope cylinder rod trunnion keeper blocks and bolts.



- 40. Install the remaining top and side wear pads and shims to forward end of the boom assembly. Shim until snug.
- 41. Install the boom length sensor (string pot) to the base boom at the aft end of the assembly and connect the measuring cable to the bracket on the telescope cylinder barrel

NOTE: Ensure that the measuring cable ring retaining hardware is assembled onto the bracket on the telescope cylinder barrel. When handling the measuring cable, do not allow sensor to freely retract the cable to the end of its' stroke at a fast rate. Always hold onto the cable ring when allowing it to retract.

- **42.** Install the boom length limit switch to the base boom at the forward end of the assembly.
- Install the jib assembly and the jib assembly level cylinder.
- **44.** Install the power track push tube to the outer mid and fly boom sections and the push tube support brackets to the inner mid boom section.

NOTE: Use shims at the fly boom and inner mid mounting areas to align the push tubes with the remaining portion of the power track assembly.

- **45.** Adjust the wire ropes per JLG wire rope tensioning procedure.
- 46. Install and adjust the proximity sensor to the outer mid extend wire rope anchor weldment.

4.3 JIB ROTATOR ORIENTATION (1100SJP ONLY)

In order for the Jib Rotator to rotate properly, it must be installed with the timing marks running parallel to the flat rotator mounting plate as shown below.

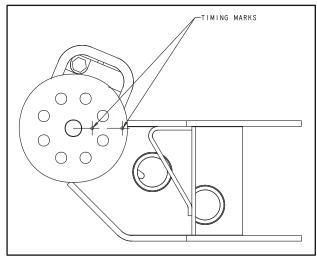


Figure 4-16. Jib Rotator Orientation

4.4 JIB LIFT END OF STROKE DAMPENING

The jib lift cylinder is constructed in a way that causes the jib lift cylinder oil flow to be restricted by an orifice while raising the jib within 5 degrees of maximum elevation. This restriction slows the jib lift speed while raising the jib. The oil flow is not restricted while lowering the jib and therefore the speed is not altered.

4.5 LOAD SENSING PIN REMOVAL AND INSTALLATION

1. Place the machine on a firm, level surface.

NOTE: Replacing the load sensing pin requires the boom sensors be re-calibrated. Make sure the machine is in an area where this can be accomplished after installation of the new pin.

- Remove the screws from the bracket connecting the engine tray to the hood.
- Swing the engine tray out to gain access to the sensing pin and retaining pin.

NOTE: The lift cylinder weighs 787 lbs. (357 kg.)

4. Run a nylon strap capable of supporting the weight of the lift cylinder around the bottom of the cylinder. Lift up on the strap to relieve the weight of the lift cylinder on the load sensing pin.



Loosen and remove the bolt that secures the retaining pin and remove the retaining pin.



Disconnect the wiring harness from the strain relief connector at the opposite side of the load sensing pin. 7. Use the Load Pin Removal Tool (JLG P/N 4846765) to prevent the pin from being damaged, and use a hammer to remove the pin. To make the tool refer to Figure 4-17., Load Pin Removal Tool, JLG P/N 4846765. If the Load Pin Removal Tool is not available, use an arbor of the proper size (as shown below). If excessive force is necessary to move the pin, it may be necessary to carefully activate lift using the auxiliary power switch to relieve lift cylinder weight from the load sensing pin.



- 8. When installing a new pin, make sure all of the holes in the turntable and lift cylinder are aligned. If the new load sensing pin does not push 1/2 to 3/4 of the way in by hand, remove the pin and align the holes better. Also make sure the pin is installed with the strain relief connector opposing the pin orientation bar as shown. Refer to Figure 4-24., Pivot Pin Installation.
- Using an oak block, carefully tap the pin until it is fully installed. Secure the pin in place with the retaining pin and retaining pin bolt.

NOTICE

DO NOT TAP ON THE CENTER OF THE PIVOT PIN.

 Connect the wiring harness to the strain relief connector and re-calibrate the boom sensors.

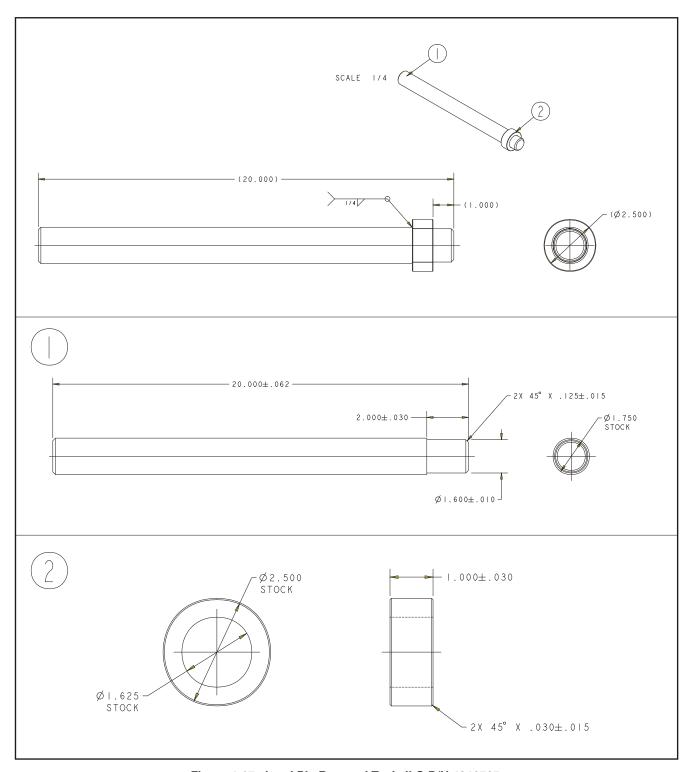


Figure 4-17. Load Pin Removal Tool, JLG P/N 4846765

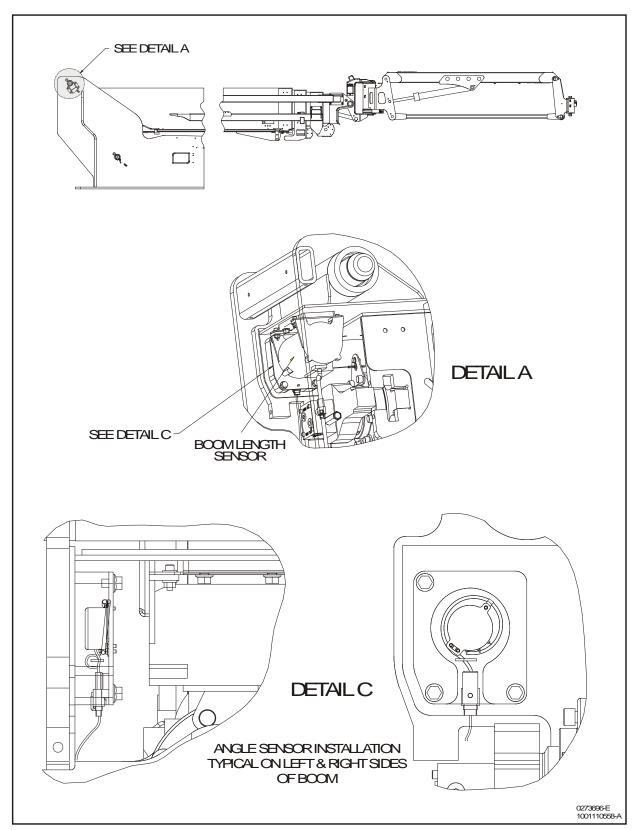


Figure 4-18. Boom/Jib Sensors and Switches Installation - Sheet 1 of 5

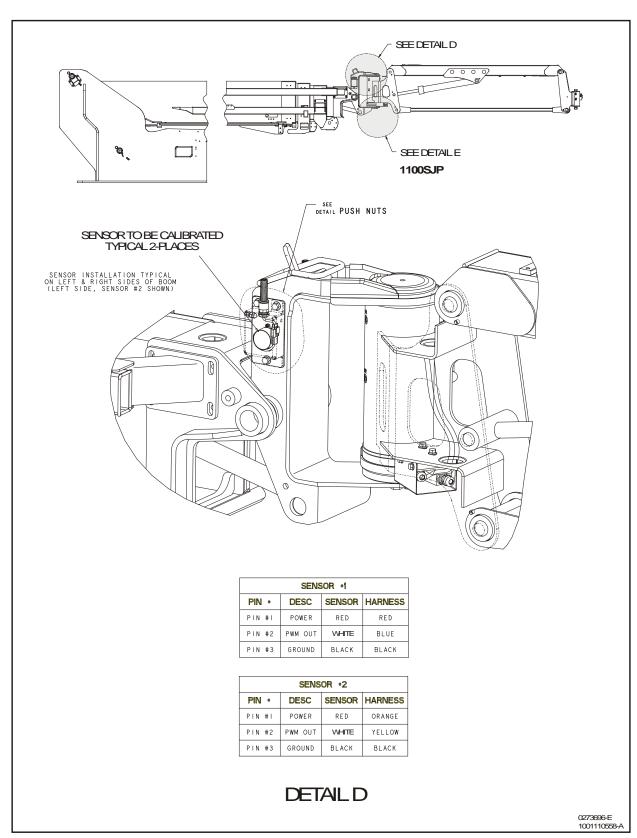


Figure 4-19. Boom/Jib Sensors and Switches Installation - Sheet 2 of 5

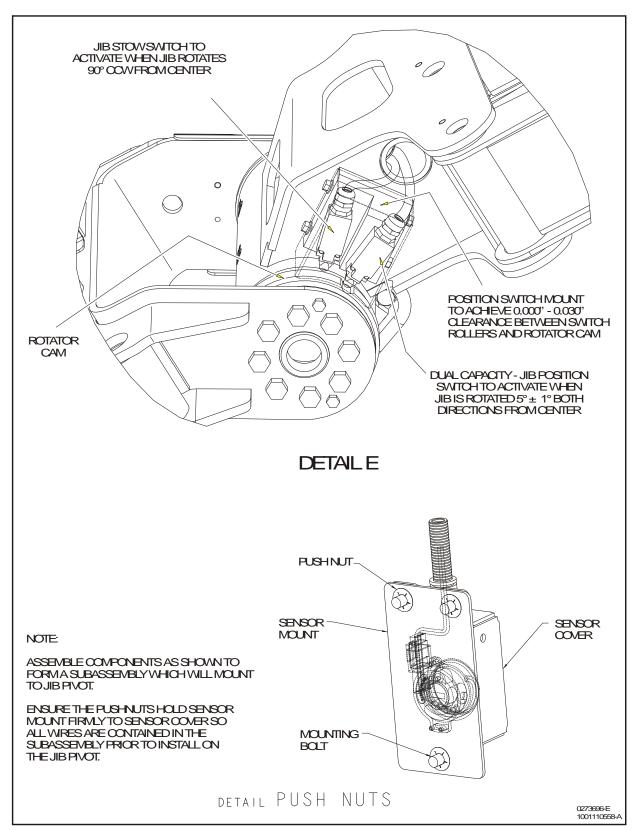


Figure 4-20. Boom/Jib Sensors and Switches Installation - Sheet 3 of 5

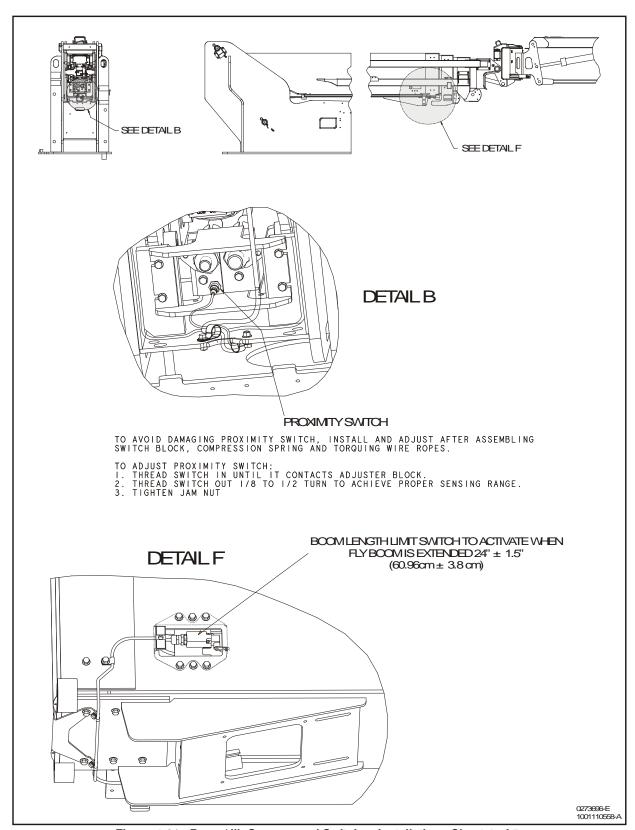


Figure 4-21. Boom/Jib Sensors and Switches Installation - Sheet 4 of 5

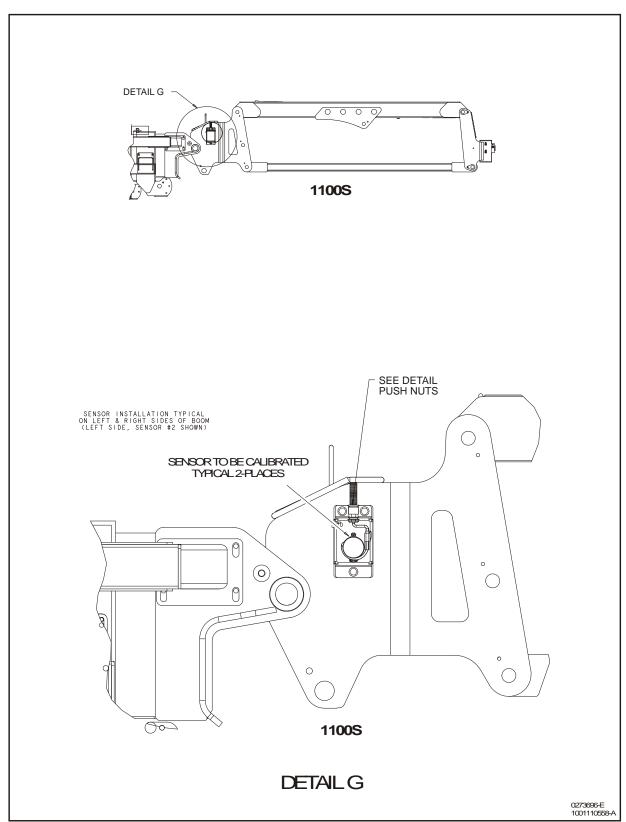
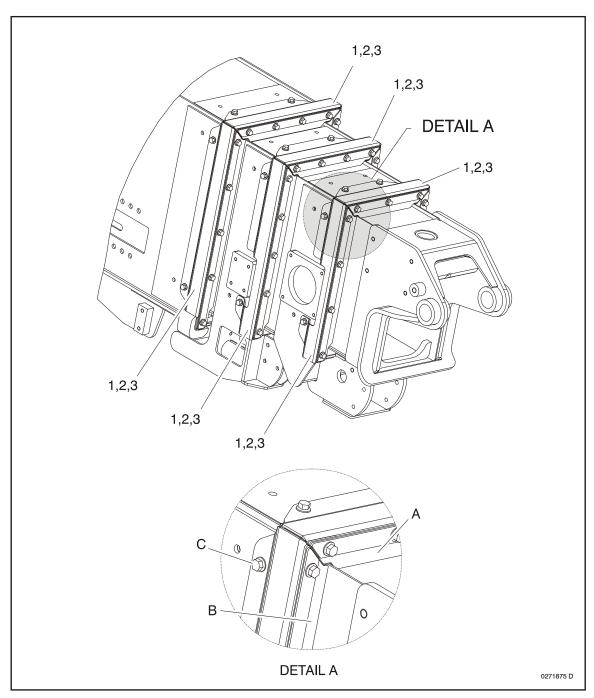


Figure 4-22. Boom/Jib Sensors and Switches Installation - Sheet 5 of 5



- 1. Bar
- 2. Blade
- 3. Mount
- A Adjust top blades 0.000 to 0.063" (0 to 1.6 mm) from top boom plate
- B Adjust side blades 0.000 to 0.063" (0 to 1.6 mm) from side boom plate
- C Apply Loctite #242 & torque to 50 ft.lbs. (70 Nm)

Figure 4-23. Boom Wiper Installation

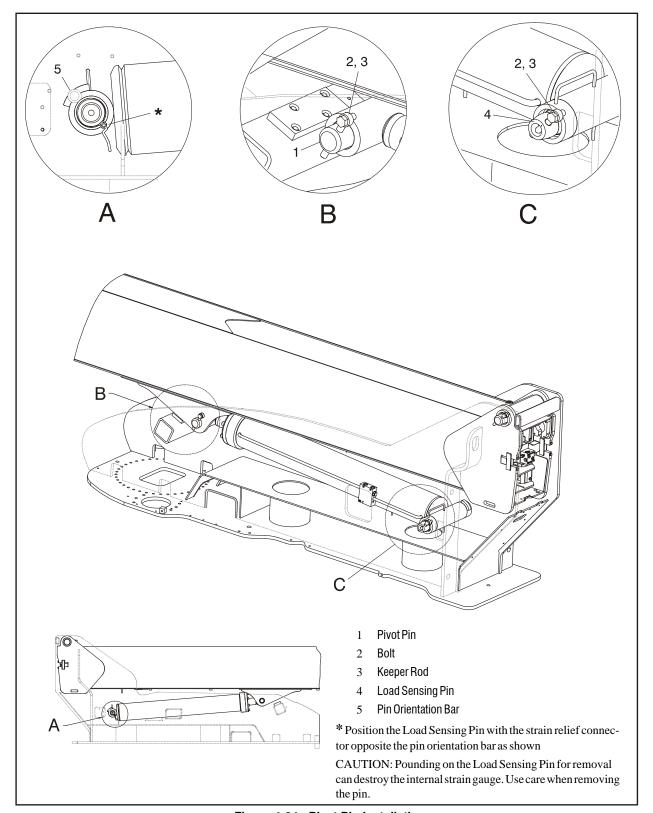


Figure 4-24. Pivot Pin Installation

4.6 POWERTRACK MAINTENANCE

One Piece Bracket Maintenance

1. Place the powertrack on a workbench.



2. Remove the screws from the bars on one side of the powertrack on the first link.





3. Remove the screws from the flat bar on the other side of the powertrack.



4. Pull up on the loose side of the round bar to allow the poly roller to slide off.



5. Slide the poly roller off of the round bar.





6. Hold the round bar to remove the other screw.



7. Slide the flat bar out.





8. Remove the snap ring from one side of the bracket.



9. Remove the snap ring from the other side of the bracket.



10. Push down with slight pressure on the link and slide the bracket side up and over the extrusion on the link.



11. Repeat the previous step on the other side.

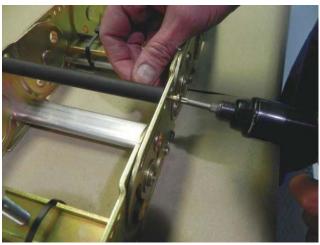


12. Slide the bracket off of the powertrack.

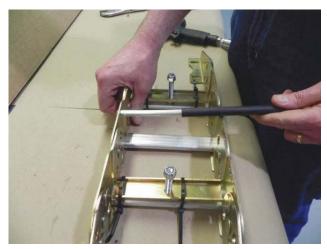


Two Piece Bracket Maintenance

1. Loosen the screw.



2. Slide the roller off the bar.



3. Hold the bar tightly and remove the other screw.



4. Hold the flat bar and remove the screws.



5. Remove the snap rings and pins.



6. Remove the screws from the bar. Remove the snap ring and pin.



7. Slide the link out.

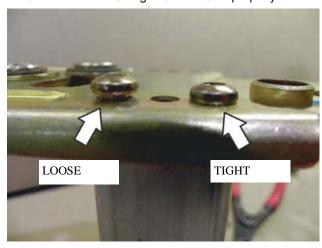


Snap Rings and Screws

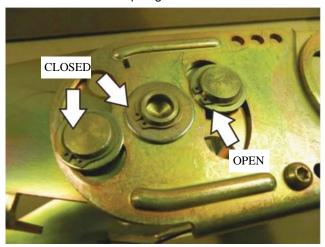
NOTICE

WHEN PERFORMING MAINTENANCE ON THE POWERTRACK, MAKE SURE TO DISCARD AND REPLACE ALL OLD SCREWS.

Make sure screws are tight and installed properly.



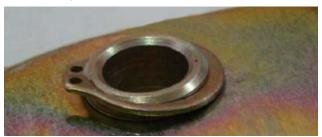
Make sure that all snap rings are closed and seated.



An open snap ring is shown below.



A snap ring that is not seated is shown below.



A seated and closed snap ring is shown below.



10-24 \times 0.812 button torx socket head with blue locking patch:

- Tighten to 45-50 in.lbs. (5-5.6 Nm).
- Use T-25 torx bit.
- Do not reuse this screw. After removing replace with a new one.

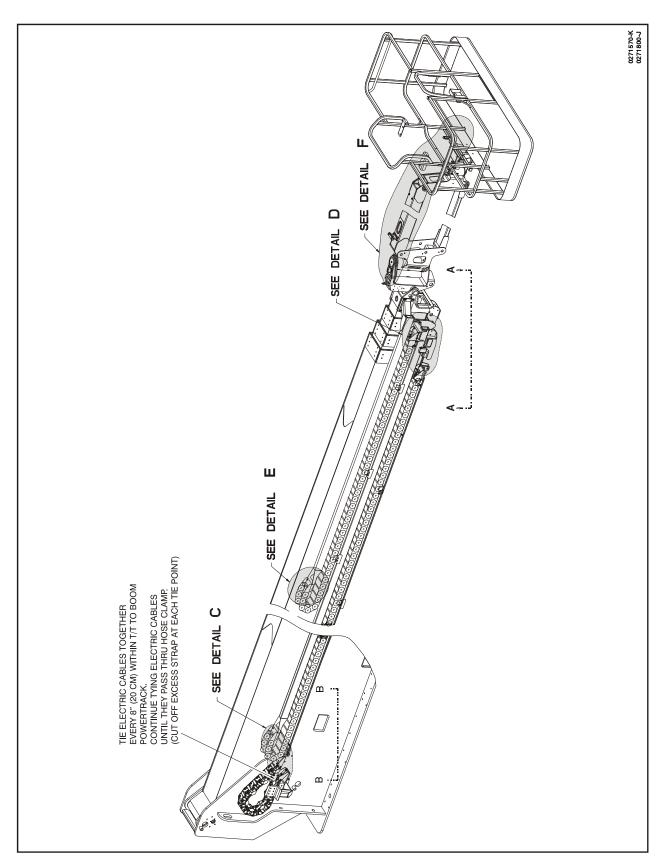


Figure 4-25. Powertrack Installation - Sheet 1 of 6

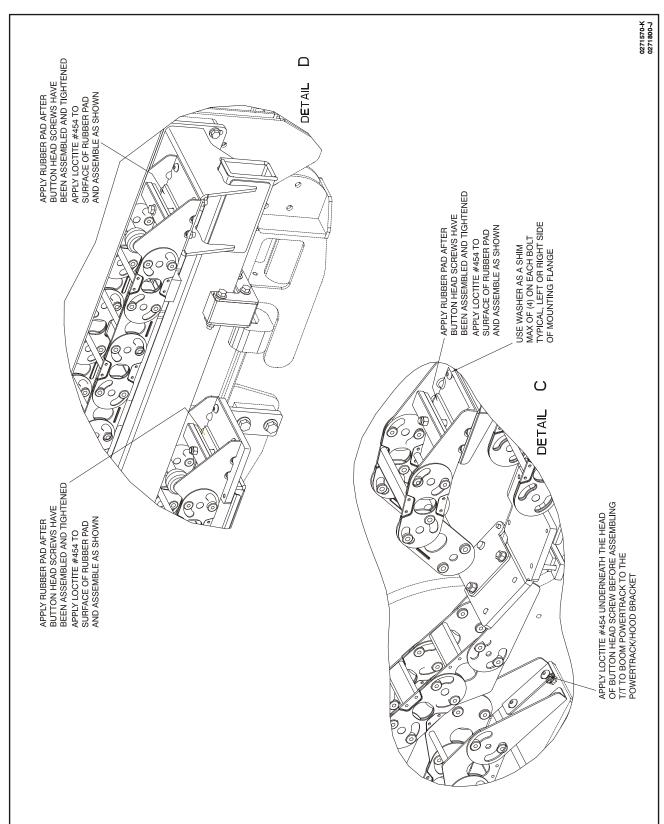


Figure 4-26. Powertrack Installation - Sheet 2 of 6

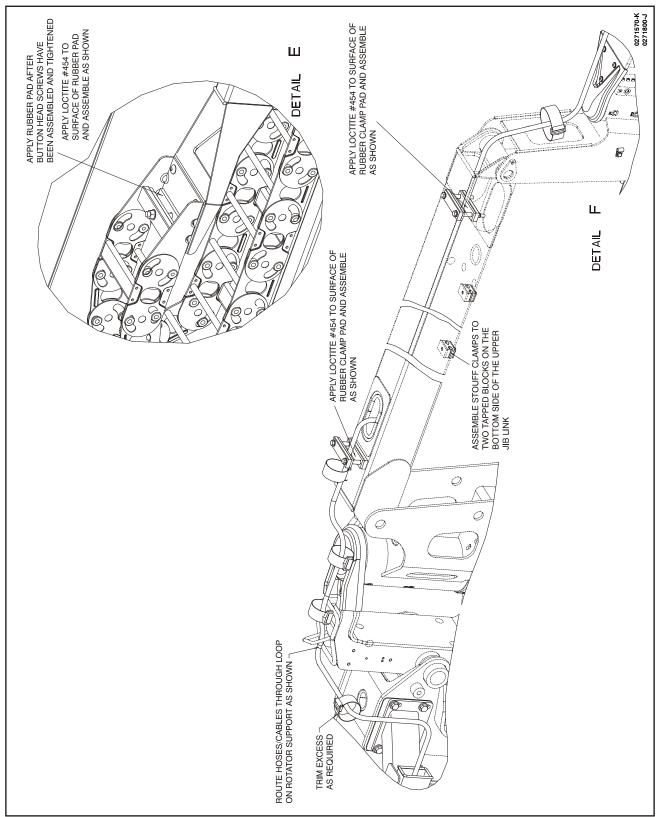


Figure 4-27. Powertrack Installation - Sheet 3 of 6

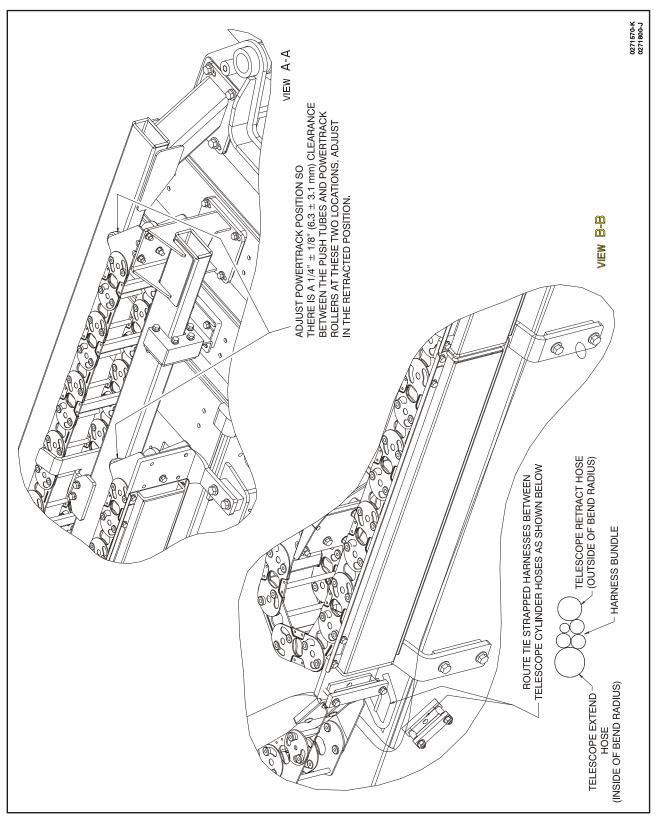


Figure 4-28. Powertrack Installation - Sheet 4 of 6

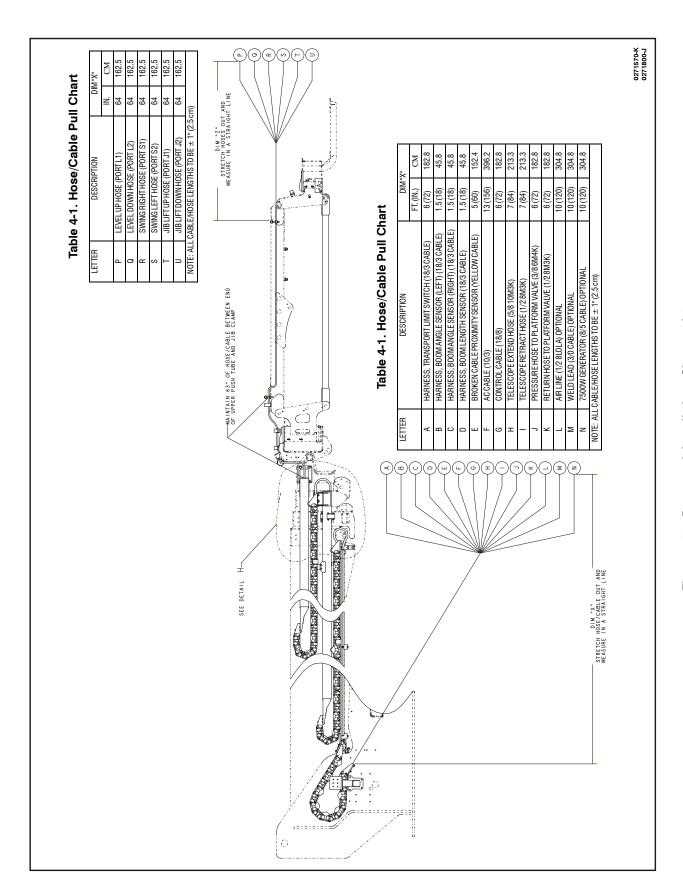


Figure 4-29. Powertrack Installation - Sheet 5 of 6

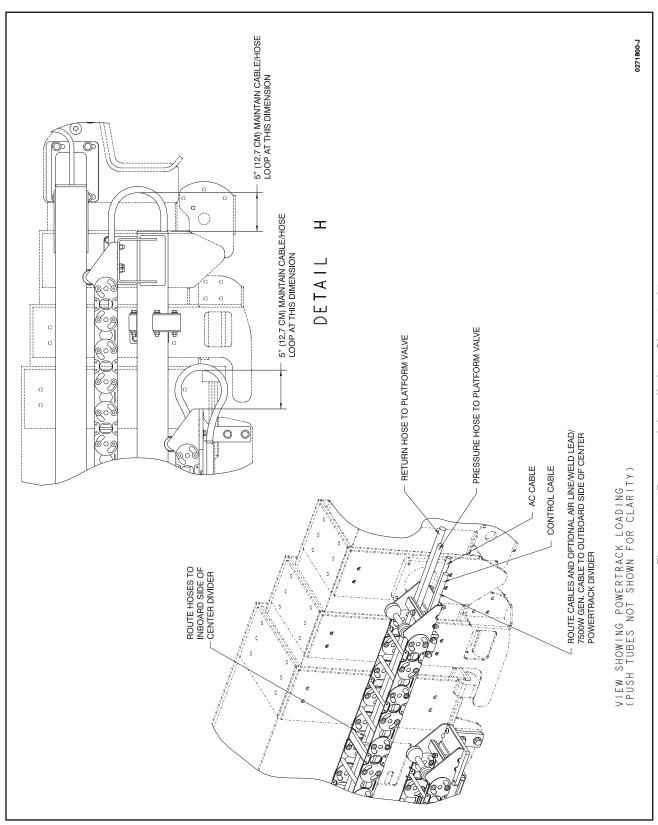


Figure 4-30. Powertrack Installation - Sheet 6 of 6

4.7 BOOM CLEANLINESS GUIDELINES

The following are guidelines for internal boom cleanliness for machines that are used in excessively dirty environments

- JLG recommends the use of the JLG Hostile Environment Package to keep the internal portions of a boom cleaner and to help prevent dirt and debris from entering the boom. This package reduces the amount of contamination which can enter the boom but does not eliminate the need for more frequent inspections and maintenance when used in these types of environments.
- 2. JLG recommends that you follow all guidelines for servicing your equipment in accordance with the instructions outlined in the JLG Service & Maintenance Manual for your machine. Periodic maintenance and inspection is vital to the proper operation of the machine. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.
- 3. Debris and foreign matter inside of the boom can cause premature failure of components and should be removed. Methods to remove debris should always be done using all applicable safety precautions outlined in the JLG Operation & Safety Manual and the JLG Service & Maintenance Manuals.
- 4. The first attempt to remove debris from inside the boom must be to utilize pressurized air to blow the debris toward the nearest exiting point from the boom. Make sure that all debris is removed before operating the machine.
- 5. If pressurized air cannot dislodge the debris, then water with mild solvents applied via a pressure washer can be used. Again the method is to wash the debris toward the nearest exiting point from the boom. Make sure that all debris is removed, that no "puddling" of water has occurred, and that the boom internal components are dry prior to operating the machine. Make sure you comply with all federal and local laws for disposing of the wash water and debris.
- 6. If neither pressurized air nor washing of the boom dislodges and removes the debris, then disassemble the boom in accordance to the instructions outlined in the JLG Service & Maintenance Manual to remove the debris.

4.8 HOSE ROUTING PROCEDURE

For proper hose routing and cable wrap placement and clamping, refer to Figure 4-25., Figure 4-26., Figure 4-27., Figure 4-28., Figure 4-29., and Figure 4-30. It is important to periodically inspect hoses, wraps and clamps for proper slack adjustments and clamping integrity (pull check). Any changes as a result of inspection should be verified by performing full strokes of boom functions especially lift, telescope, jib, and platform rotate.

4.9 WIRE ROPE

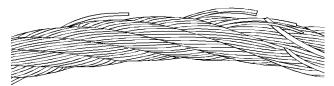
Each day before using the machine:

- 1. Raise the main boom to approximately horizontal.
- 2. Extend and retract the boom sections.
- Check for delayed movement of the fly section, which indicates loose wire ropes.

Inspection

NOTE: The pictures in this paragraph are just samples to show the replacement criteria of the rope.

 Inspect ropes for broken wires, particularly valley wire breaks and breaks at end terminations.



Flexing a wire rope can often expose broken wires hidden in valleys between strands.

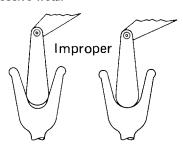
- 2. Inspect ropes for corrosion.
- 3. Inspect ropes for kinks or abuse.



A kink is caused by pulling down a loop in a slack line during improper handling, installation, or operation.

- **4.** Inspect sheaves for condition of bearings/pins. (See Dimension Of Sheaves for proper dimension.)
- **5.** Inspect sheaves for condition of flanges. (See Dimension Of Sheaves for proper dimension.)

Inspect sheaves with a groove wearout gauge for excessive wear.



Observe the groove so that it may be clearly seen whether the contour of the gauge matches the contour of the bottom of the groove.

Ropes passing inspection should be lubricated with wire rope lubricant before reassembly.

Three Month Inspection

- Remove boom covers and visually (with flashlight) inspect the ropes for rust, broken wires, frays, abuse, or any signs of abnormalities.
- Check rope tension by deflecting the ropes by hand...properly tensioned ropes should have little or no movement.

12 Year or 7000 Hour Replacement

1. Mandatory wire rope and sheave replacement.

Additional inspection required if:

- Machine is exposed to hostile environment or conditions.
- **b.** Erratic boom operation or unusual noise exists.
- c. Machine is idle for an extended period.
- d. Boom is overloaded or sustained a shock load.
- Boom exposed to electrical arc...wires may be fused internally.

Additional Replacement Criteria

- 1. Sheaves and wire rope must be replaced as sets.
- 2. Rusted or corroded wire ropes.
- 3. Kinked, "bird caged", or crushed ropes.
- 4. Ropes at end of adjustment range.
- 5. Sheaves failing wearout gage inspection.
- Ropes with 6 total broken wires in one rope lay, 3 in one strand in one rope lay, 1 valley break, or 1 break at any end termination.

Wire Rope Tensioning Procedure

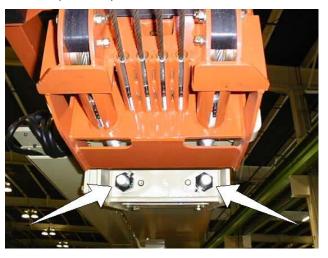
With the boom assembly in the fully retracted position and before making any adjustments to the wire ropes of the boom assembly, remove any covers necessary to visually inspect the threaded fittings, taking note of the amount of adjustment that is left for both the extend and retract wire ropes for the fly and outer mid booms. Also, take note of the position of each boom section while the assembly is in the fully retracted position. Take preliminary measurements and compare them to Figure 4-31., Wire Rope Tensioning Figure A.

NOTE: The inner mid section is positioned by the hydraulic cylinder. No adjustments will be made to this section. The wire ropes within the assembly control the movement of the outer mid and fly boom sections.

If it is necessary to reposition the outer mid and fly boom sections to achieve the measurements in Figure 4-31., Wire Rope Tensioning Figure A, sound technician judgment should be used to compare the thread adjustment (that is left on the wire rope fittings) to the position of the boom sections. The sections can be repositioned slightly to achieve a more even adjustment at the wire rope fittings when comparing the extend and retract systems.

- **1.** Remove the lock plates and nylon collar locknuts from the wire rope fittings.
- Extend the boom 5 to 6 feet (1.5 to 1.8 m) from fully retracted position while maintaining a horizontal (+/-5°) position of boom.

3. Using tool P/N 4120043, torque outer mid retract adjuster nuts to 80 ft.lb. (112 Nm), alternating between the two ropes until both maintain the required torque.



4. Using tool P/N 4120043, torque fly retract adjuster nuts to 80 ft.lb. (112 Nm), alternating between the two ropes until both maintain the required torque.



5. Retract boom 2 to 3 feet (0.6 to 0.9 m) from extension point reached in Step #2.

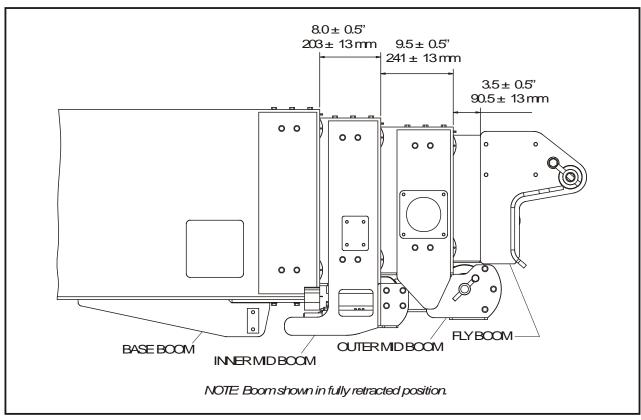
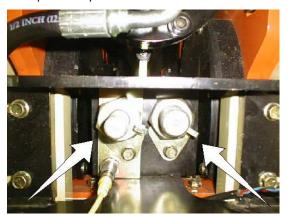


Figure 4-31. Wire Rope Tensioning Figure A

NOTE: Ensure the boom is not fully retracted for following steps.

6. Using tool P/N 4120043, torque outer mid extend adjuster nuts to 80 ft.lb. (112 Nm), alternating between the two ropes until both maintain the required torque.



7. Using tool P/N 4120040, torque fly extend adjuster nuts to 10 ft.lb. (14 Nm), alternating between the four ropes until all maintain the required torque.



- Fully retract the boom assembly and verify the exposed boom section dimensions meet the dimension tolerances shown in Figure 4-31., Wire Rope Tensioning Figure A.
- Reinstall nylon collar locknuts to fly extend wire rope fittings. Torque locknuts to 10 ft.lb. (14 Nm).
- 10. Reinstall lock plates to remaining adjuster nuts.
- Install all covers and check for proper function of boom assembly.

NOTICE

DO NOT REPEAT STEPS #2 THROUGH #7 MULTIPLE TIMES TO VERIFY ROPE TENSION. VERIFICATION OF THE ROPE TENSION SHOULD BE DETERMINED BY PROPER FUNCTION OF THE BOOM ASSEMBLY.

BOOM SECTION REPOSITIONING EXAMPLE:

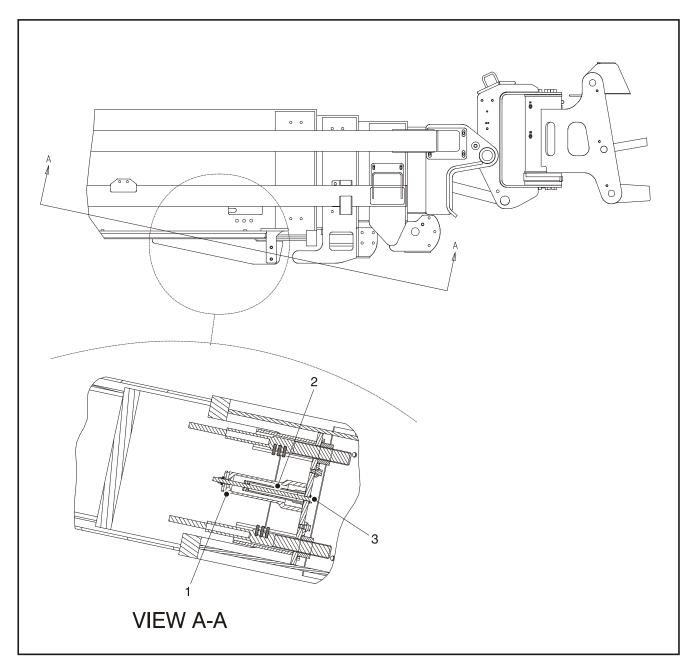
If the outer mid boom section is still extended outside of the tolerance as shown in Figure 4-31., Wire Rope Tensioning Figure A while the boom assembly is fully retracted, it will be necessary to loosen the outer mid extend wire rope fittings. After loosening the outer mid extend wire rope fittings, extend the boom assembly 5 to 6 feet (1.5 to 1.8 m) from the fully retracted position and repeat the tensioning steps for the outer mid retract ropes. Steps #5 & #6 should then be repeated. Once those steps are complete, fully retract the boom assembly and verify that the exposed boom section dimensions meet the dimension tolerances of Figure 4-31., Wire Rope Tensioning Figure A.

This same method can be applied to repositioning the fly boom section by substituting the correct steps for the fly boom wire ropes. This is also applicable if either of the sections is positioned too far in, in the retracted position. The technician should begin the repositioning procedure with the boom partially extended, slightly loosen the retract wire ropes, and partially retract the boom.

NOTE: Ensure that the boom is not fully retracted.

At this point, the correct steps should be followed to tension the extend wire ropes for that section. Once those steps are complete, the steps required to tension the retract wire ropes should then be performed.

NOTE: Any repositioning of the outer mid boom section will also effect the position of the fly boom section, as the outer mid is used to control the movement of the fly. The best practice is to correctly position the outer mid boom before repositioning the fly boom.



- 1. 2" Socket
- 2. 3/4" Socket
- Retaining Bolt

Figure 4-32. Wire Rope Adjustment Tools (Optional)

4.10 BROKEN BOOM CABLE PROXIMITY SWITCH

This system uses a proximity switch to detect excessive movement of the cable block. If movement is detected the Cable Break indicator will illuminate in the platform control panel. No restrictions are made to the functionality of the control system. It is the responsibility of the operator to take immediate action.

To avoid damaging the proximity switch, install and adjust after assembling the switch block, compression spring, and torquing the wire ropes.

Adjusting the Proximity Switch

- Thread the switch in until it contacts the adjuster block.
- 2. Thread the switch out 1/8 to 1/2 turn to achieve proper sensing range.
- 3. Tighten the jam nut.

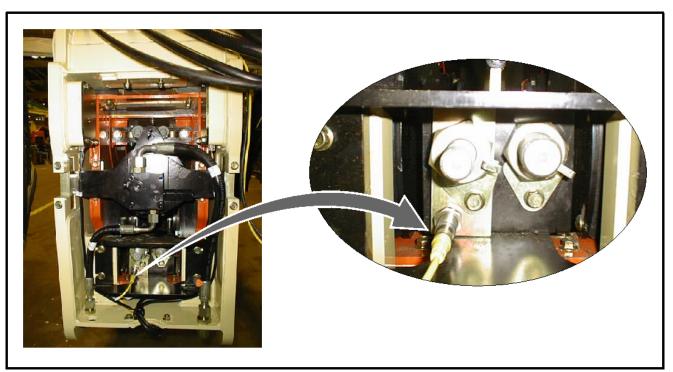


Figure 4-33. Broken Boom Cable Proximity Switch Location

4.11 ELECTRONIC PLATFORM LEVELING

NOTE: For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.

Description

Electronic platform leveling replaces the conventional hydraulic method of platform leveling.

To control electronic platform leveling the platform is equipped with a pair of tilt sensors, one primary and one secondary, mounted to the non-rotating portion of the platform rotator. The tilt sensors are monitored regularly and the platform level up and down valves are automatically controlled to maintain **set point** as the machine is operated.

PRIMARY AND SECONDARY TILT SENSOR INTERACTION

The secondary tilt sensor is used as a backup to the primary tilt sensor. Any time a tilt **set point** is reset, a value from each sensor shall be set.

If a fault occurs with the primary sensor, control will revert to the secondary sensor. (This is discussed in more detail in the error response section.)

Because of the mounting orientation of the tilt sensors, the primary tilt sensor will output ascending voltage values with increases in positive platform tilt angle. The backup or secondary tilt sensor will output descending voltage values with increases in positive platform angle.

PLATFORM VALVES

The platform specific valves are located in a manifold at the platform.

There are individual proportional control valves that control each of the four platform functions; Platform Level, Platform Rotate, Jib Lift, and Jib Swing (1100SJP Only).

There is also a Platform Dump Valve, located in the platform valve manifold, which is used to hydraulically isolate the control valves and to improve hydraulic response.

The Ground Module controls this valve to provide manual platform leveling in the event that the Platform Module is inoperable.

In ground mode, the platform dump valve is turned on whenever any platform or jib valve output is turned on. Whenever all platform and jib valves are turned off, the platform dump valve is turned off.

In platform mode, the platform dump valve is turned on whenever the footswitch is depressed.

Normal Operation

LEVELING

Two tilt sensors, mounted on either side of the platform support, are used to measure the incline of the platform with respect to gravity and control the automatic leveling function, one is used as the primary sensor and one as a secondary back up sensor.

The level system shall assume a new **fixed set point** (fixed incline of the platform with respect to gravity) each time the control system is powered up (cycling of the EMS).

Automatic platform leveling only functions while operating drive, telescope, lift or swing. It does not operate while operating any other function (e.g. rotate, jib, or steer).

The proportional control for these valves varies. This is dependant on the tilt variance from target as well as on the impact coil temperature is having on the current to the valves.

If a command from the Platform Level Up and Down toggle switch on either the platform or the ground is received, automatic platform leveling will cease and the appropriate output will be commanded to turn on.

When the toggle switch is released, after ½ second, the current filtered value of tilt angle will be taken as **the new set point**.

In order to obtain acceptable performance while performing all hydraulic functions, five sets of parameters are used. These "zones" allow compensation for differences in how the basket level changes when doing different functions. These zones are as follows:

- 1. Lift up
- 2. Lift down
- 3. Other boom functions
- 4. Drive
- 5. Auxiliary

The other boom functions zone includes Swing, Telescope, Jib swing (It is not necessary to level with jib lift, since the mechanical linkage keeps the basket level).

These zones are prioritized when multiple functions are active. The priorities are as follows.

- Auxiliary power and any other function, zone = auxiliary power
- 2. Drive and any other function, zone = Drive
- 3. Lift up and any other function, zone = Lift up
- 4. Lift down and any other function, zone = Lift down
- Other boom functions, zone = Other boom functions

During the power-up procedure, function enable, in both Platform and Ground Mode, is delayed during the 1.5 second startup lamp test. During this 1.5 second startup period, the basket level up valve will be energized at 100% duty cycle for 0.5 second, and then the basket level down valve energized at 100% duty cycle for 0.5 second. This will help to keep the valves from sticking.

PLATFORM LEVEL MANUAL OVERRIDE

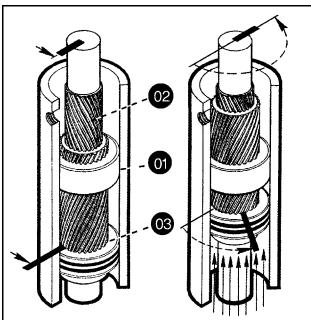
In addition to automatic leveling the operator is able to manually adjust the platform level position by means of the level override switches located at the platform and ground control positions (similar to a Master/Slave hydraulic system).

The level system assumes a **new set point** after a level override switch is operated. In other words the operator can chose a platform level incline other than level with gravity and the system will maintain this set point during automatic leveling.

4.12 ROTARY ACTUATOR

Theory of Operation

The L20 Series rotary actuator is a simple mechanism that uses the sliding spline operating concept to convert linear piston motion into powerful shaft rotation. Each actuator is composed of a housing with integrated gear teeth (01) and only two moving parts: the central shaft with integrated bearing tube and mounting flange (02), and the annular piston sleeve (03). Helical spline teeth machined on the shaft engage matching splines on the in-side diameter of the piston. The outside diameter of the piston carries a second set of splines, of opposite hand, which engage with matching splines in the housing. As hydraulic pressure is applied, the piston is displaced axially within the housing - similar to the operation of a hydraulic cylinder - while the splines cause the shaft to rotate. When the control valve is closed, oil is trapped inside the actuator, preventing piston movement and locking the shaft in position.

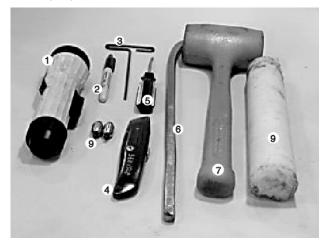


Bars indicate starting positions of piston and shaft. Arrows indicate direction they will rotate. The housing with integral ring gear remains stationary. As fluid pressure is applied, the piston is displaced axially while the helical gearing causes the piston and shaft to rotate simultaneously. The double helix design compounds rotation: shaft rotation is about twice that of the piston.

The shaft is supported radially by the large upper radial bearing and the lower radial bearing. Axially, the shaft is separated from the housing by the upper and lower thrust washers. The end cap is adjusted for axial clearance and locked in position by set screws or pins.

Required Tools

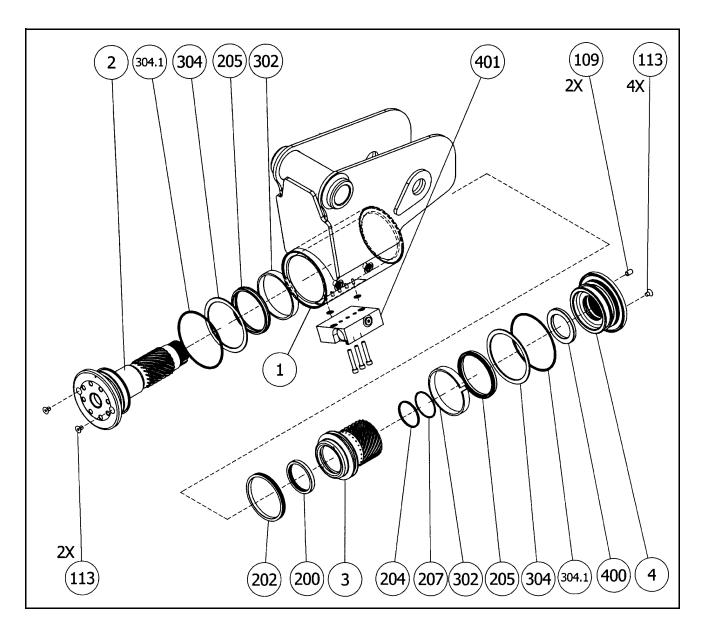
Upon assembly and disassembly of the actuator there are basic tools required. The tools and their intended functions are as follows:



- Flashlight helps examine timing marks, component failure and overall condition.
- Felt Marker match mark the timing marks and outline troubled areas.
- 3. Allen wrench removal of port plugs and set screws.
- 4. Box knife removal of seals.
- Seal tool assembly and disassembly of seals and wear guides.
- Pry bar removal of end cap and manual rotation of shaft.
- Rubber mallet- removal and installation of shaft and piston sleeve assembly.
- 8. Nylon drift installation of piston sleeve
- 9. End cap dowel pins removal and installation of end cap (sold with Helac seal kit).

The seal tool is merely a customized standard flat head screwdriver. To make this tool you will need to heat the flat end with a torch. Secure the heated end of the screwdriver in a vice and physically bend the heated end to a slight radius. Once the radius is achieved round off all sharp edges of the heated end by using a grinder. There may be some slight modifications for your own personal preference.





PARTS

1. Housing

2. Shaft

3. Piston Sleeve

4. End Cap

HARDWARE

103.1. Screw

103.2. Washer

106.1. Port Plug

106.2. Port Plug

109. Lock Pin

113. Capscrew

SEALS

200. T-Seal

202. T-Seal 204. O-ring

205. Cup Seal

207. Backup Ring

304.1. Wiper Seal

BEARINGS

302. Wear Guide 304. Thrust

Washer

ACCESSORIES

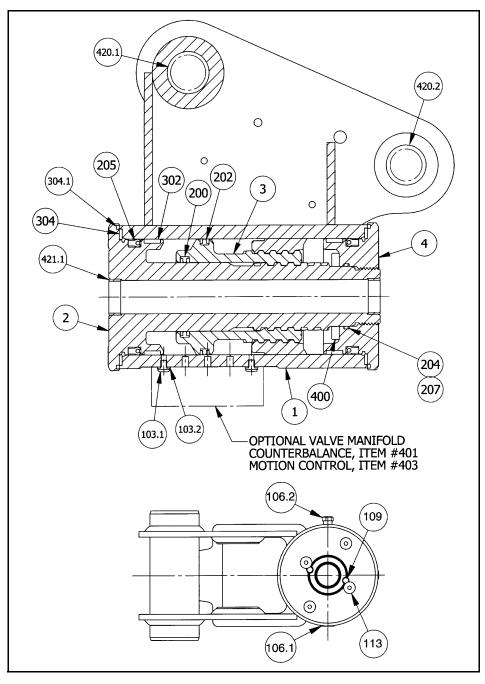
400. Stop Tube

420.1 Bushing

420.2 Bushing

421.1 Bushing

Figure 4-34. Rotary Actuator - Exploded View



PARTS		HARDWARE	SEAL	LS.	BEARINGS	ACCESSORIES
1.	Housing	103.1. Screw	200.	T-Seal	302. Wear Guide	400. Stop Tube
2.	Shaft	103.2. Washer	202.	T-Seal	304. Thrust	420.1 Bushing
3.	Piston Sleeve	106.1. Port Plug	204.	O-ring	Washer	420.2 Bushing
4.	End Cap	106.2. Port Plug	205.	Cup Seal		421.1 Bushing
		109. Lock Pin	207.	Backup Ring		

Figure 4-35. Rotary Actuator - Assembly Drawing

113. Capscrew 304.1. Wiper Seal

Disassembly

1. Remove the cap screws (113) over end cap lock pins (109).



2. Using a 1/8" (3.18mm) drill bit, drill a hole in the center of each lock pin to a depth of approximately 3/16" (4.76mm).



3. Remove the lock pins using an "Easy Out" (a size #2 is shown).



If the pin will not come out with the "Easy Out", use

- 5/1 6" drill bit to a depth of 1/2" (12.7mm) to drill out the entire pin.
- 4. Install the end cap (4) removal tools provided with the Helac seal kit.



5. Using a metal bar, or something similar, unscrew the end cap (4) by turning it counter clockwise.



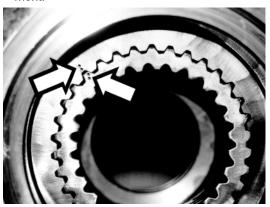
6. Remove the end cap (4) and set aside for later inspection.

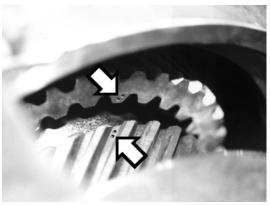


7. Remove the stop tube if included. The stop tube is an available option to limit the rotation of the actuator.



Every actuator has timing marks for proper engagement.





 Prior to removing the shaft, (2), use a felt marker to clearly indicate the timing marks between shaft and piston. This will greatly simplify timing during assembly.



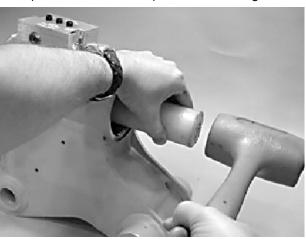
10. Remove the shaft (2). It may be necessary to strike the threaded end of the shaft with a rubber mallet.



11. Before removing the piston (3), mark the housing (1) ring gear in relation to the piston O.D. gear. There should now be timing marks on the housing (1) ring gear, the piston (3) and the shaft (2).



12. To remove the piston (3) use a rubber mallet and a plastic mandrel so the piston is not damaged.



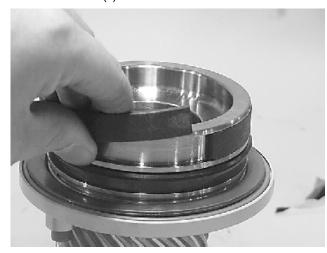
13. At the point when the piston gear teeth come out of engagement with the housing gear teeth, mark the piston and housing with a marker as shown.



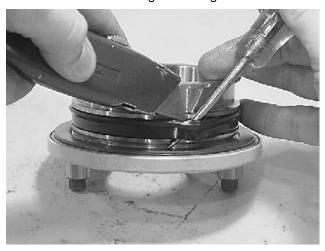
14. Remove the o-ring (204) and backup ring (207) from end cap (4) and set aside for inspection.



15. Remove the wear guides (302) from the end cap (4) and shaft (2).



16. To remove the main pressure seals (205), it is easiest to cut them using a sharp razor blade being careful not to damage the seal groove.



17. Remove the thrust washers (304), from the end cap (4) and shaft (2).



18. Remove the wiper seal (304.1) from its groove in the end cap (4) and shaft (2).



19. Remove the piston O.D. seal (202).



20. Remove the piston I.D. seal (200). You may now proceed to the inspection process.

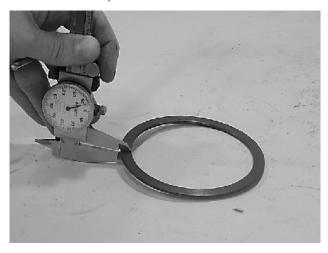


Inspection

Clean all parts in a solvent tank and dry with compressed air prior to inspecting. Carefully inspect all critical areas for any surface finish abnormalities:
 Seal grooves, bearing grooves, thrust surfaces, rod surface, housing bore and gear teeth.



2. Inspect the thrust washers (304) for rough or worn edges and surfaces. Measure it's thickness to make sure it is within specifications (Not less than 0.092" or 2.34 mm).



3. Inspect the wear guide condition and measure thickness (not less than 0.123" or 3.12 mm).



Assembly

1. Gather all the components and tools into one location prior to re-assembly. Use the cut away drawing to reference the seal orientations.



2. Install the thrust washer (304) onto shaft (2) and end cap (4).



3. Install the wiper seal (304.1/green 0-ring) into it's groove on the shaft (2) and end cap (4) around the outside edge of the thrust washer (304).



4. Using a seal tool install the main pressure seal (205) onto shaft (2) and end cap (4). Use the seal tool in a circular motion.



5. Install the wear guide (302) on the end cap (4) and shaft (2).



6. Install the inner T-seal (200) into the piston (3) using a circular motion.

Install the outer T-seal (202) by stretching it around the groove in a circular motion.

Each T-seal has 2 back-up rings (see drawing for orientation).



Beginning with the inner seal (200) insert one end of b/u ring in the lower groove and feed the rest in using a circular motion. Make sure the wedged ends overlap correctly.

Repeat this step for the outer seal (202).



7. Insert the piston (3) into the housing (1) as shown, until the outer piston seal (202) is touching inside the housing bore.



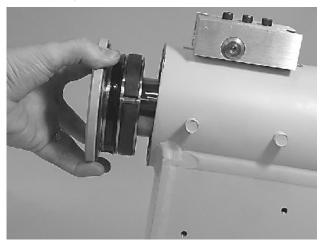
8. Looking from the angle shown, rotate the piston (3) until the marks you put on the piston and the housing (1) during disassembly line up as shown. Using a rubber mallet, tap the piston into the housing up to the point where the gear teeth meet.



9. Looking from the opposite end of the housing (1) you can see if your timing marks are lining up. When they do, tap the piston (3) in until the gear teeth mesh together. Tap the piston into the housing the rest of the way until it bottoms out.



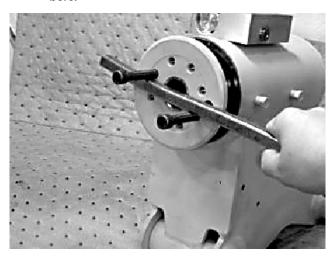
10. Install the shaft (2) into the piston (3). Be careful not to damage the seals. Do not engage the piston gear teeth yet.



11. Looking from the view shown, use the existing timing marks to line up the gear teeth on the shaft (2) with the gear teeth on the inside of the piston (3). Now tap the flange end of the shaft with a rubber mallet until the gear teeth engage.



12. Install 2 bolts in the threaded holes in the flange. Using a bar, rotate the shaft in a clockwise direction until the wear guides are seated inside the housing bore.



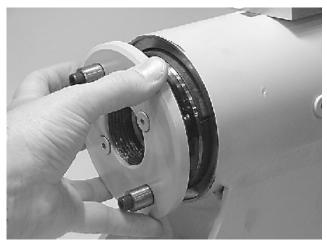
 Install the stop tube onto the shaft end. Stop tube is an available option to limit the rotation of an actuator. **14.** Coat the threads on the end of the shaft with antiseize grease to prevent galling.



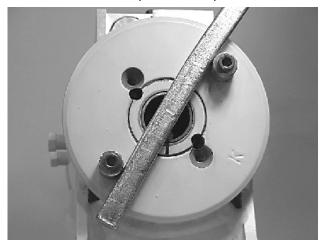
15. Install the 0-ring (204) and back-up ring (207) into the inner seal groove on the end cap (4).



16. Thread the end cap (4) onto the shaft (2) end. Make sure the wear guide stays in place on the end cap as it is threaded into the housing (1).



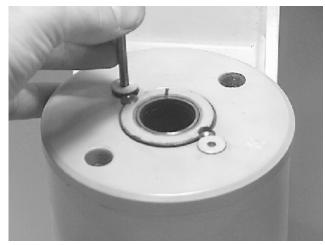
17. Tighten the end cap (4). In most cases the original holes for the lock pins will line up.



18. Place the lock pins (109) provided in the Helac seal kit in the holes with the dimple side up. Then, using a punch, tap the lock pins to the bottom of the hole.



19. Insert the set screws (113) over the lock pins. Tighten them to 25 in. lbs. (2.825 Nm).



Installing Counterbalance Valve

Refer to Figure 4-36., Rotator Counterbalance Valve.

- Make sure the surface of the actuator is clean, free of any contamination and foreign debris including old Loctite.
- Make sure the new valve has the O-rings in the counterbores of the valve to seal it to the actuator housing.
- 3. The bolts that come with the valve are grade 8 bolts. New bolts should be installed with a new valve. Loctite #242 should be applied to the shank of the three bolts at the time of installation.
- Torque the 1/4-inch bolts 110 to 120 inch pounds (12.4 to 13.5 Nm). Do not torque over 125 inch pounds (14.1 Nm). Torque the 5/16-inch bolts 140 inch pounds (15.8 Nm). Do not torque over 145 inch pounds (16.3 Nm).

Testing the Actuator

If the equipment is available, the actuator should be tested on a hydraulic test bench. The breakaway pressure — the pressure at which the shaft begins to rotate — should be approximately 400 psi (28 bar). Cycle the actuator at least 25 times at 3000 psi (210 bar) pressure. After the 25 rotations, increase the pressure to 4500 psi (315 bar) to check for leaks and cracks. Perform the test again at the end of the rotation in the opposite direction.

TESTING THE ACTUATOR FOR INTERNAL LEAKAGE

If the actuator is equipped with a counterbalance valve, plug the valve ports. Connect the hydraulic lines to the housing ports. Bleed all air from the actuator (see Installation and Bleeding) Rotate the shaft to the end of rotation at 3000 psi (210 bar) and maintain pressure. Remove the hydraulic line from the non-pressurized side.

Continuous oil flow from the open housing port indicates internal leakage across the piston. Replace the line and rotate the shaft to the end of rotation in the opposite direction. Repeat the test procedure outlined above for the other port. If there is an internal leak, disassemble, inspect and repair.

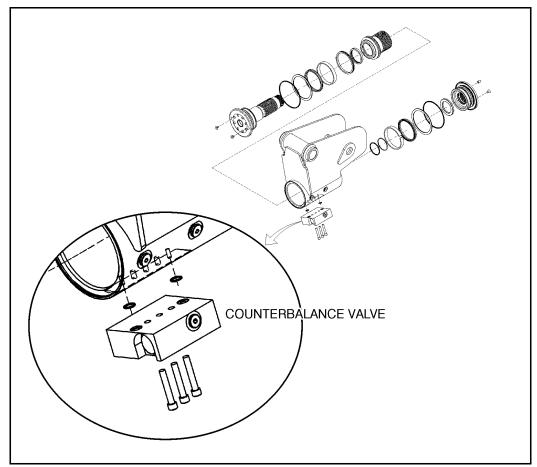


Figure 4-36. Rotator Counterbalance Valve

Troubleshooting

Table 4-1. Troubleshooting

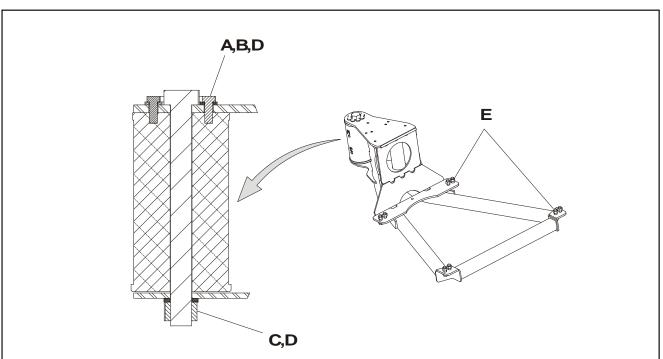
Problem	Cause	Solution
Shaft rotates slowly or not at all	a. Insufficient torque output	a. Verify correct operating pressure. Do not exceed OEM's pressure specifications. Load may be above maximum capacity of the actu-
	b. Low rate of fluid flow	ator.
		b. Inspect ports for obstructions and hydraulic lines for restrictions and leaks.
	c. Control or counterbalance valve has internal leak	c. Disconnect hydraulic lines and bypass valve. Leave valve ports open and operate the actuator through housing ports (do not exceed OEM's operating pressure). The valve must be replaced if a steady flow of
	d. Piston and/or shaft seal leak	fluid is seen coming from the valve ports.
		d. Remove the plug and the housing's valve ports. Operate the actuator through the housing ports. Conduct the internal leakage test as described in the Testing section on page 24 of this manual.
	e. Corrosion build-up on the thrust surfaces	tilis manuai.
	f. Swollen seals and composite bearings caused by incompatible hydraulic fluid	e. Re-build the actuator. Remove all rust then polish. Replacement parts may be needed.
	, ,	f. Re-build the actuator. Use fluid that is compatible with seals and bearings.
2. Operation is erratic or not responsive	a. Air in actuator	a. Purge air from actuator. See bleeding procedures.
3. Shaft will not fully rotate	a. Twisted or chipped gear teeth	a. Check for gear binding. Actuator may not be able to be re-built and may need to be replaced. Damage could be a result of overload or shock.
	b. Port fittings are obstructing the piston	b. Check thread length of port fittings. Fittings should during stroke not reach inside the housing bore.
4. Selected position cannot be maintained	a. Control or counterbalance valve has internal leak	a. Disconnect hydraulic lines and bypass valve. Leave valve ports open and operate the actuator through housing ports (do not exceed OEM's operating pressure). The valve must be replaced if a steady flow of fluid is seen coming from the valve ports.
	b. Piston and/or shaft seal leak	b. Remove the plug and the housing's valve ports. Operate the actuator through the housing ports. Conduct the internal leakage test as described in the Testing section on page 24 of this manual.
	c. Air in actuator	
		c. Purge air from actuator. See bleeding procedures

Bleeding After Installation

NOTE: Bleeding will be necessary if excessive backlash is displayed after the actuator is installed. To do this, bleeder valves must be installed in the actuator at the locations shown below. The following steps are recommended when a minimum of two gallons (8 liters) is purged.



- 1. Connect a 5 foot (1.5 m) long 3/16" inside diameter, 5/16" outside diameter clear vinyl drain tube to each of the two bleeder valves. Secure the tubes in place with hose clamps.
- Place the end of the tubes in a clean 5 gallon (19 L) container to collect the purged oil. The oil can be returned to the reservoir when the procedure is complete.
- 3. Open both bleeder valves 1/4 turn. Using the hydraulic system, rotate the platform to the end of rotation and maintain hydraulic pressure. Oil with small air bubbles should be seen flowing through the tubes. Allow 1/2 gallon (2 L) of oil to be purged from the actuator.
- 4. Keep the bleeder valves open and rotate the platform in the opposite direction to the end of rotation. Maintain hydraulic pressure until an additional 1/2 gallon (2 L) of oil is pumped out.
- **5.** Repeat steps 3 and 4. After the last 1/2 gallon (2 L) of oil is purged, close both bleed nipples before rotating away from the end of rotation.



- A Torque to 50 ft.lbs. (68 Nm)
- B Loctite #242
- C Torque to 480 ft. lbs. (650 Nm)
- D Check torque every 150 hours of opera-
- E tion

Torque to 75 ft. lbs. $(102\,\text{Nm})$

Figure 4-37. Platform Support Torque Values

SECTION 5. HYDRAULICS

5.1 LUBRICATING O-RINGS IN THE HYDRAULIC SYSTEM

When assembling connectors in the hydraulic that use oring fittings, it is necessary to lubricate all fittings with hydraulic oil prior to assembly. To lubricate the fittings, use one of the following procedures.

NOTE: All O-ring fittings must be pre-lubricated with hydraulic oil prior to assembly.

Cup and Brush

The following is needed to correctly oil the o-ring in this manner:

- A small container for hydraulic oil
- · Small paint brush



1. Hold the fitting in one hand while using the brush with the other hand to dip into the container. Remove excess hydraulic oil from the brush so an even film of oil is applied on the o-ring.



2. Holding the fitting over the hydraulic oil container, brush an even film of oil around the entire o-ring in the fitting, making sure the entire o-ring is completely saturated.



3. Turn the o-ring on the other side of the fitting and repeat the previous step, ensuring the entire o-ring is coated with hydraulic oil.



Dip Method

NOTE: This method works best with Face Seal o-rings, but will work for all o-ring fitting types.

The following is needed to correctly oil the o-ring in this manner:

- · A small leak proof container
- · Sponge cut to fit inside the container
- A small amount of hydraulic oil to saturate the sponge.
- Place the sponge inside the container and add hydraulic oil to the sponge until it is fully saturated.
- Dip the fitting into the sponge using firm pressure. Upon lifting the fitting, a small droplet will form and drip from the bottom of the fitting. This should signify an even coating of oil on the fitting.



O-ring Boss type fittings will require more pressure in able to immerse more of the fitting into the saturated sponge. This will also cause more oil to be dispersed from the sponge.



Spray Method

This method requires a pump or trigger spray bottle.

- 1. Fill the spray bottle with hydraulic oil.
- 2. Hold the fitting over a suitable catch can.
- Spray the entire o-ring surface with a medium coat of oil.



Brush-on Method

This method requires a sealed bottle brush.

- 1. Fill the bottle with hydraulic oil.
- Using slight pressure to the body of the spray bottle, invert the bottle so the brush end is in the downward position.
- **3.** Brush hydraulic oil on the entire o-ring, applying an even coat of oil.



5.2 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

NOTICE

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.

NOTICE

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

- Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source. Adequately support the cylinder rod, if applicable.
- If applicable, remove the cartridge-type holding valve and fittings from the cylinder port block. Discard o-rings.

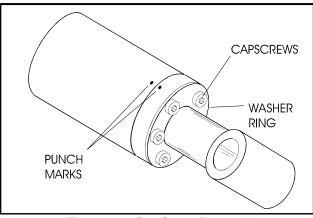


Figure 5-2. Cap Screw Removal

 Place the cylinder barrel into a suitable holding fixture.

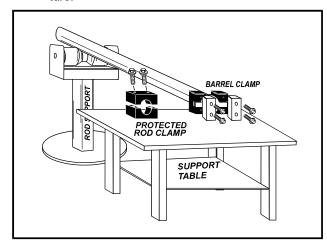
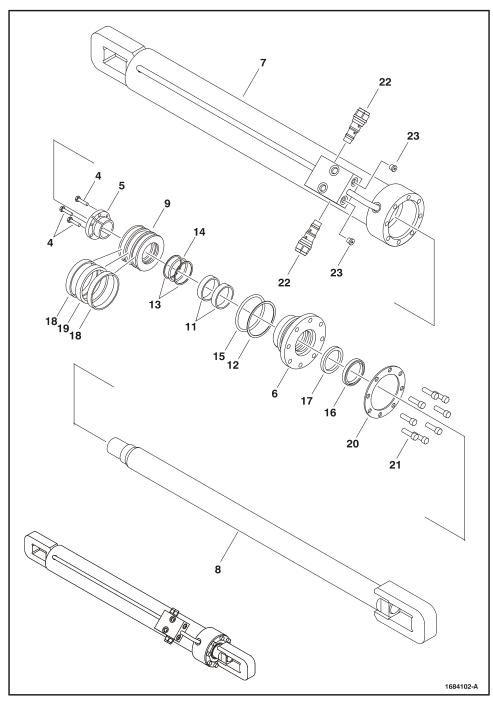


Figure 5-1. Cylinder Barrel Support

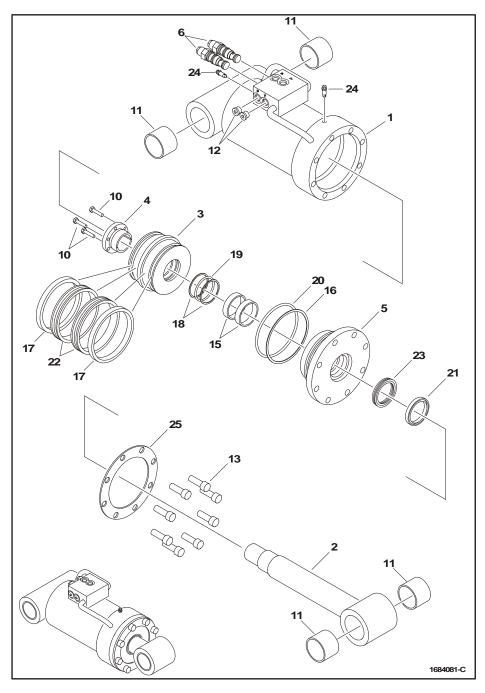
- 5. Mark cylinder head and barrel with a center punch for easy realignment. Using an allen wrench, loosen the eight (8) cylinder head retainer cap screws, and remove cap screws from cylinder barrel.
- **6.** Attach a suitable pulling device to the cylinder rod port block end or cylinder rod end, as applicable.



- 1. Loctite #242 (Not Shown)
- 2. Locking Primer (Not Shown)
- 3. Loctite #RC 609 (Not Shown)
- 4. Capscrew
- 5. Tapered Bushing
- 6. Head

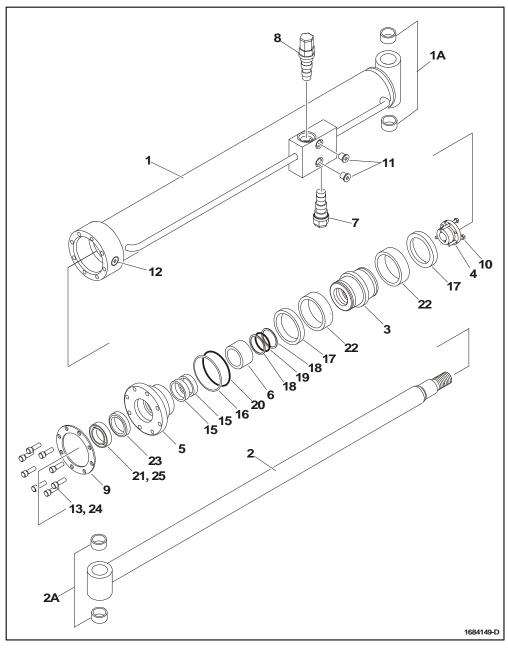
- 7. Barrel
- 8. Rod
- 9. Piston
- 10. Not Used
- 11. Wear Ring
- 12. Back-Up Ring
- 13. Back-Up Ring
- 14.0-Ring
- 15.0-Ring
- 16. Rod Wiper
- 17. Seal 18. Wear Ring
- 19. T-Seal
- 20. Washer Ring
- 21. Bolt
- 22. Holding
- Valve
- 23. 0-Ring Plug

Figure 5-3. Axle Extension Cylinder



- 1. Barrel
- 2. Rod
- 3. Piston
- 4. Bushing
- 5. Head
- 6. Counterbalance Valve
- 7. Loctite #242 (Not Shown)
- 8. Locking Primer (Not Shown)
- 9. Loctite #RC 609 (Not Shown)
- 10. Bolt
- 11. Bearing
- 12. O-ring Plug
- 13. Socket Head Bolt
- 14. Not Used
- 15. Wear Ring
- 16. Backup Ring
- 17. Lock Ring
- 18. Backup Ring
- 19. 0-ring
- 20. 0-ring
- 21. Wiper
- 22. Seal
- 23. Rod Seal
- 24. Bleeder Valve
- 25. Washer Ring

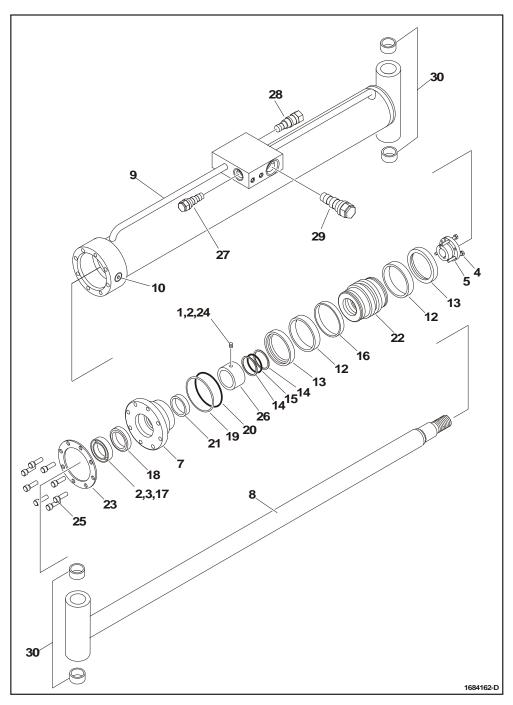
Figure 5-4. Axle Lockout Cylinder



- 1. Barrel
- 1A. Bushing
- 2. Rod
- 2A. Bushing
- 3. Piston
- 4. Tapered Bushing
- 5. Head
- 6. Spacer
- 7. Holding Valve
- 8. Cartridge, Holding Valve
- 9. Washer Ring
 - 10. Capscrew
 - 11. 0-Ring Plug
 - 12. O-Ring Plug
 - 13. Capscrew
 - 14. Not Used
 - 15. Wear Ring
 - 16. Back-Up Ring

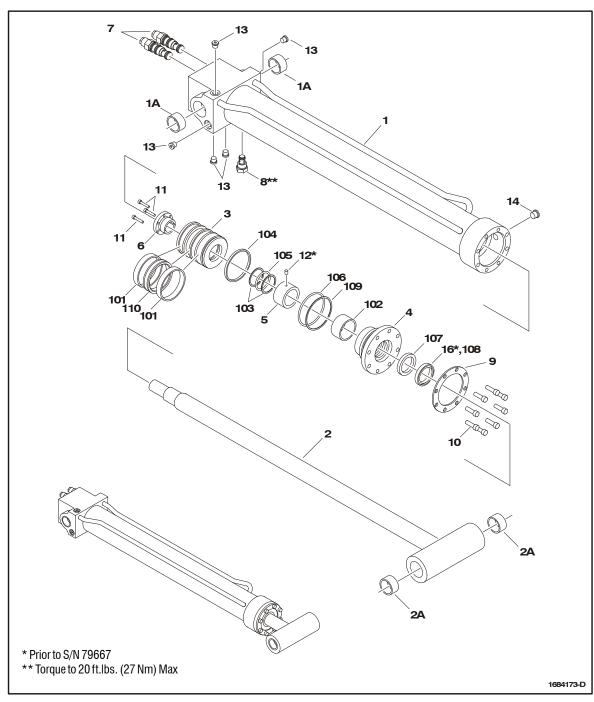
- 17. Ring, Lock
- 18. Ring, Back-Up
- 19. 0-Ring
- 20. 0-Ring
- 21. Wiper, Rod
- 22. Ring, Guide
- 23. Seal, Rod
- 24. Loctite #242 (Not Shown)
- 25. Loctite #RC 609 (Not Shown)

Figure 5-5. Level Cylinder



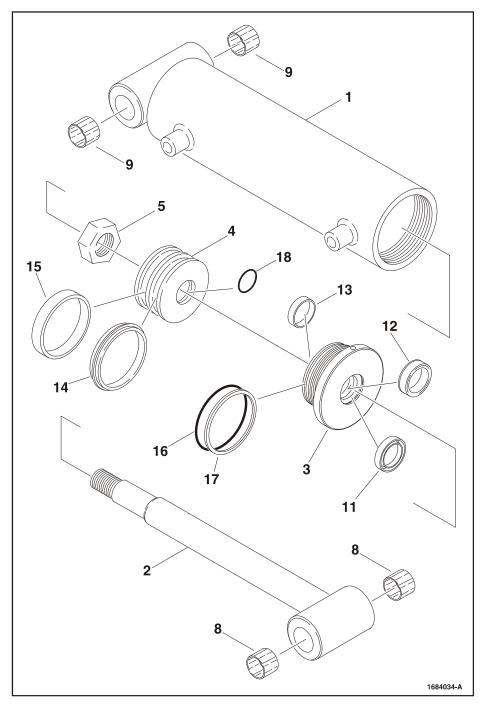
- 1. Loctite #242
- 2. Locking Primer
- 3. Not Used
- 4. Capscrew
- 5. Tapered Bushing
- 6. Not Used
- 7. Head
- 8. Rod
- 9. Barrel
- 10. O-ring Plug
- 12. Guide Ring
- 11. Not Used
- 13. Lock Ring
- 14. Back Up Ring
- 15. O-Ring
- 16. Wear Ring
- 17. Rod Wiper
- 18. Rod Seal
- 19. Backup Ring
- 20. O-ring
- 21. Wear Ring
- 22. Piston
- 23. Washer Ring 24. Not Used
- 25. Capscrew 26. Spacer
- 27. Check Valve Cartridge
- 28. Holding Valve Cartridge
- 29. Pressure Regulator Valve
- 30. Bushing

Figure 5-6. Lift Cylinder



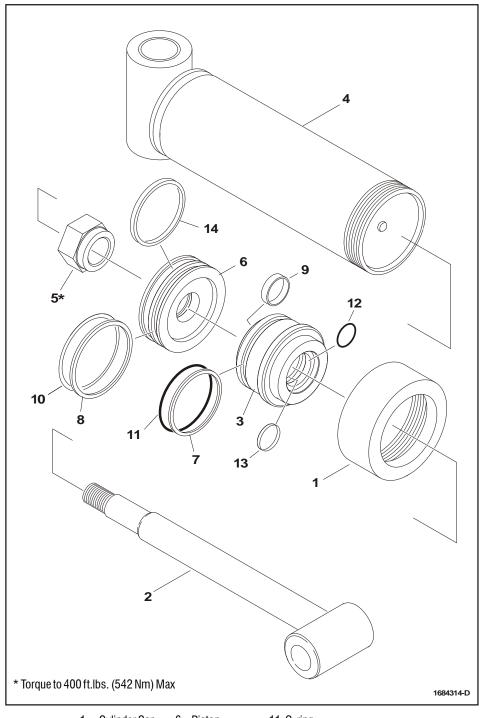
- 1. Barrel 1A. Bushing
- 2. Rod
- 2A. Bushing
- 3. Piston
- 4. Head
- 5. Spacer
- 6. Tapered Bushing
- 7. Counterbalance Cartridge
- 8. Check Valve Cartridge
- 9. Washer Ring
- 10. Capscrew
- - 11. Capscrew
 - 12. Not Used
 - 13. O-ring Plug
 - 14. O-ring Plug
 - 15. Loctite #242
 - 16. Not Used
- 101.Wear Ring
- 102. Wear Ring
- 103.Backup Ring 104.Seal
- 105.0-ring 106.0-ring
- 107.Seal
- 108.Rod Wiper 109.Backup Ring
- 110.Seal

Figure 5-7. Jib Cylinder



- 1. Barrel
- 2. Rod
- 3. Head
- 4. Piston
- 5. Nut
- 6. Loctite #222 (not shown)
- 7. Not Used
- 8. Rod End Bushing
- 9. Barrel End Bushing
- 10. Not Used
- 11. Wiper 12. Rod Seal
- 13. Wear Ring
- 14. Piston Seal
- 15. Wear Ring
- 16. 0-ring
- 17. Back Up Ring
- 18. 0-ring

Figure 5-8. Steer Cylinder - Prior to S/N 73367

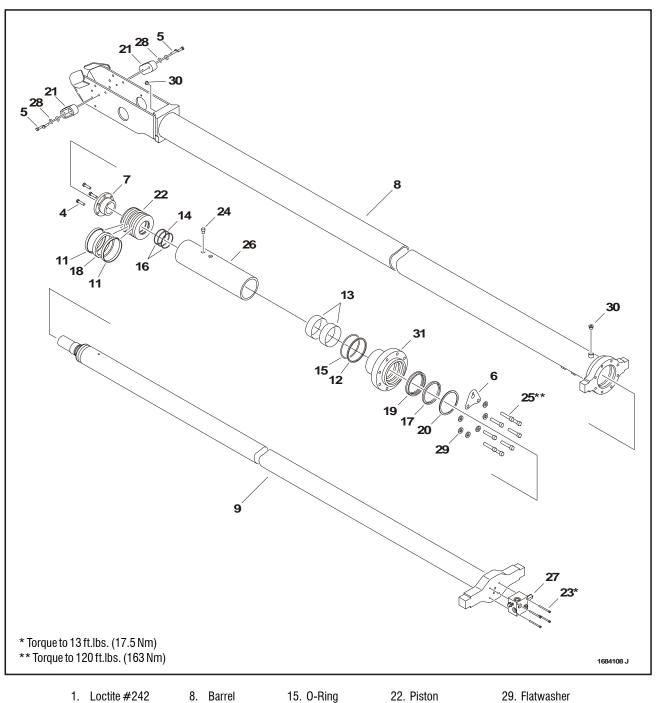


Cylinder Cap
 Rod
 Backup Ring
 Wear Ring
 Barrel
 Wear Ring
 Loctite #222 (not shown)

Figure 5-9. Steer Cylinder - S/N 73367 to Present

10.0-ring

5. Nut



1.	Loctite #242	8. Barrel	15. O-Ring	22. Piston	29. Flatwasher
2.	Locking Primer	9. Rod	16. Backup Ring	23. Capscrew	30. O-Ring Plug
3.	Not Used	10. Not Used	17. Rod Wiper	24. Capscrew	31. Head
4.	Capscrew	11. Wear Ring	18. T-Seal	25. Capscrew	
5.	Bolt	12. Backup Ring	19. Rod Seal	26. Spacer	
6.	Bracket	13. Wear Ring	20. Retaining Ring	27. Valve Assembly	
7.	Tapered Bushing	14. 0-Ring	21. Wear Pad	28. Flatwasher	

Figure 5-10. Telescope Cylinder

NOTICE

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.

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

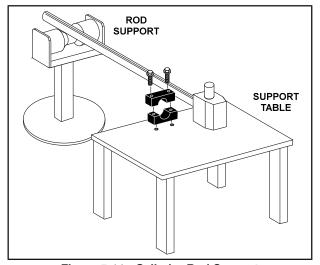


Figure 5-11. Cylinder Rod Support

 Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.

NOTE: Step 9 applies only to the steer cylinder.

- Loosen and remove nut which attaches the piston to the rod, and remove the piston.
- **10.** Loosen and remove the cap screw(s), if applicable, which attach the tapered bushing to the piston.
- 11. Insert the cap screw(s) in the threaded holes in the outer piece of the tapered bushing. Progressively tighten the cap screw(s) until the bushing is loose on the piston.
- 12. Remove the bushing from the piston.

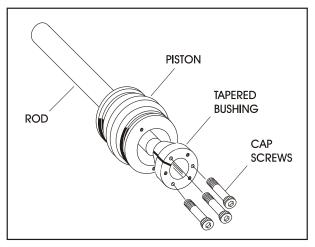


Figure 5-12. Tapered Bushing Removal

- Screw the piston CCW, by hand, and remove the piston from cylinder rod.
- Remove and discard the piston o-rings, seal rings, and backup rings.
- **15.** Remove piston spacer, if applicable, from the rod.
- **16.** Remove the rod from the holding fixture. Remove the cylinder head gland and retainer plate, if applicable. Discard the o-rings, back-up rings, rod seals, and wiper seals.

Cleaning and Inspection

- Clean all parts thoroughly in an approved cleaning solvent.
- Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
- Inspect threaded portion of rod for excessive damage. Dress threads as necessary.

- Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
- Inspect threaded portion of barrel for damage. Dress threads as necessary.
- Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
- Inspect threaded portion of piston for damage. Dress threads as necessary.
- Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
- Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
- **10.** Inspect threaded portion of head for damage. Dress threads as necessary.
- Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
- Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.

- If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
 - a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
 - **b.** Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
 - **c.** Lubricate inside of the steel bushing with WD40 prior to bearing installation.
 - d. Using an arbor of the correct size, carefully press the bearing into steel bushing.

NOTE: Install pin into the composite bearing dry. Lubrication is not required with nickel plated pins and bearings.

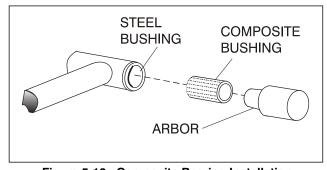


Figure 5-13. Composite Bearing Installation

- 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.
- 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.

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

 A special tool is used to install a new rod seal into the applicable cylinder head gland groove.

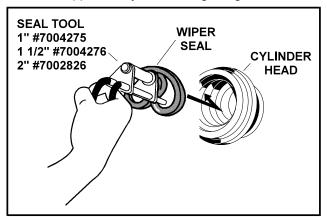


Figure 5-14. Rod Seal Installation

NOTICE

WHEN INSTALLING 'POLY-PAK' PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. REFER TO WIPER SEAL INSTALLATION FOR CORRECT SEAL ORIENTATION. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head gland groove. Install a new wear ring into the applicable cylinder head gland groove.

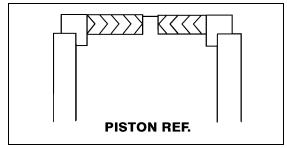


Figure 5-15. Poly-Pak Piston Seal Installation

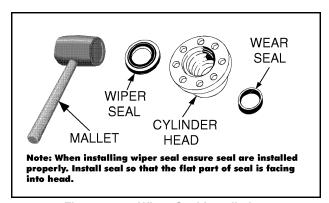


Figure 5-16. Wiper Seal Installation

3. Place a new "O-ring and back-up seal in the applicable outside diameter groove of the cylinder head.

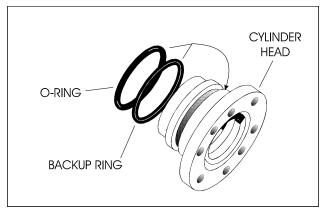


Figure 5-17. Installation of Head Seal Kit

- 4. Install washer ring onto rod, 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.
- 5. Carefully slide the piston spacer on the rod.

NOTE: Main telescope cylinder piston has an o-ring installed inside the spacer.

- **6.** If applicable, correctly place new o-ring in the inner piston diameter groove. (The backup ring side facing the O-ring is grooved.)
- 7. If applicable, correctly place new seals and guide lock rings in the outer piston diameter groove. (A tube, with I.D. slightly larger than the O.D.of the piston is recommended to install the solid seal.)

NOTE: The backup rings for the solid seal have a radius on one side. This side faces the solid seal. (See magnified insert in Figure 5-18.) The split of seals and backup rings are to be positioned so as not to be in alignment with each other.

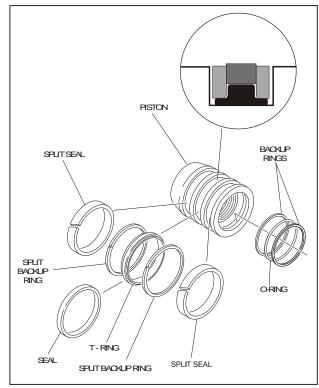


Figure 5-18. Piston Seal Kit Installation

- **8.** Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
- **9.** Carefully thread the piston on the cylinder rod hand tight, ensuring that the o-ring and back-up rings are not damaged or dislodged.

10. Thread piston onto rod until it abuts the spacer end and install the tapered bushing.

NOTE: When installing the tapered bushing, piston and mating end of rod must be free of oil.

NOTICE

WHEN REBUILDING THE TELESCOPE, LIFT, JIB, LEVEL, AXLE LOCKOUT OR AXLE EXTENSION CYLINDERS, TIGHTEN SECURELY. (SEE TABLE 5-1)

11. Assemble the tapered bushing loosely into the piston and insert JLG capscrews (not vendor capscrews) through the drilled holes in the bushing and into the tapped holes in the piston.

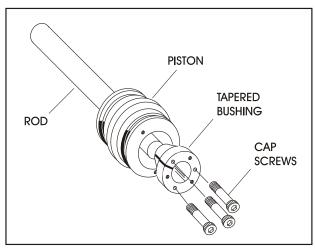


Figure 5-19. Tapered Bushing Installation

- 12. Tighten the capscrews evenly and progressively in rotation to the specified torque value. (See Table 5-1, Cylinder Head and Tapered Bushing Torque Specifications).
- 13. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;
 - a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.

b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

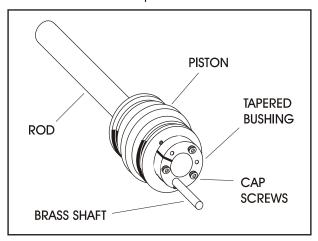


Figure 5-20. Seating the Tapered Bearing

- Retorque the capscrews evenly and progressively in rotation to the specified torque value. (See Table 5-1, Cylinder Head and Tapered Bushing Torque Specifications).
- **15.** Remove the cylinder rod from the holding fixture.
- **16.** Place new guide locks and seals in the applicable outside diameter grooves of the cylinder piston. (See Figure 5-18., Piston Seal Kit Installation)
- Position the cylinder barrel in a suitable holding fixture.

NOTICE

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.

- 18. 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.
- Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.

20. Secure the cylinder head gland using the washer ring and socket head bolts. (See Table 5-1, Cylinder Head and Tapered Bushing Torque Specifications and Table 5-2, Holding Valve Torque Specifications)

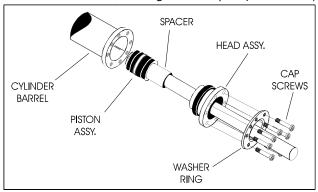


Figure 5-21. Rod Assembly Installation

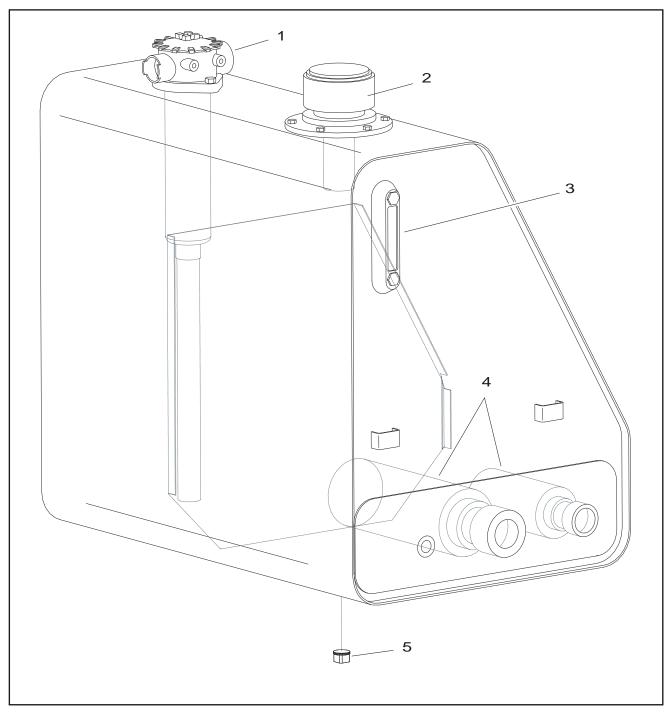
- **21.** After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any holding valve or valves.
- 22. If applicable, install the cartridge-type holding valve and fittings in the rod port block, using new o-rings as applicable. (See Table 5-2, Holding Valve Torque Specifications).

Table 5-1. Cylinder Head and Tapered Bushing Torque Specifications

Description	Head Torque Value (Wet)	Tapered Bushing Torque Value (Wet)
Tele Cylinder	120 ft. lbs.	30 ft. lbs.
(1200SJP)	(163 Nm)	(40.5 Nm)
Tele Cylinder	120 ft. lbs.	45 ft. lbs.
(1350SJP)	(163 Nm)	(63 Nm)
Level Cylinder	120 ft. lbs. (163 Nm)	9 ft. lb.s (12.6 Nm)
Jib Cylinder	30 ft. lbs. (41 Nm)	5 ft. lbs. (9 Nm)
Lift Cylinder	420 ft. lbs. (588 Nm)	120 ft. lbs. (168 Nm)
Axle Oscillation	120 ft. lbs.	9 ft. lb.s
Cylinder	(163 Nm)	(12.6 Nm)
Axle Extend	50 ft. lbs.	9 ft. lb.s
Cylinder	(70 Nm)	(12.6 Nm)

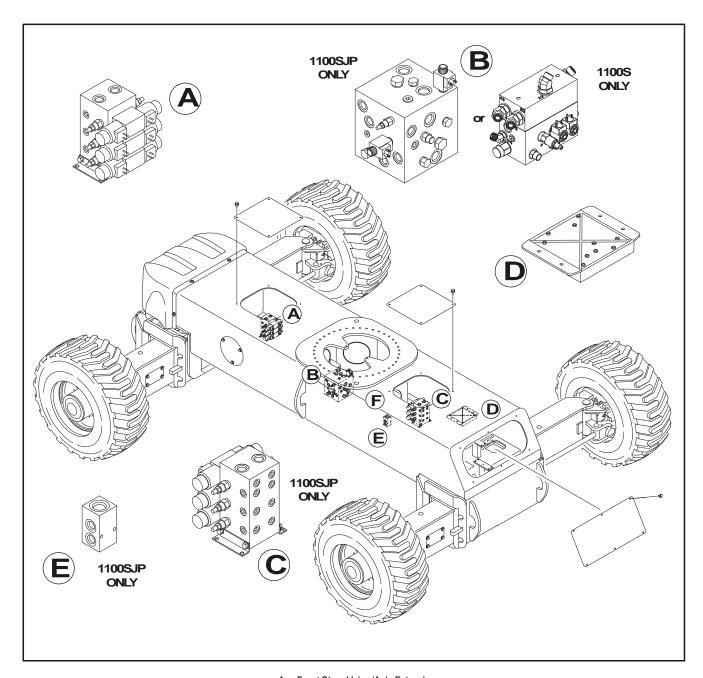
Table 5-2. Holding Valve Torque Specifications

Description	Torque Value	
SUN - 7/8 HEX M20 X 1.5 THDS.	30-35 ft. lbs. (41-48 Nm)	
SUN - 1 1/8 HEX 1 -14 UNS THDS.	45-50 ft. lbs. (61-68 Nm)	
SUN - 1 1/4 HEX M36 X 2 THDS.	150-160 ft. lbs. (204-217 Nm)	
RACINE - 1 1/8 HEX 1 1/16 - 12 THDS.	50-55 ft. lbs. (68-75 Nm)	
RACINE - 1 3/8 HEX 1 3/16 - 12 THDS.	75-80 ft. lbs. (102-109 Nm)	
RACINE - 1 7/8 HEX 1 5/8 - 12 THDS.	100-110 ft. lbs. (136-149 Nm)	



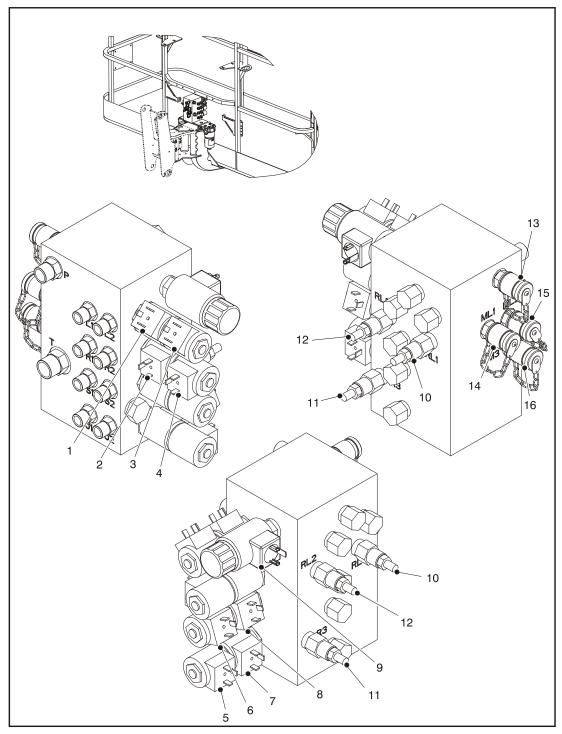
- 1. Return Filter
- Vented Fill Cap
 Sight/Temperature Gauge
- 4. Suction Strainer
- 5. Magnetic Drain Plug

Figure 5-22. Hydraulic Tank



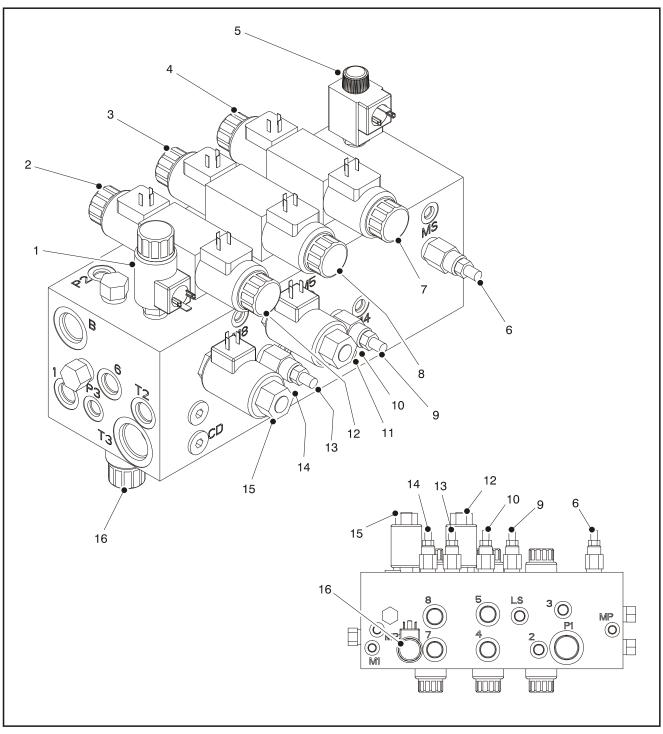
- A. Front Steer Valve/Axle Extend
- B. Traction Valve
- C. Rear Steer Valve/Axle Extend
- D. Chassis Module Controller
- E. Junction Manifold Valve

Figure 5-23. Chassis Control Valve Locations



- 1. Level Up
- 2. Rotate Right
- 3. Level Down
- 4. Rotate Left
- 5. Jib Down
- 6. Jib Swing Left (1100SJP Only)
- 7. Jib Up
- 8. Jib Swing Right (1100SJP Only)
- 9. Platform Dump
- 10. Level Up Relief
- 11. Jib Up/Down Relief
- 12. Level Down Relief
- 13. Main Pressure Check Port
- 14. Level Up Test Port
- 15. Level Down Test Port
- 16. Jib Up/Down Test Port

Figure 5-24. Platform Valve Identification



- 1. Aux Lift Down
- 2. Tele Out
- 3. Lift Up
- 4. Swing Right
- 5. Dump
- 6. Swing Relief
- 7. Swing Left
- 8. Lift Down
- 9. Lift Up Relief
- 10. Lift Down Relief
- 11. Lift Flow
- 12. Tele In
- 13. Tele Out Relief
- 14. Tele In Relief
- 15. Tele Flow
- 16. Lift Down/Aux Select

Figure 5-25. Main Valve Identification

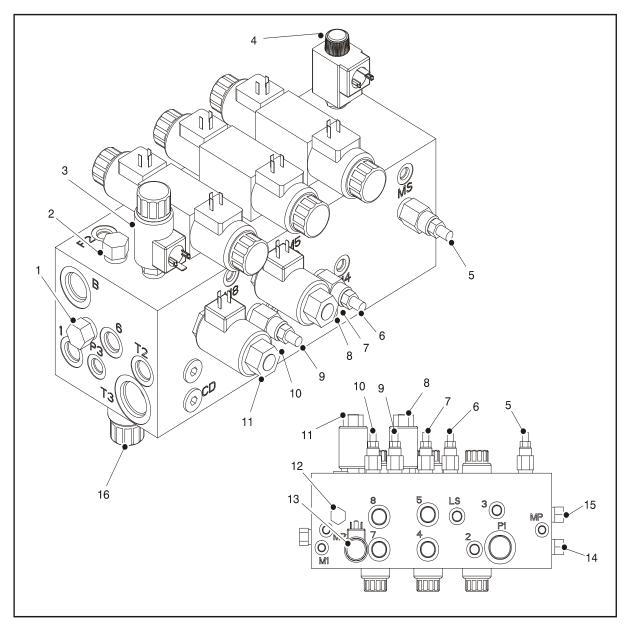


Table 5-3. Cartridge Torque Values

	Ft-Lbs.	Nm		Ft-Lbs.	Nm
1	25-30	33.9-40.6	9	30-35	40.6-47.4
2	25-30	33.9-40.6	10	30-35	40.6-47.4
3	30-35	40.6-47.4	11	30	40.6
4	30-35	40.6-47.4	12	30-35	40.6-47.4
5	30-35	40.6-47.4	13	30-35	40.6-47.4
6	30-35	40.6-47.4	14	30-35	40.6-47.5
7	30-35	40.6-47.4	15	30-35	40.6-47.5
8	30	40.6			1

Figure 5-26. Main Valve Cartridge Torque Values

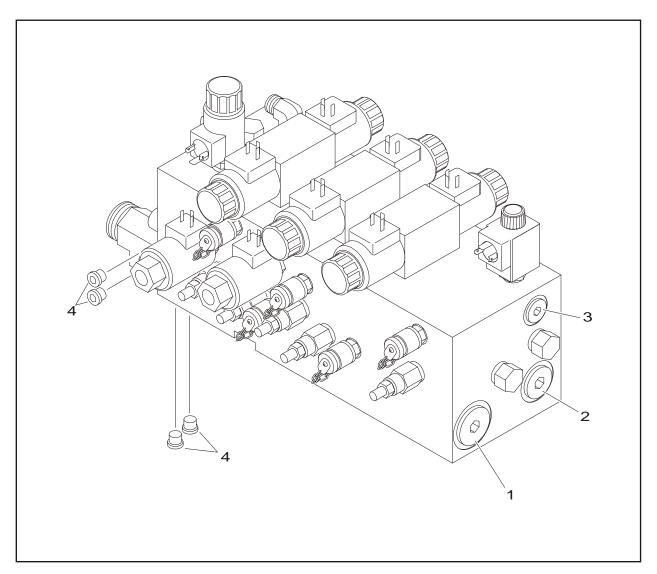


Table 5-4. Plug Torque Values

	Ft-Lbs.	Nm
1	115	156
2	100	135.5
3	40	54
4	13	17.5

Figure 5-26. Main Valve Plug Torque Values

5.3 HYDRAULIC TANK

The hydraulic tank has a capacity of 55 gallons (208 liters) and includes the hydraulic return filter and two suction strainers. It is normal for the oil level to appear low when the boom is raised and should only be checked with the machine on level ground and with the boom fully retracted and lowered. The hydraulic oil should be maintained at the full level as shown by the decal and hydraulic oil level gauge located on the side of the tank as shown in Figure 5-26., Hydraulic Oil Level Gauge. This decal shows the proper full level for both hot and cold oil. Do not fill the hydraulic tank past the appropriate full mark. Overfilling can cause the oil to overflow from the top of the hydraulic tank during emergency lowering operations.

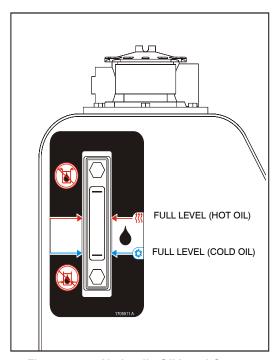


Figure 5-26. Hydraulic Oil Level Gauge

5.4 PRESSURE SETTING PROCEDURE

NOTE: The following procedures cover both 1100S and 1100SJP models. Some procedures will not be applicable to both machines.

Cold temperatures have a significant impact on pressure readings. JLG Industries Inc. recommends operating the machine until the hydraulic system has warmed to normal operating temperatures prior to checking pressures. JLG Industries Inc. also recommends the use of a calibrated gauge. Pressure readings are acceptable if they are within \pm 5% of specified pressures.

To ensure all pressures are set correctly, the following procedures must be followed in order.

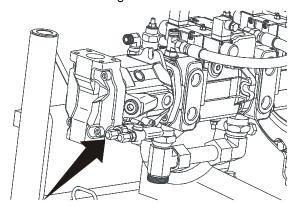
- All applicable steps in Section 5.7, Drive & Function Pump Start Up Procedures must be followed.
- 2. Set up of the function pump.
- 3. Adjustments made at the main valve bank.
- 4. Adjustments made at the platform valve.

Set Up of the Function Pump

HIGH PRESSURE RELIEF - 3400 PSI (234.4 BAR)

- Install a high pressure gauge at the MP port of the main valve block.
- Using a screwdriver, remove the Din connector from the lift down coil.
- **3.** Activate lift down. The gauge should read 3400 psi (234 bar).

4. To make an adjustment to this pressure, go back to the engine compartment to the function pump which is the back pump. The high pressure relief adjustment is the adjustment closest to the pump. Using a 17 mm wrench, remove the cover nut. Be careful not to lose the O-ring washer inside the cover nut.

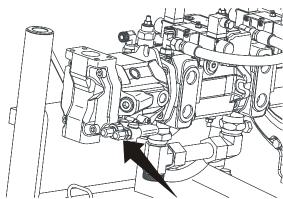


- Loosen the jam nut at the setscrew with the 17 mm wrench. Using a 3 mm allen wrench, adjust clockwise to increase, or counterclockwise to decrease.
- After adjusting the pressure, tighten the jam nut and the cover nut. This is the <u>maximum</u> relief pressure for all the functions governed by this pump.

STAND BY PRESSURE OR LOW PRESSURE RELIEF - 300 PSI (20.6 BAR)

- 1. Install a low pressure gauge at port MP of the main valve block capable of reading 300 psi (20.6 bar).
- 2. Start the engine, the gauge should read 300 psi (20.6 bar).

3. To make an adjustment to this pressure, go to the engine compartment, locate the function pump. The stand by adjustment is the adjustment outside adjustment, closest to the turntable. Use the same tools that were used in the Hi pressure adjustment procedure.



Adjustments made at the Main Valve Bank

LIFT UP - 2750 PSI (189.6 BAR)

- Install a high pressure gauge at the M5 port of the main valve block. Plug and cap the hose on port 5.
- 2. Activate lift up. The gauge should read 2750 psi (189.6 Bar).
- The adjustment cartridge is located below the M5 gauge port. Turn clockwise to increase, counterclockwise to decrease.

LIFT DOWN - 1500 PSI (103.4 BAR)

- Install a high pressure gauge at the M4 port of the main valve block.
- 2. Activate lift down to the end of the stroke. The gauge should read 1500 psi (103.4 bar).
- **3.** The adjustment cartridge is located to the left of the M4 gauge port. Turn clockwise to increase, counterclockwise to decrease.

SWING - 1500 PSI (103.4 BAR)

NOTE: Left and right are done with one adjustment.

- 1. Install a high pressure gauge at port MS.
- 2. Lock the turntable pin.
- Activate swing, the gauge should read 1500 psi (103.4 Bar). The adjustment cartridge is located below the MS gauge port.
- Turn clockwise to increase, counterclockwise to decrease.

TELESCOPE OUT - 3000 PSI (206.8 Bar)

- Install a high pressure gauge at the M8 port of the main valve bank. Plug the telescope out hose either at the valve bank (port #8) or at the inlet of the telescope cylinder (V1).
- Activate telescope out. The gauge should read 3000 psi (206.8 Bar).
- The adjustment cartridge is located below the M8 gauge port. Turn clockwise to increase, counterclockwise to decrease.

TELESCOPE IN - 3200 PSI (220.6 BAR)

- Install a high pressure gauge at the M7 port of the main valve block.
- Activate Telescope In. The gauge should read 3200 psi (220.6 Bar).
- The adjustment cartridge is located to the left of the M7 gauge port. Turn clockwise to increase, counterclockwise to decrease.

Adjustments Made at the Frame Valve Bank

AXLE EXTEND AND RETRACT, FRONT AND REAR - 2500 PSI (172.3 BAR)

- To extend the axles, drive the machine back and forth until extended. A machine that cannot be driven must be jacked up.
- 2. On both the front and rear frame valve banks, install a high pressure gauge on ports MA1 for extend and MA2 for retract. The gauge should read 2500 psi (172.3 Bar) in both directions.
- 3. The axle extend/retract cylinders are connected hydraulically in parallel. In order to get the correct pressure of the circuit being adjusted, unscrew the solenoid coil from the circuit not being adjusted and pull it away from the valve.
- Turn clockwise to increase, counterclockwise to decrease.

STEERING, FRONT AND REAR

NOTE: The following procedure requires 2 people to perform. One is needed for verifying / adjusting pressure readings and wheel spindle alignment the other for operating the steer functions and using the Analyzer from the platform.

The Analyzer is required to perform the pressure check procedure through access of the calibration menu. The calibration menu will allow for extending and retracting the steer cylinders individually, verifying pressures, and proper steer sensor calibration. Verification of the steer sensor calibration will require one of two types of measuring methods; using a square and ruler or using string as explained in Section 6 - JLG Control System. The purpose of these measuring tools is to assure that the wheel spindle is aligned "straight" with the extended axle weldment.

- Position the machine with both front and rear axles fully extended.
- Install the Analyzer in the platform control box and scroll menu's to Access Level 2 and insert password (33271) to get into Access Level 1.



3. Scroll to the calibration mode. Once in the calibration mode, press "ENTER" and scroll to steer. Once in the steer calibration mode, the Analyzer is going to ask to calibrate the steer sensors, this is going to allow extending and retracting each steer cylinder individually during this process. The JLG control system will ask to calibrate the left front sensor, the left rear sensor, the right front sensor and finally the right rear sensor in that order. During this calibration mode each individual steer cylinder will be extended and retracted to verify correct pressures with the marked MS (Measure Steer) ports on the steer / axle valve that pertains to that steer cylinder. Refer to the Hydraulic Schematic in Section 7 - Schematics.

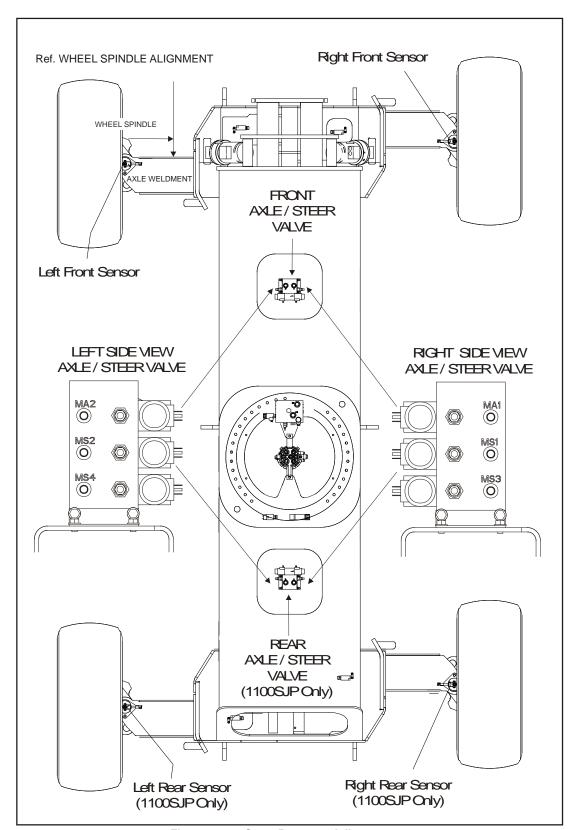


Figure 5-27. Steer Pressure Adjustments

4. Remove the front circular steer/axle access covers at the front of the chassis, and the rear square cover at the top rear of the chassis to gain access to the axle/steer valves.





Install a pressure gauge at the front axle/steer valve at MS2 port. This should be located on the left side of the valve closest to the left front wheel spindle. Position the steer switch to activate the left front steer cylinder until the rod is in the fully extended position and hold the switch for a few seconds after the rod has been fully extended. The MS2 port should read 2000 psi (138 Bar). If the pressure is not 2000 psi (138 Bar) adjust relief valve mounted next

to the MS2 port, CW to increase or CCW to decrease.

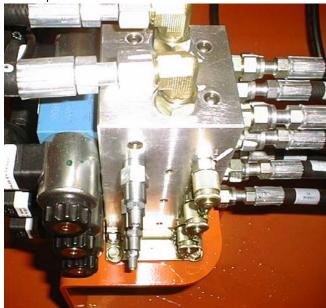


6. Remove the pressure gauge from MS2 port and install on the MS1 port, which is on the right side of the front axle/steer valve, closest to the right front wheel spindle. Position the steer switch to activate the left front steer cylinder until the rod is in the fully retracted position and hold the switch for a few seconds after the rod has stopped. The MS1 port should read 2600 psi (179 Bar). If the pressure is not correct, adjust relief valve next to MS1 port, CW to increase or CCW to decrease.



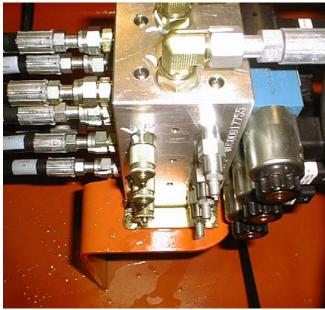
7. This step involves aligning the left front wheel spindle with the axle weldment. Position the left front wheel spindle "straight" using a square and rule or string for proper alignment (Refer to Section 6 - JLG Control System). Once the left front wheel spindle has been properly measured, press "ENTER" on the Analyzer. This is calibrating data to the JLG Control System that the left front steer sensor is centered.

8. Checking the left rear steer cylinder is identical to the procedure for left front steer cylinder, except now we are checking pressures at the rear axle/steer valve location. Install pressure gauge at MS1 port. This should be located on the left side of the valve closest to the left rear wheel spindle. MS1 port should read 2600 psi (179 Bar) when the left rear steer cylinder is activated with the rod in the fully retracted position. If the pressure is not 2600 psi (179 Bar) adjust relief valve mounted next to MS1 port CW to increase or CCW to decrease.



9. Remove the gauge from MS1 port and install on MS2 port, which is on the right side of the rear axle/steer valve, closest to the right rear wheel spindle. Position the steer switch to activate the left rear steer cylinder until the rod is in the fully extended position and hold the steer switch for a few seconds after the rod has been fully extended. The MS2 port should read 2000 psi (179 Bar). If the pressure is not cor-

rect, adjust the relief valve mounted next to MS2 port CW to increase or CCW to decrease.



- 10. The next step is identical to the left front step mentioned above. Make sure the left rear wheel spindle is straight and press "ENTER" to accept the new calibration settings, now press "ESC" (escape) and scroll to the right front steer calibration step.
- 11. Checking the right front steer cylinder is identical to the procedure laid out for the left front steer cylinder, except the pressures are now checked at MS3 port of the front axle/steer valve. This should be at the right side of the valve closest to the right front wheel spindle. Install the gauge at MS3 port. Position the steer switch to activate the right front steer cylinder until the rod is in the fully retracted position and hold the steer switch for a few seconds after the rod has been fully retracted. If the pressure is not 2600 psi (179 Bar), adjust the relief valve mounted next to the MS3 port CW to increase or CCW to decrease.

- 12. Remove the gauge from MS3 port and install on MS4 port, which is on the left side of the front axle/ steer valve, closest to the left front wheel spindle. Position the steer switch to activate the right front steer cylinder until the rod is in the fully extended position and hold the steer switch for a few seconds after the rod has stopped extending. The MS4 port should read 2000 psi (138 Bar). If the pressure is not correct, adjust relief valve mounted next to the MS4 port CW to increase or CCW to decrease.
- 13. The next step is identical to the left front step mentioned above. Make sure the right front wheel spindle is straight and press "ENTER" to accept the new calibration settings. Scroll over to right rear steer calibration step.
- 14. Checking the right rear steer cylinder is identical to the procedure laid out for the left rear steer cylinder. Install gauge at MS4 port of the rear axle/steer valve. This should be at the right side of the valve closest to the right rear wheel spindle. Position the steer switch to activate the right rear steer cylinder until the rod is in the fully extended position and hold the steer switch for a few seconds after the rod has stopped extending. The MS4 port should read 2000 psi (138 Bar. If the pressure is not correct, adjust relief valve next to the MS4 port CCW to increase or CCW to decrease.
- 15. Remove gauge from MS4 port and install on MS3 port, which is on the left side of the rear axle/steer valve, closest to the left rear wheel spindle. Position the steer switch to activate the right rear steer cylinder until the rod is in the fully retracted position and hold the steer switch for a few seconds after the rod stops retracting. If the pressure is not 2600 psi (179 Bar), adjust the relief valve mounted next to the MS3 port CW to increase or CCW to decrease.

16. The next step is identical to the left front step mentioned above, make sure the right rear wheel spindle is straight and press "ENTER" to accept the new calibration settings, now escape out of the calibration menu and remove the Analyzer and pressure gauge.

Adjustments Made at the Platform Valve Bank

PLATFORM LEVEL UP - 2500 PSI (172.3 BAR)

- 1. Install a high pressure gauge at the gauge port M1.
- 2. Activate level up to the end of stroke, it should read 2500 psi (172.3 Bar).
- All the relief valves are located on the same face.
 The level up relief valve is located closest to the M1 gauge port. Turn clockwise to increase, counterclockwise to decrease.

PLATFORM LEVEL DOWN - 1500 PSI (103.4 BAR)

- 1. Install a high pressure gauge at gauge port M2.
- 2. Activate level down to the end of stroke, it should read 1500 psi (103.4 Bar).
- The level down relief valve is located to the left of the level up relief valve. Turn clockwise to increase, counterclockwise to decrease.

ARTICULATING JIB UP AND DOWN - 2750 PSI (189.6 BAR)

 Install a high pressure gauge on gauge port M3. The jib relief valve is located below the level down relief valve. Activate jib up or down, it should read 2750 psi (189.6 Bar). Turn clockwise to increase, counterclockwise to decrease.

5.5 DRIVE PUMPS

NOTE: The following procedures cover both 1100S and 1100SJP models. Some procedures will not be applicable to both machines.

Troubleshooting Procedure

To aid in troubleshooting, refer also to the pressure measuring port connections for test gauge installation information as shown on the hydraulic circuit diagram. Procedure assumes proper gauges are installed. (Minimum gauges required: (2) 0-6000 psi, (1) 0-3000 psi & (1) 0-1000 psi [{2} 0-415 bar, {1} 0-210 bar & {1} 0-70 bar]). This procedure was written to aid the troubleshooter in following a logical approach to a hydraulic system fault.

- 1. Transmission does not propel the machine, diesel engine running properly
 - a. Is there oil in the reservoir?

No - Fill reservoir

Yes - If yes, proceed to step 1.b

b. Is the pump input shaft connected to the engine flex plate or rear of forward pump?

No - Connect pump input shaft

Yes - If yes, proceed to step 1.c

c. Are the hydraulic hoses and tubing connected in accordance with the hydraulic circuit diagram?

No - Correct the hoses/tubing Yes - If yes, proceed to step 1.d

 d. Is the pump direction of rotation correct? (clockwise as looking at the shaft)

No - Fit pump having the correct direction of rotation

Yes - If yes, proceed to step 1.e

e. Are there "O"-rings missing from fittings (as example - suction leak), pinched hoses, broken tubing, etc?

No - Proceed to step 1.f

Yes - Repair damage or fault

f. Are the electrical connectors/wiring intact and secure to the pump control solenoids?

No - Repair damage or fault

Yes - If yes, proceed to step 1.g

g. Does the engine "labor" when attempting drive, are the brakes released?

No - Proceed to step 1.h

Yes - Check brake release circuit, measure pressure at port "MP" on Traction Control manifold

h. Are all four wheel drive planetary reduction gear-boxes engaged?

No - Engage wheel drive(s)

Yes - If yes, proceed to step 2.a

- 2. Transmission does not propel the machine, diesel engine running properly Charge Pump/Relief Valve
 - a. Is there any charge pressure at port G or indicated by measuring pressure at Ma and Mb?

No - Proceed to step 2.d

Yes - Proceed to step 2.b

b. Is the charge pressure at least 500 psi while running at high engine speed?

No - Proceed to step 2.c

Yes - Proceed to step 3.a

c. Can the charge pressure be raised by removing dirt/debris from charge relief poppet or by adding or removing shims from the charge pressure relief valve mounted in the second pump of the triple?

No - Proceed to step 2.d

Yes - Adjust pressure to 500 psi +50 psi, -0 psi (34.4 bar +3.4 bar, -0 bar)

NOTE: The propulsion circuit uses a hot oil flushing valve to obtain brake release pressure. The hot oil flushing valve cartridge (#120) is mounted in the Traction Control Manifold. The flushing valve receives its oil from the "left side" wheel drive pump; the middle pump of the triple. With the engine running and propelling the machine forward or reverse, the "hot oil flushing valve" and the brake release pressure must be adjusted to 475 psi, +25 psi, -0 psi (32.7 bar, +1.7 bar, -0 bar), as set by adjusting pressure relief cartridge (#130). The brake release pressure must be 25 psi less than the charge pump pressure. Measure pressure at port "MP" using a 0-1000 psi (0 - 70 bar) pressure gauge.

d. Is the transmission pumps suction hose pinched shut?

No - Proceed to step 2e

Yes - Repair damaged hose

 e. Is the charge pump suction pressure/vacuum within recommended limits? (0.8 bar absolute or 6.3 inches of mercury)

No - Proceed to step 2.f

Yes - Proceed to step 2.q

f. Is the suction strainer inside the reservoir blocked, clogged, restricted?

No - Proceed to step 2.q

Yes - Repair/replace with a clean suction strainer

g. Is the reservoir air breather blocked or restricted?

No - Proceed to step 2.h

Yes - Clean or replace air breather

h. Remove charge pressure relief valve from the middle pump and inspect. Is it damaged?

No - Refit cartridge and proceed to step 2.i

Yes - Clean & inspect cartridge, poppet, springs, seals to determine cause of damage. Repair or fit a new cartridge and return to step 2.a

i. Remove and inspect charge pump assemblies.
 Are they damaged?

No - Proceed to step 2.j

Yes - Repair and/or replace damaged components and return to step 2.a

j. Is the charge pump installed for the clockwise rotation?

No - Refit charge pump. Return to step 2.a

Yes - With proper charge pressure and transmission still does not operate, proceed to step 3.a

- Transmission does not propel the machine, diesel engine running properly - Pump Control: (Insure Generator Drive option is not turned "on")
 - a. Are the electrical connectors & wiring connected properly to the pump control solenoids?

No - Connect a ammeter in series with solenoid wiring. Is a current of 400 mA to 1060 mA being applied. (Current signal varies with joystick position)

Yes - Proceed to step 3.b

b. Are all four of the two-speed motors, mounted in the wheel drive planetary reduction gearboxes, shifted to maximum displacement (high torque low speed)?

No - Select maximum displacement

Yes - Proceed to step 3.c

c. Actuate the pump control in both directions. Do the pumps stroke? Do they go to full stroke?

No - Refer to the pump service manual and then proceed to step 3.d

Yes - Operate the transmission

d. Remove stroking orifices in X₁ and X₂. Install pressure gauges in X₁ and X₂ (0-500 psi [0 - 35 bar]). Stroke the pump in both directions. Do the pressures at X₁ and X₂ alternate between 30 & 250 psi (2 & 17 bar)?

No - Remove the EP control module & replace it with a new unit. Repeat step 3.c

Yes - Proceed to step 3.e.

e. Is the pressure at port "R", case pressure, less than 15 psi (1 bar) gauge pressure?

No - Correct problem restricting case drain oil flow (oil cooler blockage, pinched hoses, etc)

Yes - Proceed to step 3.f

f. Stroke pump in both directions, while measuring pressure at Ma & Mb ports of the pump. Does any pressure greater than charge pressure alternate between ports Ma & Mb?

No - Verify that loading the pump will cause sys-

tem pressure to increase above charge pressure. Proceed to step 3.a

Yes - Proceed to step 3.g

g. Is it possible to adjust high pressure relief valves using 0-6000 psi (0 - 415 bar) gauges to monitor pressure at Ma & Mb? (Refer to relief valve adjustment)

No - Replace high pressure relief valve and return to step 3.c

Yes - Adjust high pressure relief valves to 5000 psi +50 psi, -0 psi (344.7 bar +3.4 bar, -0 bar)

h. Actuate control in both directions. Does transmission operate?

No - Check that minimum displacement stops on the wheel drive motors are adjusted properly, check that the motors stroke between maximum to minimum.

Yes - Operate the transmission

- 4. Transmission Drive is Sluggish or Erratic
 - a. Does the "EP" proportional pump control current vary with joystick movement?

No - Rectify the problem - broken wires, electrical connector, open solenoid coil, etc.

Yes - Proceed to step 4.b

b. Are all four (4) brakes fully released?

No - Check brake release pressure and insure each wheel receives correct release pressure.

Yes - Proceed to step 4.c

c. Are the pumps stroking time orifices installed tight and clean?

No - Remove the Plugs in ports X_1 and X_2 . Remove orifices with a 3mm allen wrench. Check that orifices are clean & re-install.

Yes - Proceed to step 4.d

- d. Is an motor displacement stroking time orifice plugged or is the two-speed shift hose pinched?
 Yes Inspect and clean stroking orifice, check two-speed hose routing
- e. Is a flow divider/combiner cartridge stuck in the Traction Control Manifold? Flow divider/combiner cartridge # 111 controls the right side wheels, # 112 controls the left side wheels. Also check to insure bypass orifices #151 (right side) and # 152 (left side are not plugged.

- 5. Transmission Drives in one direction only
 - a. Are electrical connections to pump control proportional solenoids correct, intact and without defects?

Yes - Proceed to step 5.b

No - Rectify the problem

- b. Check hot oil flushing valve cartridge #120 located in the Traction Control Manifold. Remove and inspect flushing valve cartridge for stuck spool or damaged cartridge "O"-ring seals & backup rings.
- c. Inspect "Make-Up" check valve cartridges, #190.1-190.4, installed in the Traction Control Manifold. Is a cartridge "stuck" open with debris or is an "O"-ring failed?

No - Proceed to step 5.d

Yes - Clean/repair or replace Make-Up check cartridge.

d. Swap high pressure relief valves in the transmission. Does the transmission drive in the other direction?

No - Proceed to step 5.e

Yes - Repair/clean/adjust or replace high pressure relief valve on the non-driving side

e. Replace "EP" control module. Does pump operate properly?

No - Replace or repair pump

Yes - Operate the transmission

- 6. Transmission Drives in Wrong Direction
 - a. Check to see if electrical connectors or wiring have been swapped on the pump.
 - **b.** Check to determine want end of the machine the boom is swung over.

- 7. Transmission Does Not Find or Hold Neutral
 - a. Does pump remain in neutral with electrical connectors removed?

No - proceed to step 7.b

Yes - Check electrical system for signal problem

b. With electrical connectors removed and machines wheels jacked off the ground and engine running, momentarily apply 12 volt DC signal (battery voltage) to a pump control solenoid. Does the pump return to neutral after the 12 volt signal is removed?

No - Apply 12 volts to opposite solenoid & recheck.

No - Replace pump control module, repeat step 7.a

Yes - Possibly dirt was dislodged from control module, re-check thoroughly to determine problem has definitely been resolved.

- c. Check mechanical centering of the pumps
- 8. Transmission Drives at a High Noise Level
 - a. Are the wheel drive planetary reduction gearboxes filled to the correct level and do they have the proper lubricant?

No - Fill gearbox with correct grade of oil to the prescribed level.

Yes - Proceed to step 8.b

b. Is the engine flex plate and drive coupling correctly installed and aligned with the transmission pump?

No - Install flex plate and bell housing per manufacturer's instructions

Yes - proceed to step 8.c

c. Is a rigid item or object contacting the resilient mounted engine/pump assembly?

No - Proceed to step 8.d

Yes - Insure no item is contacting the unit, transmitting air borne noise.

d. Is the suction pressure/vacuum at the charge pumps inlets within recommended limits?

No - Return to step 1.h

Yes - Proceed to step 8.e

e. Is there air in the hydraulic fluid? This may be indicated by foaming or milky colored oil.

No - Proceed to step 8.f

Yes - Deaerate the oil and inspect system for cause of air induction. Check for loose or missing "O"-rings on face seal connections.

- f. Is a wheel drive hydraulic motor operating at excessive speed?
 - **Yes -** Check minimum displacement stop screw adjustments on the motors. Should be 0.433" or 11mm above the stop screw lock nut. Is one or more motors "stuck" at minimum displacement, check for plugged/blocked two-speed stroking orifice(s).
- Transmission Operates at a Higher than Normal Temperature
 - a. Is the reservoir temperature above 195°F (90.5° C)?

No - 195°F (90.5° C) is the upper limit. If temperature is over 195°F (90.5° C), the oil cooler may need to be cleaned.

Yes - Proceed to step 9.c

b. Are the hydraulic motor(s) stalling (wheels not turning) intermittently?

No - Proceed to step 9.c

Yes - Hydraulic fluid is being heated through system pressure relief valves. Shut down system and rectify the cause of motor stall.

- c. Does oil temperature remain above 195°F (90.5°
 C), after cleaning the oil cooler?
 - **No -** Operate transmission. Check oil cooler more often.

Yes - Proceed to step 8.a

- Transmission Operates at a Higher than Normal Temperature
 - a. Check for differential temperature across the oil cooler. Is there a temperature difference?
 - **No -** Check to determine if the bypass check valve (10 psi [0.7 bar] crack pressure) is stuck open. Check to determine if the oil cooler is restricted internally, causing oil flow to pass across the bypass check valve.

Yes - Proceed to step 8.b

- NOTE: Oil cooler flow is received from the transmission pumps cases, max. continuous pump case pressure is 15 psi gauge pressure. Higher pressure will prematurely damage pump shaft seals
 - b. Disconnect pump case drain from oil cooler & check flow rate from charge pumps. Is the flow rate 3.8 GPM (14.4 LPM) with diesel idle speed of 1200 rpm?

No - Refer to charge pump removal & inspection procedure

- 11. Transmission Pump(s) Do Not Develop Maximum Horsepower (Flow & Pressure)
 - a. Does the charge pump pressure meet specification?

No - Return to step 2.a

Yes - Proceed to step 11.b

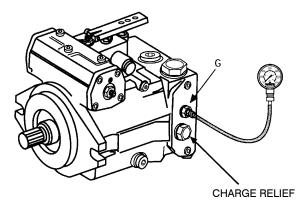
b. Does the pump case pressure exceed 15 psi gauge pressure?

No - Proceed to step 11.c

Yes - Check case drain hoses, oil cooler, etc. for pinched or restricted oil flow

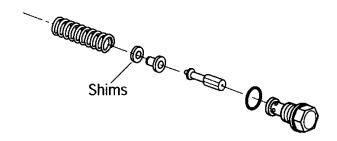
- c. Are the pump(s) high pressure cross port relief valves adjusted to the required pressure (5000 psi) so they do not bypass prematurely?
 - **No** Inspect/clean/adjust and or replace valve cartridge
 - Yes Replace the pump, after blocking the "A" & "B" ports, running the pump and measuring pressure developed at "A" & "B". This must be done to insure that flow & pressure loss in not elsewhere in the system. (motors, swivel coupling, etc)
- d. Is the diesel engine capable of developing horsepower at design rpm? Follow recommended troubleshooting procedures to insure the engine is developing full power at specified rpms.

Charge Pressure Relief Valve Adjustment



With a low pressure (0 – 1000 psi [0 - 70 bar]) pressure gauge tee'd into the "G" port or two (2) low pressure gauges installed into "Ma" and "Mb", run pump at engine idle speed. Do not place the pump on stroke – low pressure gauges installed in "Ma" & "Mb" will be damaged! Prior to adjusting pressure, insure charge pressure relief valve is clean of any dirt or debris. The charge pressure relief valve does not wear appreciably over time. If charge pressure was normal and then has decayed, check for other causes of low charge pressure. If pressure is low, remove relief valve and add shim(s). If pressure is high, remove relief valve and take out shim(s).

NOTE: Shim thickness 1 mm = 56 psi (3.86 bar). Shims are available in 0.3, 0.5, and 1.0 mm thickness.



Mechanical Centering of Pump

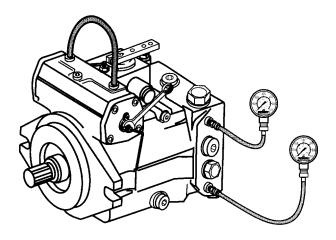
PREPARATION FOR ADJUSTMENT

The control piston has strong centering springs to ensure that once the pump is adjusted for the neutral position it will always return to neutral. If an adjustment is necessary follow the steps listed below.

To ensure there is equal pressure on both sides of the control module during the centering operation, it is necessary to connect the X_1 and X_2 ports together by means of hose or tubing. (No less than a 1/4 inch ID) The port sizes are:

Pump Size	Allen Wrench	Wrench		
28	5 mm	17 mm		

With pressure gages installed at M_A , and M_B , and with A and B ports blocked (or motor stalled), and with the pump running, loosen the jam nut. Turn the mechanical centering adjusting screw until 1000 psi is read on M_A , or M_B then turn screw opposite direction until 1000 psi is read on other pressure port. Turn the screw back, splitting the distance between the previous two positions. This should be the neutral position. Pressure on M_A , and M_B should be equal.

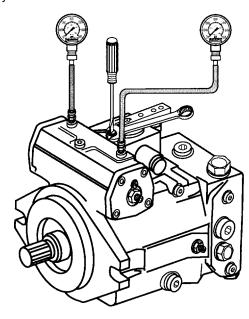


Tighten jam nut, stop the pump drive, remove the hose connecting ports X_1 and X_2 .

Hydraulic Centering of Control Modules

PREPARATION FOR ADJUSTMENT

When control modules are exchanged or replaced, it is generally necessary to center the new module. This is done by running the pump with gauges installed at ports X_1 , X_2 , M_A , and M_B Release the jam nut and turn the adjustment screw on top of the control module valve body.



The adjustment screw is an eccentric, therefore, turning more than 90' in either direction will have no further centering effect, and could cause damage to the eccentric pin.

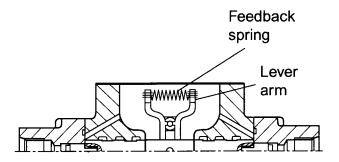
Pump Size	Tool Required	Wrench		
28	Screwdriver	10 mm		

CENTERING THE EP CONTROL MODULE

With no electrical signal to solenoids A and B, (remove both plug-in connectors), the EP control module is correctly adjusted when any or all of the following conditions exist:

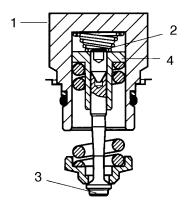
- 1. Approximately, when equal control pressures are obtained at control pressure ports X_1 and X_2 .
- 2. The hydraulic motor does not turn when the brake is released.
- Charge pressure is registered equally at ports M_A and M_B, when the flow output of the pump is deadheaded against a locked motor or a valve.

If difficulties are encountered in obtaining neutral position of the HD or EP control modules, check that the ends of the control spring are correctly located in the grooves near the end of the feedback lever arms.



High Pressure Relief Valve Adjustments

1. Remove relief valve cover from pump (ref. item 1).



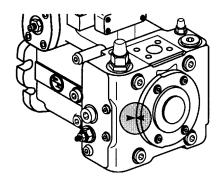
- 2. Loosen jam screw (ref. item 2).
- 3. Holding spring loading nut (ref. item 4) rotate valve spindle (ref. item 3). For high range relief valve, one turn equals approximately 630 psi (44 bar). For low range relief valve, one turn equals approximately 377 psi (26 bar).
- **4.** After adjustment is completed torque jam screw (ref. item 4) to 5 ft.lb. (7 Nm).
- 5. Install relief valve assembly into pump, reinstall cover (ref. item 1) to proper torque.

Table 5-5. Torque Specs for Relief Valves into Port Block

Pump Size	Wrench Size	Torque		
28	32 mm	66 ft.lb. (90 Nm)		

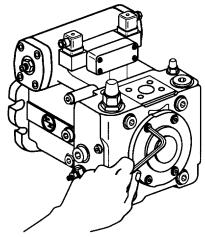
Removal and inspection of charge pump

Before removing cap screws, mark the position of the charge pump housing and separator plate in relation to the port block.



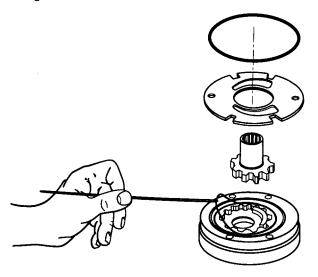
Loosen screws with metric allen wrench.

Pump Size	Allen Wrench		
28	8 mm		



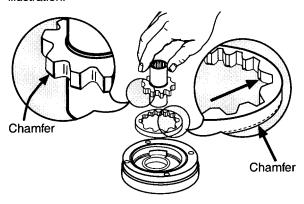
Remove charge pump housing and inspect for wear or damage to gear set and 0-ring seals. Grease 0-rings prior

to reassembly. Make sure 0-rings are completely seated in their grooves.



Withdraw pinion shaft and inspect gear teeth and bearing surfaces for abnormal wear.

When reassembling, make sure chamfer (on outer edge of driven gear and drive gear) is installed into housing per illustration.



Torque value for bolts when replacing charge pump.

Pump Size	Torque
28	18 ft.lb. (24 Nm)

NOTE: If serious wear or damage has occurred to one component, the complete charge pump assembly must be replaced because they are matched components.

Routine Maintenance

The Variable Displacement Hydrostatic Transmission Pumps are relatively maintenance free. Maintenance work is confined to the system, by way of maintaining hydraulic fluid condition, the "life blood" of the machine. Oil monitoring, changes and filter renewal promote system cleanliness. This will prevent premature breakdown and repairs. Under normal application conditions, the following maintenance intervals are suggested:

- 1. Renewal of Filter Elements
 - a. After commissioning or re-build.
 - b. At every 500 operating hours or when filter indicator shows a dirty element.
 - **c.** With the suction strainer, the strainer should be renewed as soon as charge pump inlet pressure is less than -3.2 psi, 6.3"Hg or 0.8 bar absolute.
 - d. Only JLG recommended filter elements are to be used. Paper elements cannot be cleaned; use throwaway cartridges.
- 2. Hydraulic Fluid Change
 - a. After 2000 operating hours (1st oil change)
 - **b.** Thereafter, every 2000 operating hours or annually, irrespective of operating hours achieved.
 - c. Oil change should be performed with the system in warm running condition. Before re-filling, the reservoir interior should be inspected and cleaned to remove any sludge.
 - d. Rags or threaded material must not be used.
 - e. This machine has been designed & manufactured to operate on an <u>Exxon-Mobil Oil Co.</u> hydraulic fluid, Mobilfluid #424, Product #52233-4. Consult JLG Industries prior to introducing any other type of fluid to prevent interaction or possible contamination.
 - f. The recommended interval between oil changes is based on various factors and should be carried out according to the degree of aging, contamination and water content.

g. Under application conditions with a heavy occurrence of dust or severe temperature fluctuations, the intervals between fluid maintenance should be shortened accordingly.

NOTICE

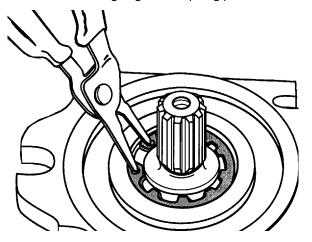
PRACTICAL EXPERIENCE SHOWS THAT MOST FLUID MAINTE-NANCE ERRORS OCCUR DURING AN OIL CHANGE DUE TO:

- USE OF AN UNSUITABLE HYDRAULIC FLUID
- USE OF OIL CONTAMINATED DUE TO POOR STORAGE PRACTICES
- FAILURE TO CLEAN THE RESERVOIR
- INADEQUATE CLEANLINESS WHEN FILLING THE RESERVOIR (DIRTY DRUMS, CONTAINERS, WATER, ETC)
- 3. Leakage Inspection
 - a. After commissioning
 - b. The complete transmission drive system (pumps, motors, hosing, filters, valves, etc) should be checked for leakage at regular intervals
 - **c.** Leaking joints & connections must only be tightened when pressureless.
- 4. Cleanliness Inspection
 - a. The oil tank breather should be regularly cleaned of dirt and dust to prevent clogging. With each cylinder movement, gallons of oil pumped, an equal amount of air exchange occurs across the reservoir breather. A dirty or clogged breather will affect all machine functions!

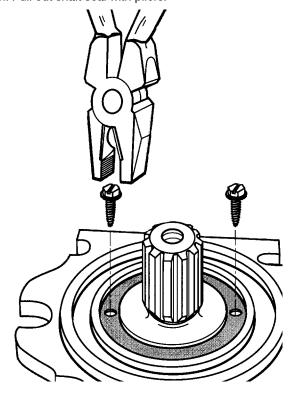
- **b.** The air/oil cooler surfaces and engine radiator should be cleaned at the same time.
- c. If hose connections are disassembled, it is imperative that the utmost care be taken that no foreign bodies infiltrate the oil circuit. Catastrophic component failure may occur.
- 5. Oil Level Inspection
 - a. Inspect oil level in the reservoir daily.
 - **b.** If "topping off" is required, use only the same Mobilfluid #424, Product #52233-4.
 - c. Do Not Mix Fluids.
- 6. Hydraulic Fluid The "Life Blood" of the Machine
 - a. The type of hydraulic fluid supplied in the machine from the factory was selected after extensive testing and development. The fluid was selected to perform under "most" applications and conditions. Should this machine be in service for extended time periods at the extremes (hot or cold), JLG should be consulted for assistance in selection of the most suitable fluid type and grade for your application.
 - b. When operating at temperatures below 0°F, allow a warm-up period, if at all possible, to a temperature of 40°F.
 - c. When beginning motion of a "cold" machine, operate all functions at reduced speeds until the "cold" oil has circulated out of the drive loop.

Removal and Installation of Shaft Seal

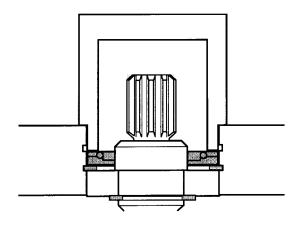
Remove the retaining ring with snap ring pliers.



Screw in sheet metal screw into the holes fitted with rubber. Pull out shaft seal with pliers.



Press in shaft seal with bushing to the stop. Then replace snap ring.



5.6 FUNCTION PUMP

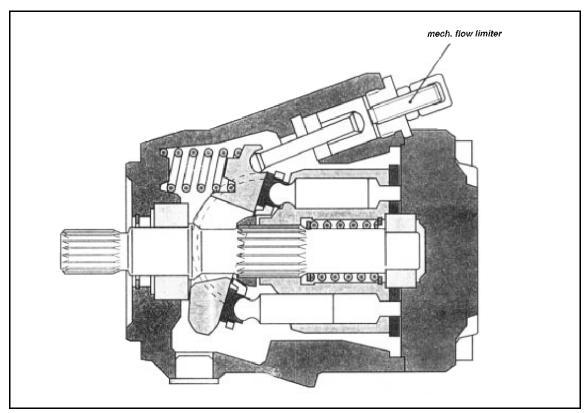
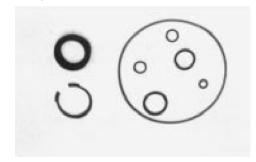


Figure 5-28. Function Pump - Sectional View

Spare Parts

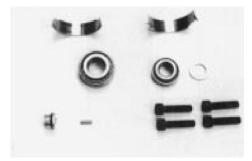
1. Sealing kit, existing spare parts: shaft sealing ring, o-rings, and a circlip.



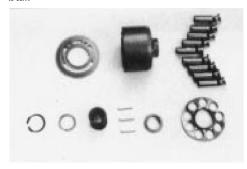
2. Drive Shaft



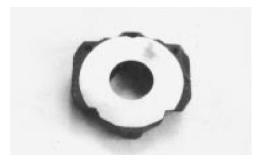
3. Bearing set, miscellaneous parts.



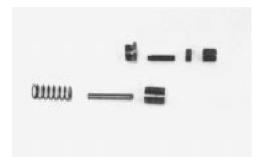
 Rotary Group complete: 9 pistons, cylinder subassembly, valve plate, retaining plate, and retaining ball.



5. Swash Plate.



Parts of the control valve: control piston, piston rod, plug, spring stopper max flow, hex nut, and hex head nut.



7. DFR pilot valve.

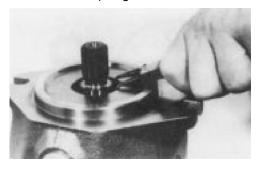


Sealing the Drive Shaft



BE VERY CAREFUL SO THE DRIVE SHAFT IS NOT DAMAGED DURING THE REMOVAL OF THE SHAFT SEALING RING.

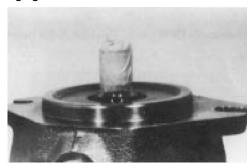
1. Remove the snap ring.



2. Change the shaft seal and check its' sliding surface (drive shaft) and housing. Grease the sealing ring.



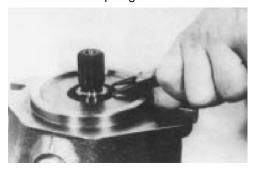
Be careful while you seal the drive shaft. Use an adhesive tape to prevent the shaft splines from damaging the seal.



4. Assemble the sealing ring, fitting tool holds the correct position of the sealing ring in the pump housing.



5. Assemble the snap ring.



6. Assemble the snap ring in the correct position.

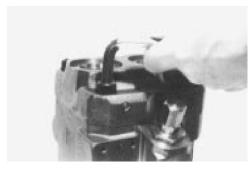


Disassembly and Assembly of the Complete Unit

1. Disassemble the pilot valve.



2. Mark the position of the port plate and remove the socket screw of the port plate.



3. Remove the port plate together with the valve plate (hold the valve plate so the plate can't fall down).



4. Remove the o-ring.



Disassemble the taper roller bearing (nearby port plate).



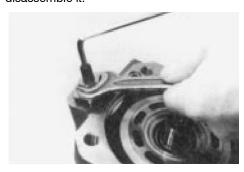
6. Remove the adjustment shim.



7. Unscrew the cap nut and remove it.



8. Loosen the fixing nut of the stopper max flow and disassemble it.



9. Turn in the stopper max flow to get swivel angle zero.



10. Disassemble the rotary group in horizontal position.



11. Disassemble the stopper max flow.



12. Remove the threaded pin.



13. Disassemble the plug.



14. Disassemble the control piston while moving the swash plate.



15. The swash plate must be lifted a little bit to disassemble the piston rod.



16. Remove the swash plate.



17. Remove the spring.



18. Remove both bearing shells.



19. Remove the drive shaft.



20. Disassemble the snap ring.



21. Disassemble the sealing ring.



22. The external front bearing ring is pulled out of the pump housing.



23. Remove the o-ring. Lifting of the valve plate isn't shown.



24. A bearing puller is used to disassemble the external bearing ring of the taper roller bearing inside the port plate. Take care of the surface of the port plate.



25. The spring has additional pretension while you disassemble the three pressure pins inside the cylinder.



Assembly

1. Measurement of the taper roller bearing pretention.



2. Ensure there is a correct connection of the piston rod and the swash plate.



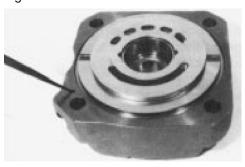
3. Pumps clockwise driven must have a position of the valve plate 4 degrees out of center in the same direction decentered like drive direction.



 Pumps counterclockwise driven must have a position of the valve plate 4 degrees decentered in the ccw position.



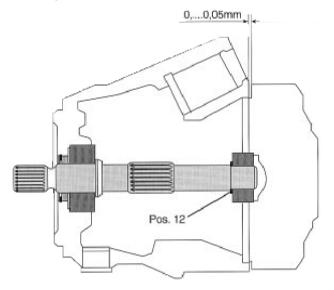
5. Note the correct position of the drilling that connects high pressure to the control valve. Check control valve drilling position at the pump housing and fit together.



Adjustments

TAPER ROLLER BEARING INITIAL TENSION

Cast Iron pump housing must have initial tension of the bearings: 0 to 0.05 mm.



MECHANICAL FLOW LIMITER

Differential volume if you are rotating the threaded pin - each rotation is approximately 3.1 cm3.

Tightening Torques

For break-off plugs, use Loctite #601. For all other parts, use Loctite #242.

Table 5-6. Tightening Torques

	M4	M5	M6	М8	M1 0	M12	M14	M16	M18	M20	M24	M30
8.8	2.3	5.0	8.5	21	41	72	115	176	240	350	600	1220
10.9	3.2	7.2	12	29	58	100	165	250	350	490	840	1670
12.9	4.1	8.5	14.5	35	70	121	195	300	410	590	990	2000

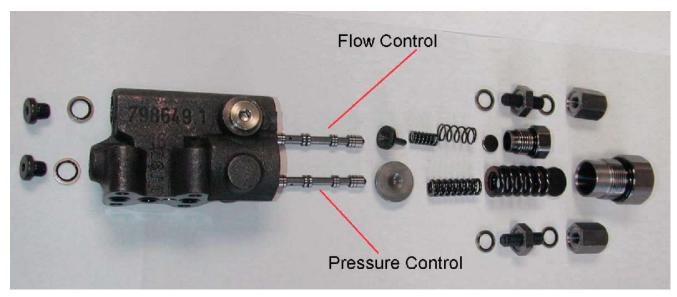


Figure 5-29. Function Pump, Pressure and Flow Control - Sheet 1

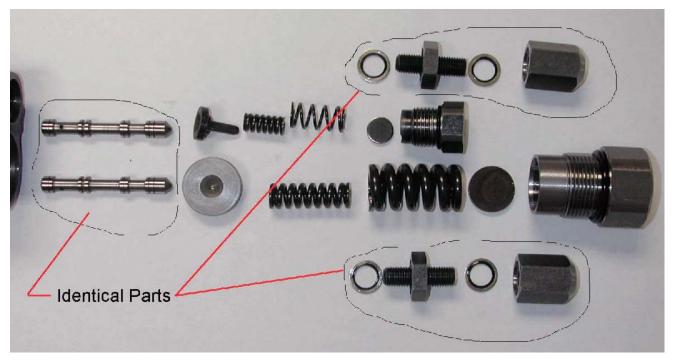


Figure 5-30. Function Pump, Pressure and Flow Control - Sheet 2

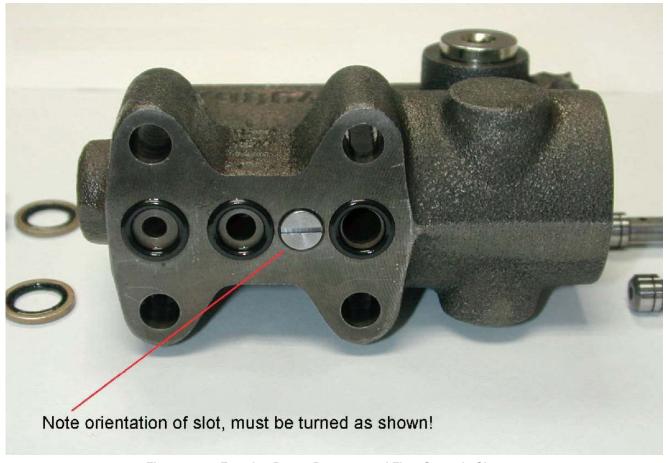


Figure 5-31. Function Pump, Pressure and Flow Control - Sheet 3

Pump Control Disassembly For Cleaning

NOTE: If the Function Pump does not perform correctly after following the pre-start start-up procedures, it is possible that a contaminate particle has lodged in the pump control preventing proper operation. The pump control's internal parts are not provided as spare parts due to the close tolerances required between the mating parts. However, the control can be disassembled, cleaned and placed back in service should the only problem prove to be contamination. Disassembly, inspection, cleaning and reassembly MUST BE done in a clean well-illuminated area.

Pump Control removal:

- Disconnect plug the hose attached to the pump control Port "X".
- Remove the four (4) socket head cap screws that attach the control to the pump. Insure that the three (3) "0"-rings are also removed with the control.

- Hydraulic fluid may drip from the pump. Wiping the surface clean and installing some adhesive tape should prevent oil from seeping from the pump control.
- 4. Work on a clean, lint free area.

NOTE: The pump control can be equipped with either Orings or a sealing plate. These components are NOT interchangeable.

- Remove the three (3) "0"-rings (Parker # 2-011, Viton 90 shore)
- Remove both the adjustment hex caps and bonded seal rings. (17 mm wrench)
- 7. Remove both the adjustment lock nuts and bonded seal rings. (17 mm wrench)
- 8. Remove both the adjusting screws. (3-mm Allen wrench)

- Remove the spring cover hex cap for the "outer" flow regulation adjustment this requires a 19-mm wrench.
- 10. Remove the spring disc.
- **11.** Remove the adjusting springs (two springs, one "nested" inside the other) and spring follower.
- 12. The flow regulation spool should slide from the control housing, (a magnet should aid in removal). If it does not, remove the hollow hex head plug at the rear of the flow regulation spool and carefully push the spool from the housing do not scratch/mar the spool's bore.
- Remove the spring cover hex cap for the "inner" pressure compensation adjustment – this requires a 30-mm wrench.
- 14. Remove the spring disc.
- **15.** Remove the adjusting springs (two springs, one "nested" inside the other).
- 16. Remove the spring follower.
- 17. The pressure compensation spool should slide from the control housing, (a magnet should aid in removal). If it does not, remove the hollow hex head plug at the rear of the flow regulation spool and carefully push the spool from the housing - do not scratch/mar the spool's bore.
- 18. The spools are identical.
- 19. Wash the housing and all parts in a clean JLG approved solvent such as non-chlorinated brake cleaner, Stoddard solvent, etc.
- 20. Blow off all the parts with clean, dry compressed air.

21. Inspect the housing for contamination or plugged orifices. Clean orifices carefully with a dead soft steel wire to insure they are open. Inspect all parts for burrs, scoring, debris, etc.

NOTE: On the mounting surface of the control housing, between the oil ports is what appears to be a slotted head screw. IT IS NOT A SCREW. This is a bleed orifice, which must be orientated to allow proper control operation. The slot in the head should be oriented to fall in-line with the oil ports, NOT PERPENDICULAR to the oil ports. If the slot is oriented perpendicular to the three ports, the pump pressure will not return from load pressure to standby pressure at the end of operating a function! The pump pressure will remain at the last highest pressure generated.)

- 22. After all parts are clean and dry, lightly oil a control spool and install in its bore. The spool must slide smoothly and easily within the housing. If it does not, check for contamination. If contamination cannot be found check for "scoring" or "burring" of the control housing. If the spool does not slide smoothly & freely, the control must be replaced with a new unit.
- 23. Lightly oil and check operation of the second spool. The spools are installed correctly when there "pointed" end faces the spring followers
- 24. Re-assemble in reverse order.
- 25. Bench set the pressure adjustments.
- **NOTE:** The pump control can be equipped with either Orings or a sealing plate. These components are NOT interchangeable.
 - 26. Re-install on the Function Pump, insure the "0"-rings are installed properly and tighten the four (4) M6 socket head cap screws to 105 inch pounds.

5.7 DRIVE & FUNCTION PUMP START UP PROCEDURES

Start-Up Procedure

The machine utilizes a Triple Combination Pump coupled to the Deutz diesel engine. The pumps are connected inline to each other as follows:

- The front hydrostatic transmission pump, or drive pump, is coupled directly to the diesel engine and provides oil flow to operate the machine's right side wheels.
- The middle hydrostatic transmission pump, or drive pump, is coupled to the back of the front pump and provides oil flow to operate the machine's left side wheels.
- The third or rear pump is the function pump. It is coupled to the back of the middle pump and provides oil flow to operate the boom, axle, steer and platform functions.

The transmission pumps share some common connections. Each pumps charge oil suction ports are connected by steel tubing, the charge pumps discharge oil flows are connected and flow to a common charge pump inline oil filter, cleaned & filtered oil flows back to the transmission pumps "G" ports. The pumps case drain ports are connected (T1 & T2), oil flow from the middle pumps T1 port also provides flows to the oil cooler. The charge pumps oil pressure is regulated by a single boost oil pressure relief valve installed in the middle pump. The front pump has an orifice cartridge (0.047" diameter) installed in place of a charge oil pressure relief cartridge. This insures that only one valve controls charge pressure & provides an amount of charge oil flow to the front pump's case to insure flushing & removal of hot oil.

Each pump has its own separate electrical proportional directional control valve to control oil flow and direction. The signals or command values to each pump are similar except when steering. During steering and propel of the machine the pump supplying oil to the "inside turning radius" has a command less than the pump supplying oil flow to the "outside turning radius" pump.

"Posi-Traction" control, front to rear on a given side of the machine, is accomplished by a flow divider/combiner cartridge installed in the Traction Control Manifold. There is a flow divider/combiner for each side. Each flow divider/combiner also has a "bleed orifice" to limit the amount of flow splitting or combining.

The middle transmission pump also supplies oil to a hot oil flushing valve cartridge, #120, in the Traction Control Manifold. This cartridge provides a means to obtain brake release oil pressure. The brake release pressure is controlled by a pressure relief valve cartridge # 130 and a solenoid operated brake release directional control cartridge, #170, also located in the Traction Control Manifold. This is important to note as the brake release oil pressure must be set 25 psi (1.7 bar) below the boost oil pressure relief valve. If the brake release pressure is set too low, brake drag and pump control will be affected. If set too high, damage to the wheel drive parking brakes could result. Prior to start, connect appropriate pressure gauges to the unit.

FOR THE START-UP OF NEW OR OVERHAULED INSTALLATIONS:

- Insure all electrical checks have been performed & the machine is set up correctly with the JLG Analyzer.
- 2. Insure the machine has all four wheels jacked & blocked off the ground per JLG procedures.
- Insure the triple pump assembly is installed and connected correctly per the hydraulic circuit diagram.
- Disconnect the electrical connector from the diesel's throttle actuator, to prevent engine start.
- Crank the engine until charge pressure reaches 50 psi or more.
- 6. Re-connect throttle actuator electrical connector and start engine. Allow engine to run at idle speed only for at least 5 minutes. This will allow the hydrostatic system to filled.
- 7. Listen for any abnormal noises.
- 8. Check for oil leaks.
- 9. Check charge pressure (500 psi +50psi, 0 psi [34.4 bar +3.4 bar, 0 bar]). Pressure can be measured a pump ports Ma & Mb or by "teeing" into the inlet for the charge oil filter. Charge pressure is checked with the joystick in neutral. A 0-1000 psi (0-70 bar) pressure gauge must be used. (If pressure gauges were installed in Ma & Mb to check charge pressure, disconnect the gauges installed in Ma & Mb, as they will be damaged if loop pressure rises above 1000 psi [34.4 bar].)

- Operate the drive system in the "turtle mode", forward and reverse.
- De-aerate the system by bleeding fluid from the Ma & Mb ports.
- 12. Switch the drive mode speed control from "turtle" to "rabbit". Gradually increase drive speed forward & reverse, still with no load - wheels off the ground.
- 13. With the joystick in neutral, check for creep in neutral. If evident, most likely dirt is present in the proportional pump control, an incorrect electrical signal is present on the pump's electrical control(s) or the control was not centered properly when overhauled. See service manual for centering instructions.
- 14. Check that the controls are connected so that the transmissions operate in the correct direction related to control input.
- Continue to monitor all pressure gauges & correct any irregularities.
- 16. Remove the brake coil (leaving the electrical connection intact) from the brake release solenoid cartridge located on the Traction Manifold. This disables the machine's ability to release the brakes! Stroke the transmission pumps slightly (less than 20%) and check the setting of the high pressure cross port relief valves. Setting should be 5000 psi +50 psi, -0 psi (344.7 bar +3.4 bar, -0 bar). Install 0-6000 psi (0 415 bar) gauges on Pump ports Ma & Mb.

- 17. Check oil level & temperature.
- Remove and inspect charge pressure oil filter, replace with new element.
- 19. Operate the transmission under no load conditions for about 15 minutes to stabilize the temperature and remove any residual air from the fluid.
- **20.** Set the machine back on the ground. Operate the transmissions under full and normal conditions.
- 21. Erratic operation may indicate there is still air trapped in the system. By working the pump controls forward and reverse the remaining air can be eliminated. The system is free of air when all functions can be operated smoothly and when the oil in the reservoir is no longer aerated. (Usually less than one hour of operation)

NOTE: If the transmissions do not perform correctly after following the pre-start & start-up procedures, refer to the relevant sections of the trouble-shooting procedures.

NOTES:	
	-
	-
	-
	-

SECTION 6. JLG CONTROL SYSTEM

6.1 INTRODUCTION

NOTICE

WHEN INSTALLING ANY NEW MODULE CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS AND PROPERLY CALIBRATE THE TILT SENSOR.

NOTICE

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG designed Control System is a 12 volt based control unit installed on the boom lift.

The JLG Control System has reduced the need for exposed terminal strips, diodes and trimpots and provides simplicity in viewing and adjusting the various personality

settings for smooth control of: acceleration, deceleration, creep, min speed, and max.-speed for all boom, drive, and steering functions.

The main lift, swing, and drive are controlled by individual joysticks, with steering being controlled by a rocker switch built into the top the drive joystick. To activate Drive, Lift, and Swing simply pull up on the slide lock location on the joystick and move the handle into the direction desired.

The control system will control the voltage output to the valves and pump, as programmed for smooth operation and maximum cycle time. Ground control speeds for all boom functions can also be programmed into the control system.

The JLG Control System controller has a built in LED to indicate any faults. The system stores recent faults which may be accessed for troubleshooting. Optional equipment includes a soft touch system, head and tail lights, and ground alarm. These options may be added later but must be programmed into the control system when installed.

The Control System may be accessed utilizing a custom designed, hand held analyzer (Analyzer Kit, JLG part no. 2901443) which will display two lines of information at a time, by scrolling through the program.

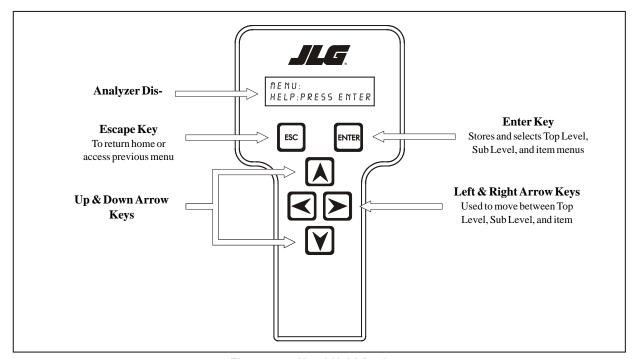


Figure 6-1. Hand Held Analyzer

6.2 CANBUS COMMUNICATIONS

CANbus: CAN (Control Area Network) is a two wire differential serial link between the Platform Module, Ground Module, Boom Length Angle Module and the Chassis Module providing bi-directional communications.

Two-wire: One wire (red) is driven high (5v) and the other low (black) (0v) to send a signal; both wires "float" (2.5v) when no signal is being sent.

Differential: Any electrical line noise can affect the high or the low wires but never both, so communications is not corrupted.

Serial Link: Messages are being sent bit by bit along the wires; the high bus speed allow all modules to be constantly updated around 20 times per second. Typical traffic is 300 - 500 messages per second.

A complete CANbus circuit is approximately 60 ohms, which can be verified at the "T" fitting inside the ground station or below the BLAM. Each individual circuit from the modules is approximately 120 ohms.

The GROUND MODULE is the master system controller. Most functions are dispatched and coordinated from this module, all other system modules (PLATFORM, BLAM L CHASSIS) handle sub-tasks. All characterized information (values) are stored into the ground module (i.e., Personalities or Calibrations).

Interlocks: Any device that sends an electrical input. (For an example a limit switch, proximity switch, etc;)

Platform Level: The GROUND MODULE stores the default values and handles interlocks. The PLATFORM MODULE reads the sensors mounted on the platform assembly and controls the Level Up / Down valves to maintain setpoint sent from the GROUND MODULE.

Steer: The GROUND MODULE stores crack points, sends desired drive direction, sends steering mode and sends axle extend / retract commands. The PLATFORM MODULE reports the steering switch position to the GROUND MODULE. The CHASSIS MODULE modulates each steer left / right valve to maintain commanded wheel position.

Drive: The GROUND MODULE stores crack points, sends commands for each drive pump to the BLAM. (Command is computed from drive joystick input, interlocks, wheel angle, etc). BLAM maintains proper current for the drive pumps by modulating PWM outputs.

Lift, Tele, & Swing: The GROUND MODULE stores default values, handles interlocks and calibration information. Lift, Telescope and Swing commands are dependent upon interlocks through out the machine. Boom angle, length and swing are controlled by the GROUND MODULE. The BLAM monitors and communicates (CANbus) to the GROUND MODULE boom angle and boom length via two angle sensors, a length sensor and a load moment pin.

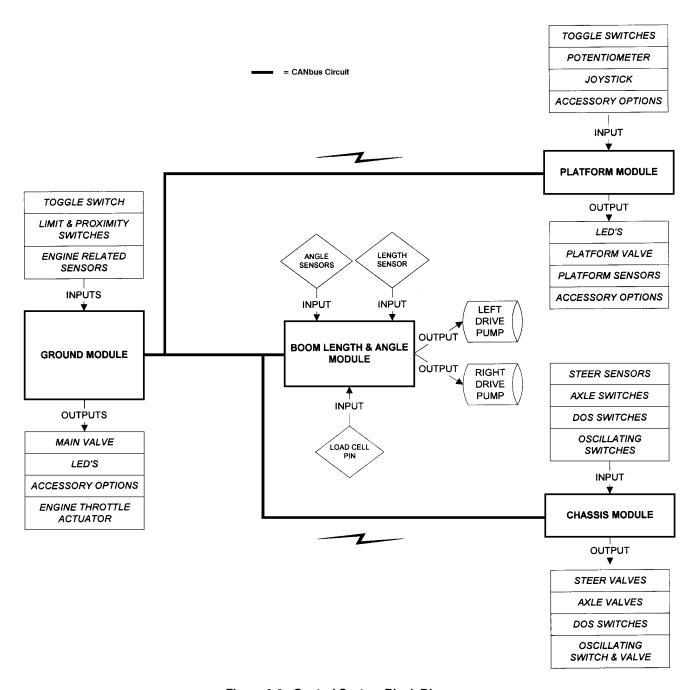


Figure 6-2. Control System Block Diagram

6.3 CALIBRATION INSTRUCTIONS

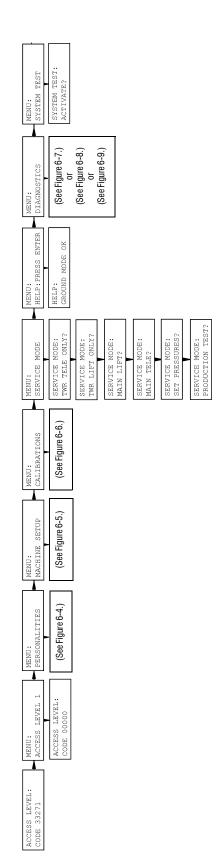
This machine incorporates a variety of sensors and a high degree of function interaction. For safety and proper machine functionality, the calibration procedures must be repeated for any control module replacement, system calibration related fault, or removal or replacement of any sensors, valves, coils, motors, or pumps. The chart below lists the calibrations required and potential reasons for recalibration. All calibration procedures are menu driven through the use of the standard analyzer. With the exception of steering calibration, no external tools are required to complete the calibration procedures. The user is prompted to exercise the machine in a specific order to use the machines physical properties to consistently establish sensor response and the interaction of valves, pumps, and motors. Steering calibration also uses the analyzer and is performed on one side of the machine at a time requiring the use of a string or other means to determine when the tires are in line with each other. With the exception of the load control calibration, all calibrations are accessed by connecting the analyzer into the control system inside the main terminal box or on the bottom of the platform control box.

Table 6-1. Calibration Instructions

Calibration Procedure	Reasons for Re-calibration
Steering Calibration	Ground module replacement Chassis module replacement Steer sensor removal or replacement Persistent wheel misalignment
Drive Calibration	Ground module replacement BLAM module replacement Drive pump/coil replacement Drive pulls to one side Drive lugs engine Poor slow speed control
Platform Leveling Calibration	Ground module replacement Platform module replacement Platform level sensor removal or replacement Platform level sensor calibration fault
Platform Level Crack Point Calibra- tion	Platform module replacement Ground module replacement Platform level valve/coil replacement Erratic platform leveling
Lift Crack Point Calibration	Ground module replacement Lift proportional valve/coil replacement Erratic controlled arc operation Erratic controlled boom angle operation

Table 6-1. Calibration Instructions

Telescope Crack Point Calibration	Ground module replacement Telescope proportional valve replacement Erratic controlled arc operation Erratic controlled boom angle operation
Chassis Tilt Calibration	Ground module removal or replacement Main terminal box removal or replace- ment Tilt indication inaccuracy
Boom Sensors Calibration	Ground module removal or replacement BLAM module removal or replacement Boom angle sensor removal or replacement Boom length sensor removal or replacement Moment pin removal or replacement Boom angle sensor calibration fault Boom length sensor calibration fault Moment pin fault Failed BCS functional check Boom control system inaccuracies Installing or removing approved accessories Changing Platform Size



NOTE: The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.

Figure 6-3. Analyzer Flow Chart

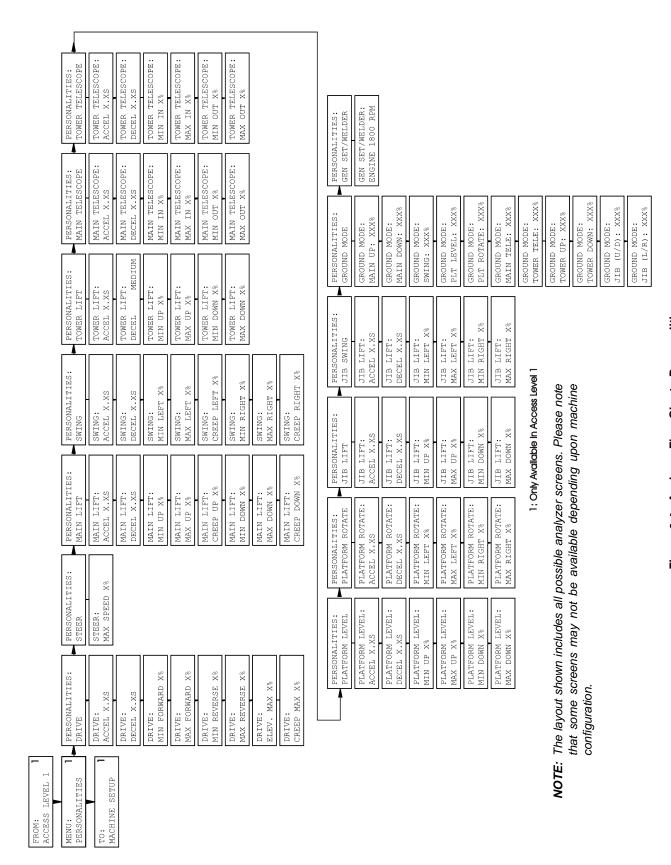


Figure 6-4. Analyzer Flow Chart - Personalities

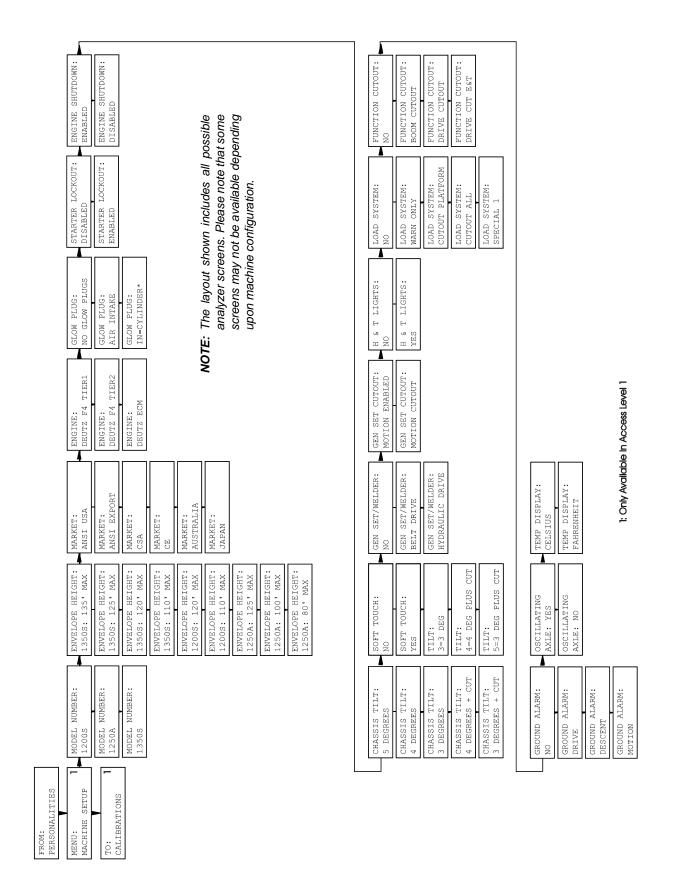


Figure 6-5. Analyzer Flow Chart - Machine Setup

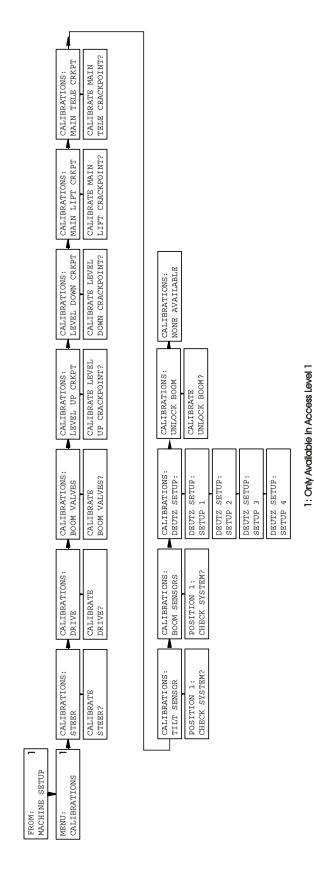


Figure 6-6. Analyzer Flow Chart - Calibrations

NOTE: The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine

configuration.

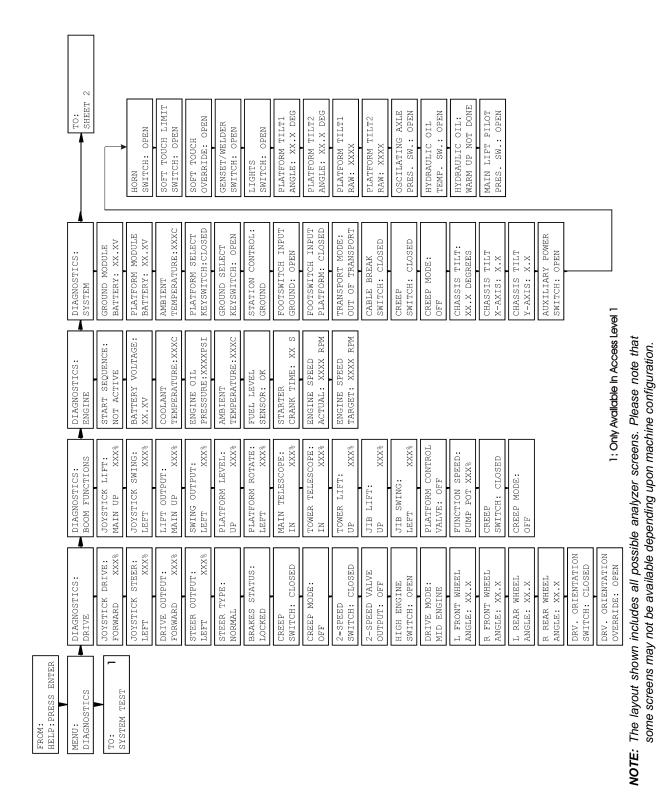
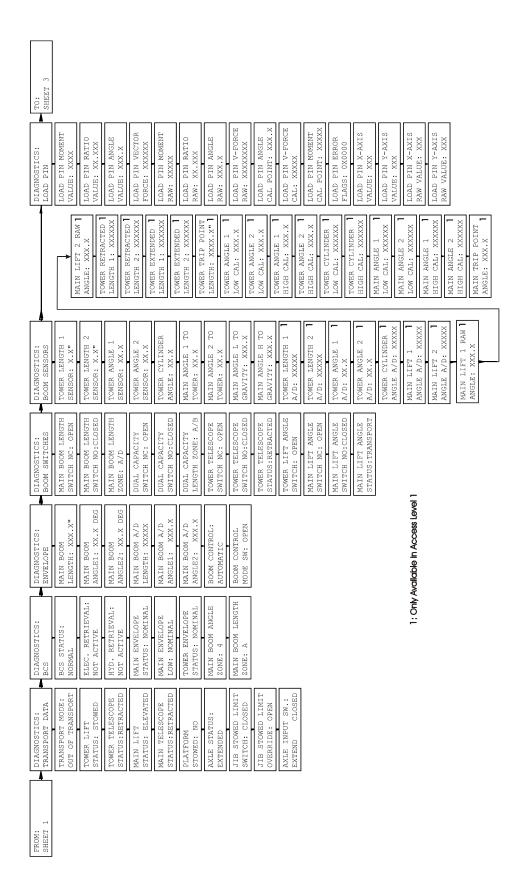
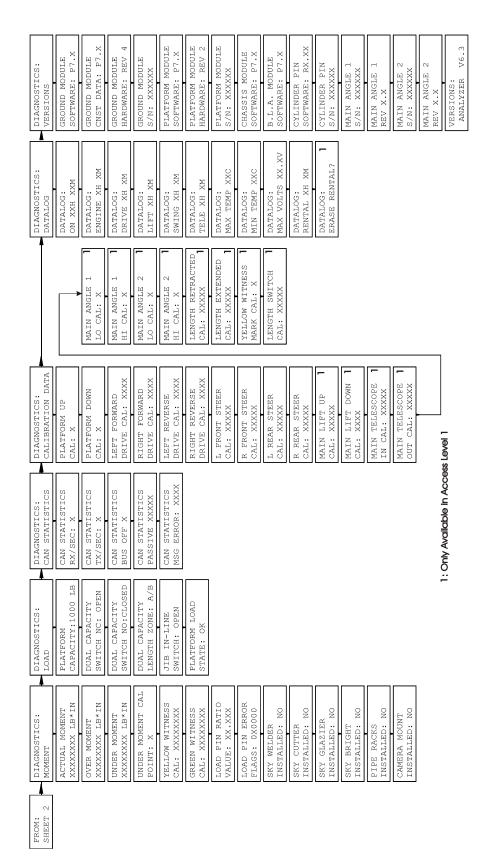


Figure 6-7. Analyzer Flow Chart - Diagnostics- Sheet 1 of 3



NOTE: The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.

Figure 6-8. Analyzer Flow Chart - Diagnostics - Sheet 2 of 3



NOTE: The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.

Figure 6-9. Analyzer Flow Chart - Diagnostics - Sheet 3 of 3

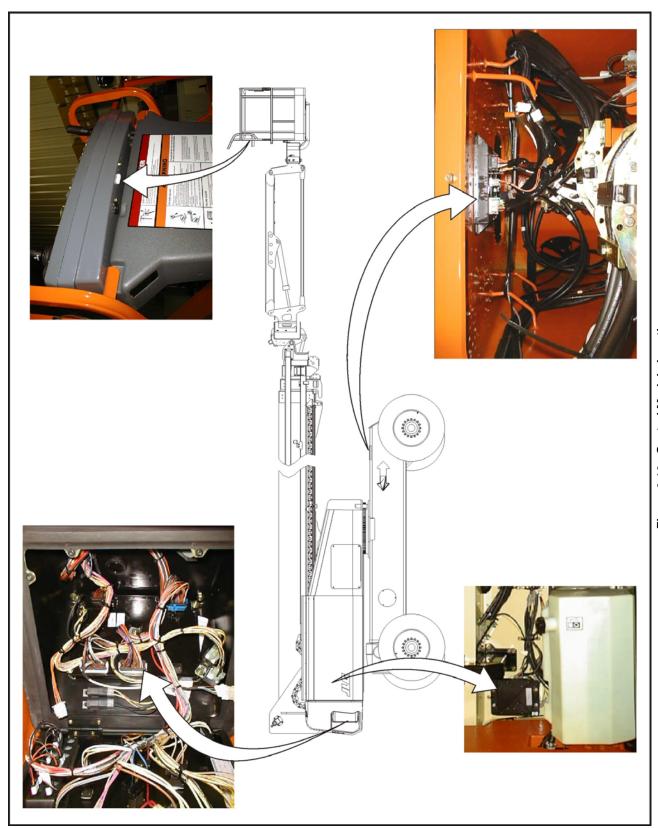


Figure 6-10. Control Module Location



PLATFORM CONNECTION



GROUND CONTROL CONNECTION

Figure 6-11. Analyzer Connecting Points

6.4 TO CONNECT THE JLG CONTROL SYSTEM ANALYZER

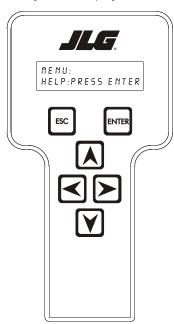
 Connect the cable supplied with the analyzer, to the controller module located in the platform box or at the controller module in the ground control box and connect the remaining end of the cable to the analyzer.

NOTE: The cable has a four pin connector at each end of the cable; the cable cannot be connected backwards.

Power up the Control System by turning the key to the platform or ground position and pulling both emergency stop buttons on.

6.5 USING THE ANALYZER

With the machine power on and the analyzer connected properly, the analyzer will display the following:



HELP: PRESS ENTER

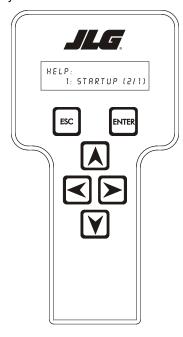
At this point, using the **RIGHT** and **LEFT** arrow keys, you can move between the top level menu items. To select a displayed menu item, press **ENTER**. To cancel a selected menu item, press ESC.; then you will be able to scroll using the right and left arrow keys to select a different menu item.

The top level menus are as follows:

HELP
DIAGNOSTICS
SYSTEM TEST
ACCESS LEVEL
PERSONALITIES
MACHINE SETUP
CALIBRATIONS (view only)

If you press ENTER, at the HELP: PRESS ENTER display, and a fault is present, the analyzer display will scroll the fault across the screen. If there was no fault detected, the display will read: HELP: EVERYTHING OK. If powered up at the ground station, the display will read: GROUND OK.

If ENTER is pressed again, the display moves to the following display:



LOGGED HELP
1: POWER CYCLE (0/0)

At this point, the analyzer will display the last fault the system has seen, if any are present. You may scroll through the fault logs to view what the last 25 faults were. Use the right and left arrow keys to scroll through the fault logs. To return to the beginning, press ESC. two times. POWER CYCLE (0/0) indicates a power up.

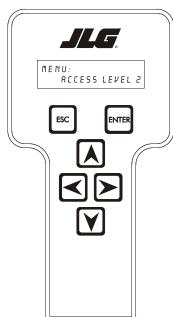
When a top level menu is selected, a new set of menu items may be offered: for example:

DRIVE BOOM SYSTEM DATALOG VERSIONS

Pressing ENTER with any of the above displayed menus, will display additional sub-menus within the selected menu. In some cases, such as DRIVE, the next level is the parameter or information to be changed. Refer to the flow chart for what menus are available within the top level menus. You may only view the personality settings for selected menus while in access level 2. Remember, you may always cancel a selected menu item by pressing the ESC. key.

6.6 CHANGING THE ACCESS LEVEL OF THE HAND HELD ANALYZER

When the analyzer is first connected, you will be in access level 2 which enables you to only view most settings which cannot be changed until you enter a password to advance to a lower level. This ensures that a setting cannot be accidentally altered. To change the access level, the correct password must be entered. To enter the password, scroll to the **ACCESS LEVEL** menu. For example:



MENU: ACCESS LEVEL 2

Press ENTER to select the ACCESS LEVEL menu.

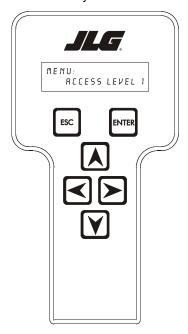
Using the **UP** or **DOWN** arrow keys, enter the first digit of the password, 3.

Then using the **RIGHT** arrow key, position the cursor to the right one space to enter the second digit of the password

Use the **UP** or **DOWN** arrow key to enter the second digit of the password which is 33271.

Continue using the arrow keys until all the remaining digits of the password is shown.

Once the correct password is displayed, press **ENTER**. The access level should display the following, if the password was entered correctly:

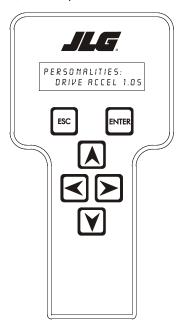


MENU: ACCESS LEVEL 1

Repeat the above steps if the correct access level is not displayed or you can not adjust the personality settings.

6.7 ADJUSTING PARAMETERS USING THE HAND HELD ANALYZER

Once you have gained access to level 1, and a personality item is selected, press the UP or DOWN arrow keys to adjust its value, for example:

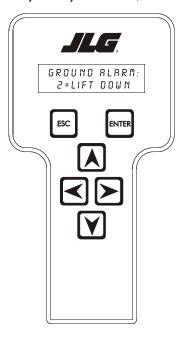


PERSONALITIES: DRIVE ACCEL 1.0s

There will be a minimum and maximum for the value to ensure efficient operation. The Value will not increase if the **UP** arrow is pressed when at the maximum value nor will the value decrease if the **DOWN** arrow is pressed and the value is at the minimum value for any particular personality. If the value does not change when pressing the up and down arrows, check the access level to ensure you are at access level 1.

6.8 MACHINE SETUP

When a machine digit item is selected, press the UP or DOWN arrow keys to adjust its value, for example:



GROUND ALARM: 2 = LIFT DOWN

The effect of the machine digit value is displayed along with its value. The above display would be selected if the machine was equipped with a ground alarm and you wanted it to sound when lifting down. There are certain settings allowed to install optional features or select the machine model.

When selection the machine model to match the size of the machine, the personality settings will all default to the factory recommended setting.

NOTE: Refer to Table 6-3, Personality Ranges/Defaults, and in this Service Manual for the recommended factory settings.

NOTE: Password 33271 will give you access to level 1, which will permit you to change all machine personality settings.

There is a setting that JLG strongly recommends that you do not change. This setting is so noted below:

ELEVATION CUTBACK



CHANGING THIS SETTING MAY ADVERSELY AFFECT THE PERFORMANCE OF YOUR MACHINE.

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
the person	ality settings	tion must be completed before any personality settings can be cl first and then changing the model number of the machine config to return to default	
MODEL NUMBER:	1	1100S	2
1	2	1200\$	
	3	1350\$	
	4	1250A	
ENVELOPE HEIGHT:	1	1350S: 135' MAX	5
2	2	1350S: 125' MAX	
	3	1350S: 120' MAX	
	4	1350S: 110' MAX	
	5	1200S: 120' MAX	
	6	1200S: 110' MAX	
	7	1250A: 125' MAX	
	8	1250A: 100' MAX	
	9	1250A: 80' MAX	
	10	1100S: 110'MAX	
Note: The default settin	ıgs (bold) will va	ary depending on the model selection with selection # 5 being the initial default	setting.
MARKET:	0	ANSIUSA	0
3	1	ANSIEXPORT	
	2	CSA	
	3	CE	
	4	AUSTRALIA	
	5	JAPAN	
ENGINE:	1	DEUTZ F4 TIER1: Deutz BF4M1011 Diesel (Tier 1)	3
4	2	DEUTZ F4 TIER2: Deutz BF4M2011 Diesel (Tier 2)	
	3	DEUTZ ECM: Engine Control Module	

 Table 6-2. Machine Configuration Programming Information

Configuration Digit			Default Number
GLOW PLUG:	0	NO GLOW PLUGS: No glow plugs installed.	2
5	1	AIR INTAKE: Glow plugs installed in the air intake on the manifold.	
	2	IN-CYLINDER: Glow plugs installed in each cylinder.	
STARTER LOCKOUT: 6	0	DISABLED: Automatic pre-glow time determined by ambient air temperature; engine start can be attempted at any time during pre-glow.	0
	1	ENABLED: Automatic pre-glow time determined by ambient air temperature; engine start is NOT permitted until pre-glow is finished.	
ENGINE SHUTDOWN:	0	DISABLED: No engine shutdown.	1
7	1	ENABLED: Shutdown engine when coolant temperature is greater than 110 deg. C or the oil pressure is less than 8 PSI.	
TILT: 8	1	5 DEGREES: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also reduces drive speed to creep.	1
	2	4 DEGREES: Reduces the maximum speed of all boom functions to creep when tilted	
	3	more than 4 degrees and above elevation; also reduces drive speed to creep. 3 DEGREES: Reduces the maximum speed of all boom functions to creep when tilted	
	4	more than 3 degrees and above elevation; also reduces drive speed to creep.	
	, T	4 DEGREES + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also disallows tower lift up, tower telescope out, drive, main telescope out and main lift up.	
	5		
		3 DEGREES + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also disallows tower lift up, tower telescope out, drive, main telescope out and main lift up.	
Note: Any of the selection also above elevation.	ons above will l	ight the tilt lamp when a tilted condition occurs and will sound the platform alarm when the	e machine is
JIB:	0	NO: No jib installed.	1
9	1	YES:Jib installed.	
(1100S Only)	2	SIDEWING: Sideswing jib is installed	
4WS:	0		0
10	0	NO: No 4 Wheel Steer installed.	"
(1100S Only)	1	YES: 4 Wheel Steer installed.	

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	
DRIVE:	0	2WD: 2 Wheel Drive installed.	0
11 (1100S Only)	1	4WD: 4 Wheel Drive installed.	
SOFT TOUCH:	0	NO: No soft touch system installed.	0
12	1	YES: Soft touch system installed.	
GEN SET/WELDER:	0	NO: No generator installed.	1
13	1	BELT DRIVE: Belt driven setup.	'
	2	HYDRAULIC DRIVE: Hydraulic driven setup.	
GEN SET CUTOUT:	0	MOTION ENABLED: Motion enabled when generator is ON.	0
14* MOTION CUTOUT: Motion cutout in platform mode only.			
* Only visible if Gen Se	t / Welder Menu	u selection is not 0.	
H&TLIGHTS:	0	NO: No head and tail lights installed.	0
15	1	YES: Head and tail lights installed.	
LOAD SYSTEM:	0	NO: No load sensor installed.	0
16*	1	WARN ONLY: Functions in creep, overload lamp lit, platform alarm beeps (5 sec ON, 2 sec OFF).	
	2	CUTOUT PLATFORM: All functions cutout, overload lamp lit, platform alarm beeps (5 sec ON, 2 sec OFF).	
	3		
		sec ON, 2 sec OFF). CUTOUT ALL: All functions cutout, flash overload light (500mS on, 500mS off), plat-	
* Only visible under ce	3	sec ON, 2 sec OFF). CUTOUT ALL: All functions cutout, flash overload light (500mS on, 500mS off), platform alarm beeps (5 sec ON, 2 sec OFF). SPECIAL 1: Functions in creep, overload lamp lit, disables main telescope out & main lift up, platform alarm beeps (5 sec ON, 2 sec OFF).	

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
FUNCTION CUTOUT:	0	NO: No drive cutout.	0
17*	1	BOOM CUTOUT: Boom function cutout while driving above elevation.	
	2	DRIVE CUTOUT: Drive cutout above elevation.	
	3	DRIVE CUT E&T: Drive cutout above elevation and tilted.	
* Only visible under cer	tain market sel	ections.	•
* Certain market select	ions will limit fu	unction cutout options or alter default setting.	
GROUND ALARM:	0	NO: No ground alarm installed.	0
18*	1	DRIVE: Travel alarm sounds when the drive function is active (Option).	
	2	DESCENT: Descent alarm sounds when lift down is active (Option).	
	3	MOTION: Motion alarm sounds when any function is active (Option).	
* Certain market select	ions will alter d	efault setting.	
OSCILLATING AXLE:	0	NO: No oscillating axle system installed.	1
19	1	YES: Oscillating axle system installed.	
		Γ	
TEMPERATURE: 20*	0	CELSIUS: Celsius unit selection.	1
	1	FAHRENHEIT: Fahrenheit unit selection.	
* Certain market select	ions will alter d	efault setting.	
LEVELING MODE:	0	LEVEL ALL: Platform Leveling during all functions.	0
21*	1	LEVEL LIFT: Platform Leveling during lift only.	
* Only applicable with a	utomatic conti	rol.	
OSCILLATING AXLE:	0	NO: No oscillating axle system installed.	1
22 YES: Oscillating axle system installed.		YES: Oscillating axle system installed.	

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6.9 MACHINE PERSONALITY SETTINGS/ FUNCTION SPEEDS

NOTE: Personality settings can be adjusted within the adjustment range in order to achieve optimum machine performance.

Table 6-3. Personality Ranges/Defaults

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2 ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES		TIME RANGE (SEC) (SEE SECTION 6.10 FOR MACHINE ORIENTATION WHEN SETTING SPEEDS)	
				1100S	1100SJ P	1100S	11100SJ P
DRIVE:	ACCEL X.Xs	Displays/adjusts drive acceleration	0.1 to 5.0 sec	2.0	2.0		
	DECEL X.Xs	Displays/adjusts drive deceleration	0.1 to 3.0 sec	1.3	1.3		
	MIN forward XX%	Displays/adjusts minimum forward drive speed	0 to 35%	1	1		
	MAX forward XXX%	Displays/adjusts maximum forward drive speed	0 to 100%	90	100	44-48	44-48
	MIN reverse XX%	Displays/adjusts minimum reverse drive speed	0 to 35%	1	1		
	MAX reverse XXX%	Displays/adjusts maximum reverse drive speed	0 to 100%	90	100	44-48	44-48
	ELEV. MAX XX%	Displays/adjusts maximum drive speed NOTE: used when elevation cutout switches are limiting maximum speed	0 to 50%	23	25	93-104	93-104
	CREEP MAX XX%	Displays/adjusts maximum drive speed NOTE: used when creep switch on pump pot is active	0 to 50%	26	35	79-87	79-87
STEER:	max SPEED XXX%	Displays/adjusts maximum steer speed.	0 to 100%	100	100 100		

Table 6-3. Personality Ranges/Defaults

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	SPLAYED PARAMETER ON (DISPLAYED ON DESCRIPTION ALYZER ANALYZER 2 ND LINE)		RANGE	DEFAULT VALUES		TIME RANGE (SEC) (SEE SECTION 6.10 FOR MACHINE ORIENTATION WHEN SETTING SPEEDS)	
				1100S	1100SJ P	1100S	11100SJ P
MAIN LIFT:	ACCEL X.Xs	Displays/adjusts main lift acceleration	0.1 to 5.0 sec	1.0	1.0		
	DECEL X.Xs	Displays/adjusts main lift deceleration	0.1 to 3.0 sec	1.0	1.0		
	MIN Up XX%	Displays/adjusts minimum main lift up speed	0 to 60%	10	10		
	MAX UP XX%	Displays/adjusts maximum main lift up speed	0 to 100%	62	62	75-100	75-100
	MIN DOWN XX%	Displays/adjusts minimum main lift down speed	0 to 60%	10	10		
	MAX DOWN XXX%	Displays/adjusts maximum main lift down speed	0 to 100%	62	62	85-110	85-110
CREEP UP XX%		Displays/adjusts maximum main lift up speed NOTE: used when creep switch on pump pot is active	0 to 65%	50	50		
	CREEP DOWN XX%	Displays/adjusts maximum main lift down speed NOTE: used when creep switch on pump pot is active	0 to 75%	45	45		
SWING:	ACCEL X.Xs	Displays/adjusts swing acceleration	0.1 to 5.0 sec	2.0	2.0		
	DECEL X.Xs	Displays/adjusts swing deceleration	0.1 to 3.0 sec	1.5	1.5		
	MIN LEFT XX%	Displays/adjusts minimum swing left speed	0 to 50%	40	40		
	MAX LEFT XXX%	Displays/adjusts maximum swing left speed	0 to 100%	63	63	115-125	115-125
	MIN RIGHT XX%	Displays/adjusts minimum swing right speed	0 to 50%	40	40		
	MAX RIGHT XXX%	Displays/adjusts maximum swing right speed	0 to 100%	65	65	115-125	115-125
	CREEP LEFT XX%	Displays/adjusts maximum swing left speed NOTE: used when creep switch on pump pot is active	0 to 65%	50	50		
	CREEP RIGHT XX%	Displays/adjusts maximum swing right speed NOTE: used when creep switch on pump pot is active	0 to 65%	50	50		

Table 6-3. Personality Ranges/Defaults

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2 ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES		TIME RANGE (SEC) (SEE SECTION 6.10 FOR MACHINE ORIENTATION WHEN SETTING SPEEDS)	
ISI DIND)				1100S	1100SJ P	1100S	11100SJ P
MAIN TELE- SCOPE:	ACCEL X.Xs	Displays/adjusts main telescope acceleration	0.1 to 5.0 sec	1.5	1.5		
	DECEL X.Xs	Displays/adjusts main telescope deceleration	0.1 to 3.0 sec	0.5	0.5		
	MIN IN XX%	Displays/adjusts minimum main telescope in speed. Same as Creep speed	0 to 65%	15	15		
	MAX IN XXX%	Displays/adjusts maximum main telescope in speed	0 to 100%	65	65	58-68	65-75
	MIN OUT XX%	Displays/adjusts minimum main telescope out speed. Same as Creep speed	0 to 65%	15	15		
	MAX OUT XXX%	Displays/adjusts maximum main telescope out speed	0 to 100%	60	60	45-55	50-60
LEVEL:	ACCEL X.Xs	Displays/adjusts basket level acceleration	0.1 to 5.0 sec	1.5	1.5		
	DECEL X.Xs	Displays/adjusts basket level deceleration	0.1 to 3.0 sec	0.5	0.5		
	MIN UP XX%	Displays/adjusts minimum basket level up speed. Same as Creep speed	0 to 65%	47	47		
	MAX UP XXX%	Displays/adjusts maximum basket level up speed	0 to 100%	70	70		
	MIN DOWN XX%	Displays/adjusts minimum basket level down speed. Same as Creep speed	0 to 65%	45	45		
	MAX DOWN XXX%	Displays/adjusts maximum basket level down speed	0 to 100%	70	70		
BASKET ROTATE:	ACCEL X.Xs	Displays/adjusts basket rotate acceleration	0.1 to 5.0 sec	1.0	1.0		
	DECEL X.Xs	Displays/adjusts basket rotate deceleration	0.1 to 3.0 sec	0.5	0.5		
	MIN LEFT XX%	Displays/adjusts minimum basket rotate left speed. Same as Creep speed	0 to 100%	60	60		
	MAX LEFT XXX%	Displays/adjusts maximum basket rotate left speed	0 to 100%	60	60	24-30 (180°)	24-30 (180°)
	MIN RIGHT XX%	Displays/adjusts minimum basket rotate right speed. Same as Creep speed	0 to 100%	60	60		
	MAX RIGHT XXX%	Displays/adjusts maximum basket rotate right speed	0 to 100%	60	60	24-30 (180°)	24-30 (180°)

Table 6-3. Personality Ranges/Defaults

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2 ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES		TIME RANGE (SEC) (SEE SECTION 6.10 FOR MACHINE ORIENTATION WHEN SETTING SPEEDS)	
				1100S	1100SJ P	1100S	11100SJ P
JIB LIFT:	ACCEL X.Xs	Displays/adjusts jib lift acceleration	0.1 to 5.0 sec	1.5	1.5		
	DECEL X.Xs	Displays/adjusts jib lift deceleration	0.1 to 3.0 sec	1.0	1.0		
	MIN UP XX%	Displays/adjusts minimum jib up speed. Same as Creep speed	0 to 65%	47	47		
	MAX UP XXX%	Displays/adjusts maximum jib up speed	0 to 100%	71	71	30-36	30-36
MIN DOWN XX%		Displays/adjusts minimum jib down speed. Same as Creep speed	0 to 65%	45	45		
	MAX DOWN XXX%	Displays/adjusts maximum jib down speed	0 to 100%	60	60	30-36	30-36
JIB SWING:	ACCEL X.Xs	Displays/adjusts jib swing acceleration	0.1 to 5.0 sec		1.5		
	DECEL X.Xs	Displays/adjusts jib swing deceleration	0.1 to 3.0 sec		0.5		
	MIN LEFT XX%	Displays/adjusts minimum jib left speed. Same as Creep speed	0 to 65%		40		
	MAX LEFT XXX%	Displays/adjusts maximum jib left speed	0 to 100%		70		60-68 (180°)
	MIN RIGHT XX%	Displays/adjusts minimum jib right speed. Same as Creep speed	0 to 65%		40		
	MAX RIGHT XXX%	Displays/adjusts maximum jib right speed	0 to 100%		70		60-68 (180°)

Table 6-3. Personality Ranges/Defaults

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2 ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES		TIME RANGE (SEC) (SEE SECTION 6.10 FOR MACHINE ORIENTATION WHEN SETTING SPEEDS)	
				1100S	1100SJ P	1100S	11100SJ P
GROUND MODE:	U. LIFT UP XXX%	Displays/adjusts fixed main lift up speed	0 to 100%	60	60		
	U. LIFT DN XXX%	Displays/adjusts main lift down speed	0 to 100%	60	60		
	SWING XXX%	Displays/adjusts fixed swing speed	0 to 100%	60	60		
	BASKET LVL XXX%	Displays/adjusts fixed basket level speed	0 to 100%	75	75		
BASKET ROT XXX%		Displays/adjusts fixed basket rotate speed	0 to 100%	75	75		
	MAIN TELE XXX%	Displays/adjusts fixed main tele- scope speed	0 to 100%	60	60		
	TOWER TELE XXX%	Displays/adjusts fixed tower tele- scope speed Not displayed if TOWER TELE=NO	0 to 100%	100	100		
	T. LIFT UP XXX%	Displays/adjusts fixed tower lift up speed Not displayed if TOWER LIFT=NO	0 to 100%	100	100		
T.	T. LIFT DN XXX%	Displays/adjusts fixed tower lift down speed Not displayed if TOWER LIFT=NO	0 to 100%	100	100		
	JIB (U/D) XXX%	Displays/adjusts jib lift speed Not displayed if JIB = 0	0 to 100%	60	60		
	JIB (L/R) XXX%	Displays/adjusts jib swing speed Displayed if JIB = 2	0 to 100%	70	70		
GEN SET/ WELDER:	ENGINE XXXX RPM	Control generator/welder RPM. Not displayed if GEN SET/ WELDER = 0	1200-2800	1800	1800		

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6.10 MACHINE ORIENTATION WHEN SETTING FUNCTION SPEEDS

Lift Up: From platform control, lowest elevation up to maximum elevation, boom retracted.

Lift Down: From platform control, maximum elevation down to minimum elevation, boom retracted.

Swing Right (Max): 360 Degrees, from platform control, boom approximately 45° elevation, boom retracted.

Swing Left (Max): 360 Degrees, from platform control, boom approximately 45° elevation, boom retracted.

Telescope Out: From platform control, boom horizontal, 500 lb. (230 kg) capacity selected (1100SJP Only).

Telescope In: From platform control, boom horizontal, 500 lb. (230 kg) capacity selected (1100SJP Only).

Drive Forward (Max): Test should be done on a smooth level surface. High Speed - Low Torque setting, drive 200 ft. (61 m) front wheels to front wheels. Timed after machine has obtained maximum speed.

Drive Reverse (Max): Test should be done on a smooth level surface. High Speed - Low Torque setting, drive 200 ft. (61 m) front wheels to front wheels. Timed after machine has obtained maximum speed.

Drive Forward (Creep Max): Test should be done on a smooth level surface. High Torque - Low Speed setting, platform speed knob at full creep.

Drive Reverse (Creep Max): Test should be done on a smooth level surface. High Torque - Low Speed setting, platform speed knob at full creep.

Drive Forward (Elevated Max - Boom Beyond Transport): Test should be done on a smooth level surface. High speed - Low Torque setting, platform speed knob out of creep, Lift boom above transport, drive forward 50 ft. (15.2 m).

Drive Reverse (Elevated Max - Boom Beyond Transport): Test should be done on a smooth level surface. High speed - Low Torque setting, platform speed knob out of creep, Lift boom above transport, drive forward 50 ft. (15.2 m).

Platform Rotate: Platform level and completely rotated one direction. Rotate the opposite direction, Record Time. Rotate the other direction, Record Time.

Articulating Jib: Platform level and centered with the boom. Start with the Jib down. Jib Up, Record Time. Jib Down, Record Time.

Test Notes

- Personality settings can be adjusted anywhere within the adjustment range in order to achieve optimum machine performance.
- Stop watch should be started when the function is activated.
- Unless noted, all speed tests are run from the platform. These speeds do not reflect the ground control operation.
- **4.** The platform speed knob control must be at full speed (turned clockwise completely).
- 5. Function speeds may vary due to cold, thick hydraulic oil. Test should be run with the oil temperature above 100° F (38° C).

6.11 SYSTEM TEST

The Control System Incorporates a built-in system test to check the system components and functions. To use this function, use the following procedures.

Test from the Platform

 Position the Platform/Ground select switch to the Platform position.



2. Plug the analyzer into the connector at the base of the platform control box.

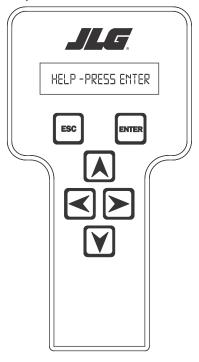


- **3.** Before proceeding, ensure that the switches on the platform console are in the following positions:
 - a. Drive speed switch is in the Middle position. (Turtle Icon)
 - b. 4WS switch is in the Middle position. (2WS mode)
 - c. Capacity select switch in the 1000 lb. (450 kg) mode (1100SJP Only).
 - d. Function speed potentiometer out of creep mode switch.
 - e. Generator (if equipped) switched to the off position.
 - f. Head and Tail lights (if equipped) switched to the off position.

4. Pull out the Emergency Stop switch and Start the engine.



5. The analyzer screen should read:



- 6. Use the arrow button to reach SYSTEM TEST. Hit Enter. The analyzer will prompt you asking if you want to activate the system test; hit Enter again to activate.
- 7. Follow the flow path in Figure 6-12., System Test Flow Chart Platform Tests and go through the component tests. Hit the ESC key during any part of the test to return to the main menu without completing all tests or wait until all tests are complete. During the TEST ALL INPUTS sequence, the analyzer allows control switches to be operated and shows if they are closed (CL) or open (OP).

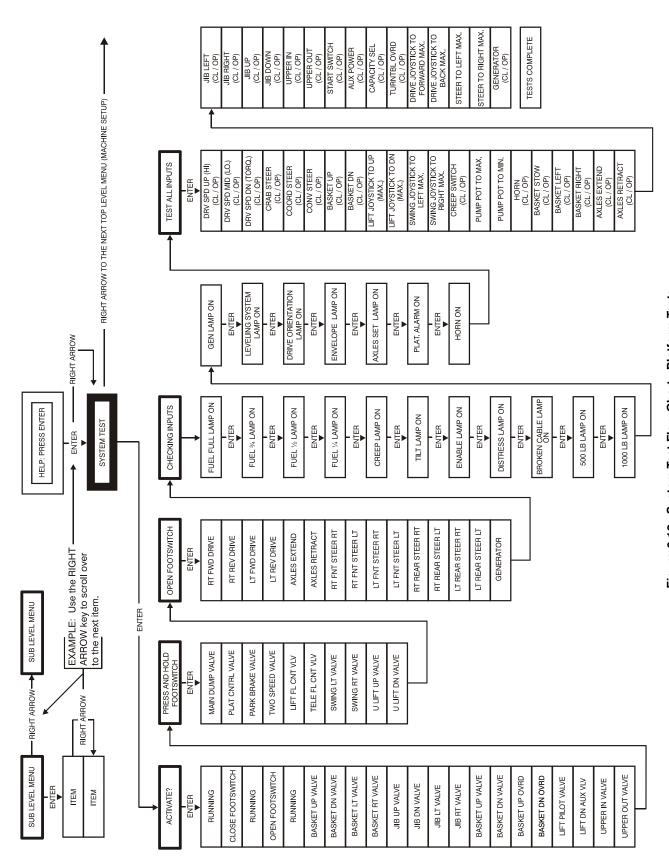


Figure 6-12. System Test Flow Chart - Platform Tests

Test from the Ground Station

1. Position the Platform/Ground select switch to the Ground position.



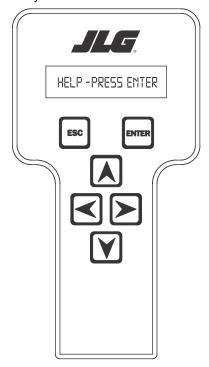
2. Plug the analyzer into the connector inside the Ground control box.



3. Pull out the Emergency Stop switch. and Start the engine.



4. The analyzer screen should read:



- Use the arrow button to reach SYSTEM TEST. Hit Enter. The analyzer will prompt you asking if you want to activate the system test; hit Enter again to activate.
- 6. Follow the flow path in Figure 6-13., System Test Flow Chart Ground Station Tests and go through the component tests. Hit the ESC key during any part of the test to return to the main menu without completing all tests or wait until all tests are complete. During the TEST ALL INPUTS sequence, the analyzer allows control switches to be operated and shows if they are closed (CL) or open (OP).

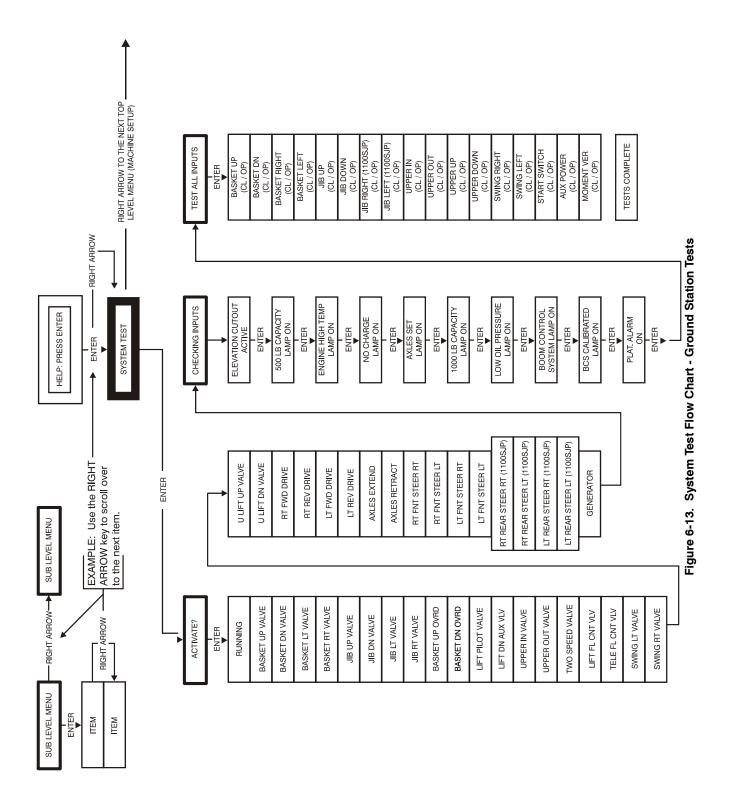


Table 6-4. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
RUNNING		Initial display when system test is run; certain "critical" checks are made. Problems that can be reported include below messages.
	ONLY 1 ANALYZER!	Do not connect two Analyzers while running the system test.
	BATTERY TOO LOW	The system test cannot run with battery voltage below minimum (9 V).
	BATTERY TOO HIGH	The system test cannot run with battery voltage above maximum. (16 V).
	CHECK CAN WIRING	The system test cannot run in platform mode unless data is being received from the platform and ground modules. The system test cannot run in ground mode unless data is being received from the platform module.
	CHECK SPEED	There is an open- or short- circuit in the speed encoder wiring. Check speed encoder.
	BAD GROUND MODULE	An internal problem was detected in the ground module.
	HIGH TILT ANGLE	The vehicle is very tilted (19.3°), or the tilt sensor has been damaged. Check tilt sensor.
	HOTENGINE	The engine temperature exceeds 100°C. This is only a warning.
	BAD I/O PORTS	The controller detected a problem with its internal circuits at switch on. If other problems are also detected, the controller may need replacing.
	SUSPECT EEPROM	The controller detected a problem with its EEPROM stored personality settings at switch on. Check and, if necessary correct, all personality settings.
	OPEN FSW	In platform mode, the footswitch must be open at the start of the test.
	CLOSEFSW	In platform mode, the footswitch must be closed when this message is displayed; the footswitch MUST BE KEPT CLOSED during the valve & contactor tests.
	BADFSW	The two footswitch signals are not changing together, probably because one is open-circuit. One footswitch signal ("FSW1") is routed to the power module, the other ("FSW2") is routed to the platform module. Check footswitch and wiring.

Table 6-4. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
TESTING VALVES		Indicates that the valve test is beginning. Each valve is alternately energized and de-energized; checks are made for open- and short-circuit valve coils. NOTE: In platform mode, the footswitch must be closed. NOTE: Tower lift valves are not tested if TOWER LIFT=NO. Tower telescope valves are not tested if TOWER TELE=NO. Jib valves are not tested if JIB = NO. Extendable axle valves are not tested if EXT AXLES=NO. Four wheel steer valves are not tested if 4WS=NO. NOTE: Left/right jib valves are not tested unless JIB = SIDESWING. Problems that can be reported include below messages.
	CANT TEST VALVES	There is a wiring problem, which prevents the valve test from functioning correctly. Check valve wiring. Check ground alarm & hour meter wiring.
	XXXXXXX S/C	The named valve is drawing too much current so is presumed to be short-circuited. Check valve wiring.
	XXXXXXX O/C	The named valve is drawing too little current so is presumed to be open-circuit. Check valve wiring.
CHECKING INPUTS		Indicates that the inputs test is beginning. Every input is checked to ensure that it is in its "normal" position; function switches should be open, cutout switches should be closed, joysticks should be in neutral. In platform mode any non-neutral platform switch or joystick is reported; any active cutouts are reported. In ground mode any non-neutral ground switches is reported; any active cutouts are reported. NOTE: Switches, which are not in use (due to the settings of machine digits), are not checked. NOTE: The pump pot is checked only for a wire-off condition; it can be at any demand from creep to maximum. Problems that can be reported include below messages.
	CHECK XXXXXXX	The named switch is not in its "normal" position. Check switch & wiring.
	CHECK XXXXXXX JOY	The named joystick appears to be faulty. Check joystick.
TESTING LAMPS		Indicates that the lamps test is beginning. Each lamp is energized in turn; a prompt asks for confirmation that the lamp is lit. ENTER must be pressed or clicked to continue the test. NOTE: Lamps, which are not in use (due to the settings of machine digits), are not checked. NOTE: Platform Lamps are only tested in platform mode. NOTE: The GM overload lamp and 500# capacity lamp are not tested. NOTE: Head and tail lamps are tested in both platform and ground mode if enabled by a machine digit.
TESTING ALARMS		Indicates that the alarms test is beginning. Each alarm is energized in turn; a prompt asks for confirmation that the alarm is sounding. ENTER must be pressed or clicked to continue the test. NOTE: The platform alarm and the horn are only tested in platform mode. NOTE: The ground alarm is not tested if GROUND ALARM = NO.

Table 6-4. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
TEST ALL INPUTS?		Prompts whether to check every operator input. If ESC is pressed or clicked, the system test ends. If ENTER is pressed or clicked, each operator input is prompted for in turn. In platform mode every platform switch and joystick is tested. In ground mode every ground switch is tested. NOTE: Tower lift switches are not tested if TOWER LIFT=NO. Tower telescope switches are not tested if TOWER TELE=NO. Jib switches are not tested if JIB = NO. Extendable axle switches are not tested if EXT AXLES=NO. Four wheel steer switches are not tested if 4WS=NO. NOTE: Left/right jib switches are not tested unless JIB = SIDESWING. Prompts displayed during the operator input test below messages.
	CLOSE XXXXXXX	The named switch should be closed.
	OPEN XXXXXXX	The named switch should be opened.
	XXXXXXX XXXXXXX TO MAX	The named joystick should be pushed to its full extent in the named direction.
	XXXXXXX XXXXXXX TO MIN	The named joystick should be returned to neutral from the named direction.
	PUMP POT TO MAX	The pump pot should be turned to maximum.
	PUMP POT TO MIN	The pump pot should be turned to minimum.
	MULTIPLE CLOSURE	More than one operator input is closed; if only one has been operated, there could be a short between two inputs.
TESTS COMPLETE		Indicates that the system test is complete. Any problems reported should have been noted and should now be rectified. Press ESC/CANCEL to return to the RUN SYSTEM TEST Analyzer menu.

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
DRIVE:			
	DRIVE	FOR/REV XXX%	Displays drive joystick direction & demand
	STEER	RIGHT/LEFT XXX%	Displays steer switch direction & demand
	4WS	NORMAL/COOR/CRAB	Displays status of four wheel steer input (Displayed if 4WS = 1)
	BRAKES	LOCKED/RELEASED	Displays brake control system status
	CREEP	ACTIVE/NOT ACTIVE	Displays pump pot creep switch status
	CRPMODE	ACTIVE/NOT ACT	Displays creep mode status
	QPRX1	ACTIVE/NOT ACTIVE	Displays status of Q-Prox sensor in drive joystick (Displayed if JOYSTICK TYPE = 1)
	QPRX2	ACTIVE/NOT ACTIVE	Displays status of Q-Prox sensor in drive joystick (Displayed if JOYSTICK TYPE = 1)
	TWO SPEED	OP/CL	Displays status of two speed switch input if selected model has two speed.
	2 speed mode	ON/OFF	Displays status of two speed valve if selected model has two speed
	high engine	OP/CL	Displays status of high engine switch
	LTFANG	XX.X	Displays status of left front steer angle (Displayed if MODEL NUMBER = 7 or 8)
	RTFANG	XX.X	Displays status of right front steer angle (Displayed if MODEL NUMBER = 7 or 8)
	LT R ANG	XX.X	Displays status of left rear steer angle (Displayed if MODEL NUMBER = 7 or 8)
	RT R ANG	XX.X	Displays status of right rear steer angle (Displayed if MODEL NUMBER = 7 or 8)
	DOS LIM sw	OP/CL	Displays status of Drive Orientation System limit switch. (Displayed if MODEL NUMBER = 7 or 8)
	DOS O/R sw	OP/CL	Displays status of Drive Orientation Limit System override switch. (Displayed if MODEL NUMBER = 7 or 8)

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
BOOM:			
	ULIFT	UP/DOWN XXX%	Displays main lift joystick direction & demand
	SWING	RIGHT/LEFT XXX%	Displays swing joystick direction & demand
	QPRX1	ACTIVE/NOT ACTIVE	Displays status of Q-Prox sensor in lift/swing joystick (Displayed if JOYSTICK TYPE = 1)
	QPRX2	ACTIVE/NOT ACTIVE	Displays status of Q-Prox sensor in lift/swing joystick (Displayed if JOYSTICK TYPE = 1)
	LEVEL	UP/DOWN XXX%	Displays basket level switch direction & demand. NOTE: demand is controlled by the pump pot
	ROT.	RIGHT/LEFT XXX%	Displays basket rotate switch direction & demand. NOTE: demand is controlled by the pump pot
	UTELE	IN/OUT XXX%	Displays main telescope switch direction & demand. NOTE: demand is controlled by the pump pot
	TTELE	IN/OUT XXX%	Displays tower telescope switch direction & demand. NOTE: demand is controlled by the pump pot Not displayed if TOWER TELE=NO (machine digit = 0)
	TLIFT	UP/DOWN XXX%	Displays tower lift switch direction & demand. NOTE: demand is controlled by the pump pot Not displayed if TOWER LIFT=NO (machine digit = 0)
	JIB	UP/DOWN XXX%	Displays jib lift switch direction & demand. NOTE: demand is controlled by the pump pot Not displayed if JIB = NO (machine digit = 0)
	JIB	RIGHT/LEFT XXX%	Displays jib swing switch direction & demand. NOTE: demand is controlled by the pump pot Displayed if JIB = SIDESWING (machine digit = 2)
	JIB INLINE	OP/CL	Displays status of jib inline limit switch. Displayed on models equipped with the Jib Stow System
	JIB LIMIT	OP/CL	Displays status of jib right limit switch. Displayed on models equipped with the Jib Stow System
	JIB LIM OVRD	OP/CL	Displays status of jib limit override switch. Displayed on models equipped with the Jib Stow System
	PCV	ON/OFF	Displays status of Platform Control Valve. Displayed on models equipped with Electronic Platform Leveling.
	PUMP POT	XXX%	Displays pump pot demand. Not displayed if MODEL = 601 (machine digit = 4)
	CREEP	ACTIVE/NOT ACTIVE	Displays pump pot creep switch status
	CRPMODE	ACTIVE/NOT ACT	Displays creep mode status

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
ENGINE:			
	START	ACTIVE/NOT ACTIVE	Displays status of the engine start circuit
	AIR FILTER	OP/CL	Displays measured status of air filter by-pass switch. (Not displayed if MODEL NUMBER = 7 or 8)
	BATTERY	XX.XV	Displays measured battery voltage
	COOLANT	XXXC	Displays measured coolant temperature
	OILPRS	LOW/OK or XXPSI	Displays measured oil pressure
	FUEL SELECT	GAS/LP	Displays status of fuel select switch. (Displayed if MODEL NUMBER = 2)
	AMB. TEMP	XXXC	Displays measured ambient air temperature
	FUEL LEVEL	1/4/1/2/3/4/FULL or LOW/OK	Displays measured fuel level
	XXXx rpm		Engine RPM

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
SYSTEM:			
	GM BATTERY	XX.XV	Ground module battery voltage
	PM BATTERY	XX.XV	Platform module battery voltage
	AMB. TEMP	XXXC	Ambient temperature
	FSW1	OP/CL	Displays footswitch status. NOTE: FSW1 is wired to the ground module.
	FSW2	OP/CL	Displays footswitch status. NOTE: FSW2 is wired to the platform module.
	ABOVE ELEV.	OP/CL/YES/NO	Displays above elevation cutout switch status or above angle status
	LEN SW 1	OP/CL	Displays status of boom length retracted limit switch (Displayed if MODEL NUMBER = 7 or 8)
	LENSW 2	OP/CL	Displays status of boom length retracted limit switch (Displayed if MODEL NUMBER = 7 or 8)
	RETRACTED	YES/NO	Displays status of boom length retracted (Displayed if MODEL NUMBER = 7 or 8)
	TRANSPORT	YES/NO	Displays status of transport position
	U LIFT CUTOUT	OP/CL	Displays status of boom length retracted limit switch (Displayed if MODEL NUMBER = 6)
	TLIFTPROX	OP/CL	Displays status of tower lift proximity switch (Displayed if TOWER PROX SWITCHES = 1)
	T TELE PROX	OP/CL	Displays status of tower telescope proximity switch (Displayed if TOWER PROX SWITCHES = 1)
	BR CABLE CUT.	OP/CL	Displays status of broken cable switch (Displayed if BRO- KEN CABLE SWITCH = 1)
	CREEP	ACTIVE/NOT ACTIVE	Displays pump pot creep switch status. Not displayed if MODEL = 601 (machine digit = 4)
	CRPMODE	ACTIVE/NOT ACT	Displays creep mode status
	SUPER CREEP	ON/OFF	Displays super creep mode status (Displayed if MODEL NUMBER = 7 or 8)
	TILT	XX.X DEG	Displays measured vehicle tilt. (Displayed if internal tilt sensor is configured)
	AUX POWER	OP/CL	Displays the status of the auxiliary power switch input
	HORN	OP/CL	Displays the status of the horn input

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
	R FILTER	OP/CL	Displays the status of the return hydraulic filter by-pass switch. Displayed ONLY if MODEL = 600 (Configuration digit = 3)
	CFILTER	OP/CL	Displays measured status of charge pump filter bypass switch. Displayed ONLY if MODEL = 600 (Configuration digit = 3)
	JIB BLOCK	OP/CL	Displays jib block limit switch status. Not displayed if associated configuration digit = 0
	BASKET STOWD	YES/NO	Displays status of basket stowed mode. (Displayed if MODEL NUMBER = 7 or 8)
	SOFTLIMIT	OP/CL	Displays status of soft touch limit switch. Not displayed if associated configuration digit $=0$
	SOFT O/R	OP/CL	Displays status of soft touch override switch. Not displayed if associated configuration digit = 0
	GEN SET/WELDER	OP/CL	Displays generator/welder switch input status. Not displayed if associated configuration digit = 0
	LIGHTS	OP/CL	Displays head and tail light switch input status. Not displayed if associated configuration digit $= 0$
	BSK TILT1	XX.X	Displays indicated platform tilt angle. Displayed on models equipped with Electronic Platform Leveling.
	BSK TILT2	XX.X	Displays indicated platform tilt angle. Displayed on models equipped with Electronic Platform Leveling.
	AXLE RET SW	OP/CL	Displays status of axle extension user switches. (Displayed if MODEL NUMBER = 7 or 8)
	AXLE EXT SW	OP/CL	Displays status of axle retraction user switches. (Displayed if MODEL NUMBER = 7 or 8)
	AXLELIMSW	RET/EXT	Displays status of axle extension limit switches. (Displayed if MODEL NUMBER = 7 or 8)
	DOS LIM SW	OP/CL	Displays status of Drive Orientation System Limit Switch. (Displayed if MODEL NUMBER = 7 or 8)
	DOS O/R SW	OP/CL	Displays status of Drive Orientation System Override switch. (Displayed if MODEL NUMBER = 7 or 8)
	CAPACITY SW	500/1000	Displays status of capacity selection switch. (Displayed if MODEL NUMBER = 7 or 8)

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
	OSC AXLE P SW	OP/CL	Displays status of oscillating axle pressure switch. (Displayed if OSCILLATING AXLE = 1)
	SKY WELDER	YES/NO	Displays the status of Sky Welder selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	SKY CUTTER	YES/NO	Displays the status of Sky Cutter selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	SKY GLAZIER	YES/NO	Displays the status of Sky Glazier selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	SKY BRIGHT	YES/NO	Displays the status of Sky Bright selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	PIPE RACKS	YES/NO	Displays the status of Pipe Racks selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	CAMERA MOUNT	YES/NO	Displays the status of Camera Mount selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
LOAD:			Not displayed if LOAD=NO, LENGTH=NO, and ANGLE=NO (machine digits = 0)
	LENGTH	OP/CL	Displays measured length, NOTE: Not displayed if MODEL NUMBER = 7 or 8
	ANGLE	OP/CL	Displays measured angle, NOTE: Not displayed if MODEL NUMBER = 7 or 8
	WEIGHT	XXXX%	Percentage of maximum calibrated weight on the platform. An uncalibrated load cell will read 1000% Displayed if LOAD is not 0 and LOAD TYPE is 0.
		OK/OVERLOADED	Displayed if LOAD is not 0 and LOAD TYPE is 1.

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
MOMENT:			Displayed if MODEL NUMBER = 7 or 8
	(LB-IN) ACTUAL	XXXXXXX	Displays current moment value
	(LB-IN) OVER	XXXXXXXX	Displays current over moment setpoint.
	(LB-IN) UNDER	XXXXXXXX	Displays current under moment setpoint.
	CALPT UNDER	XXXXXXXX	Displays the under moment value recorded during boom sensor calibration.
	CAL PT WIT YEL	XXXXXXXX	Displays the yellow witness mark moment value recorded during boom sensor calibration.
	CAL PT WIT GRN	XXXXXXX	Displays the green witness mark moment value recorded during boom sensor calibration.
	CYL PIN RATIO	X.XXX	Displays the current cylinder moment pin ratio of X and Y forces.
	PIN EFLAGS	0xXXXX	Displays the current error flag status of the cylinder moment pin.
	SKY WELDER	YES/NO	Displays the status of Sky Welder selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	SKY CUTTER	YES/NO	Displays the status of Sky Cutter selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	SKY GLAZIER	YES/NO	Displays the status of Sky Glazier selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	SKY BRIGHT	YES/NO	Displays the status of Sky Bright selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	PIPE RACKS	YES/NO	Displays the status of Pipe Racks selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)
	CAMERA MOUNT	YES/NO	Displays the status of Camera Mount selected during boom sensor calibration. (Displayed if MODEL NUMBER = 7 or 8)

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
ENVELOPE:			Displayed if MODEL NUMBER = 7 or 8
	LENGTH	XXXX.X	Displays the current indicated boom length in inches.
	ANGLE 1	XX.X	Displays the current indicated boom angle 1 in degrees.
	ANGLE 2	XX.X	Displays the current indicated boom angle 2 in degrees.
	A/D LNGTH	XXXXX	Displays the current indicated boom length in A/D counts.
	A/D ANG1	XXXXX	Displays the current indicated boom angle 1 in A/D counts or raw angle if calibrated.
	A/D ANG2	XXXXX	Displays the current indicated boom angle 2 in A/D counts or raw angel if calibrated.
CAN STATIS-			CAN Statistics as detected by the Ground Module
TICS:	RX/SEC	XXX	Displays the number of received messages per second
	TX/SEC	XXX	Displays the number of transmitted messages per second
	BUS OFF	XX	Displays the number of bus off occurrences
	PASSIVE	XX	Displays the number of bus passive occurrences

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
CALIBRATION			
DATA	BASKET UP	XXX	Displays the basket up calibration point
	BASKET DOWN	XXX	Displays the basket down calibration point
	L FWD DRIVE	XXX	Displays the left forward drive calibration point
	R FWD DRIVE	XXX	Displays the right forward drive calibration point
	L REV DRIVE	XXX	Displays the left reverse drive calibration point
	R REV DRIVE	XXX	Displays the right reverse drive calibration point
	FLTSTEER	XXX	Displays the forward left steer calibration point
	F RT STEER	XXX	Displays the forward right steer calibration point
	R LT STEER	XXX	Displays the reverse left steer calibration point
	R RT STEER	XXX	Displays the reverse right steer calibration point
	U LIFT UP	XXX	Displays the main lift up calibration point
	U LIFT DOWN	XXX	Displays the main lift down calibration point
	U TELE IN	XXX	Displays the main telescope in calibration point
	U TELE OUT	XXX	Displays the main telescope out calibration point
	BM ANG 1 LO	XXX	Displays the boom angle 1 low calibration point
	BM ANG 1 HI	XXX	Displays the boom angle 1 high calibration point
	BM ANG 2 LO	XXX	Displays the boom angle 2 low calibration point
	BM ANG 2 HI	XXX	Displays the boom angle 2 high calibration point
	LEN RETRACT	XXX	Displays the length sensor retracted calibration point
	LEN EXTEND	XXXXX	Displays the length sensor extended calibration point
	LEN WIT	XXXXX	Displays the witness mark calibration point
	LEN SWITCH	XXXX	Displays the length switch calibration point

Table 6-5. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1 st Line)	Parameter (Displayed on Analyzer 2 nd Line)	Parameter Value (Displayed on Analyzer 2 nd Line)	Description
DATALOG:			
	ON	XXXXhXXm	Displays total controller on (EMS) time
	ENGINE	XXXXhXXm	Display engine run time
	DRIVE	XXXXhXXm	Displays total controller drive operation time
	LIFT	XXXXhXXm	Displays total controller lift operation time
	SWING	XXXXhXXm	Displays total controller swing operation time
	TELE	XXXXhXXm	Displays total controller telescope operation time
	MAX TEMP	XXC	Displays maximum measured ambient temp.
	MIN TEMP	XXC	Displays minimum measured ambient temp.
	MAX VOLTS	XX.XV	Displays maximum measured battery voltage
	RENTAL	XXXXhXXm	Displays total controller operation time. NOTE: can be reset
	ERASE RENTAL?		Not available at Access Level 2. ENTER resets rental data log time to zero.
VERSIONS:			
	GM SW	PX.X	Displays ground module software version
	GM HW REV	XXXX	Displays ground module hardware revision
	GM SN	XXXXXX	Displays ground module serial number
	PM SW	PX.X	Displays platform module software version
	PM HW REV	XXXX	Displays platform module hardware revision
	PM SN	XXXXXX	Displays platform module serial number
	CMSW	PX.X	Displays chassis module software version
	BM SW	PX.X	Displays BLAM module software version
	C PIN SW		Displayed if cylinder moment load pin transmits software version.
	C PIN SN		Displayed if cylinder moment load pin transmits serial number.
	ANALYZER	VX.XXXX	Displays Analyzer software version

6.12 CALIBRATING STEER

NOTE: The following procedure is written for a machine with 4 Wheel Steering. For machines with 2 Wheel Steering, disregard references to rear wheel steering.

When calibrating steering, each individual wheel must be calibrated in order to make the tire and wheel parallel with the frame. Two methods to help ensure proper calibration are the use of a carpenter's square to square the spindle to the axle or aligning the two wheels on one side using a stretched string.





1. Position the Platform/Ground select switch to the Platform position.



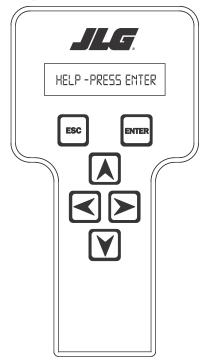
2. Plug the analyzer into the connector at the base of the platform control box.



3. Pull out the Emergency Stop switch and Start the engine.

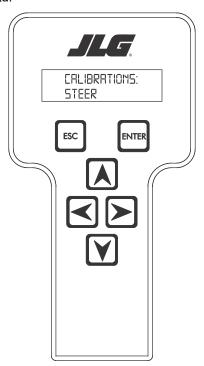


4. The analyzer screen should read:

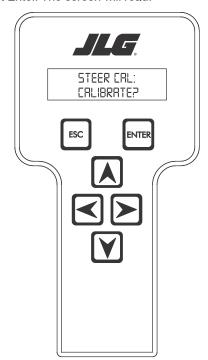


- Use the arrow button to reach ACCESS LEVEL 2. Hit Enter.
- 6. Enter the Access Code, 33271.
- Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

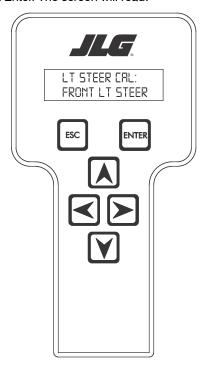
8. Use the arrow keys to reach Steer. The screen will read:



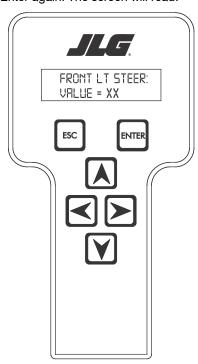
9. Hit Enter. The screen will read:



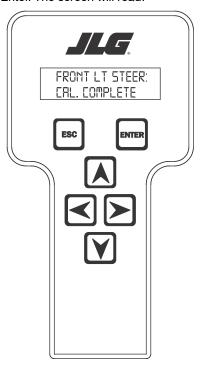
10. Hit Enter. The screen will read:



11. Hit Enter again. The screen will read:



12. Activate the steer control until the tire and wheel are straight in relationship with the chassis, then leave off the control. The display will read FRT LEFT = and show the numeric calibration value for that wheel. 13. Hit Enter. The screen will read:



- 14. Repeat steps 10 thru 12 for left rear steer.
- **15.** Left Rear Steer Calibration will be followed by Right Forward Steer Calibration which will be followed by Right Rear Steer Calibration.
- **16.** After completing all the Steer Calibrations, hit ESC twice to go back to CALIBRATIONS.

6.13 CALIBRATING DRIVE

1. Position the Platform/Ground select switch to the Platform position.



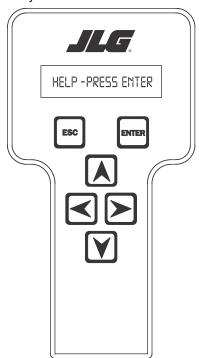
2. Plug the analyzer into the connector at the base of the platform control box.



3. Pull out the Emergency Stop switch and Start the engine.

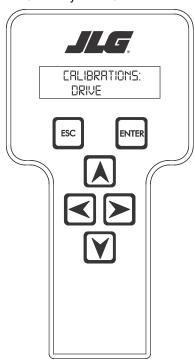


4. The analyzer screen should read:

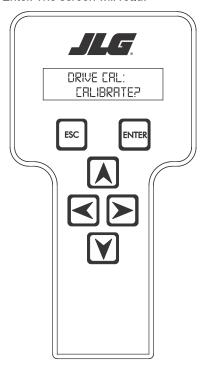


- **5.** Use the arrow button to reach ACCESS LEVEL 2. Hit Enter.
- 6. Enter the Access Code, 33271.
- Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

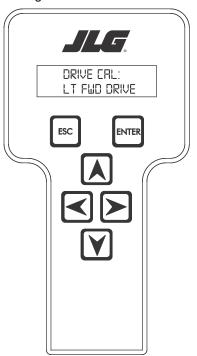
8. Use the arrow keys to reach DRIVE.



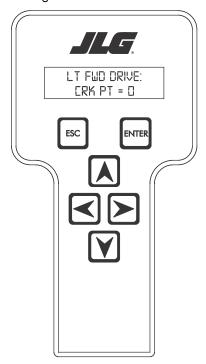
9. Hit Enter. The screen will read:



10. Hit Enter again. The screen will read:

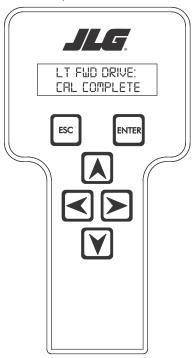


11. Hit Enter again. The screen will read:

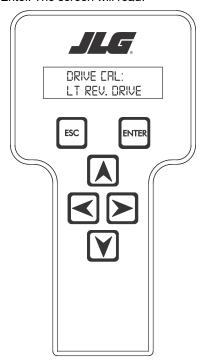


12. Activate the Drive Joystick forward full stroke until the machine just begins to move, then leave off the joystick immediately. The display will read CRK PT = and show the numeric crack point value.

13. Hit Enter. The number displayed will be the value that the crack point is set to. The screen will show:



14. Hit Enter. The screen will read:



- 15. Repeat steps 10 thru 12 for left reverse drive.
- **16.** Left Reverse Drive Calibration will be followed by Right Forward Drive Calibration which will be followed by Right Reverse Calibration.
- **17.** After completing all the Drive Calibrations, hit ESC twice to go back to CALIBRATIONS.

6.14 ELECTRONIC PLATFORM LEVELING

Platform Leveling Fault Warning

If a fault occurs in the platform leveling system the following will occur:

- Automatic platform leveling will stop (except when there is a fault in only one sensor automatic leveling will remain active as the control system will use the other sensor to control leveling)
- 2. The level fault lamp will flash
- 3. The audible alarm will sound
- **4.** All functions will default to creep speed if the platform is out of the transport position (extended more than 24" [60.9 cm], or elevated above the horizontal position).

To reset the fault the emergency stop switch should be recycled.

NOTICE

IF THE FAULT PERSISTS BRING THE PLATFORM TO THE GROUND POSITION, SWITCH THE MACHINE OFF AND CONTACT A QUALIFIED SERVICE REPRESENTATIVE TO INVESTIGATE THE FAULT.

Fault Response

ERROR RESPONSE

If basket level varies from the current **setpoint** by $\pm 5.5^{\circ}$ for more than 1.5 seconds when the platform is not in the transport position, the following events will occur:

- 1. The platform dump valve will be disabled (level, rotate and jib functions disabled).
- 2. The level system fault lamp will flash (to indicate that the leveling function has been lost).
- 3. The platform alarm will sound.
- 4. A system fault will be logged.
- All function speeds (lift, swing, telescope and drive) will be placed in creep mode (except when the platform is in the transport position see below).

When the unit is in the transport position and driving and the current setpoint varies by \pm 5.5° for more than 8 seconds the events 1,2,3 & 4 above will occur. (note function speeds will operate normally). Cycling the EMS will clear the fault and allow the operator to operate the machine as a new level **setpoint** is taken.

VALVE DRIVER ERRORS

There are three possible level valve driver errors, short to battery, short to ground, and open circuit.

- In the case of a short to ground or an open circuit, the platform valve cannot be turned on and the following will occur:
 - a. All interactions with platform leveling shall cease
 - The Electronic Leveling System Fault Lamp shall flash (to indicate that the leveling function has been lost).
 - c. The platform alarm will sound.
 - d. A system fault will be logged.
 - e. All function speeds (lift, swing, telescope and drive) will be placed in creep mode (except when the platform is in the transport position).
- In the case of a short to battery on one of the platform leveling valves, the valve cannot be turned off and the following will occur:
 - a. The platform dump valve will be turned off to prevent unintended tilting of the platform.
 - All interactions with platform leveling shall cease.
 - The Electronic Leveling System Fault Lamp shall flash (to indicate that the leveling function has been lost).
 - d. The platform alarm will sound.
 - e. A system fault will be logged.
 - f. All function speeds (lift, swing, telescope and drive) will be placed in creep mode (except when the platform is in the transport position)
- 3. In the case of a short to battery on the platform dump valve, the valve cannot be turned off. The controllability of the platform leveling function will be impaired and the following will occur:
 - a. All interactions with platform leveling shall cease.
 - The Electronic Leveling System Fault Lamp shall flash (to indicate that the leveling function has been lost).
 - c. The platform alarm will sound.
 - d. A system fault will be logged.
 - e. All function speeds (lift, swing, telescope and drive) will be placed in creep mode (except when the platform is in the transport position).

Lift, swing, drive and telescope will continue to operate

In each of the cases above it shall be necessary to recycle the EMS to clear the fault. Operable functions shall be in the creep mode except while below elevation.

TILT SENSOR ERRORS

If the secondary tilt sensor is faulty, the control system will continue to utilize information from the primary sensor.

If the primary sensor is faulty, the control system will switch to the backup sensor for control.

In both cases above the following will occur:

- The Electronic Leveling System Fault Lamp will flash (to indicate that there is a leveling fault).
- 2. The platform alarm will sound.
- A system fault will be logged.
- All function speeds (lift, swing, telescope, jib and drive) will be placed in creep mode (except when the platform is in the transport position).
- 5. Automatic leveling remains active.

Lift, swing, drive and telescope will continue to operate.

In each of the cases above it will be necessary to re-cycle the EMS to clear the fault. Operable functions shall be in the creep mode except while below elevation.

When both sensors appear to be working but have measurements that disagree by $\pm 5.5^{\circ}$ The following will occur:

- 1. All interactions with platform leveling shall cease.
- The Electronic Leveling System Fault Lamp shall flash (to indicate that the leveling function has been lost).
- 3. The platform alarm will sound.
- 4. A system fault will be logged.
- All function speeds (lift, swing, telescope and drive) will be placed in creep mode (except when the platform is in the transport position)

At this point, the operator must use the level up and down toggle switch to manually level during descent. It shall be necessary to re-cycle the EMS to clear the fault.

CAN Errors

The Ground Module has two direct outputs dedicated to overriding the Platform Module's control of the leveling valves. The Ground Module "Platform Level Up/Down" outputs are used to control the platform level up and down valves.

When in ground mode, if the Ground Module reads a platform leveling switch command, the switch command is communicated over CAN to the Platform Module where it is handled normally.

If Ground Module determines that CAN communication is inoperable, it turns on the platform control valve and the appropriate platform leveling override outputs while the switch is engaged.

If the Platform Module is still running when CAN is down nothing will operate when in platform mode. When the operator switches to ground mode, the platform will not control any of its valve outputs and a CAN error message is signaled.

Additional Platform and Jib Valves

The high side drivers for the platform left and right and the jib up and down valves are be located in the Platform Module and are proportional. Flow through the valves is individually controllable. The individually controlled duty cycle will be the same as would otherwise have been commanded to the flow control valve.

Only one platform or jib function is allowed at one time to limit the amount of current draw, minimizing the voltage drop on the supply to the Platform Module.

The function is enabled first shall remain active until it is released. Any other function commanded while another function is active is ignored.

Platform Leveling Calibration Procedure

STEP 1: SETTING THE PLATFORM VALVE MINIMUMS

- 1. Put machine into "Ground Mode".
- 2. Start machine and plug in Analyzer.
- 3. Go to the "Access Level 2" screen.
- 4. Enter "33271" to get into Access Level 1 mode.
- 5. Go to the "Personalities" menu and adjust the following personalities. Refer to the Personality Ranges/ Defaults table in Section 6 JLG Control System for proper setting values.

Basket Level Up Min Basket Level Up Max Basket Level Down Max Jib Up Min Jib Down Min

6. Recycle EMS.

STEP 3: BLEEDING THE PLATFORM VALVES

- 1. Put machine into "Ground Mode".
- 2. Start machine and plug in Analyzer.
- 3. Go to the "Access Level 2" screen.
- 4. Enter "33271" to get into Access Level 1 mode.
- 5. Go to the "Personalities" menu.
- Using the left arrow button, go to the "Ground Mode" menu.
- 7. Hit ENTER.
- 8. Using the UP/DOWN arrows, adjust the following personalities to 100%.

Basket Rotate Basket Level Jib U/D (if configured)

Start up the machine and exercise each above platform function (from the ground) eight (8) to ten (10) times for 5 seconds in each direction.

- Return the personality settings back to the values as shown in the Personality Ranges/Defaults table in Section 6 - JLG Control System.
- 10. Recycle EMS.

STEP 4: CALIBRATING THE PLATFORM LEVEL UP AND DOWN VALVE CRACKPOINTS

- 1. Put machine into "Ground Mode".
- 2. Start machine and plug in Analyzer.
- 3. Go to the "Access Level 2" screen.
- 4. Enter "33271" to get into Access Level 1 mode.
- 5. Go to the "Calibrations" menu and hit ENTER.
- 6. Go to the "Basket U Crkpt" Screen. Hit ENTER.
- "Calibrate?" prompt should appear. Hit ENTER again.
- 8. You will hear engine go to 1800 rpm.
- **9.** Using UP ARROW, increase the value until you see the basket up movement.

- **10.** Hit ENTER again. "Cal. Complete" message should appear
- 11. Engine should again return to idle.
- 12. Hit ESC should return to "Basket U Crkpt" screen.
- Hit RIGHT ARROWto get to the "Basket D Crkpt" screen. Hit ENTER.
- **14.** "Calibrate?" prompt should appear. Hit ENTER again.
- 15. You will hear engine go to 1800 rpm.

Using UP ARROW, increase the value until you see the basket down movement.

Hit ENTER again. "Cal. Complete" message should appear

Engine should again return to idle.

Hit ESC to exit.

Cycle power to the machine.

6.15 CALIBRATING PLATFORM LEVEL

STEP 1: SETTING THE PLATFORM VALVE MINIMUMS

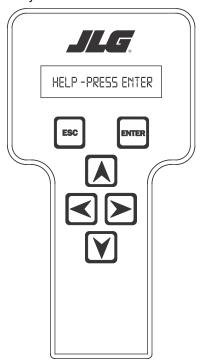
 Position the Platform/Ground select switch to the Ground position.



2. Plug the analyzer into the connector inside the Ground control box.



- **3.** Pull out the Emergency Stop switch and start the engine.
- 4. The analyzer screen should read:



- **5.** Use the arrow button to reach ACCESS LEVEL 2. Hit Enter.
- 6. Enter the Access Code, 33271.

 Use the arrow button to reach PERSONALITIES adjust the following personalities. Refer to the Personality Ranges/Defaults table for proper setting values.

Basket Level Up Min Basket Level Up Max Basket Level Down Max Jib Up Min Jib Down Min

8. Recycle EMS.

STEP 2: BLEEDING THE PLATFORM VALVES

1. Position the Platform/Ground select switch to the Ground position.

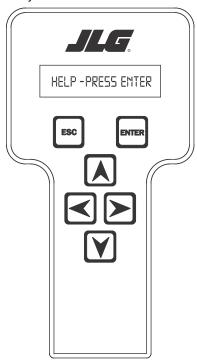


Plug the analyzer into the connector inside the Ground control box.



3. Pull out the Emergency Stop switch and start the engine.

4. The analyzer screen should read:



- Use the arrow button to reach ACCESS LEVEL 2. Hit Enter
- 6. Enter the Access Code, 33271.
- 7. Go to the PERSONALITIES menu.
- 8. Using the left arrow button, go to the GROUND MODE menu.
- 9. Hit ENTER.
- Using the UP/DOWN arrows, adjust the following personalities to 100%.

Basket Rotate Basket Level Jib U/D (if configured)

Start up the machine and exercise each above platform function (from the ground) eight (8) to ten (10) times for 5 seconds in each direction.

- 11. Return the personality settings back to the values as shown in the Personality Ranges/Defaults table in Section 6 JLG Control System.
- 12. Recycle EMS.

STEP 3: CALIBRATING THE PLATFORM LEVEL UP AND DOWN VALVE CRACKPOINTS

 Position the Platform/Ground select switch to the Ground position.

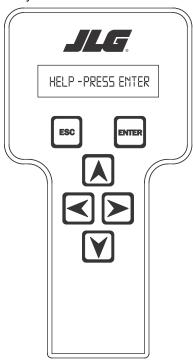


Plug the analyzer into the connector inside the Ground control box.



3. Pull out the Emergency Stop switch and start the engine.

4. The analyzer screen should read:



- Use the arrow button to reach ACCESS LEVEL 2. Hit Enter.
- 6. Enter the Access Code, 33271.
- 7. Go to the CALIBRATIONS menu and hit ENTER.
- 8. Go to the BASKET U CRKPT Screen. Hit ENTER.
- **9.** CALIBRATE? prompt should appear. Hit ENTER again.
- 10. You will hear engine go to 1800 rpm.

- **11.** Using UP ARROW, increase the value until you see the basket up movement.
- **12.** Hit ENTER again. CAL. COMPLETE message should appear
- 13. Engine should again return to idle.
- 14. Hit ESC should return to BASKET U CRKPT screen.
- **15.** Hit RIGHT ARROW to get to the "BASKET D CRKPT" screen. Hit ENTER.
- **16.** CALIBRATE? prompt should appear. Hit ENTER again.
- 17. You will hear engine go to 1800 rpm.

Using UP ARROW, increase the value until you see the basket down movement.

Hit ENTER again. CAL. COMPLETE message should appear

Engine should again return to idle.

Hit ESC to exit.

Cycle power to the machine.

6.16 CALIBRATING LIFT CRACK POINT

1. Position the Platform/Ground select switch to the Platform position.



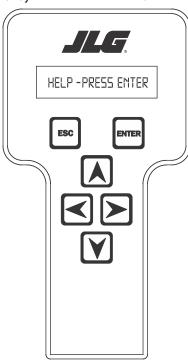
2. Plug the analyzer into the connector at the base of the platform control box.



Pull out the Emergency Stop switch and Start the engine.

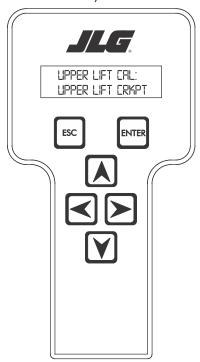


4. The analyzer screen should read:

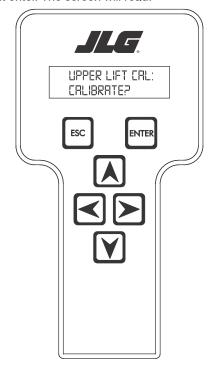


- Use the arrow button to reach ACCESS LEVEL 2. Hit Enter
- 6. Enter the Access Code, 33271.
- Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

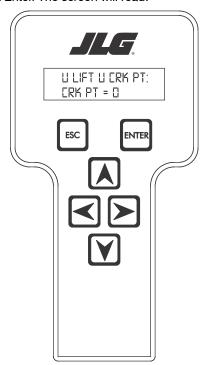
8. Use the arrow keys to reach Upper Lift Crack Point (UPPER LIFT CRKPT). The screen will read:



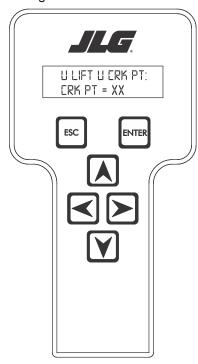
9. Hit enter. The screen will read:



10. Hit Enter. The screen will read:

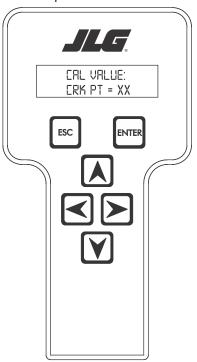


11. Hit Enter again. The screen will read:

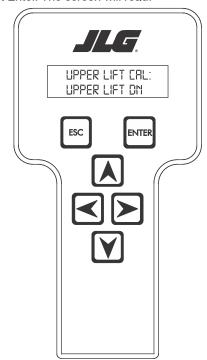


12. Activate the Lift Up function by fully stroking the joystick until the boom starts to move, then leave off immediately. The display will read CRK PT = and show the numeric crack point value.

13. Hit enter. The number displayed will be the value that the crack point is set to. The screen will show:



14. Hit Enter. The screen will read:



- 15. Repeat steps 10 thru 12 for the Lift Down function.
- **16.** After completing all the Tele Calibrations, hit ESC twice to go back to CALIBRATIONS.

6.17 CALIBRATING TELESCOPE CRACK POINT

1. Position the Platform/Ground select switch to the Platform position.



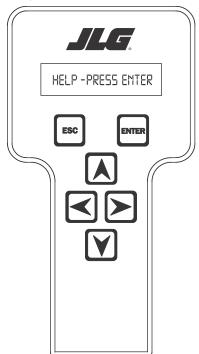
2. Plug the analyzer into the connector at the base of the platform control box.



3. Pull out the Emergency Stop switch and Start the engine.

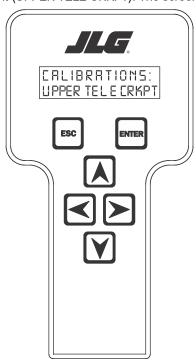


4. The analyzer screen should read:

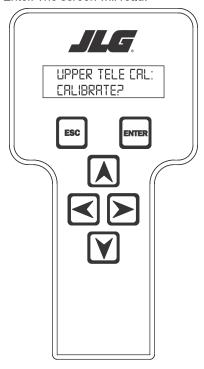


- **5.** Use the arrow button to reach ACCESS LEVEL 2. Hit Enter.
- 6. Enter the Access Code, 33271.
- Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

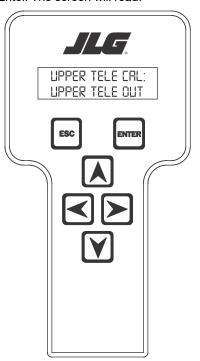
8. Use the arrow keys to reach Upper Telescope Crack Point (UPPER TELE CRKPT). The screen will read:



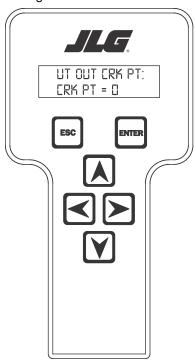
9. Hit Enter. The screen will read:



10. Hit Enter. The screen will read:

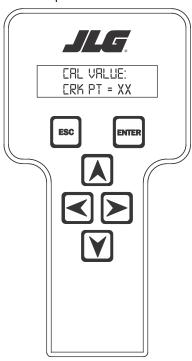


11. Hit enter again. The screen will read:

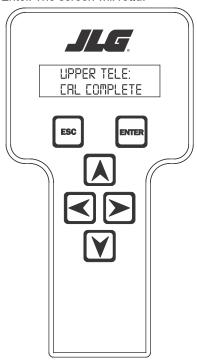


12. Activate the Tele Out function until the boom starts to move, then leave off immediately. The display will read CRK PT = and show the numeric crack point value.

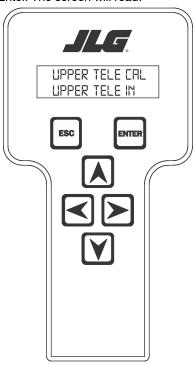
13. Hit enter. The number displayed will be the value that the crack point is set to. The screen will show:



14. Hit Enter. The screen will read:



15. Hit Enter. The screen will read:



- **16.** Repeat steps 10 thru 12 for the Tele In function.
- **17.** After completing all the Tele Calibrations, hit ESC twice to go back to CALIBRATIONS.

6.18 CALIBRATING TILT SENSOR

A NEW TILT MODULE WILL ACT AS IF IT IS TILTED ALL OF THE TIME UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

A WARNING

DO NOT CALIBRATE THE LEVEL SENSOR EXCEPT ON A LEVEL SURFACE.

Use the following procedure to calibrate the tilt sensor.

Before the tilt sensor can be calibrated, the following conditions must be met:

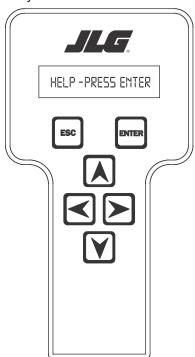
- a. Steering previously calibrated.
- b. Axles extended.
- c. Wheels straight.
- d. Turntable centered.
- e. Boom fully retracted.
- f. Boom angle is less than 45°.
- g. Machine on firm, level ground.
- 2. Position the Platform/Ground select switch to the Ground position.



3. Plug the analyzer into the connector inside the Ground control box.

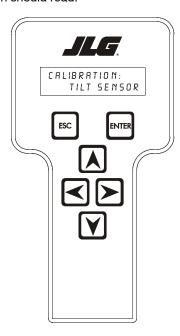


- **4.** Pull out the Emergency Stop switch and start the engine.
- **5.** The analyzer screen should read:



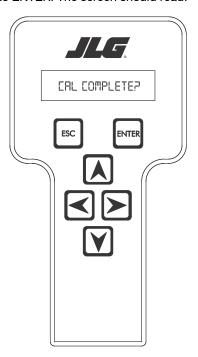
- Use the arrow button to reach ACCESS LEVEL 2. Hit Enter.
- 7. Enter the Access Code, 33271.
- 8. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

9. Use the arrow keys to reach the TILT SENSOR. The screen should read:



- 10. Press ENTER.
- **11.** When prompted, swing turntable 180° to opposite end of chassis.

12. Press ENTER. The screen should read:



- **13.** Upon completing swing calibration, swing turntable 180° back to the stowed position.
- 14. Hit ESC twice to go back to CALIBRATIONS.

6.19 CALIBRATING THE BOOM SENSORS

NOTICE

DURING THE BOOM SENSOR CALIBRATION PROCEDURE, IT IS NORMAL FOR THE REAR WHEEL TO LIFT FROM THE GROUND APPROXIMATELY 1 INCH (2.5 CM). IF THE WHEEL RAISES APPRECIABLY MORE THAN THIS (I.E. 4 INCHES [10 CM] OR MORE), CHECK THE AXLE OSCILLATION SYSTEM FOR PROPER OPERATION OR THE NEED FOR BLEEDING, THEN PROCEED WITH THE BOOM SENSOR CALIBRATION PROCEDURE.

Use the following step-by-step procedure to calibrate the boom sensors.

- Before the boom sensors can be calibrated, the following conditions must be met:
 - Steering, telescope crack points, and tilt previously calibrated
 - b. Axles Extended
 - c. Wheels Straight
 - d. Platform Unloaded
 - e. Jib Horizontal
 - f. Jib Swing Centered (1100SJP Only)
 - g. Platform Level
 - h. Platform Centered
 - i. Turntable Centered
 - j. Boom Fully Retracted
 - k. Level Ground (within 1.5°)

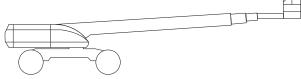


Figure 6-14. Boom Sensor Calibration Position 1

2. Position the Platform/Ground select switch to the Ground position.

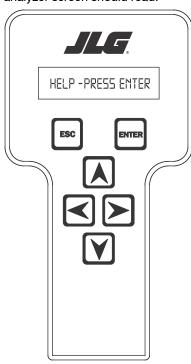


Plug the analyzer into the connector inside the Ground control box.



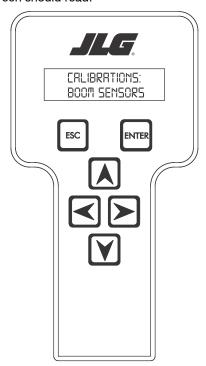
4. Pull out the Emergency Stop switch and start the engine.

5. The analyzer screen should read:

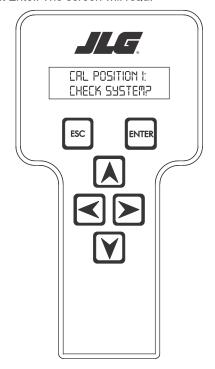


- Use the arrow button to reach ACCESS LEVEL 2. Hit Enter
- 7. Enter the Access Code, 33271.
- 8. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

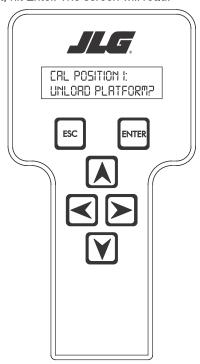
9. Use the arrow keys to reach BOOM SENSORS. The screen should read:



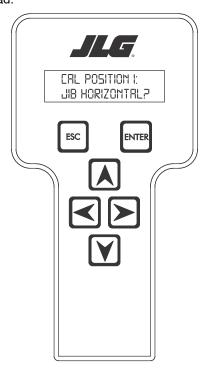
10. Hit Enter. The screen will read:



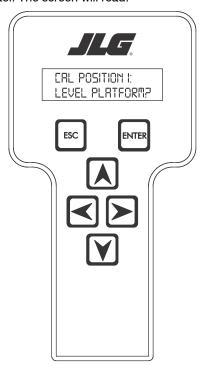
11. After verifying all the conditions listed in step 1 are met, hit Enter. The screen will read:



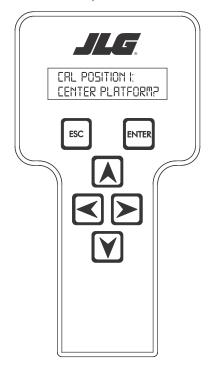
12. After verifying all load (personnel or material) is removed from the platform, hit Enter. The screen will read:



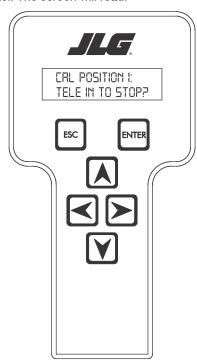
13. After visually verifying that the jib is horizontal, hit Enter. The screen will read:



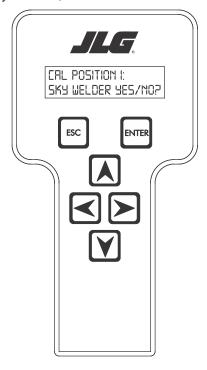
14. After visually verifying the platform is level, hit Enter. For 1100 S machines, proceed to step #15. For 1100SJP machines, the screen will read:



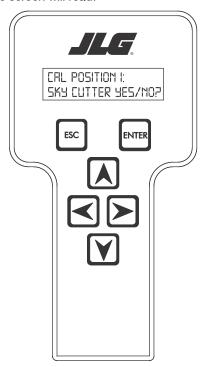
15. After visually verifying the platform is centered, hit Enter. The screen will read:



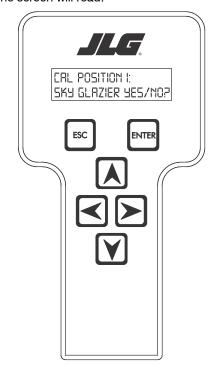
16. After operating telescope in to verify the boom is fully retracted, hit Enter. The screen will read:



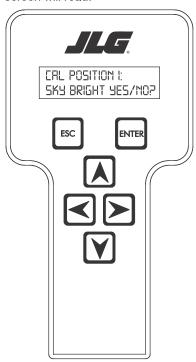
17. Use the up/down arrows to select YES if the accessory is installed, NO if it is not installed and hit enter. The screen will read:



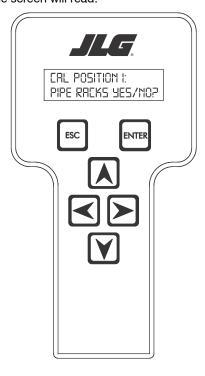
18. Use the up/down arrows to select YES if the accessory is installed, NO if it is not installed and hit enter. The screen will read:



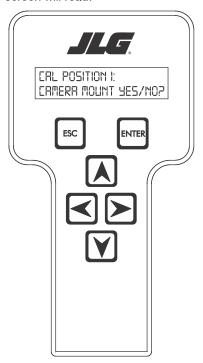
19. Use the up/down arrows to select YES if the accessory is installed, NO if it is not installed and hit enter. The screen will read:



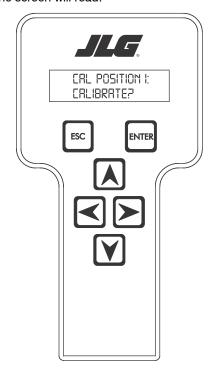
20. Use the up/down arrows to select YES if the accessory is installed, NO if it is not installed and hit enter. The screen will read:



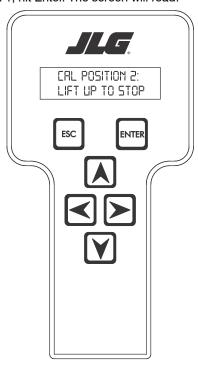
21. Use the up/down arrows to select YES if the accessory is installed, NO if it is not installed and hit enter. The screen will read:



22. Use the up/down arrows to select yes if the accessory is installed, no if it is not installed and hit Enter. The screen will read:



23. After making sure the machine is in Calibration Position 1, hit Enter. The screen will read:



24. Lift up to stop (full stroke of cylinder) for Calibration Position 2. When the machine is in that position, hit Enter.

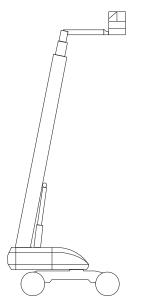
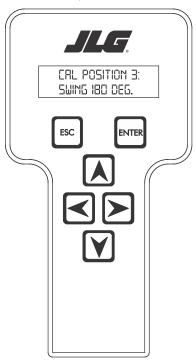


Figure 6-15. Boom Sensor Calibration Position 2

The screen will read:



25. Swing 180 degrees (centered over opposite end of chassis) for Calibration Position 3.

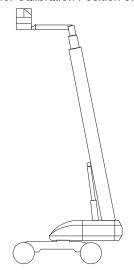
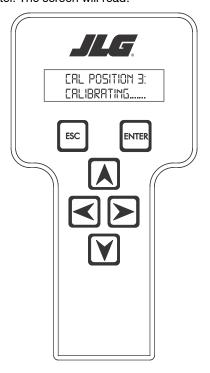
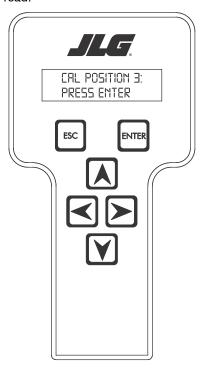


Figure 6-16. Boom Sensor Calibration Position 3

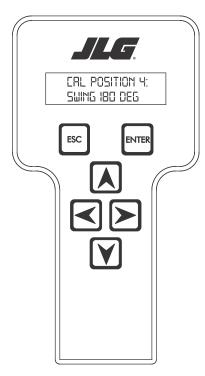
When the machine is in the proper position, hit Enter. The screen will read:



When Position 3 calibrating is complete the screen will read:



26. Press Enter. The screen will read:



Swing the machine back 180 degrees (centered over original end of chassis) for Calibration Position

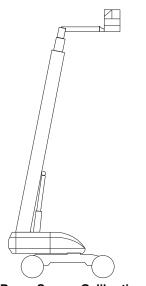
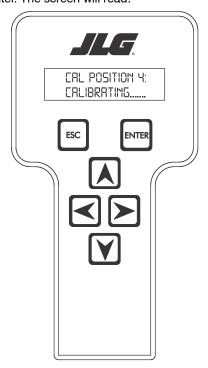
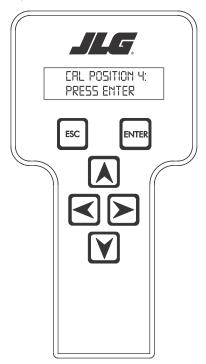


Figure 6-17. Boom Sensor Calibration Position 4

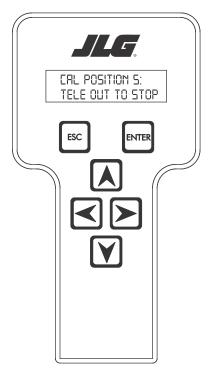
When the machine is in the proper position, hit Enter. The screen will read:



When Position 4 calibrating is complete, the screen will read:



27. Press Enter. The screen will read:



Telescope out to stop (boom must be fully extended) for Calibration Position 5.

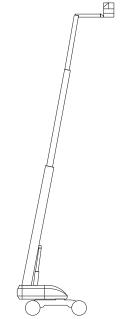
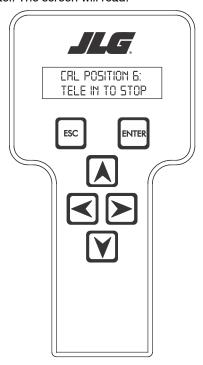


Figure 6-18. Boom Sensor Calibration Position 5

When the machine is in the proper position, hit Enter. The screen will read:



28. Retract to stop (boom must be fully retracted) for Calibration Position 6.

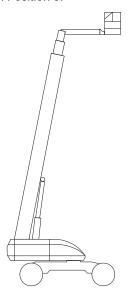
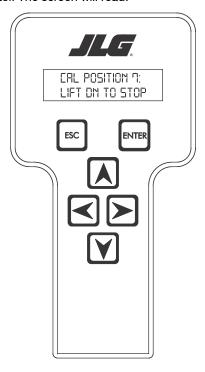


Figure 6-19. Boom Sensor Calibration Position 6

When the machine is in the proper position, hit Enter. The screen will read:



29. Lift down to stop (boom must be on boom rest) for Calibration Position 7.

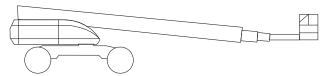
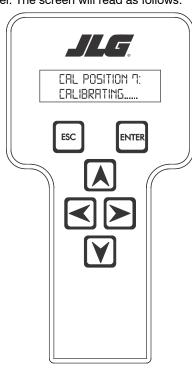
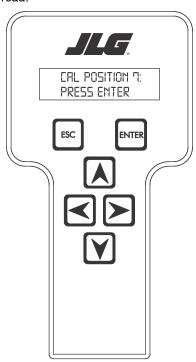


Figure 6-20. Boom Sensor Calibration Position 7

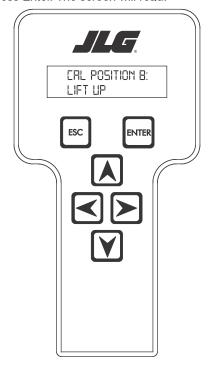
When the machine is in the proper position, hit Enter. The screen will read as follows:



When Position 7 Calibrating is complete, the screen will read:



Press Enter. The screen will read:



30. Lift until the function stops (controller will stop at 5 degrees above horizontal) for Calibration Position 8.

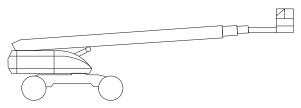
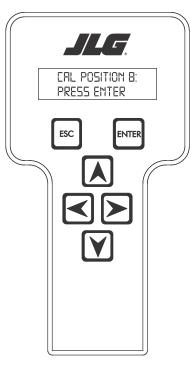
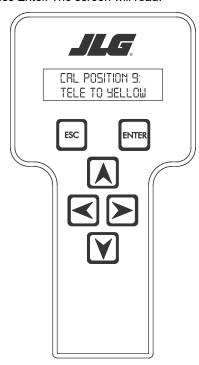


Figure 6-21. Boom Sensor Calibration Position 8

When the machine is in the proper position, hit Enter. The screen will read:



Press Enter. The screen will read:



31. Telescope to the yellow witness mark (controller will be close - operator must position the pointer to center line on decal within 0.25" [6 mm]) for Calibration Position 9.

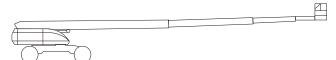
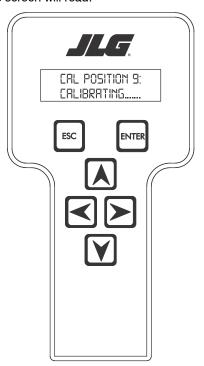


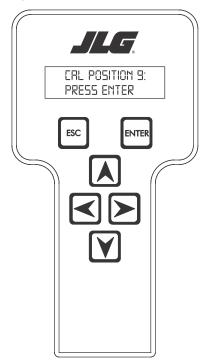
Figure 6-22. Boom Sensor Calibration Position 9



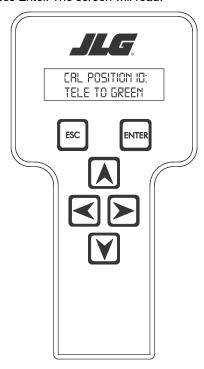
When the boom is in the proper position, hit Enter. The screen will read:



When Position 9 calibrating is complete, the screen will read:



Press Enter. The screen will read:



32. Telescope in to green witness mark (controller will find the position - operator must visually verify the position).

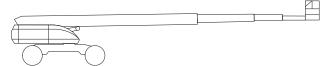
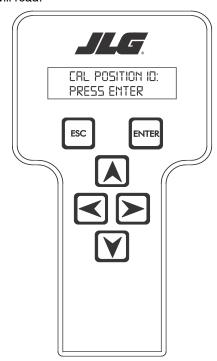
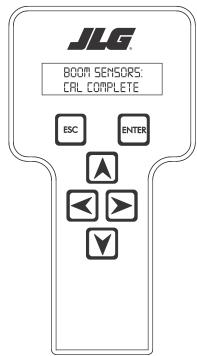


Figure 6-23. Boom Sensor Calibration Position 10

When the boom is in the proper position, the screen will read:



Press Enter. The screen will read:



- **33.** After completing all the Boom Sensors Calibrations, hit ESC twice to go back to Calibrations.
- **34.** Cycle the emergency stop switch.

Boom Control System Check Procedure

Perform the following check with no load (personnel or material) in the platform from the ground control station with the machine on a firm, level surface.

- 1. Ensure all axles are fully extended.
- With the boom fully retracted, raise the boom off the boom rest to horizontal.
- 3. Position the jib horizontal, jib straight, and platform level
- 4. Extend the boom until it stops.

- 5. Boom must stop on colored stripe matching the capacity indicator. If the boom does not stop on the correct stripe, the system must be repaired by JLG authorized Service Personnel before the machine can be used.
- 6. Push and hold the gray Boom Control System Test Button on the ground control panel. The lighting of the green Boom Control System Calibrated indicator indicates the system is functioning properly. No indicator light or the lighting of the red Boom Control System Warning indicator indicates the system must be repaired by JLG authorized Service Personnel before the machine can be used.

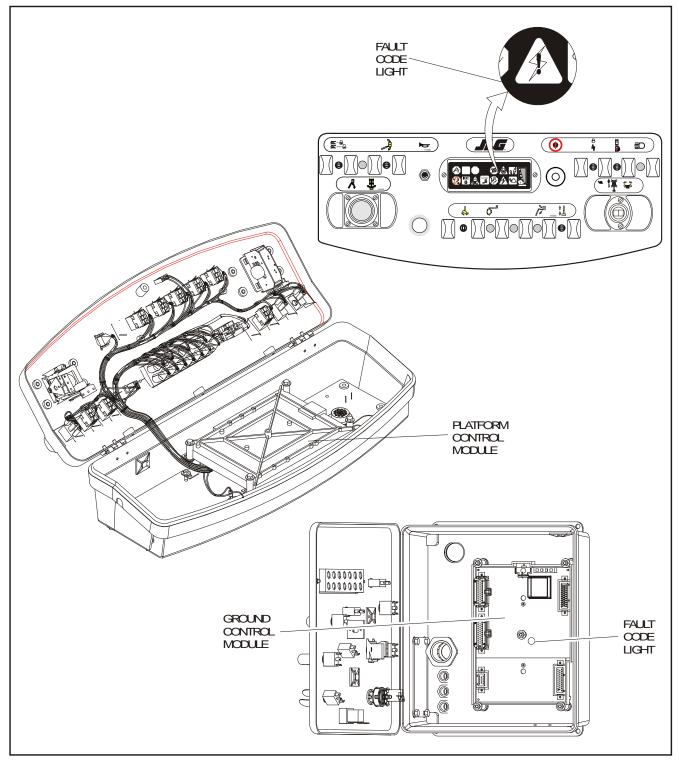


Figure 6-24. Fault Code Light Location

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
001	00	1	EVERYTHING OK	The normal help message in Platform Mode.	
002	00	2	GROUND MODE OK	The normal help message in Ground Mode.	
0010	00	10	RUNNING AT CUTBACK - OUT OF TRANSPORT POSITION	Drive speed is limited to "ELEVATED MAX" while the vehicle is out of trans- port position.	
000	00	0	<<< HELP COMMENT >>>		
0011	00	11	FSW OPEN	A drive / boom function was selected with the Footswitch open.	
0012	00	12	RUNNING AT CREEP - CREEP SWITCH OPEN	All functions at creep while the Creep Switch is open.	
0013	00	13	RUNNING AT CREEP - TILTED AND ABOVE ELEVATION	All functions at creep while the Platform is ele- vated and the Chassis is tilted.	
0014	00	14	CHASSIS TILT SENSOR OUT OF RANGE	The Chassis is tilted > 19 degrees for more then 4 seconds.	- Not reported during power-up.
0015	00	15	LOAD SENSOR READING UNDER WEIGHT	The Load Sensing System indicates > 20% under calibrated zero point.	- Not reported during power-up May occur if the Platform is resting on the ground.
0016	00	16	ENVELOPE ENCROACHED - HYDRAULICS SUSPENDED	There is an envelope violation.	- Envelope control system equipped vehicle only.
0017	00	17	OVER MOMENT - HYDRAULICS SUSPENDED	There is an over moment violation.	- Envelope control system equipped vehicle only.
0018	00	18	UNDER MOMENT - HYDRAULICS SUSPENDED	There is an under moment violation.	- Envelope control system equipped vehicle only.
0019	00	19	MAIN ENVELOPE ENCROACHED - HYDRAULICS SUS- PENDED	There is a main envelope violation.	- Main envelope system equipped vehicle only.
0020	00	20	TOWER ENVELOPE ENCROACHED - HYDRAULICS SUS- PENDED	There is a tower envelope violation.	- Tower envelope system equipped vehicle only.
210	21	0	<<< POWER-UP >>>		
211	21	1	POWER CYCLE	The normal help message is issued at each power cycle.	
212	21	2	KEYSWITCH FAULTY	Both Platform and Ground modes are selected simultaneously.	
213	21	3	FSW FAULTY	Both Footswitches are closed for more then one second.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
220	22	0	<<< PLATFORM CONTROLS >>>		
227	22	7	STEER SWITCHES FAULTY	Both Steer Left and Steer Right inputs are closed simultaneously.	
2211	22	11	FSW INTERLOCK TRIPPED	The Footswitch was closed for more then seven seconds.	- Can be reported during power-up.
2212	22	12	DRIVE LOCKED - JOYSTICK MOVED BEFORE FOOT- SWITCH	A drive function was selected with Footswitch open.	- Can be reported during power-up.
2213	22	13	STEER LOCKED - SELECTED BEFORE FOOTSWITCH	A steer function was selected with Footswitch open.	
2215	22	15	D/S JOY. OUT OF RANGE LOW	The D/S Joystick reference voltage is low.	- Resistive joysticks, these faults do not occur.
2216	22	16	D/S JOY. OUT OF RANGE HIGH	The D/S Joystick reference voltage is > 8.1V.	- Resistive joysticks If the reference voltage is > 7.7V then the reference voltage is out of tolerance of a short to battery has occurred.
2217	22	17	D/S JOY. CENTER TAP BAD	The D/S Joystick center tap voltage is < 3.08V or > 3.83V.	- Resistive joysticks There is a +/1V range. around these values due to resistor tolerances
2218	22	18	L/S JOY. OUT OF RANGE LOW	The L/S Joystick reference voltage is low.	- Resistive joysticks, these faults do not occur.
2219	22	19	L/S JOY. OUT OF RANGE HIGH	The L/S Joystick reference voltage is > 8.1V.	- Resistive joysticks If the reference voltage is > 7.7V then the reference voltage is out of tolerance of a short to battery has occurred.
2220	22	20	L/S JOY. CENTER TAP BAD	The L/S Joystick center tap voltage is < 3.08V or > 3.83V.	- Resistive joysticks There is a +/1V range. around these values due to resistor tolerances
2221	22	21	LIFT/SWING LOCKED - JOYSTICK MOVED BEFORE FOOT- SWITCH	A lift / swing function was selected with Footswitch open.	
2222	22	22	WAITING FOR FSW TO BE OPEN	The Footswitch was closed during Platform selection.	- Can be reported during power-up.
2223	22	23	FUNCTION SWITCHES LOCKED - SELECTED BEFORE ENABLE	A boom function was selected with Footswitch open.	
2224	22	24	FOOTSWITCH SELECTED BEFORE START	The Footswitch was closed during engine start.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
230	23	0	<<< GROUND CONTROLS >>>		
234	23	4	FUNCTION SWITCHES FAULTY - CHECK DIAGNOSTICS/ BOOM	A boom function has both directions selected together.	
235	23	5	FUNCTION SWITCHES LOCKED - SELECTED BEFORE AUX POWER	A boom function was selected before aux power.	
236	23	6	FUNCTION SWITCHES LOCKED - SELECTED BEFORE START SWITCH	A boom function was selected before engine start.	
237	23	7	START SWITCH LOCKED - SELECTED BEFORE KEY- SWITCH	The Start Switch was closed during power-up.	
250	25	0	<<< FUNCTION PREVENTED >>>		
259	25	9	MODEL CHANGED - HYDRAULICS SUSPENDED - CYCLE EMS	The model selection has been changed.	
2513	25	13	GENERATOR MOTION CUTOUT ACTIVE	Driving is not possible while the vehicle generator is running AND is configured to prevent drive.	
2514	25	14	BOOM PREVENTED - DRIVE SELECTED	Boom functions are not possible while the vehicle is being driven AND is configured to not allow simultaneous drive & boom operation.	
2515	25	15	DRIVE PREVENTED - BOOM SELECTED	Driving is not possible while the vehicle above elevation AND is configured to prevent drive while above elevation.	
2516	25	16	DRIVE PREVENTED - ABOVE ELEVATION	Driving is not possible while Boom functions are selected AND is configured to not allow simultaneous drive & boom operation.	
2517	25	17	DRIVE PREVENTED - TILTED & ABOVE ELEVATION	Driving is not possible while the vehicle is tilted and above elevation AND is configured to prevent drive while tilted and above elevation.	
2521	25	21	JIB SWING PREVENTED - IN 1000# MODE	JIB Swing is not possible while the vehicle is in 1000 LB Mode.	
2522	25	22	CAN DONGLE ATTACHED - HYDRAULICS NOT RESTRICTED	CAN Dongle attached. Very limited restrictions for all hydraulics sys- tems.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
2523	25	23	BACKUP BLAM COMMUNICATIONS ACTIVE	RS232 serial backup communications link to the BLAM is active.	
2524	25	24	DISCONNECT ANALYZER AND CYCLE EMS TO PERFORM BOOM RETRIEVAL	RS232 serial backup communications link to the BLAM is needed but an analyzer is connected.	
330	33	0	<<< GROUND OUTPUT DRIVER >>>		
331	33	1	BRAKE - SHORT TO BATTERY	There is a Short to Battery to the Brake Valve.	
332	33	2	BRAKE - OPEN CIRCUIT	There is an Open Circuit to the Brake Valve.	
3311	33	11	GROUND ALARM - SHORT TO BATTERY	There is a Short to Battery to the Ground Alarm.	- Ground Alarm equipped vehicles only.
3316	33	16	RIGHT FORWARD DRIVE PUMP - SHORT TO GROUND	There is a Short to Ground to the Right Forward Drive Valve.	- Chassis Module equipped vehicles only.
3317	33	17	RIGHT FORWARD DRIVE PUMP - OPEN CIRCUIT	There is an Open Circuit to the Right Forward Drive Valve.	- Chassis Module equipped vehicles only.
3318	33	18	RIGHT FORWARD DRIVE PUMP - SHORT TO BATTERY	There is a Short to Battery to the Right Forward Drive Valve.	- Chassis Module equipped vehicles only.
3320	33	20	RIGHT REVERSE DRIVE PUMP - SHORT TO GROUND	There is a Short to Ground to the Right Reverse Drive Valve.	- Chassis Module equipped vehicles only.
3321	33	21	RIGHT REVERSE DRIVE PUMP - OPEN CIRCUIT	There is an Open Circuit to the Right Reverse Drive Valve.	- Chassis Module equipped vehicles only.
3322	33	22	RIGHT REVERSE DRIVE PUMP - SHORT TO BATTERY	There is a Short to Battery to the Right Reverse Drive Valve.	- Chassis Module equipped vehicles only.
3324	33	24	LEFT FORWARD DRIVE PUMP - SHORT TO GROUND	There is a Short to Ground to the Left Forward Drive Valve.	- Chassis Module equipped vehicles only.
3325	33	25	LEFT FORWARD DRIVE PUMP - OPEN CIRCUIT	There is an Open Circuit to the Left Forward Drive Valve.	- Chassis Module equipped vehicles only.
3326	33	26	LEFT FORWARD DRIVE PUMP - SHORT TO BATTERY	There is a Short to Battery to the Left Forward Drive Valve.	- Chassis Module equipped vehicles only.
3328	33	28	LEFT REVERSE DRIVE PUMP - SHORT TO GROUND	There is a Short to Ground to the Left Reverse Drive Valve.	- Chassis Module equipped vehicles only.
3329	33	29	LEFT REVERSE DRIVE PUMP - OPEN CIRCUIT	There is an Open Circuit to the Left Reverse Drive Valve.	- Chassis Module equipped vehicles only.

Table 6-6. Diagnostic Trouble Code Chart

DTO	Flash		F. 111	F. II D	Observation
DTC	Code	Sequence	Fault Message	Fault Description	Check
3330	33	30	LEFT REVERSE DRIVE PUMP - SHORT TO BATTERY	There is a Short to Battery to the Left Reverse Drive Valve.	- Chassis Module equipped vehicles only.
3336	33	36	ALTERNATOR/ECM POWER - SHORT TO GROUND	There is a Short to Ground to the Alternator/ECM.	
3338	33	38	ALTERNATOR POWER - OPEN CIRCUIT	There is an Open Circuit to the Alternator.	
3339	33	39	ALTERNATOR POWER - SHORT TO BATTERY	There is a Short to Battery to the Alternator	
3340	33	40	AUX POWER - SHORT TO GROUND	There is a Short to Ground to the Auxiliary Power Pump Relay.	
3341	33	41	AUX POWER - OPEN CIRCUIT	There is an Open Circuit to the Auxiliary Power Pump Relay.	
3342	33	42	AUX POWER - SHORT TO BATTERY	There is a Short to Battery to the Auxiliary Power Pump Relay.	
3343	33	43	COLD START ADVANCE SOLENOID - SHORT TO GROUND	There is a Short to Ground to the Cold Start Advance Solenoid.	- CAT engines only.
3344	33	44	COLD START ADVANCE SOLENOID - OPEN CIRCUIT	There is an Open Circuit to the Cold Start Advance Solenoid.	- CAT engines only.
3345	33	45	COLD START ADVANCE SOLENOID - SHORT TO BATTERY	There is a Short to Battery to the Cold Start Advance Solenoid.	- CAT engines only.
3349	33	49	ELECTRIC PUMP - SHORT TO GROUND	There is a Short to Ground to the Pump Relay.	- CAT engines only.
3350	33	50	ELECTRIC PUMP - OPEN CIRCUIT	There is an Open Circuit to the Pump Relay.	- CAT engines only.
3351	33	51	ELECTRIC PUMP - SHORT TO BATTERY	There is a Short to Battery to the Pump Relay.	- CAT engines only.
3358	33	58	MAIN DUMP VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Dump Valve.	
3359	33	59	MAIN DUMP VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Dump Valve.	
3360	33	60	MAIN DUMP VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Dump Valve.	
3361	33	61	BRAKE - SHORT TO GROUND	There is a Short to Ground to the Brake Valve.	
3362	33	62	START SOLENOID - SHORT TO GROUND	There is a Short to Ground to the Start Relay.	- Diesel engines only.
3363	33	63	START SOLENOID - OPEN CIRCUIT	There is an Open Circuit to the Start Relay.	- Diesel engines only.
3364	33	64	START SOLENOID - SHORT TO BATTERY	There is a Short to Battery to the Start Relay.	- Diesel engines only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
3368	33	68	TWO SPEED VALVE - SHORT TO GROUND	There is a Short to Ground to the Two Speed Valve.	
3369	33	69	TWO SPEED VALVE - OPEN CIRCUIT	There is an Open Circuit to the Two Speed Valve.	
3370	33	70	TWO SPEED VALVE - SHORT TO BATTERY	There is a Short to Battery to the Two Speed Valve.	
3371	33	71	GROUND ALARM - SHORT TO GROUND	There is a Short to Ground to the Ground Alarm.	- Ground Alarm equipped vehicles only.
3372	33	72	GROUND ALARM - OPEN CIRCUIT	There is an Open Circuit to the Ground Alarm.	- Ground Alarm equipped vehicles only.
3373	33	73	GEN SET/WELDER - SHORT TO GROUND	There is a Short to Ground to the Generator Relay.	- Generator / Welder equipped vehicles only.
3374	33	74	GEN SET/WELDER - OPEN CIRCUIT	There is an Open Circuit to the Generator Relay.	- Generator / Welder equipped vehicles only.
3375	33	75	GEN SET/WELDER - SHORT TO BATTERY	There is a Short to Battery to the Generator Relay.	- Generator / Welder equipped vehicles only.
3376	33	76	HEAD TAIL LIGHT - SHORT TO GROUND	There is a Short to Ground to the Head Light Relay.	- Head Light equipped vehi- cles only.
3377	33	77	HEAD TAIL LIGHT - OPEN CIRCUIT	There is an Open Circuit to the Head Light Relay.	- Head Light equipped vehi- cles only.
3378	33	78	HEAD TAIL LIGHT - SHORT TO BATTERY	There is a Short to Battery to the Head Light Relay.	- Head Light equipped vehi- cles only.
3379	33	79	HOUR METER - SHORT TO GROUND	There is a Short to Ground to the Hour Meter.	
3380	33	80	HOUR METER - OPEN CIRCUIT	There is an Open Circuit to the Hour Meter.	- Can be reported during power-up.
3381	33	81	HOUR METER - SHORT TO BATTERY	There is a Short to Battery to the Hour Meter.	
3385	33	85	PLATFORM LEVEL UP OVERRIDE VALVE - SHORT TO GROUND	There is a Short to Ground to the Platform Level Up Override Valve.	- Electronic leveling system equipped vehicles only.
3386	33	86	PLATFORM LEVEL UP OVERRIDE VALVE - OPEN CIRCUIT	There is an Open Circuit to the Platform Level Up Override Valve.	- Electronic leveling system equipped vehicles only.
3387	33	87	PLATFORM LEVEL UP OVERRIDE VALVE - SHORT TO BATTERY	There is a Short to Battery to the Platform Level Up Override Valve.	- Electronic leveling system equipped vehicles only.
3391	33	91	PLATFORM LEVEL DOWN OVERRIDE VALVE - SHORT TO GROUND	There is a Short to Ground to the Platform Level Down Override Valve.	- Electronic leveling system equipped vehicles only.
3392	33	92	PLATFORM LEVEL DOWN OVERRIDE VALVE - OPEN CIRCUIT	There is an Open Circuit to the Platform Level Down Override Valve.	- Electronic leveling system equipped vehicles only.
3393	33	93	PLATFORM LEVEL DOWN OVERRIDE VALVE - SHORT TO BATTERY	There is a Short to Battery to the Platform Level Down Override Valve.	- Electronic leveling system equipped vehicles only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
3394	33	94	PLATFORM ROTATE LEFT VALVE - SHORT TO GROUND	There is a Short to Ground to the Platform Rotate Left Valve.	
3395	33	95	PLATFORM ROTATE LEFT VALVE - OPEN CIRCUIT	There is an Open Circuit to the Platform Rotate Left Valve.	
3396	33	96	PLATFORM ROTATE LEFT VALVE - SHORT TO BATTERY	There is a Short to Battery to the Platform Rotate Left Valve.	
3397	33	97	PLATFORM ROTATE RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the Platform Rotate Right Valve.	
3398	33	98	PLATFORM ROTATE RIGHT VALVE - OPEN CIRCUIT	There is an Open Circuit to the Platform Rotate Right Valve.	
3399	33	99	PLATFORM ROTATE RIGHT VALVE - SHORT TO BATTERY	There is a Short to Battery to the Platform Rotate Right Valve.	
33100	33	100	JIB LIFT UP VALVE - SHORT TO GROUND	There is a Short to Ground to the JIB Lift Up Valve.	
33101	33	101	JIB LIFT UP VALVE - OPEN CIRCUIT	There is an Open Circuit to the JIB Lift Up Valve.	
33102	33	102	JIB LIFT UP VALVE - SHORT TO BATTERY	There is a Short to Battery to the JIB Lift Up Valve.	
33103	33	103	JIB LIFT DOWN VALVE - SHORT TO GROUND	There is a Short to Ground to the JIB Lift Down Valve.	
33104	33	104	JIB LIFT DOWN VALVE - OPEN CIRCUIT	There is an Open Circuit to the JIB Lift Down Valve.	
33105	33	105	JIB LIFT DOWN VALVE - SHORT TO BATTERY	There is a Short to Battery to the JIB Lift Down Valve.	
33118	33	118	SWING RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the Swing Right Valve.	
33119	33	119	SWING RIGHT VALVE - OPEN CIRCUIT	There is an Open Circuit to the Swing Right Valve.	
33120	33	120	MAIN TELESCOPE IN VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Telescope In Valve.	
33121	33	121	SWING RIGHT VALVE - SHORT TO BATTERY	There is a Short to Battery to the Swing Right Valve.	
33122	33	122	SWING LEFT VALVE - SHORT TO GROUND	There is a Short to Ground to the Swing Left Valve.	
33123	33	123	MAIN TELESCOPE OUT VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Telescope Out Valve.	
33130	33	130	THROTTLE ACTUATOR - SHORT TO GROUND	There is a Short to Ground to the Throttle Actuator.	
33131	33	131	THROTTLE ACTUATOR - OPEN CIRCUIT	There is an Open Circuit to the Throttle Actuator.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
33132	33	132	THROTTLE ACTUATOR - SHORT TO BATTERY	There is a Short to Battery to the Throttle Actuator.	
33133	33	133	PLATFORM CONTROL VALVE - SHORT TO GROUND	There is a Short to Ground to the Platform Control Valve.	- Electronic leveling system equipped vehicles only.
33134	33	134	PLATFORM CONTROL VALVE - OPEN CIRCUIT	There is an Open Circuit to the Platform Control Valve.	- Electronic leveling system equipped vehicles only.
33135	33	135	PLATFORM CONTROL VALVE - SHORT TO BATTERY	There is a Short to Battery to the Platform Control Valve.	- Electronic leveling system equipped vehicles only.
33136	33	136	MAIN LIFT APU VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Lift APU Valve.	- 1250AJP only.
33137	33	137	MAIN LIFT APU VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Lift APU Valve.	- 1250AJP only.
33138	33	138	MAIN LIFT APU VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Lift APU Valve.	- 1250AJP only.
33139	33	139	MAIN LIFT PILOT - PRESSURE FAILURE	The Main Lift Pilot has a Pressure Failure.	- 1250AJP only.
33140	33	140	MAIN LIFT PILOT - NO PRESSURE	The Main Lift Pilot has No Pressure.	- 1250AJP only.
33141	33	141	MAIN LIFT PILOT - PRESSURE SWITCH FAILURE	The Main Lift Pilot has a Pressure Switch Failure.	- 1250AJP only.
33142	33	142	TOWER LIFT APU VALVE - STUCK OPEN	The Tower Lift APU Valve is Stuck Open	- 1250AJP only.
33143	33	143	TOWER LIFT ENABLE VALVE - STUCK OPEN	The Tower Lift Enable Valve is Stuck Open	- 1250AJP only.
33144	33	144	TOWER LIFT ENABLE VALVE - SHORT TO GROUND	There is a Short to Ground to the Tower Lift Enable Valve.	- 1250AJP only.
33145	33	145	TOWER LIFT ENABLE VALVE - OPEN CIRCUIT	There is an Open Circuit to the Tower Lift Enable Valve.	- 1250AJP only.
33146	33	146	TOWER LIFT ENABLE VALVE - SHORT TO BATTERY	There is a Short to Battery to the Tower Lift Enable Valve.	- 1250AJP only.
33147	33	147	TOWER TELESCOPE APU VALVE - SHORT TO GROUND	There is a Short to Ground to the Tower Telescope APU Valve.	- 1250AJP only.
33148	33	148	TOWER TELESCOPE APU VALVE - OPEN CIRCUIT	There is an Open Circuit to the Tower Telescope APU Valve.	- 1250AJP only.
33149	33	149	TOWER TELESCOPE APU VALVE - SHORT TO BATTERY	There is a Short to Battery to the Tower Telescope APU Valve.	- 1250AJP only.
33150	33	150	LIFT PILOT VALVE - SHORT TO GROUND	There is a Short to Ground to the Lift Pilot Valve.	- Gravity Lift Down equipped vehicles only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
33151	33	151	LIFT PILOT VALVE - OPEN CIRCUIT	There is an Open Circuit to the Lift Pilot Valve.	- Gravity Lift Down equipped vehicles only.
33152	33	152	LIFT PILOT VALVE - SHORT TO BATTERY	There is a Short to Battery to the Lift Pilot Valve.	- Gravity Lift Down equipped vehicles only.
33153	33	153	LIFT DOWN AUX VALVE - SHORT TO GROUND	There is a Short to Ground to the Lift Down Auxiliary Valve.	- Gravity Lift Down equipped vehicles only.
33154	33	154	LIFT DOWN AUX VALVE - OPEN CIRCUIT	There is an Open Circuit to the Lift Down Auxiliary Valve.	- Gravity Lift Down equipped vehicles only.
33155	33	155	LIFT DOWN AUX VALVE - SHORT TO BATTERY	There is a Short to Battery to the Lift Down Auxiliary Valve.	- Gravity Lift Down equipped vehicles only.
33156	33	156	TOWER LIFT APU VALVE - SHORT TO GROUND	There is a Short to Ground to the Tower Lift APU Valve.	- 1250AJP only.
33157	33	157	TOWER LIFT APU VALVE - OPEN CIRCUIT	There is an Open Circuit to the Tower Lift APU Valve.	- 1250AJP only.
33158	33	158	TOWER LIFT APU VALVE - SHORT TO BATTERY	There is a Short to Battery to the Tower Lift APU Valve.	- 1250AJP only.
33159	33	159	MAIN LIFT ENABLE VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Lift Enable Valve.	- 1250AJP only.
33160	33	160	MAIN LIFT ENABLE VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Lift Enable Valve.	- 1250AJP only.
33161	33	161	MAIN LIFT ENABLE VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Lift Enable Valve.	- 1250AJP only.
33162	33	162	TOWER TELESCOPE APU VALVE - STUCK OPEN	The Tower Telescope APU Valve is Stuck Open	- 1250AJP only.
33163	33	163	TOWER TELESCOPE ENABLE VALVE - STUCK OPEN	The Tower Telescope Enable Valve is Stuck Open	- 1250AJP only.
33164	33	164	TOWER TELESCOPE ENABLE VALVE - SHORT TO GROUND	There is a Short to Ground to the Tower Telescope APU Valve.	- 1250AJP only.
33165	33	165	TOWER TELESCOPE ENABLE VALVE - OPEN CIRCUIT	There is an Open Circuit to the Tower Telescope APU Valve.	- 1250AJP only.
33166	33	166	TOWER TELESCOPE ENABLE VALVE - SHORT TO BAT- TERY	There is a Short to Battery to the Tower Telescope APU Valve.	- 1250AJP only.
33167	33	167	PVG ENABLE VALVE - SHORT TO GROUND	There is a Short to Ground to the PVG Valve.	- 1250AJP only.
33168	33	168	PVG ENABLE VALVE - OPEN CIRCUIT	There is an Open Circuit to the PVG Valve.	- 1250AJP only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
33169	33	169	PVG ENABLE VALVE - SHORT TO BATTERY	There is a Short to Battery to the PVG Valve.	- 1250AJP only.
33173	33	173	RESTRICTED TO TRANSPORT - AXLE LOCKOUT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Axle Lockout Valve.	
33174	33	174	RESTRICTED TO TRANSPORT - BRAKE - SHORT TO BAT- TERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Brake.	
33175	33	175	JIB ROTATE LEFT VALVE - OPEN CIRCUIT	There is an Open Circuit to the JIB Rotate Left Valve.	
33176	33	176	JIB ROTATE LEFT VALVE - SHORT TO BATTERY	There is a Short to Battery to the JIB Rotate Left Valve.	
33177	33	177	JIB ROTATE LEFT VALVE - SHORT TO GROUND	There is a Shortto Ground to the JIB Rotate Left Valve.	
33178	33	178	JIB ROTATE RIGHT VALVE - OPEN CIRCUIT	There is an Open Circuit to the JIB Rotate Right Valve.	
33179	33	179	JIB ROTATE RIGHT VALVE - SHORT TO BATTERY	There is a Short to Battery to the JIB Rotate Right Valve.	
33180	33	180	JIB ROTATE RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the JIB Rotate Right Valve.	
33181	33	181	MAIN LIFT UP VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Lift Up Valve.	
33183	33	183	MAIN LIFT UP VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Lift Up Valve.	
33184	33	184	MAIN LIFT DOWN VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Lift Down Valve.	
33185	33	185	MAIN LIFT DOWN VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Lift Down Valve.	
33186	33	186	MAIN TELESCOPE OUT VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Telescope Out Valve.	
33188	33	188	MAIN TELESCOPE OUT VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Telescope Out Valve.	
33189	33	189	MAIN TELESCOPE IN VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Telescope In Valve.	
33190	33	190	MAIN TELESCOPE IN VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Telescope In Valve.	
33207	33	207	HORN - OPEN CIRCUIT	There is an Open Circuit to the Horn.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
33208	33	208	HORN - SHORT TO BATTERY	There is a Short to Battery to the Horn.	
33209	33	209	HORN - SHORT TO GROUND	There is a Short to Ground to the Horn.	
33279	33	279	GLOWPLUG - OPEN CIRCUIT	There is an Open Circuit to the Glow Plugs.	- Glowplugs equipped vehicles only.
33280	33	280	GLOWPLUG - SHORT TO BATTERY	There is a Short to Battery to the Glow Plugs.	- Glowplugs equipped vehicles only.
33281	33	281	GLOWPLUG - SHORT TO GROUND	There is a Short to Ground to the Glow Plugs.	- Glowplugs equipped vehi- cles only.
33295	33	295	SWING LEFT VALVE - OPEN CIRCUIT	There is an Open Circuit to the Swing Left Valve.	
33306	33	306	SWING LEFT VALVE - SHORT TO BATTERY	There is a Short to Battery to the Swing Left Valve.	
33307	33	307	MAIN TELESCOPE FLOW CONTROL VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Telescope Flow Control Valve.	
33308	33	308	MAIN TELESCOPE FLOW CONTROL VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Telescope Flow Control Valve.	
33309	33	309	MAIN TELESCOPE FLOW CONTROL VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Telescope Flow Control Valve.	
33310	33	310	MAIN LIFT DOWN VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Lift Down Valve.	
33311	33	311	MAIN LIFT FLOW CONTROL VALVE - SHORT TO GROUND	There is a Short to Ground to the Main Lift Flow Control Valve.	
33312	33	312	MAIN LIFT FLOW CONTROL VALVE - OPEN CIRCUIT	There is an Open Circuit to the Main Lift Flow Control Valve.	
33313	33	313	MAIN LIFT FLOW CONTROL VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Lift Flow Control Valve.	
33329	33	329	MAIN LIFT UP VALVE - SHORT TO BATTERY	There is a Short to Battery to the Main Lift Up Valve.	
340	34	0	<<< PLATFORM OUTPUT DRIVER >>>		
343	34	3	PLATFORM LEVEL UP VALVE - SHORT TO GROUND	There is a Short to Ground to the Platform Level Up Valve.	
344	34	4	PLATFORM LEVEL UP VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Platform Level Up Valve.	- Electronic leveling system equipped vehicles only.
347	34	7	PLATFORM LEVEL DOWN VALVE - SHORT TO GROUND	There is a Shortto Ground to the Platform Level Down Valve.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
348	34	8	PLATFORM LEVEL DOWN VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Platform Level Down Valve.	- Electronic leveling system equipped vehicles only.
430	43	0	<<< ENGINE >>>		
431	43	1	FUEL SENSOR SHORT TO BATTERY	The Fuel Sensor reading is > 4.3V.	
432	43	2	FUEL SENSOR SHORT TO GROUND	The Fuel Sensor reading is < 0.2V.	
433	43	3	OIL PRESSURE SHORT TO BATTERY	The Oil Pressure Sensor reading is > 6.6V.	- Deutz engine only.
434	43	4	OIL PRESSURE SHORT TO GROUND	The Oil Pressure Sensor reading is < 0.1V for more then 5 seconds.	- Deutz engine only Not reported during engine start.
435	43	5	COOLANT TEMPERATURE SHORT TO GROUND	The Coolant Temperature Sensor reading is < 0.1V.	- Deutz engine only.
437	43	7	ENGINE TROUBLE CODE	Displays engine SPN FMI code.	
438	43	8	HIGH ENGINE TEMP	(Ford engine only) The engine temperature is > 117 C. (Deutz engine only) The engine temperature is > 130 C.	- Ford / Deutz engine only.
439	43	9	AIR FILTER BYPASSED	The Air Filter is clogged.	
4310	43	10	NO ALTERNATOR OUTPUT	Battery voltage is < 11.5 volts for more then 15 seconds after engine start.	
4311	43	11	LOW OIL PRESSURE	(Ford engine only) The ECM has reported a low oil pressure fault. (Deutz engine only) Oil pressure is < 8 PSI for more then 10 seconds after engine start.	- Ford / Deutz engine only.
4313	43	13	THROTTLE ACTUATOR FAILURE	The engine RPM is > XXX for more then XX seconds.	
4314	43	14	WRONG ENGINE SELECTED - ECM DETECTED	A ECM was detected with a non-ECM type engine selected.	
4322	43	22	LOSS OF ENGINE SPEED SENSOR	The engine RPM sensor indicates 0 RPM AND the Oil Pressure Sensor indicates > 8 PSI for three seconds.	- Diesel engine only.
4323	43	23	SPEED SENSOR READING INVALID SPEED	The engine RPM sensor indicates > 4000 RPM.	- Diesel engine only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
440	44	0	<<< BATTERY SUPPLY >>>		
441	44	1	BATTERY VOLTAGE TOO LOW - SYSTEM SHUTDOWN	Battery voltage is < 9V.	
442	44	2	BATTERY VOLTAGE TOO HIGH - SYSTEM SHUTDOWN	Battery voltage is > 16V.	
445	44	5	BATTERY VOLTAGE LOW	Battery voltage is < 11V for more then 5 seconds.	
450	45	0	<<< CAN CONTROLLED VALVES >>>		
451	45	1	MAIN LIFT PVG VALVE - INTERNAL FAULT	The Main Lift PVG Valve has an internal fault.	- 1250AJP only.
452	45	2	TOWER LIFT PVG VALVE - INTERNAL FAULT	The Tower Lift PVG Valve has an internal fault.	- 1250AJP only.
453	45	3	TOWER TELESCOPE PVG VALVE - INTERNAL FAULT	The Tower Telescope PVG Valve has an internal fault.	- 1250AJP only.
454	45	4	MAIN LIFT PVG VALVE - HIGH VOLTAGE	The Main Lift PVG Valve supply voltage is high.	- 1250AJP only.
455	45	5	TOWER LIFT PVG VALVE - HIGH VOLTAGE	The Tower Lift PVG Valve supply voltage is high.	- 1250AJP only.
456	45	6	TOWER TELESCOPE PVG VALVE - HIGH VOLTAGE	The Tower Telescope PVG Valve supply voltage is high.	- 1250AJP only.
457	45	7	MAIN LIFT PVG VALVE - LOW VOLTAGE	The Main Lift PVG Valve supply voltage is low.	- 1250AJP only.
458	45	8	TOWER LIFT PVG VALVE - LOW VOLTAGE	The Tower Lift PVG Valve supply voltage is low.	- 1250AJP only.
459	45	9	TOWER TELESCOPE PVG VALVE - LOW VOLTAGE	The Tower Telescope PVG Valve supply voltage is low.	- 1250AJP only.
4510	45	10	MAIN LIFT PVG VALVE - STUCK NEUTRAL	The Main Lift PVG Valve is stuck in its neutral position.	- 1250AJP only.
4511	45	11	TOWER LIFT PVG VALVE - STUCK NEUTRAL	The Tower Lift PVG Valve is stuck in its neutral position.	- 1250AJP only.
4512	45	12	TOWER TELESCOPE PVG VALVE - STUCK NEUTRAL	The Tower Telescope PVG Valve is stuck in its neutral position.	- 1250AJP only.
4513	45	13	MAIN LIFT PVG VALVE - STUCK EXTENDED	The Main Lift PVG Valve is stuck in its extended position.	- 1250AJP only.
4514	45	14	TOWER LIFT PVG VALVE - STUCK EXTENDED	The Tower Lift PVG Valve is stuck in its extended position.	- 1250AJP only.
4515	45	15	TOWER TELESCOPE PVG VALVE - STUCK EXTENDED	The Tower Telescope PVG Valve is stuck in its extended position.	- 1250AJP only.
4516	45	16	MAIN LIFT PVG VALVE - STUCK RETRACTED	The Main Lift PVG Valve is stuck in its retracted position.	- 1250AJP only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
4517	45	17	TOWER LIFT PVG VALVE - STUCK RETRACTED	The Tower Lift PVG Valve is stuck in its retracted position.	- 1250AJP only.
4518	45	18	TOWER TELESCOPE PVG VALVE - STUCK RETRACTED	The Tower Telescope PVG Valve is stuck in its retracted position.	- 1250AJP only.
4519	45	19	MAIN LIFT PVG VALVE - OBSTRUCTED	The Main Lift PVG Valve is obstructed	- 1250AJP only.
4520	45	20	TOWER LIFT PVG VALVE - OBSTRUCTED	The Tower Lift PVG Valve is obstructed	- 1250AJP only.
4521	45	21	TOWER TELESCOPE PVG VALVE - OBSTRUCTED	The Tower Telescope PVG Valve is obstructed	- 1250AJP only.
4522	45	22	MAIN LIFT PVG VALVE - COMMAND IMPROPER	The Main Lift PVG Valve command is improper.	- 1250AJP only.
4523	45	23	TOWER LIFT PVG VALVE - COMMAND IMPROPER	The Tower Lift PVG Valve command is improper.	- 1250AJP only.
4524	45	24	TOWER TELESCOPE PVG VALVE - COMMAND IMPROPER	The Tower Telescope PVG Valve command is improper.	- 1250AJP only.
4525	45	25	MAIN LIFT PVG VALVE - TIMEOUT	The Main Lift PVG Valve has timed out.	- 1250AJP only.
4526	45	26	TOWER LIFT PVG VALVE - TIMEOUT	The Tower Lift PVG Valve has timed out.	- 1250AJP only.
4527	45	27	TOWER TELESCOPE PVG VALVE - TIMEOUT	The Tower Telescope PVG Valve has timed out.	- 1250AJP only.
4528	45	28	MAIN LIFT PVG VALVE - SETUP FAULT	The Main Lift PVG Valve has a setup fault.	- 1250AJP only.
4529	45	29	TOWER LIFT PVG VALVE - SETUP FAULT	The Tower Lift PVG Valve has a setup fault.	- 1250AJP only.
4530	45	30	TOWER TELESCOPE PVG VALVE - SETUP FAULT	The Tower Telescope PVG Valve has a setup fault.	- 1250AJP only.
4531	45	31	MAIN LIFT PVG VALVE - SENT UNRECOGNIZED FAULT	The Main Lift PVG Valve has an unrecognized fault.	- 1250AJP only.
4532	45	32	TOWER LIFT PVG VALVE - SENT UNRECOGNIZED FAULT	The Tower Lift PVG Valve has an unrecognized fault.	- 1250AJP only.
4533	45	33	TOWER TELESCOPE PVG VALVE - SENT UNRECOGNIZED FAULT	The Tower Telescope PVG Valve has an unrecog- nized fault.	- 1250AJP only.
4534	45	34	MAIN LIFT PVG VALVE - PARAMETERS INCORRECT	The Main Lift PVG Valve parameters are incorrect.	- 1250AJP only.
4535	45	35	TOWER LIFT PVG VALVE - PARAMETERS INCORRECT	The Tower Lift PVG Valve parameters are incorrect.	- 1250AJP only.
4536	45	36	TOWER TELESCOPE PVG VALVE - PARAMETERS INCOR- RECT	The Tower Telescope PVG Valve parameters are incorrect.	- 1250AJP only.
4537	45	37	MAIN LIFT PVG VALVE - LOCATION IMPROPER	The Main Lift PVG Valve is in the wrong location.	- 1250AJP only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
4538	45	38	TOWER LIFT PVG VALVE - LOCATION IMPROPER	The Tower Lift PVG Valve is in the wrong location.	- 1250AJP only.
4539	45	39	TOWER TELESCOPE PVG VALVE - LOCATION IMPROPER	The Tower Telescope PVG Valve is in the wrong location.	- 1250AJP only.
4540	45	40	MAIN LIFT PVG VALVE - WIRING INCORRECT	The Main Lift PVG Valve has incorrect wiring.	- 1250AJP only.
4541	45	41	TOWER LIFT PVG VALVE - WIRING INCORRECT	The Tower Lift PVG Valve has incorrect wiring.	- 1250AJP only.
4542	45	42	TOWER TELESCOPE PVG VALVE - WIRING INCORRECT	The Tower Telescope PVG Valve has incorrect wiring.	- 1250AJP only.
4543	45	43	MAIN LIFT PVG VALVE - SPOOL CANNOT REACH NEUTRAL	X	- 1250AJP only.
4544	45	44	TOWER LIFT PVG VALVE - SPOOL CANNOT REACH NEUTRAL	Х	- 1250AJP only.
4545	45	45	TOWER TELESCOPE PVG VALVE - SPOOL CANNOT REACH NEUTRAL	X	- 1250AJP only.
660	66	0	<<< COMMUNICATION >>>		
662	66	2	CANBUS FAILURE - PLATFORM MODULE	Platform Module CAN communication lost.	
666	66	6	CANBUS FAILURE - ENGINE CONTROLLER	Engine Control Module CAN communication lost.	- ECM equipped engine only.
667	66	7	CANBUS FAILURE - MAIN LIFT PVG	Main Lift PVG CAN com- munication lost.	- 1250AJP only.
668	66	8	CANBUS FAILURE - TOWER LIFT PVG	Tower Lift PVG CAN com- munication lost.	- 1250AJP only.
669	66	9	CANBUS FAILURE - TOWER TELESCOPE PVG	Tower Telescope PVG CAN communication lost.	- 1250AJP only.
6610	66	10	CANBUS FAILURE - BLAM	BLAM CAN communication lost.	- BLAM equipped vehicles only.
6611	66	11	CANBUS FAILURE - CHASSIS MODULE	Engine Control Module CAN communication lost.	- ECM equipped engine only.
6612	66	12	CANBUS FAILURE - CYLINDER LOAD PIN	Cylinder Load Pin CAN communication lost.	- Cylinder Load Pin equipped engine only.
6613	66	13	CANBUS FAILURE - EXCESSIVE CANBUS ERRORS	There has been > 500 Bus Off errors or > 500 Bus Passive Errors.	
6614	66	14	CANBUS FAILURE - MAIN ANGLE SENSOR #1	Angle Sensor #1 CAN communication lost.	- 1250AJP only.
6615	66	15	CANBUS FAILURE - MAIN ANGLE SENSOR #2	Angle Sensor #2 CAN communication lost.	- 1250AJP only.
6622	66	22	CANBUS FAILURE - TCU MODULE	Machine Setup/ Telemat- ics=YES, No device heartbeat for 30 sec	
6623	66	23	CANBUS FAILURE - GATEWAY MODULE	Machine Setup/Telemat- ics=YES, No device heartbeat for 30 sec	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
6629	66	29	CANBUS FAILURE - TELEMATICS CANBUS LOADING TOO HIGH	X	-Telematics only
680	68	0	<<< TELEMATICS >>>		
681	68	1	REMOTE CONTRACT MANAGEMENT OVERRIDE - ALL FUNCTIONS IN CREEP	Х	-Telematics only
810	81	0	<<< TILT SENSOR >>>		
813	81	3	CHASSIS TILT SENSOR NOT CALIBRATED	The Chassis Tilt Sensor has not been calibrated.	
815	81	5	CHASSIS TILT SENSOR DISAGREEMENT	X	
820	82	0	<<< PLATFORM LOAD SENSE >>>		
825	82	5	LSS HAS NOT BEEN CALIBRATED	The Load Sensing System Module has not been calibrated.	
826	82	6	RUNNING AT CREEP - PLATFORM OVERLOADED	All functions at creep, the Load Sensing System indicates the Platform is overloaded AND is config- ured to warn only while the Platform is over- loaded.	
827	82	7	DRIVE & BOOM PREVENTED - PLATFORM OVERLOADED	Driving and boom functions are not possible while the Load Sensing System indicates the Platform is overloaded AND is configured to prevent drive and boom functions while the Platform is overloaded.	
828	82	8	LIFT UP & TELE OUT PREVENTED - PLATFORM OVER- LOADED	Lift up and telescope out are not possible while the Load Sensing System indicates the Platform is overloaded AND is configured to prevent Lift up and telescope out while the Platform is overloaded.	
830	83	0	<<< PLATFORM LEVELING >>>		
831	83	1	PLATFORM LEVELING OVERRIDE ON	Platform Leveling forced on with Access Level 0 selection.	
832	83	2	PLATFORM LEVELING OVERRIDE OFF	Platform Leveling forced off with Access Level 0 selection.	
833	83	3	PLATFORM LEVEL UP CRACKPOINT - NOT CALIBRATED	The Platform Level Up Valve Crackpoint has not been calibrated.	- Electronic leveling system equipped vehicles only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
834	83	4	PLATFORM LEVEL DOWN CRACKPOINT - NOT CALI- BRATED	The Platform Level Down Valve Crackpoint has not been calibrated.	- Electronic leveling system equipped vehicles only.
837	83	7	PLATFORM LEVEL SENSOR #1 - SHORT TO BATTERY	There is a Short to Battery to the Platform Level Sensor #1.	- Electronic leveling system equipped vehicles only.
838	83	8	PLATFORM LEVEL SENSOR #1 - SHORT TO GROUND OR OPEN CIRCUIT	There is a Short to Ground or an Open Circuit to the Platform Level Sensor #1.	- Electronic leveling system equipped vehicles only.
8311	83	11	PLATFORM LEVEL SENSOR #2 - SHORT TO BATTERY	There is a Short to Battery to the Platform Level Sensor #2.	- Electronic leveling system equipped vehicles only.
8312	83	12	PLATFORM LEVEL SENSOR #2 - SHORT TO GROUND OR OPEN CIRCUIT	There is a Short to Ground or an Open Circuit to the Platform Level Sensor #2.	- Electronic leveling system equipped vehicles only.
8313	83	13	PLATFORM LEVEL SENSOR #1 - REFERENCE VOLTAGE OUT OF RANGE	Platform Level Sensor #1 reverence voltage is outside acceptable range (4.9 to 5.1 volts).	- Electronic leveling system equipped vehicles only.
8314	83	14	PLATFORM LEVEL SENSOR #2 - REFERENCE VOLTAGE OUT OF RANGE	Platform Level Sensor #2 reverence voltage is outside acceptable range (4.9 to 5.1 volts).	- Electronic leveling system equipped vehicles only.
8315	83	15	PLATFORM LEVELING SENSOR - DISAGREEMENT	The Platform Leveling Sensors do not agree.	- Electronic leveling system equipped vehicles only.
8316	83	16	PLATFORM LEVEL SENSOR #1 - COMMUNICATIONS LOST	Platform Level Sensor #1 serial communication lost.	- 1200S and 1350S only.
8317	83	17	PLATFORM LEVEL SENSOR #2 - COMMUNICATIONS LOST	Platform Level Sensor #2 serial communication lost.	- 1200S and 1350S only.
8318	83	18	PLATFORM LEVELING SYSTEM TIMEOUT	The Platform was unable to maintain desired level within range for the allotted time.	
840	84	0	<<< ENVELOPE >>>		
841	84	1	BOOM ANGLE SENSOR DISAGREEMENT	There is a disagreement between the Boom Angle Sensors.	- Envelope Control equipped vehicles only.
842	84	2	BOOM LENGTH SWITCH FAILED	The Boom Length Switches are reporting the same state.	- Envelope Control equipped vehicles only.
843	84	3	BOOM LENGTH SWITCH/SENSOR DISAGREEMENT	There is a disagreement between the Boom Length Switch and the Boom Length Sensor.	- Envelope Control equipped vehicles only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
844	84	4	BOOM LENGTH SENSOR NOT DETECTING LENGTH CHANGE	The Boom Length Sensor is not changing during a boom telescope command.	- Envelope Control equipped vehicles only.
845	84	5	BOOM LENGTH SENSOR - OUT OF RANGE HIGH	Boom Length Sensor out of range high.	- Envelope Control equipped vehicles only. -1200/1350 only
846	84	6	BOOM LENGTH SENSOR - OUT OF RANGE LOW	Boom Length Sensor out of range low.	- Envelope Control equipped vehicles only. -1200/1350 only
847	84	7	BOOM LENGTH SENSOR - VALUE OUT OF RANGE HIGH	Boom Length out of range high.	- Envelope Control equipped vehicles only. -1200/1350 only
848	84	8	BOOM LENGTH SENSOR - VALUE OUT OF RANGE LOW	Boom Length out of range low.	- Envelope Control equipped vehicles only. -1200/1350 only
849	84	9	BOOM ANGLE SENSOR #1 - COMMUNICATIONS FAULT	Boom Angle Sensor #1 communications lost.	- Envelope Control equipped vehicles only.
8410	84	10	BOOM ANGLE SENSOR #2 - COMMUNICATIONS FAULT	Boom Angle Sensor #2 communications lost.	- Envelope Control equipped vehicles only.
8411	84	11	BOOM ANGLE SENSOR #1 - INVALID ANGLE	Boom Angle Sensor #1 out of range.	- Envelope Control equipped vehicles only.
8412	84	12	BOOM ANGLE SENSOR #2 - INVALID ANGLE	Boom Angle Sensor #2 out of range.	- Envelope Control equipped vehicles only.
8413	84	13	WRONG TELESCOPE RESPONSE	Boom telescope is moving in the opposite direction of the command.	- Envelope Control equipped vehicles only.
8414	84	14	WRONG LIFT RESPONSE	Boom lift is moving in the opposite direction of the command.	- Envelope Control equipped vehicles only.
8415	84	15	TOWER ANGLE SENSOR DISAGREEMENT	There is a disagreement between the Tower Angle Sensors.	- Envelope Control equipped vehicles only. -1250
8416	84	16	TOWER LENGTH SENSOR DISAGREEMENT	There is a disagreement between the Tower Length Sensors.	- Envelope Control equipped vehicles only. -1250
8417	84	17	MAIN ANGLE SENSOR DISAGREEMENT	There is a disagreement between the Main Boom Angle Sensors.	- Envelope Control equipped vehicles only. -1250
8418	84	18	TOWER LENGTH SENSOR #1 - OUT OF RANGE HIGH	Tower Boom Angle Sensor #1 out of range high.	- Envelope Control equipped vehicles only. -1250
8419	84	19	TOWER LENGTH SENSOR #1 - OUT OF RANGE LOW	Tower Boom Angle Sensor #1 out of range low.	- Envelope Control equipped vehicles only. -1250
8420	84	20	TOWER LENGTH SENSOR #2 - OUT OF RANGE HIGH	Tower Boom Angle Sensor #2 out of range high.	- Envelope Control equipped vehicles only. -1250

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
8421	84	21	TOWER LENGTH SENSOR #2 - OUT OF RANGE LOW	Tower Boom Angle Sensor #2 out of range low.	- Envelope Control equipped vehicles only. -1250
8422	84	22	TOWER LENGTH SENSOR - NOT DETECTING LENGTH CHANGE	The Tower Length Sensor is not changing during a tower telescope command.	- Envelope Control equipped vehicles only. -1250
8423	84	23	TOWER LENGTH MOVEMENT WITHOUT COMMAND	The Tower Length Sensor is changing without a tower telescope command.	- Envelope Control equipped vehicles only. -1250
8424	84	24	TOWER LENGTH SENSOR #1 - OUT OF RANGE HIGH	Tower Boom Angle Sensor #1 out of range high.	- Envelope Control equipped vehicles only. -1250
8425	84	25	TOWER LENGTH SENSOR #1 - OUT OF RANGE LOW	Tower Boom Angle Sensor #1 out of range low.	- Envelope Control equipped vehicles only. -1250
8426	84	26	TOWER LENGTH SENSOR #2 - OUT OF RANGE HIGH	Tower Boom Angle Sensor #2 out of range high.	- Envelope Control equipped vehicles only. -1250
8427	84	27	TOWER LENGTH SENSOR #2 - OUT OF RANGE LOW	Tower Boom Angle Sensor #2 out of range low.	- Envelope Control equipped vehicles only. -1250
8428	84	28	TOWER ANGLE SENSOR #1 - INVALID ANGLE	Tower Boom Angle Sensor #1 out of range.	- Envelope Control equipped vehicles only. -1250
8429	84	29	TOWER ANGLE SENSOR #2 - INVALID ANGLE	Tower Boom Angle Sensor #2 out of range.	- Envelope Control equipped vehicles only. -1250
8430	84	30	TOWER ANGLE SENSOR #1 - INVALID MODEL	Wrong Tower Boom Angle Sensor #1 installed.	- Envelope Control equipped vehicles only. - 1250AJP Only - Must be a Rieker Sensor, not a Spectron Sensor.
8431	84	31	TOWER ANGLE SENSOR #2 - INVALID MODEL	Wrong Tower Boom Angle Sensor #2 installed.	- Envelope Control equipped vehicles only. - 1250AJP Only - Must be a Rieker Sensor, not a Spectron Sensor.
8432	84	32	MAIN ANGLE SENSOR #1 - INVALID ANGLE	Main Boom Angle Sensor #1 out of range.	- Envelope Control equipped vehicles only. -1250
8433	84	33	MAIN ANGLE SENSOR #2 - INVALID ANGLE	Main Boom Angle Sensor #2 out of range.	- Envelope Control equipped vehicles only. -1250
8434	84	34	MAIN ANGLE SENSOR - NOT DETECTING ANGLE CHANGE	The Main Boom Angle Sensor is not changing during a main lift com- mand.	- Envelope Control equipped vehicles only. -1250

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
8435	84	35	MAIN ANGLE MOVEMENT WITHOUT CMD	The Main Boom Angle Sensor is changing with- out a main lift command.	- Envelope Control equipped vehicles only. -1250
8436	84	36	WRONG TOWER TELESCOPE RESPONSE	Tower telescope is moving in the opposite direction of the command.	- Envelope Control equipped vehicles only. -1250
8437	84	37	WRONG TOWER LIFT RESPONSE	Tower lift is moving in the opposite direction of the command.	- Envelope Control equipped vehicles only. -1250
8438	84	38	TOWER CYLINDER ANGLE SENSOR - OUT OF RANGE HIGH	The Tower Cylinder Angle Sensor is < 4721 A/D counts.	- Envelope Control equipped vehicles only. -1250
8439	84	39	TOWER CYLINDER ANGLE SENSOR - OUT OF RANGE LOW	The Tower Cylinder Angle Sensor is > 29535 A/D counts.	- Envelope Control equipped vehicles only. -1250
8440	84	40	TOWER CYLINDER ANGLE SENSOR - NOT DETECTING CHANGE	The Tower Cylinder Angle Sensor is not changing during a tower lift com- mand.	- Envelope Control equipped vehicles only. -1250
8441	84	41	TOWER CYLINDER ANGLE MOVEMENT WITHOUT COM- MAND	The Tower Cylinder Angle Sensor is changing with- out a tower lift command.	- Envelope Control equipped vehicles only. -1250
8442	84	42	MAIN TRANSPORT ANGLE SWITCH FAILED	The Main Boom Angle Switch is bad.	- Envelope Control equipped vehicles only. -1250
8443	84	43	TWR TRANSPORT SWITCH DISAGREEMENT	There is a disagreement between the Tower Boom Length Switch and the Tower Length Sensor.	- Envelope Control equipped vehicles only. -1250
8444	84	44	TRANSPORT DUAL CAPACITY SWITCHES BAD	Both the Dual Capacity Switch and the Transport Switch are bad.	- Envelope Control equipped vehicles only. -1250
8445	84	45	TRANSPORT DUAL CAPACITY BAD TRANSITION	The Dual Capacity Switch and the Transport Switch changed state out of order.	- Envelope Control equipped vehicles only. -1250
8446	84	46	MAIN TRANSPORT LENGTH SWITCH DISAGREEMENT	There is a disagreement between the Main Boom Transport Length Switches.	- Envelope Control equipped vehicles only. -1250
8447	84	47	MAIN DUAL CAPACITY LENGTH SWITCH DISAGREEMENT	There is a disagreement between the Main Boom Dual Capacity Length Switches.	- Envelope Control equipped vehicles only. -1250
8448	84	48	MAIN TRANSPORT ANGLE SWITCH/SENSOR DISAGREE- MENT	There is a disagreement between the Main Boom Angle Switch and the Main Boom Angle Sensor.	- Envelope Control equipped vehicles only. -1250

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
8449	84	49	TOWER CYLINDER ANGLE SWITCH/SENSOR DISAGREE- MENT	There is a disagreement between the Tower Boom Angle Switch and the Tower Cylinder Angle Sensor.	- Envelope Control equipped vehicles only. -1250
8450	84	50	NEW MAIN ANGLE SENSOR #1 DETECTED	A new Main Angle Sensor 1 has been detected.	-1250
8451	84	51	NEW MAIN ANGLE SENSOR #2 DETECTED	A new Main Angle Sensor 2 has been detected.	-1250
8452	84	52	TOWER LENGTH SWITCH/SENSOR DISAGREEMENT	There is a disagreement between the Tower Length Switch and the Tower Length Sensor.	- Envelope Control equipped vehicles only. -1250
8453	84	53	WRONG MAIN TELE RESPONSE	Main telescope is moving in the opposite direction of the command.	- Envelope Control equipped vehicles only. -1250
8454	84	54	WRONG MAIN LIFT RESPONSE	Main lift is moving in the opposite direction of the command.	- Envelope Control equipped vehicles only. -1250
8482	84	82	TOWER ENVELOPE MASSIVELY ENCROACHED	Х	
8483	84	83	TOWER ENVELOPE MULTIPLE ENCROACHMENTS	Х	
8484	84	84	BCS VIOLATION - BOOM LOCKED	Х	
8485	84	85	BCS - HYDRAULIC RETRIEVAL ACTIVE	Х	
8486	84	86	BCS - ELECTRICAL RETRIEVAL ACTIVE	Х	
8487	84	87	BCS - MULTIPLE FAILURES ACTIVE	Х	
850	85	0	<<< MOMENT/LOAD PINS >>>		
851	85	1	MOMENT PIN - HORIZONTAL FORCE OUT OF RANGE	The Moment Pin horizontal force is out of range.	
852	85	2	MOMENT PIN - VERTICAL FORCE OUT OF RANGE	The Moment Pin vertical force is out of range.	
853	85	3	LOAD PIN - HORIZONTAL FORCE OUT OF RANGE	The Load Pin horizontal force is out of range.	-1250
854	85	4	LOAD PIN - VERTICAL FORCE OUT OF RANGE	The Load Pin vertical force is out of range.	-1250
855	85	5	MOMENT PIN - SENSOR FAULT	The Moment Pin has reported a fault.	
856	85	6	LOAD PIN - SENSOR FAULT	The Load Pin has reported a fault.	-1250
857	85	7	NEW MOMENT PIN DETECTED	A new Moment Pin has been detected.	
858	85	8	NEW LOAD PIN DETECTED	A new Load Pin has been detected.	-1250
859	85	9	LOAD PIN/TOWER LIFT CYLINDER ANGLE DISAGREE- MENT	There is a disagreement between the Load Pin and the Tower Lift cylinder Angle.	-1250

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
8510	85	10	LOAD PIN - FORCE VALUES NOT CHANGING	The Load Pin is not changing.	-1250
8511	85	11	LOAD PIN - FORCE TOO LOW OVER TOWER ANGLE CHANGE	Х	-1250
8512	85	12	LOAD PIN - FORCE TOO LOW OVER MAIN ANGLE CHANGE	Χ	-1250
8513	85	13	LOAD PIN - FORCE TOO LOW OVER MAIN LENGTH TRAN- SITION	Х	-1250
860	86	0	<<< STEERING/AXLE>>>		
861	86	1	RESTRICTED TO TRANSPORT - OSCILLATING AXLE PRESSURE SWITCH DISAGREEMENT	The Oscillating Axle Pressure Switch indicates pressure while not driving or does not indicate pressure while driving and restricted to transport.	- Electrically released Oscil lated Axles equipped vehi- cles only.
862	86	2	AXLE EXTEND VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Axle Extend Valve.	
863	86	3	AXLE EXTEND VALVE - SHORT TO GROUND	There is a Short to Ground to the Axle Extend Valve.	
864	86	4	AXLE RETRACT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Axle Retract Valve.	
865	86	5	AXLE RETRACT VALVE - SHORT TO GROUND	There is a Short to Ground to the Axle Retract Valve.	
866	86	6	RIGHT FRONT STEER RIGHT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Right Front Steer Right Valve.	
867	86	7	RIGHT FRONT STEER RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the Right Front Steer Right Valve.	
868	86	8	RIGHT FRONT STEER LEFT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Right Front Steer Left Valve.	
869	86	9	RIGHT FRONT STEER LEFT VALVE - SHORT TO GROUND	There is a Short to Ground to the Right Front Steer Left Valve.	
8610	86	10	LEFT FRONT STEER RIGHT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Left Front Steer Right Valve.	
8611	86	11	LEFT FRONT STEER RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the Left Front Steer Right Valve.	
8612	86	12	LEFT FRONT STEER LEFT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Left Front Steer Left Valve.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
8613	86	13	LEFT FRONT STEER LEFT VALVE - SHORT TO GROUND	There is a Short to Ground to the Left Front Steer Left Valve.	
8614	86	14	RIGHT REAR STEER RIGHT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Right Rear Steer Right Valve.	
8615	86	15	RIGHT REAR STEER RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the Right Rear Steer Right Valve.	
8616	86	16	RIGHT REAR STEER LEFT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Right Rear Steer Left Valve.	
8617	86	17	RIGHT REAR STEER LEFT VALVE - SHORT TO GROUND	There is a Short to Ground to the Right Rear Steer Left Valve.	
8618	86	18	LEFT REAR STEER RIGHT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Left Rear Steer Right Valve.	
8619	86	19	LEFT REAR STEER RIGHT VALVE - SHORT TO GROUND	There is a Short to Ground to the Left Rear Steer Right Valve.	
8620	86	20	LEFT REAR STEER LEFT VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	There is a Short to Battery or an Open Circuit to the Left Rear Steer Left Valve.	
8621	86	21	LEFT REAR STEER LEFT VALVE - SHORT TO GROUND	There is a Short to Ground to the Left Rear Steer Left Valve.	
8622	86	22	FRONT RIGHT STEER SENSOR - DECOUPLED	The Front Right Steer Sensor has become decoupled.	
8623	86	23	FRONT LEFT STEER SENSOR - DECOUPLED	The Front Left Steer Sensor has become decoupled.	
8624	86	24	REAR RIGHT STEER SENSOR - DECOUPLED	The Rear Right Steer Sensor has become decoupled.	
8625	86	25	REAR LEFT STEER SENSOR - DECOUPLED	The Rear Left Steer Sensor has become decoupled.	
8626	86	26	FRONT LEFT STEER SENSOR - NOT RESPONDING	The Front Right Steer Sensor is not responding to steer commands.	
8627	86	27	FRONT RIGHT STEER SENSOR - NOT RESPONDING	The Front Left Steer Sensor is not responding to steer commands.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
8628	86	28	REAR LEFT STEER SENSOR - NOT RESPONDING	The Rear Right Steer Sensor is not responding to steer commands.	
8629	86	29	REAR RIGHT STEER SENSOR - NOT RESPONDING	The Rear Left Steer Sensor is not responding to steer commands.	
8630	86	30	FRONT RIGHT STEER SENSOR - SHORT TO GROUND OR OPEN CIRCUIT	There is a Short to Ground or an Open Circuit to the Front Right Steer Sensor.	
8631	86	31	FRONT RIGHT STEER SENSOR - SHORT TO BATTERY	There is a Short to Battery to the Front Right Steer Sensor.	
8632	86	32	FRONT LEFT STEER SENSOR - SHORT TO GROUND OR OPEN CIRCUIT	There is a Short to Ground or an Open Circuit to the Front Left Steer Sensor.	
8633	86	33	FRONT LEFT STEER SENSOR - SHORT TO BATTERY	There is a Short to Battery to the Front Left Steer Sensor.	
8634	86	34	REAR RIGHT STEER SENSOR - SHORT TO GROUND OR OPEN CIRCUIT	There is a Short to Ground or an Open Circuit to the Rear Right Steer Sensor.	
8635	86	35	REAR RIGHT STEER SENSOR - SHORT TO BATTERY	There is a Short to Battery to the Rear Right Steer Sensor.	
8636	86	36	REAR LEFT STEER SENSOR - SHORT TO GROUND OR OPEN CIRCUIT	There is a Short to Ground or an Open Circuit to the Rear Left Steer Sensor.	
8637	86	37	REAR LEFT STEER SENSOR - SHORT TO BATTERY	There is a Short to Battery to the Rear Left Steer Sensor.	
8651	86	51	ENGINE SHUTDOWN - AXLE LOCKOUT VALVE FAULT	Engine Start is prevented while there is an Oscillat- ing Axle fault and vehicle is out of transport position	
990	99	0	<<< HARDWARE >>>		
998	99	8	EEPROM FAILURE - CHECK ALL SETTINGS	The Ground Module has reported an EEPROM failure.	
9910	99	10	FUNCTIONS LOCKED OUT - PLATFORM MODULE SOFT- WARE VERSION IMPROPER	The Platform Module soft- ware version is not com- patible with the rest of the system.	
9914	99	14	PLATFORM MODULE SOFTWARE UPDATE REQUIRED	The Platform Module software requires an updated.	
9915	99	15	CHASSIS TILT SENSOR NOT GAIN CALIBRATED	The Chassis Tilt Sensor gain calibration has been lost.	

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
9916	99	16	CHASSIS TILT SENSOR GAIN OUT OF RANGE	The Chassis Tilt Sensor gain calibration has become corrupted.	
9917	99	17	HIGH RESOLUTION A2D FAILURE - INTERRUPT LOST	The Platform Module has reported that its ADS1213 chip has stopped asserting its interrupt.	
9918	99	18	HIGH RESOLUTION A2D FAILURE - REINIT LIMIT	The Platform Module has reported that its ADS1213 chip had to be reset 3 or more times.	
9919	99	19	GROUND SENSOR REF VOLTAGE OUT OF RANGE	The Ground Module has reported that its sensor reference voltage is outside acceptable range.	- Not reported during power-up.
9920	99	20	PLATFORM SENSOR REF VOLTAGE OUT OF RANGE	The Platform Module has reported that its sensor reference voltage is outside acceptable range.	- Not reported during power-up.
9921	99	21	GROUND MODULE FAILURE - HIGH SIDE DRIVER CUTOUT FAULTY	The Ground Module has reported that its high side driver cutout failed.	
9922	99	22	PLATFORM MODULE FAILURE - HWFS CODE 1	The Platform Module has reported that the V(Low) FET has failed.	
9923	99	23	GROUND MODULE FAILURE - HWFS CODE 1	The Ground Module has reported that the V(Low) FET has failed.	
9925	99	25	FUNCTIONS LOCKED OUT - CHASSIS MODULE SOFT- WARE VERSION IMPROPER	The Chassis Module soft- ware version is not com- patible with the rest of the system.	
9926	99	26	FUNCTIONS LOCKED OUT - BLAM MODULE SOFTWARE VERSION IMPROPER	The BLAM software version is not compatible with the rest of the system.	
9927	99	27	GROUND MODULE CONSTANT DATA UPDATE REQUIRED	The Ground Module constant data requires an updated.	
9928	99	28	ENVELOPE CONTROL DISABLED	Envelope Control has been disabled by the user from Access Level 0.	- Envelope Control equipped vehicles only.
9929	99	29	MOMENT CONTROL DISABLED	Moment Control has been disabled by the user from Access Level 0.	- Envelope Control equipped vehicles only.
9930	99	30	STEER SENSORS NOT CALIBRATED	The Steer Sensors have not been calibrated.	- Chassis Module equipped vehicles only.
9931	99	31	BOOM SENSORS NOT CALIBRATED	The Boom Sensors have not been calibrated.	- BLAM equipped vehicles only.

Table 6-6. Diagnostic Trouble Code Chart

DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
9932	99	32	LIFT CRACKPOINTS NOT CALIBRATED	The Lift Valves have not been calibrated.	- 1200S and 1350S only.
9933	99	33	TELESCOPE CRACKPOINTS NOT CALIBRATED	The Telescope Valves have not been calibrated.	- 1200S and 1350S only.
9934	99	34	DRIVE CRACKPOINTS NOT CALIBRATED	The Drive Valves have not been calibrated.	- 1200S and 1350S only.
9935	99	35	BLAM SENSOR SUPPLY OUT OF RANGE HIGH	The Boom Angle Sensors supply voltage is high.	- BLAM equipped vehicles only.
9936	99	36	BLAM SENSOR SUPPLY OUT OF RANGE LOW	The Boom Angle Sensors supply voltage is low.	- BLAM equipped vehicles only.
9937	99	37	LENGTH SENSOR REF VOLTAGE HIGH	The Boom Length Sensors supply voltage is high.	
9938	99	38	LENGTH SENSOR REF VOLTAGE LOW	The Boom Length Sensors supply voltage is low.	
9939	99	39	BLAM HIGH RES A/D FAILURE	The BLAM high resolution analog to digital converter has failed.	- BLAM equipped vehicles only.
9940	99	40	CHASSIS SENSOR SUPPLY OUT OF RANGE HIGH	The Chassis Sensors supply voltage is high.	
9941	99	41	CHASSIS SENSOR SUPPLY OUT OF RANGE LOW	The Chassis Sensors supply voltage is low.	
9942	99	42	BLAM BACKUP COMMUNICATIONS LINK FAULTY	The BLAM backup com- munications link test was activated at startup, but no communication con- nection established/ maintained.	- BLAM equipped vehicles only. -1250
9943	99	43	BLAM BACKUP COMMUNICATIONS LOST - HYDRAULICS SUSPENDED	The BLAM backup communications link was activated, but no communication connection established/maintained.	- BLAM equipped vehicles only. -1250
9944	99	44	CURRENT FEEDBACK GAINS OUT OF RANGE	The factory set current feedback gains are out of range.	
9945	99	45	CURRENT FEEDBACK CALIBRATION CHECKSUM INCORRECT	The factory set current feedback checksum is not correct.	

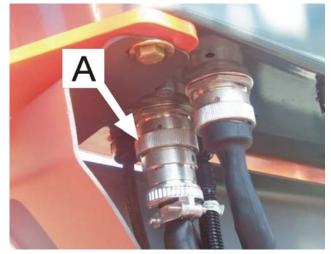
Table 6-6. Diagnostic Trouble Code Chart

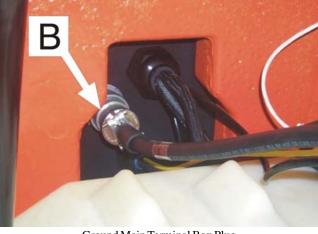
DTC	Flash Code	Sequence	Fault Message	Fault Description	Check
9975	99	75	LOAD PIN NOT CALIBRATED	The Load Pin has not been calibrated.	-1250
9979	99	79	FUNCTIONS LOCKED OUT - GROUND MODULE SOFT- WARE VERSION IMPROPER	Temporary fault for the telematics project. The model needs to be a 600S or 1350S if not this fault will be generated and Platform controls will be prevented. This fault was to insure that the software will only work for these two models.	

6.20 CANBUS TROUBLESHOOTING

The PLATFORM MODULE and the CHASSIS MODULE have "Terminator Resistors" located inside the modules, these resistors squelch high speed signal reflections in the CANbus transmission lines. The value of the terminators is determined by wire properties, this includes the type of insulation and geometry, combined to determine the perfect value for bus termination. Improper values or

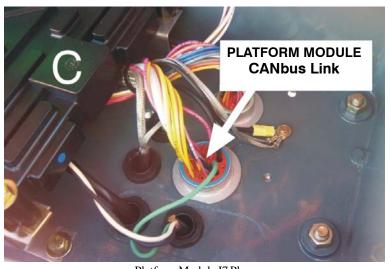
missing terminators allow bus ringing. A complete CANbus circuit (wired in parallel) is approximately 60 Ohms at the "T" fitting inside the Ground Station or at the Boom Length & Angle Module. Each individual circuit from their respective Module should read approximately 120 Ohm. For CANbus connections, refer to Figure 6-25., Figure 6-25., Figure 6-26., Figure 6-27., and Figure 6-28.





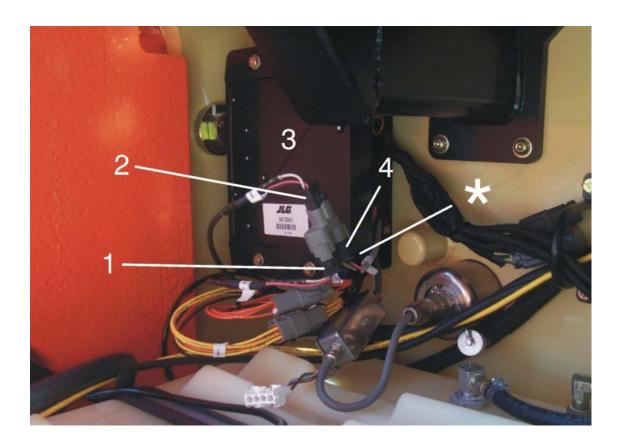
Platform Plug

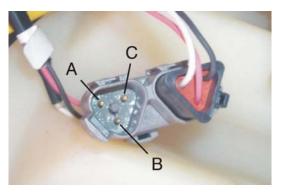
Ground Main Terminal Box Plug



Platform Module J7 Plug

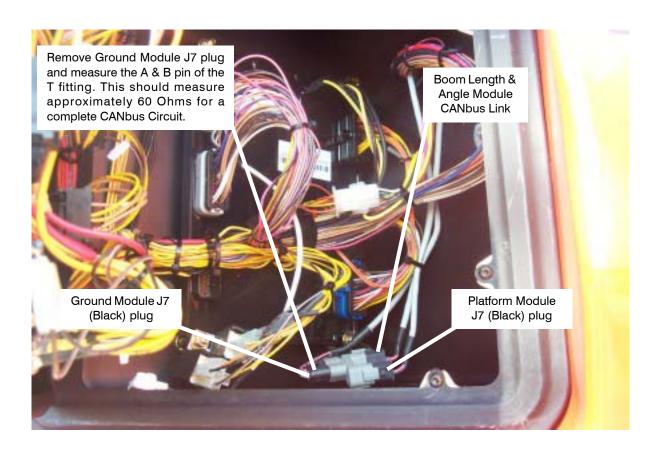
Figure 6-25. CANbus Connections - Sheet 1 of 4





- 1. Chassis Module CANbus Link
- 2. Ground Module CANbus Link
- 3. Boom Length & Angle Module
- 4. BLAM J1 (Gray) Plug
- * Remove BLAM J1 Plug and measure the A & B pin of the T fitting. This should measure approximately 60 Ohms for a complete CANbus Circuit.

Figure 6-26. CANbus Connections - Sheet 2 of 4



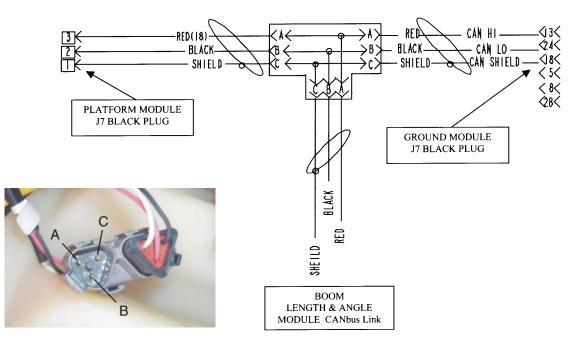
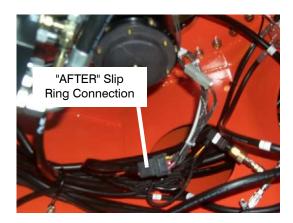


Figure 6-27. CANbus Connections - Sheet 3 of 4





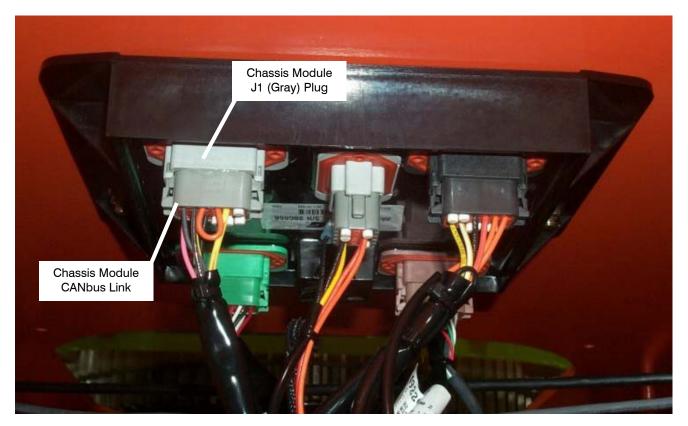


Figure 6-28. CANbus Connections - Sheet 4 of 4

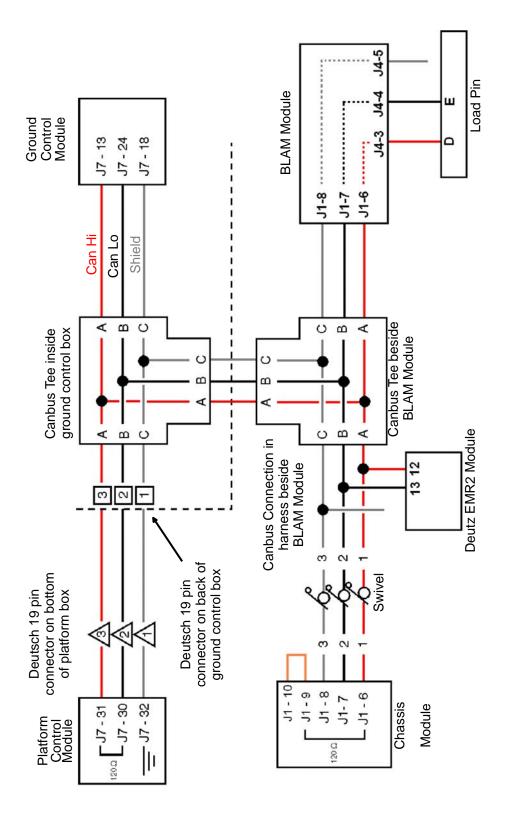


Figure 6-29. CANbus Circuit

CANbus Communication Failure

If a problem in the CANbus system is suspected, use the following step-by-step procedure to verify which part of the CANbus communication system has failed.

CANBUS LINK FROM THE PLATFORM MODULE LOST

1. Position the Platform/Ground select switch to the Ground position.

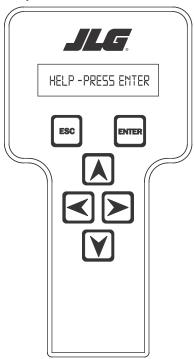


Plug the analyzer into the connector inside the Ground control box.

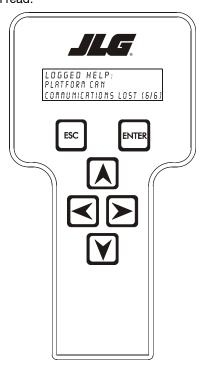


3. Pull out the Emergency Stop switch.

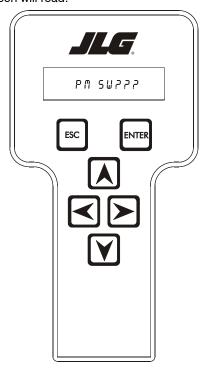
4. The analyzer screen should read:



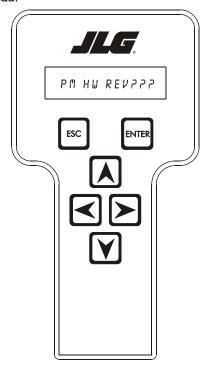
5. Press enter twice to reach Logged Help. The screen will read:



7. If the CANbus link from the platform module is lost, you will see the Ground Module SW version, Ground Module HW version, Ground Module SN, BM SW version, Chassis SW version, Platform Module SN, but you will not see the Platform Module SW version or the Platform Module HW version. The Analyzer screen will read:



8. Hit the right arrow button once. The screen will read:



TROUBLESHOOTING: PLATFORM CAN COMMUNICATIONS LOST

NOTE: PLATFORM CAN COMMUNICATIONS LOST (6/6) (Help Fault Code 6-6) basically means all communication linked to the Platform Module is lost. This does not mean that the Platform Module Link only is affected, this means the communication link between the Platform Module down to the Chassis Module has been broken, therefore all Canbus links have to be checked. Remember this link is wired in parallel, so the Ground Module has lost all MSA communication.

Table 6-7. Troubleshooting: Platform Can Communications Lost

STE P	ACTION REQUIRED	SPEC	YES	NO	
1	Install the Analyzer at the ground station, scroll to the "Diagnostics" sub level menu, press "enter" then scroll to the "Versions" menu item press "enter" and view the screen, reference the Diagnostics / Version Chart to assist you in determining which module has lost it's communication link. In some cases the module that shows up with a question may be defective if all other CANbus links check OK.	See Diagnostics / Version Chart	See step 2	See step 2	
2	Disconnect the Ground Module J7 deutsche plug connection at the "T" fitting inside of the ground control station. Perform an ohms check at the "A" and "B" pins of the "T" fitting. Inspect the shield wire "C" for shorts.	Approximately 60 ohms.	CANbus circuit is complete. Platform Module suspected defective	Reconnect plug and go to step 3	
3	Make sure the CANbus link wires are installed correctly at the Platform Module.	See Electrical Schematic in Section 7	Go to step 4	Wire per Electrical Sche- matic	
4	Disconnect the platform cannon plug and ground cannon plug that holds the CANbus link. Red (3) Black (2) and Shield (1) perform a continuity test.	Continuity	Reconnect plug and go to step 5	Repair or replace plat- form harness.	
5	Disconnect the deutsche plug connection from the Platform Module at the "T" fitting inside of the ground station. Perform an ohms check at the "A" and "B" sockets of the deutsche plug. Inspect the shield wire "C" for shorts.	Approximately 120 ohms.	Reconnect plug and go to step 6	Suspected defective Plat- form Module.	
6	Inspect the Platform Module harness connection at the ground cannon plug and at the "T"' fitting inside of the ground control station.	Continuity	Reconnect harness and go to step 7	Repair or replace harness inside the ground control station.	
7	Disconnect the deutsche plug connection from the Boom Length & Angle Module at the "T' fitting inside of the ground station. Perform an ohms check at the "A" and "B" sockets of the deutsche plug. Inspect the shield wire "C" for shorts.	Approximately 120 ohms	Reconnect plug and go to step 8	Verify step 7, inspect the BLAM to Ground Module harness connection s at both "T" fitting connections for proper continuity and correct wiring per Electrical schematic.	
8	Disconnect all deutsche plug connections at the "T" fitting in the ground station and the BLAM, perform a continuity test on all "A" "B" and "C" pins use the singular end of the fitting and cross probe the corresponding letters of the other two connections.	Continuity (NO OHM VALUES)	Reconnect all deutsche plugs at the "T" fitting and go to step 9	Replace defective "T" fit- ting plug.	
9	Disconnect the Chassis Module deutsche plug at the "T' fitting below the Boom Length & Angle Module. Perform an ohms check at the "A" and "B" sockets of the deutsche plug. Inspect the shield wire "C" for shorts.	Approximately 120 ohms	Reconnect deutsche plug and go to step 10	Inspect the harness from the "T" fitting at the BLAM to the Chassis Module plug connection at the battery. Assure proper continuity and correct wiring per Electrical Schematic.	

Table 6-7. Troubleshooting: Platform Can Communications Lost

STE P	ACTION REQUIRED	SPEC	YES	NO
10	Disconnect the Chassis Module connection at the right side of the battery at the turntable lock pin. Perform an ohms check at the #1 and #2 connections of the plug. Inspect shield wire #3 for possible short.	Approximately 120 ohms	Reconnect plug and go to step 11	Inspect the harness from the slip ring connections at the top and bottom plug connections of the swivel. Assure proper continuity and correct wiring per Electrical Schematic.
11	Disconnect the Chassis Module connection below the swivel under the machine. Perform an ohms check at the #1 and #2 connections of the plug that is routed to the Chassis Module. Inspect shield wire #3 for possible short.	Approximately 120 ohms	Reconnect plug and go to step 12	Inspect the harness from the bottom of the swivel into the Chassis Module. Assure proper continuity and wiring r schematic 1870149A.
12	Make sure the Chassis Module CANbus link wires are installed correctly at the plug near the battery, the plug below the swivel and 31 plug at the Chassis Module.	Electrical Schematic	Stop	Replace the Chassis Module.

CANBUS LINK FROM THE GROUND MODULE LOST

1. Position the Platform/Ground select switch to the Ground position.

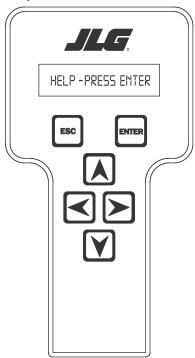


2. Plug the analyzer into the connector inside the Ground control box.

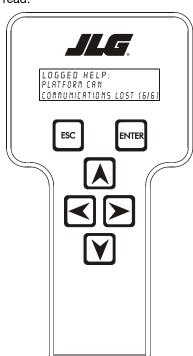


3. Pull out the Emergency Stop switch.

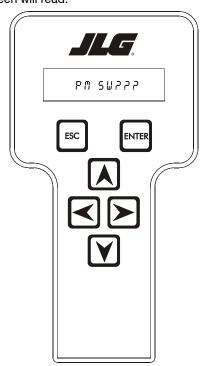
4. The analyzer screen should read:



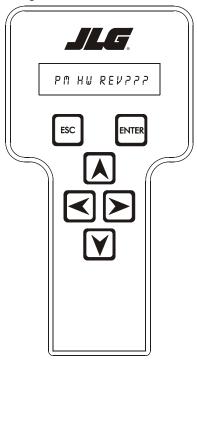
5. Press enter twice to reach Logged Help. The screen will read:



7. If the CANbus link from the ground module is lost, you will see the Ground Module SW version, Ground Module HW version, Ground Module SN, BM SW version, Chassis SW version, Platform Module SN, but you will not see the Platform Module SW version or the Platform Module HW version. The Analyzer screen will read:



8. Hit the right arrow button once. The screen will read:



CANBUS LINK FROM THE BOOM LENGTH & ANGLE MODULE (BLAM) LOST

 Position the Platform/Ground select switch to the Ground position.

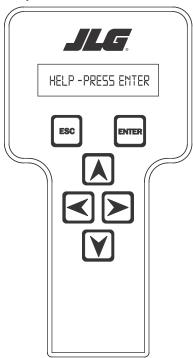


Plug the analyzer into the connector inside the Ground control box.

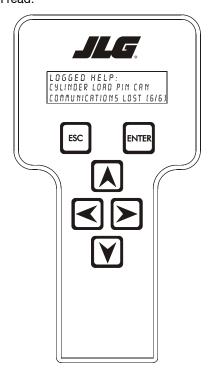


3. Pull out the Emergency Stop switch.

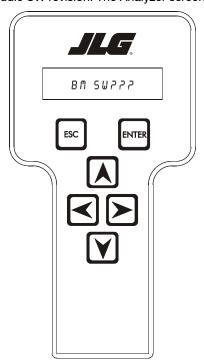
4. The analyzer screen should read:



5. Press enter twice to reach Logged Help. The screen will read:



7. If the CANbus link from the Boom Length & Angle Module is lost, you will see the Platform Module SW version, Platform Module HW Rev, Platform Module SN, Ground Module SW version, Ground Module HW Revision, Ground Module SN, Chassis SW version, but you will not see the Boom Length & Angle Module SW revision. The Analyzer screen will read:



TROUBLESHOOTING: BLAM CAN COMMUNICATIONS LOST

NOTE: BLAM CAN COMMUNICATIONS LOST (6/6) (Help Fault Code 6-6) basically means all communication linked from the Ground Module to the Boom Length &: Angle Module is lost. This also includes the lift cylinder load moment pin as well.

Table 6-8. Troubleshooting: BLAM Can Communications Lost

STE P	ACTION REQUIRED	SPEC	YES	NO
1	Install the Analyzer at the ground station, scroll to the "Diagnostics" sub level menu, press "enter" then scroll to the "Versions" menu item press "enter" and view the screen, reference the Diagnostics / Version Chart to assist you in determining which module has lost it's communication link. In some cases the module that shows up with a question may be defective if all other CANbus links check OK.	See Diagnostics / Version Chart	See step 2	See step 2
2	Disconnect the BLAM J 1 deutsche plug connection at the "T" fitting just above the fuel tank. Perform an ohms check at the "A" and "B" pins of the "T" fitting. Inspect the shield wire "C" for possible short.	Approximately 60 ohms.	CANbus circuit is complete. BLAM suspected defective.	Reconnect plug and go to step 3
3	Disconnect the Ground Module deutsche plug from "T" fitting at the BLAM above the fuel tank. Perform an ohm check at the "A" and "B" sockets of the deutsche plug. Inspect the shield wire "C" for possible short.	Approximately 120 Ohms	Reconnect harness and go to step 4	Repair or replace the Ground Module to BLAM harness.
4	Verify the CANbus link signal wires are installed correctly at the 'T" fitting at the Ground Module.	Electrical Schematic	Reconnect plug and go to step 5	Wire per Electrical Sche- matic
5	Verify the lift cylinder load moment harness has good continuity and wired correctly at the J4 plug on the BLAM.	Continuity	Reconnect plug and go to step 6	Repair or replace Chassis Module harness.
6	Disconnect the Chassis Module plug connection at the battery and perform an ohm check at the #1 and #2 socket of the deutsche plug. Inspect the shield wire #3 for possible short.	Approximately I 20 Ohms	Reconnect plug and stop	Inspect harness and connections to the Chassis Module.

CANBUS LINK FROM THE CHASSIS MODULE LOST

1. Position the Platform/Ground select switch to the Ground position.

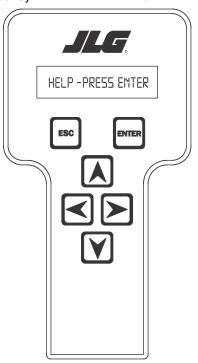


2. Plug the analyzer into the connector inside the Ground control box.

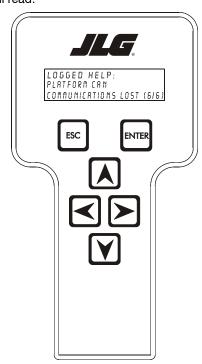


3. Pull out the Emergency Stop switch.

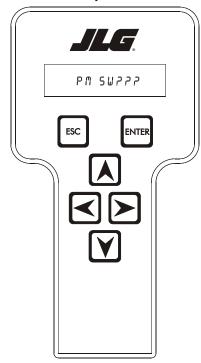
4. The analyzer screen should read:



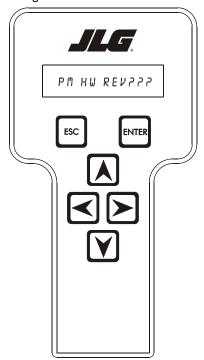
5. Press enter twice to reach Logged Help. The screen will read:



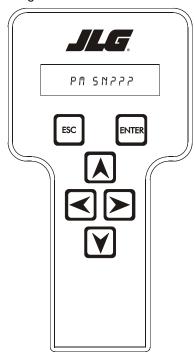
7. If the CANbus link from the Chassis Module is lost, you will NOT see the Platform Module SW version, Platform Module HW rev, Platform Module SN, Chassis SW version, Boom Length & Angle Module SW version, but you WILL see the Ground Module SW version, Ground Module HW rev, and the Ground Module SN. The analyzer screen will read:



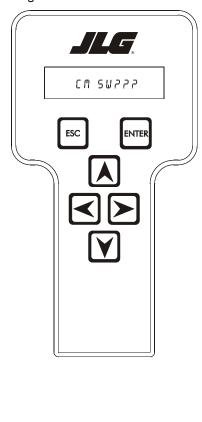
8. Hit the right arrow button once. The screen will read:



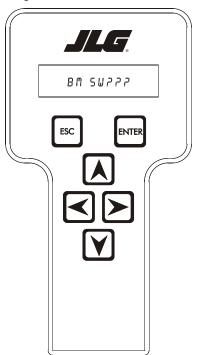
9. Hit the right arrow button once. The screen will read:



10. Hit the right arrow button once. The screen will read:



11. Hit the right arrow button once. The screen will read:



TROUBLESHOOTING: CHASSIS CAN COMMUNICATIONS LOST

NOTE: CHASSIS CAN COMMUNICATIONS LOST (6/6) (Help Fault Code 6-6) basically means all communication linked from the Ground Module to the Chassis Module is lost.

Table 6-9. Troubleshooting: Chassis Can Communications Lost

STE P	ACTION REQUIRED	SPEC	YES	NO
1	Install the Analyzer at the ground station, scroll to the "Diagnostics" sub level menu, press "enter" then scroll to the "Versions" menu item press "enter" and view the screen, reference the Diagnostics / Version Chart to assist you in determining which module has lost it's communication link. In some cases the module that shows up with a question may be defective if all other CANbus links check OK.	See Diagnostics / Version Chart	See step 2	See step 2
2	Disconnect the BLAM J1 deutsche plug connection at the "T" fitting just above the fuel tank. Perform an ohms check at the "A" and "B" pins of the "T" fitting. Inspect the shield wire "C" for possible short.	Approximately 60 ohms.	CANbus circuit is complete. Chassis Module suspected defective.	Reconnect plug and go to step 3
3	Disconnect the Chassis Module communication harness from the BLAM "T" fitting and Chassis Module plug connection at the battery. Perform a continuity test.	Continuity	Reconnect harness and go to step 4	Repair or replace BLAM and Chassis Module harness.
4	Verify the CANbus link signal wires are installed correctly at the Chassis Module plug connection at the battery and at the plug below the swivel.	Electrical Schematic	Reconnect plug and go to step 6	Wire per Electrical Sche- matic
5	Verify continuity at the Chassis Module harness from the plug connection at the battery down to the plug connection below the swivel.	Continuity	Reconnect plug and go to step 6	Repair or replace Chassis Module harness.
6	Disconnect the Chassis Module plug connection below the swivel and perform an ohms check at the #1 and #2 of the plug. Inspect the shield wire #3 plug connection for possible short.	Approximately 120 Ohms	Stop	Replace Chassis Module

Load Moment Pin Troubleshooting

The following Troubleshooting Charts outline diagnostic measures to be taken to diagnose problems within the Load Moment Pin portion of the JLG Control System. If

necessary, refer to Section 4 for information concerning replacement of the Load Moment Pin.

Table 6-10. Load Moment Pin Troubleshooting: Can Communications Lost

STE P	FAULT CODE/SYMPTOM	REPAIR	YES	NO
1	6/6 CYLINDER LOAD PIN CAN COMMUNICA- TIONS LOST	Check for correct and tight wire connections at the deutsch and phoenix connectors of the Load Sensing Pin harness and perform a continuity check.	Go to step 2	Replace harness. (4922826)
2		Check for loose pins in the potting of the Boom Length & Angle Module J4 connection.	Replace the BLAM & Perform the Boom Sensor calibration process.	Go to step 3
3		Inspect the CANbus link "T" fit- ting connections at the BLAM & Ground Module. Are the fittings dry?	Go to step 4	Replace "T" fitting con- nector. (4460945)
4		Inspect the CANbus link "T" fit- ting connections at the BLAM & Ground Module. Perform a con- tinuity check.	Go to step 5	Replace "T" fitting con- nector. (4460945)
5		Check the J1 and J4 plug con- nections on the BLAM, make sure the notched plugs line up with the plug sockets correctly.	Go to step 6	Position plug correctly.
6		Use the Analyzer, scroll – + to the DIAGNOSTICS menu, press ENTER, then scroll to the MOMENT menu, and press ENTER, check to see if Actual/Over/Under moment values are registering on the screen display.	Go to step 7	Replace the load moment pin. & Perform the Boom Sensor calibration process.
7		If the problem still exists, verify steps 1-6 again before contacting the JLG Service Dept.		Replace the load moment pin. & Perform the Boom Sensor calibration process.

Table 6-11. Load Moment Pin Troubleshooting: Moment Pin Horizontal Force Out of Range

STE P	FAULT CODE/SYMPTOM	REPAIR	YES	NO
1	8/6 MOMENT PIN HORIZONTAL FORCE OUT OF RANGE The horizontal force is out of allowed range.	Check to see if the platform is overloaded in the vertical position. Check the rated capacity requirement.	Remove excess weight	Go to step 2
2		Check to see if any additional accessories have been added to the platform without proper calibration.	Perform the Boom Sensor calibration process.	Go to step 3
3		Perform the BCS daily check procedure to make sure the boom sections are stopping correctly at the witness marks matching their capacity selection.	Go to step 4	Perform the Boom Sensor calibration process.
4		Inspect the job the machine is performing, making sure that there is no additional force applied when the boom sections are in the horizontal position. Also consider weather conditions (Wind).	Go to step 5	Position machine correctly.
5		Use the Analyzer, scroll to the DIAGNOSTICS menu, press ENTER, then scroll to the MOMENT menu, and press ENTER, check to see if Actual/Over/Under moment values are registering on the screen display.	Go to step 6	Replace the load moment pin. & Perform the Boom Sensor calibration process.
6		If the problem still exists, verify steps 1-5 again before contacting the JLG Service Dept.		Replace the load moment pin. & Perform the Boom Sensor calibration process.

Table 6-12. Load Moment Pin Troubleshooting: Moment Pin Vertical Force Out of Range

STE P	FAULT CODE/SYMPTOM	REPAIR	YES	NO
1	8/6 MOMENT PIN VERTICAL FORCE OUT OF RANGE The vertical force is out of allowed range.	Check to see if the platform is overloaded in the vertical position. Check the rated capacity requirement.	Remove excess weight	Go to step 2
2		Check to see if any additional accessories have been added to the platform without proper calibration.	Perform the Boom Sensor calibration process.	Go to step 3
3		Perform the BCS daily check procedure to make sure the boom sections are stopping correctly at the witness marks matching their capacity selection.	Go to step 4	Perform the Boom Sensor calibration process.
4		Inspect the job the machine is performing, making sure that there is no additional force applied when the boom sections are in the horizontal position. Also consider weather conditions (Wind).	Go to step 5	Position machine correctly.
5		Use the Analyzer, scroll to the DIAGNOSTICS menu, press ENTER, then scroll to the MOMENT menu, and press ENTER, check to see if Actual / Over/Under moment values are registering on the screen display.	Go to step 6	Replace the load moment pin. & Perform the Boom Sensor calibration process.
6		If the problem still exists, verify steps 1-5 again before contacting the JLG Service Dept.		Replace the load moment pin. & Perform the Boom Sensor calibration process.

Table 6-13. Load Moment Pin Troubleshooting: Moment Pin Sensor Fault

STE P	FAULT CODE/SYMPTOM	REPAIR	YES	NO
1	8/6 MOMENT PIN SENSOR FAULT The moment pin has reported a fault flag	Use the Analyzer, scroll to the DIAGNOSTICS menu, press ENTER, then scroll to the MOMENT menu, and press ENTER, check to see if PIN E FLAGS has any numbers on the screen display.	Replace load moment pin & Perform the Boom Sensor calibration process	Contact JLG Service Dept.

Table 6-14. Load Moment Pin Troubleshooting: New Moment Pin Detected Fault

STE P	FAULT CODE/SYMPTOM	REPAIR	YES	NO
1	8/6 NEW MOMENT PIN DETECTED FAULT A moment pin was detected on the system different from the one used to calibrate the machine.	Perform the Boom Sensor calibration process to accept the new load moment pin.	Verify BCS check and review all faults prior to contacting JLG Service Dept.	Contact JLG Service Dept.

SECTION 7. BASIC ELECTRICAL INFORMATION & SCHEMATICS

7.1 GENERAL

This section contains basic electrical information and 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.

7.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information. This manual assumes reasonable measuring device accuracy (at least 1%).

Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the Voltage source.

Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

Min/Max

Use of the "Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read the Voltage applied to a solenoid when it is only operational while a switch, far from the solenoid and meter, is held down.

Polarity

Getting a negative Voltage or current reading when expecting a positive reading frequently means the leads are reversed. Check what reading is expected, the location of the signal and that the leads are connected to the device under test correctly. Also check that the lead on the "COM" port goes to the Ground or negative side of the signal and the lead on the other port goes to the positive side of the signal.

Scale

M = Mega = 1,000,000 * (Displayed Number)

k = kilo = 1,000 * (Displayed Number)

m = milli = (Displayed Number) / 1,000

 $\mu = \text{micro} = (\text{Displayed Number}) / 1,000,000$

Example: $1.2 \text{ k}\Omega = 1200 \Omega$ Example: 50 mA = 0.05 A

Voltage Measurement

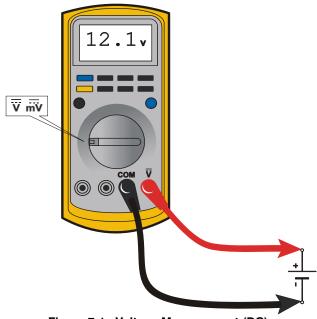


Figure 7-1. Voltage Measurement (DC)

- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- · Use firm contact with meter leads

Resistance Measurement

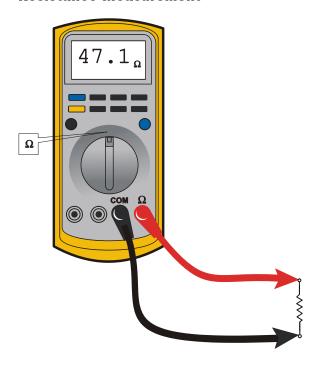


Figure 7-2. Resistance Measurement

- First test meter and leads by touching leads together. Resistance should read a short circuit (very low resistance)
- Circuit power must be turned OFF before testing resistance
- · Disconnect component from circuit before testing
- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- · Use firm contact with meter leads

Continuity Measurement

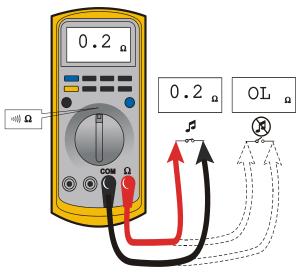


Figure 7-3. Continuity Measurement

- Some meters require a separate button press to enable audible continuity testing
- Circuit power must be turned OFF before testing continuity
- · Disconnect component from circuit before testing
- · Use firm contact with meter leads
- First test meter and leads by touching leads together. Meter should produce an audible alarm, indicating continuity

Current Measurement

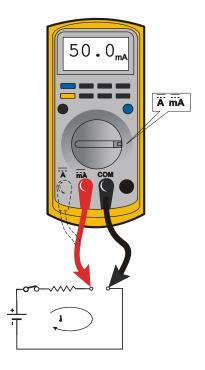


Figure 7-4. Current Measurement (DC)

- Set up the meter for the expected current range
- Be sure to connect the meter leads to the correct jacks for the current range you have selected
- If meter is not auto ranging, set it to the correct range (See multi meter's operation manual)
- · Use firm contact with meter leads

7.3 APPLYING SILICONE DIELECTRIC COMPOUND TO ELECTRICAL CONNECTIONS

Silicone Dielectric Compound must be used on all electrical connections for the following reasons:

- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Silicone Dielectric Compound to the electrical connectors. This procedure applies to all plug connections not enclosed in a box. Silicone grease should not be applied to connectors with external seals.

 To prevent oxidation, silicone grease must be packed completely around male and female pins on the inside of the connector prior to assembly. This is most easily achieved by using a syringe.

NOTE: Over a period of time, oxidation increases electrical resistance at the connection, eventually causing circuit failure.

2. To prevent shorting, silicone grease must be packed around each wire where they enter the outside of the connector housing. Also, silicone grease must be applied at the joint where the male and female connectors come together. Any other joints (around strain reliefs, etc.) where water could enter the connector should also be sealed.

NOTE: This condition is especially common when machines are pressure washed since the washing solution is much more conductive than water.

Anderson connectors for the battery boxes and battery chargers should have silicone grease applied to the contacts only.

NOTE: Curing-type sealants might also be used to prevent shorting and would be less messy, but would make future pin removal more difficult.

7.4 AMP CONNECTOR

Applying Silicone Dielectric Compound to AMP Connectors

Silicone Dielectric Compound must be used on the AMP connections for the following reasons:

- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Silicone Dielectric Compound to the electrical connectors.

- 1. To prevent oxidation and low level conductivity, silicone dielectric grease must be packed completely around male and female pins on the inside of the connector after the mating of the housing to the header. This is easily achieved by using a syringe to fill the header with silicone dielectric compound, to a point just above the top of the male pins inside the header. When assembling the housing to the header, it is possible that the housing will become air locked, thus preventing the housing latch from engaging.
- **2.** Pierce one of the unused wire seals to allow the trapped air inside the housing to escape.
- Install a hole plug into this and/or any unused wire seal that has silicone dielectric compound escaping from it.

Assembly

Check to be sure the wedge lock is in the open, or asshipped, position (See Figure 7-5.). Proceed as follows:

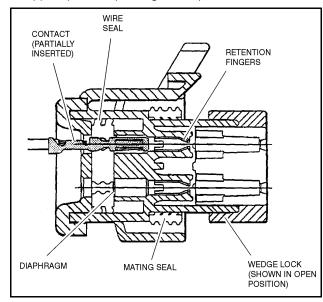


Figure 7-5. Connector Assembly Figure 1

- To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (See Figure 7-7.).
- 2. Pull back on the contact wire with a force of 1 or 2 lbs. to be sure the retention fingers are holding the contact (See Figure 7-7.).

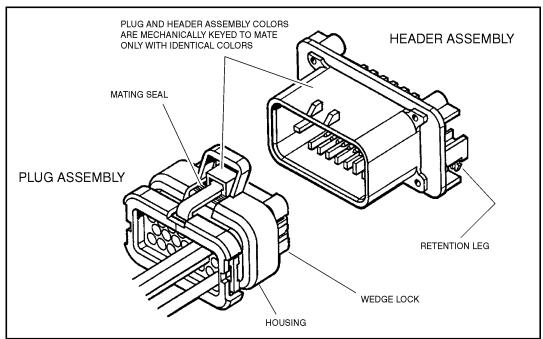


Figure 7-6. AMP Connector

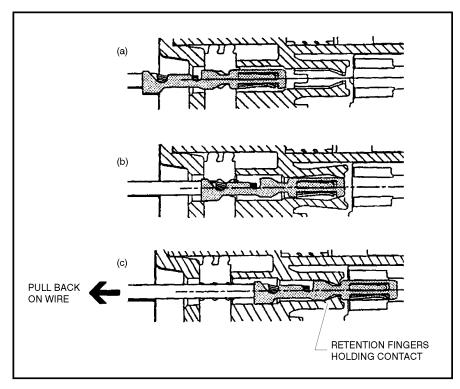


Figure 7-7. Connector Assembly Figure 2

3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 7-8.).

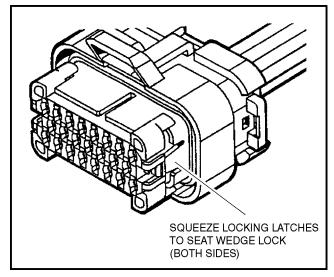


Figure 7-8. Connector Assembly Figure 3

4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 7-9.).

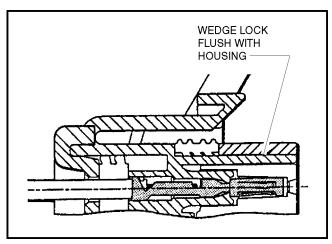


Figure 7-9. Connector Assembly Figure 4

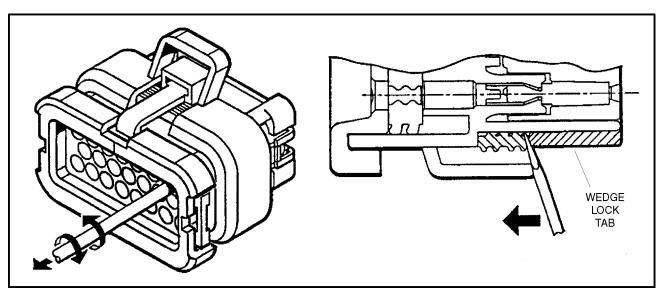


Figure 7-10. Connector Disassembly

Disassembly

- 1. Insert a 4.8 mm (3/16") wide screwdriver blade between the mating seal and one of the red wedge lock tabs.
- 2. Pry open the wedge lock to the open position.
- While rotating the wire back and forth over a half turn (1/4 turn in each direction), gently pull the wire until the contact is removed.

NOTE: The wedge lock should never be removed from the housing for insertion or removal of the contacts.

Wedge Lock

The wedge lock has slotted openings in the forward, or mating end. These slots accommodate circuit testing in the field, by using a flat probe such as a pocket knife. DO NOT use a sharp point such as an ice pick.

Service - Voltage Reading



DO NOT PIERCE WIRE INSULATION TO TAKE VOLTAGE READINGS.

It has been common practice in electrical troubleshooting to probe wires by piercing the insulation with a sharp point. This practice should be discouraged when dealing with the AMPSEAL plug assembly, or any other sealed connector system. The resulting pinholes in the insulation will allow moisture to invade the system by traveling along the wire strands. This nullifies the effectiveness of the connector seals and could result in system failure.

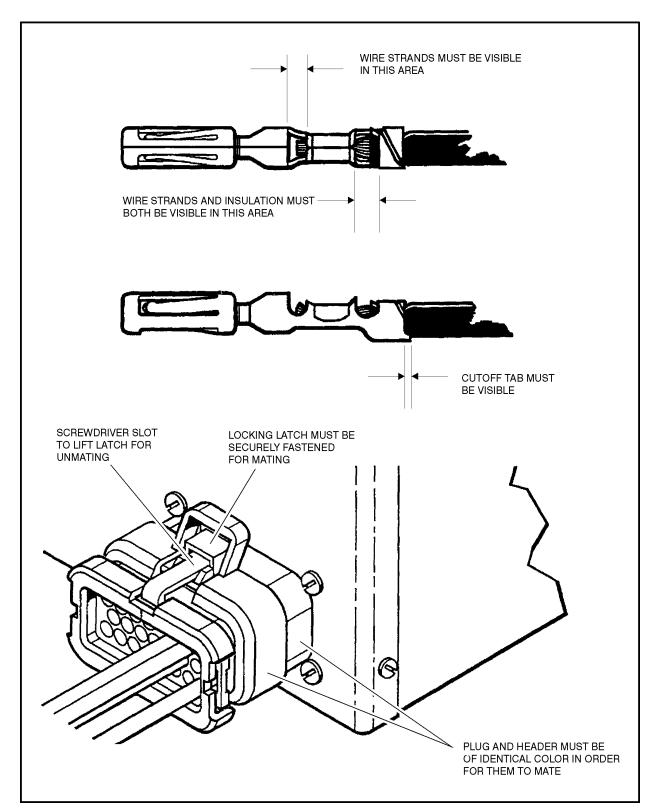


Figure 7-11. Connector Installation

7.5 DEUTSCH CONNECTORS

DT/DTP Series Assembly

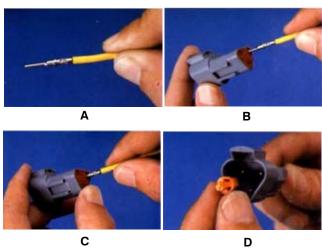


Figure 7-12. DT/DTP Contact Installation

- Grasp crimped contact about 25mm behind the contact barrel.
- 2. Hold connector with rear grommet facing you.
- Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.
- 4. Once all contacts are in place, insert wedgelock with arrow pointing toward exterior locking mechanism. The wedgelock will snap into place. Rectangular wedges are not oriented. Thy may go in either way.

NOTE: The receptacle is shown - use the same procedure for plug.

DT/DTP Series Disassembly

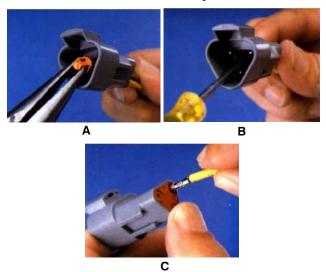


Figure 7-13. DT/DTP Contact Removal

- **1.** Remove wedgelock using needlenose pliers or a hook shaped wire to pull wedge straight out.
- To remove the contacts, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the contact with a screwdriver.
- **3.** Hold the rear seal in place, as removing the contact may displace the seal.

HD30/HDP20 Series Assembly

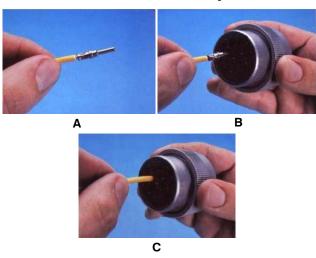


Figure 7-14. HD/HDP Contact Installation

- 1. Grasp contact about 25mm behind the contact crimp barrel.
- 2. Hold connector with rear grommet facing you.
- 3. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

LOCKING FINGERS

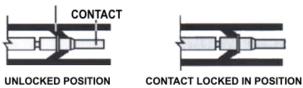


Figure 7-15. HD/HDP Locking Contacts Into Position

NOTE: For unused wire cavities, insert sealing plugs for full environmental sealing

HD30/HDP20 Series Disassembly

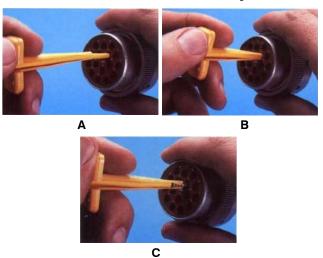


Figure 7-16. HD/HDP Contact Removal

- With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.
- 2. Slide tool along into the insert cavity until it engages contact and resistance is felt.
- 3. Pull contact-wire assembly out of connector.

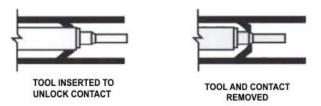


Figure 7-17. HD/HDP Unlocking Contacts

NOTE: Do Not twist or insert tool at an angle.

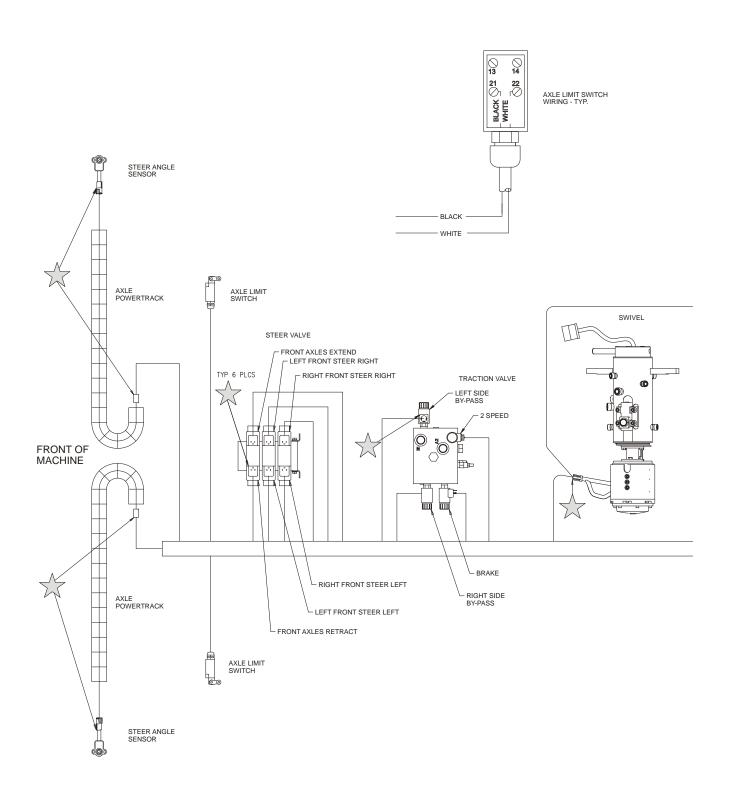
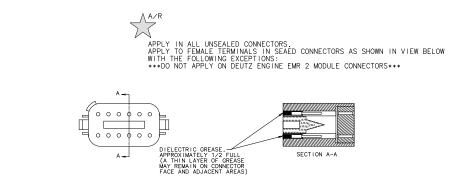
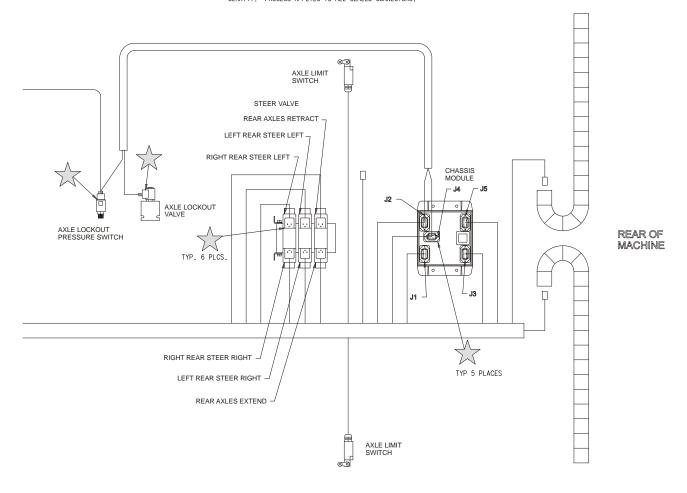


Figure 7-18. Chassis Electrical Components (1100S) - Sheet 1 of 2



THIS EXAMPLE OF A SEALED CONNECTOR SHOWN FOR CLARITY. PROCESS APPLIES TO ALL SEALED CONNECTORS.



1001112761-A

Figure 7-19. Chassis Electrical Components (1100S) - Sheet 2 of 2

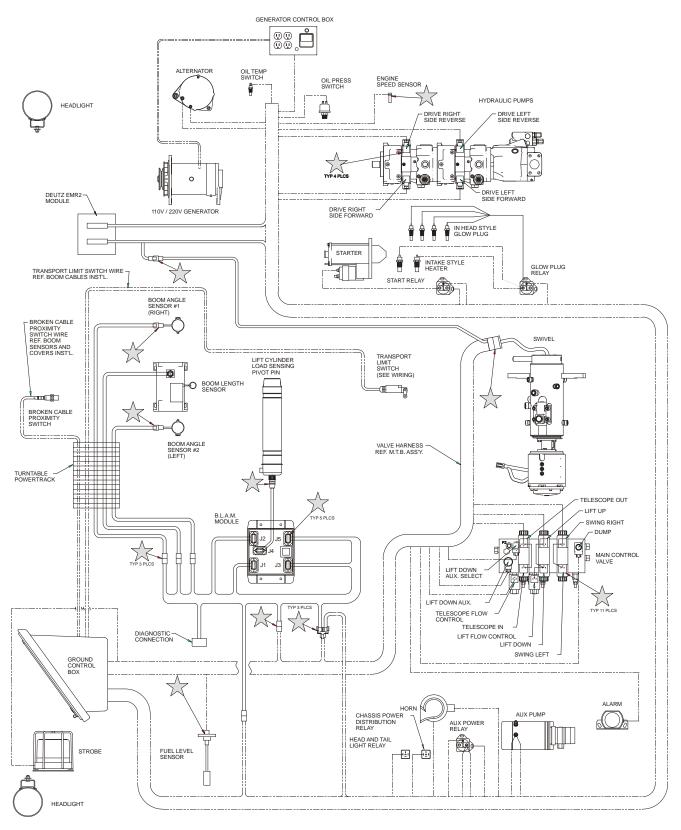
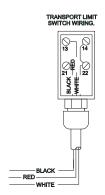
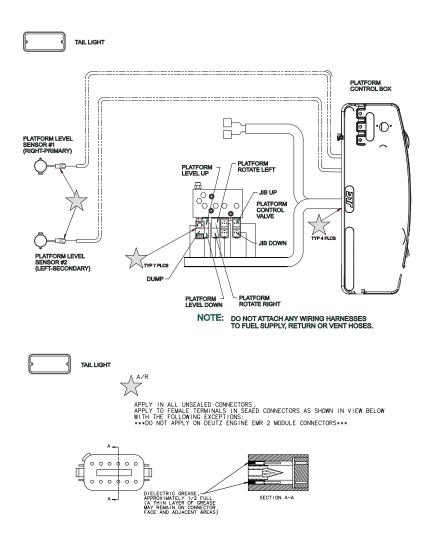


Figure 7-20. Turntable Electrical Components (1100S) - Sheet 1 of 2





1001112761-A

Figure 7-21. Turntable Electrical Components (1100S) - Sheet 2 of 2

THIS EXAMPLE OF A SEALED CONNECTOR SHOWN FOR CLARITY. PROCESS APPLIES TO ALL SEALED CONNECTORS.

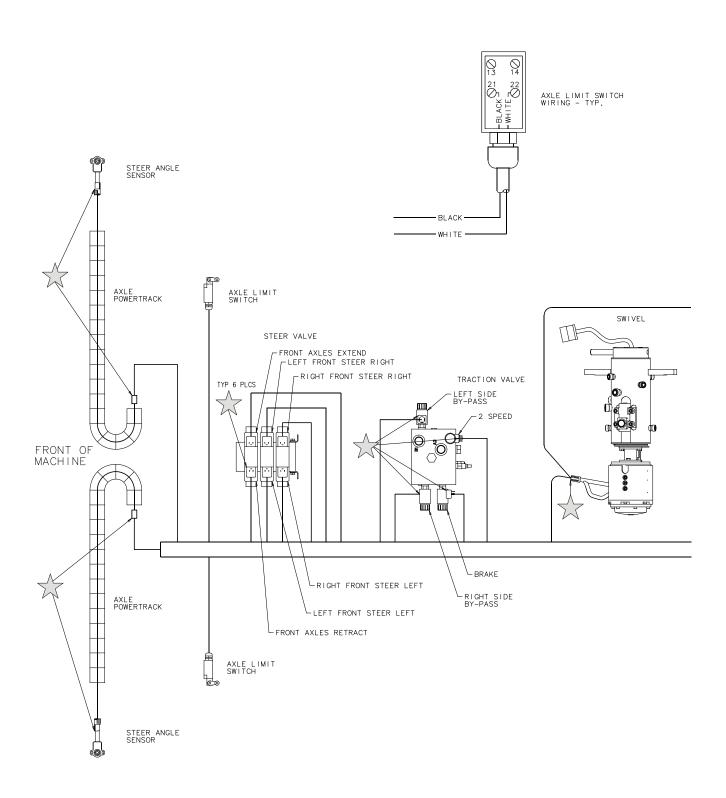


Figure 7-22. Chassis Electrical Components (1100SJP) - Sheet 1 of 2

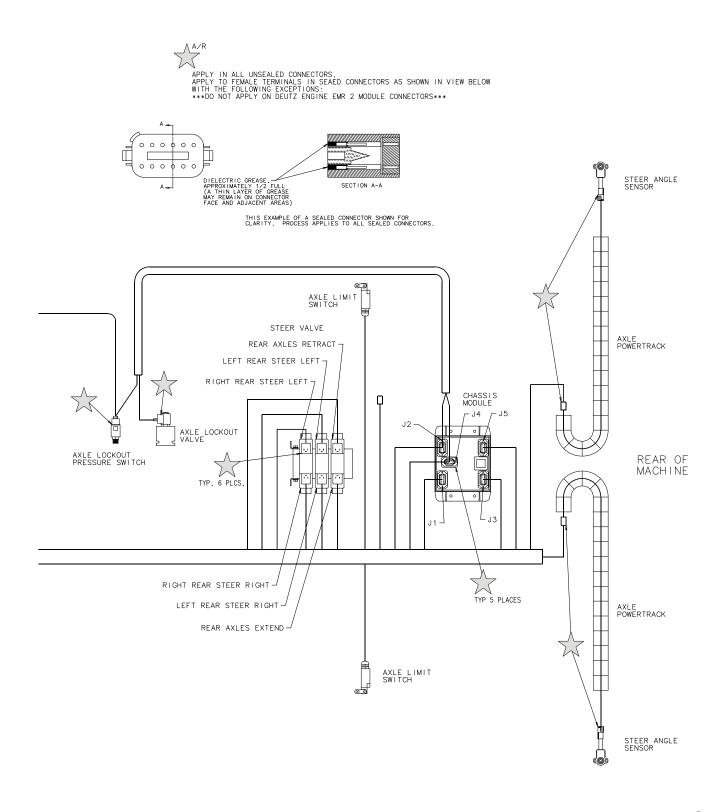


Figure 7-23. Chassis Electrical Components (1100SJP) - Sheet 2 of 2

0274660 D

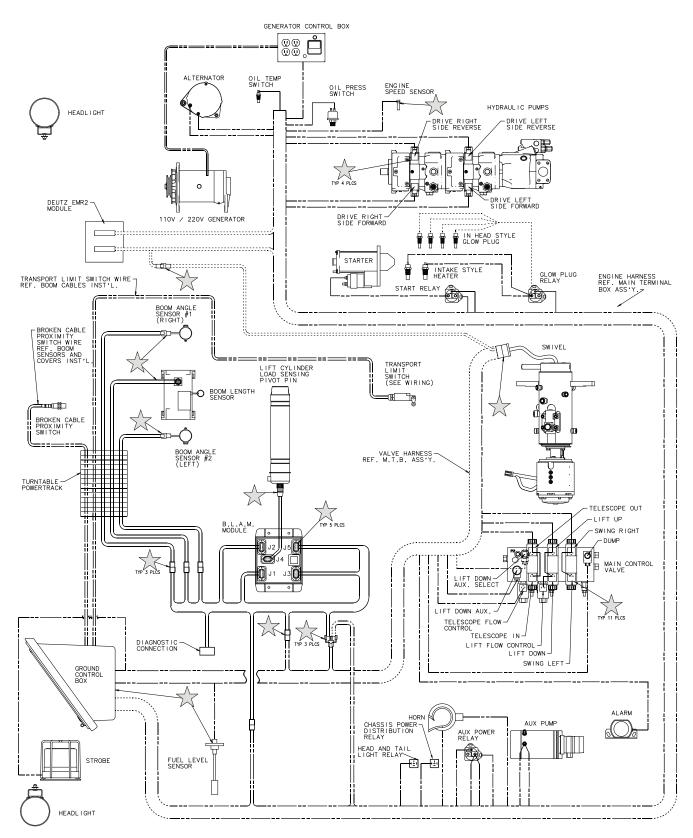
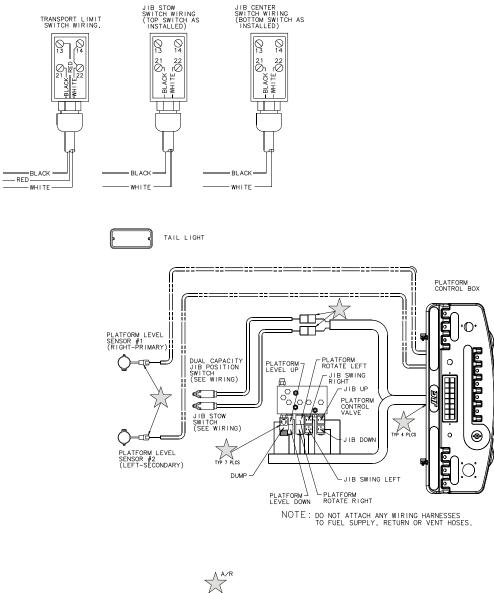
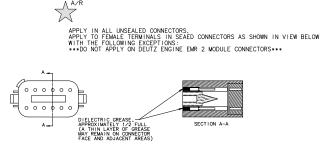


Figure 7-24. Turntable Electrical Components (1100SJP) - Sheet 1 of 2





0274660-D

Figure 7-25. Turntable Electrical Components (1100SJP) - Sheet 2 of 2

THIS EXAMPLE OF A SEALED CONNECTOR SHOWN FOR CLARITY. PROCESS APPLIES TO ALL SEALED CONNECTORS.

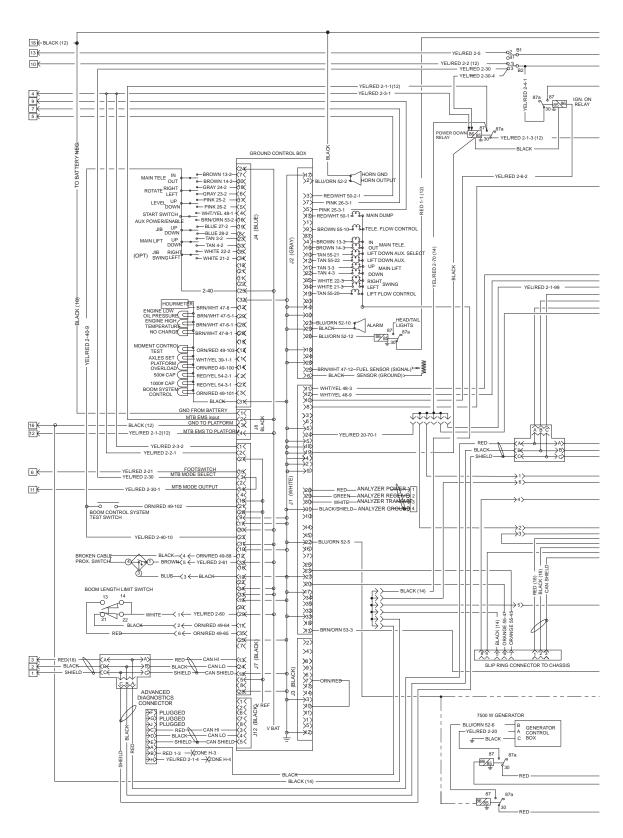


Figure 7-26. Electrical Schematic - Sheet 1 of 6

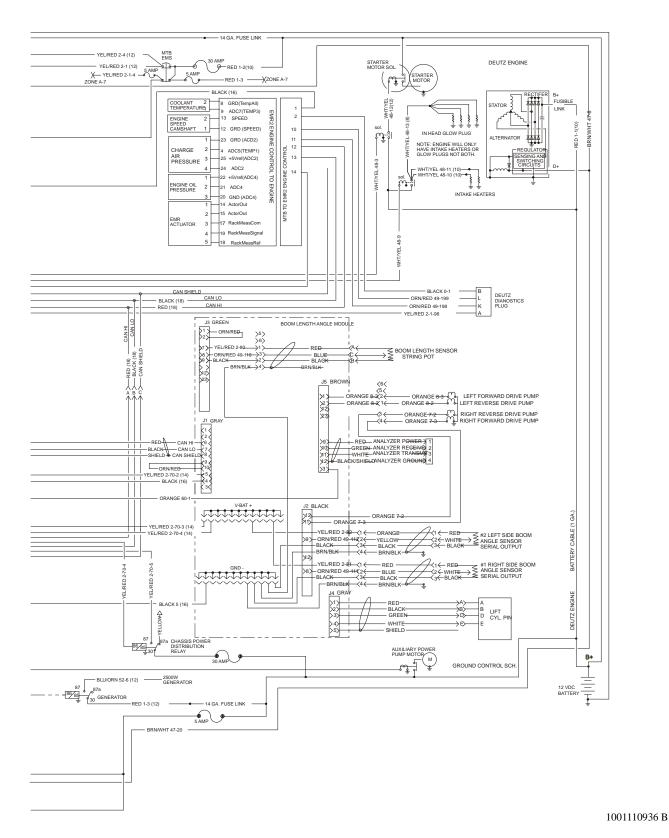


Figure 7-27. Electrical Schematic - Sheet 2 of 6

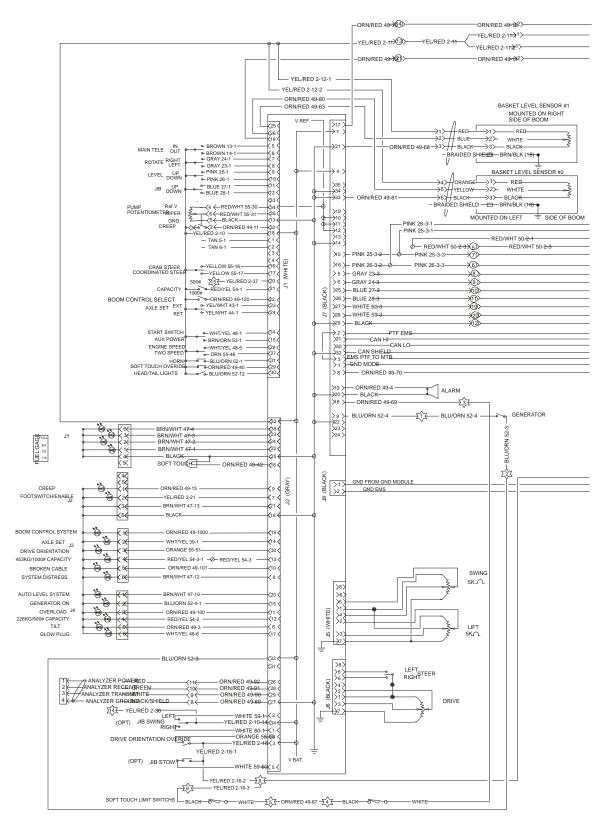
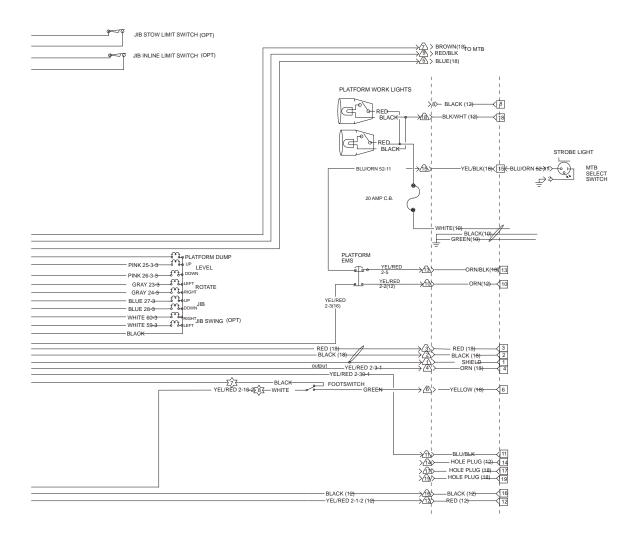


Figure 7-28. Electrical Schematic - Sheet 3 of 6



= 19 POSITION DEUTSCH CONNECTOR IN PLATFORM BOX
 = 21 POSITION DEUTSCH CONNECTOR IN PLATFORM BOX
 = 21 POSITION DEUTSCH CONNECTOR TO MAIN TERMINAL GROUND BOX

PLATFORM SCH.

Figure 7-29. Electrical Schematic - Sheet 4 of 6

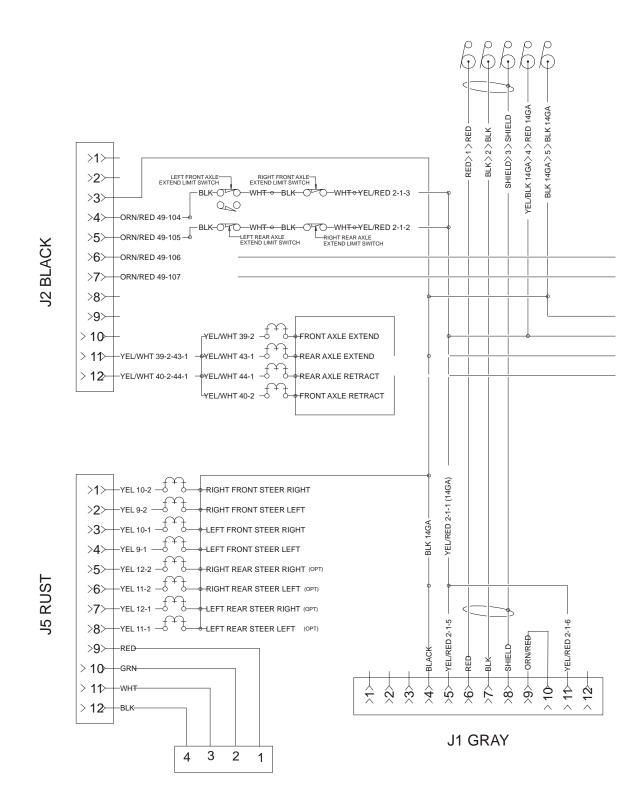
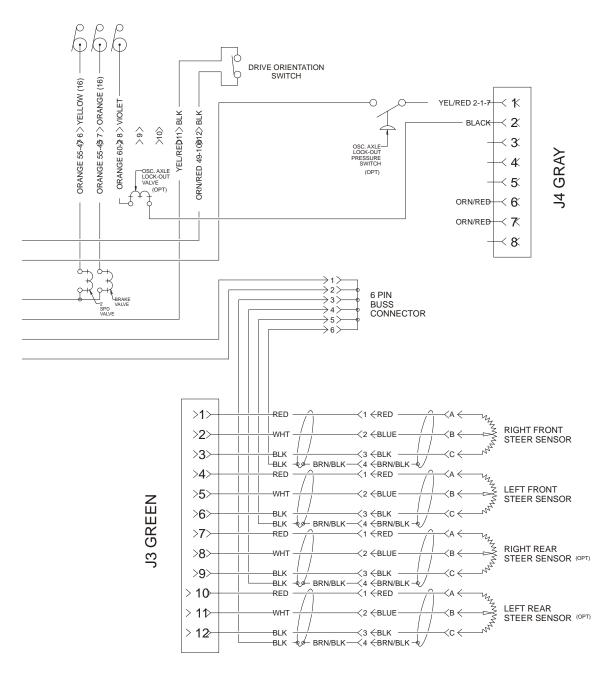


Figure 7-30. Electrical Schematic - Sheet 5 of 6



CHASSIS SCH.

Figure 7-31. Electrical Schematic - Sheet 6 of 6

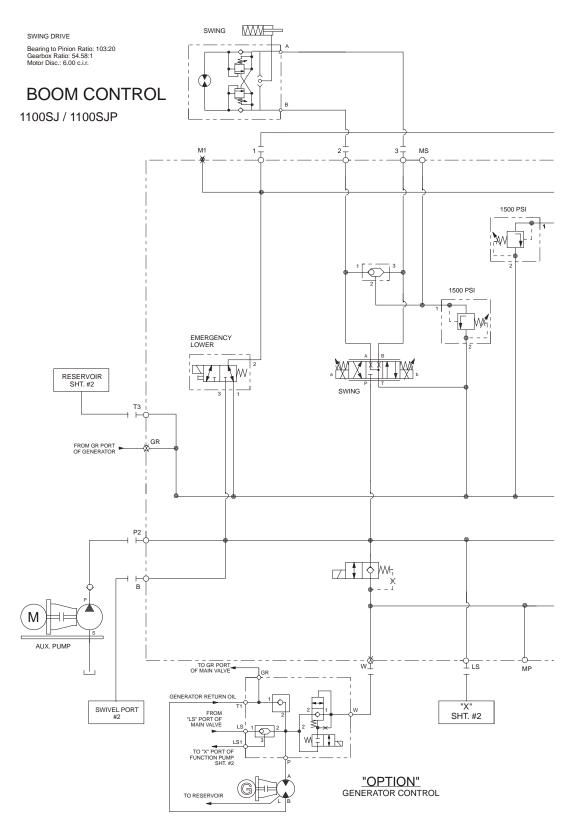


Figure 7-32. Hydraulic Schematic - Boom Control - Sheet 1 of 2

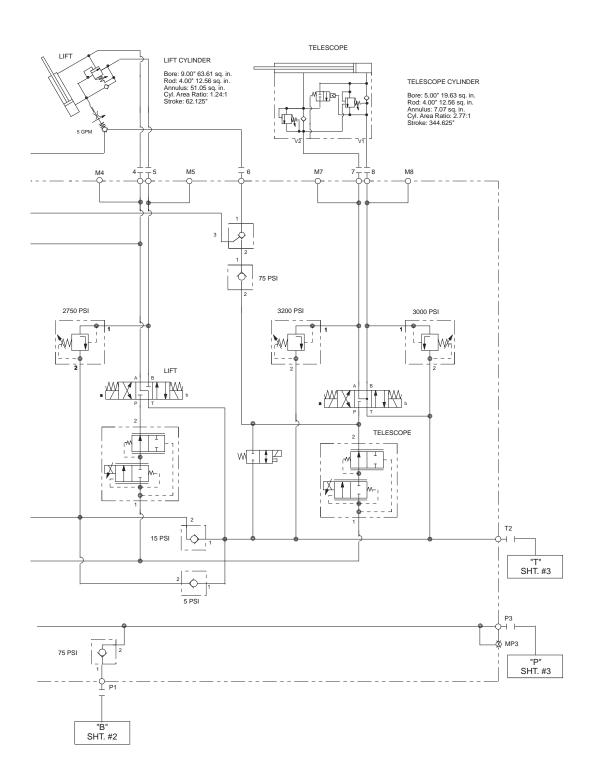


Figure 7-33. Hydraulic Schematic - Boom Control - Sheet 2 of 2

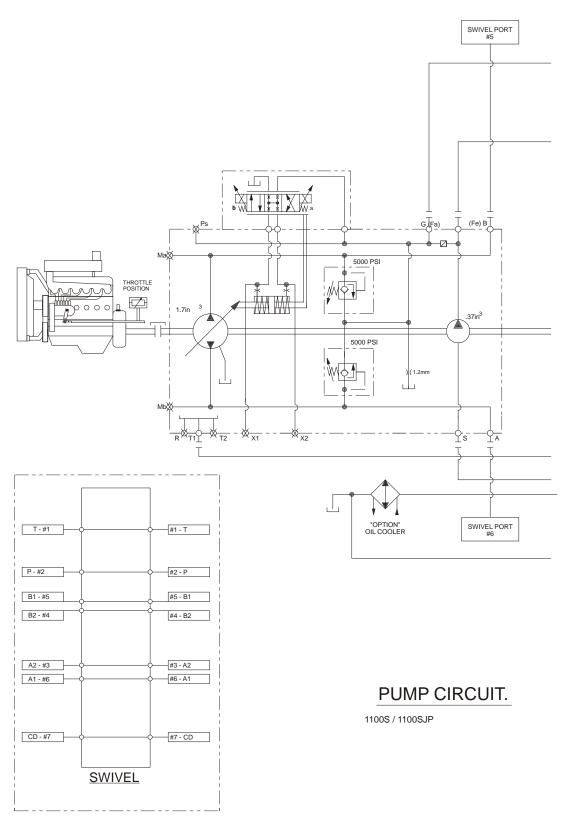


Figure 7-34. Hydraulic Schematic - Pump Circuit - Sheet 1 of 2

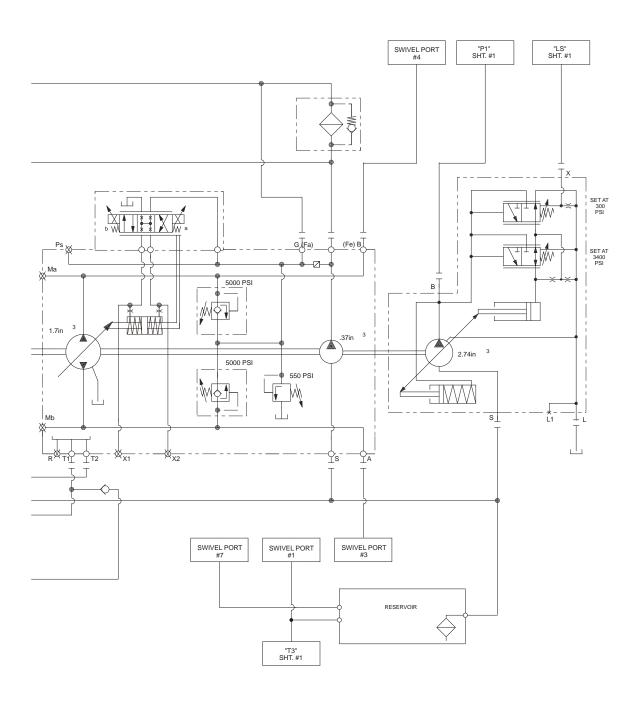
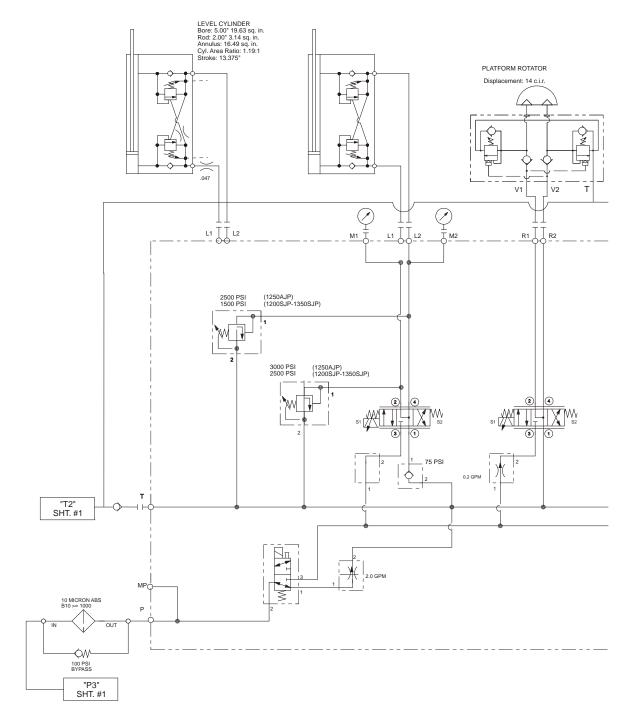


Figure 7-35. Hydraulic Schematic - Pump Circuit - Sheet 2 of 2



PLATFORM CONTROL

1100S / 1100SJP

Figure 7-36. Hydraulic Schematic - Platform Control - Sheet 1 of 2

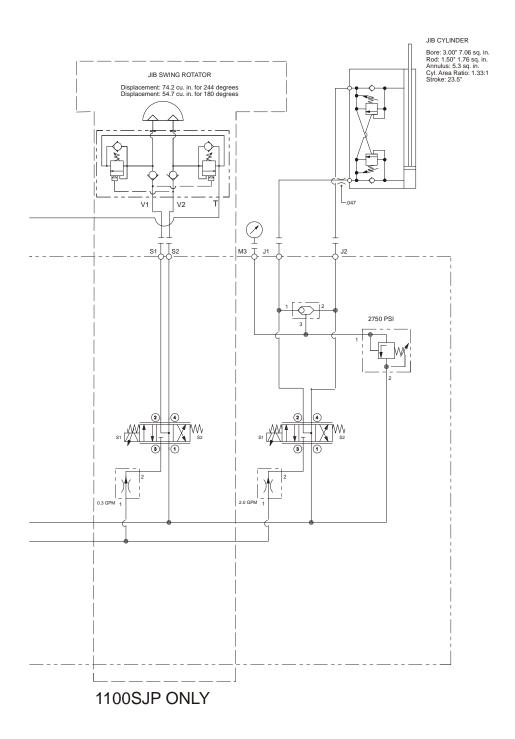


Figure 7-37. Hydraulic Schematic - Platform Control - Sheet 2 of 2

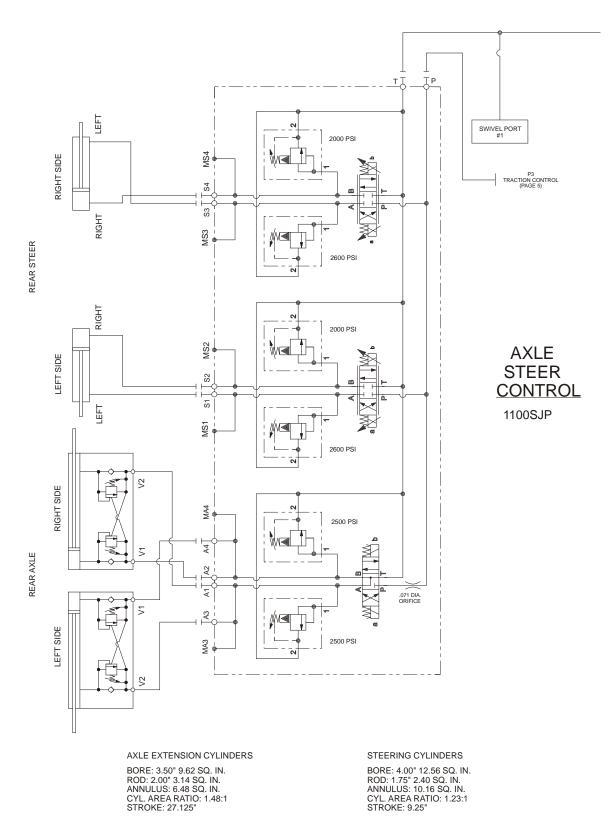


Figure 7-38. Hydraulic Schematic - Axle Steer Control (1100SJP) - Sheet 1 of 2

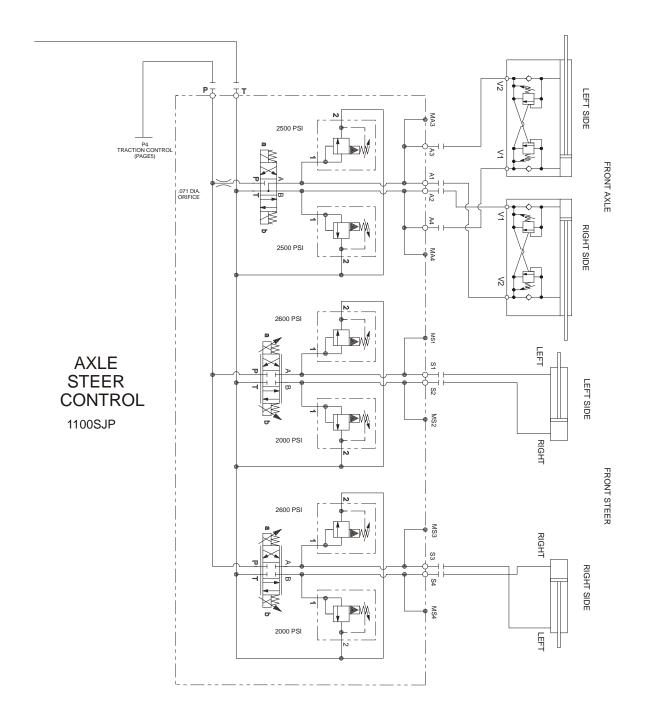


Figure 7-39. Hydraulic Schematic - Axle Steer Control (1100SJP) - Sheet 2 of 2

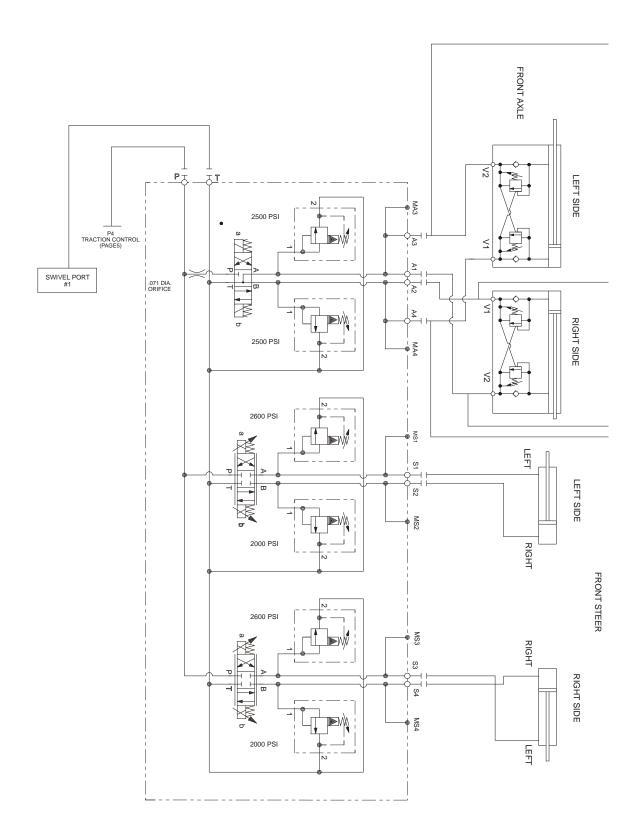
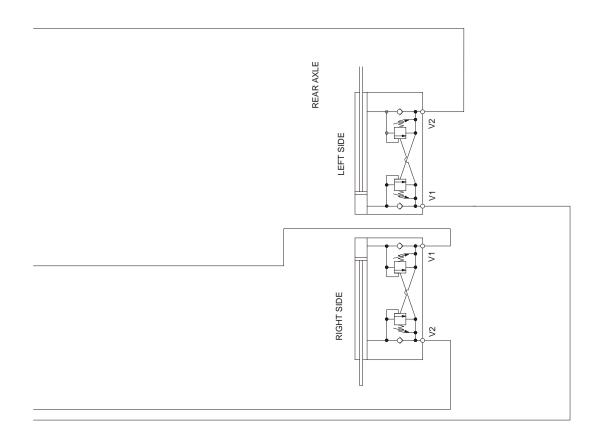


Figure 7-40. Hydraulic Schematic - Axle Steer Control (1100S) - Sheet 1 of 2



AXLE STEER CONTROL

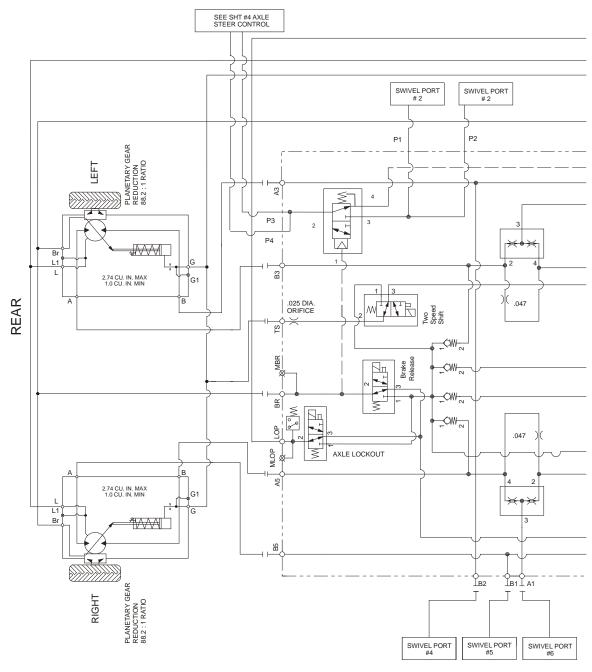
1100S

AXLE EXTENSION CYLINDERS

BORE: 3.50" 9.62 SQ. IN. ROD: 2.00" 3.14 SQ. IN. ANNULUS: 6.48 SQ. IN. CYL. AREA RATIO: 1.48:1 STROKE: 27.125" STEERING CYLINDERS

BORE: 4.00" 12.56 SQ. IN. ROD: 1.75" 2.40 SQ. IN. ANNULUS: 10.16 SQ. IN. CYL. AREA RATIO: 1.23:1 STROKE: 9.25"

Figure 7-41. Hydraulic Schematic - Axle Steer Control (1100S) - Sheet 2 of 2



TRACTION CONTROL
1100SJP

Figure 7-42. Hydraulic Schematic - Traction Control (1100SJP) - Sheet 1 of 2

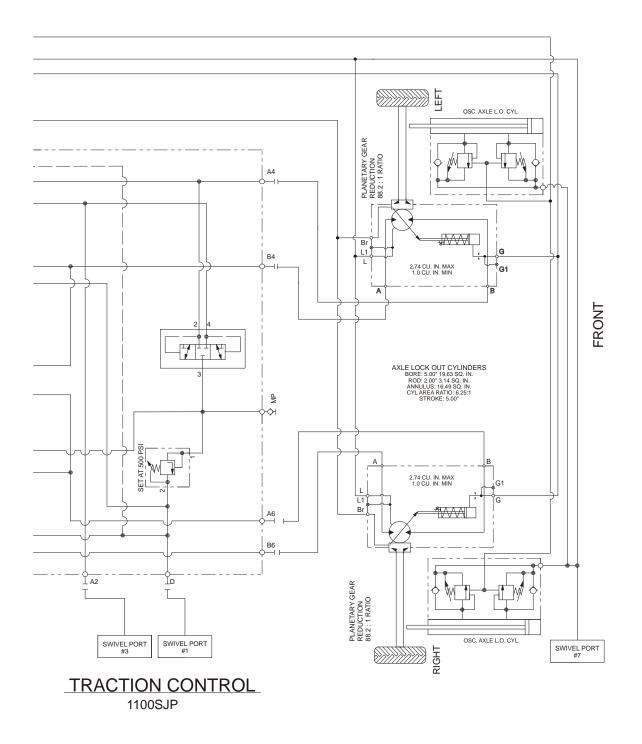


Figure 7-43. Hydraulic Schematic - Traction Control (1100SJP) - Sheet 2 of 2

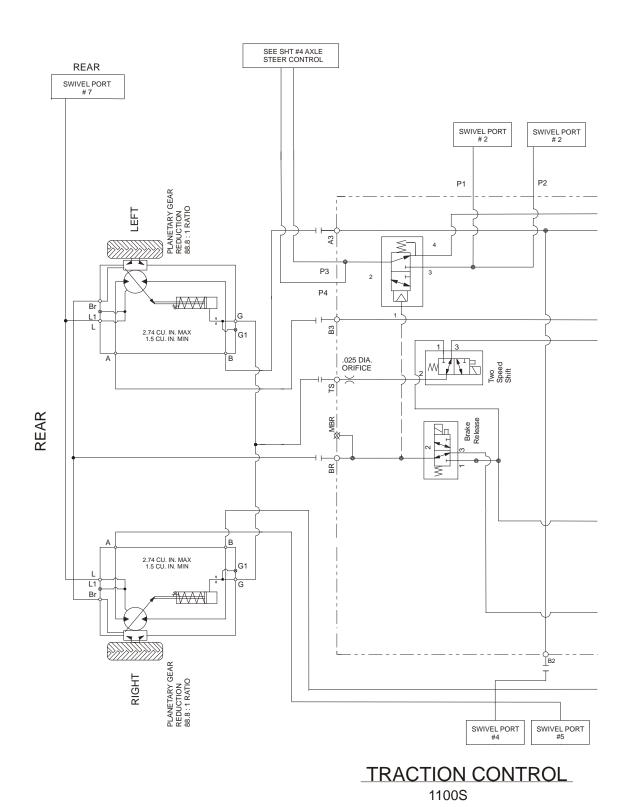


Figure 7-44. Hydraulic Schematic - Traction Control (1100S) - Sheet 1 of 2

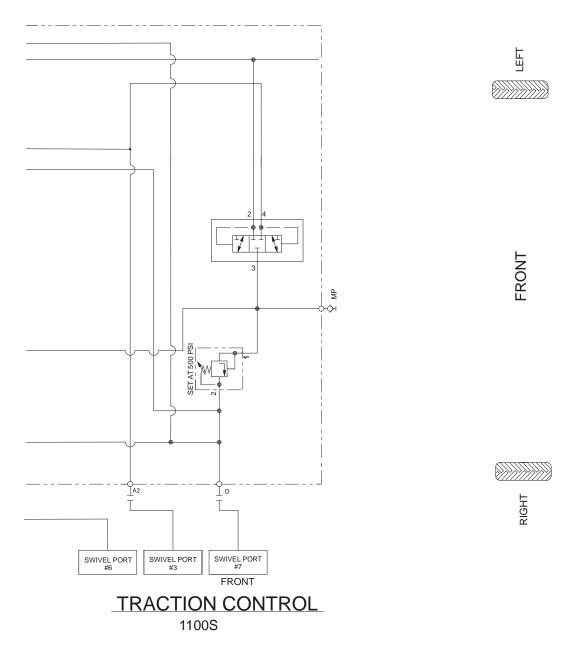


Figure 7-45. Hydraulic Schematic - Traction Control (1100S) - Sheet 2 of 2

NOTES:	

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.

A WARNING: **A**

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

1702961





An Oshkosh Corporation Company

Corporate Office JLG Industries, Inc. 1 JLG Drive McConnellsburg PA. 17233-9533 USA

(717) 485-5161(Corporate)(800) 554-5438(Service)(717) 485-6417

JLG Worldwide Locations

JLG Industries 358 Park Road Regents Park NSW 2143 Sydney 2143 Australia

** +6 (12) 87186300 +6 (12) 65813058 Email: techservicesaus@jlg.com JLG Ground Support Oude Bunders 1034 Breitwaterstraat 12A 3630 Maasmechelen Belgium

** +32 (0) 89 84 82 26 Email: emeaservice@jlg.com JLG Latino Americana LTDA Rua Antonia Martins Luiz, 580 Distrito Industrial Joao Narezzi Indiaatuba-SP 13347-404 Brasil

** +55 (19) 3936 7664 (Parts) +55(19)3936 9049 (Service) Email: comercialpecas@jlg.com Email: servicos@jlg.com Oshkosh-JLG (Tianjin) Equipment Technology LTD Shanghai Branch No 465 Xiao Nan Road Feng Xian District Shanghai 201204 China

****** +86 (21) 800 819 0050

JLG Industries Dubai Jafza View PO Box 262728, LB 19 20th Floor, Office 05 Jebel Ali, Dubai

** +971 (0) 4 884 1131 +971 (0) 4 884 7683 Email: emeaservice@jlg.com JLG France SAS Z.I. Guillaume Mon Amy 30204 Fauillet 47400 Tonniens France

+33 (0) 553 84 85 86 +33 (0) 553 84 85 74 Email: pieces@jlg.com JLG Deutschland GmbH Max Planck Str. 21 27721 Ritterhude - Ihlpohl Germany

+49 (0) 421 69350-0 +49 (0) 421 69350-45 Email:german-parts@jlg.com JLG Equipment Services Ltd. Rm 1107 Landmark North 39 Lung Sum Avenue Sheung Shui N. T. Hong Kong

+(852) 2639 5783 +(852) 2639 5797

JLG Industries (Italia) S.R.L. Via Po. 22 20010 Pregnana Milanese (MI)

+39 (0) 2 9359 5210 +39 (0) 2 9359 5211 Email: ricambi@jlg.com JLG EMEA B.V. Polaris Avenue 63 2132 JH Hoofdorf The Netherlands

+31 (0) 23 565 5665 Email: emeaservice@jlg.com JLG NZ Access Equipment & Services
2B Fisher Cresent
Mt Wellington 1060
Auckland, New Zealand

+6 (12) 87186300 +6 (12) 65813058 Email:techservicesaus@jlg.com JLG Industries Vahutinskoe shosse 24b. Khimki Moscow Region 141400 Russia Federation

+7 (499) 922 06 99 +7 (499) 922 06 99

Oshkosh-JLG Singapore Technology Equipment Pte Ltd. 35 Tuas Avenue 2 Jurong Industrial Estate Singapore 639454

+65 6591 9030 +65 6591 9045 Email: SEA@jlg.com JLG Iberica S.L. Trapadella, 2 Pol. Ind. Castellbisbal Sur 08755 Castellbisbal Barcelona Spain

** +34 (0) 93 772 47 00 +34 (0) 93 771 1762 Email:parts_iberica@jlg.com JLG Sverige AB Enkopingsvagen 150 176 27 Jarfalla Sweden

+46 (0) 8 506 595 00 +46 (0) 8 506 595 27 Email: nordicsupport@jlg.com JLG Industries (UK) Ltd. Bentley House Bentley Avenue Middleton, Greater Manchester M24 2GP United Kingdom

** +44 (0) 161 654 1000 +44 (0) 161 654 1003 Email: ukparts@jlg.com