An Oshkosh Corporation Company

Service and Maintenance Manual

Model
E300A
E300AJ
E300AJP

P/N - 3120772

January 23, 2009

ANSI

An Oshkosh Corporation Company

SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A GENERAL

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

⚠ WARNING

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

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

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

⚠ WARNING

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

B HYDRAULIC SYSTEM SAFETY

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

Relieve system pressure by cycling the applicable control several times with the engine stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.

C MAINTENANCE

⚠ WARNING

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

- ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- NO SMOKING IS MANDATORY. NEVER REFUEL DURING ELECTRICAL STORMS. ENSURE THAT FUEL CAP IS CLOSED AND SECURE AT ALL OTHER TIMES.
- REMOVE ALL RINGS, WATCHES AND JEWELRY WHEN PERFORMING ANY MAINTENANCE.
- DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.
- OBSERVE AND OBEY ALL WARNINGS AND CAUTIONS ON MACHINE AND IN SERVICEMANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- USE CAUTION WHEN CHECKING A HOT, PRESSURIZED COOLANT SYSTEM.
- NEVER WORK UNDER AN ELEVATED BOOM UNTIL BOOM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR BOOM SAFETY PROP HAS BEEN ENGAGED.
- BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.
- BATTERY SHOULD ALWAYS BE DISCONNECTEDDURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

REVISON LOG

Original Issue	November 15, 2000
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FIGURE NO.	TITLE	PAGE NO.

FIGURE NO.	TITLE	PAGE NO.

SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

Table 1-1. Capacities

Hydraulic Oil Tank	3.0 gallons (11.35 liters)
Hydraulic System (Including Tank)	4.0 gallons (15.14 liters)
Torque Hub, Drive*	17 ounces (0.50 L)
*Torque hubs should be one half full of lubricant.	

1.2 OPERATING SPECIFICATIONS

Table 1-2. Operating Specifications - E300A

Capacity: Unrestricted:	500 lbs. (227 kg)
Maximum Travel Grade, stowed Position (Gradeability) see Figure 4-3.	25%
Maximum Travel Grade, stowed Position (Side Slope) see Figure 4-3.	5%
Vertical Platform Height	30 ft. (9.14 m)
Horizontal Platform Reach (Up & Over)	20 ft. (6.1 m)
Machine Width	4 ft. (1.22 m)
Turning Radius (Outside)	10 ft. (3.05 m)
Turning Radius (Inside)	5 ft. (1.52 m)
Drive Speed (High Drive) (Above Horz.)	45-50 sec/ 200ft. (61 m) 55-68 sec/ 50 ft. (15.2 m)
Gross Machine Weight	14,300 lbs. (6,487 kg)
Maximum System Voltage	48 VDC
Maximum Main Relief Hyd. Pressure	2500 psi. (172.3 bars)

Table 1-3. Operating Specifications - E300AJ

Capacity: Unrestricted:	500 lbs. (227 kg)
Maximum Travel Grade, stowed Position (Gradeability)	25%
Maximum Travel Grade, stowed Position (Side Slope)	5%
Vertical Platform Height	30 ft. (9.14 m
Horizontal Platform Reach (Up & Over)	20 ft. (6.1 m)
Machine Width	4 ft. (1.22 m)
Turning Radius (Outside)	10 ft. (3.05 m)
Turning Radius (Inside)	5 ft. (1.52 m)
Drive Speed (High Drive) (Above Horz.)	45-50 sec/ 200ft. (61 m) 55-68 sec/ 50 ft. (15.2 m)
Gross Machine Weight	15,400 lbs. (6985 kg)
Maximum System Voltage	48 VDC
Maximum Main Relief Hyd. Pressure	2500 psi. (172.3 bars)

Table 1-4. Operating Specifications - E300AJP

Capacity: Unrestricted:	500 lbs. (227 kg)
Maximum Travel Grade, stowed Position (Gradeability)	25%
Maximum Travel Grade, stowed Position (Side Slope)	5%
Vertical Platform Height	30 ft. (9.14 m
Horizontal Platform Reach (Up & Over)	20 ft. (6.1 m)
Machine Width	4 ft. (1.22 m)
Turning Radius (Outside)	10 ft. (3.05 m)
Turning Radius (Inside)	5 ft. (1.52 m)
Drive Speed (High Drive) (Above Horz.)	45-50 sec/ 200ft. (61 m) 55-68 sec/ 50 ft. (15.2 m)
Gross Machine Weight	15,800 lbs. (7167 kg)
Maximum System Voltage	48 VDC
Maximum Main Relief Hyd. Pressure	3200 psi. (220.6 bars)

1.3 BATTERY CHARGER

Table 1-5. Battery Charger

Input	110 VAC,60 HZ
Output	48 VDC (23 Amps)
Batteries (8)	6 Volt, 370 AmpHour (20 hour rate)

1.4 DRIVE SYSTEM

Table 1-6. Drive System

Drive Motor	48 VDC, 12.5 H.P. @ 3200 rpm. continuous, rotation - reversible
Drive Brake	spring-applied, hydraulically released

1.5 TIRES

Table 1-7. Tire Specifications

Size	7.5 x 12
Compound	Non Marking Compound
Max. Tire Load	6000 lbs. (2722 kg)

1.6 HYDRAULIC FILTER

Table 1-8. Hydraulic Filter

Type	Return
Micron Rating	25 Micron

1.7 HYDRAULIC PUMP/ELECTRIC MOTOR ASSEMBLY

Table 1-9. Hydraulic Pump/Electric Motor

Motor	48 VDC, 2.14 H.P. @ 2700 rpm
Displacement	0.19 cu. in./rev. (3.12 cm^3/rev.)
Output	2.71 gpm (10,25 lpm) @ 2000 psi (137.9 Bar)

1.8 DIMENSIONAL DATA

Table 1-10. Dimensional Data

Turning Radius (Inside)	5 ft. (1.52 m.)
Turning Radius (Outside)	10 ft. - 0 in. (3.05 m)
Machine Height (stowed)	6 ft., 7.0 in. (2.0 m.)
Machine Length (stowed) E300A E300AJ/AJP	 17 ft.,2 in. (5.23 m.) 18 ft., (5.48 m)
Up and Over Platform Height	13 ft.,1.0 in. (3.99 m.).
Horizontal Reach Up and Over	20 ft. (6.1 m.).
Machine Width	4 ft., (1.22 m.)
Wheel Base	6 ft., 7.25 in. (2.01 m.)
Platform Height	30 ft., 0 in. (9.14 m.)

1.9 FUNCTION SPEEDS

Table 1-11. Function Speeds

Function	Speed in seconds (unless otherwise noted)
Travel Speed (Forward & Reverse) High drive	3 mph (4.8 kmh) (45-50 sec / 200 ft.)
Travel Speed (Forward & Reverse) boom above Horizontal	0.62 mph (1 kmh) (55-68 sec / 50ft.)
Upper Lift Up	24-27
Upper Lift Down	20-23
Boom Telescope Out E300A E300AJ, AJP	 17-20 12-15
Boom Telescope In E300A E300AJ, AJP	 17-20 12-15
Lower Lift Up	17 - 20
Lower Lift Down	17 - 20
Swing - 360 Degrees	79 - 86
Jib (300AJ) Up Down	 22 - 25 22 - 25
Jib Swing (300AJP)* Right Left *Max 10% difference between left and right	 45- 55 45- 55
Platform Rotate, Left and Right* *Max. 15% difference between left and right	10-12

1.10 TORQUE SPECIFICATIONS

Table 1-12. Torque Requirements

Description	Torque Value	Interval Hours
Bearing To Chassis (w/Loctite)	240 ft. lbs. (326 Nm)*	50/600*
Bearing To Turntable (w/Loctite)	240 ft. lbs. (326 Nm)*	50/600*
Wheel Lugs (Dry)	170 ft.lb. (230Nm)	150
NOTE: **Check swing bearing bolts for security after first 50 hours of operation and every 600 hours thereafter.*		

1.11 PRESSURE SETTINGS

Table 1-13. Pressure Settings - Prior to S/N 0300063313

Circuit	PSI	Bar
Main Control Valve		
Upper Lift Down Relief	1500	103
Lower Lift Down Relief	1350	93
Telescope In Relief (A/AJ)	2150	148
Telescope In Relief (AJP)	3000	207
Platform Level Up Relief	1500	103
Platform Level Down Relief	1500	103
Steer/Brake Valve		
Steer Relief	2300	159
Main Relief (A/AJ)	2500	172
Main Relief (AJP)	3200	221

Table 1-14. Pressure Settings - S/N 0300063313 to Present

Circuit	PSI	Bar
Main Control Valve		
Upper Lift Down Relief	550	38
Lower Lift Down Relief	1700	117
Telescope Relief (A/AJ)	2150	148
Telescope Relief (AJP)	3000	207
Platform Level Up Relief	3000	207
Platform Level Down Relief	1200	83
Steer/Brake Valve		
Steer Relief	2300	159
Main Relief (A/AJ)	2500	172
Main Relief (AJP)	3200	221

1.12 CYLINDER SPECIFICATIONS

NOTE: *All dimensions are given in inches (in.), with the metric equivalent, millimeters (mm) given in parentheses.*

Table 1-15. Cylinder Specifications

DESCRIPTION	BORE	STROKE	ROD DIA.
Upper Lift Cylinder	3.5 in. (8.9 cm)	25.9 in.(65.8 cm)	2.0 in.(5.1 cm)
Lower Lift Cylinder	3.0 in.(7.6. cm)	28.5 in.(72.4 cm)	1.5 in.(3.8 cm)
Telescope Cylinder	2.0 in.(5.1 cm)	38.5 in.(98.0 cm)	1.25 in.(3.2 cm)
Master Cylinder	3.0 in.(7.6 cm)	11.5 in.(29.1 cm)	1.25 in.(3.2 cm)
Slave Cylinder	3.0 in.(7.6 cm)	11.5 in.(29.1 cm)	1.25 in.(3.2 cm)
Steer Cylinder	2.5 in.(6.3 cm)	7.0 in.(17.8 cm)	1.5 in.(3.8 cm)

1.13 MAJOR COMPONENT WEIGHTS

⚠ WARNING

SELECT LIFTING EQUIPMENT WITH CAPACITY CAPABLE OF SAFELY SUPPORTING WEIGHT

Table 1-16. Major Component Weights

COMPONENT	LBS.	KG.
Platform & Support & Rotator	215	97.5
Main Boom complete w/ Master & Slave Cyl.	880	399.1
Telescope Cylinder	80	36.2
Lift Cylinder	103	46.7
Upright with Upper and Lower Arms	692	313.9
Tower Lift Cylinder	68	30.8
Turntable w/Cwt.,battery boxes, tank, etc.	7200	3266
Battery Box (includes batteries)	660	299.3
Chassis (includes non marking Tires)	5380	2440
Counterweight (A/AJ) Counterweight (AJP)	5300 5900	2404.1 2676.2
Machine Complete - A Machine Complete - AJ Machine Complete - AJP	14,500 15,400 15,800	6577 6985 7167
Swing Jib	320	145

Critical Stability Weights

⚠ WARNING

DO NOT REPLACE ITEMS CRITICAL TO STABILITY WITH ITEMS OF DIFFERENT WEIGHT OR SPECIFICATION (FOR EXAMPLE: BATTERIES, FILLED TIRES, PLATFORM) DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.

Table 1-17. Critical Stability Weights

Components	LBS.	KG.
Counterweight	5300	2404.1
Tire and Wheel	120	54.4
Tire and Wheel (CSA)	262	119
Platform	135	61.2
Battery (each)	110	50

1.14 SERIAL NUMBER LOCATIONS

For machines identification, a serial number plate is affixed to the turntable, on the front of the left battery box support plate. If the serial number plate is damaged or missing, the machine serial number is stamped on the top right front of the frame.

1.15 HYDRAULIC OIL

Table 1-18. Hydraulic Oil

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 require anti-wear qualities at least API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service.*

NOTE: *Machines may be equipped with Mobil EAL224H biodegradable and non-toxic hydraulic oil. This is vegetable oil based and possesses the same anti-wear and rust protection characteristics as mineral oils, but will not adversely affect the ground water or the environment when spilled or leaked in small amounts. Mobil EAL224H has a viscosity of 34 cSt at 40° C. and viscosity index of 213. The operating temperature range of this oil is -18° C. to +83° C.*

NOTE: *Aside from JLG recommendations, it is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. If use of hydraulic oil other than Mobil DTE 11M is desired, contact JLG Industries for proper recommendations.*

Table 1-19. Mobil DTE 11M Specs

ISO Viscosity Grade	#15
Gravity API	31.9
Pour Point, Max	-40°F (-40°C)
Flash Point, Min.	330°F (166°C)
Viscosity	
at 40° C	15 cSt
at 100° C	4.1 cSt
at 100° F	80 SUS
at 210° F	43 SUS
cp at -30° F	3.200
Viscosity Index	140

NOTE: *Machines Manufactured before S/N 03000046376 were filled with Mobilfluid 424 hydraulic oil. If desired to change to Mobil DTE 11M hydraulic oil, the telescope seals are recommended to be changed. These are included in (JLG) kit P/N 8457399. Also included in the kit, is a decal to be located on the hydraulic tank to identify Mobil DTE 11M oil in use.*

Table 1-20. 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 1-21. Mobil EAL 224H Specs

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

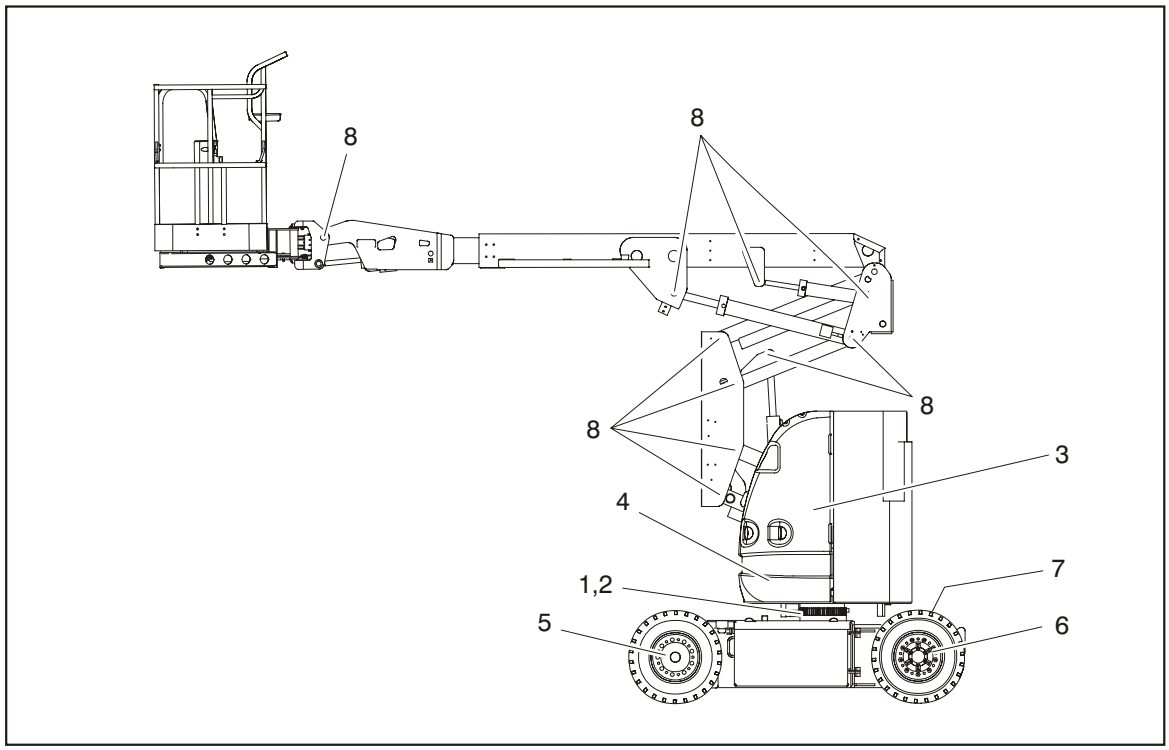


Figure 1-1. Operator Maintenance & Lubrication Diagram

1.16 LUBRICATION

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

Table 1-22. Lubrication Specifications.

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350 degrees F. Excellent water resistance and adhesive qualities; and being of extreme pressure type (Timken OK 40 pounds minimum).
EPGL	Extreme Pressure Gear Lube (oil) meeting API Service Classification GL-5 or Mil-Spec Mil-L-2105.
HO	Hydraulic Oil. Mobil DTE-11M
OG*	Open Gear Lube - Tribol Molub-Alloy 936 Open Gear Compound. (JLG Part No. 3020027)
BG*	Bearing Grease (JLG Part No. 3020029) Mobilith SHA 460.
LL	Synthetic Lithium Lubricant, Gredag 741 Grease. (JLG Part No. 3020022)
EO	Engine (crankcase) Oil. Gas - API SF/SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C.
*MPG may be substituted for these lubricants, if necessary, but service intervals will be reduced.	

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

NOTICE

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

1. Swing Bearing

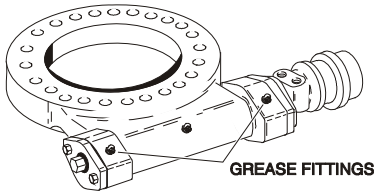
Lube Point(s) - 2 Grease Fittings
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hrs of operation

2. Swing Bearing/Worm Gear Teeth

Lube Point(s) - 2 Grease Fittings
Capacity - Spray On
Lube - Mobiltac375NC
Interval - A/R
Comments - If necessary install grease fittings into worm gear housing and grease bearings.

NOTICE

DO NOT OVERGREASE BEARINGS. OVERGREASING BEARINGS WILL RESULT IN DAMAGE TO OUTER SEAL IN HOUSING.



3. Hydraulic Tank

Lube Point(s) - Fill Cap
Capacity - 4 Gal. (15.1 L)
Lube - HO
Interval - Check Level daily; Change every 2 years or 1200 hours of operation.
Comments - On new machines, those recently overhauled, or after changing hydraulic oil, operate all systems a minimum of two complete cycles and recheck oil level in reservoir.

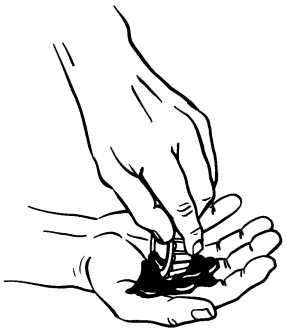
4. Hydraulic Return Filter

Interval - Change after first 50 hrs. and every 6 months or 300 hrs. thereafter.
Comments - Under certain conditions, it may be necessary to replace the hydraulic filter on a more frequent basis. A common symptom of a dirty filter is sluggishness experienced in hydraulic functions.

5. Wheel Drive Hub

Lube Point(s) - Level/Fill Plug
Capacity - 17 oz. (1/2 Full)
Lube - EPGL
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation

6. Wheel Bearings



Lube Point(s) - Repack
Capacity - A/R
Lube - MPG
Interval - Every 2 years or 1200 hours of operation

7. Spindles/Bushing

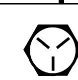
Capacity - A/R
Lube - Lithium Lubricant
Interval - Every 2 years or 1200 hours of operation
Comments - At Spindle/Bushing Replacement; Coat I.D. of bushings prior to installing king pins.

8. Boom Pivot Pins/Bushing

Capacity - A/R
Lube - Lithium Lubricant
Interval - Every 2 years or 1200 hours of operation
Comments - At boom pivot pins/bushing replacement; Coat I.D. of bushings prior to installing pivot pins.

SIZE	THDS. PER INCH	BOLT DIA.	TENSILE STRESS AREA	VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY: SAE GRADE 5 BOLTS & GRADE 2 NUTS CLAMP LOAD	TORQUE DRY OR LOCTITE 263	TORQUE LUB	TORQUE LOCTITE 262	TORQUE LOCTITE 242 OR 271	SAE GRADE 8 BOLTS & GRADE 8 NUTS & SOCKET HEAD CAP SCREWS CLAMP LOAD	TORQUE DRY OR LOCTITE 263	TORQUE LUB	TORQUE LOCTITE 262	TORQUE LOCTITE 242 OR 271	UNPLATED CAP SCREWS: UNBRAKO 1960 SERIES SOCKET HEAD CLAMP LOAD	TORQUE WITHOUT LOC-WEL PATCH	TORQUE WITH LOC-WEL PATCH
		IN	SQ. IN.	LB.	IN-LB	IN-LB	IN-LB	IN-LB	LB.	IN-LB.	IN-LB	IN-LB	IN-LB	LB.	IN-LB	IN-LB
4	40	0.1120	0.00604	380	8	6	—	—	540	12	9	—	—	—	—	—
	48		0.00661	420	9	7	—	—	600	13	10	—	—	—	—	—
6	32	0.1380	0.00909	580	16	12	—	—	820	23	17	—	—	—	—	—
	40		0.01015	610	18	13	—	—	920	25	19	—	—	—	—	—
8	32	0.1640	0.01400	900	30	22	—	—	1260	41	31	—	—	—	—	—
	36		0.01474	940	31	23	—	—	1320	43	32	—	—	—	—	—
10	24	0.1900	0.01750	1120	43	32	—	—	1580	60	45	—	—	—	—	—
	32		0.02000	1285	49	36	—	—	1800	68	51	—	—	—	—	—
1/4	20	0.2500	0.0318	2020	96	75	—	105	2860	144	108	—	160	3180	160	168
	28		0.0364	2320	120	86	—	135	3280	168	120	—	185	3640	168	178
		IN	SQ. IN.	LB.	FT-LB	FT-LB	FT-LB	FT-LB	LB.	FT-LB	FT-LB	FT-LB	FT-LB	LB.	FT-LB	FT-LB
5/16	18	0.3125	0.0524	3340	17	13	16	19	4720	25	18	22	30	5240	25	28
	24		0.0580	3700	19	14	17	21	5220	25	20	25	30	5800	27	30
3/8	16	0.3750	0.0775	4940	30	23	28	35	7000	45	35	40	50	7750	45	50
	24		0.0878	5600	35	25	32	40	7900	50	35	45	55	8780	50	55
7/16	14	0.4375	0.1063	6800	50	35	45	55	9550	70	55	63	80	10630	70	77
	20		0.1187	7550	55	40	50	60	10700	80	60	70	90	11870	75	82
1/2	13	0.5000	0.1419	9050	75	55	68	85	12750	110	80	96	120	14190	110	120
	20		0.1599	10700	90	65	80	100	14400	120	90	108	130	15990	115	127
9/16	12	0.5625	0.1820	11600	110	80	98	120	16400	150	110	139	165	18200	155	170
	18		0.2030	12950	120	90	109	135	18250	170	130	154	190	20300	165	182
5/8	11	0.6250	0.2260	14400	150	110	135	165	20350	220	170	180	240	22600	210	231
	18		0.2560	16300	170	130	153	190	23000	240	180	204	265	25600	220	242
3/4	10	0.7500	0.3340	21300	260	200	240	285	30100	380	280	301	420	33400	365	400
	16		0.3730	23800	300	220	268	330	33600	420	320	336	465	37300	400	440
7/8	9	0.8750	0.4620	29400	430	320	386	475	41600	600	460	485	660	46200	585	645
	14		0.5090	32400	470	350	425	520	45800	660	500	534	725	50900	635	700
1	8	1.0000	0.6060	38600	640	480	579	675	51500	900	680	687	990	60600	865	950
	12		0.6630	42200	700	530	633	735	59700	1000	740	796	1100	66300	915	1000
1-1/8	7	1.1250	0.7630	42300	800	600	714	840	68700	1280	960	1030	1400	76300	1240	1365
	12		0.8560	47500	880	660	802	925	77000	1440	1080	1155	1575	85600	1380	1520
1-1/4	7	1.2500	0.9690	53800	1120	840	1009	1175	87200	1820	1360	1453	2000	96900	1750	1925
	12		1.0730	59600	1240	920	1118	1300	96600	2000	1500	1610	2200	107300	1880	2070
1-3/8	6	1.3750	1.1550	64100	1460	1100	1322	1525	104000	2380	1780	1907	2625	115500	2320	2550
	12		1.3150	73000	1680	1260	1506	1750	118100	2720	2040	2165	3000	131500	2440	2685
1-1/2	6	1.5000	1.4050	78000	1940	1460	1755	2025	126500	3160	2360	2530	3475	140500	3040	3345
	12		1.5800	87700	2200	1640	1974	2300	142200	3560	2660	2844	3925	158000	3270	3600

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


SAE GRADE 5

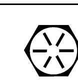

SAE GRADE 8

Figure 1-2. Torque Chart - (In/Lb - Ft/Lb). (For ASTM Fasteners)

SIZE	THDS. PER INCH	BOLT DIA.	TENSILE STRESS AREA	VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY — SAE GRADE 5 BOLTS & GRADE 2 NUTS — CLAMP LOAD	TORQUE — DRY OR LOCTITE 263	TORQUE — LUB	TORQUE — LOCTITE 262	TORQUE — LOCTITE 242 OR 271	SAE GRADE 8 BOLTS & GRADE 8 NUTS & SOCKET HEAD CAP SCREWS — CLAMP LOAD	TORQUE — DRY OR LOCTITE 263	TORQUE — LUB	TORQUE — LOCTITE 262	TORQUE — LOCTITE 242 OR 271	UNPLATED CAP SCREWS — UNBRAKO 1960 SERIES SOCKET HEAD — CLAMP LOAD	TORQUE — WITHOUT LOC-WEL PATCH	TORQUE — WITH LOC-WEL PATCH
		IN	SQ. IN.	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m
4	40	0.1120	0.00604	380	.8	.8	—	—	540	1.4	1.0	—	—	—	—	—
	48		0.00661	420	1.0	.8	—	—	600	1.5	1.0	—	—	—	—	—
6	32	0.1380	0.00909	580	1.8	1.4	—	—	820	2.6	2.0	—	—	—	—	—
	40		0.01015	610	2.0	1.6	—	—	920	2.8	2.2	—	—	—	—	—
8	32	0.1640	0.01400	900	3.4	2.4	—	—	1260	4.6	3.4	—	—	—	—	—
	36		0.01474	940	3.4	2.6	—	—	1320	5	3.6	—	—	—	—	—
10	24	0.1900	0.01750	1120	5	3.6	—	—	1580	7	5	—	—	—	—	—
	32		0.02000	1285	6	4	—	—	1800	8	6	—	—	—	—	—
1/4	20	0.2500	0.0318	2020	11	8	—	12	2860	16	12	—	18	3180	18	19
	28		0.0364	2320	14	10	—	15	3280	19	14	—	21	3640	19	20
		IN	SQ. IN.	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m
5/16	18	0.3125	0.0524	3340	23	18	22	26	4720	34	24	30	41	5240	34	38
	24		0.0580	3700	26	19	23	28	5220	34	27	34	41	5800	37	41
3/8	16	0.3750	0.0775	4940	41	31	38	47	7000	61	47	54	68	7750	61	68
	24		0.0878	5600	47	34	43	54	7900	68	47	61	75	8780	68	75
7/16	14	0.4375	0.1063	6800	68	47	61	75	9550	95	75	85	108	10630	95	104
	20		0.1187	7550	75	54	68	81	10700	108	81	95	122	11870	102	111
1/2	13	0.5000	0.1419	9050	102	75	92	115	12750	149	108	130	163	14190	149	163
	20		0.1599	10700	122	88	108	136	14400	163	122	146	183	15990	156	172
9/16	12	0.5625	0.1820	11600	149	108	133	163	16400	203	149	188	224	18200	210	230
	18		0.2030	12950	163	122	148	183	18250	230	176	209	258	20300	224	247
5/8	11	0.6250	0.2260	14400	203	149	183	224	20350	298	230	244	325	22600	285	313
	18		0.2560	16300	230	176	207	258	23000	325	244	277	359	25600	298	328
3/4	10	0.7500	0.3340	21300	353	271	325	386	30100	515	380	408	569	33400	495	542
	16		0.3730	23800	407	298	363	447	33600	569	434	456	630	37300	542	597
7/8	9	0.8750	0.4620	29400	583	434	523	644	41600	813	624	658	895	46200	793	874
	14		0.5090	32400	637	475	576	705	45800	895	678	724	983	50900	861	949
1	8	1.0000	0.6060	38600	868	651	785	915	51500	1220	922	931	1342	60600	1173	1288
	12		0.6630	42200	949	719	858	997	59700	1356	1003	1079	1491	66300	1241	1356
1-1/8	7	1.1250	0.7630	42300	1085	813	968	1139	68700	1735	1302	1396	1898	76300	1681	1851
	12		0.8560	47500	1193	895	1087	1254	77000	1952	1464	1566	2135	85600	1871	2061
1-1/4	7	1.2500	0.9690	53800	1518	1139	1368	1593	87200	2468	1844	1970	2712	96900	2373	2610
	12		1.0730	59600	1681	1247	1516	1763	96600	2712	2034	2183	2983	107300	2549	2807
1-3/8	6	1.3750	1.1550	64100	1979	1491	1792	2068	104000	3227	2413	2586	3559	115500	3145	3457
	12		1.3150	73000	2278	1708	2042	2373	118100	3688	2766	2935	4067	131500	3308	3640
1-1/2	6	1.5000	1.4050	78000	2630	1979	2379	2745	126500	4284	3200	3430	4711	140500	4122	4535
	12		1.5800	87700	2983	2224	2676	3118	142200	4827	3606	3856	5322	158000	4433	4881

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


SAE GRADE 5

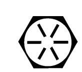

SAE GRADE 8

Figure 1-3. Torque Chart (Metric Conversion) - (For ASTM Fasteners)

			VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY									
			CLASS 8.8 METRIC BOLTS & CLASS 8 METRIC NUTS					CLASS 10.9 METRIC BOLTS & CLASS 10 METRIC NUTS				
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE				CLAMP LOAD	TORQUE			
				DRY OR LOCTITE 263	LUB	LOCTITE 262	LOCTITE 242 OR 271		DRY OR LOCTITE 263	LUB	LOCTITE 262	LOCTITE 242 OR 271
		sq. mm	KN	N, m	N, m	N, m	N, m	KN	N, m	N, m	N, m	N, m
3	.5	5.03	2.19	1.3	1.0	1.2	1.4	3.13	1.9	1.4	1.5	2.1
3.5	.6	6.78	2.95	2.1	1.6	1.9	2.3	4.22	3.0	2.2	2.4	3.3
4	.7	8.78	3.82	3.1	2.3	2.8	3.4	5.47	4.4	3.3	3.5	4.8
5	.8	14.2	6.18	6.2	4.6	5.6	6.8	8.85	8.9	6.6	7.1	9.7
6	1	20.1	8.74	11	7.9	9.4	12	12.5	15	11	12	17
7	1	28.9	12.6	18	13	16	19	18	25	19	20	28
8	1.25	36.6	15.9	25	19	23	28	22.8	37	27	29	40
10	1.5	58.0	25.2	50	38	45	55	36.1	72	54	58	79
12	1.75	84.3	36.7	88	66	79	97	52.5	126	95	101	139
14	2	115	50.0	140	105	126	154	71.6	200	150	160	220
16	2	157	68.3	219	164	197	241	97.8	313	235	250	344
18	2.5	192	83.5	301	226	271	331	119.5	430	323	344	473
20	2.5	245	106.5	426	320	383	469	152.5	610	458	488	671
22	2.5	303	132.0	581	436	523	639	189.0	832	624	665	915
24	3	353	153.5	737	553	663	811	220.0	1060	792	845	1170
27	3	459	199.5	1080	810	970	1130	286.0	1540	1160	1240	1690
30	3.5	561	244.0	1460	1100	1320	1530	349.5	2100	1570	1680	2310
33	3.5	694	302.0	1990	1490	1790	2090	432.5	2600	2140	2280	2860
36	4	817	355.0	2560	1920	2300	2690	509.0	3660	2750	2930	4020
42	4.5	1120	487.0	4090	3070	3680	4290	698.0	5860	4400	4690	6440

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

METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-4. Torque Chart - (N, m) - (For Metric Class Fasteners).

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.

Table 2-1. Inspection and Maintenance

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

2.2 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

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

Cleanliness

1. The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep air, fuel, and oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.
2. At any time when air, fuel, or oil lines are disconnected, clear adjacent areas as well as the openings and fittings themselves. As soon as a line or component is disconnected, cap or cover all openings to prevent entry of foreign matter.
3. Clean and inspect all parts during servicing or maintenance, and assure that all passages and openings are unobstructed. Cover all parts to keep them clean. Be sure all parts are clean before they are installed. New parts should remain in their containers until they are ready to be used.

Components Removal and Installation

1. Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (chains, cables, etc.) should be parallel to each other and as near perpendicular as possible to top of part being lifted.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an 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.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.
4. Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore, apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

Gaskets

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

Bolt Usage and Torque Application

1. Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
2. Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See Torque Chart Section 1.)

Hydraulic Lines and Electrical Wiring

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

Hydraulic System

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

Lubrication

Service applicable components with the amount, type, and grade of lubricant recommended in this manual, at the specified intervals. When recommended lubricants are not available, consult your local supplier for an equivalent that meets or exceeds the specifications listed.

Battery

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

Lubrication and Servicing

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

2.3 LUBRICATION AND INFORMATION

Hydraulic System

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc., to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient system warm-up or leaks in the pump supply (suction) lines.
2. The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. Hydraulic system filters should be checked, cleaned, and/or replaced as necessary, at the specified intervals required in the Lubrication Chart in Section 1. Always examine filters for evidence of metal particles.
3. Cloudy oils indicate a high moisture content which permits organic growth, resulting in oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.
4. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

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

Hydraulic Oil

1. Refer to Section 1 for recommendations for viscosity ranges.
2. JLG recommends Mobil DTE 11M Hydraulic Oil, which has an SAE viscosity of 10W and a viscosity index of 140. A decal, located on the hydraulic tank, will identify this oil.

NOTE: *Start-up of hydraulic system with oil temperatures below -15 degrees F. 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.)*

NOTE: *Mobil DTE 11M hydraulic oil may purchased from JLG in 4 Gal. containers. (P/N 2300028)*

Changing Hydraulic Oil

1. Filter elements must be changed after the first 50 hours of operation and every 300 hours thereafter. If it is necessary to change the oil, use only those oils meeting or exceeding the specifications appearing in this manual. If unable to obtain the same type of oil supplied with the machine, consult local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils. JLG Industries recommends changing the hydraulic oil annually.
2. Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the service container. Always clean the mesh element of the filter and replace the cartridge any time the system oil is changed.
3. While the unit is shut down, a good preventive maintenance measure is to make a thorough inspection of all hydraulic components, lines, fittings, etc., as well as a functional check of each system, before placing the machine back in service.

Lubrication Specifications

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

2.4 CYLINDER DRIFT TEST

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

Platform Drift

Measure the drift of the platform to the ground. Lower booms (if equipped) slightly elevated, 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.
2. Filament wound bearings should be replaced if any of the following is observed:
   a. Frayed or separated fibers on the liner surface.
   b. Cracked or damaged liner backing.
   c. Bearings that have moved or spun in their housing.
   d. Debris embedded in liner surface.
3. Pins should be replaced if any of the following is observed (pin should be properly cleaned prior to inspection):
   a. Detectable wear in the bearing area.
   b. Flaking, pealing, scoring, or scratches on the pin surface.
   c. Rusting of the pin in the bearing area.
4. Re-assembly of pinned joints using filament wound bearings.
   a. Housing should be blown out to remove all dirt and debris...bearings and bearing housings must be free of all contamination.
   b. Bearing / pins should be cleaned with a solvent to remove all grease and oil...filament wound bearing are a dry joint and should not be lubricated 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

AREA	INTERVAL					
	Pre-Start[1] Inspection	Weekly Preventive Maintenance	Monthly Preventive Maintenance	Pre-Delivery[2] or Frequent[3] Inspection	Annual[4] (Yearly) Inspection	Every 2 Years
Boom Assembly	9					
Boom Weldments				1,2,4	1,2,4	
Hose/Cable Carrier Installations				1,2,9,12	1,2,9,12	
Pivot Pins and Pin Retainers				1,2	1,2	
Sheaves, Sheave Pins				1,2	1,2	
Bearings				1,2	1,2	
Wear Pads				1,2	1,2	
Covers or Shields				1,2	1,2	
Extend/Retract Chain or Cable Systems				1,2,3	1,2,3	
Platform Assembly	9					
Platform	1,2				1,2	
Railing	1,2			1	1,2	
Gate			5	1	1,5	
Floor	1,2			1	1,2	
Rotator		9,5		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					
Platform Controls	5	5		6	6	

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL					
	Pre-Start[1] Inspection	Weekly Preventive Maintenance	Monthly Preventive Maintenance	Pre-Delivery[2] or Frequent[3] Inspection	Annual[4] (Yearly) Inspection	Every 2 Years
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						
Operation and Safety Manuals in Storage Box	21			21	21	
ANSI and EMI Manuals/Handbooks Installed					21	
Capacity Decals Installed, Secure, Legible	21			21	21	
All Decals/Placards Installed, Secure, Legible	21			21	21	

Table 2-3. Inspection and Preventive Maintenance Schedule

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

Footnotes:

[1] Prior to use each day; or at each Operator change

[2] Prior to each sale, lease, or delivery

[3] In service for 3 months or 150 Hours; or Out of service for 3 months or more; or Purchased used

[4] Annually, no later than 13 months from the date of the prior inspection

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

NOTES:

SECTION 3. CHASSIS & TURNTABLE

3.1 TIRES AND WHEELS

Tire Wear and Damage

Inspect tires periodically for wear or damage. Tires with worn edges or distorted profiles require replacement. Tires with significant damage in the tread area or side wall, require immediate evaluation before replacing the machine into service.

Wheel and Tire Replacement

Replacement wheels must have the same diameter and profile as the original. Replacement tires must be the same size and rating as the tire being replaced.

Wheel Installation

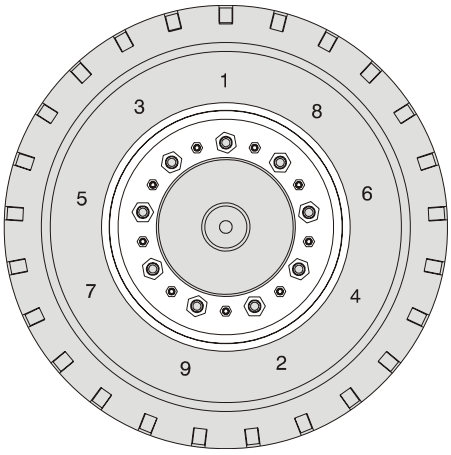
It is extremely important to apply and maintain proper wheel mounting torque.

⚠ WARNING

WHEEL NUTS MUST BE INSTALLED AND MAINTAINED AT THE PROPER TORQUE TO PREVENT LOOSE WHEELS, BROKEN STUDS, AND POSSIBLE 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:

1. 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.

Table 3-1. Wheel Torque Chart

TORQUE SEQUENCE		
1st Stage	2nd Stage	3rd Stage
40 ft lbs (55 Nm)	95 ft lbs (130 Nm)	170 ft lbs (230 Nm)

4. Wheel nuts should be torqued after first 50 hours of operation and after each wheel removal. Check the torque after the first 10 miles, 25 miles, and again at 50 miles. Check periodically thereafter.

3.2 DRIVE HUB PART NO. 2780236

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

Disassembly

1. Position drive so that one of the fill holes is at the bottom of the end cover and drain the oil.
2. Remove all bolts holding the motor and Remove motor from drive.
3. Compress the disc (59) using a simple fixture or other suitable device.
4. Remove snap ring (66) and release pressure on disc until loose. Remove tool and disc.
5. Remove the spring (55) from the input shaft (44).
6. Turn unit so that cover (8) is in the up position.
7. Remove the screw plugs (22) and seal rings (21).
8. Remove snap rings (34), and remove the cover unit (8) from drive.
9. Remove “o” ring (33).
10. Remove the first stage planetary assembly (7).
11. Remove hex bolts (23).
12. Remove ring gear (30) and “o” ring (19).
13. Remove snap rings (15).
14. Pull off planet gears (1) together with cylindrical roller bearings (11) from spindle (60).

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

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

Disassembly of Cover

1. Loosen and remove hex head bolts (53) to remove cover (51).
2. Remove shaft rod (56) and “o” ring (54).
3. Remove sleeve (52).

Disassembly of the first stage planetary assembly (7)

1. Push sun gear shaft (43) out of the first stage.
2. Remove snap rings (14).
3. Press planet pins (5) out of the planet gears (2).
4. Pull cylindrical roller bearing (10) out of the planet gears (2).
5. Remove snap ring (16) from sun gear (3) and Remove planet carrier (7) from sun gear (3).
6. Remove thrust washer (49).

Disassembly of second stage planet gears (1)

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

Assembly of first stage planetary assembly (7)

1. Pre-freeze planet pins (5) and install into planet carrier (7).
2. Install planet carrier (7) together with planet pins (5) on sun gear (3), and install snap ring (16).
3. Pre-heat thrust washer (49) and Install onto sun gear shaft (43).
4. Put sun gear shaft (43) into sun gear (3).
5. Pre-heat stay rings (17) and install onto planet pins (5).
6. Pre-heat cylindrical roller bearings (10) and install onto planet pins (5) and fix bearings with snap rings (14).

Assembly of end cover unit (8)

1. Press sleeve (52) into cover (8).
2. Install “o” ring (54) into groove of cover (8).
3. Install shift rod (56) into cover (8).
4. Install the cover (51) into cover (8) and fix cover (51) with hex bolts (53). Tighten bolts with torque wrench to 6.3 ft. lbs. (8.5 Nm).

Final Assembly

1. Install thrust washer (29) in spindle (60).
2. Install “o” ring (19) into groove of support ring (6).
3. Install planet gears (1) onto planet pins which are part of spindle (60).
4. Install snap rings (15) on planet pins of spindle (60) in order to fix the planet gears (1).
5. Put ring gear (30) onto support ring (6) and fix ring gear (30) with hex head bolts (23). Tighten bolts with torque wrench to 15.5 ft. lbs.(21.1 Nm).
6. Insert the first stage planetary assembly (7) into drive.
7. Install “o” ring (33) in groove of ring gear (30).
8. Install end the cover unit (8) on shoulder ring gear (30) and fix with snap ring (34).
9. Install seal rings (21) and screw plugs (22).
10. Before installation of motor, CHECK THAT THERE IS 1-2mm OF CLEARANCE BETWEEN THE MOTOR SPLINE SHAFT SHOULDER AND THE COUPLER (62).
11. Install the motor and reconnect hydraulic lines.
12. Roll motor so that one fill plug is at 12 o’clock position, and the other is at 3 o’clock. Fill to bottom of 3 o’ clock plug with gear oil. reinstall plugs

Initial Start-up And After Repairs

Before operating the machine, make sure that the drive is filled with clean oil, approximately 0.2 US gallons(.8 L). An accurate oil level is determined by the oil level plug, which should be removed before oil fill.

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

Daily: - Check for oil leakage

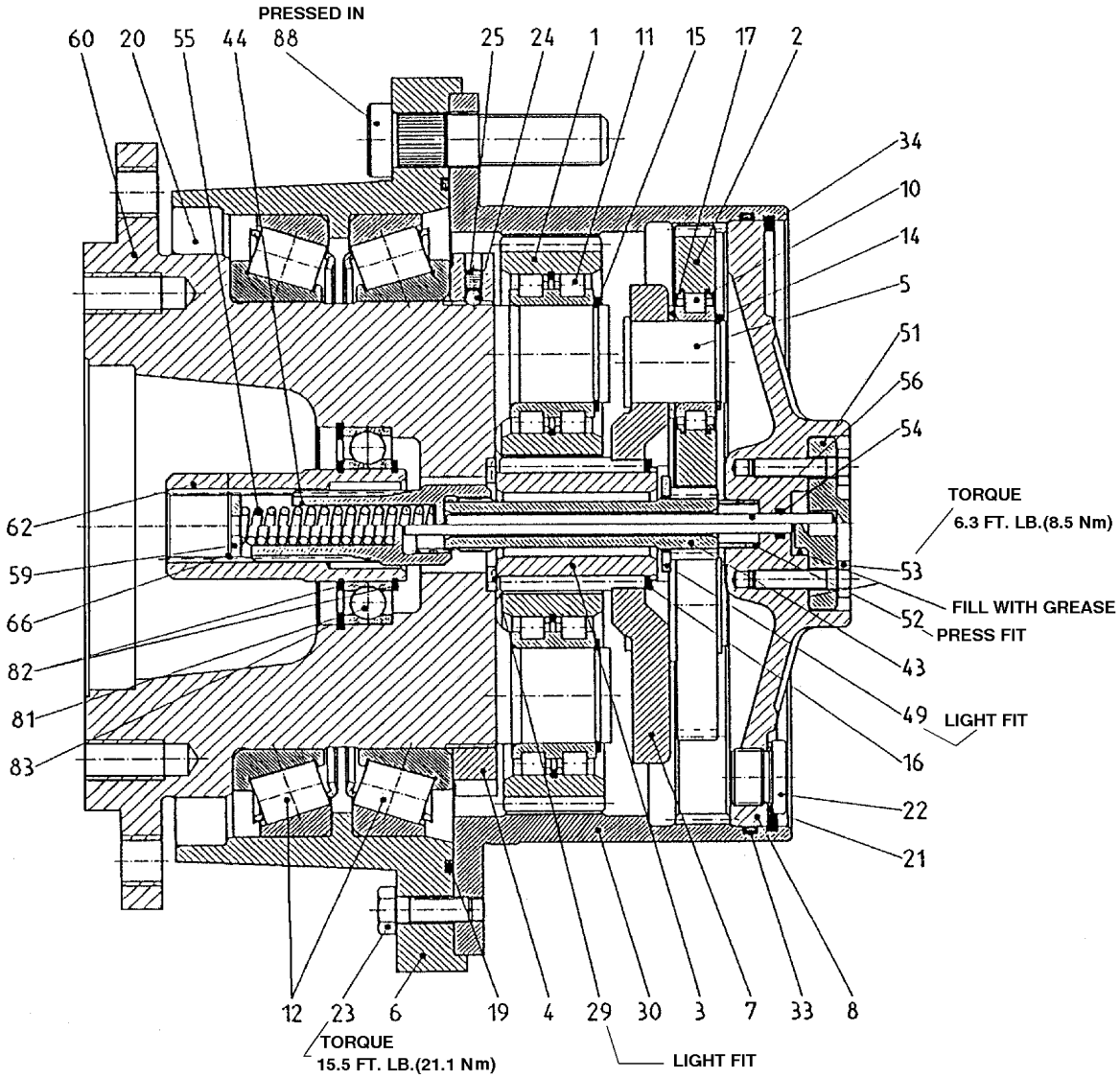
Weekly: - Check oil level

Monthly: - Check mounting bolt torque

Oil Change Interval-Gear Drive

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

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



1. GEAR, PLANET
2. GEAR, PLANET
3. GEAR, SUN
4. NUT, SHAFT
5. PIN, PLANET
6. RING, SUPPORT
7. CARRIER, PLANE
8. KIT, COVER
10. KIT, BEARING
11. BEARING, ROLLER
12. BEARING, ROLLER
14, SNAP RING
15, SNAP RING
16, SNAP RING
17, STAY RINGS
19. SEAL KIT
20. SEAL, SHAFT
21. SEAL RING
22. SCREW PLUG
23. HEX HEAD BOLT
24. BALL, DETENT
25. PLUG, EXPANDING
29. WASHER, THRUST
30. GEAR, RING
33. “O” RING
34. SNAP RING
43. SHAFT, SUN GEAR
44. SHAFT, INPUT
51. COVER
52. SLEEVE
53. HEX HEAD BOLT
54. “O” RING
55. SPRING
56. ROD, SHAFT
59. DISC
60. SPINDLE
62. COUPLER
66. SNAP RING
81. BEARING, BALL
82. SNAP RING
83. SNAP RING
88. STUD, WHEEL

Figure 3-1. Drive Hub

3.3 DRIVE HUB (S/N 115723 TO PRESENT)

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.

THE 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 constant force to the roll checker. If you feel more 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 consistency.

THE LEAK TEST (MAIN UNIT)

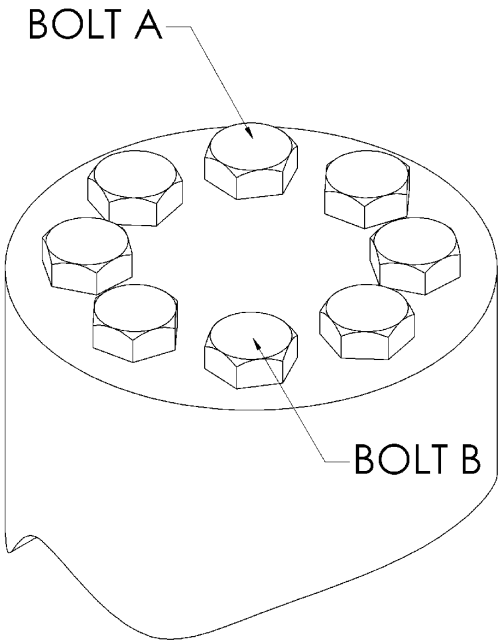
The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your leak checking fitting starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal 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 o-rings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, o-ring or gasket, the part must be replaced, and the unit rechecked. Leak test at 10 psi 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.
2. Go to the opposite side of the bolt circle and tighten bolt "B" until equally snug.
3. Crisscross around the bolt circle and tighten remaining bolts.
4. Now use a torque wrench to apply the specified torque to bolt "A".
5. Using the same sequence, crisscross around the bolt circle and apply an equal torque to the remaining bolts.



Main Disassembly

1. Perform Roll Check and Leak Check if applicable prior to disassembling the unit.
2. Drain oil from unit. Note the condition and volume of the oil.
3. Remove Coupling (7) from Spindle End first.
4. Remove Retaining Ring (6G) by prying the open end of Retaining Ring out of the groove in the Ring Gear (1F) with a screwdriver, then grasp the loose end with pliers and pull the Retaining Ring completely out of the groove.
5. Remove the Cover Subassembly (6) from the unit. The unit can be carefully pressurized with air to pop the cover out of the unit. Washer (2) may have to be removed separately because of the loose attachment.
6. Remove the First Stage Sun Gear (10) if applicable.

NOTE: *On units with ratios greater than 36:1 numerically, there will not be a separate First Stage Sun Gear (10), as the gear teeth will be integral to the Input Shaft (9).*

7. Remove the Input Carrier Sub-assembly (3). Continued on next page.
8. Remove the Second Stage Sun Gear (11).
9. Remove the Input Shaft (9).

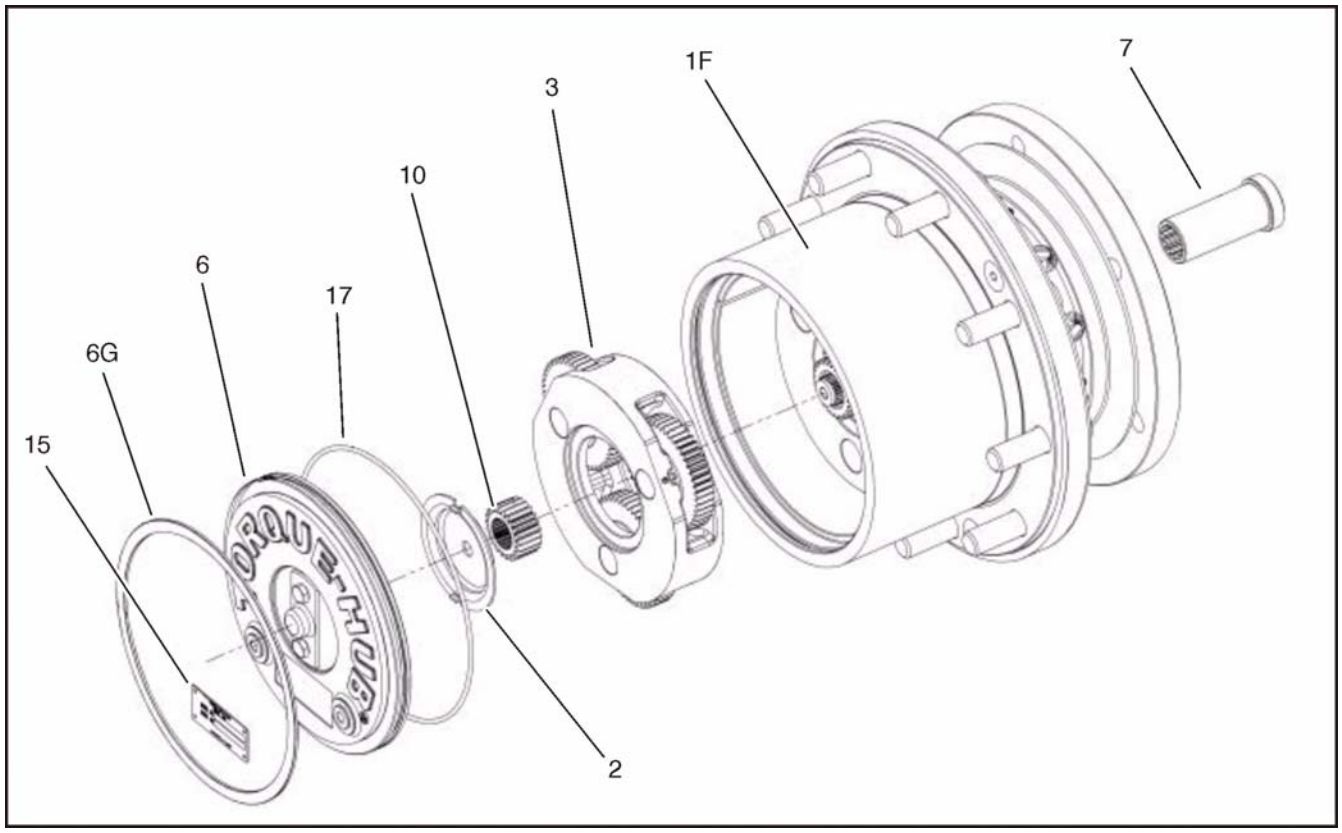
NOTE: *On units with a ratio 48:1, the Sun Gear (11) and the Input Shaft (9) will need to be removed together.*

10. Remove the Output Stage Carrier Sub-assembly (4)

11. Loosen and remove the three Flat Head Bolts (19) that retain the Ring Gear (1F) to the Housing (1G).

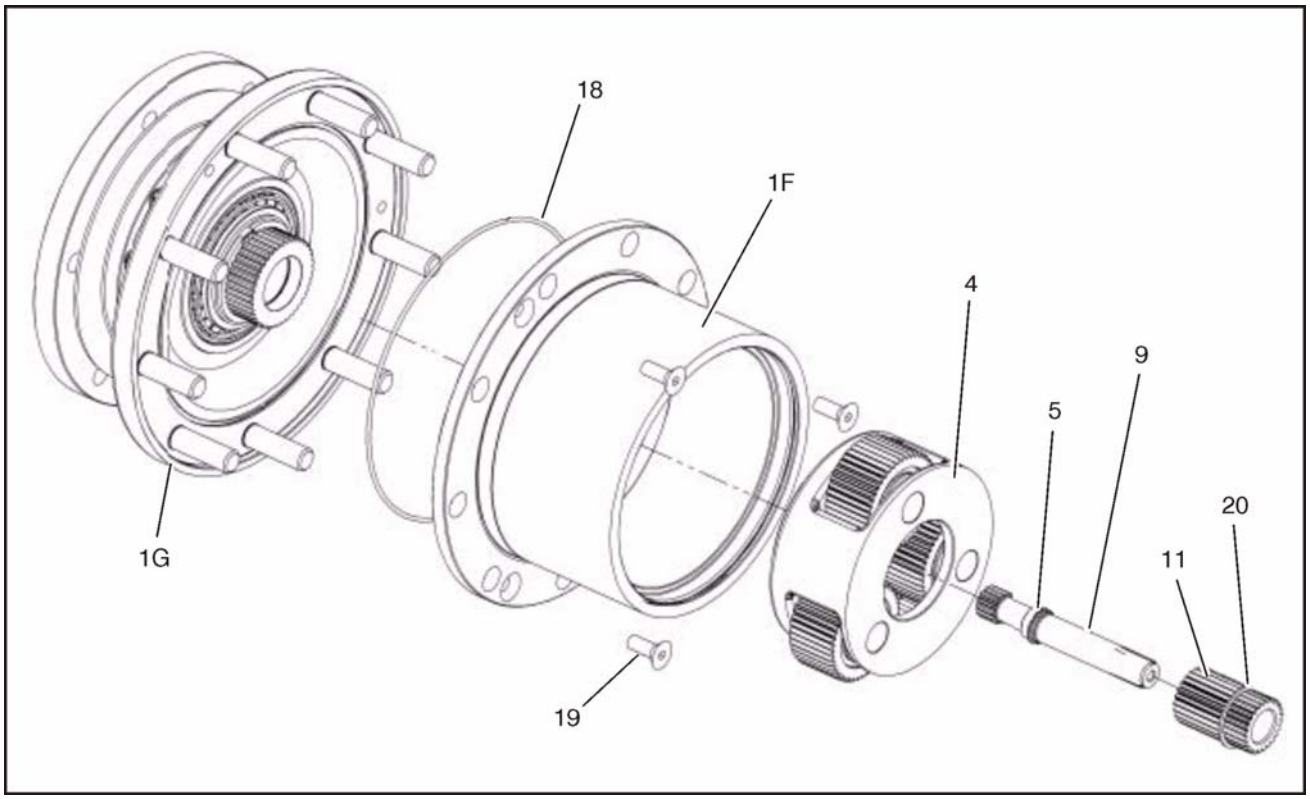
12. Lift the Ring Gear (1F) off of the Housing (1G).

13. Remove the O-ring (18) from between the Housing (1G) and the Ring Gear (1F).



1F. Ring Gear
1G. Housing
2. Washer
3. Input Carrier Subassembly
4. Output Carrier Subassembly
6. Cover Assembly
6G. Retaining Ring
7. Coupling
9. Input Shaft
10. First Stage Sun Gear
11. Second Stage Sun Gear
15. I.D. Plate
18. O-ring
19. Flat Head Bolts

Figure 3-2. Main Disassembly Drawing 1

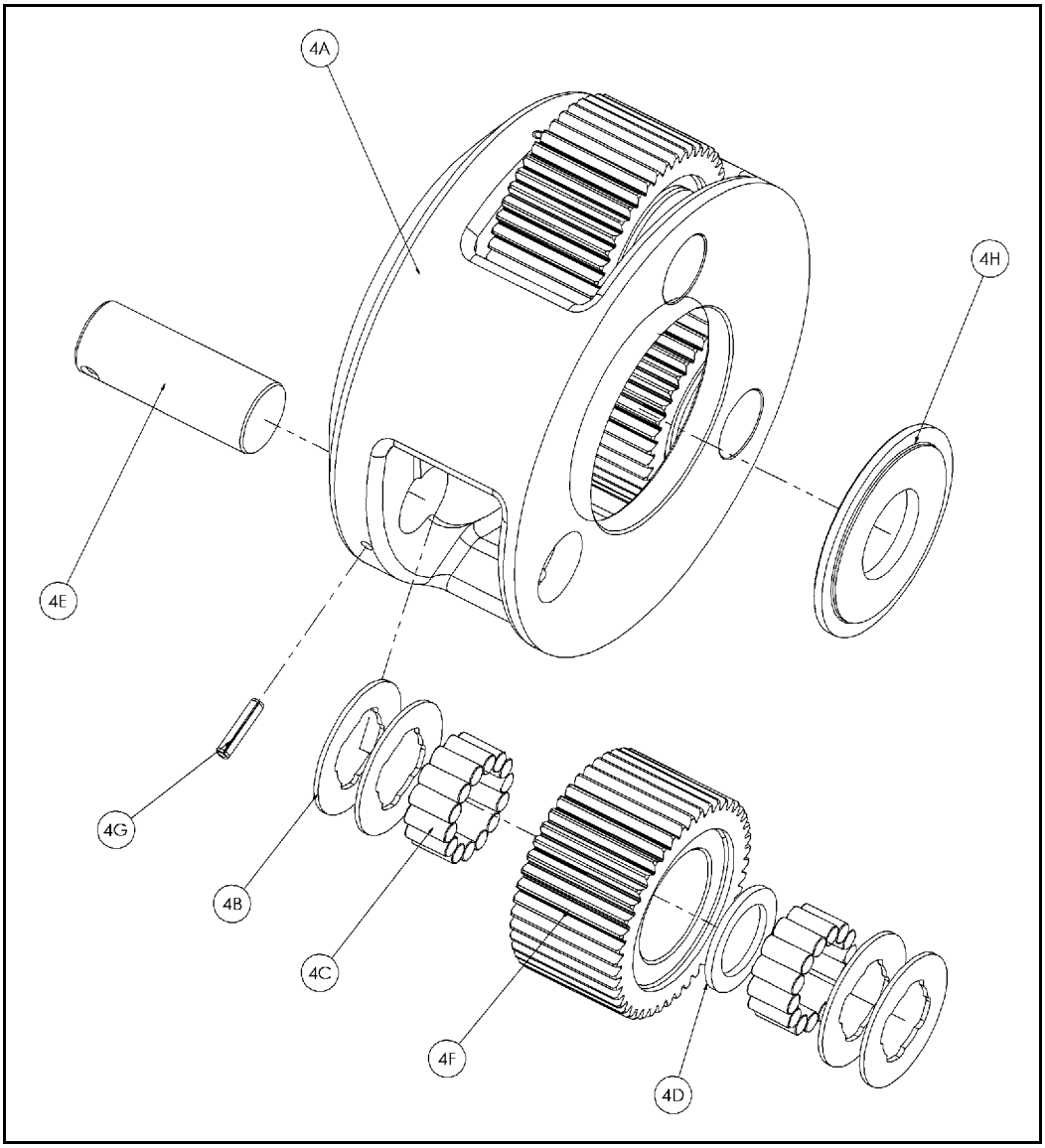


1F. Ring Gear
1G. Housing
4. Output Carrier Subassembly
5. Retaining Ring
6. Cover Assembly
6G. Retaining Ring
9. Input Shaft
10. First Stage Sun Gear
11. Second Stage Sun Gear
18. O-ring
19. Flat Head Bolts
20. Retaining Ring

Figure 3-3. Main Disassembly Drawing 2

Output Carrier Disassembly

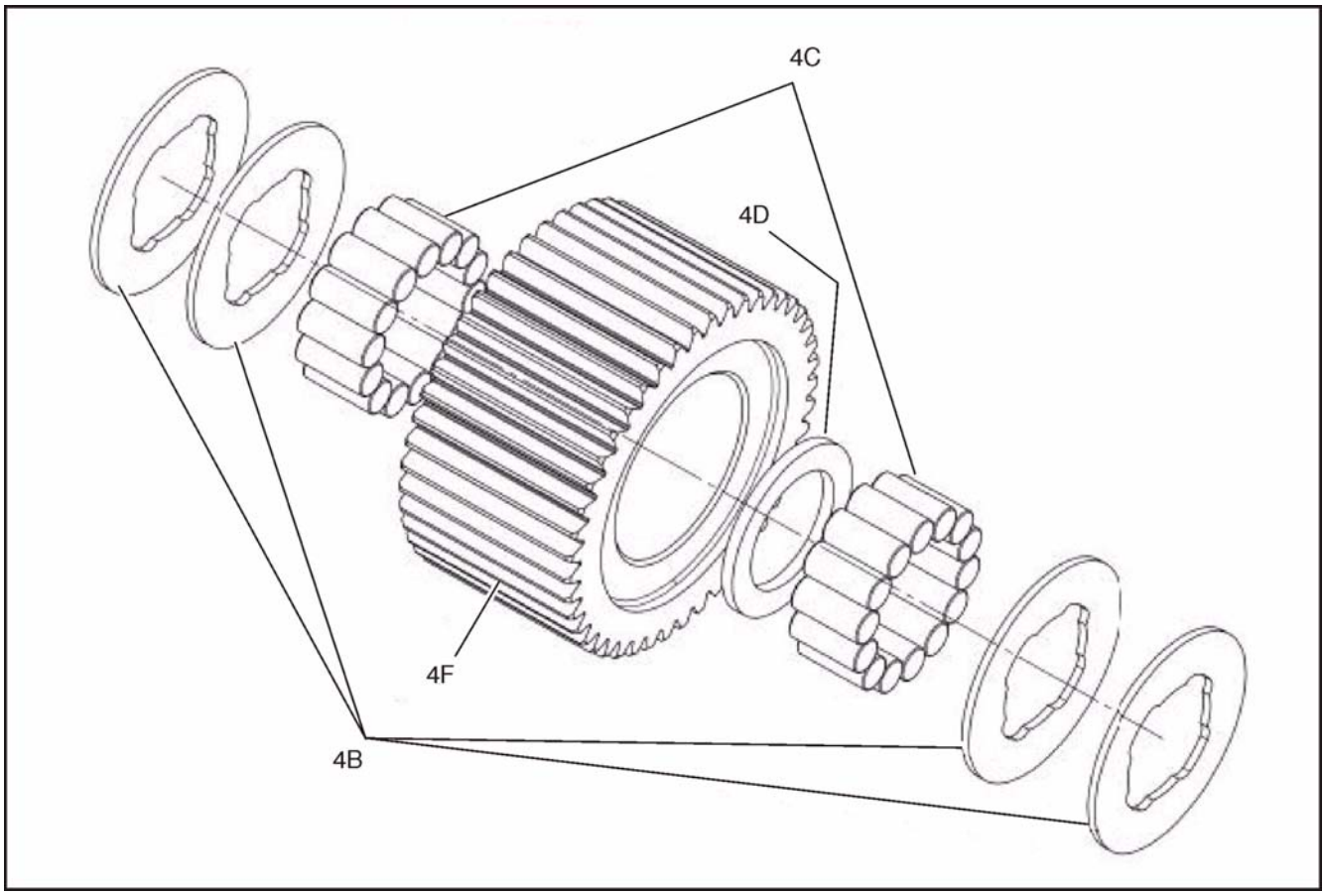
1. Using a 1/8" diameter punch, drive the Roll Pin (4G) into the Planet Shaft (4E) until it bottoms against the Carrier (3A).
2. Using a soft face hammer, tap the Planet Shaft (4E) out of the Carrier (4A).
3. Using a 1/8" diameter punch, drive the Roll Pin (4G) out of the Planet Shaft (4E). NOTE: The Roll Pins (4G) should not be reused when reassembling the unit.
4. Slide the Planet Gear Sub-assembly (4) out of the Output Carrier (4A) being careful to not drop the Needle Bearings (4C) in the process.



4A	Output Carrier	4E	Planet Shaft
4B	Thrust Washer	4F	Planet Gear
4C	Needle Bearing	4G	Roll Pin
4D	Thrust Spacer	4H	Thrust Washer

Figure 3-4. Output Carrier

5. Remove 4 Thrust Washers (4B), 28 Needle Rollers (4C) and the Thrust Spacer (4D) from the Second Stage Planet Gear (4F).
6. Repeat Steps 1 though 5 for the remaining two Planet Gears (4F).
7. Remove the Thrust Washer (4H) from the counterbore in the Output Carrier (4A).



1F Output Carrier
4B Thrust Washer
4C Needle Bearing
4D Thrust Spacer
4F Planet Gear

Figure 3-5. Planet Gear

Input Carrier Disassembly

1. Using a 1/8" diameter punch, drive the Roll Pin (4G) into the Planet Shaft (3E) until it bottoms against the Carrier (3A).
2. Using a soft face hammer, tap the Planet Shaft (3E) out of the Carrier (3A).
3. Using a 1/8" diameter punch, drive the Roll Pin (4G) out of the Planet Shaft (3E). NOTE: The Roll Pins (4G) should not be reused when reassembling the unit.
4. Slide the Planet Gear (3F) and the two Thrust Washers (3B) out of the Carrier (3A).
5. Remove the 14 needle Bearings (3C) from the bore of the Planet Gear (3F).
6. Repeat steps 1 through 5 for each of the two remaining planet gears.

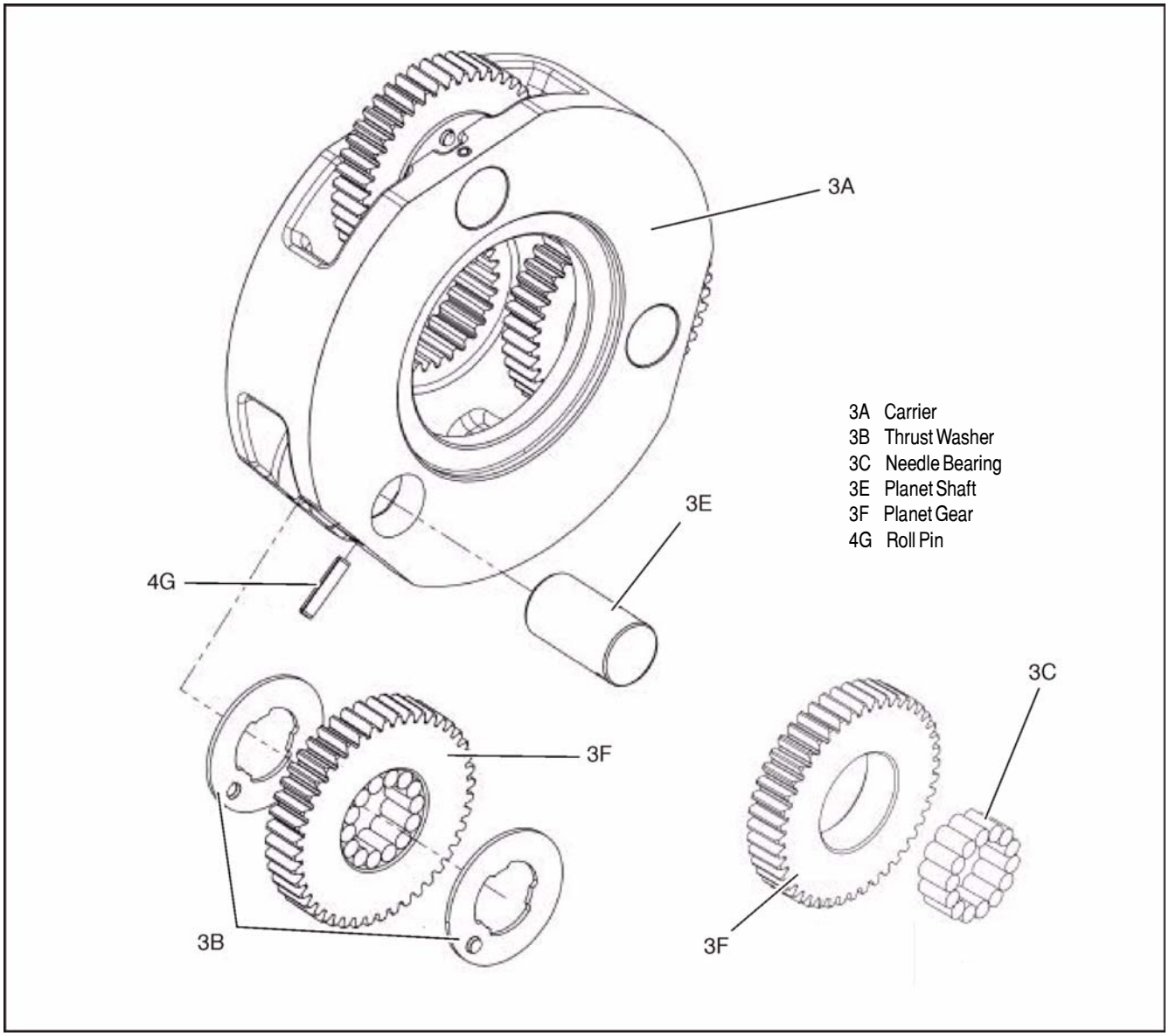


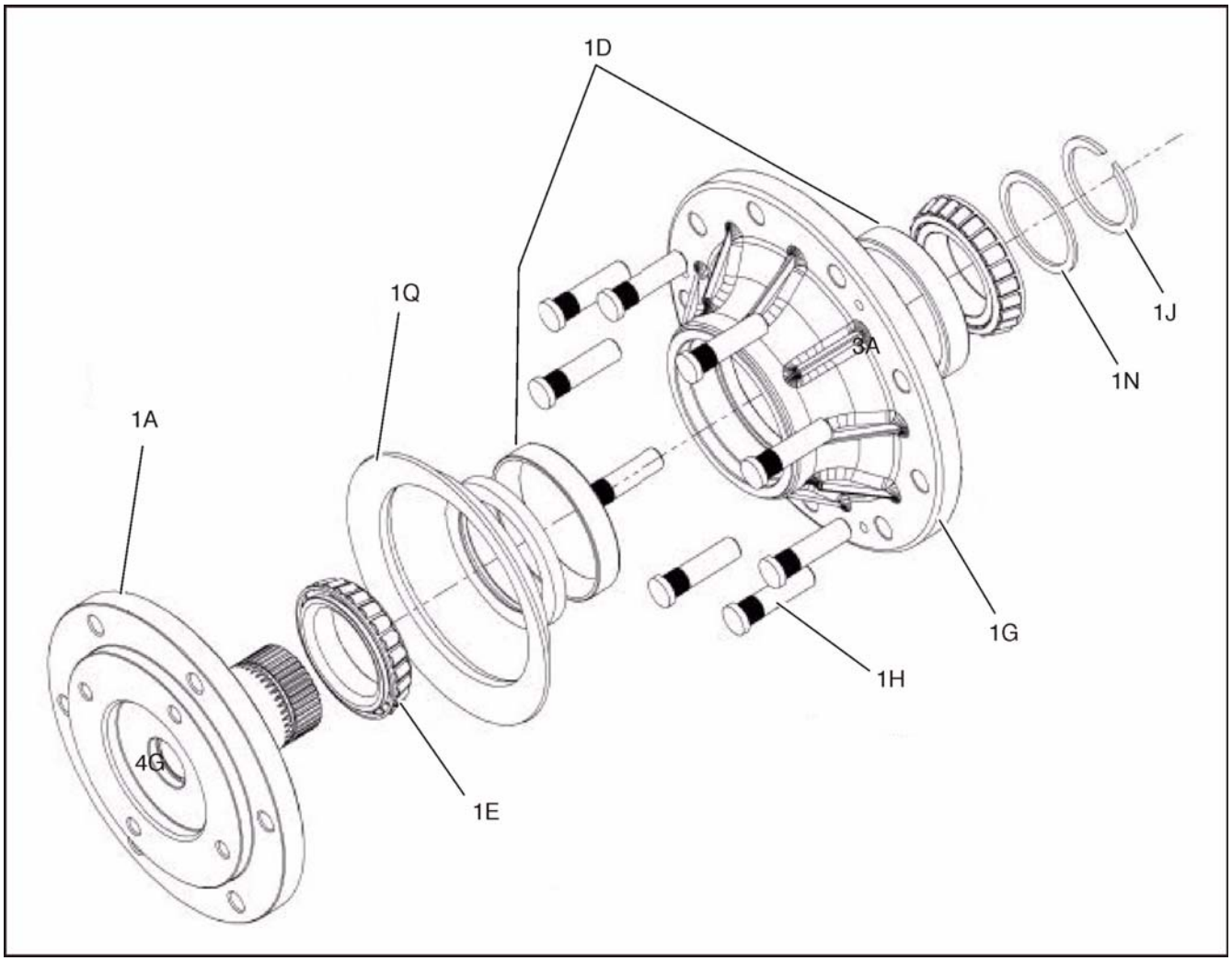
Figure 3-6. Input Carrier

Hub-Spindle Disassembly

1. Place unit on bench with Spindle (1 A) end down.
2. Remove Retaining Ring (1J) with appropriate tool.
3. Remove Spacer (1N).
4. Remove "A" position Bearing Cone (1C) from Bearing Cup (1D) in Hub (1G).
5. Lift Hub (1G) off of Spindle (1 A). Remove Boot Seal (1Q) from Hub (1G) if applicable.
6. If necessary, press 9 Studs (1H) out of Hub (1G). Locate Hub (1G) on Seal (1B) end.
7. Remove Seal (1B) from Hub (1G).

NOTE: *The Seal (1B) should NOT be reused when reassembling the unit.*

8. Remove "B" position Bearing Cone (1E) from Hub (1G).
9. Using a soft steel rod, knock both Bearing Cups (1D) out of Hub (1G).

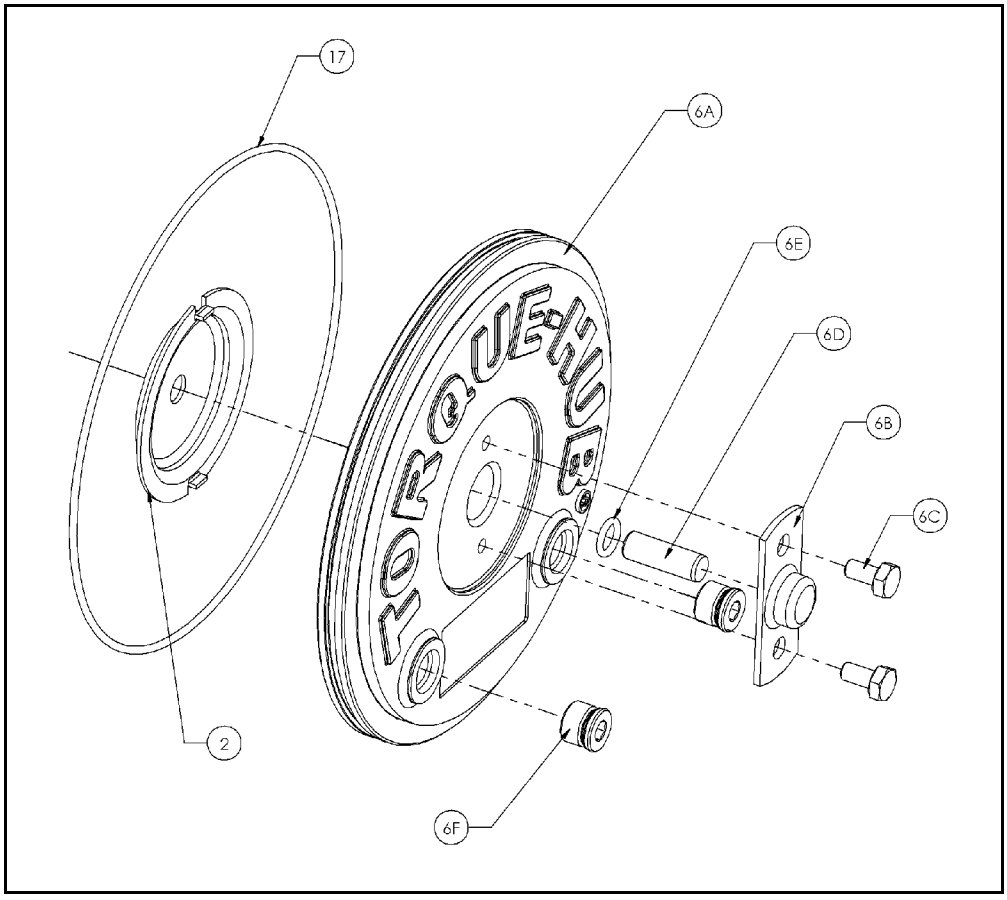


1A Spindle
1D Tapered Bearing Cup
1E Tapered Bearing Cone
1G Hub(Housing)
1H Stud
1J Retaining Ring Ext.
1N Spacer
1Q Seal Boot

Figure 3-7. Hub Spindle

Cover Disassembly

1. Remove O-Ring (17) from groove in Cover (6A).
2. Remove Thrust Washer (2) from Cover (6A) pockets.
3. Unscrew two Hex Head Bolts (6C) and remove Disengage Cap (6B) from Cover (6A).
4. Pull Disengage Rod (6D) out from Cover (6A).
5. Use appropriate tool to remove O-ring (6E) from internal groove in Cover (6A).
6. Remove two O-Ring Pipe Plugs (6F) from Cover (6A).



2 Thrust Spacer
3A Input Carrier
6A Cover
6B Disengage Cap
6C Bolt, Hex
6D Dowel Pin
6E O-ring
6F Pipe Plug
17 O-ring

Figure 3-8. Cover Assembly

Input Carrier Assembly

(Refer to Figure 3-6., Input Carrier)

1. Apply a liberal coat of grease to the bore of one Input Planet Gear (3F).
2. Line the inside of the Planet Gear (3F) with 14 Needle Rollers (3C).

NOTE: *The last roller installed must be installed end wise. That is, the end of the last roller must be placed in between the ends of the two rollers which form the space, and then slid, parallel to the other rollers, into place.*

3. Set Carrier (3A) in an upright position.
4. Insert a Planet Shaft (3E) into the planet shaft hole in the end of the Carrier (3A) opposite the splined end. The end of the planet shaft that does NOT have the roll pin hole should be inserted into the carrier FIRST.
5. Place one Thrust Washer (3B) onto the end of Planet Shaft (3E). Make sure the flat faces towards the inside of the carrier and make sure the button fits in the pocket on the inside of the Carrier (3A) towards the OD.
6. Following the thrust washer, place Planet Gear (3F) with needle rollers, onto Planet Shaft (3E).
7. Following the planet gear, place one more Thrust Washer (3B) onto Planet Shaft (3E). Align the Thrust Washer (3B) in the same manner described in Step 5.
8. Now insert Planet Shaft (3E) through the opposite planet shaft hole on Carrier (3A). Use an alignment punch or similar tool to align the roll pin holes on Carrier (3A) and Planet Shaft (3E).

NOTE: *Be sure not to hit the Planet Gears (3F) when driving in the Roll Pins (4G).*

9. Drive Roll Pin (4G) down into the aligned roll pin holes. Pin should be flush with the flat of carrier.
10. Repeat Steps 1-9 for the installation of the two remaining Planet Gears (3F).

NOTE: *Some grease may need to be applied to the Thrust Washers (3B) to hold them in place while installing the planet gears.*

Output Planet Gear Assembly

(Refer to Figure 3-5., Planet Gear)

1. Apply a liberal coat of grease to the bore of one Output Planet Gear (4F).
2. Line the inside of the Planet Gear (4F) with 14 Needle Rollers (4C).

NOTE: *The last roller installed must be installed end wise. That is, the end of the last roller must be placed in between the ends of the two rollers which form the space, and then slid, parallel to the other rollers, into place.*

3. Place Spacer (4D) into the bore of the Output Planet (4F).
4. Repeat Step 2 to put in second roll of Needle Rollers (4C).
5. Apply grease to hold two Thrust Washers (4B) together and onto Output Planet Gear (4F) counterbore. Do the same to the other side.
6. Repeat Steps 1 -5 to finish the assembly of the two remaining Output Planet Gears (4F).

Output Carrier Assembly

(Refer to Figure 3-4., Output Carrier)

1. Place Thrust Washer (4H) into counterbore of Carrier (4A). BE SURE the small diameter side of Washer (4H) facing planet gear side.
2. Place Planet Gear Sub-assembly (4) into Carrier (4A). Visually align the planet gear bore with one of the planet shaft holes on the Carrier (4A).
3. Insert a Planet Shaft (4E) into the planet shaft hole described in Step 2 on Carrier (4A). The end of the planet shaft that does NOT have the roll pin hole should be inserted into the Carrier (4A) FIRST.
4. Now insert Planet Shaft (4E) through the first set of Thrust Washers (4B), Planet gear, then the second set of Thrust Washers (4B). Use an alignment punch or similar tool to align roll pin holes on Carrier (4A) and Planet Shaft (4E).

NOTE: *Be sure not to hit the Planet Gears (4F) when driving in Roll Pins (4G).*

5. Drive Roll Pin (4G) down into the aligned roll pin holes. Pin should be flush with OD of Carrier (4A).
6. Repeat Steps 1-5 for the installation of the two remaining Planet Gears (4F).

Hub-Spindle Assembly

(Refer to Figure 3-7., Hub Spindle)

NOTE: *Spray a light film of oil on all component parts during assembly.*

1. Place Hub (1G) into pressing base. Press nine Studs (1H) into Hub.

NOTE: *Use enough pressure to press in studs. Don't use excessively high pressure to press in studs or hub may crack.*

NOTE: *Spray a generous amount of oil on bearings during installation.*

2. Press Bearing Cup (1D), position "A", into Hub (1G) using appropriate pressing tool.
3. Turn hub over and press Bearing Cup (1D), position "B", into hub using appropriate pressing tool.
4. Place Bearing Cone (1E), into Bearing Cup (1D), position "B".
5. Grease Seal (1B) lip and press seal into Hub (1G) using appropriate tool until seal is flush with end of hub.
6. Press Seal Boot (1Q) onto Hub (1G) if required. Turn Hub (1G) over and lower onto Spindle (1A).
7. Install Bearing Cone (1C) into Bearing Cup (1D), position "A".
8. Place Bearing Spacer (1N) on top of Bearing Cone (1C).
9. Using appropriate tool, install Retaining Ring (1J) into Spindle (1A) groove. Make sure ring is completely seated in groove.

NOTE: *Extra bearing pre-load caused by using tool in Step #9 must be removed. This should be done by placing a tool (NOT THE SAME TOOL USED IN STEP #9) on the end of the spindle, and then striking the tool with a piece of barstock. This should be adequate to remove any additional bearing pre-load.*

Cover Subassembly

(Refer to Figure 3-8., Cover Assembly)

1. Grease O-Ring (6E) and insert into internal groove in Cover (6A).
2. Assemble Disengage Cap (6B) onto Cover (6A) using two Hex Head Bolts (6C). Torque bolts to 70-80 in-lbs.
3. Insert Disengage Rod (6D) into hole in Cover (6A) until it touches the inside of the Disengage Cap (6B).

NOTE: *The Disengage Rod can be inserted either end first.*

4. Grease Face of Thrust Washer (2) and place in Cover (6A) making sure that tangs on washer seat into pockets in cover.
5. Install O-Ring Pipe Plugs (6F) into Cover (6A). The plugs should be hand tight according to SAE standard.

Main Assembly

(Refer to Figure 3-2., Main Disassembly Drawing 1 and Figure 3-3., Main Disassembly Drawing 2)

NOTE: *All components should receive a generous amount of lubricant oil as they are being assembled.*

1. Place Hub-Spindle Sub-Assembly on the bench.
2. Grease O-Ring (18) and place it into groove of Hub (1G).
3. Place Ring Gear (1F) onto Hub (1G). Align the three shipping Cap Screw Holes on Hub (1G) and Ring Gear (1F).
4. Install three shipping Cap Screws (19) into ring gear and hub. Torque them to 15-20 ft-lbs.
5. Place Output Carrier Sub-Assembly (4) into mesh with Spindle (1A) splines.
6. Place External Retaining Ring (5) over 13T spline to the retaining groove on Input Shaft (9).

NOTE: *For ratio 48:1, assemble Output Sun Gear (11) over Input Shaft (9) first, then install External Retaining Ring (5).*

7. Using appropriate tool to install Retaining Ring (20) into groove on Output Sun (11)
8. Place Input Shaft (9) spline end into mesh with Internal Coupling (7) splines.
9. With the modified spline end facing up, place the Output Sun Gear (11) into mesh with the output planet gears.
10. Place Input Carrier Sub-Assembly (3) onto Output Sun Gear (11) splines. Drop Input Sun (10) into mesh with planet gears for specific ratios, if required. (No timing required)
11. Grease O-Ring (17) and insert into groove in Cover Sub-Assembly (6).
12. Install Cover Sub-Assembly (6) into Ring Gear (1F) counterbore and install Retaining Ring (6G) into groove in Ring Gear (1F).
13. Attach ID Tag (15) onto unit using Drive Screws (16).
14. Check disconnect, roll and air check unit, leak check brake, and record release pressure. 14. Insert Plastic Plug (12) into place if applicable.

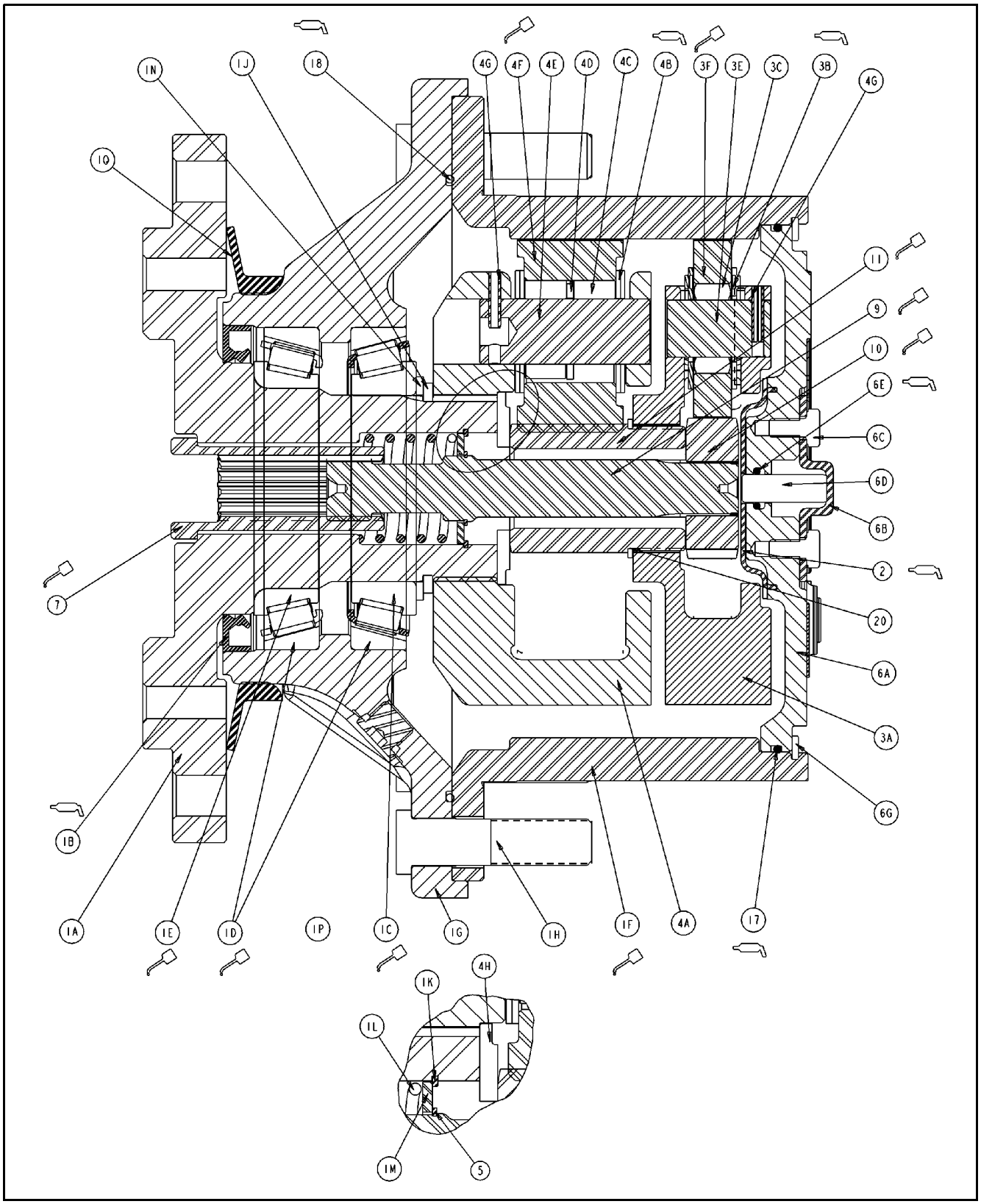


Figure 3-9. Hub Assembly - Sheet 1 of 2

1A Spindle
1B Lip Seal
1C Tapered Bearing Cone
1D Tapered Bearing Cup
1E Tapered Bearing Cone
1F Ring Gear
1G Hub(Housing)
1H Stud
1J Retaining Ring Ext.
1K Retaining Ring Int.
1L Spring (1.460,1.500)
1M Thrust Washer
1Q Seal Boot
2 Thrust Spacer
3A Input Carrier
3B Thrust Washer
3C Needle Bearing
3E Planet Shaft
3F Planet Gear
4A Output Carrier
4B Thrust Washer
4C Needle Bearing
4D Thrust Spacer
4E Planet Shaft
4F Planet Gear
4G Roll Pin
4H Thrust Washer
5 Retaining Ring - Ext
6A Cover
6B Disengage Cap
6C Bolt, Hex (.250-20 Unc, .500 Gr5)
6D Dowel Pin
6E O-ring
6F Pipe Plug
6G Retaining Ring - Int 7.086
7 Coupling
9 Input Shaft
10 Input Sun Gear
11 Output Sun Gear
15 ID Plate
16 Drive Screw
17 O-ring
18 O-ring
19 Bolt, Flat Head - Hex Skt (.375-16)
20 Retaining Ring - Ext.

Figure 3-10. Hub Assembly - Sheet 1 of 2

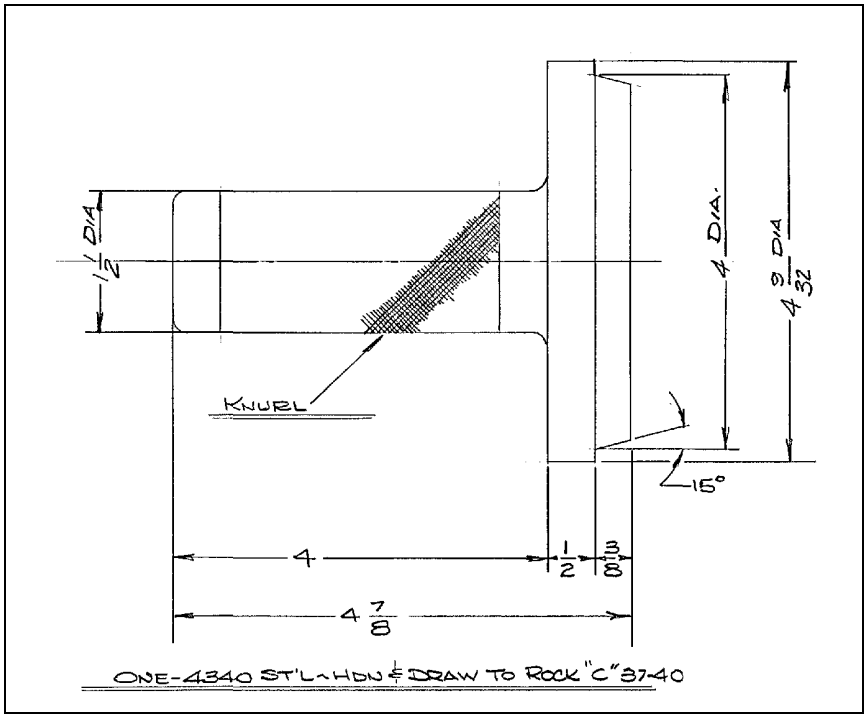


Figure 3-11. Cup Pressing Tool

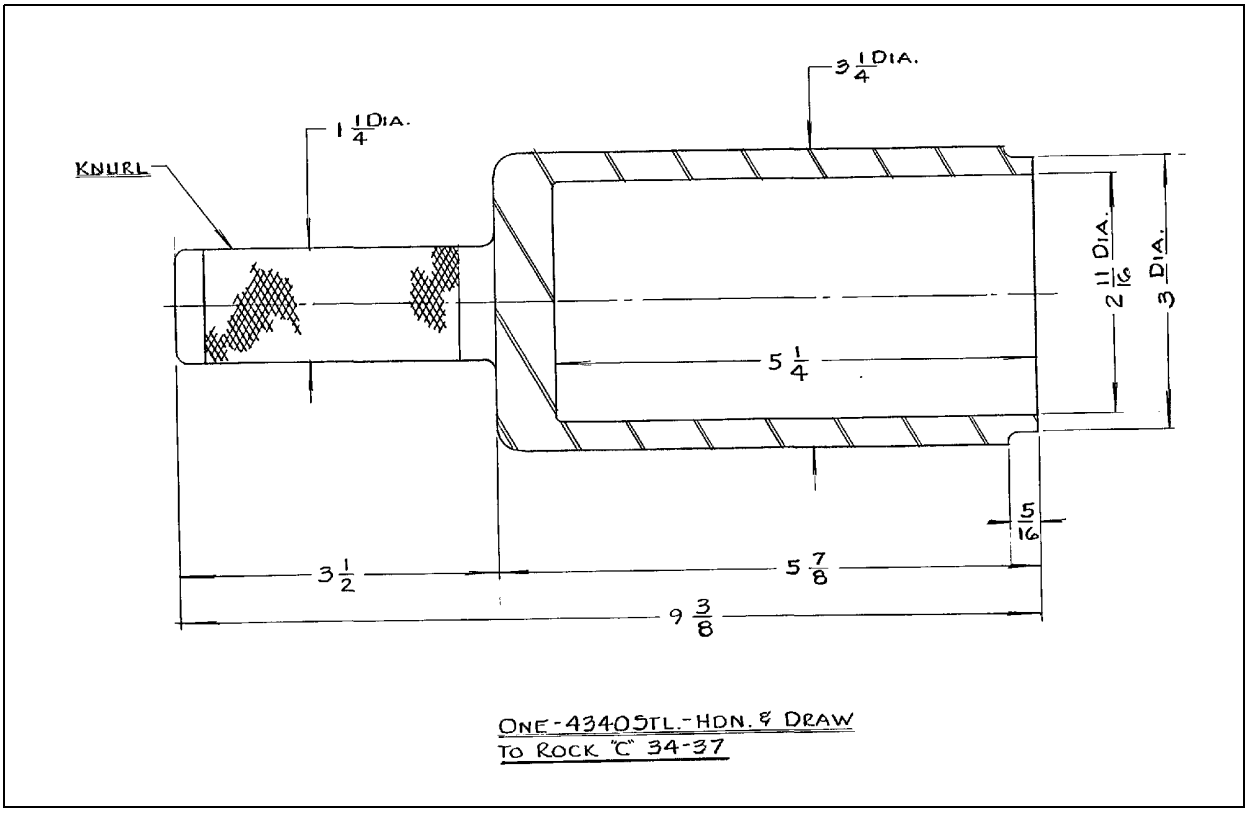


Figure 3-12. Cup Pressing Tool

3.4 DRIVE BRAKE - MICO

Disassembly

1. Remove pressure plate (3) from cover (21) by removing the capscrews (1) and washers (2).

⚠ CAUTION

PRESSURE PLATE IS UNDER SPRING TENSION OF APPROXIMATELY 1500 LBS (680 KGF). THE FOUR CAP SCREWS SHOULD BE LOOSENED EVENLY TO RELIEVE THIS FORCE. IF A HYDRAULIC PRESS IS AVAILABLE, 3000 LBS (1361 KGF) MINIMUM, THE PRESSURE PLATE CAN BE HELD IN POSITION WHILE REMOVING THE CAP SCREWS AND WASHERS

2. Remove case seal (4) from cover (21).
3. Remove piston (7) from pressure plate (3).
4. Remove o-ring (5), back-up ring (6), o-ring (8) and back-up ring (9) from piston (7).

NOTICE

IF THE SENSOR RING (12) IS DAMAGED OR NEEDS REPLACED, THE ENTIRE BRAKE MUST BE REPLACED AS A UNIT. THE SENSOR RING IS NOT AVAILABLE AS A SERVICE PART.

5. Remove stack assembly, consisting of stator disc (11), sensor ring (12), rotor disc (13), and plate (14) from cover (21).
6. Remove dowel pins (20), springs (15) and spring retainer (16) from cover (21).

NOTE: *Note number and pattern of springs for reassembly purposes.*

7. Remove retaining ring (17) from cover (21).
8. Remove shaft (10) by pressing or using a soft mallet on male end of the shaft.
9. Remove retaining ring (19) and bearing (18) from shaft (10).
10. Press rotary oil seal (20) from cover (18).

Assembly

NOTE: *Lubricate all rubber components from the repair kit with clean type fluid used in the system.*

1. Clean all parts thoroughly before assembly.
2. Press new rotary seal (22) into cover (21). **Note direction of seal**
3. Install new bearing (18) and retaining ring (19) on shaft (10).
4. Install shaft assembly and retaining ring (17) in cover (21).

NOTE: *Be sure to use the same number of springs and spring pattern as recorded during disassembly.*

5. Install dowel pins (20), spring retainer (16) and springs (5) in cover plate (21).
6. Position plate (14) on springs (15). **NOTE**: **Disc (13 &11) and plate (14) must remain dry during installation. No oil residue must be allowed to contaminate disc surfaces.**
7. Press the speed sensor ring (12) onto the rotor disc (13).
8. Place a new rotor disc (13) on the shaft (10) until it contacts the plate (14). Install stator disc (11).
9. Install new o-ring (5), new back-up ring (6), new o-ring (8) and new back-up ring (9) on piston (7). Note order of o-rings and backup rings. Insert piston (7) into pressure plate (3). Be careful not to shear o-rings or back-up rings.
10. Install new case seal (4) in cover (21).
11. Position pressure plate (3) on cover (21) aligning dowel pins (20) with holes in pressure plate.

NOTE: *A hydraulic press will simplify installation of pressure plate on cover. Clamp pressure plate in position while tightening the cap screws.*

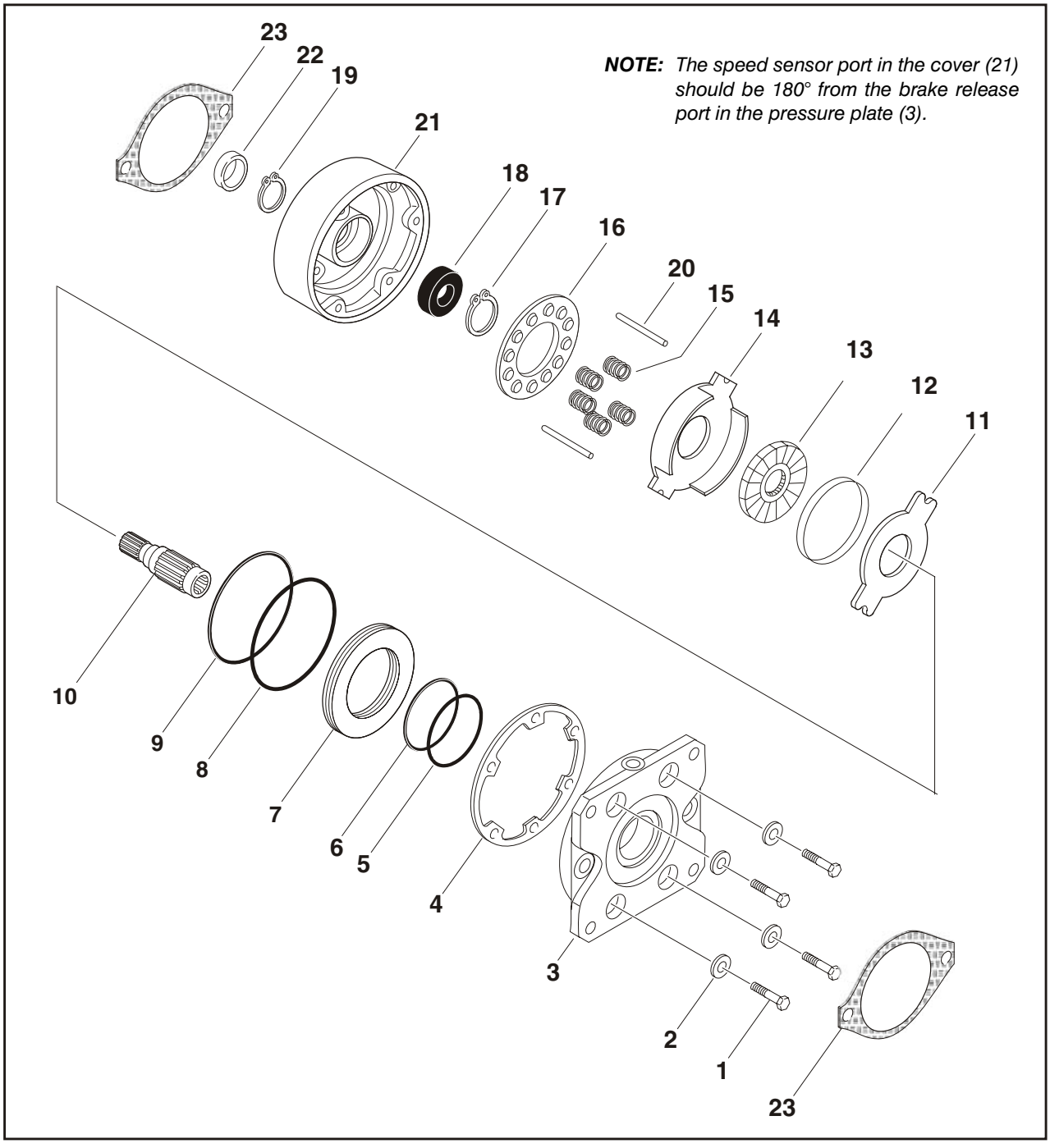
12. Install capscrews (1) and washers (2) and tighten evenly to draw pressure plate (3) to cover (21). Torque capscrews to 55 ft.lbs. (74.6 Nm).

⚠ CAUTION

IF HYDROSTATIC BENCH TESTING IS PERFORMED ON THE BRAKE ASSEMBLY, RELEASE PRESSURE SHOULD NOT EXCEED 2000 PSI (137.9 BAR) UNLESS TWO ADDITIONAL BOLTS ARE USED FOR SUPPLEMENTAL CLAMPING.

Bleeding

1. Install brake in system and connect pressure lines.
2. Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 100 psi (6.9 bar) during bleeding.
3. Apply sufficient pressure to release brake and check for proper operation in system.



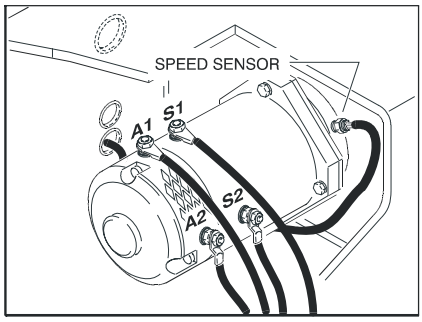
1. Capscrew	7. Piston	13. Rotor Disc	19. Retaining Ring
2. Washer	8. O-ring	14. Plate	20. Dowel Pin
3. Pressure Plate	9. Backup Ring	15. Spring	21. Cover
4. Case Seal	10. Shaft	16. Spring Retainer	22. Rotary Oil Seal
5. O-ring	11. Stator Disc	17. Retaining Ring	23. Gasket
6. Backup Ring	12. Sensor Ring	18. Bearing	

Figure 3-13. Drive Brake

Table 3-2. Drive Brake Diagnosis

Problem	Cause	Explanation	Corrective Action
Brake slips	Excessive pressure In hydraulic system	If there is back pressure in the actuation line of the brake, holding torque will be reduced.	Check filters. hose size, restrictions in other hydraulic components.
	Oil In brake if designed for dry use	Wet linings generate 67% of the dry torque rating. If the brake has oil In it, check the type of oil hydraulic or gearbox. 1. Gearbox oil 2. Hydraulic oil	Replace oil seal in brake. Check motor seal. Check piston seals. Note: Internal components will need to be inspected, cleaned, and replaced as required.
	Disc plates worn	The thickness of the disc stack sets the torque level. A thin stack reduces torque.	Check disc thickness.
	Springs broken or have taken a permanent set	Broken or set springs can cause reduced torque - rare occurrence.	Check release pressure. (See spring replacement)
Brake drags or runs hot	Low actuation pressure	The brake should be pressurized to minimum of 1.38 bar (20 psi) over the full release pressure under normal operating conditions. Lower pressures will cause the brake to drag thus generating heat.	Place pressure gauge in bleed port & check pressure with system on.
	Bearing failure	If the bearing should fall. a large amount of drag can be generated.	Replace bearing.
Brake will not release	Stuck or clogged valve	Brakes are designed to come on when system pressure drops below stated release pressure. If pressure cannot get to brake, the brake will not release.	Place pressure gauge in bleed port - check for adequate pressure. Replace defective line or component.
	Bad O-rings	f release piston will not hold pressure, brake will not release.	Replace o-rings.
	Discs frozen	These brakes are designed for only limited dynamic braking. A severe emergency stop or prolonged reduced release pressure operation may result in this type of damage.	Replace disc stack.

3.5 SPEED SENSOR ADJUSTMENT



⚠ WARNING

FOR PROPER DRIVE OPERATION, THE SPEED SENSORS (2) MUST BE PROPERLY INSTALLED AND ADJUSTED. THE SENSOR OPERATES ON A LEADING PULSE TO SHOW DIRECTION. IF INSTALLED INCORRECTLY, THE SENSOR WILL NOT BE ABLE TO SENSE THE PROPER DIRECTION. IF BOTH SENSORS ARE INSTALLED INCORRECTLY, THE JLG CONTROL SYSTEM WILL THINK THE MACHINE IS ON A HILL AND THE MACHINE WILL GO INTO FULL SPEED MODE IMMEDIATELY. IF ONLY ONE SENSOR IS INSTALLED WRONG, THE CONTROLLER SENSES A PROBLEM AND THE MACHINE WILL ONLY DRIVE AT CREEP SPEED. IF BOTH SENSORS ARE ADJUSTED TOO FAR OUT, THE CONTROL SYSTEM WILL NOT DRIVE THE MACHINE.

Adjustment Procedure

1. Back off the locking nut and o-ring.
2. Thread the sensor in to bottom. (do not force).
3. Back-off 1-2 turns and align the notch with the axis of the brake
4. Use a 1/2” wrench to hold the sensor and a 3/4” wrench to snug the lock nut to the brake.

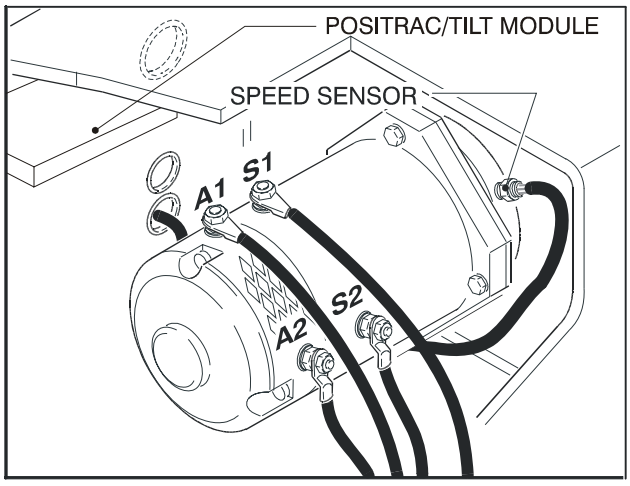
3.6 POSITRAC/TILT MODULE

When installing a new positrac/tilt module, Refer to JLG Control System Analyzer Kit instructions. Use a standard bubble level in two different directions to ensure that the machine’s frame is level prior to installing the new positrac/tilt module.

1. Place the machine on a flat, level surface. Check for level by placing a bubble level on the frame in both directions.
2. Plug in the analyzer (Analyzer - p/n 1600244, Cable - p/n 1600633) into port J9 on the power module or port J1 on the platform module.
3. Use the right arrow key to curse over to “ACCESS LEVEL 2". Depress Enter.
4. Use Up/Down arrow keys to enter the following password “33271”. Depress Enter.
5. Use the right arrow key to curse over to “LEVEL VEHICLE”. Hit Enter. Depress Enter again.
6. Verify that the tilt reading is now “0.0; 0.0".

⚠ WARNING

TO ASSURE PROPER OPERATION, THE MACHINE MUST BE LEVEL WHEN ADJUSTING OR INSTALLING AND CALIBRATING A NEW POSITRAC/TILT MODULE



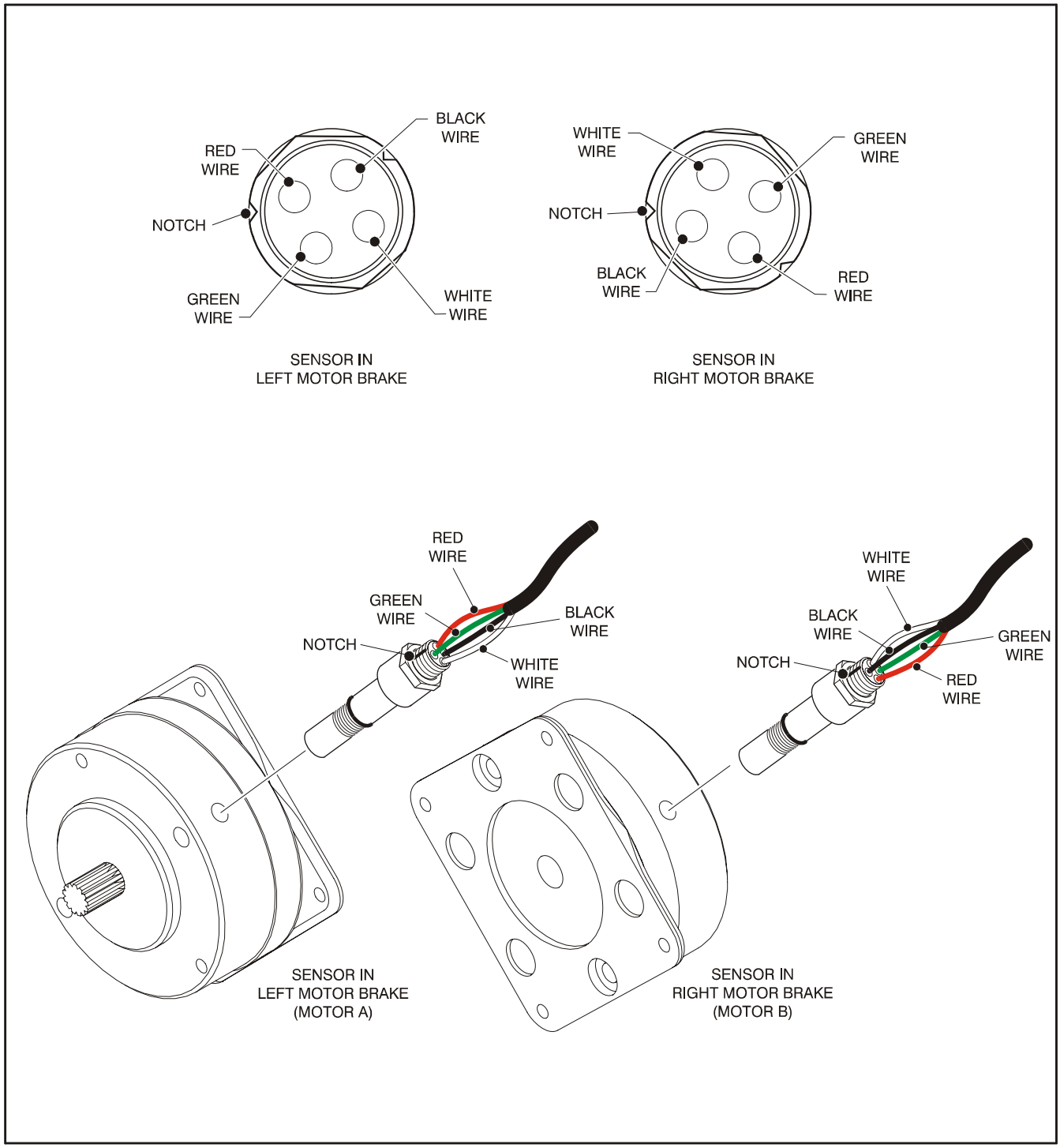


Figure 3-14. Speed Sensor Orientation. (E300)

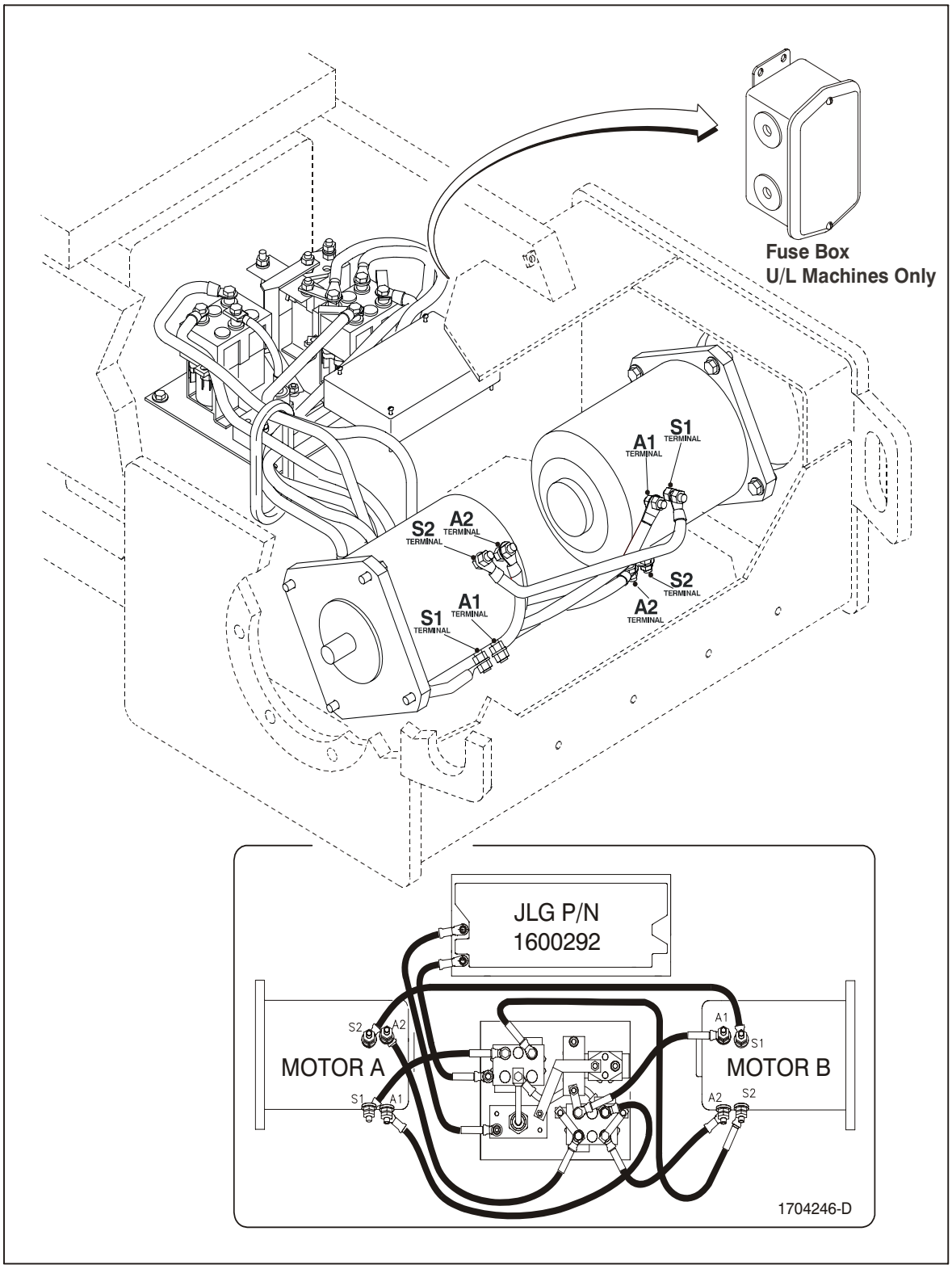
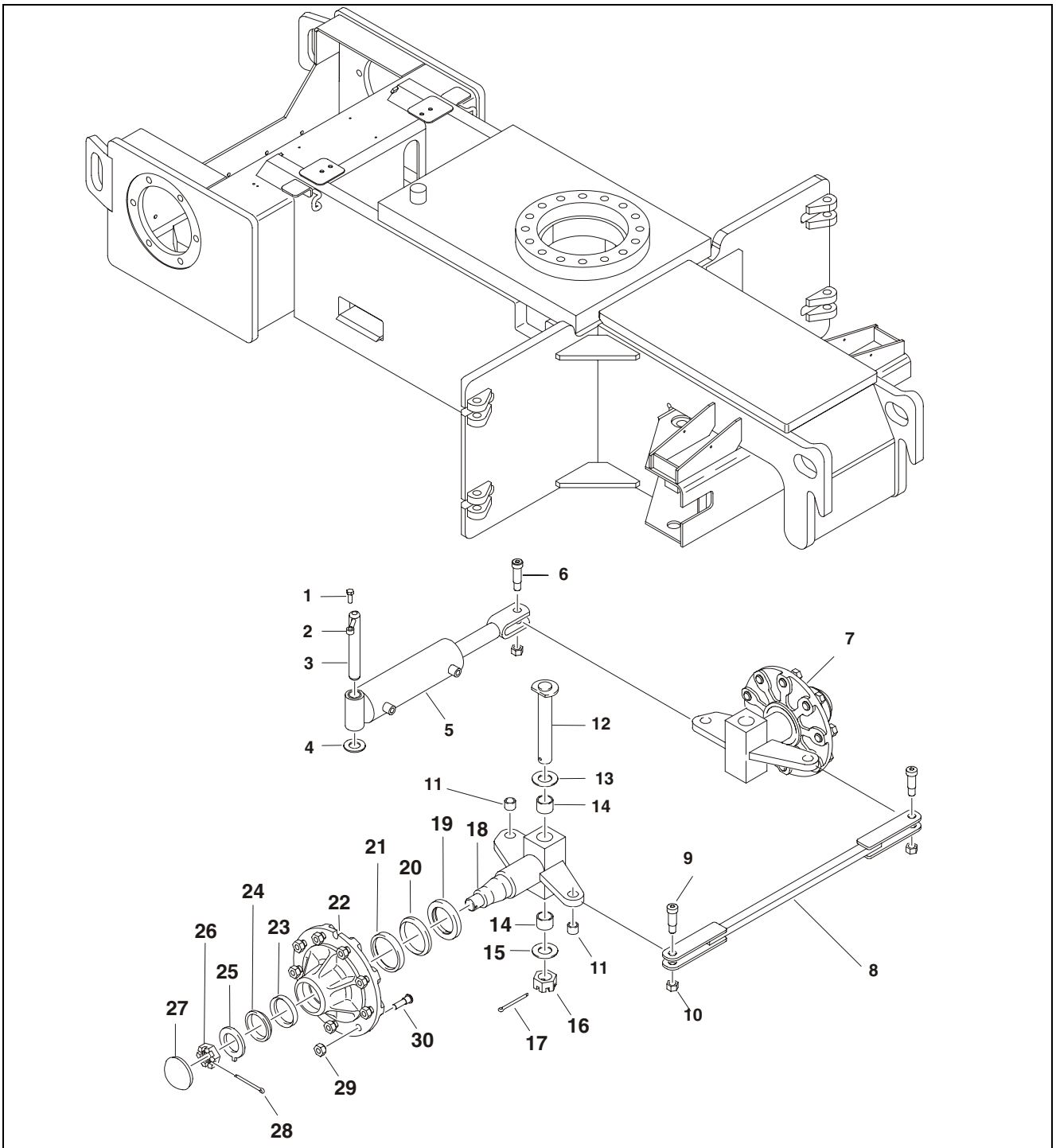


Figure 3-15. Frame Mounted Electrical Components



1. Bolt	7. Hub/Spindle Assembly	13. Thrust Bearing	19. Seal	25. Tanged Washer
2. Keeper	8. Tie Rod	14. Bushing	20. Bearing Cone	26. Castle Nut
3. Pin	9. Shoulder Bolt	15. Castle Nut	21. Bearing Cup	27. Dust Cap
4. Flatwasher	10. Locknut	16. Flatwasher	22. Hub	28. Cotter Pin
5. Steer Cylinder	11. Bearing	17. Cotter Pin	23. Bearing Cup	29. Lug Nut
6. Shoulder Bolt	12. King Pin	18. Spindle	24. Bearing Cone	30. Stud

Figure 3-16. Steering Components and Spindle

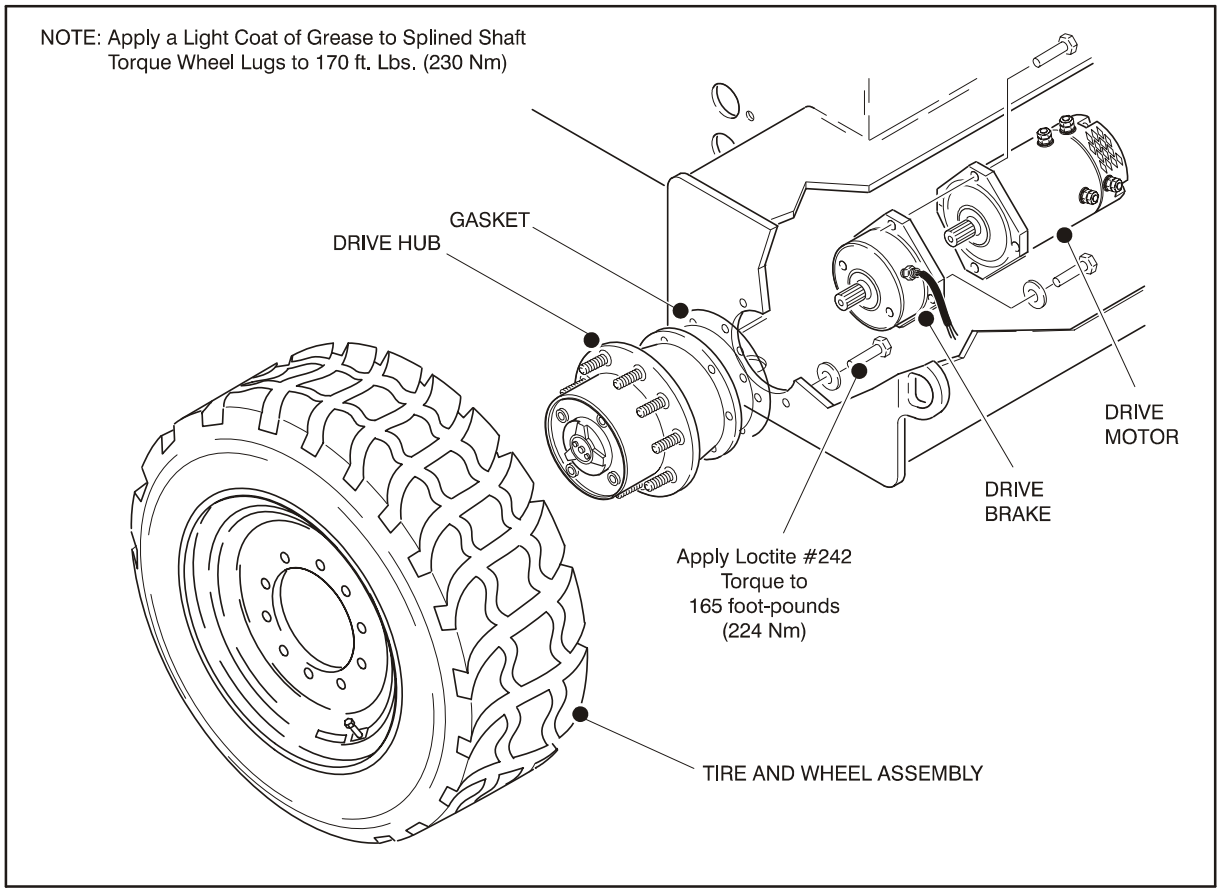


Figure 3-17. Drive Components

3.7 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

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

1. Check the frame to bearing. Attach bolts as follows:
   - **a.** On a firm level surface, elevate the fully retracted boom to 70 degrees (full elevation).
   - **b.** At the position indicated on Figure 2-20. try and insert the.0015” feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   - **c.** Assure that the.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.
2. Check the turntable to bearing. Attach bolts as follows:
   - **a.** On a firm level surface, elevate the fully retracted boom to 70 degrees (full elevation).
   - **b.** At the positions indicated on Figure 2-19. try and insert the.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 2-17 try and insert the.0015” feeler gauge between the bolt head and hardened washer at the arrow indicated position.

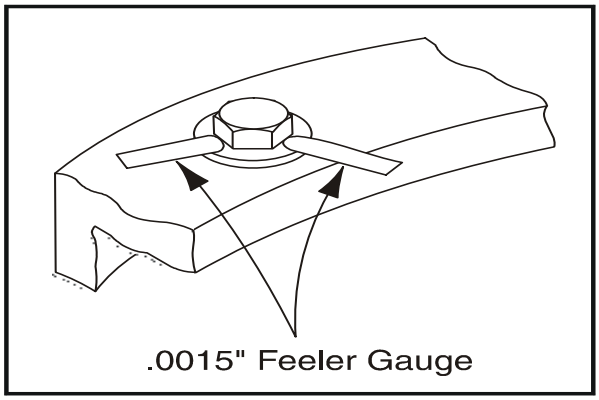


Figure 3-18. Swing Bearing Feeler Gauge Check

Wear Tolerance

1. With the boom positioned over the side of the machine, the Upper Boom horizontal with telescope fully extended and Tower Boom raised half way (approx 37°)See Figure 2-22, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable. (See Figure 2-20)
2. At the same point, with the boom positioned over the side of the machine, the Upper Boom fully retracted, the platform rotated max. to the side, and the Tower Boom fully elevated, (See Figure 2-21) using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable (See Figure 2-20).

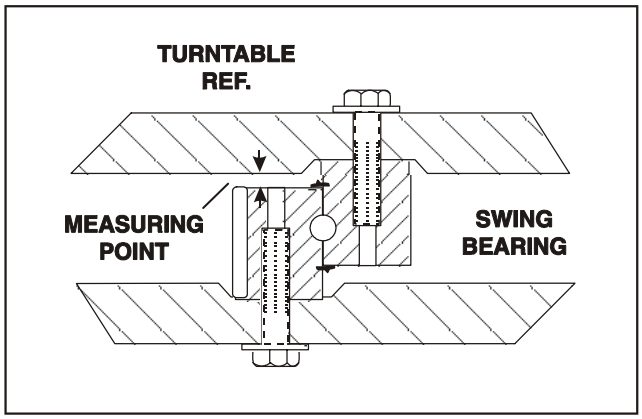


Figure 3-19. Swing Bearing Tolerance Measuring Point

3. If a difference greater than 0.057 in. (1.40 mm) is determined, the swing bearing should be replaced.
4. If a difference less than 0.057 in. (1.40 mm) is determined, and any of the following conditions exist, the bearing should be removed.
   - **a.** Metal particles in the grease.
   - **b.** Increased drive power.
   - **c.** Noise.
   - **d.** Rough rotation.
5. If bearing inspection shows no defects, reassemble bearing and return to service.

Replacement of Swing Bearing

1. Removal.
   - **a.** Attach an adequate support sling to the boom and draw all slack from sling. Prop or block the boom if feasible.
   - **b.** Tag and disconnect hydraulic lines running through center of turntable and frame. Use a suitable container to retain any residual hydraulic fluid. Cap lines and ports.
   - **c.** Attach suitable overhead lifting equipment to the base of turntable weldment.
   - **d.** 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 bolts, nuts and washers which attach the turntable to the bearing inner race. Discard nuts and bolts.
   - **e.** 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.
   - **f.** Carefully place the turntable on a suitably supported trestle.
   - **g.** 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 and rotation box assembly from the frame; move to a clean, suitably supported work area.
   - **h.** Remove the two cap screws securing the bearing to the rotation box to separate the two for inspection.

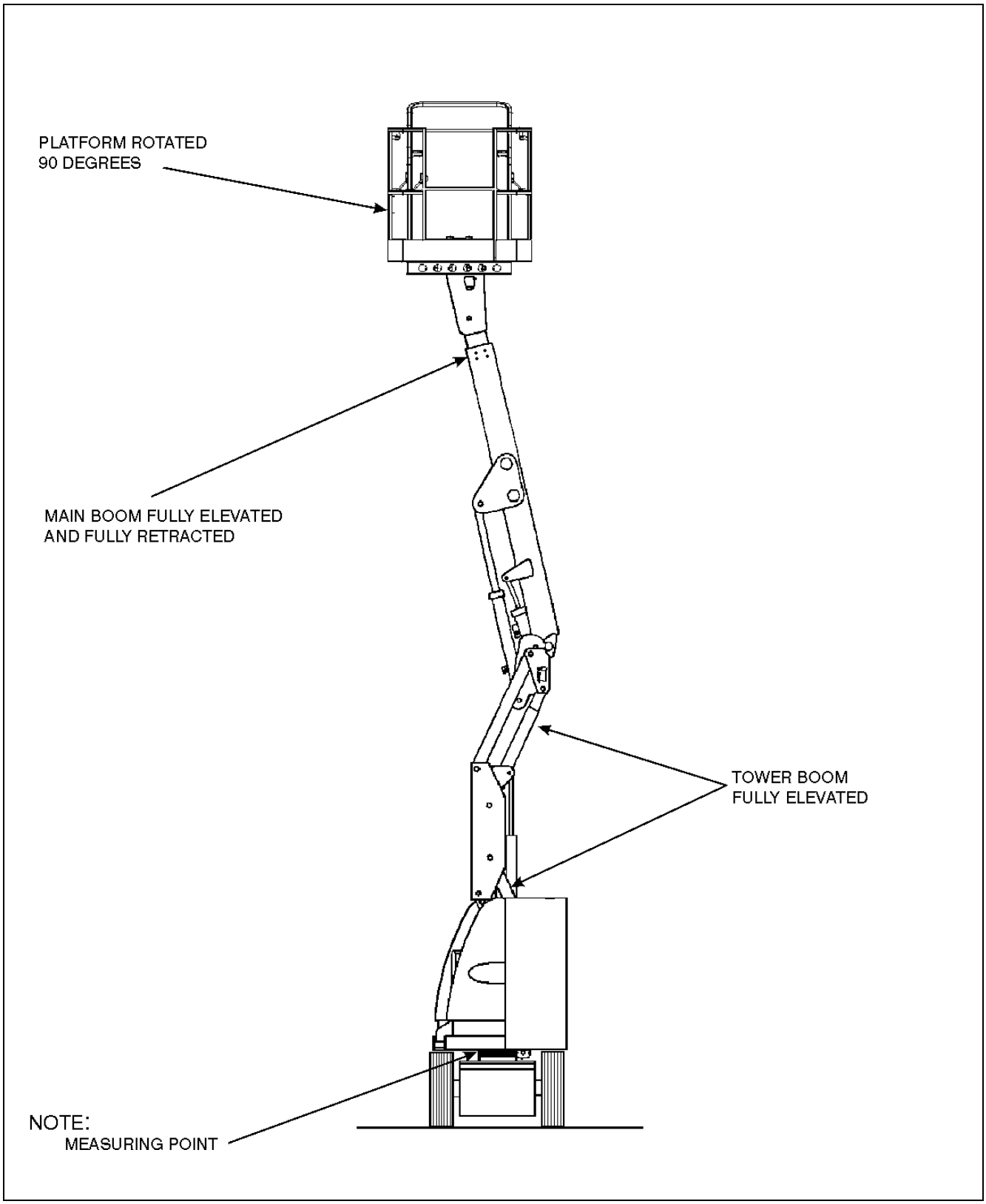


Figure 3-20. Swing Bearing Tolerance Boom Placement.

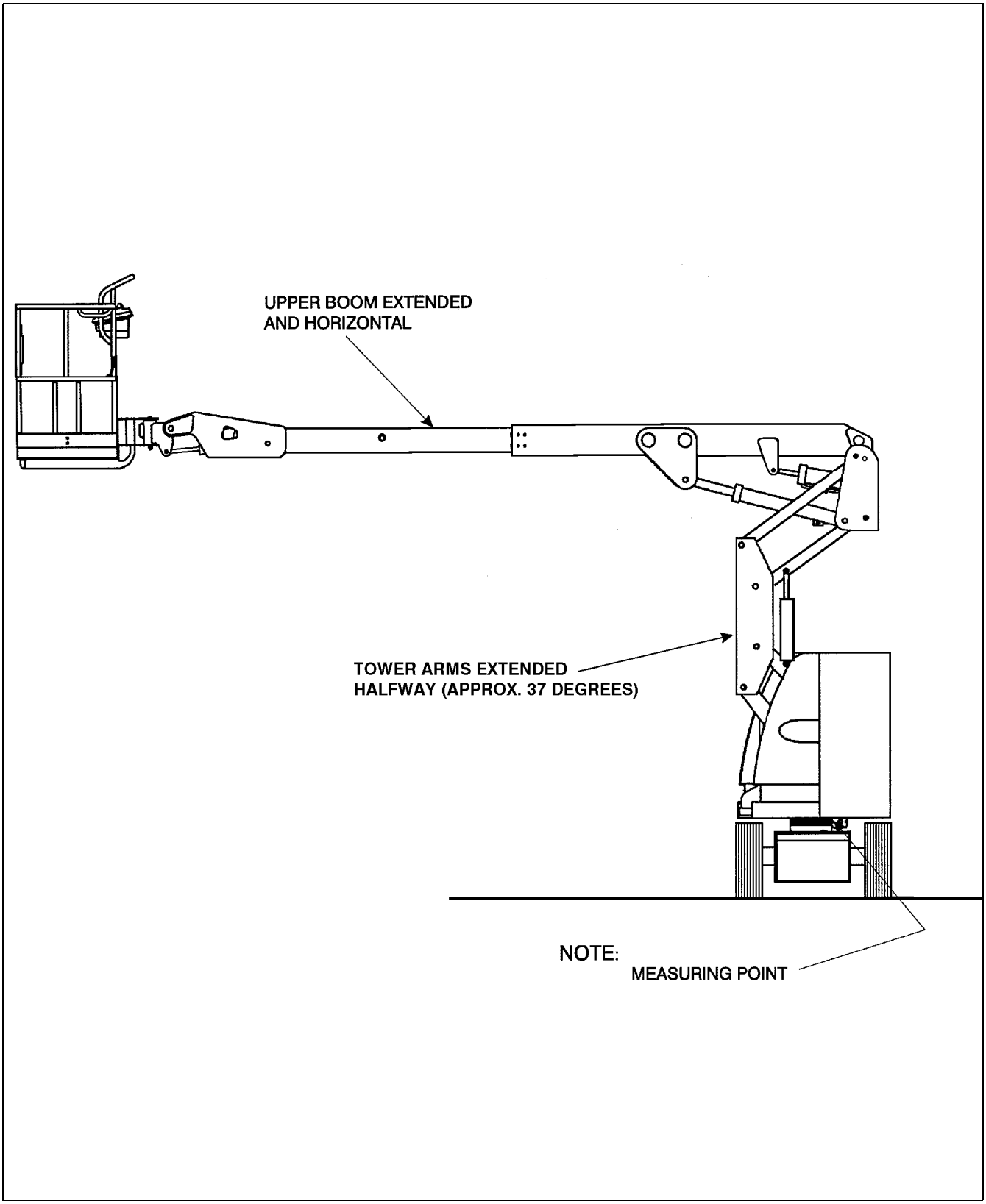


Figure 3-21. Swing Bearing Tolerance Boom Placement

2. Installation.

   a. Install bearing to rotation box with two cap screws, so that fill plug of bearing is as close to gear as bolt pattern will allow. Do not tighten cap screws.

   b. Line up high spot (blue) of bearing with center tooth of worm gear. Set backlash to 0.008 - 0.010 inch (0.20 - 0.25 mm). Tighten cap screws as shown in Figure 2-24.

   c. Spray Mobiltac 375NC open gear spray onto gear teeth.

   d. Apply Tribol Molub-Alloy 936 Open Gear Compound to bearing.

   e. Grease bearing with Mobilith SHC Bearing Grease. Grease fitting is on inside wall of inner race of bearing.

NOTE: *If Tribol Molub-Alloy 936 Open Gear Compound or Mobilith SHC Bearing Grease are not available, Multi-Purpose Grease (MPG) can be substituted, however the service interval will be shorter.*

   f. Using suitable lifting equipment, install bearing/ rotation box assembly to frame with soft spot (red) 90 degree relative to load axis. If reusing old bearing, ensure that scribed line of outer race of the bearing aligns with the scribed mark on the frame.

⚠ CAUTION

JLG INDUSTRIES RECOMMENDS THAT ALL REMOVED GRADE 8 BEARING NUTS AND BOLTS BE DISCARDED AND REPLACED WITH NEW NUTS AND BOLTS. SINCE THE SWING BEARING IS THE ONLY STRUCTURAL LINK BETWEEN THE FRAME AND TURNTABLE, IT IS IMPERATIVE THAT SUCH REPLACEMENT HARDWARE MEETS JLG SPECIFICATIONS. USE OF GENUINE JLG HARDWARE IS HIGHLY RECOMMENDED.

   g. 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.

   h. Following the torque sequence diagram shown in Figure 2-24, tighten the bolts to an initial torque of 175 ft. lbs. (237 Nm). Then following the same sequence, tighten to a final torque of 240 ft. lbs. (326 Nm).

   i. Remove lifting equipment from bearing.

   j. Use suitable lifting equipment to carefully position the turntable assembly above the machine frame.

   k. Carefully lower the turntable onto the swing bearing. Ensure that the scribed line of the inner race of the bearing aligns with the scribed mark 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 centerline of the turntable.

   l. Apply a light coating of Loctite 271 to the new bearing bolts and install through the turntable and inner race of bearing.

   m. Following the torque sequence shown in Figure 2-24, tighten the bolts to an initial torque of 175 ft. lbs. (237 Nm). Then following the same sequence, tighten the bolts to 240 ft. lbs (326 Nm).

   n. Remove the lifting equipment.

   o. Route hydraulic lines through center of turntable and frame and connect as tagged prior to removal.

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

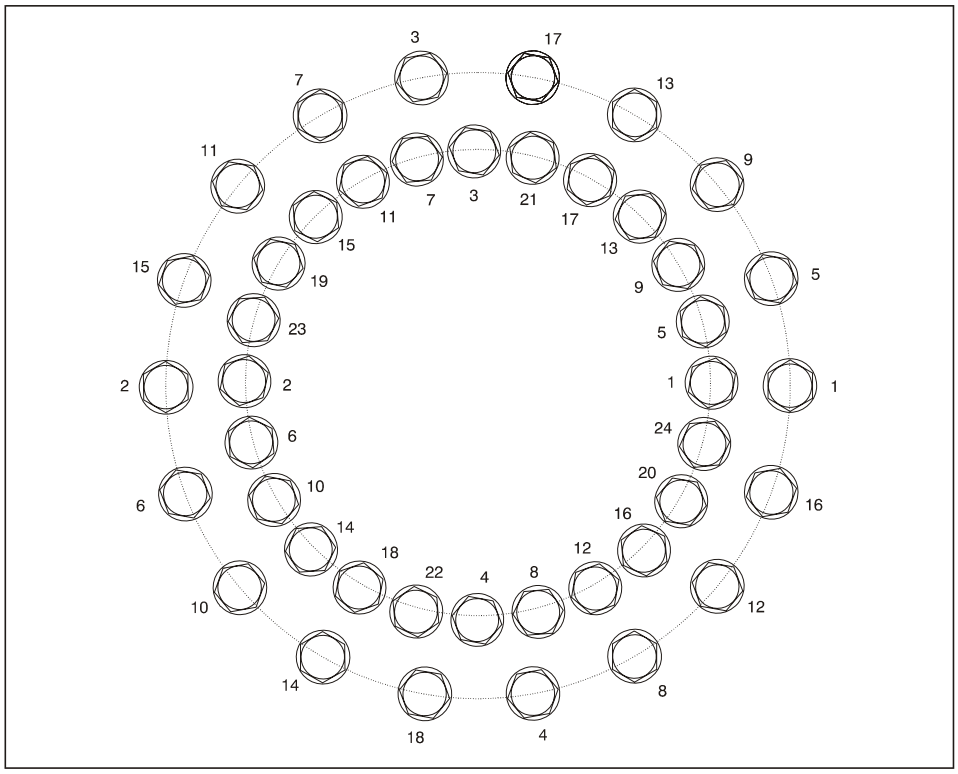


Figure 3-22. Swing Bearing Torquing Sequence

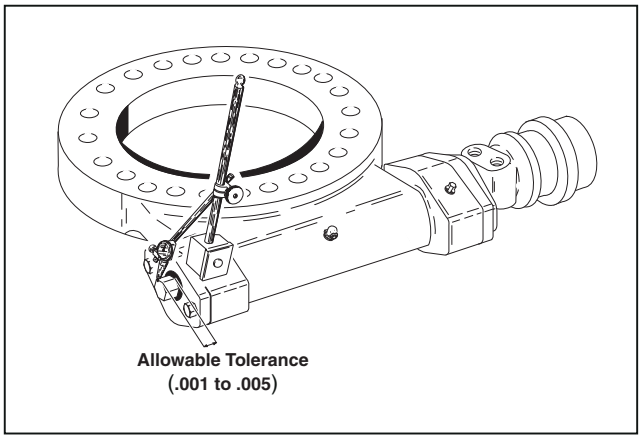
Swing Bearing Torque Value

Install bolts with Loctite - 240 ft. lbs. (326 Nm).

Checking Worm Gear End Play

JLG Industries requires that a annual inspection be performed on the worm gear end play.

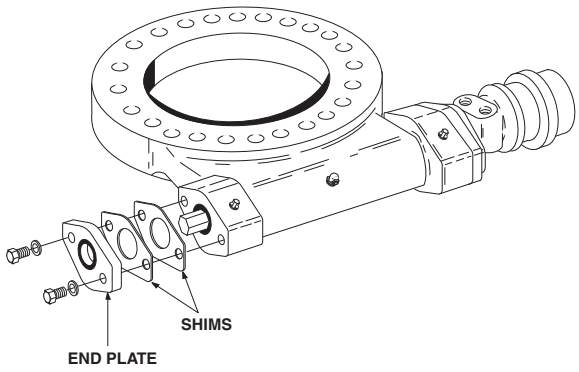
1. Using a dial indicator, measure end play of worm gear, by applying side to side movement by hand to platform.
2. If tolerance exceeds.010", reduce end play to less than.005". Refer to Adjusting End Play.



Adjusting End Play

1. Remove end plate.
2. Measure and record total thickness of existing shim pack.
3. Determine thickness of shim pack required to obtain.001" -.005" end play.
4. Adjust shim pack thickness as required to obtain proper end play. Reduce end play by removing thicker shims and replacing with thinner shims, included in kit.
5. Replace end plate and torque bolts to 90 ft. lbs. (122 Nm).
6. Recheck end play.

Fig 2 Adjusting End Play.



3.8 SWING MOTOR

Removal

1. Remove the two bolts securing the motor to the swing drive.
2. Gain access to the hydraulic lines and tag and disconnect the lines running to the motor. Cap or plug all openings.

Disassembly

NOTE: *Before disassembling the motor, it is highly recommended that paint or a marker be used to make a V shaped set of lines from the end cover to the housing to aid in proper assembly. It is also important that the steps involving timing be followed carefully to insure proper motor operation.*

1. Remove all shaft related components from the shaft (i.e. keys, wire rings, nuts). To aid in assembly of the motor, make a V shaped set of lines from the end cover to the housing using either paint or a marker.
2. With the shaft facing down, secure the motor in a vise by clamping onto the housing.
3. Loosen and remove the bolts holding the motor assembly together.
4. Remove the end cover.
5. Remove the body seal and discard the seal.
6. Remove the rotor assembly and wear plate. Remove the body seals from the rotor and housing and discard the seals.
7. Remove the drive link pin and drive link from the motor and lay aside.

8. Gently tap the shaft upward through the housing and remove through the rear of the housing. Turn the shaft over and remove the cooling plug.
9. Remove the housing from the vise and turn over. Pry the dust seal from the housing.
10. Push the seal carrier, thrust washer, and thrust bearing down and remove from the rear of the housing.

NOTE: *When removing the seal carrier, thrust washer, and thrust bearing take care not to scratch or nick the housing bore.*

11. If a new seal carrier and thrust washer are included in the repair kit, the old items may be discarded. If not, carefully pry the shaft seal, teflon backup seal, and metal backup shim from the seal from the seal carrier and discard the metal backup shim, backup seal, and shaft seal. Lay the seal carrier aside.
12. Remove the wire ring, metal backup shim, and high pressure seal from the inner bore groove of the housing with a small screwdriver and discard them.
13. All parts should be cleaned in an oil based solvent and dried using compressed air. All new seals should be lightly coated in clean oil prior to installation.

Assembly

NOTICE

FOR PROPER OPERATION, THE MOTOR DEPENDS ON THE CORRECT ORIENTATION OF PARTS AS WELL AS THE CORRECT INTERNAL TIMING.

1. Place the shaft on a clean flat surface with the output end facing up.
2. Place the thrust bearing, then thrust washer, on the shaft.
3. Install the shaft seal down onto the shaft making sure the lip on the seal faces down. Refer to Figure 3-23., Seal Orientation.

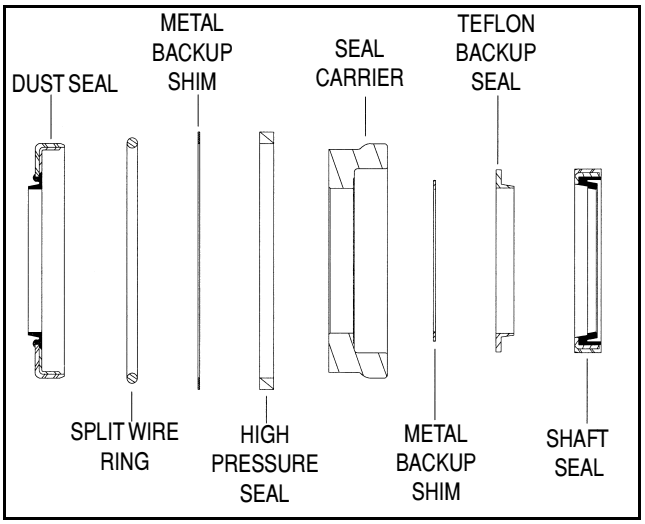


Figure 3-23. Seal Orientation

4. Install the teflon backup seal onto the shaft with the flat side up and the seal lip facing the shaft seal.
5. Place the metal backup shim onto the shaft and against the teflon backup seal.
6. Place the seal carrier onto the shaft (large end down) and carefully press the seal carrier down onto the seal assembly using an arbor press and sleeve to compress the seals into the carrier.
7. Install the high pressure seal into the groove in the housing.
8. Install the metal backup shim against the high pressure seal in the groove in the housing bore by squeezing the shim between the thumb and forefinger to bow shim (bow in the shim should be in the shape of a hill and not a valley for easier installation).
9. While maintaining the bow in the shim, start the shim into the groove and use a small screwdriver to push the shim into the groove. Install the wire ring into the groove making sure the ends are butted.

Shaft Timing Procedure

NOTICE

FOR PROPER OPERATION, THE MOTOR DEPENDS ON THE CORRECT ORIENTATION OF PARTS AS WELL AS THE CORRECT INTERNAL TIMING.

1. Turn shaft over so the output end of the shaft faces down.
2. Install the cooling plug into the shaft making sure the large OD end of the cooling plug faces up.

3. Lower the drive link into the shaft making sure that the timing mark end of the drive link faces up and the timing mark on the end of the drive link is aligned with one of the through holes in the shaft.
4. When the splines contact each other, slowly rotate the drive link counterclockwise until the drive link splines engage with those on the shaft.
5. Turn the housing over so the pilot of the housing faces down and secure the housing in a vise.
6. Without disturbing the seal carrier assembly or drive link, carefully lower the shaft assembly into the housing.
7. To seat the seal carrier against the wire ring, gently tap the drive link down until the end of the shaft is nearly flush with the rear surface of the housing.
8. Place a body seal in the groove in the rear surface of the housing.
9. Using alignment marks as a guide, place the wear plate on the housing making sure the notch in the wear plate is aligned with the port side of the housing as shown in Figure 3-24., Notch Alignment.

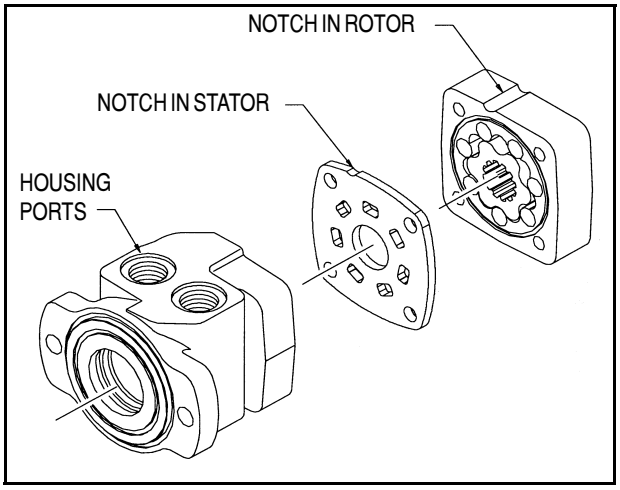


Figure 3-24. Notch Alignment

10. Place a body seal in the grove in the face of the rotor.
11. Lower the rotor onto the drive link making sure the timing mark on the drive link is aligned with a peak on the rotor as shown in Figure 3-25., Timing Mark.

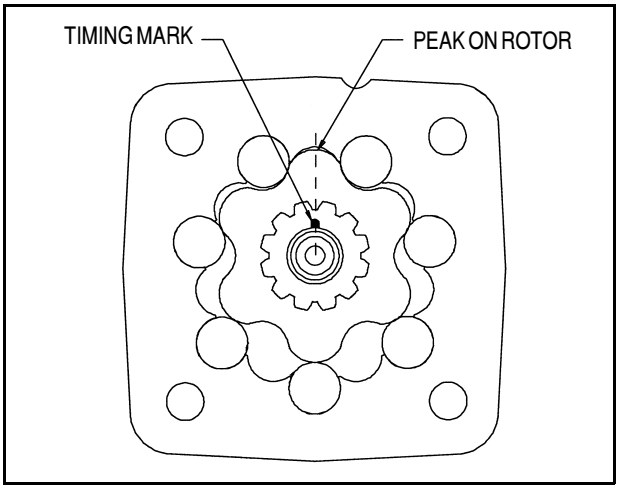
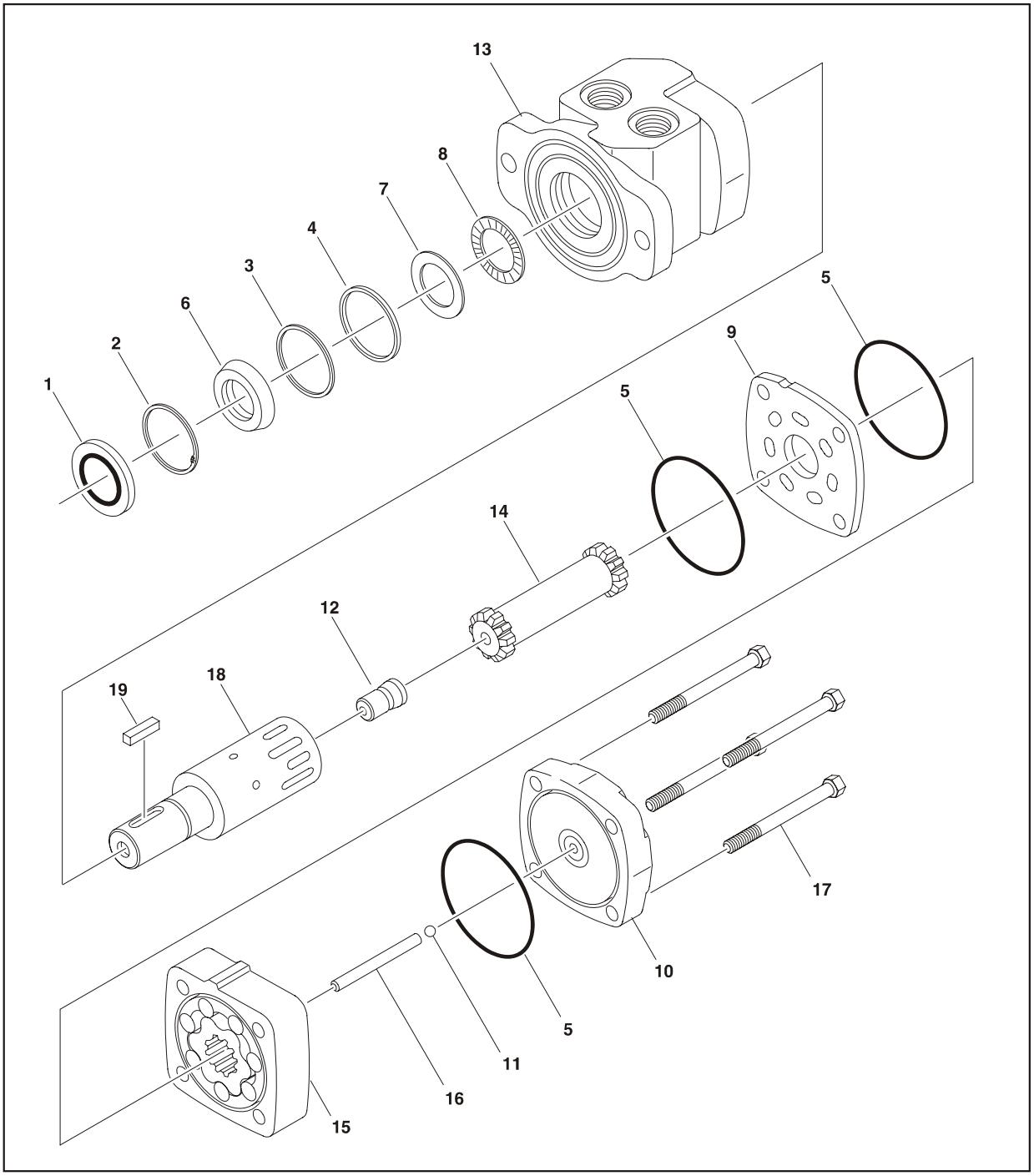


Figure 3-25. Timing Mark

12. Once splines are engaged, rotate rotor so the notch on the rotor is aligned with the notch on the wear plate and the ports on the housing. Refer to Figure 3-24., Notch Alignment.
13. Insert the drive link pin into the end of the drive link making sure the concave end faces up.
14. Place the remaining body seal in the groove in the end cover.
15. Using alignment marks as a guide, place the end cover onto the motor making sure the end of the drive link pin is in the hole in the center of the end cover.
16. Insert the four bolts and torque to an initial value of 10 ft.lbs. (13.5 Nm). Using a criss-cross pattern, apply a final torque of 50 ft.lbs. (68 Nm).
17. Remove the motor from the vise and place on a clean work surface with the shaft facing up. Making sure the lip seal faces up, place the dust seal over the shaft. Using a seal and hammer, carefully drive the dust seal into place.

Installation

1. Connect the two hydraulic lines to the motor as tagged during Removal.
2. Position the motor on the swing drive and secure in place with the retaining bolts. Apply Loctite to the bolts and torque to 120 ft.lbs. (163 Nm).



1. Dust Seal
2. Retainer Ring
3. Backup Shim
4. Housing Seal
5. Body Seal
6. Shaft Seal
7. Thrust Washer
8. Thrust Bearing
9. Wear Plate
10. End Cover
11. Ball
12. Cooling Plug
13. Housing
14. Drive Link
15. Rotor Set
16. Drive Link Pin
17. Bolt
18. Shaft
19. Key

Figure 3-26. Swing Motor

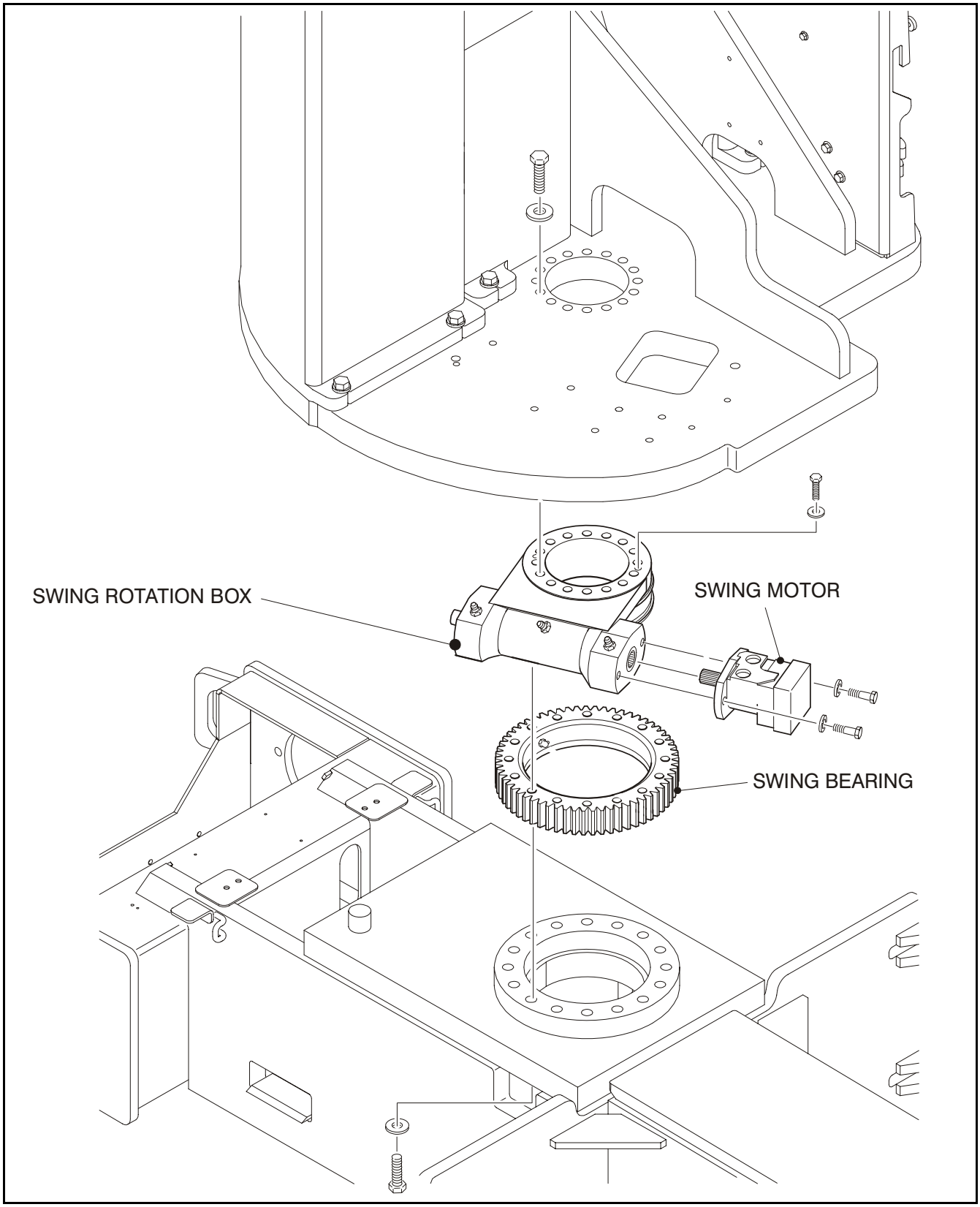


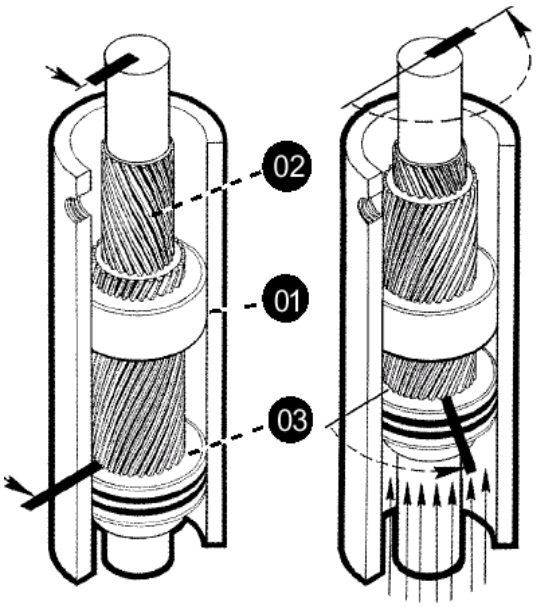
Figure 3-27. Swing Components

3.9 HELAC ROTARY ACTUATOR

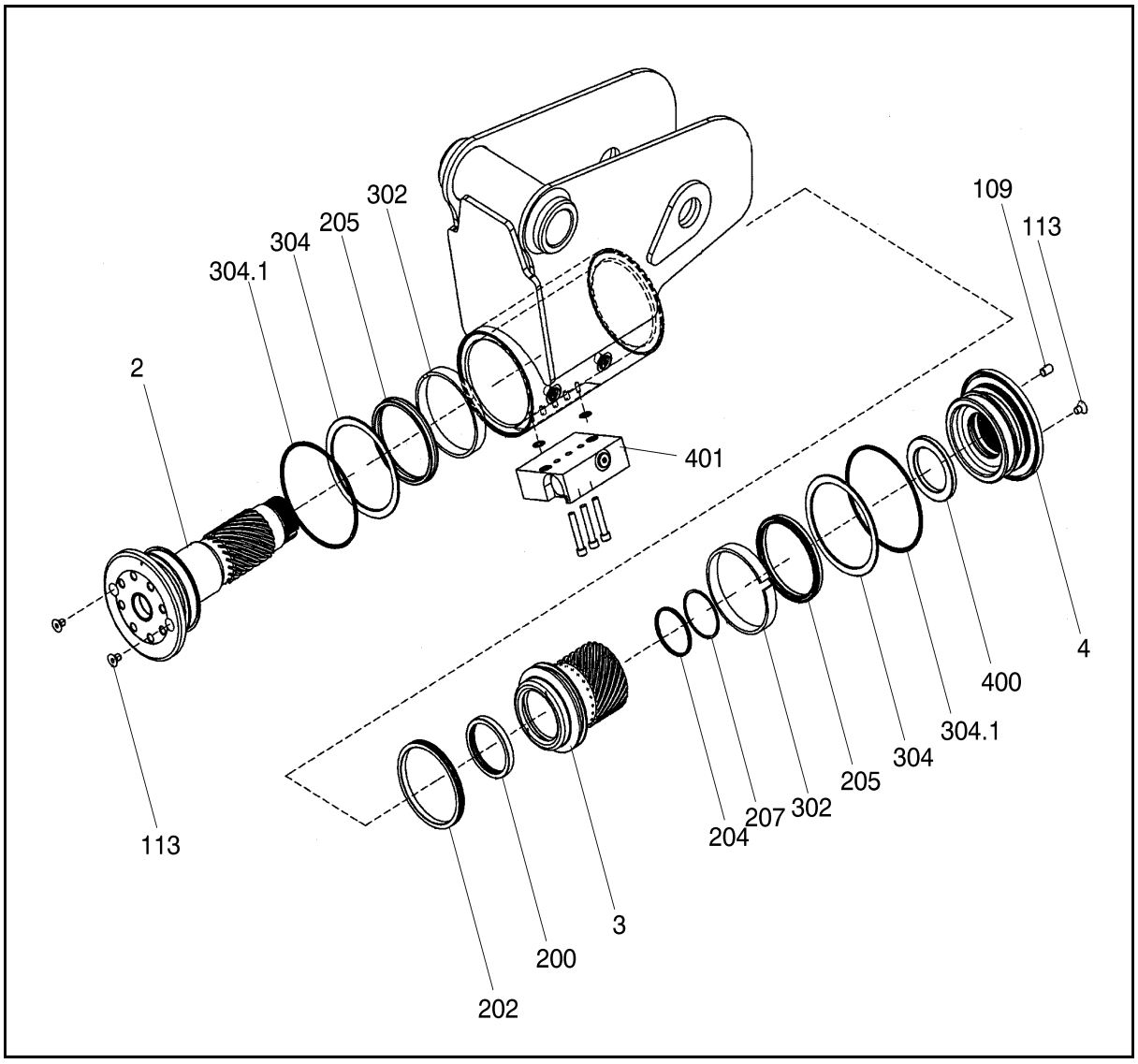
Theory Of Operation

The 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 con-trol valve is closed, oil is trapped inside the actuator, preventing piston movement and locking the shaft in position.

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.

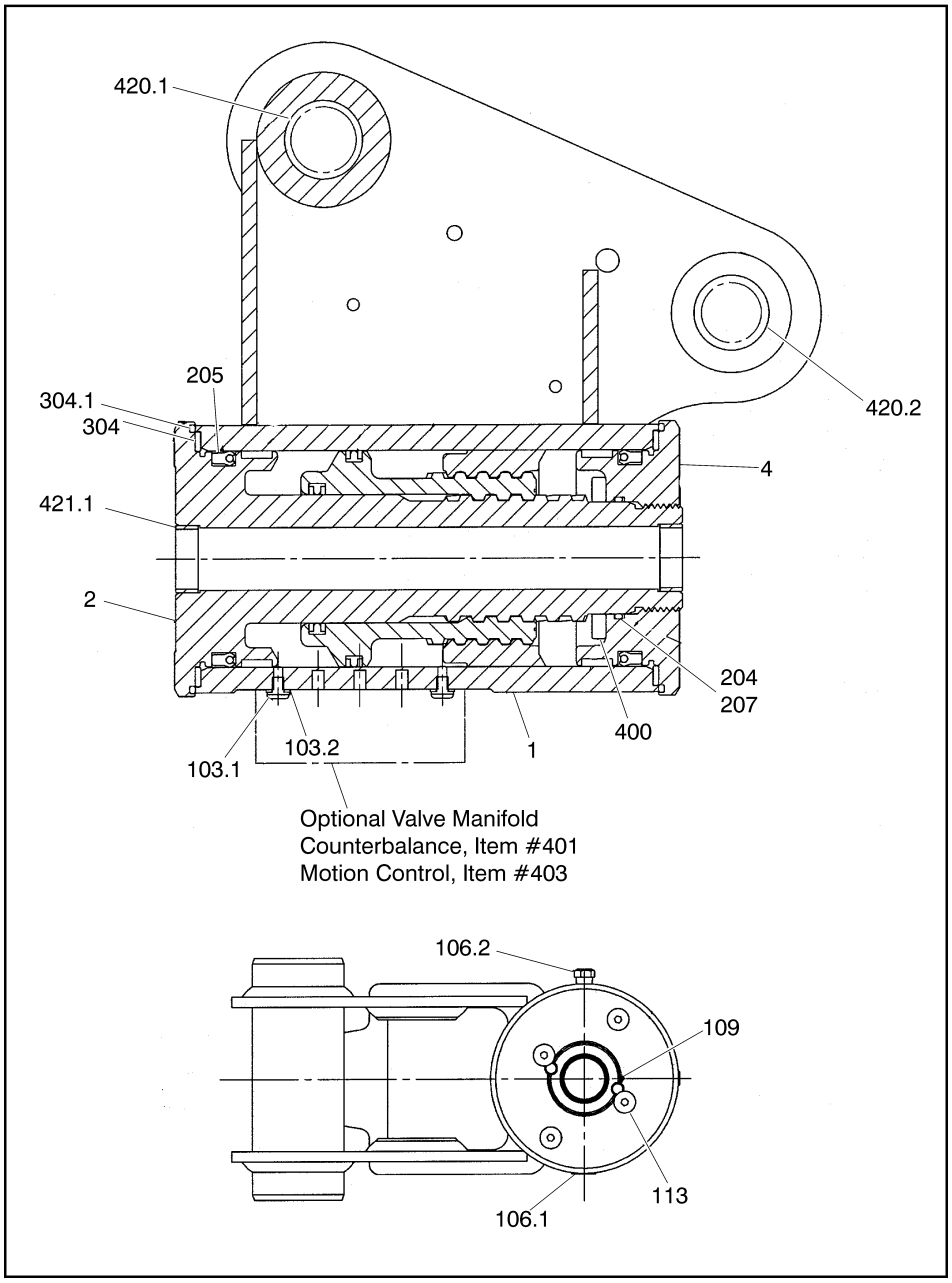


NOTE: *Bars indicate starting positions of piston and shaft. Arrows indicate direction they will rotate. The housing with integral ring gear remains stationary.*
As fluid pressure is applied, the piston is displaced axially while the helical gearing causes the piston and shaft to rotate simultaneously.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



1. Housing
2. Shaft
3. Piston Sleeve
4. End Cap
109. Lock Pin
113. Cap Screw
200. T-Seal
202. T-Seal
204. O-Ring
205. Cup Seal
207. Back-Up
302. Wear Guide
304. Thrust Washer
304.1. Wiper Seal
400. Stop Tube (Optional)
401. Counterbalance Valve

Figure 3-28. Rotary Actuator (Exploded View)



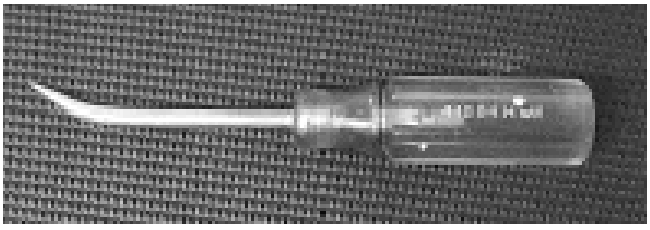
1. Housing
2. Shaft
3. Piston Sleeve
4. End Cap
109. Lock Pin
113. Cap Screw
200. T-Seal
202. T-Seal
204. O-Ring
205. Cup Seal
207. Back-Up
302. Wear Guide
304. Thrust Washer
304.1. Wiper Seal
400. Stop Tube (Optional)
401. Counterbalance Valve

Figure 3-29. Rotary Actuator (Cutaway View)

Tools Required for Assembly/Disassembly

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

1. Flashlight- helps examine timing marks, component failure and overall condition.
2. Felt Marker- match mark the timing marks and outline troubled areas.
3. Allen wrench- removal of port plugs and setscrews.
4. Box knife- removal of seals.
5. Seal tool- assembly and disassembly of seals and wear guides.
6. Pry bar- removal of end cap and manual rotation of shaft.
7. 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.

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).

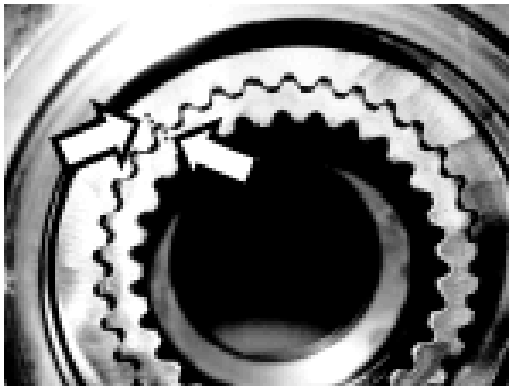
3. Remove the lock pins using an “Easy Out” (a size #2 is shown). If the pin will not come out with the “Easy Out”, use 5/16” drill bit to a depth of 1/2” (12.7mm)todrill out the entire pin.

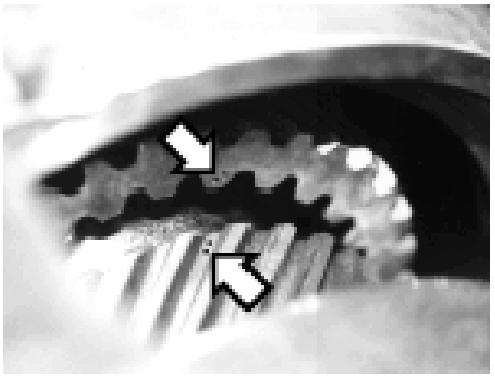
4. Install the end cap (4) removal tools provided with the Helac seal kit.

5. Using a metal bar, or something similar, un-screw the end cap (4) by turning it counter clock-wise.

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.



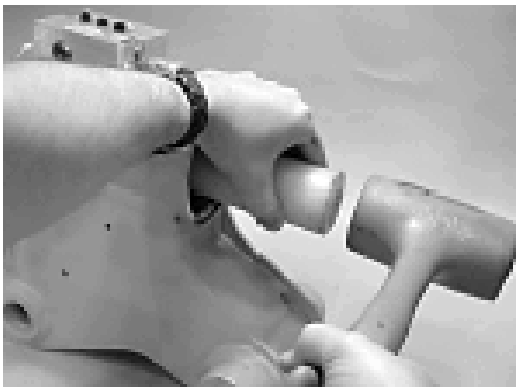


8. Every actuator has timing marks for proper engagement.

9. 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).

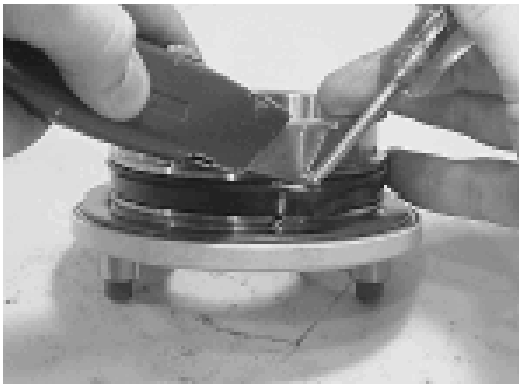


12. To remove the piston (3) use a rubber mallet and a plastic mandrel so the piston is no damaged.

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).

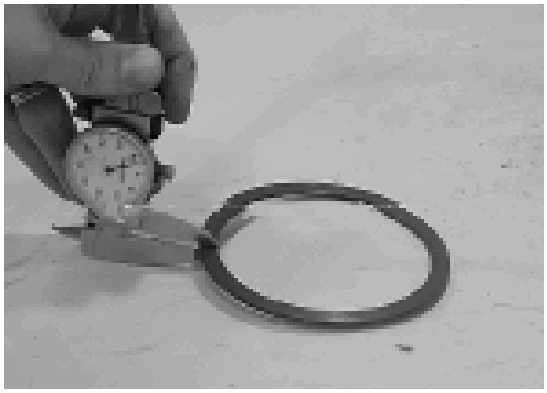
18. Remove the wiper seal (304.1) from its groove in the end cap (4) and shaft (2).

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

1. 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 O-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).

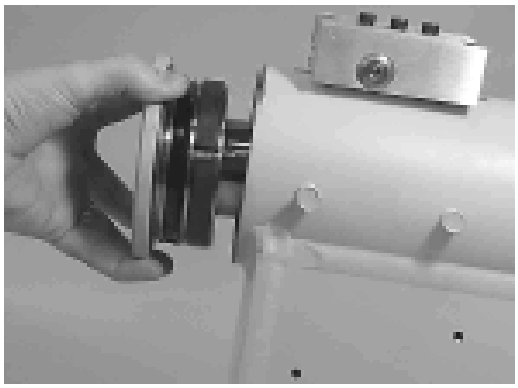
6. Install the inner T-seal (200) into the piston (3) using a circular motion. Install the outer T-seal (202) by stretching it around the groove in a circular motion. Each T-seal has 2 back-up rings (see drawing for orientation).

7. 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).

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

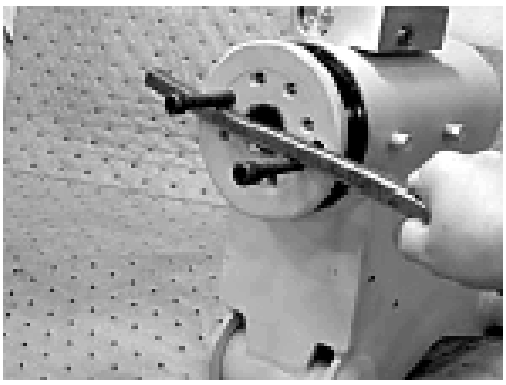
9. Looking from the angle shown, rotate the piston (3) until the marks you put on the piston and the housing (1) during disassembly line up as shown. Using a rubber mallet, tap the piston into the housing up to the point where the gear teeth meet.

10. 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.

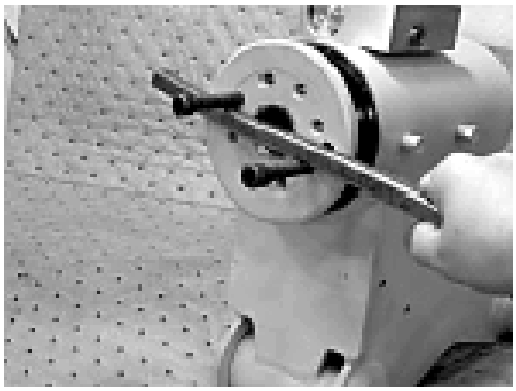


11. Install the shaft (2) into the piston (3). Be careful not to damage the seals. Do not engage the piston gear teeth yet.

12. 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.



13. 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.

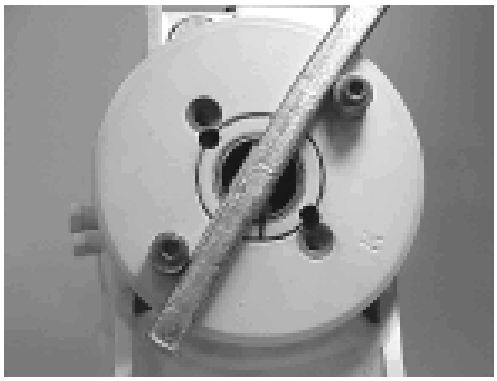


14. Install the stop tube onto the shaft end. Stop tube is an available option to limit the rotation of an actuator.

15. Coat the threads on the end of the shaft with anti-seize grease to prevent galling.

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

17. 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).



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

19. 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.

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

3.10 BATTERY MAINTENANCE AND CHARGING

Battery Maintenance, Quarterly

1. Open battery compartment cover to allow access to battery terminals and vent caps.

NOTICE

WHEN ADDING WATER TO BATTERIES, ADD WATER UNTIL ELECTROLYTE COVERS PLATES. DO NOT CHARGE BATTERIES UNLESS ELECTROLYTE COVERS THE PLATES.

NOTE: *When adding distilled water to batteries, non-metallic containers and/or funnels must be used.*

To avoid electrolyte overflow, add distilled water to batteries after charging.

When adding water to the battery, fill only to level indicated or 1.5 cm (3/8") above separators.

2. Remove all vent caps and inspect electrolyte level of each cell. Electrolyte level should be to the ring approximately one inch from top of battery. Fill batteries with distilled water only. Replace and secure all vent caps.
3. Remove battery cables from each battery post one at a time, negative first. Clean cables with acid neutralizing solution (e.g. baking soda and water or ammonia) and wire brush. Replace cables and/or cable clamp bolts as required.
4. Clean battery post with wire brush then reconnect cable to post. Coat non-contact surfaces with mineral grease or petroleum jelly.
5. When all cables and terminal posts have been cleaned, ensure all cables are properly positioned and do not get pinched. Close battery compartment cover.
6. Start hydraulic system and ensure that it functions properly.

Charging Sequence of Remote LED Card

1. Plug in charger.
2. All three LED's (light emitting diode) flash three times.
3. In sequence.
   a. Green LED flashes once.
   b. Yellow LED flashes once.
   c. Red LED flashes once.
4. All Three LED flash three times.
5. Yellow LED comes on indicates charger is charging.
6. Yellow LED will stay on until fully charged and green LED will illuminate.
7. If Red LED remains on, this indicates a fault.

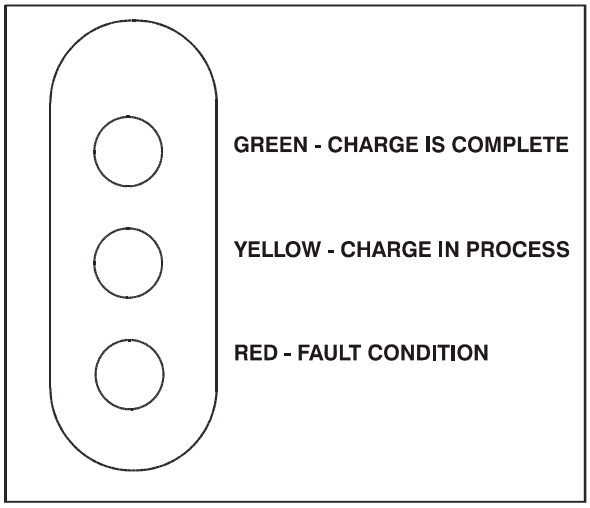
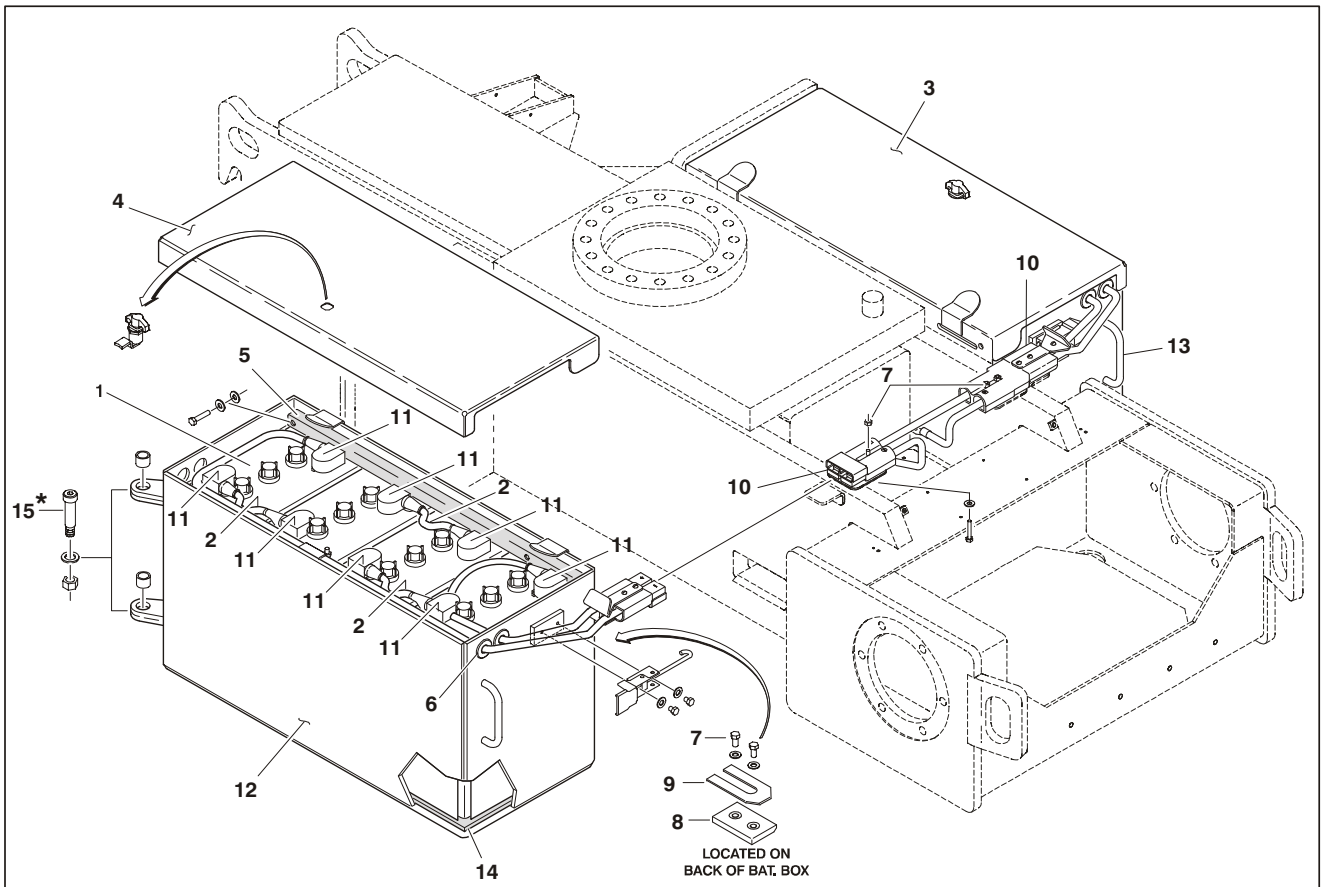


Figure 3-30. Remote LED Card



NOTE: *Apply Item #10 to contacts of Anderson connectors only.*

NOTE: *Apply Item #11 to Battery Terminal connections only.*

* Torque to 70 ft.lbs. (95 Nm)

1. Battery	5. Hold Down	9. Shim	13. Battery Box
2. Cable	6. Insulation Grommet	10. Dielectric Grease	14. Battery Box Liner
3. Cover	7. Loctite #242	11. Battery Terminal Grease	15. Shoulder Screw
4. Cover	8. Wear Pad	12. Battery Box	

Figure 3-31. Battery Installation

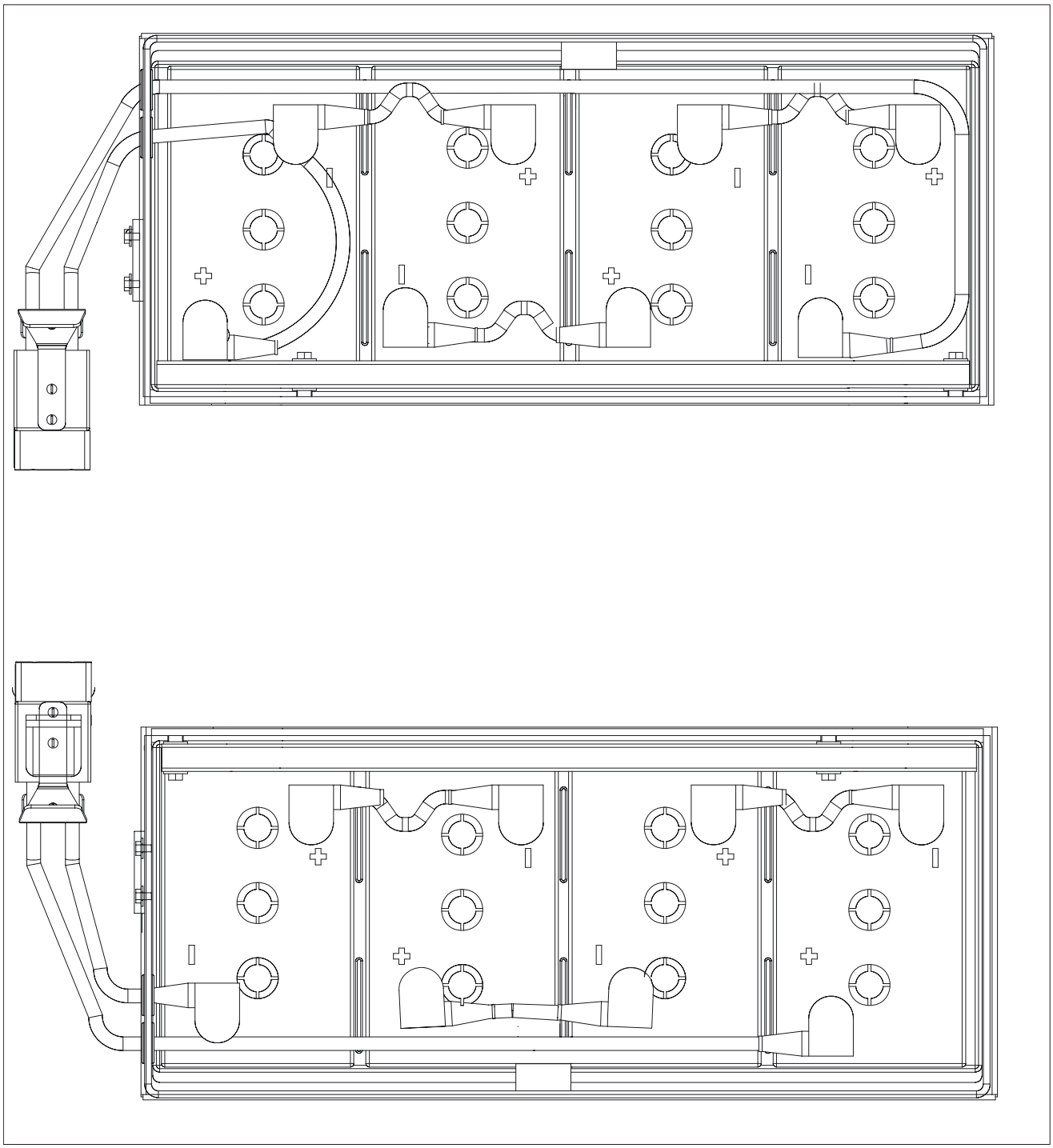


Figure 3-32. Battery Cable Connections

NOTES:

SECTION 4. BOOM & PLATFORM

4.1 BOOM MAINTENANCE

NOTICE

IF PERFORMING MAINTENANCE ON THE BOOM, DO NOT USE A LIFTING DEVICE TO LIFT THE BOOMS UNLESSTHE HOLDING VALVES HAVE BEEN REMOVED FIRST. FAILURE TO DO SO WILL RESULT IN SEVERE DAMAGE TO THE BOOM.

Removal of the Boom Assembly

1. Remove the platform and platform support as follows:
   - **a.** Disconnect electrical cable from control console.
   - **b.** Tag and disconnect the hydraulic lines running to the rotate cylinders. Cap the hydraulic lines and ports.
   - **c.** Using an overhead crane or suitable lifting device, use nylon support straps to support the platform/support, and jib if applicable.

NOTE: *When removing the retaining pin from the rod end of the level cylinder, make sure the cylinder is properly supported.*

   - **d.** Remove bolts and keeper pins that secures the retaining pins. Using a suitable brass drift and hammer, remove the retaining pins from the platform support.
2. Remove the boom from the turntable as follows:
   - **a.** Disconnect wiring harness from ground control harness connector.

NOTICE

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

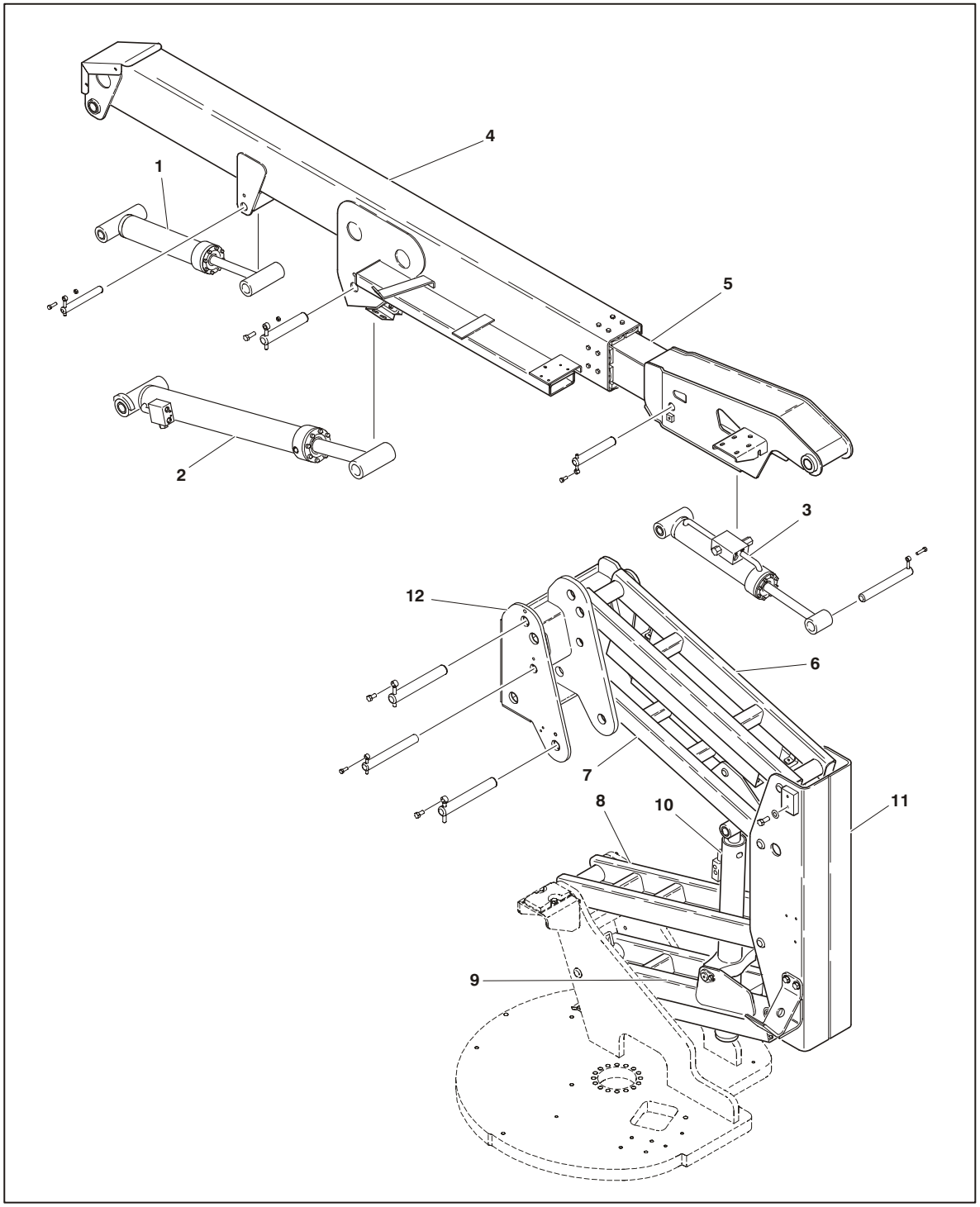
   - **b.** Tag and disconnect hydraulic lines from boom to control valve. Use a suitable container to retain any residual hydraulic fluid. Cap all hydraulic lines and ports.
   - **c.** Using a suitable lifting equipment, adequately support boom weight along entire length.
   - **d.** Remove the bolts and keeper pins securing the lift cylinder pivot pin. Using a suitable brass drift and hammer, remove the pivot pin from the lower boom.
   - **e.** Remove hardware securing the level link pivot pin. Using a suitable brass drift and hammer, remove the pin from the level link and turntable.
   - **f.** Remove hardware securing the lower boom pivot pin. Using a suitable brass drift and hammer, remove pin from the turntable.
   - **g.** Using all applicable safety precautions, carefully lift boom assembly clear of turntable and lower to ground or suitable supported work surface.

Disassembly of the Main Boom

1. Loosen bolts on aft end of fly boom wear pads and remove shims.
2. Using a portable power source, attach hose to telescope cylinder port block. Using all applicable safety precautions, activate hydraulic system and extend cylinder to gain access to cylinder rod retaining pin. Shut down hydraulic system.
3. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After initial discharge, there should be no further leakage from the retract port.
4. Remove hardware securing telescope cylinder to the fly boom section, then remove pin from fly.
5. Remove hardware securing telescope cylinder to the base boom section.

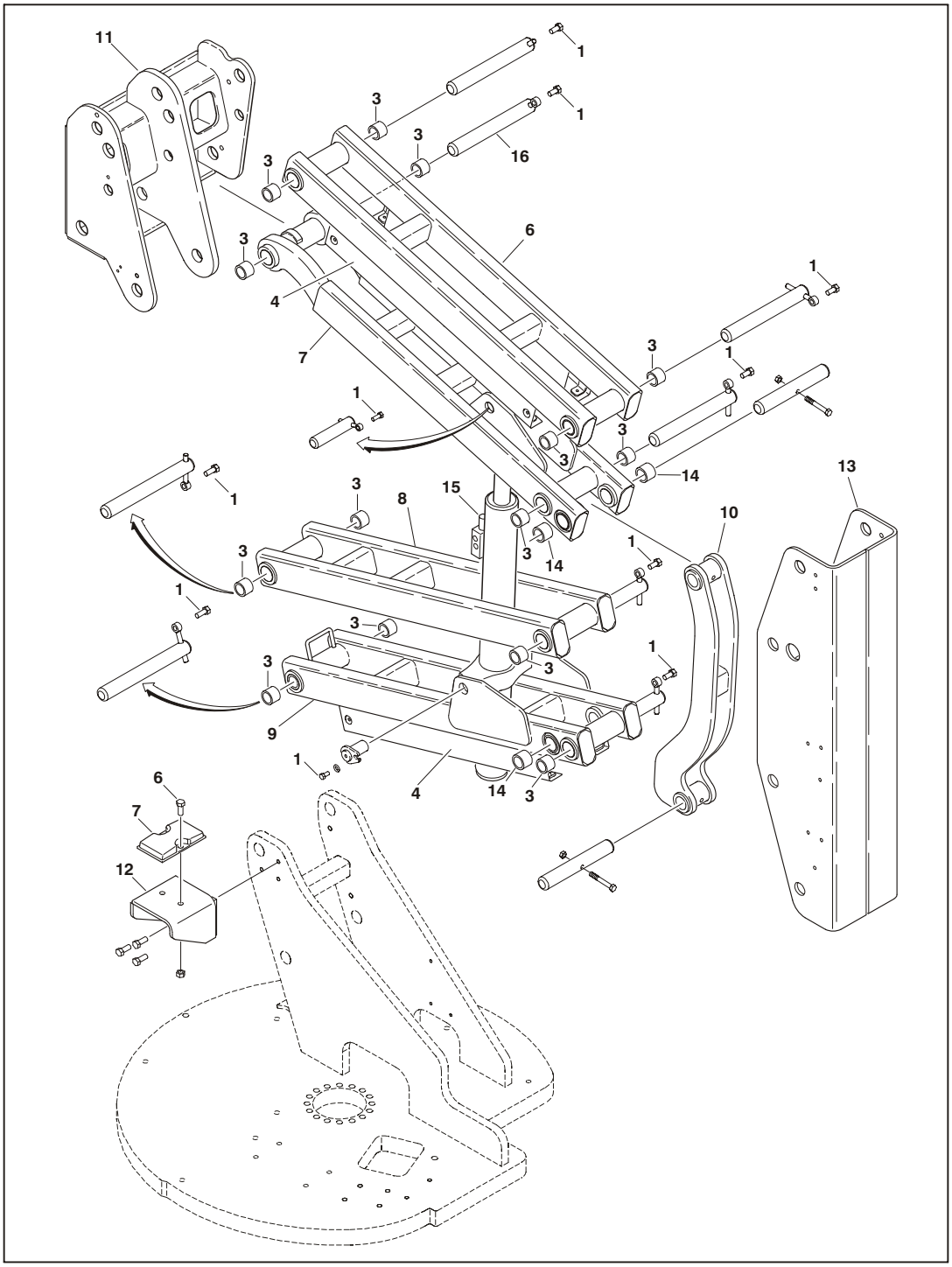
NOTICE

WHEN REMOVING TELESCOPE CYLINDER FROM BOOM SECTIONS. CARE SHOULD BE TAKEN NOT TO LEAVE CYLINDER REST ON POWERTRACK WHICH COULD CAUSE DAMAGE TO POWERTRACK.



1. Master Cylinder
2. Boom Lift
3. Level Cylinder
4. Base Boom
5. Fly Boom
6. Mid Link
7. Mid Boom
8. Lower Link
9. Lower Boom
10. Tower Lift Cylinder
11. Lower Upright
12. Upper Upright

Figure 4-1. Boom Assembly



1. Loctite #242
2. Bumper
3. Composite Bearing
4. Channel
5. Tower Lift Cylinder
6. Mid Link
7. Mid Boom
8. Lower Link
9. Lower Boom
10. Timing Link
11. Upper Upright
12. Boom Rest
13. Lower Upright
14. Composite Bearing

Figure 4-2. Tower Boom Assembly

6. Using a suitable lifting device, remove telescope cylinder from boom sections.
7. Using a piece of tape, mark the length of hoses and wires from front of fly boom and bottom of base boom for reassembly.
8. Remove hardware securing the front wear pads on base boom section, remove wear pads.
9. Remove hardware securing the power track to the aft end of the fly boom section.
10. Using a suitable lifting device, remove fly boom from boom section.
11. Remove hydraulic lines and electrical cables from power track.
12. Remove hardware securing power track to the base boom section. Remove power track.

Inspection

1. Inspect all boom pivot pins for wear, scoring or other damage, and for tapering or ovality. Replace pins as necessary.
2. Inspect lift cylinder pins for wear, scoring or other damage, and for tapering or ovality. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.
3. Inspect telescope cylinder rod attach pin for wear, scoring or other damage. Replace pin as necessary.
4. Inspect inner diameter of boom pivot bushings for scoring, distortion, wear or other damage. Replace bushings as necessary.
5. Inspect wear pads for wear.
6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.
7. Inspect structural units of boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly of the Main Boom

1. Install power track to the attach point on the base boom section. Secure power track with the attaching hardware.
2. Install hydraulic lines and electrical cables into the power track.
3. Install wear pads to the aft end of the fly section.
4. Using suitable lifting equipment, slide fly section into the base section until power track attach point aligns with holes in side of base section.
5. Attach the power track to the aft end of fly boom section. Secure power track with the attaching hardware.
6. Using suitable lifting equipment, slide fly boom section out to gain access to telescope cylinder attach pin hole.
7. Measure the distance between the telescope cylinder port block attach point on base boom section and the attach point on fly boom section.
8. Connect a suitable auxiliary hydraulic power source to the telescope cylinder port block.
9. Extend the telescope cylinder the distance of the two attach points.
10. Secure the sling and lifting device at the telescope cylinder's approximate center of gravity, and lift the cylinder to the aft end of the boom assembly.

NOTICE

WHEN INSERTING THE TELESCOPE CYLINDER INTO THE BOOM, CARE MUST BE TAKEN NOT TO DAMAGE THE POWER TRACK ASSEMBLY.

11. Slowly slide the telescope cylinder into boom assembly, align rod end with attach point in fly section. Insert pin and secure with retaining ring.
12. Align bolt holes at aft end of base boom section with telescope cylinder port block. Secure telescope cylinder with hardware.
13. Install wear pads at end of base boom section. Using shims, adjust the adjustable wear pads to zero clearance. Adjust pads alternately side to side, so that fly boom section is centered in base boom section.
14. Retract boom section fully. Using shims, adjust wear pads at aft end of boom section to zero clearance. Adjust pads alternately side to side, so that fly boom section is centered in base boom section.
15. Disconnect auxiliary power source from telescope cylinder.

Installation of the Boom Assembly

1. Using suitable lifting equipment, position boom assembly on turntable so that boom pivot holes in both boom and turntable are aligned.
2. Install boom pivot pin, ensuring that location of the hole in pivot pin aligns with attach point on upright.
3. Using all applicable safety precautions, operate lifting equipment in order to position boom lift cylinder and level link so that holes in cylinder rod end and level link are aligned with the one in the turntable. Insert cylinder pins.
4. If necessary, gently tap pins into position with a soft headed mallet, ensuring that attach holes in pins are aligned with attach holes in boom structure. Secure with hardware.
5. Connect all hosing and wiring.
6. Install the platform, and jib if applicable, to the boom assembly.
7. Connect all hosing and wiring at platform control station.
8. Using all safety precautions, operate machine systems and extend and retract boom for four or five cycles.
9. Shut down machine systems and check for leakage.

4.2 WEAR PADS

1. Shim up wear pads until snug to adjacent surface.
2. Bolt into threaded insert of wear pad.
3. Replace wear pads when worn to thickness of 9/16”.

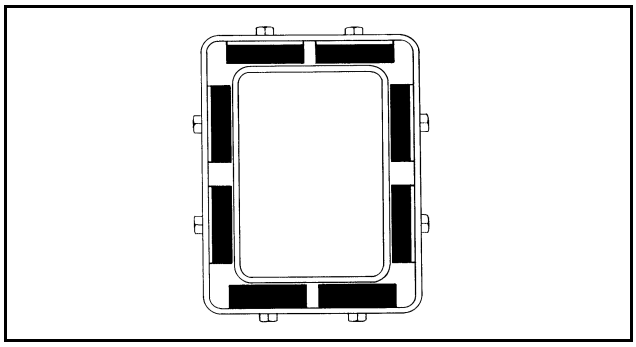


Figure 4-3. Location of wear Pads

4.3 ARTICULATING JIB (AJ/AJP)

Removal

1. Place the Jib in a horizontal position and support the complete assembly with adequate blocking.
2. Remove the Platform as follows:
   a. Disconnect the electrical connectors going into the platform control box.
   b. Remove the bolts, nuts, and washers connecting the platform basket to the platform support.
   c. Using a suitable lifting device, remove the platform basket from the platform support.
3. Tag and disconnect the hydraulic lines running to the Jib. Use a suitable container to collect any residual fluid. Cap the hydraulic lines and ports.
4. Remove the hardware securing the Jib pivot pin at the boom. Using a suitable brass drift and hammer, remove the pin from the fly boom. Use a suitable lifting device and remove the Jib.

4.4 TILT INDICATOR SWITCH LEVELING

⚠ CAUTION

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

1. Check chassis out of level indicator light located on the platform control console by driving, with the machine in level position, up a suitable ramp of at least 6° slope. Check the out of level alarm, with the machine on the ramp, raise the upper boom until it is parallel with the chassis. DO NOT RAISE ABOVE THE PARALLEL POSITION. If the light does not illuminate, return the machine to a level surface, shut down the machine, and contact a qualified technician before resuming operation.

4.5 FOOTSWITCH ADJUSTMENT

Adjust switch so that functions will operate when pedal is at center of travel. If switch operates within last 1/4 inch (6.35 mm) of travel, top or bottom, it should be adjusted.

4.6 BOOM LIMIT SWITCHES

Refer to Figure 4-7., Boom Limit Switches for adjustments to be made of the two Limit Switches which bolt in place on the upright.

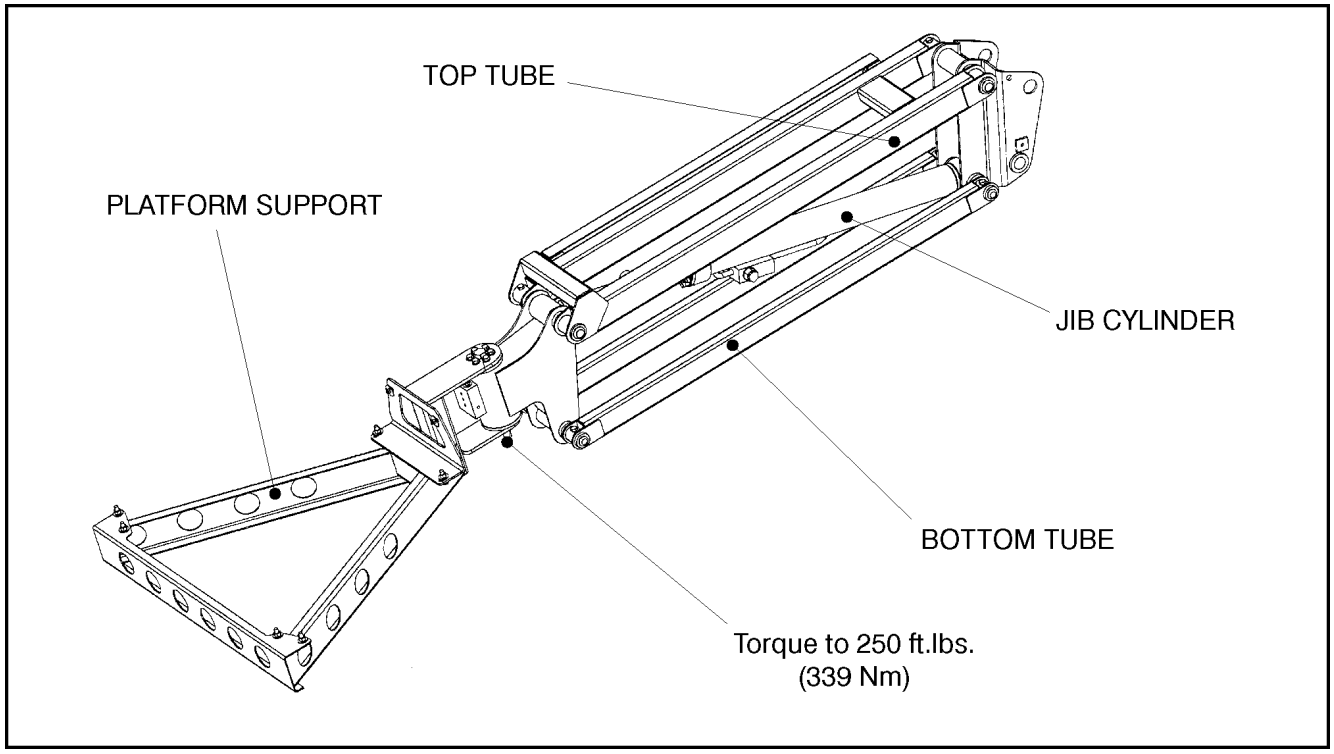


Figure 4-4. Jib - E300AJ

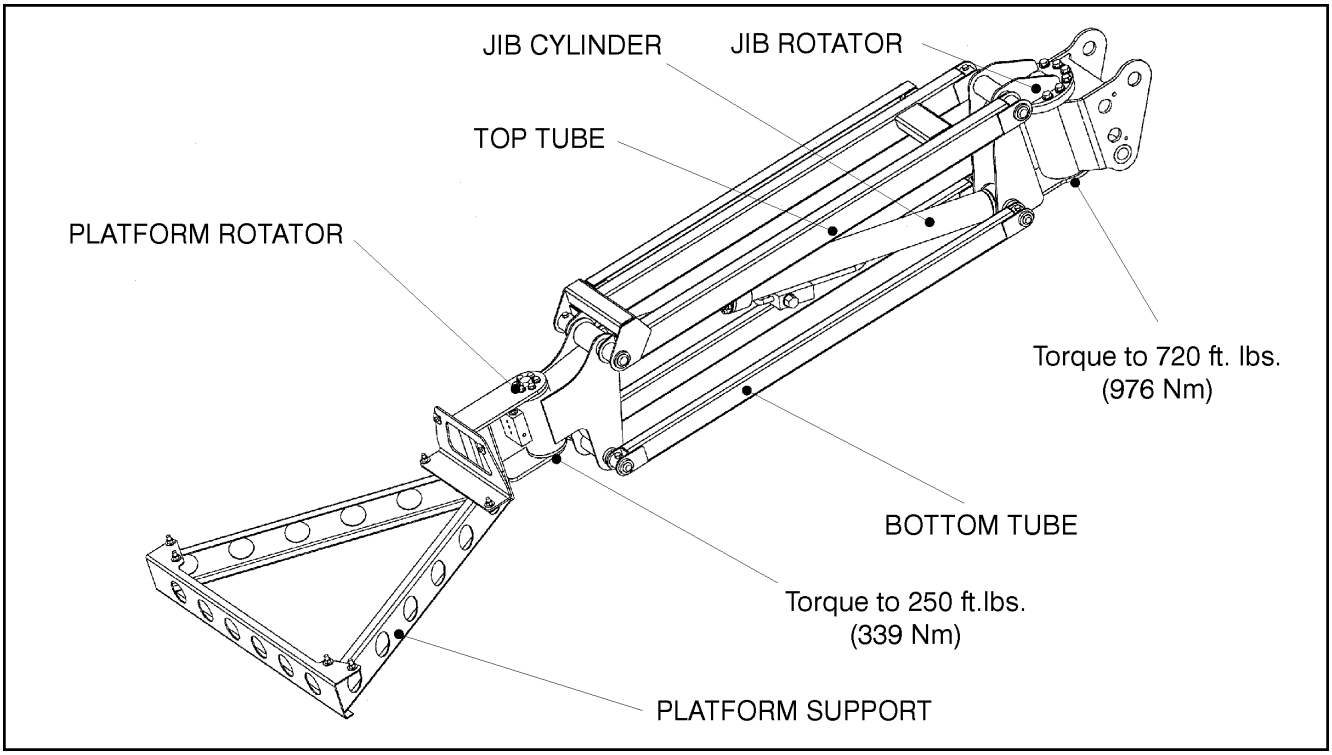
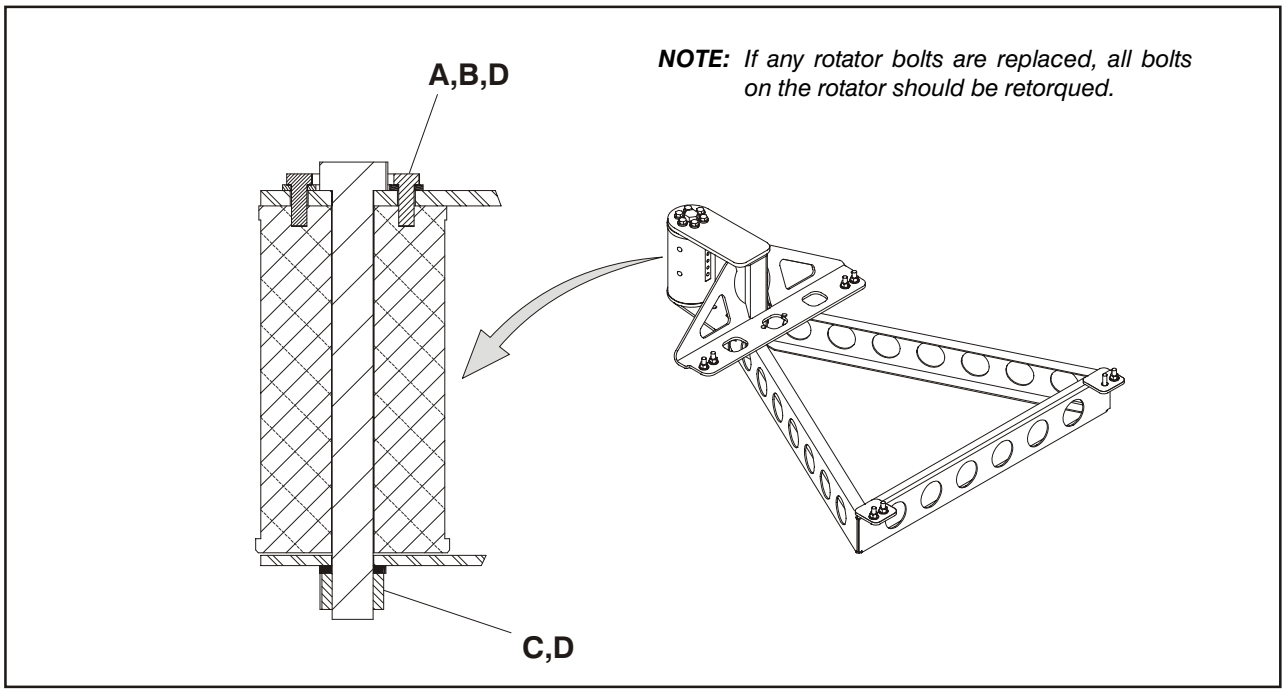


Figure 4-5. Jib - E300AJP



A Torque to 50 ft.lbs. (68 Nm)
B Loctite #242
C Torque 250-270 ft. lbs. (339-366 Nm)
D Check torque every 150 hours of operation

Figure 4-6. Platform Support Torque Values

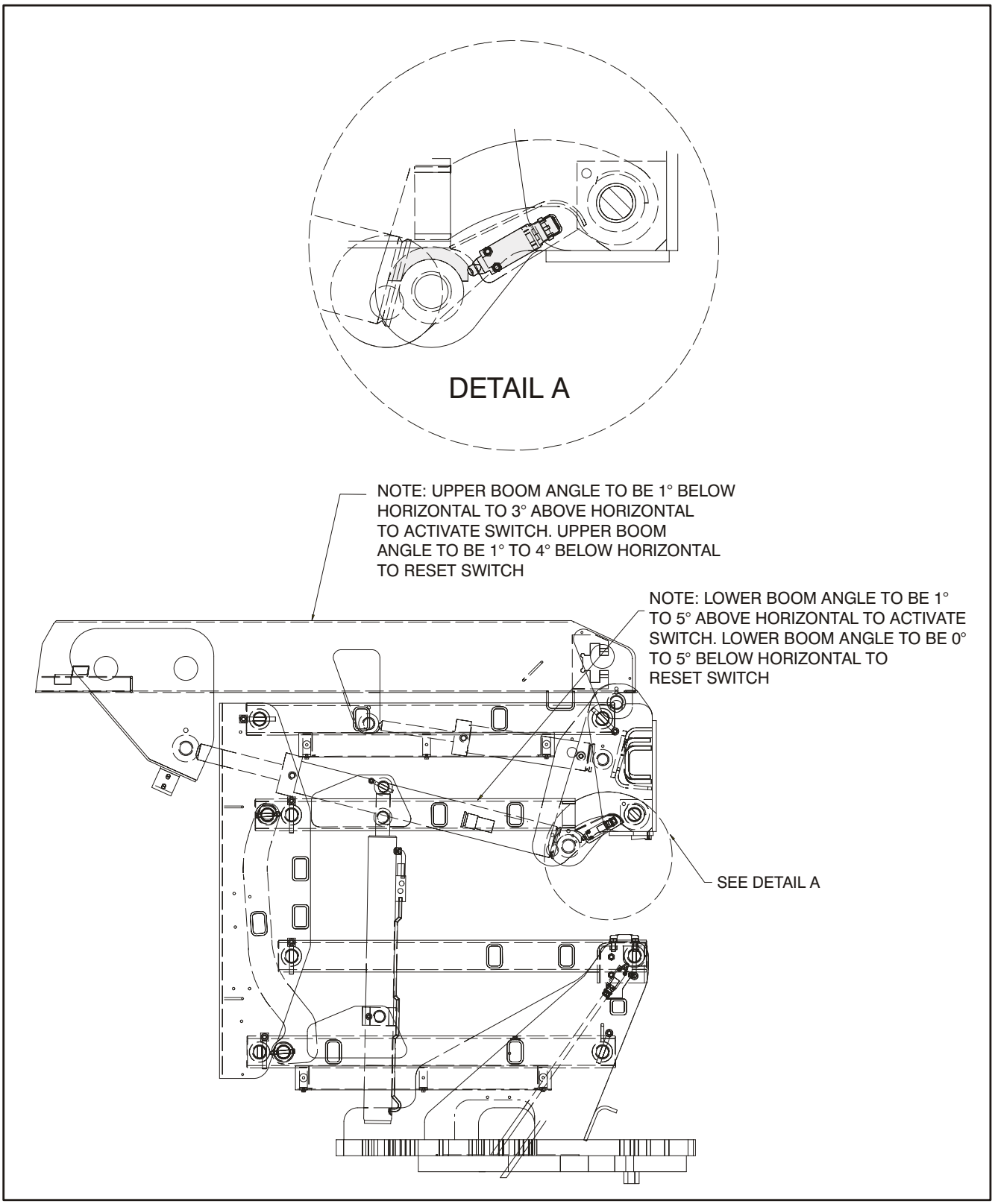


Figure 4-7. Boom Limit Switches

NOTES:

SECTION 5. HYDRAULICS

5.1 LUBRICATING O-RINGS IN THE HYDRAULIC SYSTEM

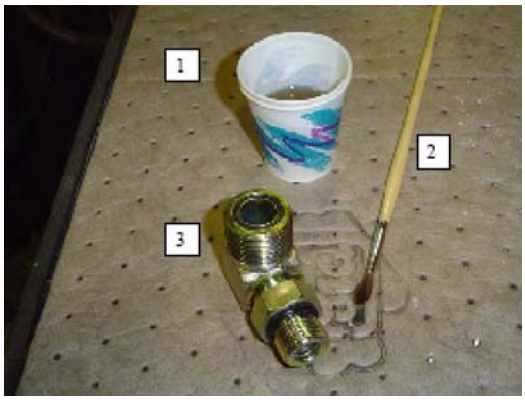
When assembling connectors in the hydraulic that use o-ring fittings, it is necessary to lubricate all fittings with hydraulic oil prior to assembly. To lubricate the fittings, use one of the following procedures.

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.

1. Place the sponge inside the container and add hydraulic oil to the sponge until it is fully saturated.
2. 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.

3. 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.
3. 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.
2. 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 CYLINDERS - THEORY OF OPERATION

Systems Incorporating Double Acting Cylinders

Upper Boom Lift, Lower Boom Lift, Telescope, Slave, Master, Steer Cylinder.

A double acting cylinder is one that requires oil flow to operate the cylinder rod in both directions. Directing oil (by actuating the corresponding control valve to the piston side of the cylinder) forces the piston to travel toward the rod end of the barrel, extending the cylinder rod (piston attached to rod). When the oil flow is stopped, movement of the rod will stop. By directing oil to the rod side of the cylinder, the piston will be forced in the opposite direction and the cylinder rod will retract.

Holding valves are used in the Lift circuits to prevent retraction of the cylinder rod should a hydraulic line rupture or leak develop between the cylinder and its related control valve.

5.3 CYLINDER CHECKING PROCEDURES

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

Cylinder Without Counterbalance Valves (Steer and Master)

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

Cylinders With Single Counterbalance Valve (Upper Lift Cylinder)

NOTICE

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

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

⚠ WARNING

WHEN WORKING ON THE UPPER BOOM LIFT CYLINDER RAISE THE UPPER BOOM TO HORIZONTAL AND PLACE A BOOM PROP APPROXIMATELY 1 INCH (2.54 CM) BELOW THE MAIN BOOM. IF WORKING ON TOWER BOOM LIFT CYLINDER, RAISE LOWER LIFT HALFWAY, FULLY ELEVATE UPPER BOOM AND ATTACH OVERHEAD CRANE TO THE UPRIGHT FOR SUPPORT, LEAVING APPROXIMATELY 1 INCH (2.54 CM) OF SLACK IN CHAIN OR SLING FOR TEST PURPOSES.

2. After completing the above, shut down hydraulic system and allow machine to sit for 10-15 minutes. This is done to relieve pressure in the hydraulic lines. Carefully remove hydraulic hoses from appropriate cylinder port block.
3. There will be initial weeping of hydraulic fluid, which can be caught in a suitable container. After the initial discharge, there should not be any further leakage from the ports. If leakage continues at a rate of 6-8 drops per minute or more, the following cylinder repairs must be made. If the retract port is leaking, the piston is leaking, the piston seals are defective and must be replaced. If the extend port is leaking, the counterbalance is defective and must be replaced.
4. If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.
5. Remove boom prop/overhead crane, activate hydraulic system and run cylinder through complete cycle to check for leaks and operation.

Cylinders With Dual Counterbalance Valve (Lower Lift, Telescope, and Slave Cylinders)

NOTICE

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

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

⚠ WARNING

WHEN WORKING ON THE UPPER BOOM LIFT CYLINDER RAISE THE UPPER BOOM TO HORIZONTAL AND PLACE A BOOM PROP APPROXIMATELY 1 INCH (2.54 CM) BELOW THE MAIN BOOM. REFER TO FIG. 2-1. IF WORKING ON LOWER LIFT CYLINDER, RAISE TOWER BOOM HALFWAY, AND ATTACH OVERHEAD CRANE TO THE UPRIGHT FOR SUPPORT, LEAVING APPROXIMATELY 1 INCH (2.54 CM) OF SLACK IN CHAIN OR SLING FOR TEST PURPOSES.

2. When working on the platform slave cylinder, stroke platform slave level cylinder forward until platform sits at a 45 degree angle.
3. After completing the above, shut down hydraulic system and allow machine to sit for 10-15 minutes. This is done to relieve pressure in the hydraulic lines. Carefully remove hydraulic hoses from appropriate cylinder port block.
4. There will be initial weeping of hydraulic fluid, which can be caught in a suitable container. After the initial discharge, there should not be any further leakage from the ports. If leakage continues at a rate of 6-8 drops per minute or more, the following cylinder repairs must be made. If the retract port is leaking, the piston is leaking, the piston seals are defective and must be replaced. If the extend port is leaking, the counterbalance is defective and must be replaced.
5. To check piston seals, carefully remove the counterbalance valve from the retract port. After initial discharge there should not be any further leakage from the ports. If leakage occurs at a rate of 6-8 drops per minute or more, the piston seals are defective and must be replaced.
6. If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.
7. Remove boom prop/overhead crane, activate hydraulic system and run cylinder through complete cycle to check for leaks and operation.

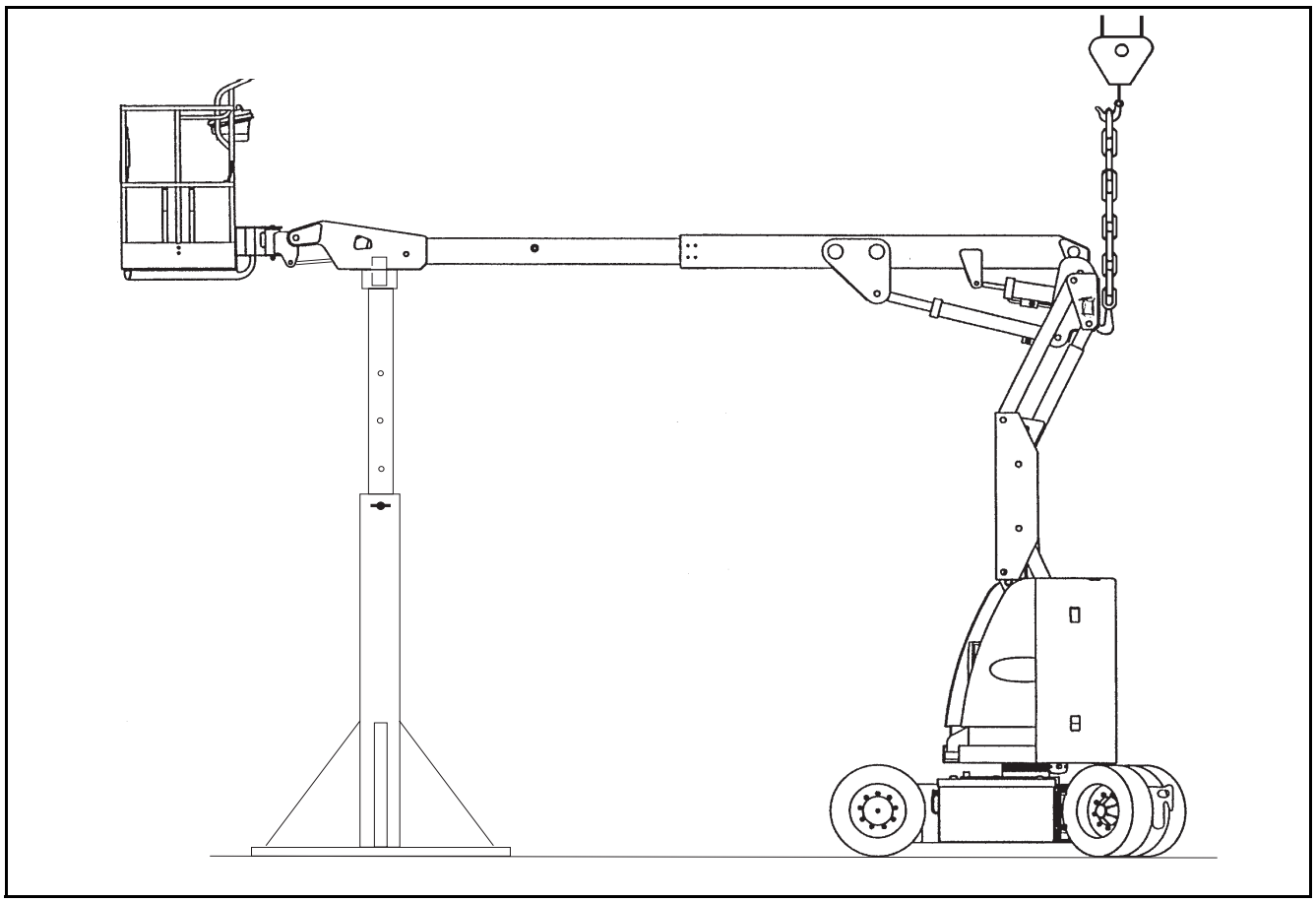


Figure 5-1. Boom Positioning and Support, Cylinder Repair

5.4 CYLINDER REPAIR

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

Disassembly

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.

⚠ WARNING

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

2. Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source. Adequately support the cylinder rod, if applicable.
3. If applicable, remove the cartridge-type holding valve and fittings from the cylinder port block. Discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture.

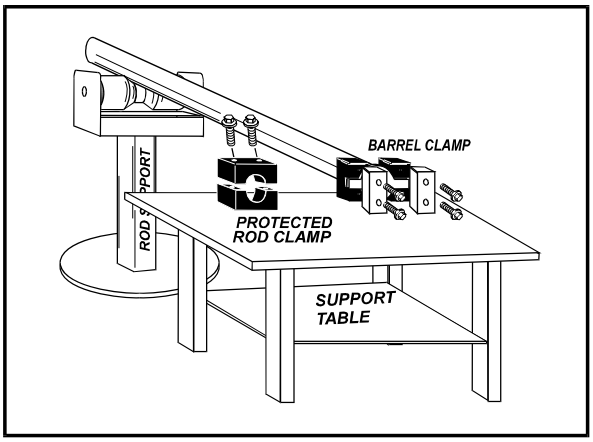


Figure 5-2. Cylinder Barrel Support

5. Mark cylinder head and barrel with a center punch for easy realignment. Using an allen wrench, loosen the cylinder head retainer cap screws, and remove cap screws from cylinder barrel.

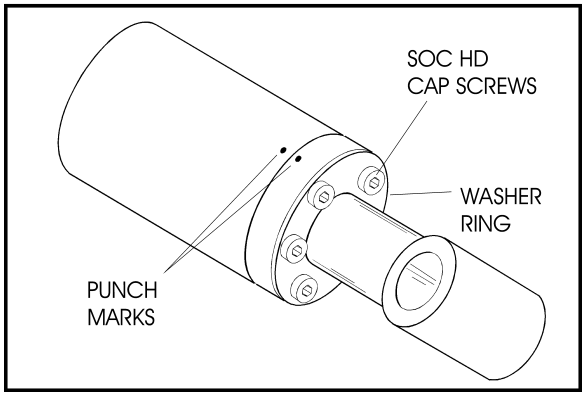


Figure 5-3. Capscrew Removal

NOTE: *Steps 6 applies only to the lower lift and telescope cylinders.*

6. Using a spanner wrench, loosen the end cap or head retainer, and remove from cylinder barrel.
7. Attach a suitable pulling device to the cylinder rod port block end or cylinder rod end, as applicable.

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.

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

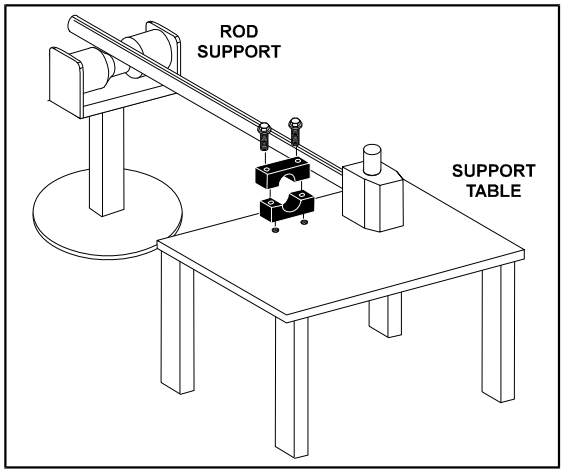


Figure 5-4. Cylinder Rod Support

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

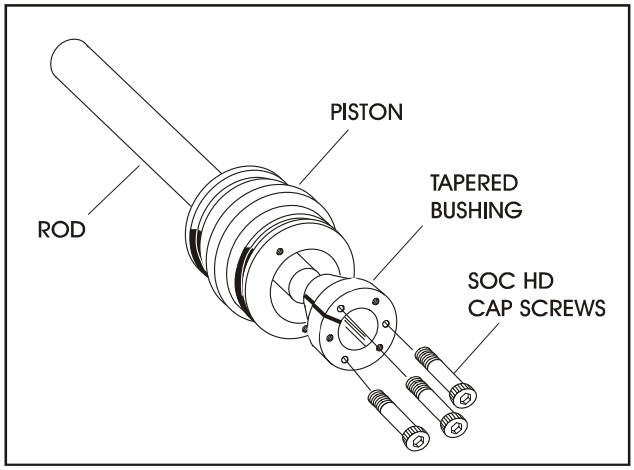


Figure 5-5. Tapered Bushing Removal

13. Screw the piston CCW, by hand, and remove the piston from cylinder rod.
14. 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

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. 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.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. 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 Gar-Max bearing dry. Lubrication is not required with nickel plated pins and bearings.*

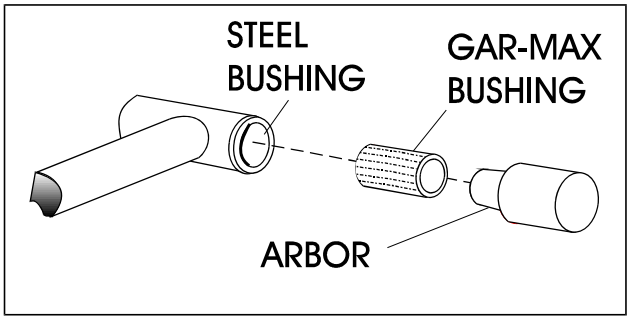
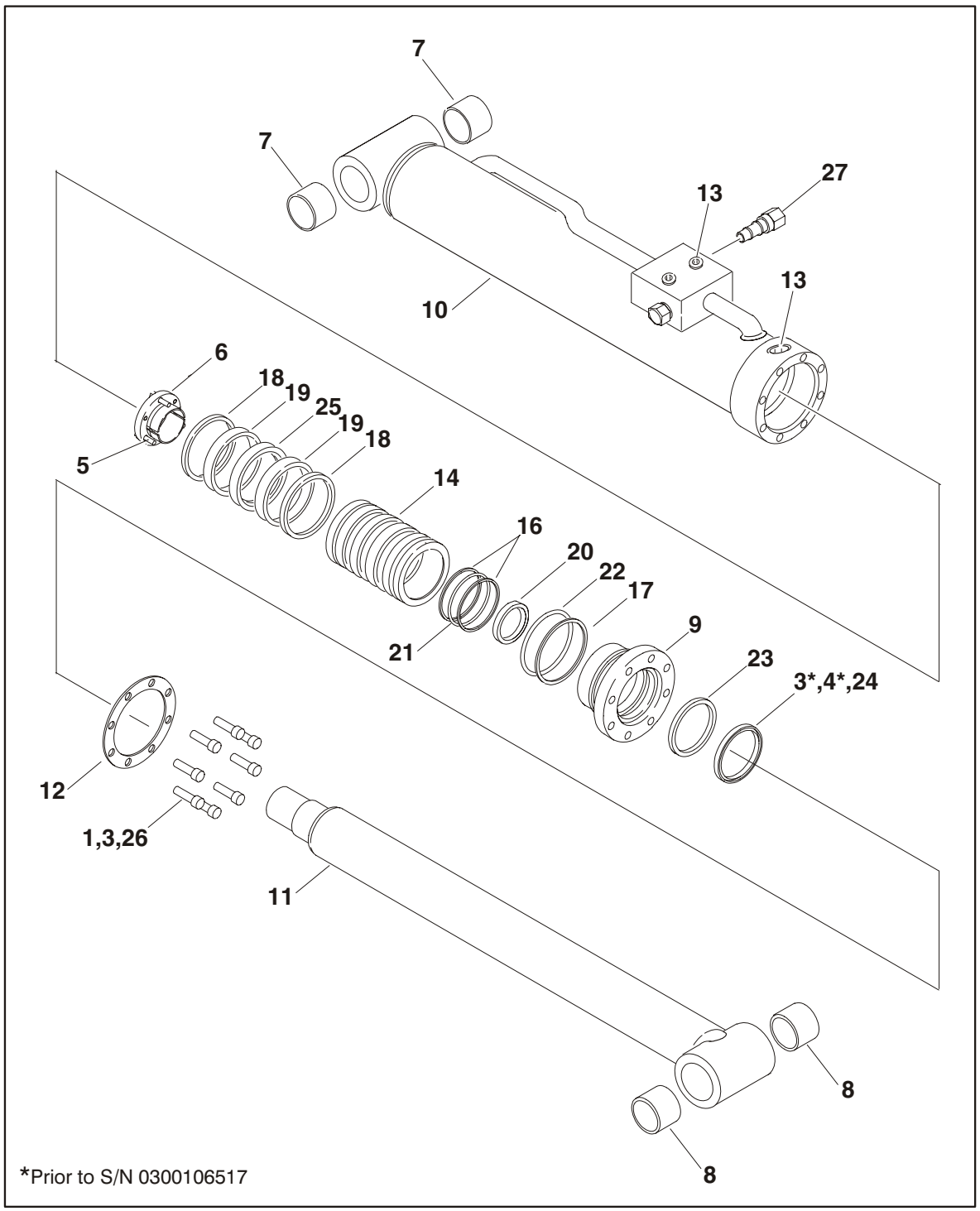


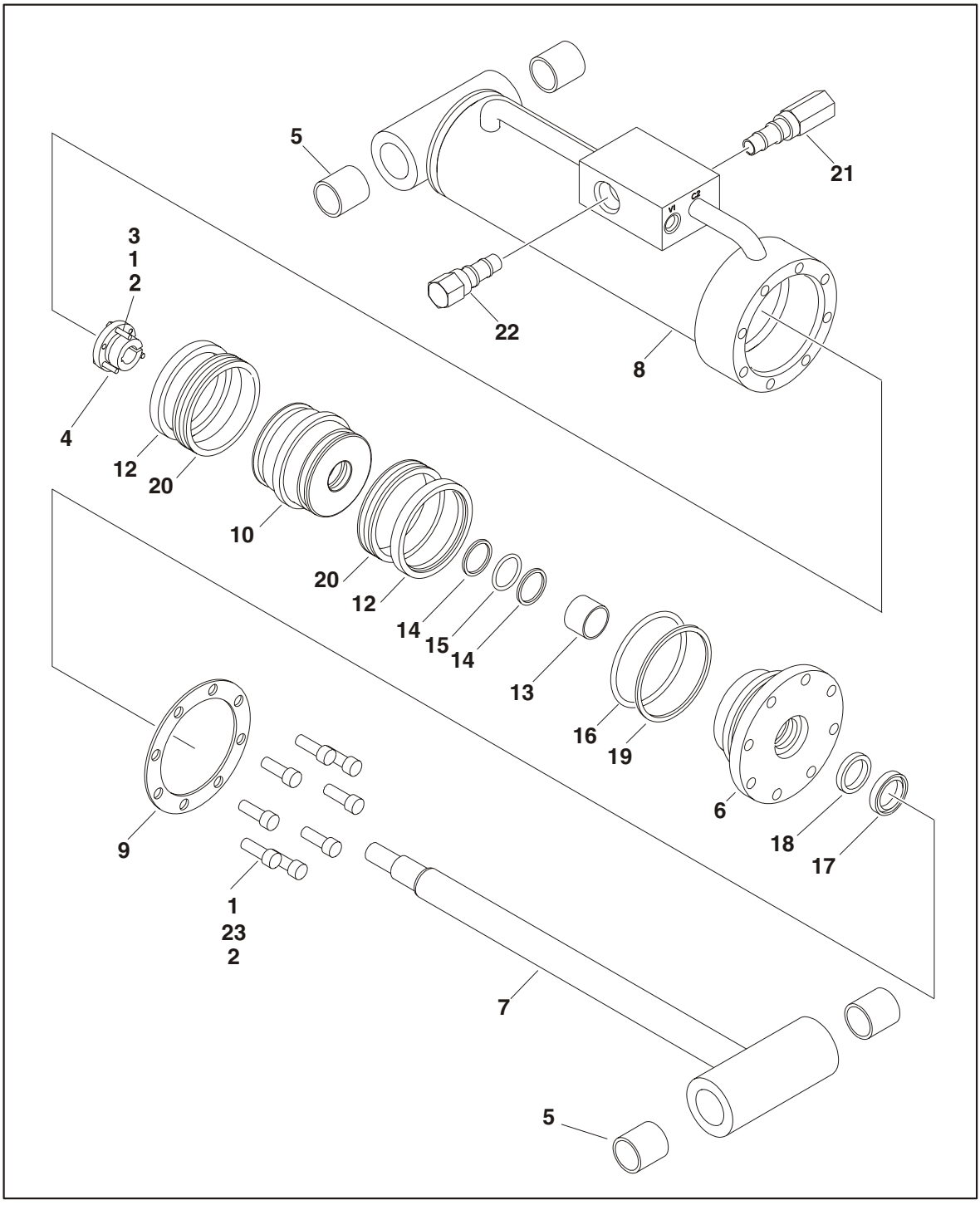
Figure 5-6. Gar-Max Bearing installation

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.
17. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.



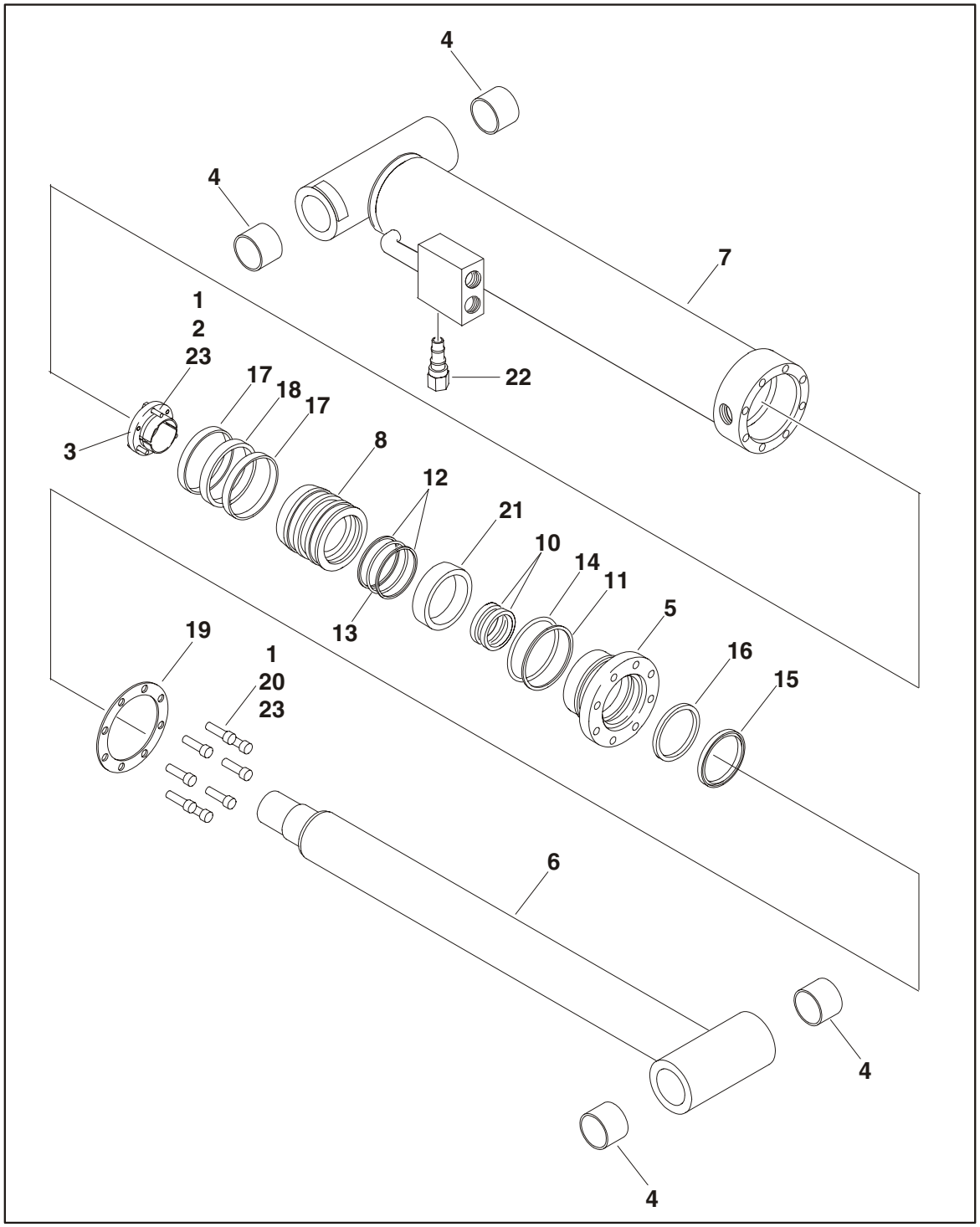
1. Loctite #242
2. Not Used
3. Primer #7471
4. Loctite RC 609
5. Bolt
6. Tapered Bushing
7. Composite Bearing
8. Composite Bearing
9. Cylinder Head
10. Barrel
11. Rod
12. Washer Ring
13. O-ring Plug
14. Piston
15. Not Used
16. Backup Ring
17. Backup Ring
18. Seal Ring
19. Wear Ring
20. Wear Ring
21. O-ring
22. O-ring
23. Seal
24. Wiper
25. Seal
26. Bolt
27. Cartridge Valve

Figure 5-7. Jib Cylinder



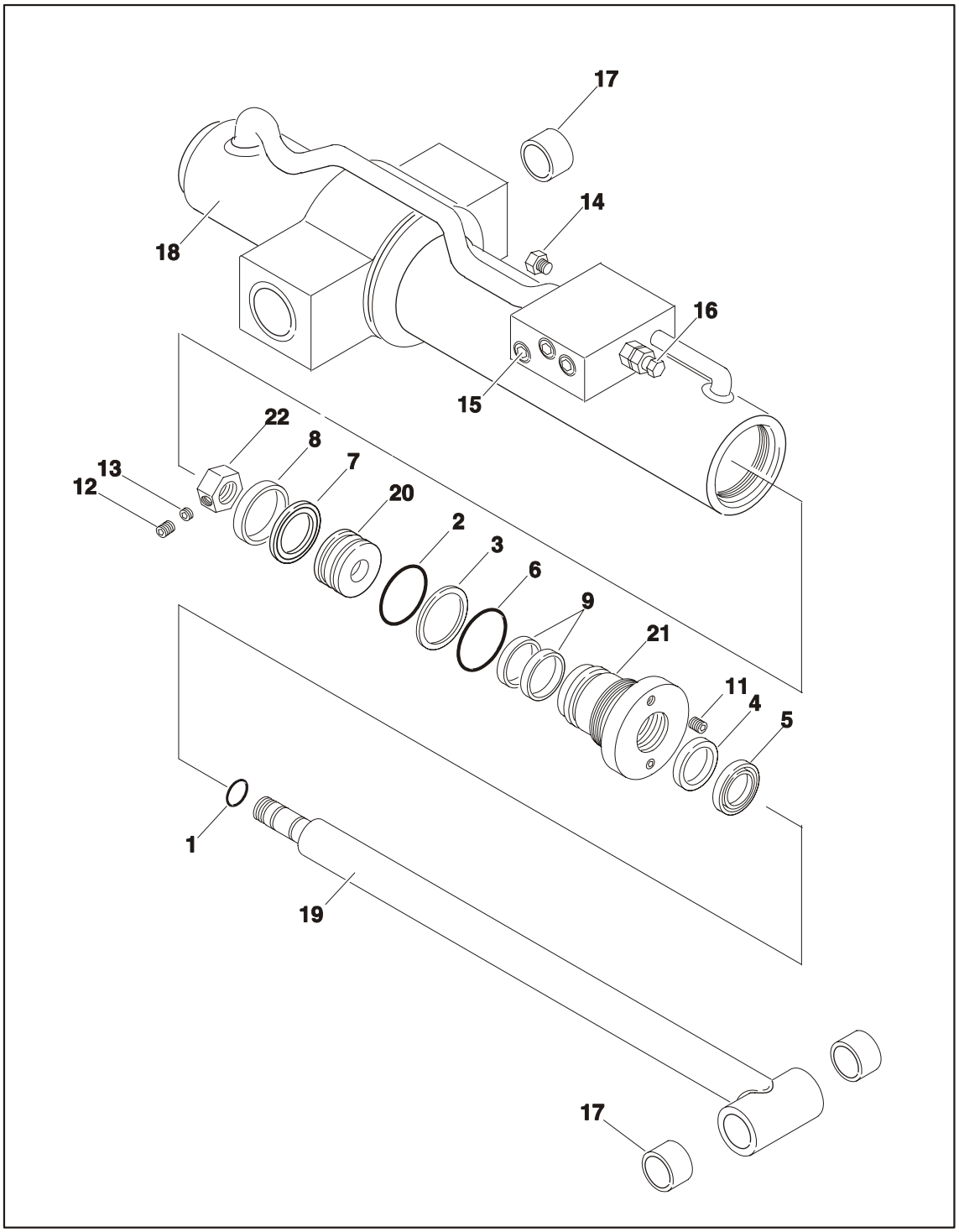
1. Loctite #242
2. Primer #7471
3. Bolt
4. Tapered Bushing
5. Composite Bushing
6. Head
7. Rod
8. Barrel
9. Ring Washer
10. Piston
11. Not Used
12. Lock Ring
13. Wear Ring
14. Backup Ring
15. O-ring
16. O-ring
17. Wiper
18. Seal
19. Backup Ring
20. Seal
21. Counterbalance Valve
22. Counterbalance Valve
23. Bolt

Figure 5-8. Level Cylinder



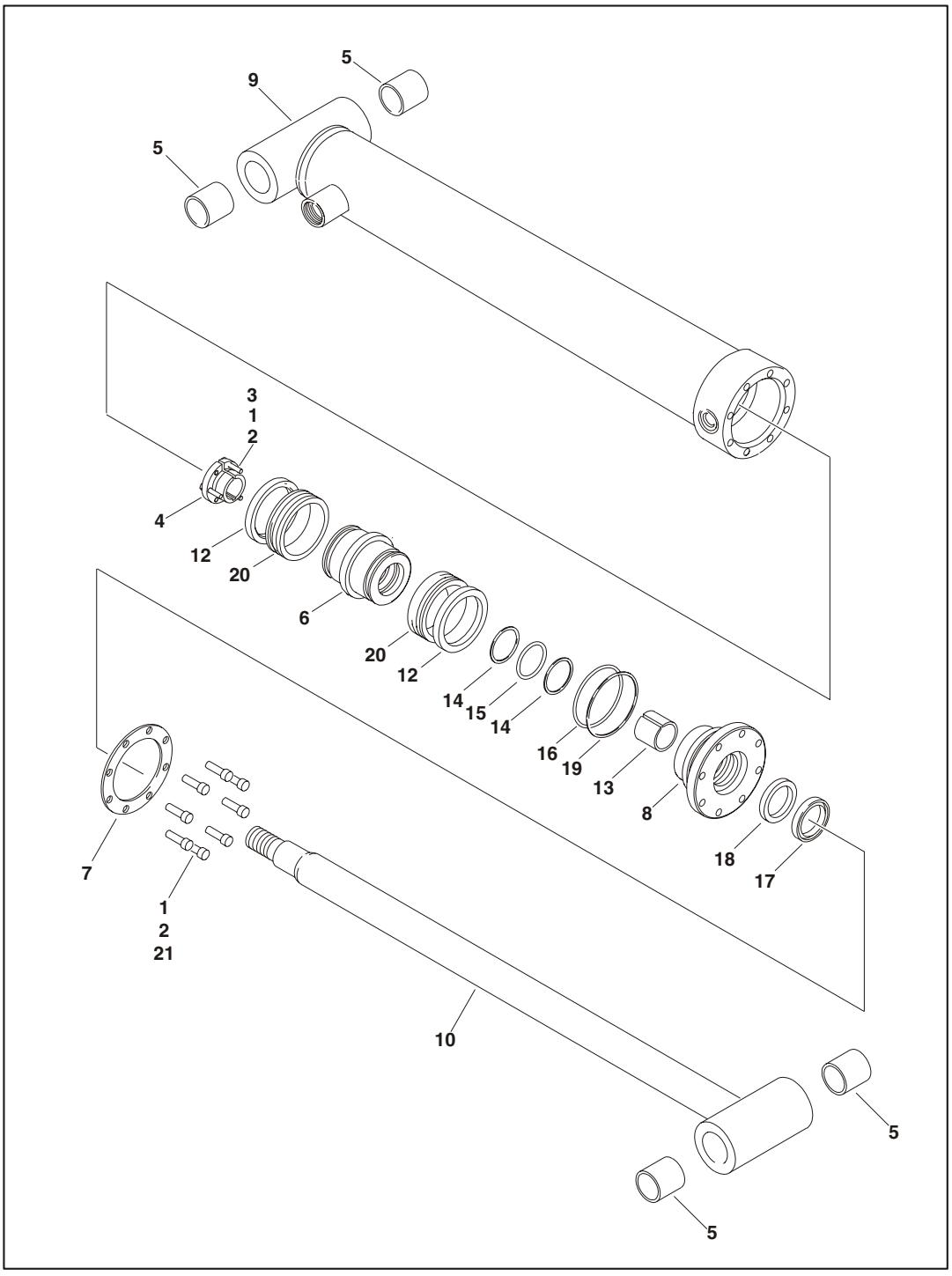
1. Loctite #242
2. Bolt
3. Tapered Bushing
4. Composite Bushing
5. Head
6. Rod
7. Barrel
8. Piston
9. Not Used
10. Wear Ring
11. Backup Ring
12. Backup Ring
13. O-ring
14. O-ring
15. Wiper
16. Seal
17. Wear Ring
18. Cap
19. Ring Washer
20. Bolt
21. Tube Spacer
22. Counterbalance Valve
23. Locking Primer

Figure 5-9. Main Boom Lift Cylinder



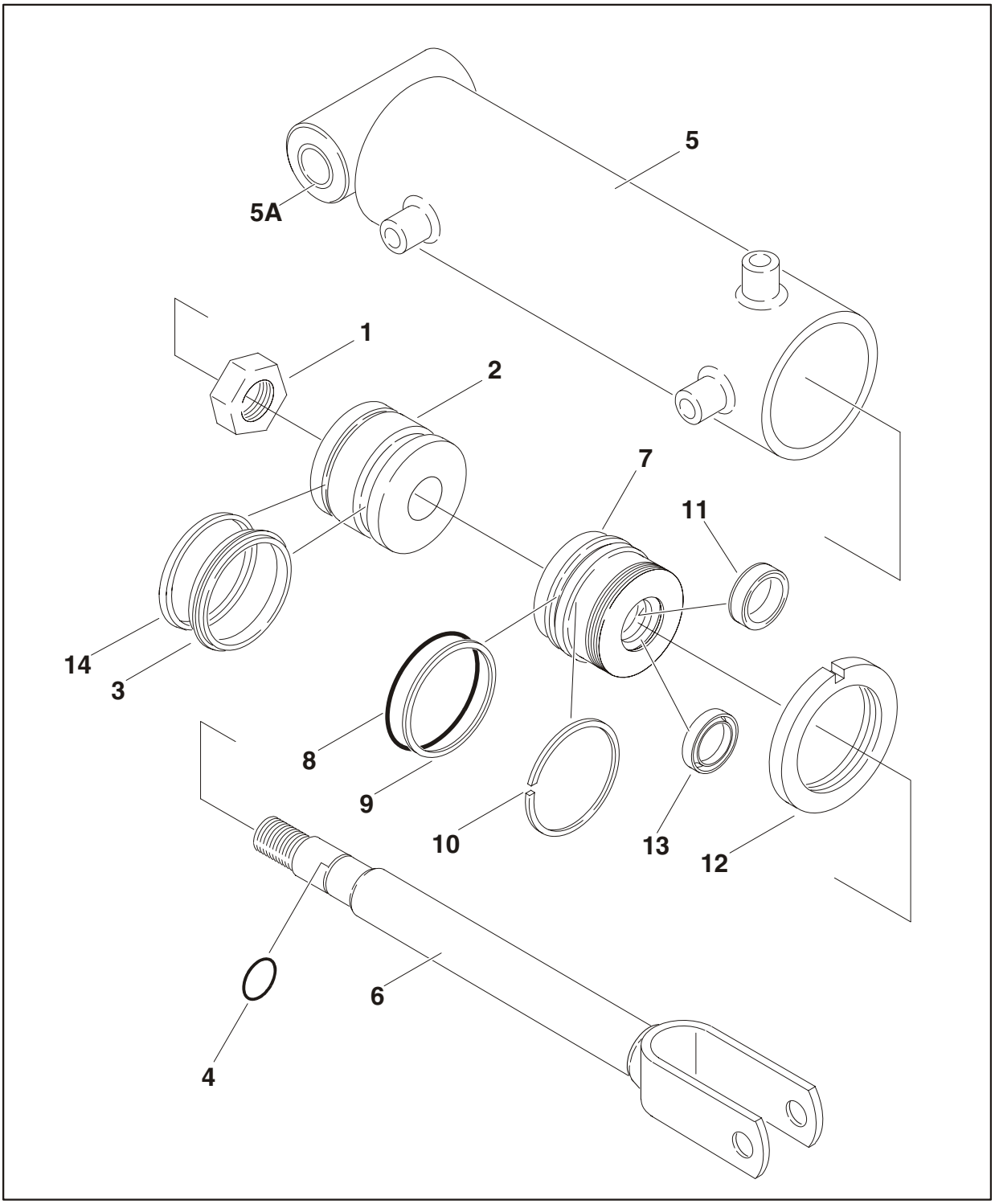
1. O-ring	6. O-ring	11. Setscrew	16. Valve Cartridge	21. Head
2. O-ring	7. Seal	12. Setscrew	17. Bushing	22. Locknut
3. Backup Ring	8. Wear Ring	13. Nylon Plug	18. Barrel	
4. Seal	9. Wear Ring	14. Plug	19. Rod	
5. Wiper	10. Not Used	15. Plug	20. Piston	

Figure 5-10. Tower Boom Lift Cylinder



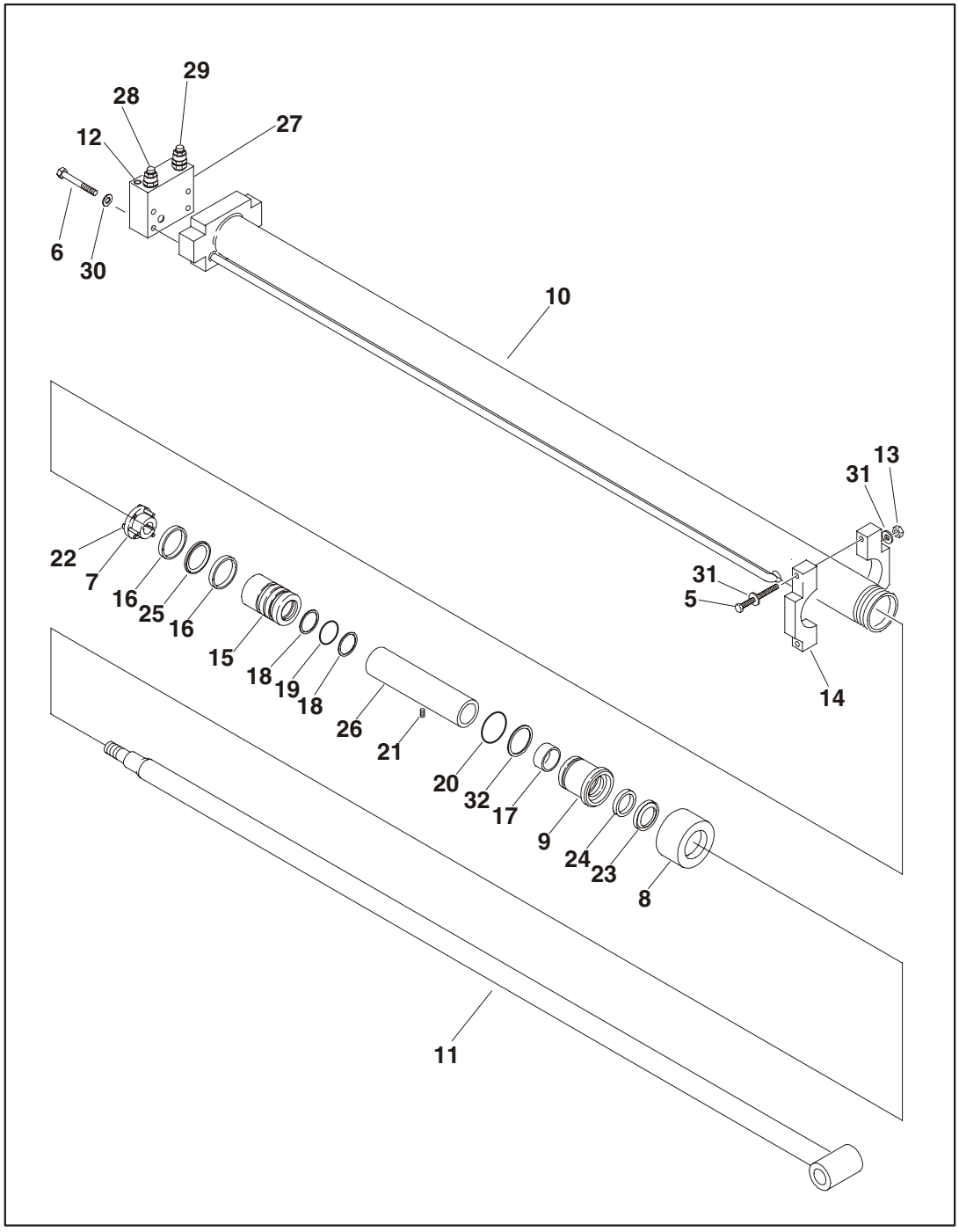
1. Loctite #242
2. Locking Primer
3. Bolt
4. Tapered Bushing
5. Composite Bushing
6. Piston
7. Ring Washer
8. Head
9. Barrel
10. Rod
11. Not Used
12. Lock Ring
13. Wear Ring
14. Backup Ring
15. O-ring
16. O-ring
17. Wiper
18. Seal
19. Backup Ring
20. Seal
21. Bolt

Figure 5-11. Master Cylinder



1. Locknut
2. Piston
3. Piston Seal
4. O-ring
5. Barrel
6. Rod
7. Guide
8. O-ring
9. Backup Ring
10. Retaining Ring
11. Seal
12. Nut
13. Wiper
14. Wear Ring

Figure 5-12. Steer Cylinder



1. Loctite #242	8. Cap	15. Piston	21. Setscrew	27. Valve Assembly
2. Not Used	9. Head	16. Wear Ring	22. Bolt	28. Valve Cartridge
3. Locking Primer	10. Barrel	17. Wear Ring	23. Wiper	29. Valve Cartridge
4. Loctite	11. Rod	18. Backup Ring	24. Seal	30. Flatwasher
5. Bolt	12. O-ring	19. O-ring	25. Teflon Seal	31. Flatwasher
6. Bolt	13. Locknut	20. O-ring	26. Tube Spacer	32. Backup Ring
7. Tapered Bushing	14. Pad			

Figure 5-13. Telescope Cylinder

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.

1. A special tool is used to install a new rod seal into the applicable cylinder head gland groove.

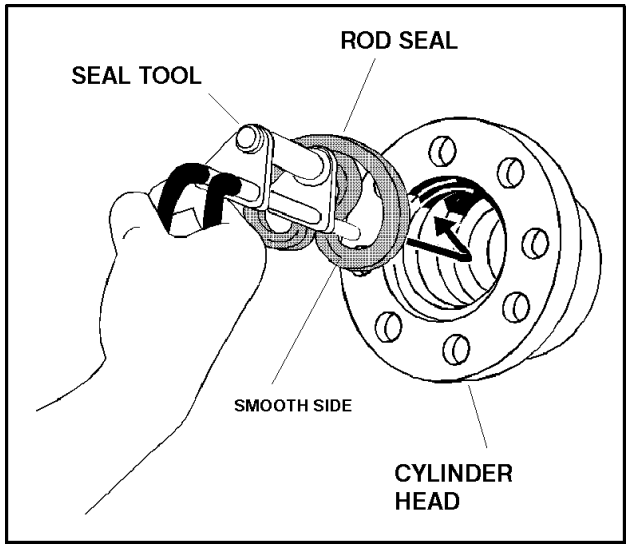


Figure 5-14. Rod Seal Installation

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.

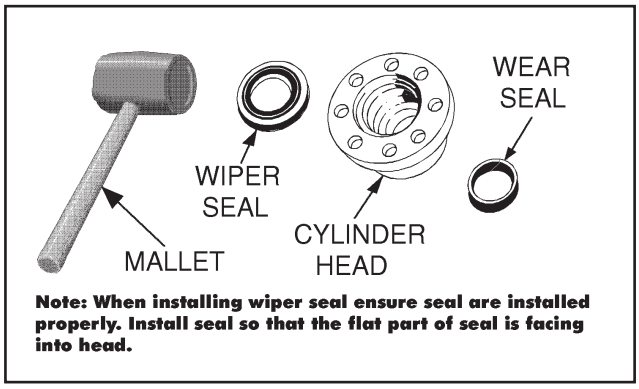


Figure 5-15. Wiper Seal Installation

3. Place a new o-ring and back-up seal in the applicable outside diameter groove of the cylinder head.
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.

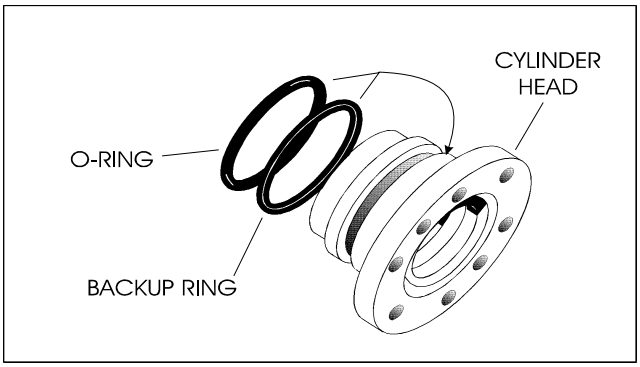


Figure 5-16. Installation of Head Seal Kit

5. Carefully slide the piston spacer on the rod.
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. The split of seals and backup rings are to be positioned so as not to be in alignment with each other.*

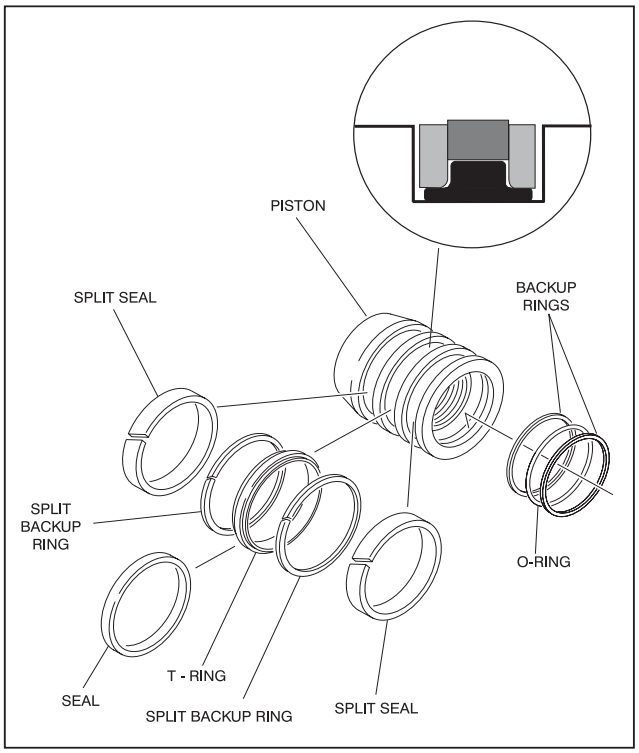


Figure 5-17. Piston Seal Kit Installation

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.*

⚠ WARNING

WHEN REBUILDING THE STEER, TOWER LIFT, LEVEL CYLINDER, UPPER LIFT CYLINDER, OR E.A.R. CYLINDERS, APPLY LOCTITE #242 TO TAPERED BUSHING BOLTS, THEN TIGHTEN SECURELY. (SEE TABLE 5-1 ANDTABLE 5-2 TORQUE SPECIFICATIONS).

11. Assemble the tapered bushing loosely into the piston and insert JLG capscrews (not vender capscrews) through the drilled holes in the bushing and into the tapped holes in the piston using loctite #242.

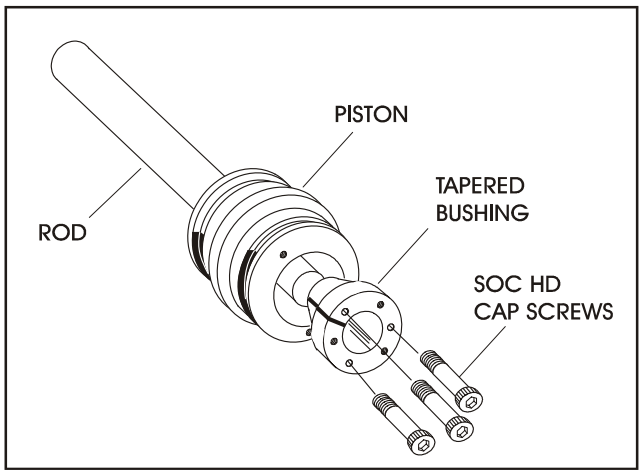


Figure 5-18. Tapered Bushing Installation

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 bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in dia.) as follows;
    a. Place the brass shaft against the tapered bushing on the spaces between the capscrews.
    b. Tap each space once; this means the tapered bushing is tapped three times as there are three spaces between the capscrews.

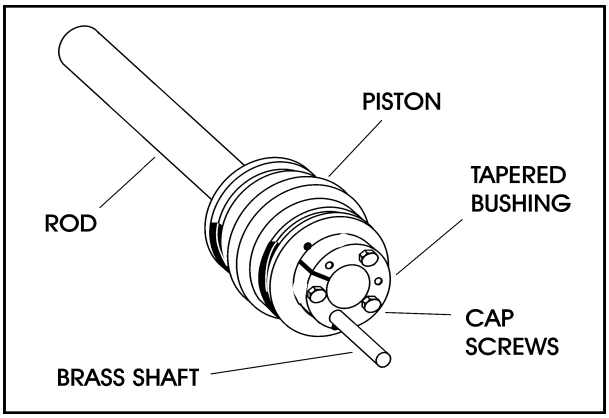


Figure 5-19. Seating the Tapered Bearing

14. 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 Table 5-17., Piston Seal Kit Installation)

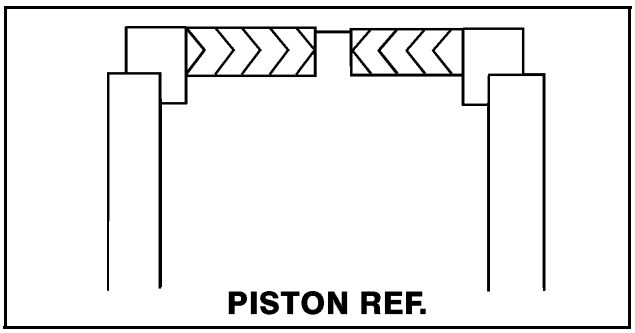


Figure 5-20. Poly-Pak Piston Seal Installation

17. 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.
19. 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 and Table 5-2).

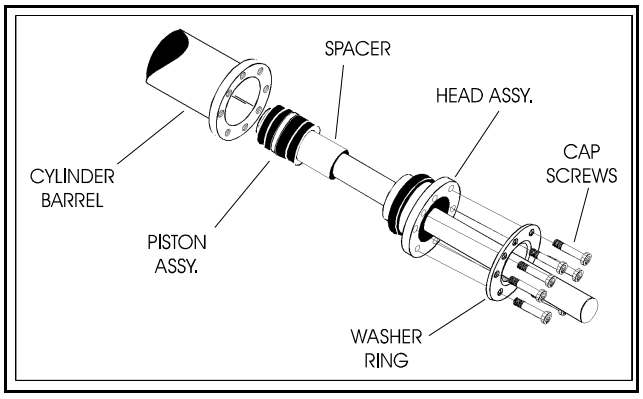


Figure 5-21. Rod Assembly Installation

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).

NOTICE

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

Table 5-1. Cylinder Head and Tapered Bushing Torque Specifications

Description	Head Torque Value (Wet)	Tapered Bushing Torque Value (Wet)
Upper Lift Cylinder	44 ft. lbs (61 Nm)	9ft. lbs. (12 Nm)
Telescope Cylinder	44 ft. lbs (61 Nm	9ft. lbs. (12 Nm)
Level Cylinder	30 ft. lbs. (41 Nm)	5 ft. lbs. (7 Nm)
Master Cylinder	30 ft. lbs. (41 Nm)	5 ft. lbs. (7Nm)
E.A.R. Cylinder	30 ft. lbs. (41 Nm)	5 ft. lbs. (7 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)

5.5 CYLINDER REMOVAL AND INSTALLATION

Upper (Main) Boom Lift Cylinder Removal

1. Place the machine on a flat and level surface. Place the Upper Boom in a horizontal position. Place Tower halfway (approx. 37 degrees). Shut down machine and prop boom.
2. Tag, disconnect and cap the upper boom lift cylinder hydraulic lines and ports.
3. Remove the hardware securing the cylinder rod attach pin #1 to the boom. Using a suitable brass drift, drive out the cylinder rod attach pin #1.

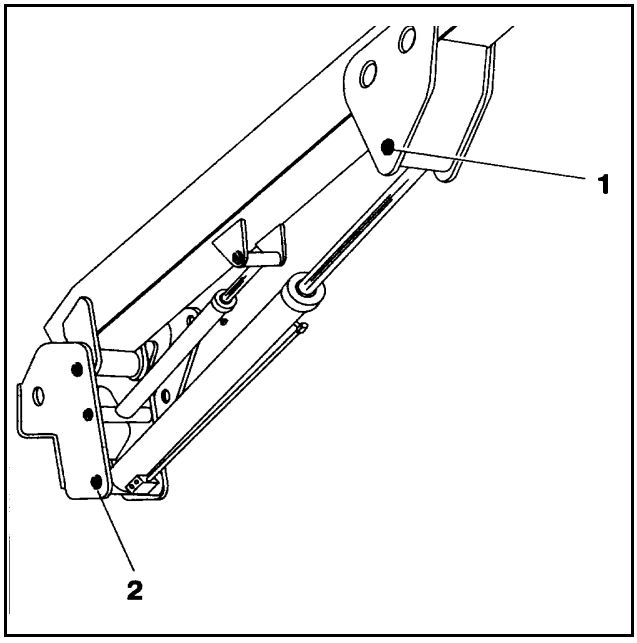


Figure 5-22. Upper Boom Lift Cylinder Removal

4. Secure the cylinder with suitable slings or supports as required. Remove the hardware securing the barrel end attach pin #2. Using a suitable brass drift, drive out the barrel end attach pin #2.
5. Remove the cylinder from the boom and place in a suitable work area.

Upper (Main) Boom Lift Cylinder Installation

NOTE: *Coat I.D. of bushings with specified lubricant prior to installing pins.*

1. Install Lift Cylinder in place using suitable slings or supports, aligning attach pin mounting holes on upright.
2. Using a suitable drift, drive the barrel end attach pin #2 through the mounting holes in the lift cylinder and upright. Secure in place with pin retaining hardware.
3. Remove cylinder port plugs and hydraulic line caps and correctly attach lines to cylinder ports.
4. With function speed switch at its slowest setting, extend the cylinder rod until attach pin hole aligns with those in boom. Using a suitable drift, drive the cylinder rod attach pin #1 through the aligned holes. Secure the pin in place with pin retaining hardware.
5. Cycle cylinder completely to check for proper functioning. Place boom in stowed position. Check hydraulic fluid level and adjust accordingly.

Lower Lift Cylinder Removal

1. Place machine on flat and level surface. Place the Upper Boom in a horizontal position. Raise the Tower halfway. See Figure 2-1. Support Upper Boom with a prop. Support upright with an overhead crane.
2. Using slings, restrain the Tower lift cylinder.
3. Remove the hardware securing the cylinder rod attach pin #5 to the boom. Using an appropriate brass drift, drive out the cylinder rod attach pin #5.

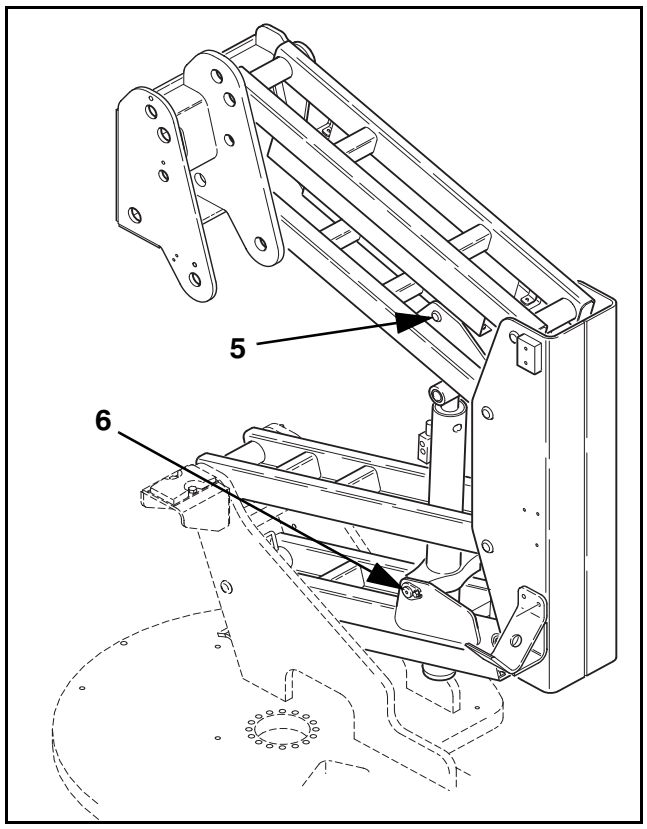


Figure 5-23. Lower Lift Cylinder Removal

4. Tag, disconnect and cap the lift cylinder hydraulic lines and ports.
5. Remove the hardware securing the barrel end attach pin #6 to the boom. Using an appropriate brass drift, drive out the cylinder barrel pin #6.
6. Carefully remove cylinder from boom. Place in a suitable work area.

Lower Lift Cylinder Installation

NOTE: *Coat I.D. of bushings with specified lubricant prior to installing pins.*

1. With the Tower positioned and supported as in Figure 5-1., place cylinder in position and secure in place using slings.
2. Install the cylinder barrel pin #6, being sure to align the hole in the cylinder barrel pin with the retaining pin screw hole. When holes align, install hardware.
3. Correctly install hydraulic lines to cylinder as previously tagged. Extend cylinder rod slowly until attach pin hole aligns with those in boom.
4. Using a suitable brass drift, drive the cylinder rod attach pin #5 through the aligned holes. Secure the pin in place using retaining hardware.
5. Remove boom prop and overhead crane. Take the lift cylinder through one complete cycle to assure correct functioning. Place boom in stowed position. Check hydraulic fluid and adjust accordingly.

Upper Boom Telescope Cylinder Removal

1. Place machine on flat and level surface, with Upper Boom in the horizontal position. Extend Upper Boom until fly attach pin #1 is accessible on fly.
2. Support Upper Boom basket end with a prop. Support Upper Upright end with an overhead crane.
3. Tag, disconnect hydraulic lines to telescope cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
4. Remove the retaining rings that retain the telescope cylinder rod to the fly boom.
5. Using a suitable brass drift, carefully drive the telescope cylinder rod pin #1 from the fly boom.
6. Remove the four (4) bolts securing the telescope cylinder barrel end to the base boom.

NOTE: *Care should be taken when removing the telescope cylinder, do not leave cylinder rest on powertrack which could cause damage to powertrack.*

7. Using a suitable brass drift, carefully drive the telescope cylinder pin from the base boom.
8. Attach a suitable sling to the telescope cylinder. Using a suitable lifting device attached to the sling carefully pull the telescope cylinder from the boom assembly.
9. Using another lifting device, support the rod end of the cylinder and remove the cylinder from the boom assembly.
10. Carefully lift the cylinder clear of the boom assembly and lower to the ground or suitably supported work area.

Upper Boom Telescope Cylinder Installation

1. Attach a hydraulic power supply to the telescope cylinder ports. Using suitable supports or lifting devices at each end of the cylinder, extend the rod so that the cylinder pin attach holes are the same distance apart as the boom pin attach holes.

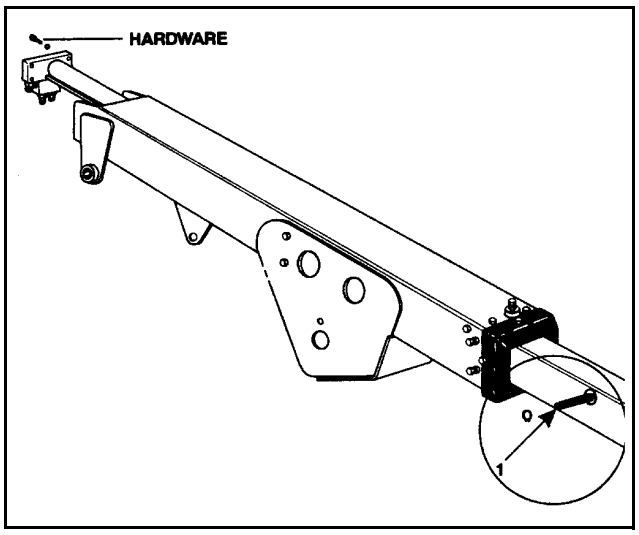


Figure 5-24. Upper Telescope Cylinder Removal

2. Using suitable lifting equipment, carefully lower the cylinder to the boom assembly.
3. Using another lifting device, support the rod end of the cylinder and install the cylinder into the boom assembly.
4. Remove lifting devices from the telescope cylinder.
5. Carefully install the telescope cylinder rod pin #1 through the fly boom and secure it with the retaining rings.
6. Carefully install the telescope cylinder barrel end to base, securing cylinder to the base boom with four (4) bolts and hardware.
7. Remove applicable hydraulic line and port caps and correctly connect the hydraulic lines to the telescope cylinder. Ensure all hoses are correctly routed.
8. Remove boom prop and overhead crane. Activate hydraulic system.
9. Using all applicable safety precautions, operate the boom functions. Check for correct operation and hydraulic leaks. Secure as necessary.
10. Check fluid level of hydraulic tank and add as necessary.

5.6 LOWER LIFT CYLINDER BLEEDING PROCEDURE

NOTE: *Bleeding procedure should only be necessary if rebuilding or replacing lift cylinder.*

1. Check oil level in the hydraulic oil tank (all booms must be retracted).
2. Lay an oil drip pan under the rod end port block and crack bleeder open from the fitting in the port block.
3. From the platform, turn the speed control knob to the slow position.
4. Lift up very slowly. This will force any air out of the circuit. If the lower boom is not extending, turn the speed control up very slowly until the lower boom starts to move.
5. Raise the Tower boom approx. 1 foot (30.5 cm), then close bleeder while the boom is still moving.
6. Lift down all the way.
7. Repeat this procedure until all air has been purged from the circuit. Re-check the hydraulic oil level.

To test, cycle the lower lift function 3-4 times to see if both cylinders stop at the same time when fully extended.

5.7 PRESSURE SETTINGS

Cold temperatures have a significant impact on pressure readings.JLG Industries Inc. recommends operating the machine until hydraulic system has warmed to normal operating temperatures prior to checking pressures. We also recommend using a calibrated gauge. Pressure readings are acceptable if within +/- 5% of specified pressures.

Main Relief at Pump

1. Install pressure gauge at port “G” on Steer/Brake valve.
2. Activate and bottom out either Upper or Lower Lift Up. Adjust Main Relief, (A/AJ) and (AJP), to value in the pressure settings table.

Upper Lift Down Relief

1. With pressure gauge at “G” port on Main Control valve, activate and bottom out Upper Lift Down.
2. Adjust Upper Lift Relief to value in the pressure settings table.

Lower Lift Down Relief

1. With pressure gauge at “G” port on Main Control valve, activate and bottom out Mid/Lower Lift Down.
2. Adjust Lower Lift Relief to value in the pressure settings table.

Swing Relief

1. With pressure gauge at “G” port on Main Control valve, activate and bottom out Swing function in either direction.
2. Adjust Swing Relief to value in the pressure settings table.

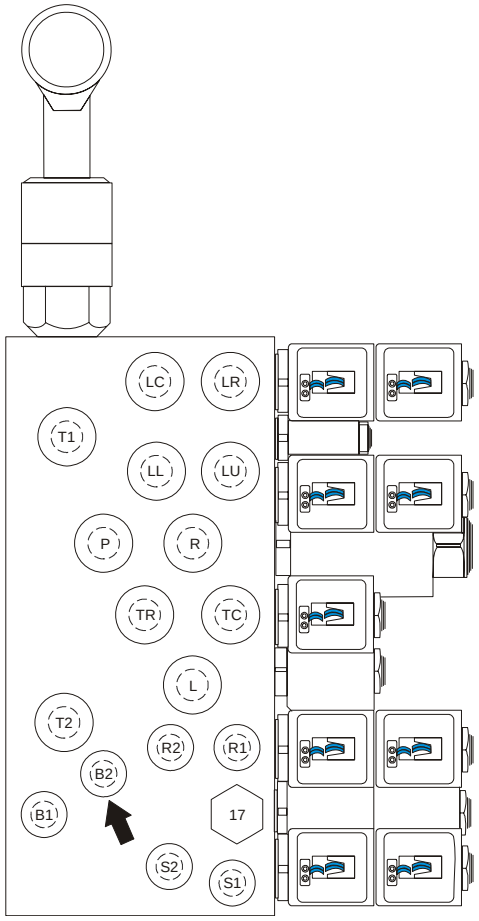
Telescope In Relief

1. With pressure gauge at “G” port on Main Control valve, activate and bottom out Telescope In.
2. Adjust the Telescope In Relief (A/AJ), to value in the pressure settings table.

Platform Level Up Relief

1. On machines prior to S/N 0300063313, install the pressure gauge at the “G” port on Main Control valve, activate and bottom out Platform Level Up.

   On machines S/N 0300063313 to present, install the pressure gauge at the "B2" port on the back of the Main Control Valve, activate and bottom out Platform Level Up.

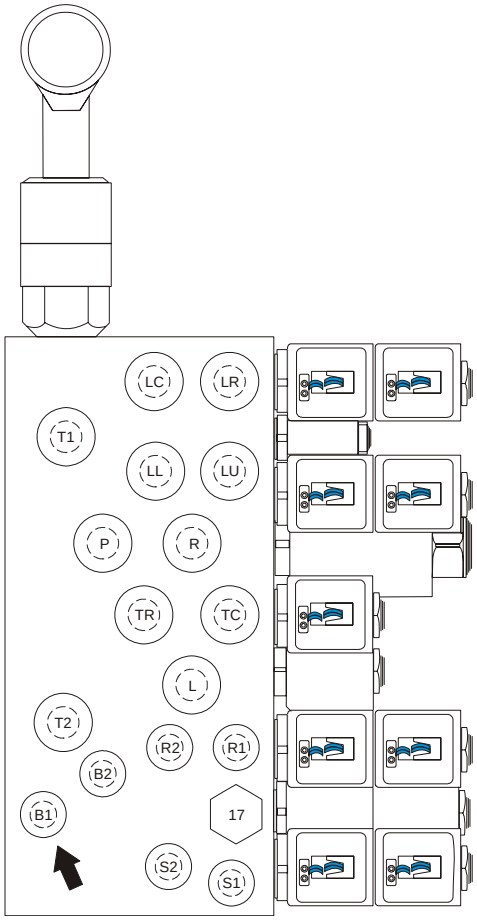


2. Adjust Platform Level Up Relief to value in the pressure settings table.

Platform Level Down Relief

1. On machines prior to S/N 0300063313, install the pressure gauge at the “G” port on Main Control valve, activate and bottom out Platform Level Down.

   On machines S/N 0300063313 to present, install the pressure gauge at the "B1" port on the back of the Main Control Valve, activate and bottom out Platform Level Down.



2. Adjust Platform Level Down Relief to value in the pressure settings table.

Steer Relief

1. With pressure gauge at “G” port on Steer/Brake valve, activate and bottom out Steer Left or Right.
2. Adjust Steer Relief to value in the pressure settings table.
3. Shut down hydraulic system and remove pressure gauge.

Jib Lift (Up and Down) Relief

1. Install the pressure gauge at the at the "G" port on the Main Control valve, activate and bottom out jib up or down.
2. Adjust the Jib LIft pressure to the value given in the pressure settings table.

Jib Swing Relief

1. Install the pressure gauge at the at the "G" port on the Main Control valve, activate and bottom out jib swing left or right.
2. Adjust the Jib Swing pressure to the value given in the pressure settings table.

Table 5-3. Pressure Settings - Prior to S/N 0300063313

Circuit	PSI	Bar
Main Control Valve		
Upper Lift Down Relief	1500	103
Lower Lift Down Relief	1350	93
Telescope In Relief (A/AJ)	2150	148
Telescope In Relief (AJP)	3000	207
Platform Level Up Relief	1500	103
Platform Level Down Relief	1500	103
Swing Relief	1500	103
Steer/Brake Valve		
Steer Relief	2300	159
Main Relief (A/AJ)	2500	172
Main Relief (AJP)	3200	221
Jib Valve		
Jib Relief (Lift Up and Down)	1500	103
Jib Swing Relief	3000	207

Table 5-4. Pressure Settings - S/N 0300063313 to Present

Circuit	PSI	Bar
Main Control Valve		
Upper Lift Down Relief	1500	103
Lower Lift Down Relief	1700	117
Telescope Relief (A/AJ)	2150	148
Telescope Relief (AJP)	3000	207
Platform Level Up Relief	3000	207
Platform Level Down Relief	1200	83
Swing Relief	1500	103
Steer/Brake Valve		
Steer Relief	2300	159
Main Relief (A/AJ)	2500	172
Main Relief (AJP)	3200	221
Jib Valve		
Jib Relief (Lift Up and Down)	1500	103
Jib Swing Relief	3000	207

5.8 BRAKE/STEER VALVE HYDRAULIC FILTER REPLACEMENT

The Brake /Steer Valve is located on the turntable, under the hydraulic tank. The hydraulic oil filter cartridge is in this valve and is recommended to be replaced every 6 months or sooner if the hydraulic controls become slow. To replace, remove the 1-3/8 hex plug w/o-ring. The filter can now be pulled out. Only the oil in the filter will be present. Insert the filter cartridge into valve to bottom. Adjust the slotted head screw to be level with outside surface of the valve, and replace the hex plug.

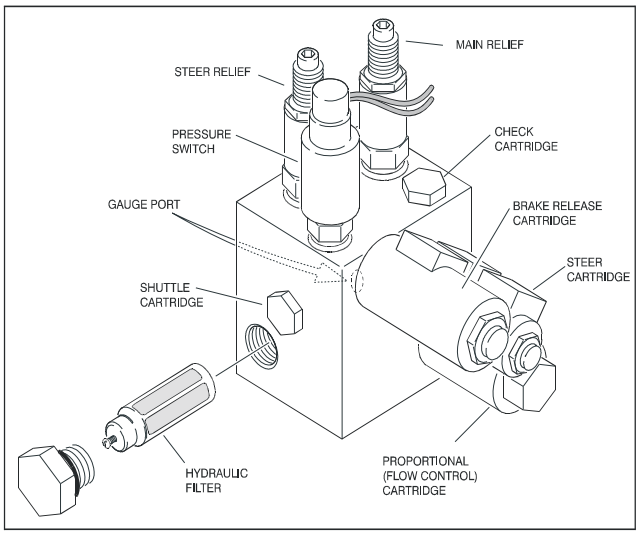


Figure 5-25. Brake/Steer Valve Components

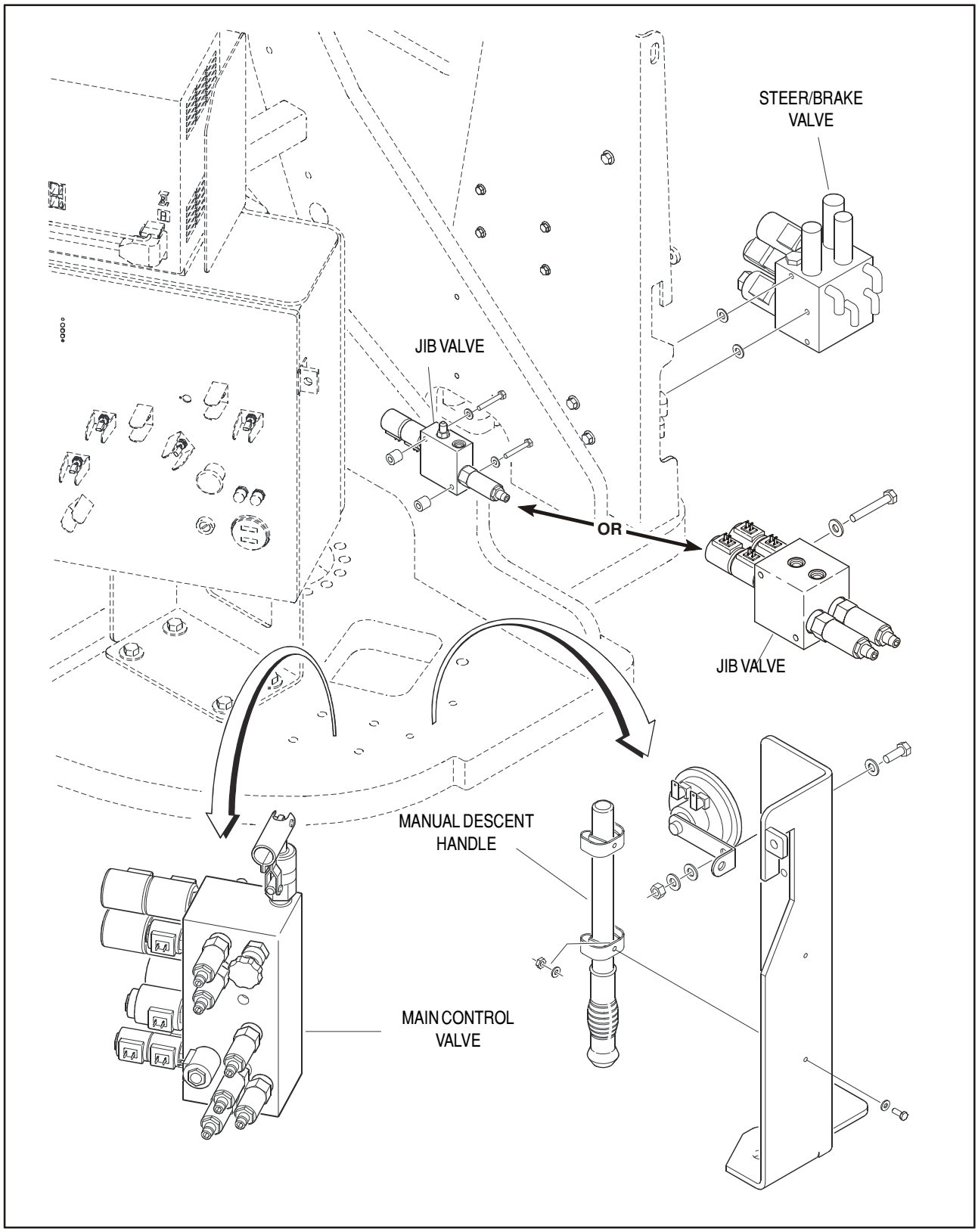


Figure 5-26. Control Valve Installation

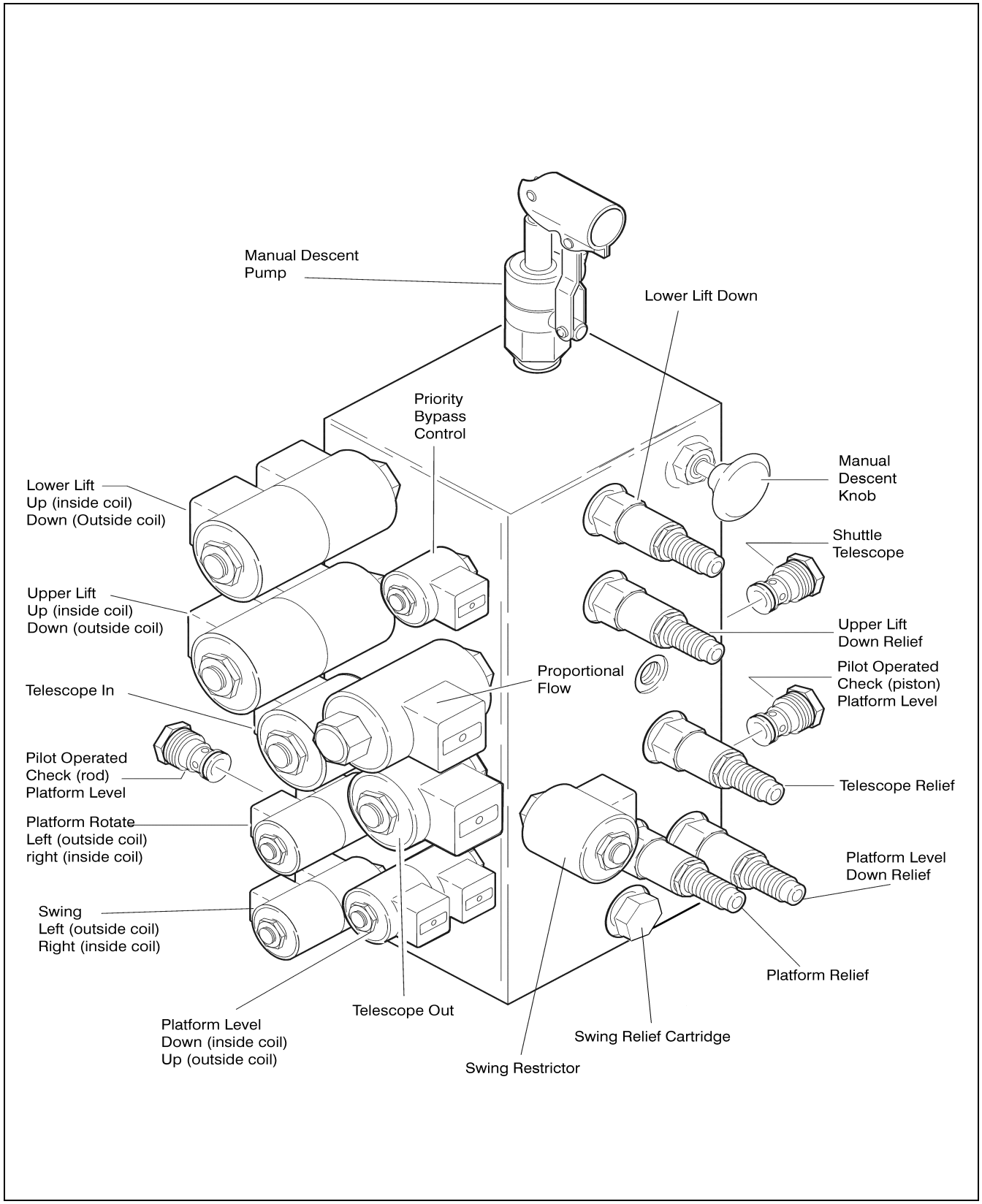
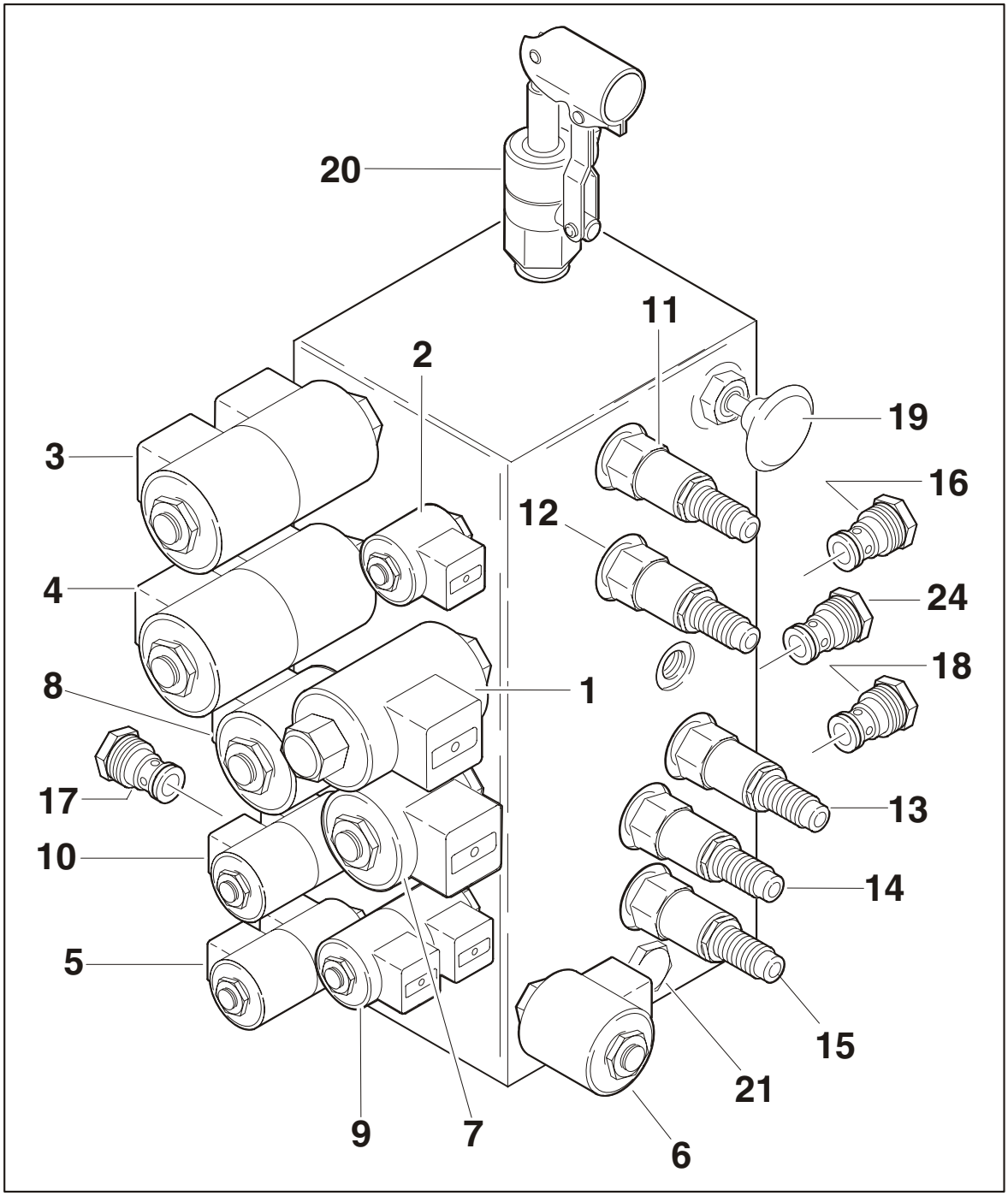
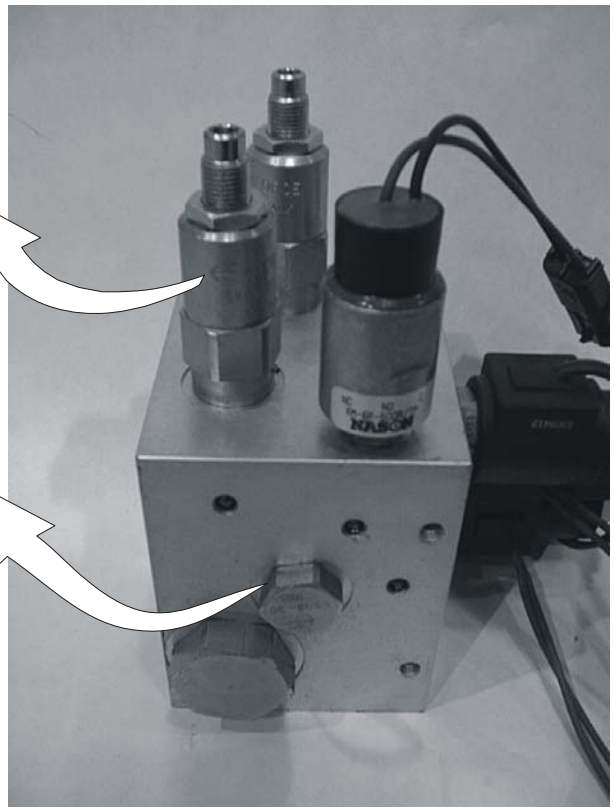


Figure 5-27. Main Valve Components - Prior to S/N 0300063313



1. Proportional Flow Regulator
2. Bypass Unloading
3. Lower Lift
4. Upper Lift
5. Swing
6. Swing Restrictor
7. Telescope Out
8. Telescope In
9. Platform Level
10. Rotator
11. Lower Lift Down
12. Upper Lift Down
13. Telescope
14. Platform Level Back
15. Platform Level Forward
16. Telescope Shuttle
17. P.O. Check - Platform Level Piston Side
18. P.O. Check - Platform Level Rod Side
19. Manual Descent Knob
20. Manual Descent Pump
21. Swing Relief Cartridge

Figure 5-28. Main Valve Components - S/N 0300063313 to Present



Size	Torque Value
04	See specific product pages
07	2.77 kg/m (20 ft/lbs.)
08	2.77 kg/m (20 ft/lbs.)
38	2.77 kg/m (20 ft/lbs.)
58	2.77 kg/m (20 ft/lbs.)
10 Waterproof	3.46 kg/m (25 ft/lbs.)
10 Spool Type	0.98 - 1.38 kg/m (7 - 10 ft/lbs.)
12 Poppet Type	4.85 kg/m (35 ft//lbs.)
12	8.32 kg/m (60 ft/lbs.)
16	6.91 kg/m (50 ft/lbs.)
20	94.6 Nm (70 ft/lbs.)
M42	94.6 Nm (70 ft/lbs.)

Figure 5-29. HydraForce Cartridge Torque Value Chart

NOTES:

SECTION 6. JLG CONTROL SYSTEM

6.1 JLG CONTROL SYSTEM ANALYZER KIT INSTRUCTIONS

Introduction

NOTICE

WHEN INSTALLING A NEW POWER MODULE CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS.

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 48 volt based motor 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 and max.-speed for all boom, drive, and steering functions.

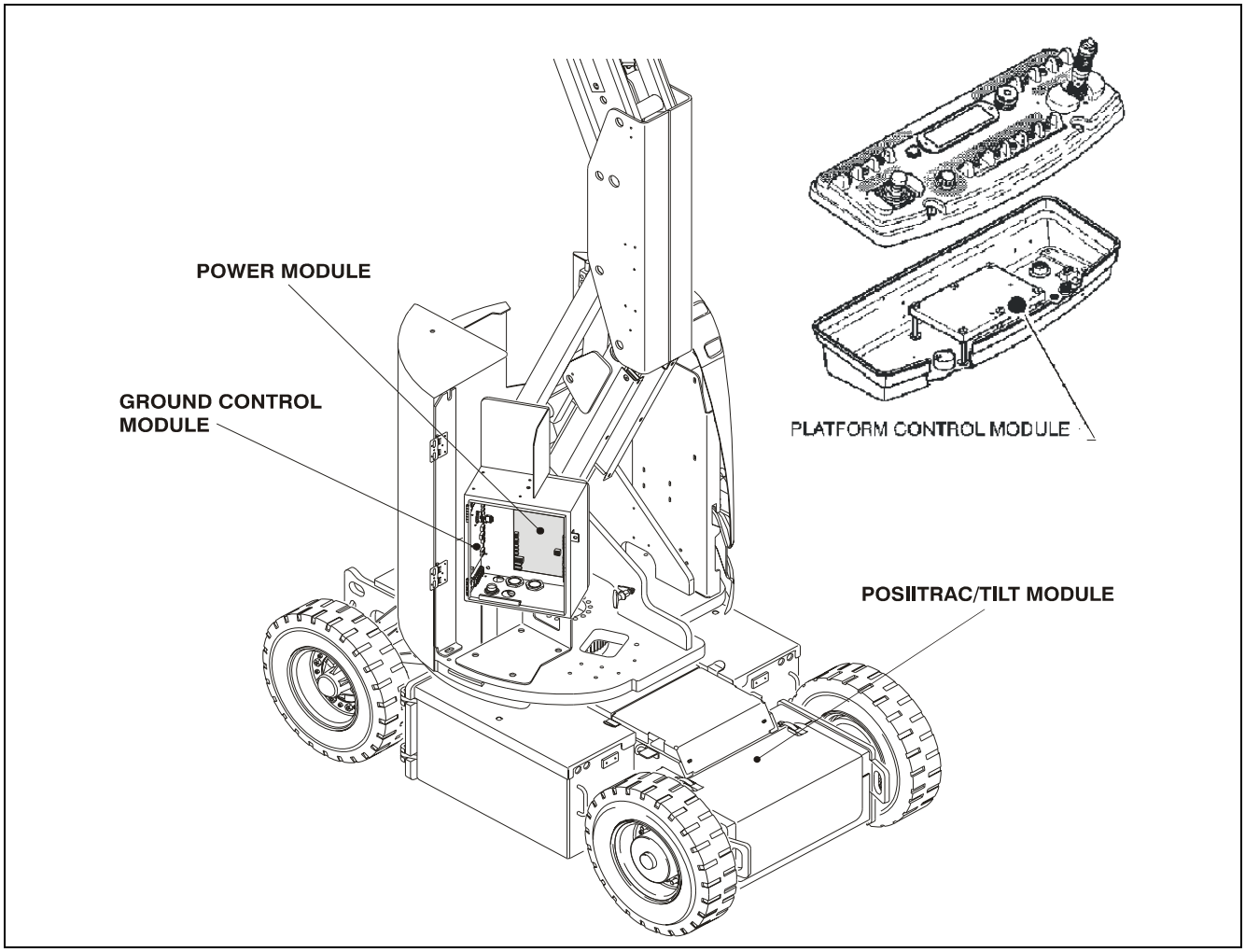


Figure 6-1. Control Module Location

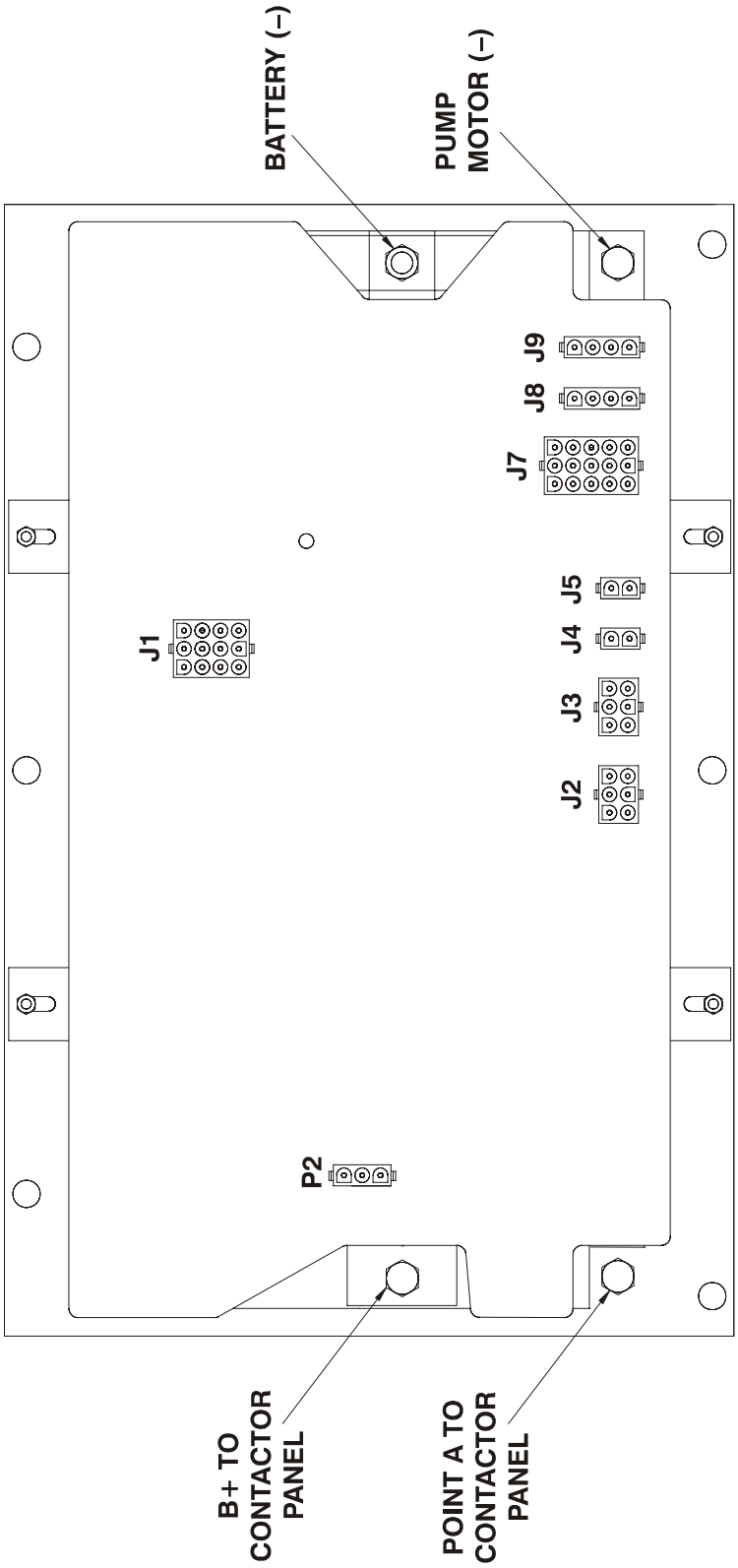


Figure 6-2. Power Module

The upper 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 motor controller will control current output, as programmed for smooth operation and maximum cycle time. Ground control speeds for all boom functions can also be programmed into the motor controller. The motor controller also features an adjustable time limit for positive traction.

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 an hour meter, beacon light, function cutout, and ground alarm. These options may be added later but must be programmed into the motor controller when installed.

The Control System may be accessed by using a custom designed, hand held analyzer (Analyzer, JLG part no. 1600244 & Cable, JLG part no. 1600633) which will display two lines of information at a time, by scrolling through the program.

NOTE: *Each module has a label with the JLG part number and a serial number which contains a date code.*

The following instructions are for using the hand held analyzer.

To Connect the JLG Control System Analyzer

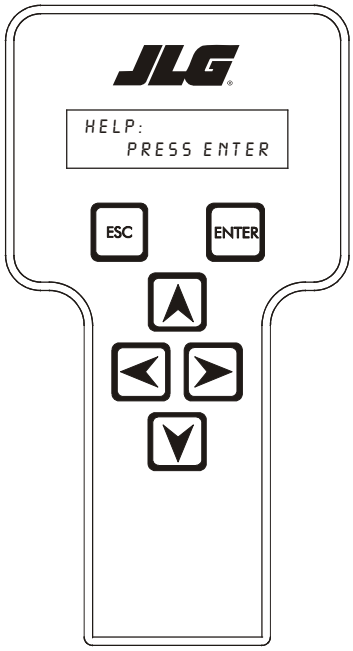
1. Connect the four pin end of the cable supplied with the analyzer, to the motor controller module located in the platform box or at the power module and connect the remaining end of the cable to the analyzer.

NOTE: *The cable has a four pin connector at each end of the cable; the cable cannot be connected backwards.*

2. Power up the Control System by turning the lower key to the platform or ground position and pulling both emergency stop buttons on.

Using the Analyzer

With the machine power on and the analyzer connected properly, the analyzer will display the following:



HELP:
PRESS ENTER

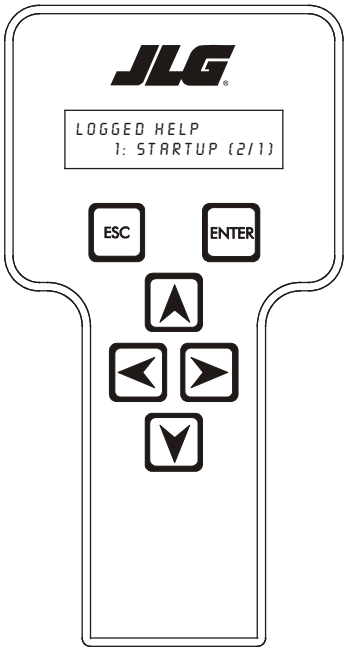
At this point, using the **RIGHT** and **LEFT** arrow keys, you can move between the top level menu items. To select a displayed menu item, press **ENTER**. To cancel a selected menu item, press ESC.; then you will be able to scroll using the right and left arrow keys to select a different menu item.

The top level menus are as follows:

HELP
DIAGNOSTICS
ACTIVATE TEST
ACCESS LEVEL
PERSONALITIES
MACHINE SETUP
LEVEL VEHICLE (level 1 only)
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: STARTUP (2/1)

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. **STARTUP (2/1)** indicates a power up.

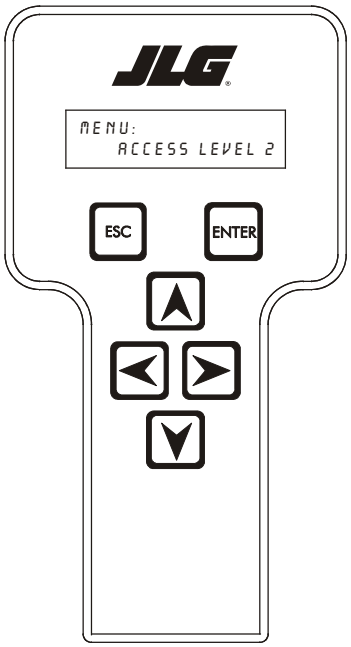
When a top level menu is selected, a new set of menu items may be offered: for example:

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.

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

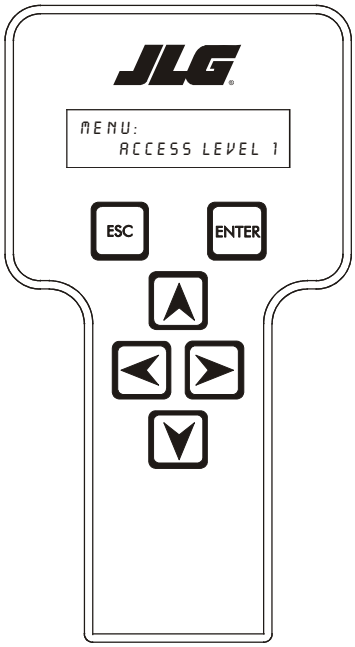
Press **ENTER** to select the **ACCESS LEVEL** menu.

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.

Once the correct password is displayed, press **ENTER**. The access level should display the following, if the password was entered correctly:

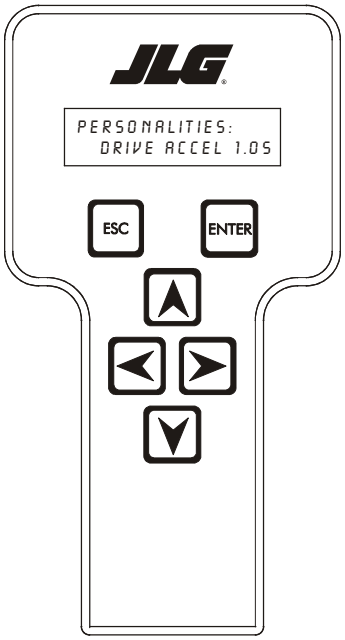


MENU:
ACCESS LEVEL 1

Repeat the above steps if the correct access level is not displayed or you can not adjust the personality settings.

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:

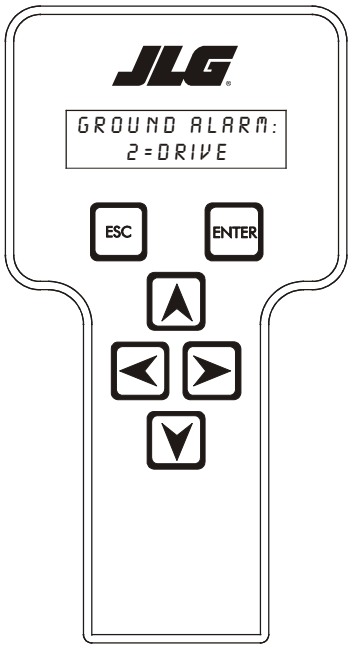


PERSONALITIES:
DRIVE ACCEL 1.0s

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.

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 = DRIVE

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 driving. 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 Table 6-1, Machine Setup Descriptions 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

⚠ WARNING

CHANGING THIS SETTING MAY ADVERSELY AFFECT THE PERFORMANCE OF YOUR MACHINE.

NOTICE

ITS 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 (30.5CM) 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.

Table 6-1. Machine Setup Descriptions

MODEL NUMBER...	Displays/adjusts machine model NOTE: all personalities reset to default when model number is altered
TILT...	Displays/adjusts tilt sensor function
DRIVE CUTOUT...	Displays/adjusts drive cutout switch presence/ function
FUNCTION CUTOUT...	Displays/adjusts function cutout switch presence/function
JIB...	Displays/adjusts jib presence
GROUND ALARM...	Displays/adjusts ground alarm presence/ function
PLATFORM ALARM...	Displays/adjusts platform alarm presence/ function
BATTERY MONITOR...	Displays/adjusts battery monitor, which indicates “WATER BATTERIES” after a number of charge/discharge cycles

Machine Configuration Programming Information

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
NOTE: *When configuring the E450, E400, or the E300 machine, the machine configuration must be completed before any personality settings can be changed. Changing the personality settings first and then changing the model number of the machine configuration will cause the personality settings to return to default values.*			
1 (Model #)	1 2 3	**Model 300** Model 400(* See Note Below) Model 45/450(*See Note Below)	**1**
NOTE: *The elevated drive speed setting must be changed to 10% for E45AJ, M45AJ, M40AJP, E40AJP, M450AJ, E450AJ, M400AJP, E400AJP, E400A, AND M400A machines going to Europe (CE). Also the elevated drive speed setting must be changed to 15% for E40AJPn, M40AJPn, E400AJPn, M400AJPn,E400Anarrow, and M400Anarrow machines going to Europe (CE).*			
2 (Tilt Switch)	1 2 3 4	5 degree-reduces the maximum speed of all boom functions to creep when tilted and above elevation. Reduces drive speed to creep when tilted. Domestic and Japan 3 degree-reduces the maximum speed of all boom functions to creep when tilted and above elevation. Reduces drive speed to creep when tilted. European and Australian 3 degree-cuts out drive and reduces boom functions to creep speed when tilted and above elevation. Reduces drive speed to creep when tilted only. Option 3 degree- cuts out drive, telescope out, upper boom lift up and reduces all other boom functions to creep speed when tilted and above elevation. Option	**1**
NOTE: *Any of the selections above will light the tilt lamp when a tilted condition occurs and will sound the platform alarm when the machine is tilted and above elevation.*			
3 (Drive Cutout)	0 1 2	Battery Charger Cutout-cuts out drive when the battery charger is plugged in. Battery Charger Cutout and Simultaneous Drive and Boom Functions disabled above elevation. Europe and Australia Battery Charger Cutout and Drive Cutout above elevation. Option	**0**
4 (Function Cutout Limit Switch)	**0** **1** **2**	No Function Cutout Cuts out all boom functions when switch opens. Option Cuts out all functions when switch opens. Option	**0**

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
5 (JIB)	0	No JIB installed.	0
	1	JIB installed which has up and down movements only. Option	
	2	JIB installed which has up and down movements and side to side movements. Option	
6 (Ground Alarm)	0	No ground alarm installed.	0
	1	Travel alarm- Sounds when the drive function is active. Option	
	2	Descent Alarm- Sounds when either lift down is active. Option	
	3	Motion alarm- Sounds when any function is active. Option	
7 (Platform Alarm)	0	Sounds continuously when above elevation and tilted only.	0
	1	Sounds continuously when above elevation and tilted, and in conjunction with fault code flashes. Option	
8 (Soft-Touch)	0	No Soft-Touch System Installed	
	1	Soft-Touch system Installed	
9 (Load Cell)	0	No Load Cell Installed	0
	1	Warn Only	
	2	Warn & Cutout	
	3	Warn & Boom cutout	

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Machine Personality Settings

NOTE: *Personality settings can be adjusted within the adjustment range in order to achieve optimum machine performance.*

Table 6-3. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
DRIVE	ACCELeration	0.5s to 5.0s	1.5
	DECELeration	0.1s to 2.0s	0.5
	MINimum speed	0 to 25%	3
	MAXimum speed	0 to 100%	95
	ELEVATED MAXimum speed	0 to 25%	20
	CREEP MAXimum speed	0 to 45%	30
	POSITRAC time	0 to 60s	10
	POSITRAC current	50-250 A	170A
LOWER LIFT	ACCELeration	0.5 to 5.0s	1.0
	DECELeration	0.0 to 3.0s	0.5
	MINimum UP speed	0 to 30%	11
	MAXimum UP speed	0 to 100%	100
	MINimum DOWN speed	0 to 20%	9
	MAXimum DOWN speed	0 to 100%	70
UPPER LIFT	ACCELeration	0.5 to 5.0	1.0
	DECELeration	0.1 to 5.0	0.3
	MINimum UP speed	0 to 20	4
	MAXimum UP speed	0 to 100	90
	CREEP Maximum UP speed	0 to 50	27
	MINimum DOWN speed	0 to 10	1
	MAXimum DOWN speed	0 to 100	80
	CREEP maximum DOWN speed	0 to 30	18

Table 6-3. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
SWING	ACCELeration	0.5 to 5.0s	2.0
	DECELeration	0.0 to 3.0s	1.5
	MINimum LEFT speed	0 to 10%	6
	MAXimum LEFT speed	0 to 60%	33
	CREEP maximum LEFT speed	0 to 35%	12
	MINimum RIGHT speed	0 to 10%	6
	MAXimum RIGHT speed	0 to 60%	33
	CREEP maximum RIGHT speed	0 to 35%	12
TELEscope	ACCELeration	0.5 to 5.0	1.0
	DECELeration	0.1 to 3.0	0.5
	MINimum IN speed	0 to 20	8
	MAXimum IN speed	0 to 100	60
	MINimum OUT speed	0 to 20	7
	MAXimum OUT speed	0 to 100	40
BASKET LEVEL	ACCELeration	0.5 to 5.0	1.0
	DECELeration	0.1 to 3.0	1.0
	MINimum UP speed	0 to 20	7
	MAXimum UP speed	0 to 50	18
	MINimum DOWN speed	0 to 20	9
	MAXimum DOWN speed	0 to 60	40
BASKET ROTATE	ACCELeration	0.5 to 5.0	2.0
	DECELeration	0.1 to 3.0	0.5
	MINimum LEFT speed	0 to 15	6
	MAXimum LEFT speed	0 to 100	20
	MINimum RIGHT speed	0 to 15	5
	MAXimum RIGHT speed	0 to 100	20

Table 6-3. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
JIB	ACCELeration	0.5 to 5.0	1.5
	DECELeration	0.5 to 3.0	0.5
	MINimum UP speed	0 to 50	9
	MAXimum UP speed	0 to 100	50
	MINimum DOWN speed	0 to 25	6
	MAXimum DOWN speed	0 to 100	35
JIB SWING	MINimum RIGHT speed	0 to 50	5
	MAXimum RIGHT speed	0 to 100	20
	MINimum LEFT speed	0 to 50	5
	MAXimum LEFT speed	0 to 100	20
STEER	MINimum speed	0 to 100	75
	MAXimum speed	0 to 100	100
GROUND MODE	Lower LIFT UP speed	0 to 100	75
	Lower LIFT DOWN speed	0 to 100	53
	UPPER LIFT speed	0 to 100	75
	SWING speed	0 to 100	25
	TELEscope speed	0 to 100	45
	BASKET ROTATE speed	0 to 100	20
	BASKET LEVEL speed	0 to 100	30
	JIB SWING speed	0 to 100	45
	JIB LIFT speed	0 to 100	42

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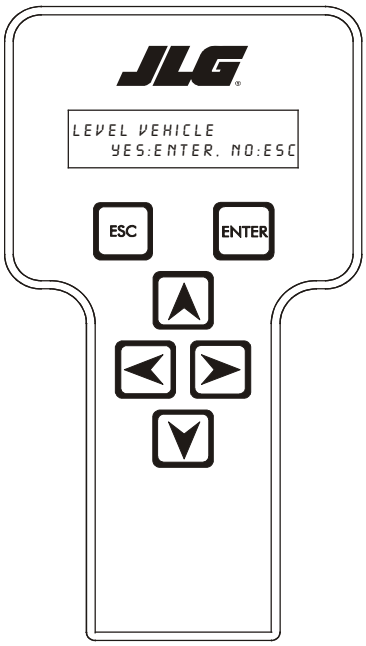
Level Vehicle Description

⚠ WARNING

DO NOT LEVEL VEHICLE EXCEPT ON A LEVEL SURFACE.



LEVEL VEHICLE
YES:ENTER, NO:ESC

Not available at password level 2 ENTER confirms that vehicle is currently level, and zeroes the tilt sensor measurements

Help Descriptions and Fault Flash Codes

Table 6-4. JLG Control System Flash Codes

Code	Description
2-1	Faulty Footswitch/EMS
2-2	Drive/Steer inputs/Footswitch Interlocks
2-3	Boom function inputs/Lift-Swing Joystick
2-5	Function Cutout/Drive Cutout
3-1	Contactors miswired/Motors miswired
3-2	Line contactor welded
3-3	Contactor short circuit or valve short circuit
3-5	Brake pressure input
4-2	Controller Over temperature
4-4	Battery voltage out of range
5-5	Speed Sensor input
6-6	CANbus inputs
7-7	Traction /Pump motor wiring or motor faulty
9-9	Power Module Failure

Table 6-5. Help Descriptions and Fault Flash Codes

Flash Code	Description
No flash code is indicated for the following help messages; they are intended to hint at a possible problem if the vehicle is not behaving as expected.	
	EVERYTHING OK The “normal” help message in platform mode
	GROUND MODE OK The “normal” help message in ground mode
	BRAKES RELEASED Indicates manual brake release in ground mode
	DRIVING AT CREEP - TILTED Drive speed is limited to creep because the vehicle is tilted.
	FWS A drive or boom function has been selected but footswitch is open.
	PUMP MOTOR AT CURRENT LIMIT Pump current has reached controller current limit or safe operating area limit.
	RUNNING AT CREEP - CREEP SWITCH OPEN All function speeds are limited to creep because the creep switch is open.
	RUNNING AT CUTBACK - ABOVE ELEVATION All function speeds are limited to cutback speed because the vehicle is above elevation.
	RUNNING AT CREEP - TILTED AND ABOVE ELEVATION All function speeds are limited to creep because the vehicle it tilted and above elevation.
	TESTS ACTIVE - RECYCLE EMS TO END The system tests have been activated; normal vehicle operation is not allowed.
	TILT MODULE FAILURE: BAD TILT SENSOR There is a problem with the tilt sensor interface circuitry; the controller defaults to massively tilted and does not try to prevent vehicle roll on the grade.
	TRACTION MOTOR AT CURRENT LIMIT Traction current has reached controller current limit or safe operating area limit.
	WATER BATTERIES The batteries have been charged a number of times (set by machine digit) and need a top-up; when this is done the count will reset
2/1	**Flash code 2/1 indicates problems with the footswitch.**
	FWS FAULTY The two footswitch signals do not agree. EMS recycle required.
	START UP Neither EMS input is active - the system is just switching on or is discharging the capacitor bank. A welded line contactor might also cause this

Table 6-5. Help Descriptions and Fault Flash Codes

2/2	**Flash code 2/2 indicates problems with drive & steer selection.**
	DRIVE JOYSTICK FAULTY The drive joystick center tap is out of valid range, or the wiper is wire-off.
	DRIVE LOCKED - JOYSTICK MOVED BEFORE EMS/FWS Drive was selected before and during footswitch closure.
	FWS INTERLOCK TRIPPED Footswitch was closed for seven seconds with no function selected.
	STEER LOCKED - SELECTED BEFORE EMS/FWS Steer was selected before and during footswitch closure.
	STEER SWITCHES FAULTY Both steer switches are active together.
	WAITING FOR FWS TO BE OPEN Footswitch was closed when platform mode was selected.
	JOYSTICK FAULTS - CHECK PLATFORM BOX WIRING More than one of the drive, lift and swing joystick center tap or wiper voltages is out of range. This is probably due to a short-circuit across a joystick port.
2/3	**Flash code 2/3 indicates problems with boom function selection.**
	LIFT/SWING JOYSTICK FAULTY The lift or swing Joystick center tap is out of valid range, or the wiper is wire-off.
	LIFT/SWING LOCKED - JOYSTICK MOVED BEFORE EMS/FWS Upper Lift or swing was selected before and during footswitch closure.
	PUMP POT FAULTY The pump pot is open-circuit; All platform boom functions except upper lift & swing will run at creep.
	PUMP SWITCHES FAULTY - CHECK DIAGNOSTICS/BOOM A boom function (lower lift, telescope, basket level, basket rotate, jib) has both directions selected together.
	PUMP SWITCHES LOCKED - SELECTED BEFORE EMS/FWS A boom function (lower lift, telescope, basket level, basket rotate, jib) was selected before and during footswitch closure.
	PUMP SWITCHED LOCKED - SELECTED BEFORE EMS A ground boom function (lower lift, telescope, basket level, basket rotate, jib,) was selected before key switch
	SWING/LIFT JOYSTICK FAULTY The swing joystick center tap is out of valid range, or the wiper is wire-off.

Table 6-5. Help Descriptions and Fault Flash Codes

2/5	**Flash code 2/5 indicates that a function is prevented due to a cutout.**
	BOOM PREVENTED - DRIVE SELECTED A boom function is selected while a drive function is selected and drive cutout is configured to prevent simultaneous drive & boom operation.
	BOOM PREVENTED - FUNCTION CUTOUT ACTIVE A boom function is selected while function cutout is active and configured to cutout boom functions.
	DRIVE & BOOM PREVENTED - FUNCTION CUTOUT ACTIVE Drive or a boom function is selected while function cutout is active and configured to cutout all functions.
	DRIVE PREVENTED - ABOVE ELEVATION Drive is selected while above elevation and drive cutout is configured to prevent drive.
	DRIVE PREVENTED - BOOM MOVEMENT SELECTED Drive is selected while a boom function is selected and drive cutout is configured to prevent simultaneous drive & boom operation.
	DRIVE PREVENTED - CHARGER CONNECTED Drive is selected while the charger is on (indicated by drive cutout being active) and drive cutout is configured to prevent drive.
	DRIVE PREVENTED - TILTED ABOVE ELEVATION Drive is selected while drive cutout is active and drive cutout is configured to prevent drive.
3/1	**Flash code 3/1 indicates that a contactor did not close when energized.**
	LINE & DIRECTION CONTACTORS MISWIRED When the line contactor was closed traction point A went high (and the capacitor bank charge did not increase to battery supply) - this occurs if the line contactor coil wiring is swapped with that for a direction contactor coil.
	OPEN-CIRCUIT FORWARD DIRECTION CONTACTOR OR TRACTION MOTOR Traction point A did not go high when forward contactor was energized (this could be due to traction motor open-circuit or a power wiring error).
	OPEN-CIRCUIT LINE CONTACTOR The capacitor bank charge did not increase to battery supply when line contactor was energized (this could be due to a power wiring error).
	OPEN-CIRCUIT REVERSE DIRECTION CONTACTOR OR TRACTION MOTOR Traction point A did not go high when reverse contactor was energized (this could be due to traction motor open-circuit or a power wiring error).
3/2	**Flash code 3/2 indicates that a contactor did not open when energized.**
	WELDED LINE CONTACTOR The capacitor bank charge did not decrease from battery supply when line contactor was deenergized (this could be due to a power wiring error). WARNING: If the line contactor is welded, the controller will not switch off when EMS or key switch is turned off.
3/3	**Flash code 3/3 indicates that a contactor coil is short-circuited.**
	OVERLOADED VALVE SUPPLY-CHECK WIRING. There is a high current draw from the valve supply when no valve is energized; this is probably due to a wiring error at the ground module.
	SHORT-CIRCUIT FORWARD CONTACTOR COIL The forward contactor was not energized when required, due to coil over current protection.
	SHORT-CIRCUIT LINE CONTACTOR COIL The line contactor was not energized when required, due to coil over current protection.
	SHORT-CIRCUIT REVERSE CONTACTOR COIL The reverse contactor was not energized when required, due to coil over current protection.

Table 6-5. Help Descriptions and Fault Flash Codes

3/5	**Flash code 3/5 indicates that there is a brake pressure problem.**
	BRAKES DID NOT LOCK Brake pressure did not clear when the brake valve was deenergized.
	BRAKES DID NOT RELEASE No brake pressure was detected when running the pump motor and energizing the brake valve
4/2	**Flash code 4/2 indicates that the controller is over temperature.**
	CONTROLLER TOO HOT - PLEASE WAIT The controller heat sink temperature reached 75 degrees. The controller is shut down until it cools to below 70 degrees.
4/4	**Flash code 4/4 indicates problems with the battery supply.**
	BATTERY LOW Battery voltage is below 40V. This is a warning - the controller does not shut down.
	BATTERY TOO HIGH - SYSTEM SHUT DOWN Battery voltage is above 62V. EMS recycle required.
	BATTERY TOO LOW - SYSTEM SHUT DOWN Battery voltage is below 33V. EMS recycle required.
5/5	**Flash code 5/5 indicates problems with vehicle speed or the encoder.**
	NO VEHICLE MOVEMENT DETECTED AT MAXIMUM POWER No speed was measured with traction motor full on. This could be due to a traction motor fault, a power wiring error, a speed encoder fault, the brakes not releasing (although brake Pressure is OK) or the vehicle being overloaded so that the motor cannot turn the wheels.
	DRIVE PREVENTED - BOTH SPEED ENCODERS FAULTY Both speed encoder input voltages are out of range.
	LEFT SPEED ENCODER FAULTY The left speed encoder input voltages are out of range. The vehicle will continue to drive at cutback using the right speed encoder.
	TILT MODULE FAILURE; NOT COMMUNICATING There is a problem with the positrac/tilt module; The controller defaults to massively tilted and does not try to prevent vehicle roll on grade.
	RIGHT SPEED ENCODER FAULTY The right speed encoder input voltages are out of range. The vehicle will continue to drive at cutback using the left speed encoder.
	SPEED ENCODERS READING INVALID SPEED One or both speed encoders is indicating an impossible number of pulses. This is probably due to a faulty speed encoder.
	VEHICLE RUNAWAY - CHECK SPEED ENCODERS Speed in the wrong direction was measured with traction motor full on. This is probably due to the speed encoder being fitted incorrectly; it could also be due to a speed encoder fault or faults as for “NO VEHICLE MOVEMENT DETECTED” with the vehicle on a grade.

Table 6-5. Help Descriptions and Fault Flash Codes

6/6	**Flash code 6/6 indicates problems with the CANbus.**
	48V PROTECTION TRIPPED - CHECK INTER-MODULE WIRING The power module is not receiving acknowledgments from the platform or ground modules to transmitted data, and the protection circuit which supplies the platform and ground modules has tripped. This is probably due to wiring problems at the platform or ground module.
	CANbus FAILURE: GROUND MODULE The power module is receiving from the platform module but not the ground module. This should not be possible!
	CANbus FAILURE: PLATFORM MODULE The power module is receiving from the ground module but not the platform module. This is probably due to wiring problems between the platform and ground modules.
	CANbus FAILURE: POWER MODULE The power module is not receiving acknowledgments from the platform or ground modules to transmitted data. This is probably due to wiring problems between the ground and power modules.
7/7	**Flash code 7/7 indicates problems with a motor.**
	CAPACITOR BANK FAULT - CHECK POWER CIRCUITS The capacitor bank is not charging. This is probably due to a power wiring error causing illegal current drain; it could also be due to a very low battery supply.
	OPEN-CIRCUIT PUMP MOTOR Pump point A is collapsing when the pump MOSFETs are pulsed. This is probably due to an open circuit pump motor or a power wiring error.
	OPEN-CIRCUIT DIRECTIONAL CONTACTOR OR TRACTION MOTOR Traction point A is collapsing when the traction MOSFETs are pulsed. This is probably due to an open circuit traction motor or a power wiring error. NOTE: This fault is unlikely to be seen due to interaction with speed control...
	PUMP POINT A LOW - CHECK POWER CIRCUITS Pump point A is near 0V when the pump MOSFETs are off. This is probably due to a power
	STALLED TRACTION MOTOR The power module traction MOSFET protection circuit is active. This is due to massive current drain and could be a stalled traction motor or a power wiring error.
	STALLED PUMP MOTOR The power module pump MOSFET protection circuit is active. This is due to massive current drain and could be a stalled pump motor or a power wiring error.
	TRACTION MOTOR OVERLOADED The traction motor has been operating in current limit at a low percentage on for a period of time greater than 10 seconds.
	PUMP MOTOR OVERLOADED The pump motor has been operating in current limit at a low percentage on for a period of time greater than 10 seconds.
	TRACTION CURRENT AT ZERO - CHECK SHUNT WIRING Traction current measurement is at zero. This is probably due to an open-circuit between the current measurement shunt and the power module.
	TRACTION POINT A HIGH - CHECK POWER CIRCUITS Traction point A is near battery supply when neither direction contactor is energized and the traction MOSFETs are off. This could be due to a welded direction contactor or a power wiring error.
	TRACTION POINT A LOW - CHECK POWER CIRCUITS Traction point A is near 0V when neither direction contactor is energized and the traction MOSFETs are off. This could be due to a power wiring error.

Table 6-5. Help Descriptions and Fault Flash Codes

9/9	**Flash code 9/9 indicates problems with the controller.**
	POWER MODULE FAILURE: CONTACTOR DRIVE CODE 1 A contactor remained energized when turned off.
	POWER MODULE FAILURE: HWFS CODE 2 The hardware fail-safe tests did not complete because traction point A is not safe, or the hardware fail-safe is permanently tripped.
	POWER MODULE FAILURE: HWFS CODE 3 The hardware fail-safe tests did not complete because a contactor was energized when all should be turned off
	POWER MODULE FAILURE: HWFS CODE 4 The hardware fail-safe tests did not complete because the hardware fail-safe tripped immediately when the traction MOSFETs were turned on.
	POWER MODULE FAILURE: HWFS CODE 10 The hardware fail-safe tests failed because the hardware fail-safe did not trip within the allowed test time.
	POWER MODULE FAILURE: HWFS CODE 11 The hardware fail-safe tests failed because the hardware fail-safe tripped too slowly.
	POWER MODULE FAILURE: HWFS CODE 12 The hardware fail-safe tests failed because the hardware fail-safe tripped too quickly.
	POWER MODULE FAILURE: HWFS CODE 13 The hardware fail-safe tests failed because the hardware fail-safe remained tripped when the traction MOSFETs were turned off.
	POWER MODULE FAILURE: HWFS CODE 14 The hardware fail-safe tests failed because the line contactor could still be energized when the hardware fail-safe was tripped
	POWER MODULE FAILURE: HWFS CODE 15 The hardware fail-safe tests failed because the contactor drive fail-safe did not trip within the allowed test time.
	POWER MODULE FAILURE: HWFS CODE 16 The hardware fail-safe tests failed because the contactor drive fail-safe tripped too slowly.
	POWER MODULE FAILURE: HWFS CODE 17 The hardware fail-safe tests failed because the contactor drive fail-safe tripped too quickly.
	POWER MODULE FAILURE: HWFS TEST STALLED The hardware fail-safe tests did not complete, but no reason can be determined.
	POWER MODULE FAILURE: BAD TEMPERATURE SENSOR The temperature sensor measurement is invalid, this is probably due to a disconnected wire within the power module. The possibility of other disconnected wires (which could cause dangerous system function) means that the controller is shut down.
	POWER MODULE FAILURE: S/C LINE CONTACTOR DRIVER The line contactor energized when the footswitch was closed, before it was turned on, this is probably due to a failed driver within the power module, although it could be due to bad power module wirings

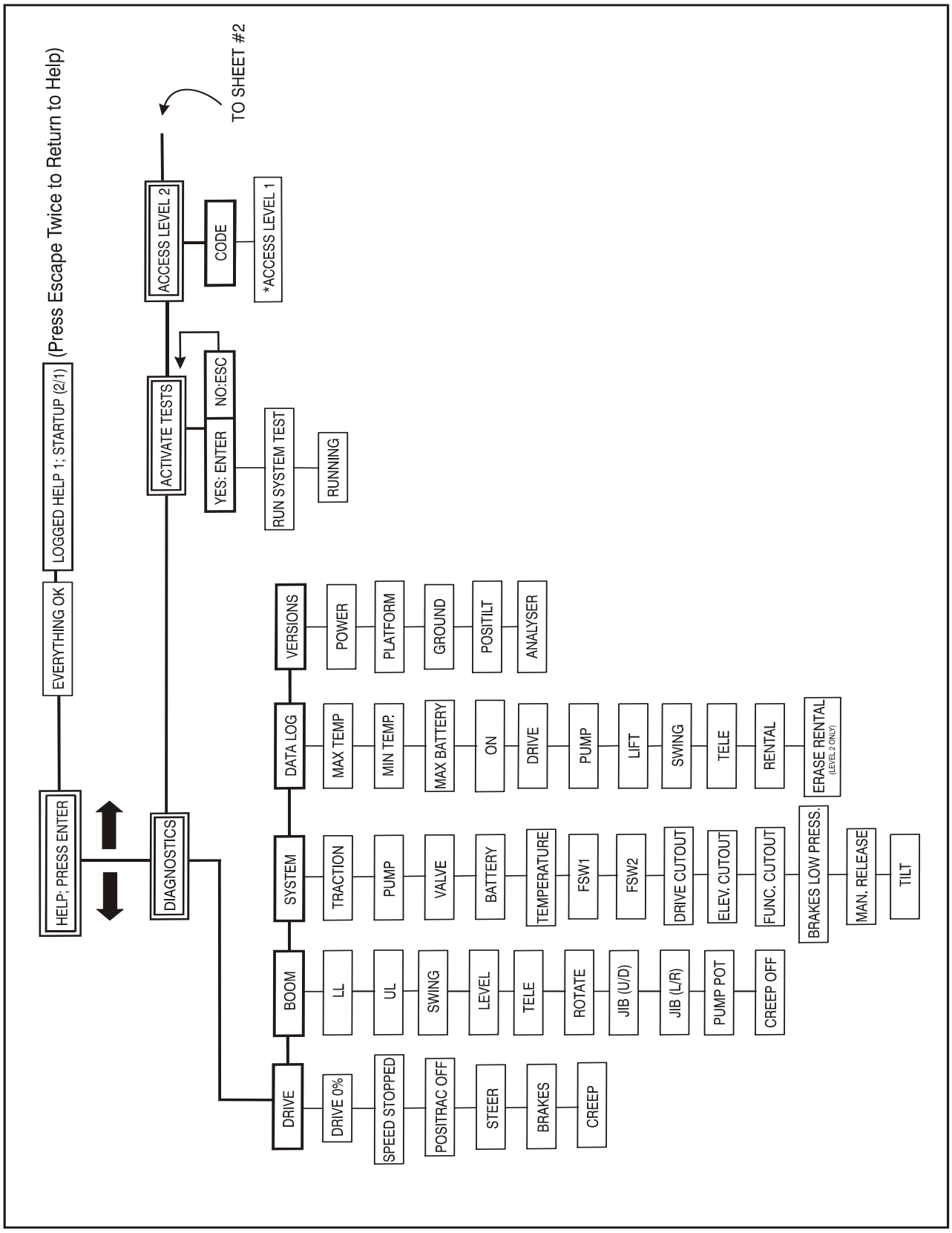


Figure 6-3. Analyzer Flow Chart - Sheet 1 of 2

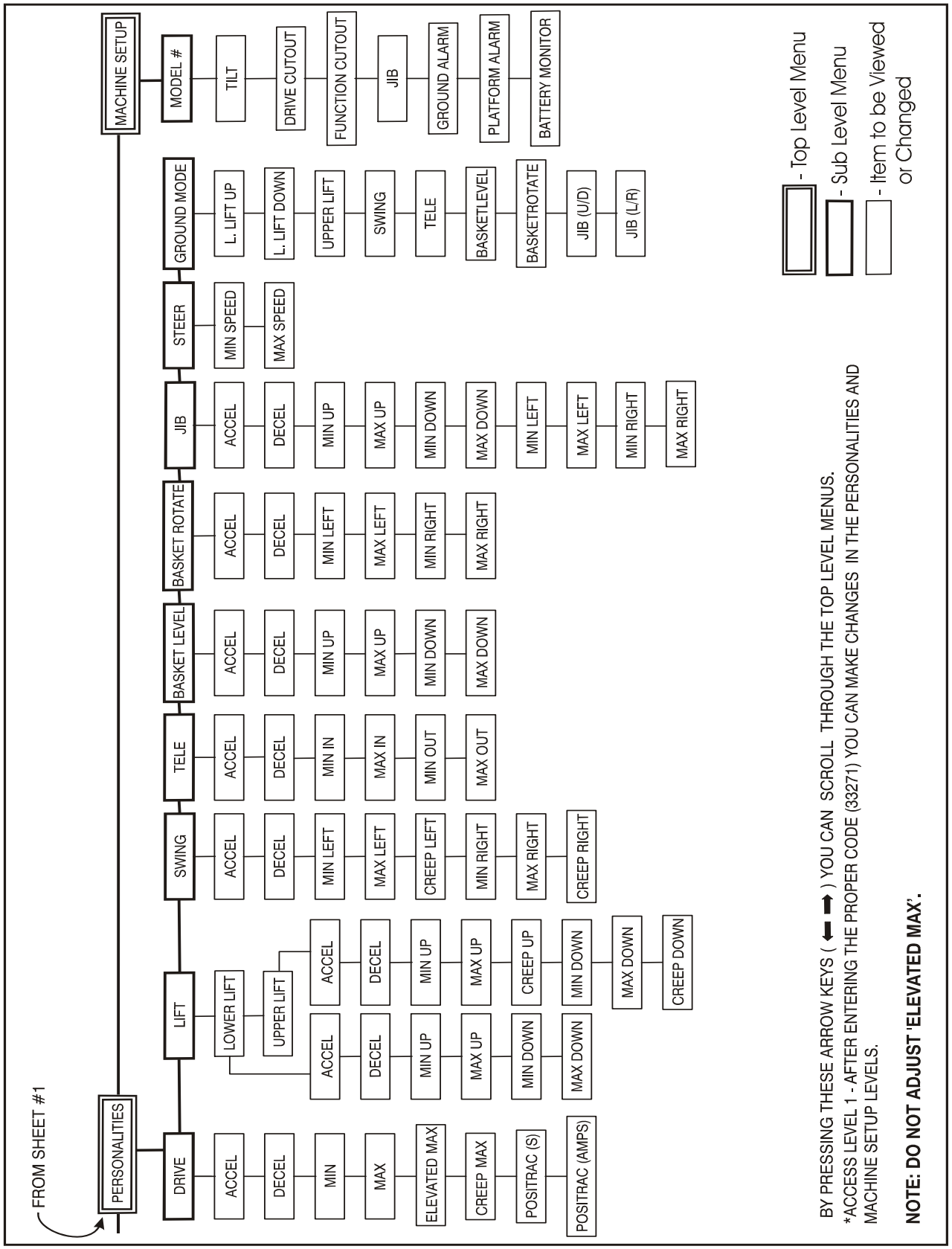


Figure 6-4. Analyzer Flow Chart - Sheet 2 of 2

Analyzer Diagnostics Menu Structure

In the following structure descriptions, an intended item is selected by pressing ENTER; pressing ESC steps back to the next outer level. The LEFT/RIGHT arrow keys move between items in the same level. The UP/DOWN arrow keys alter a value if allowed

Table 6-6. Diagnostics - Menu Descriptions

DRIVE	
DRIVE...	Displays drive joystick direction & demand
SPEED...	Displays vehicle direction & speed
POSITRAC...	Displays positrac status
STEER...	Displays steer switch direction & demand NOTE: steer demand is inversely proportional to vehicle speed
BRAKES...	Displays brake control system status
CREEP...	Displays pump pot creep switch status
BOOM	
LL....	Displays lower lift switch direction & demand NOTE: demand is controlled by the pump pot
UL.	Displays upper lift joystick direction & demand
SWING...	Displays swing joystick direction & demand
LEVEL.	Displays basket level switch direction & demand NOTE: demand is controlled by the pump pot
TELE...	Displays telescope switch direction & demand NOTE: demand is controlled by the pump pot
ROTATE.	Displays basket rotate switch direction & demand NOTE: demand is controlled by the pump pot
JIB (U/D).	Displays jib lift switch direction & demand NOTE: demand is controlled by the pump pot Not displayed if JIB = NO
JIB (L/R)	Displays jib swing switch direction & demand NOTE: demand is controlled by the pump pot Not displayed if JIB = NO
PUMP POT...	Displays pump pot demand
CREEP...	Displays pump pot creep switch status
SYSTEM	
TRACTION...	Displays measured traction motor current
PUMP...	Displays measured pump motor current
VALVE...	Displays measured valve (12V supply) current NOTE: this includes current for the ground alarm & hourmeter, but not for any lamps
BATTERY...	Displays measured battery voltage
TEMPERATURE...	Displays measured heat sink temperature
FSW1...	Displays footswitch status
FSW2...	Displays footswitch status NOTE: FSW2 is wired to the platform module
DRIVE CUTOUT...	Displays drive cutout switch status
ELEV. CUTOUT...	Displays elevation cutout switch status
FUNC. CUTOUT...	Displays function cutout switch status
BRAKES...	Displays brake pressure switch status
MAN.RELEASE...	Displays manual brake release switch status

Table 6-6. Diagnostics - Menu Descriptions

TILT...	Displays measured vehicle tilt The first value indicates tilt in die forwards reverse direction (pitch) The second value indicates tilt in the left/ right direction (roll)
DATALOG	
MAX.TEMP...	Displays maximum measured heat sink temp.
MIN.TEMP...	Displays minimum measured heat sink temp.
MAX. BATTERY.	Displays maximum measured battery voltage
ON...	Displays total controller on (EMS) time
DRIVE...	Displays total controller drive operation time
PUMP...	Displays total controller pump running time NOTE: includes all boom functions, steer and brake release
LIFT.	Displays total controller lift operation time
SWING...	Displays total controller swing operation time
TELE...	Displays total controller tell operation time
RENTAL...	Displays total controller operation time NOTE: can be reset
ERASE RENTAL YES:ENTER, NO:ESC ENTER	Not available at password level 2 Enter resets rental datalog time to zero
VERSIONS	
POWER	Displays power software version
PLATFORM	Displays platform software version
GROUND	Displays ground software version
POSITILT	Displays positilt software version
ANALYZER	Displays analyzer software version

System Self Test

The system self test is utilized to locate typical problems. See Table 6-7, System Test Descriptions for information concerning the tests performed and available messages in this mode.

1. When the key switch is in the platform position and the self test enabled, the self test function will test all valves, contactors, platform inputs, indicator lamps, and system alarms for various fault conditions.

   When the key switch is in the ground position, the self test function will test all valves, the line contactor, ground control inputs, and the ground alarm output for various fault conditions.

2. In order to test the inputs on the machine, the controller will ask the service technician to perform various tasks at the appropriate operator control station. An example of this is “Close LLU Switch”. The controller expects the operator to close the lower lift up switch. When the controller sees that the lower lift up switch has been closed, it will move on to the next input, lower lift down LLD. If the switch is faulty or the wiring is faulty, the controller will not move on to the next input. The controller will continue to wait for the closure of the input. If the operator knows the switch is faulty and wants to continue the tests he must simply press the enter key on the analyzer to continue.

3. After the controller has conducted the tests from the chosen operator station, it will display “TESTS COMPLETE”. This indicates that the controller has checked all inputs and outputs for that station.

NOTICE

IN ORDER FOR THE MACHINE TO FUNCTION AFTER THE SELF TEST IS COMPLETE, POWER MUST BE RECYCLED USING THE EMS OR THE KEY SWITCH.

Table 6-7. System Test Descriptions

ACTIVATE TESTS YES:ENTER, NO:ESC	Not available once tests are activated ENTER activates system tests NOTE: cannot be done while controller is in use (footswitch closed) and for a short time afterwards
RUN SYSTEM TEST	ENTER starts system test Not available until tests are activated Displays messages while system test runs Some messages are prompts, requiring user intervention. ENTER can be pressed if a fault is found, to confirm that the fault has been noted and to continue the system test. NOTE: a flashing message is critical, and prevents the system test running

Table 6-8. System Test Messages

RUNNING	Initial display when system test is run; certain "critical" checks are made. **Problems which can be reported** include: ONLY 1 ANALYZER! Do not connect two Analyzers while running the system test. BAD POWER WIRING The capacitor bank is not charged or pump point A is low or traction point A is high or low. Check all power wiring. LINE CONT WELDED The capacitor bank is at battery voltage. Check line contactor. Check all power wiring. BATTERY TOO LOW The system test cannot run with battery voltage below minimum. BATTERY TOO HIGH The system test cannot run with battery voltage above maximum. CHECK CAN WIRING The system test cannot run in platform mode unless data is being received from the platform, ground and positrac/tilt modules. The system test cannot run in ground mode unless data is being received from the ground and positrac/tilt modules. CHECK LEFT SPD. There is an open- or short- circuit in the left speed encoder wiring. Check left speed encoder. CHECK RIGHT SPD. There is an open- or short- circuit in the right speed encoder wiring. Check right speed encoder. CHECK SHUNT The traction current measurement is open-circuit. Check wiring between power module contactor panel. BAD PUMP WIRING Pump point A is not high, probably caused by an open-circuit pump motor or wiring. Check all power wiring. Check pump motor. BAD POWER WIRING Traction point A is high, probably caused by incorrect faction motor wiring. Check all power wiring. Check traction motor. BAD POWER MODULE An internal problem was detected in the power module. HIGH TILT ANGLE The vehicle is very tilted, or the tilt sensor has been damaged. Check tilt sensor. HOT POWER MODULE The heat sink temperature exceeds 75 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. WAIT:CAPBANK HI This message can be displayed if the system test is run shortly after the vehicle was used; after a short wait, it should clear. OPEN FWS In platform mode, the footswitch must be open at the start of the test. CLOSE FWS In platform mode, the footswitch must be closed when this message is displayed; the foot switch MUST BE KEPT CLOSED during the valve & contactor tests. BAD FWS 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 6-8. System Test Messages

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. The valves are tested in the order: PROP (main proportional), LL U, LL D, UL U, UL D, SWING L, SWING R, SWING REST, LEVEL U, LEVEL D, ROTATE L, ROTATE R, JIB U, JIB D, TELE I, TELE O, BYPASS, STEER L, STEER R, STEER PROP, BRAKE NOTE: in platform mode, the footswitch must be closed. NOTE: jib valves are not tested if JIB = NO NOTE: left/right jib are not tested unless jib = side swing. **Problems which can be reported include:** CANT TEST VALVES There is a wiring problem which prevents the valve test from functioning correctly. Check valve wiring. Check ground alarm wiring. valve name S/C The named valve is drawing too much current so is presumed to be short-circuit. Check valve wiring. valve name O/C The named valve is drawing too little current so is presumed to be open-circuit. Check valve wiring.
VALVE TEST DONE	Indicates that the valve test is complete (with or without faults).
TESTING CONTS	Indicates that the contactor test is beginning. In platform mode, the forward & reverse direction contactors are energized and de-energized; checks are made that they close & open correctly and for short-circuit coils. In platform and ground mode, the line contactor is energized and de-energized; checks are made that it closed & opened correctly and for a short-circuit coil. In platform mode, the positrac contactors are energized and de-energized; checks are made for short-circuit and open-circuit coils. **Problems which can be reported include:** CANT TEST CONTS There is a wiring problem which prevents the contactor test from functioning correctly. Check power wiring. Check contactor wiring. BAD CONT WIRING There is a wiring problem which caused the capacitor bank to be charged when a direction contactor was energized; probably the wiring to the contactor coils is incorrect. Check contactor wiring. Check power wiring. contname WELDED The named contactor appears to have not opened. Check named contactor. Check power wiring. contname COIL S/C The named contactor coil overloaded its driver circuit so is presumed to be short-circuit. Check contactor wiring. contname DIDN'T CLOSE The named contactor appears to have not closed. Check contactor wiring. Check power wiring.
CONT TEST DONE	Indicates that the contactor test is complete (with or without faults).

Table 6-8. System Test Messages

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, inputs are tested in the order: UL U, UL D, UL JOY., SWING L, SWING R, SWING JOY., LEVEL U, LEVEL D, PUMP POT., ROTATE L, ROTATE R, LL U, LL D, JIB U, JIB D, TELE I, TELE O, DRIVE FWD, DRIVE REV, DRIVE JOY., STEER L, STEER R, POSITRAC, DRIVE C/O, ELEV. C/O, FUNC. C/O, BRAKE PRES In ground mode, inputs are tested in the order: ROTATE L, ROTATE R, LEVEL U. LEVEL D, JIB U. JIB D, TELE I, TELE O, UL U, UL D, LL U, LL D, SWING L, SWING R, ELEV. C/O, FUNC. C/O, BRAKE PRES, MAN. BRAKE 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 which can be reported include:** CHECK switch name The named switch is not in its "normal" position. Check switch & wiring. CHECK switch name JOY. The named joystick appears to be faulty. Check joystick.
INPUTS DONE	Indicates that the inputs test is complete (with or without faults).
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 to continue the test. Lamps are tested in the order: ENABLE, FAULT, TILT, CREEP, POSITRAC, WATER. NOTE: lamps which are not in use (due to the settings of machine digits) are not checked. NOTE: lamps are only tested in platform mode. **Problems which can be reported include:** lamp name S/C A short-circuit condition appeared while the named lamp was being tested, presumably because it is short-circuit.
LAMP TEST DONE	Indicates that the lamps test is complete.
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 to continue the test. Alarms are tested in the order: P.ALARM, G.ALARM. NOTE: the platform alarm is only tested in platform mode. NOTE: the ground alarm is not tested if GROUND ALARM = NO. **Problems which can be reported include:** alarm name S/C A short-circuit condition appeared while the named alarm was being tested, presumably because it is short-circuit.
ALARM TEST DONE	Indicates that the alarms test is complete.

Table 6-8. System Test Messages

TEST ALL INPUTS?	Prompts whether to check every operator input. If ESC is pressed, the system test ends. If ENTER is pressed, each operator input is prompted for in turn. In platform mode, operator inputs are tested in the order: UL U, UL D, SWING L, SWING R, LEVEL U, LEVEL D, PUMP POT, CREEP, ROTATE L, ROTATE R, LL U, LL D, JIB U, JIB D, TELE I, TELE O, DRIVE FWD, DRIVE REV, STEER L, STEER R, POSITRAC In ground mode, operator inputs are tested in the order: ROTATE L, ROTATE R. LEVEL U. LEVEL D, JIB U. JIB D, TELE I, TELE O. UL U. IJL D, LL U. LL D, SWING L, SWING R NOTE: the jib switches are not tested if JIB = NO. Prompts displayed during the operator input test include: CLOSE switch name The named switch should be closed. OPEN switch name The named switch should be opened. joystick name direction TO MAX The named joystick should be pushed to its full extent in the named direction. joystickname direction 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 to return to the RUN SYSTEM TEST Analyzer menu.

NOTES:

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.

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

μ = micro = (Displayed Number) / 1,000,000

Example: 1.2 kΩ = 1200 Ω
Example: 50 mA = 0.05 A

Voltage Measurement

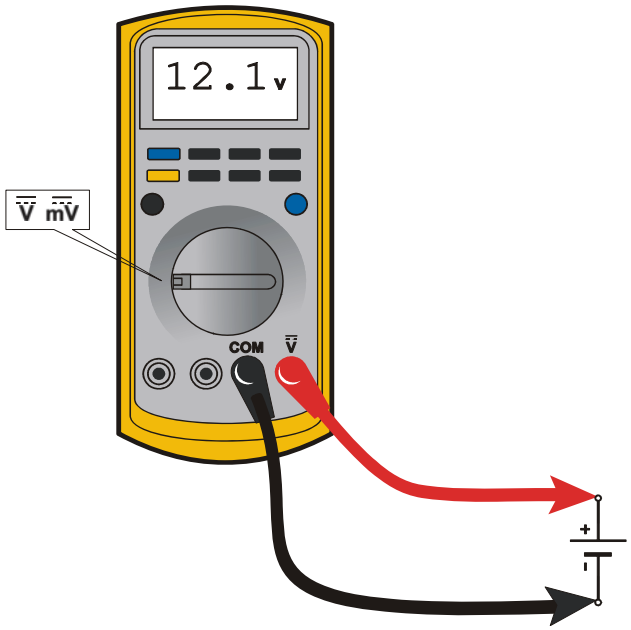


Figure 7-1. Voltage Measurement (DC)

- 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

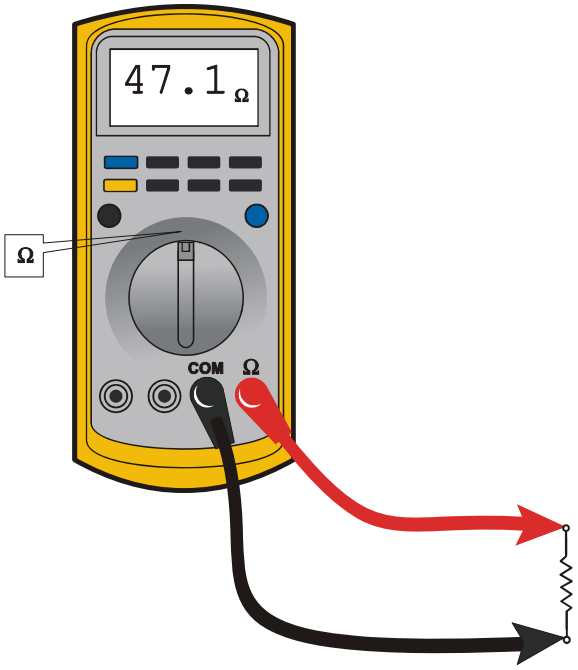


Figure 7-2. Resistance Measurement

- 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

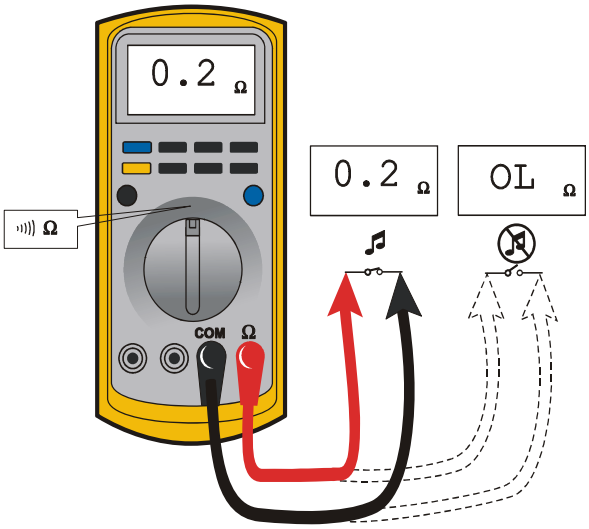


Figure 7-3. Continuity Measurement

- 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

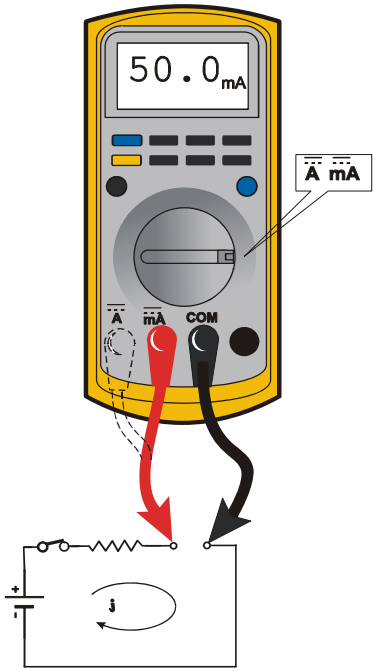


Figure 7-4. Current Measurement (DC)

- 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.

1. 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.*

3. 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.
3. 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 as-shipped, position (See Figure 7-5.). Proceed as follows:

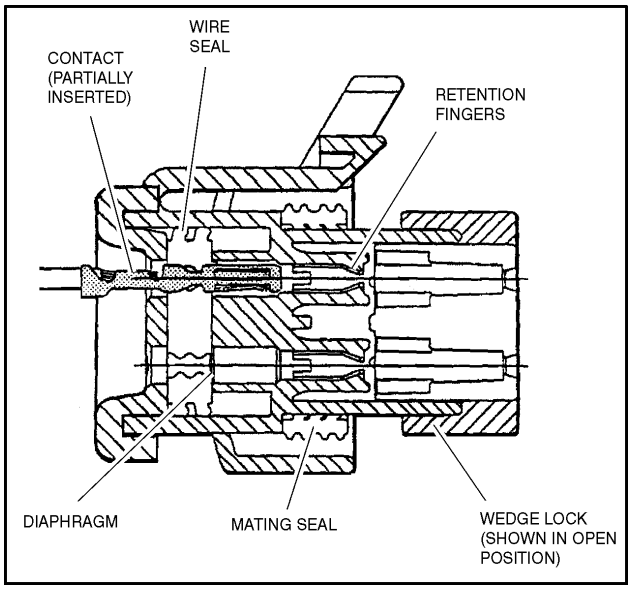


Figure 7-5. Connector Assembly Figure 1

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.).

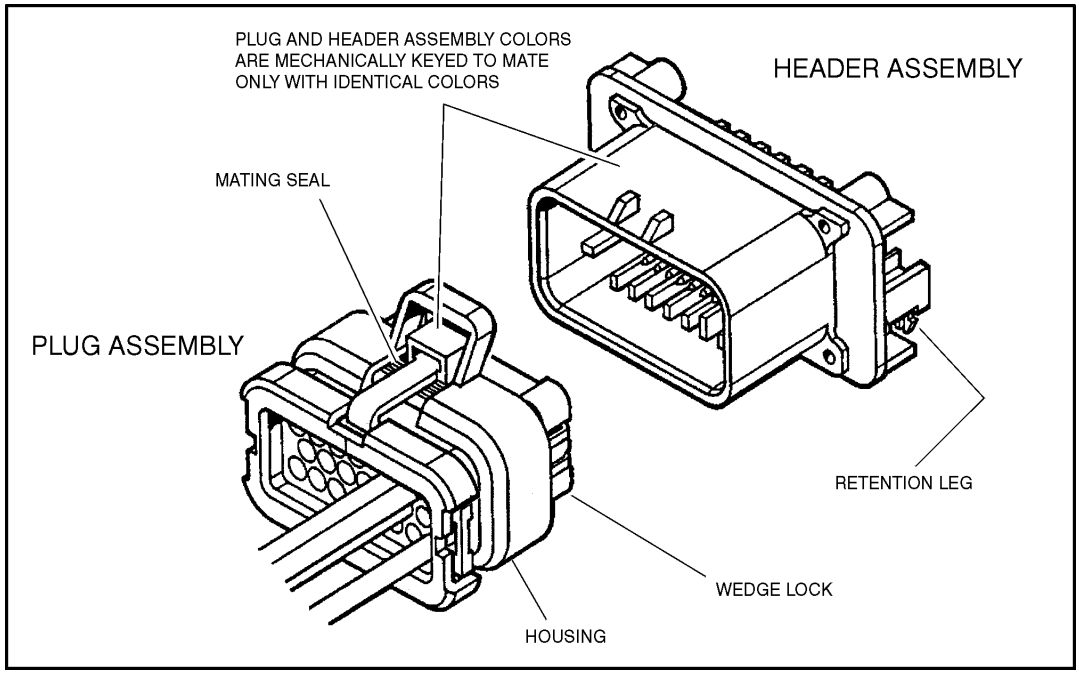


Figure 7-6. AMP Connector

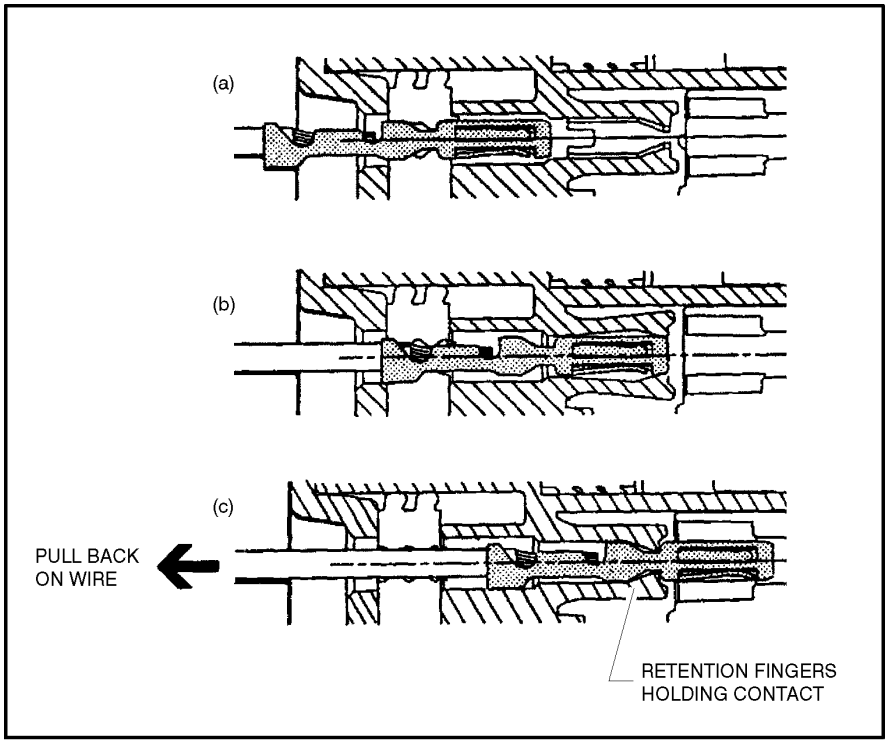


Figure 7-7. Connector Assembly Figure 2

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.).

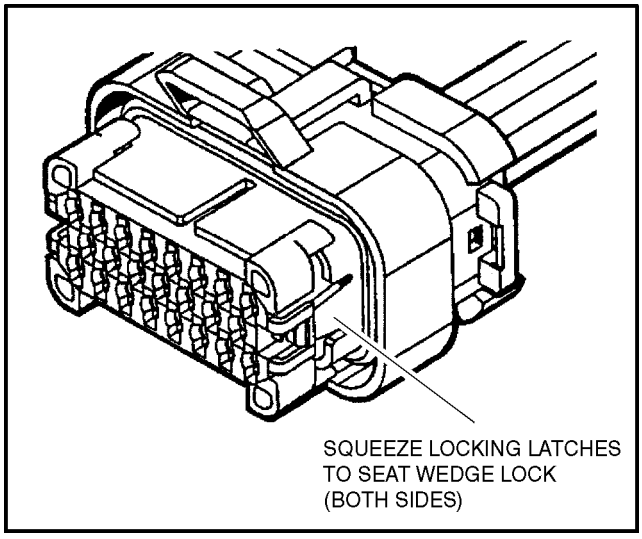


Figure 7-8. Connector Assembly Figure 3

4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 7-9.).

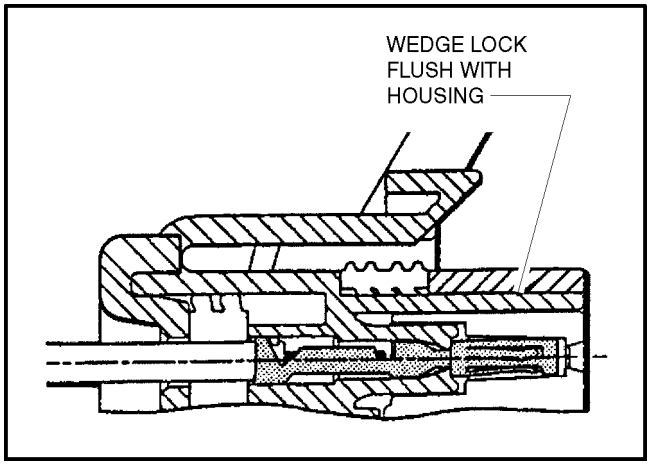


Figure 7-9. Connector Assembly Figure 4

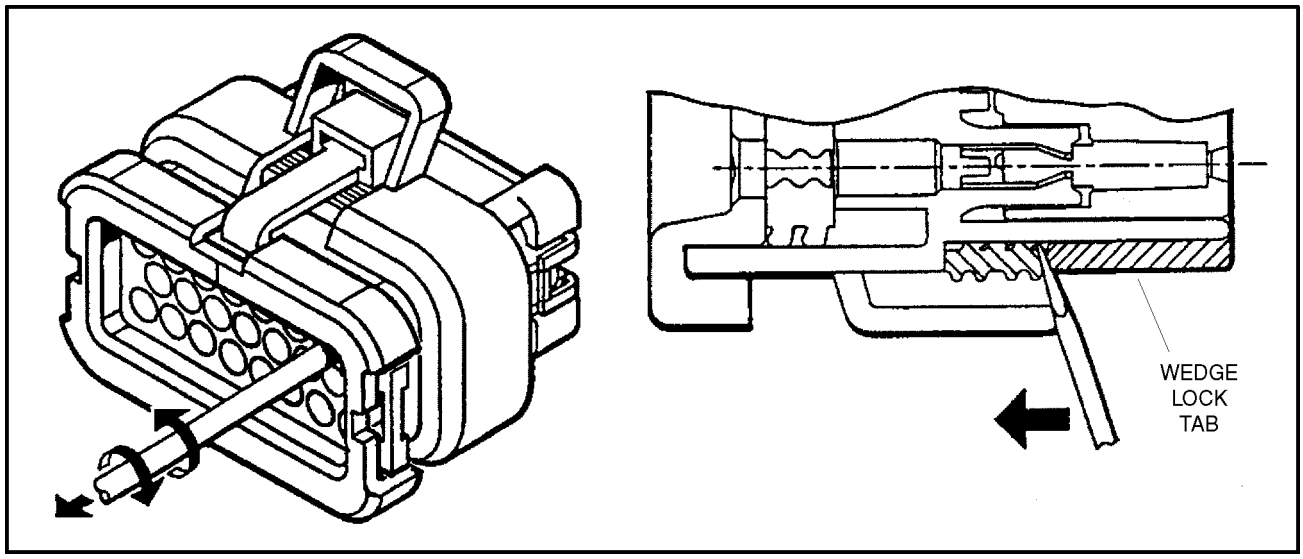


Figure 7-10. Connector Disassembly

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.
3. 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.

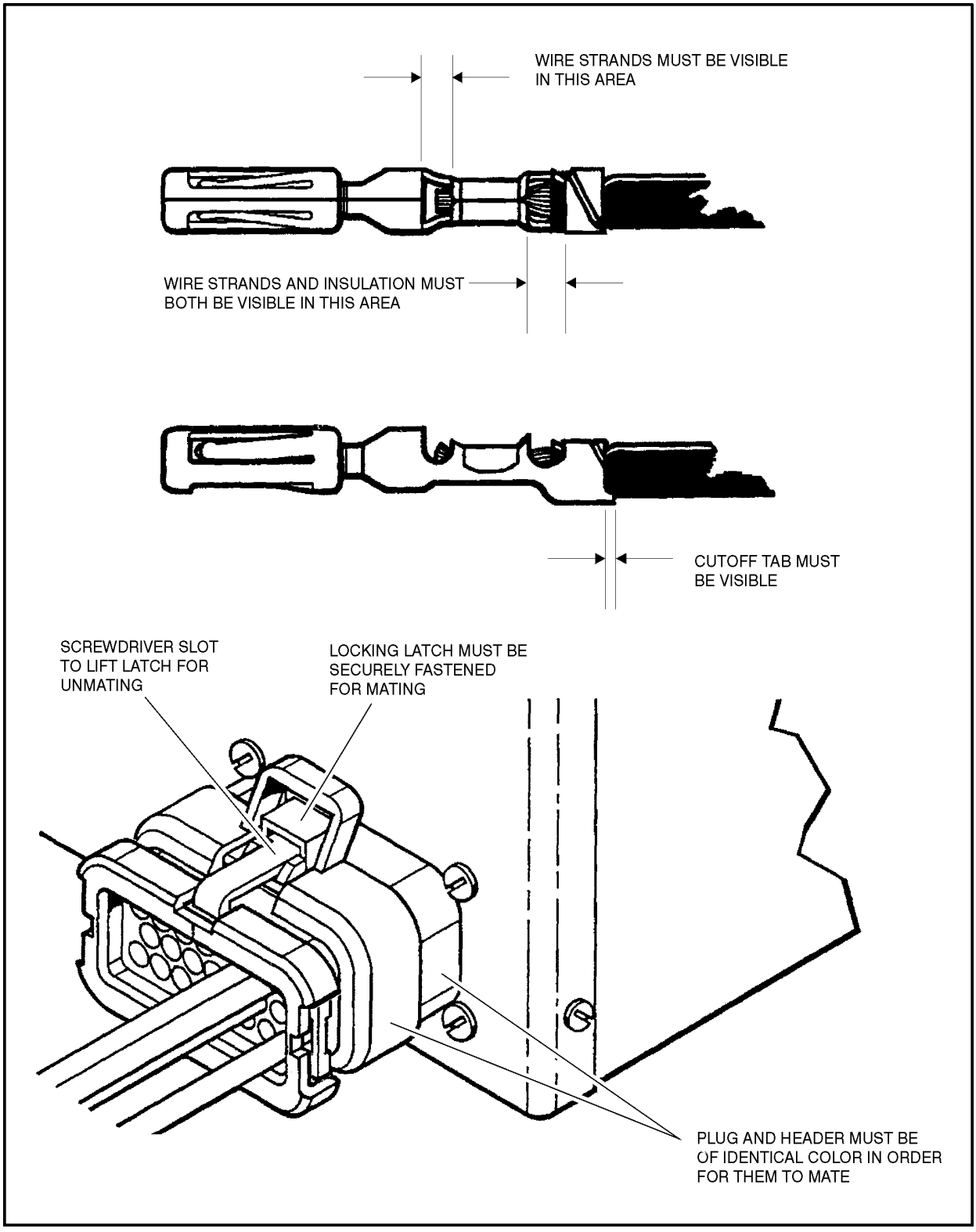


Figure 7-11. Connector Installation

7.5 DEUTSCH CONNECTORS

DT/DTP Series Assembly

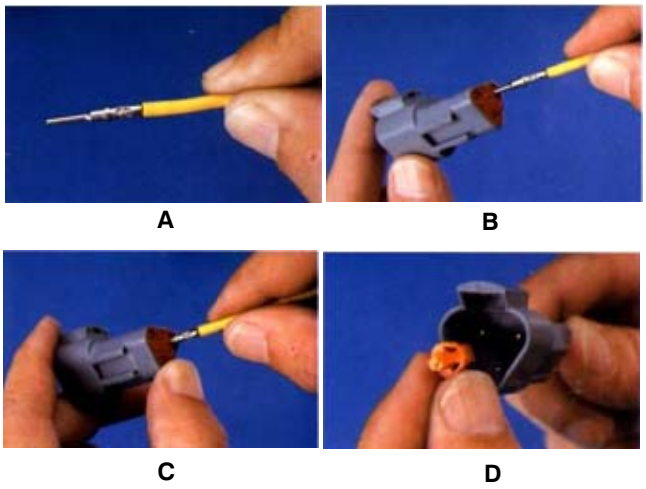


Figure 7-12. DT/DTP Contact Installation

1. Grasp crimped contact about 25mm behind the contact barrel.
2. Hold connector with rear grommet facing you.
3. 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

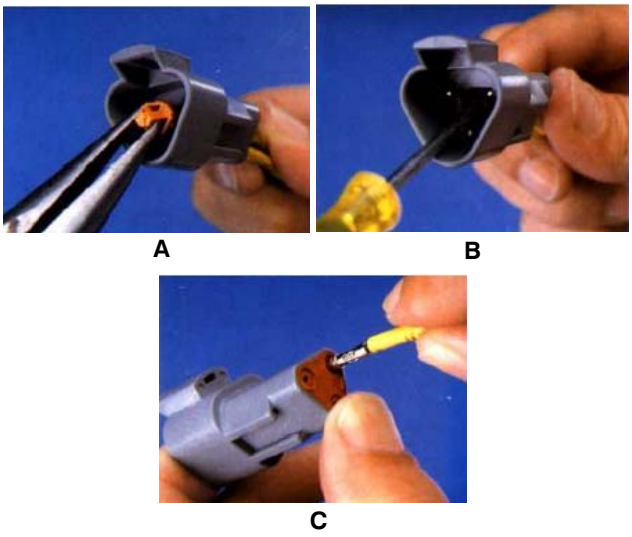


Figure 7-13. DT/DTP Contact Removal

1. Remove wedgelock using needlenose pliers or a hook shaped wire to pull wedge straight out.
2. 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

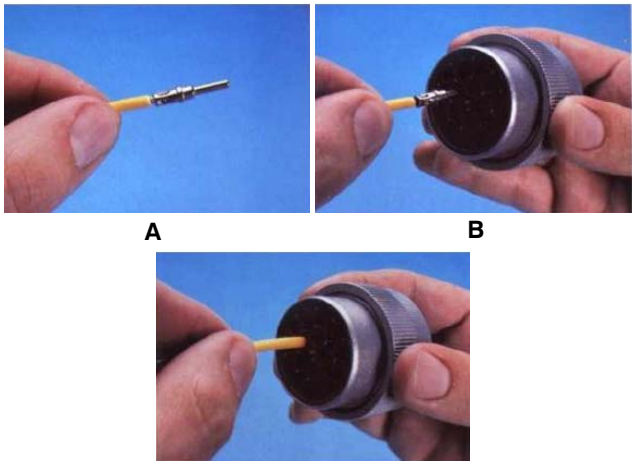


Figure 7-14. HD/HDP Contact Installation

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.

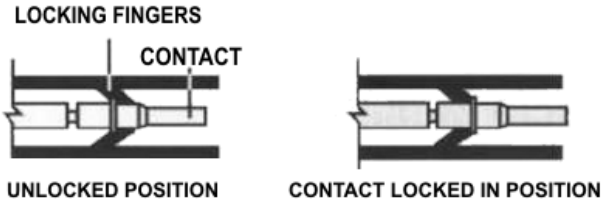


Figure 7-15. HD/HDP Locking Contacts Into Position

NOTE: *For unused wire cavities, insert sealing plugs for full environmental sealing*

HD30/HDP20 Series Disassembly

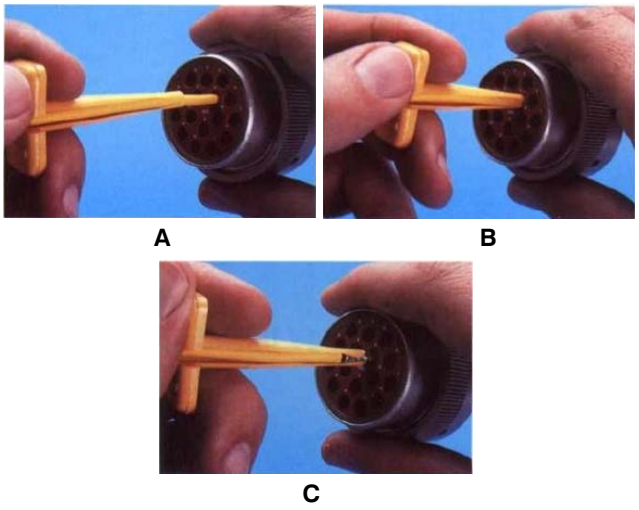


Figure 7-16. HD/HDP Contact Removal

1. 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.

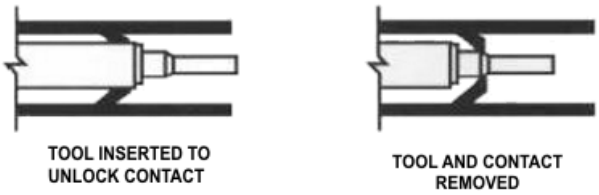


Figure 7-17. HD/HDP Unlocking Contacts

NOTE: *Do Not twist or insert tool at an angle.*

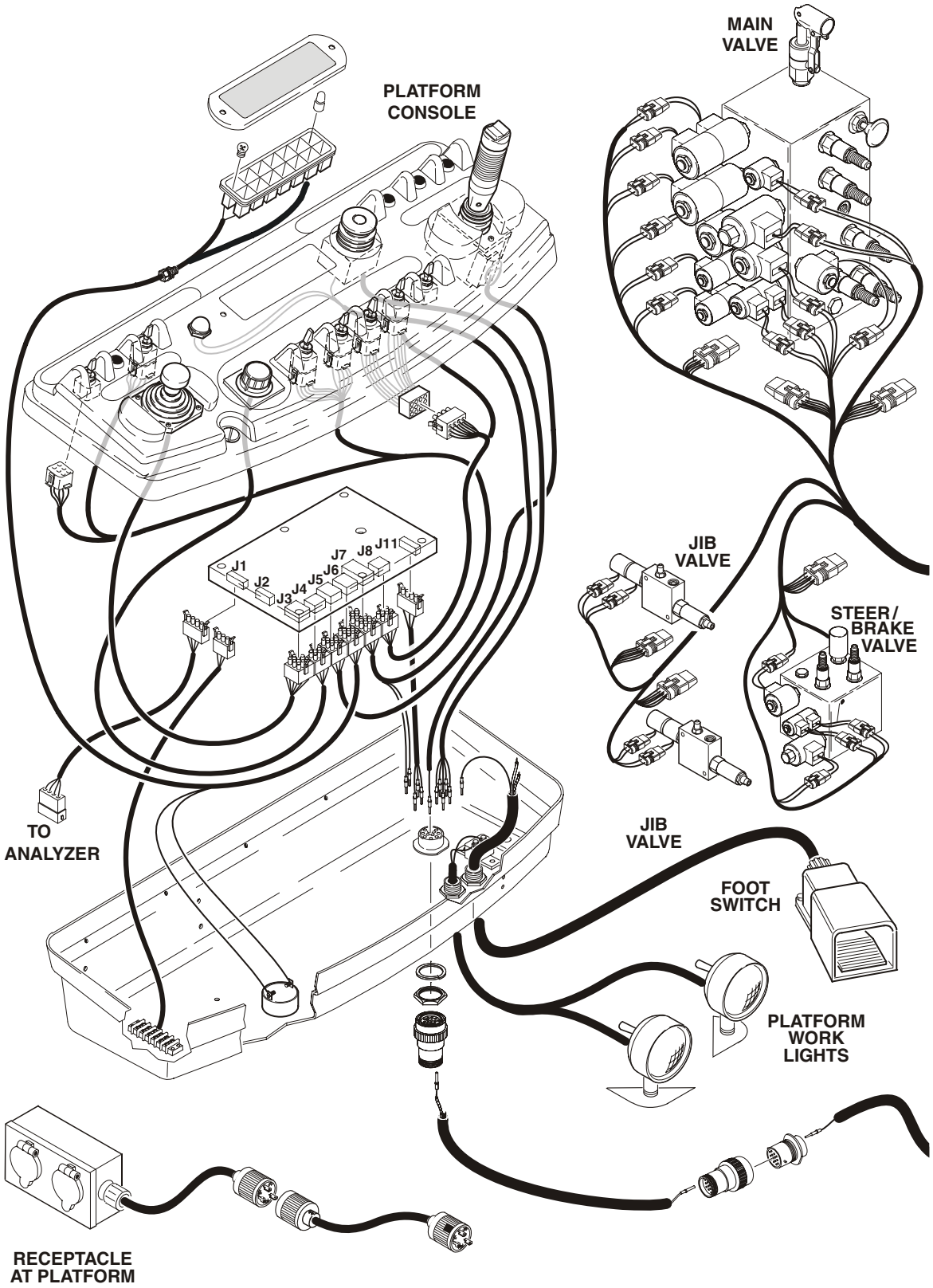


Figure 7-18. Electrical Components - Sheet 1 of 2

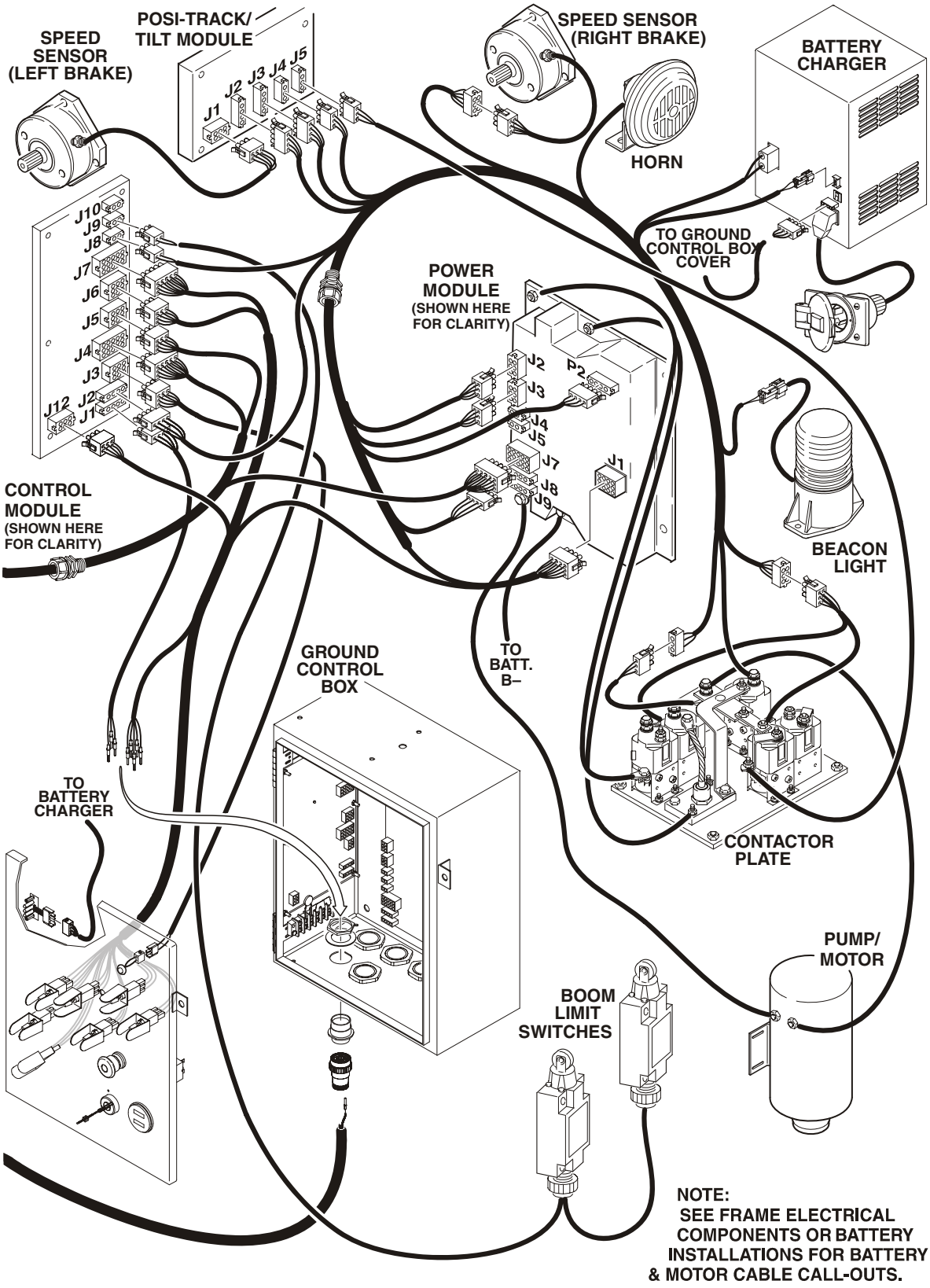


Figure 7-19. Electrical Components - Sheet 2 of 2

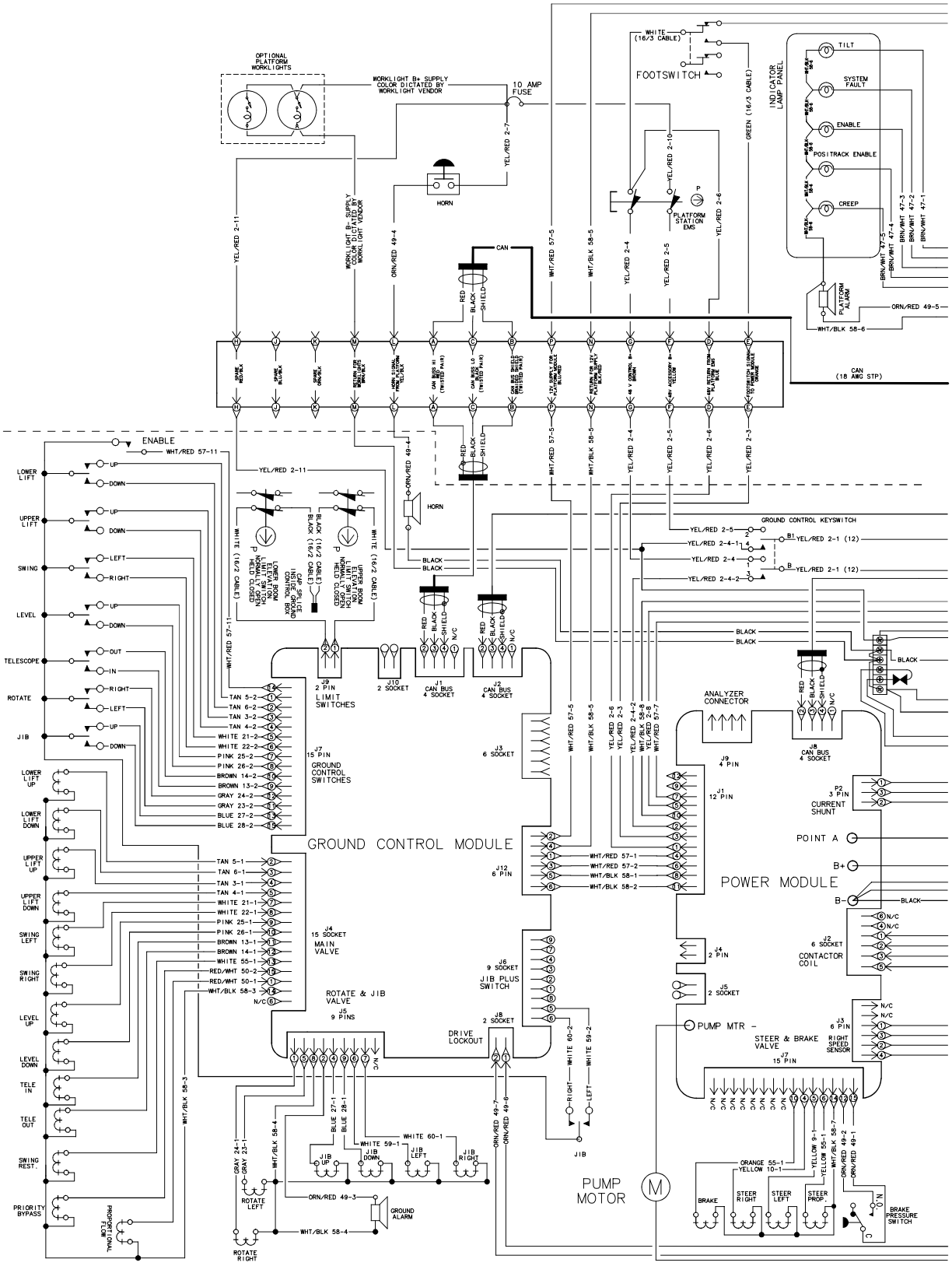


Figure 7-20. Electrical Schematic - Sheet 1 of 2

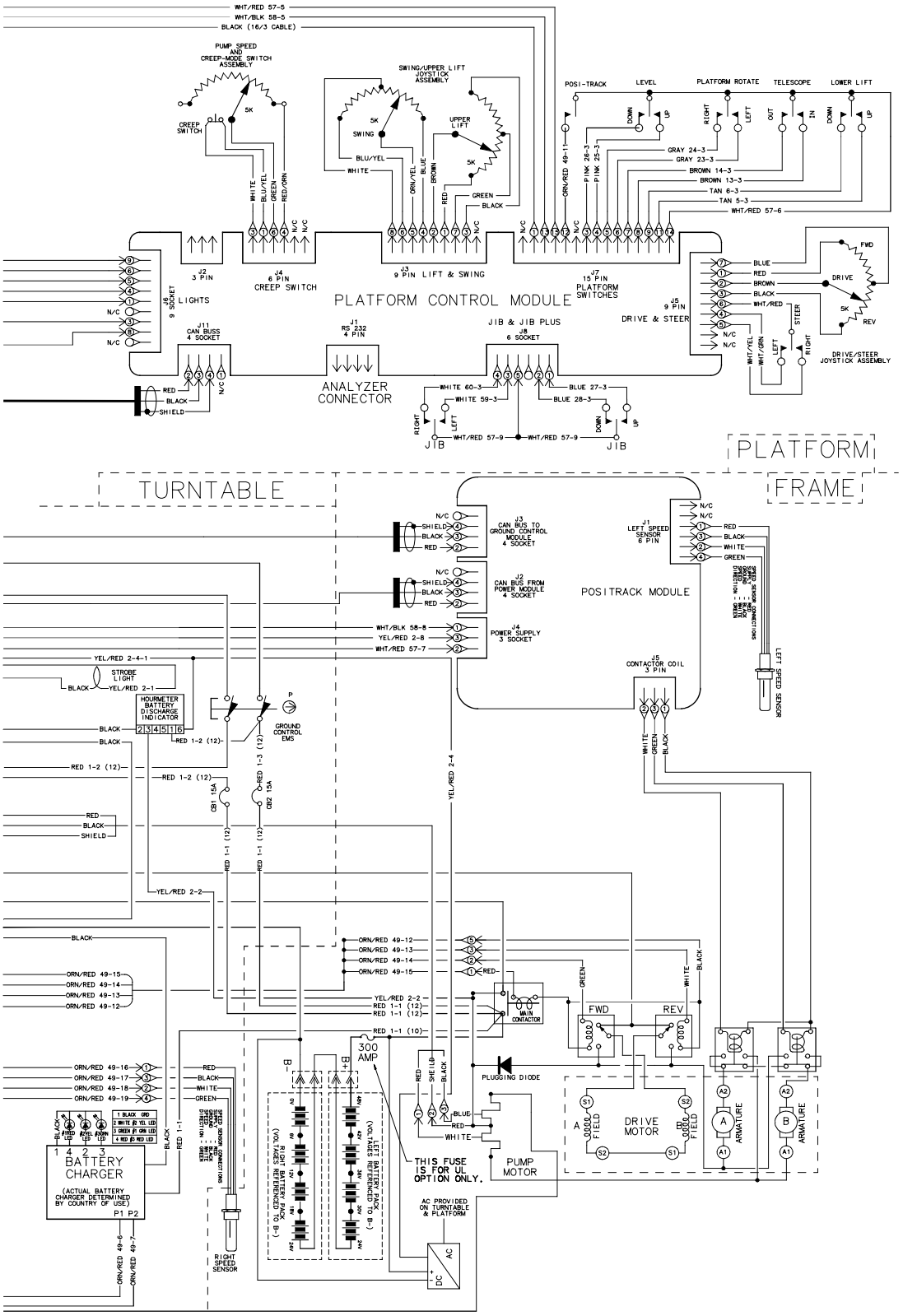


Figure 7-21. Electrical Schematic - Sheet 2 of 2

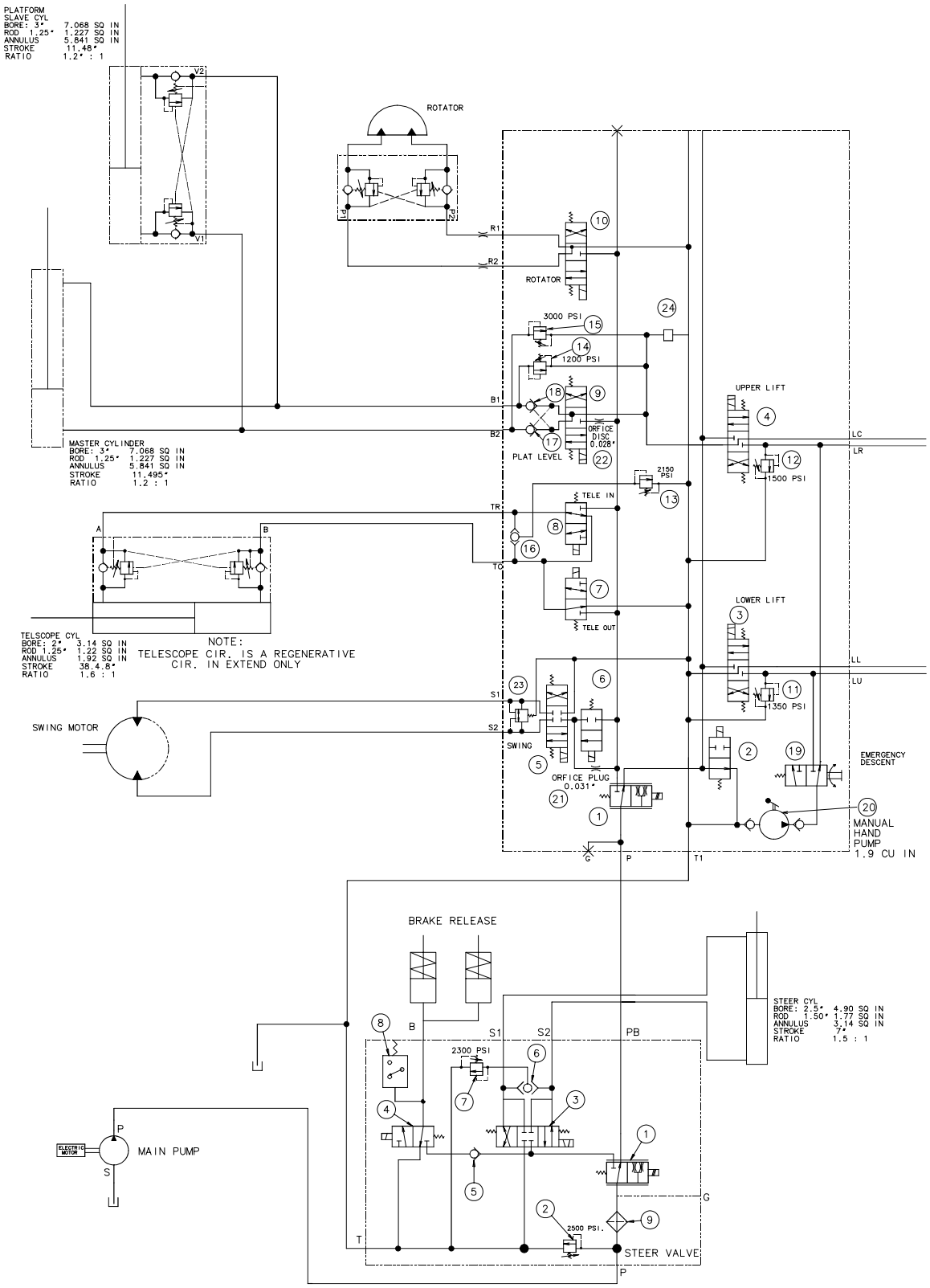
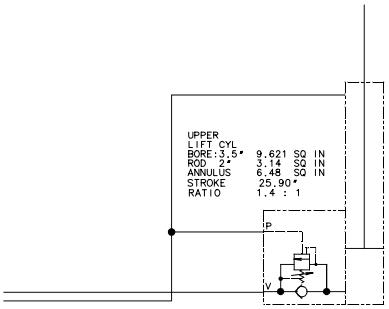
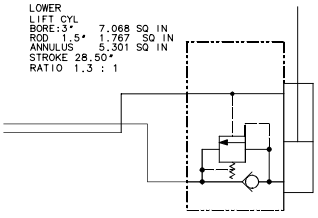


Figure 7-22. Hydraulic Schematic - 300A - Sheet 1 of 2





COMPONENTS MAIN VALVE

1. PROPORTIONAL FLOW REGULATOR, PRESSURE COMPENSATED, PV-703001B-0-N-12DW
2. 2-POS, 2-WAY POPPET VALVE, NORMALLY OPEN, SV08-21-0-N-12DW (BYPASS UNLOADING)
3. 3-POS, 4-WAY VALVE, SV10-47E-0-N-12DW, 1/2 MOTOR SPOOL (LOWER LIFT)
4. 3-POS, 4-WAY VALVE, SV10-47E-0-N-12DW, 1/2 MOTOR SPOOL (UPPER LIFT)
5. 3-POS, 4-WAY VALVE, SV08-47C-0-N-12DW, CLOSED CENTER SPOOL (SWING)
6. 2-POS, 2-WAY SPOOL VALVE, NORMALLY CLOSED SV08-24-0-N-12DW (SWING RESTRICTOR)
7. 2-POS, 3-WAY VALVE, SV10-33-0-N-12DW, (TELESCOPE OUT)
8. 2-POS, 3-WAY VALVE, SV10-33-0-N-12DW, (TELESCOPE IN)
9. 3-POS, 4-WAY VALVE, SV08-47D-0-N-12DW, MOTOR SPOOL (PLATFORM LEVEL)
10. 3-POS, 4-WAY VALVE, SV08-47C-0-N-12DW, CLOSED CENTER SPOOL (ROTATOR)
11. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (LOWER LIFT DOWN)
12. RELIEF VALVE, DIRECT ACTING, RVO8-20A-0-N-/18 (UPPER LIFT DOWN)
13. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (TELESCOPE)
14. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (PLATFORM LEVEL BACKWARD ROD E
15. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (PLATFORM LEVEL FORWARD PISTON END)
16. SHUTTLE VALVE, LS08-30-0-N, (TELESCOPE)
17. PILOT OPERATED CHECK, PC08-30-0-N, (PLATFORM LEVEL, ROD SIDE)
18. PILOT OPERATED CHECK, PC08-30-0-N, (PLATFORM LEVEL, PISTON SIDE)
19. ROTARY 2-POS, 3-WAY VALVE, MR10-31-0-N, (EMERGENCY DESCENT) w/ 6113160
20. MANUAL HAND PUMP, HP10-21A-0-N-A
21. .031"ORIFICE PLUG
22. 7051028, .028" ORIFICE DISC
23. RELIEF VALVE, RV08-3806-0-N-30/15
24. SAE #8 PLUG, #6103008

COMPONENTS STEER/BRAKE VALVE
1. PV70-30B-0-N-12DW
2. RV58-20A-0-N-46/
3. SV08-47C-0-N-12DW
4. SV38-38-0-N-12DW
5. CV08-20-0-N-4
6. LS08-30-0-N CHECK VALVE
7. RV08-20A-0-N-33/ SHUTTLE
8. XM-6A-500R/TP
9. G1761

MAIN PUMP SPEC'S

•	500 PSI	2.876 GPM
	750 PSI	2.847 GPM
	1000 PSI	2.821 GPM
	1500 PSI	2.767 GPM
	2000 PSI	2.710 GPM
	2500 PSI	2.656 GPM
	3000 PSI	2.599 GPM
	3250 PSI	2.578 GPM
	3500 PSI	2.545 GPM

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Figure 7-23. Hydraulic Schematic - 300A - Sheet 2 of 2

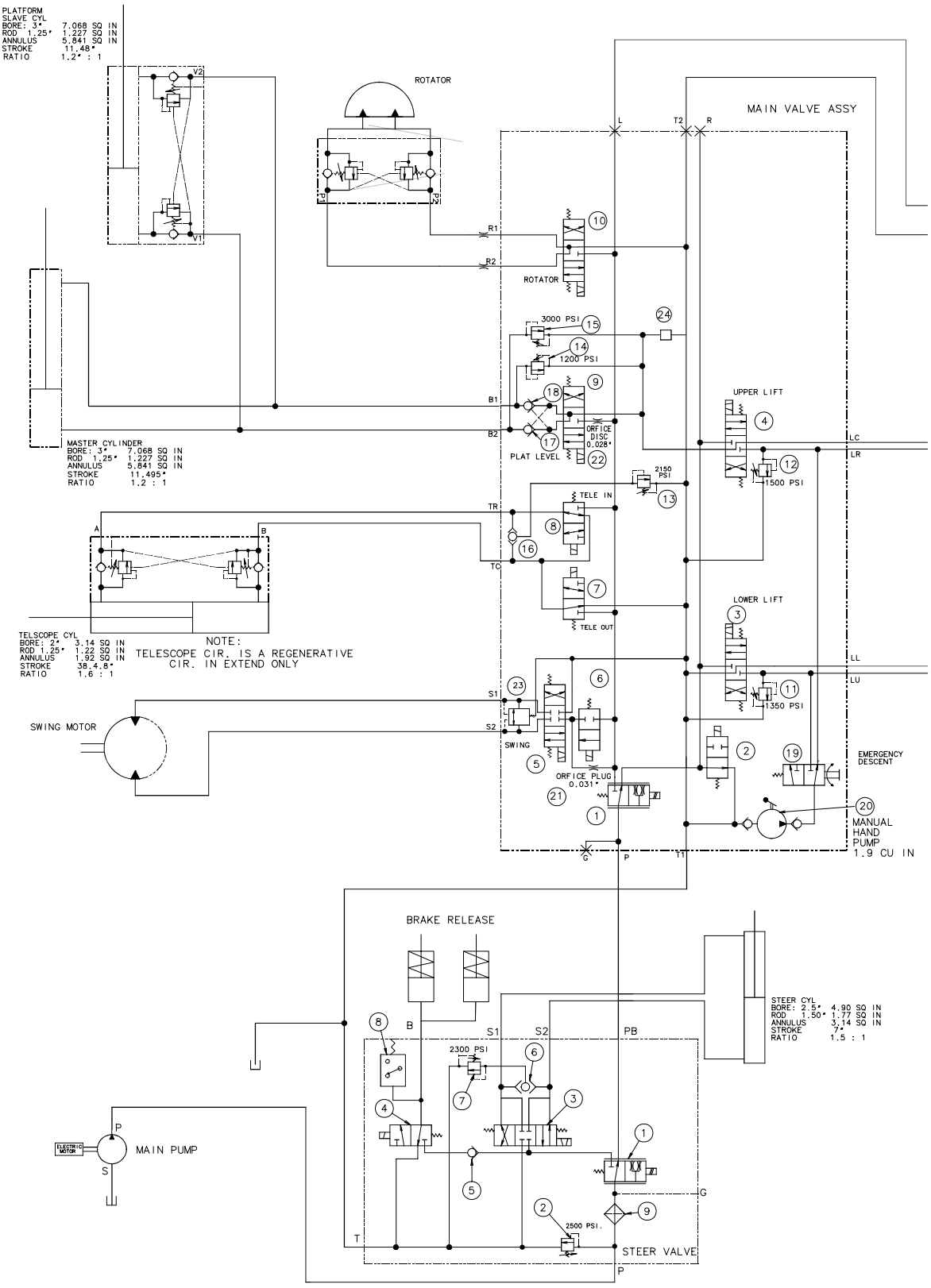
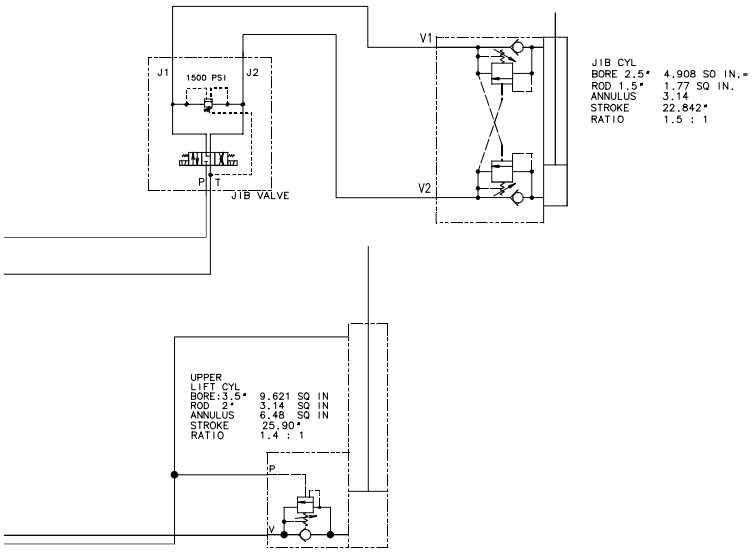
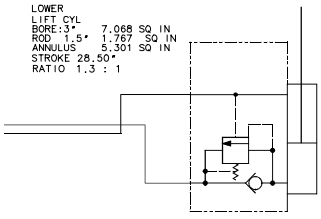


Figure 7-24. Hydraulic Schematic - 300AJ - Sheet 1 of 2





COMPONENTS MAIN VALVE

1. PROPORTIONAL FLOW REGULATOR, PRESSURE COMPENSATED, PV-703001B-0-N-12DW
2. 2-POS, 2-WAY POPPET VALVE, NORMALLY OPEN, SV08-21-0-N-12DW (BYPASS UNLOADING)
3. 3-POS, 4-WAY VALVE, SV10-47E-0-N-12DW, 1/2 MOTOR SPOOL (LOWER LIFT)
4. 3-POS, 4-WAY VALVE, SV10-47E-0-N-12DW, 1/2 MOTOR SPOOL (UPPER LIFT)
5. 3-POS, 4-WAY VALVE, SV08-47C-0-N-12DW, CLOSED CENTER SPOOL (SWING)
6. 2-POS, 2-WAY SPOOL VALVE, NORMALLY CLOSED SV08-24-0-N-12DW (SWING RESTRICTOR)
7. 2-POS, 3-WAY VALVE, SV10-33-0-N-12DW, (TELESCOPE OUT)
8. 2-POS, 3-WAY VALVE, SV10-33-0-N-12DW, (TELESCOPE IN)
9. 3-POS, 4-WAY VALVE, SV08-47D-0-N-12DW, MOTOR SPOOL (PLATFORM LEVEL)
10. 3-POS, 4-WAY VALVE, SV08-47C-0-N-12DW, CLOSED CENTER SPOOL (ROTATOR)
11. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (LOWER LIFT DOWN)
12. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/18 (UPPER LIFT DOWN)
13. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (TELESCOPE)
14. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (PLATFORM LEVEL BACKWARD ROD E
15. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (PLATFORM LEVEL FORWARD PISTON END)
16. SHUTTLE VALVE, LS08-30-0-N, (TELESCOPE)
17. PILOT OPERATED CHECK, PC08-30-0-N, (PLATFORM LEVEL, ROD SIDE)
18. PILOT OPERATED CHECK, PC08-30-0-N, (PLATFORM LEVEL, PISTON SIDE)
19. ROTARY 2-POS, 3-WAY VALVE, MR10-31-0-N, (EMERGENCY DESCENT)
20. MANUAL HAND PUMP, HP10-21A-0-N-A
21. .031" ORIFICE PLUG
22. 7051028 .028" ORIFICE DISC
23. RELIEF VALVE, RV08-3806-0-N-30/15
24. SAE #8 PLUG, #6103008

COMPONENTS STEER/BRAKE VALVE
1. PV70-30B-0-N-12DW
2. RV58-20A-0-N-46/
3. SV08-47C-0-N-12DW
4. SV38-38-0-N-12DW
5. CV08-20-0-N-4
6. LS08-30-0-N CHECK VALVE
7. RV08-20A-0-N-33/ SHUTTLE
8. XM-6A-500R/TP
9. G1761

MAIN PUMP SPEC'S

* 500	PSI	2.876 GPM
750	PSI	2.847 GPM
1000	PSI	2.821 GPM
1500	PSI	2.767 GPM
2000	PSI	2.710 GPM
2500	PSI	2.656 GPM
3000	PSI	2.599 GPM
3250	PSI	2.578 GPM
3500	PSI	2.545 GPM

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Figure 7-25. Hydraulic Schematic - 300AJ - Sheet 2 of 2

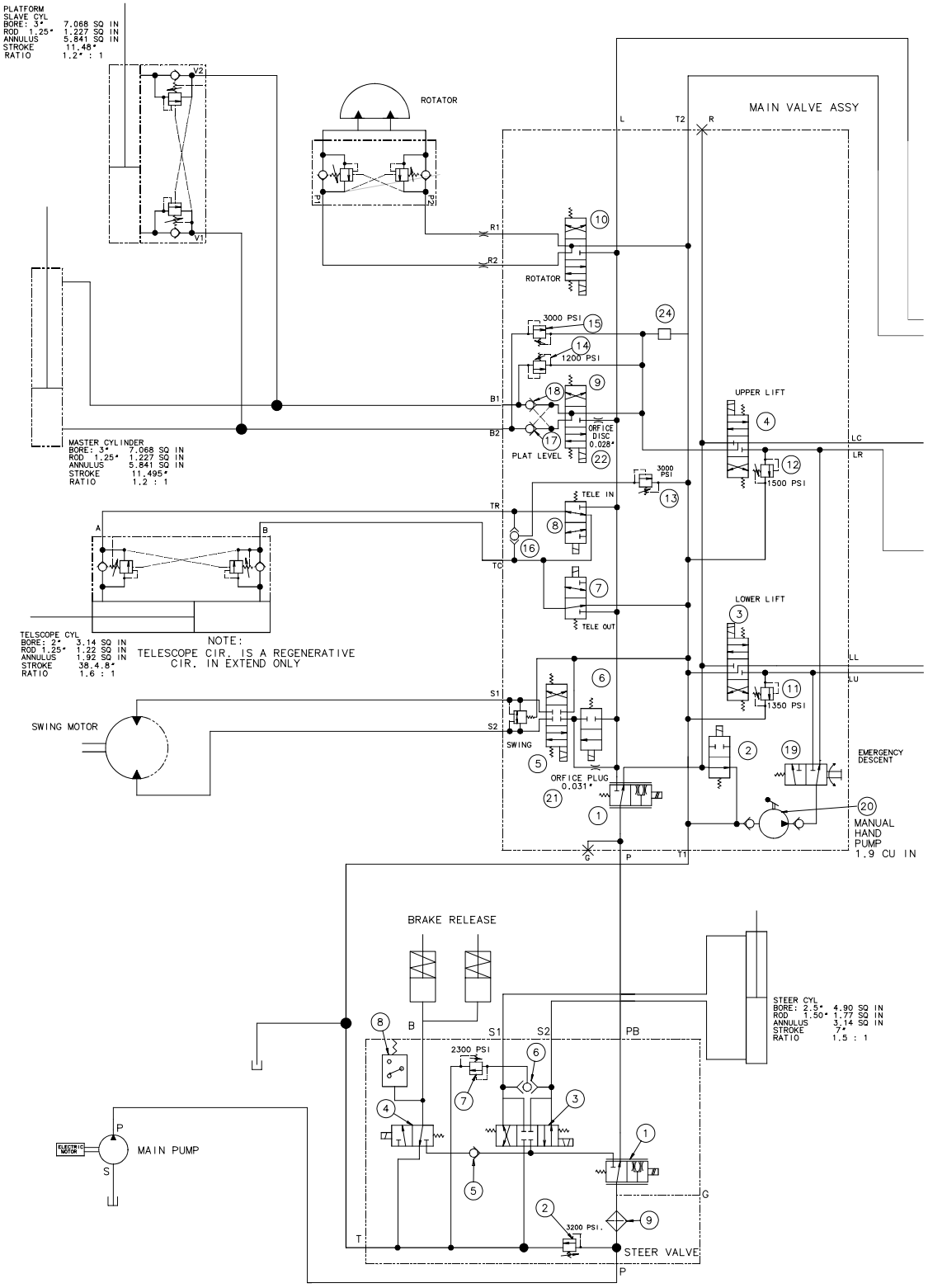
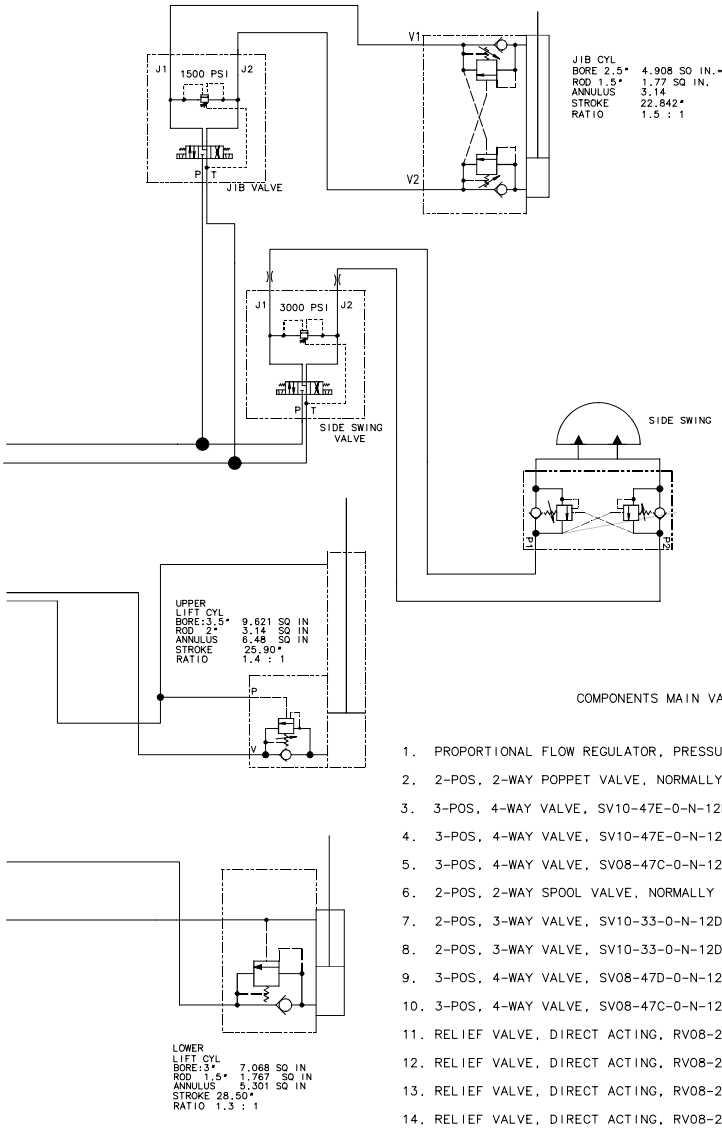


Figure 7-26. Hydraulic Schematic - 300AJP - Sheet 2 of 2



COMPONENTS MAIN VALVE

1. PROPORTIONAL FLOW REGULATOR, PRESSURE COMPENSATED, PV-703001B-0-N-12DW
2. 2-POS, 2-WAY POPPET VALVE, NORMALLY OPEN, SV08-21-0-N-12DW (BYPASS UNLOADING)
3. 3-POS, 4-WAY VALVE, SV10-47E-0-N-12DW, 1/2 MOTOR SPOOL (LOWER LIFT)
4. 3-POS, 4-WAY VALVE, SV10-47E-0-N-12DW, 1/2 MOTOR SPOOL (UPPER LIFT)
5. 3-POS, 4-WAY VALVE, SV08-47C-0-N-12DW, CLOSED CENTER SPOOL (SWING)
6. 2-POS, 2-WAY SPOOL VALVE, NORMALLY CLOSED SV08-24-0-N-12DW (SWING RESTRICTOR)
7. 2-POS, 3-WAY VALVE, SV10-33-0-N-12DW, (TELESCOPE OUT)
8. 2-POS, 3-WAY VALVE, SV10-33-0-N-12DW, (TELESCOPE IN)
9. 3-POS, 4-WAY VALVE, SV08-47D-0-N-12DW, MOTOR SPOOL (PLATFORM LEVEL)
10. 3-POS, 4-WAY VALVE, SV08-47C-0-N-12DW, CLOSED CENTER SPOOL (ROTATOR)
11. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (LOWER LIFT DOWN)
12. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/18 (UPPER LIFT DOWN)
13. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (TELESCOPE)
14. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (PLATFORM LEVEL BACKWARD ROD E
15. RELIEF VALVE, DIRECT ACTING, RV08-20A-0-N-/33 (PLATFORM LEVEL FORWARD PISTON END)
16. SHUTTLE VALVE, LS08-30-0-N, (TELESCOPE)
17. PILOT OPERATED CHECK, PC08-30-0-N, (PLATFORM LEVEL, ROD SIDE)
18. PILOT OPERATED CHECK, PC08-30-0-N, (PLATFORM LEVEL, PISTON SIDE)
19. ROTARY 2-POS, 3-WAY VALVE, MR10-31-0-N, (EMERGENCY DESCENT)
20. MANUAL HAND PUMP, HP10-21A-0-N-A
21. .031"ORIFICE PLUG
22. 7051028, .028"ORIFICE DISC
23. RELIEF VALVE, RV08-3806-0-N-30/15
24. SAE #8 PLUG, #6103008

MAIN PUMP SPEC'S

•	500 PSI	2.876 GPM
	750 PSI	2.847 GPM
	1000 PSI	2.821 GPM
	1500 PSI	2.767 GPM
	2000 PSI	2.710 GPM
	2500 PSI	2.656 GPM
	3000 PSI	2.599 GPM
	3250 PSI	2.578 GPM
	3500 PSI	2.545 GPM

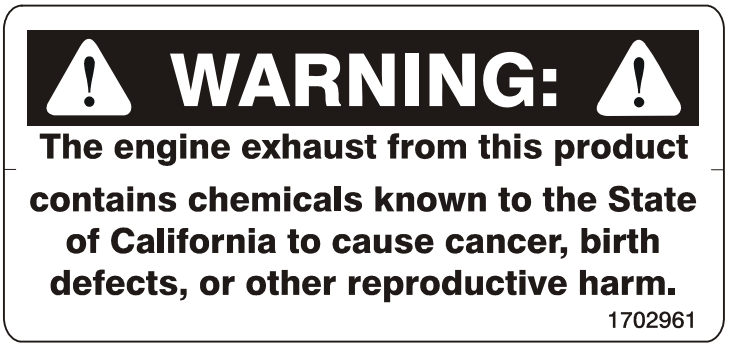
COMPONENTS STEER/BRAKE VALVE
1. PV70-30B-0-N-12DW
2. RV58-20A-0-N-46/
3. SV08-47C-0-N-12DW
4. SV38-38-0-N-12DW
5. CV08-20-0-N-4
6. LS08-30-0-N CHECK VALVE
7. RV08-20A-0-N-33/ SHUTTLE
8. XM-6A-500R/TP
9. G1761

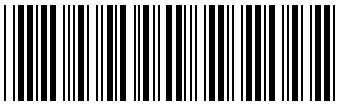
2792523 B

Figure 7-27. Hydraulic Schematic - 300AJP - Sheet 2 of 2

NOTES:


CALIFORNIA PROPOSITION 65
BATTERY 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.
WASH HANDS AFTER HANDLING !


WARNING:
The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.
1702961



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An Oshkosh Corporation Company

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

JLG Worldwide Locations

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

JLG Latino Americana Ltda.
Rua Eng. Carlos Stevenson,
80-Suite 71
13092-310 Campinas-SP
Brazil
☎ +55 19 3295 0407
+55 19 3295 1025

JLG Industries (UK) Ltd
Bentley House
Bentley Avenue
Middleton
Greater Manchester
M24 2GP - England
☎ +44 (0)161 654 1000
+44 (0)161 654 1001

JLG France SAS
Z.I. de Baulieu
47400 Fauillet
France
☎ +33 (0)5 53 88 31 70
+33 (0)5 53 88 31 79

JLG Deutschland GmbH
Max-Planck-Str. 21
D - 27721 Ritterhude - Ihlpohl
Germany
☎ +49 (0)421 69 350 20
+49 (0)421 69 350 45

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
Italy
☎ +39 029 359 5210
+39 029 359 5845

JLG Europe B.V.
Polaris Avenue 63
2132 JH Hoofddorp
The Netherlands
☎ +31 (0)23 565 5665
+31 (0)23 557 2493

JLG Polska
Ul. Krolewska
00-060 Warsawa
Poland
☎ +48 (0)914 320 245
+48 (0)914 358 200

JLG Industries (Scotland)
Wright Business Centre
1 Lonmay Road
Queenslie, Glasgow G33 4EL
Scotland
☎ +44 (0)141 781 6700
+44 (0)141 773 1907

Plataformas Elevadoras
JLG Iberica, S.L.
Trapadella, 2
P.I. Castellbisbal Sur
08755 Castellbisbal, Barcelona
Spain
☎ +34 93 772 4700
+34 93 771 1762

JLG Sverige AB
Enkopingsvagen 150
Box 704
SE - 176 27 Jarfalla
Sweden
☎ +46 (0)850 659 500
+46 (0)850 659 534

www.jlg.com