Service and Maintenance Manual

Models
E300AJ
E300AJP

SN 0300211844 to Present

3121720

January 07, 2019 - Rev C

ANSI

CE

AS/NZS

PARTS FINDER

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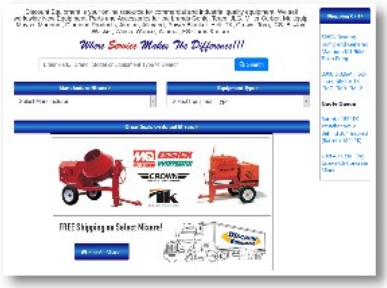

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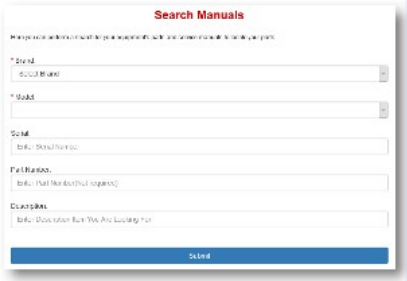

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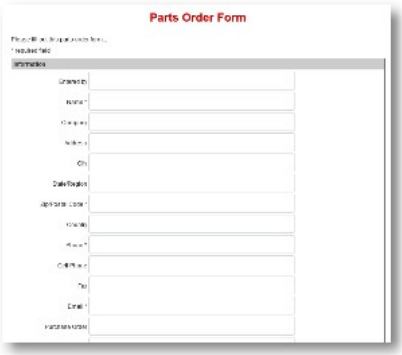

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SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

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

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

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

⚠ WARNING

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

B HYDRAULIC SYSTEM SAFETY

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

Do not use your hand to check for leaks. Use a piece of cardboard or paper to search for leaks. Wear gloves to help protect hands from spraying fluid.

C MAINTENANCE

⚠ WARNING

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

- 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 SERVICE MANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- USE CAUTION WHEN CHECKING A HOT, PRESSURIZED COOLANT SYSTEM.
- NEVER WORK UNDER AN ELEVATED BOOM UNTIL BOOM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR BOOM SAFETY PROP HAS BEEN ENGAGED.
- BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.
- BATTERY SHOULD ALWAYS BE DISCONNECTED DURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

REVISON LOG

Original Issue	A - March 30, 2017
Revised	B - June 29, 2018 - Revised Covers
Revised	C - January 07, 2019 -Revised Pages 4-49, 4-50

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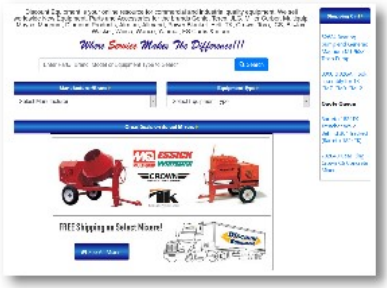

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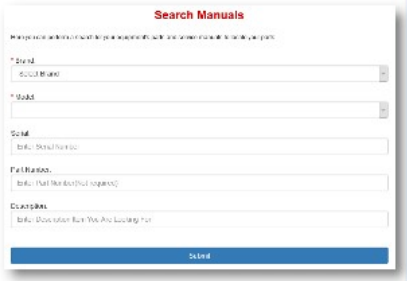

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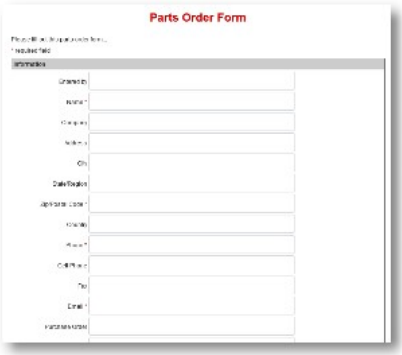

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SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications- E300AJ

Maximum Work Load (Capacity) ANSI Markets Unrestricted:	 500 lbs. (227 kg)
Maximum Work Load (Capacity) CE & Australia Markets Unrestricted:	 500 lbs. (230 kg)
Maximum Travel Grade, Stowed Position (Gradeability)	25%
Maximum Travel Grade Stowed Position (Side Slope)	5 degrees
Ground Bearing Pressure- Maximum	170 psi (11.95 kg/cm^2)
Maximum System Voltage	48V DC
Battery Life per Charge High Speed Reduced Speed	 8.7 hours 11.1 hours
Gross Machine Weight- Approximate	15060 lbs. (6831 kg)
Drive Speed Maximum Reduced Elevated	 4.5 mph (7.2 kph) 3 mph (4.8 kph) 0.3 mph (0.48 kph)
Battery Recharge Time	14 Hours from Full Discharge
Maximum Main Relief Hydraulic Pressure	3000 psi (207 bar)

Table 1-2. Operating Specifications- E300AJP

Maximum Work Load (Capacity) ANSI Markets Unrestricted:	 500 lbs. (227 kg)
Maximum Work Load (Capacity) CE & Australia Markets Unrestricted:	 500 lbs. (230 kg)
Maximum Travel Grade, Stowed Position (Gradeability)	25%
Maximum Travel Grade Stowed Position (Side Slope)	5 degrees
Ground Bearing Pressure- Maximum	170 psi (11.95 kg/cm^2)
Maximum System Voltage	48 VDC
Battery Life per Charge High Speed Reduced Speed	 8.7 hours 11.1 hours
Gross Machine Weight- Approximate	15400 lbs. (6985 kg)

Table 1-2. Operating Specifications- E300AJP

Drive Speed Maximum Reduced Elevated	 4.5 mph (7.2 kph) 2.7 mph (4.3 kph) 0.3 mph (0.48 kph)
Battery Recharge Time	14 Hours from Full Discharge
Maximum Main Relief Hydraulic Pressure	3000 psi (207 bar)

1.2 CAPACITIES

Table 1-3. Capacities

Hydraulic Oil Tank	2.9 Gal. (11 L) 2.1 Gal. (8 L) to Full Mark
Drive Hub*	25.5 oz. (0.75 L)(1/2 Full)
*Drive hubs should be one half full of lubricant.	

1.3 TIRES

Table 1-4. Tire Specifications

Size	25x7x12
Maximum Tire Load	8200 lbs. (3719 kg)
Type	Solid Non-Marking

1.4 DIMENSIONAL DATA

Table 1-5. Dimensional Data- E300AJ

Turning Radius (Inside)	5 ft. (1.52 m)
Turning Radius (Outside)	10ft. 2in. (3.1 m)
Machine Height (stowed)	6ft. 7in. (2.01 m))
Machine Length (stowed)	18ft. 2in. (5.54 m)
Up and Over Platform Height	13ft. 2in. (4.01 m)
Horizontal Reach Up and Over	20ft. 3in. (6.17 m)
Machine Width	4ft. (1.22 m)
Wheel Base	5ft. 5in. (1.65 m)
Platform Height	30ft. 2in. (9.19m))
Ground Clearance	4in. (10 cm)

Table 1-6. Dimensional Data - E300AJP

Turning Radius (Inside)	5 ft. (1.52 m)
Turning Radius (Outside)	10ft. 2in. (3.1 m)
Machine Height (stowed)	6ft. 7in. (2.01 m))
Machine Length (stowed)	18ft. 10in. (5.74 m)
Up and Over Platform Height	13ft. 2in. (4.01 m)
Horizontal Reach Up and Over	20ft. 1in. (6.12 m)
Machine Width	4ft. (1.22 m)
Wheel Base	5ft. 5in. (1.65 m)
Platform Height	29ft. 5in. (8.97 m)
Ground Clearance	4in. (10 cm)

1.5 LUBRICATION SPECIFICATIONS

Refer to Section 1.9, Operator Maintenance, for specific lubrication procedures.

Hydraulic Oil

Table 1-7. 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 must have anti-wear qualities at least to 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 antiwear 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 1-8. 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

Table 1-9. Mobil DTE 10 Excel 15 Specs

ISO Viscosity Grade	#15
Pour Point, Max	-65°F (-54°C)
Flash Point, Min.	360°F (182°C)
Viscosity	
at 40° C	15.8 cSt
at 100° C	4.07 cSt
at 100° F	15.8 cSt
at 212° F	4.07 cSt
Viscosity Index	168

Table 1-10. Mobilfluid 424 Specs

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

Table 1-11. Mobil EAL 224H Specs

Type	Biodegradable Vegetable Oil
ISO Viscosity Grade	32/46
Specific Gravity	.922
Pour Point, Max	-25°F (-32°C)
Flash Point, Min	428°F (220°C)
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 cS
at 100° C	8.4 cSt
Viscosity Index	213
NOTE: *Must be stored above 32°F (0°C)*	

Table 1-12. Mobil EAL Envirosyn H Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	32
Specific Gravity	.950
Pour Point, Max	-59°F (-51°C)
Flash Point, Min.	514°F (268°C)
Viscosity	
at 40° C	33.1 cSt
at 100° C	6.36 cSt
Viscosity Index	147

Table 1-13. Quintolubric 888-46

Density	0.91 @ 15°C (59°F)
Pour Point	<-20°C (<-4°F)
Flash Point	275°C (527°F)
Fire Point	325°C (617°F)
Autoignition Temperature	450°C (842°F)
Viscosity	
at 0° C (32°F)	360 cSt
at 20° C (68°F)	102 cSt
at 40° C (104°F)	46 cSt
at 100° C (212°F)	10 cSt
Viscosity Index	220

1.6 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 1-14. Critical Stability Weights

Component	LBS.	KG.
Counterweight (AJ)	6188	2807
Counterweight (AJP))	6348	2880
Tire and Wheel)	120	54.4
Platform (including console)	169	78
Battery (minimum each) - 305AH	87	39.5
Battery (minimum each) - 305AH (AGM)	108	49
Battery (minimum each) - 375AH & UL	110	50

1.7 FUNCTION SPEED

Table 1-15. Function Speeds

Function	Speed (In Seconds)
Main Lift Up	24-27
Main Lift Down	20-23
Turntable Swing Right & Left 360°	75-90
NOTE: *Swing Left to Swing Right should be within 10% of each other.*	
Telescope Out	8-12
Telescope In	8-12
Telescope In	23-28
Platform Rotate - Right & Left 180°	20-24
NOTE: *Rotate Left to Swing Right should be within 15% of each other.*	
Jib Lift Up	22-25
Jib Lift Down	22-25
Jib Swing Right and Left (AJ & AJP)	20-35
Lower Lift Up	17-20
Lower Lift Down	17-20
Drive Fwd Below Elevation	30-35
Drive Reduced/Drive Reverse Below Elevation	50-59
Drive Above Elevation (ANSI)	110-120
Drive Above Elevation (CE)	110-120
NOTE: *Drive Forward Max to 100% (Typical)*	
NOTE: *Drive Reverse Max = Drive Reduced Max (Below Elevation)*	

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1.8 MAJOR COMPONENT WEIGHTS

Table 1-16. Major Component Weights

Component	LB.	KG.
Platform and Support	215	97.5
Upper Boom Complete	450	204
Mid Boom Complete	419	190
Lower Boom Complete	419	190
Upper Lift Cylinder	97	44
Mid Lift Cylinder	60	27
Lower Lift Cylinder	130	59
Master Cylinder	405	184
Slave Cylinder	432	196
Telescope Cylinder	103	47
Upper Upright	222	101
Lower Upright	93	42
Turntable	948	430
Battery Box (incl. batteries)	600	272
Chassis (w/ pneu. tires)	4295	1948
Chassis (w/ foam-filled tires)	4695	2130
Counterweight (AJ)	6188	2807
Counterweight (AJP)	6348	2880
Machine Complete	15400	6985

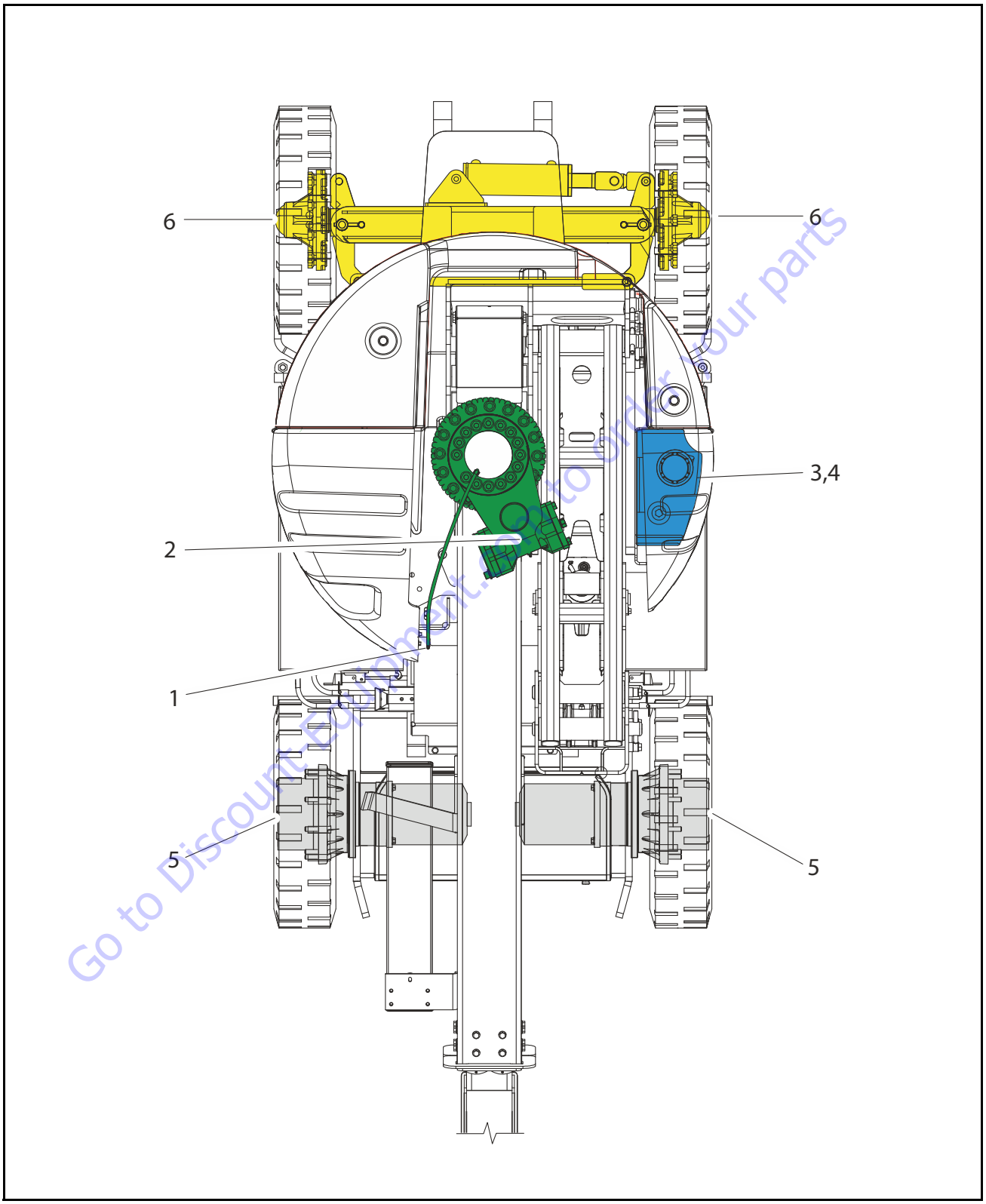


Figure 1-1. Maintenance and Lubrication Diagram

1.9 OPERATOR MAINTENANCE

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

Table 1-17. Lubrication Specifications

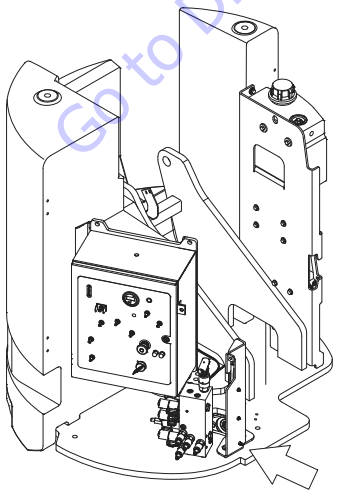
KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350 degrees F. Excellent water resistance and adhesive qualities; and being of extreme pressure type (Timken OK 40 pounds minimum).
EPGL	Extreme Pressure Gear Lube (oil) meeting API Service Classification GL-5 or Mil-Spec Mil-L-2105.
HO	Hydraulic Oil. Mobil DTE-11M
BG*	Bearing Grease (JLG Part No. 3020029) Mobilith SHA 460
*MPG may be substituted for these lubricants, if necessary, but service intervals will be reduced.	

NOTICE

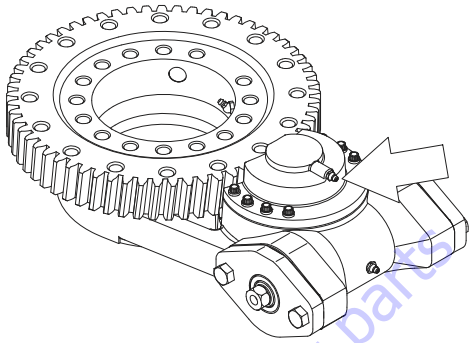
LUBRICATION INTERVALS ARE BASED ON MACHINE OPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTI-SHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

1. Swing Bearing

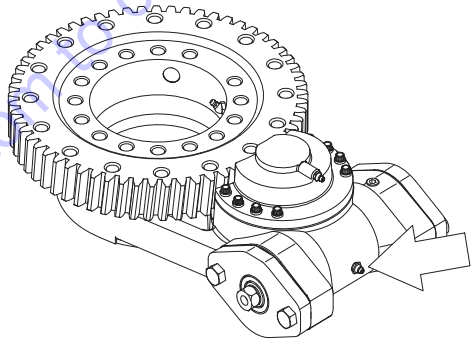
Lube Point(s) - Remote Fitting
Capacity - A/R
Lube - BG
Interval -Every 3 months or 150 hrs of operation
Comments - Apply grease and rotate in 90 degree intervals until bearing is completely lubricated.



2. Swing Bearing/Worm Gear Teeth



Lube Point(s) - Grease Fittings
Capacity - A/R
Lube - BG
Interval - A/R

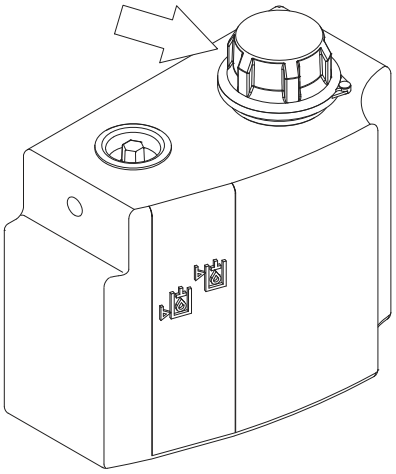


Lube Point(s) - Grease Fitting
Capacity - A/R
Lube - Mobile SHC 007
Interval - A/R

⚠ CAUTION

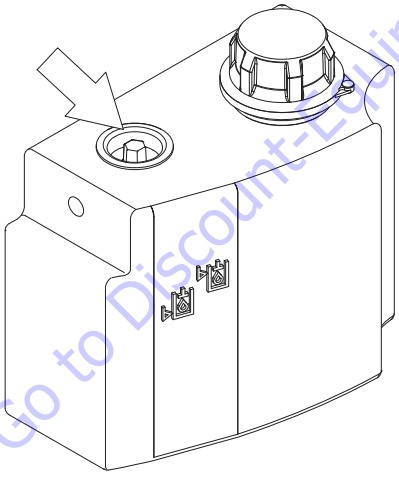
DO NOT OVERGREASE BEARINGS. OVERGREASING BEARINGS WILL RESULT IN BLOWING OUTER SEAL IN HOUSING.

3. Hydraulic Tank



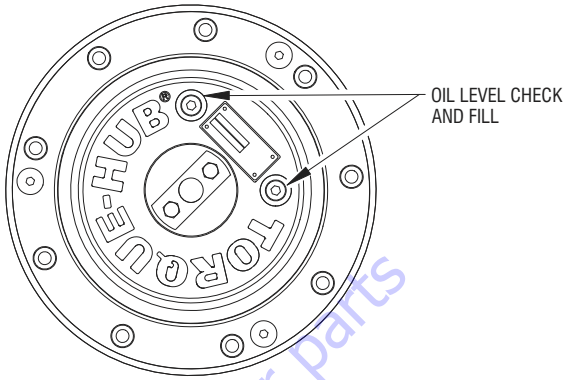
Lube Point(s) - Fill Cap
Capacity -2.9 Gal. (11 L), 2.1 Gal. (8 L) to Full Mark
Lube - HO
Interval - Check Level daily; Change every 2 years or 1200 hours of operation.
Comments - On new machines, those recently overhauled, or after changing hydraulic oil, operate all systems a minimum of two complete cycles and recheck oil level in reservoir.

4. Hydraulic Return Filter



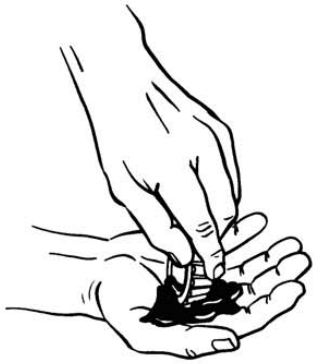
Interval - Change after first 50 hrs. and every 6 months or 300 hrs. thereafter.
Comments - Under certain conditions, it may be necessary to replace the hydraulic filter on a more frequent basis.

5. Wheel Drive Hub



Lube Point(s) - Level/Fill Plug
Capacity - 25.5 oz. (0.75 L)(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 Bearing



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

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)																		
SAE GRADE 5 BOLTS & GRADE 2 NUTS													SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*					
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry)		Torque Lubricated		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)		Torque (Loctite® 262™ or Vibra-TITE™ 131)		Clamp Load	Torque (Dry or Loctite® 263) K= 0.20		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=.18		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	8	0.9	6	0.7											
	48	0.1120	0.00661	420	9	1.0	7	0.8											
6	32	0.1380	0.00909	580	16	1.8	12	1.4											
	40	0.1380	0.01015	610	18	2.0	13	1.5											
8	32	0.1640	0.01400	900	30	3.4	22	2.5											
	36	0.1640	0.01474	940	31	3.5	23	2.6					1320	43	5				
10	24	0.1900	0.01750	1120	43	4.8	32	3.5					1580	60	7				
	32	0.1900	0.02000	1285	49	5.5	36	4					1800	68	8				
1/4	20	0.2500	0.0318	2020	96	10.8	75	9	105	12			2860	143	16	129	15		
	28	0.2500	0.0364	2320	120	13.5	86	10	135	15			3280	164	19	148	17		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	17	23	13	18	19	26	16	22	4720	25	35	20	25	20	25
	24	0.3125	0.0580	3700	19	26	14	19	21	29	17	23	5220	25	35	25	35	20	25
3/8	16	0.3750	0.0775	4940	30	41	23	31	35	48	28	38	7000	45	60	40	55	35	50
	24	0.3750	0.0878	5600	35	47	25	34	40	54	32	43	7900	50	70	45	60	35	50
7/16	14	0.4375	0.1063	6800	50	68	35	47	55	75	45	61	9550	70	95	65	90	50	70
	20	0.4375	0.1187	7550	55	75	40	54	60	82	50	68	10700	80	110	70	95	60	80
1/2	13	0.5000	0.1419	9050	75	102	55	75	85	116	68	92	12750	105	145	95	130	80	110
	20	0.5000	0.1599	10700	90	122	65	88	100	136	80	108	14400	120	165	110	150	90	120
9/16	12	0.5625	0.1820	11600	110	149	80	108	120	163	98	133	16400	155	210	140	190	115	155
	18	0.5625	0.2030	12950	120	163	90	122	135	184	109	148	18250	170	230	155	210	130	175
5/8	11	0.6250	0.2260	14400	150	203	110	149	165	224	135	183	20350	210	285	190	260	160	220
	18	0.6250	0.2560	16300	170	230	130	176	190	258	153	207	23000	240	325	215	290	180	245
3/4	10	0.7500	0.3340	21300	260	353	200		285	388	240	325	30100	375	510	340	460	280	380
	16	0.7500	0.3730	23800	300	407	220	298	330	449	268	363	33600	420	570	380	515	315	430
7/8	9	0.8750	0.4620	29400	430	583	320	434	475	646	386	523	41600	605	825	545	740	455	620
	14	0.8750	0.5090	32400	470	637	350	475	520	707	425	576	45800	670	910	600	815	500	680
1	8	1.0000	0.6060	38600	640	868	480	651	675	918	579	785	51500	860	1170	770	1045	645	875
	12	1.0000	0.6630	42200	700	949	530	719	735	1000	633	858	59700	995	1355	895	1215	745	1015
1 1/8	7	1.1250	0.7630	42300	800	1085	600	813	840	1142	714	968	68700	1290	1755	1160	1580	965	1310
	12	1.1250	0.8560	47500	880	1193	660	895	925	1258	802	1087	77000	1445	1965	1300	1770	1085	1475
1 1/4	7	1.2500	0.9690	53800	1120	1518	840	1139	1175	1598	1009	1368	87200	1815	2470	1635	2225	1365	1855
	12	1.2500	1.0730	59600	1240	1681	920	1247	1300	1768	1118	1516	96600	2015	2740	1810	2460	1510	2055
1 3/8	6	1.3750	1.1550	64100	1460	1979	1100	1491	1525	2074	1322	1792	104000	2385	3245	2145	2915	1785	2430
	12	1.3750	1.3150	73000	1680	2278	1260	1708	1750	2380	1506	2042	118100	2705	3680	2435	3310	2030	2760
1 1/2	6	1.5000	1.4050	78000	1940	2630	1460	1979	2025	2754	1755	2379	126500	3165	4305	2845	3870	2370	3225
	12	1.5000	1.5800	87700	2200	2983	1640	2224	2300	3128	1974	2676	142200	3555	4835	3200	4350	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS
2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%
3. * ASSEMBLY USES HARDENED WASHER

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Figure 1-2. Torque Chart (SAE Fasteners - Sheet 1 of 5)

REFERENCE JLG THREAD LOCKING COMPOUND			
JLG P/N	Loctite® P/N	ND Industries P/N	Description
0100011	242™	Vibra-TITE™ 121	Medium Strength (Blue)
0100019	271™	Vibra-TITE™ 140	High Strength (Red)
0100071	262™	Vibra-TITE™ 131	Medium - High Strength (Red)

				Values for Magni Coating Fasteners (Ref 4150701)												
				SAE GRADE 5 BOLTS & GRADE 2 NUTS							SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*						
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry) K=0.17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15		Clamp Load	Torque (Dry or Loctite® 263) K= 0.17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	7	0.8											
	48	0.1120	0.00661	420	8	0.9											
6	32	0.1380	0.00909	580	14	1.5											
	40	0.1380	0.01015	610	14	1.6											
8	32	0.1640	0.01400	900	25	2.8											
	36	0.1640	0.01474	940	26	2.9					1320	37	4				
10	24	0.1900	0.01750	1120	36	4.1					1580	51	6				
	32	0.1900	0.02000	1285	42	4.7					1800	58	7				
1/4	20	0.2500	0.0318	2020	86	9.7	80	9			2860	122	14	114	13		
	28	0.2500	0.0364	2320	99	11.1	95	11			3280	139	16	131	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	15	20	14	19	15	20	4720	20	25	20	25	20	25
	24	0.3125	0.0580	3700	15	20	15	21	15	20	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	4940	25	35	25	34	25	34	7000	35	50	35	50	35	50
	24	0.3750	0.0878	5600	30	40	28	38	25	34	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	6800	40	55	40	54	35	48	9550	60	80	55	75	50	70
	20	0.4375	0.1187	7550	45	60	44	60	40	54	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	9050	65	90	60	82	55	75	12750	90	120	85	115	80	110
	20	0.5000	0.1599	10700	75	100	71	97	65	88	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	11600	90	120	87	118	80	109	16400	130	175	125	170	115	155
	18	0.5625	0.2030	12950	105	145	97	132	90	122	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	14400	130	175	120	163	115	156	20350	180	245	170	230	160	220
	18	0.6250	0.2560	16300	145	195	136	185	125	170	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	21300	225	305	213	290	200	272	30100	320	435	300	410	280	380
	16	0.7500	0.3730	23800	255	345	238	324	225	306	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	29400	365	495	343	466	320	435	41600	515	700	485	660	455	620
	14	0.8750	0.5090	32400	400	545	378	514	355	483	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	38600	545	740	515	700	480	653	51500	730	995	685	930	645	875
	12	1.0000	0.6630	42200	600	815	563	765	530	721	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	42300	675	920	635	863	595	809	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	47500	755	1025	713	969	670	911	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	53800	955	1300	897	1219	840	1142	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	59600	1055	1435	993	1351	930	1265	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	64100	1250	1700	1175	1598	1100	1496	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	73000	1420	1930	1338	1820	1255	1707	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	78000	1660	2260	1560	2122	1465	1992	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	87700	1865	2535	1754	2385	1645	2237	142200	3020	4105	2845	3870	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS
2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%
3. * ASSEMBLY USES HARDENED WASHER

NO. 5000059 REV. K

Figure 1-3. Torque Chart (SAE Fasteners - Sheet 2 of 5)

Size	TPI	Bolt Dia	Tensile Stress Area	SOCKET HEAD CAP SCREWS												
				Magni Coating (Ref 4150701)*							Zinc Yellow Chromate Fasteners (Ref 4150707)*					
				Clamp Load See Note 4	Torque (Dry) K = .17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85®) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15		Clamp Load See Note 4	Torque (Dry) K = .20		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85®) K=0.18		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604														
	48	0.1120	0.00661														
6	32	0.1380	0.00909														
	40	0.1380	0.01015														
8	32	0.1640	0.01400														
	36	0.1640	0.01474														
10	24	0.1900	0.01750														
	32	0.1900	0.02000														
1/4	20	0.2500	0.0318	2860	122	14	114	13			2860	143	16	129	15		
	28	0.2500	0.0364	3280	139	16	131	15			3280	164	19	148	17		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	20	25	20	25	20	25	4720	25	35	20	25	20	25
	24	0.3125	0.0580	5220	25	35	20	25	20	25	5220	25	35	25	35	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50	7000	45	60	40	55	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50	7900	50	70	45	60	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70	9550	70	95	65	90	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80	10700	80	110	70	95	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110	12750	105	145	95	130	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120	14400	120	165	110	150	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155	16400	155	210	140	190	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175	18250	170	230	155	210	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220	20350	210	285	190	260	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245	23000	240	325	215	290	180	245
3/4	10	0.7500	0.3340	30100	320	435	300		280	380	30100	375	510	340	460	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430	33600	420	570	380	515	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620	41600	605	825	545	740	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680	45800	670	910	600	815	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875	51500	860	1170	775	1055	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015	59700	995	1355	895	1215	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310	68700	1290	1755	1160	1580	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475	77000	1445	1965	1300	1770	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855	87200	1815	2470	1635	2225	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055	96600	2015	2740	1810	2460	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430	104000	2385	3245	2145	2915	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760	118100	2705	3680	2435	3310	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225	126500	3165	4305	2845	3870	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625	142200	3555	4835	3200	4350	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM

4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

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Figure 1-4. Torque Chart (SAE Fasteners - Sheet 3 of 5)

			Values for Zinc Yellow Chromate Fasteners (Ref 4150707)								
			CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS					CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3 - M5*			
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™)	Torque (Lub)	Torque (Loctite® 262™ OR Vibra-TITE™ 131)	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.20	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K= 0.18	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]	[N.m]	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.3	1.0	1.2	1.4	3.13			
3.5	0.6	6.78	2.95	2.1	1.6	1.9	2.3	4.22			
4	0.7	8.78	3.82	3.1	2.3	2.8	3.4	5.47			
5	0.8	14.20	6.18	6.2	4.6	5.6	6.8	8.85			
6	1	20.10	8.74	11	7.9	9.4	12	12.5			
7	1	28.90	12.6	18	13	16	19	18.0	25	23	19
8	1.25	36.60	15.9	26	19	23	28	22.8	37	33	27
10	1.5	58.00	25.2	50	38	45	55	36.1	70	65	55
12	1.75	84.30	36.7	88	66	79	97	52.5	125	115	95
14	2	115	50.0	140	105	126	154	71.6	200	180	150
16	2	157	68.3	219	164	197	241	97.8	315	280	235
18	2.5	192	83.5	301	226	271	331	119.5	430	385	325
20	2.5	245	106.5	426	320	383	469	152.5	610	550	460
22	2.5	303	132.0	581	436	523	639	189.0	830	750	625
24	3	353	153.5	737	553	663	811	222.0	1065	960	800
27	3	459	199.5	1080	810	970	1130	286.0	1545	1390	1160
30	3.5	561	244.0	1460	1100	1320	1530	349.5	2095	1885	1575
33	3.5	694	302.0	1990	1490	1790	2090	432.5	2855	2570	2140
36	4	817	355.5	2560	1920	2300	2690	509.0	3665	3300	2750
42	4.5	1120	487.0	4090	3070	3680	4290	698.0	5865	5275	4395

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS
2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%
*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM
4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

NO. 5000059 REV. K

Figure 1-5. Torque Chart (METRIC Fasteners - Sheet 4 of 5)

Values for Magni Coated Fasteners (Ref 4150701)										
			CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS				CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M6 AND ABOVE*			
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™) K=0.17	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.16	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=0.15	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.17	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K= 0.16	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.1	1.1	1.0	3.13			
3.5	0.6	6.78	2.95	1.8	1.7	1.5	4.22			
4	0.7	8.78	3.82	2.6	2.4	2.3	5.47			
5	0.8	14.20	6.18	5.3	4.9	4.6	8.85			
6	1	20.10	8.74	9	8.4	7.9	12.5	13	12	11
7	1	28.90	12.6	15	14	13	18.0	21	20	19
8	1.25	36.60	15.9	22	20	19	22.8	31	29	27
10	1.5	58.00	25.2	43	40	38	36.1	61	58	55
12	1.75	84.30	36.7	75	70	66	52.5	105	100	95
14	2	115	50.0	119	110	105	71.6	170	160	150
16	2	157	68.3	186	175	165	97.8	265	250	235
18	2.5	192	83.5	256	240	225	119.5	365	345	325
20	2.5	245	106.5	362	340	320	152.5	520	490	460
22	2.5	303	132.0	494	465	435	189.0	705	665	625
24	3	353	153.5	627	590	555	222.0	905	850	800
27	3	459	199.5	916	860	810	286.0	1315	1235	1160
30	3.5	561	244.0	1245	1170	1100	349.5	1780	1680	1575
33	3.5	694	302.0	1694	1595	1495	432.5	2425	2285	2140
36	4	817	355.5	2176	2050	1920	509.0	3115	2930	2750
42	4.5	1120	487.0	3477	3275	3070	698.0	4985	4690	4395

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS
2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%
*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM
4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

NO. 5000059 REV. K

Figure 1-6. Torque Chart (METRIC Fasteners - Sheet 5 of 5)

PARTS FINDER

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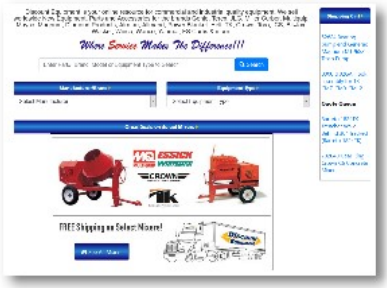

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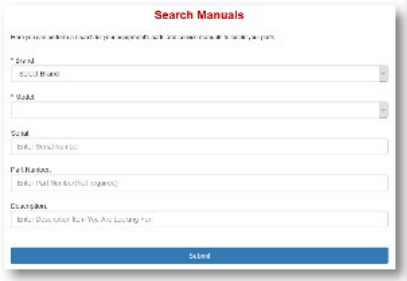

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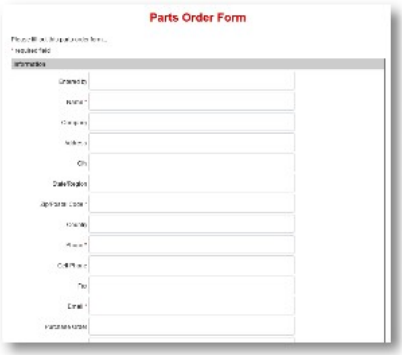

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

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. With proper care, maintenance, and inspections performed per JLG's recommendations, and with any and all discrepancies corrected, this product will be fit for continued use.

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-Trained 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 whenever there's an Operator change.	User or Operator	User or Operator	Operation 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-Trained Service Technician (Recommended)	Service and Maintenance Manual and applicable JLG inspection form.
Preventive 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 Assembly

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

NOTICE

SELF LOCKING FASTENERS, SUCH AS NYLON INSERT AND THREAD DEFORMING LOCKNUTS, ARE NOT INTENDED TO BE REINSTALLED AFTER REMOVAL.

1. Always use new replacement hardware when installing locking fasteners.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 DTE11M hydraulic oil, which has an SAE viscosity of 10W and a viscosity index of 168.

NOTE: *Start-up of hydraulic system with oil temperatures below -20 degrees F (-29 degrees C) is not recommended. If it is necessary to start the system in a sub-zero environment, it will be necessary to heat the oil with a low density, 100VAC heater to a minimum temperature of -20 degrees F (-29 degrees C).*

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.
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

Theory

When a hydraulic cylinder is supporting a load, cylinder drift may occur as a result of any of the circumstances below:

- Normal leakage of load holding valves or malfunction of load holding valves. See Cylinder Leakage Test and Table 2-2, Cylinder Drift below for evaluation.
- Damaged or worn piston seals.
- Normal thermal expansion or contraction of the hydraulic oil within cylinders (See Cylinder Thermal Drift below).

The first two circumstances may result in cylinder movement due to oil leaking out of the cylinder externally or by leaking back to tank or due to oil leaking internally from one cylinder chamber to the other.

Thermal expansion or contraction of oil in hydraulic cylinders is a normal occurrence and does not result in oil leaking out of the cylinder or leaking internally from one cylinder chamber to the other. Thermal expansion or contraction is the tendency for materials to change size in response to a change in temperature.

Cylinder Leakage Test

Cylinder oil must be at stabilized ambient temperature before beginning this test.

Measure drift at cylinder rod with a calibrated dial indicator.

In an area free of obstructions, cylinder must have load applied and appropriately positioned to detect drift.

Cylinder leakage is acceptable if it passes this test.

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	0.004	0.10
9	228.6	0.003	0.08

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

Cylinder Thermal Drift

The oil in all hydraulic cylinders will expand or contract due to thermal effects over time and may result in changes to the boom and/or platform position while the machine is stationary. These effects occur as the cylinder oil changes temperature, usually from a higher oil temperature as it cools and approaches the ambient air temperature. Results of these effects are related to several factors including cylinder length and change in temperature over the time the cylinder remains stationary.

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-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection	Every 2 Years
Boom Assembly			
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			
Platform		1,2	
Railing	1	1,2	
Gate	1,5	1,5	
Floor	1	1,2	
Rotator	5,9,15		
Lanyard Anchorage Point	1,2,10	1,2,10	
Turntable Assembly			
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			
Tires	16,17,18	16,17,18	
Wheel Nuts/Bolts	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			
Platform Controls	5,6	6	

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL		
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection	Every 2 Years
Ground Controls	5,6	6	
Function Control Locks, Guards, or Detents	1,5	5	
Footswitch	5	5	
Emergency Stop Switches (Ground & Platform)	5	5	
Function Limit or Cutout Switch Systems	5	5	
Capacity Indicator		5	
Drive Brakes	5		
Swing Brakes	5		
Boom Synchronization/Sequencing Systems		5	
Manual Descent or Auxiliary Power	5	5	
Power System			
Engine Idle, Throttle, and RPM	3	3	
Engine Fluids (Oil, Coolant, Fuel)	9,11	11	
Air/Fuel Filter	1,7	7	
Exhaust System	1,9	9	
Batteries	1,9	19	
Battery Fluid	11	11	
Battery Charger	5	5	
Fuel Reservoir, Cap, and Breather	1,2,5	1,5	
Hydraulic/Electric System			
Hydraulic Pumps	1,2,9		
Hydraulic Cylinders	1,2,7,9	1,2,9	
Cylinder Attachment Pins and Pin Retainers	1,2,9	1,2	
Hydraulic Hoses, Lines, and Fittings	1,2,9,12	1,2,9,12	
Hydraulic Reservoir, Cap, and Breather	1,2,5,9	1,5	24
Hydraulic Filter	1,7,9	7	
Hydraulic Fluid	7,11	7,11	
Electrical Connections	1,20	20	
Instruments, Gauges, Switches, Lights, Horn	1	5,23	
General			
Operators and Safety Manuals in Storage Box	21	21	
ANSI and EMI Manuals/Handbooks Installed		21	
Capacity Decals Installed, Secure, Legible	21	21	
All Decals/Placards Installed, Secure, Legible	21	21	

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL		
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection	Every 2 Years
Walk-Around Inspection Performed			
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, 22	
Paint and Appearance	7	7	
Stamp Inspection Date on Frame		22	
Notify JLG of Machine Ownership		22	

Footnotes:'

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

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

[3] 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

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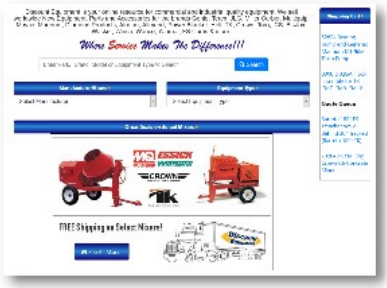

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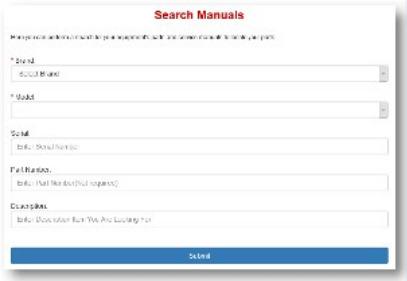

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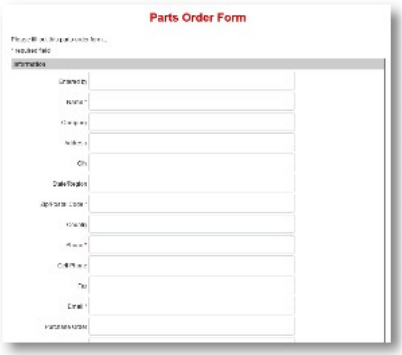

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

SECTION 3. CHASSIS & TURNTABLE

3.1 TIRES & WHEELS

Tire Inflation

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

Tire Damage

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

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

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

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

Tire Replacement

JLG recommends a replacement tire be the same size, ply and brand as originally installed on the machine. Please refer to the JLG Parts Manual for the part number of the approved tires for a particular machine model. If not using a JLG approved replacement tire, we recommend that replacement tires have the following characteristics:

- Equal or greater ply/load rating and size of original
- Tire tread contact width equal or greater than original
- Wheel diameter, width, and offset dimensions equal to the original
- Approved for the application by the tire manufacturer (including inflation pressure and maximum tire load)

Unless specifically approved by JLG Industries Inc. do not replace a foam filled or ballast filled tire assembly with a pneumatic tire. When selecting and installing a replacement tire, ensure that all tires are inflated to the pressure recommended by JLG. Due to size variations between tire brands, both tires on the same axle should be the same.

Wheel and Tire Replacement

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

Wheel Installation

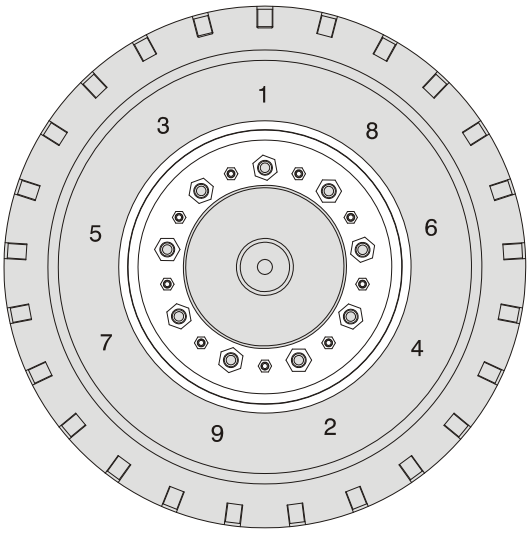
It is extremely important to apply and maintain proper wheel mounting torque.

⚠ WARNING

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

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

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 chart.

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 SPINDLE

Setting Wheel Bearing End Play

NOTICE

BE SURE NOT TO OVER-TIGHTEN THE SPINDLE NUT.

1. Tighten the spindle nut to assure the bearings are properly seated.
2. Loosen the spindle nut completely until the nut can be turned by hand.
3. Tighten the spindle nut by hand using a socket without rotating the hub.
4. If the cotter pin can be assembled with the spindle nut finger tight, insert cotter pin without backing the nut off. If the cotter pin cannot be assembled with the spindle nut hand tight, tighten the spindle nut to the nearest available slot and insert cotter pin. If more than ½ of the cotter pin hole in the spindle can be seen in a slot, back nut off to nearest slot and insert pin.
5. Check the unit for end play by moving the hub up & down parallel along the centerline of the spindle. If you can feel excessive end play (over the 0.010" [0.25 mm] specification), recheck the nut to see what is causing the excessive end play. Keep in mind that there can be some movement and still be within the 0.010" (0.25 mm) maximum specification. If there is no way of getting the excessive end play out by using your fingers, a socket or wrench may have to be used to set the end play.
6. The units should be checked visually to make sure the cotter pins are installed and that the correct components have been used. Each unit must also be checked for the proper feel to make sure there isn't excessive end play and the hubs turn freely.
7. Insert the dust cap and check to make sure the cotter pin is not going to interfere. Cap must be pressed all the way down. The unit should be checked again to assure it spins freely after the dust cap is installed.

Specifications

The end play specification is 0.001"/0.010" (0.025 / 0.254 mm) for all units.

Checking

The end play is checked by clamping the spindle in a fixture or vise and moving the hub parallel to the spindle centerline without rocking the hub. If the end play is set properly the following should apply:

1. Hub should rotate freely when spun by hand.
2. The hub should not be noticeably loose when moved parallel with spindle centerline.

Greasing Requirements

Hub assemblies shall have grease packed in the bearings via an appropriate greasing spindle or by hand. In either method, the bearing must be greased so the grease is forced thru the entire bearing cavity and thru the rollers of both inner and outer bearings.

Dust or grease caps used shall have grease applied to the inside of the cap.

The bearing cavity shall be filled 50 - 80% full of grease on all applications.

Dust or grease caps shall also be filled 10-20% full of grease on all applications prior to final assembly.

Visually verify that grease has flowed through all rollers of the inner and outer bearings.

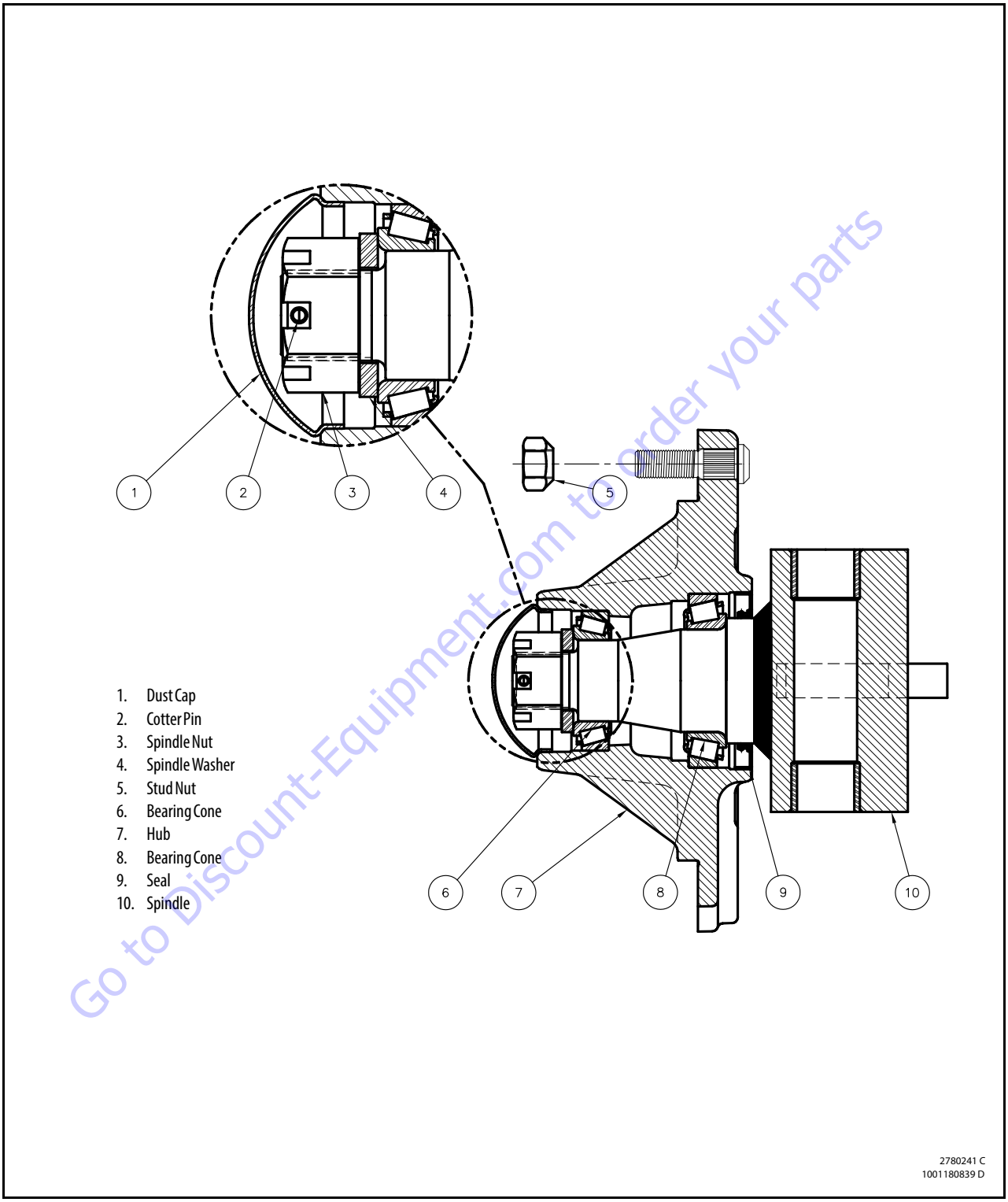
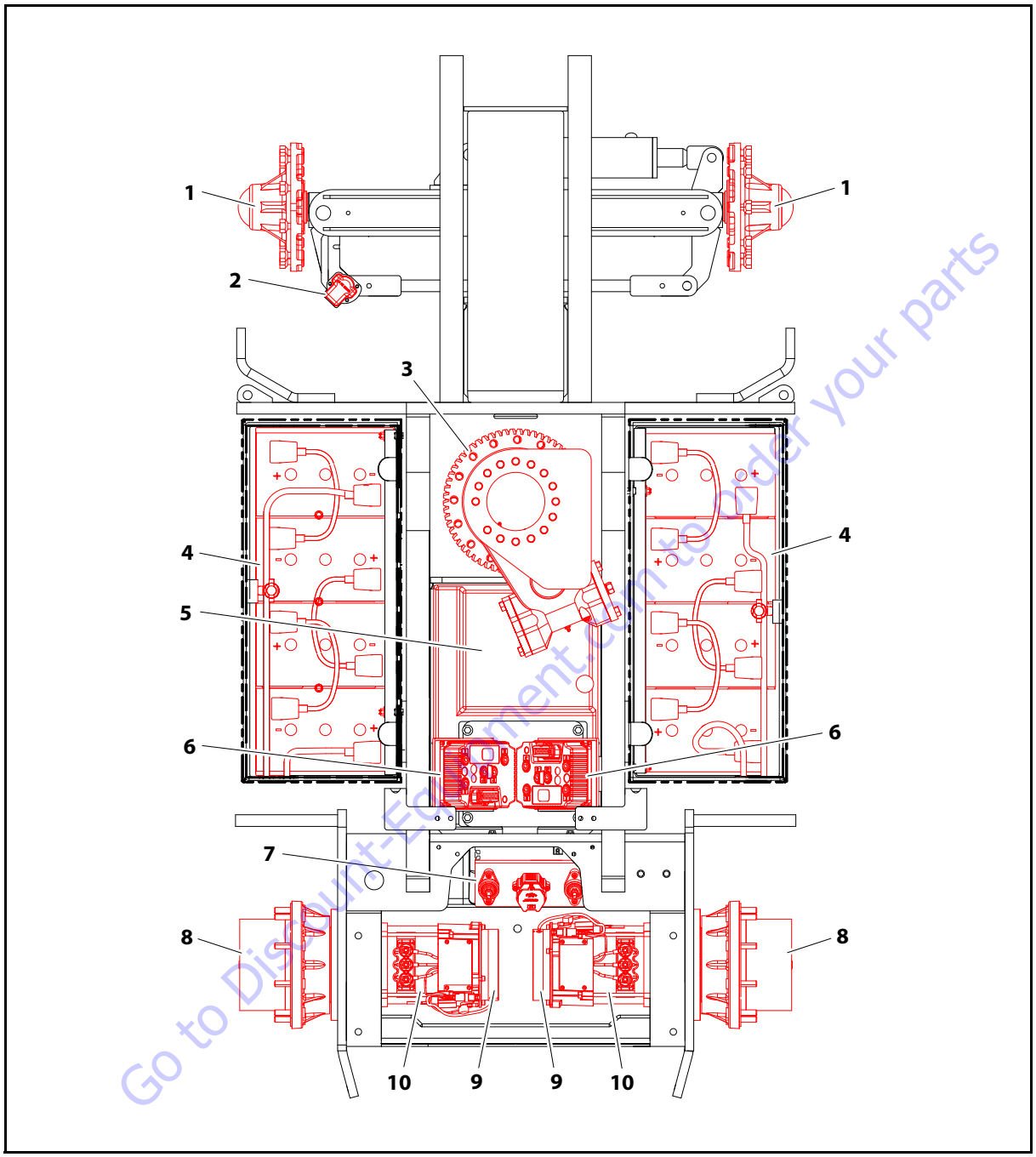
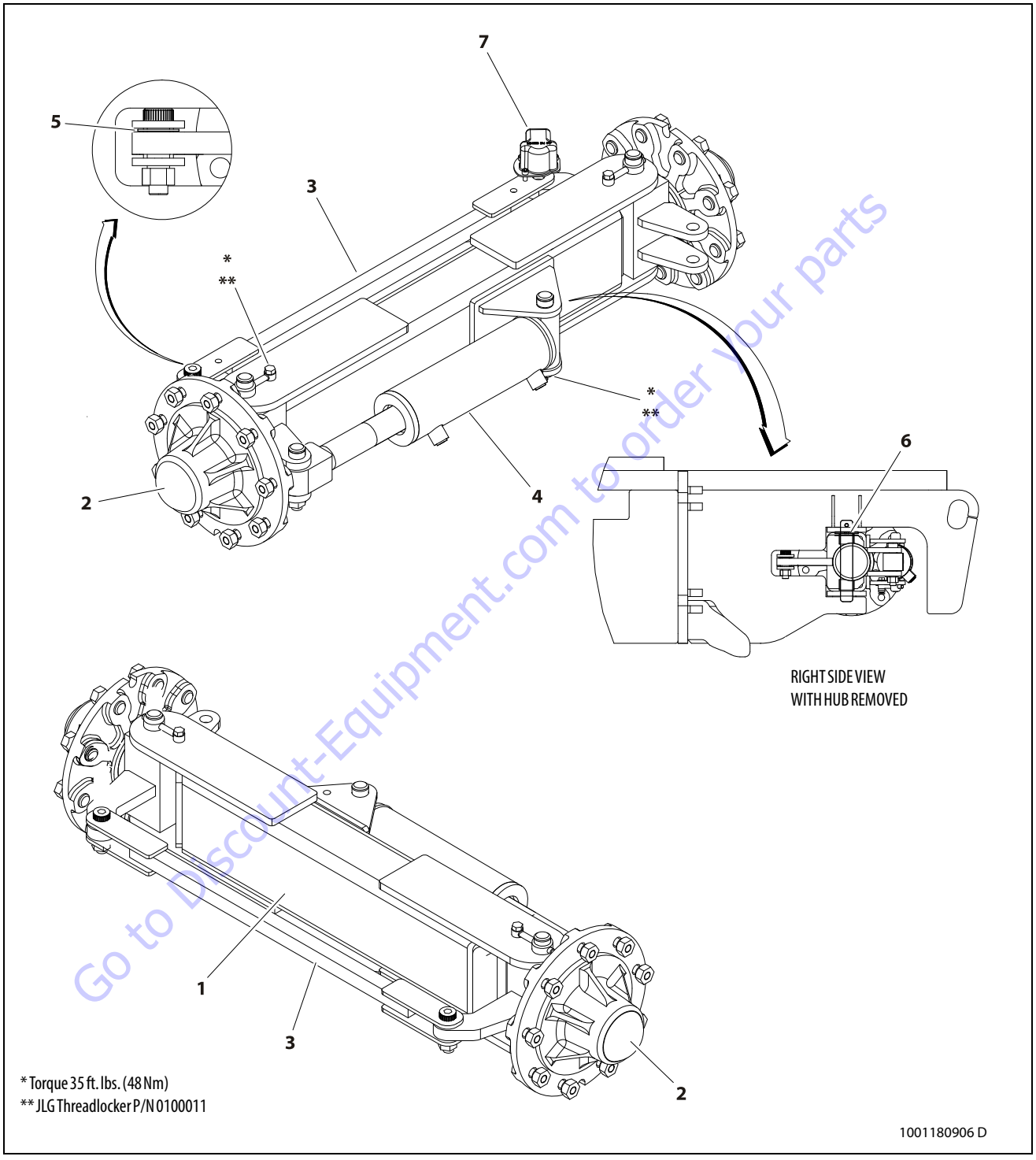


Figure 3-1. Spindle Assembly



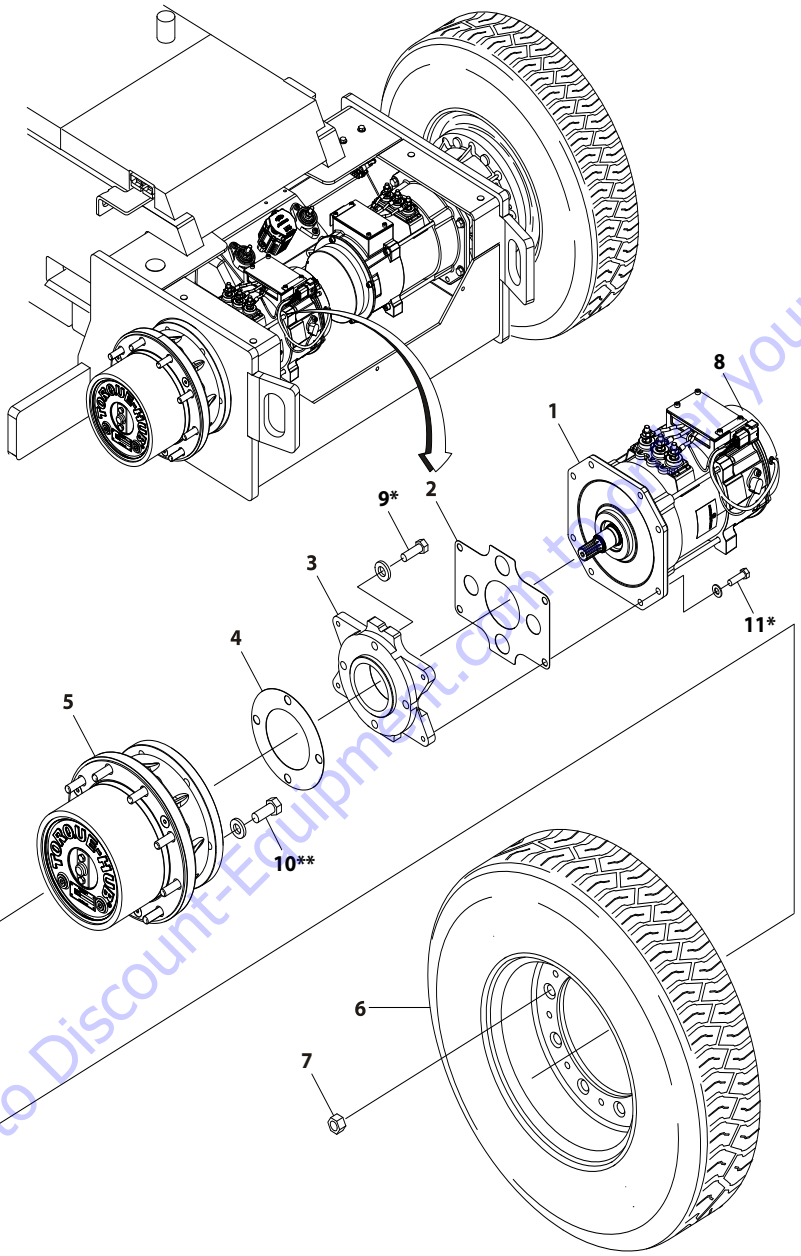
1. Spindle Assembly
2. Steer Angle Sensor
3. Swing Bearing
4. Battery
5. Hydraulic Tank
6. Drive Module
7. Electrical Assembly
8. Drive Hub
9. Drive Brake
10. Drive Motor

Figure 3-2. Chassis Component Location



1. Axle Assembly
2. Spindle Assembly
3. Tie Rod
4. Steer Cylinder
5. Thrust Washer
6. Thrust Bearing
7. Sensor Switch

Figure 3-3. Steering Installation



* Apply JLG Threadlocker P/N 0100011
**Apply JLG Threadlocker P/N 0100019 and Torque to 190 ft. lbs. (260 Nm)
Note: Before installing brake and motor, apply a light coat of grease to the splined shafts

1001179774 J

1. Drive Motor
2. Motor Seal
3. Motor Adapter
4. Hub Seal
5. Drive Hub
6. Tire & Wheel
7. Lug Nut
8. Drive Brake
9. Bolt
10. Bolt
11. Bolt

Figure 3-4. Drive Components

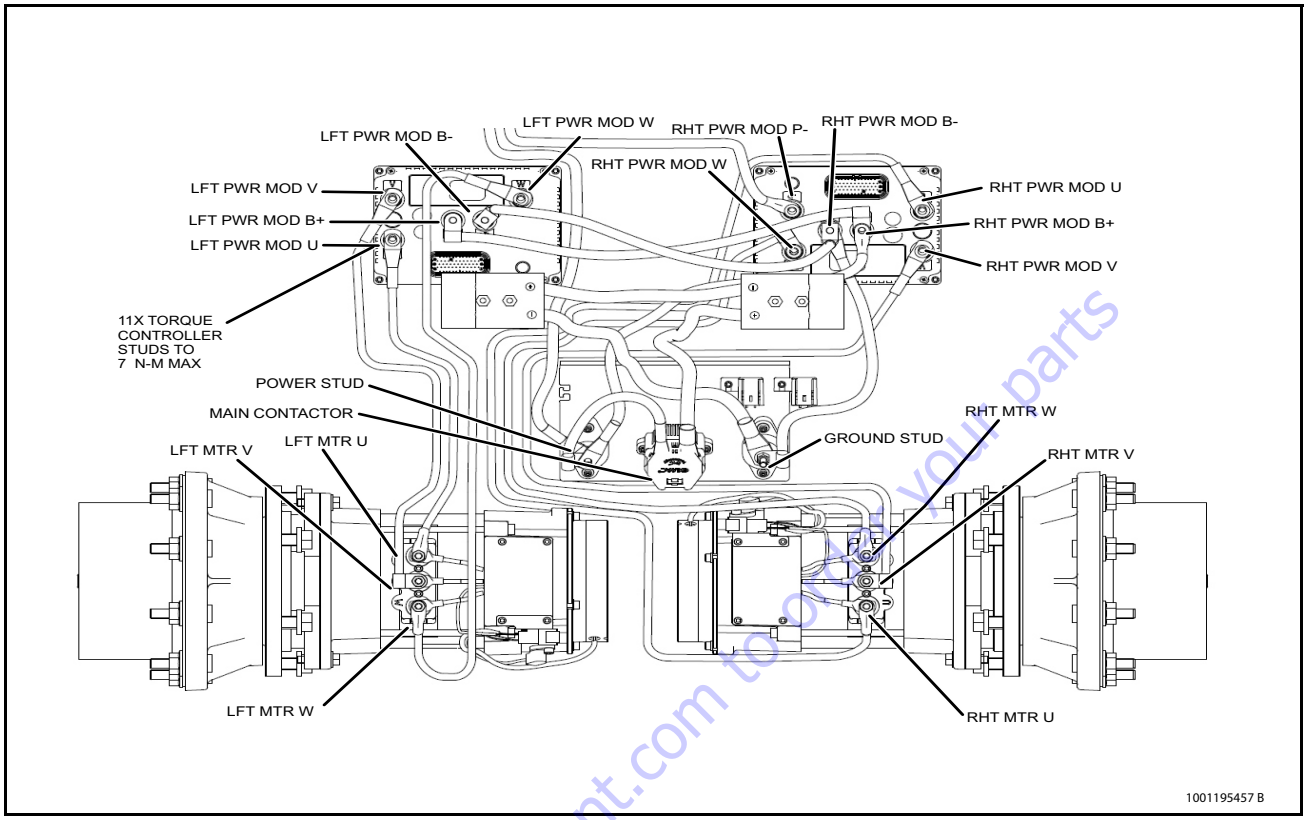


Figure 3-5. Frame Mounted Electrical Connection

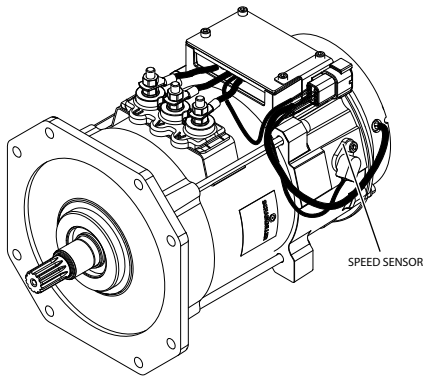
3.3 TILT SENSOR

When installing a new tilt sensor, always ensure that it is calibrated using the JLG Control System analyzer before operating the machine. Refer to Section 6, JLG Control System Analyzer Kit Instructions. For Tilt Sensor calibration refer to Section 6, Calibrating Tilt Sensor.

⚠ WARNING

TO ASSURE PROPER OPERATION, THE MACHINE MUST BE LEVEL WHEN INSTALLING AND CALIBRATING A NEW TILT SENSOR.

3.4 SPEED SENSOR



For proper drive operation, the speed sensors must be properly installed and adjusted. The sensor operates on a leading pulse to show direction. If installed wrong, the sensor will not be able to sense the proper direction.

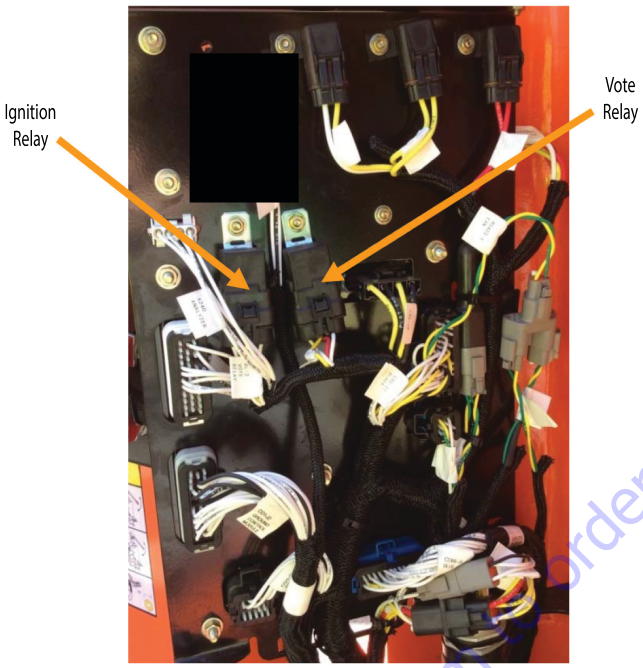


Figure 3-6. Relay

Figure 3-7. System Fuses

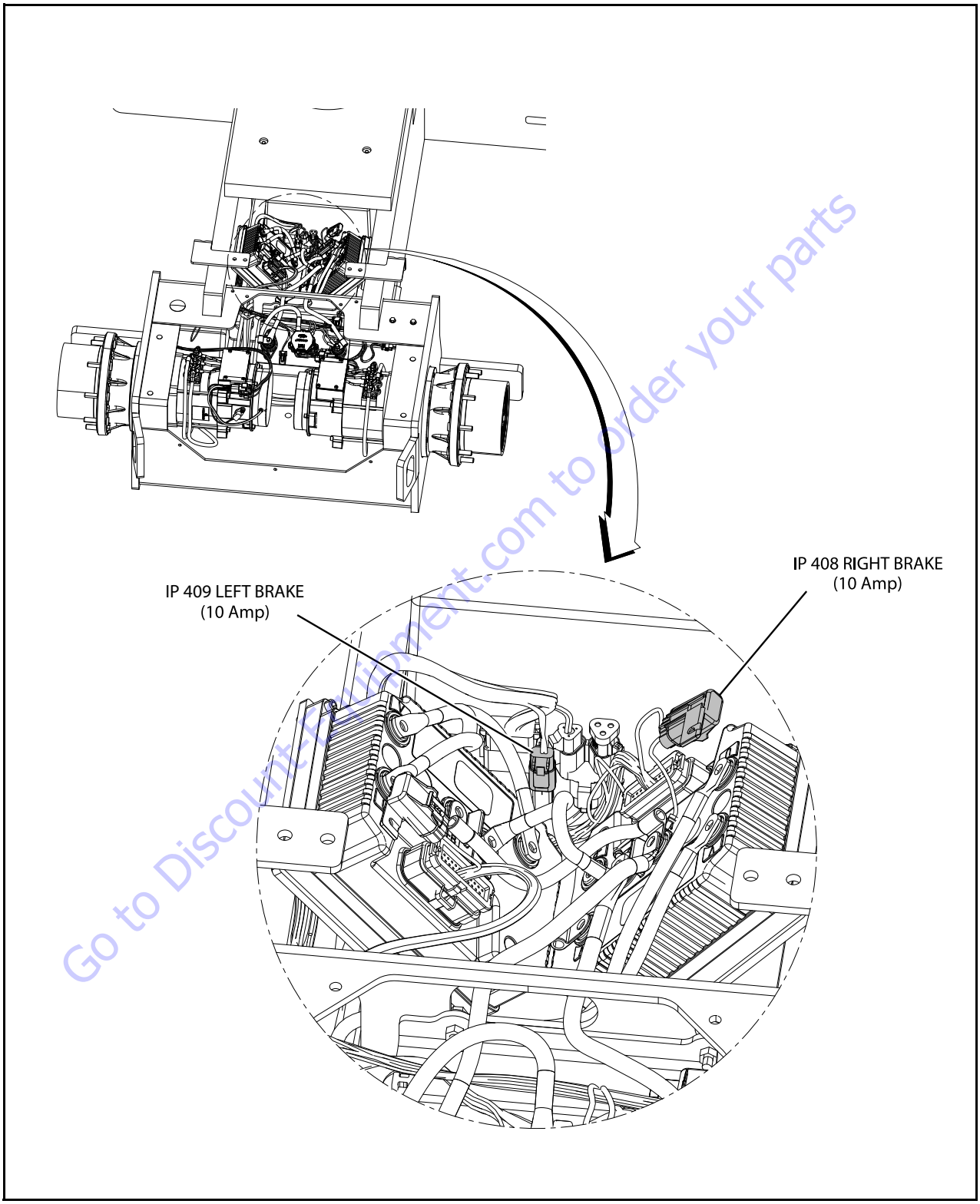


Figure 3-8. Brake Fuses

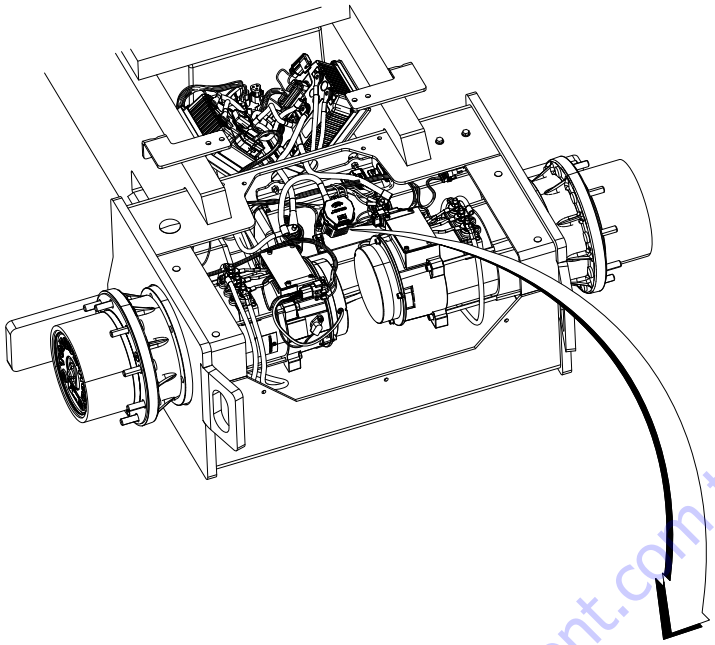


Figure 3-9. Drive Fuses

3.5 DRIVE HUB

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 property. The following information briefly outlines what to look for when performing these tests.

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

NOTE: *Bolts must be removed while performing brake release test.*

Roll Test

The purpose of the roll test is to determine if the unit's gears are rotating freely and properly. You should be able to rotate the gears in your unit by applying 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.

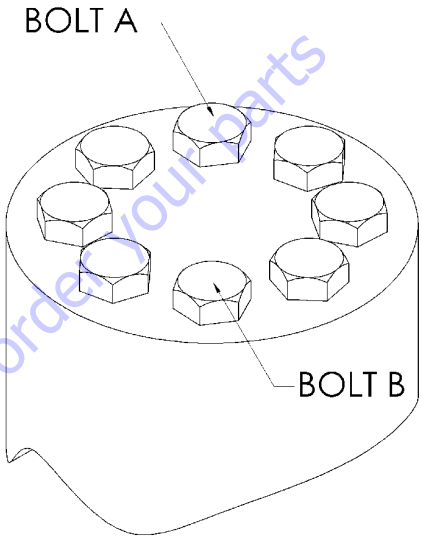
Leak Test (Main Unit)

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

NOTE: *Refer to Figure 3-10., Main Assembly - Sheet 1 of 2, and Figure 3-11., Main Assembly - Sheet 2 of 2,*

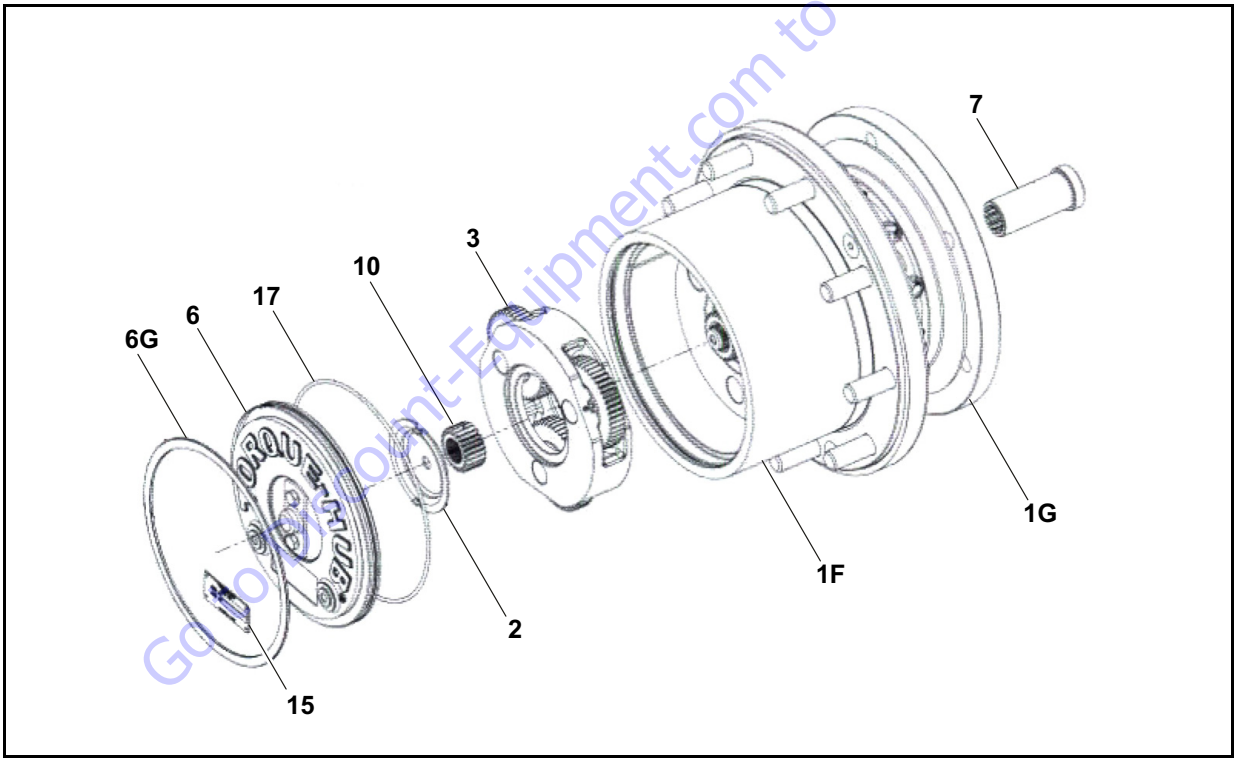
1. Perform Roll Check and Leak Check if applicable prior to disassembling the unit.
2. Drain oil from unit. Note the condition and volume of the oil.
3. Remove Coupling (7) from Spindle End first.
4. Remove Retaining Ring (6G) by prying the open end of Retaining Ring out of the groove in the Ring Gear (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).
8. Remove the Second Stage Sun Gear (11).
9. Remove the Input Shaft (9).

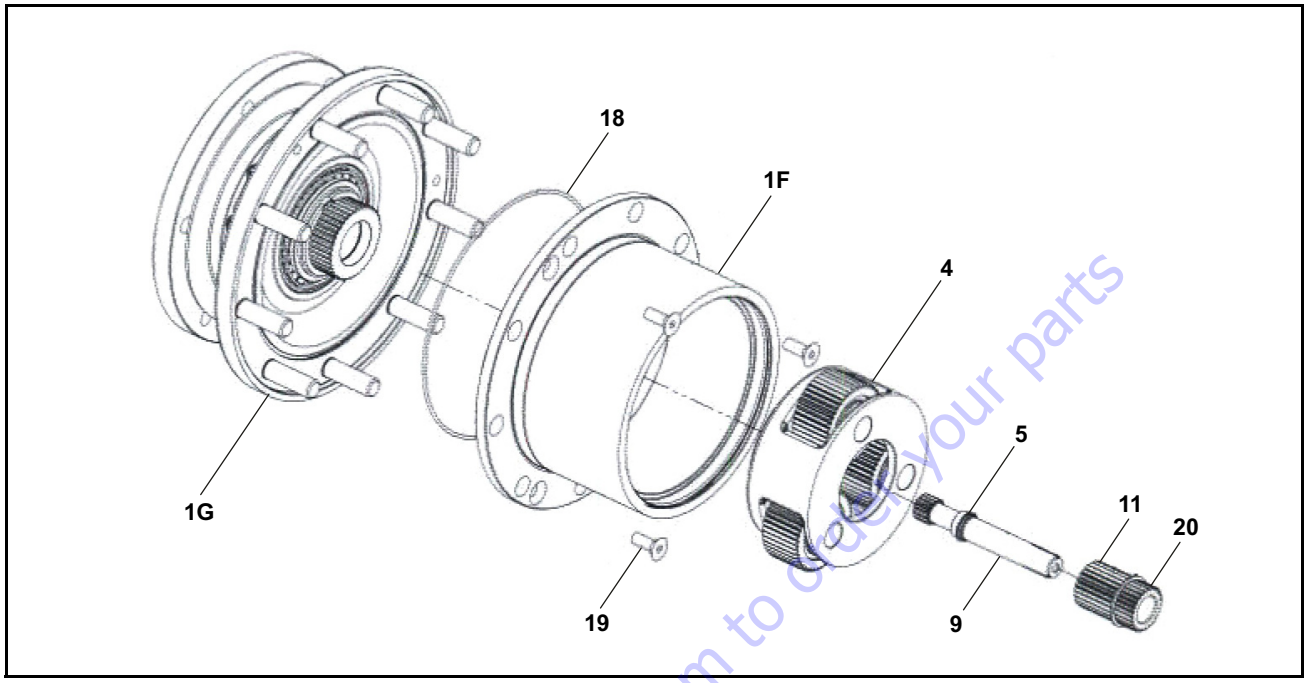
NOTE: *On units with a ratio 48:1, the Sun Gear (11) and the Input Shaft (9) will need to be removed together.*

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	7 Coupling
1G Housing	9 Input Shaft
2 Washer	10 First Stage Sun Gear
3 Input carrier Subassembly	11 Second Stage Sun Gear
4. Output carrier Subassembly	18 O-ring
8 Cover Assembly	19 Flat Head Bolt

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



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 Bolt
20 Retaining Ring

Figure 3-11. Main Assembly - Sheet 2 of 2

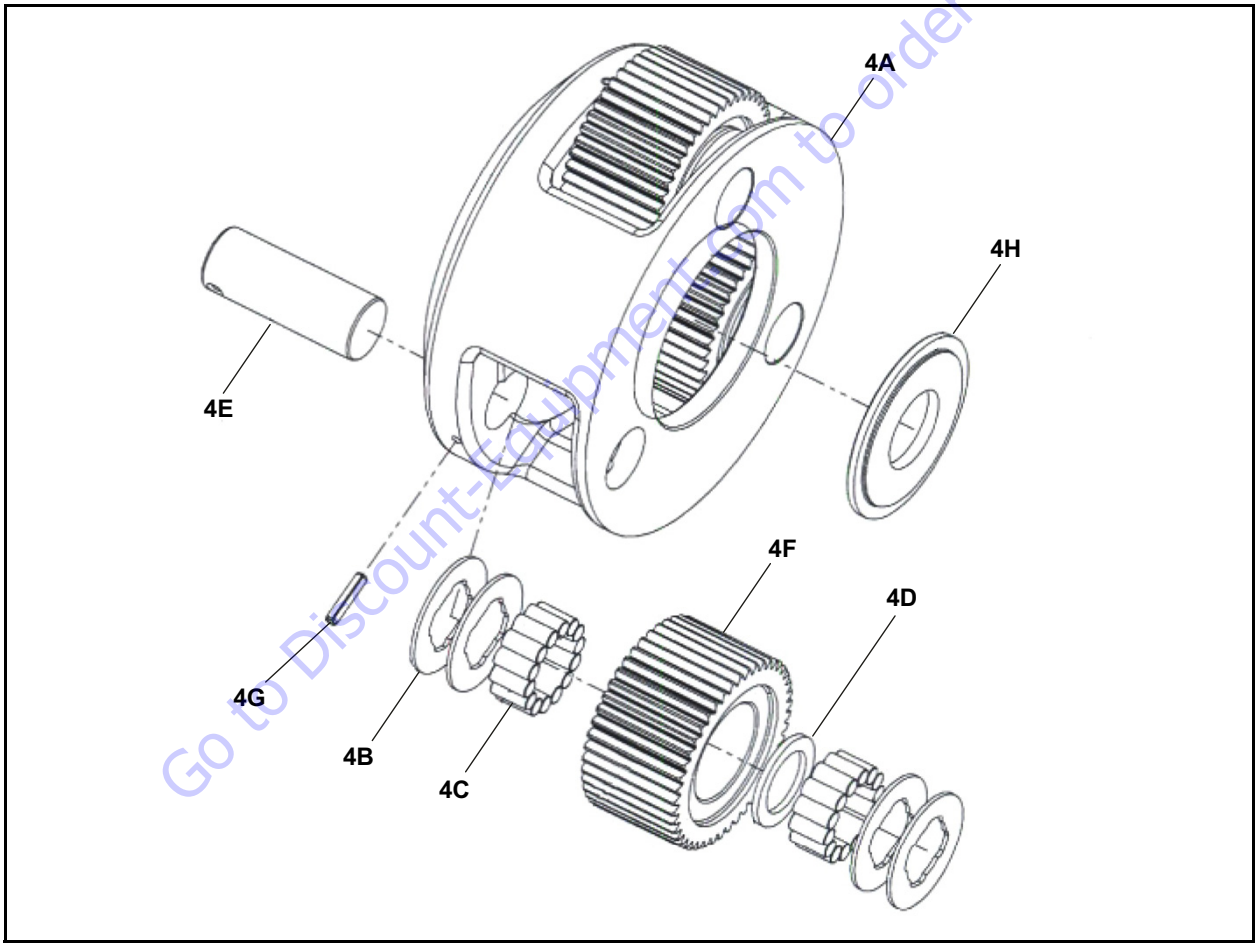
Output Carrier Disassembly

NOTE: *Refer to Figure 3-12., Output Carrier, and Figure 3-13., Planet Gear.*

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).

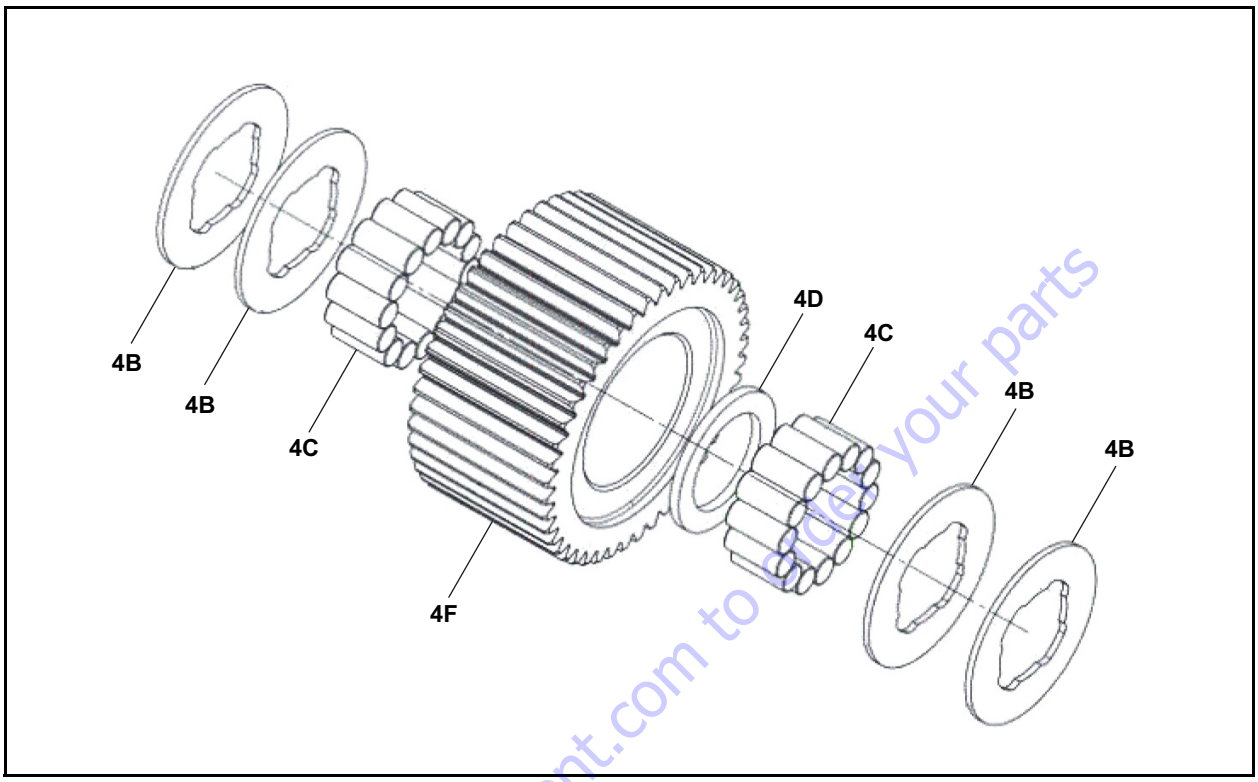
NOTE: *The Roll Pins (4G) should not be reused when reassembling the unit.*

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.
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).



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 3-12. Output Carrier



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

Figure 3-13. Planet Gear

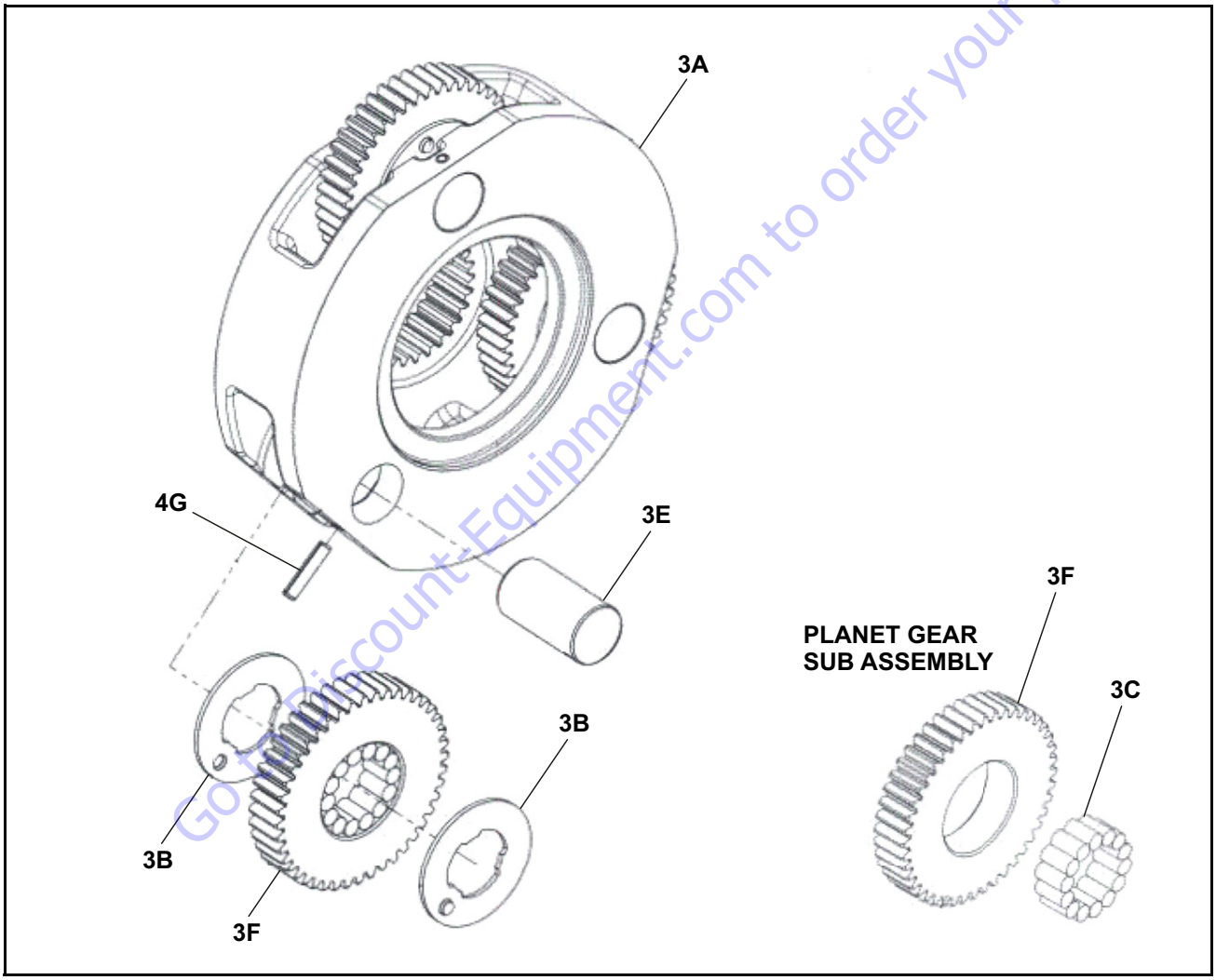
Input Carrier Disassembly

NOTE: *Refer to Figure 3-14., Input Carrier*

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.



3A Carrier	3E Planet Shaft
3B Thrust Washer	3F Planet Gear
3C Needle Bearing	4G Roll Pin

Figure 3-14. Input Carrier

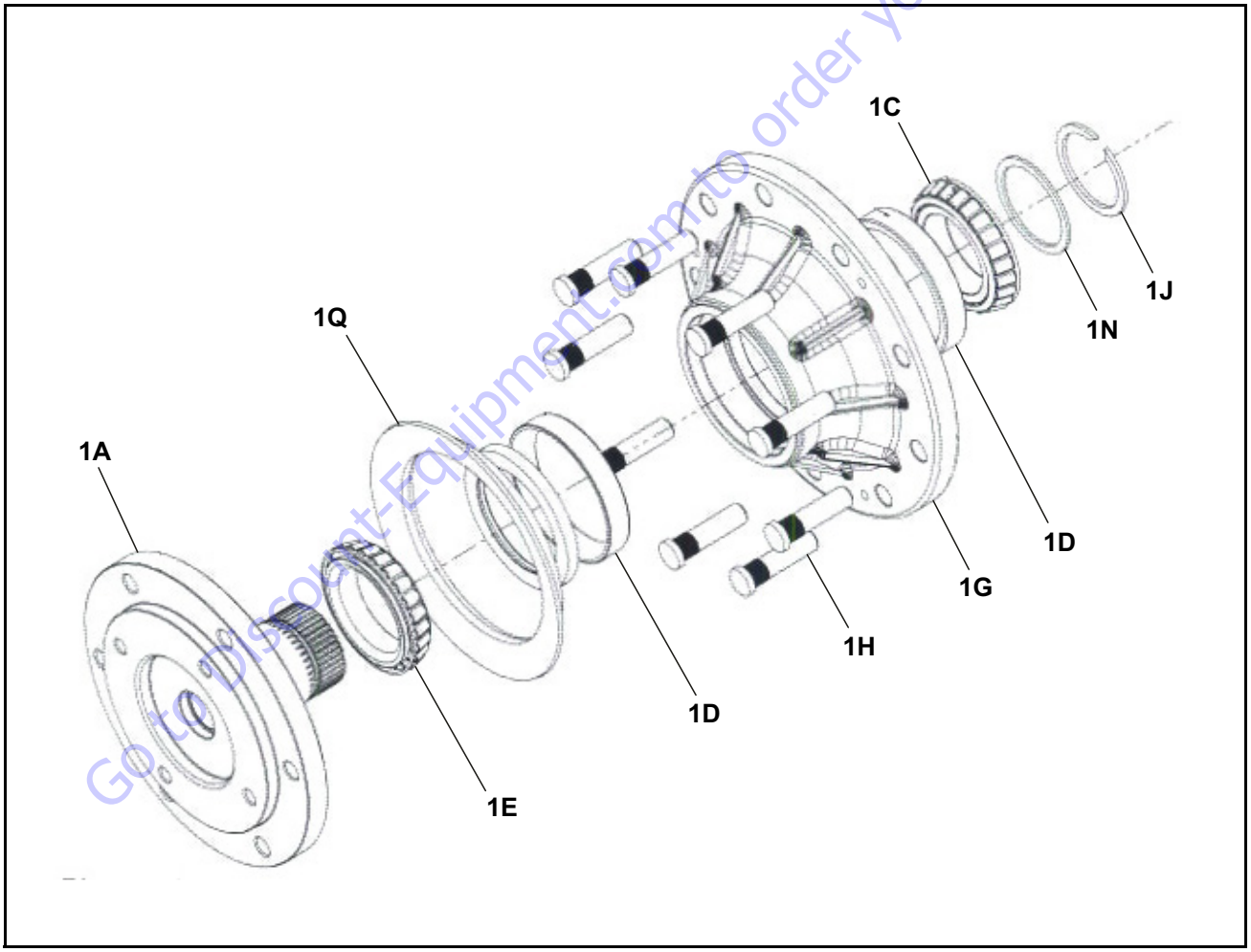
Hub-spindle Disassembly

NOTE: *Refer to Figure 3-15., Hub Spindle.*

1. Place unit on bench with Spindle (1A) end down.
2. Remove Retaining Ring (1J) with appropriate tool.
3. Remove Spacer (1N).
4. Remove Bearing Cone (1C) from Bearing Cup (1D) in Hub (1G).
5. Lift Hub (1G) off of Spindle (1A). 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 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
1N Spacer
1Q Seal Boot

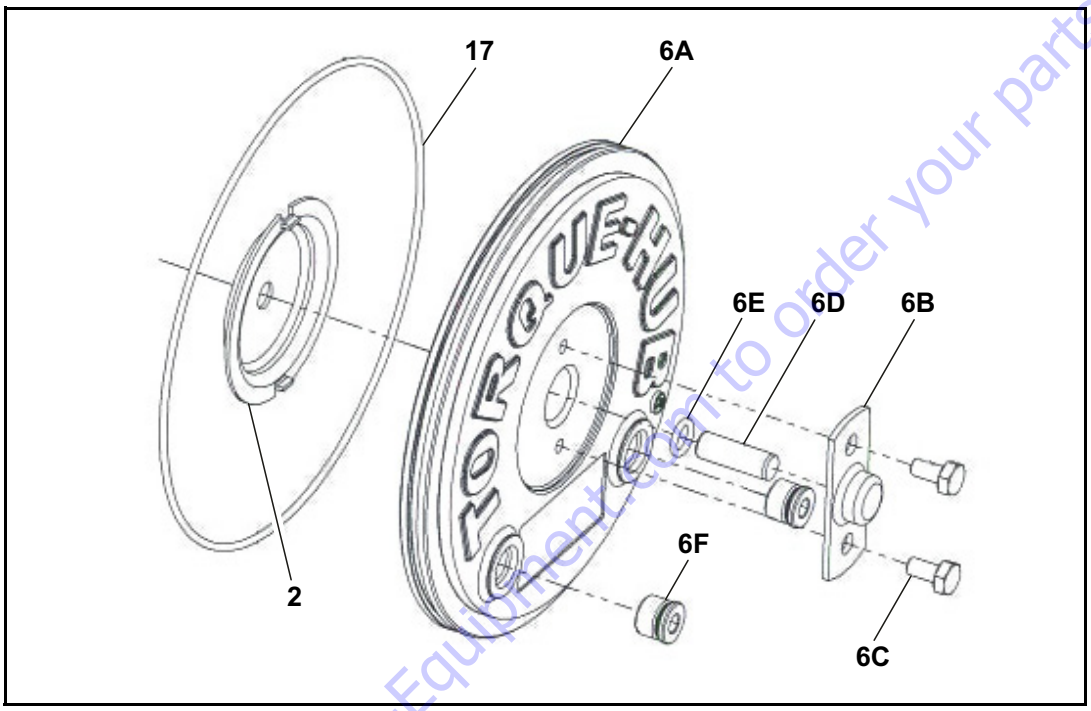
Figure 3-15. Hub Spindle

Cover Disassembly

NOTE: *Refer to Figure 3-16., Cover Assembly.*

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).

NOTE: *For reassembling unit, please refer to the exploded views in the disassembly sections.*



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

Figure 3-16. Cover Assembly

Input Carrier Assembly

NOTE: *Refer to Figure 3-14., 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 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

NOTE: *Refer to Figure 3-13., Planet Gear.*

11. Apply a liberal coat of grease to the bore of one Output Planet Gear (4F).
12. 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.*

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

Output Carrier Assembly

NOTE: *Refer to Figure 3-12., 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 0D of Carrier (4A).
6. Repeat Steps 1-5 for the installation of the two remaining Planet Gears (4F).

Hub-spindle Assembly

NOTE: *Refer to Figure 3-15., 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) into hub using appropriate pressing tool.
3. Turn hub over and press Bearing Cup (1D) into hub using appropriate pressing tool.
4. Place Bearing Cone (1E), into Bearing Cup (1D).
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).
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 Assembly

NOTE: *Refer to Figure 3-16., 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 (8-9 Nm).
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

NOTE: *Refer to Figure 3-10., Main Assembly - Sheet 1 of 2 and Figure 3-11., Main Assembly - Sheet 2 of 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 (20-27 Nm).

NOTE: *The output carrier sub- assembly does not need timed with the spindle splines.*

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.
15. Insert Plastic Plug (12) into place if applicable.

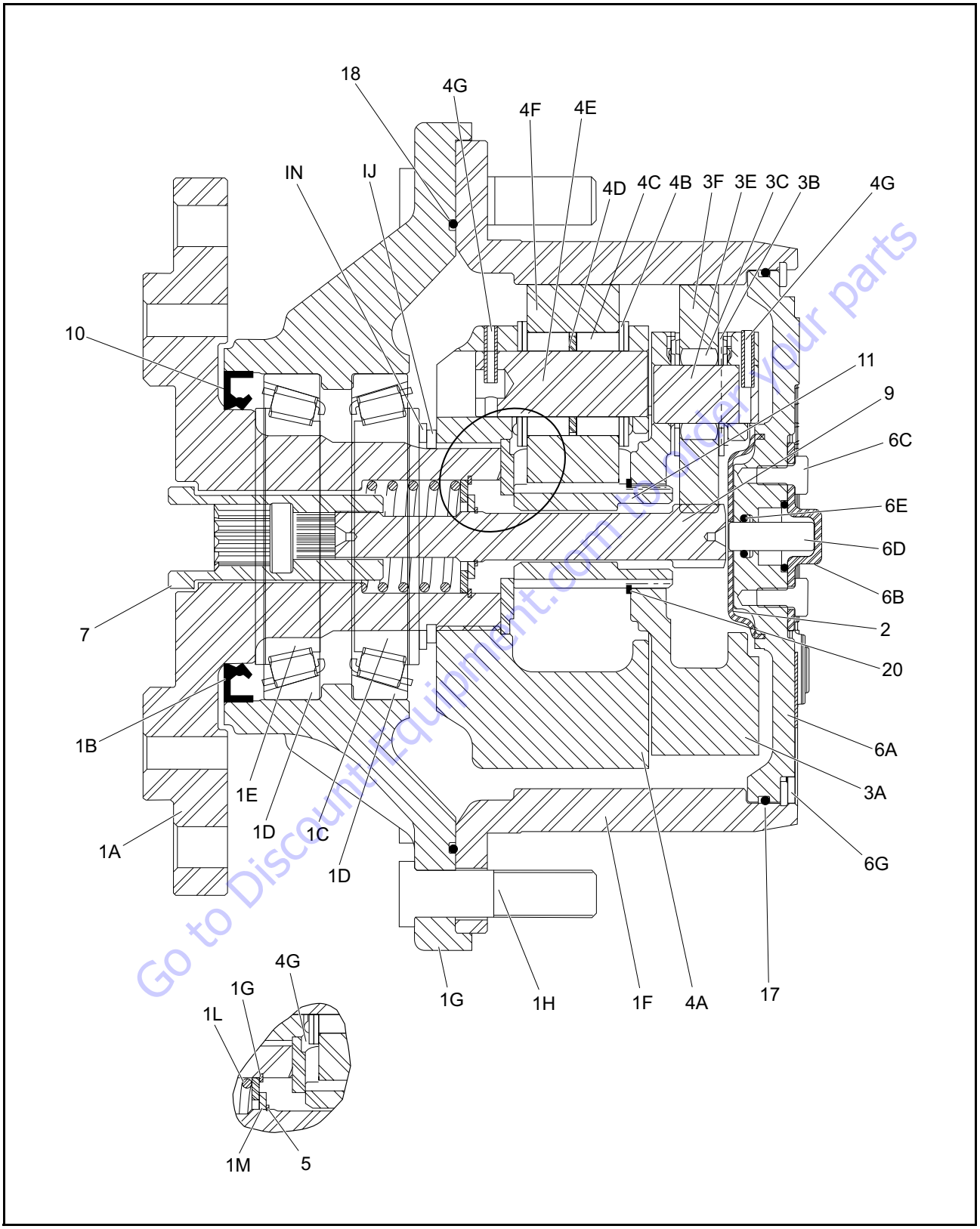


Figure 3-17. Drive Hub - Sheet 1 of 2

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
1K Retaining Ring
1L Spring
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
6A Cover
6B Disengage Cap
6C Bolt
6D Dowel Pin
6E O-ring
6F Pipe Plug
6G Retaining Ring
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
20 Retaining Ring

Figure 3-18. Drive Hub - Sheet 2 of 2

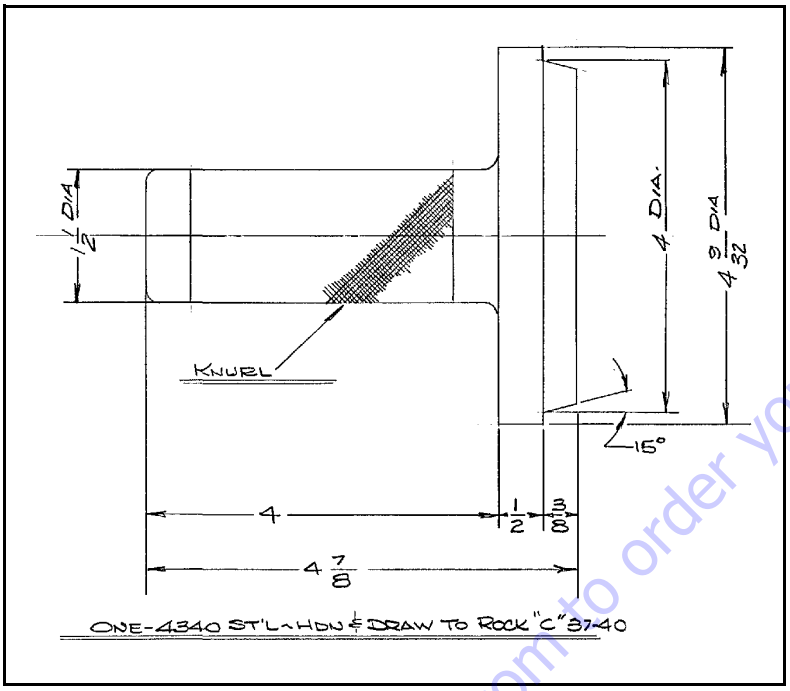


Figure 3-19. Cup Pressing Tool

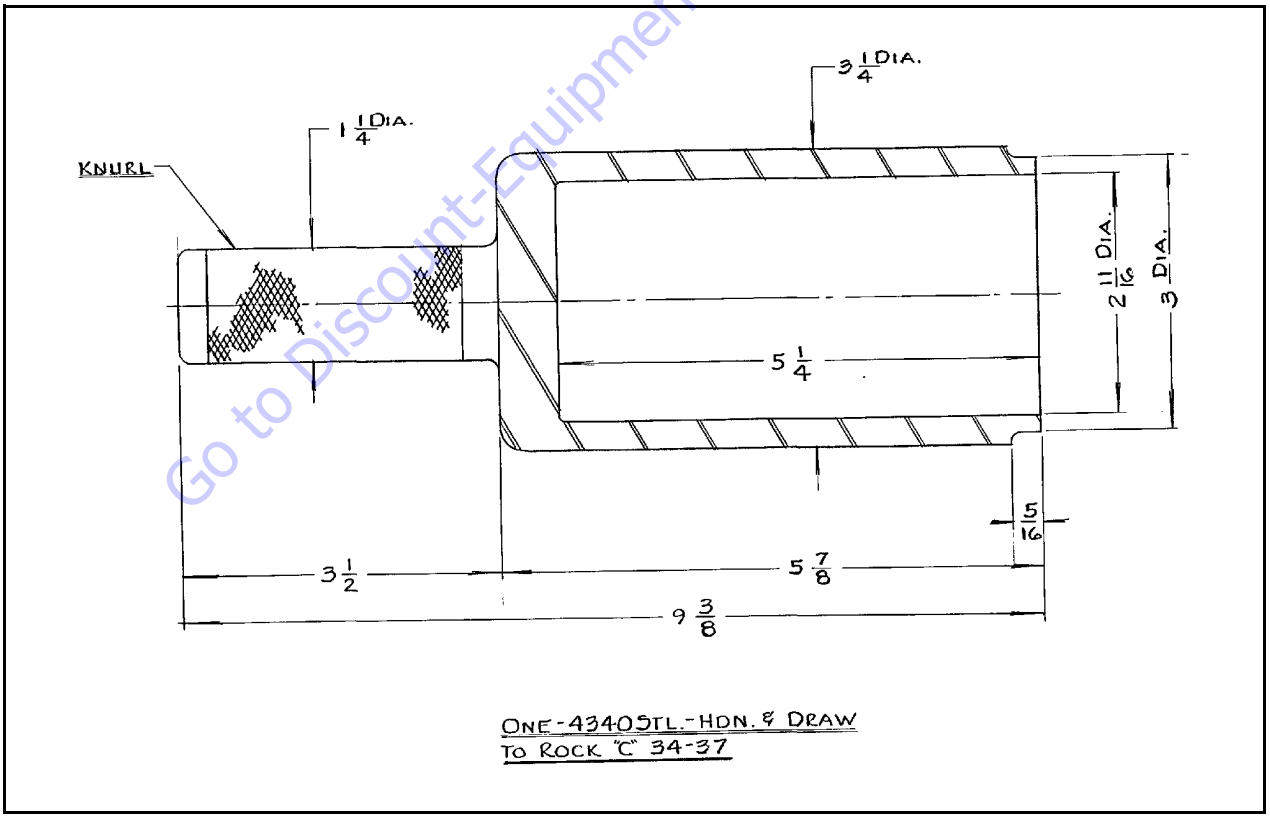


Figure 3-20. Cup Pressing Tool

3.6 DRIVE MOTOR

Removal

1. Place machine on the firm level surface.
2. Disconnect the battery power and all electrical connections from the drive motor.

NOTE: *The drive motor weighs approximately 95 lbs. (43 kg).*

3. Use suitable lifting device to support the drive motor.
4. Remove four bolts attached drive motor to the frame.
5. Remove the motor from machine and place in a clean work area.
6. Clean the motor for dirt. Remove rust or corrosion from coupling shaft.

Disassembly

NOTE: *Refer to Figure 3-21., Drive Motor.*

1. Place the motor in a soft jawed vice, with coupling shaft from motor pointing down and the vise jaws clamping firmly to the sides of the end shield (8).

⚠ WARNING

IF THE MOTOR IS NOT FIRMLY HELD IN THE VISE, IT COULD BE DISLODGED DURING THE SERVICE PROCEDURES, CAUSING INJURY.

2. Remove the three nuts (4) and relevant washers (5) from the terminal board (3).
3. Remove the terminal board (3) from the terminal base (6).
4. Remove the screws (7). Make sure that the screws are not damage.
5. Remove four screw (35) that attach the drive brake (36) onto the drive motor. Remove the drive brake.
6. Remove the terminal base (6) from the stator (2).
7. Remove the temperature sensor (27) from the stator (2).
8. Remove the screws (22) from the retaining plate (23).
9. Remove the retaining plate (23) from the cover (21).
10. Remove the cover (21) from the shield end (18).
11. Remove the seals (20) and (19).
12. Disconnect the connector (34) from the sensor (13).
13. Remove the sensor (13) from shield end.
14. Remove four screws (26) attached to the drive end plate (8).
15. Remove end plate and shield end.
16. Remove the Shaft Seal (10). To avoid damaging the shaft during removal, install a large sheet metal screw into the chuck of a slide hammer. Drive the screw into the seal surface and use the slide hammer to pull the seal.
17. Remove Washer (12), O-ring (9) and Bearing from Stator (2).
18. Remove the retainer clips (31) and (30).
19. Remove the Bearing (24), O-ring (28) and retainer clip (25).
20. Use mallet to remove the Gear (33) and remove Gear Key (32) from the Rotor (29).
21. Remove the rotor (29) from the stator (2).
22. Remove the stator (2).
23. Keep all parts in a clean work area.

Inspection

Inspect the new seal, the motor housing seal bore, and the sealing area on the shaft for rust, wear, and contamination. Polish the shaft and clean the housing if necessary.

Assembly

NOTE: *Refer to Figure 3-21., Drive Motor.*

1. Install the rotor (29) into the stator (2).
2. Install the gear key (32) on to the rotor shaft.
3. Align the gear notch with key and install the gear (33) on to the rotor shaft.
4. Install the bearing (24), o-ring (28) and retainer clip (25).
5. Install the retainer clips (31) and (30).
6. Install washer (12), o-ring (9) and bearing into the stator (2).
7. Install the shaft seal (10).
8. Attach four bolts to secure the drive end plate with the shield end.
9. Connect the connector (34) to the sensor (13).
10. Install the sensor (13) to the shield end.
11. Install the seals (20) and (19).
12. Install the cover (21) onto the shield end (18).
13. Install the retaining plate (23) onto the cover (21).
14. Attach the bolts (22) to secure the retaining plate (23).
15. Attach the temperature sensor (27) to the stator (2).
16. Install the terminal base (6) onto the stator (2).
17. Install the screws (7).
18. Install the terminal board (3) onto the terminal base (6).
19. Attach the three nuts (4) and relevant washers (5) to the terminal board (3).
20. Install the drive brake (36) onto the drive motor.
21. Attach the screws (35) to the drive brake (36).

Installation

NOTE: *The drive motor weighs approximately 95 lbs. (43 kg).*

22. Use suitable lifting device to support the drive motor.
23. Install the drive motor to the machine.

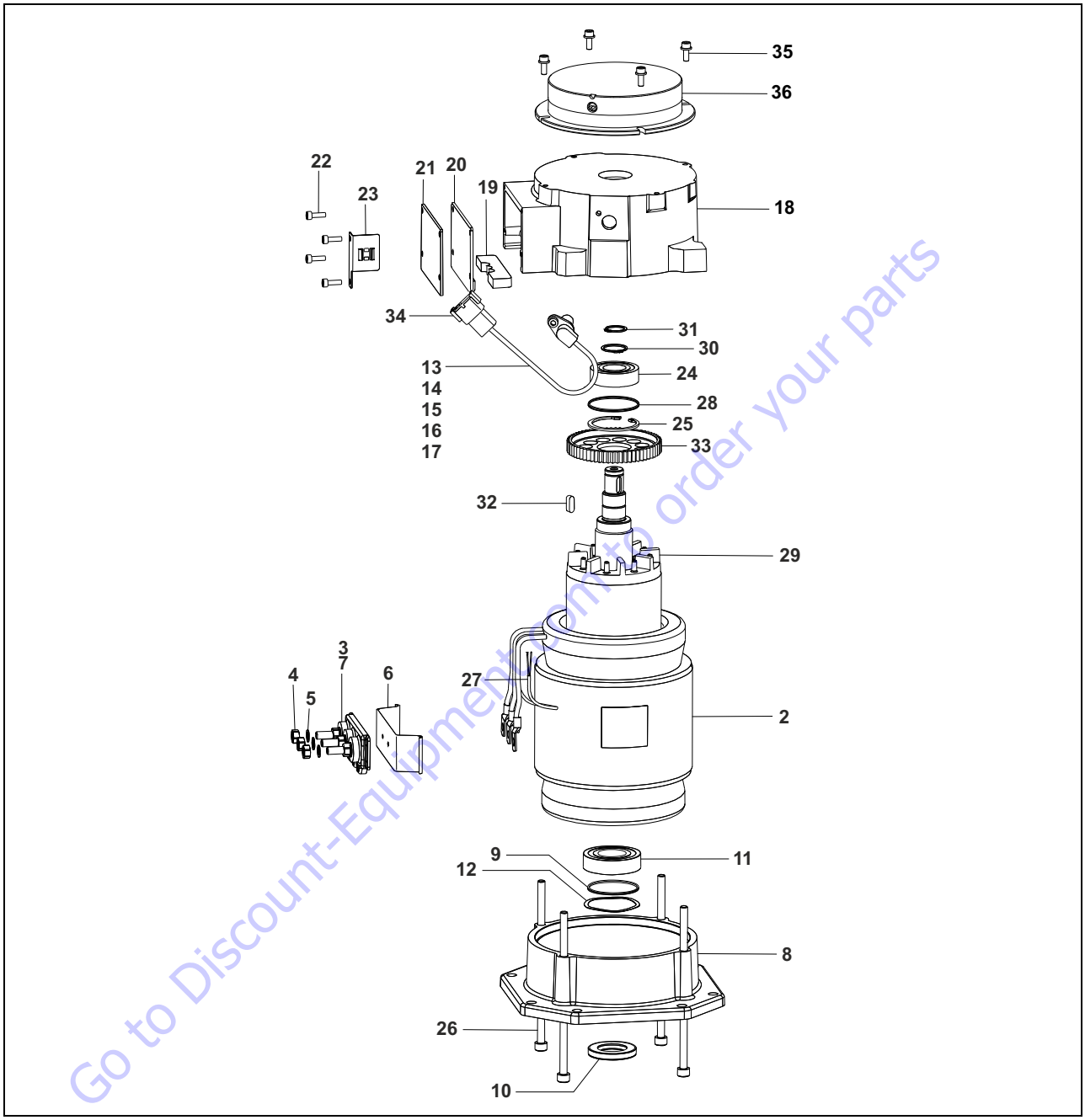
⚠ CAUTION

INCORRECT SHAFT ALIGNMENT MAY RESULT IN DAMAGE TO DRIVE SHAFT, BEARINGS, OR SEAL WHICH CAN CAUSE EXTERNAL OIL LEAKAGE.

24. Make sure that the pump shaft is properly aligned.
25. Use the four bolts and attach the drive motor to the machine. Tighten the bolts to torque 35 ft. lbs. (48 Nm).

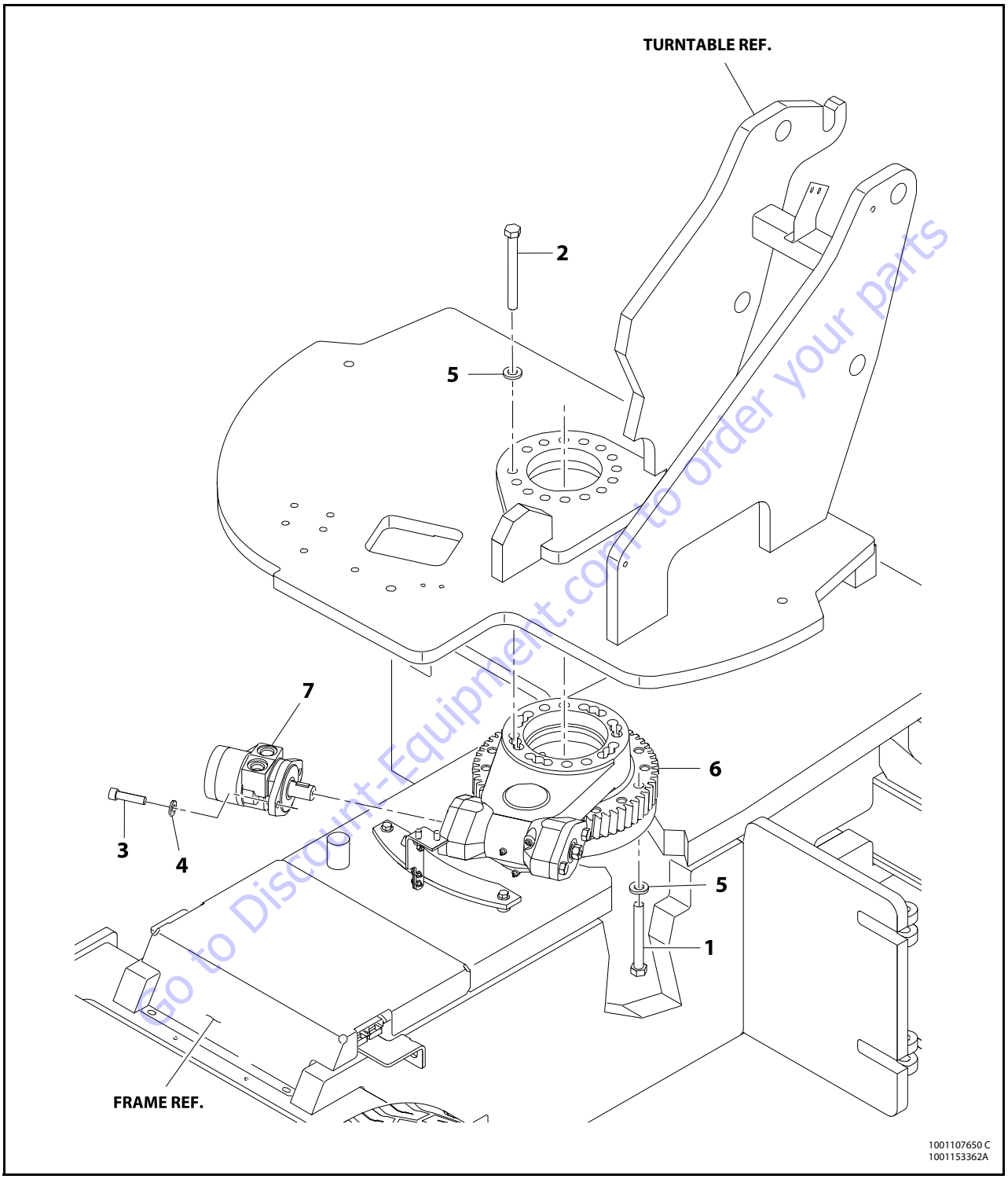
NOTE: *Apply JLG Threadlocker P/N 0100011 to bolts before installation.*

26. Install drive brake on to the drive motor.
27. Reconnect all electrical connections to the drive motor.
28. Start the machine and check the motor for proper functioning.



1. Not Included
2. Stator
3. Terminal Board
4. Nut
5. Washer
6. Terminal Base
7. Screw
8. Drive End Plate
9. O-Ring
10. Shaft Seal
11. Bearing
12. Washer
13. Sensor
14. Screw
15. Wedge
16. Connector
17. Male Pin
18. End Shield
19. Seal
20. Seal
21. Cover
22. Screw
23. Retaining Plate
24. Bearing
25. Retainer Clip
26. Screw
27. Temperature Sensor
28. O-Ring
29. Rotor
30. Retainer Clip
31. Retainer Clip
32. Key
33. Gear
34. Connector
35. Screw
36. Drive Brake

Figure 3-21. Drive Motor



1. Bolt
2. Bolt
3. Bolt
4. Washer
5. Washer
6. Swing Bearing
7. Swing Motor

Figure 3-22. Swing Components

3.7 SWING DRIVE

NOTE: *The swing drive must be removed from the machine to be serviced.*

The swing drive has five major components; the housing, worm, worm gear, output pinion, and gear/pinion cap.

Tools required:

- hydraulic press
- 5/16" 12 point socket
- 7/16" socket
- 3/4" socket
- torque wrench (80 lb-ft)
- steel hammer
- soft face hammer
- bearing puller (external and internal)
- large flat blade screw driver

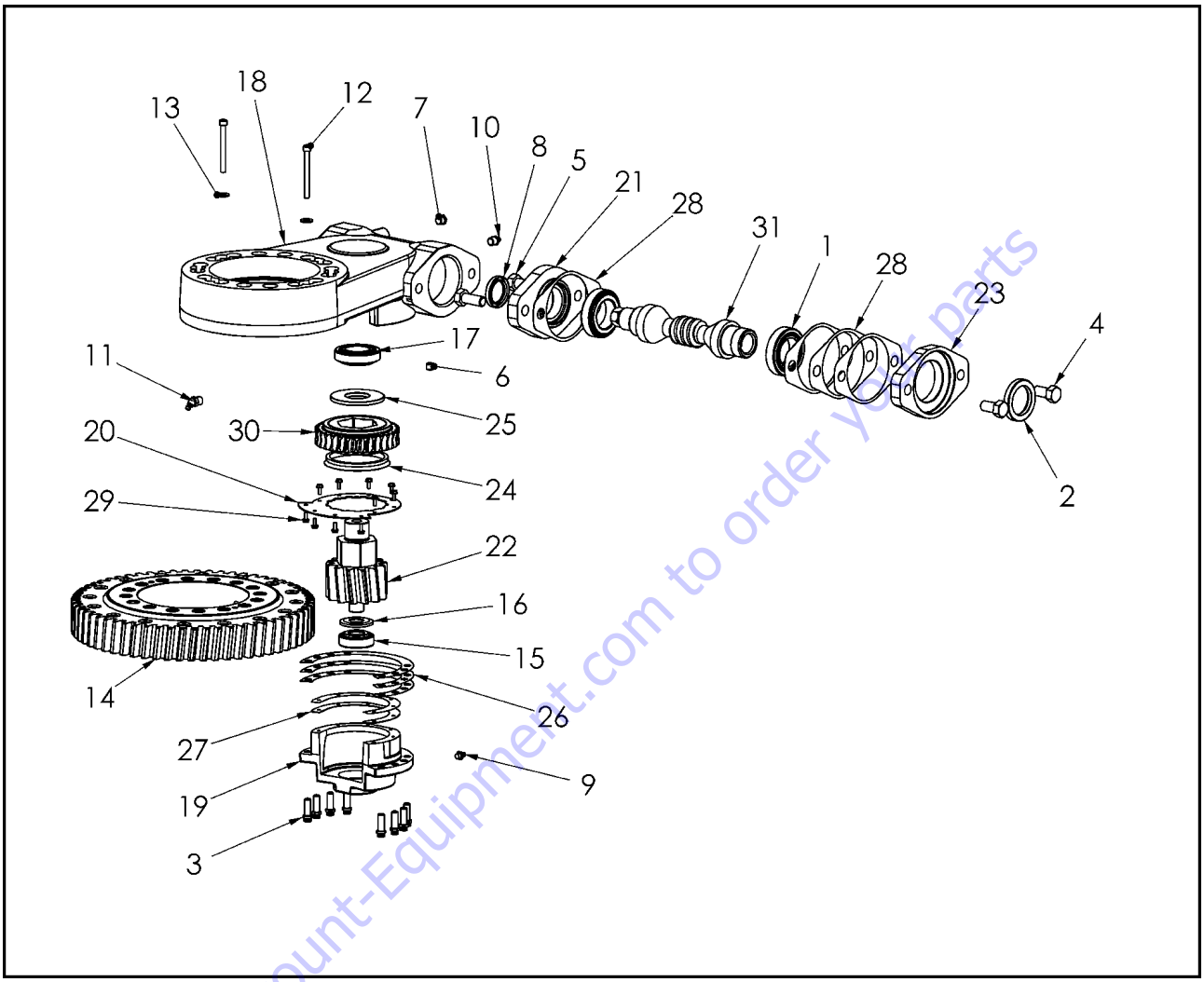
NOTE: *Also needed are a shim and seal kit, 3/4" steel rod at least 10" long, Loctite#515, Mobil SHC 007 grease (available as SW007GK), Mobil SHC 460 grease, JLG Threadlocker P/N 0100011 for bolts and any other parts that may be worn out.*

Disassembly'

1. Remove the slew ring (14) by removing the two 1/4" bolts (12) and washers (13) that hold the slew ring to the housing.
2. Remove four #6 machine screws (29) that are located on cover plate (20) immediately in front of Pinion (22).
3. Remove eight 5/16" 12 point capscrews (3) from gear/pinion cap (19). Pry the cap from the housing. The cover plate (20) will come off with cap. Note where sealant is on Cover and plate so when assembling sealant can be applied in the same place. Note number and color of shims (26) between the cap and housing. Remove six small screws (29) from cover plate. Pry the cover plate (20) from cap (19) and discard the cover plate. Note the number and color of shims between cover plate and cap.
4. Remove the Pinion and Gear assembly (15, 16, 17, 22, 24, 25, 30) from the housing. The assembly lifts directly upward from the housing.
5. Using a press, disassemble the pinion and gear assembly. Support the worm gear (30) on the press with the pinion (22) down allowing room for pinion to be pressed out of gear. Press pinion out of bearing (17) spacer (25) and worm gear (30) Pressing on end of pinion. Remove face seal (24) from face of worm gear (30). Note how the seal is assembled.
6. Remove the bearing (15) and Nilos Ring (16) from the pinion (22) using an external bearing puller or press.
7. Remove the motor and motor adapter (23) and shims (28).
8. Remove 1/2" bolts (5) from the Worm Cap (21) using 3/4" socket. Remove the shim (28) and seal (8) and discard.
9. Remove the worm (31) from the housing (18) by pushing it from the motor end using steel rod and a hammer. The bearing cup (1) on the hex end of the worm will be forced out of the housing. Once the bearing cup (1) has come out of housing, use a soft hammer to tap the worm on the hex end to remove the other bearing cup (1) out the other end of housing.
10. Remove both bearings (1) from the worm (31) using external bearing puller or press.
11. The bearing cup (17) can be removed from the housing (18) by lifting it out (this is not a press fit just a close slip fit).
12. The bearing cup (15) can be removed from the cap (19) using a small pry bar, or by welding a small bead of weld on the internal diameter of cup, this is a press fit.

Assembly

1. Press the bearing cup (15) into the cap (19).
2. Place the bearing cup (17) into the housing (18).
3. Put the face seal (24) onto the hub of the worm gear (30) with the flap of the seal pointing away from gear.
4. Place the worm gear (30) onto the press with the face seal up and press the pinion (22) into the worm gear. Place the Nilos Ring (16) onto the pinion so the cup shape is up and press the bearing (15) onto the pinion tight to the Nilos Ring.
5. Turn the assembly over and place the spacer (25) on the pinion against the gear hub so the large chamfer on the I.D. of spacer is against the bronze gear. Press the bearing (17) onto the pinion tight to the spacer and gear.
6. Place the pinion/gear assembly into the housing. Place the gear cap (19) and shims (26) over the gear/pinion assembly to achieve a slight preload on the pinion bearings. Remove the cap and shims and set the shims aside. Install a new cover plate (20) onto the cap using 6 screws (29) and shims (27) equal to or close to equal to the total thickness of shims set aside during Disassembly. Apply sealant (Loctite#515) to both sides of each of these shims and tighten the screws taking care not to twist these screws off. Clean extra sealant from the surfaces of the cover plate. Apply a small amount of grease to this flap. Set this assembly to the side.
7. Install the bearing (1) on the bore end of the worm (31) only. This is almost a slip fit, may have to be lightly tapped with soft hammer.
8. Install the worm (31) into the housing (18), hex end first.
9. On the bore end of the worm, install the bearing cup (1) into the worm bore of the housing. Also on the bore end of worm (31), install the motor adapter (23) and 1 shim (28 yellow) to the housing using 1/2-13 x 1" bolts (4) and sealant. Torque to 75 ft.lbs. (101.5 Nm). These bolts will be replaced with motor bolts when the motor is mounted.
10. Install the bearing cone (1) on the hex end of the worm (31). Place a bearing cup (1) over the bearing and lightly tap the cup into the bore using a soft hammer.
11. Install the worm cap (21) using proper shims (28) to achieve 0.000 to 0.001" (0.000 to 0.025 mm) end play. Apply JLG Threadlocker P/N 0100011 to end of 1/2-13 x 1.25" grade 5 bolts (5) and Loctite#515 sealant to shims. Torque the bolts to 75 lbs-ft (101.5 Nm).
12. Place the pinion/gear assembly into the housing so the gear teeth mesh with the worm gear teeth. The worm or gear set may have to be turned by hand to achieve this.
13. Apply Loctite#515 to surfaces of the housing where the cap assembly will touch. This includes the vertical surfaces.
14. Place the gear cap assembly and shims set aside in step 6, over the pinion assembly.
15. Apply JLG Threadlocker P/N 0100011 to the end of eight 5/16" 12 point screws (3) and torque to 20 ft.lbs. (27 Nm).
16. Install 4 small screws (29) through the cover plate (20) and into the housing (18). Tighten the screws taking care not the twist the screws off.
17. Install the seal (8) in the worm cap at the hex end of the worm.
18. Install the slew ring (14) using two 1/4" bolts (12) and washers (13). Adjust backlash with the pinion to 0.008/0.012" (0.203/0.304 mm) and torque bolts to 10 ft.lbs. (13.5 Nm).
19. Fill the unit with SHC 007 grease (available as SW007GK) and grease the pinion bearing (15) thru the fitting (9) with Mobil SHC 460 grease.



1. Bearing
2. Oil Seal
3. Capscrew
4. Bolt
5. Bolt
6. Plug
7. Pressure Vent
8. Seal
9. Grease Fitting
10. Grease Fitting
11. Grease Fitting
12. Bolt
13. Washer
14. Slew Ring
15. Bearing
16. Ring
17. Bearing
18. Housing
19. Gear/Pinion Cap
20. Cover Plate
21. Worm Cap
22. Pinion
23. Motor Adapter
24. Face Seal
25. Spacer
26. Shim
27. Shim
28. Shim
29. Machine Screw
30. Worm Gear
31. Worm

Figure 3-23. Swing Drive - Exploded View

3.8 SWING MOTOR

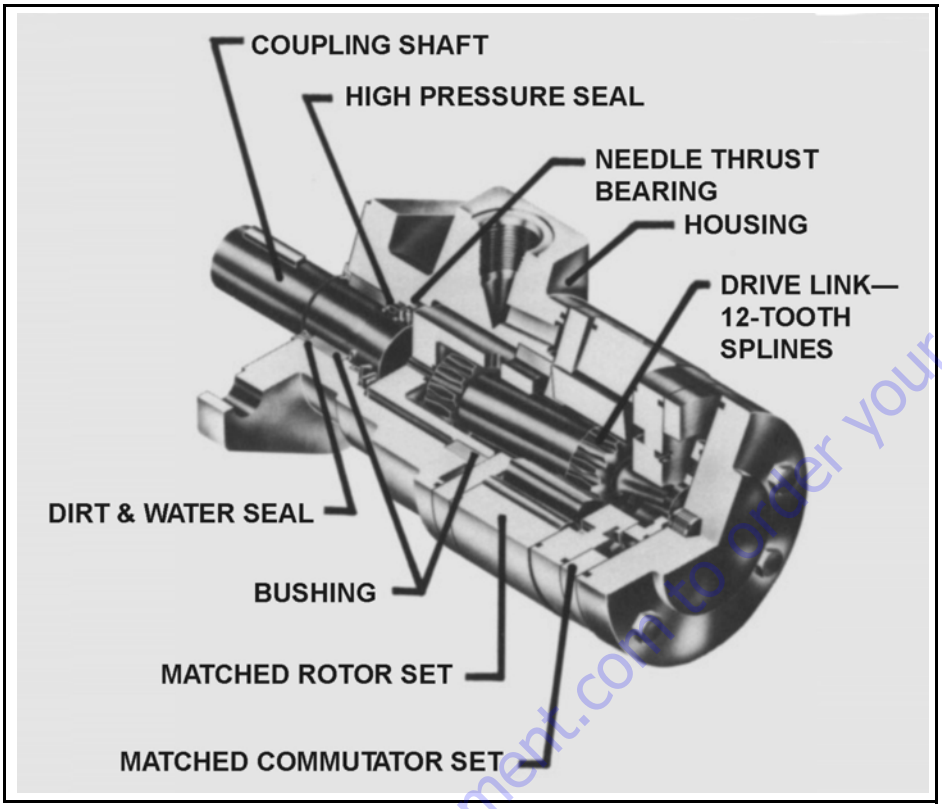


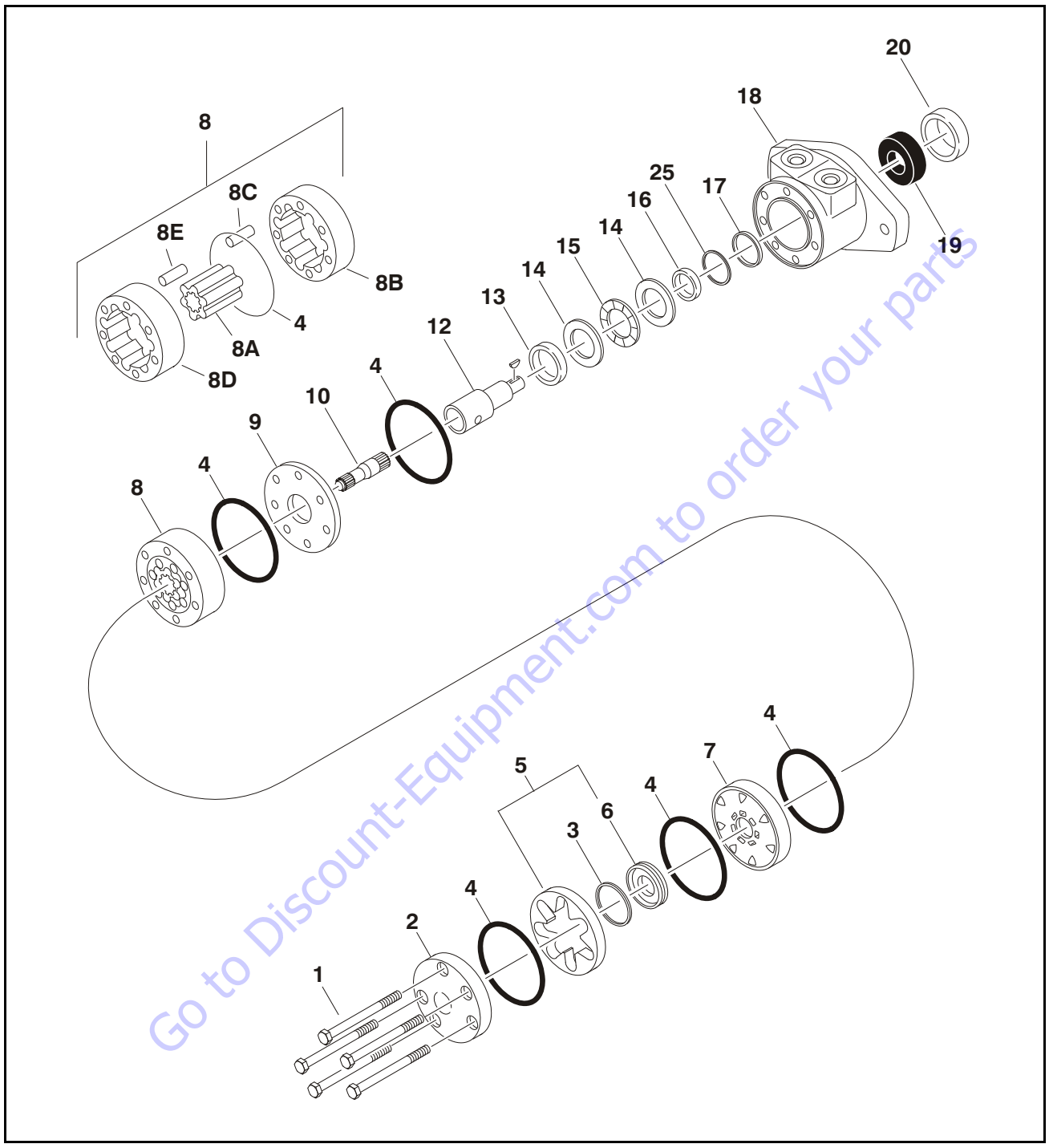
Figure 3-24. Swing Motor - Cutaway

⚠ CAUTION

IF THE HYDRAULIC SYSTEM FLUID BECOMES OVERHEATED [IN EXCESS OF 200°F (93.3°C)], SEALS IN THE SYSTEM CAN SHRINK, HARDEN OR CRACK, THUS LOSING THEIR SEALING ABILITY.

Table 3-2. Swing Motor Troubleshooting

Trouble	Cause	Remedy
Oil Leakage	1. Hose fittings loose, worn or damaged.	Check & replace damaged fittings or "O" Rings. Torque to manufacturers specifications.
	2. Oil seal rings (4) deteriorated by excess heat.	Replace oil seal rings by disassembling unit.
	3. Special bolt (1, 1 A, 1B or 1C) loose or its sealing area deteriorated by corrosion.	(a) Loosen then tighten single bolt to torque specification. (b) Replace bolt.
	4. Internal shaft seal (16) worn or damaged.	Replace seal. Disassembly of motor unit necessary.
	5. Worn coupling shaft (12) and internal seal (16).	Replace coupling shaft and seal by disassembling unit.
Significant loss of speed under load	1. Lack of sufficient oil supply	(a) Check for faulty relief valve and adjust or replace as required. (b) Check for and repair worn pump. (c) Check for and use correct oil for temperature of operation.
	2. High internal motor leakage	Replace worn rotor set by disassembling unit.
	3. Severely worn or damaged internal splines.	Replace rotor set, drive link and coupling shaft by disassembling unit.
	4. Excessive heat.	Locate excessive heat source (usually a restriction) in the system and correct the condition.
Low mechanical efficiency or undue high pressure required to operate unit	1. Line blockage	Locate blockage source and repair or replace.
	2. Internal interference	Disassemble unit, identify and remedy cause and repair, replacing parts as necessary.
	3. Lack of pumping pressure	Check for and repair worn pump.
	4. Excessive binding or loading in system external to motor unit.	Locate source and eliminate cause.



1. Bolt
2. End Cover
3. Seal Ring
4. Seal Ring
5. Commutator
6. Commutator Ring
7. Manifold
8. Rotor Set
8A. Rotor
8B. Stator Half
8C. Stator Vane
8D. Stator Half
9. Wear Plate
10. Drive Link
11. Thrust Bearing
12. Coupling Shaft
13. Inner Bushing
14. Thrust Washer
15. Thrust Bearing
16. Seal
17. Backup Ring
18. Housing
19. Outer Bushing
20. Dirt & Water Seal
21. Not Used
22. Not Used
23. Not Used
24. Not Used
25. Backup Washer

Figure 3-25. Swing Motor - Exploded View

Preparation Before Disassembly

- Before you disassemble the motor unit or any of its components read this entire section. It provides important information on parts and procedures you will need to know to service the motor.
- Thoroughly clean off all outside dirt, especially from around fittings and hose connections, before disconnecting and removing the motor. Remove rust or corrosion from coupling shaft.
- Remove coupling shaft connections and hose fittings and immediately plug port holes and fluid lines.
- Remove the motor from system, drain it of fluid and take it to a clean work surface.
- Clean and dry the motor before you start to disassemble the unit.
- As you disassemble the motor clean all parts, except seals, in clean petroleum-based solvent, and blow them dry.

⚠ WARNING

PETROLEUM-BASE SOLVENTS ARE FLAMMABLE. BE EXTREMELY CAREFUL WHEN USING ANY SOLVENT. EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.

⚠ WARNING

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

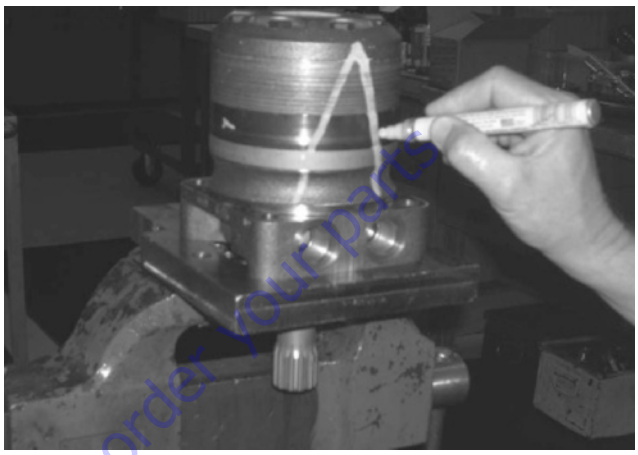
⚠ CAUTION

NEVER STEAM OR HIGH PRESSURE WASH HYDRAULIC COMPONENTS. DO NOT FORCE OR ABUSE CLOSELY FITTED PARTS.

- Keep parts separate to avoid nicks and burrs.
- Discard all seals and seal rings as they are removed from the motor. Replace all seals, seal rings and any damaged or worn parts with OEM approved service parts.

Disassembly and Inspection

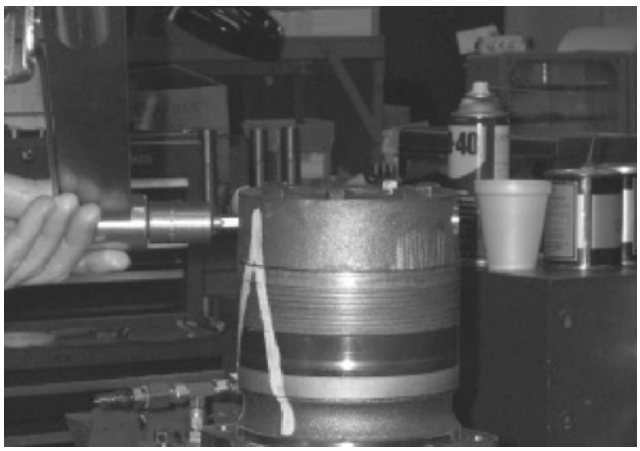
1. Place the motor in a soft jawed vice, with coupling shaft (12) pointed down and the vise jaws clamping firmly on the sides of the housing (18) mounting flange or port bosses. Remove manifold port O-Rings if applicable.

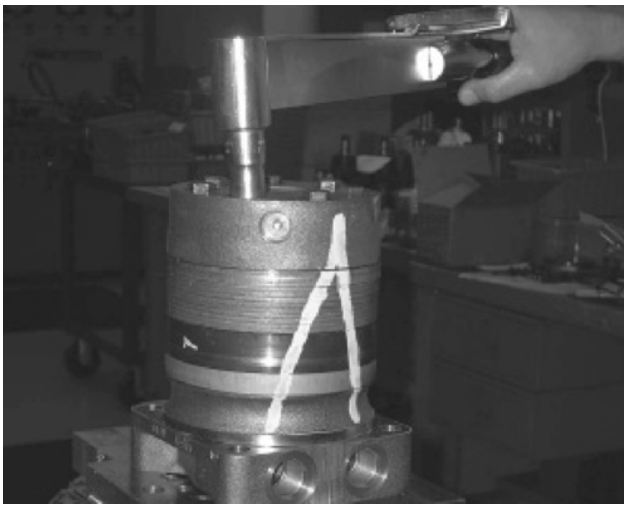


⚠ WARNING

IF THE MOTOR IS NOT FIRMLY HELD IN THE VISE, IT COULD BE DISLODGED DURING THE SERVICE PROCEDURES, CAUSING INJURY.

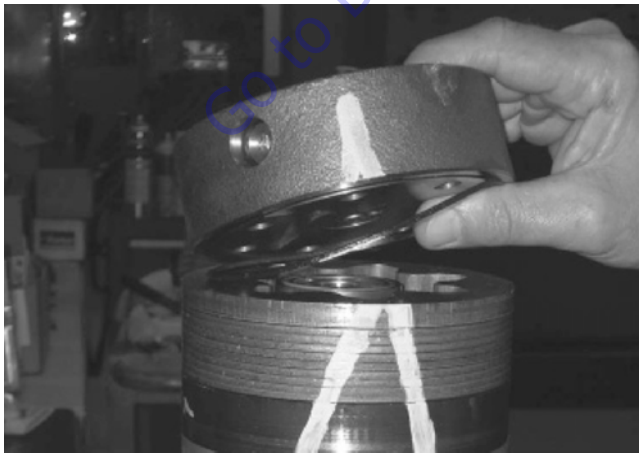
2. Scribe an alignment mark down and across the motor components from end cover (2) to housing (18) to facilitate reassembly orientation where required.



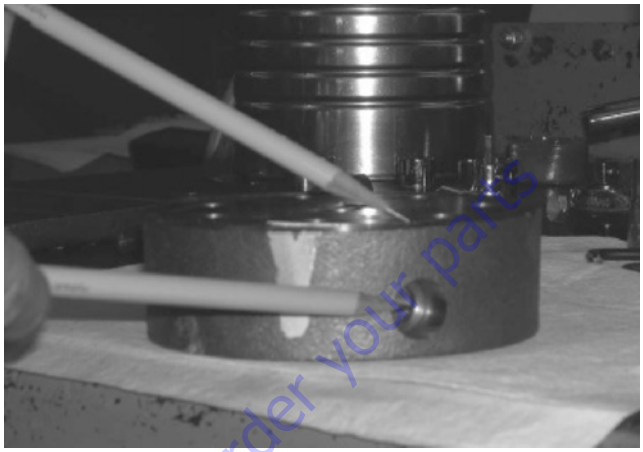


3. Remove the special ring head bolts (1) using an appropriate 1/2 or 9/16 inch size socket. Inspect bolts for damaged threads, or sealing rings, under the bolt head. Replace damaged bolts.

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

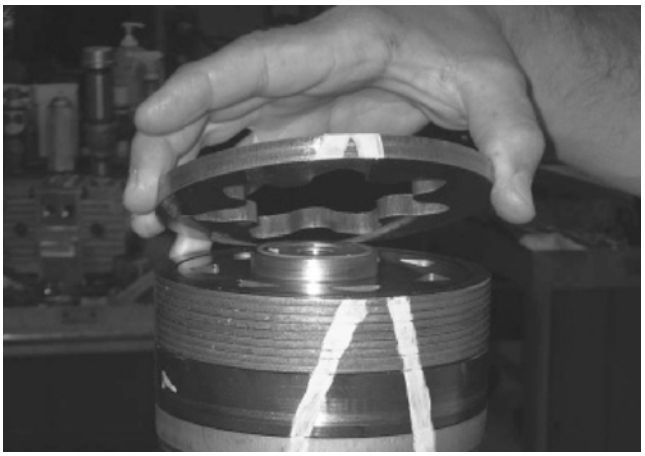


5. Thoroughly wash end cover (2) in proper solvent and blow dry. Be sure the end cover valve apertures are free of contamination. Inspect end cover for cracks and the bolt head recesses for good bolt head sealing surfaces. Replace end cover as necessary.



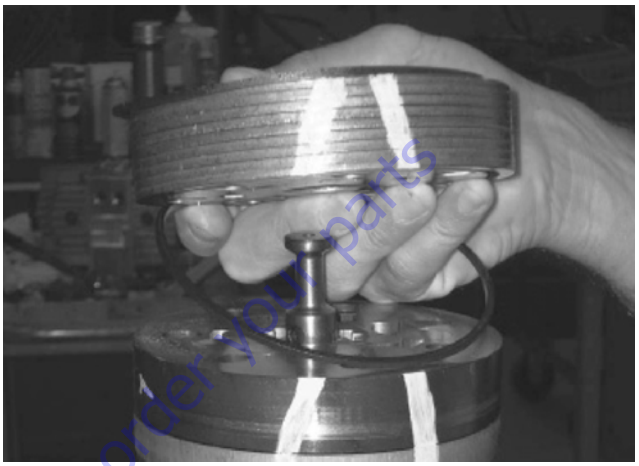
NOTE: *A polished pattern (not scratches) on the cover from rotation of the commutator (5) is normal. Discoloration would indicate excess fluid temperature, thermal shock, or excess speed and require system investigation for cause and close inspection of end cover, commutator, manifold, and rotor set.*

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



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

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



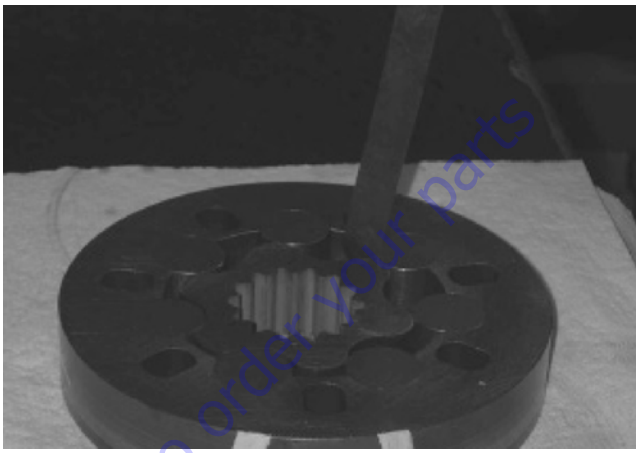
NOTE: *The manifold is constructed of plates bonded together to form an integral component not subject to further disassembly for service. Compare configuration of both sides of the manifold to ensure that same surface is reassembled against the rotor set.*

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

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

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

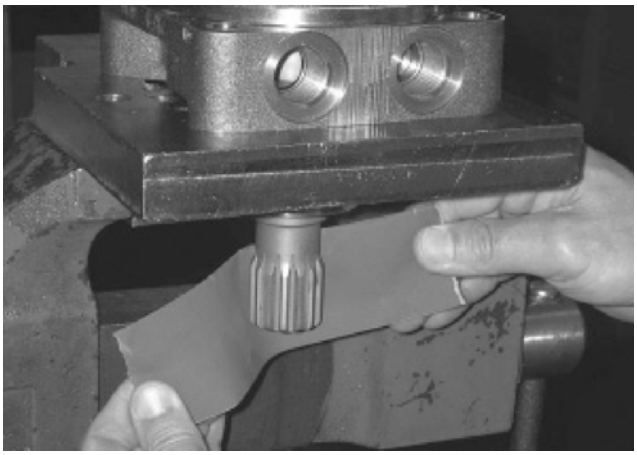
10. Place rotor set (8) and wear plate (9) on a flat surface and center rotor in stator such that two rotor lobes (180 degrees apart) and a roller vane centerline are on the same stator centerline. Check the rotor lobe to roller vane clearance with a feeler gage at this common centerline. If there is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



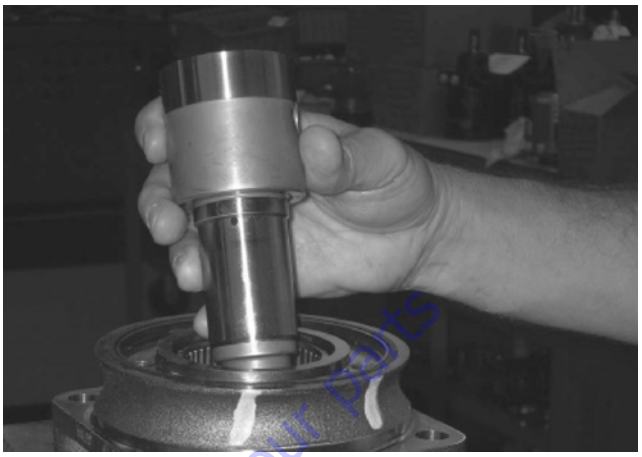
NOTE: *If rotor set (8) has two stator halves and two sets of seven vanes as shown, check the rotor lobe to roller vane clearance at both ends of rotor.*

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

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



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



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

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

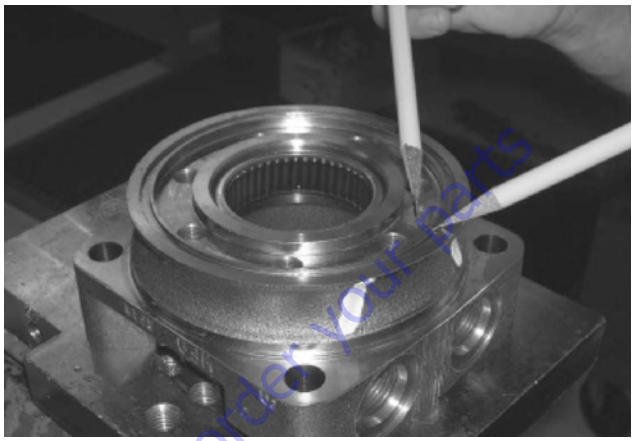
14. Remove and discard seal ring (4) from housing (18).

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

16. Remove seal (16) and back up ring (17) from housing (18) and backup washer (25). Discard both.

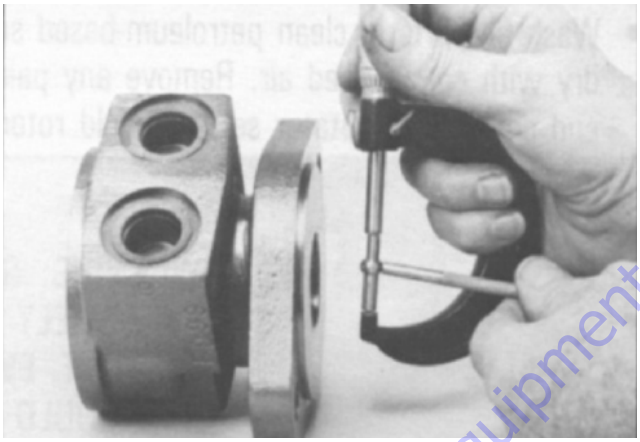
17. Remove housing (18) from vise, invert it and remove and discard seal (20). A blind hole bearing or seal puller is required.

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



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

this inspection the disassembly of the motor is completed.



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

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

Assembly

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

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

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

⚠ WARNING

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

⚠ WARNING

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

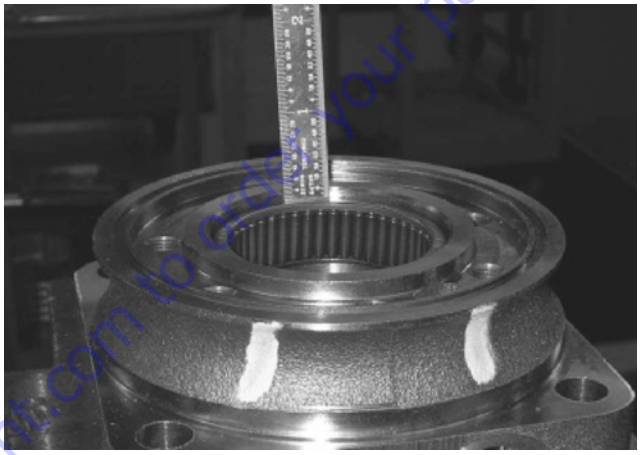
1. If the housing (18) bearing components were removed for replacement, thoroughly coat and pack a new outer bearing/bushing (19) with clean corrosion resistant grease recommended in the material section. Press the new bearing/bushing into the counterbore at the mounting flange end of the housing, using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

   The housing requires the use of bearing mandrel to press bearing/ bushing (19) into the housing to a required depth of 0.151/0.161 inches (3.84/4.09 mm) from the end of the bearing counterbore.

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

⚠ CAUTION

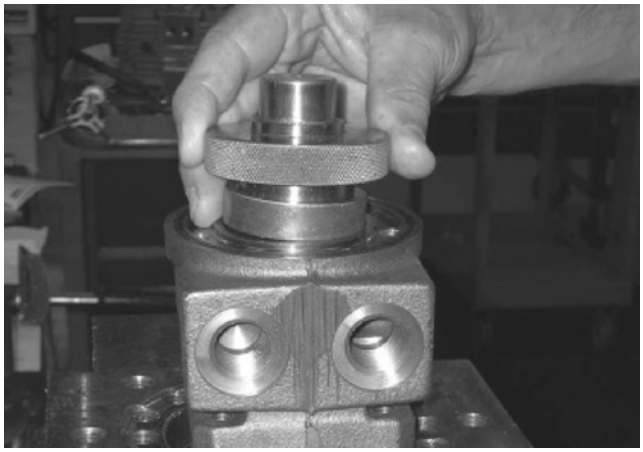
IF A BEARING MANDREL IS NOT AVAILABLE AND ALTERNATE METHODS ARE USED TO PRESS IN BEARING/BUSHING (13) AND (19) THE BEARING/BUSHING DEPTHS SPECIFIED MUST BE ACHIEVED TO INSURE ADEQUATE BEARING SUPPORT AND CORRECT RELATIONSHIP TO ADJACENT COMPONENTS WHEN ASSEMBLED.



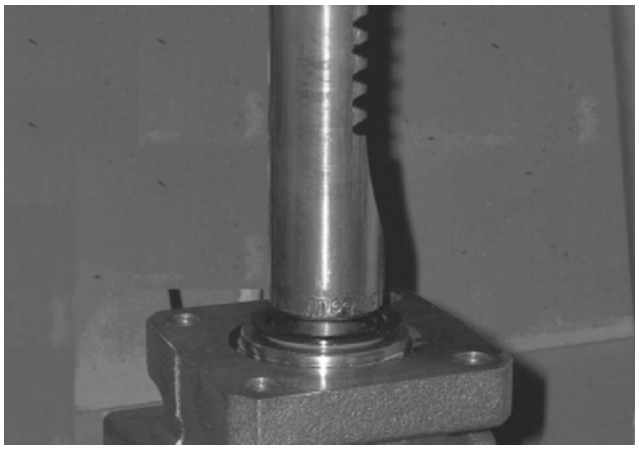
⚠ CAUTION

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

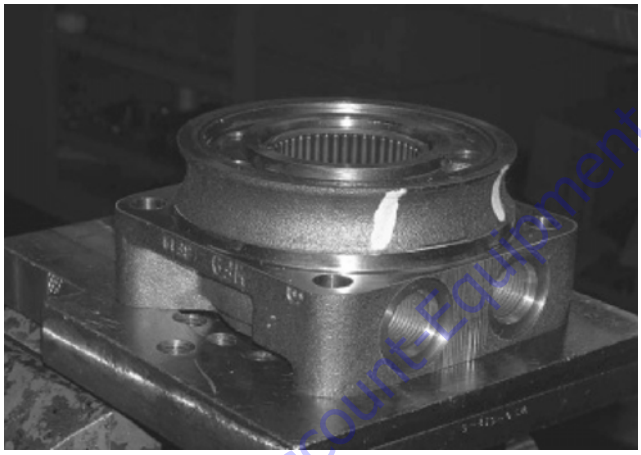
2. The inner housing bearing/bushing (13) can now be pressed into its counter-bore in housing (18) flush to 0.03 inch (0.76 mm) below the housing wear plate contact face. Use the opposite end of the bearing mandrel that was used to press in the outer bearing/bushing (19).



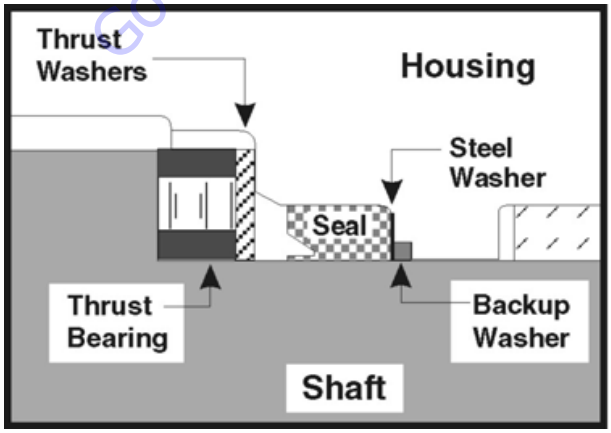
3. Press a new dirt and water seal (20) into the housing (18) outer bearing counterbore. The dirt and water seal (20) must be pressed in until its' flange is flush against the housing.



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



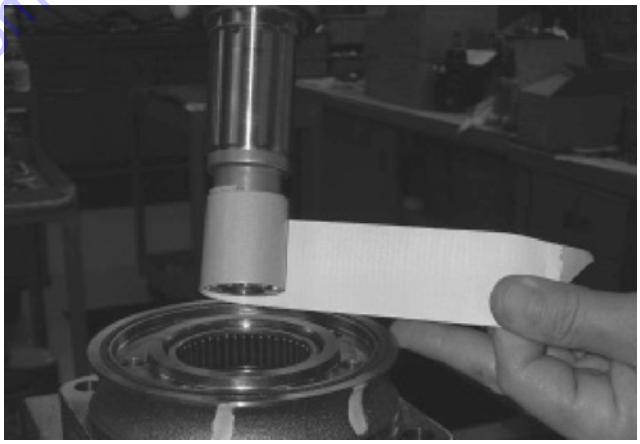
5. Assemble a new backup ring (17), new backup washer (25) and new seal (16) with the seal lip facing toward the inside of the motor, into their respective counterbores in housing (18).



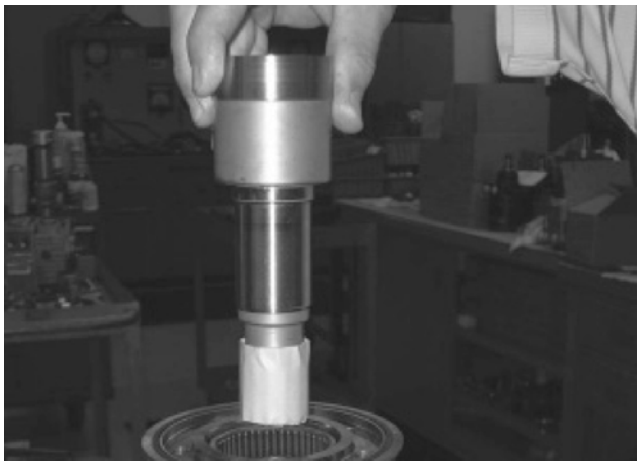
6. Assemble thrust washer (14) then thrust bearing (15) that was removed from the motor.

NOTE: *The motor requires one thrust washer (14) with thrust bearing (15). The coupling shaft will be seated directly against the thrust bearing.*

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



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



⚠ CAUTION

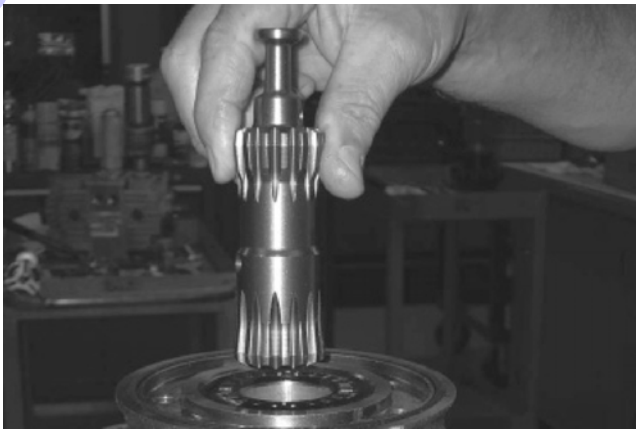
THE OUTER BEARING (19) IS NOT LUBRICATED BY THE SYSTEM'S HYDRAULIC FLUID. BE SURE IT IS THOROUGHLY PACKED WITH THE RECOMMENDED GREASE.

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

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

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

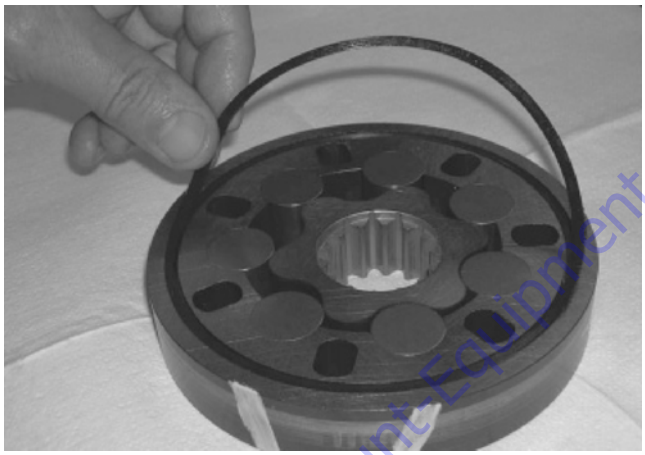
10. Install drive link (10) the long splined end down into the coupling shaft (12) and engage the drive link splines into mesh with the coupling shaft splines.



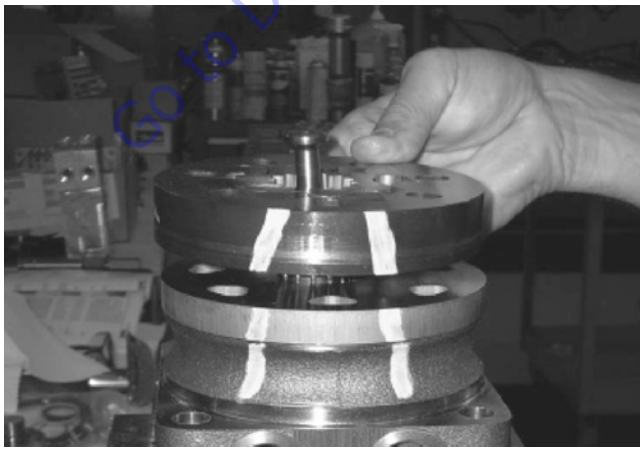
NOTE: *Use any alignment marks put on the coupling shaft and drive link before disassembly to assemble the drive link splines in their original position in the mating coupling shaft splines.*

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

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



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

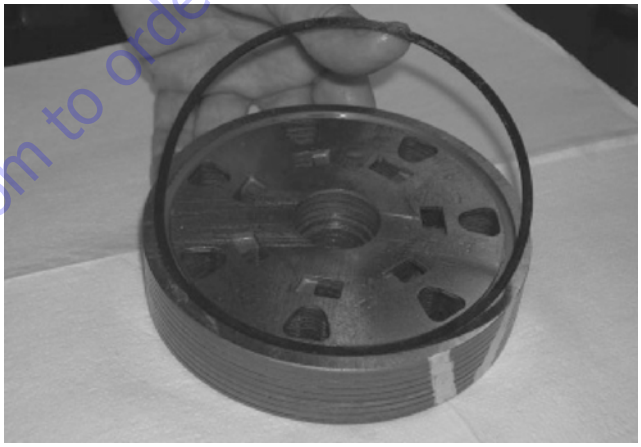


NOTE: *It may be necessary to turn one alignment stud out of the housing (18) temporarily to assemble rotor set (8) or manifold (7) over the drive link.*

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

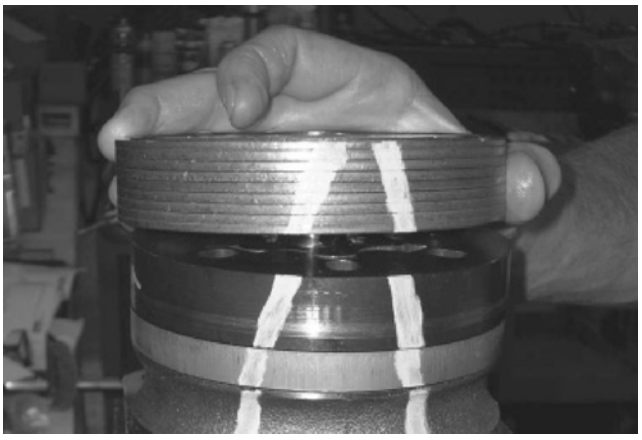
NOTE: *The rotor set rotor counterbore side must be down against wear plate for drive link clearance and to maintain the original rotor-drive link spline contact. A rotor set without a counterbore and that was not etched before disassembly can be reinstalled using the drive link spline pattern on the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

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

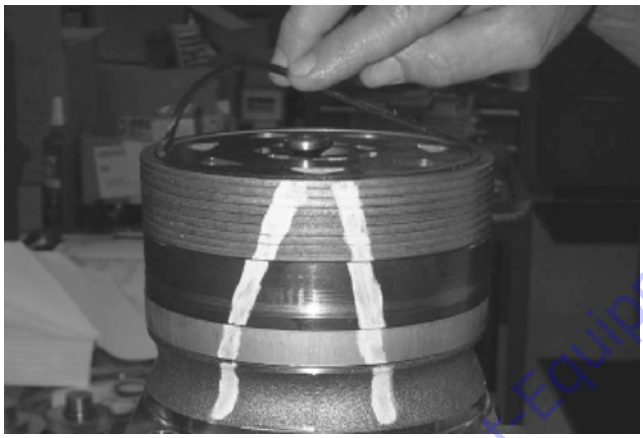


NOTE: *The manifold (7) is made up of several plates bonded together permanently to form an integral component. The manifold surface that must contact the rotor set has it's series of irregular shaped cavities on the largest circumference or circle around the inside diameter. The polished impression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

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

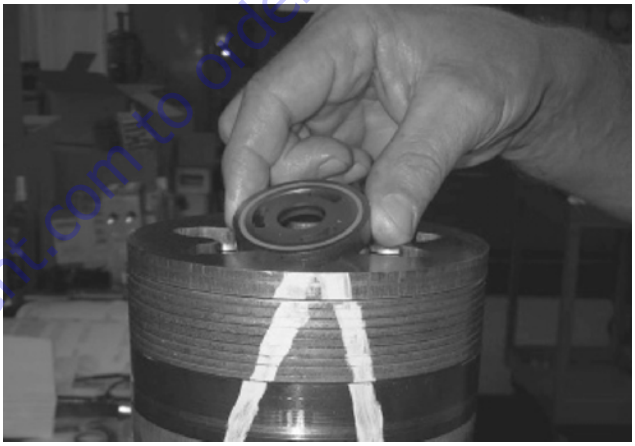


16. Apply grease to a new seal ring (4) and insert it in the seal ring groove exposed on the manifold.

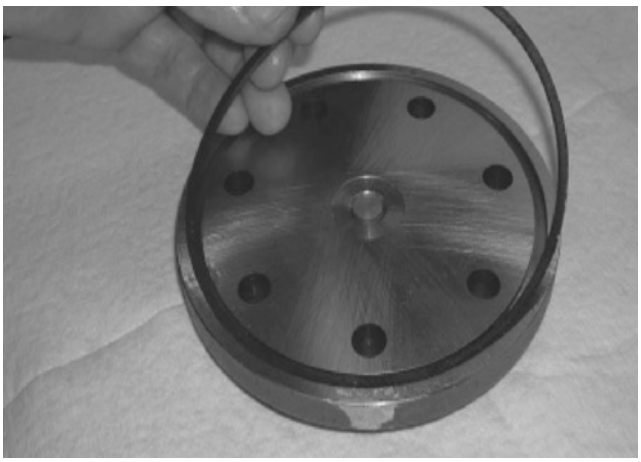


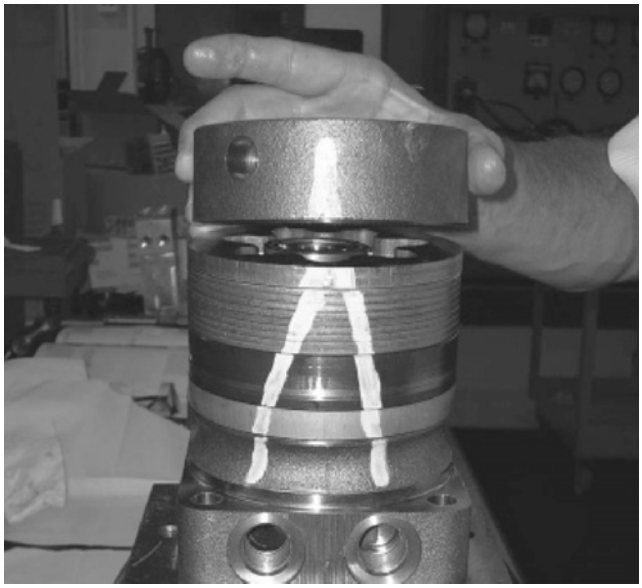
17. Assemble the commutator ring (6) over alignment studs onto the manifold.

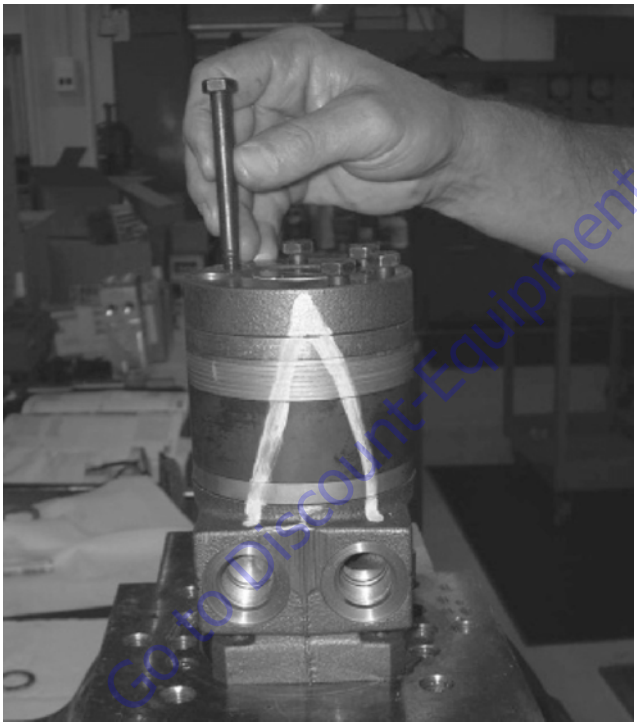
18. Assemble a new seal ring (3) flat side up, into commutator (5) and assemble commutator over the end of drive link (10) onto manifold (7) with seal ring side up.



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

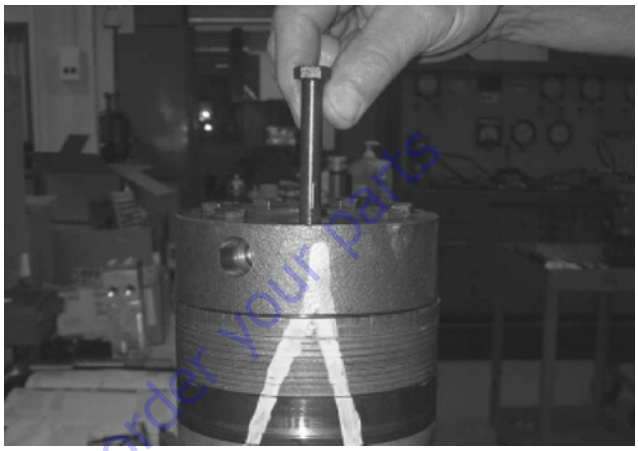


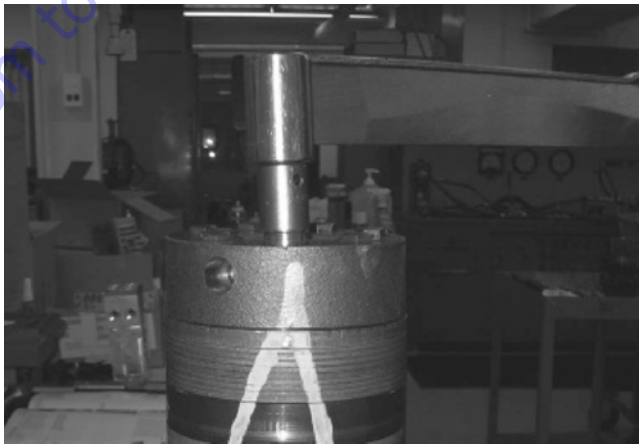


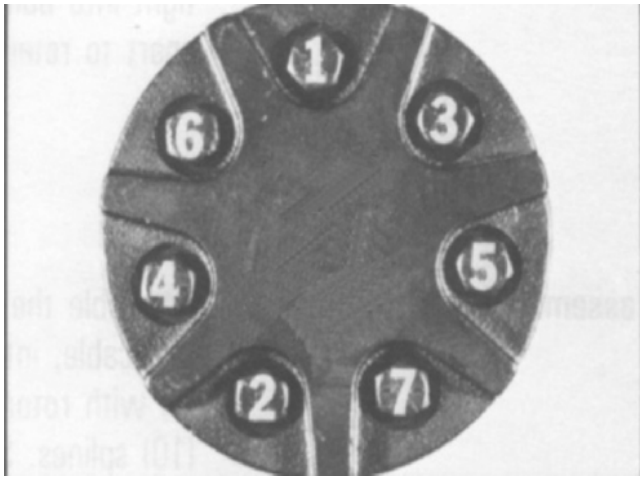


NOTE: *If the end cover has a valve (24) or has five bolt holes, use the line you previously scribed on the cover to radially align the end cover into its original position.*

20. Assemble the bolts (1) and screw in finger tight. Remove and replace the two alignment studs with bolts after the other bolts are in place. Alternately and progressively tighten the bolts to pull the end cover and other components into place with a final torque of 25-30 ft. lbs. (34-41 N m).







One Piece Stator Construction

A disassembled rotor stator and vanes that cannot be readily assembled by hand can be assembled by the following procedures.

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

2. If assembly alignment studs are not being utilized, align stator bolt holes with wear plate and housing bolt holes and turn two bolts (1) finger tight into bolt holes approximately 180 degrees apart to retain stator and wear plate stationary.

3. Assemble the rotor, counterbore down if applicable, into stator, and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.

4. Assemble six vanes, or as many vanes that will readily assemble into the stator vane pockets.

⚠ CAUTION

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

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

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

Go to assembly procedure #15, to continue assembly.

Two Piece Stator Construction

A disassembled rotor set (8) that cannot be readily assembled by hand and has a two piece stator can be assembled by the following procedures.

1. Place stator half onto wear plate (9) with seal ring (4) side down, after following motor assembly procedures 1 through 13. Be sure the seal ring is in place.
2. Align stator bolt holes with wear plate and housing bolts and turn two alignment studs finger tight into bolt holes approximately 180 degrees apart to retain stator half and wear plate stationary.
3. Assemble rotor, counterbore down if applicable, into stator half, and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.

NOTE: *Use any marking you applied to rotor set components to reassemble the components in their original relationship to ensure ultimate wear life and performance.*

4. Assemble six vanes, or as many vanes that will readily assemble into the stator vane pockets.

⚠ CAUTION

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

5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes (8C) into stator half, creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.
6. Place second stator half on a fl at surface with seal ring groove up. Apply a small amount of grease to a new seal ring (4) and assemble it into stator half ring groove.
7. Assemble the second stator half over the two alignment studs and rotor with seal ring side down onto the first stator half aligning any timing marks applied for this purpose.

⚠ CAUTION

IF THE STATOR HALF (8B) IS A DIFFERENT HEIGHT (THICKNESS) THAN STATOR HALF (8D) THE STATOR VANES (8C) OR (8E)OF THE SAME LENGTH (HEIGHT) AS THE STATOR HALF MUST BE REASSEMBLED IN THEIR RESPECTIVE STATOR HALF FOR THE ROTOR SET TO FUNCTION PROPERLY.

8. Assemble six vanes, or as many vanes that will readily assemble into the stator vane pockets.
9. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes into stator, creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.

Go to assembly procedure #15, to continue assembly.

Final Checks

1. Pressurize the motor with 100 p.s.i. dry air or nitrogen and submerge in solvent to check for external leaks.
2. Check motor for rotation. Torque required to rotate coupling shaft should not be more than 50 ft. lbs. (68 N m)
3. Pressure port with “A” cast under it on housing (18) is for clockwise coupling shaft rotation as viewed from the output end of coupling shaft. Pressure port with “B” cast under it is for counter clockwise coupling shaft rotation.
4. Use test stand if available, to check operation of the motor.

Installation Torque

When installing the swing motor onto the swing drive, apply JLG Threadlocker P/N 0100019 to the threads of the retaining bolts and torque to 85 ft. lbs (115 Nm).

3.9 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 JLG Threadlocker P/N 0100019. After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.*

1. Check the frame to bearing. Attach bolts as follows:
   a. Elevate the fully retracted boom to 70 degrees (full elevation).
   b. At the positions indicated on Figure 3-27., Swing Bearing Tolerance Boom Placement try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   c. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
   d. Swing the turntable 90 degrees, and check some selected bolts at the new position.
   e. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.
2. Check the turntable to bearing. Attach bolts as follows:
   a. Elevate the fully retracted boom to 70 degrees (full elevation).
   b. At the positions indicated on Figure 3-26. try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   c. Lower the boom to horizontal and fully extend the boom.
   d. At the position indicated on Figure 3-26., Swing Bearing Feeler Gauge Check try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

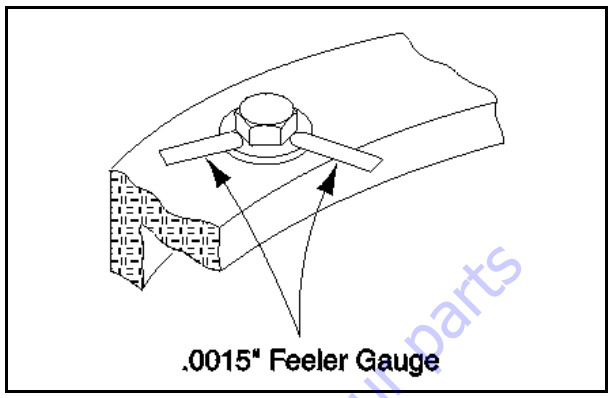


Figure 3-26. Swing Bearing Feeler Gauge Check

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 3-27., Swing Bearing Tolerance Boom Placement), using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable. Figure 3-29., Swing Bearing Tolerance Measuring Point.

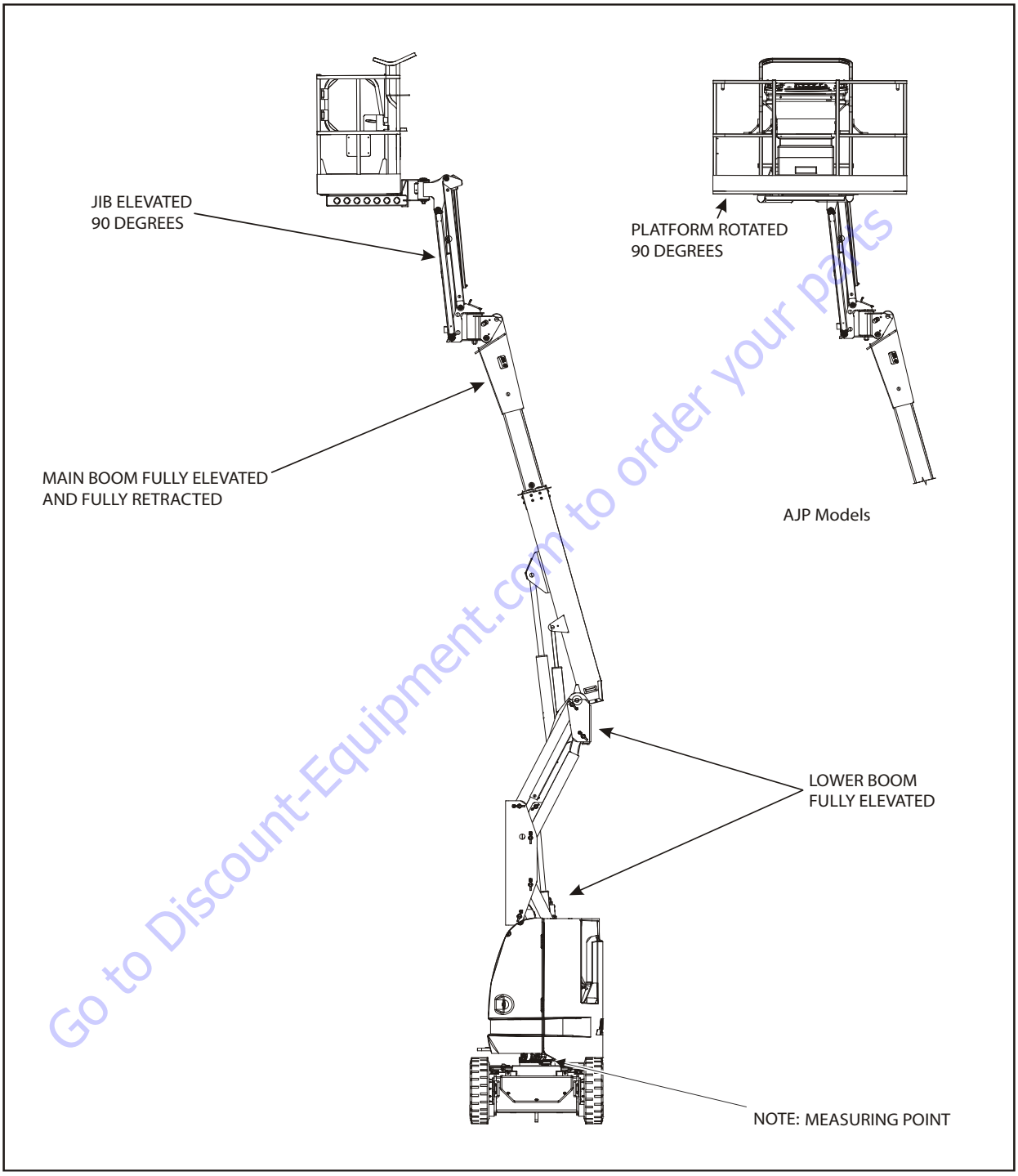


Figure 3-27. Swing Bearing Tolerance Boom Placement

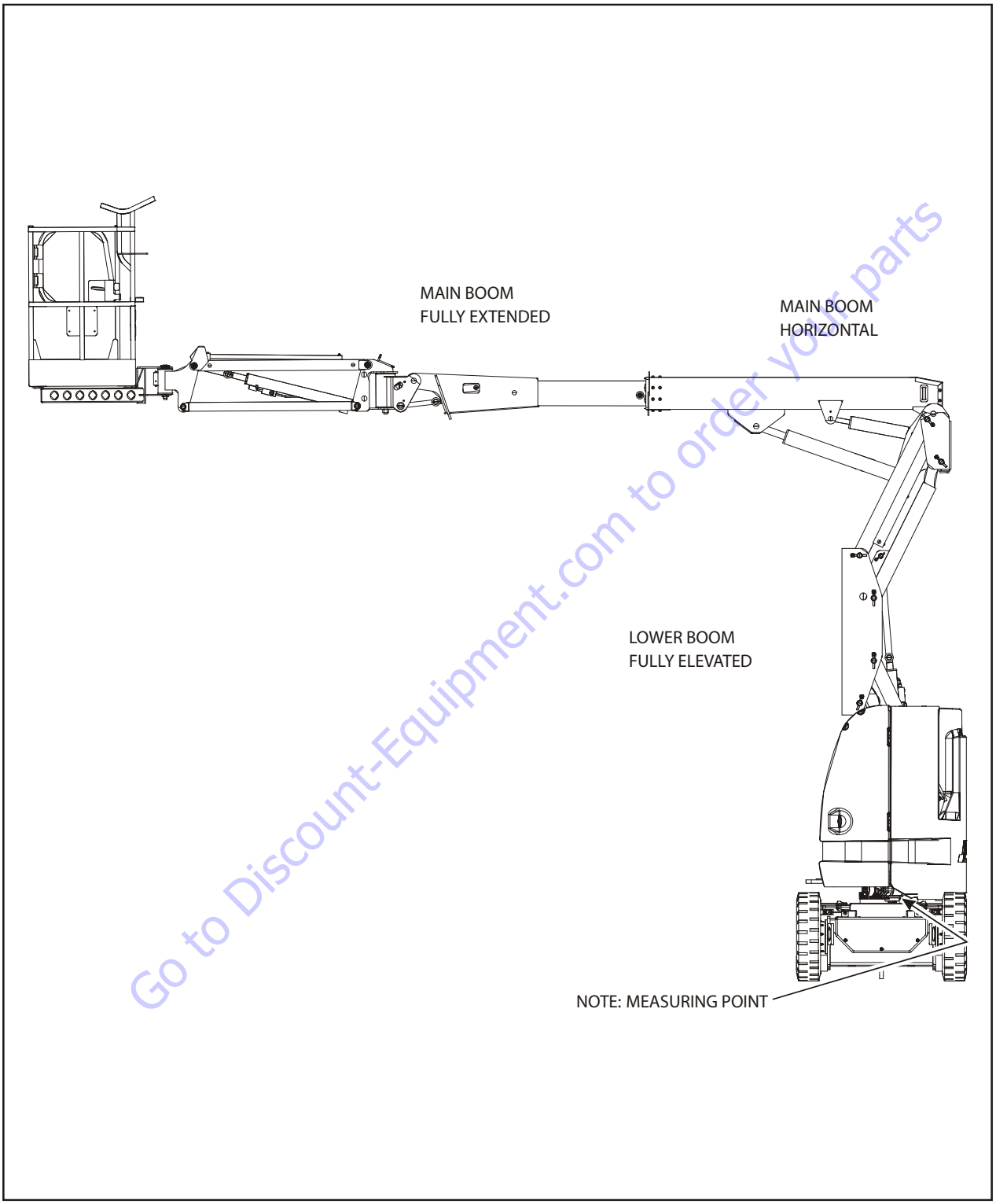


Figure 3-28. Swing Bearing Tolerance Boom Placement

2. At the same point, with the boom positioned over the side of the machine, the Upper Boom fully elevated and the Mid/Lower Boom fully elevated, Figure 3-27., Swing Bearing Tolerance Boom Placement using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable (See Figure 3-29., Swing Bearing Tolerance Measuring Point).

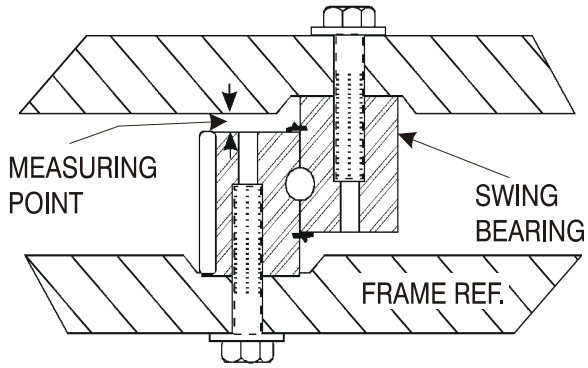


Figure 3-29. Swing Bearing Tolerance Measuring Point

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.

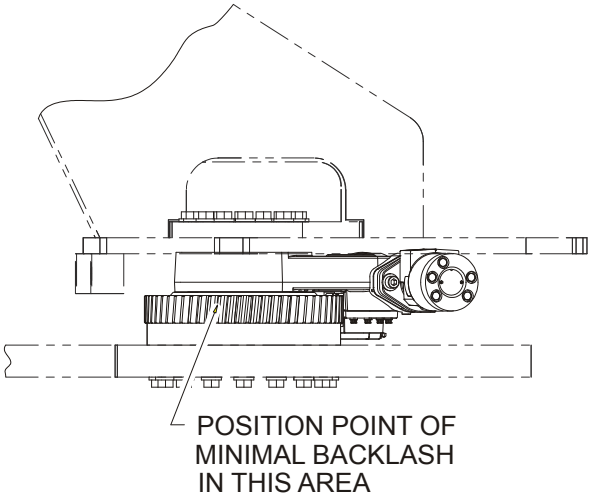
Replacement of Swing Bearing

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 capscrews securing the bearing to the rotation box to separate the two for inspection.

2. Installation.

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

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 capscrews as shown in Figure 3-30., Swing Bearing Torque Sequence.



c. Apply Tribol Molub-Alloy 936 Open Gear Compound to bearing and worm gear teeth.

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

⚠ 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.

e. Apply a light coating of JLG Threadlocker P/N 0100019 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.

f. Following the torque sequence diagram shown in Figure 3-30., Swing Bearing Torque Sequence, tighten the bolts to an initial torque of 140 ft. lbs. (190 Nm). Then following the same sequence, tighten to a final torque of 190 ft. lbs. (260 Nm).

g. Remove lifting equipment from bearing.

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

i. 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.

j. Apply a light coating of JLG Threadlocker P/N 0100019 to the new bearing bolts and install through the turntable and inner race of bearing.

k. Following the torque sequence shown in Figure 3-30., tighten the bolts to an initial torque of 130 ft. lbs. (175 Nm). Then following the same sequence, tighten the bolts to 190 ft. lbs (260 Nm).

l. Remove the lifting equipment.

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

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

Swing Bearing Torque Value

Install bolts with JLG Threadlocker P/N 0100019 - 190 ft. lbs. (260 Nm).

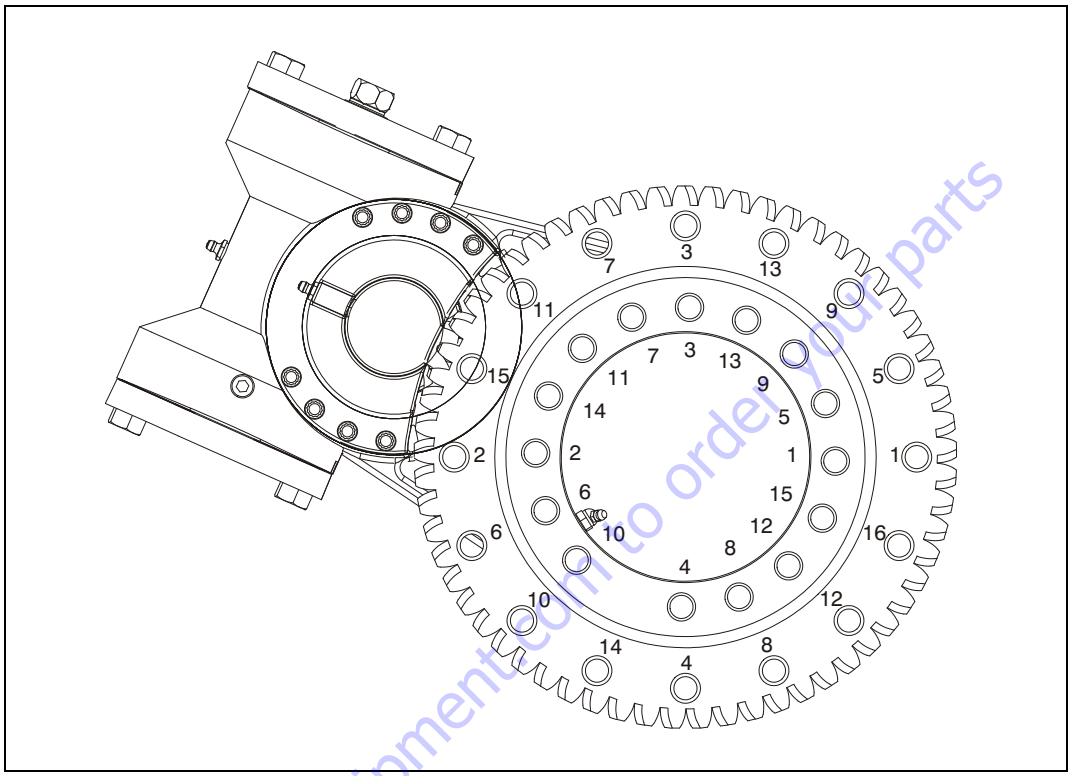


Figure 3-30. Swing Bearing Torque Sequence

3.10 BATTERY MAINTENANCE AND CHARGING

⚠ WARNING

TO AVOID INJURY FROM AN EXPLOSION, DO NOT SMOKE OR ALLOW SPARKS OR A FLAME NEAR BATTERY DURING SERVICING. ALWAYS WEAR EYE AND HAND PROTECTION WHEN SERVICING BATTERIES.

Battery Maintenance, Quarterly

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

⚠ CAUTION

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 3/8" (1cm) 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 re-connect 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.

Battery Charging, Daily

NOTE: *To avoid excessive battery charging time, do not allow batteries to become completely discharged.*

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

NOTE: *When adding water to the battery, fill only to level indicated or 3/8" above separators.*

7. Charge batteries at the end of each work day, or when machine performance is significantly reduced due to batteries becoming discharged.
8. Charge batteries in accordance with the following procedure:
   a. Open battery compartment, and battery charger compartment covers.

⚠ WARNING

WHEN BATTERY CHARGER IS TO BE USED, CHARGING HARNESS MUST BE PLUGGED INTO A GROUNDED RECEPTACLE. IF RECEPTACLE IS NOT GROUNDED AND A MALFUNCTION SHOULD OCCUR, THE MACHINE COULD CAUSE SERIOUS ELECTRICAL SHOCK.

   b. Remove charging harness cable and connect to a receptacle or the correct voltage.
   c. Allow batteries to charge until 100% LED is illuminated.

NOTE: *When batteries are completely charged, disconnect charging harness cable from receptacle. Store charging harness cable.*

   d. Ensure battery cables are positioned and are not pinched. Close and secure all compartment doors.

3.11 BATTERY CHARGER

NOTICE

JLG MACHINES EQUIPPED WITH DELTA Q BATTERY CHARGERS ARE DESIGNED FOR THE BEST PERFORMANCE WITH OEM FACTORY APPROVED BATTERIES.

APPROVED JLG REPLACEMENT BATTERIES ARE AVAILABLE THROUGH JLG'S AFTERMARKET PARTS DISTRIBUTION CENTERS OR JLG'S AFTERMARKET PROGRAMS. FOR ASSISTANCE WITH PROPER BATTERY REPLACEMENT, PLEASE CONTACT YOUR LOCAL JLG SUPPORT OFFICE.

BATTERIES APPROVED BY JLG HAVE BEEN TESTED FOR COMPATIBILITY WITH THE ALGORITHM PROGRAMMING OF THE DELTA Q BATTERY CHARGER TO OPTIMIZE BATTERY LIFE AND MACHINE C YCLE TIMES. THE USE OF NON APPROVED BATTERIES IN YOUR JLG EQUIPMENT MAY RESULT IN PERFORMANCE ISSUES OR BATTERY CHARGER FAULT CODES. JLG ASSUMES NO RESPONSIBILITY FOR SERVICE OR PERFORMANCE ISSUES ARISING FROM THE USE OF NON APPROVED BATTERIES.

⚠ WARNING

LEAD ACID BATTERIES MAY GENERATE EXPLOSIVE HYDROGEN GAS DURING NORMAL OPERATION. KEEP SPARKS, FLAMES, AND SMOKING MATERIALS AWAY FROM BATTERIES. PROVIDE ADEQUATE VENTILATION DURING CHARGING. NEVER CHARGE A FROZEN BATTERY. STUDY ALL BATTERY MANUFACTURERS' SPECIFIC PRECAUTIONS SUCH AS RECOMMENDED RATES OF CHARGE AND REMOVING OR NOT REMOVING CELL CAPS WHILE CHARGING.

⚠ WARNING

RISK OF ELECTRIC SHOCK. CONNECT CHARGER POWER CORD TO AN OUTLET THAT HAS BEEN PROPERLY INSTALLED AND GROUNDED IN ACCORDANCE WITH ALL LOCAL CODES AND ORDINANCES. A GROUNDED OUTLET IS REQUIRED TO REDUCE RISK OF ELECTRIC SHOCK - DO NOT USE GROUND ADAPTERS OR MODIFY PLUG. DO NOT TOUCH UNINSULATED PORTION OF OUTPUT CONNECTOR OR UNINSULATED BATTERY TERMINAL. DISCONNECT THE AC SUPPLY BEFORE MAKING OR BREAKING THE CONNECTIONS TO THE BATTERY WHILE CHARGING. DO NOT OPEN OR DISASSEMBLE CHARGER. DO NOT OPERATE CHARGER IF THE AC SUPPLY CORD IS DAMAGED OR IF THE CHARGER HAS RECEIVED A SHARP BLOW, BEEN DROPPED, OR OTHERWISE DAMAGED IN ANY WAY - REFER ALL REPAIR WORK TO QUALIFIED PERSONNEL. NOT FOR USE BY CHILDREN.

Operating Instructions

NOTICE

ALWAYS USE A GROUNDED OUTLET. WHEN USING AN EXTENSION CORD, AVOID EXCESSIVE VOLTAGE DROPS BY USING A GROUNDED 3-WIRE 12 AWG CORD.

1. The charger will automatically turn on and go through a short self-test. All LED's will flash in an up-down sequence for two seconds. The yellow "Charging" LED will turn on and a trickle current will be applied until a minimum voltage is reached.
2. Once a minimum battery voltage of 2 volts per cell is detected, the charger will enter the constant-current charging stage and the yellow LED will remain on. The length of charge time will vary by input voltage and ambient temperature.
3. When the green "Charged" LED turns on, the batteries are completely charged. The charger may now be unplugged from AC power. If left plugged in, the charger will automatically restart a complete charge cycle if battery voltage drops below a minimum voltage or 30 days have elapsed.
4. If a fault occurred during charging, the red "Fault" LED will flash with a code corresponding to the error.

Maintenance Instructions

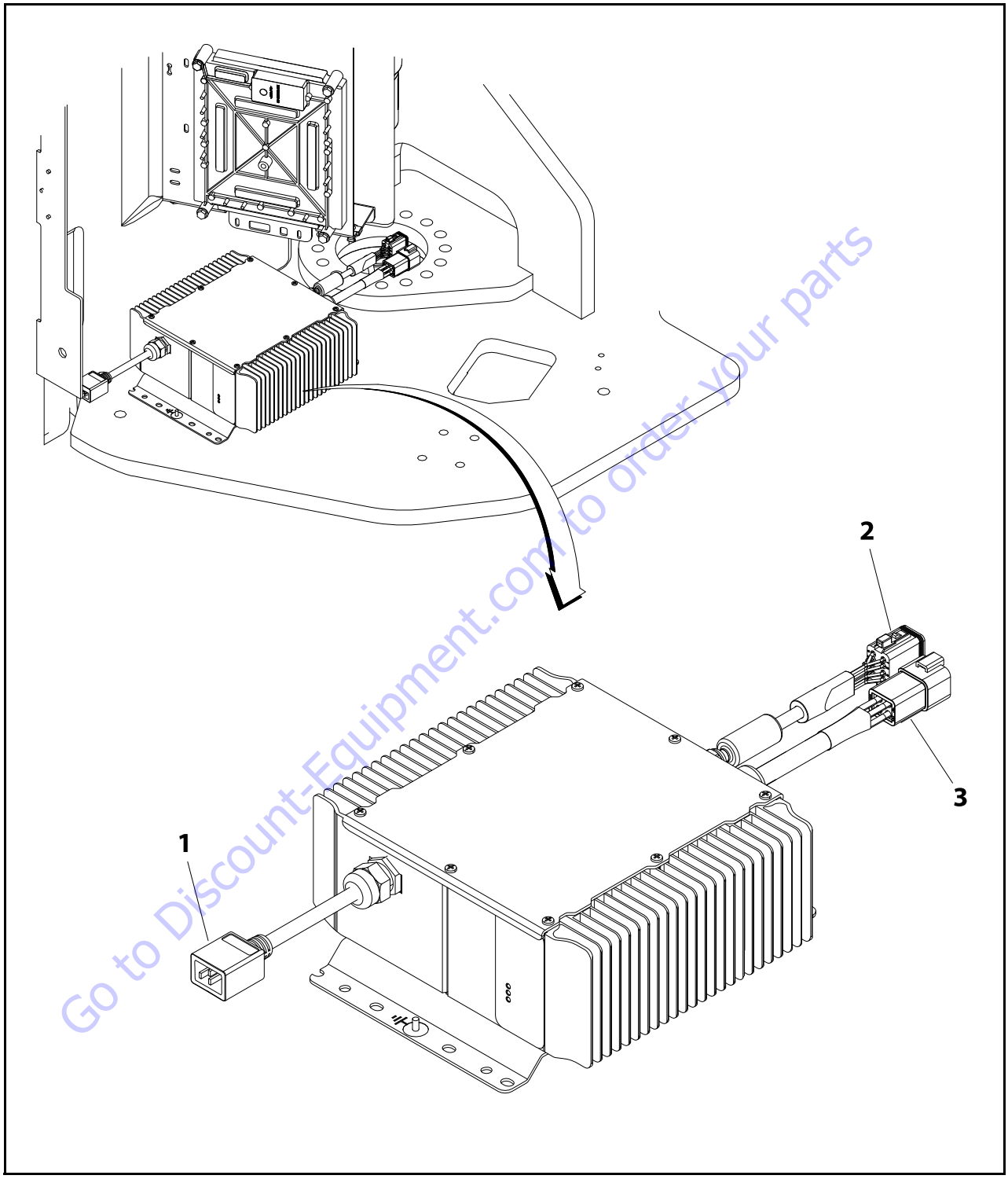
1. For flooded lead-acid batteries, regularly check water levels of each battery cell after charging and add distilled water as required to level specified by battery manufacturer. Follow the safety instructions recommended by the battery manufacturer.
2. Make sure charger connections to battery terminals are tight and clean.
3. Do not expose charger to oil or to direct heavy water spraying when cleaning vehicle.

Battery Charger Fault Codes

If a fault occurred during charging, the red "Fault" LED will flash with a code corresponding to the error. Refer to the table following for the flash codes and their removal.

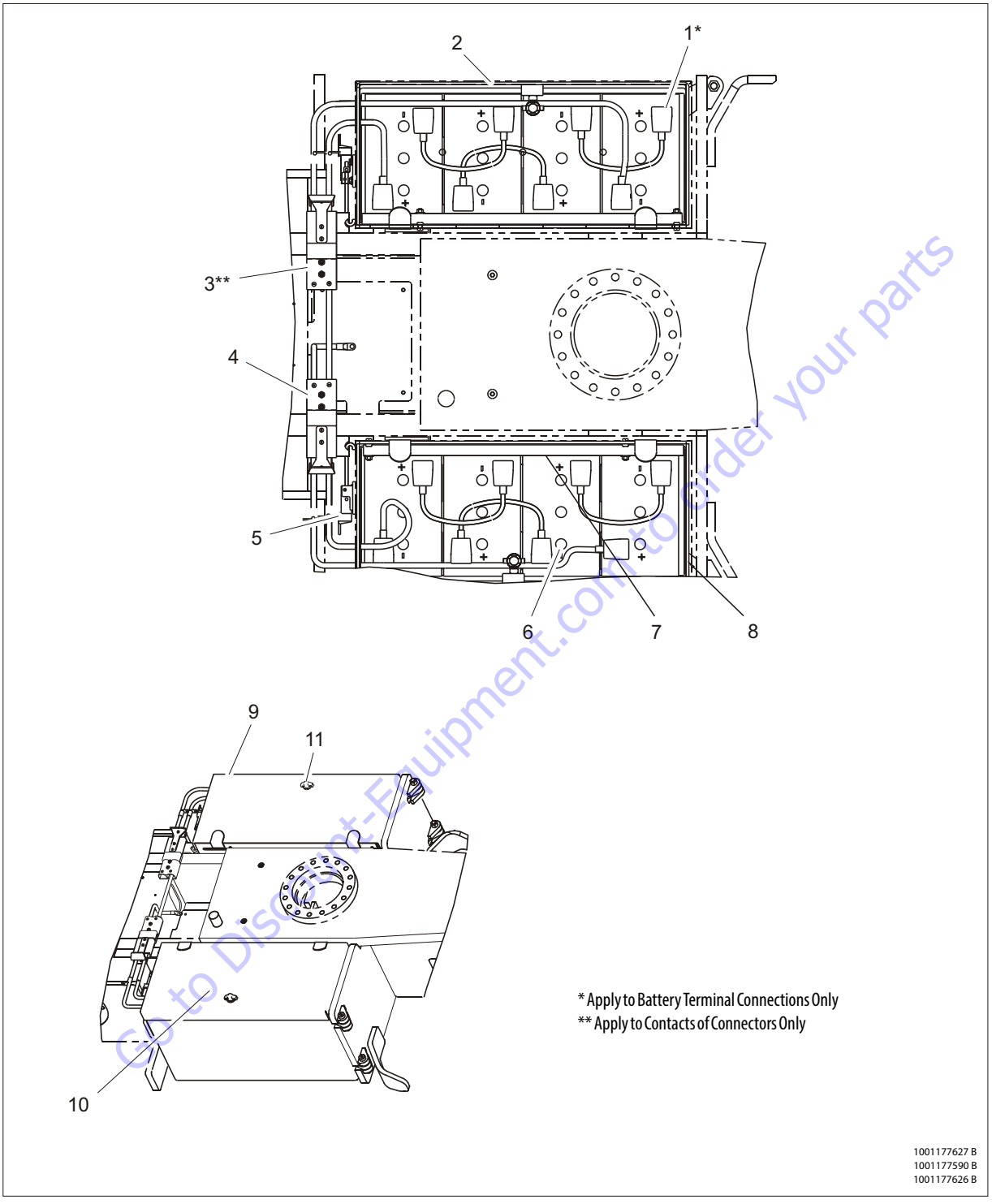
Table 3-3. Battery Charger Fault Codes (Delta-Q)

Flash(s)	Fault	Fault Removal
1	Battery voltage high	Auto-recover - Indicates a high battery pack voltage
2	Battery voltage low	Auto-recover - Indicates either a battery pack failure, battery pack not connected to charger or battery volts per cell is less than 0.5 VDC. Check the battery pack and connections
3	Charge time-out	Indicates the batteries did not charge in the allowed time. This could occur if the batteries are a larger capacity than the algorithm is intended for or if the batteries are damaged old or in poor condition.
4	Check battery	Indicates the batteries could not be trickle charged up to the minimum voltage per cell level required for the charge to be started.
5	Over-temperature	Auto-recover - Indicates charger has shut down due to high internal temperature
6	QuiQ fault	Indicates that the battery will not accept charge current, or an internal fault has been detected in the charger. This fault will nearly always be set within the first 30 seconds of operation. Once it has been determined that the batteries and connections are not faulty and fault 6 is again displayed after interrupting AC power for at least 10 seconds, the charger must be brought to a qualified service depot.



1. AC Voltage - Input Cable
2. Battery Charge Signal Cable
3. DC Power Cable to Batteries

Figure 3-31. Battery Charger



1. Battery Terminal Grease
2. Left Battery Box
3. Dielectric Grease
4. Battery Connector
5. Draw Latch
6. Battery
7. Battery Hold Down
8. Right Battery Box
9. Left Cover
10. Right Cover
11. Latch

Figure 3-32. Battery Boxes

NO LIGHTS AT ALL

No Lights at all indicate that AC power to the charger is not connected or that the AC voltage is too low. It could also indicate an internal failure in the charger.

1. Check the connections to AC power. Check for AC voltage between 90 and 260 VAC at the charger.
2. If the AC voltage is verified to be correct at the connection to the charger, and the charger still displays no lights at all, return the charger for service.

FAULT LED FLASHING

The Fault LED flashes to indicate the microcontroller inside the battery charger has detected a fault. The fault detected is indicated by the number of flashes. Count the number of flashes to determine the fault.

With any battery system, the most common problem will be a faulty battery connection. Because of the high likelihood of a battery connection problem, it is always worthwhile to confirm that all connections are good before checking for any other problems.

[1 Flash] - High Battery Voltage

1. Indicates a high battery voltage. Check that the battery charger voltage is consistent with the battery pack voltage. The first two digits of the four digit model name indicate the battery voltage the charger supports.
2. Check for wiring errors.
3. This fault will automatically clear and the charger will restart charging when this problem is removed.
4. High battery voltage could also occur if there is another source charging the battery. Disconnect any other sources during charging.
5. If this problem does not clear after the battery voltage is confirmed to be less than 2.5V per cell, return the charger for service.

[2 Flashes] - Low Battery Voltage

1. Indicates either a battery failure, no battery connected, or a lower than expected battery voltage. check the battery and battery connections.
2. Check the nominal battery voltage. The first two digits of the four digit model name indicate the battery voltage the charger supports. Confirm that a nominal battery voltage is the same as the charger voltage.
3. This fault will clear automatically when the low battery voltage problem is rectified.
4. If this problem does not clear after the battery voltage is confirmed to be higher than 1.0V per cell and all connections are good, return the charger for service.

[3 Flashes] - Charge Timeout

Indicates the battery failed to charge within the allowed time. This could occur if the battery is of larger capacity than the algorithm is intended for. In unusual cases it could mean charger output is reduced due to high ambient temperature. It can also occur if the battery is damaged, old, or in poor condition.

1. Check the battery for damage such as shorted cells and insufficient water. Try the charger on a good battery.
2. If the same fault occurs on a good battery, check the connections on the battery and connection to AC, and the AC voltage itself.
3. Confirm that the nominal battery pack voltage is the same as the battery charger voltage.
4. This fault must be cleared manually by unplugging the AC, waiting 30 seconds and reconnecting the AC power.
5. If a charger displays this fault on a battery pack, and the pack is of questionable status, reset the charger by disconnecting AC for 30 seconds, and then reconnect the AC to start a new charge cycle. After a few charge cycles, this problem could stop occurring as the pack "recovers."

[4 Flashes] - Check Battery

This fault indicates the battery pack could not be trickle charged up to the minimum level required for the normal charge cycle to be started.

1. Check that none of the battery pack connections between modules are reversed or incorrectly connected.
2. Check that one or more cells in the battery are no shorted.
3. Confirm that the nominal battery pack voltage is the same as the battery charger voltage.
4. Try the charger on a good battery.
5. If this fault occurs, the battery is likely in poor condition. Try to recover the pack with a charger that can charge the individual cells - such as an automotive charger. Be sure to set this charger to the appropriate voltage - 6V per 6V battery, 12V per 12V string/battery.

[5 Flashes] - Over Temperature

This fault indicates the charger has become too hot during operation. Though not damanging to the charger, charge time will be extended significantly.

1. This fault indication will not clear automatically, but the charger will restart charging automatically when the temperature drops. The fault indicaiton must be cleared manually by unplugging the AC, waiting 30 seconds and reconnecting the AC power.
2. If possible, move the machine to a cooler location.
3. Confirm that dirt or mud is not blocking the cooling fins of the charger. Clean the charger. Rinse the charger with a low pressure hose if required. Do no use high pressure. Do not us a pressure washer.

[6 Flashes] - Over Load/Over Temperature

This fault indicates that the batteries will not accept charge current, or an internal fault has been detected in the charger. This fault will nearly always be set within the first 30 seconds of operation. If it occurs after the charger has started charging normally, be sure to make a note of it.

1. Remove excessive AC loads from inverter if installed.
2. Try to clear the fault by unplugging the AC, waiting 30 seconds and reconnecting the ac power.
3. Check all battery connections. Look for a high resistance connection.The most likely reason for this fault is a fault in the battery such as a bad battery connection, an open cell, or insufficient water.
4. This fault will occur if an internal fuse inside the charger blows. If the green wire is shorted to ground even momentarily, this fuse will blow. To check the fuse, measure with an ohmmeter between the green and red wires with the AC disconnected. If a short circuit is not measured, the fuse has blown. Return unit to a service depot to have this fuse replaced.
5. If this fault occurs after battery charging has started, confirm that AC power was not interrupted and that all battery connections are good.
6. If all battery connections are good, an internal fault has been detected and the charger must be brought to a qualified service depot.

Excessive Battery Watering Requirements or Strong Sulphur (Rotten Egg) Smell

These symptoms indicate over-charging or high battery temperature. These symptoms are unlikely to be caused by too high a charge current since the maximum charge current of the charger will be small compared to even a moderately sized battery pack. The most likely cause for this problem is incorrect charge algorithm setting and/or high ambient temperatures.

1. Confirm that the battery pack is not too small - usually > 50Ah.
2. Confirm that the nominal battery voltage matches the charger output voltage.
3. Confirm the correct battery charge algorithm. If the battery pack is new, the algorithm will need to be changed if the pack is not the same as the old one. for instructions on how to determine and change the battery charge algorithm see the following sub-section.
4. If the output voltage of the charger seems excessive, return the charger for service. Contact JLG to get the expected battery voltage settings for the charger in question. Be sure to have the charger's serial number and charge algorithm setting available when calling.

Checking/Changing the Battery Charger Algorithm

The charger is pre-loaded with programming algorithms for the specific batteries detailed in Table 3-4, Battery Algorithms.

NOTE: *Contact JLG if your specific battery model is not listed.*

Each time AC power is applied with the battery pack not connected, the charger enters an algorithm select/display mode for approximately 11 seconds. During this time, the current Algorithm # is indicated on the Yellow Charging LED. A single digit Algorithm # is indicated by the number of blinks separated by a pause. A two digit Algorithm # is indicated by the number of blinks for the first digit followed by a short pause, then the number of blinks for the second digit followed by a longer pause.

To check / change the charging algorithm:

1. Disconnect the charger positive connector from the battery pack. Apply AC power and after the LED test, the Algorithm # will display for 11 seconds.
2. To change the algorithm, touch the connector to the battery's positive terminal for 3 seconds during the 11 second display period and then remove. The Algorithm # will advance after 3 seconds. Repeat this procedure until the desired Algorithm # is displayed. A 30 second timeout is extended for every increment. Incrementing beyond the last Algorithm will recycle back to the first Algorithm. When the desired Algorithm is displayed, touch the charger connector to the battery positive terminal until the output relay makes a clicking noise (approx. 10 seconds). The algorithm is now in the permanent memory.
3. Remove the AC power from the charger and reconnect the charger's positive connector to the battery. It is recommended to check a newly changed algorithm by repeating the above steps 1 and 3.

Table 3-4. Battery Algorithms

Algorithm #	JLG P/N	Battery Type	Proper Algorithm Setting
173	1001105091	US BATT 6V-305-S	73
173	0400055	US BATT L16	173
173	1001114782	DISCOVER EV 305A-A	43

3.12 DRIVE ORIENTATION SYSTEM

NOTE:

The Drive Orientation System (DOS) is intended to indicate to the operator conditions that could make the direction of movement of the chassis different than the direction of movement of the drive/steer control handle. The system indicates to the operator the need to match the black and white directional arrows on the platform control panel to the arrows on the chassis. The system uses a proximity switch mounted under the turntable, a "target" mounted to the frame, an indicator light and an override switch on the platform display panel. The proximity switch trips when the turntable is swung +/- 28 degrees off center of the normal driving position. This occurs roughly when the boom is swung past a rear tire. When the turntable is in the normal drive position with the boom between the rear tires, no indications or interlocks are made. When the machine is actively driving when the turntable is swung past the switch point, the system is ignored until drive/steer is released. When drive is initiated with the boom swung past the switch point, the DOS indicator will flash and the drive/steer functions will be disabled. The operator must engage the DOS override switch to enable Drive/steer (high drive will remain disabled). When the DOS is enabled, the DOS indicator will be illuminated continuously and a 3-second enable timer will be started and will continue for 3 seconds after the end the last drive/steer command. If the timer expires, the DOS override switch must be re-engaged to enable drive/steer.

3.13 HOODS

The right hood weighs 15 lbs. (6.8 kg) and the left hood weighs 10.3 lbs. (4.7 kg). See Figure 3-33., Hoods 3-28.,

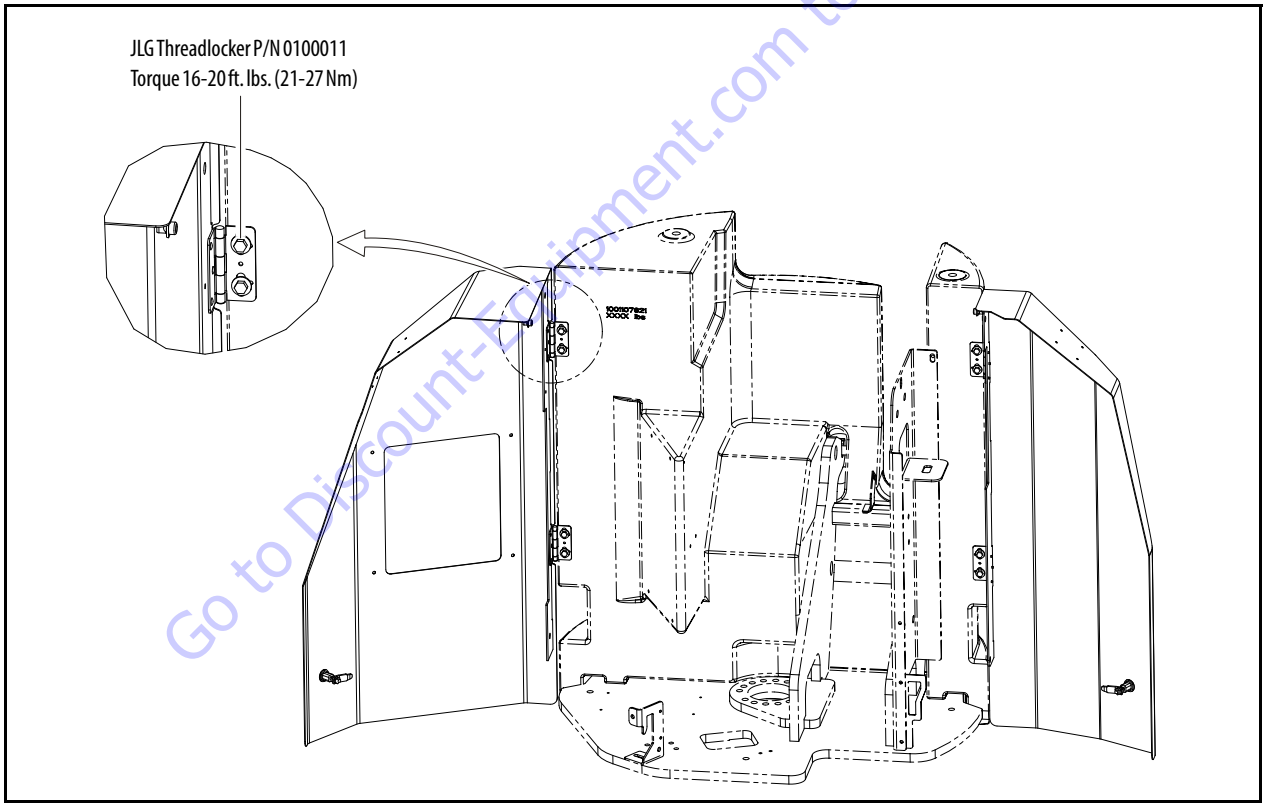


Figure 3-33. Hoods

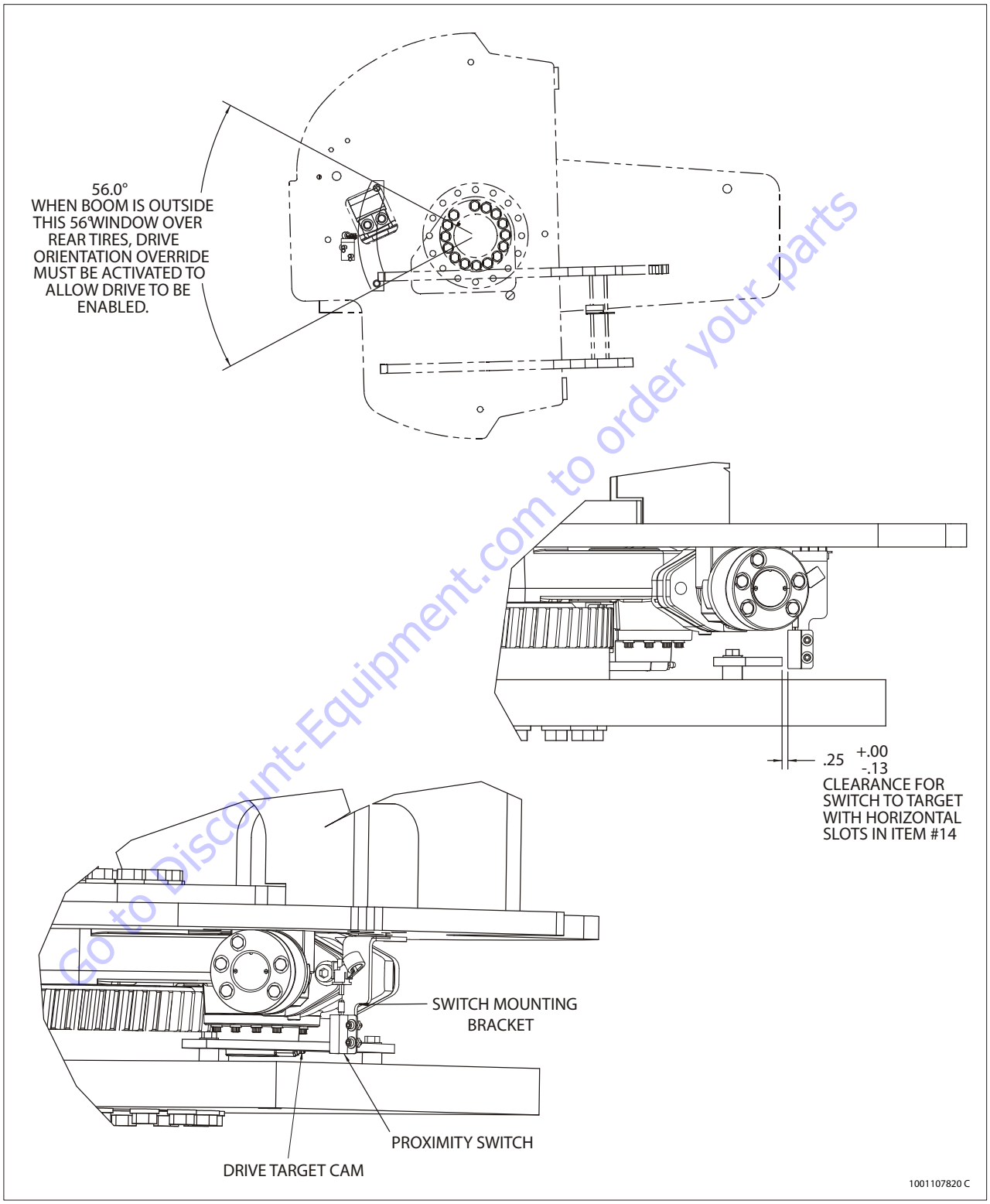


Figure 3-34. Drive Orientation Switch

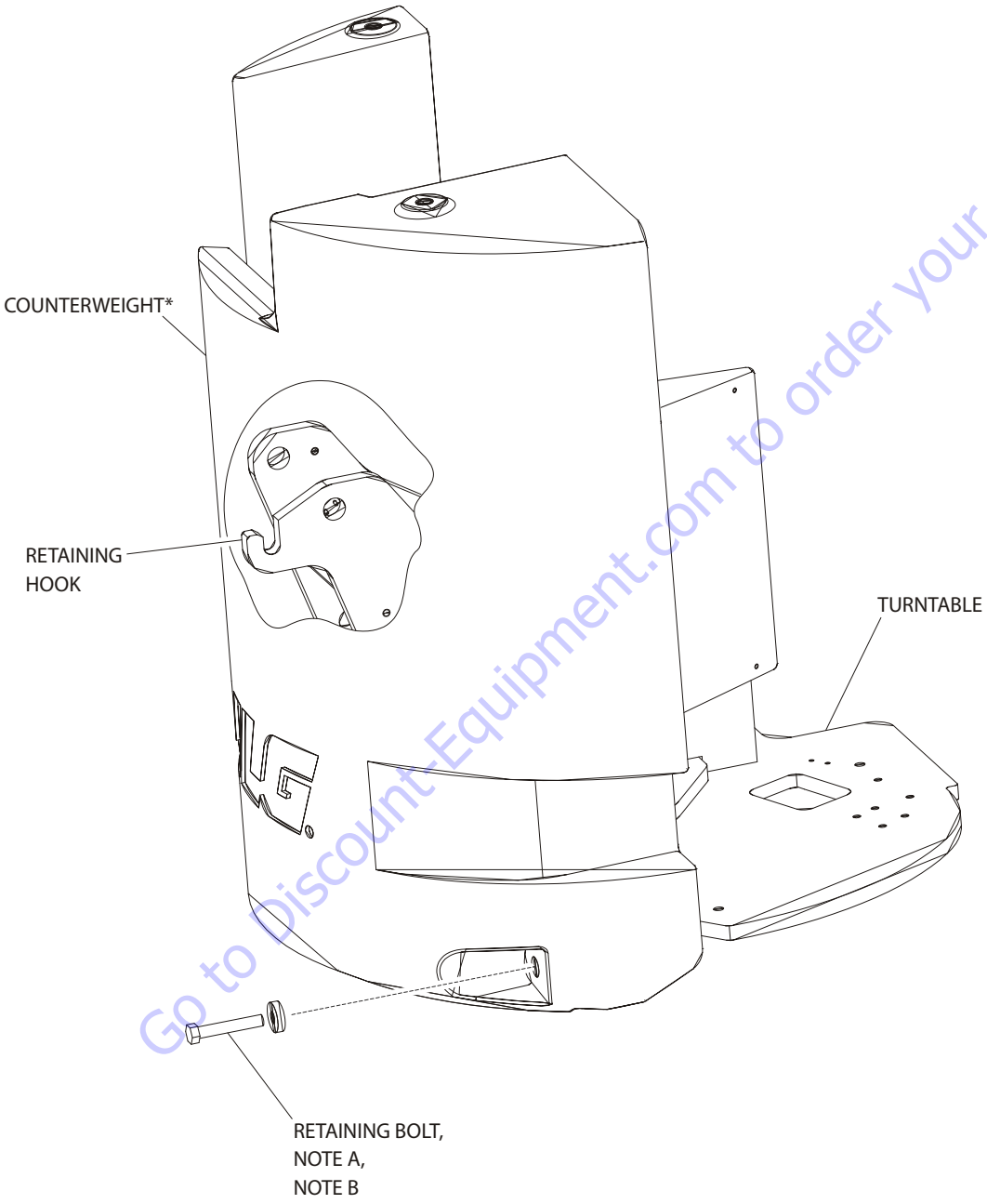


Figure 3-35. Counterweight

PARTS FINDER

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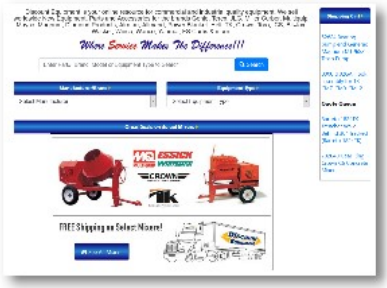
Discount Equipment



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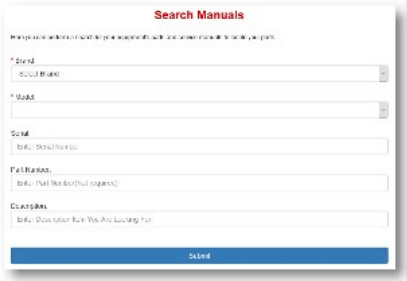

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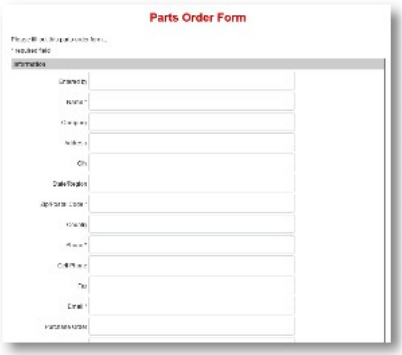

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SECTION 4. BOOM & PLATFORM

4.1 PLATFORM

Support Removal

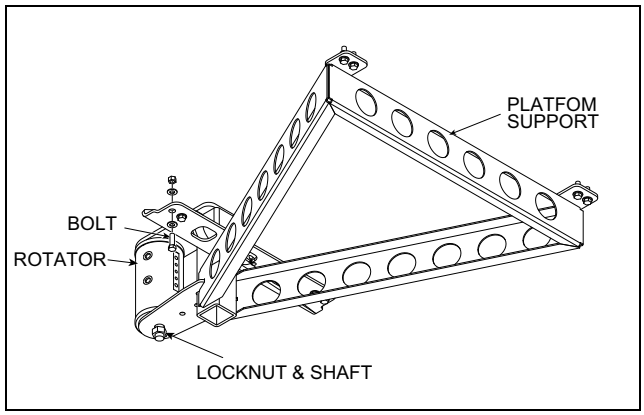
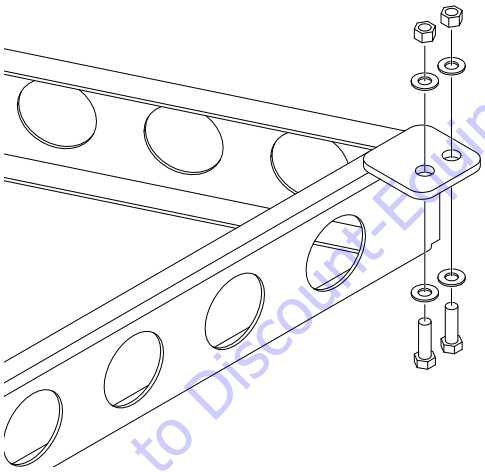


Figure 4-1. Location of Components Platform Support

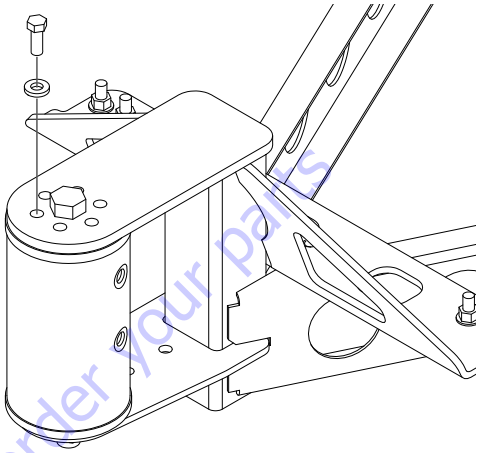
1. Disconnect electrical cables from control console.
2. Remove the bolts securing the platform to the platform support, then remove the platform.



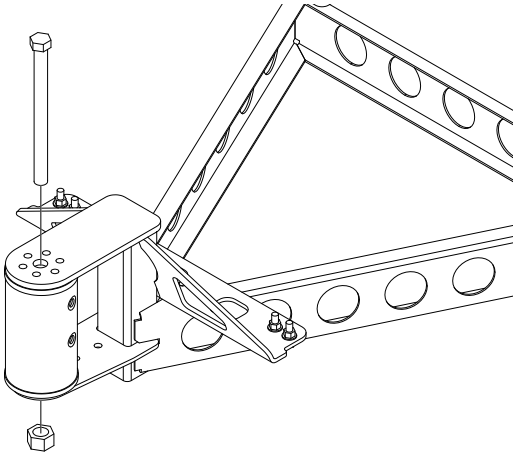
3. Using a suitable lifting device, support the platform support.

NOTE: *The platform support weighs approximately 77 lbs. (35 kg).*

4. Remove the bolts and locknut securing the support to the rotator.



5. Using a suitable brass drift and hammer, remove the rotator shaft, then remove the support from the rotator.

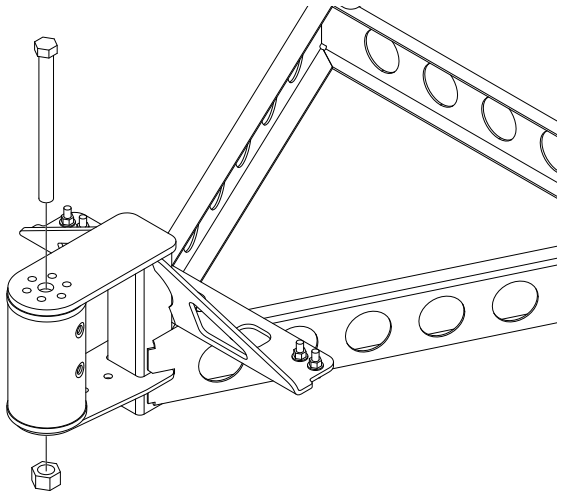


Support Installation

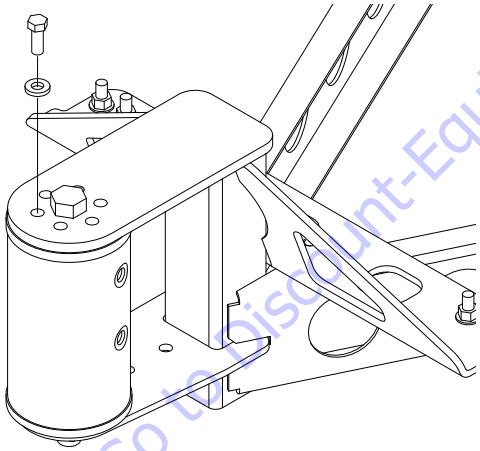
1. Using a suitable lifting device, support the platform support and position it on the rotator.

NOTE: *The platform support weighs approximately 77 lbs. (35 kg).*

2. Install the rotator center bolt.

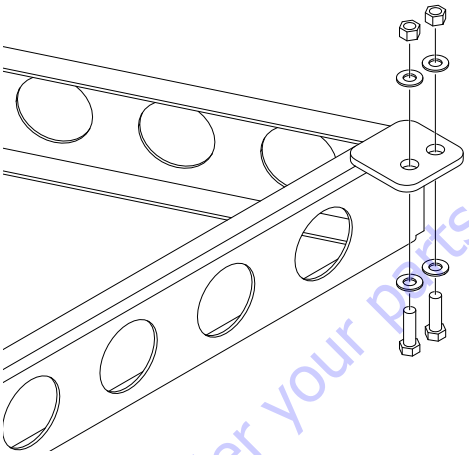


3. Apply JLG Threadlocker P/N 0100011 to the bolts and locknuts securing the support to the rotator and install the bolts and locknuts.

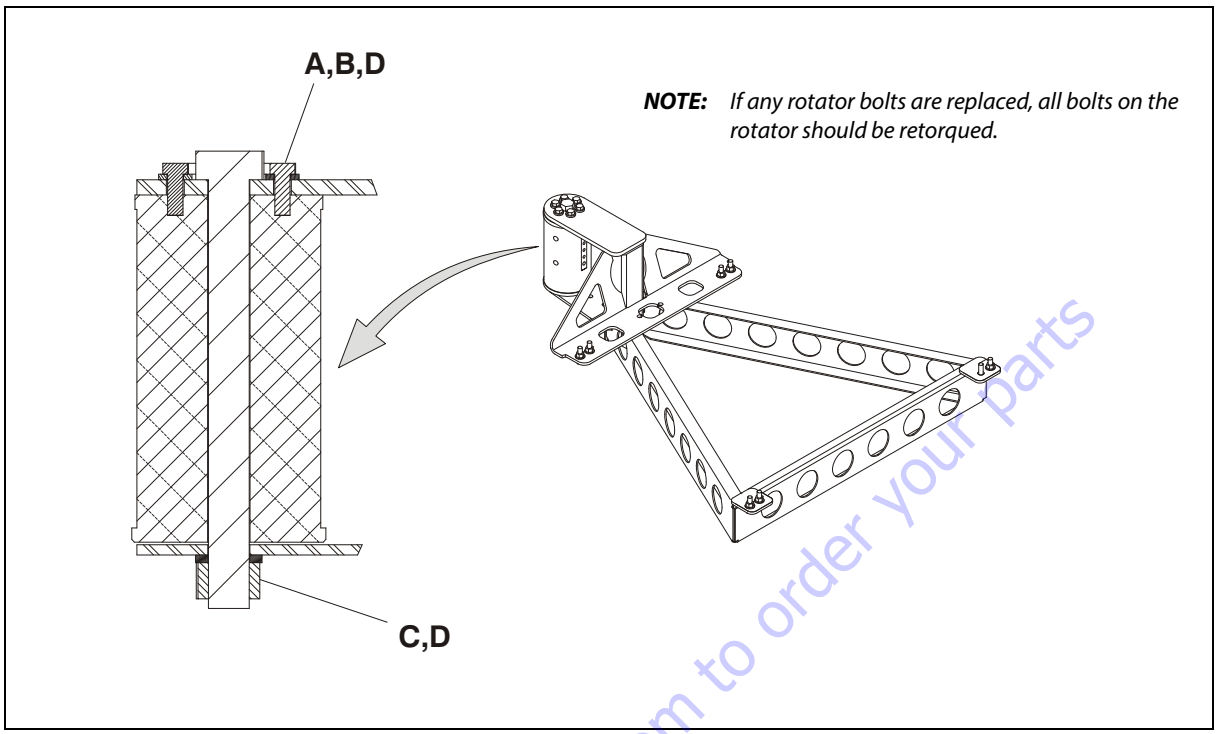


4. Torque the nut on the rotator center bolt to 250-270 ft. lbs. (339-366 Nm). Torque the retaining bolts to 40 ft. lbs. (55 Nm).

5. Position the platform on the platform support and install the bolts securing the platform to the platform support.



6. Connect the electrical cables to the platform control console.



A Torque to 40 ft.lbs. (55 Nm)
B JLG Thread locker (#0100011)
C Torque to 250-270 ft. lbs. (339-366 Nm)
D Check torque every 150 hours of operation

Figure 4-2. Platform Support Torque Values

4.2 BOOM MAINTENANCE

Removal of the Main Boom

NOTICE

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

1. Raise the boom to a horizontal position.
2. Place blocking in the tower boom for support and prevent it from lowering.

NOTE: *The jib/platform assembly weighs approximately 500 lbs. (230 kg).*

3. Support the weight of the jib/platform assembly using adequate lifting or blocking equipment.

NOTE: *The main boom assembly weighs approximately 475 lbs. (216 kg).*

4. Support the weight of the main boom with an adequate lifting device.
5. Tag and disconnect all electrical lines running to the platform.
6. Tag and disconnect all hydraulic lines running to the platform rotator, jib rotator (if equipped), and jib cylinder. Cap or plug all openings.
7. Remove the hose cover from the top of the jib and remove the hydraulic hoses from the jib.

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

8. Remove the retaining bolt, keeper, and pin that secures the level cylinder to the jib.
9. Remove the retaining bolt, keeper, and pin that secures the main boom to the jib.
10. Remove the jib and platform assembly from the boom.
11. Tag and disconnect the hydraulic lines running to the level cylinder. Cap or plug all openings.
12. Remove the cable cover from the side of the main boom.
13. Tag and disconnect all the hose/line couplings found behind the cable cover. Cap or plug all openings. Remove the clamp blocks securing the hoses/ lines.
14. Unbolt the power track from the boom and remove the power track and hoses/lines from the boom.
15. Remove the cover at the rear of the boom.
16. Tag and disconnect the hydraulic lines running to the telescope cylinder. Cap or plug all openings.

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

17. Remove the retaining bolt, keeper, and pin that secures the upper lift cylinder rod end to the main boom.

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

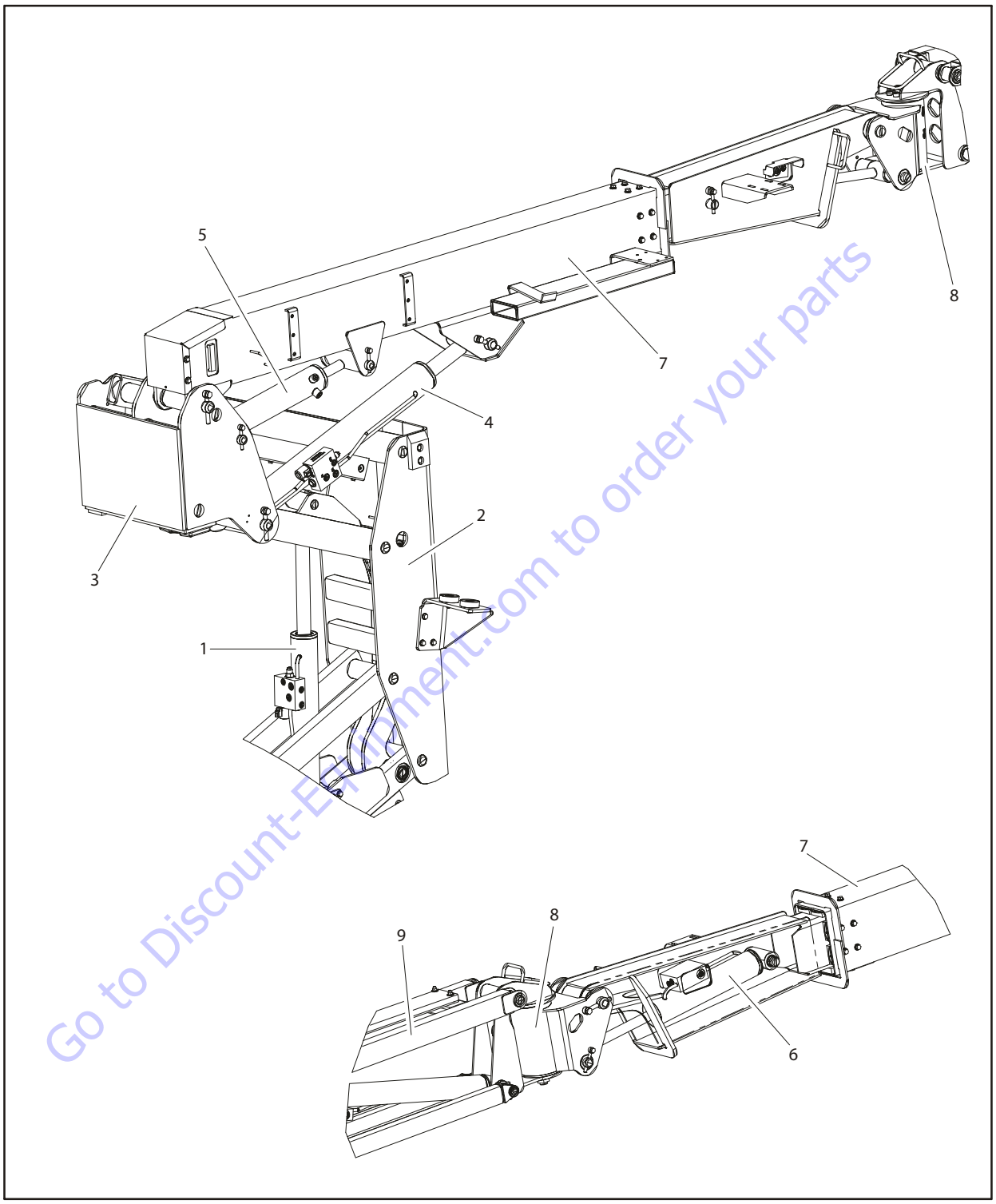
18. Remove the retaining bolt, keeper, and pin that secures the master cylinder rod end to the main boom.
19. Remove the retaining bolt, keeper, and pin that secures the main boom to the upper upright.
20. Remove the boom from the machine and place it on suitable blocking.

Disassembly of the Main Boom

1. Loosen the wear pad retaining bolts at the rear of fly boom section and remove the shims and wear pads noting the location and amount of shims to aid in reassembly.
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 the portable power source.
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. Cap or plug all openings.

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

4. Remove the retaining ring and pin securing the telescope cylinder rod end to the fly boom section.
5. Remove the bolts and washers securing telescope cylinder to the rear of the base boom section.



1. Tower Lift Cylinder
2. Tower Upright
3. Upper Upright
4. Upper Lift Cylinder
5. Master Cylinder
6. Level Cylinder
7. Boom Assembly
8. Jib Rotator
9. Jib

Figure 4-3. Boom Assembly

NOTE: *The telescope cylinder weighs approximately 53 lbs. (24 kg).*

1. Using a suitable lifting device, remove telescope cylinder from the rear of the boom sections.
2. Remove hardware securing the front wear pads on base boom section, remove wear pads and shims, noting the location and amount of shims to aid in reassembly.

NOTE: *The fly boom section weighs approximately 188 lbs. (85 kg).*

3. Using a suitable lifting device, remove fly boom from boom section.

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. Lubricate the boom sections as shown in Figure 4-4., Boom Lubrication Instructions.
2. Using JLG Threadlocker P/N 0100011 or equivalent, install the bottom wear pads and shims as noted during disassembly on the rear of the fly section. Torque the retaining bolts to 41 ft.lbs. (55 Nm). Install the rest of the wear pads on the rear of the fly section but do not install the shims or torque them at this time.
3. Using an adequate lifting device, slide the fly boom section into the base boom section. Install the remaining shims on the rear of the fly section as noted during disassembly and torque the retaining bolts to 40 ft.lbs. (55 Nm). Pull the fly section out of the base section enough to install the pin that secures the telescope cylinder rod to the fly boom section.
4. Using JLG Threadlocker P/N 0100011 or equivalent, install the front wear pads and shims as noted during disassembly on the base boom section. Torque the retaining bolts to 41 ft.lbs. (55 Nm).
5. Using an adequate lifting device, install the telescope cylinder into the boom assembly. It will aid assembly if the cylinder is extended to enable connection to the fly boom section.
6. Align the telescope cylinder rod end with the corresponding hole in the fly boom section. If necessary, attach a portable power supply to the cylinder to extend or retract the cylinder for alignment. Install the retaining pin and secure it in place with the retaining ring.
7. Using JLG Threadlocker P/N 0100011 or equivalent, secure the rear of the telescope cylinder to the base boom section with the attaching bolts and washers. Torque the bolts 95 ft.lbs. (129 Nm).

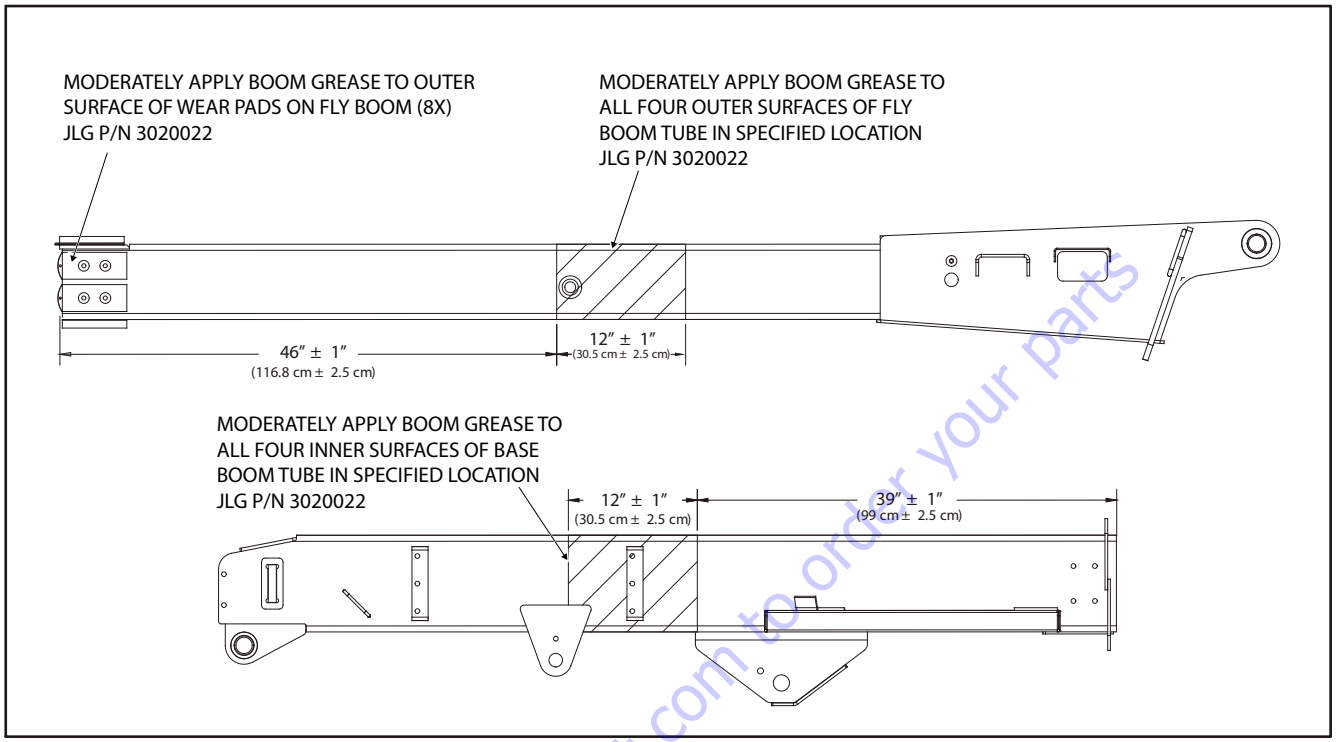


Figure 4-4. Boom Lubrication Instructions

Installation of the Main Boom

NOTE: *The main boom assembly weighs approximately 475 lbs. (216 kg).*

1. Using suitable lifting equipment, position boom assembly into the upper upright so the boom pivot holes in both the boom and upright are aligned.
2. Using JLG Threadlocker P/N 0100011 or equivalent, install the retaining bolt, keeper, and pin that secures the main boom to the upper upright. Torque the retaining bolt to 85 ft.lbs. (116 Nm).
3. Using JLG Threadlocker P/N 0100011 or equivalent, install the retaining bolt, keeper, and pin that secures the master cylinder rod end to the main boom. Torque the retaining bolt to 41 ft.lbs. (55 Nm).
4. Using JLG Threadlocker P/N 0100011 or equivalent, install the retaining bolt, keeper, and pin that secures the upper lift cylinder rod end to the main boom. Torque the retaining bolts to 72 ft.lbs. (97 Nm).
5. Connect the hydraulic lines running to the telescope cylinder as tagged during removal.
6. Install the cover at the rear of the boom.
7. Install the power track and hoses/lines onto the boom support brackets and secure in place with the retaining hardware. Refer to,Figure 4-5., Power Track Hoses

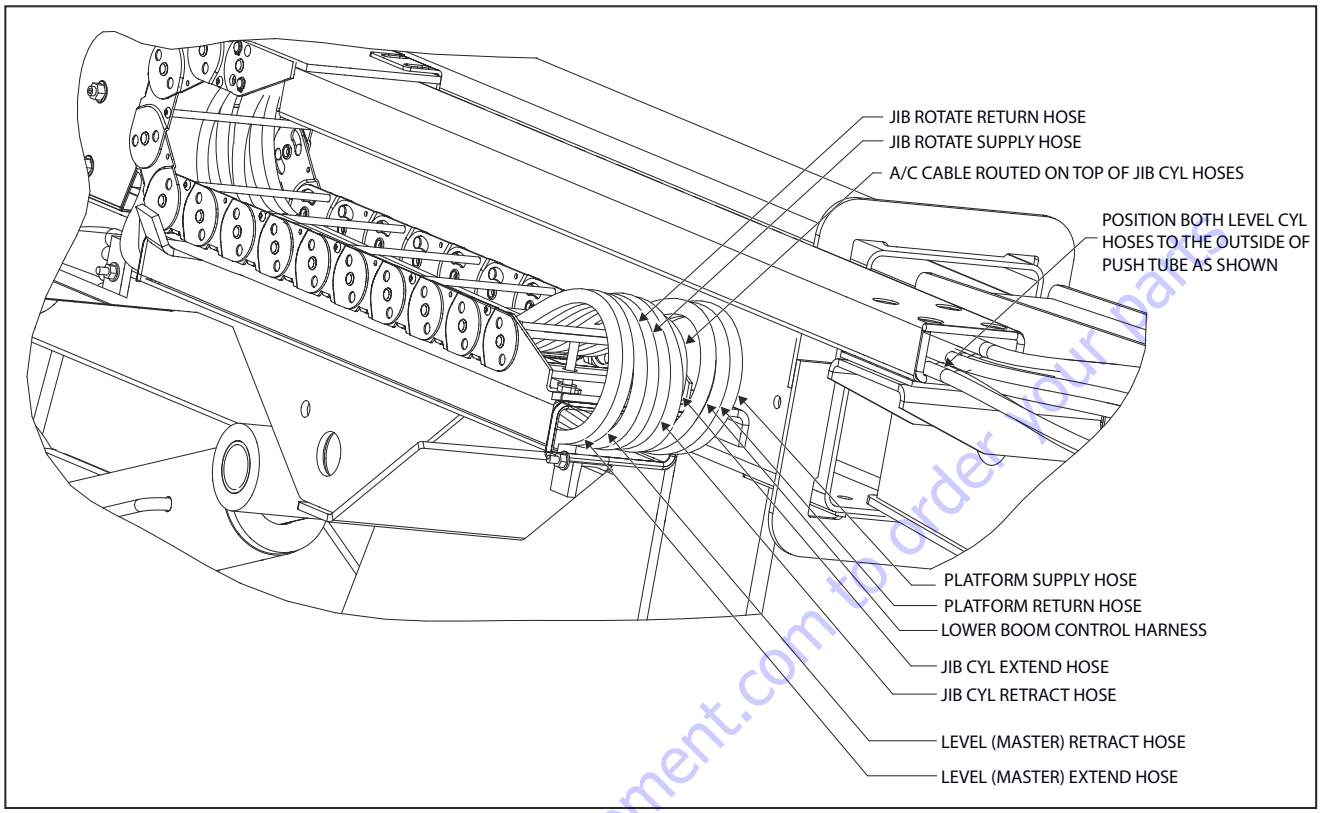


Figure 4-5. Power Track Hoses

8. Connect all the hose/line couplings on the side of the boom as tagged during removal. Install the clamp blocks securing the hoses/lines. Refer to Figure 4-6., Clamp Block Installation.
9. Install the cable cover onto the side of the main boom.
10. Connect the hydraulic lines running to the level cylinder as tagged during removal.
11. Align the jib and platform assembly with the attach points on the boom.
12. Using JLG Threadlocker P/N 0100011 or equivalent, install the retaining bolt, keeper, and pin that secures the main boom to the jib. Torque the retaining bolt to 85 ft.lbs. (116 Nm).

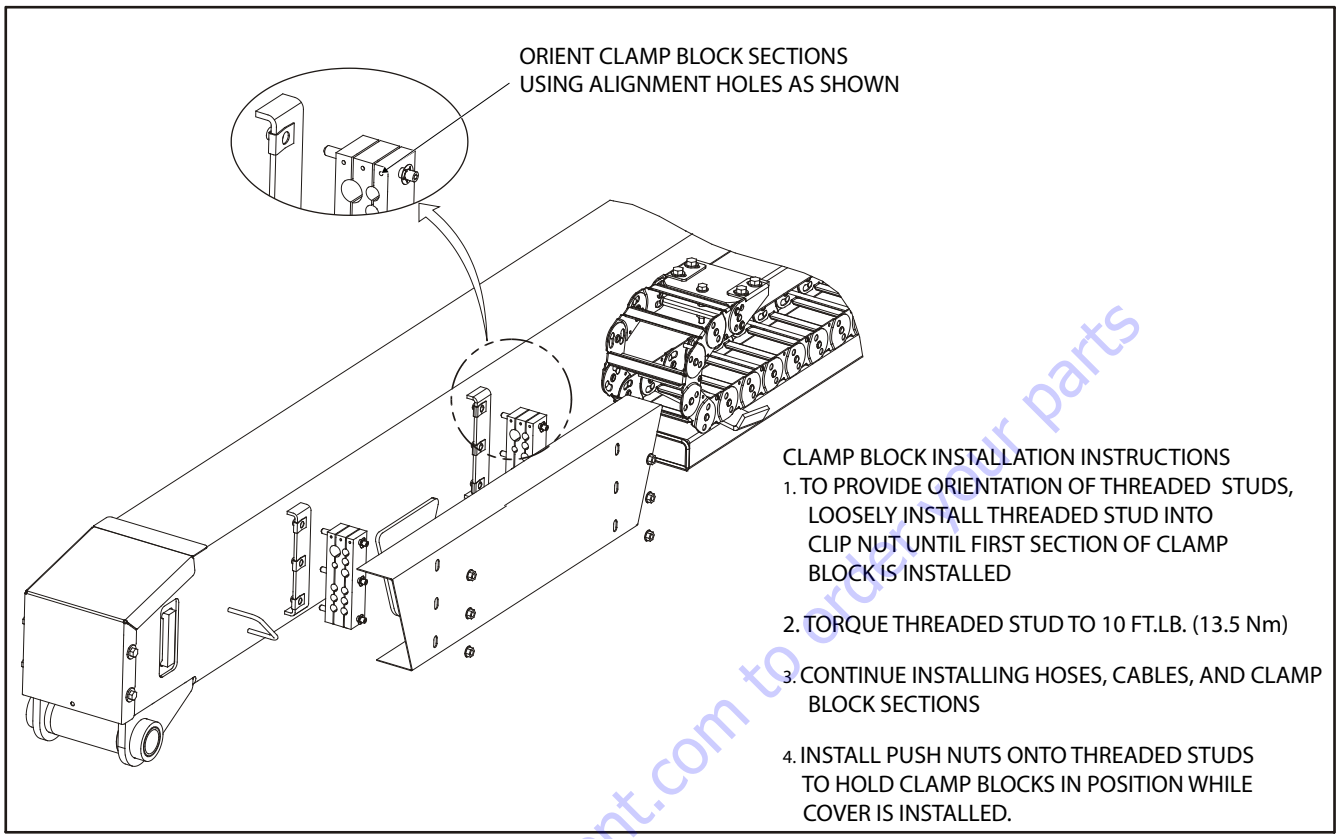
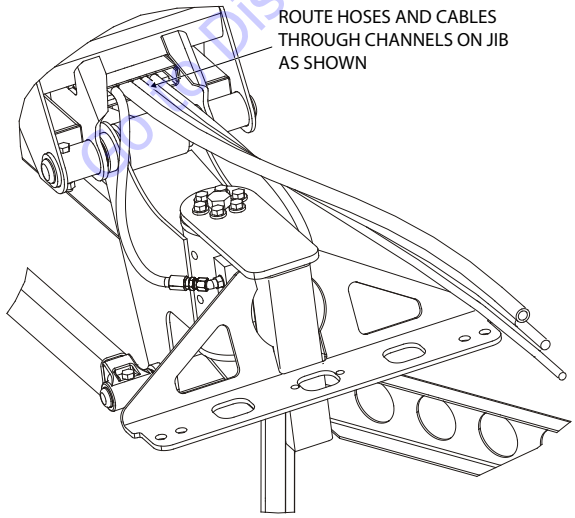


Figure 4-6. Clamp Block Installation

13. Using JLG Threadlocker P/N 0100011 or equivalent, install the retaining bolt, keeper, and pin that secures the level cylinder to the jib. Torque the retaining bolt to 35 ft.lbs. (48 Nm).

14. Route the hydraulic hoses on top of the jib and install the hose cover.

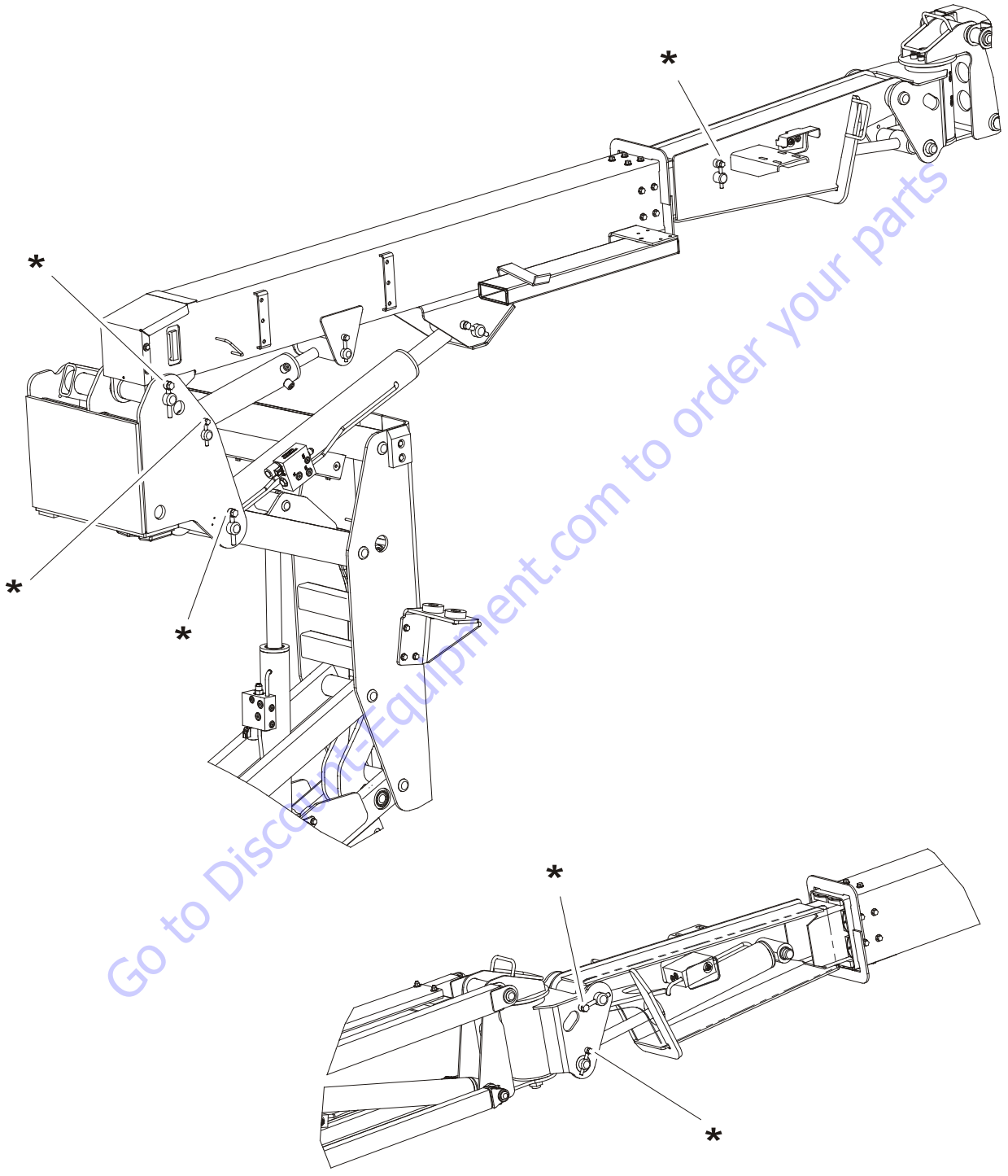


15. Connect all hydraulic lines running to the plaform rotator, jib rotator (if equipped), and jib cylinder as tagged during removal.

16. Connect all electrical lines running to the platform as tagged during removal.

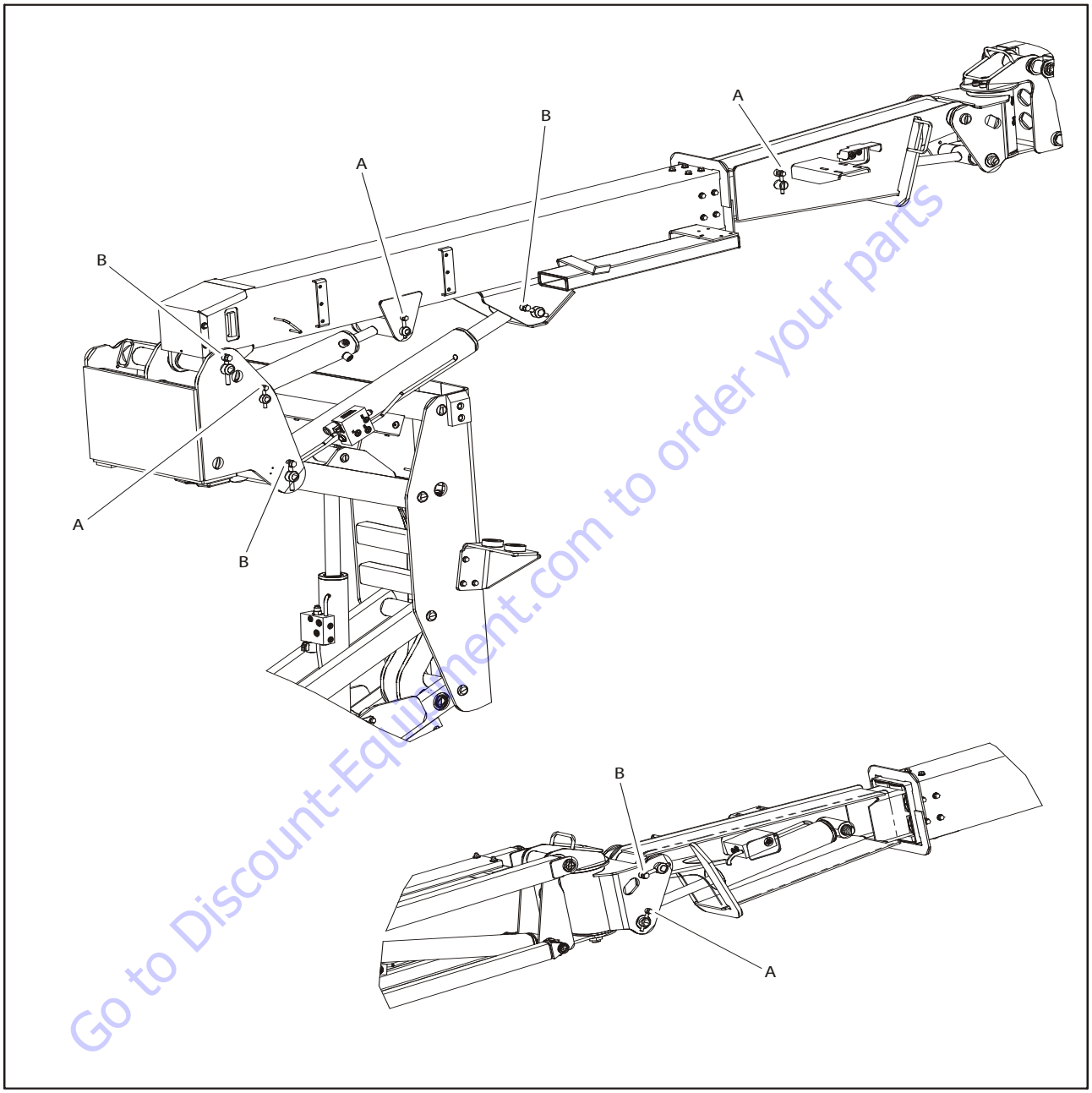
17. Using all safety precautions, operate machine systems and extend and retract boom for four or five cycles, checking for proper operation.

18. Shut down the machine and check for leakage.



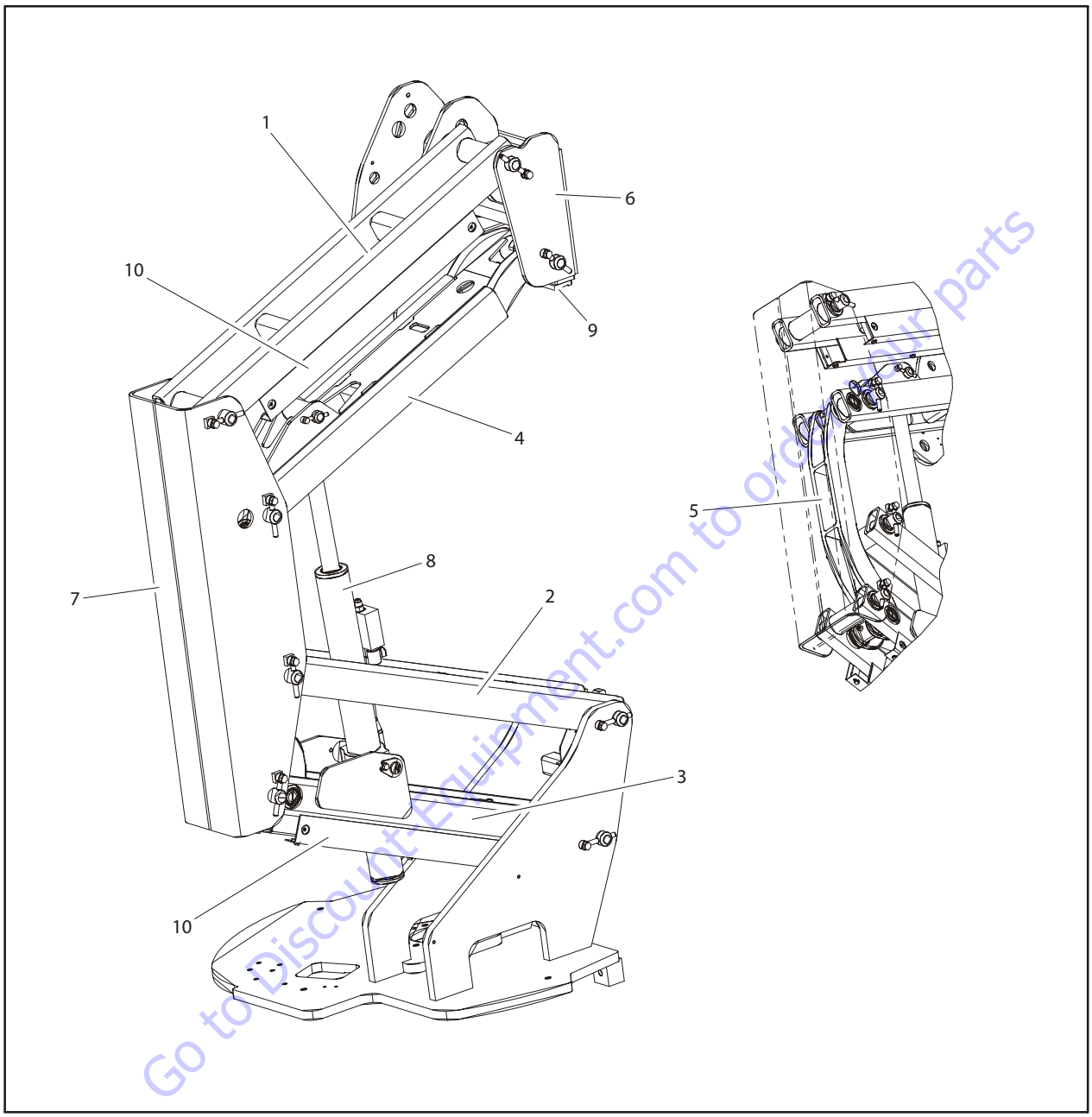
* Use JLG Threadlocker P/N 0100011 or Equivalent

Figure 4-7. Boom Thread Locking Compound Location



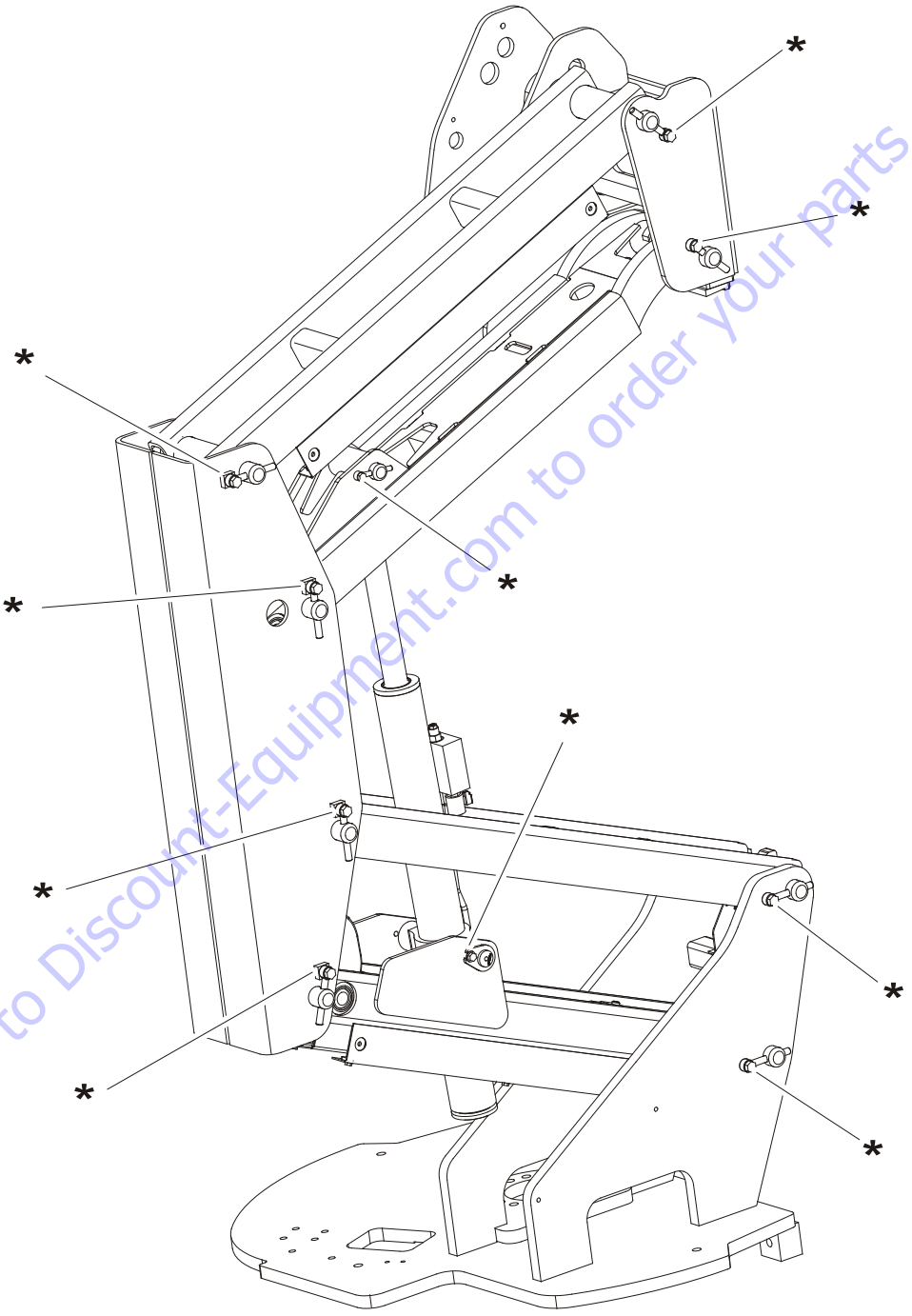
A - Torque 41 ft.lbs. (55 Nm)
B - Torque 72 ft.lbs. (97 Nm)

Figure 4-8. Boom Torque Values



1. Link
2. Level Link
3 Lower Boom
4. Mid Boom
5. Timing Link
6. Upper Upright Weldment
7. Tower Upright Weldment
8. Tower Lift Cylinder
9. Bumper
10. Hose Channel Protector

Figure 4-9. Lower Boom



* Use JLG Threadlocker P/N 0100011 or Equivalent

Figure 4-10. Lower Boom Thread Locking Compound Location

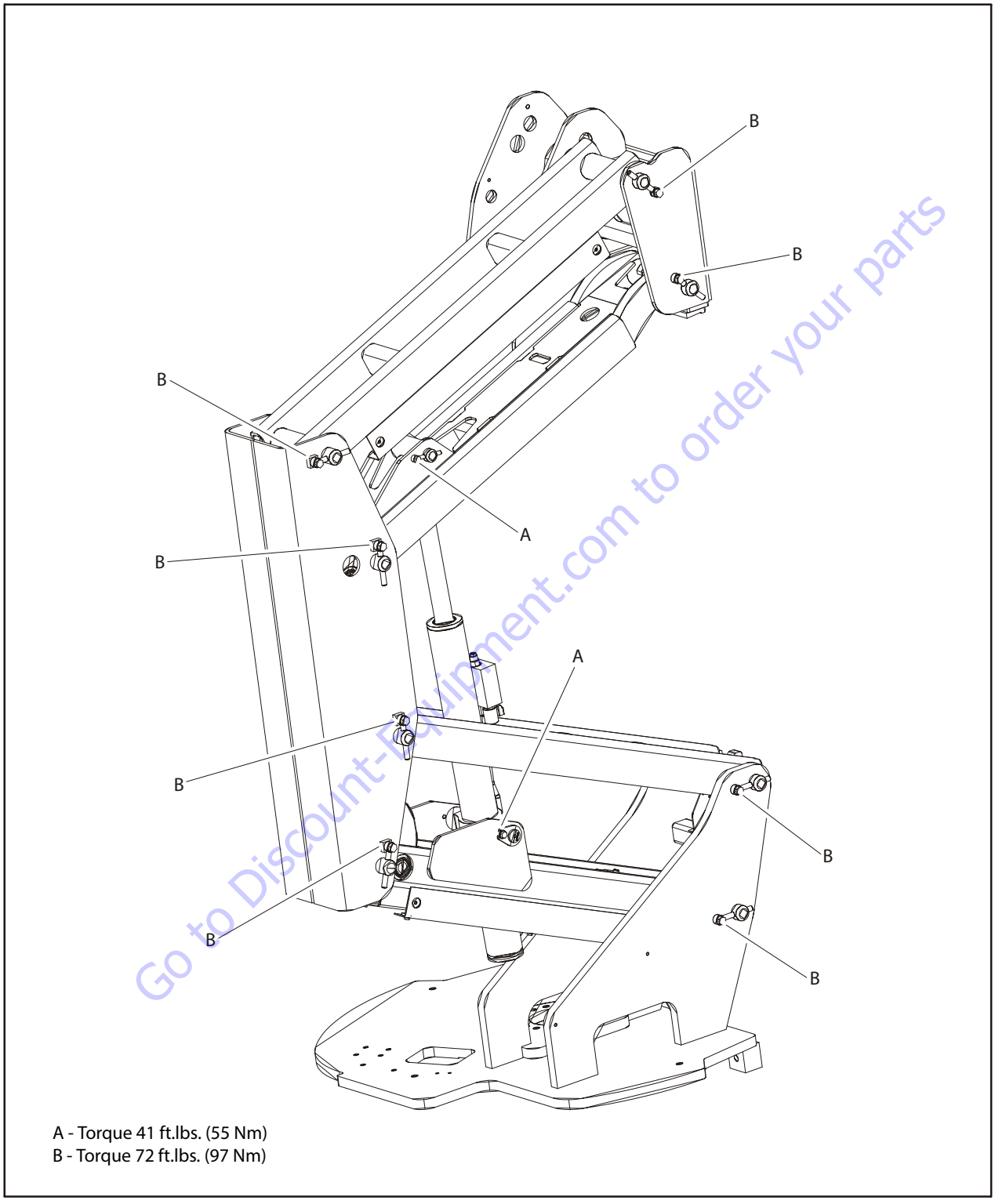


Figure 4-11. Lower Boom Torque Values

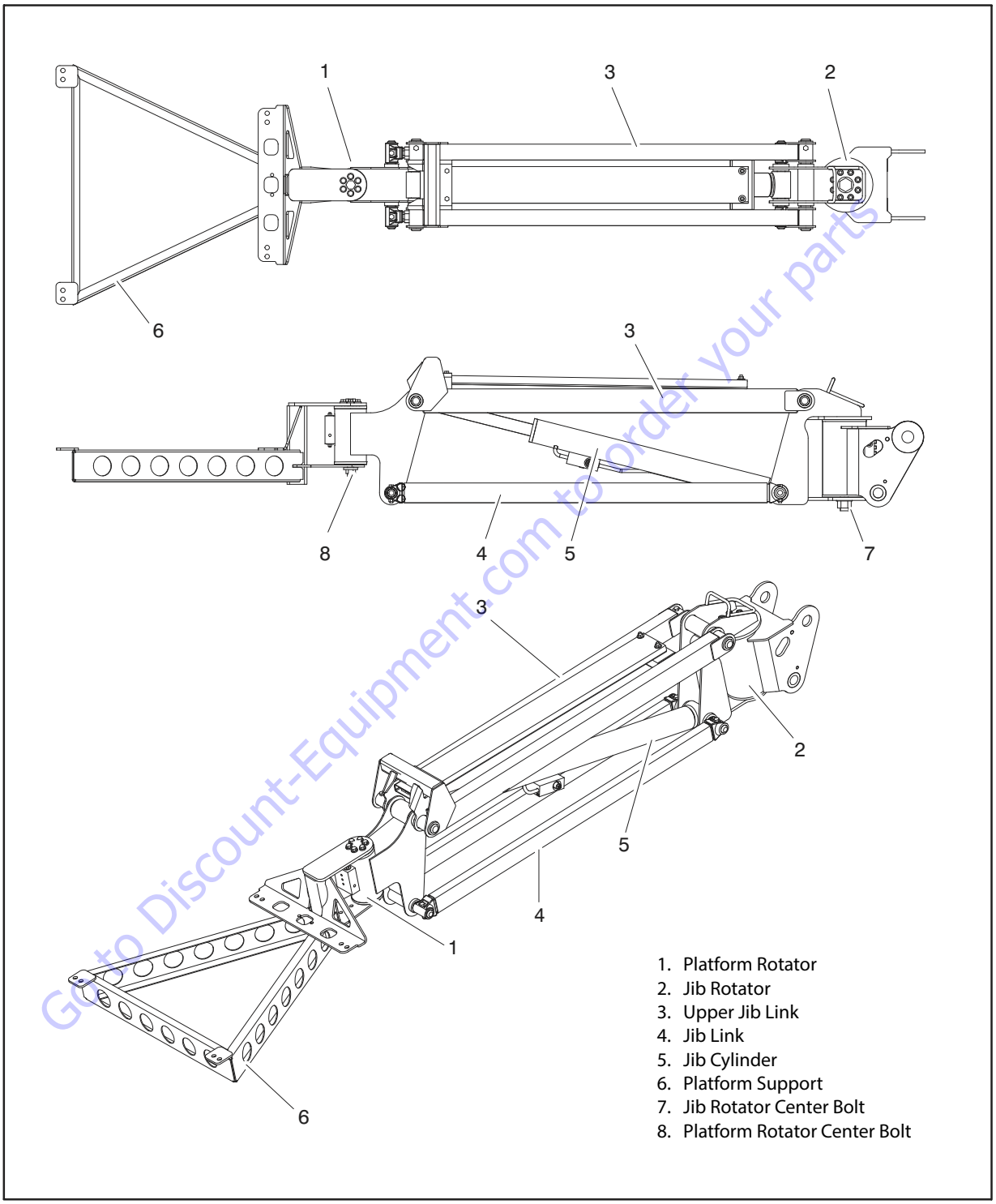
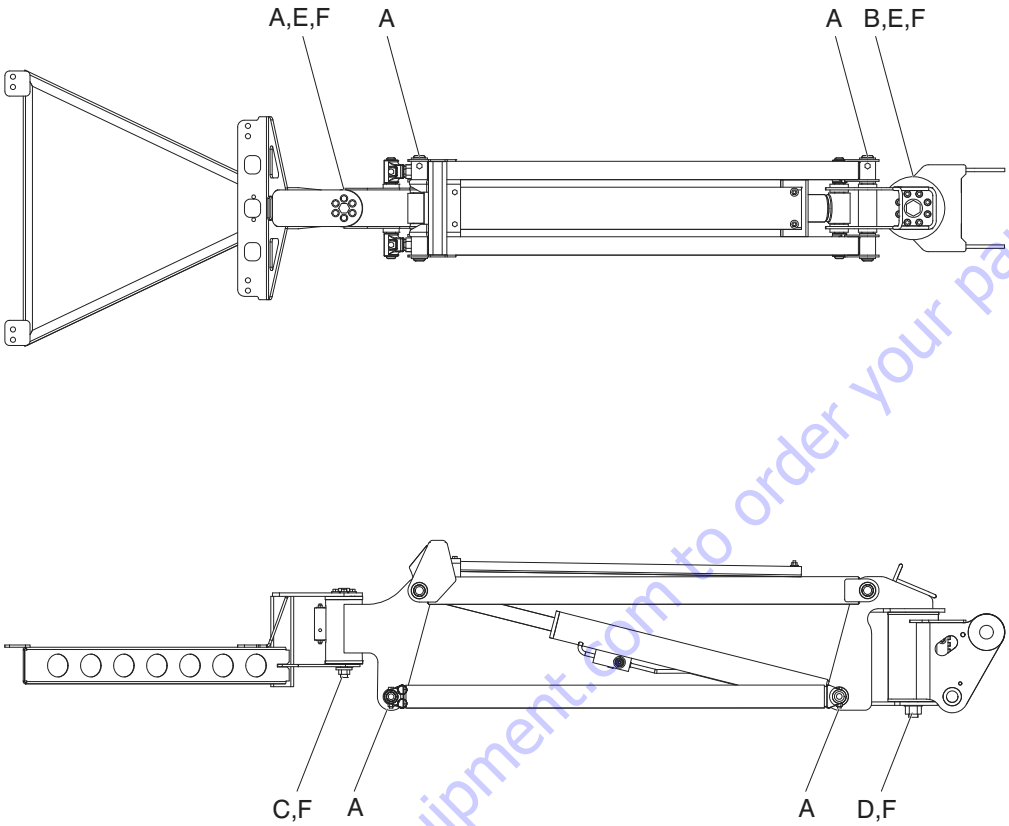


Figure 4-12. AJP Jib



NOTE: *If any rotator bolts are replaced, all bolts on the rotator should be retorqued.*

A Torque to 35 ft.lbs. (48 Nm)
B Torque to 85 ft.lbs. (115 Nm)
C Torque to 250 ft. lbs. (339 Nm)
D Torque to 480 ft. lbs. (650 Nm)
E JLG P/N 0100011Thread Locking Compound
F Check torque every 150 hours of operation

Figure 4-13. AJP Jib Torque Values

4.3 WEAR PADS

1. Shim up wear pads until snug to adjacent surface.
2. Replace wear pads when worn to thickness shown below.

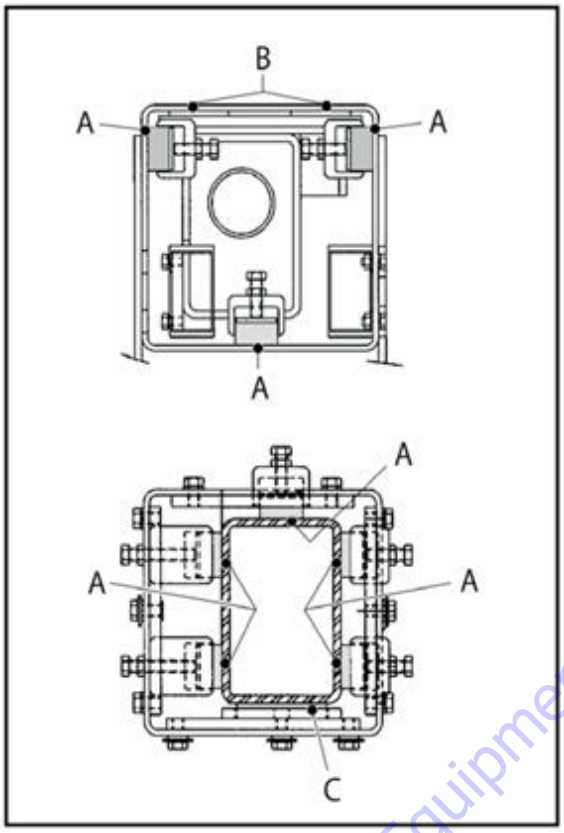


Figure 4-14. Wear Pad Thickness

3. Adjust wear pads as follows:
   a. Loosen jam nut on adjustment bolt, turn bolt CW until wear pad is snug to adjacent surface.
   b. After adjustments have been made, tighten the jam nuts on wear pad bolts.

4.4 TILT SENSOR CHECK

⚠ CAUTION

PERFORM TILT SENSOR CHECK 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.
2. If necessary, verify the tilt sensor with the analyzer. Refer to Section 3.

4.5 BOOM LIMIT SWITCHES

Refer to Figure 4-15., Boom Limit Switches for adjustments to be made to the two Boom Limit Switches which bolt in place on the upright.

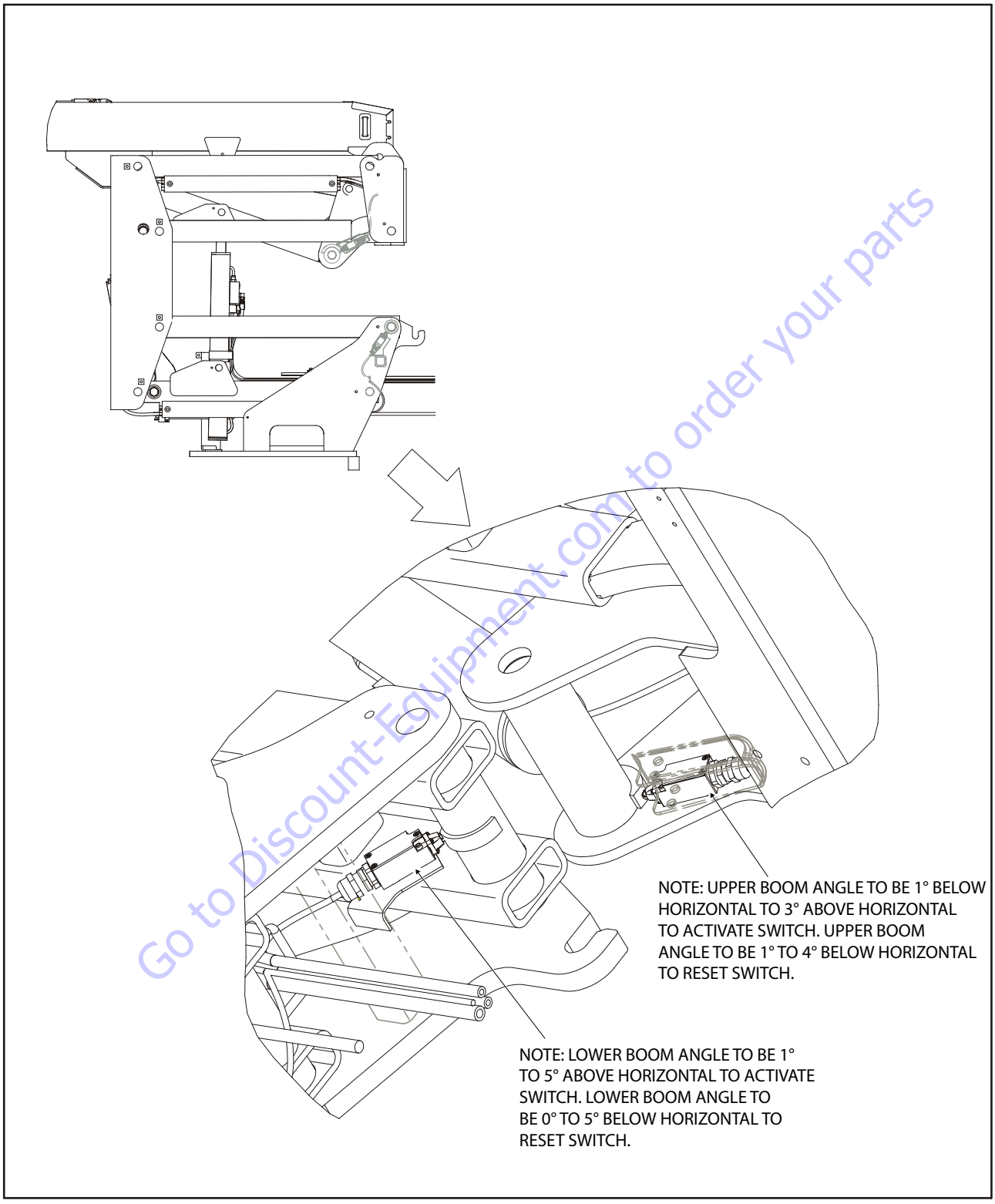


Figure 4-15. Boom Limit Switches

4.6 BOOM CLEANLINESS GUIDELINES

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

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

4.7 FOOT SWITCH 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.

4.8 ARTICULATING JIB BOOM

Removal

1. For platform/support removal see platform/support removal diagram. See Section 4.1, Platform.
2. Position the articulating jib boom level with ground.
3. Remove mounting hardware from slave leveling cylinder pin #1. Using a suitable brass drift and hammer, remove the cylinder pin from articulating jib boom.

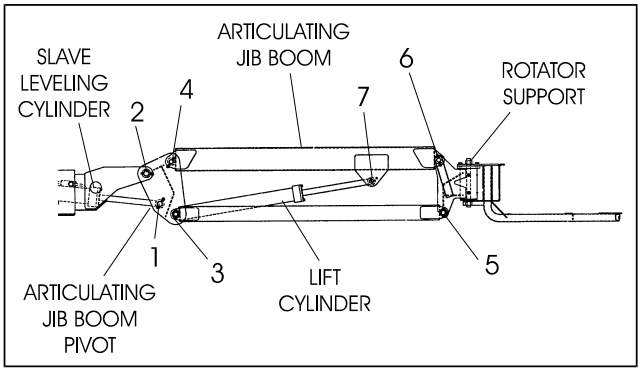


Figure 4-16. Location of Components - Articulating Jib Boom

4. Remove mounting hardware from articulating jib boom pivot pin #2. Using a suitable brass drift and hammer, remove the pivot pin from boom assembly.

Disassembly

1. Remove mounting hardware from articulating jib boom pivot pins #3 and #4. Using a suitable brass drift and hammer, remove the pins from articulating jib boom pivot weldment.
2. Remove mounting hardware from rotator support pins #5 and #6. Using a suitable brass drift and hammer, remove the pins from rotator support.
3. Remove mounting hardware from lift cylinder pin #7. Using a suitable brass drift and hammer, remove the cylinder pin from articulating jib boom.

Inspection

NOTE: *When inspecting pins and bearings refer to Section 2, Pins and Composite Bearing Repair Guidelines.*

1. Inspect articulating fly boom pivot pin for wear, scoring, tapering and ovality, or other damage. Replace pins as necessary.
2. Inspect articulating fly boom pivot attach points for scoring, tapering and ovality, or other damage. Replace pins as necessary.
3. Inspect inner diameter of articulating fly boom pivot bearings for scoring, distortion, wear, or other damage. Replace bearings as necessary. (See Section 5, Cylinder Repair For Bearing Replacement).
4. Inspect lift cylinder attach pin for wear, scoring, tapering and ovality, or other damage. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.
5. Inspect inner diameter of rotator attach point bearings for scoring, distortion, wear, or other damage. Replace bearing as necessary. (See Section 5, Cylinder Repair For Bearing Replacement).
6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.
7. Inspect structural units of articulating jib boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly

NOTE: *For location of components See Figure 4-16., Location of Components - Articulating Jib Boom.*

1. Align lift cylinder with attach holes in articulating jib boom. Using a soft head mallet, install cylinder pin #7 into articulating jib boom and secure with mounting hardware.
2. Align rotator support with attach hole in articulating jib boom. Using a soft head mallet, install rotator support pin #6 into articulating jib boom and secure with mounting hardware.

3. Align bottom tubes with attach holes in rotator support. Using a soft head mallet, install rotator support pin #5 into articulating jib boom and secure with mounting hardware.
4. Align articulating jib boom with attach hole in articulating jib boom pivot weldment. Using a soft head mallet, install rotator support pin #4 into articulating jib boom and secure with mounting hardware.
5. Align bottom tubes with attach holes in articulating jib boom pivot weldment. Using a soft head mallet, install rotator support pin #3 into articulating jib boom pivot weldment and secure with mounting hardware.
6. Align articulating jib boom pivot weldment with attach holes in fly boom assembly. Using a soft head mallet, install pivot pin #2 into fly boom assembly and secure with mounting hardware.
7. Align the slave leveling cylinder with attach holes in articulating jib boom pivot weldment. Using a soft head mallet, install slave leveling cylinder pin #1 into articulating jib boom pivot weldment and secure with mounting hardware.

4.9 BOOM SYNCHRONIZING PROCEDURE

NOTE: *If the Lower Boom assembly does not fully lower:*

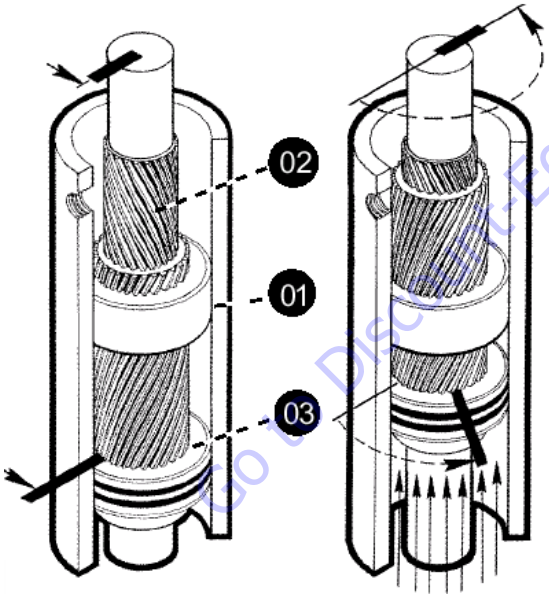
1. Remove all personnel from the platform.
2. Pull the red knob located under the main control valve.
3. From Ground Control, activate the lift control switch, raise Lower Boom 6 feet (1.8m).
4. After raising Lower Boom, release the red knob.
5. Activate Lower Boom Down, fully lower boom.
6. Repeat steps 1 thru 5 if necessary.

4.10 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 control 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.

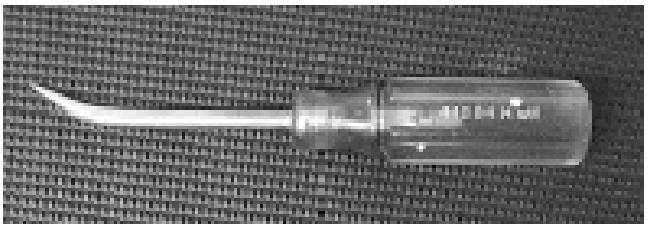


NOTE: *Bars indicate starting positions of piston and shaft. Arrows indicate direction they will rotate. The housing with integral ring gear remains stationary.*
As fluid pressure is applied, the piston is displaced axially while the helical gearing causes the piston and shaft to rotate simultaneously.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

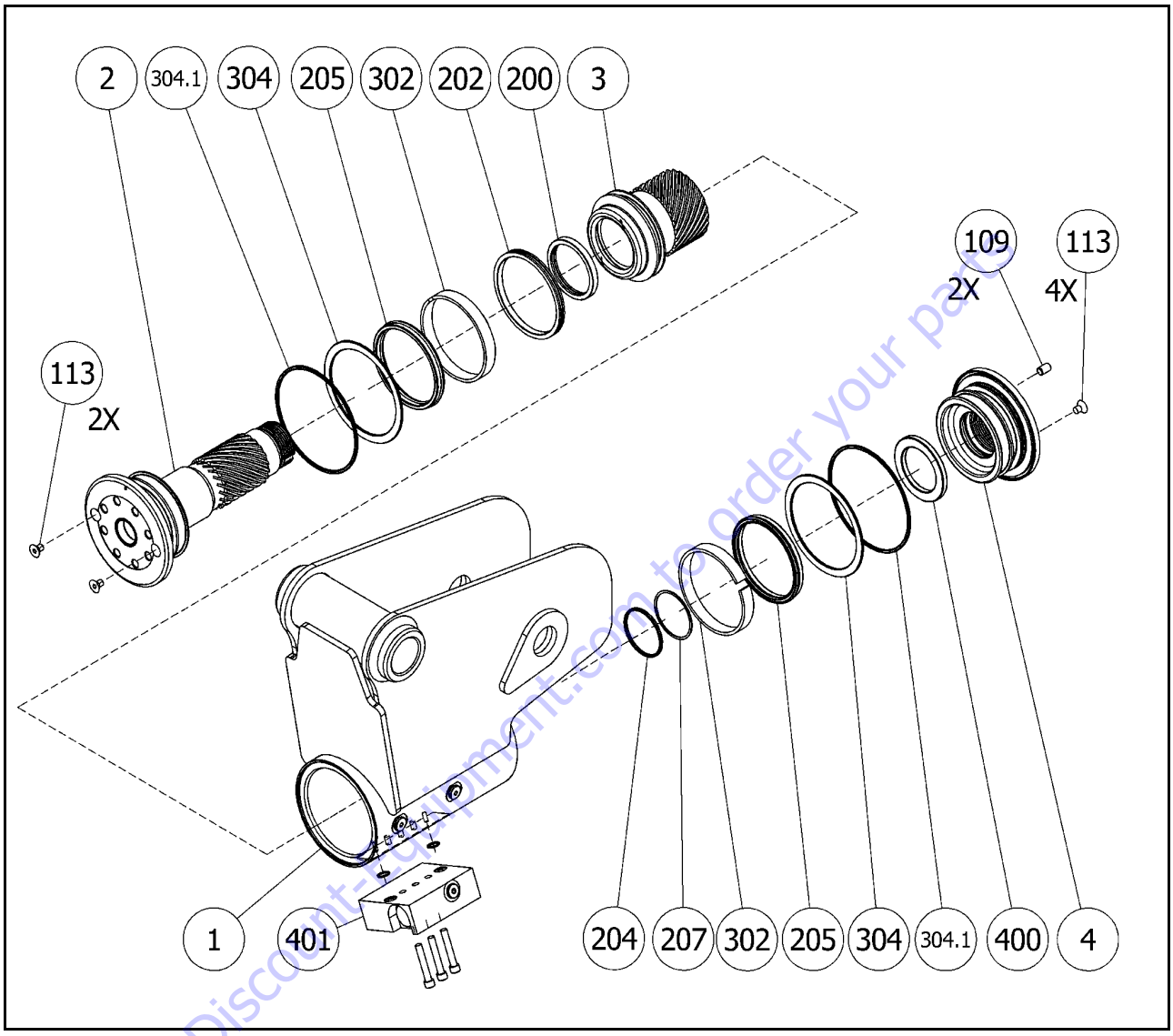
Tools Required for Assembly/Disassembly

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).

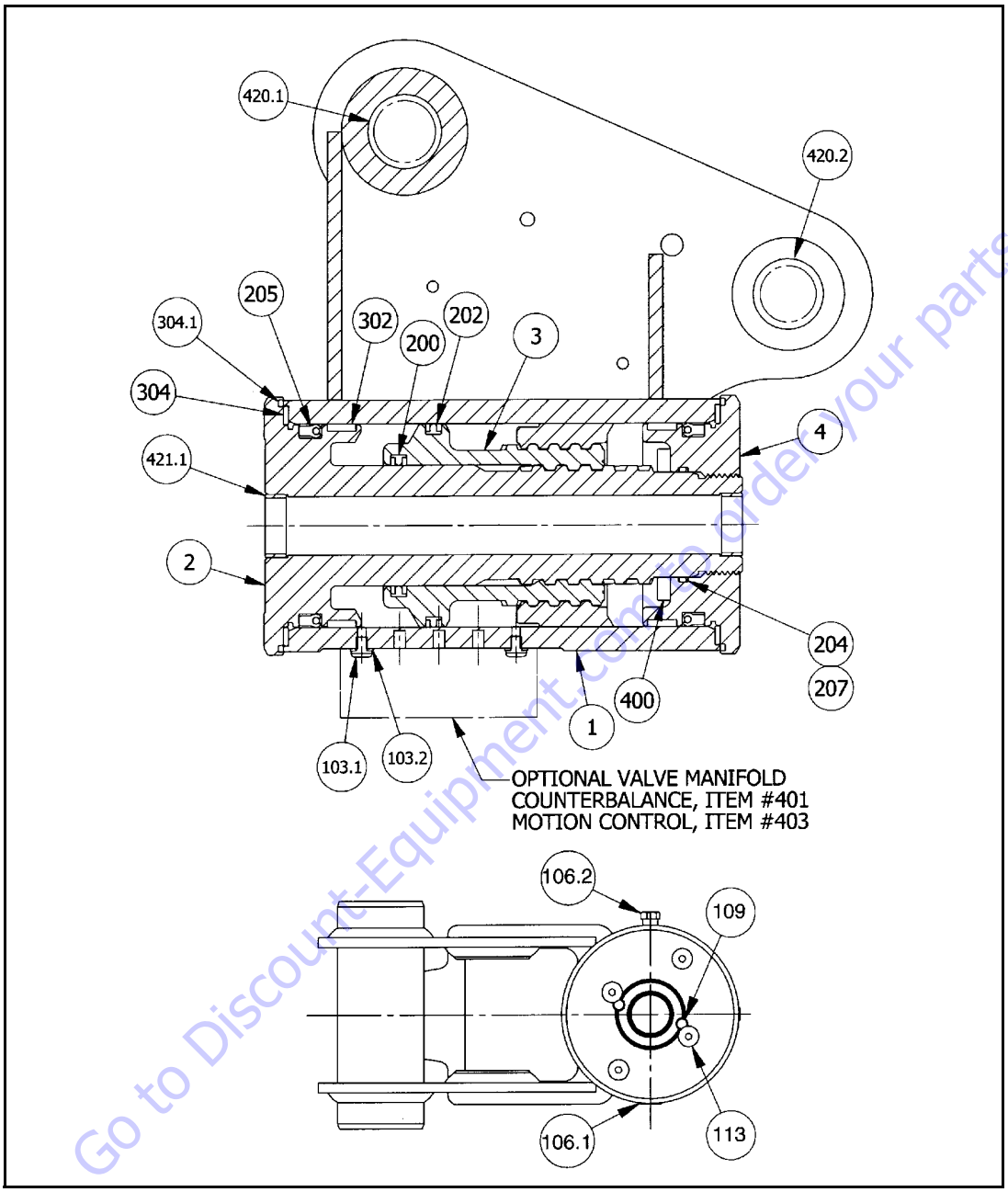


The seal tool is merely a customized standard flat headscrewdriver. To make this tool you will need to heat the flat end with a torch. Secure the heated end of the screwdriver in a vice and physically bend the heated end to a slight radius. Once the radius is achieved round off all sharp edges of the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



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 4-17. Rotary Actuator (Exploded View)



PARTS	HARDWARE	SEALS	BEARINGS	ACCESSORIES
1. Housing	103.1. Screw	200. T-Seal	302. Wear Guide	400. Stop Tube
2. Shaft	103.2. Washer	202. T-Seal	304. Thrust Washer	420.1 Bushing
3. Piston Sleeve	106.1. Port Plug	204. O-ring		420.2 Bushing
4. End Cap	106.2. Port Plug	205. Cup Seal		421.1 Bushing
	109. Lock Pin	207. Backup Ring		
	113. Capscrew	304.1. Wiper Seal		

Figure 4-18. Rotator- Assembly Drawing

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.

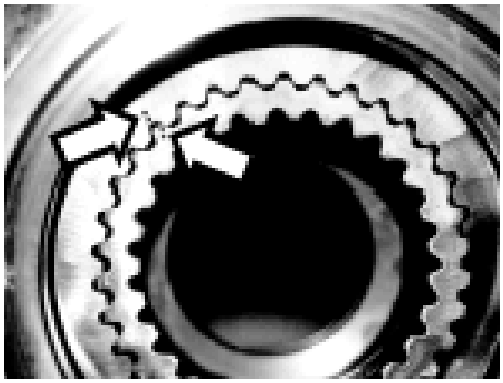
4. Install the end cap (4) removal tools provided with the Helac seal kit.

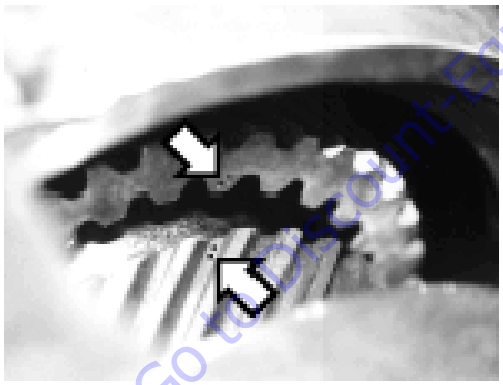
5. Using a metal bar, or something similar, un-screw the end cap (4) by turning it counter clock-wise.

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.

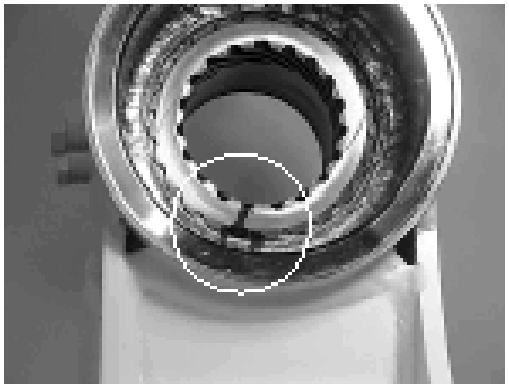




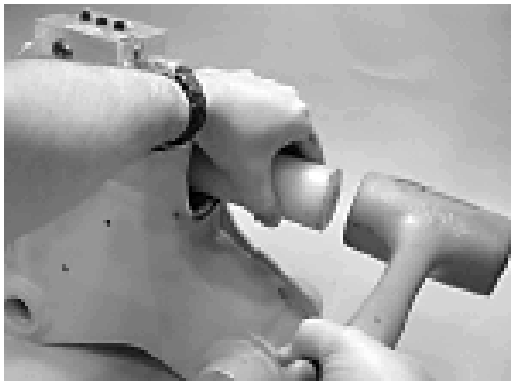
9. Prior to removing the shaft, (2), use a felt marker to clearly indicate the timing marks between shaft and piston. This will greatly simplify timing during assembly.

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).

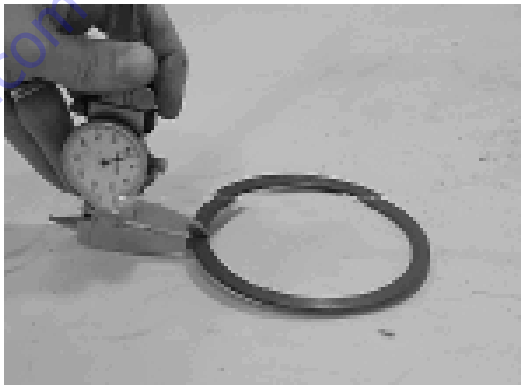
19. Remove the piston O.D. seal (202).

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).

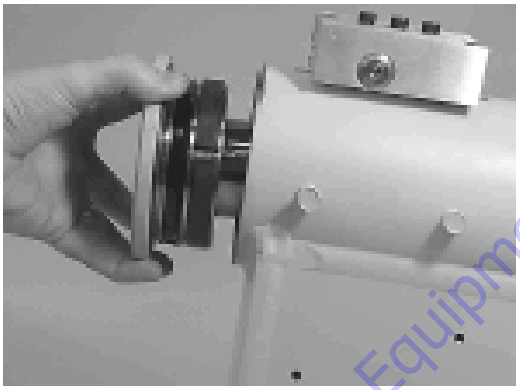
7. Beginning with the inner seal (200) insert one end of b/u ring in the lower groove and feed the rest in using a circular motion. Make sure the wedged ends overlap correctly. Repeat this step for the outer seal (202).

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.

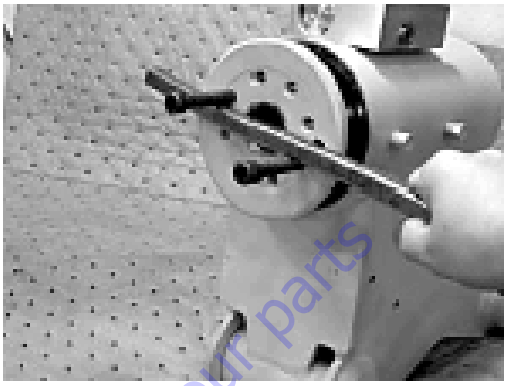
10. Looking from the opposite end of the housing (1) you can see if your timing marks are lining up. When they do, tap the piston (3) in until the gear teeth mesh together. Tap the piston into the housing the rest of the way until it bottoms out.

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

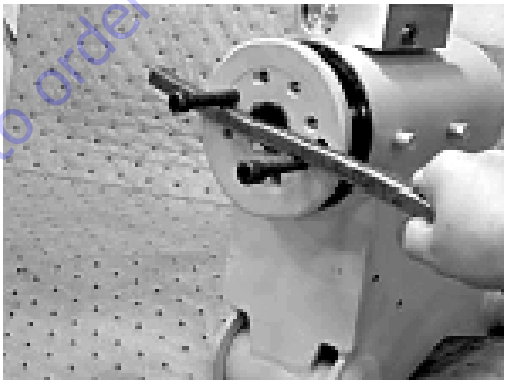


12. Looking from the view shown, use the existing timing marks to line up the gear teeth on the shaft (2) with the gear teeth on the inside of the piston (3). Now tap the flange end of the shaft with a rubber mallet until the gear teeth engage.

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).

Installing Counterbalance Valve

Refer to Figure 4-19., Rotator Counterbalance Valve.

1. Make sure the surface of the actuator is clean, free of any contamination and foreign debris including old Loctite.
2. Make sure the new valve has the O-rings in the counterbores of the valve to seal it to the actuator housing.
3. The bolts that come with the valve are grade 8 bolts. New bolts should be installed with a new valve. JLG Threadlocker P/N 0100011 should be applied to the shank of the three bolts at the time of installation.
4. Torque the 1/4-inch bolts 110 to 120 inch pounds (12.4 to 13.5 Nm). Do not torque over 125 inch pounds (14.1 Nm). Torque the 5/16-inch bolts 140 inch pounds (15.8 Nm). Do not torque over 145 inch pounds (16.3 Nm).
5. Make sure the valve is seated against the housing valve flat. If it is raised up on any side or corner, remove the valve to determine what the obstruction is. If possible test this using hydraulic hand pump or electric test.

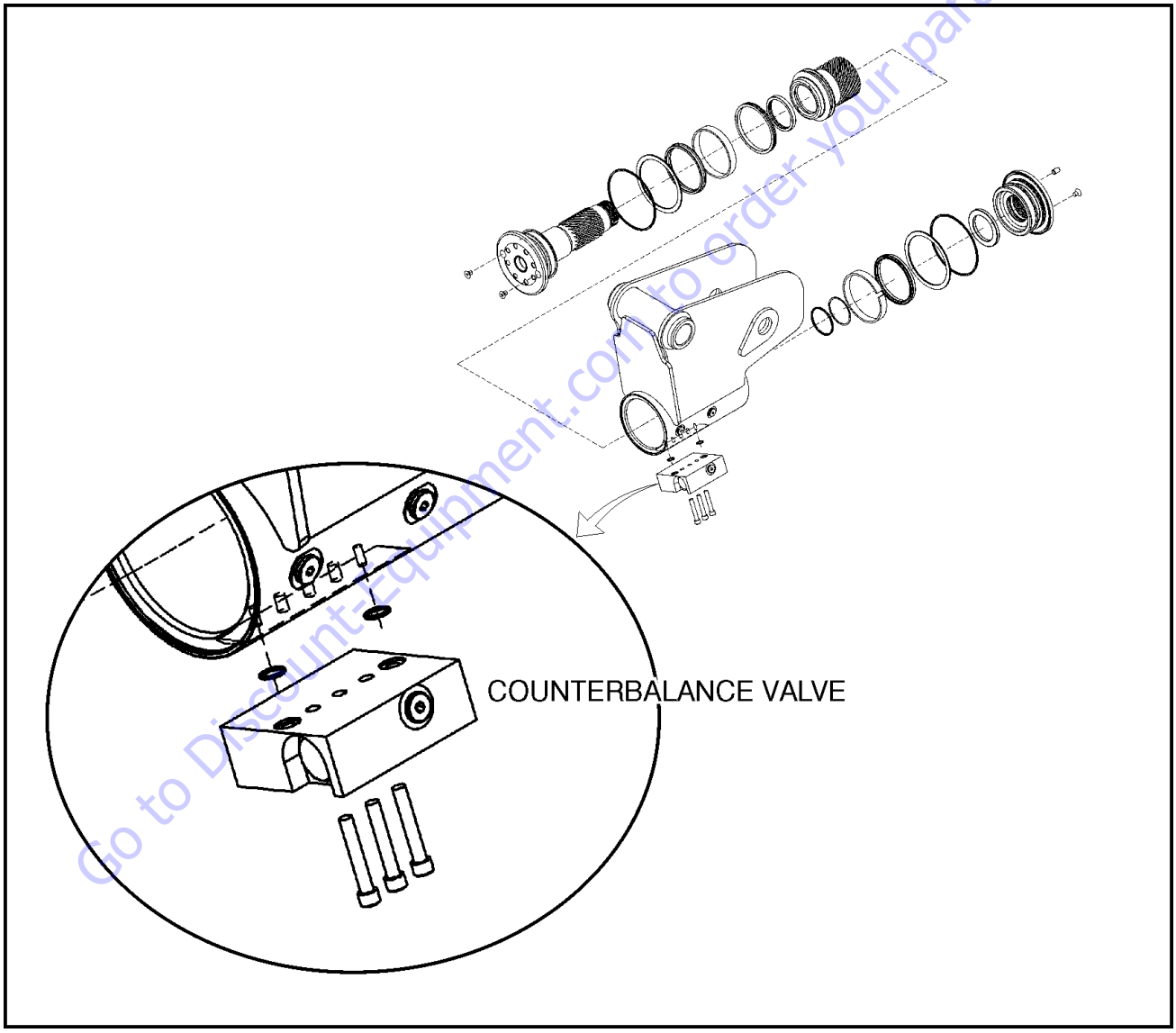


Figure 4-19. Rotator Counterbalance Valve

Greasing Thrust Washers

6. After the actuator is assembled but before it is put into service, the thrust washer area must be packed with Lithium grease.

7. There are two grease ports located on both the shaft flange and the end cap. They are plugged with cap screws (113) or set screws. Remove the grease port screws from the shaft flange and end cap. (See exploded view)

NOTICE

IF A HYDRAULIC TEST BENCH IS NOT AVAILABLE, THE ACTUATOR CAN BE ROTATED BY HAND, OPEN THE PRESSURE PORTS AND USE A PRY BAR WITH CAP SCREWS INSERTED INTO THE SHAFT FLANGE TO TURN THE SHAFT IN THE DESIRED DIRECTION.

8. Insert the tip of a grease gun into one port and apply grease to the shaft flange. Continue applying until grease flows from the opposite port. Cycle the actuator five times and apply grease again. Repeat this process on the end cap. Insert the cap screws into the grease ports and tighten to 25 in-lbs. (2.8 Nm).

Testing the Actuator

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

TESTING THE ACTUATOR FOR INTERNAL LEAKAGE

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

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

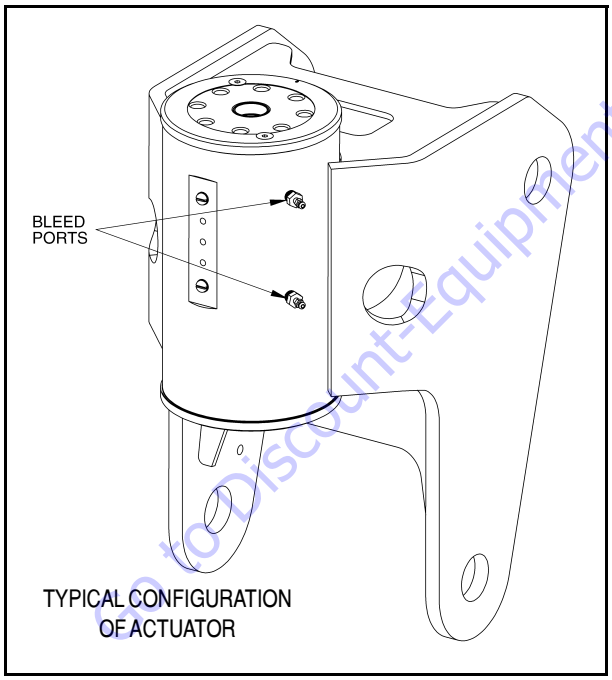
Installation and Bleeding

After installation of the actuator on the equipment, it is important that all safety devices such as tie rods or safety cables are properly reattached.

To purge air from the hydraulic lines, connect them together to create a closed loop and pump hydraulic fluid through them. Review the hydraulic schematic to determine which hydraulic lines to connect. The linear feet and inside diameter of the hydraulic supply lines together with pump capacity will determine the amount of pumping time required to fully purge the hydraulic system.

Bleeding may be necessary if excessive backlash is exhibited after the actuator is connected to the hydraulic system. The following steps are recommended when a minimum of two gallons (8 liters) is purged.

1. Connect a 3/16" inside diameter x 5/16" outside diameter x 5 foot clear, vinyl drain tube to each of the two bleed nipples. Secure them with hose clamps. Place the vinyl tubes in a clean 5-gallon container to collect the purged oil. The oil can be returned to the reservoir after this procedure is completed.



TYPICAL CONFIGURATION
OF ACTUATOR

2. With an operator in the platform, open both bleed nipples 1/4 turn. Hydraulically rotate the platform to the end of rotation (either clockwise or counterclockwise), and maintain hydraulic pressure. Oil with small air bubbles will be seen flowing through the tubes. Allow a 1/2 gallon of fluid to be purged from the actuator.
3. Keep the fittings open and rotate the platform in the opposite direction to the end position. Maintain hydraulic pressure until an additional 1/4 gallon of fluid is pumped into the container.
4. Repeat steps 2 & 3. After the last 1/2 gallon is purged, close both bleed nipples before rotating away from the end position.

Troubleshooting

Table 4-1. Troubleshooting

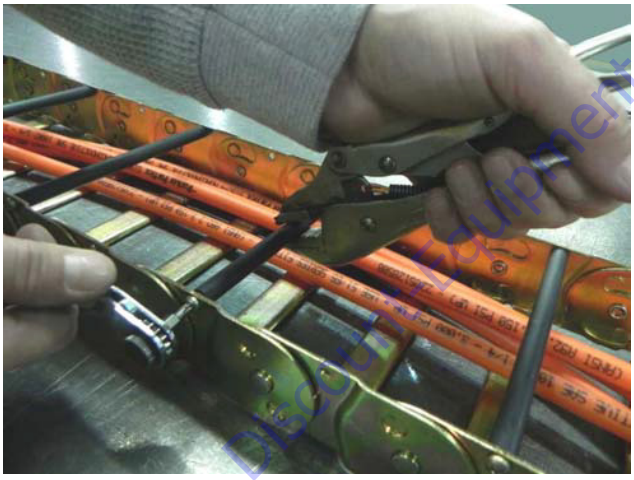
Problem	Cause	Solution
10. Shaft rotates slowly or not at all	a. Insufficient torque output	a. Verify correct operating pressure. Do not exceed OEM's pressure specifications. Load may be above maximum capacity of the actuator.
	b. Low rate of fluid flow	b. Inspect ports for obstructions and hydraulic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

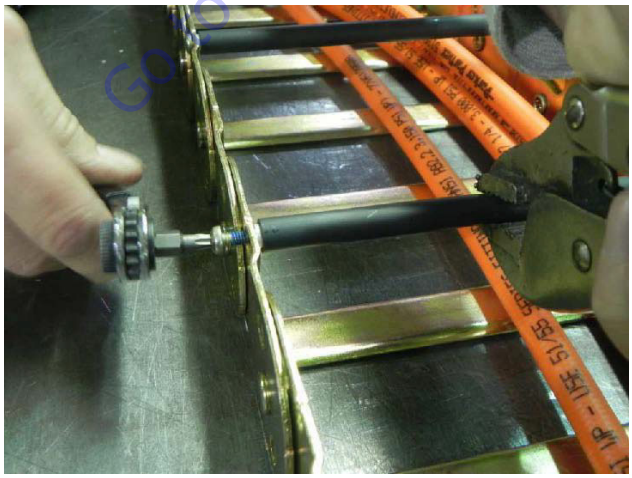
4.11 POWERTRACK MAINTENANCE

Removing a Link

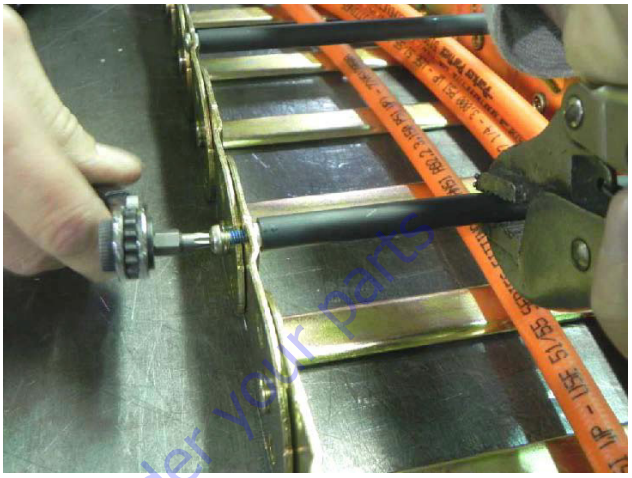
NOTE: *Hoses shown in the powertrack are for example only. Actual hose and cable arrangements will be different.*

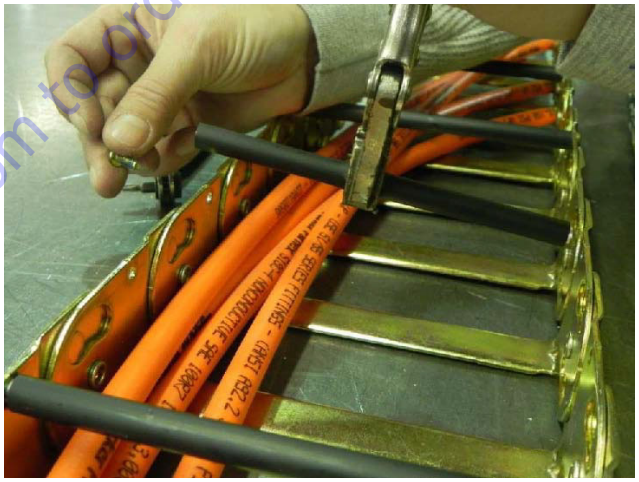
1. Clamp the bar and poly roller tightly so they do not spin when removing the screw. With a small ¼" ratchet and a t-20 torx bit, remove the 8-32 x 0.500 screw from one side.



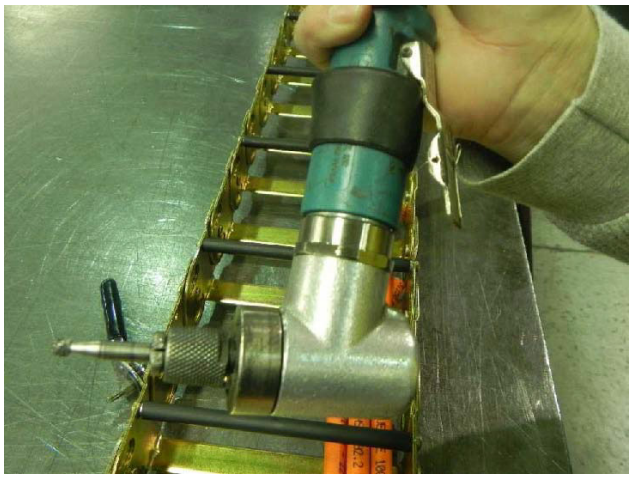


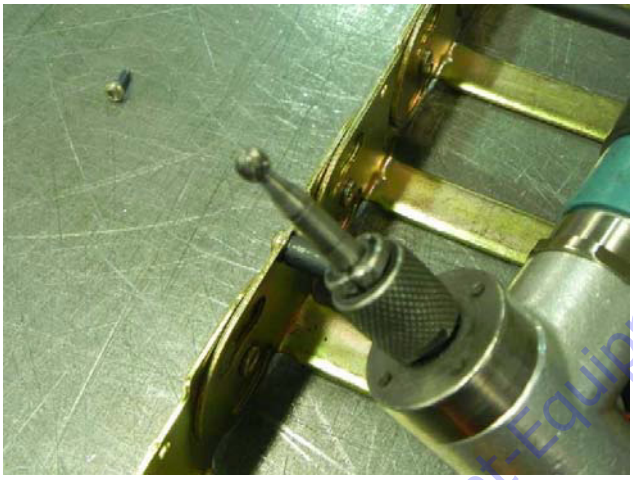
2. Repeat step 1 and remove the screw from the other side of track. Remove the bar/poly roller from the powertrack. .





3. To remove a link, the rivets holding the links together must be removed. Use a right-angle pneumatic die grinder with a ¼" ball double cut bur attachment.

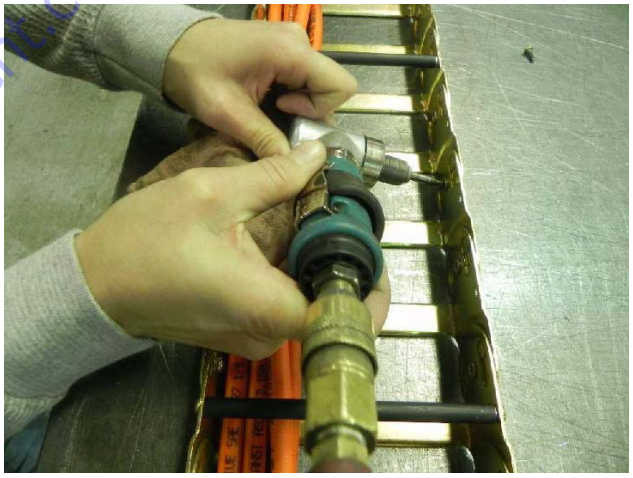




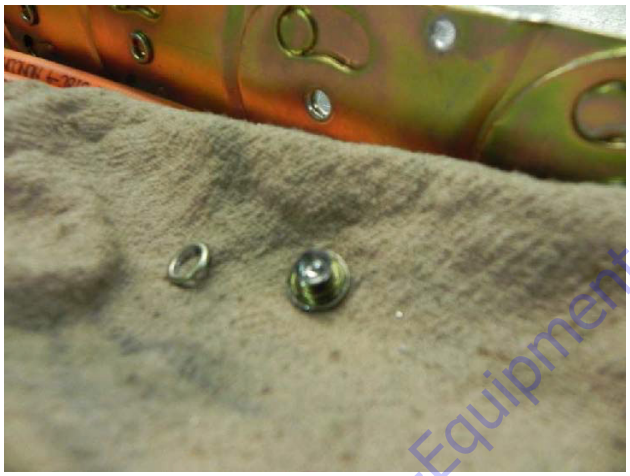
NOTICE

MOVE THE CABLES/HOSES OUT OF THE WAY DURING THE GRINDING PROCESS TO PROTECT THEM. KEEP THE HOSES AND CABLES COVERED TO PREVENT ANY DEBRIS FROM GETTING ON THEM.

4. insert the tool into the rolled over end of the rivet as shown. Grind out the middle of the rivet until the rolled over part of the rivet falls off. Repeat this step for all the rivets that must be removed.

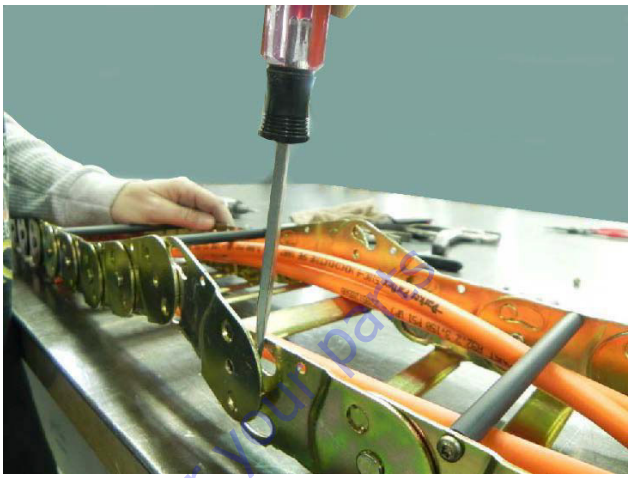


5. After grinding it may be neccesary to help the rivet out by using a center punch with a hammer.



NOTE: *It may be necessary to loosen the fixed end brackets from the machine in order to twist and pull the track section enough to disconnect the links.*

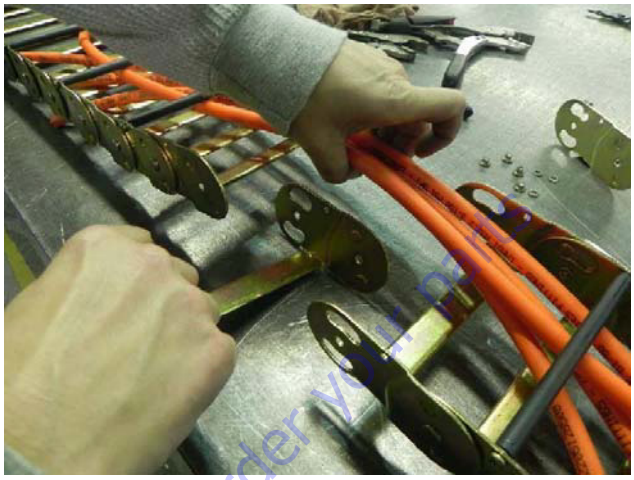
6. Using a flat head screwdriver between the links, twist the screwdriver and pull the links apart.



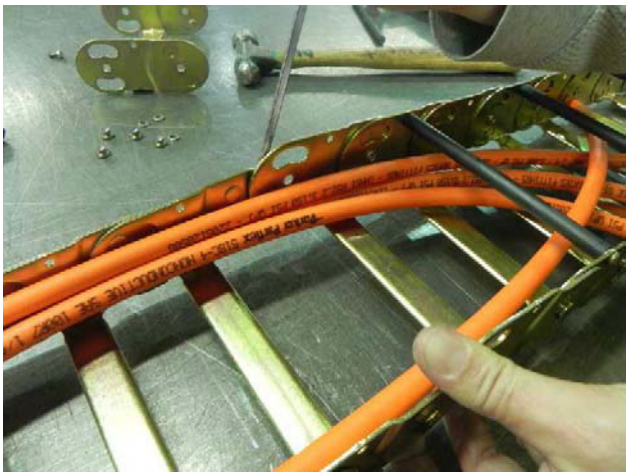
7. Remove the link from the other section of the powertrack using a screwdriver.

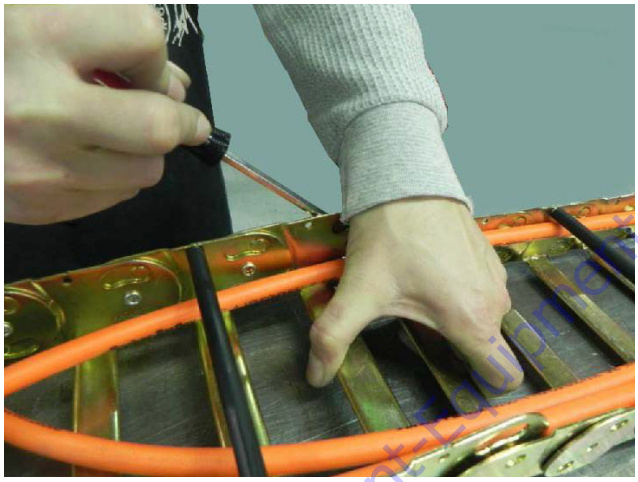
Installing a New Link

1. Squeeze the peanut cut out end of the new link into the half-shear (female) end of the track section.

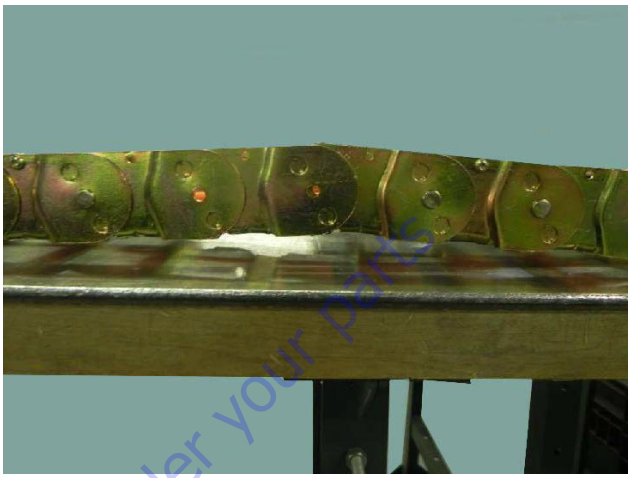


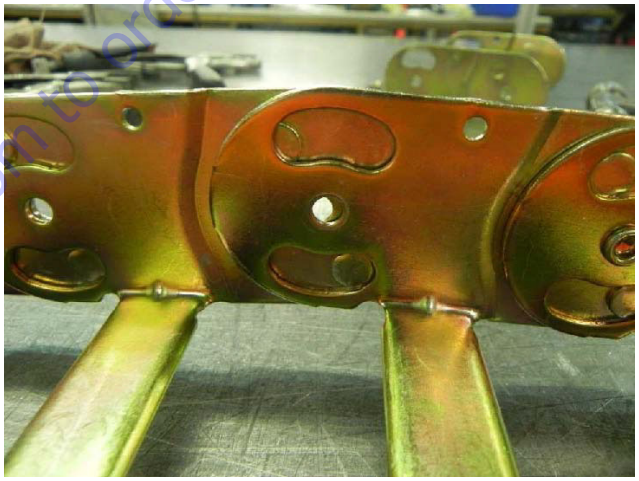
2. Spread apart the half-shear (female) end of the new link and slide the peanut end of the track section into it. a screwdriver may be necessary to do this.



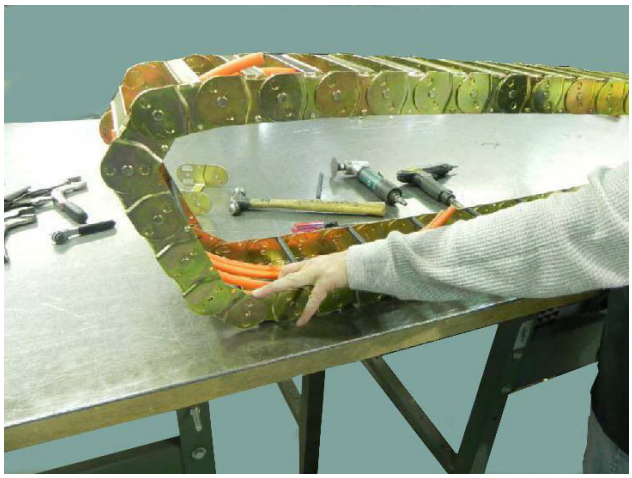


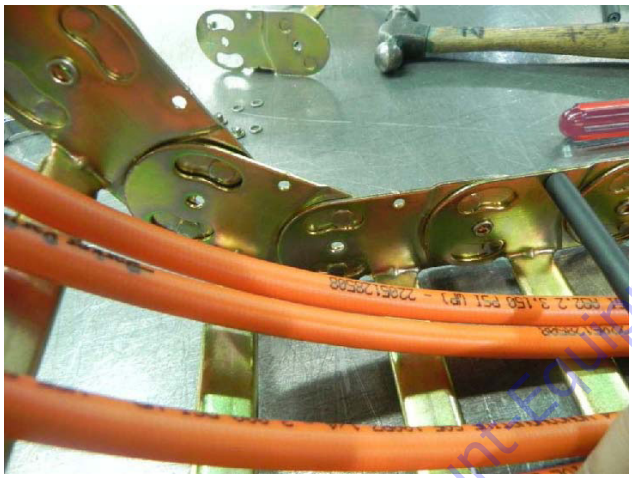
3. After the new link is installed in the powertrack the round half-shears will not fit properly in the peanut cut-outs yet.



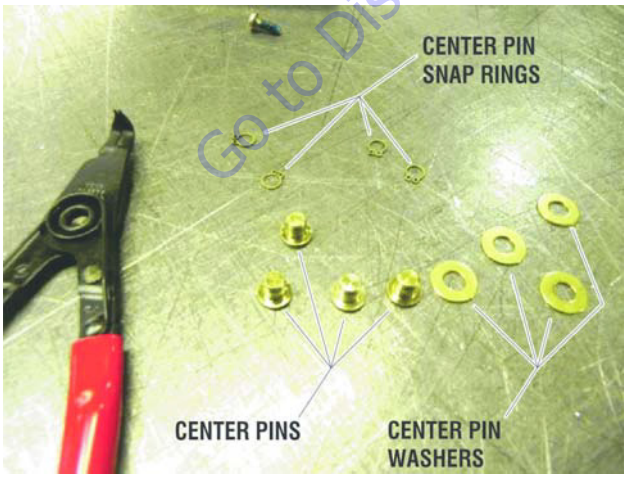


4. Pull the moving end out over the track so that the new connection is positioned in the curve of the powertrack. In this position the round half-shears will rotate into the peanut cut outs.

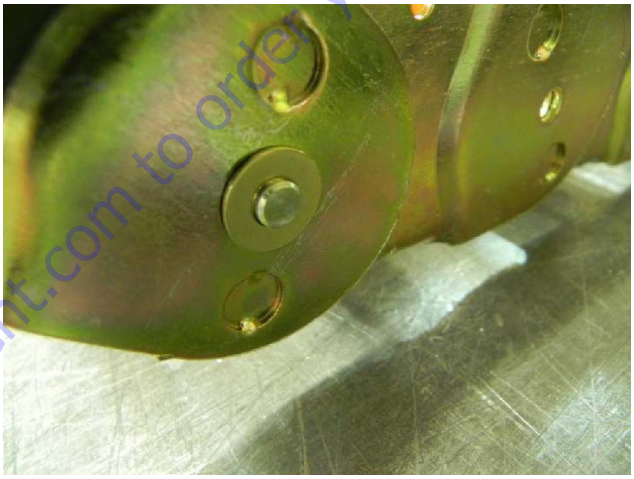




5. The parts shown below will be used to connect the new link to the powertrack.

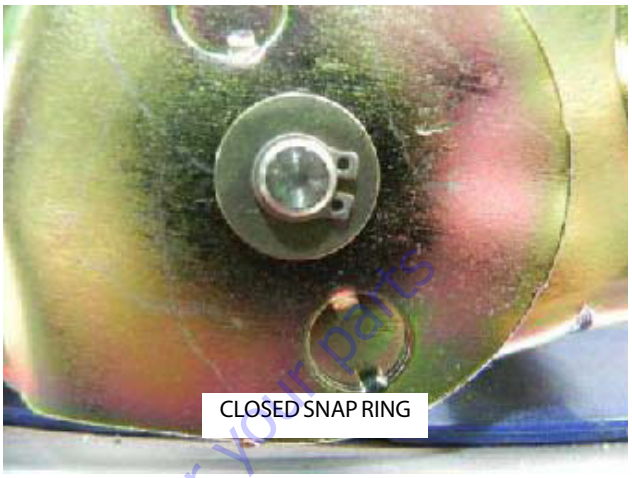


6. Push pin thru center hole then slide washer on pin.



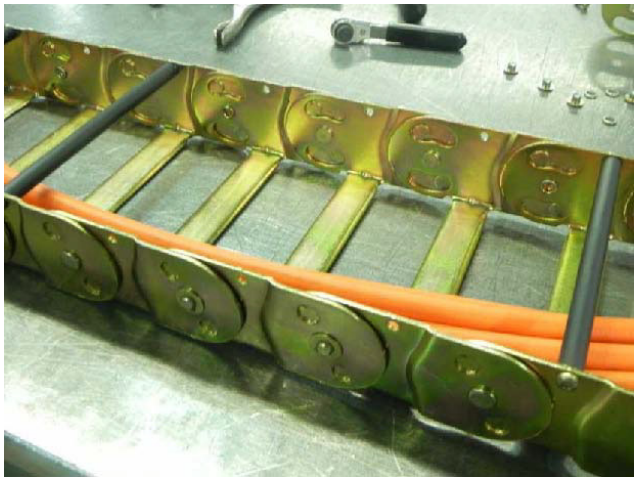
7. Install the snap ring in the groove on the pin. Repeat the pin installation steps for all center holes that have the rivets removed.

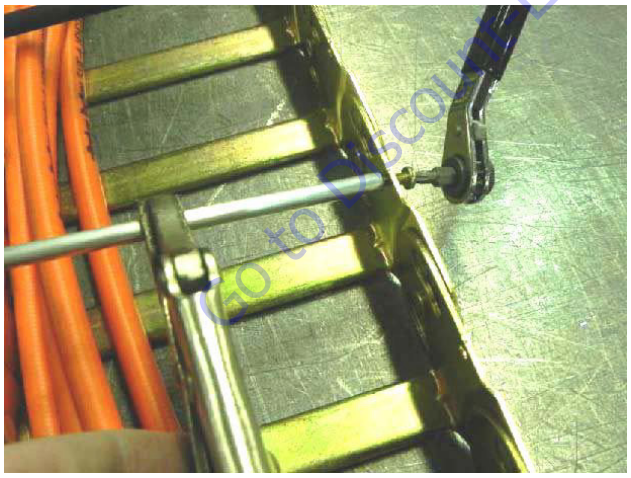
NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



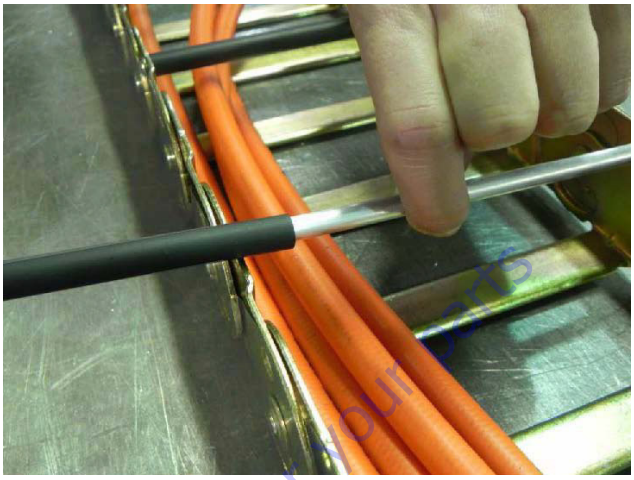
8. Hold new aluminum round bar tightly, then install new 8-32 x 0.500 self-threading torx head screw into one end.

NOTE: *Maximum tightening torque is 18-20 in-lbs.*

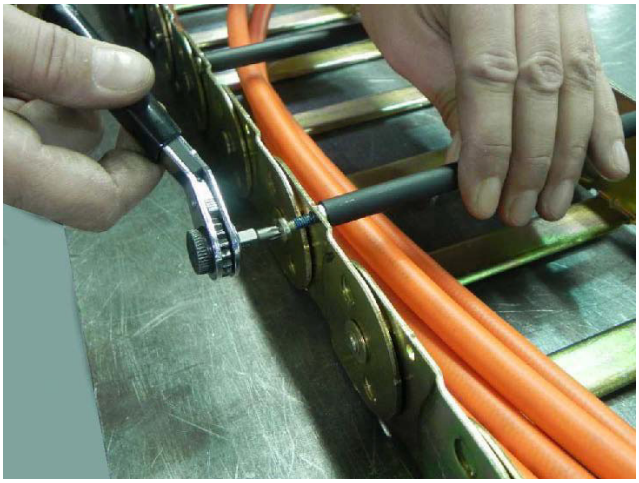




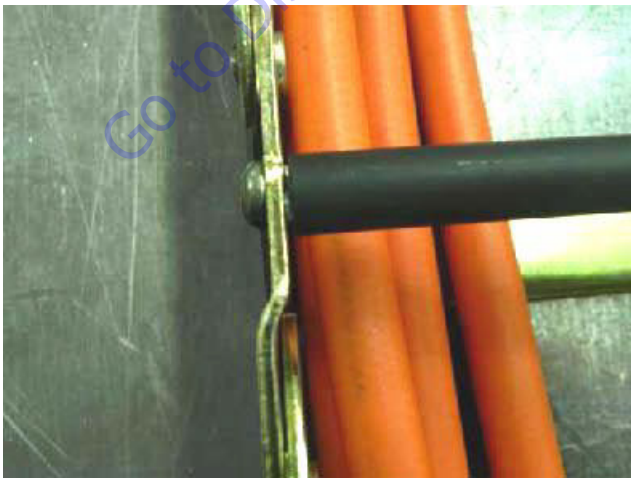
9. Pull up on the other end of the round bar and slide the new poly roller onto the bar.



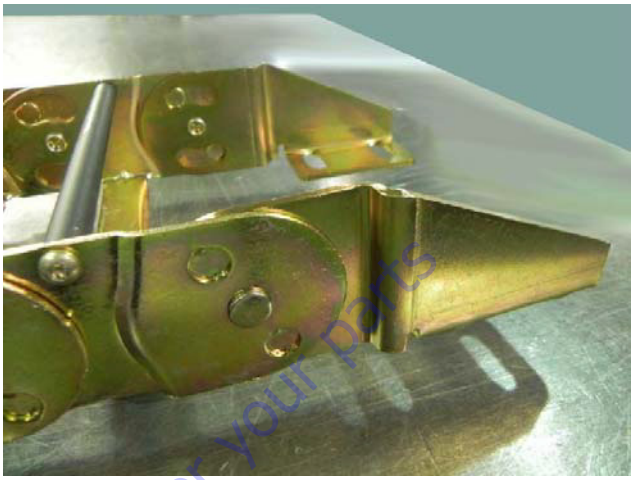
10. Install a new 8-32 x 0.500 self threading screw on the other side.



NOTE: *When tightening screws make sure screw head is seated against link with no space in between the link and underside of screw head. Maximum tightening torque is 18-20 in-lbs.*



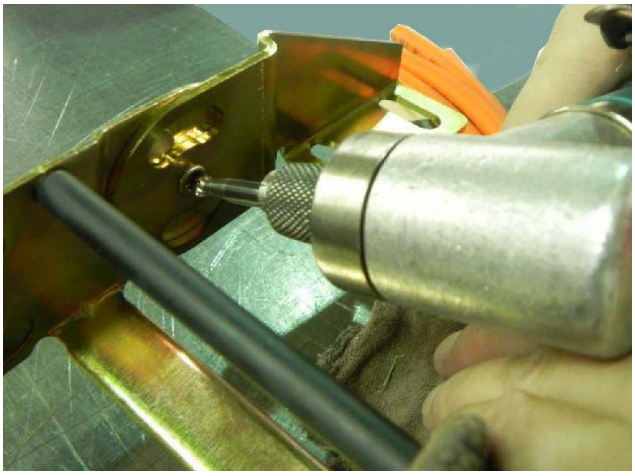
Replacing Fixed End Brackets

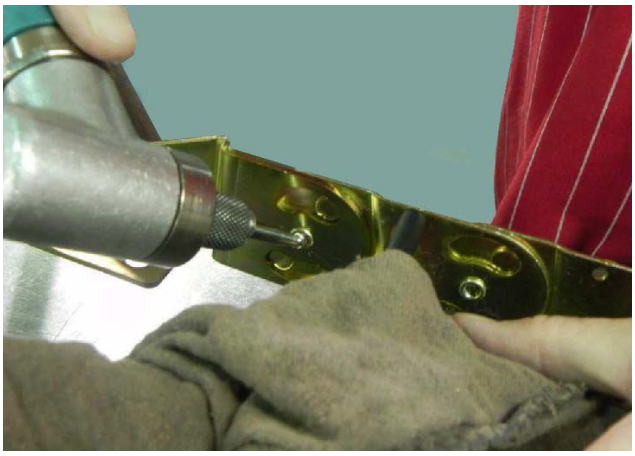


1. Remove the rivets the same way as shown under the link removal instructions.

NOTICE

MOVE THE CABLES/HOSES OUT OF THE WAY DURING THE GRINDING PROCESS TO PROTECT THEM. KEEP THE HOSES AND CABLES COVERED TO PREVENT ANY DEBRIS FROM GETTING ON THEM.

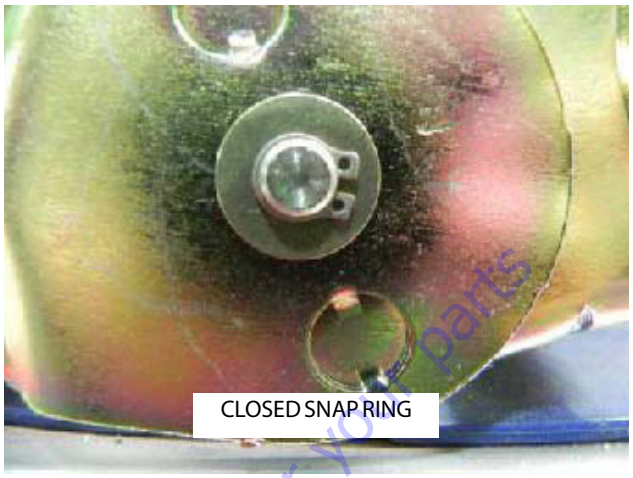




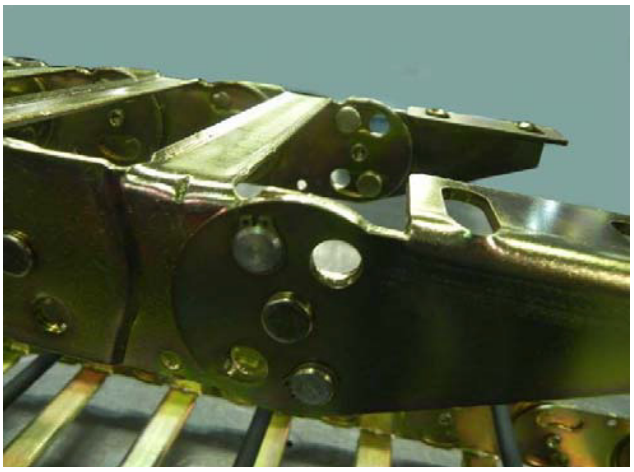
2. Parts used: Bracket Center Pin and Center Pin Snap Ring.

3. Take the new bracket and install bracket center pin and snap ring. Repeat on the other bracket if replacing it as well.

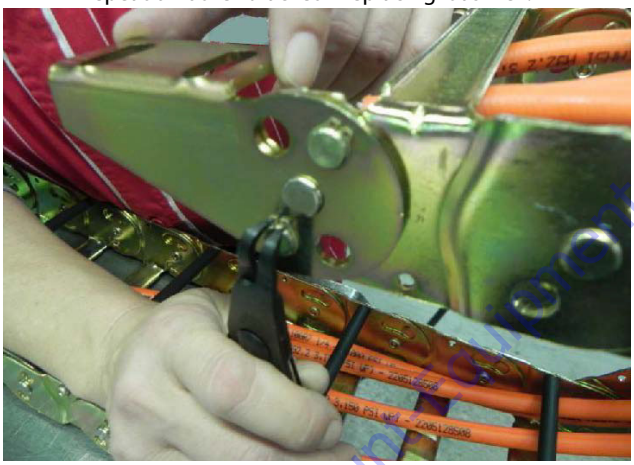
NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



Replacing Moving End Brackets

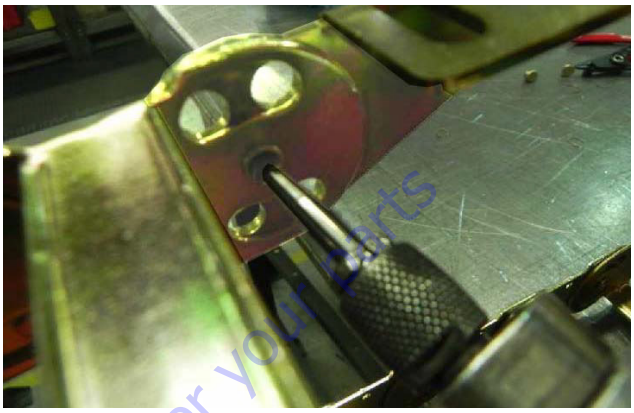


1. Remove existing pins and center rivet. Remove the rivet the same way as shown in the link removal instructions. Repeat on other bracket if replacing it as well.

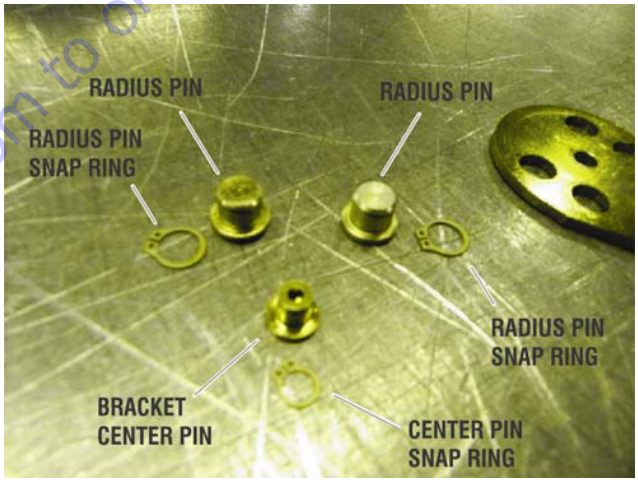


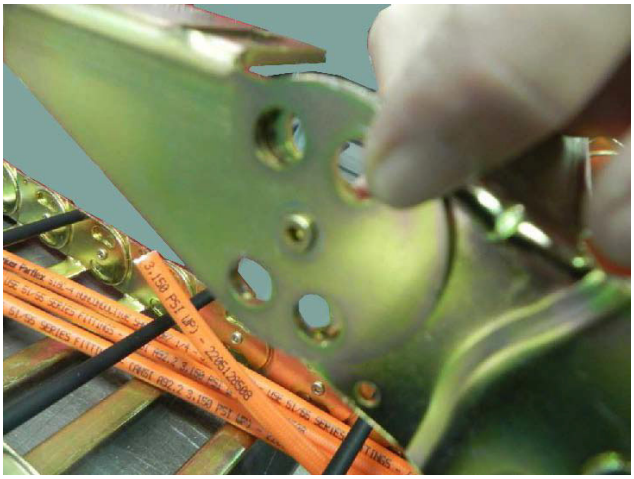
NOTICE

MOVE THE CABLES/HOSES OUT OF THE WAY DURING THE GRINDING PROCESS TO PROTECT THEM. KEEP THE HOSES AND CABLES COVERED TO PREVENT ANY DEBRIS FROM GETTING ON THEM.

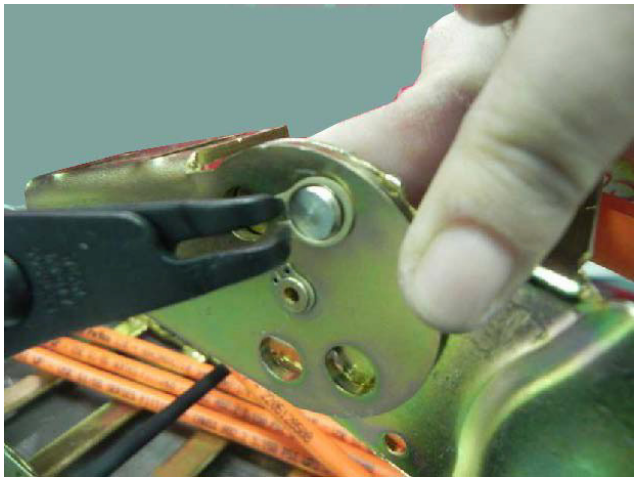


2. Take new bracket and install center pin with snap ring.

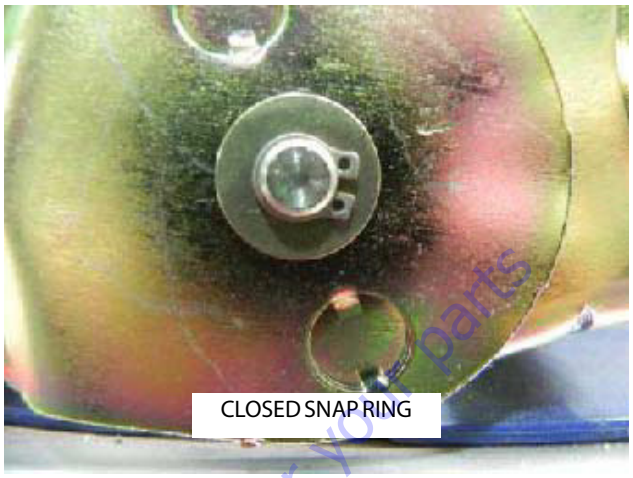




3. Install radius pins into their original locations and install snap rings. Repeat with other moving end if replacing as well.



NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



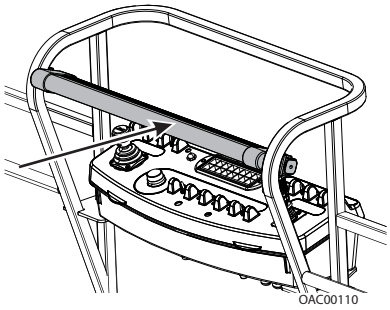
4. When complete make sure that both brackets rotate correctly.

4.12 SKYGUARD

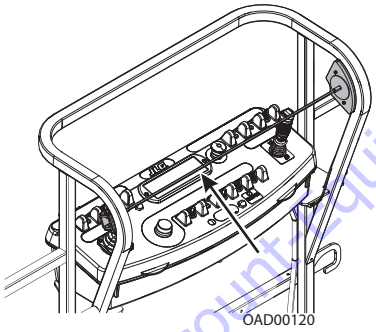
Operation

SkyGuard provides enhanced control panel protection. When the SkyGuard sensor is activated, functions in use at the time of actuation will reverse or cutout. The SkyGuard Function Table provides more details on these functions.

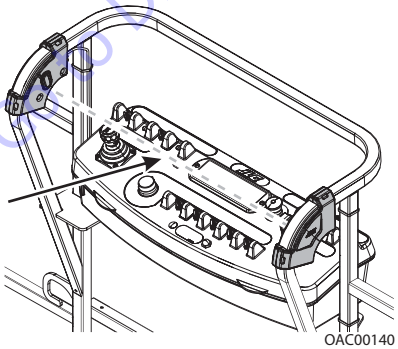
Consult the following illustrations to determine which type of SkyGuard the machine is equipped with. Regardless of the type, SkyGuard function according to the SkyGuard Function Table does not change.



SkyGuard



SkyGuard SkyLine™



SkyGuard SkyEye™

⚠ WARNING

THE MACHINE OPERATOR IS REQUIRED TO PERFORM A DAILY FUNCTION TEST TO ENSURE PROPER OPERATION OF THE SKYGUARD SYSTEM.

Function Test

SKYGUARD ONLY

Perform this function test if **SkyGuard only** is selected in machine setup (refer to Table 6-2).

From the Platform Control Console in an area free from obstructions:

1. Operate the telescope out function, then activate SkyGuard sensor.
2. Once sensor has been activated, ensure telescope out function stops then telescope in function operates for a short duration. Additionally, verify Soft Touch/SkyGuard indicator light flashes and horn sounds. If machine is equipped with SkyGuard beacon, ensure it flashes when sensor activates.
3. With SkyGuard sensor still engaged, press and hold yellow Soft Touch/SkyGuard override button. Operate a function to verify operation can be resumed.
4. Disengage SkyGuard sensor, release controls, and recycle footswitch. Ensure normal operation available.

In Ground Mode:

Operation is allowed regardless of SkyGuard activation.

SOFT TOUCH ONLY

If **Soft Touch only** is selected in machine setup (refer to Table 6-2), machine will treat the Soft Touch/SkyGuard override switch as if it is a Soft Touch switch.

SKYGUARD NOT SELECTED IN MACHINE SETUP

If the SkyGuard system is installed on the machine, but no option is selected in the machine setup (refer to Table 6-2), SkyGuard sensor status will be ignored. No function cutout or reversal will be implemented.

Diagnostics & Troubleshooting

If SkyGuard does not function when the sensor is engaged, first verify the configuration under the
MACHINE SETUP: SKYGUARD OPTION menu using the handheld Analyzer. Ensure the selected configuration matches the actual system installed on the machine. If not, select the correct configuration, then verify operation.

Additionally, use the handheld analyzer to navigate to the DIAGNOSTICS: FEATURES → SKYGUARD INPUTS menu to determine additional SkyGuard fault information.

Engage the SkyGuard sensor and observe the Analyzer to determine if the switch/relay closes.

If the status of the switch/relay remains OPEN while the SkyGuard sensor is actively engaged, it is possible the sensor has failed and should be replaced immediately.

If the status of the switch/relay remains CLOSED while the SkyGuard sensor is actively engaged, a power or ground wire may not be making good contact or may be loose or broken. Additionally, there is a low probability that both relays may have failed.

If the switch/relay status is in disagreement, then one may have failed or is not installed correctly. In this case, the machine will be inoperable.

FAULT CODES

Refer to Table 6-10 for more fault code information

- **0039 -** SkyGuard switch activation fault
- **2563 -** SkyGuard switch disagreement fault

Table 4-2. SkyGuard Function Table

Drive Forward	Drive Reverse	Steer	Swing	Tower Lift Up	Tower Lift Down	Boom Lift Up	Boom Lift Down	Boom Tele Out	Boom Tele In	Jib Lift	Jib Swing	Basket Level	Basket Rotate
R*/C**	R	C	R	R	C	R	C	R	C	C	C	C	C
R = Indicates Reversal is Activated													
C = Indicates Cutout is Activated													
*DOS (Drive Orientation System) Enabled													
**DOS Not Enabled, Machine is driving straight without steering, and any other hydraulic function is active													

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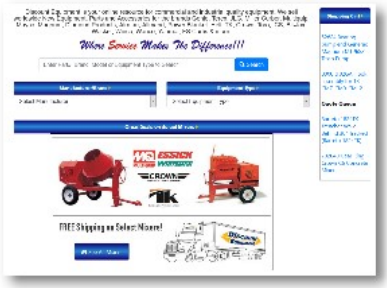

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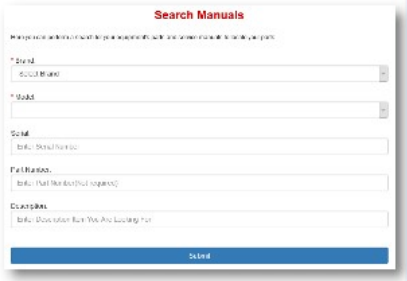

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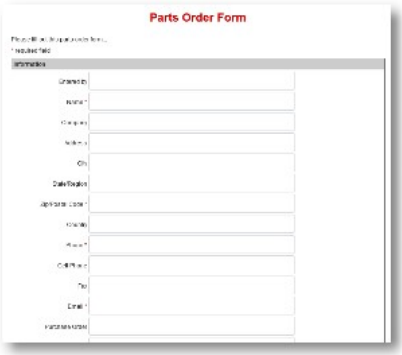

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SECTION 5. BASIC HYDRAULIC INFORMATION & SCHEMATICS

5.1 LUBRICATING O-RINGS IN THE HYDRAULIC SYSTEM

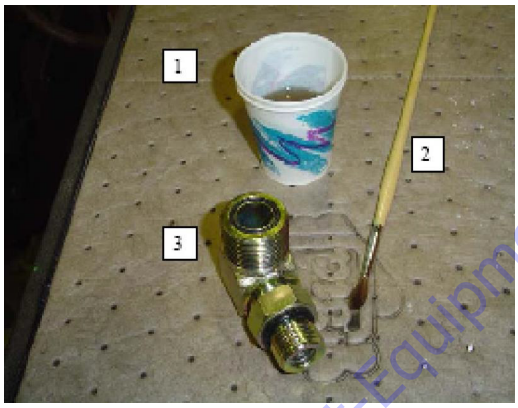
When assembling connectors in the hydraulic that use o-ring fittings, it is necessary to lubricate all fittings with hydraulic oil prior to assembly. To lubricate the fittings, use one of the following procedures.

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 HYDRAULIC CYLINDERS

Platform Slave Cylinder

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. Remove the cartridge valves and plugs from the cylinder port block. Discard the o-rings.
4. Place the cylinder barrel into a suitable holding fixture.

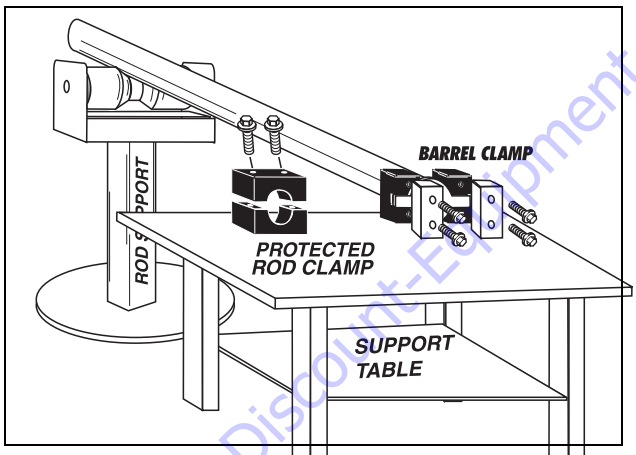


Figure 5-1. Cylinder Barrel Support

5. Using the hook spanner wrench, unscrew the cylinder head from the barrel.
6. Attach a suitable pulling device to the cylinder rod end.

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.

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

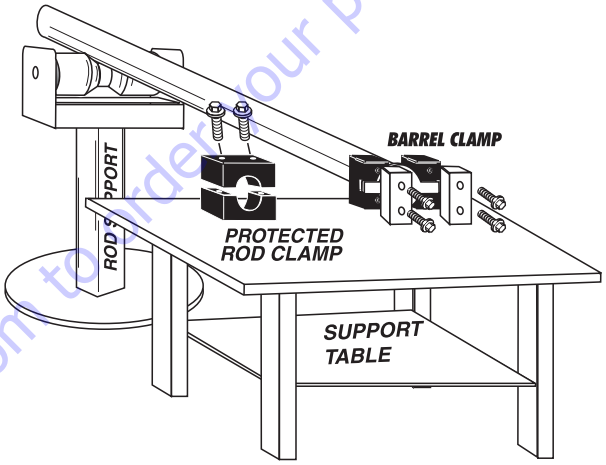
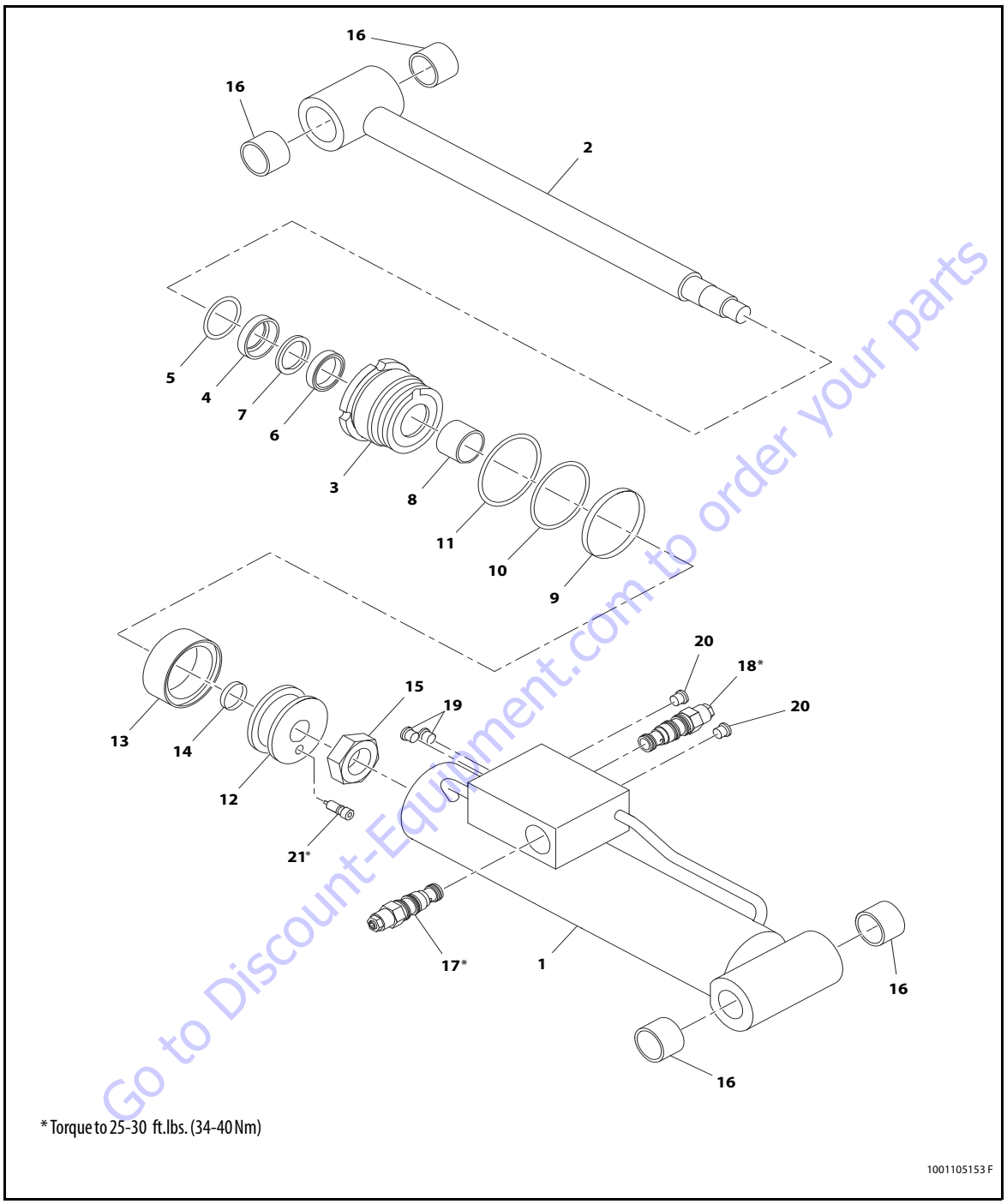


Figure 5-2. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Wiper Seal
5. Retaining Ring
6. Rod Seal
7. Backup Ring
8. Wear Ring
9. O-ring
10. Backup Ring
11. O-ring
12. Piston
13. Piston Seal
14. O-ring
15. Nut
16. Bearing
17. Cartridge Valve
18. Cartridge Valve
19. Plug
20. Plug
21. Phase Valve

Figure 5-3. Platform Slave Cylinder

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
9. Loosen and remove lock nut which attach the piston to the rod.
10. Remove the phase valve from the piston.
11. Screw the piston counterclockwise, by hand, and remove the piston from cylinder rod.
12. Remove and discard the piston seal and o- ring of the piston.
13. Remove the rod from the holding fixture. Remove the cylinder head. Discard the o-ring, backup ring, rod seal, wear ring, retaining ring and wiper seal.

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 piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
6. Inspect threaded portion of piston for damage. Dress threads as necessary.
7. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
8. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
9. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
10. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
11. 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 steel bushing prior to bearing installation.
    d. Using an arbor of the correct size, carefully press the bearing into steel bushing.

NOTE: *Install pin into the composite bearing dry. Lubrication is not required with nickel plated pins and bearings.*

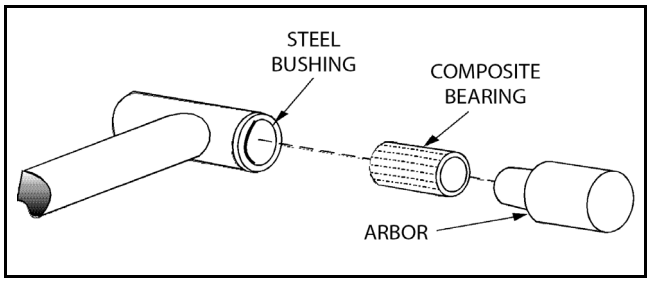


Figure 5-4. Composite Bearing Installation

12. If applicable, inspect port block fittings and holding valve. Replace as necessary.
13. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
14. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

ASSEMBLY

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

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

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

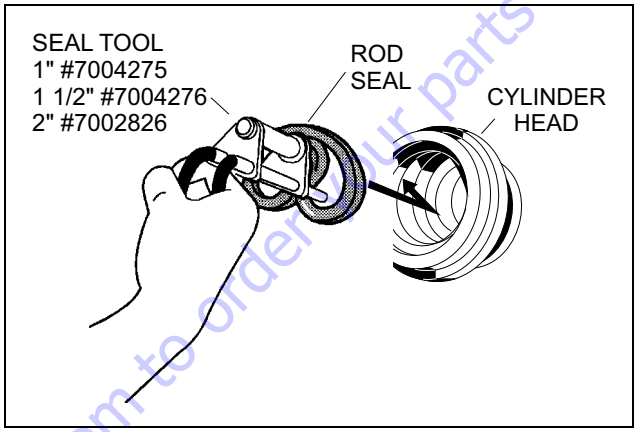


Figure 5-5. Rod Seal Installation

NOTICE

WHEN INSTALLING NEW SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

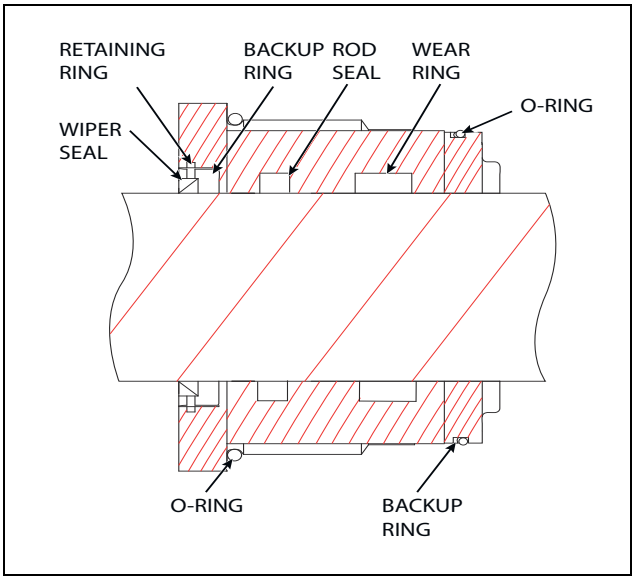


Figure 5-6. Cylinder Head Seal Installation

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head groove.

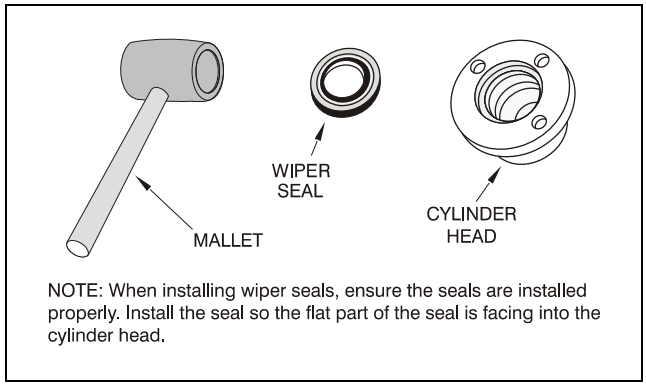


Figure 5-7. Wiper Seal Installation

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

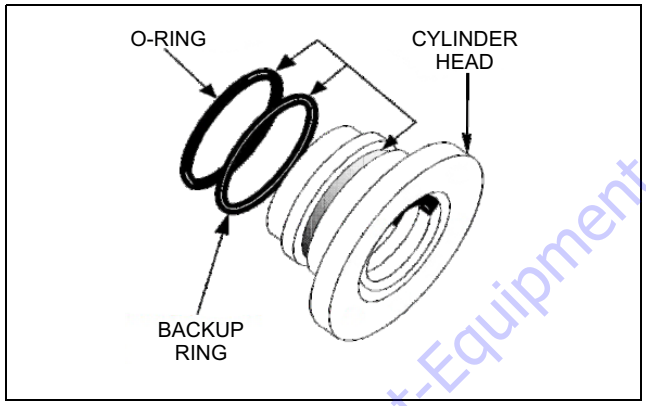


Figure 5-8. Installation of Head Seal Kit

4. Install o-ring onto the cylinder rod. Carefully install the piston head on the rod, ensuring that the wiper seal and rod seals are not damaged or dislodged. Push the head along the rod to the rod end.
5. Place a new o-ring in the inner piston diameter groove.
6. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
7. Carefully thread the piston on the cylinder rod hand tight, ensuring that the o-ring are not damaged or dislodged.
8. Install the valve phase into the piston and torque to 25-30 ft.lbs (34-40 Nm).
9. Install the lock nut onto the cylinder rod.
10. Remove the cylinder rod from the holding fixture.
11. Place new piston seal 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).

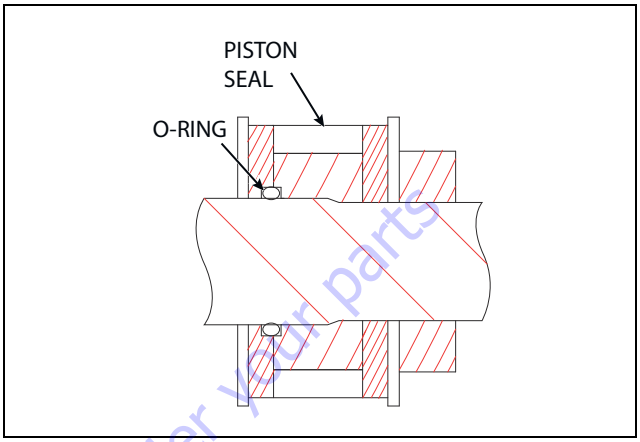


Figure 5-9. Piston Seal Kit Installation

12. 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.

13. 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.
14. Continue pushing the rod into the barrel until the cylinder head can be inserted into the barrel cylinder.
15. Screw the cylinder head into the barrel using a spanner wrench.
16. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the re-installation of any holding valve or valves.
17. Install the cartridge valves and torque to 25-30 ft.lbs (34-40 Nm).
18. Install the plugs into the port blocks.

Jib Lift Cylinder

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. Remove the counterbalance valves and plugs from the cylinder port block. Discard the o-rings.
4. Place the cylinder barrel into a suitable holding fixture.

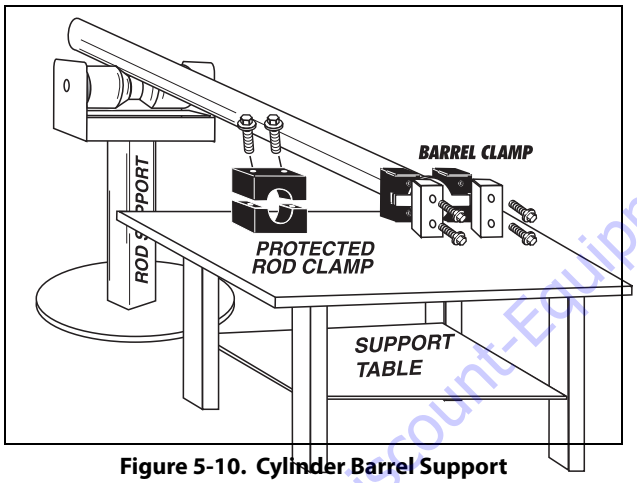


Figure 5-10. Cylinder Barrel Support

5. Using the hook spanner wrench unscrew the cylinder head from the barrel.
6. Attach a suitable pulling device to the cylinder rod end.

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.

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

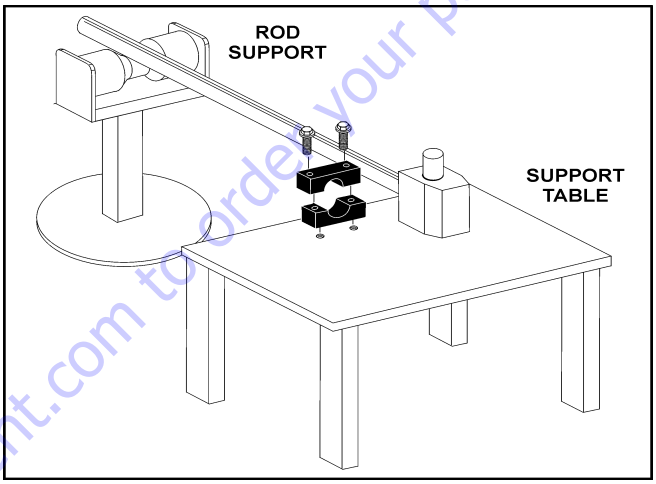
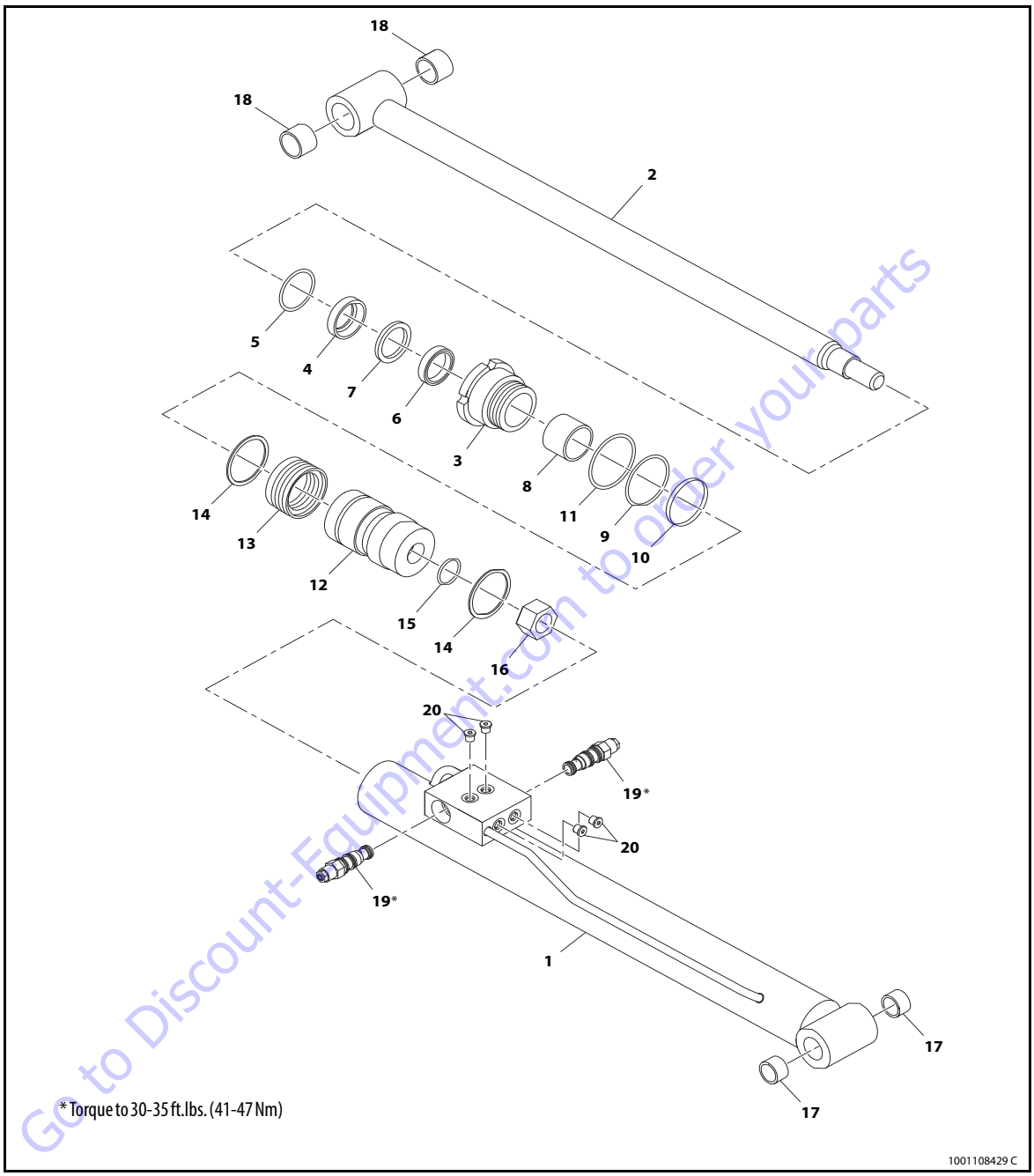


Figure 5-11. Cylinder Rod Support



1. Barrel	5. Retaining Ring	9. O-ring	13. Piston Seal	17. Bearing
2. Rod	6. Rod Seal	10. Backup Ring	14. Piston Ring	18. Bearing
3. Head	7. Backup Ring	11. O-ring	15. O-Ring	19. Counterbalance Valve
4. Wiper Seal	8. Wear Ring	12. Piston	16. Nut	20. Plug

Figure 5-12. Jib Lift Cylinder

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
9. Loosen and remove lock nut which attach the piston to the rod.
10. Screw the piston counterclockwise, by hand and remove the piston from cylinder rod.
11. Remove and discard the piston seal, piston ring and o-ring.
12. Remove the rod from the holding fixture. Remove the cylinder head. Discard the o-rings, back-up ring, retaining ring, rod seal, wiper seal and wear ring.

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 piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
6. Inspect threaded portion of piston for damage. Dress threads as necessary.
7. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
8. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
9. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
10. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
11. 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 steel bushing prior to bearing installation.
    d. Using an arbor of the correct size, carefully press the bearing into steel bushing.

NOTE: *Install pin into the composite bearing dry. Lubrication is not required with nickel plated pins and bearings.*

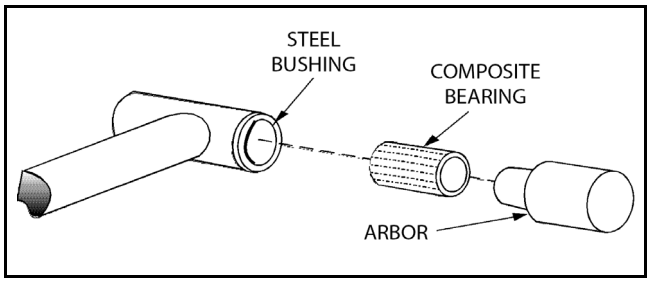


Figure 5-13. Composite Bearing Installation

12. If applicable, inspect port block fittings and holding valve. Replace as necessary.
13. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
14. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

ASSEMBLY

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

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

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

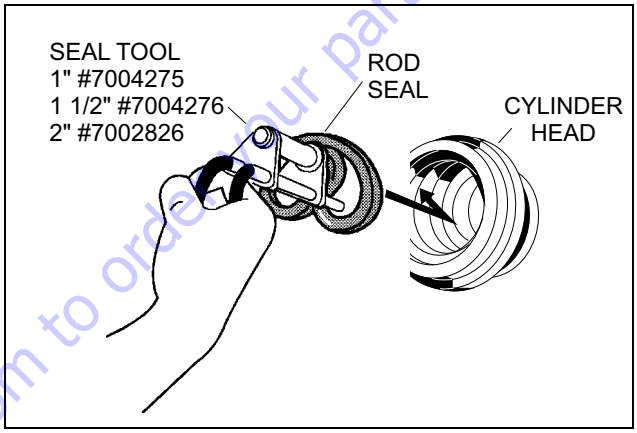


Figure 5-14. Rod Seal Installation

NOTICE

WHEN INSTALLING NEW SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

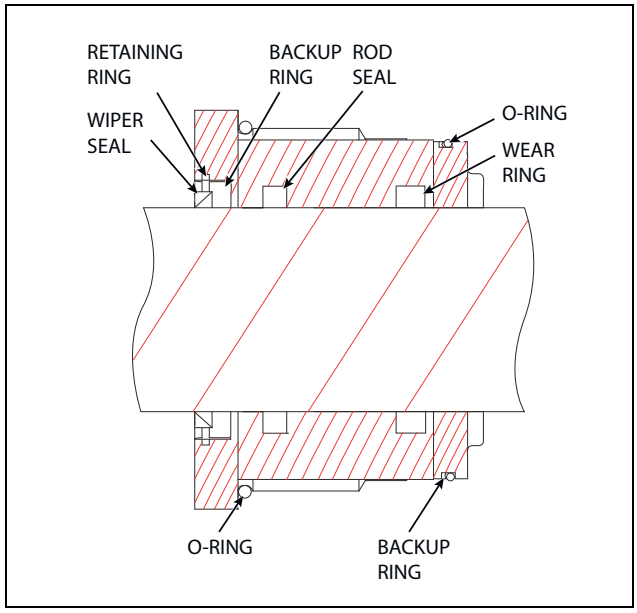


Figure 5-15. Cylinder Head Seal Installation

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head groove. Install the new retaining ring into the applicable cylinder head groove.

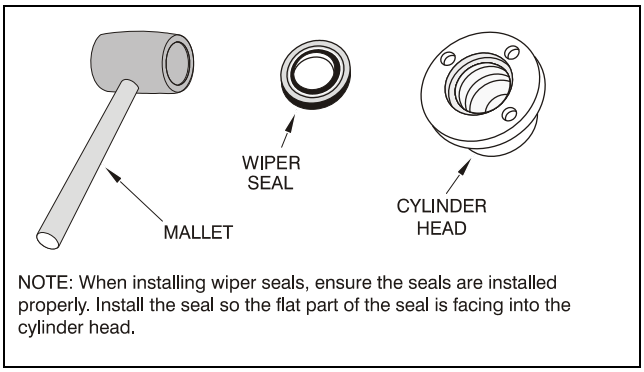


Figure 5-16. Wiper Seal Installation

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

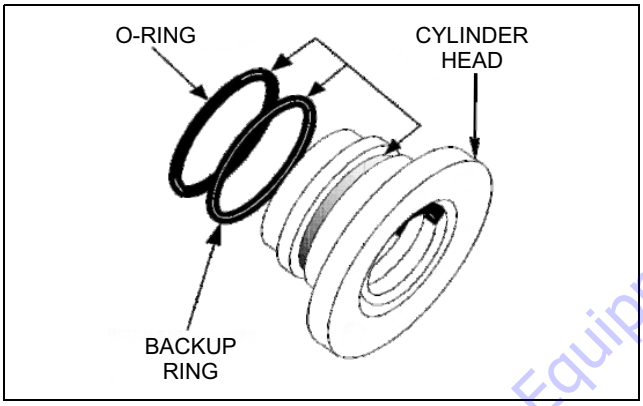


Figure 5-17. Installation of Head Seal Kit

4. Install o-ring onto the cylinder rod. Carefully install the head on the rod, ensuring that the wiper seal and rod seal are not damaged or dislodged. Push the head along the rod to the rod end.
5. Place a new o-ring in the inner piston diameter groove.
6. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
7. Carefully thread the piston on the cylinder rod hand tight, ensuring that the o-ring is not damaged or dislodged.
8. Install the lock nut onto the cylinder rod.
9. Remove the cylinder rod from the holding fixture.
10. Place new piston rings and seal 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).

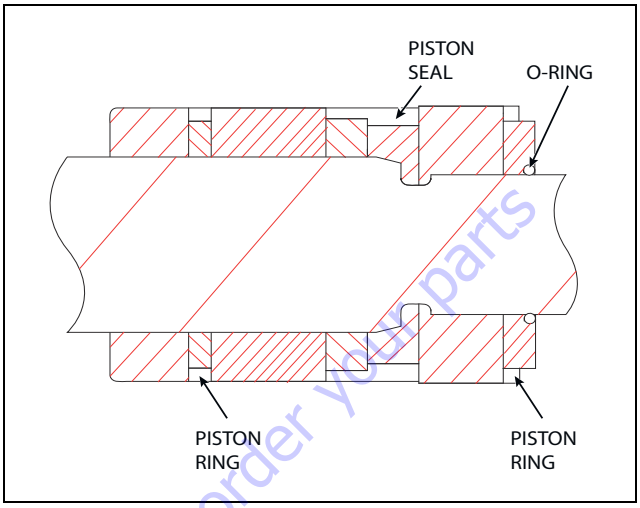


Figure 5-18. Piston Seal Kit Installation

11. 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.

12. With barrel clamped securely, and while adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.
13. Continue pushing the rod into the barrel until the cylinder head can be inserted into the barrel cylinder.
14. Screw the cylinder head into the barrel using a spanner wrench.
15. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the re-installation of any holding valve or valves.
16. Install the counterbalance valves in the rod port block. Torque to 30-35 ft.lbs. (40-47 Nm).
17. Install the plugs into the port blocks.

Main Boom Lift Cylinder

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. Remove the counterbalance valve, check valve and 2 way poppet valve from the cylinder port block and discard the o-rings.
4. Remove the plugs and orifice from the cylinder port block and discard the o-rings.
5. Place the cylinder barrel into a suitable holding fixture.

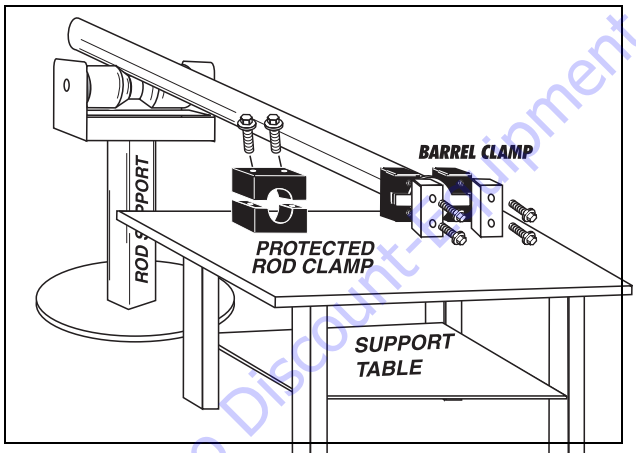


Figure 5-19. Cylinder Barrel Support

6. Using the hook spanner wrench, unscrew the cylinder head from the barrel.
7. Attach a suitable pulling device to the cylinder rod end.

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.

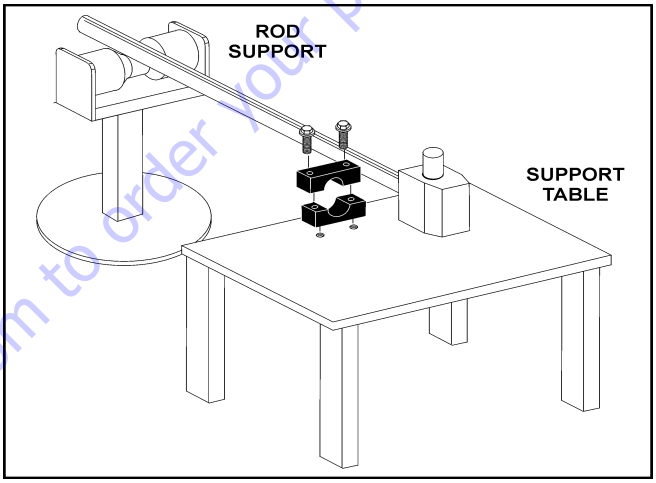
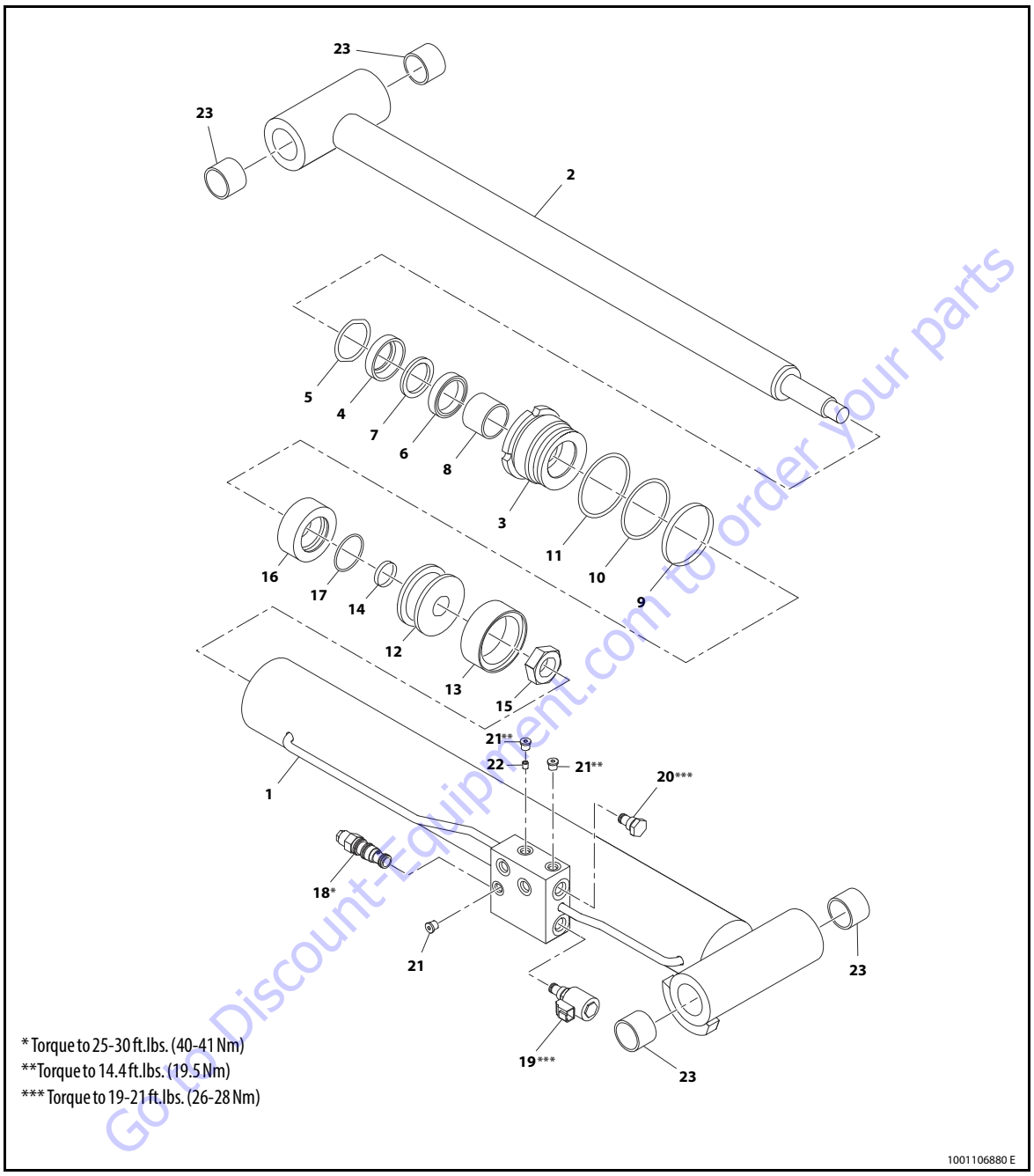


Figure 5-20. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Wiper Seal
5. Retaining Ring
6. Rod Seal
7. Backup Ring
8. Wear Ring
9. O-ring
10. Backup Ring
11. O-ring
12. Piston
13. Piston Seal
14. O-Ring
15. Nut
16. Spacer
17. O-ring
18. Cartridge Valve
19. Cartridge Valve
20. Cartridge Valve
21. Plug
22. Orifice
23. Bearing

Figure 5-21. Main Boom Lift Cylinder

9. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
10. Remove the bearings from the barrel.
11. Loosen and remove lock nut from the piston rod.
12. Screw the piston counterclockwise by hand and remove the piston from cylinder rod.
13. Remove and discard the piston seal and o-rings.
14. Remove the spacer from the rod.
15. Remove the rod from the holding fixture. Remove the cylinder head. Remove and discard the o-rings, back-up ring, wear ring, rod seal, retainer ring and wiper seal.

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 piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
6. Inspect threaded portion of piston for damage. Dress threads as necessary.
7. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
8. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
9. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
10. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
11. 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 steel bushing prior to bearing installation.
    d. Using an arbor of the correct size, carefully press the bearing into steel bushing.

NOTE: *Install pin into the composite bearing dry. Lubrication is not required with nickel plated pins and bearings.*

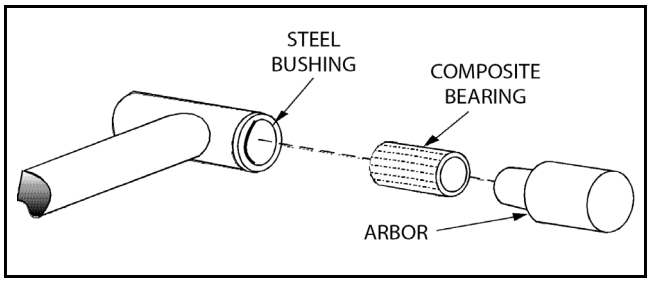


Figure 5-22. Composite Bearing Installation

12. Inspect spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
13. If applicable, inspect port block fittings and holding valve. Replace as necessary.
14. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
15. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

ASSEMBLY

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

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

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

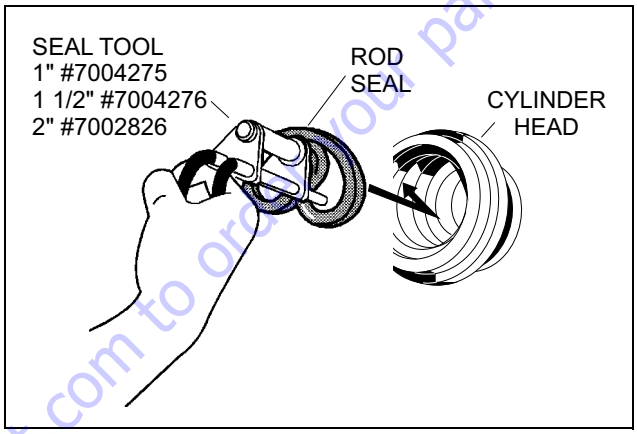


Figure 5-23. Rod Seal Installation

NOTICE

WHEN INSTALLING NEW SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

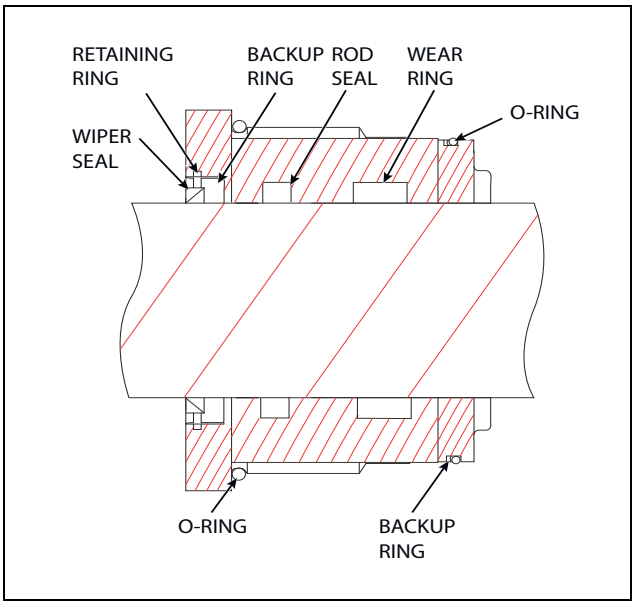


Figure 5-24. Cylinder Head Seal Installation

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head groove. Install the new wear ring into the applicable cylinder head groove.

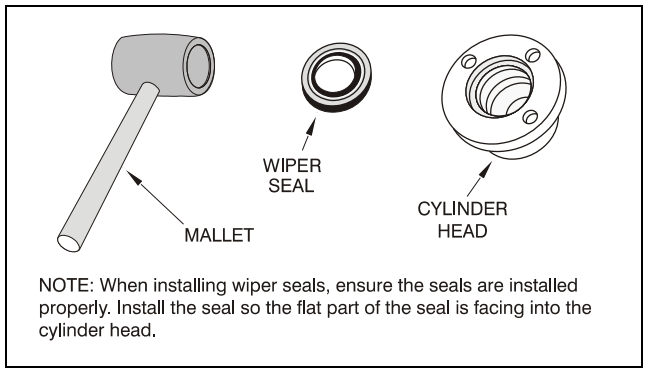


Figure 5-25. Wiper Seal Installation

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

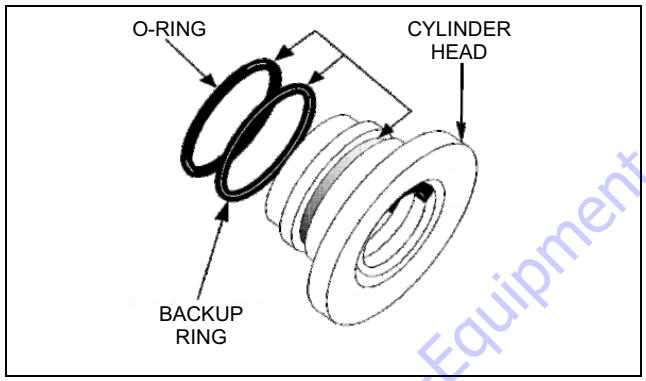


Figure 5-26. Installation of Head Seal Kit

4. Carefully install the head on the rod, ensuring that the wiper seal and rod seals are not damaged or dislodged. Push the head along the rod to the rod end.
5. Install the spacer on the cylinder rod.
6. Place a new o-ring and retaining ring in the inner piston diameter groove.
7. Place the o-rings in outer piston diameter groove.
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 until it abuts the spacer end, ensuring that the o-ring are not damaged or dislodged.
10. Install the lock nut.
11. Remove the cylinder rod from the holding fixture.
12. Place new piston seal and spacer 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).

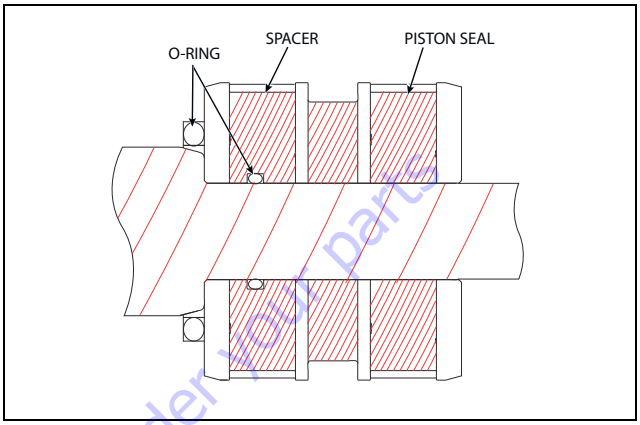


Figure 5-27. Piston Seal Kit Installation

13. 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.

14. 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.
15. Continue pushing the rod into the barrel until the cylinder head can be inserted into the barrel cylinder.
16. Secure the cylinder head and cylinder cap.
17. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the re-installation of any holding valve or valves.
18. Install the counterbalance valve in the rod port block. Torque to 25-30 ft.lbs. (40-47 Nm).
19. Install the check valve and 2 way poppet valve in the respective port blocks. Torque to 19-21 ft.lbs. (26-28 Nm).
20. Install the orifice and plugs in port block. Torque plugs to 14.4 ft.lbs. (19.5 Nm).

Master Cylinder

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. Remove the plugs from the barrel and discard the o-rings.
4. Place the cylinder barrel into a suitable holding fixture.

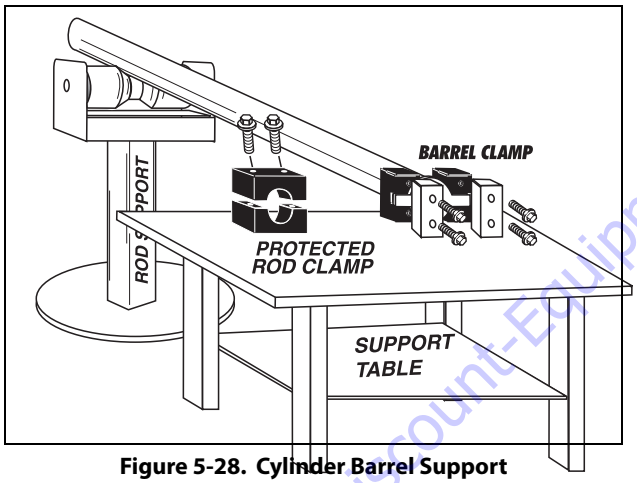


Figure 5-28. Cylinder Barrel Support

5. Using a hook spanner wrench, unscrew the cylinder head from the barrel.
6. Attach a suitable pulling device to the cylinder rod end.

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.

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

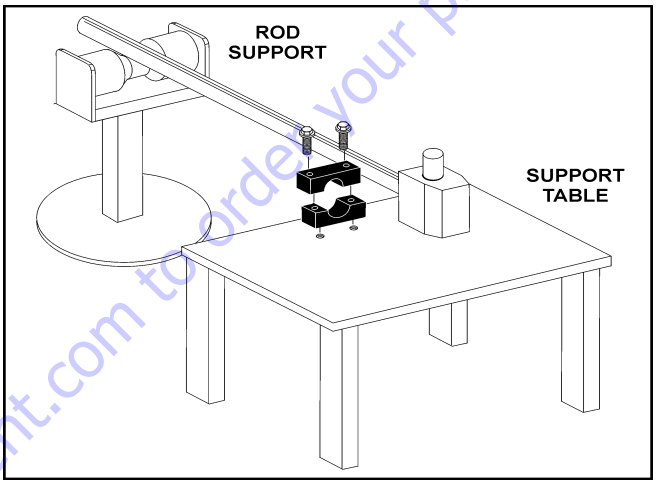
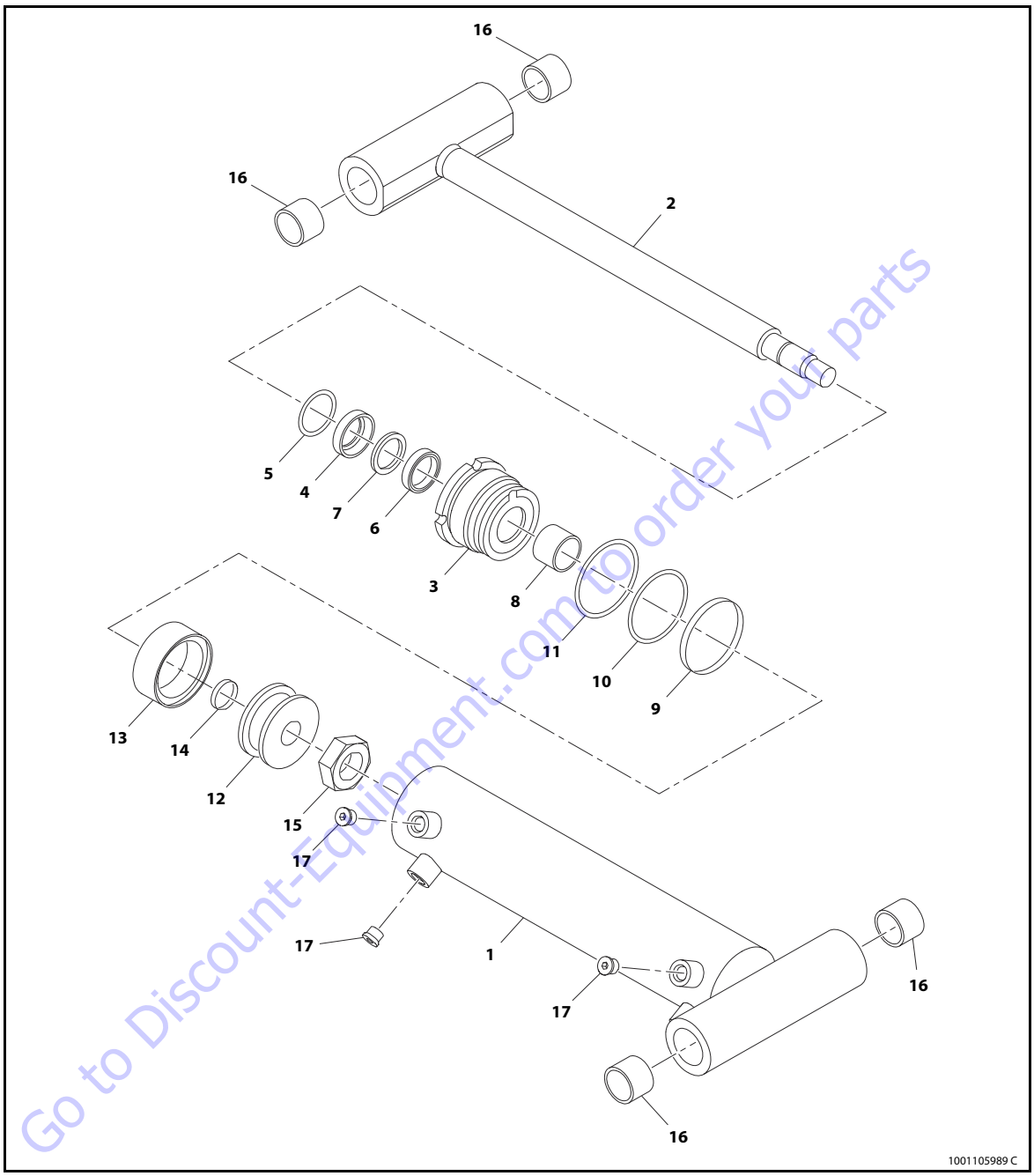


Figure 5-29. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Wiper Seal
5. Retaining Ring
6. Rod Seal
7. Backup Ring
8. Wear Ring
9. O-ring
10. Backup Ring
11. O-ring
12. Piston
13. Piston Seal
14. O-ring
15. Nut
16. Bearing
17. Plug

Figure 5-30. Master Cylinder