Service and Maintenance Manual

Models
E600
E600J
E600JP
M600
M600J
M600JP

SN 0300219230 to Present

3121711

January 07, 2019 - Rev E

ANSI

CE

AS/NZS

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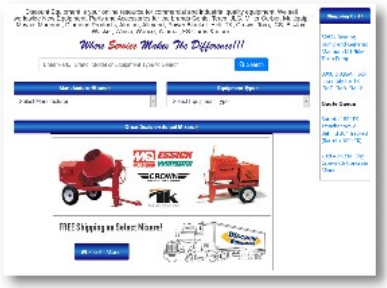

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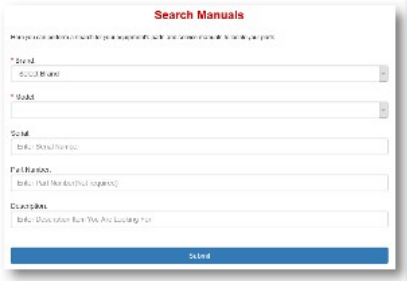

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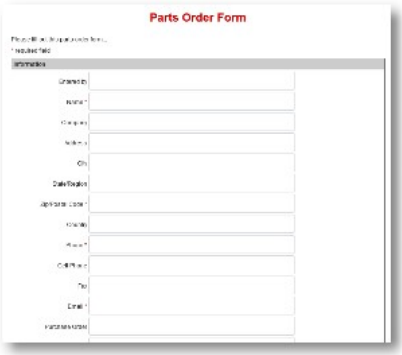

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SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

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 - August 22, 2017
Revised	C - May 30, 2018
Revised	D - June 29, 2018 - Revised Covers
Revised	E - January 07, 2019 - Revised Pages 4-35, 4-36, 4-37, 4-39

SECTION NO.	TITLE	PAGE NO.

SECTION 3 - CHASSIS & TURNTABLE

SECTION NO. TITLE PAGE NO.

SECTION 7 - BASIC ELECTRICAL INFORMATION & SCHEMATICS

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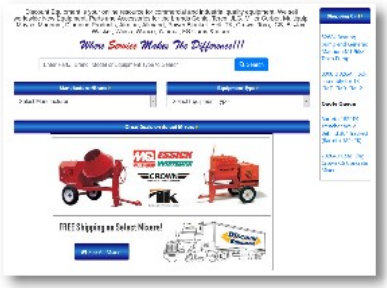

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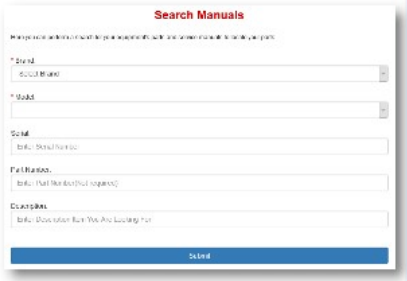

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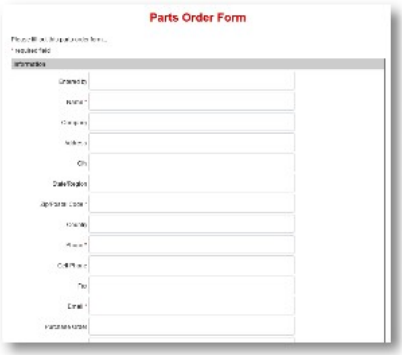

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SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

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 (Gradeability) with Boom retracted and approximately horizontal. Tower Boom fully lowered.)	30%
Maximum Travel Grade (Side Slope) with Boom retracted and approximately horizontal. Tower Boom fully lowered.	5°
Tilt Alarm Setting (See Section 3) ANSI, CSA CE E/M600 & E/M600J CE E/M 600JP	 5° 4° 3°
Maximum Vertical Platform Height:	60 ft. (18.29 m)
Maximum Horizontal Platform Reach E600 E600J	 43 ft. (13.11 m) 42 ft. 9 in. (13.11 m)
Machine Width 2WD 4WD	 7.94 ft. (2.42 m) 7.94 ft. (2.42 m)
Machine Length E/M600 E/M600J E/M600JP	 30.94 ft. (9.43 m) 30.74 ft. (9.37 m) 33.3 ft. (10.15 m)
Turning Radius (outside)	15.26 ft. (4.65 m)
Turning Radius (inside)	4 ft. (1.23 m)
Maximum Tire Load:	7700 lbs (3493 kg)
Maximum Ground Bearing Pressure E600J/M600J E600JP/M600JP	 52 psi (3.7 kg/cm^2) 51 psi (3.6 kg/cm^2)
Maximum Drive Speed:	4.0 mph (1.79 m/s)
Electrical System Voltage	48 volts
Maximum Hydraulic System Pressure	3200 psi (221 Bar)
Maximum Wind Speed	28 mph (12.5 m/s)
Maximum Manual Force	400N
Gross Machine Weight (Platform Empty) E600J/M600J E600JP/M600JP	 16,710 lbs. (7,580 kg) 17,210 lbs. (7,806 kg)

1.2 CAPACITIES

Table 1-2. Capacities

Generator Fuel Tank (M Models Only)	13 gal. (49.2L)
Hydraulic Tank	15.9 gal. (60.2 L) 12.4 gal. (46.9 L) to full mark
Drive Hub	0.4 gal. (1.5 liters)

1.3 TIRES

Table 1-3. Tire Specifications

Size	Type	Pressure
36/14 LL-22.5	pneumatic	55 psi (4.0 Bar)
36/14 LL-22.5	foam filled	N/A

1.4 FUNCTION SPEED

Table 1-4. Function Speeds

Function	Speed (In Seconds)
Main Lift Up & Down	55-61
Swing Right & Left	72-84
Main Telescope In & Out	46-50
Jib Lift Up	25-27
Jib Lift Down	21-23
Jib Swing Right & Left (E/M600JP)	30-40
Platform Rotate Right & Left	12-16
Drive Below Elevation FWD	34-39
Drive Reduced/Reverse Below Elevation	65-70
Drive Above Elevation (ANSI- E/M600J/JP) & (CE- E/M600J)	65-71
Drive Above Elevation (CE) (E/M600JP)	112 min.

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1.5 HYDRAULIC OIL

Table 1-5. 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: *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 10 is desired, contact JLG Industries for proper recommendations.*

Table 1-6. 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	4.1 cSt
at 100° F	15.8 cSt
at 210° F	4.1 cSt
Viscosity Index	168

Table 1-7. Mobil EAL Envirosyn H 32 Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	32
Density at 15° C	.869
Pour Point, Max	-38°F (-39°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 1-8. Mobil EAL Envirosyn SHC 32 Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	32
Density at 15° C	.936
Pour Point, Max	-27°F (-33°C)
Flash Point, Min.	540°F (282°C)
Viscosity	
at 40° C	33.1 cSt
at 100° C	6.2 cSt
Viscosity Index	152

Table 1-9. DTE 10 Excel 32 Specs

ISO Viscosity Grade	32
Pour Point, Max	-65°F (-54°C)
Flash Point, Min	482°F (250°C)
Viscosity	
at 40° C	32.7 cSt
at 100° C	6.63 cSt
at 100° F	32.7 cSt
at 212° F	6.63 cSt
Viscosity Index	164

1.6 TORQUE REQUIREMENTS

Table 1-10. Torque Requirements

Description	Torque Value (Dry)	Interval Hours
Wheel Lugs	170 ft. lbs. (238 Nm)	150
T/T Counterweight Bolts	400 ft.lbs. (560 Nm)	A/R
Swing Bearing Bolts	190 ft.lbs. (260 Nm)	50/600*
*Check swing bearing bolts for security after first 50 hours of operation and every 600 hours thereafter. (See Swing Bearing in Section 3.)		
NOTE: *When maintenance becomes necessary or a fastener has loosened, refer to the Torque Chart to determine proper torque value.*		

1.7 MAJOR COMPONENT WEIGHTS

Table 1-11. Component Weights

Component	Pounds	Kilograms
Frame (bare)	1381	626
T/T (bare)	2093	950
Boom Assembly (E/M 600)	4464	2025
Boom Assembly (E/M 600J)	4464	2025
Tire & Wheel	226	102.5
Swing Drive	70	32
Swing Bearing	100	45.4
Platform Console	25	11
Side Entry Platform - 30x72 (bare)	175	80
Side Entry Platform - 30x48 (bare)	144	66
Counterweight	2560	1161

1.8 SERIAL NUMBER LOCATION

A serial number plate is affixed to the right side of the frame. If the serial number plate is damaged or missing, the machine serial number is stamped on the left side of the frame at the top.

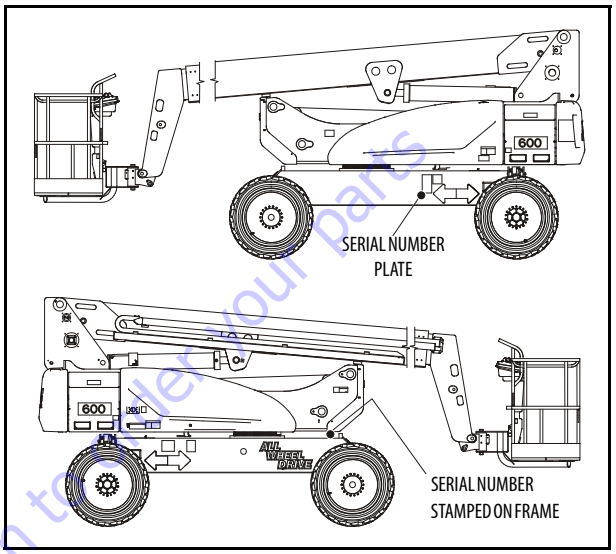


Figure 1-1. Serial Number Location

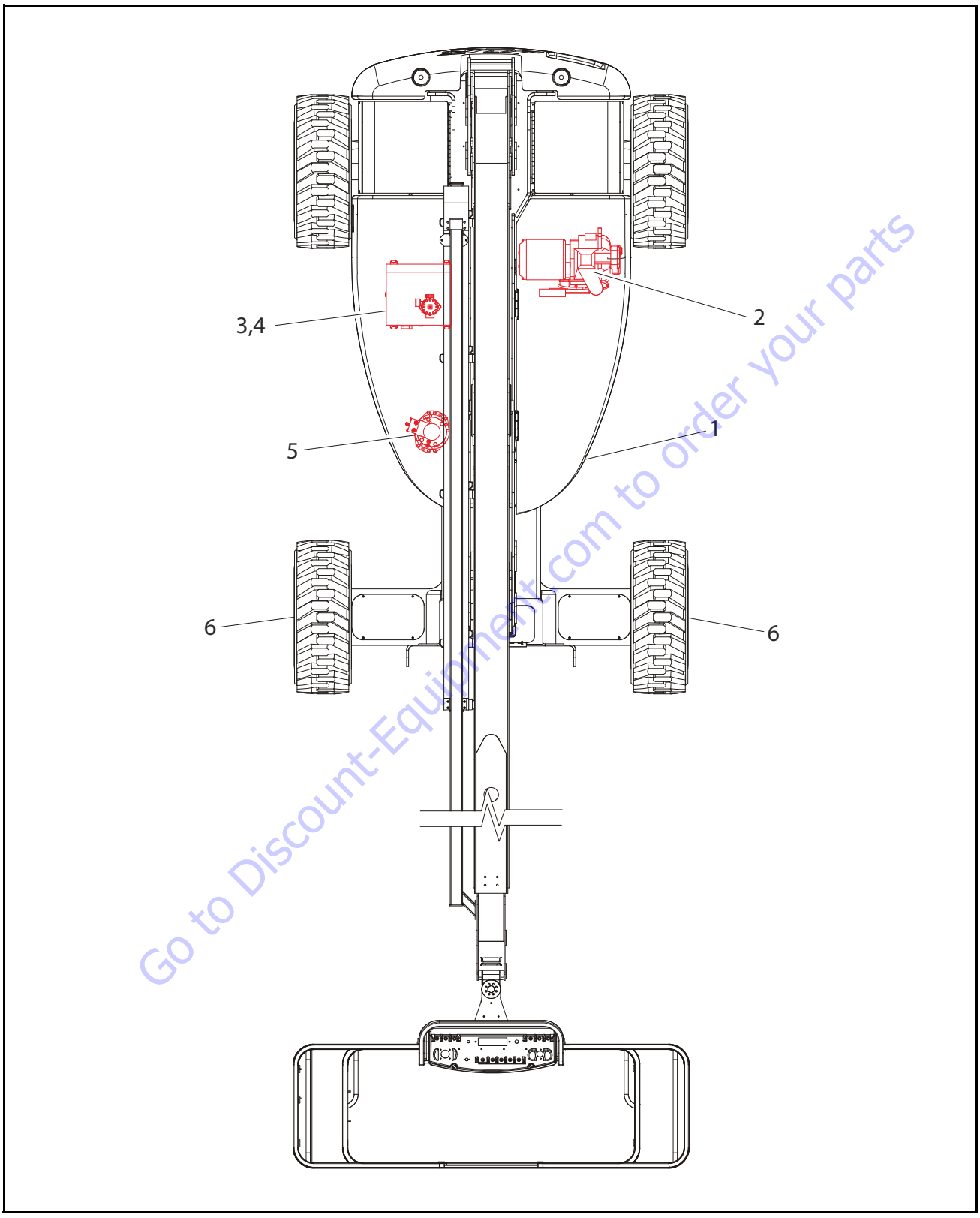


Figure 1-2. Operator Maintenance and Lubrication Diagram

1.9 OPERATOR MAINTENANCE

NOTE: *The following numbers correspond to those in Figure 1-2., Operator Maintenance and Lubrication Diagram*

Table 1-12. Lubrication Specifications.

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

NOTICE

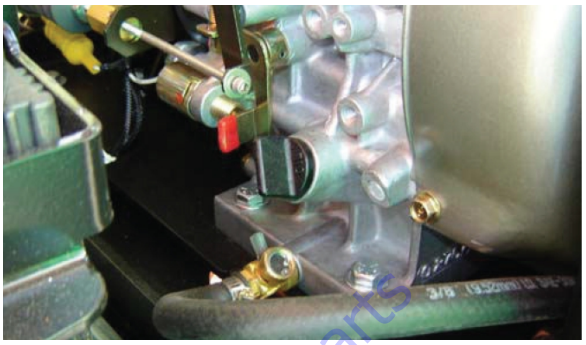
LUBRICATION INTERVALS ARE BASED ON MACHINEOPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTISHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

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

1. Swing Bearing - Internal Ball Bearing

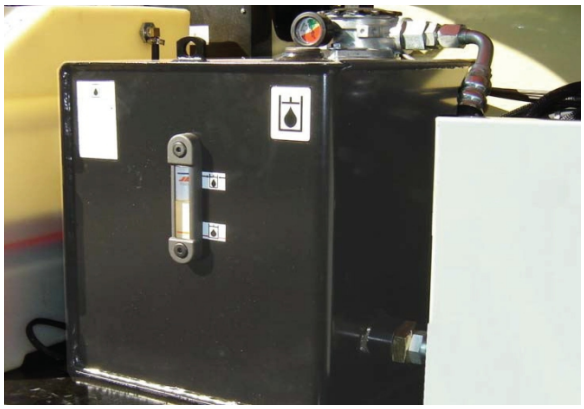
Lube Point(s) - 1 Grease Fittings
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hrs of operation

2. Generator Engine (If Equipped)



Lube Point(s) - Fill Cap
Capacity - Refer to Engine Manual
Lube - EO
Comments - Check daily.Change in accordance with engine manual.

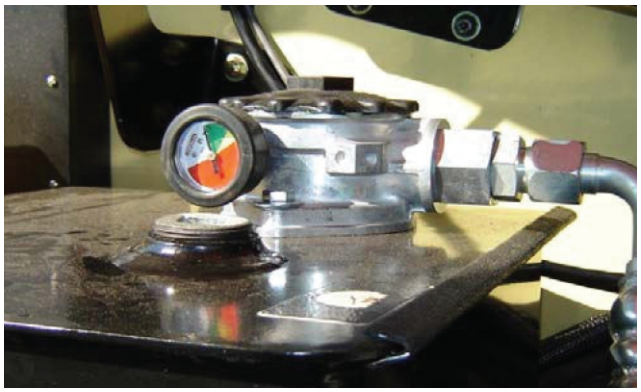
3. Hydraulic Tank



Lube Point(s) - Fill Cap

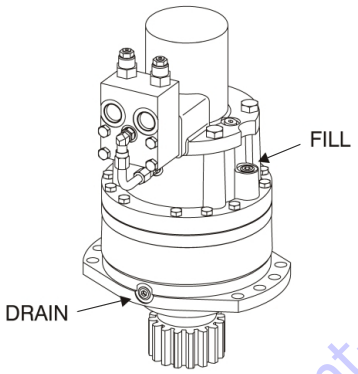
Capacity -15.9 gal. system (56.7L) 12.4 gal. (46.9 L) to Full Mark
Lube - HO
Interval - Check Level daily; Change every 2 years or 1200 hours of operation.

4. Hydraulic Filter



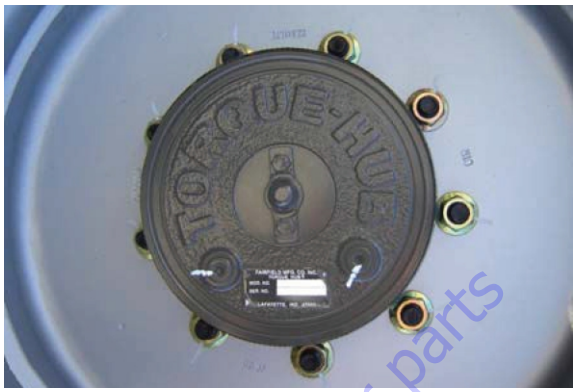
Interval - Change after first 50 hrs. and every 6 months or 300 hrs. thereafter or as indicated by Condition Indicator.
Comments - Under certain conditions, it may be necessary to replace the filter on a more frequent basis.

5. Swing Drive Hub



Lube Point(s) - Level/Fill Plug
Capacity - 24 oz. (0.7 L)
Lube - EPGL
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation

6. Wheel Drive Hub



Lube Point(s) - Level/Fill Plug
Capacity - 0.4 gal. (1.5 L)
Lube - EPGL
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)

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	3535	4835	3200	4350	2665	3625

SAE GRADE 5 BOLTS & GRADE 2 NUTS

SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*

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

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)

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

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 1-4. Torque Chart (SAE Fasteners - Sheet 2 of 5)

SOCKET HEAD CAP SCREWS																	
				Magni Coating (Ref 4150701)*							Zinc Yellow Chromate Fasteners (Ref 4150707)*						
Size	TPI	Bolt Dia	Tensile Stress Area	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 1-5. 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.

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Figure 1-6. 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.

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Figure 1-7. Torque Chart (METRIC Fasteners - Sheet 5 of 5)

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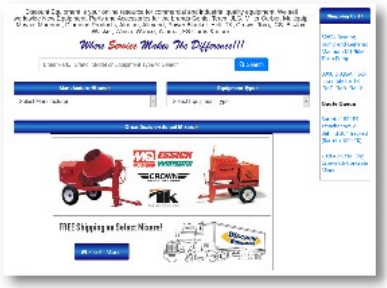

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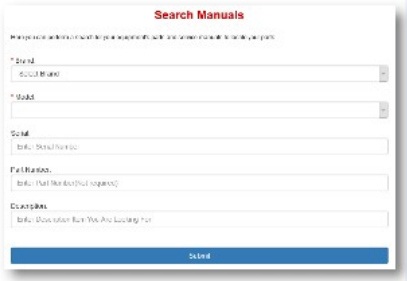

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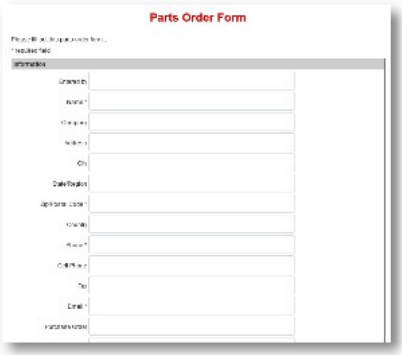

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, 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 At each 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 Reassembly

When disassembling or reassembling a component, complete the procedural steps in sequence. Do not partially disassemble or assemble one part, then start on another. Always recheck your work to assure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

Pressure-Fit Parts

When assembling pressure-fit parts, use an anti-seize or molybdenum disulfide base compound to lubricate the mating surface.

Bearings

1. When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.
4. Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore, apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

Gaskets

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

Bolt Usage and Torque Application

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 DTE 10 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 seal.
- Normal thermal expansion and contraction of the hydraulic oil within cylinders (See Cylinder Thermal Drift below).

The first two circumstances may result in cylinder movement due to oil leakage 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	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	
Foot switch	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:

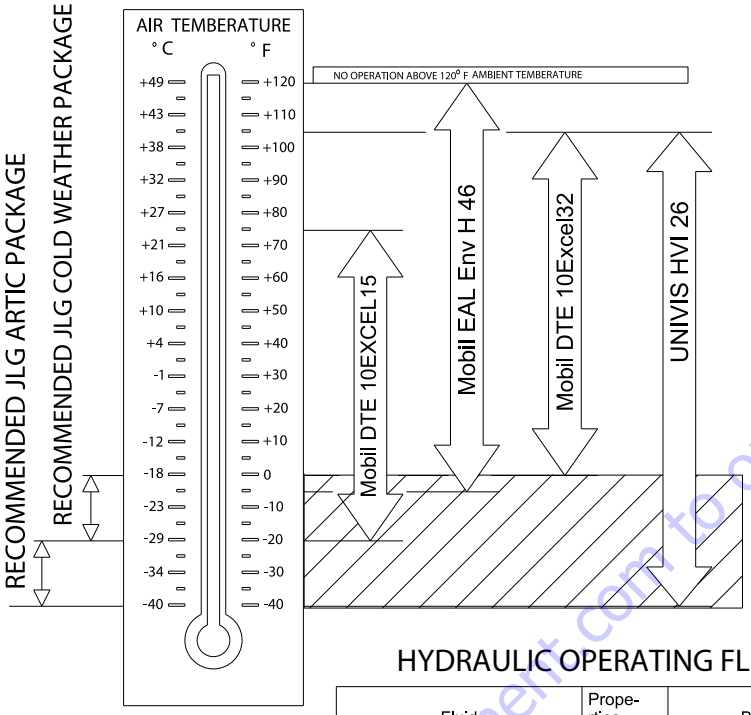
[1] Prior to each sale, lease, or delivery

[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



HYDRAULIC OPERATING FLUID CHART

Fluid	Prope-rties		Base					Classi-fication		
Description	Visc @ 40 C	Visc Index	Mineral Oils	Vegetable Oils	Synthetic	Synthetic Polyol Esters	Water Glycol	Readilly Biodegradeable*	Virtually Non-toxic**	Fire Resistant***
Mobil DTE 10Excel32	32	141	X							
UNIVIS HVI 26	26	376	X							
Mobil EAL Env H 46	46	145			X			X	X	
Mobil DTE 10EXCEL15	15	168	X							

* Readily biodegradable classification indicates one of the following:
CO2 Conversion>60% per EPA 560/6-82-003
CO2 Conversion>80% per CEC-L-33-A-93

** Virtually Non-toxic classification indicates an LC50>5000 ppm per OECD 203.

*** Fire Resistant classification indicates Factory Mutual Research Corp. (FMRC) Approval.

NOTE: *DRIVE PERFORMANCE MAY BE REDUCED BELOW 0 DEG F.*

NOTICE: MACHINE OPERATION USING NON-JLG APPROVED HYDRAULIC FLUIDS OR OPERATION OUTSIDE OF THE TEMPERATURE BOUNDARIES OUTLINES IN THE “HYDRAULIC FLUID OPERATION CHART” MAY RESULT IN PREMATURE WEAR OR DAMAGE TO COMPONENTS OF THE HYDRAULIC SYSTEM.

1001211621 A

Figure 2-1. Hydraulic Oil Specification

PARTS FINDER

Search Website by Part Number

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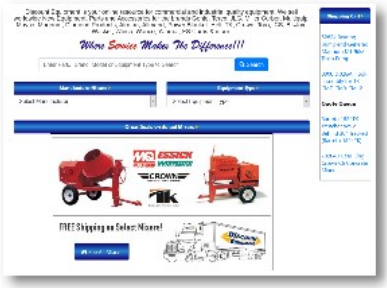

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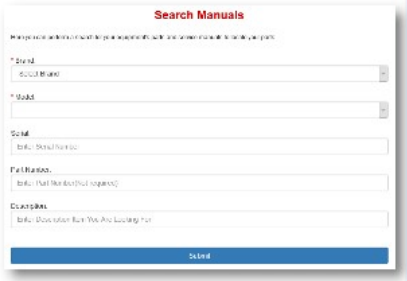

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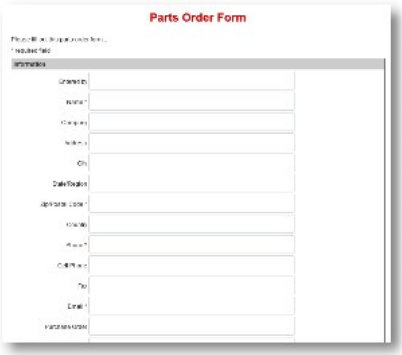

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Click on this link: http://www.discount-equipment.com/category/5443-parts/ and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on once of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

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
- TMf"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 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

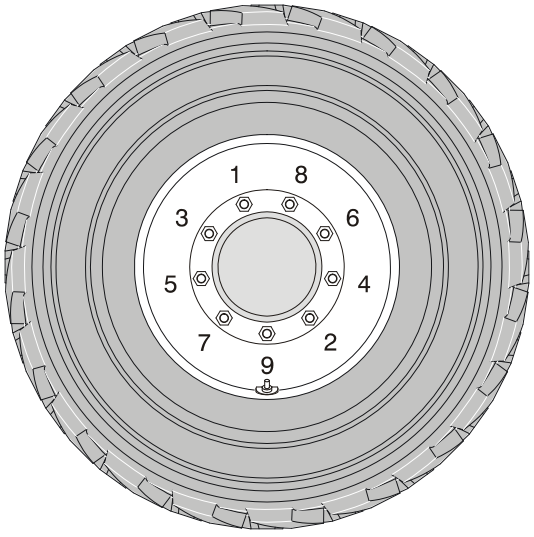
It is extremely important to apply and maintain proper wheel mounting torque.

⚠ 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)	100ft. lbs. (130 Nm)	170 ft. lbs. (255 Nm)

4. Wheel nuts should be torqued after first 50 hours of operation and after each wheel removal. Check torque every 3 months or 150 hours of operation.

3.2 SPINDLE, 2WD

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 through the entire bearing cavity and through 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.

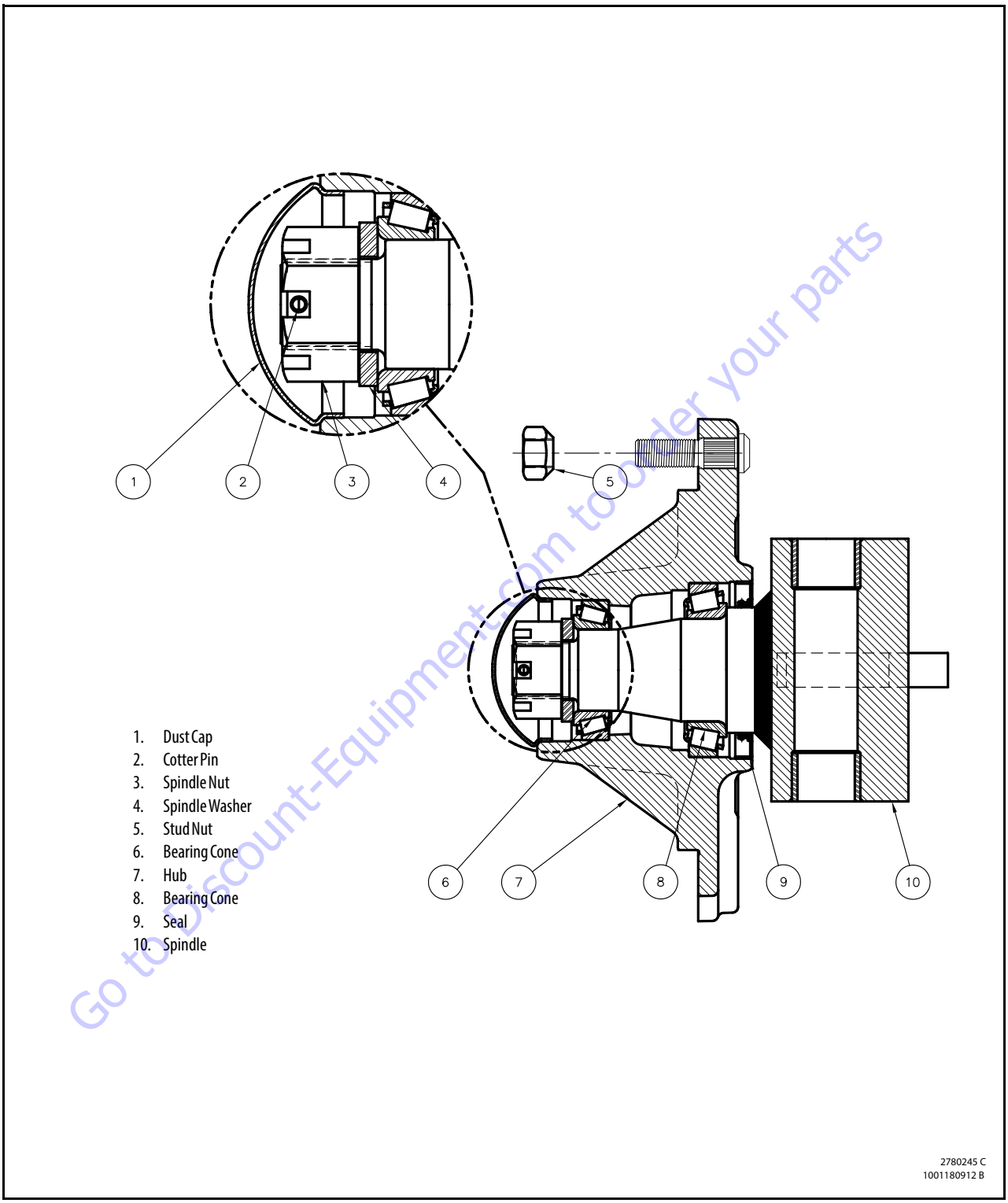


Figure 3-1. Spindle Assembly

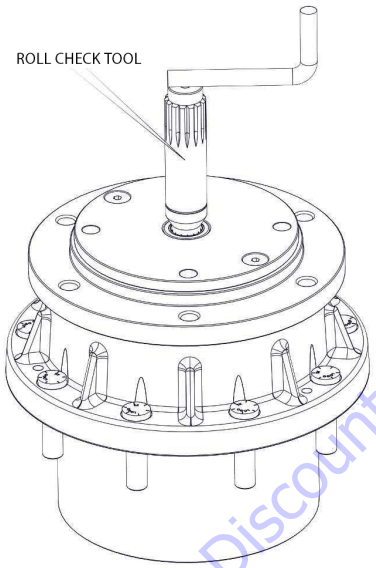
3.3 DRIVE HUB

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

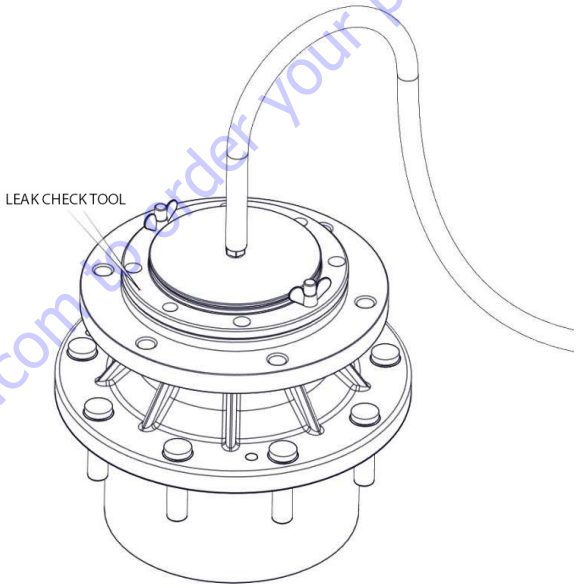
THE ROLL TEST

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



THE LEAK TEST (MAIN UNIT)

The purpose of a leak test is to make sure the unit is airtight. 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.

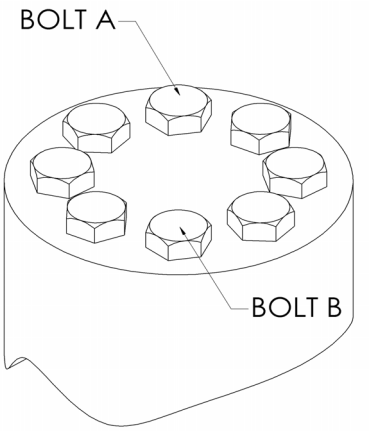


Tightening and Torquing Bolts

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 3-2., Main Disassembly Drawing 1, and Figure 3-3., Main Disassembly Drawing 2,*

1. Perform a roll check and leak check prior to disassembling the unit.
2. Remove the two Magnetic Pipe Plugs (6F) and drain the oil out of the gearbox.

NOTE: *Record the condition and volume of the oil.*

3. Remove Retaining Ring (6G) from the Cover Subassembly.
4. Lift the Cover Subassembly off the unit.
5. Remove the Input Sun Gear (10) if applicable.

NOTE: *On units with a ratio of greater than 36:1, there will be no Input Sun Gear (10). The teeth will be integrated on the Input Shaft.*

6. Lift out the Input Carrier Subassembly from Hub-Spindle Subassembly.
7. Remove the Input Shaft Subassembly out of the Hub-Spindle Subassembly.

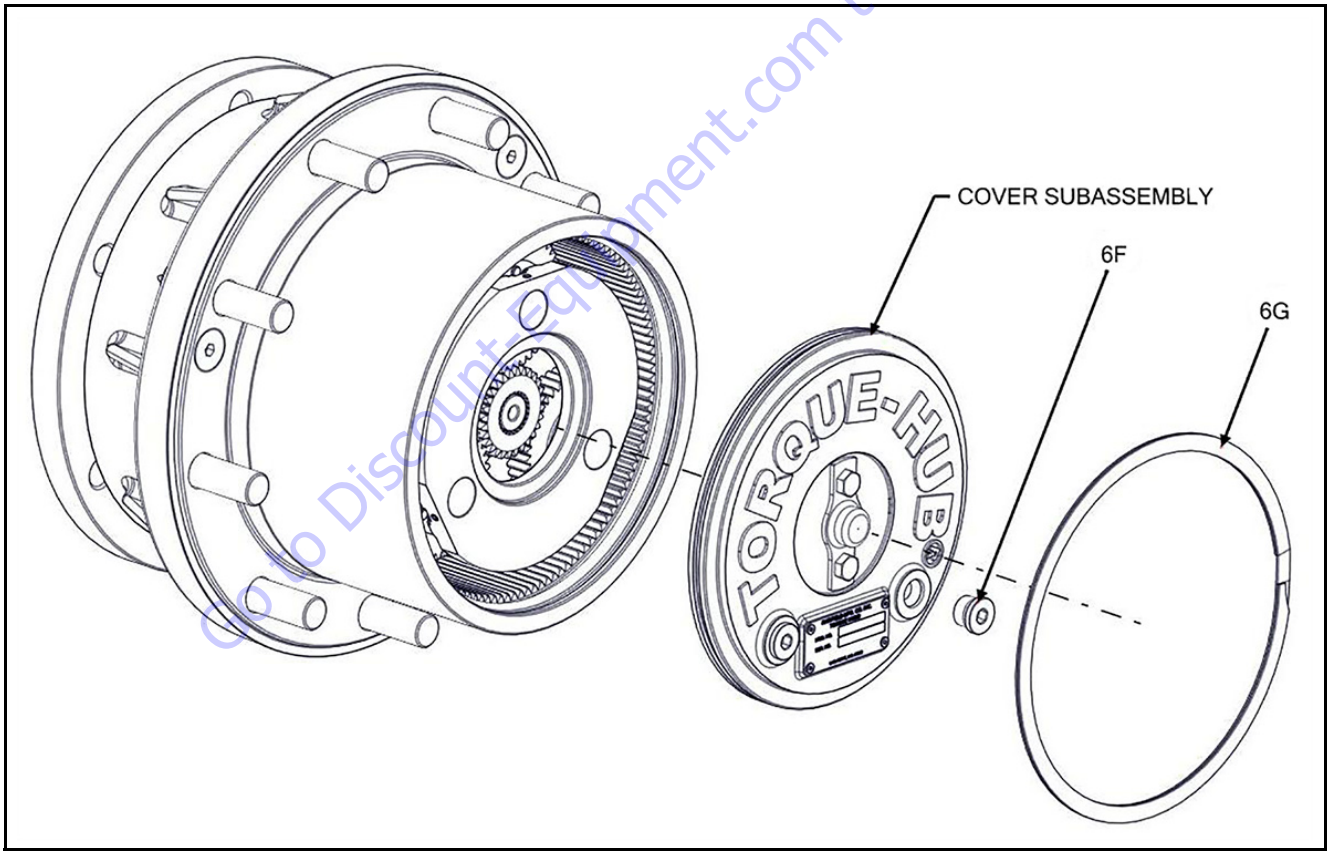
⚠ CAUTION

SAFETY GLASSES MUST BE WORN DURING THESE NEXT STEPS

8. Remove the Retaining Ring (5) from the Input Shaft (9).
9. Remove the Second Stage Sun Gear (11).
10. Remove the Retaining Ring (20) from the Second Stage Sun Gear (11).

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

11. Loosen and remove the three Flat Head Bolts (19) that retain the Ring Gear (1E) to the Housing (1G).
12. Lift the Ring Gear (1E) from Hub-Spindle Subassembly.



6F. Magnetic Pipe Plug

6G. Retaining Ring

Figure 3-2. Main Disassembly Drawing 1

NOTE: *Discard the O-ring in the step below. Do not re-use it.*

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

14. Using a 1/8" diameter punch, drive the Roll Pin (4G) into the Planet Shaft (4E) until it bottoms against the Hub-Spindle Subassembly.

15. Grasp the Roll Pin (4G) using needle nosed pliers or some sort of hooked tool, and pull the Planet Shaft (4E) out of the Hub-Spindle Subassembly.

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.*

16. Slide the Planet Gear Subassembly (4F) out of the Hub-Spindle Subassembly being careful not to drop the Needle Bearings (4C) in the process.

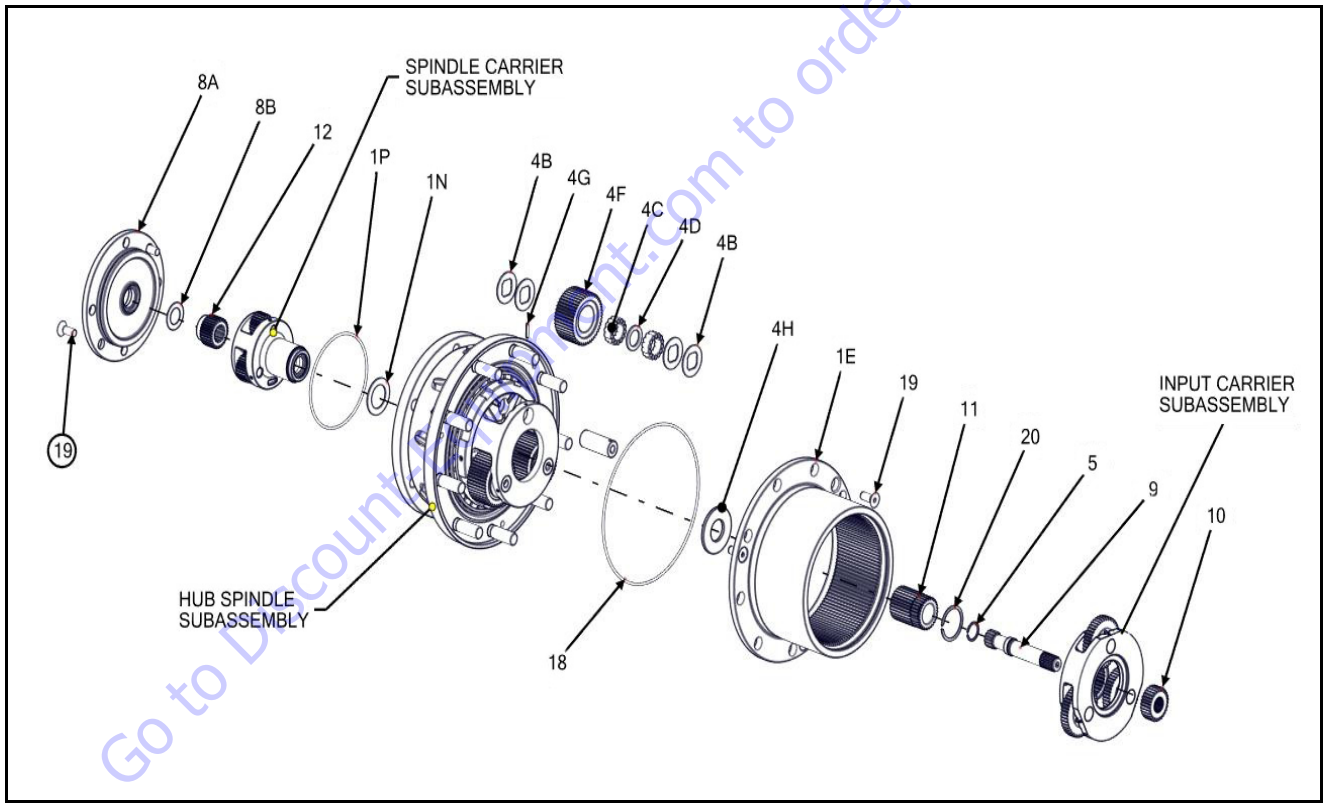
17. Remove Thrust Washer (4H) from the counter-bore in the spindle.

18. Set unit on planet carrier end of spindle.

NOTE: *Discard the O-ring in the step below. Do not re-use it.*

19. Remove Flat Head Screws (19) from Spindle (1A). Remove Adapter Plate (8A). Remove O-ring (1P) and Thrust Washer (8B).

20. Remove Carrier Sub-assembly inside the Spindle (1A). Remove Thrust Washer (1N).



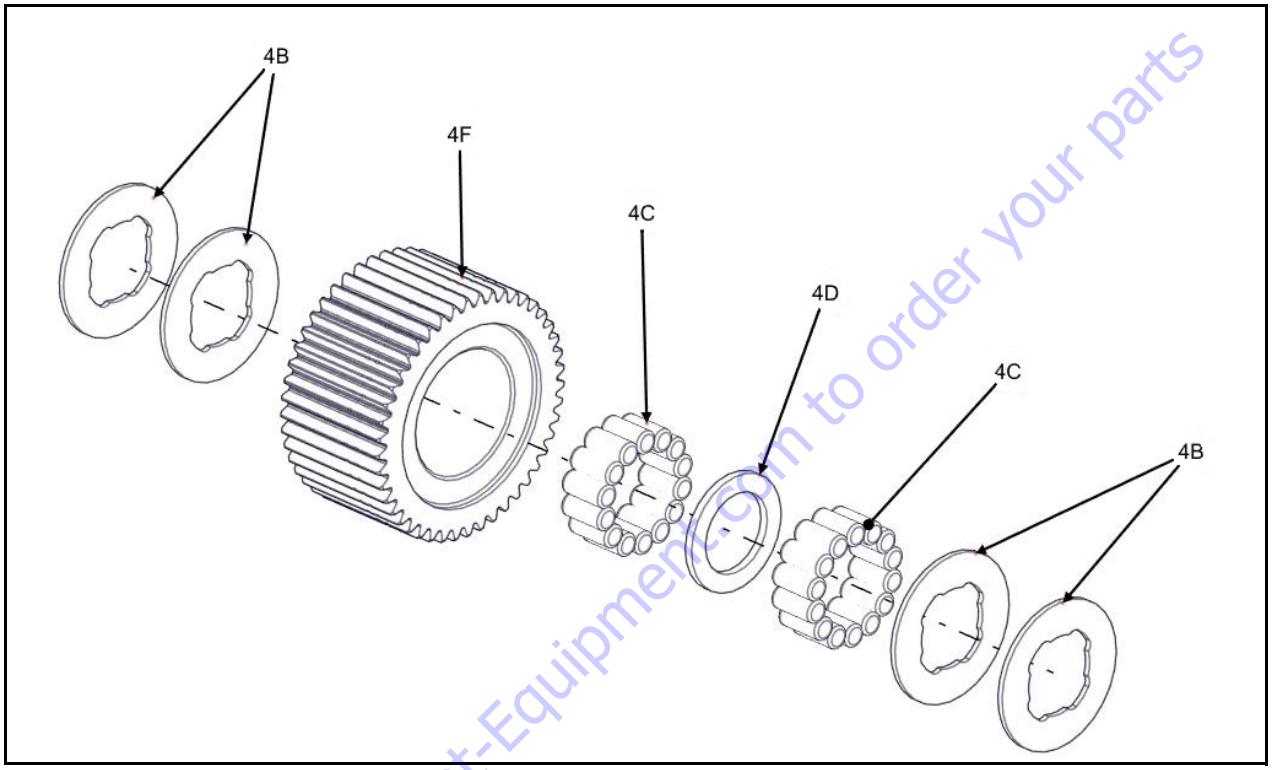
1G. Ring Gear
1N. Thrust Washer
1P. O-ring
4B. Thrust Washer
4C. Needle Bearing
4D. Thrust Spacer
4F. Planet Gear Subassembly
4G. Roll Pin
4H. Thrust Washer
5. Retaining Ring
8A. Adapter Plate
8B. Thrust Washer
9. Input Shaft
10. Sun Gear
11. Second Stage Sun Gear
12. Sun Gear
18. O-ring
19. Flat Head Bolt
20. Retaining Ring

Figure 3-3. Main Disassembly Drawing 2

Output Planet Gear Disassembly

NOTE: *Refer to Figure 3-4., Output Planet Gear Disassembly*

1. Remove 4 Thrust Washers (4B) from the Planet Gear (4F).
2. Remove 28 Needle Rollers (4C) from the Planet Gear (4F).
3. Remove the Thrust Spacer (4D) from the Planet Gear (4F).
4. Repeat Steps 1 through 3 for the remaining two Planet Gears (4F).



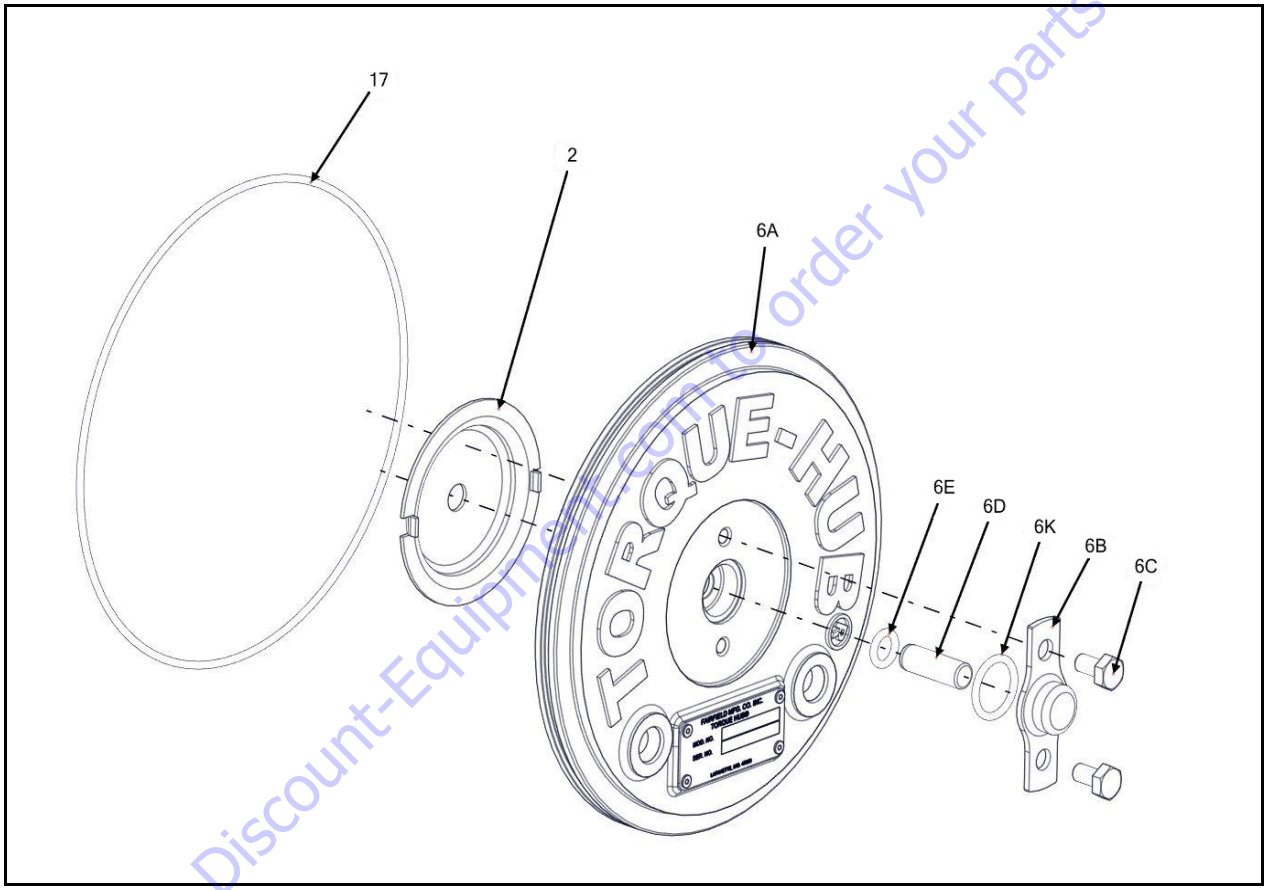
4B. Thrust Washer
4C. Needle Bearing
4D. Thrust Spacer
4F. Planet Gear Subassembly

Figure 3-4. Output Planet Gear Disassembly

Cover Disassembly

NOTE: *Figure 3-5., Cover Disassembly*

1. Remove the O-Ring (17) from groove in the Cover (6A) and discard O-Ring.
2. Remove Thrust Washer (2) from pockets in the Cover (6A).
3. Unscrew the Hex Head Bolts (6C) from the Disengage Cap (6B), if required.
4. Remove the Disengage Cap (6B) from the Cover (6A).
5. Pull the Disengage Rod (6D) out of the Cover (6A).
6. Remove O-Ring (6E) from the Cover (6A) and discard.



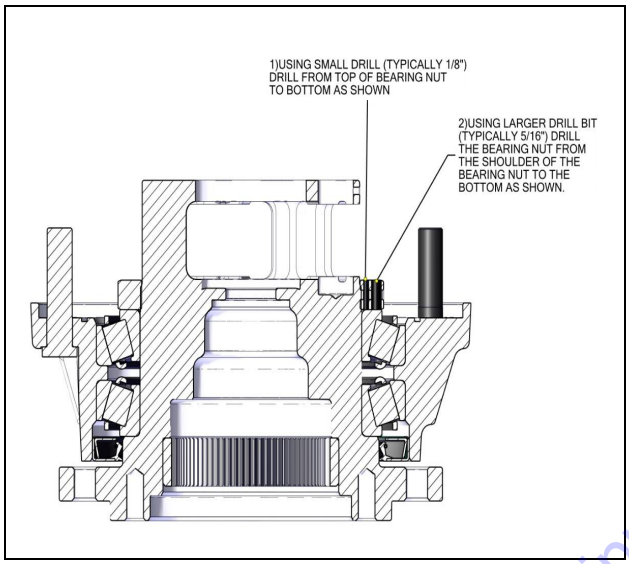
2. Thrust Washer
6A. Cover
6B. Disengage Cap
6C. Hex Head Bolt
6D. Disengage Rod
6E. O-ring
6K. O-ring
17. O-ring

Figure 3-5. Cover Disassembly

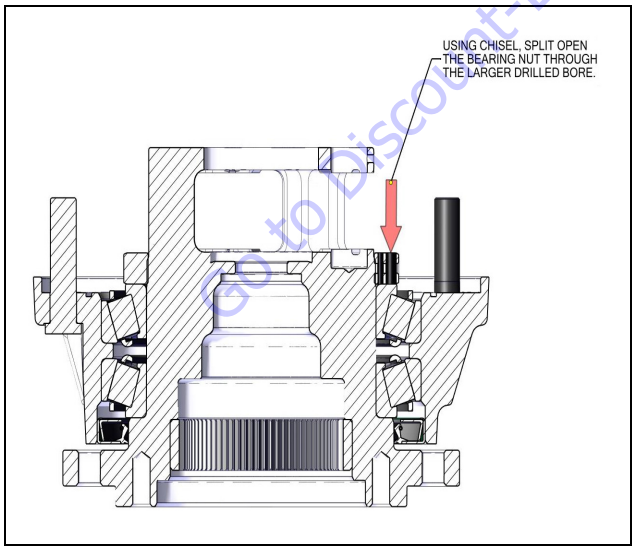
Housing-Spindle Disassembly

NOTE: *Refer to Figure 3-6., Housing Spindle Disassembly*

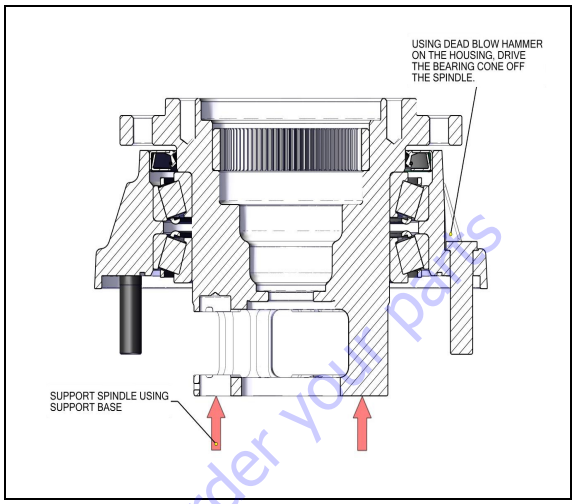
1. Set the unit on a bench so that the Spindle (1A) flange is down.
2. Using a small drill bit (typically 1/8”), drill from the top of the bearing nut to the bottom as shown below.
3. Using a larger drill bit (typically 5/16”), drill the bearing nut from the shoulder of the bearing nut to the bottom as shown below.



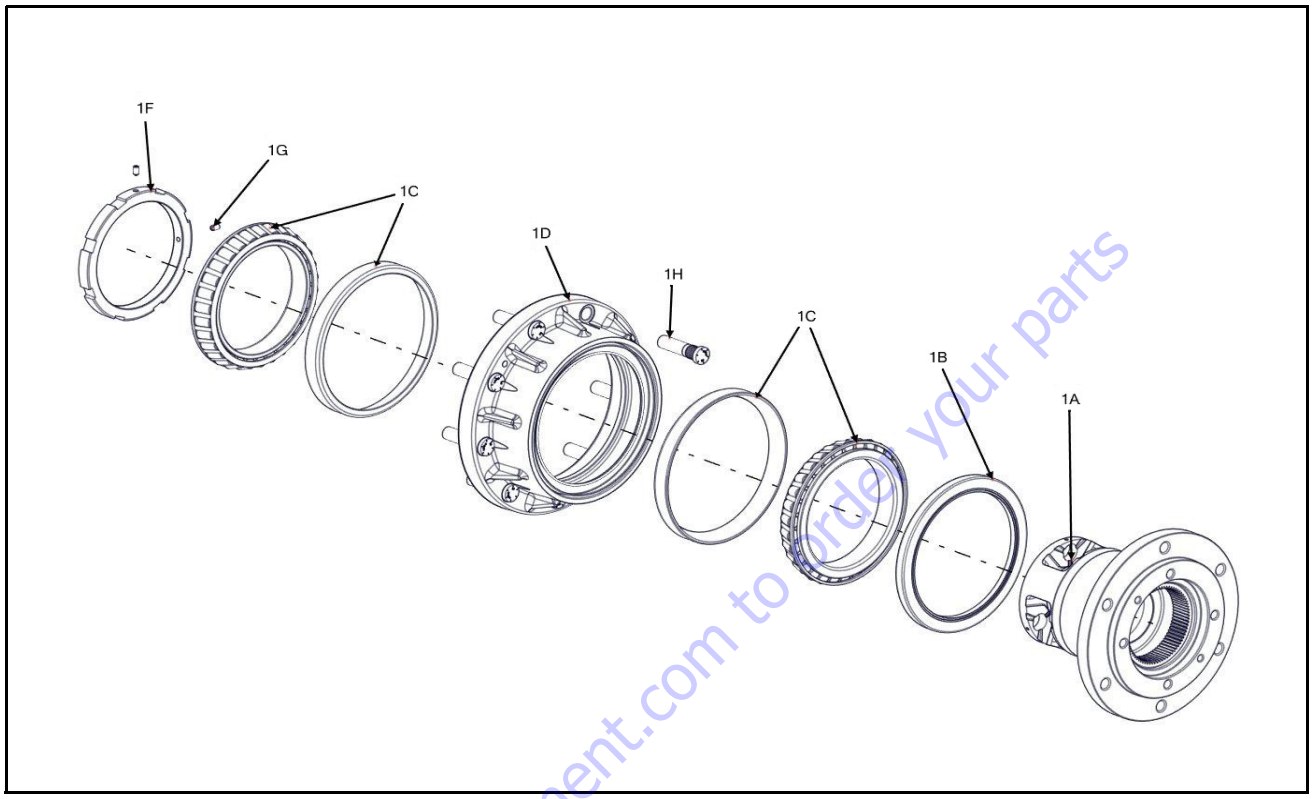
4. Using a chisel, split open the bearing nut through the larger drilled bore as shown below.



5. Turn the unit over and carefully place the unit on a support base until the Spindle (1A) rests on it. Ensure there is enough gap to lower the Housing (1D) down.



6. Use a dead blow hammer on the Housing (1D) flange to drive the inboard Bearing Cone (1C) off of the Spindle.
7. Lift the Spindle (1A) out of the Housing (1D).
8. If necessary, remove the Boot Seal (1Q).
9. Remove Lip Seal (1B) from Housing (1D).
10. Remove the Bearing Cone (1C) from Housing (1D).
11. Using a hammer and punch drive the inboard Bearing Cup (1C) out of the Housing (1D). Be careful not to damage the counter bore in the housing.
12. Turn the Housing (1D) over and drive the outboard Bearing Cup (1C) out of the Housing. Be careful not to damage the counter-bore in the housing.



1A. Spindle
1B. Lip Seal
1C. Bearing Cup
1D. Housing
1F. Bearing Nut
1G. Housing
1H. Wheel Stud

Figure 3-6. Housing Spindle Disassembly

Housing-Spindle Subassembly

NOTE: *Refer to Figure 3-6., Housing Spindle Disassembly*

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

1. Press one Bearing Cup (1C) into bearing counter bore of spindle end of housing until seated against shoulder in Housing (1D).
2. Turn Housing (1D) over and press one Bearing Cup (1C) into bearing counter bore of cover end of Housing (1D) making sure that it is fully seated against shoulder in the housing.
3. Place one Bearing Cone (1C) into the Housing (1D).
4. Spray the housing seal bore with alcohol, then wipe with a clean rag. Ensure there is no debris left in the bore.

NOTE: *Generally seals should not be reused.*

5. Spray the O.D. of the Lip Seal (1B) with alcohol and wipe with a clean rag. Place and visually align the Lip Seal (1B) with spring side down into the housing (1D) seal bore. Press the seal into the housing. When the seal press tool makes contact with the Housing (1G) the seal is fully seated.
6. Spray the Spindle (1A) seal diameter with alcohol and wipe with a clean rag. Apply a coat of oil to the Spindle (1A) seal lip diameter.
7. If necessary, install Boot Seal (1Q) onto Housing (1D), apply a small amount to grease to the flap of the boot seal.
8. Install the Housing (1D) onto the spindle with seal side down.
9. Place other Bearing Cone (1C) onto Spindle (1A) until it is seated in Bearing Cup (1C) in Housing (1G) and spray with a light coat of oil.
10. Apply Loctite 263 to the threads of Bearing nut (1F) and Spindle (1A).
11. Install Bearing Nut (1F) onto Spindle (1A) and tighten using locknut wrench. Torque Bearing Nut (1F) to 150 ft-lbs, rotate Housing (1G) in both directions, and then torque Bearing Nut to 150 ft-lbs. Rotate Housing (1G) in both directions again and torque bearing nut to 150 ft-lbs. Repeat this until Bearing Nut (1F) does not move when 150 ft-lbs of torque is applied.
12. Apply Loctite 263 to Set Screws (1G) and install them into Bearing Nut threaded holes. Make sure Set Screw is driven into the spindle thread. Tighten the set screws to damage the thread and stake the edge of the nut around the Set Screws (1G) so the nut will not loosen.

Output Planet Gear Subassembly

NOTE: *Refer to Figure 3-4., Output Planet Gear Disassembly*

1. Apply a liberal coat of grease to the bore of the Planet Gear (4F). This will enable the Needle Rollers (4C) to be held in place during assembly.
2. Install Needle Rollers (4C) into the inside of the Planet Gear (4F).

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 that form the space, and then slide parallel to the other rollers into place.*

3. Place one Spacer (4D) on top of the Needle Rollers (4C) inside the Planet Gear (4F).
4. Install Needle Rollers (4C) into the other side of the Planet Gear (4F), as above.
5. Apply grease to hold two Thrust Washers (4B) together and onto Output Planet Gear (4F) counter bore. Do the same to the other side.
6. Repeat Steps 1-5 to finish the assembly of the remaining Output Planet Gears (4F).

Cover Subassembly

NOTE: *Refer to Figure 3-5., Cover Disassembly*

1. Install two Pipe Plugs (6F) into the Cover (6A).
2. Grease the O-ring (17) and place it in the groove in the Cover (6A). Grease O-ring (6K) and place in face-groove in the center of the cover.
3. Grease the Thrust Washer (2) and place on the inner hub of the Cover (6A), keeping the two tangs aligned with the cast slots in the Cover (6A).
4. Grease the O-ring (6E) and install into the internal groove in the Cover (6A).
5. Attach the Disengage Cap (6B) to the Cover (6A) using Hex Bolts (6C). Tighten the Bolts to a torque of 70-80 in-lbs.
6. Turn the Cover (6A) over and push Disengage Rod (6D) until Disengage Rod (6D) bottoms out on the Disengage Cap (6B).

Main Assembly

NOTE: *Refer to Figure 3-7., Main Assembly Drawing*

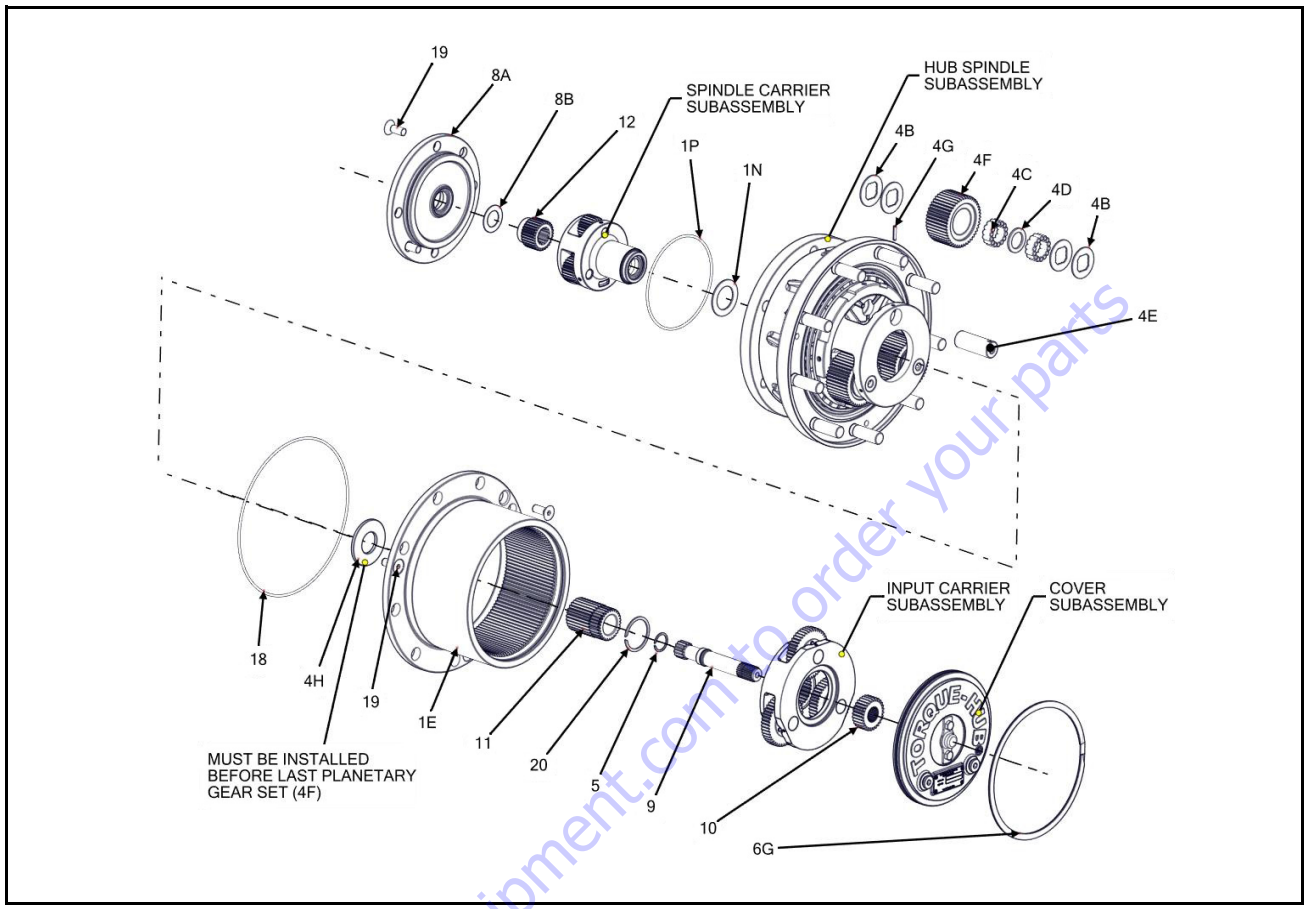
NOTE: *Spray component parts with a liberal amount of oil as they are being assembled.*

1. Place Hub-Spindle Subassembly with spindle flange side up.
2. Using a small amount of grease, install Thrust Washer (1N) into the spindle counter-bore.
3. Install Input Carrier Sub-Assembly into the spindle. Install Sun Gear (12) into the Input Carrier Sub-Assembly
4. Install O-ring (1P) into groove of Input Adapter (8A) with grease. Install Thrust Washer (8B) into Input Adapter (8A) counter-bore with grease.
5. Install Input Adapter (8A) onto spindle, install Flat Head Bolts (19) through Adapter into spindle, torque to 15-20 ft.lbs.
6. Turn Hub-Spindle Sub-Assembly over and place on spindle flange. Install the Thrust Washer (4H) in the counter bore in the Hub-Spindle Subassembly.
7. Place output planet gear assembly (4F) into the windows of spindle (1A). The output planets must have their part number facing up. Align the planet gear holes with planet shaft holes.
8. Install Planet Shaft (4E) with pin hole chamfer side up into spindle. Make sure to align the pin hole in the Planet Shaft (4E) with pin hole in Spindle (1A) while installation.
9. Using a 1/8" diameter punch, drive the Roll Pin (4G) in the Planet Shaft (4E). Insure everything is aligned and push the planet shaft (4E) into the Spindle (1A) until roll pin holes are aligned. Use an alignment punch or similar tool to align roll pin holes on Spindle (1A) and Planet Shaft (4E).
10. Drive Roll Pin (4G) down into t he aligned roll pin holes. Pin should be flush with OD of spindle.
11. Install O-Ring (18) onto groove of Housing (1G).
12. Place Ring Gear (1E) onto Housing (1D). Align the three shipping Cap Screw Holes on Hub (1D) and Ring Gear (1E).
13. Install three shipping Cap Screws (19) into Ring Gear (1E) and Housing (1D). Torque them to 15-20 ft-lbs.

⚠ CAUTION

SAFETY GLASSES MUST BE WORN DURING THESE NEXT STEPS.

14. Install the Retaining Ring (20) on to the Sun Gear (11).
15. Install Sun gear (11) into output planet gear mesh with spline side up.
16. Install Retaining Ring (5) into Input Shaft (9).
17. Insert Input Shaft Input into Carrier until seated.
18. Install Input Sun Gear (10) onto input Shaft.
19. Install Cover Subassembly (6A) to Housing (1G) using Retaining Ring (6G).
20. The unit should now be leak and roll checked as per instructions on page 9, 10, 11and 12. The motor can be reinstalled into the gearbox for the leak check to seal it off, and the unit pressurized through a pipe plug hole on the cover.



1E. Ring Gear
1N. Thrust Washer
1P. O-ring
4B. Thrust Washer
4C. Needle Bearing
4D. Thrust Spacer
4E. Planet Shaft
4F. Planet Gear Subassembly
4G. Roll Pin
4H. Thrust Washer
5. Retaining Ring
6G. Retaining Ring
8A. Adapter Plate
8B. Thrust Washer
9. Input Shaft
10. Sun Gear
11. Sun Gear
12. Sun Gear
18. O-ring
19. Flat Head Bolt
20. Retaining Ring

Figure 3-7. Main Assembly Drawing

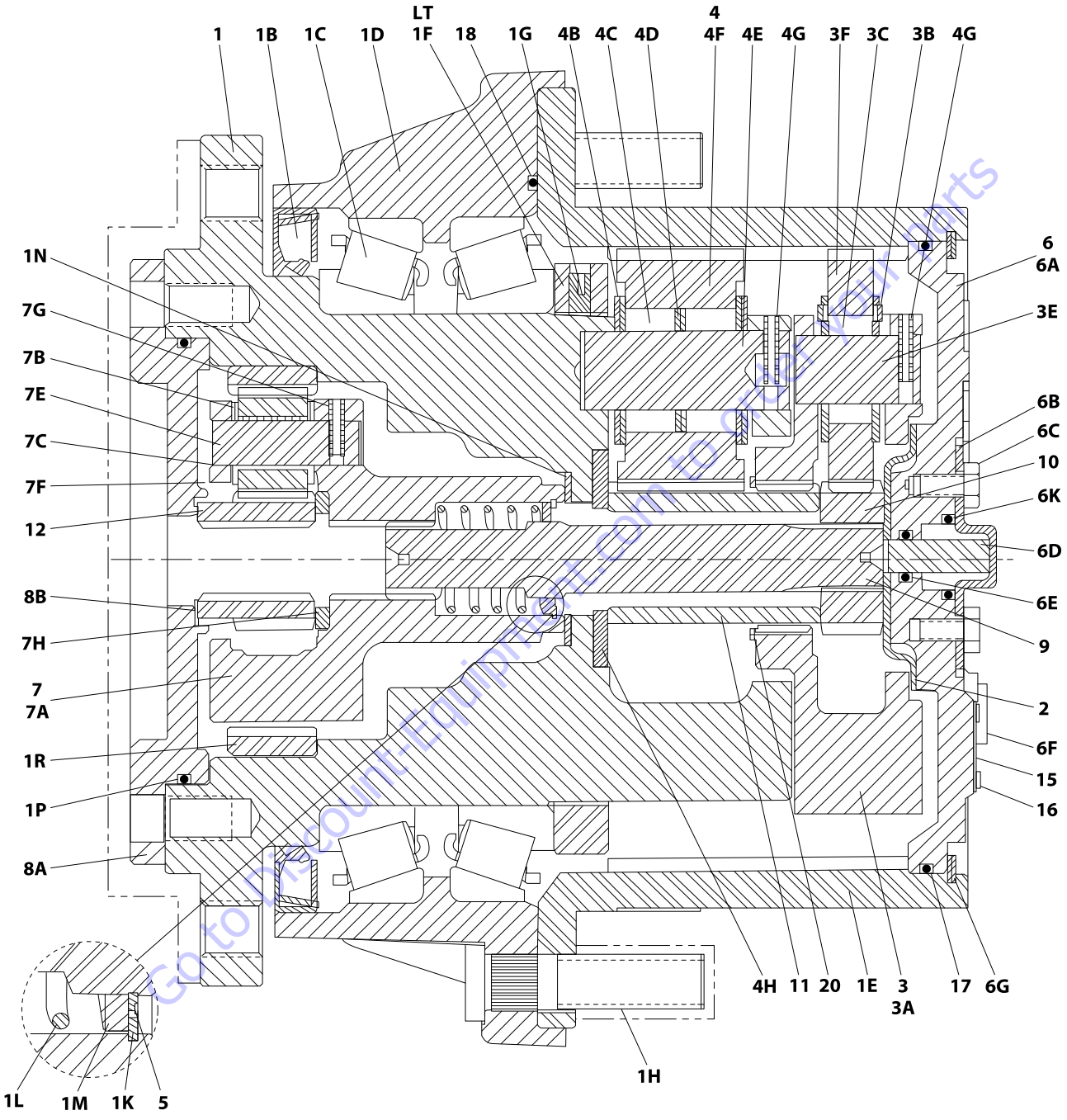


Figure 3-8. Hub Assembly - Sheet 1 of 2

1A. Spindle
1B. Lip Seal
1C. Tapered Bearing Cup
1D. Housing
1E. Ring Gear
1F. Bearing Nut
1G. Housing
1H. Wheel Stud
1K. Retaining Ring
1L. Spring
1M. Thrust Washer
1N. Thrust Washer
1P. O-ring
1R. Ring Gear
2. Thrust Spacer
3. Carrier
3A. Input Carrier
3B. Thrust Washer
3C. Bearing
3E. Planet Shaft
3F. Planet Gear
4. Planet Gear Subassembly
4B. Thrust Washer
4C. Needle Bearing
4D. Thrust Spacer
4E. Planet Shaft
4F. Planet Gear Subassembly
4G. Roll Pin
4H. Thrust Washer
5. Retaining Ring
6. Gear Cover Subassembly
6A. Cover
6B. Disengage Cap
6C. Hex Head Bolt
6D. Disengage Rod
6E. O-ring
6F. Oil Plug
6G. Retaining Ring
6K. O-ring
7. Carrier Subassembly
7A. Input Carrier Spindle
7B. Thrust Washer
7C. Bushing
7E. Planet Shaft
7F. Gear Planet
7G. Roll Pin
7H. Thrust Washer
8A. Adapter Plate
8B. Thrust Washer
9. Input Shaft
10. Sun Gear
11. Sun Gear
12. Sun Gear
15. ID Plate
16. Rivet
17. O-ring
18. O-ring
19. Flat Head Bolt
20. Retaining Ring

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

3.4 DRIVE MOTOR

Removal

1. Place machine on the firm level surface.
2. Disconnect the battery power and all electrical connections from the drive motor.
3. Use suitable lifting device to support the drive motor.
4. Remove drive brake from the drive motor.
5. Remove four bolts attached drive motor to the frame.
6. Remove the motor from machine and place in a clean work area.
7. Clean the motor for dirt. Remove rust or corrosion from coupling shaft.

Disassembly

NOTE: *Refer to Figure 3-10., 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 the terminal base (6) from the stator (2).
6. Remove the temperature sensor (27) from the stator (2).
7. Remove the screws (22) from the retaining plate (23).
8. Remove the retaining plate (23) from the cover (21).
9. Remove the cover (21) from the shield end (18).
10. Remove the seals (20) and (19).
11. Disconnect the connector (40) from the sensor (13).
12. Remove the sensor (13) from shield end.
13. Remove four screws (26) attached to the drive end plate (8).
14. Remove end plate and shield end.
15. 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.
16. Remove Washer (12), O-ring (9) and Bearing from Stator (2).
17. Remove the retainer clips (31) and (30).
18. Remove the Bearing (24), O-ring (28) and retainer clip (25).
19. Use mallet to remove the Gear (33) and remove Gear Key (32) from the Rotor (29).
20. Remove the rotor (29) from the stator (2).
21. Remove the stator (2).
22. 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 3-10., 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 (40) 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).

Installation

1. Install the drive motor to the machine.

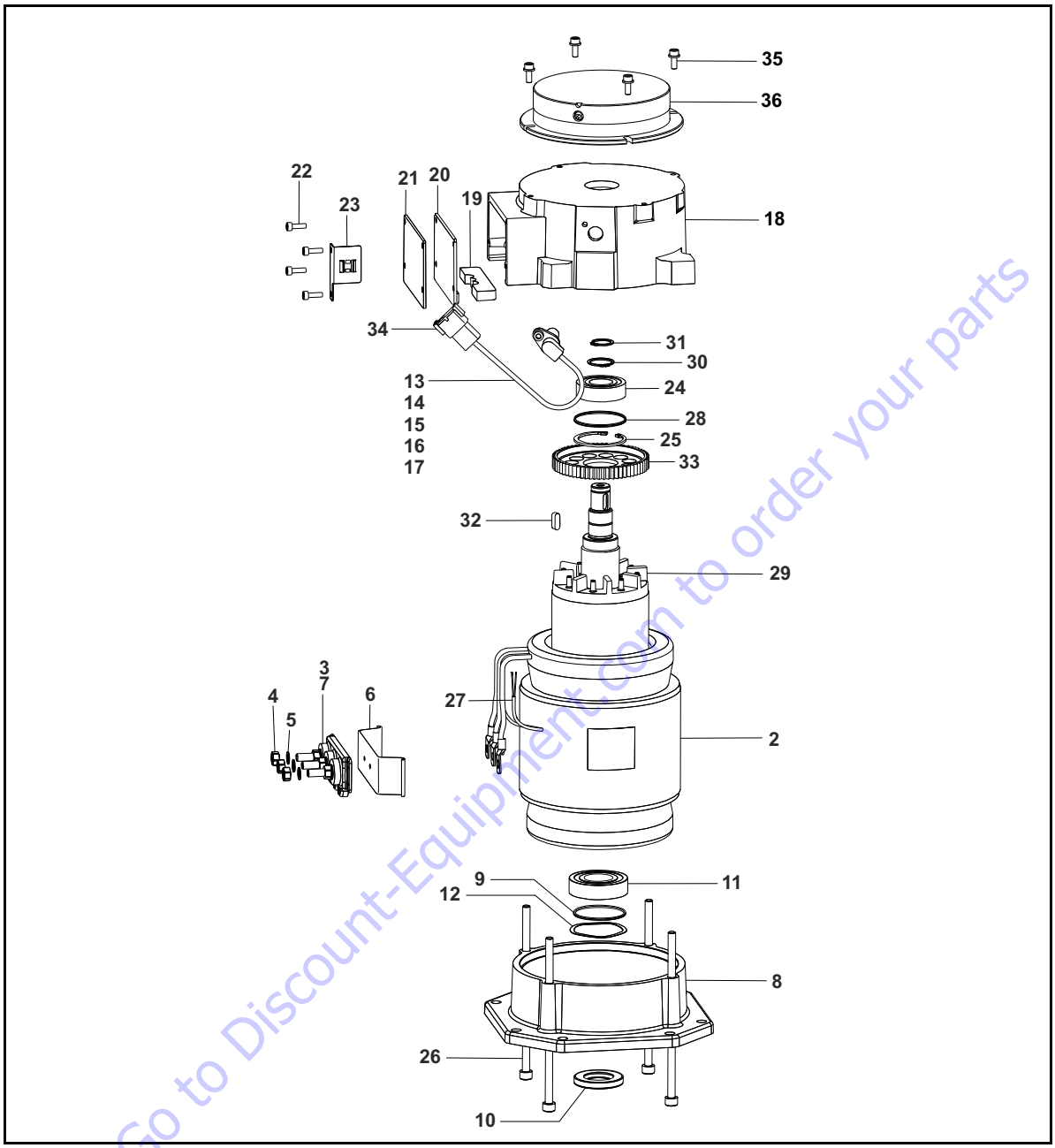
⚠ CAUTION

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

2. Make sure that the pump shaft is properly aligned.
3. 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.*

4. Install drive brake on to the drive motor.
5. Reconnect all electrical connections to the drive motor.
6. 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. Speed 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 3-10. Drive Motor

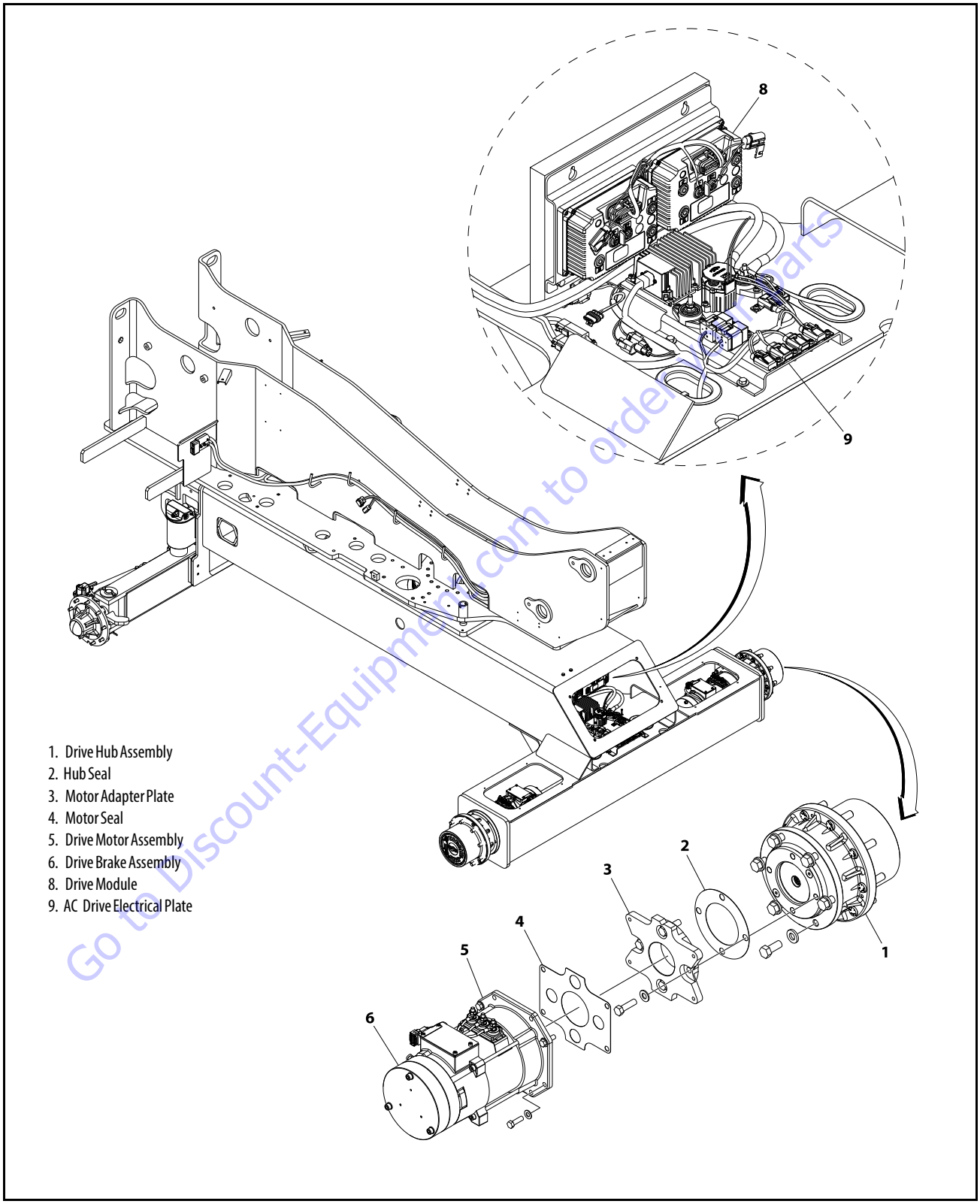


Figure 3-11. Drive Components

3.5 OSCILLATING AXLE LOCKOUT TEST (IF EQUIPPED)

NOTICE

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

NOTE: *Ensure boom is fully retracted, lowered, and centered between drive wheels prior to beginning lockout cylinder test.*

1. Place a 6 inches (15.2 cm) high block with ascension ramp in front of left front wheel.
2. From platform control station, start engine
3. Place the Drive control lever to the forward position and carefully drive machine up ascension ramp until left front wheel is on top of block.
4. Carefully activate Swing control lever and position boom over right side of machine.
5. With boom over right side of machine, place Drive control lever to Reverse and drive machine off of block and ramp.
6. Have an assistant check to see that left front or right rear wheel remains elevated in position off of ground.
7. Carefully activate Swing control lever and return boom to stowed position (centered between drive wheels). When boom reaches center, stowed position, lockout cylinders should release and allow wheel to rest on ground, it may be necessary to activate Drive to release cylinders.
8. Place the 6 inches (15.2 cm) high block with ascension ramp in front of right front wheel.
9. Place Drive control lever to Forward and carefully drive machine up ascension ramp until right front wheel is on top of block.
10. With boom over left side of machine, place Drive control lever to Reverse and drive machine off of block and ramp.
11. Have an assistant check to see that right front or left rear wheel remains elevated in position off of ground.
12. Carefully activate Swing control lever and return boom to stowed position (centered between drive wheels). When boom reaches center, stowed position, lockout cylinders should release and allow wheel to rest on ground, it may be necessary activate Drive to release cylinder.
13. If lockout cylinders do not function properly, have qualified personnel correct the malfunction prior to any further operation.

3.6 OSCILLATION CYLINDER BLEEDING

NOTE: *The oscillating axle must be checked daily for proper operation.*

Bleeding Procedure

1. Position the boom in the normal stowed transport position.
2. Disconnect the wires from the brake pressure switch.
3. Disengage both drive hubs by bolting its center cap inside out.
4. Attach clear tubing to bleeder valve nipple. Position a small bucket/bottle in front of the lockout cylinder bleeder valve and insert clear tubing.
5. From the platform control box, activate low speed drive and hold using a 3/8" wrench. Loosen the bleeder valve, slowly turning counter clockwise.
6. Bleed air from the top of the ram cylinder. Capture hydraulic oil until a steady unbroken stream of hydraulic oil is flowing. Tighten the bleeder valve while stream of hydraulic oil is running. Then release the drive function and close the bleeder valve.
7. Repeat process on other side of the machine.
8. Reconnect the brake pressure switch and re-engage the drive hubs.

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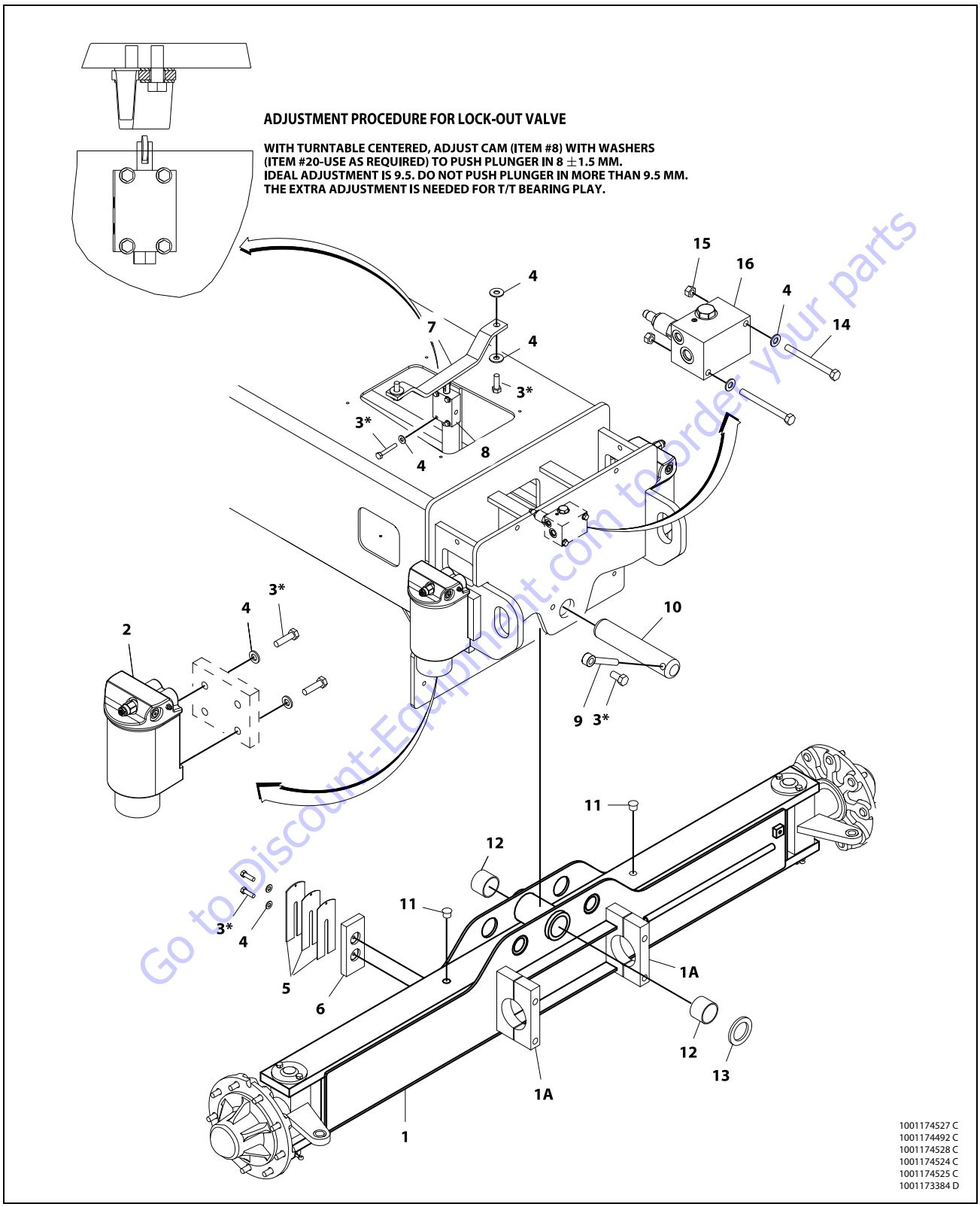


Figure 3-12. Oscillating Axle - Sheet 1 of 2

1. Axle Weldment
1A. Steer Cylinder Mounting Block Assembly
2. Lockout Cylinder Assembly
3. Bolt
4. Washer
5. Shim
6. Wear Pad
7. Lockout Cam
8. Lockout Valve Assembly
9. Pin Keeper
10. Axle Pivot Pin
11. Hole Plug
12. Bushing
13. Thrust Washer
14. Bolt
15. Nut
16. Axle Lockout Valve

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

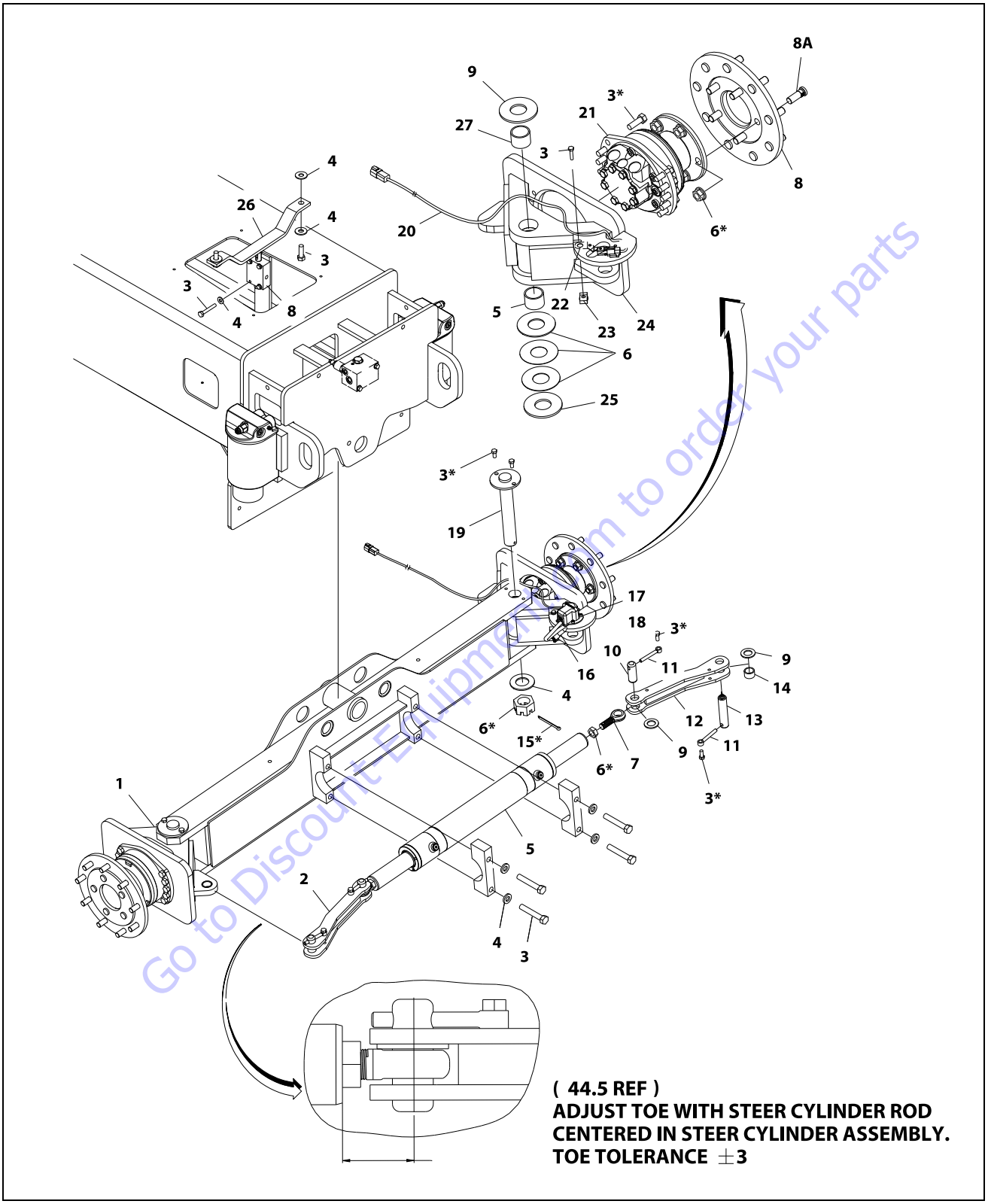


Figure 3-14. Axle Oscillation Lockout Valve - Sheet 1 of 2

1. Spindle
2. Tie-Rod
3. Bolt
4. Washer
5. Steer Cylinder Assembly
6. Nut
7. End Rod
8. Drive Adapter Assembly
8A Wheel Stud
9. Thrust Washer
10. Pin
11. Pin Keeper
12. Tie Rod
13. Steer Sensor Pin
14. Bearing
15. Cotter Pin
16. Rotary Angle Sensor Switch
17. Capscrew
18. Cover
19. Kingpin
20. Steering Harness
21. Drive Motor Assembly
22. Mount
23. Lockout Cam
24. Spindle
25. Shim
26. Bushing

Figure 3-15. Axle Oscillation Lockout Valve - Sheet 2 of 2

3.7 SWING DRIVE

Roll, Leak and Brake Testing

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

NOTE: *The brake must be released and hydraulic lines to motor removed before performing the roll test.*

THE ROLL TEST

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

THE LEAK TEST (MAIN UNIT)

The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your air checker starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings or gaskets are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where the 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.

THE BRAKE TEST

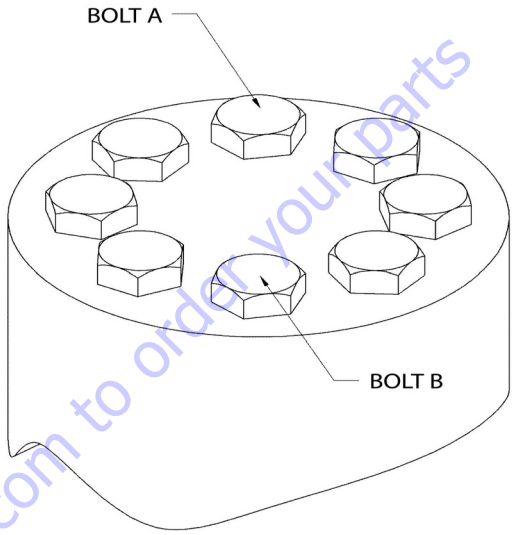
The brake test should be performed prior to disassembly and after reassembly to ensure that the brake functions properly. The brake test procedure can be found in the Motor-Brake Subassembly section of this manual.

NOTE: *Failure to perform this test may result in damaged or ineffective brake parts.*

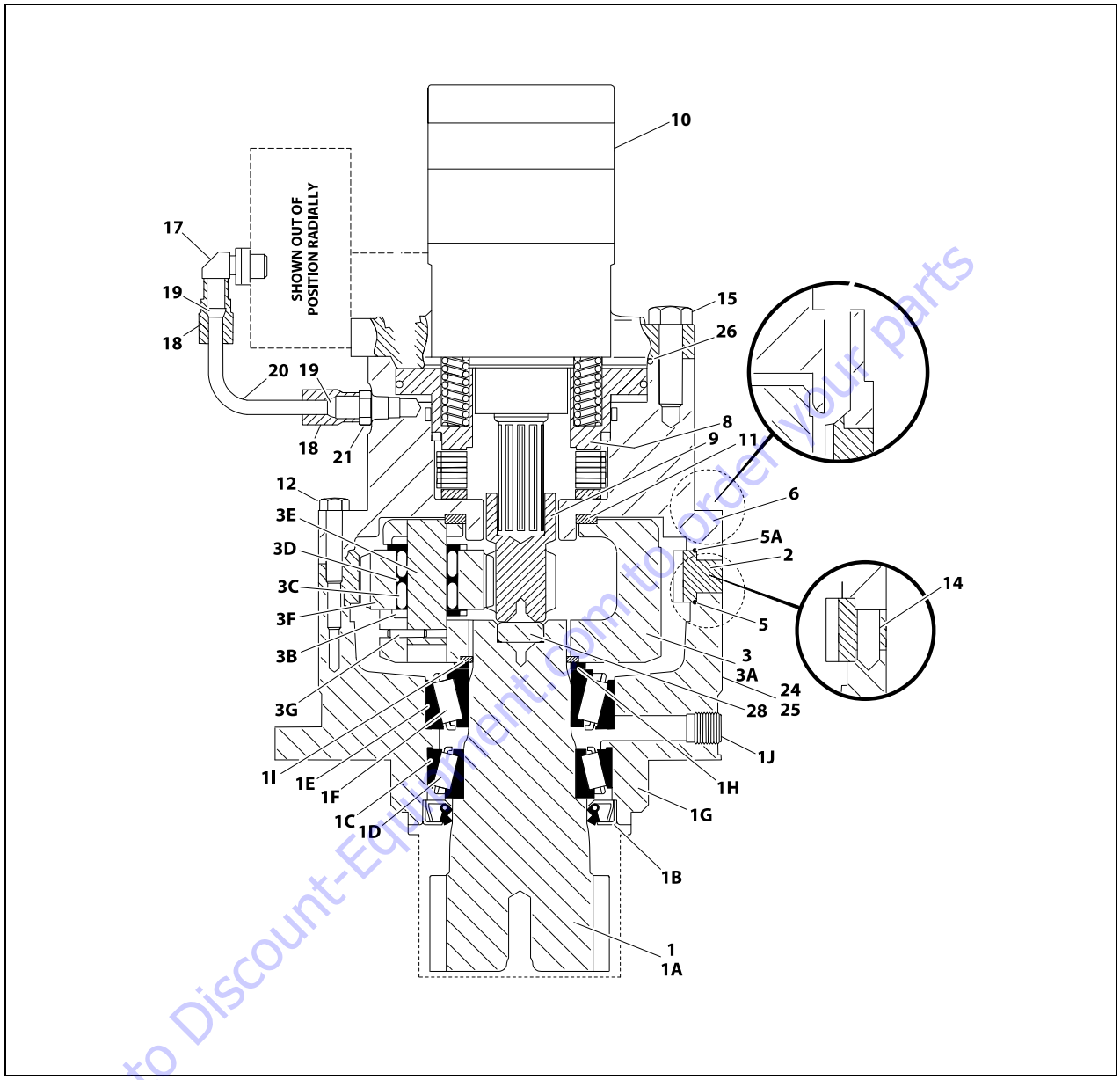
Tightening and Torquing Bolts

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.



1. Housing Assembly
1A. Output Shaft
1B. Lip Seal
1C. Tapered-Cup Bearing
1D. Tapered-Cone Bearing
1E. Tapered-Cup Bearing
1F. Tapered-Cone Bearing
1G. Housing
1H. Thrust Washer
1I. Retaining Ring
1J. Pipe Plug
2. Gear Ring
3. Carrier Assembly
3A. Carrier
3B. Thrust Washer
3C. Needle Bearing
3D. Thrust Spacer
3E. Shaft Planet
3F. Gear Planet
3G. Roll Pin
5. O-ring
5A. O-ring
6. Brake Hub
8. Input Brake
9. Sun Gear
10. Hydraulic Motor
11. Thrust Washer
12. Bolt
14. Dowel Pin
15. Bolt
17. Elbow
18. Tube Nut
19. Female Tube
20. Tubing
21. Connector
24. ID Plate
25. Screw Drive
26. O-Ring
28. Spacer

Figure 3-16. Swing Motor Assembly - Sectional View

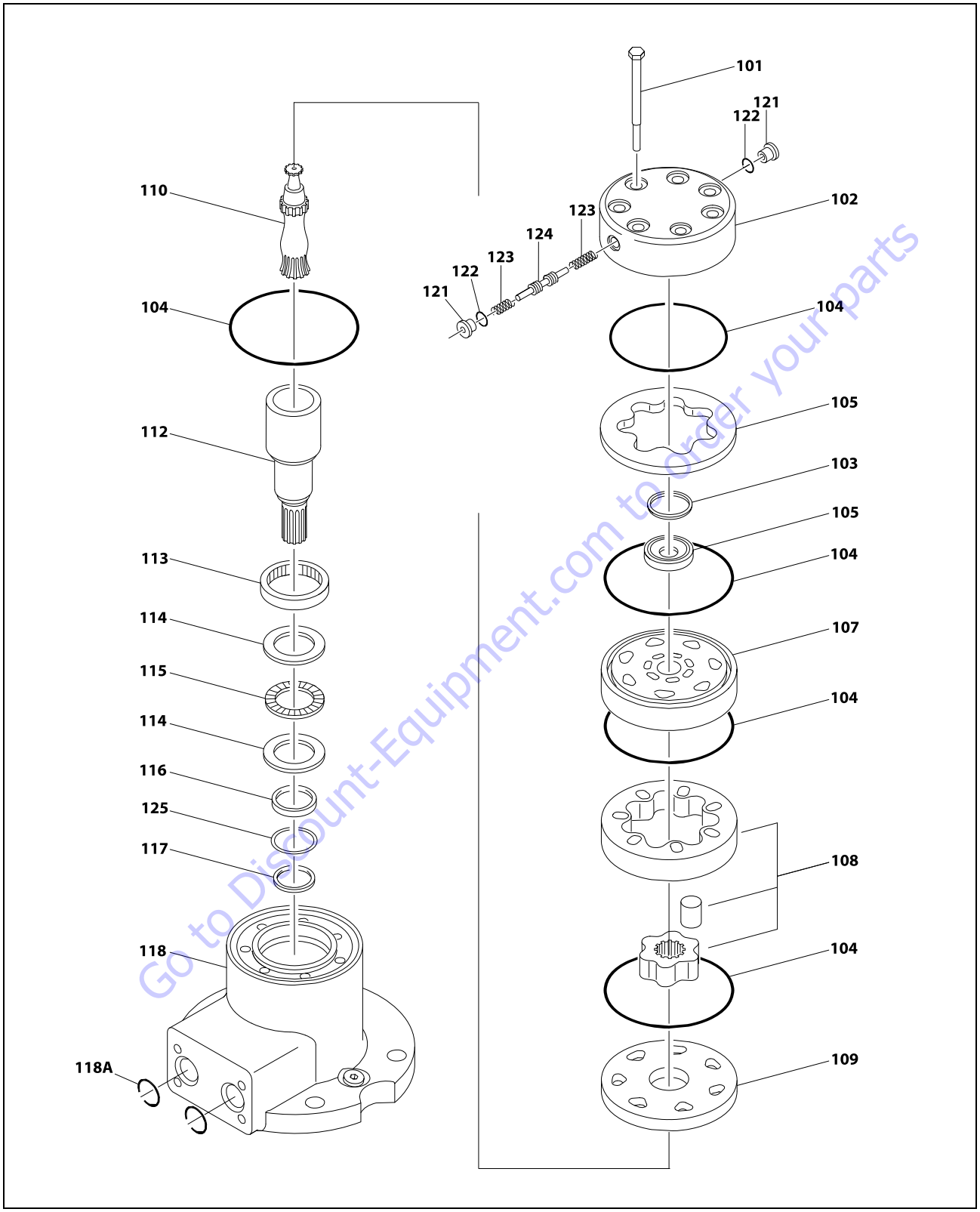


Figure 3-17. Swing Motor Assembly - Sheet 1 of 2

101. Bolt
102. End Cover
103. Commutator Seal
104. Seal Ring
105. Commutator and Ring Assembly
107. Manifold
108. Rotor Set
109. Wear Plate
110. Drive Link
112. Coupling Shaft
113. Bushing
114. Thrust Washer
115. Thrust Bearing
116. Seal
117. Backup Washer
118. Housing
118A O-Ring
121. Plug
122. O-Ring
123. Spring
124. Valve
125. Backup Washer

Figure 3-18. Swing Motor Assembly - Sheet 2 of 2

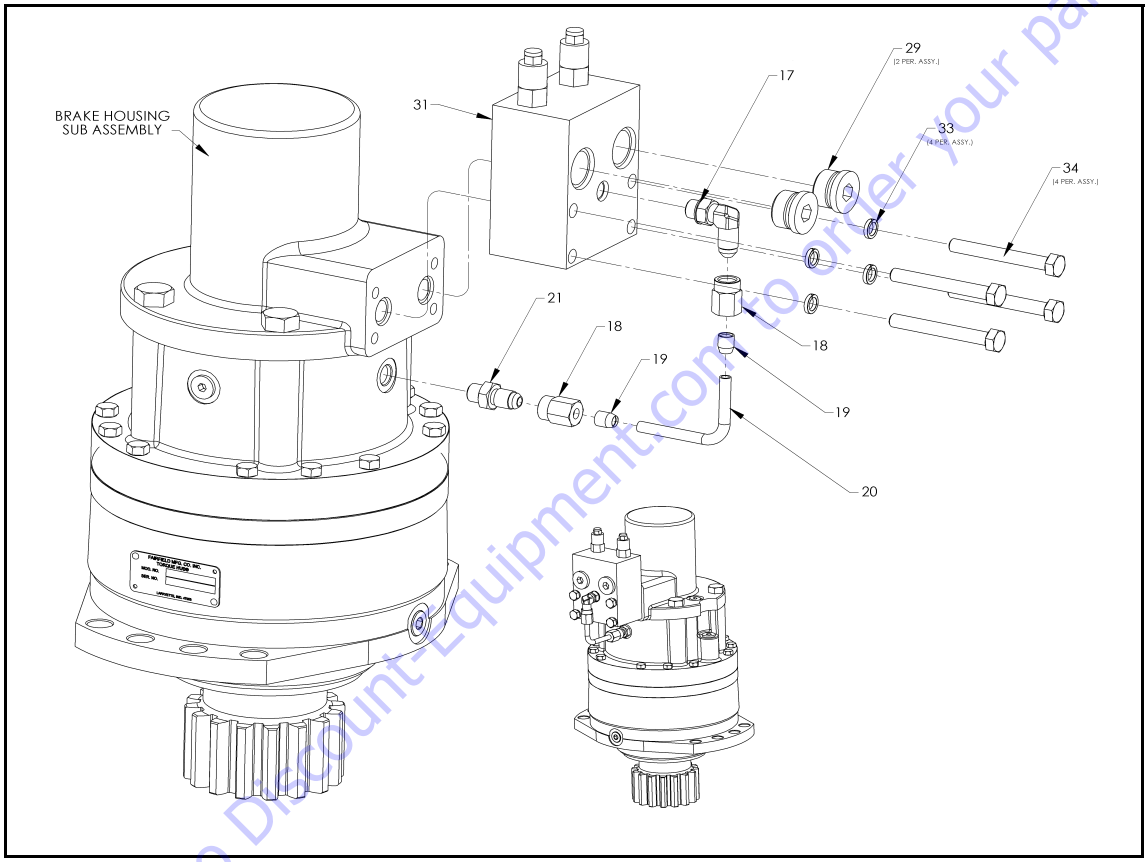
Motor Control Valve Disassembly

NOTE: *Refer to Figure 3-19., Motor Control Valve*

1. Place unit on bench with the motor end up.
2. Remove Hydraulic Tubing Assembly (20) by loosening Fittings (18) on both ends of tube with a wrench.

NOTE: *Items (18) & (19) are included on Item (20) when ordering a replacement Tubing Assembly.*

3. Using a wrench, loosen jam nut on Elbow Fitting (17) and remove fitting from Motor Control Valve (31).
4. Using a wrench, remove Fitting (21) from Brake Housing.
5. Remove Motor Control Valve (31) from Motor (10) by removing the four Bolts (34) and washers (33).



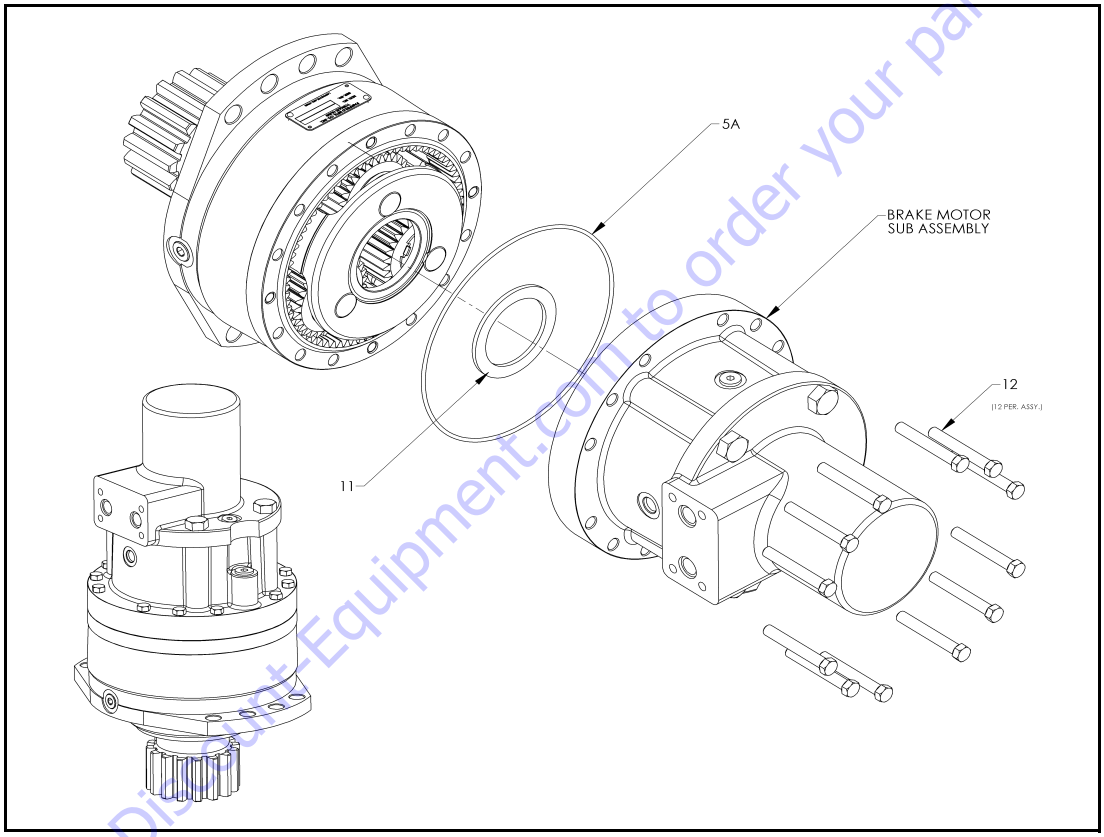
17. Elbow Fitting
18. Fittings
19. Ferrule
20. Tubing Assembly
21. Fitting
29. Plug
31. Motor Control Valve
33. Washers
34. Bolts

Figure 3-19. Motor Control Valve

Motor and Brake Disassembly

NOTE: *Refer to Figure 3-20., Motor and Brake*

1. With unit resting on bench with Motor (10) end up, loosen Hex Bolts (12) and remove Brake/Motor Subassembly from the Housing (1G) (See assembly drawing).
2. Remove O-Ring (5A) from between Brake/Motor Subassembly and Housing (1G) (See assembly drawing).
3. Remove Thrust Washer (11) from between Brake/ Motor Subassembly and Carrier.
4. Remove one O-Ring Plug (13) from Motor (10) and one O-Ring Plug (13) from Brake Housing (6).
5. Remove O-Ring Plug (4) from Brake Housing (6).



5A. O-ring
11. Thrust Washer
12. Hex Bolts

Figure 3-20. Motor and Brake

6. Remove Motor (10) from Brake Housing (6) by removing four Bolts (15) incrementally until spring pressure is relieved.

7. Remove O-Ring (26) from between Motor (10) and Brake Housing (6).

8. Remove Springs (8-6) & (8-7) from Brake Piston (8- 2).

⚠ CAUTION

WEAR EYE PROTECTION DURING THE NEXT STEP OF THIS PROCEDURE.

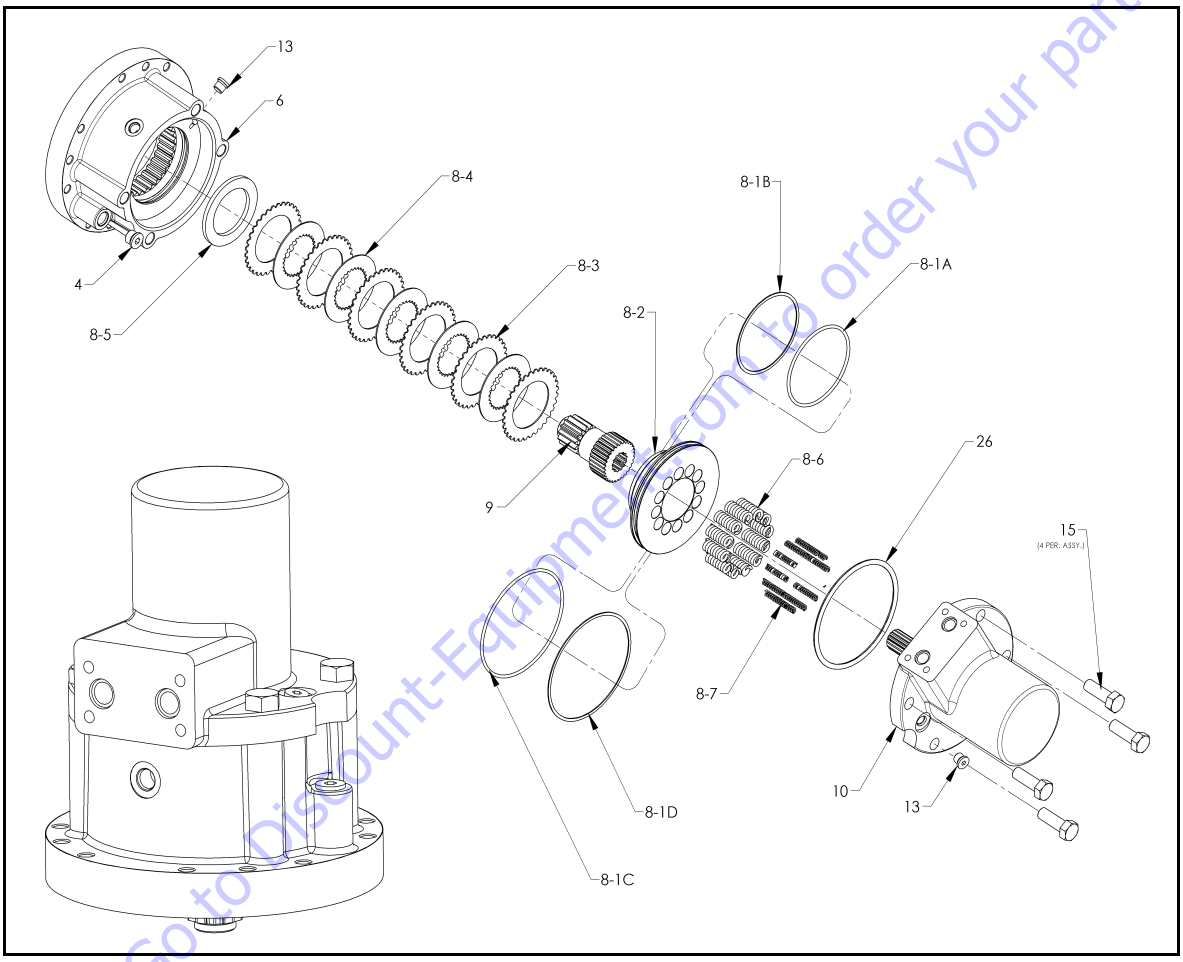
9. Remove Brake Piston (8-2) from Brake Housing (6) by slowly pressurizing brake port in Brake Housing (6) with air.

10. Remove O-Rings (8-1A) & (8-1C) and Backup Rings (8-1B) & (8-1D) from Brake Piston (8-2).

11. Remove Sun Gear (9).

12. Remove Outer Plates (8-3) and Inner Plates (8-4) from the Brake Housing (6).

13. Remove the Thrust Spacer (8-5).



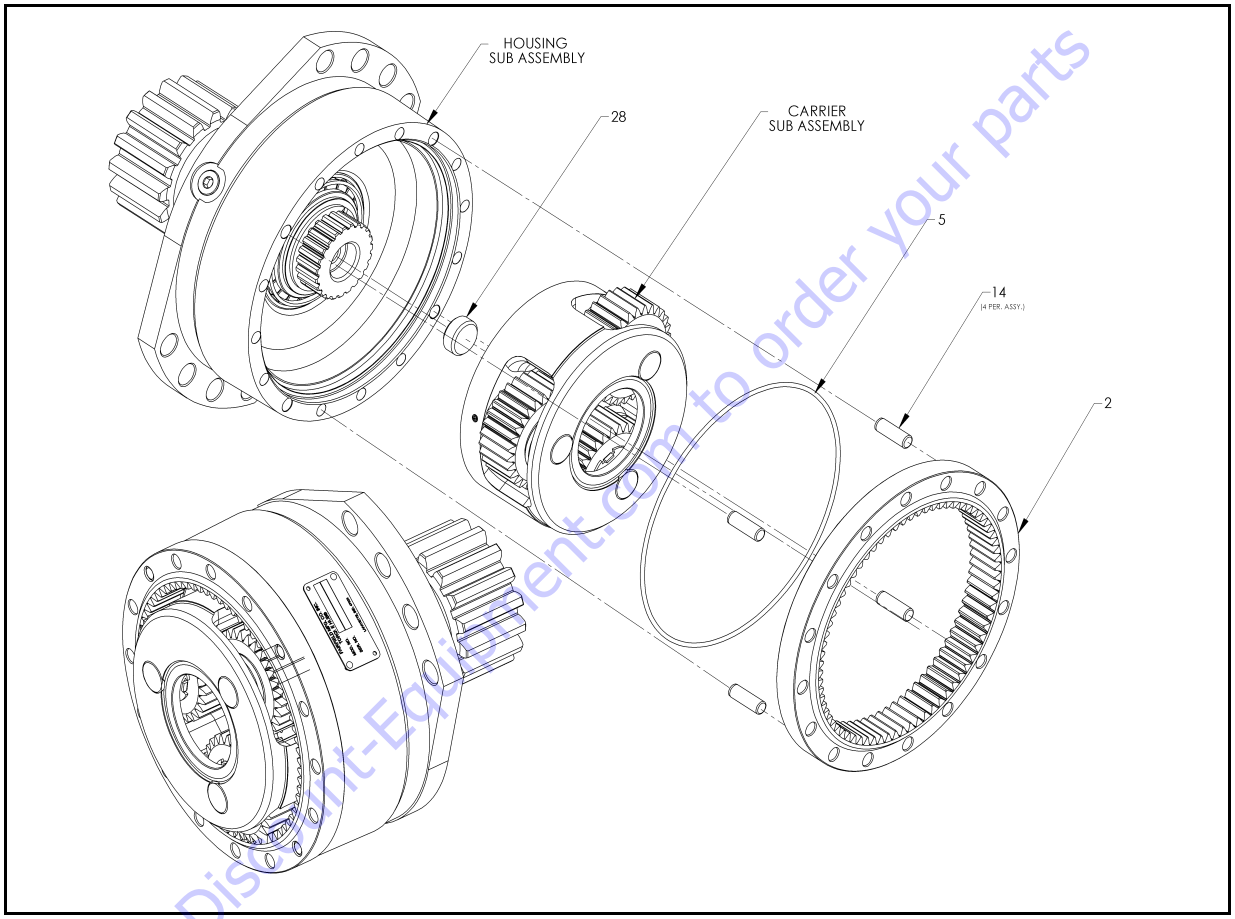
4. O-ring Plug
6. Brake Housing
8-1A. O-ring
8-1B. Backup Ring
8-1C. O-ring
8-1D. Backup Ring
8-2. Brake Piston
8-3. Outer Plates
8-4. Inner Plates
8.5. Thrust Spacer
8-6. Spring
8.7. Spring
9. Sun Gear
10. Motor
13. O-ring Plug
15. Bolts
26. O-ring

Figure 3-21. Brake

Main Disassembly

NOTE: *Refer to Figure 3-22., Main Assembly*

1. With the unit resting on the Output Shaft (Pinion) (1A), remove the Carrier Subassembly.
2. Remove Ring Gear (2) from Housing Subassembly.
3. Remove O-ring (5) from between Ring Gear (2) and Housing Subassembly.
4. Remove four Dowel Pins (14) from Housing Subassembly.



2. Ring Gear
5. O-Ring
14. Dowel Pins
28. Input Spacer

Figure 3-22. Main Assembly

Hub-shaft Disassembly

NOTE: *Refer to Figure 3-23., Hub Shaft*

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

⚠ CAUTION

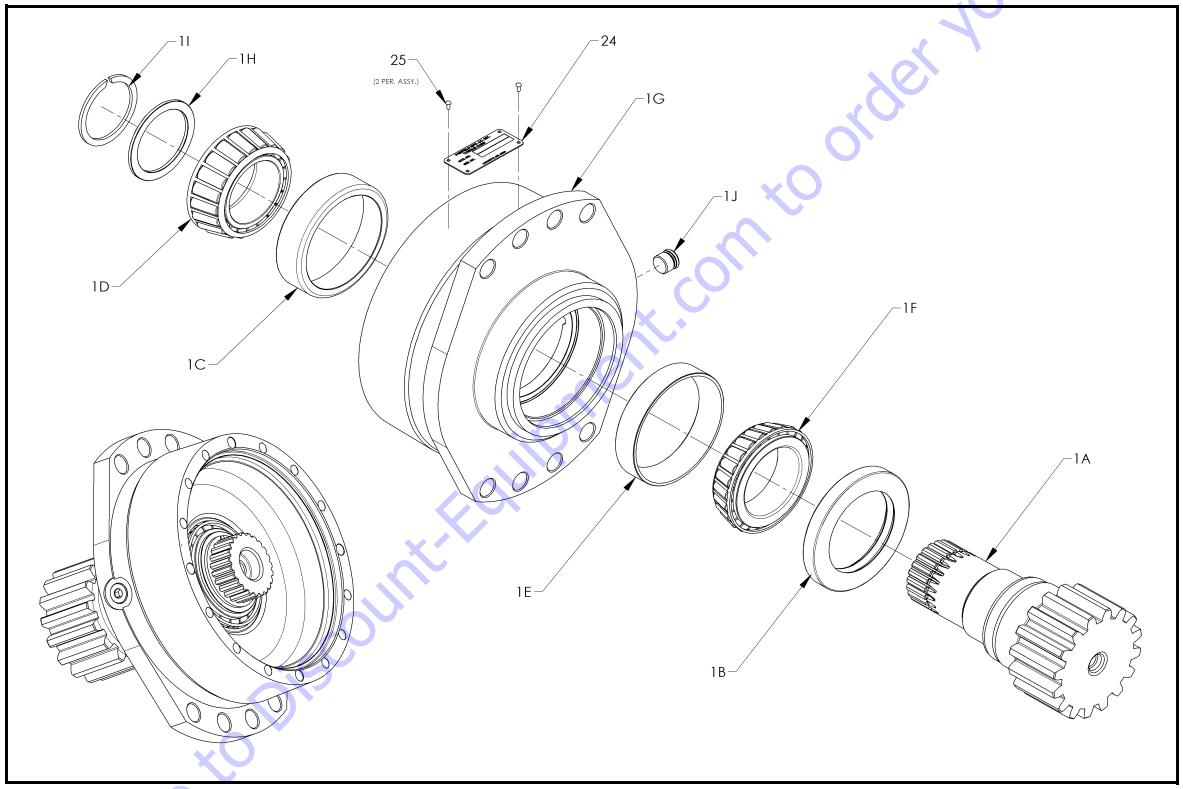
EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

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

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

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

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



1A. Output Shaft
1B. Lip Seal
1C. Bearing Cup
1D. Bearing Cone
1E. Bearing Cup
1F. Bearing Cone
1G. Housing
1H. Thrust Washer
1I. Retaining Ring
24. ID Plate
25. Drive Screw

Figure 3-23. Hub Shaft

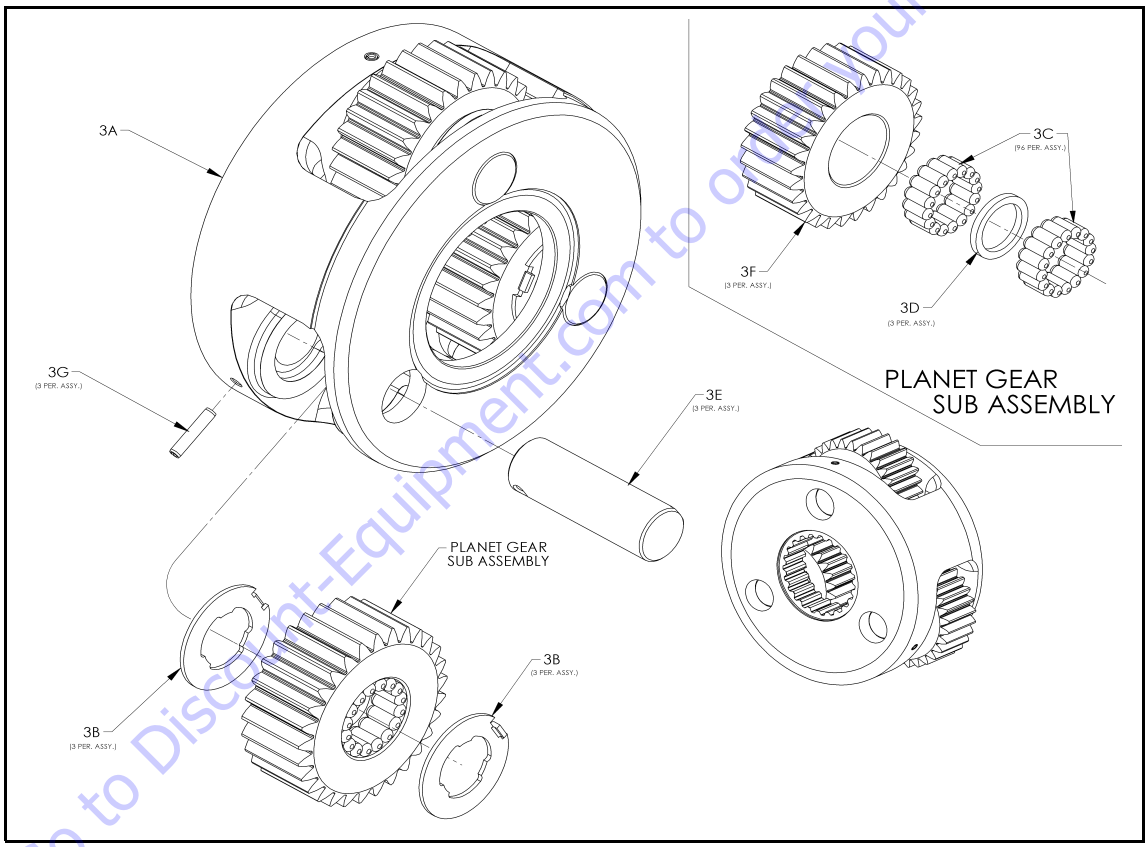
Carrier Disassembly

NOTE: *Refer to Figure 3-24., Carrier*

1. Using a 1/4" punch, drive the Roll Pin (3G) which holds the Planet Shaft (3E) in the Carrier (3A) down into the Planet Shaft (3E) until it bottoms.

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

2. Remove the Planet Shaft (3E) from the Carrier (3A).
3. Slide the Planet Gear (3F) and the two Thrust Washers (3B) out of the Carrier (3A).
4. Remove both rows of Needle Bearings (3C) and the Spacer (3D) from the bore of the Planet Gear (3F).
5. Using a 1/4" punch, drive the Roll Pin (3G) out of the Planet Shaft (3E).
6. Repeat Steps 1 through 5 for the remaining two Planet Gears (3F).



3A. Carrier
3B. Thrust Washers
3C. Needle Bearings
3D. Spacer
3E. Planet Shaft
3F. Planet Gear
3G. Roll Pin

Figure 3-24. Carrier

Hub-Shaft Sub-Assembly

NOTE: *Refer to Figure 3-23., Hub Shaft*

1. Press Bearing Cup (1E) into Motor end of Housing (1G) using an appropriate pressing tool.
2. Invert Housing (1G) and press Bearing Cup (1C) into Housing (1G) using an appropriate pressing tool.Set Bearing Cone (1F) onto Bearing Cup (1E).
3. Using an appropriate pressing tool, press Seal (1B) into Housing (1G) until it is flush with the end of the Housing (1G).
4. Apply liberal amount of grease to lip of Seal (1B).
5. Invert Housing (1G) and lower onto Output Shaft (1A).

NOTE: *Be careful not to damage seal while lowering Housing onto Output Shaft.*

6. Press Bearing Cone (1D) onto Output Shaft (1A) until it seats against the bearing shoulder.
7. Place Thrust Washer (1H) onto Bearing Cone (1D).

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING THE NEXT STEP OF THIS PROCEDURE.

NOTE: *Retaining Ring (1I) should never be reused in a repair or rebuild.*

8. Using retaining ring pliers, install Retaining Ring (1I) into groove in Output Shaft (1A). If Retaining Ring (1I) will not seat completely into groove, use an appropriate pressing tool to press down on Bearing Cone (1D) while rotating Housing (1G). Reinstall Thrust Washer (1H) and Retaining Ring according to preceding procedures. Tap the Retaining Ring (1I) with a soft metal punch to ensure that the Retaining Ring (1I) is completely seated in the groove of the Output Shaft (1A).
9. Using a soft face hammer, hit the end of the Shaft (1A) to remove the bearing preload.
10. Install O-ring Plug (1J) and torque to 23 to 24 ft-lbs.

Carrier Sub-Assembly

NOTE: *Refer to Figure 3-24., Carrier*

1. Apply a liberal coat of grease to the bore of Planet Gear (3F). This will enable the Needle Rollers (3C) to be held in place during assembly.
2. Install the first row of 16 Needle Rollers (3C) into the bore of Planet Gear (3F).
3. Insert Spacer (3D) into bore of Planet Gear (3F) on top of the Needle Rollers (3C).
4. Place second row of Needle Rollers (3C) into bore of Planet Gear (3F) against Spacer (3D) and remove Planet Shaft (3E).
5. Place Carrier (3A) on bench so that one of the Roll Pin (3G) holes is straight up.
6. Paying attention to the location of the Roll Pin (3G) hole in the Planet Shaft (3E), start Planet Shaft (3E) through the hole in Carrier (3A). Using ample grease to hold it in position, slide one Thrust Washer (3B) over the Planet Shaft (3E) with the tang resting in the cast slot of the Carrier (3A).
7. Place the Planet Gear (3F) into position in Carrier (3A) and push Planet Shaft (3E) through the Planet Gear (3F) without going all the way through.
8. Slide the second Thrust Washer (3B) between the Planet Gear (3F) and the Carrier (3A) with the tang of the washer located in the cast slot of the Carrier (3A). Finish sliding the Planet Shaft (3E) through the Thrust Washer (3B) and into the Carrier (3A).
9. Position the non-chamfered side on the Planet Shaft (3E) roll pin hole so that it is in line with the hole in the Carrier (3A) using a 1/8 inch diameter punch.

NOTE: *If Planet Shaft (3E) has a flat on the end, position the flat toward the center of the Carrier (3A).*

10. After using a 1/4" punch to align the Roll Pin (3G) holes in the Carrier (3A) and the Planet Shaft (3E), drive the Roll Pin (3G) through Carrier (3A) and into the Planet Shaft (3E) until the Roll Pin (3G) is flush with the bottom of the cast tang slot in the Carrier (3A). Use a 1/4" pin punch to make sure the Roll Pin (3G) is flush in the slot.

NOTE: *On 6:1 Ratios of S1C"s, the pin must be 0.125" below the surface of the outside diameter.*

11. Repeat Steps 1 through 10 for the remaining two Planet Gears (3F).

Main Assembly

NOTE: *Refer to Figure 3-22., Main Assembly*

1. With the Housing-Shaft Subassembly resting on the Shaft (1A) install one Dowel Pin (14) into each of the four counter-bored holes in the Housing (1G) (See assembly drawing) until they bottom out. Also at this time, mark the four Dowel Pin (14) holes on the O.D. of the Housing (1G) (See assembly drawing). This is for identification later in the assembly.
2. Install Thrust Spacer (28) into counter-bore in splined end of the Output Shaft (1A).
3. Place O-Ring (5) into Housing (1G) counter-bore. Use grease to hold O-ring in place.

⚠ CAUTION

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

4. Install Carrier Subassembly with splined end down so that the spline of the Carrier Subassembly is in mesh with the spline of the Housing-Shaft Subassembly. Rotate carrier in assembly to check for freedom of rotation.
5. With large shoulder side of Ring Gear (2) facing down, place Ring Gear (2) onto Housing-Shaft Subassembly with gear teeth in mesh with the Planet Gears (3f) in the Carrier (3A). The side of the Ring Gear (4) with an "X" or punch mark stamped on it should be up and the marked hole should be at a Dowel Pin (14) location.

Motor-Brake Subassembly

NOTE: *See Figure 3-20., Motor and Brake*

1. Place Brake Housing (6) on bench with flange end down. Either block Brake Housing (6) up or place over hole in bench large enough for the shoulder of the Sun Gear (9) to rest on the bottom of the Brake Housing (6). Then install Sun Gear (9) with gear end down into Brake Housing (6).
2. Place Spacer (8-5) into Brake Housing (6) in bottom of small counter bore below splines.
3. Install brake disks, starting with an Outer Plate (8-3), then alternating Inner Plates (8-4) and Outer Plates (8-3) into splined bore.
4. Grease the O Rings (8-1A) & (8-1C) and Backup Rings (8-1B) & (8-1D), and place them in their respective grooves in the Piston (8-2). Make sure the backup-rings are correctly positioned as per the assembly print.

NOTE: *Be sure that Backup Rings (8-1B) & (8-1D) are located as tightly into the grooves in the Piston (8-2) as possible to prevent them from being "shaved" when Piston (8-2) is installed into Brake Housing (6).*

5. Apply grease sparingly to Piston (8-2) O.D. and the cylinder bore of Brake Housing (6). Insert Piston (8- 2) into cylinder of Brake Housing (6), be sure not to cut the O Rings (8-1A) & (8-1C) or Backup Rings (8- 1B) & (8-1D).
6. Install Compression Springs (8-6) into spring pockets in Piston (8-2).
7. Install Compression Springs (8-7) into Compression Springs (8-6) in spring pockets in Piston (8-2).
8. Grease O-Ring (26) and install into counter-bore in Brake Housing (6).
9. Assemble Test Cover (See Tools at back of manual for drawing) to Brake Housing (6) using four Bolts (15) evenly tightening Bolts (15) to 80-100 ft-lbs.
10. Check the brake for release. Apply pressure to brake port in side of Brake Housing (6) while trying to rotate Sun Gear (9) by hand. The brake should release between 200-255psi. Remove Test Cover.
11. Assuming that Brake passed the Brake Test, place Motor (10) into Brake Housing (6) with splines of Motor (10) meshing with splines of Sun Gear (9).
12. Attach Motor (10) to Brake Housing (6) with four Bolts (15) and torque to Bolts (15) to 80–100 ft-lbs.

Motor-Brake Assembly

NOTE: *See Figure 3-20., Motor and Brake*

1. Grease Thrust Washer (11) and install into counterbore of Carrier Subassembly, which should already be installed into the Main Subassembly.
2. Grease O-Ring (5A) and install into counter-bore of the Brake Housing (6) in the Motor-Brake Subassembly.
3. Install Motor-Brake Subassembly onto Main Assembly using twelve Bolts (12). Torque bolts to 23 – 27 ft.lbs. (31-37 Nm).

Motor Control Valve Assembly

1. Lay assembly down with motor ports facing up. Remove the two plastic plugs in the motor ports on new motors, being careful not to loose the O ring in each port. Assemble the Motor control Valve (31) onto the Motor (10) with Bolts (34) and Washers (33). Torque Bolts (34) to 23-27 ft-lbs.

NOTE: *Be sure to align the holes in the control valve with the motor ports and make sure o-ring is in hole.*

2. Install Straight Fitting (21) into Brake Housing (6) and torque to 13-15 ft-lbs.
3. Install Elbow Fitting (17) into Motor Control Valve (31) with chamfered end of fitting pointing towards straight Fitting (21). Thread fitting all the way in until in the correct position, then torque jam nut to 13-15 ft-lbs.
4. Assemble Tubing (20) Nuts (18) and Ferrules (19) per the procedures below.

Tube Fitting Assembly Procedures

NOTE: *Be sure the tube is inline with the fitting. If required, gently modify the tube bends to be inline.*

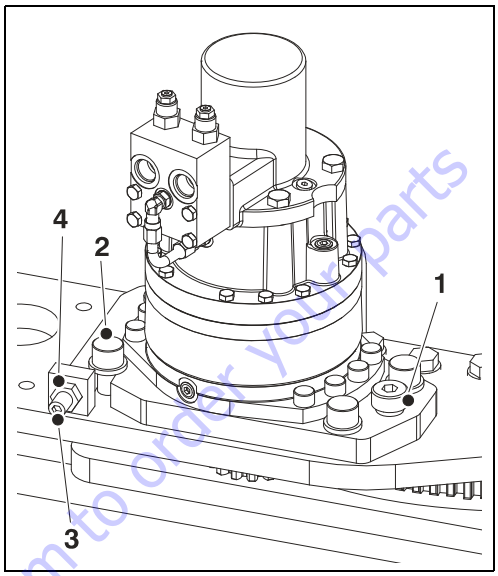
1. Assemble nut onto tubing with threaded end toward the assembled end of the tube.
2. Assemble ferrule onto tube with the large tapered end into the nut.
3. Place tube tight against the flared fitting in the assembly.
4. Lubricate threads and fitting end with hydraulic oil.
5. Slide ferrule and nut against fitting and hand tighten nut to the fitting.
6. Mark nut in relation to the fitting.
7. Hold tube tight against fitting and tighten nut 1-1/4 turns of the nut past the marked location.

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

8. Pressure test brake, tube and control valve connections by applying 3000psi pressure to the brake bleed port and holding for 1 minute. Check for leaks at the control-valve-motor interface and the tube connections. Release pressure.

Procedure for Setting Gear Backlash

NOTE: *Ensure mounting plate and mounting location of the base plate are clean and painted with a uniform coating of minimum thickness (no runs, drips, etc.).*



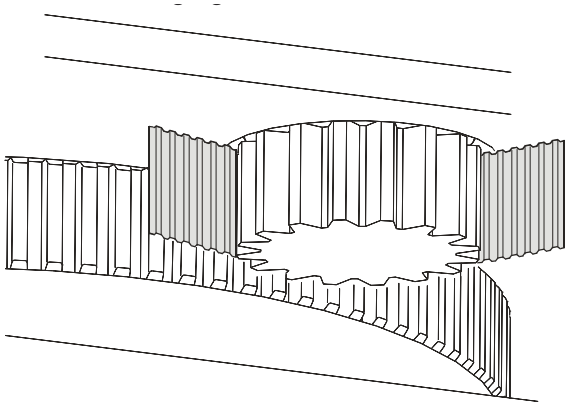
1. Shoulder Screw
2. Capscrew
3. Setscrew
4. Jam Nut

Figure 3-25. Setting Gear Backlash

NOTE: *The bearing high spot will be marked with yellow paint.*

Set backlash to 0.008 in. to 0.012 in. (0.2 mm - 0.3 mm) using the following procedure:

1. Place a shim between the pinion and bearing high spot.



2. Torque the Shoulder Screw (1) to 205 ft.lbs. (278 Nm) with JLG Threadlocker P/N 0100019.
3. Remove the turntable lock pin.
4. Pre-torque the 3/4 inch Capscrews (2) to 30 ft.lbs. (41 Nm) with JLG Threadlocker P/N 0100019.

5. Tighten the Setscrew (3) until the pinion is completely snug against the shim and bearing and then back off the setscrew.
6. Torque the setscrew to 50 ft.lbs. (70 Nm).
7. Tighten the Jam Nut (4).
8. Torque the four 3/4 inch capscrews (2) to 300 ft.lbs. (407 Nm).
9. Remove and discard the shim.

3.8 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

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

Check the frame to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to full elevation and rotate platform 90o.
2. Swing turntable over the side.
3. On the frame, at the rear of the turntable, try to insert the 0.0015" feeler gauge between the bolt head and hardened washer at the indicated position. (Figure 3-25., Swing Bearing Feeler Gauge Check)
4. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
5. Swing the turntable 90 degrees, and check some selected bolts at the new position.
6. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.
7. Lower the boom to horizontal and fully extend the boom.
8. Swing the turntable over the side.
9. On the frame, at the front of the turntable, try to insert the 0.0015" feeler gauge between the bolt head and hardened washer at the indicated position.
10. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
11. Swing the turntable 90 degrees, and check some selected bolts at the new position.
12. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

Check the turntable to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to full elevation and rotate the platform 90o.
2. Swing the turntable over the side.
3. At turntable rear, try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

4. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
5. Swing the turntable 90 degrees, and check some selected bolts at the new position.
6. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

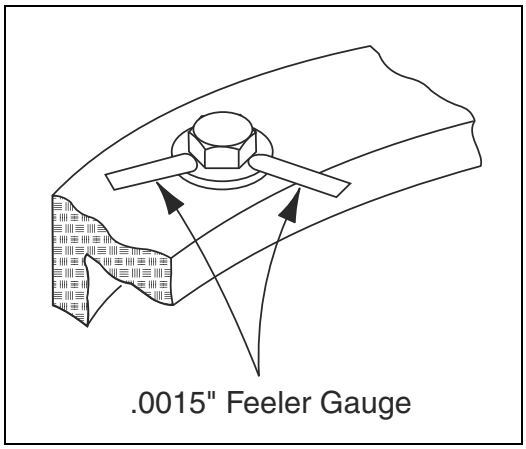


Figure 3-26. Swing Bearing Feeler Gauge Check

7. Lower the boom to horizontal and fully extend the boom.
8. At turntable front, try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
9. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
10. Swing the turntable 90 degrees, and check some selected bolts at the new position.
11. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

Wear Tolerance

1. With the boom positioned over the side of the machine, the Boom horizontal with telescope fully extended, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable front.
2. With the boom positioned over the side of the machine, the Boom fully elevated, retracted, and platform rotated 90o, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable rear.

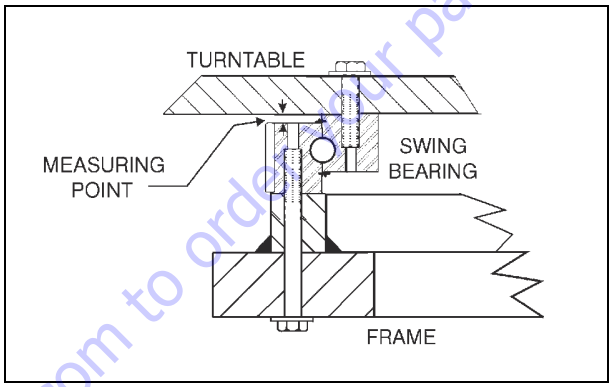
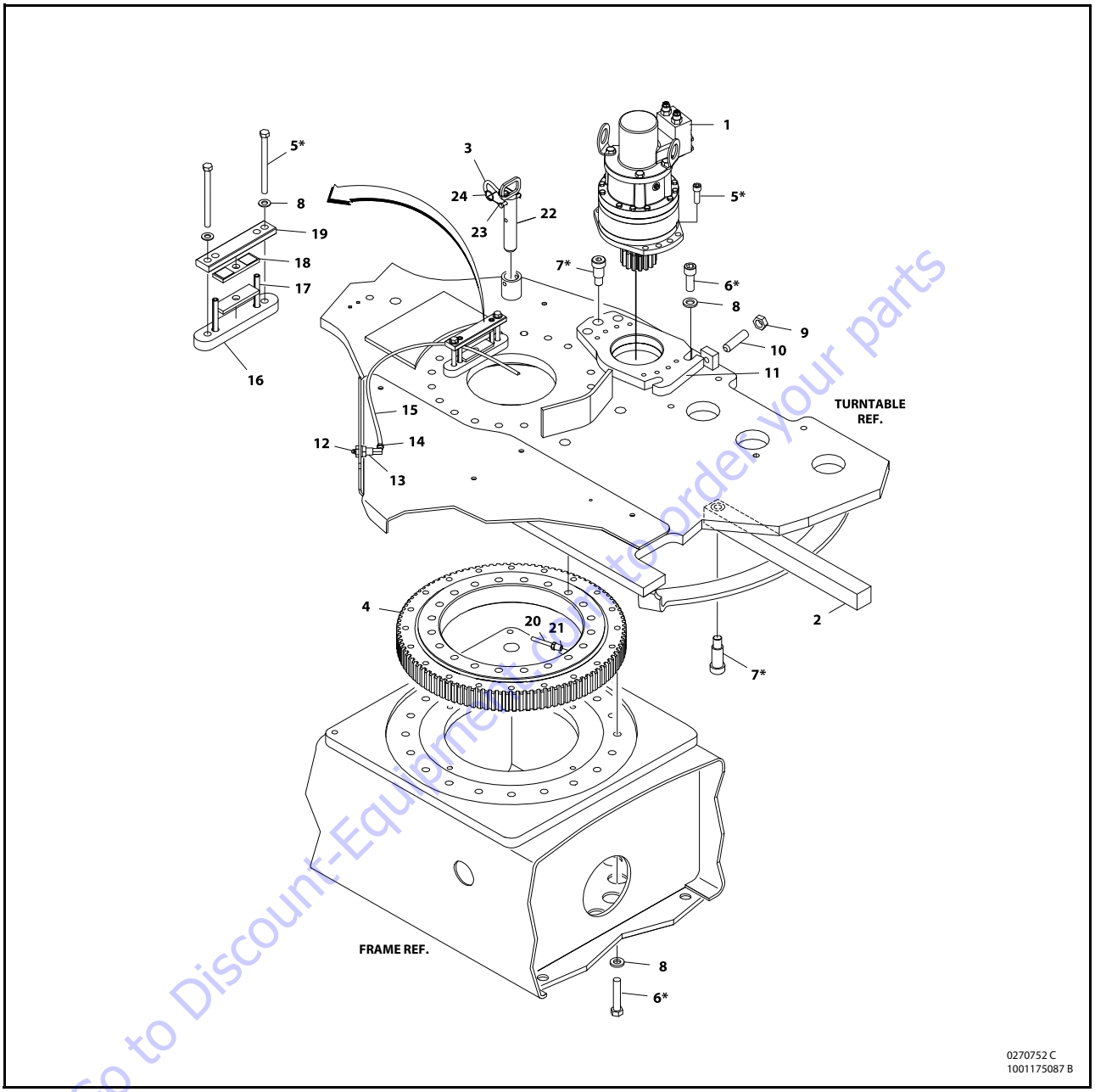


Figure 3-27. Swing Bearing Tolerance Measuring Point

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.



1. Swing Motor Assembly
2. Turntable Stop
3. Chain
4. Turntable Bearing
5. Capscrew
6. Bolt
7. Shoulder Screw
8. Washer
9. Nut
10. Setscrew
11. Mounting Plate
12. Grease Fitting
13. Bulkhead Fitting
14. Adapter Fitting
15. Hose
16. Clamp
17. Rollpin
18. Rubber Pad
19. Clamp Bar
20. Hose
21. Reducer Fitting
22. Weldment Pin
23. Snap Pin
24. Quick Release Ring

Figure 3-28. Swing Drive and Bearing Installation

Replacement of Swing Bearing

Removal of the swing bearing is as follows:

1. Attach an adequate support sling to the boom and draw all slack from sling. Prop or block the boom if feasible.
2. 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.
3. Attach suitable overhead lifting equipment to the base of turntable weldment.
4. 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.
5. 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.
6. Carefully place the turntable on a suitably supported trestle.

NOTE: *The bearing weighs approximately 100 lbs. (45 kg.).*

7. Use a suitable tool to scribe a line on the outer race of the swing bearing and the frame. This line will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the outer race of the bearing to the frame. Discard the bolts. Use suitable lifting equipment to remove the bearing from the frame; move to a clean, suitably supported work area.

Installation of the swing bearing is as follows:

1. Install bearing to turntable with two capscrews, so the grease hose is on the forward side of the frame as close to the centerline of the turntable as the bolt pattern will allow. Do not tighten capscrews.
2. Line up high spot (marked with yellow paint) of bearing with center tooth of bull gear. Set backlash to0.008 - 0.012 inch (0.20 - 0.30 mm). Refer to Swing Drive Installation. Tighten capscrews as shown in Figure 3-28., Swing Bearing Torque Sequence
3. Grease bearing with Mobilith SHC Bearing Grease.Grease fitting is on inside wall of inner race of bearing.

NOTE: *If Mobiltac 375NC is not available, Tribol Molub-Alloy 936 Open Gear Compound or Mobilith SHC Bearing Grease or Multi-Purpose Grease (MPG) can be substituted, however the service interval will be shorter.*

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

⚠ CAUTION

JLG INDUSTRIES RECOMMENDS THAT ALL REMOVED GRADE 8 BEARING NUTS AND BOLTS BE DISCARDED AND REPLACED WITH NEW GRADE 8 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.

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

⚠ CAUTION

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

6. Following the torque sequence diagram shown in Figure 3-28., Swing Bearing Torque Sequence, tighten the bolts to an initial torque of 130 ft. lbs. (175 Nm). Then following the same sequence, tighten to a final torque of 190 ft. lbs. (260 Nm).
7. Remove lifting equipment from bearing.
8. Use suitable lifting equipment to carefully position the turntable assembly above the machine frame.
9. 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.
10. Apply a light coating of Loctite 271 to the new bearing bolts and install through the turntable and inner race of bearing.

11. Following the torque sequence shown in Figure 3- 28., Swing Bearing Torque Sequence 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).
12. Remove the lifting equipment.
13. Route hydraulic lines through center of turntable and frame and connect as tagged prior to removal.
14. Using all applicable safety precautions, activate the hydraulic system and functionally check swing system for proper and safe operation.

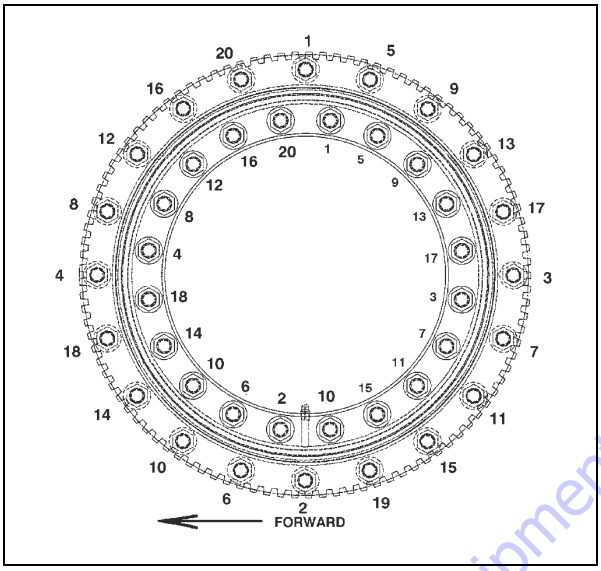


Figure 3-29. Swing Bearing Torque Sequence

Swing Bearing Torque Value

Install with Loctite - 190 ft. lbs. (260 Nm).

Swing Drive Installation

1. Coat the threads of the socket head bolts securing the swing drive to the mounting plate with Loctite #271 and torque to 120 ft.lbs. (168 Nm).
2. Position swing drive to location of bearing gear max eccentric tooth. High spot is marked with yellow paint in tooth.
3. With the mounting plate pivoting about the shoulder bolt, adjust backlash between the pinion and bearing gear teeth to 0.008 to 0.012 inch backlash (0.20mm to 0.30mm).
4. Tighten the adjusting bolt, jam nut, and shoulder bolt to prevent the swing drive from moving. Coat the threads of the shoulder bolt with Loctite #271 and torque to 420 ft.lbs. (588 Nm).
5. Coat the threads of the mounting plate bolts with Loctite #271 and torque to 420 ft.lbs. (588 Nm).

3.9 BATTERY MAINTENANCE AND CHARGING

Battery Maintenance, Quarterly

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

NOTICE

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

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

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

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

2. Remove all vent caps and inspect electrolyte level of each cell. Electrolyte level should be to the ring approximately one inch from top of battery. Fill batteries with distilled water only. Replace and secure all vent caps.
3. Remove battery cables from each battery post one at a time, negative first. Clean cables with acid neutralizing solution (e.g. baking soda and water or ammonia) and wire brush. Replace cables and/or cable clamp bolts as required.
4. Clean battery post with wire brush then 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.

Optional On Board Generator

⚠ WARNING

EXHAUST GAS HAZARD. RUN THE GENERATOR IN A WELL VENTILATED AREA ONLY.

NOTICE

WHEN THE GENERATOR ENABLE CONTROL LOCATED IN THE PLATFORM CONTROL BOX IS IN THE ON POSITION AND THE GROUND EMERGENCY STOP SWITCH IS ON (PULLED OUT), THE GENERATOR WILL START AUTOMATICALLY WHEN THE BATTERIES REACH A LOW-CHARGE STATE, AUTOMATICALLY CHARGING THE BATTERIES. THE GENERATOR WILL ALSO AUTOMATICALLY START IF THE GENERATOR START BATTERY IS LOW.

NOTE: *The engine will automatically shut down under the following conditions:*

High Engine Oil Temperature
Low Engine Oil Pressure
Engine Overspeed
Generator Overvoltage
Batteries fully charged

⚠ 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 Charging (On Board Charger)

1. For maximum battery life:
   a. Avoid completely discharging the batteries.
   b. Fully charge the batteries each day the machine is used.
   c. Charge the batteries at available times between charging.
   d. Be sure the battery fluid covers the battery plates before charging, but to avoid overflow, do not top off the fluid level until charging.
2. To charge the batteries, connect the charger to a 115 volt source with a 15 amp minimum capacity.
3. The Charger will shut off automatically when the batteries are fully charged.
4. The charge cycle is complete when the ammeter reads 0 amps. Any reading indicates the charge cycle is not complete.
5. Depleted batteries will take approximately 17 hours to charge.

Removing the Battery Box

To remove the battery box, perform the following steps.

1. Pull the pull ring to disconnect the batteries at the battery disconnect beside the box.
2. Remove the two attachment bolts that secure the battery box to the turntable.

NOTE: *The battery box and batteries complete weigh approximately 668 pounds (303 kg).*

3. Using a forklift, lift the battery box up enough to clear the notch on the battery box rails and remove the battery box from the machine.

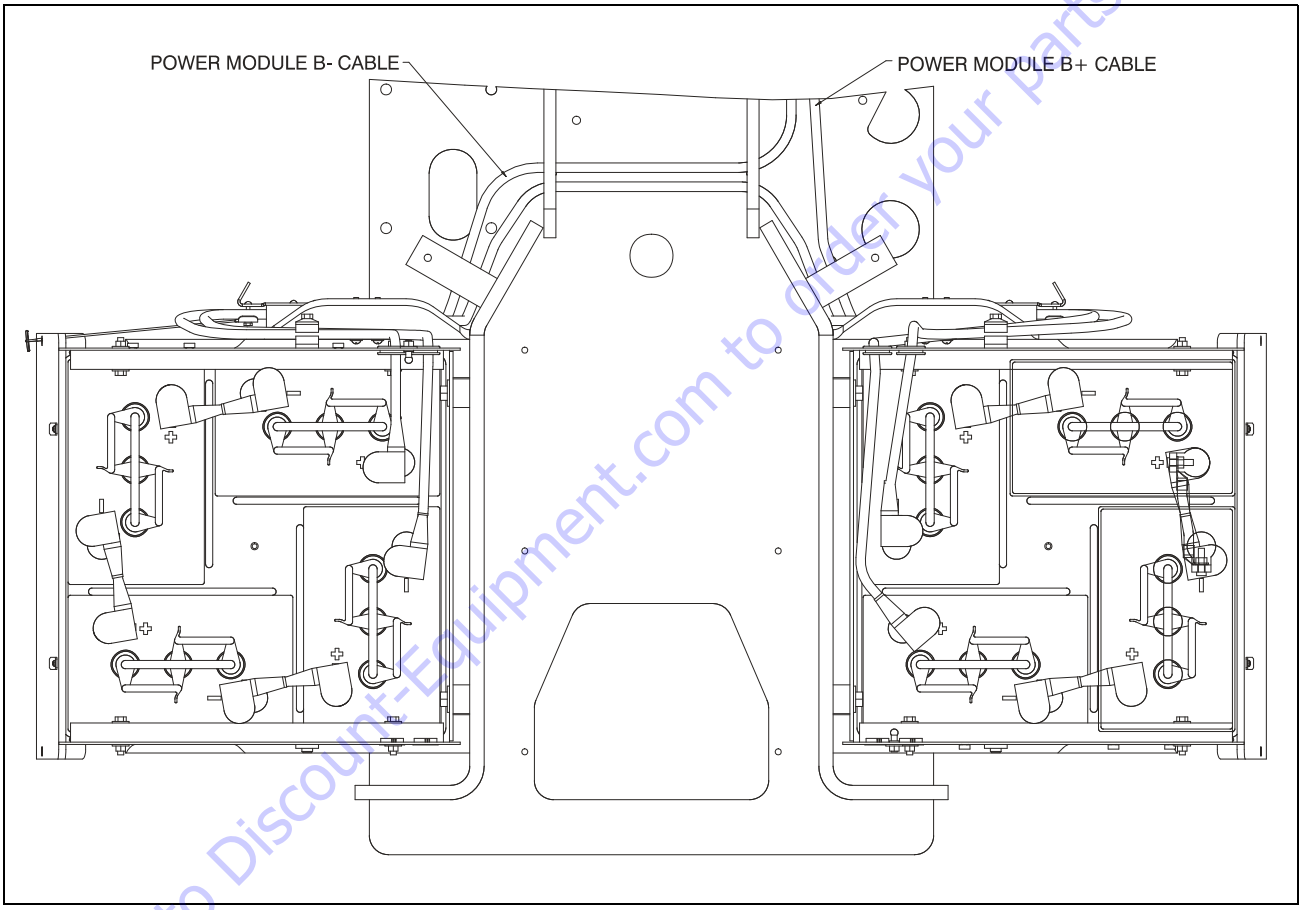


Figure 3-30. Battery Cable Routing

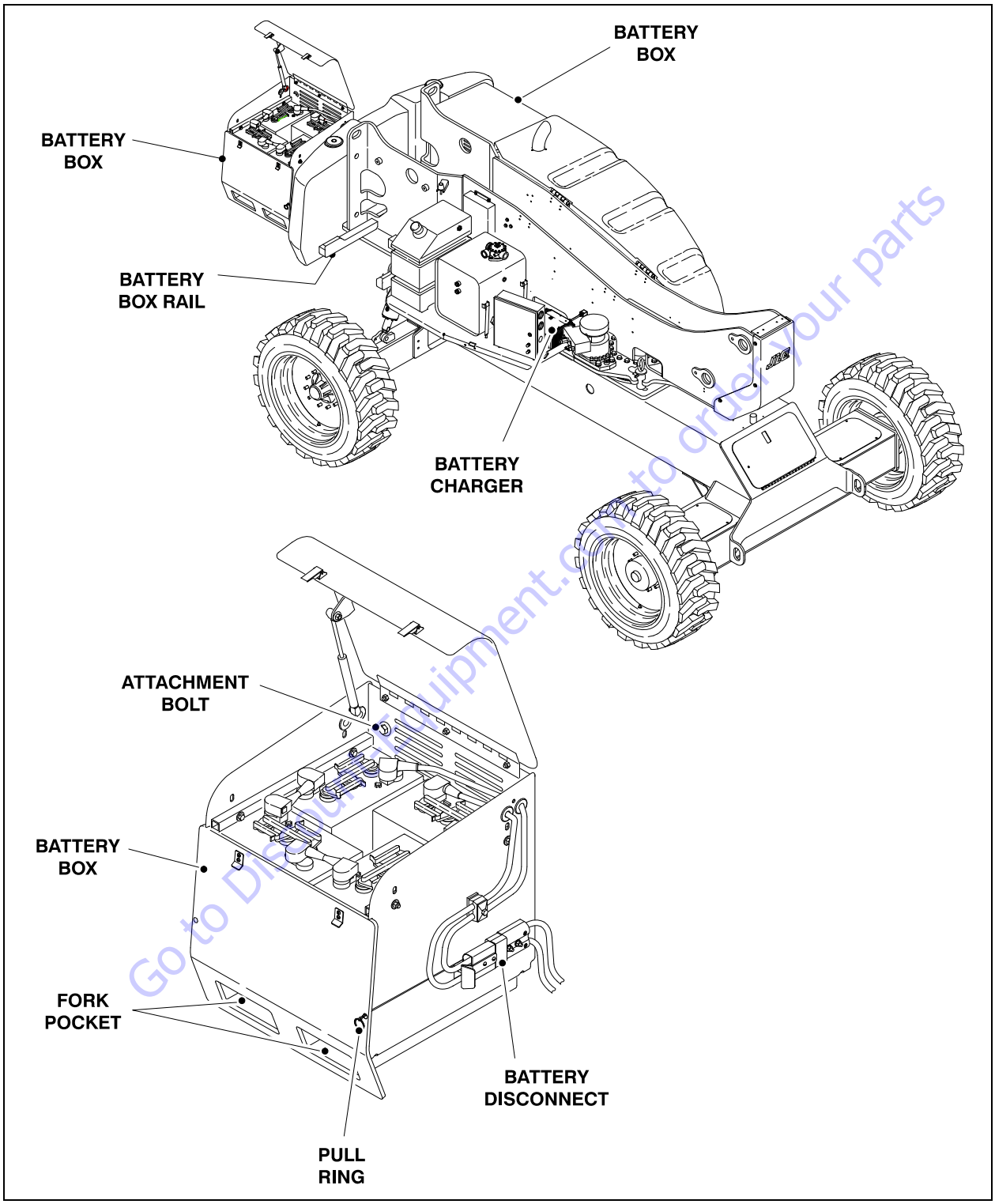


Figure 3-31. Batteries and Battery Charger

3.10 BATTERY CHARGER

NOTICE

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

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 3-2. 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.

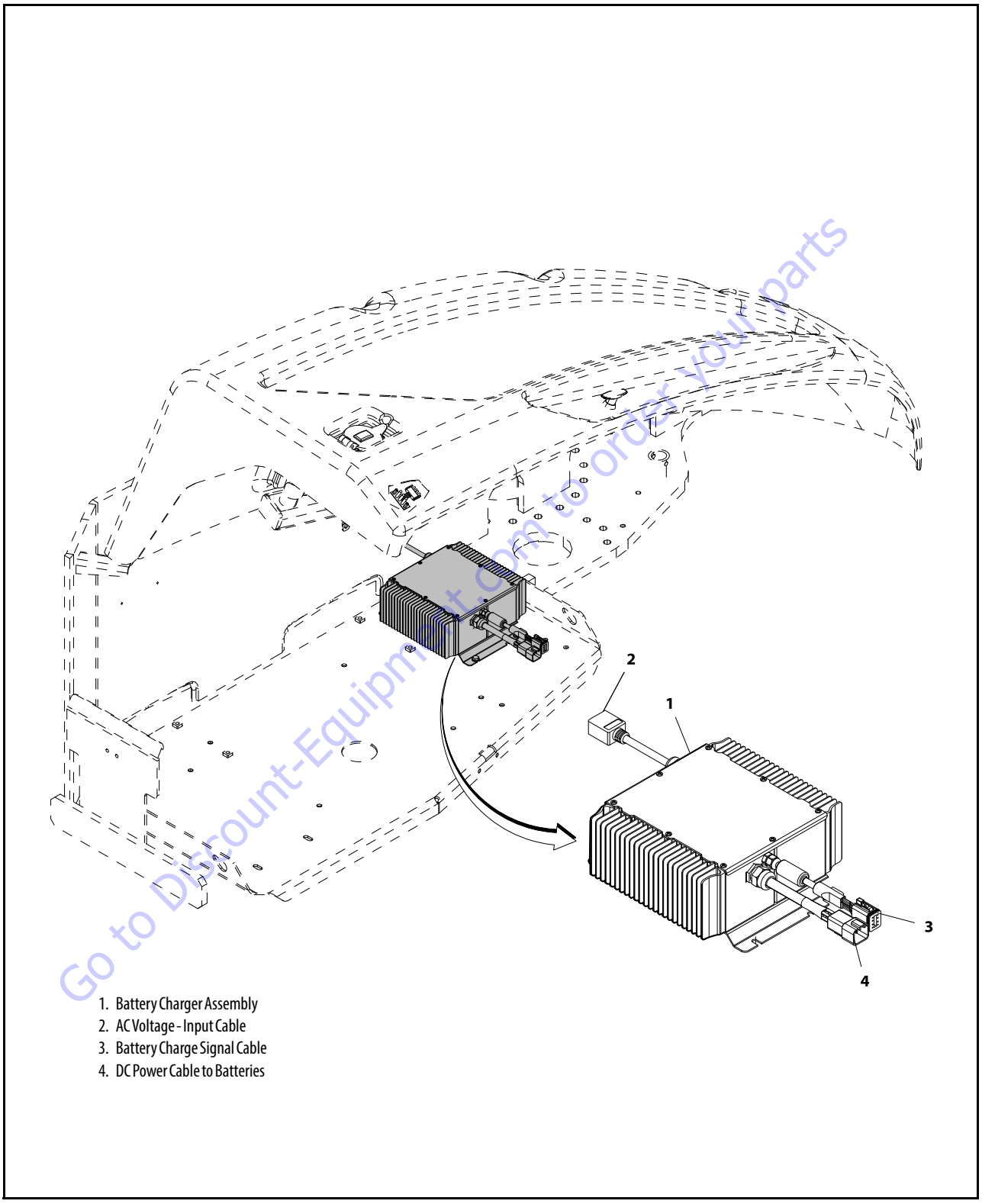


Figure 3-32. Battery Charger

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 3-3, 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 3-3. Battery Algorithms

Algorithm #	JLG P/N	Battery Type	Proper Algorithm Setting
173	1001105091	6V-305-S	73
173	0400202	6V-415S	173
173	1001102534	6V-EVL16A-A	143

3.11 GENERATOR

NOTE: *Throughout the Generator section, the abbreviation RBS is used. RBS stands for Rotary Battery System, which is the generator system.*

The engine-driven generator is designed to produce a DC output directly without the need of a separate rectifier. Included in the RBS unit is the engine, generator, engine/generator controller, harness and related components.

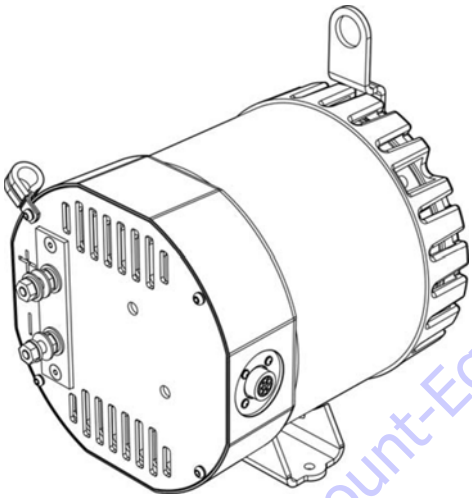
Engine

Peak rating:

Continuous rating: 6.2 HP
5.6 HP at 3600 RPM

Refer to the Engine Manual for a complete description of the engine.

Alternator



The RBS is equipped with a brushless DC output alternator.

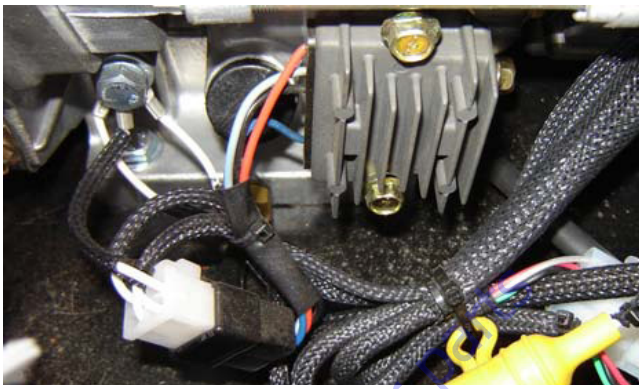
The 3-phase AC output of the alternator is full wave rectified and presented to the output terminals.

Output rating: 58.0V at 45A

Voltage regulation and current limiting is provided by the RBS Engine/Generator Controller.

The rectifier diodes and output current sensor are located in the alternator endbell.

Dynamo and Dynamo Voltage Regulator

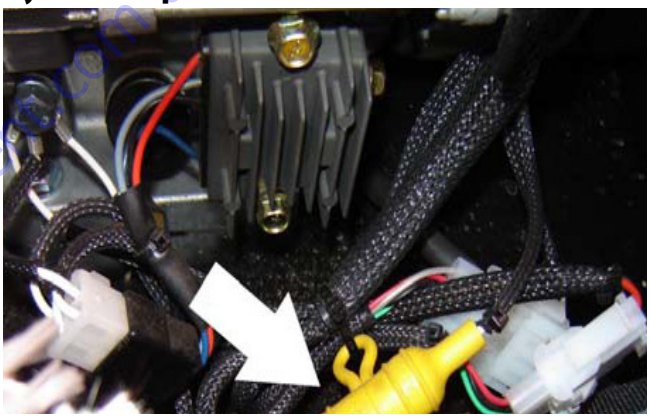


The engine is equipped with a dynamo and dynamo voltage regulator.

Dynamo output: 12V
7A DC

Refer to the Engine Manual for a complete description of the dynamo and dynamo voltage regulator.

Dynamo Output Fuse



This fuse protects the dynamo output; it is located on the left side of the engine.

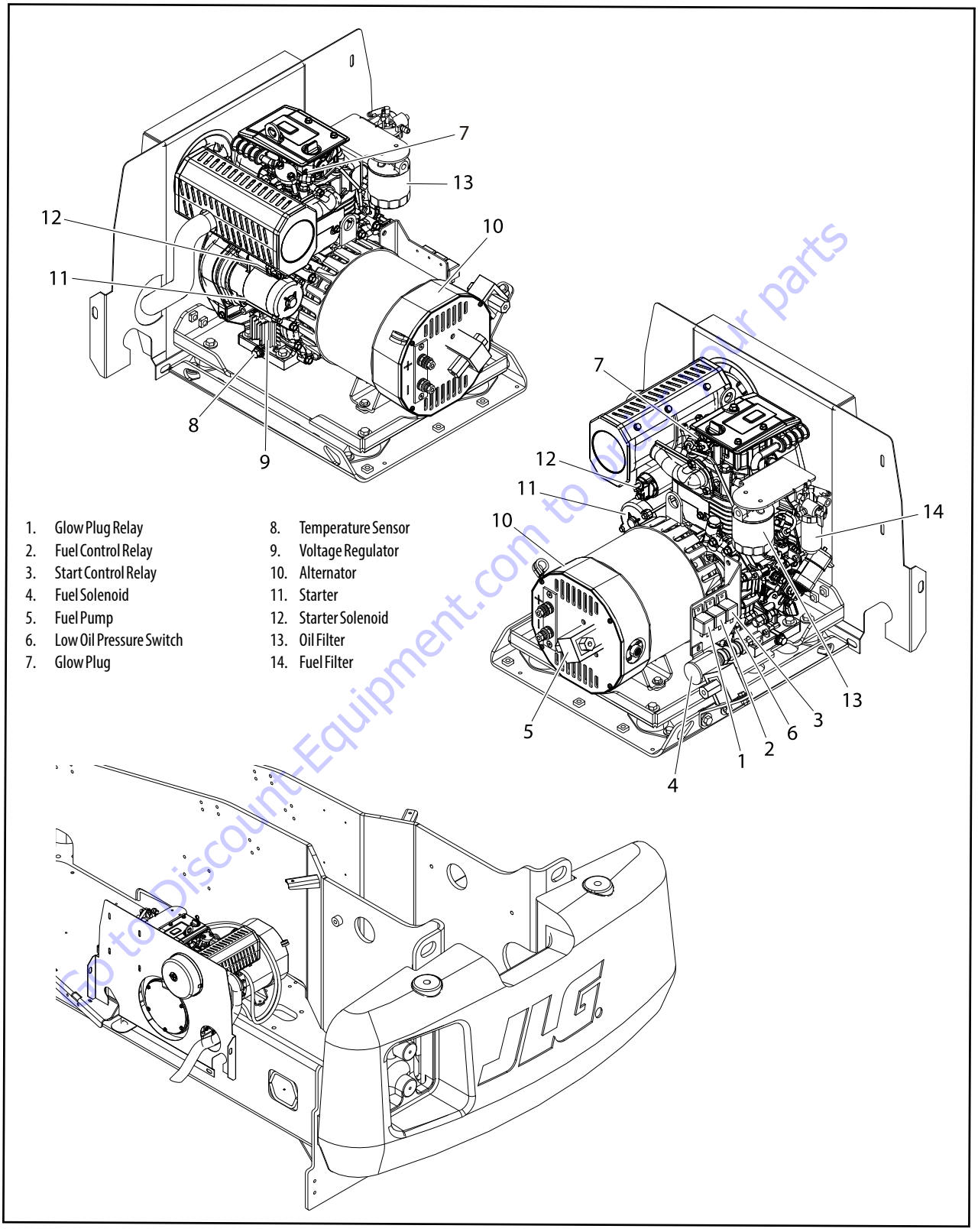
Rating: 20ADC

Control Fuse

The control fuse provides power to the engine/generator controller and the relays for start control, fuel control and glow plug.

Rating: 15ADC

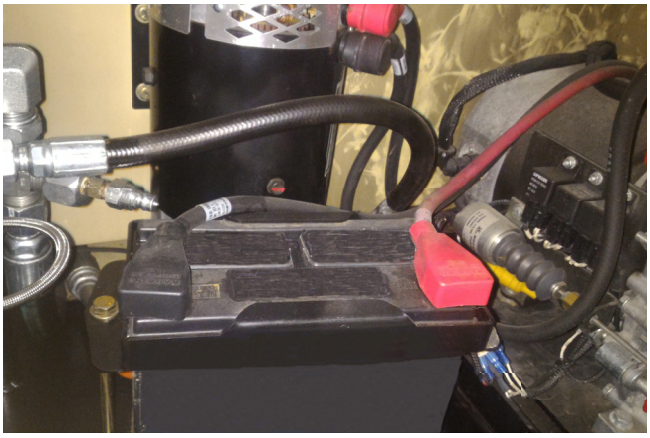
This fuse is located on the right side of the engine.



1. Glow Plug Relay
2. Fuel Control Relay
3. Start Control Relay
4. Fuel Solenoid
5. Fuel Pump
6. Low Oil Pressure Switch
7. Glow Plug
8. Temperature Sensor
9. Voltage Regulator
10. Alternator
11. Starter
12. Starter Solenoid
13. Oil Filter
14. Fuel Filter

Figure 3-33. Generator

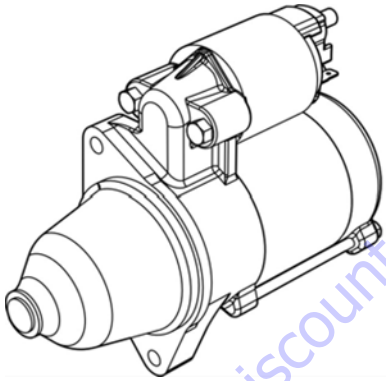
Start Battery



The RBS requires a 12V lead-acid start battery (not supplied with the system), which provides starting power and power for the RBS controls.

This battery is charged by the engine dynamo and dynamo regulator when the engine is running.

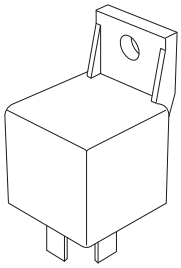
Engine Starter

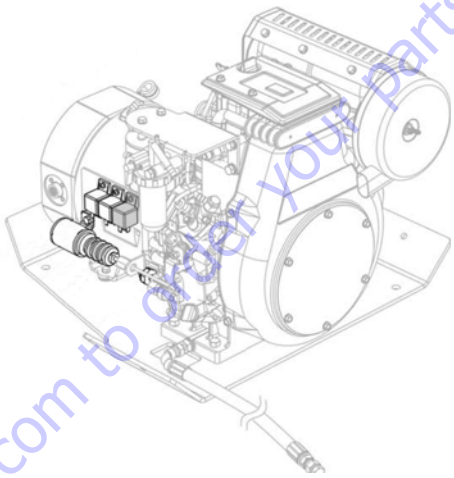


The engine is equipped with a 12VDC starter, which provides the mechanical power to crank the engine. Electrical power for the starter is provided by the start battery.

The starter is energized by the start control relay.

Start Control Relay



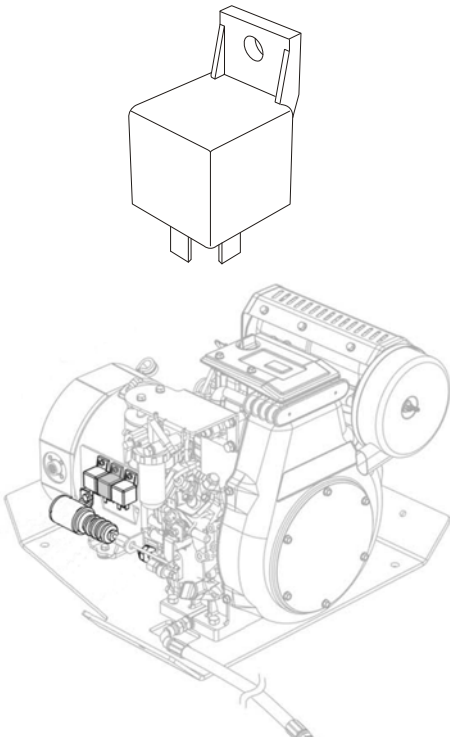


The start control relay energizes the solenoid of the engine starter and the pull coil of the engine fuel solenoid.

The start control relay is energized by the engine/generator controller from pin J2-4.

The start control relay is located on the fuel solenoid bracket on the right side of the engine.

Fuel Control Relay

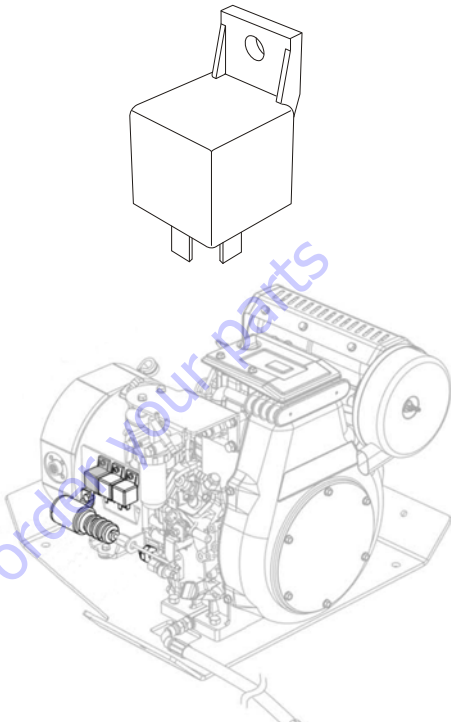


The fuel control relay energizes the hold coil of the fuel solenoid.

The fuel control relay is energized by the engine/generator controller from pin J2-3.

The fuel control relay is located on the fuel solenoid bracket on the right side of the engine.

Glow Plug Control Relay



The glow plug control relay energizes the glow plug. It is energized by the engine/generator controller, pin J2-27.

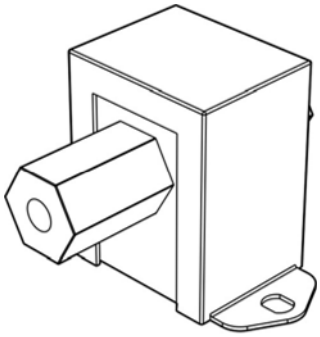
The glow plug control relay is located on the fuel solenoid bracket on the right side of the engine.

Glow Plug

The glow plug is a resistive heating element located in the combustion chamber. It is used during starting at temperatures below 32°F (0°C).

The heater is energized by the glow plug control relay.

Fuel Pump

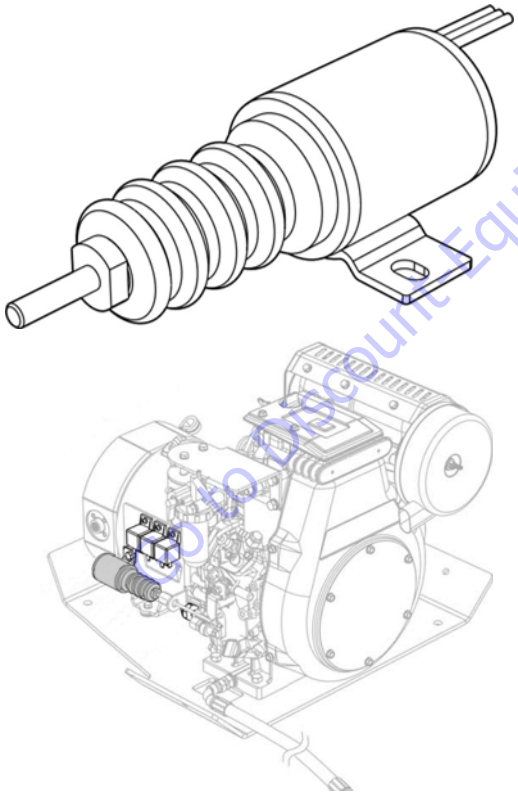


The fuel pump runs in parallel with the fuel solenoid hold coil which is run by the fuel control relay.

The pump runs whenever the engine runs, and keeps the fuel filter filled. Excess fuel flows through the return line back to the fuel tank.

The fuel pump is located on the right side of the engine.

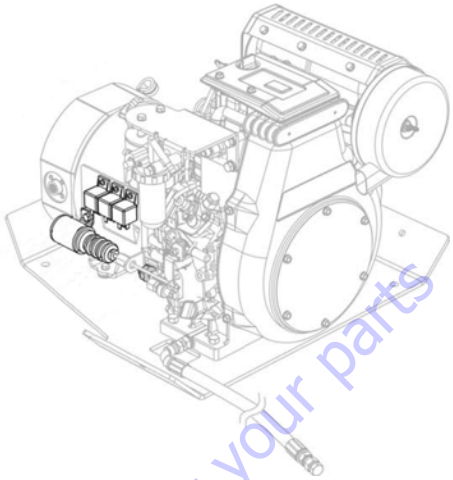
Fuel Solenoid



The fuel solenoid actuates the run/stop lever of the engine. This solenoid has a pull coil energized by the start control relay and a hold coil energized by the fuel control relay.

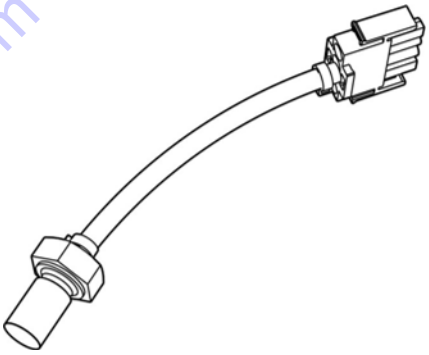
The fuel solenoid is located on the right side of the engine.

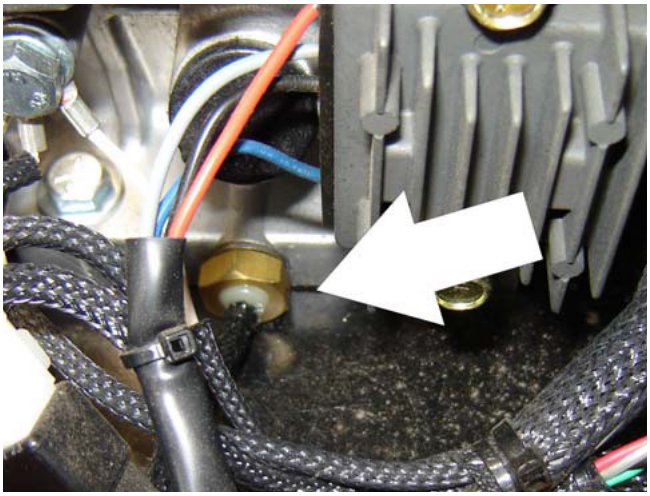
Engine Low Oil Pressure Switch



The engine is equipped with a low oil pressure switch. This switch is closed when the oil pressure is below 7psi. It is mounted on the side cover.

Engine Oil Temperature Sensor





The engine oil temperature sensor is used to sense the temperature of the oil in the sump of the engine.

This sensor provides an analog signal to the engine/generator controller. The primary use of this signal is for high

engine temperature shutdown 248°F (120°C) for the engine. The signal is also used in determining if the air glow plug should be energized.

The engine oil temperature sensor is connected to the engine/generator controller at pins J2-8 and J2-19.

The engine oil temperature sensor is located on the left side of the engine.

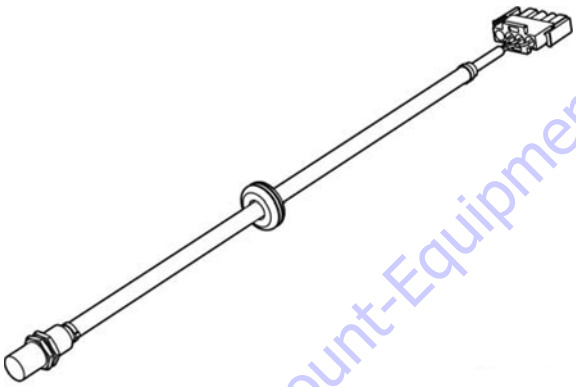
Alternator Output Current Sensor

The alternator output current sensor provides a signal proportional to the output current of the alternator to the engine/generator controller. The output current is regulated at 45ADC.

The alternator output current sensor is connected to the engine/generator controller at pins J2-21, J2-31 and J2-32.

The alternator output current sensor is located inside the rear cover of the alternator.

Engine Speed Sensor



The engine speed sensor provides a signal proportional to the rotational speed of the engine to the engine/generator controller. This signal is used by the engine/generator controller to determine starter cut-out, overspeed fault and underspeed fault. If the signal is not present at the engine/generator controller, the unit will fault with a loss of speed signal indication.

The engine speed sensor is connected to the engine/generator controller at pins J2-9, J2-15 and J2-20.

The engine speed sensor is located inside the recoil starter cover at the front of the engine.

RBS Engine/Generator Controller

The control system enclosure houses the RBS engine/generator controller, which performs all control tasks associated with the RBS.

The engine/generator controller interface is via a J2 35-pin connector.

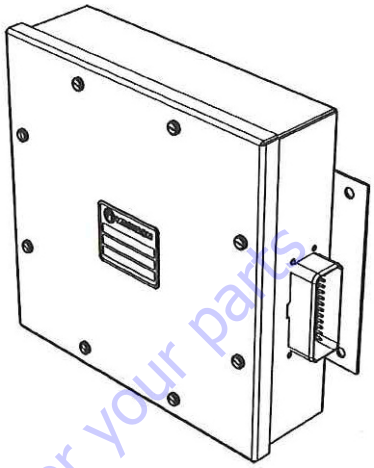


Table 3-4. Controller Interface Pin Assignments

PIN	FUNCTION
1	System 48VDC
2	System 0V DC
3	Fuel solenoid
4	Starter Solenoid
5	Manual call to start
6	Low oil pressure
7	Not used
8	Engine oil temperature
9	Speed sensing input
10	RS-232 +12V
11	RXD
12	TXD
13	LED Driver GND
14	LED Driver +48V
15	Speed sensor GND
16	Not used
17	Not used
18	- Output voltage
19	Engine oil temperature/ambient temp. + 8V
20	Speed Sensing + 8V
21	Output current sensor (GND)
22	Not used
23	RS-232 GND
24	- Field drive
25	+ Start battery
26	- Start battery

Table 3-4. Controller Interface Pin Assignments

27	Pre-heat
28	Inhibit run
29	Engine temp. switch
30	+ Output voltage
31	Speed sensing + 5V
32	Output current senset
33	Not used
34	Not used
35	Field Drive

Warnings and Safety Precautions

⚠ WARNING

THE RBS MAY START WITHOUT WARNING.

⚠ WARNING

MORE THAN ONE LIVE CIRCUIT IS USED INSIDE THE RBS CONTROL PANEL. EXERCISE CAUTION WHEN THE CONTROL PANEL IS OPEN, EVEN WHEN THE RBS IS NOT RUNNING.

System Controls

INHIBIT RUN INPUT

The inhibit run input prevents the RBS from starting, clears any existing calls to start and stops the engine immediately. To return to normal operating mode, the inhibit run input must be removed.

MANUAL CALL TO START

The manual call to start input initiates an automatic run of the RBS unit.

RS232 PORT

The RS232 allows the RBS to be monitored and controlled using an analyzer.

System Status and Performance Monitoring

System status and performance can be monitored by the analyzer.

System Settings

CALL TO START SETTINGS

Low battery voltage call to start level	48.0 VDC
Low battery voltage remove call to start level	54.0 VDC
Low temperature call to start level	5°C
Low temperature remove call to start level	8°C
Low start battery voltage call to start level	12.2 V
Low start battery voltage remove call to start level	12.9 V

CURRENT AND VOLTAGE SETTINGS

Normal output voltage level	58.0 VDC
Extend output voltage level	58.0 VDC
Current limit level	45 ADC
High voltage shutdown level	63 ADC
Finish charging current level	30 ADC

TIME DELAY SETTINGS

TD engine start	30s
TD purge	0s
TD bypass	10s
TD engine run	1800s
TD cool-down	30s
TD high volts	2s

CRANK SETTINGS

Crank time	15s
Reset time	15s
Crank cycles	3

SPEED TIME AND GLOW PLUG SETTINGS

TD no speed signal	5s
TD DC sensing fault	10s
Starter disconnect	1000 Hz
Overspeed shutdown	3800 RPM
Underspeed shutdown	2000 RPM
Glow plug on temperature	5°C
Glow plug on time	15s

RBS Start

Call to start	Manual	48V DC applied to the input
	Automatic	1 Low battery voltage (below 48VDC)
		2 Low engine temperature (below 5°C)
		3 Low start battery voltage (below 12.2V)
Engine start time delay		RBS waits to verify that call to start is valid (not a transient condition).
Preheat delay		- if engine temperature is below 32°F (0°C)
Crank time (Rest time)		RBS will crank and rest until engine starts, or Overcrank fault is indicated after 3 failed crank cycles.
Time delay bypass		RBS waits until normal engine operating conditions are reached before Low oil pressure and Underspeed faults are monitored.

RBS shutdown

Call to start removed	Manually	Inhibit run input applied
	Automatically:	1 Battery voltage above 54VDC and finish charging current below 30ADC
		2 Engine temperature above 8°C
		3 Start battery voltage above 12.9V and finish charging current below 30ADC
Engine run time delay		This period ensures that no further call to start conditions occur prior to cool-down period.
Cool-down period		Alternator output is reduced to a minimal level to allow the engine to cool down.

RBS Alarms and Flash Codes

In the event of an RBS alarm, a flash code will be issued and an alarm indicated on the analyzer.

Table 3-5. RBS Alarms and Flash Codes

Flash Code	Problem		RBS Condition
1-1	Low Oil Pressure [1]	Below 7psi	Shutdown
1-2	High Engine Temp.	Over248°F(120°C)	Shutdown
1-3	Overspeed	Over 3800 RPM	Shutdown
1-4	Underspeed 1	Below 2000 RPM	Shutdown
	Overcrank	3 failed crank cyclesCall to start removed	Call to start removed
1-5	No Speed Signal[2]		Shutdown
2-1	Overvoltage [3]	Over 63VDC	Shutdown
2-2	Engine Starting System fault 4		Alarm
2-4	Loss Of Voltage Sense	Alternator output less than 1/2 of the system nominal voltage (58VDC)	Shutdown
steady	Unit Enabled, no faults		Unit can respond to any call to start
-	Unit Off / Disabled		Unit will not respond to any call to start
Notes:			
1 Enabled once time delay bypass period has elapsed after engine startup.			
2 Delayed to ensure the fault was not momentary.			
3 Measured at the alternator output, shutdown is delayed by a factory set period to ensure the fault was not caused by a transient condition.			
4 Indicates a problem with the engine start battery, engine magneto or magneto-voltage regulator.			

Alarms must be reset once the fault has been corrected (see below).

Resetting the RBS Controller

The RBS can be reset using the analyzer or by disabling and re-enabling the RBS controller. This will clear any current fault condition with the controller.

Maintenance Schedule

Check oil level every 24 hours

Change engine oil and filter every 150 hours

Troubleshooting

Table 3-6. Troubleshooting

Flash Code	Problem	Solution
-	Unit Off / Disabled (engine will not crank)	Check position of selector switch. Verify that the inhibit run is released. Check the warning LED. Remedy fault if present and restart the RBS. Check the start battery voltage. Check control fuse. Check for loose wiring or connection.
1-1	Low Oil Pressure	Check oil level. Check oil supply lines. Refer to Kubota Workshop manual WSM OC60/80/95. Verify correct operation of oil pressure switch with a test gauge.
1-2	High Engine Temp.	Check for obstructions in the cooling airflow to the engine. Check that the ambient temperature is within the design limits of the engine. Verify correct operation of engine temperature sensor.
1-3	Overspeed	Verify setting of governor lever. Readjust, if required. Refer to Kubota Workshop manual WSM OC60/80/95.
1-4	Underspeed	Ensure there is an adequate supply of fuel to the engine. Ensure there is an adequate supply of combustion air to the engine. Check air cleaner. Verify setting of governor lever. Readjust if required. Refer to Kubota OC60 Engine Manual.
	Overcrank	Check fuel level. Check fuel connections. Verify operation of fuel solenoid and fuel pump. Check the start battery voltage. If the engine exhaust contains white smoke then fuel is entering the engine but the engine is not firing. Refer to the Kubota OC60 Engine Manual for further checks. If the ambient temperature is low, verify that the heater and/or glow plug are operating.
1-5	No Speed Signal	Check wiring connections.
2-1	Overvoltage	Check alternator output voltage.
2-2	Engine Starting System fault	Check engine start battery charging system for current output. Check for failed engine start battery.
2-4	Loss Of Voltage Sense	

APU Engine Start Battery Boosting

Always connect the POSITIVE (+) of the booster battery to the POSITIVE (+) of the APU start battery, and the NEGATIVE (-) of the booster battery to the ground of the engine block.

WARNINGS:

⚠ WARNING

ALWAYS SHIELD YOUR EYES AND AVOID LEANING OVER THE BATTERY WHENEVER POSSIBLE.

⚠ WARNING

DO NOT ALLOW BATTERY ACID TO CONTACT EYES OR SKIN. FLUSH ANY CONTACTED AREA WITH WATER IMMEDIATELY. SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS.

⚠ WARNING

STARTING BATTERIES GENERATE EXPLOSIVE GASES. KEEP SPARKS, FLAME AND LIGHTED CIGARETTES AWAY FROM BATTERIES.

⚠ WARNING

IMPROPER USE OF A BOOSTER BATTERY TO START AN APU MAY CAUSE AN EXPLOSION.

⚠ WARNING

DO NOT ATTEMPT TO JUMP START AN APU WITH A LOW ACID LEVEL IN THE BATTERY.

⚠ WARNING

THE VOLTAGE OF THE BOOSTER BATTERY MUST BE RATED AT 12V. THE AMP-HOUR CAPACITY OF THE BOOSTER BATTERY MUST NOT BE LOWER OR SUBSTANTIALLY HIGHER THAN THAT OF THE DISCHARGED BATTERY. USE OF BATTERIES OF DIFFERENT VOLTAGE OR SUBSTANTIALLY DIFFERENT AMP-HOUR RATING MAY CAUSE AN EXPLOSION OR PERSONAL INJURY. APPLYING A HIGHER VOLTAGE WHILE BOOSTING WILL ALSO CAUSE DAMAGE TO SENSITIVE ELECTRONIC COMPONENTS.

⚠ WARNING

A CHARGING SYSTEM (BATTERY CHARGER OR BATTERY CHARGING ALTERNATOR) MUST NEVER BE ENERGIZED WHILE BOOSTING. DAMAGE TO SENSITIVE ELECTRONIC COMPONENTS WILL RESULT.

NOTICE

THE MAIN BATTERY OF THE LIFT MUST NEVER BE USED TO BOOST THE APU. DAMAGE TO SENSITIVE ELECTRONIC COMPONENTS WILL RESULT.

3.12 SUPPLEMENTARY FUSE FOR APU

The purpose of this section is to describe the procedure to add a supplementary fuse for the Engine Generator Controller for the APU.

Tools and Material

- - Weather proof fuse holder - JLG P/N 2400081
- - AGC1, 1 Amp fuse - JLG P/N 2400080
- - 45 cm of #16 AWG wire - JLG P/N 4920019
- - 2 X insulated butt splice connectors - JLG P/N 4460035
- - 6 X medium length wire ties - JLG P/N 4240033
- - Wire/Side cutters
- - 5/32" Allen Key
- - Crimping tool

Procedure

⚠ WARNING

BEFORE BEGINNING THIS PROCEDURE, ENSURE THAT ALL SOURCES OF POWER ARE DISCONNECTED FROM THE APU!

This procedure is common for all applications of the APU. The photos contained in this document illustrate the modification performed to an APU supplied in a JLG M450 lift.

1. Locate the harness at the rear of the APU.

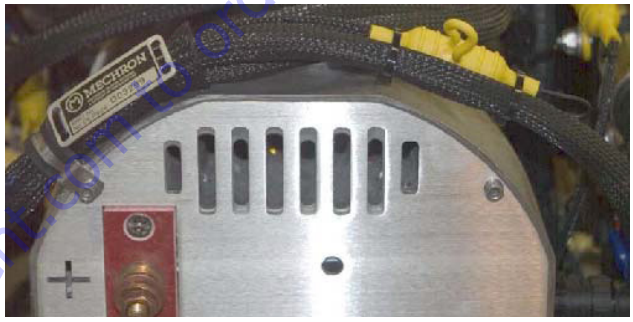
2. where the harness attaches to the rear cover of the generator and the connection point for the new inline fuse.

3. Remove the socket head drive screw with a 5/32" Allen key. Next remove the cable clamp from the harness.

4. Cut and remove the Wire Ties holding the Harness label to the harness. Next, remove the Wire Ties so that the cable sleeve can be moved, exposing the conductors of the harness.

5. Cut wire 106 going to the Engine/Generator Controller after the existing connection point and install the conductors that lead to the new inline fuse holder. Use insulated butt splice connectors for these conductors.

6. Re-install the harness with the new fuse in place.



7. Reconnect the lift and APU start battery. The APU is now ready for use.

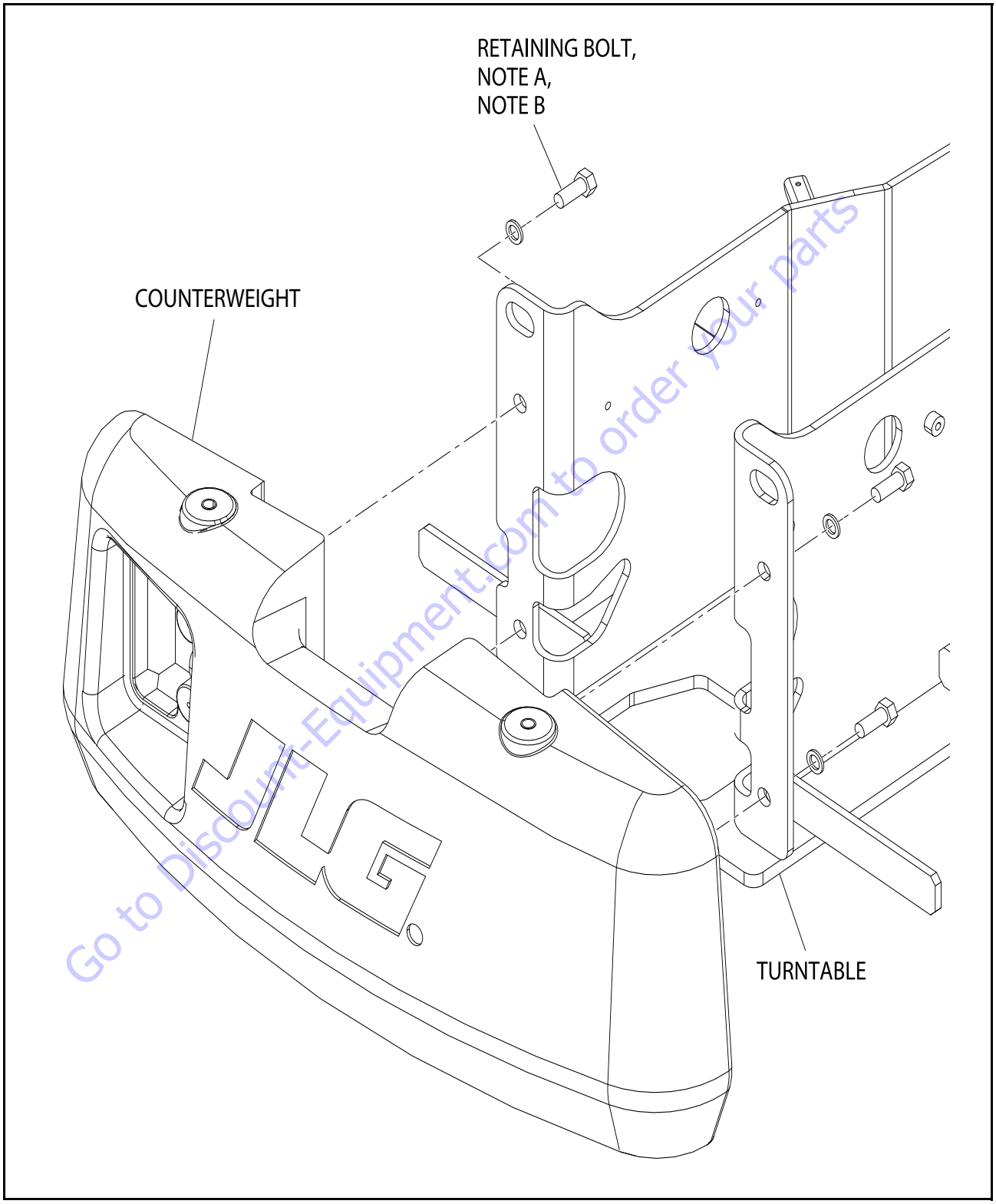


Figure 3-34. Counterweight

PARTS FINDER

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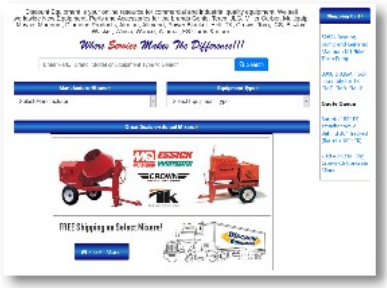

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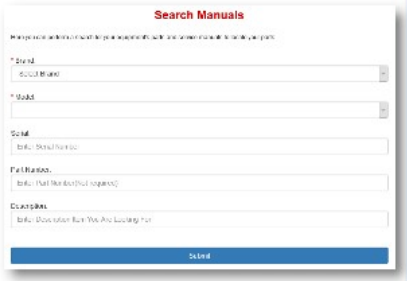

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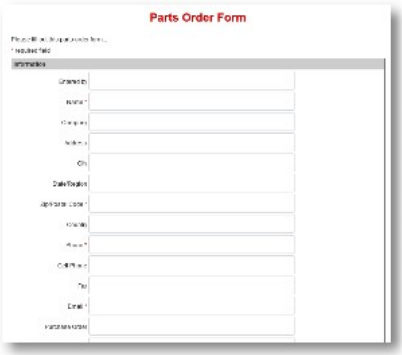

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SECTION 4. BOOM & PLATFORM

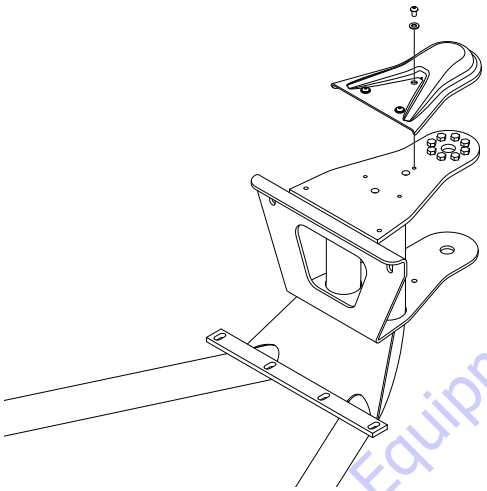
4.1 PLATFORM

Platform Valve Removal

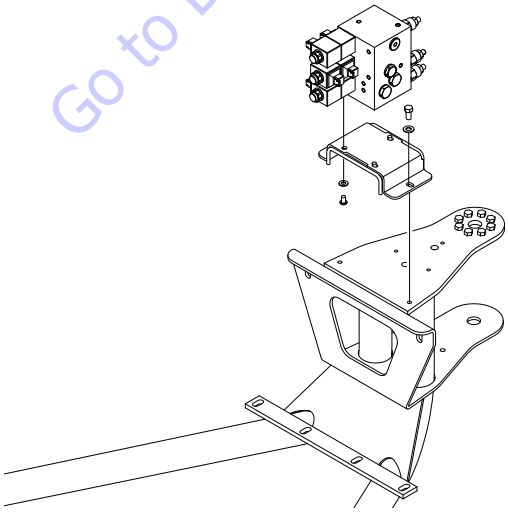
1. Tag and disconnect the hydraulic lines from the platform control valve. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
2. Using a suitable device, support the platform support.

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

3. Remove hardware securing cover from the platform support. Remove cover.



4. Remove hardware securing the mounting bracket to the platform support. Take out the mounting bracket along with platform control valve.
5. Remove hardware securing the platform control valve to the mounting bracket. Remove platform control valve...



Support Removal

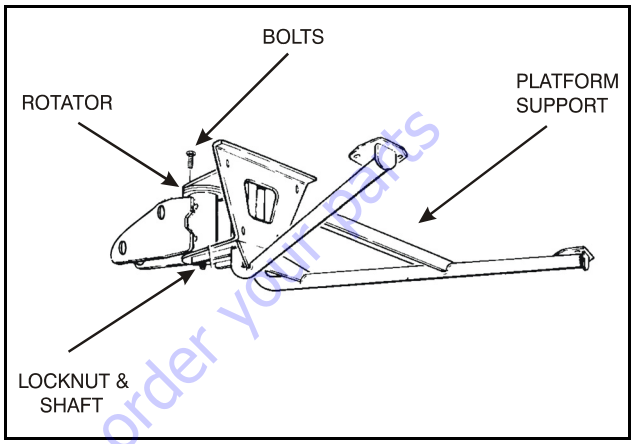
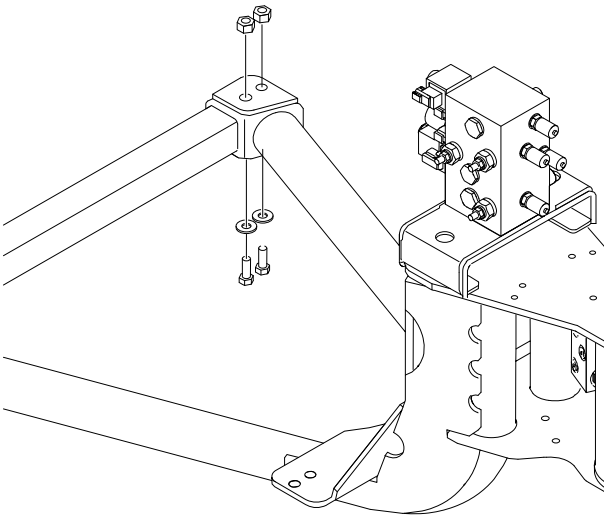


Figure 4-1. Location of Components Platform Support

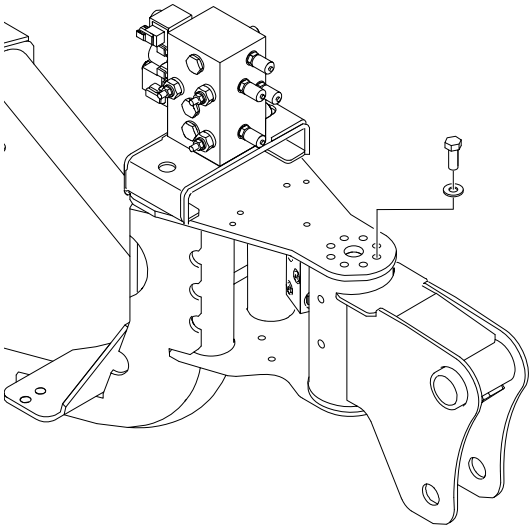
1. Disconnect electrical cables from control console.
2. Remove the bolts and Washers securing the platform to the platform support, then remove the platform.



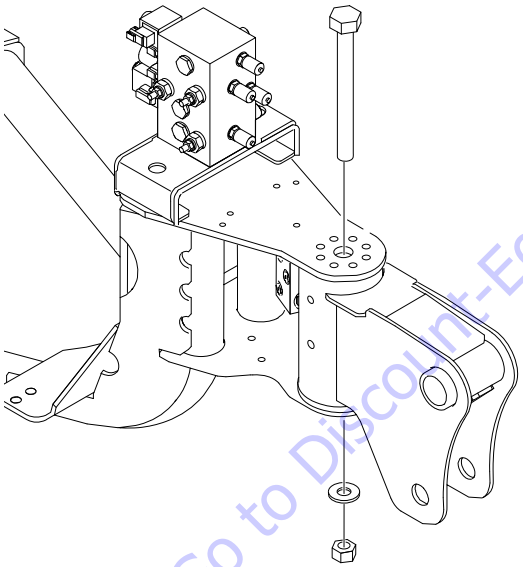
3. Using a suitable device, support the platform support.

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

4. Remove the bolts and locknuts 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.

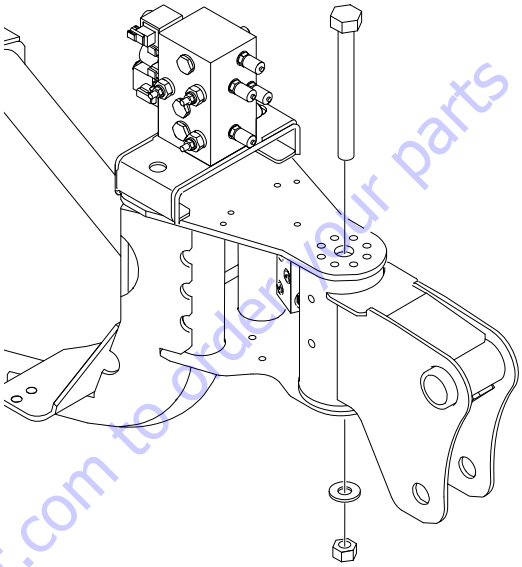


Support Installation

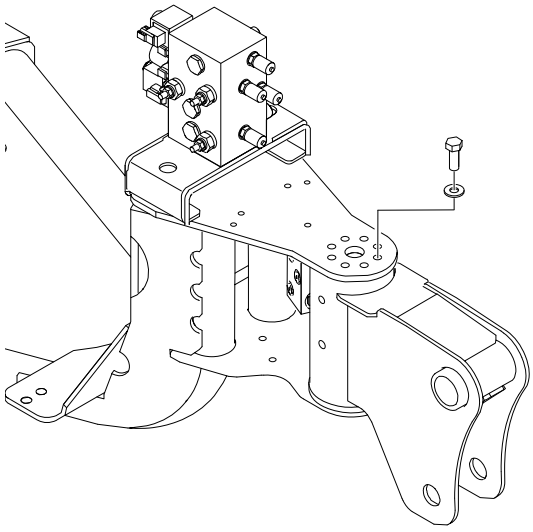
1. Using a suitable lifting device, support the platform support and position it on the rotator.

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

2. Install the rotator center bolt.

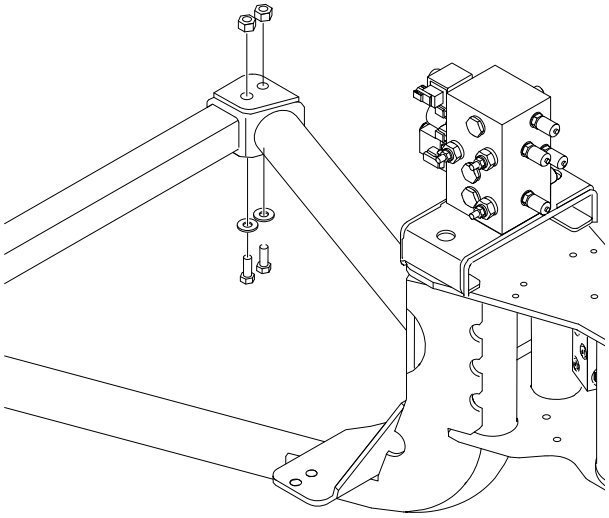


3. Apply JLG Threadlocker P/N 0100011 to the bolts and locknuts securing the support to the rotator and install the bolts and locknuts.



4. Torque the nut on the rotator center bolt to 586 ft. lbs. (795 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.Torque the bolts to 75 ft. lbs. (102 Nm).



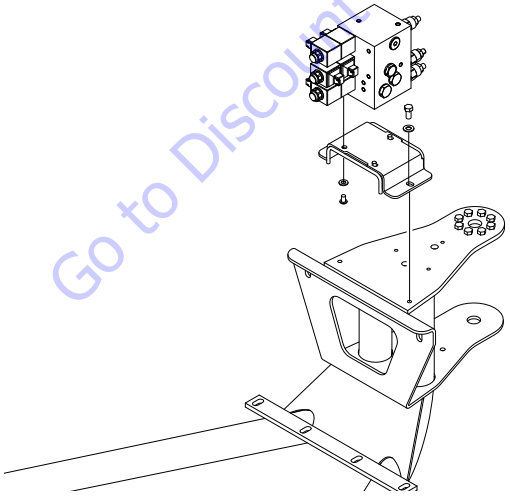
6. Connect the electrical cables to the platform control console.

Platform Valve Installation

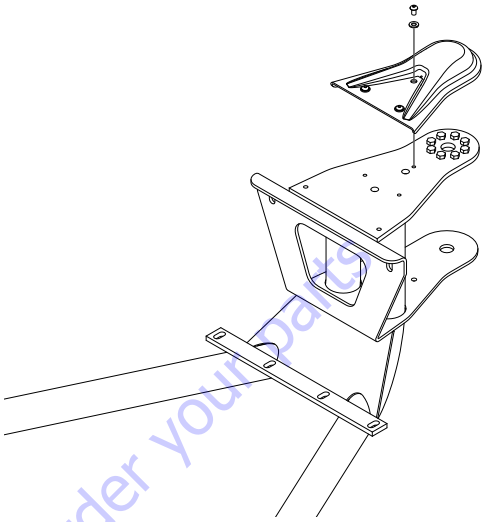
1. Using a suitable device, support the platform support.

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

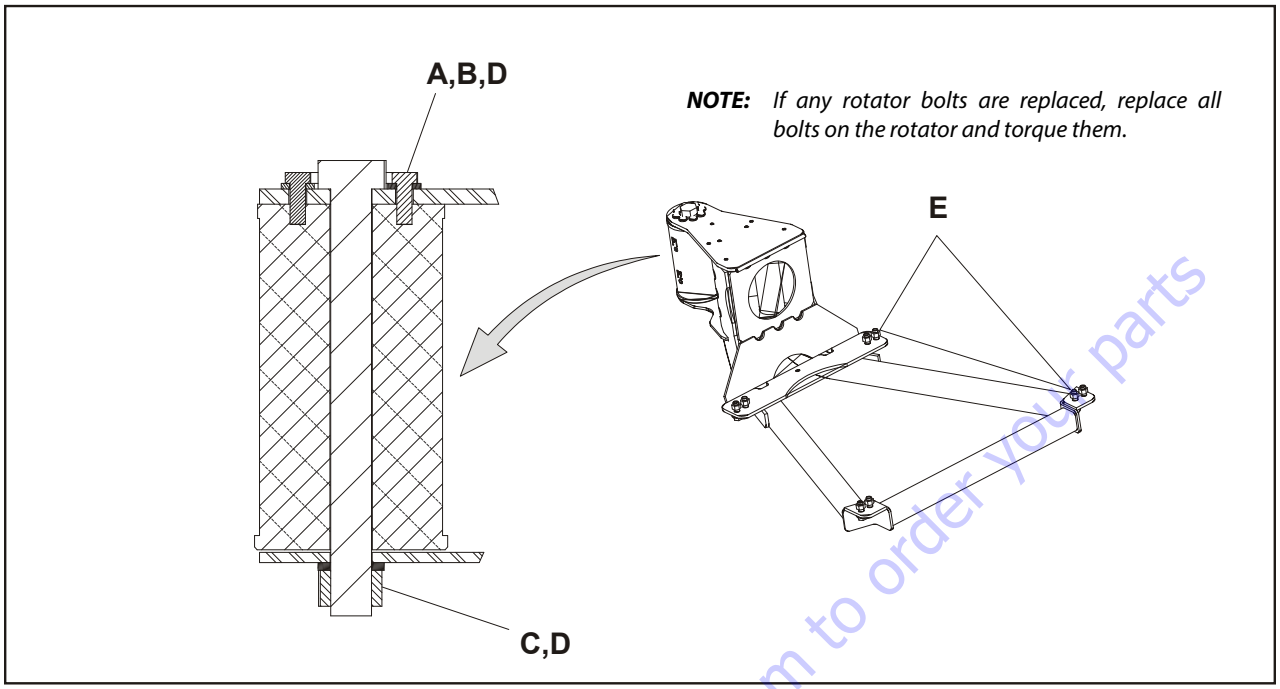
2. Install platform control valve onto the mounting bracket and secure using hardware.
3. Install the mounting bracket onto the platform support and secure using hardware.



4. Install cover onto the platform support securing the hardware.



5. Remove tag and reconnect the hydraulic lines to the platform control valve.



A Torque to 40 ft.lbs. (55 Nm)
B JLG Thread locker P/N 0100011
C Torque to 586 ft. lbs. (795 Nm)
D Check torque every 150 hours of operation
E Torque to 75 ft. lbs. (102 Nm)

Figure 4-2. Platform Support Torque Values

4.2 BOOM MAINTENANCE

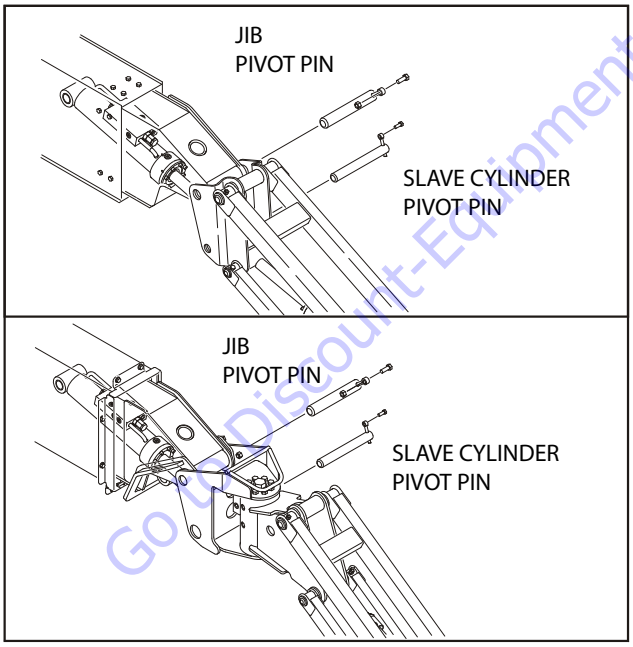
Removal

NOTE: *The main boom assembly weighs approximately 1993 lbs. (904 kg).*

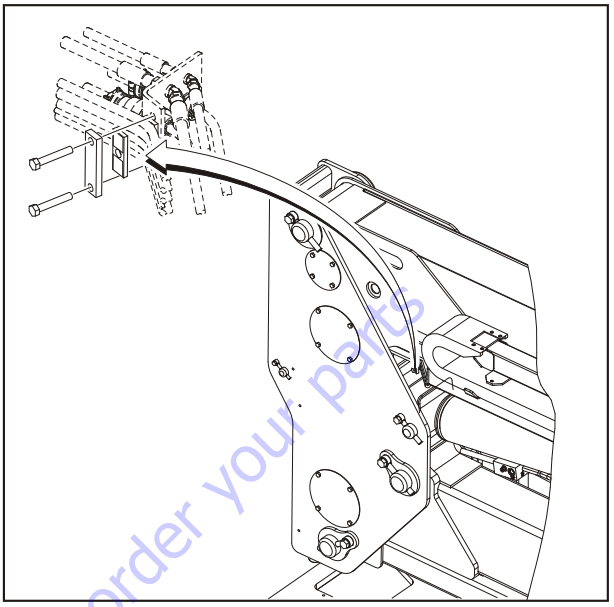
1. Raise the boom to horizontal and make sure that it is adequately supported with a lifting device or blocking.
2. Tag and disconnect the electrical leads at the platform and the platform valve.
3. Tag and disconnect all hydraulic lines on the platform valve and rotator. Cap or plug all openings.
4. Remove the hardware attaching the platform and platform support and remove the platform.

NOTE: *Steps 5 and 6 are only applicable if the machine is equipped with a jib.*

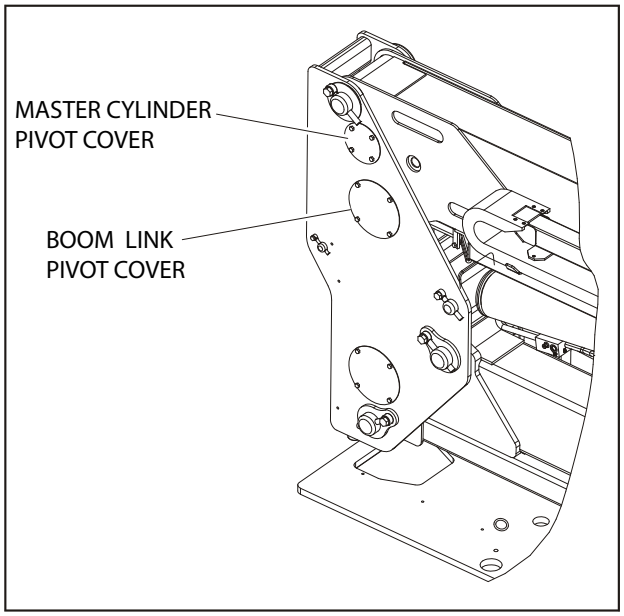
5. If equipped with a jib, place the jib in a horizontal position and support it with blocking. Tag and disconnect the hydraulic lines running to the jib cylinder. If equipped with a side swing jib, also tag and disconnect the hydraulic lines running to the jib rotator.



6. Remove the jib pivot pin and the slave cylinder pivot pin and remove the jib.



7. Disconnect the hydraulic and electrical lines from the bulkhead fittings at the rear of the boom.
8. Remove the cover at the rear of the upright.



9. Remove the covers on the side of the upright for the pivot pins.
10. Tag and disconnect the hydraulic lines running to the telescope cylinder.
11. Tag and disconnect the hydraulic lines running to the master cylinder.
12. Remove the upper lift cylinder pivot pin.

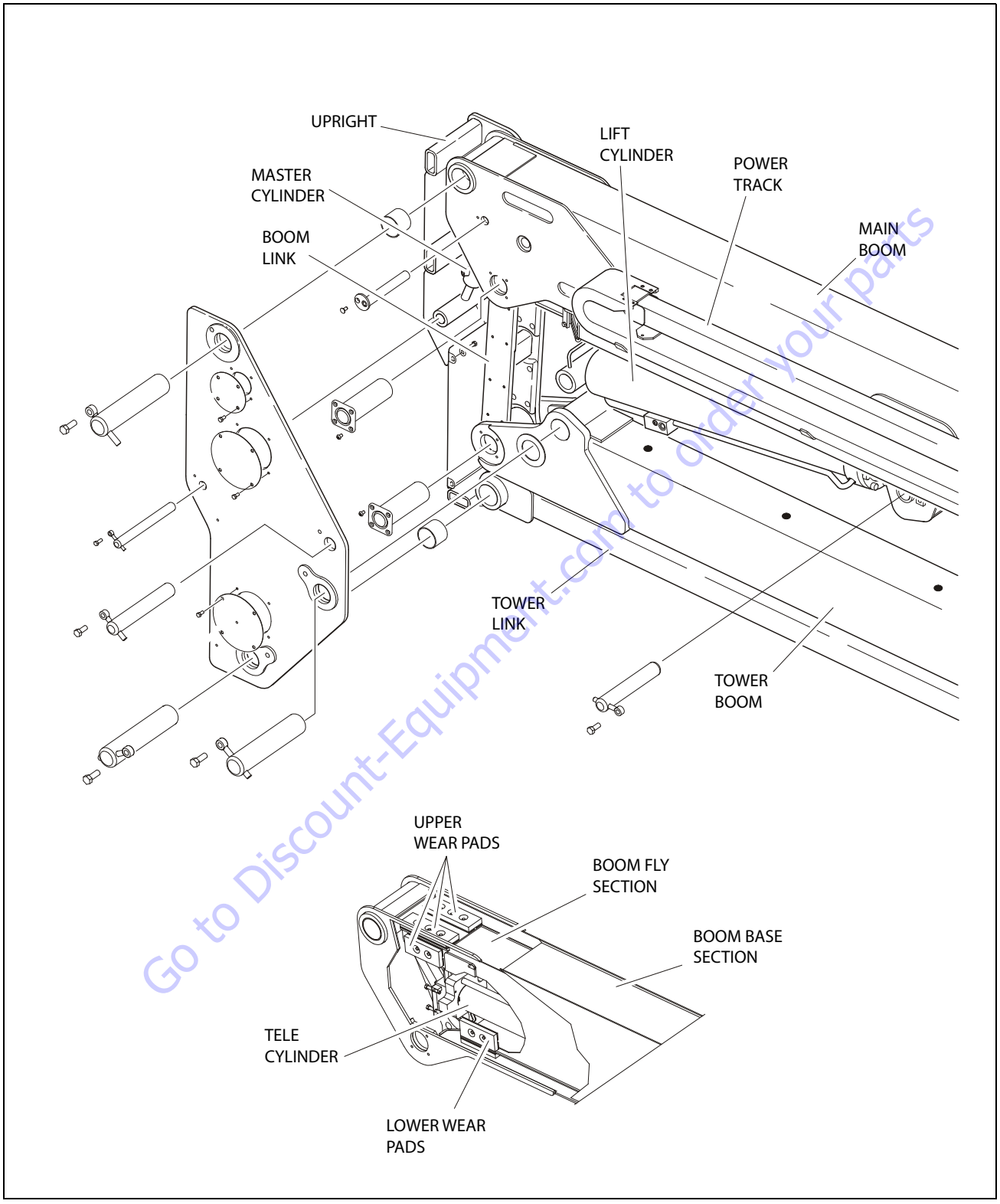


Figure 4-3. Boom Assembly - Sheet 1 of 3

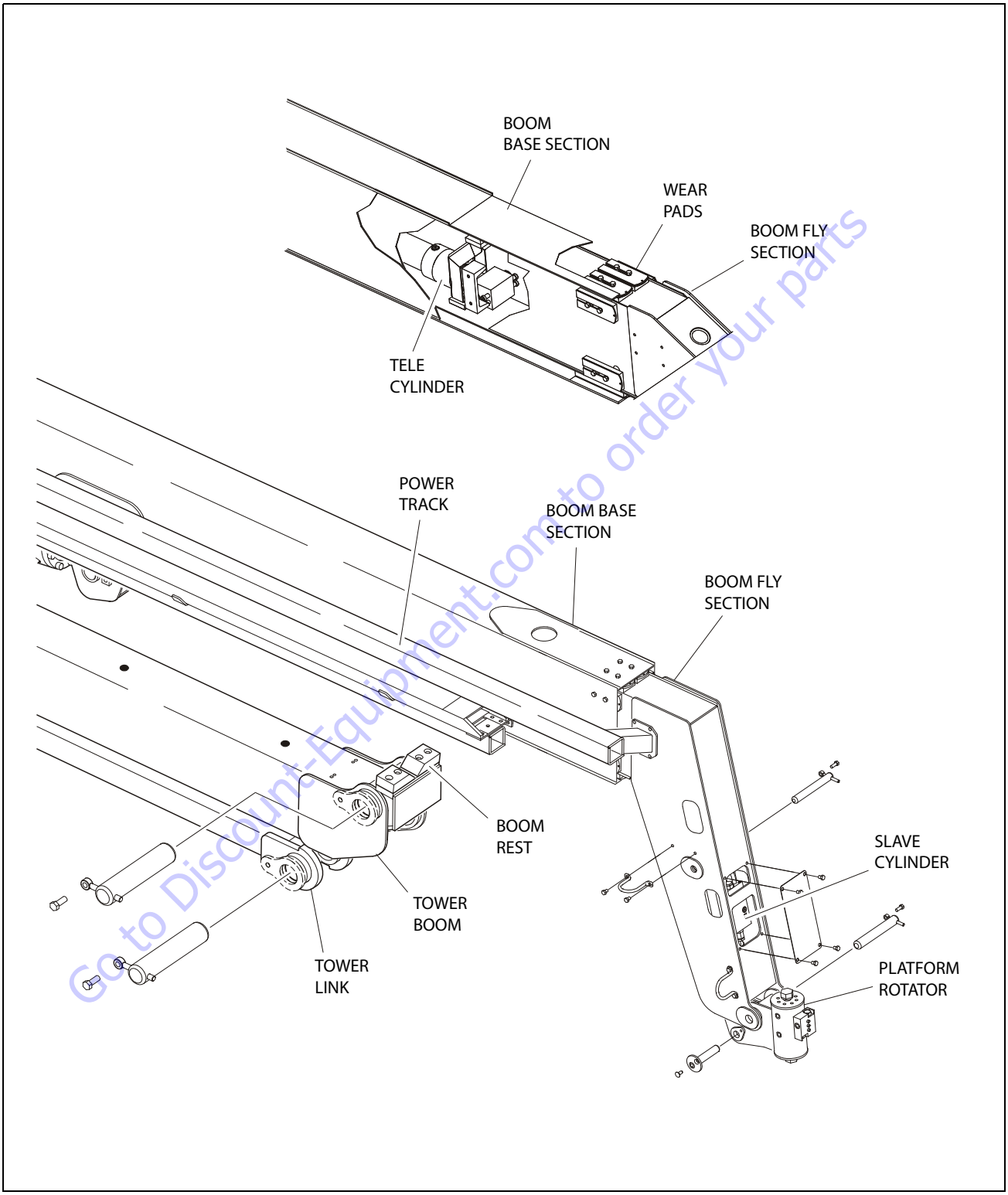


Figure 4-4. Boom Assembly - Sheet 2 of 3

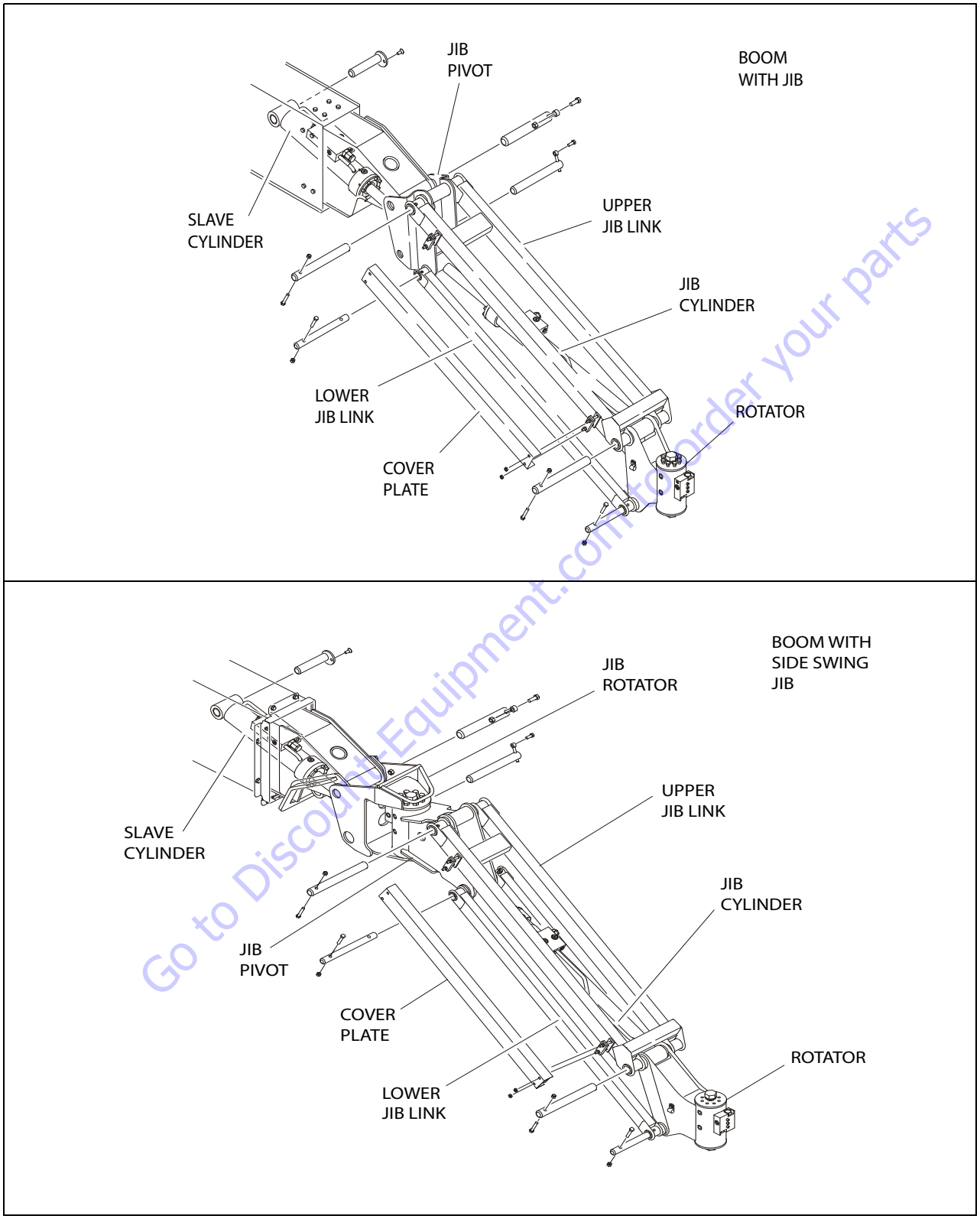
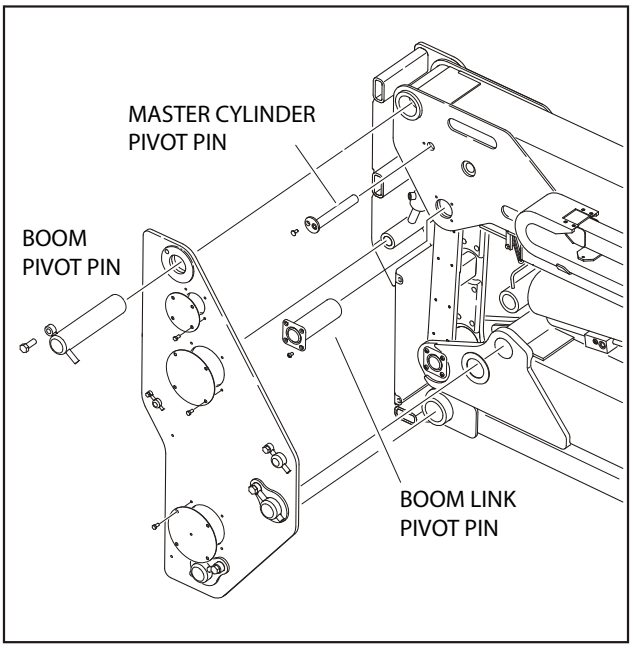


Figure 4-5. Boom Assembly - Sheet 3 of 3



13. Remove the upper master cylinder pivot pin.
14. Remove the boom pivot pin.
15. Remove the boom link pivot pin.

NOTE: *The main boom assembly weighs approximately 1993 lbs. (904 kg).*

16. Using an adequate lifting device, remove the boom from the machine.

Installation

1. Using an adequate lifting/supporting device, position the boom into the proper position on the upright.
2. Install the boom link pivot pin.
3. Install the boom pivot pin.
4. Install the upper master cylinder pivot pin.
5. Install the upper lift cylinder pivot pin.
6. Connect the hydraulic lines running to the master cylinder as tagged during removal.
7. Connect the hydraulic lines running to the telescope cylinder as tagged during removal.
8. Install the covers on the side of the upright to conceal the pivot pins.
9. Install the rear cover on to the upright.
10. Connect all the hydraulic and electrical lines at the bulkhead fitting at the rear of the boom.

NOTE: *Steps 10 and 11 are only applicable if the machine is equipped with a jib.*

11. Position the jib to the pivot points and install the jib-pivot pin and the slave cylinder pivot pin.
12. Connect the hydraulic lines running to the jib cylinder as tagged during removal. If equipped with a side swing jib, connect the hydraulic lines running to the jib rotator.
13. Install the platform support and platform.
14. Install the hydraulic lines to the platform valve and rotator as tagged during removal.
15. Reconnect the electrical leads at the platform and platform valve as tagged during disassembly.
16. Cycle test the boom from the ground station to ensure all functions operate properly.
17. After verifying that all functions operate properly from the ground station, cycle test the boom from the platform station to ensure all functions operate properly from the platform station as well.

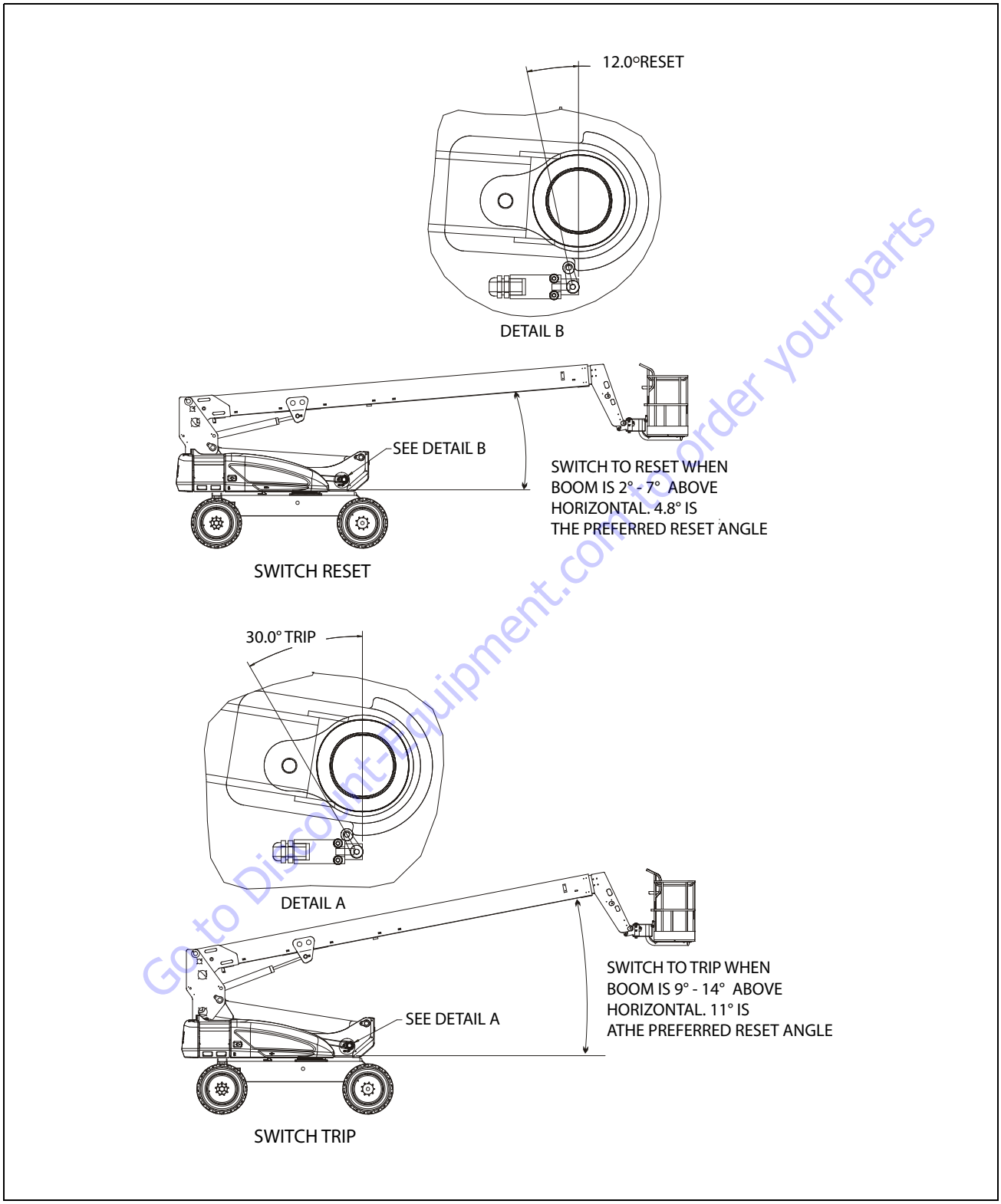


Figure 4-6. Boom Limit Switch Adjustment

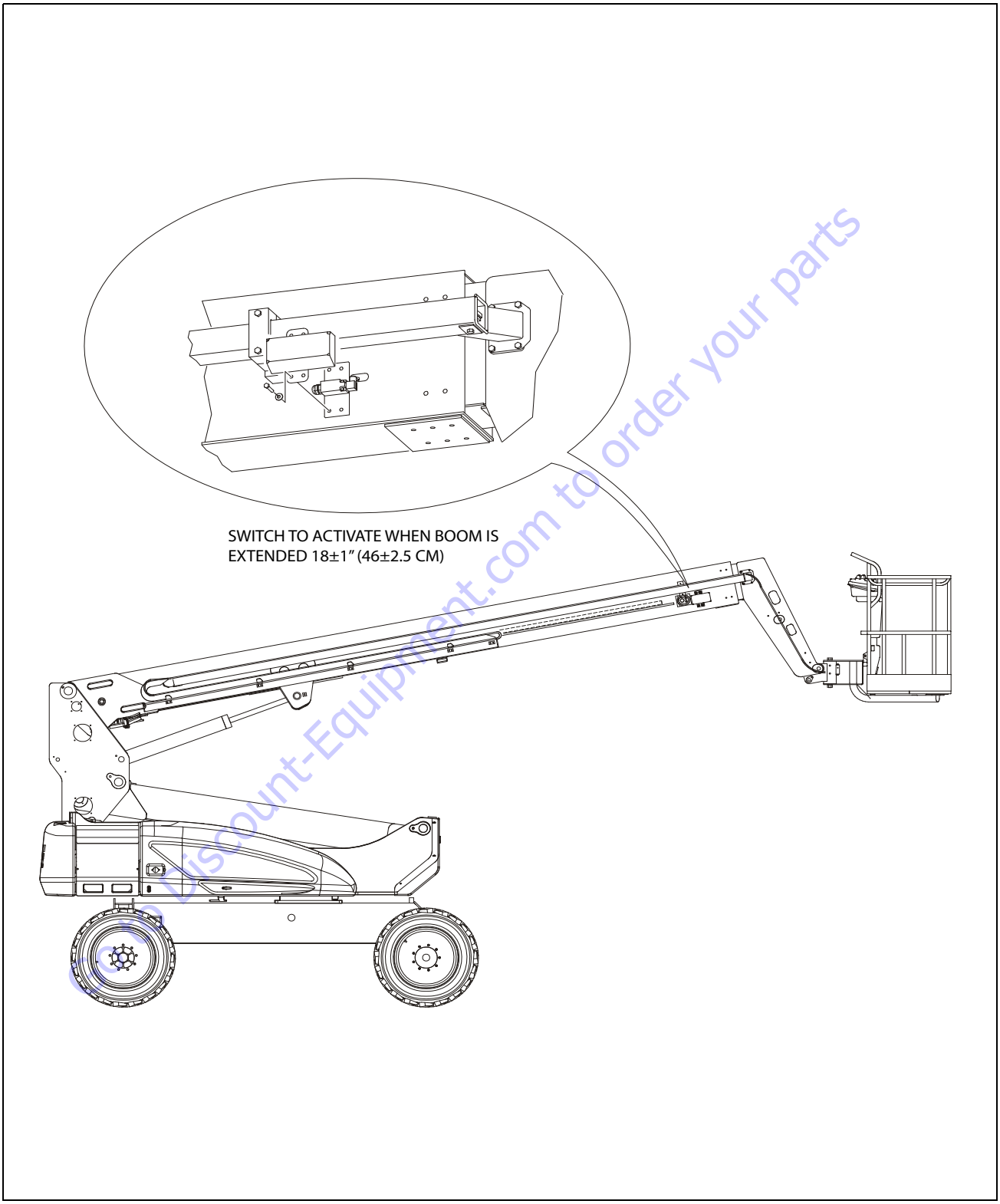


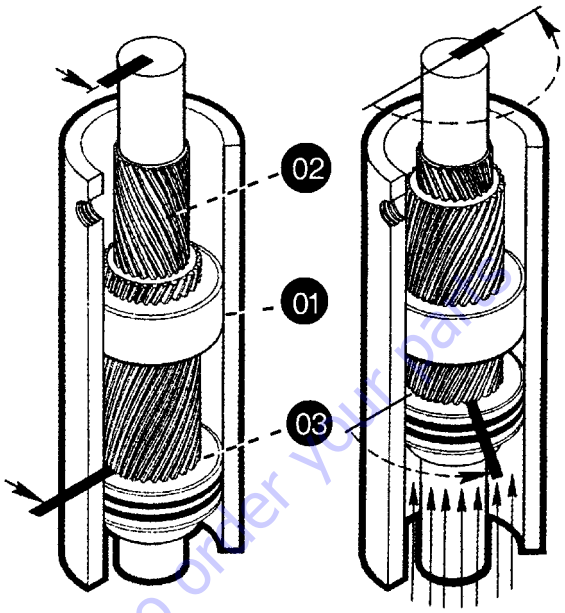
Figure 4-7. Transport Limit Switch (CE Only)

4.3 PLATFORM ROTATOR

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.



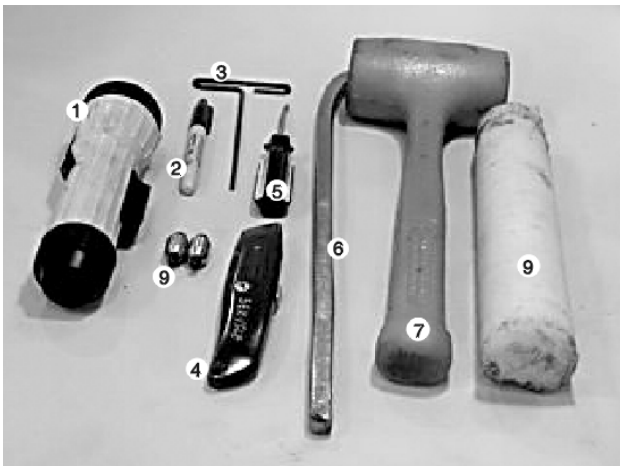
Bars indicate starting positions of piston and shaft. Arrows indicate direction they will rotate. The housing with integral ring gear remains stationary.

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.

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.

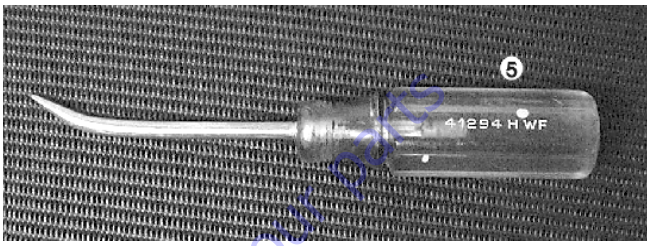
Tools Required for Assembly/Disassembly

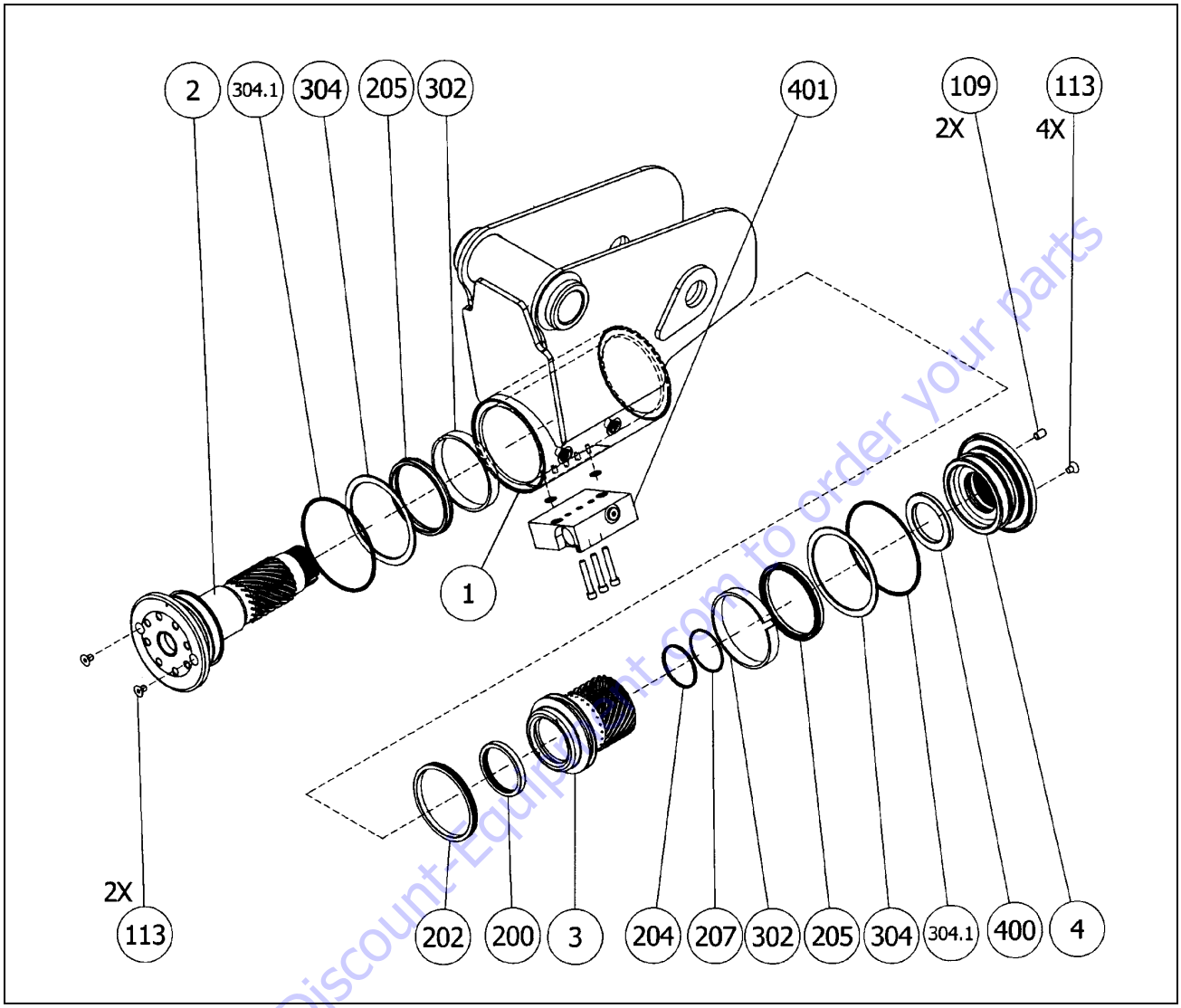
Upon assembly and disassembly of the actuator there are basic tools required. The tools and their intended functions are as follows:



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).

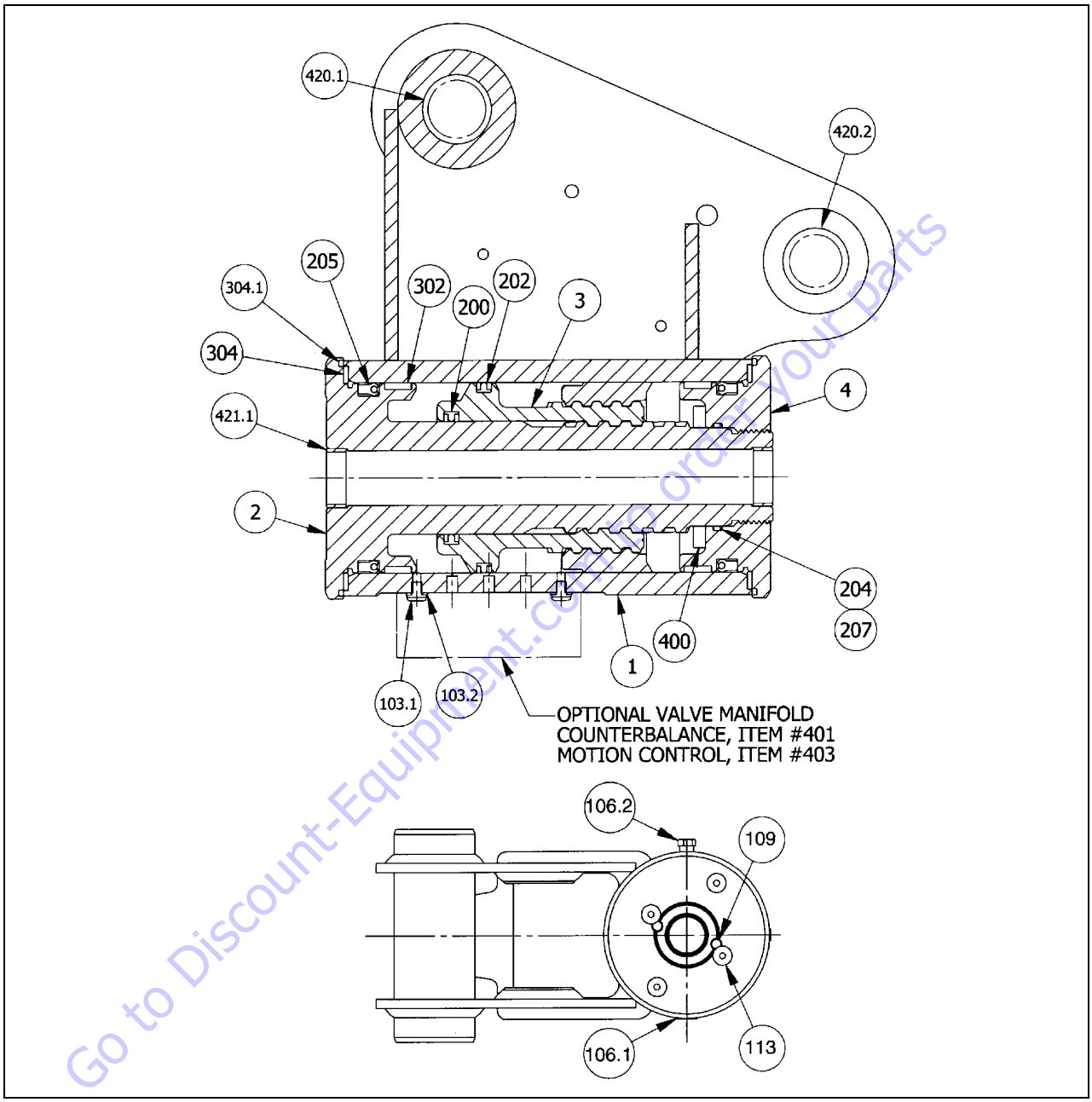
The seal tool is merely a customized standard flat head screwdriver. To make this tool you will need to heat the flat end with a torch. Secure the heated end of the screwdriver in a vice and physically bend the heated end to a slight radius. Once the radius is achieved round off all sharp edges of the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





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 4-8. Rotary Actuator (Exploded View)

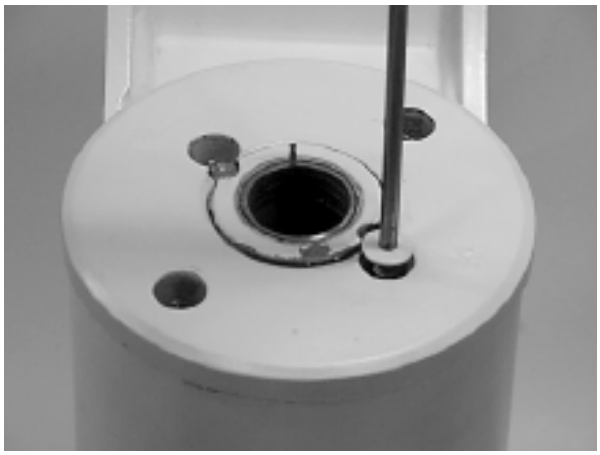


PARTS	HARDWARE	SEALS	BEARINGS	ACCESSORIES
1. Housing	103.1. Screw	200. T-Seal	302. Wear Guide	400. Stop Tube
2. Shaft	103.2. Washer	202. T-Seal	304. Thrust Washer	420.1 Bushing
3. Piston Sleeve	106.1. Port Plug	204. O-ring		420.2 Bushing
4. End Cap	106.2. Port Plug	205. Cup Seal		421.1 Bushing
	109.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

Figure 4-9. Rotator- Assembly Drawing

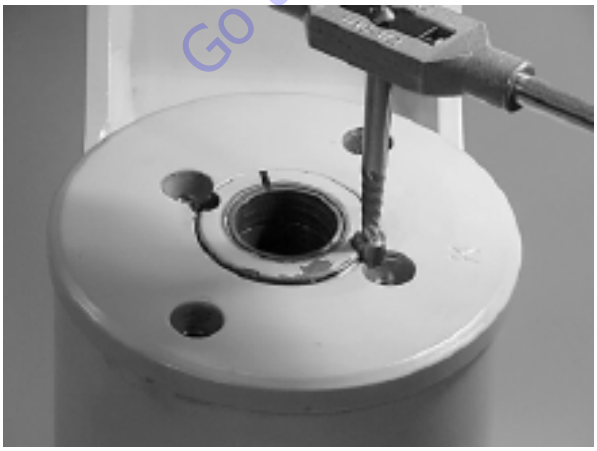
Disassembly

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.



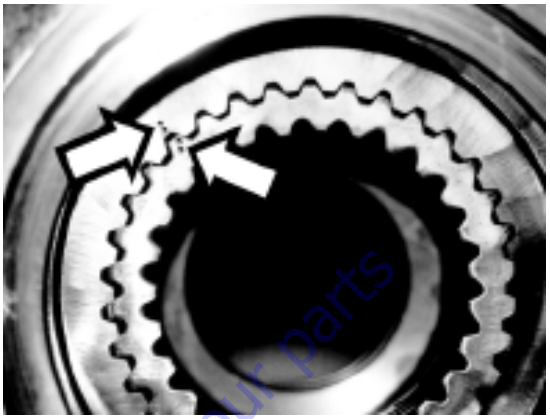
4. Install the end cap (4) removal tools provided with the Helac seal kit.

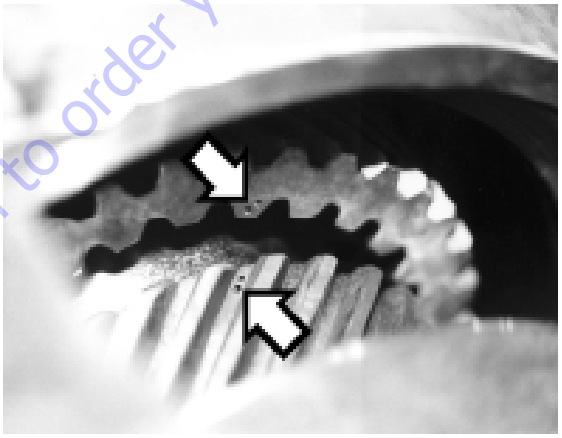
5. Using a metal bar, or something similar, un-screw the end cap (4) by turning it counter clock-wise.

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

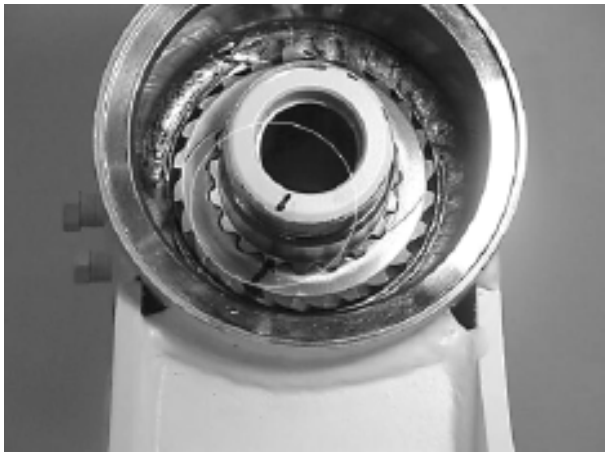
7. Remove the stop tube if included. The stop tube is an available option to limit the rotation of the actuator.

8. Every actuator has timing marks for proper engagement.

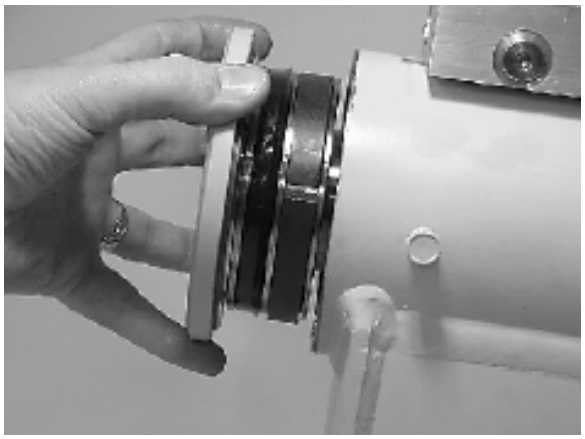




9. Prior to removing the shaft, (2), use a felt marker to clearly indicate the timing marks between shaft and piston. This will greatly simplify timing during assembly.

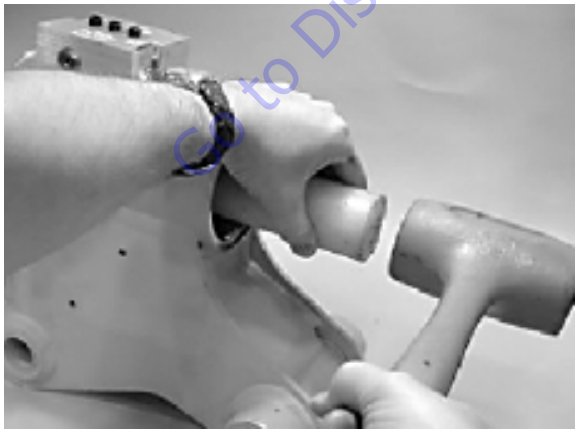


10. Remove the shaft (2). It may be necessary to strike the threaded end of the shaft with a rubber mallet.



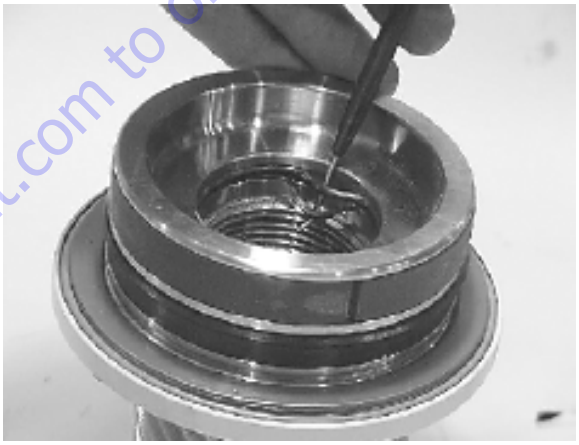
11. Before removing the piston (3), mark the housing (1) ring gear in relation to the piston O.D. gear. There should now be timing marks on the housing (1) ring gear, the piston (3) and the shaft (2).

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

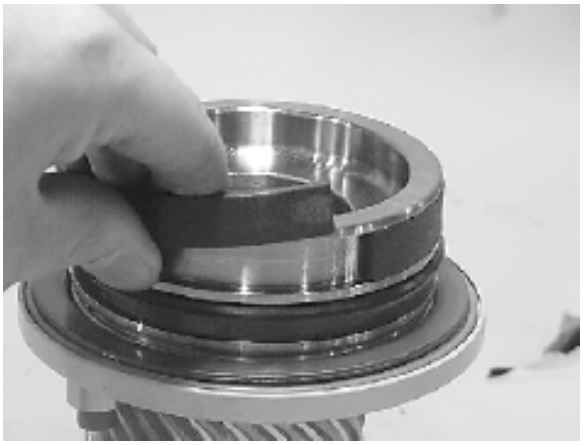


13. At the point when the piston gear teeth come out of engagement with the housing gear teeth, mark the piston and housing with a marker as shown.

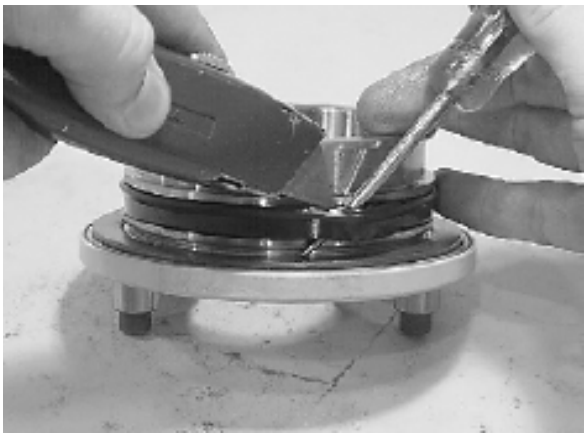
14. Remove the o-ring (204) and backup ring (207) from end cap (4) and set aside for inspection.



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).

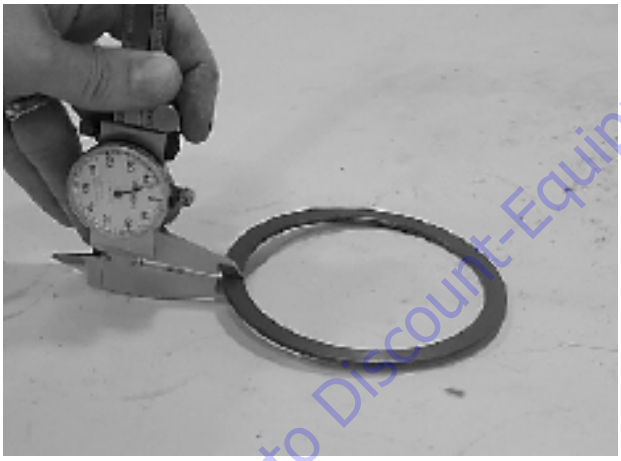
19. Remove the piston O.D. seal (202).

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).

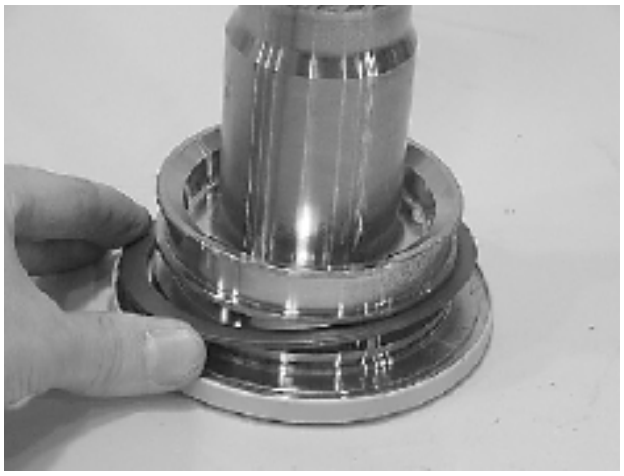


3. Inspect the wear guide condition and measure thickness (not less than 0.123" or 3.12 mm).

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.

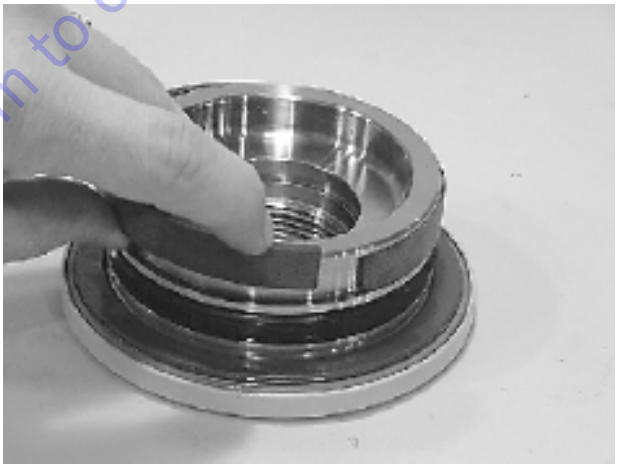
2. Install the thrust washer (304) onto shaft (2) and end cap (4).



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.

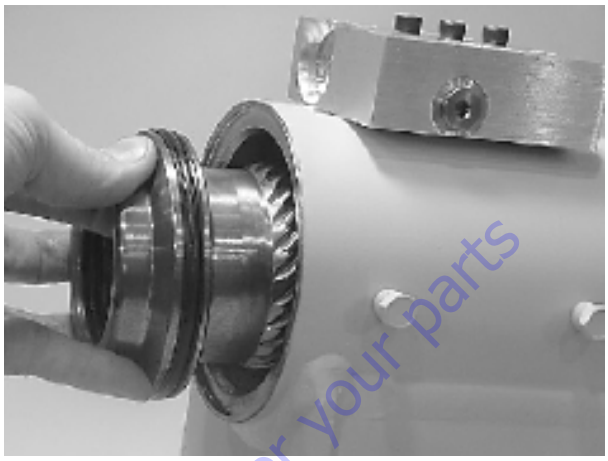
5. Install the wear guide (302) on the end cap (4) and shaft (2).



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).

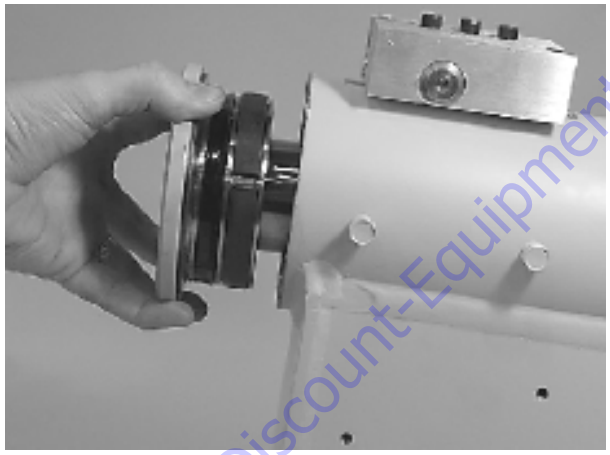
8. Insert the piston (3) into the housing (1) as shown, until the outer piston seal (202) is touching inside the housing bore.



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.

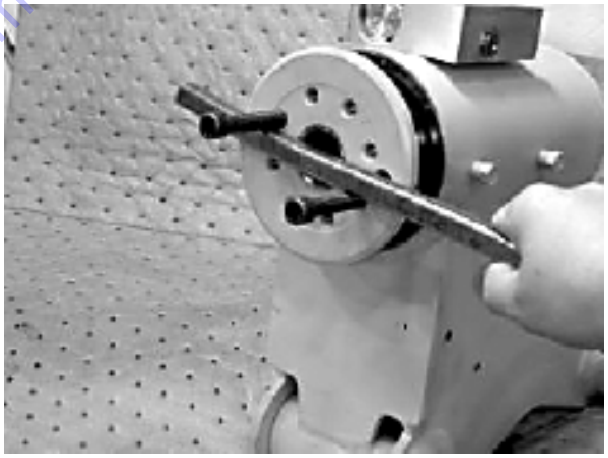
10. Looking from the opposite end of the housing (1) you can see if your timing marks are lining up. When they do, tap the piston (3) in until the gear teeth mesh together. Tap the piston into the housing the rest of the way until it bottoms out.

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



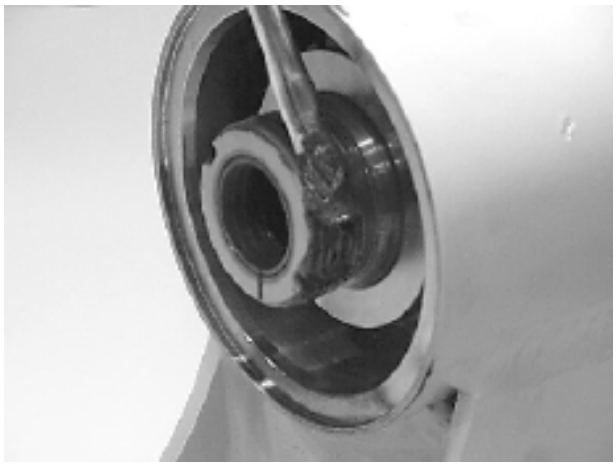
12. Looking from the view shown, use the existing timing marks to line up the gear teeth on the shaft (2) with the gear teeth on the inside of the piston (3). Now tap the flange end of the shaft with a rubber mallet until the gear teeth engage.

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.



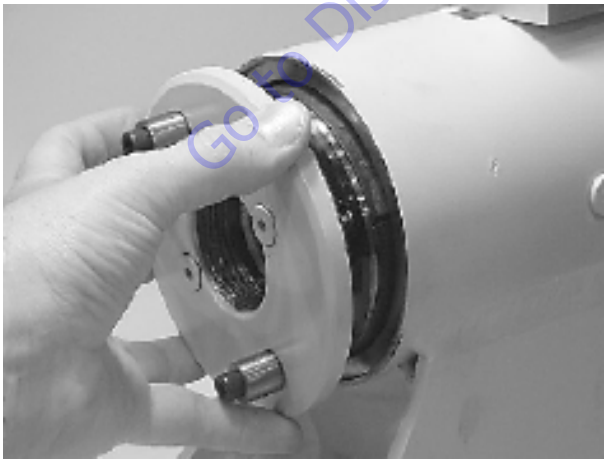
14. Install the stop tube onto the shaft end. Stop tube is an available option to limit the rotation of an actuator.

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

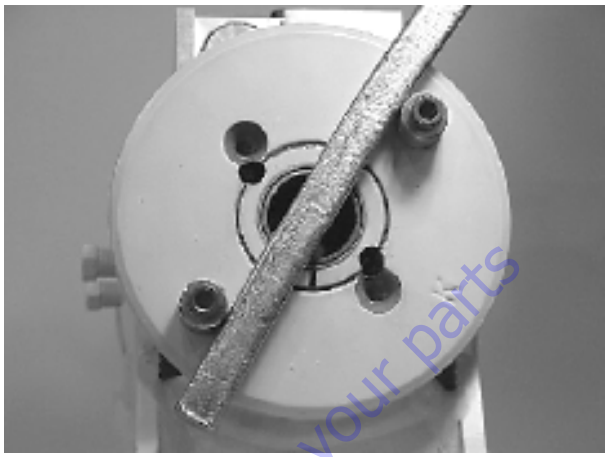


16. Install the O-ring (204) and back-up ring (207) into the inner seal groove on the end cap (4).

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).

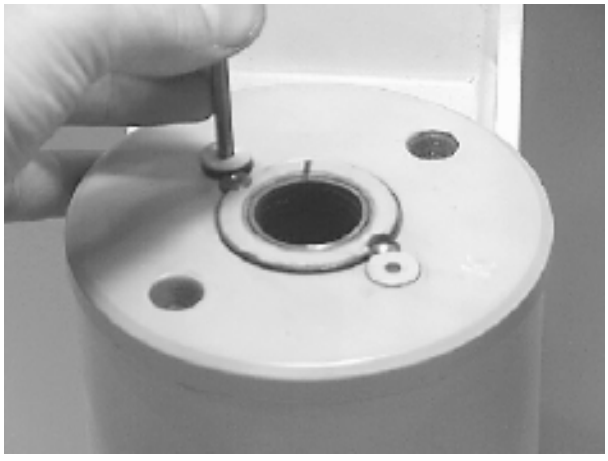


18. Tighten the end cap (4). In most cases the original holes for the lock pins will line up.



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).



Greasing Thrust Washers

1. After the actuator is assembled but before it is put into service, the thrust washer area must be packed with Lithium grease.
2. 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.

3. 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).

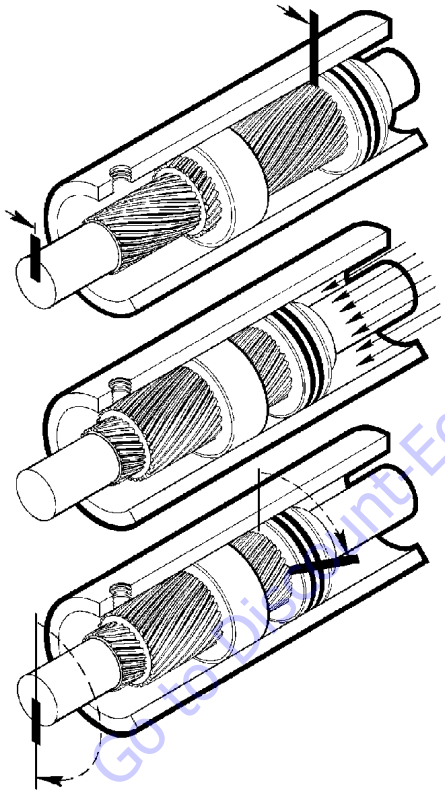
4.4 JIB ROTATOR

Operating Principle

Helac's helical hydraulic rotary actuators use our sliding spline technology which converts linear piston motion into powerful shaft rotation. The actuators are composed of a housing and only two moving parts, the central shaft and the annular piston. Helical spline teeth machined on the shaft engage matching splines on the inside diameter of the piston. The outside diameter of the piston carries a second set of splines, of opposite hand, which engage matching splines in the housing's ring gear. As hydraulic pressure powers the piston back and forth within the housing – similar to the operation of a hydraulic cylinder – the splines cause the shaft to rotate.

Disassembly

1. Remove all hydraulic fittings Drain the oil from both sides of the piston through the pressure ports.
2. Place the actuator horizontally on a clean work bench with ample room to place the internal parts as they are removed.
3. Unthread the socket head cap screws (102) from the lockwasher (05). Remove the lock washer from the shaft (02).
4. Secure the actuator firmly to the work surface to prevent movement. A pipe vise works well. Insert two long screws (1/4-20) into the end cap (04) and, using a pry bar, unthread the end cap from shaft by turning in a counterclockwise direction as shown below.



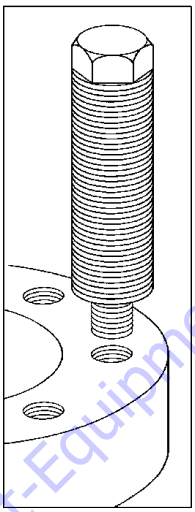
Bars indicate starting positions of piston and shaft. Arrows indicate direction they will rotate. The housing's ring gear remains stationary.

As fluid pressure is applied, the piston is displaced axially while, simultaneously.

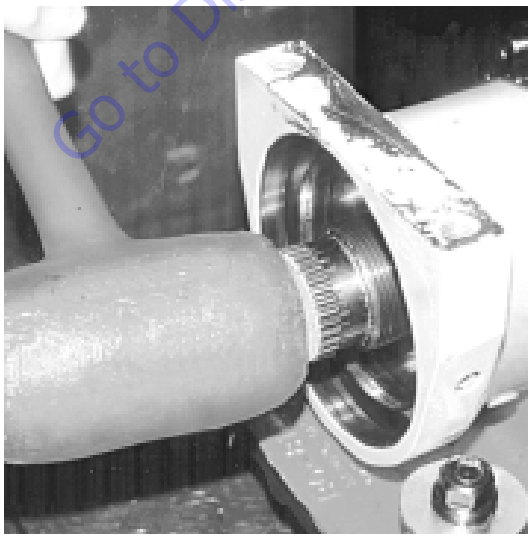
The helical gearing forces the rotation of the shaft. Note how the double helix design compounds rotation: shaft rotation is about twice that of the piston.

Figure 4-10. Operating Principle - Jib Rotator

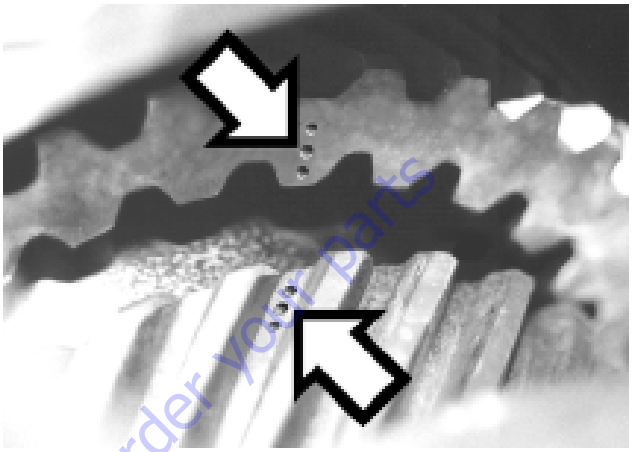
A considerable amount of torque may be required to loosen the end cap. Completely filling the length of the screws with a stack of washers or a bushing as seen in the illustration to the right will permit more force to be applied to the screws and prevent them from bending – be sure to thread the screws completely into the endcap. If the end cap is difficult to break loose, special tooling may be fabricated according to the drawing below



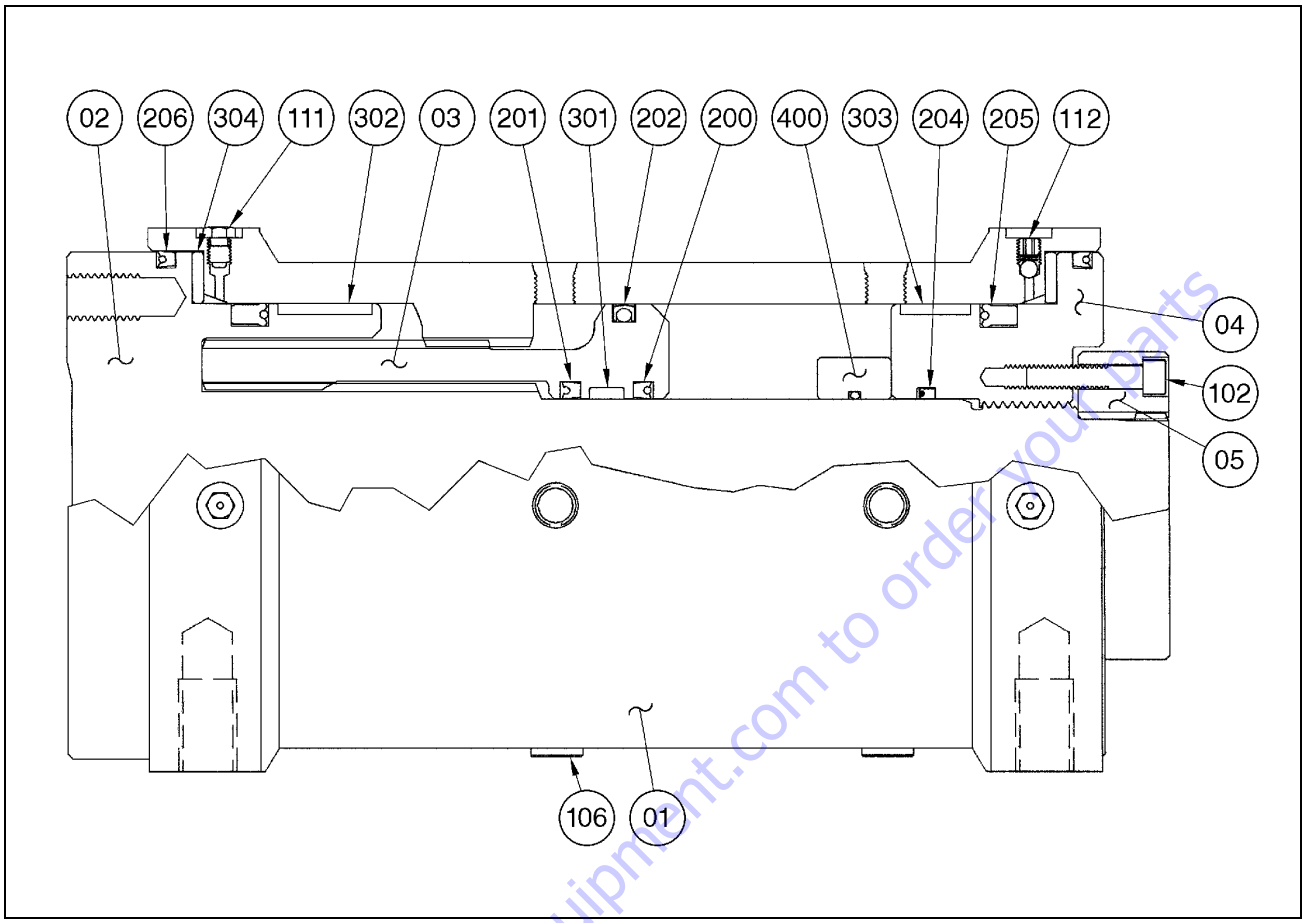
5. Remove the shaft from the housing assembly by driving it out with a plastic hammer as seen below.



Before the shaft and piston gearing are completely disengaged, note the orientation between the spline teeth: small punch marks on the face of the piston and the root of a spline tooth on the shaft gearing indicate timing as seen below



Marking the teeth at this time with a permanent felt tip marker will make the marks easier to see and greatly simplify actuator timing during reassembly. For 120° rotation actuators, remove the stop tube from the shaft before removing the shaft from the housing. Do not remove the 0-ring from the stoptube. It performs no sealing functions and should be reused when the actuator is reassembled.



1. Housing
2. Shaft
3. Piston Sleeve
4. End Cap
5. Locking
102. Socket Head Capscrew
106. Port Plug
111. Grease Fitting
112. Grease Relief Valve
400. Stop Tube
200. Rod Seal
201. Rod Seal
202. Piston Seal
204. Cap Seal
205. Bearing Seal
206. Exclusion Seal
301. Piston Bearing
302. Shaft Bearing
303. Shaft Bearing
304. Thrust Washer

Figure 4-11. Jib Rotator Assembly

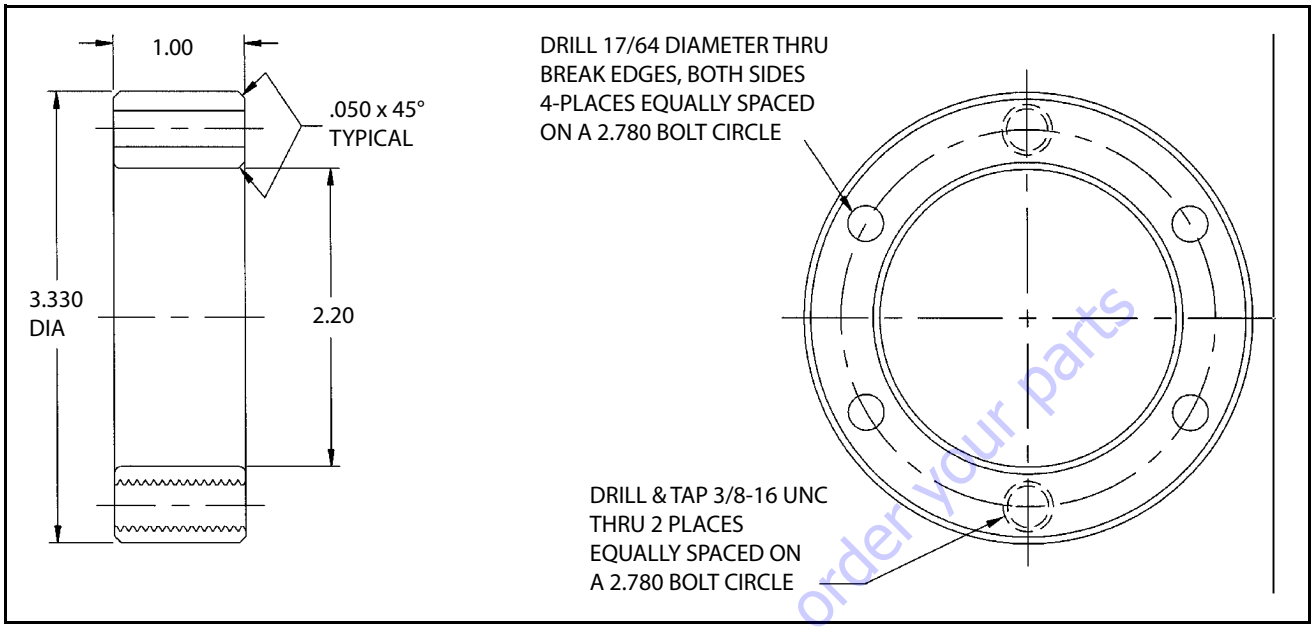
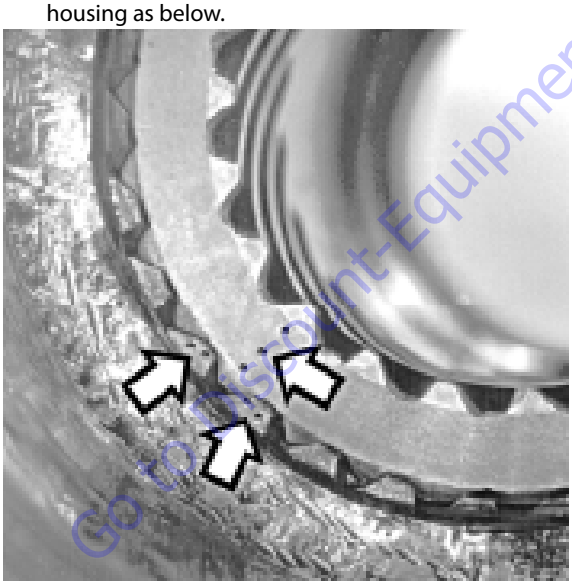
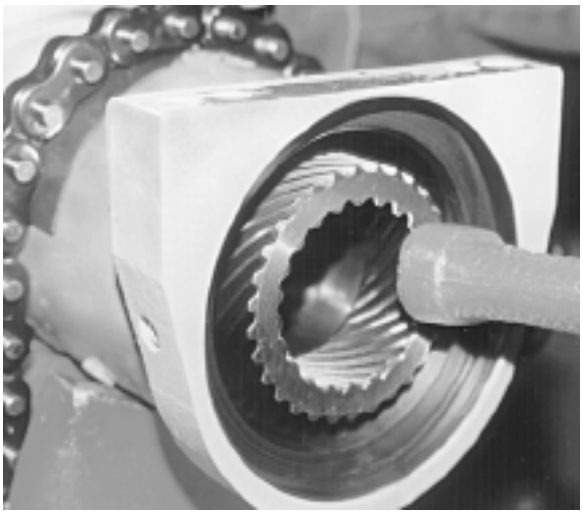


Figure 4-12. Tool for Removing End Cap

6. With the shaft removed, note the orientation of the timing marks on the piston sleeve and ring gear in the housing as below.



The adjacent weld can make the ring gear timing marks difficult to locate; using a light can help. Again, mark the teeth with a felt tip marker to make the marks easier to see and to simplify timing during reassembly. Drive the piston sleeve out of the housing using the handle of a rubber mallet as shown below.



Support the piston sleeve as it is removed from the housing. Great care should be taken to insure that the gear teeth are not damaged and the piston sleeve does not damage the housing bore as it i removed.

7. Remove all seals and bearings from their grooves. Note the orientation of the sealing lips prior to removal.

8. Clean all components thoroughly with solvent or in a parts washer. Be sure to flush all grease and contaminants from the grease fittings and grease relief passages.

Inspection

Inspect all parts for wear, damage, cracks, etc.

HOUSING

Inspect the cylinder bore for wear and scratches. The surface finish should be 32 RMS or better. Rehone if necessary. Minor scratches and damage can be repaired by local polishing. Inspect all bearing contact surfaces for damage and/or contamination and repair and clean as necessary. Inspect the exterior of the housing for damage, cracks, integrity of welds, etc.

SHAFT

Check the sealing surface of the shaft for scratches and damage. Polish if necessary.

GEAR COMPONENTS

Check gearing for excessive wear. Nominal movement between gear components in excess of 1.5 degrees can result in sloppy response.

BEARINGS

All radial bearings are of a reinforced nylon material. If the thickness measures less than 0.123 in. (3.125 mm), the bearings should be replaced.

THRUST WASHERS

Manufactured from an orkot material. If the thickness measures less than 0.113 in. (2.870 mm), or if contaminants are noticed imbedded in the material, the thrust washers should be replaced.

Reassembly

It is recommended that you first practice assembling the actuator with the bearings and thrust washers installed but without the seals. The seals are easily damaged and their increased friction makes assembly more difficult. Be sure that the timing marks on the gear components are engaged in the correct orientation. Mark the timing marks with a felt tip marker for better visibility to make assembly easier.

1. Wash all parts thoroughly in cleaning solvent and blow dry.

2. Pump a high quality NLGI-2 lithium based grease into the grease fittings (111) to flush any contaminants out of the fittings and passages and to insure the fittings are functioning properly. Replace any non functioning fittings. Wipe off all excess grease. The set screws of the relief valves (112) must be flush with the countersunk bore to ensure proper tension on the spring as seen in Photo F. If the set screws are threaded in too far, the seals will be extruded during greasing and damaged. Secure the set screws with Loctite# 242.

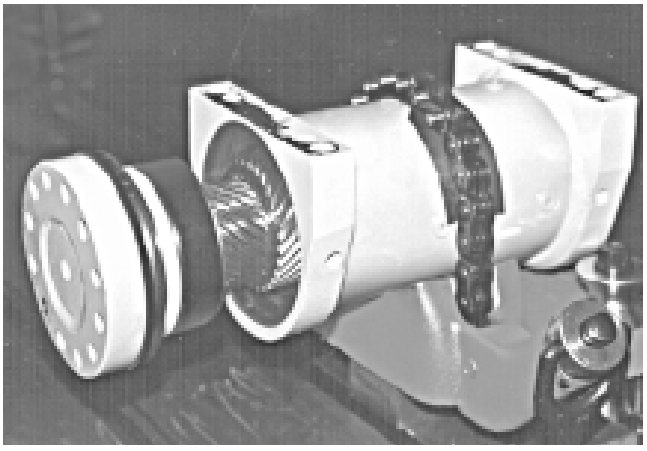
3. Lightly coat the thrust washers (304) with grease and install them on the shaft (02) and end cap (04) prior to seal installation.

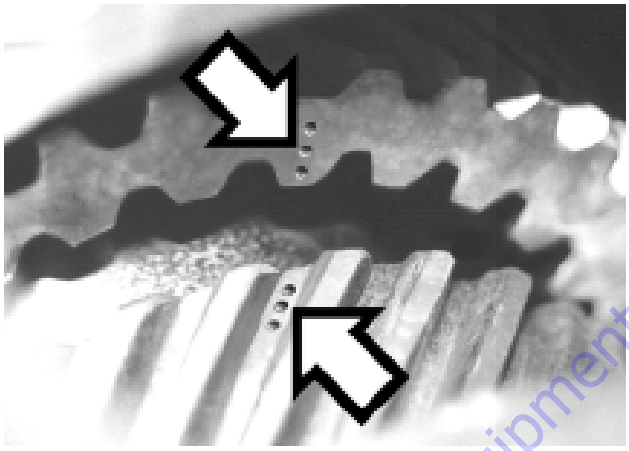
4. Lightly coat all sealing and working surfaces with a good grade of hydraulic oil.

5. Install all seals in their respective grooves. Refer to the Assembly Drawing on page 2 to ensure the correct orientation of all seals. Note that the 0-ring energizer should be removed from seal (201) on the inside diameter of the piston nearest the piston splines. This prevents pressure from being trapped between seals (200) and (201).

6. With the housing positioned horizontally and firmly secured to prevent movement, insert the piston sleeve into the housing bore until the piston seal contacts the housing chamfer. Look through the opposite side (shaft flange side) of the housing bore and rotate the piston sleeve as necessary to align the timing marks on the housing ring gear and piston sleeve. While holding the piston sleeve steady to prevent damage to the cylinder bore, drive the piston sleeve into the housing with a rubber mallet until the gear teeth engage. This assembly step is difficult and might require several attempts to successfully engage the gear teeth. Double check the timing marks and the engagement of the gear teeth to insure correct alignment, then drive the piston sleeve as far as possible into the housing until it comes to a stop against the ring gear.

7. Install the shaft as seen below in timed relation to the piston sleeve by aligning the punched timing marks as shown below. Temporarily taping the threaded portion of the shaft with masking tape will make it easier to clear the rod seals and prevent their damage Once the gear teeth are engaged, rotate the shaft clockwise until it is bottomed out against the piston sleeve. Using a rubber mallet, drive the shaft into the housing until the thrust washer comes to a stop against the housing thrust surface.





8. Remove the masking tape and apply anti-seize to the shaft threads.
9. Install the stop tube if applicable.
10. Apply a thin film of grease to the seals, then thread the end cap onto the shaft to a net fit where the end cap just begins to damp against the thrust washer. Tighten the end cap to approximately 120 FT-LB (163 N.m).
11. Apply a generous amount of anti-seize to the splines at the end of the shaft. Locate the correct position of the locknut to align its bolt circle with that of the end cap. If the bolt circles do not align, unthread the end cap no more than a half a pitch of the shaft splines. Insert the cap screws and torque to 108 IN-LB (147 N.m).
12. Grease the thrust washers. Pump a high quality NLGI-2 lithium based grease into the grease fittings at both ends of the housing until it begins to ooze from the grease reliefs. If possible, rotate the shaft during greasing to ensure even distribution on the thrust surfaces.

Installing Counterbalance Valve

Refer to Figure 4-13., 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 counter-bores 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.

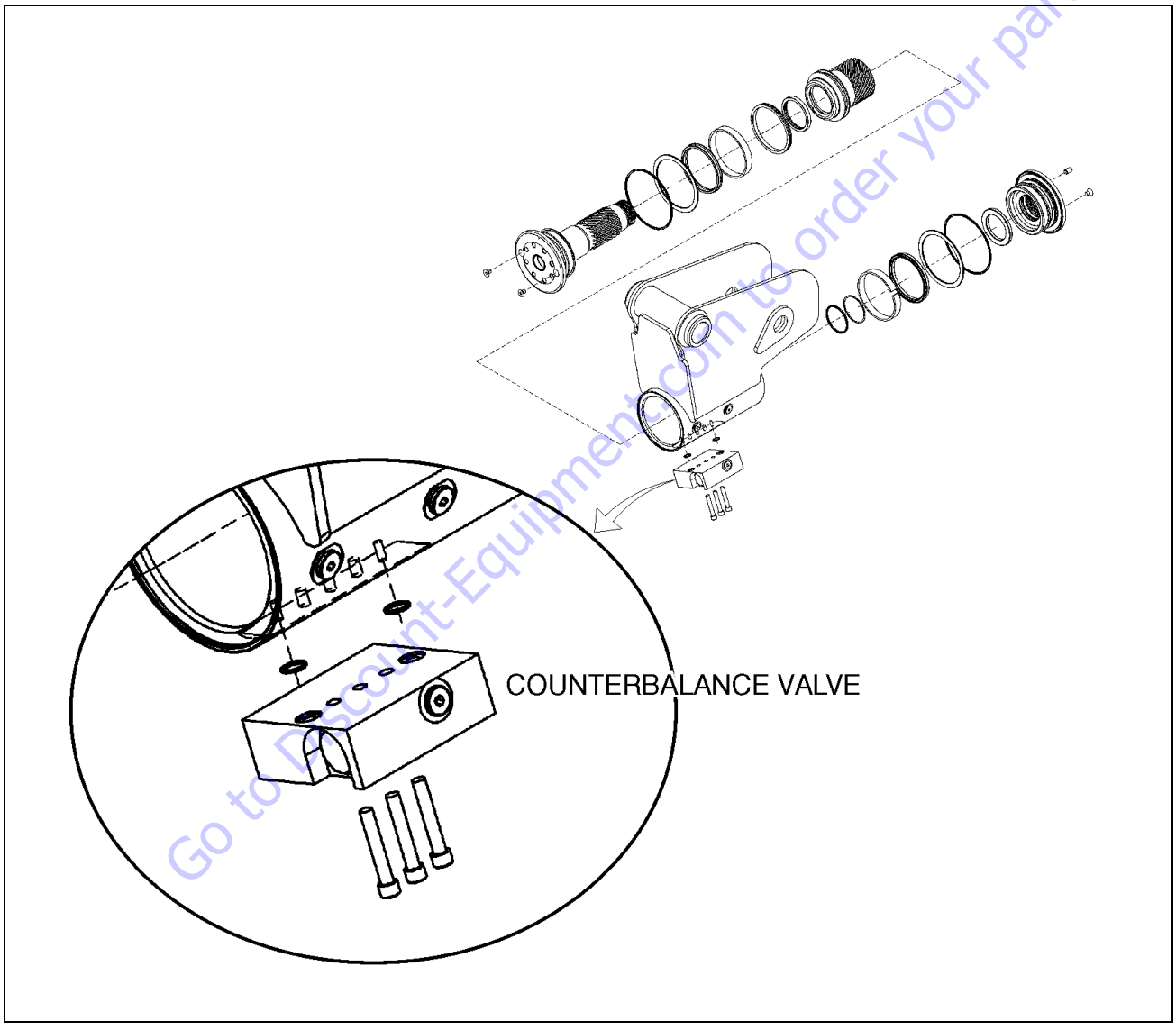


Figure 4-13. Rotator Counterbalance Valve

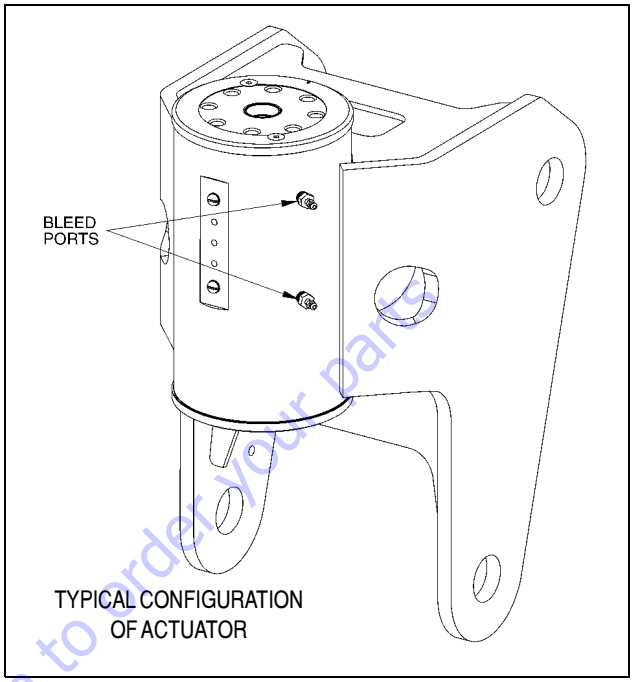
Testing the Actuator

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.



TYPICAL CONFIGURATION
OF ACTUATOR

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.
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.

Table 4-1. Troubleshooting

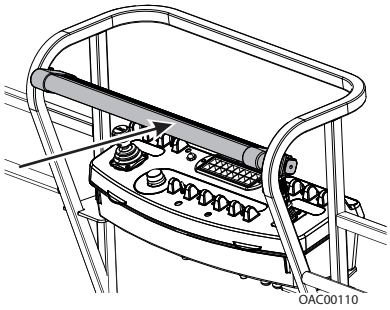
Problem	Cause	Solution
126. Shaft rotates slowly or not at all	a. Insufficient torque output	a. Verify correct operating pressure. Do not exceed OEM's pressure specifications. Load may be above maximum capacity of the actuator.
	b. Low rate of fluid flow	b. Inspect ports for obstructions and hydraulic 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.
127. Operation is erratic or not responsive	a. Air in actuator	a. Purge air from actuator. See bleeding procedures.
128. 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.
129. 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

4.5 SKYGUARD

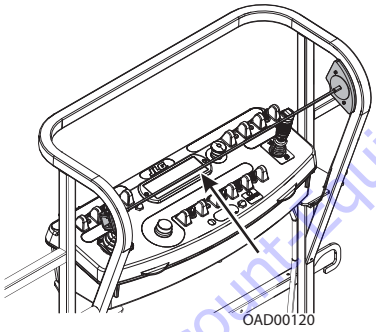
Operation

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.

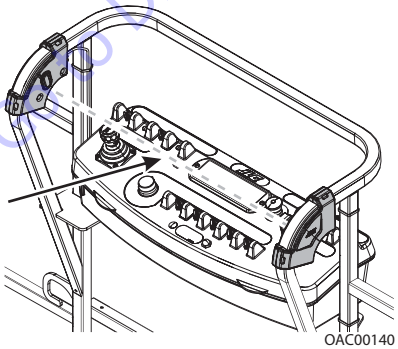
Consult the following illustrations to determine which type of SkyGuard the machine is equipped with. Regardless of the type, SkyGuard function according to the SkyGuard Function Table does not change.



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 6-15 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	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	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											

4.6 BOLT-ON EXTERNAL FALL ARREST

The Bolt-On External Fall Arrest system is designed to provide a lanyard attach point while allowing the operator to access areas outside the platform. Exit/Enter the platform through the gate area only. The system is designed for use by one person.

Personnel must use fall protection at all times. A full body harness is required with lanyard not to exceed 6 ft. (1.8 M) in length, that limits the maximum arrest force to 900 lbs. (408 kg).

Bolt-On External Fall Arrest system capacity is 310 lb (140 kg) - one (1) person maximum.

Do not move the platform during use of the Bolt-On External Fall Arrest system.

⚠ WARNING

DO NOT OPERATE ANY MACHINE FUNCTIONS WHILE OUTSIDE OF PLATFORM. BE CAREFUL WHEN ENTERING/EXITING THE PLATFORM AT ELEVATION.

⚠ WARNING

IF THE BOLT-ON EXTERNAL FALL ARREST SYSTEM IS USED TO ARREST A FALL OR IS OTHERWISE DAMAGED, THE ENTIRE SYSTEM MUST BE REPLACED AND THE PLATFORM FULLY INSPECTED BEFORE RETURNING TO SERVICE. REFER TO THE SERVICE MANUAL FOR REMOVAL AND INSTALLATION PROCEDURES.

THE BOLT-ON EXTERNAL FALL ARREST SYSTEM REQUIRES AN ANNUAL INSPECTION AND CERTIFICATION. THE ANNUAL INSPECTION AND CERTIFICATION MUST BE PERFORMED BY A QUALIFIED PERSON OTHER THAN THE USER.

Inspection Before Use

The Bolt-On External Fall Arrest system must be inspected before each use of the aerial work platform. Replace components if there are any signs of wear or damage.

Before each use, perform a visual inspection of the following components:

- Cable: Inspect cable for proper tension, broken strands, kinks, or any signs of corrosion.

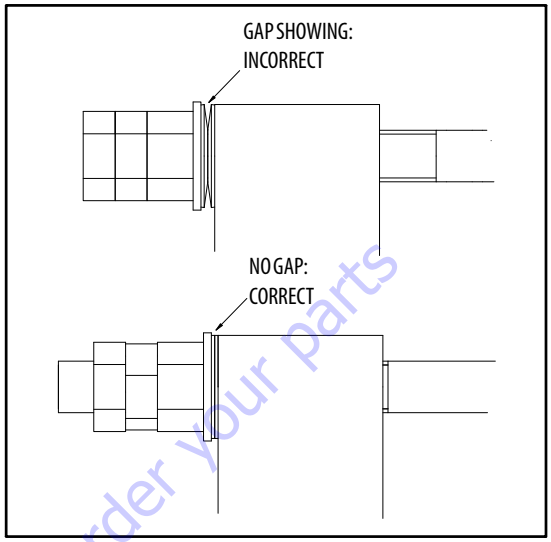
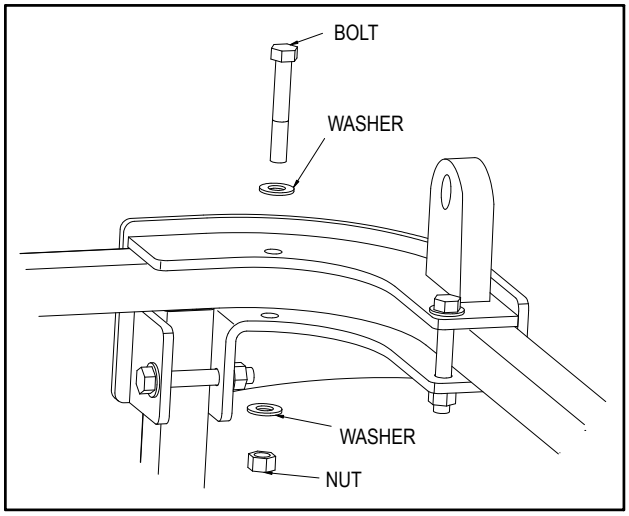


Figure 4-14. Bolt-On External Fall Arrest Cable Tension

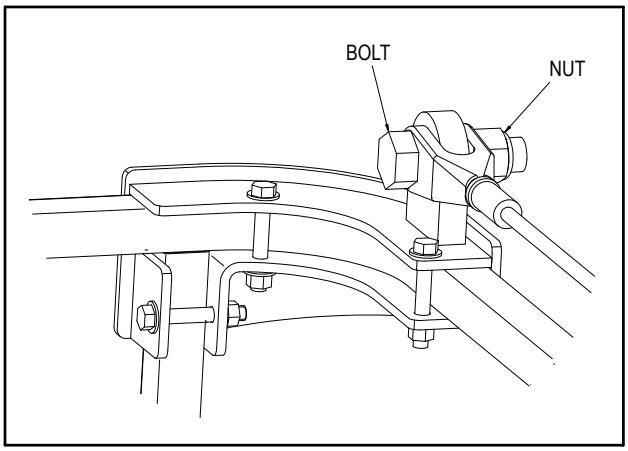
- Fittings & Brackets: Ensure all fittings are tight and there are no signs of fractures. Inspect brackets for any damage.
- Attachment Ring: No cracks or signs of wear are acceptable. Any signs of corrosion requires replacement.
- Attaching Hardware: Inspect all attaching hardware to ensure there are no missing components and hardware is properly tightened.
- Platform Rails: No visible damage is acceptable.

Installation

1. Install the retaining hardware (bolts, nuts, and washers) and secure the brackets to the platform rail. Tighten the nuts but do not torque them yet.

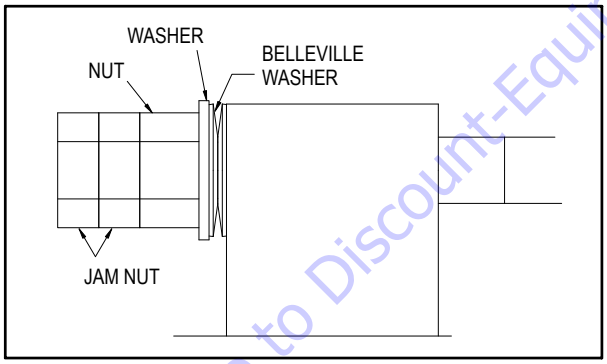


2. Attach the fall arrest cable to the right hand bracket Using the attaching bolt and nut. Orient the bolt as shown below. Do not tighten the nut so cable can still rotate.

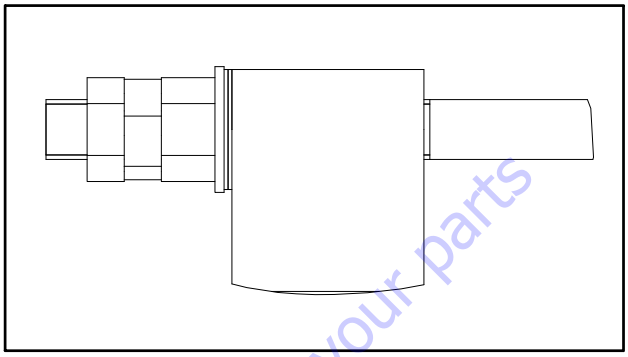


3. Install the Attachment Ring onto the cable.

4. Without twisting the fall arrest cable, pull it thru the left hand bracket and mark the top of the swaged cable end. Install the fall arrest cable through the left hand bracket and secure it using the belleville washers, washer, retaining nut, and jam nuts. Orient the hardware as shown below and with the belleville washers so the gap is present at the outside diameter of the washers. install the nuts onto the cable finger tight so the mark on the cable does not move.

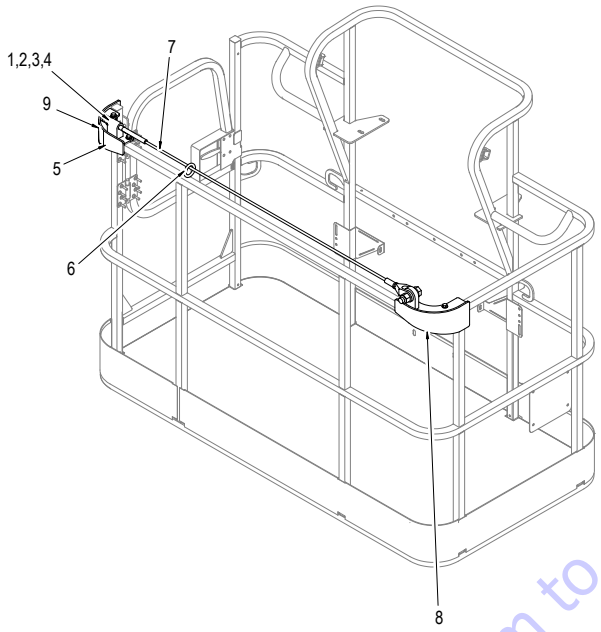


5. Use the two jam nuts to prevent the cable from rotating while the nut is tightened. Tighten the nut until the belleville washers are fully compressed and no gap is present at the outside diameter of the washers. Ensure the cable has not rotated during tightening.



6. Tighten the first jam nut against the retaining nut to keep the nut from loosening. Tighten the remaining jam nut against the first jam nut.

7. Torque the nuts and bolts securing the brackets to 15 ft.lbs. (20 Nm).



1. Belleville Washer
2. Washer
3. Hex Nut
4. Jam Nut
5. LH Bracket
6. Attachment Ring
7. Cable
8. RH Bracket
9. Decal

Figure 4-15. Bolt-On External Fall Arrest System

PARTS FINDER

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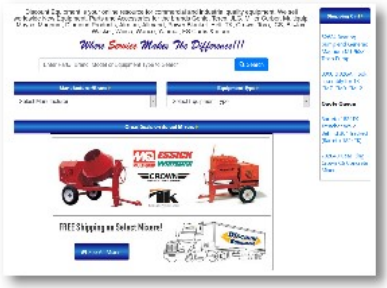

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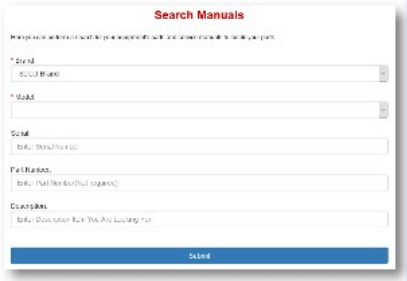

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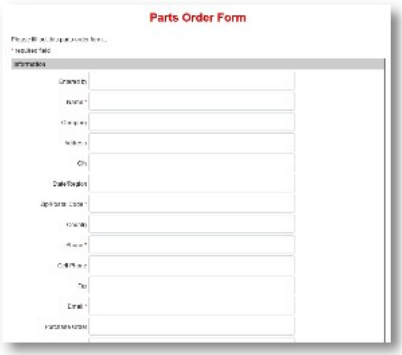

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SECTION 5. BASIC HYDRAULIC INFORMATION & SCHEMATICS

5.1 LUBRICATING O-RINGS IN THE HYDRAULIC SYSTEM

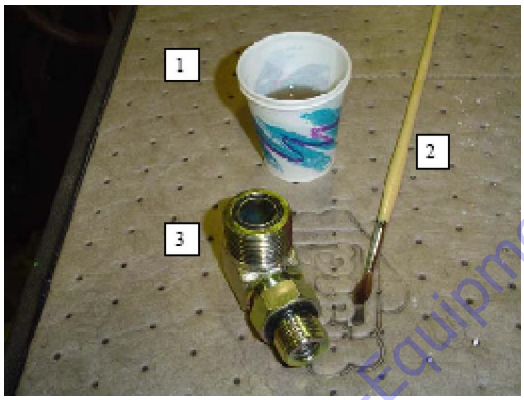
When assembling connectors in the hydraulic that use o-ring fittings, it is necessary to lubricate all fittings with hydraulic oil prior to assembly. To lubricate the fittings, use one of the following procedures.

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

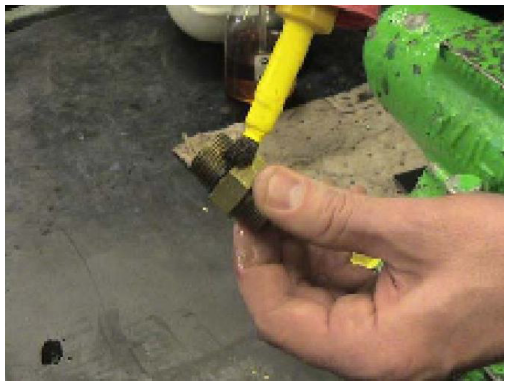
This method requires a pump or trigger spray bottle.

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

Axle Lockout Cylinder

DISASSEMBLY

NOTICE

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

⚠ WARNING

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

1. Open bleeder valve. Rotate rod and remove from barrel.
2. Remove wiper seal. Do not scratch barrel bore.
3. Remove two wear rings and rod seal from grooves of rod bore. Do not scratch barrel bore.
4. Remove counterbalance valve and fitting from the cylinder port block.

CLEANING AND INSPECTION

1. Inspect bore and rod for scoring, pitting, or excessive wear.
2. Remove minor surface blemishes with wet sandpaper. Pitting requires replacement of barrel and rod.
3. Clean all parts with approved solvent and dry with compressed air.

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.*

NOTICE

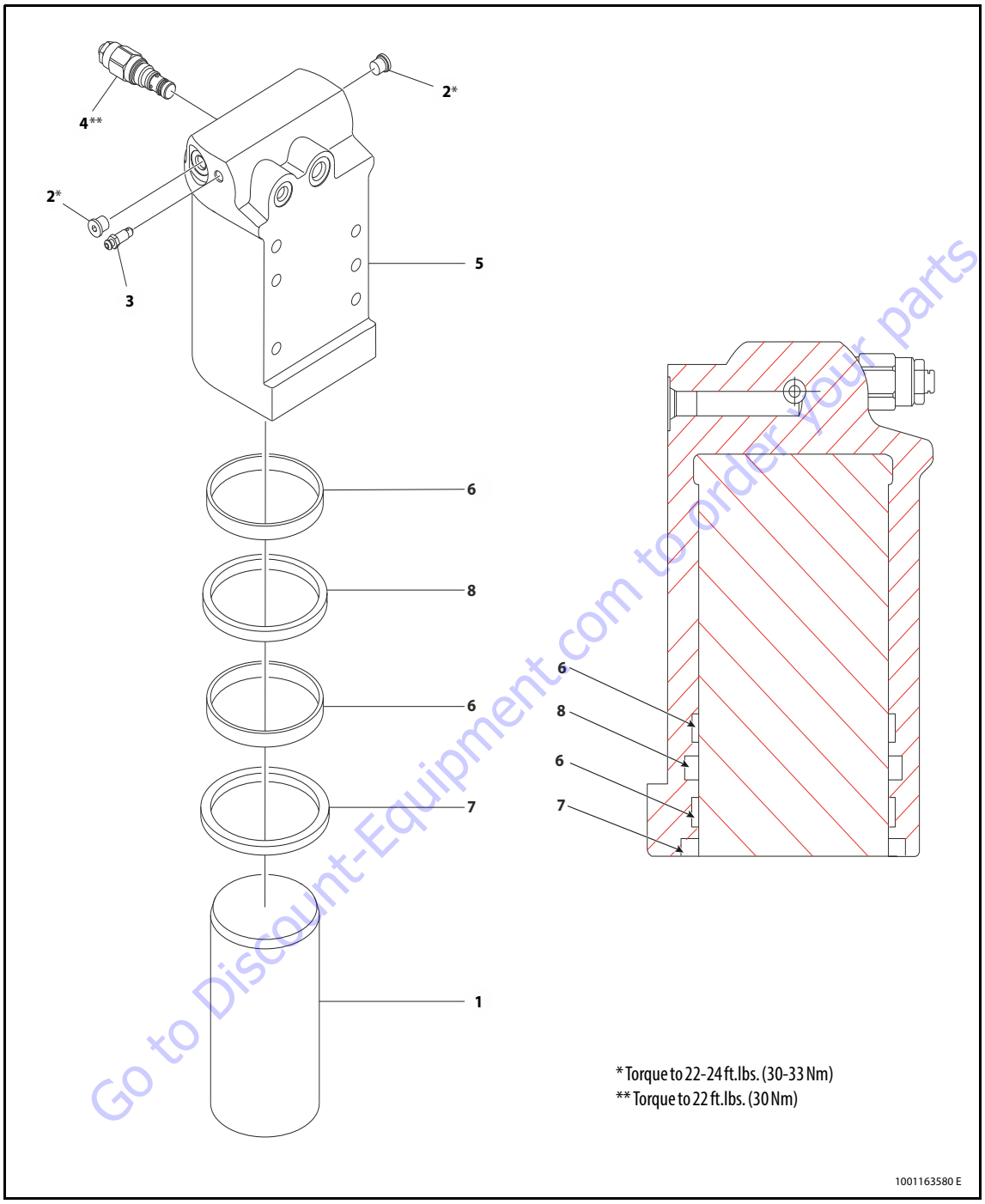
WHEN INSTALLING NEW SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

1. Install two new wear rings and rod seal in rod bore grooves. Make sure they are not twisted.
2. Install new wiper in barrel.
3. Lubricate rod bore with clean hydraulic fluid.

NOTICE

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

4. Install rod in bore and push to top of the bore.
5. Install the bleeder valve into the barrel.
6. Install counterbalance valve into the cylinder port block. Torque to 22 ft.lbs. (30 Nm).
7. Install the plugs into the cylinder. Torque to 22-24 ft.lbs. (30 -33 Nm).



1. Rod
2. O-ring Plug
3. Bleeder Valve
4. Cartridge Valve
5. Barrel
6. Wear Ring
7. Wiper Seal
8. Rod Seal

Figure 5-1. Axle Lockout Cylinder

Slave Cylinder (E/M600 only)

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.
3. Remove the cartridge-type counterbalance valves and plugs from the cylinder port block and discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

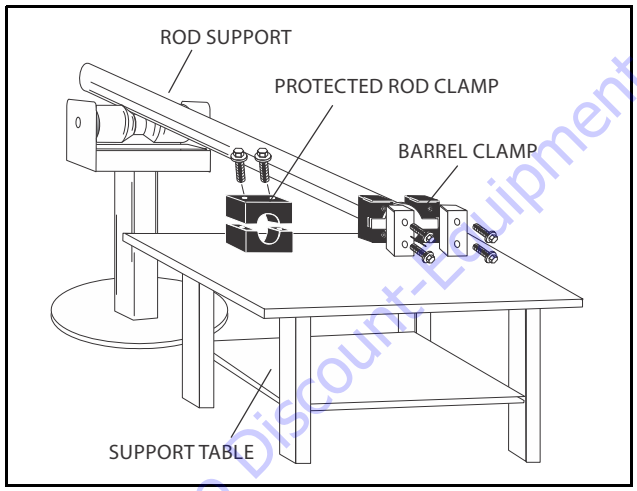


Figure 5-2. Cylinder Barrel Support

5. Mark cylinder head and barrel with center punch marks for later realignment. Remove cylinder head capscrews.

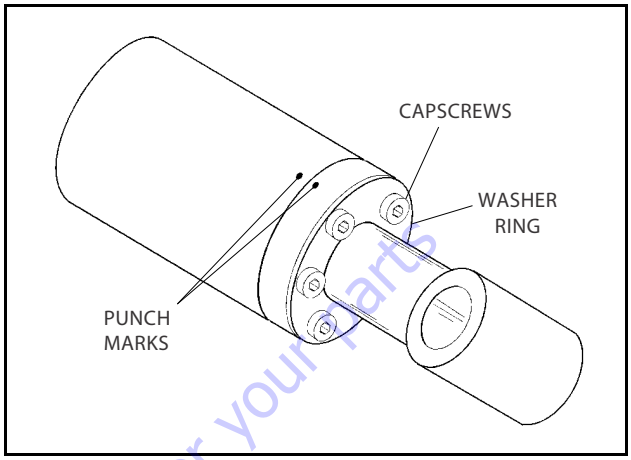


Figure 5-3. Capscrew Removal

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, carefully withdraw the complete rod assembly from the cylinder barrel.

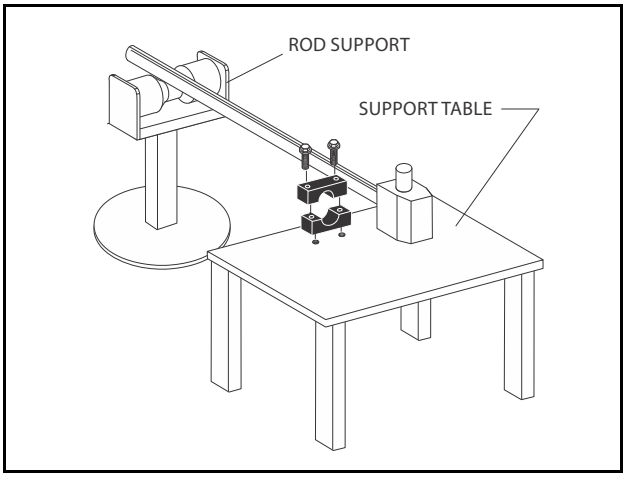
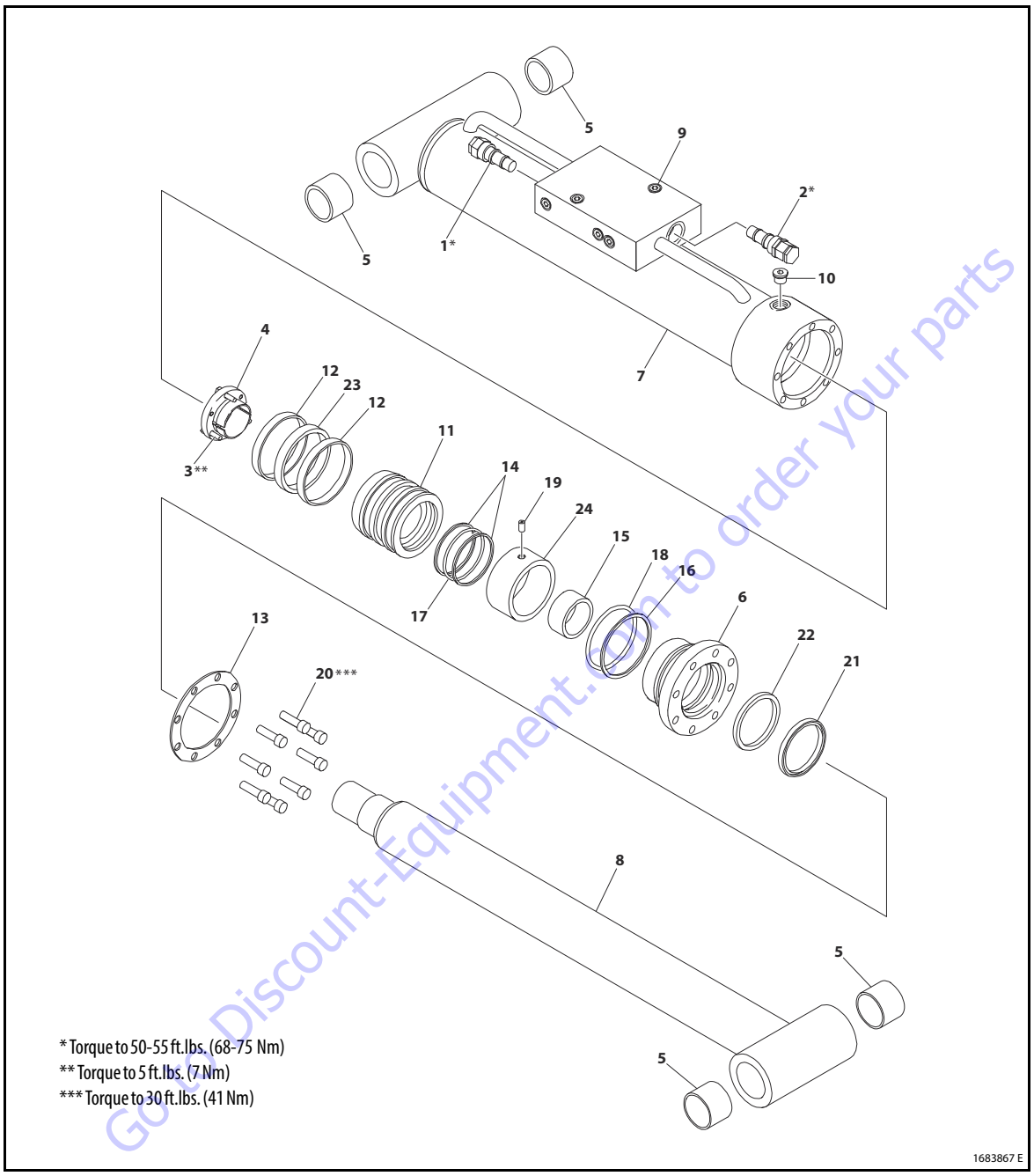


Figure 5-4. Cylinder Rod Support



1. Cartridge Valve
2. Cartridge Valve
3. Bolt
4. Tapered Bushing
5. Bushing
6. Head
7. Barrel
8. Rod
9. Plug
10. Plug
11. Piston
12. Wear Ring
13. Washer Ring
14. Back-up Ring
15. Wear Ring
16. Back-up Ring
17. O-Ring
18. O-Ring
19. Setscrew
20. Bolt
21. Wiper Seal
22. Seal
23. Seal
24. Spacer

Figure 5-5. Slave Cylinder (E/M600 only)

8. Using suitable protection, clamp the cylinder rod in a vise or holding fixture as close to the piston as possible.
9. Loosen and remove bolts from tapered bushing and piston.
10. Insert bolts in threaded holes in outer piece of tapered bushing. Progressively tighten bolts until bushing is loose. Remove tapered bushing from piston.

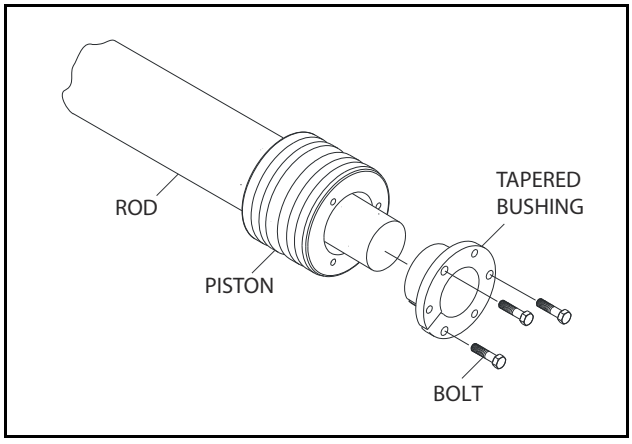


Figure 5-6. Tapered Bushing Removal

11. Screw the piston counterclockwise by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

12. Remove and discard backup ring and o-ring from the inside grooves of piston. Remove and discard wear ring and seal from the outside grooves of piston.
13. Remove the setscrew from the spacer and remove the spacer from the cylinder rod.
14. Remove wear ring from the cylinder rod.
15. Remove the rod from the holding fixture. Remove the cylinder head and washer ring. Remove and discard the o-ring, backup ring, wiper seal and rod 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 threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. 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: *Lubrication is not required with nickel plated pins and bearings. Install pin into the composite bearing dry.*

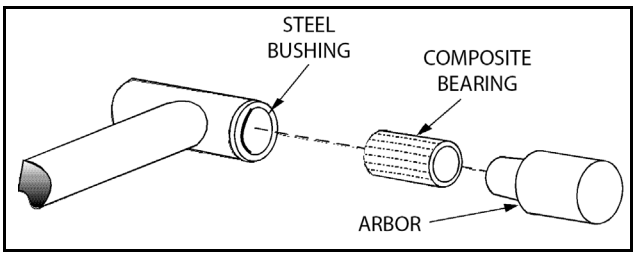


Figure 5-7. Composite Bearing Installation

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

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. 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 gland groove.

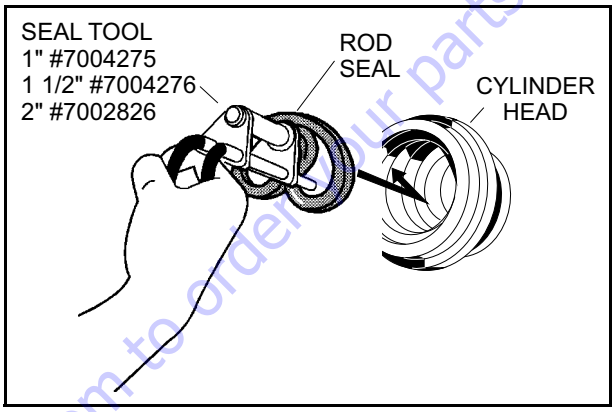


Figure 5-8. Rod Seal Installation

NOTICE

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

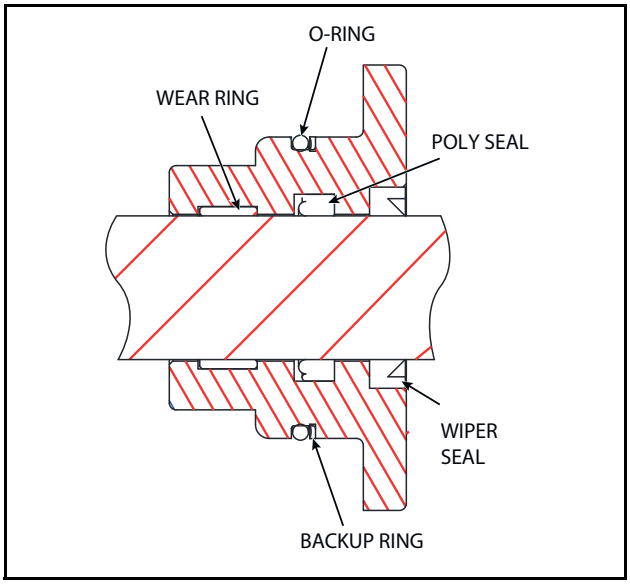


Figure 5-9. Cylinder Head Seal Installation

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

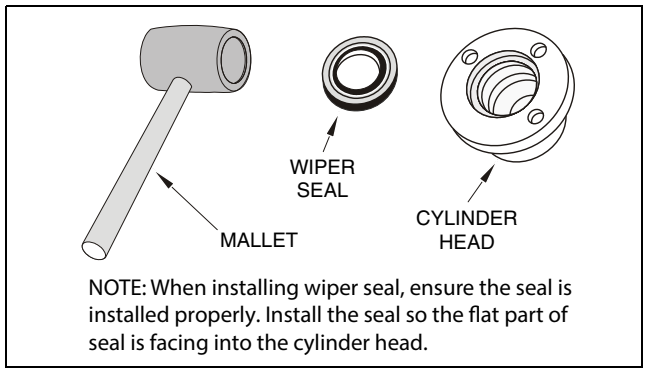


Figure 5-10. Wiper Seal Installation

3. Install wear ring in the applicable inner groove of the cylinder head.
4. Place a new o-ring and back-up seal in the applicable outer groove of the cylinder head.

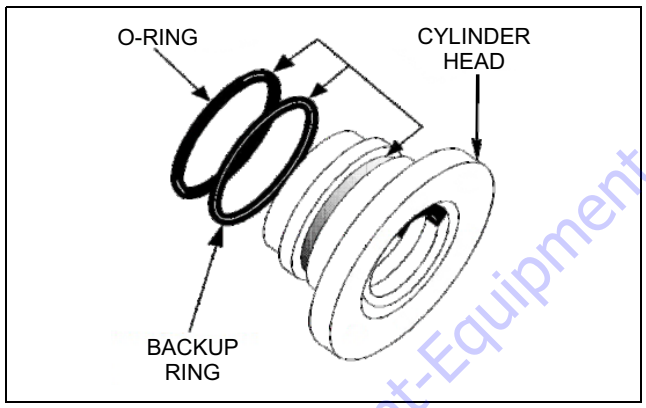


Figure 5-11. Installation of Head Seal Kit

5. Slide washer ring on rod. Install cylinder head assembly on rod. Do not damage or dislodge wiper and rod seals. Push cylinder head to rod end.
6. 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.
7. Install the spacer tube, use setscrew to attach spacer onto the cylinder rod.
8. Install a new o-ring and back-up rings in the inside groove of the piston.
9. Install new wear ring, and seal in outside grooves of piston.

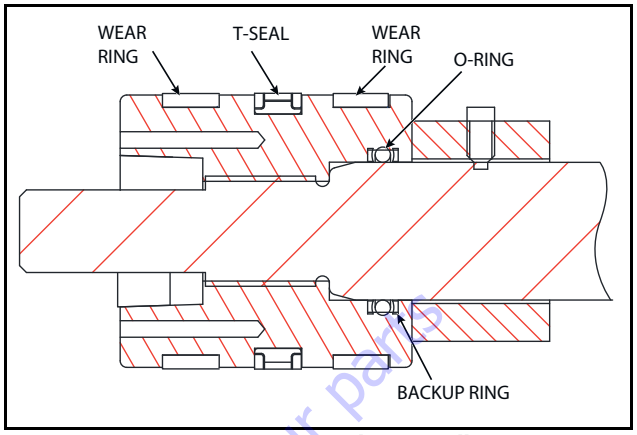


Figure 5-12. Piston Seal Kit Installation

10. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
11. Thread the piston on the cylinder rod hand tight, ensuring that the o-ring are not damaged or dislodged.

NOTE: *When installing the tapered bushing, piston and mating end of rod must be free of oil.*

12. Assemble the tapered bushing loosely into the piston and insert capscrews through the drilled holes in the bushing and into the tapped holes in the piston.

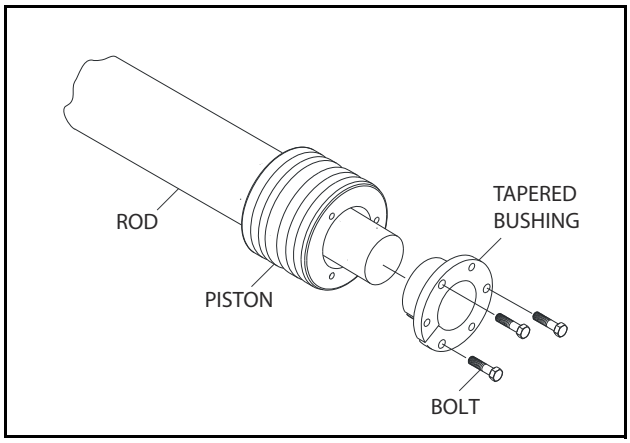


Figure 5-13. Tapered Bushing Removal

13. Tighten the bolt evenly and progressively in rotation to 5 ft.lbs. (7 Nm).
14. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;
    a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.

b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

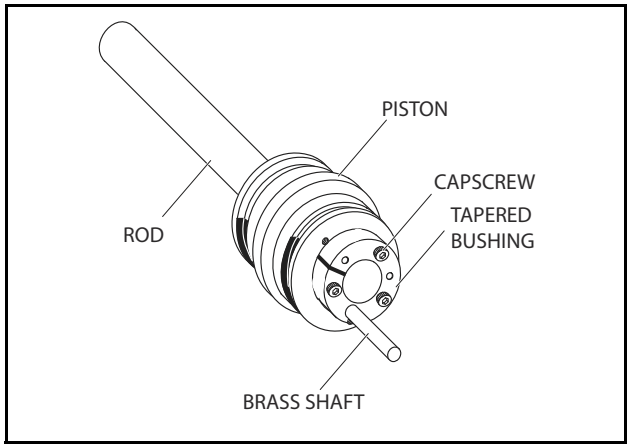


Figure 5-14. Seating the Tapered Bushing

15. Rotate the bolt evenly and progressively in rotation to 5 ft.lbs. (7 Nm).

16. Install the spacer tube onto the piston rod and lock the spacer tube using a setscrew.

17. Remove the cylinder rod from the holding fixture.

NOTICE

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

18. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston wear ring and seal.

19. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.

NOTE: *Apply locking primer and JLG Threadlocker (P/N 0100011) to capscrews.*

20. Secure cylinder head and washer ring with capscrews. Torque capscrew to 30 ft.lbs. (41 Nm).

21. 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.

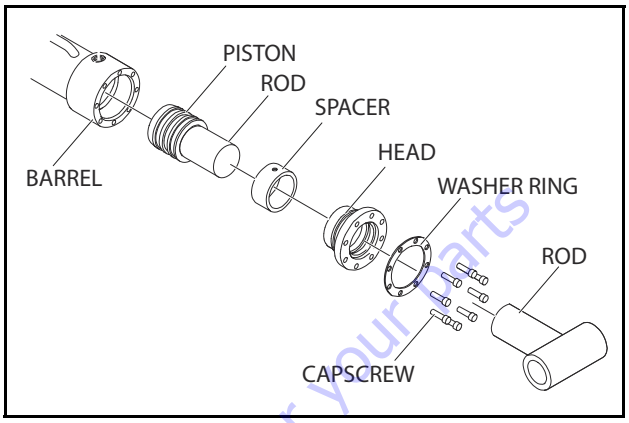


Figure 5-15. Rod Assembly Installation

22. Install the new o-ring plugs into the valve block.

23. Install the cartridge valves in the rod port block. Torque to 50-55 ft.lbs. (68-75 Nm).

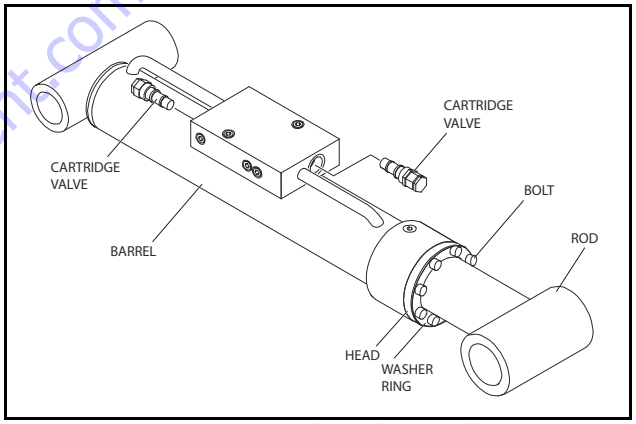


Figure 5-16. Cartridge Valve Installation

Slave Cylinder (E/M600J/JP)

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.
3. Remove the cartridge-type counterbalance valves and plugs from the cylinder port block and discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

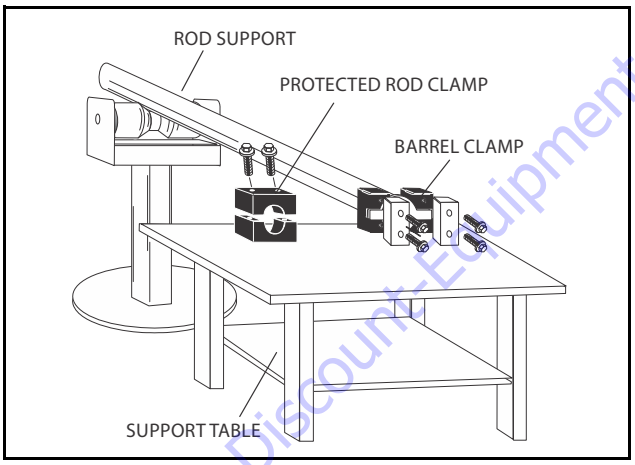


Figure 5-17. Cylinder Barrel Support

5. Using a pin-face spanner wrench, unscrew the cylinder head from the barrel.

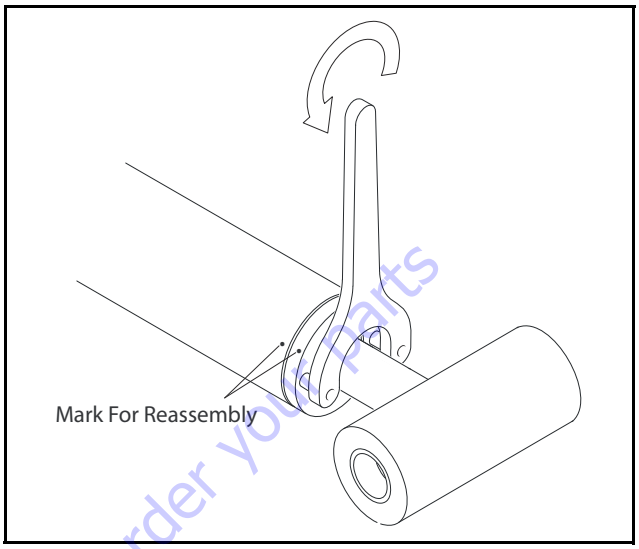


Figure 5-18. Cylinder Head Removal

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. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.

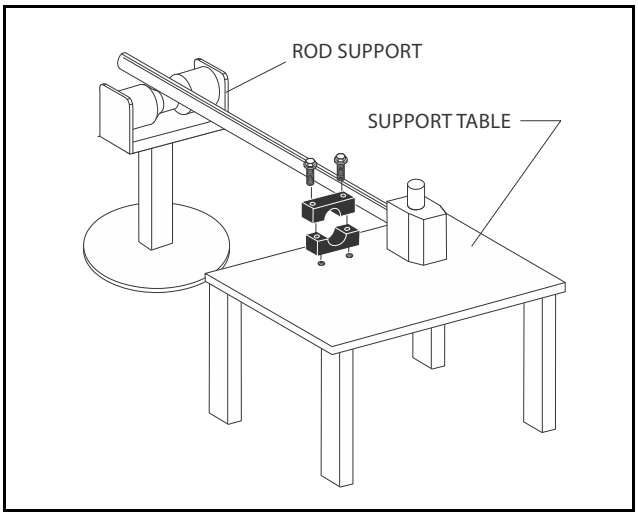
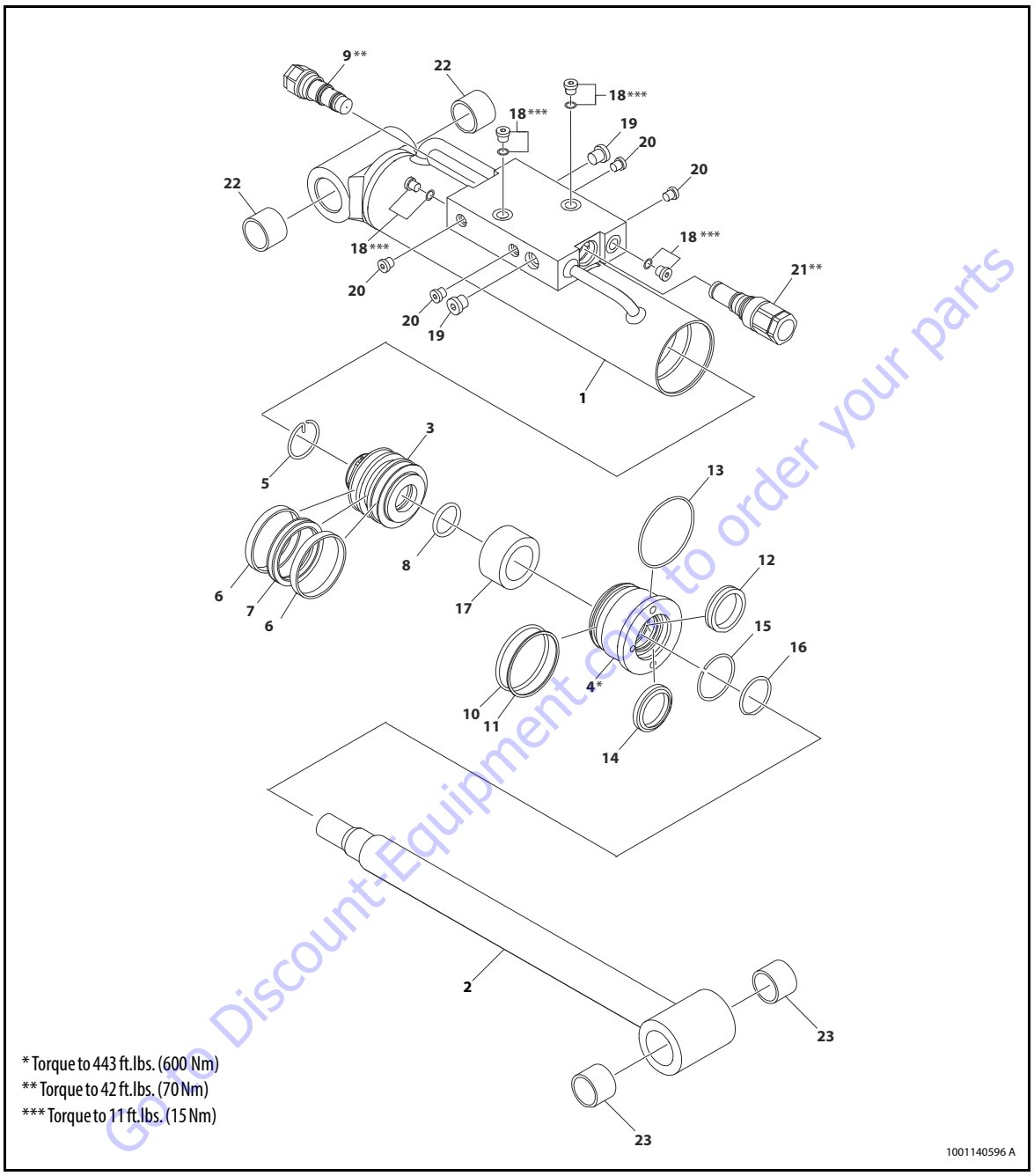


Figure 5-19. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Piston
5. Retainer
6. Wear Ring
7. Seal
8. O-ring
9. Counterbalance valve
10. O-ring
11. Backup ing
12. Seal
13. O-ring
14. Wiper Seal
15. Retaining Ring
16. O-ring
17. Spacer
18. Plug
19. Plug
20. Plug
21. Counterbalance valve
22. Bushing
23. Bushing

Figure 5-20. Slave Cylinder (E/M600J/JP)

8. Using suitable protection, clamp the cylinder rod in a vise or holding fixture as close to the piston as possible.
9. Remove the retainer from rod end.
10. Screw the piston counterclockwise by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

11. Remove and discard the wear ring, seal from the outside groove of the piston. Remove and discard the o-ring from the inside groove of the piston.
12. Remove the spacer from the cylinder rod.
13. Remove the rod from the holding fixture. Remove the cylinder head.
14. Remove and discard the o-ring, backup ring from the outside groove of the cylinder head. Remove and discard rod seal, wiper seal, retaining ring, o-ring from the inside groove of the cylinder head.

CLEANING AND INSPECTION

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

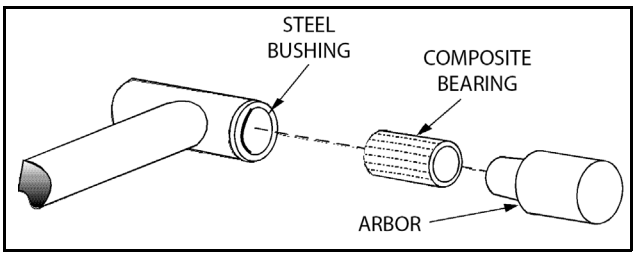


Figure 5-21. Composite Bearing Installation

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

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. 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 gland groove.

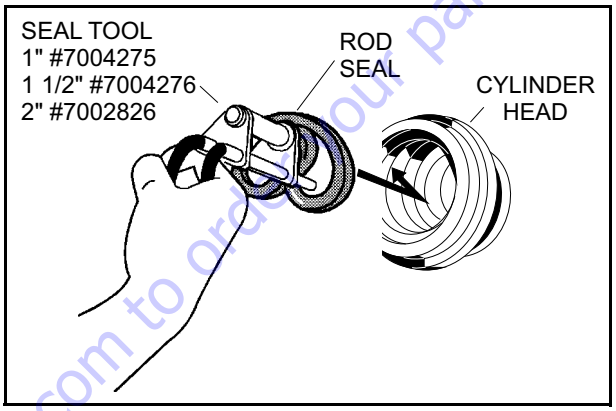


Figure 5-22. Rod Seal Installation

NOTICE

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

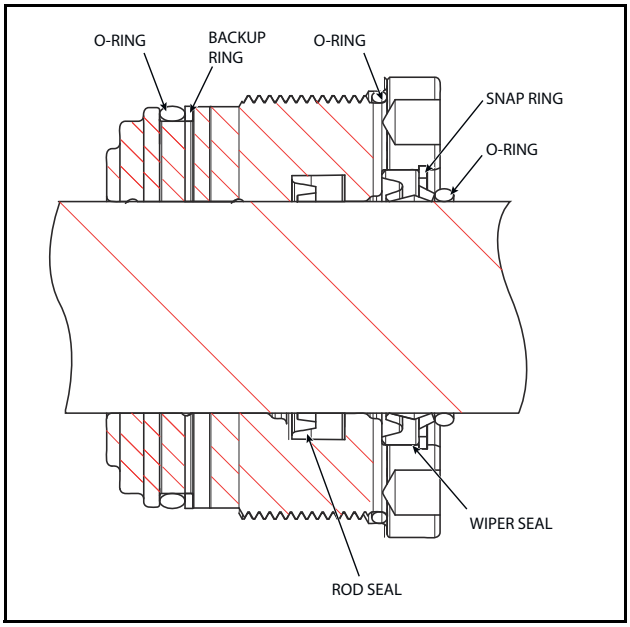
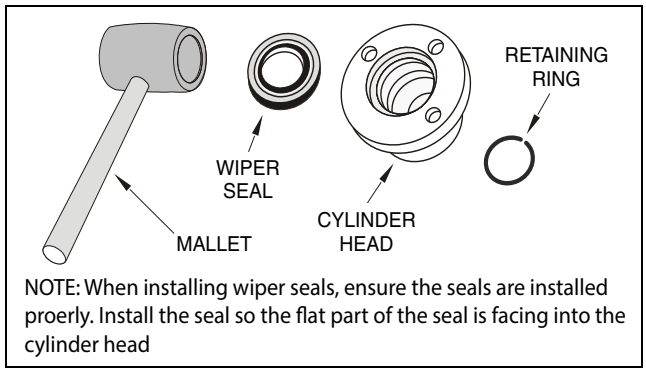


Figure 5-23. Cylinder Head Seal Installation

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



NOTE: When installing wiper seals, ensure the seals are installed proerly. Install the seal so the flat part of the seal is facing into the cylinder head

Figure 5-24. Wiper Seal Installation

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

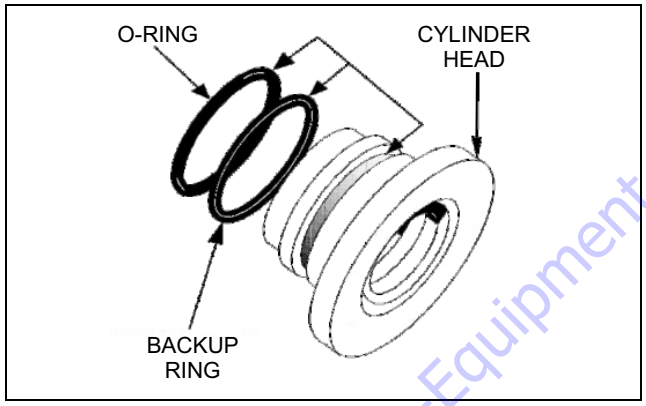


Figure 5-25. Installation of Head Seal Kit

4. Install o-ring onto the cylinder rod. Carefully install the head on the rod, ensuring that the wiper seal, retaining ring and rod seal are not damaged or dislodged. Push the head along the rod to the rod end.
5. Install the spacer tube onto the cylinder rod.
6. Place a new o-ring in the inner piston diameter groove.
7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
8. Carefully thread the piston on the cylinder rod hand tight, ensuring that the o-ring are not damaged or dislodged.
9. Remove the cylinder rod from the holding fixture.
10. Place new piston seal and wear rings in the outer piston diameter groove. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

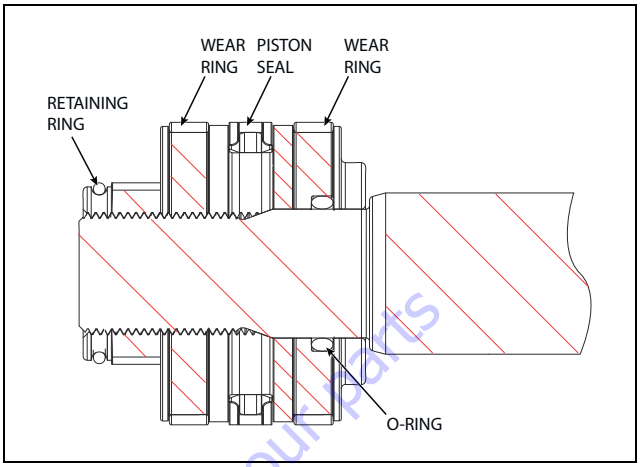


Figure 5-26. Piston Seal Kit Installation

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 gland can be inserted into the barrel cylinder.
14. Screw the cylinder head gland into the barrel using a pin-face spanner wrench and torque gland to 443 ft.lbs. (600 Nm).
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 70 ft.lbs. (52 Nm).
17. Install the new o-rings and plugs into the cylinder port block and torque plug to 11 ft.lbs. (11 Nm).

Jib Lift Cylinder (E/M600J/JP)

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 counterbalance valve from the cylinder port block. Discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture.

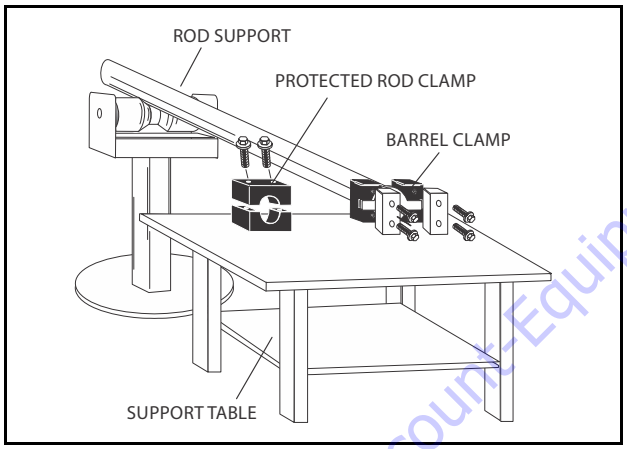


Figure 5-27. Cylinder Barrel Support

5. Using a pin-face spanner wrench, unscrew the cylinder head from the barrel.

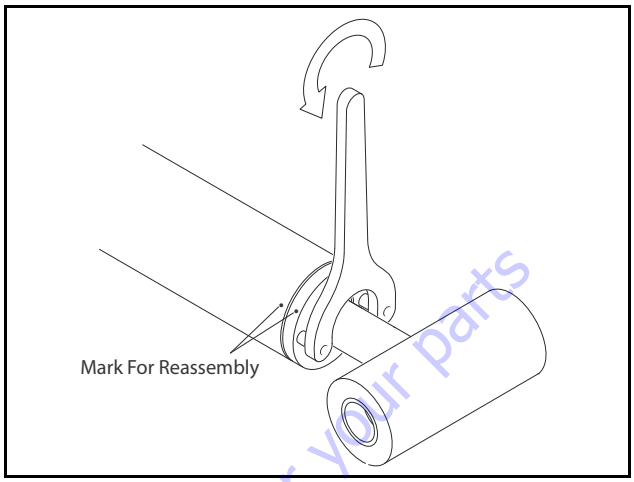


Figure 5-28. Cylinder Head Removal

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. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.

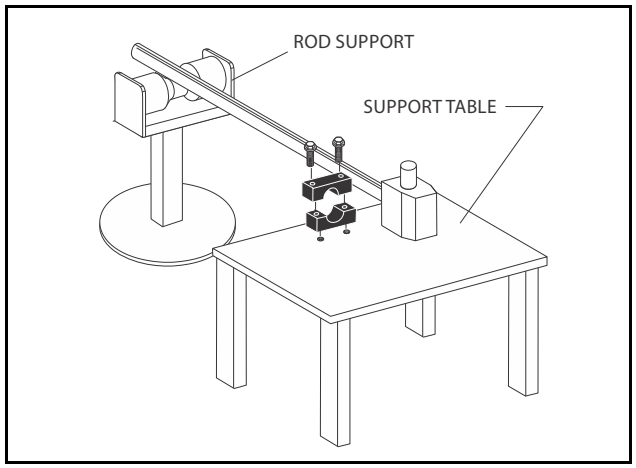
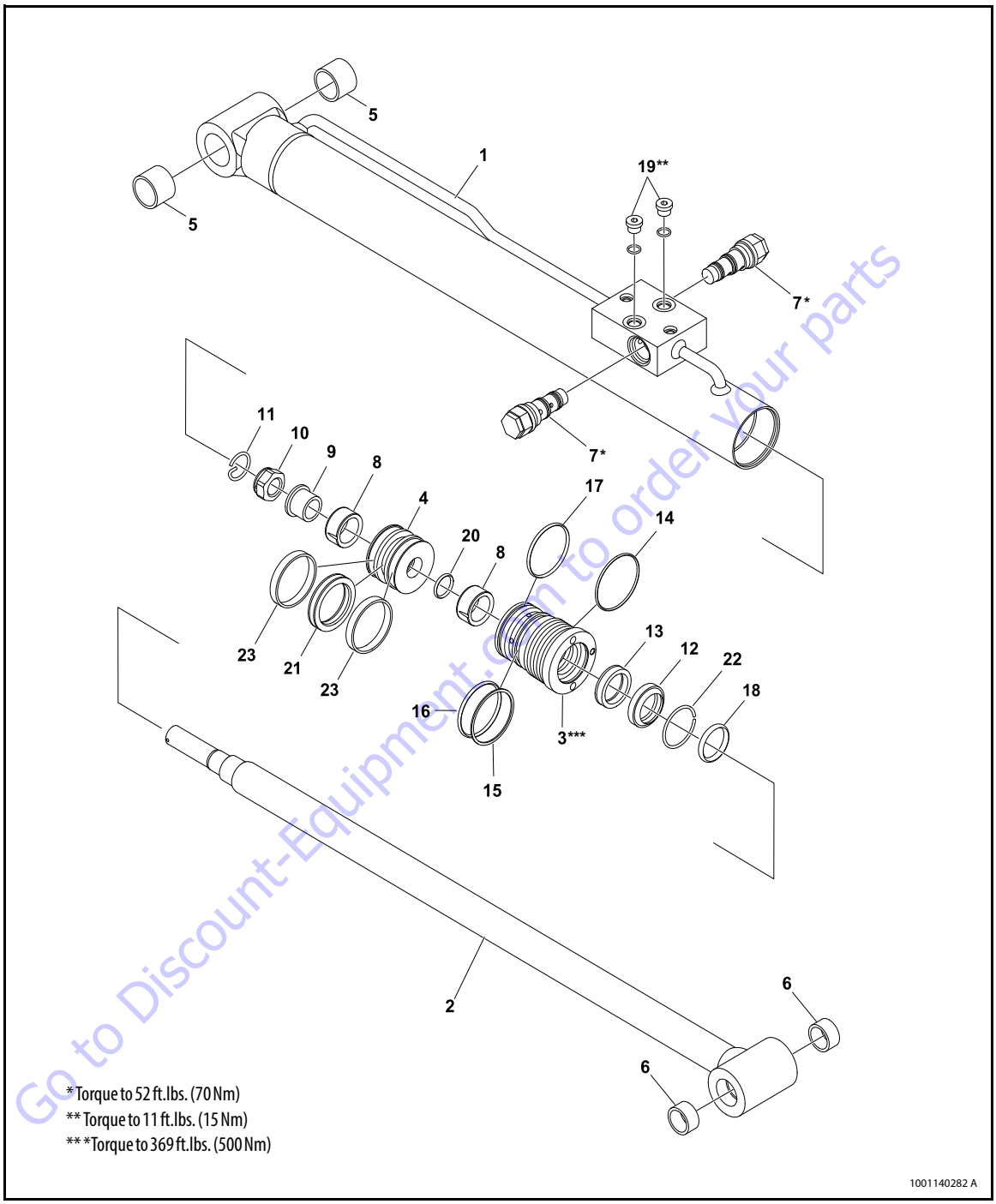


Figure 5-29. Cylinder Rod Support



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

Figure 5-30. 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. Remove the retainer from the cylinder rod.
10. Loosen and remove the lock nut which attach the piston to the rod.
11. Remove the bushing and sleeve from the cylinder rod.
12. Screw the piston counterclockwise, by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

13. Remove and discard the piston seal, wear ring from the outer groove of the piston. Remove and discard the o-ring from the inner groove of the piston.
14. Remove bushings from the cylinder rod.
15. Remove the rod from the holding fixture. Remove the cylinder head gland.
16. Remove and discard the o-ring, back-up ring from the outer groove of the cylinder head. Remove and discard the retaining rings, rod seals, wiper seals, o-ring from the inner groove of the cylinder head.

CLEANING AND INSPECTION

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. 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.*

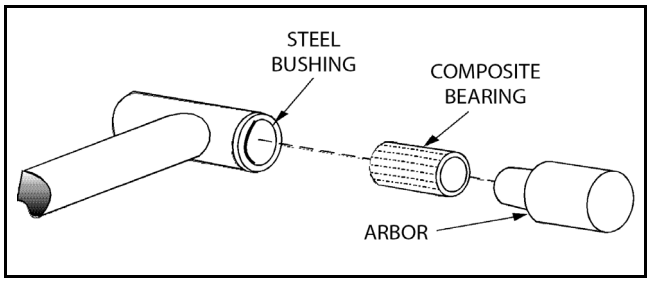


Figure 5-31. Composite Bearing Installation

14. Inspect port block fittings and holding valve. Replace as necessary.
15. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
16. 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 gland groove.

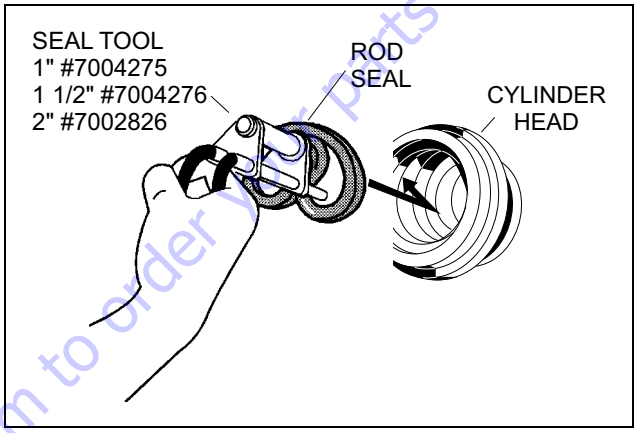


Figure 5-32. Rod Seal Installation

NOTICE

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

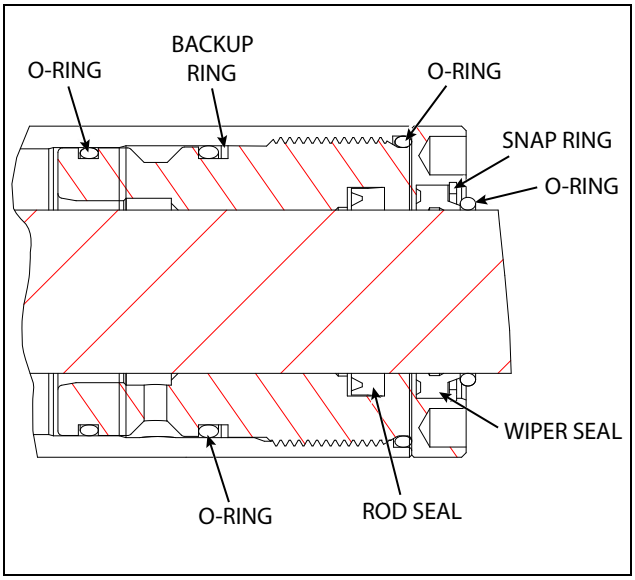
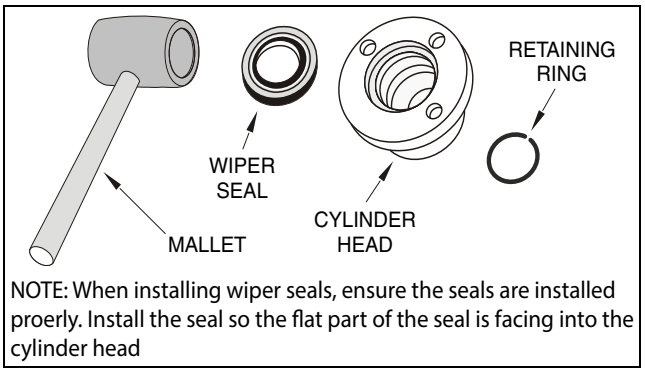


Figure 5-33. Cylinder Head Seal Installation

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



NOTE: When installing wiper seals, ensure the seals are installed proerly. Install the seal so the flat part of the seal is facing into the cylinder head

Figure 5-34. Wiper Seal Installation

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

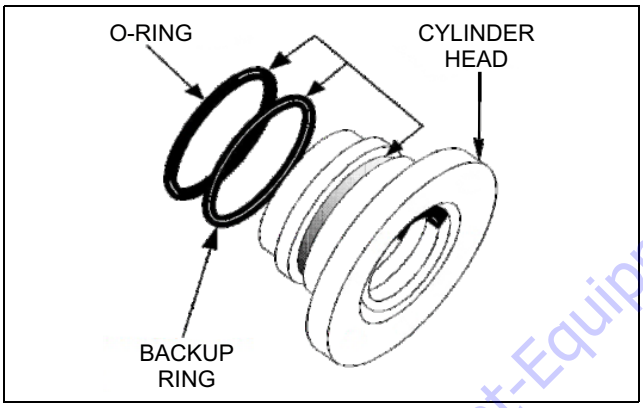


Figure 5-35. Installation of Head Seal Kit

4. Install o-ring onto the cylinder rod. Carefully install the head gland on the rod, ensuring that the wiper and rod seals are not damaged or dislodged. Push the head along the rod to the rod end.
5. Push the bushing onto the cylinder rod.
6. Place a new o-ring in the inner piston diameter groove.
7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
8. Carefully thread the piston on the cylinder rod hand tight, ensuring that the o-ring are not damaged or dislodged.
9. Thread piston onto rod until it abuts the spacer end and install the retainer.
10. Remove the cylinder rod from the holding fixture.
11. Place new piston seal and wear rings in the outer piston diameter groove. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

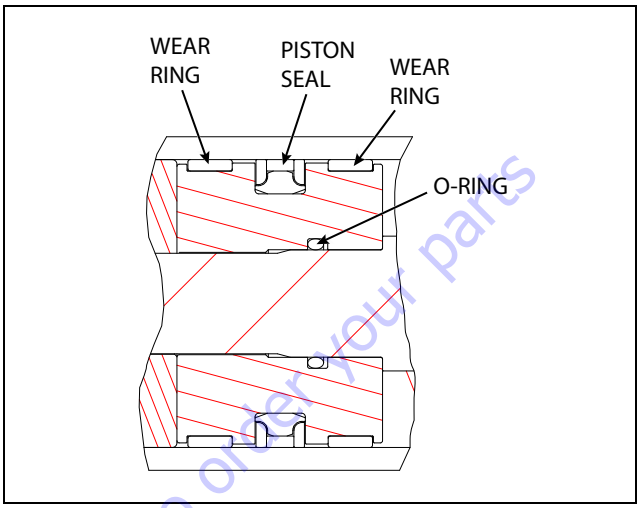


Figure 5-36. Piston Seal Kit Installation

12. Install the bushing and sleeve onto the cylinder rod.
13. Tighten the nut onto the cylinder rod and Install the retainer.
14. 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.

15. 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.
16. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.
17. Screw the cylinder head gland into the barrel using a pin-face spanner wrench and torque gland to 369 ft.lbs. (500 Nm).
18. 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.
19. Install the counterbalance valves in the cylinder port block and torque to 52 ft.lbs. (70 Nm).
20. Install the o-ring and plugs in the cylinder port block and torque to 7 ft.lbs. (10 Nm).

Main 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.
3. Remove the cartridge-type counterbalance valves and plugs from the cylinder port block and discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

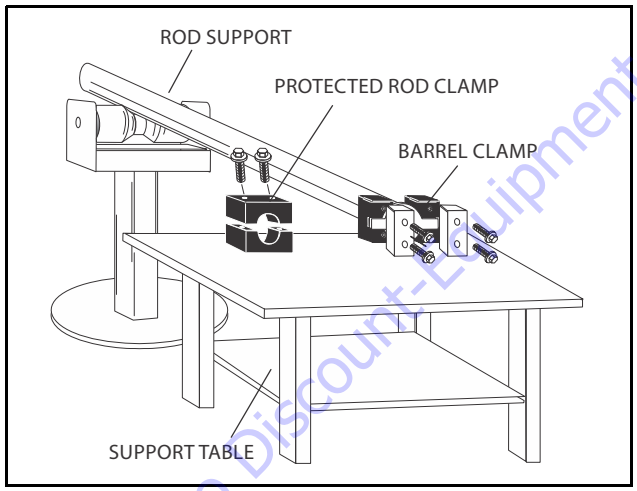


Figure 5-37. Cylinder Barrel Support

5. Mark cylinder head and barrel with center punch marks for later realignment. Remove cylinder head capscrews.

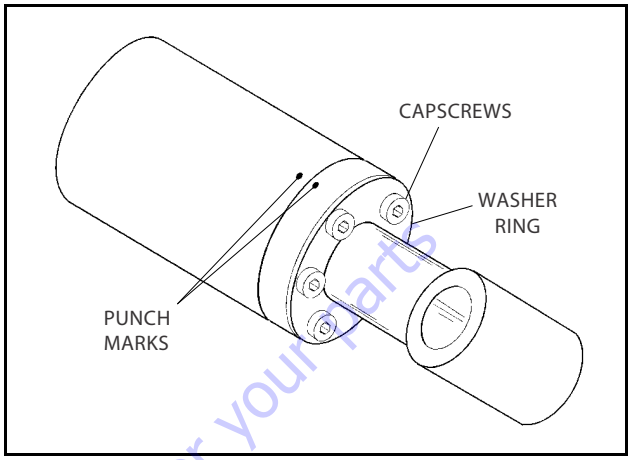


Figure 5-38. Capscrew Removal

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, carefully withdraw the complete rod assembly from the cylinder barrel.

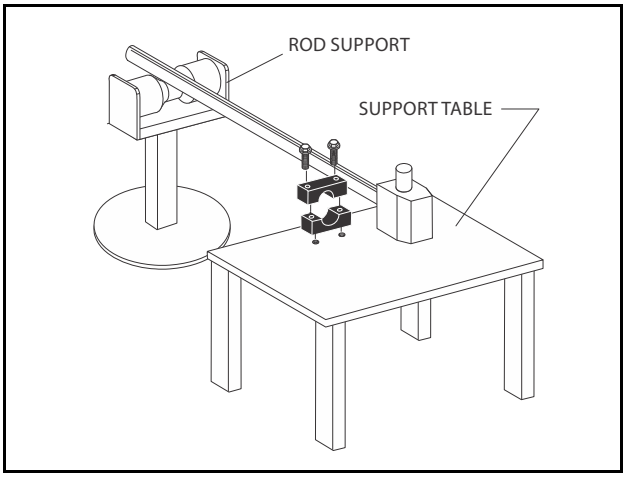
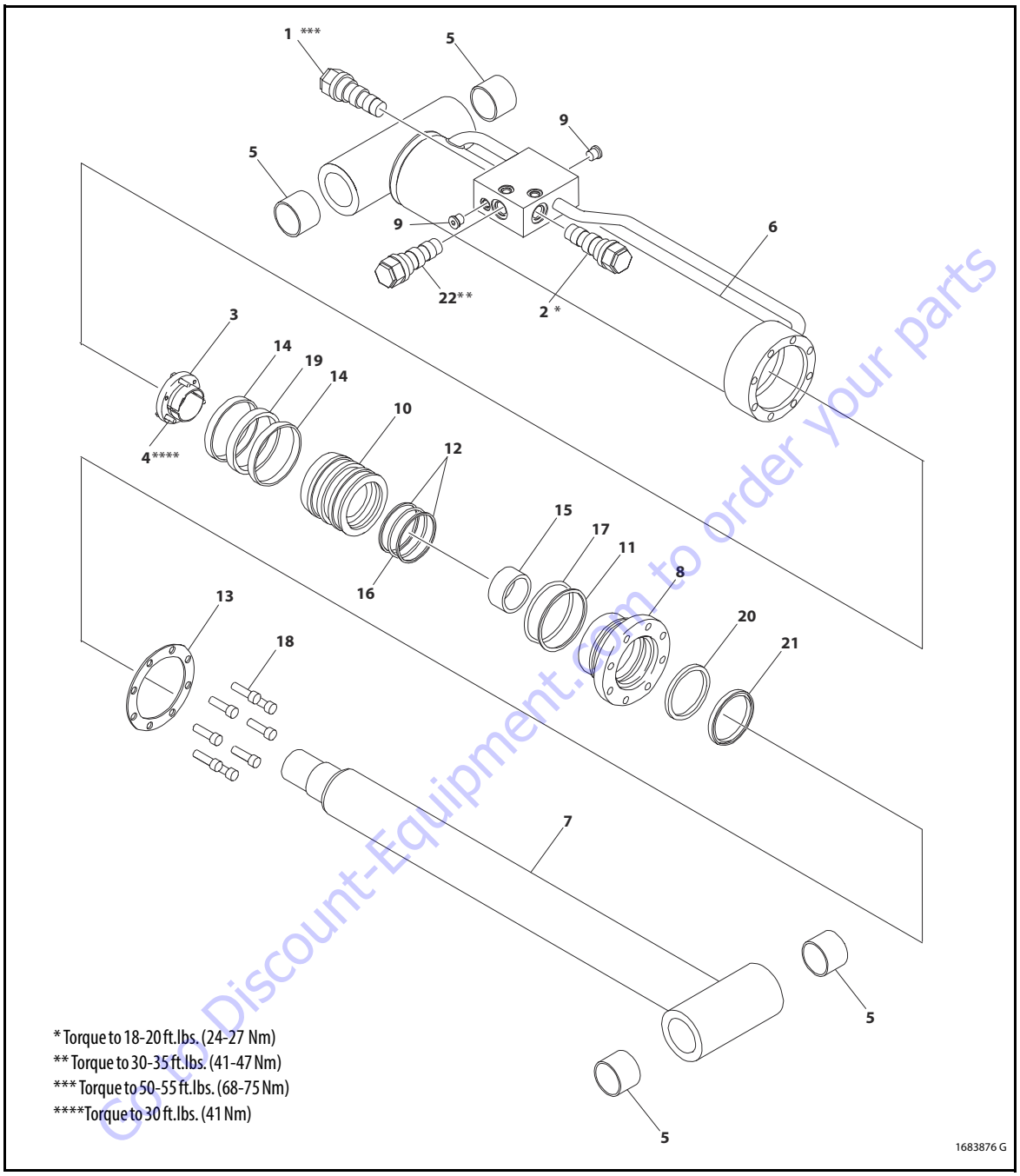


Figure 5-39. Cylinder Rod Support



1. Counterbalance Valve
2. Check Valve
3. Tapered Bushing
4. Bolt
5. Bushing
6. Barrel
7. Rod
8. Head
9. O-ring
10. Piston
11. Backup Ring
12. Backup Ring
13. Washer Ring
14. Wear Ring
15. Wear Ring
16. O-Ring
17. O-Ring
18. Cap screw
19. T-seal
20. Rod Seal
21. Wiper Seal
22. Check Valve

Figure 5-40. Main Lift Cylinder (E/M600J/JP)

8. Using suitable protection, clamp the cylinder rod in a vise or holding fixture as close to the piston as possible.
9. Loosen and remove bolt from tapered bushing and piston.
10. Insert bolts in threaded holes in outer piece of tapered bushing. Progressively tighten bolts until bushing is loose. Remove tapered bushing from piston.

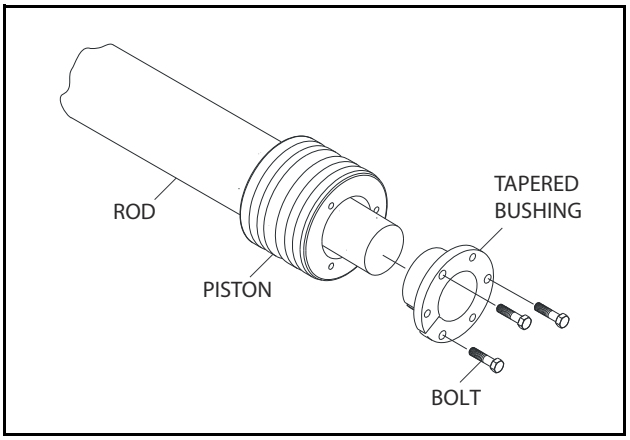


Figure 5-41. Tapered Bushing Removal

11. Screw the piston counterclockwise by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

12. Remove and discard backup ring and o-ring from the inside groove of piston. Remove and discard wear ring and piston seal from the outside groove of the piston.
13. Remove wear ring from the cylinder rod.
14. Remove the rod from the holding fixture. Remove the cylinder head and washer ring.
15. Remove and discard the o-ring, backup ring from outer groove of the cylinder head. Remove and discard the wiper seal and rod seal inner groove of the cylinder head.

CLEANING AND INSPECTION

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

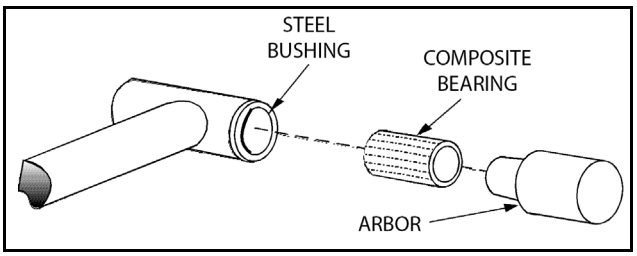


Figure 5-42. Composite Bearing Installation

14. Inspect port block fittings and holding valve. Replace as necessary.
15. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
16. Inspect piston rings for cracks or other damage. Replace as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. 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 gland groove.

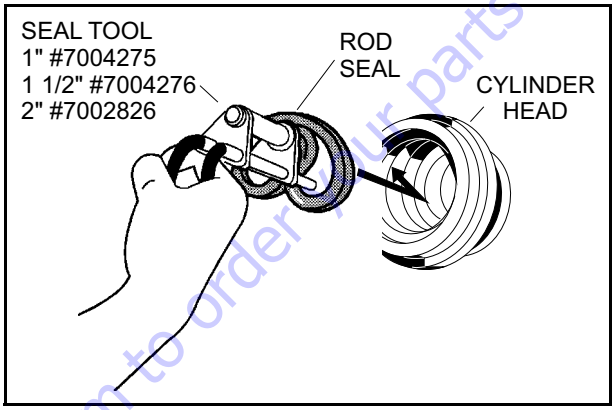


Figure 5-43. Rod Seal Installation

NOTICE

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

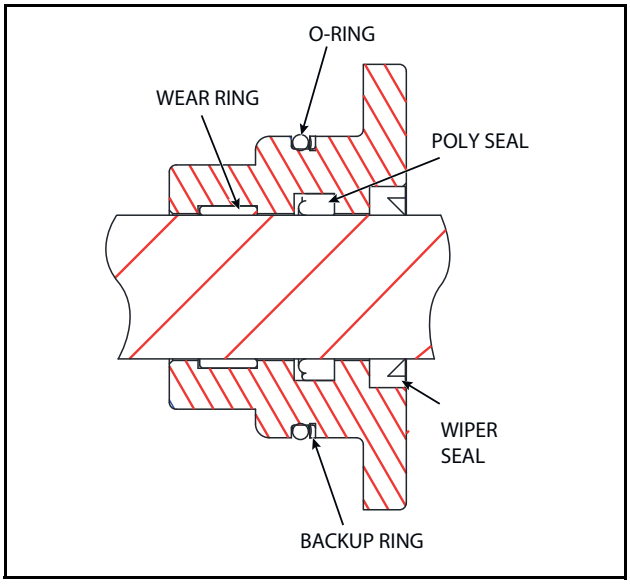


Figure 5-44. Cylinder Head Seal Installation

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

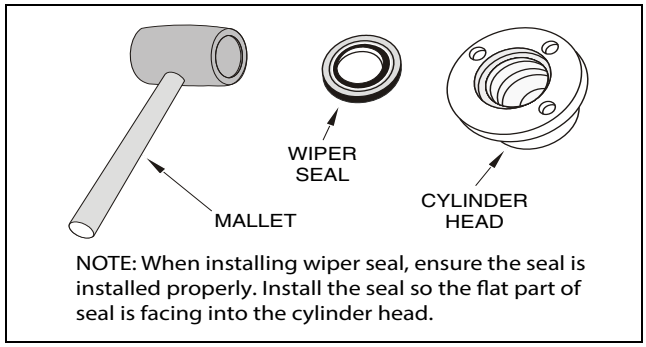


Figure 5-45. Wiper Seal Installation

3. Install wear ring in the applicable inner groove of the cylinder head.

4. Place a new o-ring and backup ring in the applicable outer groove of the cylinder head.

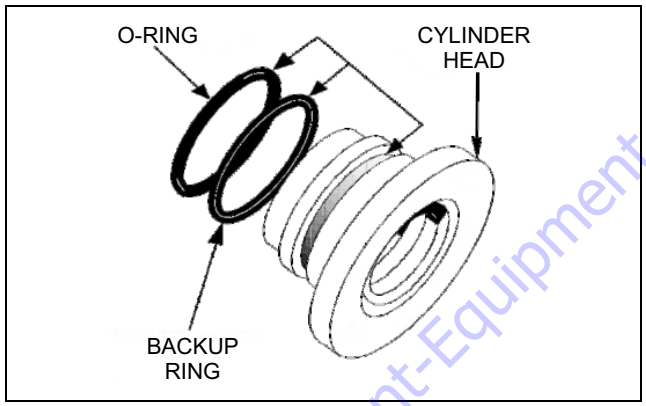


Figure 5-46. Installation of Head Seal Kit

5. Slide washer ring on 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.

6. Install a new o-ring and backup rings in the inside groove of the piston.

7. Install new wear ring and piston seal in outside grooves of piston.

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

9. Thread the piston on the cylinder rod hand tight, ensuring that the o-ring are not damaged or dislodged.

NOTE: *When installing the tapered bushing, piston and mating end of rod must be free of oil.*

10. Assemble the tapered bushing loosely into the piston and insert capscrews through the drilled holes in the bushing and into the tapped holes in the piston.

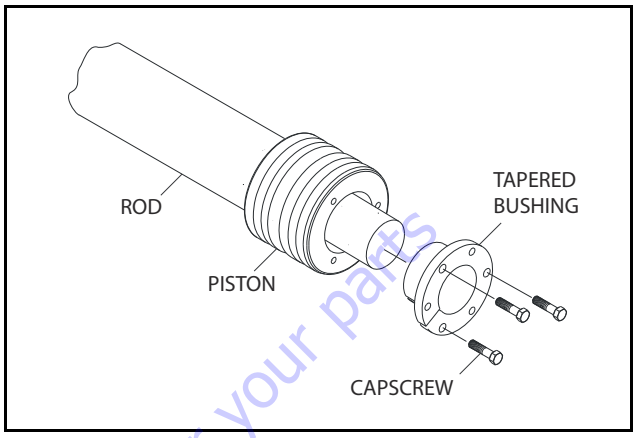


Figure 5-47. Tapered Bushing Removal

11. Tighten the bolt evenly and progressively in rotation to 30 ft.lbs. (41 Nm).

12. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;

    a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.

    b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

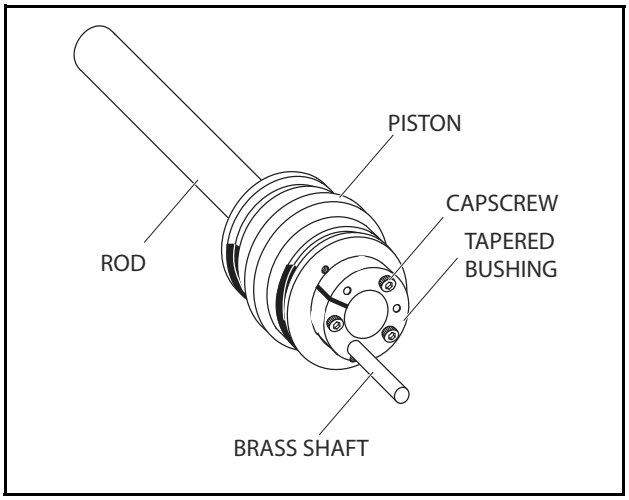


Figure 5-48. Seating the Tapered Bushing

13. Rotate the bolt evenly and progressively in rotation to 30 ft.lbs. (41 Nm).

14. Remove the cylinder rod from the 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.

15. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston wear ring and seal.
16. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.

NOTE: *Apply locking primer and JLG Threadlocker (P/N 0100011) to capscrews.*

17. Secure cylinder head and washer ring with capscrews. Torque capscrew to 170 ft.lbs. (230 Nm).

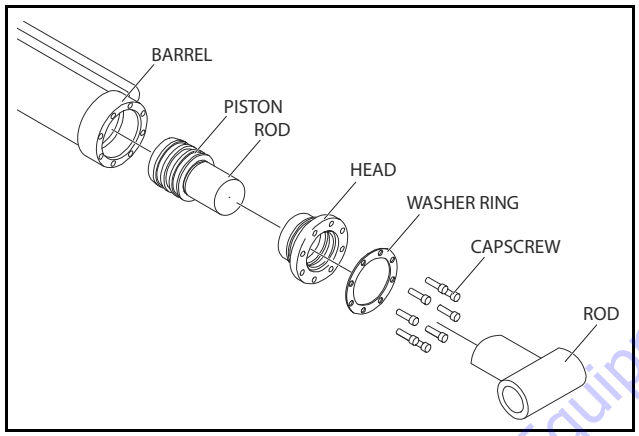


Figure 5-49. Rod Assembly installation

18. 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.
19. Install the new o-ring plugs into the valve block.
20. Install the check valve in the cylinder port block and torque to 30-35 ft.lbs. (41-47 Nm).
21. Install the counterbalance valves in the rod port block. Torque to 50-55 ft.lbs. (68-75 Nm).
22. Install the check valve in the cylinder port block and torque to 18-20 ft.lbs. (24-27 Nm).

Master Cylinder (E/M600)

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. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

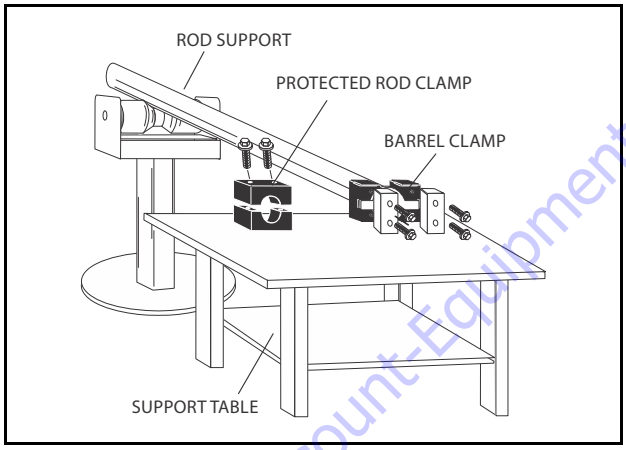


Figure 5-50. Cylinder Barrel Support

4. Using a hook spanner wrench, loosen the setscrew and remove setscrew from the cylinder barrel.

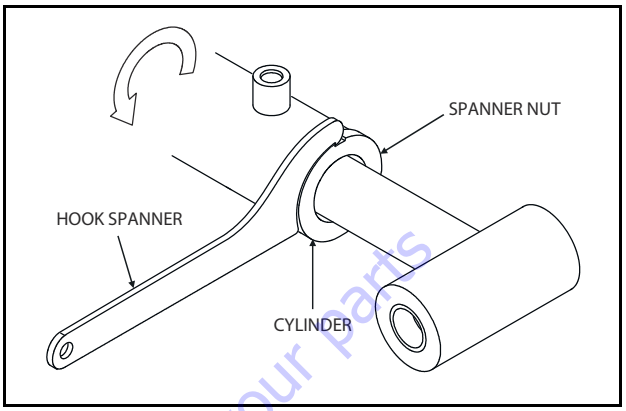


Figure 5-51. Cylinder Head Removal

5. 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.

6. With the barrel clamped securely, carefully withdraw the complete rod assembly from the cylinder barrel.

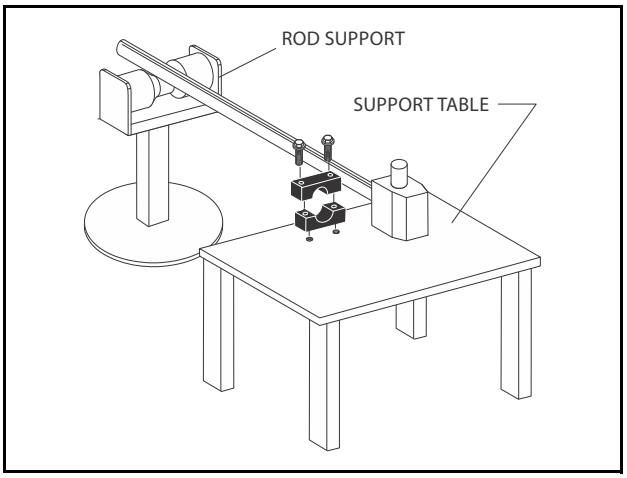
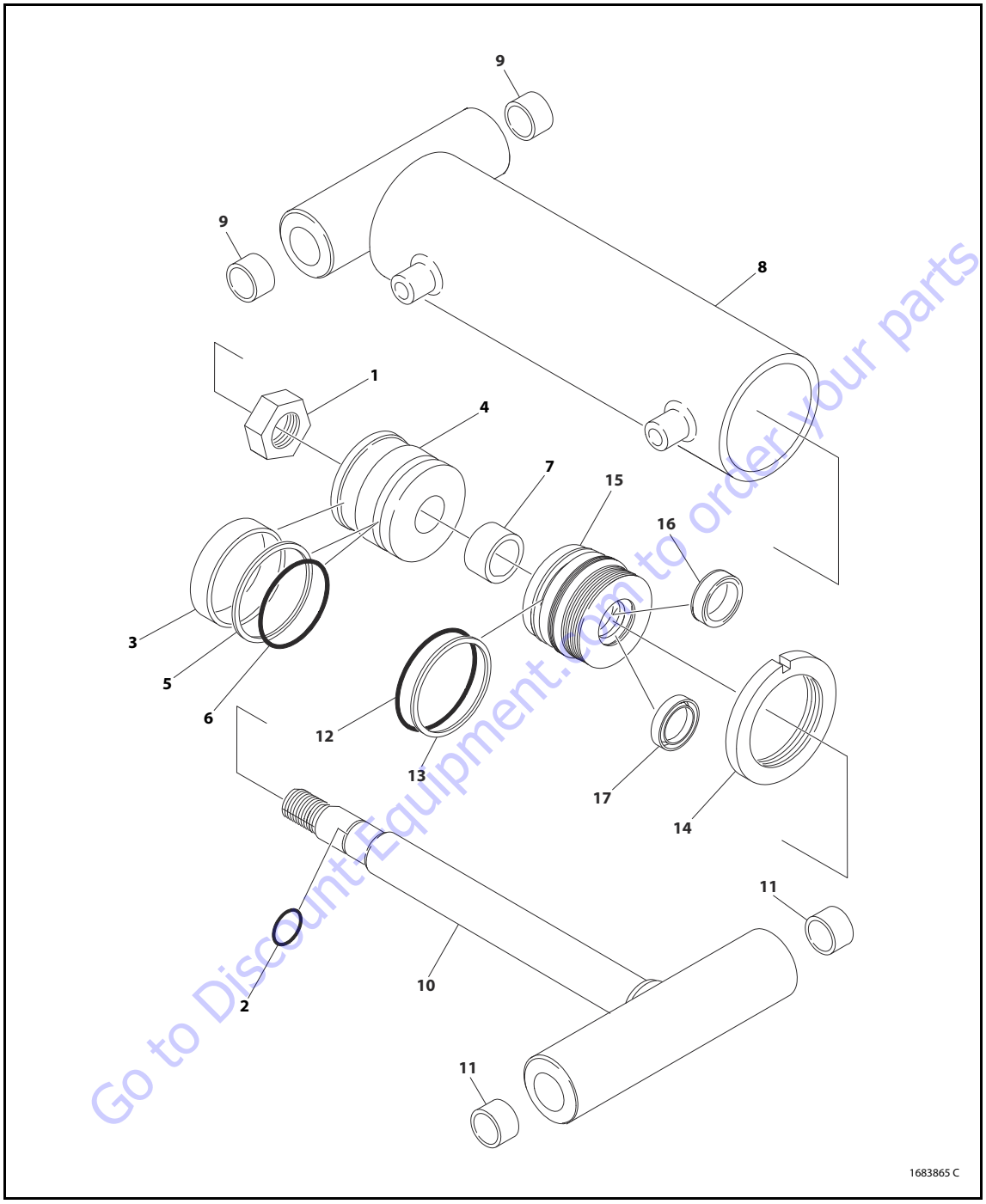


Figure 5-52. Cylinder Rod Support



1. Lock Nut
2. O-ring
3. Wear Ring
4. Piston
5. Piston Seal
6. O-ring
7. Spacer
8. Barrel
9. Bushing
10. Rod
11. Bushing
12. O-ring
13. Backup Ring
14. Spanner Nut
15. Guide
16. Seal
17. Wiper Seal

Figure 5-53. Master Cylinder (E/M600 only)

7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
8. Loose and remove the nut from the cylinder rod.
9. Screw the piston counterclockwise, by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

10. Remove and discard the piston seal, wear ring and o-ring from the outside groove of the piston.
11. Remove o-ring from the groove of the cylinder rod end.
12. Remove spacer from the cylinder rod.
13. Remove the rod from the holding fixture. Remove the cylinder head.
14. Remove and discard the o-ring, back-up ring from the outer groove of the cylinder head. Remove and discard rod seal, wiper seal from the inner groove of the cylinder head.
15. Remove the spanner nut from the cylinder rod.

CLEANING AND INSPECTION

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. 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.*

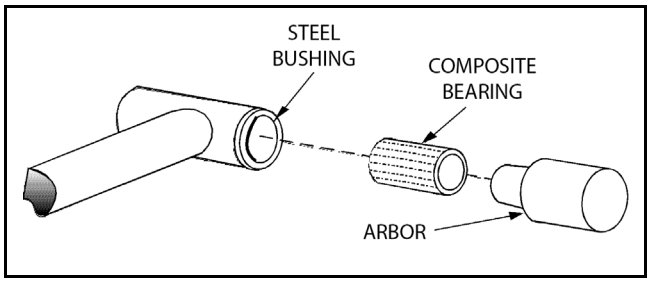


Figure 5-54. Composite Bearing Installation

14. Inspect spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
15. Inspect port block fittings and holding valve. Replace as necessary.
16. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
17. 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 gland groove.

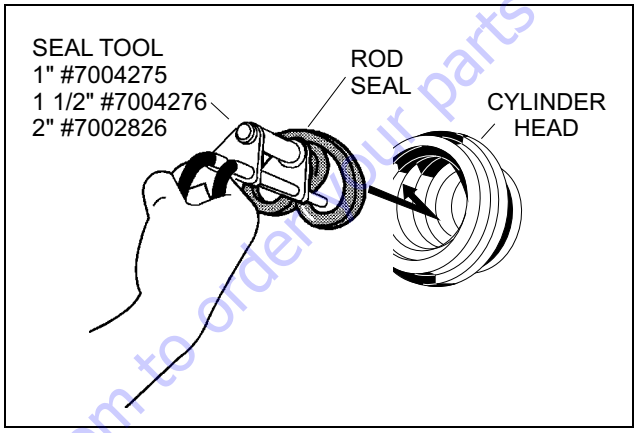


Figure 5-55. Rod Seal Installation

NOTICE

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

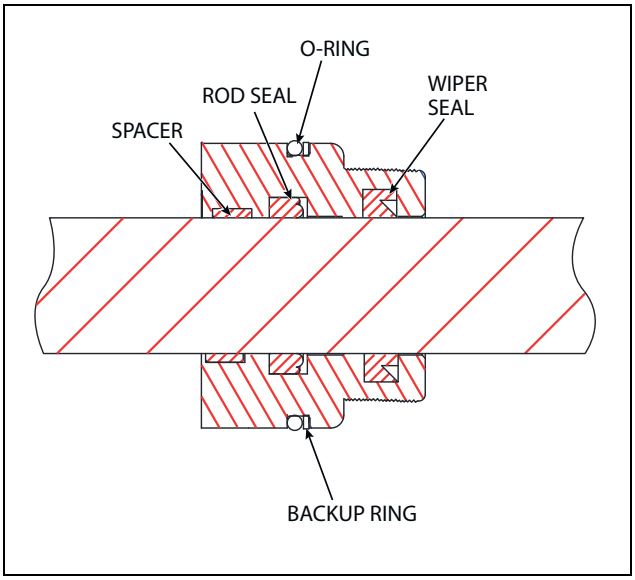


Figure 5-56. Cylinder Head Seal Installation

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

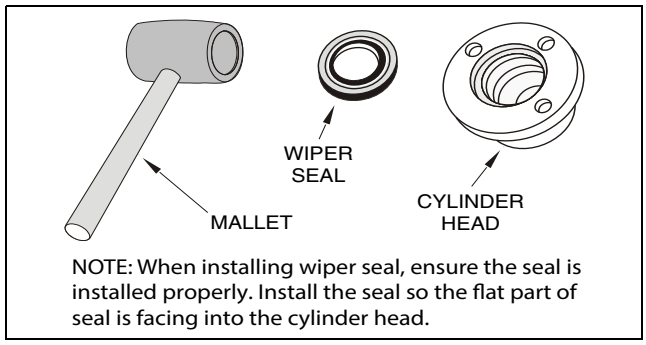


Figure 5-57. Wiper Seal Installation

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

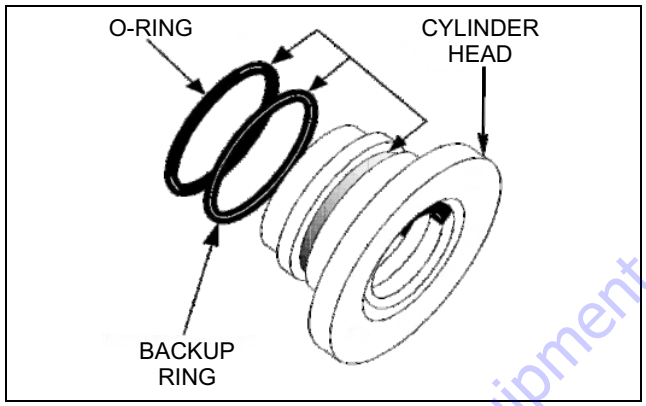


Figure 5-58. Installation of Head Seal Kit

4. Install the spanner nut onto the cylinder rod.
5. 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.
6. Push the spacer onto the rod.
7. Install o-ring in the groove of the cylinder rod.
8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture close to piston as possible.
9. Carefully thread the piston on the cylinder rod hand tight.
10. Install and tighten the lock nut onto the cylinder rod.
11. Remove the cylinder rod from the holding fixture.
12. Place new piston seal, wear rings and o-ring in the outer and inner piston diameter groove. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

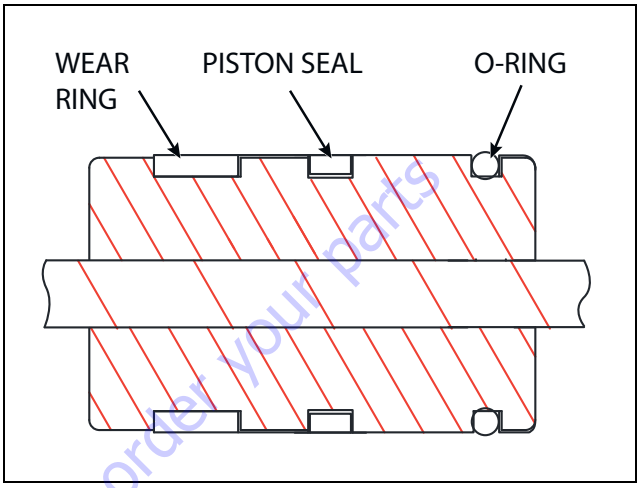


Figure 5-59. Piston Seal Kit Installation

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. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston wear ring and seal.
15. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.
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.

Master Cylinder (E/M600J/JP)

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. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

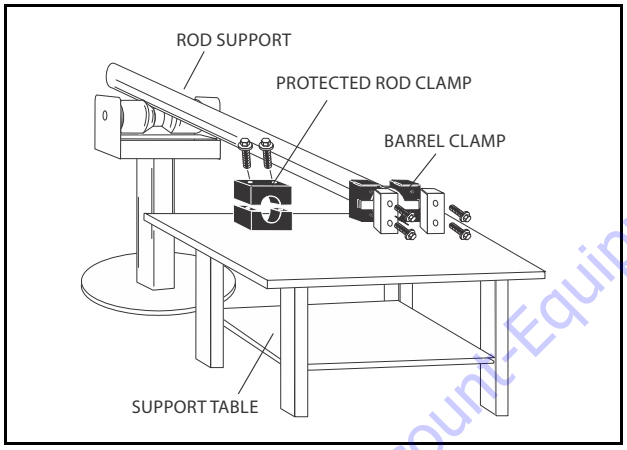


Figure 5-60. Cylinder Barrel Support

4. Using a hook spanner wrench, loosen the setscrew and remove setscrew from the cylinder barrel.

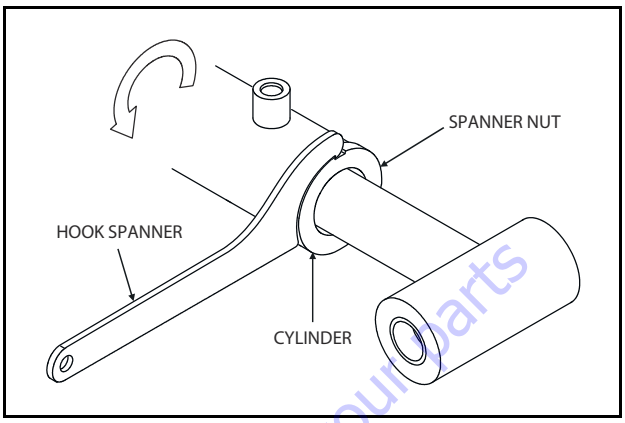


Figure 5-61. Cylinder Head Removal

5. 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.

6. With the barrel clamped securely, carefully withdraw the complete rod assembly from the cylinder barrel.

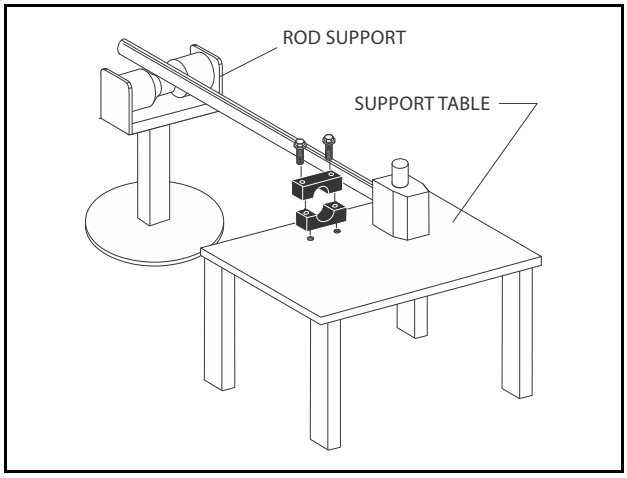
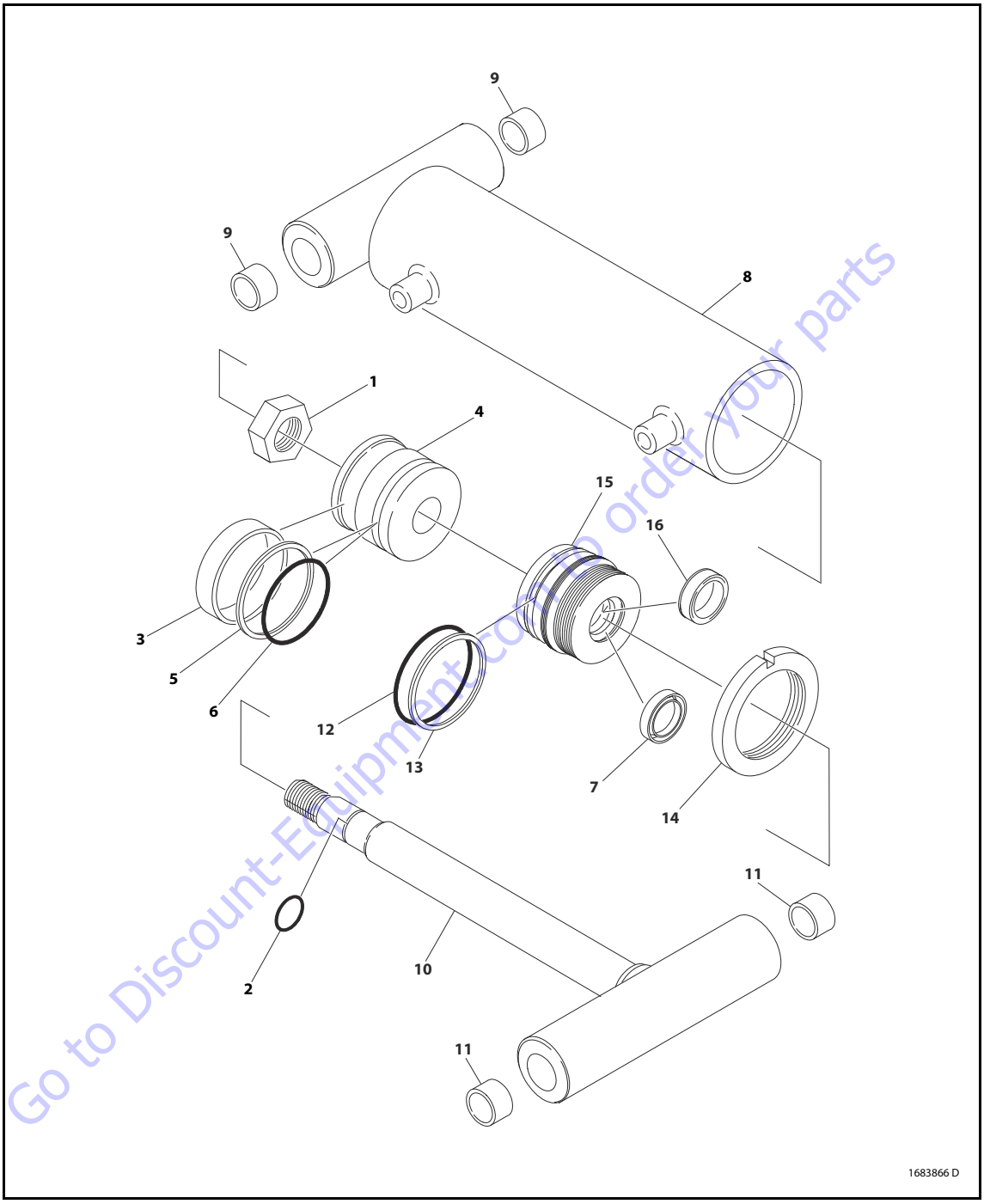


Figure 5-62. Cylinder Rod Support



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

Figure 5-63. Master Cylinder (E/M600J/JP)

7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
8. Loose and remove the nut from the cylinder rod.
9. Screw the piston counterclockwise, by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

10. Remove and discard the piston seal, wear ring and o-ring from the outside groove of the piston.
11. Remove o-ring from the groove of the cylinder rod end.
12. Remove the rod from the holding fixture. Remove the cylinder head.
13. Remove and discard the o-ring, back-up ring from the outer groove of the cylinder head. Remove and discard rod seal, wiper seal from the inner groove of the cylinder head.
14. Remove the spanner nut from the cylinder rod.

CLEANING AND INSPECTION

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. 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.*

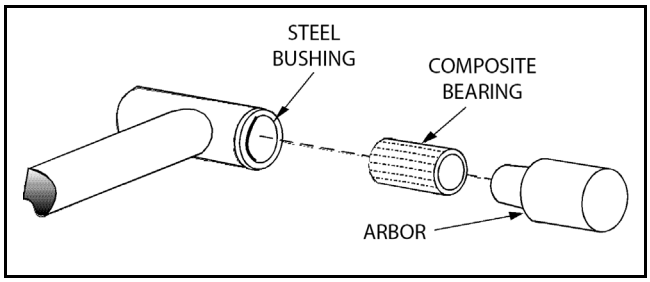


Figure 5-64. Composite Bearing Installation

14. Inspect port block fittings and holding valve. Replace as necessary.
15. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
16. 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 gland groove.

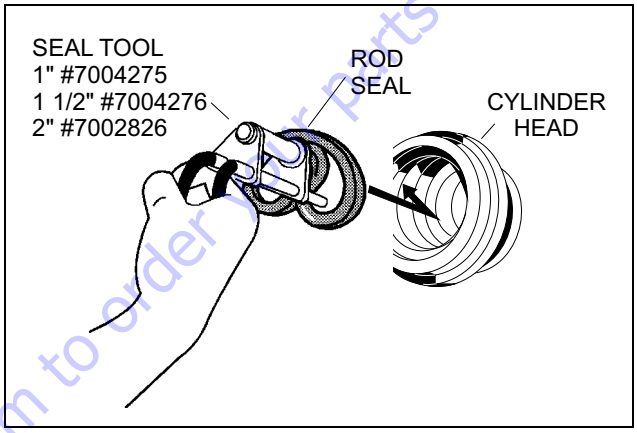


Figure 5-65. Rod Seal Installation

NOTICE

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

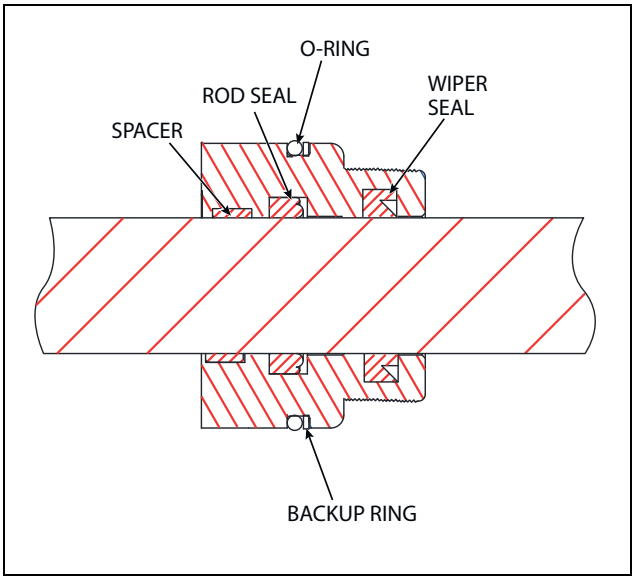


Figure 5-66. Cylinder Head Seal Installation

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

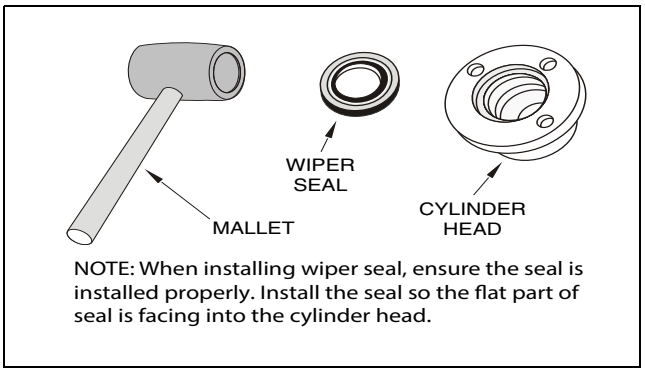


Figure 5-67. Wiper Seal Installation

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

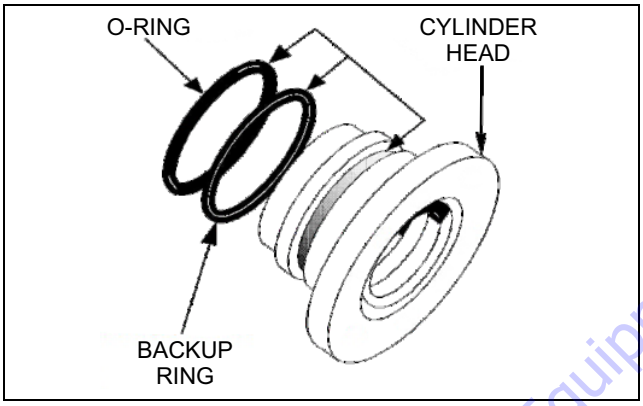


Figure 5-68. Installation of Head Seal Kit

4. Install the spanner nut onto the cylinder rod.
5. 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.
6. Install o-ring in the groove of the cylinder rod.
7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture close to piston as possible.
8. Carefully thread the piston on the cylinder rod hand tight.
9. Install and tighten the lock nut onto the cylinder rod.
10. Remove the cylinder rod from the holding fixture.
11. Place new piston seal, wear rings and o-ring in the outer and inner piston diameter groove. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

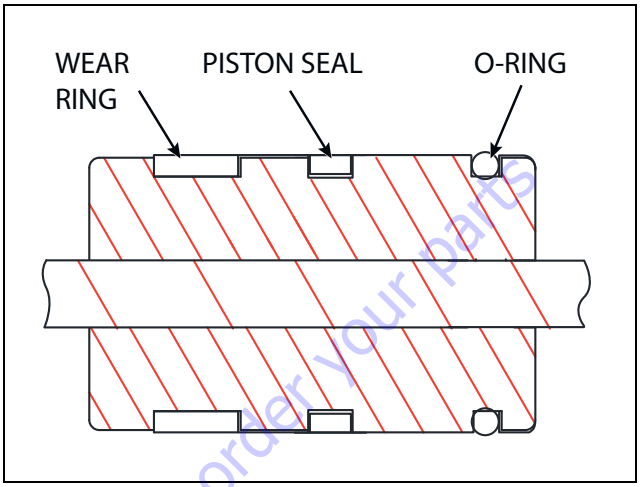


Figure 5-69. Piston Seal Kit Installation

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. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston wear ring and seal.
14. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.
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.

Steer 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 plugs from cylinder port.
4. Place the cylinder barrel into a suitable holding fixture.Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

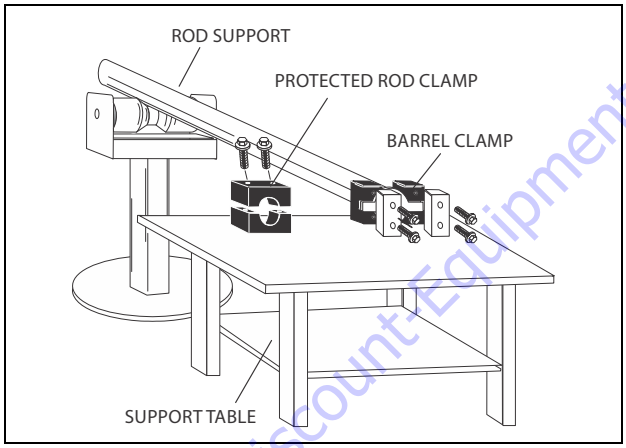


Figure 5-70. Cylinder Barrel Support

5. Using a pin-face spanner wrench, unscrew the cylinder head from both ends of the barrel.

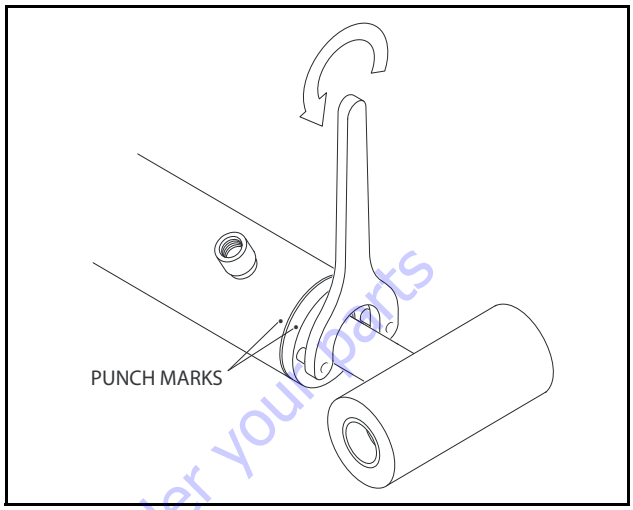


Figure 5-71. Cylinder Head Removal

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, carefully withdraw the complete rod assembly from the cylinder barrel.

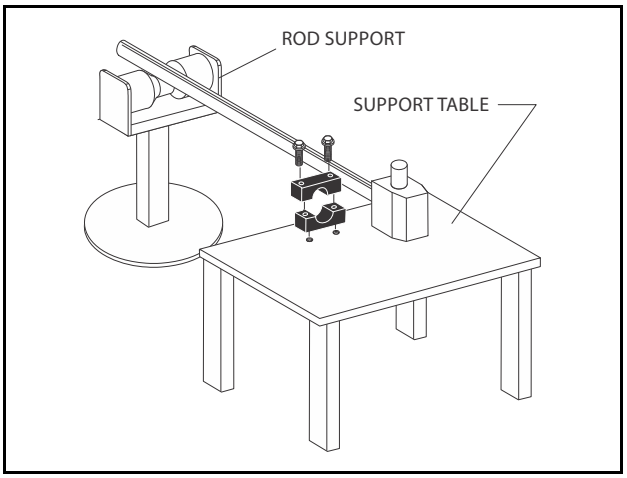
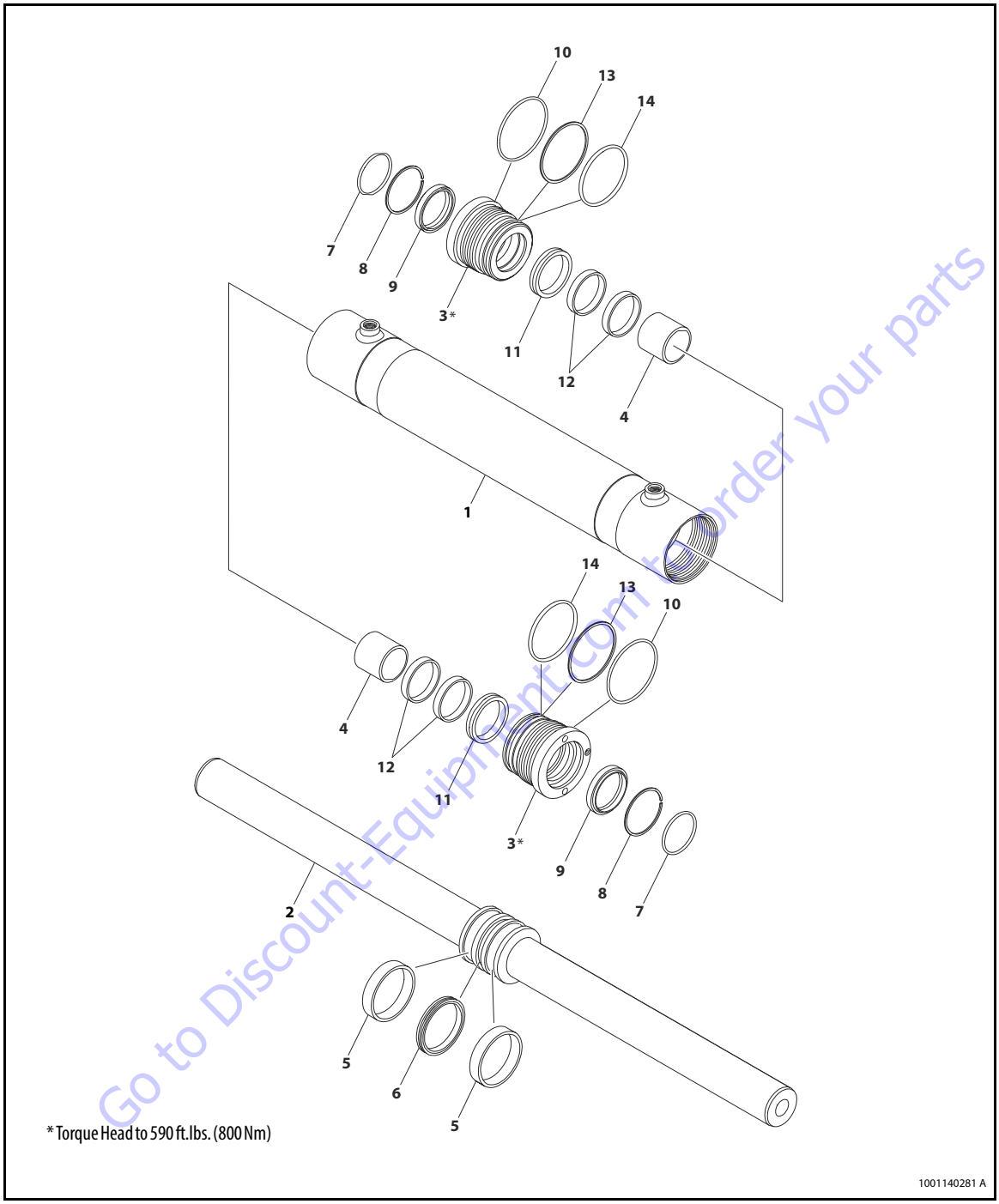


Figure 5-72. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Spacer
5. Wear Ring
6. T-seal
7. O-Ring
8. Retainer
9. Wiper Seal
10. O-Ring
11. Piston Seal
12. Wear Ring
13. Backup Ring
14. O-Ring

Figure 5-73. Steer Cylinder

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

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

10. Remove and discard the o-rings and backup ring from the outer groove of the cylinder.
11. Remove and discard the o-rings, retainer, wiper seal, rod seal and wear ring from the applicable inner groove of the cylinder heads.
12. Remove spacer from the cylinder rod.

NOTE: *Repeat steps 8 thru 11 to remove cylinder head assembly from the other end of cylinder rod.*

13. Screw the piston counterclockwise, by hand and remove the piston from cylinder rod.
14. Remove and discard wear ring and piston seal from the piston.

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

NOTICE

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

1. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture close to piston as possible.
2. Carefully thread the piston on the cylinder rod hand tight.
3. Place new piston seal and wear rings in outer groove of the piston. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

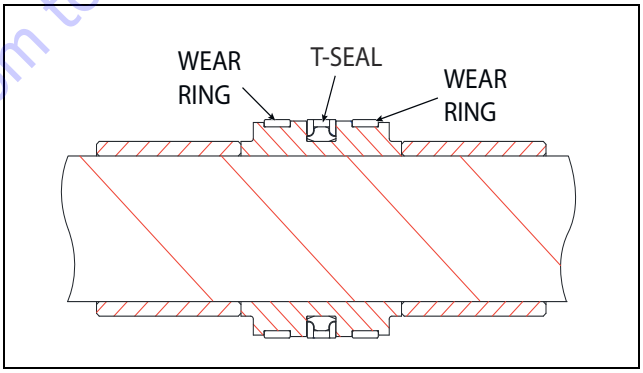


Figure 5-74. Installation of Piston Seal Kit

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

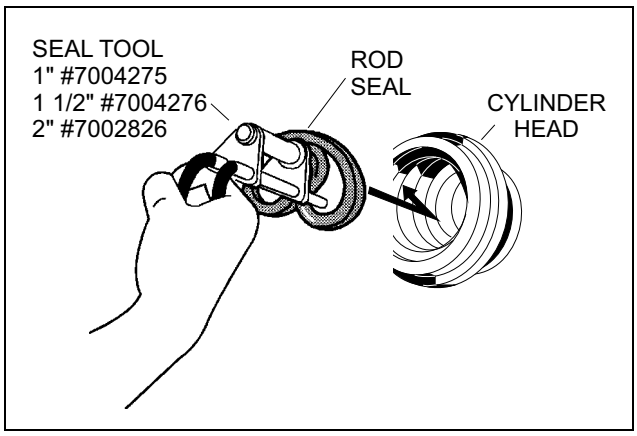
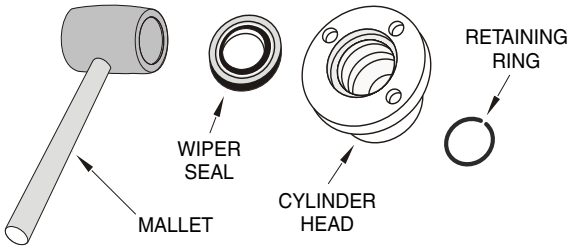


Figure 5-75. Rod Seal Installation

5. Use a soft mallet to tap a new wiper seal into the applicable cylinder guide gland groove. Install the new retaining ring into the applicable groove of the cylinder Head.



NOTE: When installing wiper seals, ensure the seals are installed proerly. Install the seal so the flat part of the seal is facing into the cylinder head

Figure 5-76. Wiper Seal Installation

6. Place a new o-ring and wear ring in the applicable inner groove of the cylinder head.
7. Place a new o-rings and backup ring in the applicable outer groove of the cylinder head.

NOTE: *Repeat steps 4 thru 7 to install cylinder head assembly into the other end of barrel.*

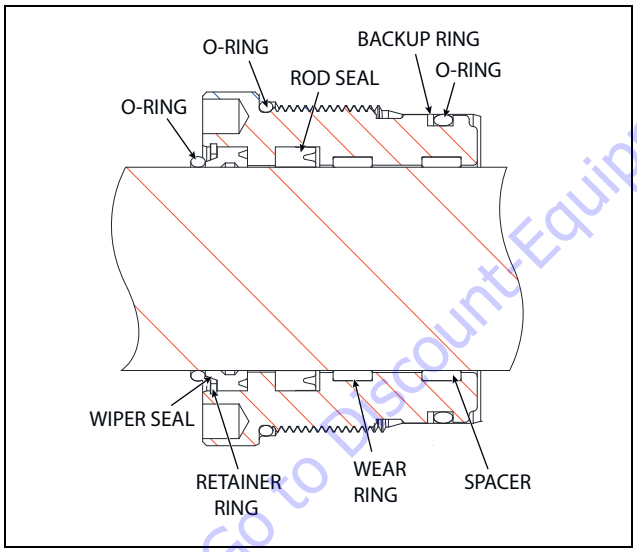


Figure 5-77. Cylinder Head Seal Installation

8. Remove the cylinder rod from the 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.

9. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston wear ring and seal.
10. Install Cylinder head assembly onto both ends od cylinder rod.
11. Screw cylinder head into the barrel from both end. Torque to 590 ft.lbs. (800 Nm).
12. Install plug into the cylinder port and torque to 22 ft.lbs (30 Nm).

Telescope 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. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

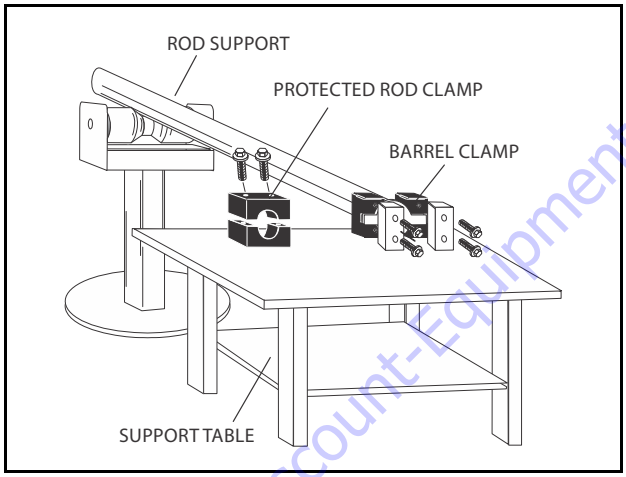


Figure 5-78. Cylinder Barrel Support

4. Remove bolts and valve assembly from the barrel end. Discard o-rings.

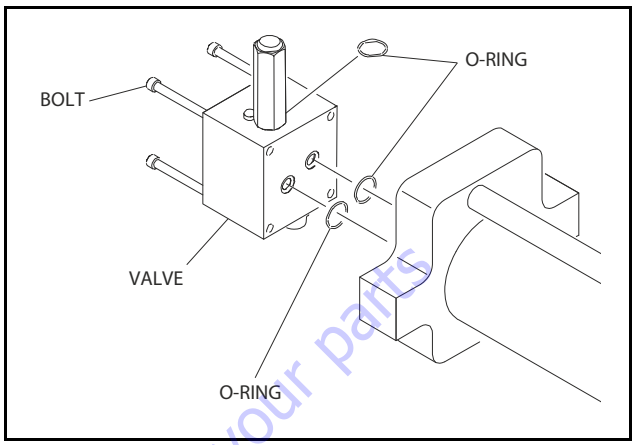


Figure 5-79. Valve Removal

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

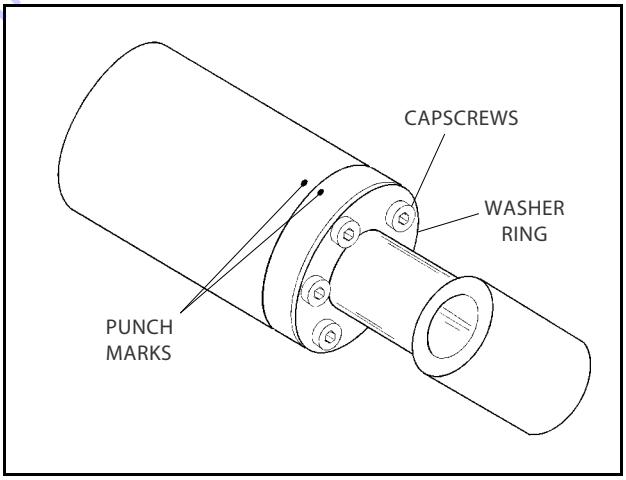
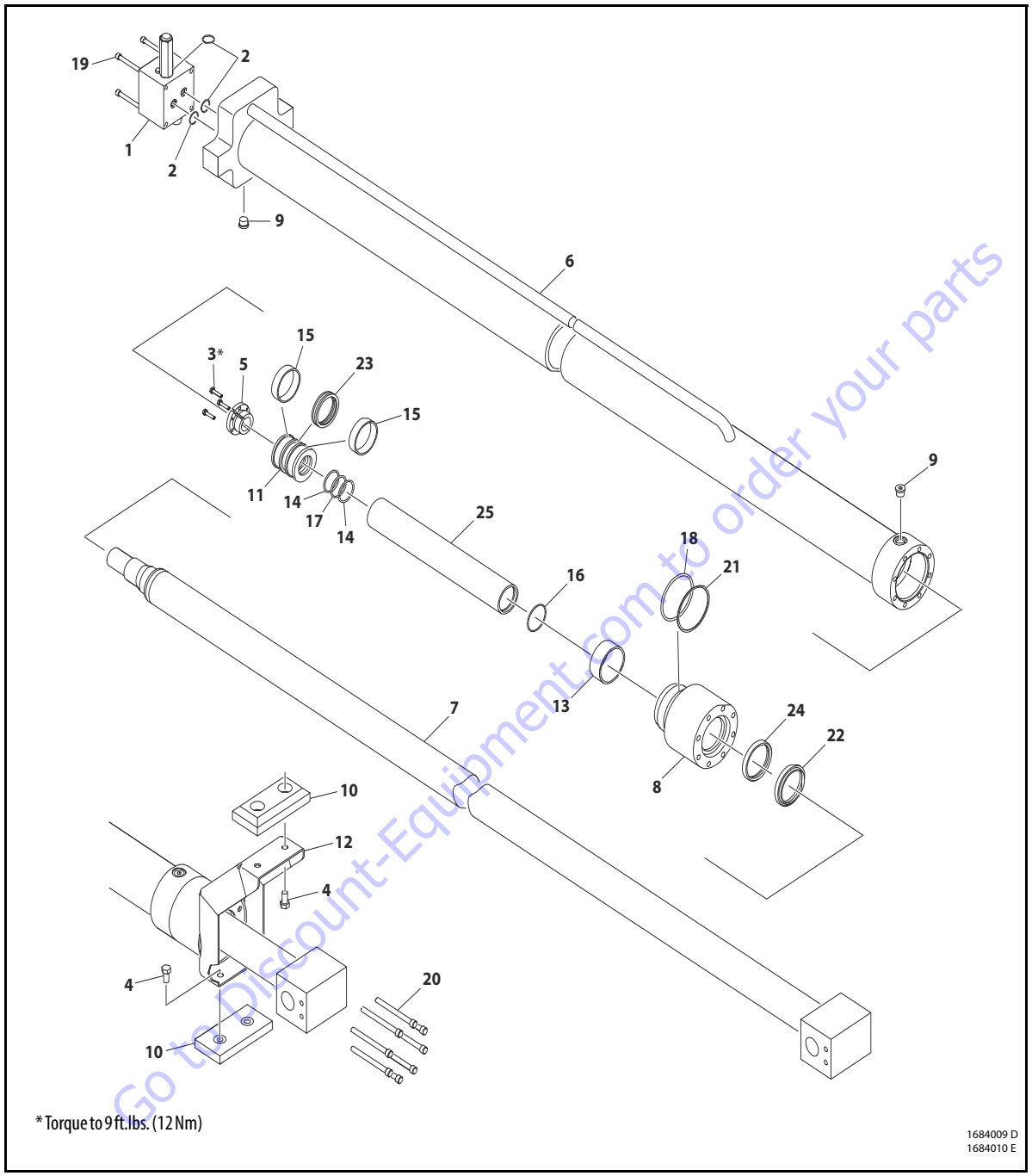


Figure 5-80. Cylinder Head Removal

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.



1. Valve Assembly	6. Barrel	11. Piston	16. O-ring	21. Back-up Ring
2. Valve Seal	7. Rod	12. Support Plate	17. O-ring	22. Wiper Seal
3. Bolt	8. Head	13. Wear Ring	18. O-ring	23. Piston Seal
4. Bolt	9. Plug	14. Back-up Ring	19. Capscrew	24. Rod Seal
5. Tapered Bushing	10. Pad Support	15. Wear Ring	20. Bolt	25. Spacer

Figure 5-81. Telescope Cylinder

7. With the barrel clamped securely, carefully withdraw the complete rod assembly from the cylinder barrel.

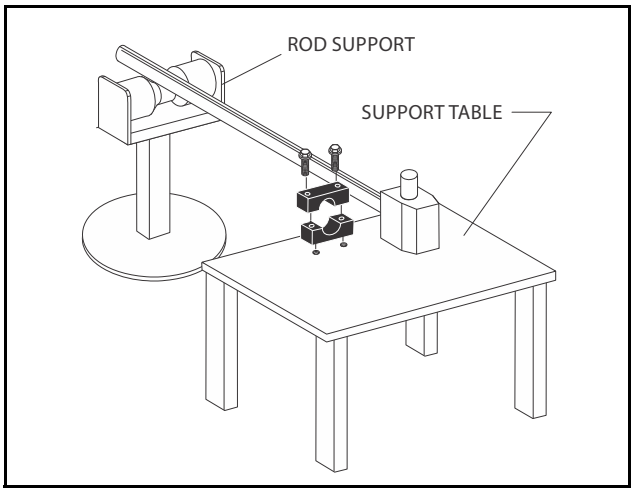


Figure 5-82. Cylinder Rod Support

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
9. Loosen and remove bolt from tapered bushing and piston.
10. Insert bolts in threaded holes in outer piece of tapered bushing. Progressively tighten bolts until bushing is loose. Remove tapered bushing from piston.

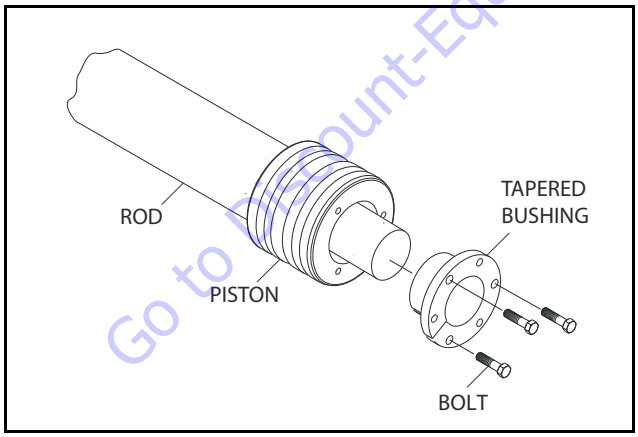


Figure 5-83. Tapered Bushing Removal

11. Screw the piston counterclockwise by hand and remove the piston from cylinder rod.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

12. Remove and discard backup ring and o-ring from the inside groove of piston. Remove and discard wear ring and piston seal from the outside groove of the piston.
13. Remove spacer from the cylinder rod.
14. Remove and discard the o-ring, backup ring from outer groove of the cylinder head. Remove and discard the wear ring, o-ring, wiper seal and rod seal inner groove of the cylinder head.
15. Remove the rod from the holding fixture. Remove the cylinder head.

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.
12. Inspect wear pads for damage and worn pads. Replace parts as required.

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

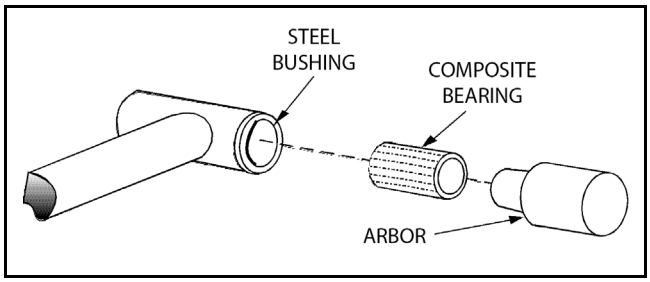


Figure 5-84. Composite Bearing Installation

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

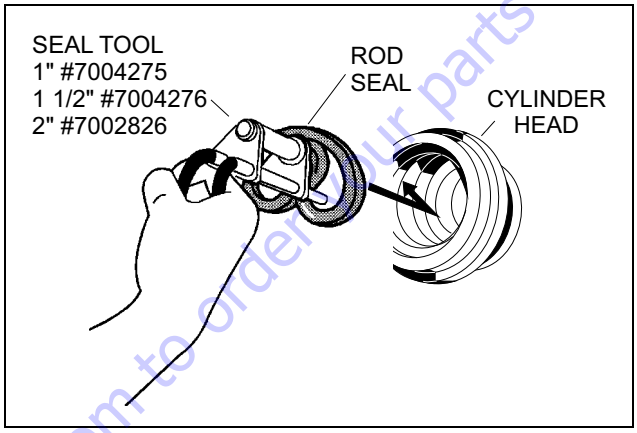


Figure 5-85. Rod Seal Installation

NOTICE

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

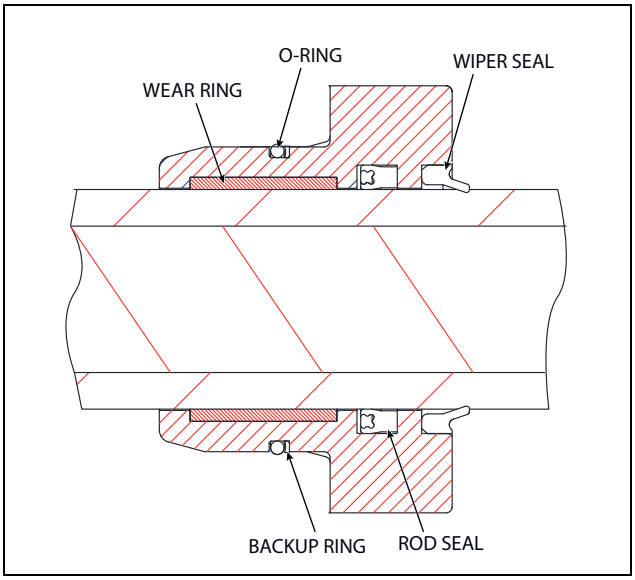


Figure 5-86. Cylinder Head Seal Installation

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

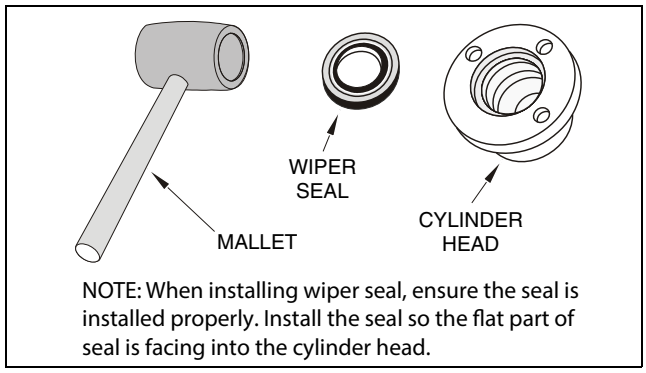


Figure 5-87. Wiper Seal Installation

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

4. Place a new wear ring in the applicable inside groove of cylinder head.

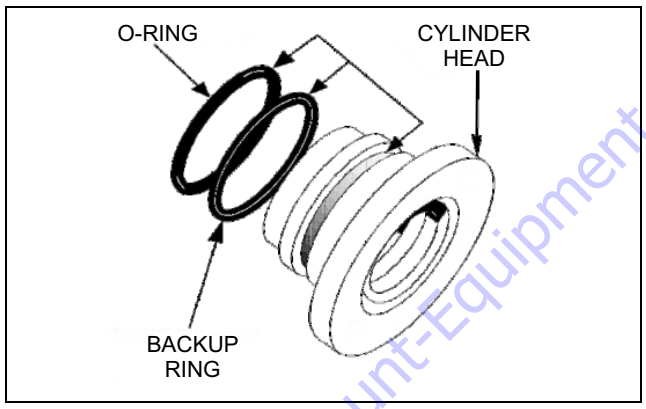


Figure 5-88. Installation of Head Seal Kit

5. Place the cylinder cap over the rod and 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.

6. Push spacer onto the cylinder rod.

7. Place a new o-ring and backup ring in the inner groove of the piston.

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

9. Thread the piston on the cylinder rod hand tight, ensuring that the o-ring are not damaged or dislodged.

NOTE: *When installing the tapered bushing, piston and mating end of rod must be free of oil.*

10. Assemble the tapered bushing loosely into the piston and insert capscrews through the drilled holes in the bushing and into the tapped holes in the piston.

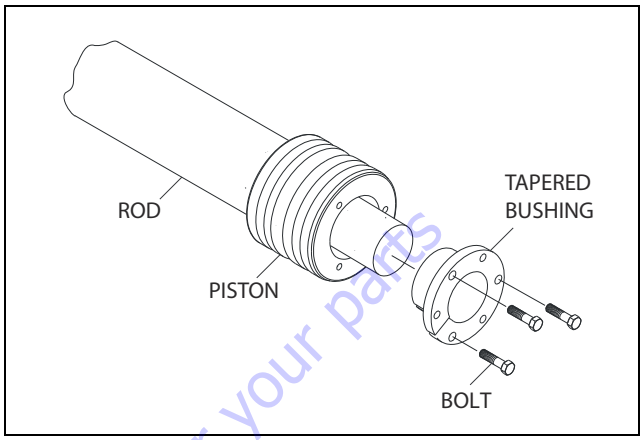


Figure 5-89. Tapered Bushing Removal

11. Tighten the bolt evenly and progressively in rotation to 9 ft.lbs. (12 Nm).

12. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;

    a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.

    b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

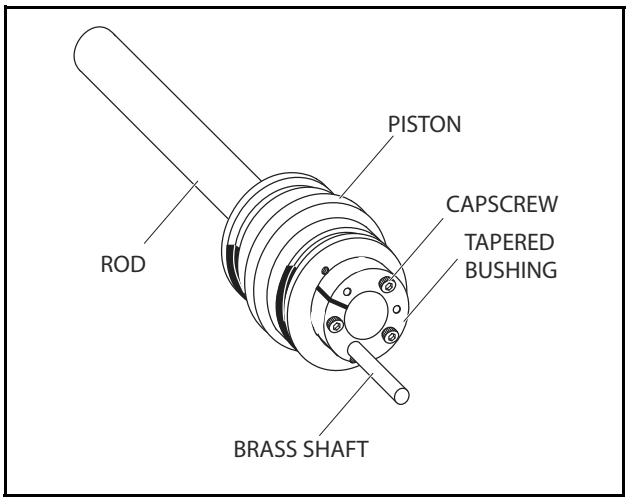


Figure 5-90. Seating the Tapered Bushing

13. Rotate the bolt evenly and progressively in rotation to 9 ft.lbs. (12 Nm).

14. Remove the cylinder rod from the holding fixture.

15. Place new cap seal and wear rings in the outer piston diameter groove. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

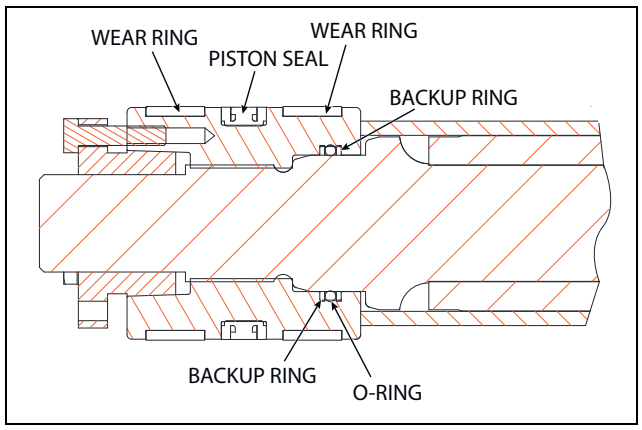


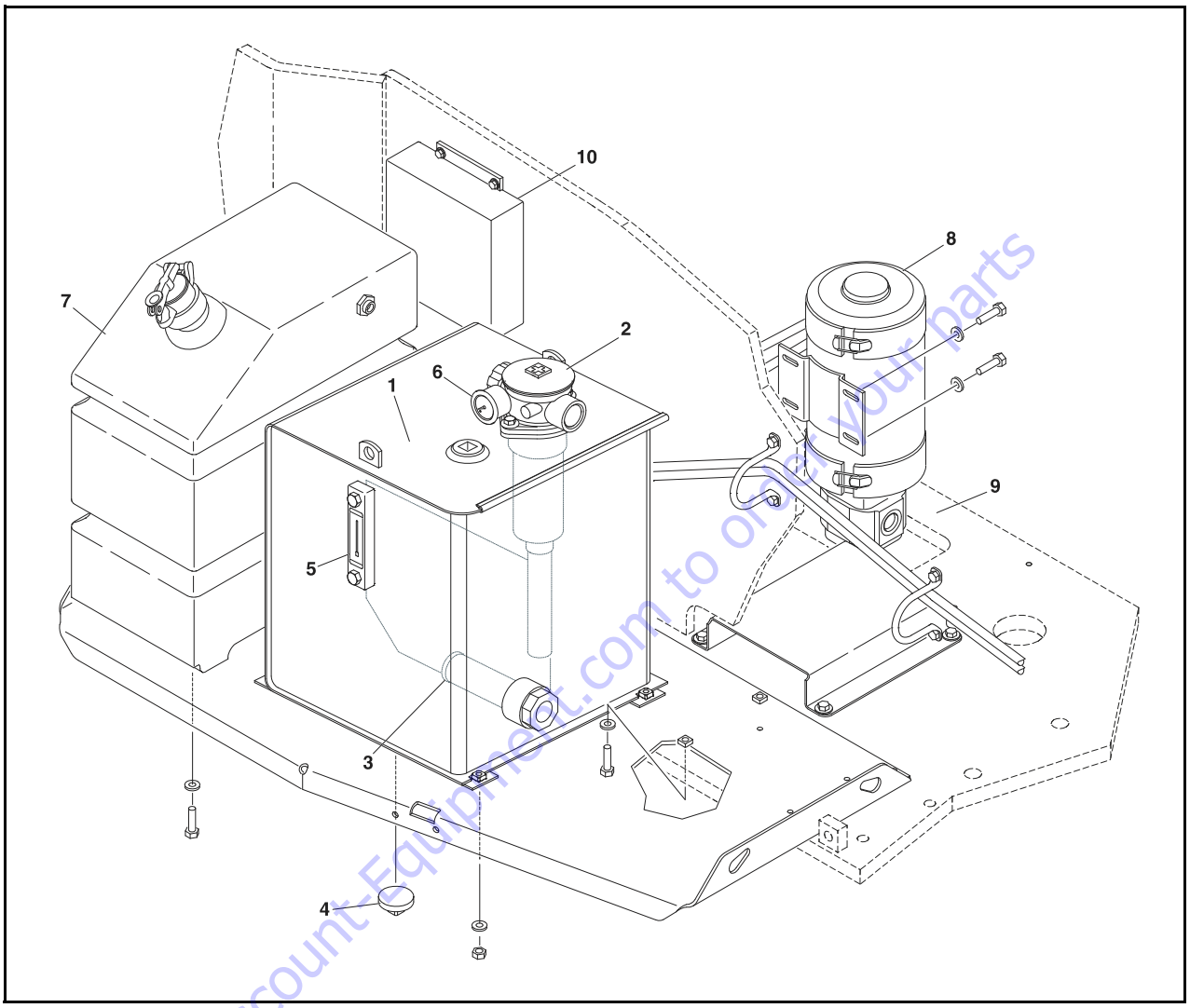
Figure 5-91. Piston Seal Kit Installation

16. 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.

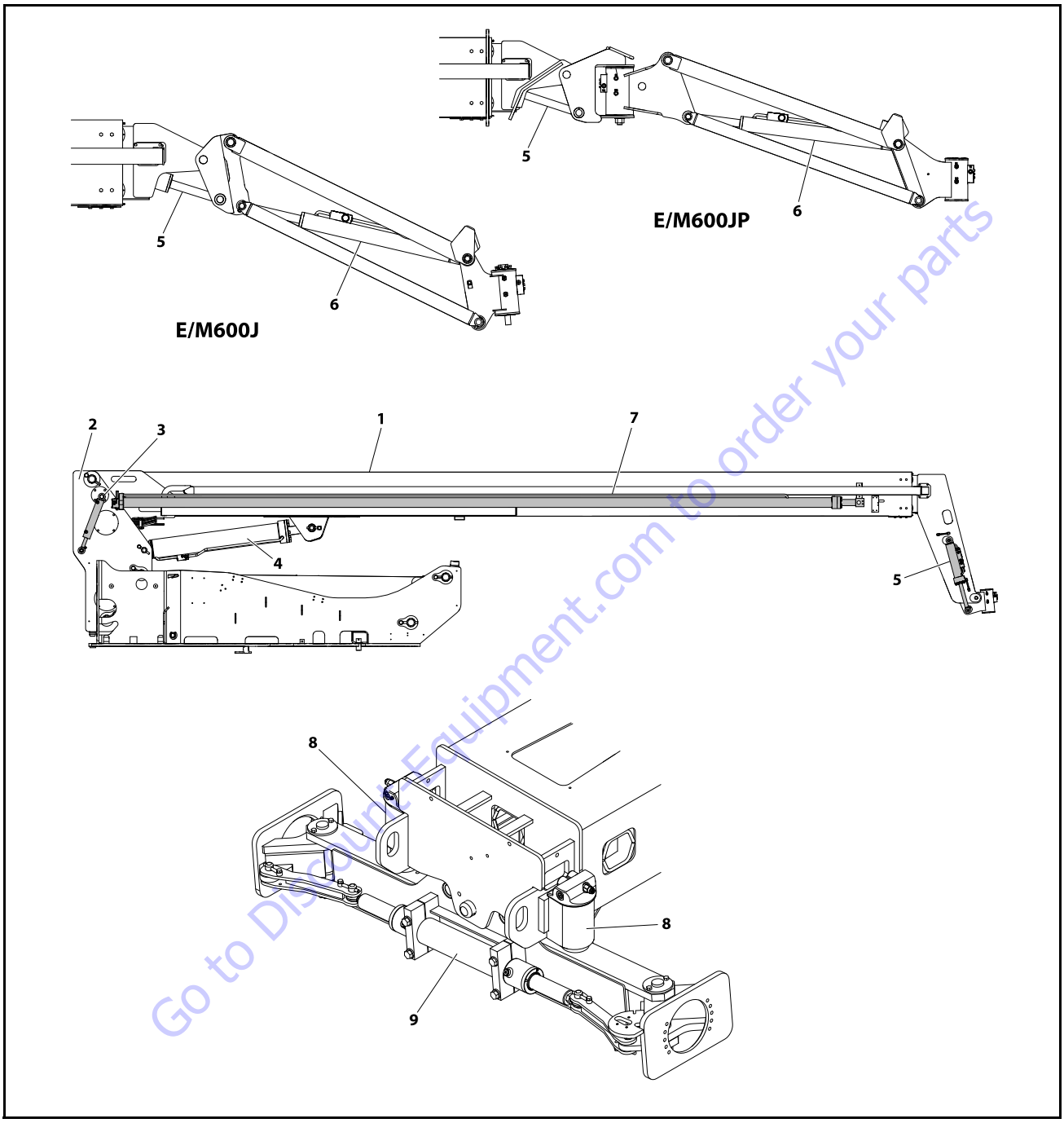
17. With barrel clamped securely, and while adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.
18. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.
19. Secure the cylinder head and cylinder cap in the cylinder barrel..
20. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any holding valve or valves.
21. Install valve assembly, new o-ring and plugs on the cylinder barrel.



1. Hydraulic Tank
2. Filter & Pressure Switch
3. Suction Strainer
4. Magnetic Plug
5. Sight Gauge
6. Filter Indicator
7. Tank Strap
8. Electric Motor
9. Hydraulic Pump
10. Contactor Module
11. Fuel Tank (M Models Only)

Figure 5-92. Hydraulic Tank and Pump

5.3 CYLINDER REMOVAL AND INSTALLATION



1. Main Boom
2. Upright Level
3. Master Cylinder
4. Main Lift Cylinder
5. Slave Cylinder
6. Jib Lift Cylinder
7. Main Telescope Cylinder
8. Axle Lockout Cylinder
9. Steer Cylinder

Figure 5-93. Hydraulic Cylinder Location

Main Boom Telescope Cylinder Removal

1. Place machine on a flat and level surface, with main boom in the horizontal position.

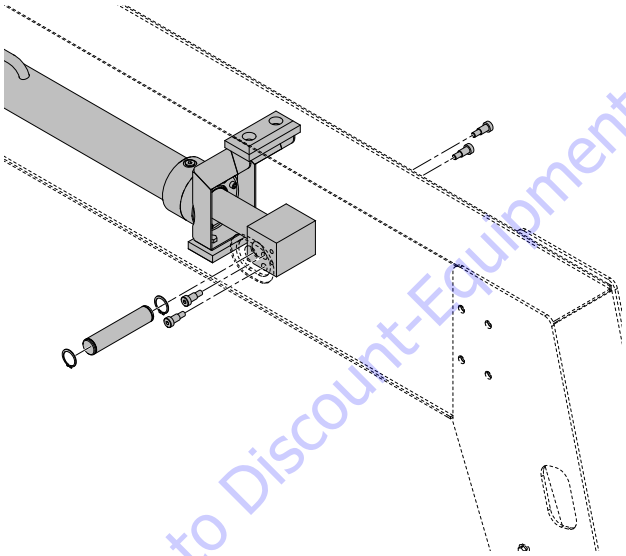
NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

2. Support platform end of the main boom with suitable lifting device.
3. Extend the boom to gain access to main fly boom telescope cylinder rod end pin.

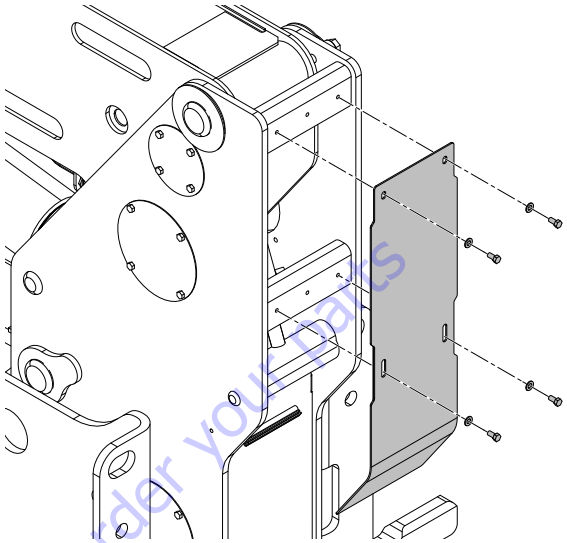
NOTICE

CAP HYDRAULIC LINES AND PORTS IMMEDIATELY AFTER DISCONNECTING LINES TO PREVENT SYSTEM CONTAMINATION.

4. Tag and disconnect hydraulic lines to telescope cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic line and ports.
5. Remove bolt and keeper pin from cylinder rod pin.
6. Carefully drive out telescope cylinder rod pin from the fly boom using suitable brass drift.

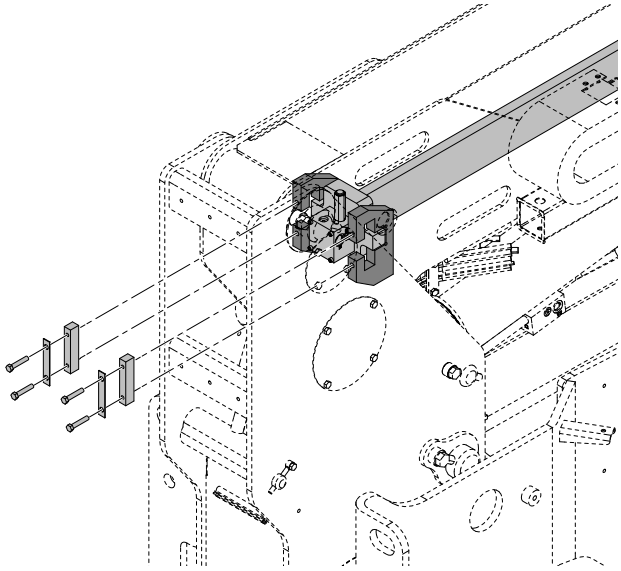


7. Remove four bolt which attach cover plate on the rear of the upright and remove upright cover plate.



NOTE: *First remove master cylinder from the upright then Remove main boom telescope cylinder. Refer "Main Boom Lift Cylinder Removal" on page 51.*

8. Remove four bolts, two blocks and shims from telescope cylinder barrel end support.



NOTE: *The main telescope cylinder weighs* approximately *370 lbs. (168 kg).*

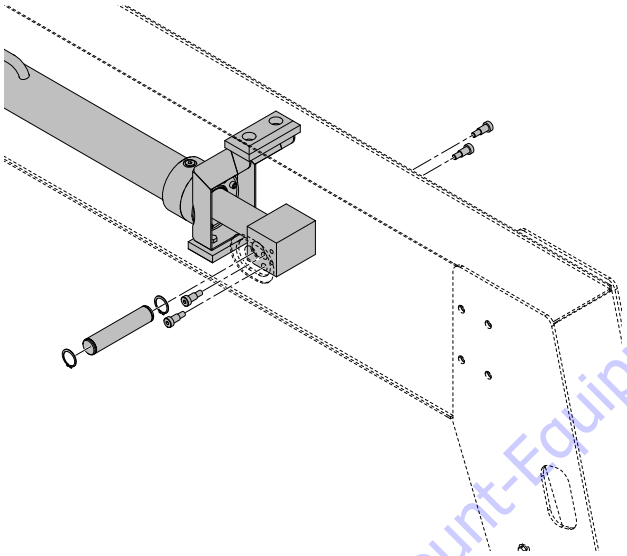
9. Attach a suitable sling to telescope cylinder. Attach suitable lifting device to sling and pull cylinder partially from the boom assembly.
10. Secure cylinder with a suitable sling and lifting device at approximate center of gravity.

Main Boom Telescope Cylinder Installation

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

NOTE: *The main telescope cylinder weighs* approximately *370 lbs. (168 kg).*

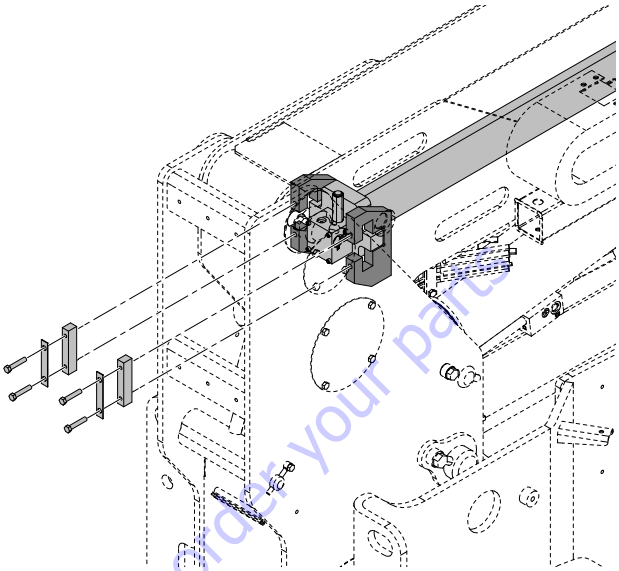
3. Using suitable lifting device, carefully lower the cylinder to boom assembly and place telescope cylinder into the boom assembly.
4. Remove lifting device from the telescope cylinder.
5. Install telescope cylinder rod pin in fly boom. Install keeper pin and bolt.



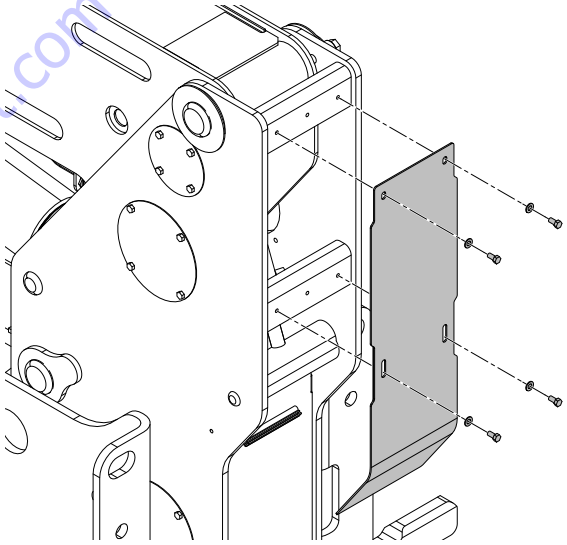
6. Install telescope cylinder barrel end support in slot in base boom.

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

7. Install four bolts, two blocks and shims to attach telescope cylinder barrel ens support to boom assembly.



8. Install four bolts which attach cover plate on the rear of the upright.



9. Remove hydraulic line and port caps. Correctly route and connect hydraulic lines as tagged to the telescope cylinder.
10. Remove boom prop and suitable lifting device. Activate hydraulic system.
11. Using all applicable safety precautions, operate boom functions. Check for proper operation and hydraulic leaks. Secure as necessary.
12. Check fluid level of hydraulic tank. Adjust as needed.

Main Boom Lift Cylinder Removal

1. Place machine on a flat and level surface, with main boom in the horizontal position.

NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

2. Support platform end of the main boom with suitable lifting device.

NOTICE

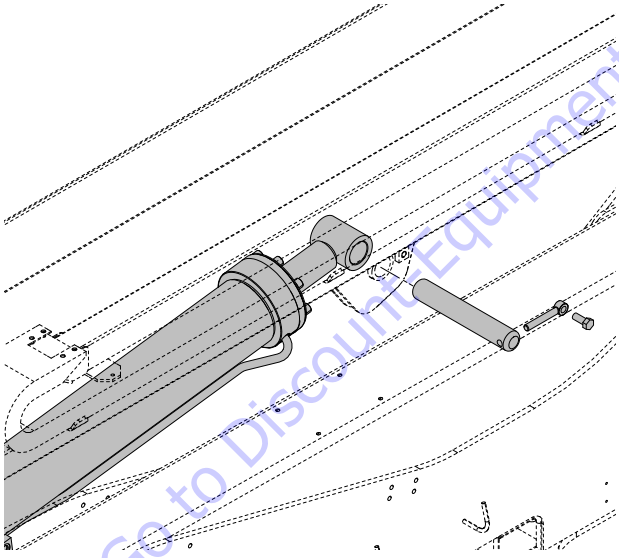
CAP HYDRAULIC LINES AND PORTS IMMEDIATELY AFTER DISCONNECTING LINES TO PREVENT SYSTEM CONTAMINATION.

3. Tag and disconnect hydraulic lines to lift cylinder. Use suitable container to retain residual hydraulic fluid. Cap hydraulic line and ports.

NOTE: *The main lift cylinder weighs* approximately *300 lbs. (136 kg).*

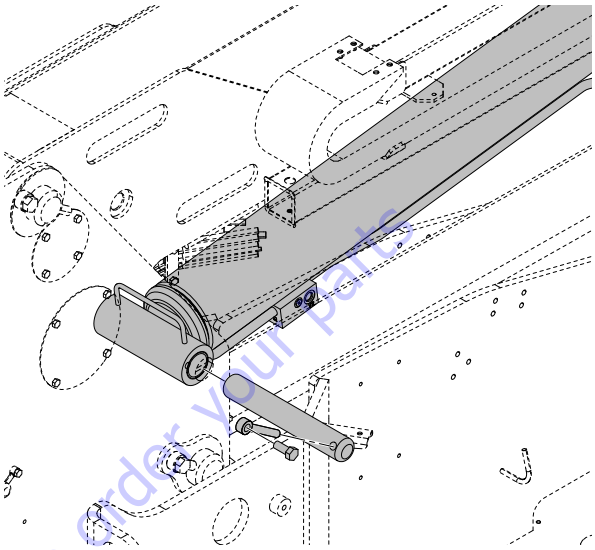
4. Attach a suitable lifting device to support main boom lift cylinder.

5. Remove bolt and keeper pin from cylinder rod pin. Carefully drive out pin using suitable brass drift.



6. Fully retract lift cylinder rod using auxiliary power.

7. Remove bolt and keeper pin from barrel end attach pin. Carefully drive out barrel end attach pin using suitable brass drift.



8. Remove cylinder from the machine and place in suitable work area.

Main Boom Lift Cylinder Installation

NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

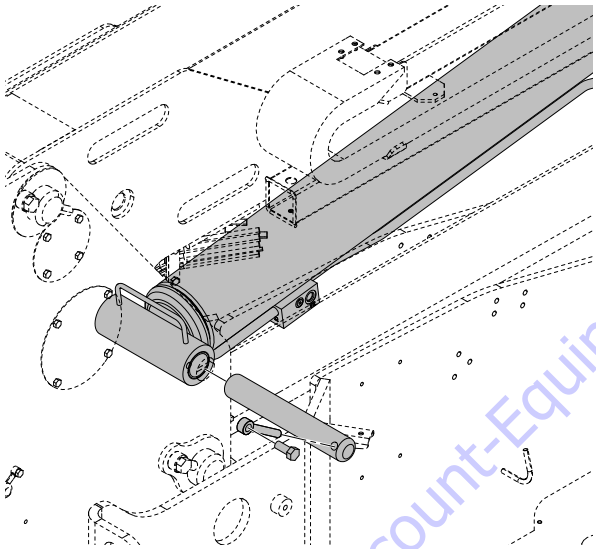
1. Support platform end of the main boom with suitable prop.

NOTE: *The main boom lift cylinder weighs* approximately *300 lbs. (136 kg).*

2. Install lift cylinder in place using suitable lifting device and support. Align attach pin mounting holes on upright.

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

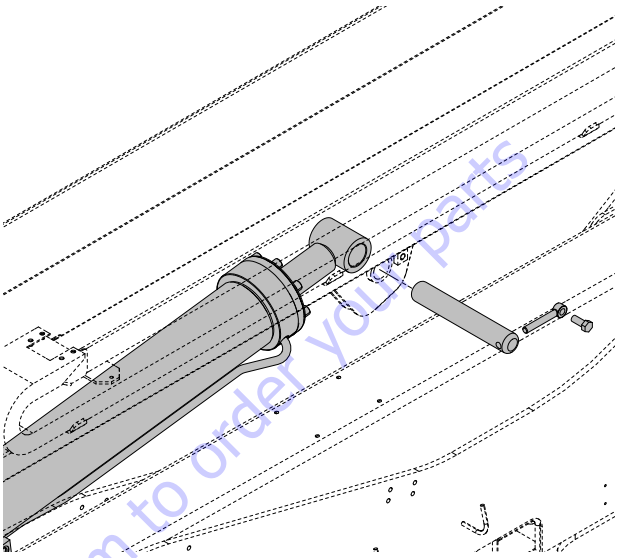
3. Use a suitable drift, drive barrel end attach pin through mounting holes in lift cylinder and upright. Install keeper pin and bolt.



4. Remove cylinder port plugs and hydraulic line caps. Connect previously tagged lines to cylinder ports.

5. Use auxiliary power to extend cylinder rod until attach pin hole aligns with hole in the boom.

6. Use a suitable drift to drive cylinder rod attach pin through aligned holes, take care to align the grooved pin holes. Install keeper pin and bolt.



7. Remove boom prop and lifting devices. Activate hydraulic system.

8. Using all applicable safety precautions, operate boom functions. Check for proper operation and hydraulic leaks. Secure as necessary.

9. Check fluid level of hydraulic tank. Adjust as needed.

Master Cylinder Removal

1. Place machine on a flat and level surface, with main boom in the horizontal position.

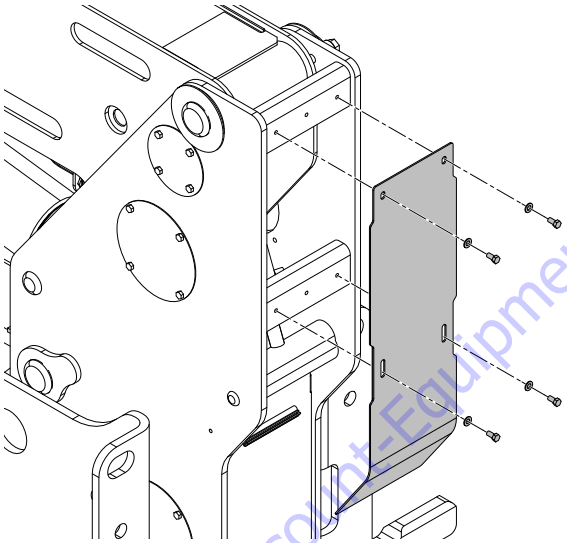
NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

2. Support platform end of the main boom with suitable prop.

NOTICE

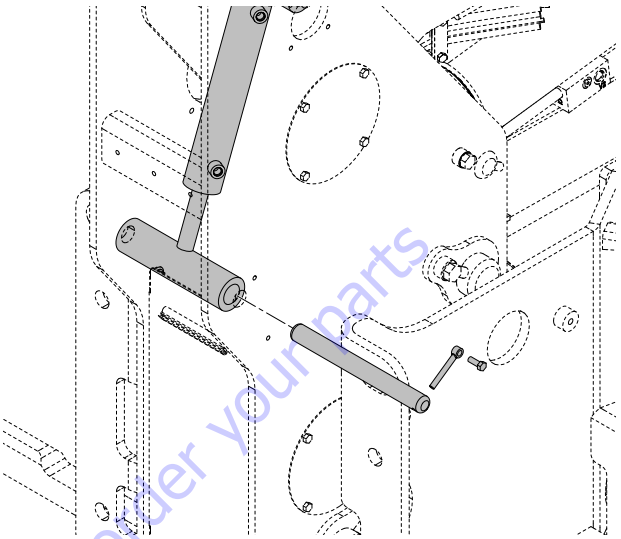
CAP HYDRAULIC LINES AND PORTS IMMEDIATELY AFTER DISCONNECTING LINES TO PREVENT SYSTEM CONTAMINATION.

3. Tag and disconnect hydraulic lines to lift cylinder. Use suitable container to retain residual hydraulic fluid. Cap hydraulic line and ports.
4. Remove four bolts which attach cover plate on the rear of the upright and remove upright cover plate.

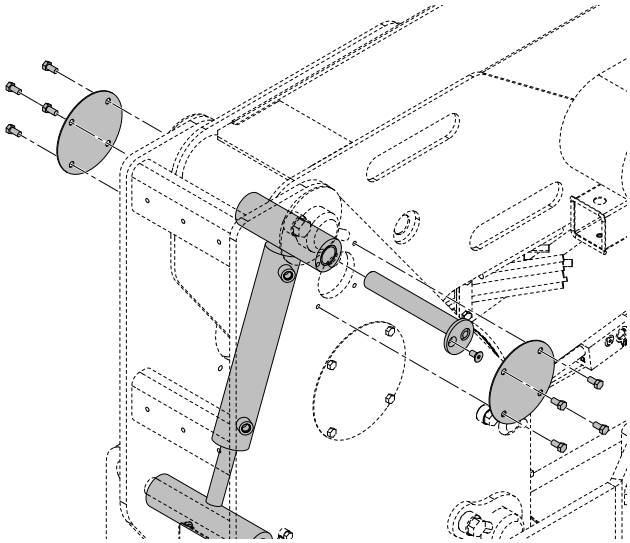


NOTE: *The master cylinder weighs* approximately *44 lbs. (20 kg).*

5. Use a suitable lifting device to support master cylinder.
6. Remove bolt and keeper pin from cylinder rod pin. Carefully drive out rod pin using suitable brass drift.



7. Remove four bolts which attach cover on top of the upright. Remove cover plate from both side.
8. Remove screw from barrel end attach pin. Carefully drive out barrel end attach pin using suitable brass drift.



9. Remove cylinder from the machine and place in suitable work area.

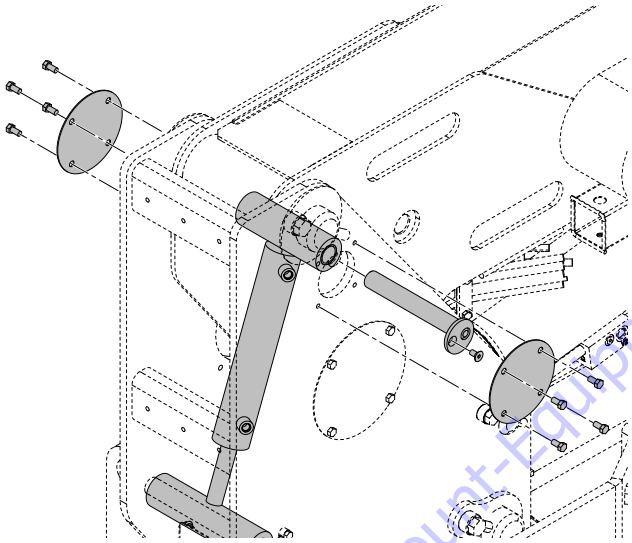
Master Cylinder Installation

NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

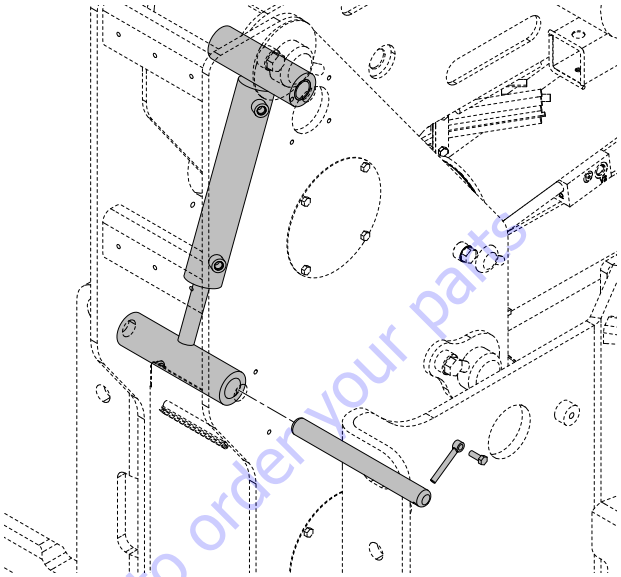
1. Support platform end of the main boom with suitable prop.
2. Install master cylinder in place using suitable lifting device and support. Align attach pin mounting holes on upright.

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

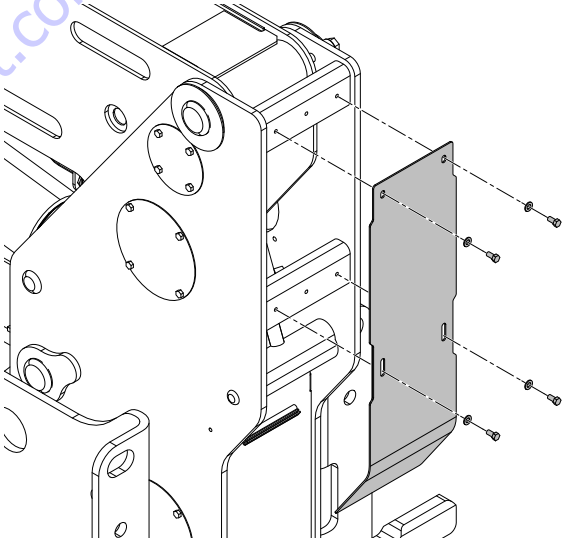
3. Use a suitable drift to drive barrel end attach pin through mounting holes in master cylinder and upright. Secure barrel end attach pin with screw.
4. Install cover plates to the upright using four bolt on both side.



5. Use a suitable drift to drive cylinder rod attach pin through aligned holes, take care to align the grooved pin holes. Install keeper pin and bolt.



6. Install cover plate on the rear of the upright using four bolts.



7. Remove cylinder port plugs and hydraulic line caps. Connect previously tagged lines to cylinder ports.
8. Remove boom prop and lifting devices. Activate hydraulic system.
9. Using all applicable safety precautions, operate boom functions. Check for proper operation and hydraulic leaks. Secure as necessary.
10. Check fluid level of hydraulic tank. Adjust as needed.

Slave Cylinder Removal

1. Place machine on a flat and level surface, with main boom to the lowest position.
2. Use auxiliary power to retract the slave cylinder rod completely.

NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

3. Using a suitable lifting device, properly secure the platform to prevent the platform from tilting backward or forward during removal of the slave cylinder.

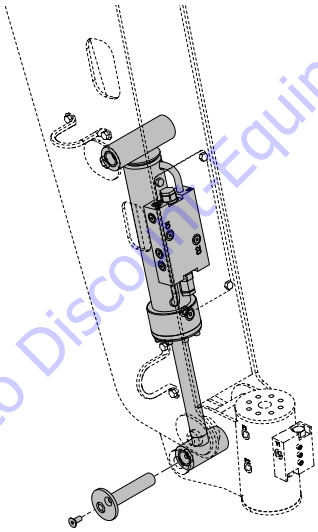
NOTICE

CAP HYDRAULIC LINES AND PORTS IMMEDIATELY AFTER DISCONNECTING LINES TO PREVENT SYSTEM CONTAMINATION.

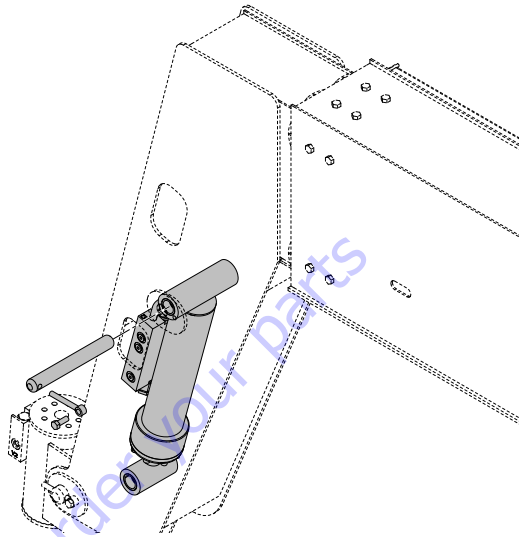
4. Tag and disconnect hydraulic lines to lift cylinder. Use suitable container to retain residual hydraulic fluid. Cap hydraulic line and ports.

NOTE: *The Slave cylinder weighs approximately 68 lbs (31 kg).*

5. Use suitable sling and lifting device to support slave cylinder.
6. Remove screw from cylinder rod attach pin. Carefully drive out rod pin using suitable brass drift.



7. Remove bolt and keeper pin from cylinder barrel attach pin. Carefully drive out rod pin using suitable brass drift.



8. Remove cylinder from the machine and place in suitable work area.

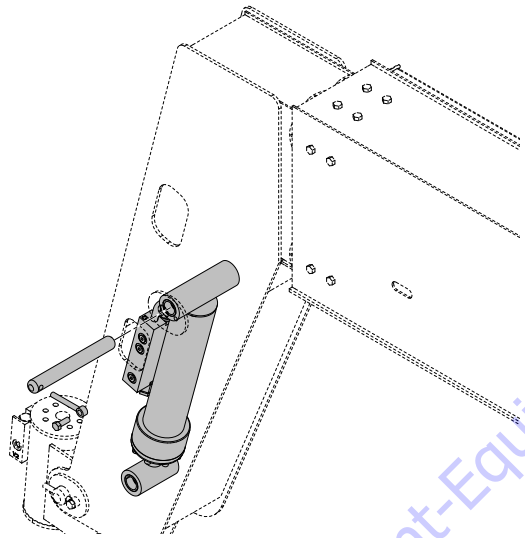
Slave Cylinder Installation

NOTE: *The main boom weighs* approximately *1816 lbs. (824 kg).*

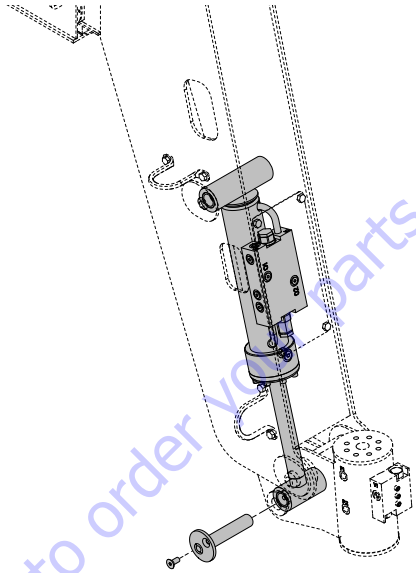
1. Using a suitable lifting device, properly secure the platform to prevent the platform from tilting backward or forward during removal of the slave cylinder.
2. Install slave cylinder in place using suitable lifting device and support. Align attach pin mounting holes in fly boom.

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

3. Use a suitable drift to drive barrel end attach pin through mounting holes in slave cylinder and fly boom. Install keeper pin and bolt.



4. Use a suitable drift to drive cylinder rod attach pin through aligned holes in slave cylinder and rotator. Secure rod end attach pin with screw.



5. Remove cylinder port plugs and hydraulic line caps. Connect previously tagged lines to cylinder ports.
6. Remove boom lifting devices. Activate hydraulic system.
7. Using all applicable safety precautions, operate boom functions. Check for proper operation and hydraulic leaks. Secure as necessary.
8. Check fluid level of hydraulic tank. Adjust as needed.

5.4 PRESSURE SETTING

Proportional Main Relief - 3200 psi (220 Bar)

Lift Down - 1100 psi (76 Bar)

Lift Up - 2500 (172 Bar)

Swing - 2500 psi (172 Bar)

Flow Control / Bang Bang Main Relief - 3000 psi (207 Bar)

Steer - 1800 (124 Bar)

Platform Level Up - 2500 psi (172 Bar)

Platform Level Down - 1500 psi (103 Bar)

Jib Up - 2300 psi (158.5 Bar)

Jib Down - 2300 psi (158.5 Bar)

NOTE: *All functions must be activated from the platform control station when adjusting pressures at the Platform Control and Main Valve Blocks.*

Proportional Main Relief

1. Connect the pressure gauge at the MP port on the main valve and disconnect the lift up coil on the main valve block.
2. Activate the lift up switch from the platform. Adjust pressure to 3200 psi (220 Bar).

Lift Down

1. Connect the pressure gauge at the MP port on the main valve.
2. Activate and bottom out lift down. Adjust pressure to 1100 psi (76 Bar).

Lift Up

1. Connect the pressure gauge at the MP port on the main valve.
2. Activate lift up until end of lift cylinder stroke. Adjust pressure to 2500 psi (172 Bar). If ceiling height will not allow elevation, disconnect lift up hose (port #8 on valve bank) and cap the port to make the setting.

Swing

1. Connect the pressure gauge at the MP port on the main valve.
2. Activate the swing function with the turntable lock pin engaged. Adjust pressure to 2500 psi (172 Bar).

Flow Control / Bang Bang Main Relief

1. Connect the pressure gauge at the MP port on the main valve.
2. Activate and bottom out telescope in. Adjust pressure to 3000 psi (207 Bar).

Steer

1. Connect the pressure gauge at the MP port on the main valve.
2. Activate and bottom out steer right or left. Adjust pressure to 1800 psi (124 Bar).

Platform Level Down

1. Connect a pressure gauge to the M1 port on the platform control valve bank.
2. Activate and bottom out Platform Level Down. Adjust to 1500 psi (103 Bar).

Platform Level Up Relief

1. Connect a pressure gauge to the M1 port on the platform control valve bank.
2. Activate and bottom out Platform Level Up. Adjust to 2500 psi (172 Bar).

Jib Relief

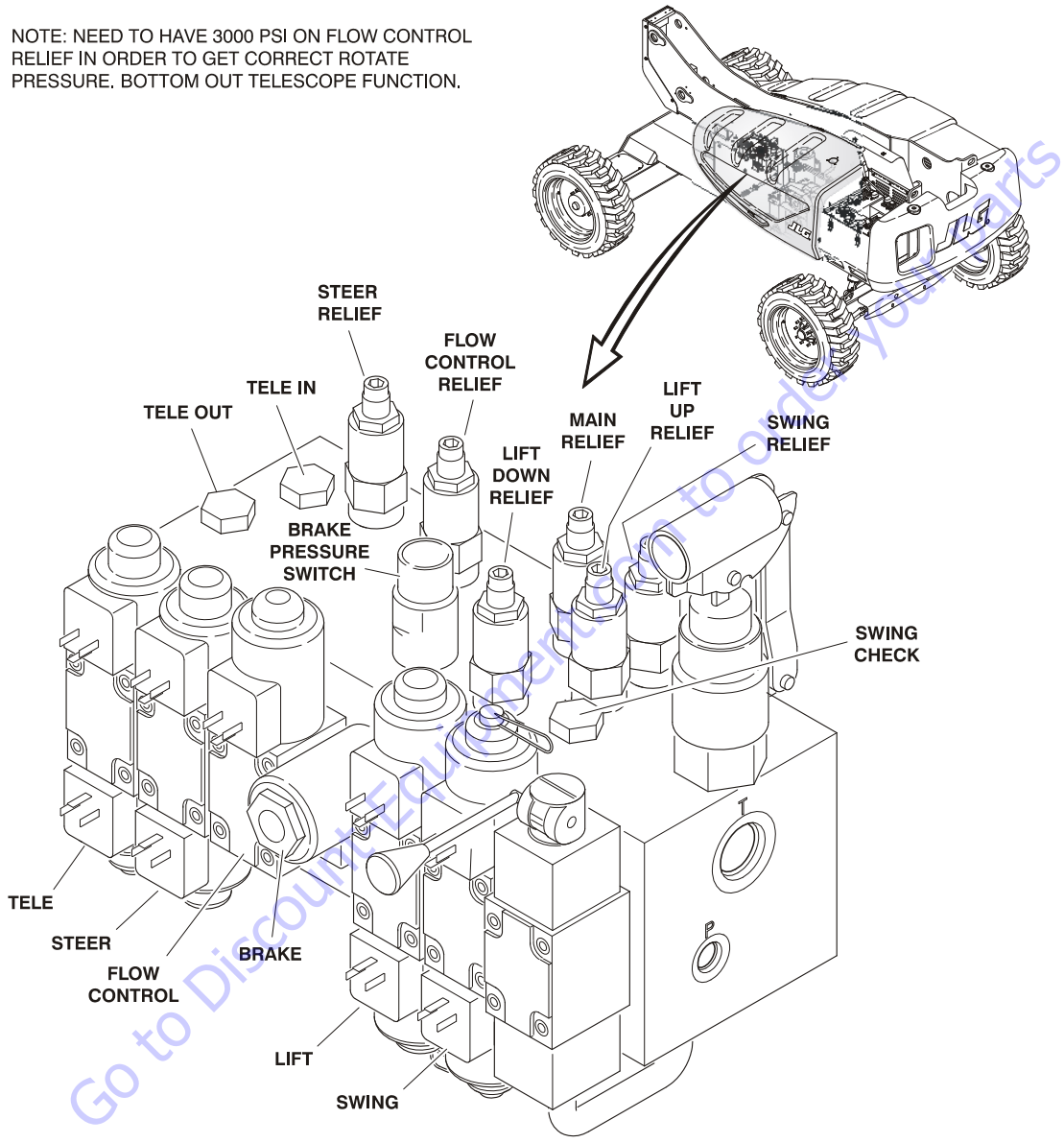
1. Connect a pressure gauge at the M1 port on the platform control valve bank.
2. Activate and bottom out either Jib Up or Down. Adjust the relief to 2300 psi (158.5 Bar).

Proportional Main Relief

1. Connect the pressure gauge at the MP port on the main valve and disconnect the lift up coil on the main valve block.
2. Activate the lift up switch from the platform. Adjust pressure to 3200 psi (220 Bar).

NOTE: WHEN CHECKING MAIN RELIEF PRESSURE UNPLUG LIFT UP COIL.

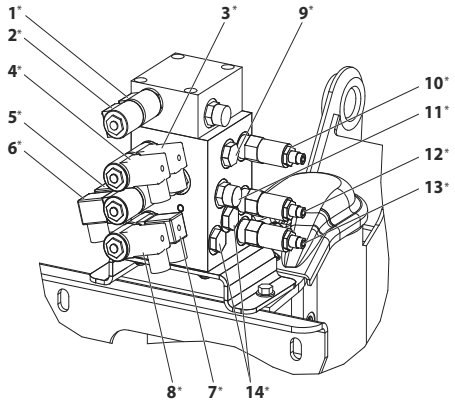
NOTE: NEED TO HAVE 3000 PSI ON FLOW CONTROL RELIEF IN ORDER TO GET CORRECT ROTATE PRESSURE. BOTTOM OUT TELESCOPE FUNCTION.



NOTE: *Torque all cartridges to 20 ft. lbs.(28 Nm).*

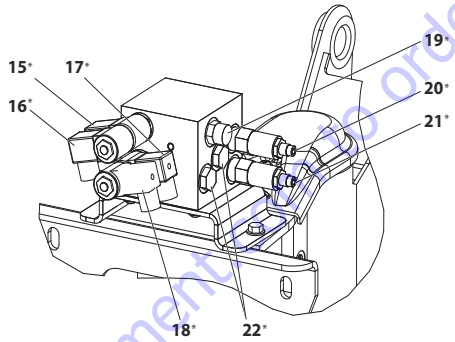
Figure 5-94. Main Control Valve - Hydraulic

JIB Plus Model



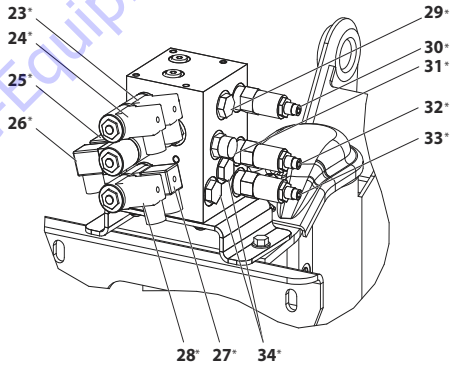
* Torque to 20 ft.lbs. (28 Nm)

Straight Boom Model



* Torque to 20 ft.lbs. (28 Nm)

JIB Model



* Torque to 20 ft.lbs. (28 Nm)

1. JIB Right
2. JIB Left
3. JIB Down
4. JIB Up
5. Rotate Right
6. Rotate Left
7. Level Up
8. Level Down
9. JIB Load Shuttle
10. JIB
11. Rotate Regulator
12. Level Backward
13. Level Forward
14. Platform Level Check
15. Rotate Right
16. Rotate Left
17. Level Up
18. Level Down
19. Rotate Regulator
20. Level Backward
21. Level Forward
22. Platform Level Check
23. JIB Down
24. JIB Up
25. Rotate Right
26. Rotate Left
27. Level Up
28. Level Down
29. JIB Load Shuttle
30. JIB
31. Rotate Regulator
32. Level Backward
33. Level Forward
34. Platform level Check

Figure 5-95. Platform Control valve Assembly

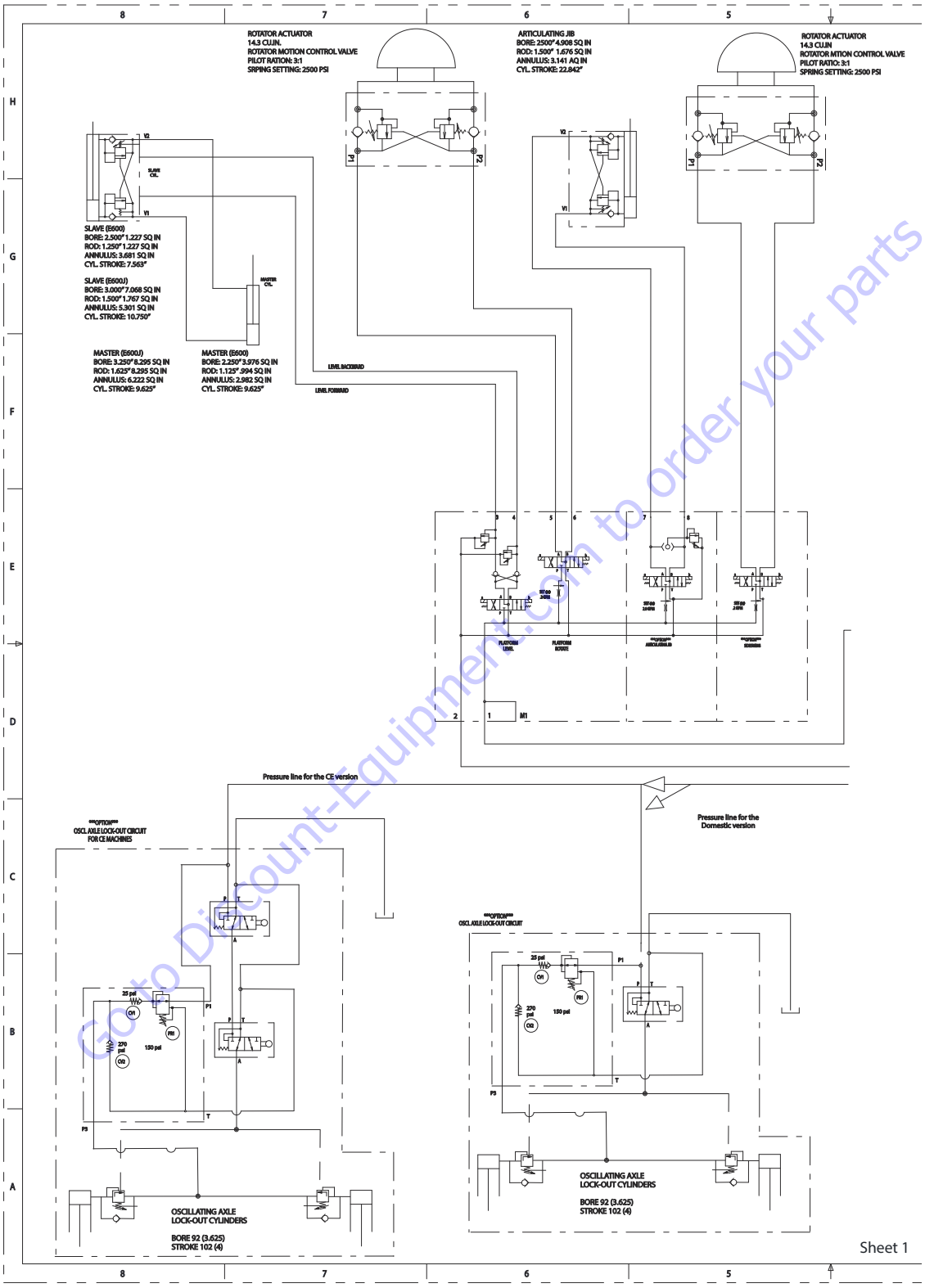


Figure 5-96. Hydraulic Schematics - Sheet 1 of 2

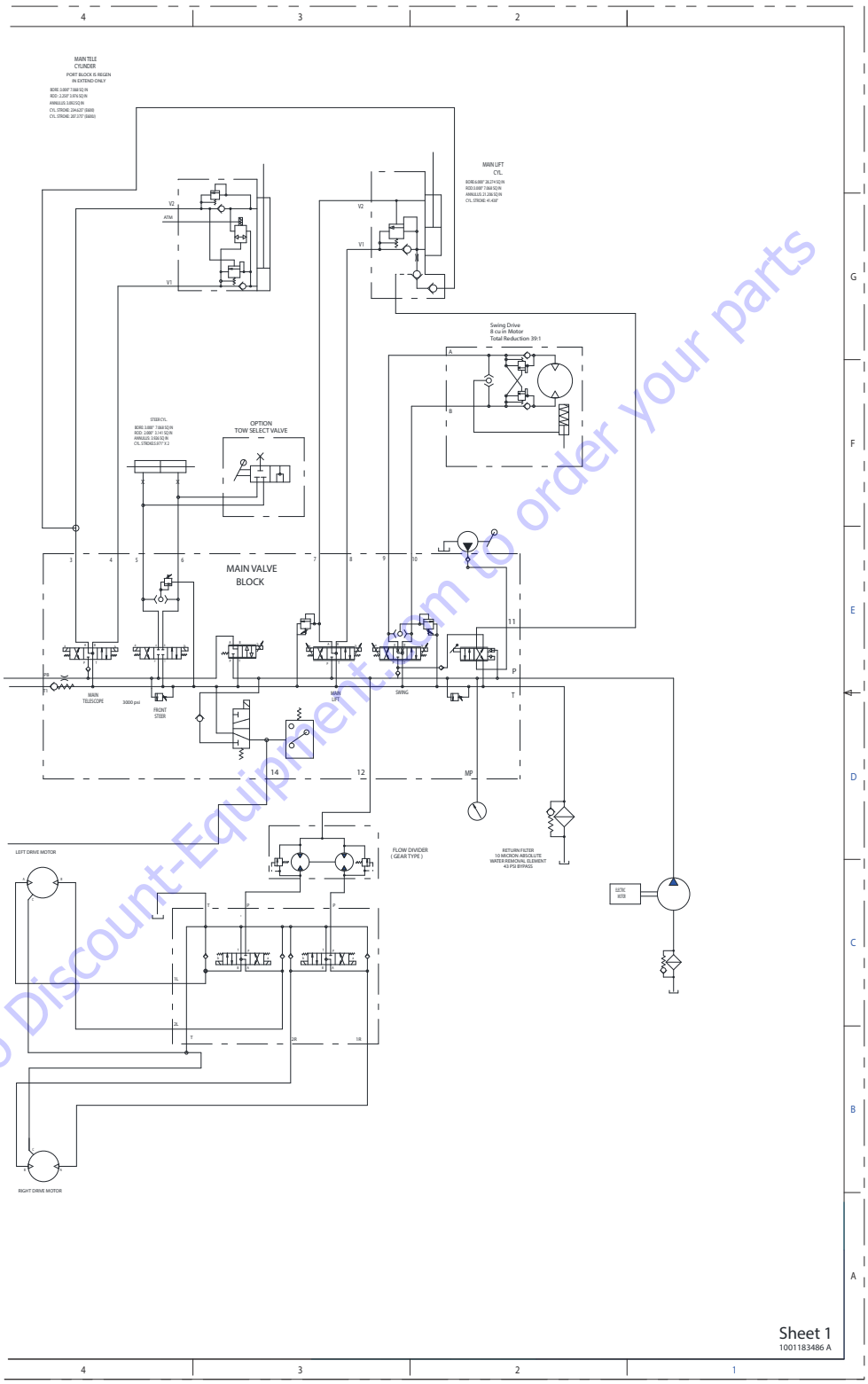
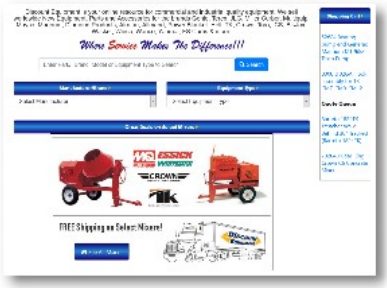


Figure 5-97. Hydraulic Schematics - Sheet 2 of 2

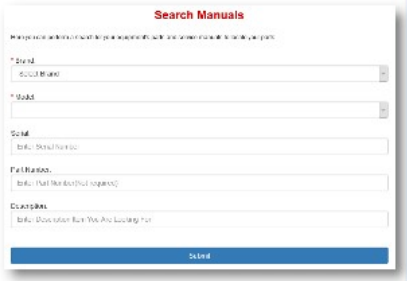
PARTS FINDER

Search Website by Part Number

Discount Equipment



Search Manual Library For Parts Manual & Lookup Part Numbers – Purchase or Request Quote



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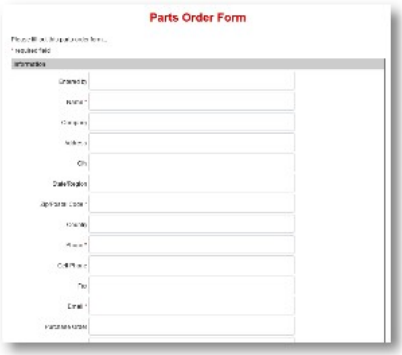

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, 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 6. JLG CONTROL SYSTEM

6.1 INTRODUCTION

NOTICE

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

NOTICE

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG designed Control System is a 48 volt based motor control unit installed on the boom lift.

The JLG Control System has reduced the need for exposed terminal strips, diodes and trimpots and provides simplicity in viewing and adjusting the various personality settings for smooth control of: acceleration, deceleration, creep and max.-speed for all boom, drive, and steering functions.

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

The JLG Control System controller has a built in LED to indicate any faults. The system stores recent faults which may be accessed for troubleshooting. Optional equipment includes an hour meter, beacon light, function cutout, and ground alarm. These options may be added later but must be programmed into the motor controller when installed.

The Control System may be accessed in one of two ways: Utilizing a custom designed, hand held analyzer (Analyzer Kit, JLG part no. 2901443) which will display two lines of information at a time, by scrolling through the program.

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

The following instructions are for using the hand held analyzer.

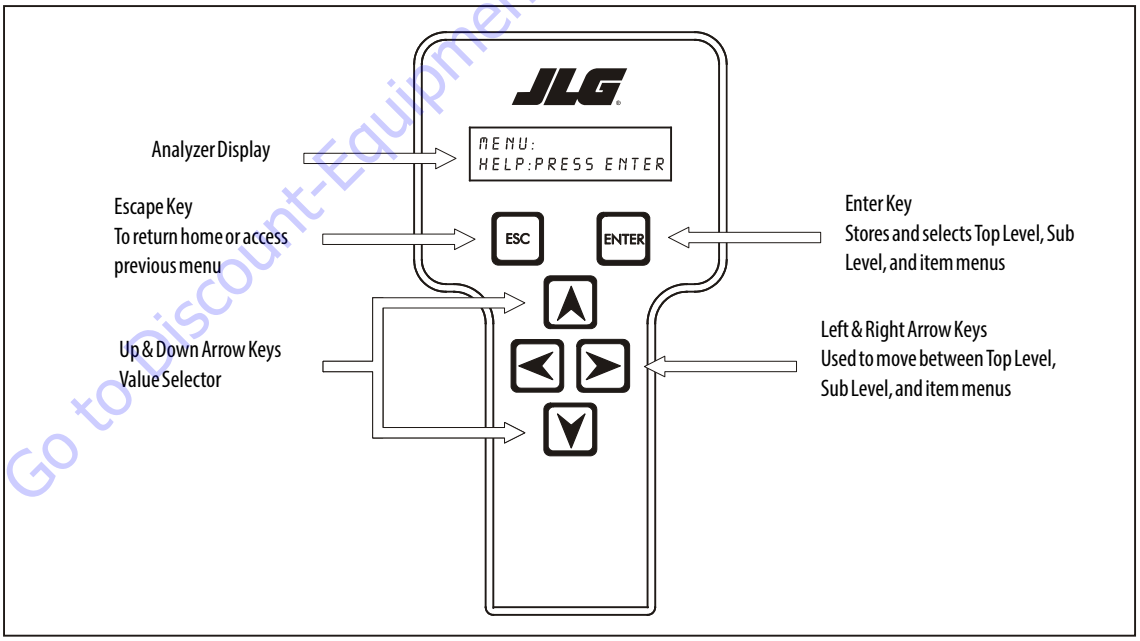


Figure 6-1. Hand Held Analyzer

6.2 TO CONNECT THE JLG CONTROL SYSTEM ANALYZER

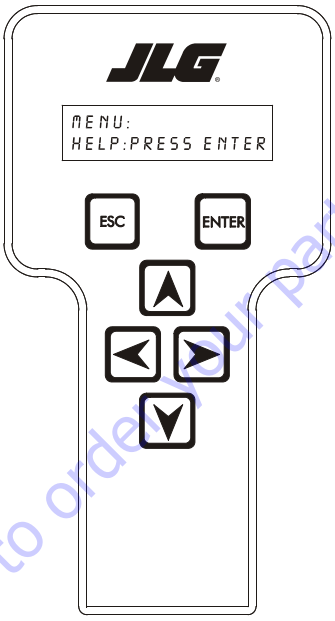
1. Connect the four pin end of the cable supplied with the analyzer, to the motor controller module located in the platform box or at the power module and connect the remaining end of the cable to the analyzer.

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

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

Using the Analyzer

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



HELP:
PRESS ENTER

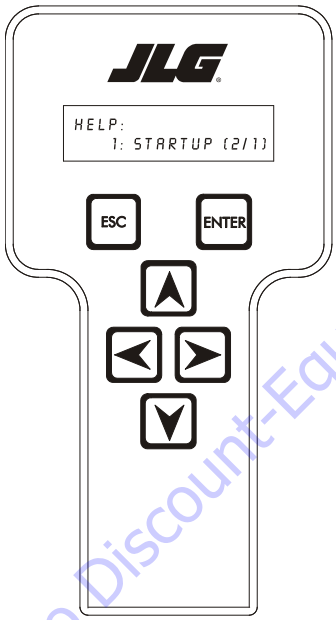
At this point, using the **RIGHT** and **LEFT** arrow keys, you can move between the top level menu items. To select a displayed menu item, press **ENTER** To cancel a selected menu item, press **ESC** then you will be able to scroll using the right and left arrow keys to select a different menu item.

The top level menus are as follows:

HELP
DIAGNOSTICS
SYSTEM TEST
ACCESS LEVEL
PERSONALITIES
MACHINE SETUP
CALIBRATIONS (view only)

If you press **ENTER** (ENTER), at the **HELP: PRESS ENTER** display, and a fault is present, the analyzer display will scroll the fault across the screen. If there was no fault detected, the display will read: **HELP: EVERYTHING OK.** If powered up at the ground station, the display will read: **GROUND OK.**

If **ENTER** (ENTER) is pressed again, the display moves to the following display:



LOGGED HELP
1: STARTUP (2/1)

At this point, the analyzer will display the last fault the system has seen, if any are present. You may scroll through the fault logs to view what the last 25 faults were. Use the right and left arrow keys to scroll through the fault logs. To return to the beginning, press **ESCAPE** (ESC) two times. **STARTUP (2/1)** indicates a power up.

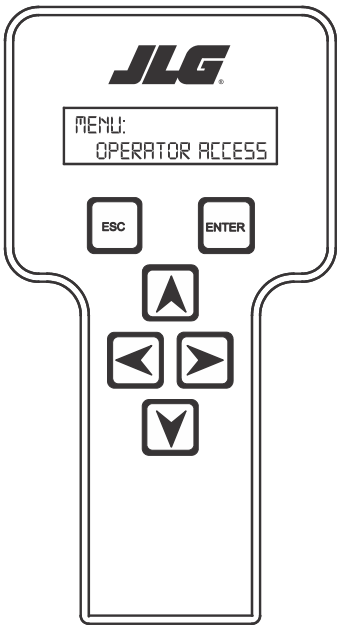
When a top level menu is selected, a new set of menu items may be offered: for example:

DRIVE
BOOM
SYSTEM
DATALOG
VERSIONS

Pressing **ENTER** (ENTER) with any of the above displayed menus, will display additional sub-menus within the selected menu. In some cases, such as **DRIVE**, the next level is the parameter or information to be changed. Refer to the flow chart for what menus are available within the top level menus. You may only view the personality settings for selected menus while in access level 2. Remember, you may always cancel a selected menu item by pressing the **ESCAPE** (ESC) key.

Changing the Access Level of the Hand Held Analyzer

When the analyzer is first connected, you will be in access level 2 which enables you to only view most settings which cannot be changed until you enter a password to advance to a lower level. This ensures that a setting cannot be accidentally altered. To change the access level, the correct password must be entered. To enter the password, scroll to the **ACCESS LEVEL** menu. For example:



MENU:
OPERATOR ACCESS

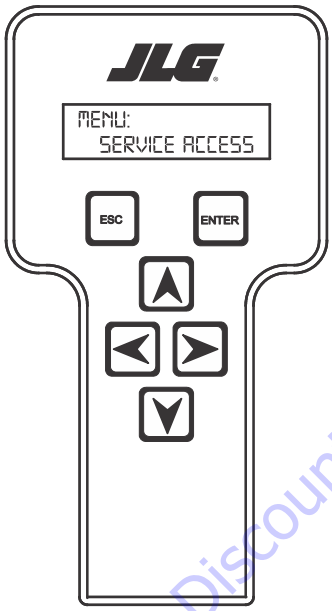
Press **ENTER** ENTER to select the **ACCESS LEVEL** menu.

Using the **UP** or **DOWN** arrow keys, enter the first digit of the password, 3.

Then using the **RIGHT** arrow key, position the cursor to the right one space to enter the second digit of the password.

Use the **UP** or **DOWN** arrow key to enter the second digit of the password which is 33271.

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

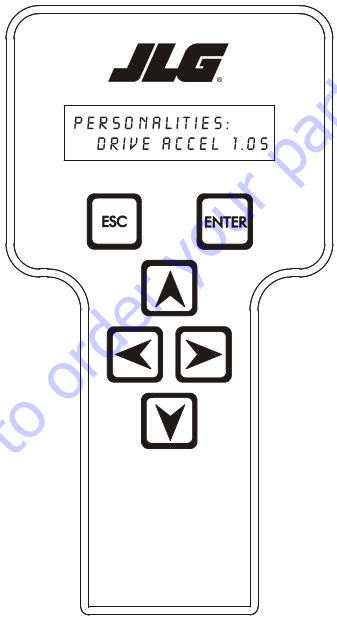


MENU:
SERVICE ACCESS

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

Adjusting Parameters Using the Hand Held Analyzer

Once you have gained access to level 1, and a personality item is selected, press the **UP** or **DOWN** arrow keys to adjust its value, for example:

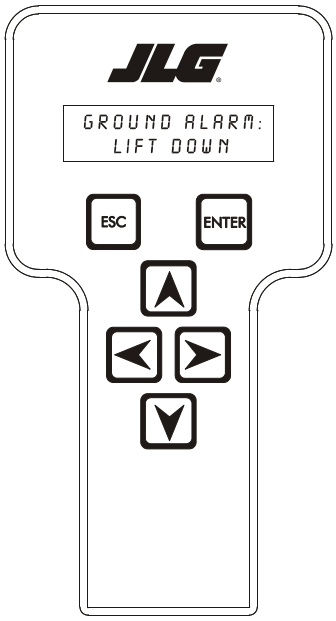


PERSONALITIES:
DRIVE ACCEL 1.0s

There will be a minimum and maximum for the value to ensure efficient operation. The Value will not increase if the **UP** arrow is pressed when at the maximum value nor will the value decrease if the **DOWN** arrow is pressed and the value is at the minimum value for any particular personality. If the value does not change when pressing the up and won arrows, check the access level to ensure you are at Service Access.

Machine Setup

When a machine digit item is selected, press the **UP** or **DOWN** arrow keys to adjust its value, for example:



GROUND ALARM:
LIFT DOWN

The effect of the machine digit value is displayed along with its value. The above display would be selected if the machine was equipped with a ground alarm and you wanted it to sound when driving. There are certain settings allowed to install optional features or select the machine model.

When selection the machine model to match the size of the machine, the personality settings will all default to the factory recommended setting.

NOTE: *Refer to Table 6-4, Personality Ranges/Defaults, and Table 6-5, Machine Setup Descriptions in this Service Manual for the recommended factory settings.*

NOTE: *Password 33271 will give you access to Service Access, which will permit you to change all machine personality settings.*

There is a setting that JLG strongly recommends that you do not change. This setting is so noted below:

ELEVATION CUTBACK

⚠ WARNING

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

NOTICE

ITS IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

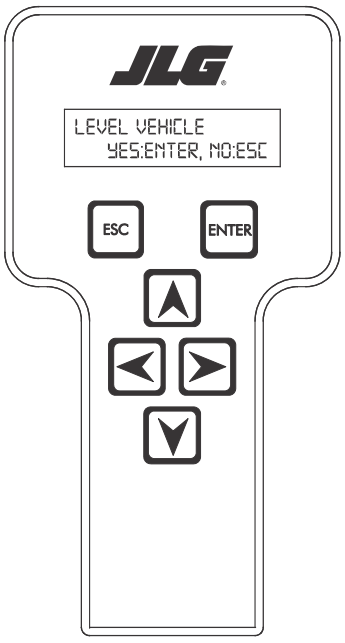
Level Vehicle Description

NOTICE

A NEW TILT MODULE WILL ACT AS IF IT IS TILTED ALL OF THE TIME UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

⚠ WARNING

DO NOT LEVEL VEHICLE EXCEPT ON A LEVEL SURFACE.



LEVEL VEHICLE
YES:ENTER, NO:ESC

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

Table 6-1. Analyzer Abbreviations

ABBREVIATION	MEANING
ACCEL	ACCELERATE
ACT	ACTIVE
A/D	ANALOG DIGITAL CONVERTER COUNT
AMB.	AMBIENT
ANG	ANGLE
AUX	AUXILIARY
BCS	BOOM CONTROL SYSTEM
BM	BOOM LENGTH ANGLE MODULE
BLAM	BOOM LENGTH ANGLE MODULE
BR	BROKEN
BSK	BASKET
CAL	CALIBRATION
CL	CLOSED
CM	CHASSIS MODULE
CNTL	CONTROL
CNTRL	CONTROL
C/O	CUT OUT
CONT(S)	CONTRACTOR(S)
COOR	COORDINATED
CRK PT	CRACK POINT
CRP	CREEP
CUT	CUTOUT
CYL	CYLINDER
DECEL	DECELERATE
D	DOWN
DN	DOWN
DWN	DOWN
DEG.	DEGREE
DOS	DRIVE ORIENTATION SYSTEM
DRV	DRIVE
E	ERROR
E&T	ELEVATED & TILTED
ELEV	ELEVATION
ENG	ENGINE
EXT	EXTEND
F	FRONT
FL	FLOW
FNT	FRONT
FOR	FORWARD
FWD	FORWARD
FSW	FOOT SWITCH
FUNC	FUNCTION
G	GROUND

Table 6-1. Analyzer Abbreviations

ABBREVIATION	MEANING
GND	GROUND
GRN	GREEN
GM	GROUND MODULE
H	HOURS
HW	HARDWARE
HWFS	HARDWARE FAILSAFE
I	IN or CURRENT
JOY	JOYSTICK
L	LEFT
LB	POUND
LEN	LENGTH
LIM	LIMIT
LT	LEFT
LVL	LEVEL
M	MINUTES
MIN	MINIMUM
MAX	MAXIMUM
M	MAIN
MN	MAIN
NO	NORMALLY OPEN or NO
NC	NORMALLY CLOSED
O	OUT
O/C	OPEN CIRCUIT
OP	OPEN
O/R	OVERRIDE or OUTRIGGER
O//R	OVERRIDE
OSC	OSCILLATING
OVRD	OVERRIDE
P	PLATFORM
P	PRESSURE
PCV	PROPORTIONAL CONTROL VALVE
PLAT	PLATFORM
PLT	PLATFORM
PM	PLATFORM MODULE
POT	POTENTIOMETER
PRES	PRESSURE
PRS	PRESSURE
PT	POINT
R	REAR or RIGHT
REV	REVERSE or REVISION
RET	RETRACT
ROT.	ROTATE
RT	RIGHT

Table 6-1. Analyzer Abbreviations

ABBREVIATION	MEANING
S/C	SHORT CIRCUIT
SEL	SELECTOR
SN	SERIAL NUMBER
SPD	SPEED
STOW	STOWED
STOWD	STOWED
SW	SWITCH or SOFTWARE
TELE	TELESCOPE
TEMP	TEMPERATURE
TORQ.	TORQUE
TRN	TRANSPORT
T/T	TURNTABLE
T	TOWER
TURNTBL	TURNTABLE
TWR	TOWER
U	UPPER or UP
V	VOLT
VER	VERSION
VLV	VALVE
WIT	WITNESS
YEL	YELLOW

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
NOTE: *The machine configuration must be completed before any personality settings can be changed. Changing the personality settings first and then changing the model number of the machine configuration will cause the personality settings to return to default values.*			
MODEL NUMBER: 1	1 2 3 4 **5**	E300 E400 E400N E450 **E600**	 **5**
MARKET: 2	**1** 2 3 4 5 6 7	**ANSI USA** ANSI EXPORT CSA CE AUSTRALIA JAPAN GB	**1**
BATTERY: 3* * Certain battery visibilities are dependent on model selection.	1 2 3 **4** 5	310AH Flooded 375AH Flooded) 312AH AGM **415AH Flooded** 390AH AGM)	 **4**

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
TILT: 4	**1**	**5 DEGREES+CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also disallows the tower lift up, drive, telescope out and lift up.**	**1 ANSI USA, ANSI Export, CSA, JAPAN**
	2	4 DEGREES+CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also disallows the tower lift up, drive, telescope out and lift up.	
	3	**3 DEGREES+CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also disallows the tower lift up, drive, telescope out and lift up.**	**3 CE, AUS, GB**
GROUND ALARM: 5	1	NO: No ground alarm installed.	
	2	DRIVE: Travel alarm sounds when the drive function is active.	
	3	DESCENT: Descent alarm sounds when lift down is active.	
	4	**MOTION: Motion alarm sounds when any function is active.**	**4**
JIB: 6	1	NO: No jib installed.	
	2	**YES: Jib installed which has up and down movements only.**	**2**
JIB SWING: 7	1	NO: No jib swing installed.	
	2	**YES: Jib installed which has side to side movements.**	**2**
SKYGUARD: 8	1	NO: No Sky Guard system installed.	
	2	**YES: Sky Guard system installed.**	**2**
SOFT TOUCH: 9	**1**	**NO: No Soft Touch system installed.**	**1**
	2	YES: Soft Touch system installed.	
H&T LIGHTS: 10	**1**	**NO: No head and tail lights installed.**	**1**
	2	YES: head and tail lights installed	

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
LOAD SYSTEM: 11* * Only visible under certain market selections. * Certain market selections will limit load system options or alter default setting.	**1** 2 3 4	**NO: No load sensor installed.** WARN ONLY: Functions in creep, overload lamp lit, platform alarm beeps(5 sec ON, 2 sec OFF). CUTOUT PLATFORM: All functions cutout, overload lamp lit, platform alarm beeps(5 sec ON, 2 sec OFF). CUTOUT ALL: All functions cutout, flash overload light (500 mS on, 500 mS off), platform alarm beeps(5 sec ON, 2 sec OFF).	**1**
FUNCTION CUTOUT: 12* * Only visible under certain market selections. * Certain market selections will limit load system options or alter default setting.	**1** **2** 3	**NO: No drive cutout.** **BOOM CUTOUT: Boom function cutout while driving above elevation.** DRIVE CUTOUT: Drive and steer cutout above elevation.	**1** **ANSI US, ANSI EXP, CSA, AUS, JAPAN** **2** **CE**
DISPLAY UNITS: 13	**1** **2**	**METRIC** **IMPERIAL**	**1** **CSA, CE, AUS, JAPAN, GB** **2** **ANSI USA, ANSI Export**
ALERT BEACON: 14* * Only visible if Skyguard is selected.	**1** 2	**OFF FOR CREEP.** 20 FPM FOR CREEP.	**1**
TEMP CUTOUT: 15* * Certain market selection will display temp cutout options.	**1** 2	**NO:** YES: Low temp cutout system is installed.	**1** **ANSI EXP, CE**
WHEEL DRIVE: 16* * Only visible if E600 model is selected.	**1** 2	**4WD:Front wheel assist (4WD) system is installed** 2WD: Front wheel assist (4WD) system is not installed.	**1**

Table 6-2. Machine Configuration Programming Information

Configuration Digit	Number	Description	Default Number
CHARGER INTERLOCK: 17	**1** 2	**DRIVE ONLY: Drive function is disabled when battery charger is plugged in.** CUTOUT ALL: Drive and bottom function is disabled when battery charger is plugged in.	**1**
PLAT LVL OVR CUT: 18	**1** 2	**NO: Platform level functions above elevation.** YES: Platform level does not function above elevation.	**1**

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Table 6-3. Machine Configuration Programming Settings

E600	ANSI USA	ANSI Export	CSA	CE	Australia	Japan
Model Number	**5**	**5**	**5**	**5**	**5**	**5**
Market	**1**	**2**	**3**	**4**	**5**	**6**
Batteries	X	X	X	X	X	X
	X	X	X	X	X	X
	X	X	X	X	X	X
	4	**4**	**4**	**4**	**4**	**4**
	5	5	5	5	5	5
Tilt	**1**	**1**	**1**	X	X	**1**
	2	2	2	X	X	2
	3	3	3	**3**	**3**	3
Ground Alarm	1	1	1	1	1	1
	2	2	2	2	2	2
	3	3	3	3	3	3
	4	**4**	**4**	**4**	**4**	**4**
Jib	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**
Jib Swing	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**
Skyguard	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2
Soft Touch	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2
Head & Tail Lights	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2
Load System	X	**1**	X	1	1	1
	X	*2*	X	X	X	*2*
	X	3	X	X	**3**	**3**
	X	4	X	**4**	X	4
Function Cutout	**1**	**1**	**1**	X	**1**	**1**
	X	2	2	**2**	2	2
	3	3	3	X	3	3

Table 6-3. Machine Configuration Programming Settings

E600	ANSI USA	ANSI Export	CSA	CE	Australia	Japan
Display Units	1	1	**1**	**1**	**1**	**1**
	2	**2**	2	2	2	2
Alert Beacon	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2
Temp Cutout	X	**1**	X	**1**	X	X
	X	2	X	2	X	X
Wheel Drive	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2
Charger Interlock	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2
Plat Lvl Ovr Cut	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2

BOLD TEXT indicates the default setting. Plain text indicates another available selection. ***ITALIC*** *text* indicates the default when option is factory installed. SHADED CELLS indicate hidden menu or selection.

6.3 MACHINE PERSONALITY SETTINGS

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

Table 6-4. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
DRIVE	ACCELeration	0.5 to 5.0s	2.0s
	DECELeration	0.3 to 5.0s	3.0s
	DECELeration to stop	0.3 to 2.0s	1.0s
	MAXimum speed	75 to 100%	100%
	REDUCED MAXimum speed and MAXimum Reverse Drive	50 to 70%	50%
	ELEVATED MAXimum speed (ANSI)	5 to 15%	12%
	ELEVATED MAXimum speed (CE)	5 to 15%	12%
	CREEP MAXimum speed	5 to 15%	10%
STEER	ACCELeration	0.1 to 5.0s	0.5s
	DECELeration	0.1 to 5.0s	0.1s
	MINimum LEFT speed	10 to 50%	45%
	MAXimum LEFT speed	51 to 100%	58%
	MINimum RIGHT speed	10 to 50%	45%
	MAXimum RIGHT speed	51 to 100%	58%
	PUMP MAX	16 to 100%	25%
SWING	ACCELeration	0.1 to 5.0s	2.0s
	DECELeration	0.1 to 5.0s	1.0s
	MINimum LEFT speed	30 to 45%	38%
	MAXimum LEFT speed	47 to 100%	50%
	CREEP Maximum LEFT speed	31 to 46%	42%
	MINimum RIGHT speed	30 to 45%	38%
	MAXimum RIGHT speed	47 to 100%	50%
	CREEP maximum RIGHT speed	31 to 46%	42%
	PUMP MAX	16 to 100%	16%

Table 6-4. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
BOOM LIFT	ACCELeration	0.1 to 5.0s	2.0s
	DECELeration	0.1 to 5.0s	1.5s
	MINimum UP speed	40 to 55%	48%
	MAXimum UP speed	57 to 70%	69%
	CREEP maximum UP speed	41 to 56%	55%
	MINimum DOWN speed	40 to 55%	48%
	MAXimum DOWN speed	57 to 70%	69%
	CREEP maximum DOWN speed	41 to 56%	52%
	MAXimum PUMP Up	16 to 90%	85%
	MAXimum PUMP Down	16 to 50%	48%
TOWER LIFT	ACCELeration	N/A	N/A
	DECELeration	N/A	N/A
	MINimum UP speed	N/A	N/A
	MAXimum UP speed	N/A	N/A
	CREEP maximum UP speed	N/A	N/A
	MINimum DOWN speed	N/A	N/A
	MAXimum DOWN speed	N/A	N/A
	CREEP maximum DOWN speed	N/A	N/A
TELESCOPE	ACCELeration	0.1 to 5.0s	1.5s
	DECELeration	0.1 to 5.0s	1.5s
	MINimum IN speed	40 to 50%	45%
	MAXimum IN speed	56 to 70%	65%
	CREEP maximum IN speed	41 to 55%	52%
	MINimum OUT speed	40 to 50%	46%
	MAXimum OUT speed	56 to 70%	69%
	CREEP maximum OUT speed	41 to 55%	52%
	IN PUMP MAX	16 to 65%	60%
	OUT PUMP MAX	16 to 65%	60%

Table 6-4. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
JIB LIFT	ACCELeration	0.1 to 5.0s	1.5s
	DECELeration	0.1 to 5.0s	0.5s
	MINimum UP speed	40 to 50%	45%
	MAXimum UP speed	53 to 100%	55%
	CREEP maximum UP speed	41 to 52%	48%
	MINimum DOWN speed	40 to 50%	45%
	MAXimum DOWN speed	53 to 100%	55%
	CREEP maximum DOWN speed	41 to 52%	52%
	UP Pump Max	16 to 100%	27%
	Down Pump Max	16 to 100%	18%
JIB SWING	ACCELeration	0.1 to 5.0s	0.5s
	DECELeration	0.1 to 5.0s	0.5s
	MINimum LEFT speed	40 to 49%	46%
	MAXimum LEFT speed	51 to 100%	55%
	CREEP Maximum LEFT speed	41 to 50%	48%
	MINimum RIGHT speed	40 to 49%	46%
	MAXimum RIGHT speed	51 to 100%	55%
	CREEP maximum RIGHT speed	41 to 50%	48%
	Pump Max	16 to 25%	16%
PLATFORM LEVEL	ACCELeration	0.1 to 5.0s	0.5s
	DECELeration	0.1 to 5.0s	0.5s
	MINimum UP speed	35 to 50%	42%
	MAXimum UP speed	52 to 100%	55%
	CREEP maximum UP speed	36 to 51%	50%
	MINimum DOWN speed	35 to 50%	42%
	MAXimum DOWN speed	52 to 100%	55%
	CREEP maximum DOWN speed	36 to 51%	50%
	UP Pump Max	16 to 100%	30%
	Down Pump Max	16 to 100%	16%

Table 6-4. Personality Ranges/Defaults

FUNCTION	PERSONALITY	RANGE	DEFAULTS
PLATFORM ROTATE	ACCELeration	0.1 to 5.0s	0.5s
	DECELeration	0.1 to 5.0s	0.5s
	MINimum LEFT speed	40 to 50%	46%
	MAXimum LEFT speed	52 to 100%	52%
	CREEP Maximum LEFT speed	41 to 51%	47%
	MINimum RIGHT speed	40 to 50%	46%
	MAXimum RIGHT speed	52 to 100%	52%
	CREEP maximum RIGHT speed	41 to 51%	47%
	Pump Max	16 to 100%	16%
GROUND MODE	Swing	46 to 99%	49%
	Tower UP	N/A	N/A
	Tower Down	N/A	N/A
	Lift UP	56 to 69%	68%
	Lift DOWN	56 to 69%	68%
	Telescope IN	55 to 69%	64%
	Telescope OUT	55 to 69%	68%
	Jib UP	51 to 99%	54%
	Jib DOWN	51 to 99%	54%
	Jib SWING	50 to 99%	54%
	Platform LEVEL	46 to 99%	54%
	Platform ROTATE	51 to 99%	51%
ALARM/HORN	Volume HORN	25 to 100%	100%
	Volume ALARM	25 to 100%	75%
TEMPERATURE CUT	LOW Cutout set	-30 to 0C	-30C
	OFFset	0 to 10C	5C

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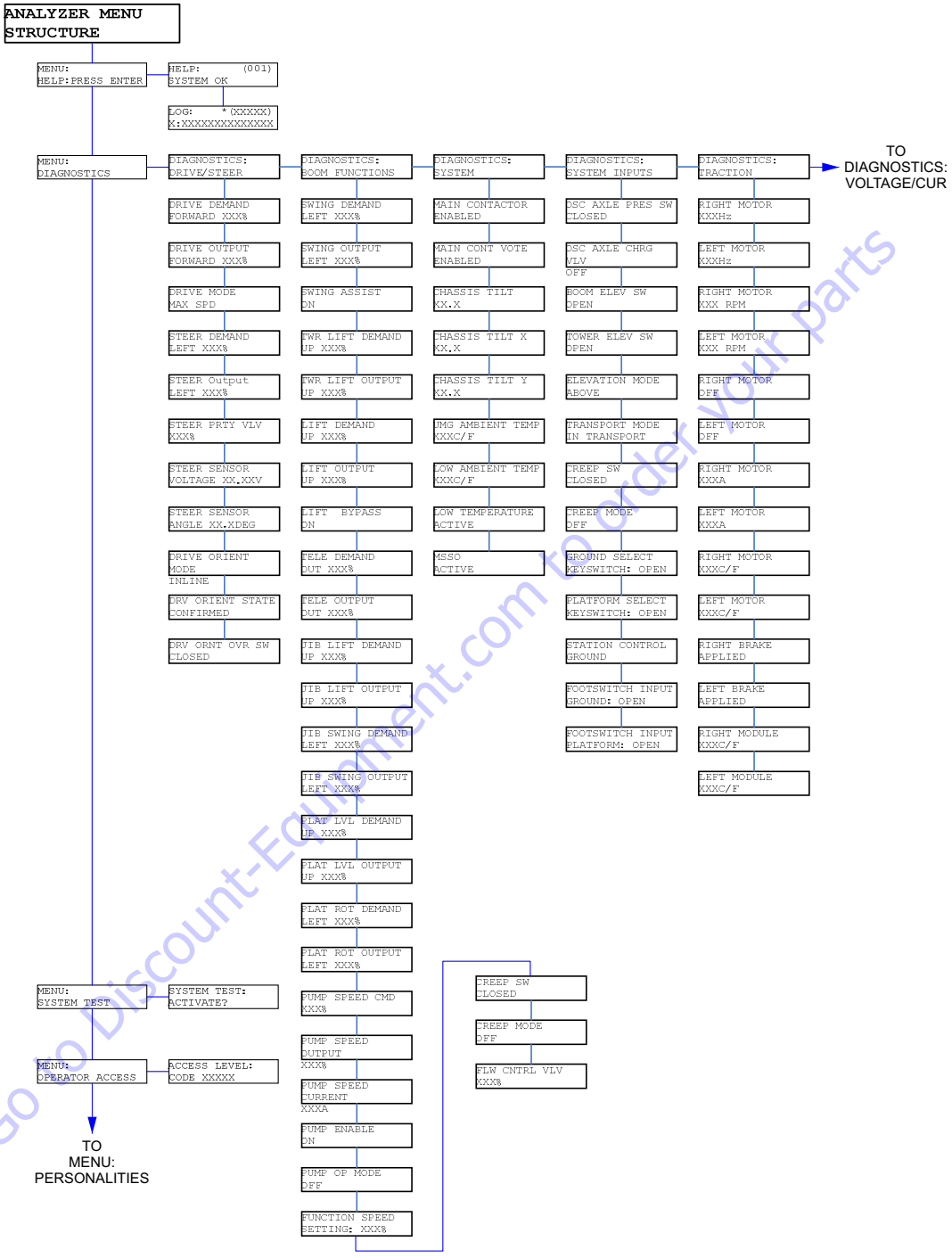
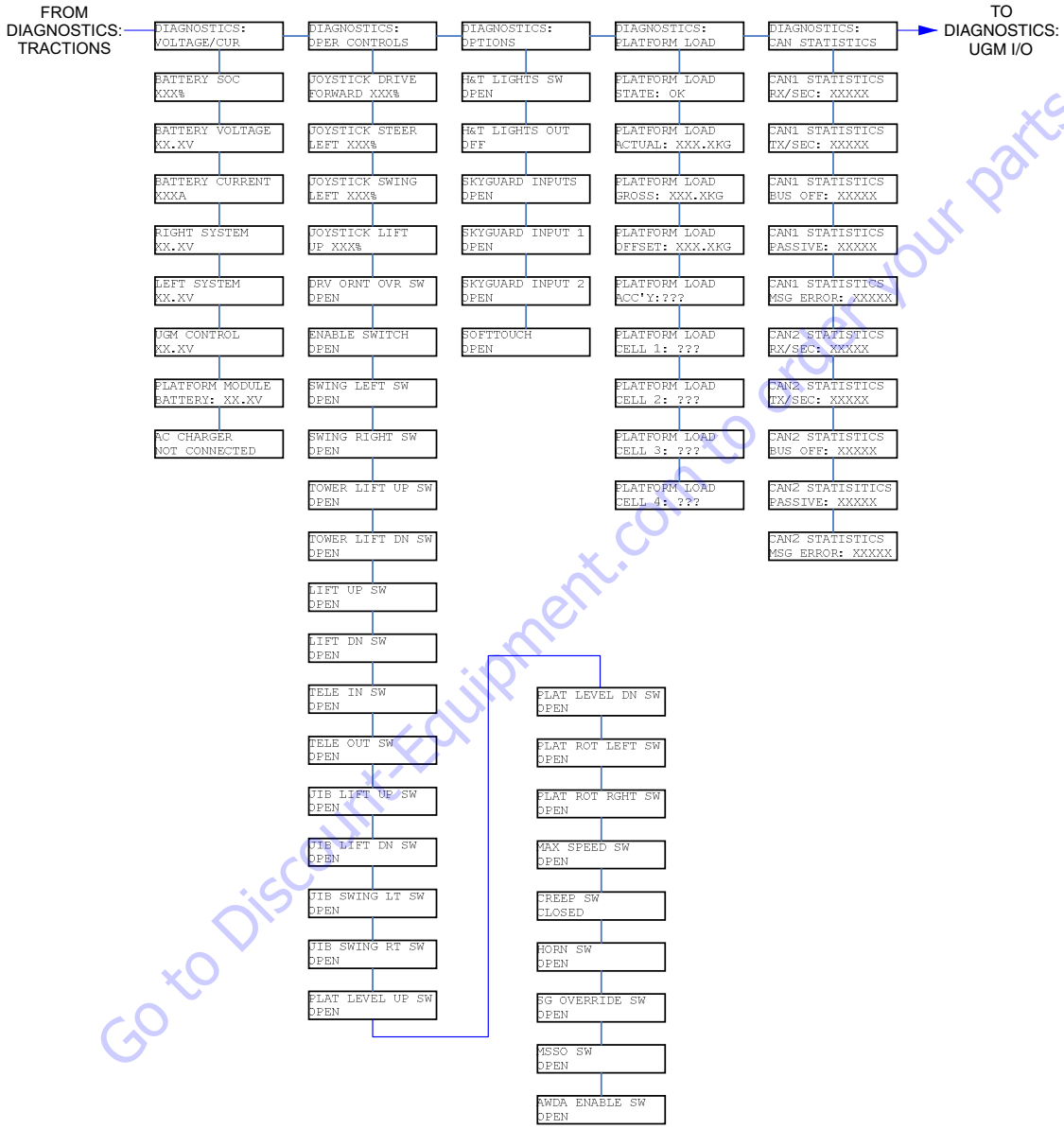


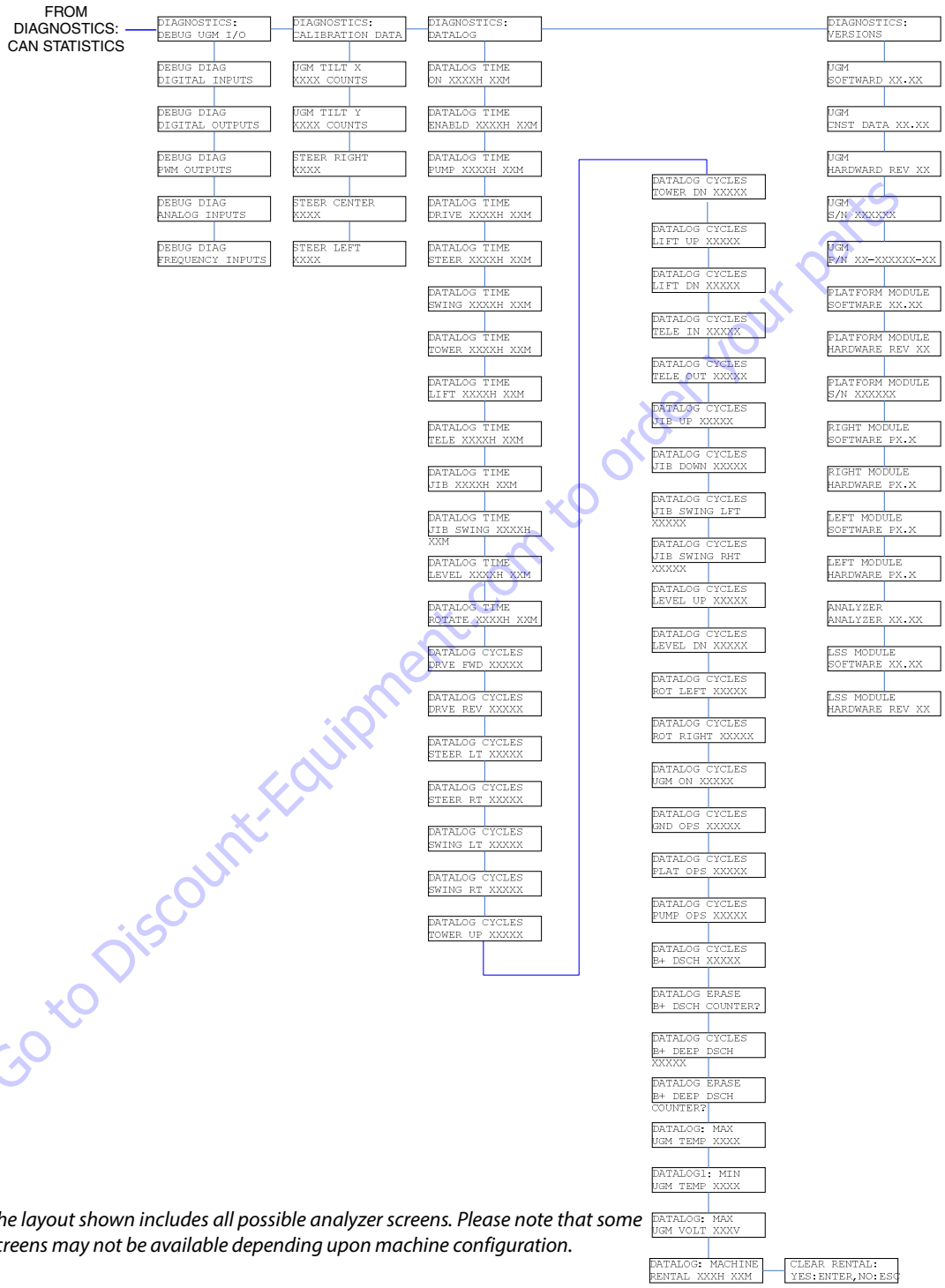
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-2. Analyzer Flow Chart, Version 1.3 - Sheet 1 of 5



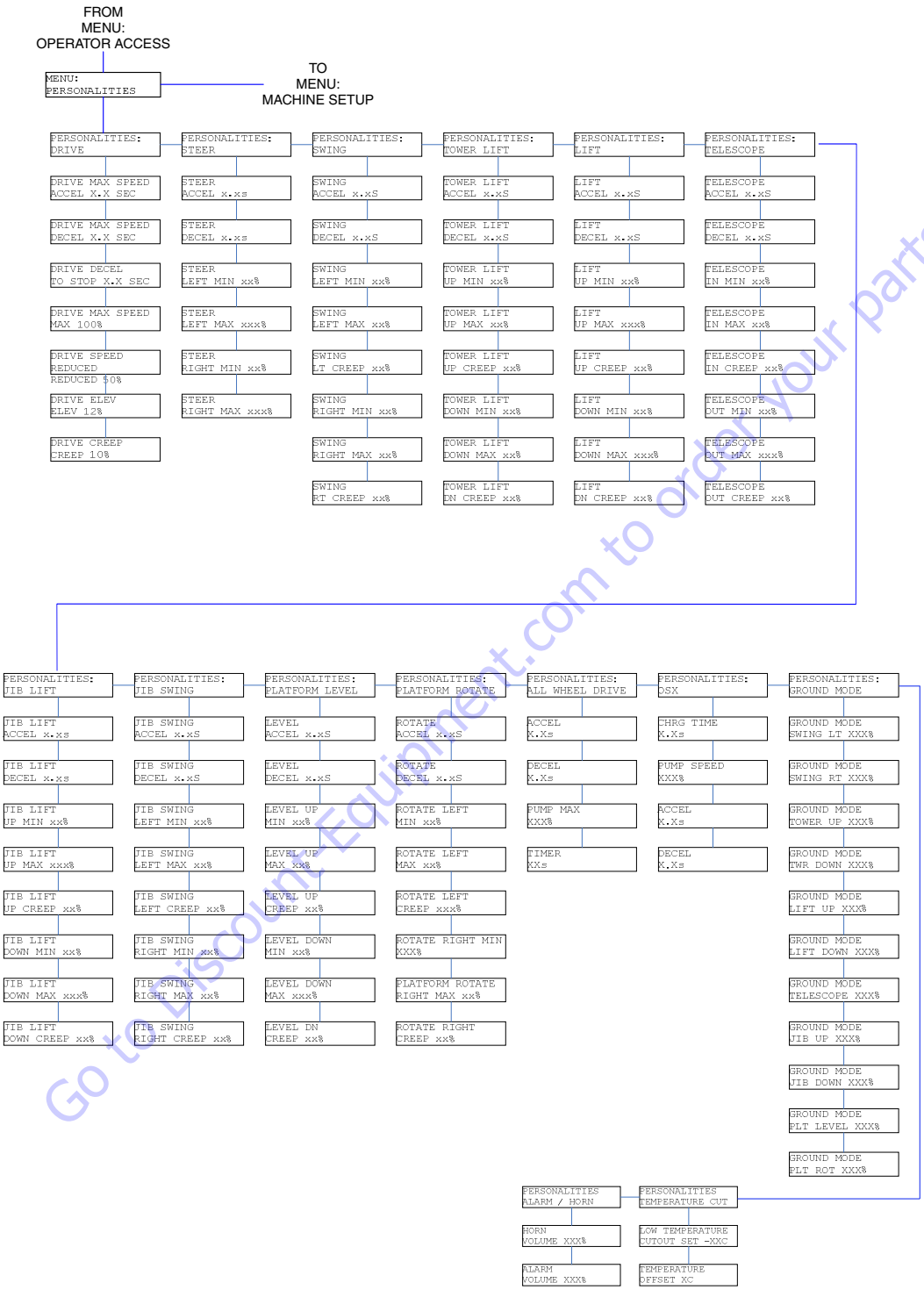
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-3. Analyzer Flow Chart, Version 1.3 - Sheet 2 of 5



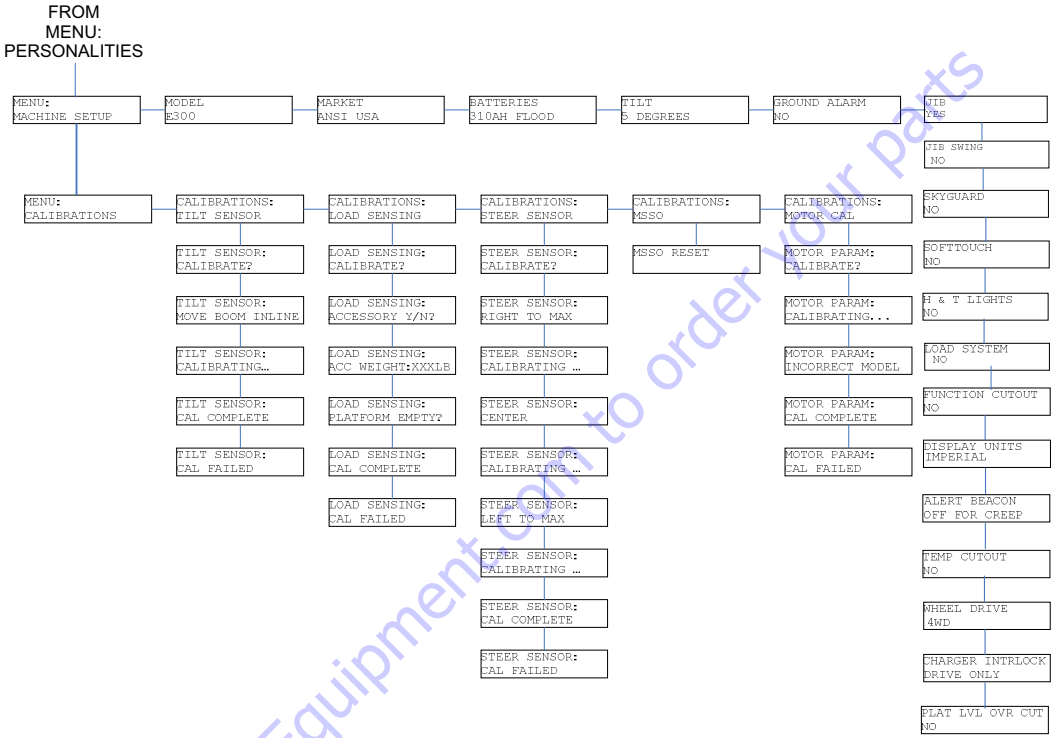
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-4. Analyzer Flow Chart, Version 1.3 - Sheet 3 of 5



NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-5. Analyzer Flow Chart, Version 1.3 - Sheet 4 of 5



NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-6. Analyzer Flow Chart, Version 1.3 - Sheet 5 of 5

6.4 MACHINE ORIENTATION WHEN PERFORMING TEST

Drive (Below elevation): Test should be done on a smooth, level surface. The Drive select switch should be in the "Max Speed" position. Start approximately 25ft (7.6m) from starting point so the unit is at a maximum speed when starting the test. Result should be recorded for a 200ft (61m) course. Drive Forward, "High speed", record time. Drive Reverse, "High speed", record time.

Drive Reduced (below elevation): Test should be done on a smooth, level surface. The Drive select switch should be in the "Reduced Speed" position. Start approximately 25ft (7.6m) from starting point so the unit is at a maximum speed when starting the test. Result should be recorded for a 200ft (61m) course. Drive Forward, "Reduced speed", record Time. Drive Reverse, "Reduced speed", record Time.

Drive (above elevation): Test should be done on a smooth, level surface. The drive select switch should be in the "Max Speed" position, the boom should be >10° above horizontal to ensure the drive is operating in elevated mode. Result should be recorded for a 50ft (15.2m) course. Drive Forward, Record Time. Drive reverse, Record Time.

Swing: Boom at full elevation, Telescope retracted. Swing turntable right to end stop. Swing Left to end stop, record time. Swing Right to end stop, record time. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on Panel must be energized. Verify that machine will Swing left and right. Return Knob to fully clockwise.

Tower Lift: Tower Lift in stowed position, Telescope Retracted, Main lift horizontal. Tower Lift Up, record time. Tower Lift Down, record time. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on Panel must be energized. Verify that machine will Tower Up and Down. Return Knob to fully clockwise.

Main lift: Main Lift in stowed position Tower Lift in stowed position, Telescope Retracted. Main Lift Up, record time. Main Lift Down, record time. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on Panel must be energized. Verify that machine will Lift Up and Down. Return Knob to fully clockwise.

Telescope: Main Lift at full elevation, Telescope Retracted. Telescope Out, record time. Telescope In, record time. Turn Platform Speed Control Knob fully counterclockwise to enter creep mode; creep light on Panel must be energized. Verify that machine will Telescope Up and Down. Return Knob to fully clockwise.

Jib Lift: Platform level and centered with boom. Jib Lift Down until stop. Jib Lift Up, record time. Jib Lift Down, record time. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on Panel must be energized. Verify that machine will Jib Lift Up and Down. Return Knob to fully clockwise.

Jib Swing: Platform level and centered with boom. Jib Lift Horizontal and swing fully to left stop. Swing right to end stop, record time. Swing left to end stop, record time. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on Panel must be energized. Verify that machine will Jib swing left and right. Return Knob to fully clockwise.

Platform Rotate: Platform level, Rotate Platform Right until stop. Platform Left, record time. Platform Right, record time. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on Panel must be energized. Verify that machine will Platform Rotate Left and Right. Return Knob to fully clockwise.

Test Notes

1. Stop watch should be started with the function movement, not with actuation of joystick and switch.
2. Drive speeds should be set to the values below regardless of the tire size.
3. All speed tests are run from the platform. These speeds do not reflect the ground control operation.
4. The platform speed knob control must be at full speed (turned clockwise completely).
5. Some flow control functions may not work with the Platform Speed Control knob clicked into the creep position.
6. Functional speeds may vary due to cold, thick hydraulic oil. Test should be run with the oil temperature above 100° F (38° C).

Table 6-5. Machine Setup Descriptions

MODEL NUMBER	Displays/adjusts machine model NOTE: all personalities reset to default when model number is altered
TILT	Displays/adjusts tilt sensor function
DRIVE CUTOUT	Displays/adjusts drive cutout switch presence/ function
FUNCTION CUTOUT	Displays/adjusts function cutout switch presence/ function
JIB	Displays/adjusts jib presence
GROUND ALARM	Displays/adjusts ground alarm presence/ function
4WD ASSIST	Displays/adjusts 4WD assist presence
SOFT TOUCH	Displays/adjusts soft-touch system presence

Help Descriptions and Fault Flash Codes

Table 6-6. JLG Control System Flash Codes

Code	Description
2-1	Faulty Footswitch/EMS
2-2	Drive/Steer inputs/Footswitch Interlocks
2-3	Boom function inputs/Lift-Swing Joystick
2-5	Function Cutout/Drive Cutout
3-1	Contactors miswired/Motors miswired
3-2	Line contactor welded
3-3	Contactor short circuit or valve short circuit
4-2	Controller Overtemperature
4-4	Battery voltage out of range
6-6	CANbus inputs
7-7	Traction /Pump motor wiring or motor faulty
9-9	Problem with Controller

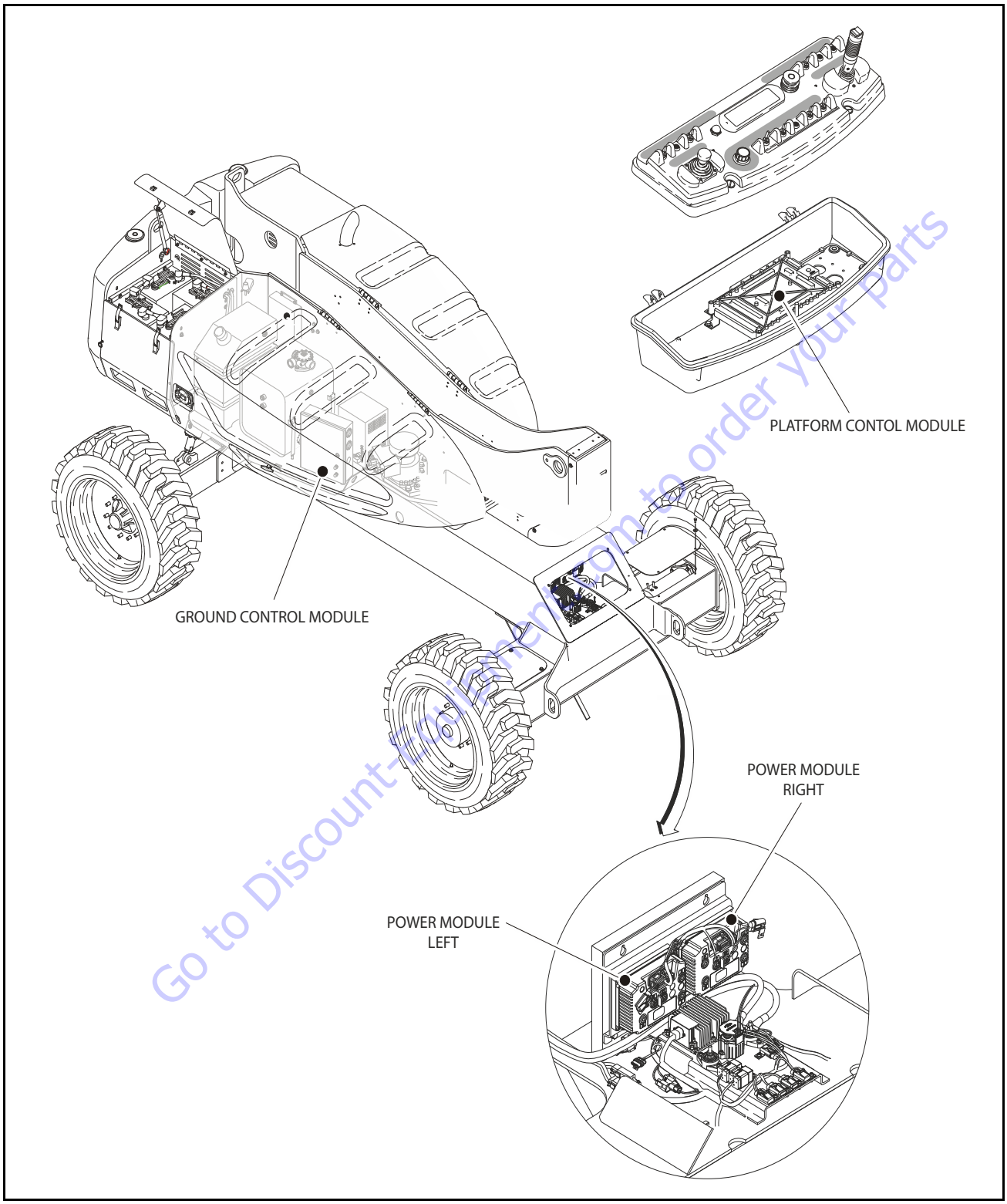
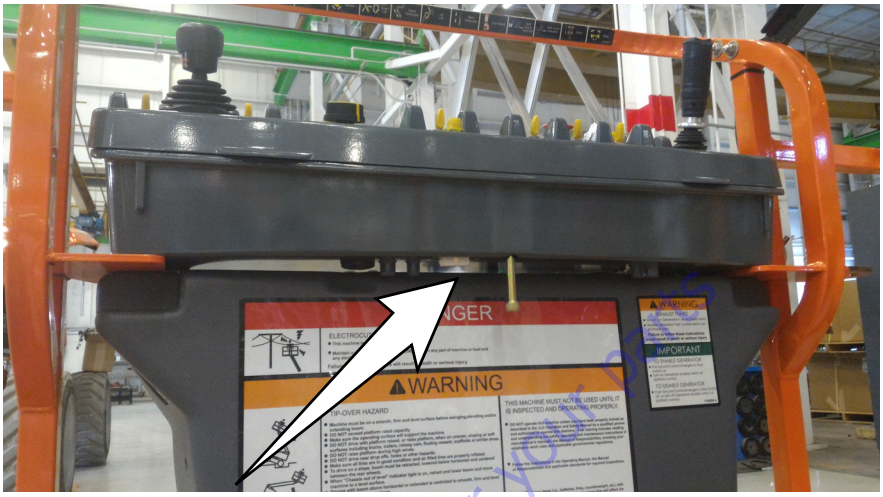
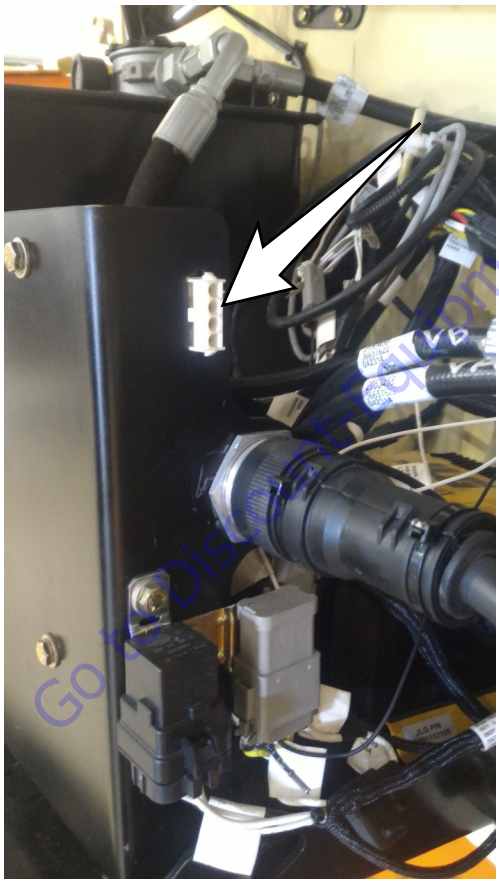


Figure 6-7. Control Module Location

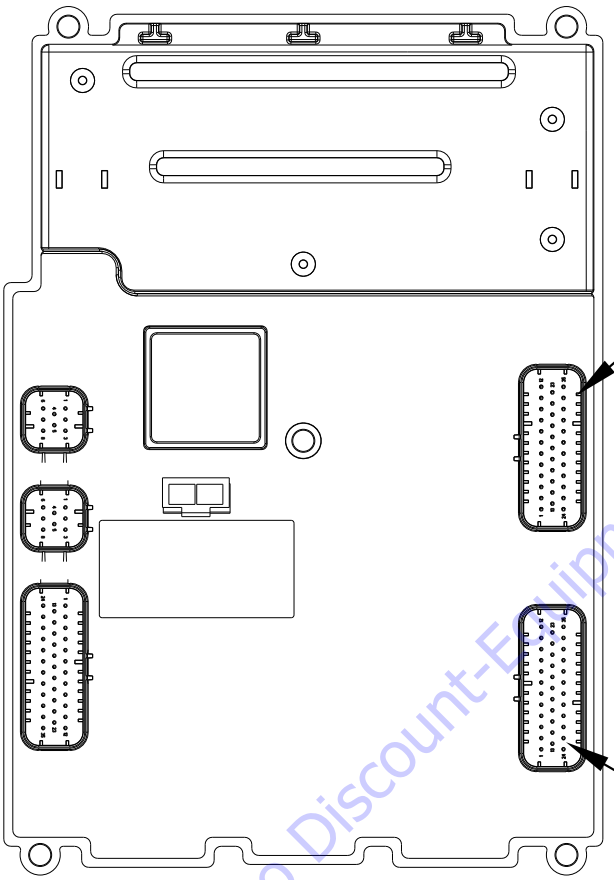


PLATFORM CONNECTION



GROUND CONTROL CONNECTION

Figure 6-8. Analyzer Connecting Points



CONNECTOR	PIN	ASSIGNMENT	FUNCTION
J2 GRAY	1	UNALLOCATED (JIB RT)	DIGITAL INPUT
	2	UNALLOCATED (JIB LT)	DIGITAL INPUT
	3	UNUSED (BATTERY VOLTAGE)	BATTERY VOLTAGE
	4	DRIVE ORIENTATION SYSTEM OVERRIDE SWITCH	HS DIGITAL INPUT
	5	UNALLOCATED (BASKET STOW SWITCH)	DIGITAL INPUT
	6	CHASSIS TILTED INDICATOR	LAMP OUTPUT
	7	FUNCTION ENABLE INDICATOR	LAMP OUTPUT
	8	VEHICLE SYSTEM DISTRESS INDICATOR	LAMP OUTPUT
	9	CREEP SPEED INDICATOR	LAMP OUTPUT
	10	UNUSED (BROKEN CABLE INDICATOR)	LAMP OUTPUT
	11	PLATFORM OVERLOADED INDICATOR	LAMP OUTPUT
	12	UNUSED (500 LB CAPACITY INDICATOR)	LAMP OUTPUT
	13	LOW BATTERY INDICATOR	LAMP OUTPUT
	14	DRIVE ORIENTATION SYSTEM INDICATOR	LAMP OUTPUT
	15	UNUSED (GENERATOR ON INDICATOR)	LAMP OUTPUT
	16	SKYGUARD INDICATOR	LAMP OUTPUT
	17	UNUSED (GLOW PLUG ENGAGED INDICATOR)	LAMP OUTPUT
	18	LAMP RETURN	GROUND
	19	SOFT TOUCH INDICATOR	LAMP OUTPUT
	20	UNUSED	LAMP OUTPUT
	21	UNUSED (LOW FUEL INDICATOR)	LAMP OUTPUT
	22	1/4 BAT CHG INDICATOR	LAMP OUTPUT
	23	3/4 BAT CHG INDICATOR	LAMP OUTPUT
	24	1/2 BAT CHG INDICATOR	LAMP OUTPUT
	25	BAT CHG INDICATORS RETURN	GROUND
	26	ANALYZER POWER	ANALYZER POWER
	27	ANALYZER GROUND	ANALYZER GROUND
	28	ANALYZER RX	ANALYZER RX
	29	ANALYZER TX	ANALYZER TX
	30	UNUSED (BATTERY VOLTAGE)	BATTERY VOLTAGE
	31	SOFT TOUCH POWER	BATTERY VOLTAGE
	32	LSS POWER	BATTERY VOLTAGE
	33	UNUSED (PLT DISP POWER)	BATTERY VOLTAGE
	34	UNUSED (SWITCH POWER)	BATTERY VOLTAGE
	35	FULL BAT CHG INDICATOR	LAMP OUTPUT

CONNECTOR	PIN	ASSIGNMENT	FUNCTION
J1 NATURAL	1	UNUSED	DIGITAL INPUT
	2	UNUSED	DIGITAL INPUT
	3	UNUSED (TOWER TELESCOPE IN)	DIGITAL INPUT
	4	UNUSED (TOWER TELESCOPE OUT)	DIGITAL INPUT
	5	MAIN TELESCOPE IN	DIGITAL INPUT
	6	MAIN TELESCOPE OUT	DIGITAL INPUT
	7	PLATFORM ROTATE RIGHT	DIGITAL INPUT
	8	PLATFORM ROTATE LEFT	DIGITAL INPUT
	9	PLATFORM LEVEL UP	DIGITAL INPUT
	10	PLATFORM LEVEL DOWN	DIGITAL INPUT
	11	JIB UP	DIGITAL INPUT
	12	JIB DOWN	DIGITAL INPUT
	13	SPEED PUMP POTENTIOMETER GROUND	GROUND
	14	UNUSED (ENGINE START)	DIGITAL INPUT
	15	UNUSED (AUXILIARY DESCENT)	DIGITAL INPUT
	16	UNUSED (CRAB STEER SELECT)	DIGITAL INPUT
	17	UNUSED (COORDINATED STEER SELECT)	DIGITAL INPUT
	18	SWITCH POWER	BATTERY VOLTAGE
	19	UNALLOCATED	DIGITAL INPUT
	20	SOFT TOUCH SWITCH	DIGITAL INPUT
	21	UNALLOCATED	DIGITAL INPUT
	22	UNALLOCATED	DIGITAL INPUT
	23	SKYGUARD INPUT #2	DIGITAL INPUT
	24	UNALLOCATED	DIGITAL INPUT
	25	UNALLOCATED	DIGITAL INPUT
	26	UNALLOCATED	DIGITAL INPUT
	27	SPEED MODE	DIGITAL INPUT
	28	UNUSED (TORQUE MODE (LOW ENGINE))	AWDA ENABLE
	29	SOFT TOUCH/SKYGUARD OVERRIDE	DIGITAL INPUT
	30	HEAD/TAIL LIGHT	DIGITAL INPUT
	31	HORN	DIGITAL INPUT
	32	CREEP MODE	DIGITAL INPUT
	33	UNUSED (GENSET ENABLE/DISABLE)	DIGITAL INPUT
	34	SPEED PUMP POTENTIOMETER REFERENCE VOLTAGE	+7 REFERENCE VOLTAGE
	35	SPEED PUMP POTENTIOMETER	ANALOG INPUT

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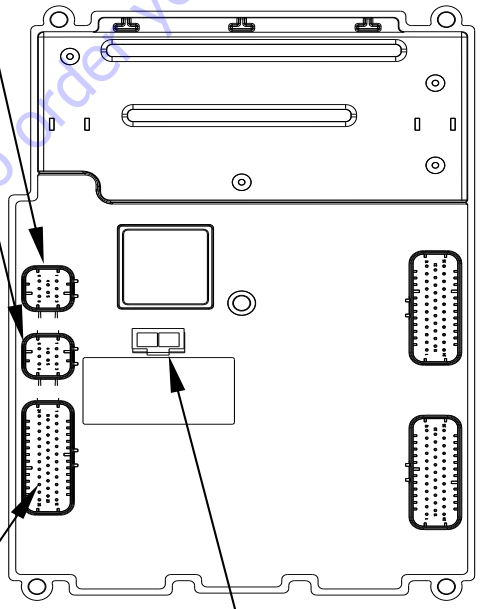
Figure 6-9. Platform Control Module - Sheet 1 of 2

CONNECTOR	PIN	ASSIGNMENT	FUNCTION
J5 NATURAL	1	LIFT / SWING JOYSTICK SUPPLY VOLTAGE	SUPPLY VOLTAGE
	2	LIFT CENTER TAP	ANALOG INPUT
	3	LIFT SIGNAL	ANALOG INPUT
	4	SWING SIGNAL	ANALOG INPUT
	5	SWING CENTER TAP	ANALOG INPUT
	6	UNUSED	ANALOG INPUT
	7	LIFT / SWING JOYSTICK RETURN	GROUND
	8	UNUSED	GROUND

CONNECTOR	PIN	ASSIGNMENT	FUNCTION
J6 BLACK	1	DRIVE / STEER JOYSTICK SUPPLY VOLTAGE	SUPPLY VOLTAGE
	2	DRIVE CENTER TAP	ANALOG INPUT
	3	DRIVE SIGNAL	ANALOG INPUT
	4	UNUSED	ANALOG INPUT
	5	STEER LEFT	ANALOG INPUT
	6	STEER RIGHT	ANALOG INPUT
	7	DRIVE / STEER JOYSTICK RETURN	GROUND
	8	UNUSED	GROUND

CONNECTOR	PIN	ASSIGNMENT	FUNCTION
J7 BLACK	1	GROUND MODE	PLATFORM EMS
	2	PLATFORM EMS	PLATFORM MODE
	3	PLATFORM EMS TO GROUND MODULE	GROUND MODE
	4	FOOTSWITCH (FUNCTION ENABLE SWITCH) POWER	BATTERY VOLTAGE
	5	UNUSED (INVERTER SWITCH POWER)	BATTERY VOLTAGE
	6	UNUSED (JIB BLOCK LIMIT SWITCH POWER)	BATTERY VOLTAGE
	7	SKYGUARD POWER	BATTERY VOLTAGE
	8	FOOTSWITCH SIGNAL	DIGITAL INPUT
	9	UNUSED (INVERTER ON SIGNAL)	DIGITAL INPUT
	10	UNUSED (+7 REFERENCE VOLTAGE)	+7 REFERENCE VOLTAGE
	11	UNUSED (LOAD CELL INPUT 1)	ANALOG INPUT
	12	UNUSED (LOAD CELL INPUT 2)	ANALOG INPUT
	13	UNALLOCATED	ANALOG INPUT
	14	UNUSED (GROUND RETURN)	GROUND
	15	UNUSED (LOAD CELL REFERENCE VOLTAGE)	+7 REFERENCE VOLTAGE
	16	LOAD CELL RETURN	GROUND
	17	UNUSED (JIB BLOCK LIMIT SWITCH)	HS DIGITAL INPUT
	18	SKYGUARD INPUT #1	HS DIGITAL INPUT
	19	PLATFORM ALARM	LAMP OUTPUT
	20	PLATFORM ALARM RETURN	GROUND
	21	PLATFORM LEVEL UP	ME DIGITAL OUTPUT
	22	PLATFORM LEVEL DOWN	ME DIGITAL OUTPUT
	23	VALVE RETURN	GROUND
	24	SKYGUARD RETURN	GROUND
	25	JIB UP	ME DIGITAL OUTPUT
	26	JIB DOWN	ME DIGITAL OUTPUT
	27	JIB RIGHT	ME DIGITAL OUTPUT
	28	JIB LEFT	ME DIGITAL OUTPUT
	29	PLT DISP RETURN	GROUND
	30	CAN LOW	CAN LOW
	31	CAN HIGH	CAN HIGH
	32	UNUSED (CAN SHIELD)	CAN SHIELD
	33	PLATFORM ROTATE LEFT	ME DIGITAL OUTPUT
	34	PLATFORM ROTATE RIGHT	ME DIGITAL OUTPUT
	35	UNUSED (GROUND RETURN)	GROUND



CONNECTOR	PIN	ASSIGNMENT	FUNCTION
J8	1	MODULE GROUND	GROUND
	2	MODULE POWER	BATTERY VOLTAGE

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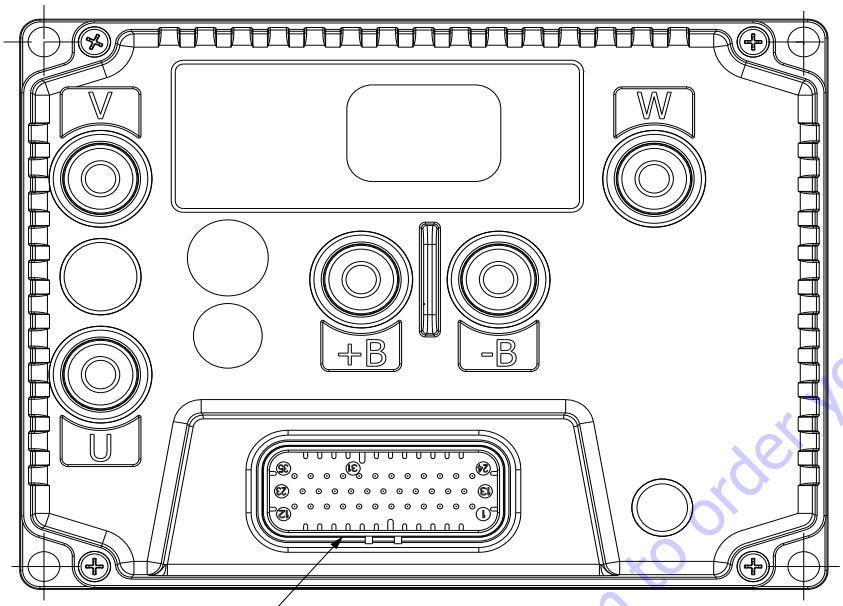
Figure 6-10. Platform Control Module - Sheet 2 of 2



CONNECTOR	PIN	FUNCTION	TYPE	
J1	1	UNUSED	DIGITAL	INPUT
	2	ELECTRO BRAKE	DIGITAL	OUTPUT
	3	ELECTRO BRAKE SUPPLY (POS)	VBAT	INPUT
	4	ELECTRO BRAKE DRIVER (NEG)	PWM	OUTPUT
	5	SENSOR GROUND	GROUND	INPUT
	6	MODULE ADDRESS	DIGITAL	INPUT
	7	UNUSED	DIGITAL	INPUT
	8	UNUSED	DIGITAL	OUTPUT
	9	UNUSED	DIGITAL	OUTPUT
	10	KEY SWITCH (IGNITION)	DIGITAL	INPUT
	11	UNUSED	DIGITAL	OUTPUT
	12	UNUSED	PWM	OUTPUT
	13	WHEEL ENCODER PIN B	DIGITAL	INPUT
	14	WHEEL ENCODER PIN A	DIGITAL	INPUT
	15	UNUSED	ANALOG	INPUT
	16	UNUSED	DIGITAL	INPUT
	17	UNUSED	DIGITAL	INPUT
	18	UNUSED	DIGITAL	INPUT
	19	UNUSED	DIGITAL	INPUT
	20	UNUSED	DIGITAL	INPUT
	21	UNUSED	DIGITAL	INPUT
	22	MOTOR THERMAL SENSOR	ANALOG	INPUT
	23	UNUSED	PWM	OUTPUT
	24	UNUSED	PWM	OUTPUT
	25	WHEEL ENCODER POWER (+5 VOLTS)	VOLTAGE	OUTPUT
	26	UNUSED	DIGITAL	OUTPUT
	27	CAN LOW	COMM	I/O
	28	CAN HIGH	COMM	I/O
	29	UNUSED	DIGITAL	INPUT
	30	UNUSED	ANALOG	INPUT
	31	UNUSED	DIGITAL	INPUT
	32	UNUSED	DIGITAL	INPUT
	33	UNUSED	DIGITAL	OUTPUT
	34	UNUSED	DIGITAL	OUTPUT
	35	UNUSED	DIGITAL	INPUT

CONNECTOR	PIN	FUNCTION	TYPE	
-B	1	MODULE GROUND	GROUND	INPUT

CONNECTOR	PIN	FUNCTION	TYPE	
+B	1	MODULE POWER	VBAT	INPUT

CONNECTOR	PIN	FUNCTION	TYPE	
U	1	MOTOR PHASE U	AC	OUTPUT

CONNECTOR	PIN	FUNCTION	TYPE	
V	1	MOTOR PHASE V	AC	OUTPUT

CONNECTOR	PIN	FUNCTION	TYPE	
W	1	MOTOR PHASE W	AC	OUTPUT

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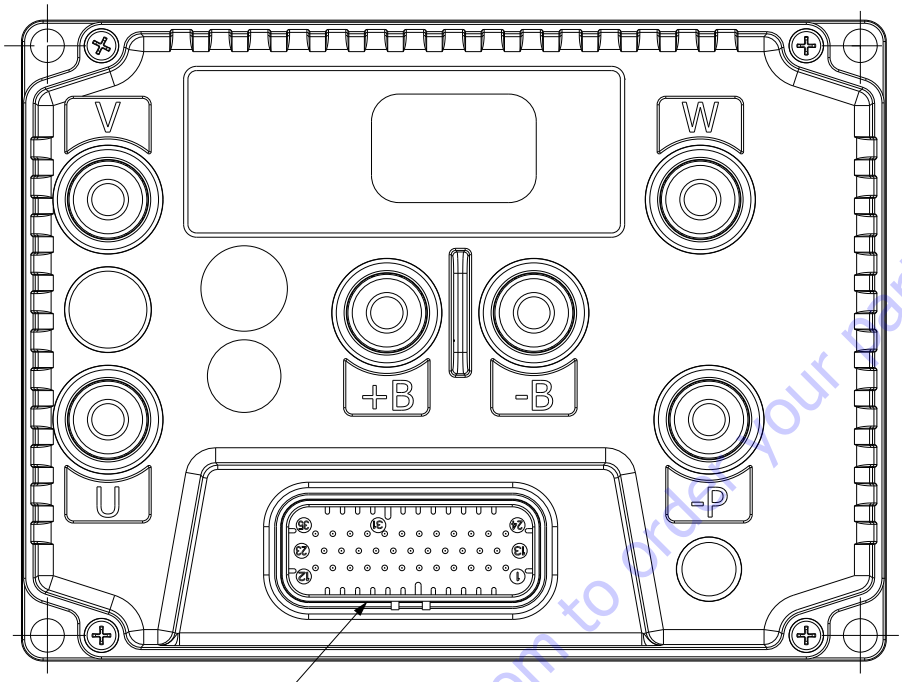
Figure 6-11. Power Module - LH



CONNECTOR	PIN	FUNCTION	TYPE	
J1	1	UNUSED	DIGITAL	INPUT
	2	ELECTRO BRAKE	DIGITAL	OUTPUT
	3	ELECTRO BRAKE SUPPLY (POS)	VBAT	INPUT
	4	ELECTRO BRAKE DRIVER (NEG)	PWM	OUTPUT
	5	WHEEL ENCODER GROUND	GROUND	INPUT
	6	MODULE ADDRESS	DIGITAL	INPUT
	7	UNUSED	DIGITAL	INPUT
	8	UNUSED	DIGITAL	OUTPUT
	9	UNUSED	DIGITAL	OUTPUT
	10	KEY SWITCH (IGNITION)	DIGITAL	INPUT
	11	UNUSED	DIGITAL	OUTPUT
	12	CONTACTOR DRIVER (MASTER)	PWM	OUTPUT
	13	WHEEL ENCODER PIN B	DIGITAL	INPUT
	14	WHEEL ENCODER PIN A	DIGITAL	INPUT
	15	STEERING ANGLE (MASTER)	ANALOG	INPUT
	16	CHARGER INTERLOCK (MASTER)	DIGITAL	INPUT
	17	UNUSED	DIGITAL	INPUT
	18	UNUSED	DIGITAL	INPUT
	19	UNUSED	DIGITAL	INPUT
	20	UNUSED	DIGITAL	INPUT
	21	UNUSED	DIGITAL	INPUT
	22	MOTOR THERMAL SENSOR	ANALOG	INPUT
	23	UNUSED	PWM	OUTPUT
	24	UNUSED	PWM	OUTPUT
	25	WHEEL ENCODER POWER (+5 VOLTS)	VOLTAGE	OUTPUT
	26	UNUSED	DIGITAL	OUTPUT
	27	CAN LOW	COMM	I/O
	28	CAN HIGH	COMM	I/O
	29	UNUSED	DIGITAL	INPUT
	30	UNUSED	ANALOG	INPUT
	31	UNUSED	DIGITAL	INPUT
	32	UNUSED	DIGITAL	INPUT
	33	UNUSED	DIGITAL	OUTPUT
	34	UNUSED	DIGITAL	OUTPUT
	35	UNUSED	DIGITAL	INPUT

CONNECTOR	PIN	FUNCTION	TYPE	
-B	1	MODULE GROUND	GROUND	INPUT

CONNECTOR	PIN	FUNCTION	TYPE	
+B	1	MODULE POWER	VBAT	INPUT

CONNECTOR	PIN	FUNCTION	TYPE	
-P	1	PUMP	PWM	OUTPUT

CONNECTOR	PIN	FUNCTION	TYPE	
U	1	MOTOR PHASE U	AC	OUTPUT

CONNECTOR	PIN	FUNCTION	TYPE	
V	1	MOTOR PHASE V	AC	OUTPUT

CONNECTOR	PIN	FUNCTION	TYPE	
W	1	MOTOR PHASE W	AC	OUTPUT

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Figure 6-12. Power Module - RH

Connector	Pin	Function	Type	
J1 (Natural)	1	UNUSED	DIGITAL	OUTPUT
	2	ALERT BEACON POWER	DIGITAL	OUTPUT
	3	UNUSED	DIGITAL	OUTPUT
	4	ALERT BEACON GROUND	GROUND	INPUT
	5	UNUSED	GROUND	INPUT
	6	UNUSED	DIGITAL	OUTPUT
	7	UNUSED	DIGITAL	OUTPUT
	8	UNUSED (GROUND)	GROUND	INPUT
	9	UNUSED (GROUND)	GROUND	INPUT
	10	UNUSED	DIGITAL	OUTPUT
	11	UNUSED	DIGITAL	OUTPUT
	12	UNUSED	DIGITAL	OUTPUT
	13	DRIVE ENABLE RELAY (VOTE RELAY)	DIGITAL	OUTPUT
	14	UNUSED	ANALOG	INPUT
	15	UNUSED	ANALOG	INPUT
	16	UNUSED	FREQUENCY	INPUT
	17	UNUSED	GROUND	INPUT
	18	UNUSED	GROUND	INPUT
	19	DRIVE ENABLE RELAY GROUND (VOTE RELAY)	GROUND	INPUT
	20	UNUSED	DIGITAL	OUTPUT
	21	UNUSED	DIGITAL	INPUT
	22	UNUSED	DIGITAL	OUTPUT
	23	UNUSED	DIGITAL	OUTPUT
	24	UNUSED	N/C	N/C
	25	UNUSED (RESERVED FOR RS-485 HIGH)	SERIAL	I/O
	26	UNUSED (RESERVED FOR RS-485 LOW)	SERIAL	I/O
	27	UNUSED (GROUND)	GROUND	INPUT
	28	ANALYZER POWER	VOLTAGE	OUTPUT
	29	ANALYZER RS-232 RX	SERIAL	INPUT
	30	ANALYZER RS-232 TX	SERIAL	OUTPUT
	31	ANALYZER GROUND	GROUND	INPUT
	32	UNUSED	DIGITAL	OUTPUT
	33	UNUSED (GROUND)	GROUND	INPUT
	34	UNUSED	DIGITAL	INPUT
	35	UNUSED	DIGITAL	INPUT

Connector	Pin	Function	Type	
J2 (Gray)	1	UNUSED	DIGITAL	OUTPUT
	2	UNUSED	DIGITAL	OUTPUT
	3	TELESCOPE IN SOLENOID	DIGITAL	OUTPUT
	4	UNUSED	DIGITAL	OUTPUT
	5	PLATFORM LEVEL UP SOLENOID / FWD A	DIGITAL	OUTPUT
	6	UNUSED	GROUND	INPUT
	7	PLATFORM LEVEL DOWN SOLENOID / AWD RIGHT FWD B	DIGITAL	OUTPUT
	8	UNUSED	DIGITAL	OUTPUT
	9	UNUSED	DIGITAL	OUTPUT
	10	PLATFORM ROTATE LEFT SOLENOID / AWD REV A	DIGITAL	OUTPUT
	11	MAIN LIFT UP SOLENOID	DIGITAL	OUTPUT
	12	JIB UP SOLENOID	DIGITAL	OUTPUT
	13	UNUSED	DIGITAL	OUTPUT
	14	PLATFORM/JIB ROTATE SOLENOID GROUND / AWD SOLENOID GROUND	GROUND	INPUT
	15	TELESCOPE OUT SOLENOID	DIGITAL	OUTPUT
	16	UNUSED	DIGITAL	OUTPUT
	17	TELESCOPE SOLENOID GROUND	GROUND	INPUT
	18	SWING ARREST SOLENOID GROUND / OSC AXLE CHARGE SOL GROUND	GROUND	INPUT
	19	SWING ARREST SOLENOID / OSC AXLE CHARGE SOLENOID	DIGITAL	OUTPUT
	20	UNUSED	DIGITAL	OUTPUT
	21	PLATFORM ROTATE RIGHT SOLENOID / AWD REV B	DIGITAL	OUTPUT
	22	LIFT DOWN SOLENOID	DIGITAL	OUTPUT
	23	JIB DOWN SOLENOID	DIGITAL	OUTPUT
	24	OSC AXEL PRESSURE SWITCH	DIGITAL	INPUT
	25	UNUSED	ANALOG	INPUT
	26	HEAD / TAIL LIGHT ENABLE RELAY	DIGITAL	OUTPUT
	27	GROUND ALARM OUTPUT	DIGITAL	OUTPUT
	28	STEER SOLENOID GROUND	GROUND	INPUT
	29	GROUND ALARM GROUND	GROUND	INPUT
	30	OSC AXEL PRESSURE SWITCH GROUND	GROUND	INPUT
	31	FLOW CONTROL SOLENOID	DIGITAL	OUTPUT
	32	STEER RIGHT SOLENOID	DIGITAL	OUTPUT
	33	STEER LEFT SOLENOID	DIGITAL	OUTPUT
	34	SWING LEFT SOLENOID	DIGITAL	OUTPUT
	35	SWING RIGHT SOLENOID	DIGITAL	OUTPUT

Connector	Pin	Function	Type	
J3 (Black)	1	UNUSED	GROUND	INPUT
	2	MAIN LIFT CURRENT FEEDBACK (LSD CURRENT SENSE 2)	GROUND	INPUT
	3	UNUSED (GROUND)	GROUND	INPUT
	4	SWING CURRENT FEEDBACK (LSD CURRENT SENSE 4)	GROUND	INPUT
	5	UNUSED	GROUND	INPUT
	6	FLOW CONTROL VALVE CURRENT FEEDBACK (LSD CURRENT SENSE 6)	GROUND	INPUT
	7	BATTERY VOLTAGE FOR GROUND ALARM	VBAT	OUTPUT
	8	UNUSED	DIGITAL	INPUT
	9	UNSUED	DIGITAL	INPUT
	10	UNUSED	DIGITAL	INPUT
	11	UNUSED	DIGITAL	INPUT
	12	UNUSED (+5 VOLTS)	VOLTAGE	OUTPUT
	13	UNUSED	ANALOG	INPUT
	14	UNUSED (LSD CURRENT SENSE 3)	GROUND	INPUT

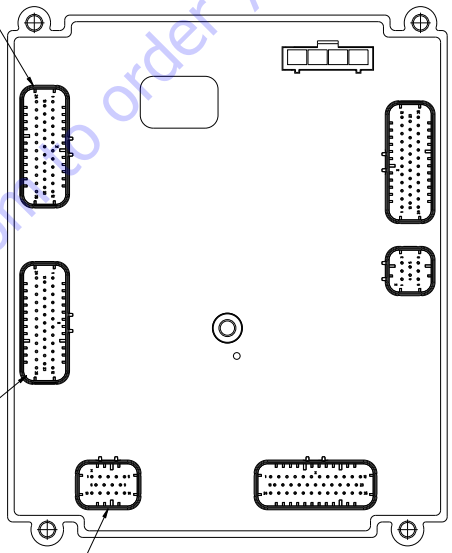

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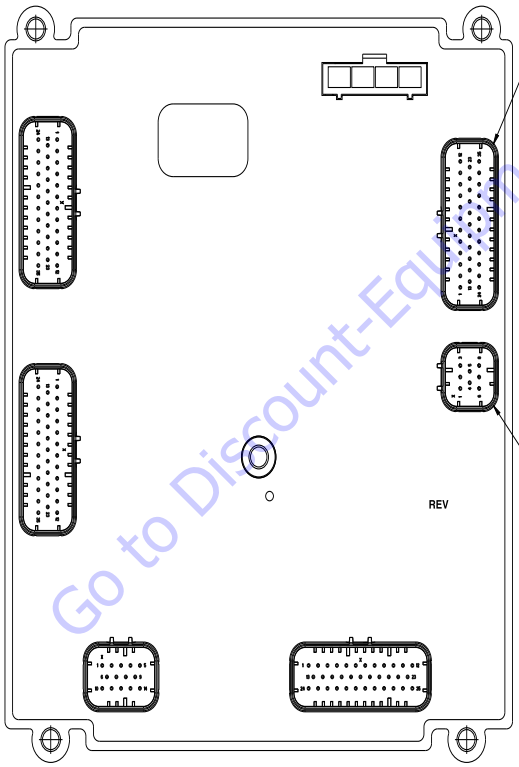
Figure 6-13. Ground Control Module - Sheet 1 of 3



Connector	Pin	Function	Type	
J7 (Black)	1	PLATFORM EMS	DIGITAL	INPUT
	2	PLATFORM MODE	DIGITAL	INPUT
	3	GROUND MODE	DIGITAL	INPUT
	4	UPPER BOOM ELEVATION SWITCH	ANALOG	INPUT
	5	UNUSED	VOLTAGE	OUTPUT
	6	CAN1 TERMINATOR	TERM	I/O
	7	UNUSED	ANALOG	INPUT
	8	UNUSED	ANALOG	INPUT
	9	UNUSED (GROUND)	GROUND	INPUT
	10	UNUSED (GROUND)	GROUND	INPUT
	11	DOS SWITCH	DIGITAL	INPUT
	12	UNUSED	DIGITAL	INPUT
	13	CAN1 HIGH	SERIAL	I/O
	14	GROUND MODE POWER TO PLATFORM	DIGITAL	INPUT
	15	FOOTSWITCH	DIGITAL	INPUT
	16	UNUSED (+5 VOLTS)	VOLTAGE	OUTPUT
	17	CAN1 TERMINATOR	TERM	I/O
	18	UNUSED	GROUND	INPUT
	19	UNUSED (GROUND)	GROUND	INPUT
	20	UNUSED	ANALOG	INPUT
	21	UNUSED	DIGITAL	INPUT
	22	UNUSED	DIGITAL	INPUT
	23	UNUSED	DIGITAL	INPUT
	24	CAN1 LOW	SERIAL	I/O
	25	TILT SENSOR GROUND	GROUND	INPUT
	26	UNUSED (+5 VOLTS)	VOLTAGE	OUTPUT
	27	UNUSED (+5 VOLTS)	VOLTAGE	OUTPUT
	28	UNUSED	GROUND	INPUT
	29	BATTERY VOLTAGE FOR TILT SENSOR	VBAT	OUTPUT
	30	BATTERY VOLTAGE FOR BOOM LIMIT SWITCH	VBAT	OUTPUT
	31	UNUSED	VBAT	OUTPUT
	32	DOS SWITCH POWER	VBAT	OUTPUT
	33	UNUSED	VBAT	OUTPUT
	34	UNUSED	VBAT	OUTPUT
	35	UNUSED	DIGITAL	INPUT

Connector	Pin	Function	Type	
J12 (Blue)	1	UNUSED	FREQUENCY	INPUT
	2	UNUSED	FREQUENCY	INPUT
	3	CAN2 HIGH (ISOLATED)	SERIAL	I/O
	4	CAN2 LOW (ISOLATED)	SERIAL	I/O
	5	CAN2 SHIELD (ISOLATED)	GROUND	INPUT
	6	UNUSED	TERM	I/O
	7	UNUSED	TERM	I/O
	8	MSSO INPUT	DIGITAL	INPUT

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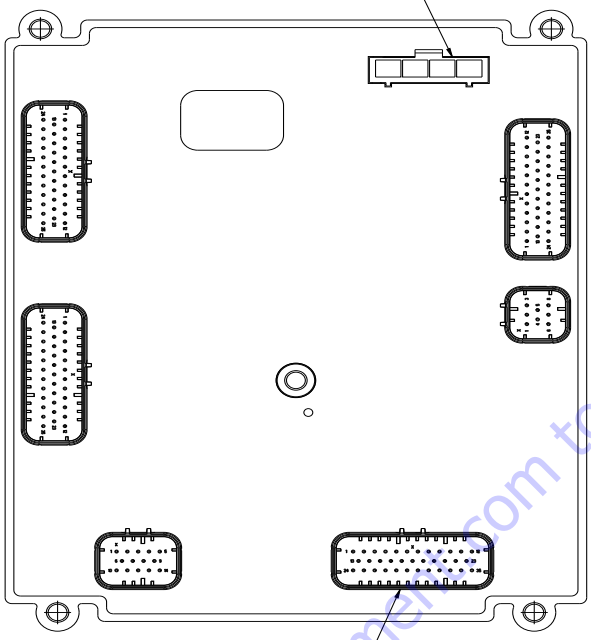
Figure 6-14. Ground Control Module - Sheet 2 of 3

Connector	Pin	Function	Type	
J8 (Black)	1	MODULE GROUND / GROUND FROM BATTERY	GROUND	OUTPUT
	2	MODULE POWER / GROUND EMS	VBAT	INPUT
	3	GROUND TO PLATFORM MODULE	GROUND	INPUT
	4	POWER TO PLATFORM MODULE / GROUND EMS OUT TO PLATFORM	VBAT	OUTPUT



Connector	Pin	Function	Type	
J4 (Blue)	1	UNUSED	DIGITAL	OUTPUT
	2	UNUSED	DIGITAL	OUTPUT
	3	UNUSED	DIGITAL	OUTPUT
	4	UNUSED	DIGITAL	INPUT
	5	PLATFORM LEVEL DOWN	DIGITAL	INPUT
	6	PLATFORM ROTATE LEFT	DIGITAL	INPUT
	7	MAIN TELESCOPE IN	DIGITAL	INPUT
	8	JIB DOWN	DIGITAL	INPUT
	9	JIB LEFT	DIGITAL	INPUT
	10	UNUSED	DIGITAL	INPUT
	11	UNUSED	DIGITAL	INPUT
	12	UNUSED	DIGITAL	OUTPUT
	13	UNUSED	DIGITAL	OUTPUT
	14	PLATFORM OVERLOADED INDICATOR	DIGITAL	OUTPUT
	15	UNUSED	DIGITAL	OUTPUT
	16	AUXILIARY POWER / FUNCTION ENABLE	DIGITAL	INPUT
	17	PLATFORM LEVEL UP	DIGITAL	INPUT
	18	PLATFORM ROTATE RIGHT	DIGITAL	INPUT
	19	JIB UP	DIGITAL	INPUT
	20	JIB RIGHT	DIGITAL	INPUT
	21	UNUSED	DIGITAL	INPUT
	22	UNUSED	DIGITAL	INPUT
	23	MAIN LIFT UP	DIGITAL	INPUT
	24	BATTERY VOLTAGE FOR MDI	VBAT	OUTPUT
	25	BATTERY VOLTAGE FOR SWITCHES	VBAT	OUTPUT
	26	UNUSED	DIGITAL	OUTPUT
	27	UNUSED	DIGITAL	OUTPUT
	28	UNUSED	DIGITAL	OUTPUT
	29	UNUSED	DIGITAL	OUTPUT
	30	TELESCOPE OUT	DIGITAL	INPUT
	31	LAMP GROUND	GROUND	INPUT
	32	MDI GROUND	GROUND	INPUT
	33	MAIN LIFT DOWN	DIGITAL	INPUT
	34	SWING LEFT	DIGITAL	INPUT
	35	SWING RIGHT	DIGITAL	INPUT

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Figure 6-15. Ground Control Module - Sheet 3 of 3

Analyzer Diagnostics Menu Structure

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

Table 6-7. DIAGNOSTICS - Menu Descriptions

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
DRIVE/STEER [Platform Mode =True]	DRIVE DEMAND	FORWARD/REVERSE XXX%	Direction and calibrated Control System Command percentage
	DRIVE OUTPUT	FORWARD/REVERSE XXX%	UGM direction and output speed command
	DRIVE MODE	MAX SPEED/REDUCED SPEED	Drive Mode status
	STEER DEMAND	LEFT/RIGHT XXX%	Direction and percentage of input command from Drive/Steer Joystick
	STEER OUTPUT	LEFT/RIGHT XXX%	UGM directional valve output status
	STEER PRTY VLV	XXX%	Steer priority bypass valve
	STEER SENSOR	VOLTAGE XX.XXV	Steer sensor raw voltage reported by MTM
	STEER SENSOR	ANGLE XX.XDEG	Steer sensor angle reported by MTM
	DRV ORIENT MODE	INLINE/SWUNG	State of DOS switch (prox energized when in line to close normally open contacts)
	DRV ORIENT STATE	CONFIRMED/REQUIRED	InLine and DOS Active = Confirmed
	DRV ORNT OVR SW	CLOSED/OPEN	State of Drive Orientation Override Switch
BOOM FUNCTIONS	SWING DEMAND	LEFT/RIGHT XXX%	Direction and percentage of input command from Swing Joystick or Ground %
	SWING OUTPUT	LEFT/RIGHT XXX%	Direction and valve PWM output percentage
	SWING ASSIST	ON/OFF	Status of swing restriction bypass valve
	LIFT DEMAND	UP/DOWNXXX%	Direction and percentage of input command from Function Speed Pot or Ground %
	LIFT OUTPUT	UP/DOWN XXX%	Direction and valve PWM output percentage
	TELE DEMAND	IN/OUT XXX%/CREEP	Direction and percentage of input command (or CREEP if applicable) from Function Speed Pot or Ground%
	TELE OUTPUT	IN/OUT/OFF	Direction/state of Tele directional valve
	JIB LIFT DEMAND	UP/DOWN XXX%/CREEP	Direction and percentage of input command (or CREEP if applicable) from Function Speed Pot or Ground% [Machine SetUP -> JIB -> YES]
	JIB LIFT OUTPUT	UP/OFF/DOWN XXX%	Direction for Up, but % command for Down [Machine SetUP -> JIB -> YES]
	JIB SWING DEMAND	LEFT/RIGHT XXX%/CREEP	Direction and percentage of input command (or CREEP if applicable) from Function Speed Pot or Ground% [Machine SetUP -> JIB SWING -> YES]
	JIB SWING OUTPUT	LEFT/RIGHT XXX%	Direction for Left, but % command for Right [Machine SetUP -> JIB SWING -> YES]

Table 6-7. DIAGNOSTICS - Menu Descriptions

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
	PLAT LVL DEMAND	UP/DOWN XXX%/CREEP	Direction and percentage of input command (or CREEP if applicable) from Function Speed Pot or Ground%
	PLAT LVL OUTPUT	UP/DOWN XXX%	Direction/state of Level directional valve
	PLAT ROT DEMAND	LEFT/RIGHT XXX%/CREEP	Direction and percentage of input command (or CREEP if applicable) from Function Speed Pot or Ground%
	PLAT ROT OUTPUT	LEFT/RIGHT XXX%	Direction/state of Rotate directional valve
	PUMP SPEED CMD	XXX%	UGM pump command value: 0-100%
	PUMP SPEED FDBK	XXX%	Pump PWM reported from MTM
	PUMP CURRENT	FDBK: XXXA	Pump current reported from MTM
	PUMP ENABLE	ON/OFF	UGM pump enable bit status
	PUMP OP MODE	OFF/RUNNING	Pump status from MTM
	FUNCTION SPEED [Platform Mode = True]	SETTING: XXX%	Displays the percentage demand from the Function Speed Potentiometer.
	CREEP SW [Platform Mode = True]	OPEN/CLOSED	Status of Creep Switch Input
	CREEP MODE	ON/OFF	Displays status of Creep Mode
	FLOW CONTRL VLV	XXX%	Duty cycle of flow control proportional valve
SYSTEM	MAIN CONTACTOR	ENABLED/DISABLED	Status of Main Contactor reported by Zapi module
	MAIN CONT VOTE	ENABLED/DISABLED	Status of Main Contactor voting relay by UGM
	CHASSIS TILT	XX.XDEG	Combined X/Y Absolute Angle
	CHASSIS TILT	X-AXIS: XX.XDEG	X Angle with respect to sign
	CHASSIS TILT	Y-AXIS: XX.XDEG	Y Angle with respect to sign
	UGM AMBIENT TEMP	XXXC/XXXF	Ambient Temperature Sensor Reading from on-board UGM Sensor
	LOW AMBIENT TEMP	XXXC/XXXF	Low Temp Cutout Sensor Ambient Temperature sensor Reading [MACHINE SETUP ' TEMP CUTOUT = YES
	LOW TEMPERATURE	CUTOUT: ACTIVE/INACTIVE/FAULTY	Status of Low Temperature Cutout; Only displayed if MACHINE SETUP→TEMP CUTOUT = YES
	MSSO	ACTIVE/INACTIVE	Status of MSSO [MACHINE SETUP'MARKET=CE and Operating Mode=Ground]

Table 6-7. DIAGNOSTICS - Menu Descriptions

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
SYSTEM INPUTS	OSC AXLE PRESS SW	CLOSED/OPEN	Closed for High Pressure
	OSC AXLE PRESS	HIGH/LOW	Pressure high if input = high
	BOOM ELEV SW	OPEN/CLOSED	State of Boom Elevation Switch #1
	ELEVATION MODE	ABOVE/NOT ABOVE	Elevation State
	TRANSPORT MODE	IN TRANSPORT/OUT OF TRANSPORT	Transport Position
	CREEP SW	OPEN/CLOSED	Status of Creep Switch Input
	CREEP MODE	ON/OFF	Displays status of Creep Mode
	GROUND SELECT	KEYSWITCH: OPEN	Displays whether Ground Keyswitch position is being selected
		KEYSWITCH: CLOSED	
	PLATFORM SELECT	KEYSWITCH: OPEN	Displays whether Platform Keyswitch position is being selected
		KEYSWITCH: CLOSED	
	STATION CONTROL	GROUND/PLATFORM	Displays Active control station per System Mode definition
	FOOTSWITCH INPUT	GROUND: OPEN	State of Footswitch input at UGM (Open with Footswitch is not activated).
		GROUND: CLOSED	
	FOOTSWITCH INPUT	PLATFORM: CLOSED	State of Footswitch input at PM (Closed when footswitch not activated).
		PLATFORM: OPEN	
TRACTION	RIGHT MOTOR	FREQ XXX.X Hz	Motor drive frequency reported by associated PM
	LEFT MOTOR	FREQ XXX.X Hz	Motor drive frequency reported by associated PM
	RIGHT MOTOR	SPEED XXX RPM	Motor encoder speed reported by associated PM
	LEFT MOTOR	SPEED XXX RPM	Motor encoder speed reported by associated PM
	RIGHT MOTOR	OFF/REGEN/DRIVE/MOTOR BRAKE/ PARKING BRAKE	Traction mode status as reported by associated PM
	LEFT MOTOR	OFF/REGEN/DRIVE/MOTOR BRAKE/ PARKING BRAKE	Traction mode status as reported by associated PM
	RIGHT MOTOR	CURRENT XXXA	ACrms Motor current reported by associated PM; display in Platform Mode only
	LEFT MOTOR	CURRENT XXXA	ACrms Motor current reported by associated PM; display in Platform Mode only
	RIGHT MOTOR	TEMP XXXC/F	Module temperature reported by PM; display in Platform Mode only
	LEFT MOTOR	TEMP XXXC/F	Module temperature reported by PM; display in Platform Mode only
	RIGHT BRAKE	APPLIED/RELEASED	Brake status reported by associated PM
	LEFT BRAKE	APPLIED/RELEASED	Brake status reported by associated PM
	RIGHT MODULE	TEMP XXXC/F	Module temperature reported by PM; display in Platform Mode only
	LEFT MODULE	TEMP XXXC/F	Module temperature reported by PM; display in Platform Mode only

Table 6-7. DIAGNOSTICS - Menu Descriptions

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
VOLTAGE/CUR	BATTERY SOC	XXX%/DISCHARGED/DEEP DISCHARGED	UGM calculated battery State-of-Charge; display percentage unless Discharged or Deeply Discharged
	BATTERY VOLTAGE	XX.XXV	UGM computed Vbat from MTM with compensation for voltage drop
	BATTERY CURRENT	XXXA	
	RIGHT SYSTEM	VOLTAGE XX.XXV	Real time system voltage reported by associated PM and compensated by UGM; not SOC
	LEFT SYSTEM	VOLTAGE XX.XXV	Real time system voltage reported by associated PM and compensated by UGM; not SOC
	UGM CONTROL	VOLTAGE XX.XV	UGM measured system control voltage
	PLATFORM MODULE	VOLTAGE XX.XV	Platform Module reported battery voltage measurement
	AC CHARGER	CONNECTED/NOT CONNECTED	Reflect status of charger connectivity reported by MTM
OPER CONTROLS	JOYSTICK DRIVE	FORWARD/REVERSE XXX%	Drive Joystick drive direction and command percentage as reported from PM [Platform Mode = TRUE]
	JOYSTICK STEER	LEFT/RIGHT XXX%	Drive Joystick steer direction and percentage command as reported from PM [Platform Mode = TRUE]
	JOYSTICK SWING	LEFT/RIGHT XXX%	Lift/Swing Joystick Swing direction and percentage command as reported from PM [Platform Mode = TRUE]
	JOYSTICK LIFT	UP/DOWN XXX%	Lift/Swing Joystick Lift direction and percentage command as reported from PM [Platform Mode = TRUE]
	DRV ORNT OVR SW	CLOSED/OPEN	State of Drive Orientation Override Switch [Platform Mode = TRUE]
	ENABLE	OPEN/CLOSED	Status of FUNCTION ENABLE Toggle Switch Input [Ground Mode = TRUE]
	SWING LEFT SW	OPEN/CLOSED	Status of Ground Toggle Switch Input [Ground Mode = TRUE]
	SWING RIGHT SW	OPEN/CLOSED	Status of Ground Toggle Switch Input [Ground Mode = TRUE]
	LIFT UP SW	OPEN/CLOSED	Status of Ground Toggle Switch Input [Ground Mode = TRUE]
	LIFT DN SW	OPEN/CLOSED	Status of Ground Toggle Switch Input [Ground Mode = TRUE]
	TELE IN SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	TELE OUT SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	JIB LIFT UP SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input [MACHINE SETUP ' Jib = YES]
	JIB LIFT DN SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input [MACHINE SETUP ' Jib = YES]

Table 6-7. DIAGNOSTICS - Menu Descriptions

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
	JIB SWING LT SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input [MACHINE SETUP ' Jib Swing = YES]
	JIB SWING RT SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input [MACHINE SETUP ' Jib Swing = YES]
	PLAT LEVEL UP SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	PLAT LEVEL DN SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	PLAT ROT LEFT SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	PLAT ROT RGHT SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	MAX SPEED SW	OPEN/CLOSED	Status of Platform Toggle Switch Input [Platform Mode = TRUE]
	CREEP SW	OPEN/CLOSED	Status of Creep Switch Input [Platform Mode = TRUE]
	HORN SW	OPEN/CLOSED	Status of Platform Switch Input [Platform Mode = TRUE]
	SG OVERRIDE SW	OPEN/CLOSED	Status of Platform SkyGuard Override Switch Input if MACHINE SETUP →SKYGUARD = YES
	MSSO SW	OPEN/CLOSED	Status of MSSO switch; [MACHINE SETUP'MARKET=CE and Ground mode = TRUE]
	AWDA ENABLE	OPEN/CLOSED	Status of AWDA Enable
OPTIONS	H&T LIGHTS SW	OPEN/CLOSED	Status of Platform Toggle Switch Input [Platform Mode = TRUE and MACHINE SETUP ' H&T LIGHTS = YES]
	H&T LIGHTS OUT	ON/OFF	UGM Nite Brite Relay Enable output [Platform Mode = TRUE and MACHINE SETUP ' H&T LIGHTS = YES]
	SKYGUARD INPUTS	OPEN/CLOSED/DISAGREE	SkyGuard Input #1 (PLT J7-18) AND SkyGuard Input #2 (PLT J1-23) state [Platform Mode = TRUE and MACHINE SETUP ' SKYGUARD ? NO]
	SKYGUARD INPUT 1	OPEN/CLOSED	State of SkyGuard Platform Input #1 (J7-18); relay NC contacts - closed when active [Platform Mode = true and MACHINE SETUP ' SKYGUARD ? NO]
	SKYGUARD INPUT 2	OPEN/CLOSED	State of SkyGuard Platform Input #2 (J1-23); relay NC contacts - closed when active [Platform Mode= TRUE and MACHINE SETUP ' SKYGUARD ? NO]
	SOFTTOUCH INPUT	OPEN/CLOSED	State of softtouch input (Platform input J1-20) [MACHINE SETUP ' SOFTTOUCH = YES]

Table 6-7. DIAGNOSTICS - Menu Descriptions

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
CAN STATISTICS	CAN 1 STATISTICS	RX/SEC: XXX	
	CAN 1 STATISTICS	TX/SEC: XXX	
	CAN 1 STATISTICS	BUS OFF: XXX	
	CAN 1 STATISTICS	PASSIVE: XXX	
	CAN 1 STATISTICS	MSG ERROR: XXXX	
	CAN 2 STATISTICS	RX/SEC: XXX	
	CAN 2 STATISTICS	TX/SEC: XXX	
	CAN 2 STATISTICS	BUS OFF: XXX	
	CAN 2 STATISTICS	PASSIVE: XXX	
	CAN 2 STATISTICS	MSG ERROR: XXXX	

System Self Test

The system self test is utilized to locate typical problems. See Table 6-8, System Test Descriptions and Table 6-9, System Test Messages for information concerning the tests performed and available messages in this mode.

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

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

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

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

NOTICE

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

Table 6-8. System Test Descriptions

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

Table 6-9. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
RUNNING		Initial display when system test is run while running certain "critical" checks are made.
	CHECK GROUND/ PLATFORM SELECT	The analyzer must be connected to the active control station to run the system test
	CHECK CAN WIRING	The system test cannot run unless the CAN Bus is operating properly
	BATTERY VOLTAGE TOO LOW	The system test cannot run with MTM-reported battery voltage below 39.5V (not UGM-compensated value)
	BATTERY VOLTAGE TOO HIGH	The system test cannot run with the MTM-reported battery voltage above 65V
	CHECK SPEED	Reported vehicle speed must = 0 Hz (or mph)
	HIGH TILT ANGLE	The vehicle is tilted > 3° or the tilt sensor if faulty
	OPEN FOOTSWITCH	In platform mode, the footswitch must be open at the start of the test.
	CLOSE FOOTSWITCH	In platform mode, the operator must close the footswitch when this message is displayed
	BAD FOOTSWITCH	The two footswitch signals are not changing together, probably because one is open circuit. Check footswitch and wiring.
	OPEN FOOTSWITCH	In platform mode, the operator must open the footswitch when this message is displayed.
	PLATFORM OVERLOADED	Load Sensing is configured and the ground module considers the platform to be overloaded
TESTING OUTPUTS?	CLOSE FOOTSWITCH	*Check for Footswitch closed
	OPEN FOOTSWITCH	*Wait for Footswitch to open
	PRESS AND HOLD FOOTSWITCH	*The operator must engage and hold the footswitch for the next batch of tests to be successful. This is due to the hardware high side driver cutout in the ground module
	OPEN FOOTSWITCH	*Wait for Footswitch to open the advance
	FLOW CTRL VALVE	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	STEER RIGHT	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay
	STEER LEFT	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	SWING LEFT	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	SWING RIGHT	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	LIFT UP	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	LIFT DOWN	SHORT TO BATTERY or OPEN-CIRCUIT; or SHORT TO GROUND (or advance test after short delay)
	TELESCOPE OUT	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	TELESCOPE IN	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	JIB UP	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	JIB DOWN	SHORT TO BATTERY or OPEN-CIRCUIT (or advance test after short delay)
	JIB LT VALVE	SHORT TO BATTERY or OPEN-CIRCUIT (or advance test after short delay)
	JIB RT VALVE	SHORT TO BATTERY or OPEN-CIRCUIT (or advance test after short delay)
	PLATFORM LT VALVE	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	PLATFORM RT VALVE	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	PLATFORM LEVEL UP	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	PLATFORM LEVEL DOWN	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay)
	AWD	Check for Short-to-Battery and Short-to-Ground; do not assess Open circuit (can be normal condition); applies to E600 only
	OSC AXLE POWER	Check for Short-to-Battery and Short-to-Ground; do not assess Open circuit (can be normal condition); applies to E600 only

Table 6-9. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
	HEAD/TAIL LIGHTS	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay); displayed if the head/tail light option is configured.
	VOTE RELAY	SHORT TO BATTERY or OPEN-CIRCUIT or SHORT TO GROUND (or advance test after short delay); displayed if the head/tail light option is configured.
CHECKING PLATFORM INPUTS?	DRIVE MAX SPEED	OPEN or CLOSED (advance after switch closed to open)
	DRIVE REDUCED SPEED	OPEN or CLOSED (advance after switch closed to open)
	CL PLATFORM UP	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM UP	OPEN or CLOSED (advanced test after switch toggles)
	CL PLATFORM DOWN	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM DOWN	OPEN or CLOSED (advanced test after switch toggles)
	LIFT JOYSTICK TO UP MAX	(wait for joystick to reach +100% then advance)
	LIFT JOYSTICK TO DOWN MAX	(wait for joystick to reach -100% then advance)
	SWING JOYSTICK TO LEFT MAX	(wait for joystick to reach -100% then advance)
	SWING JOYSTICK TO RIGHT MAX	(wait for joystick to reach +100% then advance)
	CREEP SWITCH CCW	OPEN or CLOSED (advanced test after switch toggles)
	CREEP SWITCH CW	OPEN or CLOSED (advanced test after switch toggles)
	FUNC SPD TO MAX	
	FUNC SPD TO MIN	
	CL HORN	OPEN or CLOSED (advanced test after switch toggles)
	OP HORN	OPEN or CLOSED (advanced test after switch toggles)
	CL PLATFORM LEFT	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM LEFT	OPEN or CLOSED (advanced test after switch toggles)
	CL PLATFORM RGHT	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM RGHT	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB UP	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB UP	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB DOWN	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB DOWN	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB LEFT	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB LEFT	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB RIGHT	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB RIGHT	OPEN or CLOSED (advanced test after switch toggles)
	CL TELE IN	OPEN or CLOSED (advanced test after switch toggles)

Table 6-9. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
	OP TELE IN	OPEN or CLOSED (advanced test after switch toggles)
	CL TELE OUT	OPEN or CLOSED (advanced test after switch toggles)
	OP TELE OUT	OPEN or CLOSED (advanced test after switch toggles)
	CL DRIVE ORIENT	OPEN or CLOSED (advanced test after switch toggles)
	OP DRIVE ORIENT	OPEN or CLOSED (advanced test after switch toggles)
	DRIVE JOYSTICK TO FORWARD MAX	(wait for joystick to reach +100% then advance)
	DRIVE JOYSTICK TO BACK MAX	(wait for joystick to reach -100% then advance)
	STEER TO LEFT MAX	OPEN or CLOSED (advanced test after switch toggles)
	STEER TO RIGHT MAX	OPEN or CLOSED (advanced test after switch toggles)
	CL HEADLIGHT SWITCH	OPEN or CLOSED (advanced test after switch toggles)
	OP HEADLIGHT SWITCH	OPEN or CLOSED (advanced test after switch toggles)
	CL SKYGUARD OVR	OPEN or CLOSED (advanced test after switch toggles); display on if MACHINE SETUP ' SKYGUARD = YES
	OP SKYGUARD OVR	OPEN or CLOSED (advanced test after switch toggles); display on if MACHINE SETUP ' SKYGUARD = YES
	ENGAGE SKYGUARD	SkyGuard bar pressed; SkyGuard inputs #1 and #2 must both change to low state for passing condition; display on if MACHINE SETUP ' SKYGUARD = YES
	RELEASE SKYGUARD	Both SkyGuard inputs must change to high; display on if MACHINE SETUP ' SKYGUARD = YES
	ENGAGE SOFTTOUCH	OPEN or CLOSED (advanced test after switch toggles); display on if MACHINE SETUP ' SOFTTOUCH = YES
	RELEASE SOFTTOUCH	OPEN or CLOSED (advanced test after switch toggles); display on if MACHINE SETUP ' SOFTTOUCH= YES
TEST GROUND INPUTS?	CL SWING RIGHT	OPEN or CLOSED (advanced test after switch toggles)
	OP SWING RIGHT	OPEN or CLOSED (advanced test after switch toggles)
	CL SWING LEFT	OPEN or CLOSED (advanced test after switch toggles)
	OP SWING LEFT	OPEN or CLOSED (advanced test after switch toggles)
	CL LIFT UP	OPEN or CLOSED (advanced test after switch toggles)
	OP LIFT UP	OPEN or CLOSED (advanced test after switch toggles)
	CL LIFT DOWN	OPEN or CLOSED (advanced test after switch toggles)
	OP LIFT DOWN	OPEN or CLOSED (advanced test after switch toggles)
	CL TELE OUT	OPEN or CLOSED (advanced test after switch toggles)
	OP TELE OUT	OPEN or CLOSED (advanced test after switch toggles)
	CL TELE IN	OPEN or CLOSED (advanced test after switch toggles)
	OP TELE IN	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB UP	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB UP	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB DOWN	OPEN or CLOSED (advanced test after switch toggles)

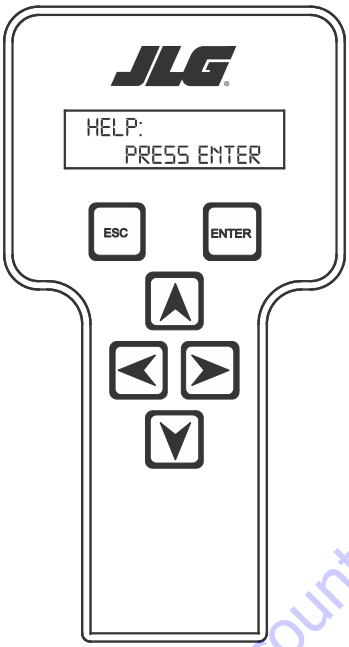
Table 6-9. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
	OP JIB DOWN	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB SWING LEFT	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB SWING LEFT	OPEN or CLOSED (advanced test after switch toggles)
	CL JIB SWING RIGHT	OPEN or CLOSED (advanced test after switch toggles)
	OP JIB SWING RIGHT	OPEN or CLOSED (advanced test after switch toggles)
	CL PATFORM LEFT	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM LEFT	OPEN or CLOSED (advanced test after switch toggles)
	CL PLATFORM RGHT	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM RGHT	OPEN or CLOSED (advanced test after switch toggles)
	CL PLATFORM UP	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM UP	OPEN or CLOSED (advanced test after switch toggles)
	CL PLATFORM DOWN	OPEN or CLOSED (advanced test after switch toggles)
	OP PLATFORM DOWN	OPEN or CLOSED (advanced test after switch toggles)
	CL FUNC ENABLE	OPEN or CLOSED (advanced test after switch toggles)
	OP FUNC ENABLE	OPEN or CLOSED (advanced test after switch toggles)
	CL MSSO SWITCH	OPEN or CLOSED (advanced test after switch toggles); display only if MACHINE SETUP ' MARKET = CE
	OP MSSO SWITCH	OPEN or CLOSED (advanced test after switch toggles); display only if MACHINE SETUP ' MARKET = CE
TEST PLATFORM INDICATORS?	BAT FULL LAMP ON	
	BAT 3/4 LAMP ON	
	BAT 1/2 LAMP ON	
	BAT 1/4 LAMP ON	
	LOW BATTERY	
	ENABLE LAMP ON	
	CREEP LAMP ON	
	DISTRESS LAMP ON	
	TILT LAMP ON	
	OVERLOAD LAMP ON	Display only if LSS configured
	DRIVE ORIENTATION LAMP ON	
	SKYGUARD LAMP ON	Display on if SkyGuard configured
	SOFTTOUCH	Display if Soft Touch configured
	PLAT ALARM ON	
	HORN ON	
TEST GROUND INDICATORS?	OVERLOAD LAMP ON	Display only if MACHINE SETUP ' MARKET = CE
	ALERT BEACON	Display only if MACHINE SETUP-> ALERT BEACON = 20FPM FOR CREEP
TESTS COMPLETE		Indicates that the system test is complete. Any problems reported should have been noted and should now be rectified. Press ESC/CANCEL to return to the RUN SYSTEM TEST Analyzer menu.

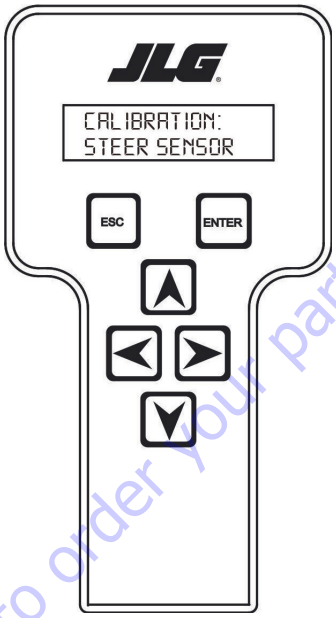
6.5 CALIBRATING STEER

When calibrating steering, each individual wheel must be calibrated in order to make the tire and wheel parallel with the frame. Two methods to help ensure proper calibration are the use of a carpenter's square to square the spindle to the axle or aligning the two wheels on one side using a stretched string.

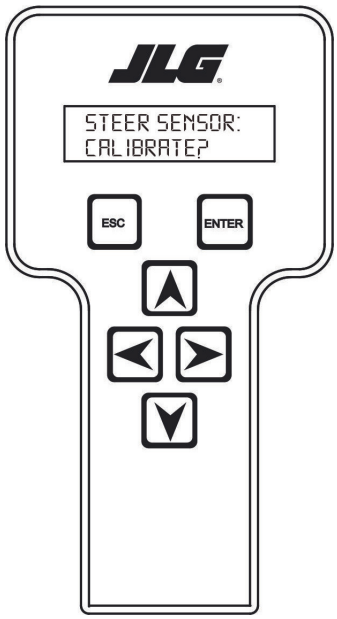
1. Position the Platform/Ground select switch to the Platform position.
2. Plug the analyzer into the connector at the base of the platform control box.
3. Pull out the Emergency Stop switch and Start the engine.
4. The analyzer screen should read:



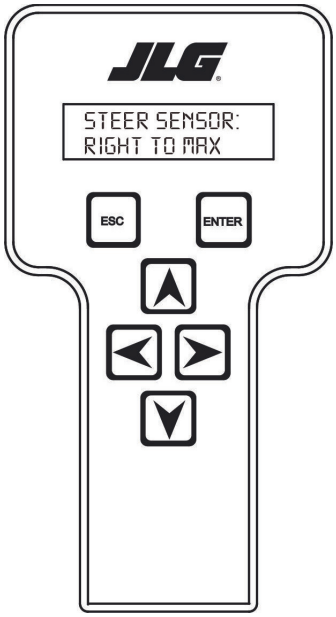
5. Use the arrow button to reach ACCESS LEVEL. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.
8. Use the arrow keys to reach STEER SENSOR. The screen will read:



9. Hit Enter. The screen will read:



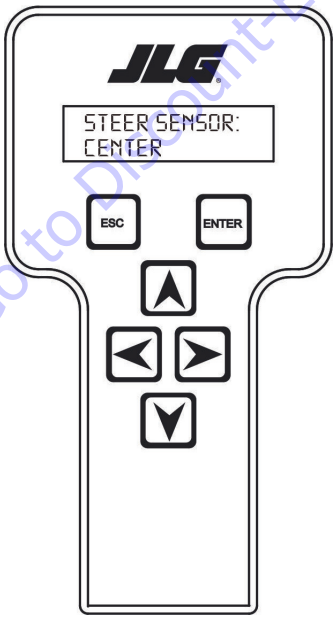
10. Hit Enter. The screen will read:



11. Activate the steer control until the tire and wheel are straight in relationship with the chassis, then leave off the control. The display will read Right Steer Maximum value.

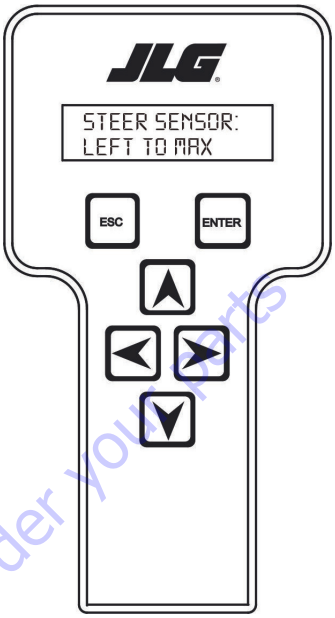
12. Hit Enter. The screen will read:

NOTE: *It's important that the tires are pointed as straight as possible. This will allow Max Drive Speed, longer run times and reduced motor and controller heat.*



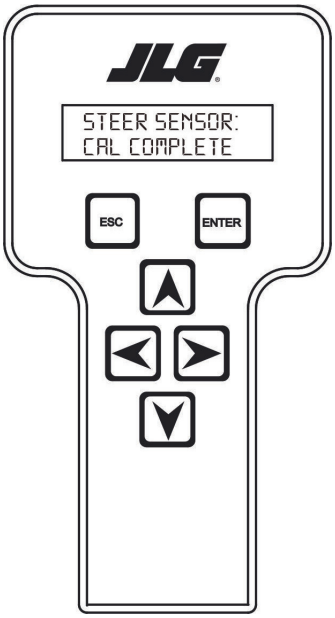
13. The display will read steering Center position value.

14. Hit Enter. The screen will read:



15. The display will read Left Steer Maximum value.

16. Hit Enter. The screen will read:



17. After completing all the Steer Calibrations, hit ESC twice to go back to CALIBRATIONS.

6.6 CALIBRATING TILT SENSOR

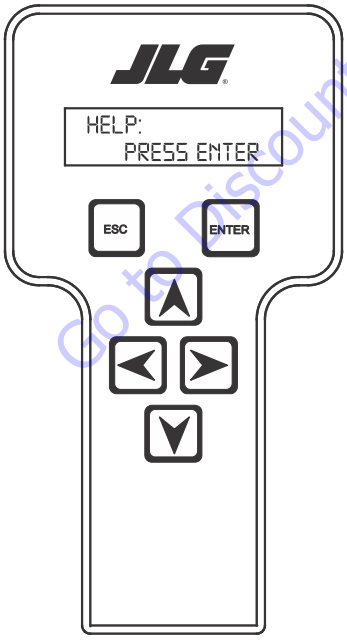
NOTICE

A NEW TILT MODULE WILL ACT AS IF IT IS TILTED ALL OF THE TIME UNTIL THE-FOLLOWING PROCEDURE IS PERFORMED.

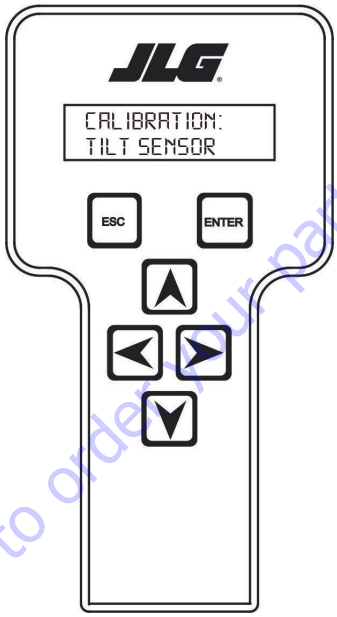
⚠ WARNING

DO NOT CALIBRATE THE LEVEL SENSOR EXCEPT ON A LEVEL SURFACE.

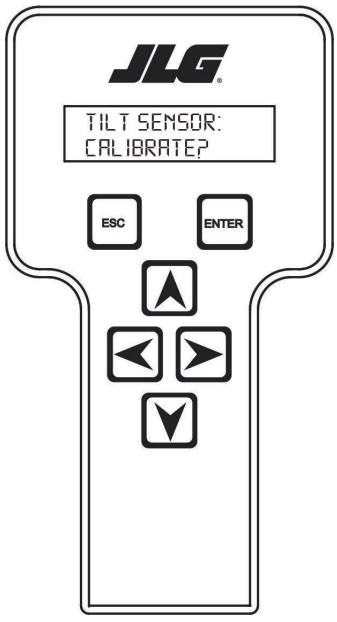
1. Use the following procedure to calibrate the tilt sensor.
2. Before the tilt sensor can be calibrated, the following conditions must be met:
   a. Steering previously calibrated.
   b. Wheels straight.
   c. Turntable centered.
   d. Boom fully retracted.
   e. Boom angle is less than 45°.
   f. Machine on firm, level ground.
3. Position the Platform/Ground select switch to the Platform position.
4. Plug the analyzer into the connector inside the Ground control box.
5. Pull out the Emergency Stop switch and Start the engine.
6. The analyzer screen should read:



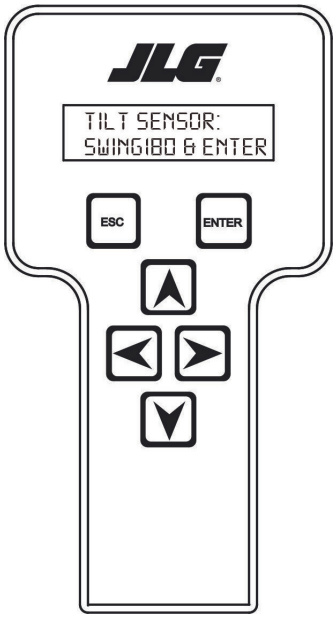
7. Use the arrow button to reach ACCESS LEVEL. Hit Enter.
8. Enter the Access Code, 33271.
9. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.
10. Use the arrow keys to reach TILT SENSOR. The screen will read:



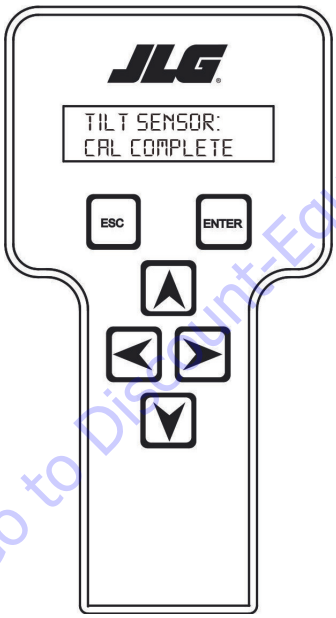
11. Hit Enter. The screen will read:



12. When prompted, swing turntable 180° to opposite end of chassis.



13. Hit Enter. The screen will read:



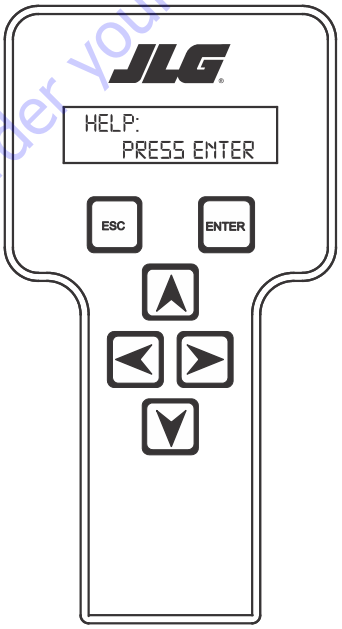
14. Upon completing swing calibration, swing turntable 180° back to the stowed position.

15. Hit ESC twice to go back to CALIBRATIONS.

6.7 CALIBRATING LOAD SENSING

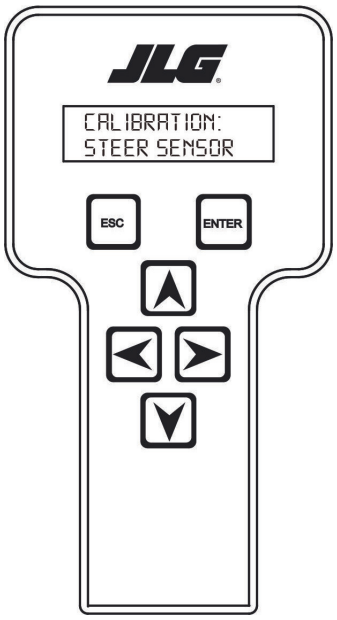
NOTE: *Calibration sub-menu LOAD SENSING is visible only if MACHINE SET-UP sub-menu LOAD SYSTEM is selected to NO.*

1. Position the Platform/Ground select switch to the Platform position.
2. Plug the analyzer into the connector at the base of the platform control box.
3. Pull out the Emergency Stop switch and Start the engine.
4. The analyzer screen should read:

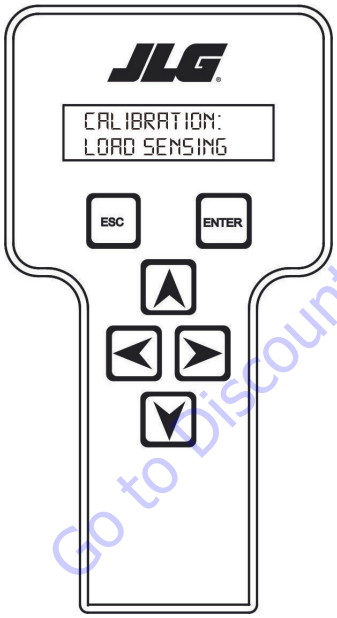


5. Use the arrow button to reach ACCESS LEVEL. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

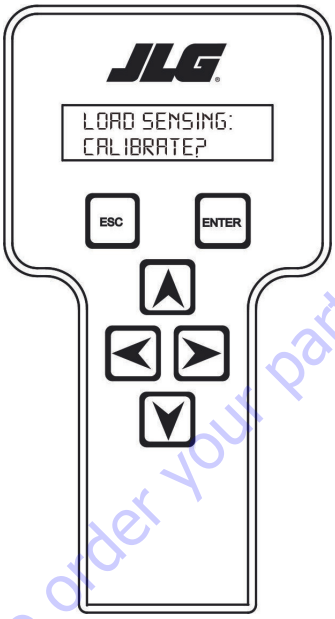
8. Use the arrow keys to reach LOAD SENSING. The screen will read:



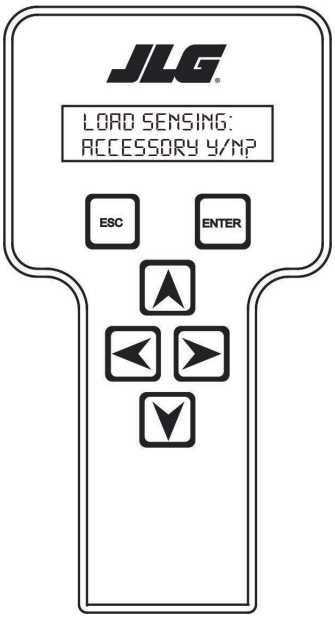
9. Hit Enter. The screen will read:



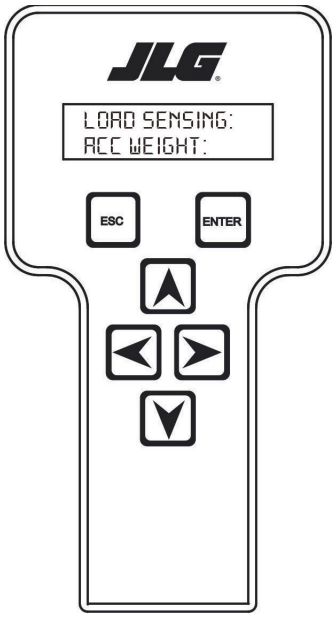
10. Hit Enter. The screen will read:



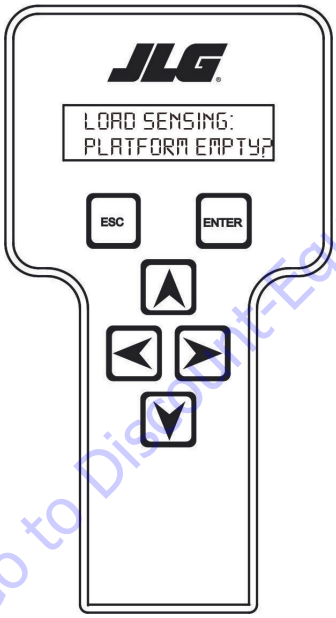
11. Hit Enter. The screen will read:



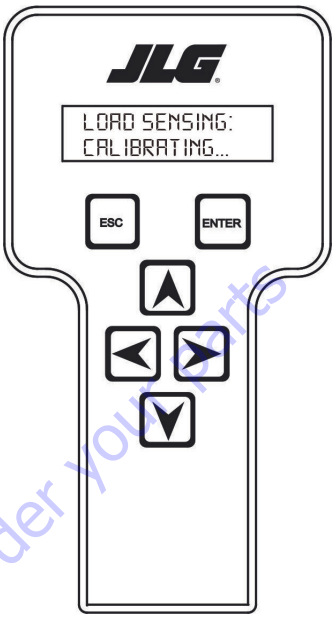
12. Hit Enter. The screen will read:



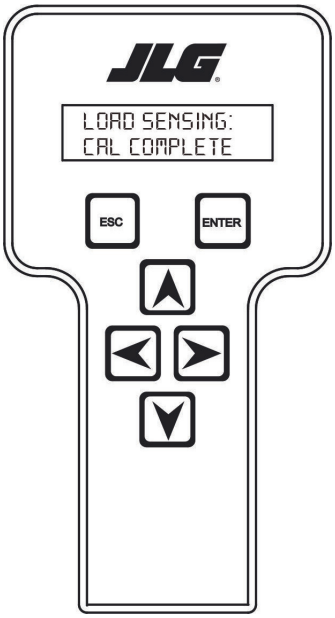
13. Hit Enter. The screen will read:



14. Hit Enter. The screen will read:



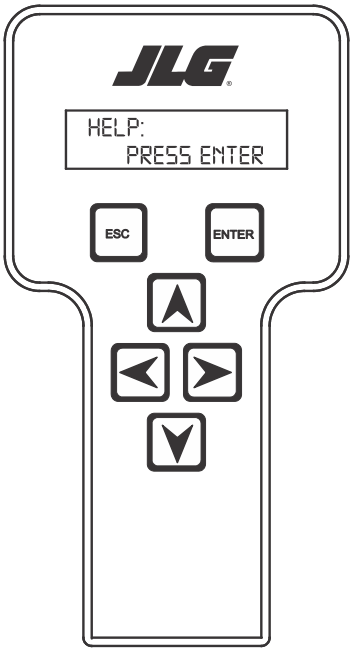
15. After few seconds, the screen will read:



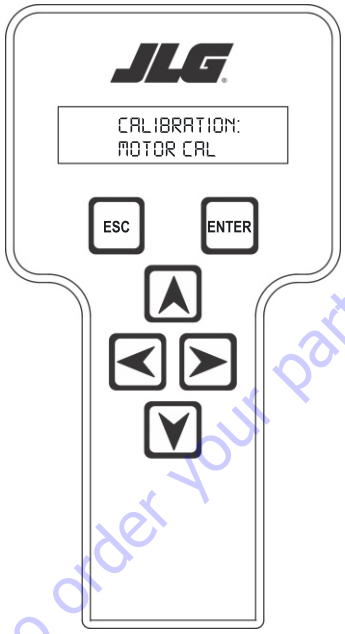
16. Hit ESC twice to go back to CALIBRATIONS.

6.8 CALIBRATION OF MOTOR (WITH NEW ZAPI MODULE)

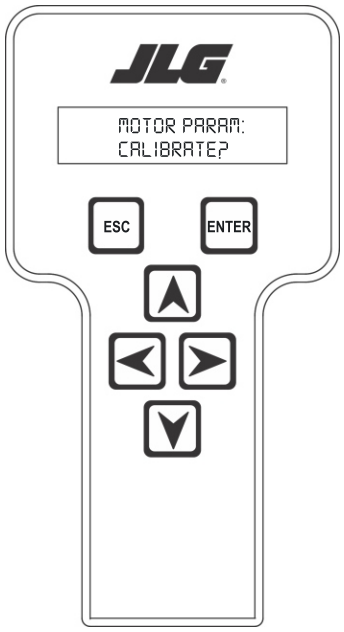
1. Position the Platform/Ground select switch to the Platform position.
2. Plug the analyzer into the connector at the base of the platform control box.
3. Pull out the Emergency Stop switch and start the engine.
4. The analyzer screen should read:



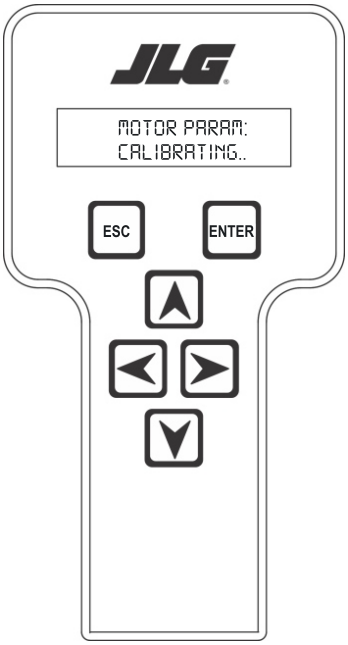
5. Use the arrow button to reach ACESS LEVEL. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.
8. The screen will read:



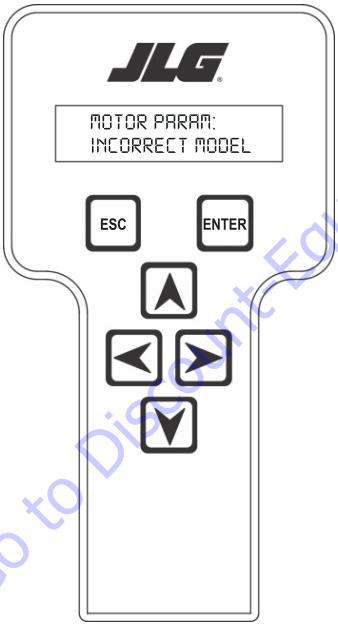
9. Hit Enter. The screen will read:



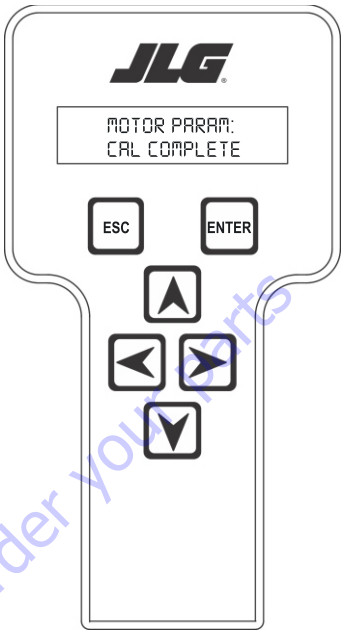
10. Hit Enter. The screen will read:



11. The screen will read:



12. After few seconds, the screen will read:

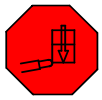


13. Hit ESC twice to go back to CALIBRATIONS.

6.9 LSS SYSTEM

The JLG-designed Load Sensing System (LSS) measures platform load via a sensor mounted in the platform support structure. If the actual platform load exceeds the selected Rated Load, the following will occur:

1. The Overload Visual Warning Indicator will flash at the selected control position (platform or ground).



2. The Platform and Ground Alarms will sound 5 seconds On, and 2 seconds Off.
3. All normal movement will be prevented from the platform control position (optional - ground control functions may be prevented).
4. Further movement is permitted by:
   - **a.** Removing the excess platform load until actual platform load is less than Rated Load.
   - **b.** Operation of the overriding emergency system (Auxiliary Power Unit).
   - **c.** By an authorized person at the ground control position (optional - ground control functions may be prevented).

NOTICE

THE LOAD SENSING SYSTEM MUST BE CALIBRATED WHEN ONE OR MORE OF THE FOLLOWING CONDITIONS OCCUR:

- **a.** LSS Sensor removal or replacement
- **b.** Addition or removal of certain platform mounted accessories. (Refer to Calibration)
- **c.** Platform is removed, replaced, repaired or shows evidence of impact.

NOTICE

THE LOAD SENSING SYSTEM REQUIRES PERIODIC FUNCTION VERIFICATION NOT TO EXCEED 6 MONTHS FROM PREVIOUS VERIFICATION. REFER TO TESTING & EVALUATION.

All calibration procedures are menu driven through the use of a JLG Analyzer.

Diagnostic Menu

The Diagnostic Menu is another troubleshooting tool for the Load Sensing System. Sensor and status information is presented in real-time for the technician. Several sub-menus exist to organize the data.

To access the Diagnostic Menu, use the LEFT and RIGHT Arrow keys to select DIAGNOSTICS from the Top Level Menu. Press the ENTER key to view the menu.

Press the LEFT and RIGHT Arrow keys to view the displays and select the various sub-menus. To access a sub-menu, press the ENTER key. Once in a sub-menu, press the LEFT and RIGHT Arrow keys to view the various displays (just like a Top Level menu). To exit a sub-menu, press the ESC key.

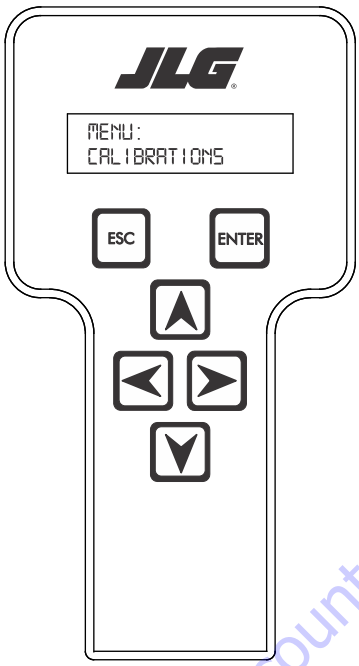
Table 6-10, Diagnostic Menu Descriptions details the structure of the Diagnostic Menu, and describes the meaning of each piece of information presented.

Table 6-10. Diagnostic Menu Descriptions

Diagnostics Menu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 2nd Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
PLATFORM LOAD	STATE:	OK / OVERLOAD	LSS Status.
PLATFORM LOAD	ACTUAL:	XXX.X KG	Calibrated weight of the platform. ??? if Platform Load is Unhealthy**.
PLATFORM LOAD (service*)	GROSS:	XXX.X KG	Gross weight of the platform. ??? if both Cells are Unhealthy**.
PLATFORM LOAD (service*)	OFFSET 1:	XXX.X KG	Stored offset weight of Cell 1. ??? if LSS is not calibrated.
PLATFORM LOAD (service*)	OFFSET 2:	XXX.X KG	Stored offset weight of Cell 1. ??? if LSS is not calibrated.
PLATFORM LOAD (service*)	ACCESSORY	XXX.X KG	Stored accessory weight. ??? if LSS is not calibrated.
PLATFORM LOAD (service*)	UNRESTRICT	XXX.X KG	UGM will set Unrestricted Rated Load as defined by Machine Configuration.
PLATFORM LOAD (service*)	RESTRICT	XXX.X KG	UGM will set Restricted Rated Load as defined by Machine Configuration.
PLATFORM LOAD (service*)	RAW 1:	XXX.X KG	Gross value from Cell 1. ??? if Unhealthy**.
PLATFORM LOAD (service*)	RAW 2:	XXX.X KG	Gross value from Cell 2. ??? if Unhealthy**.
* Indicates only visible in service view mode ** Typically indicates a DTC is active			

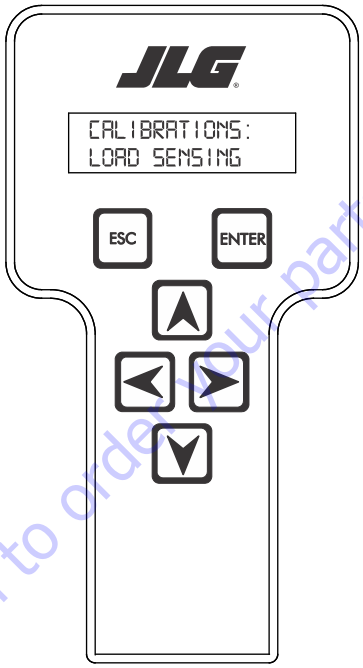
Calibration Procedure

1. Remove everything from the platform, except permanently fixed JLG Accessories, to allow the Load Sensing System to record its' weight during calibration. This includes all tools, debris, and customer-installed devices.
2. Plug the JLG Analyzer into the Machine at the Ground Station and enter Service Access Password 33271.
3. The platform should be approximately level for calibration. Level the platform from ground control (if necessary) to within +/- 5°.
4. To access the Calibration Menu, use the LEFT and RIGHT Arrow keys to select CALIBRATION from the Top Level Menu. The screen will read:

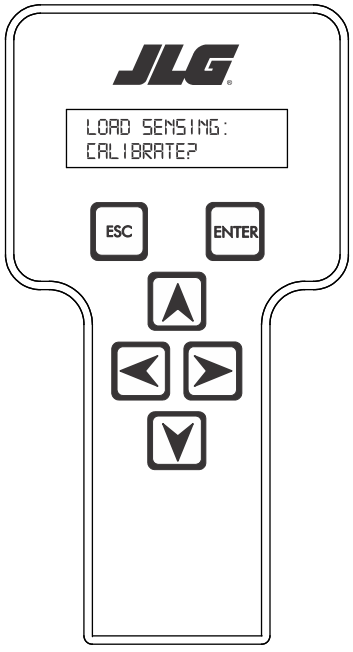


NOTE: *The Calibration Menu is not available in OPERATOR ACCESS.*

5. Press the ENTER key (ENTER) to view the menu. Upon entry to the Calibration Menu, the JLG Control System will link to the Analyzer and the screen will read:



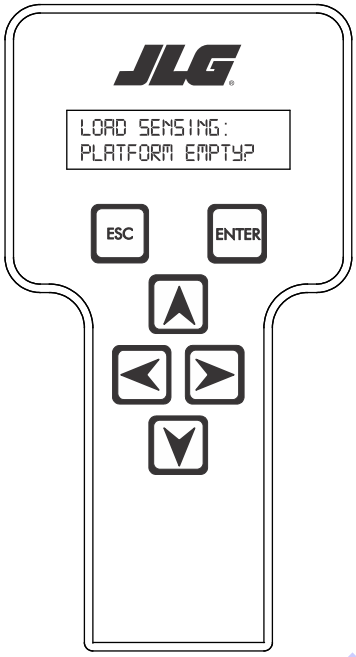
6. Press Enter (ENTER). The Screen will read:



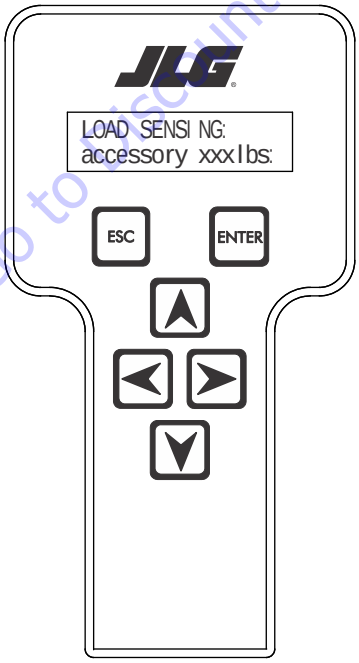
NOTE: *Calibration will auto fail if LSS DTC's are active (443, 444, 4479, 4480, 663, 821, 822, 823, 824, 8218, 8222 -> 8238, 991, 992, 993, 994 or 99285).*

NOTE: *Pressing the ESC key [ESC] after starting calibration and before calibration is complete will display the CAL FAILED message. This will not disturb the prior calibration information.*

7. Press ENTER [ENTER]. The analyzer screen will read:



8. If the platform is empty, press ENTER [ENTER]. The screen will read:



NOTE: *Accessory weight will reset to 0 lbs. each time the machine is re-calibrated and will need to be re-entered.*

NOTE: *The Accessory weight will be temporarily stored in the Control System until calibration has been completed successfully.*

Refer to Table 6-11, Accessory Weights. Use the up and down analyzer keys to enter the accessory weight(s) (in lbs). When all the accessory weights are entered, press ENTER [ENTER]. The screen will read:

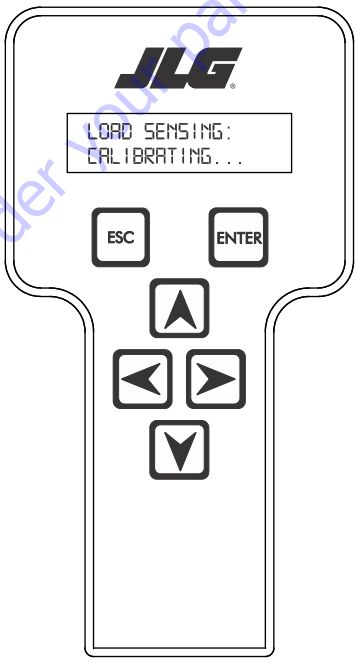


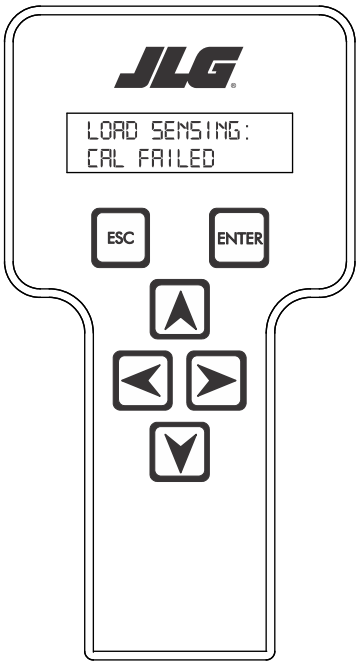
Table 6-11. Accessory Weights

Accessory	Weight
SkyWelder (stick welder)	70 lb (32 kg)
SkyWelder Prep	Prep only = 15 lb (7 kg) Full install = 70 lb (32 kg)
SkyCutter (plasma cutter)	70 lb (32 kg)
SkCutter / SkyWelder Combo	140 lb (64 kg)
Fire Extinguisher	45 lb (20 kg)
Overhead SoftTouch	80 lb (36 kg)
Work Surface	20 lb (9 kg)

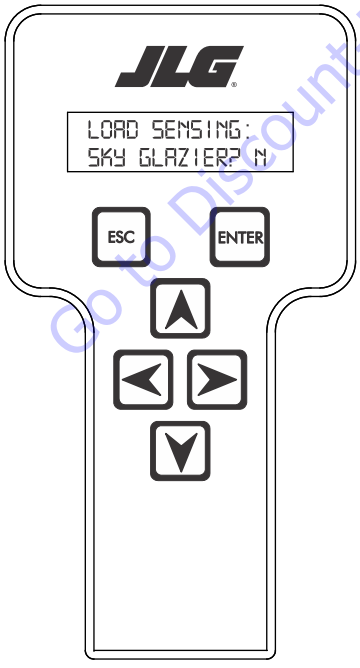
NOTE: *Not all Accessories are available on every JLG model. Some Accessory combinations are prohibited due to excessive weight and/or load restriction. If any installed JLG Accessories are labeled with weight decals but are not listed in the table above, include their weight when entering the ACC WEIGHT value.*

9. The control system will calculate the load cell readings and ensure it is greater than 130 lbs. (59 kg), but less than 575 lbs.(261 kg).

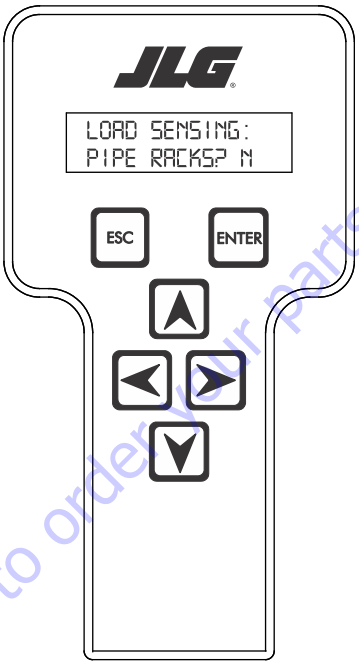
If the platform weight is not within the allowed range, the calibration attempt will be unsuccessful and the Analyzer will show the following:



10. Press ENTER (ENTER). The control system will ask for installed accessories. The screen will show the following:



11. Use the analyzer keys to select N for no or Y for yes. Press ENTER (ENTER). The screen will read:



12. Use the analyzer keys to select N for no or Y for yes. Press ENTER (ENTER). The control system will default to an estimate of unrestricted capacity, which can be adjusted if necessary. Refer to Table 6-12, SkyGlazier Capacity Reductions and Table 6-13, Pipe Rack Capacity Reductions.

The screen will read:

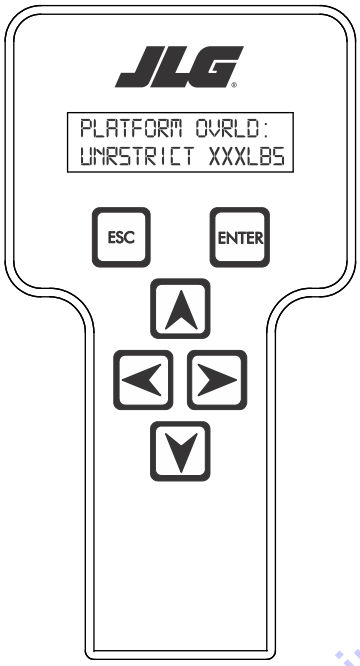


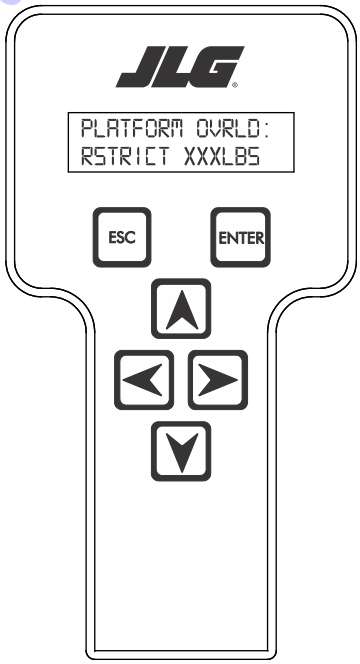
Table 6-12. SkyGlazier Capacity Reductions

Capacity	PLATFORM OVRLD	PLATFORM OVRLD RESTRICT
500 lb (227 kg)	400 lb (181 kg)	n/a
550 lb (250 kg)	400 lb (181 kg)	n/a
600 lb (272 kg)	400 lb (181 kg)	n/a
750 lb (340 kg)	n/a	590 lb (268 kg)
1000 lb (454 kg)	n/a	750 lb (340 kg)
Note: If both SkyGlazier and Pipe Racks are configured, capacity will be the lower of the two values.		

Table 6-13. Pipe Rack Capacity Reductions

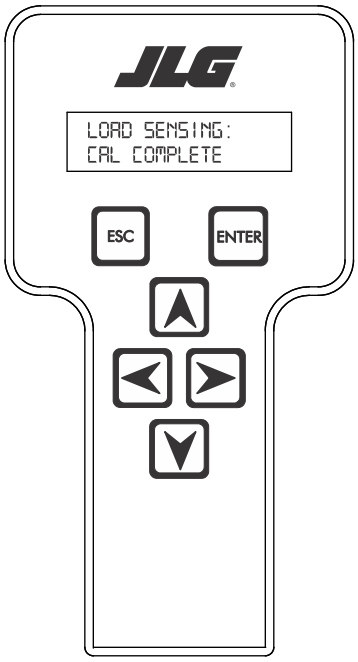
Capacity	PLATFORM OVRLD	PLATFORM OVRLD RESTRICT
500 lb (227 kg)	400 lb (181 kg)	n/a
550 lb (250 kg)	450 lb (204 kg)	n/a
600 lb (272 kg)	500 lb (227 kg)	n/a
750 lb (340 kg)	n/a	650 lb (295 kg)
1000 lb (454 kg)	n/a	900 lb (408 kg)
Note: If both SkyGlazier and Pipe Racks are configured, capacity will be the lower of the two values.		

13. Press ENTER (ENTER). The following screen will be displayed for restricted capacity, which can be adjusted if necessary. Refer to Table 6-12, SkyGlazier Capacity Reductions and Table 6-13, Pipe Rack Capacity Reductions.



14. Press ENTER 

. If calibration is successful, the screen will read:



Testing & Evaluation

Refer to Troubleshooting if the Load Sensing System fails to meet these guidelines.

1. Connect the JLG Analyzer.
2. Level the Platform. The platform should be approximately level for analysis, or the guidelines below will not be applicable. Level the platform from Ground Control (if necessary) to within ±5 degrees.
3. Observe the Empty Platform Weight. Proceed to the DIAGNOSTICS, PLTLOAD sub-menu and observe the measured platform load. All tools, debris, and customer-installed devices shall be removed during evaluation. Ideally, the PLTLOAD should be zero but can vary ±15lbs (± 7kg). Further, the reading should be stable and should not vary by more than ±2lbs (±1kg) (unless there is heavy influence from wind or vibration).
4. Use the Technician's Weight to Evaluate. The technician should enter the platform and record the PLTLOAD reading while standing in the center of the platform.
5. Confirm Control System Warnings and Interlocks. Using the keyswitch, select Platform Mode and power-up. Start the vehicle's engine and ensure that all controls are functional and the Load Sensing System's Overload Visual and Audible Warnings are not active. Simulate an Overload by unplugging the Shear Beam Load Cell. The Overload Visual Warning should flash, and the Audible Warning (at Platform and Ground) should sound for 5 seconds On, and 2 seconds Off. With the engine running, all control should be prevented. Cycle the Platform EMS to stop the engine and then power-up again. The Overload Visual and Audible Warning should continue. Confirm that controls are responsive when using the Auxiliary Power Unit for emergency movement. Reconnect the Load Cell. The Overload Visual and Audible Warnings should cease and normal control function should return. Switch the vehicle's keyswitch to Ground Mode and repeat the above procedure. The Overload Visual Warning at the Ground Controls should flash, and the Audible Warning (at Platform and Ground) should sound for 5 seconds On, 2 seconds Off. However, the controls should remain functional when using the engine and the Auxiliary Power Unit (if the Control System's MACHINE SETUP, LOAD is set to "2=CUTOUT PLT". If set to "3=CUTOUT ALL", then Ground Controls will be prevented when using the engine as in the platform).
6. Confirm Control System Capacity Indication (optional for vehicles with Dual Capacity Ratings). For vehicles equipped with a Capacity Select switch on the Platform Console Box, it is necessary to examine an additional interface between the Load Sensing System and the Control System. Using the keyswitch, select Platform Mode and power-up. If necessary, put the boom in the transport position (completely stowed) and center the Jib Plus (if equipped). Place the Capacity Select switch in the unrestricted position and ensure that the proper indicator illuminates on the Platform Console Box. Plug the JLG Analyzer into the Analyzer connection and proceed to the DIAGNOSTICS, SYSTEM submenu. Ensure that the CAPACITY displays indicate OFF. Place the Capacity Select switch in the unrestricted position (if so equipped) and ensure that the proper indicator illuminates on the Platform Console Box (but does not flash). For vehicles with unrestricted capacity, ensure that the unrestricted CAPACITY display indicates ON but the restricted CAPACITY indicates OFF. For vehicles with restricted capacity, ensure that the unrestricted CAPACITY display indicates OFF but the restricted CAPACITY indicates ON.
7. Confirm Load Sensing System Performance with Calibrated Weights. Operate the vehicle from Ground Control and place the boom in the transport position (fully stowed) for safety. Plug the JLG Analyzer into the control system connection and proceed to the DIAGNOSTICS, PLTLOAD display. Place 500lbs (230kg) in the platform and ensure that PLTLOAD is with ±5% of the actual weight. For Dual Capacity vehicles, do the same for the alternate capacity (unrestricted or restricted).

Troubleshooting

The following tables are furnished to provide possible resolutions for common difficulties. Difficulties are classified as General, Calibration, Measurement Performance, and Host System Functionality.

Table 6-14. LSS Troubleshooting Chart

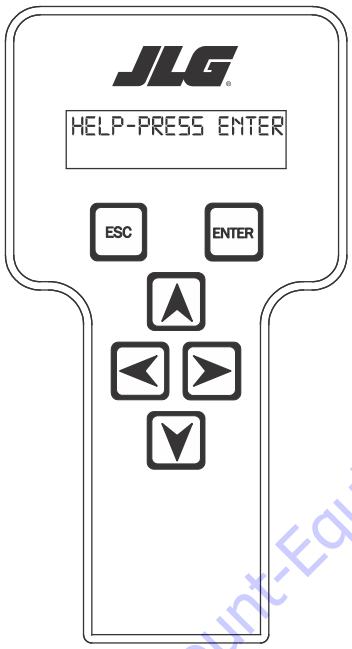
Difficulty	Possible Resolution
Empty Platform Weight (DIAGNOSTICS, PLATFORM LOAD) is not within ±15lbs (±7kg) of zero. or Platform Load readings (DIAGNOTICS, PLTLOAD) are unstable by more than ±2lbs (±1kg) (without the influence of vibration or wind). or There are large variations in Platform Load (DIAGNOSTICS, PLTLOAD) based on the location of the load. Tolerance to variations is 20lbs for an evaluation using the technician's weight, and ±5% of Rated Load when using calibrated weights.	The LSS System is unable to properly measure the platform weight. 1. The Load Cell is not properly plugged into the LSS Harness. It is possible poor electrical contact is made. 2. Wiring leading to the Load Cell is damaged. Carefully inspect sensor wiring where it passes through cable clamps for signs of damage. Inspect wiring where damage to the channel is apparent. 3. The Load Cell was not assembled properly during installation. Examine the sensor's reading using the JLG Analyzer. Proceed to the DIAGNOSTICS, CELL, LOAD displays and determine if the readings are reasonable. It is often helpful to apply slight downward pressure above the sensor and observe that its output increases (increasing force measurement; decreasing means the sensor is mounted upside-down). 4. The Load Cell is contaminated by debris or moisture. Examine the sensor's reading using the JLG Analyzer. Proceed to the DIAGNOSTICS, CELL, LOAD displays and determine if the readings are reasonable and stable (not changing by more than ±2lbs (±1kg) (without the influence of vibration or wind). Lack of measurement stability is a key indication of contamination. Unplug the connector and inspect for dirt or moisture. Look carefully into the female connector on the sensor's cordset for evidence of contamination. Debris should be brushed away with a soft bristle brush (do not introduce any cleaners as they will leave conductive residue). Moisture should be allowed to evaporate or accelerated with a heat-gun (use low heat and be carefully to not melt connector materials). Moisture intrusion into the molded portion of the connector (capillary action into the wire bundle) or the Shear Beam Load Cell itself will require replacement of the sensor. 5. The Load Cell has been mechanically damaged. If the Load Cell is physically deformed or has damage to the cover it should be replaced immediately. It is also possible to have invisible mechanical damage resulting from an extreme overload (>6000lbs [>2722kg]).
The Visual and Audible Overload Warnings fail to sound when platform is loaded beyond Rated Load, or when simulated by unplugging the Load Cell. Controls remain functional at Platform and Ground Control positions.	The Control System is failing to regard the overload signal from the LSS System, or the signal is shorted. 1. The Load Sensing System must be enabled within the Control System. Plug the JLG Analyzer into the Control System, enter the Access Level 1 password (33271), and examine the MACHINE SETUP, LOAD sub-menu. The selection "2=CUTOUT PLT" should be displayed (platform controls prevented during overload, ground controls remain operational). In country- or customer-specific circumstance, the selection "3=CUTOUT ALL" is used (platform and ground controls prevented during overload).
The Ground Audible Warning fails to sound, but the Platform Audible Warning sounds properly.	The Ground Alarm is missing or improperly installed. Verify that the device is mounted. Verify wiring from the Main Terminal Box and Ground Module.
Controls remain functional at the Ground Control position during an overload, or when simulated by unplugging the Load Cell. The Controls at the Platform Control position are prevented when using the engine, but not when using the Auxiliary Power Unit.	The JLG Control System is configured to prevent platform controls only in the event of overload. Alternately, the Host Control System can be configured to prevent ground and platform controls for country- or customer-specific circumstances. Using the JLG Analyzer, enter the Access Level 1 password (33271). Proceed to the MACHINE SETUP, LOAD sub-menu. Set this parameter to "2=CUTOUT PLT" to prevent platform controls in the event of overload. Set this parameter to "3=CUTOUT ALL" to prevent platform and ground controls in the event of overload.

6.10 RESETTING THE MSSO SYSTEM

1. Use the following procedure to reset the MSSO system.
2. Position the Platform/Ground select switch to the desired position.
3. Plug the analyzer into the connector coming from the ground control module or from the platform console.

NOTE: *If performing the procedure from the platform console, the Emergency Stop switch on the ground console must also be pulled out.*

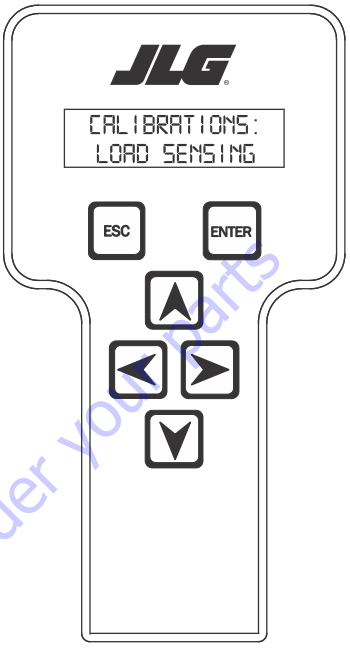
4. Pull out the Emergency Stop switch.
5. The analyzer screen should read:



6. Use the arrow button to reach OPERATOR ACCESS. Press Enter 

.
7. Enter the Access Code, 33271.
8. Use the right Arrow key to reach MENU: CALIBRATIONS. Press Enter 

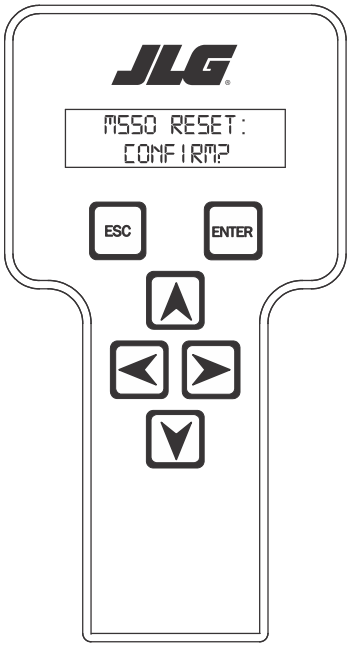
.
9. Use the arrow keys to reach the LOAD SENSING menu. The screen should read:



10. Press ENTER 

.
11. Use the Down  arrow to reach MSSO RESET.

12. Press Enter ENTER. The screen will read:



13. Press Enter ENTER. The JLG Control System will reset an active 873 DTC and the MSSO System will be reset. Press Escape ESC to return to the CALIBRATIONS menu.

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
001	EVERYTHING OK	The UGM determines that platform station (EVERYTING OK) OR ground station (GROUND MODE OK) is selected and no system faults exist, including Power Module check; 0 (No Fault)	Occurrence of active DTC
002	GROUND MODE OK	The normal help message in Ground Mode. Displays on the analyzer only.	Ground Mode selected; & occurrence of active DTC
008	FUNCTIONS LOCKED OUT - SYSTEM POWERED DOWN	Conditions exist and time for automatic power-down has expired.	Power cycled
0010	RUNNING AT CUTBACK - OUT OF TRANSPORT POSITION	Machine is in the Out Of Transport Position	Machine is not Out of Transport; If Swung, DOS transition requirements are required to return to In Line speed
0011	FSW OPEN	Machine is in Platform Mode; Any of the following Platform inputs become active after power up, but before Machine Enabled: Drive joystick is not in the neutral position, Steer, Lift and/or Swing joystick is not in the neutral position; Tower Lift; Telescope; Platform Level; Platform Rotate; Jib Lift (if MACHINE SETUP -> JIB = YES); Jib Swing (if MACHINE SETUP -> JIB PLUS = YES);	Controls initialized
0012	RUNNING AT CREEP - CREEP SWITCH OPEN	Machine is in Platform Mode; Platform creep switch input = HIGH; Fault RUNNING AT CREEP – TILTED AND ABOVE ELEVATION (0013) is not active	Platform creep switch input = Low
0013	RUNNING AT CREEP - TILTED AND ABOVE ELEVATION	Machine is in Platform mode; Machine is Above Elevation and Tilted; MACHINE SETUP-> TILT (not + CUT)	Not all of the trigger conditions are met; Then non-Creep function speed permitted after controls initialized
0015	LOAD SENSOR READING UNDER WEIGHT	LSS has been calibrated and the UGM has determined that the load sensing system reading is less than -50lbs for 2 seconds. If the load sensing system determines that the reading is greater than -50lbs for 5 seconds this fault will no longer be annunciated. No control system interlocks present when DTC is active.	Ensure platform is not resting on the ground or is not leveled at an extreme negative angle. Re-calibrate the load sensing system if the above items are not a factor.
0033	TRACTION MOTOR AT CURRENT LIMIT	Machine is in Platform Mode and UGM detects that Traction Current reported by any Power Module > 270A for 3000ms; MTM or SPM will keep the Traction motor current below limit (280A@48V) but will not report fault;	Currents return to levels below trigger level for same time period as trigger; UGM shall remove Creep speed restriction after controls initialized
0036	FUNCTION PREVENTED - FUNCTION SELECTED BEFORE GROUND ENABLE	Machine is in Ground Mode (DTC 002); Machine is not enabled; Any valid ground control input becomes active;	Controls Initialized.
0039	SKYGUARD ACTIVE – FUNCTIONS CUTOUT	Machine is in Platform Mode and SkyGuard Enabled	Trigger conditions are no longer true

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
0046	TORQUE CUTBACK - EXCESSIVE TILT	UGM detects that the machine is ascending an inclination of greater than or equal to: 28 degrees for period of greater than 1 second. [MACHINE SETUP = E600 2WD/4WD].	The UGM detects that the grade in direction of travel is more than 3 degrees less than the machine's trip point
0047	DRIVING IN CREEP – STEEP DESCENT	UGM detects that the machine is descending a grade steeper than the MAX Grade setpoint (greater than or equal to): MAX Grade Setpoint = 28 degrees for a period of greater than 1 second. [MACHINE SETUP = 600 2WD/4WD].	The UGM detects that the grade in direction of travel is more than 3 degrees less than the machine's trip point.
0048	BATTERY CHARGE LOW	Battery SOC < 10%	Battery SOC > Discharged; speed restrictions removed after controls initialized
211	POWER CYCLE	The normal help message is issued to designate the start of each power cycle in Analyzer Logged Help; new entry only recorded if new DTCs occurred since last power cycle	No special conditions required
212	KEYSWITCH FAULTY	UGM Ground Mode (input J7-3) and UGM Platform Mode (input J7-2) are both HIGH at the same time	UGM Ground Mode (input J7-3) or UGM Platform Mode (input J7-2) = LOW
213	FSW FAULTY	The ground footswitch input and platform footswitch input have been both HIGH or both LOW for greater than or equal to 1 second	Power cycled
221	FUNCTION PROBLEM - HORN PERMANENTLY SELECTED	The horn switch was closed during power-up	Horn switch input = LOW
224	FUNCTION PROBLEM - STEER LEFT PERMANENTLY SELECTED	Machine in Platform Mode; Steer Left Switch input = HIGH at Startup	Steer Left Switch returns to neutral; steer functions enabled after remaining controls are initialized
225	FUNCTION PROBLEM - STEER RIGHT PERMANENTLY SELECTED	Machine in Platform Mode; Steer Right Switch input = HIGH at Startup	Steer Right Switch returns to neutral; Steer functions enabled after remaining controls are initialized
227	STEER SWITCHES FAULTY	Both steer switch inputs on the Drive/Steer joystick are High (detectable in Platform or Ground mode).	Steer Right and Steer Left are no longer simultaneous HIGH: steer and full Drive speed permitted after controls are initialized
2211	FSW INTERLOCK TRIPPED	Machine is in Platform Mode; A Machine Enabled state has been active for greater than or equal to 7 seconds without activation of any drive, steer, or boom functions	The footswitch is released
2212	DRIVE LOCKED - JOYSTICK MOVED BEFORE FOOTSWITCH	The machine is in Platform Mode and the drive joystick is not in the neutral position immediately following Start Up,. The machine is in Platform Mode and a proper machine enable signal is received or DTC 2213, 2221 or 2223 is active while the drive joystick is not in the neutral position.	If triggered by the drive joystick not being in the neutral position immediately following Start Up THEN when Drive joystick is returned to its neutral position and the machine is not in the Enabled state. If triggered by proper machine enable signal being received while the drive joystick is not in the neutral position then when the Drive joystick is returned to neutral or the footswitch is released
2213	STEER LOCKED - SELECTED BEFORE FOOTSWITCH	The UGM detects that the machine is in Platform Mode and a proper machine enable signal is received or DTC 2212, 2221 or 2223 is active while the steer controls are not in the neutral position.	When the steer controls are returned to neutral or the footswitch is released

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
2216	D/S JOY. OUT OF RANGE HIGH	The PM detects that the drive or steer joystick signal voltage > 8.1V and reports the fault to the UGM.	The PM no longer reports the fault
2217	D/S JOY. CENTER TAP BAD	The PM detects that the drive/steer center tap voltage is not between 3.31 volts and 3.75 volts and reports the fault to the UGM	The PM detects that the drive/steer center tap voltage is between 3.31 and 3.75 volts and no longer reports the fault to the UGM
2219	L/S JOY. OUT OF RANGE HIGH	The PM detects that the Lift or Swing joystick signal voltage > 8.1V and reports the fault to the UGM.	The PM detects that the lift/swing center tap voltage is between 3.31 and 3.75 volts and no longer reports the fault to the UGM
2220	L/S JOY. CENTER TAP BAD	The PM detects that the Lift or Swing center tap voltage is not between 3.31 volts and 3.75 volts and reports the fault to the UGM	The PM detects that the lift/swing center tap voltage is between 3.31 and 3.75 volts and no longer reports the fault to the UGM
2221	LIFT/SWING LOCKED - JOYSTICK MOVED BEFORE FOOTSWITCH	The machine is in Platform Mode and the Lift and/or Swing controls are not in the neutral position immediately following Start Up -OR- The machine is in Platform Mode and a proper machine enable signal is received or DTC 2212, 2213 or 2223 is active while the Lift/Swing joystick is not in the neutral position.	If triggered by the Lift/Swing controls not being in the neutral position immediately following Start Up, then when Lift/Swing controls are returned to neutral and the machine is not in the Enabled state. If triggered by proper machine enable signal being received while the Lift/Swing controls are not in the neutral position, then when the Lift/Swing controls are returned to neutral or the footswitch is released
2222	WAITING FOR FSW TO BE OPEN	Machine is in Platform Mode AND Footswitch has been engaged since Start Up	Footswitch is disengaged
2223	FUNCTION SWITCHES LOCKED - SELECTED BEFORE ENABLE	The machine is in Platform Mode and a proper machine enable signal is received or DTC 2212, 2213 or 2221 is active while any of the following boom control inputs are engaged: AWDA Enable, Tower Lift, Telescope, Platform Level, Platform Rotate, Jib Lift (if MACHINE SETUP -> JIB = YES) and Jib Rotate (if MACHINE SETUP -> JIB PLUS = YES)	None of the boom controls that trigger this fault are engaged or the Footswitch is disengaged.
2245	FUNCTION PROBLEM - JIB SWING LEFT PERMANENTLY SELECTED	The machine is in Platform mode and the Jib Swing Left input = High at Startup	Jib Swing Left input = LOW while the machine is not Enabled
2246	FUNCTION PROBLEM - JIB SWING RIGHT PERMANENTLY SELECTED	The machine is in Platform mode and the Jib Swing Right input = High at Startup	Jib Swing Right input = LOW while the machine is not Enabled
2247	FUNCTION PROBLEM - PLATFORM ROTATE LEFT PERMANENTLY SELECTED	The machine is in Platform mode and the Platform Rotate Left input = High at Startup	Platform Rotate Left input = LOW while the machine is not Enabled
2248	FUNCTION PROBLEM - PLATFORM ROTATE RIGHT PERMANENTLY SELECTED	The machine is in Platform mode and the Platform Rotate Right input = High at Startup	Platform Rotate Right input = LOW while the machine is not Enabled
2249	FUNCTION PROBLEM - JIB LIFT UP PERMANENTLY SELECTED	The machine is in Platform mode and the Jib Lift Up input = High at Startup	Jib Lift Up input = LOW while the machine is not Enabled
2250	FUNCTION PROBLEM - JIB LIFT DOWN PERMANENTLY SELECTED	The machine is in Platform mode and the Jib Lift Down input = High at Startup	Jib Lift Down input = LOW while the machine is not Enabled
2251	FUNCTION PROBLEM - TELESCOPE IN PERMANENTLY SELECTED	The machine is in Platform mode and the Telescope In input = High at Startup	Telescope In input = LOW while the machine is not Enabled
2252	FUNCTION PROBLEM - TELESCOPE OUT PERMANENTLY SELECTED	The machine is in Platform mode and the Telescope Out input = High at Startup	Telescope Out input = LOW while the machine is not Enabled
2257	FUNCTION PROBLEM - TOWER LIFT UP PERMANENTLY SELECTED	The machine is in Platform mode and the Tower Lift Up input = High at Startup	Telescope Out input = LOW while the machine is not Enabled

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
2258	FUNCTION PROBLEM - TOWER LIFT DOWN PERMANENTLY SELECTED	The machine is in Platform mode and the Tower Lift Down input = High at Startup	Tower Lift Down input = LOW while the machine is not Enabled
2262	FUNCTION PROBLEM - PLATFORM LEVEL UP PERMANENTLY SELECTED	The machine is in Platform mode and the Platform Level Up input = High at Startup	Platform Level Up input = LOW while the machine is not Enabled
2263	FUNCTION PROBLEM - PLATFORM LEVEL DOWN PERMANENTLY SELECTED	The machine is in Platform mode and the Platform Level Down input = High at Startup	Platform Level Down input = LOW while the machine is not Enabled
2264	FUNCTION PROBLEM - DOS OVERRIDE PERMANENTLY SELECTED	The machine is in Platform mode and the Drive Orientation switch input = High at Startup	Drive Orientation input = LOW while the machine is not Enabled
2286	FUNCTION PROBLEM - SOFT TOUCH / SKYGUARD OVERRIDE PERMANENTLY SELECTED	[(MACHINE SETUP→SKYGUARD = YES) or (MACHINE SETUP→ SOFT TOUCH = YES)]; Machine is in Platform Mode; The Soft Touch / SkyGuard Override switch input = High at Startup	The Soft Touch / SkyGuard Override switch input = Low
234	FUNCTION SWITCHES FAULTY - CHECK DIAGNOSTICS/BOOM	Both inputs associated with mutually exclusive operations are simultaneously active.	Trigger conditions no longer true.
2310	FUNCTION PROBLEM - GROUND ENABLE PERMANENTLY SELECTED	The machine is in Ground mode and the Function Enable input = High at Startup	Enable switch = LOW; Enable permitted after controls initializ
2370	FUNCTION PROBLEM - JIB LIFT UP PERMANENTLY SELECTED	If MACHINE SETUP ü JIB = YES and the machine is in Ground mode and the subject switch input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
2371	FUNCTION PROBLEM - JIB LIFT DOWN PERMANENTLY SELECTED	If MACHINE SETUP ü JIB = YES and the machine is in Ground mode and the subject switch input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
2372	FUNCTION PROBLEM - SWING LEFT PERMANENTLY SELECTED	The machine is in Ground mode and the Swing Left = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
2373	FUNCTION PROBLEM - SWING RIGHT PERMANENTLY SELECTED	The machine is in Ground mode and the Swing Right input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23105	FUNCTION PROBLEM - TOWER LIFT UP PERMANENTLY SELECTED	The machine is in Ground mode and the Tower Lift Up input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23106	FUNCTION PROBLEM - TOWER LIFT DOWN PERMANENTLY SELECTED	The machine is in Ground mode and the Tower Lift Down input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23107	FUNCTION PROBLEM - LIFT UP PERMANENTLY SELECTED	The machine is in Ground mode and the Lift Up input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23108	FUNCTION PROBLEM - LIFT DOWN PERMANENTLY SELECTED	The machine is in Ground mode and the Lift Down input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23109	FUNCTION PROBLEM - TELESCOPE IN PERMANENTLY SELECTED	The machine is in Ground mode and the Telescope In input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23110	FUNCTION PROBLEM - TELESCOPE OUT PERMANENTLY SELECTED	The machine is in Ground mode and the Telescope Out input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23111	FUNCTION PROBLEM - PLATFORM LEVEL UP PERMANENTLY SELECTED	The machine is in Ground mode and the Platform Level Up input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23112	FUNCTION PROBLEM - PLATFORM LEVEL DOWN PERMANENTLY SELECTED	The machine is in Ground mode and the Platform Level Down input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23113	FUNCTION PROBLEM - PLATFORM ROTATE LEFT PERMANENTLY SELECTED	The machine is in Ground mode and the Platform Rotate Left input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23114	FUNCTION PROBLEM - PLATFORM ROTATE RIGHT PERMANENTLY SELECTED	The machine is in Ground mode and the Platform Rotate Right input = High at Start Up	Function switch returns to neutral and the machine is not in the Enabled state.
23163	FUNCTION PROBLEM - MSSO PERMANENTLY SELECTED	UGM determines that MSSO low-side switch is selected at Startup	Function switch returns to neutral and the machine is not in the Enabled state.

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
23171	FUNCTION PROBLEM - JIB SWING LEFT PERMANENTLY SELECTED	The machine is in Ground mode and the Jib Swing Left input = High at Start Up	Jib Swing Left input = LOW and the machine is not in the Enabled state.
23172	FUNCTION PROBLEM - JIB SWING RIGHT PERMANENTLY SELECTED	The machine is in Ground mode and the Jib Swing Right input = High at Start Up	Jib Swing Right input = LOW and the machine is not in the Enabled state.
241	AMBIENT TEMPERATURE SENSOR - OUT OF RANGE LOW	System is in platform mode; MACHINE SETUP -> TEMP CUTOUT = yes; Low Temperature Cutout Sensor reads less than or equal to -50 C.f	Ambient Temperature sensor reading > -50 °C THEN speed restrictions removed after controls are initialized
242	AMBIENT TEMPERATURE SENSOR - OUT OF RANGE HIGH	System is in platform mode; MACHINE SETUP -> TEMP CUTOUT = yes; Low Temperature Cutout Sensor reads greater than or equal to 85 C.	Ambient Temperature sensor reading > -50 °C; Speed restrictions removed after controls are initialized
253	DRIVE PREVENTED - CHARGER CONNECTED	MACHINE SETUP => CHARGER INTERLOCK = DRIVE ONLY;	Trigger conditions not true; Restrictions remove after CntlNi
259	MODEL CHANGED - HYDRAULICS SUSPENDED - CYCLE EMS	The MACHINE SETUP => MODEL has changed	Power cycle
2514	BOOM PREVENTED - DRIVE SELECTED	MACHINE SETUP => FUNCTION CUTOUT = BOOM CUTOUT; Drive or Steer is already engaged; The boom is Above Elevation; The operator is attempting to activate one of the boom functions DTC 2514 supersedes DTC 2518 if drive/steer and boom functions are both active when machine transitions from Below Elevation to Above Elevation.	Not all of the trigger conditions are met
2516	DRIVE PREVENTED - ABOVE ELEVATION	MACHINE SETUP => FUNCTION CUTOUT = DRIVE CUTOUT; The boom is Above Elevation; The operator is attempting to activate Drive or Steer;	Not all of the trigger conditions are met
2518	DRIVE PREVENTED – BOOM SELECTED	MACHINE SETUP => FUNCTION CUTOUT = DRIVE CUTOUT; The boom is Above Elevation; The operator is attempting to activate Drive or Steer;	Not all of the trigger conditions are met
2538	FUNCTION PREVENTED – CHARGER CONNECTED	MACHINE SETUP => CHARGER INTERLOCK = CUTOUT ALL; MTM reports charger connected; UGM determines that machine is Enabled, and a function command was attempted.	Not all of the trigger conditions are met; Restricts removed after CntlNi
2548	SYSTEM TEST MODE ACTIVE	UGM determines that System Test Mode is active	Power cycled
2549	DRIVE & BOOM PREVENTED - SOFT TOUCH ACTIVE	MACHINE SETUP → SOFT TOUCH = YES; Machine is in Platform Mode; Soft Touch State = Enabled	Not all of the trigger conditions are met
2563	SKYGUARD SWITCH – DISAGREEMENT	MACHINE SETUP => SKYGUARD ≠ NO; Machine is in Platform Mode; [(SkyGuard input #1 Platform Module J7-18) ≠ (SkyGuard input #2 Platform Module J1-23)] > 160ms	[{SkyGuard inputs (Platform Module J7-18 = High) and (Platform Module J1-23 = High)} and (Footswitch State = Not Depressed)]
2564	DRIVE PREVENTED – LEFT BRAKE NOT RELEASING	Module detects brakes have not released because EB coil is damaged	Power cycle
2565	DRIVE PREVENTED – RIGHT BRAKE NOT RELEASING	Module detects brakes have not released because EB coil is damaged	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
2568	TEMPERATURE CUTOUT ACTIVE – AMBIENT TEMPERATURE TOO LOW	Low Temperature Cutout = Active	Low Temperature Cutout = Inactive; speed restrictions removed after controls are initialized
2576	PLATFORM LEVEL PREVENTED – ABOVE ELEVATION	UGM has determined that all of the following conditions exists: Platform Level Override Cutout = Enabled; Machine is Enabled; The Platform Level Up or Down switch input = High;	Not all of the trigger conditions are met
2578	FUNCTION PREVENTED – TILTED & ABOVE ELEVATION	Machine is in Platform mode Machine is Above Elevation and Tilted MACHINE SETUP→TILT→ X DEGREES + CUT and the operator is attempting to activate Drive or Steer, Lift Up, Tower Up or Telescope Out. Where X = 3, 4, or 5 Degrees)	At least one of the trigger conditions is not met; then non-Creep function speed permitted after controls initialized.
2579	DRIVE PREVENTED – EXCESSIVE GRADE	DTC 0046 is active; Drive speed request, in direction of ascending grade, is greater than zero;	CntlNi (drive joystick returned to center position)
3111	MAIN CONTACTOR DRIVER – PERMANENTLY OFF	Master Traction Module detects that the line contactor driver is out of order and not able to close.	Power cycle
3112	MAIN CONTACTOR – OPEN CIRCUIT	Master Traction Module detects current through Contactor Coil but no voltage on Contactor contacts during active traction or pump.	Power cycled
3212	MAIN CONTACTOR – WELDED OR MISWIRED	Master Traction Module determines at Startup that Line Contactor is closed/stuck before command	Power cycle
3213	MAIN CONTACTOR DRIVER – PERMANENTLY ON	Master Traction Module detects that the line contactor driver output failed short or contactor coil is disconnected/open circuit.	Power cycle
334	LIFT UP VALVE – OPEN CIRCUIT	The UGM detects OC at the Lift Up Solenoid.	UGM no longer detects OC; Speed restriction removed after CntlNi;
336	LIFT DOWN VALVE – OPEN CIRCUIT	The UGM detects OC at the Lift Down Solenoid.	UGM no longer detects open circuit; Inhibits and restrictions removed after CntrlIni;
337	STEER LEFT VALVE – SHORT TO BATTERY	UGM detects a short to battery at steer left output.	Power cycle
338	STEER LEFT VALVE – OPEN CIRCUIT	The UGM detects an open circuit at steer left output	UGM no longer detects OC; Speed restriction removed after CntlNi.
339	STEER RIGHT VALVE – SHORT TO BATTERY	The UGM detects a short to battery at steer right output	Power cycle
3310	STEER RIGHT VALVE – OPEN CIRCUIT	The UGM detects an open circuit at steer right output	UGM no longer detects OC; Speed restriction removed after CntlNi.
3311	GROUND ALARM – SHORT TO BATTERY	The UGM detects a short to 12V battery at this output	Power cycle
3371	GROUND ALARM – SHORT TO GROUND	The UGM detects a short to ground at this output	Power cycle
3376	HEAD TAIL LIGHT - SHORT TO GROUND	MACHINE SETUP -> H & T LIGHTS = YES; UGM detects a short to ground at head/tail light relay output	Power cycle
3377	HEAD TAIL LIGHT - OPEN CIRCUIT	MACHINE SETUP -> H & T LIGHTS = YES; UGM detects a short to ground at head/tail light relay output	UGM no longer detects open circuit
3378	HEAD TAIL LIGHT - SHORT TO BATTERY	MACHINE SETUP -> H & T LIGHTS = YES; UGM detects a short to battery at head/tail light relay output	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
3382	PLATFORM LEVEL UP VALVE - SHORT TO GROUND	The UGM detects a short to ground at the platform level up output	Power cycle
3383	PLATFORM LEVEL UP VALVE - OPEN CIRCUIT	The UGM detects an open circuit at the platform level up output	UGM no longer detects open circuit; speed restrictions removed after controls are initialized
3384	PLATFORM LEVEL UP VALVE - SHORT TO BATTERY	The UGM detects a short to 12V battery at the platform level up output	Power cycle
3388	PLATFORM LEVEL DOWN VALVE - SHORT TO GROUND	The UGM detects a short to ground at the platform level down output	Power cycle
3389	PLATFORM LEVEL DOWN VALVE - OPEN CIRCUIT	The UGM detects an open circuit at the platform level down output	UGM no longer detects open circuit; Prohibits and restrictions removed after CntlIni
3390	PLATFORM LEVEL DOWN VALVE - SHORT TO BATTERY	The UGM detects a short to 12V battery at the platform level down output	Power cycle
3394	PLATFORM ROTATE LEFT VALVE - SHORT TO GROUND	UGM detects a short to ground at platform rotate left output	Power cycle
3395	PLATFORM ROTATE LEFT VALVE - OPEN CIRCUIT	UGM detects an open circuit at platform rotate left output	UGM no longer detects OC; Speed restrictions removed after CntlIni;
3396	PLATFORM ROTATE LEFT VALVE - SHORT TO BATTERY	UGM detects a short to battery at platform rotate left output	Power cycle
3397	PLATFORM ROTATE RIGHT VALVE - SHORT TO GROUND	UGM detects a short to ground at platform rotate right output	Power cycle
3398	PLATFORM ROTATE RIGHT VALVE - OPEN CIRCUIT	UGM detects an open circuit at platform rotate right output	UGM no longer detects OC; Speed restrictions removed after CntlIni;
3399	PLATFORM ROTATE RIGHT VALVE - SHORT TO BATTERY	UGM detects a short to battery at platform rotate right output	Power cycle
33100	JIB LIFT UP VALVE - SHORT TO GROUND	MachineSetup -> Jib = YES; UGM detects a short to ground at the jib lift up output;	Power cycle
33101	JIB LIFT UP VALVE - OPEN CIRCUIT	MachineSetup -> Jib = YES; UGM detects a open circuit at the jib lift up output	UGM no longer detects OC; Speed restriction removed after CntlIni;
33102	JIB LIFT UP VALVE - SHORT TO BATTERY	MachineSetup -> Jib = YES; UGM detects a short to battery at the jib lift up output	Power cycle
33103	JIB LIFT DOWN VALVE - SHORT TO GROUND	MachineSetup -> Jib = YES; UGM detects a short to ground at the jib lift down output	Power cycle
33104	JIB LIFT DOWN VALVE - OPEN CIRCUIT	MachineSetup -> Jib = YES; UGM detects a open circuit at the jib lift down output	UGM no longer detects open circuit; Inhibits and restrictions removed after CntrlIni;
33105	JIB LIFT DOWN VALVE - SHORT TO BATTERY	MachineSetup -> Jib = YES; UGM detects a short to battery at the jib lift down output	Power cycle
33106	TOWER LIFT UP VALVE - SHORT TO GROUND	The UGM detects a short to ground at the tower lift up output	Power cycle
33107	TOWER LIFT UP VALVE - OPEN CIRCUIT	The UGM detects an open circuit at the tower lift up output	UGM no longer detects OC; Speed restriction removed after CntlIni;
33108	TOWER LIFT UP VALVE - SHORT TO BATTERY	The UGM detects a short to ground at the tower lift up output	Power cycle
33109	TOWER LIFT DOWN VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
33110	TOWER LIFT DOWN VALVE - OPEN CIRCUIT	The UGM detects an open circuit supporting the Tower Down Solenoid	UGM no longer detects open circuit; Inhibits and restrictions removed after CntrlIni;
33111	TOWER LIFT DOWN VALVE - SHORT TO BATTERY	The UGM detects a short to ground at the tower lift down output	Power cycle
33118	SWING RIGHT VALVE - SHORT TO GROUND	The UGM detects a short to ground at the Swing Right output	Power cycle
33119	SWING RIGHT VALVE - OPEN CIRCUIT	The UGM detects an open circuit at the Swing Right output	UGM no longer detects OC; Speed restrictions removed after CntlIni
33120	TELESCOPE IN VALVE - SHORT TO BATTERY	The UGM detects a short to 12V battery at this output	Power cycle
33122	SWING LEFT VALVE - SHORT TO GROUND	The UGM detects a short to ground at the Swing Left output	Power cycle
33123	TELESCOPE OUT VALVE - SHORT TO BATTERY	The UGM detects a short to 12V battery at this output	Power cycle
33175	JIB ROTATE LEFT VALVE - OPEN CIRCUIT	MACHINE SETUP -> JIB PLUS = YES; UGM detects an open circuit at the jib rotate left output	UGM no longer detects OC; Speed restrictions removed after CntlIni
33176	JIB ROTATE LEFT VALVE - SHORT TO BATTERY	MACHINE SETUP -> JIB PLUS = YES; UGM detects a short to ground at the jib rotate left output	Power cycle
33177	JIB ROTATE LEFT VALVE - SHORT TO GROUND	MACHINE SETUP -> JIB PLUS = YES; UGM detects a short to battery at the jib rotate left output	Power cycle
33178	JIB ROTATE RIGHT VALVE - OPEN CIRCUIT	MACHINE SETUP -> JIB PLUS = YES; UGM detects an open circuit at the jib rotate right output	UGM no longer detects OC; Speed restrictions removed after CntlIni
33179	JIB ROTATE RIGHT VALVE - SHORT TO BATTERY	MACHINE SETUP -> JIB PLUS = YES; UGM detects a short to battery at the jib rotate right output	Power cycle
33180	JIB ROTATE RIGHT VALVE - SHORT TO GROUND	MACHINE SETUP -> JIB PLUS = YES; UGM detects a short to ground at the jib rotate right output	Power cycle
33182	LIFT VALVES - SHORT TO BATTERY	UGM detects a short to 12V battery at either the Lift Up or Lift Down valve	Power cycle
33186	TELESCOPE OUT VALVE - OPEN CIRCUIT	UGM detects an open circuit at this output	UGM no longer detects OC. Speed restrictions removed after CntlIni
33188	TELESCOPE OUT VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power cycle
33189	TELESCOPE IN VALVE - OPEN CIRCU	The UGM detects an open circuit at this output	UGM no longer detects OC. Speed restrictions removed after CntlIni
33190	TELESCOPE IN VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power cycle
33295	SWING LEFT VALVE - OPEN CIRCUIT	The UGM detects an open circuit at the Swing Left output	UGM no longer detects OC; Speed restrictions removed after CntlIni
33298	STEER LEFT - SHORT TO GROUND	The UGM detects a short to ground at steer left output.	Power cycle
33305	STEER RIGHT - SHORT TO GROUND	The UGM detects a short to ground at steer right output.	Power cycle
33314	FLOW CONTROL VALVE - OPEN CIRCUIT	The UGM detects an OC at this output	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
33315	FLOW CONTROL VALVE - SHORT TO BATTERY	The UGM detects a short to 12V battery at this output	Power cycle
33316	FLOW CONTROL VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power cycle
33406	LIFT UP VALVE - SHORT TO GROUND	The UGM detects STG at the Lift Up Solenoid	Power cycle
33407	LIFT DOWN VALVE - SHORT TO GROUND	The UGM detects STG at the Lift Down Solenoid	Power cycle
33412	SWING VALVES - SHORT TO BATTERY	The UGM detects a short to 12V battery at the either Swing output	Power cycle
33425	TOWER LIFT VALVES - SHORT TO BATTERY	The UGM detects a short to battery at either the Tower Lift Up or Tower Lift Down valve.	Power cycle
33479	VOTING RELAY - SHORT TO BATTERY	UGM detects a short to battery at this output	Power cycle
33480	VOTING RELAY - SHORT TO GROUND	UGM detects a short to ground at the voting relay output	Power cycle
33549	VOTING RELAY - OPEN CIRCUIT	UGM detects an open circuit at the voting relay output	Power cycle
33578	STEER PRIORITY BYPASS VALVE - OPEN CIRCUIT	The UGM detects an OC at steer priority bypass output	UGM no longer detects OC; Speed restriction removed after CntIni.
33579	STEER PRIORITY BYPASS VALVE - SHORT TO GROUND	The UGM detects a short to ground at steer priority bypass output	Power cycle
33580	STEER PRIORITY BYPASS VALVE - SHORT TO BATTERY	The UGM detects a short to battery at steer priority bypass output	Power cycle
33624	SWING BYPASS VALVE - SHORT TO GROUND	The UGM detects a short to ground at swing bypass output	Power cycle
33625	SWING BYPASS VALVE - SHORT TO BATTERY	The UGM detects a short to battery at swing bypass output	Power cycle
33626	SWING BYPASS VALVE - OPEN CIRCUIT	The UGM detects open circuit at swing bypass output	UGM no longer detects OC; Speed restriction removed after CntIni.
33627	LIFT BYPASS VALVE - SHORT TO GROUND	The UGM detects STG at lift bypass output;	Power cycle
33628	LIFT BYPASS VALVE - SHORT TO BATTERY	The UGM detects STB at lift bypass output	Power cycle
33629	LIFT BYPASS VALVE - OPEN CIRCUIT	The UGM detects OC at lift bypass output	Power cycle
4219	REAR LEFT MODULE TEMPERATURE - OUT OF RANGE	The Power Module temperature sensor is out of the permitted operating range and reports a fault	Traction module no longer reporting fault; Creep restriction removed after controls initialized
4220	REAR RIGHT MODULE TEMPERATURE - OUT OF RANGE	The Front Right Power Module temperature sensor is out of the permitted operating range and reports a fault	Traction module no longer reporting fault; Creep restriction removed after controls initialized
4223	REAR LEFT MODULE TOO HOT - PLEASE WAIT	Associated Power Module has reached thermal cut-out limit	Traction module no longer reporting fault; Creep restriction removed after controls initialized
4224	REAR RIGHT MODULE TOO HOT - PLEASE WAIT	Front Right Power Module has reached thermal cut-out limit	Traction module no longer reporting fault; Creep restriction removed after controls initialized
4228	REAR LEFT MOTOR TEMPERATURE - OUT OF RANGE	The Power Module reports that motor temperature sensor is out of range due to Open-Circuit (Temp Out of Range – High > 240°C), STG (Temp Out of Range – Low < -30°C) or damage	Traction module no longer reporting fault; Creep restriction removed after controls initialized
4229	REAR RIGHT MOTOR TEMPERATURE - OUT OF RANGE	The Power Module reports that motor temperature sensor is out of range due to Open-Circuit (Temp Out of Range – High > 240°C), STG (Temp Out of Range – Low < -30°C) or damage	Traction module no longer reporting fault; Creep restriction removed after controls initialized

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
4232	REAR LEFT MOTOR TOO HOT - PLEASE WAIT	The UGM determines that the drive motor temperature reported by the PM > 140°C but < 200 °C or the PM determines that motor temperature sensor is reporting > 150°C UGM to suppress if DTCs 4228 is active.	Power Module no longer report fault and UGM determines motor temp ≤ 140 °C (149-10 °C) and Controls initialized. Drive disable reset when motor temp ≤ 139 °C (149-10 °C)and Drive Joystick in Neutral.
4233	REAR RIGHT MOTOR TOO HOT - PLEASE WAIT	The UGM determines that the drive motor temperature reported by the PM > 140°C but < 200 °C or the PM determines that motor temperature sensor is reporting > 150°C UGM to suppress if DTCs 4229 is active.	Power Module no longer report fault and UGM determines motor temp ≤ 140 °C (149-10 °C) and Controls initialized. Drive disable reset when motor temp ≤ 139 °C (149-10 °C)and Drive Joystick in Neutral.
441	BATTERY VOLTAGE TOO LOW - SYSTEM SHUTDOWN	The UGM detects that its 12V supply voltage is less than 9.0 volts for 5 seconds.	UGM voltage > 9.25V
442	BATTERY VOLTAGE TOO HIGH - SYSTEM SHUTDOWN	The UGM detects that its 12V supply voltage > 16.0 volts	Power cycle
443	LSS BATTERY VOLTAGE TOO HIGH	The load sensor has determined that its supply voltage is too high (> 16V). The machine will assume the platform is overloaded.	Check for issue with sensor supply voltage.
444	LSS BATTERY VOLTAGE TOO LOW	The load sensor has determined that its supply voltage is too low (> 8V). The machine will assume the platform is overloaded.	Check for issue with sensor supply voltage.
4420	BATTERY DEEPLY DISCHARGED	UGM determines that the SOC% related to the Battery has reached the Deeply Discharged condition. Based on SOC% only, not Voltage threshold; No audible annunciation for this DTC.	Power cycle
4430	BATTERY VOLTAGE TOO LOW	UGM detects that its supply voltage < 11 volts for 5 seconds.	UGM voltage > 11.25V
4463	REAR LEFT MODULE - VOLTAGE OUT OF RANGE	Associated Power Module determines System Overvoltage/Undervoltage, Voltage measurement ≥ 65V or ≤ 12V	Traction modules no longer report fault then controls initialized.
4464	REAR RIGHT MODULE - VOLTAGE OUT OF RANGE	Associated Power Module determines System Overvoltage/Undervoltage, Voltage measurement ≥ 65V or ≤ 12V	Traction modules no longer report fault then controls initialized.
4479	LSS BATTERY VOLTAGE - INITIALIZATION ERROR	The shear beam is reporting a Sensor Supply Voltage Initialization Error The machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
4480	LSS BATTERY VOLTAGE - NOT CALIBRATED	The shear beam is reporting a Sensor Supply Voltage calibration error. The machine will assume the platform is over-loaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
4692	REAR LEFT BRAKE - SHORT TO GROUND OR OPEN CIRCUIT	Associated Power Module detects A4 shorted to ground: at Standby as or at Running (PWM Supple-mental info not applicable to this DTC for initiating separate DTC: Power Module detects A4 shorted to ground at Startup as or Power Module detects A2 shorted to ground only at Startup, not detected in Standby or Running.	Power cycle
4693	REAR RIGHT BRAKE - SHORT TO GROUND OR OPEN CIRCUIT	Associated Power Module detects A4 shorted to ground: at Standby as or at Running (PWM Supple-mental info not applicable to this DTC for initiating separate DTC: Power Module detects A4 shorted to ground at Startup as or Power Module detects A2 shorted to ground only at Startup, as not detected in Standby or Running.	Power cycle
46100	REAR LEFT BRAKE RETURN - SHORT TO BAT-TERY	Traction Module detects an overcurrent condition on pin A4, indicating a short between B+ and the Elec-tric Brake FET	Power cycle
46130	MAIN CONTACTOR / REAR RIGHT BRAKE RETURN - SHORT TO BATTERY	At Startup, the Master Traction Module detects an overcurrent condition on pin A12, indicating a short between B+ and the Main Contactor. During active traction, the Master Traction Module detects an overcurrent condition on pin A4. Electric Brake FET	Power cycle
46104	REAR LEFT SPEED SENSOR - NOT RESPONDING PROPERLY	Associated Power Module has detected an encoder or directional sensing problem	Power cycle
46105	REAR RIGHT SPEED SENSOR - NOT RESPOND-ING PROPERLY	Associated Power Module has detected an encoder or directional sensing problem	Power cycle
46108	REAR LEFT SPEED SENSOR - RPM HIGH	Associated Power Module determines an overspeed condition (measured motor speed > DRIVE MAX + 15Hz) has occurred on a motor	Power cycle
46109	REAR RIGHT SPEED SENSOR - RPM HIGH	Associated Power Module determines an overspeed condition (measured motor speed > DRIVE MAX + 15Hz) has occurred on a motor	Power cycle
46136	REAR LEFT BRAKE SUPPLY VOLTAGE – OUT OF RANGE LOW	Associated Power Module determines that a low parking brake supply voltage condition exists.	Power cycle
46137	REAR RIGHT BRAKE SUPPLY VOLTAGE – OUT OF RANGE LOW	Associated Power Module determines that a low parking brake supply voltage condition exists.	Power cycle
662	CANBUS FAILURE - PLATFORM MODULE	UGM does not receive any CAN messages from Plat-form Module in 250ms	CAN1 messages are received from the PM and con-trols are initialized

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
663	CANBUS FAILURE - LOAD SENSING SYSTEM MODULE	The control system has lost communication with the load sensing system load pin. The machine will assume the platform is over-loaded.	Check wiring to load sensor.
6613	CANBUS FAILURE - EXCESSIVE CANBUS ERRORS	UGM observes more than 22 error frames per second for 4 seconds or more than 500 Buss Off conditions since last power cycle.	Power cycle
6635	CANBUS FAILURE - CHASSIS TILT SENSOR	UGM does not receive any CAN1 messages from Chassis Tilt Sensor in 250ms	CAN1 messages are received from the sensor and controls are initialized;
6654	CANBUS FAILURE - REAR LEFT MODULE	After Startup complete, Power Module CAN2 messages are not received in 200ms	UGM receives all traction modules CAN2 messages and shall command main contactor closed; once fault reset, motion permitted after controls are initialized. If CAN messages are lost more than 5 times, the fault shall be latched until Power Cycle.G352
6655	CANBUS FAILURE - REAR RIGHT MODUL	After Startup complete, UGM or Power Modules not receive the designated CAN messages in 200ms (250ms for UGM)	UGM receives all traction modules CAN2 messages and shall command main contactor closed; once fault reset, motion permitted after controls are initialized. If CAN messages are lost more than 5 times, the fault shall be latched until Power Cycle.
6657	CANBUS FAILURE - TEMPERATURE SENSOR	UGM determines that: • MACHINE SETUP→ TEMP CUTOUT = YES • UGM does not receive any CAN1 messages from the Low Temperature Cutout sensor in 250ms Suppress DTCs 241 and 242 if this DTC is active.	UGM receives CAN1 messages from the Ambient Temperature sensor; speed restrictions removed after controls initialized
7725	PUMP MOTOR - NOT RESPONDING	The Master Traction Module detects that the pump motor feedback is not responding when the pump is being commanded	Power cycle
7730	PUMP MOTOR OUTPUT - OUT OF RANGE HIGH	Master Traction Module detects that the pump motor voltage output is higher than expected (Pump Vmn High; 29/MC Drive Open). Too high with respect to PWM applied.	Power cycle
7731	PUMP MOTOR OUTPUT - OUT OF RANGE LOW	Master Traction Module detects that the pump motor voltage output lower than expected. Too low with respect to PWM applied.	Power cycle
7737	PUMP MOTOR OVERLOADED	UGM detects that Pump Current reported by MTM > 210A for 3000ms (both Constant Data Values); MTM detects pump current > 220A	Currents return to levels below trigger level for same time period as trigger and controls initialized.UGM shall remove Drive Creep speed restriction after controls initialized
7753	REAR LEFT MOTOR STALLED	The UGM or Power Module(s) detects that the motor is stalled during active traction. For the UGM commanded speed ≥ Creep AND (RIGHT) +30 > Steer Angle < -45 (LEFT), the reported avg motor encoder feedback < 70 counts/s for 5 seconds (1.685 Hz). Avg motor encoder feedback evaluate on a 1s running average. For MTM, the encoder-measured motor speed < 0.6Hz for 5 seconds, when applied frequency > 1.5 Hz and Command > 10 Hz	UGM and Left Power Module shall clear the fault after drive joystick returns to neutral (and command returns to zero).

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
7754	REAR RIGHT MOTOR STALLED	The UGM or Power Module(s) detects that the motor is stalled during active traction. For the UGM commanded speed ≥ Creep AND (RIGHT) +30 > Steer Angle < -45 (LEFT), the reported avg motor encoder feedback < 70 counts/s for 5 seconds (1.685 Hz). Avg motor encoder feedback evaluate on a 1s running average. For MTM, the encoder-measured motor speed < 0.6Hz for 5 seconds, when applied frequency > 1.5 Hz and Command > 10 Hz	UGM and Right Power Module shall clear the fault after drive joystick returns to neutral (and command returns to zero)
7757	REAR LEFT MOTOR OUTPUT - OUT OF RANGE HIGH	Associated Power Module detects at Startup or during active traction that the motor voltage output is higher than expected	Power cycle
7758	REAR RIGHT MOTOR OUTPUT - OUT OF RANGE HIGH	Associated Power Module detects at Startup or during active traction that the motor voltage output is higher than expected	Power cycle
7761	REAR LEFT MOTOR OUTPUT - OUT OF RANGE LOW	Associated Power Module detects at Startup or during active traction that the motor voltage output is lower than expected	Power cycle
7762	REAR RIGHT MOTOR OUTPUT - OUT OF RANGE LOW	Associated Power Module detects at Startup or during active traction that the motor voltage output is lower than expected	Power cycle
7765	REAR LEFT MOTOR - FEEDBACK FAILURE	After main contactor is closed, Power Module detects that the motor voltage feedback circuits are damaged	Power cycle
7766	REAR RIGHT MOTOR - FEEDBACK FAILURE	After main contactor is closed, Power Module detects that the motor voltage feedback circuits are damaged	Power cycle
7769	REAR LEFT MOTOR - ROTATION OPPOSITE CONTROL	Associated Power Module detects that the motor is rotating in the direction opposite of the commanded direction and deceleration is less than 15% of deceleration personality setting for a period of more than 0.5 seconds	Power cycle
7770	REAR RIGHT MOTOR - ROTATION OPPOSITE CONTROL	Associated Power Module detects that the motor is rotating in the direction opposite of the commanded direction and deceleration is less than 15% of deceleration personality setting for a period of more than 0.5 seconds	Power cycle
7773	REAR LEFT MOTOR - OPEN CIRCUIT	When motor output is active, the Power Module detects that a motor phase is disconnected/open during active traction	Power cycle
7774	REAR RIGHT MOTOR - OPEN CIRCUIT	When motor output is active, the Power Module detects that a motor phase is disconnected/open during active traction	Power cycle
813	CHASSIS TILT SENSOR NOT CALIBRATED	UGM determines that tilt sensor, • has not been calibrated • serial number does not match stored value uninitialized sensor has been installed	Tilt sensor calibrated;

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
814	CHASSIS TILT SENSOR OUT OF RANGE	Fault CHASSIS TILT SENSOR NOT CALIBRATED (813) is not present and either of the external tilt sensor X or Y axis ? ABS [35 º] for 4 seconds. Not to be reported during Tilt Sensor calibration.	Not all of the trigger conditions are met;
818	TILT SENSOR STAGNANT	UGM shall consider the Tilt Sensor stagnant if neither the X-axis or Y-axis unfiltered reading change by ≥ ±0.05º in 5000ms while the reported Drive speed ≥ Drive Creep Hz for all Traction modules	Power cycle;
821	LSS CELL #1 ERROR	MACHINE SETUP -> LOAD SYSTEM ≠ NO; The UGM detects that LSS is reporting error with Cell #1	Not all of the trigger conditions are met; motion restrictions removed after controls initialized
8211	LSS READING UNDER WEIGHT	LSS has been calibrated and the UGM has determined that the load sensing system reading is underweight while a period of time while operating drive or boom lift up at speeds greater than creep OR the UGM has determined that the load sensing system reading is less than -1.5 x Gross Platform Weight. The machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Ensure platform is not resting on the ground or is not leveled at an extreme negative angle. Re-calibrate the load sensing system if the above items are not a factor.
8218	LSS SENSOR DISAGREEMENT	The control system has determined that the difference between the calculated load for sensor 1 and sensor 2 differ by more than 50lbs OR the internal strain gauge sensor 1 gross platform weight reading and the internal strain gauge sensor 2 gross platform weight reading differ by more than 200lbs. If the platform is not considered to be overloaded boom functions will be restricted to creep. This fault, once annunciated is latched within a given key cycle.	Attempt to re-calibrate the load sensing system. Possible sensor hardware issue.
822	LSS CELL #2 ERROR	MACHINE SETUP -> LOAD SYSTEM ≠ NO; The UGM detects that LSS is reporting error with Cell #2	Not all of the trigger conditions are met; motion restrictions removed after controls initialized
8222	LSS STRAIN GAUGE 1 - STAGNANT	The control system has determined that the strain gauge 1 reading in the load sensor is stagnant (not changing). If the platform is not considered to be overloaded boom functions will be restricted to creep.. If DTC 8223 is active in combination with DTC 8222 the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
8223	LSS STRAIN GAUGE 2 - STAGNANT	The control system has determined that the strain gauge 2 reading in the load sensor is stagnant (not changing). If the platform is not considered to be overloaded boom functions will be restricted to creep. If DTC 8222 is active in combination with DTC 8223 the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8224	LSS STRAIN GAUGE 1 - OUT OF RANGE LOW	The shear beam is reporting an out of range low issue with the strain gauge 1 reading. If the platform is not overloaded the machine will be placed in to creep. If DTC 8225 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8225	LSS STRAIN GAUGE 2 - OUT OF RANGE LOW	The shear beam is reporting an out of range low issue with the strain gauge 2 reading. If the platform is not overloaded the machine will be placed in to creep. If DTC 8224 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8226	LSS STRAIN GAUGE 1 - OUT OF RANGE HIGH	The shear beam is reporting an out of range high issue with the strain gauge 1 reading. If the platform is not overloaded the machine will be placed in to creep. If DTC 8227 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
8227	LSS STRAIN GAUGE 2 - OUT OF RANGE HIGH	The shear beam is reporting an out of range high issue with the strain gauge 2 reading. If the platform is not overloaded the machine will be placed in to creep. If DTC 8226 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8228	LSS STRAIN GAUGE 1 - INITIALIZATION ERROR	The shear beam is reporting an initialization issue with the strain gauge 1 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8229 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8229	LSS STRAIN GAUGE 2 - INITIALIZATION ERROR	The shear beam is reporting an initialization issue with the strain gauge 2 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8228 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8230	LSS STRAIN GAUGE 1 - NOT CALIBRATED	The shear beam is reporting a calibration issue with the strain gauge 1 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8231 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
823	LSS CELL #3 ERROR	MACHINE SETUP -> LOAD SYSTEM ≠ NO; The UGM detects that LSS is reporting error with Cell #3	Not all of the trigger conditions are met; motion restrictions removed after controls initialized

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
8231	LSS STRAIN GAUGE 2 - NOT CALIBRATED	The shear beam is reporting a calibration issue with the strain gauge 2 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8230 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8232	LSS STRAIN GAUGE 1 - SENSOR DEFECT	The shear beam is reporting a sensor defect issue with the strain gauge 1 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8233 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8233	LSS STRAIN GAUGE 2 - SENSOR DEFECT	The shear beam is reporting a sensor defect issue with the strain gauge 2 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8232 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8234	LSS STRAIN GAUGE 1 - NOT INSTALLED	The shear beam is reporting a not installed issue with the strain gauge 1 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8235 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
8235	LSS STRAIN GAUGE 2 - NOT INSTALLED	The shear beam is reporting a not installed issue with the strain gauge 2 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8234 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8236	LSS NOT DETECTING CHANGE	The control system has determined that the load sensor reading has not deviated by more than 1lb for 5s while operating drive or boom functions at greater than creep speed. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8237	LSS STRAIN GAUGE 1 - A/D DEFECT	The shear beam is reporting an internal issue with the strain gauge 1 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8238 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
8238	LSS STRAIN GAUGE 2 - A/D DEFECT	The shear beam is reporting an internal issue with the strain gauge 2 sensor. If the platform is not overloaded the machine will be placed in to creep. If DTC 8237 is also active the machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.
824	LSS CELL #4 ERROR	MACHINE SETUP -> LOAD SYSTEM ≠ NO; The UGM detects that LSS is reporting error with Cell #4	Not all of the trigger conditions are met; motion restrictions removed after controls initialized
825	LSS HAS NOT BEEN CALIBRATED	MACHINE SETUP -> LOAD SYSTEM ≠ NO The load sensor has not been calibrated, or DTC 992 (LSS EEPROM ERROR) is active, or DTC 9977 (LSS CORRUPT EEPROM) is active	Not all of the trigger conditions are met
826	RUNNING AT CREEP - PLATFORM OVER-LOADED	MACHINE SETUP -> LOAD SYSTEM = WARN ONLY; The platform is Overloaded;	UGM determines that the Platform is not Over-loaded; motion restrictions removed after controls initialized

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
829	FUNCTIONS CUTOUT - PLATFORM OVER-LOADED	The Platform is Overloaded and MACHINE SETUP -> LOAD SYSTEM = CUTOUT PLATFORM, Platform Mode is active, and conditions of LSS section apply. -or- The Platform is Overloaded and MACHINE SETUP -> LOAD SYSTEM = CUTOUT ALL and conditions of LSS section apply	UGM determines that the Platform is not Over-loaded; motion restrictions removed after controls initialized
8211	LSS READING UNDER WEIGHT	MACHINE SETUP -> LOAD SYSTEM ≠ NO; The load sensor has been calibrated and Gross Platform Weight < (0.5 * Empty Platform Weight)	Not all of the trigger conditions are met; full func-tionality permitted after controls initialized
8664	STEER SENSOR - OUT OF RANGE HIGH	The UGM observes the Master Traction Module reported steer raw voltage signal ≥ 4.5V (Constant Data)	UGM observes steer voltage within calibrated range for 1000ms; Drive Creep restriction lifted after fault clears and controls initialized
8665	STEER SENSOR - OUT OF RANGE LOW	The UGM observes the Master Traction Module reported steer raw voltage signal ≤0.3V (Constant Data)	UGM observes steer angle voltage within cali-brated range for 1000ms; Drive Creep restriction lifted after fault clears and controls initialized
8666	STEER SENSOR - DECOUPLED	The UGM observes the Master Traction Module reported steer raw voltage 0.3V < signal < 0.5V (Constant Data)	UGM determines steer angle within allowed range; Drive Creep restriction removed after fault clears and controls initialized;
8667	STEER SENSOR - NOT RESPONDING	The UGM determines that the Master Traction Mod-ule reported Machine Steer Angle does not change ≥ 1.0° in 4000mS while the steering output is being commanded while steer is calibrated and properly reported by MTM in range that is not within 3deg of calibrated MAX.	UGM determines steer angle changes more than trigger amount while in allowed evaluation range; Drive Creep restriction removed after fault clears and controls initialized
8668	STEER SENSOR - NOT CALIBRATED	UGM determines that the steering sensor has not been calibrated; UGM EEPROM values are default, do not match MTM, or UGM fails to successfully read from 0x212, 0x213, or 0x214 three times during Startup	UGM determines that sensor is calibrated
873	MACHINE SAFETY SYSTEM OVERRIDE OCCURRED	UGM determines that an MSSO has occurred	TBD
991	LSS WATCHDOG RESET	MACHINE SETUP -> LOAD SYSTEM ≠ NO; UGM detects LSS report of an anomaly exists that has caused a WatchDog Timer reset.	Power cycle
992	LSS EEPROM ERROR	MACHINE SETUP -> LOAD SYSTEM ≠ NO; UGM detects LSS report of an anomaly that exists in the LSS EEPROM	Power cycle
993	LSS INTERNAL ERROR - PIN EXCITATION	MACHINE SETUP -> LOAD SYSTEM ≠ NO; UGM detects LSS report of improper excitation volt-age	Power cycle
994	LSS INTERNAL ERROR - DRDY MISSING FROM A/D	MACHINE SETUP -> LOAD SYSTEM ≠ NO; UGM detects LSS report of an anomaly that exists in the LSS A/D converter operations.	Power cycle
998	EEPROM FAILURE - CHECK ALL SETTINGS	The UGM has detected an anomaly in EEPROM that can not be auto-corrected from the backup EEPROM bank.	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
9910	FUNCTIONS LOCKED OUT - PLATFORM MODULE SOFTWARE VERSION IMPROPER	The UGM software version type is 'P' The UGM has received valid version information from the PM. The PM software version type is 'P' The UGM software major version number does not match the major version number of the platform software	Not all of the trigger conditions are met
9911	FUNCTIONS LOCKED OUT	MACHINE SETUP -> LOAD SYSTEM ≠ NO; The UGM determines that the LSS software version is not compatible with existing code per the referenced Software Version Compatibility table.	Power cycle
9919	GROUND SENSOR REF VOLTAGE OUT OF RANGE	The UGM has detected reference voltage is out of range: 2.3V < Reference Voltage < 2.7V(debounced for 100ms)	Power cycle
9920	PLATFORM SENSOR REF VOLTAGE OUT OF RANGE	The UGM detects that its reference voltage being reported by PM out of range (4.8V < voltage < 5.2V); debounced for 100ms	Power cycle
9921	GROUND MODULE FAILURE - HIGH SIDE DRIVER CUTOUT FAULTY	The UGM footswitch input J7-15 is LOW	Power cycle
9922	PLATFORM MODULE FAILURE - HWFS CODE 1	The PM detects that its V(low) FET has failed and reports this fault to the UGM	Power cycle
9924	FUNCTIONS LOCKED OUT - MACHINE NOT CONFIGURED	The machine is powered up and no model has been selected yet in the MACHINE SETUP menu	Power cycle
9927	GROUND MODULE CONSTANT DATA UPDATE REQUIRED	The UGM detects one of the following conditions when software type is 'P' or 'B': The Version Verification Word #1 or the Version Verification Word #2 values located in the constant data sector of flash memory (found on constant data spreadsheet tab pstConstantDataVersion) do not match the values located in the code area of flash memory. The Version Major value located in the constant data sector of flash memory (found on constant data spreadsheet tab pstConstantDataVersion) does not match the value located in the code area of flash memory.	A different application code or constant data version is programmed so that the values match; Power cycled
9944	CURRENT FEEDBACK GAINS OUT OF RANGE	One or more of the current feedback gains that are calculated and written to flash memory during the JDES manufacturing test process are detected as being out of range	Power cycle
9945	CURRENT FEEDBACK CALIBRATION CHECKSUM INCORRECT	The current feedback gains checksum that is calculated and written to flash memory during the JDES manufacturing test process is detected as being incorrect	Power cycle
9949	MACHINE CONFIGURATION OUT OF RANGE - CHECK ALL SETTINGS	UGM has detected an anomaly in EEPROM with regard to the Machine Setup configuration.	Power cycle
9977	LSS CORRUPT EEPROM	MACHINE SETUP ->LOAD SYSTEM ≠ NO and one of the following conditions: UGM determines LSS-stored values for Unloaded weight in Indirect 0x100≠ 0x108 or UGM determines LSS-stored values for Accessory weight in Indirect 0x102≠ 0x10A; UGM determines LSS-stored checksum1 (0x10F) ≠ checksum 2 (0x107)	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
9979	FUNCTIONS LOCKED OUT - GROUND MODULE SOFTWARE VERSION IMPROPER	Ground software has been installed on a UGM with a ST10F274 processor (Hardware Rev < 6), which does not have guaranteed flash storage in the sector where Constant Data is written.	Power cycle
9986	GROUND MODULE VLOW FET FAILURE	VLow FET determined to be failed on Startup; UGM unable to read high-sensing inputs.	Power cycle
99167	PUMP COMMAND ERROR	Master Traction Module determines that an inconsistency has occurred between the Pump Enable bits and the Pump commands; Pump enable bit = set, but Pump Command = 0	Power cycle
99234	REAR LEFT MODULE - EEPROM FAILURE	Applicable Power Module determines at Startup that an internal EEPROM error exists or UGM fails to successfully verify or write to/read back Indirect Table three times	Power cycle
99235	REAR LEFT MODULE - PROTECTION FAILURE	Applicable Power Module determines that an internal failure exists in the hardware protection circuit	Power cycle
99236	REAR LEFT MODULE - CHECK POWER CIRCUITS OR MOSFET SHORT CIRCUITC	Applicable Power Module determines at Startup that a short circuit exists on the power MOSFET outputs	Power cycle
99237	REAR LEFT MODULE - WATCHDOG RESET	Applicable Power Module determines that Watchdog failure/reset has occurred to one if two, or both	Power cycle
99238	REAR LEFT MODULE - WATCHDOG2 RESET	Applicable Power Module determines that Watchdog2 failure/reset has occurred	Power cycle
99239	REAR LEFT MODULE - RAM FAILURE	Applicable Power Module determines that a RAM checksum error has occurred	Power cycle
99240	REAR LEFT MODULE - INTERNAL ERROR	Applicable Power Module determines at Startup that the current gain is incorrect and may cause incorrect data acquisition values	Power cycle
99241	REAR LEFT MODULE - INTERNAL ERROR	Applicable Power Module determines that the data acquisition is in error	Power cycle
99242	REAR LEFT MODULE - INTERNAL ERROR	Applicable Power Module determines that the Pump current is being measured is not zero when expected to be zero at Startup or during standby	Power cycle
99243	REAR LEFT MODULE - INTERNAL ERROR	Applicable Power Module determines that the Slip Profile is in error	Power cycle
99244	REAR LEFT MODULE - INTERNAL ERROR	Applicable Power Module determines that the current feedbacks are out of range at Startup or when in standby	Power cycle
99245	REAR LEFT MODULE - INTERNAL ERROR	Applicable Power Module determines at Startup that there is a problem with overvoltage/undervoltage detection	Power cycle
99246	REAR LEFT MODULE - CAPACITOR BANK FAULT	The power capacitor bank of the Power Module is not charging properly (increasing voltage) at Startup	Power cycle
99247	REAR LEFT MODULE - A/D FAILURE	Applicable Power Module determines that an internal Analog Input error exists	Power cycle
99248	REAR RIGHT MODULE - EEPROM FAILURE	Applicable Power Module determines at Startup that an internal EEPROM error exists or UGM fails to successfully verify or write to/read back Indirect Table three times	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
99249	REAR RIGHT MODULE - PROTECTION FAILURE	Applicable Power Module determines that an internal failure exists in the hardware protection circuit	Power cycle
99250	REAR RIGHT MODULE - CHECK POWER CIRCUITS OR MOSFET SHORT CIRCUIT	Applicable Power Module determines at Startup that a short circuit exists on the power MOSFET outputs	Power cycle
99251	REAR RIGHT MODULE - WATCHDOG RESET	Applicable Power Module determines that Watchdog failure/reset has occurred to one if two, or both	Power cycle
99252	REAR RIGHT MODULE - WATCHDOG2 RESET	Applicable Power Module determines that Watchdog 2 failure/reset has occurred	Power cycle
99253	REAR RIGHT MODULE - RAM FAILURE	Applicable Power Module determines that a RAM checksum error has occurred	Power cycle
99254	REAR RIGHT MODULE - INTERNAL ERROR	Applicable Power Module determines at Startup that the current gain is incorrect and may cause incorrect data acquisition values	Power cycle
99255	REAR RIGHT MODULE - INTERNAL ERROR	Applicable Power Module determines that the data acquisition is in error	Power cycle
99256	REAR RIGHT MODULE - INTERNAL ERROR	Applicable Power Module determines that the Pump current is being measured is not zero when expected to be zero at Startup or during standby	Power cycle
99257	REAR RIGHT MODULE - INTERNAL ERROR	Applicable Power Module determines that the Slip Profile is in error	Power cycle
99258	REAR RIGHT MODULE - INTERNAL ERROR	Applicable Power Module determines that the current feedbacks are out of range at Startup or when in standby	Power cycle
99259	REAR RIGHT MODULE - INTERNAL ERROR	Applicable Power Module determines at Startup that there is a problem with overvoltage/undervoltage detection	Power cycle
99260	REAR RIGHT MODULE - CAPACITOR BANK FAULT	The power capacitor bank of the Power Module is not charging properly (increasing voltage) at Startup	Power cycle
99261	REAR RIGHT MODULE - A/D FAILURE	Applicable Power Module determines that an internal Analog Input error exists	Power cycle
99264	REAR LEFT MODULE - CURRENT MEASUREMENT ERROR	Power Module determines at when traction is active that the current feedback sensors are out of the permitted range and may cause incorrect data acquisition values	Power cycle
99265	REAR RIGHT MODULE - CURRENT MEASUREMENT ERROR	Power Module determines at when traction is active that the current feedback sensors are out of the permitted range and may cause incorrect data acquisition values	Power cycle
99270	REAR RIGHT MODULE - DRIVE COMMAND ERROR	Power Modules determine that an inconsistency has occurred between the Drive direction/enable bits and Drive magnitude/direction command	Power cycle
99269	REAR LEFT MODULE - DRIVE COMMAND ERROR	Power Modules determine that an inconsistency has occurred between the Drive direction/enable bits and Drive magnitude/direction command	Power cycle

Table 6-15. Diagnostic Trouble Codes

DTC	DTC Text	Fault Description	Solution
99273	FUNCTIONS LOCKED OUT – REAR LEFT MODULE SOFTWARE VERSION IMPROPER	The UGM software version type is 'P' The UGM has received valid version information from all Power Modules. The Power Module major version number is not compliant with the version specified on the Software section of this document.	Not all of the trigger conditions are met
99274	FUNCTIONS LOCKED OUT – REAR RIGHT MODULE SOFTWARE VERSION IMPROPER	The UGM software version type is 'P' The UGM has received valid version information from all Power Modules. The Power Module major version number is not compliant with the version specified on the Software section of this document.	Not all of the trigger conditions are met
99281	FUNCTIONS LOCKED OUT - IMPROPER MOTOR PARAMETERS	The UGM determines an incorrect protected Indirect Table value at start-up	Power cycle
99285	LSS - FACTORY CALIBRATION ERROR	The load sensor is reporting a factor calibration issue (internal error) The machine will assume the platform is overloaded. This fault, once annunciated is latched within a given key cycle.	Possible sensor hardware issue.

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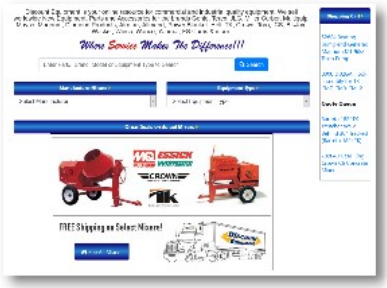

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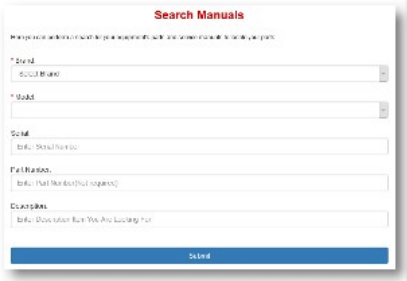

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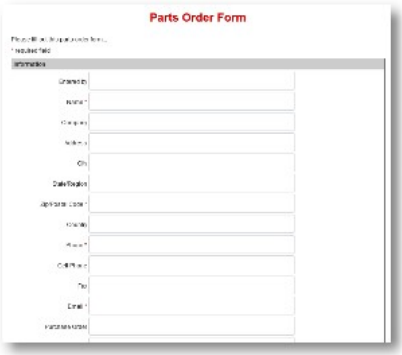

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NOTES:

SECTION 7. BASIC ELECTRICAL INFORMATION & SCHEMATICS

7.1 GENERAL

This section contains basic electrical information and schematics to be used for locating and correcting most of the operating problems which may develop. If a problem should develop which is not presented in this section or which is not corrected by listed corrective actions, technically qualified guidance should be obtained before proceeding with any maintenance.

NOTE: *Some of the procedures/connectors shown in this section may not be applicable to all models.*

7.2 MULTIMETER BASICS

A wide variety of multimeter's or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information.

Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the Voltage source.

Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

Min/Max

Use of the "Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read the Voltage applied to a solenoid when it is only operational while a switch, far from the solenoid and meter, is held down.

Polarity

Getting a negative Voltage or current reading when expecting a positive reading frequently means the leads are reversed. Check what reading is expected, the location of the signal and that the leads are connected to the device under test correctly. Also check that the lead on the "COM" port goes to the Ground or negative side of the signal and the lead on the other port goes to the positive side of the signal.

Scale

M = Mega = 1,000,000 * (Displayed Number)

k = kilo = 1,000 * (Displayed Number)

m = milli = (Displayed Number) / 1,000

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

Example: 1.2 kW = 1200 W
Example: 50 mA = 0.05 A

Voltage Measurement

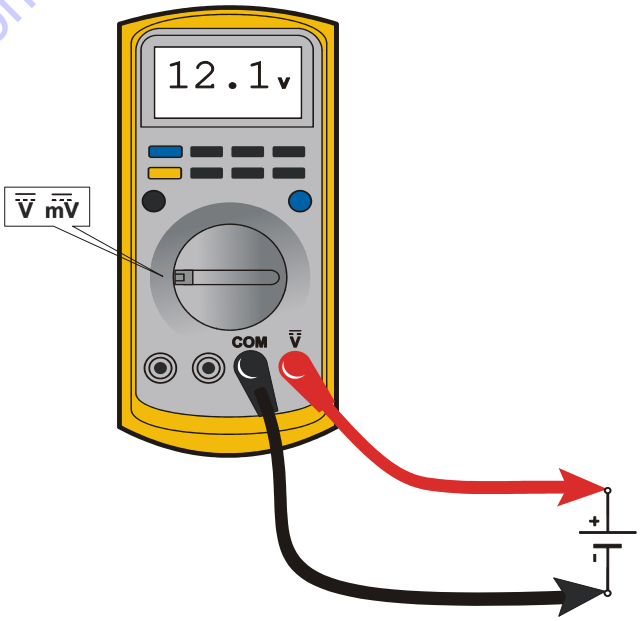


Figure 7-1. Voltage Measurement (DC)

- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual).
- Use firm contact with meter leads.

Resistance Measurement

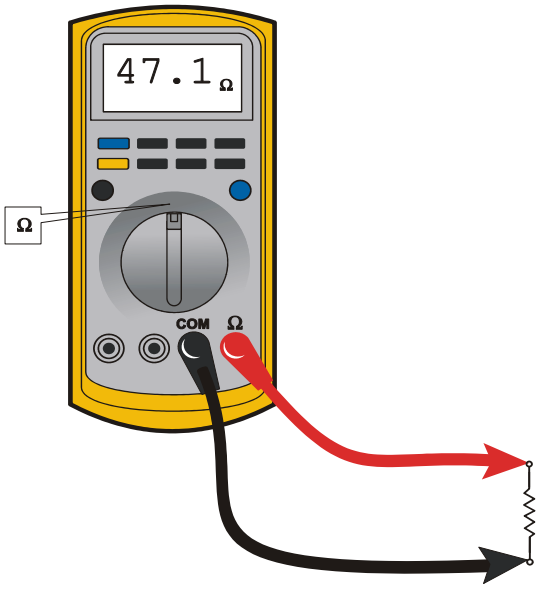


Figure 7-2. Resistance Measurement

- First test meter and leads by touching leads together. Resistance should read a short circuit (very low resistance).
- Circuit power must be turned OFF before testing resistance.
- Disconnect component from circuit before testing.
- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual).
- Use firm contact with meter leads.

Continuity Measurement

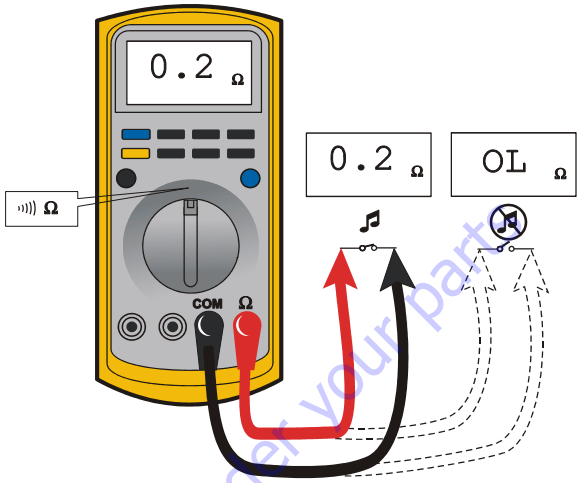


Figure 7-3. Continuity Measurement

- Some meters require a separate button press to enable audible continuity testing.
- Circuit power must be turned OFF before testing continuity.
- Disconnect component from circuit before testing.
- Use firm contact with meter leads.
- First test meter and leads by touching leads together. Meter should produce an audible alarm, indicating continuity.

Current Measurement

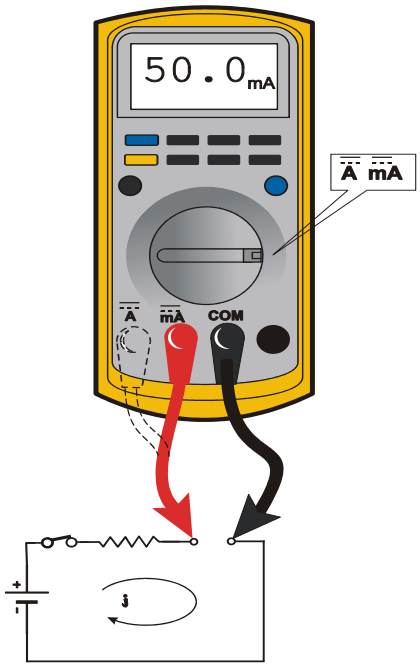


Figure 7-4. Current Measurement (DC)

- Set up the meter for the expected current range.
- Be sure to connect the meter leads to the correct jacks for the current range you have selected.
- If meter is not auto ranging, set it to the correct range (See multi meter's operation manual).
- Use firm contact with meter leads.

7.3 CHECKING SWITCHES

Basic Check

The following check determines if the switch is functioning properly, not the circuit in which the switch is placed. A switch is functioning properly when there is continuity between the correct terminals or contacts only when selected.

1. De-energize the circuit.
2. Isolate the switch from the rest of the circuit if possible. If not possible, keep in mind it may affect readings.
3. Access the terminals to the switch.
4. If the switch has two terminals:
   a. Measure resistance across the terminals.
   b. Change the switch position.
   c. Measure resistance again with the leads in the same positions. If the meter was reading short, it should read an open. If the meter was reading open it should read short.
5. If the switch has more than two terminals, consult the schematic or switch diagram to determine what terminals will be connected. The test is similar to testing a switch with two terminals.
   a. Place one meter lead on the common contact and the other on a different contact in the same circuit.
   b. Cycle through all positions of the switch. The meter should read short only when the switch connects the two terminals and open otherwise.
   c. If the switch has more than one common contact repeat the process for that circuit.

Limit Switches

Limit switches are used to control movement or indicate position. Mechanical limit switches are just like manually operated switches except that the moving object operates the switch. These switches can be tested the same way as a standard switch by manually operating the sensing arm.

Another type of limit switch used by JLG is the inductive proximity switch, also referred to as a "prox switch". Inductive proximity switches are actuated only by ferrous metal (metal that contains Iron, such as steel) near the switch. They do not require contact, and must be energized to actuate. These types of switches can be used to detect boom or platform position, for example. These switches have a sensing face where the switch can detect ferrous metal close to it. To find the sensing face, take note how the switch is mounted and how the mechanisms meet the switch. Test this type of switch as follows:

1. Remove proximity switch from its mount.
2. Reconnect harness if it was disconnected for step a, and turn on machine.
3. Hold switch away from metal and observe switch state in the control system diagnostics using the Analyzer. See vehicle or control system documentation on how to do this.
4. Place sensing face of switch on the object to be sensed by the switch. If that is not available, use a piece of ferrous metal physically similar to it. The switch state in the control system diagnostics should change.
5. When reinstalling or replacing switch be sure to follow mounting instructions and properly set the gap between the switch and object sensed.

Automatic Switches

If the switch is actuated automatically, by temperature or pressure for example, find a way to manually actuate the switch to test it. Do this either by applying heat or pressure, for example, to the switch. These switches may need to be energized to actuate.

1. Connect instrumentation to monitor and/or control the parameter the switch is measuring.
2. Observe switch state in control system with the Analyzer. See vehicle or control system documentation on how to do this.
3. Operate system such that the switch actuates. This could be going over a certain pressure or temperature, for example. The state indicated in the control system should change.

Switch Wiring - Low Side, High Side

When controlling a load, a switch can be wired between the positive side of the power source and the load. This switch is called a "high side" switch. The switch supplies the power to the load. When a switch is wired between the negative side of the power source and the load, it is a "low side" switch. The switch provides the ground to the load.

A low side switch will allow voltage to be present on the load. No power is applied because the switch is stopping current flow. This voltage can be seen if the measurement is taken with one test lead on the load and the other on the battery negative side or grounded to the vehicle. What is actually being measured is the voltage drop across the switch. This could mislead a technician into thinking the load is receiving power but not operating. To produce an accurate picture of power or voltage applied to the load, measure voltage across the load's power terminals. Also, the technician can measure the voltage at both power terminals with respect to battery ground. Tsurements is the voltage applied to the load.

7.4 APPLYING SILICONE DIELECTRIC COMPOUND TO ELECTRICAL CONNECTIONS

NOTE: *This section is not applicable for battery terminals.*

NOTICE

JLG P/N 0100048 DIELECTRIC GREASE (NOVAGARD G661) IS THE ONLY MATERIAL APPROVED FOR USE AS A DIELECTRIC GREASE.

NOTE: *Do NOT apply dielectric grease to the following connections:*

- Main Boom Rotary sensor connections (on Celesco Sensor),
- LSS Modules connections.
- Deutz EMR 2 ECM connection.

Silicone Dielectric Compound must be used on all electrical connections except for those mentioned above for the following reasons:

- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Silicone Dielectric Compound to the electrical connectors. This procedure applies to all plug connections not enclosed in a box. Silicone grease should not be applied to connectors with external seals.

1. To prevent oxidation, silicone grease must be packed completely around male and female pins on the inside of the connector prior to assembly. This is most easily achieved by using a syringe.

NOTE: *Over a period of time, oxidation increases electrical resistance at the connection, eventually causing circuit failure.*

2. To prevent shorting, silicone grease must be packed around each wire where they enter the outside of the connector housing. Also, silicone grease must be applied at the joint where the male and female connectors come together. Any other joints (around strain reliefs, etc.) where water could enter the connector should also be sealed.

NOTICE

THIS CONDITION IS ESPECIALLY COMMON WHEN MACHINES ARE PRESSURE WASHED SINCE THE WASHING SOLUTION IS MUCH MORE CONDUCTIVE THAN WATER.

3. Anderson connectors for the battery boxes and battery chargers should have silicone grease applied to the contacts only.

NOTE: *Curing-type sealants might also be used to prevent shorting and would be less messy, but would make future pin removal more difficult.*

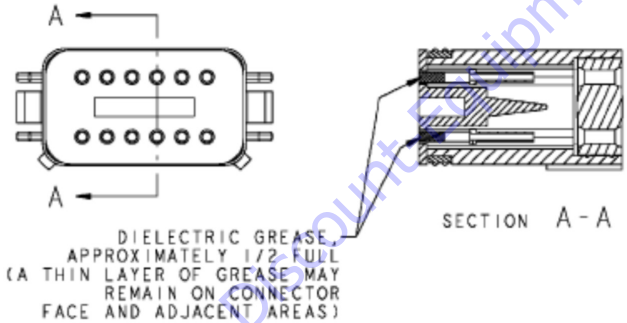
When applied to electrical connections, dielectric grease helps to prevent corrosion of electrical contacts and improper conductivity between contacts from moisture intrusion. Open and sealed connectors benefit from the application of dielectric grease.

Dielectric grease shall be applied to all electrical connectors at the time of connection (except those noted under Exclusions).

Installation of Dielectric Grease

Before following these instructions, refer to excluded connector types (See Exclusions below).

1. Use dielectric grease in a tube for larger connection points or apply with a syringe for small connectors.
2. Apply dielectric grease to the female contact (fill it approximately ½ full; see example below).
3. Leave a thin layer of dielectric grease on the face of the connector.
4. Assemble the connector system immediately to prevent moisture ingress or dust contamination.
5. Pierce one of the unused wire seals prior to assembly if the connector system tends to trap air (i.e. AMP Seal) and then install a seal plug.



Deutsch HD, DT, DTM, DRC Series

The Deutsch connector system is commonly used for harsh environment interconnect. Follow the installation instructions.

AWP Seal

The AMP Seal connector system is used on the Control ADE Platform and Ground Modules.

Apply dielectric grease to the female contact. If trapped air prevents the connector from latching, pierce one of the unused wire seals. After assembly, install a seal plug (JLG #4460905) in that location to prevent moisture ingress.

Note that seal plugs may be installed by the wire harness manufacturer if an unused wire seal becomes compromised (wire inserted in the wrong cavity during assembly and then corrected).

Figure 7-5. Application to Female Contacts

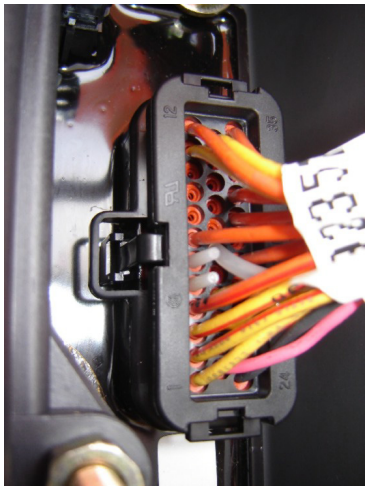
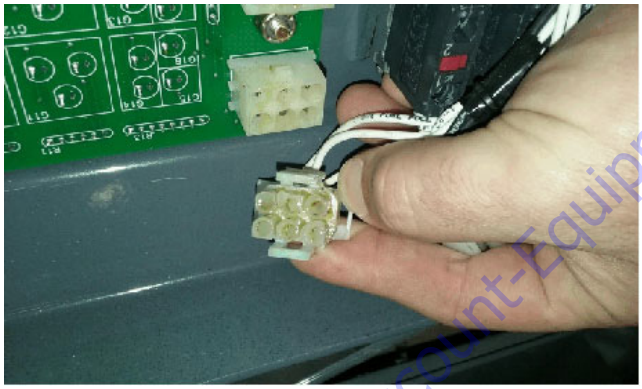


Figure 7-6. Use of Seal Plugs

AMP Mate-N-Lok

This connector system is widely used inside enclosures for general-purpose interconnect. Follow the installation instructions.



DIN Connectors

This connector is typically used on hydraulic valves. Follow the installation instructions.

Exclusions

A limited number of connectors do not benefit from dielectric grease, or may be permanently damaged by application. Dielectric grease may not be required in properly sealed enclosures.

BRAD HARRISON / PHOENIX CONTACT M12

The connector uses gold contact material to resist corrosion and an o-ring seal for moisture integrity. If dielectric grease is mistakenly applied to this connector system, the low-force contacts cannot displace the grease to achieve electrical contact. Once contaminated, there is no practical way to remove the dielectric grease (replacement of female contacts required). The JLG Load Sensing System and 1250AJP Rotary Angle Sensors are examples of components with the M12 connector system.

AMP JUNIOR TIMER

This type of connector uses back-seals for moisture integrity. However, the low-force contacts cannot displace dielectric grease and create electrical contact. It is possible to use solvents (i.e. contact cleaner or mineral spirits) for the removal of improperly applied dielectric grease. The EMR2 engine control module from Deutz employs this connector system (for example).

7.5 AMP CONNECTOR

Applying Silicone Dielectric Compound to AMP Connectors

Silicone Dielectric Compound must be used on the AMP connections for the following reasons:

- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Silicone Dielectric Compound to the electrical connectors.

1. To prevent oxidation and low level conductivity, silicone dielectric grease must be packed completely around male and female pins on the inside of the connector after the mating of the housing to the header. This is easily achieved by using a syringe to fill the header with silicone dielectric compound, to a point just above the top of the male pins inside the header. When assembling the housing to the header, it is possible that the housing will become air locked, thus preventing the housing latch from engaging.
2. Pierce one of the unused wire seals to allow the trapped air inside the housing to escape.
3. Install a hole plug into this and/or any unused wire seal that has silicone dielectric compound escaping from it.

Assembly

Check to be sure the wedge lock is in the open, or as-shipped, position (See Figure 7-7.). Proceed as follows:

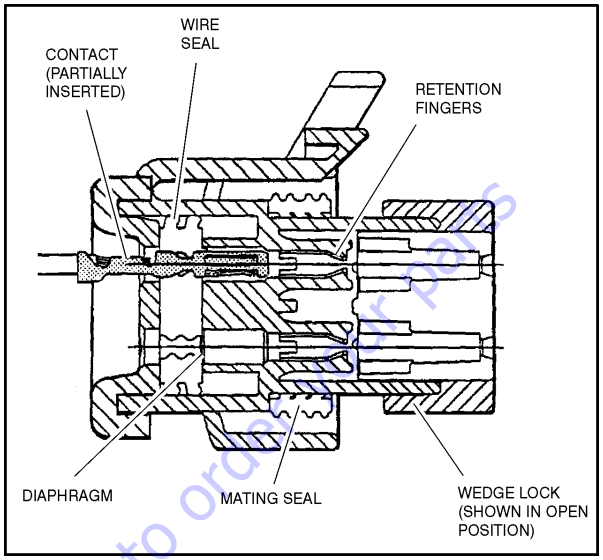


Figure 7-7. Connector Assembly Figure 1

1. To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (See Figure 7-9.).
2. Pull back on the contact wire with a force of 1 or 2 lbs. to be sure the retention fingers are holding the contact (See Figure 7-9.).

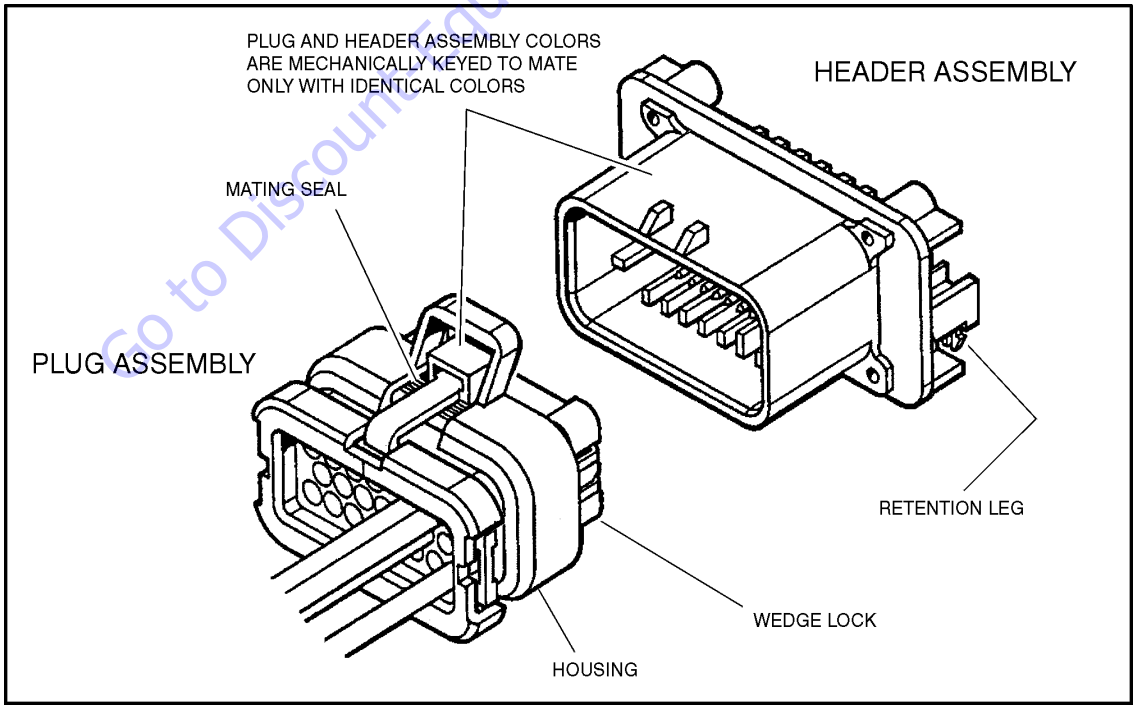


Figure 7-8. AMP Connector

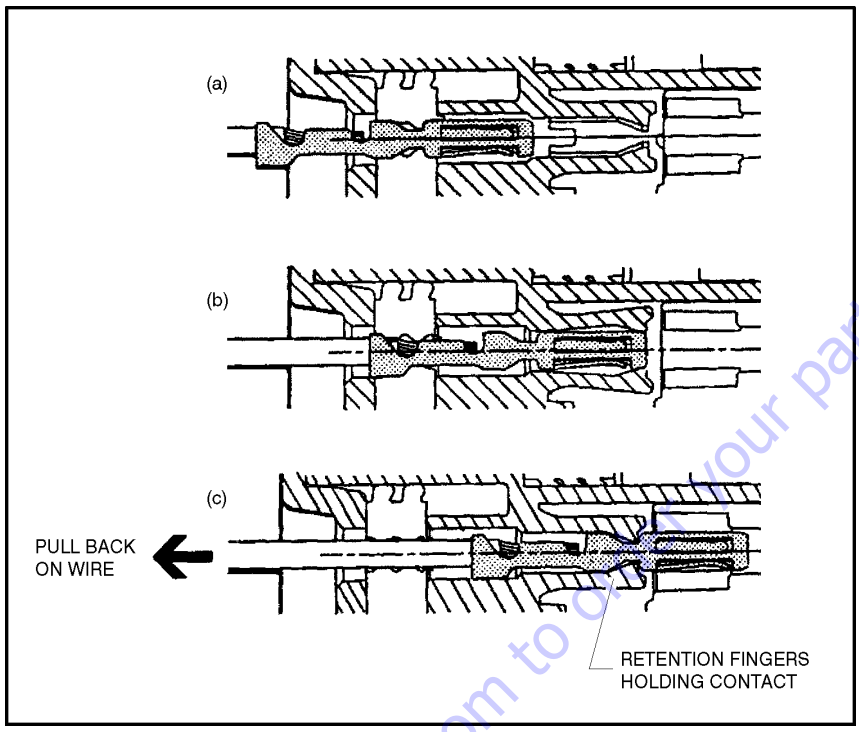


Figure 7-9. Connector Assembly Figure 2

3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 7-10.).

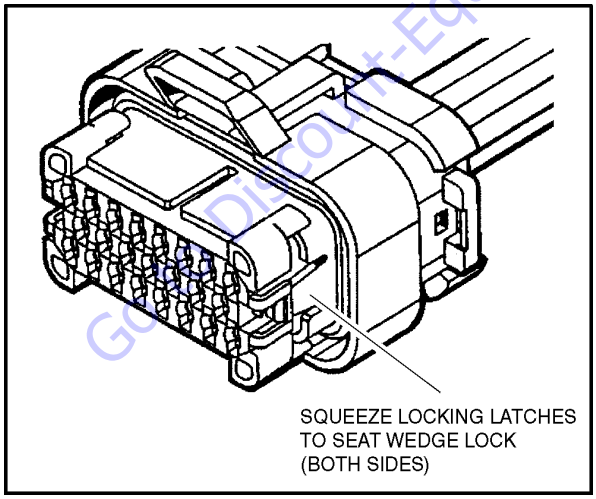


Figure 7-10. Connector Assembly Figure 3

4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 7-11.).

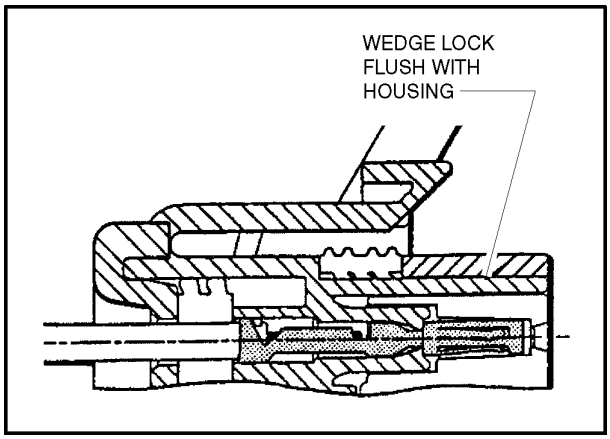


Figure 7-11. Connector Assembly Figure 4

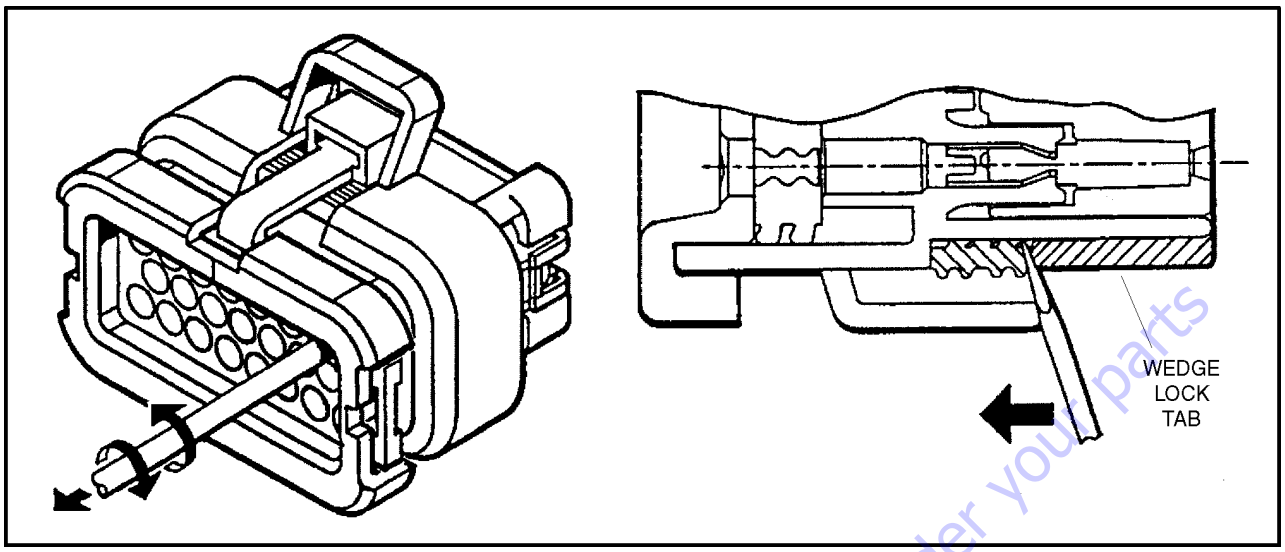


Figure 7-12. Connector Disassembly

Disassembly

1. Insert a 4.8 mm (3/16") wide screwdriver blade between the mating seal and one of the red wedge lock tabs.
2. Pry open the wedge lock to the open position.
3. While rotating the wire back and forth over a half turn (1/4 turn in each direction), gently pull the wire until the contact is removed.

NOTE: *The wedge lock should never be removed from the housing for insertion or removal of the contacts.*

Wedge Lock

The wedge lock has slotted openings in the forward, or mating end. These slots accommodate circuit testing in the field, by using a flat probe such as a pocket knife. DO NOT use a sharp point such as an ice pick.

Service - Voltage Reading

NOTICE

DO NOT PIERCE WIRE INSULATION TO TAKE VOLTAGE READINGS.

It has been common practice in electrical troubleshooting to probe wires by piercing the insulation with a sharp point. This practice should be discouraged when dealing with the AMPSEAL plug assembly, or any other sealed connector system. The resulting pinholes in the insulation will allow moisture to invade the system by traveling along the wire strands. This nullifies the effectiveness of the connector seals and could result in system failure.

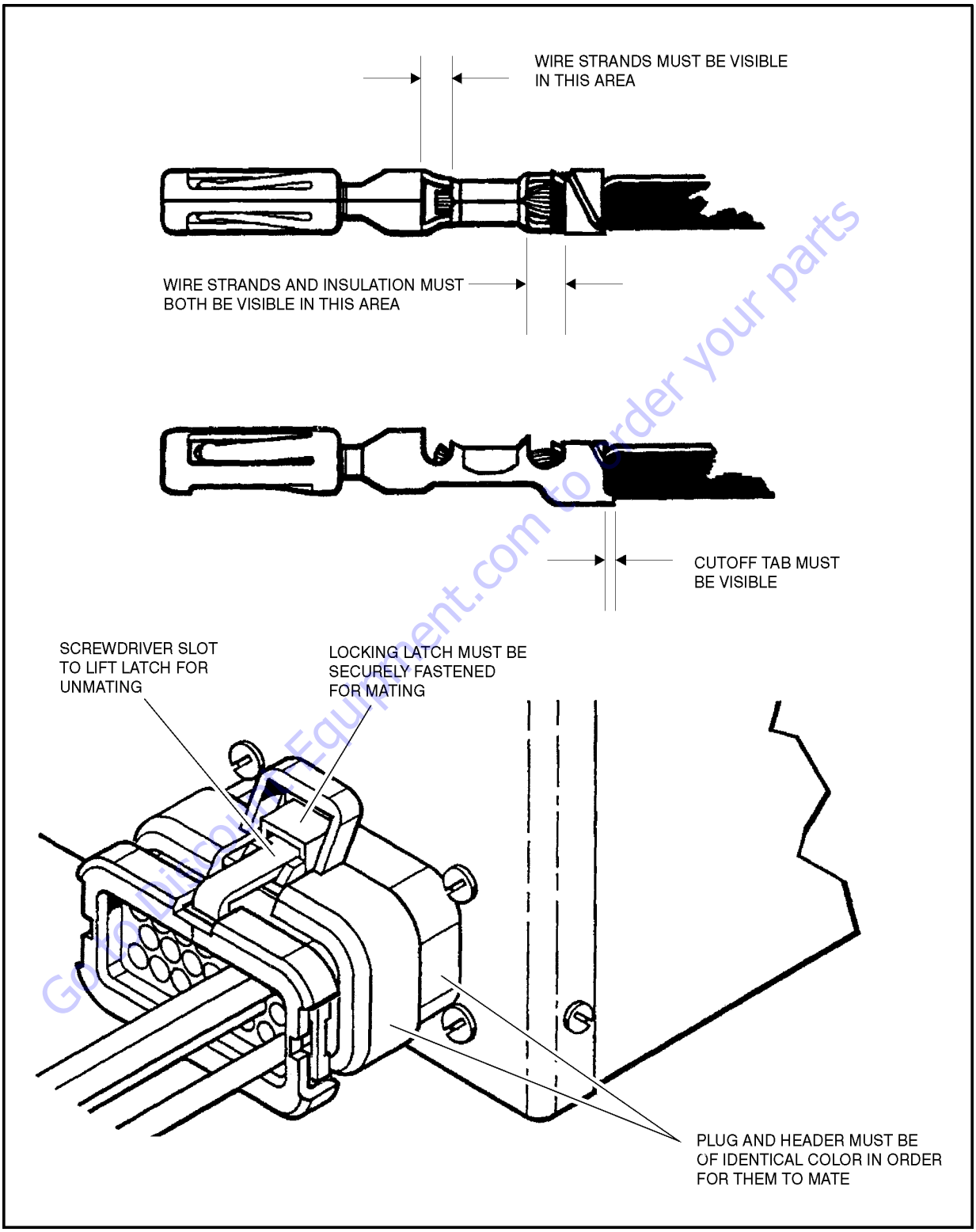


Figure 7-13. Connector Installation

7.6 DEUTSCH CONNECTORS

DT/DTP Series Assembly

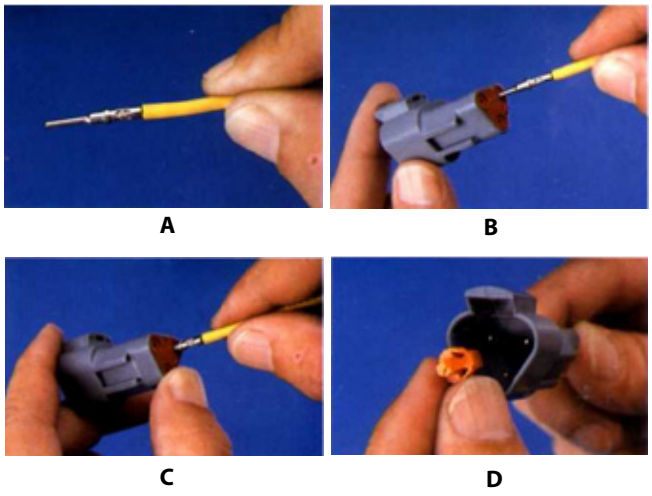


Figure 7-14. DT/DTP Contact Installation

1. Grasp crimped contact about 25mm behind the contact barrel.
2. Hold connector with rear grommet facing you.
3. Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.
4. Once all contacts are in place, insert wedgelock with arrow pointing toward exterior locking mechanism. The wedgelock will snap into place. Rectangular wedges are not oriented. They may go in either way.

NOTE: *The receptacle is shown - use the same procedure for plug.*

DT/DTP Series Disassembly

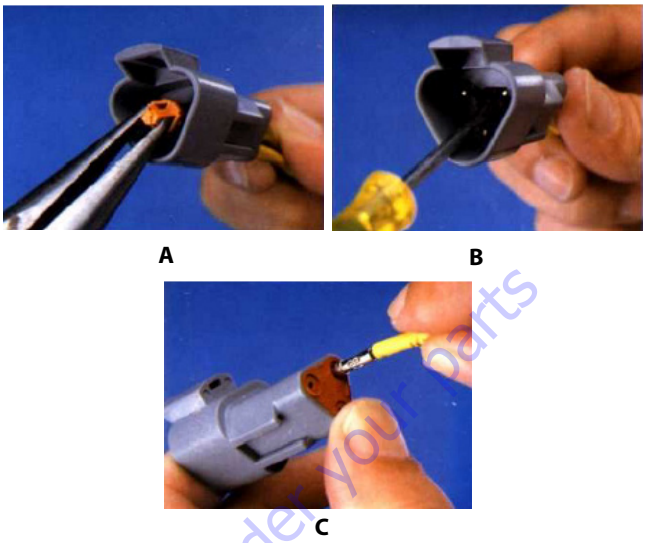


Figure 7-15. DT/DTP Contact Removal

1. Remove wedgelock using needle nose pliers or a hook shaped wire to pull wedge straight out.
2. To remove the contacts, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the contact with a screwdriver.
3. Hold the rear seal in place, as removing the contact may displace the seal.

HD30/HDP20 Series Assembly

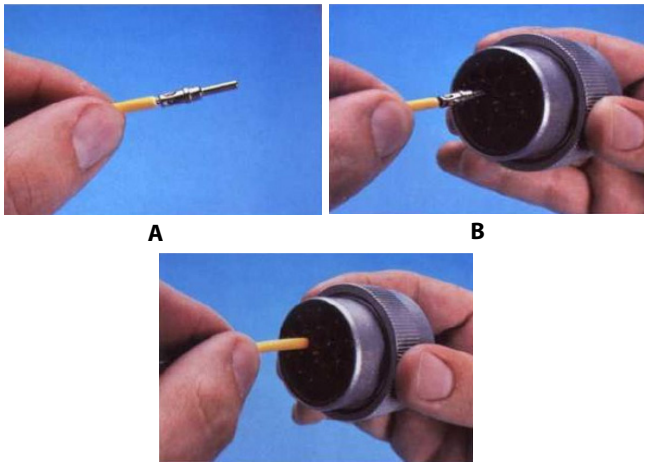


Figure 7-16. HD/HDP Contact Installation

1. Grasp contact about 25mm behind the contact crimp barrel.
2. Hold connector with rear grommet facing you.
3. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

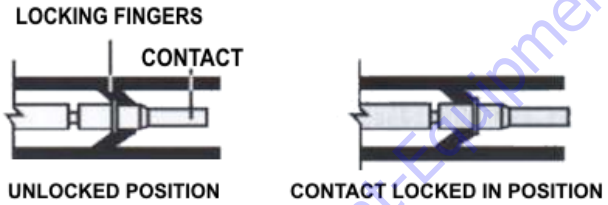


Figure 7-17. HD/HDP Locking Contacts Into Position

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

HD30/HDP20 Series Disassembly

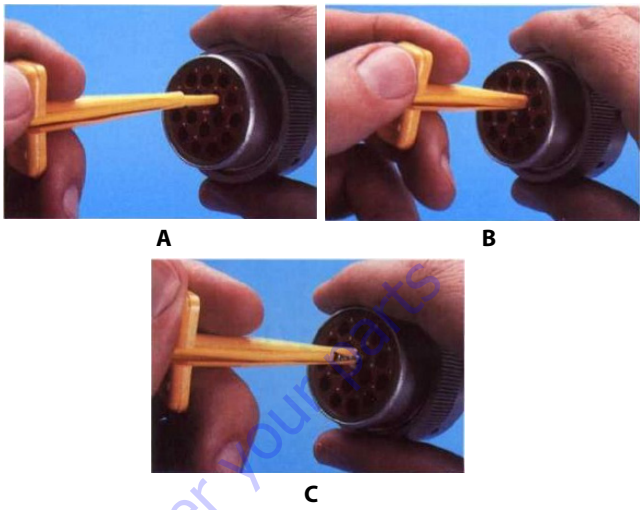


Figure 7-18. HD/HDP Contact Removal

1. With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.
2. Slide tool along into the insert cavity until it engages contact and resistance is felt.
3. Pull contact-wire assembly out of connector.

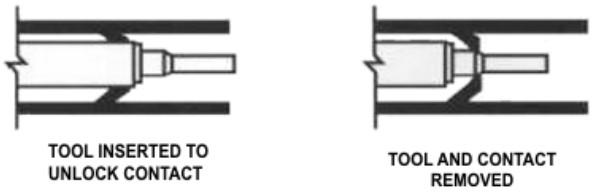


Figure 7-19. HD/HDP Unlocking Contacts

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

7.7 WIRING HARNESS CONNECTOR LABELS

Connector Labels

Connectors between harnesses are identified by the prefix "X" and a sequentially assigned number. An optional suffix (letters & numbers) may be added when multiple terminations occur at one device or when there are optional connections.

Example:

X25 connects to X25 in another harness

X65A, X65B connect to different portions of one device.

X163 connects to X163A in ANSI and X163B in CE machine.

Component Labels

Every component on the vehicle has a unique identification. A standard prefix letter is assigned according to the table below, followed by a unique sequential number. An optional suffix (letters & numbers) may be added when multiple terminations occur at one device.

Terminals that are not loaded into connectors are considered independent components and labeled in the same fashion.

Table 7-1. Wiring Harness Connector Labels

Components	Category	Label
Audible	Alarms	AH
	Horns	
Battery	Batteries	BT
	Battery Terminals	
Control Module	Ground	CO
	LSS	
	Platform	
Engine	Alternator	EC
	Cold Start	
	Controller	
	Coolant Temp	
	Fuel Pump	
	Fuel Solenoid	
	Glow Plugs	
	Oil Pressure	
	Starter	
Fuse & CB Fuse FC	Fuse	FC
	Fusible Link	FC
	Circuit Breaker	CB
Gauge & Display	Board	GD
	Cluster	
	Hour meter	
	LMI	
	Speedometer	
Inline	Resistor	R
	Diode	D
Joystick & Steering	Electronic	JS
	Hydraulic	
Lights	Dome	LB
	Headlights	
	Simple	
	Taillights	
Membrane Panel		MP
Miscellaneous	Radio	MS
	Speakers	
	Splice Blocks	
	T-Connectors	

Table 7-1. Wiring Harness Connector Labels

Components	Category	Label
Other Switches	Disconnect	SW
	EMS	
	Foot	
	HVAC	WH
	Key	SW
	Park brake	
	Pump pot	
	Push	
	Shifter	
	Turn signal	
Relay	5 Pin	RL
	4 Pin	
	Contactor	
	Power module	
Rocker Switch		SW
Sensor	Angle	SN
	Fuel	
	Length	
	Limit	
	Load	
	Pressure	
	Proximity	
	Speed	
	Temperature	
Terminals	Pins	T
	Sockets	
	Male Blades	
	Female Blades	
	Rings	
	Forks	
Toggle Switch	DPDT	SW
	DPST	
	SPDT	
	SPST	
	Special	
Valves	Simple	HV
	Suppression	

Examples:

T67 is a ring terminal connected during installation.
CO1-J3 is the J3 connector for a UGM control module.
EC9 is a glow plug supplied with the engine

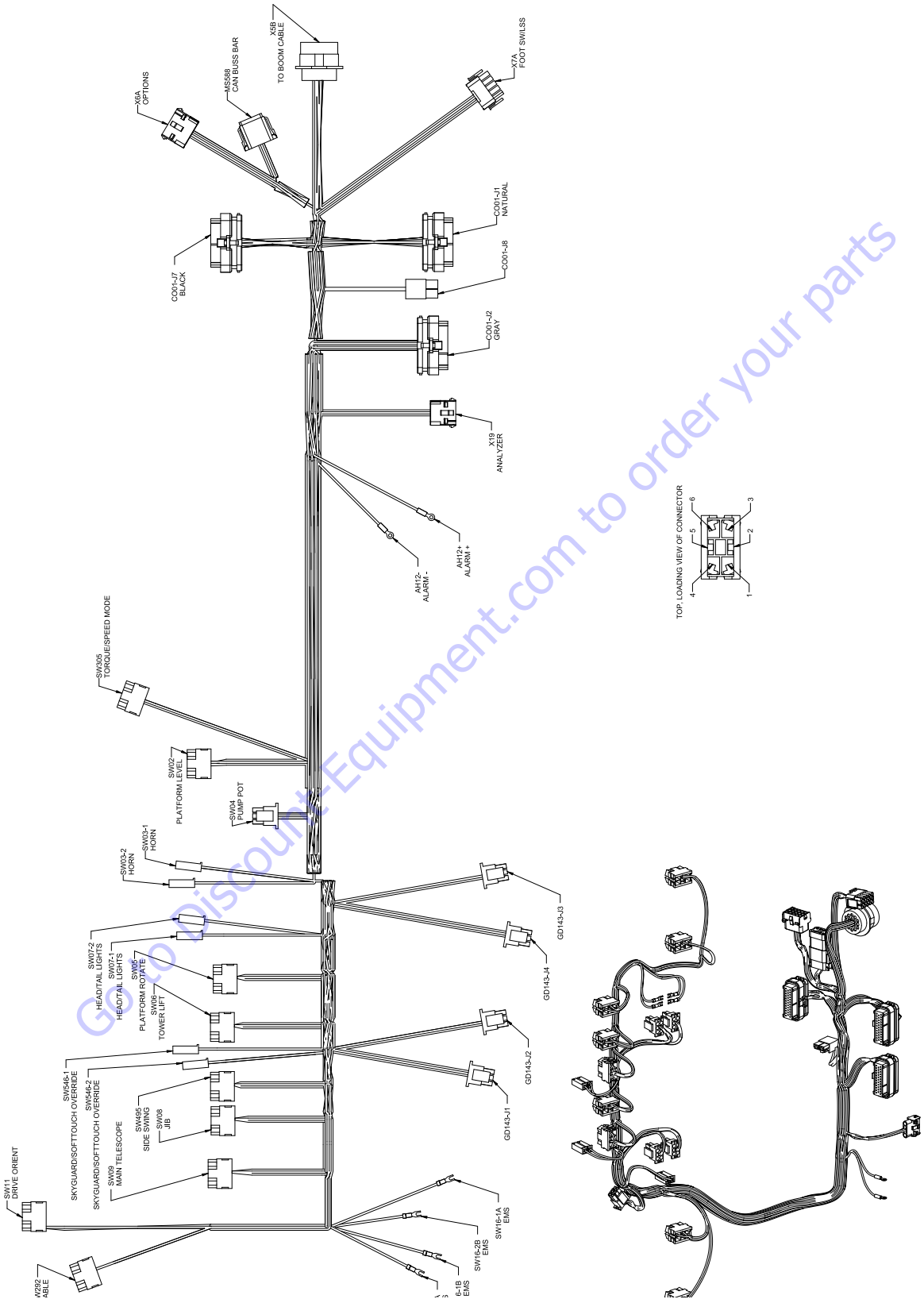


Figure 7-20. Platform Console Harness - Sheet 1 of 4

SW11 - DRIVE ORIENT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	122-1 DOS	18 AWG	GXL	1001159186		CO01-J2 (4)
2	YEL	5-14-10	18 AWG	GXL	4460419		SW546-2 (1)
2	YEL	5-14-9	18 AWG	GXL	4460419		SW03-1 (1)
3							
4							
5							
6							

SW292 - GEN ENABLE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1							
2	WHT	2-12-2 GEN ENABLE IGN	18 AWG	GXL	1001159186		X5B (7)
3	WHT	8-3 GEN ENABLE	18 AWG	GXL	1001159186		X5B (5)
4							
5							
6							

SW07-1 - HEAD/TAIL LIGHTS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	88-1 HEAD/TAIL LT	18 AWG	GXL	4460259		CO01-J1 (30)

SW07-2 - HEAD/TAIL LIGHTS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	5-14-11	18 AWG	GXL	4460259		SW546-2 (1)

SW16-2A - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
2A	YEL	5-11-3	18 AWG	GXL			CO01-J7 (2)

SW16-1B - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1B	YEL	5-2-6	18 AWG	GXL			X5B (13)

SW16-2B - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
2B	YEL	5-2-5	18 AWG	GXL			X5B (15)
2B							

SW16-1A - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1A	YEL	5-11-2	18 AWG	GXL			X5B (9)

SW546-1 - SKYGUARD/SOFTTOUCH OVERRIDE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	124-3 OVERRIDE	18 AWG	GXL	4460259		CO01-J1 (29)

SW546-2 - SKYGUARD/SOFTTOUCH OVERRIDE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	5-14-10	18 AWG	GXL	4460259		SW11 (2)
1	YEL	5-14-11	18 AWG	GXL	4460259		SW07-2 (1)

GD143-J1

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	98-3 1/4 BAT CHG	18 AWG	GXL	4460226		CO01-J2 (22)
2	WHT	98-4 1/2 BAT CHG	18 AWG	GXL	4460226		CO01-J2 (24)
3	WHT	98-5 3/4 BAT CHG	18 AWG	GXL	4460226		CO01-J2 (23)
4	WHT	1-25 CHG IND GND	18 AWG	GXL	4460226		CO01-J2 (25)
5					4460226		
6	WHT	98-6 BAT FULL	18 AWG	GXL	4460226		CO01-J2 (35)

SW09 - MAIN TELESCOPE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	14-0 MAIN TELE OUT	18 AWG	GXL	1001159186		CO01-J1 (6)
2	YEL	5-14-2	18 AWG	GXL	4460419		SW06 (2)
2	YEL	5-14-3	18 AWG	GXL	4460419		SW05 (2)
3	WHT	13-0 MAIN TELE IN	18 AWG	GXL	1001159186		CO01-J1 (5)
4							
5							
6							

SW08 - JIB

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	28-0 JIB DN	18 AWG	GXL	1001159186		CO01-J1 (12)
2	YEL	5-14-5	18 AWG	GXL	4460419		SW02 (2)
2	YEL	5-14-6	18 AWG	GXL	4460419		SW495 (2)
3	WHT	27-0 JIB UP	18 AWG	GXL	1001159186		CO01-J1 (11)
4							
5							
6							

SW495 - SIDE SWING

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	31-0 SIDE SWING LEFT	18 AWG	GXL	1001159186		CO01-J1 (26)
2	YEL	5-14-6	18 AWG	GXL	4460419		SW08 (2)
2	YEL	5-14-7	18 AWG	GXL	4460419		SW04 (1)
3	WHT	32-0 SIDE SWING RIGHT	18 AWG	GXL	1001159186		CO01-J1 (25)
4							
5							
6							

SW06 - TOWER LIFT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	29-30 TWR LFT DN	18 AWG	GXL	1001159186		CO01-J1 (2)
2	YEL	5-14-1	18 AWG	GXL	4460419		SW305 (2)
2	YEL	5-14-1	18 AWG	GXL	4460419		SW305 (2)
2	YEL	5-14-2	18 AWG	GXL	4460419		SW09 (2)
3	WHT	29-0 TWR LFT UP	18 AWG	GXL	1001159186		CO01-J1 (1)
4							
5							
6							

SW05 - PLATFORM ROTATE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	23-0 PLAT ROT LFT	18 AWG	GXL	1001159186		CO01-J1 (8)
2	YEL	5-14-3	18 AWG	GXL	4460419		SW09 (2)
2	YEL	5-14-4	18 AWG	GXL	4460419		SW02 (2)
3	WHT	24-0 PLAT ROT RT	18 AWG	GXL	1001159186		CO01-J1 (7)
4							
5							
6							

GD143-J2

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	98-7 BAT LOW	18 AWG	GXL	4460226		CO01-J2 (13)
2	WHT	131-3 FUNC ENABLE	18 AWG	GXL	4460226		CO01-J2 (7)
3							
4							
5							
6	WHT	1-26 DISPLAY GND	18 AWG	GXL	4460226		CO01-J2 (18)

GD143-J4

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	129-1 TILT	18 AWG	GXL	4460226		CO01-J2 (6)
2	WHT	128-1 OVERLOAD	18 AWG	GXL	4460226		CO01-J2 (11)
3	WHT	127-1 SYS FAULT	18 AWG	GXL	4460226		CO01-J2 (8)
4	WHT	122-2 DOS	18 AWG	GXL	4460226		CO01-J2 (14)
5					4460226		
6							

GD143-J3

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	125-2 CREEP MODE	18 AWG	GXL	4460226		CO01-J2 (9)
2	WHT	130-1 SOFT TOUCH	18 AWG	GXL	4460226		CO01-J2 (19)
3	WHT	134 SKY GUARD	18 AWG	GXL	4460226		CO01-J2 (16)
4							
5							
6					4460226		

Figure 7-21. Platform Console Harness - Sheet 2 of 4

SW03-2 - HORN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	49-0-1 HORN	18 AWG	GXL	4460259		CO01-J1 (31)

SW03-1 - HORN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	5-14-8	18 AWG	GXL	4460259		SW04 (1)
1	YEL	5-14-9	18 AWG	GXL	4460259		SW11 (2)

SW305 - TORQUE/SPEED MODE							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	120-2 AWDA MAN	18 AWG	GXL	1001159186		CO01-J1 (28)
2	YEL	5-14-1	18 AWG	GXL	1001159186		SW06 (2)
3	WHT	120-1 TORQUE/SPEED MODE	18 AWG	GXL	1001159186		CO01-J1 (27)
4							
5							
6							

SW02 - PLATFORM LEVEL							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	26-0 PLAT LVL DN	18 AWG	GXL	1001159186		CO01-J1 (10)
2	YEL	5-14-4	18 AWG	GXL	4460419		SW05 (2)
2	YEL	5-14-5	18 AWG	GXL	4460419		SW08 (2)
3	WHT	25-0 PLAT LVL UP	18 AWG	GXL	1001159186		CO01-J1 (9)
4							
5							
6							

SW04 - PUMP POT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	5-14-7	18 AWG	GXL	4460267		SW495 (2)
1	YEL	5-14-8	18 AWG	GXL	4460267		SW03-1 (1)
2	YEL	5-14	18 AWG	GXL	4460267		CO01-J1 (18)
3	WHT	125-1 CREEP MODE	18 AWG	GXL	4460267		CO01-J1 (32)
4	WHT	126-1 PUMP POT PWR	18 AWG	GXL	4460267		CO01-J1 (34)
5	WHT	1-23 PUMP POT RETURN	18 AWG	GXL	4460267		CO01-J1 (13)
6	WHT	126-2 PUMP POT CMD	18 AWG	GXL	4460267		CO01-J1 (35)

AH12- - ALARM -							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-27 ALARM GND	18 AWG	GXL			CO01-J7 (20)

AH12+ - ALARM +							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	132 PLAT ALARM	18 AWG	GXL			CO01-J7 (19)
1							

X19 - ANALYZER							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	51-0 ANALYZER PWR	18 AWG	GXL	4460227		CO01-J2 (26)
2	GRN	52-0 ANALYZER RX	18 AWG	GXL	4460227		CO01-J2 (28)
3	WHT	53-0 ANALYZER TX	18 AWG	GXL	4460227		CO01-J2 (29)
4	BLK	54-0 ANALYZER GND	18 AWG	GXL	4460227		CO01-J2 (27)

CO01-J7 - BLACK							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	81-0 GND MODE RX	18 AWG	GXL	4460871		X5B (11)
1	WHT	132 PLAT ALARM	18 AWG	GXL	4460871		AH12+ (1)
1					4460871		
2	YEL	5-11-3	18 AWG	GXL	4460871		SW16-2A (2A)
3	WHT	82-0 PLAT TX	18 AWG	GXL	4460871		X5B (4)
4	WHT	3-16 FOOTSWITCH	18 AWG	GXL	4460871		X7A (5)
5					4460905		
6					4460905		
7	WHT	3-18 SKYG PWR	18 AWG	GXL	4460871		X7A (7)
8	WHT	131-1 FOOT SWITCH	18 AWG	GXL	4460871		X7A (4)
9					4460905		
10					4460905		
11					4460905		
12					4460905		
13					4460905		
14					4460905		
15					4460905		
16	WHT	1-28 LSS GND	18 AWG	GXL	4460871		X7A (14)
17					4460905		
18	WHT	124-1 SKYG INPUT#1	18 AWG	GXL	4460871		X7A (10)
19					4460871		
20	WHT	1-27 ALARM GND	18 AWG	GXL	4460871		AH12- (1)
21	WHT	25-0-3 PLAT LVL UP	18 AWG	GXL	4460871		X6A (13)
22	WHT	26-0-3 PLAT LVL DN	18 AWG	GXL	4460871		X6A (14)
23	WHT	1-30 VLV GND	18 AWG	GXL	4460871		X6A (5)
24	WHT	1-36 SKYG GND	18 AWG	GXL	4460871		X7A (8)
25	WHT	27-0-3 JIB UP	18 AWG	GXL	4460871		X6A (3)
26	WHT	28-0-3 JIB DN	18 AWG	GXL	4460871		X6A (4)
27	WHT	31-0-3 JIB RHT	18 AWG	GXL	4460871		X6A (11)
28	WHT	30-0-3 JIB LFT	18 AWG	GXL	4460871		X6A (12)
29	WHT	1-29 OPTION GND	18 AWG	GXL	4460871		X6A (6)
30	GRN	CAN1 LOW	18 AWG	GXL	4460871		MS588 (3)
31	YEL	CAN1 HIGH	18 AWG	GXL	4460871		MS588 (1)
32					4460905		
33	WHT	23-0-3 PLAT ROT LFT	18 AWG	GXL	4460871		X6A (1)
34	WHT	24-0-3 PLAT ROT RHT	18 AWG	GXL	4460871		X6A (2)
35					4460905		
NC					4460871		

X6A - OPTIONS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	23-0-3 PLAT ROT LFT	18 AWG	GXL	4460226		CO01-J7 (33)
2	WHT	24-0-3 PLAT ROT RHT	18 AWG	GXL	4460226		CO01-J7 (34)
3	WHT	27-0-3 JIB UP	18 AWG	GXL	4460226		CO01-J7 (25)
4	WHT	28-0-3 JIB DN	18 AWG	GXL	4460226		CO01-J7 (26)
5	WHT	1-30 VLV GND	18 AWG	GXL	4460226		CO01-J7 (23)
6	WHT	1-29 OPTION GND	18 AWG	GXL	4460226		CO01-J7 (29)
7							
8	YEL	CAN1 HIGH	18 AWG	GXL	4460226		MS588 (8)
9	GRN	CAN1 LOW	18 AWG	GXL	4460226		MS588 (6)
10							
11	WHT	31-0-3 JIB RHT	18 AWG	GXL	4460226		CO01-J7 (27)
12	WHT	30-0-3 JIB LFT	18 AWG	GXL	4460226		CO01-J7 (28)
13	WHT	25-0-3 PLAT LVL UP	18 AWG	GXL	4460226		CO01-J7 (21)
14	WHT	26-0-3 PLAT LVL DN	18 AWG	GXL	4460226		CO01-J7 (22)
15							

MS588 - CAN BUSS BAR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	CAN1 HIGH	18 AWG	GXL	4460465		CO01-J7 (31)
2					4460466		
3	GRN	CAN1 LOW	18 AWG	GXL	4460465		CO01-J7 (30)
4					4460466		
5	GRN	CAN1 LOW	18 AWG	GXL	4460465		X5B (2)
6	GRN	CAN1 LOW	18 AWG	GXL	4460465		X6A (9)
7	YEL	CAN1 HIGH	18 AWG	GXL	4460465		X5B (3)
8	YEL	CAN1 HIGH	18 AWG	GXL	4460465		X6A (8)

Figure 7-22. Platform Console Harness - Sheet 3 of 4

X5B - TO BOOM CABLE							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460466		
2	GRN	CAN1 LOW	18 AWG	GXL	4460464		MS588 (5)
3	YEL	CAN1 HIGH	18 AWG	GXL	4460464		MS588 (7)
4	WHT	82-0 PLAT TX	18 AWG	GXL	4460464		CO01-J7 (3)
5	WHT	8-3 GEN ENABLE	18 AWG	GXL	4460464		SW292 (3)
6	GRN	131-2 FOOT PEDAL	18 AWG	GXL	4460464		X7A (6)
7	WHT	2-12-2 GEN ENABLE IGN	18 AWG	GXL	4460464		SW292 (2)
8					4460466		
9	YEL	5-11-2	18 AWG	GXL	4460464		SW16-1A (1A)
10					4460466		
11	WHT	81-0 GND MODE RX	18 AWG	GXL	4460464		CO01-J7 (1)
12	YEL	3-8 PLAT IGN	12 AWG	GXL	4460508		CO01-J8 (2)
13	YEL	5-2-6	18 AWG	GXL	4460464		SW16-1B (1B)
14					4460466		
15	YEL	5-2-5	18 AWG	GXL	4460464		SW16-2B (2B)
16	BLK	1-5 PLAT GND	12 AWG	GXL	4460508		CO01-J8 (1)
17					4460466		
18					4460466		
19					4460466		

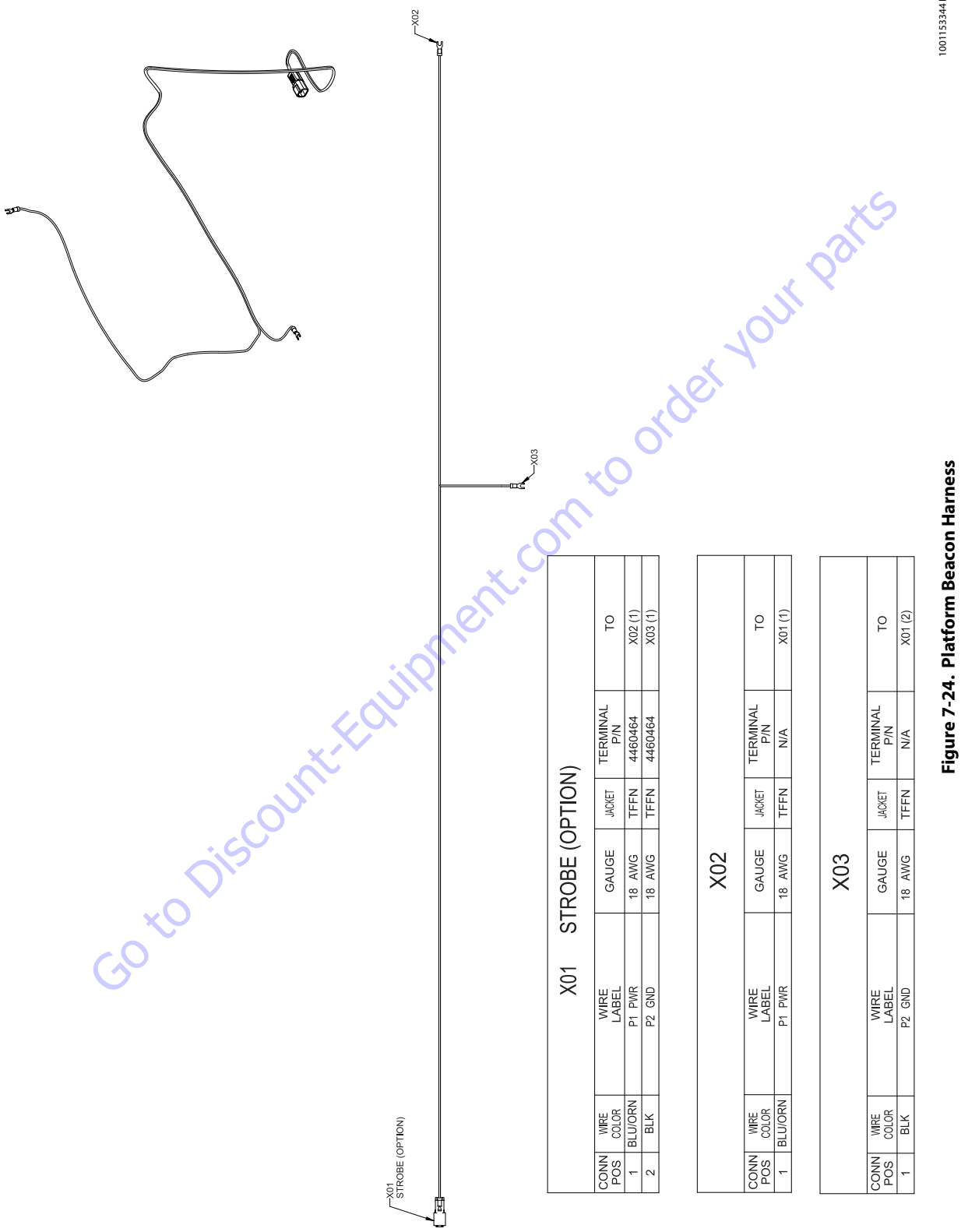
CO01-J1 - NATURAL							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	29-0 TWR LFT UP	18 AWG	GXL	4460871		SW06 (3)
2	WHT	29-30 TWR LFT DN	18 AWG	GXL	4460871		SW06 (1)
3					4460905		
4					4460905		
5	WHT	13-0 MAIN TELE IN	18 AWG	GXL	4460871		SW09 (3)
6	WHT	14-0 MAIN TELE OUT	18 AWG	GXL	4460871		SW09 (1)
7	WHT	24-0 PLAT ROT RT	18 AWG	GXL	4460871		SW05 (3)
8	WHT	23-0 PLAT ROT LFT	18 AWG	GXL	4460871		SW05 (1)
9	WHT	25-0 PLAT LVL UP	18 AWG	GXL	4460871		SW02 (3)
10	WHT	26-0 PLAT LVL DN	18 AWG	GXL	4460871		SW02 (1)
11	WHT	27-0 JIB UP	18 AWG	GXL	4460871		SW08 (3)
12	WHT	28-0 JIB DN	18 AWG	GXL	4460871		SW08 (1)
13	WHT	1-23 PUMP POT RETURN	18 AWG	GXL	4460871		SW04 (5)
14					4460905		
15					4460905		
16					4460905		
17					4460905		
18	YEL	5-14	18 AWG	GXL	4460871		SW04 (2)
19					4460905		
20	WHT	124-5 SOFTT	18 AWG	GXL	4460871		X7A (12)
21					4460905		
22					4460905		
23	WHT	124-2 SKYG INPUT#2	18 AWG	GXL	4460871		X7A (11)
24					4460905		
25	WHT	32-0 SIDE SWING RIGHT	18 AWG	GXL	4460871		SW495 (3)
26	WHT	31-0 SIDE SWING LEFT	18 AWG	GXL	4460871		SW495 (1)
27	WHT	120-1 TORQUE/SPEED MODE	18 AWG	GXL	4460871		SW305 (3)
28	WHT	120-2 AWDA MAN	18 AWG	GXL	4460871		SW305 (1)
29	WHT	124-3 OVERRIDE	18 AWG	GXL	4460871		SW546-1 (1)
30	WHT	88-1 HEAD/TAIL LT	18 AWG	GXL	4460871		SW07-1 (1)
31	WHT	49-0-1 HORN	18 AWG	GXL	4460871		SW03-2 (1)
32	WHT	125-1 CREEP MODE	18 AWG	GXL	4460871		SW04 (3)
33					4460905		
34	WHT	126-1 PUMP POT PWR	18 AWG	GXL	4460871		SW04 (4)
35	WHT	126-2 PUMP POT CMD	18 AWG	GXL	4460871		SW04 (6)

CO01-J2 - GRAY							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2					4460905		
3					4460905		
4	WHT	122-1 DOS	18 AWG	GXL	4460871		SW11 (1)
5					4460905		
6	WHT	129-1 TILT	18 AWG	GXL	4460871		GD143-J4 (1)
7	WHT	131-3 FUNC ENABLE	18 AWG	GXL	4460871		GD143-J2 (2)
8	WHT	127-1 SYS FAULT	18 AWG	GXL	4460871		GD143-J4 (3)
9	WHT	125-2 CREEP MODE	18 AWG	GXL	4460871		GD143-J3 (1)
10					4460905		
11	WHT	128-1 OVERLOAD	18 AWG	GXL	4460871		GD143-J4 (2)
12					4460905		
13	WHT	98-7 BAT LOW	18 AWG	GXL	4460871		GD143-J2 (1)
14	WHT	122-2 DOS	18 AWG	GXL	4460871		GD143-J4 (4)
15					4460905		
16	WHT	134 SKY GUARD	18 AWG	GXL	4460871		GD143-J3 (3)
17					4460905		
18	WHT	1-26 DISPLAY GND	18 AWG	GXL	4460871		GD143-J2 (6)
19	WHT	130-1 SOFT TOUCH	18 AWG	GXL	4460871		GD143-J3 (2)
20					4460905		
21					4460905		
22	WHT	98-3 1/4 BAT CHG	18 AWG	GXL	4460871		GD143-J1 (1)
23	WHT	98-5 3/4 BAT CHG	18 AWG	GXL	4460871		GD143-J1 (3)
24	WHT	98-4 1/2 BAT CHG	18 AWG	GXL	4460871		GD143-J1 (2)
25	WHT	1-25 CHG IND GND	18 AWG	GXL	4460871		GD143-J1 (4)
26	RED	51-0 ANALYZER PWR	18 AWG	GXL	4460871		X19 (1)
27	BLK	54-0 ANALYZER GND	18 AWG	GXL	4460871		X19 (4)
28	GRN	52-0 ANALYZER RX	18 AWG	GXL	4460871		X19 (2)
29	WHT	53-0 ANALYZER TX	18 AWG	GXL	4460871		X19 (3)
30					4460905		
31	WHT	3-25 SOFTT PWR	18 AWG	GXL	4460871		X7A (9)
32	WHT	3-20 LSS PWR	18 AWG	GXL	4460871		X7A (15)
33					4460905		
34					4460905		
35	WHT	98-6 BAT FULL	18 AWG	GXL	4460871		GD143-J1 (6)

X7A - FOOT SW/LSS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1							
2							
3	WHT	1-551 JUMPER	18 AWG	GXL	4460227		X7A (13)
4	WHT	131-1 FOOT SWITCH	18 AWG	GXL	4460227		CO01-J7 (8)
5	WHT	3-16 FOOTSWITCH	18 AWG	GXL	4460227		CO01-J7 (4)
6	GRN	131-2 FOOT PEDAL	18 AWG	GXL	4460227		X5B (6)
7	WHT	3-18 SKYG PWR	18 AWG	GXL	4460227		CO01-J7 (7)
8	WHT	1-36 SKYG GND	18 AWG	GXL	4460227		CO01-J7 (24)
9	WHT	3-25 SOFTT PWR	18 AWG	GXL	4460227		CO01-J2 (31)
10	WHT	124-1 SKYG INPUT#1	18 AWG	GXL	4460227		CO01-J7 (18)
11	WHT	124-2 SKYG INPUT#2	18 AWG	GXL	4460227		CO01-J1 (23)
12	WHT	124-5 SOFTT	18 AWG	GXL	4460227		CO01-J1 (20)
13	WHT	1-551 JUMPER	18 AWG	GXL	4460227		X7A (3)
14	WHT	1-28 LSS GND	18 AWG	GXL	4460227		CO01-J7 (16)
15	WHT	3-20 LSS PWR	18 AWG	GXL	4460227		CO01-J2 (32)

CO01-J8							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-5 PLAT GND	12 AWG	GXL	4460887		X5B (16)
2	YEL	3-8 PLAT IGN	12 AWG	GXL	4460887		X5B (12)

Figure 7-23. Platform Console Harness - Sheet 4 of 4



X01 STROBE (OPTION)

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	TO
1	BLU/ORN	P1 PWR	18 AWG	TFFN	4460464	X02 (1)
2	BLK	P2 GND	18 AWG	TFFN	4460464	X03 (1)

X02

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	TO
1	BLU/ORN	P1 PWR	18 AWG	TFFN	N/A	X01 (1)

X03

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	TO
1	BLK	P2 GND	18 AWG	TFFN	N/A	X01 (2)

Figure 7-24. Platform Beacon Harness

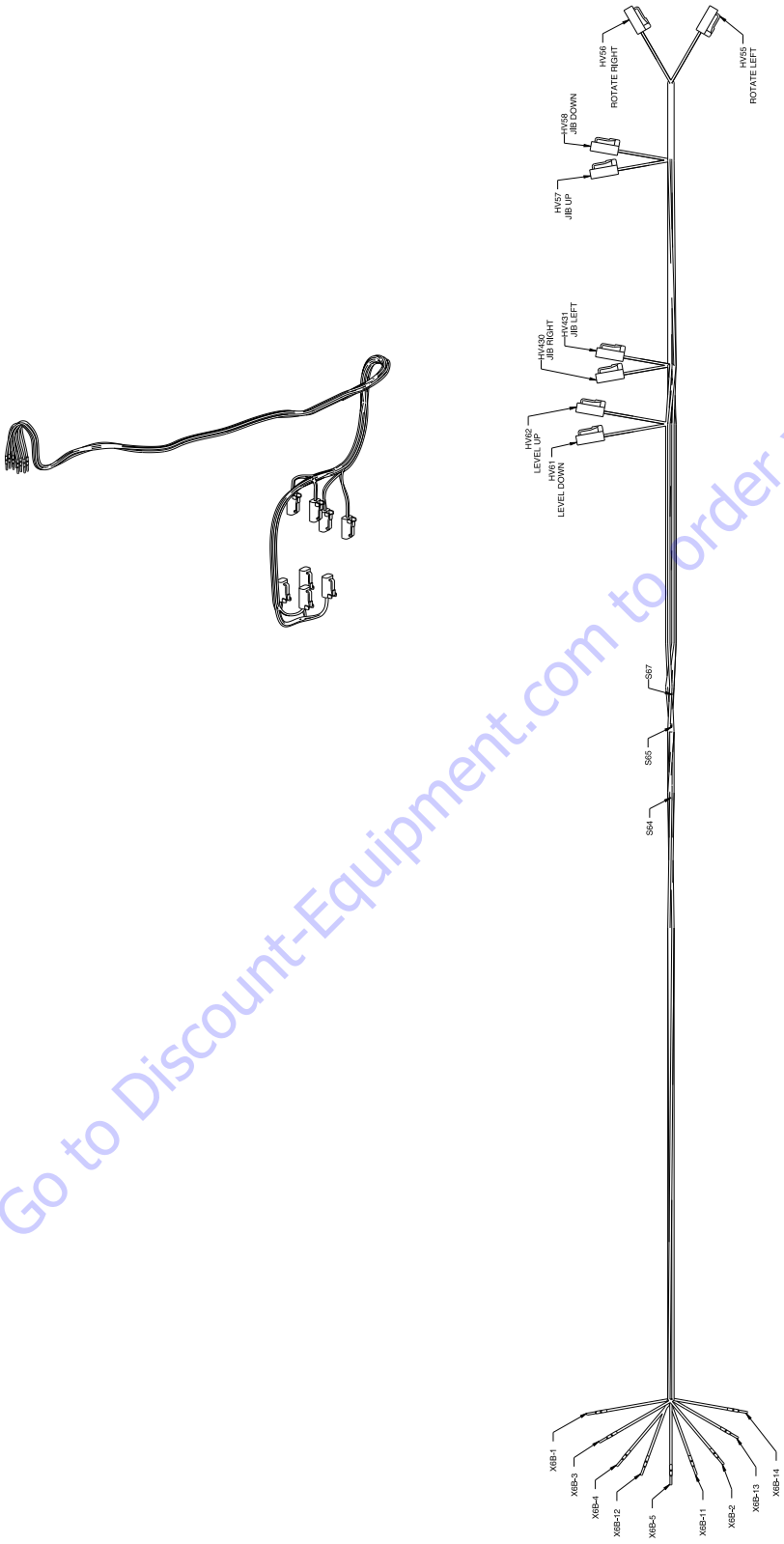


Figure 7-25. Upper Valve Harness - Sheet 1 of 2

X6B-1 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	173-1 PLAT ROT LEFT	18 AWG	GXL	N/A		HV55 (1)

X6B-3 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	171-1 JIB UP	18 AWG	GXL	N/A		HV57 (1)

X6B-4 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	170-1 JIB DOWN	18 AWG	GXL	N/A		HV58 (1)

X6B-12 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	115-2 JIB SWING LEFT	18 AWG	GXL	N/A		HV431 (1)

X6B-2 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	172-1 PLAT ROT RIGHT	18 AWG	GXL	N/A		HV56 (1)

X6B-11 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	115-1 JIB SWING RIGHT	18 AWG	GXL	N/A		HV430 (1)

X6B-5 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-24 VALVE RETURN	18 AWG	GXL	N/A		S64 (2)

X6B-13 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	113-3 PLAT LEVEL UP	18 AWG	GXL	N/A		HV62 (1)

X6B-14 - TO CONSOLE HARNESS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	114-3 PLAT LEVEL DOWN	18 AWG	GXL	N/A		HV61 (1)

S64							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-24-1 PLATFORM GND	18 AWG	GXL	N/A		S67 (1)
1	WHT	1-24-2 JIB GND	18 AWG	GXL	N/A		S65 (1)
2	WHT	1-24 VALVE RETURN	18 AWG	GXL	N/A		X6B-5 (1)

S65							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-24-2 JIB GND	18 AWG	GXL	N/A		S64 (1)
1	WHT	1-24-9 JIB RIGHT GND	18 AWG	GXL	N/A		HV430 (2)
2	WHT	1-24-6 JIB UP GND	18 AWG	GXL	N/A		HV57 (2)
2	WHT	1-24-7 JIB DOWN GND	18 AWG	GXL	N/A		HV58 (2)
2	WHT	1-24-8 JIB LEFT GND	18 AWG	GXL	N/A		HV431 (2)

S67							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-24-1 PLATFORM GND	18 AWG	GXL	N/A		S64 (1)
1	WHT	1-24-5 PLAT LEVEL UP GND	18 AWG	GXL	N/A		HV62 (2)
2	WHT	1-24-10 PLAT LEVEL DOWN GND	18 AWG	GXL	N/A		HV61 (2)
2	WHT	1-24-3 PLAT ROT LEFT GND	18 AWG	GXL	N/A		HV55 (2)
2	WHT	1-24-4 PLAT ROT RIGHT GND	18 AWG	GXL	N/A		HV56 (2)

HV57 - JIB UP							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	171-1 JIB UP	18 AWG	GXL	4460465		X6B-3 (1)
2	WHT	1-24-6 JIB UP GND	18 AWG	GXL	4460465		S65 (2)

HV58 - JIB DOWN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	170-1 JIB DOWN	18 AWG	GXL	4460465		X6B-4 (1)
2	WHT	1-24-7 JIB DOWN GND	18 AWG	GXL	4460465		S65 (2)

HV56-ROTATE RIGHT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	172-1 PLAT ROT RIGHT	18 AWG	GXL	4460465		X6B-2 (1)
2	WHT	1-24-4 PLAT ROT RIGHT GND	18 AWG	GXL	4460465		S67 (2)

HV55 - ROTATE LEFT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	173-1 PLAT ROT LEFT	18 AWG	GXL	4460465		X6B-1 (1)
2	WHT	1-24-3 PLAT ROT LEFT GND	18 AWG	GXL	4460465		S67 (2)

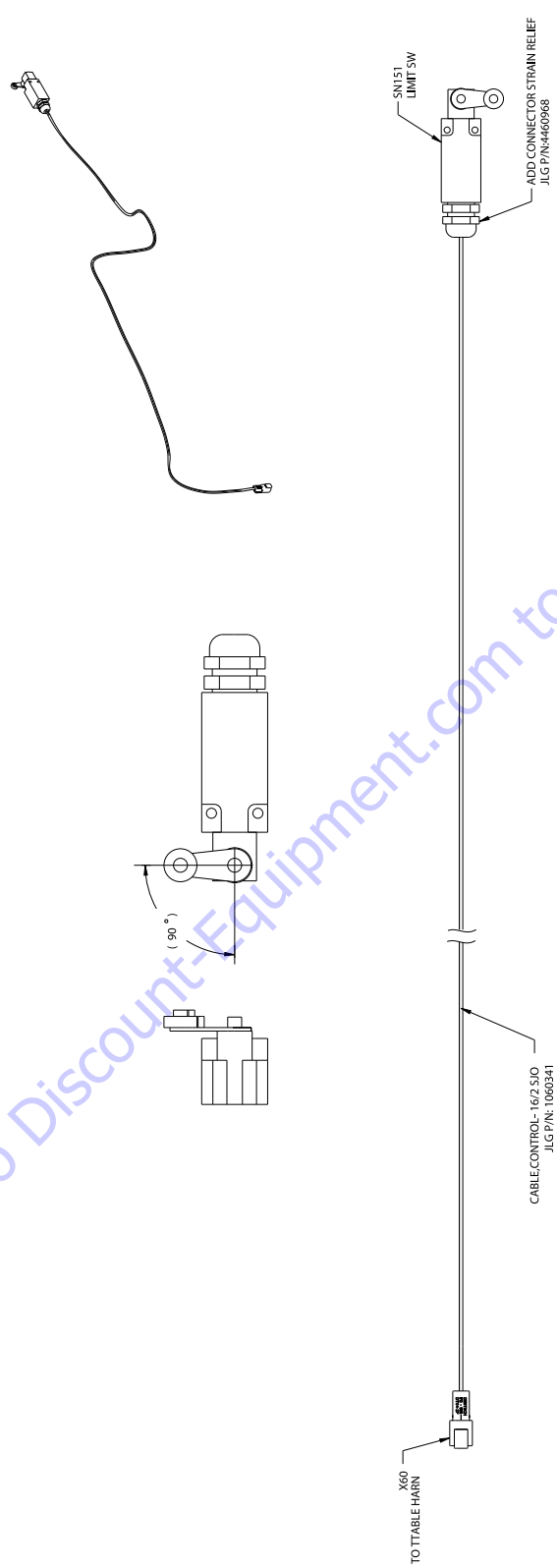
HV61- LEVEL DOWN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	114-3 PLAT LEVEL DOWN	18 AWG	GXL	4460465		X6B-14 (1)
2	WHT	1-24-10 PLAT LEVEL DOWN GND	18 AWG	GXL	4460465		S67 (2)

HV62- LEVEL UP							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	113-3 PLAT LEVEL UP	18 AWG	GXL	4460465		X6B-13 (1)
2	WHT	1-24-5 PLAT LEVEL UP GND	18 AWG	GXL	4460465		S67 (1)

HV430 - JIB RIGHT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	115-1 JIB SWING RIGHT	18 AWG	GXL	4460465		X6B-11 (1)
2	WHT	1-24-9 JIB RIGHT GND	18 AWG	GXL	4460465		S65 (1)

HV431 - JIB LEFT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	115-2 JIB SWING LEFT	18 AWG	GXL	4460465		X6B-12 (1)
2	WHT	1-24-8 JIB LEFT GND	18 AWG	GXL	4460465		S65 (2)

Figure 7-26. Upper Valve Harness - Sheet 2 of 2



SN151 - LIMIT SW

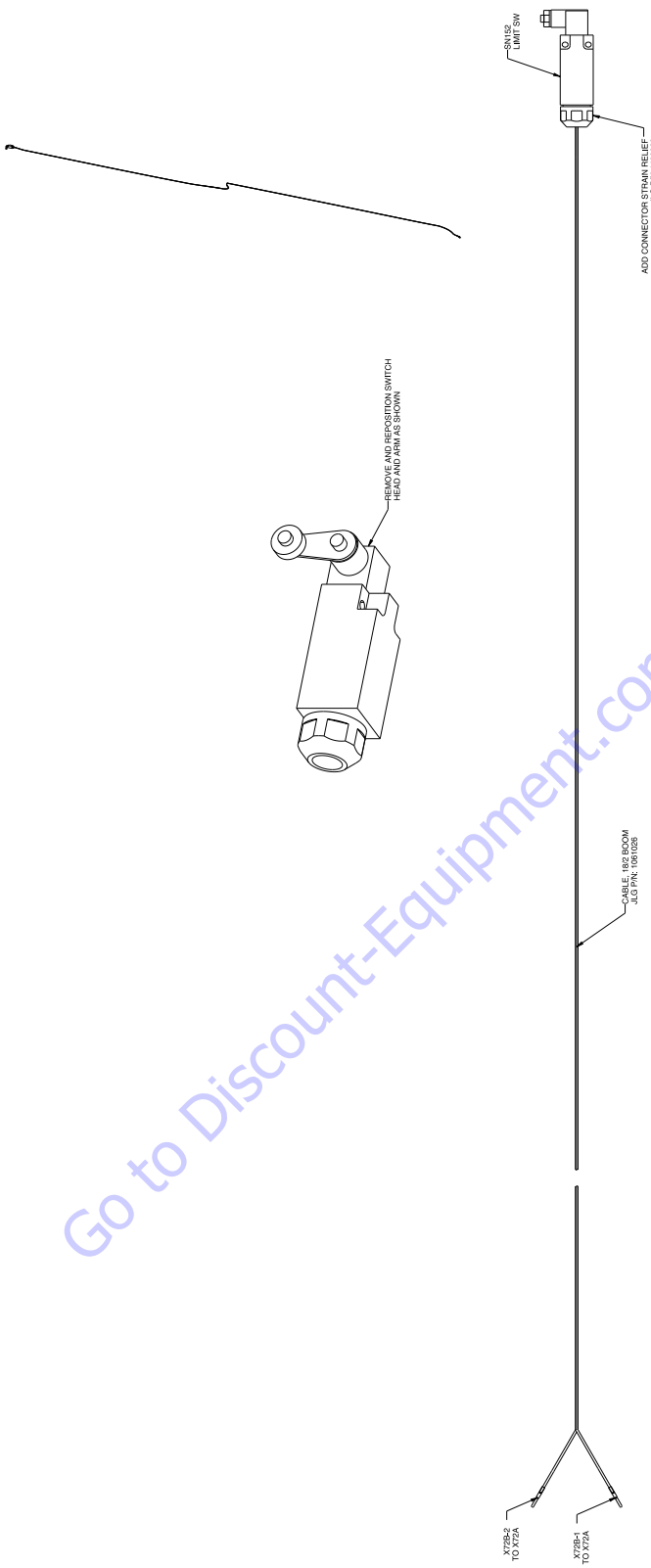
CONNECTOR PART NUMBER:			4360579					
CONN POS.	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
21	WHT		16 AWG	CABLE			X60 (1)
22	BLK		16 AWG	CABLE			X60 (2)
NC							
NC							

X60 - TO TTABLE HARN

CONNECTOR PART NUMBER:		4460897					
CONN POS.	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT		16 AWG	CABLE	4460464		SN151 (21)
2	BLK		16 AWG	CABLE	4460464		SN151 (22)

1001200173 C

Figure 7-27. Boom Limit Switch Harness



SN152 - LIMIT SW

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
21	WHT		18 AWG	CABLE			X72B-1 (1)
22	BLK		18 AWG	CABLE			X72B-2 (1)
NC							
NC1							

X72B-2 - TO X72A

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK		18 AWG	CABLE	N/A		SN152 (22)

X72B-1 - TO X72A

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT		18 AWG	CABLE	N/A		SN152 (21)

1001201247 B

Figure 7-28. Transport Limit Switch Harness

X71-TO LIMIT SWITCH							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	71-0 TRANSPORT SW	18 AWG	GXL	4460465		X72A (1)
2	BLK	72-0 TRANSPORT SW	18 AWG	GXL	4460465		X70 (1)

X72A - TO TRANSPORT SW							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	71-0 TRANSPORT SW	18 AWG	GXL	4460465		X71 (1)
2	BLK	70-0 TRANSPORT SW	18 AWG	GXL	4460465		X70 (2)

X70 - TO TTABLE HARN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	72-0 TRANSPORT SW	18 AWG	GXL	4460464		X71 (2)
2	BLK	70-0 TRANSPORT SW	18 AWG	GXL	4460464		X72A (2)

Figure 7-29. Transport Boom Harness

1001201329 D

Figure 7-30. Load Sensing System Harness (LSS) - Sheet 1 of 2

T394 - LSS GND							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-28 LSS GND	18 AWG	GXL	N/A		CO44-J1 (2)

T395 - LSS PWR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-20 LSS PWR	18 AWG	GXL	N/A		CO44-J1 (1)

T393 - CAN SHD							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	SHLD	TP CAN CABLE	20 AWG	J1939 CABLE	N/A		CO44-J2 (NC)

T392 - CAN LO							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	GRN	TP CAN CABLE	20 AWG	J1939 CABLE	N/A		CO44-J2 (9)

T391 - CAN HI							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	TP CAN CABLE	20 AWG	J1939 CABLE	N/A		CO44-J2 (4)

CO44-J2 - LSS CAN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460466		
2					4460466		
3					4460466		
4	YEL	TP CAN CABLE	20 AWG	J1939 CABLE	4460944		T391 (1)
5					4460466		
6					4460466		
7					4460466		
8					4460466		
9	GRN	TP CAN CABLE	20 AWG	J1939 CABLE	4460944		T392 (1)
10					4460466		
11					4460466		
12					4460466		
NC	SHLD	TP CAN CABLE	20 AWG	J1939 CABLE	N/A		T393 (1)

CO44-J1 - LSS PWR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-20 LSS PWR	18 AWG	GXL	4460465		T395 (1)
2	WHT	1-28 LSS GND	18 AWG	GXL	4460465		T394 (1)
3					4460466		
4					4460466		
5					4460466		
6					4460466		
7					4460466		
8					4460466		
9					4460466		
10					4460466		
11					4460466		
12					4460466		

Figure 7-31. Load Sensing System Harness (LSS) - Sheet 2 of 2

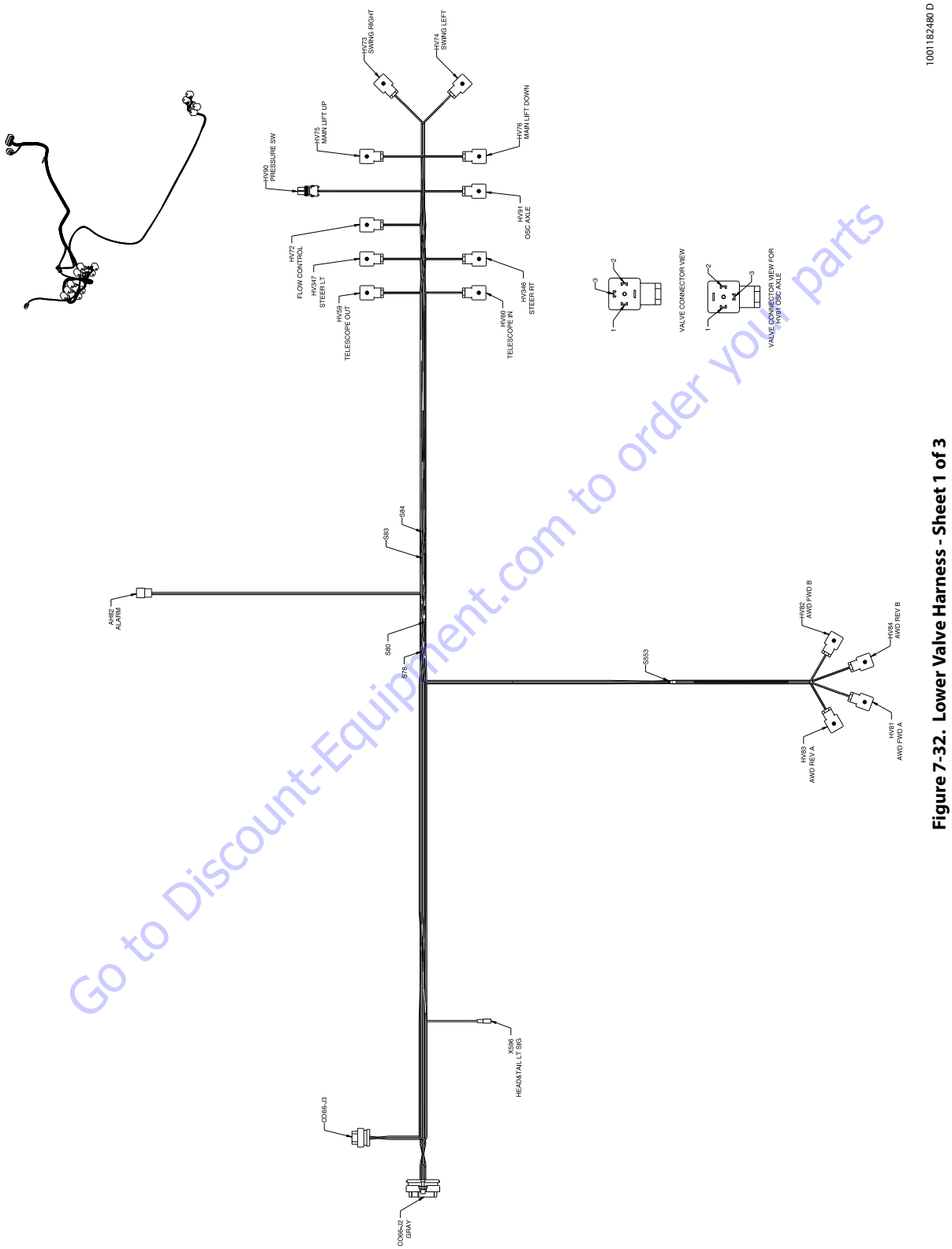


Figure 7-32. Lower Valve Harness - Sheet 1 of 3

CO66-J2 - GRAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2					4460905		
3	WHT	107-3 TELE IN	18 AWG	GXL	4460871		HV60 (1)
4					4460905		
5	WHT	155-1 AWD FWD A	18 AWG	GXL	4460871		HV81 (1)
6					4460905		
7	WHT	155-2 AWD FWD B	18 AWG	GXL	4460871		HV82 (1)
8					4460905		
9					4460905		
10	WHT	155-3 AWD REV A	18 AWG	GXL	4460871		HV83 (1)
11	WHT	101-3 MAIN LIFT UP	18 AWG	GXL	4460871		HV75 (1)
12					4460905		
13					4460905		
14	WHT	1-55 AWD GND	18 AWG	GXL	4460871		S553 (2)
15	WHT	108-3 TELE OUT	18 AWG	GXL	4460871		HV59 (1)
16					4460905		
17	WHT	1-18 TELE RETURN	18 AWG	GXL	4460871		S83 (2)
18	WHT	201-2 OSC AXLE RETURN	18 AWG	GXL	4460871		HV91 (2)
19	WHT	201-1 OSC AXLE	18 AWG	GXL	4460871		HV91 (1)
20					4460905		
21	WHT	155-4 AWD REV B	18 AWG	GXL	4460871		HV84 (1)
22	WHT	102-3 MAIN LIFT DOWN	18 AWG	GXL	4460871		HV76 (1)
23					4460905		
24	WHT	200-1 PRESS SW	18 AWG	GXL	4460871		HV90 (1)
25					4460905		
26	WHT	88-2-1 LIGHTING	16 AWG	GXL	4460871		X596 (1)
27	WHT	99-2 GROUND ALARM SIGNAL	18 AWG	GXL	4460871		AH82 (B)
28	WHT	1-18-1 STEER RETURN	18 AWG	GXL	4460871		S80 (2)
29	WHT	1-21 GROUND ALARM GND	18 AWG	GXL	4460871		AH82 (C)
30	WHT	200-2 PRESS SW RETURN	18 AWG	GXL	4460871		HV90 (2)
31	WHT	115-3 FLOW COTROL	18 AWG	GXL	4460871		HV72 (1)
32	WHT	78-1 STEER RT	18 AWG	GXL	4460871		HV346 (1)
33	WHT	79-1 STEER LT	18 AWG	GXL	4460871		HV347 (1)
34	WHT	103-3 SWING LT	18 AWG	GXL	4460871		HV74 (1)
35	WHT	104-3 SWING RT	18 AWG	GXL	4460871		HV73 (1)

CO66-J3

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2	WHT	1-19 MAIN LIFT RETURN	18 AWG	GXL	4460871		S78 (2)
3					4460905		
4	WHT	1-18-3 SWING RETURN	18 AWG	GXL	4460871		S84 (2)
5					4460905		
6	WHT	1-15 FLOW CONTROL RETURN	18 AWG	GXL	4460871		HV72 (2)
7	WHT	99-1 GROUND ALARM POWER	18 AWG	GXL	4460871		AH82 (A)
8					4460905		
9					4460905		
10					4460905		
11					4460905		
12					4460905		
13					4460905		
14					4460905		

AH82 - ALARM

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	WHT	99-1 GROUND ALARM POWER	18 AWG	GXL	4460465		CO66-J3 (7)
B	WHT	99-2 GROUND ALARM SIGNAL	18 AWG	GXL	4460465		CO66-J2 (27)
C	WHT	1-21 GROUND ALARM GND	18 AWG	GXL	4460465		CO66-J2 (29)

X596 - HEAD&TAIL LT SIG

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	88-2-1 LIGHTING	16 AWG	GXL	N/A		CO66-J2 (26)

S78

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-19-1 MAIN LIFT UP GND	18 AWG	GXL	N/A		HV75 (2)
1	WHT	1-19-2 MAIN LIFT DOWN GND	18 AWG	GXL	N/A		HV76 (2)
2	WHT	1-19 MAIN LIFT RETURN	18 AWG	GXL	N/A		CO66-J3 (2)

S553

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-55-1 AWD FWD A GND	18 AWG	GXL	N/A		HV81 (2)
1	WHT	1-55-2 AWD FWD B GND	18 AWG	GXL	N/A		HV82 (2)
1	WHT	1-55-3 AWD REV A GND	18 AWG	GXL	N/A		HV83 (2)
1	WHT	1-55-4 AWD REV B GND	18 AWG	GXL	N/A		HV84 (2)
2	WHT	1-55 AWD GND	18 AWG	GXL	N/A		CO66-J2 (14)

HV83 - AWD REV A

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	155-3 AWD REV A	18 AWG	GXL	N/A		CO66-J2 (10)
2	WHT	1-55-3 AWD REV A GND	18 AWG	GXL	N/A		S553 (1)

HV81 - AWD FWD A

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	155-1 AWD FWD A	18 AWG	GXL	N/A		CO66-J2 (5)
2	WHT	1-55-1 AWD FWD A GND	18 AWG	GXL	N/A		S553 (1)

S80

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-18-7 STEER RIGHT GND	18 AWG	GXL	N/A		HV346 (2)
1	WHT	1-18-8 STEER LEFT GND	18 AWG	GXL	N/A		HV347 (2)
2	WHT	1-18-1 STEER RETURN	18 AWG	GXL	N/A		CO66-J2 (28)

S83

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-18-6 TELE OUT GND	18 AWG	GXL	N/A		HV59 (2)
1	WHT	1-18-9 TELE IN GND	18 AWG	GXL	N/A		HV60 (2)
2	WHT	1-18 TELE RETURN	18 AWG	GXL	N/A		CO66-J2 (17)

S84

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-18-10 SWING LEFT GND	18 AWG	GXL	N/A		HV74 (2)
1	WHT	1-18-4 SWING RIGHT GND	18 AWG	GXL	N/A		HV73 (2)
2	WHT	1-18-3 SWING RETURN	18 AWG	GXL	N/A		CO66-J3 (4)

HV59 - TELESCOPE OUT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	108-3 TELE OUT	18 AWG	GXL	N/A		CO66-J2 (15)
2	WHT	1-18-6 TELE OUT GND	18 AWG	GXL	N/A		S83 (1)

HV347 - STEER LT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	79-1 STEER LT	18 AWG	GXL	N/A		CO66-J2 (33)
2	WHT	1-18-8 STEER LEFT GND	18 AWG	GXL	N/A		S80 (1)

HV72 - FLOW CONTROL

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	115-3 FLOW COTROL	18 AWG	GXL	N/A		CO66-J2 (31)
2	WHT	1-15 FLOW CONTROL RETURN	18 AWG	GXL	N/A		CO66-J3 (6)

HV75 - MAIN LIFT UP

CONNECTOR PART NUMBER: 4460449

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	101-3 MAIN LIFT UP	18 AWG	GXL	N/A		CO66-J2 (11)
2	WHT	1-19-1 MAIN LIFT UP GND	18 AWG	GXL	N/A		S78 (1)

HV73 - SWING RIGHT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	104-3 SWING RT	18 AWG	GXL	N/A		CO66-J2 (35)
2	WHT	1-18-4 SWING RIGHT GND	18 AWG	GXL	N/A		S84 (1)

HV90 - PRESSURE SW

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	200-1 PRESS SW	18 AWG	GXL	4460743	4460458	CO66-J2 (24)
2	WHT	200-2 PRESS SW RETURN	18 AWG	GXL	4460743	4460458	CO66-J2 (30)

Figure 7-33. Lower Valve Harness - Sheet 2 of 3

HV91- OSC AXLE							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	201-1 OSC AXLE	18 AWG	GXL	N/A		CO66-J2 (19)
2	WHT	201-2 OSC AXLE RETURN	18 AWG	GXL	N/A		CO66-J2 (18)

HV74 - SWING LEFT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	103-3 SWING LT	18 AWG	GXL	N/A		CO66-J2 (34)
2	WHT	1-18-10 SWING LEFT GND	18 AWG	GXL	N/A		S84 (1)

HV346 - STEER RT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	78-1 STEER RT	18 AWG	GXL	N/A		CO66-J2 (32)
2	WHT	1-18-7 STEER RIGHT GND	18 AWG	GXL	N/A		S80 (1)

HV76 - MAIN LIFT DOWN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	102-3 MAIN LIFT DOWN	18 AWG	GXL	N/A		CO66-J2 (22)
2	WHT	1-19-2 MAIN LIFT DOWN GND	18 AWG	GXL	N/A		S78 (1)

HV60 - TELESCOPE IN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	107-3 TELE IN	18 AWG	GXL	N/A		CO66-J2 (3)
2	WHT	1-18-9 TELE IN GND	18 AWG	GXL	N/A		S83 (1)

HV82 - AWD FWD B							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	155-2 AWD FWD B	18 AWG	GXL	N/A		CO66-J2 (7)
2	WHT	1-55-2 AWD FWD B GND	18 AWG	GXL	N/A		S553 (1)

HV84 - AWD REV B							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	155-4 AWD REV B	18 AWG	GXL	N/A		CO66-J2 (21)
2	WHT	1-55-4 AWD REV B GND	18 AWG	GXL	N/A		S553 (1)

Figure 7-34. Lower Valve Harness - Sheet 3 of 3

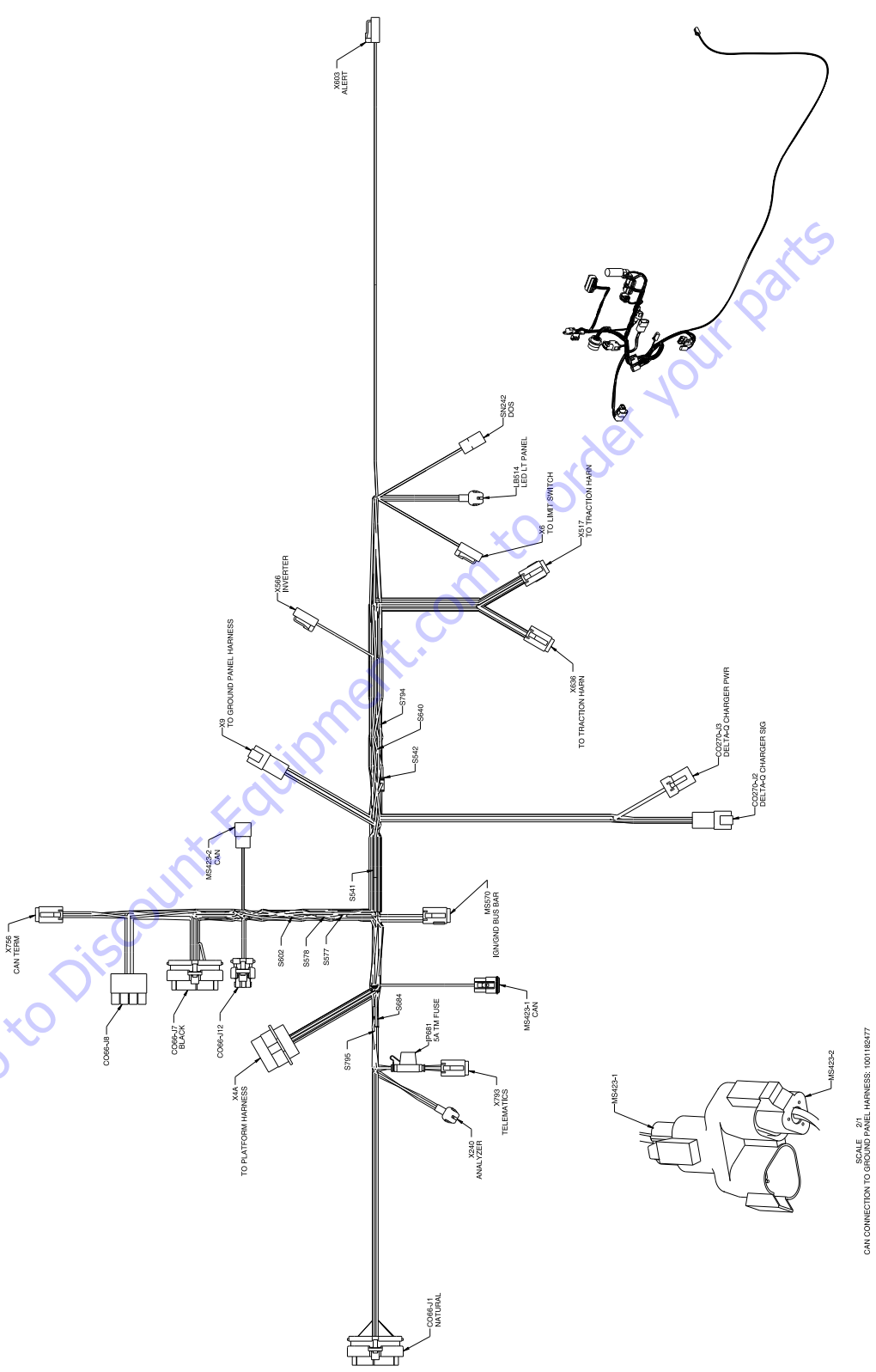


Figure 7-35. Turntable Harness - Sheet 1 of 3

CO66-J1 - NATURAL

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2	WHT	300-1 ALERT PWR	18 AWG	GXL	4460871		X603 (1)
3					4460905		
4	BLK	300-2 ALERT GND	18 AWG	GXL	4460871		X603 (2)
5					4460905		
6					4460905		
7					4460905		
8					4460905		
9					4460905		
10					4460905		
11					4460905		
12					4460905		
13	WHT	2-3-2 DRIVE ENABLE RELAY	18 AWG	GXL	4460871		X517 (3)
14					4460905		
15					4460905		
16					4460905		
17					4460905		
18					4460905		
19	WHT	2-20-1 DRIVE ENABLE RLY GND	18 AWG	GXL	4460871		X517 (2)
20					4460905		
21					4460905		
22					4460905		
23					4460905		
24					4460905		
25					4460905		
26					4460905		
27					4460905		
28	WHT	87-1 ANALYZER PWR	18 AWG	GXL	4460871		X240 (1)
29	WHT	87-2 ANALYZER RS-232 RX	18 AWG	GXL	4460871		X240 (2)
30	WHT	87-3 ANALYZER RS-232 TX	18 AWG	GXL	4460871		X240 (3)
31	WHT	87-4 ANALYZER GND	18 AWG	GXL	4460871		X240 (4)
32					4460905		
33					4460905		
34					4460905		
35					4460905		

CO66-J7 - BLACK

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	2-10 PLAT TX	18 AWG	GXL	4460871		S602 (1)
2	WHT	2-10-2 PLAT TX	18 AWG	GXL	4460871		S602 (1)
3	WHT	2-7 GMODE SELECT	18 AWG	GXL	4460871		X9 (6)
4	WHT	85-3 BOOM ELEV SW1	18 AWG	GXL	4460871		X6 (2)
5					4460905		
6	WHT	CAN TERM JUMPER	18 AWG	GXL	4460871		CO66-J7 (17)
7					4460905		
8					4460905		
9					4460905		
10					4460905		
11	WHT	85-7-2 DOS LIMIT SW PWR	18 AWG	GXL	4460871		SN242 (2)
12					4460905		
13	YEL	80-0 CAN1 HIGH	18 AWG	GXL	4460871		S577 (1)
14	WHT	2-11 GMODE ATTAINED	18 AWG	GXL	4460871		X4A (11)
15	WHT	131-2 FOOTSWITCH	18 AWG	GXL	4460871		X4A (6)
16					4460905		
17	WHT	CAN TERM JUMPER	18 AWG	GXL	4460871		CO66-J7 (6)
18					4460905		
19					4460905		
20					4460905		
21					4460905		
22					4460905		
23					4460905		
24	GRN	81-0 CAN1 LOW	18 AWG	GXL	4460871		S578 (1)
25	BLK	4-55	18 AWG	GXL	4460871		X517 (8)
26					4460905		
27					4460905		
28					4460905		
29	YEL	5-50	18 AWG	GXL	4460871		X517 (6)
30	WHT	85 BOOM LIMIT SW PWR	18 AWG	GXL	4460871		X6 (1)
31					4460905		
32	WHT	85-7-1 DOS LIMIT SW	18 AWG	GXL	4460871		SN242 (1)
33					4460905		
34					4460905		
35					4460905		

X756 - CAN TERM

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	83-1 CAN2 HI	18 AWG	GXL	4460465		X636 (1)
2	YEL	83-1-1 CAN2 HI	18 AWG	GXL	4460465		CO66-J12 (3)
3	GRN	84-1-1 CAN2 LO	18 AWG	GXL	4460465		CO66-J12 (4)
4	GRN	84-1 CAN2 LO	18 AWG	GXL	4460465		X636 (2)

CO66-J8

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-10 INSTRUMENT GND	12 AWG	GXL	4460887		X517 (4)
2	YEL	5-10-1 IGN	14 AWG	GXL	4460887		S541 (1)
3	BLK	1-5 PLAT GND	12 AWG	GXL	4460887		X4A (16)
4	YEL	3-8 PLATFORM PWR	12 AWG	GXL	4460887		X4A (12)

CO66-J12

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2					4460905		
3	YEL	83-1-1 CAN2 HI	18 AWG	GXL	4460871		X756 (2)
4	GRN	84-1-1 CAN2 LO	18 AWG	GXL	4460871		X756 (3)
5					4460905		
6					4460905		
7					4460905		
8	WHT	80-0 MSSO	18 AWG	GXL	4460871		X9 (7)
NC							

IP681 - 5A TM FUSE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK		14 AWG	GXL	N/A		S684 (2)
2	BLK		14 AWG	GXL	N/A		X793 (3)

X4A - TO PLATFORM HARNESS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460466		
2	GRN	81-2 CAN1 LOW	18 AWG	GXL	4460943		MS423-1 (B)
3	YEL	80-2 CAN1 HIGH	18 AWG	GXL	4460943		MS423-1 (A)
4	WHT	2-10-1 PLAT TX	18 AWG	GXL	4460464		S602 (2)
5					4460466		
6	WHT	131-2 FOOTSWITCH	18 AWG	GXL	4460464		CO66-J7 (15)
7	WHT	2-13-2 IGN	18 AWG	GXL	4460464		MS570 (7)
8					4460466		
9	WHT	2-6-1 PMODE SELECT	18 AWG	GXL	4460464		S795 (1)
10	YEL	5-6	14 AWG	GXL	4460508		MS570 (5)
11	WHT	2-11 GMODE ATTAINED	18 AWG	GXL	4460464		CO66-J7 (14)
12	YEL	3-8 PLATFORM PWR	12 AWG	GXL	4460508		CO66-J8 (4)
13	WHT	2-8 PMODE SELECT IGN	18 AWG	GXL	4460464		X9 (3)
14					4460466		
15	YEL	3-4-3 IGNITION	16 AWG	GXL	4460464		S542 (1)
16	BLK	1-5 PLAT GND	12 AWG	GXL	4460508		CO66-J8 (3)
17					4460466		
18	BLK	4-20	14 AWG	GXL	4460508		MS570 (2)
19					4460466		

MS423-2 - CAN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	80-1 CAN1 HIGH	18 AWG	GXL	4460944		S577 (1)
B	GRN	81-1 CAN1 LOW	18 AWG	GXL	4460944		S578 (1)
C					4460466		

MS423-1 - CAN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	80-2 CAN1 HIGH	18 AWG	GXL	4460944		X4A (3)
B	GRN	81-2 CAN1 LOW	18 AWG	GXL	4460944		X4A (2)
C					4460466		

S602

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	2-10 PLAT TX	18 AWG	GXL	N/A		CO66-J7 (1)
1	WHT	2-10-2 PLAT TX	18 AWG	GXL	N/A		CO66-J7 (2)
2	WHT	2-10-1 PLAT TX	18 AWG	GXL	N/A		X4A (4)

S578

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	GRN	81-0 CAN1 LOW	18 AWG	GXL	N/A		CO66-J7 (24)
1	GRN	81-1 CAN1 LOW	18 AWG	GXL	N/A		MS423-2 (B)
2	GRN	81-2 CAN1 LOW	18 AWG	GXL	N/A		X517 (12)

S577

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	80-0 CAN1 HIGH	18 AWG	GXL	N/A		CO66-J7 (13)
1	YEL	80-1 CAN1 HIGH	18 AWG	GXL	N/A		MS423-2 (A)
2	YEL	80-2 CAN1 HIGH	18 AWG	GXL	N/A		X517 (11)

Figure 7-36. Turntable Harness - Sheet 2 of 3

MS570 - IGN/GND BUS BAR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	4-0-3 INST GND	14 AWG	GXL	4460942		X517 (10)
2	BLK	4-20	14 AWG	GXL	4460942		X4A (18)
3					4460466		
4	YEL	3-5 SWITCHED PWR	12 AWG	GXL	4460509		X517 (7)
5	YEL	5-6	14 AWG	GXL	4460942		X4A (10)
6					4460466		
7	WHT	2-13-2 IGN	18 AWG	GXL	4460465		X4A (7)
8					4460466		
9					4460466		
10					4460466		
11	BLK	1-8-2 GND	18 AWG	GXL	4460465		X793 (2)
12					4460466		

X793 - TELEMATICS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	3-4-1-2 UNSW IGN	18 AWG	GXL	4460465		S794 (2)
2	BLK	1-8-2 GND	18 AWG	GXL	4460465		MS570 (11)
3	BLK		14 AWG	GXL	4460942		IP681 (2)
4	WHT	2-6-2 PMODE SELECT	18 AWG	GXL	4460465		S795 (2)

X240 - ANALYZER

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	87-1 ANALYZER PWR	18 AWG	GXL	4460227		CO66-J1 (28)
2	WHT	87-2 ANALYZER RS-232 RX	18 AWG	GXL	4460227		CO66-J1 (29)
3	WHT	87-3 ANALYZER RS-232 TX	18 AWG	GXL	4460227		CO66-J1 (30)
4	WHT	87-4 ANALYZER GND	18 AWG	GXL	4460227		CO66-J1 (31)

S541

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	5-10-1 IGN	14 AWG	GXL	N/A		CO66-J8 (2)
1	YEL	5-10-6 IGN	14 AWG	GXL	N/A		S684 (1)
2	YEL	5-10-2 IGN	14 AWG	GXL	N/A		X517 (9)
2	YEL	5-10-5 IGN	14 AWG	GXL	N/A		X9 (2)

S795

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	2-6 PMODE SELECT	18 AWG	GXL	N/A		X9 (5)
1	WHT	2-6-1 PMODE SELECT	18 AWG	GXL	N/A		X4A (9)
2	WHT	2-6-2 PMODE SELECT	18 AWG	GXL	N/A		X793 (4)

X9 - TO GROUND PANEL HARNESS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	3-4-1-1 UNSW IGN	12 AWG	GXL	1001157891		S794 (2)
2	YEL	5-10-5 IGN	14 AWG	GXL	1001157891		S541 (2)
3	WHT	2-8 PMODE SELECT IGN	18 AWG	GXL	1001116693		X4A (13)
4	YEL	3-4-2 IGNITION	18 AWG	GXL	1001116693		S542 (1)
5	WHT	2-6 PMODE SELECT	18 AWG	GXL	1001116693		S795 (1)
6	WHT	2-7 GMODE SELECT	18 AWG	GXL	1001116693		CO66-J7 (3)
7	WHT	80-0 MSSO	18 AWG	GXL	1001116693		CO66-J12 (8)
8					4460466		

X566 - INVERTER

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	6-2-5 INVERTER	18 AWG	GXL	4460465		S640 (2)
2					4460466		

X603 - ALERT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	300-1 ALERT PWR	18 AWG	GXL	4460465		CO66-J1 (2)
2	BLK	300-2 ALERT GND	18 AWG	GXL	4460465		CO66-J1 (4)

S542

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	3-4-2 IGNITION	18 AWG	GXL	N/A		X9 (4)
1	YEL	3-4-3 IGNITION	16 AWG	GXL	N/A		X4A (15)
2	YEL	3-4-4 IGN	18 AWG	GXL	N/A		X517 (5)

S640

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	6-2-2 IGN 48 VOLT	18 AWG	GXL	N/A		CO270-J2 (8)
2	YEL	6-2-5 INVERTER	18 AWG	GXL	N/A		X566 (1)
2	YEL	6-2-6 IGN 48 VOLT	18 AWG	GXL	N/A		X636 (6)

S794

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	3-4-1 UNSW IGN	12 AWG	GXL	N/A		X517 (1)
2	RED	3-4-1-1 UNSW IGN	12 AWG	GXL	N/A		X9 (1)
2	RED	3-4-1-2 UNSW IGN	18 AWG	GXL	N/A		X793 (1)

SN242 - DOS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	85-7-1 DOS LIMIT SW	18 AWG	GXL	4460226		CO66-J7 (32)
2	WHT	85-7-2 DOS LIMIT SW PWR	18 AWG	GXL	4460226		CO66-J7 (11)

LB514 - LED LT PANEL

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	4-56	18 AWG	GXL	4460227		CO270-J2 (5)
2	WHT	206 YEL LED	18 AWG	GXL	4460227		CO270-J2 (4)
3	WHT	207 GRN LED	18 AWG	GXL	4460227		CO270-J2 (6)
4	WHT	205 RED LED	18 AWG	GXL	4460227		CO270-J2 (3)

X6 - TO LIMIT SWITCH

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	85 BOOM LIMIT SW PWR	18 AWG	GXL	4460465		CO66-J7 (30)
2	WHT	85-3 BOOM ELEV SW1	18 AWG	GXL	4460465		CO66-J7 (4)

X517 - TO TRACTION HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	3-4-1 UNSW IGN	12 AWG	GXL	1001157890		S794 (1)
2	WHT	2-20-1 DRIVE ENABLE RLY GND	18 AWG	GXL	4460465		CO66-J1 (19)
3	WHT	2-3-2 DRIVE ENABLE RELAY	18 AWG	GXL	4460465		CO66-J1 (13)
4	BLK	1-10 INSTRUMENT GND	12 AWG	GXL	1001157890		CO66-J8 (1)
5	YEL	3-4-4 IGN	18 AWG	GXL	4460465		S542 (2)
6	YEL	5-50	18 AWG	GXL	4460465		CO66-J7 (29)
7	YEL	3-5 SWITCHED PWR	12 AWG	GXL	1001157890		MS570 (4)
8	BLK	4-55	18 AWG	GXL	4460465		CO66-J7 (25)
9	YEL	5-10-2 IGN	14 AWG	GXL	1001157890		S541 (2)
10	BLK	4-0-3 INST GND	14 AWG	GXL	1001157890		MS570 (1)
11	YEL	80-2 CAN1 HIGH	18 AWG	GXL	4460944		S577 (2)
12	GRN	81-2 CAN1 LOW	18 AWG	GXL	4460944		S578 (2)

X636 - TO TRACTION HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	83-1 CAN2 HI	18 AWG	GXL	4460944		X756 (1)
2	GRN	84-1 CAN2 LO	18 AWG	GXL	4460944		X756 (4)
3	BLK	46-2 B-	12 AWG	GXL	1001157890		CO270-J3 (3)
4	WHT	45-3-3 CHARGING STAT	18 AWG	GXL	4460465		CO270-J2 (1)
5	RED	45 B+	12 AWG	GXL	1001157890		CO270-J3 (1)
6	YEL	6-2-6 IGN 48 VOLT	18 AWG	GXL	4460465		S640 (2)

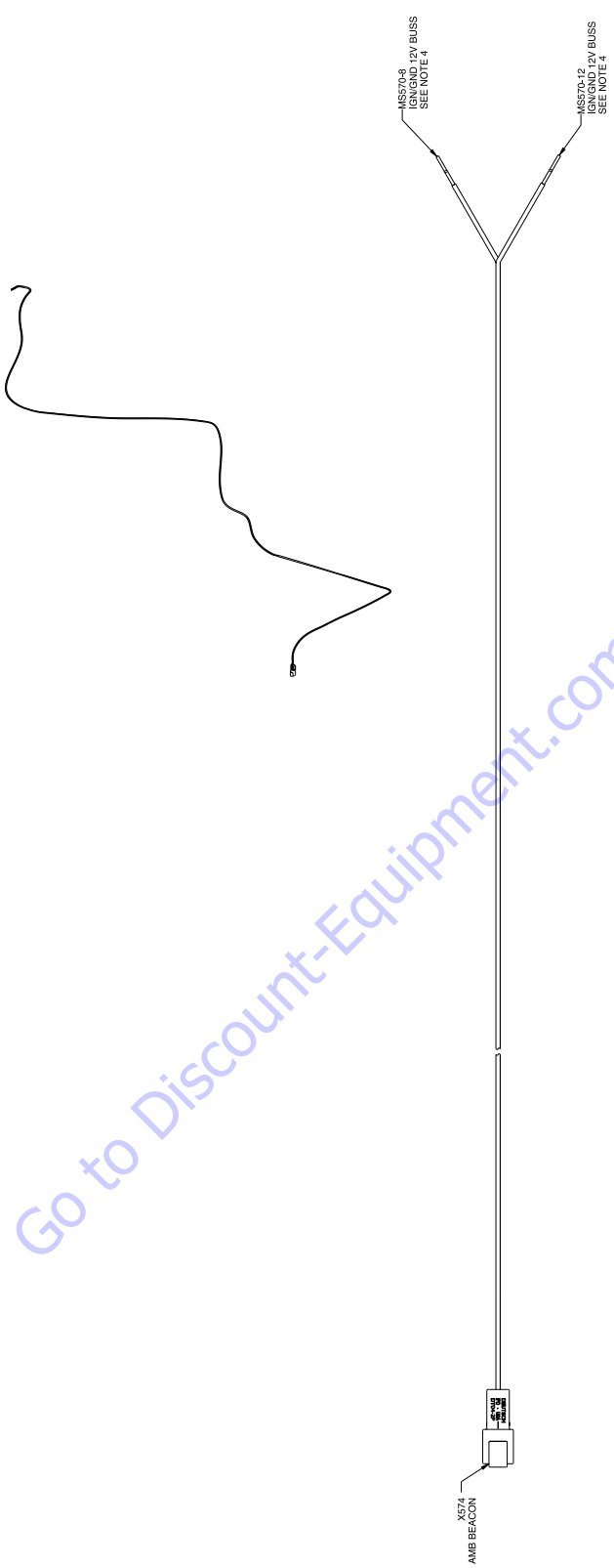
CO270-J2 - DELTA-Q CHARGER SIG

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	45-3-3 CHARGING STAT	18 AWG	GXL	4460464		X636 (4)
2					4460466		
3	WHT	205 RED LED	18 AWG	GXL	4460464		LB514 (4)
4	WHT	206 YEL LED	18 AWG	GXL	4460464		LB514 (2)
5	WHT	4-56	18 AWG	GXL	4460464		LB514 (1)
6	WHT	207 GRN LED	18 AWG	GXL	4460464		LB514 (3)
7					4460466		
8	YEL	6-2-2 IGN 48 VOLT	18 AWG	GXL	4460464		S640 (1)

CO270-J3 - DELTA-Q CHARGER PWR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	45 B+	12 AWG	GXL	4460509		X636 (5)
2					4460466		
3	BLK	46-2 B-	12 AWG	GXL	4460509		X636 (3)
4					4460466		

Figure 7-37. Turntable Harness - Sheet 3 of 3



X574- AMB BEACON

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	2-13 STROBE	18 AWG	GXL	4460465		MS570-8 (1)
2	BLK	1-8-1 GND	18 AWG	GXL	4460465		MS570-12 (1)

MS570-12- IGN/GND 12V BUSS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-8-1 GND	18 AWG	GXL	N/A		X574 (2)

MS570-8- IGN/GND 12V BUSS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	2-13 STROBE	18 AWG	GXL	N/A		X574 (1)

1001198866 C

Figure 7-38. Amber Beacon Harness

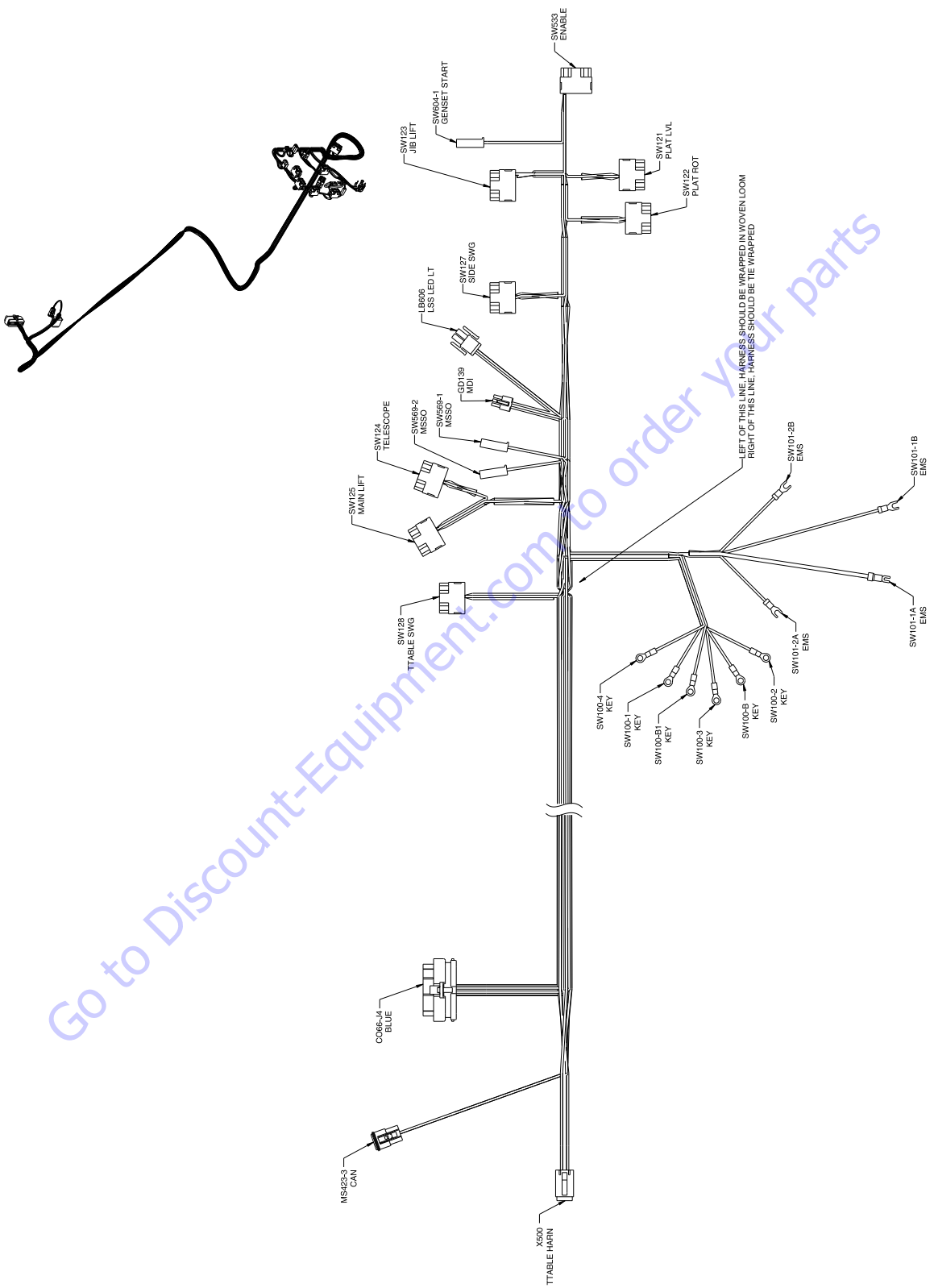


Figure 7-39. Ground Panel Harness - Sheet 1 of 3

CO66-J4 - BLUE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2					4460905		
3					4460905		
4					4460905		
5	WHT	114-2 PLAT LVL DN	18 AWG	GXL	4460871		SW121 (3)
6	WHT	112-2 PLAT ROT LEFT	18 AWG	GXL	4460871		SW122 (3)
7	WHT	107-2 TELE IN	18 AWG	GXL	4460871		SW124 (3)
8	WHT	110-2 JIB DN	18 AWG	GXL	4460871		SW123 (3)
9	WHT	117-2 SIDESWING LEFT	18 AWG	GXL	4460871		SW127 (3)
10					4460905		
11					4460905		
12					4460905		
13					4460905		
14	WHT	1-128 LSS LAMP	18 AWG	GXL	4460871		LB606 (1)
15					4460905		
16	WHT	137 FUNCTIONS ENABLED	18 AWG	GXL	4460871		SW533 (1)
17	WHT	113-2 PLAT LVL UP	18 AWG	GXL	4460871		SW121 (1)
18	WHT	111-2 PLAT ROT RIGHT	18 AWG	GXL	4460871		SW122 (1)
19	WHT	109-2 JIB UP	18 AWG	GXL	4460871		SW123 (1)
20	WHT	118-2 SIDESWING RIGHT	18 AWG	GXL	4460871		SW127 (1)
21					4460905		
22					4460905		
23	WHT	101-2 MAIN LIFT UP	18 AWG	GXL	4460871		SW125 (1)
24	WHT	3-21 METER PWR	18 AWG	GXL	4460871		GD139 (1)
25	WHT	3-15 SW POWER	18 AWG	GXL	4460871		SW128 (2)
26					4460905		
27					4460905		
28					4460905		
29					4460905		
30	WHT	108-2 TELE OUT	18 AWG	GXL	4460871		SW124 (1)
31	BLK	1-31 INDICATOR GND	18 AWG	GXL	4460871		LB606 (2)
32	BLK	1-32 METER GND	18 AWG	GXL	4460871		GD139 (2)
33	WHT	102-2 MAIN LIFT DN	18 AWG	GXL	4460871		SW125 (3)
34	WHT	103-2 SWING LEFT	18 AWG	GXL	4460871		SW128 (3)
35	WHT	104-2 SWING RIGHT	18 AWG	GXL	4460871		SW128 (1)

MS423-3-CAN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	80-3 CAN1 HIGH	18 AWG	GXL	4460944		GD139 (4)
B	GRN	81-3 CAN1 LOW	18 AWG	GXL	4460944		GD139 (3)
C					4460466		

X500 - TTABLE HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	2-4-1 IGNITION	12 AWG	GXL	1001116692		SW101-1A (1A)
2	RED	2-5-1 SWITCHED IGNITION	18 AWG	GXL	1001116692		SW101-1B (1B)
3	WHT	2-8 PMODE SELECT IGN	18 AWG	GXL	1001116692		SW100-2 (1)
4	WHT	2-20 GMODE IGNITION	18 AWG	GXL	1001116692		SW100-4 (1)
5	WHT	2-6 PMODE SELECT	18 AWG	GXL	1001116692		SW100-1 (1)
6	WHT	2-7 GMODE	18 AWG	GXL	1001116692		SW100-3 (1)
7	WHT	119-1 MSSO	18 AWG	GXL	1001116692		SW569-2 (1)
8					4460466		

SW128 - TTABLE SWG

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	104-2 SWING RIGHT	18 AWG	GXL	1001159186		CO66-J4 (35)
2	WHT	3-15 SW POWER	18 AWG	GXL	4460419		CO66-J4 (25)
2	WHT	3-15-8 SW POWER	18 AWG	GXL	4460419		SW127 (2)
3	WHT	103-2 SWING LEFT	18 AWG	GXL	1001159186		CO66-J4 (34)
4							
5							
6							

SW125 - MAIN LIFT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	101-2 MAIN LIFT UP	18 AWG	GXL	1001159186		CO66-J4 (23)
2	WHT	3-15-1 SW POWER	18 AWG	GXL	4460419		SW533 (2)
2	WHT	3-15-3 SW POWER	18 AWG	GXL	4460419		SW124 (2)
3	WHT	102-2 MAIN LIFT DN	18 AWG	GXL	1001159186		CO66-J4 (33)
4							
5							
6							

SW124 - TELESCOPE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	108-2 TELE OUT	18 AWG	GXL	1001159186		CO66-J4 (30)
2	WHT	3-15-3 SW POWER	18 AWG	GXL	4460419		SW125 (2)
2	WHT	3-15-4 SW POWER	18 AWG	GXL	4460419		SW122 (2)
3	WHT	107-2 TELE IN	18 AWG	GXL	1001159186		CO66-J4 (7)
4							
5							
6							

SW127 - SIDE SWG

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	118-2 SIDESWING RIGHT	18 AWG	GXL	1001159186		CO66-J4 (20)
2	WHT	3-15-7 SW POWER	18 AWG	GXL	4460419		SW123 (2)
2	WHT	3-15-8 SW POWER	18 AWG	GXL	4460419		SW128 (2)
3	WHT	117-2 SIDESWING LEFT	18 AWG	GXL	1001159186		CO66-J4 (9)
4							
5							
6							

SW122 - PLAT ROT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	111-2 PLAT ROT RIGHT	18 AWG	GXL	1001159186		CO66-J4 (18)
2	WHT	3-15-4 SW POWER	18 AWG	GXL	4460419		SW124 (2)
2	WHT	3-15-5 SW POWER	18 AWG	GXL	4460419		SW121 (2)
3	WHT	112-2 PLAT ROT LEFT	18 AWG	GXL	1001159186		CO66-J4 (6)
4							
5							
6							

SW123 - JIB LIFT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	109-2 JIB UP	18 AWG	GXL	1001159186		CO66-J4 (19)
2	WHT	3-15-6 SW POWER	18 AWG	GXL	4460419		SW121 (2)
2	WHT	3-15-7 SW POWER	18 AWG	GXL	4460419		SW127 (2)
3	WHT	110-2 JIB DN	18 AWG	GXL	1001159186		CO66-J4 (8)
4							
5							
6							

SW121 - PLAT LVL

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	113-2 PLAT LVL UP	18 AWG	GXL	1001159186		CO66-J4 (17)
2	WHT	3-15-5 SW POWER	18 AWG	GXL	4460419		SW122 (2)
2	WHT	3-15-6 SW POWER	18 AWG	GXL	4460419		SW123 (2)
3	WHT	114-2 PLAT LVL DN	18 AWG	GXL	1001159186		CO66-J4 (5)
4							
5							
6							

SW533 - ENABLE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	137 FUNCTIONS ENABLED	18 AWG	GXL	1001159186		CO66-J4 (16)
2	WHT	3-15-1 SW POWER	18 AWG	GXL	4460419		SW125 (2)
2	WHT	3-15-9 SW POWER	18 AWG	GXL	4460419		SW604-1 (1)
3							
4							
5							
6							

SW569-2 - MSSO

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	119-1 MSSO	18 AWG	GXL	4460259		X500 (7)

SW569-1 - MSSO

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-31-1 INDICATOR GND	18 AWG	GXL	4460259		LB606 (2)

Figure 7-40. Ground Panel Harness - Sheet 2 of 3

GD139 - MDI							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-21 METER PWR	18 AWG	GXL	4460877		CO66-J4 (24)
2	BLK	1-32 METER GND	18 AWG	GXL	4460877		CO66-J4 (32)
3	GRN	81-3 CAN1 LOW	18 AWG	GXL	4460877		MS423-3 (B)
4	YEL	80-3 CAN1 HIGH	18 AWG	GXL	4460877		MS423-3 (A)
5							
6							
NC							

LB606 - LSS LED LT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-128 LSS LAMP	18 AWG	GXL	4460227		CO66-J4 (14)
2	BLK	1-31 INDICATOR GND	18 AWG	GXL	4460267		CO66-J4 (31)
2	BLK	1-31-1 INDICATOR GND	18 AWG	GXL	4460267		SW569-1 (1)

SW101-1A - EMS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1A	RED	2-4-1 IGNITION	12 AWG	GXL	N/A		X500 (1)

SW101-1B - EMS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1B	RED	2-5-1 SWITCHED IGNITION	18 AWG	GXL	N/A		X500 (2)

SW101-2A - EMS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
2A	WHT	2-5 EMS IGNITION	18 AWG	GXL	N/A		SW100-B1 (1)

SW101-2B - EMS							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
2B	WHT	2-4 EMS SW IGNITION	18 AWG	GXL	N/A		SW100-B (1)

SW604-1 - GENSET START							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-15-9 SW POWER	18 AWG	GXL	4460259		SW533 (2)

Figure 7-41. Ground Panel Harness - Sheet 3 of 3

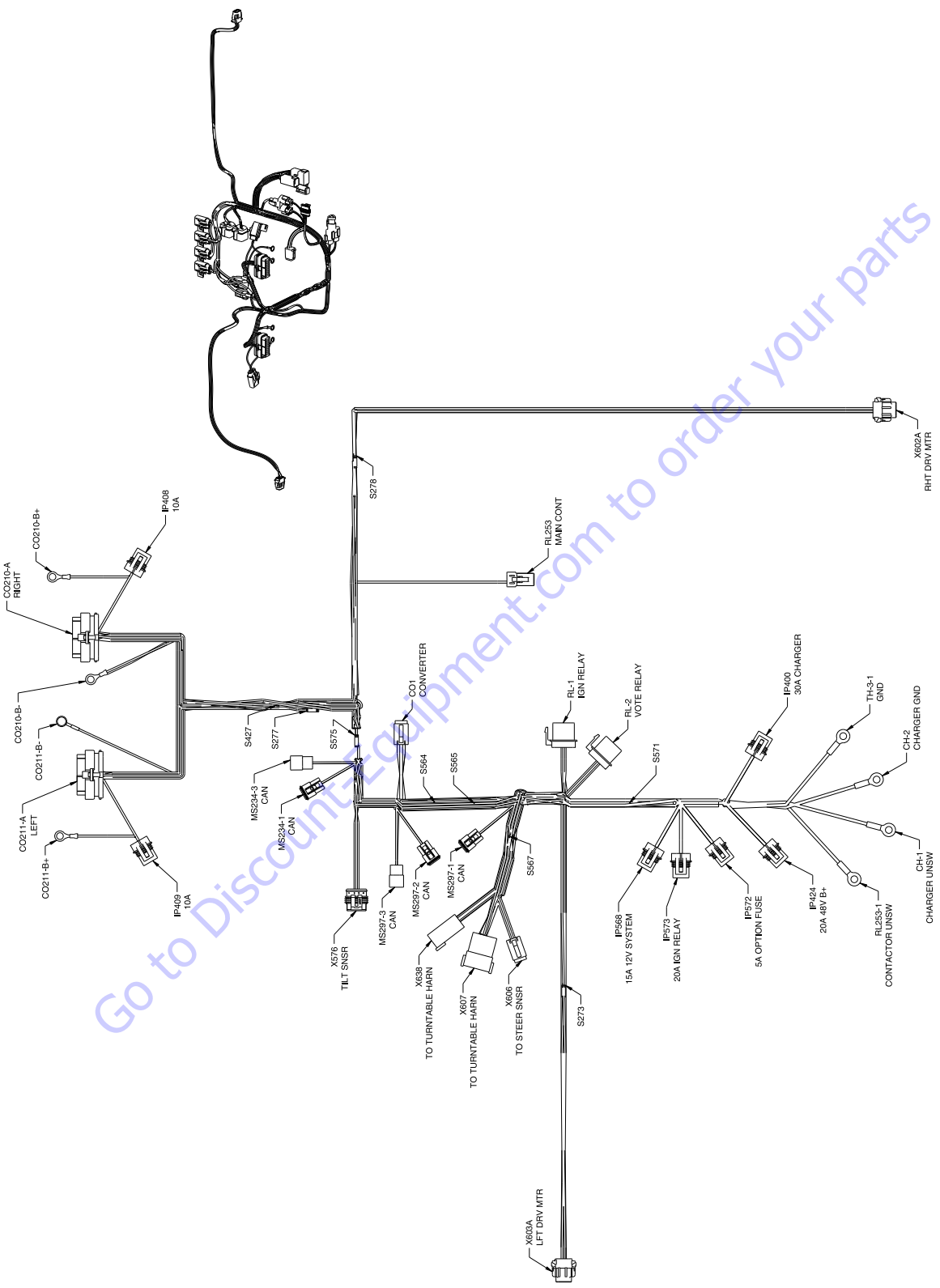


Figure 7-42. Traction Harness - Sheet 1 of 4

CO1 - CONVERTER

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-25 CONV B+	12 AWG	GXL	1001157890		S564 (2)
2	YEL	6-2-3 IGN 48 VOLT	18 AWG	GXL	1001116692		S565 (1)
3	BLK/WHT	10-14 CONV B-	12 AWG	GXL	1001157890		TH-3-1 (1)
4	RED	2-2-1 12V UNSW	12 AWG	GXL	1001157890		IP568 (1)
5	YEL	4-2 12V SW	12 AWG	GXL	1001157890		S571 (1)
6	BLK	1-35-3 GND	12 AWG	GXL	1001157890		S567 (2)

RL-1 - IGN RELAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	1-0-2 B+	18 AWG	GXL	1001116732	1001116763	S564 (1)
2	WHT	5-2-2 IGN	18 AWG	GXL	1001116732		X607 (5)
3							
4	YEL	6-2 IGN 48 VOLT	18 AWG	GXL	1001116732	1001116763	S565 (2)
5	BLK	4-0-2 INSTR GND	18 AWG	GXL	1001116732		S567 (2)

RL-2 - VOTE RELAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	11-2-1 B+	16 AWG	GXL	1001116733	1001116763	S564 (1)
2	BLK	1-35-2 GND	18 AWG	GXL	1001116732		X607 (2)
3							
4	WHT	5-1 MAIN CONT POS	16 AWG	GXL	1001116733	1001116763	RL253 (1)
5	WHT	9 UGM MAIN VOTE	18 AWG	GXL	1001116732		X607 (3)

MS297-1 - CAN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	CAN2 HI	18 AWG	GXL	4460944		X638 (1)
B	GRN	CAN2 LOW	18 AWG	GXL	4460944		X638 (2)
C					4460466		

MS297-2 - CAN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	75-9 CAN2 HIGH	18 AWG	GXL	4460944		MS234-1 (A)
B	GRN	76-9 CAN2 LOW	18 AWG	GXL	4460944		MS234-1 (B)
C					4460466		

MS297-3 - CAN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	75-7 CAN2 HIGH	18 AWG	GXL	4460944		CO210-A (28)
B	GRN	76-7 CAN2 LOW	18 AWG	GXL	4460944		CO210-A (27)
C					4460466		

X603A - LFT DRV MTR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	56 ENC PWR	18 AWG	GXL	1001126008		CO211-A (25)
2	BRN	60 ENC B	18 AWG	GXL	1001126008		CO211-A (13)
3	YEL	59 ENC A	18 AWG	GXL	1001126008		CO211-A (14)
4	BLK	57-1 ENC GND	18 AWG	GXL	1001126008		S273 (1)
5	WHT	58 MOTOR TEMP	18 AWG	GXL	1001126008		CO211-A (22)
6	BLK	57-2 TEMP GND	18 AWG	GXL	1001126008		S273 (1)
7	ORG	94 BRAKE POS	18 AWG	GXL	1001126008		CO211-A (2)
8	BLK	95 BRAKE NEG	18 AWG	GXL	1001126008		CO211-A (4)
NC	BLK	SHLD 2 SHLD	18 AWG	GXL			CO211-B- (1)

X606 - TO STEER SNSR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	50-2 STEER SN IGN	18 AWG	GXL	4460465		S277 (2)
2	BLU	52 STEER SN SIG	18 AWG	GXL	4460465		CO210-A (15)
3	BLK	51-2 STEER SN GND	18 AWG	GXL	4460465		S278 (1)
4	BLK	SHLD 5 SHLD	18 AWG	GXL	4460465		CO210-B- (1)

X607 - TO TURNTABLE HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	2-2-2 12V UNSW	12 AWG	GXL	1001157891		IP568 (2)
2	BLK	1-35-2 GND	18 AWG	GXL	4460464		RL-2 (2)
3	WHT	9 UGM MAIN VOTE	18 AWG	GXL	4460464		RL-2 (5)
4	BLK	1-35-3 GND	12 AWG	GXL	1001157891		S567 (1)
5	WHT	5-2-2 IGN	18 AWG	GXL	4460464		RL-1 (2)
6	YEL	5-50 TILT PWR	18 AWG	GXL	4460464		X576 (1)
7	YEL	4-2-2 12V SW	12 AWG	GXL	1001157891		IP572 (2)
8	BLK	4-55 TILT GND	18 AWG	GXL	4460464		X576 (2)
9	YEL	5-10-2 IGN	12 AWG	GXL	1001157891		IP573 (2)
10	BLK	4-0-3 INST GND	14 AWG	GXL	1001157891		S567 (1)
11	YEL	CAN 1 HI	18 AWG	GXL	4460943		X576 (3)
12	GRN	CAN 1 LO	18 AWG	GXL	4460943		X576 (4)

X576 - TILT SNSR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	5-50 TILT PWR	18 AWG	GXL	1001107854	1001104498	X607 (6)
2	BLK	4-55 TILT GND	18 AWG	GXL	1001107854	1001104498	X607 (8)
3	YEL	CAN 1 HI	18 AWG	GXL	1001107854	1001104498	X607 (11)
4	GRN	CAN 1 LO	18 AWG	GXL	1001107854	1001104498	X607 (12)

X638 - TO TURNTABLE HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	CAN2 HI	18 AWG	GXL	4460943		MS297-1 (A)
2	GRN	CAN2 LOW	18 AWG	GXL	4460943		MS297-1 (B)
3	BLK	46 B-	12 AWG	GXL	1001157891		CH-2 (1)
4	WHT	45-3-2 CHARGING STAT	18 AWG	GXL	4460464		CO210-A (16)
5	RED	45-3-2 B+	12 AWG	GXL	1001157891		IP400 (2)
6	YEL	6-2-1 IGN 48 VOLT	18 AWG	GXL	4460464		S565 (2)

IP400 - 30A CHARGER

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	45-3 B+	12 AWG	GXL	1001116734		CH-1 (1)
2	RED	45-3-2 B+	12 AWG	GXL	1001116734		X638 (5)

IP424 - 20A 48V B+

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-2-2 B+	12 AWG	GXL	1001116734		RL253-1 (1)
2	RED	1-0 B+	12 AWG	GXL	1001116734		S564 (1)

IP568 - 15A 12V SYSTEM

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	2-2-1 12V UNSW	12 AWG	GXL	1001116734		CO1 (4)
2	RED	2-2-2 12V UNSW	12 AWG	GXL	1001116734		X607 (1)

IP572 - 5A OPTION FUSE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	4-2 12V SW	12 AWG	GXL	1001116734		S571 (2)
2	YEL	4-2-2 12V SW	12 AWG	GXL	1001116734		X607 (7)

IP573 - 20A IGN RELAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	4-2-4 12V SW	12 AWG	GXL	1001116733		S571 (2)
2	YEL	5-10-2 IGN	12 AWG	GXL	1001116734		X607 (9)

Figure 7-43. Traction Harness - Sheet 2 of 4

CH-1 - CHARGER UNSW							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	45-3 B+	12 AWG	GXL	N/A		IP400 (1)

CH-2 - CHARGER GND							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	46 B-	12 AWG	GXL			X638 (3)

RL253-1 - CONTACTOR UNSW							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-2-2 B+	12 AWG	GXL	N/A		IP424 (1)

TH-3-1 - GND							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK/WHT	10-14 CONV B-	12 AWG	GXL	N/A		CO1 (3)

S273							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	57-1 ENC GND	18 AWG	GXL	N/A		X603A (4)
1	BLK	57-2 TEMP GND	18 AWG	GXL	N/A		X603A (6)
2	BLK	57 ENC GND	18 AWG	GXL	N/A		CO211-A (5)

S564							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	1-0 B+	12 AWG	GXL	N/A		IP424 (2)
1	RED	1-0-2 B+	18 AWG	GXL	N/A		RL-1 (1)
1	YEL	11-2-1 B+	16 AWG	GXL	N/A		RL-2 (1)
2	RED	11-25 CONV B+	12 AWG	GXL	N/A		CO1 (1)

S565							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	4-1 ZAPI IGN	16 AWG	GXL	N/A		S575 (1)
1	YEL	6-2-3 IGN 48 VOLT	18 AWG	GXL	N/A		CO1 (2)
2	YEL	6-2 IGN 48 VOLT	18 AWG	GXL	N/A		RL-1 (4)
2	YEL	6-2-1 IGN 48 VOLT	18 AWG	GXL	N/A		X638 (6)

S567							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-35-3 GND	12 AWG	GXL	N/A		X607 (4)
1	BLK	4-0-3 INST GND	14 AWG	GXL	N/A		X607 (10)
2	BLK	1-35-3 GND	12 AWG	GXL	N/A		CO1 (6)
2	BLK	4-0-2 INSTR GND	18 AWG	GXL	N/A		RL-1 (5)

S571							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	4-2 12V SW	12 AWG	GXL	N/A		CO1 (5)
2	YEL	4-2 12V SW	12 AWG	GXL	N/A		IP572 (1)
2	YEL	4-2-4 12V SW	12 AWG	GXL	N/A		IP573 (1)

CO210-A - RIGHT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2	ORG	92 BRAKE POS	18 AWG	GXL	4460871		X602A (7)
3	RED	11-17-1 +VALVES	16 AWG	GXL	4460871		IP408 (1)
4	BLK	93 BRAKE NEG	18 AWG	GXL	4460871		X602A (8)
5	BLK	51 ENC GND	18 AWG	GXL	4460871		S278 (1)
6	BLK	10-9 ADDRESSING	18 AWG	GXL	4460871		CO210-B- (1)
7					4460905		
8					4460905		
9					4460905		
10	WHT	4-3 ZAPI IGN	16 AWG	GXL	4460871		S575 (2)
11					4460905		
12	WHT	6 MAIN CONT NEG	18 AWG	GXL	4460871		RL253 (2)
13	BRN	55 ENC B	18 AWG	GXL	4460871		X602A (2)
14	YEL	54 ENC A	18 AWG	GXL	4460871		X602A (3)
15	BLU	52 STEER SN SIG	18 AWG	GXL	4460871		X606 (2)
16	WHT	45-3-2 CHARGING STAT	18 AWG	GXL	4460871		X638 (4)
17					4460905		
18					4460905		
19					4460905		
20					4460905		
21					4460905		
22	WHT	53 MOTOR TEMP	18 AWG	GXL	4460871		X602A (5)
23					4460905		
24					4460905		
25	RED	50 ENC PWR	18 AWG	GXL	4460871		S277 (1)
26					4460905		
27	GRN	76-7 CAN2 LOW	18 AWG	GXL	4460871		MS297-3 (B)
28	YEL	75-7 CAN2 HIGH	18 AWG	GXL	4460871		MS297-3 (A)
29					4460905		
30					4460905		
31					4460905		
32					4460905		
33					4460905		
34					4460905		
35					4460905		
NC					N/A		

CO210-B+							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-17	16 AWG	GXL	N/A		IP408 (2)

CO210-B-							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	10-9 ADDRESSING	18 AWG	GXL	N/A		CO210-A (6)
1	BLK	SHLD 1 SHLD	18 AWG	GXL	N/A		X602A (NC)
1	BLK	SHLD 5 SHLD	18 AWG	GXL	N/A		X606 (4)

MS234-1 - CAN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	75-9 CAN2 HIGH	18 AWG	GXL	4460944		MS297-2 (A)
B	GRN	76-9 CAN2 LOW	18 AWG	GXL	4460944		MS297-2 (B)
C					4460466		

MS234-3 - CAN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
A	YEL	75-10 CAN2 HIGH	18 AWG	GXL	4460944		CO211-A (28)
B	GRN	76-10 CAN2 LOW	18 AWG	GXL	4460944		CO211-A (27)
C					4460466		

RL253 - MAIN CONT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	5-1 MAIN CONT POS	16 AWG	GXL	1001126008		RL-2 (4)
2	WHT	6 MAIN CONT NEG	18 AWG	GXL	1001126008		CO210-A (12)

IP408 - 10A							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-17-1 +VALVES	16 AWG	GXL	1001116733		CO210-A (3)
2	RED	11-17	16 AWG	GXL	1001116733		CO210-B+ (1)

Figure 7-44. Traction Harness - Sheet 3 of 4

S277							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	50 ENC PWR	18 AWG	GXL	N/A		CO210-A (25)
2	RED	50-1 ENC PWR	18 AWG	GXL	N/A		X602A (1)
2	RED	50-2 STEER SN IGN	18 AWG	GXL	N/A		X606 (1)

CO211-A - LEFT							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2	ORG	94 BRAKE POS	18 AWG	GXL	4460871		X603A (7)
3	RED	11-18-1	16 AWG	GXL	4460871		IP409 (1)
4	BLK	95 BRAKE NEG	18 AWG	GXL	4460871		X603A (8)
5	BLK	57 ENC GND	18 AWG	GXL	4460871		S273 (2)
6	WHT	4-2-3 ADDR 1	18 AWG	GXL	4460871		S427 (2)
7					4460905		
8					4460905		
9					4460905		
10	WHT	4-2-1 ZAPI IGN	16 AWG	GXL	4460871		S427 (2)
11					4460905		
12					4460905		
13	BRN	60 ENC B	18 AWG	GXL	4460871		X603A (2)
14	YEL	59 ENC A	18 AWG	GXL	4460871		X603A (3)
15					4460905		
16					4460905		
17					4460905		
18					4460905		
19					4460905		
20					4460905		
21					4460905		
22	WHT	58 MOTOR TEMP	18 AWG	GXL	4460871		X603A (5)
23					4460905		
24					4460905		
25	RED	56 ENC PWR	18 AWG	GXL	4460871		X603A (1)
26					4460905		
27	GRN	76-10 CAN2 LOW	18 AWG	GXL	4460871		MS234-3 (B)
28	YEL	75-10 CAN2 HIGH	18 AWG	GXL	4460871		MS234-3 (A)
29					4460905		
30					4460905		
31					4460905		
32					4460905		
33					4460905		
34					4460905		
35					4460905		
NC					N/A		

CO211-B+							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-18	16 AWG	GXL	N/A		IP409 (2)

CO211-B-							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	SHLD 2 SHLD	18 AWG	GXL	N/A		X603A (NC)

X602A - RHT DRV MTR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	50-1 ENC PWR	18 AWG	GXL	1001126008		S277 (2)
2	BRN	55 ENC B	18 AWG	GXL	1001126008		CO210-A (13)
3	YEL	54 ENC A	18 AWG	GXL	1001126008		CO210-A (14)
4	BLK	51-1 ENC GND	18 AWG	GXL	1001126008		S278 (2)
5	WHT	53 MOTOR TEMP	18 AWG	GXL	1001126008		CO210-A (22)
6	BLK	51-3 TEMP GND	18 AWG	GXL	1001126008		S278 (2)
7	ORG	92 BRAKE POS	18 AWG	GXL	1001126008		CO210-A (2)
8	BLK	93 BRAKE NEG	18 AWG	GXL	1001126008		CO210-A (4)
NC	BLK	SHLD 1 SHLD	18 AWG	GXL			CO210-B- (1)

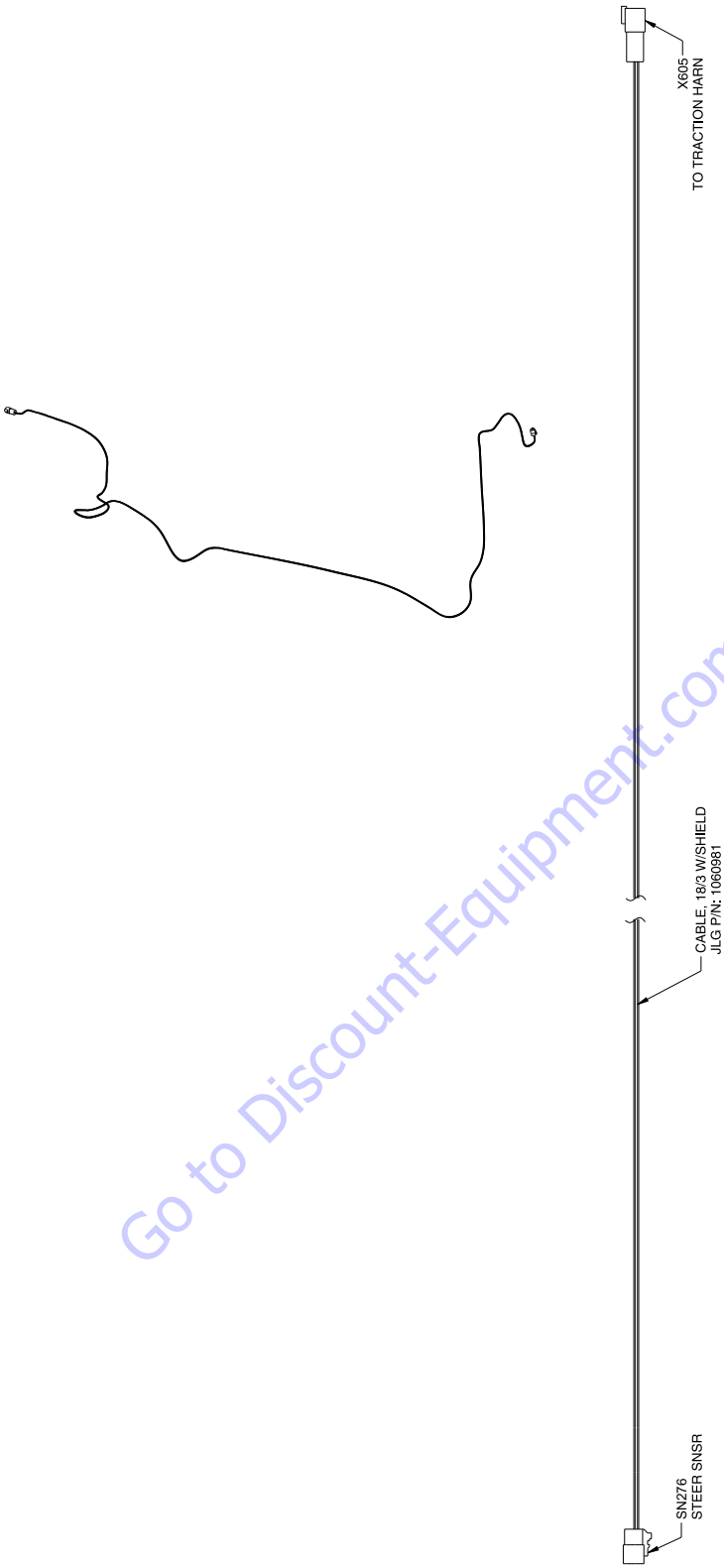
IP409 - 10A							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	11-18-1	16 AWG	GXL	1001116733		CO211-A (3)
2	RED	11-18	16 AWG	GXL	1001116733		CO211-B+ (1)

S278							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	51 ENC GND	18 AWG	GXL	N/A		CO210-A (5)
1	BLK	51-2 STEER SN GND	18 AWG	GXL	N/A		X606 (3)
2	BLK	51-1 ENC GND	18 AWG	GXL	N/A		X602A (4)
2	BLK	51-3 TEMP GND	18 AWG	GXL	N/A		X602A (6)

S427							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	4-4 ZAPI IGN	16 AWG	GXL	N/A		S575 (1)
2	WHT	4-2-1 ZAPI IGN	16 AWG	GXL	N/A		CO211-A (10)
2	WHT	4-2-3 ADDR 1	18 AWG	GXL	N/A		CO211-A (6)

S575							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	4-1 ZAPI IGN	16 AWG	GXL	N/A		S565 (1)
1	WHT	4-4 ZAPI IGN	16 AWG	GXL	N/A		S427 (1)
2	WHT	4-3 ZAPI IGN	16 AWG	GXL	N/A		CO210-A (10)

Figure 7-45. Traction Harness - Sheet 4 of 4



SN276 - STEER SNSR

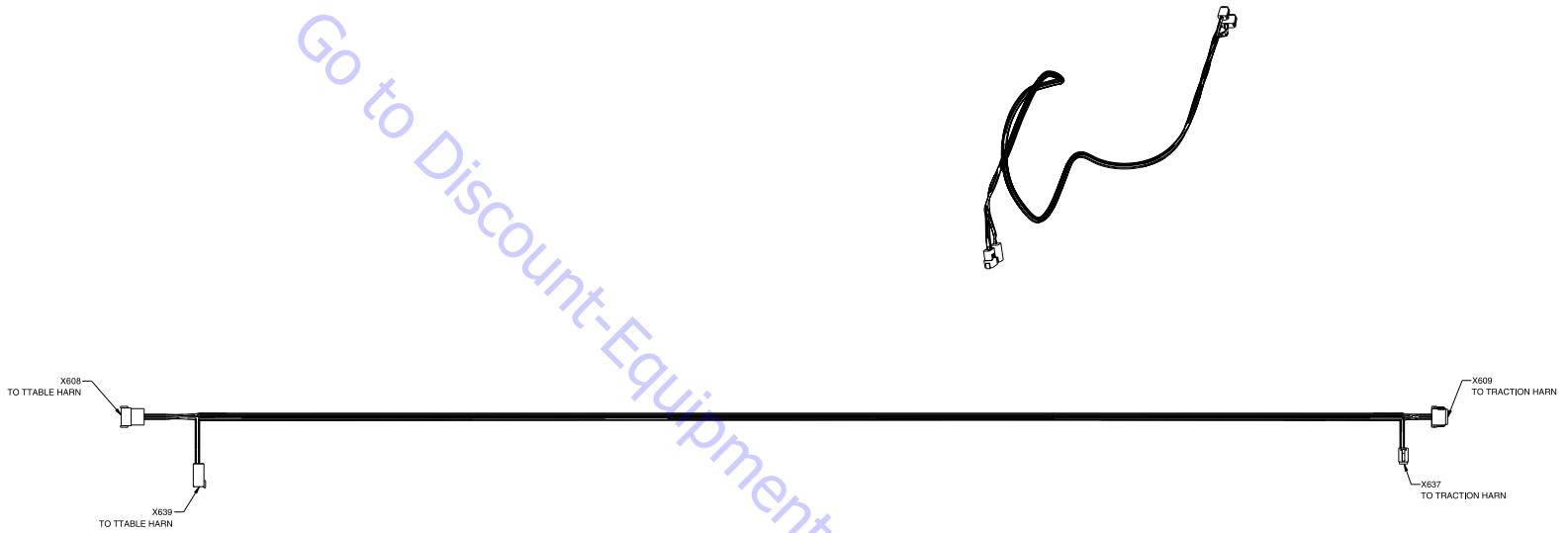
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED		18 AWG	CABLE	4460944		X605 (1)
2	BLU		18 AWG	CABLE	4460944		X605 (2)
3	BLK		18 AWG	CABLE	4460944		X605 (3)
NC	SHLD		18 AWG	CABLE	N/A		X605 (4)

X605 - TO TRACTION HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED		18 AWG	CABLE	4460464		SN276 (1)
2	BLU		18 AWG	CABLE	4460464		SN276 (2)
3	BLK		18 AWG	CABLE	4460464		SN276 (3)
4	SHLD		18 AWG	CABLE	4460464		SN276 (NC)

1001195835 B

Figure 7-46. Steering SNSR Harness



X608 - TO TTABLE HARN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	2-2-2 12V UNSW	12 AWG	GXL	1001157891		X609 (1)
2	BLK	1-35-4 GND	18 AWG	GXL	4460464		X609 (2)
3	WHT	9-1 UGM MAIN VOTE	18 AWG	GXL	4460464		X609 (3)
4	BLK	1-35-5 GND	12 AWG	GXL	1001157891		X609 (4)
5	WHT	5-2-3 IGN	18 AWG	GXL	4460464		X609 (5)
6	YEL	5-50-2 TILT PWR	18 AWG	GXL	4460464		X609 (6)
7	YEL	4-2-2 12V SW	12 AWG	GXL	1001157891		X609 (7)
8	BLK	4-55-2 TILT GND	18 AWG	GXL	4460464		X609 (8)
9	YEL	5-10-4 IGN	12 AWG	GXL	1001157891		X609 (9)
10	BLK	5-10-3 INST GND	14 AWG	GXL	1001157891		X609 (10)
11	YEL	CAN1 HI	18 AWG	GXL	4460943		X609 (11)
12	GRN	CAN1 LOW	18 AWG	GXL	4460943		X609 (12)

X609 - TO TRACTION HARN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	RED	2-2-2 12V UNSW	12 AWG	GXL	1001157890		X608 (1)
2	BLK	1-35-4 GND	18 AWG	GXL	4460465		X608 (2)
3	WHT	9-1 UGM MAIN VOTE	18 AWG	GXL	4460465		X608 (3)
4	BLK	1-35-5 GND	12 AWG	GXL	1001157890		X608 (4)
5	WHT	5-2-3 IGN	18 AWG	GXL	4460465		X608 (5)
6	YEL	5-50-2 TILT PWR	18 AWG	GXL	4460465		X608 (6)
7	YEL	4-2-2 12V SW	12 AWG	GXL	1001157890		X608 (7)
8	BLK	4-55-2 TILT GND	18 AWG	GXL	4460465		X608 (8)
9	YEL	5-10-4 IGN	12 AWG	GXL	1001157890		X608 (9)
10	BLK	5-10-3 INST GND	14 AWG	GXL	1001157890		X608 (10)
11	YEL	CAN1 HI	18 AWG	GXL	4460944		X608 (11)
12	GRN	CAN1 LOW	18 AWG	GXL	4460944		X608 (12)

X639 - TO TTABLE HARN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	CAN2 HI	18 AWG	GXL	4460943		X637 (1)
2	GRN	CAN2 LOW	18 AWG	GXL	4460943		X637 (2)
3	BLK	46-1 B-	12 AWG	GXL	1001157891		X637 (3)
4	WHT	45-3-4 CHARGING STAT	18 AWG	GXL	4460464		X637 (4)
5	RED	45-3-5 B+	12 AWG	GXL	1001157891		X637 (5)
6	YEL	6-2-4 IGN 48V	18 AWG	GXL	4460464		X637 (6)

X637 - TO TRACTION HARN							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	CAN2 HI	18 AWG	GXL	4460944		X639 (1)
2	GRN	CAN2 LOW	18 AWG	GXL	4460944		X639 (2)
3	BLK	46-1 B-	12 AWG	GXL	1001157890		X639 (3)
4	WHT	45-3-4 CHARGING STAT	18 AWG	GXL	4460465		X639 (4)
5	RED	45-3-5 B+	12 AWG	GXL	1001157890		X639 (5)
6	YEL	6-2-4 IGN 48V	18 AWG	GXL	4460465		X639 (6)

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Figure 7-47. Traction to Turntable Harness

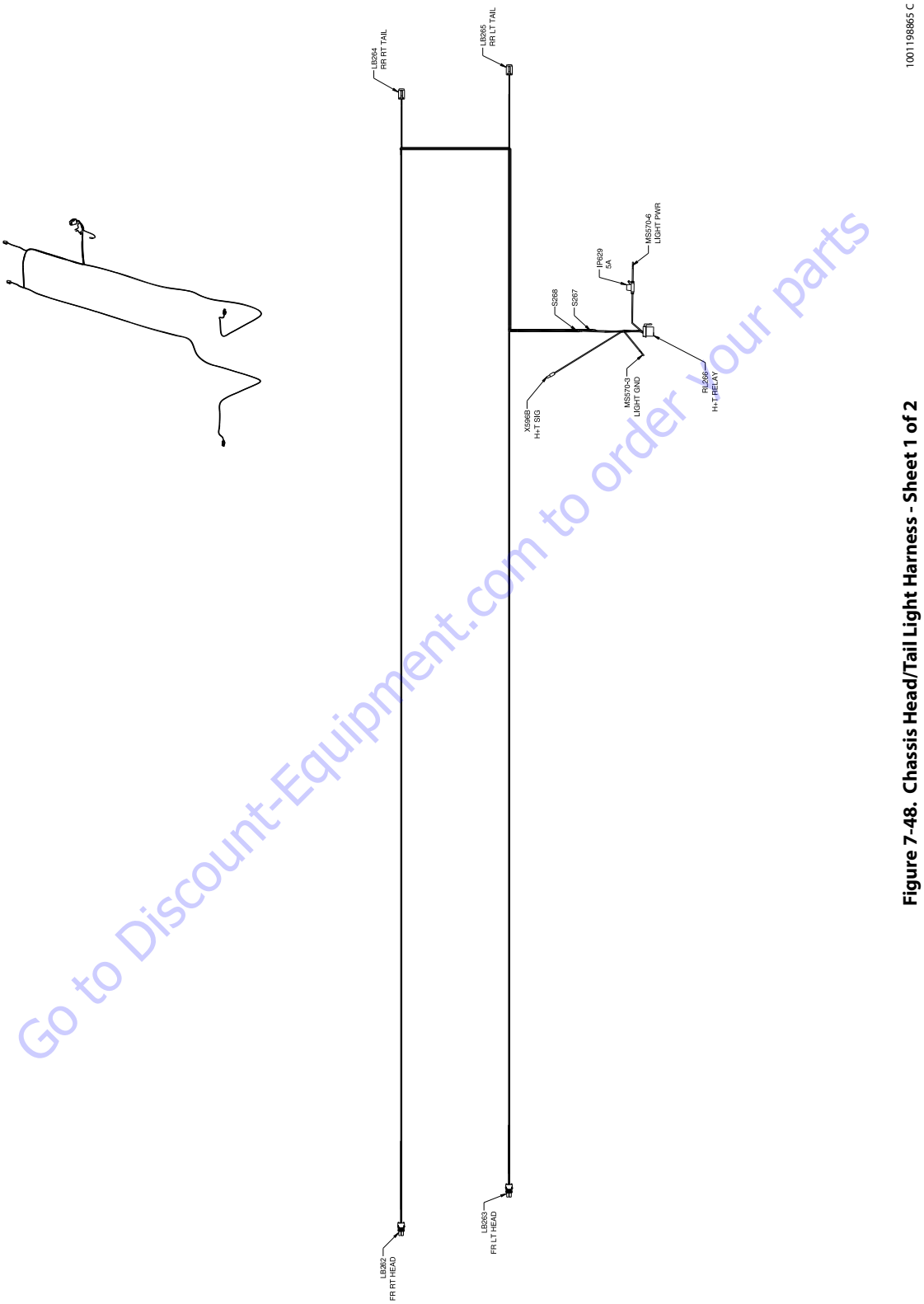


Figure 7-48. Chassis Head/Tail Light Harness - Sheet 1 of 2

LB262 - FR RT HEAD							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-22-1 GND	16 AWG	GXL	4460457	4460458	S268 (2)
2	WHT	3-12-1 LIGHT	16 AWG	GXL	4460457	4460458	S267 (2)

LB263 - FR LT HEAD							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-22-2 GND	16 AWG	GXL	4460457	4460458	S268 (2)
2	WHT	3-12-2 LIGHT	16 AWG	GXL	4460457	4460458	S267 (2)

S268							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-22 LIGHT GND	14 AWG	GXL	N/A		MS570-3 (1)
1	BLK	1-22-5 GND	18 AWG	GXL	N/A		RL266 (2)
2	BLK	1-22-1 GND	16 AWG	GXL	N/A		LB262 (1)
2	BLK	1-22-2 GND	16 AWG	GXL	N/A		LB263 (1)
2	BLK	1-22-3 GND	16 AWG	GXL	N/A		LB264 (1)
2	BLK	1-22-4 GND	16 AWG	GXL	N/A		LB265 (1)

LB264 - RR RT TAIL							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-22-3 GND	16 AWG	GXL	4460465		S268 (2)
2	WHT	3-12-3 LIGHT	16 AWG	GXL	4460465		S267 (2)
3					4460466		
4					4460466		

LB265 - RR LT TAIL							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-22-4 GND	16 AWG	GXL	4460465		S268 (2)
2	WHT	3-12-4 LIGHT	16 AWG	GXL	4460465		S267 (2)
3					4460466		
4					4460466		

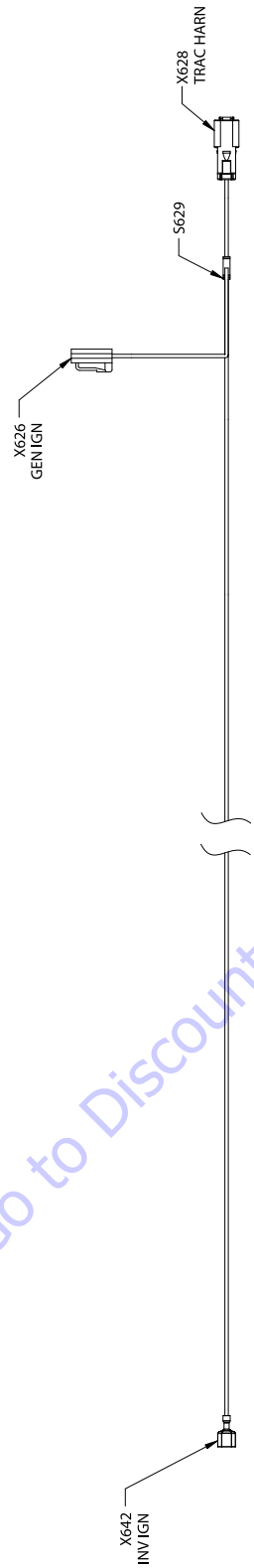
S267							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-12 LIGHT PWR	14 AWG	GXL	N/A		RL266 (4)
2	WHT	3-12-1 LIGHT	16 AWG	GXL	N/A		LB262 (2)
2	WHT	3-12-2 LIGHT	16 AWG	GXL	N/A		LB263 (2)
2	WHT	3-12-3 LIGHT	16 AWG	GXL	N/A		LB264 (2)
2	WHT	3-12-4 LIGHT	16 AWG	GXL	N/A		LB265 (2)

MS570-3 - LIGHT GND							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	1-22 LIGHT GND	14 AWG	GXL			S268 (1)

RL266 - H+T RELAY							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK		14 AWG	GXL	1001116733		IP629 (2)
2	BLK	1-22-5 GND	18 AWG	GXL	1001116732		S268 (1)
3							
4	WHT	3-12 LIGHT PWR	14 AWG	GXL	1001116733		S267 (1)
5	WHT	88-2 LIGHTING	16 AWG	GXL	1001116732		X596B (1)

X596B - H+T SIG							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	88-2 LIGHTING	16 AWG	GXL			RL266 (5)

Figure 7-49. Chassis Head/Tail Light Harness - Sheet 2 of 2



X642 - INV IGN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	IGN 48V	18 AWG	GXL	1001193545		S629 (2)

X626 - GEN IGN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-8-3	18 AWG	GXL	4460465		S629 (2)
2					4460466		

X628 - TRAC HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-8-1	18 AWG	GXL	4460464		S629 (1)
2					4460466		

S629

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-8-1	18 AWG	GXL	N/A		X628 (1)
2	WHT	IGN 48V	18 AWG	GXL	N/A		X642 (1)
2	WHT	8-8-3	18 AWG	GXL	N/A		X626 (1)

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Figure 7-50. Inverter Ign Harness

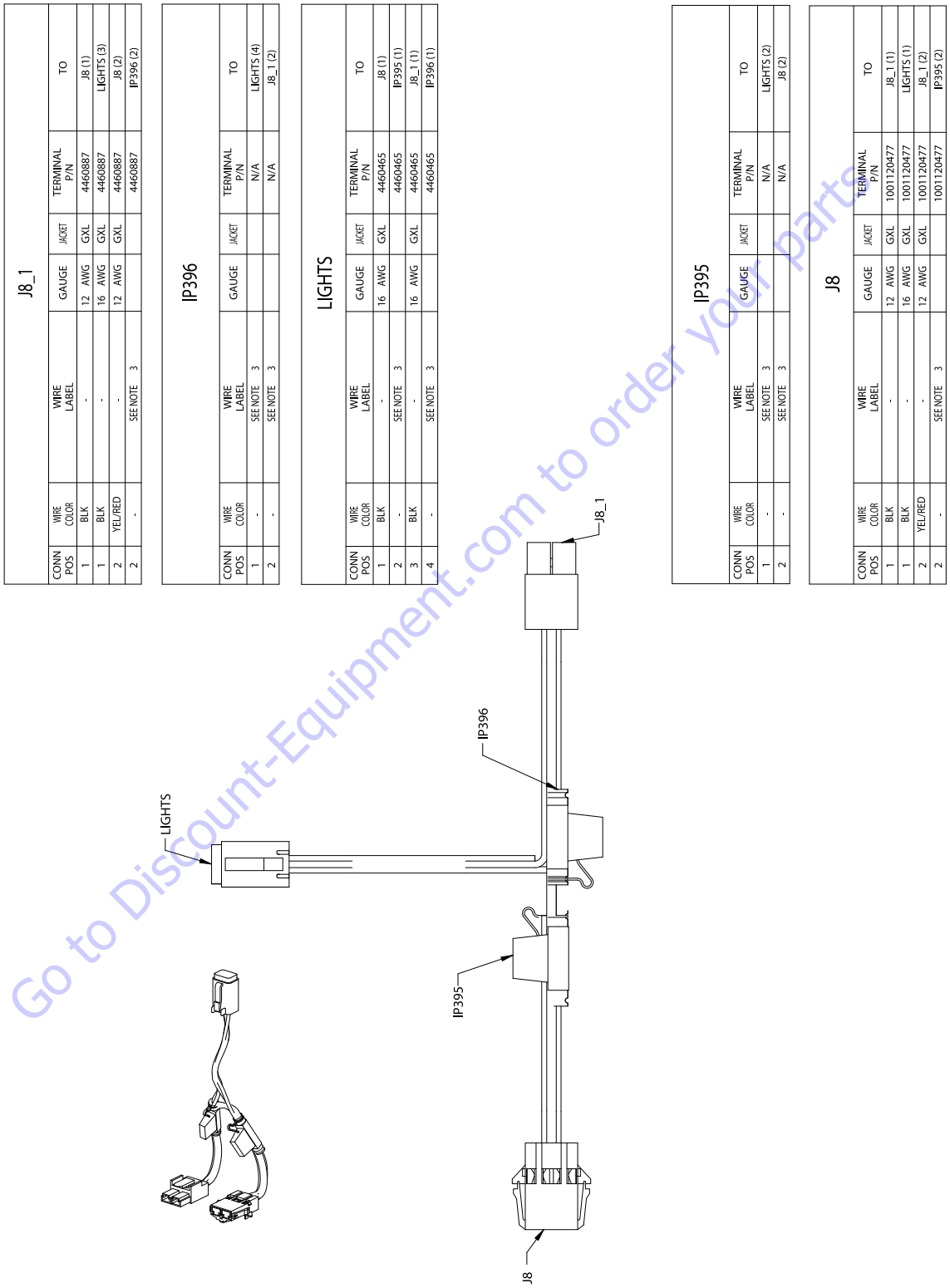


Figure 7-51. Platform Work Light Harness

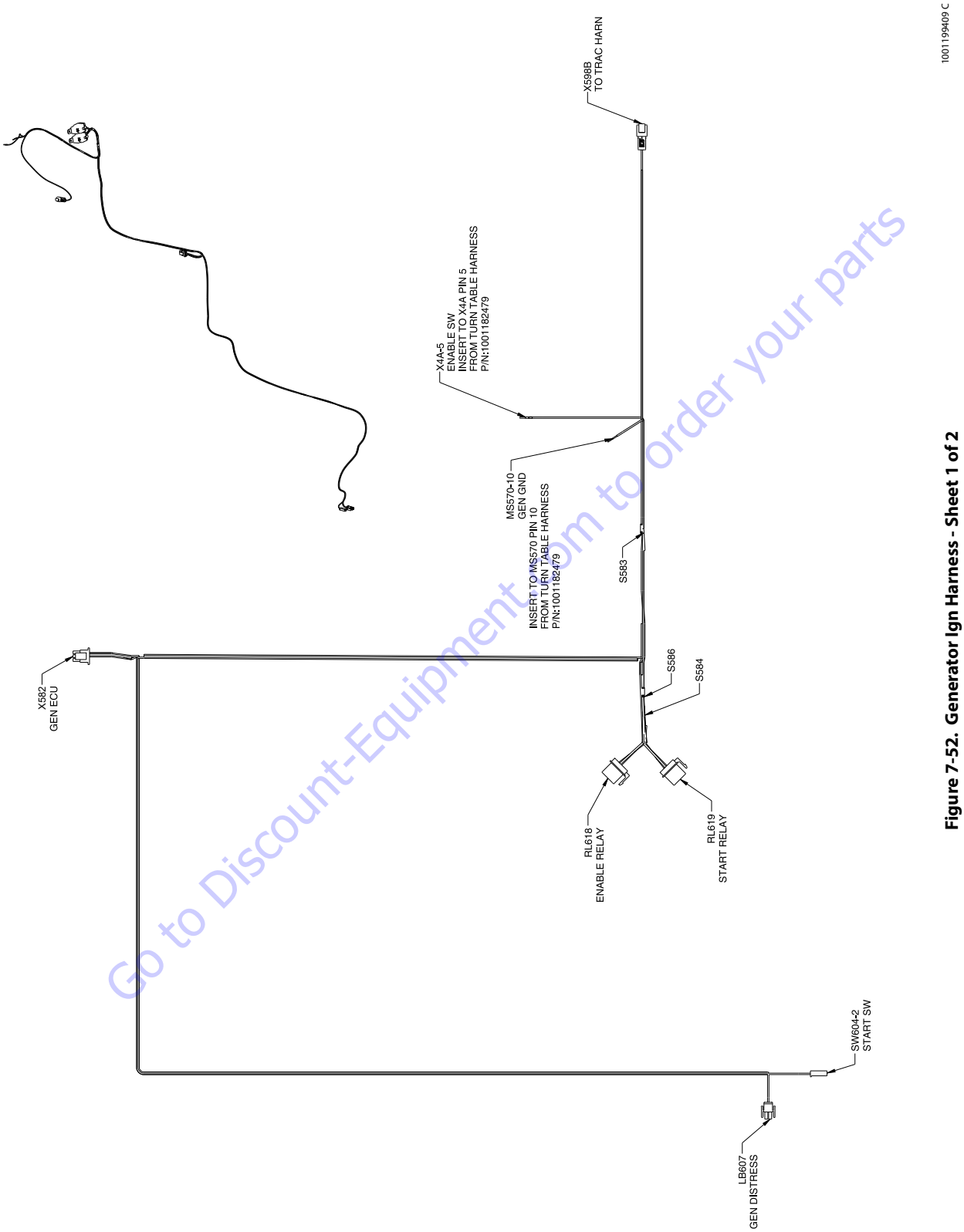


Figure 7-52. Generator Ign Harness - Sheet 1 of 2

MS570-10 - GEN GND

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	8-1 GND	18 AWG	GXL	N/A		S586 (1)

X4A-5 - ENABLE SW

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-3 GENSET ENABLE SW	18 AWG	GXL	N/A		RL618 (5)

X582 - GEN ECU

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-6	14 AWG	GXL	4460267		RL618 (4)
2	WHT	8-7	14 AWG	GXL	4460267		RL619 (4)
3	WHT	8-8 GEN DISTRESS POWER	18 AWG	GXL	4460267		LB607 (2)
4	WHT	8-5 GEN DISTRESS GND	18 AWG	GXL	4460267		LB607 (1)
5	WHT	8-4-2 IGN 48VOLT	18 AWG	GXL	4460267		S583 (2)
6							

X598B - TO TRAC HARN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-4-1 IGN 48VOLT	18 AWG	GXL	4460464		S583 (1)
2					4460466		

LB607 - GEN DISTRESS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-5 GEN DISTRESS GND	18 AWG	GXL	4460227		X582 (4)
2	WHT	8-8 GEN DISTRESS POWER	18 AWG	GXL	4460227		X582 (3)

RL618 - ENABLE RELAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-4-4 IGN 48VOLT	14 AWG	GXL	1001116733		S584 (2)
2	BLK	8-1-2 GND	18 AWG	GXL	1001116732		S586 (2)
3							
4	WHT	8-6	14 AWG	GXL	1001116733		X582 (1)
5	WHT	8-3 GENSET ENABLE SW	18 AWG	GXL	1001116732		X4A-5 (1)

RL619 - START RELAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-4-5 IGN 48VOLT	14 AWG	GXL	1001116733		S584 (2)
2	BLK	8-1-3 GND	18 AWG	GXL	1001116732		S586 (2)
3							
4	WHT	8-7	14 AWG	GXL	1001116733		X582 (2)
5	WHT	8-2 GENSET START SW	18 AWG	GXL	1001116732		SW604-2 (1)

SW604-2 - START SW

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-2 GENSET START SW	18 AWG	GXL	4460259		RL619 (5)

S583

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-4-1 IGN 48VOLT	18 AWG	GXL	N/A		X598B (1)
2	WHT	8-4-2 IGN 48VOLT	18 AWG	GXL	N/A		X582 (5)
2	WHT	8-4-3 IGN 48VOLT	18 AWG	GXL	N/A		S584 (1)

S584

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	8-4-3 IGN 48VOLT	18 AWG	GXL	N/A		S583 (2)
2	WHT	8-4-4 IGN 48VOLT	14 AWG	GXL	N/A		RL618 (1)
2	WHT	8-4-5 IGN 48VOLT	14 AWG	GXL	N/A		RL619 (1)

S586

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK	8-1 GND	18 AWG	GXL	N/A		MS570-10 (1)
2	BLK	8-1-2 GND	18 AWG	GXL	N/A		RL618 (2)
2	BLK	8-1-3 GND	18 AWG	GXL	N/A		RL619 (2)

Figure 7-53. Generator Ign Harness - Sheet 2 of 2

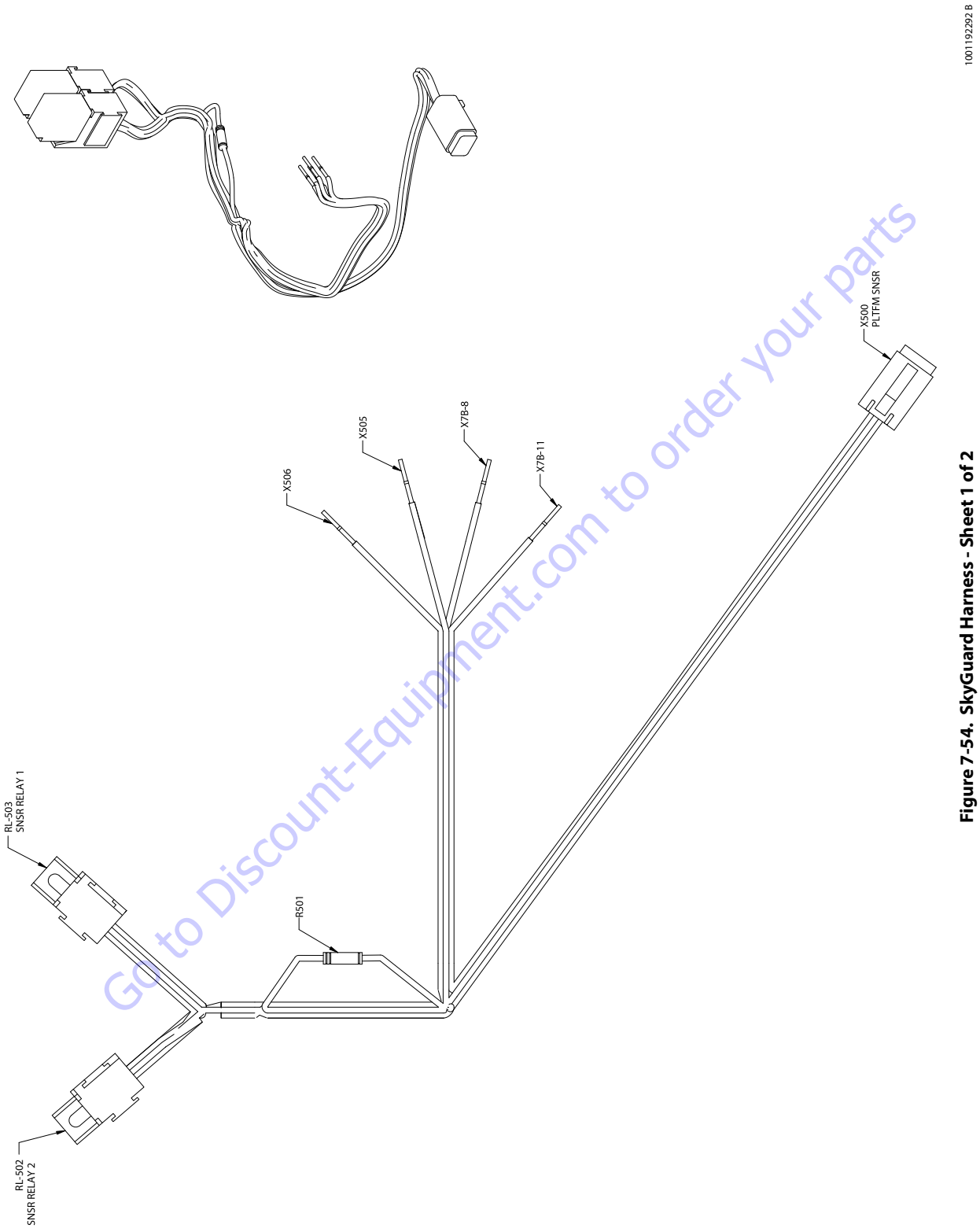


Figure 7-54. SkyGuard Harness - Sheet 1 of 2

X506							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P1	18 AWG	GXL			RL-503 (87)

X505							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P2	18 AWG	GXL			R501 (1)
1	WHT	P9	18 AWG	GXL			RL-503 (30)

X7B-8							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P6	18 AWG	GXL			X500 (2)

X7B-11							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P3	18 AWG	GXL			RL-502 (87)

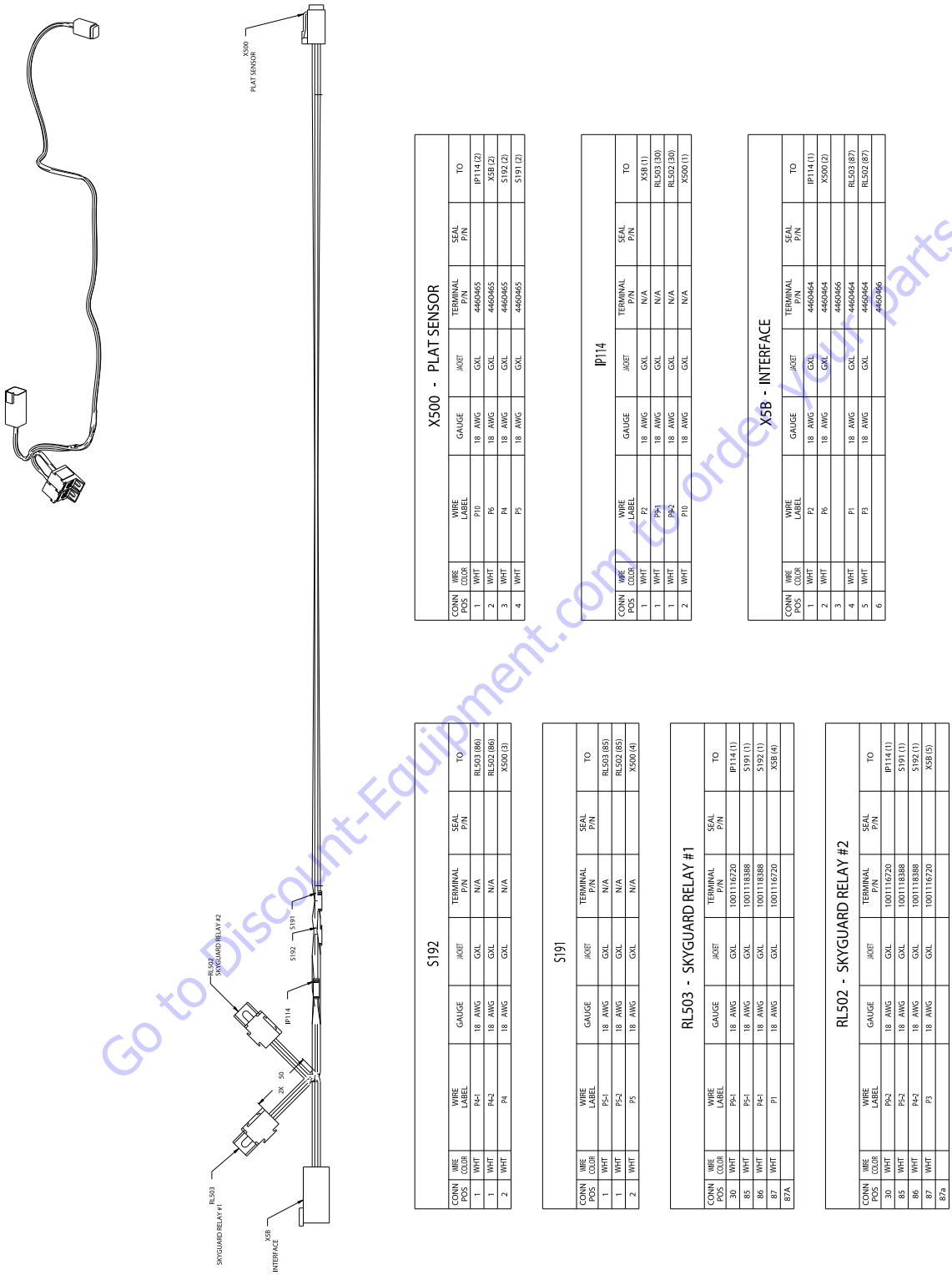
X500 - PLTFM SNSR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P10	18 AWG	GXL	4460465		R501 (2)
2	WHT	P6	18 AWG	GXL	4460465		X7B-8 (1)
3	WHT	P4	18 AWG	GXL	4460465		RL-502 (86)
4	WHT	P5	18 AWG	GXL	4460465		RL-502 (85)

RL-502 - SNSR RELAY 2							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
30	WHT	P9-1	18 AWG	GXL	1001116720		RL-503 (30)
85	WHT	P5	18 AWG	GXL	1001116720		X500 (4)
85	WHT	P5-1	18 AWG	GXL	1001116720		RL-503 (85)
86	WHT	P4	18 AWG	GXL	1001116720		X500 (3)
86	WHT	P4-1	18 AWG	GXL	1001116720		RL-503 (86)
87	WHT	P3	18 AWG	GXL	1001116720		X7B-11 (1)
87a							

RL-503 - SNSR RELAY 1							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
30	WHT	P9	18 AWG	GXL	1001116720		X505 (1)
30	WHT	P9-1	18 AWG	GXL	1001116720		RL-502 (30)
85	WHT	P5-1	18 AWG	GXL	1001116720		RL-502 (85)
86	WHT	P4-1	18 AWG	GXL	1001116720		RL-502 (86)
87	WHT	P1	18 AWG	GXL	1001116720		X506 (1)
87a							

R501							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P2	18 AWG	GXL	N/A		X505 (1)
2	WHT	P10	18 AWG	GXL	N/A		X500 (1)

Figure 7-55. SkyGuard Harness - Sheet 2 of 2



X500 - PLAT SENSOR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P10	18 AWG	GXL	4460465		IP114 (2)
2	WHT	P6	18 AWG	GXL	4460465		X5B (2)
3	WHT	P4	18 AWG	GXL	4460465		S192 (2)
4	WHT	P5	18 AWG	GXL	4460465		S191 (2)

IP114

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P2	18 AWG	GXL	N/A		X5B (1)
1	WHT	P9-1	18 AWG	GXL	N/A		RL503 (30)
1	WHT	P9-2	18 AWG	GXL	N/A		RL502 (30)
2	WHT	P10	18 AWG	GXL	N/A		X500 (1)

X5B - INTERFACE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P2	18 AWG	GXL	4460464		IP114 (1)
2	WHT	P6	18 AWG	GXL	4460464		X500 (2)
3					4460466		
4	WHT	P1	18 AWG	GXL	4460464		RL503 (87)
5	WHT	P3	18 AWG	GXL	4460464		RL502 (87)
6					4460466		

S192

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P4-1	18 AWG	GXL	N/A		RL503 (86)
1	WHT	P4-2	18 AWG	GXL	N/A		RL502 (86)
2	WHT	P4	18 AWG	GXL	N/A		X500 (3)

S191

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P5-1	18 AWG	GXL	N/A		RL503 (85)
1	WHT	P5-2	18 AWG	GXL	N/A		RL502 (85)
2	WHT	P5	18 AWG	GXL	N/A		X500 (4)

RL503 - SKYGUARD RELAY #1

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
30	WHT	P9-1	18 AWG	GXL	1001116720		IP114 (1)
85	WHT	P5-1	18 AWG	GXL	1001118388		S191 (1)
86	WHT	P4-1	18 AWG	GXL	1001118388		S192 (1)
87	WHT	P1	18 AWG	GXL	1001116720		X5B (4)
87A							

RL502 - SKYGUARD RELAY #2

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
30	WHT	P9-2	18 AWG	GXL	1001116720		IP114 (1)
85	WHT	P5-2	18 AWG	GXL	1001118388		S191 (1)
86	WHT	P4-2	18 AWG	GXL	1001118388		S192 (1)
87	WHT	P3	18 AWG	GXL	1001116720		X5B (5)
87a							

Figure 7-56. Gen to Plate Interface Harness

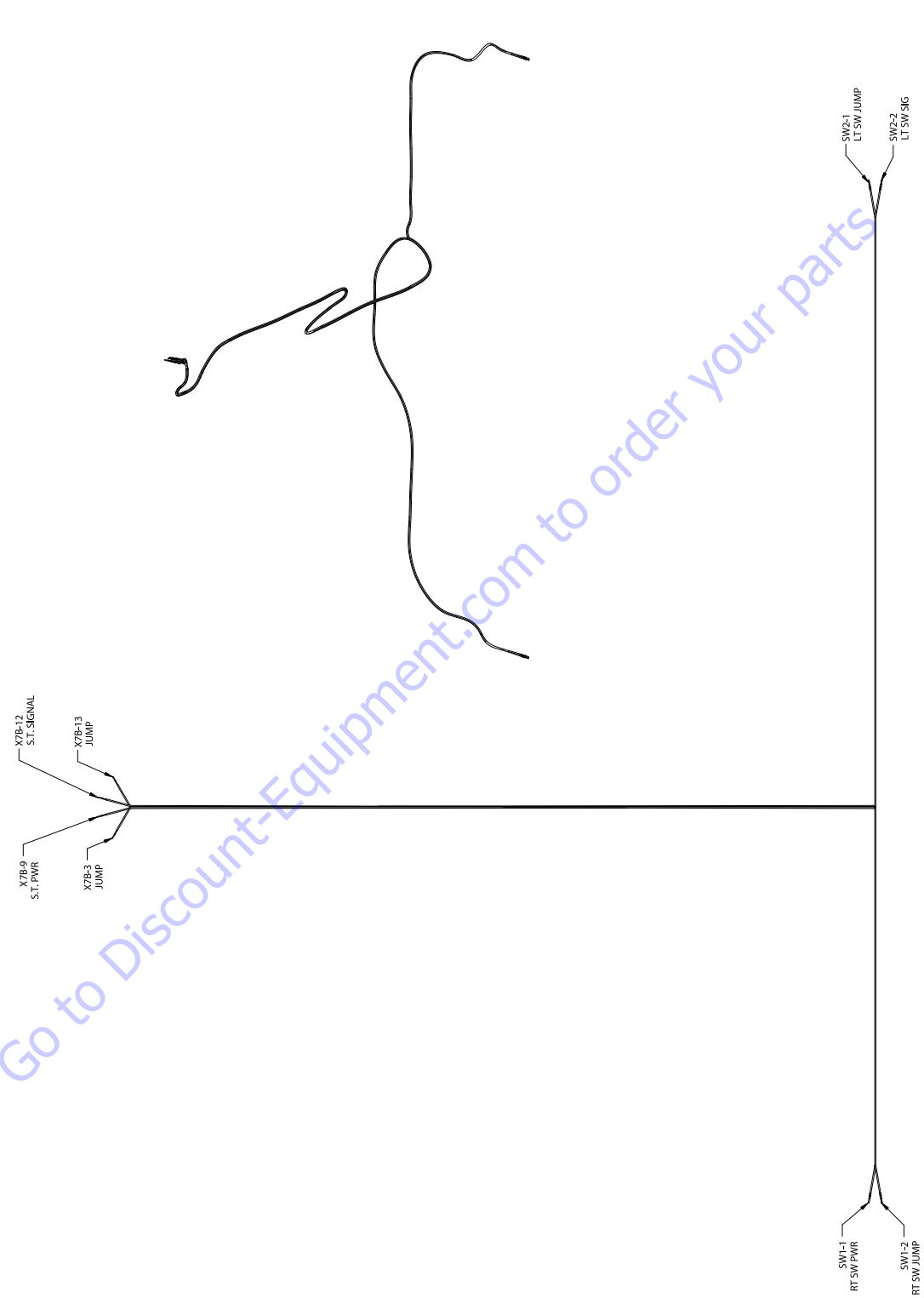


Figure 7-57. Soft Touch Harness - Sheet 1 of 2

X7B-13 - JUMP							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-551-3 JUMPER	18 AWG	GXL	N/A		SW2-1 (1)

X7B-12 - S.T. SIGNAL							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	124-5-2 ST SWITCH	18 AWG	GXL	N/A		SW2-2 (1)

X7B-9 - S.T. PWR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-25-2 ST PWR	18 AWG	GXL	N/A		SW1-1 (1)

X7B-3 - JUMP							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-551-2 JUMPER	18 AWG	GXL	N/A		SW1-2 (1)

SW1-1 - RT SW PWR							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-25-2 ST PWR	18 AWG	GXL	N/A		X7B-9 (1)

SW1-2 - RT SW JUMP							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-551-2 JUMPER	18 AWG	GXL	N/A		X7B-3 (1)

SW2-1 - LT SW JUMP							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-551-2 JUMPER	18 AWG	GXL	N/A		X7B-3 (1)

SW2-2 - LT SW SIG							
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	124-5-2 ST SWITCH	18 AWG	GXL	N/A		X7B-12 (1)

Figure 7-58. Soft Touch Harness - Sheet 2 of 2

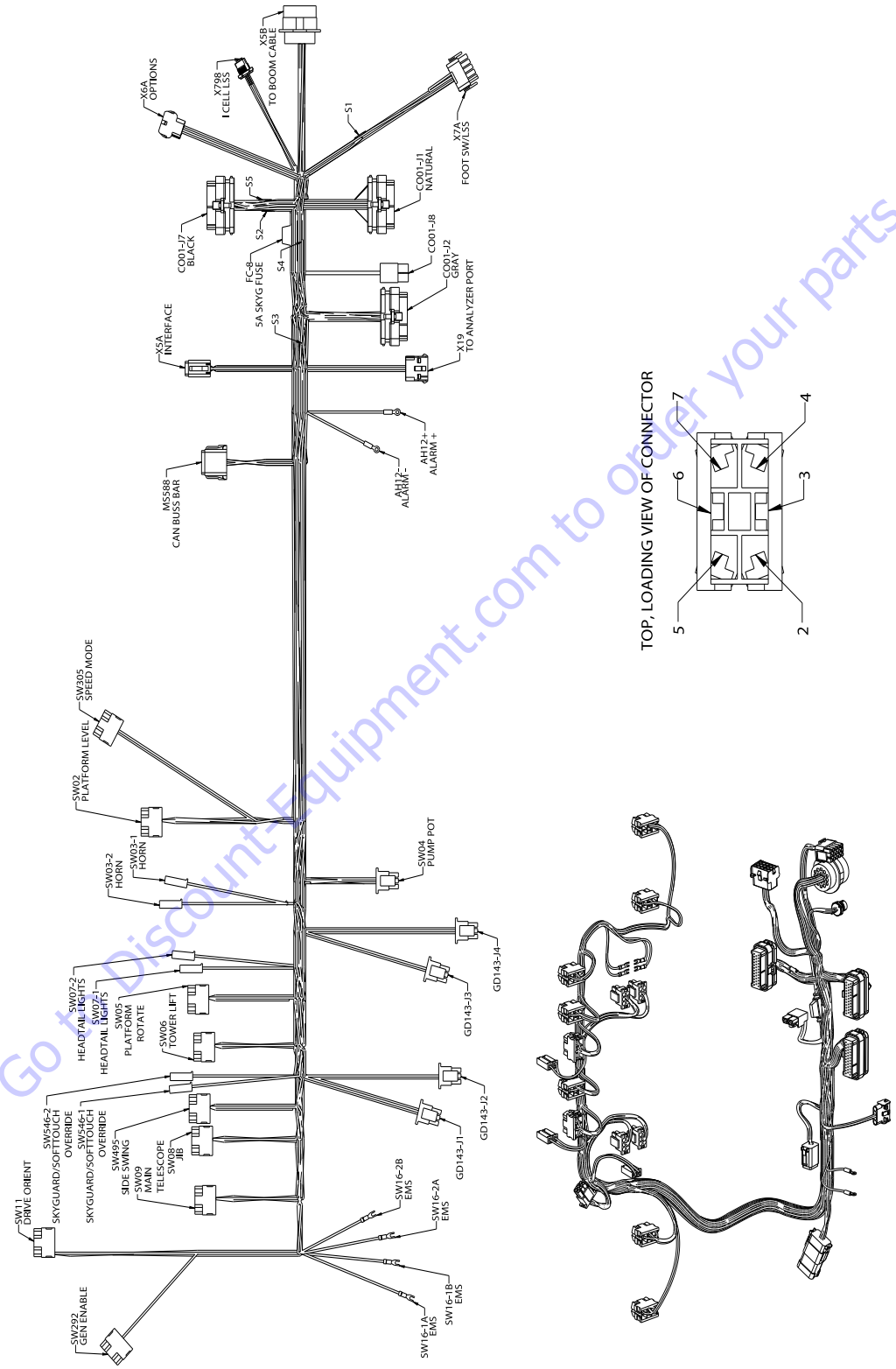


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Figure 7-59. Console Harness with SkyGuard and 1 CELL LSS - Sheet 1 of 4

SW11 - DRIVE ORIENT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	122-1 DOS	18 AWG	GXL	1001159186		CO01-J2 (4)
2	WHT	5-14-10 SW PWR	18 AWG	GXL	4460419		SW546-2 (1)
2	WHT	5-14-9 SW PWR	18 AWG	GXL	4460419		SW03-1 (1)
3							
4							
5							
6							

SW292 - GEN ENABLE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1							
2	WHT	2-12-2 GEN ENABLE IGN	18 AWG	GXL	1001159186		X5B (7)
3	WHT	8-3 GEN ENABLE	18 AWG	GXL	1001159186		X5B (5)
4							
5							
6							

SW09 - MAIN TELESCOPE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	14-0 MAIN TELE OUT	18 AWG	GXL	1001159186		CO01-J1 (6)
2	WHT	5-14-2 SW PWR	18 AWG	GXL	4460419		SW06 (2)
2	WHT	5-14-3 SW PWR	18 AWG	GXL	4460419		SW05 (2)
3	WHT	13-0 MAIN TELE IN	18 AWG	GXL	1001159186		CO01-J1 (5)
4							
5							
6							

SW08 - JIB

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	28-0 JIB DN	18 AWG	GXL	1001159186		CO01-J1 (12)
2	WHT	5-14-5 SW PWR	18 AWG	GXL	4460419		SW02 (2)
2	WHT	5-14-6 SW PWR	18 AWG	GXL	4460419		SW495 (2)
3	WHT	27-0 JIB UP	18 AWG	GXL	1001159186		CO01-J1 (11)
4							
5							
6							

SW16-1A - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1A	WHT	5-11-2 KEYSW PLATFORM MODE	18 AWG	GXL	N/A		X5B (9)

SW16-1B - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1B	WHT	5-2-6 KEYSW IGN	18 AWG	GXL	N/A		X5B (13)

SW16-2A - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
2A	WHT	5-11-3 PLAT EMS SW	18 AWG	GXL	N/A		CO01-J7 (2)

SW16-2B - EMS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
2B	WHT	5-2-5	18 AWG	GXL	N/A		X5B (15)

SW5463 - SKYGUARD/SOFTTOUCH OVERRIDE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
5	WHT	124-1 OVERRIDE	22 AWG	GXL	4460263		CO01-J1 (33)

SW9 - PLATFORM ROTATE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
5	WHT	234 PLAT ROT LFT	22 AWG	GXL	1001159190		CO01-J1 (12)
6	WHT	5-139 SW PWR	22 AWG	GXL	4460423		SW09 (6)
6	WHT	5-140 SW PWR	22 AWG	GXL	4460423		SW02 (6)
7	WHT	244 PLAT ROT RT	22 AWG	GXL	1001159190		CO01-J1 (11)
8							
9							
10							

SW03-1 - HORN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	5-14-8 SW PWR	18 AWG	GXL	4460259		SW04 (1)
1	WHT	5-14-9 SW PWR	18 AWG	GXL	4460259		SW11 (2)

SW495 - SIDE SWING

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	31-0 SIDE SWING LEFT	18 AWG	GXL	1001159186		CO01-J1 (26)
2	WHT	5-14-6 SW PWR	18 AWG	GXL	4460419		SW08 (2)
2	WHT	5-14-7 SW PWR	18 AWG	GXL	4460419		SW04 (1)
3	WHT	32-0 SIDE SWING RIGHT	18 AWG	GXL	1001159186		CO01-J1 (25)
4							
5							
6							

GD143-J1

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	98-3 1/4 BAT CHG	18 AWG	GXL	4460226		CO01-J2 (22)
2	WHT	98-4 1/2 BAT CHG	18 AWG	GXL	4460226		CO01-J2 (24)
3	WHT	98-5 3/4 BAT CHG	18 AWG	GXL	4460226		CO01-J2 (23)
4	WHT	1-25 CHG IND GND	18 AWG	GXL	4460226		CO01-J2 (25)
5							
6	WHT	98-6 BAT FULL	18 AWG	GXL	4460226		CO01-J2 (35)

SW06 - TOWER LIFT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	29-30 TWR LFT DN	18 AWG	GXL	1001159186		CO01-J1 (2)
2	WHT	5-14-1 SW PWR	18 AWG	GXL	4460419		SW305 (2)
2	WHT	5-14-2 SW PWR	18 AWG	GXL	4460419		SW09 (2)
3	WHT	29-0 TWR LFT UP	18 AWG	GXL	1001159186		CO01-J1 (1)
4							
5							
6							

GD143-J2

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	98-7 BAT LOW	18 AWG	GXL	4460226		CO01-J2 (13)
2	WHT	131-1 FUNC ENABLE	18 AWG	GXL	4460226		CO01-J2 (7)
3							
4							
5							
6	WHT	1-26 DISPLAY GND	18 AWG	GXL	4460226		CO01-J2 (18)

GD143-J2

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
0	WHT	125-3 CREEP MODE	17 AWG	GXL	4460225		CO01-J2 (8)
1	WHT	130-2 SOFT TOUCH	17 AWG	GXL	4460225		CO01-J2 (18)
2	WHT	133 SKY GUARD	17 AWG	GXL	4460225		CO01-J2 (15)
3							
4							
5							

GD143-J4

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	129-1 TILT	18 AWG	GXL	4460226		CO01-J2 (6)
2	WHT	128-1 OVERLOAD	18 AWG	GXL	4460226		CO01-J2 (11)
3	WHT	127-1 SYS FAULT	18 AWG	GXL	4460226		CO01-J2 (8)
4	WHT	122-2 DOS	18 AWG	GXL	4460226		CO01-J2 (14)
5							
6							

SW73 - HEADTAIL LIGHTS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
5	WHT	883 HEAD/TAIL LT	22 AWG	GXL	4460263		CO01-J1 (34)

SW5462 - SKYGUARD/SOFTTOUCH OVERRIDE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
5	WHT	5-14-6 SW PWR	22 AWG	GXL	4460263		SW11 (6)
5	WHT	5-14-7 SW PWR	22 AWG	GXL	4460263		SW07-2 (5)

SW72 - HEADTAIL LIGHTS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
5	WHT	5-14-7 SW PWR	22 AWG	GXL	4460263		SW546-2 (5)

SW03-2 - HORN

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	49-0-1 HORN	18 AWG	GXL	4460259		CO01-J1 (31)

Figure 7-60. Console Harness with SkyGuard and 1 CELL LSS - Sheet 2 of 4

SW04 - PUMP POT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	5-14-7 SW PWR	18 AWG	GXL	4460267		SW495 (2)
1	WHT	5-14-8 SW PWR	18 AWG	GXL	4460267		SW03-1 (1)
2	WHT	5-14 SW PWR	18 AWG	GXL	4460267		CO01-J1 (18)
3	WHT	125-1 CREEP MODE	18 AWG	GXL	4460267		CO01-J1 (32)
4	WHT	126-1 PUMP POT PWR	18 AWG	GXL	4460267		CO01-J1 (34)
5	WHT	1-23 PUMP POT RETURN	18 AWG	GXL	4460267		CO01-J1 (13)
6	WHT	126-2 PUMP POT CMD	18 AWG	GXL	4460267		CO01-J1 (35)

SW305 - SPEED MODE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	120-2 AWDA MAN	18 AWG	GXL	1001159186		CO01-J1 (28)
2	WHT	5-14-1 SW PWR	18 AWG	GXL	4460419		SW06 (2)
3	WHT	120-1 TORQUE/SPEED MODE	18 AWG	GXL	1001159186		CO01-J1 (27)
4							
5							
6							

SW02 - PLATFORM LEVEL

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	26-0 PLAT LVL DN	18 AWG	GXL	1001159186		CO01-J1 (10)
2	WHT	5-14-4 SW PWR	18 AWG	GXL	4460419		SW05 (2)
2	WHT	5-14-5 SW PWR	18 AWG	GXL	4460419		SW08 (2)
3	WHT	25-0 PLAT LVL UP	18 AWG	GXL	1001159186		CO01-J1 (9)
4							
5							
6							

AH12- - ALARM -

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-27 PLAT ALARM GND	18 AWG	GXL	N/A		CO01-J7 (20)

AH12+ - ALARM +

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	132 PLAT ALARM	18 AWG	GXL	N/A		CO01-J7 (19)

MS588 - CAN BUSS BAR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	YEL	CAN1 HIGH	18 AWG	GXL	4460465		CO01-J7 (31)
2	BLK	CAN1 HIGH	20 AWG	CABLE	4460466		X798 (5)
3	GRN	CAN1 LOW	18 AWG	GXL	4460465		CO01-J7 (30)
4	GRY	CAN1 LOW	20 AWG	CABLE	4460466		X798 (4)
5	GRN	CAN1 LOW	18 AWG	GXL	4460465		X5B (2)
6	GRN	CAN1 LOW	18 AWG	GXL	4460465		X6A (9)
7	YEL	CAN1 HIGH	18 AWG	GXL	4460465		X5B (3)
8	YEL	CAN1 HIGH	18 AWG	GXL	4460465		X6A (8)

CO01-J8

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-5 PLAT GND	12 AWG	GXL	4460887		X5B (16)
2	WHT	3-8 PLAT IGN	12 AWG	GXL	4460887		X5B (12)

S1

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-20 LSS PWR	18 AWG	GXL	N/A		CO01-J2 (32)
1	WHT	3-20-2 LSS PWR	20 AWG	CABLE	N/A		X798 (2)
2	WHT	3-20-1 LSS PWR	18 AWG	GXL	N/A		X7A (15)

S2

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	1-28 LSS GND	18 AWG	GXL	N/A		CO01-J7 (16)
2	WHT	1-28-1 LSS GND	18 AWG	GXL	N/A		X7A (14)
2	BLU	1-28-2 LSS GND	20 AWG	CABLE	N/A		X798 (3)

CO01-J7 - BLACK

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	81-0 GND MODE RX	18 AWG	GXL	4460871		X5B (11)
2	WHT	5-11-3 PLAT EMS SW	18 AWG	GXL	4460871		SW16-2A (2A)
3	WHT	82-0 PLAT TX	18 AWG	GXL	4460871		X5B (4)
4	WHT	3-16 FOOTSWITCH	18 AWG	GXL	4460871		X7A (5)
5					4460905		
6					4460905		
7	WHT	3-18 SKYG PWR	18 AWG	GXL	4460871		S5 (1)
8	WHT	131-1 FOOT SWITCH	18 AWG	GXL	4460871		X7A (4)
9					4460905		
10					4460905		
11					4460905		
12					4460905		
13					4460905		
14					4460905		
15					4460905		
16	WHT	1-28 LSS GND	18 AWG	GXL	4460871		S2 (1)
17					4460905		
18	WHT	124-1 SKYG INPUT#1	20 AWG	GXL	4460871		X5A (4)
19	WHT	132 PLAT ALARM	18 AWG	GXL	4460871		AH12+ (1)
20	WHT	1-27 PLAT ALARM GND	18 AWG	GXL	4460871		AH12- (1)
21	WHT	25-0-3 PLAT LVL UP	18 AWG	GXL	4460871		X6A (13)
22	WHT	26-0-3 PLAT LVL DN	18 AWG	GXL	4460871		X6A (14)
23	WHT	1-30 VLV GND	18 AWG	GXL	4460871		X6A (5)
24	WHT	1-36 SKYG GND	18 AWG	GXL	4460871		X5A (2)
25	WHT	27-0-3 JIB UP	18 AWG	GXL	4460871		X6A (3)
26	WHT	28-0-3 JIB DN	18 AWG	GXL	4460871		X6A (4)
27	WHT	31-0-3 JIB RHT	18 AWG	GXL	4460871		X6A (11)
28	WHT	30-0-3 JIB LFT	18 AWG	GXL	4460871		X6A (12)
29	WHT	1-29 OPTION GND	18 AWG	GXL	4460871		X6A (6)
30	GRN	CAN1 LOW	18 AWG	GXL	4460871		MS588 (3)
31	YEL	CAN1 HIGH	18 AWG	GXL	4460871		MS588 (1)
32					4460905		
33	WHT	23-0-3 PLAT ROT LFT	18 AWG	GXL	4460871		X6A (1)
34	WHT	24-0-3 PLAT ROT RHT	18 AWG	GXL	4460871		X6A (2)
35					4460905		
NC					4460905		

X5A - INTERFACE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-18-1 SKYG PWR	18 AWG	GXL	4460465		S3 (2)
2	WHT	1-36 SKYG GND	18 AWG	GXL	4460465		CO01-J7 (24)
3	WHT	3-18-2 SOFTT SENSE	20 AWG	GXL	4460465		S3 (2)
4	WHT	124-1 SKYG INPUT#1	20 AWG	GXL	4460465		CO01-J7 (18)
5	WHT	124-2 SKYG INPUT#2	20 AWG	GXL	4460465		CO01-J1 (23)
6	WHT	124-5-1 SOFTT OUT	20 AWG	GXL	4460465		S4 (2)

X6A - OPTIONS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	23-0-3 PLAT ROT LFT	18 AWG	GXL	4460226		CO01-J7 (33)
2	WHT	24-0-3 PLAT ROT RHT	18 AWG	GXL	4460226		CO01-J7 (34)
3	WHT	27-0-3 JIB UP	18 AWG	GXL	4460226		CO01-J7 (25)
4	WHT	28-0-3 JIB DN	18 AWG	GXL	4460226		CO01-J7 (26)
5	WHT	1-30 VLV GND	18 AWG	GXL	4460226		CO01-J7 (23)
6	WHT	1-29 OPTION GND	18 AWG	GXL	4460226		CO01-J7 (29)
7							
8	YEL	CAN1 HIGH	18 AWG	GXL	4460226		MS588 (8)
9	GRN	CAN1 LOW	18 AWG	GXL	4460226		MS588 (6)
10							
11	WHT	31-0-3 JIB RHT	18 AWG	GXL	4460226		CO01-J7 (27)
12	WHT	30-0-3 JIB LFT	18 AWG	GXL	4460226		CO01-J7 (28)
13	WHT	25-0-3 PLAT LVL UP	18 AWG	GXL	4460226		CO01-J7 (21)
14	WHT	26-0-3 PLAT LVL DN	18 AWG	GXL	4460226		CO01-J7 (22)
15							

X18 - TO ANALYZER PORT

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
0	RED	51-1 ANALYZER PWR	17 AWG	GXL	4460226		CO01-J2 (25)
1	GRN	52-1 ANALYZER RX	17 AWG	GXL	4460226		CO01-J2 (27)
2	WHT	53-1 ANALYZER TX	17 AWG	GXL	4460226		CO01-J2 (28)
3	BLK	54-1 ANALYZER GND	17 AWG	GXL	4460226		CO01-J2 (26)

FC-8 - 5A SKYG FUSE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK		14 AWG	GXL	N/A		S5 (2)
2	BLK		14 AWG	GXL	N/A		S3 (1)

S4

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	124-5 SOFTT	20 AWG	GXL	N/A		CO01-J1 (20)
1	WHT	124-5-2 SOFTT OUT	20 AWG	GXL	N/A		X7A (12)
2	WHT	124-5-1 SOFTT OUT	20 AWG	GXL	N/A		X5A (6)

Figure 7-61. Console Harness with SkyGuard and 1 CELL LSS - Sheet 3 of 4

X5A - INTERFACE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-18-1 SKYG PWR	18 AWG	GXL	4460465		S3 (2)
2	WHT	1-36 SKYG GND	18 AWG	GXL	4460465		C001-J7 (24)
3	WHT	3-18-2 SOFTT SENSE	20 AWG	GXL	4460465		S3 (2)
4	WHT	124-1 SKYG INPUT#1	20 AWG	GXL	4460465		C001-J7 (18)
5	WHT	124-2 SKYG INPUT#2	20 AWG	GXL	4460465		C001-J1 (23)
6	WHT	124-5-1 SOFTT OUT	20 AWG	GXL	4460465		S4 (2)

X6A - OPTIONS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	23-0-3 PLAT ROT LFT	18 AWG	GXL	4460226		C001-J7 (33)
2	WHT	24-0-3 PLAT ROT RHT	18 AWG	GXL	4460226		C001-J7 (34)
3	WHT	27-0-3 JIB UP	18 AWG	GXL	4460226		C001-J7 (25)
4	WHT	28-0-3 JIB DN	18 AWG	GXL	4460226		C001-J7 (26)
5	WHT	1-30 VLV GND	18 AWG	GXL	4460226		C001-J7 (23)
6	WHT	1-29 OPTION GND	18 AWG	GXL	4460226		C001-J7 (29)
7							
8	YEL	CAN1 HIGH	18 AWG	GXL	4460226		MS588 (8)
9	GRN	CAN1 LOW	18 AWG	GXL	4460226		MS588 (6)
10							
11	WHT	31-0-3 JIB RHT	18 AWG	GXL	4460226		C001-J7 (27)
12	WHT	30-0-3 JIB LFT	18 AWG	GXL	4460226		C001-J7 (28)
13	WHT	25-0-3 PLAT LVL UP	18 AWG	GXL	4460226		C001-J7 (21)
14	WHT	26-0-3 PLAT LVL DN	18 AWG	GXL	4460226		C001-J7 (22)
15							

X798 - 1CELL LSS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1							
2	WHT	3-20-2 LSS PWR	20 AWG	CABLE			S1 (1)
3	BLU	1-28-2 LSS GND	20 AWG	CABLE			S2 (2)
4	GRY	CAN1 LOW	20 AWG	CABLE			MS588 (4)
5	BLK	CAN1 HIGH	20 AWG	CABLE			MS588 (2)

X5B - TO BOOM CABLE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460466		
2	GRN	CAN1 LOW	18 AWG	GXL	4460464		MS588 (5)
3	YEL	CAN1 HIGH	18 AWG	GXL	4460464		MS588 (7)
4	WHT	82-0 PLAT TX	18 AWG	GXL	4460464		C001-J7 (3)
5	WHT	8-3 GEN ENABLE	18 AWG	GXL	4460464		SW292 (3)
6	WHT	131-3 FOOT PEDAL	18 AWG	GXL	4460464		X7A (6)
7	WHT	2-13-2 GEN ENABLE IGN	18 AWG	GXL	4460464		SW292 (2)
8					4460466		
9	WHT	5-1-2 KEYSW PLATFORM MODE	18 AWG	GXL	4460464		SW16-1A (1A)
10					4460466		
11	WHT	81-0 GND MODE RX	18 AWG	GXL	4460464		C001-J7 (1)
12	WHT	3-8 PLAT IGN	12 AWG	GXL	4460508		C001-J8 (2)
13	WHT	5-2-5 KEYSW IGN	18 AWG	GXL	4460464		SW16-1B (1B)
14					4460466		
15	WHT	5-2-3	18 AWG	GXL	4460464		SW16-2B (2B)
16	WHT	1-3 PLAT GND	12 AWG	GXL	4460508		C001-J8 (1)
17					4460466		
18					4460466		
19					4460466		

X7A - FOOT SW/LSS

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1							
2							
3	WHT	1-551 JUMPER	18 AWG	GXL	4460227		X7A (13)
4	WHT	131-1 FOOT SWITCH	18 AWG	GXL	4460227		C001-J7 (8)
5	WHT	3-16 FOOTSWITCH	18 AWG	GXL	4460227		C001-J7 (4)
6	WHT	131-3 FOOT PEDAL	18 AWG	GXL	4460227		X5B (6)
7							
8							
9	WHT	3-25 SOFTT PWR	18 AWG	GXL	4460227		C001-J2 (31)
10							
11							
12	WHT	124-5-2 SOFTT OUT	20 AWG	GXL	4460227		S4 (1)
13	WHT	1-551 JUMPER	18 AWG	GXL	4460227		X7A (3)
14	WHT	1-28-1 LSS GND	18 AWG	GXL	4460227		S2 (2)
15	WHT	3-20-1 LSS PWR	18 AWG	GXL	4460227		S1 (2)

S3

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	BLK		14 AWG	GXL	N/A		FC-8 (2)
2	WHT	3-18-1 SKYG PWR	18 AWG	GXL	N/A		X5A (1)
2	WHT	3-18-2 SOFTT SENSE	20 AWG	GXL	N/A		X5A (3)

C001-J2 - GRAY

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1					4460905		
2					4460905		
3					4460905		
4	WHT	122-1 DOS	18 AWG	GXL	4460871		SW111 (1)
5					4460905		
6	WHT	129-1 TILT	18 AWG	GXL	4460871		GD143-J4 (1)
7	WHT	131-3 FUNC ENABLE	18 AWG	GXL	4460871		GD143-J2 (2)
8	WHT	127-1 SYS FAULT	18 AWG	GXL	4460871		GD143-J4 (3)
9	WHT	125-2 CREEP MODE	18 AWG	GXL	4460871		GD143-J3 (1)
10					4460905		
11	WHT	128-1 OVERLOAD	18 AWG	GXL	4460871		GD143-J4 (2)
12					4460905		
13	WHT	98-7 BAT LOW	18 AWG	GXL	4460871		GD143-J2 (1)
14	WHT	122-2 DOS	18 AWG	GXL	4460871		GD143-J4 (4)
15					4460905		
16	WHT	134 SKY GUARD	18 AWG	GXL	4460871		GD143-J3 (3)
17					4460905		
18	WHT	1-26 DISPLAY GND	18 AWG	GXL	4460871		GD143-J2 (6)
19	WHT	130-1 SOFT TOUCH	18 AWG	GXL	4460871		GD143-J3 (2)
20					4460905		
21					4460905		
22	WHT	98-3 1/4 BAT CHG	18 AWG	GXL	4460871		GD143-J1 (1)
23	WHT	98-5 3/4 BAT CHG	18 AWG	GXL	4460871		GD143-J1 (3)
24	WHT	98-4 1/2 BAT CHG	18 AWG	GXL	4460871		GD143-J1 (2)
25	WHT	1-25 CHG GND GND	18 AWG	GXL	4460871		GD143-J1 (4)
26	RED	51-0 ANALYZER PWR	18 AWG	GXL	4460871		X19 (1)
27	BLK	54-0 ANALYZER GND	18 AWG	GXL	4460871		X19 (4)
28	GRN	52-0 ANALYZER RX	18 AWG	GXL	4460871		X19 (2)
29	WHT	53-0 ANALYZER TX	18 AWG	GXL	4460871		X19 (3)
30					4460905		
31	WHT	3-25 SOFTT PWR	18 AWG	GXL	4460871		X7A (9)
32	WHT	3-20 LSS PWR	18 AWG	GXL	4460871		S1 (1)
33					4460905		
34					4460905		
35	WHT	98-6 BAT FULL	18 AWG	GXL	4460871		GD143-J1 (6)

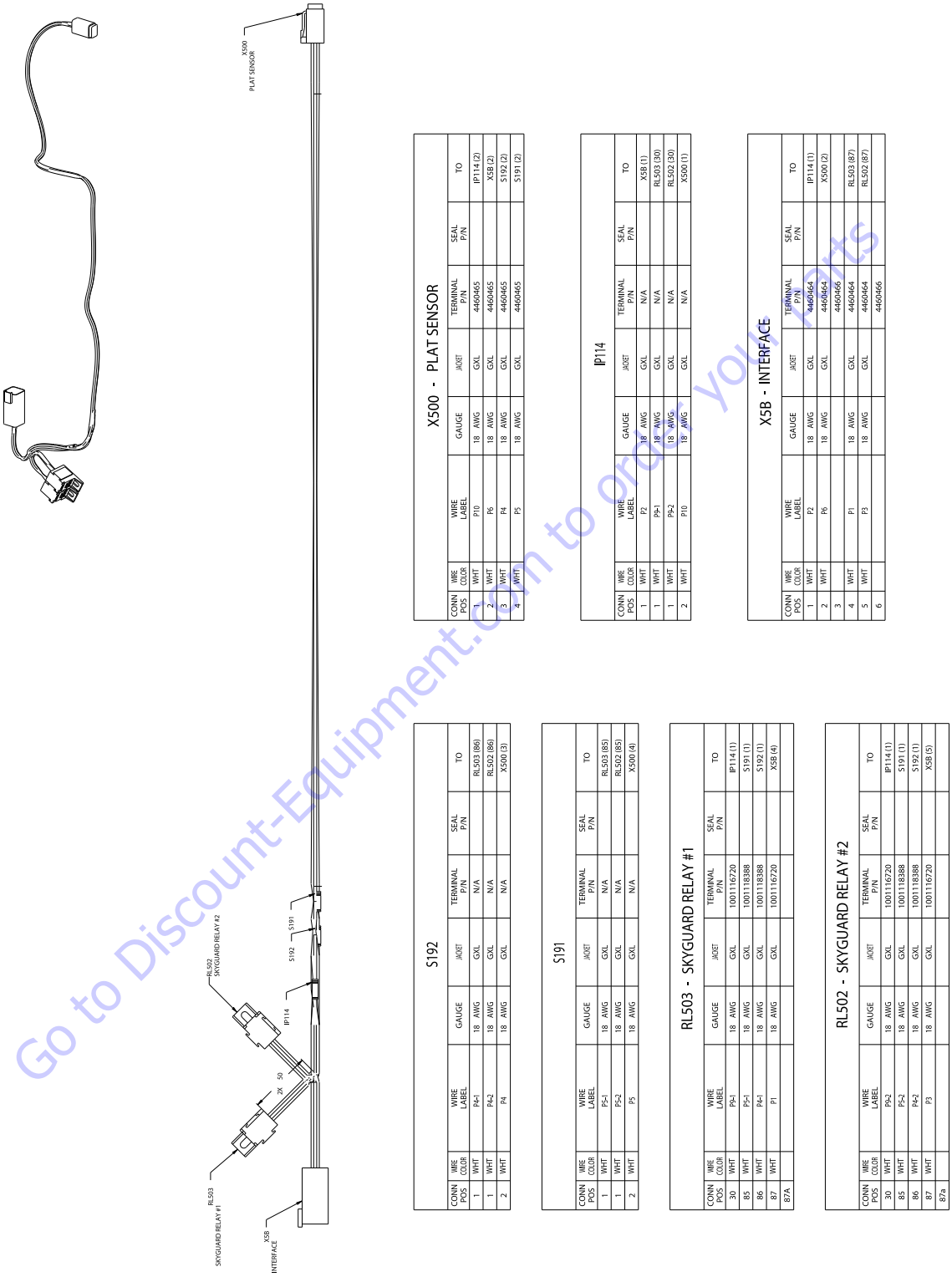
C001-J1 - NATURAL

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	29-0 TWR LFT UP	18 AWG	GXL	4460871		SW06 (3)
2	WHT	29-30 TWR LFT DN	18 AWG	GXL	4460871		SW06 (1)
3					4460905		
4					4460905		
5	WHT	13-0 MAIN TELE IN	18 AWG	GXL	4460871		SW09 (3)
6	WHT	14-0 MAIN TELE OUT	18 AWG	GXL	4460871		SW09 (1)
7	WHT	24-0 PLAT ROT RT	18 AWG	GXL	4460871		SW05 (3)
8	WHT	23-0 PLAT ROT LFT	18 AWG	GXL	4460871		SW05 (1)
9	WHT	25-0 PLAT LVL UP	18 AWG	GXL	4460871		SW02 (3)
10	WHT	26-0 PLAT LVL DN	18 AWG	GXL	4460871		SW02 (1)
11	WHT	27-0 JIB UP	18 AWG	GXL	4460871		SW08 (3)
12	WHT	28-0 JIB DN	18 AWG	GXL	4460871		SW08 (1)
13	WHT	1-23 PUMP POT RETURN	18 AWG	GXL	4460871		SW04 (5)
14					4460905		
15					4460905		
16					4460905		
17					4460905		
18	WHT	5-14 SW PWR	18 AWG	GXL	4460871		SW04 (2)
19					4460905		
20	WHT	124-5 SOFTT	20 AWG	GXL	4460871		S4 (1)
21					4460905		
22					4460905		
23	WHT	124-2 SKYG INPUT#2	20 AWG	GXL	4460871		X5A (5)
24					4460905		
25	WHT	32-0 SIDE SWING RIGHT	18 AWG	GXL	4460871		SW495 (3)
26	WHT	31-0 SIDE SWING LEFT	18 AWG	GXL	4460871		SW495 (1)
27	WHT	120-1 TORQUE/SPEED MODE	18 AWG	GXL	4460871		SW305 (3)
28	WHT	120-2 AWDA MAN	18 AWG	GXL	4460871		SW305 (1)
29	WHT	124-3 OVERRIDE	18 AWG	GXL	4460871		SW546-1 (1)
30	WHT	88-1 HEAD/TAIL LT	18 AWG	GXL	4460871		SW07-1 (1)
31	WHT	49-0-1 HORN	18 AWG	GXL	4460871		SW03-2 (1)
32	WHT	125-1 CREEP MODE	18 AWG	GXL	4460871		SW04 (3)
33					4460905		
34	WHT	126-1 PUMP POT PWR	18 AWG	GXL	4460871		SW04 (4)
35	WHT	126-2 PUMP POT CMD	18 AWG	GXL	4460871		SW04 (6)

S5

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	3-18 SKYG PWR	18 AWG	GXL	N/A		C001-J7 (7)
2	BLK		14 AWG	GXL	N/A		FC-8 (1)

Figure 7-62. Console Harness with SkyGuard and 1 CELL LSS - Sheet 4 of 4



X500 - PLAT SENSOR

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P10	18 AWG	GXL	4460465		IP114 (2)
2	WHT	P6	18 AWG	GXL	4460465		X5B (2)
3	WHT	P4	18 AWG	GXL	4460465		S192 (2)
4	WHT	P5	18 AWG	GXL	4460465		S191 (2)

IP114

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P2	18 AWG	GXL	N/A		X5B (1)
1	WHT	P9-1	18 AWG	GXL	N/A		RL503 (30)
1	WHT	P9-2	18 AWG	GXL	N/A		RL502 (30)
2	WHT	P10	18 AWG	GXL	N/A		X500 (1)

X5B - INTERFACE

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P2	18 AWG	GXL	4460464		IP114 (1)
2	WHT	P6	18 AWG	GXL	4460464		X500 (2)
3					4460466		
4	WHT	P1	18 AWG	GXL	4460464		RL503 (87)
5	WHT	P3	18 AWG	GXL	4460464		RL502 (87)
6					4460466		

S192

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P4-1	18 AWG	GXL	N/A		RL503 (86)
1	WHT	P4-2	18 AWG	GXL	N/A		RL502 (86)
2	WHT	P4	18 AWG	GXL	N/A		X500 (3)

S191

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
1	WHT	P5-1	18 AWG	GXL	N/A		RL503 (85)
1	WHT	P5-2	18 AWG	GXL	N/A		RL502 (85)
2	WHT	P5	18 AWG	GXL	N/A		X500 (4)

RL503 - SKYGUARD RELAY #1

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
30	WHT	P9-1	18 AWG	GXL	1001116720		IP114 (1)
85	WHT	P5-1	18 AWG	GXL	1001118388		S191 (1)
86	WHT	P4-1	18 AWG	GXL	1001118388		S192 (1)
87	WHT	P1	18 AWG	GXL	1001116720		X5B (4)
87A							

RL502 - SKYGUARD RELAY #2

CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TERMINAL P/N	SEAL P/N	TO
30	WHT	P9-2	18 AWG	GXL	1001116720		IP114 (1)
85	WHT	P5-2	18 AWG	GXL	1001118388		S191 (1)
86	WHT	P4-2	18 AWG	GXL	1001118388		S192 (1)
87	WHT	P3	18 AWG	GXL	1001116720		X5B (5)
87a							

Figure 7-63. Gen 2 Plate Interface Harness

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ELECTRICAL SCHEMATICS

SHEET 2: PLATFORM CONSOLE
- CONSOLE HARNESS
- PLATFORM BEACON

SHEET 3: PLATFORM AND BOOM COMPONENTS
- UPPER VALVE HARNESS
- BOOM LIMIT SWITCH HARNESS
- TRANSPORT LIMIT SWITCH HARNESS
- TRANSPORT BOOM HARNESS
- LSS HARNESS

SHEET 4: CHASSIS, TURNTABLE, AND UGM
- LOWER VALVE HARNESS
- TURNTABLE HARNESS
- AMBER BEACON

SHEET 5: GROUND USER INTERFACE
- GROUND PANEL HARNESS

SHEET 6: TRACTION SYSTEM
- TRACTION HARNESS
- STEERING SNSR HARNESS
- TRACTION TO TURNTABLE HARNESS

SHEET 7: OPTIONS:
- GENERATOR

SHEET 8: OPTIONS:
- CHASSIS HEAD/TAIL LIGHT
- INVERTER IGN
- PLATFORM WORK LIGHT
- GENERATOR IGN
- SKY GUARD
- SOFT TOUCH

SHEET 9: PLATFORM
- CONSOLE HARNESS WITH SKYGUARD AND 1 CELL LSS

SHEET 10: PLATFORM INTERFACE
- GEN 2 PLAT INTERFACE

SHEET 1

1001179395 H

Figure 7-64. Electrical Schematic - Sheet 1 of 16

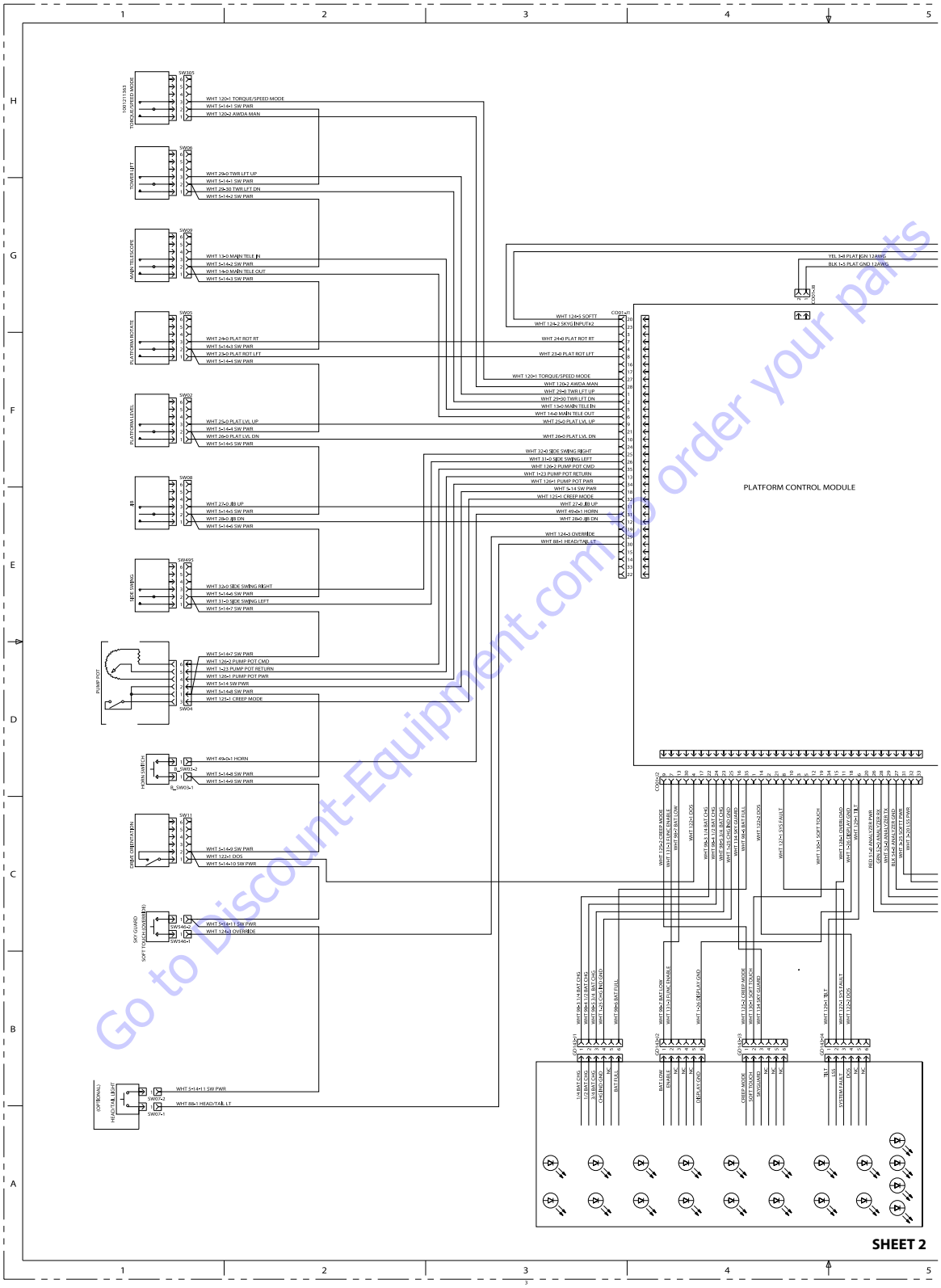

Figure 7-65. Electrical Schematic - Sheet 2 of 16

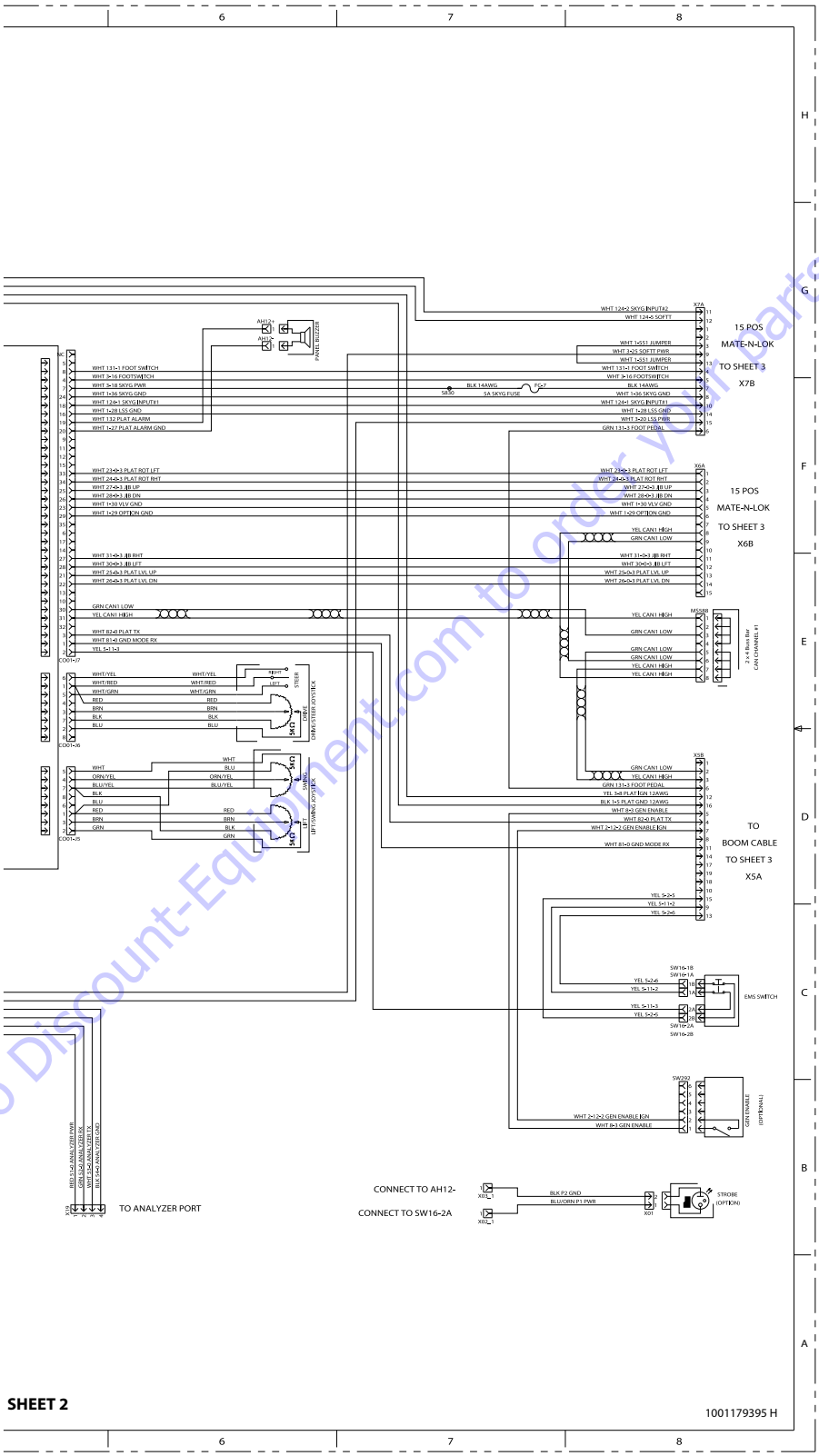

Figure 7-66. Electrical Schematic - Sheet 3 of 16

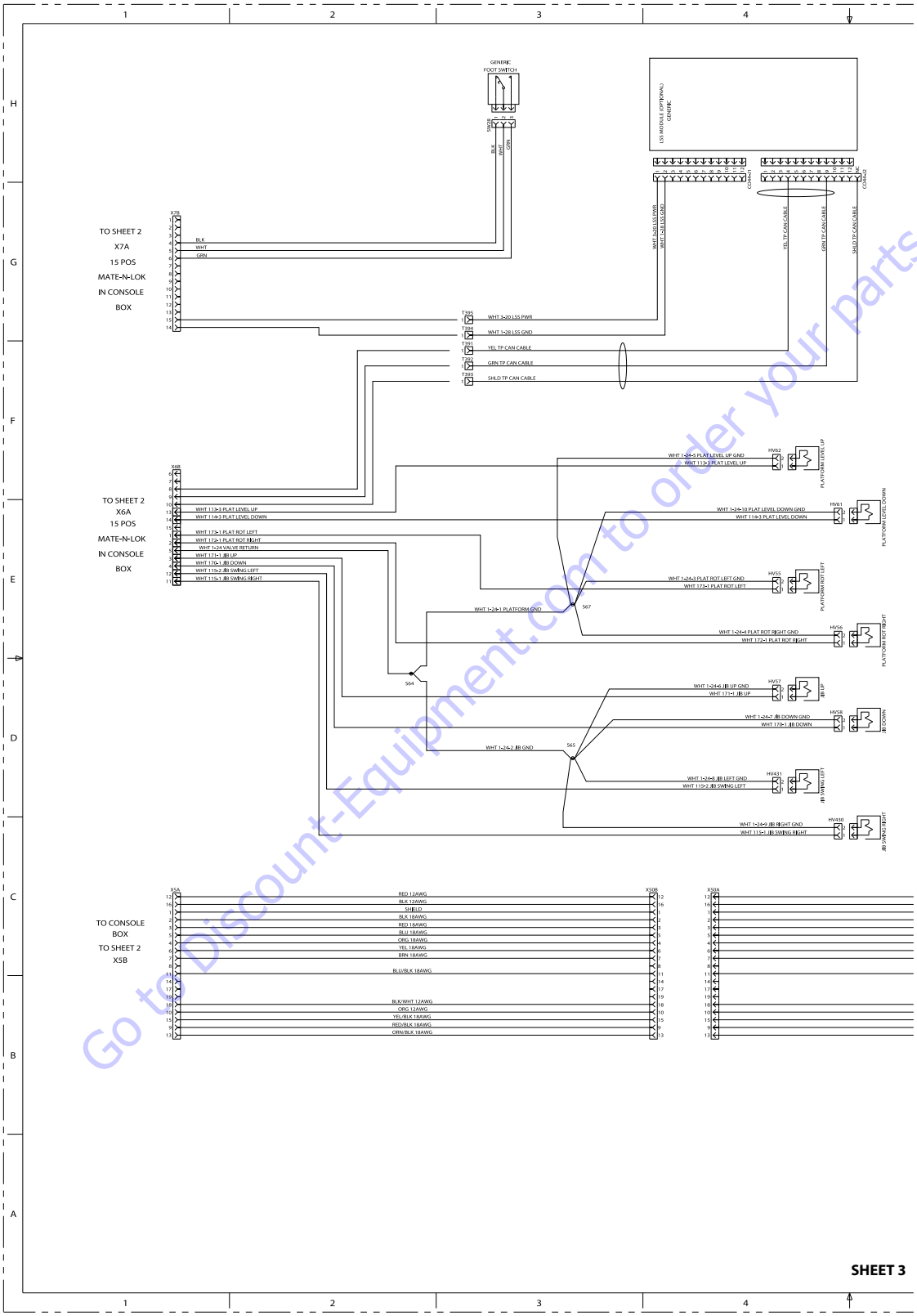

Figure 7-67. Electrical Schematic - Sheet 4 of 16

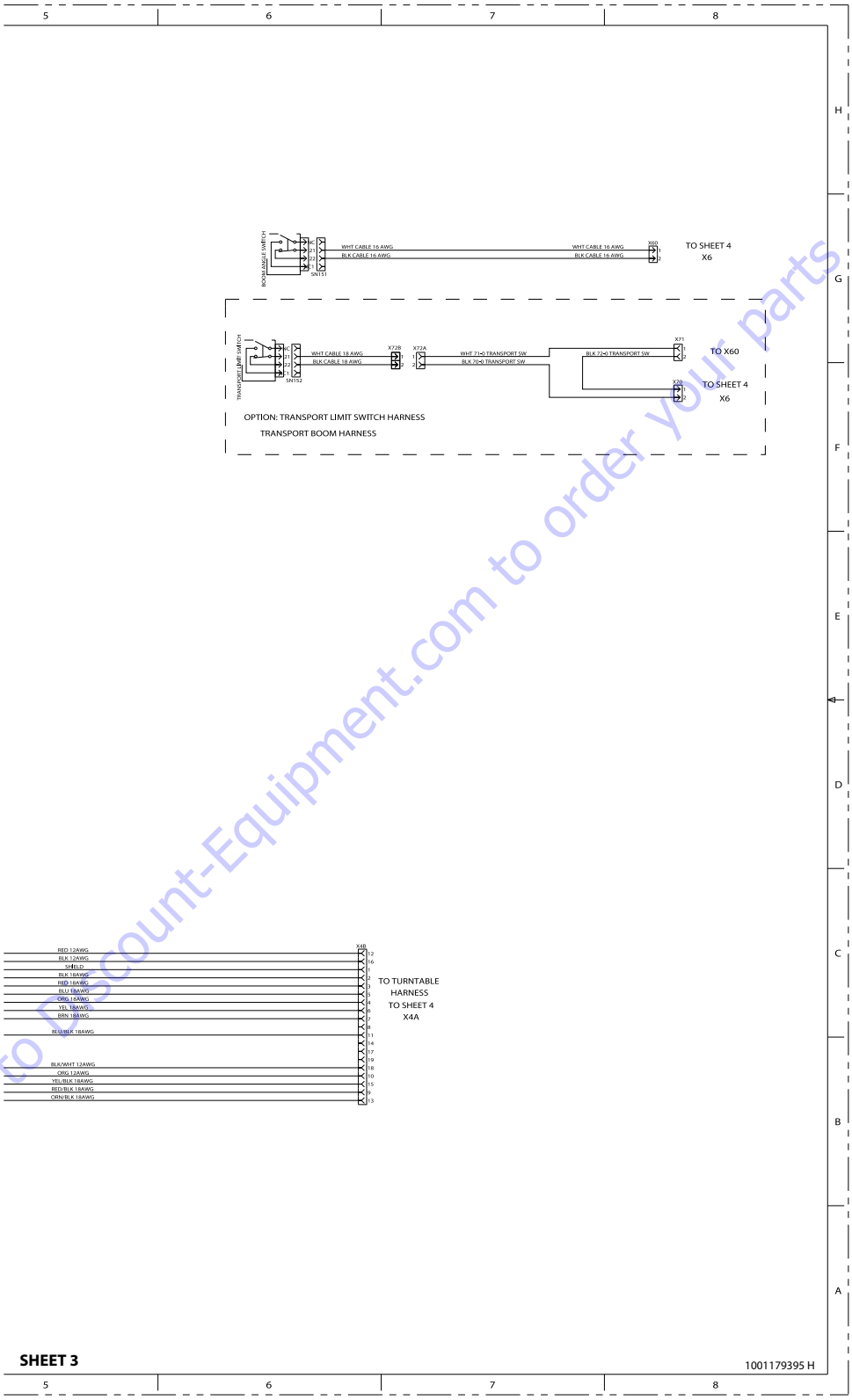

Figure 7-68. Electrical Schematic - Sheet 4 of 16

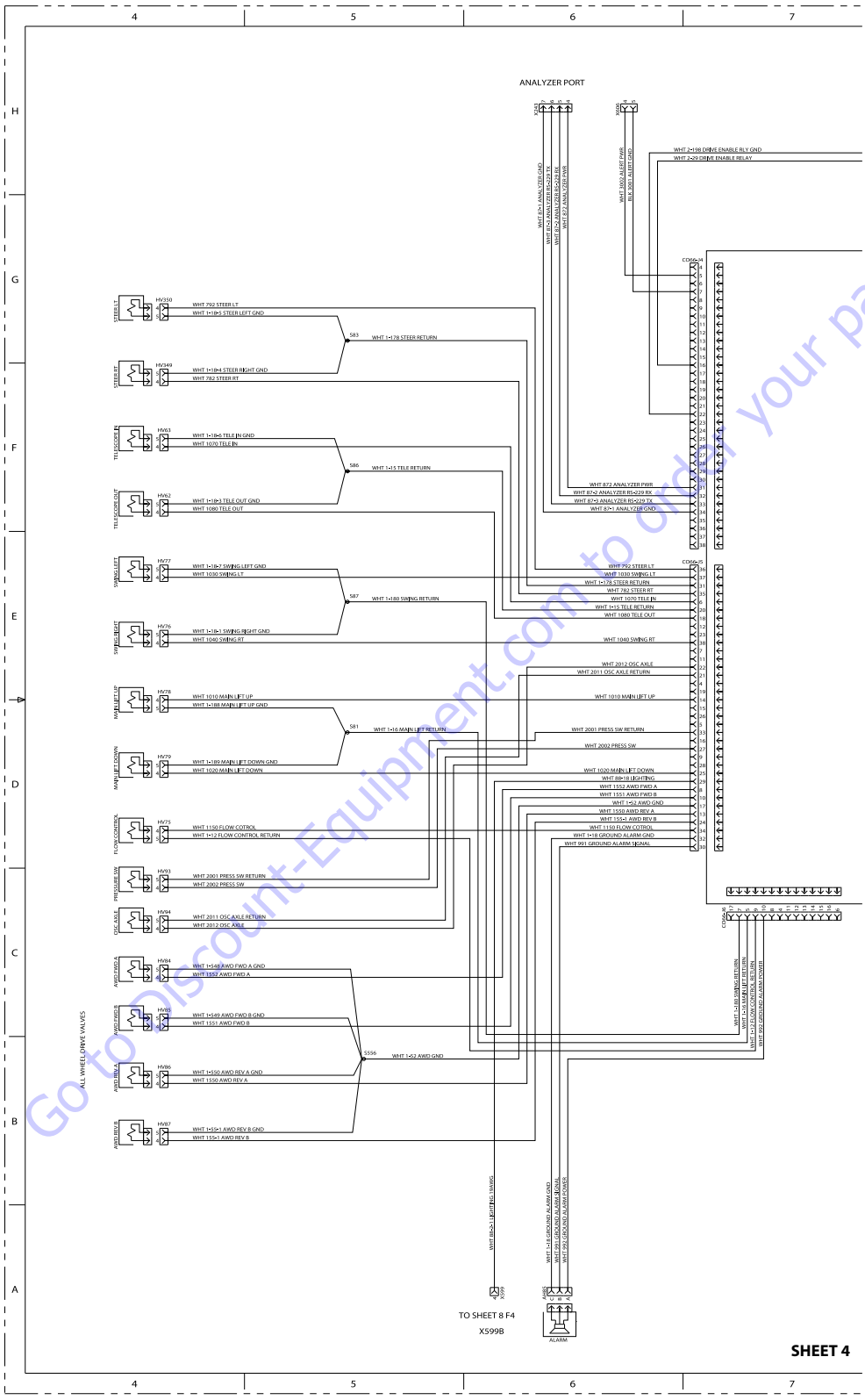

Figure 7-69. Electrical Schematic - Sheet 5 of 16

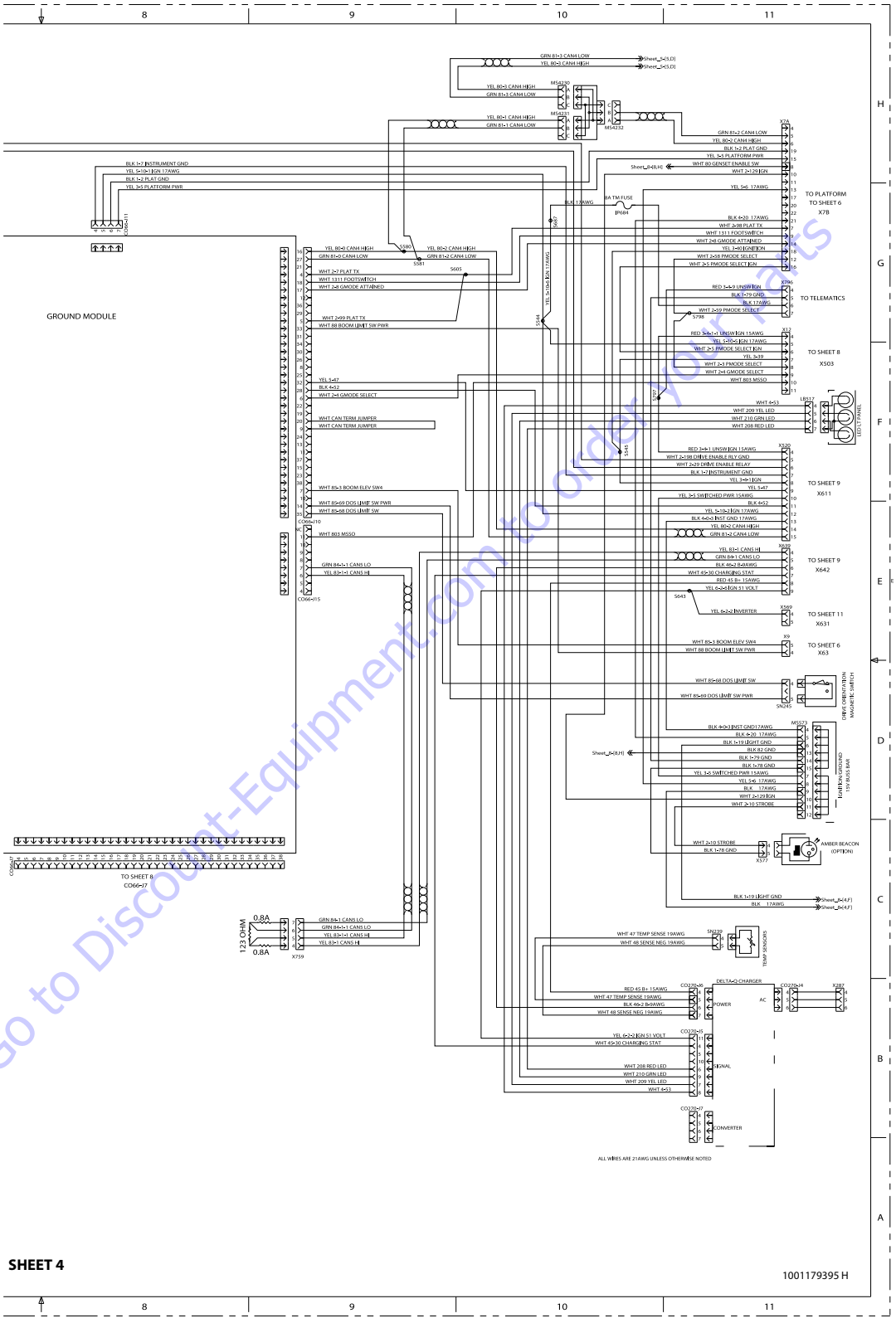

Figure 7-70. Electrical Schematic - Sheet 6 of 16

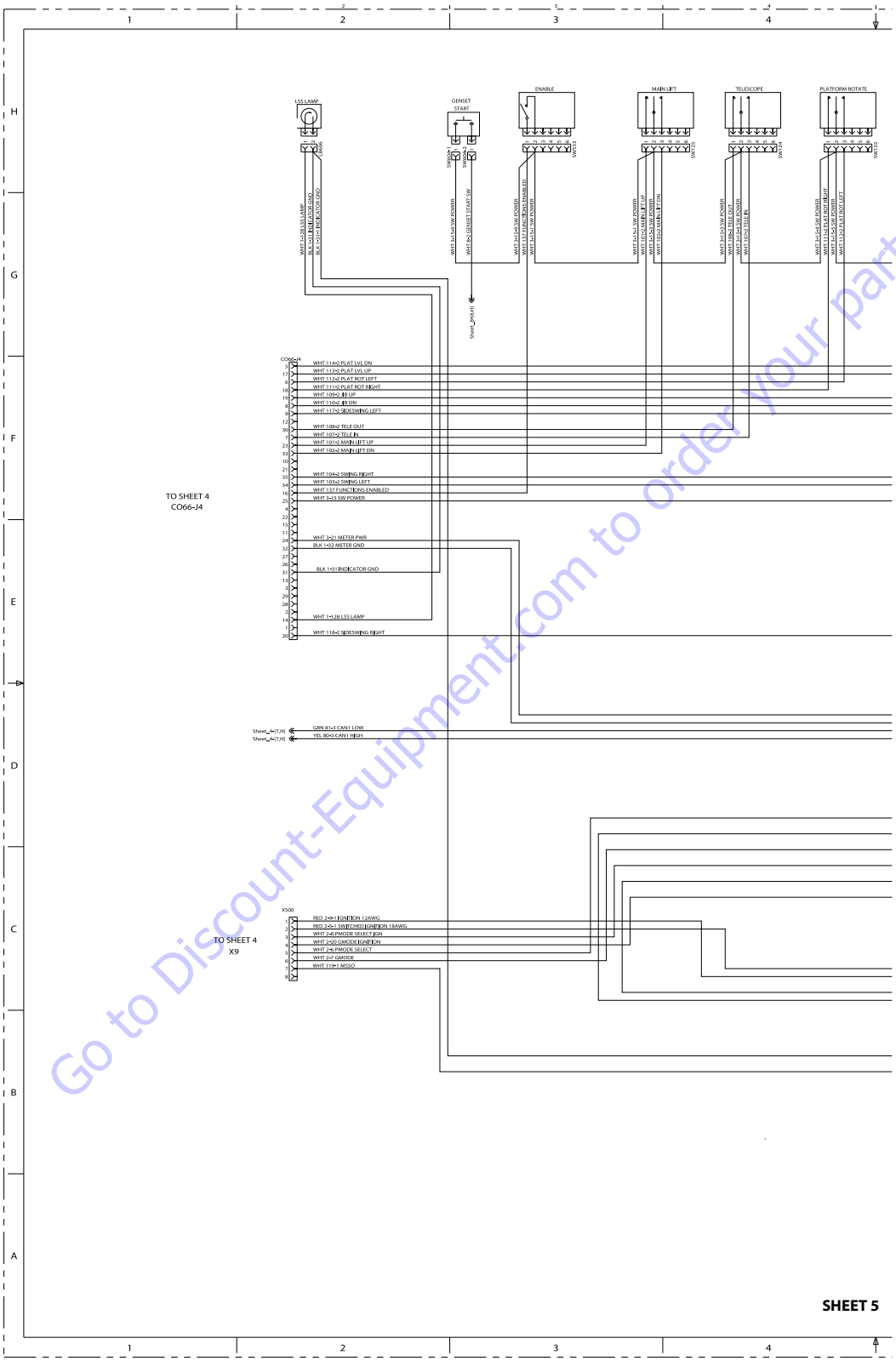

Figure 7-71. Electrical Schematic - Sheet 7 of 16

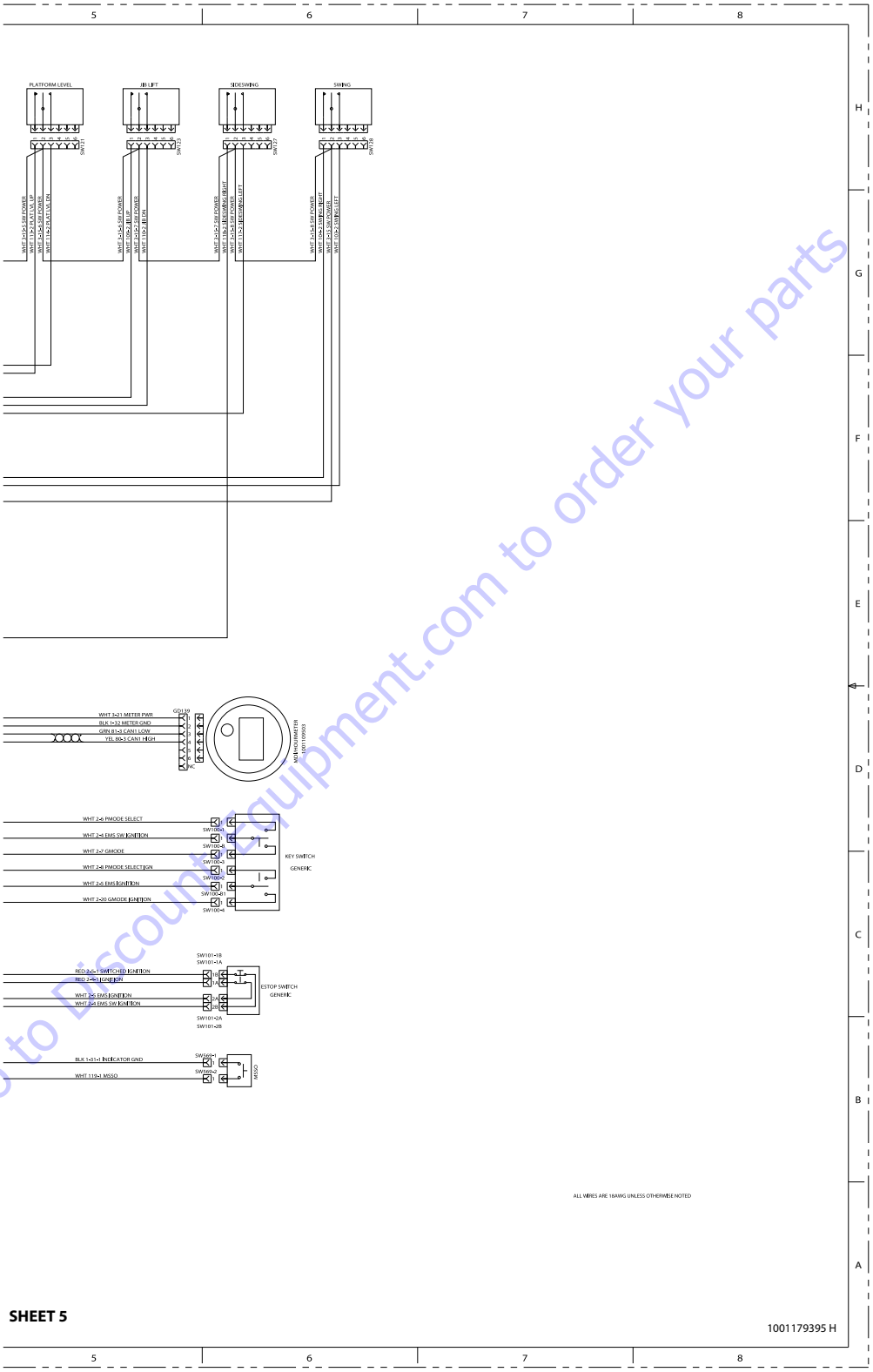

Figure 7-72. Electrical Schematic - Sheet 8 of 16

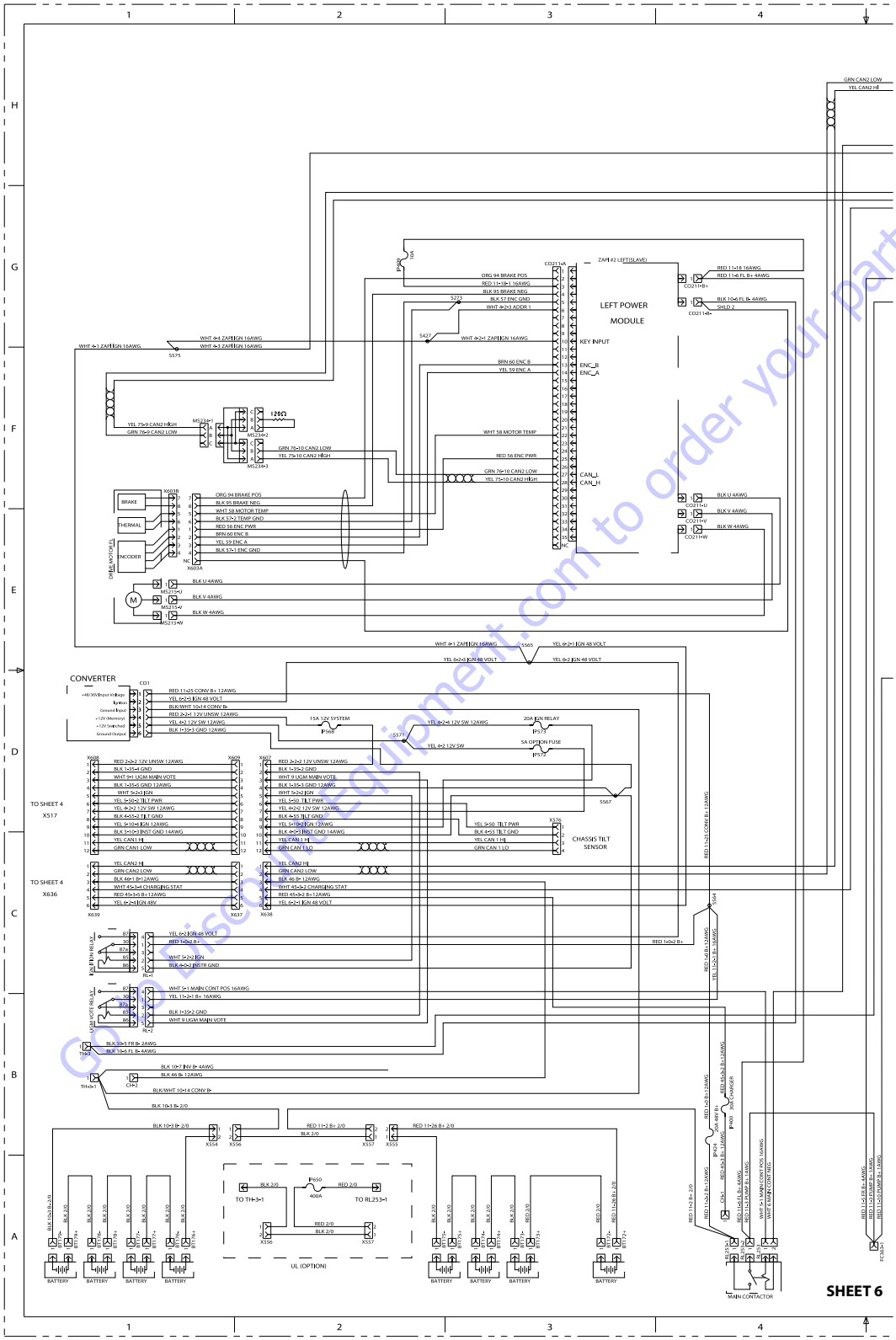

Figure 7-73. Electrical Schematic - Sheet 9 of 16

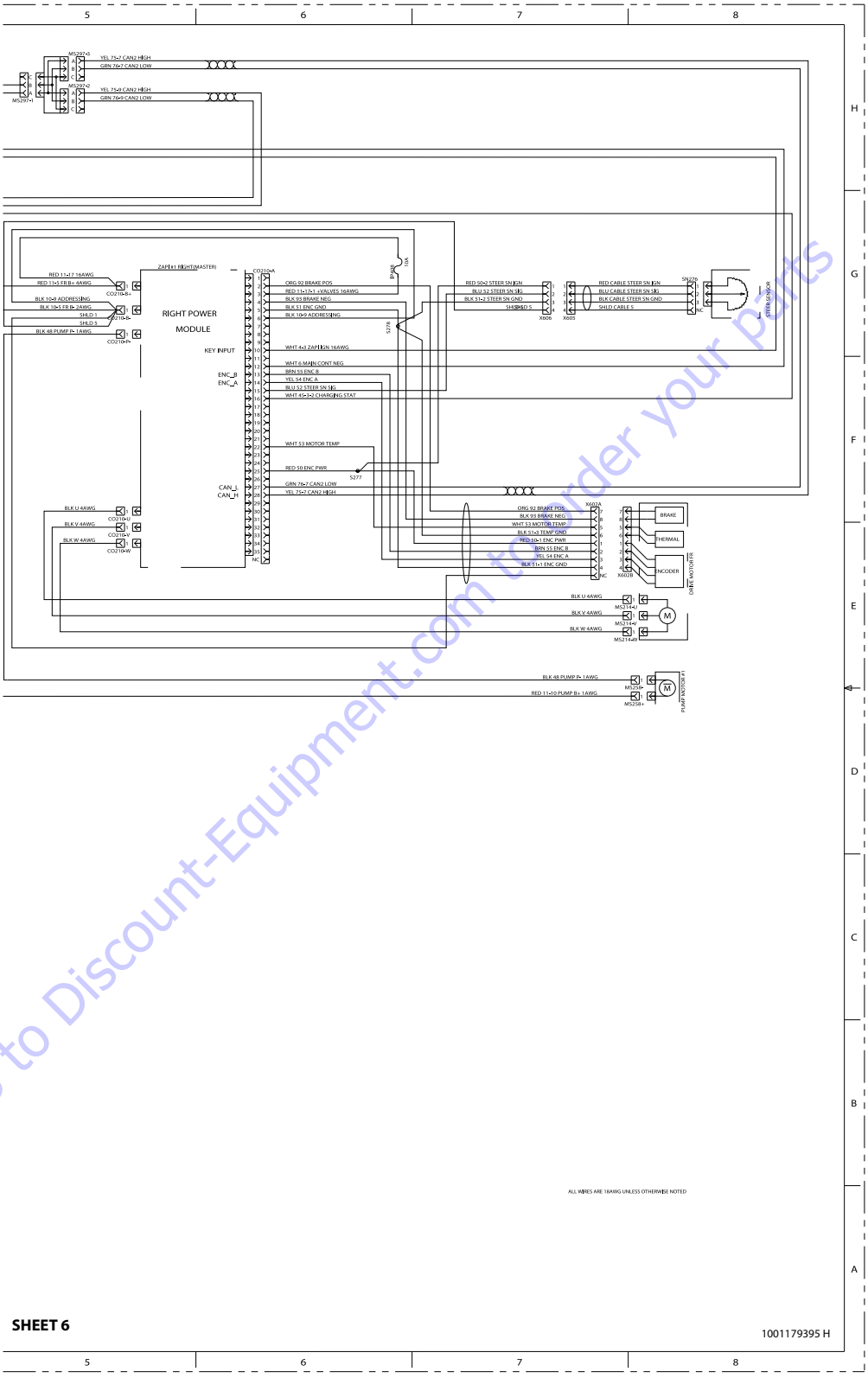

Figure 7-74. Electrical Schematic - Sheet 10 of 16

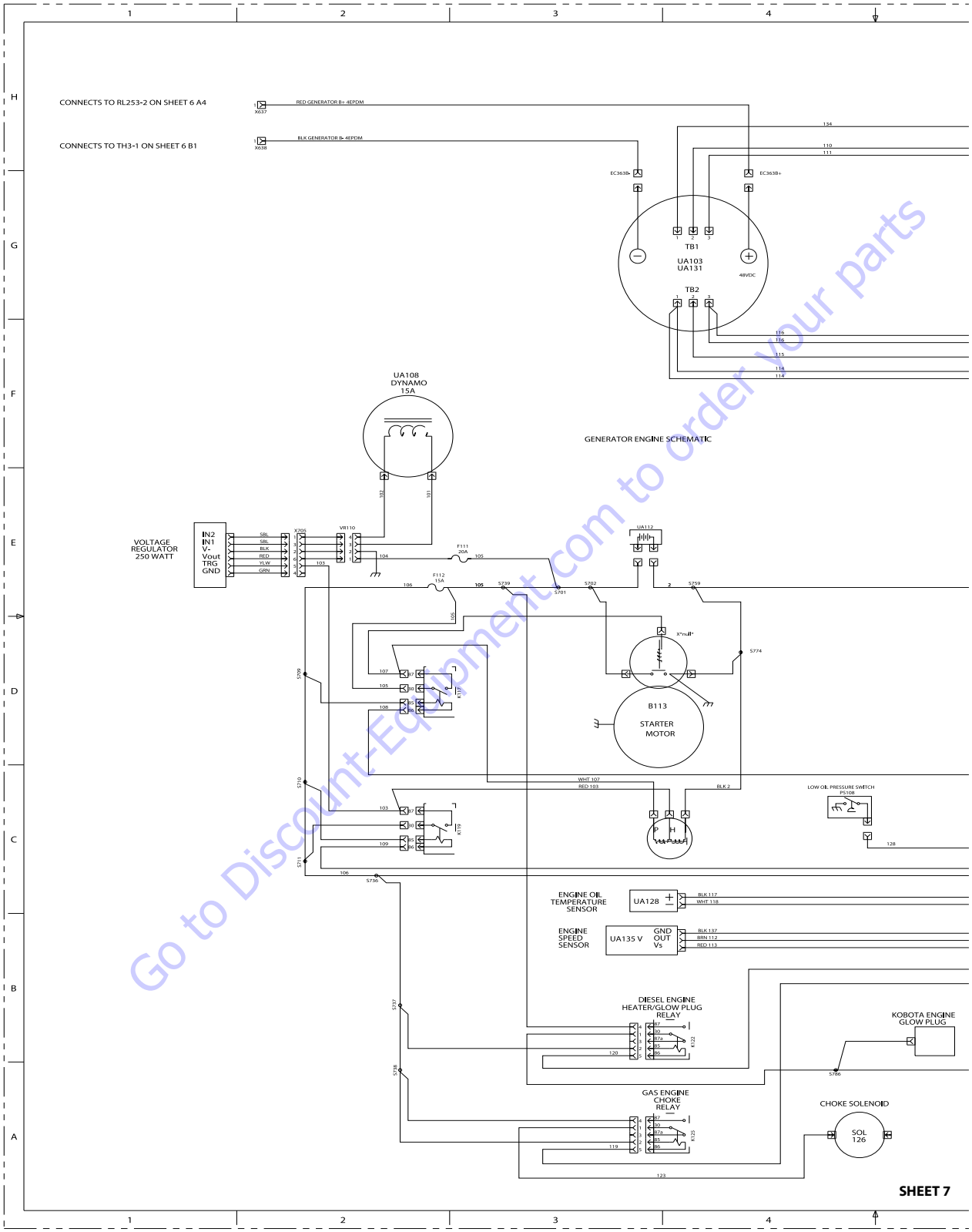

Figure 7-75. Electrical Schematic - Sheet 11 of 16

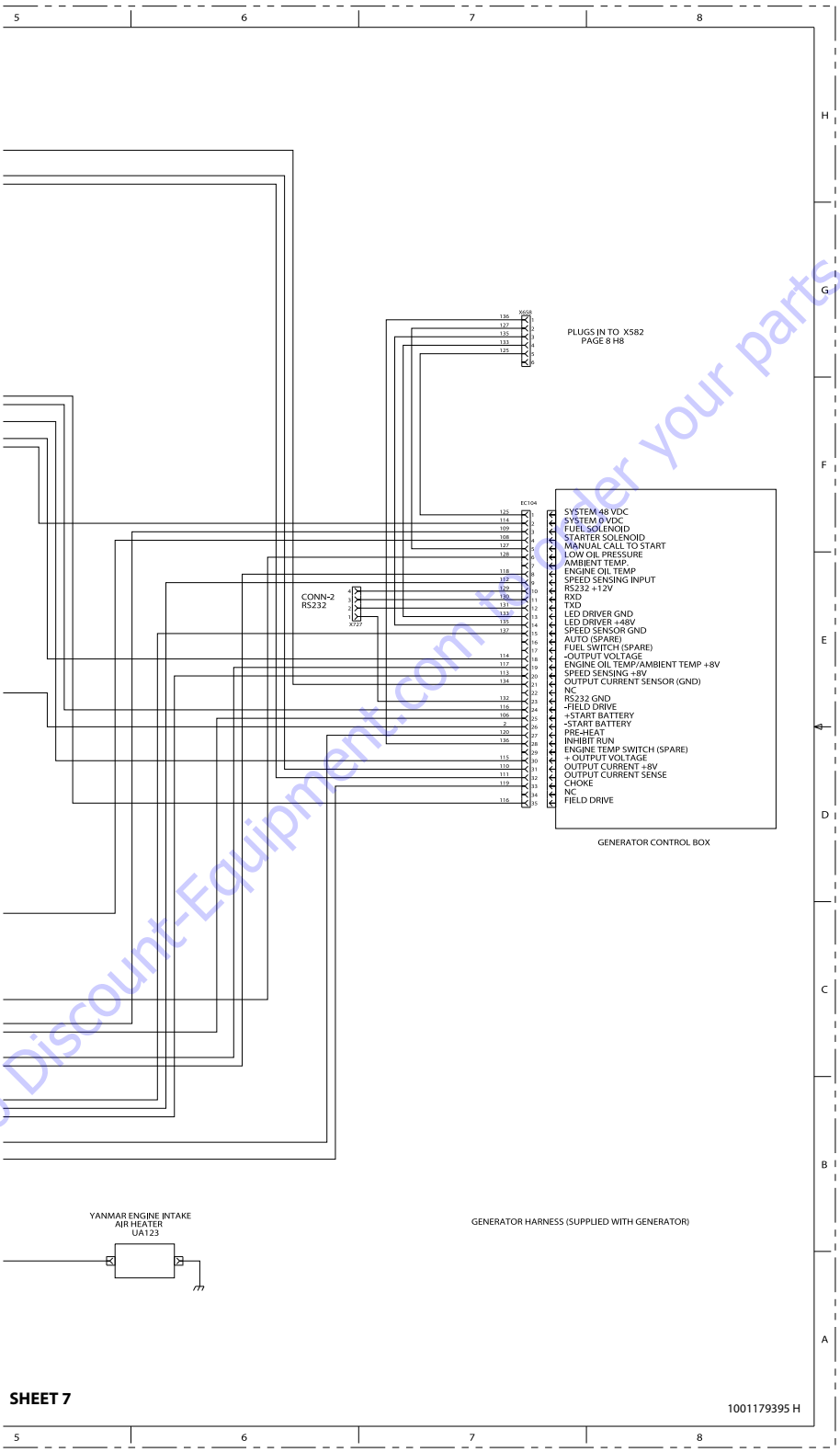

Figure 7-76. Electrical Schematic - Sheet 12 of 16

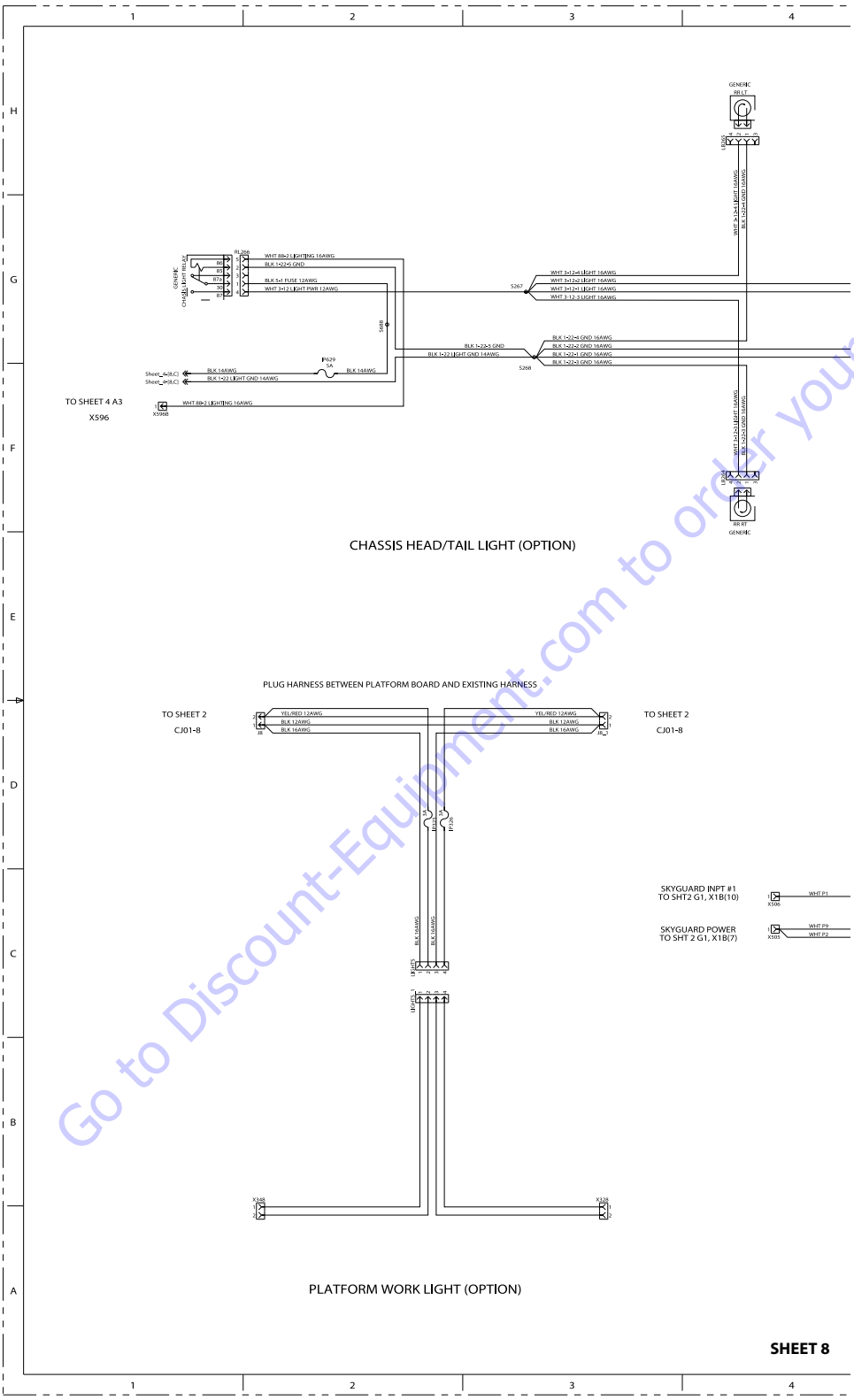

Figure 7-77. Electrical Schematic - Sheet 13 of 16

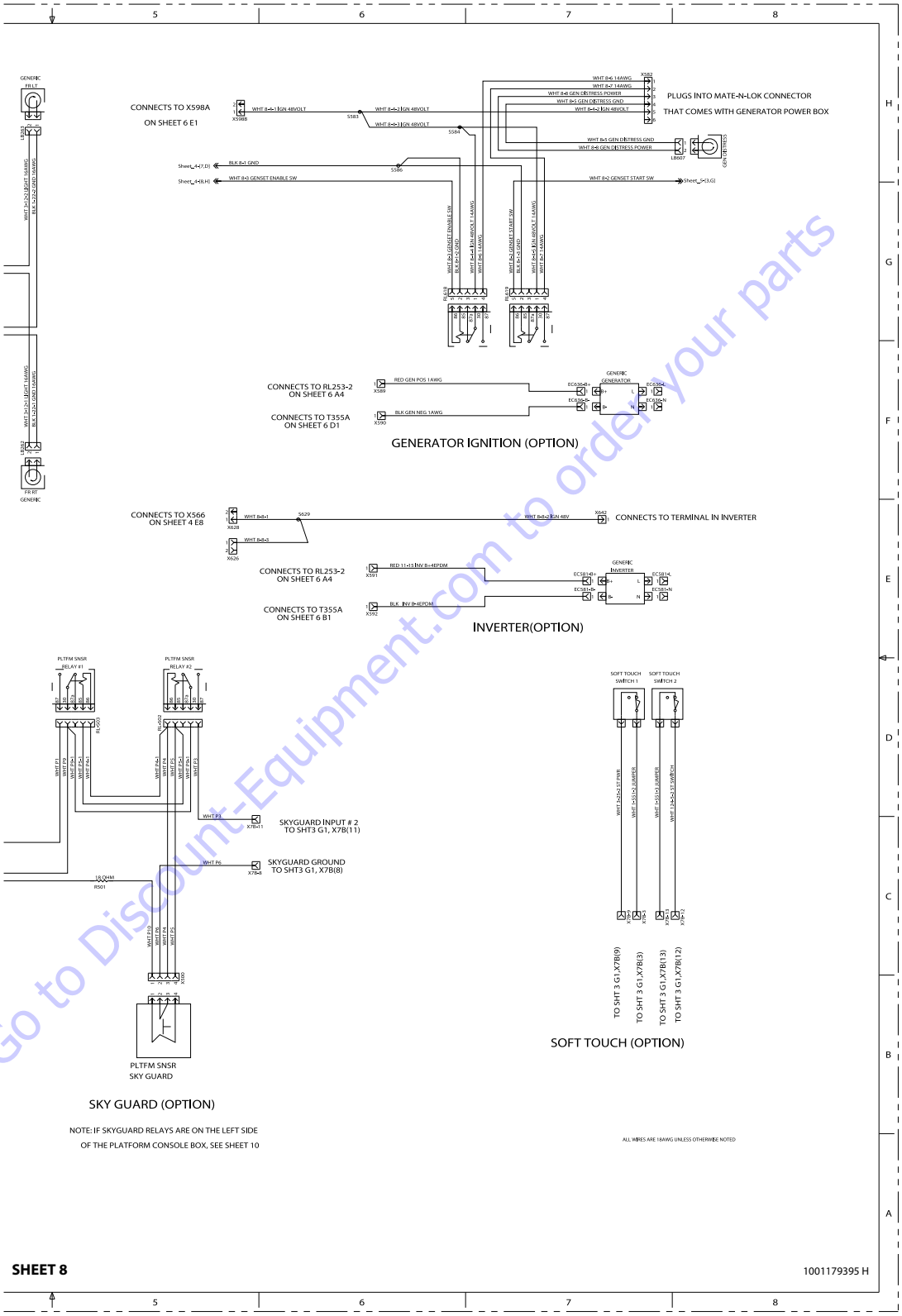

Figure 7-78. Electrical Schematic - Sheet 14 of 16

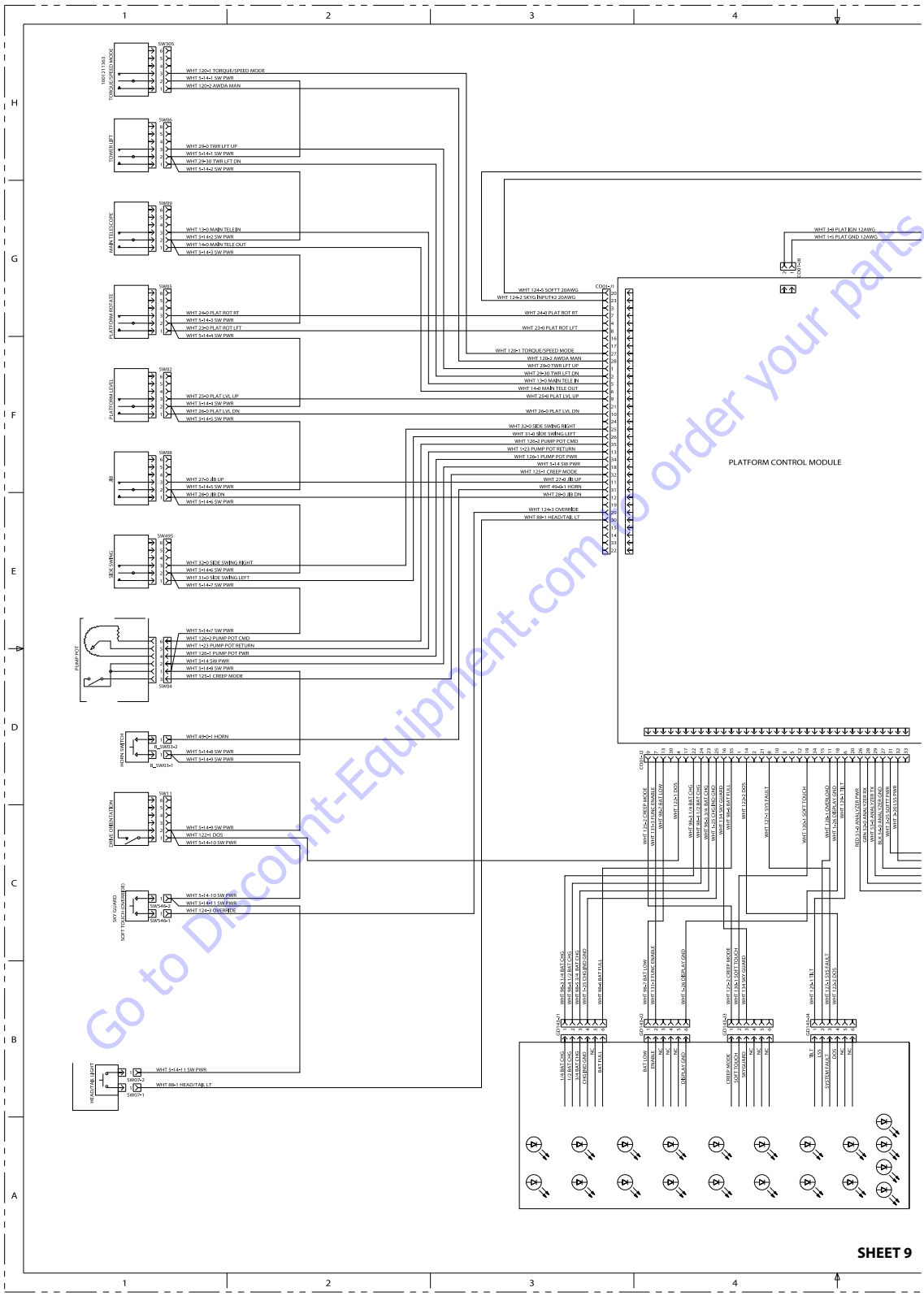

Figure 7-79. Electrical Schematic - Sheet 15 of 16

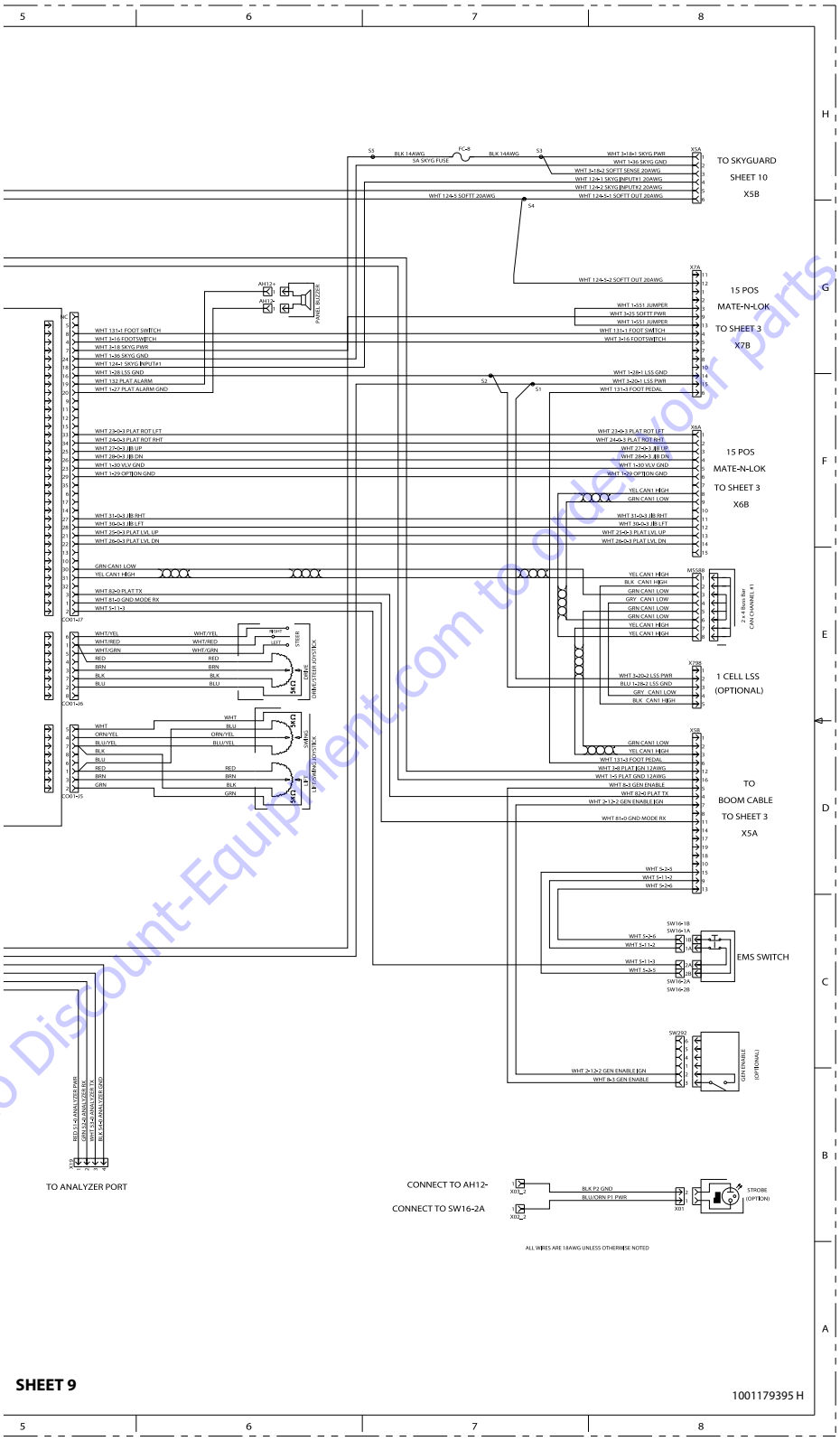

Figure 7-80. Electrical Schematic - Sheet 16 of 16

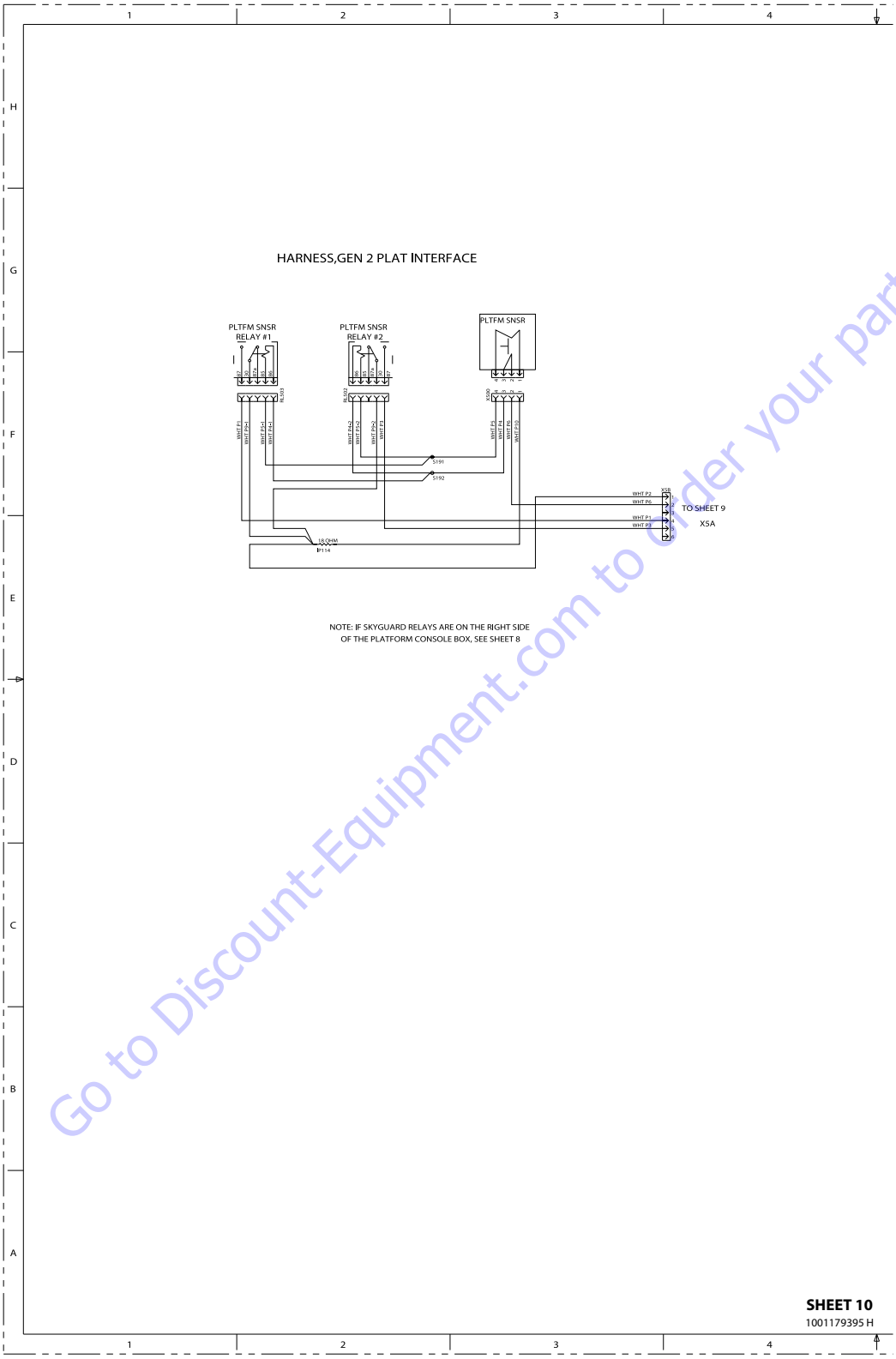

Figure 7-81. Electrical Schematic - Sheet 16 of 16

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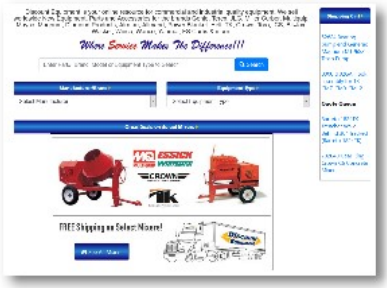

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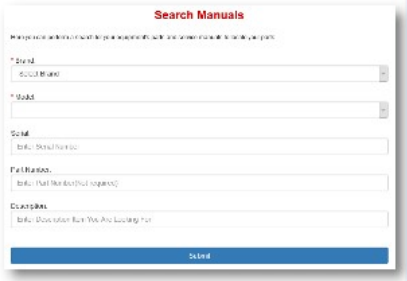

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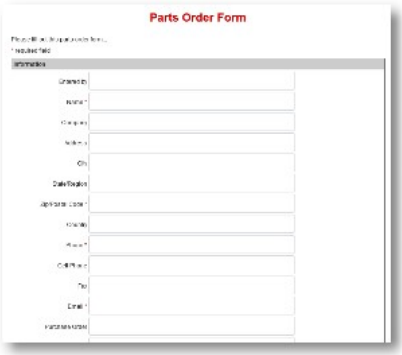

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