An Oshkosh Corporation Company

Service and Maintenance Manual

Models
660SJC

PVC 2001

PN - 31215037

December 26, 2019 - Rev A

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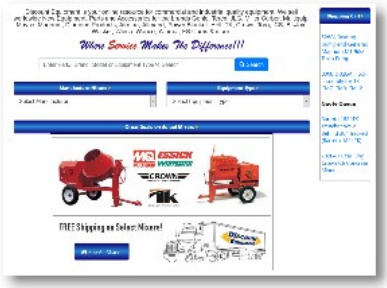

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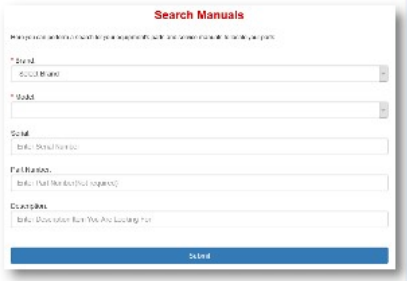

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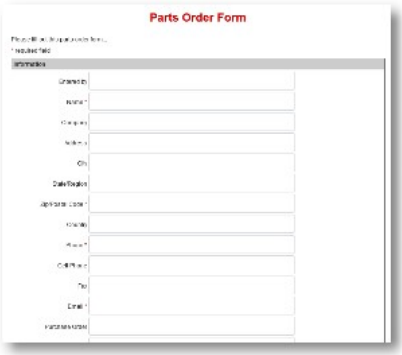

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SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A GENERAL

This section contains general safety precautions which must be observed during mobile elevating work platform maintenance. 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 the machine is safe to operate.

⚠ WARNING

MODIFICATION OR ALTERATION OF A MOBILE ELEVATING 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 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 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 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.

- USE ONLY REPLACEMENT PARTS OR COMPONENTS THAT ARE APPROVED BY JLG. TO BE CONSIDERED APPROVED, REPLACEMENT PARTS OR COMPONENTS MUST BE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- 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.
- ALWAYS DISCONNECT BATTERY DURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

REVISON LOG

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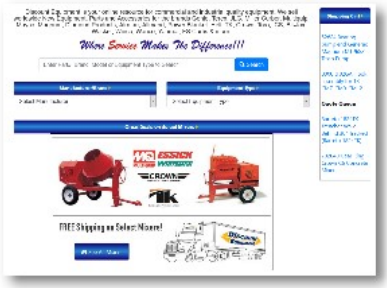

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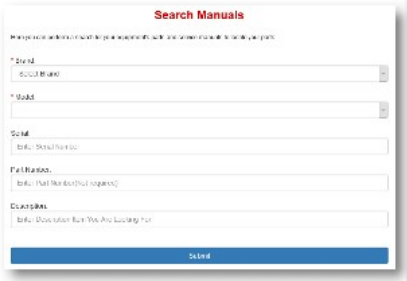

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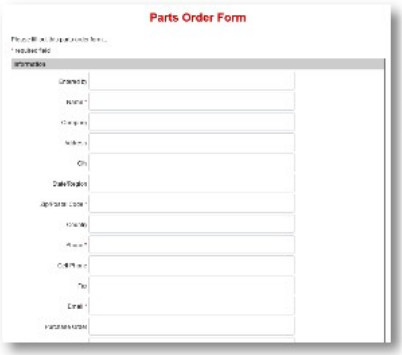

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SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Machine Specifications

Maximum Work Load (Capacity)* Unrestricted: Restricted:	 550 lb (250 kg) 750 lb (340 kg)
Maximum Travel Grade (Gradeability)	55%
Maximum Travel Grade (Side Slope)	5°
Maximum Operating Slope	5°
Maximum Manual Force	90 lbs. (445 N)
Maximum Wind Speed	28 mph (12.5 m/s)
Ground Bearing Pressure	11.28 psi (0.79 kg/cm^2)
Maximum Drive Speed	1.6 MPH (2.57 Km/hr.)
Electrical System	12V DC
Gross Machine Weight (Approximate)	27620 lb (12528 kg)
**Maximum Work Load (Capacity) can be affected by the addition of the Soft Touch option. If equipped with Soft Touch, refer to Section 6 and the decal on your machine for these values.*	

1.2 DIMENSIONAL DATA

Machine Height (Stowed)	8 ft. 1.2 in. (2.47 m)
Machine Length (Stowed)	35 ft. 4.7 in. (10.79 m)
Machine Width	8 ft. 1.6 in. (2.48 m)
Wheelbase	8 ft. 9.9 in. (2.69 m)
Ground Clearance	1 ft. 4.7 in. (0.42 m)
Platform Height	65 ft. 7 in. (19.99 m)
Horizontal Reach	57 ft. 0.6 in. (17.39 m)
Horizontal Reach from center of rotation - 550 lb (250 kg) Zone 750 lb (340 kg) Zone	 57 ft. 0.6 in. (17.39 m) 47 ft. 11.5 in. (14.618 m)
Horizontal Reach over end 550 lb (250 kg) Zone 750 lb (340 kg) Zone	 51 ft. 5.4 in. (15.68 m) 42 ft. 4.3 in. (12.91 m)
Horizontal Reach over side 550 lb (250 kg) Zone 750 lb (340 kg) Zone	 52 ft. 11.6 in. (16.14 m) 43 ft. 10.5 in. (13.37 m)
Tail Swing	4 ft. (1.22 m)
Track Width	1 ft. 7.7 in. (0.5 m)

1.3 CAPACITIES

Fuel Tank	31 Gallons (117 L)
Hydraulic Oil Tank	25 Gallons (94.6 L)
Hydraulic System (Including Tank)	40 Gallons (151.4 L)
Final Drive	2.1 Gallons (7.9 L)
Engine Crankcase Deutz D2011L04 Deutz 2.9 L	 10 quarts (9.4 L) 9.6 quarts (9.1L)
NOTE: *Fill torque hubs half (1/2) full of lubricant.*	

1.4 ENGINE DATA

Table 1-1. Deutz TD2.9 L4

Fuel	Ultra Low Sulfur Diesel (15 ppm allowable sulfur content)
Max Output (Power)	67 hp (50kW) @ 2600 RPM
Max Output (Torque)	173 ft. lbs. (234 Nm) @ 1800 RPM
Engine Oil Capacity	2.11 gal (8.0 L) w/filter
Coolant Capacity (System)	0.92 gal (3.5 L)
Average Fuel Consumption	2.7 GPH (10.24 lph)
Low RPM	1200 ± 50 RPM
High RPM	2600 ± 50 RPM
Alternator	95 Amp

Table 1-2. Deutz D2011L04 Specifications

Fuel	Diesel
Max Output (Power)	61.6 hp (46kw) @ 2600 RPM
Engine Oil Capacity Cooling System Crankcase Total Capacity	 5 Quarts (4.7 L) 11 Quarts (10.4 L) w/Filter 16 Quarts (15.1 L)
Idle RPM	1000 ± 50 RPM
High RPM	2600 ± 50 RPM
Alternator	60 Amp
Battery	950 Cold Cranking Amps, 205 Minutes Reserve Capacity, 12 VDC
Fuel Consumption	1.93 gph (7.32 Lph)

Table 1-3. Deutz TD 2.9 L4 GUO III Specifications

Fuel	Low Sulfur Diesel (500 ppm allowable sulfur content)
Max Output (Power)	67 hp (50 kW)
Max Output (Torque)	173 ft. lbs. (234 Nm) @ 1800 RPM
Engine Oil Capacity	8.5 Quarts (8.0 L) w/filter
Coolant Capacity (System)	3.7 Quarts (3.5 L)
Average Fuel Consumption	1.06 GPH (4.02lph)
Low RPM	1200 ± 50 RPM
High RPM	2600 ± 50 RPM
Alternator	95 Amp

1.5 CRITICAL STABILITY WEIGHTS

⚠ WARNING

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

Components		LB	KG
Engine (Complete tray including pump)	Deutz TD2.9L4	1433	650
	Deutz D2011L04	983	445
Counterweight	Chassis	3175	1440
	Turntable	4910	2227
Platform Only (No Control Box or Foot switch)	4 ft. (M) Swing Gate	132	60
	5 ft. (M) Swing Gate	145.5	66
	6 ft. (M) Swing Gate	159	72
	8 ft. (2.44 M) Swing Gate	230	104
	6 ft. (M) Shipyard Option	247	112

1.6 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, 10W-30
+50° to + 210° F (+10° to +99° C)	20W-20

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

NOTE: *When temperatures remain below 20°F (-7°C), JLG Industries recommends the use of Premium Hydraulic Fluid.*

NOTE: *Aside from JLG recommendations, it is not advisable to mix oils of different brands or types. They may not contain required additives or be of comparable viscosities.*

Table 1-4. Mobilfluid 424

SAE Grade	10W-30
ISO	55
Gravity, API	29.0
Density, Lb/Gal. 60°F	7.35
Pour Point, Max	-46°F (-43°C)
Flash Point, Min.	442°F (228°C)
Viscosity	
Brookfield, cP at -18°C	2700
at 40° C	55 cSt
at 100° C	9.3 cSt
Viscosity Index	152

Table 1-5. Mobil DTE 10 Excel 32

ISO Viscosity Grade	#32
Specific Gravity	0.877
Pour Point, Max	-40°F (-40°C)
Flash Point, Min.	330°F (166°C)
Viscosity	
at 40° C	32.7 cSt
at 100° C	6.6 cSt
at 100° F	169 SUS
at 210° F	48 SUS
cp at -20° F	6200
Viscosity Index	164

Table 1-6. Quintolubric 888-46

Density	0.92 @ 15°C (59°F)
Pour Point	<-20°F (<-30°C)
Flash Point	275°F (300°C)
Fire Point	325°F (360°C)
Auto Ignition Temperature	450°F(842°C)
Viscosity	
at 0° C (32° F)	360 cSt
at 20° C (104° F)	102 cSt
at 40° C (104° F)	46 cSt
at 100° C (150° F)	10 cSt
Viscosity Index	220

Table 1-7. Mobil EAL 224 H

Type	Synthetic Biodegradable
ISO Viscosity Grade	32/46
Specific Gravity	0.922
Pour Point	-25°F (-32°C)
Flash Point	428°F (220°C)
Operating Temp.	0 to 180°F (-17 to 82°C)
Weight	7.64 lb per gal. (0.9 kg per liter)
Viscosity	
at 40° C	37 cSt
at 100° C	8.4 cSt
Viscosity Index	213
NOTE: *Must be stored above 32°F (14°C)*	

Table 1-8. Mobil EAL Envirosyn H 46

Type	Synthetic Biodegradable
ISO Viscosity Grade	46
Specific Gravity	0.910
Density	0.874 @ 15°C (59°F)
Pour Point	-44°F (-42°C)
Flash Point	500°F (260°C)
Operating Temp.	0 to 180°F (-17 to162°C)
Viscosity	
at 40° C	48.8 cSt
at 100° C	7.8 cSt
Viscosity Index	145

Table 1-9. Exxon Univis HVI 26 Specs

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

1.7 TORQUE REQUIREMENTS

Description	Torque Value (Dry)	Interval Hours
Bearing To Chassis	190 ft.lbs (260 Nm)	
Bearing To Turntable	190 ft.lbs (260 Nm)	
Wire Rope	15 ft. lbs (20 Nm)	150
Engine Mounting Bolts M12 M16	 84.8 ft.lbs (115 Nm) 206.5 ft.lbs (280 Nm)	
NOTE: *Check swing bearing bolts after first 50 hours of operation and every 600 hours thereafter. (See Section 3.6, Swing Bearing).*		

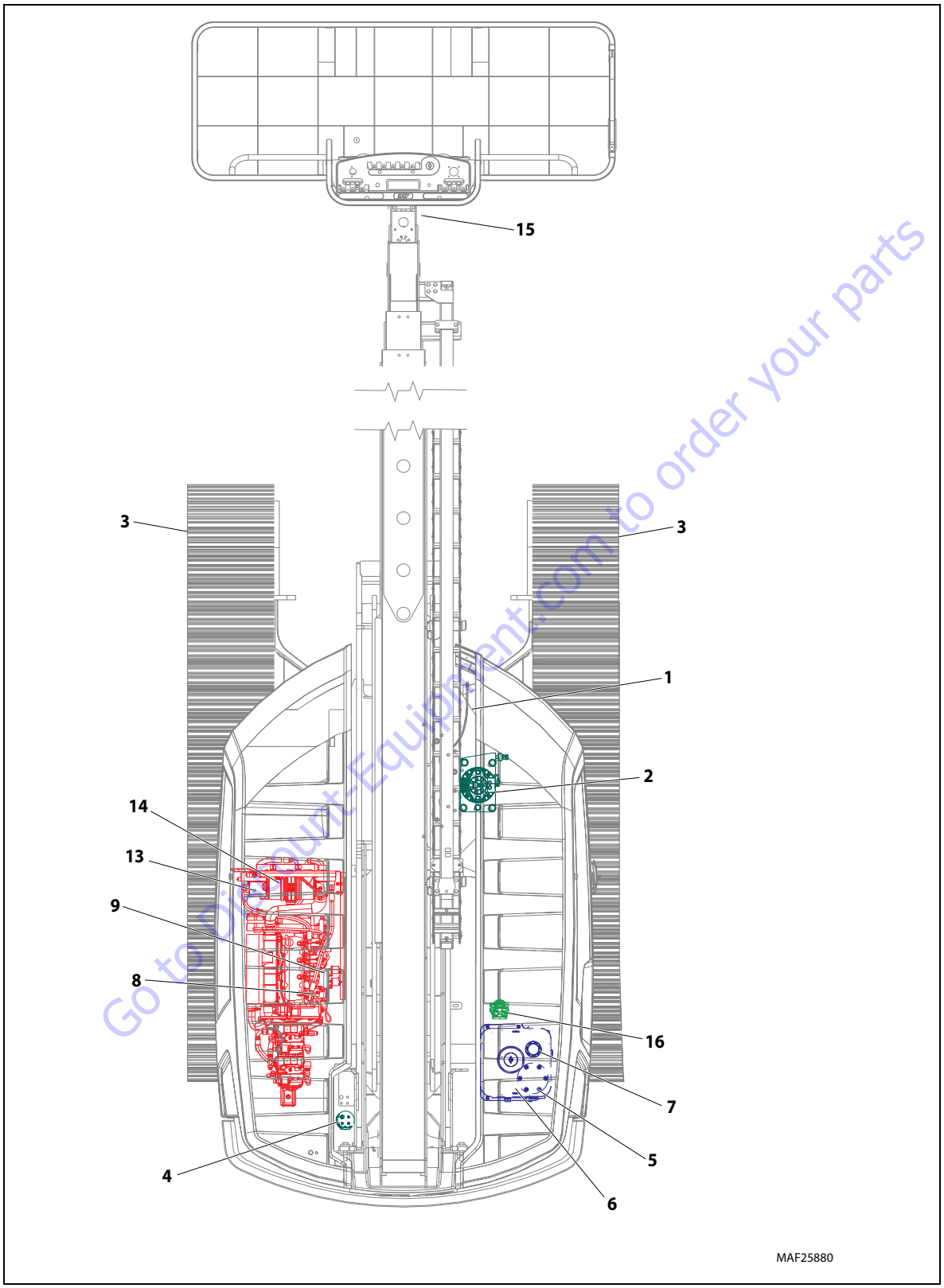


Figure 1-1. Maintenance and Lubrication Diagram - Deutz D2011L04

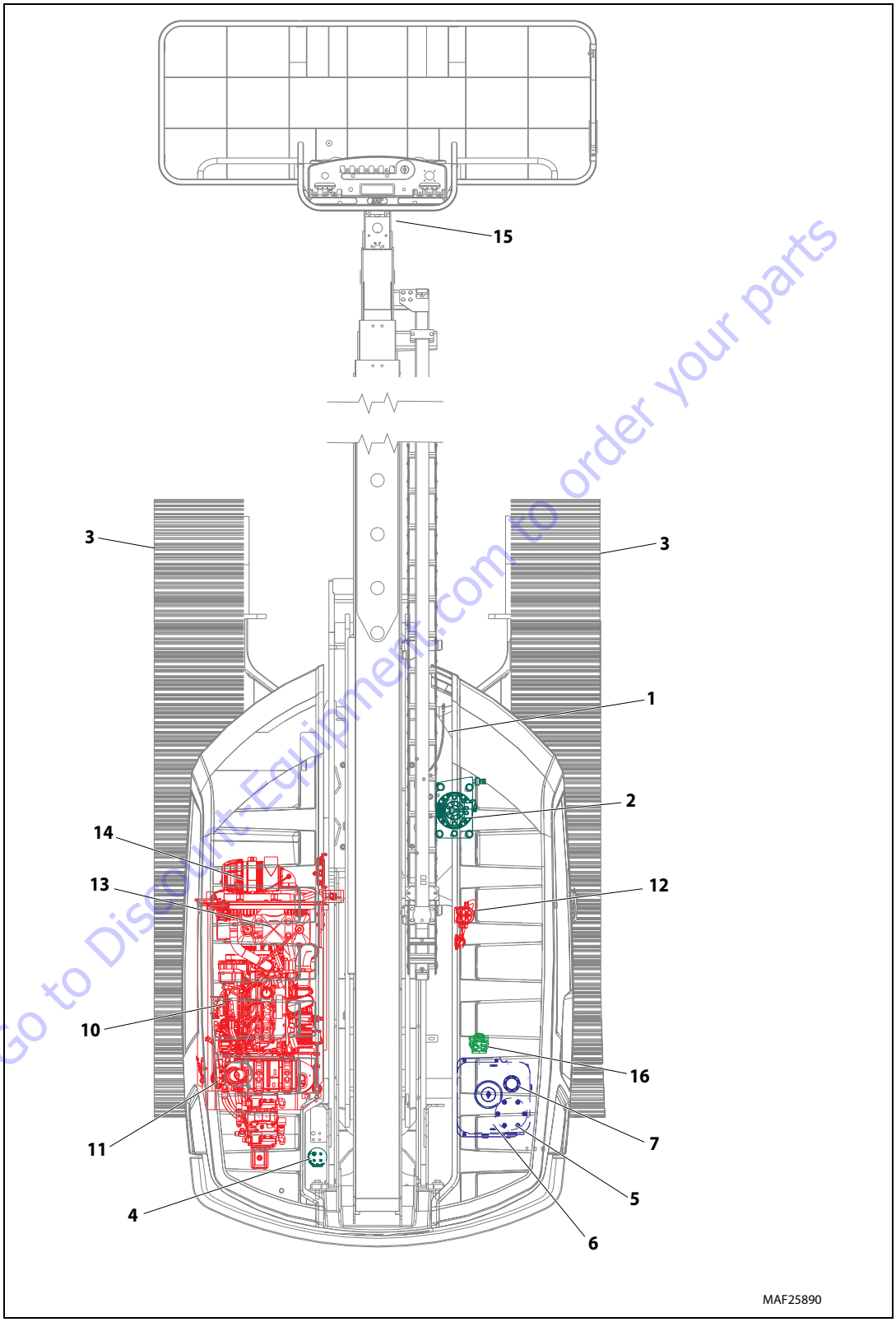


Figure 1-2. Maintenance and Lubrication Diagram - Deutz TD 2.9 and TD 2.9 L4 GUO III

1.8 MAINTENANCE AND LUBRICATION

NOTE: *The following numbers correspond to those in Figure 1-1. and Figure 1-2.*

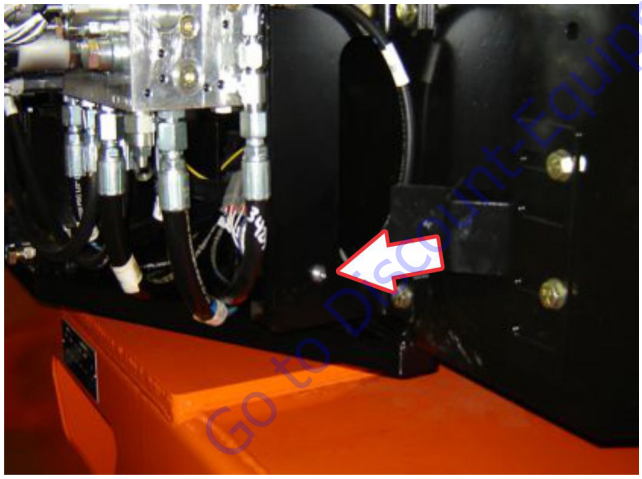
Table 1-10. Lubrication Specifications.

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350° F (177° C). Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105
HO	Hydraulic Oil. Refer Section 1.6, Hydraulic Oil.
EO	Engine (crankcase) Oil. Gas - API SF, SH, SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C

NOTICE

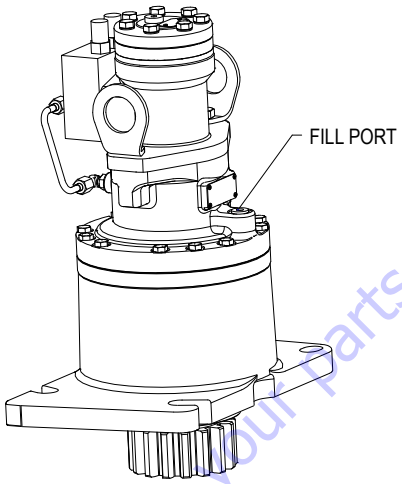
LUBRICATION INTERVALS ARE BASED ON MACHINE OPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTI-SHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

1. Swing Bearing



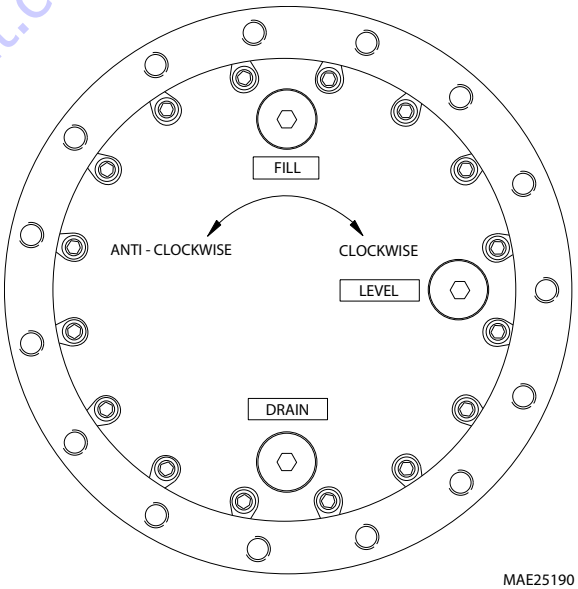
Lube Point(s) - 1 Grease Fittings
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hrs of operation
Comments - Remote Access. Apply grease and rotate in 90 degree intervals until bearing is completely lubricated.

2. Swing Drive Hub



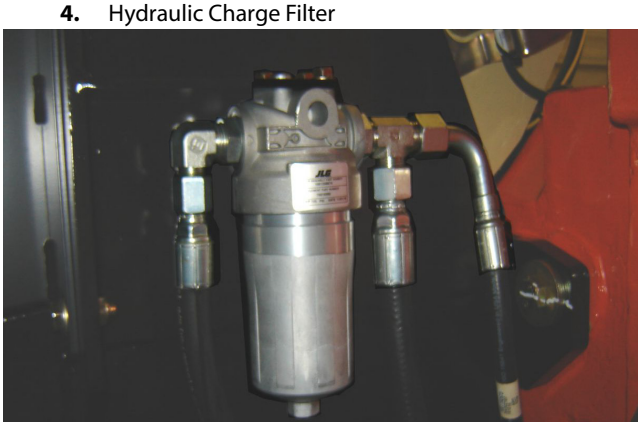
Lube Point(s) - Level/Fill Plug
Capacity - 32 oz. (0.95 L)
Lube - 80w90 Gear Oil
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation.

3. Drive Hub



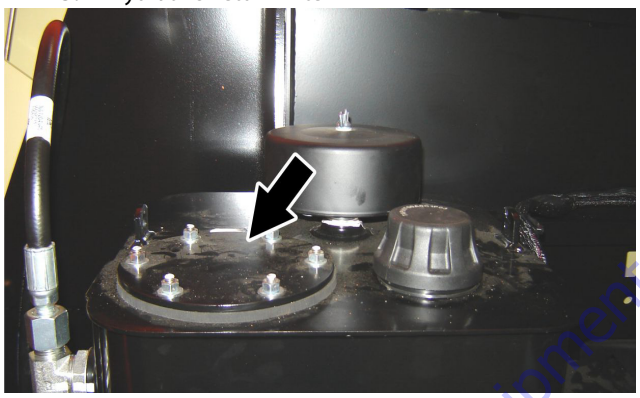
Lube Point(s) - Level/Fill Plug
Capacity - 24 oz. (0.7 L)
Lube - 80w90 Gear Oil
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation.

4. Hydraulic Charge Filter



Interval - Change after first 50 hrs. and every 6 months or 300 hrs.

5. Hydraulic Return Filter

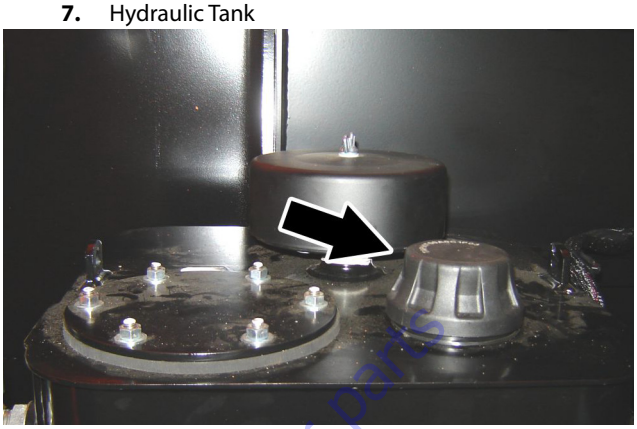


Interval - Change after first 50 hrs. and every 6 months or 300 hrs.

6. Hydraulic Tank Breather

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

7. Hydraulic Tank

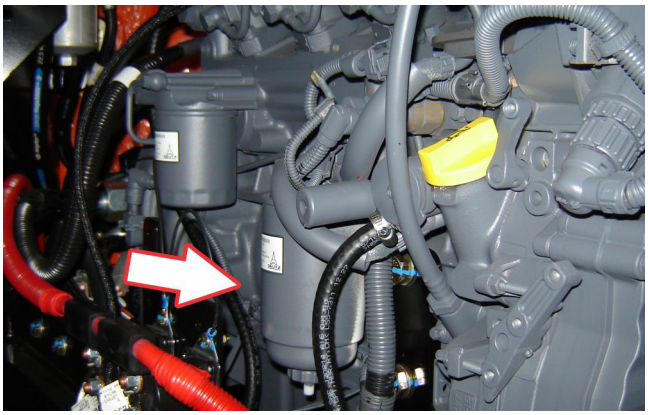


Lube Point(s) - Fill Cap Capacity - 21 gal tank (79.5 L) 40.0 gal system (151 L) Lube - HO Interval - Check Level daily; Change every 2 years or 1200 hours of operation
Comments - On new machines, those recently overhauled, or after changing hydraulic oil, operate all systems a minimum of two complete cycles and recheck oil level in reservoir.

8. Oil Change w/Filter - Deutz D2011

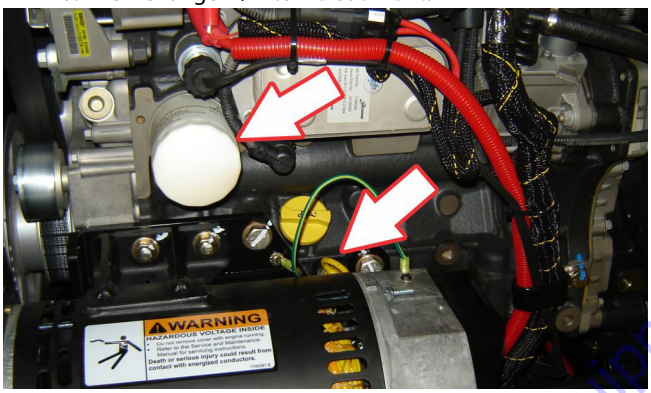
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 11 Quarts (10.4 L) Crankcase;
5 Quarts (4.7 L) Cooler
Type - Deutz approved engine oil.
Lube - EO
Interval - Every Year or 1200 hours of operation
Comments - Check level daily/Change in accordance with engine manual. Use Deutz approved engine oil type.

9. Fuel Filter - Deutz D2011L04



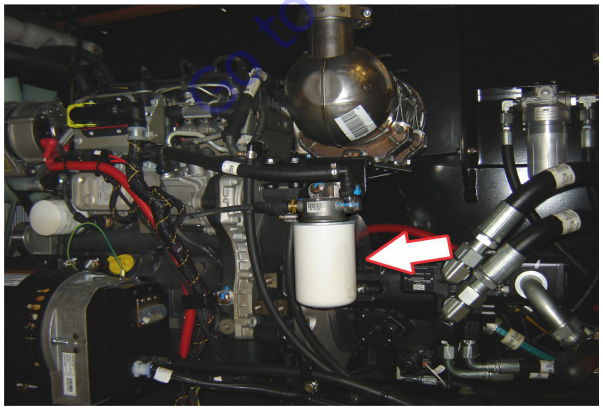
Lube Point(s) - Replaceable Element
Interval - Every Year or 600 hours of operation.

10. Oil Change w/Filter - Deutz TD2.9



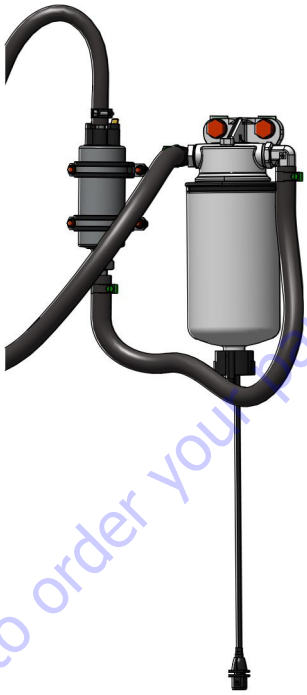
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 9.6 Quarts (9.1 L) Crankcase;
Type - Deutz approved engine oil
Lube - EO
Interval - Every Year or 600 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

11. Fuel Filter - Deutz TD2.9



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

12. Fuel Pre-Filter - Deutz TD2.9

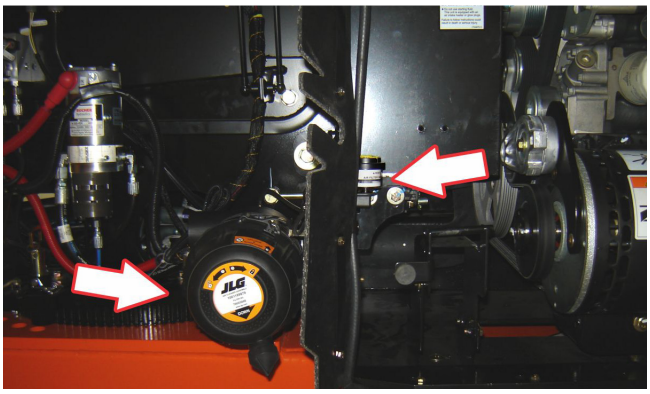


Lube Point(s) - Replaceable Element
Interval - Drain water daily;
Filter must be replaced every year or 600 hours of operation (whichever comes first).

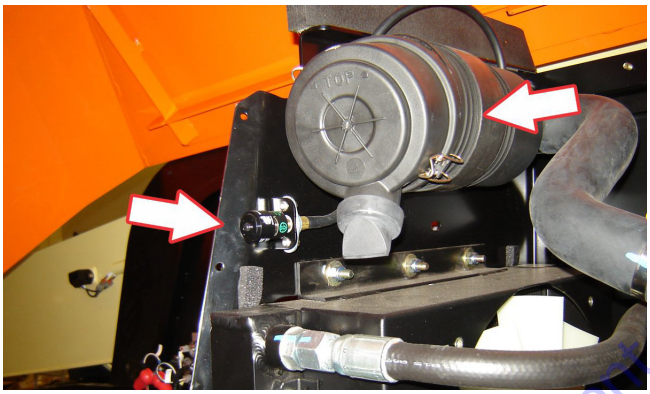
13. Engine Coolant - Deutz TD2.9

Lube Point(s) - Fill Cap
Capacity - 13.2 Quarts (12.5 L)
Type - Deutz approved engine coolant
Lube - Anti-Freeze
Interval - Check level daily; change every 1000 hours or two years, whichever comes first.

14. A. Air Filter - Deutz TD2.9L

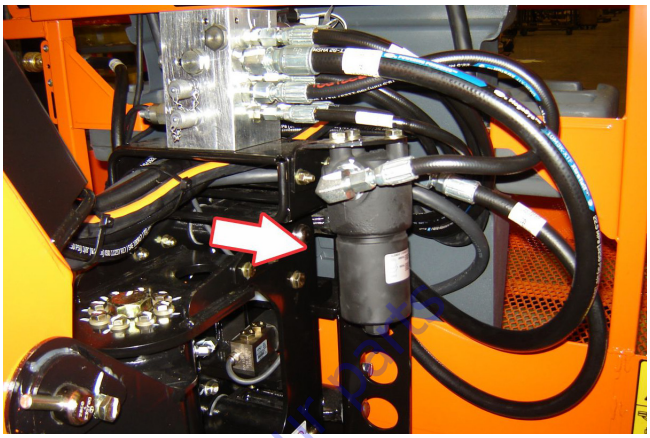


B. Air Filter - Deutz D2011L04



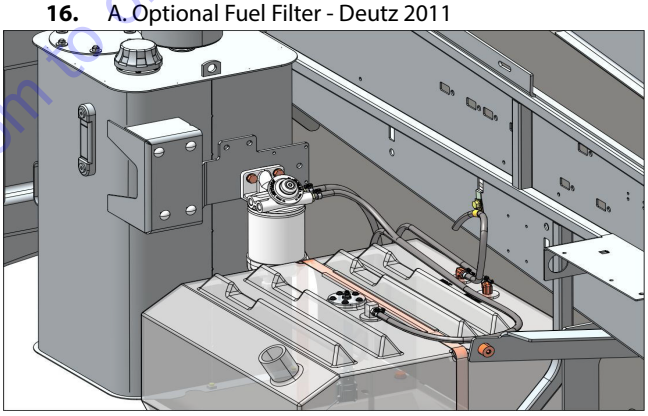
Lube Point(s) - Replaceable Element
Interval - Every 6 months or 300 hours of operation or as indicated by the condition indicator.

15. Platform Filter

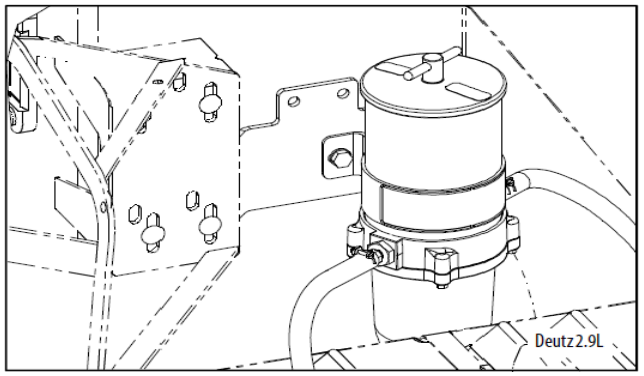


Lube Point - Replaceable Element
Interval - Change after first 50 hours and then every year or 600 hours of operation, whichever comes first.

16. A. Optional Fuel Filter - Deutz 2011



B. Fuel Filter/Water Separator - Deutz 2.9L



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

1.9 THREAD LOCKING COMPOUND

JLG PN	Loctite®	ND Industries	Description
0100011	242™	Vibra-TITE™ 121	Medium Strength (Blue)
1001095650	243™	Vibra-TITE™ 122	Medium Strength (Blue)
0100019	271™	Vibra-TITE™ 140	High Strength (Red)
0100071	262™	Vibra-TITE™ 131	Medium - High Strength (Red)

NOTE: *Loctite® 243™ can be substituted in place of Loctite® 242™. Vibra-TITE™ 122 can be substituted in place of Vibra-TITE™ 121.*

1.10 TORQUE CHARTS

SAE Fastener Torque Chart

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)												
SAE GRADE 5 BOLTS & GRADE 2 NUTS												
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry)		Torque Lubricated		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140)		Torque (Loctite® 262™ or Vibra-TITE™ 111)	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	8	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				
10	24	0.1900	0.01750	1120	43	4.8	32	3.5				
	32	0.1900	0.02000	1285	49	5.5	36	4				
1/4	20	0.2500	0.0318	2020	96	10.8	75	9	105	12		
	28	0.2500	0.0364	2320	120	13.5	86	10	135	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	17	23	13	18	19	26	16	22
	24	0.3125	0.0580	3700	19	26	14	19	21	29	17	23
3/8	16	0.3750	0.0775	4940	30	41	23	31	35	48	28	38
	24	0.3750	0.0878	5600	35	47	25	34	40	54	32	43
7/16	14	0.4375	0.1063	6800	50	68	35	47	55	75	45	61
	20	0.4375	0.1187	7550	55	75	40	54	60	82	50	68
1/2	13	0.5000	0.1419	9050	75	102	55	75	85	116	68	92
	20	0.5000	0.1599	10700	90	122	65	88	100	136	80	108
9/16	12	0.5625	0.1820	11600	110	149	80	108	120	163	98	133
	18	0.5625	0.2030	12950	120	163	90	122	135	184	109	148
5/8	11	0.6250	0.2260	14400	150	203	110	149	165	224	135	183
	18	0.6250	0.2560	16300	170	230	130	176	190	258	153	207
3/4	10	0.7500	0.3340	21300	260	353	200	271	285	388	240	325
	16	0.7500	0.3730	23800	300	407	220	298	330	449	268	363
7/8	9	0.8750	0.4620	29400	430	583	320	434	475	646	386	523
	14	0.8750	0.5090	32400	470	637	350	475	520	707	425	576
1	8	1.0000	0.6060	38600	640	868	480	651	675	918	579	785
	12	1.0000	0.6630	42200	700	949	530	719	735	1000	633	858
1 1/8	7	1.1250	0.7630	42300	800	1085	600	813	840	1142	714	968
	12	1.1250	0.8560	47500	880	1193	660	895	925	1258	802	1087
1 1/4	7	1.2500	0.9690	53800	1120	1518	840	1139	1175	1598	1009	1368
	12	1.2500	1.0730	59600	1240	1681	920	1247	1300	1768	1118	1516
1 3/8	6	1.3750	1.1550	64100	1460	1979	1100	1491	1525	2074	1322	1792
	12	1.3750	1.3150	73000	1680	2278	1260	1708	1750	2380	1506	2042
1 1/2	6	1.5000	1.4050	78000	1940	2630	1460	1979	2025	2754	1755	2379
	12	1.5000	1.5800	87700	2200	2983	1640	2224	2300	3128	1974	2676

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)										
SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263) K=0.20		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) 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]
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	1320	43	5				
10	24	0.1900	0.01750	1580	60	7				
	32	0.1900	0.02000	1800	68	8				
1/4	20	0.2500	0.0318	2860	143	16	129	15		
	28	0.2500	0.0364	3280	164	19	148	17		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	25	35	20	25	20	25
	24	0.3125	0.0580	5220	25	35	25	35	20	25
3/8	16	0.3750	0.0775	7000	45	60	40	55	35	50
	24	0.3750	0.0878	7900	50	70	45	60	35	50
7/16	14	0.4375	0.1063	9550	70	95	65	90	50	70
	20	0.4375	0.1187	10700	80	110	70	95	60	80
1/2	13	0.5000	0.1419	12750	105	145	95	130	80	110
	20	0.5000	0.1599	14400	120	165	110	150	90	120
9/16	12	0.5625	0.1820	16400	155	210	140	190	115	155
	18	0.5625	0.2030	18250	170	230	155	210	130	175
5/8	11	0.6250	0.2260	20350	210	285	190	260	160	220
	18	0.6250	0.2560	23000	240	325	215	290	180	245
3/4	10	0.7500	0.3340	30100	375	510	340	460	280	380
	16	0.7500	0.3730	33600	420	570	380	515	315	430
7/8	9	0.8750	0.4620	41600	605	825	545	740	455	620
	14	0.8750	0.5090	45800	670	910	600	815	500	680
1	8	1.0000	0.6060	51500	860	1170	770	1045	645	875
	12	1.0000	0.6630	59700	995	1355	895	1215	745	1015
1 1/8	7	1.1250	0.7630	68700	1290	1755	1160	1580	965	1310
	12	1.1250	0.8560	77000	1445	1965	1300	1770	1085	1475
1 1/4	7	1.2500	0.9690	87200	1815	2470	1635	2225	1365	1855
	12	1.2500	1.0730	96600	2015	2740	1810	2460	1510	2055
1 3/8	6	1.3750	1.1550	104000	2385	3245	2145	2915	1785	2430
	12	1.3750	1.3150	118100	2705	3680	2435	3310	2030	2760
1 1/2	6	1.5000	1.4050	126500	3165	4305	2845	3870	2370	3225
	12	1.5000	1.5800	142200	3555	4835	3200	4350	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

Values for Magni Coating Fasteners (Ref 4150701)										
SAE GRADE 5 BOLTS & GRADE 2 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	
		In	Sq In	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				
10	24	0.1900	0.01750	1120	36	4.1				
	32	0.1900	0.02000	1285	42	4.7				
1/4	20	0.2500	0.0318	2020	86	9.7	80	9		
	28	0.2500	0.0364	2320	99	11.1	95	11		
		In	Sq In	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
	24	0.3125	0.0580	3700	15	20	15	21	15	20
3/8	16	0.3750	0.0775	4940	25	35	25	34	25	34
	24	0.3750	0.0878	5600	30	40	28	38	25	34
7/16	14	0.4375	0.1063	6800	40	55	40	54	35	48
	20	0.4375	0.1187	7550	45	60	44	60	40	54
1/2	13	0.5000	0.1419	9050	65	90	60	82	55	75
	20	0.5000	0.1599	10700	75	100	71	97	65	88
9/16	12	0.5625	0.1820	11600	90	120	87	118	80	109
	18	0.5625	0.2030	12950	105	145	97	132	90	122
5/8	11	0.6250	0.2260	14400	130	175	120	163	115	156
	18	0.6250	0.2560	16300	145	195	136	185	125	170
3/4	10	0.7500	0.3340	21300	225	305	213	290	200	272
	16	0.7500	0.3730	23800	255	345	238	324	225	306
7/8	9	0.8750	0.4620	29400	365	495	343	466	320	435
	14	0.8750	0.5090	32400	400	545	378	514	355	483
1	8	1.0000	0.6060	38600	545	740	515	700	480	653
	12	1.0000	0.6630	42200	600	815	563	765	530	721
1 1/8	7	1.1250	0.7630	42300	675	920	635	863	595	809
	12	1.1250	0.8560	47500	755	1025	713	969	670	911
1 1/4	7	1.2500	0.9690	53800	955	1300	897	1219	840	1142
	12	1.2500	1.0730	59600	1055	1435	993	1351	930	1265
1 3/8	6	1.3750	1.1550	64100	1250	1700	1175	1598	1100	1496
	12	1.3750	1.3150	73000	1420	1930	1338	1820	1255	1707
1 1/2	6	1.5000	1.4050	78000	1660	2260	1560	2122	1465	1992
	12	1.5000	1.5800	87700	1865	2535	1754	2385	1645	2237

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

5000059K

Values for Magni Coating Fasteners (Ref 4150701)										
SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263) 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	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474	1320	37	4				
10	24	0.1900	0.01750	1580	51	6				
	32	0.1900	0.02000	1800	58	7				
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	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
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	410	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

Values for Magni Coating Fasteners (Ref 4150701)										
SOCKET HEAD CAPSCREWS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K=0.17		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	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474							
10	24	0.1900	0.01750							
	32	0.1900	0.02000							
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	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
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	415	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

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.

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*										
SOCKET HEAD CAPSCREWS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K=0.17		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	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474							
10	24	0.1900	0.01750							
	32	0.1900	0.02000							
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	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
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	415	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

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.

Metric Fastener Torque Chart

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*							
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS							
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™)	Torque (Lube)	Torque (Loctite® 262™ or 271™ or Vibra-TITE™ 131)	Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 141)
		Sq mm	KN	[N.m]		[N.m]	[N.m]
3	0.5	5.03	2.19	1.3	1.0	1.2	1.4
3.5	0.6	6.78	2.95	2.1	1.6	1.9	2.3
4	0.7	8.78	3.82	3.1	2.3	2.8	3.4
5	0.8	14.20	6.18	6.2	4.6	5.6	6.8
6	1	20.10	8.74	11	7.9	9.4	12
7	1	28.90	12.6	18	13	16	19
8	1.25	36.60	15.9	26	19	23	28
10	1.5	58.00	25.2	50	38	45	55
12	1.75	84.30	36.7	88	66	79	97
14	2	115	50.0	140	105	126	154
16	2	157	68.3	219	164	197	241
18	2.5	192	83.5	301	226	271	331
20	2.5	245	106.5	426	320	383	469
22	2.5	303	132.0	581	436	523	639
24	3	353	153.5	737	553	663	811
27	3	459	199.5	1080	810	970	1130
30	3.5	561	244.0	1460	1100	1320	1530
33	3.5	694	302.0	1990	1490	1790	2090
36	4	817	355.5	2560	1920	2300	2690
42	4.5	1120	487.0	4090	3070	3680	4290

NOTES:
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3. * ASSEMBLY USES HARDENED WASHER
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.

5000059K

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS, CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAPSCREWS M3 - M5*						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.20	Torque (Lube 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]
3	0.5	5.03	3.13			
3.5	0.6	6.78	4.22			
4	0.7	8.78	5.47			
5	0.8	14.20	8.85			
6	1	20.10	12.5			
7	1	28.90	18.0	25	23	19
8	1.25	36.60	22.8	37	33	27
10	1.5	58.00	36.1	70	65	55
12	1.75	84.30	52.5	125	115	95
14	2	115	71.6	200	180	150
16	2	157	97.8	315	280	235
18	2.5	192	119.5	430	385	325
20	2.5	245	152.5	610	550	460
22	2.5	303	189.0	830	750	625
24	3	353	222.0	1065	960	800
27	3	459	286.0	1545	1390	1160
30	3.5	561	349.5	2095	1885	1575
33	3.5	694	432.5	2855	2570	2140
36	4	817	509.0	3665	3300	2750
42	4.5	1120	698.0	5865	5275	4395

NOTES:

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5000059K

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3. * ASSEMBLY USES HARDENED WASHER
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.

Values for Magni Coated Fasteners (Ref 4150701)*						
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.17	Torque (Lube 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]
3	0.5	5.03	2.19	1.1	1.1	1.0
3.5	0.6	6.78	2.95	1.8	1.7	1.5
4	0.7	8.78	3.82	2.6	2.4	2.3
5	0.8	14.20	6.18	5.3	4.9	4.6
6	1	20.10	8.74	9	8.4	7.9
7	1	28.90	12.6	15	14	13
8	1.25	36.60	15.9	22	20	19
10	1.5	58.00	25.2	43	40	38
12	1.75	84.30	36.7	75	70	66
14	2	115	50.0	119	110	105
16	2	157	68.3	186	175	165
18	2.5	192	83.5	256	240	225
20	2.5	245	106.5	362	340	320
22	2.5	303	132.0	494	465	435
24	3	353	153.5	627	590	555
27	3	459	199.5	916	860	810
30	3.5	561	244.0	1245	1170	1100
33	3.5	694	302.0	1694	1595	1495
36	4	817	355.5	2176	2050	1920
42	4.5	1120	487.0	3477	3275	3070

NOTES:

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3. * ASSEMBLY USES HARDENED WASHER
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.

Values for Magni Coated Fasteners (Ref 4150701)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS, CLASS 12.9 SOCKET HEAD CAPSCREWS M6 AND ABOVE*						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.17	Torque (Lube 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]
3	0.5	5.03	3.13			
3.5	0.6	6.78	4.22			
4	0.7	8.78	5.47			
5	0.8	14.20	8.85			
6	1	20.10	12.5	13	12	11
7	1	28.90	18.0	21	20	19
8	1.25	36.60	22.8	31	29	27
10	1.5	58.00	36.1	61	58	55
12	1.75	84.30	52.5	105	100	95
14	2	115	71.6	170	160	150
16	2	157	97.8	265	250	235
18	2.5	192	119.5	365	345	325
20	2.5	245	152.5	520	490	460
22	2.5	303	189.0	705	665	625
24	3	353	222.0	905	850	800
27	3	459	286.0	1315	1235	1160
30	3.5	561	349.5	1780	1680	1575
33	3.5	694	432.5	2425	2285	2140
36	4	817	509.0	3115	2930	2750
42	4.5	1120	698.0	4985	4690	4395

NOTES:

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

5000059K

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

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 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 periodic machine inspections and maintenance recommended by JLG Industries, Inc. Consult your national, regional, or local regulations for further requirements for mobile elevating work platforms. 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 Operation and Safety Manual for completion procedures for the Pre-Start Inspection. The Operation 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. 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 Preventive 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 on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. JLG Industries recommends this task be performed by a Factory-Trained Service Technician. JLG Industries, Inc. recognizes a Factory-Trained 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 Inspection and Preventive Maintenance Schedule for items requiring inspection. Reference 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 current machine ownership.

Preventive Maintenance

In conjunction with 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 Preventive 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 date of 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 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. Ensure all passages and openings are unobstructed. Cover all parts to keep them clean. Make sure all parts are clean before they are installed. New parts should remain in their containers until 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 the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting structure and component becomes less than 90 degrees.
3. If a part resists removal, check to see if all nuts, bolts, cables, brackets, wiring, etc., have been removed and 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 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. 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 Section 1.10 - Torque Charts.)

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 high moisture content which permits organic growth and causes 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 Standard UTTO Fluid, which has an SAE viscosity of 10W and a viscosity index of 140.

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 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 Section 2-2 - Cylinder Drift below for evaluation.
- Damaged or worn piston seals.
- Normal thermal expansion or contraction of the hydraulic oil within cylinders (See Cylinder Thermal Drift below).

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

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

Cylinder Leakage Test

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

Measure drift at cylinder rod with a calibrated dial indicator.

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

Cylinder leakage is acceptable if it passes this test.

Table 2-2. Cylinder Drift

Cylinder Bore Diameter		Max. Acceptable Drift in 10 Minutes	
inches	mm	inches	mm
3	76.2	0.026	0.66
3.5	89	0.019	0.48
4	101.6	0.015	0.38
5	127	0.009	0.22
6	152.4	0.006	0.15
7	177.8	0.005	0.13
8	203.2	0.004	0.10
9	228.6	0.003	0.08

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

Cylinder Thermal Drift

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

2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

1. Pinned joints should be disassembled and inspected if the following occurs:
   a. Excessive sloppiness in joints.
   b. Noise originating from 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 (Clean pin before inspection):
   a. Detectable bearing area wear.
   b. Flaking, peeling, scoring, or scratches on pin surface.
   c. Rusting of pin in bearing area.
4. Re-assembly of pinned joints using filament wound bearings:
   a. Blow out housing using compressed air to remove all dirt and debris. Bearings and bearing housings must be free of all contamination.
   b. Clean bearings and pins with solvent to remove all grease and oil.
   c. Inspect pin to ensure it is free of burrs, nicks, and scratches which can damage 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.
- Ground only to structure being welded.
- Unplug all pressure transducers (Refer to Section 6 - JLG Control System.

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 THESE INSTRUCTIONS 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
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
Boom Assembly	14	14
Platform Assembly		
Platform	1,2	1,2
Railing	1	1,2
Gate	1,5	1,5
Floor	1	1,2
Rotator	9,5,15	9,5,15
Lanyard Anchorage Point	1,2,10	1,2,10
Turntable Assembly		
Swing Bearing	1,2,14	1,2,3,13,14
Oil Coupling	9	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		
Spindle Thrust Bearing/Washers	1,2	1,2
Drive Hubs	11	11
Functions/Controls		
Platform Controls	5,6	5,6
Ground Controls	5,6	5,6
Function Control Locks, Guards, or Detents	1,5	1,5
Footswitch	5	5
Emergency Stop Switches (Ground & Platform)	5	5
Function Limit or Cutout Switch Systems	5	5

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL	
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection
Swing Brakes	5	5
Auxiliary Power	5	5
Power System		
Engine Idle, Throttle, and RPM	3	3
Engine Fluids (Oil, Coolant, Fuel)	9,11	9,11
Air/Fuel Filter	1,7	1,7
Exhaust System	1,9	1,9
Batteries	1,9	1,9,19
Battery Fluid	11	11
Battery Charger	5	5
Fuel Reservoir, Cap, and Breather	1,2,5	1,2,5
Hydraulic/Electric System		
Hydraulic Pumps	1,2,9	1,2,9
Hydraulic Cylinders	1,2,7,9	1,2,7,9
Cylinder Attachment Pins and Pin Retainers	1,2,9	1,2,9
Hydraulic Hoses, Lines, and Fittings	1,2,9,12	1,2,9,12
Hydraulic Reservoir, Cap, and Breather	1,2,5,9	1,2,5,9,24
Hydraulic Filter	1,7,9	1,7,9
Hydraulic Fluid	7,11	7,11
Electrical Connections	1,20	1,20
Instruments, Gauges, Switches, Lights, Horn	5,23	5,23
General		
Operation and Safety Manuals in Storage Box	21	21
ANSI Manual of Responsibilities and AEM Safety Manual in Storage Box (ANSI Only)	21	21
Capacity Decals Installed, Secure, Legible	21	21
All Decals/Placards Installed, Secure, Legible	21	21
Annual Machine Inspection Due	21	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, 22	21, 22
Paint and Appearance	7	7

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL	
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection
Stamp Inspection Date on Frame		22
Notify JLG of Machine Ownership		22

Footnotes:

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

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

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

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

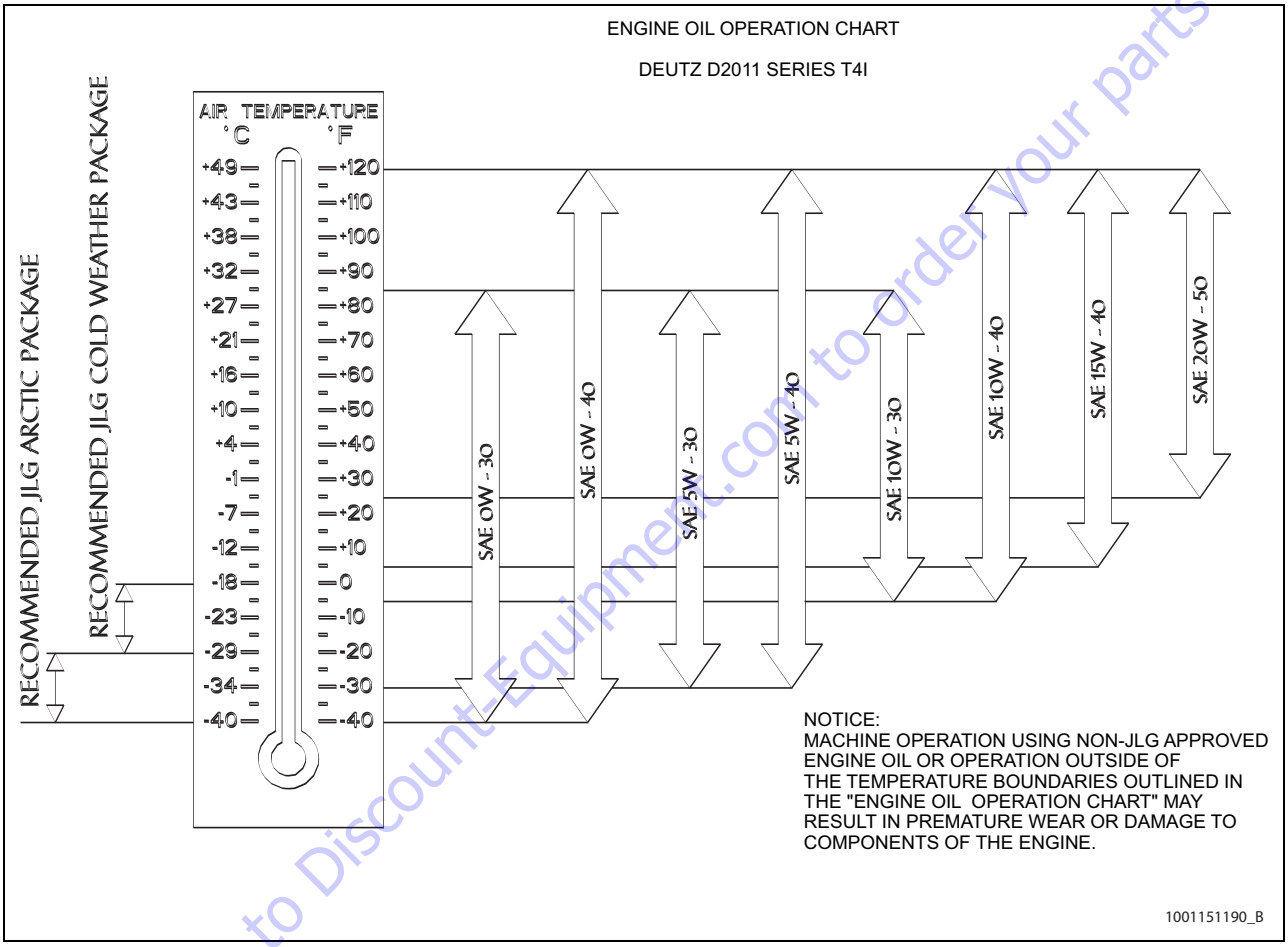


Figure 2-1. Engine Operating Temperature Specifications - Deutz D2011L04

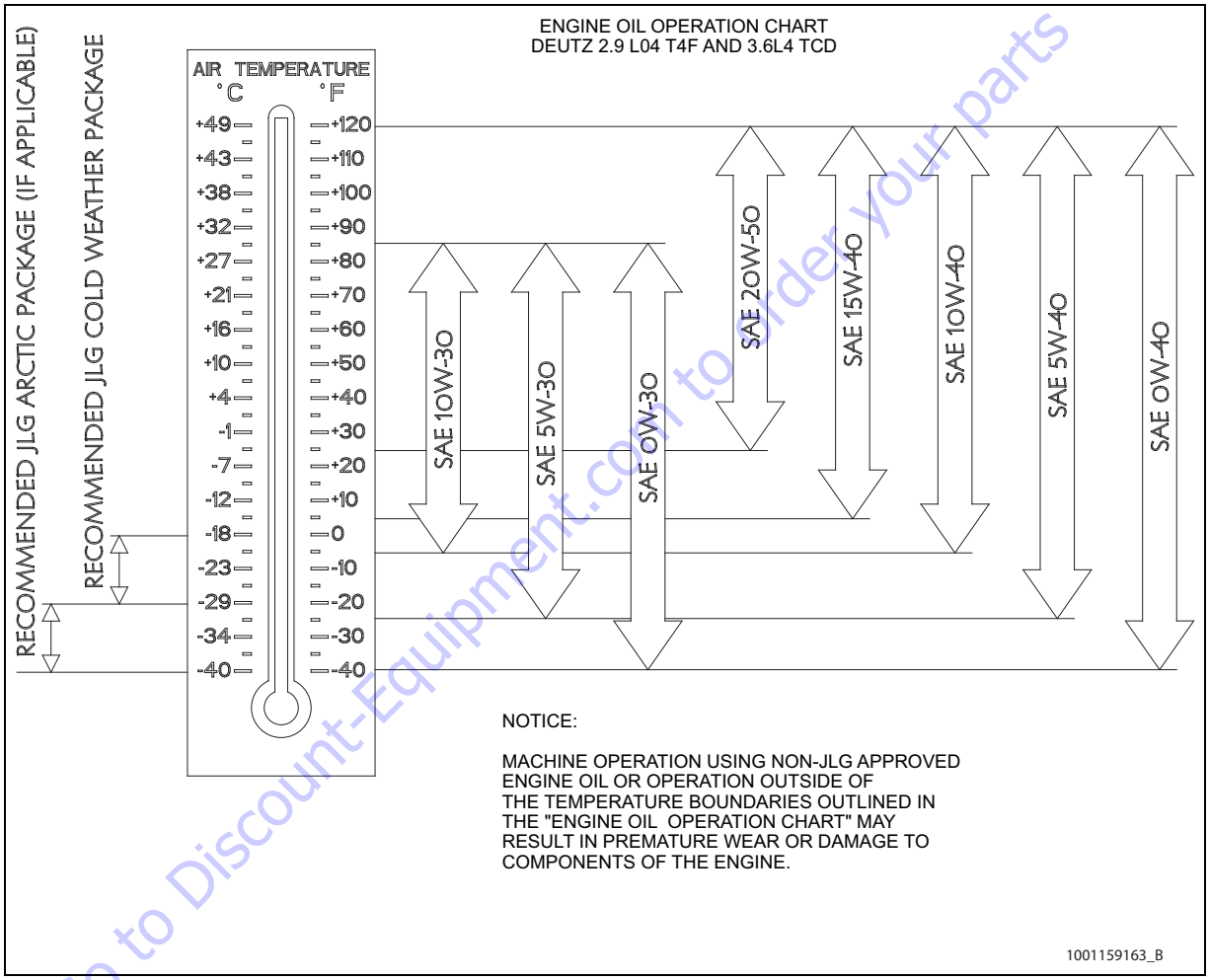
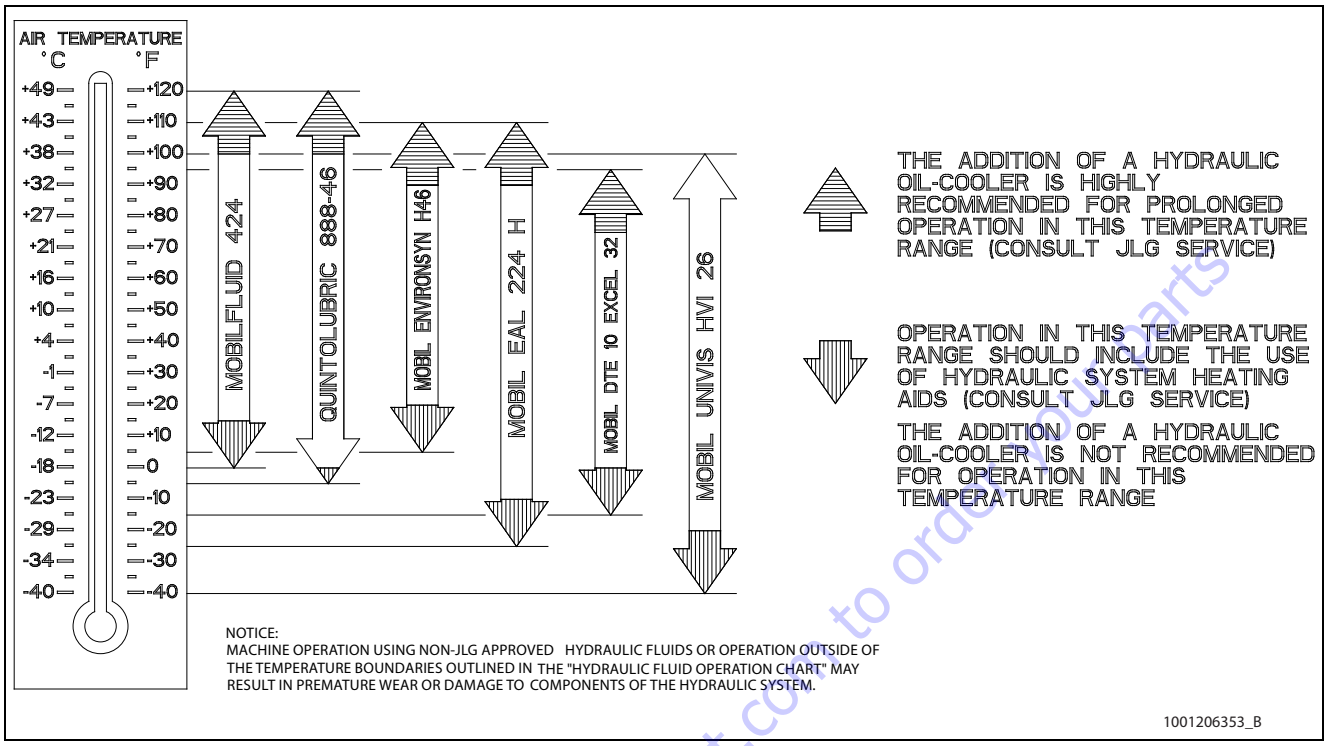


Figure 2-2. Engine Operating Temperature Specifications - Deutz TD2.9



Fluid	Properties		Base				Classifications		
Description	Viscosity at 40° C (cSt, Typical)	Viscosity Index	Mineral Oils	Vegetable Oils	Synthetic	Synthetic Polyol Esters	Readily Biodegradable*	Virtually Non-toxic**	Fire Resistant***
Mobilfluid 424	55	145	X						
Mobil DTE 10 Excel 32	32	141	X						
Univis HVI 26	26	376	X						
Mobil EAL 224 H	36	212		X			X	X	
Mobil Envirosyn H46	49	145			X		X	X	
Quintolubric 888-46	50	185				X	X	X	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

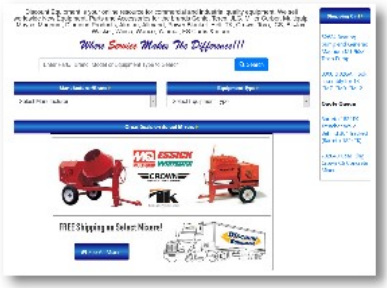
*** Fire Resistant classification indicates Factory Mutual Research Corp. (FMRC) Approval

Figure 2-3. Hydraulic Oil Operating Temperature Specifications

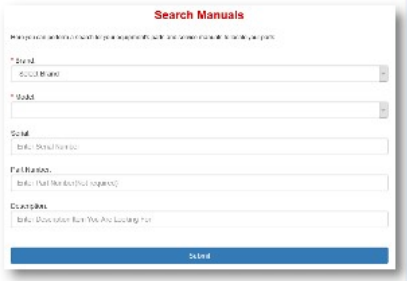
PARTS FINDER

Search Website by Part Number

Discount Equipment



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



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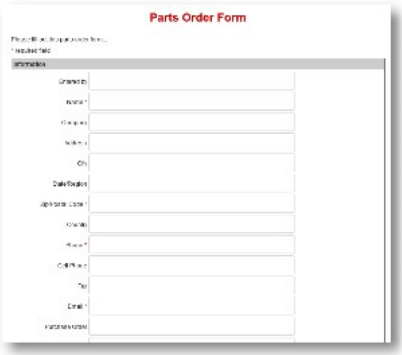

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, 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 3. CHASSIS & TURNTABLE

3.1 CHASSIS TILT INDICATOR SYSTEM

The Chassis Tilt Indicator System measures the turntable angle with respect to level ground. The control system reads the reading and compares it to a preset turntable tilt angle value. When the machine is in transport position, it can travel at up to maximum speed until it tilts more than 8.0°, then the system will limit the drive speed to maximum displacement mode (slow drive speed). However, when the machine is out of transport position and the turntable tilts more than the preset value, the boom functions can only operate in creep speed mode, and the drive function is disabled. The operator has to return the machine into transport mode in order to continue to drive the machine. For machine setup see section 6.

3.2 AUXILIARY POWER SYSTEM

The Auxiliary Power System is intended as a secondary means to bring an operator from work height down to the ground in the event of primary power loss. This system uses an electric motor/pump unit powered by a 12V battery. It is not intended to be used as the main power source. All functions can be retracted or lowered and the jib can be lifted up. The auxiliary system levels the platform when lifting down. The drive func tion is excluded from the auxiliary system.

3.3 DRIVE ORIENTATION SYSTEM

The Drive Orientation System (DOS) indicates the conditions that could make the direction of movement of the chassis different than the direction of movement of the drive/steer control handle to the operator.

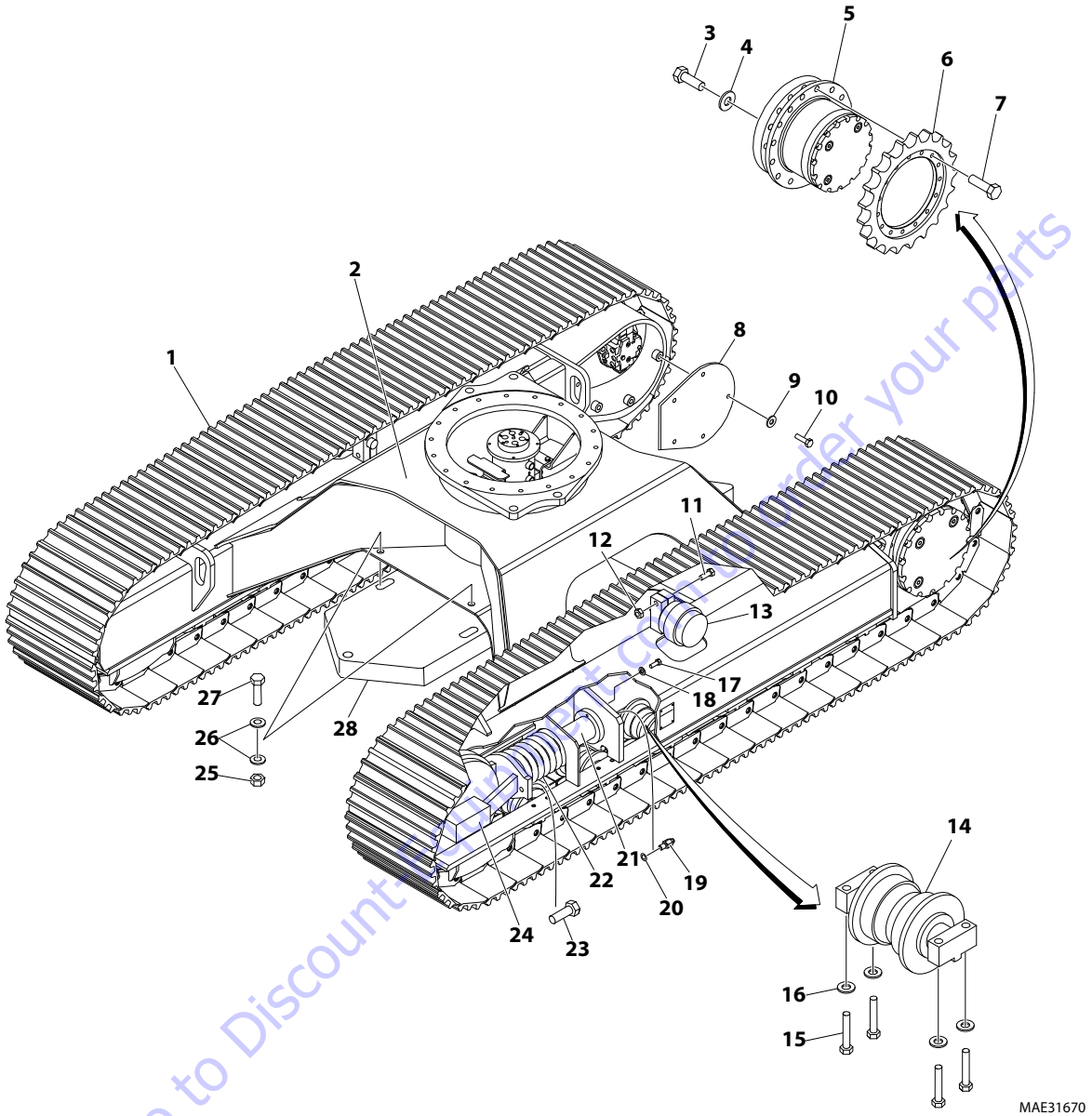
The system indicates to the operator the need to match the black and white directional arrows on the platform control panel to the arrows on the chassis. The system uses a proximity switch mounted on the hydraulic swivel, an indicator light and a spring return override switch on the platform display panel. The proximity switch trips when the turntable is swung ± 45 degrees off center of the normal driving position.

This occurs roughly when the main boom is swung beyond the rear of the machine. When the turntable is in the normal drive position with the boom at the rear of the machine, no indications or interlocks are made. When the machine is actively driving when the turntable is swung beyond the switch point, the system is ignored until drive/steer is released.

When drive is initiated with the boom swung beyond the switch point, the DOS indicator will flash and the drive/steer functions will be disabled. The operator must engage the DOS override switch to enable Drive/steer (high drive will remain disabled).

When the DOS is enabled, the DOS indicator will be illuminated continuously and a 3-second enable timer will be started and will continue for 3 seconds after the end of the last drive/steer command. If the timer expires, the DOS override switch must be re-engaged to enable drive/steer.

3.4 CHASSIS COMPONENTS AND SERVICING



1. Track Chain Assembly
2. Undercarriage
3. Bolt
4. Flat Washer
5. Drive Assembly
6. Drive Sprocket
7. Flanged Bolt
8. Cover Plate
9. Lock washer
10. Bolt
11. Bolt
12. Locknut
13. Carrier Track Roller
14. Bottom Track Roller
15. Bolt
16. Flat Washer
17. Bolt
18. Lock washer
19. Grease Fitting
20. Seal
21. Shock Assembly
22. Spring Assembly
23. Capscrew
24. Idler Assembly
25. Nut
26. Flat Washer
27. Bolt
28. Counterweight

Figure 3-1. Chassis Assembly

Service Notes

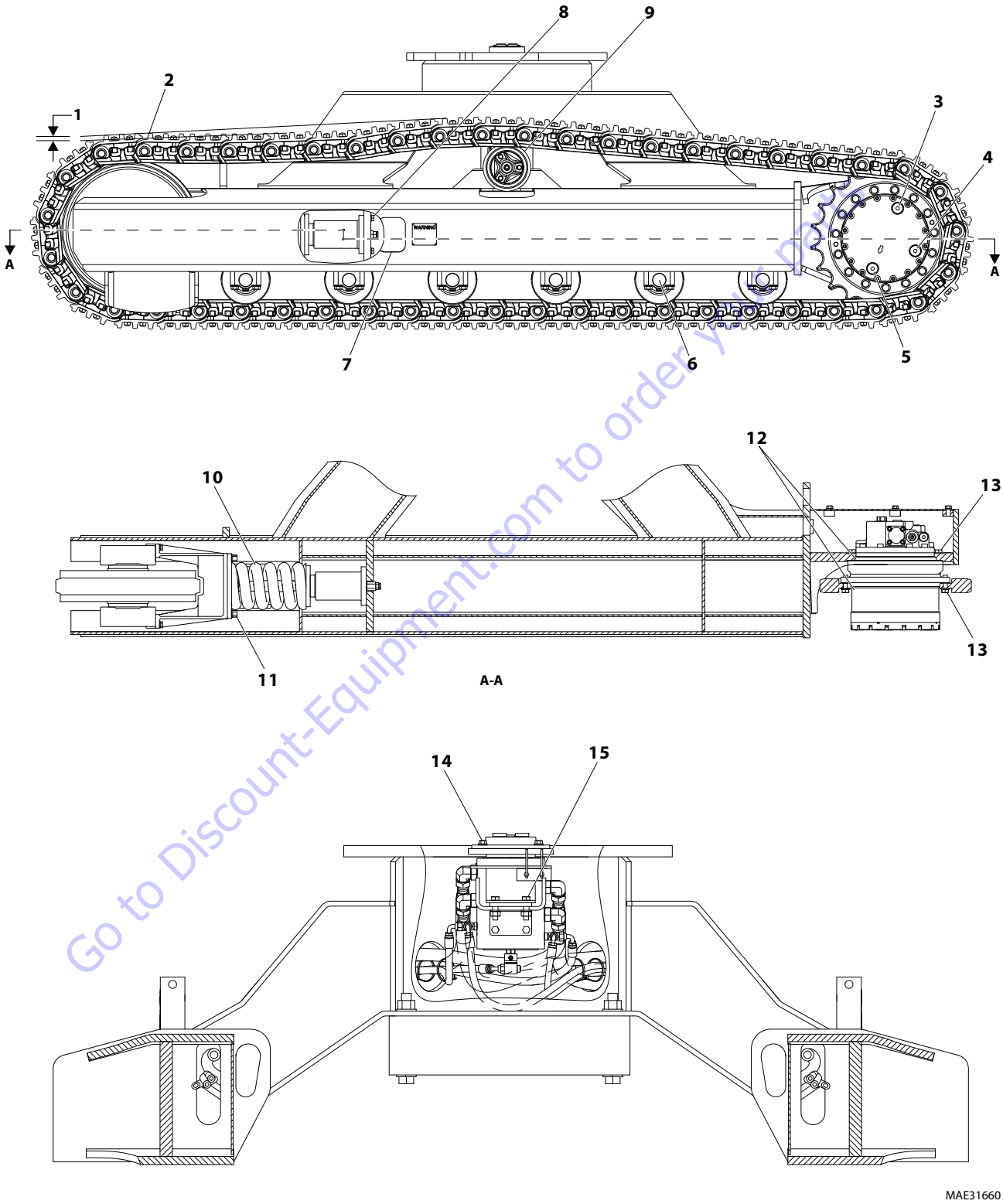
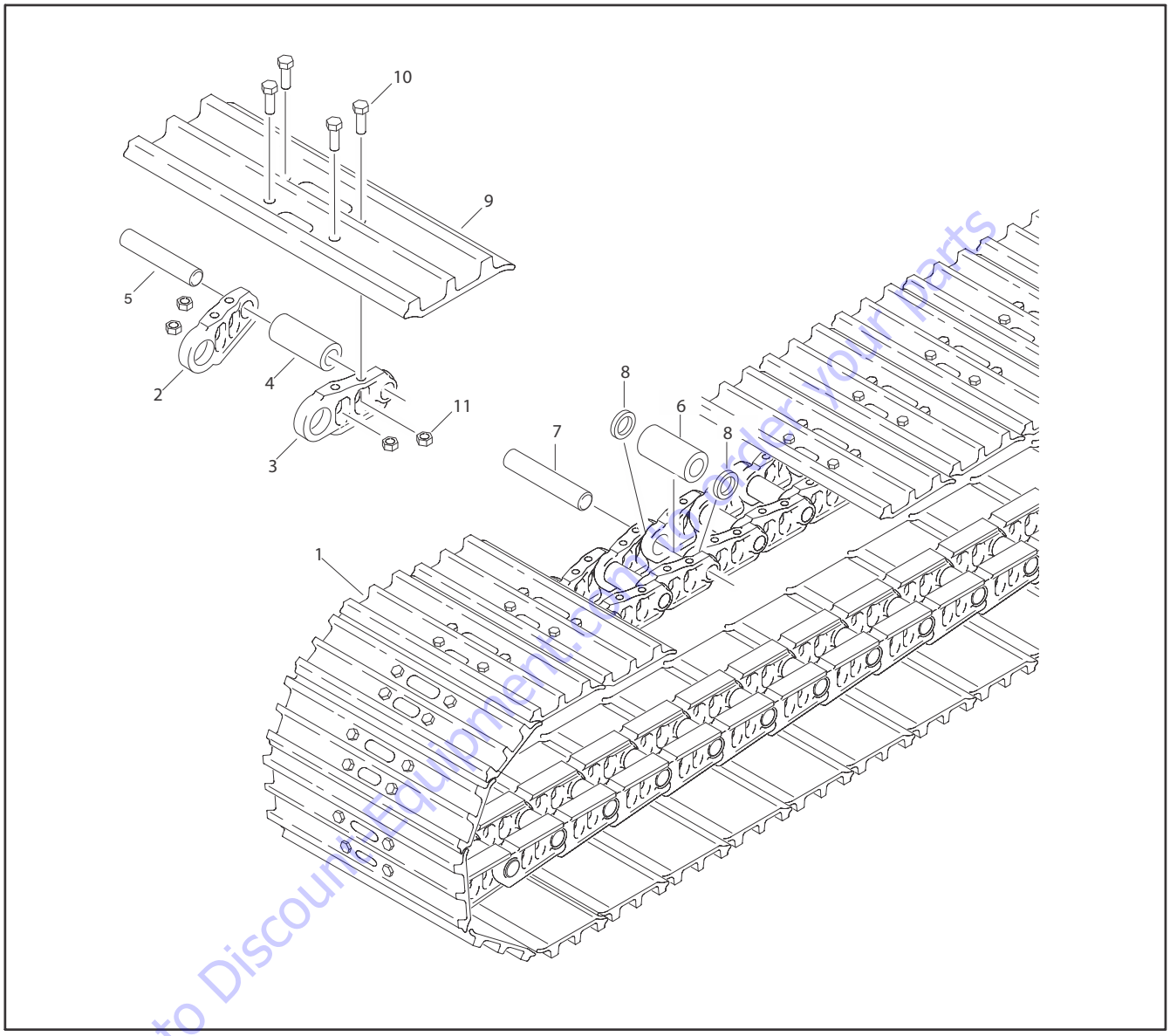


Figure 3-2. Chassis Service Notes - 1 of 2

1	Track tension adjustment to be made between the idler and carrier roller: 0.781 in (19.8 mm)
2	Anti-Seize Compound to be used on master link pin before assembly. Torque Pad bolts over master link to 65 ft-lbs +6,-6 then tighten 1/3 (120°)turn further.
3	Fill Plug
4	Check oil level of left & right crawler drives (0.69 Gal [2.6 L] grade 90 Gear Oil)
5	Drain Plug
6	Torque to 200 ft-lb, +15 -0 (280 Nm, +21 -0)
7	Use Gradall 8381-3109 Large Button Head Grease Fitting Adapter to Adjust Tracks
8	Torque to 65 ft-lb, +10 -0 (91 Nm, +15 -0)
9	Torque to 340 ft-lb, +25 -0 (476 Nm, +35 -0)
10	Offset in Idler Spring from center line of Idler to be oriented down.
11	Torque to 165 ft-lb, +15 -0 (231 Nm, +21 -0)
12	Apply Anti-Seize Compound to both mounting pilots Drive Motors
13	Torque to 230 ft-lb, +15 -0 (322 Nm, +21 -0)
14	Torque to 93 ft-lb, +10 -0 (130 Nm, +14 -0)
15	Torque to 53 ft-lb, +5 -0 (74 Nm, +7 -0)

Figure 3-3. Chassis Service Notes - 2 of 2

Track and Chain



1. Track Assembly
2. Left Link
3. Right Link
4. Bushing
5. Hinge Pin
6. Splice Bushing
7. Splice Hinge Pin
8. Spacer
9. Track Cleat
10. Bolt
11. Nut

TRACK SHOES

1. Visually check for loose or missing bolts at the start of each operating shift.
2. Check bolt torque approximately every 100 hours. Torque track shoe bolts to 65 ft-lb, +6 (91 Nm, +8.4), then tighten 1/3 turn (120°) further.

TRACK PIN

The track pin is pressed in the right and left link of the chain. It is also installed through bushing at each end of the link. Outside diameter (O.D.) of pin wears against inside diameter (I.D.) of bushing with which it is making contact. Once pin reaches allowable wear limit it may be rotated 180 degrees for extended life.

TRACK BUSHING (BEARING)

Track bushings fit in the counterbore of each link. There is one bushing per link set. The O.D. of the bushing contacts drive sprocket teeth during travel and results in bushing wear at sprocket side only. This wear and pin wear is a major factor in looseness and damage to the chain by increasing pitch length.

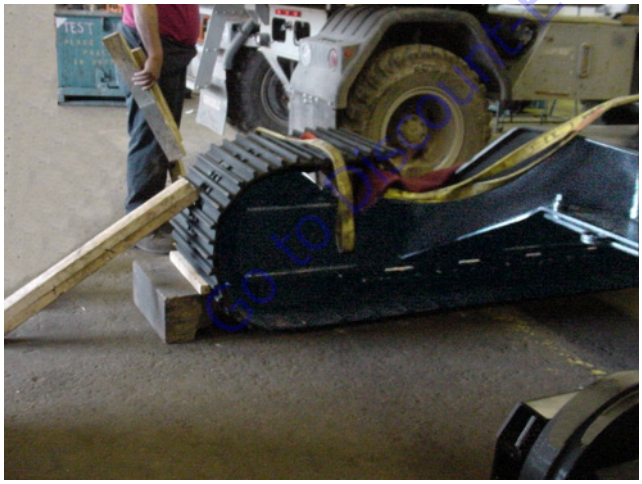
Replace Track

REMOVE TRACK

⚠ WARNING

UNCONTROLLED TRACK MOVEMENT CAN CAUSE SERIOUS INJURY. KEEP CLEAR OF TRACK WHEN REMOVING PIN.

1. Use wood blocking, a come-along, or other device to prevent track and chain assembly from falling uncontrolled to ground.



2. Remove four bolts (10), nuts (11), and track cleat (9) from chain assembly. Repeat with adjacent track cleat.
3. Use a portable press to push pin (5) out. Remove bushing (4).

LINKS, PIN, AND BUSHING WEAR MEASUREMENT

To establish average wear measurement, choose a length of 4 sections of link assembly on top of the undercarriage in a well tensioned zone.

When wear measurement reaches 100% limit turn pins 180° for extended life. If this operation has been previously performed, worn parts must be replaced.

INSTALL TRACK

NOTE: *Chain must be installed with pin end of links facing back of machine at ground level.*

1. Align chain and C-clamp spacer in two places on chain. Hammer in chain link aligning pin hole.
2. Insert alignment pin through hole to temporarily hold track together.
3. Position wood blocks to frame rail for tracks to lay onto when connecting track ends to get proper extension for connecting end links.

NOTICE

PINS AND BUSHINGS MUST BE WELL LUBRICATED DURING ASSEMBLY.

4. Apply anti-seize compound to pin. Line up end links. start pin in hole by driving with a hammer.
5. Place portable power pin press over track and pin. place washers in press ends. Carefully press in track pin.

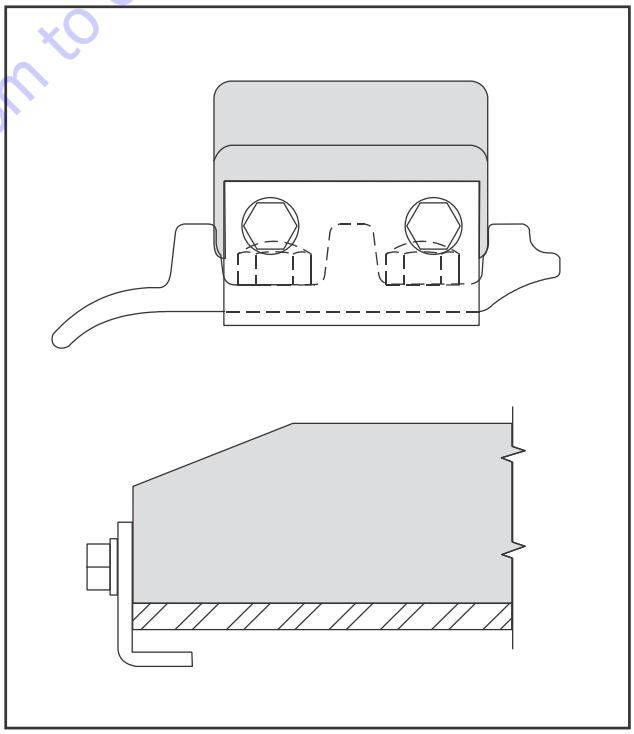
6. Re-assemble four track shoes to assembled links.
7. Torque track shoe bolts to 65 ft-lb, +6 (91 Nm, +8.4), then tighten 1/3 turn (120°) further.

Track tensioning

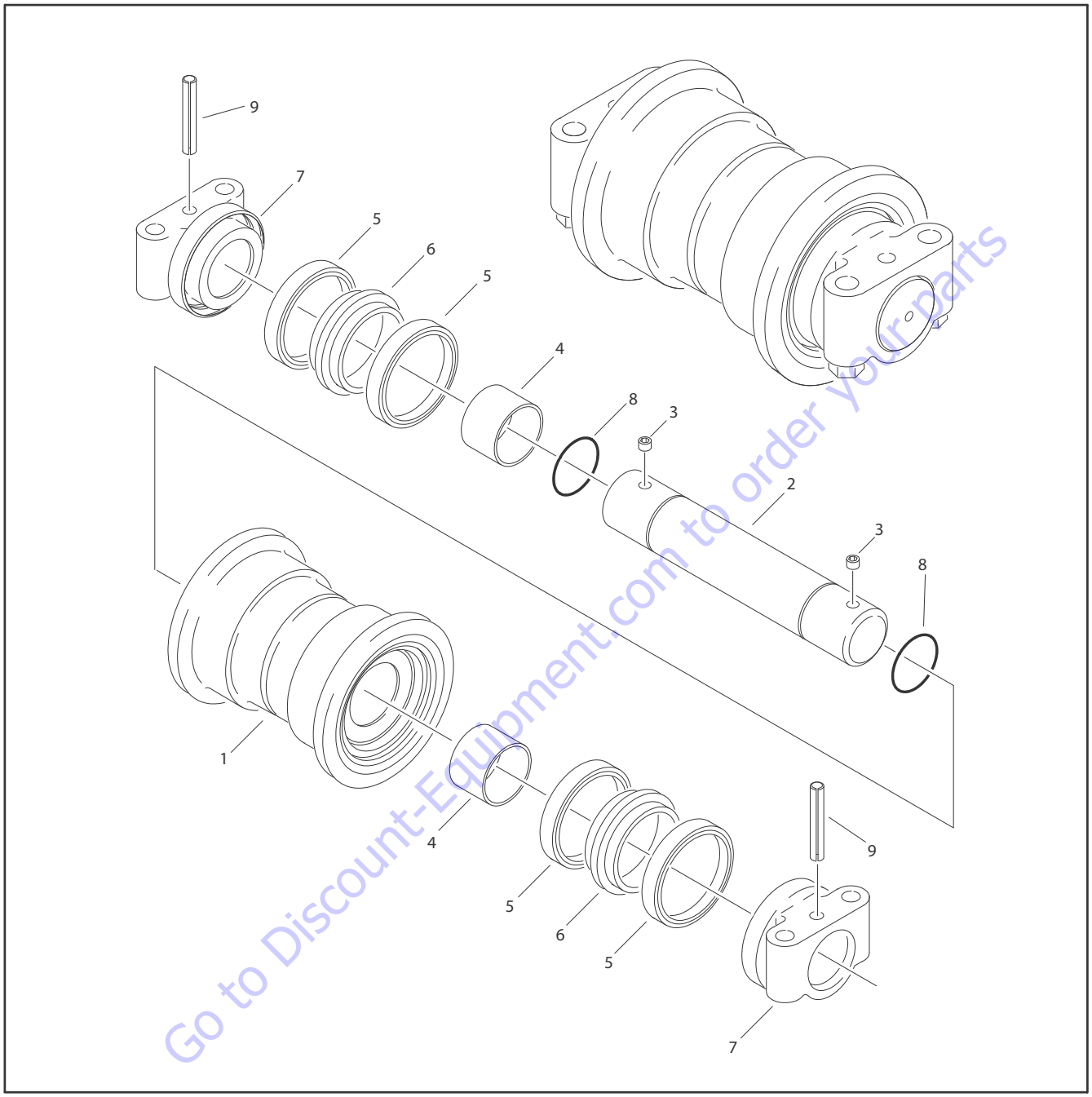
1. Using special grease fitting tool (PN 83813109), pump in grease to add tension to track.

2. Check for 0.781 in (19.8 mm) tension between idler & carrier roller with level and gage. Remove special fitting.

Rubber Track Pad Installation

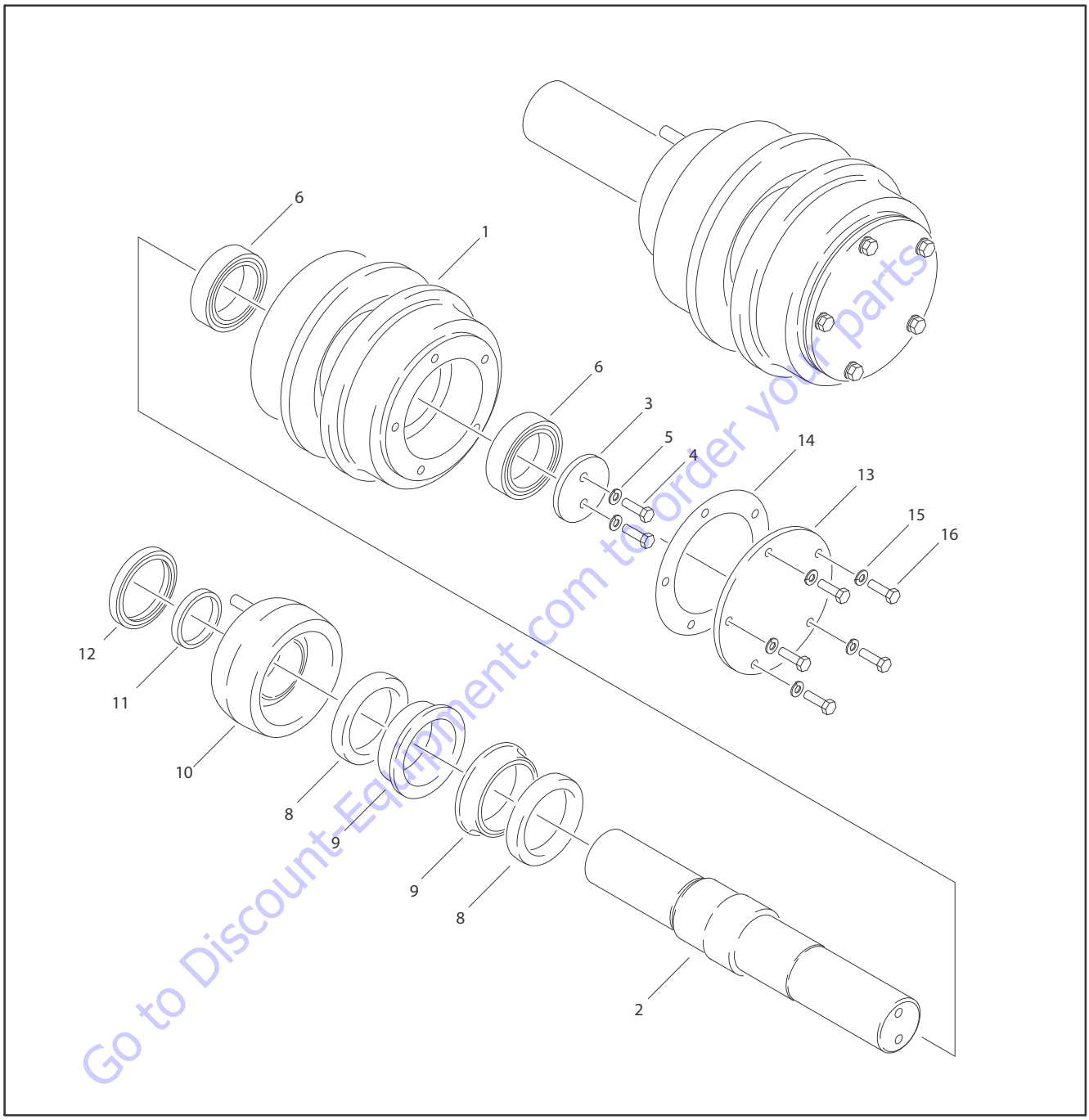


1. Seat rubber track pad over center rib of steel track.
2. Apply Medium Strength Threadlocking Compound to retaining plate bolts. Install bolts and flat washers to end of rubber pad.
3. Torque bolts to 70 ft-lb (97 Nm).



1.	Guide Roller	4.	Bearing	7.	Mounting Bracket
2.	Shaft	5.	Ring	8.	O-ring
3.	Plug	6.	Seal	9.	Roll Pin

Figure 3-4. Bottom Track Roller Assembly



1. Guide Roller
2. Shaft
3. Internal Cover
4. Bolt
5. Washer
6. Roller Bearing
7. Not Used
8. Seal Ring
9. Tension Ring
10. Collar
11. Packing Ring
12. Seal Ring
13. Cover
14. Cover Seal
15. Lockwasher
16. Bolt

Figure 3-5. Upper Carrier Track Roller Assembly

Rollers

Rollers are "lifetime" lubricated and under normal working conditions no further lubrication is required. Idlers should be randomly checked while working to protect against destruction should a seal be damaged.

ROLLER SEALS

NOTICE

USED SEALS WILL MOST LIKELY FAIL SHORTLY AFTER REBUILD. ALWAYS USE NEW SEALS WHEN REASSEMBLING TRACK ROLLER.

NOTE: *Mating surface where seals contact must be dry and clean; free of dirt, nicks, and burrs.*

1. Install O-ring on roller shaft.
2. Install seal group into roller shell seat. Remove plastic band holding rings together.
3. Press collar on roller shaft and lock in place with dowel.
4. Invert roller assembly and perform steps 1 through 4.
5. Fill roller with lube.

TRACK ROLLER DISASSEMBLY

1. Remove lube fill plug and dump lube into a container.
2. Press dowel pin out of collar.
3. Remove seals and shaft.
4. Press out bushings.

TRACK ROLLER ASSEMBLY

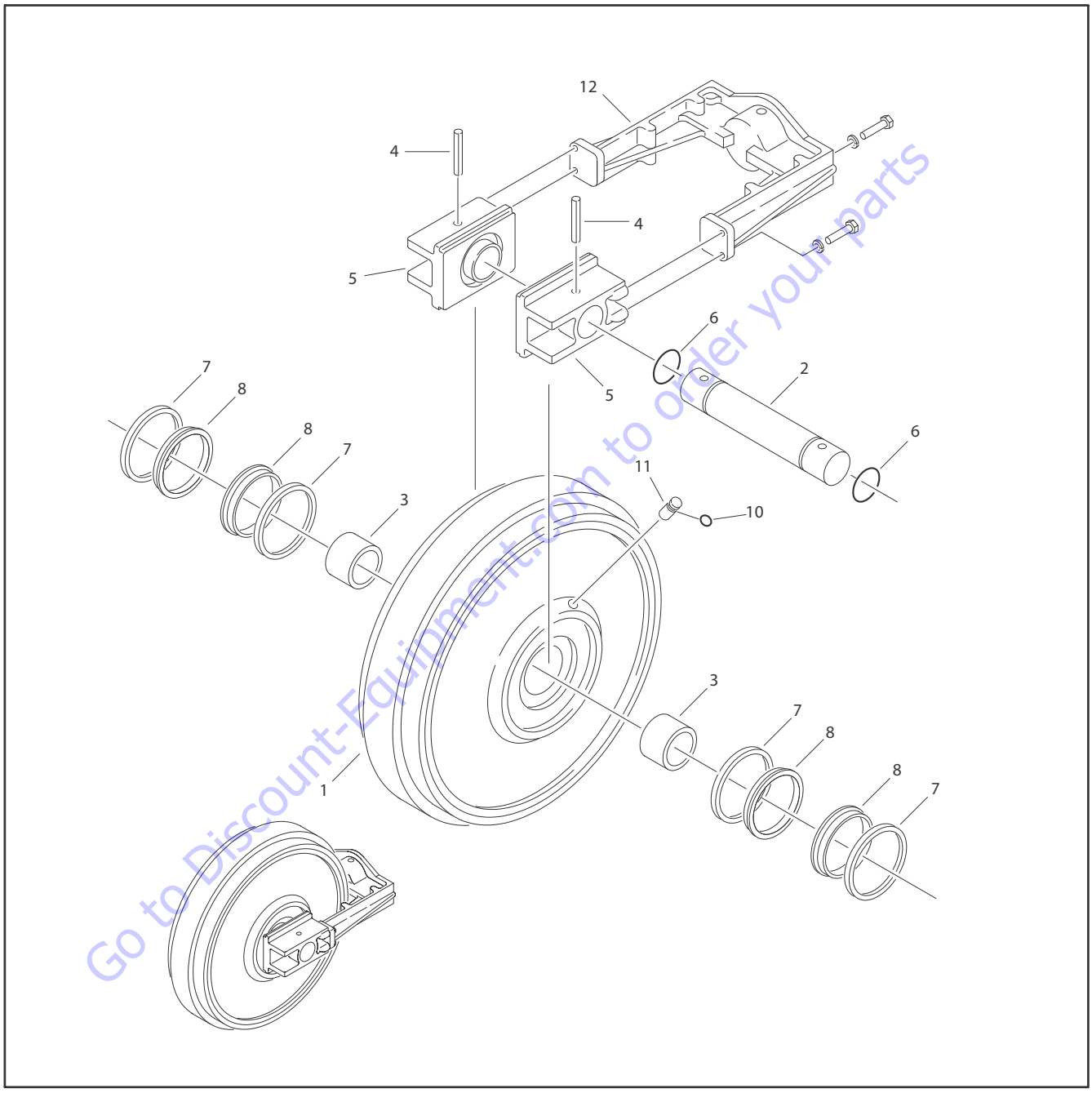
1. Install bushings in roller shell.
2. Install collar to roller shaft.
3. Install dowel pin through collar and shaft.
4. Install O-ring in roller shaft.
5. Install seal group in roller shell seal seat.
6. Insert collar and shaft into shell until collar bottoms to the seal group.
7. Invert roller 180°.
8. Complete component assembly as in steps 2 through 6.
9. Fill Roller with lube.

BOTTOM TRACK ROLLER INSTALLATION

1. Blow out roller mounting holes With air gun. Wipe mounting surfaces clean with rag. Threads must be clean of grease and oil.
2. Apply Medium Strength Threadlocking Compound to four bolts. Align roller on frame and secure with four washers and bolts.
3. Torque bolts to 200 ft-lb +15-0 (280 Nm, +21 -0).
4. Use a low pressure pump with a nozzle that will fit through idler body fill hole. Fill with SAE 30 or SAE 40 oil at capacities for your machine.

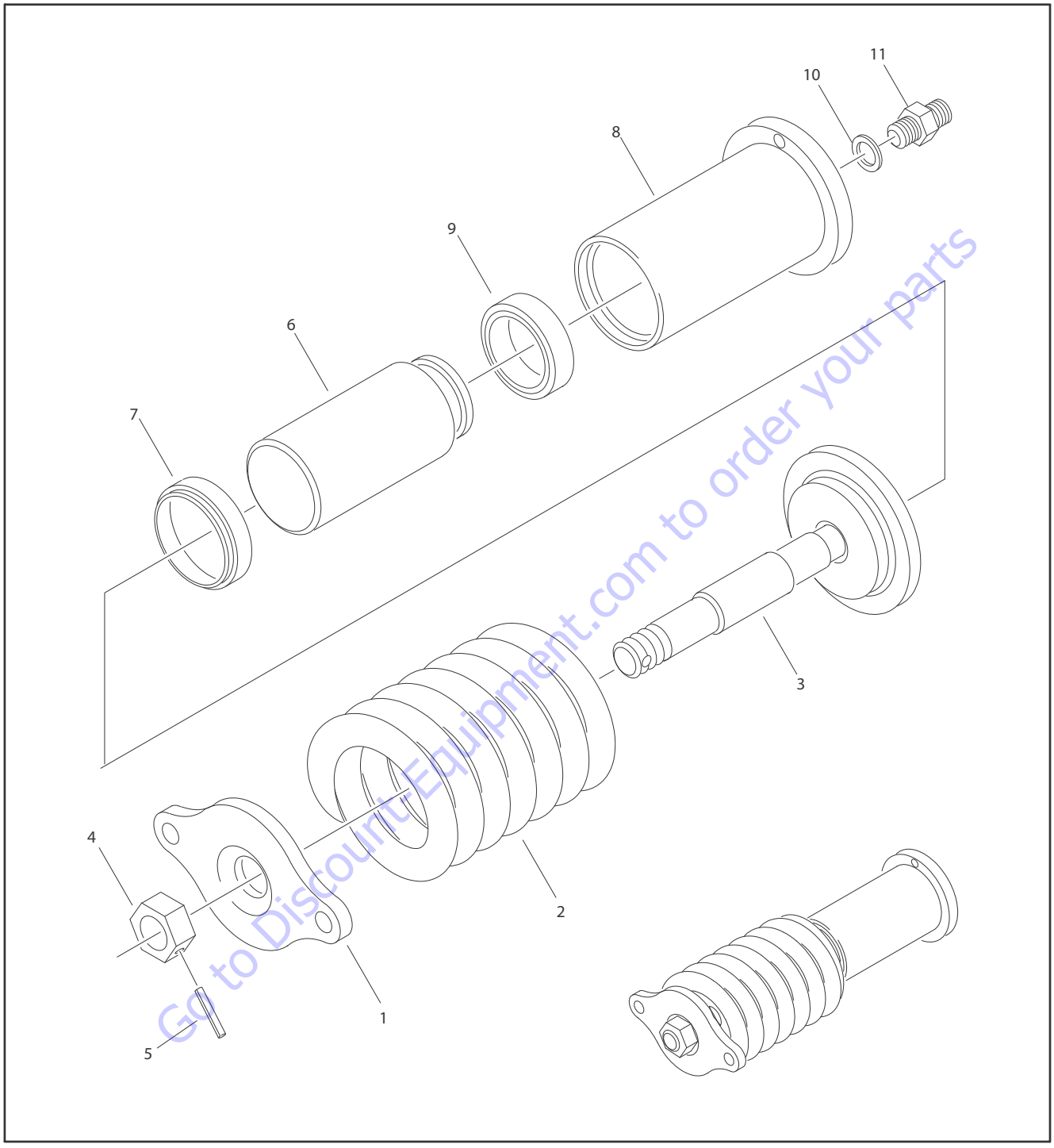
Idler Roller Assembly

The idler roller assembly is located at the front of each side frame and acts as a shock absorber for the track system. Compensation is accomplished by a tensioning spring and hydraulic cylinder.



1.	Idler	5.	Mounting Bracket	9.	Not Used
2.	Shaft	6.	Seal	10.	O-ring
3.	Bearing	7.	Seal	11.	Plug
4.	Roll Pin	8.	Seal Holder	12.	Bracket

Figure 3-6. Idler Assembly



1. Mounting Flange
2. Spring
3. Base Plate
4. Locknut
5. Roll Pin
6. Piston/Rod
7. Wiper
8. Barrel
9. Seal
10. Seal
11. Fitting

Figure 3-7. Spring & Shock Assembly

TRACK TENSION AND IDLER ROLLER DISASSEMBLY

1. Relieve all pressure from track tensioning cylinder.
2. Carefully separate track chain and lay it on the ground.
3. Remove recoil device group.
4. Remove track tension group.
5. Remove two (slide brackets) support groups and idler pin from side frame.
6. Remove idler roller from machine.
7. Examine all fasteners and seals for damage. Replace damaged components.

TRACK TENSION AND IDLER ROLLER REASSEMBLY

1. Clean, lubricate, and check all components for damage.
2. Reassemble idler roller with support group and fork and install into side frame.
3. Install track tension group.
4. Torque all fasteners to correct value.
5. Reassemble track chain to side frame and lack master pin and bushing as required.
6. Pressurize tensioning cylinder to achieve the correct track adjustment.
7. Install cover over opening in side frame for valve used for tensioning cylinder adjustment.

IDLER ROLLER DISASSEMBLY

NOTE: *Remove recoil components to access idler roller.*

1. Remove one of the dowel pins that fasten the bracket to the shaft.
2. Remove remaining components which are now free of shaft.
3. Press out bushing. (Bushing can only be removed by a vertical press with correct tooling.)
4. If necessary, remove remaining dowel pins and bracket.

IDLER ROLLER ASSEMBLY

1. Press bushings into idler shell.
2. Mount a bracket on shaft.
3. Insert seal group into idler shell seal seat.
4. Install O-ring on shaft.
5. Insert complete sub assembly in idler shell to point where it bottoms the seal group.
6. Invert idler and assemble components as in steps 1 through 4.
7. After loose assembly press tightly together using a vertical press.

NOTE: *Seal group is assembled same as in bottom rollers.*

IDLER ROLLER AND TRACK TENSIONER REMOVAL AND REPLACEMENT TO SIDE FRAME

⚠ WARNING

SERIOUS INJURY COULD RESULT IF THE PRESSURE IS NOT RELIEVED FROM TENSIONER AND RECOIL SYSTEM.

1. To remove pressure from cylinder, carefully back off one or two turns on the fill fitting. As soon as lube starts to come out vent hole **STOP backing off fitting.**
2. Once pressure is relieved it is safe to remove roller and tensioner assembly.
3. Assemble fitting and fitting seal in end of each shock assembly. Torque to chart specifications.

INSTALL SHOCK

1. Assemble shock assembly in position. Secure with bolts, washers, and Medium Strength Threadlocking Compound. Torque to 65 ft-lb +10-0 (91 Nm, +15 -0).
2. Using an adequate lifting device, pick up spring assembly upright onto idler assembly. Install using bolts, washers, and Medium Strength Threadlocking Compound. Torque to 165 ft-lb +15-0 (231 Nm, +21 -0).
3. Reference offset in idler spring from centerline of idler (to be oriented down). Using gantry crane and sling, pick up and slide spring/idler assembly into pre-greased slider area. Use nylon sledge hammer lightly to assemble.
4. Push idler assembly against seat. Using special adapter, pump in grease to expand shock assembly just enough to inspect for proper assembly.

3.5 SWING DRIVE HUB

Removal

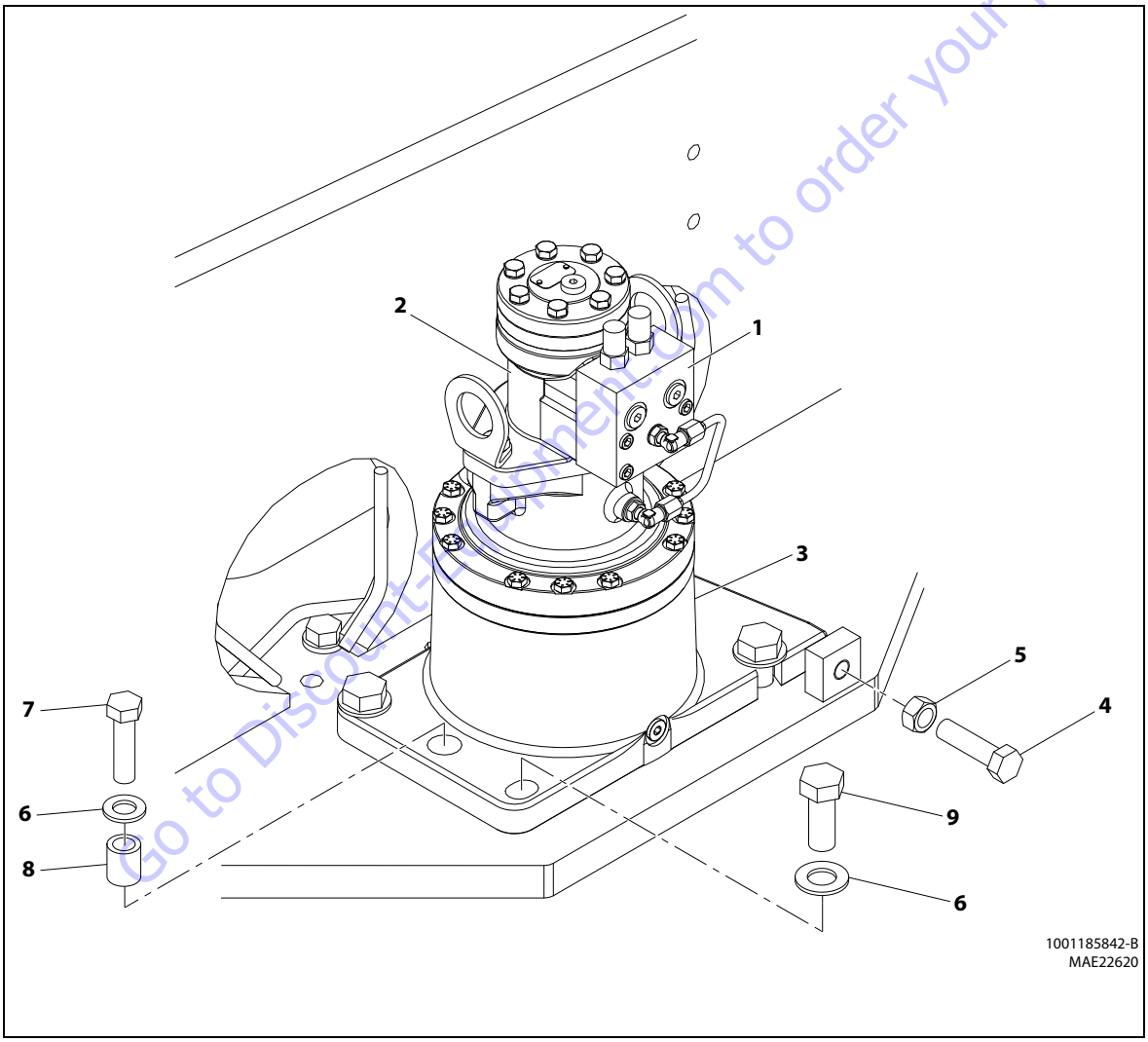
1. Gently loosen the jack bolt (4). Do not remove.
2. Remove the pivot bolt (7).
3. Remove the mounting bolts (9) securing swing drive hub to the turntable.
4. Using the suitable lifting device, remove the swing drive hub from mounting plate without damaging the swing gear.
5. Place swing drive hub in the clean area.
6. Refer to Section 3-8., Swing Drive Installation, for swing drive maintenance.

Assembly/Disassembly

For detail assembly/disassembly instructions, Refer Swing Drive Hub Manual (PN 3128853).

Installation

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.).



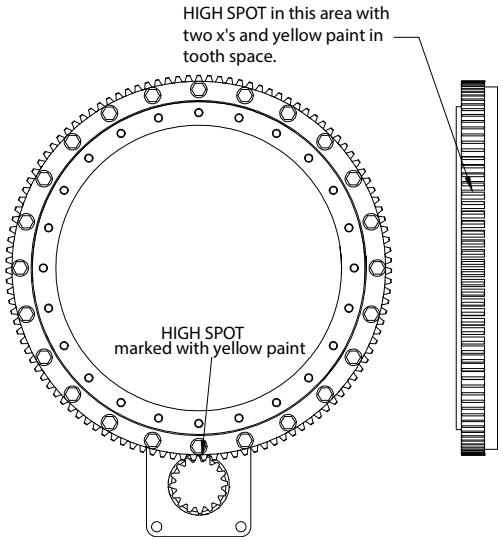
1. Motor Control Valve
2. Swing Motor
3. Swing Hub Assembly
4. Jack Bolt
5. Nut
6. Washer
7. Pivot Bolt
8. Spacer
9. Bolt

Figure 3-8. Swing Drive Installation

Procedure For Setting Swing Gear Backlash

Set backlash to 0.010 inch to 0.015 inch (0.254 mm - 0.381 mm) using the following procedure:

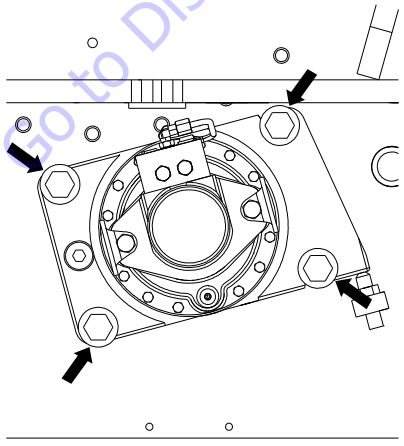
1. Place the machine on firm, level ground.
2. Place shim between pinion and bearing at bearing high spot (shown below).



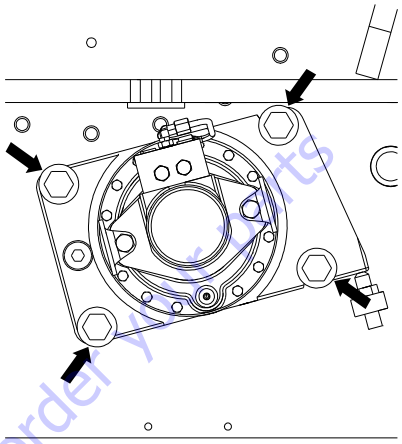
3. Apply High Strength Threadlocking Compound and torque pivot bolt to 205 ft. lbs. (280 Nm).

NOTE: *Make sure the turntable is properly supported during the following step. The turntable can swing a few degrees when the turntable lock is removed if the turntable is not balanced properly.*

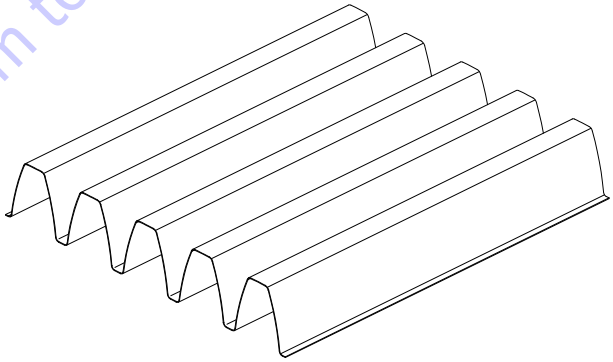
4. Remove turntable lock pin.
5. Apply High Strength Threadlocking Compound and pre-torque swing drive mounting bolts to 30 ft. lbs. (40 Nm).



6. Tighten jack bolt until pinion is completely snug against shim and bearing then loosen jack bolt.
7. Apply High Strength Threadlocking Compound and torque jack bolt 50 ft. lbs. (68 Nm).
8. Apply High Strength Threadlocking Compound and tighten jam nut.
9. Torque mounting bolts to 340 ft. lbs. (Nm).

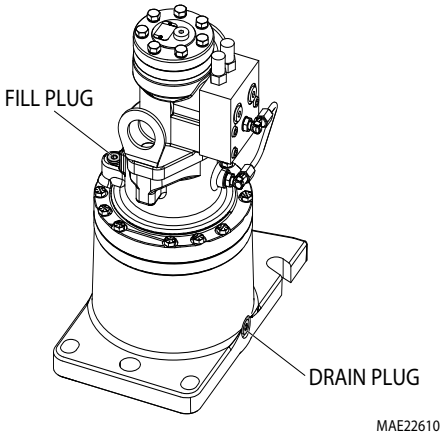


10. Remove shim and discard.



Swing Drive Lubrication

Fill Swing Drive Gearbox with 32 oz (0.946 L) 80w90 gear oil with EP additives. Oil should cover the ring gear. Torque pipe plug to 23-25 ft.lbs (31- 33 Nm).



3.6 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

NOTE: *This check is designed to replace existing bearing bolt torque checks on JLG Lifts in service. This check must be performed after 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* High Strength Threadlocking Compound. *After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.*

1. Check frame to bearing. Attach bolts as follows:
   - **a.** Elevate fully retracted main boom to 70 degrees (full elevation).
   - **b.** At the positions indicated on (See Figure 3-9.), try and insert the 0.0015 inch (0.0381 mm) feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   - **c.** Assure that the 0.0015 inch (0.0381 mm) feeler gauge will not penetrate under the bolt head to the bolt shank.
   - **d.** Swing turntable 90 degrees and check some selected bolts are at the new position.
   - **e.** Continue rotating turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.
2. Check the turntable to bearing. Attach bolts as follows:
   - **a.** Elevate the fully retracted boom to 70 degrees (full elevation).
   - **b.** Try and insert the 0.0015" feeler gauge between bolt head and hardened washer at position shown in (See Figure 3-9.).
   - **c.** Lower the boom to horizontal and fully extend the boom.
   - **d.** Try and insert the 0.0015" feeler gauge between bolt head and hardened washer at position shown in (See Figure 3-9.).

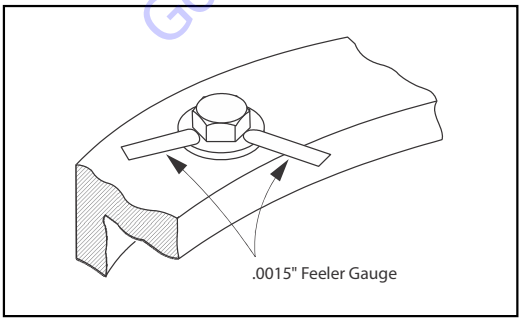


Figure 3-9. Swing Bearing Bolt Feeler Gauge Check

Wear Tolerance

1. From underside of the machine, at rear center, with the boom fully elevated and fully retracted, as shown in Figure 3-11., Swing Bearing Tolerance Measurement Location & Boom Placement A, using a magnetic base dial indicator, measure and record distance between swing bearing and turntable as shown in Figure 3-10., Swing Bearing Tolerance Measuring Point.
2. At the same point, with the boom horizontal and fully extended, as shown in the Figure 3-11., Swing Bearing Tolerance Measurement Location & Boom Placement B, using a magnetic base dial indicator, measure and record distance between swing bearing and turntable as shown in Figure 3-10., Swing Bearing Tolerance Measuring Point.
3. If difference is greater than 0.079 inch (2.00 mm), is determined, the swing bearing should be replaced.
4. If a difference less than 0.079 inch (2.00 mm) is determined, and any of the following conditions exist, the bearing should be removed, disassembled, and inspected for the following:
   - **a.** Metal particles in grease.
   - **b.** Increased drive power required.
   - **c.** Noise.
   - **d.** Rough rotation.
5. If bearing inspection shows no defects, reassemble and return to service.

NOTICE

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

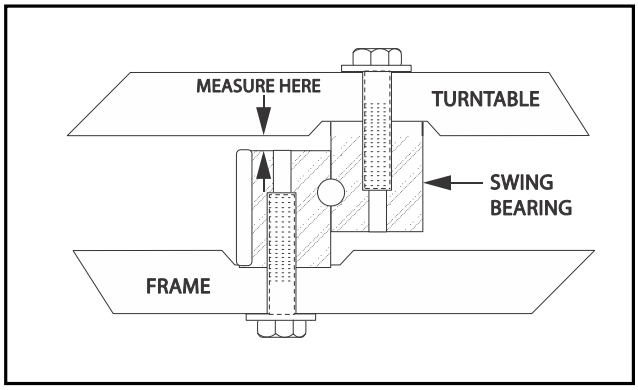


Figure 3-10. Swing Bearing Tolerance Measuring Point

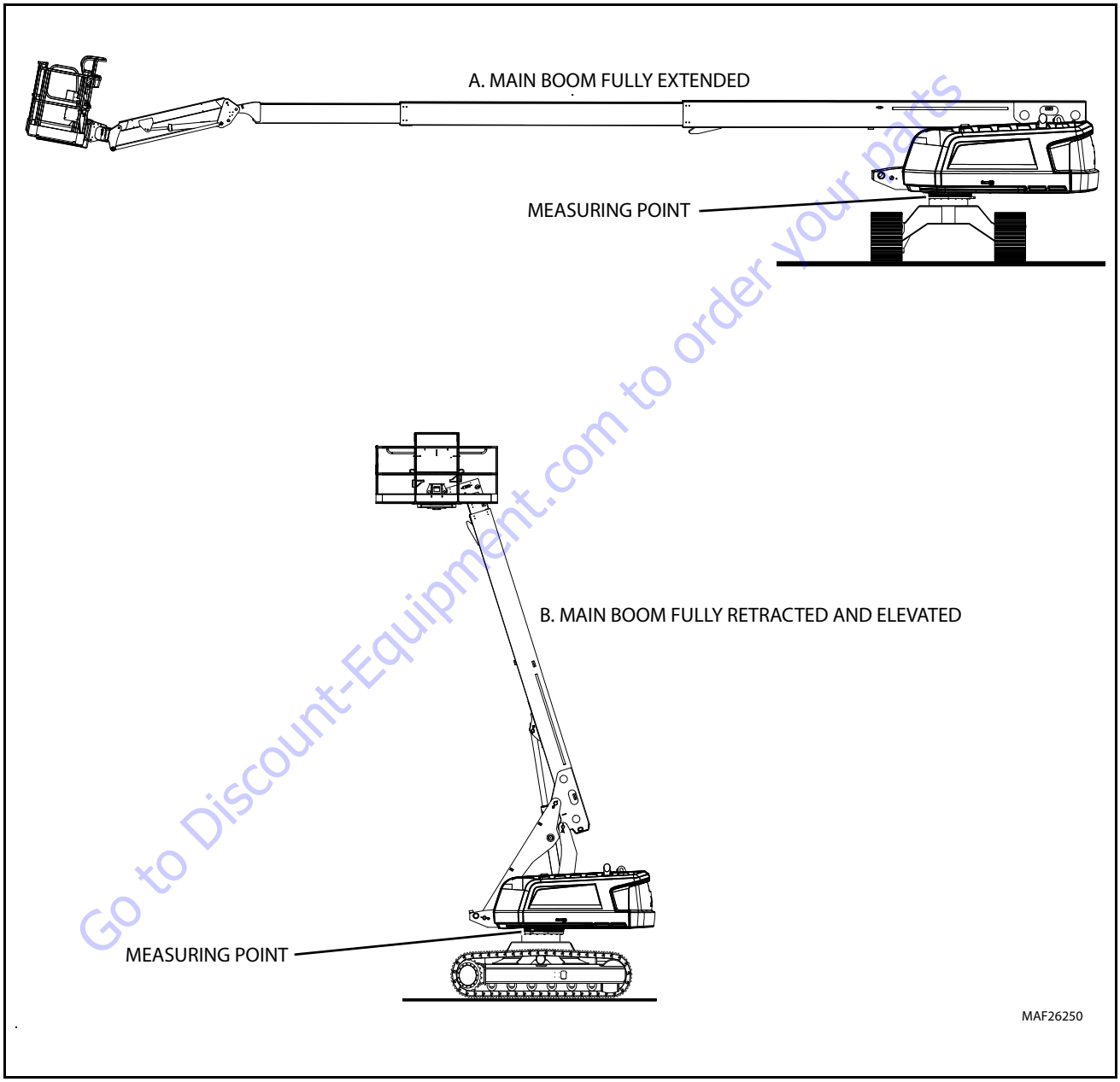


Figure 3-11. Swing Bearing Tolerance Measurement Location & Boom Placement

Swing Bearing Replacement

REMOVAL

1. From Ground Control station, place the boom in a level position.

⚠ WARNING

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

2. Adequately secure the boom to the rear of the turntable, as shown in Figure 3-13., Swing Bearing Removal.
3. Using the front lifting eyes in the turntable and a location on the boom equidistant from the center of gravity, as shown in Figure 3-13., Swing Bearing Removal, secure the turntable assembly with adequate lifting equipment.
4. From inside turntable, remove mounting hardware attaching rotary coupling retaining yoke brackets to turntable.

NOTICE

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

5. Tag and disconnect hydraulic lines from the fittings on the top of the rotary coupling. Use a suitable container to retain any residual hydraulic fluid. Immediately cap lines and ports.
6. Use a suitable tool to scribe a line on the inner race of the swing bearing and on the underside of the turntable. This will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the turntable to the bearing inner race. Discard the bolts.
7. 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.
8. Carefully place the turntable on a suitably supported trestle.
9. Use a suitable tool to scribe a line on the outer race of the swing bearing and the frame. This line will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the outer race of the bearing to the frame. Discard the bolts. Use suitable lifting equipment to remove the bearing from the frame, then move the bearing to a clean, suitably supported work area.

INSTALLATION

1. Using suitable lifting equipment, carefully lower the swing bearing into position on the frame. Ensure the scribed line of the outer race of the bearing aligns with the scribed line on the frame. If a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft center line of the frame.

⚠ CAUTION

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

2. Apply a light coating of High Strength Threadlocking Compound to the new bearing bolts, and loosely install the bolts and washers through the frame and outer race of bearing.

⚠ CAUTION

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

3. Refer to the Torque Sequence diagram as shown in Figure 3-12., Swing Bearing Torque Sequence, Swing Bearing Torque Sequence Clean any residue off the new bearing bolts, then apply a light coating of High Strength Threadlocking Compound and install the bolts and washers through the frame and outer race of the bearing. Tighten the bolts to an initial torque of 190 ft. lbs. (260 Nm) w/Threadlocking compound.
4. Remove the lifting equipment from the bearing.
5. Using suitable lifting equipment, carefully position the turntable assembly above the machine frame.
6. Carefully lower the turntable onto the swing bearing, ensuring that the scribed line of the inner race of the bearing aligns with scribed line on the turntable. If a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft center line of the turntable.
7. Clean any residue off the new bearing bolts, then apply a light coating of High Strength Threadlocking Compound and install the bolts and washers through the turntable and inner race of the bearing.
8. Following the Torque Sequence diagram shown in Figure 3-12., Swing Bearing Torque Sequence, tighten the bolts to a torque of 190 ft. lbs. (260 Nm) w/Threadlocking Compound.
9. Install the rotary coupling retaining yoke brackets, apply a light coating of High Strength Threadlocking Compound to the attaching bolts and secure the yoke to the turntable with the mounting hardware.

10. Connect the hydraulic lines to the rotary coupling as tagged prior to removal.
11. Remove the lifting equipment.
12. Unsecure the boom from rear of turntable.
13. At ground control station, use boom lift control to lower boom to stowed position.
14. Using all applicable safety precautions, activate the hydraulic system and check the swing system for proper and safe operation.

Swing Bearing Torque Values

1. Outer Race - 190 ft-lb (260 Nm) w/Threadlocking Compound.
2. Inner Race - 190 ft-lb (260 Nm) w/Threadlocking Compound.
3. See Figure 3-12., Swing Bearing Torque Sequence.

⚠ WARNING

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

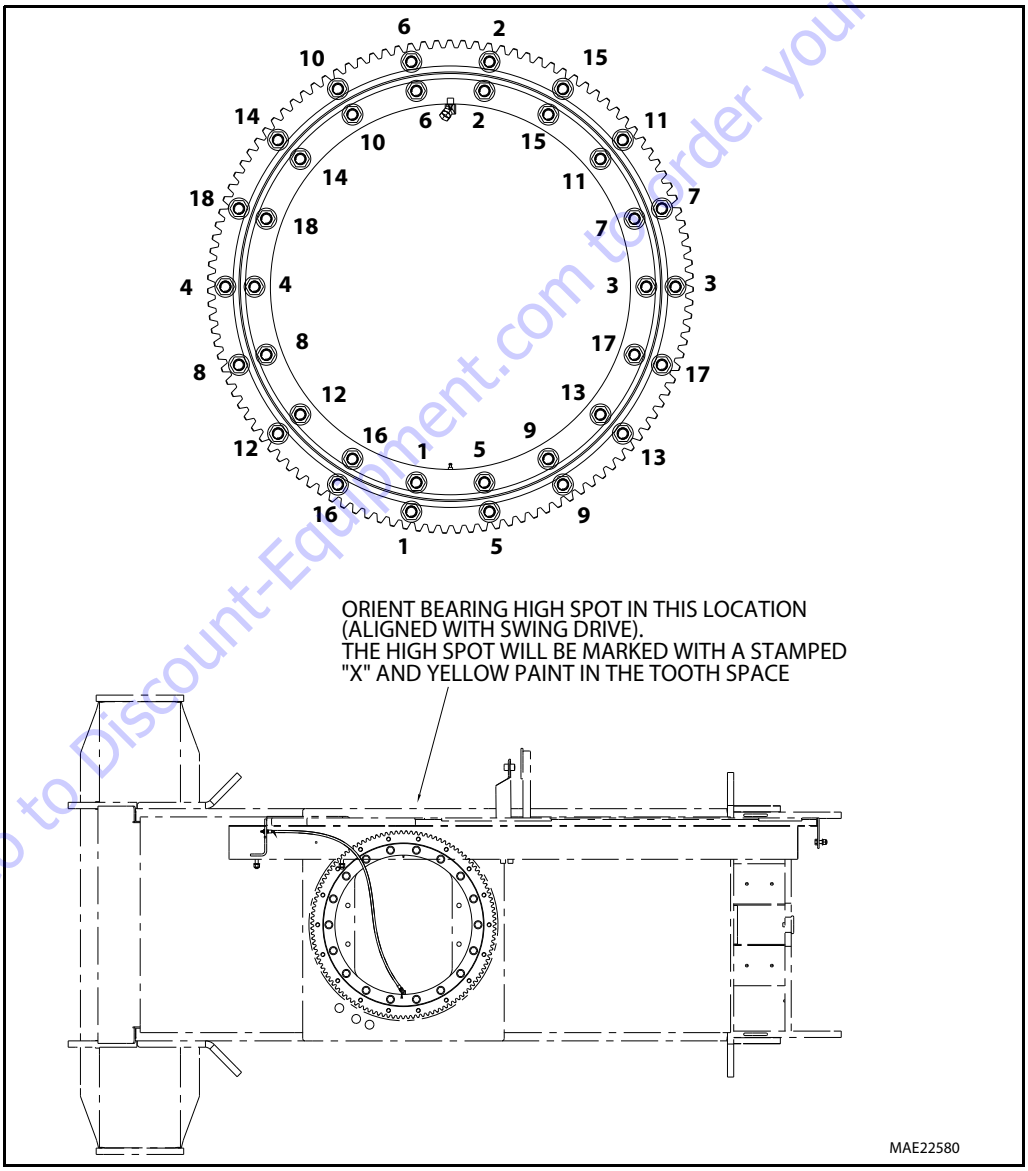


Figure 3-12. Swing Bearing Torque Sequence

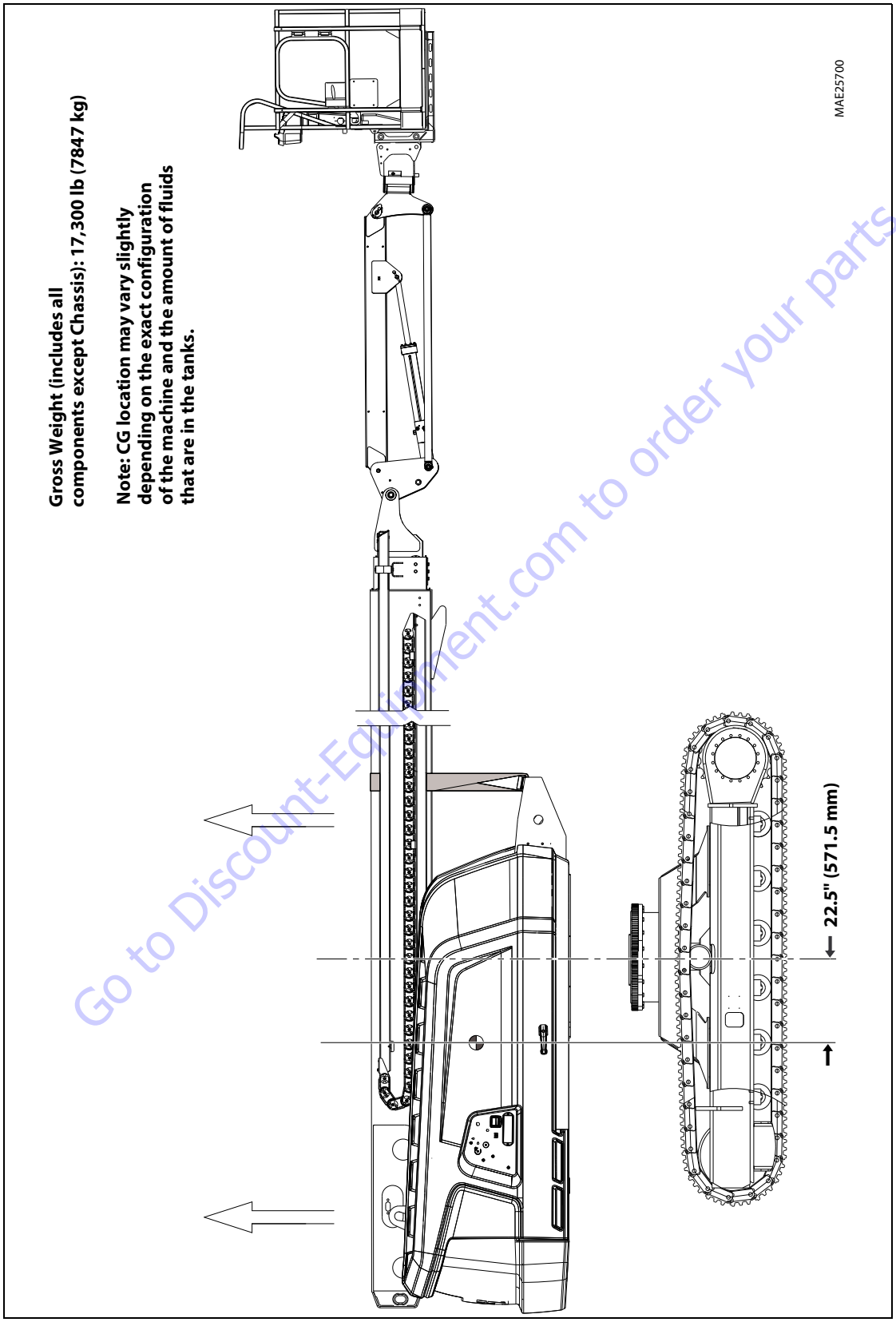
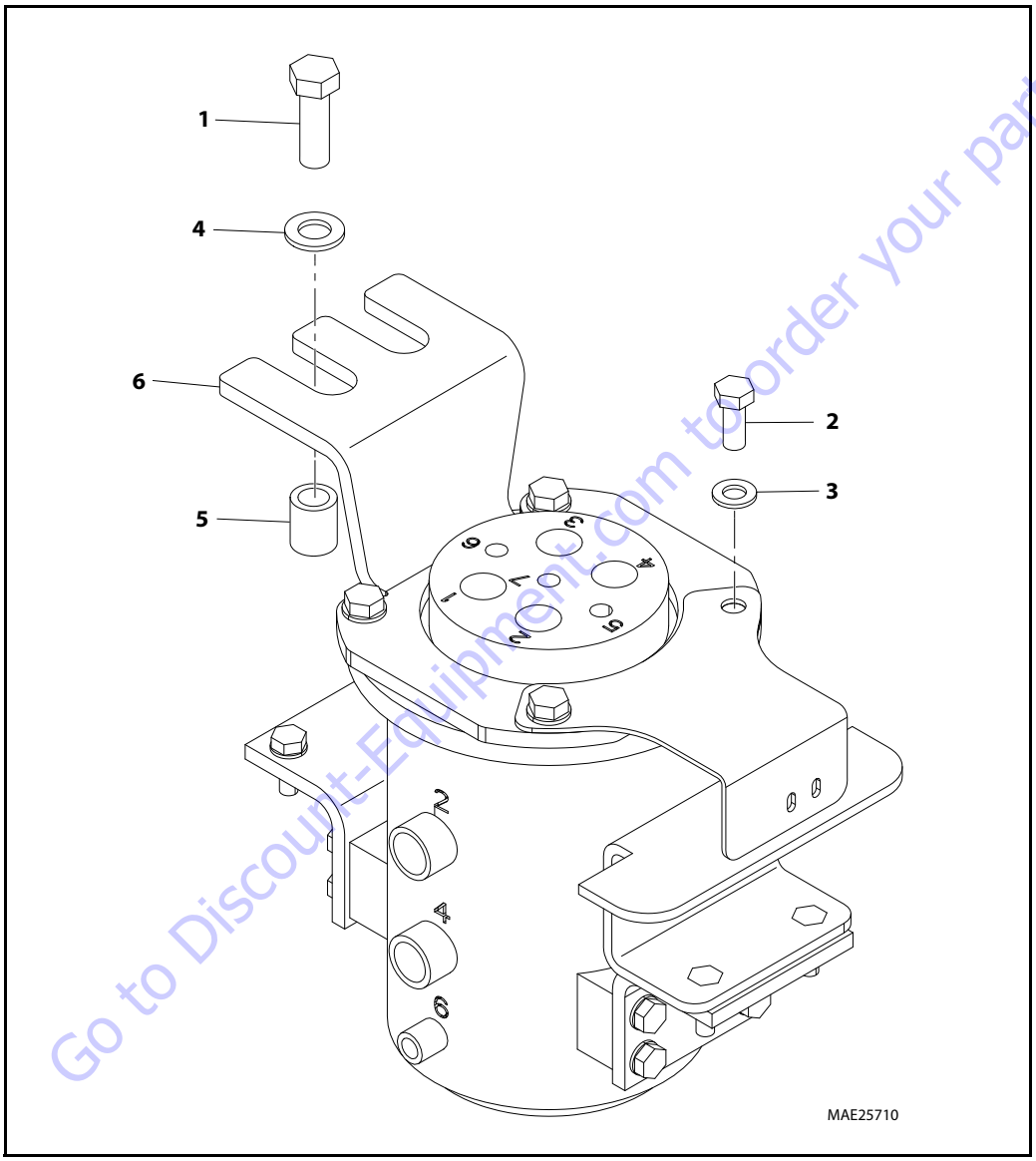


Figure 3-13. Swing Bearing Removal

3.7 ROTARY COUPLING

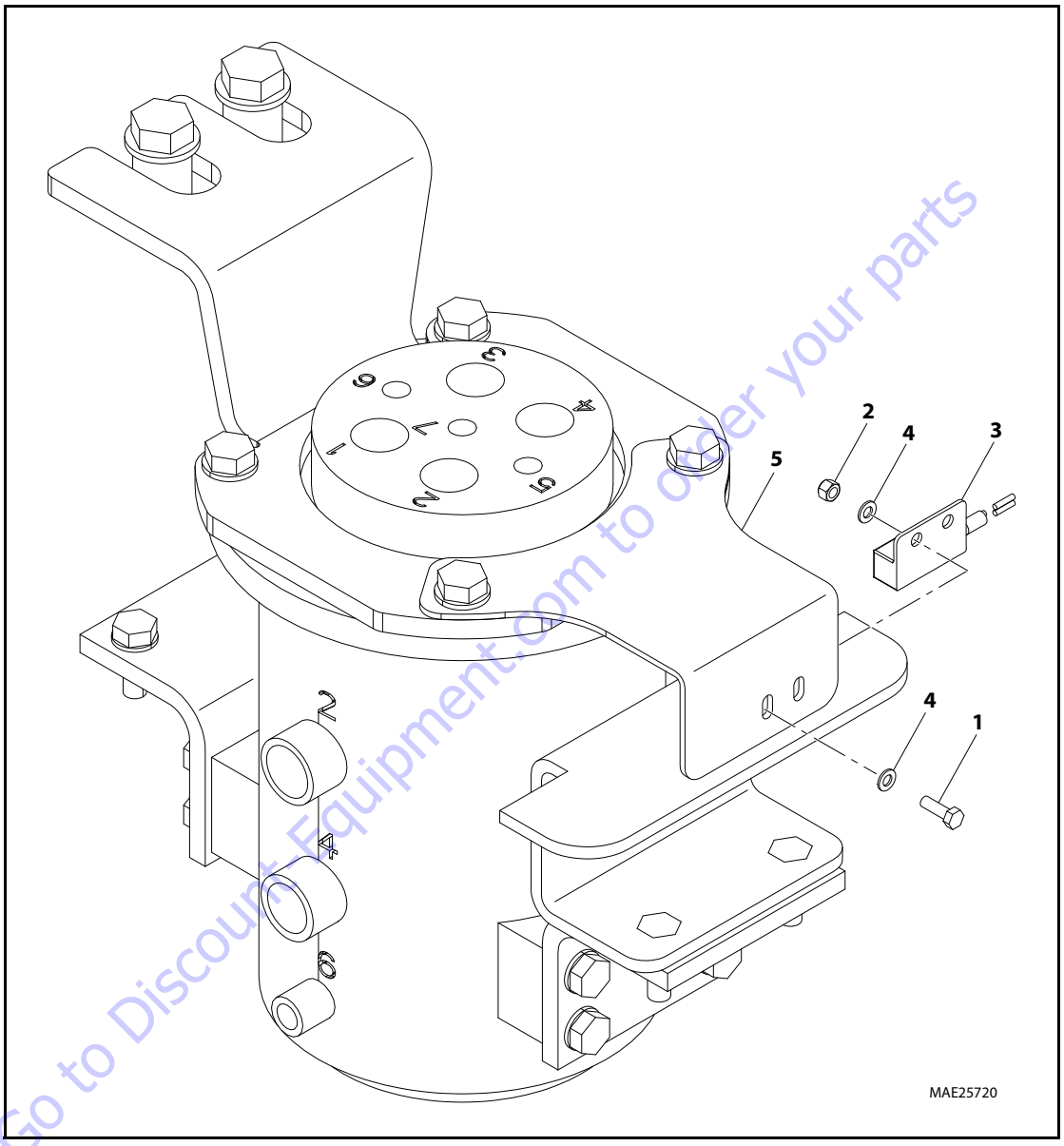
Assembly/Disassembly

For detail assembly/disassembly instructions and seal replacement of rotary coupling, contact JLG dealer.



1. Bolt
2. Bolt
3. Washer
4. Washer
5. Spacer
6. Mount

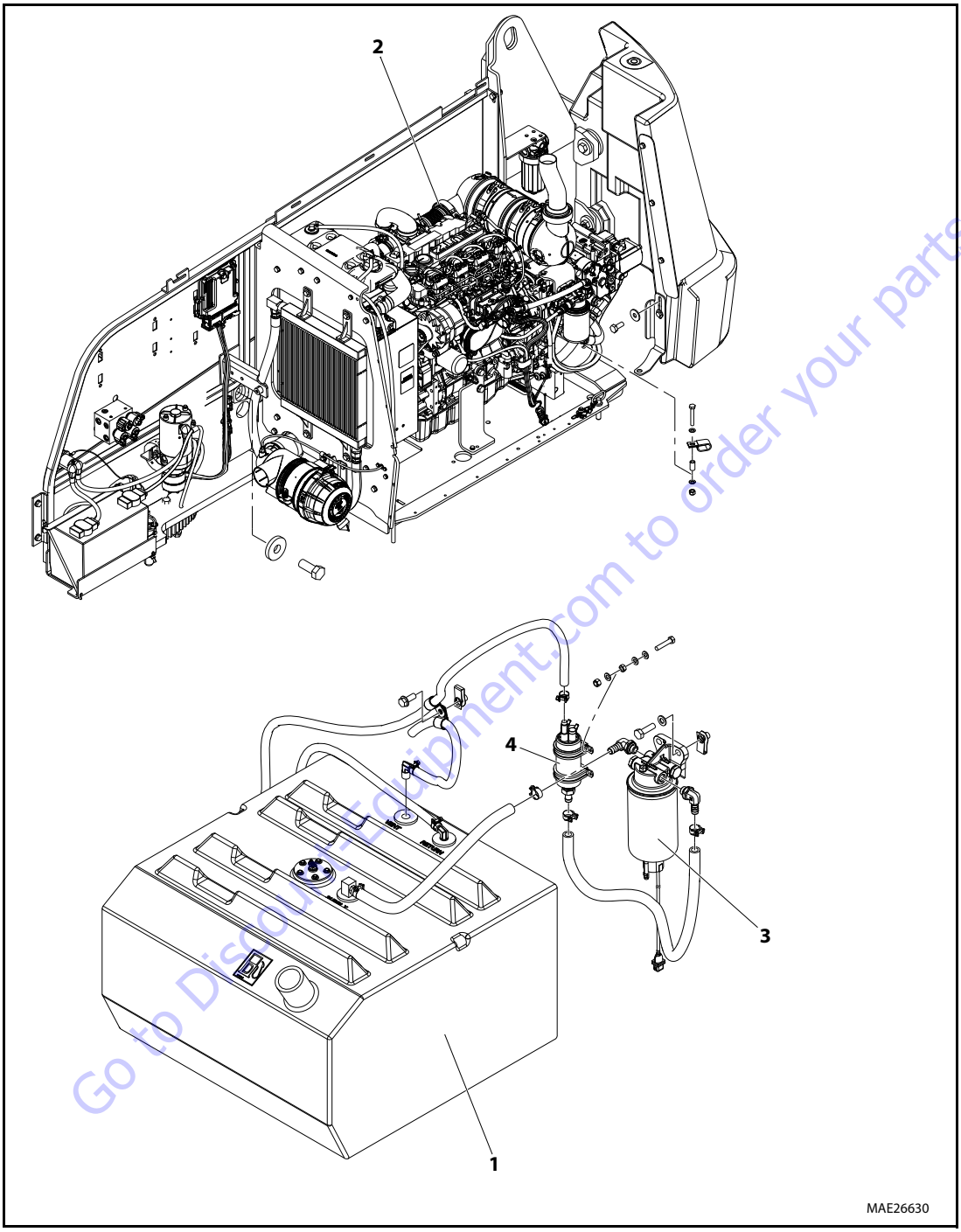
Figure 3-14. Rotary Coupling Installation



1. Bolt
2. Nut
3. Proximity Switch
4. Washer
5. Bracket

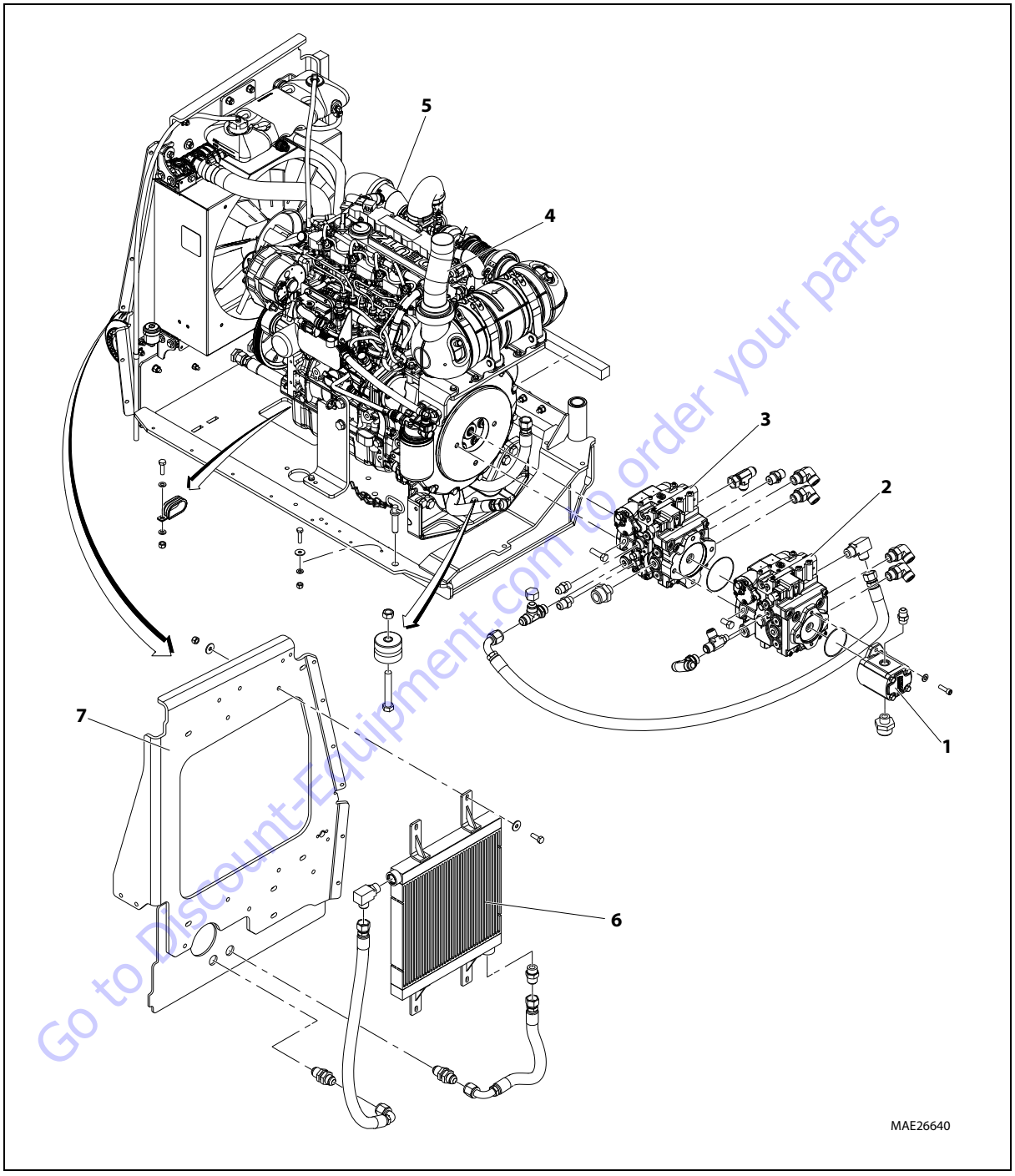
Figure 3-15. Rotary Coupling - Drive Orientation

3.8 DEUTZ TD2.9 L4 ENGINE



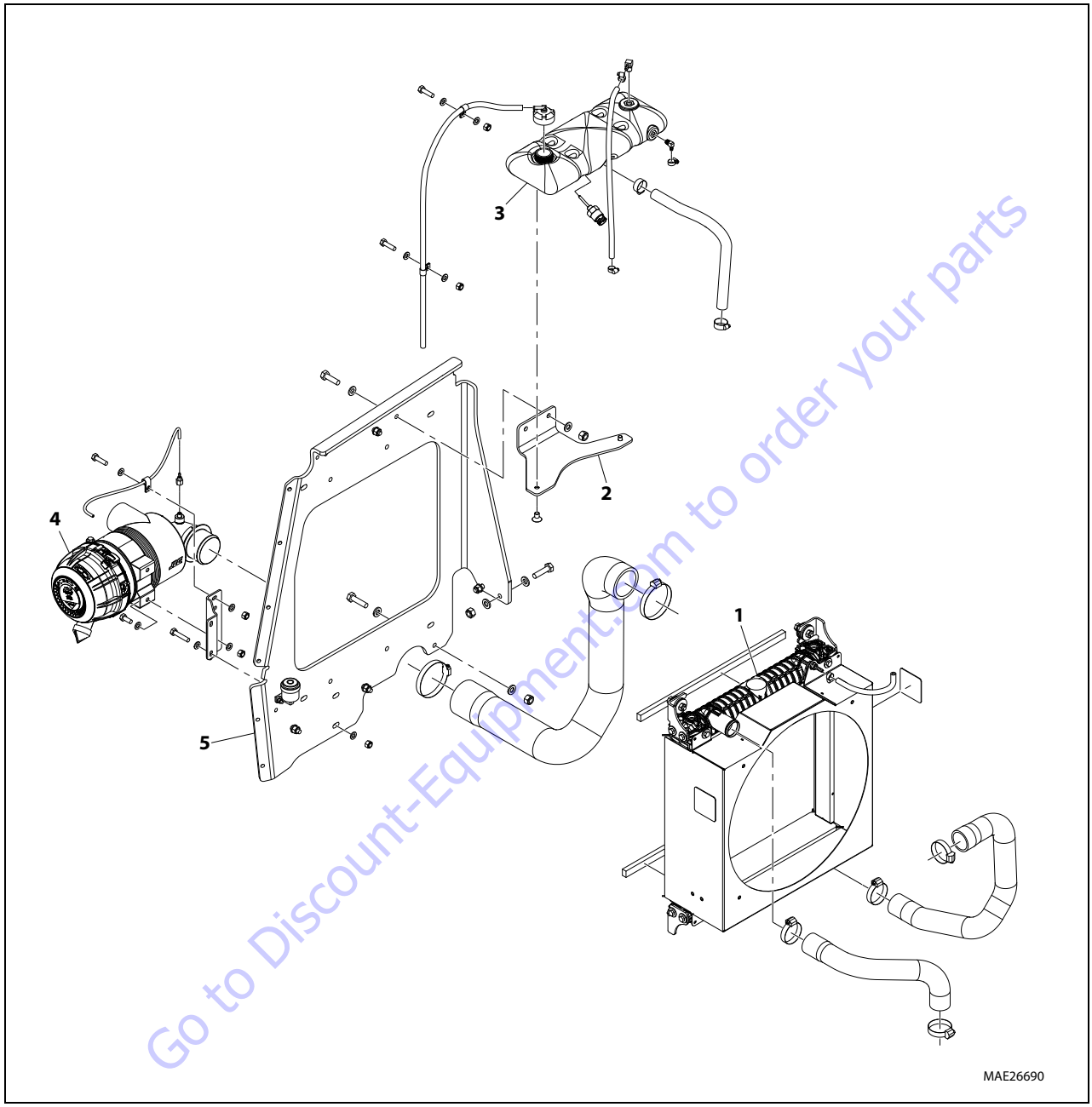
1. Fuel Tank
2. Deutz TD2.9L4 Engine and Pump Assembly
3. Fuel Filter
4. Fuel Supply Pump

Figure 3-16. Deutz TD2.9 L4 Engine Installation



1. Gear Pump Assembly
2. Piston Pump Assembly - Rear
3. Piston Pump Assembly - Front
4. Exhaust Pipe
5. Deutz TD2.9L4 Engine Assembly
6. Hydraulic Oil Cooler
7. Support

Figure 3-17. Deutz TD2.9 L4 Engine and Pumps Sub-Assembly



1. Radiator
2. Bracket
3. Surge Tank
4. Air Filter
5. Support
6. Pump Coupling
7. Bracket
8. Deutz TD2.9L4 Engine
9. Adapter
10. Fan
11. Pulley
12. Adapter
13. Tray
14. Bracket
15. Engine Mount
16. Engine Mount

Figure 3-18. Deutz TD2.9 L4 Engine Assembly - Sheet 1 of 2

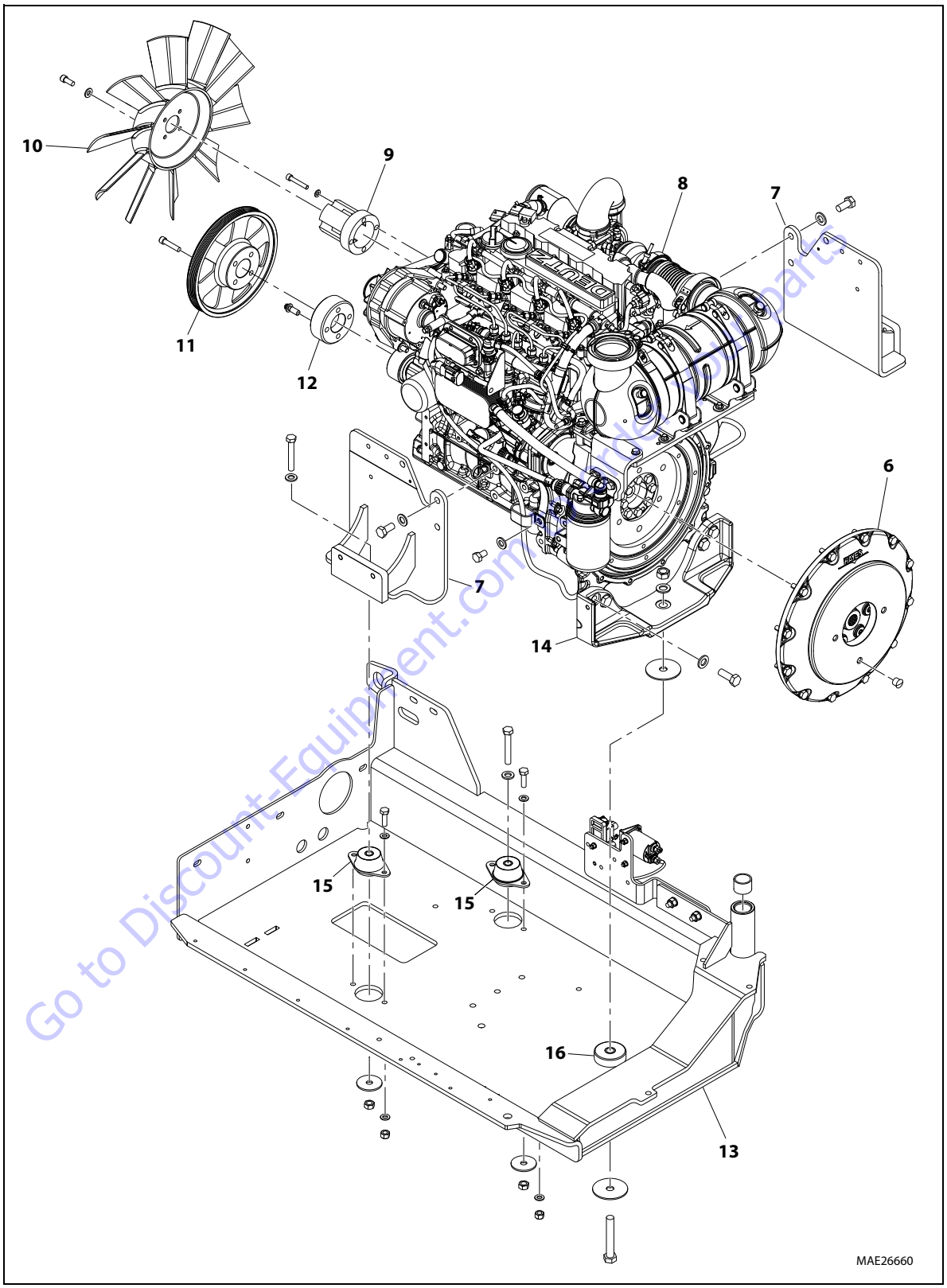


Figure 3-19. Deutz TD2.9 L4 Engine Assembly - Sheet 2 of 2

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

Check Oil Level

1. Make sure machine and engine are level and switch engine OFF before checking oil level.
2. Remove oil dipstick and wipe with clean cloth.
3. Insert dipstick to the stop and remove again.
4. Check oil level. Top oil level as shown in figure below with an approved grade and type of oil outlined in engine manufacturer's operator's manual.

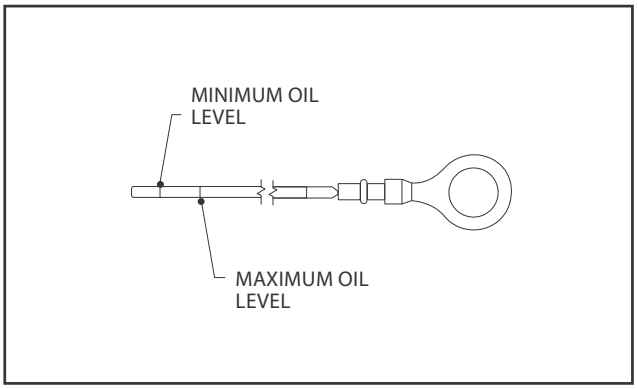


Figure 3-20. Deutz 2.9 T4F Dipstick Markings

5. Replace dipstick until fully seated.

Change Engine Oil

1. Allow engine to warm up. Engine oil should reach approximately 176° F (80° C).
2. Make sure machine and engine are level and switch off engine.
3. Place oil tray under engine.

⚠ CAUTION

HOT ENGINE OIL CAN CAUSE BURNS. AVOID CONTACT WITH HOT OIL WHEN DRAINING.

NOTICE

COLLECT USED OIL IN A CONTAINER SUITABLE FOR DISPOSAL OR RECYCLING. DISPOSE OF USED ENGINE OIL IN ACCORDANCE WITH ENVIRONMENTAL REGULATIONS.

4. Open oil drain valve and drain oil.
5. Close oil drain valve.
6. Pour in new engine oil. Refer to Section 1 for capacity and Figure 3-21., Engine Oil Viscosity.

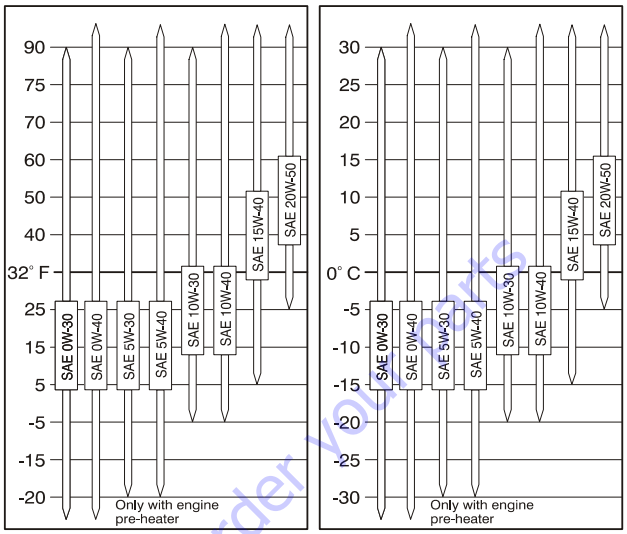
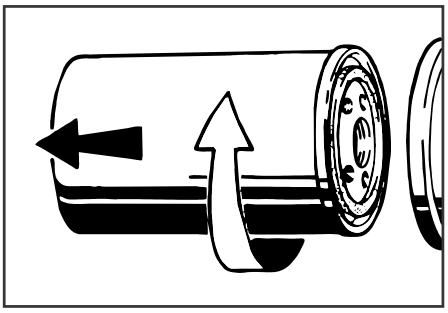


Figure 3-21. Engine Oil Viscosity

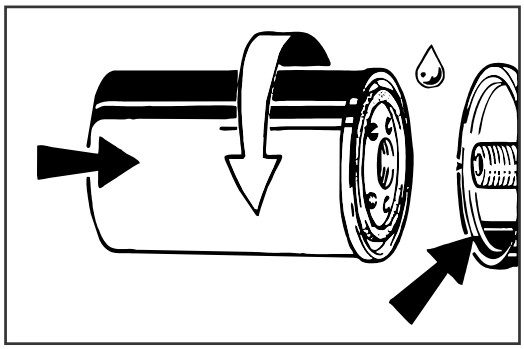
Change Oil Filter

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



3. Catch any escaping oil.
4. Clean any dirt from filter carrier sealing surface.
5. Lightly coat new oil filter rubber gasket with clean oil.
6. Screw in new filter by hand until gasket is flush.

7. Hand-tighten filter another half-turn.



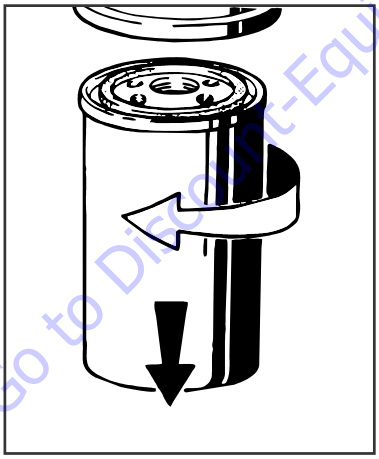
8. Check oil level.
9. Check oil pressure.
10. Check oil filter cartridge for leaks.

Change Fuel Filters

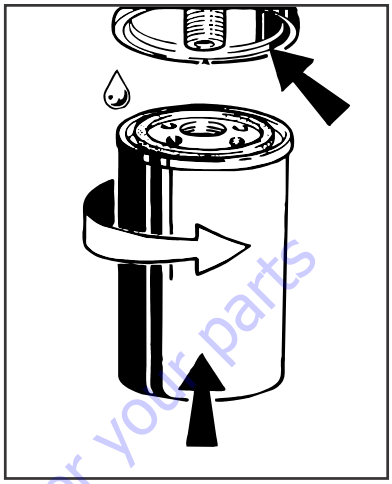
⚠ WARNING

FUEL IS FLAMMABLE AND CAN CAUSE DEATH OR SERIOUS INJURY. MAKE SURE NO OPEN FLAMES OR SPARKS ARE IN THE AREA WHEN WORKING ON FUEL SYSTEM. DO NOT SMOKE WHEN WORKING ON FUEL SYSTEM.

1. Wipe area around filter to clean any dirt from area.
2. Disconnect water sensor connector (Pre-filter Only).
3. Remove fuel filter cartridge. Catch any escaping fuel.



4. Clean dirt from filter carrier sealing surface.
5. Apply light film of oil or diesel fuel to rubber gasket of new filter cartridge.
6. Screw in new filter by hand until gasket is flush. Hand-tighten filter another half-turn.



7. Connect water sensor connector (Pre-filter Only).
8. Open fuel shut-off valve.
9. Check for leaks.

Spark Arrester Cleaning Instructions

1. Remove cleanout plug in bottom of spark arrester (muffler).
2. Without causing deformation (or any type of damage to spark arrester) repeatedly tap on arrester near cleanout plug. This may be enough to begin spark trap drainage.
3. An industrial vacuum cleaner can do a complete job at this point.
   a. Or, IN A SAFE AREA, start engine. Alternate between low idle and high idle for two to three minutes.
   b. Or, operate engine as required by application for two to three minutes.
4. Install cleanout plug.

Glow Plugs

If glow plug option is enabled in the JLG Control System, glow plug and indicator lamp will be energized when Power/Emergency Stop switch is pulled on if ambient air temperature is less than 50° F (10° C) and engine coolant temperature is less than 140° F (60° C).

This determination occurs one second after the Power/Emergency Stop switch has been pulled on. Lamp and glow plugs remain energized for period of time specified by setting in the JLG Control System. Engine start is disabled during this period.

On Deutz engines, glow plugs continue (post glow) after engine has started three times the machine digit setting.

Replacing the Fuel Pre-Filter

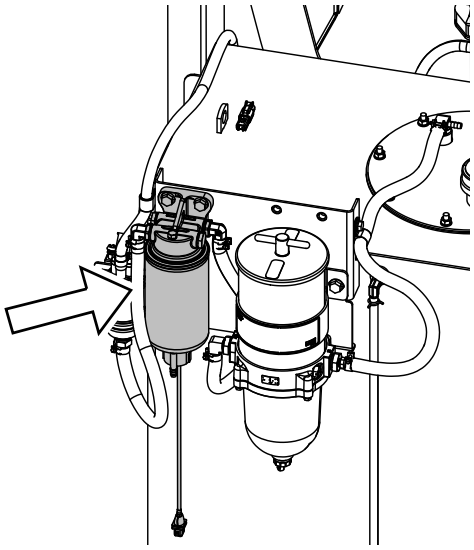
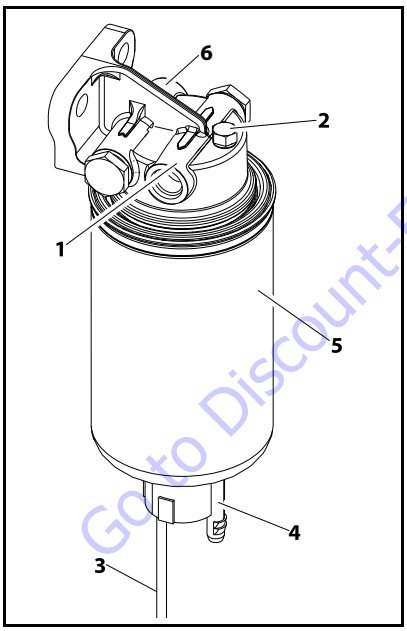


Figure 3-22. Location of Fuel Pre-Filter

NOTE: *ReferFigure 3-23.., Components of Fuel Pre-Filter.*



1. Fuel Supply Flow to the Pump
2. Venting Screw
3. Electrical Connection for Water Level Sensor
4. Drain Plug
5. Filter Element

Figure 3-23. Components of Fuel Pre-Filter

⚠ WARNING

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

1. Switch off the engine.
2. Fuel supply from the fuel tank may need to be blocked to prevent fuel flow from the tank.
3. Place suitable collecting container under drain plug.
4. Disconnect electrical connections from water sensor.
5. Loosen drain plug and drain liquid.
6. Remove filter element.
7. Catch any escaping fuel.
8. Clean any dirt of the sealing surfaces of the new filter element and opposite side of filter head.
9. Wet the sealing surfaces of new filter element slightly with fuel.
10. Install new filter onto the filter head in clockwise direction. Torque to 12.5-13.3 ft. lbs. (17-18 Nm).
11. Install the drain plug and tighten to torque 1-1.4 ft. lbs. (1.3-1.9 Nm).
12. Connect electrical connection to water sensor.
13. Check for leaks after starting engine.

Water in Fuel Sensing System (Optional)

The Water in Fuel Sensing System detects when there is an excessive amount of water in the fuel and sets a DTC code in the JLG Control System to alert the operator and/or service technician.

When Water in Fuel condition occurs, the machine will respond in the following way:

- The engine will shut down automatically.
- The JLG Control System will set DTC 4375 - Water in Fuel.
- An alarm will sound from the active control station (ground or platform).
- If in platform mode, the Low Fuel Indicator will flash.
- Engine Restart will be permitted after the machine senses the Water in Fuel condition, but will only run for 2 minutes and the engine will shut down again. This restart process will continue until the Water in Fuel condition is corrected.

Draining Water

Frequency of water draining is determined by the contamination level of the fuel. Inspect or drain the collection bowl of water daily or as necessary. The collection bowl must be drained before contaminants reach the top of the turbine or

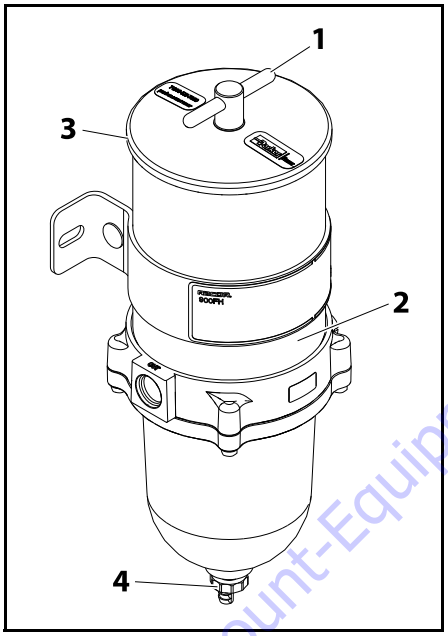
when the Water Detection Module (optional) indicates it's time to drain water.

Pressure Applications / Installations:

1. Open the drain plug on the bottom of the bowl to evacuate water and contaminants with a suitable collection container in place.
2. Close the drain after all the water and contaminants have been evacuated.

NOTE: *Do not leave the drain open too long as it may completely drain the entire filter assembly of water and fuel.*

Auxiliary Fuel Filter



1. T-handle
2. Filter Element
3. Lid
4. Drain Plug

Figure 3-24. Components of Auxiliary Fuel Filter

⚠ WARNING

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

ELEMENT REPLACEMENT

Frequency of element replacement is determined by the contamination level of the fuel. Replace the elements every 500 hours, if power loss is noticed or annually, which ever comes first.

1. Switch off the engine.
2. Fuel supply from the fuel tank may need to be blocked to prevent fuel flow from the tank.
3. Wipe the area around the filter to clean any dirt from the area.
4. Remove the T-handle and lid.
5. Remove the element by holding the bail handles and slowly pulling upward with a twisting motion. Dispose of properly.
6. Replace old lid gasket and T-handle O-ring with new seals (supplied with new element). Lubricate both seals with motor oil or diesel fuel before installation.
7. Refer to Priming of auxiliary fuel filter or fill the unit with clean fuel, then replace the lid and T-handle then tighten snugly by hand only.

NOTE: *Do not use any tool for removal and installation of T-handle.*

PRIMING OF AUXILIARY FUEL FILTER

1. Remove the T-handle and lid from the top of the filter assembly.
2. Fill the filter assembly with clean fuel.
3. Lubricate lid gasket and T-handle O-ring with clean fuel or motor oil.
4. Replace the lid and T-handle and tighten snugly by hand only.

NOTE: *Do not use any tool for removal and installation of T-handle.*

5. Start engine and check for fuel system leaks.
6. Correct as necessary with engine off and pressure relieved from filter assembly.

DRAINING WATER

Frequency of water draining is determined by the contamination level of the fuel. Inspect or drain the collection bowl of water daily or as necessary. The collection bowl must be drained before contaminants reach the top of the turbine or when the Water Detection Module (optional) indicates it's time to drain water.

Pressure Applications / Installations:

1. Open the self-venting drain plug on the bottom of the bowl to evacuate water and contaminants with a sui able collection container in place. Head pressure will push any water and contaminants out of the drain while keeping the filter primed.
2. Close the drain after all the water and contaminants have been evacuated.
3. If necessary, follow priming of auxiliary fuel filter.

NOTE: *Do not leave the drain open too long as it may completely drain the entire filter assembly of water and fuel.*

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
16	0	No detail information
16	0	BusOff error CAN No detail information
29	3	Hand throttle idle validation switch; short circuit to battery
29	4	Hand throttle; short circuit to ground
29	2	Plausibility error between sensor and idle switch, Acceleration Pedal Detection. In case of Hand Throttle with Low Idle Switch, it is the plausibility check between hand throttle and idle switch.
51	5	Intake Throttle Flap, H-Bridge, wiring harness broken at connected actuator
51	6	Intake Throttle Flap, H-Bridge, current above maximum threshold
51	3	Intake Throttle Flap, H-Bridge, short circuit to battery (A02)
51	3	Intake Throttle Flap, H-Bridge, short circuit to battery (A67)
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground (A02)
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground (A67)
51	7	Intake Throttle Flap, H-Bridge, position of actuator not plausible (deviation from set point more than 7%)
51	3	Intake Throttle Flap, H-Bridge, short circuit to battery oder broken wiring harness
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground
91	3	Sensor error accelerator pedal. signal range check high.
91	4	Sensor error accelerator pedal. Signal is below the range.
91	11	Plausibility error between APP1 and APP2 or APP1 and idle switch.
94	3	Sensor error low fuel pressure; signal range check high
94	4	Sensor error low fuel pressure; signal range check low
94	1	Low fuel pressure; warning threshold exceeded
94	1	Low fuel pressure; shut off threshold exceeded
97	3	Sensor error water in fuel; signal range check high
97	4	Sensor error water in fuel; signal range check low.
97	12	Water in fuel level prefilter; maximum value exceeded
98	2	Plausibility Check; No detail information
100	3	Sensor error oil pressure; signal range check high
100	4	Sensor error oil pressure sensor; signal range check low
100	0	High oil pressure; warning threshold exceeded.
100	0	High oil pressure; shut off threshold exceeded
100	1	Low oil pressure; warning threshold exceeded
100	1	Low oil pressure; shut off threshold exceeded
102	2	Charged air pressure above warning threshold.
102	2	Charged air pressure above shut off threshold.
102	2	Pressure downstream charge air cooler, plausibility error
102	1	Pressure downstream charge air cooler, pressure below lower physical threshold
102	3	Pressure downstream charge air cooler, short circuit to battery or open load
102	4	Pressure downstream charge air cooler, short circuit to ground
105	1	Charged Air cooler down stream temperature. Temperature below lower physical threshold.
105	3	Electrical error charged air temperature. Signal range check high. (SRC)

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
105	4	Electrical error charged air temperature. Signal range check low.
105	0	Charged air cooler temperature. System reaction initiated. High charged air cooler temperature. Warning threshold exceeded.
105	0	High charged air cooler temperature. Shut off threshold exceeded.
105	11	Diagnostic fault check for charged air cooler downstream temperature sensor No detail information
107	3	Sensor error air filter differential pressure; short circuit to battery
107	0	Sensor error air filter differential pressure; short circuit to ground
107	0	Air filter differential pressure; air filter clogged.
108	11	DFC for CAN message
108	3	Sensor error ambient air pressure; signal range check high
108	4	Sensor error ambient air pressure; signal range check low
110	2	Defect fault check for Absolute plausibility test. No detail information
110	0	Physical Range Check high for Coolant temperature
110	1	Physical Range Check low for Coolant temperature.
110	3	Sensor error coolant temperature; signal range check high
110	4	Sensor error coolant temperature; signal range check low
110	0	High coolant temperature; warning threshold exceeded
110	0	Coolant temperature; system reaction initiated
111	1	Coolant level too low
132	1	The air mass flow AFS_dm is greater than or equal to AFS_PhysRng.Min_C Physical Range Check low for air mass flow sensor. No detail information
157	0	Rail pressure raw value is intermittent. No detail information
157	1	Rail pressure raw value is above maximum offset. No detail information
157	3	Sensor error rail pressure. Sensor voltage above upper limit.
157	4	Sensor error rail pressure. Sensor voltage below lower limit.
164	2	Rail pressure safety function is not executed correctly.
168	3	Sensor error battery voltage; signal range check high.
168	4	Sensor error battery voltage; signal range check low
168	2	High battery voltage; warning threshold exceeded
168	2	High battery voltage; shot off threshold exceeded
168	0	Physical range check high for battery voltage
168	1	Physical range check low for battery voltage
171	0	Environment temperature sensor, temperature above upper physical threshold
171	1	Environment Temperature Physical Range Check low
171	3	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check high
171	4	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check low
172	2	Air inlet filter temperature, plausibility error
172	3	Air flow temperature sensor; short circuit to battery or open load.
172	4	Air flow temperature sensor; short circuit to ground
172	1	Air inlet filter sensor out of physical range check
172	0	air temperature within air filter box above maximum physical value

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
174	11	DFC for fuel temperature plausibility check function. No detail information
175	3	Sensor error oil temperature; signal range check high
175	4	Sensor error oil temperature; signal range check low
175	0	High oil temperature; warning threshold exceeded
175	0	High oil temperature; shut off threshold exceeded
175	2	Customer oil temperature: signal unplausible
190	0	Engine speed above warning threshold Over speed detection in component engine protection
190	0	Engine speed above warning threshold (FOC-Level 1)
190	11	Engine speed above warning threshold (FOC-Level 2)
190	14	Engine speed above warning threshold (Overrun Mode)
190	8	Sensor camshaft speed; disturbed signal
190	12	Sensor camshaft detection; out of range, signal disrupted; no signal
190	2	Offset angle between crank- and camshaft sensor is too large.
190	8	Sensor crankshaft detection; out of range, signal disrupted; disturbed signal
190	12	Speed detection; out of range, signal disrupted Sensor crankshaft speed; no signal
190	14	Camshaft- and Crankshaft speed sensor signal not available on CAN
411	4	Physical range check low for EGR differential pressure
411	0	Delta pressure across venturi in EGR line above physical high limit
411	0	Plausibility Check fault for deviation of desired and actual EGR-mass flow, where the latter is calculated out of EGR Delta Pressure Sensor
411	3	Sensor error differential pressure Venturiunit (EGR), signal range check low.
411	4	Sensor error differential pressure Venturiunit (EGR), signal range check high.
412	3	Electrical error EGR cooler downstream temperature. Signal range check high.
412	4	electrical error EGR cooler downstream temperature. Signal range check low.
520	9	Timeout Error of CAN-Receive-Frame TSC1TR; control signal
598	2	Plausibility check for Clutch. No detail information
624	5	SVS lamp; open load
624	12	SVS lamp: power stage over temperature
624	3	SVS lamp; short circuit to battery
624	4	SVS lamp; short circuit to ground
630	12	Access error EEPROM memory (delete)
630	12	Access error EEPROM memory (read)
630	12	Access error EEPROM memory (write)
639	14	CAN-Bus 0 "BusOff-Status"
651	5	Injector 1 (in firing order); interruption of electric connection
651	3	Injector 1 (in firing order); short circuit
652	5	Injector 2 (in firing order); interruption of electric connection
652	3	Injector 2 (in firing order); short circuit
653	5	Injector 3 (in firing order); interruption of electric connection
653	3	Injector 3 (in firing order); short circuit
654	5	Injector 4 (in firing order); interruption of electric connection
654	3	Injector 4 (in firing order); short circuit

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
655	5	Injector 5 (in firing order); interruption of electric connection
655	3	Injector 5 (in firing order); short circuit
655	4	High side to low side short circuit in the injector 5 (in firing order)
656	5	Injector 6 (in firing order); interruption of electric connection
656	3	Injector 6 (in firing order); short circuit
656	4	High side to low side short circuit in the injector 6 (in firing order)
676	11	Cold start device relay error
676	11	Cold start aid relay open load
677	3	Starter relay high side. Short circuit to battery.
677	4	Starter relay high side short circuit to ground.
677	5	Starter relay low side no load error.
677	12	Starter relay power stage over temperature.
677	3	Starter relay low side short circuit to battery.
677	4	Starter relay low side short circuit to ground.
729	5	Cold start aid relay open load
729	12	Cold start aid relay; over temperature error
729	3	Intake Air Heater Device; Short circuit to battery
729	4	Air intake heater; Short circuit to ground error for power stage on CJ945.
898	9	Timeout Error of CAN-Receive-Frame TSC1TE; Set point
975	5	PWM-Signal Fan, Open load or short-circuit ground
975	3	PWM-Signal Fan, short-circuit to plus
975	4	PWM-Signal Fan, open load or short circuit to ground
1079	13	Failure of sensor supply voltage 1.
1080	13	Failure of sensor supply voltage 2.
1109	2	Engine shut off demand ignored
1136	0	Physical range check high for ECU temperature
1176	0	Pressure sensor upstream turbine, Physical Range Check high.
1176	1	Pressure sensor upstream turbine, Physical Range Check low.
1176	3	Pressure sensor upstream turbine, signal range check (SRC) high.
1176	4	Pressure sensor upstream turbine, signal range check (SRC) low.
1180	3	Sensor error exhaust gas temperature upstream turbine; signal range check high
1180	4	Sensor error exhaust gas temperature upstream turbine; signal range check low
1180	0	Physical range check high for exhaust gas temperature upstream turbine
1180	1	Physical range check low for exhaust gas temperature upstream turbine
1188	11	Wastegate actuator; internal error
1188	11	Wastegate actuator; EOL calibration not performed correctly
1188	13	Wastegate actuator calibration deviation too large, re-calibration required
1188	2	Wastegate; status message from ECU missing
1188	7	Wastegate actuator; blocked
1188	11	Wastegate actuator; over temperature (> 135°C)
1188	11	Wastegate actuator; operating voltage error
1188	7	Turbocharger wastegate, mechanical blocking detected.
1188	2	Turbocharger wastegate, CAN Error

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
1188	13	Turbocharger wastegate, EOL calibration error.
1188	12	Turbocharger wastegate, internal electrical error
1188	13	Turbocharger wastegate, learning process aborted.
1188	6	Turbocharger wastegate, current above maximum threshold.
1188	3	Turbocharger wastegate, supply voltage above maximum threshold.
1188	4	Turbocharger wastegate, supply voltage below minimum threshold.
1188	13	Turbocharger wastegate, learning process out of range.
1188	7	Turbocharger wastegate, broken spring detected.
1188	0	Turbocharger wastegate, temperature critical high.
1231	14	CAN-Bus 1 "BusOff-Status"
1235	14	CAN-Bus 2 = CAN_C reports Bus-error (for engines <8L and CV52 it is the engine-CAN@250kbaud) CAN Bus error passive; warning CAN C - engine CAN
1235	14	CAN-Bus 2 = engine bus "BusOff-Status"
1237	2	Override switch; plausibility error.
1322	12	N/A
1323	12	Too many recognized misfires in cylinder 1 (in firing order)
1323	12	N/A
1323	12	N/A
1323	12	N/A
1323	12	N/A
1323	12	N/A
1346	0	Misfire detection monitoring No detail information
1638	2	Hydraulic oil temperature check for Shut off condition
1639	12	Fan speed sensor; electrical error or signal disturbed or very low fan speed
1639	0	Sensor error fan speed; signal range check high or engine speed respective fan speed too high
1639	1	Sensor error fan speed; signal range check low or fan speed too low
1761	14	DEF tank level; warning threshold exceeded
1761	0	DEF tank, DEF level above upper physical threshold
1761	1	DEF tank, DEF level below lower physical threshold
1761	14	Urea Tank Signal to HMI for indicating the Urea Tank-Level (Urea tank volume ratio low threshold 1)
1761	14	DEF tank, DEF level below first warning threshold
1761	14	DEF tank, DEF level below second warning threshold
1761	2	DEF tank level, plausibility error
1761	14	DEF tank, DEF level below third warning threshold
2634	12	Early opening defect of main relay No detail information
2634	12	DFC for stuck main relay error No detail information
2659	2	Exhaust Gas Recirculation AGS Sensor; signal not plausible
2659	0	Exhaust Gas Recirculation AGS Sensor; Sensed exhaust mass value above maximum physical value
2659	1	Exhaust Gas Recirculation AGS Sensor; Sensed exhaust mass value below minimum physical value
2659	12	Exhaust Gas Recirculation AGS Sensor; plausibility error, AGS sensor has not passed the burn off process
2659	2	Exhaust Gas Recirculation AGS Sensor; Temperature of EGR mass not plausible
2791	12	Actuator EGR Valve; power stage over temperature
2791	7	EGR actuator, actuator blocked

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
2791	2	EGR actuator, CAN error
2791	13	EGR actuator, EOL calibration error
2791	12	EGR Actuator, internal electrical fault
2791	13	EGR actuator, learning process aborted
2791	6	EGR actuator current is above maximum threshold
2791	3	EGR actuator supply voltage is above the maximum threshold
2791	4	EGR actuator supply voltage is below minimum threshold.
2791	13	EGR actuator, learning process out of range
2791	7	EGR actuator, broken spring detected.
2791	16	EGR actuator, temperature high.
2791	0	EGR actuator, temperature critical high
2797	4	Timeout of Short-Circuit Ground Diagnosis Cyl. Bank 0;_IVDiaShCirGndToutBnk_0
2797	4	Injector diagnostic; Short circuit to ground cylinder bank 0
2798	4	Timeout of Short-Circuit Ground Diagnosis Cyl. Bank 1;_IVDiaShCirGndToutBnk_1
2798	4	Injector diagnostic; Short circuit to ground cylinder bank 1
3031	0	DEF tank, DEF temperature in DEF tank is to high.
3031	1	DEF tank, DEF temperature below lower physical threshold
3031	2	Urea tank temperature outside of plausible thresholds
3219	2	DFC SAE J1939 error No detail information
3224	2	DLC Error of CAN-Receive-Frame AT1IG1 NOX Sensor (SCR-system upstream cat; DPF-system downstream cat); length of frame incorrect
3224	9	Timeout Error of CAN-Receive-Frame AT1IG1; NOX sensor upstream
3224	2	DLC Error of CAN-Receive-Frame AT1IG1Vol NOX sensor.
3224	9	Timeout Error of CAN-Receive-Frame AT1IG1Vol; NOX sensor.
3224	1	DFC for plausibility error Max for NOx sensor upstream of SCR Cat
3226	2	Nox feed back fault detection No detail information
3227	2	DFC SAE J1939 error No detail information
3234	2	DLC Error of CAN-Receive-Frame AT1O1 No detail information
3234	9	Timeout Error of CAN-Receive-Frame AT1OG1; NOX sensor (SCR-system downstream cat; DPF-system downstream cat)
3234	2	DLC Error of CAN-Receive-Frame AT1O1Vol NOX
3234	9	Timeout Error of CAN-Receive-Frame AT1OG1Vol.
3234	11	DFC for plausibility error Min for NOx sensor downstream of SCR Cat.
3241	0	Sensor SCR catalyst upstream temperature too high; plausibility error.
3248	4	Sensor error particle filter downstream temperature; signal range check low
3251	0	Differential pressure DPF maximum value is exceeded
3251	0	Differential pressure sensor across DPF exceeds warning high limit
3251	1	Differential pressure DPF, pressure below lower shutoff threshold.
3251	1	Differential pressure DPF, pressure below lower warning threshold.
3253	2	Differential pressure DPF, plausibility error
3253	3	Electrical error differential pressure B58 (DPF). (signal range check high)
3253	4	Electrical error differential pressure (DPF). signal range check low.
3253	2	Sensor differential pressure (DPF); plausibility error
3361	7	DEF dosing valve blocked (SCR)

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
3361	6	DEF dosing valve; power at the end of injection too high
3361	3	DEF dosing valve; short circuit to battery on low side
3361	3	DEF dosing valve; short circuit to battery or open load on high side
3361	4	Urea dosing valve; short circuit to ground or open load on low side
3361	4	DEF dosing valve; short circuit on high side
3519	12	DEF tank temperature, temperature too high
3519	3	DEF quality sensor, internal temperature sensor short circuit to battery or open load
3519	4	DEF quality sensor, internal temperature sensor short circuit to ground
3519	13	Temperature at UQS invalid
3520	3	DEF quality sensor, short circuit to battery or open load
3520	4	DEF quality sensor, short circuit to ground
3520	2	DEF quality sensor, bad DEF quality detected or no DEF measuring possible.
3520	13	Urea quality at UQS invalid
3532	3	Sensor error DEF tank level; signal range check high
3532	4	Sensor error DEF tank level; signal range check low
3532	3	The DEF Level at UQS out of max. physical range
3532	4	Quality at UQS out of min. physical range
3699	2	Passive regeneration of DPF; plausibility error DPF differential pressure sensor and a further sensor or actuator CRT system defective
3699	2	Passive regeneration of DPF; DOC error Temperature sensor us. and ds. DOC simultaneously defect
3699	0	Maximum standstill time reached; oil exchange request ignored
3711	12	Temperature during stand-still main phase too low or too high
3936	14	Standstill request ignored too long.
3936	14	Standstill time based escalation requests Inducement step 2
4171	2	Dynamic temperature check of temp before SCR
4243	11	SCR heater; Pressure line heater error and temperature condition to perform an afterrun (Group error diagnosis heater) SCR system heater diagnostic reports error; shut off SCR-system
4334	0	Supply module DEF, DEF pressure above upper physical threshold
4334	1	Urea supply module pressure sensor; physical range check low (defect pressure sensor)
4334	0	Urea pump pressure sensor; high signal not plausible
4334	1	Urea pump pressure sensor; low signal not plausible
4334	2	DEF supply module pressure, plausibility error
4341	5	SCR heater relay DEF supply line secondary side; open load
4341	5	SCR heater relay DEF supply line primary side; open load
4341	3	SCR-heater DEF supply line; short circuit to battery
4341	4	SCR-heater DEF supply line; short circuit to ground
4343	11	SCR Monitoring; Pressure stabilization error, general pressure check error (SCR)
4343	5	SCR heater relay DEF pressure line secondary side; open load
4343	5	SCR heater relay DEF pressure line primary side; open load
4343	12	Over Temperature error No detail information
4343	3	SCR heater DEF pressure line; short circuit to battery
4343	4	SCR heater DEF pressure line; short circuit to ground
4345	11	Sensor back flow line pressure (SCR); plausibility error

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
4345	5	SCR heater relay DEF return line secondary side; open load
4345	5	SCR heater relay DEF return line primary side; open load
4345	12	Over Temperature error No detail information
4345	3	SCR heater DEF return line; short circuit to battery
4345	4	SCR heater DEF return line; short circuit to ground
4360	0	Exhaust temperature upstream SCR-Cat, temperature above upper physical threshold
4360	1	Sensed exhaust temperature before SCR-Cat is < physical low limit
4360	2	Exhaust temperature sensor upstream SCR, plausibility error
4361	2	Signal error for CAN message No detail information
4361	3	Sensor error DEF catalyst exhaust gas temperature upstream; signal range check high
4361	4	Sensor error DEF catalyst exhaust gas temperature upstream; signal range check low
4365	0	DEF tank temperature too high.
4365	2	Tank temperature signal error for CAN message
4365	3	Sensor error urea tank temperature: short circuit to battery
4365	4	Sensor error urea tank temperature; short circuit to ground.
4365	3	DEF quality sensor, tank temperature; Short circuit to battery or open load
4365	4	DEF quality sensor, tank temperature; Short circuit to ground
4366	5	SCR main relay (secondary side): open load
4366	5	SCR main relay (secondary side); Shortcut to battery
4366	5	SCR main relay (secondary side), heat relay (secondary side), heating elements or heating valve short to ground.
4366	5	SCR Tank heating valve secondary side: open load
4366	5	SCR tank heating valve primary side; open load
4366	12	SCR-heater relay urea tank power stage output; over temperature
4366	3	SCR Tank heating valve; short circuit to battery
4366	4	SCR Tank heating valve; short circuit to ground
4374	13	Pressure stabilization error dosing valve (SCR)
4375	5	Urea pump motor; open load
4375	3	Urea pump motor; short circuit to battery
4375	4	Urea pump motor; short circuit to ground
4376	5	SCR reversal valve; open load
4376	12	SCR reversing valve; over temperature
4376	3	SCR reversal valve; short circuit to battery
4376	4	SCR reversing valve; short circuit to ground
4376	5	SCR reverting valve; open load
4376	12	SCR reverting valve; over temperature
4376	4	eSCR reverting valve; short circuit to ground
4765	0	Temperature upstream DOC, temperature above upper shutoff threshold
4765	0	Temperature upstream DOC, temperature above upper warning threshold
4766	0	Temperature downstream DOC, temperature above upper shutoff threshold
4766	0	Temperature downstream DOC, temperature above upper warning threshold
4768	2	Temperature upstream DOC, plausibility error
4768	3	Electrical error exhaust gas temperature upstream (DOC); signal range check high
4768	4	Electrical error exhaust gas temperature upstream (DOC); signal range check low

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
4768	2	Exhaust gas temperature sensors up and downstream DOC are physically swapped
4769	2	Temperature downstream DOC, plausibility error
4769	3	Sensor error exhaust gas temperature downstream (DOC); signal range check high
4769	4	Sensor error exhaust gas temperature downstream (DOC); signal range check low
4769	2	Sensor exhaust gas temperature OxiCat downstream (normal operation); plausibility error
4769	2	Sensor exhaust gas temperature OxiCat downstream (regeneration); plausibility error
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check high.
5763	7	Actuator position for EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8) not plausible.
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check high
5763	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low
5763	3	Position sensor error of actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check high.
5763	4	Position sensor error actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check low.
5763	5	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); open load
5763	6	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (6.1,7.8); over current
5763	3	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery
5763	3	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery
5763	4	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground
5763	4	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); Overload by short-circuit
5763	11	Power stage over temperature due to high current.
5763	4	Actuator AGR valve (2.9;3.6) throttle valve (4.1;6.1;7.8); Voltage below threshold.
5763	0	Warning threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap
5763	1	Shut off threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap
520521	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low.
523008	1	Manipulation control was triggered
523008	2	Timeout error in Manipulation control
523009	9	The pressure relief valve (PRV) has reached the number of allowed activations.
523009	10	Open time of Pressure Relief Valve (PRV) for wear out monitoring had exceeded
523090	2	Engine Brake Pre-Selection switch; Plausibility Error
523211	9	Timeout Error of CAN-Receive-Frame EBC1
523212	9	Timeout Error of CAN-Receive-Frame ComEngPrt; Engine Protection
523213	12	Timeout Error of CAN-Transmit-Frame ERC1 No detail information
523216	9	Timeout Error of CAN-Receive-Frame PrHtEnCmd; pre-heat command, engine command
523240	9	Timeout CAN-message FunModCtl; Function Mode Control
523330	14	Immobilizer status; fuel blocked
523330	14	DFC to block the fuel by Sia No detail information
523330	14	DFC to indicate that TEN-code or UC-code received if ECU is learned. No detail information
523330	14	DFC to indicate that no code is received via CAN. No detail information
523330	14	DFC to indicate that wrong code is received. No detail information
523350	4	Injector cylinder-bank 1; short circuit

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523352	4	Injector cylinder-bank 2; short circuit
523354	12	Injector power stage output defect
523470	2	Pressure relief valve is forced to open, perform pressure increase.
523470	2	Pressure Relief Valve (PRV) forced to open. Performed by pressure increase.
523470	12	Pressure Relief Valve (PRV) forced to open. Shutoff conditions.
523470	12	Pressure Relief Valve (PRV) forced to open. Warning conditions.
523470	14	Open Pressure Relief Valve (PRV)
523470	11	Pressure Relief Valve (PRV) error; Rail pressure out of tolerance range.
523470	11	Rail pressure out of tolerance range. The PRV can not be opened at this operating point with a pressure shock.
523470	7	Maximum rail pressure exceeded (PRV).
523550	12	Terminal 50 was operated too long
523580	2	Data set variant with the desired number not found Invalid variant data set Identifier error No detail information
523580	11	An error has occurred in the switch over to the desired data set variant in the code word. Variant data set switching error No detail information
523580	11	The code word could not be read correctly from the EEPROM Variant dataset switching error; No detail information
523601	13	Failure of sensor supply voltage 3.
523602	0	High fan speed; warning threshold exceeded
523602	0	High fan speed; shut off threshold exceeded
523603	9	Timeout Error of CAN-Receive-Frame AMB; Ambient Temperature Sensor
523605	9	Timeout Error of CAN-Receive-Frame TSC1AE; Traction Control
523606	9	Timeout Error of CAN-Receive-Frame TSC1AR; Retarder
523612	12	Internal software error ECU; injection cut off
523612	12	Internal ECU monitoring detection reported error
523612	12	ECU reported internal software error Internal ECU monitoring detection reported error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error.
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	Injection system, electrical error injectors
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	Diagnostic fault check to report the accelerator pedal position error
523612	12	Diagnostic fault check to report the engine speed error
523612	12	Error in the plausibility of the injection energizing time
523612	12	Error in the plausibility of the start of energizing angles
523612	12	Diagnostic fault check to report the error due to non plausibility in ZFC

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523612	12	Diagnosis fault check to report the demand for normal mode due to an error in the PoI2 quantity
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI2 shut-off
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI3 efficiency factor
523612	12	Internal ECU monitoring detection reported error
523612	12	Monitoring of Fuel Quantity Correction
523612	12	Diagnostic fault check to report the plausibility error in rail pressure monitoring
523612	12	Diagnostic fault check to report the error due to torque comparison
523612	12	Diagnosis of curr path limitation forced by ECU monitoring level 2
523612	12	Diagnosis of lead path limitation forced by ECU monitoring level 2
523612	12	Diagnosis of set path limitation forced by ECU monitoring level 2.
523612	3	Reported Over Voltage of Supply
523612	4	Reported Under Voltage of Supply
523612	12	Diagnostic fault check to report WDA active due to errors in query-/response communication
523612	12	Diagnostic fault check to report ABE active due to under voltage detection
523612	12	Diagnostic fault check to report ABE active due to overvoltage detection
523612	12	Diagnostic fault check to report WDA/ABE active due to unknown reason
523612	14	Software reset CPU SWReset_0
523612	14	Software reset CPU SWReset_1
523612	14	Software reset CPU SWReset_2
523612	12	Internal software error ECU
523612	12	Engine starter, plausibility error of starter release condition
523613	0	Rail pressure metering unit, Positive governor deviation.
523613	0	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure exceeded.
523613	0	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure in metering unit exceeded (RailMeUn1).
523613	0	Rail pressure metering unit, Rail pressure below the target range (RailMeUn2) Rail system leakage detected. (RailMeUn10)
523613	1	Rail pressure metering unit, Minimum rail pressure exceeded (RailMeUn3) Negative deviation of rail pressure second stage (RailMeUn22)
523613	0	Rail pressure metering unit, Maximum rail pressure exceeded.
523613	2	Rail pressure metering unit, Set point of metering unit in overrun mode not plausible.
523613	0	Set point of metering unit in overrun mode not plausible
523615	5	Metering unit (Fuel-System); open load
523615	12	Metering unit (Fuel-System); power stage over temperature
523615	3	Metering unit (Fuel-System); short circuit to battery high side
523615	4	Metering unit (Fuel-System); short circuit to ground high side
523615	3	Metering unit (Fuel-System); short circuit to battery low side
523615	4	Metering Unit (Fuel-System); short circuit to ground low side
523615	3	Metering unit, short circuit to battery
523615	4	Metering unit, short circuit to ground
523618	3	Gearbox oil temperature; Short circuit to battery or broken harness
523618	4	Gearbox oil temperature; Short circuit to ground
523619	2	Physical range check high for exhaust gas temperature up stream (SCR-CAT)
523632	16	Pump pressure SCR metering unit too high.

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523632	18	Pump pressure SCR metering unit too low
523632	0	Pressure overload of SCR-System.
523632	1	Pressure build-up error SCR-System.
523632	11	Pump motor not available for actuation
523632	2	Signal error for CAN message No detail information
523632	3	Sensor error urea pump pressure; signal range check high
523632	4	Sensor error urea pump pressure; signal range check low
523633	11	Long term adoption factor below threshold
523633	11	Nox conversion rate insufficient (SCR-Cat defect, bad DEF quality)
523633	11	Nox conversion rate insufficient (SCR-Cat defect, bad DEF quality); temperature range 1
523698	11	Shut off request from supervisory monitoring function
523699	3	Boost pressure control; negative governor deviation below limit
523699	4	learning value too high No detail information
523704	12	Timeout Error of CAN-Transmit-Frame EEC3
523706	12	Timeout Error of CAN-Transmit-Frame FlEco No detail information
523717	12	Timeout Error of CAN-Transmit-Frame AmbCon; Weather environments
523718	5	tank heating valve; open load
523718	12	SCR main relay (primary side); power stage over temperature
523718	3	SCR main relay (primary side); short circuit to battery
523718	4	SCR main relay (primary side); short circuit to ground
523718	5	SCR main relay; open load (only CV56B)
523718	3	SCR main relay; short circuit to battery (only CV56B)
523718	4	SCR main relay; short circuit to ground (only CV56B)
523719	5	SCR heater relay DEF supply module secondary side; open load
523719	5	SCR heater relay DEF supply module primary side; open load
523719	12	Over Temperature error No detail information
523719	3	SCR heater DEF supply module; short circuit to battery
523719	4	SCR heater DEF supply module; short circuit to ground
523720	2	DEF supply module heater temperature; plausibility error (normal condition).
523720	2	Sensor DEF supply module heater temperature; plausibility error (cold start condition)
523720	8	DEF supply module heater temperature; duty cycle in failure range.
523720	8	DEF supply module heater temperature; duty cycle in invalid range.
523721	2	Sensor DEF supply module temperature; plausibility error (normal condition)
523721	2	Sensor DEF supply module temperature; plausibility error (cold start condition)
523721	11	Urea supply module temperature measurement not available.
523721	8	DEF supply module temperature; duty cycle in failure range.
523721	8	Urea supply module temperature; duty cycle in invalid range.
523722	8	DEF supply module PWM signal; period outside valid range.
523722	8	Detect faulty PWM signal from Supply Module.
523741	14	Engine shut off request through CAN No detail information
523752	0	Plausibility error during Rich to Lean switch over No detail information
523752	0	Monitoring of Nox signal readiness No detail information
523756	14	special pattern for special cases No detail information

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523757	14	special pattern for special cases No detail information
523758	14	special pattern for special cases No detail information
523759	14	special pattern for special cases No detail information
523760	14	special pattern for special cases No detail information
523766	9	Timeout Error of CAN-Receive-Frame Active TSC1AE
523767	9	Timeout Error of CAN-Receive-Frame Passive TSC1AE
523768	9	Timeout Error of CAN-Receive-Frame Active TSC1AR
523769	9	Timeout Error of CAN-Receive-Frame Passive TSC1AR
523776	9	Timeout Error of CAN-Receive-Frame TSC1TE - active
523777	9	Passive Timeout Error of CAN-Receive-Frame TSC1TE; Set point
523778	9	Timeout Error of CAN-Receive-Frame TSC1TR
523779	9	Passive Timeout Error of CAN-Receive-Frame TSC1TR
523788	12	Timeout Error of CAN-Transmit-Frame TrbCH; Status Waste gate
523788	0	Waste gate plausibility error off CAN transmit message.
523788	0	Timeout Error of CAN-Receive-Frame ComTrbChActr; Wastegate
523793	9	Timeout Error of CAN-Receive-Frame UAA10; AGS sensor service message
523794	9	Timeout Error of CAN-Receive-Frame UAA11; AGS sensor data
523803	9	Timeout error of CAN Receive Message RxEngPres; Status Burner Air Pump
523858	12	Timeout Error of CAN-Transmit-Frame UAA11
523867	12	Timeout Error of CAN-Transmit-Frame UAA1 on CAN 2. Control burner air pump;
523889	3	Over temperature of device driver of pressure control valve No detail information
523891	14	When AirHt_ctDefSRCLoOn_mp is less than AirHt_ctMaxDef_C. DFC to SRC Low error when heater is On No detail information
523895	13	Check of missing injector adjustment value programming (IMA) injector 1 (in firing order).
523896	13	Check of missing injector adjustment value programming (IMA) injector 2 (in firing order).
523897	13	Check of missing injector adjustment value programming (IMA) injector 3 (in firing order).
523898	13	Check of missing injector adjustment value programming (IMA) injector 4 (in firing order).
523899	13	Check of missing injector adjustment value programming (IMA) injector 5 (in firing order).
523900	13	Check of missing injector adjustment value programming (IMA) injector 6 (in firing order).
523906	5	Electrical fuel pre - supply pump; open load
523906	12	Electrical fuel pre - supply pump. ECU powerstage over temperature.
523906	3	Electrical fuel pre - supply pump; short circuit to battery
523906	4	Electrical fuel pre - supply pump. Short circuit to ground.
523910	14	Air pump doesn't achieve air mass flow setpoint Burner Control - burner air pump
523910	9	Burner Control; Air Pump - CAN Lost Air Pump; CAN communication lost
523910	7	Air pump; CAN communication interrupted no purge function available
523910	12	Air Pump; internal error
523910	0	Air Pump; operating voltage error
523910	6	Burner Control Air Pump; over current Air pump electrically overloaded
523911	0	Burner dosing valve (DV2); over current at the end of the injection phase
523911	12	Burner dosing valve (DV2); power stage over temperature
523911	3	Burner dosing valve (DV2); short circuit to battery
523911	4	Burner dosing valve (DV2); short circuit to ground

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523911	11	Burner dosing valve (DV2); short circuit high side power stage
523912	2	Burner dosing valve (DV2) downstream pressure sensor; plausibility error
523912	0	Physical range check high for burner dosing valve (DV2) downstream pressure; shut off regeneration
523912	1	Physical range check low for burner dosing valve (DV2) downstream pressure; shut off regeneration. When burner injector is actuated, the measured pressure does not rise above ca. 1250mbar abs (expected: ca. 2400mbar).
523912	3	Sensor error burner dosing valve (DV2) downstream pressure sensor; signal range check high
523912	4	@ engines < 4I: Throttle valve error, Open Load or Short cut to Battery, blocked valve or wrong control signal for valve. @ engines with Burner T4i: Pressure Sensor error after valve (DV2), lower limit reached
523913	3	Sensor error glow plug control diagnostic line voltage; signal range check high
523913	4	Sensor error glow plug control diagnostic line voltage; signal range check low
523914	5	Glow plug control; open load water pump control (PWM)
523914	12	Glow plug control; power stage over temperature
523914	3	Glow plug control; short circuit to battery water pump control (PWM)
523914	4	Glow plug control; short circuit to ground water pump control (PWM)
523915	0	HCI dosing valve (DV1); over current at the end of the injection phase
523915	12	HCI dosing valve (DV1); power stage over temperature
523915	3	HCI dosing valve (DV1); short circuit to battery
523915	3	HCI dosing valve (DV1); short circuit to battery high side
523915	4	HCI dosing valve (DV1); short circuit to ground
523915	11	HCI dosing valve (DV1); short circuit high side power stage
523915	7	HCI dosing valve (DV1); blocked open
523916	2	Sensor HCI dosing valve (DV1) downstream pressure; plausibility error
523916	0	Physical range check high for HCI dosing valve (DV1) downstream pressure; shut off regeneration
523916	1	Physical range check low for HCI dosing valve (DV1) downstream pressure; shut off regeneration
523916	3	Sensor error HCI dosing valve (DV1) downstream pressure; signal range check high
523916	4	Sensor error HCI dosing valve (DV1) downstream pressure; signal range check low
523917	3	Sensor error DV1 & DV2 upstream pressure; signal range check high
523917	4	Sensor error DV1 & DV2 upstream pressure; signal range check low
523918	3	Sensor error DV1 & DV2 upstream temperature; signal range check high
523918	4	Sensor error DV1 & DV2 upstream temperature; signal range check low
523919	2	DPF burner air pump pressure sensor, plausibility error
523919	0	DPF burner air pump pressure sensor, pressure above upper shutoff threshold
523919	1	DPF burner air pump pressure sensor, pressure below lower shutoff threshold
523919	3	DPF burner air pump pressure sensor, short circuit to battery or open load
523919	4	DPF burner air pump pressure sensor, short circuit to ground
523919	2	Sensor air pump air pressure; plausibility error
523920	2	Exhaust gas pressure upstream burner, plausibility error
523920	0	Exhaust gas pressure upstream burner, pressure above upper shutoff threshold
523920	3	Exhaust gas pressure upstream burner, short circuit to battery or open load
523920	4	Exhaust gas pressure upstream burner, short circuit to ground
523920	2	Sensor exhaust gas back pressure burner; plausibility error
523921	3	Sensor error burner temperature; signal range check high
523921	4	Sensor error burner temperature; signal range check low

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523921	0	Burner temperature, temperature above upper shutoff threshold
523921	1	Burner temperature, temperature below lower shutoff threshold
523921	2	Burner temperature sensor; Plausibility Check for burner temperature sensor Sensor burner temperature; plausibility error
523922	3	Burner shut of valve; short circuit to battery
523922	7	Burner Control; Shut-off Valve - Blocked closed Burner Shut Off Valve; blocked closed
523922	7	Burner Shut Off Valve; blocked open
523922	5	Burner Shut Off Valve; open load
523922	12	Burner Shut Off Valve; power stage over temperature
523922	4	Burner Shut Off Valve; short circuit to ground
523923	3	UB1; Short circuit to battery error of actuator relay 1
523923	4	Short circuit to ground error No detail information
523924	3	UB2; Short circuit to battery error of actuator relay 2
523924	4	UB2; Short circuit to ground actuator relay 2
523925	3	UB3: Short circuit to battery error of actuator relay 3.
523925	4	UB3; Short circuit to ground actuator relay 3
523926	4	UB4; Short circuit to ground actuator relay 4.
523927	3	UB5; Short circuit to battery error of actuator relay 5.
523935	12	Timeout Error of CAN-Transmit-Frame EEC3V0L1; Engine send messages
523936	12	Timeout Error of CAN-Transmit-Frame EEC3V0L2; Engine send messages
523937	9	Timeout DFC for NOxSensGlbReqTx. No detail information
523938	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1IGCVol1.
523939	9	Broadcast Announce Message of the calibration message of the upstream catalytic NOx sensor has failed.
523940	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1IGCVol1
523941	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1OGCVol2.
523942	9	Calibration message 1 of the after catalyst NOx sensor has failed.
523943	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1OGCVol2.
523946	0	Zerofuel calibration injector 1 (in firing order); maximum value exceeded
523946	1	Zerofuel calibration injector 1 (in firing order); minimum value exceeded
523947	0	Zerofuel calibration injector 2 (in firing order); maximum value exceeded
523947	1	Zerofuel calibration injector 2 (in firing order); minimum value exceeded
523948	0	Zerofuel calibration injector 3 (in firing order); maximum value exceeded
523948	1	Zerofuel calibration injector 3 (in firing order); minimum value exceeded
523949	0	Zerofuel calibration injector 4 (in firing order); maximum value exceeded
523949	1	Zerofuel calibration injector 4 (in firing order); minimum value exceeded
523950	0	Zerofuel calibration injector 5 (in firing order); maximum value exceeded
523950	1	Zerofuel calibration injector 5 (in firing order); minimum value exceeded
523951	0	Zerofuel calibration injector 6 (in firing order); maximum value exceeded
523953	2	Healing takes place if the condition for error detection is not present. Air temperature monitoring plausibility check array No detail information
523955	2	Healing takes place if the condition for error detection is not present. Air temperature monitoring plausibility check array No detail information
523960	0	Physical range check high for EGR cooler downstream temperature.
523960	1	Physical range check low for EGR cooler downstream temperature.

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
523960	0	High exhaust gas temperature EGR cooler downstream; warning threshold exceeded.
523969	11	Fault entry for override control mode. No detail information
523973	14	SCR Tamper detection; derating timer below limit 1
523974	14	SCR Tamper detection; derating timer below limit 2
523975	14	Urea quality; derating timer below limit 1
523976	14	Urea quality; derating timer below limit 2
523977	14	Urea tank level; derating timer below limit 1
523978	14	Urea tank level; derating timer below limit 2
523981	11	SCR plausibility, OBD and diagnosis; Stuck in range check of DEF tank temperature sensor DEF-tank without heating function (heating phase)
523982	0	Power stage diagnosis disabled; high battery voltage
523982	1	Power stage diagnosis disabled; low battery voltage
523984	3	UB7; Short circuit to battery error of actuator relay 7
523986	4	UB6; Short circuit to ground actuator relay 6
523987	4	UB7; Short circuit to ground actuator relay 7
523992	9	N/A
523993	9	N/A
523995	13	Check of missing injector adjustment value programming (IMA) injector 7 (in firing order)
523996	13	check of missing injector adjustment value programming (IMA) injector 8 (in firing order)
523997	4	Injector cylinder bank 1 slave; short circuit
523998	4	Injector cylinder bank 2 slave; short circuit
523999	12	Injector power stage output Slave defect
524000	5	Injector 7 (in firing order); interruption of electric connection
524000	3	Injector 7 (in firing order); short circuit
524001	5	Injector 8 (in firing order); interruption of electric connection
524001	3	Injector 8 (in firing order); short circuit
524013	7	Burner Control; burner Flame; Burner does not start after x trials (burner flame lost detection) Burner flame unintentional deleted
524013	7	Burner Control; Flame lost max Burner operation is interrupted too often
524014	1	Air inlet EPV - pressure too low Air pressure glow plug flush line; below limit
524016	11	Burner Control; HFM - Electrical Fault HFM sensor; electrical fault
524016	2	Burner Control; HFM - Plausibility error1 Amount of air is not plausible to pump speed
524018	14	HMI engine derate service state DPF wasn't regenerated, power reduction phase 1 (manual regeneration request)
524019	11	Burner Control; Air Line - Blocked Air Pump; air lines blocked
524020	14	Burner Control: power reduction due to low lambda. Engine power; Not enough oxygen for regeneration.
524021	11	Burner Control; Fuel line ShutOff downstream - broken Burner fuel line pipe leak behind Shut Off Valve
524022	14	HMI engine derate stop state DPF wasn't regenerated, power reduction phase 2 (manual regeneration request)
524024	11	Deviation of the exhaust gas temperature set point to actual value downstream (DOC) too high

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
524025	14	Particulate filter regeneration. Regeneration after time X is not successful (The error occurs when the regeneration times (3x) over the max. has been aborted allowed recovery time)
524025	5	DPF system; operating voltage error
524025	14	The standstill-regeneration mode time exceeds the long-limit. Vehicle was too long or too often in standstill mode. Make oil change and reset counter.
524025	14	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode. Make oil change and reset counter.
524025	8	Max. launch time for stand still exceeded (60min).
524028	2	CAN message PROEGRActr; plausibility error
524029	2	Timeout Error of CAN-Receive-Frame ComEGRActr - exhaust gas recirculation positioner
524030	7	EGR actuator; internal error
524031	13	EGR actuator, calibration error
524032	2	EGR actuator; status message "EGRCust" is missing
524033	7	EGR actuator; due to overload in Save Mode
524034	5	Disc Separator; open load
524034	12	Disc Separator; power stage over temperature
524034	3	Disc separator; short circuit to battery
524034	4	Disc separator; short circuit to ground
524035	12	Injector diagnostics; time out error in the SPI communication
524036	12	Injector diagnostics Slave; time out error in the SPI communication
524038	9	Timeout error of CAN-Receive-Frame ComMS_Sys1TO (error memory Slave); Master-Slave internal CAN message
524039	9	Timeout error of CAN-Receive-Frame ComMS_Sys2TO (error memory Slave); Master-Slave internal CAN message
524040	9	Timeout error of CAN-Receive-Frame ComMS_Sys3TO (error memory Slave); Master-Slave internal CAN message
524041	9	Timeout error of CAN-Receive-Frame ComMS_Sys4TO (error memory Slave); Master-Slave internal CAN message
524042	9	Timeout error of CAN-Receive-Frame ComMS_Sys5TO (error memory Slave); Master-Slave internal CAN message
524043	9	Timeout error of CAN-Receive-Frame ComMS_Sys6TO (error memory Slave); Master-Slave internal CAN message
524044	9	CAN message ComMS_Sys7 not received from slave
524045	9	Master Slave, Error of message counter CAN receive message ComMSMoFOvR; ComMSMoFOvR1CNT
524046	9	Master-Slave CAN; Error Checksum of CAN-Receive Message
524047	9	Master-Slave CAN; Error of message length of CAN receive message ComMSMoFOvR;_ComMSMoFOvR1DLC
524048	9	Timeout error CAN message ComMSMoFOvR1TO error memory Slave
524052	11	Error memory Slave reports FID MSMonFC2 (collective error)
524052	11	Error memory Slave reports FID MSMonFC3 (collective error)
524052	11	Master ECU and Slave ECU data sets or software are not identical
524057	2	Fuel low pressure pump; error pressure build up
524058	2	Particulate filter; regeneration not successful
524063	5	Relay Urea back flow line heater: broken wiring detected (open load) Row engine: SCR-back flow line (K29) V-engine: Master: SCR-suction / back flow line (K32.1) Slave: SCR-suction / back flow line (K32.2)
524063	5	SCR main relay not connected
524063	5	SCR heater pressure line; open load
524063	3	SCR heater main relay; short circuit to battery

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
524063	4	SCR heater main relay load side (K31) on heating valve (Y31), Short cut to ground.
524063	5	Relay Urea suction line: broken wiring detected (open load) Row engine: SCR suction line (K28) V-engine: Master: common SCR-suction line (K28) Slave: common SCR back flow line (K29)
524063	5	SCR heater supply module; open load
524063	5	SCR heater tank; open load
524063	12	DEF supply module, time for defrosting too long
524063	12	DEF tank, time for defrosting too long
524065	0	Pressure sensor upstream SCR-CAT, pressure above upper physical threshold
524065	1	Pressure sensor upstream SCR-CAT, pressure below lower physical threshold
524065	3	Pressure sensor upstream SCR-CAT; short circuit battery or open load
524065	4	Pressure sensor upstream SCR-CAT; short circuit ground
524065	2	Pressure sensor upstream SCR-CAT, plausibility error
524066	3	SCR measurement heater output stage; short circuit battery or open load
524067	0	DEF supply module, heater temperature above upper physical threshold
524067	1	DEF supply module, heater temperature below lower physical threshold
524067	0	DEF supply module, temperature above upper physical threshold
524067	1	DEF supply module, temperature below lower physical threshold
524067	2	Supply module heater temperature, plausibility error
524067	2	Supply module temperature, plausibility error
524068	2	Master ECU and Slave ECU have been identified as the same types
524069	9	Timeout Error of CAN-Receive-Frame MSMon_FidFCCTO; Master-Slave CAN communication faulty
524070	2	(Upstream NOx-Sensor) Diagnostic Fault Check for invalid upstream NOx value (Sensor self diagnostic DFC set by Deutz-SW) NOx-Sensor before SCR-Cat: Invalid upstream NOx value
524071	2	(Downstream NOx-Sensor) Diagnostic Fault Check for invalid downstream lambda value (Sensor self diagnostic DFC set by Deutz-SW)
524072	2	(Upstream NOx-Sensor) Diagnostic Fault Check for invalid upstream lambda value (Sensor self diagnostic DFC set by Deutz-SW)
524073	2	(Downstream NOx-Sensor) Diagnostic Fault Check for invalid downstream NOx value (Sensor self diagnostic DFC set by Deutz-SW)
524074	9	NOx sensor downstream SCR-CAT, sensor internally open load
524074	2	NOx-Sensor after SCR-Cat: Nox-Sensor dew point problem or plausibility problem
524075	11	NOx sensor downstream SCR-CAT, sensor internally short circuit
524076	9	NOx sensor upstream SCR-CAT, sensor internally open line
524076	2	NOx-Sensor before SCR-Cat: Nox-Sensor dew point problem or plausibility problem
524077	11	NOx sensor upstream SCR-CAT, sensor internally short circuit
524078	9	NOx sensor downstream SCR-CAT, lambda value above upper physical threshold
524079	9	NOx sensor downstream SCR-CAT, lambda value below lower physical threshold
524080	9	NOx sensor upstream SCR-CAT, lambda value above upper physical threshold
524081	9	NOx sensor upstream SCR-CAT, lambda value below lower physical threshold
524082	9	(Downstream NOx-Sensor) Diagnostic Fault Check for downstream NOx value over maximum limit (DFC set by Deutz-SW)
524083	9	NOx-Sensor downstream SCR-CAT, NOx value below minimum value.

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
524084	9	NOx-Sensor upstream SCR-CAT, NOx value above maximum value.
524085	9	NOx sensor upstream SCR-CAT, NOx value below lower physical threshold
524087	5	Urea Error Lamp; open load
524087	12	Urea Error Lamp; temperature over limit
524087	3	Urea Error Lamp; short circuit battery
524087	4	Urea Error Lamp; short circuit ground
524096	14	Control of the SCR system; If the start stop counter (EPA-Counter) exceeds the threshold SCRCtl_ctEngStrtStopThresh_C. This counter will increment only once in each driving cycle in case of an SCR error. If the counter reaches the threshold, the DFC will be set to inhibit the engine start. Engine will not be started, because of EPA-Counter
524097	9	Timeout error of CAN-Transmit-Frame DPFBrnAirPmpCtl
524098	9	Timeout error of CAN-Transmit-Frame ComDPFBrnPT
524099	9	Timeout error of CAN-Transmit-Frame ComDPFC1
524100	9	Timeout error of CAN-Transmit-Frame ComDPFHisDat.
524101	9	Timeout error of CAN-Transmit-Frame ComDPFTstMon
524102	9	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmpCtl
524103	9	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmp
524104	9	Timeout error of CAN-Receive-Frame ComRxDPFCtl.
524105	9	Timeout error of CAN-Transmit-Frame ComEGRMsFlw (EGR Steller)
524106	9	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw1 (EGR actuator)
524107	9	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw2 (EGR actuator)
524108	9	Timeout error of CAN-Transmit-Frame ComEGRTVActr (EGR actuator)
524109	9	Timeout error of CAN-Receive-Frame ComRxEGRTVActr (EGR actuator)
524110	9	Timeout error of CAN-Transmit-Frame ComETVActrT0.
524111	9	Timeout error of CAN-Receive-Frame ComRxETVActr
524112	9	Timeout ComIntake Throttle Valve Actr.
524113	9	Timeout error of CAN-Receive-Frame ComRxITVActr
524114	9	Timeout error of CAN-Transmit-Frame A1DOC
524115	9	Timeout error of CAN-Transmit-Frame AT1S
524116	9	Timeout error of CAN-Transmit-Frame SCR2
524117	9	Timeout error of CAN-Transmit-Frame SCR3
524118	9	Timeout error of CAN-Receive-Frame ComRxCM1
524119	9	Timeout error of CAN-Receive-Frame ComRxCustSCR3
524120	9	Timeout error of CAN-Receive-Frame ComRxSCRHtDiag
524121	9	Timeout error of CAN-Receive-Frame ComRxTrbChActr (wastegate actuator)
524122	9	Timeout error of CAN-Receive-Frame ComRxUQSens (Urea quality)
524123	9	Timeout error of CAN-Receive-Frame ComSCRHtCtl
524124	9	Timeout error of CAN-Receive-Frame ComTxAT1IMG
524125	9	Timeout error of CAN-Receive-Frame ComTxTrbChActr (Wastegate actuator)
524132	2	Fuel low pressure upstream fuel low pressure pump not plausible
524132	0	Fuel low pressure upstream fuel low pressure pump, pressure above maximum warning threshold
524132	0	Fuel low pressure upstream fuel low pressure pump, pressure above maximum shut off threshold
524132	1	Fuel low pressure upstream fuel low pressure pump, pressure below minimum shut off threshold
524132	1	Fuel low pressure upstream fuel low pressure pump, pressure below minimum warning threshold

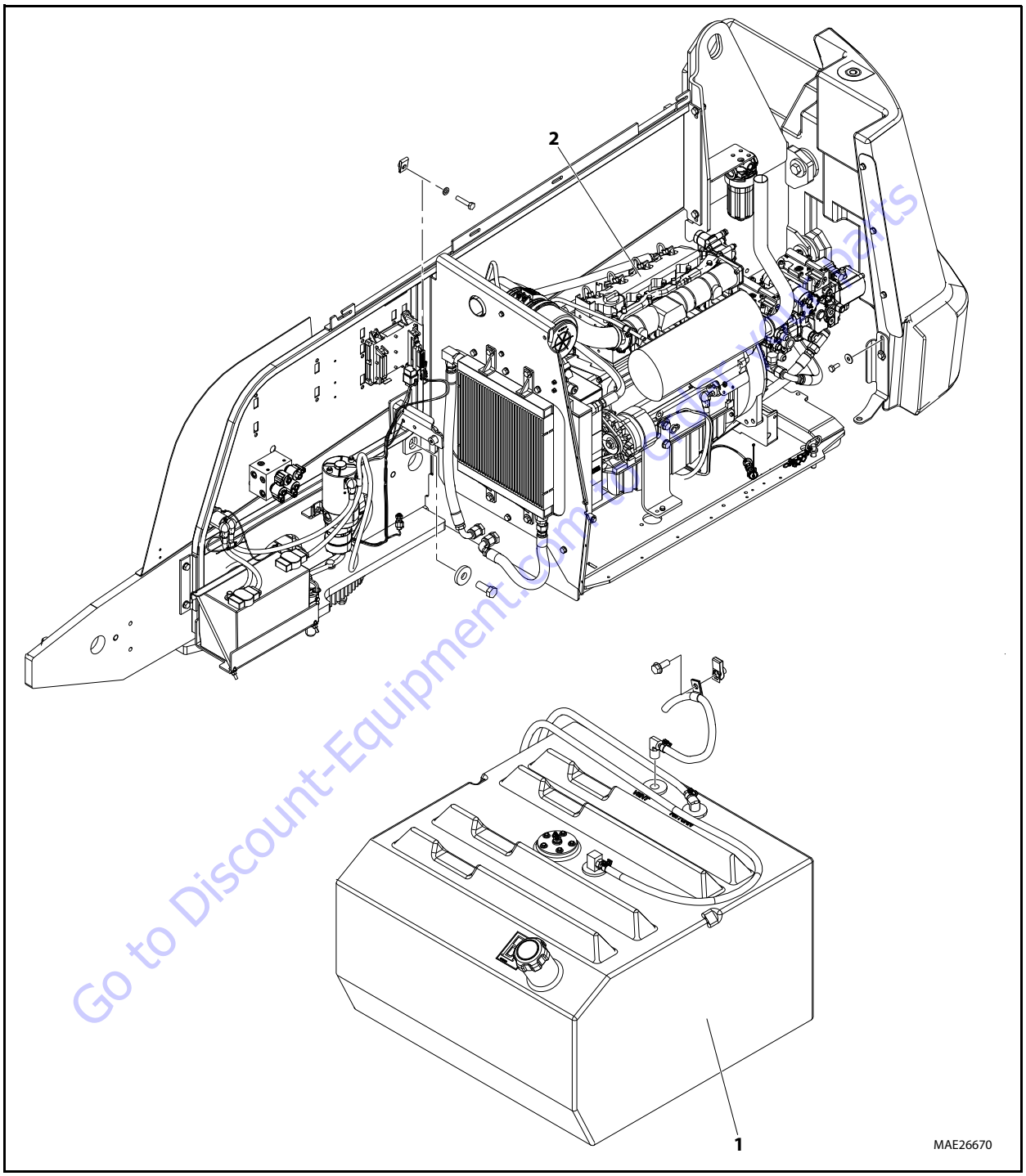
Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

SPN	FMI	Error Identification
524133	2	HMI system; set if restore button blocked
524134	0	DPF, ash load exceeds the shutoff threshold
524134	0	DPF, ash load exceeds the warning threshold
524135	0	DPF, soot load exceeds the shutoff threshold
524135	14	DPF, soot load exceeds the service request threshold
524135	0	DPF, soot load exceeds the warning threshold
524141	7	DEF dosing valve, dosing valve blocked
524147	13	SCR System, pressure build up not possible
524147	7	SCR-System, reverting valve blocked
524147	13	Set together with DFC_SCRCoBldUpLoPres. DFC_SCRCoBldUpLoPresRst is only used for inducement purposes. It ensures that legal inducement is working correctly.
524149	2	Plausibility error between pressure downstream turbine (PTrbnDs) and ambient air pressure (EnvP)
524149	2	Pressure downstream turbine, plausibility error
524152	2	Urea Quality Sensor; Timeout CAN message
524153	2	Urea tank level & urea tank temperature via CAN bus, timeout of CAN message
524156	9	Timeout error of CAN-Receive-Frame ComRxEBC2.
524157	9	Fan control; time out for fan governing
524159	0	Fan; short circuit battery or open load
524159	1	Fan; short circuit ground
524160	5	Fan; in/outlet valve 1; open load
524160	3	Fan; in/outlet valve 1; short circuit battery
524160	4	Fan; in/outlet valve 1; open load ground
524161	5	Fan; in/outlet valve 2; open load
524161	3	Fan; in/outlet valve 2; short circuit battery
524161	4	Fan; in/outlet valve 2; open load ground
524162	12	Fan; fan control; angle sensor defect
524163	12	Fan; fan control; fan or valve defect
524175	0	SCR-CAT, Nox emissions above maximum threshold
524177	7	SCR System, DEF suction line blocked
524178	7	SCR System, DEF pressure out of range
524189	9	Master / Slave Can disturbed.
524190	14	Inducement level 1 active
524191	14	Inducement level 2 active
524193	8	The standstill-regeneration mode time exceeds the long limit threshold. Vehicle was too long or too often in standstill mode. Change oil and reset counter.
524194	8	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode. Change oil and reset counter.
524195	14	Standstill request due to crystallization ignored too long
524196	13	Variant handling, address error
524196	2	Variant handling, Synchronisation error
524202	11	SCR error code in master ECU active.
524203	11	DEF tank level failure is in master ECU active.
524204	11	SCR after run failure is in master ECU active.

Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

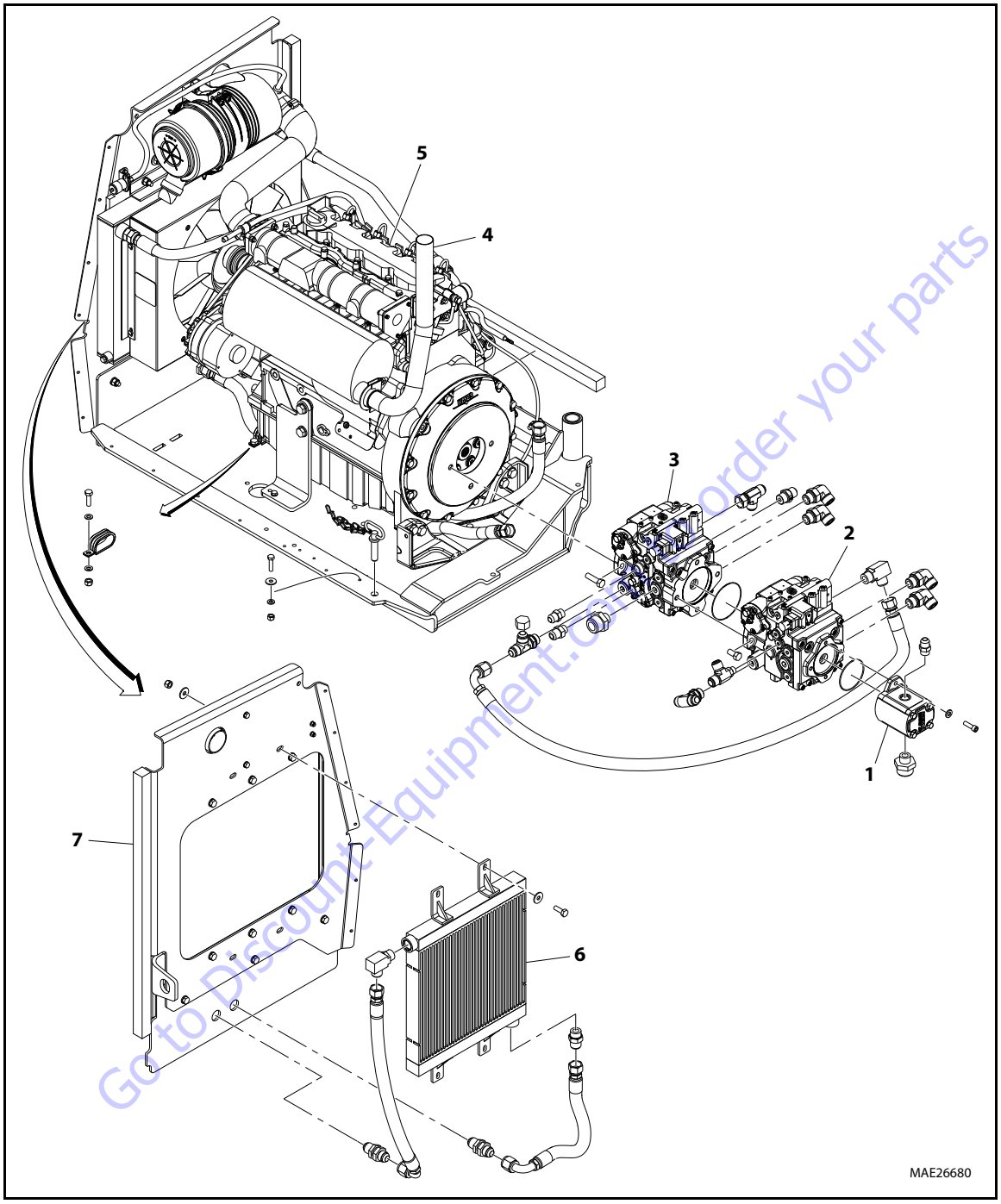
SPN	FMI	Error Identification
524205	11	SCR Co2Off failure is in master ECU active.
524206	11	SCR disable DEF dosing failure is in master ECU active.
524230	11	Inducement HW Failure Slave.
524231	11	Inducement SCR Tamp. Slave
524232	11	Inducement DEF Quality in Slave ECU
524239	11	SCR regeneration failure is in slave ECU active.
524248	11	NOX sensor downstream error in slave ECU
524249	11	DEF dosing valve error in slave ECU
524251	11	DEF pressure problems in slave ECU
524252	11	Reverting valve error in slave ECU
524253	11	DEF back flow line heater error on slave ECU
524254	11	Error NOx-Tailpipe emissions exceeded on Slave ECU
524255	11	DEF suction line heater error on slave ECU
524256	11	DEF supply module heater error on slave ECU
524257	11	Error Exhaust pressure upstream SCR on Slave ECU
524258	11	Error Exhaust temperature upstream SCR on Slave ECU
524259	11	DEF pressure line heater error on slave ECU
524260	11	Error Urea pump temperature on Slave ECU
524261	11	Error DEF heater relays on Slave ECU
524267	14	Announcement triggers the Inducement Level 2

3.9 DEUTZ D2011L04 ENGINE



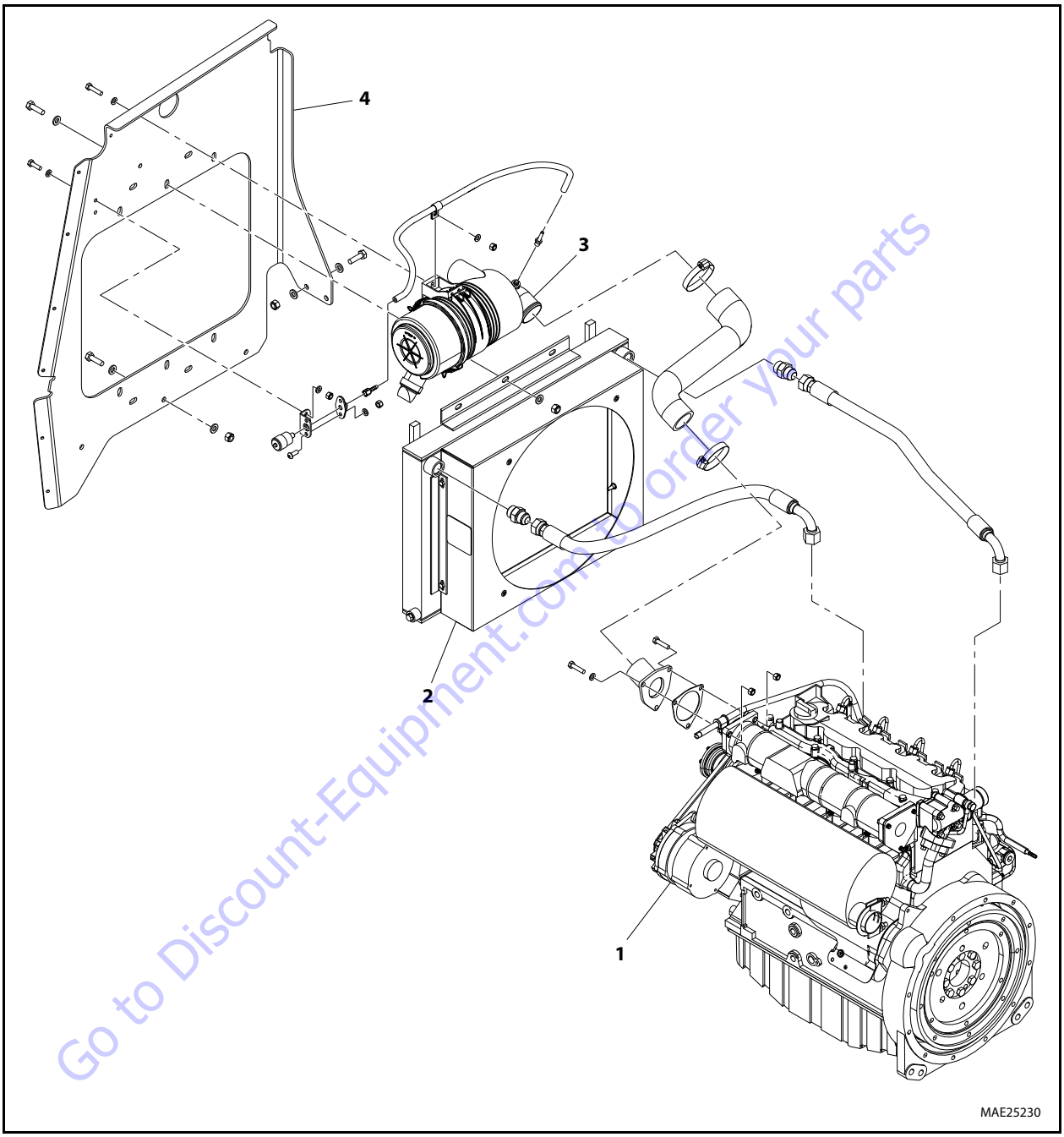
1. Fuel Tank
2. Deutz D2011 Engine and Pumps Sub-Assembly

Figure 3-25. Deutz D2011 Engine Installation



1. Gear Pump Assembly
2. Piston Pump Assembly - Rear
3. Piston Pump Assembly - Front
4. Exhaust Pipe
5. DeutzD2011 Engine Assembly
6. Hydraulic Oil Cooler
7. Support

Figure 3-26. Deutz D2011 Engine and Pumps Sub-Assembly



1. Deutz D20111 Engine
2. Radiator
3. Air Filter
4. Support
5. Pump Coupling
6. Bracket
7. Glow Plug Harness
8. Adapter
9. Fan
10. Tray
11. Bracket
12. Engine Mount
13. Engine Mount

Figure 3-27. Deutz D2011 Engine Assembly - Sheet 1 of 2

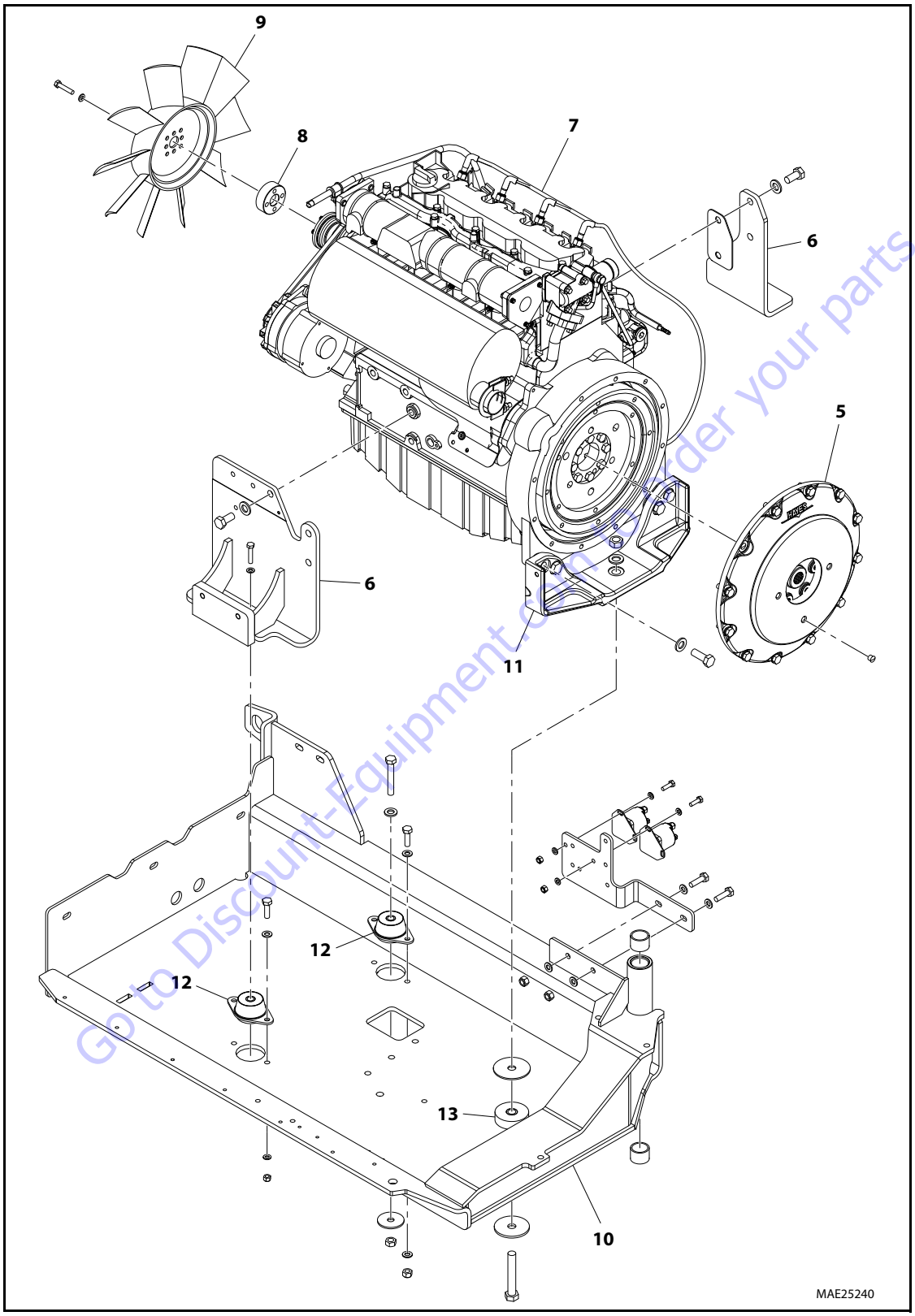


Figure 3-28. Deutz D2011 Engine Assembly - Sheet 2 of 2

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

Checking Oil Level

1. Make sure machine and engine are level and switch engine OFF before checking oil level.
2. Remove oil dipstick and wipe with clean cloth.
3. Insert dipstick to the stop and remove again.
4. Check oil level. Top oil level as shown in figure below with an approved grade and type of oil outlined in engine manufacturer's operator's manual.

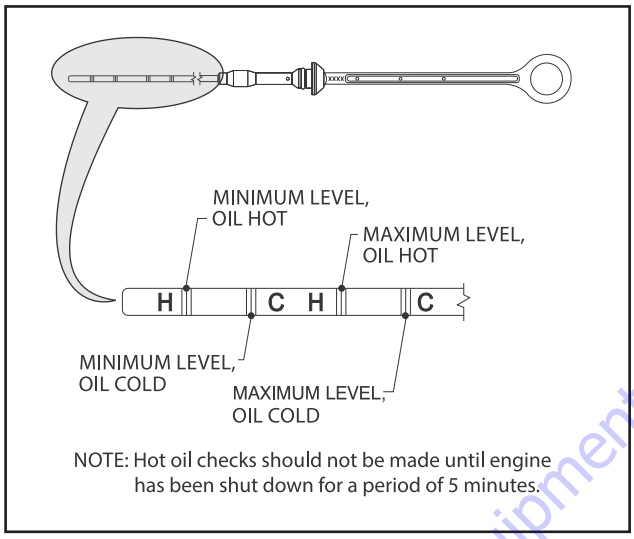


Figure 3-29. Deutz Dipstick Markings

5. Replace dipstick until fully seated.

Changing Engine Oil

1. Allow engine to warm up. Engine oil should reach approximately 176° F (80° C).
2. Make sure machine and engine are level and switch off engine.
3. Place oil tray under engine.

⚠ CAUTION

HOT ENGINE OIL CAN CAUSE BURNS. AVOID CONTACT WITH HOT OIL WHEN DRAINING.

NOTICE

COLLECT USED OIL IN A CONTAINER SUITABLE FOR DISPOSAL OR RECYCLING. DISPOSE OF USED ENGINE OIL IN ACCORDANCE WITH ENVIRONMENTAL REGULATIONS.

4. Open oil drain valve and drain oil.
5. Close oil drain valve.
6. Pour in new engine oil. Refer to Section 1 for capacity and Figure 3-30., Engine Oil Viscosity.

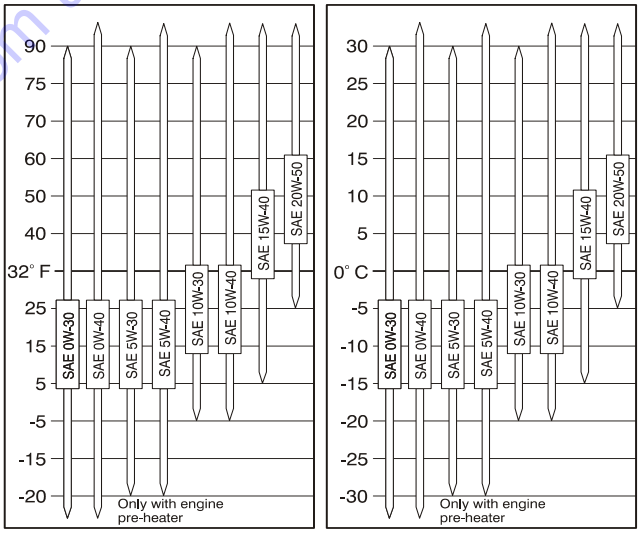
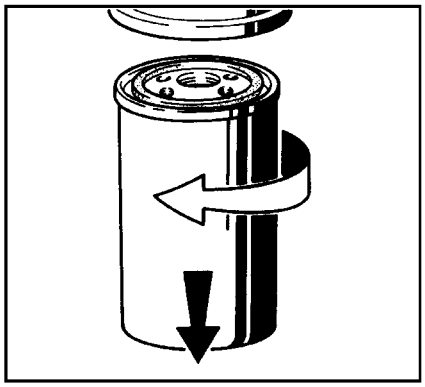


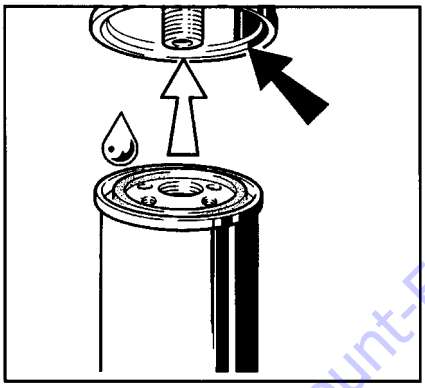
Figure 3-30. Engine Oil Viscosity

Changing Oil Filter

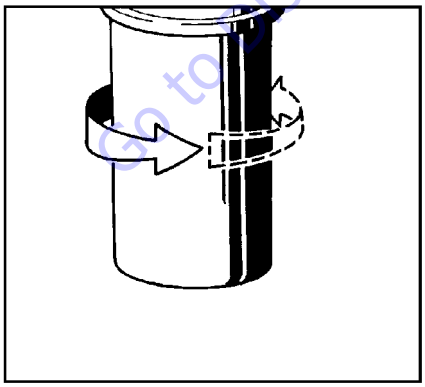
1. Wipe area around filter to clean any dirt from area.
2. Using a suitable oil filter removal tool, loosen lube oil filter cartridge and spin off.



3. Catch any escaping oil.
4. Clean any dirt from filter carrier sealing surface.
5. Lightly coat new oil filter rubber gasket with clean oil.



6. Screw in new filter by hand until gasket is flush.



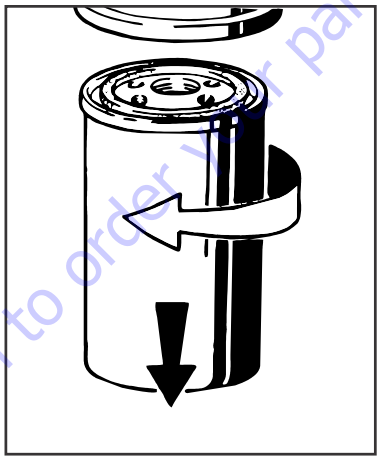
7. Hand-tighten filter another half-turn.
8. Check oil level.
9. Check oil pressure.
10. Check oil filter cartridge for leaks.

Replace Fuel Filter

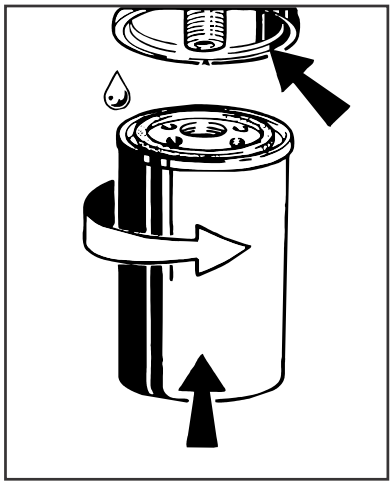
⚠ WARNING

FUEL IS FLAMMABLE AND CAN CAUSE DEATH OR SERIOUS INJURY. MAKE SURE NO OPEN FLAMES OR SPARKS ARE IN THE AREA WHEN WORKING ON FUEL SYSTEM. DO NOT SMOKE WHEN WORKING ON FUEL SYSTEM.

1. Wipe area around filter to clean any dirt from area.
2. Remove fuel filter cartridge. Catch any escaping fuel.



3. Clean dirt from filter carrier sealing surface.
4. Apply light film of oil or diesel fuel to rubber gasket of new filter cartridge.
5. Screw in new filter by hand until gasket is flush. Hand-tighten filter another half-turn.



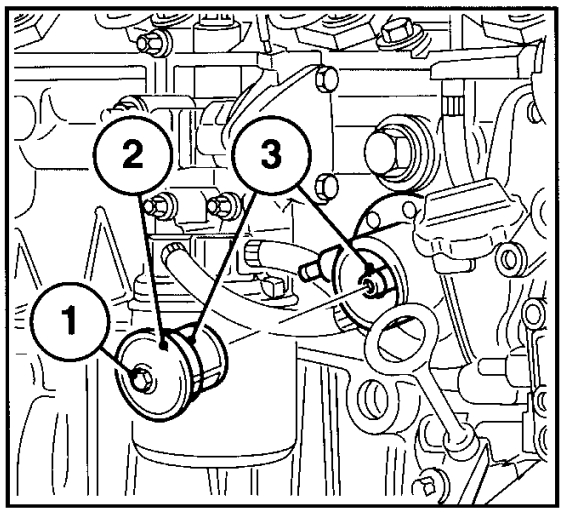
6. Open fuel shut-off valve.
7. Check for leaks.

Clean Fuel Strainer

⚠ WARNING

FUEL IS FLAMMABLE AND CAN CAUSE DEATH OR SERIOUS INJURY. MAKE SURE NO OPEN FLAMES OR SPARKS ARE IN THE AREA WHEN WORKING ON FUEL SYSTEM. DO NOT SMOKE WHEN WORKING ON FUEL SYSTEM.

1. Unscrew hexagonal nut (1).



2. Remove fuel strainer cover (2).
3. Clean fuel strainer with diesel fuel and replace as needed.
4. Place seal (3) in position.
5. Install fuel strainer cover (2). Tighten screw (1).
6. Check for leaks.

3.10 SPARK ARRESTER CLEANING INSTRUCTIONS

1. Remove cleanout plug in bottom of spark arrester (muffler).
2. Without causing deformation (or any type of damage to spark arrester) repeatedly tap on arrester near cleanout plug. This may be enough to begin spark trap drainage.
3. An industrial vacuum cleaner can do a complete job at this point.
   a. Or, IN A SAFE AREA, start engine. Alternate between low idle and high idle for two to three minutes.
   b. Or, operate engine as required by application for two to three minutes.
4. Install cleanout plug.

3.11 GLOW PLUGS

If glow plug option is enabled in the JLG Control System, glow plug and indicator lamp will be energized when Power/Emergency Stop switch is pulled on if ambient air temperature is less than 50° F (10° C) and engine coolant temperature is less than 140° F (60° C).

This determination occurs one second after the Power/Emergency Stop switch has been pulled on. Lamp and glow plugs remain energized for period of time specified by setting in the JLG Control System. Engine start is disabled during this period.

On Deutz engines, glow plugs continue (post glow) after engine has started three times the machine digit setting.

Table 3-2. Deutz Trouble Codes (D2011L04 Engine)

FAULT GROUP	FAULT NO. (IN SERDIA)	FAULT LOCALITY/ FAULT DESCRIPTION	SPN	FMI	CAUSE	REMARKS	HELP
Zero error display	-	No faults	524287	31	No active faults present		
Revolutions/ speed acquisition	01	Speed sensor 1	190	8	Sensor failure. Distance from gear too far. Additional fault impulses. Cable joint interrupted.	Governor in emergency operation (if sensor 2 available). Emergency switch-off (if sensor 2 not available or failed).	Check distance. Check cable connection. Check sensor and replace if required.
						Governor in emergency operation (with sensor 1) Emergency switch-off (if sensor 1 not available or failed).	
	3	Speed sensor	84	8	Tacho failed. Additional fault impulses. Cable connection interrupted.	Governor in emergency operation.	Check cable connection and Tacho. Replace if required.
	4	Excess speed switch-off	190	0	Speed was/is in excess of limit.e.	Engine stop.	Check parameter (21). Check speed settings.
					Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator (impulse on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.		
Sensors	07	Charge air pressure	102	2	Fault at corresponding sensor entry (e.g. short circuit or cable break).	With failure of the sensor, the associated monitoring function is de-activated.	Check sensor cable. Check sensor and replace if required. Check fault limits for sensor.
	08	Oil pressure	100	2			
	09	Coolant temperature	110	2			
	10	Charge air temperature	105	2			
	11	Fuel temperature	174	2			

Table 3-2. Deutz Trouble Codes (D2011L04 Engine)

FAULT GROUP	FAULT NO. (IN SERDIA)	FAULT LOCALITY/ FAULT DESCRIPTION	SPN	FMI	CAUSE	REMARKS	HELP
Functional fault warning	30	Oil pressure warning	100	1	Oil pressure below speed-dependent warning line characteristic	Fault message (disappears when oil pressure is again above recovery limit). After a delay time - fill limitation.	Check engine (oil level, oil pump). Check oil pressure sensor and cable. Check oil pressure warning line characteristic.
	31	Coolant temperature warning	110	0	Coolant temperature has exceeded warning level.	Fault message (disappears when coolant temperature again drops below recovery level). After a delay time - fill limitation.	Check coolant. Check coolant temperature sensor and cable.
	32	Charge air temperature warning	105	0	Charge air temperature has exceeded warning level.	Fault message (disappears when charge air temperature gain drops below recovery level). After a delay time - fill limitation.	Check charge air. Check charge air-temperature sensor and cable.
	34	Coolant level warning	111	1	Switch input "Low coolant level" is active.	Fault message.	Check coolant level. Check coolant level sensor and cable.
	35	Speed warning (with thrust mode operation).	S ID 190	14	revolutions was/is above (top) revolution speed limit. "Thrust mode" function is active.		Check parameters. Check speed settings.
					Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator. Check speed sensor (impulses on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.		
	36	Fuel temperature warning	174	0	Fuel-temperature has exceeded warning level.	Fault message (disappears when fuel temperature again drops below recovery level).	Check fuel. Check fuel temperature sensor and cable.
Functional fault, switch-off	42	Charge air temperature switch- off	105	0	Charge air temperature has exceeded switch-off limit.	Emergency stop	Check charge air. Check charge air-temperature sensor and cable. Check switch-off limit.
	44	Coolant level switch-off	111	1	Switch input "Low coolant level" is active.	Emergency stop. Start lock.	Check coolant level. Check coolant level sensor and cable.

Table 3-2. Deutz Trouble Codes (D2011L04 Engine)

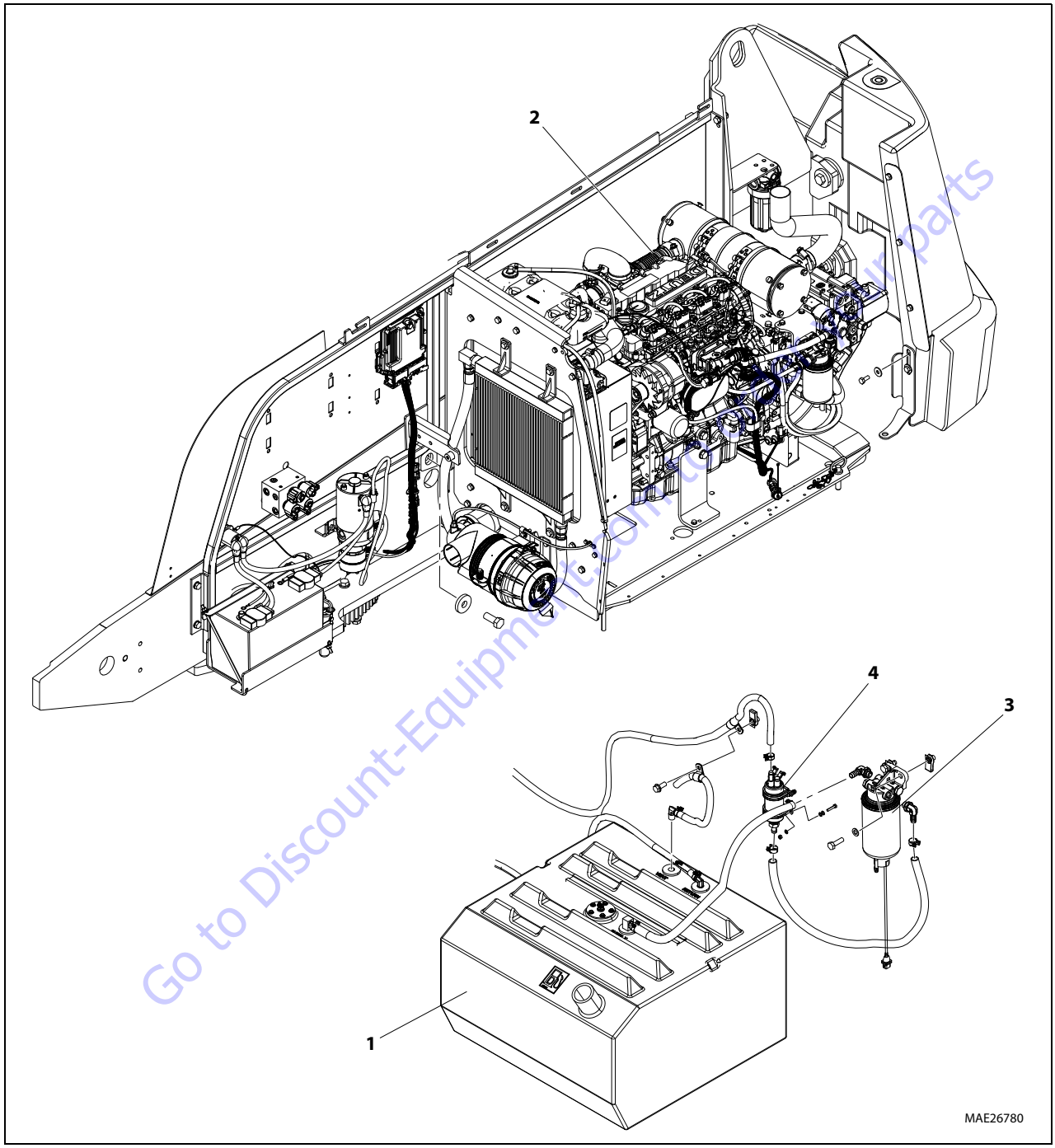
FAULT GROUP	FAULT NO. (IN SERDIA)	FAULT LOCALITY/ FAULT DESCRIPTION	SPN	FMI	CAUSE	REMARKS	HELP
Actuator	50	Feedback	S ID 24	1 2	Actuator not connected. Fault in actuator confirmation.	Emergency switch-off. Actuator cannot be operated.	Check actuator, replace if required. Check cable, check fault limits for “Confirmation”.
	52	Reference feedback	S ID 24	1 3			Check actuator, replace if required. Check cable, check fault limits for “Rifeness confirmation”.
	53	Control travel difference	DI 23	7	Injection pump/actuator jammed or not connected. Difference between nominal/actual control travel is > 10% of the overall control path.	Fault message (disappears when difference is < 10%).	Check actuator/actuator rods / injection pump, replace if required. Check actuator cable.
	59	Auto calibration BOSCH-EDC pumps faulty operation	S ID 23	1 3	No automatic actuator equalization possible. Incorrect input of the actuator reference values.	Engine stop / start lock. Governor cannot be taken into use. EDC actuator calibration required.	Check actuator and replaced if required. Check feedback cable.
							Check fault limits and reference values of the feedback. Program the fault limits for feedback, save values. Switch ignition off and on again.Check again. If faulty, inform DEUTZ-Service and carry out automatic equalization again. Set fault limits again.
Hardware inputs/ outputs	60	Digital output 3 (Switch-off solenoid, pin M 2)	S ID 51	2	Fault (short circuit / cable break) at digital output.	Driver level is switched off.	Check cable of digital output (cable break or short circuit).
	62	Digital output 6, pin M 7	S ID 60	2		Fault message.	
	63	Excess voltage switch-off solenoid	S ID 51	6			
	67	Error Hand Setp1	9 1	1 1			
	68	Error CAN Step 1	8 9 8	2			
Communication	70	CAN-Bus controller	S ID 231	1 2	CAN-controller for CAN-bus is faulty. Fault removal despite re- initializing continuously not possible	Application-dependent.	Check CAN connection, terminating resistor (see Chapter 12.4), Check control unit.
	71	CAN interface SAE J 1939	S ID 231	9	Overflow in input buffer or a transmission cannot be placed on the bus.		
	74	Cable break, short circuit or bus-error	S ID 231	1 4			Check CAN connection, cable connection. Check sensor and replace if required.

Table 3-2. Deutz Trouble Codes (D2011L04 Engine)

FAULT GROUP	FAULT NO. (IN SERDIA)	FAULT LOCALITY/ FAULT DESCRIPTION	SPN	FMI	CAUSE	REMARKS	HELP
Memory	76	Parameter programming (write EEPROM)	S ID 253	1 2	Fault in parameter programming in the governor fixed value memory.	Emergency switch-off. engine cannot be started.	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service
	7 7	Cyclic program test	S ID 240	1 2	Constant monitoring of program memory shows error (so-called "Flash-test").		
	78	Cyclic RAM test	S ID 254	2	Constant monitoring of working memory shows error.		Note values of parameters (3895 and 3896). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
Control unit hardware	80	Power supply (Actuator)	S ID 254	2	Power supply for actuator not in the permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	83	Reference voltage 1	S ID 254	2	Reference voltage for actuator not in the permissible range.	Fault message (disappears when power again in the normal range). Auxiliary value 5 V	Check voltage supply. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	84	Reference voltage 2	S ID 254	2			
	85	Reference voltage 4	S ID 254	2			
	86	Internal temperature	171	12	Internal temperature for control unit not in permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	87	Atmospheric pressure	1 0 8	12	Atmospheric pressure not in permissible range.	Fault message (disappears when power again in normal range). Atmospheric pressure monitoring function de-activated.	
Program logic	90	Parameter fault (EEPROM retrieval or checksum faulty).	S ID 253	2	No data found or checksum of data is faulty (note: fault only occurs during setting of parameter / saving or reset.).	Engine cannot be started.	Check data for correct settings. Save parameters. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	93	Stack overflow	S ID 240	2	Internal calculation fault (so-called "Stack over flow" fault).	Emergency switch-off. Engine cannot be started.	Note parameters (3897 and 3898). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	94	Internal fa u lt	S ID 254	2			

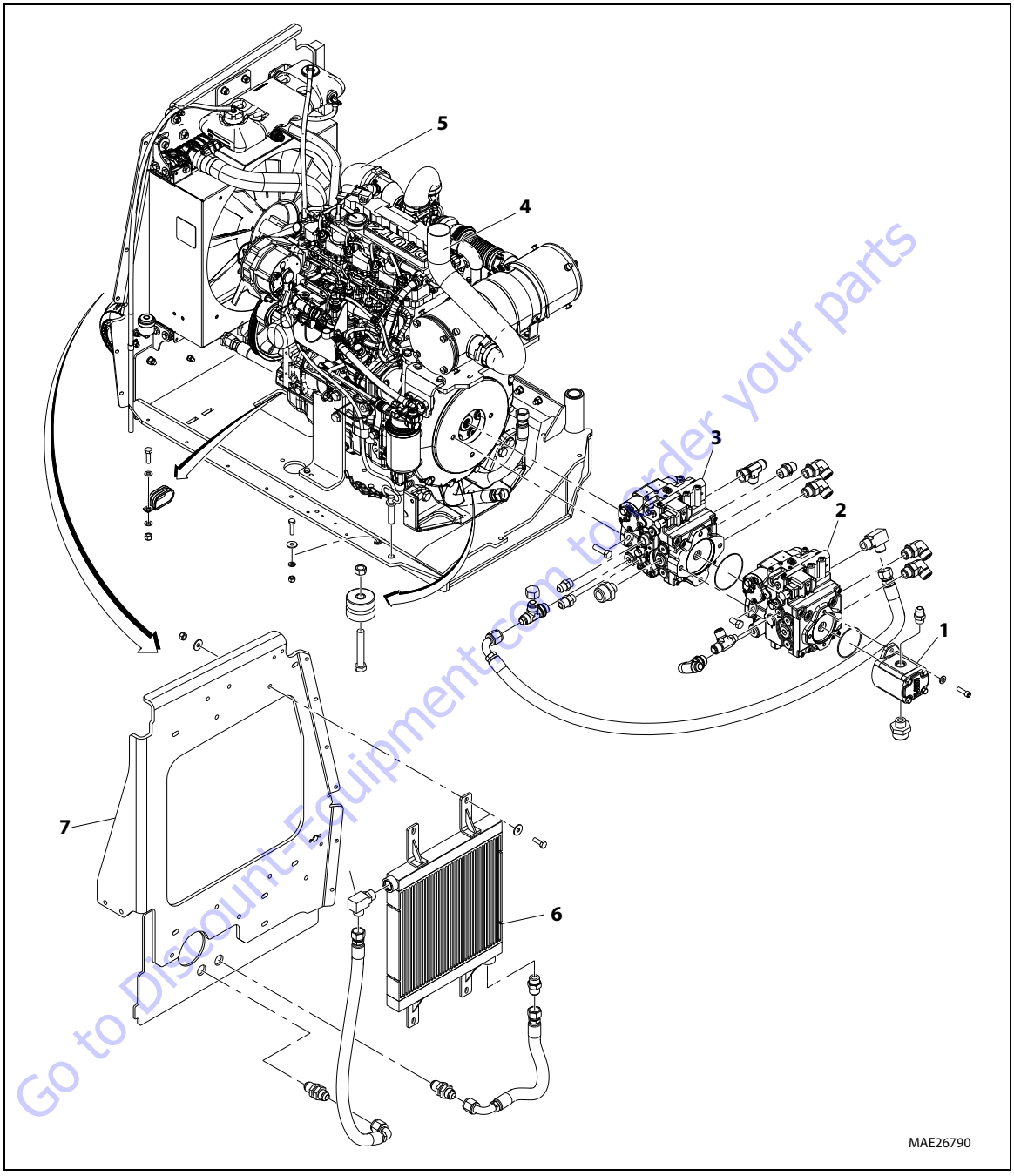
NOTE: *SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.*

3.12 DEUTZ TD 2.9 L4 GUO III ENGINE



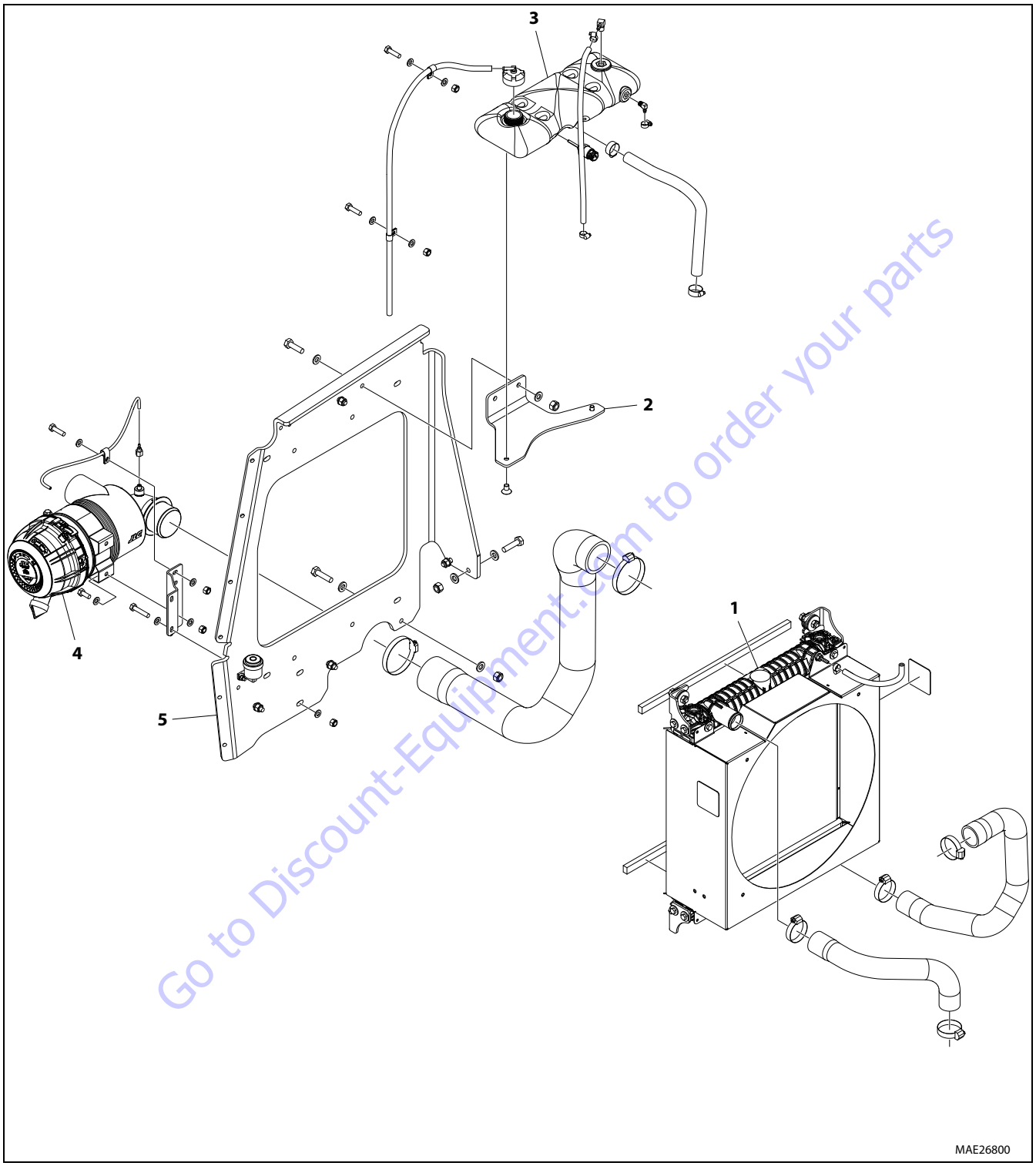
1. Fuel Tank
2. Deutz TD2.9L4 Engine and Pump Assembly
3. Fuel Filter
4. Fuel Supply Pump

Figure 3-31. Deutz TD 2.9 L4 GUO III Engine Installation



1. Gear Pump Assembly
2. Piston Pump Assembly - Rear
3. Piston Pump Assembly - Front
4. Exhaust Pipe
5. Deutz TD2.9L4 GUO III Engine Assembly
6. Hydraulic Oil Cooler
7. Support

Figure 3-32. Deutz TD 2.9 L4 GUO III Engine and Pumps Sub-Assembly



1. Radiator
2. Bracket
3. Surge Tank
4. Air Filter
5. Support
6. Pump Coupling
7. Bracket
8. Deutz TD2.9L4 GUO III Engine
9. Adapter
10. Fan
11. Pulley
12. Adapter
13. Tray
14. Bracket
15. Engine Mount
16. Engine Mount

Figure 3-33. Deutz TD 2.9 L4 GUO III Engine Assembly - Sheet 1 of 2

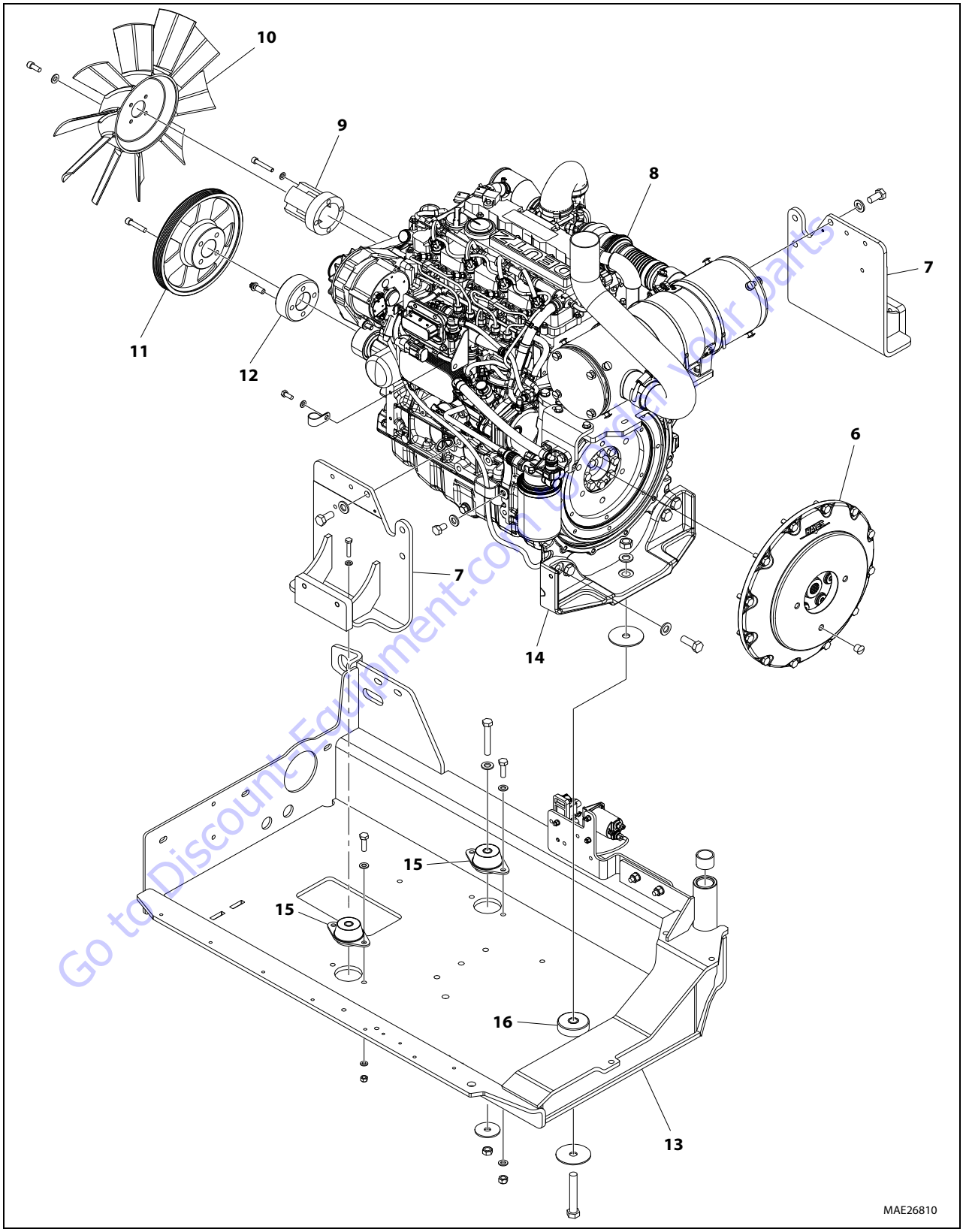
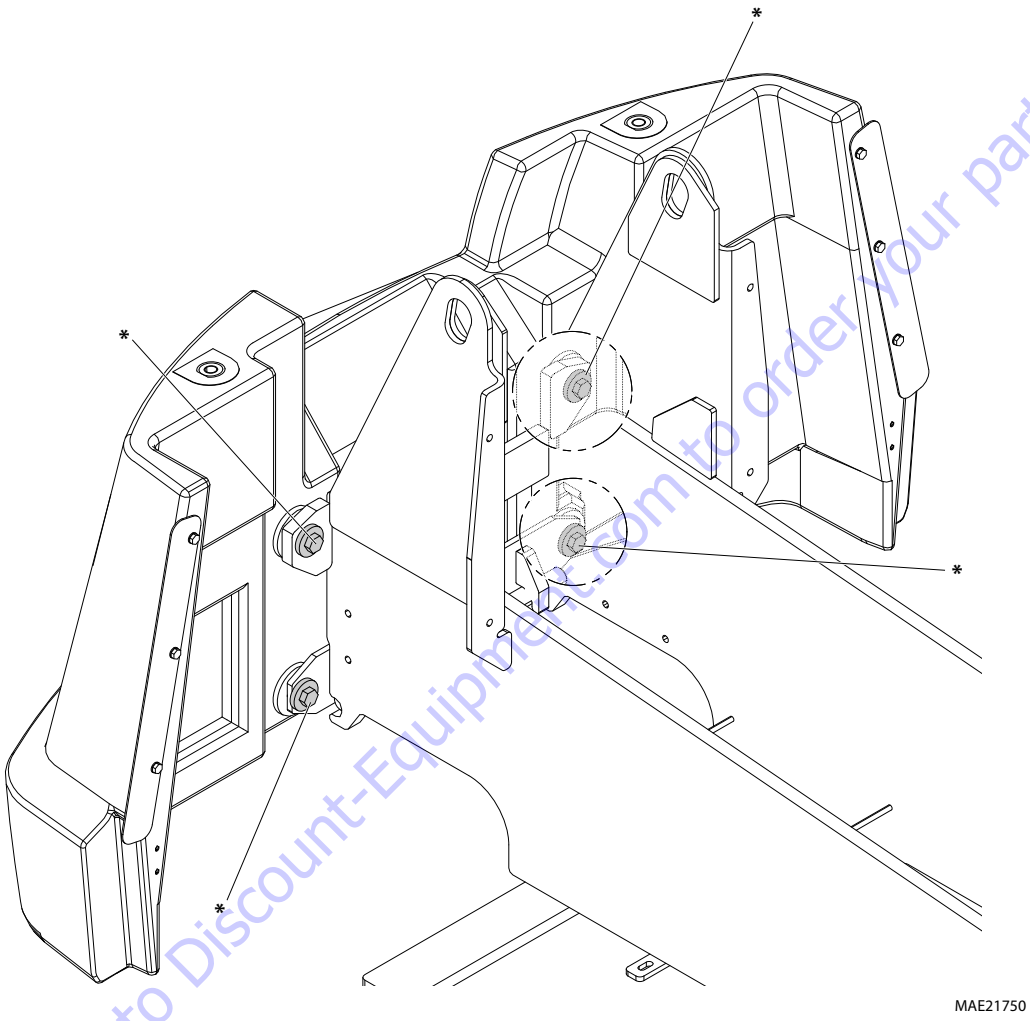


Figure 3-34. Deutz TD 2.9 L4 GUO III Engine Assembly - Sheet 2 of 2

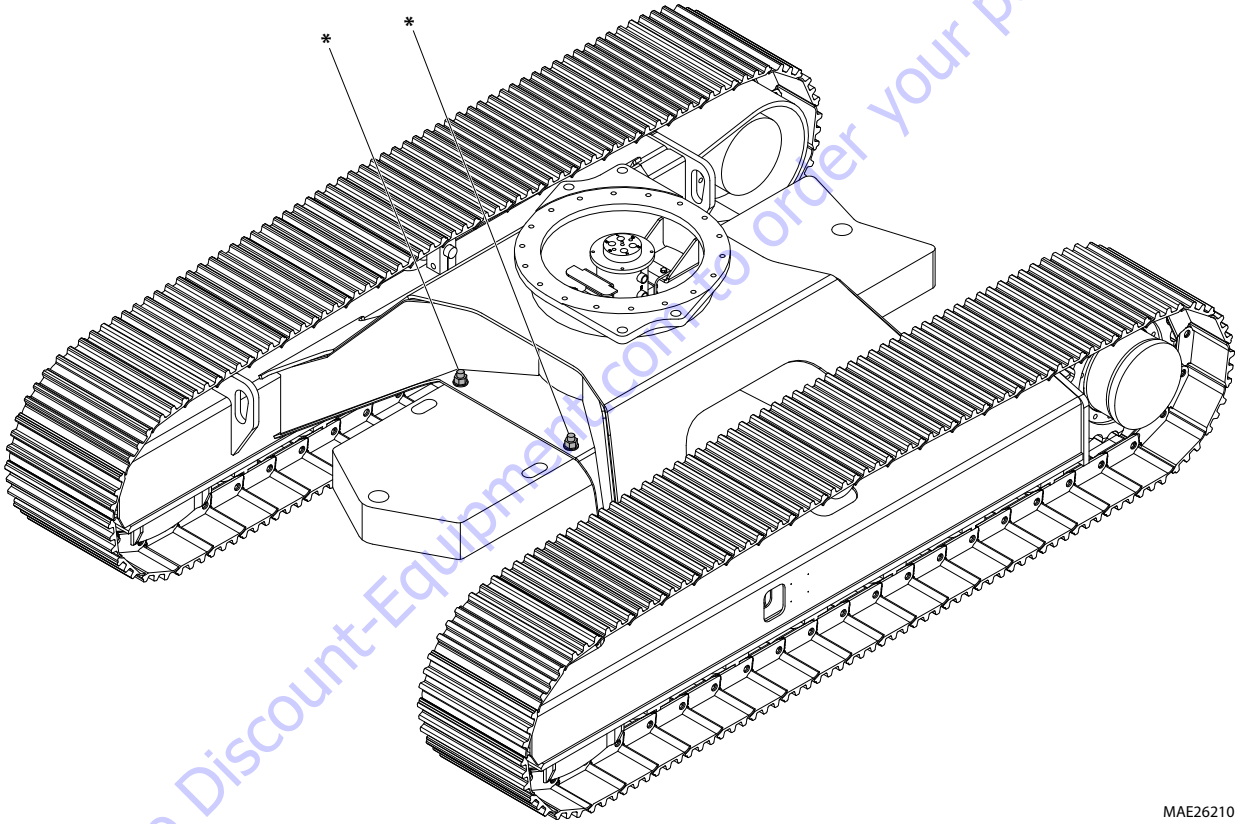
3.13 COUNTERWEIGHT

If the counterweight has been removed, ensure the retaining bolts are torqued to the proper value as shown in Figure 3-35., Counterweight Bolt Torque.



*Torque the bolts to 346 ft-lb (469 Nm)

Figure 3-35. Counterweight Bolt Torque



*Torque the bolts to 795 - 845 ft-lb (1078 - 1146 Nm)

Figure 3-36. Counterweight Bolt Torque

3.14 GENERATOR

Every 250 hours

Check drive belt tension every 250 hours of operation,.

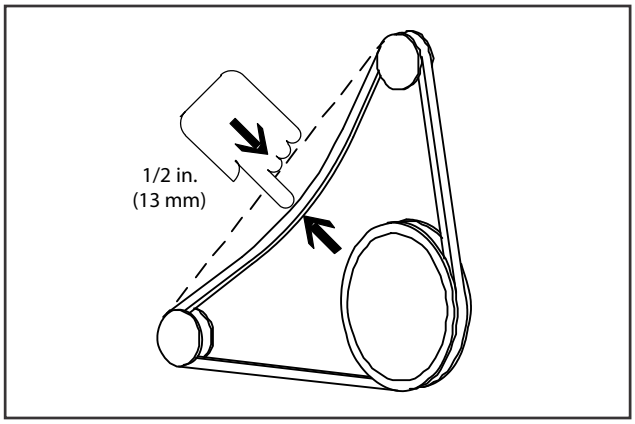


Figure 3-37. Generator Belt Tension

Every 500 hours

Service generator brushes and slip rings every 500 hours of operation. Hostile environments may require more frequent service.

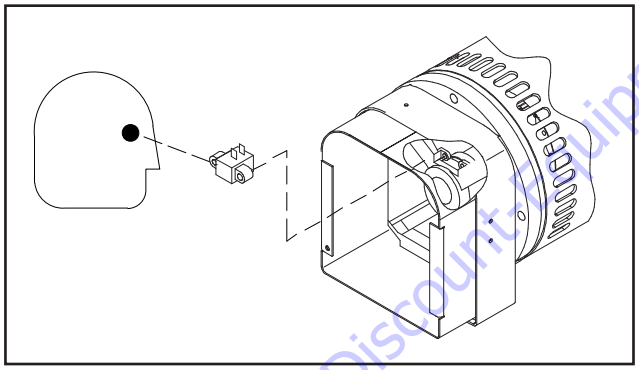


Figure 3-38. Generator Brushes and Slip Rings

Blow out inside of generator every 500 hours of service. If operating in a hostile environment, clean monthly.

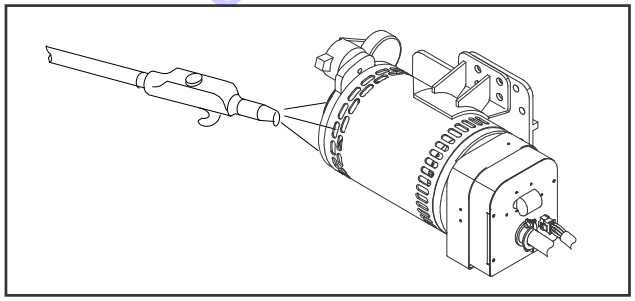


Figure 3-39. Generator Cleaning

Overload Protection

⚠ CAUTION

STOP ENGINE WHENEVER CHECKING OR INSPECTING CIRCUIT BREAKER.

The circuit breaker protects generator windings from overload. Generator output stops if circuit breaker opens.

If circuit breaker continues to open, check for faulty equipment connected to platform receptacles.

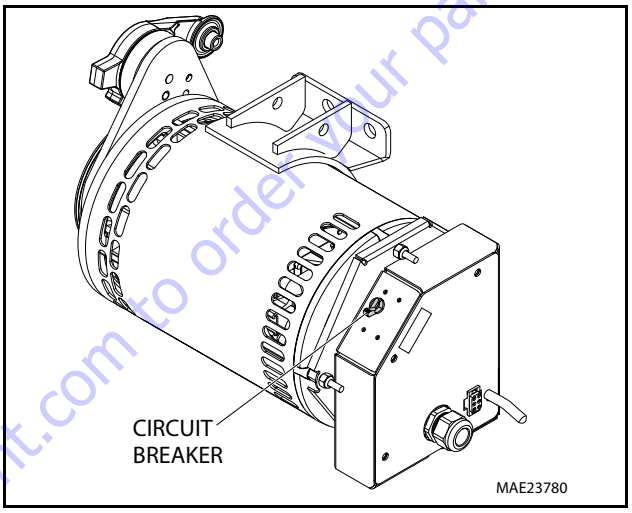


Figure 3-40. Generator Circuit Breaker Location (If Equipped with 2500W and 4000W)

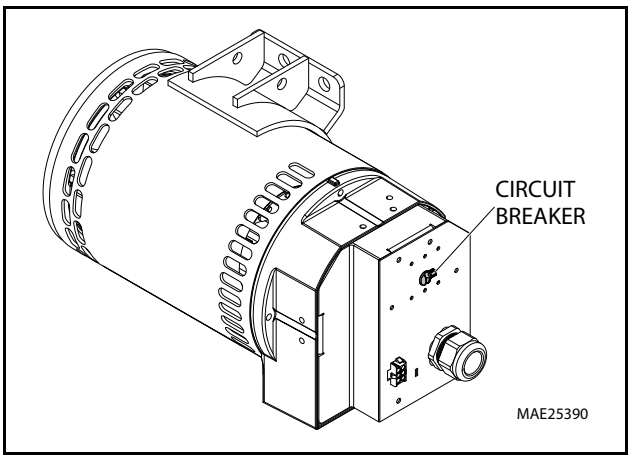


Figure 3-41. Generator Circuit Breaker Location (If Equipped with 7500W)

Inspecting Brushes, Replacing Brushes, and Cleaning Slip Rings

INSPECTING BRUSH POSITION

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

INSPECTING BRUSHES

1. Remove end panel. Inspect wires.
2. Remove brush holder assembly. Pull brushes from holders.
3. Replace brushes if damaged, or if brush is at or near minimum length.

CLEANING SLIP RINGS

1. Visually inspect the slip rings. Under normal use, the rings turn dark brown.
2. If slip rings are corroded or their surface is uneven, remove belt to turn shaft by hand for cleaning.
3. Clean rings with 220 grit emery paper. Remove as little material as possible. If rings are deeply pitted and do not clean up, consult generator factory service.
4. Reinstall belt, brush holder assembly, and end panel.

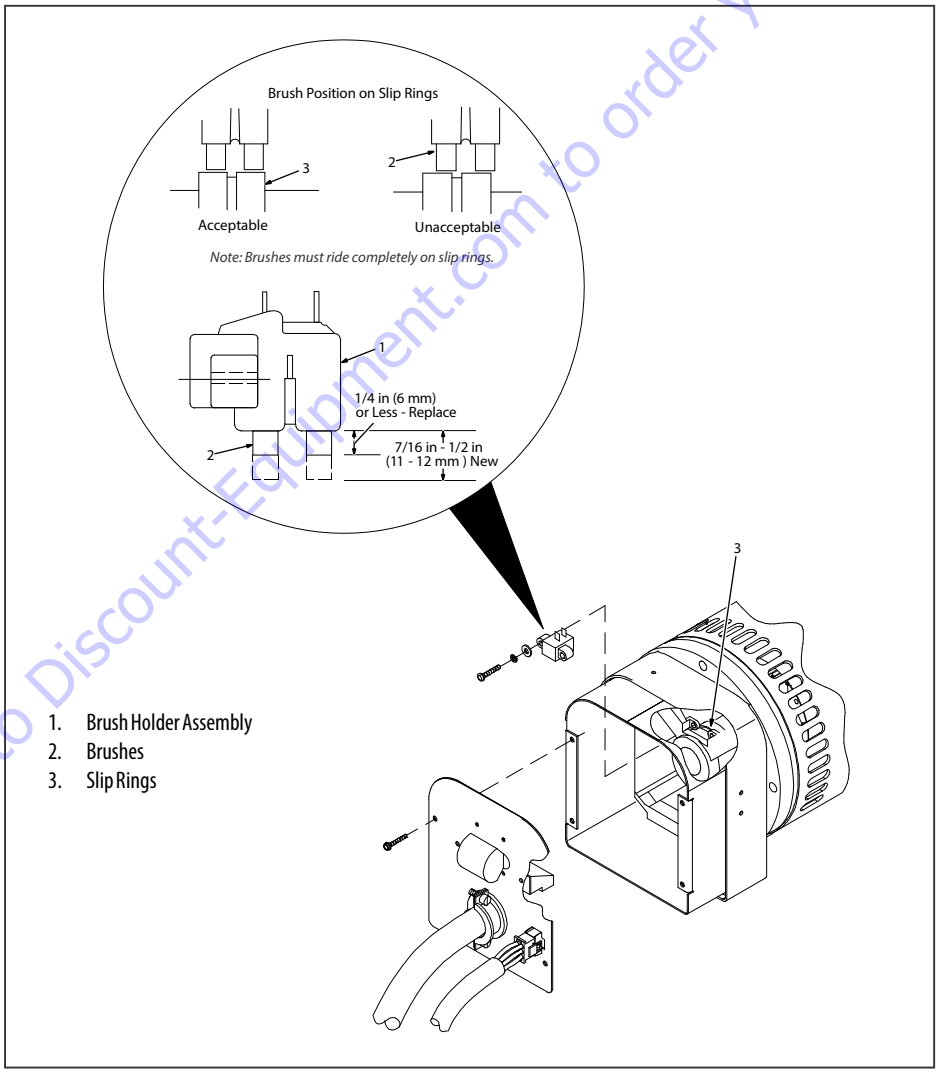


Figure 3-42. Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings

Troubleshooting

Table 3-3. Troubleshooting

Trouble	Remedy
No generator output at platform AC receptacles.	Be sure generator control switch is turned on at platform.
	Check and secure electrical connections at platform, generator, and control box.
	Be sure all equipment is turned off when starting unit.
	Reset circuit breaker CB1.
	Check plug PLG3 connection and/or connections at receptacles RC3 and RC5.
	Be sure + 12 volts DC input voltage is being supplied to control box.
	Check slip rings, wiring to brushes, and brush position on slip rings. Install new brushes if necessary.
	Disconnect leads 12 and 13 from brushes, and check continuity across slip rings (nominal reading is 26 ohms). Replace generator if rotor is open.
	Disconnect stator weld leads 1, 2, and 3 from circuit breaker CB1 , and check continuity between leads. Replace generator if necessary.
	Disconnect plug PLG4 and check continuity between exciter leads 5 and 6. Replace generator if necessary.
	Check power board PC1 and connections, and replace if necessary.
	Check control board PC2 and connections, and replace if necessary.
Low generator output at platform AC receptacles.	Verify generator is running at 3600 rpm (60 Hz) or 3000 rpm (50 Hz).
	Check slip rings, wiring to brushes, and brush position on slip rings. Install new brushes if necessary.
	Disconnect leads 12 and 13 from brushes, and check continuity across slip rings nominal reading is 26 ohms). Replace generator if rotor is open.
	Disconnect stator weld leads 1, 2, and 3 from circuit breaker CB1, and check continuity between leads. Replace generator if necessary.
	Disconnect plug PLG4 and check continuity between exciter leads 5 and 6. Replace generator if necessary.
	Check power board PC1 and connections, and replace if necessary.
	Check control board PC2 and connections, and replace if necessary.
High generator output at platform AC receptacles.	Verify generator is running at 3600 rpm (60 Hz) or 3000 rpm (50 Hz).
	Check slip rings, wiring to brushes, and brush position on slip rings. Install new brushes if necessary.
	Check power board PC1 and connections, and replace if necessary.
	Check control board PC2 and connections, and replace if necessary.
Erratic generator output at platform AC receptacles.	Check and secure electrical connections at platform, generator, and control box.
	Verify generator is running at 3600 rpm (60 Hz) or 3000 rpm (50 Hz).
	Check slip rings, wiring to brushes, and brush position on slip rings. Install new brushes n necessary.
	Disconnect leads 12 and 13 from brushes, and check continuity across slip rings nominal reading is 26 ohms). Replace generator if rotor is open.
	Check power board PC1 and connections, and replace if necessary
	Check control board PC2 and connections, and replace if necessary

Generator Disassembly and Assembly

Refer to Figure 3-60. and Figure 3-61. to determine if trouble is in stator, rotor, control box, or combination of these components.

1. Rotor
2. Stator Assembly

⚠ CAUTION

DO NOT DAMAGE ROTOR OR STATOR WINDINGS DURING DISASSEMBLY AND ASSEMBLY PROCEDURE.

DISASSEMBLY

1. Mark and disconnect all electrical leads, secure using cable ties.
2. Remove brush holder assembly.
3. Disassemble generator parts shown in Figure 3-59.
4. Clean all parts with approved solvent and dry with compressed air, If applicable.

ASSEMBLY

1. Assemble generator parts using torque values in table.
2. Reconnect all leads. Use cable ties to secure leads away from moving or hot parts.

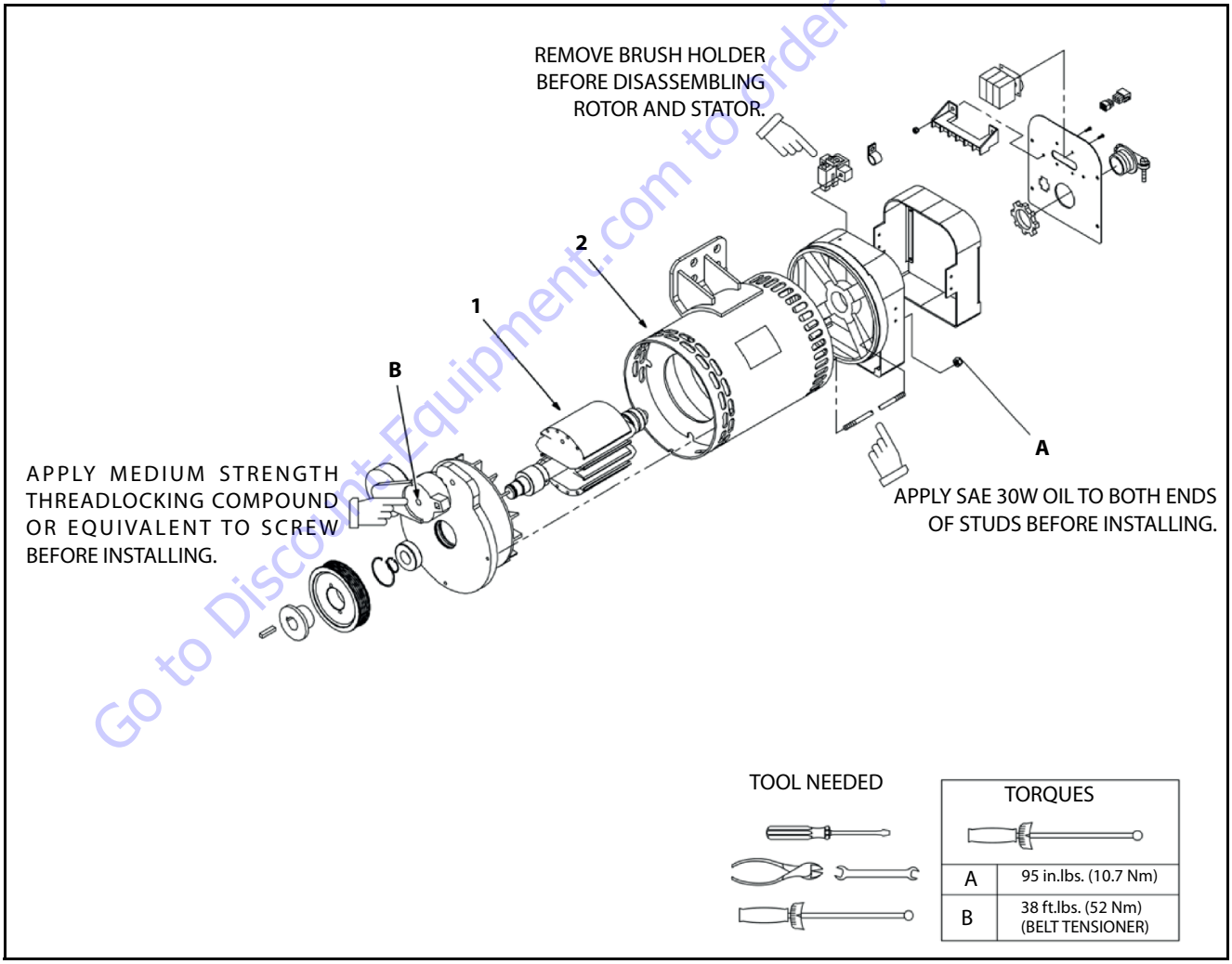


Figure 3-43. Generator Disassembly and Assembly

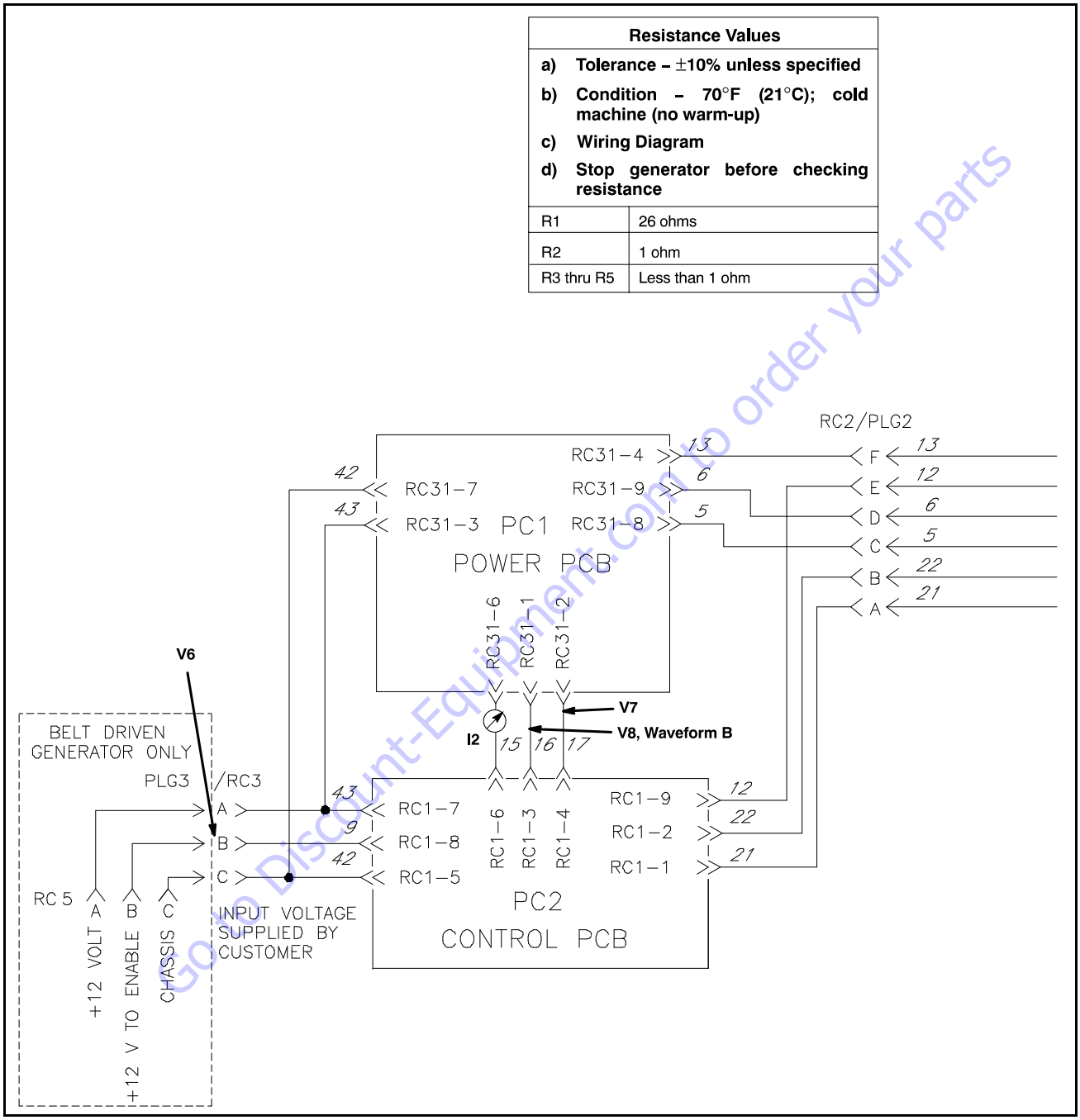
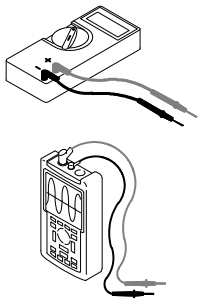


Figure 3-44. Generator Troubleshooting Circuit Diagram (Sheet 1 of 2)

Test Equipment Needed:



Amperage Readings	
a) Tolerance – ±5% unless specified b) Condition – 70°F (21°C); cold machine (no warm-up); no load	
I1	1 amps DC (60 Hz) No greater than 3.5 amps DC under load
I2	1 amps DC (60 Hz) No greater than 3.5 amps DC under load

Voltage Readings	
a) Tolerance – ±10% unless specified b) Condition – 70°F (21°C); cold machine (no warm-up); no load c) Weld/power rpm unless specified d) Reference – single arrow: reference to circuit common (lead 42); double arrow: reference to points indicated e) Wiring Diagram	
V1	Rotor: +25 volts DC at no load ±20%; +75 volts DC at full load ±10%
V2	Exciter: 150 volts AC
V3	Voltage Feedback: 240 volts AC
V4	Output (Odd Leg): 245 volts AC
V5	Output: 120 volts AC
V6	Generator Enable: +12 volts DC when generator is enabled (On); 0 volts DC when not enabled (Off)
V7	Shutdown Signal: +12 volts DC when shutdown is latched; 0 volts DC when not latched
V8	PWM Signal: 0 to +15 volts DC

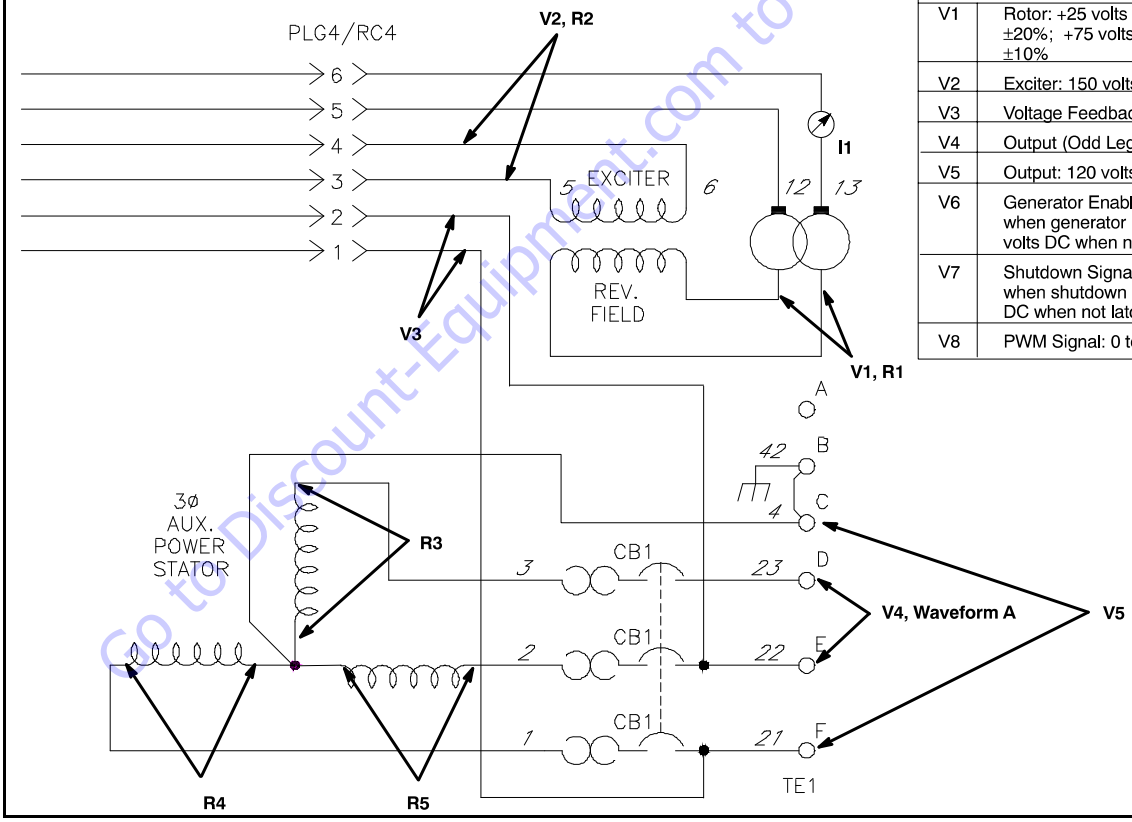


Figure 3-45. Generator Troubleshooting Circuit Diagram (Sheet 2 of 2)

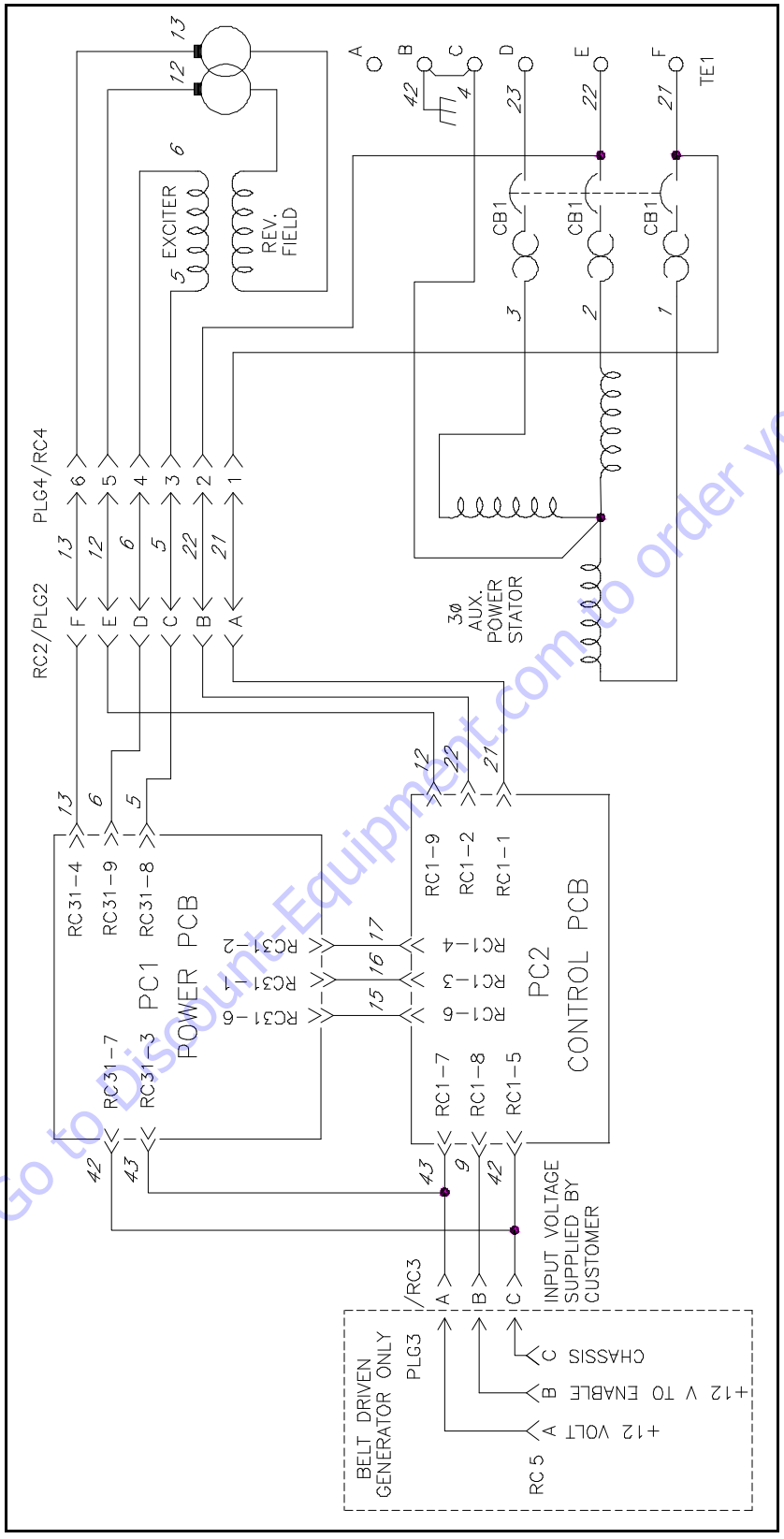


Figure 3-46. Generator Electrical Circuit Diagram

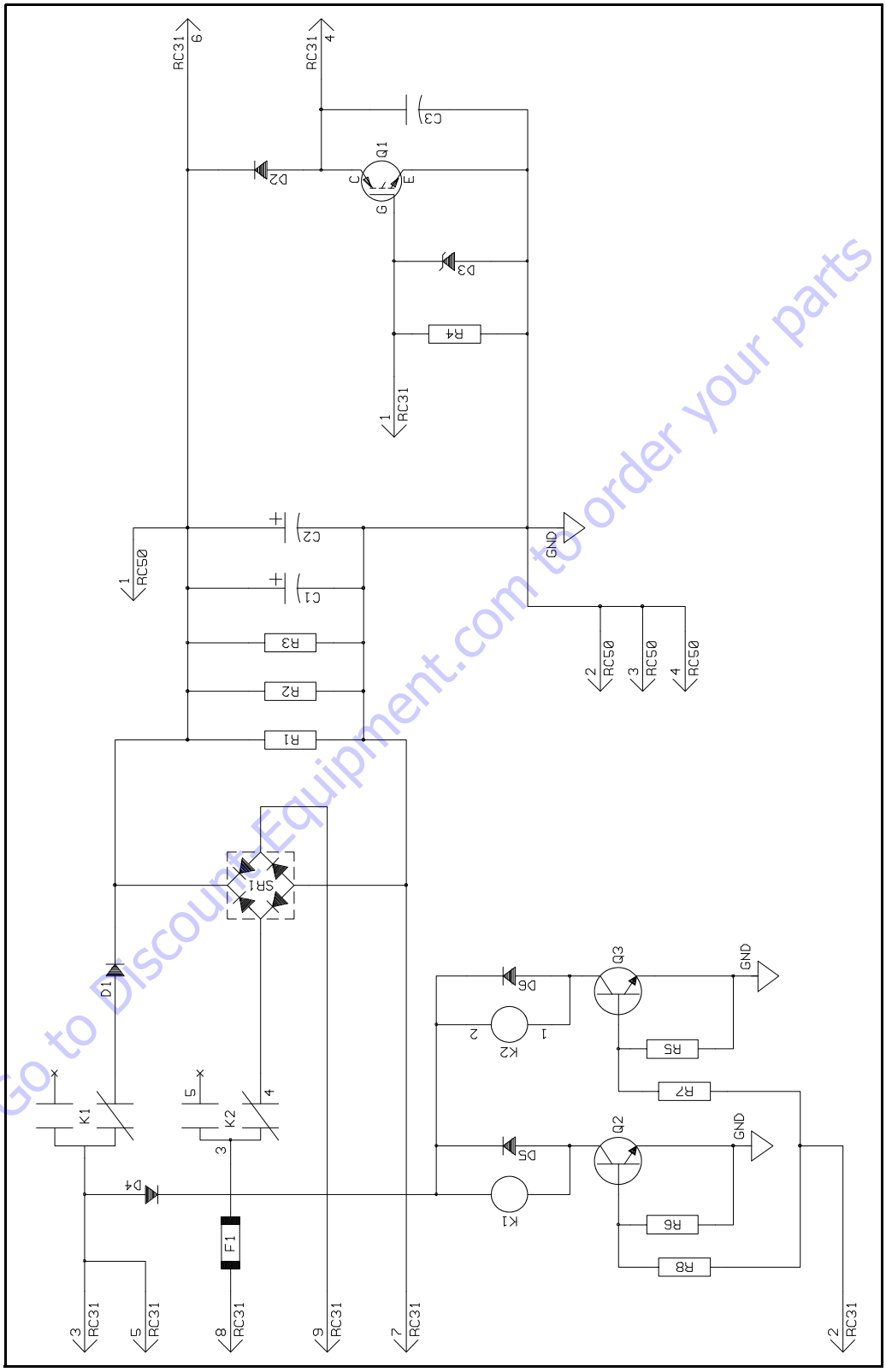


Figure 3-47. Power Board PC1 Electrical Circuit Diagram

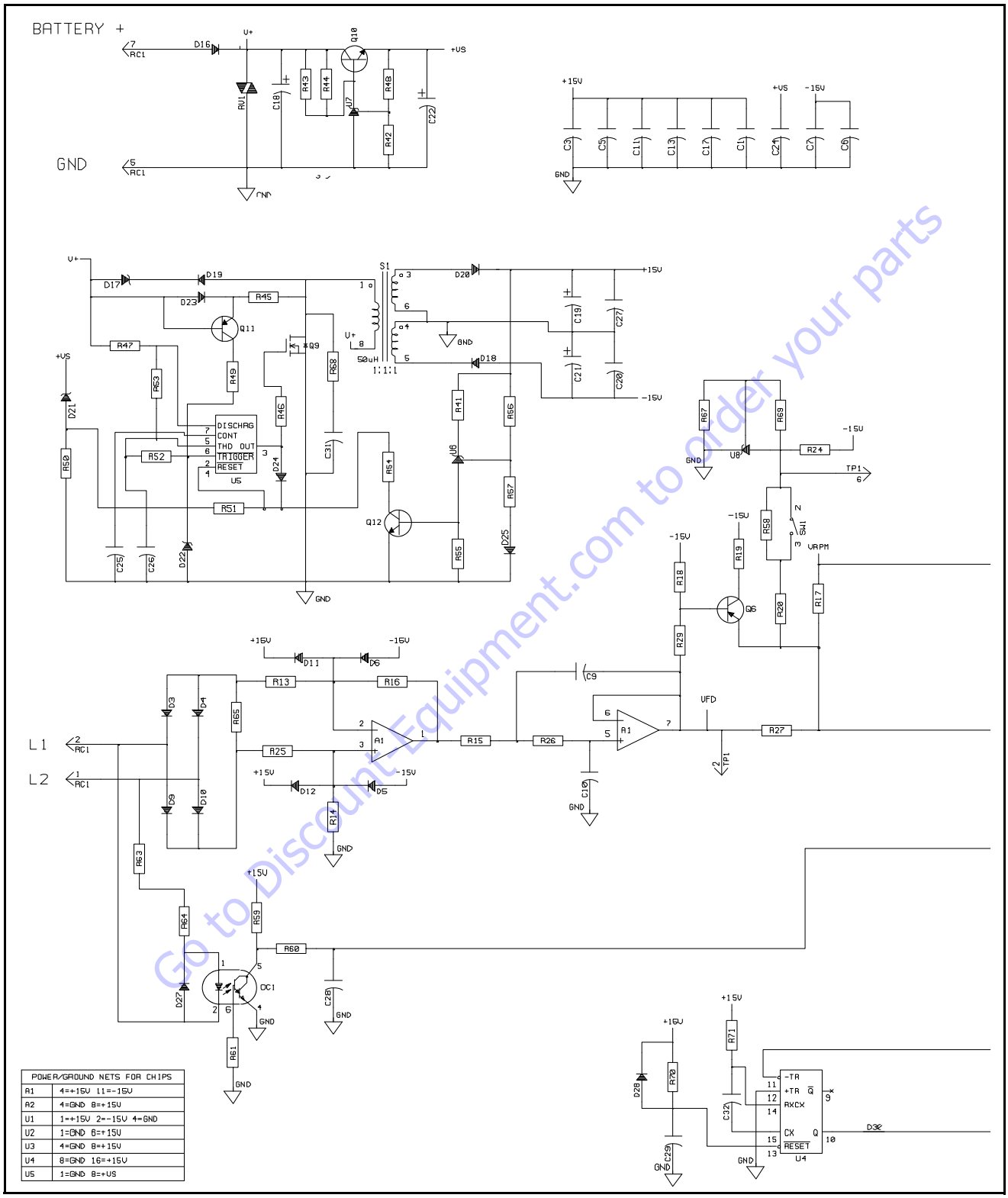


Figure 3-48. Power Board PC2 Electrical Circuit Diagram (Sheet 1 of 2)

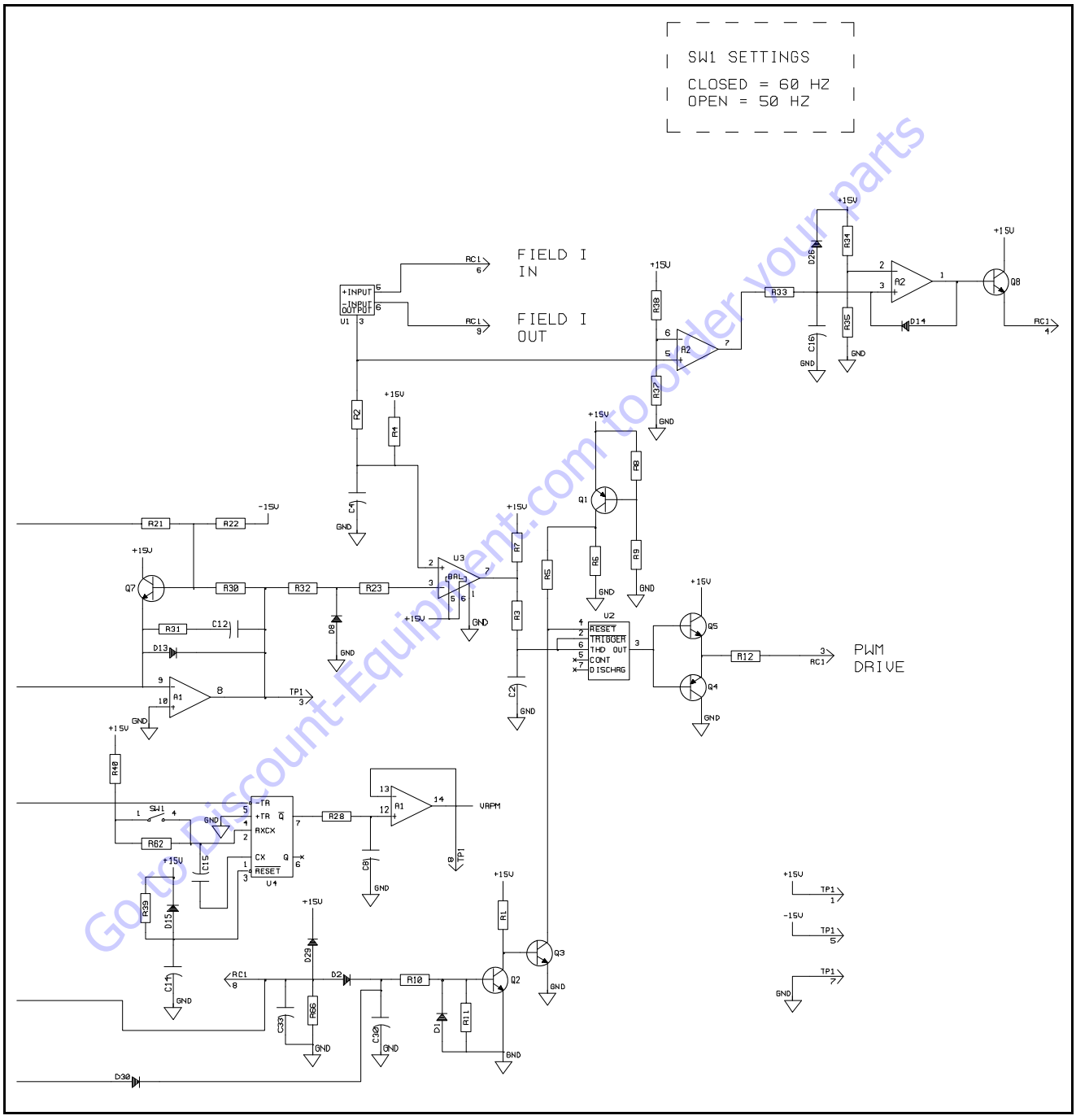


Figure 3-49. Power Board PC2 Electrical Circuit Diagram (Sheet 2 of 2)

Lead Connection List for Generator

NOTE: *Table shows physical lead connections and should be used with circuit diagram (table replaces wiring diagram).*

NOTE: *Apply small amount of dielectric grade, non conductive electric grease to connectors where factory-applied grease had been present.*

Table 3-4. Lead Connection List for Generator

Leads	Connections
1A	STATOR TO CB1
2A	STATOR TO CB1
3A	STATOR TO CB1
4A	STATOR TO TE1 (C)
5A	STATOR TO RC4 (3)
5B	PLG2 (C) TO PLG4 (3)
5C	RC2 (C) PLG31 (8)
6A	STATOR TO RC4 (4)
6B	PLG2 (D) TO PLG4 (4)
6C	RC2 (D) PLG31 (9)
9A	RC5 (B) TO PLG3 (B) (Customer Supplied)
9B	RC3 (B) PLG1 (8)
12A	PLG2 (E) TO PLG4 (5)
12B	RC2 (E) PLG1 (9)
12C	RC4 (5) TO BRUSH
13A	PLG2 (F) TO PLG4 (6)
13B	RC2 (F) PLG31 (4)
13C	RC4 (6) TO BRUSH
15A	PLG1 (6) TO PLG31 (6)
16A	PLG1 (3) TO PLG31 (1)
17A	PLG1 (4) TO PLG31 (2)
21A	CB1 TO TE1 (F)
21B	PLG2 (A) TO PLG4 (1)
21C	PLG1 (1) TO RC2 (A)
21D	RC4 (1) TO CB1
22A	CB1 TO TE1 (E)
22B	PLG2 (B) TO PLG4 (2)
22C	PLG1 (2) TO RC2 (B)
22D	RC4 (2) TO CB1
23A	CB1 TO TE1 (D)
42A	RC5 (C) TO PLG3 (C) (Customer Supplied)
42B	RC3 (C) TO CONNECTION POINT 1
42C	PLG31 (7) TO CONNECTION POINT 1
42D	PLG1 (5) TO CONNECTION POINT 1
42F	END BELL SHROUD TO ENGINE MOUNT
42G	CHASSIS TO TE1 (B)
43A	RC5 (A) TO PLG3 (A) (Customer Supplied)
43B	RC3 (A) TO CONNECTION POINT 2
43C	PLG31 (3) TO CONNECTION POINT 2
43D	PLG1 (7) TO CONNECTION POINT 2

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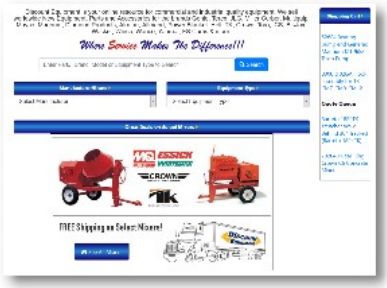

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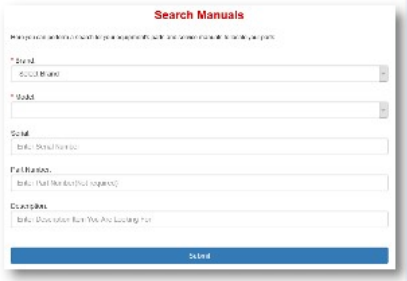

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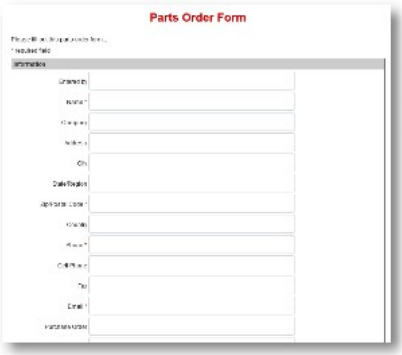

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SECTION 4. BOOM & PLATFORM

⚠ WARNING

CRUSH HAZARD. DO NOT SUPPORT THE BOOM WITH A BOOM PROP OR CRANE OR ALLOW THE PLATFORM TO REST ON THE GROUND WHEN SERVICING BOOM COMPONENTS. BOOM MUST BE ON BOOM REST OR COMPLETELY REMOVED FROM MACHINE WHEN SERVICING. FAILURE TO COMPLY COULD RESULT IN DEATH OR SERIOUS INJURY.

4.1 TRANSPORT POSITION SENSING SYSTEM

The transport position sensing system consists of a boom angle sensor (this sensor is a hall effect sensor with built-in redundancy) mounted at the pivot point between the main boom and tension link. The system uses this sensor to sense if the boom is in the position associated with high speed travel. The control circuit reads two redundant angular sensor signals from the boom angle sensor. Above transport angle is recognized when one angular sensor signal from the boom angle sensor reads more than 5° greater than horizontal (with respect to the turntable) and resets to within transport position when both angular sensor signals read less than 3° greater than horizontal (with respect to the turntable). The position of the articulated jib is not considered. This system is used to control the following systems:
Beyond Transport - Drive Speed Cutback System
Drive/Steer – Boom Function Interlock System

4.2 BEYOND TRANSPORT - DRIVE SPEED CUTBACK SYSTEM

When the boom is positioned beyond the transport position, the drive motors are automatically restricted to their maximum displacement position (slow speed). See the Tilt Indicator System for interaction with the tilt sensor.

4.3 DUAL CAPACITY SYSTEM

The dual capacity selection and indicator system consists of a capacity mode toggle switch at the platform control box, a set of redundant proximity sensors to detect boom extension, and a main boom angle sensor.

The control system obtain the platform load from Platform Load Sensing System (LSS) and determines the working zone:
• 660SJC: 550 lb (250 kg) unrestricted, 750 lb (340 kg) restricted.

The light indicator in the platform control box will change to match the selected mode, unless there is a system DTC that forces the machine into the restricted mode. The system uses the boom extension proximity sensors and boom angle sensor to prevent the platform from entering the unrestricted zone if the restricted mode is selected.

When the dual capacity switch is in the restricted position, the platform will move but stop at the boundaries of the restricted zone. The platform will not be able to enter the unrestricted zone. When the machine control system senses the platform is already on the boundaries of the restricted zone, it only allows the retraction of the boom or lifting up of the boom as these movements place the platform further away from the unrestricted zone.

In case the platform is already inside the restricted zone and the dual capacity switch is flipped to the unrestricted position at that time, the machine will only allow the boom to retract and will only allow the boom to lift up, as these movements will bring the platform towards the restricted zone.

When the dual capacity switch is in the unrestricted position, the platform can go anywhere within the whole boundaries.

4.4 PLATFORM LOAD SENSING SYSTEM

The Platform Load Sensing System consists of a single load cell mounted within the platform support. This system compares the capacity mode recognized by the triple capacity system to the measured weight in the platform.When the platform capacity is exceeded or when there is a fault in the system, the platform overload indicator will flash, the platform alarm will sound at the rate of 5 sec on / 2 sec off and all platform function controls (except auxiliary power) will be disabled.The ground controls are unaffected unless configured otherwise in the machine setup selection.

4.5 ELECTRONIC PLATFORM LEVELING

The Electronic Platform Leveling System simulates a conventional master/slave cylinder arrangement by adjusting the leveling cylinder stroke based on the boom angle changes during the lift operation. The system uses two rotary angle sensors (Internally Redundant Hall Effect Sensors), one to measure the main boom angle relative to the tension link and one to measure the platform angle relative to the main boom.
The first angle sensor is mounted concentric with the pin that connects the base boom to the tension link. As the boom rises or lowers the sensor sends a signal to the UGM which determines, through an algorithm that considers the boom linkage geometry, the required angle at the second sensor.
For 660SJC, the sensor is mounted with the pin between fly boom and jib pivot. As the level cylinder in the fly boom is activated to adjust the angle between the platform and the fly boom the angle sensor signal is sent to the UGM. Once the required platform to fly boom angle (as determined by the UGM based on the first sensors input) is reached the movement of the level cylinder is stopped. This leveling system operates like a conventional master/slave cylinder system, meaning that it will not correct level relative to gravity but maintain the platform angle relative to gravity as it was manually set by the operator prior to activation of the lift function.

4.6 FUEL LEVEL CUTOUT SYSTEM

The Fuel Shutoff System senses when the fuel level is getting low and automatically shuts the engine down before the fuel tank is emptied. When the fuel level gets below 1.2 gallons, the fault light will flash at the platform controls and the control system will report fault 0/0 "FUEL LEVEL LOW – ENGINE SHUT-DOWN" on the analyzer. There is an analyzer personality setting in the control system to control the machines response to this fault. With the "RESTART" setting, the operator will be able to start the engine and run for 2 minutes. After 2 minutes, the engine will shut off and a power cycle will allow the engine to run for 2 more minutes. With the "ENGINE STOP" setting, the machine will remain in this fault mode until the fuel level is returned to a level above 1.2 gallons. With the "ONE RESTART" setting, the operator will be able to start the engine and run for 2 minutes. After 2 minutes, the engine will shut off for a second time and the machine will return to the "Engine Shut-down" fault mode. The machine will then stay in this mode until the fuel level is returned to a level above 1.2 gallons.

4.7 GROUND CONTROL KEYSWITCH SYSTEM

The ground control keyswitch is used for selecting the active control of the machine between the platform or ground control stations and as another shut off switch for machine power. On the standard keyswitch, the key is removable only in the off position. This allows the ground control station to have ultimate priority over the platform control.

4.8 FUNCTION SPEED CONTROL SYSTEM

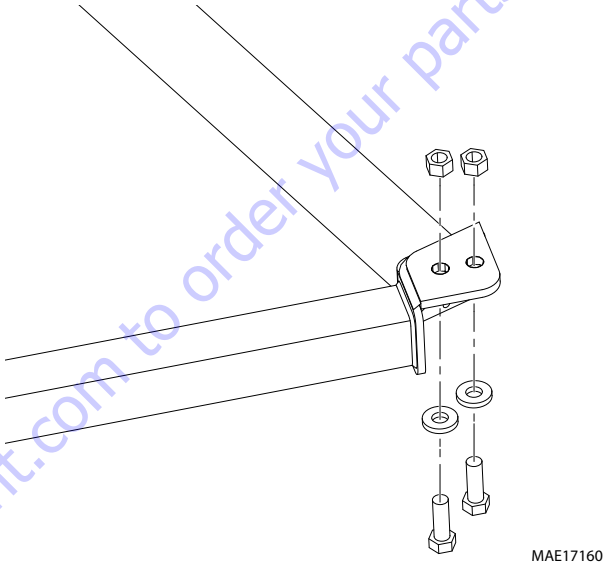
The platform controls for the platform rotate, platform level, jib lift, telescope, and tower lift functions are controlled through a common variable speed control knob. This knob provides a common control signal allowing a smooth ramp up, controlled maximum output speed, and ramp down. Each function has its own personality settings allowing the characteristics of each function to be modified using the standard analyzer. Not all functions will respond the same to the changes in the function speed knob position.

The variable speed control knob when turned counterclockwise and into the detent position (shown with a snail on the control panel decal), will place all functions, including proportional functions, in creep.

4.9 PLATFORM

Support Removal

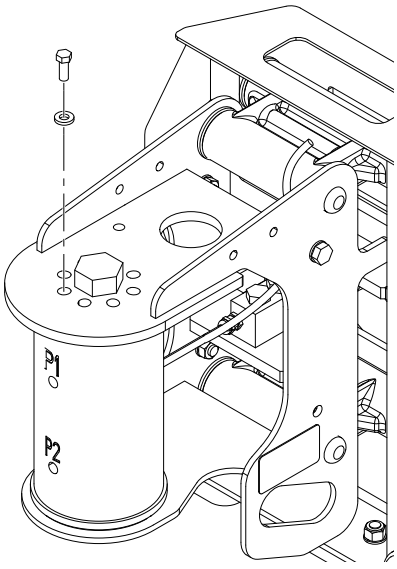
1. Disconnect electrical cables from control console.
2. Tag and disconnect the hydraulic lines from the rotator. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
3. Remove the bolts securing the platform to the platform support, then remove the platform.



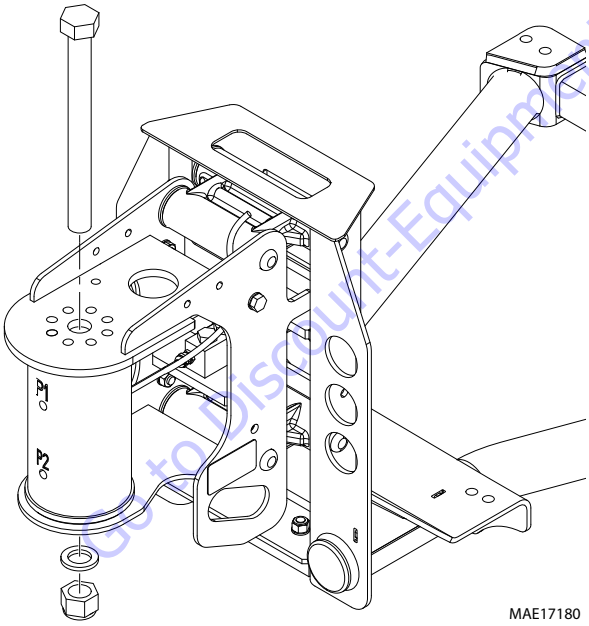
4. Using a suitable lifting device, support the platform support.

NOTE: *The platform support weighs approximately 125 lb (56.7 kg).*

5. Remove the bolts and washers securing the support to the rotator.



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

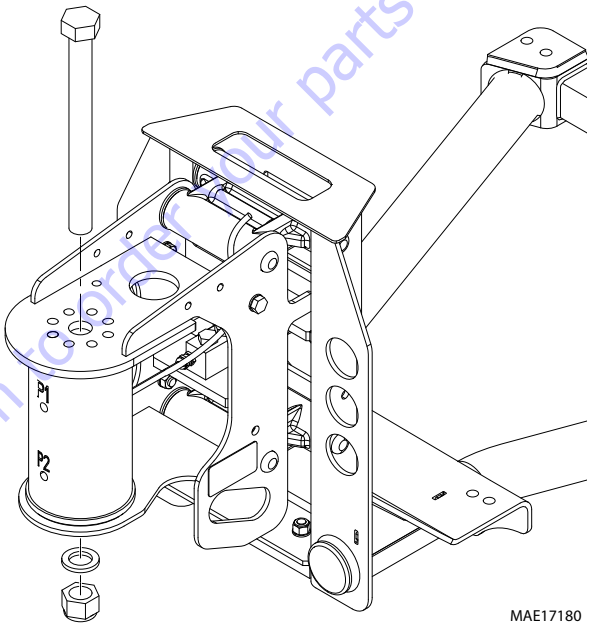


Support Installation

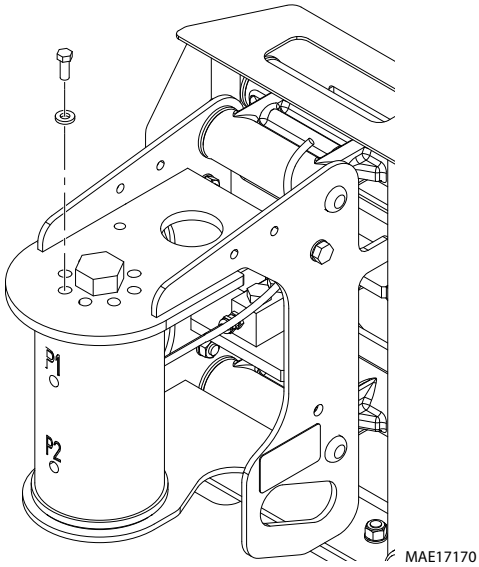
1. Using a suitable lifting device, support the platform support and position it on the rotator.

NOTE: *The platform support weighs approximately 125 lb (56.7 kg).*

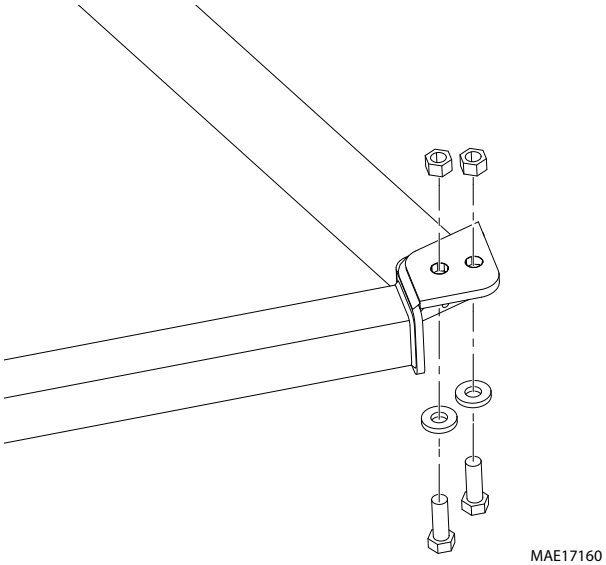
NOTE: *Install the rotator center bolt.*



2. Apply Medium Strength Threadlocking Compound to the bolts and washers securing the support to the rotator and install the bolts and washers.

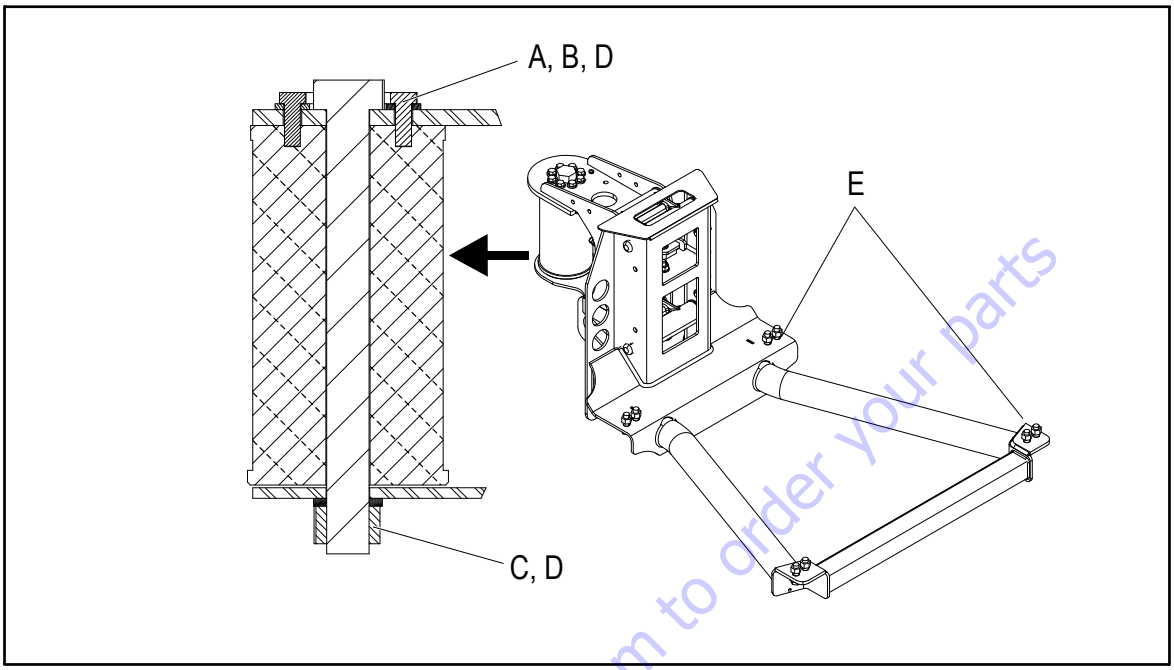


3. Torque the nut on the rotator center bolt to 586 ft. lbs. (795 Nm). Torque the retaining bolts to 40 ft. lbs. (55 Nm).
4. Position the platform on the platform support and install the bolts securing the platform to the platform support.



MAE17160

5. Remove tag and reconnect the hydraulic lines to the rotator.
6. Connect the electrical cables to the platform control console.



A - Torque to 40 ft-lb (55 Nm)

B - Medium Strength Threadlocking Compound

C - Torque to 586 ft-lb (795 Nm)

D - Check torque every 150 hours of operation

E - Torque to 65 ft-lb (88 Nm)

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

Figure 4-1. Platform Support Torque Values

4.10 ROTATOR AND SLAVE CYLINDER

NOTE: *Refer Figure 4-2., Removal of Components - Rotator and Platform Level Cylinder.*

Removal

1. Tag and disconnect hydraulic lines from the rotator. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
2. Supporting the rotator, remove hardware from pin (1). Using a suitable brass drift and hammer remove pin (1) from the jib assembly.
3. Remove the hardware from pin (2). Using a suitable brass drift and hammer, remove pin (2) from the jib assembly and remove the rotator.
4. Telescope the fly section out approximately 20 in. (50.8 cm) to gain access to the slave leveling cylinder.
5. Remove the hardware from pin (3). Using a suitable brass drift and hammer remove pin (3) from the jib assembly.
6. Supporting the slave cylinder, remove the hardware from pin (4). Using a suitable brass drift and hammer remove pin (4) from the fly boom.

Assembly/Disassembly

For detail assembly/disassembly instruction, Refer Rotary Actuator Manual (PN 3128848).

Installation

1. Telescope the fly section out approximately 20 in. (50.8 cm) to gain access to the slave leveling cylinder.
2. Support the slave cylinder. Using a suitable brass drift and hammer, install pin (4) to the fly boom.
3. Using a suitable brass drift and hammer, install pin (3) to the jib assembly.
4. Support the rotator. Using a suitable brass drift and hammer, install pin (2) to the fly boom and install the rotator.
5. Using a suitable brass drift and hammer, install pin (1) to the rotator.
6. Remove tag and reconnect the hydraulic lines to the rotator and the slave cylinder.

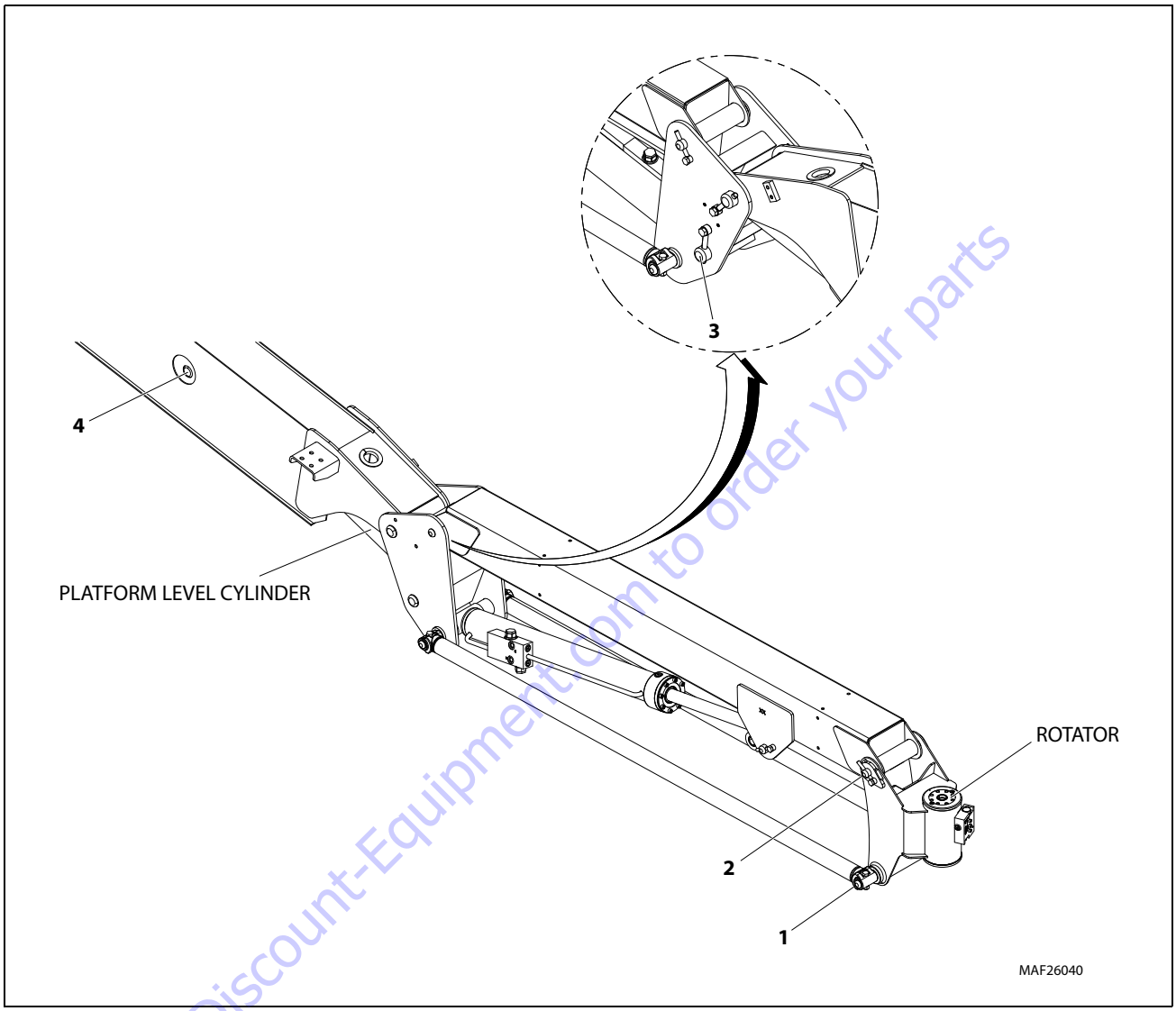


Figure 4-2. Removal of Components - Rotator and Platform Level Cylinder

4.11 MAIN BOOM ASSEMBLY

Removal

NOTE: *Refer to Figure 4-3., Boom Assembly Removal and Installation.*

1. Level the boom and support boom assembly and tower link with adequate lifting equipment as shown below.
2. Use a ratchet strap to bind the tower link to boom.

NOTE: *The boom alone weighs approximately 2792 lb (1269 kg). Including the powertrack, slave cylinder, rotator, jib, platform and platform support the assembly weighs approximately 7500 lb (3400 kg).*

3. Tag and disconnect all electrical connections from the boom assembly.
4. Tag, disconnect and cap hydraulic lines from telescope cylinder and boom lift cylinder. Use an adequate container to catch any residual hydraulic fluid.

NOTICE

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

5. Tag and disconnect hydraulic lines from boom to the main control valve. Use an adequate container to catch any residual hydraulic fluid. Cap or plug all open hydraulic lines and ports.
6. Remove retaining bolt, keeper pin, and pin (1) securing the tower link to the turntable.
7. Lift and move forward the boom assembly with tower link and boom lift cylinder to gain the access to boom pivot pin (2). Ensure tension link pivot pin is above the turntable lifting point.
8. Insert an adequate metal rod into the lifting eye holes to support the tension link.
9. Remove retaining bolt, keeper pin, and pin securing the main boom pivot pin (2) to the tension link.
10. Remove complete boom assembly and lift cylinder with tower link and lift cylinder from the machine and place it on a suitable support.
11. Support the boom lift cylinder and remove retaining bolts, keeper pins, and pins (3 and 4) securing the lift cylinder and tower link to the boom assembly.
12. Remove the boom assembly.
13. If required, remove retaining bolt, keeper pin, and pin (5) securing tension link to the turntable and place it on an adequate support.

NOTE: *The tension link weighs approximately 419 lb (190 kg).*

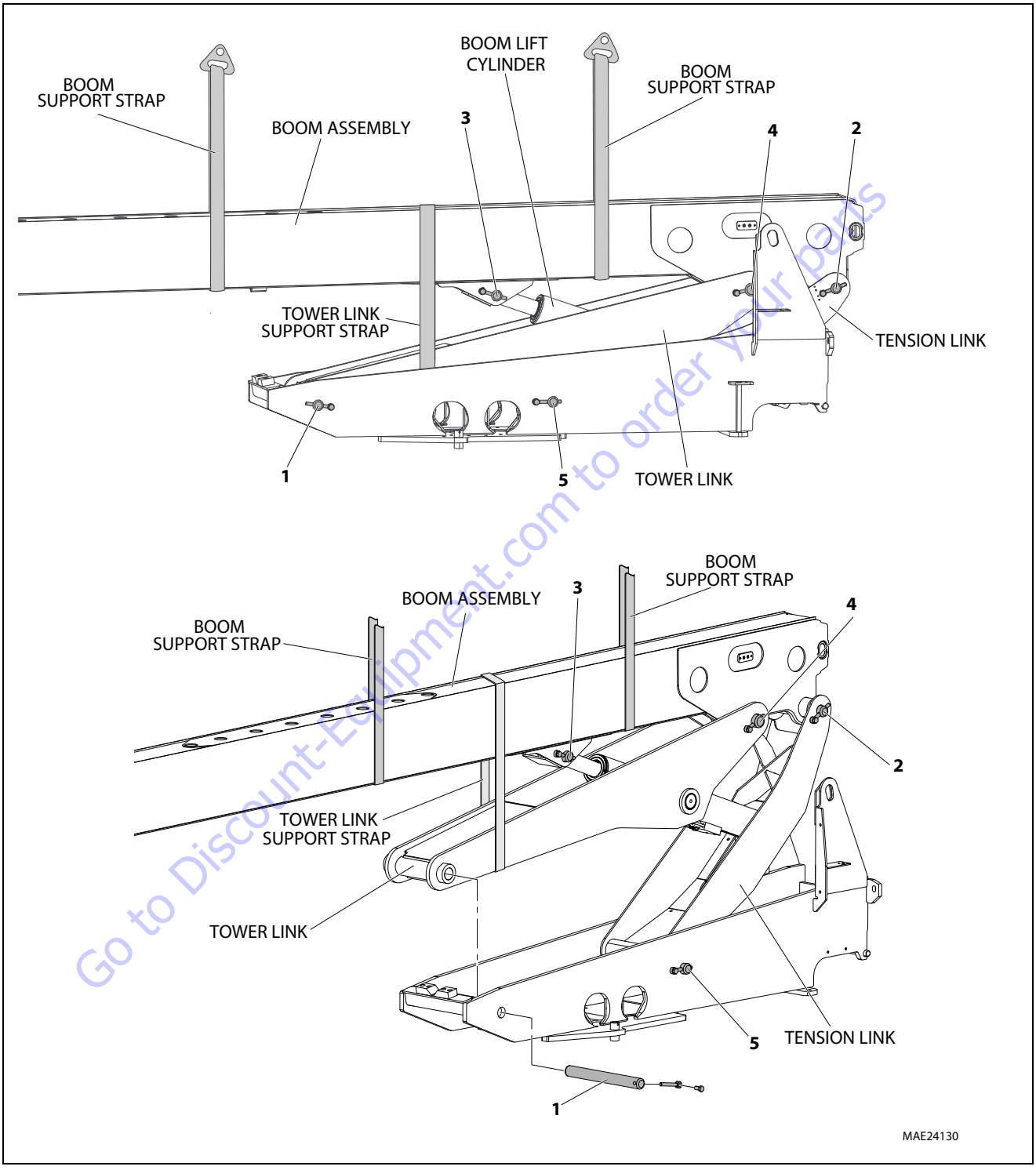
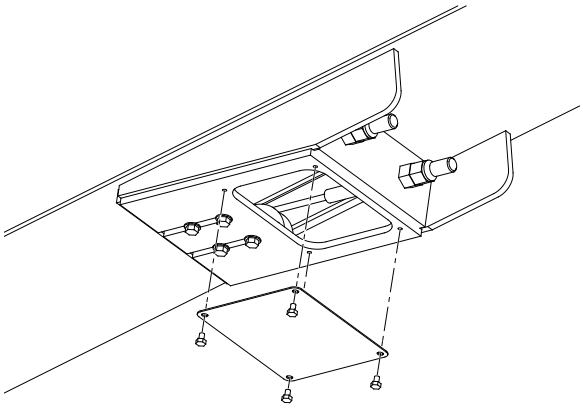


Figure 4-3. Boom Assembly Removal and Installation

Boom Disassembly

1. Tag and disconnect the hoses and electrical harnesses that run to the platform. Cap or plug all openings.
2. Remove hardware securing the cover plate and sheave blocks on the bottom front of the base boom section. Remove the cover plate and sheave blocks.

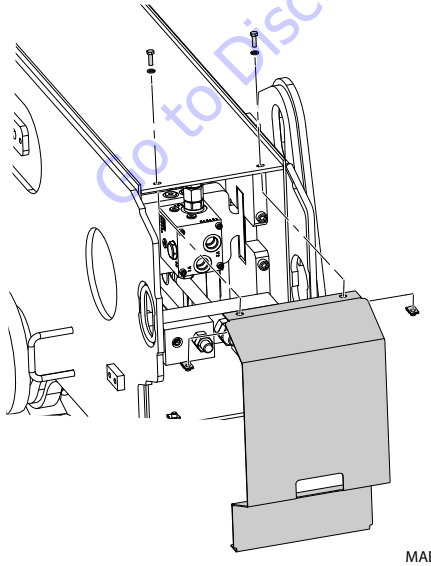
NOTE: *Do not allow wire rope to rotate. This may damage the wire rope. Clamp both threaded ends of wire rope to prevent rotation.*



3. Clamp both threaded ends of wire rope to prevent rotation.

NOTE: *Do not clamp on threads. Remove jam nuts and nuts which secure the wire rope adjustments to the bottom front of the base boom section.*

4. Remove the hardware securing base boom cover plate and base boom. Remove base boom cover plate from the end of the boom section.



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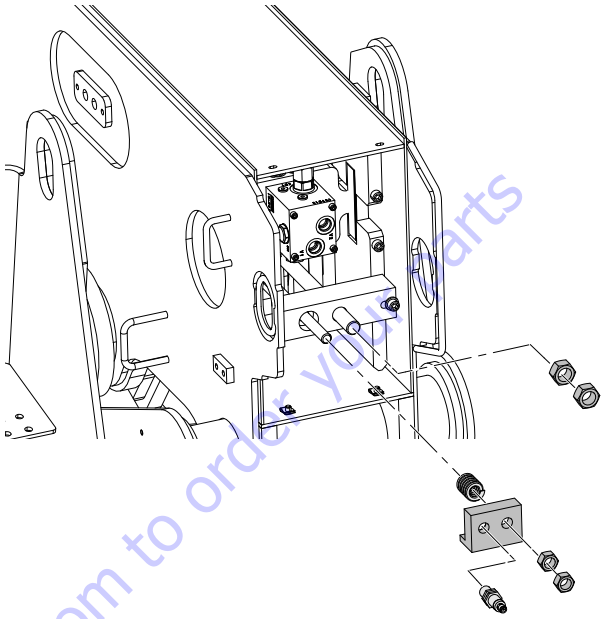
5. Remove the hardware securing spring mounting plate and spring to the cable block. Remove the spring mounting plate and spring from the end of the boom section.



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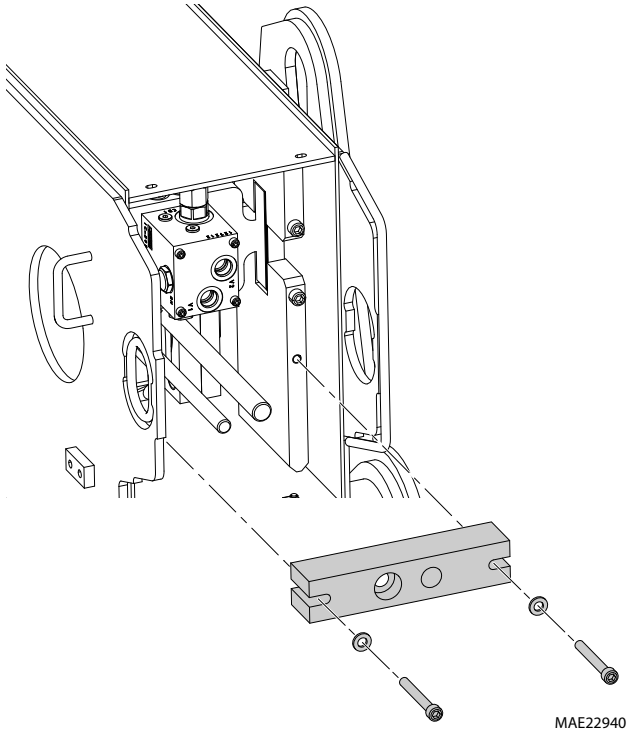
6. Remove hardware securing cable block to boom section. Remove cable block.



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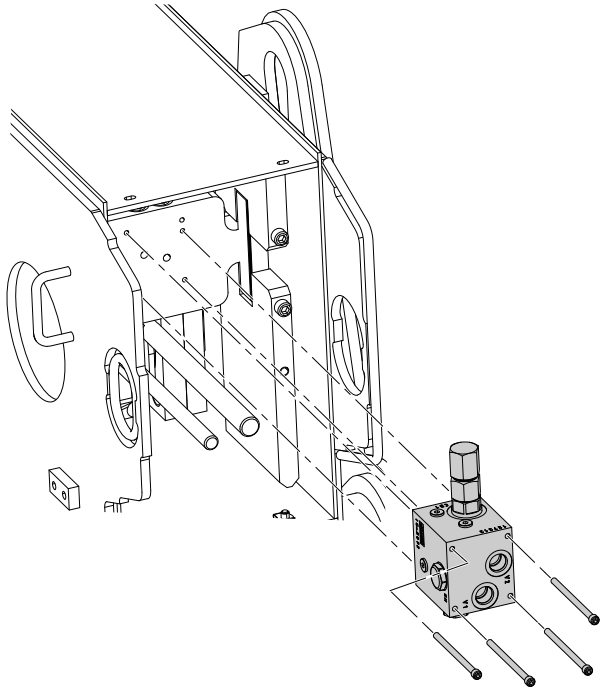
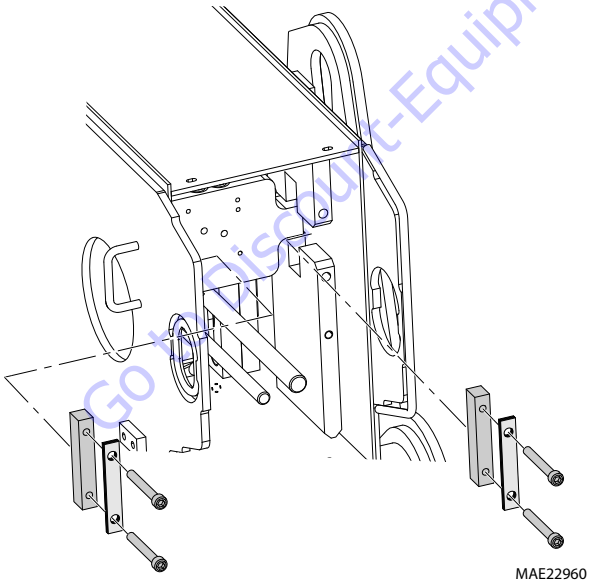
7. Remove hardware securing valve to telescope cylinder. Remove the valve assembly.



MAE22950

8. Remove the four bolts, shims, and block that secure the telescope cylinder rod to the boom base section.



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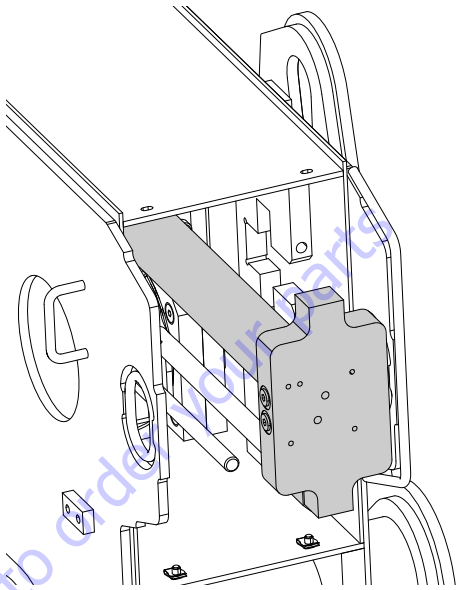
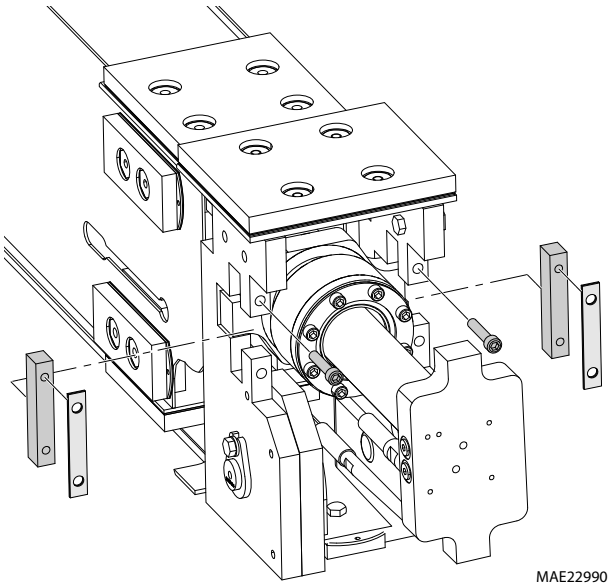
9. Attach an auxiliary hydraulic power source to the telescope cylinder and extend the cylinder rod enough to turn the trunnion in a vertical position.



MAE22970

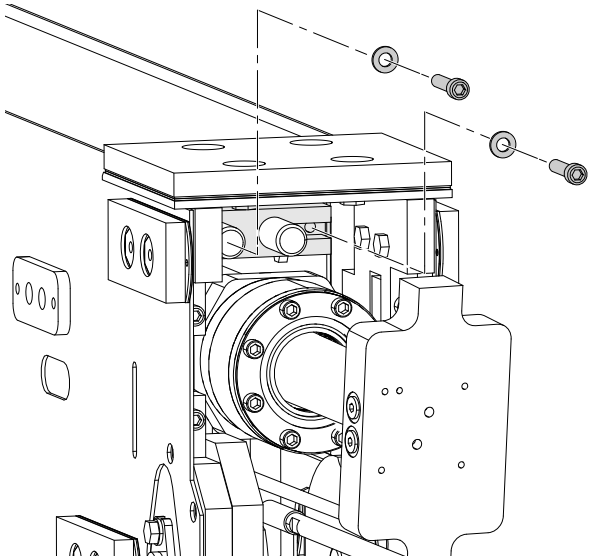
10. Pull the mid and fly boom sections from the base boom section. Use additional lifting device and lifting straps as necessary as the sections are withdrawn. It will be helpful during this step to pull the mid retract cable out from the front of the boom section as the other sections are being pulled out. This will prevent the cables from tangling as the sections are withdrawn.

11. Remove the trunnion blocks that secure the telescope cylinder barrel to the inner mid boom section.



MAE22990

12. Remove the hardware that secure rope extend block to the fly boom section.

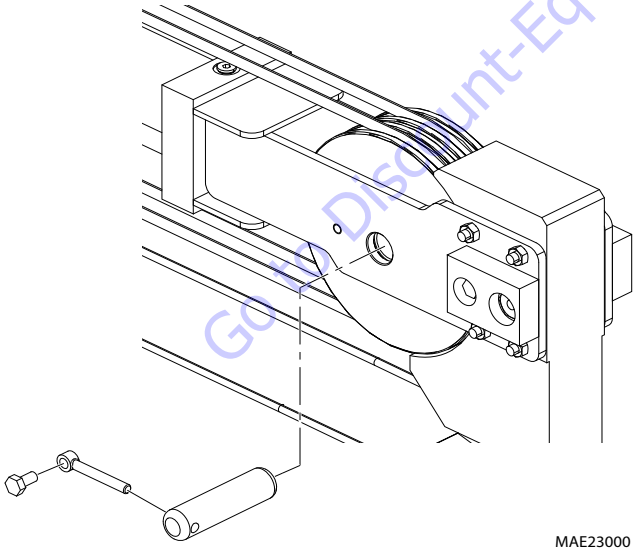


MAE23020

13. Attach a lifting device to the telescope cylinder, pull the cylinder along with the extend cables, sheave assembly and sheave guard out of the fly boom section. Reposition the lifting device as necessary to balance the cylinder.

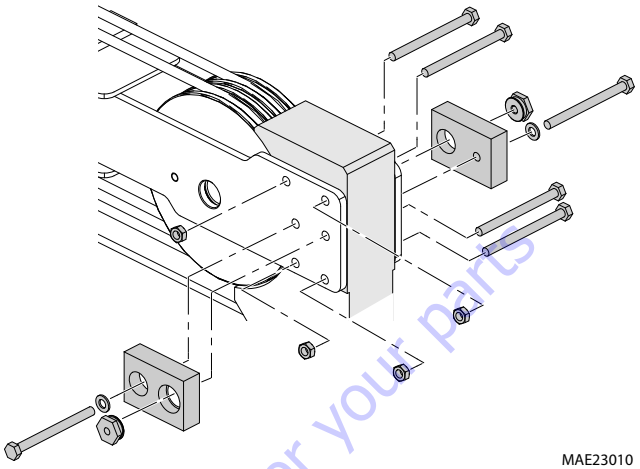
14. Remove extent block and cable from the telescope cylinder.

15. Remove the pin that secures sheave assembly to telescope cylinder.



MAE23000

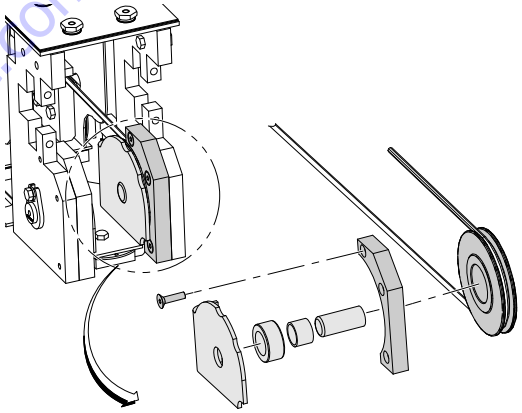
16. Remove spacer and hardware that secure sheave guard to the telescope cylinder.



MAE23010

17. Remove the sheave assembly by adjusting the sheave guard then remove the bracket and cable.

18. Remove the cable retainer plate, cable retainer block, bushing and sheave.



MAE23030

19. Remove the top, bottom and side wear pads from the front mid boom sections.

20. Attach a lifting device to the fly boom section, pull the fly boom from mid boom.

NOTE: *When removing fly boom section from mid boom section, retract wire rope must be dragged along with fly boom section.*

21. Remove the top, bottom and side wear pads from the rear end fly boom sections.

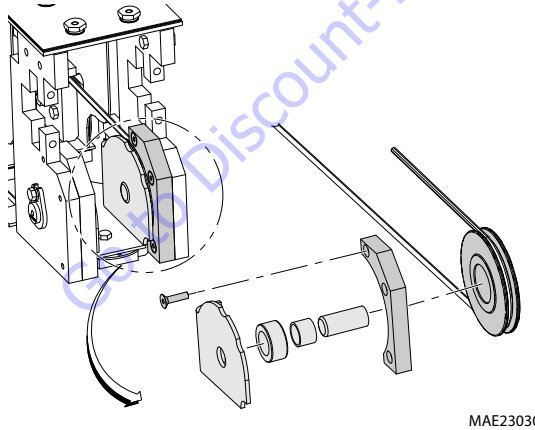
22. Remove the fly boom retract cables from the bottom of the fly boom sections.

23. Thoroughly clean the boom sections.

Assembly

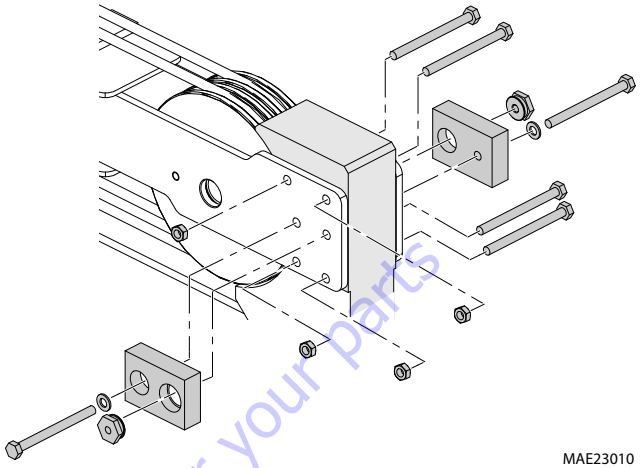
NOTE: *When installing fly section wear pads, install same number and thickness of shims as were removed during disassembly.*

1. Measure inside dimensions of the base and mid sections to determine the number of shims required for proper lift.
2. Install side, top and bottom wear pads to the rear end of fly section; shim evenly to the measurements of the inside of mid section. Torque the bolts to 40.6 ft. lbs. (55 Nm).
3. Install retract wire ropes into rear end of fly section, route wire ropes through holes in side of fly boom section and pull into slot.
4. Install side, top and bottom wear pads to the rear end of mid section, shim evenly to the measurements of the inside of mid section. Torque the bolts to 40.6 ft. lbs. (55 Nm).
5. Using Super Lube, lubricate all wear surfaces on the outside of fly boom and inside of the mid boom.
6. Slide fly boom section into mid boom section.
7. Install wear pads into the front end of the mid boom section. Torque the bolts to 40.6 ft. lbs. (55Nm).
8. Apply a thin coat of moly paste lubricant to the inside diameter of the sheave composite bearings. Install the fly retract sheaves and bushings while guiding the wire ropes into the sheave grooves. Apply moly paste lubricant on the inside diameter of the sheave bushing cup. Ensure the sheaves move freely.



MAE23030

9. Install sheave on the telescope cylinder secure with pin and bolts.



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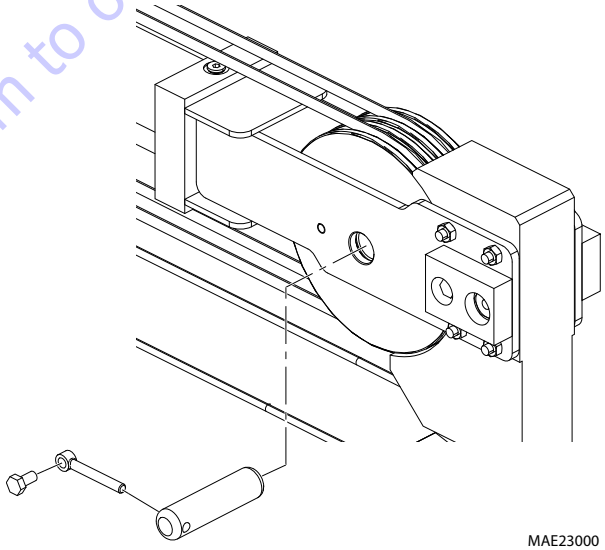
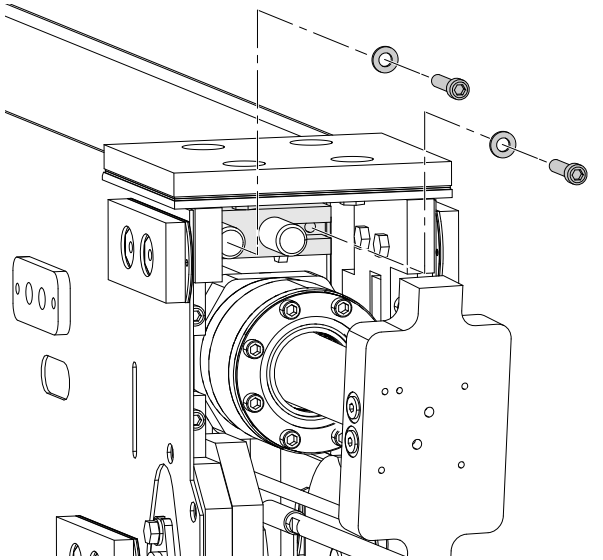
10. Route the cables around the sheave on the cylinder and install the sheave guard.



MAE23000

11. Using an adequate lifting device, insert the cylinder and cables part way into the inner fly boom.

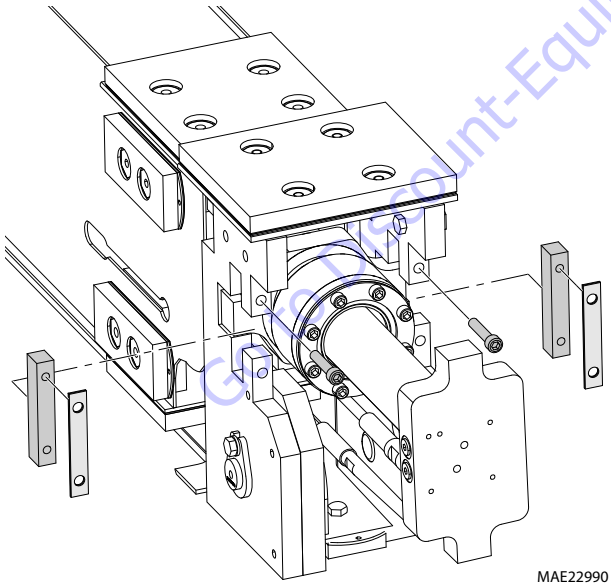
12. Install end of the extend cables into the extend rope block.



MAE23020

13. Install the bolts and washers securing the extend rope block to the fly boom. Torque the bolts to 40.6 ft. lbs. (55 Nm).

14. Install the cylinder trunnion block and shims that secure the telescope cylinder barrel to the mid boom section. Torque the bolts to 40.6 ft. lbs. (55 Nm).



MAE22990

15. Turn the trunnion of Rod in a vertical position.

16. Using Super Lube, lubricate all wear surfaces on the inside of the base section and the outside of the mid boom.

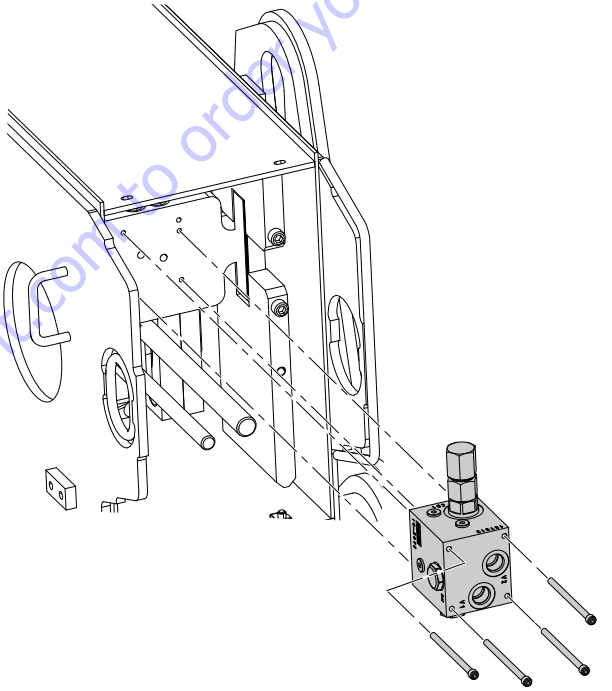
17. Insert the mid, fly and Tele cylinder assembly way into the boom base section enough to be able to pull the outer mid retract cables out through the hole at the bottom front of the boom base section.

18. Install the front lower wear pads into the boom base section. Torque the bolts to 40.6 ft. lbs. (55 Nm).

19. Push the mid boom assembly the rest of the way into the boom base section, adjusting the lifting device as necessary to keep the weight balanced.

20. Install the side and upper wear pads into the boom base section. Torque the bolts to 40.6 ft. lbs. (55 Nm).

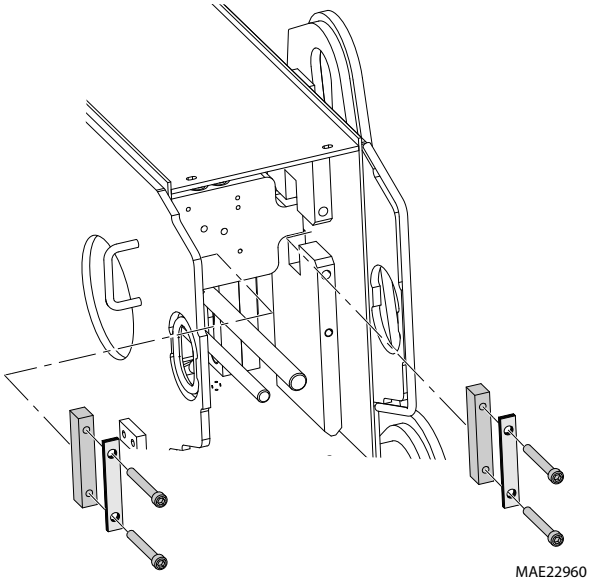
21. Install hardware securing valve to telescope cylinder. Install the valve assembly. Torque the bolts to 42.8 ft. lbs. (58 Nm).



MAE22950

22. Attach an auxiliary hydraulic power source to the telescope cylinder, extend cylinder enough so the trunnion of Rod out of base boom, turn rod trunnion to horizontal position. Retract cylinder so the trunnion of rod slide into the slot on base boom.

23. Install the four bolts, shims, and bars that secure the telescope cylinder rod to the boom base section. Torque the bolts to 40.6 ft. lbs. (55 Nm).



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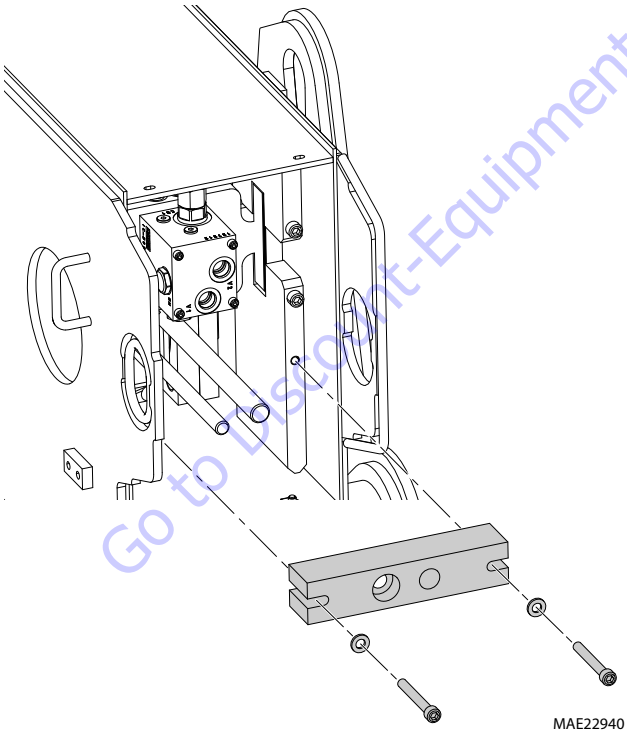
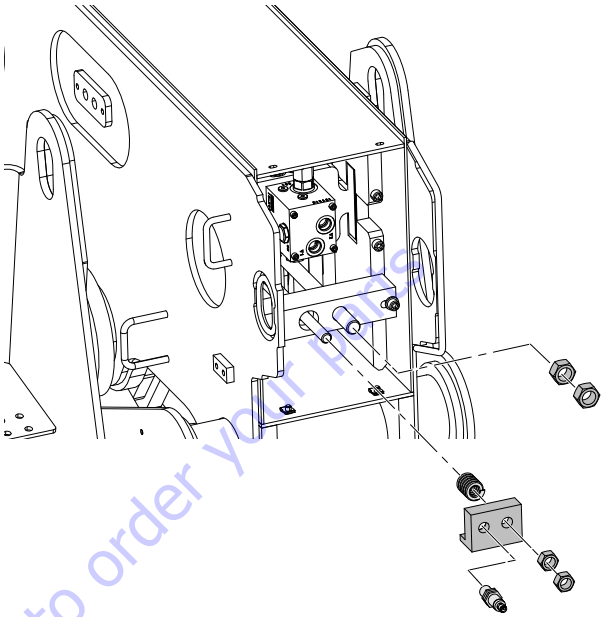
24. Route extend cable through cable block and install the cable block on base boom.



MAE22940

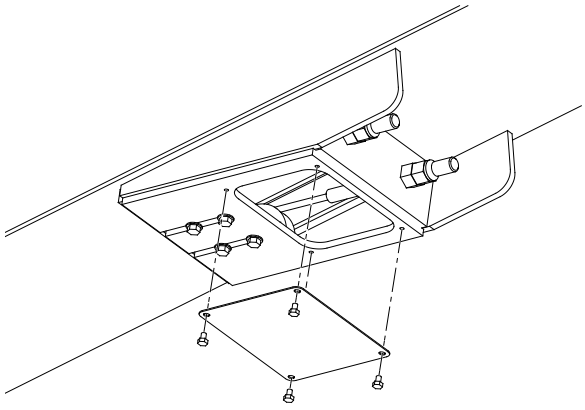
25. Install the hardware securing spring mounting plate and spring to the cable block.



MAE22930

26. Install base boom cover plate to base boom at the end of the boom section.

27. Install the cover plate and sheave blocks.



28. Connect the hydraulic hoses to the telescope cylinder as tagged during removal.

29. Adjust the boom cables. Refer to Section 4.15, Wire Rope Tensioning Adjustment.

30. Install jam nuts and nuts which secure the wire rope.

Installation

NOTE: *Refer to Figure 4-3., Boom Assembly Removal and Installation.*

NOTE: *The boom alone weighs approximately 2792 lb (1269 kg). Including the powertrack, slave cylinder, rotator, jib, platform and platform support the assembly weighs approximately 7500 lb (3400 kg).*

1. If tension link is removed, insert an adequate metal rod into the turntable lifting eye holes to support the tension link.
2. Using an adequate lifting device, position the tension link on turntable so that the pivot holes of tension link and turntable holes are aligned.

NOTE: *The tension link weighs approximately 419 lb (190 kg).*

3. Install pin, keeper pin, and retaining bolt (5) securing tension link to the turntable. Apply Medium Strength Threadlocking Compound and torque to 346 ft.lbs. (469 Nm).

NOTE: *Steps 1, 2, and 3 are only necessary if the tension link has been removed.*

4. Place the tower link with boom lift cylinder on the proper support.
5. Use an adequate lifting device, lift the boom assembly and install pin, keeper pin, and retaining bolt (4) securing the tower link to the boom assembly. Apply Medium Strength Threadlocking Compound and torque to 346 ft.lbs. (469 Nm).
6. Install pin, keeper pin, and retaining bolt (3) securing lift cylinder rod end pin to main boom assembly. Apply Medium Strength Threadlocking Compound and torque to 346 ft.lbs. (469 Nm).
7. Using an adequate lifting device, lift and position the boom assembly with tower link and boom lift cylinder on turntable so that the pivot holes of boom assembly and tension link are aligned.
8. Install boom pivot pin, keeper pin, and retaining bolt (2), ensuring that location of hole in pin is aligned with attach point on tension link.
9. Lift and move forward the boom and tower link assembly.
10. Remove metal rod from the turntable lifting eye holes and level the boom assembly to normal position.
11. Install pin, keeper pin, and retaining bolt (1) securing tower link to turntable. Apply Medium Strength Threadlocking Compound and torque to 346 ft.lbs. (469 Nm).
12. Reconnect all hydraulic lines as tagged during removal.
13. Reconnect all electrical connections to the boom assembly as tagged during removal.
14. If necessary, adjust retract and extend cables to the proper torque. Refer to Section 4.15, Wire Rope Tensioning Adjustment for wire rope torque procedures.
15. Using all applicable safety precautions, raise and extend boom fully, then retract and lower boom. Check for proper operation and hydraulic leaks.

4.12 MAIN BOOM LIFT CYLINDER

Removal

NOTE: *Refer to Figure 4-4., Main Boom Lift Cylinder Removal and Installation.*

1. Remove main boom assembly with tower link and lift cylinder from the machine and place it on a suitable support. Refer to Section 4.11, Main Boom Assembly for removal procedure.
2. Place blocking under the lift cylinder to prevent it from falling when the attaching hardware is removed.
3. Attach an adequate lifting device and sling to the main lift cylinder.

NOTE: *The Main Lift Cylinder weighs approximately 557 lb (253 kg).*

4. Remove trunnion pins (1), hardware and bearings (if necessary) securing boom lift cylinder to the tower link.
5. Carefully lift the cylinder clear of the tower link and lower to the ground or suitably supported work area.

Installation

1. Using an adequate lifting device, position the lift cylinder in tower link in the same manner that it was removed.
2. Install trunnion pins (1), hardware and bearings securing boom lift cylinder to the tower link.
3. Install main boom assembly with tower link and lift cylinder to the turntable. Refer to Section 4.11, Main Boom Assembly for Install procedure.

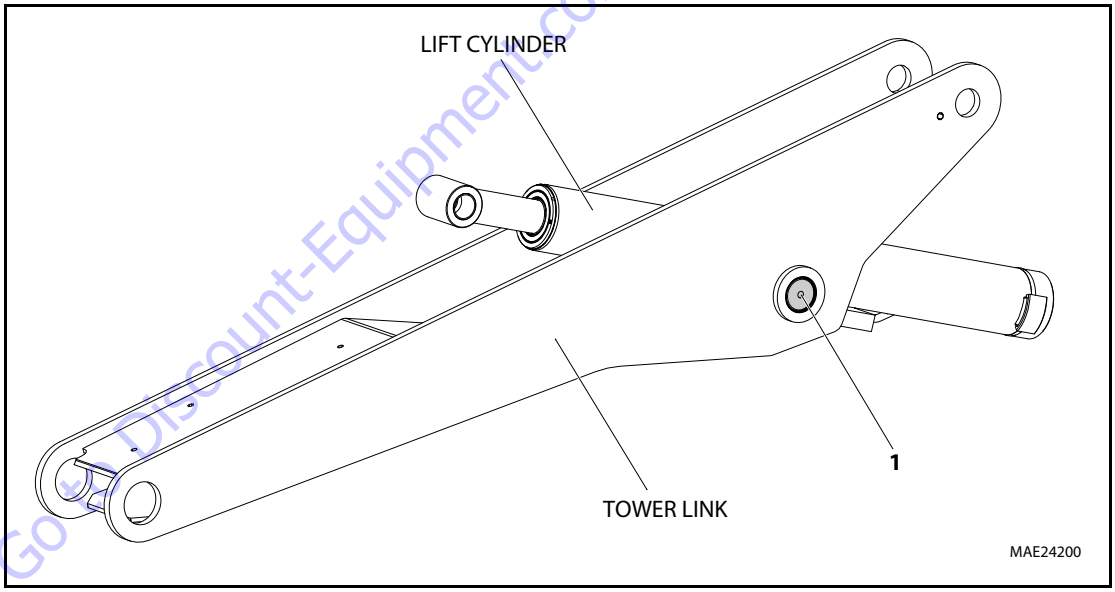


Figure 4-4. Main Boom Lift Cylinder Removal and Installation

4.13 MAIN BOOM POWERTRACK

Removal

1. Disconnect wiring harness from ground control box.

NOTICE

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

2. Tag and disconnect hydraulic lines from boom to control valve. Use a suitable container for residual hydraulic fluid. Cap hydraulic lines and ports.
3. Remove hydraulic lines and electrical cables from the powertrack.
4. Using a suitable lifting equipment, adequately support powertrack weight along entire length.
5. Remove bolts (1) securing push tube on fly boom section.
6. Remove bolts (2) securing push tube on mid boom section.
7. With powertrack support and using all applicable safety precautions, remove bolts (3) securing rail to the base boom section. Remove powertrack from boom section.

Installation

1. With powertrack supported and using all applicable safety precautions, install hardware (3) securing rail to the base boom.
2. With adequate support and lifting device align, place mid boom push tube on the boom section to get access to install hardware (2).
3. Install the hardware (1) securing powertrack to fly boom push tube.
4. Connect all hydraulic lines and electrical cables to powertrack as tagged during removal.
5. Connect wiring harness to ground control box.

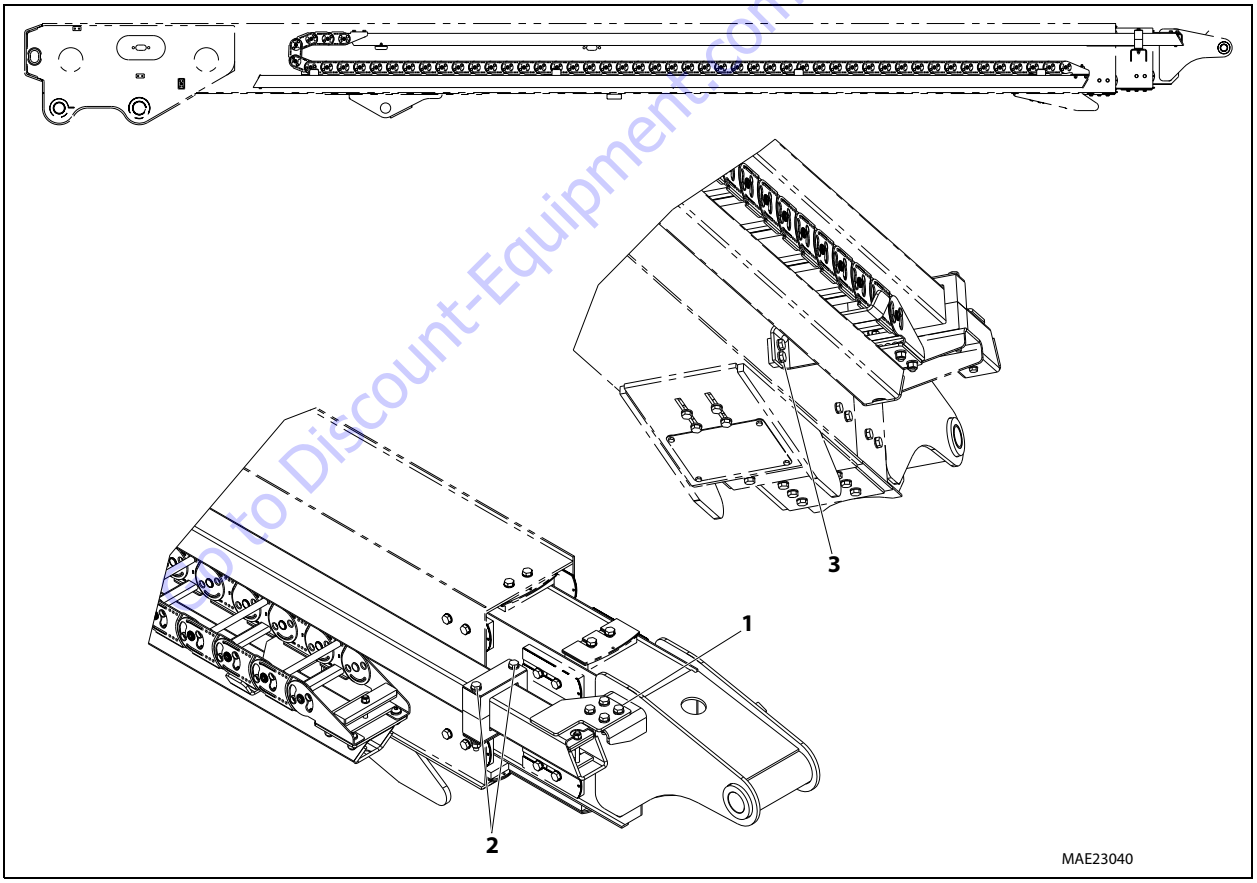
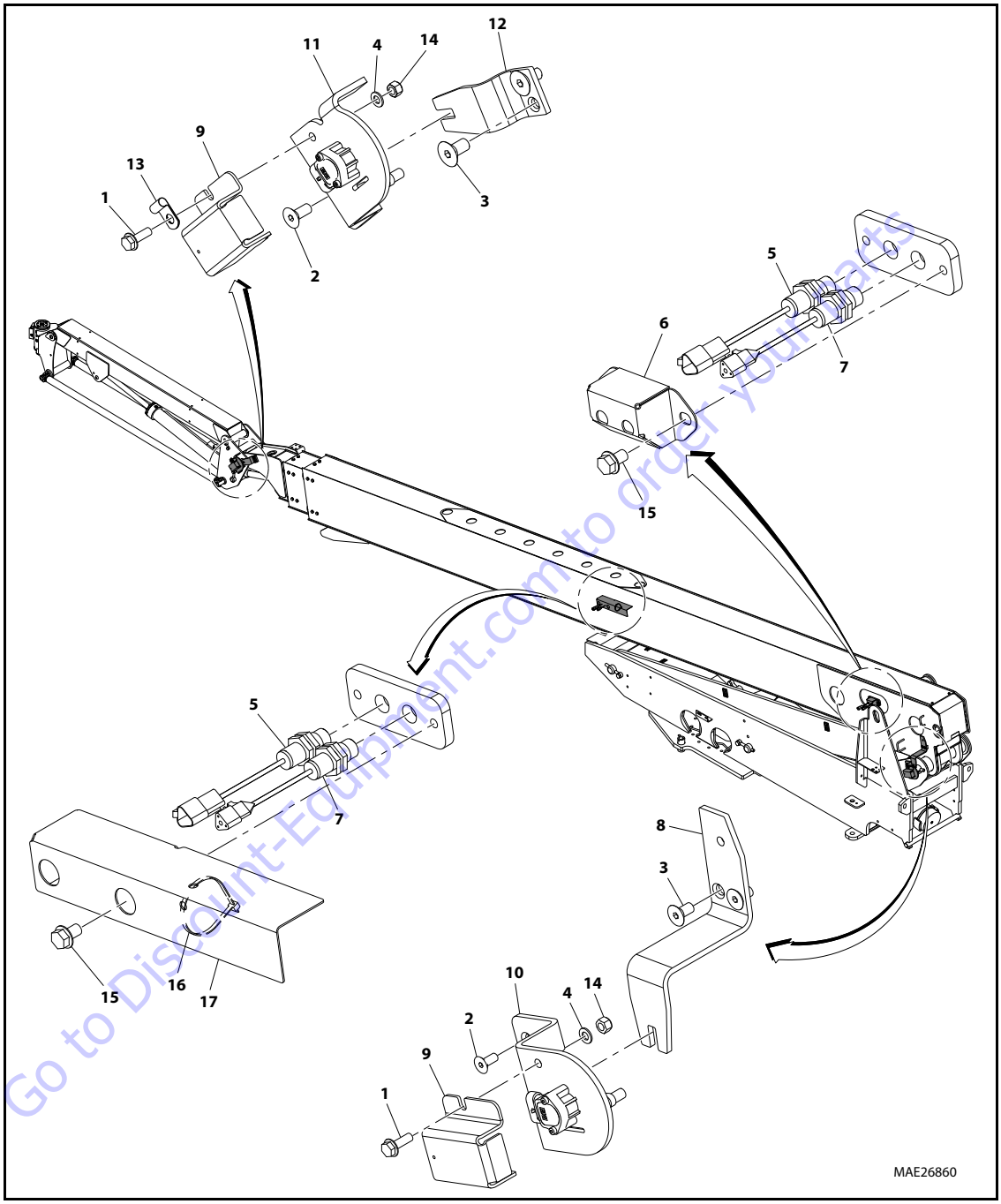


Figure 4-5. Powertrack Components



1. Bolt
2. Screw
3. Screw
4. Washer
5. Proximity Sensor
6. Bracket
7. Proximity Sensor
8. Plate
9. Shield
10. Boom Angle Sensor (Lower)
11. Boom Angle Sensor (Upper)
12. Plate
13. Clip
14. Nut
15. Bolt
16. Tie-Strap
17. Plate

Figure 4-6. Boom Sensors Installation

4.14 WIRE ROPE

⚠ WARNING

IF DELAYED MOVEMENT IS DETECTED IN WIRE ROPE OPERATION, LOWER PLATFORM TO STOWED POSITION, SHUT DOWN MACHINE, AND HAVE WIRE ROPES INSPECTED/SERVICED BY A QUALIFIED JLG MECHANIC. LOOSE OR MIS-ADJUSTED WIRE ROPES COULD RESULT IN SERIOUS INJURY OR DEATH.

⚠ CAUTION

WIRE ROPE CAN HAVE SHARP EDGES AND CAUSE SERIOUS INJURY. NEVER HANDLE WIRE ROPE WITH BARE HANDS.

Each day before using machine:

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

Inspection

NOTE: *Pictures in this paragraph are samples to show rope replacement criteria.*

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

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

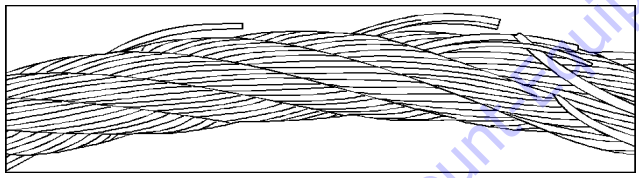


Figure 4-7. Wire Rope Wire Breaks

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

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

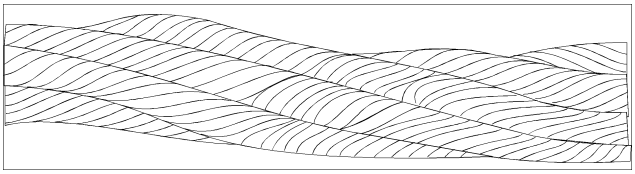


Figure 4-8. Wire Rope Kink

4. Inspect sheaves for condition of bearings/pins. (See Dimension Of Sheaves for proper dimension.)Inspect sheaves for condition of flanges. (See Dimension Of Sheaves for proper dimension.)
5. Inspect sheaves with a groove wearout gauge for excessive wear.

NOTE: *Check groove so that it may be clearly seen if gauge contour matches sheave groove contour.*

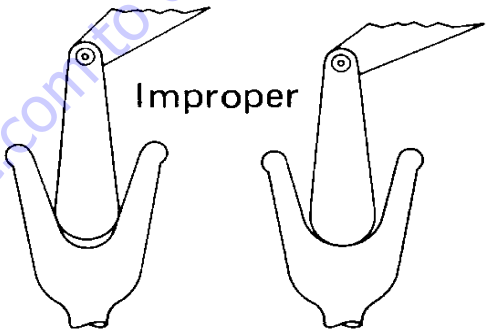


Figure 4-9. Sheave Groove Wear

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

Three Month Inspection

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

Additional Inspection Required If:

1. Machine is exposed to hostile environment or conditions.
2. Erratic boom operation or unusual noise exists.
3. Machine is idle for an extended period.
4. Boom is overloaded or sustained a shock load.
5. Boom exposed to electrical arc. Wires may be fused internally.

12 Year or 7000 Hour Replacement

1. Mandatory wire rope and sheave replacement.

Additional Replacement Criteria

NOTE: *Sheaves and wire rope must be replaced as sets.*

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

4.15 WIRE ROPE TENSIONING ADJUSTMENT

Wire Rope Tensioning Procedure

1. Position boom in fully down and retracted position.

Model	660SJC
Dim. A	17" (44cm)
Dim. B	9" (23cm)

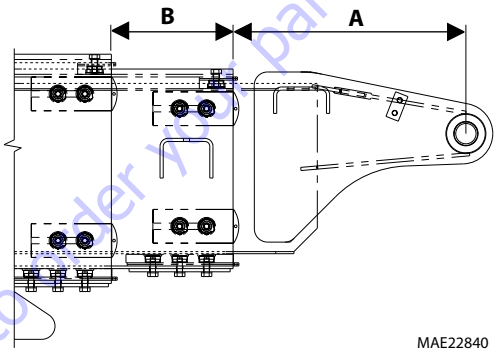


Figure 4-10. Dimensions of Boom Sections

NOTICE

DO NOT CLAMP ON THREADS OR THREADS MAY BE DAMAGED.

DO NOT ALLOW WIRE ROPE TO ROTATE OR WIRE ROPE MAY BE DAMAGED. CLAMP THREADED ENDS OF WIRE ROPE TO PREVENT ROTATION.

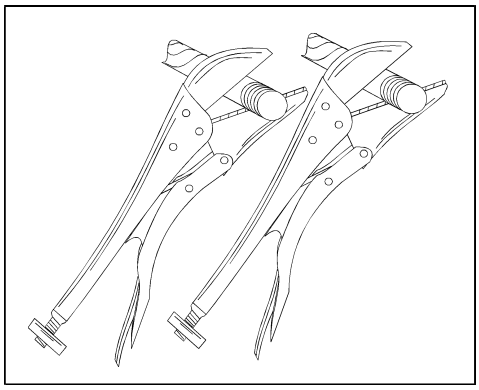


Figure 4-11. Clamping Wire Ropes

2. Install adjusting nuts (or remove nylon collar locknuts if re-adjusting) to both retract and extend wire ropes.
3. Torque retract adjusting nuts (platform end) to 15 ft-lb (20 Nm) alternating between the two wire ropes and keeping approximately the same amount of thread beyond the adjusting nut.
4. Repeat torque procedure in step #3 to extend wire ropes (turntable end).
5. Extend boom 2 - 3 feet using telescope function. Repeat step #3.
6. Retract boom 1 - 2 feet using telescope function. Do not bottom out telescope cylinder. Repeat step #4.
7. Extend boom approximately 2 - 3 feet again and check torque on retract wire ropes.
8. Retract boom without bottoming out telescope cylinder. Check torque on extend wire ropes.

NOTE: *Step #7 and #8 may need to be repeated to equalize the torque on all 4 wire ropes.*

9. After all wire ropes are properly torqued, install nylon collar locknuts. Remove all clamping devices and install all covers and guards. Check boom for proper function.

4.16 WIRE ROPE SERVICE INDICATOR

The wire rope service indicator is integrated into the mounting block that the extension wire ropes mount to at the end of the base boom. More specifically, the smaller diameter wire rope mounts to a spring loaded block that also contains a proxy sensor. In the event that the rope breaks, the block with the proxy sensor is pushed away from the main mounting block through the spring which causes a warning light to be lit in the platform control box. All boom functions are still operable.

4.17 JIB ASSEMBLY

NOTE: *Using a suitable lifting device, support the jib.*

Removal

1. For platform and support removal see Section 4.9 - Platform.
2. Position the articulating jib boom level with ground.

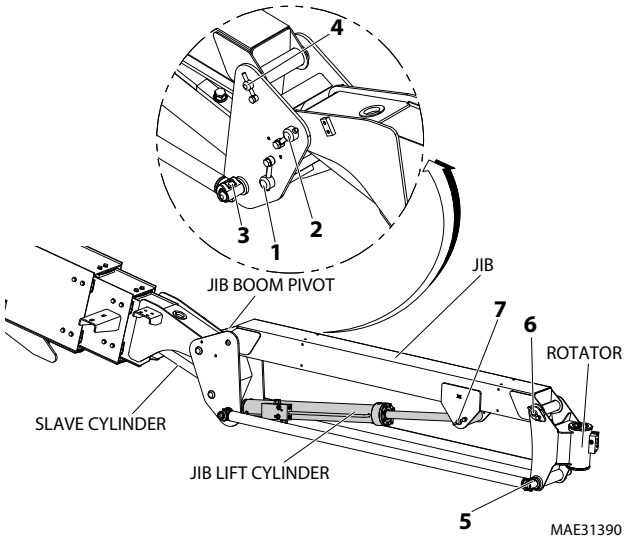
NOTICE

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

3. Tag and disconnect hydraulic lines from level cylinder and lift cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
4. Remove mounting hardware from slave leveling cylinder pin (1). Using a suitable brass drift and hammer, remove the cylinder pin from jib assembly.
5. Remove mounting hardware from jib assembly boom pivot pin (2). Using a suitable brass drift and hammer, remove the pivot pin from boom assembly.

Disassembly

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



Inspection

NOTE: *When inspecting pins and bearings Refer to Section 2.5, Pins and Composite Bearing Repair Guidelines.*

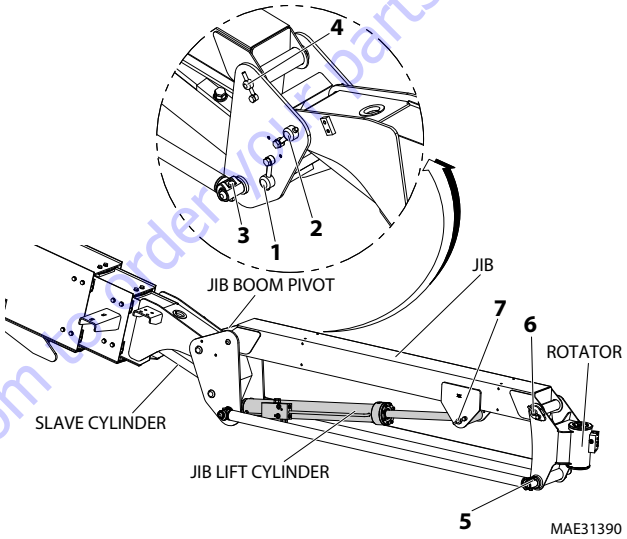
1. Inspect fly boom pivot pin for wear, scoring, tapering and ovality, or other damage. Replace pins as necessary.
2. Inspect fly boom pivot attach points for scoring, tapering and ovality, or other damage. Replace pins as necessary.
3. Inspect inner diameter of fly boom pivot bearings for scoring, distortion,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

Assembly

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

Installation

1. Align jib boom pivot weldment with attach holes in fly boom assembly. Using a soft head mallet, install pivot pin (2) into fly boom assembly and secure with mounting hardware.
2. Align the slave leveling cylinder with attach holes in jib boom pivot weldment. Using a soft head mallet, install slave leveling cylinder pin (1) into articulating jib boom pivot weldment and secure with mounting hardware.



4.18 BOOM CLEANLINESS GUIDELINES

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

1. JLG recommends use of JLG Hostile Environment Package to keep internal portions of a boom cleaner and help prevent dirt and debris from entering the boom. This package reduces the amount of contamination which can enter the boom, but does not eliminate the need for more frequent inspections and maintenance when used in these types of environments.
2. JLG recommends you follow all guidelines for servicing your equipment in accordance with instruction in the JLG Service & Maintenance Manual for your machine. Periodic maintenance and inspection is vital to proper operation of the machine. Frequency of service and maintenance must be increased as environment, severity, and frequency of usage requires.
3. Debris and contamination inside the boom can cause premature failure of components and should be removed. Methods to remove debris should always be done using all applicable safety precautions outlined in the JLG Operation & Safety Manual and the JLG Service & Maintenance Manuals.

4. The first attempt to remove debris from inside the boom must be to utilize pressurized air to blow the debris toward the nearest exiting point from the boom. Make sure that all debris is removed before operating the machine.

5. If pressurized air cannot dislodge debris, then water with mild solvents applied with a pressure washer can be used. Wash debris toward the nearest exiting point from the boom. Make sure all debris is removed, no "puddling" of water has occurred, and boom internal components are dry before operating machine. Make sure you comply with all federal and local laws for disposing of wash water and debris.

6. If pressurized air or washing boom does not dislodge and remove debris, disassemble boom following instructions outlined in the JLG Service & Maintenance Manual to remove debris.

4.19 FOOT SWITCH ADJUSTMENT

Adjust foot switch to operate functions when pedal is at center of travel. Adjust if switch operates within last 1/4 in. (6.35 mm) of top or bottom travel.

⚠ WARNING

ELECTRIC SHOCK OR UNCONTROLLED MACHINE MOVEMENT CAN CAUSE DEATH OR SERIOUS INJURY. DISCONNECT INPUT POWER BEFORE PERFORMING INSTALLATION OR MAINTENANCE.

NOTE: *For models with two switches, both switches can be independently adjusted.*

1. Remove four socket head capscrews and cover from foot switch assembly.

2. To increase travel before switch is activated, turn Adjustment Screw clockwise.

3. To decrease travel before switch is activated, turn Adjustment Screw counterclockwise.

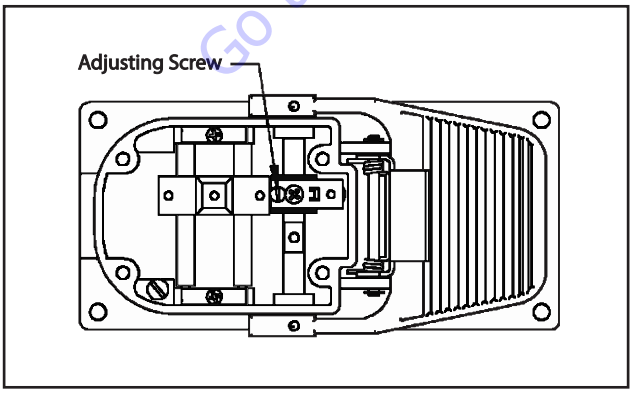


Figure 4-12. Foot Switch Adjustment

4. Install cover and secure with four socket head caps crews. Torque to 18-22 in-lb (2-3 Nm).

4.20 PLATFORM CONTROL ENABLE SYSTEM

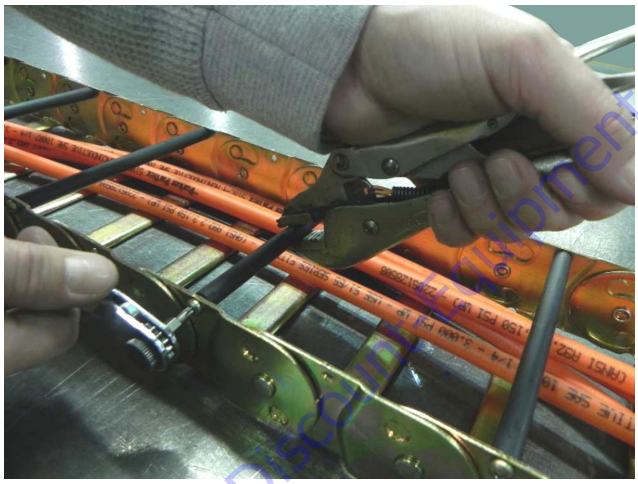
The platform controls use a time dependant enable circuit to limit the time availability of "live" or enabled controls. When the footswitch is depressed, the controls are enabled and the operator has 7 seconds to operate any control. The controls will remain enabled as long as the operator continues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

4.21 POWERTRACK MAINTENANCE

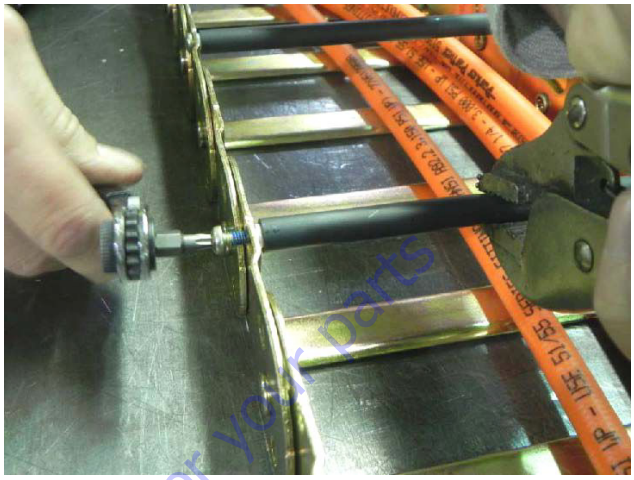
Remove Link

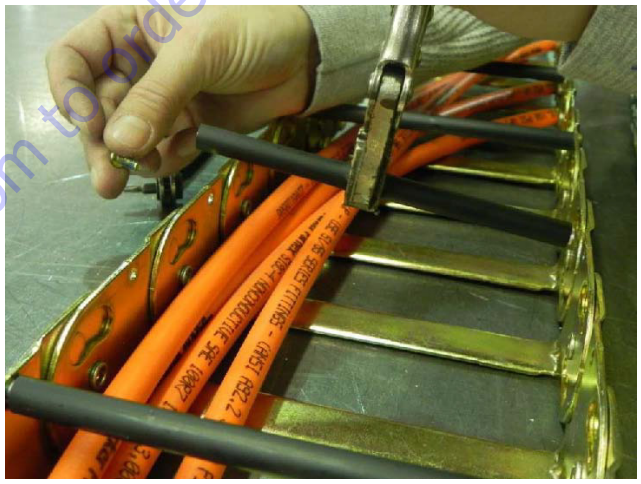
NOTE: *Hoses shown in powertrack are for example only. Actual hose and cable arrangements are different.*

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



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

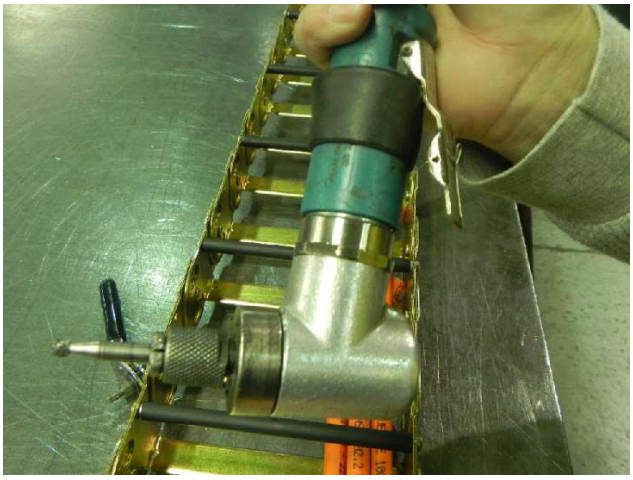




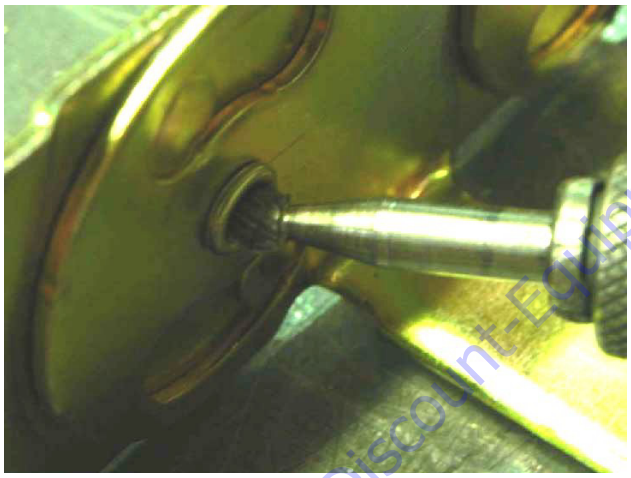
NOTICE

REPOSITION CABLES/HOSES. KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

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

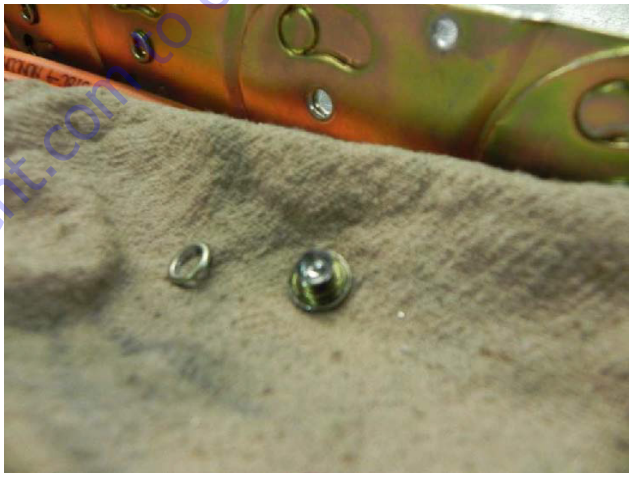


4. insert tool into rolled over end of rivet. Grind out middle of rivet until rolled over part of rivet falls off. Repeat for all rivets to be removed.

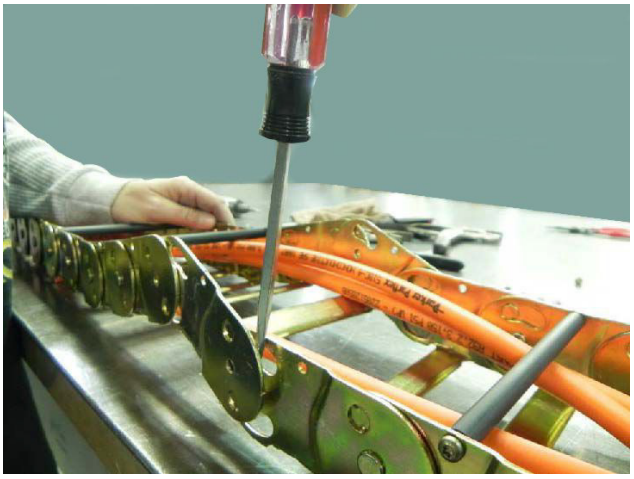


5. After grinding it may be necessary to use a center punch with a hammer to remove rivet.

NOTE: *It may be necessary to loosen fixed end brackets from machine to move track section enough to disconnect links.*



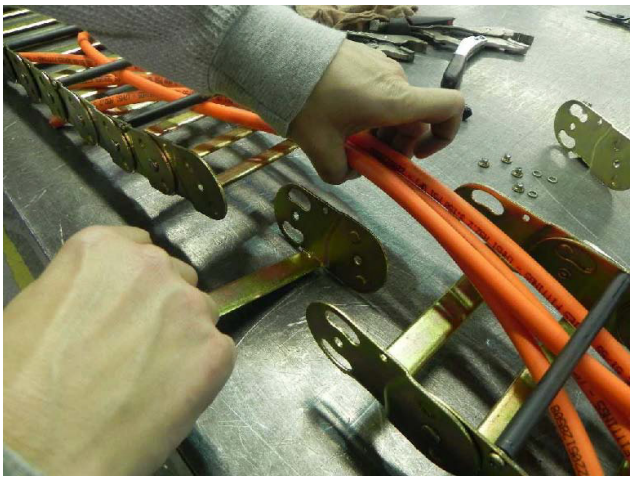
6. Insert flat head screwdriver between links. Twist and pull links apart.



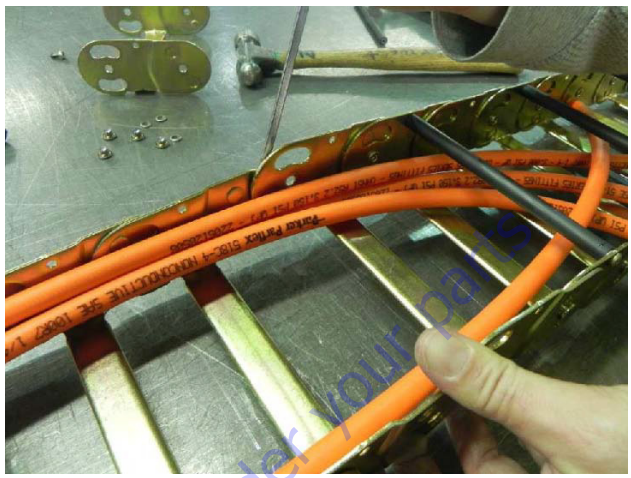
7. Remove link from other section of powertrack using screwdriver.

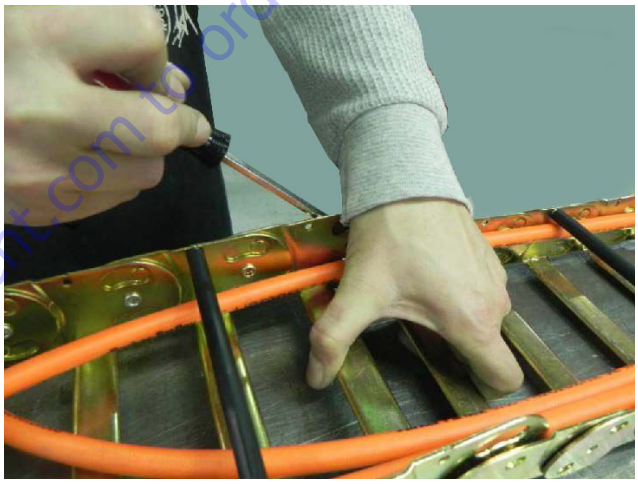
Install New Link

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

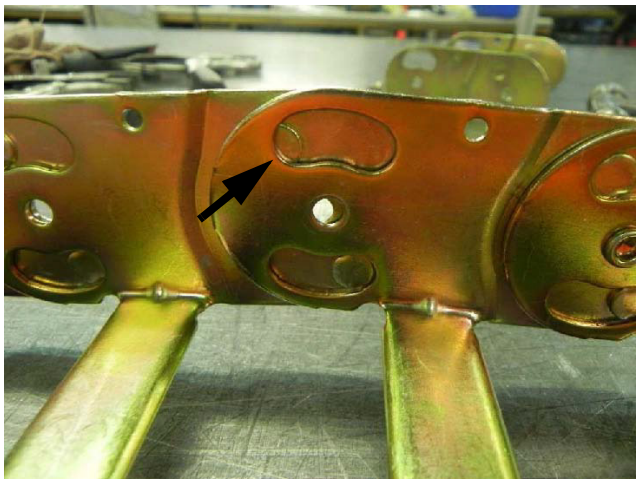


2. Spread half-shear (female) end of new link and slide cut-out end of track section into it. Use screwdriver if necessary.

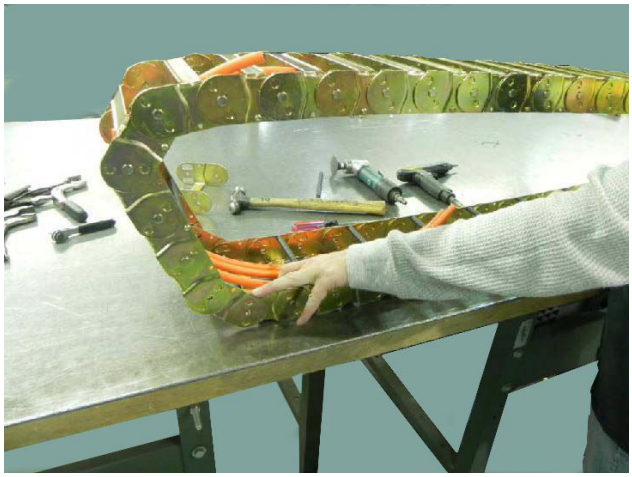




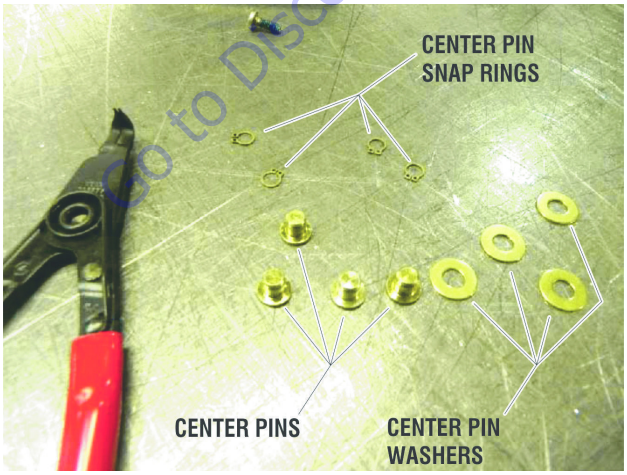
3. Round half-shears will not fit properly in cut-outs after new link is installed.



4. Pull moving end over track so new connection is positioned in curve of powertrack. Round half-shears will rotate into cut-outs.



5. Parts shown below connect new link to powertrack.

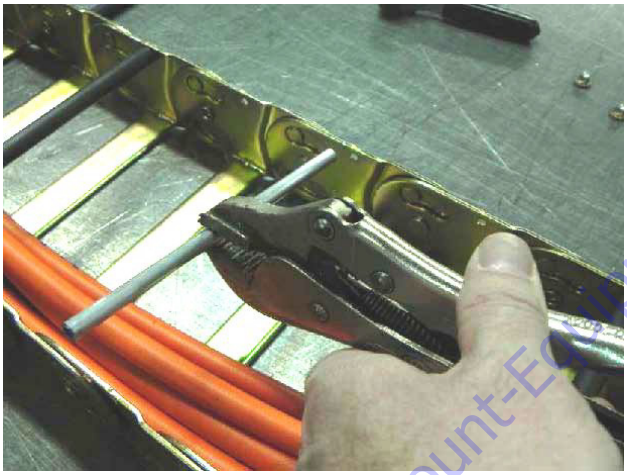


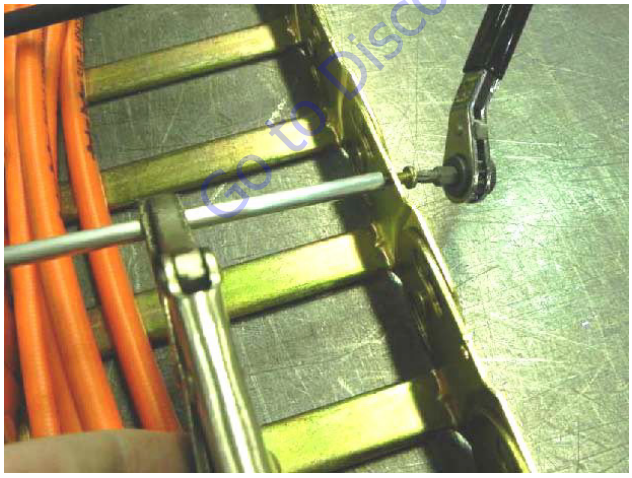
6. Push pin through center hole. Slide washer on pin.

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

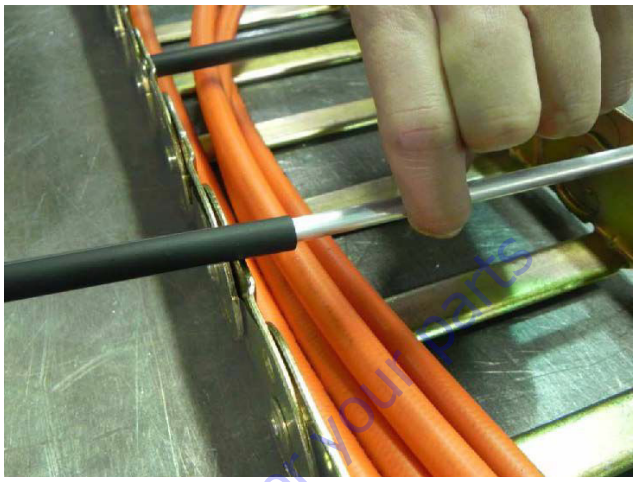
NOTE: *Make sure snap rings are seated in pin groove and closed properly.*

1. Install new 8-32 x 0.500 self-threading Torx head screw in end of new aluminum round bar. Torque to 18-20 in-lb (2-2.25 Nm).

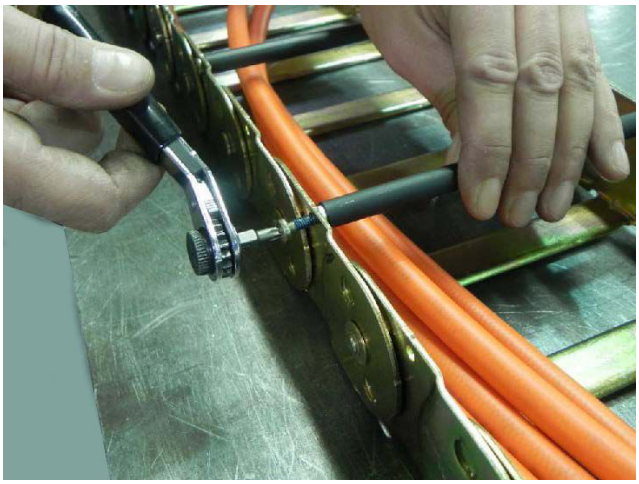




2. Pull up on other end of round bar. Slide new poly roller on bar.

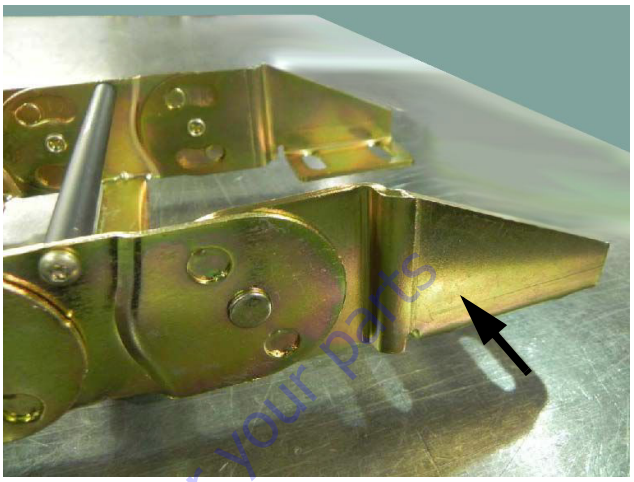


3. Install new 8-32 x 0.500 self threading screw on other side. Torque to 18-20 in-lb (2-2.25 Nm).



NOTE: *When tightening screws make sure screw head is seated against link with no space in between link and underside of screw head.*

Replace Fixed End Brackets



NOTICE

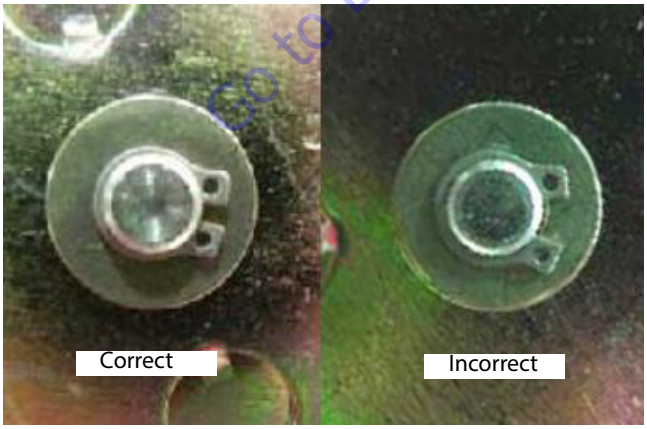
REPOSITION CABLES/HOSES. KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

1. Remove rivets as shown in link removal instructions.

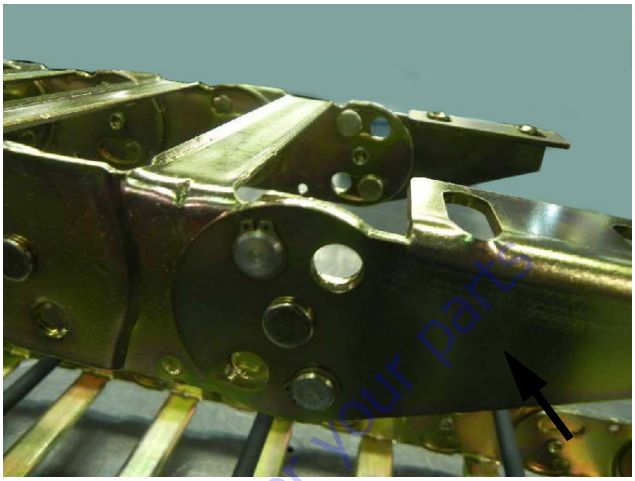
2. Parts used: Bracket Center Pin and Center Pin Snap Ring.

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

NOTE: *Ensure snap rings are seated in pin groove and closed properly.*



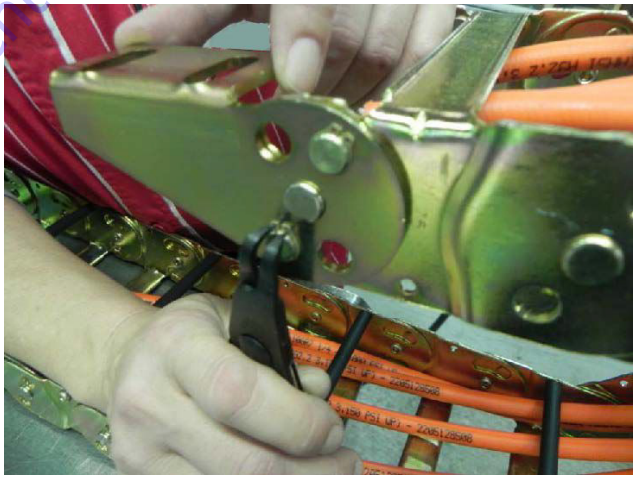
Replace Moving End Brackets



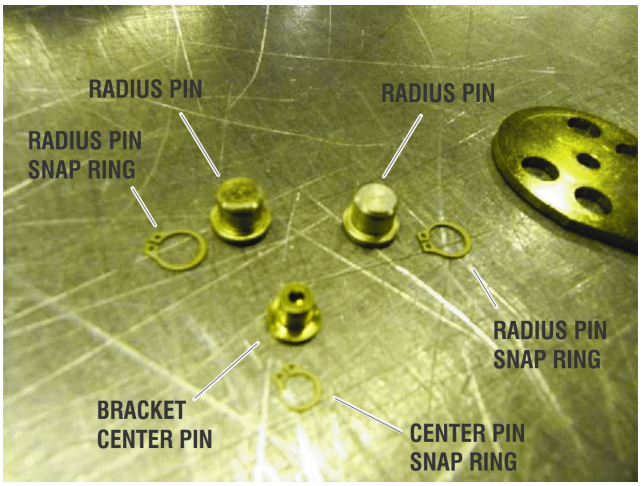
NOTICE

REPOSITION CABLES AND HOSES. KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

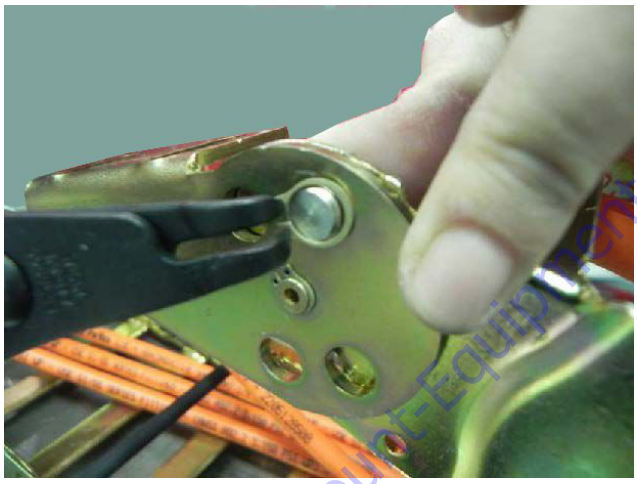
1. Remove existing pins and center rivet. Remove rivet as shown in link removal instructions on page 4-25. Repeat on other bracket if replaced.



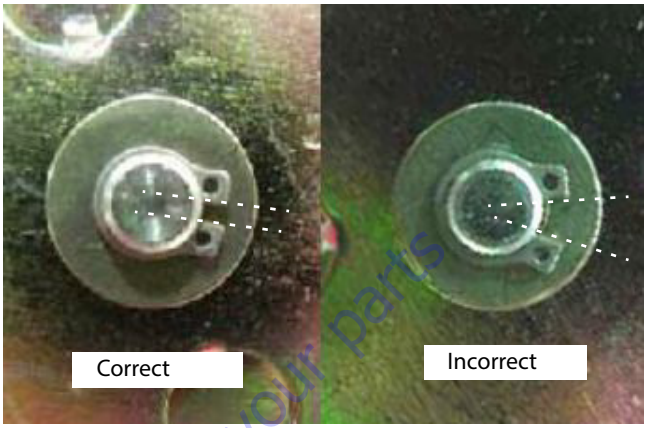
2. Install center pin with snap ring in new bracket.



3. Install radius pins and snap rings in original locations. Repeat with other moving end if replaced.



NOTE: *Ensure snap rings are seated in pin groove and closed properly.*



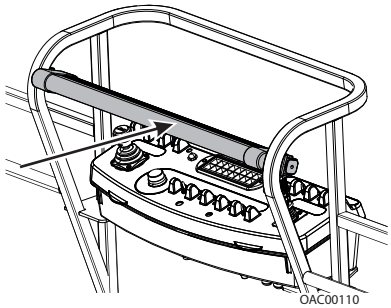
4. Make sure both brackets rotate correctly.

4.22 SKYGUARD

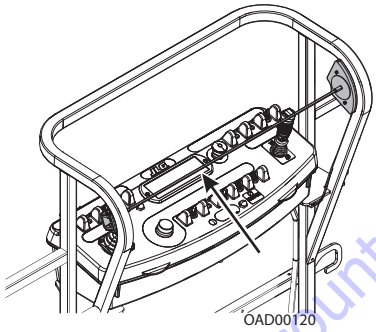
Operation

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.

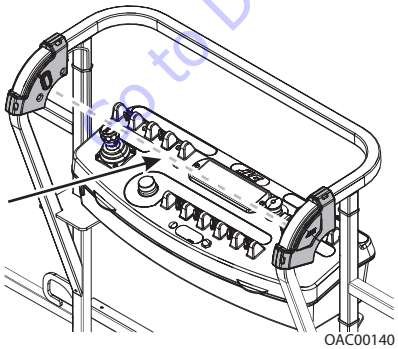
Consult the following illustrations to determine which type of SkyGuard the machine is equipped with. Regardless of the type, SkyGuard function according to the SkyGuard Function Table does not change.



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 6-13 for more fault code information

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

Table 4-1. SkyGuard Function Table

Drive Forward	Drive Reverse	Steer	Swing	Boom Lift Up	Boom Lift Down	Boom Tele Out	Boom Tele In	Jib Lift	Basket Level	Basket Rotate
C	C	C	R	R	R	R	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										

SECTION 5. BASIC HYDRAULICS 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:

- 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 container
- A small amount of hydraulic oil to saturate sponge.

1. Place sponge inside container and add hydraulic oil to the sponge until 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 suitable catch can.
3. Spray 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 CONNECTION ASSEMBLY AND TORQUE SPECIFICATION

Tapered Thread Types

NPTF = national tapered fuel (Dry Seal) per SAE J476/J512

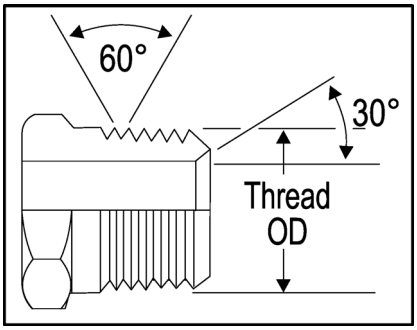


Figure 5-1. NPTF Thread

BSPT = British standard pipe tapered per ISO7-1

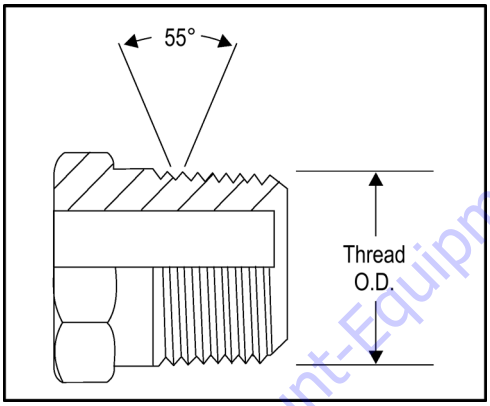


Figure 5-2. BSPT Thread

Straight Thread Types, Tube and Hose Connections

JIC = 37° flare per SAE J514

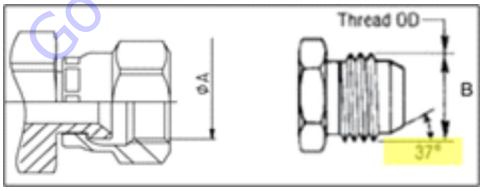


Figure 5-3. JIC Thread

SAE = 45° flare per SAE J512

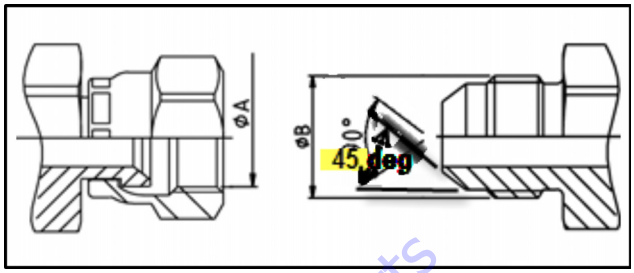


Figure 5-4. SAE Thread

ORFS = o-ring face seal per SAE J1453

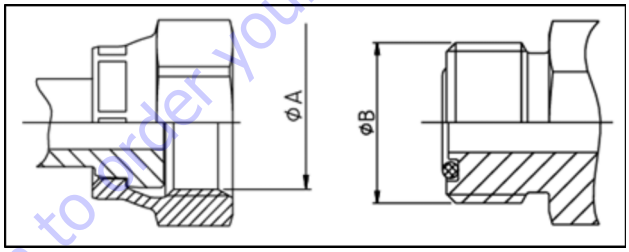


Figure 5-5. ORFS Thread

MBTL = metric flareless bite type fitting, pressure rating L (medium) per ISO 8434, DIN 2353

MBTS = metric flareless bite type fitting, pressure rating S (high) per ISO 8434, DIN 2353

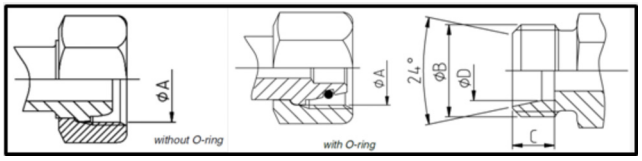


Figure 5-6. MTBL-MBTS Thread

BH = bulkhead connection – JIC, ORFS, MBTL, or MBTS types

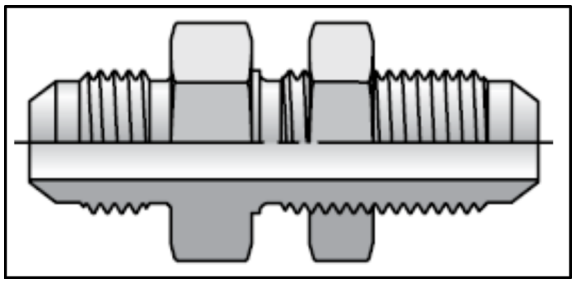


Figure 5-7. Bulkhead Thread

Straight Thread Types, Port Connections

ORB = o-ring boss per SAE J1926, ISO 11926

MPP = metric pipe parallel o-ring boss per SAE J2244, ISO 6149, DIN 3852

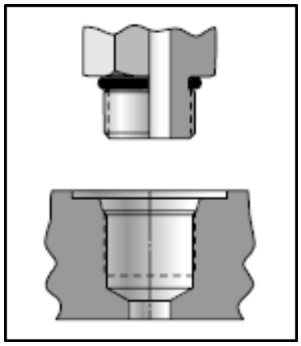


Figure 5-8. ORB-MPP Thread

MFF = metric flat face port per ISO 9974-1

BSPP = British standard parallel pipe per ISO 1179-1, DIN 3852-2

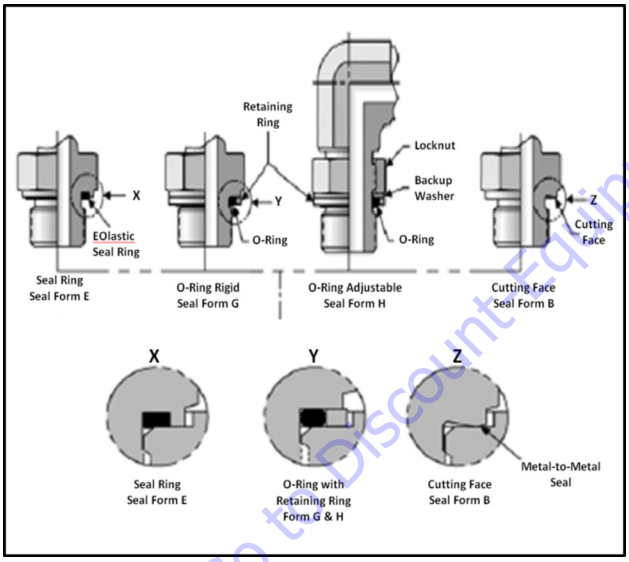


Figure 5-9. MFF-BSPP Thread

Flange Connection Types

FL61 = code 61 flange per SAE J518, ISO 6162

FL62 = code 62 flange per SAE J518, ISO 6162

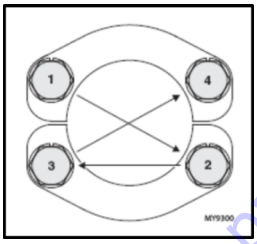


Figure 5-10. FL61-FL62

Tightening Methods

Torque = Application of a twisting force to the applicable connection by use of a precise measurement instrument (i.e. torque wrench).

Finger Tight = The point where the connector will no longer thread onto the mating part when tightened by hand or fingers. Finger Tight is relative to user strength and will have some variance. The average torque applied by this method is 3 ft-lbs [4 N-m]. Also referred to as 'Hand Tight.'

TFFT = Turns From Finger Tight; Application of a preload to a connection by first tightening the connection by hand (fingers) and applying an additional rotation counted by a defined number of turns by use of a tool.

FFWR = Flats from Wrench Resistance; Application of a preload to a connection by tightening to the point of initial wrench resistance and turning the nut a described number of 'flats'. A 'flat' is one side of the hexagonal tube nut and equates to 1/6 of a turn. Also referred to as the 'Flats Method'.

Assembly And Torque Specifications

Prior to selecting the appropriate torque from the tables within this section, it is necessary to properly identify the connector being installed. Refer to the Figures and Tables in this section.

GENERAL TUBE TYPE FITTING ASSEMBLY INSTRUCTIONS

1. Take precautions to ensure that fittings and mating components are not damaged during storage, handling or assembly. Nicks and scratches in sealing surfaces can create a path for leaks which could lead to component contamination and/or failure.
2. When making a connection to tubing, compression or flare, inspect the tube in the area of the fitting attachment to ensure that the tube has not been damaged.
3. The assembly process is one of the leading causes for contamination in air and hydraulic systems. Contamination can prevent proper tightening of fittings and adapters from occurring.
   - **a.** Avoid using dirty or oily rags when handling fittings.
   - **b.** If fittings are disassembled, they should be cleaned and inspected for damage. Replace fittings as necessary before re-installing.
   - **c.** Sealing compounds should be applied where specified; however, care should be taken not to introduce sealant into the system.
   - **d.** Avoid applying sealant to the area of the threads where the sealant will be forced into the system. This is generally the first two threads of a fitting.
   - **e.** Sealant should only be applied to the male threads.
   - **f.** Straight thread fittings do not require sealants. O-rings or washers are provided for sealing.
   - **g.** When replacing or installing an O-ring, care is to be taken while transferring the O-ring over the threads as it may become nicked or torn. When replacing an O-ring on a fitting, the use of a thread protector is recommended.
   - **h.** When installing fittings with O-rings, lubrication shall be used to prevent scuffing or tearing of the O-ring. See O-ring Installation (Replacement) in this section.
4. Take care to identify the material of parts to apply the correct torque values.
   - **a.** Verify the material designation in the table headings.
   - **b.** If specifications are given only for steel fittings and components, the values for alternate materials shall be as follows: Aluminum and Brass- reduce steel values by 35%; Stainless Steel - Use the upper limit for steel.
5. To achieve the specified torque, the torque wrench is to be held perpendicular to the axis of rotation.

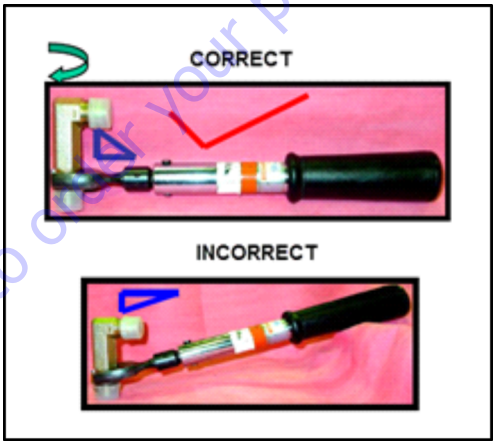


Figure 5-11. Torque Wrench Angle

6. Refer to the appropriate section in this manual for more specific instructions and procedures for each type of fitting connection.

Assembly Instructions for American Standard Pipe Thread Tapered (NPTF) Connections.

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply a suitable thread sealant, such as High Strength Threadlocking Compound, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

⚠ CAUTION

OVER TIGHTENING MAY CAUSE DEFORMATION OF THE PIPE FITTING AND DAMAGE TO THE JOINING FITTING, FLANGE OR COMPONENT MAY OCCUR.

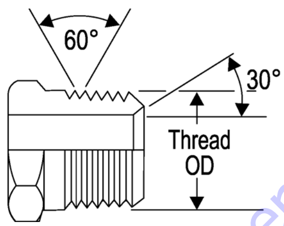
NEVER BACK OFF (LOOSEN) PIPE THREADED CONNECTORS TO ACHIEVE ALIGNMENT. MEET THE MINIMUM REQUIRED TURNS AND USE THE LAST TURN FOR ALIGNMENT.

5. Rotate male fitting the number of turns per Table 5-1, NPTF Pipe Thread. See FFWR and TFFT Methods for TFFT procedure requirements.

NOTE: *TFFT values provided in Table 5-1, NPTF Pipe Thread are applicable for the following material configurations:*

- **a.** STEEL fittings with STEEL mating components.
- **b.** STEEL fittings with ALUMINUM or BRASS mating components.
- **c.** ALUMINUM or BRASS fittings with STEEL mating components.
- **d.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-1. NPTF Pipe Thread



ØA dimension is measured on the 4th pitch of the thread

TYPE/FITTING IDENTIFICATION					Turns From Finger Tight (TFFT)**
Material	Dash Size	Thread Size	ØA*		
		(UNF)	(in)	(mm)	
STEEL, ALUMINUM, OR BRASS FITTINGS WITH STEEL, ALUMINUM, OR BRASS MATING COMPONENTS	2	1/8 - 27	0.40	10.24	2 to 3
	4	1/4 - 18	0.54	13.61	2 to 3
	6	3/8 - 18	0.67	17.05	2 to 3
	8	1/2 - 14	0.84	21.22	2 to 3
	12	3/4 - 14	1.05	26.56	2 to 3
	16	1 - 11 1/2	1.31	33.22	1.5 to 2.5
	20	1 1/4 - 11 1/2	1.65	41.98	1.5 to 2.5
	24	1 1/2 - 11 1/2	1.89	48.05	1.5 to 2.5
	32	2 - 11 1/2	2.37	60.09	1.5 to 2.5

* ØA thread dimension for reference only.

** See FFWR and TFFT Methods for TFFT procedure requirements.

Assembly Instructions for British Standard Pipe Thread Tapered (BSPT) Connections

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply a suitable thread sealant, such as High Strength Threadlocking Compound, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

⚠ CAUTION

OVER TIGHTENING MAY CAUSE DEFORMATION OF THE PIPE FITTING AND DAMAGE TO THE JOINING FITTING, FLANGE OR COMPONENT MAY OCCUR.

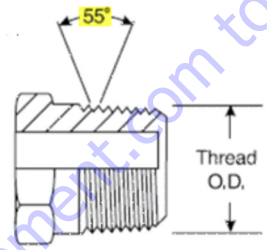
NEVER BACK OFF (LOOSEN) PIPE THREADED CONNECTORS TO ACHIEVE ALIGNMENT. MEET THE MINIMUM REQUIRED TURNS AND USE THE LAST TURN FOR ALIGNMENT.

5. Rotate male fitting the number of turns per Table 5-2, BSPT Pipe Thread. See FFWR and TFFT Methods for TFFT procedure requirements.

NOTE: *TFFT values provided in Table 5-2, BSPT Pipe Thread are applicable for the following material configurations:*

- **a.** STEEL fittings with STEEL mating components.
- **b.** STEEL fittings with ALUMINUM or BRASS mating components.
- **c.** ALUMINUM or BRASS fittings with STEEL mating components.
- **d.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-2. BSPT Pipe Thread



TYPE/FITTING IDENTIFICATION					Turns From Finger Tight (TFFT)**
MATERIAL	Dash Size	Thread Size (BSPT)	ØA* (in)	ØA* (mm)	
STEEL, ALUMINUM, OR BRASS FITTINGS WITH STEEL, ALUMINUM, OR BRASS MATING COMPONENTS	2	1/8-28	0.38	9.73	2 to 3
	4	1/4-19	0.52	13.16	2 to 3
	6	3/8-19	0.66	16.66	2 to 3
	8	1/2-14	0.83	20.96	2 to 3
	12	3/4-14	1.04	26.44	2 to 3
	16	1-11	1.31	33.25	1.5 to 2.5
	20	1 1/4-11	1.65	41.91	1.5 to 2.5
	24	1 1/2-11	1.88	47.80	1.5 to 2.5
	32	2-11	2.35	59.61	1.5 to 2.5

* ØA thread dimension for reference only.

** See FFWR and TFFT Methods for TFFT procedure requirements.

Assembly Instructions for 37° (JIC) Flare Fittings

1. Inspect the flare for obvious visual squareness and concentricity issues with the tube OD. Ensure surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary replace fitting or adapter.

⚠ CAUTION

DO NOT FORCE A MISALIGNED OR SHORT HOSE/TUBE INTO ALIGNMENT. IT PUTS UNDESIRABLE STRAIN ONTO THE JOINT EVENTUALLY LEADING TO LEAKAGE.

2. Align tube to fitting and start threads by hand.

⚠ CAUTION

THE TORQUE METHOD SHOULD NOT BE USED ON LUBRICATED OR OILY FITTINGS. NO LUBRICATION OR SEALANT IS REQUIRED. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

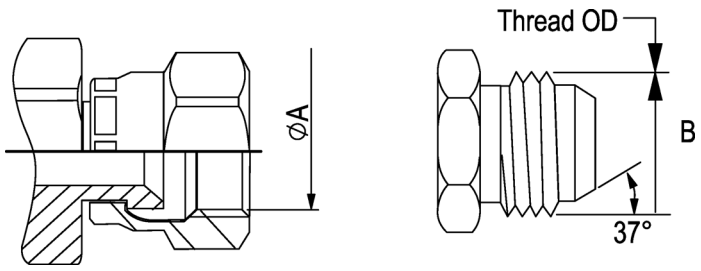
3. Torque assembly to value listed in Table 5-3, 37° Flare (JIC) Thread - Steel or Table 5-4, 37° Flare (JIC) Thread - Aluminum/Brass while using the Double Wrench Method per Double Wrench Method. Refer to FFWR and TFFT Methods for procedure requirements if using the FFWR method.

NOTE: *Torque values provided in Table 5-3, 37° Flare (JIC) Thread - Steel and Table 5-4, 37° Flare (JIC) Thread - Aluminum/Brass are segregated based on the material configuration of the connection.*

'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-3. 37° Flare (JIC) Thread - Steel

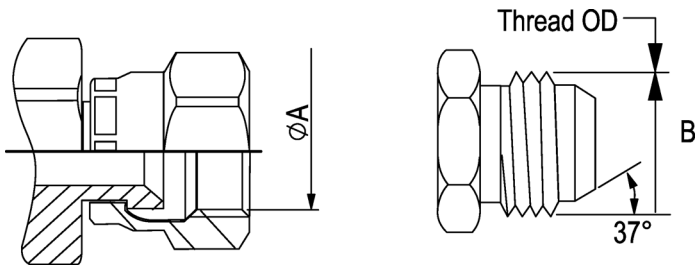


TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	6	7	7	8	9	10	--
	3	3/8-24	0.34	8.60	0.37	9.50	8	9	10	11	12	14	--
	4	7/16-20	0.39	10.00	0.44	11.10	13	14	14	18	19	19	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	14	15	15	19	20	21	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	22	23	24	30	31	33	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	42	44	46	57	60	63	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	60	63	66	81	85	89	1 to 1-1/2
	12	1 1/16-12	0.97	24.60	1.06	27.00	84	88	92	114	120	125	1 to 1-1/2
	14	1 3/16-12	1.11	28.30	1.19	30.10	100	105	110	136	142	149	1 to 1-1/2
	16	1 5/16-12	1.23	31.30	1.31	33.30	118	124	130	160	168	176	3/4 to 1
	20	1 5/8-12	1.54	39.20	1.63	41.30	168	176	185	228	239	251	3/4 to 1
	24	1 7/8-12	1.80	45.60	1.87	47.60	195	205	215	264	278	291	3/4 to 1
	32	2 1/2-12	2.42	61.50	2.50	63.50	265	278	292	359	377	395	3/4 to 1

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

Table 5-4. 37° Flare (JIC) Thread - Aluminum/Brass



TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	4	4	5	5	6	7	--
	3	3/8-24	0.34	8.60	0.37	9.50	5	6	7	7	8	9	--
	4	7/16-20	0.39	10.00	0.44	11.10	8	9	9	11	12	13	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	9	10	10	12	13	14	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	14	15	16	19	20	21	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	27	29	30	37	39	41	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	39	41	43	53	56	58	1 to 1-1/2
	12	1 1/16-12	0.97	24.60	1.06	27.00	55	57	60	74	78	81	1 to 1-1/2
	14	13/16-12	1.11	28.30	1.19	30.10	65	68	72	88	93	97	1 to 1-1/2
	16	15/16-12	1.23	31.30	1.31	33.30	77	81	84	104	109	114	3/4 to 1
	20	1 5/8-12	1.54	39.20	1.63	41.30	109	115	120	148	155	163	3/4 to 1
	24	1 7/8-12	1.80	45.60	1.87	47.60	127	133	139	172	180	189	3/4 to 1
	32	2 1/2-12	2.42	61.50	2.50	63.50	172	181	189	234	245	257	3/4 to 1

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

Assembly Instructions for 45° SAE Flare Fittings

1. Inspect the flare for obvious visual squareness and concentricity issues with the tube OD. Ensure surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary replace fitting or adapter.

⚠ CAUTION

DO NOT FORCE A MISALIGNED OR SHORT HOSE/TUBE INTO ALIGNMENT. IT PUTS UNDESIRABLE STRAIN ONTO THE JOINT EVENTUALLY LEADING TO LEAKAGE.

2. Align tube to fitting.
3. Tighten fitting by hand until hand tight.

⚠ CAUTION

THE TORQUE METHOD SHOULD NOT BE USED ON LUBRICATED OR OILY FITTINGS. NO LUBRICATION OR SEALANT IS REQUIRED. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

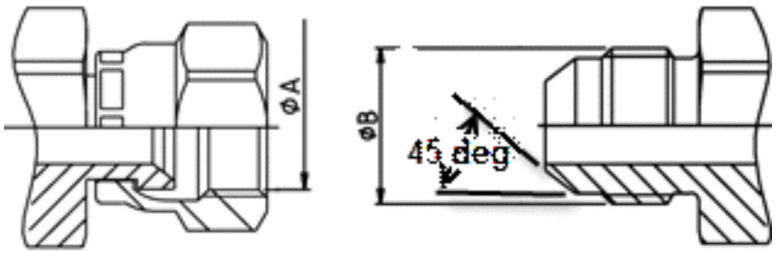
4. Torque fitting to value listed in Table 5-5, 45° Flare (SAE) - Steel and Table 5-6, 45° Flare (SAE) - Aluminum/Brass while using the Double Wrench Method outlined in this section. Refer to FFWR and TFFT Methods for procedure requirements if using the TFFT method.

NOTE: *Torque values provided in Table 5-5, 45° Flare (SAE) - Steel and Table 5-6, 45° Flare (SAE) - Aluminum/Brass are segregated based on the material configuration of the connection.*

'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-5. 45° Flare (SAE) - Steel

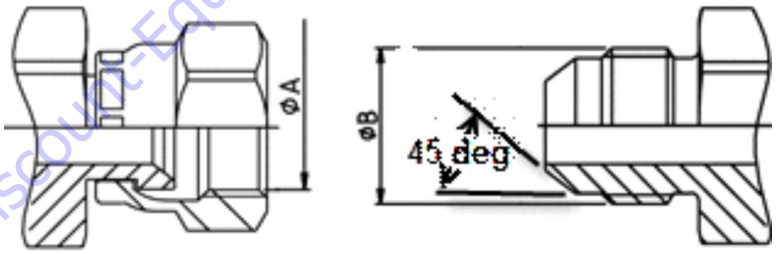


TYPE/FITTING IDENTIFICATION							Torque						Turns From Finger Tight (TFFT)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	13	14	14	18	19	19	1/4 to 1/2
	6	5/8-18	0.56	14.30	0.63	15.90	22	23	24	30	31	33	1/4 to 1/2
	8	3/4-16	0.69	17.50	0.75	19.10	42	44	46	57	60	62	1/4 to 1/2
	10	7/8-14	0.81	20.60	0.87	22.20	60	63	66	81	85	89	1/4 to 1/2
	12	1 1/16-14	0.98	25.00	1.06	27.00	84	88	92	114	119	125	1/4 to 1/2

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for TFFT procedure requirements.

Table 5-6. 45° Flare (SAE) - Aluminum/Brass



TYPE/FITTING IDENTIFICATION							Torque						Turns From Finger Tight (TFFT)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	8	9	9	11	12	12	1/4 to 1/2
	6	5/8-18	0.56	14.30	0.63	15.90	14	15	15	19	20	20	1/4 to 1/2
	8	3/4-16	0.69	17.50	0.75	19.10	27	29	30	37	39	41	1/4 to 1/2
	10	7/8-14	0.81	20.60	0.87	22.20	39	41	43	53	56	58	1/4 to 1/2
	12	1 1/16-14	0.98	25.00	1.06	27.00	55	58	61	75	79	83	1/4 to 1/2

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for TFFT procedure requirements.

Assembly Instructions for O-Ring Face Seal (ORFS) Fittings

1. Ensure proper O-ring is installed. If O-ring is missing install per O-ring Installation (Replacement).
2. Ensure surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary replace fitting or adapter.

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

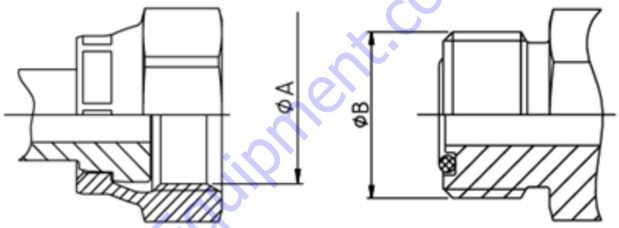
3. Pre-lubricate the O-ring with Hydraulic Oil.
4. Place the tube assembly against the fitting body so that the flat face comes in contact with the O-ring. Hand thread the nut onto the fitting body.
5. Torque nut to value listed in Table 5-7, O-ring Face Seal (ORFS) - Steel or Table 5-8, O-ring Face Seal (ORFS) - Aluminum/Brass while using the Double Wrench Method. Refer to FFWR and TFFT Methods for procedure requirements if using the FFWR method.

NOTE: *Torque values provided in Table 5-7, O-ring Face Seal (ORFS) - Steel and Table 5-8, O-ring Face Seal (ORFS) - Aluminum/Brass are segregated based on the material configuration of the connection.*

'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

a. STEEL fittings with ALUMINUM or BRASS mating components.
b. ALUMINUM or BRASS fittings with STEEL mating components.
c. ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-7. O-ring Face Seal (ORFS) - Steel

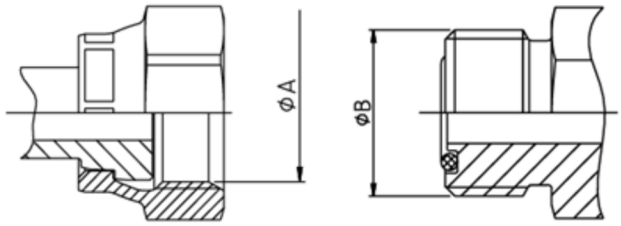


TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**	
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18	0.51	13.00	0.56	14.20	18	19	20	25	26	27	1/4 to 1/2	1/2 to 3/4
	6	11/16-16	0.63	15.90	0.69	17.50	30	32	33	40	43	45	1/4 to 1/2	1/2 to 3/4
	8	13/16-16	0.75	19.10	0.81	20.60	40	42	44	55	57	60	1/4 to 1/2	1/2 to 3/4
	10	1-14	0.94	23.80	1.00	25.40	60	63	66	81	85	89	1/4 to 1/2	1/2 to 3/4
	12	13/16-12	1.11	28.20	1.19	30.10	85	90	94	115	122	127	1/4 to 1/2	1/2 to 3/4
	16	17/16-12	1.34	34.15	1.44	36.50	110	116	121	149	157	164	1/4 to 1/2	1/2 to 3/4
	20	111/16-12	1.59	40.50	1.69	42.90	150	158	165	203	214	224	1/4 to 1/2	1/2 to 3/4
	24	2-12	1.92	48.80	2.00	50.80	230	242	253	312	328	343	1/4 to 1/2	1/2 to 3/4
	32	21/2-12	2.43	61.67	2.50	63.50	375	394	413	508	534	560	1/4 to 1/2	1/2 to 3/4

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

Table 5-8. O-ring Face Seal (ORFS) - Aluminum/Brass



TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**	
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18	0.51	13.00	0.56	14.20	12	13	13	16	18	18	1/4 to 1/2	1/2 to 3/4
	6	11/16-16	0.63	15.90	0.69	17.50	20	21	22	27	28	30	1/4 to 1/2	1/2 to 3/4
	8	13/16-16	0.75	19.10	0.81	20.60	26	28	29	35	38	39	1/4 to 1/2	1/2 to 3/4
	10	1-14	0.94	23.80	1.00	25.40	39	41	43	53	56	58	1/4 to 1/2	1/2 to 3/4
	12	13/16-12	1.11	28.20	1.19	30.10	55	58	61	75	79	83	1/4 to 1/2	1/2 to 3/4
	16	17/16-12	1.34	34.15	1.44	36.50	72	76	79	98	103	107	1/4 to 1/2	1/2 to 3/4
	20	1 11/16-12	1.59	40.50	1.69	42.90	98	103	108	133	140	146	1/4 to 1/2	1/2 to 3/4
	24	2-12	1.92	48.80	2.00	50.80	12	13	13	16	18	18	1/4 to 1/2	1/2 to 3/4
	32	2 1/2-12	2.43	61.67	2.50	63.50	20	21	22	27	28	30	1/4 to 1/2	1/2 to 3/4

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

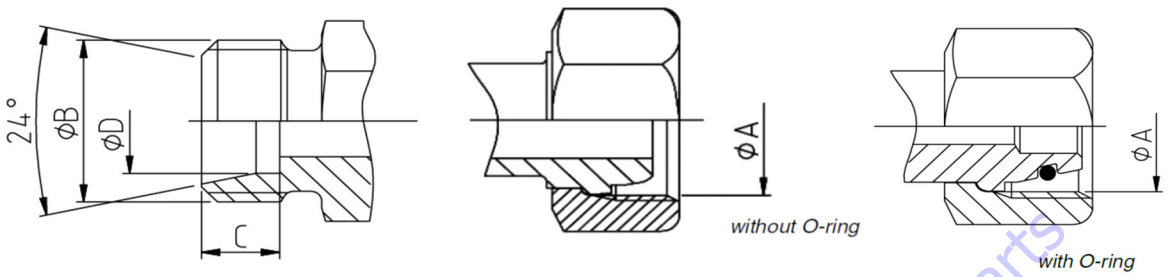
Assembly Instructions for DIN 24° Flare Bite Type Fittings (MBTL and MBTS)

⚠ CAUTION

A NON-SQUARE TUBE END CAN CAUSE IMPROPERLY SEATED FITTINGS AND LEAKAGE.

1. Inspect the components to ensure free of contamination, external damage, rust, splits, dirt, foreign matter, or burrs. Ensure tube end is visibly square. If necessary replace fitting or tube.
2. Lubricate thread and cone of fitting body or hardened pre-assembly tool, as well as the progressive ring and nut threads.
3. Slip nut and progressive ring over tube, assuring that they are in the proper orientation.
4. Push the tube end into the coupling body.
5. Slide collet into position and tighten until finger tight. Mark nut and tube in the finger-tight position. Tighten nut to the number of flats listed in Table 5-9, DIN 24° Cone (MBTL & MBTS) while using the Double Wrench Method. The tube must not turn with the nut.

Table 5-9. DIN 24° Cone (MBTL & MBTS)



TYPE/FITTING IDENTIFICATION								DIN 24° CONE FLARELESS BITE FITTING (With or Without O-Ring)						
MATERIAL	TYPE	Tube O.D.	Thread M Size	ØA*	ØB*	C*	ØD*	Torque [Ft-Lb] Min	Nom	Max	Torque [N-m] Min	Nom	Max	Flats from Wrench Resistance (F.F.W.R)**
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)							
STEEL FITTINGS WITH STEEL MATING COMPONENTS	DIN 24° CONE FLARELESS BITE (MBTL) FITTING	6	M12x1.5	10.50	12.00	7.00	6.20	FFWR is the recommended method of fitting assembly. Torque values are application specific due to variability in the fitting supplier, coating, lubrication, and other physical characteristics of the connection. Refer to the specific procedure in the						1.5 to 1.75
		8	M14x1.5	12.50	14.00	7.00	8.20							1.5 to 1.75
		10	M16x1.5	14.50	16.00	7.00	10.20							1.5 to 1.75
		12	M18x1.5	16.50	18.00	7.00	12.20							1.5 to 1.75
		15	M22x1.5	20.50	22.00	7.00	15.20							1.5 to 1.75
		18	M26x1.5	24.50	26.00	7.50	18.20							1.5 to 1.75
		22	M30x2	27.90	30.00	7.50	22.20							1.5 to 1.75
		28	M36x2	33.90	36.00	7.50	28.20							1.5 to 1.75
		35	M45x2	42.90	45.00	10.50	35.30							1.5 to 1.75
		42	M52x2	49.90	52.00	11.00	42.30							1.5 to 1.75
	TYPE	Tube O.D.	Thread M Size	ØA*	ØB*	C*	ØD*	Torque [Ft-Lb] Min	Nom	Max	Torque [N-m] Min	Nom	Max	Flats from Wrench Resistance (F.F.W.R)**
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)							
	DIN 24° CONE FLARELESS BITE (MBTS) FITTING	6	M14x1.5	12.50	14.00	7.00	6.20	FFWR is the recommended method of fitting assembly. Torque values are application specific due to variability in the fitting supplier, coating, lubrication, and other physical characteristics of the connection. Refer to the specific procedure in the						1.5 to 1.75
		8	M16x1.5	14.50	16.00	7.00	8.20							1.5 to 1.75
		10	M18x1.5	16.50	18.00	7.50	10.20							1.5 to 1.75
		12	M20x1.5	18.50	20.00	7.50	12.20							1.5 to 1.75
		14	M22x1.5	20.50	22.00	8.00	14.20							1.5 to 1.75
		16	M24x1.5	22.50	24.00	8.50	16.20							1.5 to 1.75
		20	M30x2	27.90	30.00	10.50	20.20							1.5 to 1.75
		25	M36x2	33.90	36.00	12.00	25.20							1.5 to 1.75
		30	M42x2	39.90	42.00	13.50	30.20							1.5 to 1.75
		38	M52x2	49.90	52.00	16.00	38.30							1.5 to 1.75

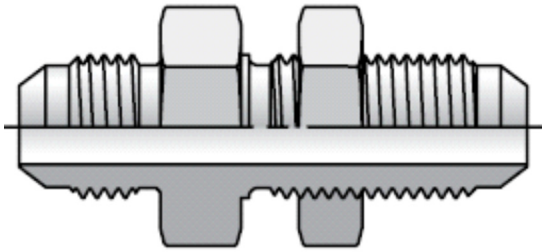
* ØA, ØB, C, & ØD thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

Assembly Instructions for Bulkhead (BH) Fittings

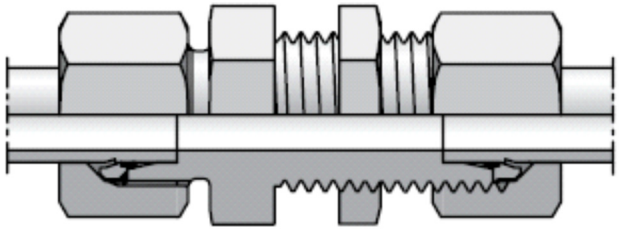
1. Ensure threads and surface are free of rust, weld and brazing splatter, splits, burrs or other foreign material. If necessary replace fitting or adapter.
2. Remove the locknut from the bulkhead assembly.
3. Insert the bulkhead side of the fitting into the panel or bulkhead bracket opening.
4. Hand thread the locknut onto the bulkhead end of the fitting body.
5. Torque nut onto fitting per Table 5-10, Bulkhead Fittings (BH) - INCH and Table 5-11, Bulkhead Fittings (BH) - METRIC while using the Double Wrench Method.

Table 5-10. Bulkhead Fittings (BH) - INCH



TYPE/FITTING IDENTIFICATION				FASTENING JAM NUT for Bulkhead Connectors					
MATERIAL	TYPE	Dash Size	Thread Size	Torque					
				[Ft-Lb]			[N-m]		
			(UNF)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS	O-RING FACE SEAL (ORFS) BULKHEAD FITTING	4	9/16-18	15	16	17	20	22	23
		6	11/16-16	25	27	28	34	37	38
		8	13/16-16	55	58	61	75	79	83
		10	1-14	85	90	94	115	122	127
		12	13/16-12	135	142	149	183	193	202
		14	15/16-12	170	179	187	230	243	254
		16	17/16-12	200	210	220	271	285	298
		20	111/16-12	245	258	270	332	350	366
		24	2-12	270	284	297	366	385	403
	TYPE	Dash Size	Thread Size	Torque					
				[Ft-Lb]			[N-m]		
			(UNF)	Min	Nom	Max	Min	Nom	Max
	37° FLARE (JIC) BULKHEAD FITTING	3	3/8-24	8	9	9	11	12	12
		4	7/16-20	13	14	14	18	19	19
		5	1/2-20	20	21	22	27	28	30
		6	9/16-18	25	27	28	34	37	38
		8	3/4-16	50	53	55	68	72	75
		10	7/8-14	85	90	94	115	122	127
		12	11/16-12	135	142	149	183	193	202
		14	13/16-12	170	179	187	230	243	254
		16	15/16-12	200	210	220	271	285	298
		20	15/8-12	245	258	270	332	350	366
		24	17/8-12	270	284	297	366	385	403
		32	21/2-12	310	326	341	420	442	462

Table 5-11. Bulkhead Fittings (BH) - METRIC



TYPE/FITTING IDENTIFICATION				FASTENING JAM NUT for Bulkhead Connectors					
MATERIAL	TYPE	Connecting Tube O.D.	Thread M Size	Torque					
				[Ft-Lb]			[N-m]		
		(mm)	(metric)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS	DIN 24° CONE FLARELESS BITE (MBTL) BULKHEAD FITTING	6	M12x1.5	14	15	16	19	20	22
		8	M14x1.5	17	18	19	23	24	26
		10	M16x1.5	22	23	24	30	31	33
		12	M18x1.5	35	37	39	47	50	53
		15	M22x1.5	44	47	50	60	64	68
		18	M26x1.5	70	75	80	95	102	108
		22	M30x2	115	120	125	156	163	169
		28	M36x2	150	157	164	203	213	222
		35	M45x2	155	162	169	210	220	229
		42	M52x2	220	230	240	298	312	325
	DIN 24° CONE FLARELESS BITE (MBTS) BULKHEAD FITTING	Connecting Tube O.D.	Thread M Size	Torque					
				[Ft-Lb]			[N-m]		
		(mm)	(metric)	Min	Nom	Max	Min	Nom	Max
		6	M14x1.5	17	15	16	23	20	22
		8	M16x1.5	22	18	19	30	24	26
		10	M18x1.5	35	23	24	47	31	33
		12	M20x1.5	40	35	37	54	47	50
		14	M22x1.5	44	47	50	60	64	68
		16	M24x1.5	70	75	80	95	102	108
		20	M30x2	115	120	125	156	163	169
		25	M36x2	150	157	164	203	213	222
		30	M42x2	155	162	169	210	220	229
		38	M52x2	220	230	240	298	312	325

Assembly Instructions for O-Ring Boss (ORB) Fittings

1. Inspect components to ensure that male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Ensure proper O-ring is installed. If O-ring is missing install per O-ring Installation (Replacement).

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-12 thru Tables 5-17, O-RING BOSS (ORB) while using the Double Wrench Method.

NOTE: *The table headings identify the straight thread O-ring port and the type on the other side of the fitting. The torque will be applied to the straight thread O-ring port.*

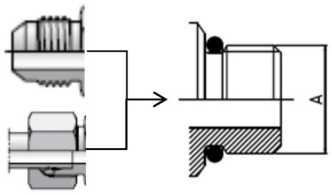
NOTE: *Torque values provided in Table 5-12 thru Table 5-17, O-RING BOSS (ORB) are segregated based on the material configuration of the connection.*

'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-12. O-ring Boss (ORB) - Table 1 of 6



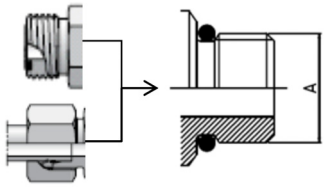
TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(85)	(90)	(94)	10	10	11
	3	3/8-24	0.37	9.52	(155)	(163)	(171)	18	18	19
	4	7/16-20	0.44	11.11	22	23	24	29	31	33
	5	1/2-20	0.50	12.70	23	25	26	32	34	35
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	11/16-12	1.06	27.00	135	142	149	185	193	202
	14	13/16-12	1.19	30.10	175	184	193	235	249	262
	16	15/16-12	1.31	33.30	200	210	220	270	285	298
	20	15/8-12	1.63	41.30	250	263	275	340	357	373
	24	17/8-12	1.87	47.60	305	321	336	415	435	456
	32	21/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(55)	(58)	(61)	6	7	7
	3	3/8-24	0.37	9.52	(101)	(106)	(111)	11	12	13
	4	7/16-20	0.44	11.11	14	15	16	19	20	22
	5	1/2-20	0.50	12.70	15	16	17	20	22	23
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	11/16-12	1.06	27.00	88	93	97	119	126	132
	14	13/16-12	1.19	30.10	114	120	126	155	163	171
	16	15/16-12	1.31	33.30	130	137	143	176	186	194
	20	15/8-12	1.63	41.30	163	171	179	221	232	243
	24	17/8-12	1.87	47.60	198	208	218	268	282	296
	32	21/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-13. O-ring Boss (ORB) - Table 2 of 6



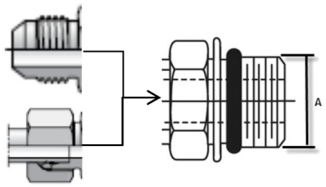
TYPE/FITTING IDENTIFICATION					STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	26	27	28	35	37	38
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	17	18	18	23	24	24
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-14. O-ring Boss (ORB) - Table 3 of 6



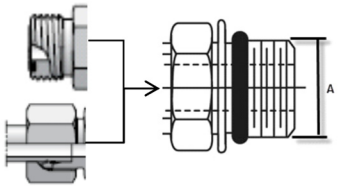
TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(60)	(63)	(66)	7	7	7
	3	3/8-24	0.37	9.52	(100)	(105)	(110)	11	12	12
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	21	22	23	28	30	31
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	11/16-12	1.06	27.00	135	142	149	185	193	202
	14	13/16-12	1.19	30.10	175	184	193	235	249	262
	16	15/16-12	1.31	33.30	200	210	220	270	285	298
	20	15/8-12	1.63	41.30	250	263	275	340	357	373
	24	17/8-12	1.87	47.60	305	321	336	415	435	456
	32	21/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(39)	(41)	(43)	4	5	5
	3	3/8-24	0.37	9.52	(65)	(69)	(72)	7	8	8
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	15	19	20	20
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	11/16-12	1.06	27.00	88	93	97	119	126	132
	14	13/16-12	1.19	30.10	114	120	126	155	163	171
	16	15/16-12	1.31	33.30	130	137	143	176	186	194
	20	15/8-12	1.63	41.30	163	171	179	221	232	243
	24	17/8-12	1.87	47.60	198	208	218	268	282	296
	32	21/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-15. O-ring Boss (ORB) - Table 4 of 6



TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-16. O-ring Boss (ORB) - Table 5 of 6

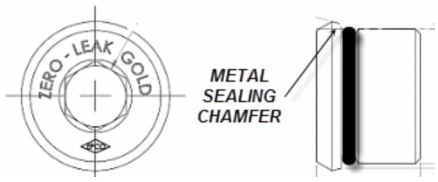
TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(30)	(32)	(33)	3	4	4
	3	3/8-24	0.37	9.52	(55)	(58)	(61)	6	7	7
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	16	19	20	22
	6	9/16-18	0.56	14.28	34	36	38	46	49	52
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(20)	(21)	(21)	2	2	2
	3	3/8-24	0.37	9.52	(36)	(38)	(40)	4	4	5
	4	7/16-20	0.44	11.11	6	7	7	8	9	9
	5	1/2-20	0.50	12.70	9	10	10	12	14	14
	6	9/16-18	0.56	14.28	22	24	25	30	33	34
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-17. O-ring Boss (ORB) - Table 6 of 6



TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
					Torque**					
					Ft-Lb or (in-lb)			[N-m]		
MATERIAL	Dash Size	Thread Size	ØA*							
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	11/16-12	1.06	27.00	51	54	57	69	73	77
	14	13/16-12	1.19	30.10	Fitting size greater than -12 not typically specified on JLG applications. Consult specific service procedure if encountered.					
	16	15/16-12	1.31	33.30						
	20	15/8-12	1.63	41.30						
	24	17/8-12	1.87	47.60						
	32	21/2-12	2.50	63.50						

TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
					Torque**					
					Ft-Lb or (in-lb)			[N-m]		
MATERIAL	Dash Size	Thread Size	ØA*							
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	11/16-12	1.06	27.00	51	54	57	69	73	77
	14	13/16-12	1.19	30.10	Fitting size greater than -12 not typically specified on JLG applications. Consult specific service procedure if encountered.					
	16	15/16-12	1.31	33.30						
	20	15/8-12	1.63	41.30						
	24	17/8-12	1.87	47.60						
	32	21/2-12	2.50	63.50						

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Assembly Instructions for Adjustable Port End Metric (MFF) Fittings

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not pre-installed, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-18, Table 5-19, Table 5-20, Metric Flat Face Port (MFF) - L Series and Table 5-21, Table 5-22, Table 5-23, Metric Flat Face Port (MFF) - S Series while using the Double Wrench Method.

NOTE: *The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.*

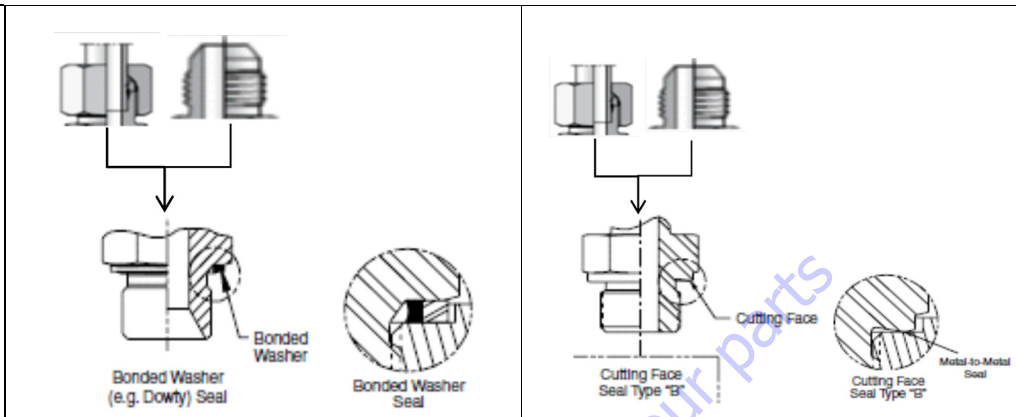
NOTE: *Torque values provided in Table 5-18, Table 5-19, Table 5-20,* Metric Flat Face Port (MFF) - L Series *and Table 5-21, Table 5-22, and Table 5-23,* Metric Flat Face Port (MFF) - S Series *are segregated based on the material configuration of the connection.*

'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

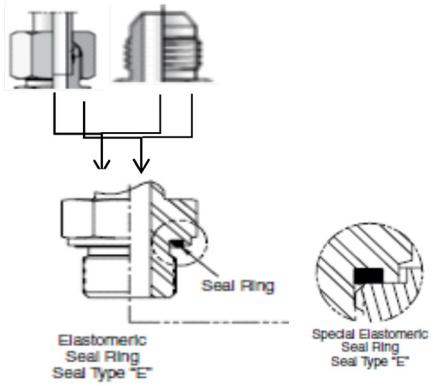
7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

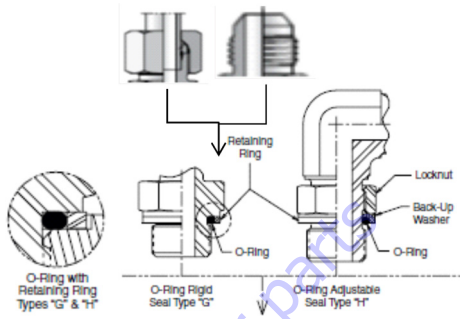
Table 5-18. Metric Flat Face Port (MFF) - L Series - Table 1 of 3



TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	7	8	8	9	11	11	13	14	14	18	19	19
	M12x1.5	8	15	16	17	20	22	23	22	23	24	30	31	33
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	33	35	36	45	47	49	48	51	53	65	69	72
	M18x1.5	15	41	43	45	55	58	61	59	62	65	80	84	88
	M22x1.5	18	48	51	53	65	69	72	103	108	113	140	146	153
	M27x2	22	66	70	73	90	95	99	140	147	154	190	199	209
	M33x2	28	111	117	122	150	159	165	251	264	276	340	358	374
	M42x2	35	177	186	195	240	252	264	369	388	406	500	526	550
	M48x2	42	214	225	235	290	305	319	465	489	512	630	663	694
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	4	5	5	5	7	7	8	9	9	11	12	12
	M12x1.5	8	10	11	11	14	15	15	14	15	16	19	20	22
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	21	22	23	28	30	31	31	33	34	42	45	46
	M18x1.5	15	27	28	29	37	38	39	38	40	42	52	54	57
	M22x1.5	18	31	33	34	42	45	46	67	70	73	91	95	99
	M27x2	22	43	45	47	58	61	64	91	96	100	123	130	136
	M33x2	28	72	76	79	98	103	107	163	171	179	221	232	243
	M42x2	35	115	121	127	156	164	172	240	252	264	325	342	358
	M48x2	42	139	146	153	188	198	207	302	318	332	409	431	450

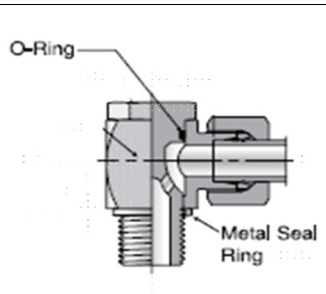
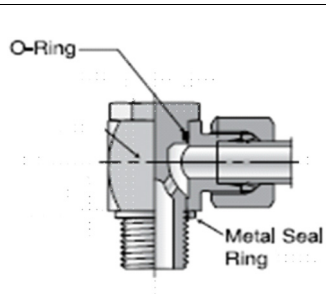
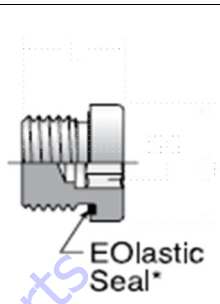
Table 5-19. Metric Flat Face Port (MFF) - L Series - Table 2 of 3





TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	15	18	19	20
	M12x1.5	8	18	19	20	25	26	27	18	19	20	25	26	28
	M14x1.5	10	33	35	36	45	47	49	30	31	32	40	42	44
	M16x1.5	12	41	43	45	55	58	61	41	43	45	55	58	61
	M18x1.5	15	52	55	57	70	75	77	52	54	57	70	74	77
	M22x1.5	18	92	97	101	125	132	137	66	70	73	90	95	99
	M27x2	22	133	140	146	180	190	198	133	139	146	180	189	198
	M33x2	28	229	241	252	310	327	342	229	240	252	310	326	341
	M42x2	35	332	349	365	450	473	495	332	348	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12
	M12x1.5	8	12	13	13	16	18	18	12	13	13	16	18	18
	M14x1.5	10	21	22	23	28	30	31	19	20	21	26	27	29
	M16x1.5	12	27	28	29	37	38	39	26	28	29	36	38	39
	M18x1.5	15	34	36	37	46	49	50	34	35	37	46	48	50
	M22x1.5	18	60	63	66	81	85	89	43	45	47	59	61	64
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

Table 5-20. Metric Flat Face Port (MFF) - L Series - Table 3 of 3

					
TYPE/FITTING IDENTIFICATION			**BANJO FITTINGS with L series DIN (MBTL) opposite end**	**HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end**	**FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS**

MATERIAL	Thread M Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	14	18	19	19	9	10	10	12	14	14
	M12x1.5	8	26	28	29	35	38	39	33	35	36	45	47	49	18	19	20	25	26	27
	M14x1.5	10	37	39	41	50	53	56	41	43	45	55	58	61	26	28	29	35	38	39
	M16x1.5	12	44	46	48	60	62	65	59	62	65	80	84	88	41	43	45	55	58	61
	M18x1.5	15	59	62	65	80	84	88	74	78	81	100	106	110	48	51	53	65	69	72
	M22x1.5	18	89	94	98	120	127	133	103	108	113	140	146	153	66	70	73	90	95	99
	M27x2	22	96	101	106	130	137	144	236	248	260	320	336	353	100	105	110	135	142	149
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	166	175	183	225	237	248
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	266	280	293	360	380	397
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	266	280	293	360	380	397

MATERIAL	Thread M Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	M12x1.5	8	17	18	19	23	24	26	21	22	23	28	30	31	12	13	13	16	18	18
	M14x1.5	10	24	26	27	33	35	37	27	28	29	37	38	39	17	18	19	23	24	26
	M16x1.5	12	29	30	31	39	41	42	38	40	42	52	54	57	27	28	29	37	38	39
	M18x1.5	15	38	40	42	52	54	57	48	51	53	65	69	72	31	33	34	42	45	46
	M22x1.5	18	58	61	64	79	83	87	67	70	73	91	95	99	43	45	47	58	61	64
	M27x2	22	62	66	69	84	89	94	153	161	169	207	218	229	65	69	72	88	94	98
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	108	114	119	146	155	161
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	173	182	190	235	247	258
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	173	182	190	235	247	258

Table 5-21. Metric Flat Face Port (MFF) - S Series - Table 1 of 3

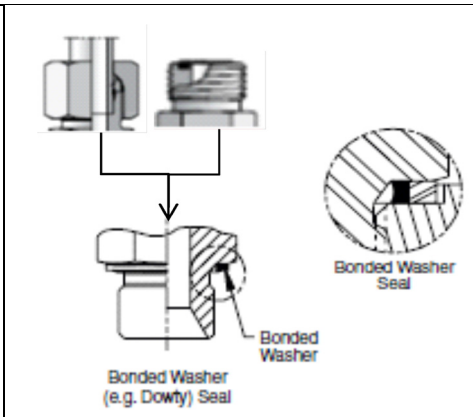
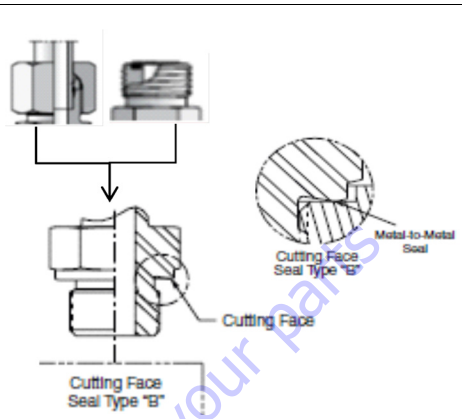
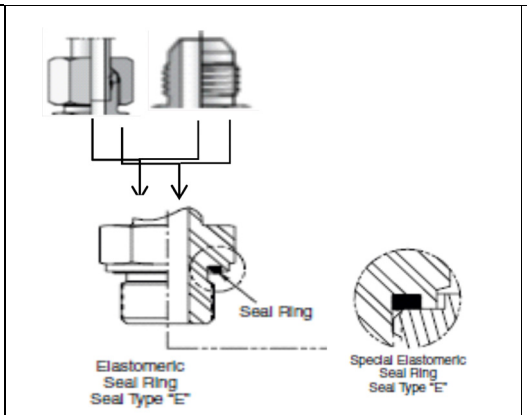
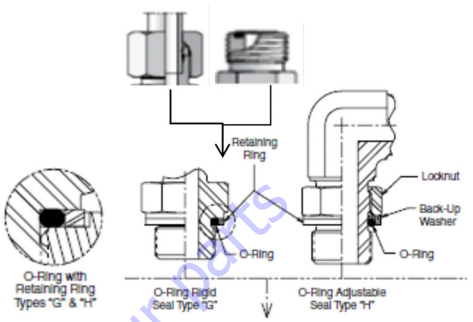
														
TYPE/FITTING IDENTIFICATION			**FORM A (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end**						**FORM B (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end**					
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	15	16	17	20	22	23	26	28	29	35	38	39
	M14x1.5	8	26	28	29	35	38	39	41	43	45	55	58	61
	M16x1.5	10	33	35	36	45	47	49	52	55	57	70	75	77
	M18x1.5	12	41	43	45	55	58	61	81	85	89	110	115	121
	M20x1.5	14	41	43	45	55	58	61	111	117	122	150	159	165
	M22x1.5	16	48	51	53	65	69	72	125	132	138	170	179	187
	M27x2	20	66	70	73	89	95	99	199	209	219	270	283	297
	M33x2	25	111	117	122	150	159	165	302	317	332	410	430	450
	M42x2	30	177	186	195	240	252	264	398	418	438	540	567	594
	M48x2	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	10	11	11	14	15	15	17	18	19	23	24	26
	M14x1.5	8	17	18	19	23	24	26	27	28	29	37	38	39
	M16x1.5	10	21	22	23	28	30	31	34	36	37	46	49	50
	M18x1.5	12	27	28	29	37	38	39	53	56	58	72	76	79
	M20x1.5	14	27	28	29	37	38	39	72	76	79	98	103	107
	M22x1.5	16	31	33	34	42	45	46	81	86	90	110	117	122
	M27x2	20	43	45	47	58	61	64	129	136	142	175	184	193
	M33x2	25	72	76	79	98	103	107	196	206	216	266	279	293
	M42x2	30	115	121	127	156	164	172	259	272	285	351	369	386
	M48x2	38	139	146	153	188	198	207	335	352	369	454	477	500

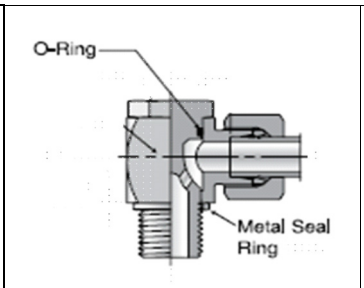
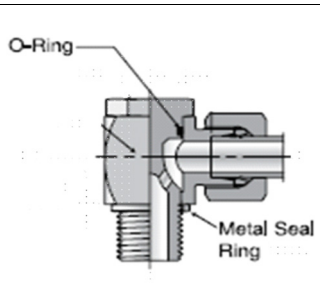
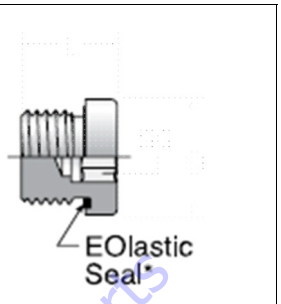
Table 5-22. Metric Flat Face Port (MFF) - S Series - Table 2 of 3





TYPE/FITTING IDENTIFICATION			FORM E (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end						FORM G/H (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	26	28	29	35	38	39
	M12x1.5	8	33	35	36	45	47	49	41	43	45	55	58	61
	M14x1.5	10	52	55	57	70	75	77	52	55	57	70	75	77
	M16x1.5	12	66	70	73	90	95	99	66	70	73	90	95	99
	M18x1.5	15	92	97	101	125	132	137	92	97	101	125	132	137
	M22x1.5	18	100	105	110	135	142	149	100	105	110	135	142	149
	M27x2	22	133	140	146	180	190	198	133	140	146	180	190	198
	M33x2	28	229	241	252	310	327	342	229	241	252	310	327	342
	M42x2	35	332	349	365	450	473	495	332	349	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	17	18	19	23	24	26
	M12x1.5	8	21	23	23	29	31	32	27	28	29	37	38	39
	M14x1.5	10	34	36	37	46	49	50	34	36	37	46	49	50
	M16x1.5	12	43	45	47	58	61	64	43	45	47	58	61	64
	M18x1.5	15	60	63	66	81	85	89	60	63	66	81	85	89
	M22x1.5	18	65	69	72	88	94	98	65	69	72	88	94	98
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

Table 5-23. Metric Flat Face Port (MFF) - S Series - Table 3 of 3

																		
TYPE/FITTING IDENTIFICATION			**BANJO FITTINGS with S series DIN (MBTS) opposite end**						**HIGH PRESSURE BANJO FITTINGS with S series DIN (MBTS) opposite end**						**FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS**					
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	33	35	36	45	47	49	--	--	--	--	--	--
	M12x1.5	8	37	39	41	50	53	56	41	43	45	55	58	61	--	--	--	--	--	--
	M14x1.5	10	44	46	48	60	62	65	59	62	65	80	84	88	--	--	--	--	--	--
	M16x1.5	12	59	62	65	80	84	88	74	78	81	100	106	110	--	--	--	--	--	--
	M18x1.5	15	81	85	89	110	115	121	92	97	101	125	132	137	59	62	65	80	84	88
	M22x1.5	18	89	94	98	120	127	133	100	105	110	135	142	149	--	--	--	--	--	--
	M27x2	22	100	105	110	135	142	149	236	248	260	320	336	353	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	--	--	--	--	--	--
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	21	22	23	28	30	31	--	--	--	--	--	--
	M12x1.5	8	24	26	27	33	35	37	27	28	29	37	38	39	--	--	--	--	--	--
	M14x1.5	10	29	30	31	39	41	42	38	40	42	52	54	57	--	--	--	--	--	--
	M16x1.5	12	38	40	42	52	54	57	48	51	53	65	69	72	--	--	--	--	--	--
	M18x1.5	15	53	56	58	72	76	79	60	63	66	81	85	89	38	40	42	52	54	57
	M22x1.5	18	58	61	64	79	83	87	65	69	72	88	94	98	--	--	--	--	--	--
	M27x2	22	65	69	72	88	94	98	153	161	169	207	218	229	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	--	--	--	--	--	--

Assembly Instructions for Metric ISO 6149 (MPP) Port Assembly Stud Ends

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not preinstalled, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-24, Metric Pipe Parallel O-ring Boss (MPP) while using the Double Wrench Method.

NOTE: *The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.*

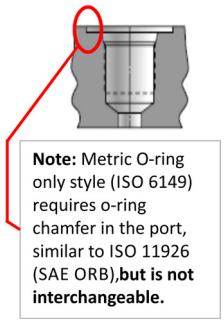
NOTE: *Torque values provided in Table 5-24*, Metric Pipe Parallel O-ring Boss (MPP) *are segregated based on the material configuration of the connection.*

'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

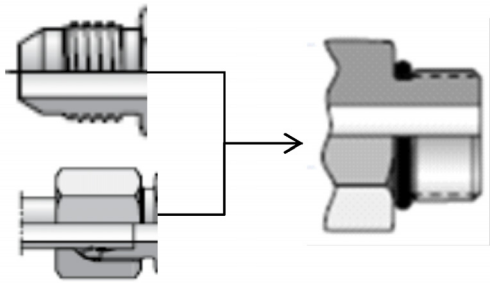
- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

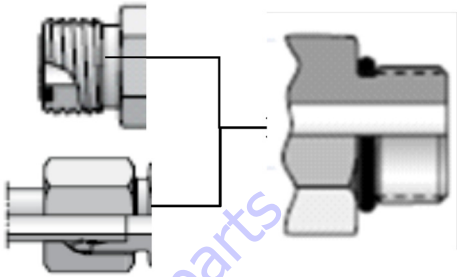
7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-24. Metric Pipe Parallel O-Ring Boss (MPP)



Note: Metric O-ring only style (ISO 6149) requires o-ring chamfer in the port, similar to ISO 11926 (SAE ORB),**but is not interchangeable.**





TYPE/FITTING IDENTIFICATION			STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	6	7	7	8	9	9	8	9	9	10	12	12
	M10x1	6	11	12	12	15	16	16	15	16	17	20	22	23
	M12x1.5	8	18	19	20	25	26	27	26	28	29	35	38	39
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	30	32	33	40	43	45	41	43	45	55	58	61
	M18x1.5	15	33	35	36	45	47	49	52	55	57	70	75	77
	M20x1.5	--	--	--	--	--	--	--	59	62	65	80	84	88
	M22x1.5	18	44	46	48	60	62	65	74	78	81	100	106	110
	M27x2	22	74	78	81	100	106	110	125	132	138	170	179	187
	M30x2	--	95	100	105	130	136	142	175	184	193	237	249	262
	M33x2	25	120	126	132	160	171	179	230	242	253	310	328	343
	M38x2	--	135	142	149	183	193	202	235	247	259	319	335	351
	M42x2	30	155	163	171	210	221	232	245	258	270	330	350	366
	M48x2	38	190	200	209	260	271	283	310	326	341	420	442	462
	M60x2	50	230	242	253	315	328	343	370	389	407	500	527	552
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	4	5	5	5	7	7	5	6	6	7	8	8
	M10x1	6	7	8	8	9	11	11	10	11	11	14	15	15
	M12x1.5	8	12	13	13	16	18	18	17	18	19	23	24	26
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	20	21	21	27	28	28	27	28	29	37	38	39
	M18x1.5	15	21	22	23	28	30	31	34	36	37	46	49	50
	M20x1.5	--	--	--	--	--	--	--	30	40	42	41	54	57
	M22x1.5	18	29	30	31	39	41	42	48	51	53	65	69	72
	M27x2	22	48	51	53	65	69	72	81	86	90	110	117	122
	M30x2	--	62	65	68	84	88	92	114	120	125	155	163	169
	M33x2	25	78	82	86	106	111	117	150	157	164	203	213	222
	M38x2	--	88	93	97	119	126	132	153	161	168	207	218	228
	M42x2	30	101	106	111	137	144	150	159	168	176	216	228	239
	M48x2	38	124	130	136	168	176	184	202	212	222	274	287	301
	M60x2	50	150	157	164	203	213	222	241	253	265	327	343	359

Assembly instructions for Adjustable Port End (BSPP) Fittings

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not pre-installed, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-25, Table 5-26, Table 5-27, British Standard Parallel Pipe Port (BSPP) - L Series and Table 5-28, Table 5-29, Table 5-30, British Standard Parallel Pipe Port (BSPP) - S Series while using the Double Wrench Method.

NOTE: *The table headings identify the BSPP port and the type on the other side of the fitting. The torque will be applied to the BSPP port.*

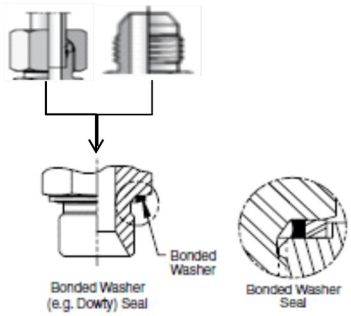
NOTE: *Torque values provided in Table 5-25, Table 5-26, Table 5-27,* British Standard Parallel Pipe Port (BSPP) - L Series *and Table 5-28, Table 5-29, Table 5-30,* British Standard Parallel Pipe Port (BSPP) - S Series *are segregated based on the material configuration of the connection.*

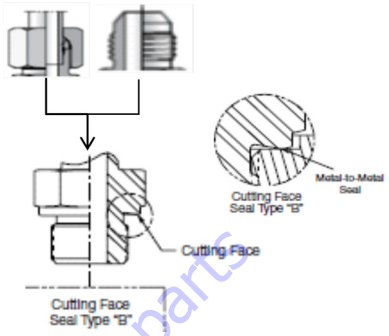
'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-25. British Standard Parallel Pipe Port (BSPP) - L Series - Table 1 of 3





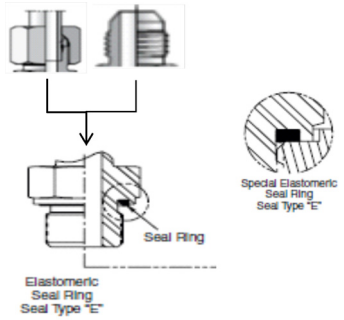
TYPE/FITTING IDENTIFICATION			FORM A** (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B** (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	7	8	8	9	11	11	13	14	14	18	19	19
	G 1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G 1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G 3/8A	12	33	35	36	45	47	49	52	55	57	70	75	77
	G 1/2A	15	48	51	53	65	69	72	103	108	113	140	146	153
	G 1/2A	18	48	51	53	65	69	72	74	78	81	100	106	110
	G 3/4A	22	66	70	73	90	95	99	133	140	146	180	190	198
	G 1A	28	111	117	122	150	159	165	243	255	267	330	346	362
	G 1-1/4A	35	177	186	195	240	252	264	398	418	438	540	567	594
	G 1-1/2A	42	214	225	235	290	305	319	465	489	512	630	663	694
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	4	5	5	5	7	7	8	9	9	11	12	12
	G 1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G 1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G 3/8A	12	21	22	23	28	30	31	34	36	37	46	49	50
	G 1/2A	15	31	33	34	42	45	46	67	70	73	91	95	99
	G 1/2A	18	31	33	34	42	45	46	48	51	53	65	69	72
	G 3/4A	22	42	45	47	57	61	64	86	91	95	117	123	129
	G 1A	28	72	76	79	98	103	107	158	166	174	214	225	236
	G 1-1/4A	35	115	121	127	156	164	172	259	272	285	351	369	386
	G 1-1/2A	42	139	146	153	188	198	207	302	318	333	409	431	451

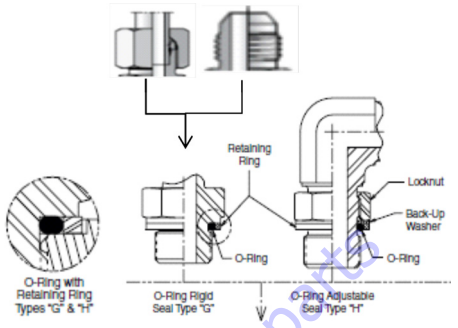
* Typical for JLG Straight Male Stud Fittings.

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings.

Table 5-26. British Standard Parallel Pipe Port (BSPP) - L Series - Table 2 of 3





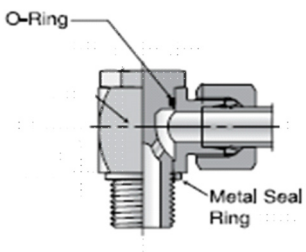
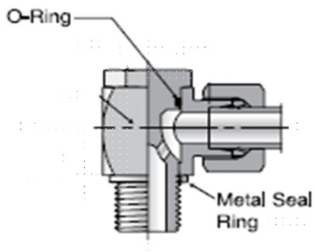
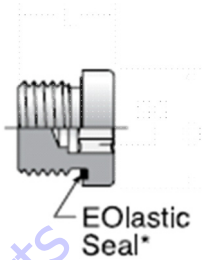
TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19
	G 1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G 1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G 3/8A	12	52	55	57	70	75	77	52	55	57	70	75	77
	G 1/2A	15	66	70	73	90	95	99	66	70	73	90	95	99
	G 1/2A	18	66	70	73	90	95	99	66	70	73	90	95	99
	G 3/4A	22	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	28	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	35	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12
	G 1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G 1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G 3/8A	12	34	36	37	46	49	50	34	36	37	46	49	50
	G 1/2A	15	43	45	47	58	61	64	43	45	47	58	61	64
	G 1/2A	18	43	45	47	58	61	64	43	45	47	58	61	64
	G 3/4A	22	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	28	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/4A	35	216	227	237	293	308	321	216	227	237	293	308	321
	G 1-1/2A	42	259	272	285	351	369	386	259	272	285	351	369	386

*Typical for JLG Straight Male Stud Fittings.

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings.

Table 5-27. British Standard Parallel Pipe Port (BSPP) - L Series - Table 3 of 3

			
TYPE/FITTING IDENTIFICATION	**BANJO FITTINGS with L series DIN (MBTL) opposite end**	**HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end**	**FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS**

MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19	10	11	11	13	15	15
	G 1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G 1/4A	10	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G 3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77	44	46	48	60	62	65
	G 1/2A	15	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G 1/2A	18	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G 3/4A	22	92	97	101	125	132	137	170	179	187	230	243	254	103	108	113	140	146	153
	G 1A	28	--	--	--	--	--	--	236	248	260	320	336	353	148	156	163	200	212	221
	G 1-1/4A	35	--	--	--	--	--	--	398	418	438	540	567	594	295	313.5	332	400	425	450
	G 1-1/2A	42	--	--	--	--	--	--	516	542	568	700	735	770	332	349	365	450	473	495

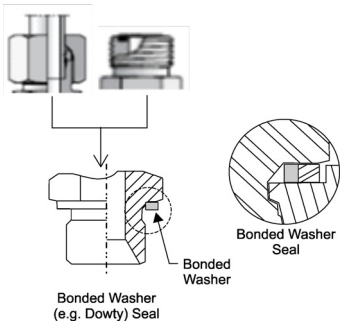
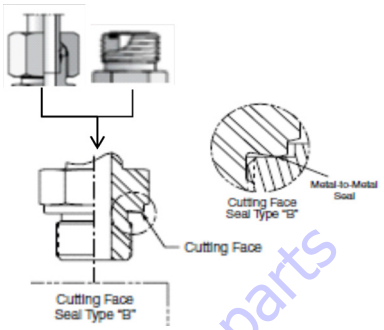
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	G 1/4A	8	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G 1/4A	10	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G 3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50	29	30	31	39	41	42
	G 1/2A	15	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G 1/2A	18	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G 3/4A	22	60	63	66	81	85	89	111	117	122	150	159	165	67	70	73	91	95	99
	G 1A	28	--	--	--	--	--	--	153	161	169	207	218	229	96	101	106	130	137	144
	G 1-1/4A	35	--	--	--	--	--	--	259	272	285	351	369	386	216	227	237	293	308	321
	G 1-1/2A	42	--	--	--	--	--	--	335	352	369	454	477	500	216	227	237	293	308	321

* Typical for JLG Straight Male Stud Fittings.

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings.

Table 5-28. British Standard Parallel Pipe Port (BSPP) - S Series - Table 1 of 3

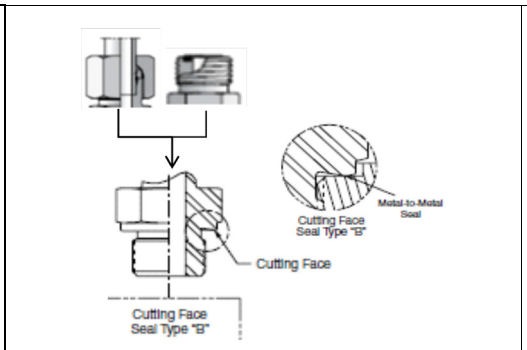
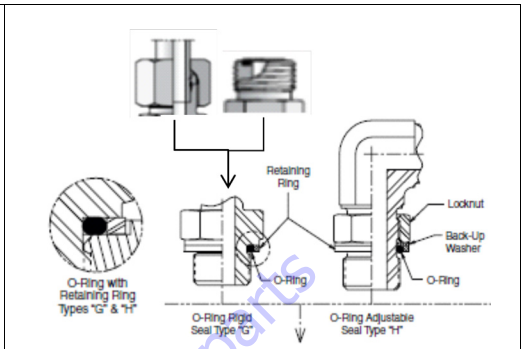
TYPE/FITTING IDENTIFICATION			FORM A** (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end						FORM B** (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	26	28	29	35	38	39	41	43	45	55	58	61
	G 1/4A	8	26	28	29	35	38	39	41	43	45	55	58	61
	G 3/8A	10	33	35	36	45	47	49	66	70	73	90	95	99
	G 3/8A	12	33	35	36	45	47	49	66	70	73	90	95	99
	G 1/2A	14	48	51	53	65	69	72	111	117	122	150	159	165
	G 1/2A	16	48	51	53	65	69	72	96	101	106	130	137	144
	G 3/4A	20	66	70	73	90	95	99	199	209	219	270	283	297
	G 1A	25	111	117	122	150	159	165	251	264	276	340	358	374
	G 1-1/4A	30	177	186	195	240	252	264	398	418	438	540	567	594
	G 1-1/2A	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	17	18	19	23	24	26	27	28	29	37	38	39
	G 1/4A	8	17	18	19	23	24	26	27	28	29	37	38	39
	G 3/8A	10	21	22	23	28	30	31	43	45	47	58	61	64
	G 3/8A	12	21	22	23	28	30	31	43	45	47	58	61	64
	G 1/2A	14	31	33	34	42	45	46	72	76	79	98	103	107
	G 1/2A	16	31	33	34	42	45	46	62	66	69	84	89	94
	G 3/4A	20	43	45	47	58	61	64	129	136	142	175	184	193
	G 1A	25	72	76	79	98	103	107	163	171	179	221	232	243
	G 1-1/4A	30	115	121	127	156	164	172	259	272	285	351	369	386
	G 1-1/2A	38	139	146	153	188	198	207	335	352	369	454	477	500

*Typical for JLG Straight Male Stud Fittings.

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings.

Table 5-29. British Standard Parallel Pipe Port (BSPP) - S Series - Table 2 of 3

		
TYPE/FITTING IDENTIFICATION	**FORM E* (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end**	**FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end**

MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	41	43	45	55	58	61	26	28	29	35	38	39
	G 1/4A	8	41	43	45	55	58	61	26	28	29	35	38	39
	G 3/8A	10	59	62	65	80	84	88	52	55	57	70	75	77
	G 3/8A	12	59	62	65	80	84	88	52	55	57	70	75	77
	G 1/2A	14	85	90	94	115	122	127	66	70	73	90	95	99
	G 1/2A	16	85	90	94	115	122	127	66	70	73	90	95	99
	G 3/4A	20	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	25	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	30	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	38	398	418	438	540	567	594	398	418	438	540	567	594

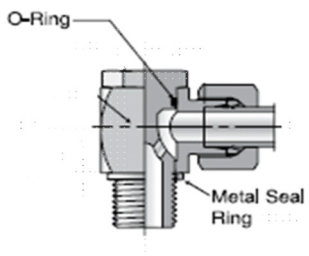
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	27	28	29	37	38	39	17	18	19	23	24	26
	G 1/4A	8	27	28	29	37	38	39	17	18	19	23	24	26
	G 3/8A	10	38	40	42	52	54	57	34	36	37	46	49	50
	G 3/8A	12	38	40	42	52	54	57	34	36	37	46	49	50
	G 1/2A	14	55	58	61	75	79	83	43	45	47	58	61	64
	G 1/2A	16	55	58	61	75	79	83	43	45	47	58	61	64
	G 3/4A	20	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	25	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/4A	30	216	227	237	293	308	321	216	227	237	293	308	321
	G 1-1/2A	38	259	272	285	351	369	386	259	272	285	351	369	386

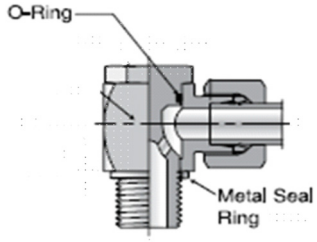
* Typical for JLG Straight Male Stud Fittings.

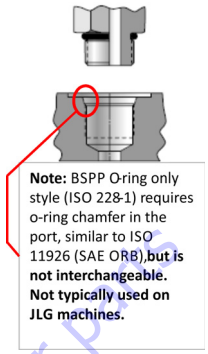
** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings.

Table 5-30. British Standard Parallel Pipe Port (BSPP) - S Series - Table 3 of 3







TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with S series DIN (MBTS) opposite end						HIGH PRESSURE BANJO FITTINGS with S series DIN (MBTS) opposite end						JIS/BSPP O-RING ONLY					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	30	32	33	40	43	45	33	35	36	45	47	49	Fitting type not typically specified on JLG applications. Refer to the specific procedure in this Service Manual.					
	G1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49						
	G3/8A	10	48	51	53	65	69	72	52	55	57	70	75	77						
	G3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77						
	G1/2A	14	66	70	73	90	95	99	89	94	98	120	127	133						
	G1/2A	16	66	70	73	90	95	99	89	94	98	120	127	133						
	G3/4A	20	92	97	101	125	132	137	170	179	187	230	243	254						
	G1A	25	--	--	--	--	--	--	236	248	260	320	336	353						
	G1-1/4A	30	--	--	--	--	--	--	398	418	438	540	567	594						
	G1-1/2A	38	--	--	--	--	--	--	516	542	568	700	735	770						
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	20	21	21	27	28	28	22	22	23	30	30	31	Fitting type not typically specified on JLG applications. Refer to the specific procedure in this Service Manual.					
	G1/4A	8	20	21	21	27	28	28	22	22	23	30	30	31						
	G3/8A	10	31	33	34	42	45	46	34	36	37	46	49	50						
	G3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50						
	G1/2A	14	43	45	47	58	61	64	58	61	64	79	83	87						
	G1/2A	16	43	45	47	58	61	64	58	61	64	79	83	87						
	G3/4A	20	60	63	66	81	85	89	111	117	122	150	159	165						
	G1A	25	--	--	--	--	--	--	153	161	169	207	218	229						
	G1-1/4A	30	--	--	--	--	--	--	259	272	285	351	369	386						
	G1-1/2A	38	--	--	--	--	--	--	335	352	368	454	477	499						

*Typical for JLG Straight Male Stud Fittings.

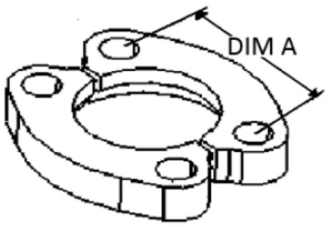
**Non typical for JLG Straight Male Stud Fittings, reference only.

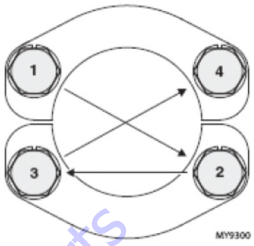
***Typical for JLG Adjustable Fittings.

Assembly Instructions for Flange Connections: (FL61 and FL62)

1. Make sure sealing surfaces are free of rust, splits, scratches, dirt, foreign matter, or burrs.
2. See O-ring Installation (Replacement) for O-ring installation instructions.
3. Pre-lubricate the O-ring with Hydraulic Oil.
4. Position flange and clamp halves.
5. Place lock washers on bolt and bolt through clamp halves.
6. Tighten all bolts by hand.
7. Torque bolts in diagonal sequence in two or more increments to the torque listed on Table 5-31, Flange Code (FL61 & FL62) - Inch Fasteners and Table 5-32, Flange Code (FL61 & FL62) - Metric Fasteners.

Table 5-31. Flange Code (FL61 & FL62) -Inch Fasteners

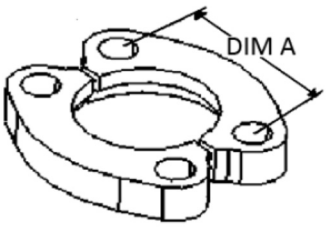


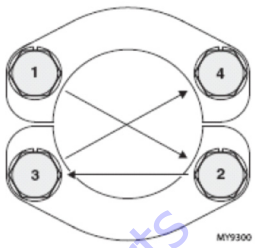


TYPE/FITTING IDENTIFICATION						STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)													
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws					
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
		(in)	(mm)	(in)	(mm)	(UNF)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 61 SPLIT FLANGE (FL61)	8	0.50	13	1.50	38.10	5/16-18	18	19	19	24	25	26	24	25	26	32	34	35
	12	0.75	19	1.88	47.75	3/8-16	32	33	35	43	45	47	44	46	49	60	63	66
	16	1.00	25	2.06	52.32	3/8-16	32	33	35	43	45	47	44	46	49	60	63	66
	20	1.25	32	2.31	58.67	7/16-14	52	54	57	70	74	77	68	71	75	92	97	101
	24	1.50	38	2.75	69.85	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165
	32	2.00	51	3.06	77.72	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165
	40	2.50	64	3.50	88.90	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165
	48	3.00	76	4.19	106.43	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
	56	3.50	89	4.75	120.65	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
	64	4.00	102	5.13	130.30	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
	80	5.00	127	6.00	152.40	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws					
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
		(in)	(mm)	(in)	(mm)	(UNF)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 62 SPLIT FLANGE (FL62)	8	0.50	13	1.59	40.39	5/16-18	--	--	--	--	--	--	24	25	26	32	34	35
	12	0.75	19	2.00	50.80	3/8-16	--	--	--	--	--	--	44	46	49	60	63	66
	16	1.00	25	2.25	57.15	7/16-14	--	--	--	--	--	--	68	71	75	92	97	101
	20	1.25	32	2.62	66.55	1/2-13	--	--	--	--	--	--	111	116	122	150	158	165
	20	1.25	32	2.62	66.55	--	--	--	--	--	--	--	--	--	--	--	--	--
	24	1.50	38	3.12	79.25	5/8-11	--	--	--	--	--	--	218	228	239	295	310	325
	32	2.00	51	3.81	96.77	3/4-10	--	--	--	--	--	--	332	348	365	450	473	495

* A dimension for reference only.

Table 5-32. Flange Code (FL61 & FL62) - Metric Fasteners





TYPE/FITTING IDENTIFICATION						STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)													
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with CLASS 8.8 Screws						Fastener Torque for Flanges Equipped with CLASS 10.9 Screws					
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
		(in)	(mm)	(in)	(mm)	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 61 SPLIT FLANGE (FL61)	8	0.50	13	1.50	38.10	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
	12	0.75	19	1.88	47.75	M8x1.25	18	19	19	24	25	26	18	19	19	24	25	26
	16	1.00	25	2.06	52.32	M10x1.5	37	39	41	50	53	55	37	39	41	50	53	55
	20	1.25	32	2.31	58.67	M10x1.5	37	39	41	50	53	55	37	39	41	50	53	55
	24	1.50	38	2.75	69.85	M10x1.5	37	39	41	50	53	55	37	39	41	50	53	55
	32	2.00	51	3.06	77.72	M12x1.75	68	71	75	92	97	101	68	71	75	92	97	101
	40	2.50	64	3.50	88.90	M12x1.75	68	71	75	92	97	101	68	71	75	92	97	101
	48	3.00	76	4.19	106.43	M12x1.75	68	71	75	92	97	101	68	71	75	92	97	101
	56	3.50	89	4.75	120.65	M16x2	155	163	170	210	221	231	155	163	170	210	221	231
	64	4.00	102	5.13	130.30	M16x2	155	163	170	210	221	231	155	163	170	210	221	231
	80	5.00	127	6.00	152.40	M16x2	155	163	170	210	221	231	155	163	170	210	221	231
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with CLASS 8.8 Screws						Fastener Torque for Flanges Equipped with CLASS 10.9 Screws					
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
		(in)	(mm)	(in)	(mm)	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 62 SPLIT FLANGE (FL62)	8	0.50	13	1.59	40.39	M8x1.25	--	--	--	--	--	--	24	25	26	32	34	35
	12	0.75	19	2.00	50.80	M10x1.5	--	--	--	--	--	--	52	54	57	70	74	77
	16	1.00	25	2.25	57.15	M12x1.75	--	--	--	--	--	--	96	101	105	130	137	143
	20	1.25	32	2.62	66.55	M12x1.75	--	--	--	--	--	--	96	101	105	130	137	143
	20	1.25	32	2.62	66.55	M14x2	--	--	--	--	--	--	133	139	146	180	189	198
	24	1.50	38	3.12	79.25	M16x2	--	--	--	--	--	--	218	228	239	295	310	325
	32	2.00	51	3.81	96.77	M20x2.5	--	--	--	--	--	--	406	426	446	550	578	605

* A dimension for reference only.

Double Wrench Method

To prevent undesired hose or connector rotation, two wrenches must be used; one torque wrench and one backup wrench. If two wrenches are not used, inadvertent component rotation may occur which absorbs torque and causes improper joint load and leads to leaks. For hose connections, the 'layline' printed on the hose is a good indicator of proper hose installation. A twisted lay-line usually indicates the hose is twisted. See Figure 5-12. for double wrench method requirements.

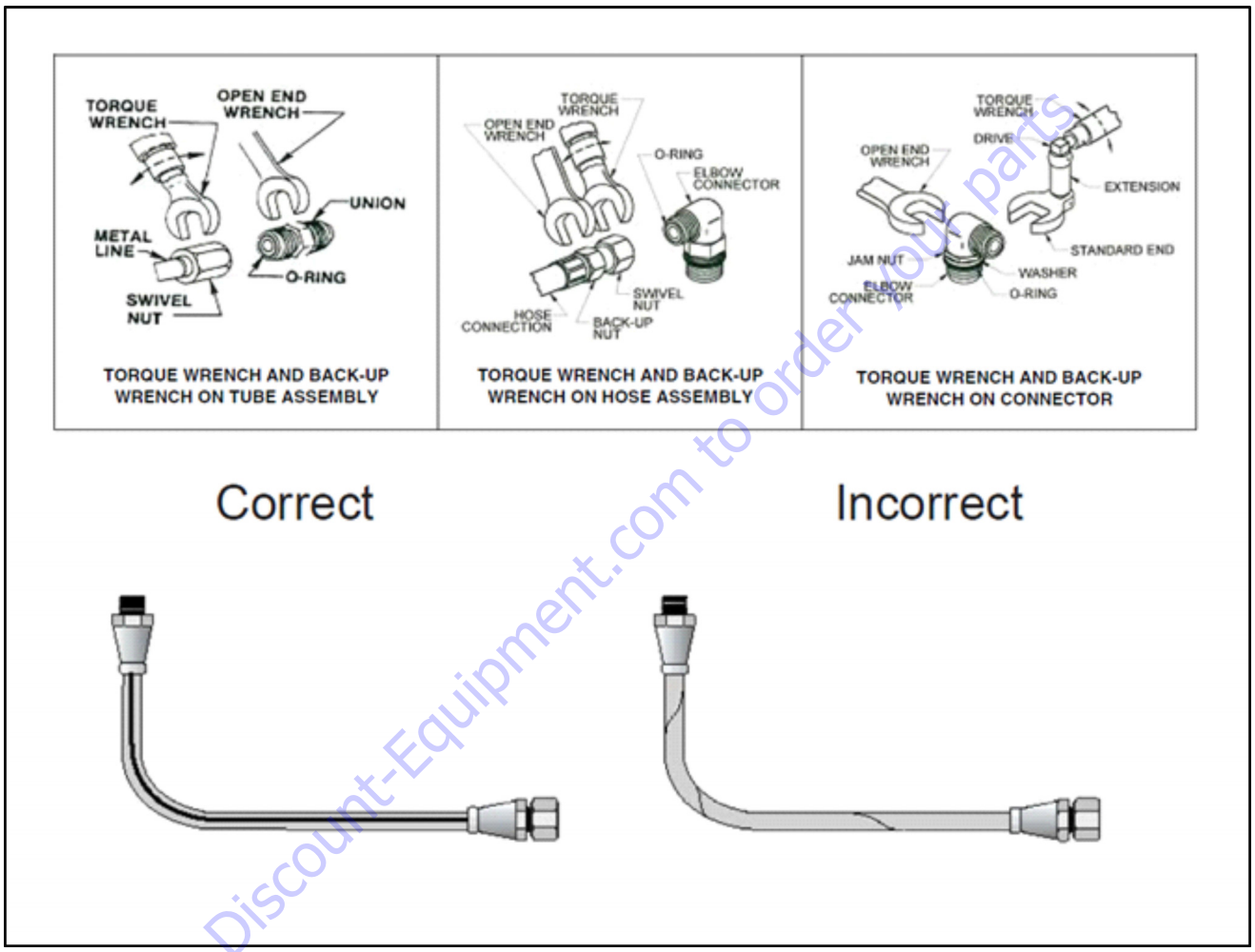


Figure 5-12. Double Wrench Method

FFWR and TFFT Methods

FFWR (FLATS FROM WRENCH RESISTANCE METHOD)

1. Tighten the swivel nut to the mating fitting until no lateral movement of the swivel nut can be detected; finger tight condition.
2. Mark a dot on one of the swivel hex nut flats and another dot in line on the connecting tube adapter. See Figure 5-13.
3. Use the double wrench method, turn the swivel nut to tighten as shown in Figure 5-13. The nut is to be rotated clockwise the number of hex flats as defined by the applicable Table in Section 5.0.
4. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots, to indicate the connection has been properly tightened. See Figure 5-13.

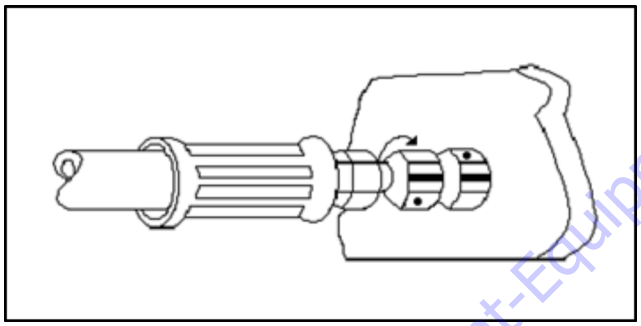


Figure 5-13. FFWR Method

TFFT (TURNS FROM FINGER TIGHT METHOD)

1. Tighten the swivel nut to the mating fitting until no lateral movement of the swivel nut can be detected; finger tight condition.
2. Mark a dot on one of the swivel hex nut flats and another dot in line on the connecting tube adapter.
3. Use the double wrench method, turn the swivel nut to tighten. The nut is to be rotated clockwise the number of turns as defined by the applicable Table in Section 5.0.
4. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots, to indicate the connection has been properly tightened.

Adjustable Stud End Assembly

For Adjustable Stud End Connections; the following assembly steps are to be performed:

1. Lubricate the o-ring with a light coat of hydraulic oil.
2. Position #1 – The o-ring should be located in the groove adjacent to the face of the backup washer. The washer and o-ring should be positioned at the extreme top end of the groove as shown.
3. Position #2 – Position the locknut to just touch the backup washer as shown. The locknut in this position will eliminate potential backup washer damage during the next step.
4. Position #3 – Install the connector into the straight thread box port until the metal backup washer contacts the face of the port as shown.
5. Position #4 – Adjust the connector to the proper position by turning out (counterclockwise) up to a maximum of one turn as shown to provide proper alignment with the mating connector, tube assembly, or hose assembly.
6. Position #5 – Using two wrenches, use the backup wrench to hold the connector in the desired position and then use the torque wrench to tighten the locknut to the appropriate torque.
7. Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.

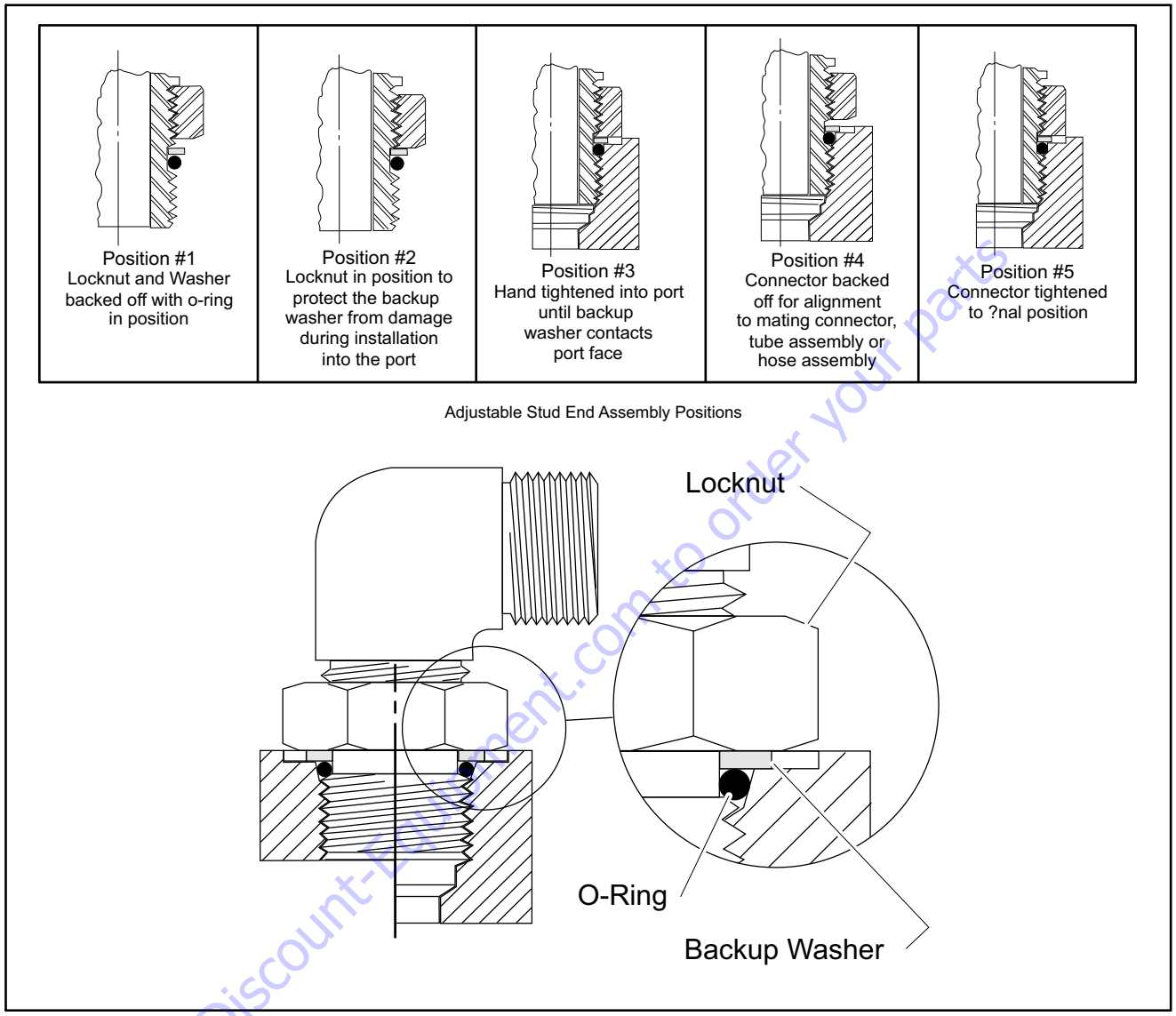


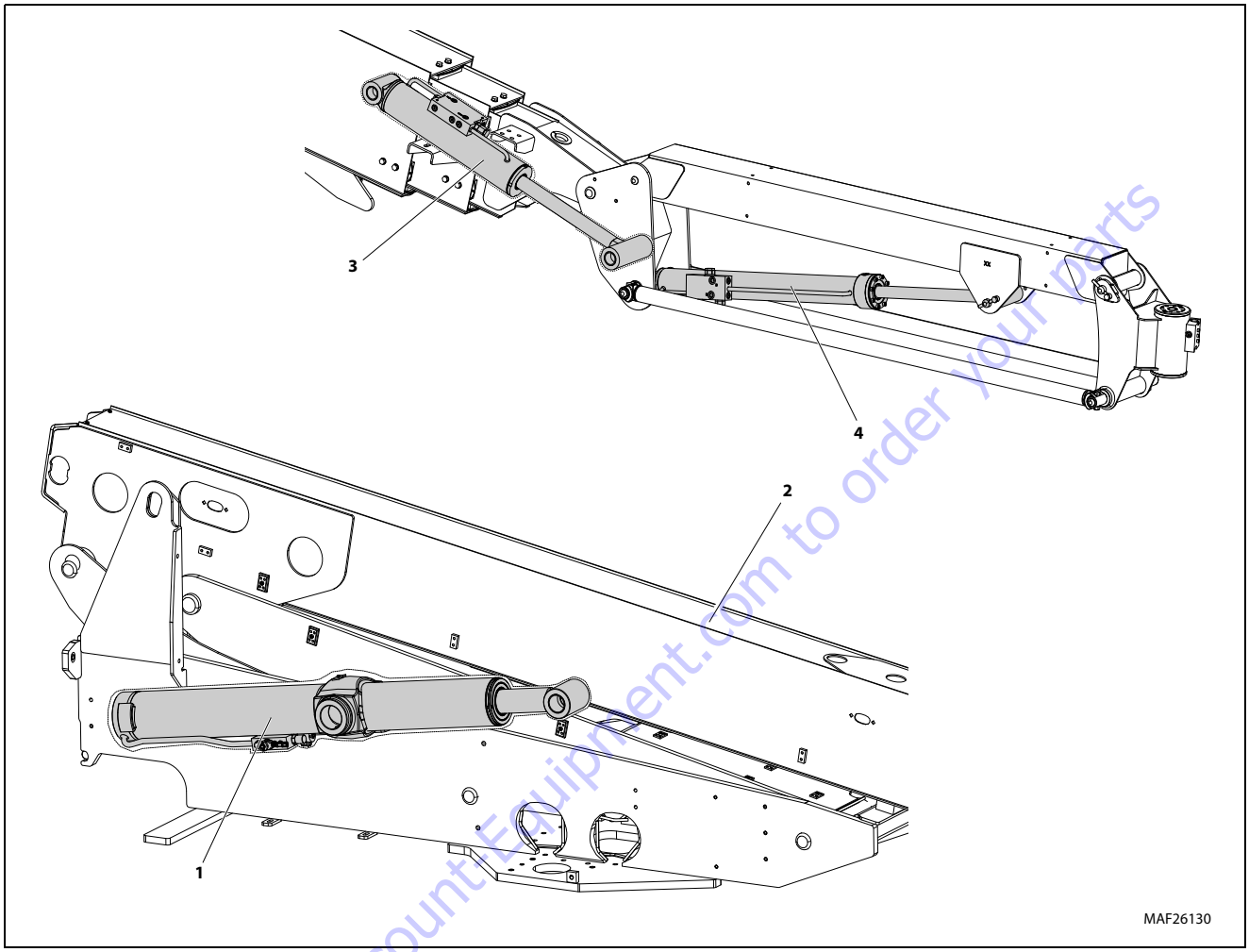
Figure 5-14. Adjustable Stud End Assembly

O-ring Installation (Replacement)

Care must be taken when installing O-rings over threads during replacement or installation. O-rings could become nicked or torn. A damaged O-ring could lead to leakage problems.

1. Inspect O-ring for tears or nicks. If any are found replace O-ring.
2. Ensure proper O-ring to be installed. Many O-rings look the same but are of different material, different hardness, or are slightly different diameters or widths.
3. Use a thread protector when replacing O-rings on fittings.
4. In ORB; ensure O-ring is properly seated in groove. On straight threads, ensure O-ring is seated all the way past the threads prior to installation.
5. Inspect O-ring for any visible nicks or tears. Replace if found.

Cylinder Locations



1. Main Lift Cylinder
2. Telescope Cylinder
3. Platform Level Cylinder
4. Jib Lift Cylinder

Figure 5-15. Hydraulic Cylinder Locations

Main Lift Cylinder

DISASSEMBLY

NOTE: *Refer to Figure 5-19. Main Lift Cylinder.*

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

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

⚠ WARNING

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

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod, if applicable.
3. If applicable, remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
4. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

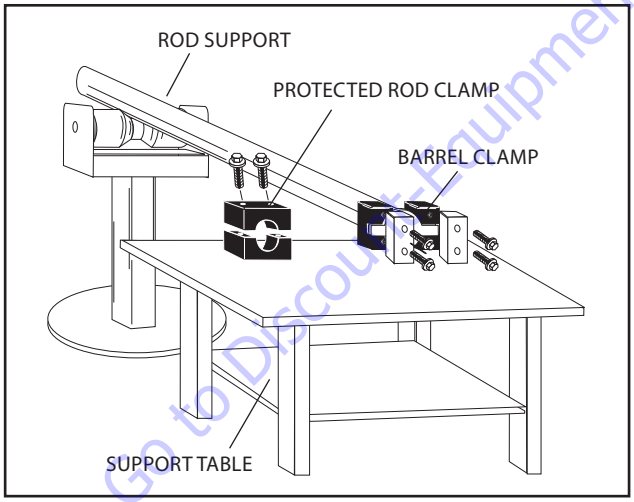


Figure 5-16. Cylinder Barrel Support

5. Unscrew cylinder head collar (5) with pin-face spanner wrench.

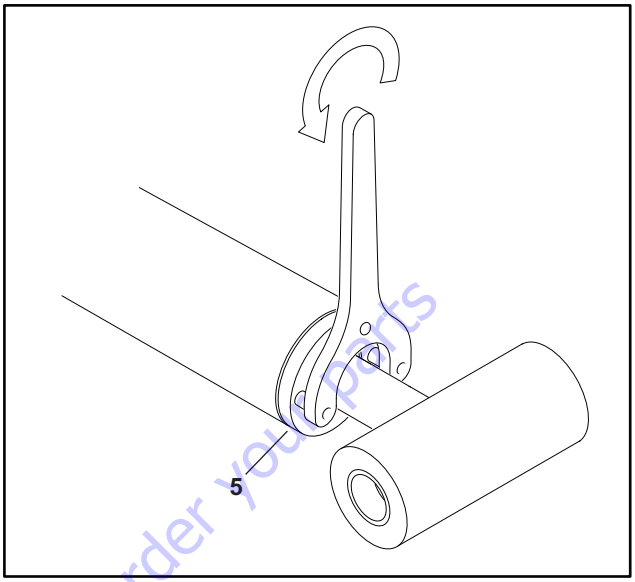


Figure 5-17. Cylinder Head Removal

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

6. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.
7. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

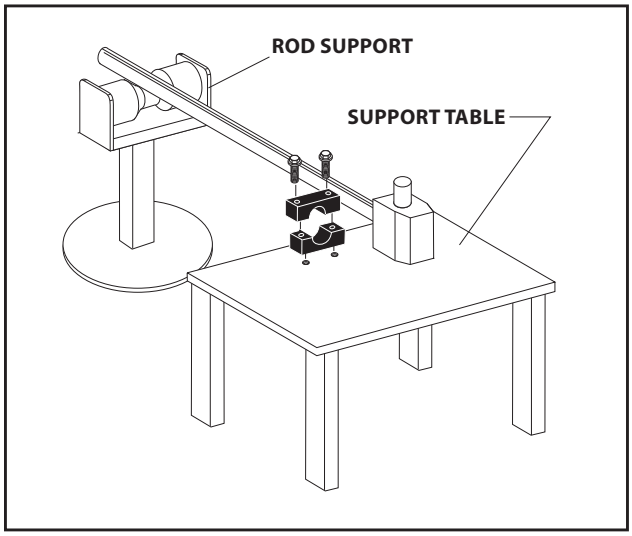
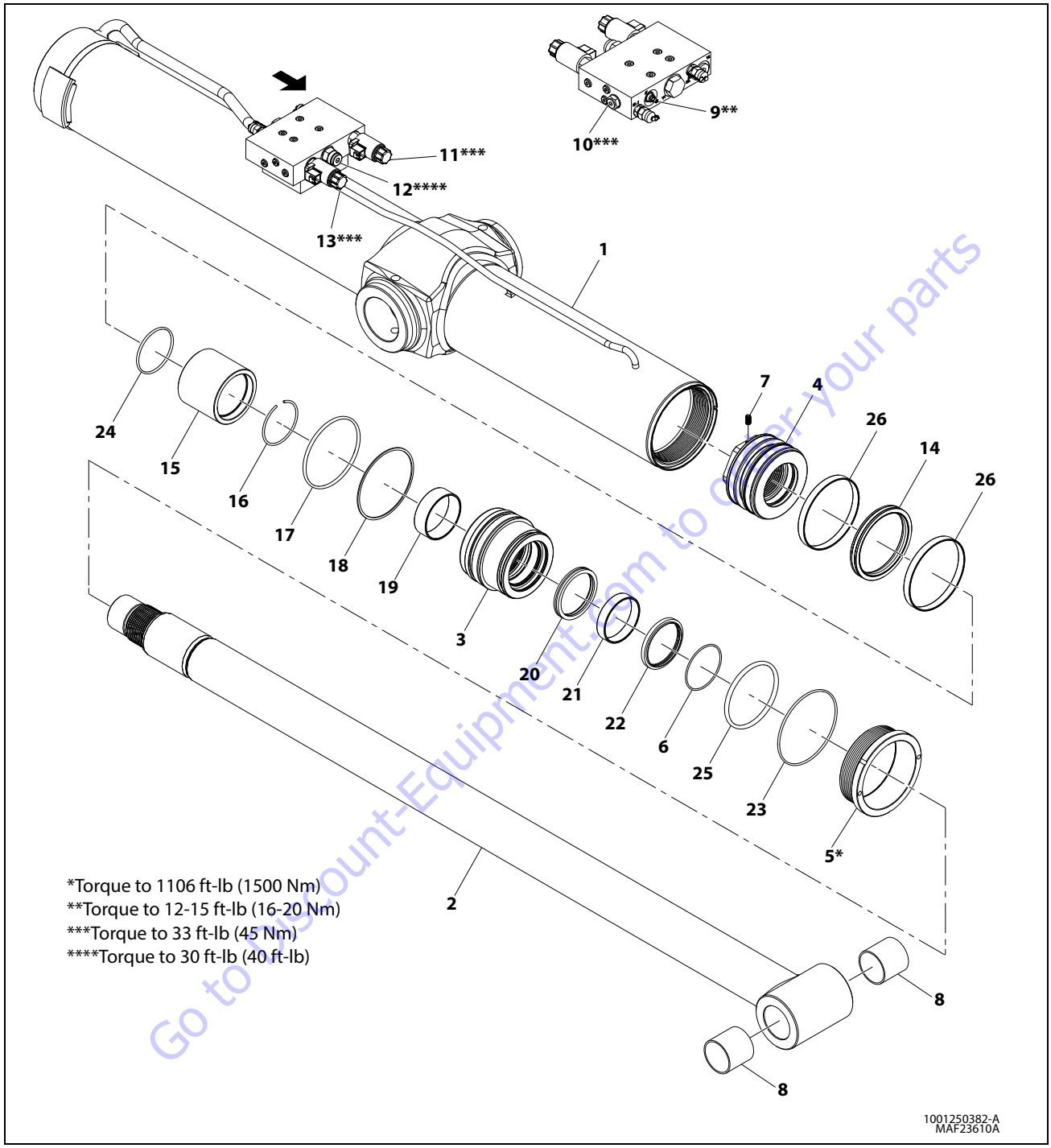


Figure 5-18. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Piston
5. Collar
6. Ring
7. Setscrew
8. Bushing
9. Solenoid Valve
10. Check Valve
11. Solenoid Valve
12. Check Valve
13. Solenoid Valve
14. Seal
15. Spacer
16. Retaining Ring
17. O-Ring
18. Backup Ring
19. Bearing Ring
20. Seal
21. Bearing Ring
22. Wiper
23. O-Ring
24. O-Ring
25. O-Ring
26. Bearing Ring

Figure 5-19. Main Lift Cylinder

NOTICE

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

8. Loosen setscrew (7) in piston (4).
9. Screw piston counterclockwise and remove from rod.
10. Remove and discard O-ring (24), bearing rings (26) and seal (14).

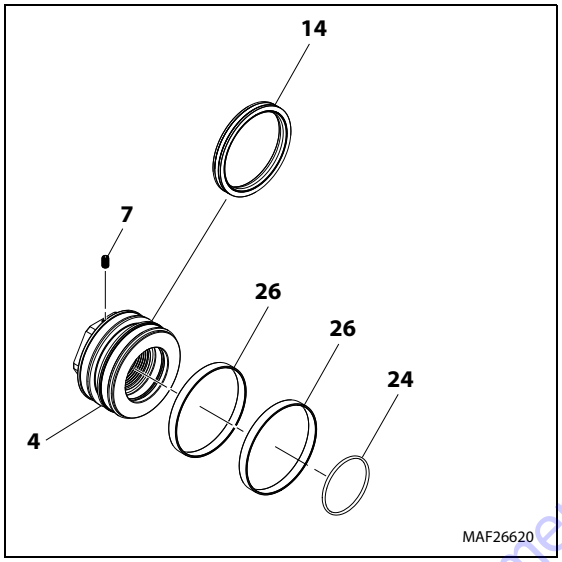


Figure 5-20. Piston Disassembly

11. Remove rod from holding fixture.
12. Remove cylinder head assembly (3) from rod (2).
13. Remove and discard O-ring (17), backup ring (18), and O-ring (25) from cylinder head (3).
14. Remove and discard retaining ring (16), wiper (22), bearing ring (19), rod seal (20), and bearing ring (21) from cylinder head (3).

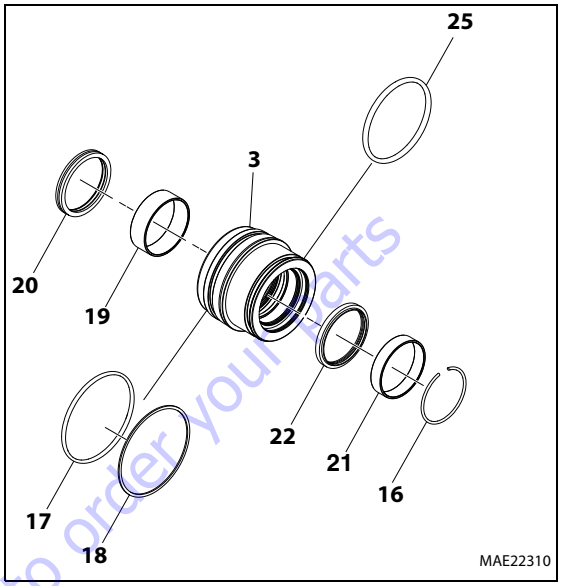


Figure 5-21. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect 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, scoring, or 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 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, damage, ovality, and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

    d. Press composite bushing into barrel or rod bushing with correct size arbor.

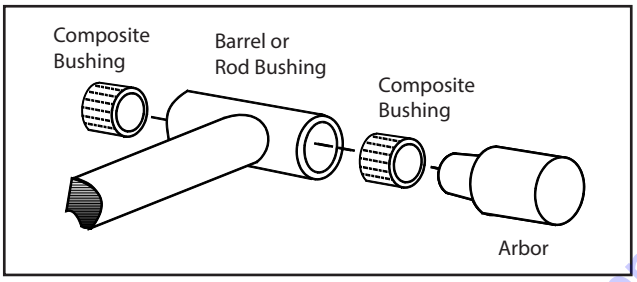


Figure 5-22. Composite Bushing Installation

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

ASSEMBLY

NOTICE

INCORRECT SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE ALL PISTON SEALS ARE CORRECTLY INSTALLED. REFER TO CROSS SECTION ILLUSTRATIONS FOR CORRECT SEAL ORIENTATION.

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

1. Support rod in holding fixture.
2. Install retaining ring (16), bearing ring (19), seal (20), and wiper (22) inside cylinder head (3).
3. Install O-ring (17), backup ring (18), and O-ring (19) on cylinder head.
4. Slide cylinder head assembly on rod (2) to rod end. Do not dislodge or damage seals.

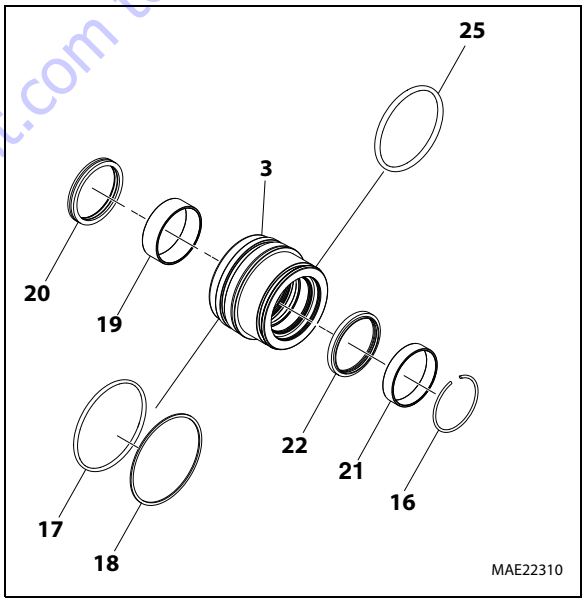


Figure 5-23. Cylinder Head Assembly

5. Install two seals (14) and O-rings (24) on piston.
6. Apply Medium Strength Threadlocking Compound to piston threads. Install piston on rod. Torque to 1475 ft-lb (2000 Nm).
7. Install setscrew (7).

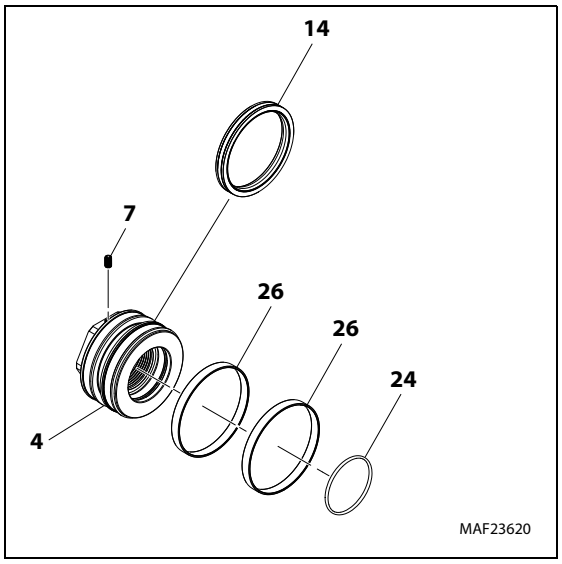


Figure 5-24. Piston Assembly

8. Carefully install piston on cylinder rod. Do not damage or dislodge O-ring and backup rings.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

9. Clamp barrel clamped securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston loading O-ring and seal ring.
10. Remove cylinder rod from holding fixture.
11. Place cylinder barrel in suitable holding fixture.
12. Apply anti-seize to cylinder head collar (5) threads. Screw in cylinder head. Torque to 1106 ft-lb (1500 Nm). Adjust cylinder head so screw hole is aligned between cylinder head and barrel. Secure cylinder head gland using washer ring and socket head bolts.

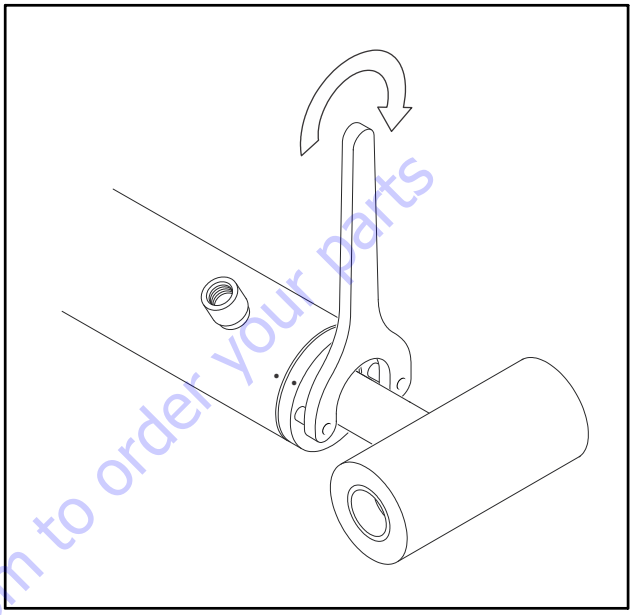


Figure 5-25. Cylinder Head Installation

Telescope Cylinder

DISASSEMBLY

NOTE: *Refer to Figure 5-29. Telescope Cylinder.*

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

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

⚠ WARNING

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

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod, if applicable.
3. If applicable, remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
4. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

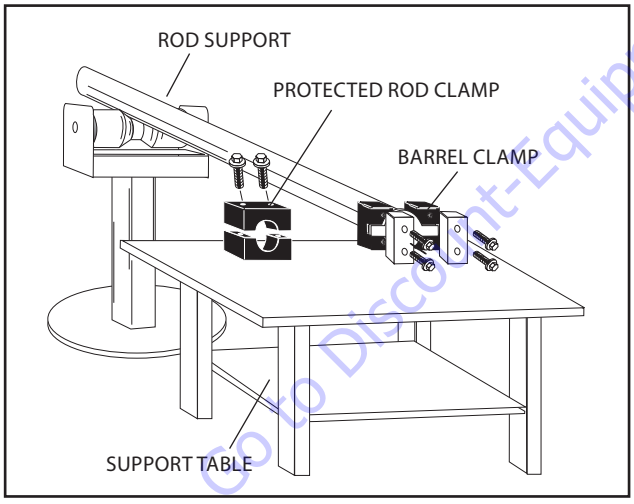


Figure 5-26. Cylinder Barrel Support

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

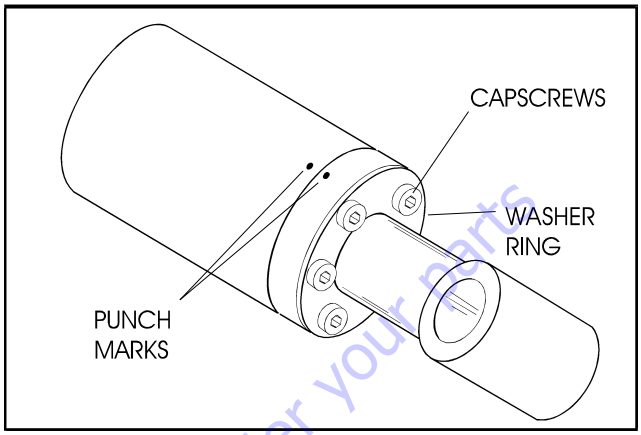


Figure 5-27. Capscrew Removal

6. Attach a suitable pulling device to the cylinder rod end.

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

7. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.
8. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

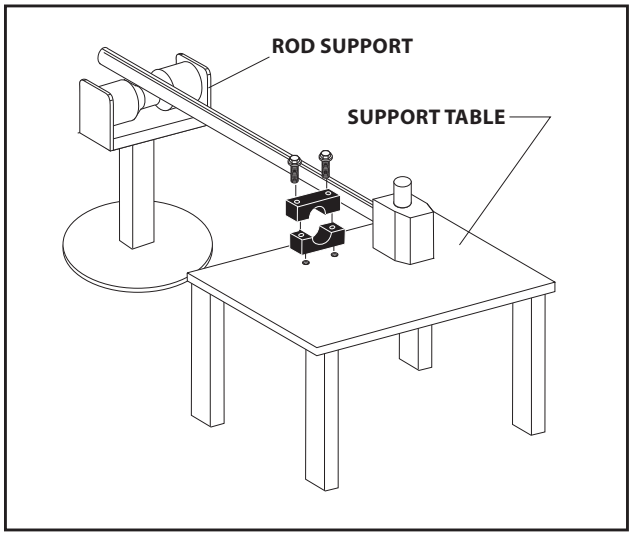
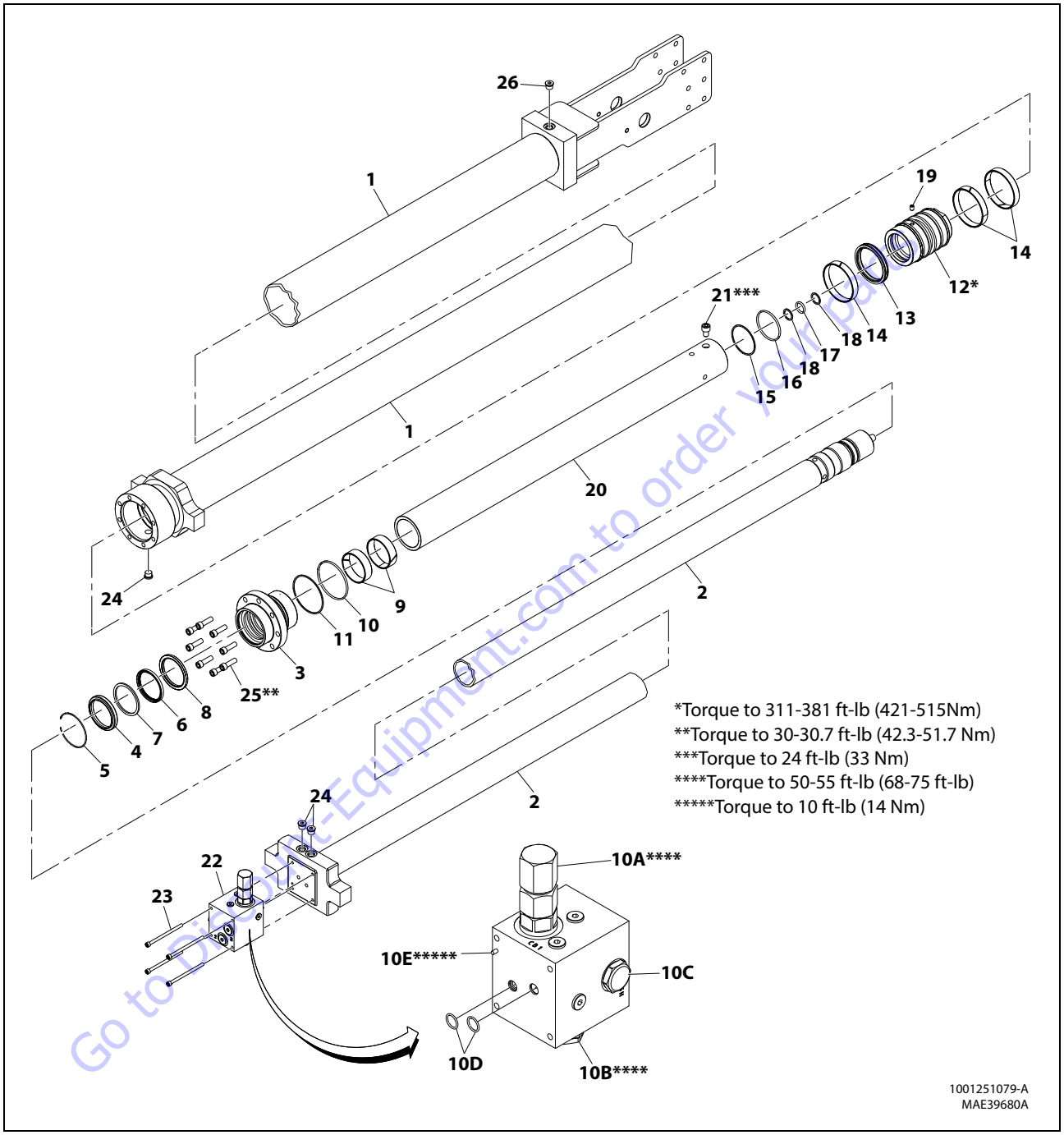


Figure 5-28. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Wiper Seal
5. Retaining Ring
6. Rod Seal
7. Backup Ring
8. Buffer Ring
9. Wear Ring
10. O-ring
10 A. Cartridge
10 B. Cartridge
10 C. Cartridge
10 D. Seal
10 E. Roll Pin
11. Backup Ring
12. Piston
13. Piston Seal
14. Wear Ring
15. O-ring
16. Backup Ring
17. O-ring
18. Backup Ring
19. Setscrew
20. Spacer
21. Capscrew
22. Valve Assembly
23. Capscrew
24. Plug
25. Capscrew
26. Plug

Figure 5-29. Telescope Cylinder

9. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
10. Loosen and remove the setscrew (19) which is attached to the piston assembly.
11. Screw the piston (12) counterclockwise and remove the piston from cylinder rod (2).
12. Remove and discard o-ring (15) and backup ring (16) from inside of piston (12).
13. Remove and discard o-ring (17) and backup ring (18) from inside of piston (12).
14. Remove and discard piston seal (13) and wear ring (14) from outside grooves of piston (12).

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.

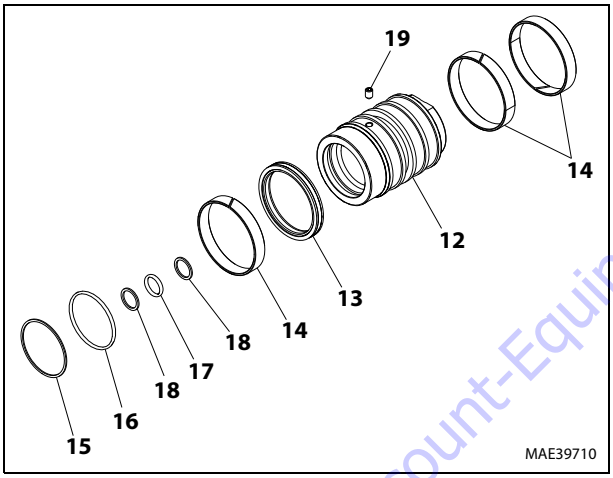


Figure 5-30. Piston Disassembly

15. Remove spacer (20) from rod (2).
16. Remove rod from holding fixture. Remove cylinder head gland.
17. Remove and discard wear ring (9) and wiper (4) from inside of cylinder head (3).
18. Remove and discard retaining ring (5), rod seal (6), backup ring (7) and buffer ring (8) from inside of cylinder head (3).
19. Remove and discard o-ring (10) and backup ring (11) from outside of cylinder head (3).

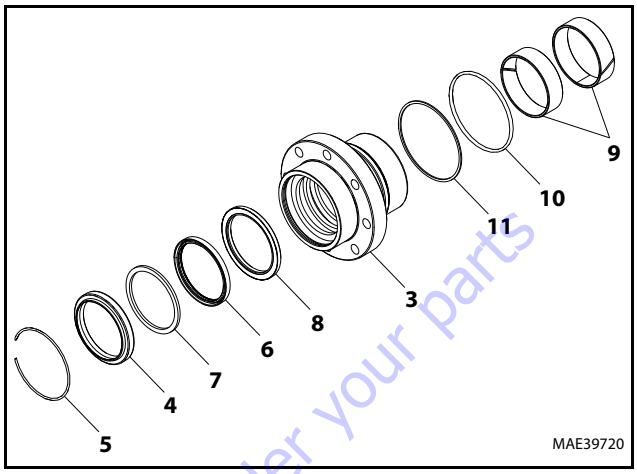


Figure 5-31. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect 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, scoring, or 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 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, damage, ovality, and tapering. Replace as necessary.

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

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

    d. Press composite bushing into barrel or rod bushing with correct size arbor.

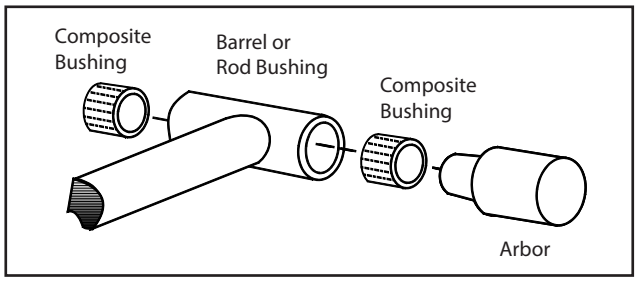


Figure 5-32. Composite Bushing Installation

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

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. WIPER SEAL ROUNDED SURFACE MUST FACE TOWARD PISTON AS NOTED DURING DISASSEMBLY.

1. Use seal tool to install new rod seal into applicable cylinder head gland groove

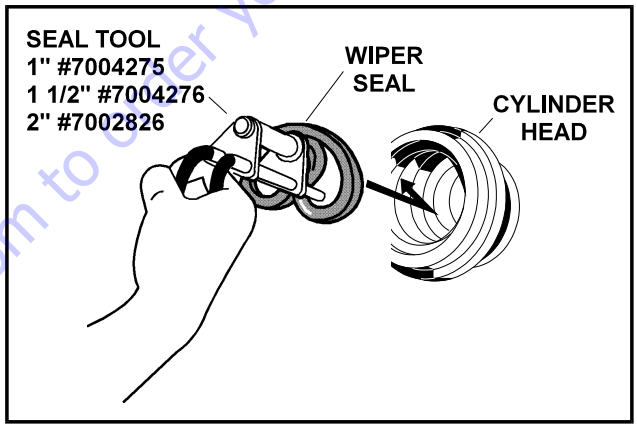


Figure 5-33. Rod Seal Installation

2. Support rod in holding fixture.
3. Install rod seal (6), backup ring (7) and buffer ring (8) inside the cylinder head (3).
4. Install wear ring (9), wiper (4) and retaining ring (5) inside the cylinder head (3).
5. Install o-ring (10) and backup ring(11) on outside grooves of the cylinder head (3).

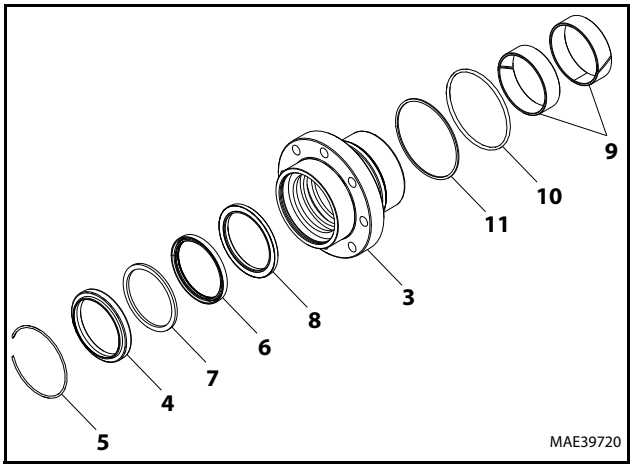


Figure 5-34. Cylinder Head Assembly

6. Slide cylinder head assembly on rod (2) to rod end. Do not dislodge or damage seals.
7. Carefully slide the spacer (20) onto rod (2).
8. Install o-ring (15) and backup ring (16) inside the piston (12).
9. Install o-ring (17) and backup ring (18) inside the piston (12).
10. Install Piston seal (13) and wear ring (14) on outside grooves of the piston (12).
11. Carefully thread piston (12) on cylinder rod (2) hand tight. Do not damaged or dislodge O-ring and backup rings.

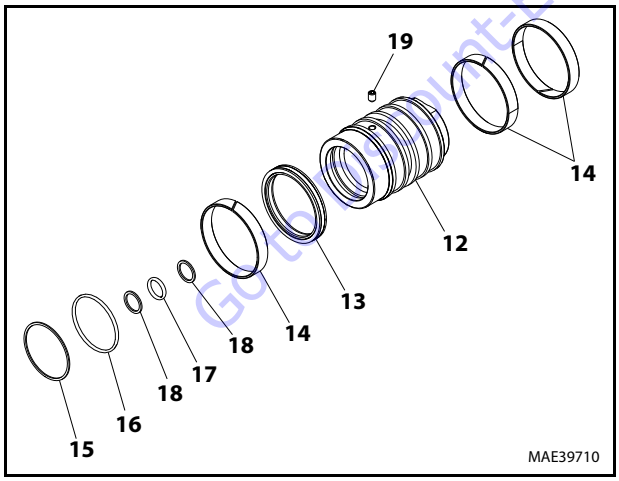


Figure 5-35. Piston Assembly

11. Install setscrew (19) on the piston (12) and attach piston (12) to the rod (2).
12. Position cylinder barrel (1) in a suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

13. Continue pushing rod in barrel until cylinder head (3) can be inserted into the barrel.
14. Secure the cylinder head gland using the washer ring and socket head bolts.
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 valve assembly, counterbalance valve if applicable.

Platform Level Cylinder

DISASSEMBLY

NOTE: *Refer to Figure 5-39. Platform Level Cylinder.*

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

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

⚠ WARNING

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

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod, if applicable.
3. If applicable, remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
4. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

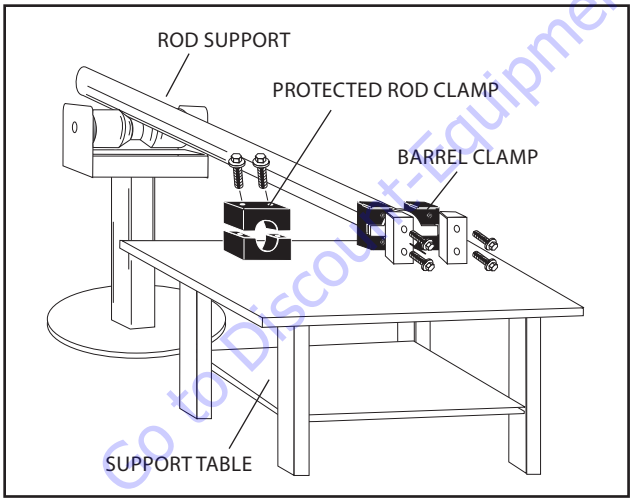


Figure 5-36. Cylinder Barrel Support

5. Unscrew cylinder head with hook spanner wrench.

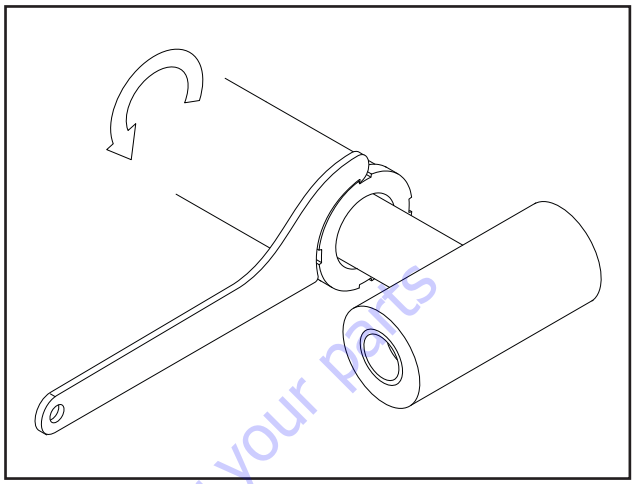


Figure 5-37. Marking Cylinder for Alignment

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

6. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.
7. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

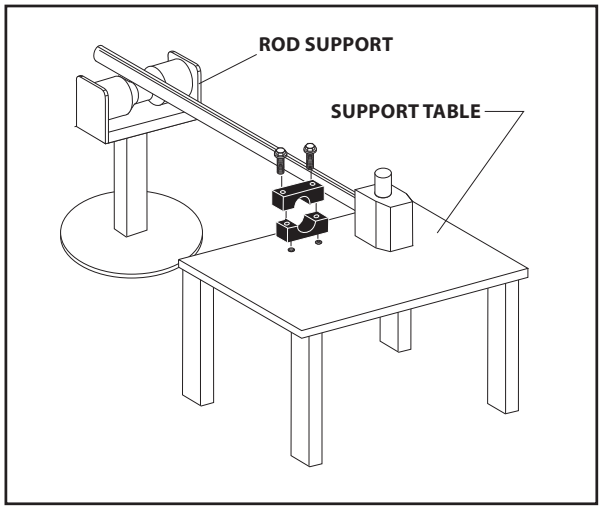
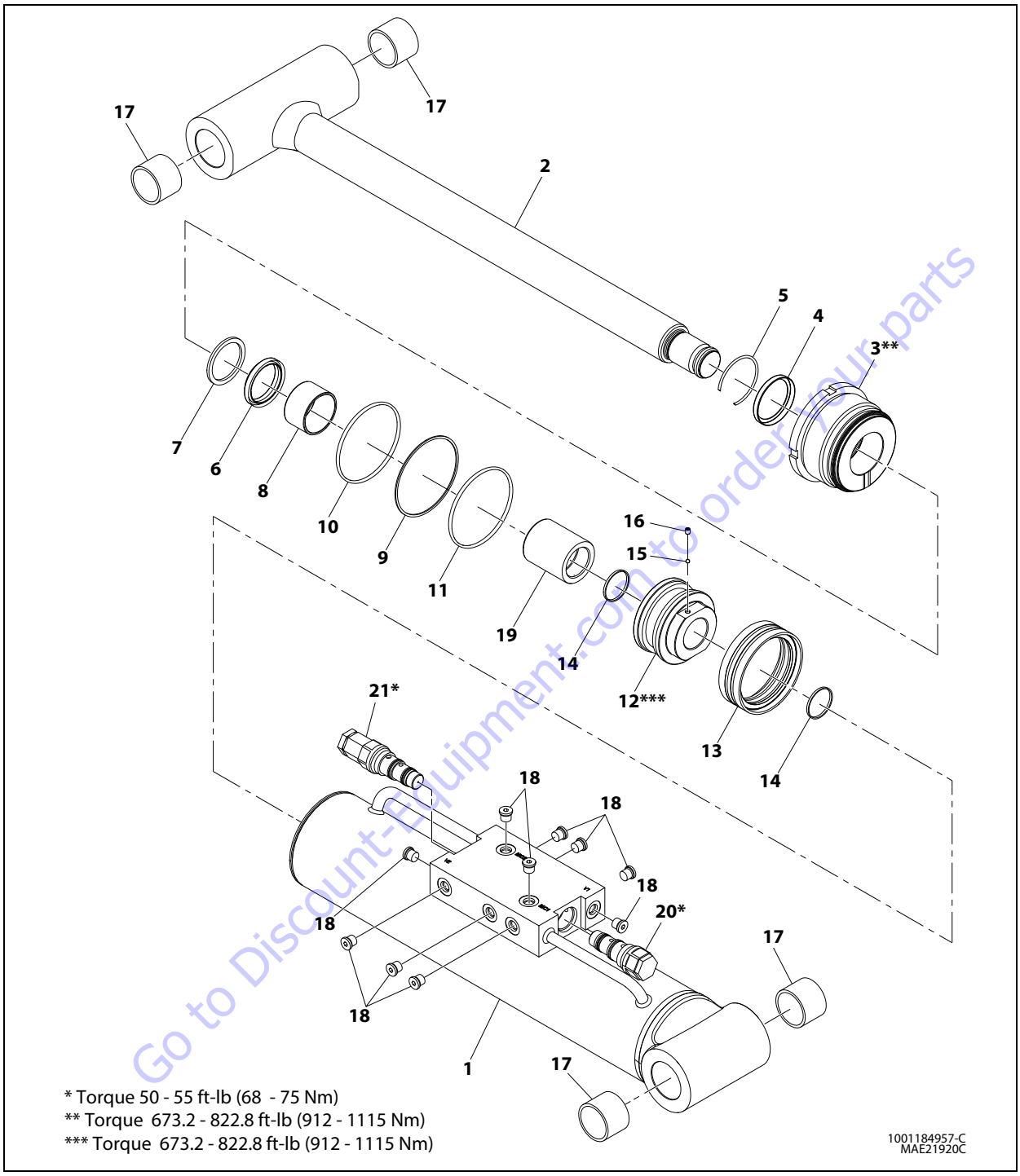


Figure 5-38. Cylinder Rod Support



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

Figure 5-39. Platform Level Cylinder

8. Loosen setscrew (16) retaining ball (15) in piston (12).
9. Screw piston counterclockwise and remove from rod.
10. Remove and discard O-ring (14) and seal (13).

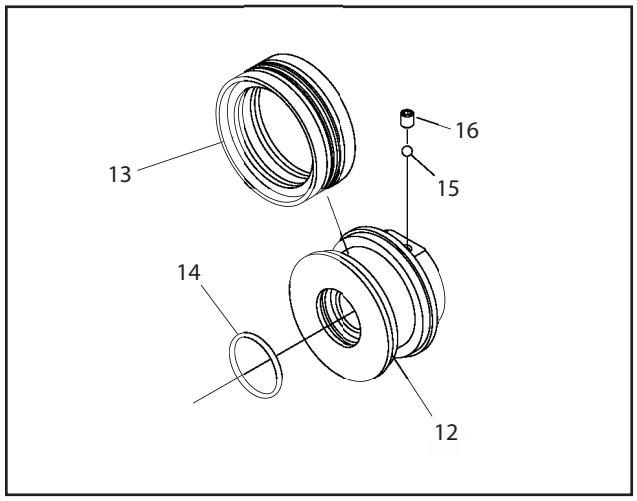


Figure 5-40. Piston Disassembly

11. Remove rod from holding fixture.
12. Remove cylinder head assembly (3) from rod (2).
13. Remove and discard O-ring (9), backup ring (10), and O-ring (11) from cylinder head.
14. Remove and discard retaining ring (5), wiper (4), dry bearing (8), rod seal (7), and backup ring (6) from cylinder head (3).

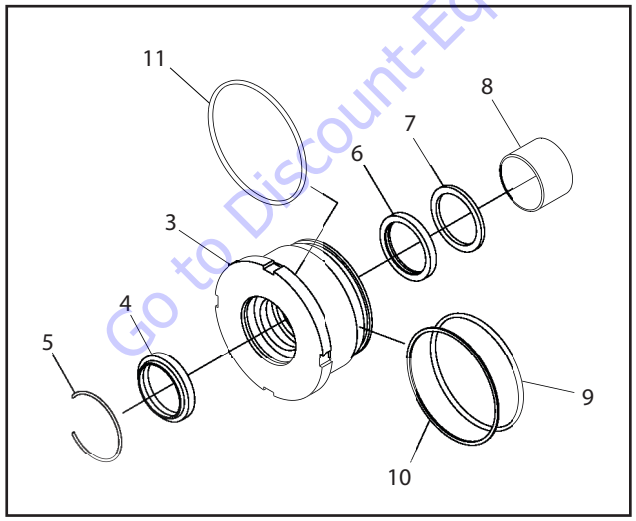


Figure 5-41. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect 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, scoring, or 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 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, damage, ovality, and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.
    d. Press composite bushing into barrel or rod bushing with correct size arbor.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

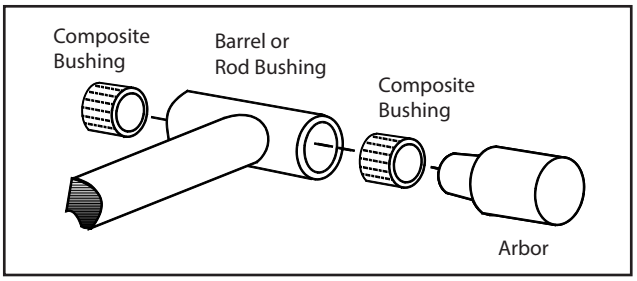


Figure 5-42. Composite Bushing Installation

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

ASSEMBLY

NOTICE

INCORRECT SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE ALL PISTON SEALS ARE CORRECTLY INSTALLED. REFER TO CROSS SECTION ILLUSTRATIONS FOR CORRECT SEAL ORIENTATION.

NOTE: *Use correct cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

1. Support rod in holding fixture.
2. Install backup ring (6), rod seal (7), and dry bearing (8) in cylinder head (3).
3. Install wiper (4) and retaining ring (5) in cylinder head.
4. Install O-ring (11) on cylinder head.
5. Install backup ring (10) and O-ring (9) on cylinder head.
6. Slide cylinder head assembly on rod (2) to rod end. Do not dislodge or damage seals.

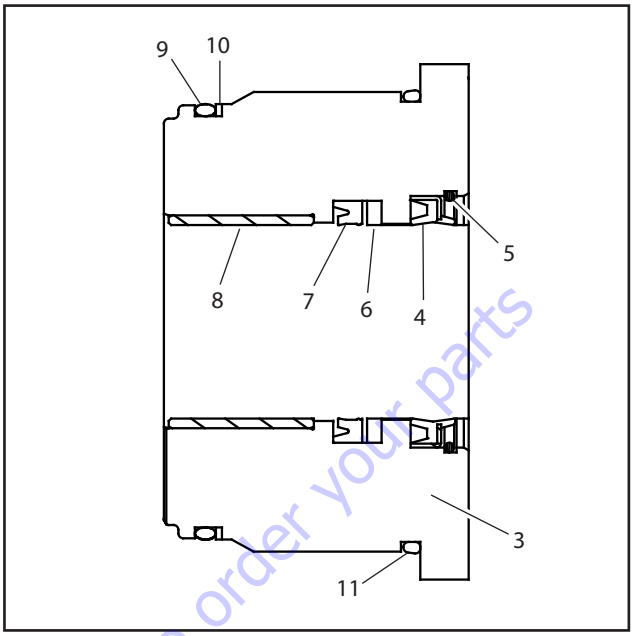


Figure 5-43. Cylinder Head Seal Installation

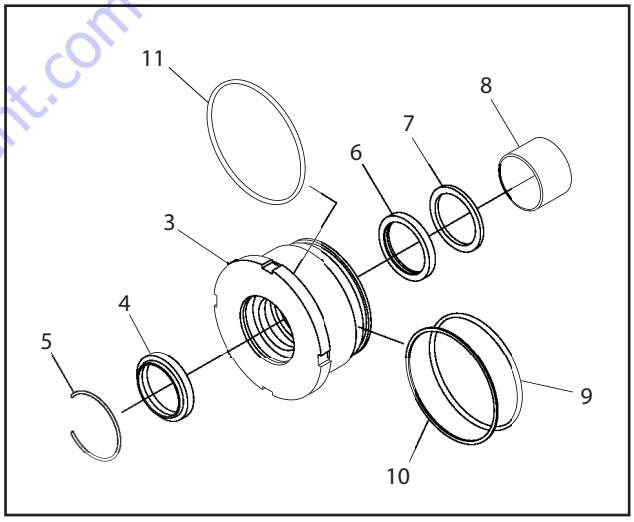


Figure 5-44. Cylinder Head Assembly

7. Install O-ring (14) in piston (12).
8. Install seal (16) on piston.
9. Apply Medium Strength Threadlocking Compound to piston threads. Install piston on rod.
10. Install ball (15) and setscrew (16).

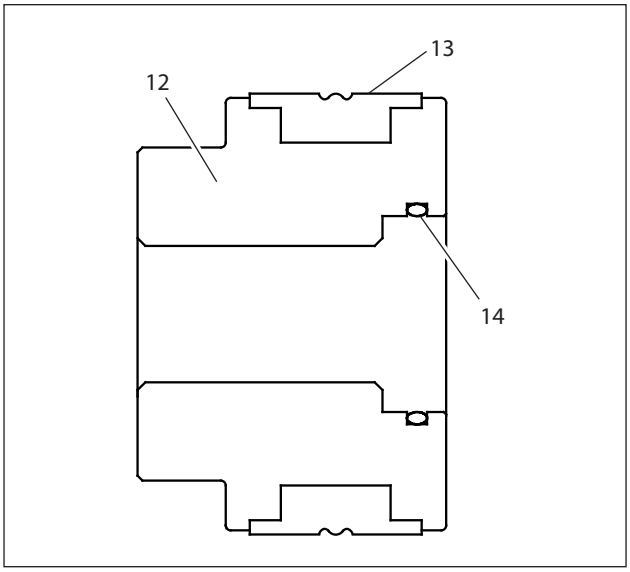


Figure 5-45. Piston Seal Installation

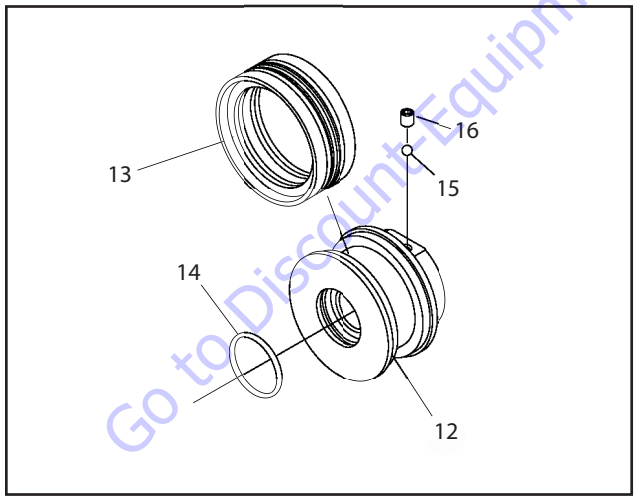


Figure 5-46. Piston Assembly

11. Position cylinder barrel in a suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

12. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge seal.
13. Remove cylinder rod from holding fixture.
14. Place cylinder barrel in suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

15. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston O-rings and backup ring.
16. Continue pushing rod into barrel. Screw in cylinder head.

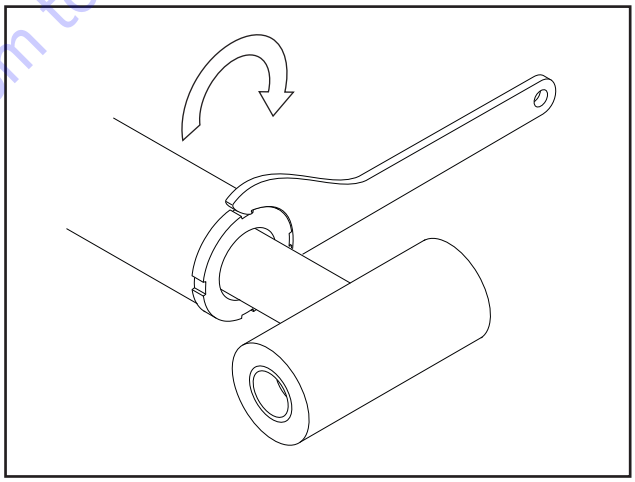
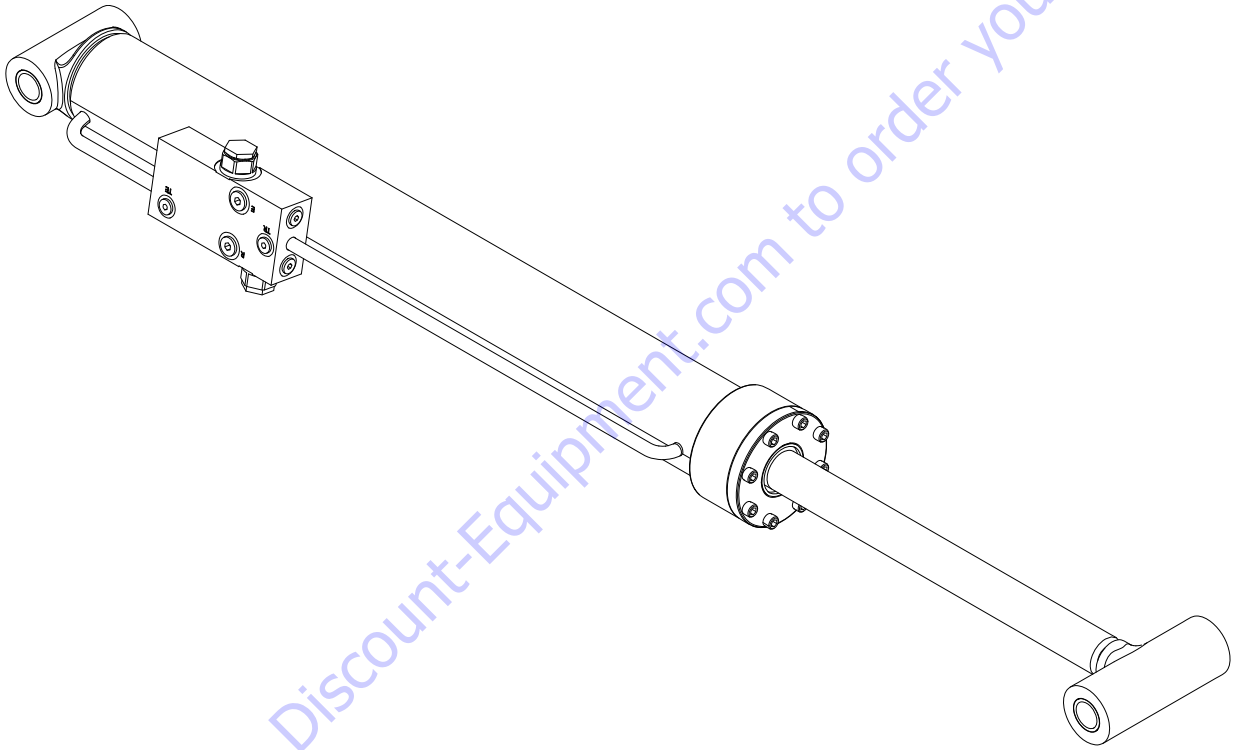


Figure 5-47. Cylinder Head Installation

Jib Lift Cylinder

NOTE: *SERVICE INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION.*



MAF27840

Figure 5-48. Jib Lift Cylinder Assembly

5.3 HYDRAULIC PUMP (GEAR)

Removal

⚠ WARNING

ENSURE THE PRESSURE IS PROPERLY RELIEVED FROM THE HYDRAULIC SYSTEM BEFORE PROCEEDING TO REMOVAL OF THE PUMP MOTOR.

1. Disconnect the hydraulic hoses from inlet and outlet ports of the gear pump.

NOTICE

CAP ALL THE HYDRAULIC HOSES TO PREVENT ENTRAPPING OF THE DUST AND DIRT INTO IT.

2. Remove bolts and washers secured on the gear pump.
3. Carefully dislodge the gear pump shaft from the rear piston pump assembly.
4. Carefully place the gear pump on the clean working surface.

Assembly/Disassembly

For detail assembly/disassembly instructions, contact local JLG or JLG dealer for information.

Installation

NOTICE

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

1. Check for gear teeth on shaft for scoring, pitting tapering and damage. If damaged need to be replaced with a new assembly completely.
2. Apply thin film of spline grease on the gear shaft.
3. Carefully insert the shaft into the piston pump and secure the gear pump using two bolts and washers. Medium Strength Threadlocking Compound to end of bolts. Torque bolts to 20-24 ft.lbs (27-33 Nm).
4. Remove cap from the hydraulic hoses and re-connect to their original locations.

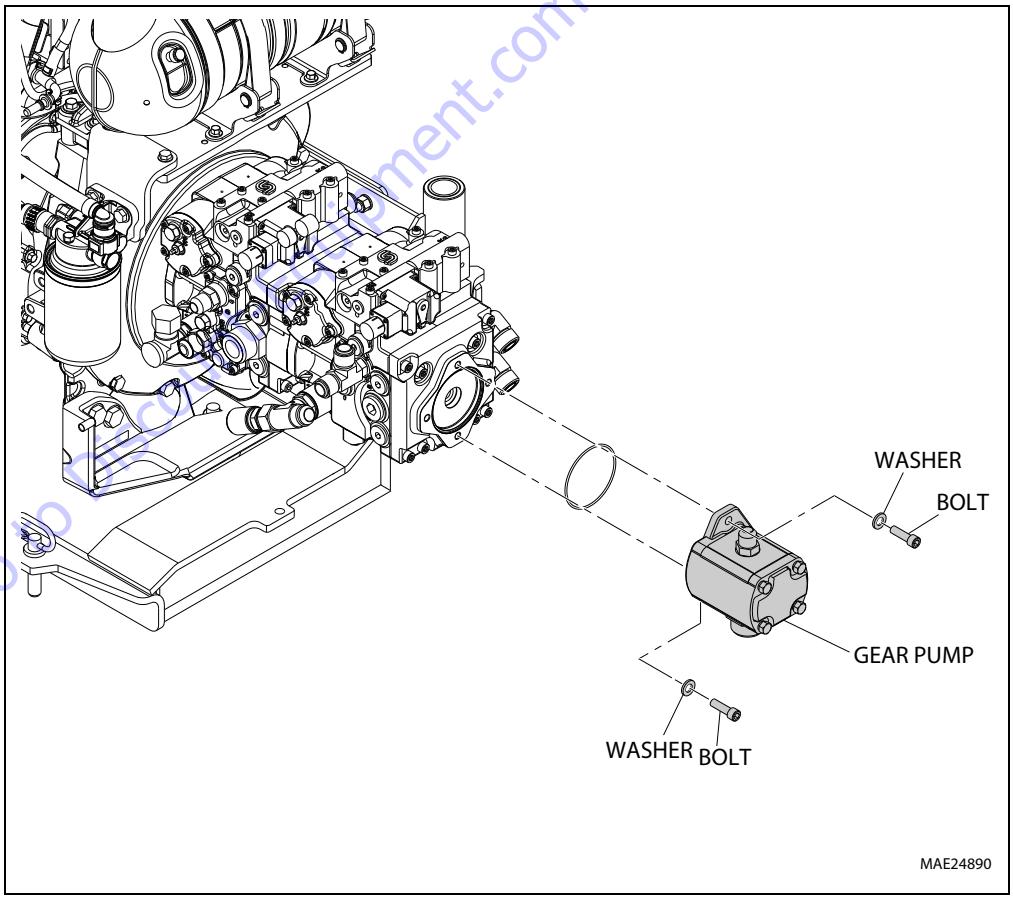


Figure 5-49. Hydraulic Pump Installation

5.4 VARIABLE PUMP

Removal

⚠ WARNING

ENSURE THE PRESSURE IS PROPERLY RELIEVED FROM THE HYDRAULIC SYSTEM BEFORE PROCEEDING TO REMOVAL OF THE PUMP MOTOR.

1. Disconnect the hydraulic hoses from inlet and outlet ports of the front and rear variable pumps.

NOTICE

CAP ALL THE HYDRAULIC HOSES TO PREVENT ENTRAPPING OF THE DUST AND DIRT INTO IT.

2. Remove two bolts secured on the rear variable pump.
3. Carefully dislodge the rear variable pump shaft from the front variable pump assembly.
4. Carefully place the rear variable pump on the clean working surface.
5. Remove two bolts secured on the front variable pump.
6. Carefully dislodge the front variable pump shaft from the front engine assembly.
7. Carefully place the front variable pump on the clean working surface.

Assembly/Disassembly

For detail assembly/disassembly instructions, contact local JLG or JLG dealer for information.

Installation

NOTICE

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

1. Check for gear teeth on shaft for scoring, pitting tapering and damage. If damaged need to be replaced with a new assembly completely.
2. Apply thin film of spline grease on the gear shaft.
3. Carefully insert the shaft of front variable pump into the engine and secure it using two bolts. Apply Medium Strength Threadlocking Compound to end of bolts. Torque bolts to 46-56 ft.lbs (62-76 Nm).
4. Carefully insert the shaft of rear variable pump into the front piston pump and secure it using two bolts. Apply Medium Strength Threadlocking Compound to end of bolts. Torque bolts to 46-56 ft.lbs (62-76 Nm).
5. Remove cap from the hydraulic hoses and re-connect to their original locations.

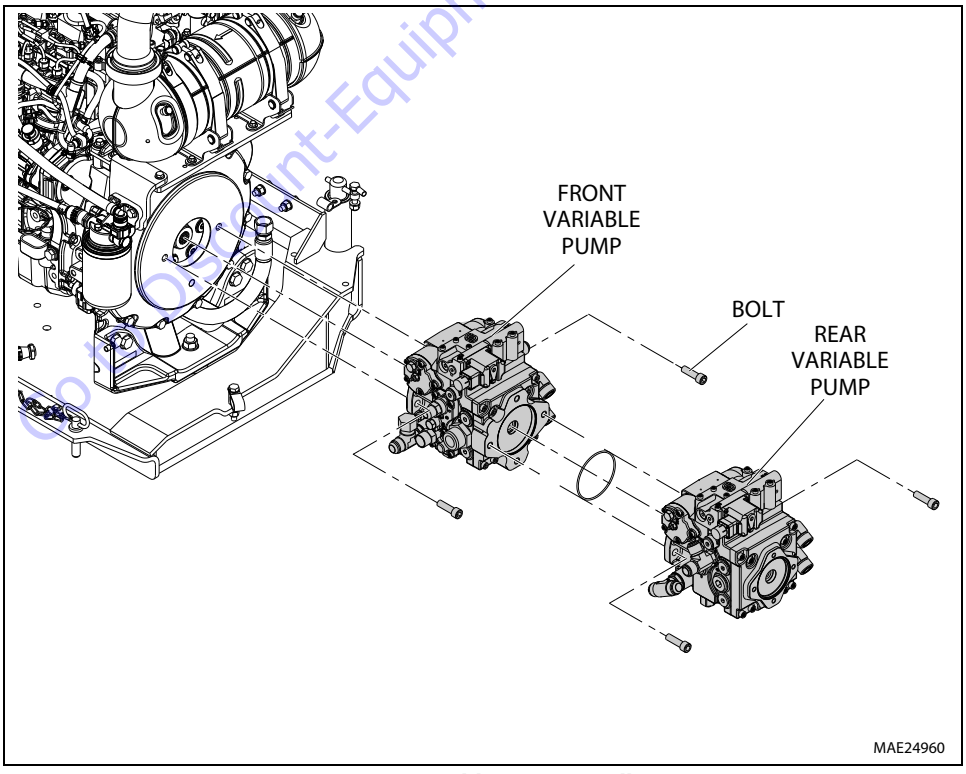


Figure 5-50. Variable Pump Installation

5.5 MAIN VALVE BLOCK PRESSURE SETTING PROCEDURE

Refer to Figure 5-51. Main Control Valve Block.

NOTICE

COLD TEMPERATURES HAVE A SIGNIFICANT IMPACT ON PRESSURE READINGS. JLG INDUSTRIES INC. RECOMMENDS OPERATING THE MACHINE UNTIL THE HYDRAULIC SYSTEM HAS WARMED TO NORMAL OPERATING TEMPERATURES PRIOR TO CHECKING PRESSURES. JLG INDUSTRIES INC. ALSO RECOMMENDS THE USE OF A CALIBRATED GAUGE. PRESSURE READINGS ARE ACCEPTABLE IF THEY ARE WITHIN ± 5% OF SPECIFIED PRESSURES.

Load Sense Compensator

1. Install a pressure gauge at port MP1 of the main control valve capable of reading pressures up to 1000 psi (70 bar).
2. Start the Engine.
3. Adjust Load Sense Compensator (1) to 400 - 450 psi (27.5 - 31 bar). Turn adjuster clockwise to increase or counterclockwise to decrease pressure.

Main Relief Valve

1. Install a pressure gauge at port MP1 of the main control valve capable of reading pressures up to 5000 psi (345 bar).
2. Activate telescope in and hold.
3. Adjust main relief valve (2) to 3350 - 3400 psi (231 - 234.5 bar). Turn adjuster clockwise to increase or counterclockwise to decrease pressure.
4. If the pressure will not rise to 3350 psi, the load sense relief valve will have to increase. Locate the load sense relief valve. Increase this setting by 1 turn clockwise. Go back to the main relief valve and increase until the correct pressure is achieved.

Load Sense Relief Valve

1. Install a pressure gauge at port MJ of the main control valve capable of reading pressures up to 5000 psi (345 bar).
2. Activate telescope in and hold.
3. Adjust load sense relief valve (3) to 3200 - 3250 psi (220.6 - 224.1 bar). Turn adjuster clockwise to increase or counterclockwise to decrease pressure.

Turntable Swing Relief Valve

1. Install a pressure gauge at port MJ of the main control valve.
2. The turntable should be locked in place with the turntable lock pin. Activate swing right.
3. Adjust Relief Valve (8) to 1700 - 1750 psi (117 - 120.5 bar).
4. One adjustment will take care of both directions. Swing left will be approximately 50 - 100 psi (3.5 - 7 bar) lower. Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.

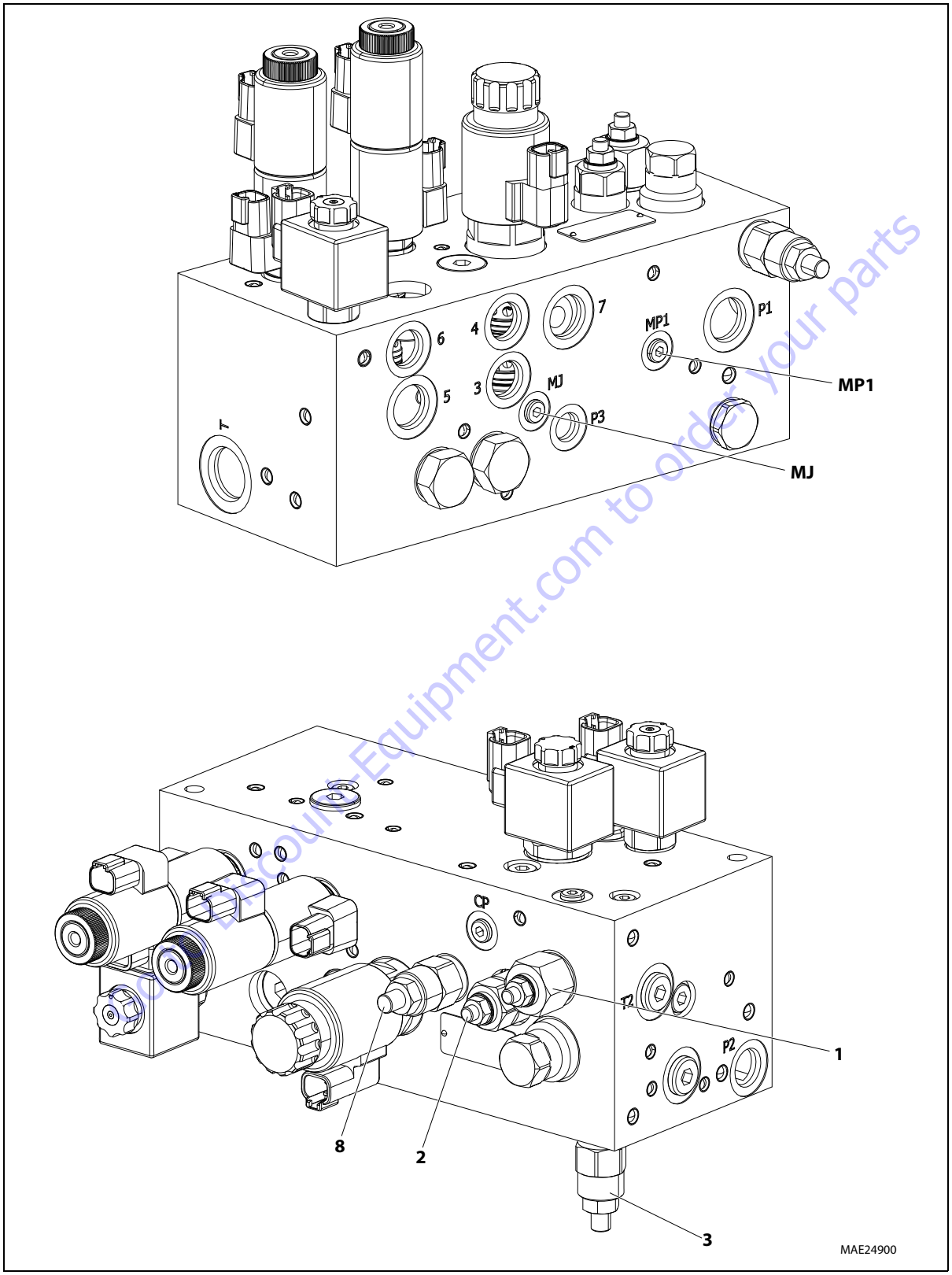


Figure 5-51. Main Control Valve Block

5.6 PLATFORM VALVE BLOCK PRESSURE SETTING PROCEDURE

Refer to Figure 5-52. Platform Control Valve Block.

Main High Pressure Relief Valve

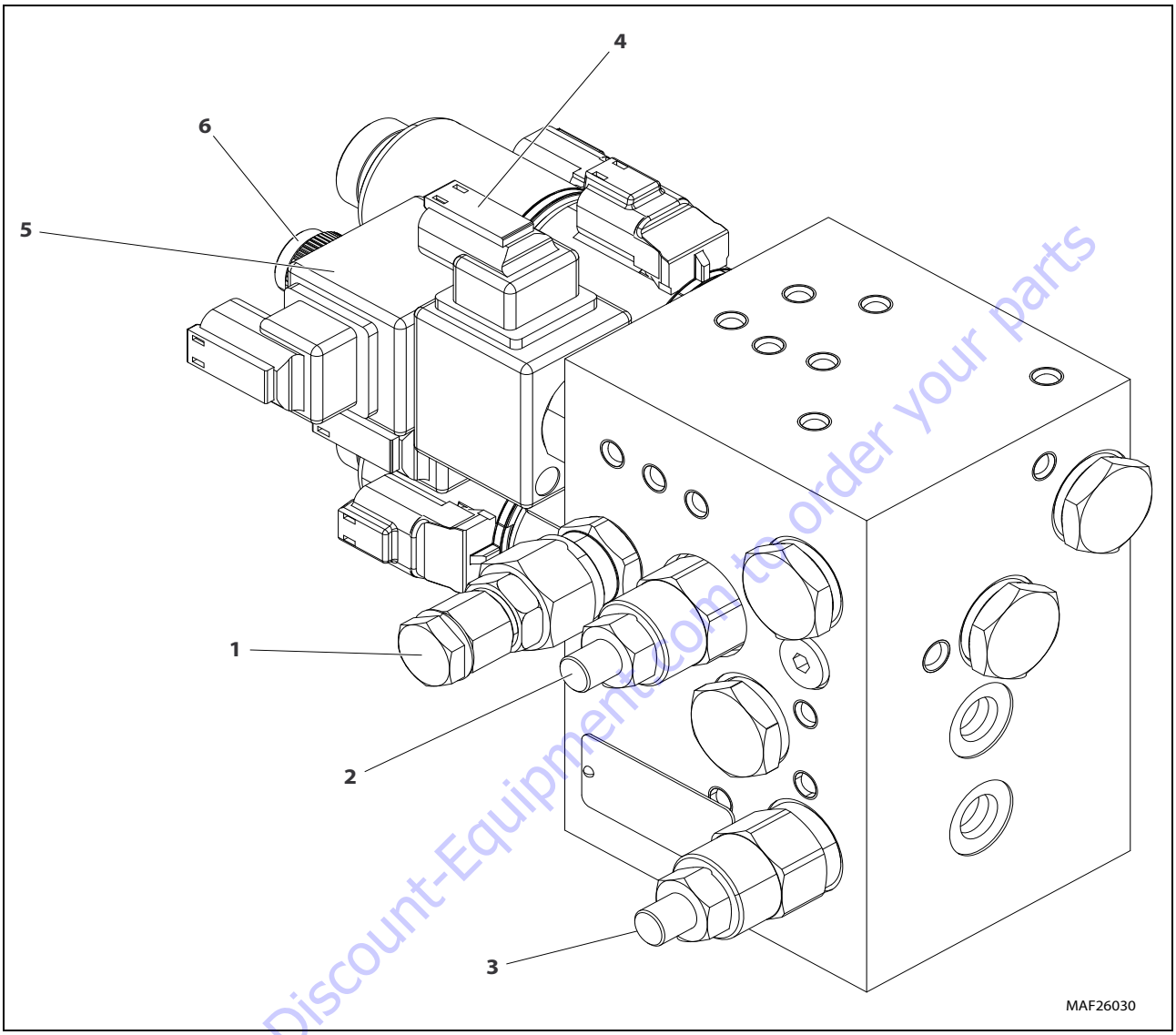
1. Install a pressure gauge at port MP1 of the platform control valve capable of reading pressures up to 5000 psi (345 bar).
2. Activate platform right or left to the end of stroke and hold.
3. Adjust Relief Valve (1) to 2950 - 3000 psi (204.5 - 207 bar). Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.

Low Pressure Relief Valve

1. Install a pressure gauge at port MP1 of the platform control valve capable of reading pressures up to 5000 psi (345 bar).
2. To check or set this adjustment locate the dump directional valve (6) at the platform manifold. Flip the wires between the two solenoid coils. After the relief has been set, flip the wires back to their original place.
3. Activate rotate right or left to the end of stroke.
4. Adjust Relief Valve (2) to 2200 ± 50 psi (152 ± 3.5 bar). Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.

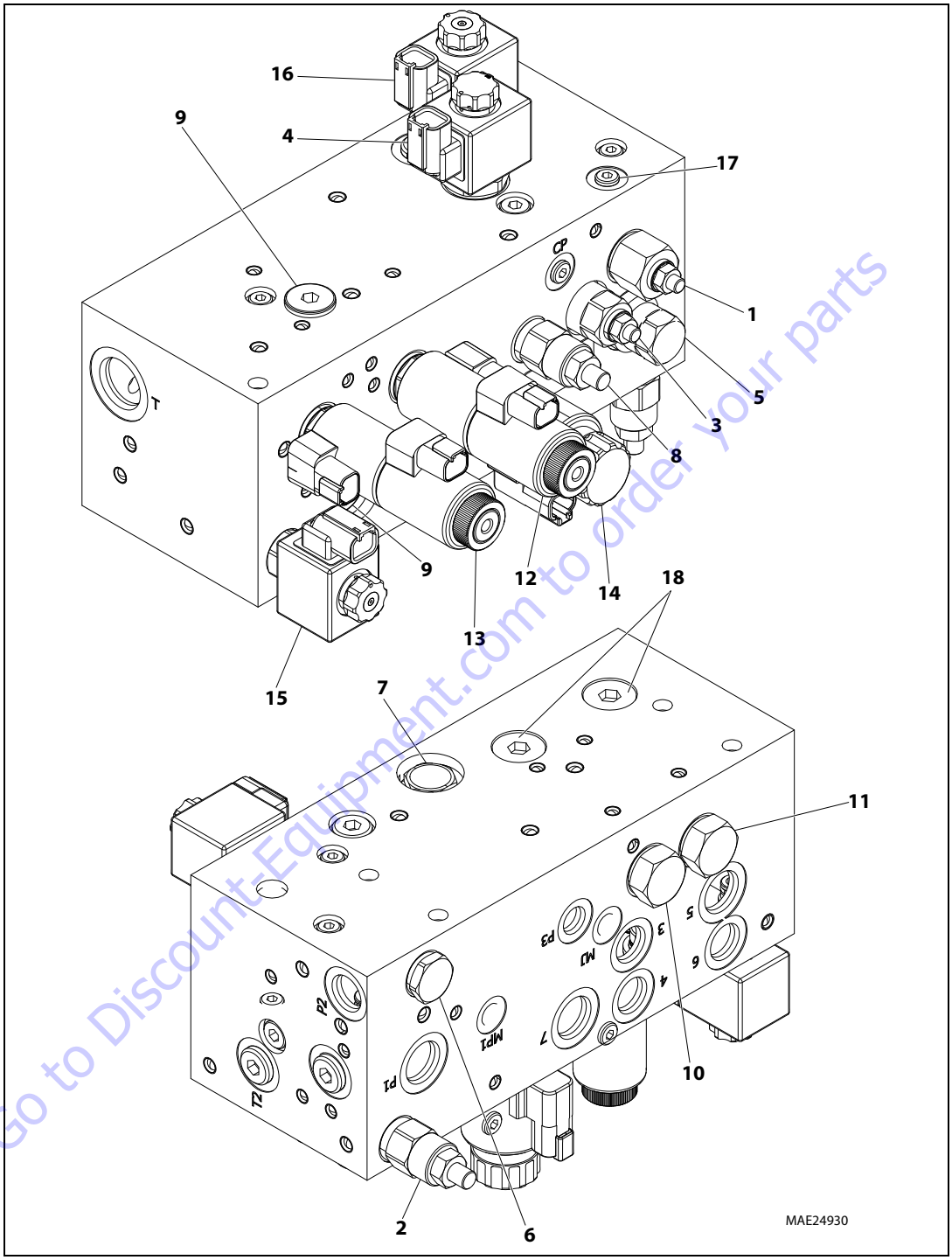
Platform Jib Down Relief Valve

1. Install a pressure gauge at port M5-6 of the platform control valve capable of reading pressures up to 5000 psi (345 bar).
2. Activate jib down to the end of stroke and hold.
3. Adjust Relief Valve (7) to 1600 - 1650 psi (110 - 113.5 bar).
4. This one adjustment will take care of jib up and down. Jib up will automatically be approximately 50 - 100 psi (3.5 - 7 bar) higher than jib down. Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.



1. Main High Pressure Relief Valve
2. Low Pressure Relief Valve
3. Jib Relief Valve
4. Low Pressure Relief Solenoid
5. High Pressure Relief Solenoid
6. Dump Directional Valve

Figure 5-52. Platform Control Valve Block



1. Load Sense Compensator
2. Relief Valve
3. Relief Valve
4. Solenoid Valve
5. Priority Flow Control Valve
6. Check Valve
7. Flow/Pressure Control Valve
8. Relief Valve
9. Shuttle Valve
10. Pressure Compensator Valve
11. Pressure Compensator Valve
12. Solenoid Valve
13. Solenoid Valve
14. Solenoid Valve
15. Solenoid Valve
16. Solenoid Valve
17. Orifice Plug
18. Check Valve

Figure 5-53. Main Control Valve

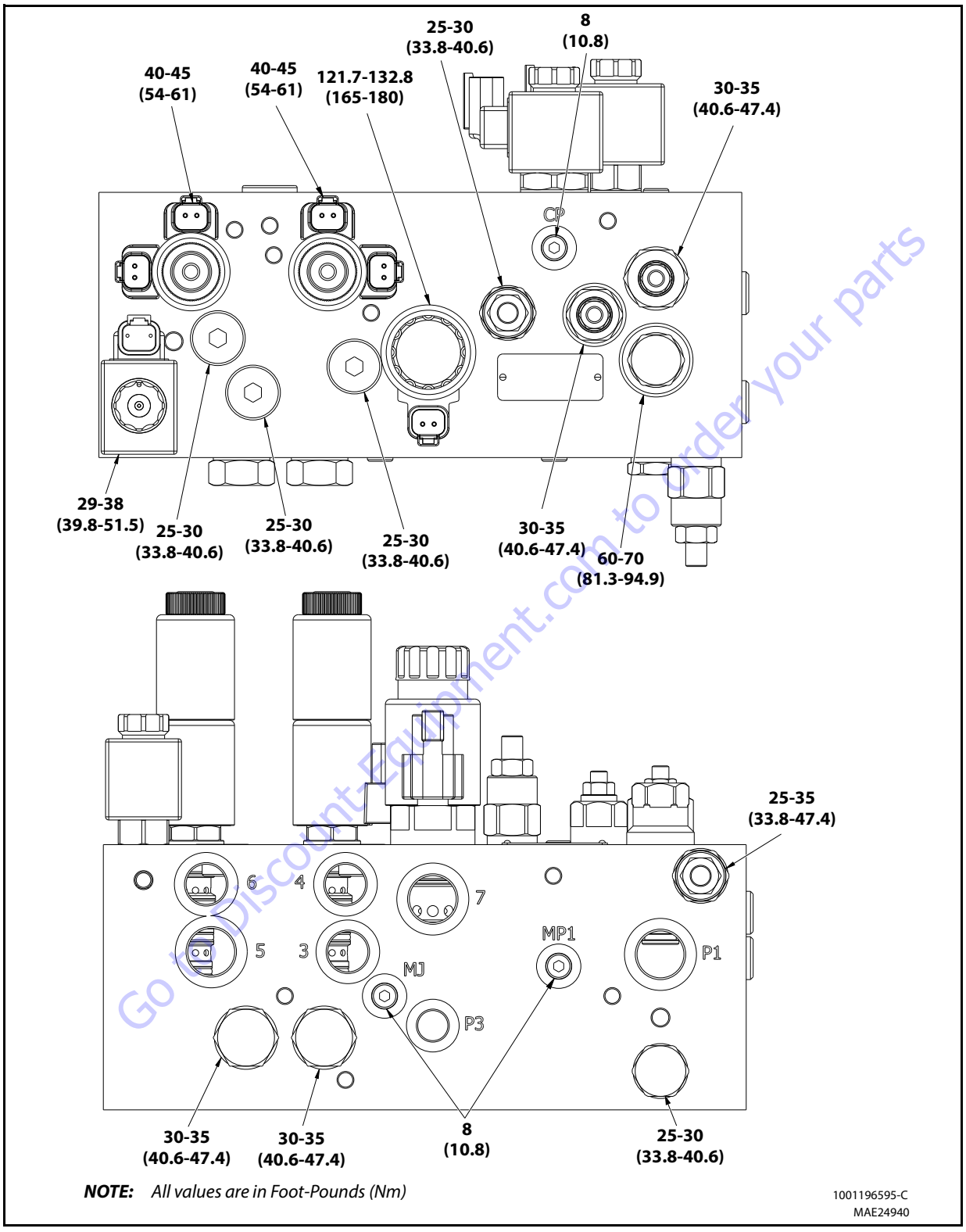


Figure 5-54. Main Control Valve Torque Values - Sheet 1 of 2

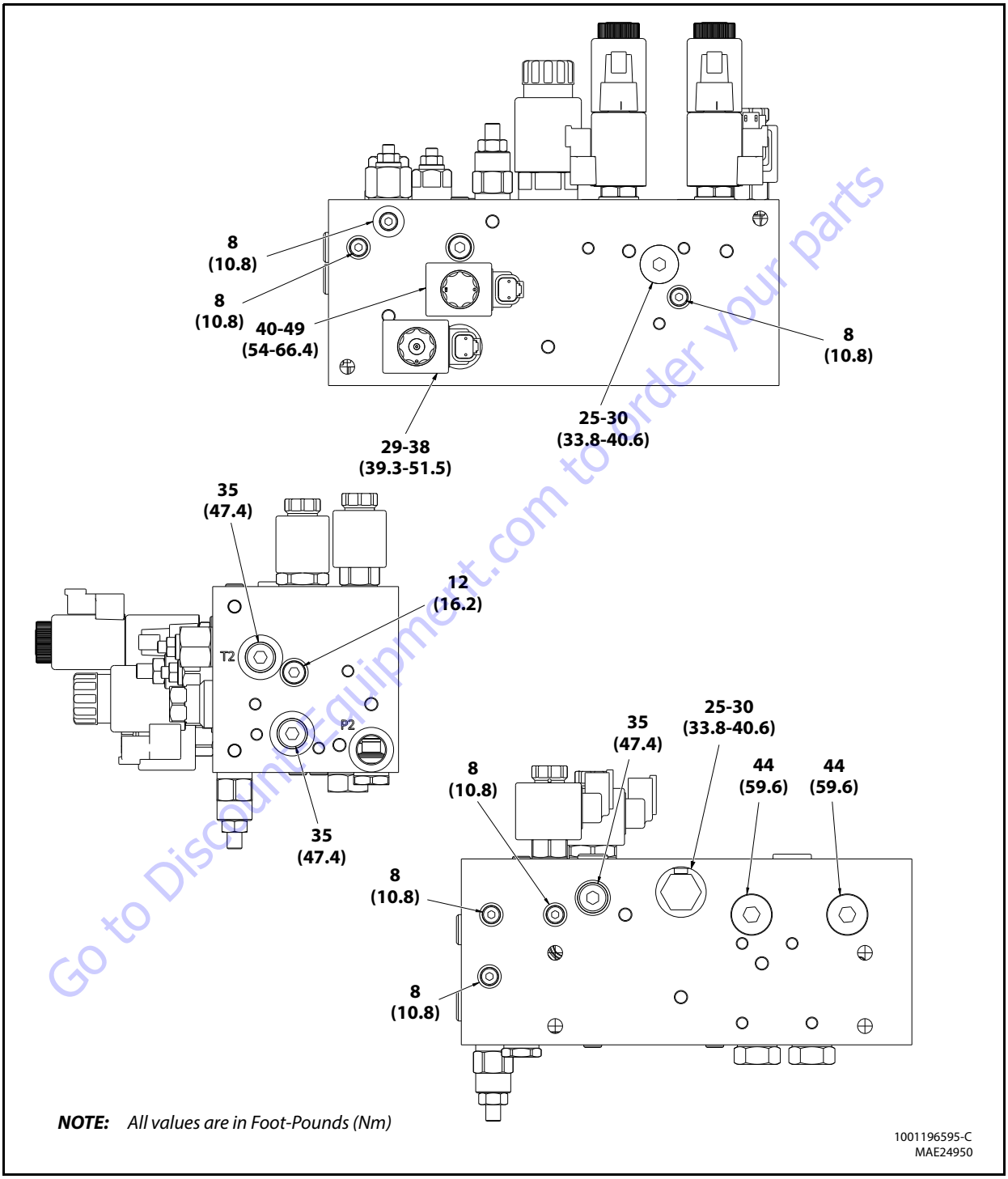


Figure 5-55. Main Control Valve Torque Values - Sheet 2 of 2

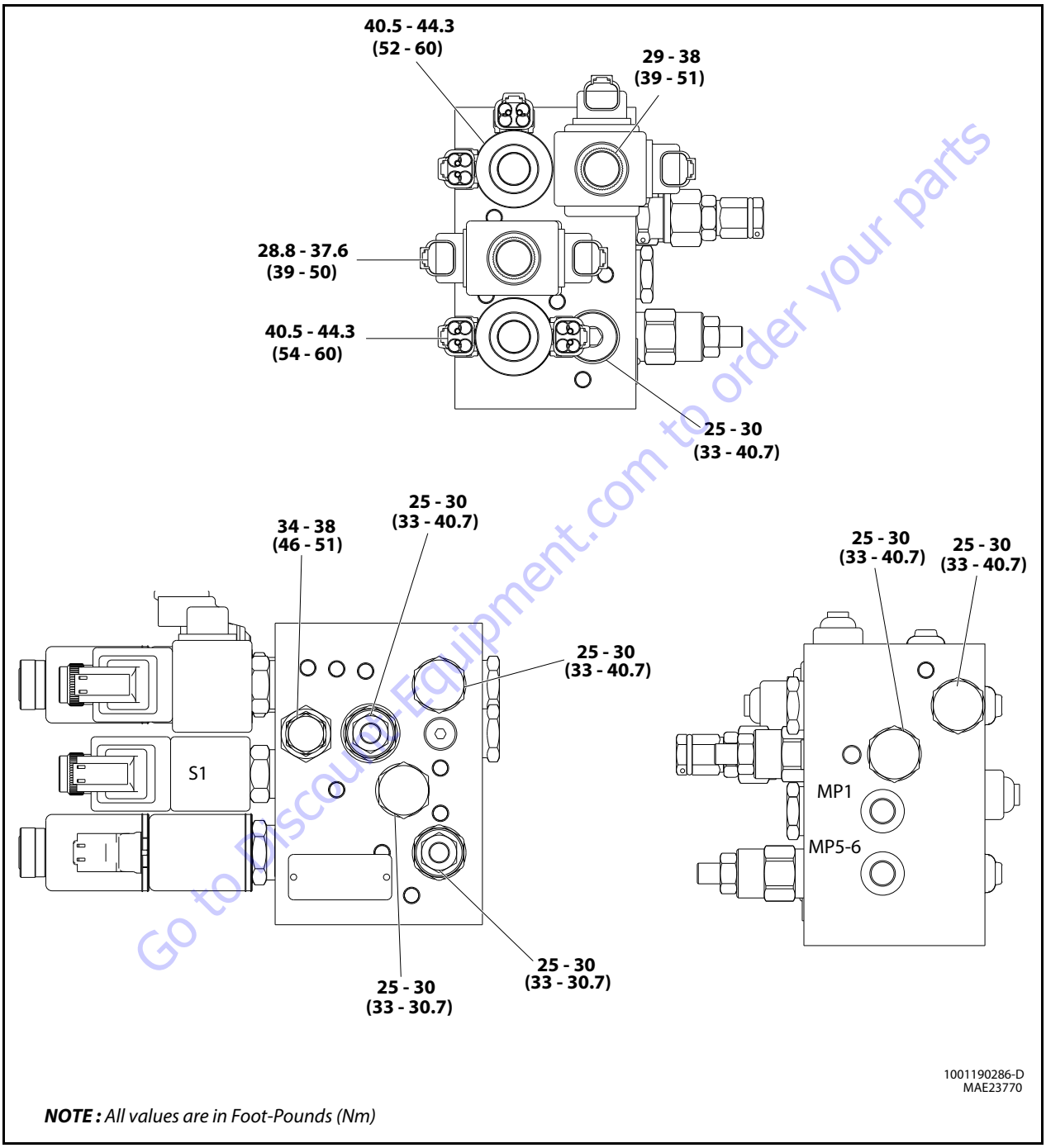


Figure 5-56. Platform Valve Torque Values

5.7 HYDRAULIC SCHEMATICS

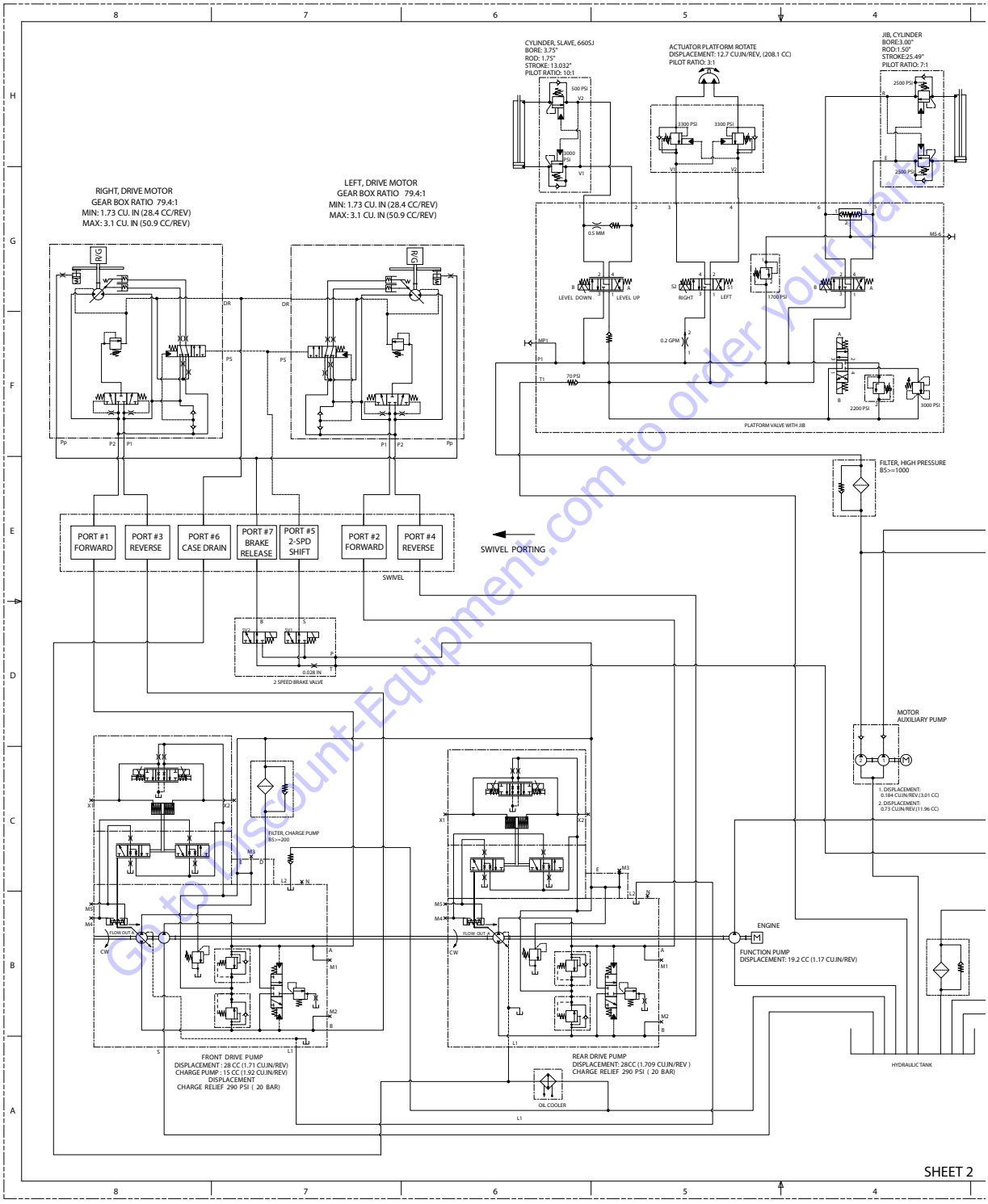


Figure 5-57. Hydraulic Schematic - Sheet 1 of 2

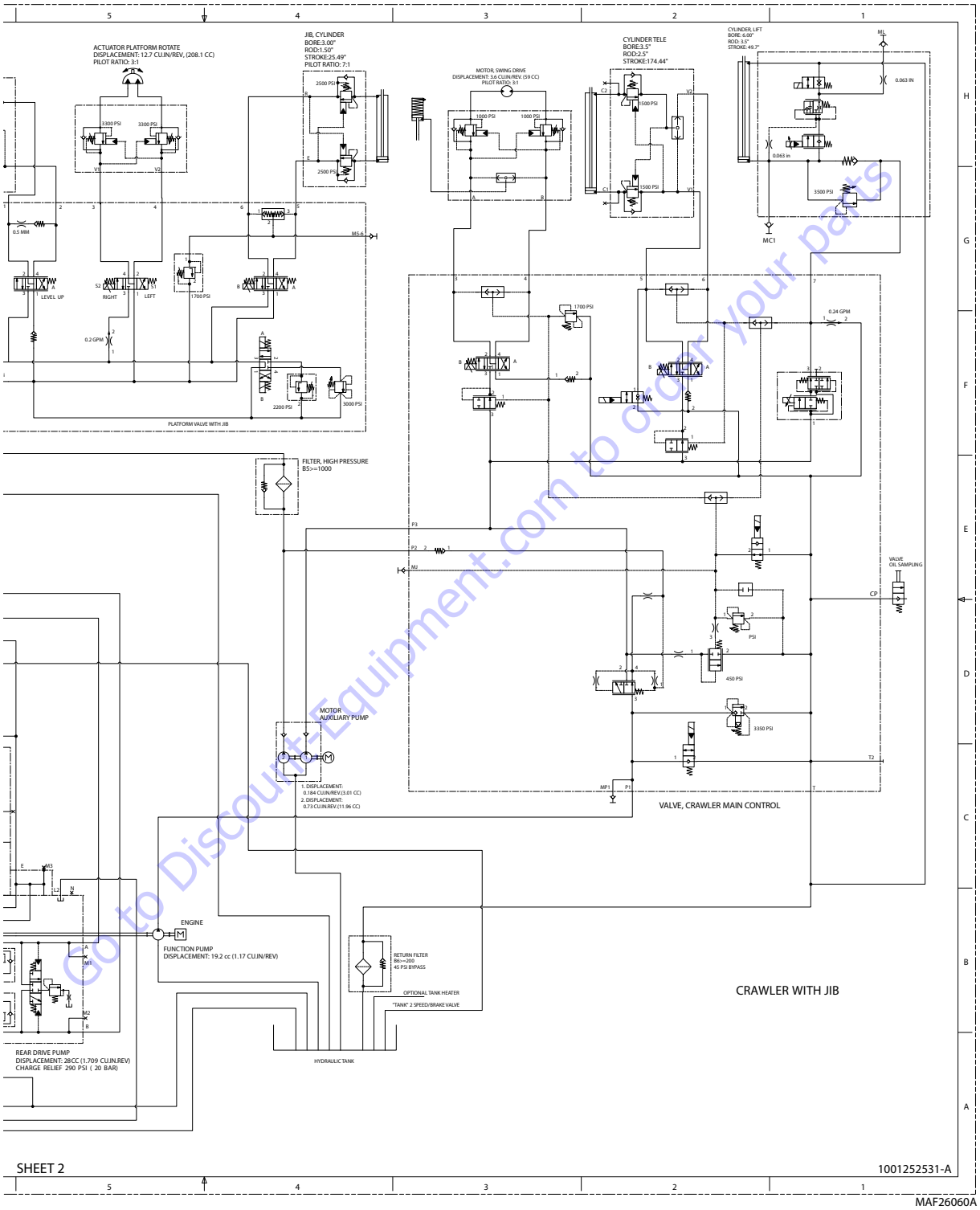


Figure 5-58. Hydraulic Schematic - Sheet 1 of 2

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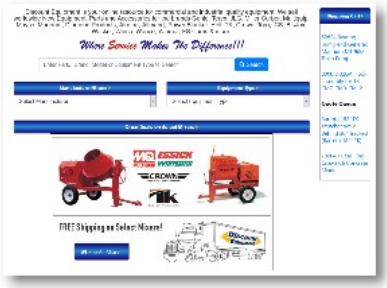

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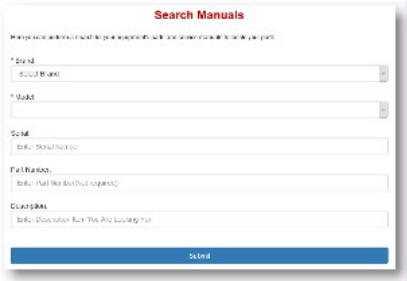

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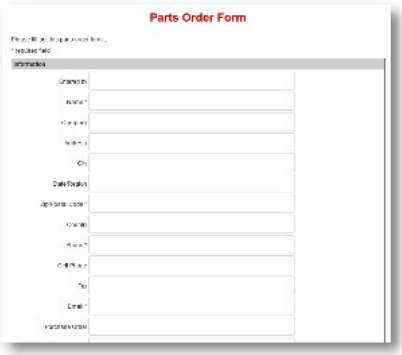

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber,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

6.1 JLG CONTROL SYSTEM ANALYZER KIT INSTRUCTIONS

NOTICE

WHEN INSTALLING A NEW GROUND MODULE CONTROLLER IT IS NECESSARY TO PROGRAM THE CONTROLLER FOR PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS.

NOTICE

AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. IF PRESSURE-WASHING IS USED 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) FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG designed Control System is a 12 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, min speed, and max.-speed for all boom, drive, and steering functions.

Upper lift, swing, and drive are controlled by individual joysticks. Steering is controlled by a rocker switch built in the top of the drive joystick. To activate Drive, Lift, and Swing; pull up the slide lock on the joystick and move the handle in the desired direction.

The control system provides voltage output to the valves and pump, as programmed, for smooth operation and maximum cycle time. Ground control speeds for all boom functions can also be programmed in the control system.

The JLG Control System controller has a built in LED to indicate any faults. The system stores recent faults which may be accessed for troubleshooting. Optional equipment includes a soft touch system, head and tail lights, and ground alarm. These options may be added later but must be programmed into the control system when installed.

The Control System may be accessed with a custom designed, direct connect hand held analyzer or wireless adapter using an app on your Android or iPhone/iPad device. The analyzer or wireless output displays two lines of information at a time, by scrolling through the program.

Each module has a label with JLG part number and a serial number containing a date code.

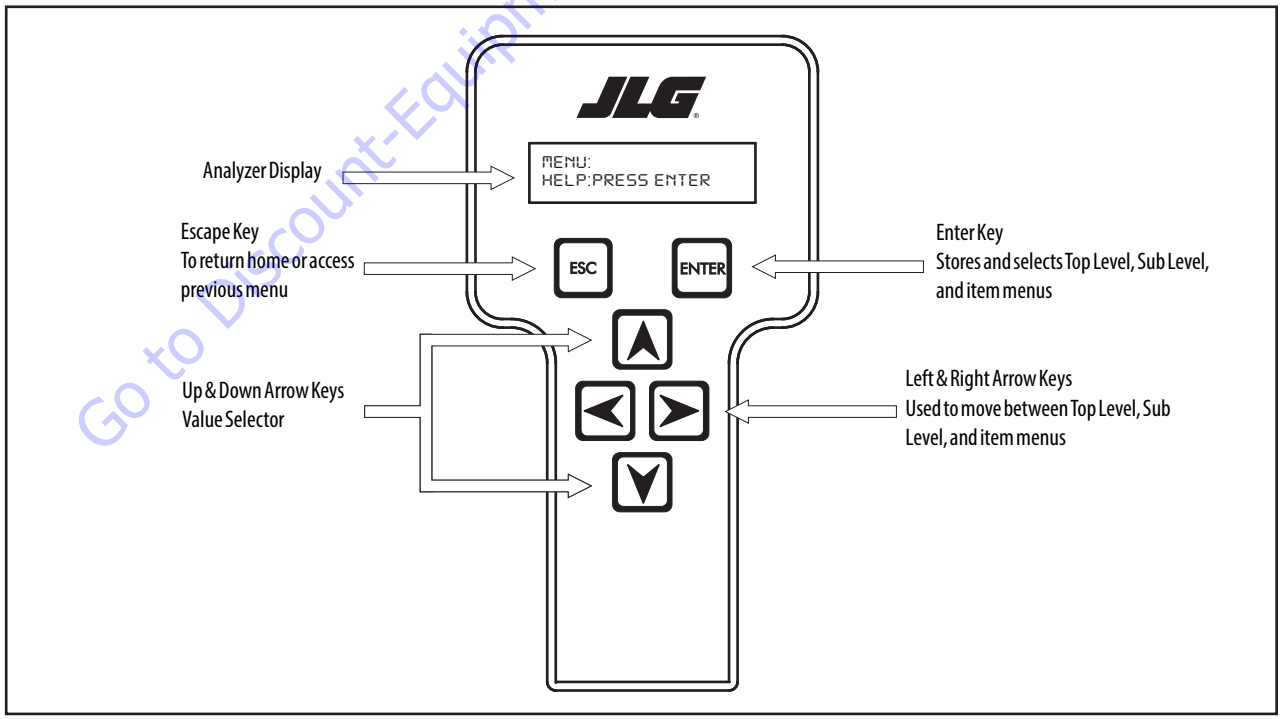


Figure 6-1. Hand Held Analyzer

Connect JLG Control System Analyzer

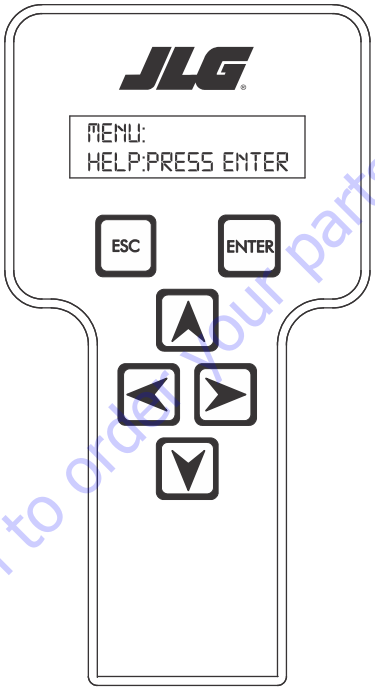
1. Connect the four pin end of the cable supplied with the analyzer, to the motor controller module located in the platform box or at the power module and connect the remaining end of the cable to the analyzer.

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 Analyzer

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



MENU:
HELP:PRESS ENTER

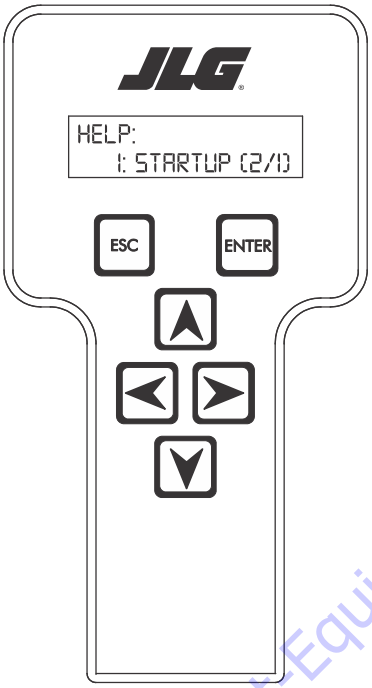
Move between top level menu items using **RIGHT** and **LEFT** arrow keys. To select a displayed menu item, press **ENTER** (ENTER). To cancel a selected menu item press **ESC** (ESC). Scroll using right and left arrow keys to select a different menu item.

Top level menus are as follows:

HELP
DIAGNOSTICS
SYSTEM TEST
OPERATOR ACCESS
PERSONALITIES
MACHINE SETUP
CALIBRATIONS

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 shows: **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 **ESC** (ESC) two times. **STARTUP (2/1)** indicates a power up.

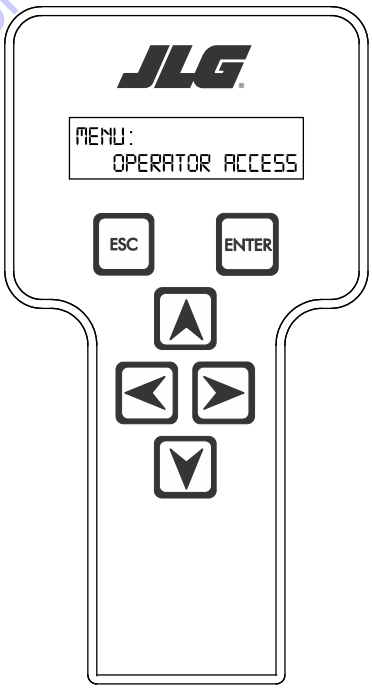
When a top level menu is selected, a new set of menu items may be offered: for example:

DRIVE
BOOM
SYSTEM
DATALOG
VERSIONS

Pressing **ENTER** (ENTER) with any of the above displayed menus, displays 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 Access Level

When 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 access level, the correct password must be entered. To enter password, scroll to **ACCESS LEVEL** menu. For example:



ACCESS LEVEL:
CODE 00000

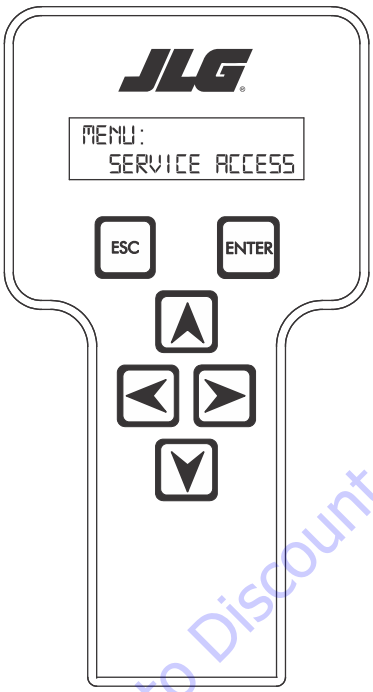
Press **ENTER** ENTER to select the **ACCESS LEVEL** menu.

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

Then using the **RIGHT** arrow key, position cursor 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.

When correct password is displayed, press **ENTER** ENTER. The access level displays the following if password was entered correctly:

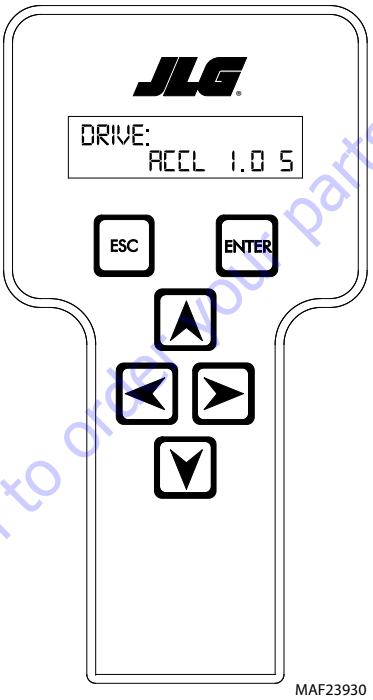


MENU:
SERVICE ACCESS

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

Adjust Parameters

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:



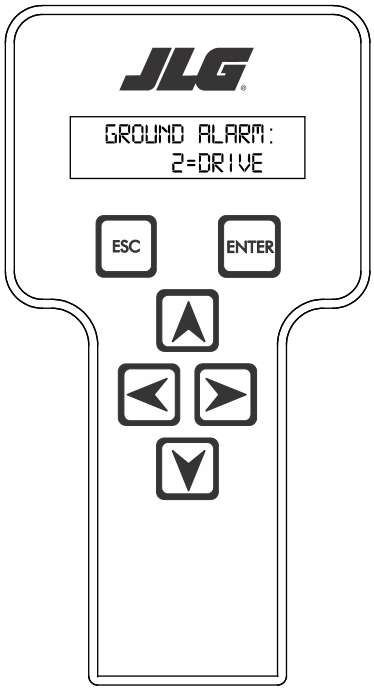
MAF23930

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 at maximum value or decrease if the **DOWN** arrow is pressed at minimum value for any personality. If value does not change when pressing up and down arrows, check access level is at access level 1.

Machine Setup

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



GROUND ALARM:
2 = DRIVE

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

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

NOTE: *Refer to Personality Ranges/Defaults for the recommended factory settings.*

NOTE: *Password 33271 allows access to level 1 to change 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 ELEVATION CUTBACK SETTING MAY ADVERSELY AFFECT PERFORMANCE OF YOUR MACHINE.

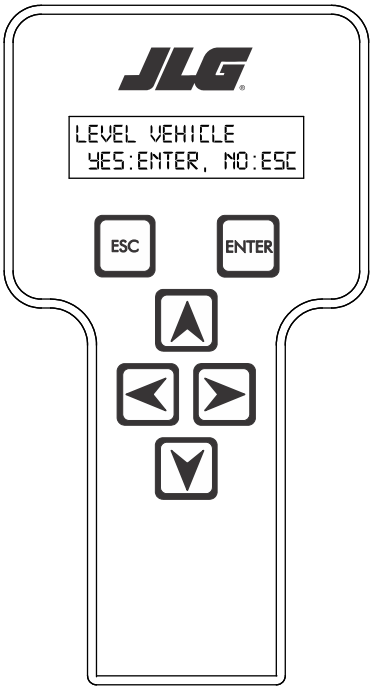
NOTICE

AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. IF PRESSURE-WASHING IS USED 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) FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

Level Vehicle Description

⚠ WARNING

DO NOT LEVEL VEHICLE EXCEPT ON A LEVEL SURFACE.



LEVEL VEHICLE
YES: ENTER, NO: ESC

Not available at password level 2. **ENTER** confirms 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

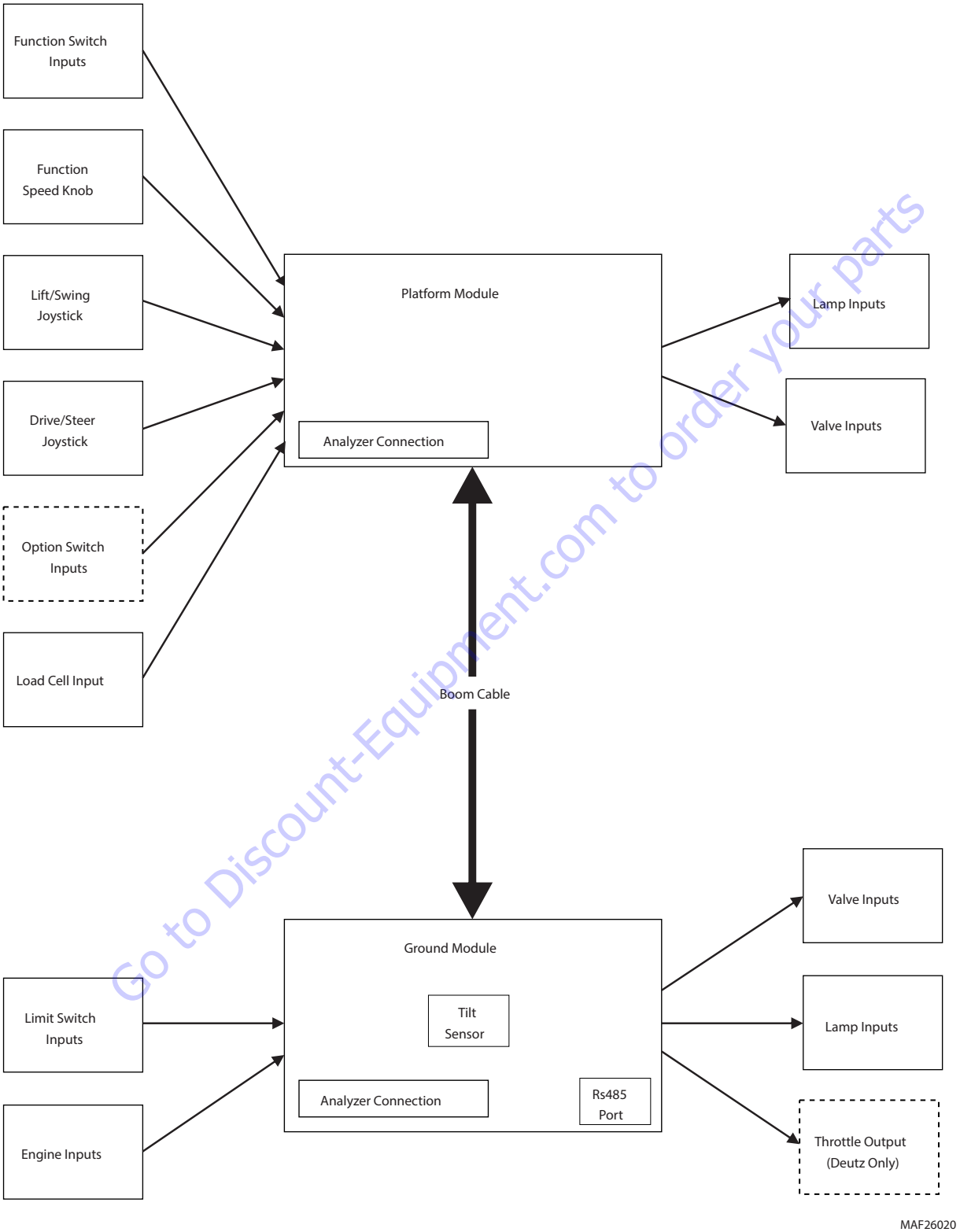
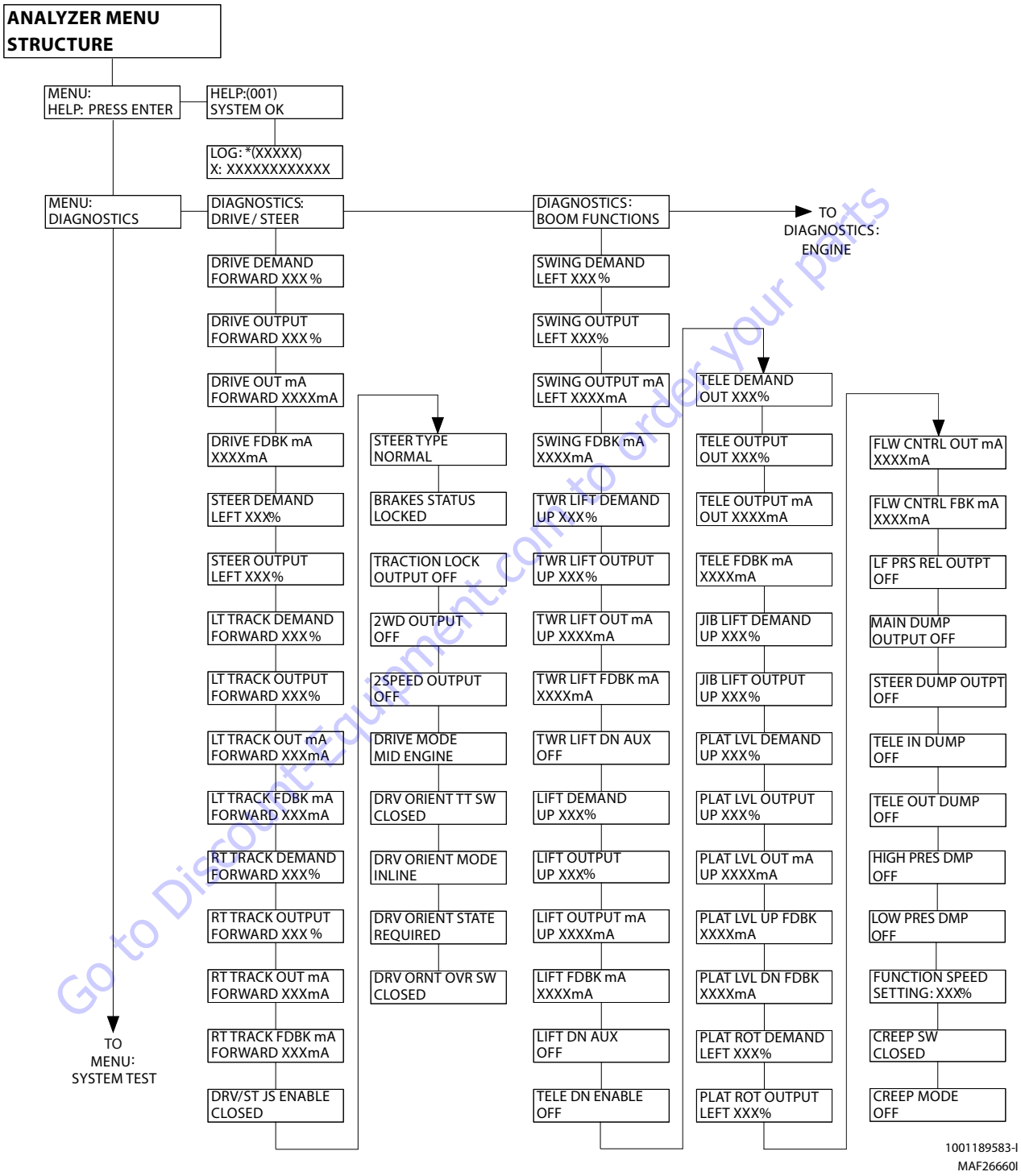
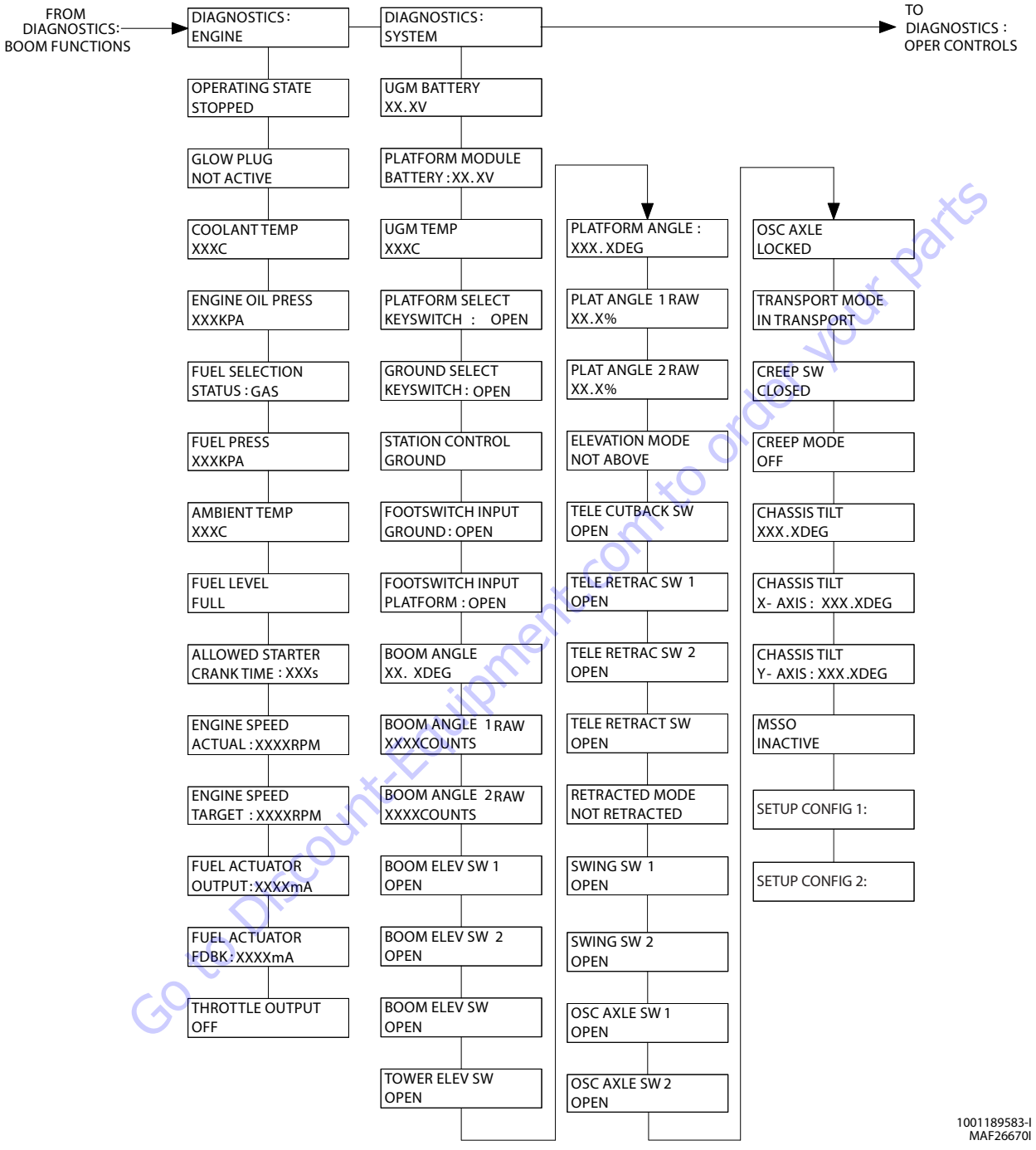


Figure 6-2. ADE Block Diagram



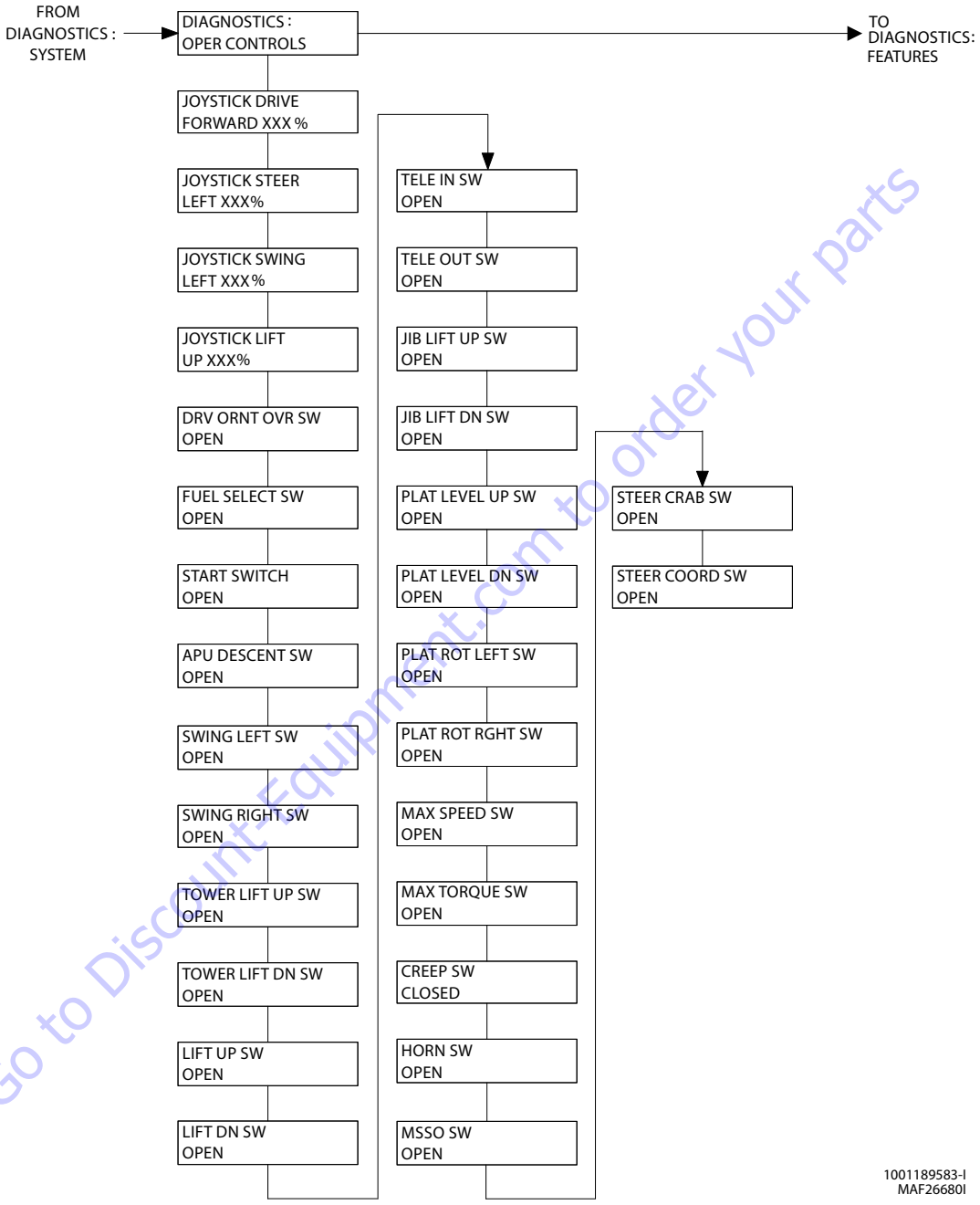
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-3. Analyzer Software P2.14 - Sheet 1 of 14



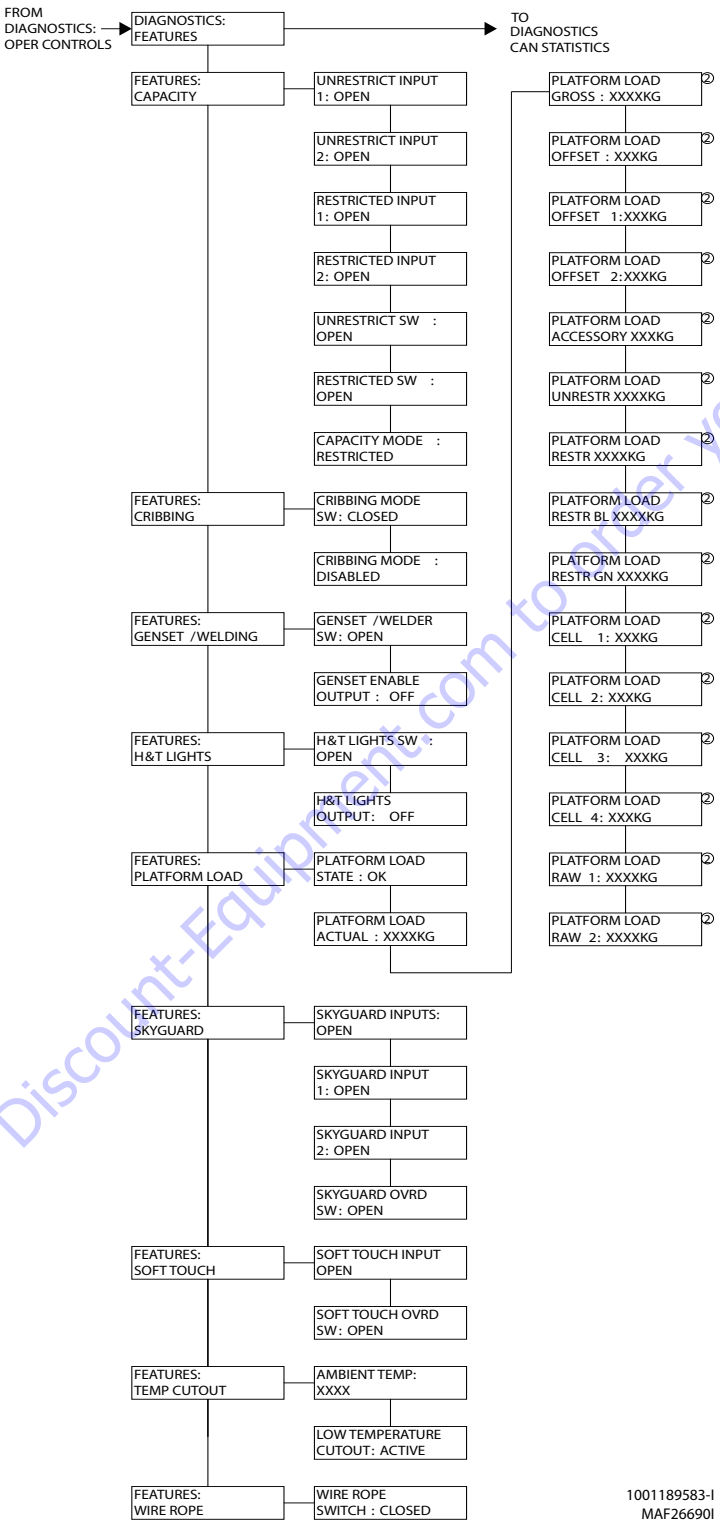
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-4. Analyzer Software P2.14 - Sheet 2 of 14



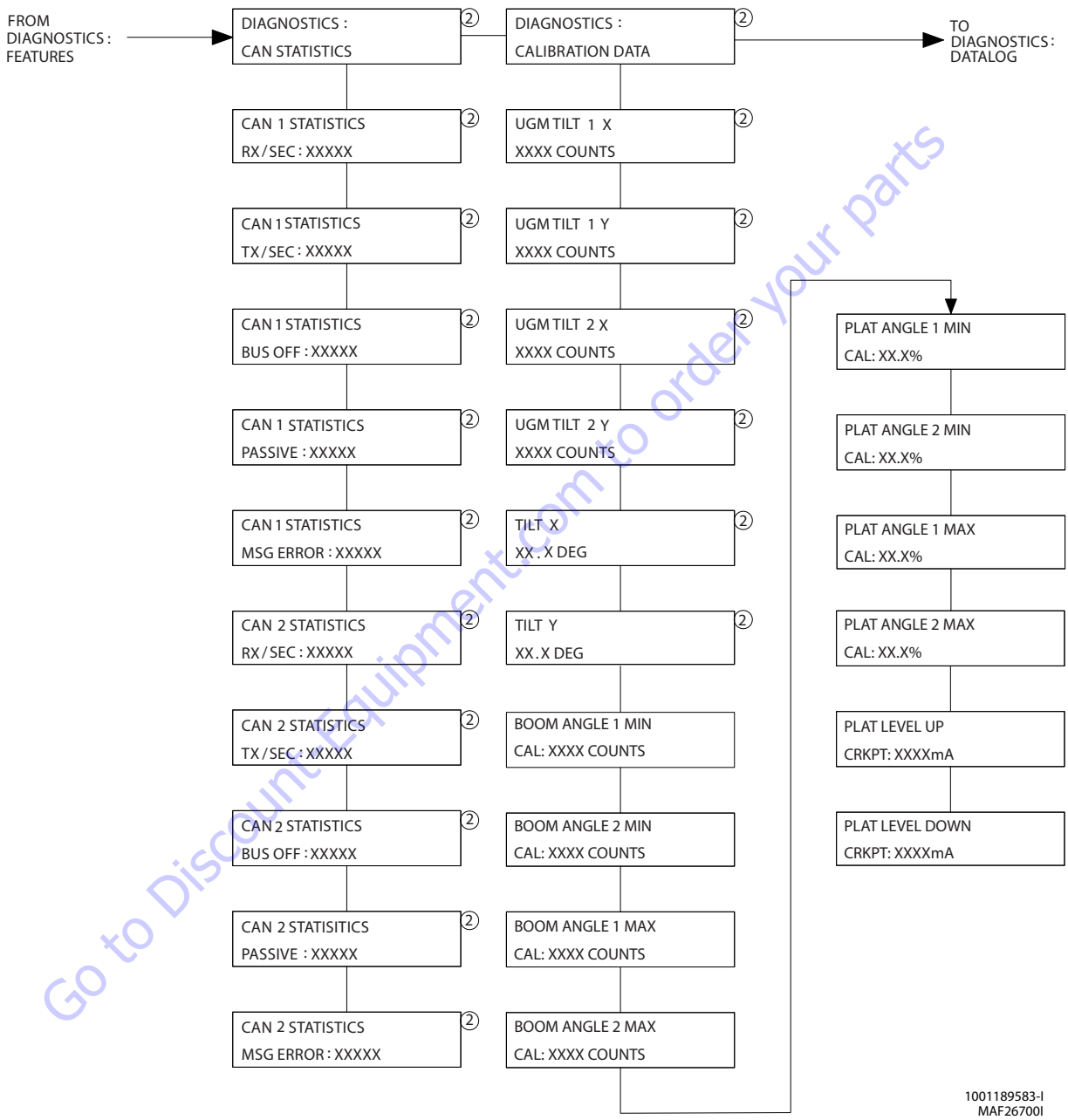
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-5. Analyzer Software P2.14 - Sheet 3 of 14



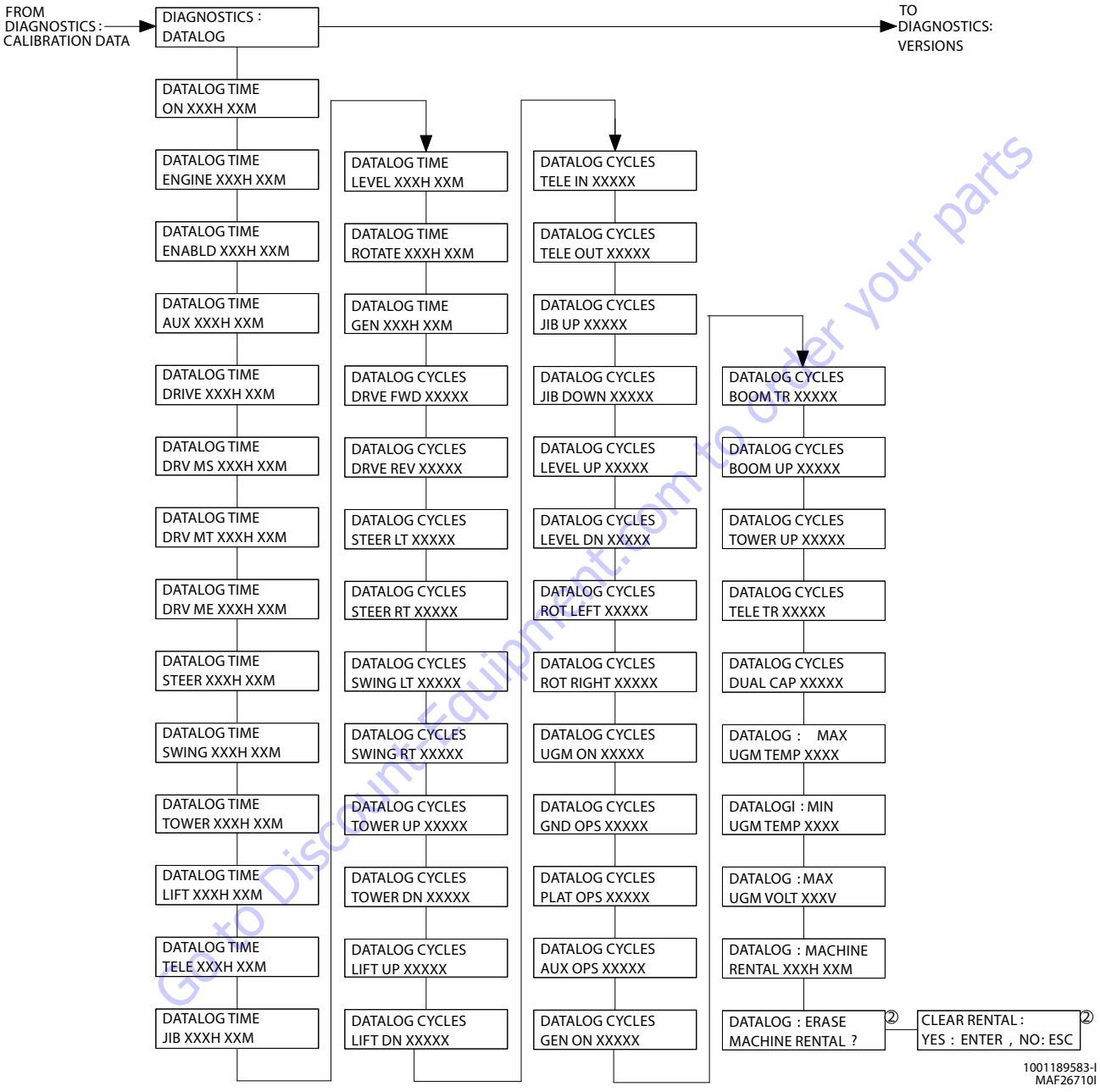
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-6. Analyzer Software P2.14 - Sheet 4 of 14



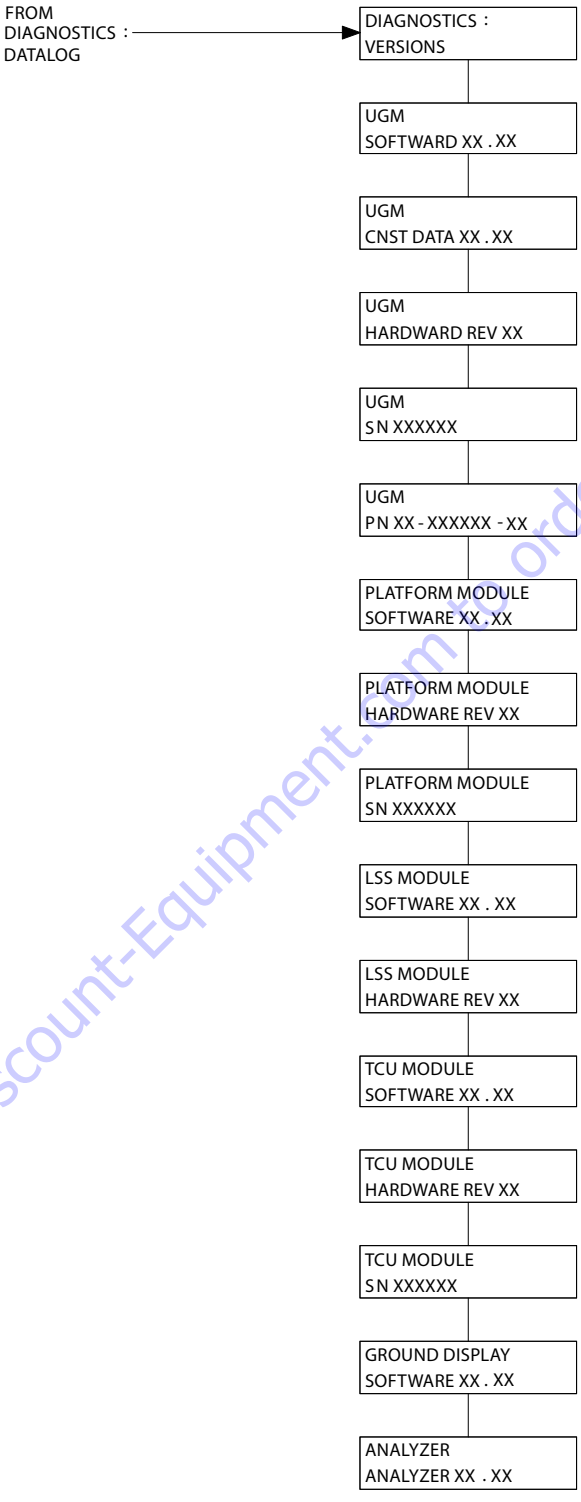
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-7. Analyzer Software P2.14 - Sheet 5 of 14



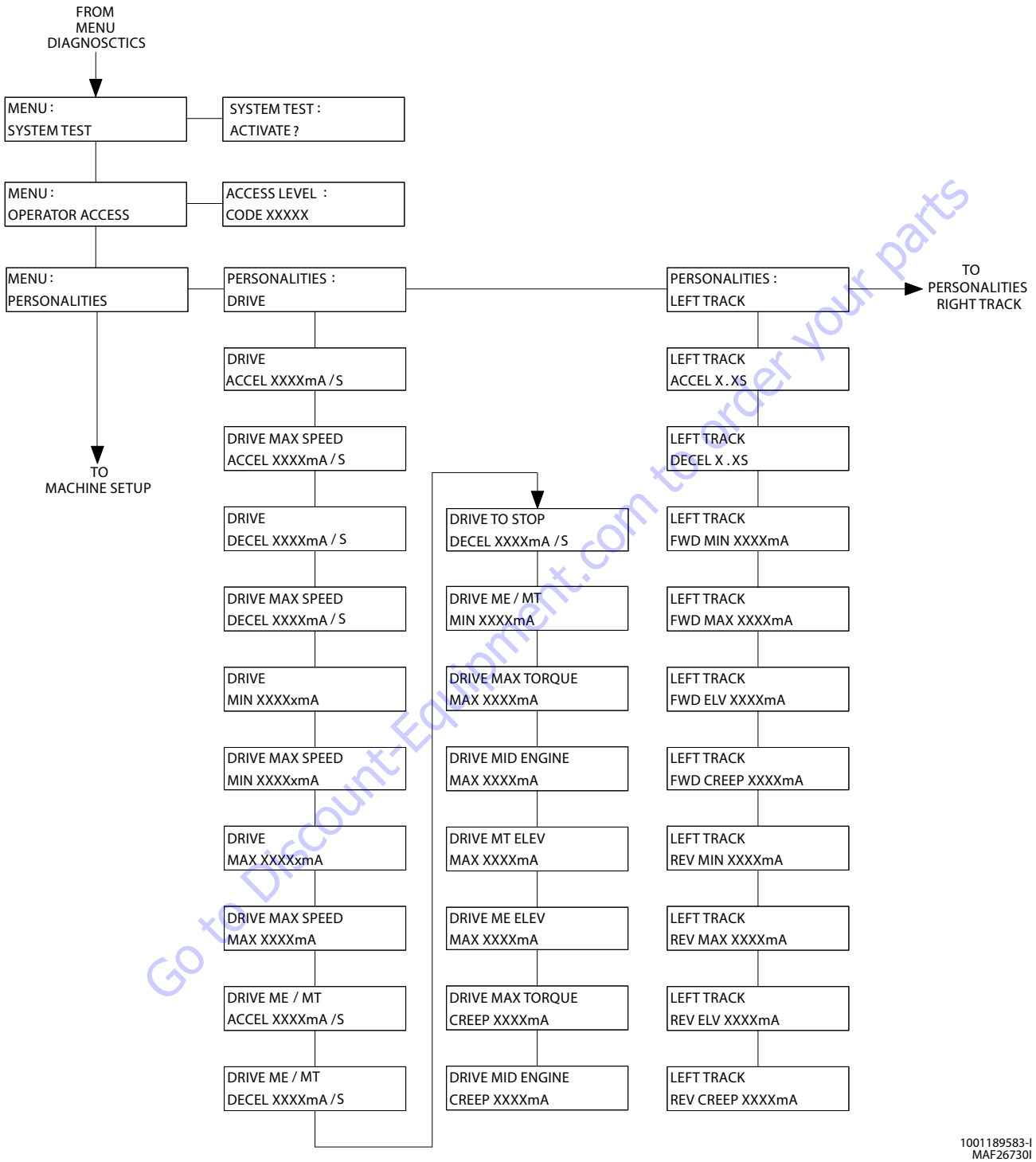
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-8. Analyzer Software P2.14 - Sheet 6 of 14



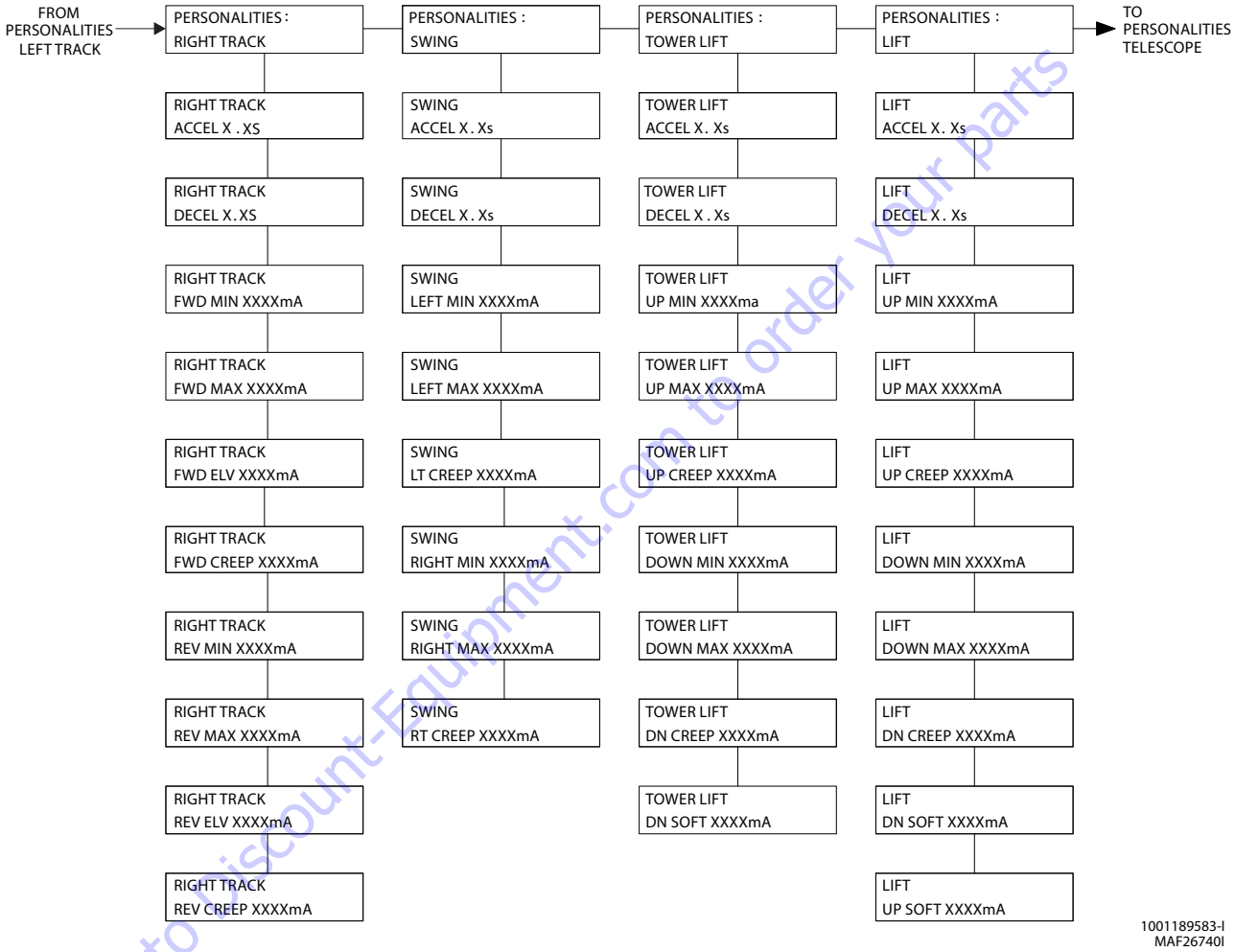
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-9. Analyzer Software P2.14 - Sheet 7 of 14



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

Figure 6-10. Analyzer Software P2.14 - Sheet 8 of 14

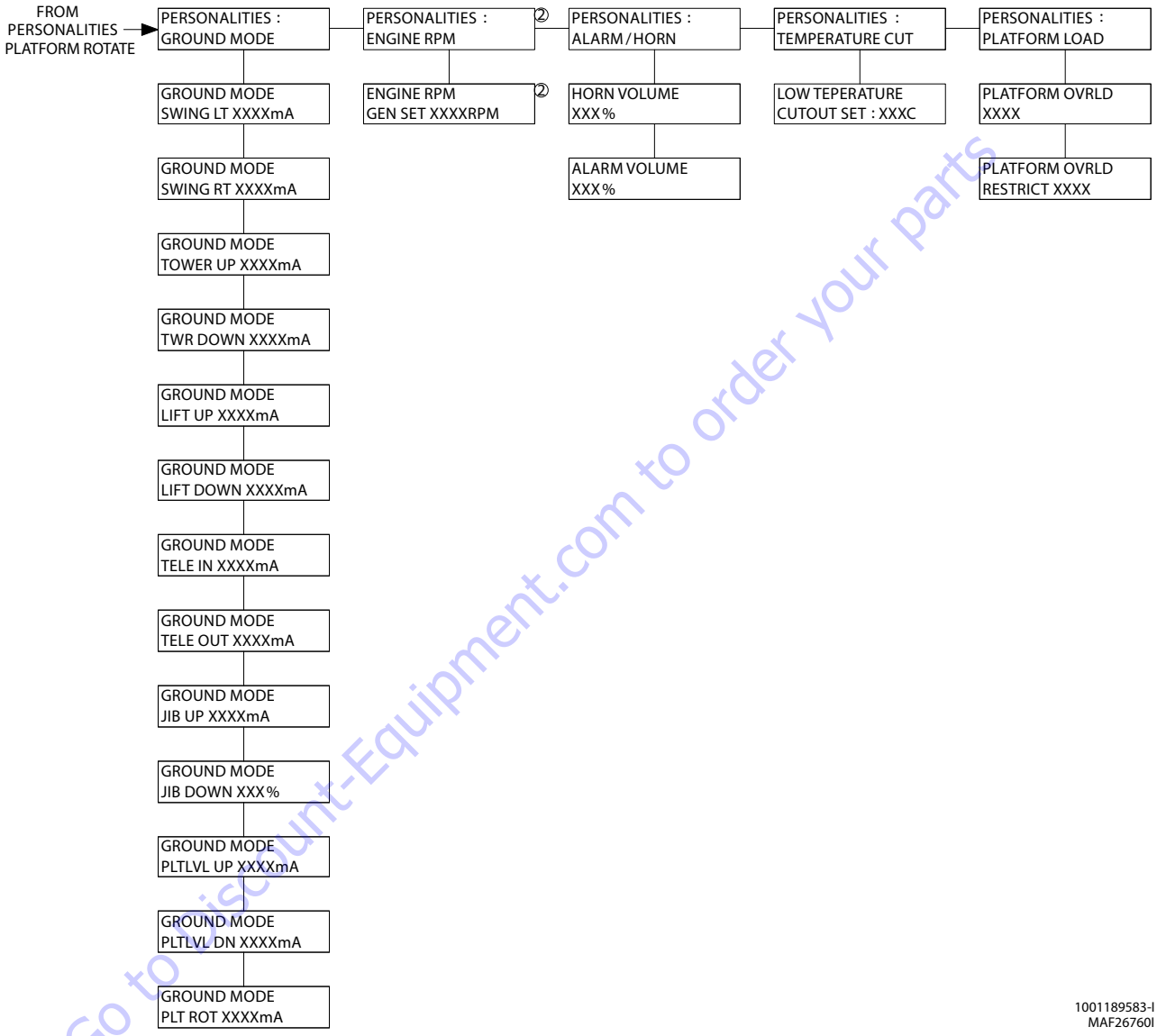


NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-11. Analyzer Software P2.14 - Sheet 9 of 14

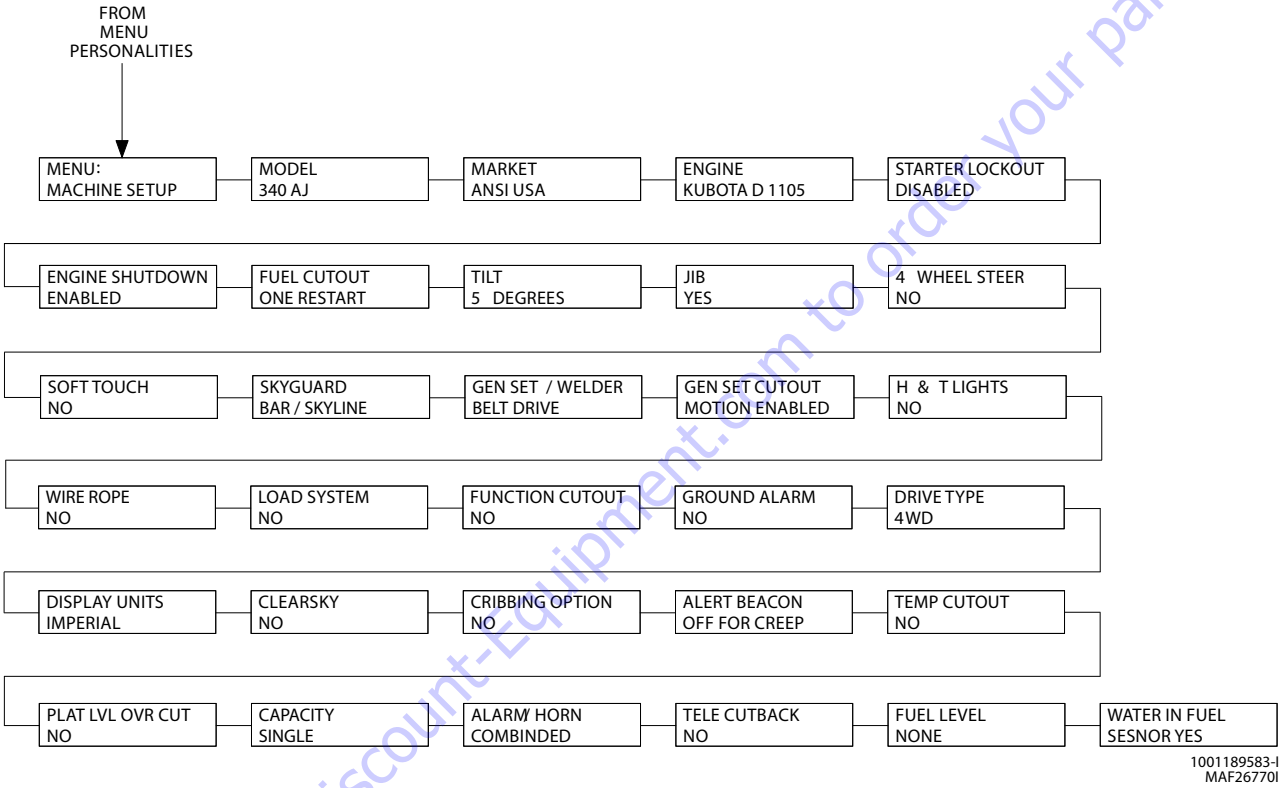
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-12. Analyzer Software P2.14 - Sheet 10 of 14



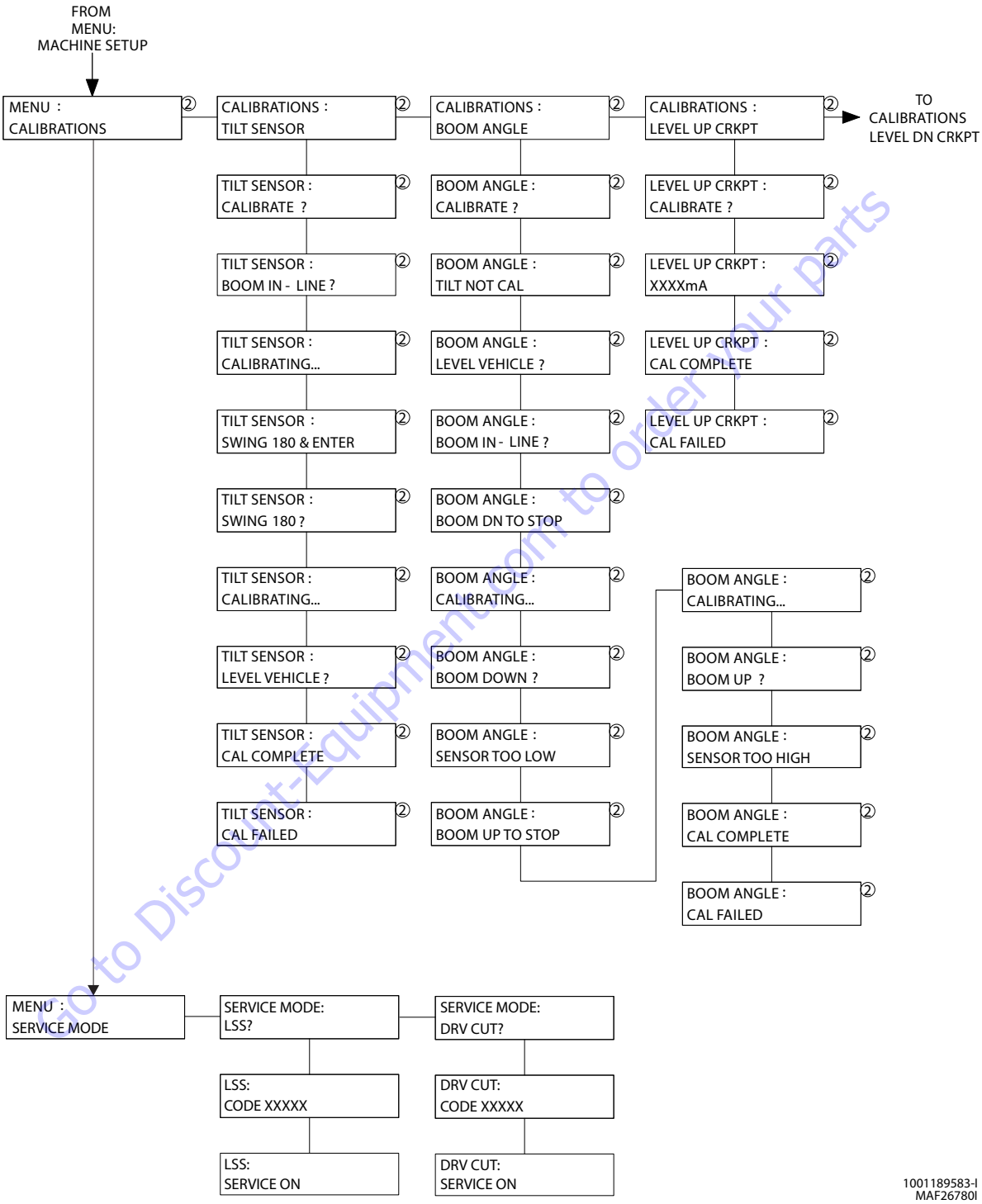
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-13. Analyzer Software P2.14 - Sheet 11 of 14



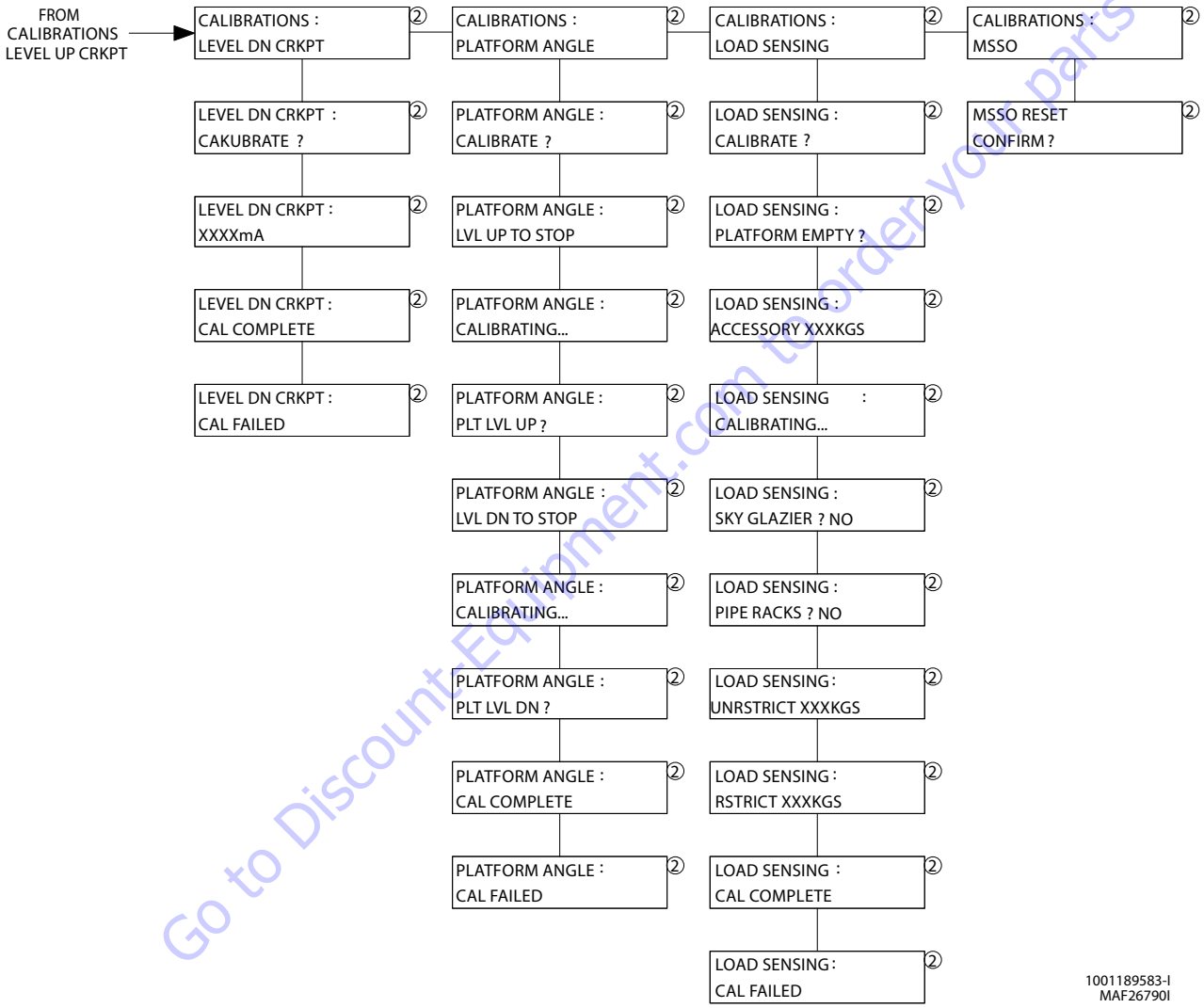
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration and software versions.*

Figure 6-14. Analyzer Software P2.14 - Sheet 12 of 14



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

Figure 6-15. Analyzer Software P2.14 - Sheet 13 of 14



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

Figure 6-16. Analyzer Software P2.14 - Sheet 14 of 14

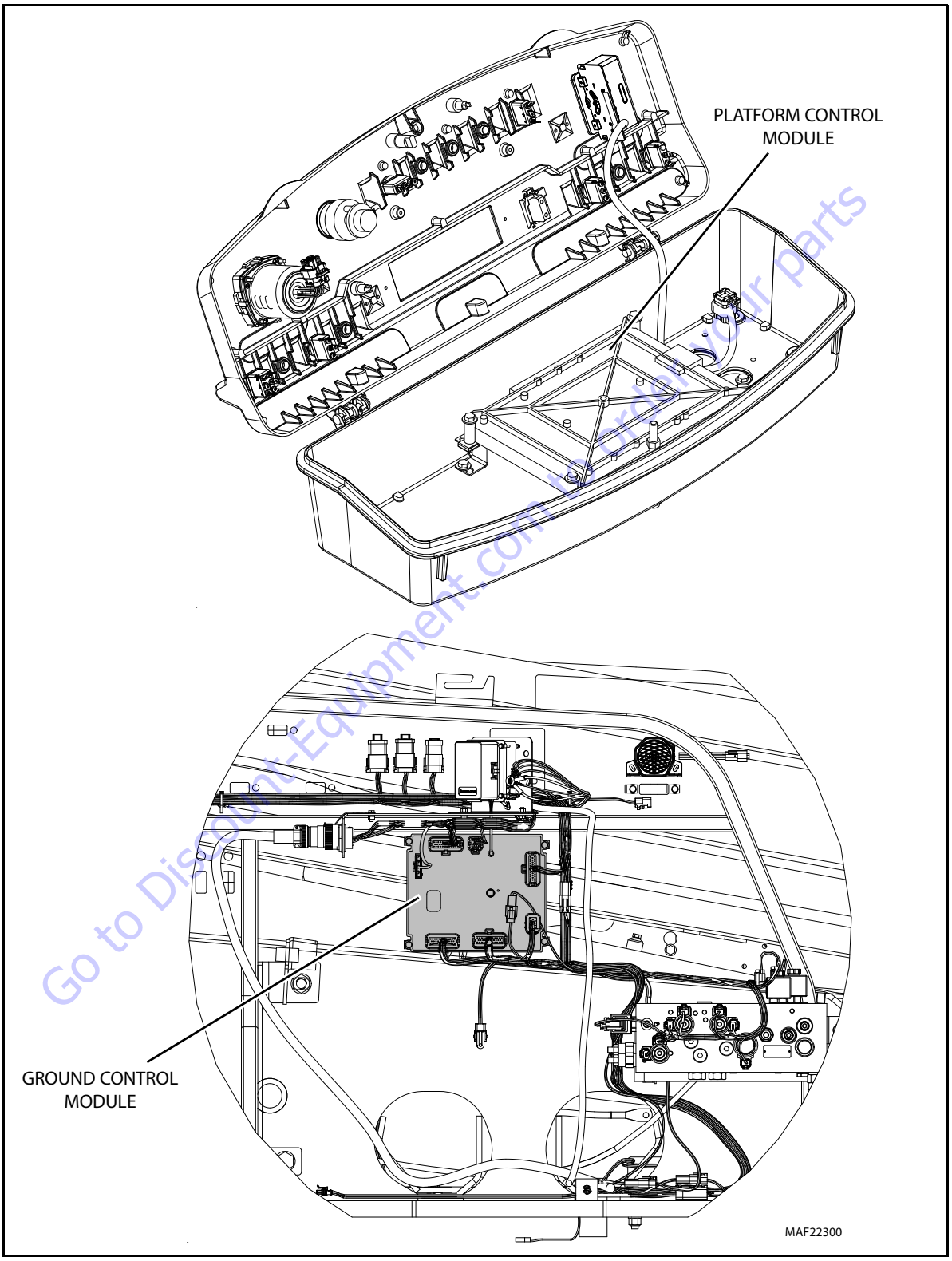


Figure 6-17. Control Module Locations

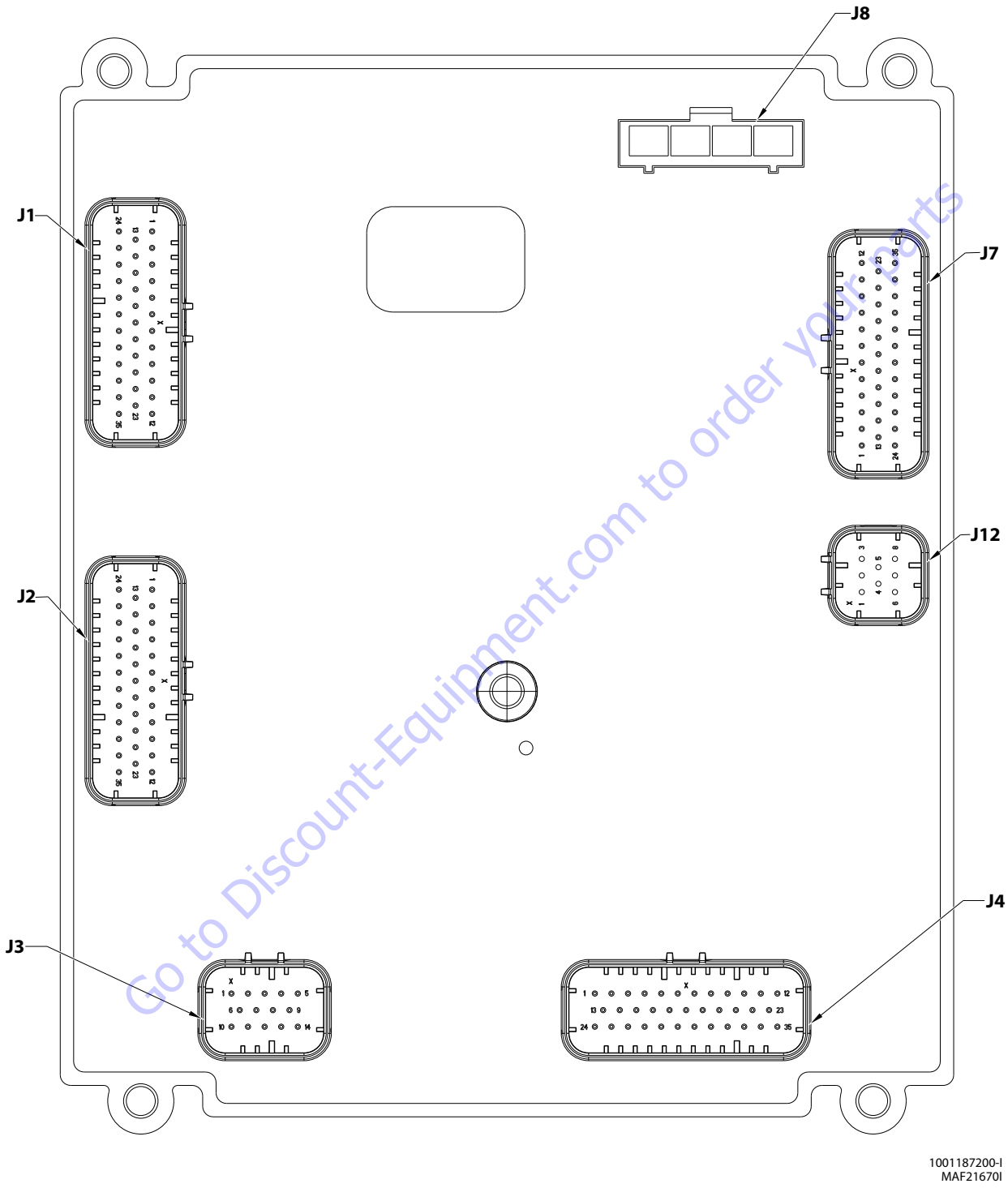


Figure 6-18. Ground Control Module Pin Connections

Connector	Pin	Function	Type	
J1 (Natural)	1	UNUSED (FUEL RACK ACTUATOR)	DIGITAL	OUTPUT
	2	OSCILLATING AXLE VALVE #2	DIGITAL	OUTPUT
	3	DRIVE FORWARD / LEFT TRACK FORWARD VALVE	DIGITAL	OUTPUT
	4	UNUSED	GROUND	INPUT
	5	UNUSED	GROUND	INPUT
	6	DRIVE REVERSE / LEFT TRACK REVERSE VALVE	DIGITAL	OUTPUT
	7	OSCILLATING AXLE VALVE #1	DIGITAL	OUTPUT
	8	UNUSED	GROUND	INPUT
	9	MSSO SWITCH GROUND	GROUND	INPUT
	10	ECU POWER	DIGITAL	OUTPUT
	11	ENGINE START	DIGITAL	OUTPUT
	12	ENGINE GLOW PLUGS	DIGITAL	OUTPUT
	13	APU ENABLE RELAY	DIGITAL	OUTPUT
	14	UNUSED (ENGINE COOLANT TEMPERATURE SENSOR)	ANALOG	INPUT
	15	UNUSED (ENGINE OIL PRESSURE SENSOR)	ANALOG	INPUT
	16	UNUSED (ENGINE SPEED SENSOR)	FREQUENCY	INPUT
	17	UNUSED (ENGINE SPEED SENSOR GROUND)	GROUND	INPUT
	18	UNUSED (ENGINE GROUND)	GROUND	INPUT
	19	UNUSED (ENGINE GROUND)	GROUND	INPUT
	20	2 SPEED VALVE	DIGITAL	OUTPUT
	21	UNUSED (TOWER ELEVATION SWITCH #2)	DIGITAL	INPUT
	22	GENERATOR ENABLE RELAY	DIGITAL	OUTPUT
	23	BRAKE VALVE	DIGITAL	OUTPUT
	24	UNUSED	N/C	N/C
	25	UNUSED (RS-485 HIGH)	SERIAL	I/O
	26	UNUSED (RS-485 LOW)	SERIAL	I/O
	27	BRAKE / 2 SPEED VALVE 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	ALTERNATOR EXCITATION	DIGITAL	OUTPUT
	33	UNUSED (RS-485 GROUND)	GROUND	INPUT
	34	TELESCOPE RETRACTED SWITCH #2	DIGITAL	INPUT
	35	CAPACITY LENGTH SWITCH #2	DIGITAL	INPUT

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

Connector	Pin	Function	Type	
J2 (Gray)	1	STEER DUMP VALVE	DIGITAL	OUTPUT
	2	GROUND ALARM	DIGITAL	OUTPUT
	3	PLATFORM DUMP VALVE #1	DIGITAL	OUTPUT
	4	BYPASS DUMP VALVE	DIGITAL	OUTPUT
	5	PLATFORM LEVEL UP VALVE	DIGITAL	OUTPUT
	6	FUEL SENSOR GROUND	GROUND	INPUT
	7	PLATFORM LEVEL DOWN VALVE	DIGITAL	OUTPUT
	8	FRONT STEER RIGHT/RIGHTTRACK REVERSE VALVE	DIGITAL	OUTPUT
	9	MAIN TELESCOPE IN VALVE	DIGITAL	OUTPUT
	10	UNUSED (PLATFORM ROTATE LEFT VALVE)	DIGITAL	OUTPUT
	11	MAIN LIFT UP VALVE	DIGITAL	OUTPUT
	12	UNUSED (JIB LIFT UP VALVE)	DIGITAL	OUTPUT
	13	MAIN DUMP VALVE	DIGITAL	OUTPUT
	14	UNUSED (MAIN TELESCOPE VALVES GROUND)	GROUND	INPUT
	15	UNUSED (TOWER TELESCOPE OUT VALVE)	DIGITAL	OUTPUT
	16	USED (MAIN TELESCOPE OUT VALVE)	DIGITAL	OUTPUT
	17	UNUSED (PLATFORM ROTATE / JIB LIFT VALVE GROUND)	GROUND	INPUT
	18	STEER DUMP VALVE GROUND	GROUND	INPUT
	19	FRONT LEFT STEER VALVE / RIGHT TRACK FORWARD VALVE	DIGITAL	OUTPUT
	20	MAIN TELESCOPEOUT VALVE	DIGITAL	OUTPUT
	21	AUX MAIN LIFT DOWN VALVE	DIGITAL	OUTPUT
	22	MAIN LIFT DOWN VALVE	DIGITAL	OUTPUT
	23	PLATFORM DUMP VALVE #2	DIGITAL	OUTPUT
	24	CONFIGURATION #2	DIGITAL	INPUT
	25	FUEL SENSOR	ANALOG	INPUT
	26	HEAD / TAIL LIGHT ENABLE RELAY	DIGITAL	OUTPUT
	27	GROUND ALARM / HORN	DIGITAL	OUTPUT
	28	STEER VALVES GROUND	GROUND	INPUT
	29	GROUND ALARM / HORN GROUND	GROUND	INPUT
	30	MAIN/TELESCOPE IN/ BYPASS DUMP VALVE GROUND	GROUND	INPUT
	31	TELESCOPE IN DUMP VALVE	DIGITAL	OUTPUT
	32	REAR STEER RIGHT VALVE	DIGITAL	OUTPUT
	33	REAR STEER LEFT VALVE	DIGITAL	OUTPUT
	34	SWING LEFT VALVE	DIGITAL	OUTPUT
	35	SWING RIGHT VALVE	DIGITAL	OUTPUT

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

Connector	Pin	Function	Type	
J3 (Black)	1	DRIVE/ LEFT TRACK DRIVE VALVES CURRENT FEEDBACK	GROUND	INPUT
	2	AUX DOWN / RIGHT TRACK VALVES CURRENT FEEDBACK	GROUND	INPUT
	3	WIRE ROPE SERVICE SWITCH GROUND	GROUND	INPUT
	4	SWING VALVES CURRENT FEEDBACK	GROUND	INPUT
	5	AUX DOWN VALVES CURRENT FEEDBACK	GROUND	INPUT
	6	TELESCOPE FLOW CONTROL VALVES CURRENT FEEDBACK	GROUND	INPUT
	7	GROUND ALARM POWER	VBAT	OUTPUT
	8	WIRE ROPE SERVICE SWITCH	DIGITAL	INPUT
	9	CRIBBING ENABLE SWITCH	DIGITAL	INPUT
	10	UNUSED	DIGITAL	INPUT
	11	CONFIGURATION #1	DIGITAL	INPUT
	12	UNUSED	VOLTAGE	OUTPUT
	13	UNUSED	ANALOG	INPUT
	14	MAIN LIFT VALVES CURRENT FEEDBACK	GROUND	INPUT

Connector	Pin	Function	Type	
J4 (Blue)	1	CRIBBING ENGAGED INDICATOR	DIGITAL	OUTPUT
	2	SYSTEM DISTRESS INDICATOR	DIGITAL	OUTPUT
	3	GLOWPLUG INDICATOR	DIGITAL	OUTPUT
	4	ENGINE START SWITCH	DIGITAL	INPUT
	5	PLATFORM LEVEL DOWN SWITCH	DIGITAL	INPUT
	6	PLATFORM ROTATE LEFT SWITCH	DIGITAL	INPUT
	7	MAIN TELESCOPE IN SWITCH	DIGITAL	INPUT
	8	JIB LIFT DOWN SWITCH	DIGITAL	INPUT
	9	UNUSED (JIB LEFT SWITCH)	DIGITAL	INPUT
	10	UNUSED (TOWER LIFT UP SWITCH)	DIGITAL	INPUT
	11	UNUSED (TOWER TELESCOPE IN SWITCH)	DIGITAL	INPUT
	12	UNUSED (HOURMETER)	DIGITAL	OUTPUT
	13	LOW FUEL INDICATOR	DIGITAL	OUTPUT
	14	PLATFORM OVERLOADED INDICATOR	DIGITAL	OUTPUT
	15	UNUSED (UMS INDICATOR)	DIGITAL	OUTPUT
	16	AUXILIARY POWER / FUNCTION ENABLE	DIGITAL	INPUT
	17	PLATFORM LEVEL UP SWITCH	DIGITAL	INPUT
	18	PLATFORM ROTATE RIGHT SWITCH	DIGITAL	INPUT
	19	JIB LIFT UP SWITCH	DIGITAL	INPUT
	20	UNUSED (JIB RIGHT SWITCH)	DIGITAL	INPUT
	21	UNUSED (TOWER LIFT DOWN SWITCH)	DIGITAL	INPUT
	22	UNUSED (TOWER TELESCOPE OUT SWITCH)	DIGITAL	INPUT
	23	MAIN LIFT UP SWITCH	DIGITAL	INPUT
	24	UNUSED	VBAT	OUTPUT
	25	SWITCHES POWER	VBAT	OUTPUT
	26	BATTERY LOW / NOT CHARGING INDICATOR	DIGITAL	OUTPUT
	27	UNUSED	DIGITAL	OUTPUT
	28	UNUSED	DIGITAL	OUTPUT
	29	CHECK ENGINE INDICATOR	DIGITAL	OUTPUT
	30	MAIN TELESCOPE OUT SWITCH	DIGITAL	INPUT
	31	INDICATORS GROUND	GROUND	INPUT
	32	INDICATORS GROUND	GROUND	INPUT
	33	MAIN LIFT DOWN SWITCH	DIGITAL	INPUT
	34	SWING LEFT SWITCH	DIGITAL	INPUT
	35	SWING RIGHT SWITCH	DIGITAL	INPUT

Connector	Pin	Function	Type	
J7 (Black)	1	PLATFORM EMS	DIGITAL	INPUT
	2	PLATFORM MODE	DIGITAL	INPUT
	3	GROUND MODE	DIGITAL	INPUT
	4	BOOM ANGLE SENSOR #1	ANALOG	INPUT
	5	UNUSED (ENGINE SPEED SENSOR)	VOLTAGE	OUTPUT
	6	CAN1 TERMINATOR	TERM	I/O
	7	BOOM ANGLE SENSOR #2	ANALOG	INPUT
	8	UNUSED	ANALOG	INPUT
	9	BOOM ANGLE SENSOR GROUND	GROUND	INPUT
	10	TILT SENSOR GROUND	GROUND	INPUT
	11	UNUSED (TOWER ELEVATION SWITCH #1)	DIGITAL	INPUT
	12	UNUSED (OSCILLATING AXLE SWING SWITCH #1)	DIGITAL	PUT
	13	CAN1 HIGH	SERIAL	I/O
	14	GROUND MODE POWER TO PLATFORM	DIGITAL	INPUT
	15	FOOTSWITCH	DIGITAL	INPUT
	16	BOOM ANGLE SENSOR POWER	VOLTAGE	OUTPUT
	17	CAN1 TERMINATOR	TERM	I/O
	18	UNUSED (CAN1 SHIELD)	GROUND	INPUT
	19	IGNITION RELAY GROUND	GROUND	INPUT
	20	UNUSED (OSCILLATING AXLE SWING SWITCH #2)	ANALOG	INPUT
	21	TELESCOPE RETRACTED SWITCH #1	DIGITAL	INPUT
	22	UNUSED	DIGITAL	INPUT
	23	CAPACITY LENGTH SWITCH #1	DIGITAL	INPUT
	24	CAN1 LOW	SERIAL	I/O
	25	GROUND DISPLAY GROUND	GROUND	INPUT
	26	UNUSED	VOLTAGE	OUTPUT
	27	UNUSED	VOLTAGE	OUTPUT
	28	TELESCOPE RETRACTED SWITCH GROUND	GROUND	INPUT
	29	GROUND DISPLAY POWER	VBAT	OUTPUT
	30	UNUSED	VBAT	OUTPUT
	31	WIRE ROPE SERVICE SWITCH POWER	VBAT	OUTPUT
	32	TRANSPORT SWITCHES POWER	VBAT	OUTPUT
	33	TELESCOPE RETRACTED SWITCH POWER	VBAT	OUTPUT
	34	TILT SENSOR POWER	VBAT	OUTPUT
	35	DOS SWITCH	DIGITAL	INPUT

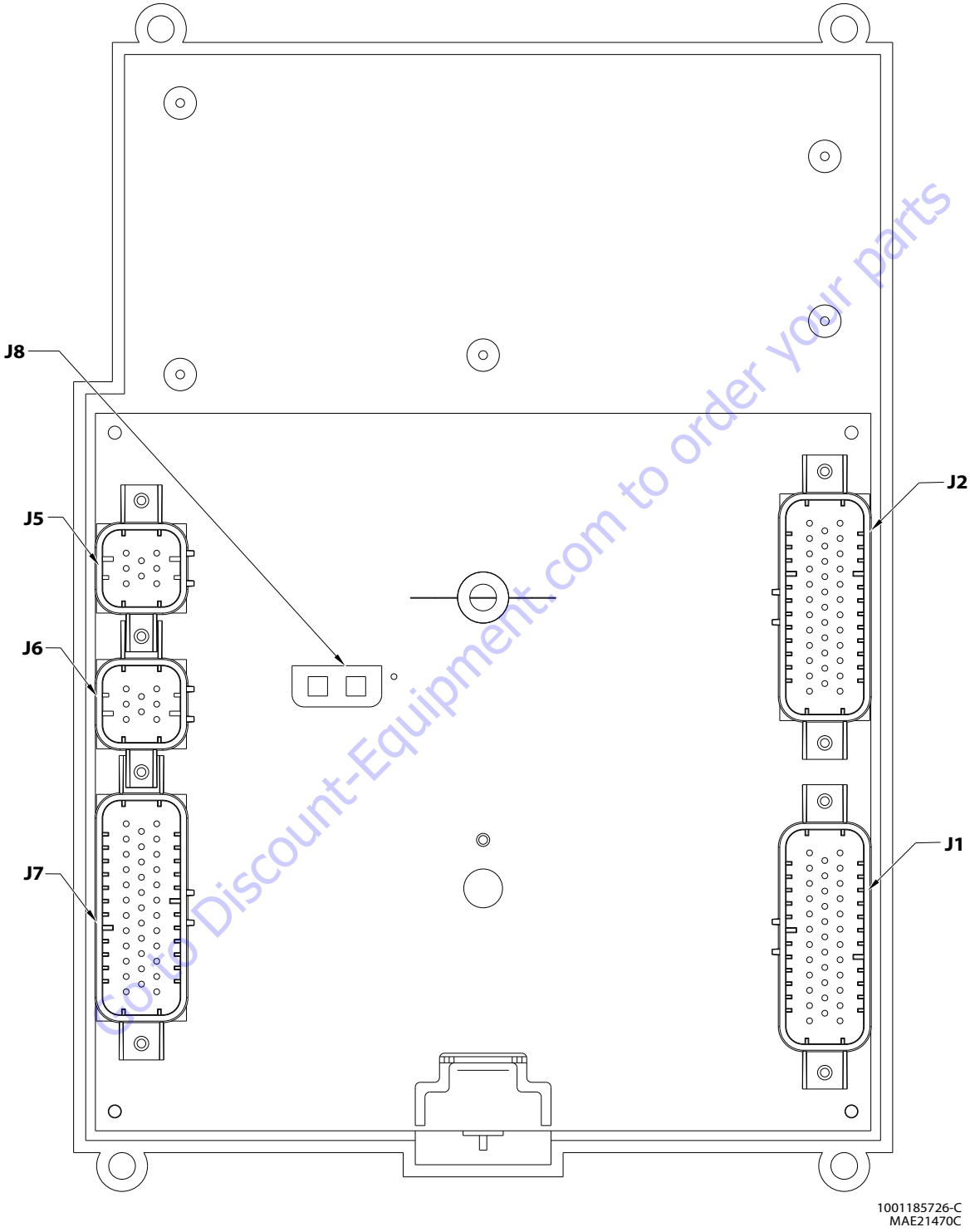


Figure 6-19. Platform Control Module Pin Connections

Connector	Pin	Assignment	Function
J1 (NATURAL)	1	UNUSED (TOWER LIFT UP SWITCH)	HS DIGITAL INPUT
	2	UNUSED (TOWER LIFT DOWN SWITCH)	HS DIGITAL INPUT
	3	UNUSED (TOWER TELESCOPE IN SWITCH)	HS DIGITAL INPUT
	4	UNUSED (TOWER TELESCOPE OUT SWITCH)	HS DIGITAL INPUT
	5	MAIN TELESCOPE IN SWITCH	HS DIGITAL INPUT
	6	MAIN TELESCOPE OUT SWITCH	HS DIGITAL INPUT
	7	PLATFORM ROTATE RIGHT SWITCH	HS DIGITAL INPUT
	8	PLATFORM ROTATE LEFT SWITCH	HS DIGITAL INPUT
	9	PLATFORM LEVEL UP SWITCH	HS DIGITAL INPUT
	10	PLATFORM LEVEL DOWN SWITCH	HS DIGITAL INPUT
	11	JIB LIFT UP SWITCH	HS DIGITAL INPUT
	12	JIB LIFT DOWN SWITCH	HS DIGITAL INPUT
	13	SPEED PUMP POTENTIOMETER GROUND	GROUND
	14	ENGINE START SWITCH	HS DIGITAL INPUT
	15	AUXILIARY POWER SWITCH	HS DIGITAL INPUT
	16	CRAB STEER SELECT SWITCH	HS DIGITAL INPUT
	17	CORDINATED STEER SELECT SWITCH	HS DIGITAL INPUT
	18	SWITCHES POWER	BATTERY VOLTAGE
	19	UNUSED	HS DIGITAL INPUT
	20	SOFT TOUCH SWITCH	HS DIGITAL INPUT
	21	CAPACITY SELECT SWITCH	HS DIGITAL INPUT
	22	UNUSED	HS DIGITAL INPUT
	23	SKYGUARD INPUT #2 SWITCH	HS DIGITAL INPUT
	24	UNUSED	HS DIGITAL INPUT
	25	PLATFORM ANGLE SENSOR #1	HS DIGITAL INPUT
	26	PLATFORM ANGLE SENSOR #2	HS DIGITAL INPUT
	27	MAX ENGINE SPEED SWITCH	HS DIGITAL INPUT
	28	MAX ENGINE TORQUE SWITCH	HS DIGITAL INPUT
	29	SOFT TOUCH / SKYGUARD OVERRIDE SWITCH	HS DIGITAL INPUT
	30	HEAD/TAIL LIGHT SWITCH	HS DIGITAL INPUT
	31	HORN	HS DIGITAL INPUT
	32	CREEP SWITCH	HS DIGITAL INPUT
	33	FUEL SELECT SWITCH	HS DIGITAL INPUT
	34	SPEED PUMP POTENTIOMETER POWER	+7 REFERENCE VOLTAGE
	35	SPEED PUMP POTENTIOMETER	ANALOG INPUT

Connector	Pin	Assignment	Function
J2 (BLUE)	1	UNUSED (JIB RIGHT SWITCH)	HS DIGITAL INPUT
	2	UNUSED (JIB LEFT SWITCH)	HS DIGITAL INPUT
	3	UNUSED	BATTERY VOLTAGE
	4	DOS OVERRIDE SWITCH	HS DIGITAL INPUT
	5	UNUSED	HS DIGITAL INPUT
	6	CHASSIS TILT INDICATOR	LAMP OUTPUT
	7	FUNCTION ENABLE INDICATOR	LAMP OUTPUT
	8	VEHICLE SYSTEM DISTRESS INDICATOR	LAMP OUTPUT
	9	CREEP SPEED INDICATOR	LAMP OUTPUT
	10	WIRE ROPE SERVICE INDICATOR	LAMP OUTPUT
	11	PLATFORM OVERLOADED INDICATOR	LAMP OUTPUT
	12	UNRESTRICTED CAPACITY INDICATOR	LAMP OUTPUT
	13	RESTRICTED CAPACITY INDICATOR	LAMP OUTPUT
	14	DOS INDICATOR	LAMP OUTPUT
	15	GENERATOR ON INDICATOR	LAMP OUTPUT
	16	SOFT TOUCH / SKYGUARD INDICATOR	LAMP OUTPUT
	17	GLOW PLUG ENGAGED INDICATOR	LAMP OUTPUT
	18	INDICATOR GROUND	GROUND
	19	LEVEL SYSTEM INDICATOR	LAMP OUTPUT
	20	DRIVE DISABLED INDICATOR	LAMP OUTPUT
	21	LOW FUEL INDICATOR	LAMP OUTPUT
	22	1/4 FUEL LEVEL INDICATOR	LAMP OUTPUT
	23	3/4 FUEL LEVEL INDICATOR	LAMP OUTPUT
	24	1/2 FUEL LEVEL INDICATOR	LAMP OUTPUT
	25	INDICATOR GROUND	GROUND
	26	ANALYZER POWER	ANALYZER POWER
	27	ANALYZER GROUND	ANALYZER GROUND
	28	ANALYZER RX	ANALYZER RX
	29	ANALYZER TX	ANALYZER TX
	30	UNUSED	LAMP OUTPUT
	31	SOFT TOUCH POWER	DIGITAL OUTPUT
	32	LSS POWER	BATTERY VOLTAGE
	33	OPTION POWER	BATTERY VOLTAGE
	34	UNUSED	BATTERY VOLTAGE
	35	FULL FUEL INDICATOR	LAMP OUTPUT

Connector	Pin	Assignment	Function
J5 (NATURAL)	1	MAIN LIFT / SWING JOYSTICK POWER	SUPPLY VOLTAGE
	2	MAIN LIFT CENTER TAP	ANALOG INPUT
	3	MAIN LIFT SIGNAL	ANALOG INPUT
	4	SWING SIGNAL	ANALOG INPUT
	5	SWING CENTER TAP	ANALOG INPUT
	6	UNUSED	ANALOG INPUT
	7	MAIN LIFT / SWING JOYSTICK GROUND	GROUND
	8	UNUSED	GROUND

Connector	Pin	Assignment	Function
J6 (BLACK)	1	DRIVE / STEER JOYSTICK POWER	SUPPLY VOLTAGE
	2	DRIVE CENTER TAP	ANALOG INPUT
	3	DRIVE SIGNAL	ANALOG INPUT
	4	DRIVE ENABLE	ANALOG INPUT
	5	STEER LEFT / STEER SIGNAL	ANALOG INPUT
	6	STEER RIGHT / STEER CENTER TAP	ANALOG INPUT
	7	DRIVE / STEER JOYSTICK RETURN	GROUND
	8	UNUSED	GROUND

Connector	Pin	Assignment	Function
J8	1	MODULE GROUND	GROUND
	2	MODULE POWER	BATTERY VOLTAGE

Connector	Pin	Assignment	Function
J7 (BLACK)	1	GROUND MODE	GROUND MODE
	2	PLATFORM EMS	PLATFORM EMS
	3	PLATFORM EMS TO GROUND MODULE	PLATFORM MODE
	4	FOOTSWITCH (FUNCTION ENABLE SWITCH) POWER	BATTERY VOLTAGE
	5	PLATFORM ROTATE LEFT VALVE	ME DIGITAL OUTPUT
	6	PLATFORM ROTATE RIGHT VALVE	ME DIGITAL OUTPUT
	7	SKYGUARD POWER	BATTERY VOLTAGE
	8	FOOTSWITCH SIGNAL	DIGITAL INPUT
	9	GENERATOR SWITCH	DIGITAL INPUT
	10	UNUSED	+7 REFERENCE VOLTAGE
	11	PLATFORM ANGLE SENSOR POWER	+5V REFERENCE VOLTAGE
	12	UNUSED	+5V REFERENCE VOLTAGE
	13	UNUSED	ANALOG INPUT
	14	PLATFORM ANGLE SENSOR GROUND	GROUND
	15	PLATFORM LEVEL UP VALVE	HS DIGITAL OUTPUT
	16	PLATFORM LEVEL DOWN VALVE	HS DIGITAL OUTPUT
	17	UNUSED	HS DIGITAL INPUT
	18	SKYGUARD INPUT #1 SWITCH	HS DIGITAL INPUT
	19	PLATFORM ALARM	LAMP OUTPUT
	20	PLATFORM ALARM GROUND	GROUND
	21	SKYGUARD GROUND	GROUND
	22	LSS GROUND	GROUND
	23	VALVES GROUND	ANALOG INPUT
	24	UNUSED	DIGITAL OUTPUT
	25	JIB LIFT UP VALVE	ME DIGITAL OUTPUT
	26	JIB LIFT DOWN VALVE	ME DIGITAL OUTPUT
	27	UNUSED (JIB RIGHT VALVE)	ME DIGITAL OUTPUT
	28	UNUSED (JIB LEFT VALVE)	ME DIGITAL OUTPUT
	29	OPTIONS GROUND	GROUND
	30	CAN LOW	CAN LOW
	31	CAN HIGH	CAN HIGH
	32	UNUSED (CAN SHIELD)	CAN SHIELD
	33	UNUSED	GROUND
	34	UNUSED	GROUND
	35	UNUSED	ANALOG INPUT

Table 6-2. Machine Configuration Programming Information- Version P2.14

Configuration Digit	Number	Description	Default Number
NOTE: *The machine configuration must be completed before any personality settings can be changed. Changing personality settings first and then changing the model number of the machine configuration will cause personality settings to return to default.*			
MODEL NUMBER: 1	0 1 **2**	????: Visible only on a Non-Configured UGM 600S: For 600S / 600S HC3 / 660SJ / 660SJ HC3 **600SC: For 600SC / 660SJC**	**1**
MARKET: 2*	**1** 2 3 4 5 6 7	**ANSI USA** ANSI EXPORT CSA CE AUSTRALIA JAPAN GB	**1**
* Certain model selections will limit market options.			
ENGINE: 3*	1 2 3 4 **5** 6	KUBOTA D1105 GM DUAL FUEL: GM/PSI 0.97L Duel Fuel (Tier 3) KUBOTA DUAL FUEL FORD DUAL FUEL **DEUTZ EMR2: (Tier 4i)** DEUTZ EMR4: (Tier 4f)	**5**
* Certain model selections will limit engine options. * Certain market selections will limit engine options.			
STARTER LOCKOUT: 4*	**1** 2	**DISABLED: Automatic pre-glow time determined by ambient air temperature; engine start can be attempted at any time during pre-glow.** ENABLED: Automatic pre-glow time determined by ambient air temperature; engine start is NOT permitted until pre-glow is finished.	**1**
* Only visible for diesel engine selections.			
ENGINE SHUTDOWN: 5	1 **2**	DISABLED: No engine shutdown. **ENABLED: Shutdown engine for high coolant temperature fault or low oil pressure fault**	**2**

Table 6-2. Machine Configuration Programming Information- Version P2.14

Configuration Digit	Number	Description	Default Number
FUEL CUTOUT: 6*	1 2 3 **4**	ONE RESTART: One restart with limited run time when near Empty. ENGINE STOP: No starting permitted when near Empty. NONE **RESTART: Restarts allowed with limited run time when near Empty**	 **4**
* Only visible for diesel engine selections.			
TILT: 7*	1 2 3 4 5 6 **7** 8 9	5 DEGREES: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also reduces drive speed to creep. 4 DEGREES: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also reduces drive speed to creep. 3 DEGREES: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also reduces drive speed to creep. 5 DEGREES + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also disallows tower lift up, tower telescope out, drive, main telescope out and main lift up. 4 DEG + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also disallows tower lift up, drive, telescope out and lift up. 3 DEG + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also disallows tower lift up, drive, telescope out and lift up. **5 DEG + DRV CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also reduces drive speed to creep when drive reversal is allowed, drive is disallowed otherwise.** 4 DEG + DRV CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also reduces drive speed to creep when drive reversal is allowed, drive is disallowed otherwise. 3 DEG + DRV CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also reduces drive speed to creep when drive reversal is allowed, drive is disallowed otherwise.	 **7**
* Certain market selections will limit tilt options and alter default setting.			
4 WHEEL STEER: 8*	**1** 2	**NO: 4 Wheel Steer not installed.** YES: 4 Wheel Steer installed.	**1**
* Certain model selections will limit visibility.			

Table 6-2. Machine Configuration Programming Information- Version P2.14

Configuration Digit	Number	Description	Default Number
JIB: 9*	**1** 2	**NO: No Jib installed.** YES: Jib installed which has up and down movements only.	**1**
* Certain model selections will limit visibility.			
SOFT TOUCH: 10*	**1** 2	**NO: No Soft Touch system installed.** YES: Soft Touch system installed.	**1**
* Certain model selections will limit visibility.			
SKYGUARD: 11	1 **2** 3	NO: No SkyGuard system installed. **BAR/SKYLINE: SkyGuard system installed.** SKYEYE: SkyGuard system installed.	**2**
GEN SET/WELDER: 12	**1** 2	**NO: No generator installed.** BELT DRIVE: Belt driven setup	**1**
GEN SET CUTOUT: 13*	**1** 2	**MOTION ENABLED: Motion enabled when generator is ON.** MOTION CUTOUT: Motion cutout in platform mode only.	**1**
* Only visible if gen set / welder selection is not NO.			
H & T LIGHTS: 14	**1** 2	**NO: No head and tail lights installed.** YES: Head and tail lights installed.	**1**
LOAD SYSTEM: 15*	1 2 **3** 4	NO: No load sensor installed. WARN ONLY: Functions in creep, overload lamp lit, platform alarm beeps. **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 (500mS on, 500mS off), platform alarm beeps (5 sec ON, 2 sec OFF).	**3**
* Certain market selections will limit load system options or alter default setting.			
FUNCTION CUTOUT: 16*	**1** 2 3 4	**NO: No drive cutout.** BOOM CUTOUT: Boom function cutout while driving above elevation. DRIVE CUTOUT: Drive and steer cutout above elevation. DRIVE CUT E/T: Drive & steer cutout above elevation or telescoped.	**1**
* Certain market selections will limit function cutout options or alter default setting.			

Table 6-2. Machine Configuration Programming Information- Version P2.14

Configuration Digit	Number	Description	Default Number
GROUND ALARM: 17	1 2 3 **4**	NO: No ground alarm installed. DRIVE: Travel alarm sounds when the drive function is active. DESCENT: Descent alarm sounds when lift down is active. **MOTION: Motion alarm sounds when any function is active.**	**4**
DRIVE TYPE: 18*	**1** 2	**4 WD: 4 wheel drive.** 2WD: 2 wheel drive.	**1**
* Certain model selections will limit visibility.			
DISPLAY UNITS: 19*	1 **2**	METRIC: Celsius, Kilograms, KiloPascal. **IMPERIAL: Fahrenheit, Pounds, Pounds/in^2**	**2**
* Certain market selections will alter default setting.			
CLEARSKY: 20	**1** 2	**NO: ClearSky (telematics) options is disabled.** YES: ClearSky (telematics) option is enabled.	**1**
CRIBBING OPTION: 21*	**1** 2	**NO: Cribbing Option is disabled.** YES: Cribbing Option is enabled.	**1**
* Certain model selections will limit visibility.			
ALERT BECON: 22	**1** 2	**OFF FOR CREEP** IN CREEP 20FPM	**1**
TEMP CUTOUT: 23*	**1** 2	**NO: No Low Temp Cutout system installed** YES: Low Temp Cutout system installed	**1**
* Only visible under certain market selections.			
PLAT LVL OVR CUT: 24	**1** 2	**NO: Platform Level functions above elevation** YES: Platform Level does not function above elevation	**1**

Table 6-2. Machine Configuration Programming Information- Version P2.14

Configuration Digit	Number	Description	Default Number
CAPACITY: 25*	1 **2** **3**	SINGLE: Single Capacity system installed. **DUAL: Dual Capacity system installed.** TRIPLE: Triple Capacity system installed.	**2**
* Certain model selections will limit visibility. * Certain model selections will limit capacity options. * Certain market selections will limit capacity options.			
ALARM / HORN: 26	1 **2**	SEPARATE: Ambient alarm installed. **COMBINED: Single Horn / Alarm installed.**	**2**
WATER IN FUELSENSOR: 27*	**1** 2	**NO: Water in Fuel Sensor not installed.** YES: Water in Fuel Sensor installed.	**1**
* Only visible if engine selection is Deutz EMR4.			
LIFT CYL WITH: 28*	**1** 2	**AUX VALVE: Lift Down Aux Valve is installed.** ENABLE VALVE: Lift Down Enable Valve is installed	**1**
* Certain model selections will limit visibility.			

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Table 6-3. Machine Configuration Programming Settings- Version P2.14

660SJC	ANSI USA	ANSI Export	CSA	CE	Australia	Japan	GB
Model Number	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Market	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Engine	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	4	4	4	4	4	4	4
	5	**5**	**5**	**5**	**5**	**5**	**5**
	6	6	6	6	6	6	6
Starter Lockout	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
Engine Shutdown	1	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**	**2**
Fuel Cutout	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	X	X	X	X	X	X	X
	4	**4**	**4**	**4**	**4**	**4**	**4**
Tilt	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	4	4	4	4	4	4	4
	5	5	5	5	5	5	5
	6	6	6	6	6	6	6
	7	**7**	**7**	**7**	**7**	**7**	**7**
	8	8	8	8	8	8	8
	9	9	9	9	9	9	9
4 Wheel Steer	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
Jib	1	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**	**2**
SOFT TOUCH	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
SKYGUARD	1	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**	**2**
	3	3	3	3	3	3	3
Gen Set / Welder	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
Gen Set Cutout	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
Head & Tail lights	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2

Table 6-3. Machine Configuration Programming Settings- Version P2.14

660SJC	ANSI USA	ANSI Export	CSA	CE	Australia	Japan	GB
Load System	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	3	**3**	**3**	X	**3**	**3**	**3**
	4	4	4	**4**	X	4	4
Function Cutout	**1**	**1**	**1**	X	**1**	**1**	**1**
	X	2	2	**2**	2	2	2
	3	3	3	X	3	3	3
	4	4	4	X	4	4	4
Ground Alarm	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	3	3	3	3	3	3	3
	4	**4**	**4**	**4**	**4**	**4**	**4**
Drive Type	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
Display Units	1	1	**1**	**1**	**1**	**1**	**1**
	2	**2**	2	2	2	2	2
Clearsky	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
Cribbing Option	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	X	X	X	X	X	X
Alert Beacon	**1**	**1**	**1**	**1**	1	**1**	**1**
	2	2	2	2	**2**	2	2
Temp Cutout	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	X	2	X	2	X	X	2
PLAT LVL OVR CUT	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
Capacity	X	X	X	X	X	X	X
	2	**2**	**2**	**2**	**2**	**2**	**2**
	X	X	X	X	X	X	X
ALARM / HORN	1	1	1	1	1	1	1
	2	**2**	**2**	**2**	**2**	**2**	**2**
Water in Fuel Sensor	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2
Water in Fuel Sensor	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	2	2	2	2	2	2	2

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

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6.2 MACHINE PERSONALITY SETTINGS

NOTE: *Personality settings can be adjusted within the adjustment range for optimum machine performance.*

Table 6-4. Machine Personality Settings and Function Speed (Software Version P2.14)

FUNCTION		ADJUSTMENT RANGE	DEFAULT VALUES	TIME RANGE (IN SECONDS)
DRIVE LEFT TRACK				
	Accel	0.0 - 5.0 s	1.0 s	
	Decel	0.0 - 5.0 s	1.0 s	
FORWARD	Min	0.0 - 250 mA	50 mA	
	Max	0.0 - 250 mA	185 mA	85 - 97
	Elevated	0.0 - 250 mA	108 mA	85 - 97
	Creep	0.0 - 250 mA	108 mA	
REVERSE	Min	0.0 - 250 mA	60 mA	
	Max	0.0 - 250 mA	200 mA	85 - 97
	Elevated	0.0 - 250 mA	125 mA	85 - 97
	Creep	0.0 - 250 mA	125 mA	
DRIVE RIGHT TRACK				
	Accel	0.0 - 5.0 s	1.0 s	
	Decel	0.0 - 5.0 s	1.0 s	
FORWARD	Min	0.0 - 250 mA	70 mA	
	Max	0.0 - 250 mA	193 mA	85 - 97
	Elevated	0.0 - 250 mA	121 mA	85 - 97
	Creep	0.0 - 250 mA	121 mA	
REVERSE	Min	0.0 - 250 mA	65 mA	
	Max	0.0 - 250 mA	180 mA	85 - 97
	Elevated	0.0 - 250 mA	115 mA	85 - 97
	Creep	0.0 - 250 mA	115 mA	
SWING				
	Accel	0.0 - 3.0 s	3.0 s	
	Decel	0.0 - 2.0 s	1.6 s	
LEFT	Min	250 - 1000 mA	430 mA	
	Max	250 - 1000 mA	875 mA	79 - 99
	Creep	250 - 1000 mA	675 mA	
RIGHT	Min	250 - 1000 mA	430 mA	
	Max	250 - 1000 mA	900 mA	79 - 99
	Creep	250 - 1000 mA	675 mA	

Table 6-4. Machine Personality Settings and Function Speed (Software Version P2.14)

FUNCTION		ADJUSTMENT RANGE	DEFAULT VALUES	TIME RANGE (IN SECONDS)
LIFT				
	Accel	0.0 - 3.0 s	2.5 s	
	Decel	0.0 - 2.0 s	1.2 s	
UP	Min	250 - 1500 mA	525 mA	
	Max	250 - 1500 mA	1400 mA	55 - 75
	Creep	250 - 1500 mA	1000 mA	
DOWN	Min	250 - 1300 mA	700 mA	
	Max	250 - 1300 mA	1200 mA	55 - 75
	Creep	250 - 1300 mA	1000 mA	
	Soft Down	250 - 1500 mA	900 mA	
	Soft Down	250 - 1300 mA	850 mA	
TELESCOPE				
	Accel	0.0 - 3.0 s	0.7 s	
	Decel	0.0 - 2.0 s	0.5 s	
IN	Min	250 - 1200 mA	420 mA	
	Max	250 - 1200 mA	1000 mA	40 - 50
	Creep	250 - 1200 mA	650 mA	
OUT	Min	250 - 1200 mA	480 mA	
	Max	250 - 1200 mA	1050 mA	42 - 52
	Creep	250 - 1200 mA	710 mA	
JIB LIFT				
	Accel	0.0 - 3.0 s	3.0 s	
	Decel	0.0 - 2.0 s	0.8 s	
UP	Min	10 - 50%	27%	
	Max	10 - 50%	41%	25 - 32
	Creep	10 - 50%	34%	
DOWN	Min	10 - 50%	27%	
	Max	10 - 50%	40%	22 - 28
	Creep	10 - 50%	35%	
	Up Cutback	10 - 50%	33%	
	Down Cutback	10 - 50%	33%	

Table 6-4. Machine Personality Settings and Function Speed (Software Version P2.14)

FUNCTION		ADJUSTMENT RANGE	DEFAULT VALUES	TIME RANGE (IN SECONDS)
PLATFORM LEVEL				
	Accel	0.0 - 3.0 s	0.0 s	
	Decel	0.0 - 2.0 s	0.0 s	
UP	Min	250 - 1500 mA	800 mA	
	Max	250 - 1500 mA	1300 mA	
	Creep	250 - 1500 mA	1100 mA	
DOWN	Min	250 - 1500 mA	850 mA	
	Max	250 - 1500 mA	1400 mA	
	Creep	250 - 1500 mA	1250 mA	
GROUND MODE				
SWING	Left	250 - 1000 mA	670 mA	
	Right	250 - 1000 mA	895 mA	
Lift	Up	250 - 1500 mA	1395 mA	
	Down	250 - 1300 mA	1195 mA	
Telescope	In	250 - 1200 mA	995 mA	
	Out	250 - 1200 mA	1045 mA	
JIB	Up	10 - 50%	40%	
	Down	10 - 50%	39%	
Platform	Up	250 - 1500 mA	1295 mA	
	Down	250 - 1500 mA	1395 mA	

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6.3 MACHINE ORIENTATION WHEN SETTING FUNCTION SPEEDS

Crawler 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 25 ft. (7.6m) from starting point so the unit is at a maximum speed when starting the test. Results should be recorded for a 200 ft. (61m) course. Adjust the Left track/Right track drive FWD/REV maximums to achieve the best straight tracking performance introducing steer. Drive forward, "High Speed", record time. Drive reverse, "High Speed", record time.

Crawler 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 Max Torque mode. Result should be recorded for a 50 ft (15.2m) course. Adjust the Left track/Right track FWD/REV elevated drive maximum to achieve the best straight tracking without introducing steer. Drive forward, record time. Drive reverse, record time. Lower boom below < 5° and retract boom. Turn Platform Speed Control Knob fully counterclockwise to enter Creep mode; Creep light on panel must be energized. Verify that machine will Drive Forward and Reverse. If needed, Adjust the Left track/Right track drive FWD/REV creep drive maximums to achieve the best straight tracking performance. Return knob to fully clockwise.

SWING: Boom at full elevation, Telescope retracted. Swing Right until over rear axle or end stop (if equipped). Swing Left 360° or end stop (if equipped), record time. Swing Right 360° or end stop (if equipped), 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.

MAIN LIFT: Main 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 In and Out. Return Knob to fully clockwise.

JIB LIFT: Platform level and centered with the 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.

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.

NOTE: *When the platform speed control knob is turned fully counterclockwise. The platform rotate may not work, this is acceptable.*

Test Notes

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

6.4 CANBUS COMMUNICATIONS

CANbus: CAN (Control Area Network) is a two wire differential serial link between the Platform and Ground Modules providing bi-directional communications.

Two-wire: One wire (red) is driven high (5v) and the other low (black) (0v) to send a signal. Both wires "float" (2.5v) when no signal is being sent.

Differential: Any electrical line noise can affect the high or the low wires but never both, so communications is not corrupted.

Serial Link: Messages are being sent bit by bit along the wires; the high bus speed allow all modules to be constantly updated around 20 times per second. Typical traffic is 300 - 500 messages per second.

A complete CANbus circuit is approximately 60 ohms, which can be verified at the "T" fitting inside the ground station. Individual circuits are approximately 120 ohms.

The GROUND MODULE (UGM) is the master system controller. Most functions are dispatched and coordinated from this module. The PLATFORM MODULE handles sub-tasks. All characterized information (values) are stored in the ground module (i.e., Personalities or Calibrations).

Interlocks: Any device that sends an electrical input. (For an example a limit switch, proximity switch, etc;).

Platform Level: The GROUND MODULE stores default values and handles interlocks. The PLATFORM MODULE reads sensors mounted on the platform assembly and controls Level Up / Down valves to maintain setpoint sent from the GROUND MODULE.

Steer: The GROUND MODULE stores crack points, and sends desired drive direction, steering mode, and axle extend/retract commands. The PLATFORM MODULE reports steering switch position to the GROUND MODULE.

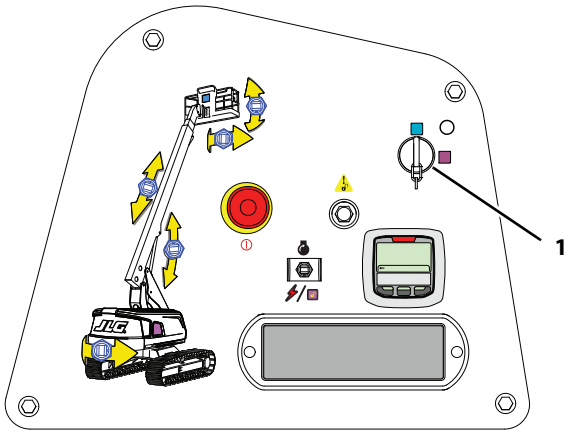
Lift, Tele, & Swing: The GROUND MODULE stores default values, and handles interlocks and calibration information. Lift, Telescope, and Swing commands depend on interlocks through out the machine. Boom angle, length, and swing are controlled by the GROUND MODULE.

6.5 SYSTEM TEST

The Control System Incorporates a built-in system test to check the system components and functions. To use this function, use the following procedures.

Test from the Platform

1. Position the Platform/Ground Select switch (1) to the Platform position.



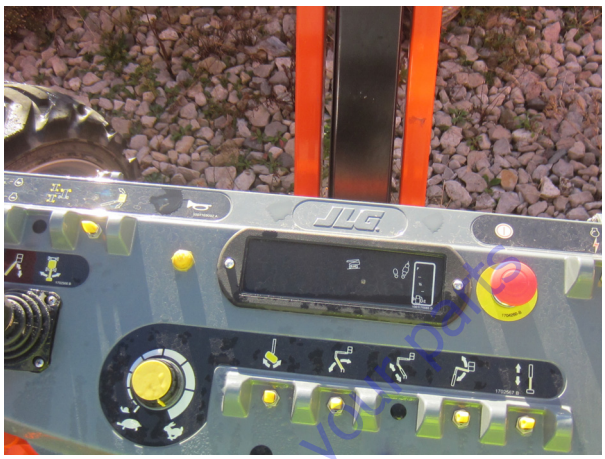
MAE27280

2. Plug the analyzer into the connector at the base of the platform control box.

MAE15680

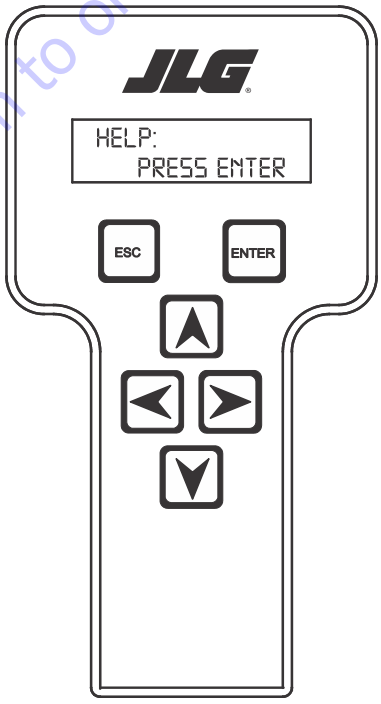
3. Before proceeding, ensure that the switches on the platform console are in the following positions:
   - **a.** Drive speed dial is in the slow position. (Turtle Icon).
   - **b.** Function speed potentiometer out of creep mode switch.
   - **c.** Generator (if equipped) switched to the off position.
   - **d.** Head and Tail lights (if equipped) switched to the off position.

4. Pull out the Emergency Stop switch and Start the engine.



MAE15700

5. The analyzer screen should read:



6. Use the arrow button to reach SYSTEM TEST. Hit Enter. The analyzer will prompt you asking if you want to activate the system test; hit Enter again to activate.

7. Follow the flow path in Figure 6-20., System Test Flow Chart - Platform Tests (Sheet 1 of 2) & Figure 6-21., System Test Flow Chart - Platform Tests (Sheet 2 of 2) and go through the component tests. Hit the ESC key during any part of the test to return to the main menu without completing all tests or wait until all tests are complete. During the TEST ALL INPUTS sequence, the analyzer allows control switches to be operated and shows if they are closed (CL) or open (OP).

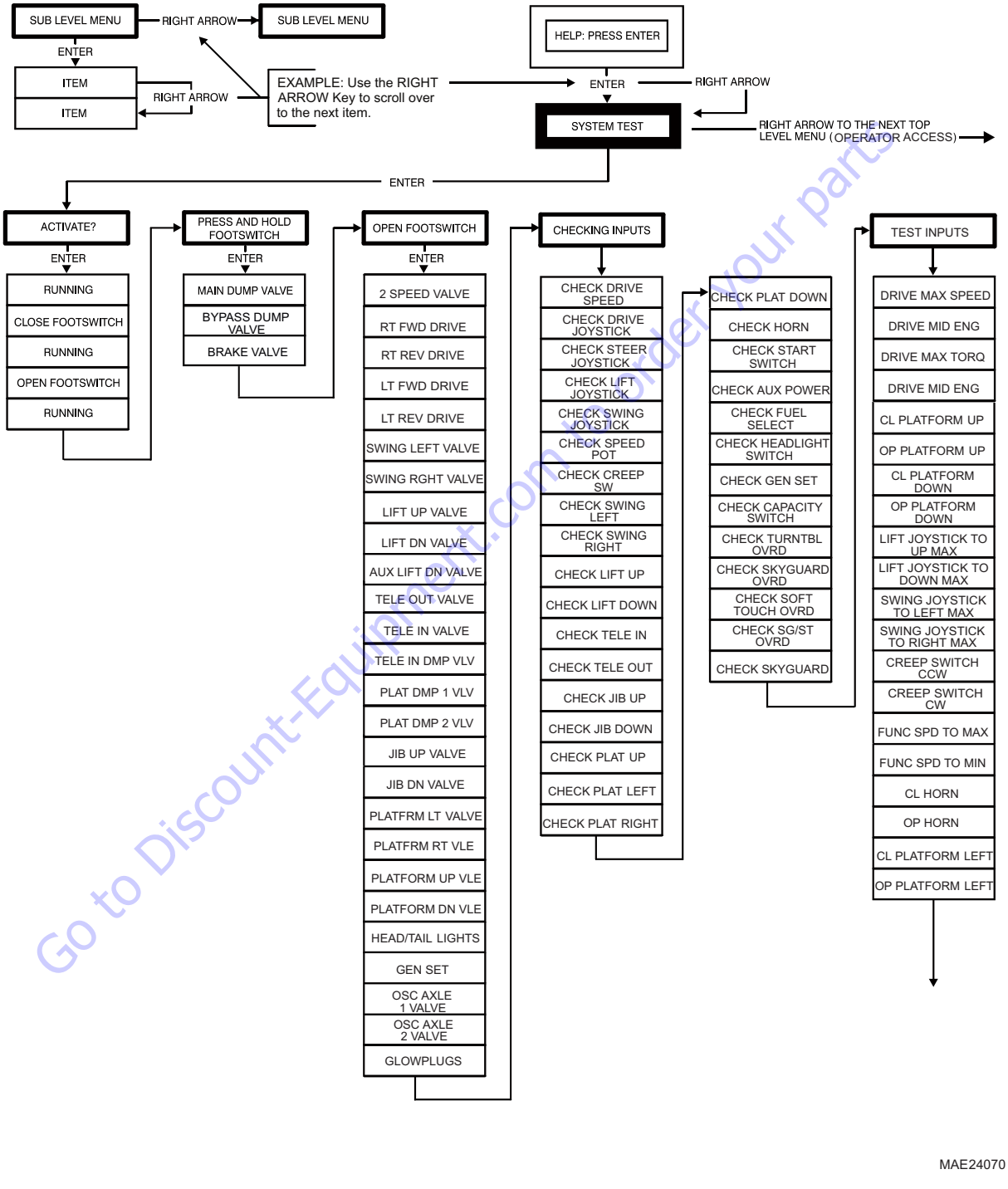


Figure 6-20. System Test Flow Chart - Platform Tests (Sheet 1 of 2)

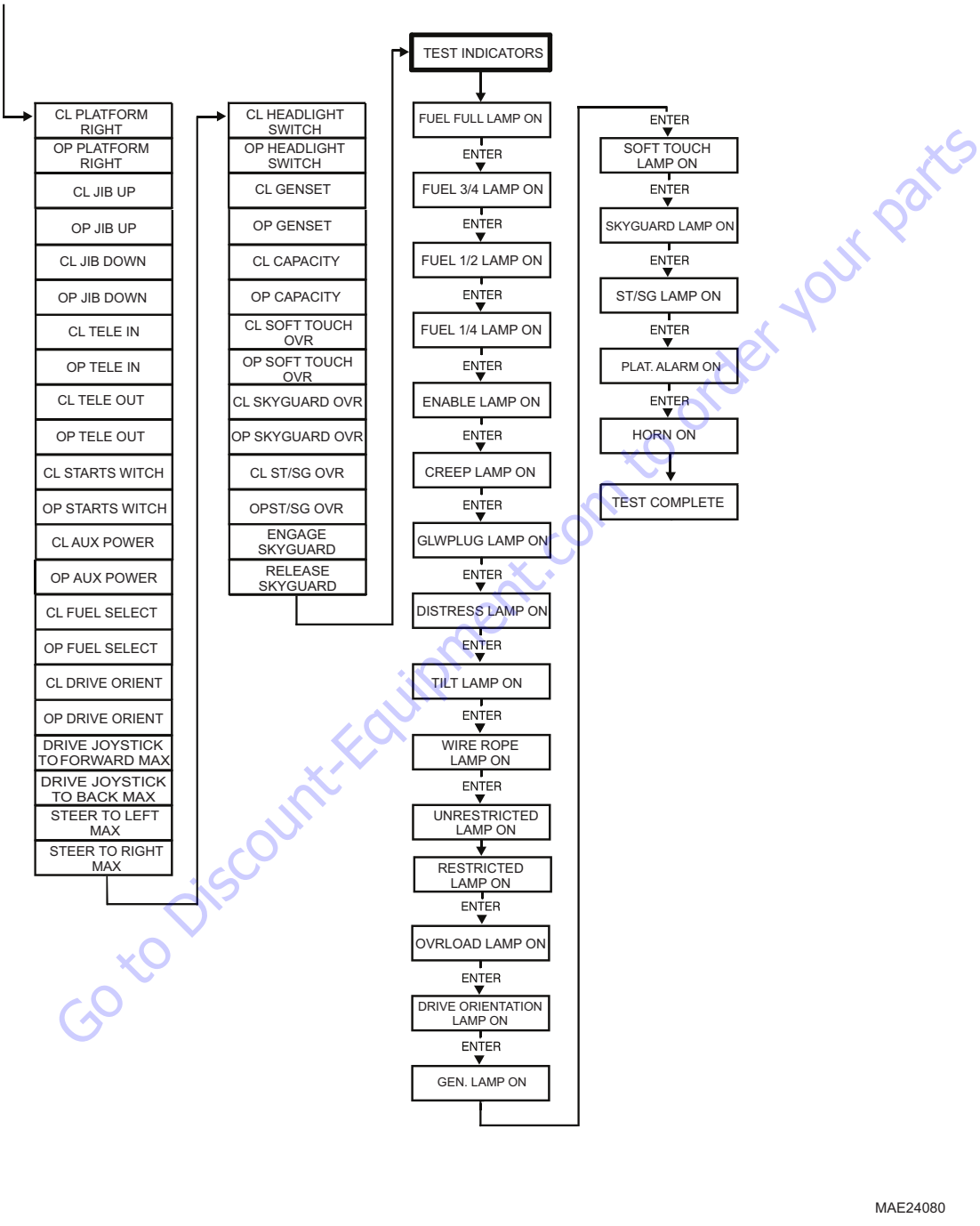
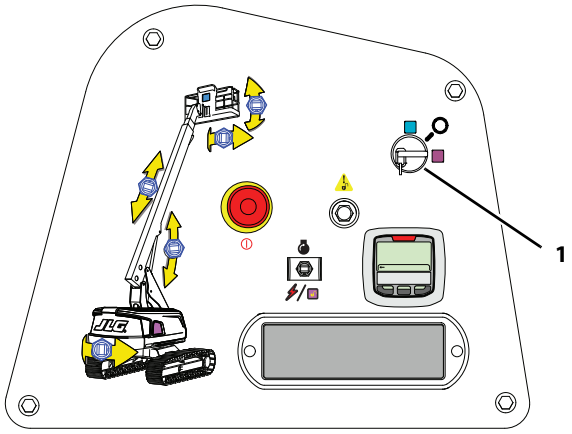


Figure 6-21. System Test Flow Chart - Platform Tests (Sheet 2 of 2)

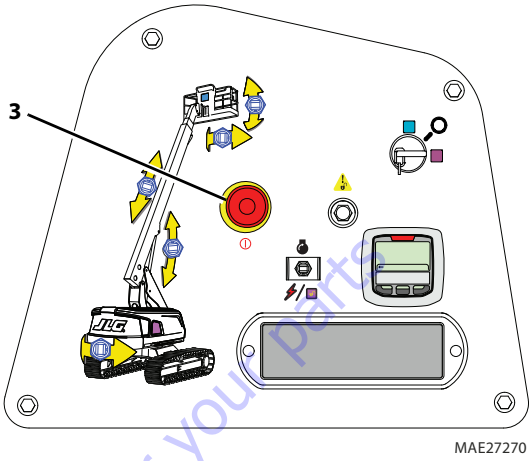
Test from the Ground Station

1. Position the Platform/Ground select switch (1) to ground.

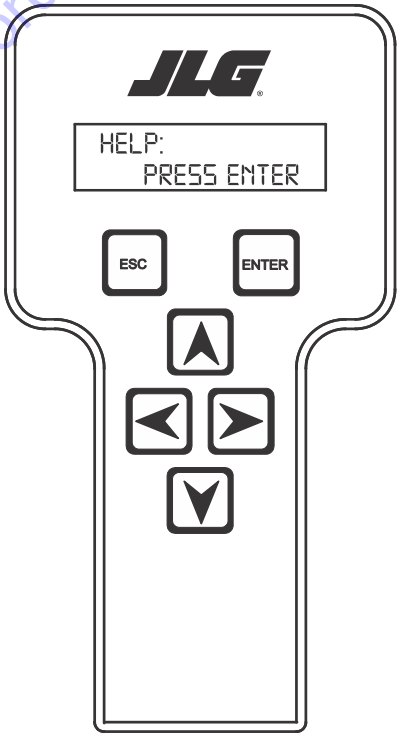


2. Plug the analyzer into the connector (2) inside the Ground control box.

3. Pull out the Emergency Stop switch (3) and Start the engine.



4. The analyzer screen should read:



5. Use the arrow button to reach SYSTEM TEST. Hit Enter. The analyzer will prompt you asking if you want to activate the system test; hit Enter again to activate.

6. Follow the flow path in Figure 6-22., System Test Flow Chart - Ground Station Tests and go through the component tests. Hit the ESC key during any part of the test to return to the main menu without completing all tests or wait until all tests are complete. During the TEST ALL INPUTS sequence, the analyzer allows control switches to be operated and shows if they are closed (CL) or open (OP).

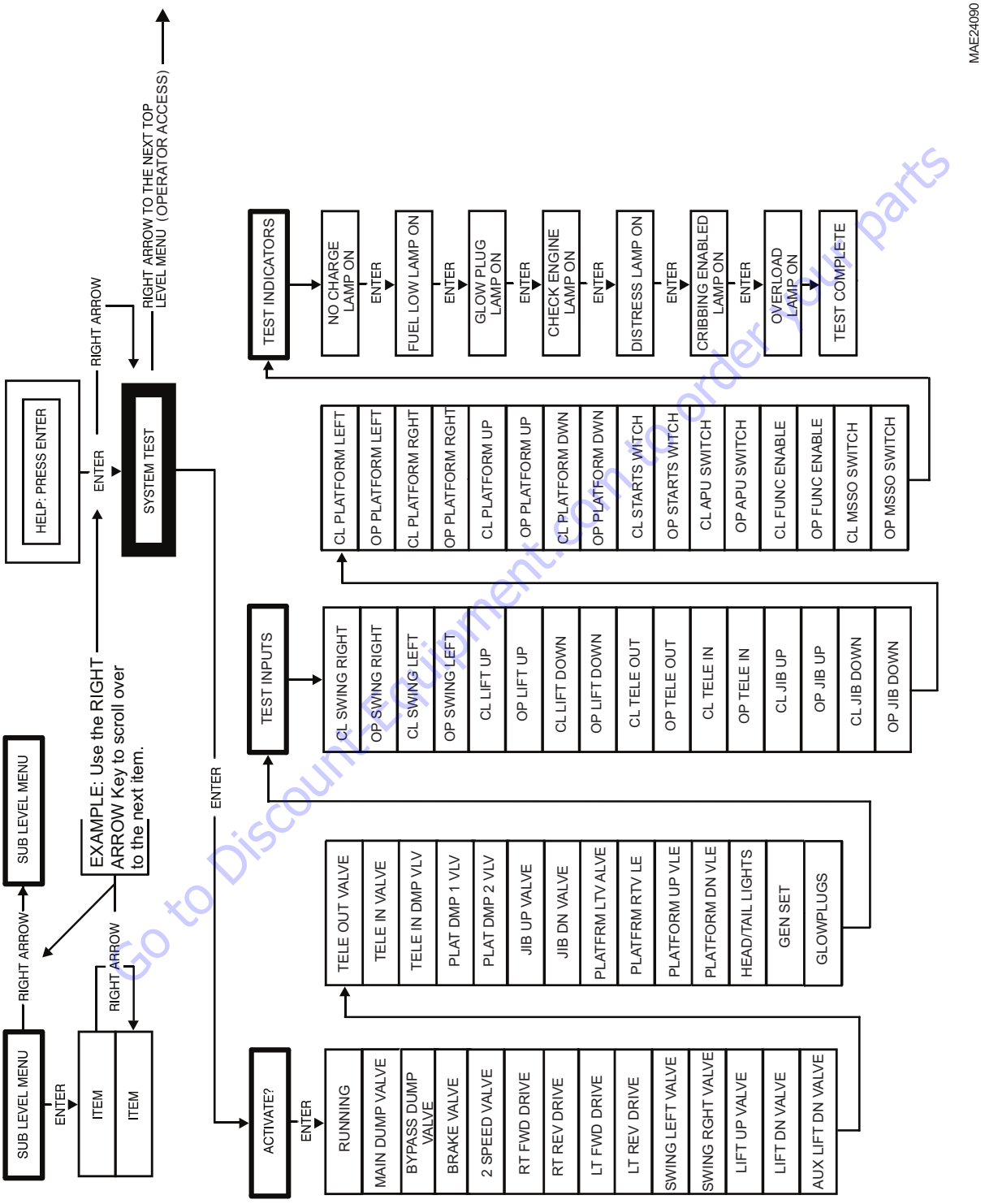


Figure 6-22. System Test Flow Chart - Ground Station Tests

6.6 SYSTEM TEST MESSAGES

Table 6-5. 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
	BATTERY VOLTAGE TOO LOW	The system test may not run properly with battery voltage below 11V
	BATTERY VOLTAGE TOO HIGH	The system test may not operate properly with the battery voltage above 16V
	CHECK CAN WIRING	The system test will not operate properly unless the CAN bus is functional
	ENGINE RUNNING?	The LOSS OF ENGINE SPEED SENSOR fault 4322 is active or CANBUS FAILURE – ENGINE CONNTROL-LER fault 666 is active
	HIGH TILT ANGLE	The CHASSIS TILT SENSOR OUT OF RANGE fault 814 is active
	HOT ENGINE	The HIGH ENGINE TEMP fault 438 is active
	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 VALVES		Indicates that the valve test is beginning. Each valve is alternately energized and de-energized; checks are made for open- and short- circuit valve coils NOTE: In platform mode, the footswitch must be closed NOTE: Tower lift valves are not tested if TOWER LIFT=NO. Tower telescope valves are not tested if TOWER TELE=NO. Jib valves are not tested if JIB = NO. Extendable axle valves are not tested if EXT AXLES=NO. Four wheel steer valves are not tested if 4WS=NO NOTE: Left/right jib valves are not tested unless JIB = SIDESWING Problems that can be reported include below messages
	CANT TEST VALVES	There is a wiring problem, which prevents the valve test from functioning correctly. Check valve wiring. Check ground alarm & hour meter wiring
	XXXXXXX S/C	The named valve is drawing too much current so is presumed to be short-circuited. Check valve wiring
	XXXXXXX O/C	The named valve is drawing too little current so is presumed to be open-circuit. Check valve wiring
CHECKING INPUTS		Indicates that the inputs test is beginning. Every input is checked to ensure that it is in its "normal" position; function switches should be open, cutout switches should be closed, joysticks should be in neutral In platform mode any non-neutral platform switch or joystick is reported; any active cutouts are reported In ground mode any non-neutral ground switches is reported; any active cutouts are reported. NOTE: Switches, which are not in use (due to the settings of machine digits), are not checked. NOTE: The pump pot is checked only for a wire-off condition; it can be at any demand from creep to maximum Problems that can be reported include below messages
	CHECK XXXXXXX	The named switch is not in its "normal" position. Check switch & wiring
	CHECK XXXXXXX JOY	The named joystick appears to be faulty. Check joystick

Table 6-5. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
TESTING LAMPS		Indicates that the lamps test is beginning. Each lamp is energized in turn; a prompt asks for confirmation that the lamp is lit ENTER must be pressed or clicked to continue the test NOTE: Lamps, which are not in use (due to the settings of machine digits), are not checked NOTE: Platform Lamps are only tested in platform mode NOTE: The GM overload lamp and 500# capacity lamp are not tested NOTE: Head and tail lamps are tested in both platform and ground mode if enabled by a machine digit
TESTING ALARMS		Indicates that the alarms test is beginning. Each alarm is energized in turn; a prompt asks for confirmation that the alarm is sounding
		ENTER must be pressed or clicked to continue the test
		NOTE: The platform alarm and the horn are only tested in platform mode
		NOTE: The ground alarm is not tested if GROUND ALARM = NO
TEST ALL INPUTS?		Prompts whether to check every operator input. If ESC is pressed or clicked, the system test ends If ENTER is pressed or clicked, each operator input is prompted for in turn In platform mode every platform switch and joystick is tested In ground mode every ground switch is tested. NOTE: Tower lift switches are not tested if TOWER LIFT=NO. Tower telescope switches are not tested if TOWER TELE=NO. Jib switches are not tested if JIB = NO. Extendable axle switches are not tested if EXT AXLES=NO. Four wheel steer switches are not tested if 4WS=NO. NOTE: Left/right jib switches are not tested unless JIB = SIDESWING. Prompts displayed during the operator input test below messages.
	CLOSE XXXXXXX	The named switch should be closed
	OPEN XXXXXXX	The named switch should be opened
	XXXXXXX XXXXXXX TO MAX	The named joystick should be pushed to its full extent in the named direction
	XXXXXXX XXXXXXX TO MIN	The named joystick should be returned to neutral from the named direction
	PUMP POT TO MAX	The pump pot should be turned to maximum
	PUMP POT TO MIN	The pump pot should be turned to minimum
	MULTIPLE CLOSURE	More than one operator input is closed; if only one has been operated, there could be a short between two inputs
TESTS COMPLETE		Indicates that the system test is complete. Any problems reported should have been noted and should now be rectified. Press ESC/CANCEL to return to the RUN SYSTEM TEST Analyzer menu

6.7 MACHINE DIAGNOSTICS PARAMETERS

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
DRIVE/STEER	DRIVE DEMAND	FORWARD/REVERSE XXX%	Direction and command percentage of Drive as reported by PM
	DRIVE OUTPUT	FORWARD/REVERSE XXX%	Direction and current output percentage
	DRIVE OUT mA	FORWARD/REVERSE XXXXmA	Direction and current output command
	DRIVE FDBK mA	XXXXmA	Current feedback measurement
	STEER DEMAND	LEFT/RIGHT XXX%	Direction and command percentage of Steer as reported by PM.
	STEER OUPTUT	LEFT/RIGHT XXX%	Direction and PWM output percentage
	LT TRACK DEMAND	FORWARD/REVERSE XXX%	Direction and command percentage of Left Track Drive as reported by PM
	LT TRACK OUTPUT	FORWARD/REVERSE XXX%	Direction and current Left Track output percentage
	LT TRACK OUT mA	FORWARD/REVERSE XXXXmA	Direction and current Left Track output command
	LT TRACK FDBK mA	XXXXmA	Left Track current feedback measurement
	RT TRACK DEMAND	FORWARD/REVERSE XXX%	Direction and command percentage of Right Track Drive as reported by PM
	RT TRACK OUTPUT	FORWARD/REVERSE XXX%	Direction and current Right Track output percentage
	RT TRACK OUT mA	FORWARD/REVERSE XXXXmA	Direction and current Right Track output command
	RT TRACK FDBK mA	XXXXmA	Right Track current feedback measurement
	DRV/ST JS ENABLE	CLOSED/OPEN	State of Drive / Steer Joystick Enable
	STEER TYPE	NORMAL/CRAB/COORDINATED	Steer Type Status (MACHINE SETUP ⟶ 4 WHEEL STEER = YES)
	BRAKES STATUS	LOCKED/RELEASED	Status of Brake Valve output
	2SPEED OUTPUT	ON/OFF	Status of 2 Speed Valve output
	DRIVE MODE	MAX SPEED/MAX TORQUE/MID ENGINE	Drive Mode Status
	DRV ORIENT TT SW	OPEN /CLOSED	State of DOS Switch
	DRV ORIENT MODE	INLINE/SWUNG	DOS state
	DRV ORIENT STATE	CONFIRMED/REQUIRED	InLine and DOS Active = Confirmed
	DRV ORNT OVR SW	CLOSED/OPEN	State of Drive Orientation Override Switch
	CRIBBING MODE SW	CLOSED/OPEN	State of Cribbing Mode Switch; only displayed if MACHINE SETUP ⟶ CRIBBING = YES
	CRIBBING MODE	DISBLED/ENABLED	Reflects state of Cribbing Mode Switch; only displayed if MACHINE SETUP ⟶ CRIBBING = YES
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 current output percentage
	SWING OUTPUT mA	LEFT/RIGHT XXXXmA	Direction and current output command
	SWING FDBK mA	XXXXmA	Current feedback measurement
	LIFT DEMAND	UP/DOWN XXX%	Direction and percentage of Lift input command
	LIFT OUTPUT	UP/DOWN XXX%	Direction and current output percentage

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
BOOM FUNCTIONS	LIFT OUTPUT mA	UP/DOWN XXXXmA	Direction and current output command
	LIFT FDBK mA	XXXXmA	Current feedback measurement
	LIFT DN AUX	ON/OFF	Status of Aux Lift Down
	TELE DEMAND	IN/OUT XXX%/CREEP	Direction and percentage of input command (or CREEP if selected) from Function Speed Pot or Ground%
	TELE OUTPUT	IN/OUT XXX%	Direction and current output percentage for Flow Control Valve mapped to Tele Personalities
	TELE OUTPUT mA	IN/OUT XXXXmA	Direction and current output command
	TELE FDBK mA	XXXXmA	Current feedback measurement
	JIB LIFT DEMAND	UP/DOWN XXX%/CREEP	Direction and percentage of input command (or CREEP if selected) from Function Speed Pot or Ground%; only displayed if MACHINE SETUP ⟶ JIB = YES
	JIB LIFT OUTPUT	UP/DOWN XXX%	For Up, direction and current output percentage for Flow Control mapped to Jib Lift Up Personality range; for Down, direction and PWM output percentage; only displayed if MACHINE SETUP ⟶ JIB = YES
	PLAT LVL DEMAND	UP/DOWN XXX%/CREEP	Direction and percentage of input command (or CREEP if selected) from Function Speed Pot or Ground%
	PLAT LVL OUTPUT	UP/DOWN XXX%	Direction and current output percentage for Flow Control mapped to Platform Level Personality range
	PLAT LVL OUT mA	UP/DOWN XXXXmA	Direction and current output command
	PLAT LVL UP FDBK	XXXXmA	Platform Level Up Current feedback measurement
	PLAT LVL DN FDBK	XXXXmA	Platform Level Down Current feedback measurement
	PLAT ROT DEMAND	LEFT/RIGHT XXX%/CREEP	Direction and percentage of input command (or CREEP if selected) from Function Speed Pot or Ground% value = 0% or 100%
	PLAT ROT OUTPUT	LEFT/RIGHT XXX%	Direction and current output percentage for Flow Control mapped to Platform Rotate Personality range; for 600SC value = 0% or 100%
	LF PRS REL OUTPT	ON/OFF	Status of Low Flow Pressure Release Valve; Only display if Low Flow Pressure Release is Configured
	MAIN DUMP OUTPUT	ON/OFF	Status of Main Dump Valve
	TELE IN DUMP	ON/OFF	Status of Telescope In Dump Valve
	FUNCTION SPEED	SETTING: XXX%	Displays the percentage demand from the Function Speed Potenti- ometer.
	CREEP SW	OPEN/CLOSED	Status of Creep Switch Input
	CREEP MODE	ON/OFF	Displays status of Creep Mode

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
ENGINE	OPERATING STATE	STOPPED/CRANKING/ STARTING/ RUNNING	Displays Engine State
	GLOW PLUG	NOT ACTIVE/ACTIVE	Display diagnostic if glow plugs configured: MACHINE SETUP → GLOW PLUG ≠ NO GLOW PLUGS
	COOLANT TEMP	XXXC/XXXF	Degrees F or C displayed depending on Machine Setup Configuration
	ENGINE OIL PRESS	XXXXPSI/XXXXKPA	If Ford read > 10 PSI display OK, else LOW If Deutz, display transmitted value
	FUEL SELECTION	STATUS GAS/LP	MACHINE SETUP → ENGINE = FORD DUAL FUEL
	FUEL PRESS	XXXXPSI/XXXXKPA	MACHINE SETUP → ENGINE = EMR 4
	AMBIENT TEMP	XXXC/XXXF	
	FUEL LEVEL	FULL; ¾; ½; ¼; LOW; EMPTY; OK; ERROR	MACHINE SETUP → FUEL LEVEL ≠ NONE
	ENGINE SPEED	ACTUAL XXXXRPM	RPM read from speed sensor if engine = over CAN2 for Deutz, Ford Dual Fuel
	ENGINE SPEED	TARGET XXXXRPM	UGM - commanded Target RPM
SYSTEM	UGM BATTERY	XX.XV	UGM measured battery voltage
	PLATFORM MODULE	BATTERY XX.XV	PM measured battery voltage
	UGM TEMP	XXXC/XXXF	UGM on-board temperature measurement
	PLATFORM SELECT	KEYSWITCH: OPEN KEYSWITCH: CLOSED	Displays whether Platform Keyswitch position is being selected
	GROUND SELECT	KEYSWITCH: OPEN KEYSWITCH: CLOSED	Displays whether Ground Keyswitch position is being selected
	STATION CONTROL	GROUND/PLATFORM	Displays Active control station per System Mode definition
	FOOTSWITCH INPUT	GROUND: OPEN GROUND: CLOSED	State of Footswitch input at UGM
	FOOTSWITCH INPUT	PLATFORM: OPEN PLATFORM: CLOSED	State of Footswitch input at PM (closed when footswitch not acti- vated)
	PLATFORM ANGLE:	XXX.XDEG	Platform Angle with respect to Chassis
	PLAT ANGLE 1 RAW	XX.X%	Platform Angle sensor #1 raw PWM%
	PLAT ANGLE 2 RAW	XX.X%	Platform Angle sensor #2 raw PWM%
	ELEVATION MODE	ABOVE/NOT ABOVE	Elevation State
	CAPACITY MODE	RESTRICTED/UNRESTRICTED/ERROR	Dual Capacity State; Dual Capacity is configured
	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
	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

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
SYSTEM	GENSET/WELDER SW	OPEN/CLOSED	Platform Generator Enable switch; only displayed if MACHINE SETUP ⟶ GEN SET/ WELDER ≠ NO
	GENSET ENABLE	OUTPUT: ON/OFF	UGM Generator Relay Enable output; only displayed if MACHINE SETUP ⟶ GEN SET/ WELDER ≠ NO
	H&T LIGHTS SW	OPEN/CLOSED	Only displayed if in Platform Mode and MACHINE SETUP ⟶ H&T LIGHTS = YES
	H&T LIGHTS OUT	ON/OFF	UGM Nite Brite Relay Enable output; only displayed if in Platform Mode and MACHINE SETUP ⟶ H&T LIGHTS = YES
	SOFT TOUCH INPUT	OPEN/CLOSED	State of Soft Touch Platform Input (J1-20); closed when active; only displayed if in Platform Mode and MACHINE SETUP ⟶ SOFT TOUCH = YES.
	SKYGUARD INPUTS	OPEN/CLOSED/DISAGREE	SkyGuard Input #1 (PLT J7-18) AND SkyGuard Input #2 (PLT J1-23) state; only displayed if in Platform Mode and MACHINE SETUP ⟶ SKYGUARD = YES.
	SKYGUARD INPUT 1	OPEN/CLOSED	State of SkyGuard Platform Input #1 (J7-18); relay NC contacts – closed when active; only displayed if in Platform Mode and MACHINE SETUP ⟶ SKYGUARD = YES.
	SKYGUARD INPUT 2	OPEN/CLOSED	State of SkyGuard Platform Input #2 (J1-23); relay NC contacts – closed when active; only displayed if in Platform Mode and MACHINE SETUP ⟶ SKYGUARD = YES.
	AMBIENT TEMP	XXXC/XXXF	Ambient Temperature sensor reading; Only displayed if 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; Only displayed if MACHINE SETUP ⟶ MARKET = CE
	WIRE ROPE	SWITCH: OPEN/CLOSED	State of Wire Rope Service Switch input (J3-8); closed when active; MACHINE SETUP ⟶ CABLE SWITCH = YES
OPER CONTROLS	JOYSTICK DRIVE	FORWARD/REVERSE XXX%	Drive Joystick drive direction and command percentage as reported from PM; only displayed if in Platform Mode
	JOYSTICK STEER	LEFT/RIGHT XXX%	Drive Joystick steer direction and percentage command as reported from PM; only displayed if in Platform Mode
	JOYSTICK SWING	LEFT/RIGHT XXX%	Lift/Swing Joystick Swing direction and percentage command as reported from PM; only displayed if in Platform Mode
	JOYSTICK LIFT	UP/DOWN XXX%	Lift/Swing Joystick Lift direction and percentage command as reported from PM; only displayed if in Platform Mode
	DRV ORNT OVR SW	CLOSED/OPEN	State of Drive Orientation Override Switch if in Platform Mode
	FUEL SELECT SW	OPEN/CLOSED	Status of Platform Toggle Switch Input if in Platform Mode and MACHINE SETUP ⟶ ENGINE = FORD DUAL FUEL
	START SWITCH	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input
	SWING LEFT SW	OPEN/CLOSED	Status of Ground Toggle Switch Input if in Ground Mode
	SWING RIGHT SW	OPEN/CLOSED	Status of Ground Toggle Switch Input if in Ground Mode

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
OPER CONTROLS	LIFT UP SW	OPEN/CLOSED	Status of Ground Toggle Switch Input if in Ground Mode
	LIFT DN SW	OPEN/CLOSED	Status of Ground Toggle Switch Input if in Ground Mode
	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; only displayed if MACHINE SETUP⟶JIB = YES
	JIB LIFT DN SW	OPEN/CLOSED	Status of Ground/Platform Toggle Switch Input; only displayed if MACHINE SETUP ⟶ JIB = 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; only displayed if in Platform Mode
	MAX TORQUE SW	OPEN/CLOSED	Status of Platform Toggle Switch Input; only displayed if in Platform Mode
	CREEP SW	OPEN/CLOSED	Status of Creep Switch Input; only displayed if in Platform Mode
	HORN SW	OPEN/CLOSED	Status of Platform Switch Input; only displayed if in Platform Mode
	H&T LIGHT SW	OPEN/CLOSED	Status of Platform Toggle Switch Input; only displayed if in Platform Mode and MACHINE SETUP ⟶ H&T LIGHTS = YES
	GENSET/WELDER SW	OPEN/CLOSED	Status of Platform Toggle Switch Input; only displayed if MACHINE SETUP ⟶ GEN SET/ WELDER ≠ NO
	SG OVERRIDE SW	OPEN/CLOSED	Status of Platform SkyGuard Override Switch Input; only displayed if in Platform Mode MACHINE SETUP ⟶ SOFT TOUCH = NO and MACHINE SETUP ⟶ SKYGUARD = YES
	ST OVERRIDE SW	OPEN/CLOSED	Status of Platform SkyGuard Override Switch Input; only displayed if in Platform ModeMACHINE SETUP ⟶ SOFT TOUCH = YES and MACHINE SETUP ⟶ SKYGUARD = NO
	SG/ST OVRIDE SW	OPEN/CLOSED	Status of Platform SkyGuard Override Switch Input; only displayed if in Platform Mode and MACHINE SETUP ⟶ SOFT TOUCH = YES and MACHINE SETUP ⟶ SKYGUARD = YES
	MSSO SW	OPEN/CLOSED	Status of Ground MSSO Switch Input; only displayed if MACHINE SETUP ⟶ MARKET = CE
	CAPACITY SW	OPEN/CLOSED	Status of Platform Dual Capacity Switch Input; only displayed if Dual Capacity is configured

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
PLATFORM LOAD (DISPLAY ONLY IF MACHINE SETUP → LOAD SYSTEM ≠ NO)	PLATFORM LOAD	STATE: OK/OVERLOAD	LSS Status
	PLATFORM LOAD	ACTUAL: XXXXIb	Platform Load??? if Platform Load == Unhealthy
	PLATFORM LOAD[2]	GROSS: XXXXIb	If 4-Cell LSS; Combined weight of all cells (accounting for sign) If 1-Cell LSS; Platform Gross used to calculate Platform Load ??? if (Platform Gross 1 == Unhealthy and Platform Gross 2 == Unhealthy)
	PLATFORM LOAD[2]	OFFSET: XXXIb	If 4-Cell LSS; Stored Platform Empty weight
	PLATFORM LOAD[2]	OFFSET 1: XXXIb	If 1-Cell LSS; Stored Unloaded Platform Weight of Strain Gauge 1 ??? if DTC 825 is active
	PLATFORM LOAD[2]	OFFSET 2: XXXIb	If 1-Cell LSS; Stored Unloaded Platform Weight of Strain Gauge 2 ??? if DTC 825 is active
	PLATFORM LOAD[2]	ACCESSORY XXXIb	Stored Accessory weight; ??? if DTC 825 is active
	PLATFORM LOAD[2]	UNRSTRICT XXXIb	Stored Unrestricted Rated Load; ??? if DTC 825 is active
	PLATFORM LOAD[2]	RSTRICT XXXXIb	If Dual Capacity is Configured; Stored Restricted Rated Load; ??? if DTC 825 is active
	PLATFORM LOAD[2]	CELL 1: XXXIb	If 4-Cell LSS; Gross weight reading of Cell 1
	PLATFORM LOAD[2]	CELL 2: XXXIb	If 4-Cell LSS; Gross weight reading of Cell 2
	PLATFORM LOAD[2]	CELL 3: XXXIb	If 4-Cell LSS; Gross weight reading of Cell 3
	PLATFORM LOAD[2]	CELL 4: XXXIb	If 4-Cell LSS; Gross weight reading of Cell 4
	PLATFORM LOAD[2]	RAW 1: XXXXIb	If 1-Cell LSS; Platform Gross 1; ??? if Platform Gross 1 == Unhealthy
	PLATFORM LOAD[2]	RAW 2: XXXXIb	If 1-Cell LSS; Platform Gross 2; ??? if Platform Gross 2 == Unhealthy
CAN STATISTICS[2]	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	

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
DEBUG UGM I/O[2]	DEBUG DIAG DIGITAL INPUTS	DIG IN J1-21 HIGH/LOW DIG IN J1-34 HIGH/LOW DIG IN J1-35 HIGH/LOW DIG IN J2-24 HIGH/LOW DIG IN J3-8 HIGH/LOW DIG IN J3-9 HIGH/LOW DIG IN J3-10 HIGH/LOW DIG IN J3-11 HIGH/LOW DIG IN J4-4 HIGH/LOW DIG IN J4-5 HIGH/LOW DIG IN J4-6 HIGH/LOW DIG IN J4-7 HIGH/LOW DIG IN J4-8 HIGH/LOW DIG IN J4-9 HIGH/LOW DIG IN J4-10 HIGH/LOW DIG IN J4-11 HIGH/LOW DIG IN J4-16 HIGH/LOW DIG IN J4-17 HIGH/LOW DIG IN J4-18 HIGH/LOW DIG IN J4-19 HIGH/LOW DIG IN J4-20 HIGH/LOW DIG IN J4-21 HIGH/LOW DIG IN J4-22 HIGH/LOW DIG IN J4-23 HIGH/LOW DIG IN J4-30 HIGH/LOW DIG IN J4-33 HIGH/LOW DIG IN J4-34 HIGH/LOW DIG IN J4-35 HIGH/LOW DIG IN J7-2 HIGH/LOW DIG IN J7-3 HIGH/LOW DIG IN J7-12 HIGH/LOW DIG IN J7-15 HIGH/LOW DIG IN J7-21 HIGH/LOW DIG IN J12-8 HIGH/LOW	Left and Right arrow keys scroll through the inputs. 1st Line = DIG IN

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
	DEBUG DIAG DIGITAL OUTPUTS	DIG OUT J1-2 ON/OFF DIG OUT J1-7 ON/OFF DIG OUT J1-11 ON/OFF DIG OUT J1-12 ON/OFF DIG OUT J1-13 ON/OFF DIG OUT J1-23 ON/OFF DIG OUT J1-32 ON/OFF DIG OUT J2-2 ON/OFF DIG OUT J2-3 ON/OFF DIG OUT J2-4 ON/OFF DIG OUT J2-5 ON/OFF DIG OUT J2-7 ON/OFF DIG OUT J2-10 ON/OFF DIG OUT J2-12 ON/OFF DIG OUT J2-13 ON/OFF DIG OUT J2-15 ON/OFF DIG OUT J2-16 ON/OFF DIG OUT J2-21 ON/OFF DIG OUT J2-23 ON/OFF DIG OUT J2-32 ON/OFF DIG OUT J2-33 ON/OFF DIG OUT J4-1 ON/OFF DIG OUT J4-2 ON/OFF DIG OUT J4-3 ON/OFF DIG OUT J4-13 ON/OFF DIG OUT J4-14 ON/OFF DIG OUT J4-15 ON/OFF DIG OUT J4-26 ON/OFF DIG OUT J4-27 ON/OFF DIG OUT J4-28 ON/OFF DIG OUT J4-29 ON/OFF DIG OUT CS1GC ON/OFF[1] DIG OUT CS2GC ON/OFF[1] DIG OUT LED ON/OFF DIG OUT TP1[1]	Left and Right arrow keys scroll through the inputs. 1st Line = DIG OUT JX.XX and 2nd Line displays output value

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
	DEBUG DIAG PWM OUTPUTS	PWM J1-1 XXX.XX% XXXHZ PWM J1-3 XXX.XX% XXXHZ PWM J1-6 XXX.XX% XXXHZ PWM J1-10 XXX.XX% XXXHZ PWM J1-20 XXX.XX% XXXHZ PWM J1-22 XXX.XX% XXXHZ PWM J2-8 XXX.XX% XXXHZ PWM J2-9 XXX.XX% XXXHZ PWM J2-11 XXX.XX% XXXHZ PWM J2-19 XXX.XX% XXXHZ PWM J2-20 XXX.XX% XXXHZ PWM J2-22 XXX.XX% XXXHZ PWM J2-26 XXX.XX% XXXHZ PWM J2-27 XXX.XX% XXXHZ PWM J2-31 XXX.XX% XXXHZ PWM J2-34 XXX.XX% XXXHZ PWM J2-35 XXX.XX% XXXHZ FET J3-1 XXX.XX% XXXHZ FET J3-2 XXX.XX% XXXHZ FET J3-4 XXX.XX% XXXHZ FET J3-5 XXX.XX% XXXHZ FET J3-6 XXX.XX% XXXHZ	

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
		FET J3-14 XXX.XX% XXXHZ PWM J4-12 XXX.XX% XXXHZ	
	ANALOG INPUTS	ADC J1-01 FB XXXX1 ADC J1-01 IS XXXX1 ADC J1-02 FB XXXX1 ADC J1-03 FB XXXX1 ADC J1-06 FB XXXX1 ADC J1-07 FB XXXX1 ADC J1-10 FB XXXX1 ADC J1-11 FB XXXX1 ADC J1-12 FB XXXX1 ADC J1-13 FB XXXX1 ADC J1-14 XXXX ADC J1-15 XXXX ADC J1-20 FB XXXX1 ADC J1-22 FB XXXX1 ADC J1-23 FB XXXX1 ADC J2-01 FB XXXX1 ADC J2-02 FB XXXX1 ADC J2-03 FB XXXX1 ADC J2-04 FB XXXX1 ADC J2-05 FB XXXX1 ADC J2-07 FB XXXX1 ADC J2-08 FB XXXX1 ADC J2-09 FB XXXX1 ADC J2-10 FB XXXX1 ADC J2-11 FB XXXX1 ADC J2-12 FB XXXX1 ADC J2-13 FB XXXX1 ADC J2-15 FB XXXX1 ADC J2-16 FB XXXX1 ADC J2-19 FB XXXX1 ADC J2-20 FB XXXX1 ADC J2-22 FB XXXX1 ADC J2-23 FB XXXX1 ADC J2-25 XXXX ADC J2-26 FB XXXX1 ADC J2-27 FB XXXX1 ADC J2-31 FB XXXX1 ADC J2-32 FB XXXX1 ADC J2-33 FB XXXX1	Left and Right arrow keys scroll through the inputs. 1st Line = ADC

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
		ADC J2-34 FB XXXX1 ADC J2-35 FB XXXX1 ADC J3-01 IS XXXX1 ADC J3-02 IS XXXX1 ADC J3-04 IS XXXX1 ADC J3-05 IS XXXX1 ADC J3-06 IS XXXX1 ADC J3-13 XXXX ADC J3-14 IS XXXX1 ADC J4-12 FB XXXX1 ADC J7-2 XXXX ADC J7-04 XXXX ADC J7-07 XXXX ADC J7-08 XXXX ADC J7-20 XXXX ADC J8-02 XXXX ADC AMBIENT XXXX1 ADC VOFCS XXXX1	
	FREQUENCY INPUTS	FREQ IN J1-16 XXXXX HZ FREQ IN J12-1 XXXXX HZ FREQ IN J12-2 XXXXX HZ	Left and Right arrow keys scroll through the inputs. 1st Line = FREQ IN JX.XX and 2nd Line displays frequency of measurement XXXXX Hz
DATALOG	DATALOG TIME	ON XXXXH XXM	*Controller On time
	DATALOG TIME	ENGINE XXXXH XXM	*Engine Running time
	DATALOG TIME	ENABLD XXXXH XXM	*Combined time for Machine Enabled in Platform Mode while ENGINE RUNNING + any function active while in Ground Mode (excludes APU/ Emergency Descent)
	DATALOG TIME	AUX XXXXH XXM	Auxiliary Power/Emergency Descent Active time
	DATALOG TIME	DRIVE XXXXH XXM	Drive Forward + Reverse time
	DATALOG TIME	DRV MS XXXXH XXM	Max Speed Drive Forward + Reverse time
	DATALOG TIME	DRV MT XXXXH XXM	Max Torque Drive Forward + Reverse time
	DATALOG TIME	DRV ME XXXXH XXM	Mid Engine Drive Forward + Reverse time
	DATALOG TIME	DRV CP XXXXH XXM	Creep Drive Forward + Reverse time
	DATALOG TIME	STEER XXXXH XXM	Steer Left + Right time
	DATALOG TIME	SWING XXXXH XXM	Swing Left + Right time
	DATALOG TIME	LIFT XXXXH XXM	Lift Up + Down time
	DATALOG TIME	TELE XXXXH XXM	Tele In + Out time
	DATALOG TIME	JIB XXXXH XXM	Jib Lift Up + Down time (MACHINE SETUP → JIB = YES)
	DATALOG TIME	LEVEL XXXXH XXM	Platform Level Up + Down time
	DATALOG TIME	ROTATE XXXXH XXM	Platform Rotate Left + Right time
	DATALOG TIME	GEN XXXXH XXM	*Generator Enable Relay on time

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
	For time logging of functions with 30-second resolution, the first 15 seconds of function run time shall be logged as a ½ minute increment and there after every 30 seconds of run time shall be logged as a ½ minute increment. *The functions annotated with an asterisk in the description are function timers with 60-second resolution, for which the timer in the rule above is doubled.		
	DATALOG CYCLES	DRVE FWD XXXXXXX	Number of times Drive Forward is commanded
	DATALOG CYCLES	DRVE REV XXXXXXX	Number of times Drive Reverse is commanded
	DATALOG CYCLES	STEER LT XXXXXXXX	Number of times Steer Left Output is commanded
	DATALOG CYCLES	STEER RT XXXXXXXX	Number of times Steer Right Output is commanded
	DATALOG CYCLES	SWING LT XXXXXXX	Number of times Swing Left output is commanded
	DATALOG CYCLES	SWING RT XXXXXXX	Number of times Swing Right output is commanded
	DATALOG CYCLES	LIFT UP XXXXXXX	Number of times Lift Up output is commanded
	DATALOG CYCLES	LIFT DN XXXXXXX	Number of times Lift Down output is commanded
	DATALOG CYCLES	TELE IN XXXXXXX	Number of times Tele In output is commanded
	DATALOG CYCLES	TELE OUT XXXXXXX	Number of times Tele Out output is commanded
	DATALOG CYCLES	JIB UP XXXXXXX	Number of times Jib Lift Up is commanded (MACHINE SETUP ⟶ JIB = YES)
	DATALOG CYCLES	JIB DOWN XXXXXXX	Number of times Jib Lift Down is commanded (MACHINE SETUP⟶ JIB = YES)
	DATALOG CYCLES	LEVEL UP XXXXXXX	Number of times Level Up is commanded
	DATALOG CYCLES	LEVEL DN XXXXXXX	Number of times Level Down is commanded
	DATALOG CYCLES	ROT LEFT XXXXXXX	Number of times Rotate Left is commanded
	DATALOG CYCLES	ROT RGHT XXXXXXX	Number of times Rotate Right is commanded
	DATALOG CYCLES	UGM ON XXXXXXX	Number of times Power is applied
	DATALOG CYCLES	GND OPS XXXXXXX	Number of times machine is in Ground Mode and any function is active (excludes APU/ Emergency Descent)
	DATALOG CYCLES	PLAT OPS XXXXXXX	Number of times machine is Enabled from Platform Station (excludes APU/Emergency Descent)
	DATALOG CYCLES	AUX OPS XXXXXXX	Number of times machine Auxiliary Power/Emergency Descent is Enabled
	DATALOG CYCLES	GEN ON XXXXXXX	Number of times Generator Enable Relay is turned On; information logged and stored only if machine configured for generator.
	DATALOG CYCLES	BOOM TR XXXXXXX	Number of times the Boom transitions from Below Elevation to Above Elevation
	DATALOG CYCLES	DUAL CAP XXXXXXX	Number of times the Boom transitions from Restricted to Unrestricted mode (Dual Capacity is configured)
	Cycle counter shall increment up to a limit of 1,000,000, except Steer shall have a limit of 2,000,000 per direction.		
	DATALOG: MAX	UGM TEMP XXXC/	Hottest Temp observed by UGM
		UGM TEMP XXXF	
	DATALOG: MIN	UGM TEMP XXXC/	Coldest Temp observed by UGM
		UGM TEMP XXXF	

Table 6-6. Machine Diagnostics Parameters

Diagnostics Submenu (Displayed on Analyzer 1st Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Description
	DATALOG: MAX	UGM VOLT XX.XV	Maximum input voltage observed by UGM
	DATALOG: MACHINE	RENTAL XXXXH XXM	*Stores Machine hours since last memory clear
	DATALOG: ERASE 2	MACHINE RENTAL?	Erases stored machine rental hours
VERSIONS:	UGM	SOFTWARE PX.X	
	UGM	CNST DATA PX.X	
	UGM	HARDWARE REV X	
	UGM	SN XXXXXX	
	ugm	PN XXXXXXXXXX	
	PLATFORM MODULE	SOFTWARE PX.X	
	PLATFORM MODULE	HARDWARE REV X	
	PLATFORM MODULE	SN XXXXXX	
	LSS MODULE	SOFTWARE PX.X	Displayed on if LSS is configured (4-Cell LSS)
	LSS MODULE	HARDWARE REV X	Display if LSS is configured (4-Cell LSS)
	TCU MODULE	SOFTWARE X.Xx	Displayed on if TCU is configured
	TCU MODULE	HARDWARE REV X	Displayed on if TCU is configured
	TCU MODULE	SN XXXXXX	Displayed on if TCU is configured
	ANALYZER	ANALYZER vX.X	

6.8 CALIBRATING TILT SENSOR

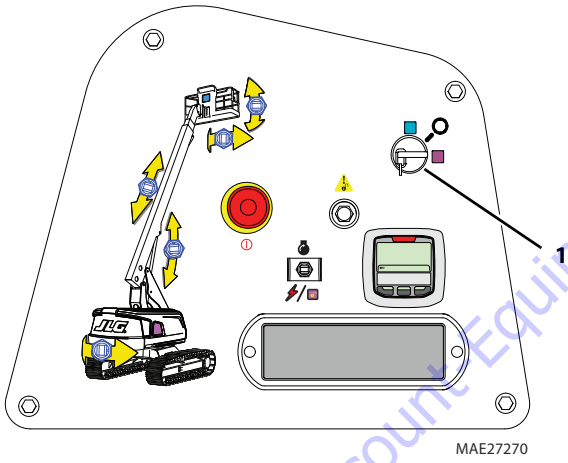
NOTICE

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

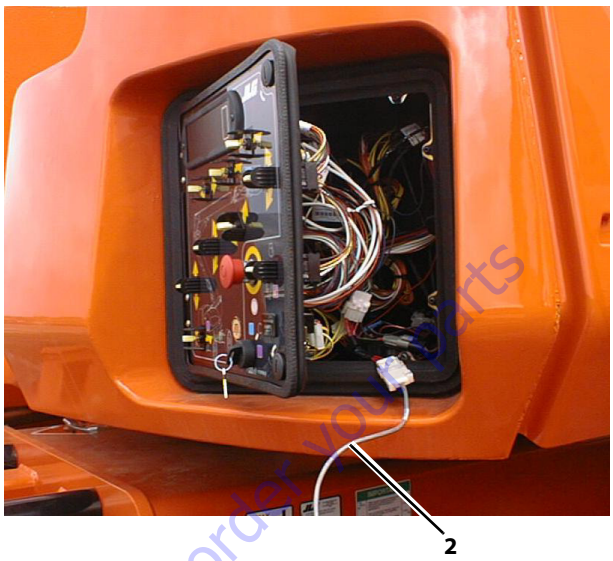
⚠ WARNING

DO NOT CALIBRATE THE LEVEL SENSOR EXCEPT ON A LEVEL SURFACE.

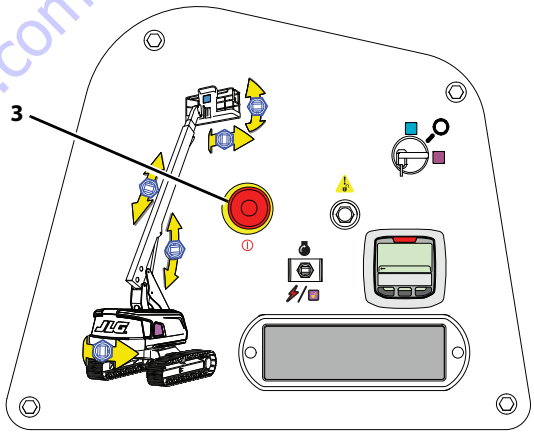
1. Use the following procedure to calibrate the tilt sensor.
2. Before the tilt sensor can be calibrated, the following conditions must be met:
   a. Turntable centered.
   b. Boom fully retracted.
   c. Boom angle is less than 45°.
   d. Machine on firm, level ground.
3. Position the Platform/Ground select switch (1) to the Ground position.



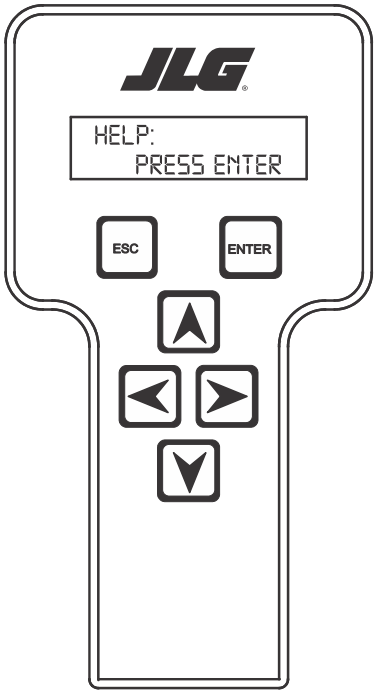
4. Plug the analyzer into the connector (2) at the base of the Ground control box.



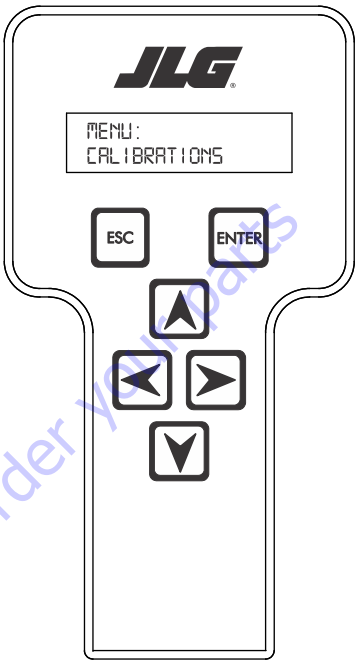
5. Pull out the Emergency Stop switch (3) and Start the engine.



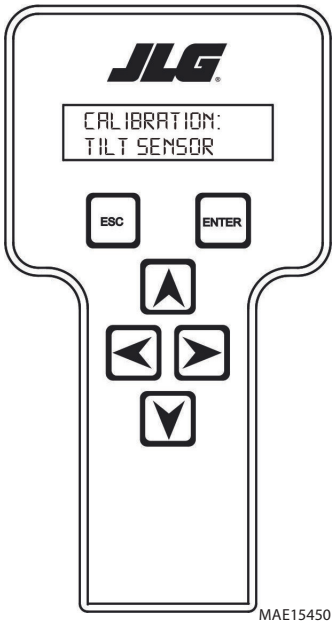
6. The analyzer screen should read:



7. Use the arrow button to reach SERVICE ACCESS. Hit Enter.
8. Enter the Access Code, 33271.
9. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.
10. Using the arrow keys, navigate to Calibrations Menu as shown below and press **ENTER** ENTER.

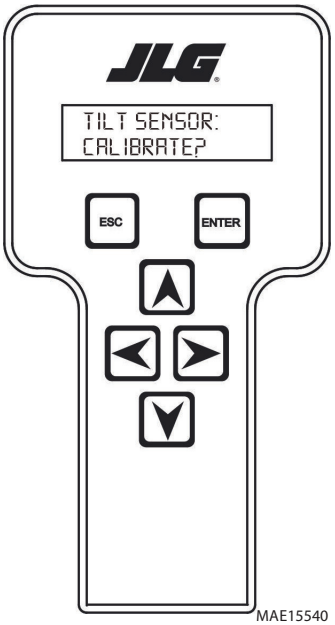


11. Using the arrow keys, navigate to the Tilt Sensor calibration as shown below and press **ENTER** ENTER



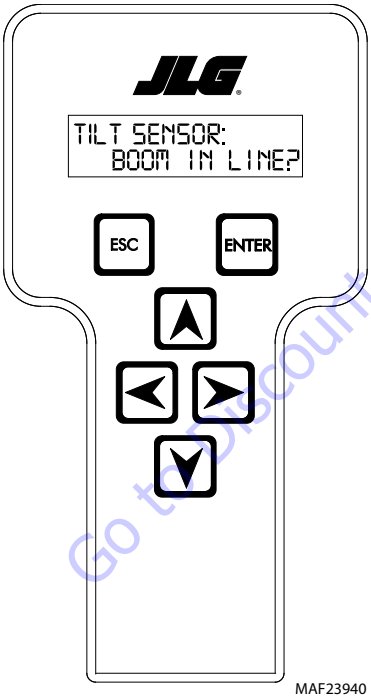
MAE15450

12. Hit Enter. The screen will read.

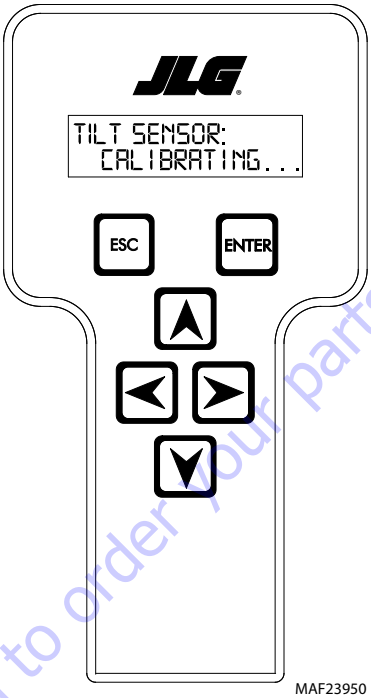


MAE15540

13. UGM will confirm the position of the boom, then the screen will read:

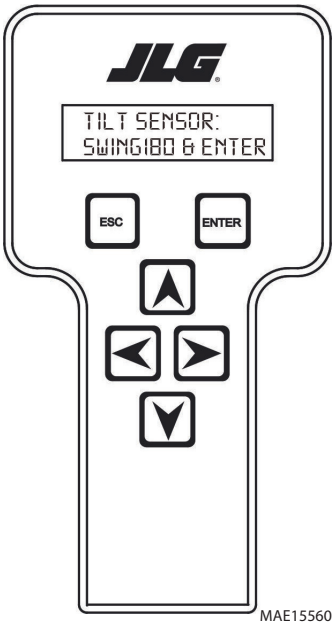


MAF23940



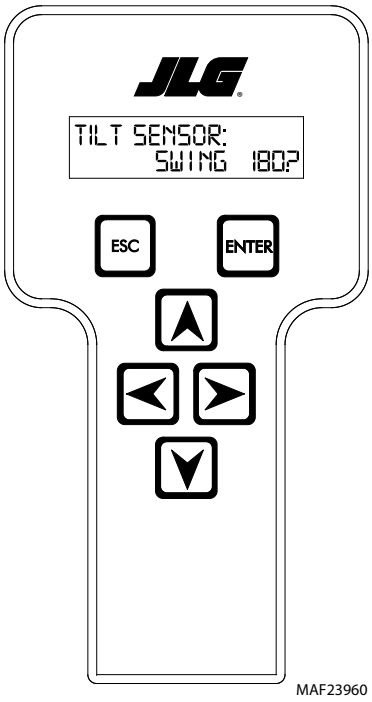
MAF23950

14. When the sensor is calibrated in that position, the screen will read:

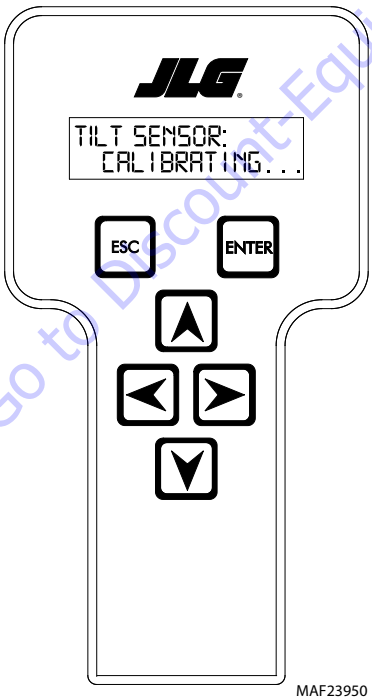


MAE15560

15. Swing the machine 180 degrees, making sure the boom is centered and in the transport position, and **ENTER** ENTER. The screen will read:



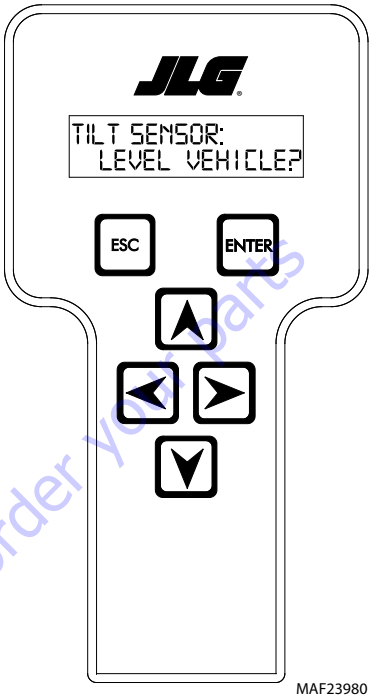
MAF23960



MAF23950

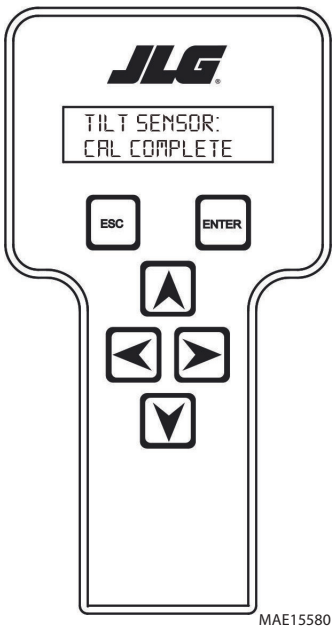
16. Hit Enter. The screen will read.

NOTE: *Screen appears only if the machine is on more then a 3 degree slope.*



MAF23980

17. When the calibration is complete the screen will read as shown below. Return the machine to the travel position.

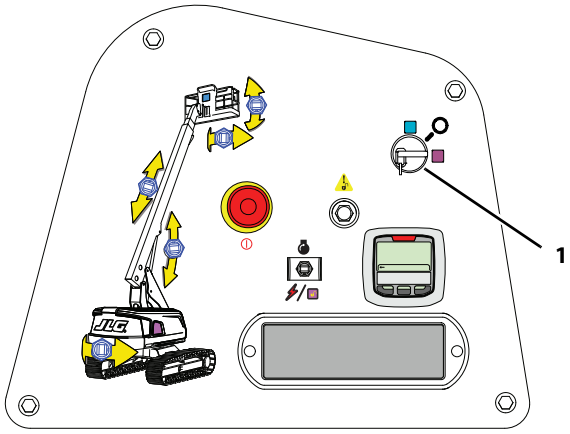


MAE15580

18. Hit ESC twice to go back to CALIBRATIONS.

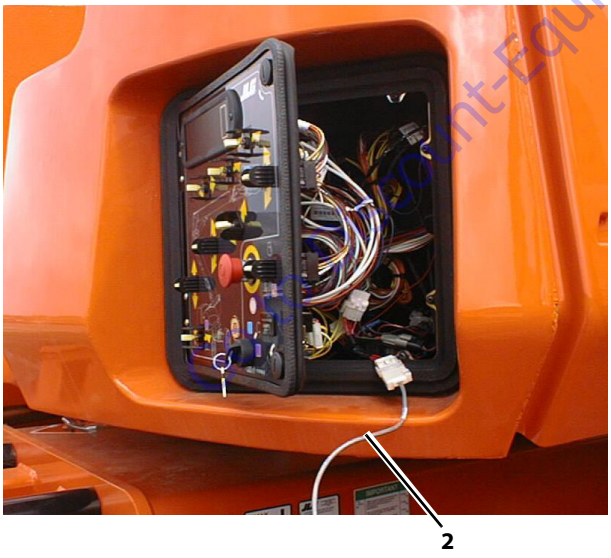
6.9 CALIBRATING BOOM ANGLE

1. Use the following procedure to calibrate the boom angle sensor.
2. Before the tilt sensor can be calibrated, the following conditions must be met:
   a. Tilt sensor previously calibrated.
   b. Machine on firm, level ground.
3. Position the Platform/Ground select switch (1) to ground.

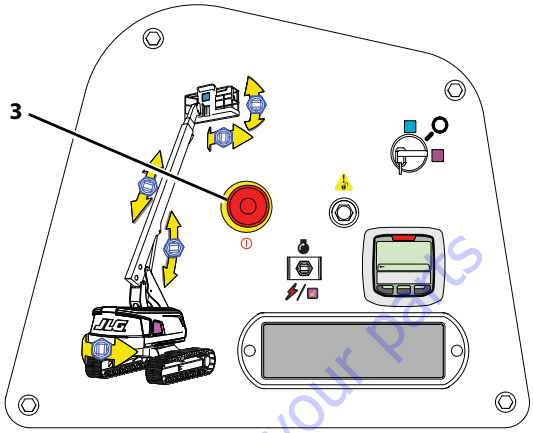


MAE27270

4. Plug the analyzer into the connector (2) at the base of the Ground control box.

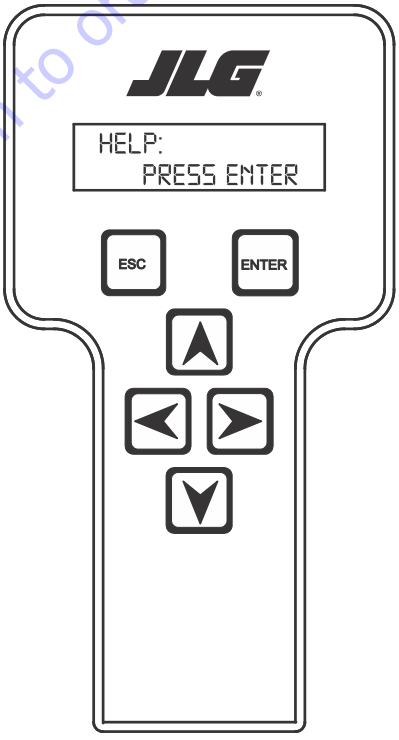


5. Pull out the Emergency Stop switch (3) and Start the engine.



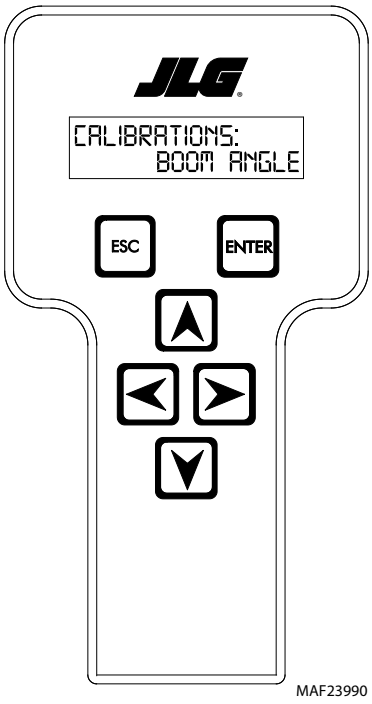
MAE27270

6. The analyzer screen should read:



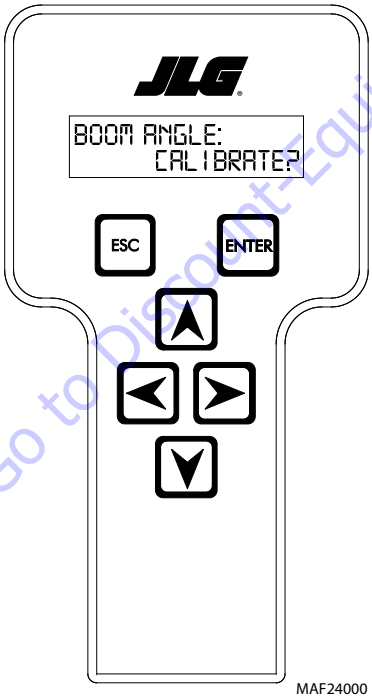
7. Use the arrow button to reach SERVICE ACCESS. Hit Enter.
8. Enter the Access Code, 33271.
9. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

10. Use arrow keys to reach BOOM ANGLE. The Screen will read:



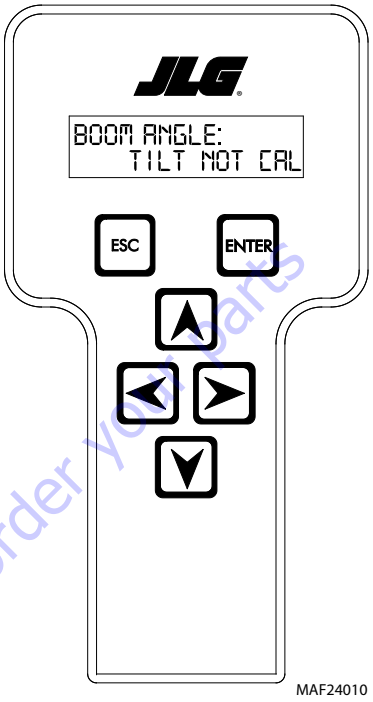
MAF23990

11. Hit Enter. The screen will read.



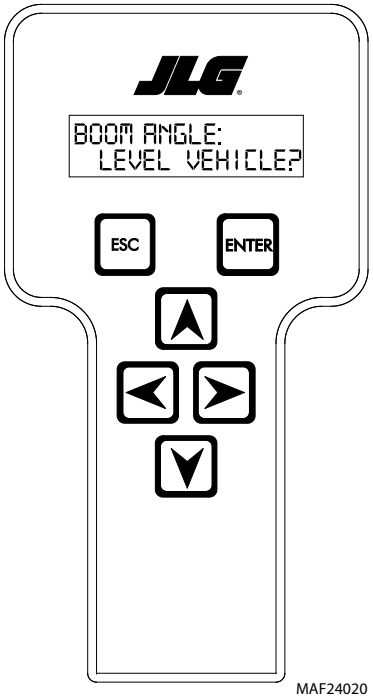
MAF24000

12. UGM will confirm the tilt sensor calibration. The screen will read.



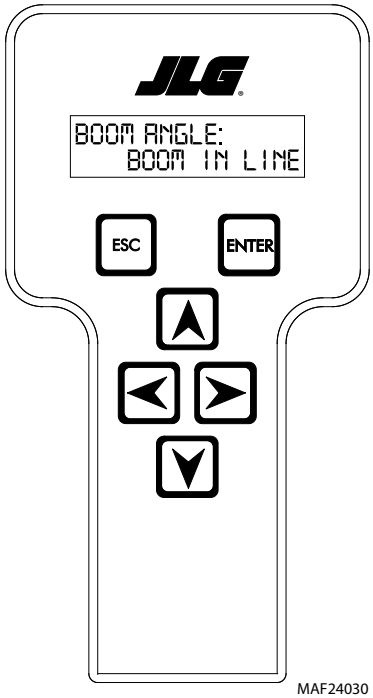
MAF24010

13. Hit Enter. The screen will read.



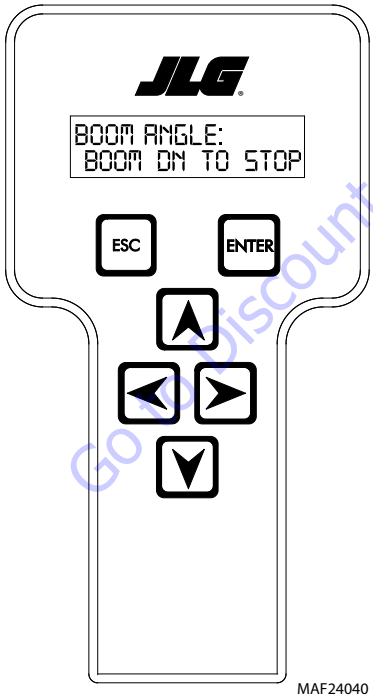
MAF24020

14. UGM will confirm the Boom In-Line position. The screen will read:



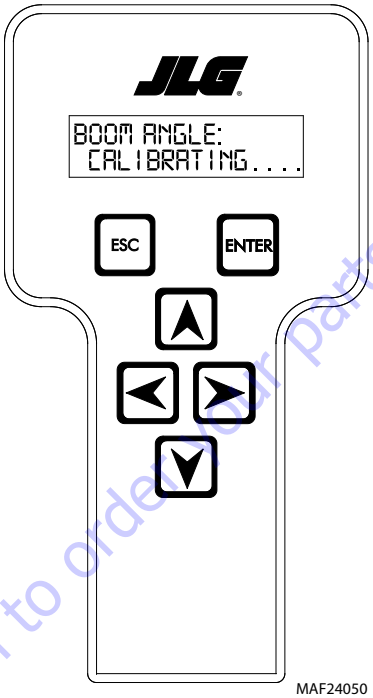
MAF24030

15. Hit Enter. The Screen will read:



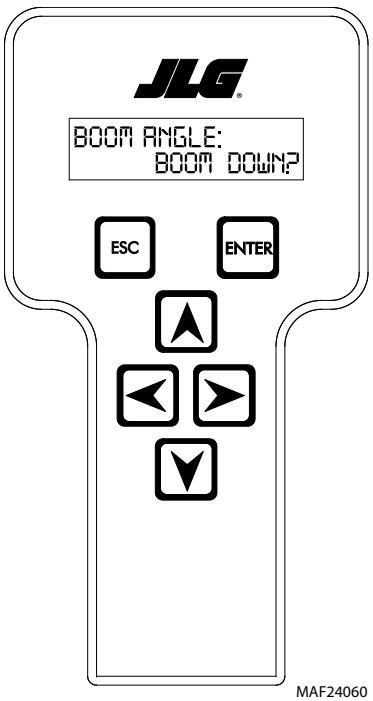
MAF24040

16. When the sensor is calibrated at lower position of the boom. The screen will read:



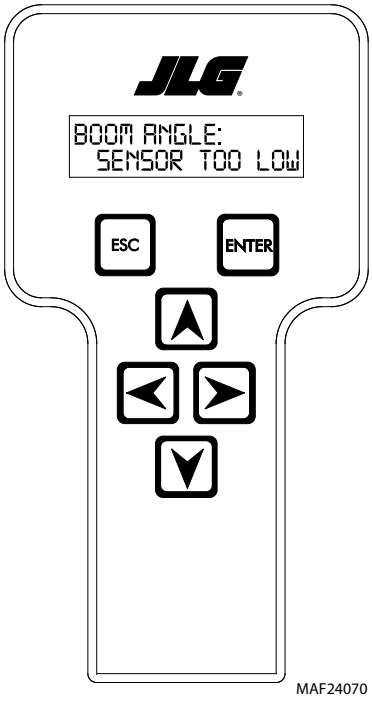
MAF24050

17. Hit Enter. The Screen will read:



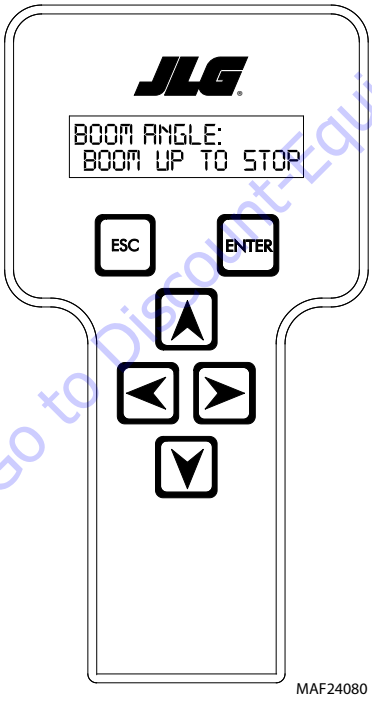
MAF24060

18. Hit Enter. The Screen will read:



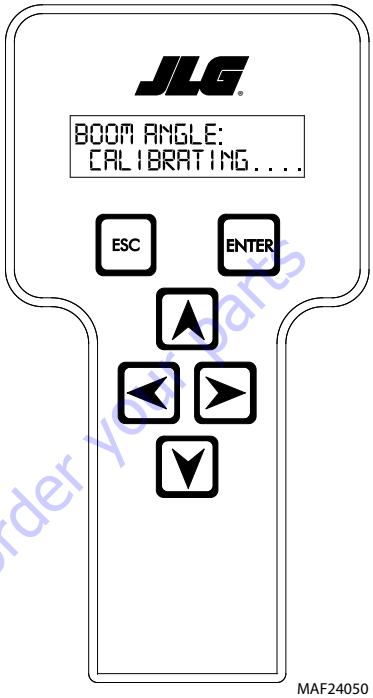
MAF24070

19. UGM will confirm the position of the boom. Press Enter. The screen will read:



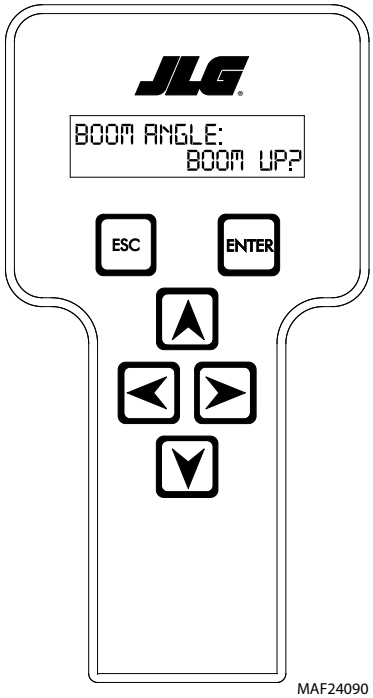
MAF24080

20. When the sensor is calibrated at upper position of the boom. The screen will read:



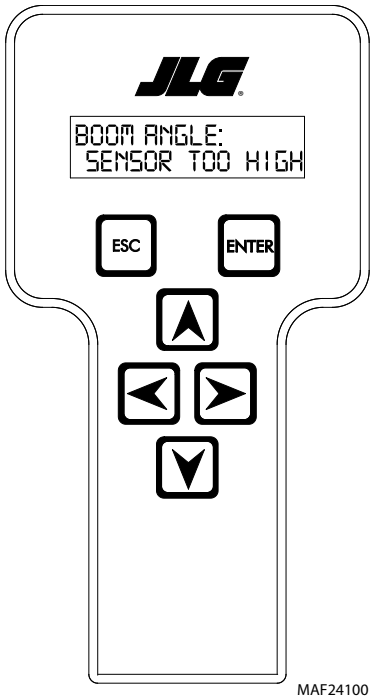
MAF24050

21. UGM will confirm the position of the boom. Press Enter. The screen will read:



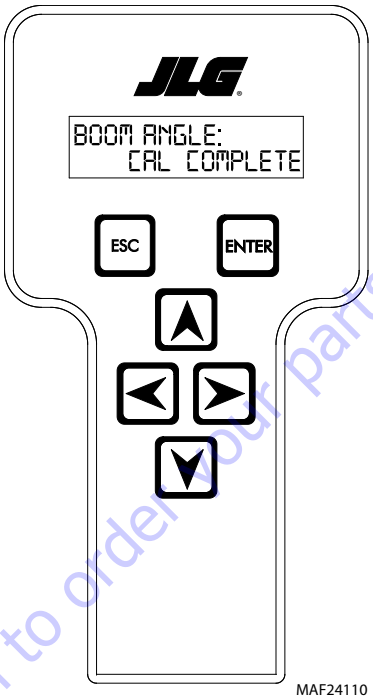
MAF24090

22. Hit Enter. The Screen will read:



MAF24100

23. After few seconds. The screen will read:

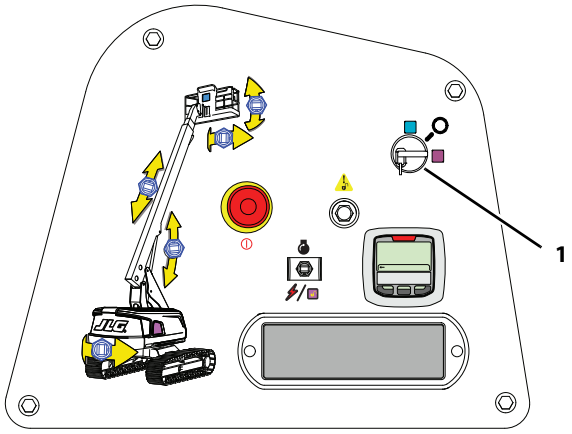


MAF24110

24. Hit ESC twice to go back to CALIBRATIONS.

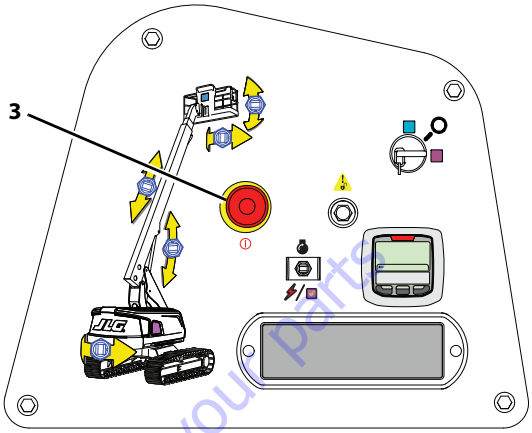
6.10 CALIBRATING LEVEL UP CRACKPOINT

1. Position the Platform/Ground select switch (1) to ground.

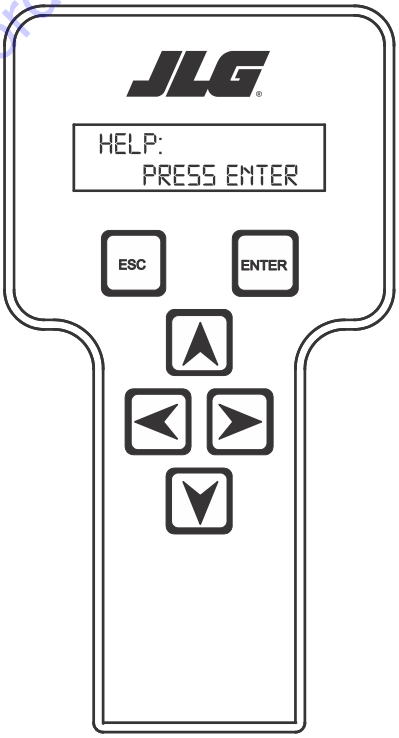


2. Plug the analyzer into the connector (2) at the base of the Ground control box.

3. Pull out the Emergency Stop switch (3) and Start the engine.

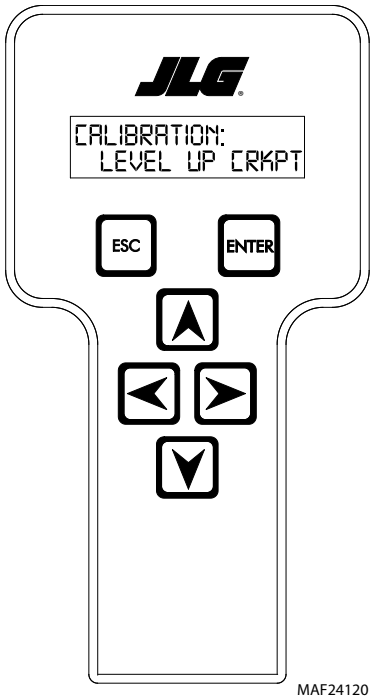


4. The analyzer screen should read:



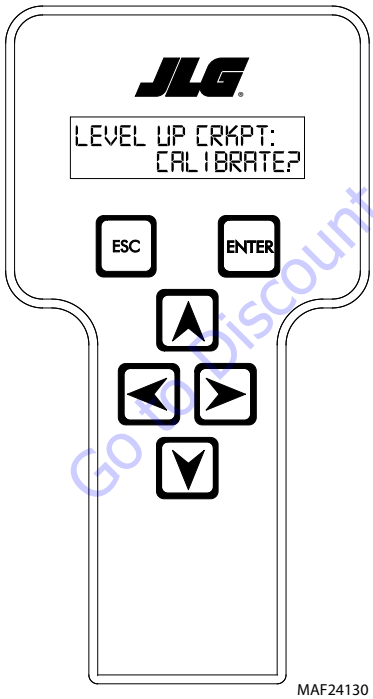
5. Use the arrow button to reach SERVICE ACCESS. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

8. Use the arrow keys to reach LEVEL UP CRKPT. The screen will read.



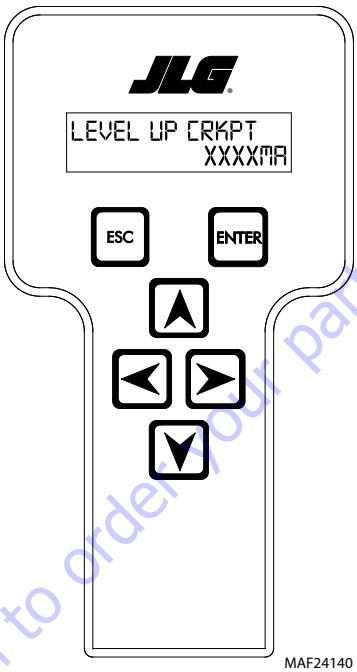
MAF24120

9. Hit Enter. The screen will read.



MAF24130

10. Use arrow keys to increase the value until the function begins to move.



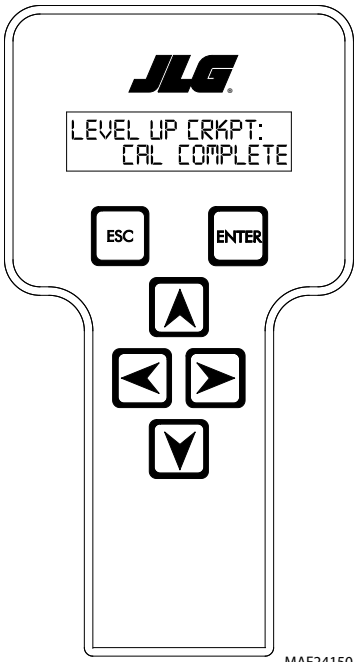
MAF24140

11. Engine RPM will reach to 1400 RPM.

12. Using UP ARROW, increase the value until you see the basket up movement.

NOTE: *Maximum Crack Point value is 1200mA. Calibration will fail if the value is increased to more than 1200mA.*

13. Hit Enter. After few seconds, The screen will read:

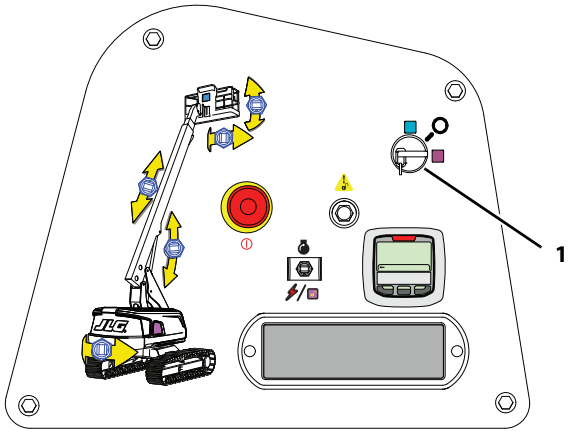


MAF24150

14. Hit ESC twice to go back to CALIBRATIONS.

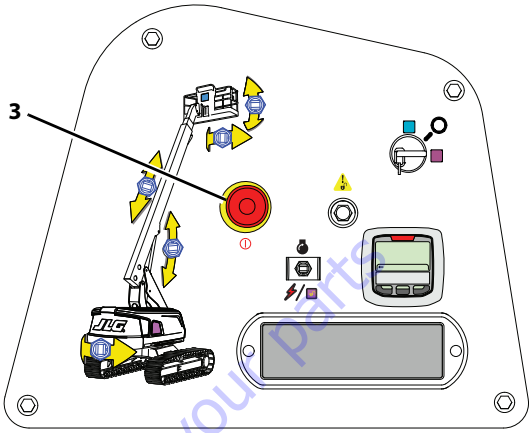
6.11 CALIBRATING LEVEL DOWN CRACKPOINT

1. Position the Platform/Ground select switch (1) to ground.

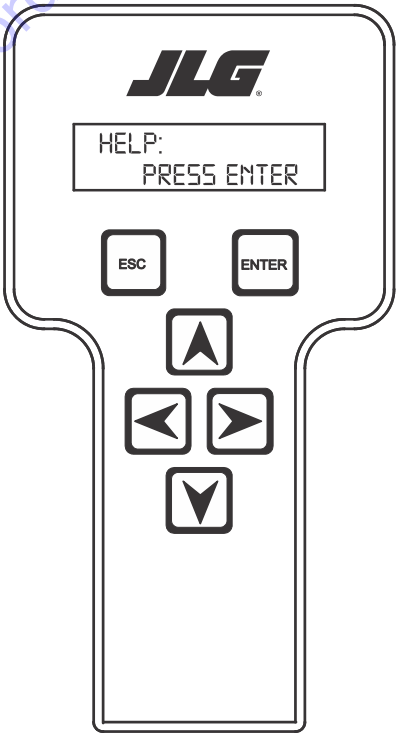


2. Plug the analyzer into the connector (2) at the base of the Ground control box.

3. Pull out the Emergency Stop switch (3) and Start the engine.

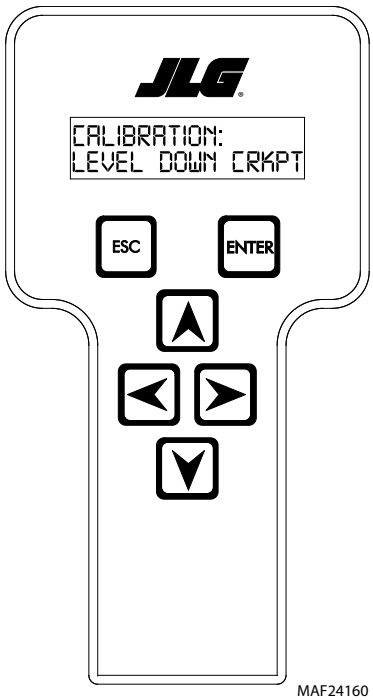


4. The analyzer screen should read:



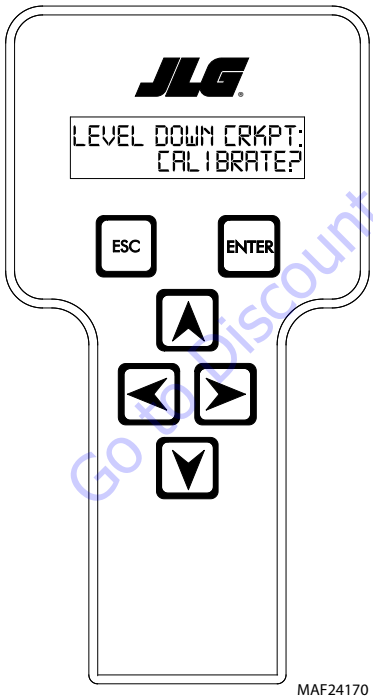
5. Use the arrow button to reach SERVICE ACCESS. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

8. Use the arrow keys to reach LEVEL DOWN CRKPT. The screen will read.



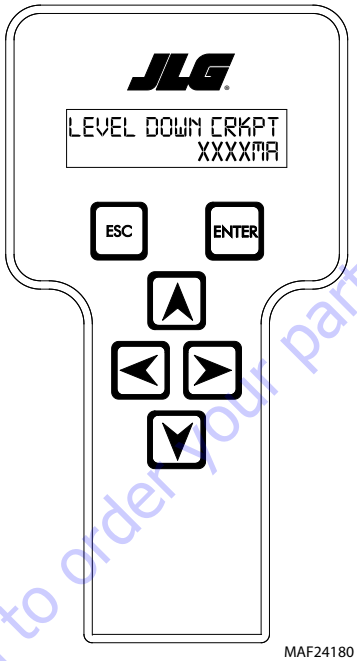
MAF24160

9. Hit Enter. The screen will read.



MAF24170

10. Use arrow keys to increase the value until the function begins to move.



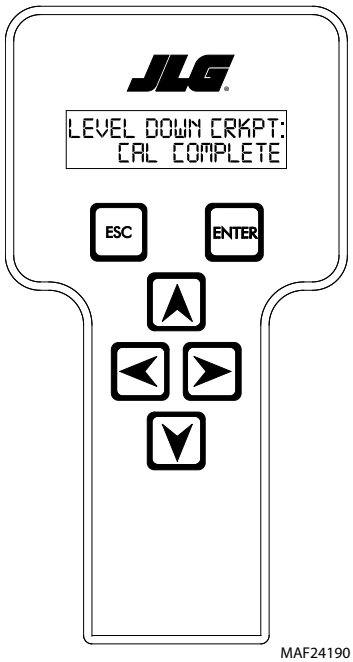
MAF24180

11. Engine RPM will reach to 1400 RPM.

12. Using UP ARROW, increase the value until you see the basket up movement.

NOTE: *Maximum Crack Point value is 1200mA. Calibration will fail if the value is increased to more than 1200mA.*

13. Hit Enter. After few seconds, The screen will read:

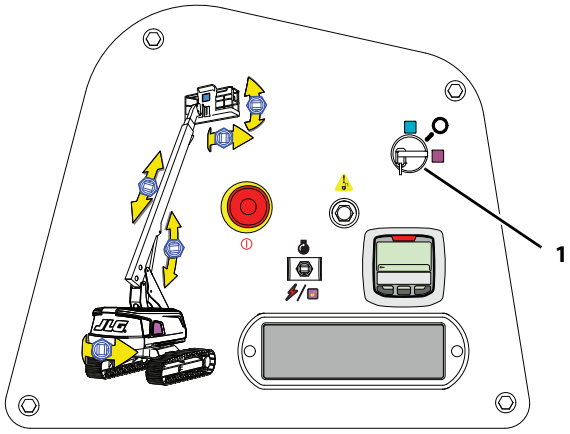


MAF24190

14. Hit ESC twice to go back to CALIBRATIONS.

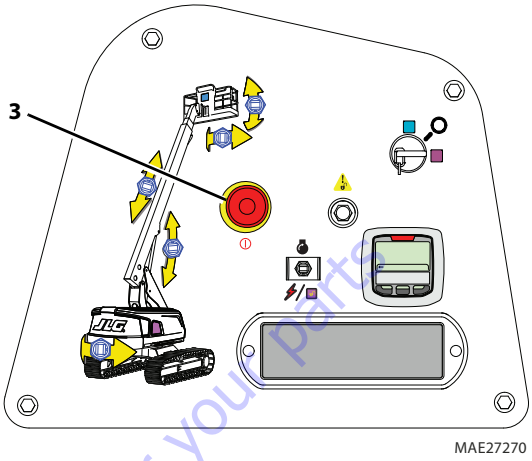
6.12 CALIBRATING PLATFORM ANGLE SENSOR

1. Position the Platform/Ground select switch (1) to ground.

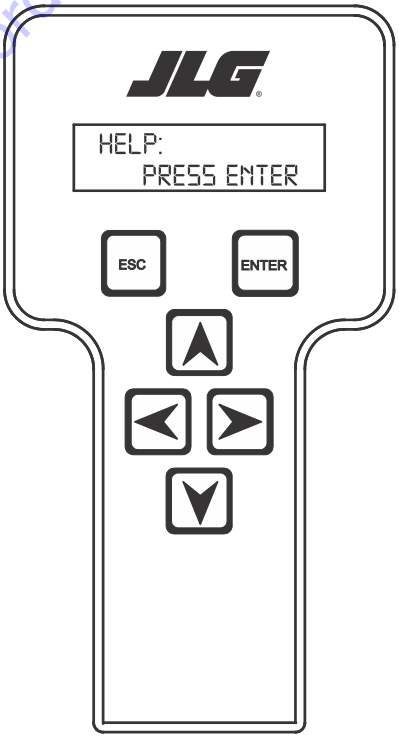


2. Plug the analyzer into the connector (2) at the base of the Ground control box.

3. Pull out the Emergency Stop switch (3) and Start the engine.

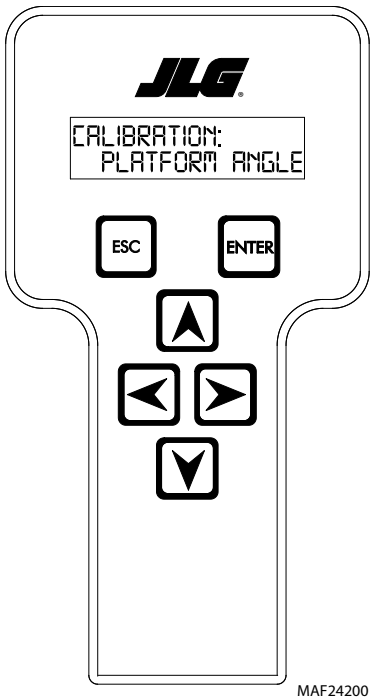


4. The analyzer screen should read:



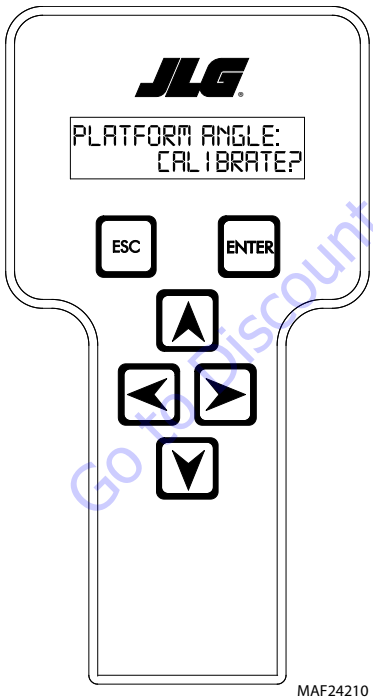
5. Use the arrow button to reach SERVICE ACCESS. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

8. Use the arrow keys to reach PLATFORM ANGLE. The screen will read.



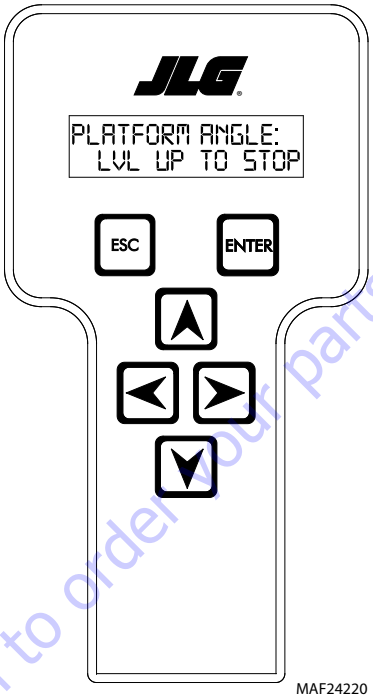
MAF24200

9. Hit Enter. The screen will read:



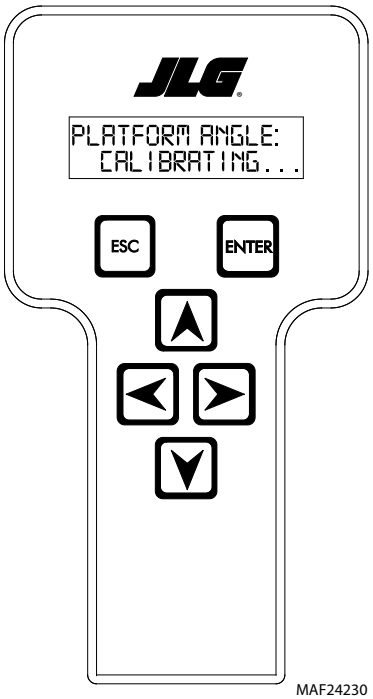
MAF24210

10. Hit Enter. The screen will read:



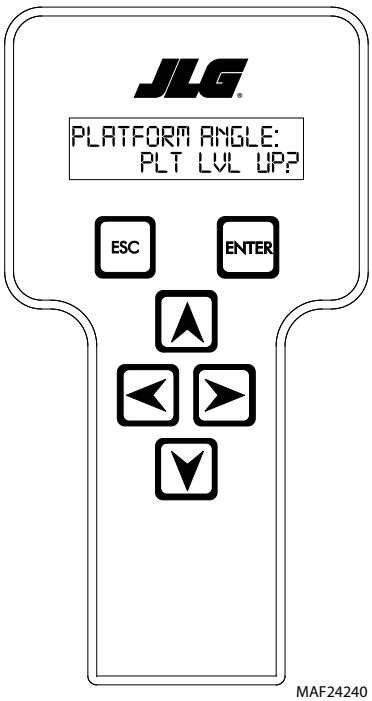
MAF24220

11. Hit Enter. The screen will read:



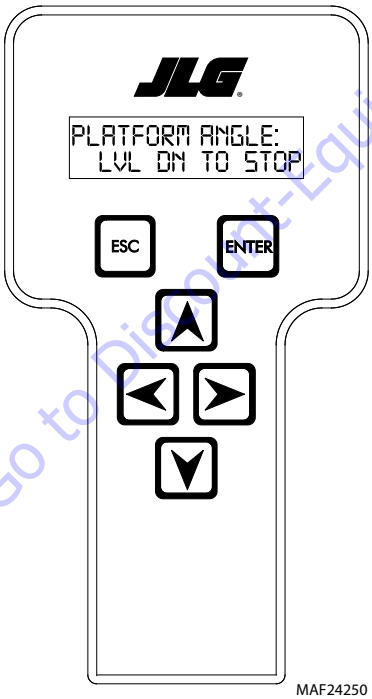
MAF24230

12. UGM will confirm Platform Angle Max sensor readings. The screen will read:



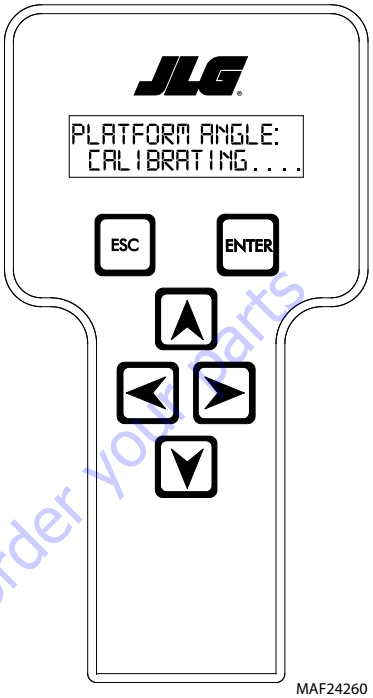
MAF24240

13. Hit Enter. The screen will read:



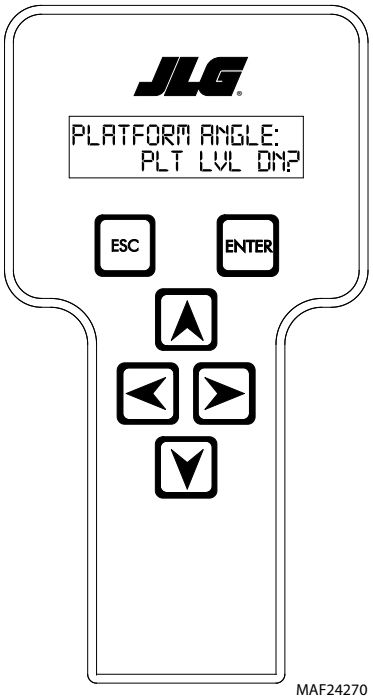
MAF24250

14. After few seconds. The screen will read:



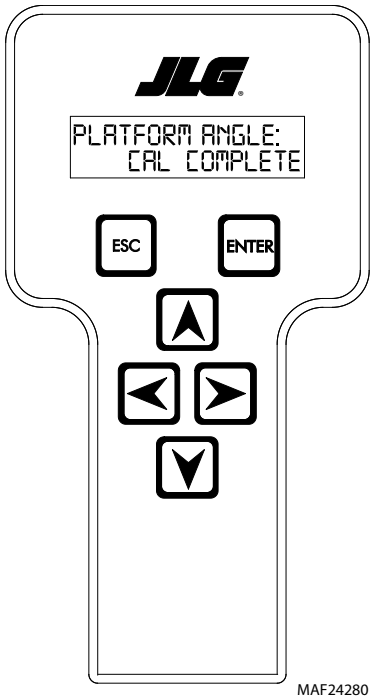
MAF24260

15. UGM will confirm Platform Angle Min sensor readings. The screen will read:



MAF24270

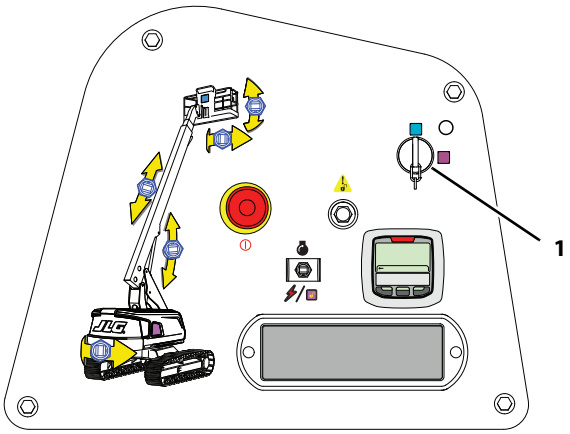
16. After few seconds. The screen will read:



17. Hit ESC twice to go back to CALIBRATIONS.

6.13 RESETTING THE MSSO SYSTEM

1. Position the Platform/Ground select switch (1) to the Platform position.



MAE27280

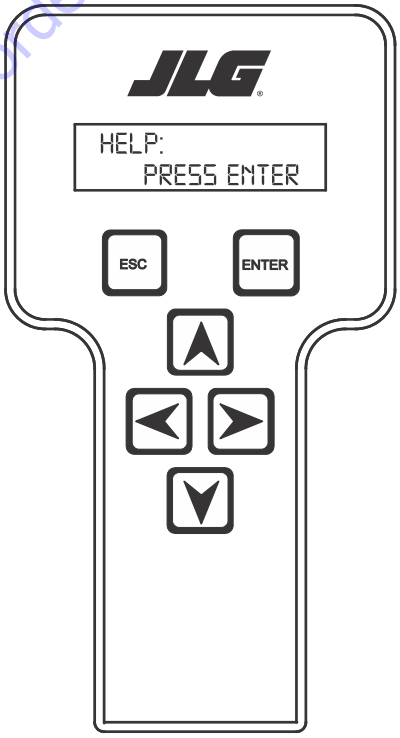
2. Plug the analyzer into the connector at the base of the platform control box.

MAE15680

3. Pull out the Emergency Stop switch and Start the engine.

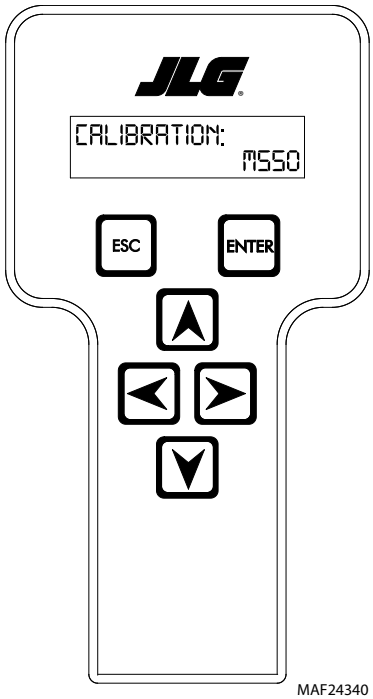
MAE17820

4. The analyzer screen should read:



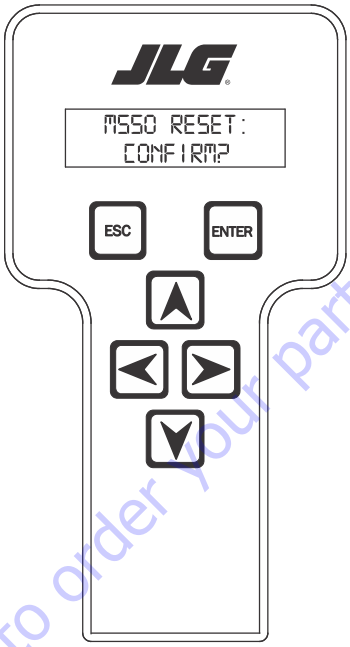
5. Use the arrow button to reach SERVICE ACCESS. Hit Enter.
6. Enter the Access Code, 33271.
7. Use the right Arrow key to reach CALIBRATIONS. Hit Enter.

8. Use the arrow keys to reach MSSO. The screen will read:



MAF24340

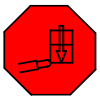
9. Hit Enter. The screen will read:



6.14 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 OFTHE FOLLOWING CONDITIONS OCCUR:

- **d.** LSS Sensor removal or replacement.
- **e.** Addition or removal of certain platform mounted accessories. (Refer to Calibration).
- **f.** 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 6-7, Diagnostic Menu Descriptions details the structure of the Diagnostic Menu, and describes the meaning of each piece of information presented.

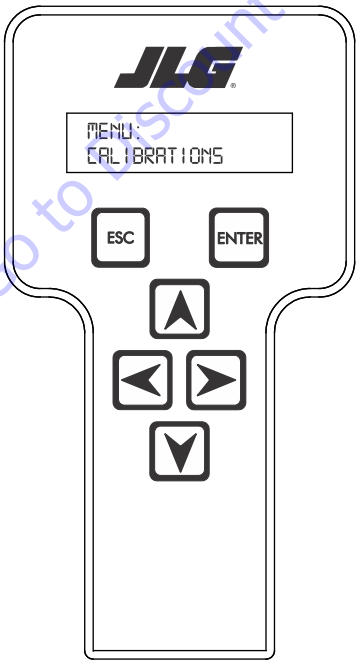
Table 6-7. Diagnostic Menu Descriptions

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

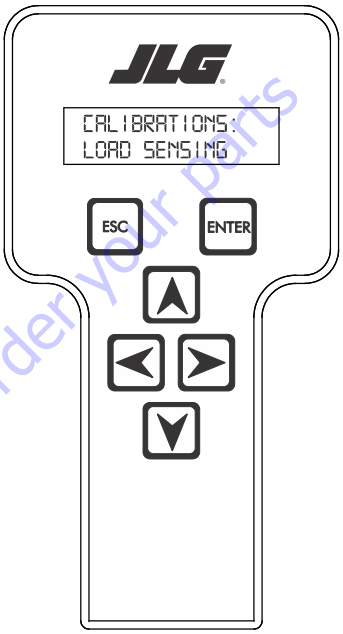
1. Remove everything from the platform, except permanently fixed JLG Accessories, to allow the Load Sensing System to record its' weight during calibration. This includes all tools, debris, and customer-installed devices.
2. Plug the JLG Analyzer into the Machine at the Ground Station and enter Service 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:

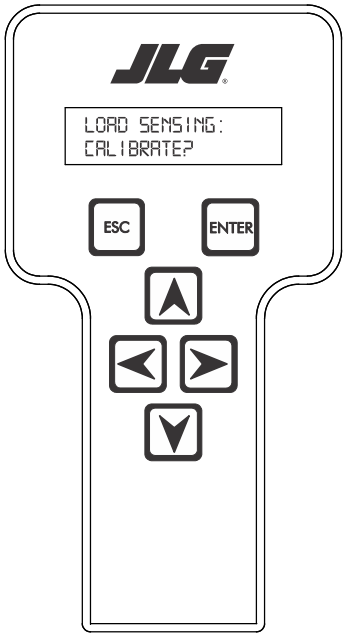


NOTE: *The Calibration Menu is not available in OPERATOR ACCESS.*

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:



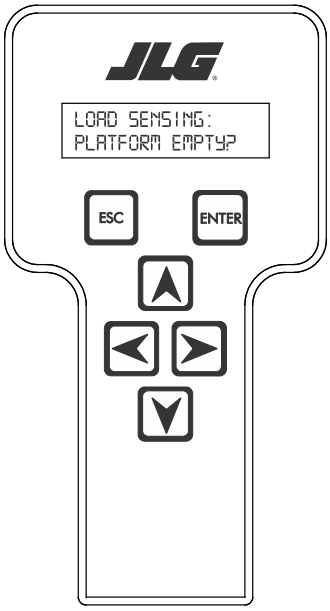
6. Press Enter ENTER. The Screen will read:



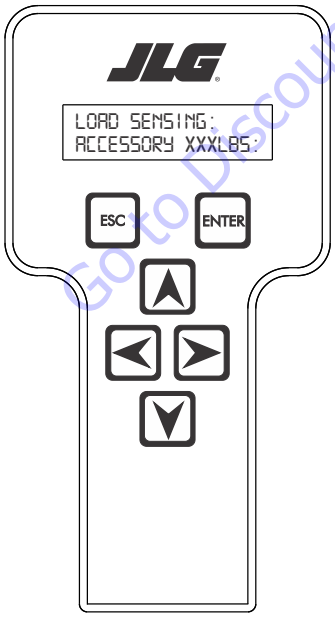
NOTE: *Calibration will auto fail if LSS DTC's are active (443, 444, 4479, 4480, 663, 821, 822, 823, 824, 8218, 8222 -> 8238, 991, 992, 993, 994 or 99285).*

Pressing the ESC [ESC] key 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 lb 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 6-8, Accessory Weights. Use the up and down analyzer keys to enter the accessory weight(s) (in lb). When all the accessory weights are entered, press ENTER [ENTER]. The screen will read:

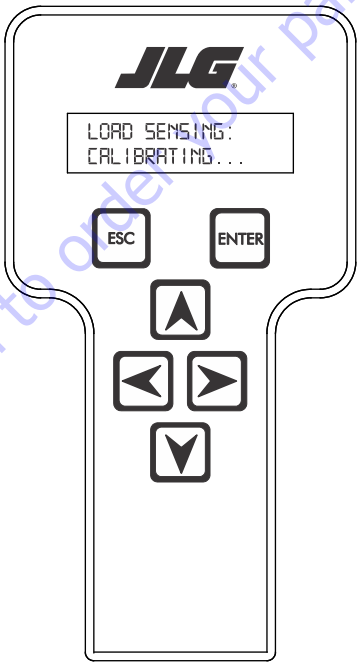


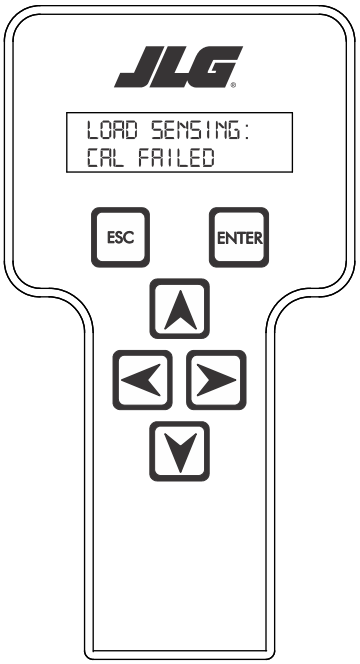
Table 6-8. Accessory Weights

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)
SkyCutter / SkyWelder Combo	140 lb (64 kg)
Fire Extinguisher	45 lb (20 kg)
Overhead SoftTouch	80 lb (36 kg)
Work Surface	20 lb (9 kg)

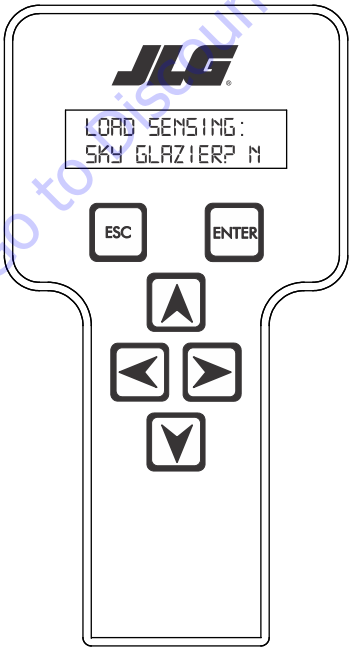
NOTE: *Not all Accessories are available on every JLG model. Some Accessory combinations are prohibited due to excessive weight and/or load restriction. If any installed JLG Accessories are labeled with weight decals but are not listed in the table above, include their weight when entering the ACC WEIGHT value.*

9. The control system will calculate the load cell readings and ensure it is greater than 130 lb (59 kg), but less than 575 lb(261 kg).

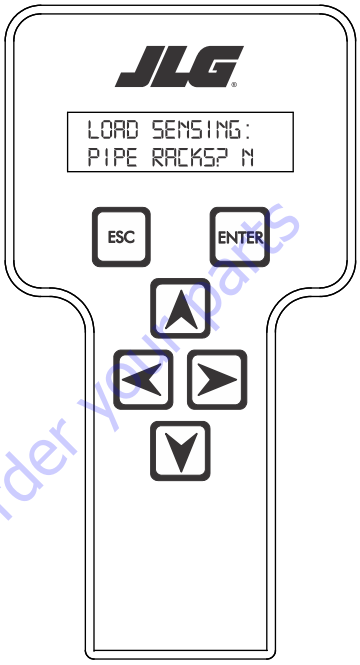
If the platform weight is not within the allowed range, the calibration attempt will be unsuccessful and the Analyzer will show the following:



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 6-9, SkyGlazier Capacity Reductions and Table 6-10, Pipe Rack Capacity Reductions. The screen will read:

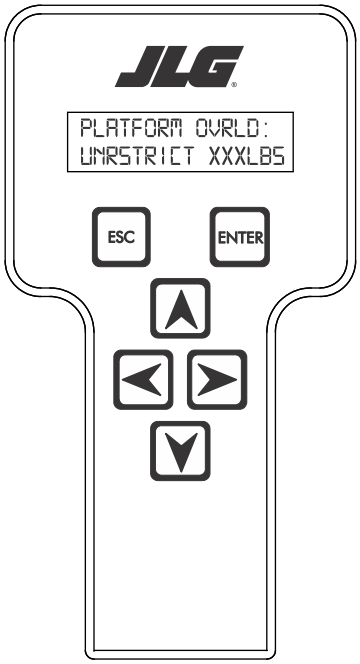


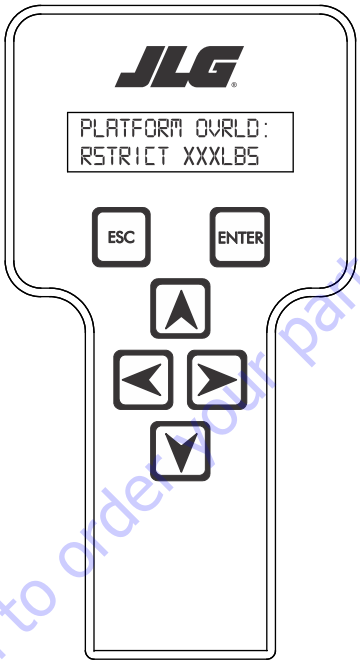
Table 6-9. SkyGlazier Capacity Reductions

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.*		

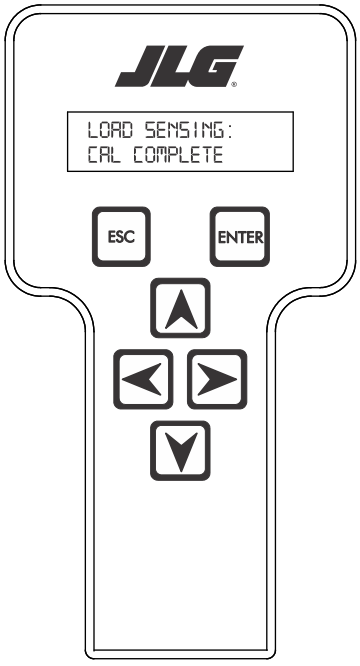
Table 6-10. Pipe Rack Capacity Reductions

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 6-9, SkyGlazier Capacity Reductions and Table 6-10, Pipe Rack Capacity Reductions.



14. Press ENTER (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 ±15lb (± 7kg). Further, the reading should be stable and should not vary by more than ±2lb (±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 500lb (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).

LSS Service Mode

To facilitate the servicing and enabling of functions due to component faults, there is a need to override the normal operation of the machine. Service Mode shall become visible only after entering Service Access Level.

Table 6-11. LSS Service Mode

Service Mode Submenu (Displayed on Analyzer 2nd Line)	Parameter (Displayed on Analyzer 1st Line)	Parameter Value (Displayed on Analyzer 2nd Line)	Transition and Software Checks
LSS? (NOT VISIBLE IF MACHINE SETUP? LOAD SYSTEM = NO)	LSS:	CODE: XXXXX	Operator uses Up and Down Arrow keys on Analyzer to input Service Mode Code; On ENTER, UGM to confirm code of 18171. If correct advance to next menu. If incorrect or on ESC, go to SERVICE MODE menu.
	LSS:	SERVICE ON	The UGM shall treat MACHINE SETUP --> LOAD SYSTEM as if it is set to WARN ONLY until: - Power is Cycled - Analyzer is disconnected - ESC is pressed On ESC, go to SERVICE MODE menu.
DRV CUT? (NOT VISIBLE IF MACHINE SETUP --> TILT = X DEGREES)	DRY CUT:	CODE: XXXXX	Operator uses Up and Down Arrow keys on Analyzer to input Service Mode Code; On ENTER, UGM to confirm code of 23732. If correct advance to next menu. If incorrect or on ESC, go to SERVICE MODE menu.
	DRY CUT:	SERVICE ON	UGM shall treat MACHINE SETUP -->TILT as if it is set to X DEGREES (where X is the currently selected tilt degree value) until: - Power is Cycled - Analyzer is disconnected - ESC is pressed On ESC, go to SERVICE MODE menu.

LSS Service Mode Event Log

The Service Mode events listed below shall be stored in the Service Mode event log (DIAGNOSTICS --> DATALOG --> SERVICE LOG) if their corresponding conditions are met.

- SERVICE LSS – Logged when the LSS Service mode transitions from OFF to ON
- SERVICE DRV CUT – Logged when the LSS Service mode transitions from OFF to ON

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 6-12. LSS Troubleshooting Chart

Difficulty	Possible Resolution
Empty Platform Weight (DIAGNOSTICS, PLATFORM LOAD) is not within ±15lb (±7 kg) of zero. or Platform Load readings (DIAGNOTICS, PLTLOAD) are unstable by more than ±2lb (±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 20lb 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 ±2 lb (±1 kg) (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 (>6000lb [>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.

6.15 MACHINE FAULT CODES

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
001	EVERYTHING OK	Machine is in Platform Mode; The UGM determines no problems exist	
002	GROUND MODE OK	Machine is in Ground Mode; The UGM determines no problems exist	
0010	RUNNING AT CUTBACK – OUT OF TRANSPORT POSITION	Machine is in the Out of Transport position	Machine is not in the Out of Transport position
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; Telescope; Platform Level; Platform Rotate; Jib Lift (if MACHINE SETUP ⟶ JIB = YES)	Controls initialized
0012	RUNNING AT CREEP - CREEP SWITCH OPEN	Machine is in Platform Mode; Platform Creep switch input = HIGH; DTC 0013 is not active	Platform Creep switch input = Low
0013	RUNNING AT CREEP - TILTED AND ABOVE ELEVATION	Machine is in Platform Mode; The Boom is Above Elevation; Machine chassis is considered Tilted	Not all of the trigger conditions are met
0015	LOAD SENSOR READING UNDER WEIGHT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; UGM determines that the Platform Load < -50 lb for 2 seconds; Do not report if DTC (0030, 825 or 8211) is active or if Platform Load == Unhealthy	UGM determines that the Platform Load >= -50 lb for 5 seconds
0031	FUEL LEVEL LOW – ENGINE SHUT-DOWN	MACHINE SETUP ⟶ FUEL LEVEL ≠ NONE; Engine Shutdown has occurred due to Fuel Level = EMPTY condition.	Power Cycled
0035	APU ACTIVE	Auxiliary Power/Emergency Descent Mode is active	Auxiliary Power/Emergency Descent Mode is not active

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
0036	FUNCTION PREVENTED - FUNCTION SELECTED BEFORE GROUND ENABLE	Machine is in Ground Mode; (Jumper Configuration Status = 0)} and Jumper Configuration Status < 2]); Any of the following Ground inputs become active after power up, but before Machine Enabled: Lift; Swing; Telescope; Platform Level; Platform Rotate; Jib Lift (if MACHINE SETUP ⟶ JIB = YES)	Controls initialized
0039	SKYGUARD ACTIVE – FUNCTIONS CUTOUT	MACHINE SETUP ⟶ SKYGUARD = YES; Machine is in Platform Mode; SkyGuard Enabled	Not all of the trigger conditions are met
212	KEYSWITCH FAULTY	UGM Ground Mode input J7-3 input = High; UGM Platform Mode input J7-2 input = High	(J7-3 input = LOW) or (J7-2 input = 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	Machine is in Platform Mode; The Horn switch input = High at Startup	The Horn switch input = Low
224	FUNCTION PROBLEM - STEER LEFT PERMANENTLY SELECTED	Machine is in Platform Mode; The Steer Left switch input = High at Startup	The Steer Left switch input = Low; Steer Left and Right and full Drive speed permitted after controls are initialized
225	FUNCTION PROBLEM - STEER RIGHT PERMANENTLY SELECTED	Machine is in Platform Mode; The Steer Right switch input = High at Startup	The Steer Right switch input = Low; Steer Left and Right and full Drive speed permitted after controls are initialized
227	STEER SWITCHES FAULTY	The Steer Left switch input = High; The Steer Right switch input = High; (detectable in Platform or Ground mode)	The Steer Left switch input = Low; The Steer Right switch input = Low; Steer and full Drive speed permitted after controls are initialized
2211	FSW INTERLOCK TRIPPED	Machine is in Platform Mode; The Footswitch is active for more than seven seconds with no Drive, Steer, or Boom commands	The footswitch is released
2212	DRIVE LOCKED - JOYSTICK MOVED BEFORE FOOTSWITCH	Machine is in Platform Mode; The UGM detects one of the following conditions: Drive joystick is not in the neutral position at Startup; Drive joystick is not in the neutral position when Footswitch becomes active or while DTC 2213, 2221 or 2223 is active	If triggered by the Drive joystick not being in the neutral position at Startup, then (Drive joystick is returned to its neutral position) and (Drive and Steer permitted after controls initialized) If triggered by the Drive joystick not being in the neutral position when Footswitch becomes active or while DTC 2213, 2221 or 2223, then controls initialized

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
2213	STEER LOCKED - SELECTED BEFORE FOOTSWITCH	Machine is in Platform Mode; A Steer input is active when Footswitch becomes active or while DTC 2212, 2221 or 2223 is active	Controls initialized
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 or 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 and Swing joystick signal voltage is < 8.1V 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	Machine is in Platform Mode; The UGM detects one of the following conditions: Lift and/or Swing joystick is not in the neutral position at Startup; Lift and/or Swing joystick is not in the neutral position when Footswitch becomes active or while DTC 2212, 2213 or 2223 is active	If triggered by the Lift and/or Swing joystick not being in the neutral position at Startup, then (Lift and/or Swing joystick is returned to its neutral position) and (Lift and Swing permitted after controls initialized) If triggered by the Lift and/or Swing joystick is not in the neutral position when Footswitch becomes active or while DTC 2212, 2213 or 2223 is active, then controls initialized
2222	WAITING FOR FSW TO BE OPEN	Machine is in Platform Mode; Footswitch is active at Start Up	Controls initialized
2223	FUNCTION SWITCHES LOCKED - SELECTED BEFORE ENABLE	Machine is in Platform Mode; Any of the following Platform inputs are active when Footswitch becomes active or while DTC 2212, 2213 or 2221 is active: Tower Lift; Telescope; Platform Level; Platform Rotate; Jib Lift (if MACHINE SETUP → JIB = YES)	Controls initialized
2224	FOOTSWITCH SELECTED BEFORE START	Machine is in Platform Mode; The engine is stopped; Startup time has expired; The Footswitch is active before the Platform Engine Start switch input = High	The Platform Engine Start switch input = Low;
2247	FUNCTION PROBLEM - PLATFORM ROTATE LEFT PERMANENTLY SELECTED	Machine is in Platform Mode; The Platform Rotate Left switch input = High at Startup	The Platform Rotate Left switch input = Low; Platform Rotate Left and Right permitted after controls are initialized

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
2248	FUNCTION PROBLEM - PLATFORM ROTATE RIGHT PERMANENTLY SELECTED	Machine is in Platform Mode; The Platform Rotate Right switch input = High at Startup	The Platform Rotate Right switch input = Low; Platform Rotate Left and Right permitted after controls are initialized
2249	FUNCTION PROBLEM - JIB LIFT UP PERMANENTLY SELECTED	Machine is in Platform Mode; MACHINE SETUP → JIB = YES; The Jib Lift Up switch input = High at Startup	The Jib Lift Up switch input = Low; Jib Lift Up and Down permitted after controls are initialized
2250	FUNCTION PROBLEM - JIB LIFT DOWN PERMANENTLY SELECTED	Machine is in Platform Mode; MACHINE SETUP → JIB = YES; The Jib Lift Down switch input = High at Startup	The Jib Lift Down switch input = Low; Jib Lift Up and Down permitted after controls are initialized
2251	FUNCTION PROBLEM - TELESCOPE IN PERMANENTLY SELECTED	Machine is in Platform Mode; The Telescope In switch input = High at Startup	The Telescope In switch input = Low; Telescope permitted after controls are initialized
2252	FUNCTION PROBLEM - TELESCOPE OUT PERMANENTLY SELECTED	Machine is in Platform Mode; The Telescope Out switch input = High at Startup	The Telescope Out switch input = Low; Telescope permitted after controls are initialized
2262	FUNCTION PROBLEM - PLATFORM LEVEL UP PERMANENTLY SELECTED	Machine is in Platform Mode; The Platform Level Up switch input = High at Startup	The Platform Level Up switch input = Low; Platform Level Up and Down permitted after controls are initialized
2263	FUNCTION PROBLEM - PLATFORM LEVEL DOWN PERMANENTLY SELECTED	Machine is in Platform Mode; The Platform Level Down switch input = High at Startup	The Platform Level Down switch input = Low; Platform Level Up and Down permitted after controls are initialized
2264	FUNCTION PROBLEM - DOS OVERRIDE PERMANENTLY SELECTED	Machine is in Platform Mode; The DOS Override switch input = High at Startup	The DOS Override switch input = Low
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
2287	PLATFORM ANGLE SENSOR - NOT CALIBRATED	The Platform Angle Sensor has not been calibrated	Platform angle sensor calibrated
2289	PLATFORM ANGLE SENSOR - NOT RESPONDING	The UGM detects the following conditions: The UGM detects < 1 deg change of Platform Angle; Platform Level Up or Platform Level Down output value ≥ Creep output value; Platform Level Up or Platform Level Down has been active longer than 5 seconds; Platform Angle < (Platform Angle Max -1.5 deg); Platform Angle > (Platform Angle Min ± 1.5 deg);	Power Cycled
2290	PLATFORM ANGLE SENSOR DISAGREEMENT	The UGM detects that Platform Angle Sensor #1 and Platform Angle Sensor #2 readings disagree ≥ 2.5 deg for longer than 5 seconds; Do not report if DTC 2287 is active	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
2295	PLATFORM ANGLE SENSOR - OUT OF RANGE HIGH	The UGM detects that Platform Angle Sensor #1 < 5% or Platform Angle Sensor #2 signal voltage > 95%.	Power Cycled
2296	PLATFORM ANGLE SENSOR - OUT OF RANGE LOW	The UGM detects that Platform Angle Sensor #1 > 95% or Platform Angle Sensor #2 signal voltage < 5%.	Power Cycled
2297	PLATFORM ANGLE SENSOR – FREQUENCY OUT OF RANGE	The UGM detects that Platform Angle Sensor #1 or Platform Angle Sensor #2 signal frequency is not within 100Hz +/- 5Hz	Power Cycled
234	FUNCTION SWITCHES FAULTY - CHECK DIAGNOSTICS/BOOM	The UGM detects one of the following conditions (continuous monitoring): The machine is in Ground Mode and both direction inputs of the following boom controls are engaged at the same time: Engine Start/Aux, Telescope, Platform Level, Platform Rotate, Jib Lift, Tower Lift, Lift, or Swing. The machine is in Platform Mode and both direction inputs of the following boom controls are engaged at the same time: Engine Start/Aux, Telescope, Platform Level, Platform Rotate, Jib Lift (MACHINE SETUP ⟶ JIB = YES)	None of the boom controls that trigger this fault have both of their direction inputs engaged at the same time
235	FUNCTION SWITCHES LOCKED - SELECTED BEFORE AUX POWER	The UGM detects one of the following conditions: The machine is in Ground Mode and the engine is stopped and the ground APU/Function Enable switch becomes engaged while a Ground control input is already engaged. The machine is in Platform Mode and the engine is stopped and the platform APU/Auxiliary Descent switch becomes engaged while a Platform control input is already engaged.	The applicable APU/Auxiliary Descent switch is disengaged or all applicable control inputs become disengaged or the engine state becomes ENGINE RUNNING
236	FUNCTION SWITCHES LOCKED - SELECTED BEFORE START SWITCH	The UGM detects one of the following conditions: The machine is in Ground Mode and the engine is stopped and any configured boom control is already engaged and the ground start switch changes from not engaged to engaged The machine is in Platform Mode and the engine is stopped and any drive/ steer or configured boom control is already engaged and the footswitch is not engaged and the platform start switch changes from not engaged to engaged	The selected station's start switch is no longer engaged
237	START SWITCH LOCKED - SELECTED BEFORE KEYSWITCH	The start switch for the selected station is engaged during the UGM startup sequence	The selected station's start switch is no longer engaged
2310	FUNCTION PROBLEM - GROUND ENABLE PERMANENTLY SELECTED	Machine is in Ground Mode; (Jumper Configuration Status = 0)} and Jumper Configuration Status < 2]); The Ground Enable switch input = High at Startup	Controls initialized
2343	BOOM ANGLE SENSOR – NOT CALIBRATED	The Boom Angle Sensor has not been calibrated	Boom angle sensor calibrated
2344	BOOM ANGLE SENSOR - OUT OF RANGE HIGH	The UGM detects that Boom Angle Sensor #1 < 0.5V or Boom Angle Sensor #2 signal voltage > 4.5V.	Power Cycled
2345	BOOM ANGLE SENSOR - OUT OF RANGE LOW	The UGM detects that Boom Angle Sensor #1 > 4.5V or Boom Angle Sensor #2 signal voltage < 0.5V.	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
2346	BOOM ANGLE SENSOR – NOT RESPONDING	The UGM detects the following conditions: The UGM detects < 1 deg change of Boom Angle; Main Lift Up or Main Lift Down output value ≥ Creep output value; Main Lift Up or Main Lift Down has been active longer than 5 seconds; Boom Angle < (Boom Angle Max -1.5 deg); Boom Angle > (Boom Angle Min ± 1.5 deg);	Power Cycled
2370	FUNCTION PROBLEM - JIB LIFT UP PERMANENTLY SELECTED	Machine is in Ground Mode; MACHINE SETUP ⟶ JIB = YES; The Jib Lift Up switch input = High at Startup	The Jib Lift Up switch input = Low; Jib Lift Up and Down permitted after controls are initialized
2371	FUNCTION PROBLEM - JIB LIFT DOWN PERMANENTLY SELECTED	Machine is in Ground Mode; MACHINE SETUP ⟶ JIB = YES; The Jib Lift Down switch input = High at Startup	The Jib Lift Down switch input = Low; Jib Lift Up and Down permitted after controls are initialized
2372	FUNCTION PROBLEM - SWING LEFT PERMANENTLY SELECTED	Machine is in Ground Mode; The Swing Left switch input = High at Startup	The Swing Left switch input = Low; Swing Left and Right permitted after controls are initialized
2373	FUNCTION PROBLEM - SWING RIGHT PERMANENTLY SELECTED	Machine is in Ground Mode; The Swing Right switch input = High at Startup	The Swing Left switch input = Low; Swing Left and Right permitted after controls are initialized
2396	BOOM ANGLE SENSOR DISAGREEMENT	The UGM detects that Boom Angle Sensor #1 and Boom Angle Sensor #2 readings disagree ≥ 2.5 deg for longer than 5 seconds; Do not report if DTC 2343 is active	Power Cycled
23107	FUNCTION PROBLEM - LIFT UP PERMANENTLY SELECTED	Machine is in Ground Mode; The Lift Up switch input = High at Startup	The Lift Up switch input = Low; Lift Up and Down permitted after controls are initialized
23108	FUNCTION PROBLEM - LIFT DOWN PERMANENTLY SELECTED	Machine is in Ground Mode; The Lift Down switch input = High at Startup	The Lift Down switch input = Low; Lift Up and Down permitted after controls are initialized
23109	FUNCTION PROBLEM - TELESCOPE IN PERMANENTLY SELECTED	Machine is in Ground Mode; The Telescope In switch input = High at Startup	The Telescope In switch input = Low; Telescope In and Out permitted after controls are initialized
23110	FUNCTION PROBLEM - TELESCOPE OUT PERMANENTLY SELECTED	Machine is in Ground Mode; The Telescope Out switch input = High at Startup	The Telescope Out switch input = Low; Telescope In and Out permitted after controls are initialized
23111	FUNCTION PROBLEM - PLATFORM LEVEL UP PERMANENTLY SELECTED	Machine is in Ground Mode; The Platform Level Up switch input = High at Startup	The Platform Level Up switch input = Low; Platform Level Up and Down permitted after controls are initialized
23112	FUNCTION PROBLEM - PLATFORM LEVEL DOWN PERMANENTLY SELECTED	Machine is in Ground Mode; The Platform Level Down switch input = High at Startup	The Platform Level Down switch input = Low; Platform Level Up and Down permitted after controls are initialized
23113	FUNCTION PROBLEM - PLATFORM ROTATE LEFT PERMANENTLY SELECTED	Machine is in Ground Mode; The Platform Rotate Left switch input = High at Startup	The Platform Rotate Left switch input = Low; Platform Rotate Left and Right permitted after controls are initialized

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
23114	FUNCTION PROBLEM - PLATFORM ROTATE RIGHT PERMANENTLY SELECTED	Machine is in Ground Mode; The Platform Rotate Right switch input = High at Startup	The Platform Rotate Right switch input = Low; Platform Rotate Left and Right permitted after controls are initialized
23154	TELESCOPE RETRACT SWITCHES - DISAGREEMENT	The UGM detects the following conditions: Telescope Retracted Switch #1 and Telescope Retracted Switch #2 readings disagree for longer than 5 seconds; Telescope In or Telescope Out output value ≥ Creep output value	Power Cycled
23163	FUNCTION PROBLEM – MSSO PERMANENTLY SELECTED	The MSSO switch input = Low at Startup	Power Cycled
23170	BOOM ANGLE SENSOR - SINGLE POINT CALIBRATION PERFORMED	Single point Boom Angle calibration is successfully completed	Fault shall be retentive through Power Cycled; Can be reset if CALIBRATIONS ⟶ BOOM ANGLE is successfully completed
23173	CAPACITY LENGTH SWITCHES - DISAGREEMENT	Dual Capacity is configured; The UGM detects the following conditions: Capacity Length Switch #1 and Capacity Length Switch #2 readings disagree for longer than 5 seconds; Telescope In or Telescope Out output value ≥ Creep output value	Power Cycled
23239	BOOM ANGLE SENSOR – ANGLE OUT OF RANGE HIGH	The UGM detects a Boom Angle ≥ (Boom Angle Max + 1.5 deg); Do not report if Boom Angle == Unhealthy	Fault shall be retentive through Power Cycled; Can be reset by performing a Boom Angle Sensor Calibration
23240	BOOM ANGLE SENSOR - ANGLE OUT OF RANGE LOW	The UGM detects a Boom Angle < (Boom Angle Min - 1.5 deg); Do not report if Boom Angle == Unhealthy	Fault shall be retentive through Power Cycled; Can be reset by performing a Boom Angle Sensor Calibration
241	AMBIENT TEMPERATURE SENSOR – OUT OF RANGE LOW	MACHINE SETUP ⟶ TEMP CUTOUT = YES; Ambient Temperature sensor reading ≤ -50C; Do not report if DTC 6657 is active	Ambient Temperature sensor reading > -50C; Full Speed permitted after controls are initialized
242	AMBIENT TEMPERATURE SENSOR – OUT OF RANGE HIGH	MACHINE SETUP ⟶ TEMP CUTOUT = YES; Ambient Temperature sensor reading ≥ 85C; Do not report if DTC 6657 is active	Ambient Temperature sensor reading < 85C; Full Speed permitted after controls are initialized
259	MODEL CHANGED – HYDRAULICS SUSPENDED – CYCLE EMS	The MACHINE SETUP ⟶ MODEL NUMBER is changed using the analyzer	Power Cycled
2513	GENERATOR MOTION CUTOUT ACTIVE	MACHINE SETUP ⟶ GEN SET = BELT DRIVE; MACHINE SETUP ⟶ GEN SET CUTOUT = MOTION CUTOUT; The platform Generator Switch is engaged Footswitch State = Depressed The machine is in Platform mode	Not all of the trigger conditions are met
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 supercedes 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

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
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
2517	DRIVE PREVENTED – TILTED & ABOVE ELEVATION	MACHINE SETUP ⟶ FUNCTION CUTOUT = DRIVE CUT E&T The boom is Above Elevation The chassis is considered Tilted 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 = BOOM CUTOUT The boom is Above Elevation Any boom function is already active The operator attempts to activate Drive or Steer	Not all of the trigger conditions are met
2519	DRIVE PREVENTED - TILTED & EXTENDED OR HIGH ANGLE	Chassis Tilt is > 1.8 degrees and either the boom is above 55 degrees main boom angle and/or the boom is telescoped out beyond the drive disable switches.(Dual Cap Prox.)	Boom lifted below 55 degrees and/or the boom retracted to inside the drive disable length switches. (Dual Cap)
2548	SYSTEM TEST MODE ACTIVE	UGM determines that System Test Mode is active	Power Cycle
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 = YES; 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)]
2568	TEMPERATURE CUTOUT ACTIVE – AMBIENT TEMPERATURE TOO LOW	Low Temperature Cutout = Active	Low Temperature Cutout = Inactive; Full Speed permitted after controls are initialized
2576	PLATFORM LEVEL PREVENTED – ABOVE ELEVATION	Platform Level Override Cutout = Enabled; The Platform Level Up or Down switch input = High; Footswitch is active If 600S: Auto Platform Level = Enabled	Controls initialized
2587	RUNNING AT CREEP – PLATFORM LEVELED UNDER	Platform Leveled Under State = Set	Platform Leveled Under State = Cleared
331	BRAKE – SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
332	BRAKE – OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
334	LIFT UP VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit; Full speed Lift Up and Down permitted after controls are initialized
336	LIFT DOWN VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit; Full speed Lift Up and Lift Down permitted after controls are initialized

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
3311	GROUND ALARM – SHORT TO BATTERY	MACHINE SETUP ⟶ ALARM / HORN = SEPARATE; The UGM detects a short to battery on J2-2	Power Cycled
3358	MAIN DUMP VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
3359	MAIN DUMP VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
3360	MAIN DUMP VALVE – SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
3361	BRAKE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
3362	START SOLENOID – SHORT TO GROUND	UGM detects a short to ground at this output	Power Cycled
3363	START SOLENOID – OPEN CIRCUIT	UGM detects an open circuit at this output; if MACHINE SETUP ⟶ ENGINE = FORD DUAL FUEL only evaluate until first Start is attempted for each power cycle due to possibility of ECU opening ground solenoid return path to disable Start and causing erroneous diagnostics.	Power Cycled
3364	START SOLENOID – SHORT TO BATTERY	UGM detects a short to battery at this output	Power Cycled
3368	TWO SPEED VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
3369	TWO SPEED VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
3370	TWO SPEED VALVE - SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
3371	GROUND ALARM – SHORT TO GROUND	MACHINE SETUP ⟶ ALARM / HORN = SEPARATE; The UGM detects a short to ground on J2-2	Power Cycled
3372	GROUND ALARM – OPEN CIRCUIT	MACHINE SETUP ⟶ ALARM / HORN = SEPARATE; The UGM detects an open circuit on J2-2	Power Cycled
3373	GEN SET/WELDER – SHORT TO GROUND	MACHINE SETUP ⟶ GEN SET = BELT DRIVE and the UGM detects a short to ground at this output	Power Cycled
3374	GEN SET/WELDER – OPEN CIRCUIT	MACHINE SETUP ⟶ GEN SET = BELT DRIVE and the UGM detect an open circuit at this output	Power Cycled
3375	GEN SET/WELDER – SHORT TO BATTERY	MACHINE SETUP ⟶ GEN SET = BELT DRIVE and the UGM detects a short to battery at this output	Power Cycled
3376	HEAD TAIL LIGHT – SHORT TO GROUND	MACHINE SETUP ⟶ H & T LIGHTS = YES and the UGM detects a short to ground at this output	Power Cycled
3377	HEAD TAIL LIGHT – OPEN CIRCUIT	MACHINE SETUP ⟶ H & T LIGHTS = YES and the UGM detects an open circuit at this output	Power Cycled
3378	HEAD TAIL LIGHT – SHORT TO BATTERY	MACHINE SETUP ⟶ H & T LIGHTS = YES and the UGM detects a short to battery at this output	Power Cycled
3385	PLATFORM LEVEL UP OVERRIDE VALVE - SHORT TO GROUND	DTC 662 is active; The UGM detects a short to ground at this output	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
3386	PLATFORM LEVEL UP OVERRIDE VALVE - OPEN CIRCUIT	DTC 662 is active; The UGM detects an open circuit at this output	Power Cycled
3387	PLATFORM LEVEL UP OVERRIDE VALVE - SHORT TO BATTERY	DTC 662 is active; The UGM detects a short to battery at this output	Power Cycled
3391	PLATFORM DOWN OVERRIDE – SHORT TO GROUND	DTC 662 is active; The UGM detects a short to ground at this output	Power Cycled
3392	PLATFORM DOWN OVERRIDE – OPEN CIRCUIT	DTC 662 is active; The UGM detects an open circuit at this output	Power Cycled
3393	PLATFORM DOWN OVERRIDE – SHORT TO BATTERY	DTC 662 is active; The UGM detects a short to battery at this output	Power Cycled
33118	SWING RIGHT VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33119	SWING RIGHT VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit; Full speed Swing Left and Right permitted after controls are initialized
33122	SWING LEFT VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33182	LIFT VALVES – SHORT TO BATTERY	The UGM detects a short to battery at either the Lift Up or Lift Down valve	Power Cycled
33186	TELESCOPE OUT VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit; Full speed Telescope In and Out permitted after controls are initialized
33187	TELESCOPE VALVES – SHORT TO BATTERY	The UGM detects a short to battery at either the Tele In or Tele Out valve.	Power Cycled
33188	TELESCOPE OUT VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33189	TELESCOPE IN VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit; Telescope Out permitted after controls are initialized; Full speed Telescope In permitted after controls are initialized
33190	TELESCOPE IN VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33208	HORN – SHORT TO BATTERY	The UGM detects a short to battery on J2-27	Power Cycled
33276	APU PUMP RELAY - OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
33277	APU PUMP RELAY - SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
33278	APU PUMP RELAY - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33279	GLOWPLUG – OPEN CIRCUIT	MACHINE SETUP ⟶ ENGINE ≠ DEUTZ EMR4, FORD DUAL FUEL; MACHINE SETUP ⟶ GLOW PLUG ≠ NO; The UGM detects an open circuit at this output	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
33280	GLOWPLUG – SHORT TO BATTERY	MACHINE SETUP → ENGINE ≠ DEUTZ EMR4, FORD DUAL FUEL; MACHINE SETUP → GLOW PLUG ≠ NO; The UGM detects a short to battery at this output	Power Cycled
33281	GLOWPLUG – SHORT TO GROUND	MACHINE SETUP → ENGINE ≠ DEUTZ EMR4, FORD DUAL FUEL; MACHINE SETUP → GLOW PLUG ≠ NO; The UGM detects a short to ground at this output	Power Cycled
33287	LIFT – CURRENT FEEDBACK READING TOO LOW	The Engine State = ENGINE RUNNING; The UGM commanded current > 250mA; The difference between the commanded current and the measured feedback current > [the larger of (125mA) or (15% of the commanded function Max)] for longer than 1 second	Power Cycled
33288	TELESCOPE – CURRENT FEEDBACK READING TOO LOW	The Engine State = ENGINE RUNNING; The UGM commanded current > 250mA; The difference between the commanded current and the measured feedback current > [the larger of (125mA) or (15% of the commanded function Max)] for longer than 1 second	Power Cycled
33295	SWING LEFT VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit; Full speed Swing Left and Right permitted after controls are initialized
33332	LEFT TRACK - CURRENT FEEDBACK READING TOO LOW	The Engine State = ENGINE RUNNING; The UGM commanded current > 250mA; The difference between the commanded current and the measured feedback current > [the larger of (125mA) or (15% of the commanded function Max)] for longer than 1 second	Power Cycled
33333	RIGHT TRACK - CURRENT FEEDBACK READING TOO LOW	The Engine State = ENGINE RUNNING; The UGM commanded current > 250mA; The difference between the commanded current and the measured feedback current > [the larger of (125mA) or (15% of the commanded function Max)] for longer than 1 second	Power Cycled
33406	LIFT UP VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33407	LIFT DOWN VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33408	RIGHT TRACK - LOSS OF CURRENT FEEDBACK	Measured feedback current < 225mA while PWM output > 40% for a period of 100ms.	Power Cycled
33409	LEFT TRACK - LOSS OF CURRENT FEEDBACK	Measured feedback current < 225mA while PWM output > 40% for a period of 100ms.	Power Cycled
33412	SWING VALVES – SHORT TO BATTERY	The UGM detects a short to battery at either the Swing Right or Swing Left valve	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
33414	SWING – CURRENT FEEDBACK READING TOO LOW	The Engine State = ENGINE RUNNING; The UGM commanded current > 250mA; The difference between the commanded current and the measured feedback current > [the larger of (125mA) or (15% of the commanded function Max)] for longer than 1 second	Power Cycled
33417	LIFT – CURRENT FEEDBACK READING LOST	Measured feedback current < 225mA while PWM output > 40% for a period of 100ms.	Power Cycled
33418	SWING – CURRENT FEEDBACK READING LOST	Measured feedback current < 225mA while PWM output > 40% for a period of 100ms.	Power Cycled
33443	TELESCOPE – CURRENT FEEDBACK READING LOST	Measured feedback current < 225mA while PWM output > 40% for a period of 100ms.	Power Cycled
33537	AUXILIARY LIFT DOWN VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33538	AUXILIARY LIFT DOWN VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit
33539	AUXILIARY LIFT DOWN VALVE - SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
33567	AUXILIARY VALVES - SHORT TO BATTERY	The UGM detects a short to battery at either the Aux Lift Down or Aux Tower Lift Down valve	Power Cycled
33568	AUXILIARY - CURRENT FEEDBACK READING LOST	Measured feedback current < 225mA while output is active for a period of 100ms.	Power Cycled
33575	ECM PULL DOWN RESISTOR - OPEN CIRCUIT	MACHINE SETUP → ENGINE = DEUTZ EMR4; Pull down resister not detected	Power Cycled
33633	PLATFORM DUMP 1 VALVE - SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
33634	PLATFORM DUMP 1 VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33635	PLATFORM DUMP 1 VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit
33636	PLATFORM DUMP 2 VALVE - SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
33637	PLATFORM DUMP 2 VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33638	PLATFORM DUMP 2 VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit
33639	TELESCOPE IN DUMP VALVE - SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
33640	TELESCOPE IN DUMP VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33641	TELESCOPE IN DUMP VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
33736	BYPASS DUMP VALVE – SHORT TO BATTERY	The UGM detects a short to battery at this output	Power Cycled
33737	BYPASS DUMP VALVE – SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
33738	BYPASS DUMP VALVE – OPEN CIRCUIT	The UGM detects an open circuit at this output	The UGM no longer detects open circuit
343	PLATFORM LEVEL UP VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
344	PLATFORM LEVEL UP VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	The UGM detects a short to battery or an open circuit at this output	Power Cycled
347	PLATFORM LEVEL DOWN VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
348	PLATFORM LEVEL DOWN VALVE - SHORT TO BATTERY OR OPEN CIRCUIT	The UGM detects a short to battery or an open circuit at this output	Power Cycled
349	PLATFORM ROTATE LEFT VALVE – OPEN CIRCUIT	The PM detects an open circuit at this output and reports it to the UGM	The PM no longer detects open circuit; Full speed Platform Rotate Right and Left permitted after controls are initialized
3410	PLATFORM ROTATE LEFT VALVE – SHORT TO BATTERY	The PM detects a short to battery at this output and reports it to the UGM	Power Cycled
3411	PLATFORM ROTATE LEFT VALVE – SHORT TO GROUND	The PM detects a short to ground at this output and reports it to the UGM	Power Cycled
3412	PLATFORM ROTATE RIGHT VALVE – OPEN CIRCUIT	The PM detects an open circuit at this output and reports it to the UGM	The PM no longer detects open circuit; Full speed Platform Rotate Right and Left permitted after controls are initialized
3413	PLATFORM ROTATE RIGHT VALVE – SHORT TO BATTERY	The PM detects a short to battery at this output and reports it to the UGM	Power Cycled
3414	PLATFORM ROTATE RIGHT VALVE – SHORT TO GROUND	The PM detects a short to ground at this output and reports it to the UGM	Power Cycled
3415	JIB LIFT UP VALVE – OPEN CIRCUIT	MACHINE SETUP → JIB = YES The PM detects an open circuit at this output and reports it to the UGM	The PM no longer detects open circuit; Full speed Jib Lift Up and Down permitted after controls are initialized
3416	JIB LIFT UP VALVE – SHORT TO BATTERY	MACHINE SETUP → JIB = YES The PM detects a short to battery at this output and reports it to the UGM	Power Cycled
3417	JIB LIFT UP VALVE – SHORT TO GROUND	MACHINE SETUP → JIB = YES The PM detects a short to ground at this output and reports it to the UGM	Power Cycled
3418	JIB LIFT DOWN VALVE – OPEN CIRCUIT	MACHINE SETUP → JIB = YES The PM detects an open circuit at this output and reports it to the UGM	The PM no longer detects open circuit; Jib Lift Up permitted after controls are initialized Full speed Jib Lift Down permitted after controls are initialized

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
3419	JIB LIFT DOWN VALVE – SHORT TO BATTERY	MACHINE SETUP → JIB = YES The PM detects a short to battery at this output and reports it to the UGM	Power Cycled
3420	JIB LIFT DOWN VALVE – SHORT TO GROUND	MACHINE SETUP → JIB = YES The PM detects a short to ground at this output and reports it to the UGM; detection occurs for PWM output approximately ≤ 15% or for STG condition.	Power Cycled
431	FUEL SENSOR - SHORT TO BATTERY OR OPEN CIRCUIT	MACHINE SETUP → FUEL LEVEL = SENSOR; UGM fuel sensor analog input J2-25 detects a voltage higher than 2.50 volts (A/D > 512)	Power Cycled
432	FUEL SENSOR - SHORT TO GROUND	MACHINE SETUP → FUEL LEVEL = SENSOR; UGM fuel sensor analog input J2-25 detects a voltage less than or equal to 0.3 volts (A/D < 61)	Power Cycled
437	ENGINE TROUBLE CODE	An engine with a CAN engine controller is configured in MACHINE SETUP The engine controller reports a J1939 fault	Power Cycled
438	HIGH ENGINE TEMP	An engine with a CAN engine controller is not configured in MACHINE SETUP: - The Engine State = ENGINE RUNNING > 10 seconds - The coolant temperature is greater than or equal to the configured engines max allowed temperature. - The maximum allowed temperature > 110°C. An engine with a CAN engine controller is configured in MACHINE SETUP: - ECM transmits a J1939 DM1 message for an engine coolant high temperature critical fault (SPN:FMI 110:0) on CAN2 or uses the J1939 Transport Protocol every one second to send this information if multiple engine faults exist.	Power Cycled
4310	NO ALTERNATOR OUTPUT	The Engine State = ENGINE RUNNING > 10 seconds and UGM system voltage < 11.5 volts for 10 seconds	UGM system voltage > 11.7 volts
4311	LOW OIL PRESSURE	An engine with a CAN engine controller is not configured in MACHINE SETUP - The Engine State = ENGINE RUNNING > 10 seconds - The engine oil pressure is LOW (debounce 3s). An engine with a CAN engine controller is configured in MACHINE SETUP - ECM transmits a J1939 DM1 message for an engine oil low pressure critical fault (SPN:FMI 100:1) on CAN2 or uses the J1939 Transport Protocol every one second to send this information if multiple engine faults exist.	Power Cycled
4334	ENGINE COOLANT – LOW LEVEL	MACHINE SETUP → ENGINE = DEUTZ EMR4; ECM transmits a J1939 DM1 message for an engine coolant low level fault (SPN:FMI 111:1) on CAN2 or uses the J1939 Transport Protocol every one second to send this information if multiple engine faults exist.	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
4375	WATER IN FUEL	MACHINE SETUP ⟶ ENGINE = DEUTZ EMR4; ECM transmits a J1939 DM1 message for a water in fuel fault (SPN 97) on CAN2 or uses the J1939 Transport Protocol every one second to send this information if multiple engine faults exist.	Power Cycled
441	BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	The UGM detects that its supply voltage is less than 9 volts Engine State ≠ ENGINE CRANKING Auxiliary Power/Emergency Descent Mode is not active	Voltage is greater than 9.25 volts
442	BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	The UGM detects that its supply voltage > 16.0 volts	Power Cycled
443	LSS BATTERY VOLTAGE TOO HIGH	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; The UGM determines that the LSS reports supply voltage > 16.0V	Not all of the trigger conditions are met
444	LSS BATTERY VOLTAGE TOO LOW	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Engine State ≠ ENGINE CRANKING or ENGINE STARTING; Auxiliary Power/Emergency Descent Mode is not active; If Load System is the 4-Cell LSS; The UGM determines that the LSS reports supply voltage < 9.0V If Load System is the 1-Cell LSS; The UGM determines that the LSS reports supply voltage < 8.0V or the LSS Supply Voltage reports Out of Range Low Error	Not all of the trigger conditions are met
445	BATTERY VOLTAGE LOW	The UGM detects that its supply voltage < 11 volts for 5 seconds. Engine State ≠ ENGINE CRANKING Auxiliary Power/Emergency Descent Mode is not active Glow Plugs are not energized	Voltage is greater than 11.25 volts
4434	ENGINE START FAILED - TOO MANY ATTEMPTS	MACHINE SETUP ⟶ ENGINE = FORD DUAL FUEL; Cumulative Crank Time > 24 seconds	Power Cycled
4479	LSS BATTERY VOLTAGE - INITIALIZATION ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; LSS Supply Voltage reports Initialization Error	Power Cycled
4480	LSS BATTERY VOLTAGE - NOT CALIBRATED	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; LSS Supply Voltage reports Not Calibrated Error	Power Cycled
662	CANBUS FAILURE – PLATFORM MODULE	UGM does not receive any CAN messages from the PM in 250ms	CAN messages are received from the PM
663	CANBUS FAILURE – LOAD SENSING SYSTEM MODULE	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; UGM does not receive any CAN messages from the LSS module in 250ms; If Load System is the 1-Cell LSS; Engine State ≠ (ENGINE CRANKING or ENGINE STARTING) > 2 seconds;	Not all of the trigger conditions are met

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
666	CANBUS FAILURE – ENGINE CONTROLLER	An engine with a CAN engine controller is configured in MACHINE SETUP No CAN messages are received from the engine controller for more than 250ms	CAN messages are received from the engine controller; UGM shall require re-activation of Footswitch (Platform Mode) or Ground Enable (Ground Mode) to enable functions and resume operation.
6613	CANBUS FAILURE – EXCESSIVE CANBUS ERRORS	More than 22 error frames per second for 4 seconds or more than 500 Buss Off conditions since last power cycle.	Power Cycled
6622	CANBUS FAILURE – TCU MODULE	MACHINE SETUP ⟶ CLEARSKY = YES No CAN2 messages are received from the TCU module for more than 30 seconds	Not all of the trigger conditions are met
6635	CANBUS FAILURE – CHASSIS TILT SENSOR	UGM does not receive any CAN messages from the Chassis Tile Sensor in 250ms	CAN messages are received from the Chassis tilt Sensor and controls are initialized
6651	CANBUS FAILURE - GROUND DISPLAY	UGM does not receive any CAN messages from the Ground Display in 250ms	CAN messages are received from the Ground Display
6657	CANBUS FAILURE – TEMPERATURE SENSOR	MACHINE SETUP ⟶ TEMP CUTOUT = YES; UGM does not receive any CAN messages from the Ambient Temperature sensor in 250ms	CAN messages are received from the Ambient Temperature sensor
681	REMOTE CONTRACT MANAGEMENT OVERRIDE – ALL FUNCTIONS IN CREEP	MACHINE SETUP ⟶ CLEARSKY = YES Value set by ClearSky TCU	Cleared by ClearSky TCU
813	CHASSIS TILT SENSOR NOT CALIBRATED	The UGM detects one of the follow conditions: The tilt sensor has not been calibrated; For 600S the Tilt Sensor source Address is 0xC0; For 600S the Tilt Sensor Serial number does not match	Tilt sensor calibrated
814	CHASSIS TILT SENSOR OUT OF RANGE	Fault CHASSIS TILT SENSOR NOT CALIBRATED (813) is not present and Tilt sensor measurement > 19º for 4 seconds (internal tilt sensor based machines) or > 35º (external tilt sensor based machines) Not to be reported during Tilt Sensor calibration.	Not all of the trigger conditions are met.
818	TILT SENSOR STAGNANT	The UGM detects the following conditions: The X axis or Y axis raw readings change by < ±0.05º in 5 second; Drive Forward or Drive Reverse output value is ≥ Creep output value; Do not report if DTC 6635, 813 or 814 are active	Power Cycled
8112	CHASSIS TILT SENSOR - SINGLE POINT CALIBRATION PERFORMED	Single point Chassis Tilt calibration is successfully completed	Fault shall be retentive through Power Cycled; Can be reset if CALIBRATIONS ⟶ TILT SENSOR is successfully completed
821	LSS CELL #1 ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; The UGM detects that LSS is reporting error with Cell #1	Not all of the trigger conditions are met
822	LSS CELL #2 ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; The UGM detects that LSS is reporting error with Cell #2	Not all of the trigger conditions are met

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
823	LSS CELL #3 ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; The UGM detects that LSS is reporting error with Cell #3	Not all of the trigger conditions are met
824	LSS CELL #4 ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; The UGM detects that LSS is reporting error with Cell #4.	Not all of the trigger conditions are met
825	LSS HAS NOT BEEN CALIBRATED	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO If Load System is the 4-Cell LSS; The load sensor has not been calibrated, or DTC 992 (LSS EEPROM ERROR) is active, or DTC 9977 (LSS CORRUPT EEPROM) is active If Load System is the 1-Cell LSS; The LSS serial number does not match	Not all of the trigger conditions are met
826	RUNNING AT CREEP – PLATFORM OVERLOADED	Refer to Table 7-1 for trigger conditions and machine response requirements	Not all of the trigger conditions are met
828	LIFT UP & TELE OUT PREVENTED – PLATFORM OVERLOADED	Refer to Table 7-1 for trigger conditions and machine response requirements	Not all of the trigger conditions are met
829	FUNCTIONS CUTOUT – PLATFORM OVERLOADED	Refer to Table 7-1 for trigger conditions and machine response requirements	Not all of the trigger conditions are met
8211	LSS READING UNDER WEIGHT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; If Load System is the 4-Cell LSS; The load sensor has been calibrated and Gross Platform Weight < (0.5 * Empty Platform Weight); If Load System is the 1-Cell LSS; UGM determines that the Platform Load < (-1.5 * Unloaded Platform Weight); If Load System is the 1-Cell LSS; Drive Forward / Reverse or Lift Up output value is ≥ Creep output value; Platform Load is < -50 lb for the first 5 seconds of command; Do not report if DTC (0030 or 825) is active or if Platform Load == Unhealthy	If Load System is the 4-Cell LSS; Not all of the trigger conditions are met If Load System is the 1-Cell LSS; Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
8218	LSS SENSOR DISAGREEMENT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; The UGM detects that (Platform Load 1 and Platform Load 2 disagree by 50 lb for longer than 3 seconds) or (that Platform Gross 1 and Platform Gross 2 disagree by 200 lb for longer than 3 seconds); Do not report if (DTC 8222 or 8223) is active or if Platform Load == Unhealthy, Platform Gross 1 == Unhealthy or Platform Gross 2 == Unhealthy	Power Cycled or CALIBRATIONS LOAD SENSING is successfully completed
8222	LSS STRAIN GAUGE 1 - STAGNANT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Engine State ≠ (ENGINE CRANKING or ENGINE STARTING) > 2 seconds; Load System is the 1-Cell LSS; Strain Gauge 1 raw reading does change value for 5 seconds; Do not report if Platform Gross 1 == Unhealthy	Power Cycled
8223	LSS STRAIN GAUGE 2 - STAGNANT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Engine State ≠ (ENGINE CRANKING or ENGINE STARTING) > 2 seconds; Load System is the 1-Cell LSS; Strain Gauge 2 raw reading does change value for 5 seconds; Do not report if DTC Platform Gross 2 == Unhealthy	Power Cycled
8224	LSS STRAIN GAUGE 1 - OUT OF RANGE LOW	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 1 reports an Out of Range Low error	Power Cycled
8225	LSS STRAIN GAUGE 2 - OUT OF RANGE LOW	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 2 reports an Out of Range Low error	Power Cycled
8226	LSS STRAIN GAUGE 1 - OUT OF RANGE HIGH	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 1 reports an Out of Range High error	Power Cycled
8227	LSS STRAIN GAUGE 2 - OUT OF RANGE HIGH	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 2 reports an Out of Range High error	Power Cycled
8228	LSS STRAIN GAUGE 1 - INITIALIZATION ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Engine State ≠ (ENGINE CRANKING or ENGINE STARTING) > 2 seconds; Load System is the 1-Cell LSS; Strain Gauge 1 reports an Initialization error	Power Cycled
8229	LSS STRAIN GAUGE 2 - INITIALIZATION ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Engine State ≠ (ENGINE CRANKING or ENGINE STARTING) > 2 seconds; Load System is the 1-Cell LSS; Strain Gauge 2 reports an Initialization error	Power Cycled
8230	LSS STRAIN GAUGE 1 - NOT CALIBRATED	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 1 reports a Not Calibrated error	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
8231	LSS STRAIN GAUGE 2 - NOT CALIBRATED	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 2 reports a Not Calibrated error	Power Cycled
8232	LSS STRAIN GAUGE 1 - SENSOR DEFECT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 1 reports a Sensor Defect error	Power Cycled
8233	LSS STRAIN GAUGE 2 - SENSOR DEFECT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 2 reports a Sensor Defect error	Power Cycled
8234	LSS STRAIN GAUGE 1 - NOT INSTALLED	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 1 reports a Not Installed error	Power Cycled
8235	LSS STRAIN GAUGE 2 - NOT INSTALLED	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 2 reports a Not Installed error	Power Cycled
8236	LSS NOT DETECTING CHANGE	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Machine is in Platform Mode; Load System is the 1-Cell LSS; Drive Forward / Reverse or Lift Up output value is ≥ Creep output value; Platform Load does not change (peak to peak) by more than 1 lb within the first 5 seconds of the command; Do not report if Platform Load == Unhealthy	Power Cycled
8237	LSS STRAIN GAUGE 1 - A/D DEFECT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 1 reports a A/D Defect error	Power Cycled
8238	LSS STRAIN GAUGE 2 - A/D DEFECT	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; Strain Gauge 2 reports a A/D Defect error	Power Cycled
8652	RIGHT TRACK FORWARD VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
8654	RIGHT TRACK FORWARD VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
8655	RIGHT TRACK REVERSE VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
8657	RIGHT TRACK REVERSE VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
8658	LEFT TRACK FORWARD VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled
8660	LEFT TRACK FORWARD VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
8661	LEFT TRACK REVERSE VALVE - OPEN CIRCUIT	The UGM detects an open circuit at this output	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
8663	LEFT TRACK REVERSE VALVE - SHORT TO GROUND	The UGM detects a short to ground at this output	Power Cycled
8690	LEFT TRACK VALVES - SHORT TO BATTERY	The UGM detects a short to battery at either the Left Track Forward or Left Track Reverse valves	Power Cycled
8691	RIGHT TRACK VALVES - SHORT TO BATTERY	The UGM detects a short to battery at either the Right Track Forward or Right Track Reverse valves	Power Cycled
873	MACHINE SAFETY SYSTEM OVERRIDE OCCURRED	MSSO = Active	Fault shall be retentive through Power Cycled; Can be reset only with an Analyzer via the CALIBRATIONS → MSSO → MSSO RESET menu
876	WIRE ROPE SERVICE REQUIRED	MACHINE SETUP → CABLE SWITCH = YES; Wire Rope Service = Enabled	Power Cycled
991	LSS WATCHDOG RESET	MACHINE SETUP → LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; UGM detects LSS report of an anomaly exists that has caused a WatchDog Timer reset.	Power Cycled
992	LSS EEPROM ERROR	MACHINE SETUP → LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; UGM detects LSS report of an anomaly that exists in the LSS EEPROM	Power Cycled
993	LSS INTERNAL ERROR – PIN EXCITATION	MACHINE SETUP → LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; UGM detects LSS report of improper excitation voltage	Power Cycled
994	LSS INTERNAL ERROR – DRDY MISSING FROM A/D	MACHINE SETUP → LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; UGM detects LSS report of an anomaly that exists in the LSS A/D converter operations.	Power Cycled
998	EEPROM FAILURE - CHECK ALL SETTINGS	The UGM has detected an anomaly in EEPROM	Power Cycled
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	FUNCTION LOCKED OUT - LSS MODULE SOFTWARE VERSION IMPROPER	MACHINE SETUP → LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; The UGM determines that the LSS software version is not compatible with existing code	Power Cycled
9915	CHASSIS TILT SENSOR NOT GAIN CALIBRATED	The tilt sensor gain calibration values recorded to flash memory during Phoenix International's manufacturing test are not present	Valid values are present
9920	PLATFORM SENSOR REF VOLTAGE OUT OF RANGE	The PM detects that its reference voltage is out of range and reports the fault to the UGM	Power Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
9921	GROUND MODULE FAILURE:HIGH SIDE DRIVER CUTOUT FAULTY	The engine is not running The engine is not cranking The UGM footswitch input J7-15 is LOW The machine is in Platform Mode The Main Dump output J2-13 is detected as HIGH via the analog feedback 300ms after it is attempted to be activated during the one time startup test of the UGM hardware shutoff circuitry	Power Cycled
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 Cycled
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 Cycled
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 PIC manufacturing test process are detected as being out of range	Power Cycled
9945	CURRENT FEEDBACK CALIBRATION CHECKSUM INCORRECT	The current feedback gains checksum that is calculated and written to flash memory during the PIC manufacturing test process is detected as being incorrect	Power Cycled
9949	MACHINE CONFIGURATION OUT OF RANGE – CHECK ALL SETTINGS	UGM has detected an anomaly in EEPROM with regard to the Machine Setup configuration.	Power Cycled and EEPROM data in associated area is changed
9977	LSS CORRUPT EEPROM	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 4-Cell LSS; 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 Cycled
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 Cycled

Table 6-13. Diagnostic Trouble Codes

DTC	Help Message	Fault Condition/Trigger (For configurable items, fault applies only if configured. All listed conditions to be met unless stated otherwise)	Conditions Required for Movement and/or to Clear Fault
9986	GROUND MODULE VLOW FET FAILURE	VLow FET determined to be failed because all Digital Inputs are high; UGM unable to read high-sensing inputs.	Power Cycled
99285	LSS - FACTORY CALIBRATION ERROR	MACHINE SETUP ⟶ LOAD SYSTEM ≠ NO; Load System is the 1-Cell LSS; LSS reports an Error Status (other than 0,1,2,8,30,31)	Power Cycled

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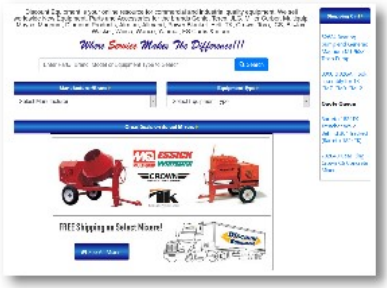

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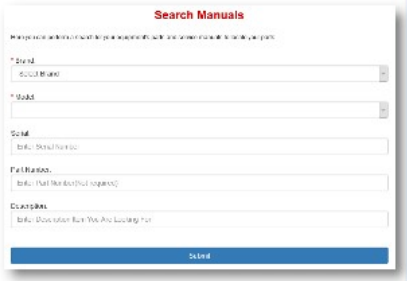

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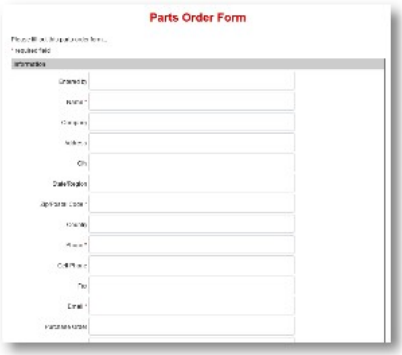

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SECTION 7. BASIC ELECTRICAL INFORMATION & ELECTRICAL SCHEMATICS

7.1 GENERAL

This section contains basic electrical information and schematics for locating and correcting most electrical problems. If a problem develops which is not presented in this section or corrected by listed corrective actions, obtain technically qualified guidance before proceeding with any additional maintenance.

NOTE: *Some procedures/connectors shown in this section may not apply to all models.*

7.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information.

Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the Voltage source.

Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

Min/Max

Use of the "Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read 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, location of the signal and leads are correctly connected to the device under test. Also check the lead on the "COM" port goes to the ground or negative side of the signal and 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

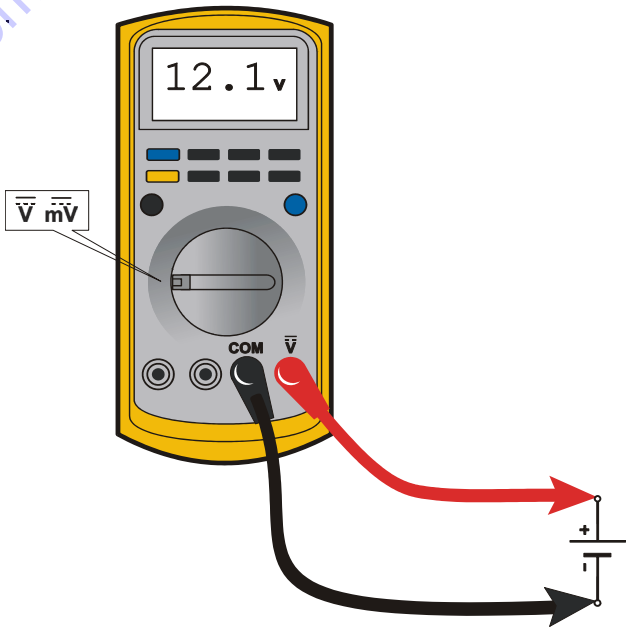


Figure 7-1. Voltage Measurement (DC)

- 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

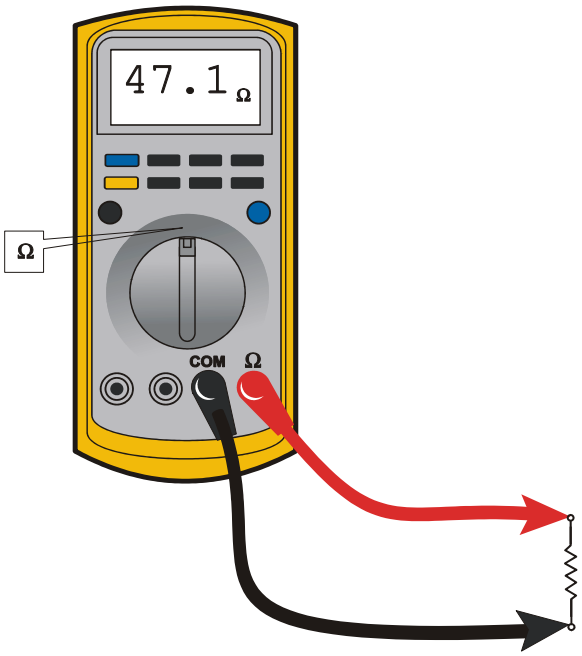


Figure 7-2. Resistance Measurement

- 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

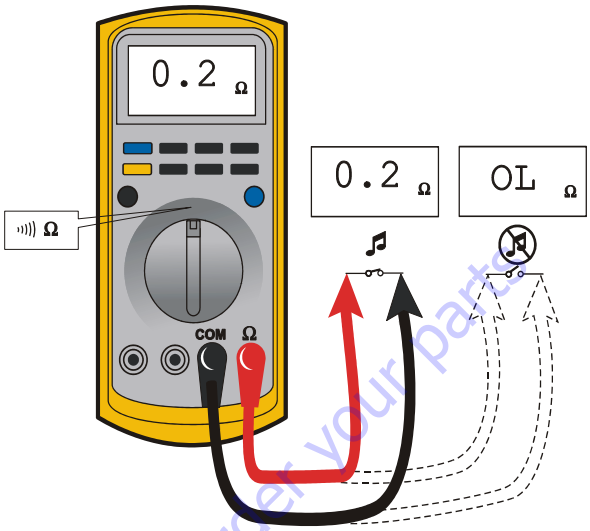


Figure 7-3. Continuity Measurement

- 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

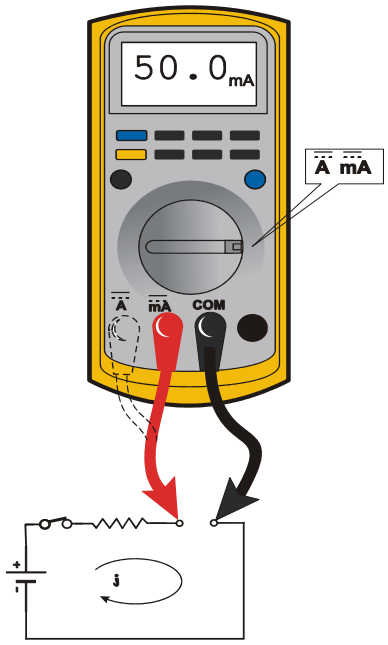


Figure 7-4. Current Measurement (DC)

- Set up meter for expected current range
- Be sure to connect meter leads to correct jacks for selected current range
- If meter is not auto ranging, set it to correct range (See multi meter's operation manual)
- Use firm contact with meter leads

7.3 APPLYING SILICONE DIELECTRIC COMPOUND TO ELECTRICAL CONNECTIONS

NOTE: *This section is not applicable for battery terminals.*

NOTICE

JLG PN 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.

NOTE: *This condition is especially common when machines are pressure washed since the washing solution is much more conductive than water.*

3. Anderson connectors for the battery boxes and battery chargers should have silicone grease applied to the contacts only.

NOTE: *Curing-type sealants might also be used to prevent shorting and would be less messy, but would make future pin removal more difficult.*

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).

7.4 DIELECTRIC GREASE APPLICATION

Dielectric grease helps to prevent corrosion of electrical contacts and improper conductivity between contacts from moisture intrusion. Non-waterproof connectors benefit from the application of dielectric grease.

Installation

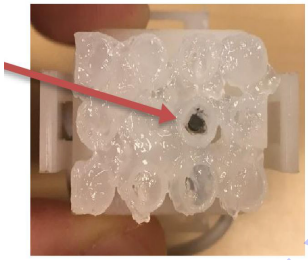
The following is general guidance for the installation of dielectric grease in a connector system.

- Use dielectric grease in a tube for larger connection points or apply with a syringe for small connectors.
- Apply dielectric grease to plug/male connector housing which typically contains sockets contact/female terminals.
- Leave a layer of dielectric grease on the mating face of the connector, completely covering each connector terminal hole. Refer the pictures shown below.
- Assemble the connector system immediately to prevent moisture ingress or dust contamination.

The following connector systems are specifically addressed because of their widespread use at JLG. However, this guidance may be applied to similar devices.

AMP Mate-N-Lok

This connector system is widely used inside enclosures for general-purpose interconnect. Follow the general guidance for installation.



Improper

Proper

AMP Faston

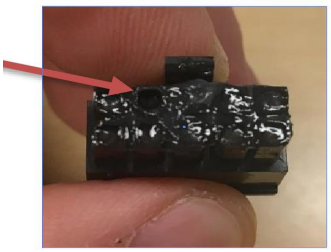
This connector system is typically used on operator switches at JLG. Follow the general guidance for installation.

Improper

Proper

AMP Micro-Fit

This connector system is typically used on control modules at JLG. Follow the general guidance for installation.

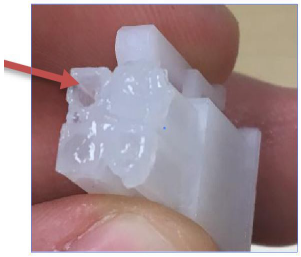


Improper

Proper

AMP Mini Fit Jr

This connector system is typically used on control modules at JLG. Follow the general guidance for installation.

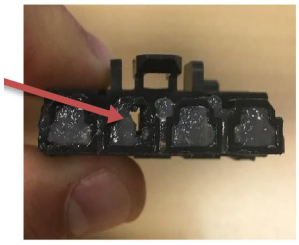


Improper

Proper

Mini Fit Sr

This connector system is typically used on control modules at JLG. Follow the general guidance for installation.

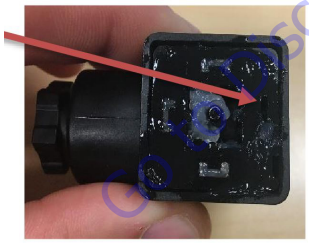


Improper

Proper

DIN Connectors

This connector is typically used on hydraulic valves. Follow the installation instructions



Improper

Proper

Exceptions

Some waterproof connector applications do benefit from dielectric grease, and some non waterproof connectors do not benefit from dielectric grease.

In the exceptions below, we have found dielectric grease is not needed for some applications, and in some cases can interfere with the intended connection. Dielectric grease shall be used as an exception in other applications.

Enclosures

Application of dielectric grease is not required in properly sealed enclosures. To meet criteria, the enclosure must be rated to at least IP56 (dust protected; protected from powerful jets of water).

Carling Switch Connectors

Carling switches may experience high impedance, or discontinuity, due to silicone dielectric grease ingress when switching inductive loads. Therefore, dielectric grease shall not be applied to Carling switch mating connectors unless specifically noted.

7.5 AMP CONNECTOR

Assembly

Check to be sure the wedge lock is in the open, or as-shipped, position (See Figure 7-5.). Proceed as follows:

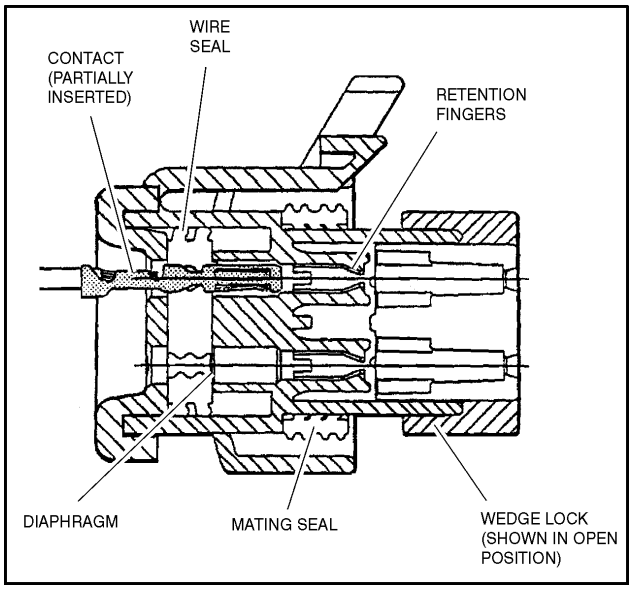


Figure 7-5. Connector Assembly Figure 1

1. To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (See Figure 7-7.).
2. Pull back on the contact wire with a force of 1 or 2 lb to be sure the retention fingers are holding the contact (See Figure 7-7.).

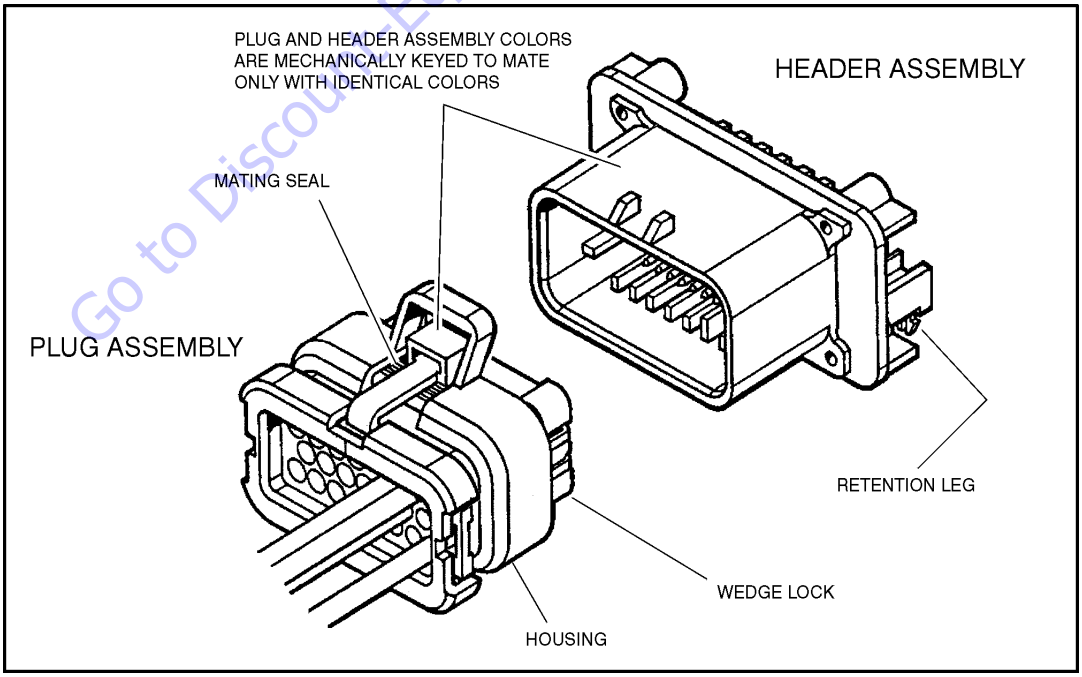


Figure 7-6. AMP Connector

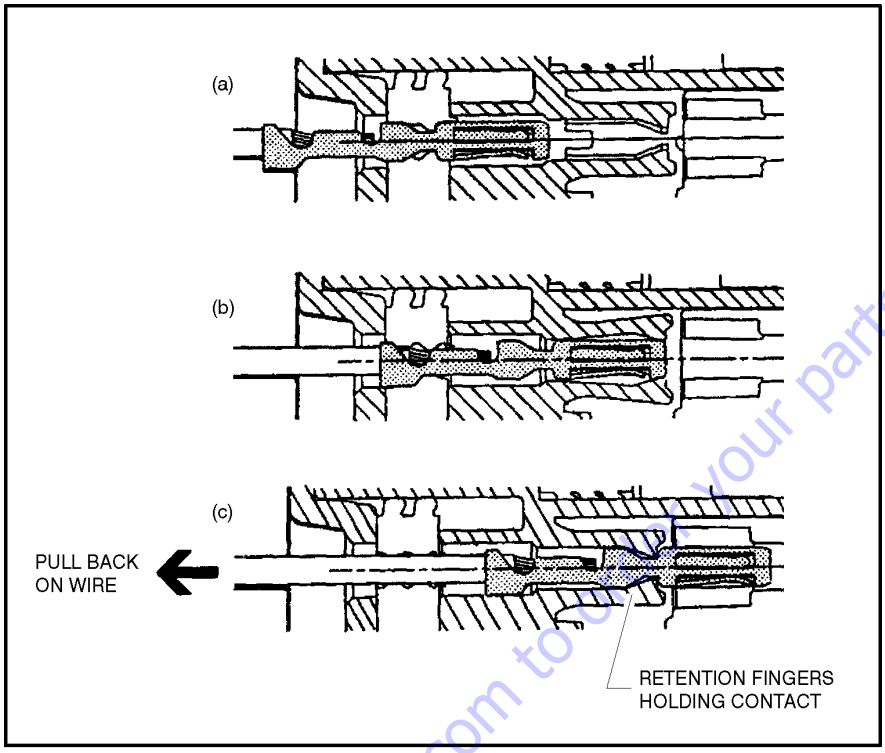


Figure 7-7. Connector Assembly Figure 2

3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 7-8.).

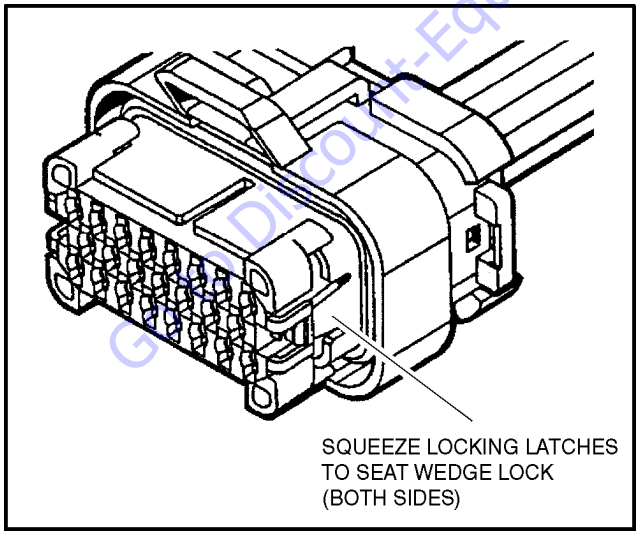


Figure 7-8. Connector Assembly Figure 3

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

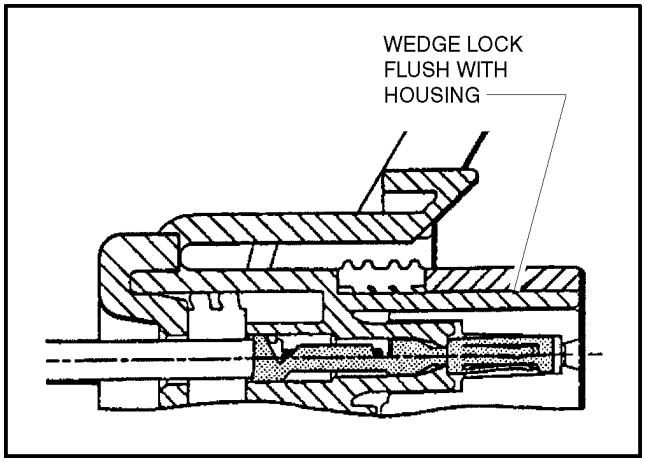


Figure 7-9. Connector Assembly Figure 4

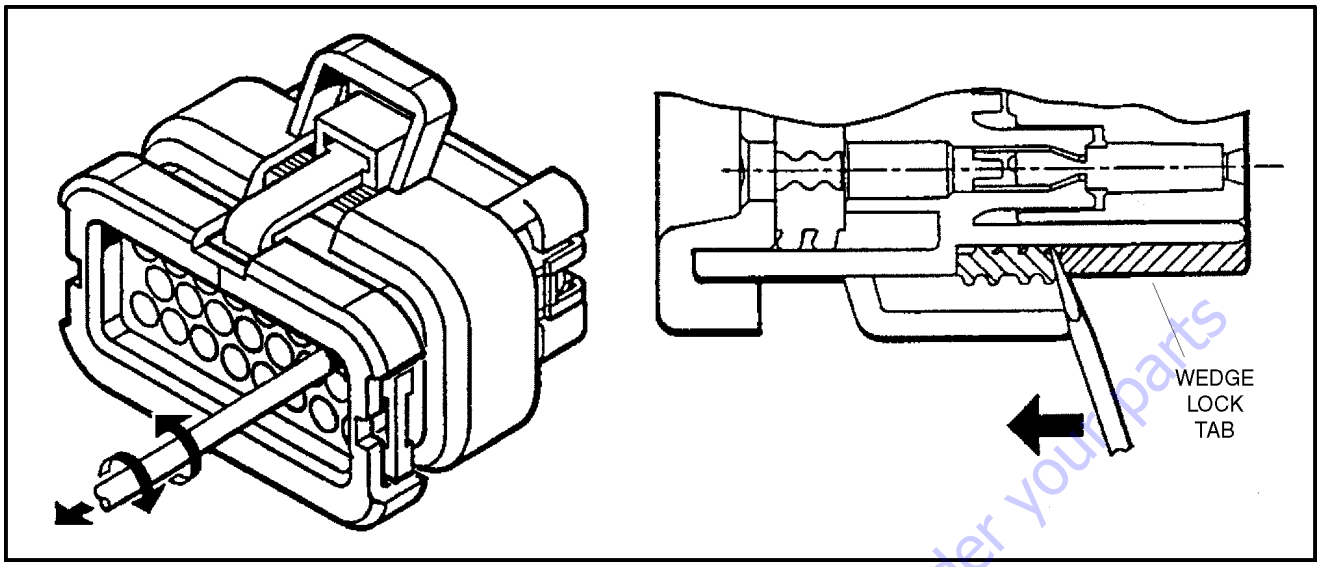


Figure 7-10. Connector Disassembly

Disassembly

5. Insert a 4.8 mm (3/16") wide screwdriver blade between the mating seal and one of the red wedge lock tabs.
6. Pry open the wedge lock to the open position.
7. 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 AMP-SEAL plug assembly, or any other sealed connector system. The resulting pinholes in the insulation will allow moisture to invade the system by traveling along the wire strands. This nullifies the effectiveness of the connector seals and could result in system failure.

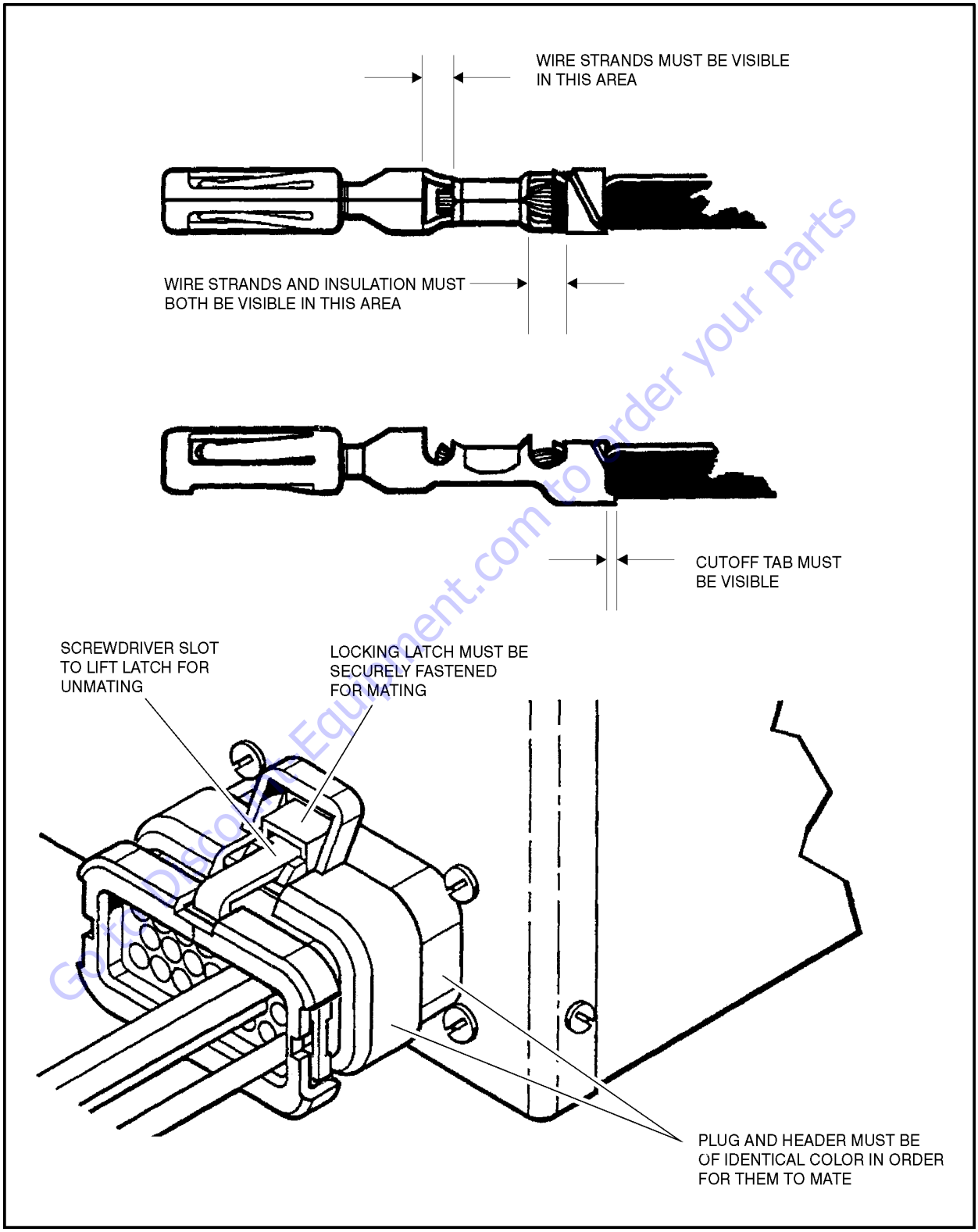


Figure 7-11. Connector Installation

7.6 DEUTSCH CONNECTORS

DT/DTP Series Assembly

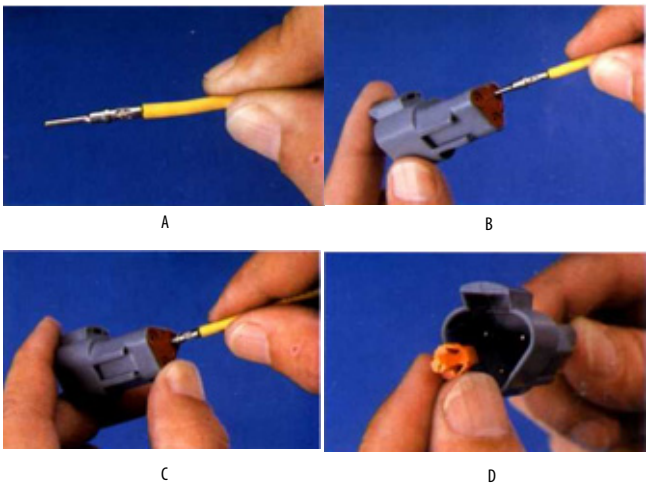


Figure 7-12. DT/DTP Contact Installation

1. Grasp crimped contact about 25mm behind the contact barrel.
2. Hold connector with rear grommet facing you.
3. Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.
4. Once all contacts are in place, insert wedgelock with arrow pointing toward exterior locking mechanism. The wedgelock will snap into place. Rectangular wedges are not oriented. Thy may go in either way.

NOTE: *The receptacle is shown - use the same procedure for plug.*

DT/DTP Series Disassembly

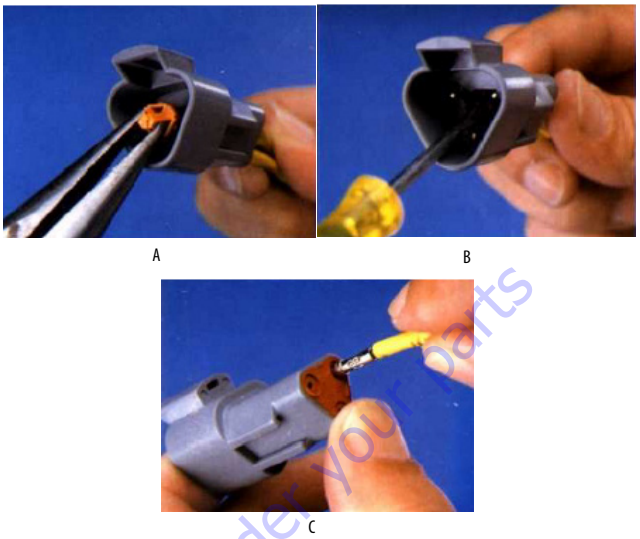


Figure 7-13. DT/DTP Contact Removal

5. Remove wedgelock using needlenose pliers or a hook shaped wire to pull wedge straight out.
6. 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.
7. Hold the rear seal in place, as removing the contact may displace the seal.

HD30/HDP20 Series Assembly

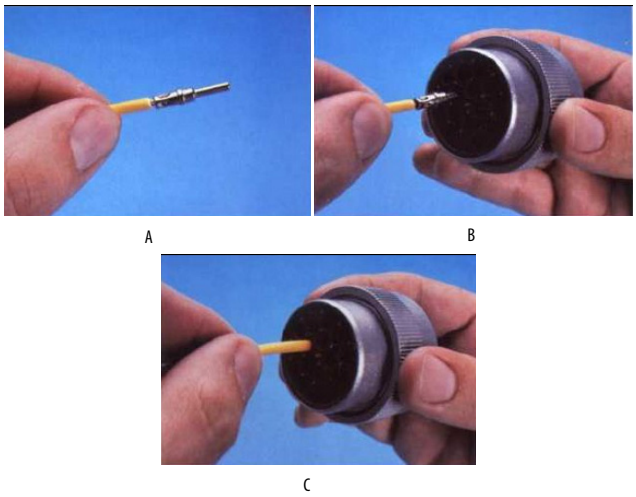


Figure 7-14. HD/HDP Contact Installation

8. Grasp contact about 25mm behind the contact crimp barrel.
9. Hold connector with rear grommet facing you.
10. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

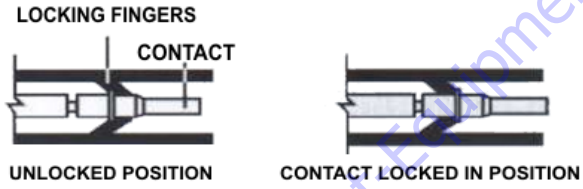


Figure 7-15. HD/HDP Locking Contacts Into Position

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

HD30/HDP20 Series Disassembly

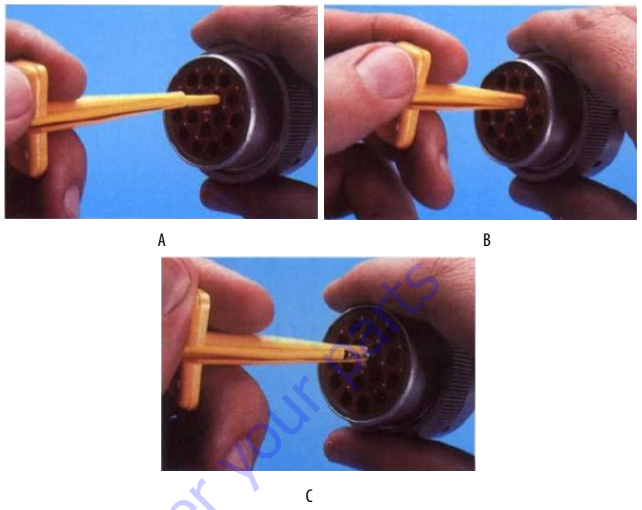


Figure 7-16. HD/HDP Contact Removal

11. With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.
12. Slide tool along into the insert cavity until it engages contact and resistance is felt.
13. Pull contact-wire assembly out of connector.

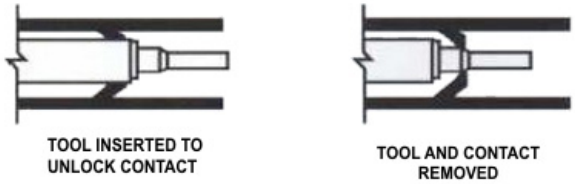


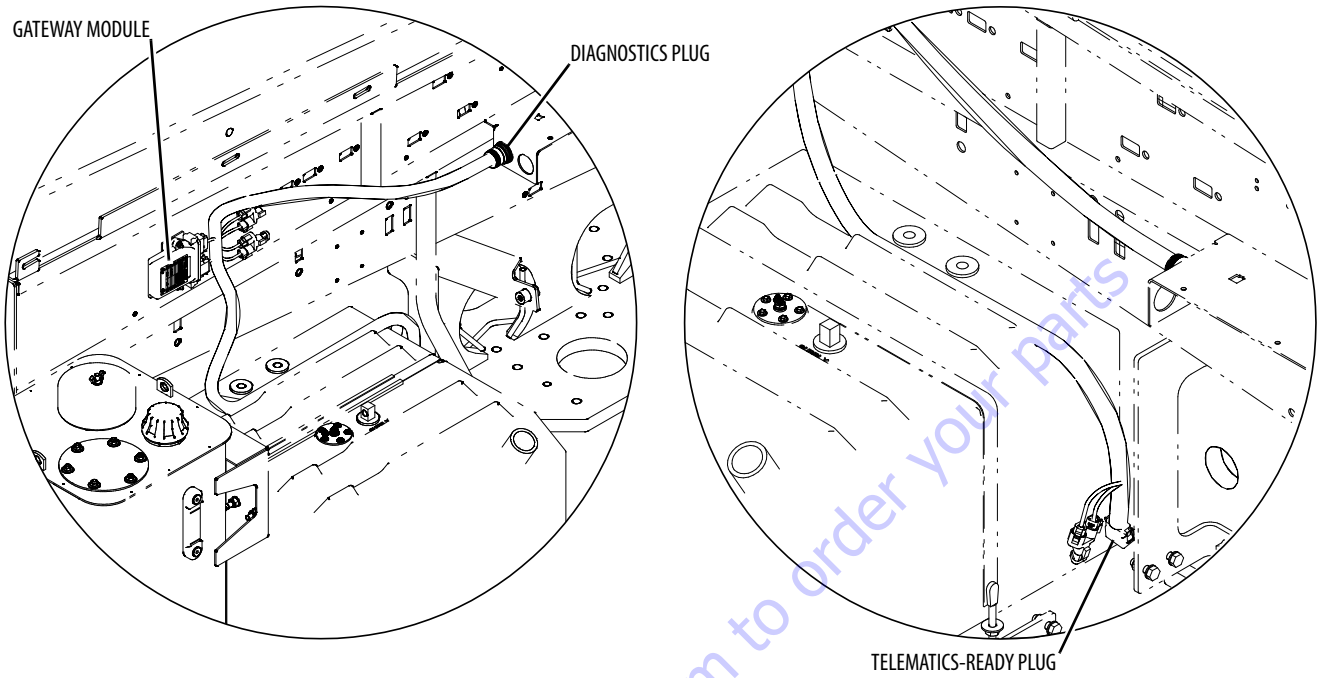
Figure 7-17. HD/HDP Unlocking Contacts

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

7.7 TELEMATICS GATEWAY

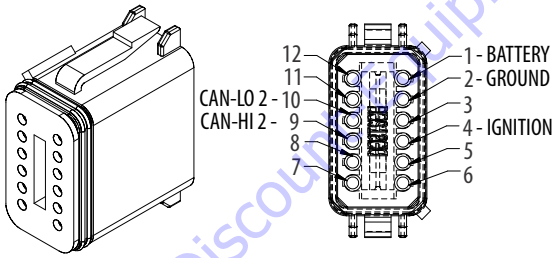
Personnel using machines equipped with an optional telematics gateway will be able to view the following data through their telematics device:

JLG LABEL	DESCRIPTION	UNIT
Engine Speed	Actual engine speed.	RPM
DEF Tank Level (If Equipped)	Indicates the level of DEF (diesel exhaust fluid) within the DEF tank if the machine is equipped with DEF tank. • 0% = Empty • 100% = Full	Percentage (%)
JLG Machine Faults: Active / Not-Active	• 00 - No Machine Faults • 01 - Active Machine Fault • 10 - Error • 11 - Not available	Bit
Total Idle Fuel Used	Total amount of fuel used during vehicle operation during idle conditions.	Liters
Total Idle Hours	Total time of engine operation during idle conditions.	Seconds
Total Engine Hours	Total time of engine operation.	Seconds
Total Fuel Used	Total amount of fuel used during vehicle operation.	Liters
Fuel Rate	Amount of fuel consumed by engine per unit of time.	Liters/Hour
Fuel Level	Ratio of fuel volume to the total volume of the fuel storage container. When a low fuel limit switch is present, the fuel level will indicate "full" until the switch opens, which will then indicate 10% fuel remaining. When Fuel Level 2 (SPN 38) is not used, Fuel Level 1 represents the total fuel in all fuel storage containers. When Fuel Level 2 is used, Fuel Level 1 represents the fuel level in the primary or left side fuel storage container.	Percentage (%)
DM1 Engine Faults	Shows actual engine fault codes.	N/A



Telematics-Ready (TCU) Plug

The telematics-ready (TCU) plug is a standard 12-pin Deutsch connector. Pin-out locations are shown below:



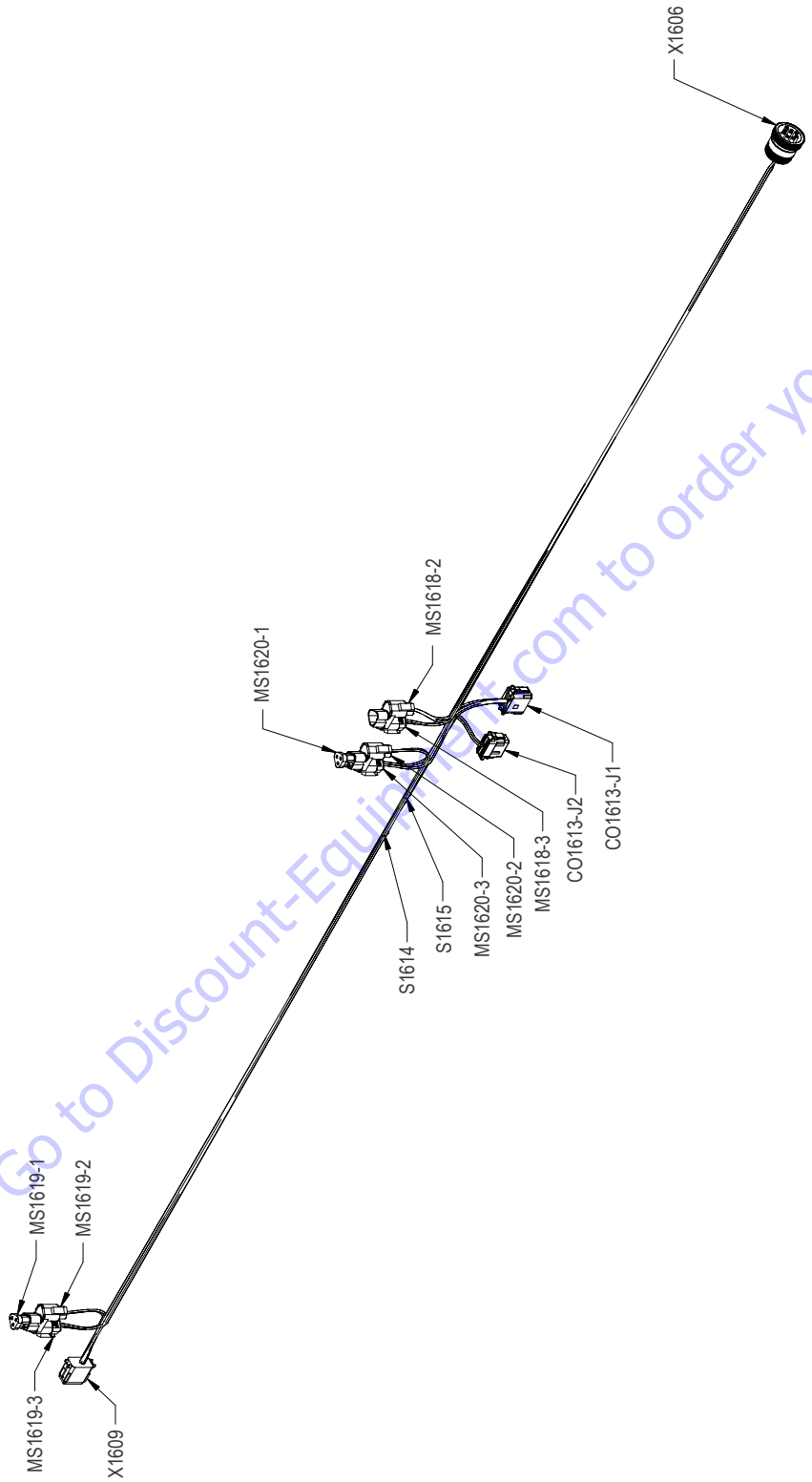


Figure 7-18. Telematics Gateway Harness - Sheet 1 of 3

X1609 (TCU)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-0 BAT	16 AWG	GXL	X1606 (B)
2	BLK	0-0 GND	16 AWG	GXL	S1615 (1)
4	ORN	2-0 IGN	16 AWG	GXL	S1614 (1)
9	GRN	CANL2	18 AWG	GXL	MS1619-2 (B)
10	YEL	CANH2	18 AWG	GXL	MS1619-2 (A)

MS1619-2 (CAN-T 2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CANH2	18 AWG	GXL	X1609 (10)
B	GRN	CANL2	18 AWG	GXL	X1609 (9)

MS1619-3 (CAN-T 2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CANH2	18 AWG	GXL	MS1620-2 (A)
B	GRN	CANL2	18 AWG	GXL	MS1620-2 (B)

CO1613-J1 (GATEWAY 1)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
9	GRN	CAN1	18 AWG	GXL	MS1618-2 (B)
10	YEL	CANH1	18 AWG	GXL	MS1618-2 (A)
11	BLK	0-2 GND	16 AWG	GXL	S1615 (2)
12	ORN	2-2 IGN	16 AWG	GXL	S1614 (2)

CO1613-J2 (GATEWAY 2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
9	GRN	CANL2	18 AWG	GXL	MS1620-3 (B)
10	YEL	CANH2	18 AWG	GXL	MS1620-3 (A)

MS1620-2 (CAN-T 2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CANH2	18 AWG	GXL	MS1619-3 (A)
B	GRN	CANL2	18 AWG	GXL	MS1619-3 (B)

MS1620-3 (CAN-T 2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CANH2	18 AWG	GXL	CO1613-J2 (10)
B	GRN	CANL2	18 AWG	GXL	CO1613-J2 (9)

S1614					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	ORN	2-0 IGN	16 AWG	GXL	X1609 (4)
2	ORN	2-1 IGN	16 AWG	GXL	X1606 (H)
2	ORN	2-2 IGN	16 AWG	GXL	CO1613-J1 (12)

S1615					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-0 GND	16 AWG	GXL	X1609 (2)
2	BLK	0-1 GND	16 AWG	GXL	X1606 (A)
2	BLK	0-2 GND	16 AWG	GXL	CO1613-J1 (11)

MS1618-2 (CAN-T 1)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CANH1	18 AWG	GXL	CO1613-J1 (10)
B	GRN	CANL1	18 AWG	GXL	CO1613-J1 (9)

MS1618-3 (CAN-T 1)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CANH1	18 AWG	GXL	X1606 (C)
B	GRN	CANL1	18 AWG	GXL	X1606 (D)

X1606 (DIAG)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	BLK	0-1 GND	16 AWG	GXL	S1615 (2)
B	RED	1-0 BAT	16 AWG	GXL	X1609 (1)
C	YEL	CANH1	18 AWG	GXL	MS1618-3 (A)
D	GRN	CANL1	18 AWG	GXL	MS1618-3 (B)
H	ORN	2-1 IGN	16 AWG	GXL	S1614 (2)

Figure 7-19. Telematics Gateway Harness - Sheet 2 of 3

					FROM		TO	
WIRE NO.	COLOR	WIRE GAUGE	LENGTH (mm)	JACKET	REFERENCE	PIN	REFERENCE	PIN
CAN L2	GRN	18 AWG	1151	GXL	MS1619-3	B	MS1620-2	B
CAN L2	GRN	18 AWG	151	GXL	X1609	9	MS1619-2	B
CAN L1	GRN	18 AWG	157	GXL	MS1618-2	B	CO1613-J1	9
CAN L2	GRN	18 AWG	225	GXL	MS1620-3	B	CO1613-J2	9
CAN L1	GRN	18 AWG	1076	GXL	MS1618-3	B	X1606	D
CAN H2	YEL	18 AWG	155	GXL	X1609	10	MS1619-2	A
CAN H2	YEL	18 AWG	233	GXL	MS1620-3	A	CO1613-J2	10
CAN H1	YEL	18 AWG	157	GXL	MS1618-2	A	CO1613-J1	10
CAN H2	YEL	18 AWG	1150	GXL	MS1619-3	A	MS1620-2	A
CAN H1	YEL	18 AWG	1079	GXL	MS1618-3	A	X1606	C
0-0 GND	BLK	16 AWG	1006	GXL	X1609	2	S1615	1
0-1 GND	BLK	16 AWG	1145	GXL	X1606	A	S1615	2
0-2 GND	BLK	16 AWG	223	GXL	CO1613-J1	11	S1615	2
1-0 BAT	RED	16 AWG	2150	GXL	X1609	1	X1606	B
2-0 IGN	ORN	16 AWG	939	GXL	X1609	4	S1614	1
2-1 IGN	ORN	16 AWG	1212	GXL	S1614	2	X1606	H
2-2 IGN	ORN	16 AWG	287	GXL	CO1613-J1	12	S1614	2

Figure 7-20. Telematics Gateway Harness - Sheet 3 of 3

7.8 WIRING HARNESS

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.

Examples:

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 machines

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

Component	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

Component	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.
C01-J3 is the J3 connector for a UGM control module.
EC9 is a glow plug supplied with the engine

7.9 WIRING HARNESS

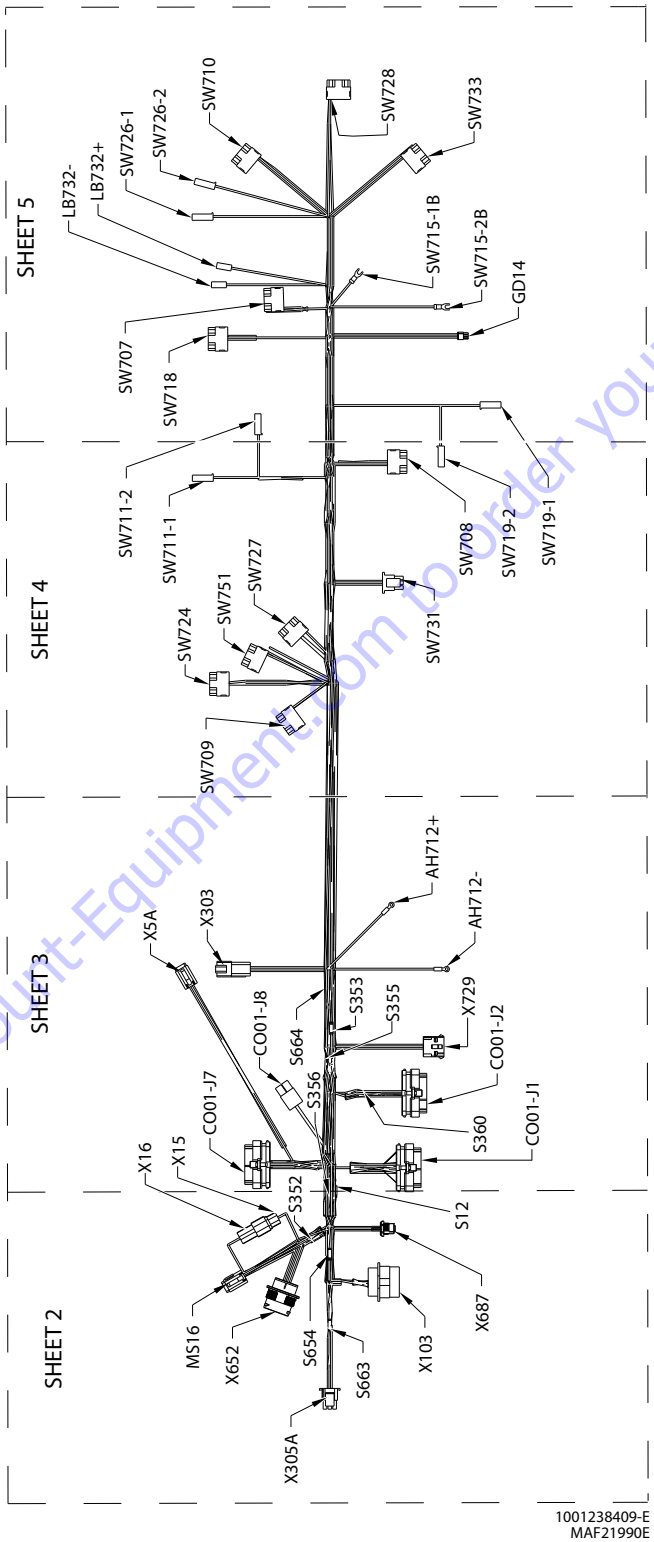


Figure 7-21. Platform Box Harness - Sheet 1 of 6

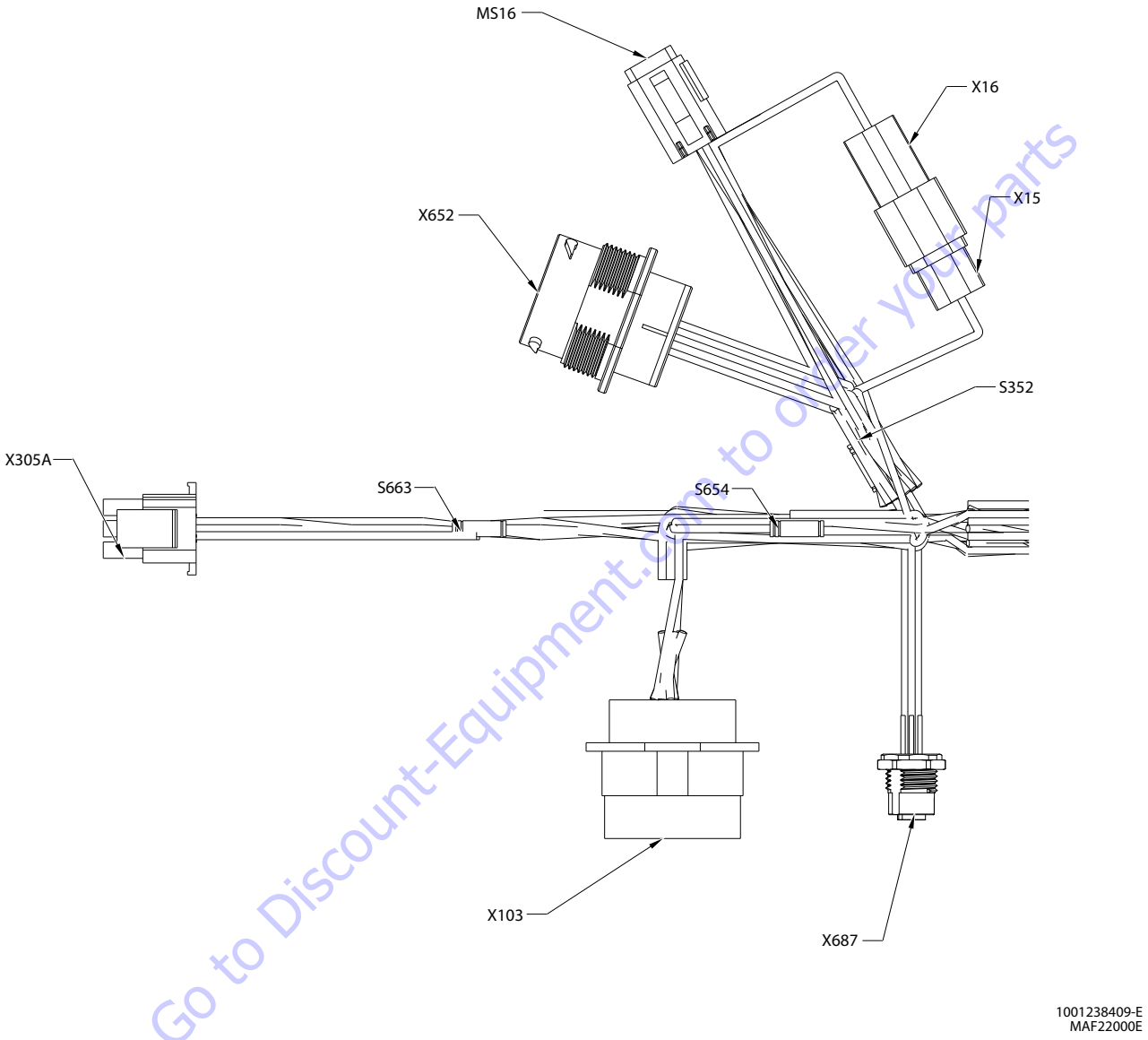


Figure 7-22. Platform Box Harness - Sheet 2 of 6

X16 CAN 1 TAP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN-ONE HIGH	18 AWG	GXL	MS16 (11)
B	GRN	CAN-ONE LOW	18 AWG	GXL	MS16 (5)
C					

X652 TO PLATFORM VALVE HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	12-3-1 PLAT VLV-	18 AWG	GXL	S664 (2)
2					
3	WHT	90-1 HI PRS DUMP	18 AWG	GXL	X103 (13)
4	WHT	88-1-2 LEVEL UP	18 AWG	GXL	S352 (2)
5	WHT	89-1-2 LEVEL DOWN	18 AWG	GXL	S654 (1)
6					
7					
8	WHT	58-1 PLAT ANGLE 1	18 AWG	GXL	C001-J1 (25)
9	WHT	58-0 PLAT ANGLE 2	18 AWG	GXL	C001-J1 (26)
10	WHT	11-1-1 ANGLE SNSR 5V+	18 AWG	GXL	S356 (2)
11	WHT	11-1-2 ANGLE SNSR 5V+	18 AWG	GXL	S356 (2)
12	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	X103 (15)
13	WHT	86-3 ROTATE LEFT	18 AWG	GXL	C001-J7 (5)
14	WHT	87-3 ROTATE RIGHT	18 AWG	GXL	C001-J7 (6)
15	WHT	82-3 JIB UP	18 AWG	GXL	C001-J7 (25)
16	WHT	83-3 JIB DOWN	18 AWG	GXL	C001-J7 (26)
17					
18					
19					
20	BLK	12-11-2 ANGLE SNSR-	18 AWG	GXL	S355 (2)
21	BLK	12-11-1 ANGLE SNSR-	18 AWG	GXL	S355 (2)

X15 CAN 1 TAP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN-ONE HIGH	18 AWG	GXL	X103 (3)
B	GRN	CAN-ONE LOW	18 AWG	GXL	X103 (2)
C					

X103 TO BOOM CABLE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	GRN	CAN-ONE LOW	18 AWG	GXL	X15 (B)
3	YEL	CAN-ONE HIGH	18 AWG	GXL	X15 (A)
4	WHT	9-0 PLAT MODE/GND ENABLE	18 AWG	GXL	C001-J7 (3)
5	WHT	88-1-1 LEVEL UP	18 AWG	GXL	S352 (1)
6					
7	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	S654 (2)
8					
9	YEL	4-0	18 AWG	GXL	SW715-1B (1B)
10					
11	WHT	8-0 GND MODE/PLAT ENABLE	18 AWG	GXL	C001-J7 (1)
12	YEL	2-7	12 AWG	GXL	C001-J8 (2)
13	WHT	90-1 HI PRS DUMP	18 AWG	GXL	X652 (3)
14					
15	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	X652 (12)
16	BLK	0-7	12 AWG	GXL	C001-J8 (1)
17					
18					
19					

MS16 CAN 1 BUSS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	CAN-ONE HIGH	20 AWG	CABLE	X687 (4)
2	YEL	CAN-ONE HIGH	18 AWG	GXL	X303 (8)
3	YEL	CAN-ONE HIGH	18 AWG	GXL	C001-J7 (31)
4	GRN	CAN-ONE LOW	18 AWG	GXL	C001-J7 (30)
5	GRN	CAN-ONE LOW	18 AWG	GXL	X16 (B)
6	GRY	CAN-ONE LOW	20 AWG	CABLE	X687 (5)
7	GRN	CAN-ONE LOW	18 AWG	GXL	X303 (9)
8					
9	GRN	CAN-ONE LOW	20 AWG	TXL	GD14 (4)
10	YEL	CAN-ONE HIGH	20 AWG	TXL	GD14 (1)
11	YEL	CAN-ONE HIGH	18 AWG	GXL	X16 (A)
12					

S352					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	88-1 LEVEL UP	18 AWG	GXL	C001-J7 (15)
1	WHT	88-1-1 LEVEL UP	18 AWG	GXL	X103 (5)
2	WHT	88-1-2 LEVEL UP	18 AWG	GXL	X652 (4)

S654					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	89-1-2 LEVEL DOWN	18 AWG	GXL	X652 (5)
2	WHT	89-1 LEVEL DOWN	18 AWG	GXL	C001-J7 (16)
2	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	X103 (7)

S663					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-10 SKYG/GEN+	18 AWG	GXL	C001-J7 (7)
1	YEL	10-10-2 SKY GUARD+	18 AWG	GXL	X5A (1)
2	YEL	10-10-1 GEN+	18 AWG	GXL	X305A (2)

X687 SINGLE CELL LSS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	YEL	10-2 LSS+	20 AWG	CABLE	C001-J2 (32)
3	BLU	12-4 LSS-	20 AWG	CABLE	C001-J7 (22)
4	BLK	CAN-ONE HIGH	20 AWG	CABLE	MS16 (1)
5	GRY	CAN-ONE LOW	20 AWG	CABLE	MS16 (6)

X305A OPTIONS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	508-1 GENERATOR SW INPUT	18 AWG	GXL	C001-J7 (9)
2	YEL	10-10-1 GEN+	18 AWG	GXL	S663 (2)
3					
4	WHT	7-2 FOOT SW N.C.	18 AWG	GXL	C001-J7 (8)
5	YEL	10-3 FOOT SW+	18 AWG	GXL	C001-J7 (4)
6					
7					
8					
9	YEL	10-8-2 SOFT TOUCH+	18 AWG	GXL	S360 (2)
10					
11					
12	WHT	504-1-2 SOFT TOUCH	18 AWG	GXL	S12 (2)
13					
14	WHT	1-551	18 AWG	GXL	X305A (15)
15	WHT	1-551	18 AWG	GXL	X305A (14)

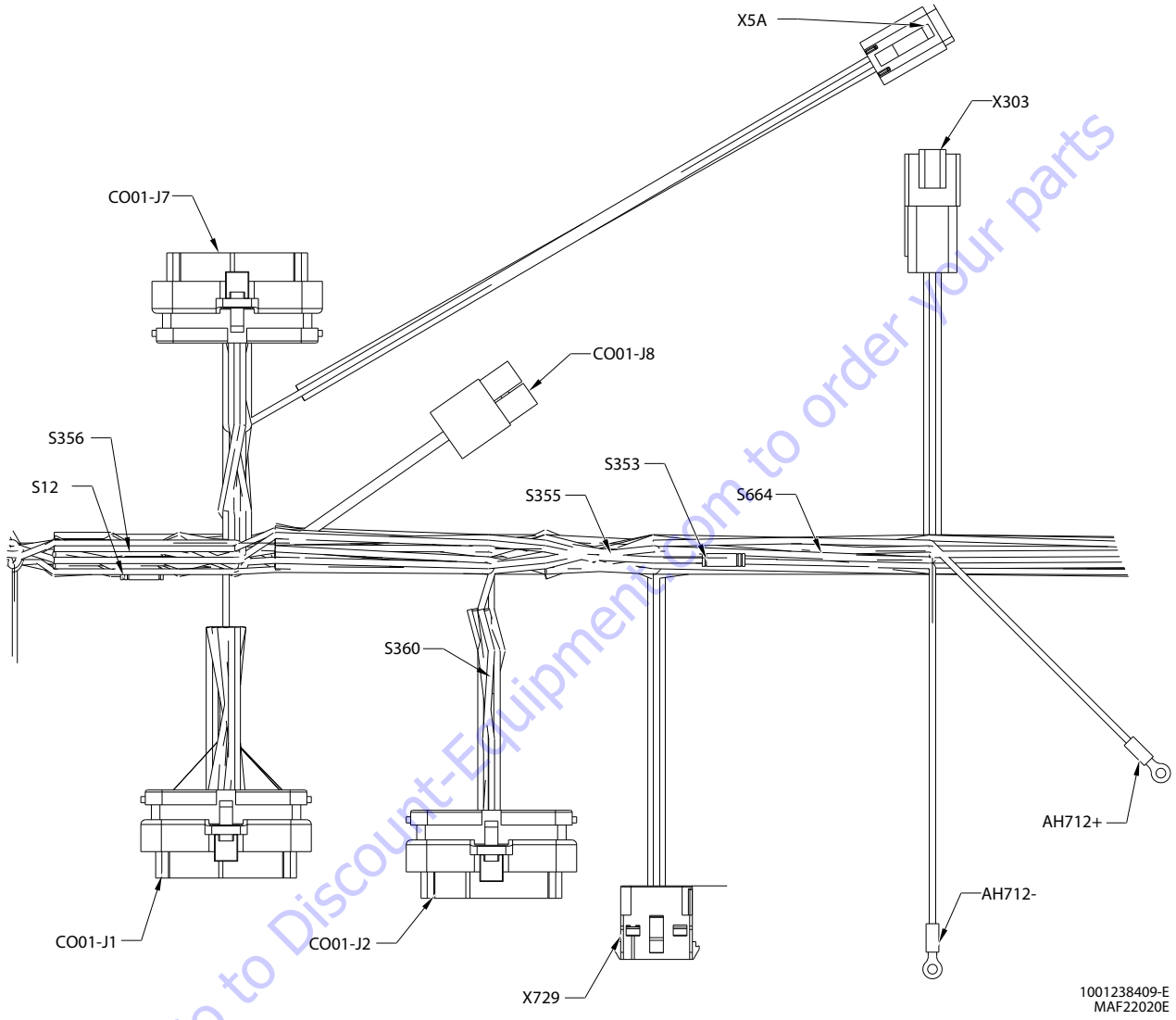


Figure 7-23. Platform Box Harness - Sheet 3 of 6

S12					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	504-1 SOFT TOUCH	18 AWG	GXL	C001-J1 (20)
2	WHT	504-1-1 SOFT TOUCH	18 AWG	GXL	X5A (6)
2	WHT	504-1-2 SOFT TOUCH	18 AWG	GXL	X305A (12)

S356					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	11-1 ANGLE SNSR 5V+	18 AWG	GXL	C001-J7 (11)
2	WHT	11-1-1 ANGLE SNSR 5V+	18 AWG	GXL	X652 (10)
2	WHT	11-1-2 ANGLE SNSR 5V+	18 AWG	GXL	X652 (11)

S360					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-8 SOFT TOUCH+	18 AWG	GXL	C001-J2 (34)
2	YEL	10-8-1 SOFT TOUCH+	18 AWG	GXL	X5A (3)
2	YEL	10-8-2 SOFT TOUCH+	18 AWG	GXL	X305A (9)

S353					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-6 OPTION+	18 AWG	GXL	C001-J2 (33)
2	YEL	10-6-1 OPTION+	18 AWG	GXL	X303 (7)
2	YEL	10-6-2 OPTION+	18 AWG	GXL	X303 (11)

S355					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	12-11 ANGLE SNSR-	18 AWG	GXL	C001-J7 (14)
2	BLK	12-11-1 ANGLE SNSR-	18 AWG	GXL	X652 (21)
2	BLK	12-11-2 ANGLE SNSR-	18 AWG	GXL	X652 (20)

AH712+ ALARM					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	94-2 PLAT ALARM	18 AWG	GXL	C001-J7 (19)

X5A SG/ST					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-10-2 SKY GUARD+	18 AWG	GXL	S663 (1)
2	BLK	12-10 SKY GUARD-	18 AWG	GXL	C001-J7 (21)
3	YEL	10-8-1 SOFT TOUCH+	18 AWG	GXL	S360 (2)
4	WHT	503-1 SKYG INPUT 1	18 AWG	GXL	C001-J7 (18)
5	WHT	503-2 SKYG INPUT 2	18 AWG	GXL	C001-J1 (23)
6	WHT	504-1-1 SOFT TOUCH	18 AWG	GXL	S12 (2)

X303 OPTIONS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3					
4					
5					
6	BLK	12-2-2 OPTION-	18 AWG	GXL	S664 (2)
7	YEL	10-6-1 OPTION+	18 AWG	GXL	S353 (2)
8	YEL	CAN-ONE HIGH	18 AWG	GXL	MS16 (2)
9	GRN	CAN-ONE LOW	18 AWG	GXL	MS16 (7)
10					
11	YEL	10-6-2 OPTION+	18 AWG	GXL	S353 (2)
12	BLK	12-3-2 DISPLAY-	18 AWG	GXL	S664 (2)

X729 ANALYZER					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-7 ANALYZER+	18 AWG	GXL	C001-J2 (26)
2	WHT	13-3 RECEIVE	18 AWG	GXL	C001-J2 (28)
3	WHT	13-4 TRANSMIT	18 AWG	GXL	C001-J2 (29)
4	BLK	12-6 ANALYZER-	18 AWG	GXL	C001-J2 (27)

S664					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	12-3 PLAT VLV-	18 AWG	GXL	C001-J7 (29)
2	BLK	12-3-1 PLAT VLV-	18 AWG	GXL	X652 (1)
2	BLK	12-3-2 DISPLAY	18 AWG	GXL	X303 (12)

C001-J7 BLACK					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	8-0 GND MODE/PLAT ENABLE	18 AWG	GXL	X103 (11)
2	YEL	5-0	18 AWG	GXL	SW715-2B (2B)
3	WHT	9-0 PLAT MODE/GND ENABLE	18 AWG	GXL	X103 (4)
4	YEL	10-3 FOOT SW+	18 AWG	GXL	X305A (5)
5	WHT	86-3 ROTATE LEFT	18 AWG	GXL	X652 (13)
6	WHT	87-3 ROTATE RIGHT	18 AWG	GXL	X652 (14)
7	YEL	10-10 SKYG/GEN+	18 AWG	GXL	S663 (1)
8	WHT	7-2 FOOT SW N.C.	18 AWG	GXL	X305A (4)
9	WHT	508-1 GENERATOR SW INPUT	18 AWG	GXL	X305A (1)
10					
11	WHT	11-1 ANGLE SNSR 5V+	18 AWG	GXL	S356 (1)
12					
13					
14	BLK	12-11 ANGLE SNSR-	18 AWG	GXL	S355 (1)
15	WHT	88-1 LEVEL UP	18 AWG	GXL	S352 (1)
16	WHT	89-1 LEVEL DOWN	18 AWG	GXL	S654 (2)
17					
18	WHT	503-1 SKYG INPUT 1	18 AWG	GXL	X5A (4)
19	WHT	94-2 PLAT ALARM	18 AWG	GXL	AH712+ (1)
20	BLK	12-1 PLAT ALARM-	18 AWG	GXL	AH712- (1)
21	BLK	12-10 SKY GUARD-	18 AWG	GXL	X5A (2)
22	BLU	12-4 LSS-	20 AWG	CABLE	X687 (3)
23					
24					
25	WHT	82-3 JIB UP	18 AWG	GXL	X652A (15)
26	WHT	83-3 JIB DOWN	18 AWG	GXL	X652A (16)
27					
28					
29	BLK	12-3 PLAT VLV-	18 AWG	GXL	S664 (1)
30	GRN	CAN-ONE LOW	18 AWG	GXL	MS16 (4)
31	YEL	CAN-ONE HIGH	18 AWG	GXL	MS16 (3)
32					
33					
34	BLK	12-2 OPTION-	18AWG	GXL	X303 (6)
35					

C001-J1 NATURAL					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3					
4					
5	WHT	78-2 TELE IN	18 AWG	GXL	SW707 (3)
6	WHT	79-2 TELE OUT	18 AWG	GXL	SW707 (1)
7	WHT	87-2 ROTATE RIGHT	18 AWG	GXL	SW708 (3)
8	WHT	86-2 ROTATE LEFT	18 AWG	GXL	SW708 (1)
9	WHT	88-2 LEVEL UP	18 AWG	GXL	SW709 (3)
10	WHT	89-2 LEVEL DOWN	18 AWG	GXL	SW709 (1)
11	WHT	82-2 JIB UP	18 AWG	GXL	SW718 (3)
12	WHT	83-2 JIB DOWN	18 AWG	GXL	SW718 (1)
13	BLK	12-0 FUNCTION SPD-	18 AWG	GXL	SW731 (5)
14	WHT	100-2 START SWITCH	18 AWG	GXL	SW710 (3)
15	WHT	93-2 AUX POWER	18 AWG	GXL	SW710 (1)
16	WHT	17-1 CRAB STEER	18 AWG	GXL	SW751 (3)
17	WHT	17-0 COORD STEER	18 AWG	GXL	SW751 (1)
18	YEL	10-0 PLAT CNTRL +	18 AWG	GXL	SW724 (2)
19	WHT	54-5 FULL EXTENTION	18 AWG	GXL	SW733 (1)
20	WHT	504-1 SOFT TOUCH	18 AWG	GXL	S12 (1)
21	WHT	54-2 CAPACITY	18 AWG	GXL	SW733 (3)
22					
23	WHT	503-2 SKYG INPUT 2	18 AWG	GXL	X5A (5)
24					
25	WHT	58-1 PLAT ANGLE 1	18 AWG	GXL	X652 (8)
26	WHT	58-0 PLAT ANGLE 2	18 AWG	GXL	X652 (9)
27	WHT	24-2 TWO SPEED	18 AWG	GXL	SW724 (1)
28	WHT	25-1 MAX TORQUE	18 AWG	GXL	SW724 (3)
29	WHT	504-0 SOFT/SKYG OVRIDE	18 AWG	GXL	SW719-1 (1)
30	WHT	500-3 HEAD LIGHTS	18 AWG	GXL	SW726-1 (1)
31	WHT	30-0 HORN	18 AWG	GXL	SW711-1 (1)
32	WHT	29-0 CREEP SW	18 AWG	GXL	SW731 (2)
33	WHT	107-0 FUEL SELECT	18 AWG	GXL	SW727 (3)
34	WHT	11-0 FUNCTION SPD 7V+	18 AWG	GXL	SW731 (4)
35	WHT	69-0 FUNCTION SPD INPUT	18 AWG	GXL	SW731 (6)

C001-J2 BLUE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3	YEL	10-9 DISPLAY+	20 AWG	TXL	GD14 (3)
4	WHT	51-2 DRV ORENTION SW	18 AWG	GXL	SW728 (1)
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16	WHT	504-2 SOFT TCH/SKYG LT	18 AWG	GXL	LB732+ (1)
17					
18	BLK	12-8 DISPLAY-	20 AWG	TXL	GD14 (6)
19					
20					
21					
22					
23					
24					
25	BLK	12-7 SKYG LT-	18 AWG	GXL	LB732- (1)
26	YEL	10-7 ANALYZER+	18 AWG	GXL	X729 (1)
27	BLK	12-6 ANALYZER-	18 AWG	GXL	X729 (4)
28	WHT	13-3 RECEIVE	18 AWG	GXL	X729 (2)
29	WHT	13-4 TRANSMIT	18 AWG	GXL	X729 (3)
30					
31					
32	YEL	10-2 LSS+	20 AWG	CABLE	X687 (2)
33	YEL	10-6 OPTION+	18 AWG	GXL	S353 (1)
34	YEL	10-8 SOFT TOUCH+	18 AWG	GXL	S360 (1)
35					

AH712- ALARM					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	12-1 PLAT ALARM-	18 AWG	GXL	C001-J7 (20)

C001-J8					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-7	12 AWG	GXL	X103 (16)
2	YEL	2-7	12 AWG	GXL	X103 (12)

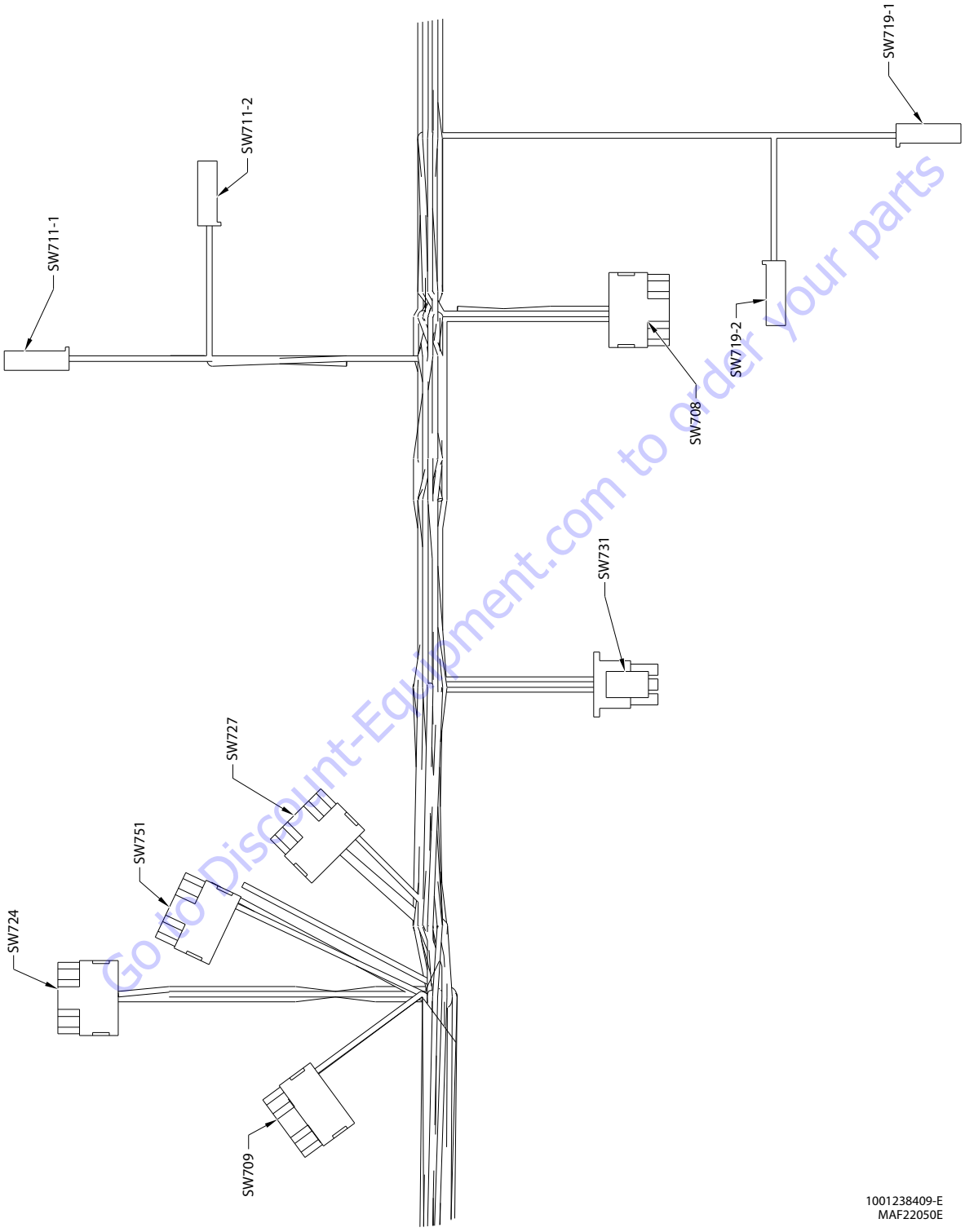


Figure 7-24. Platform Box Harness - Sheet 4 of 6

SW709 LEVEL					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	89-2 LEVEL DOWN	18 AWG	GXL	C001-J1 (10)
2	YEL	10-0-7 PLAT CNTRL +	18 AWG	GXL	SW710 (2)
2	YEL	10-0-8 PLAT CNTRL +	18 AWG	GXL	SW708 (2)
3	WHT	88-2 LEVEL UP	18 AWG	GXL	C001-J1 (9)
4					
5					
6					

SW708 PLATFORM ROTATE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	86-2 ROTATE LEFT	18 AWG	GXL	C001-J1 (8)
2	YEL	10-0-8 PLAT CNTRL +	18 AWG	GXL	SW709 (2)
2	YEL	10-0-9 PLAT CNTRL +	18 AWG	GXL	SW733 (2)
3	WHT	87-2 ROTATE RIGHT	18 AWG	GXL	C001-J1 (7)
4					
5					
6					

SW724 ENGINE SPEED					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	24-2 TWO SPEED	18 AWG	GXL	C001-J1 (27)
2	YEL	10-0 PLAT CNTRL +	18 AWG	GXL	C001-J1 (18)
2	YEL	10-0-1 PLAT CNTRL +	18 AWG	GXL	SW751 (2)
3	WHT	25-1 MAX TORQUE	18 AWG	GXL	C001-J1 (28)
4					
5					
6					

SW731 PUMP POT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	WHT	29-0 CREEP SW	18 AWG	GXL	C001-J1 (32)
3	YEL	10-0-11 PLAT CNTRL +	18 AWG	GXL	SW707 (2)
3	YEL	10-0-12 PLAT CNTRL +	18 AWG	GXL	SW711-2 (1)
4	WHT	11-0 FUNCTION SPD 7V+	18 AWG	GXL	C001-J1 (34)
5	BLK	12-0 FUNCTION SPD -	18 AWG	GXL	C001-J1 (13)
6	WHT	69-0 FUNCTION SPD INPUT	18 AWG	GXL	C001-J1 (35)

SW751 STEER SELECT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	17-0 COORD STEER	18 AWG	GXL	C001-J1 (17)
2	YEL	10-0-1 PLAT CNTRL +	18 AWG	GXL	SW724 (2)
2	YEL	10-0-2 PLAT CNTRL +	18 AWG	GXL	SW727 (2)
3	WHT	17-1 CRAB STEER	18 AWG	GXL	C001-J1 (16)
4					
5					
6					

SW711-2 HORN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-0-12 PLAT CNTRL +	18 AWG	GXL	SW731 (3)
1	YEL	10-0-13 PLAT CNTRL +	18 AWG	GXL	SW719-2 (1)

SW719-1 SOFT TCH/SKYG OVRD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	504-0 SOFT/SKYG OVRIDE	18 AWG	GXL	C001-J1 (29)

SW727 FUEL SELECT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	YEL	10-0-2 PLAT CNTRL +	18 AWG	GXL	SW751 (2)
2	YEL	10-0-3 PLAT CNTRL +	18 AWG	GXL	SW726-2 (1)
3	WHT	107-0 FUEL SELECT	18 AWG	GXL	C001-J1 (33)
4					
5					
6					

SW719-2 SOFT TCH/SKYG OVRD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-0-13 PLAT CNTRL +	18 AWG	GXL	SW711-2 (1)

SW711-1 HORN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	30-0 HORN	18 AWG	GXL	C001-J1 (31)

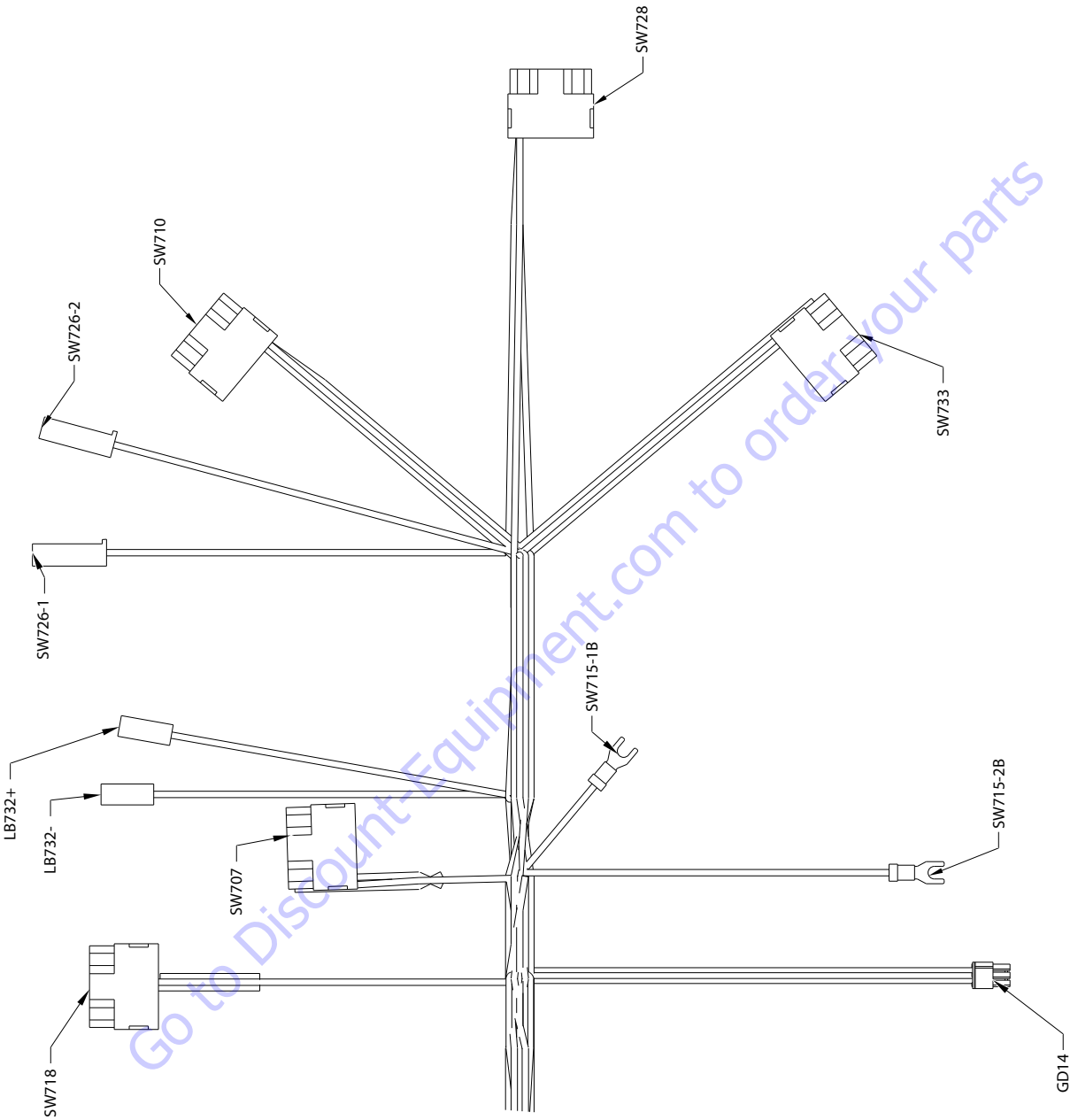


Figure 7-25. Platform Box Harness - Sheet 5 of 6

1001238409-E
MAF22070E

SW715-2B EMS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
2B	YEL	5-0	18 AWG	GXL	C001-J7 (2)

GD14 LED DISPLAY					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CAN-ONE HIGH	20 AWG	TXL	MS16 (10)
2					
3	YEL	10-9 DISPLAY+	20 AWG	TXL	C001-J2 (3)
4	GRN	CAN-ONE LOW	20 AWG	TXL	MS16 (9)
5					
6	BLK	12-8 DISPLAY-	20 AWG	TXL	C001-J2 (18)

SW715-1B EMS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1B	YEL	4-0	18 AWG	GXL	X103 (9)

SW718 JIB LIFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	83-2 JIB DOWN	18 AWG	GXL	C001-J1 (12)
2	YEL	10-0-4 PLAT CNTRL +	18 AWG	GXL	SW726-2 (1)
2	YEL	10-0-5 PLAT CNTRL +	18 AWG	GXL	SW728 (2)
3	WHT	82-2 JIB UP	18 AWG	GXL	C001-J1 (11)
4					
5					
6					

LB732- SOFT TCH/SKYG WARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	12-7 SKYG LT-	18 AWG	GXL	C001-J2 (25)

SW707 BOOM TELE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	79-2 TELE OUT	18 AWG	GXL	C001-J1 (6)
2	YEL	10-0-10 PLAT CNTRL +	18 AWG	GXL	SW733 (2)
2	YEL	10-0-11 PLAT CNTRL +	18 AWG	GXL	SW731 (3)
3	WHT	78-2 TELE IN	18 AWG	GXL	C001-J1 (5)
4					
5					
6					

SW726-1 HEAD&TAIL LT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	500-3 HEAD LIGHTS	18 AWG	GXL	C001-J1 (30)

SW726-2 HEAD&TAIL LT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	10-0-3 PLAT CNTRL +	18 AWG	GXL	SW727 (2)
1	YEL	10-0-4 PLAT CNTRL +	18 AWG	GXL	SW718 (2)

LB732+ SOFT TCH/SKYG WARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	504-2 SOFT TCH/SKYG LT	18 AWG	GXL	C001-J2 (16)

SW710 START AUX					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	93-2 AUX POWER	18 AWG	GXL	C001-J1 (15)
2	YEL	10-0-6 PLAT CNTRL +	18 AWG	GXL	SW728 (2)
2	YEL	10-0-7 PLAT CNTRL +	18 AWG	GXL	SW709 (2)
3	WHT	100-2 START SWITCH	18 AWG	GXL	C001-J1 (14)
4					
5					
6					

SW728 DRIVE ORNT OVRIDE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	51-2 DRV ORENTION SW	18 AWG	GXL	C001-J2 (4)
2	YEL	10-0-5 PLAT CNTRL +	18 AWG	GXL	SW718 (2)
2	YEL	10-0-6 PLAT CNTRL +	18 AWG	GXL	SW710 (2)
3					
4					
5					
6					

SW733 CAPACITY					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	54-5 FULL EXTENTION	18 AWG	GXL	C001-J1 (19)
2	YEL	10-0-10 PLAT CNTRL +	18 AWG	GXL	SW707 (2)
2	YEL	10-0-9 PLAT CNTRL +	18 AWG	GXL	SW708 (2)
3	WHT	54-2 CAPACITY	18 AWG	GXL	C001-J1 (21)
4					
5					
6					

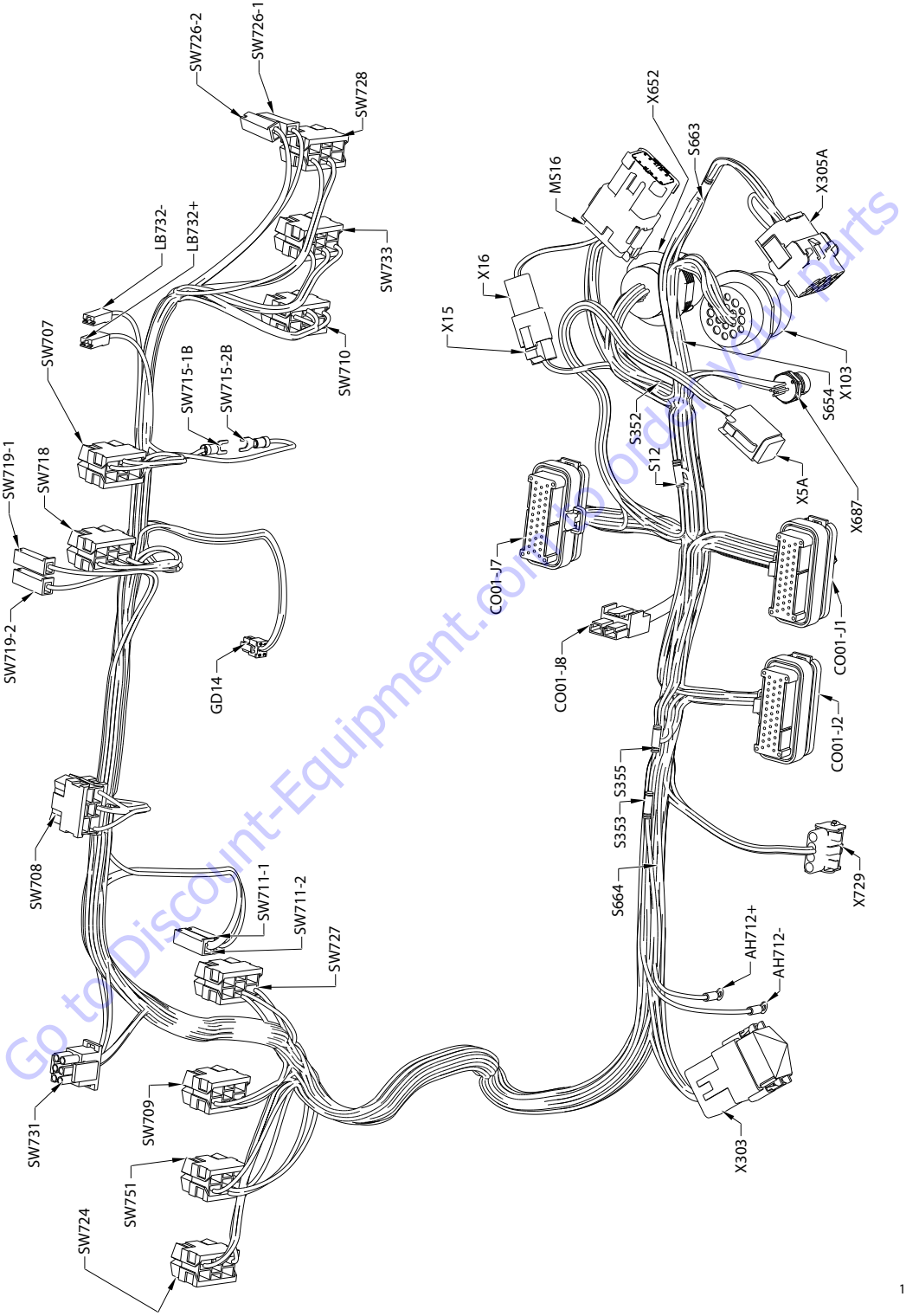


Figure 7-26. Platform Box Harness - Sheet 6 of 6

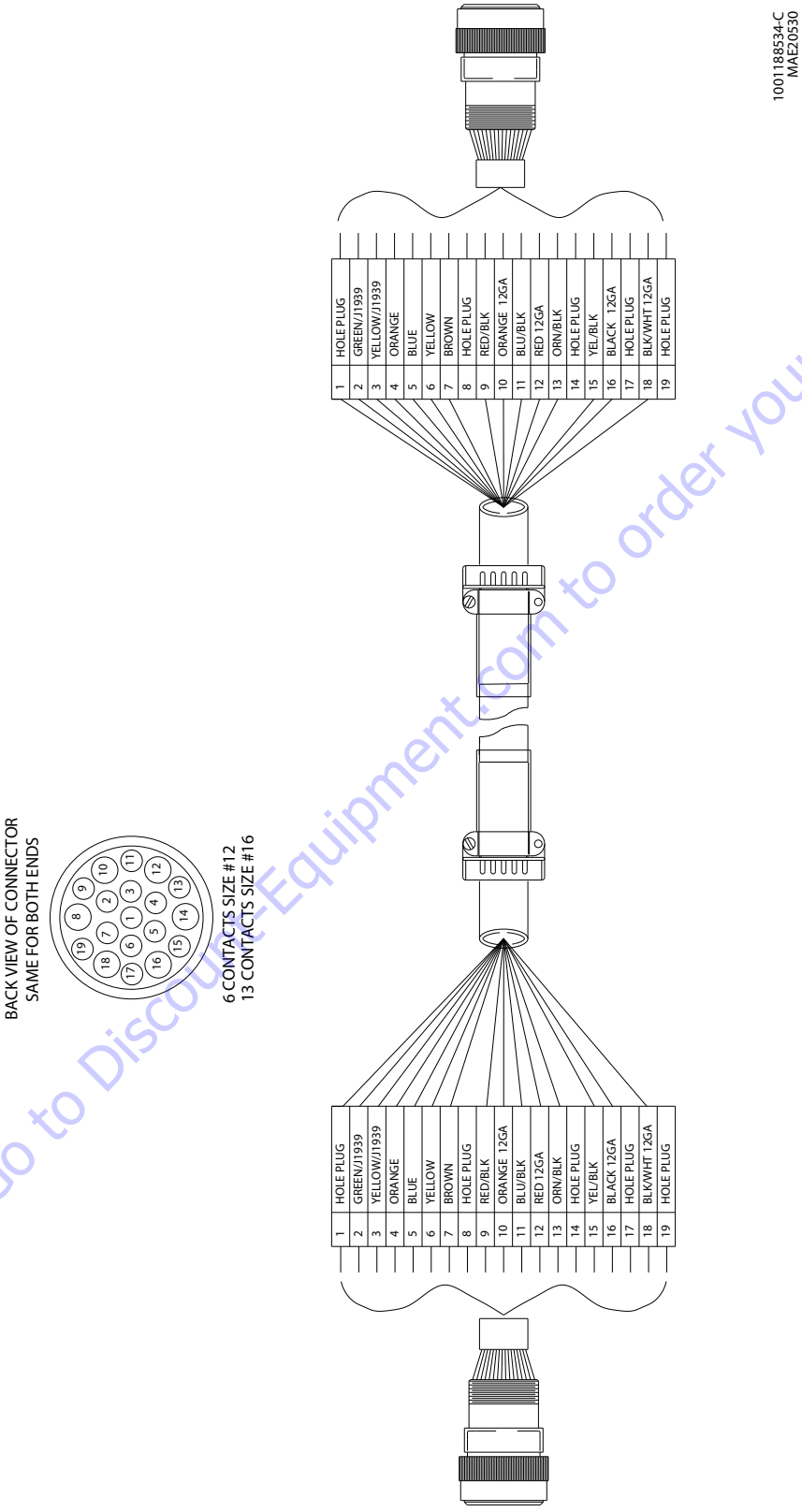


Figure 7-27. Main Boom Harness (With Jib)

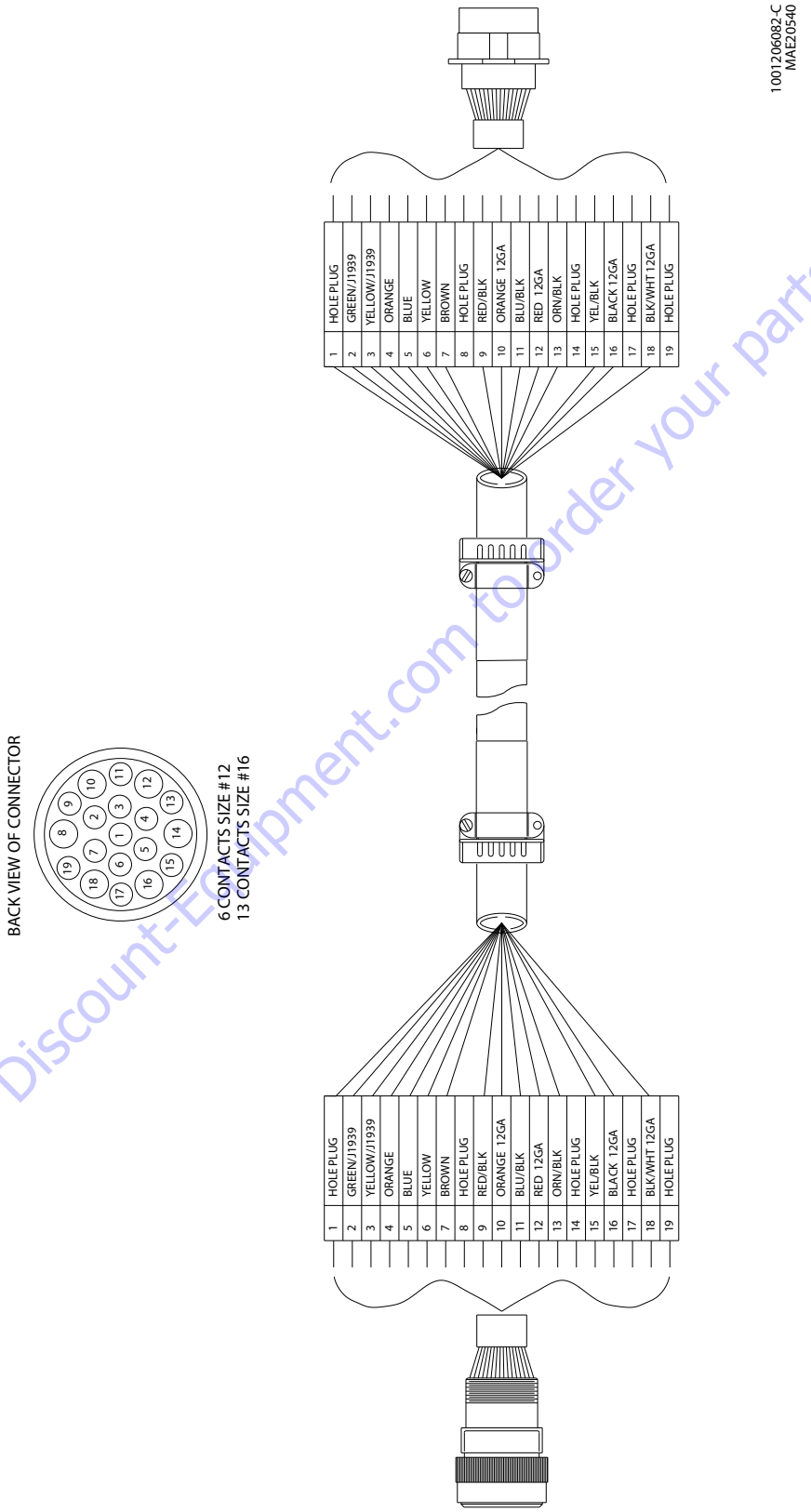


Figure 7-28. Main Boom Harness (TT)

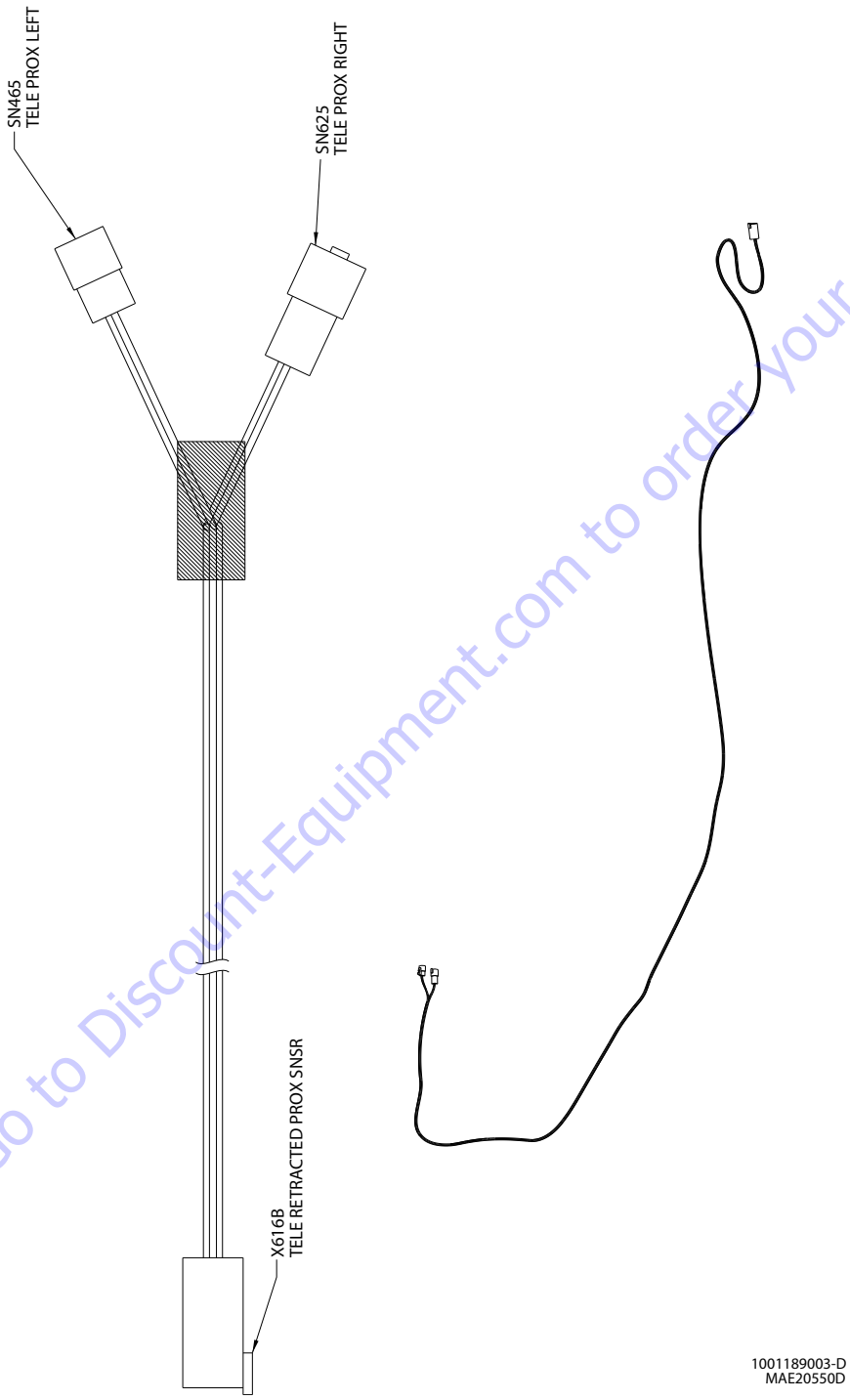


Figure 7-29. Proximity Switch Harness (Telescope In)

X616B TELE RETRACTED PROX SNSR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	ORN/BLK	CABLE CABLE	18 AWG	TFFN	SN465 (1)
2	BLK/RED	CABLE CABLE	18 AWG	TFFN	SN465 (3)
3	BLU/RED	CABLE CABLE	18 AWG	TFFN	SN465 (2)
4	YEL/BLK	CABLE CABLE	18 AWG	TFFN	SN625 (1)
5	BRN/BLK	CABLE CABLE	18 AWG	TFFN	SN625 (3)
6	BLU/BLK	CABLE CABLE	18 AWG	TFFN	SN625 (2)

SN625 TELE PROX RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL/BLK	CABLE CABLE	18 AWG	TFFN	X616B (4)
2	BLU/BLK	CABLE CABLE	18 AWG	TFFN	X616B (6)
3	BRN/BLK	CABLE CABLE	18 AWG	TFFN	X616B (5)

SN465 TELE PROX LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	ORN/BLK	CABLE CABLE	18 AWG	TFFN	X616B (1)
2	BLU/RED	CABLE CABLE	18 AWG	TFFN	X616B (3)
3	BLK/RED	CABLE CABLE	18 AWG	TFFN	X616B (2)

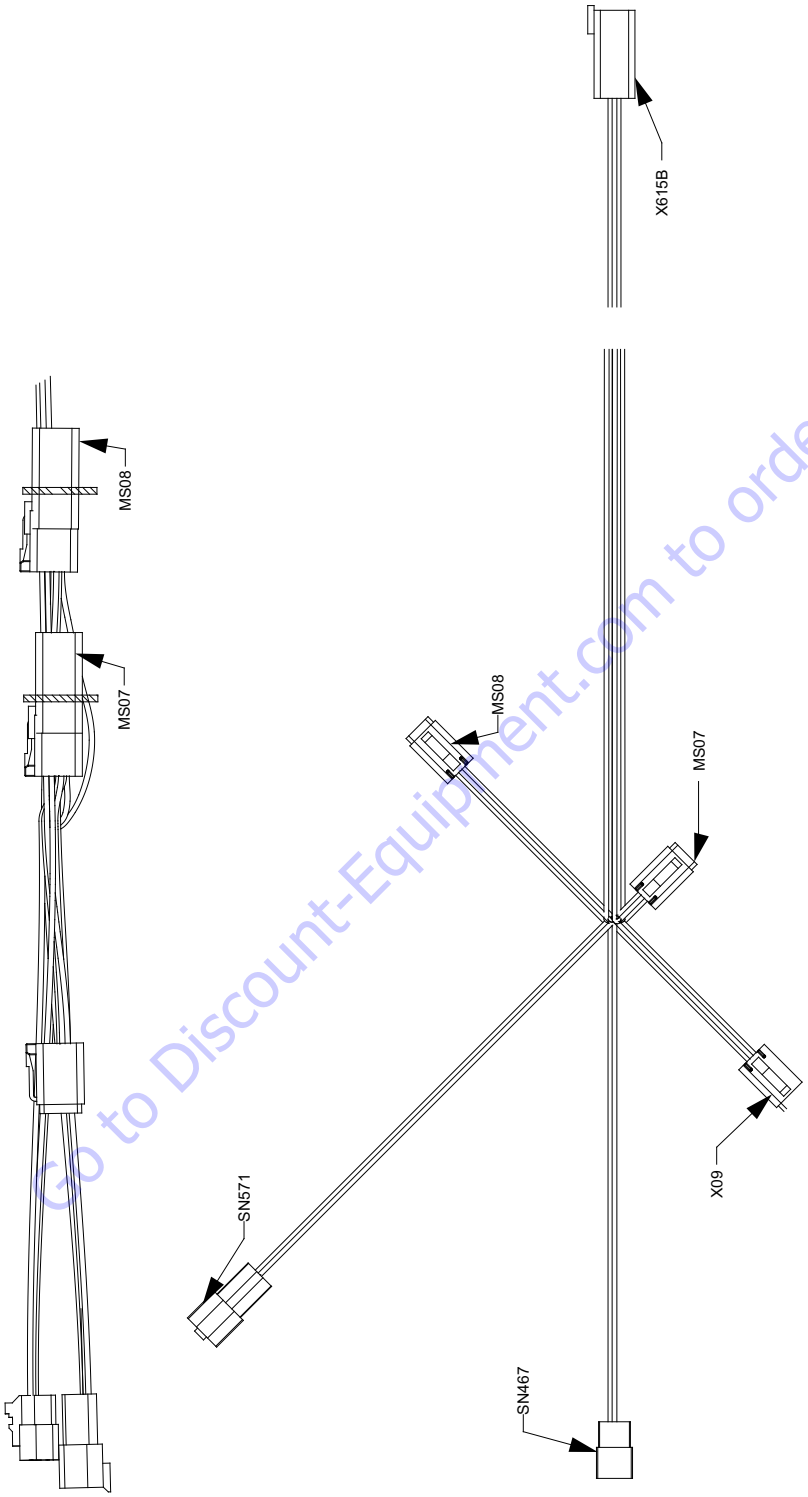


Figure 7-30. Boom Sensor Cable

SN571 CAPACITY LENGTH NC 2					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	7	18 AWG	GXL	MS07 (4)
2	BLU-BLK	114	18 AWG	TFFN	X615B (6)
3	BLK	5	18 AWG	GXL	MS08 (4)

X09 TO FULL EXTENSION					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	4	18 AWG	GXL	MS07 (2)
2	ORG-BLK	110	18 AWG	TFFN	X615B (4)
3	BLK	2	18 AWG	GXL	MS08 (2)
4	YEL	3	18 AWG	GXL	MS07 (1)
5	BLK-RED	112	18 AWG	TFFN	X615B (5)
6	BLK	1	18 AWG	GXL	MS08 (1)

SN467 CAPACITY LENGTH NO 1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	8	18 AWG	GXL	MS07 (5)
2	BLU-RED	111	18 AWG	TFFN	X615B (3)
3	BLK	6	18 AWG	GXL	MS08 (5)

X615B CAP LENGTH PROX SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL-BLK	113	18 AWG	TFFN	MS07 (3)
2	BRN-BLK	115	18 AWG	TFFN	MS08 (3)
3	BLU-RED	111	18 AWG	TFFN	SN467 (2)
4	ORG-BLK	110	18 AWG	TFFN	X09 (2)
5	BLK-RED	112	18 AWG	TFFN	X09 (5)
6	BLU-BLK	114	18 AWG	TFFN	SN571 (2)

MS08 GND BUSS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	1	18 AWG	GXL	X09 (6)
2	BLK	2	18 AWG	GXL	X09 (3)
3	BRN-BLK	115	18 AWG	TFFN	X615B (2)
4	BLK	5	18 AWG	GXL	SN571 (3)
5	BLK	6	18 AWG	GXL	SN467 (3)
6					

MS07 PWR BUSS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	3	18 AWG	GXL	X09 (4)
2	YEL	4	18 AWG	GXL	X09 (1)
3	YEL-BLK	113	18 AWG	TFFN	X615B (1)
4	YEL	7	18 AWG	GXL	SN571 (1)
5	YEL	8	18 AWG	GXL	SN467 (1)
6					

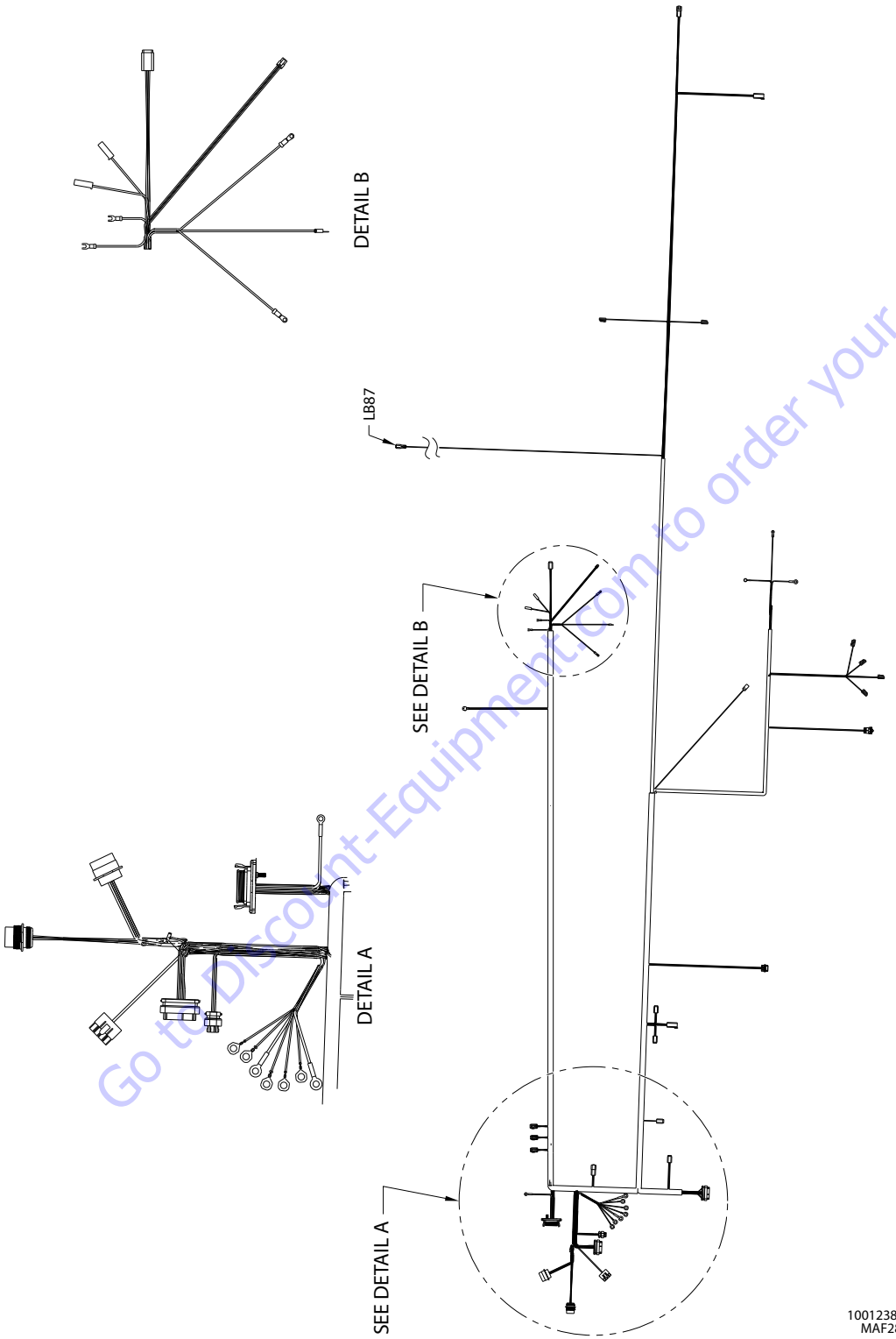


Figure 7-31. Turntable Harness - Sheet 1 of 7

LB87 STROBE LIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-11	18 AWG	GXL	FC155 (A4)
2	BLK	0-11	18 AWG	GXL	X127 (1)

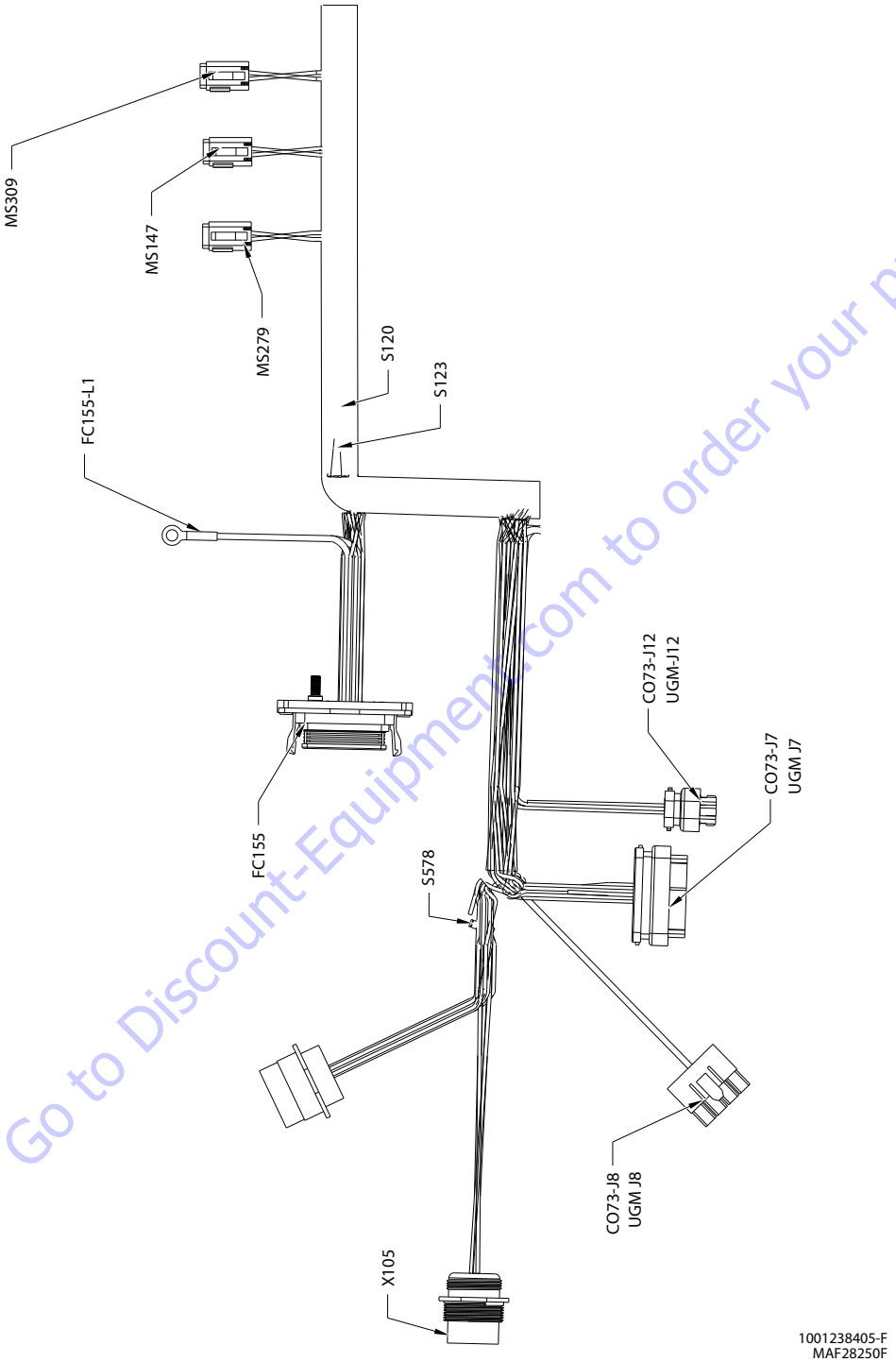


Figure 7-32. Turntable Harness - Sheet 2 of 7

FC155 FUSE BOX					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A1	YEL	2-5	12 AWG	GXL	C073-J8 (2)
A10					
A2	YEL	2-7	12 AWG	GXL	X102 (12)
A3	YEL	2-9	18 AWG	GXL	X183A (1)
A4	YEL	2-11	18 AWG	GXL	LB87 (1)
A5	YEL	2-15	18 AWG	GXL	X113 (1)
A6	YEL	2-13	18 AWG	GXL	X105 (H)
A7	YEL	2-14	18 AWG	GXL	X117 (3)
A8					
A9					
B1	RED	1-2	12 AWG	GXL	S125 (2)
B10					
B2	WHT	6-3 IGN PWR ENABLE	18 AWG	GXL	S120 (1)
B3	RED	1-4	12 AWG	GXL	S124 (2)
B4	WHT	6-4 IGN PWR ENABLE	18 AWG	GXL	S120 (1)
B5					
B8					
C10	WHT	9-0-1 PLAT MODE/ GND ENABLE	18 AWG	GXL	S85 (2)
C2					
C4					
C5					
C6	YEL	4-2 PLAT STAT	18 AWG	GXL	X117 (4)
C7	RED	1-0	18 AWG	GXL	S136 (2)
C8	RED	1-5	18 AWG	GXL	S135 (2)
C9	YEL	3-0	18 AWG	GXL	SW83-1 (1)
D1	BLK	0-1-1	18 AWG	GXL	S123 (2)
D10	WHT	6-1 IGN PWR ENABLE	18 AWG	GXL	S120 (2)
D2	YEL	2-2	12 AWG	GXL	FC155-L1 (L1)
D3	BLK	0-1-3	18 AWG	GXL	S123 (2)
D4	YEL	2-4	12 AWG	GXL	FC155-L1 (L1)
D5					
D6	YEL	4-1	18 AWG	GXL	SW83-3 (1)
D7	RED	1-1	18 AWG	GXL	SW84-2A (2A)
D8	RED	1-7	18 AWG	GXL	S578 (1)
D9	WHT	6-0 IGN PWR ENABLE	18 AWG	GXL	S120 (2)

FC155-L1 FUSE BLK IGN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
L1	YEL	2-2	12 AWG	GXL	FC155 (D2)
L1	YEL	2-4	12 AWG	GXL	FC155 (D4)

S123					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-1	18 AWG	GXL	X129 (1)
2	BLK	0-1-1	18 AWG	GXL	FC155 (D1)
2	BLK	0-1-3	18 AWG	GXL	FC155 (D3)

MS279 PROX BUSS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-1-3 TELE PROX +	18 AWG	GXL	X616A (4)
2	YEL	14-1-1 TELE PROX +	18 AWG	GXL	X616A (1)
3					
4	BLK	16-1-3 TELE PROX -	18 AWG	GXL	X616A (5)
5	BLK	16-1-1 TELE PROX -	18 AWG	GXL	X616A (2)
6					
7					
8	BLK	16-1 TELE PROX -	18 AWG	GXL	C073-J7 (28)
9	BLK	16-1-2 TELE PROX -	18 AWG	GXL	X615A (2)
10					
11	YEL	14-1 TELE PROX +	18 AWG	GXL	C073-J7 (33)
12	YEL	14-1-2 TELE PROX +	18 AWG	GXL	X615A (1)

MS147 CAN CHANNEL 1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3	YEL	CAN-ONE HIGH	18 AWG	GXL	X102A (3)
4	GRN	CAN-ONE LOW	18 AWG	GXL	X102A (2)
5	GRN	CAN-ONE LOW	18 AWG	GXL	C073-J7 (24)
6					
7	GRN	CAN-ONE LOW	18 AWG	GXL	SN476 (4)
8	GRN	CAN-ONE LOW	20 AWG	TXL	GD174 (4)
9					
10	YEL	CAN-ONE HIGH	18 AWG	GXL	C073-J7 (13)
11	YEL	CAN-ONE HIGH	20 AWG	TXL	GD174 (1)
12	YEL	CAN-ONE HIGH	18 AWG	GXL	SN476 (3)

S578					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-7	18 AWG	GXL	FC155 (D8)
2	RED	1-6	18 AWG	GXL	X105 (B)
2	RED	1-7	18 AWG	GXL	X117 (1)

MS309 CAN CHANNEL 2					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	GRN	CAN-TWO LOW	18 AWG	GXL	GD169 (4)
3	GRN	CAN-TWO LOW	18 AWG	GXL	C073-J12 (4)
4	YEL	CAN-TWO HIGH	18 AWG	GXL	GD169 (3)
5	YEL	CAN-TWO HIGH	18 AWG	GXL	C073-J12 (3)
6					
7					
8	YEL	CAN-TWO HIGH	18 AWG	GXL	X183A (3)
9	YEL	CAN-TWO HIGH	18 AWG	GXL	X105 (C)
10					
11	GRN	CAN-TWO LOW	18 AWG	GXL	X183A (4)
12	GRN	CAN-TWO LOW	18 AWG	GXL	X105 (D)

C073-J12 UGM-J12					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3	YEL	CAN-TWO HIGH	18 AWG	GXL	MS309 (5)
4	GRN	CAN-TWO LOW	18 AWG	GXL	MS309 (3)
5					
6	WHT	4-96 CAN2 TERM	18 AWG	GXL	C073-J12 (7)
7	WHT	4-96 CAN2 TERM	18 AWG	GXL	C073-J12 (6)
8	WHT	507-0 MSSO INPUT	18 AWG	GXL	SW114-1 (1)

C073-J8 UGM J8					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-5	12 AWG	GXL	X131 (1)
2	YEL	2-5	12 AWG	GXL	FC155 (A1)
3					
4					

S120					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-3 IGN PWR ENABLE	18 AWG	GXL	FC155 (B2)
2	WHT	6-4 IGN PWR ENABLE	18 AWG	GXL	FC155 (B4)
3	WHT	6-0 IGN PWR ENABLE	18 AWG	GXL	FC155 (D9)
4	WHT	6-1 IGN PWR ENABLE	18 AWG	GXL	FC155 (D10)

C073-J7 UGM J7					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	9-0-2 PLAT MODE/ GND ENABLE	18 AWG	GXL	S85 (1)
2	WHT	9-0-3 PLAT MODE/ GND ENABLE	18 AWG	GXL	S85 (1)
3	YEL	3-1	18 AWG	GXL	SW83-1 (1)
4	WHT	60-0 ANGLE SNSR 1	18 AWG	GXL	X743 (3)
5					
6	WHT	4-133 CAN1 TERM	18 AWG	GXL	C073-J7 (17)
7	WHT	60-1 ANGLE SNSR 2	18 AWG	GXL	X743 (4)
8					
9	BLK	16-0 ANGLE SNSR-	18 AWG	GXL	X743 (1)
10	BLK	16-13TILT -	18 AWG	GXL	SN476 (2)
11					
12					
13	YEL	CAN-ONE HIGH	18 AWG	GXL	MS147 (10)
14	WHT	8-0 GND MODE/PLAT ENABLE	18 AWG	GXL	X102 (11)
15	WHT	7-0 FOOT SW INPUT	18 AWG	GXL	X102 (6)
16	WHT	15-0 ANGLE SNSR 5V+	18 AWG	GXL	X743 (2)
17	WHT	4-133 CAN1 TERM	18 AWG	GXL	C073-J7 (6)
18					
19					
20					
21	WHT	53-1 NO TRANSPORT LNTH	18 AWG	GXL	X616 (3)
22	WHT	108-1 WIF	18 AWG	GXL	X181A (8)
23	WHT	54-0 NO CAPACITY LNTH	18 AWG	GXL	X615 (3)
24	GRN	CAN-ONELOW	18 AWG	GXL	MS147 (5)
25	BLK	16-5 DISPLAY -	18 AWG	GXL	S148 (1)
26					
27					
28	BLK	16-1 TELE PROX -	18 AWG	GXL	MS279 (5)
29	YEL	14-4 DISPLAY +	18 AWG	GXL	S153 (1)
30	YEL	14-8-3 WIF +	18 AWG	GXL	X181A (7)
31	YEL	14-11 SERVICE CABLE+	18 AWG	GXL	X171 (4)
32	YEL	14-6 DOS +	18 AWG	GXL	X112 (1)
33	YEL	14-1 TELE PROX +	18 AWG	GXL	MS279 (7)
34	YEL	14-7TILT +	18 AWG	GXL	SN476 (1)
35	WHT	51-0 DOS SW	18 AWG	GXL	X112 (2)

X102 BOOM CABLE CONNECTION					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	GRN	CAN-ONE LOW	18 AWG	GXL	MS147 (4)
3	YEL	CAN-ONE HIGH	18 AWG	GXL	MS147 (3)
4	WHT	9-0 PLAT MODE / GND ENABLE	18 AWG	GXL	S85 (2)
5	WHT	88-1-1 LEVEL UP	18 AWG	GXL	X701A (3)
6	WHT	7-0 FOOT SW INPUT	18 AWG	GXL	C073-J7 (15)
7	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	X701A (4)
8					
9	YEL	4-0	18 AWG	GXL	SW83-1 (1)
10					
11	WHT	8-0 GND MODE/PLAT ENABLE	18 AWG	GXL	C073-J7 (14)
12	YEL	2-7	12 AWG	GXL	FC155 (A2)
13	WHT	90-1 HI PRS DUMP	18 AWG	GXL	X701A (1)
14					
15	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	X701A (2)
16	BLK	0-7	12 AWG	GXL	X133 (1)
17					
18					
19					

X105 JLG DIAGNOSTIC					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	BLK	0-13	18 AWG	GXL	X127 (1)
B	RED	1-6	18 AWG	GXL	S578 (2)
C	YEL	CAN-TWO HIGH	18 AWG	GXL	MS309 (9)
D	GRN	CAN-TWO LOW	18 AWG	GXL	MS309 (12)
E					
F					
G					
H	YEL	2-13	18 AWG	GXL	FC155 (A6)
J					

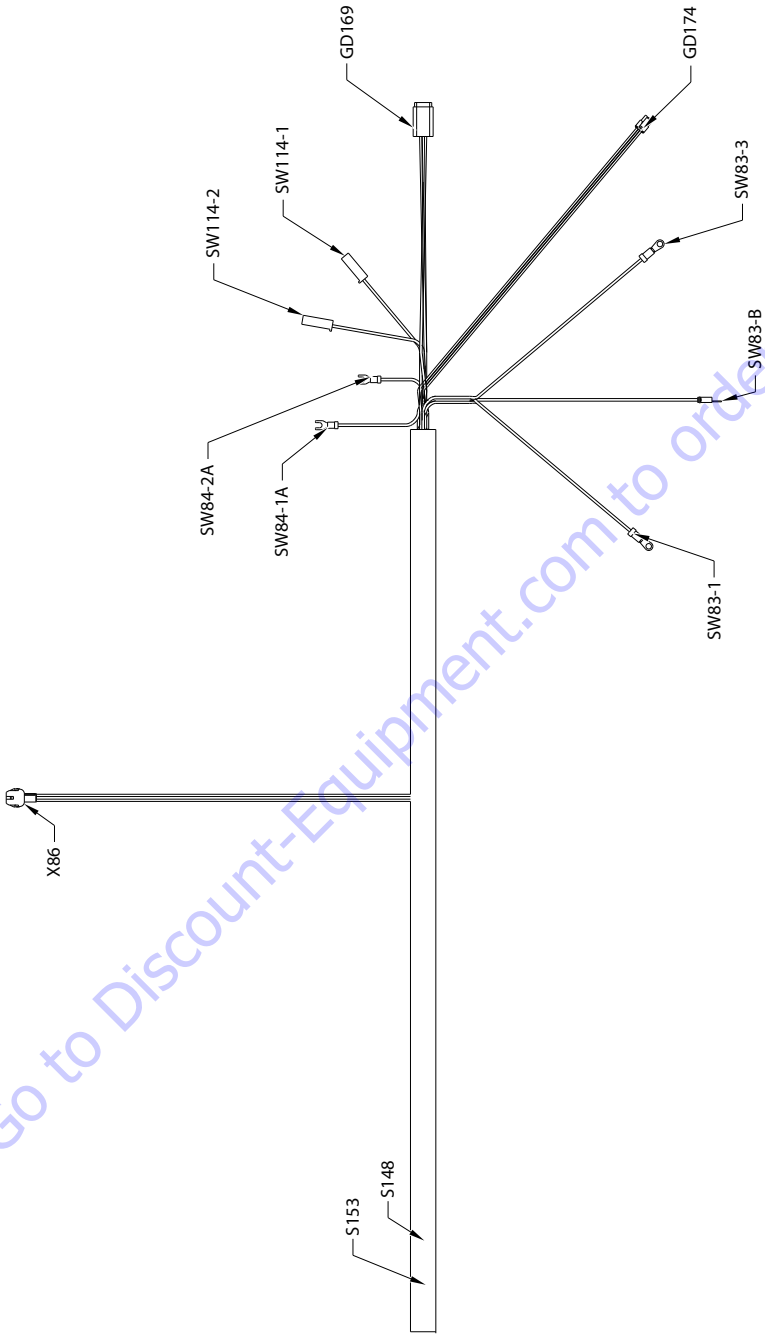


Figure 7-33. Turntable Harness - Sheet 3 of 7

S153					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-4 DISPLAY +	18 AWG	GXL	C073-J7 (29)
2	YEL	14-4-1 DISPLAY +	18 AWG	GXL	GD169 (2)
2	YEL	14-4-2 DISPLAY +	20 AWG	TXL	GD174 (3)
2	YEL	14-4-3 DISPLAY +	20 AWG	TXL	GD174 (2)

S148					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-5 DISPLAY -	18 AWG	GXL	C073-J7 (25)
2	BLK	16-5-1 DISPLAY -	18 AWG	GXL	GD169 (1)
2	BLK	16-5-2 DISPLAY -	20 AWG	TXL	GD174 (6)

X86 ANALYZER					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-2 ANALYZER +	18 AWG	GXL	C073-J1 (28)
2	WHT	13-1 RECEIVE	18 AWG	GXL	C073-J1 (29)
3	WHT	13-2 TRANSMIT	18 AWG	GXL	C073-J1 (30)
4	BLK	16-4 ANALYZER -	18 AWG	GXL	C073-J1 (31)

SW84-1A E-STOP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1A	YEL	2-0	18 AWG	GXL	SW83-B (1)

SW83-3 PLAT MODE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	3-0	18 AWG	GXL	FC155 (C9)
1	YEL	3-1	18 AWG	GXL	C073-J7 (3)

SW83-B KEY SW B+					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-0	18 AWG	GXL	SW84-1A (1A)

GD174					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CAN-ONE HIGH	20 AWG	TXL	MS147 (11)
2	YEL	14-4-3 DISPLAY +	20 AWG	TXL	S153 (2)
3	YEL	14-4-2 DISPLAY +	20 AWG	TXL	S153 (2)
4	GRN	CAN-ONE LOW	20 AWG	TXL	MS147 (8)
5					
6	BLK	16-5-2 DISPLAY -	20 AWG	TXL	S148 (2)

SW84-2A E-STOP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
2A	RED	1-1	18 AWG	GXL	FC155 (D7)

SW114-2 MSSO					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-3 MSSO -	18 AWG	GXL	C073-J1 (9)

SW114-1 MSSO					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	507-0 MSSO INPUT	18 AWG	GXL	C073-J12 (8)

GD169 KONGSBERG DISPLAY					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-5-1 DISPLAY -	18 AWG	GXL	S148 (2)
2	YEL	14-4-1 DISPLAY +	18 AWG	GXL	S153 (2)
3	YEL	CAN-TWO HIGH	18 AWG	GXL	MS309 (4)
4	GRN	CAN-TWO LOW	18 AWG	GXL	MS309 (2)
5					
6					

SW83-1 GROUND MODE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	4-0	18 AWG	GXL	X102A (9)
1	YEL	4-1	18 AWG	GXL	FC155 (D6)

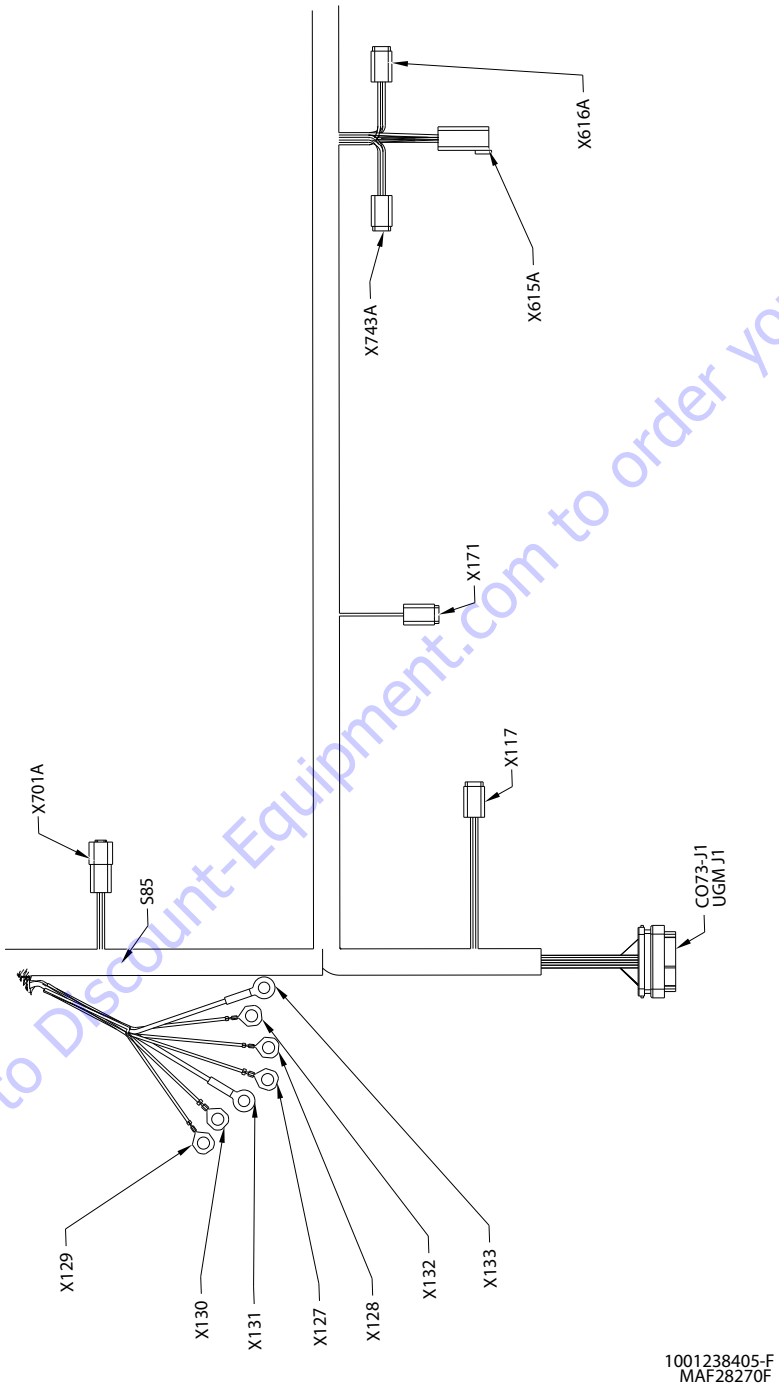


Figure 7-34. Turntable Harness - Sheet 4 of 7

C073-J1 UGM J1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	WHT	40-2 OSC AXL VLV 2	18 AWG	GXL	HV161 (1)
3	WHT	27-1 DRIVE FORWARD	18 AWG	GXL	HV159 (1)
4					
5	BLK	16-2 BRK/2SPD VLV -	18 AWG	GXL	S80 (2)
6	WHT	28-1 DRIVE REVERSE	18 AWG	GXL	HV160 (1)
7	WHT	40-1 OSC AXL VLV 1	18 AWG	GXL	HV162 (1)
8					
9	BLK	16-3 MSSO -	18 AWG	GXL	SW114-2 (1)
10	WHT	103-0 DELAYED ECU PWR	18 AWG	GXL	X181A (1)
11	WHT	100-1 START	16 AWG	GXL	X183A (2)
12	WHT	102-0 GLOW PLUG	16 AWG	GXL	X181A (4)
13	WHT	93-1 AUX PUMP	18 AWG	GXL	X106 (1)
14					
15					
16					
17					
18					
19					
20	WHT	24-1 TWO SPD	18 AWG	GXL	HV78 (1)
21	WHT	54-6 NC CAPACITY LNTH	18 AWG	GXL	X615 (5)
22	WHT	508-0 GEN ENABLE	18 AWG	GXL	X113 (2)
23	WHT	23-1 BRAKE	18 AWG	GXL	HV79 (1)
24					
25					
26					
27					
28	YEL	14-2 ANALYZER +	18 AWG	GXL	X86 (1)
29	WHT	13-1 RECEIVE	18 AWG	GXL	X86 (2)
30	WHT	13-2 TRANSMIT	18 AWG	GXL	X86 (3)
31	BLK	16-4 ANALYZER -	18 AWG	GXL	X86 (4)
32	WHT	101-0 ALT EXCITE	16 AWG	GXL	X183A (5)
33					
34	WHT	53-0 NC TRANSPORT LNTH	18 AWG	GXL	X616A (6)
35	WHT	54-1 NC CAPACITY LNTH	18 AWG	GXL	X615A (6)

X701A TO MAIN VALVE HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-1 HI PRS DUMP	18 AWG	GXL	X102A (13)
2	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	X102A (15)
3	WHT	88-1-1 LEVEL UP	18 AWG	GXL	X102A (5)
4	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	X102A (7)

S85					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	9-0-2 PLAT MODE/ GND ENABLE	18 AWG	GXL	C073-J7 (1)
1	WHT	9-0-3 PLAT MODE/ GND ENABLE	18 AWG	GXL	C073-J7 (2)
2	WHT	9-0 PLAT MODE/ GND ENABLE	18 AWG	GXL	X102A (4)
2	WHT	9-0-1 PLAT MODE/ GND ENABLE	18 AWG	GXL	FC155 (C10)

X130 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-15	18 AWG	GXL	X113 (3)
1	BLK	0-9	18 AWG	GXL	X181A (2)

X117 UNI TELEM					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-7	18 AWG	GXL	S578 (2)
2	BLK	0-2	18 AWG	GXL	X128 (1)
3	YEL	2-14	18 AWG	GXL	FC155 (A7)
4	YEL	4-2 PLAT STAT	18 AWG	GXL	FC155 (C6)

X129 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-1	18 AWG	GXL	S123 (1)

X132 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-40	18 AWG	GXL	S164 (2)

X127 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-11	18 AWG	GXL	LB87 (2)
1	BLK	0-13	18 AWG	GXL	X105 (A)

X133 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-7	12 AWG	GXL	X102A (16)

X131 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-5	12 AWG	GXL	C073-J8 (1)

X128 GROUND STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-2	18 AWG	GXL	X117 (2)

X743A MAIN BOOM ANGLE SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-0 ANGLE SNSR-	18 AWG	GXL	C073-J7 (9)
2	WHT	15-0 ANGLE SNSR 5V+	18 AWG	GXL	C073-J7 (16)
3	WHT	60-0 ANGLE SNSR 1	18 AWG	GXL	C073-J7 (4)
4	WHT	60-1 ANGLE SNSR 2	18 AWG	GXL	C073-J7 (7)

X171 MAIN VALVE INTERFACE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-1 DRV RTN	18 AWG	GXL	S163 (2)
2					
3					
4	YEL	14-11 SERVICE CABLE+	18 AWG	GXL	C073-J7 (31)
5	WHT	54-7 NO CAPACITY LNTH	18 AWG	GXL	X615A (4)
6					

X616 TELESCOPE RETRACTED PROXIMITY SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-1-1 TELE PROX +	18 AWG	GXL	MS279 (2)
2	BLK	16-1-1 TELE PROX -	18 AWG	GXL	MS279 (5)
3	WHT	53-1 NO TRANSPORT LNTH	18 AWG	GXL	C073-J7 (21)
4	YEL	14-1-3 TELE PROX +	18 AWG	GXL	MS279 (1)
5	BLK	16-1-3 TELE PROX -	18 AWG	GXL	MS279 (3)
6	WHT	53-0 NC TRANSPORT LNTH	18 AWG	GXL	C073-J1 (34)

X615 DUAL/TRI CAP LENGTH					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-1-2 TELE PROX +	18 AWG	GXL	MS279 (12)
2	BLK	16-1-2 TELE PROX -	18 AWG	GXL	MS279 (9)
3	WHT	54-0 NO CAPACITY LNTH	18 AWG	GXL	C073-J7 (23)
4	WHT	54-7 NO CAPACITY LNTH	18 AWG	GXL	X171 (5)
5	WHT	54-6 NC CAPACITY LNTH	18 AWG	GXL	C073-J1 (21)
6	WHT	54-1 NC CAPACITY LNTH	18 AWG	GXL	C073-J1 (35)

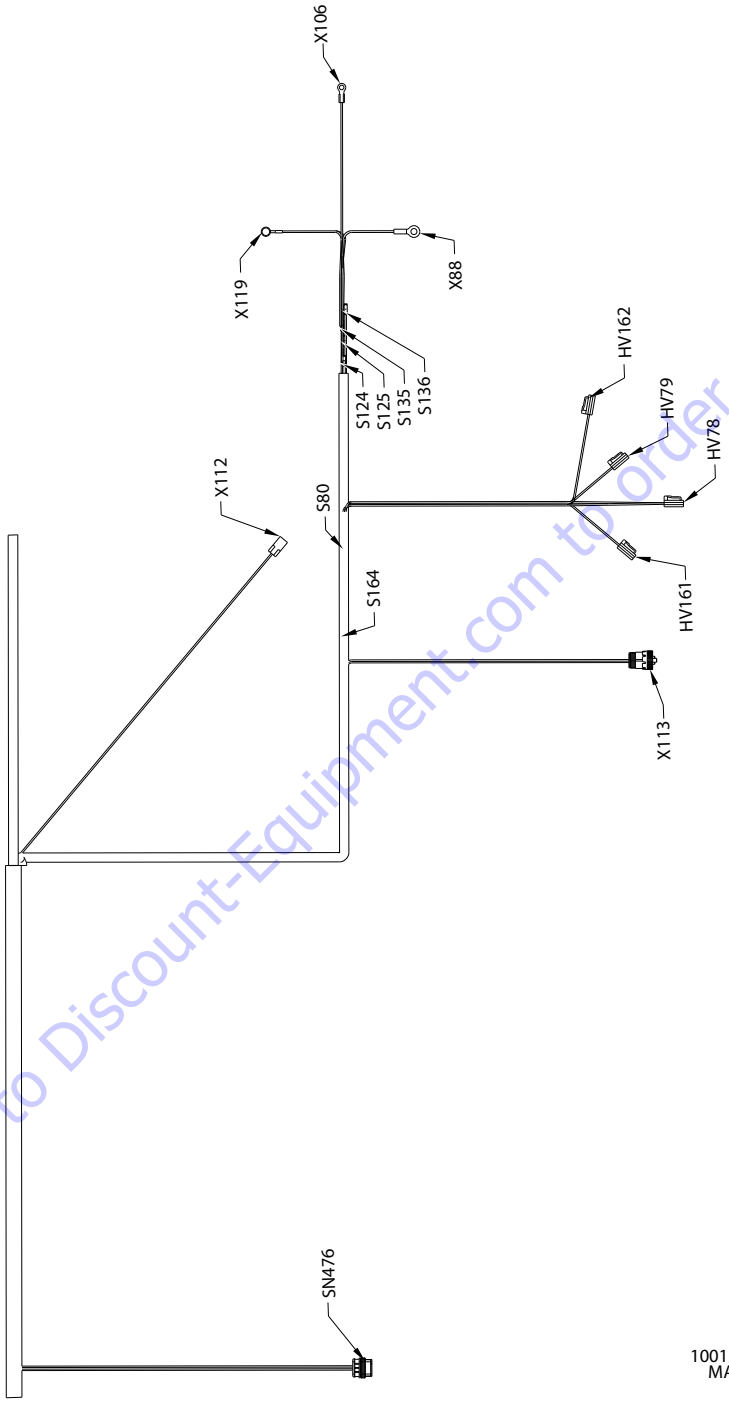


Figure 7-35. Turntable Harness - Sheet 5 of 7

SN476 TILT SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-7 TILT +	18 AWG	GXL	C073-J7 (34)
2	BLK	16-13 TILT -	18 AWG	GXL	C073-J7 (10)
3	YEL	CAN-ONE HIGH	18 AWG	GXL	MS147 (12)
4	GRN	CAN-ONE LOW	18 AWG	GXL	MS147 (7)

X112 DRIVE ORNT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-6 DOS +	18 AWG	GXL	C073-J7 (32)
2	WHT	51-0 DOS SW	18 AWG	GXL	C073-J7 (35)

X113 GENERATOR CONNECTOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-15	18 AWG	GXL	FC155 (A5)
2	WHT	508-0 GEN ENABLE	18 AWG	GXL	C073-J1 (22)
3	BLK	0-15	18 AWG	GXL	X130 (1)

S164					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-40-1	18 AWG	GXL	HV161 (2)
1	BLK	0-40-2	18 AWG	GXL	HV162 (2)
2	BLK	0-40	18 AWG	GXL	X132 (1)

S80					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-2-1 BRK/2SPD VLV -	18 AWG	GXL	HV79 (2)
1	BLK	16-2-2 BRK/2SPD VLV -	18 AWG	GXL	HV78 (2)
2	BLK	16-2 BRK/2SPD VLV -	18 AWG	GXL	C073-J1 (5)

HV78 2 SPEED					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	24-1 TWO SPD	18 AWG	GXL	C073-J1 (20)
2	BLK	16-2-2 BRK/2SPD VLV -	18 AWG	GXL	S80 (1)

HV79 BRAKE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	23-1 BRAKE	18 AWG	GXL	C073-J1 (23)
2	BLK	16-2-1 BRK/2SPD VLV -	18 AWG	GXL	S80 (1)

HV161 OSC AXLE #2					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	40-2 OSC AXL VLV 2	18 AWG	GXL	C073-J1 (2)
2	BLK	0-40-1	18 AWG	GXL	S164 (1)

HV162 OSC AXLE #1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	40-1 OSC AXL VLV 1	18 AWG	GXL	C073-J1 (7)
2	BLK	0-40-2	18 AWG	GXL	S164 (1)

X119 SYSTEM B+					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1		03	20 AWG	FUSIBLE LINK	S136 (1)
1		04	20 AWG	FUSIBLE LINK	S135 (1)

X106 AUX PUMP COIL					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	93-1 AUX PUMP	18 AWG	GXL	C073-J1 (13)

X88 SYSTEM B+					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1		01	16 AWG	FUSIBLE LINK	S125 (1)
1		02	16 AWG	FUSIBLE LINK	S124 (1)

S124					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1		02	16 AWG	FUSIBLE LINK	X88 (1)
2	RED	1-4	12 AWG	GXL	FC155 (B3)

S125					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1		01	16 AWG	FUSIBLE LINK	X88 (1)
2	RED	1-2	12 AWG	GXL	FC155 (B1)

S135					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1		04	20 AWG	FUSIBLE LINK	X119 (1)
2	RED	1-5	18 AWG	GXL	FC155 (C8)

S136					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1		03	20 AWG	FUSIBLE LINK	X119 (1)
2	RED	1-0	18 AWG	GXL	FC155 (C7)

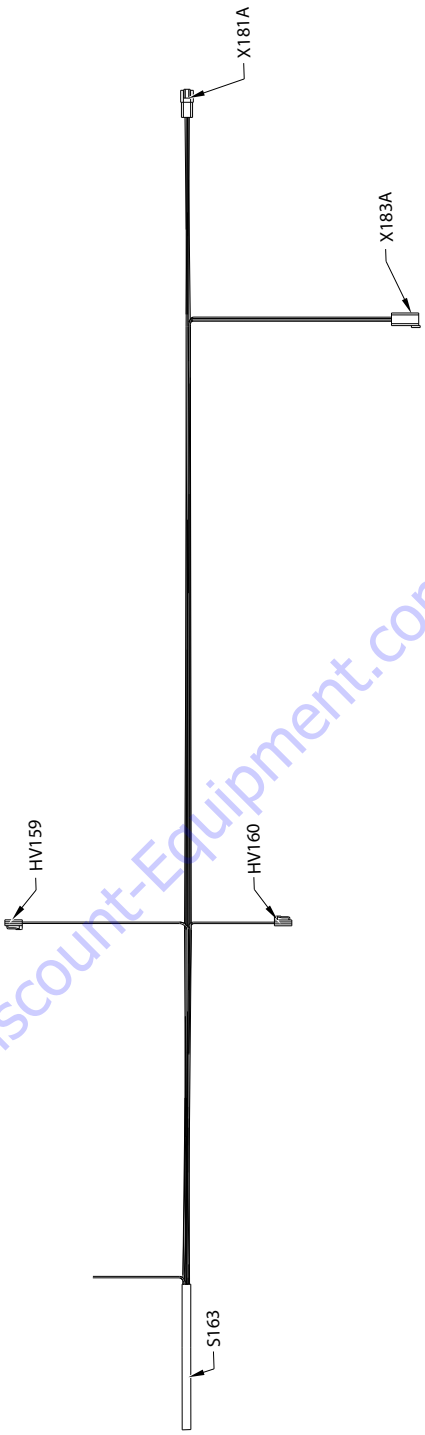


Figure 7-36. Turntable Harness - Sheet 6 of 7

HV160 DRIVE REVERSE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	28-1 DRIVE REVERSE	18 AWG	GXL	C073-J1 (6)
2	WHT	50-1-1 DRV RTN	18 AWG	GXL	S163 (1)

HV159 DRIVE FORWARD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	27-1 DRIVE FORWARD	18 AWG	GXL	C073-J1 (3)
2	WHT	50-1-2 DRV RTN	18 AWG	GXL	S163 (1)

X181A ENGINE CONNETOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	103-0 DELAYED ECU PWR	18 AWG	GXL	C073-J1 (10)
2	BLK	0-9	18 AWG	GXL	X130 (1)
3					
4	WHT	102-0 GLOW PLUG	16 AWG	GXL	C073-J1 (12)
5					
6					
7	YEL	14-8-3 WIF +	18 AWG	GXL	C073-J7 (30)
8	WHT	108-1 WIF	18 AWG	GXL	C073-J7 (22)

S163					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-1-1 DRV RTN	18 AWG	GXL	HV160 (2)
1	WHT	50-1-2 DRV RTN	18 AWG	GXL	HV159 (2)
2	WHT	50-1 DRV RTN	18 AWG	GXL	X171 (1)

X183A ENGINE CONNECTOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-9	18 AWG	GXL	FC155 (A3)
2	WHT	100-1 START	16 AWG	GXL	C073-J1 (11)
3	YEL	CAN-TWO HIGH	18 AWG	GXL	MS309 (8)
4	GRN	CAN-TWO LOW	18 AWG	GXL	MS309 (11)
5	WHT	101-0 ALT EXCITE	16 AWG	GXL	C073-J1 (32)
6					

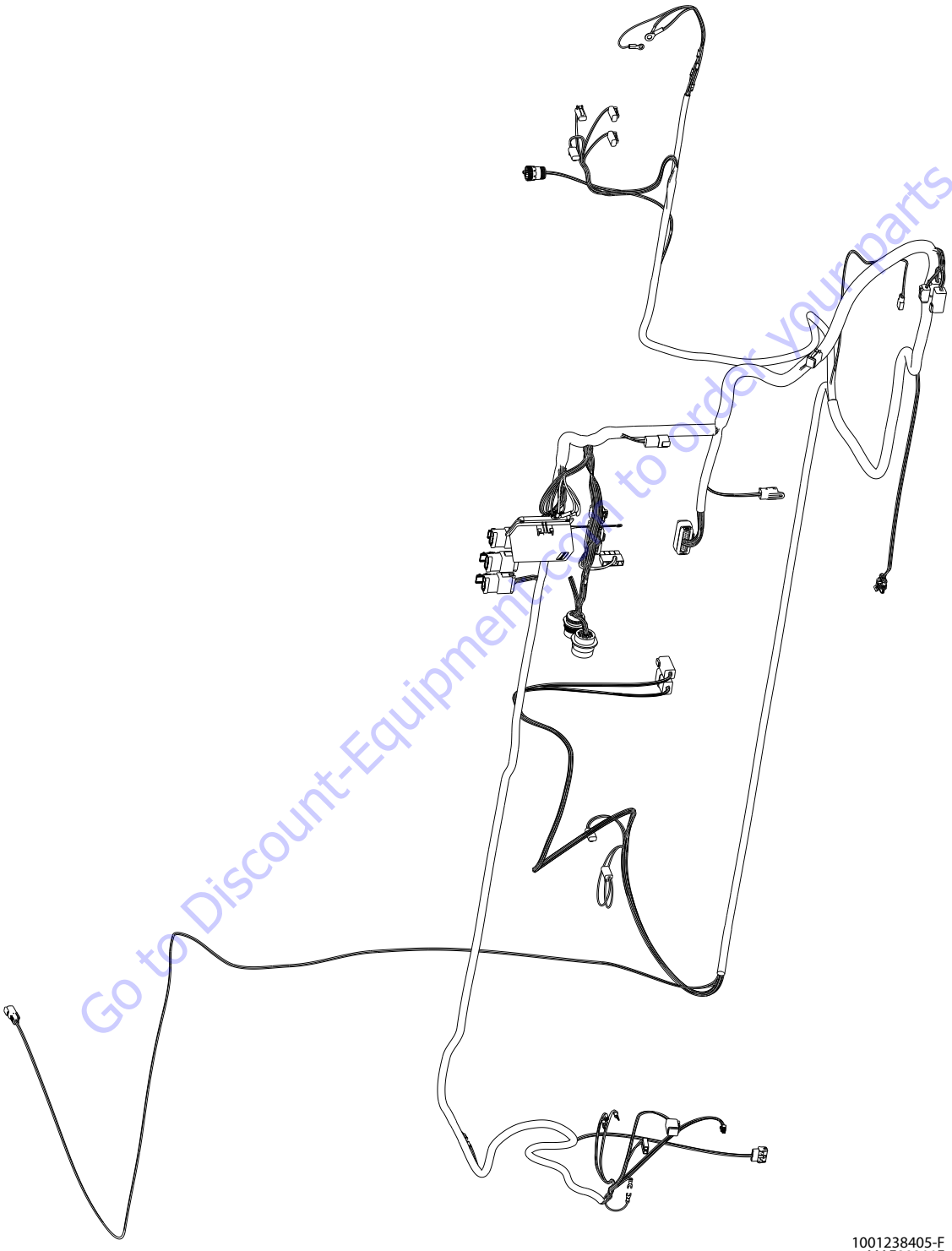


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Figure 7-37. Turntable Harness - Sheet 7 of 7

X281- 12V BATTERY STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	1 GND	2 AWG	EPDM	X280 (1)

X280- 12V BATTERY STUD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	1 GND	2 AWG	EPDM	X281 (1)

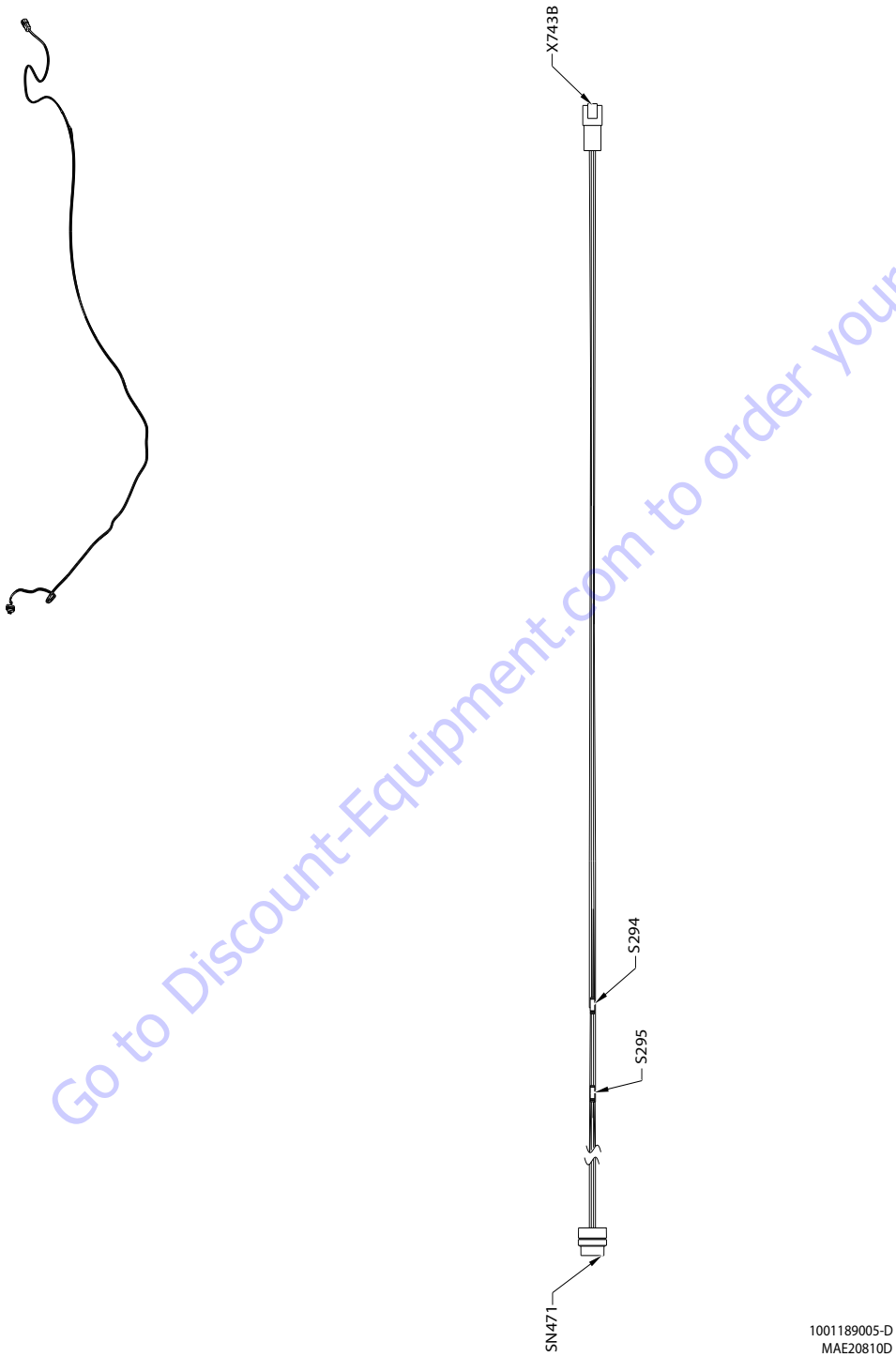


Figure 7-39. Boom Angle Sensor Harness

S294					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-108 PWR 5V	18 AWG	GXL	X743B (2)
2	ORN/BLK	4-106 PWR 5V	18 AWG	TFFN	SN471 (B)
2	YEL/BLK	4-112 PWR 5V	18 AWG	TFFN	SN471 (F)

S295					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-40-76 GND	18 AWG	GXL	X743B (1)
2	BLK/RED	000-40-78 GND	18 AWG	TFFN	SN471 (A)
2	BRN/BLK	000-40-79 GND	18 AWG	TFFN	SN471 (E)

SN471					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	BLK/RED	000-40-78 GND	18 AWG	TFFN	S295 (2)
B	ORN/BLK	4-106 PWR 5V	18 AWG	TFFN	S294 (2)
C	BLU/BLK	4-86 BM ANGLE SEN 1	18 AWG	TFFN	X743B (3)
D	BLU/RED	4-87 BM ANGLE SEN 2	18 AWG	TFFN	X743B (4)
E	BRN/BLK	000-40-79 GND	18 AWG	TFFN	S295 (2)
F	YEL/BLK	4-112 PWR 5V	18 AWG	TFFN	S294 (2)

X743B					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-40-76 GND	18 AWG	GXL	S295 (1)
2	WHT	4-108 PWR 5V	18 AWG	GXL	S294 (1)
3	BLU/BLK	4-86 BM ANGLE SEN 1	18 AWG	TFFN	SN471 (C)
4	BLU/RED	4-87 BM ANGLE SEN 2	18 AWG	TFFN	SN471 (D)

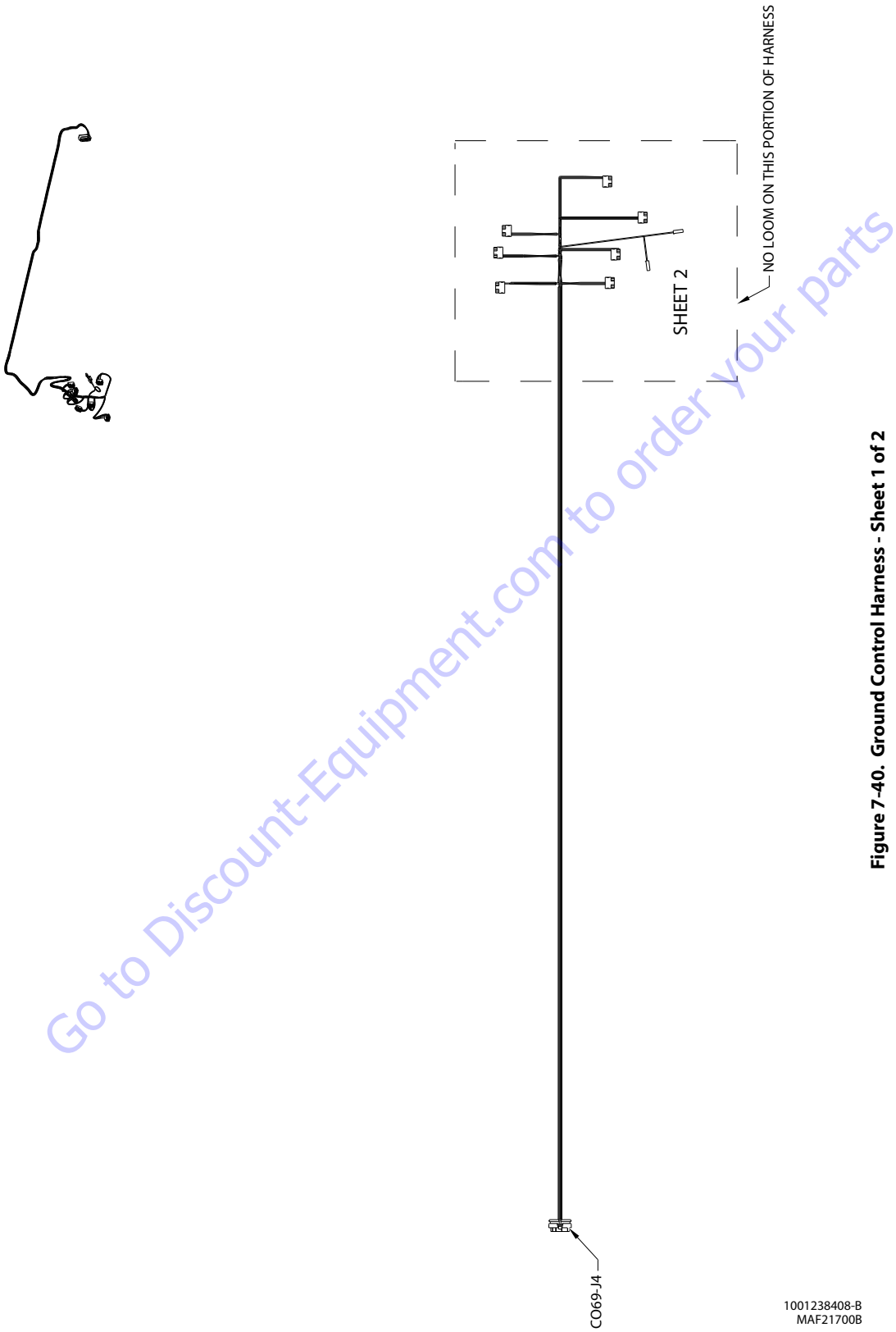


Figure 7-40. Ground Control Harness - Sheet 1 of 2

C069-J4 BLUE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3					
4	WHT	100-0 START	18 AWG	GXL	SW179 (1)
5	WHT	89-0 LEVEL DOWN	18 AWG	GXL	SW178 (3)
6	WHT	86-0 ROTATE LEFT	18 AWG	GXL	SW176 (3)
7	WHT	78-0 TELE IN	18 AWG	GXL	SW177 (3)
8	WHT	83-0 JIB DOWN	18 AWG	GXL	SW180 (3)
9	WHT	109-0 ENG REGEN	18 AWG	GXL	SW293-2 (1)
10					
11					
12					
13					
14					
15					
16	WHT	93-0 AUX PWR	18 AWG	GXL	SW179 (3)
17	WHT	88-0 LEVEL UP	18 AWG	GXL	SW178 (1)
18	WHT	87-0 ROTATE RIGHT	18 AWG	GXL	SW176 (1)
19	WHT	82-0 JIB UP	18 AWG	GXL	SW180 (1)
20					
21					
22					
23	WHT	76-0 BOOM LIFT UP	18 AWG	GXL	SW181 (1)
24					
25	YEL	14-0 GND CNTRL+	18 AWG	GXL	SW177 (2)
26					
27					
28					
29					
30	WHT	79-0 TELE OUT	18 AWG	GXL	SW177 (1)
31					
32					
33	WHT	77-0 BOOM LIFT DOWN	18 AWG	GXL	SW181 (3)
34	WHT	70-0 SWING LEFT	18 AWG	GXL	SW182 (3)
35	WHT	71-0 SWING RIGHT	18 AWG	GXL	SW182 (1)

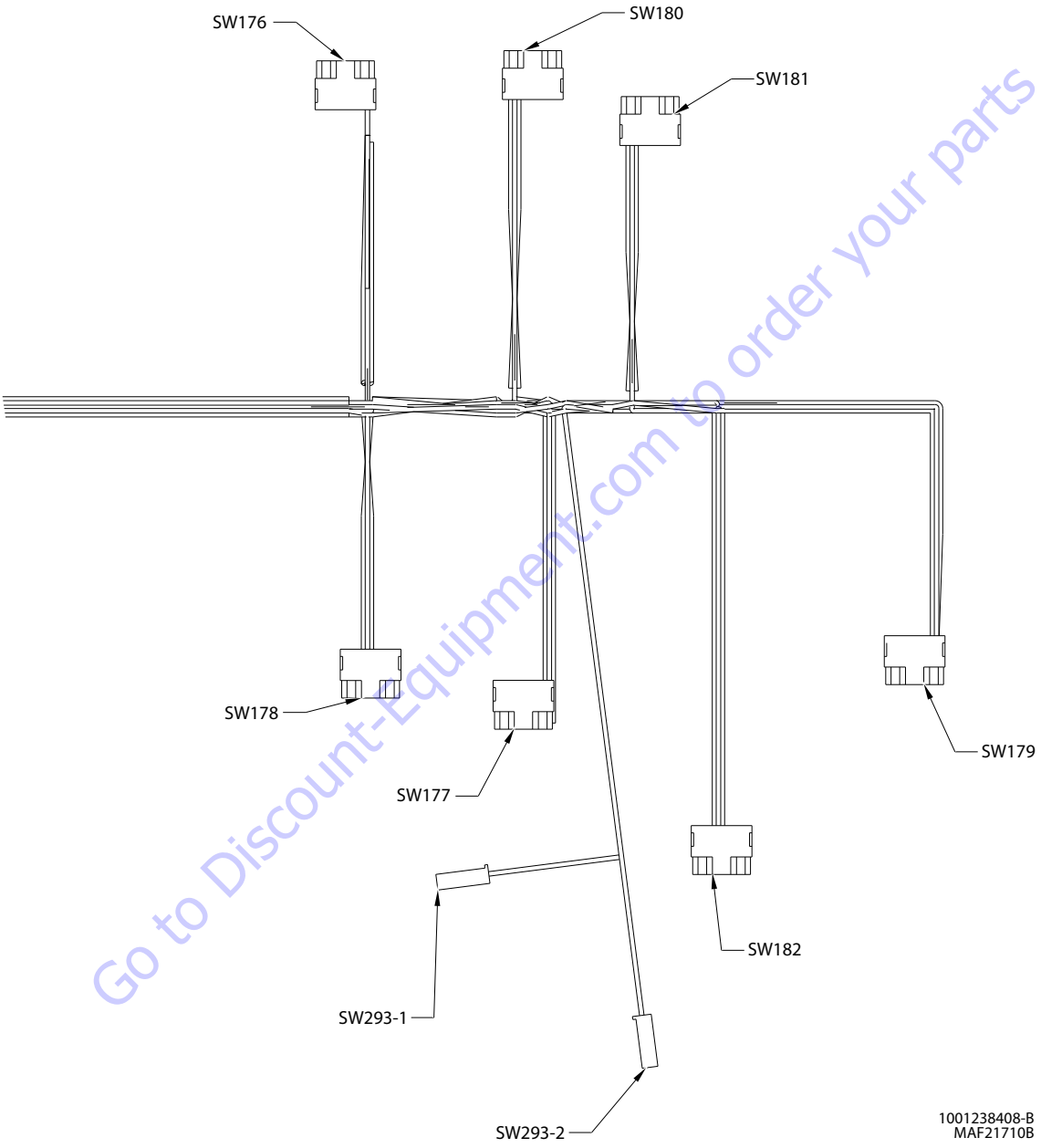


Figure 7-41. Ground Control Harness - Sheet 2 of 2

SW176 ROTATE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	87-0 ROTATE RIGHT	18 AWG	GXL	C069-J4 (18)
2	YEL	14-0-1 GND CNTRL+	18 AWG	GXL	SW177 (2)
2	YEL	14-0-2 GND CNTRL+	18 AWG	GXL	SW178 (2)
3	WHT	86-0 ROTATE LEFT	18 AWG	GXL	C069-J4 (6)
4					
5					
6					

SW178 LEVEL					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	88-0 LEVEL UP	18 AWG	GXL	C069-J4 (17)
2	YEL	14-0-2 GND CNTRL+	18 AWG	GXL	SW176 (2)
2	YEL	14-0-3 GND CNTRL+	18 AWG	GXL	SW179 (2)
3	WHT	89-0 LEVEL DOWN	18 AWG	GXL	C069-J4 (5)
4					
5					
6					

SW180 JIB					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	82-0 JIB UP	18 AWG	GXL	C069-J4 (19)
2	YEL	14-0-4 GND CNTRL+	18 AWG	GXL	SW179 (2)
2	YEL	14-0-5 GND CNTRL+	18 AWG	GXL	SW181 (2)
3	WHT	83-0 JIB DOWN	18 AWG	GXL	C069-J4 (8)
4					
5					
6					

SW177 BOOM TELE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	79-0 TELE OUT	18 AWG	GXL	C069-J4 (30)
2	YEL	14-0 GND CNTRL+	18 AWG	GXL	C069-J4 (25)
2	YEL	14-0-1 GND CNTRL+	18 AWG	GXL	SW176 (2)
3	WHT	78-0 TELE IN	18 AWG	GXL	C069-J4 (7)
4					
5					
6					

SW181 BOOM LIFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	76-0 BOOM LIFT UP	18 AWG	GXL	C069-J4 (23)
2	YEL	14-0-5 GND CNTRL+	18 AWG	GXL	SW180 (2)
2	YEL	14-0-6 GND CNTRL+	18 AWG	GXL	SW182 (2)
3	WHT	77-0 BOOM LIFT DOWN	18 AWG	GXL	C069-J4 (33)
4					
5					
6					

SW182 SWING					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	71-0 SWING RIGHT	18 AWG	GXL	C069-J4 (35)
2	YEL	14-0-6 GND CNTRL+	18 AWG	GXL	SW181 (2)
2	YEL	14-0-7 GND CNTRL+	18 AWG	GXL	SW293-1 (1)
3	WHT	70-0 SWING LEFT	18 AWG	GXL	C069-J4 (34)
4					
5					
6					

SW293-1 ENGINE REGENERATION					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-0-7 GND CNTRL+	18 AWG	GXL	SW182 (2)

SW293-2 ENGINE REGENERATION					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	109-0 ENG REGEN	18 AWG	GXL	C069-J4 (9)

SW179 START/ AUX PWR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	100-0 START	18 AWG	GXL	C069-J4 (4)
2	YEL	14-0-3 GND CNTRL+	18 AWG	GXL	SW178 (2)
2	YEL	14-0-4 GND CNTRL+	18 AWG	GXL	SW180 (2)
3	WHT	93-0 AUX PWR	18 AWG	GXL	C069-J4 (16)
4					
5					
6					

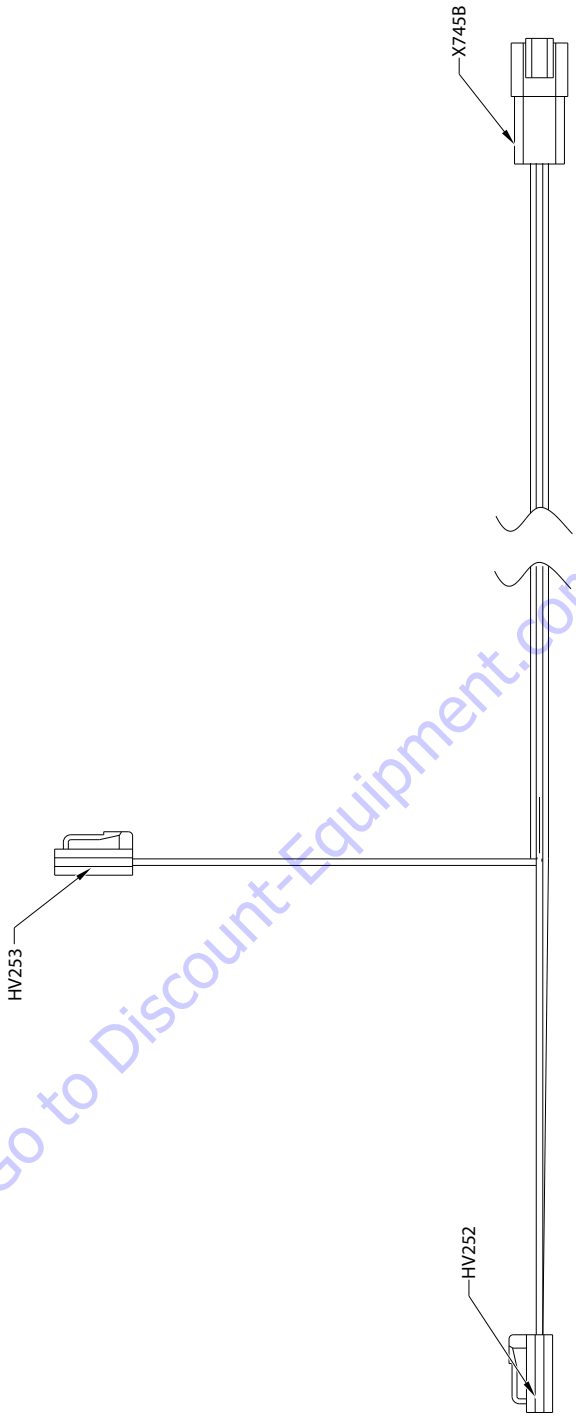


Figure 7-42. Lift Cylinder Harness

HV252 BOOM LIFT DOWN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-1 BOOM LIFT DN	18 AWG	GXL	X745B (1)
2	WHT	50-4-1 LIFT RTN	18 AWG	GXL	X745B (3)

HV253 BOOM LIFT DN ENBL/AUX					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-2 BOOM LIFT DN ENBL/AUX	18 AWG	GXL	X745B (2)
2	WHT	50-5 LIFT DN ENBL/AUX RTN	18 AWG	GXL	X745B (4)

X745B TO MAIN VALVE HARNESS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-1 BOOM LIFT DN	18 AWG	GXL	HV252 (1)
2	WHT	77-2 BOOM LIFT DN ENBL/AUX	18 AWG	GXL	HV253 (1)
3	WHT	50-4-1 LIFT RTN	18 AWG	GXL	HV252 (2)
4	WHT	50-5 LIFT DN ENBL/ AUX RTN	18 AWG	GXL	HV253 (2)

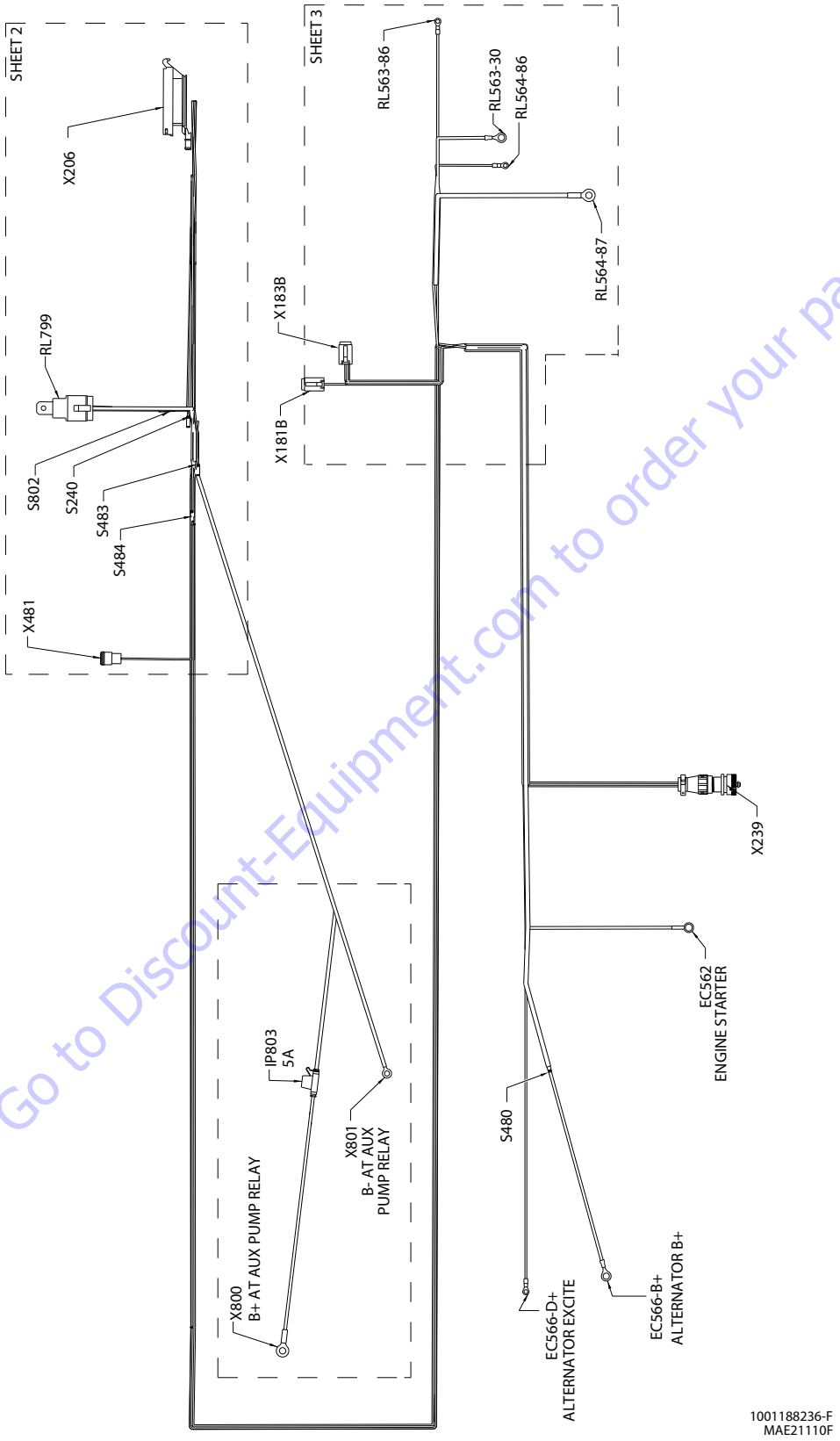


Figure 7-43. Deutz D2011L04 Engine Harness - Sheet 1 of 3

EC566-D+ ALTERNATOR EXCITE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	6-51 ALT EXCITE	16 AWG	GXL	X183B (5)

EC566-B+ ALTERNATOR B+					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	-	FUSE LINK	12 AWG	FUSIBLE LINK	S480 (2)

EC562 ENGINE STARTER					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	12AWG	12 AWG	GXL	RL563-30 (1)

S480					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	8 AWG	8 AWG	GXL	RL564-87 (1)
2	-	FUSE LINK	12 AWG	FUSIBLE LINK	EC566-B+ (1)

X239					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	WHT	6-17 DIAGNOSTIC	18 AWG	GXL	S240 (2)
B	BLK	000-6-3	18 AWG	GXL	X206 (2)
K	WHT	24-6	18 AWG	GXL	X206 (11)
L	WHT	23-6	18 AWG	GXL	X206 (10)

X800 B+ AT AUX PUMP RELAY					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	FUSE LEAD	12 AWG	GXL	IP803 (2)

IP803 5A					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	6-15-2	16 AWG	GXL	RL799 (1)
2	RED	FUSE LEAD	12 AWG	GXL	X800 (1)

X801 B- AT AUX PUMP RELAY					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-6-1-3	10 AWG	GXL	S802 (2)

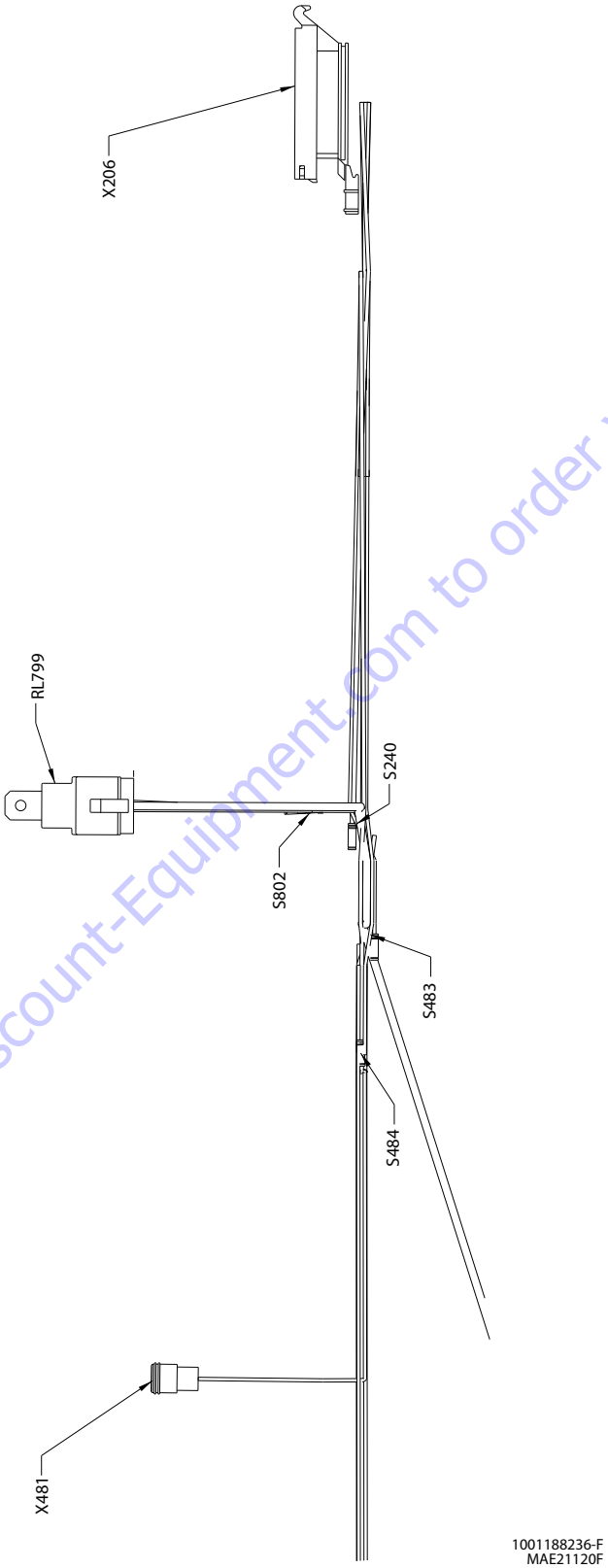


Figure 7-44. Deutz D2011L04 Engine Harness - Sheet 2 of 3

X481					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CABLE CAN HI	18 AWG	CABLE	S484 (1)
B	GRN	CABLE CAN LO	18 AWG	CABLE	S483 (2)
C					

S484					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CABLE CAN HI	18 AWG	CABLE	X183B (3)
1	YEL	CABLE CAN HI	18 AWG	CABLE	X481 (A)
2	YEL	CABLE CAN HI	18 AWG	CABLE	X206 (12)

RL799					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	6-15-2	16 AWG	GXL	IP803 (1)
2	WHT	6-15 DIAGNOSTIC	18 AWG	GXL	S240 (2)
3					
4	WHT	6-15-3	18 AWG	GXL	X206 (14)
5	BLK	000-6-1-2	18 AWG	GXL	S802 (1)

S483					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	GRN	CABLE CAN LO	18 AWG	CABLE	X183B (4)
2	GRN	CABLE CAN LO	18 AWG	CABLE	X481 (B)
2	GRN	CABLE CAN LO	18 AWG	CABLE	X206 (13)

S240					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-16	18 AWG	GXL	X183B (1)
2	WHT	6-15 DIAGNOSTIC	18 AWG	GXL	RL799 (2)
2	WHT	6-17 DIAGNOSTIC	18 AWG	GXL	X239 (A)

S802					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-6-1 GROUND	16 AWG	TFFN	X206 (1)
1	BLK	000-6-1-2	18 AWG	GXL	RL799 (5)
2	BLK	000-6-1-3	10 AWG	GXL	X801 (1)

X206					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-6-1 GROUND	16 AWG	TFFN	S802 (1)
2	BLK	000-6-3	18 AWG	GXL	X239 (B)
3					
4					
5					
6					
7					
8					
9					
10	WHT	6-23	18 AWG	GXL	X239 (L)
11	WHT	6-24	18 AWG	GXL	X239 (K)
12	YEL	CABLE CAN HI	18 AWG	CABLE	S484 (2)
13	GRN	CABLE CAN LO	18 AWG	CABLE	S483 (2)
14	WHT	6-15-3	18 AWG	GXL	RL799 (4)
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

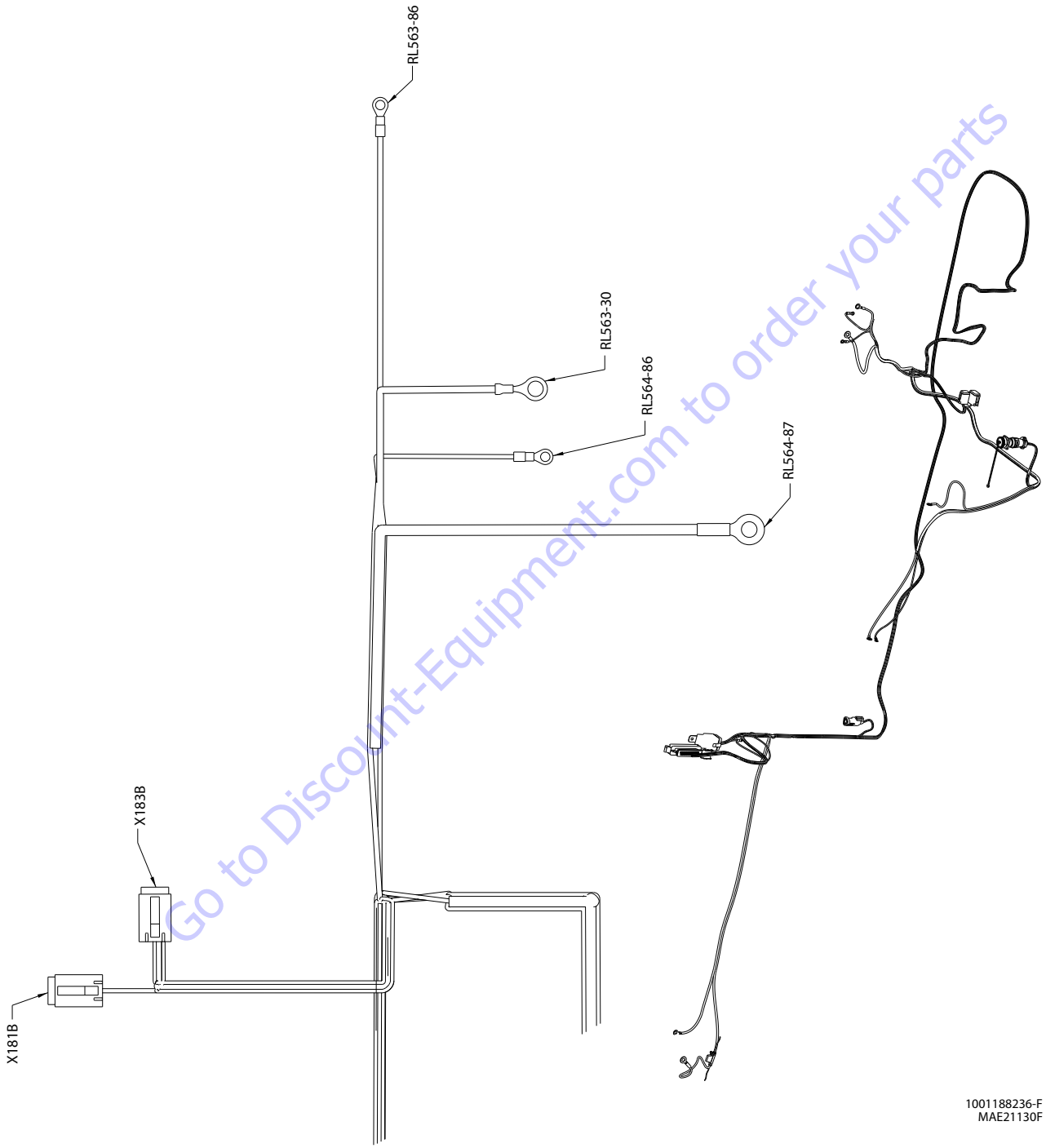


Figure 7-45. Deutz D2011L04 Engine Harness - Sheet 3 of 3

X183B					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-16	18 AWG	GXL	S240 (1)
2	WHT	6-25 ENGINE START	14 AWG	GXL	RL563-86 (1)
3	YEL	CABLE CAN HI	18 AWG	CABLE	S484 (1)
4	GRN	CABLE CAN LO	18 AWG	CABLE	S483 (1)
5	RED	6-51 ALT EXCITE	16 AWG	GXL	EC566-D+ (1)
6					

X181B					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3					
4	WHT	6-18 GLOW	18 AWG	GXL	RL564-86 (1)
5					
6					
7					
8					

RL564-86					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-18 GLOW	18 AWG	GXL	X181B (4)

RL564-87					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	8 AWG	8 AWG	GXL	S480 (1)

RL563-86					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-25 ENGINE START	14 AWG	GXL	X183B (2)

RL563-30					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	12AWG	12 AWG	GXL	EC562 (1)

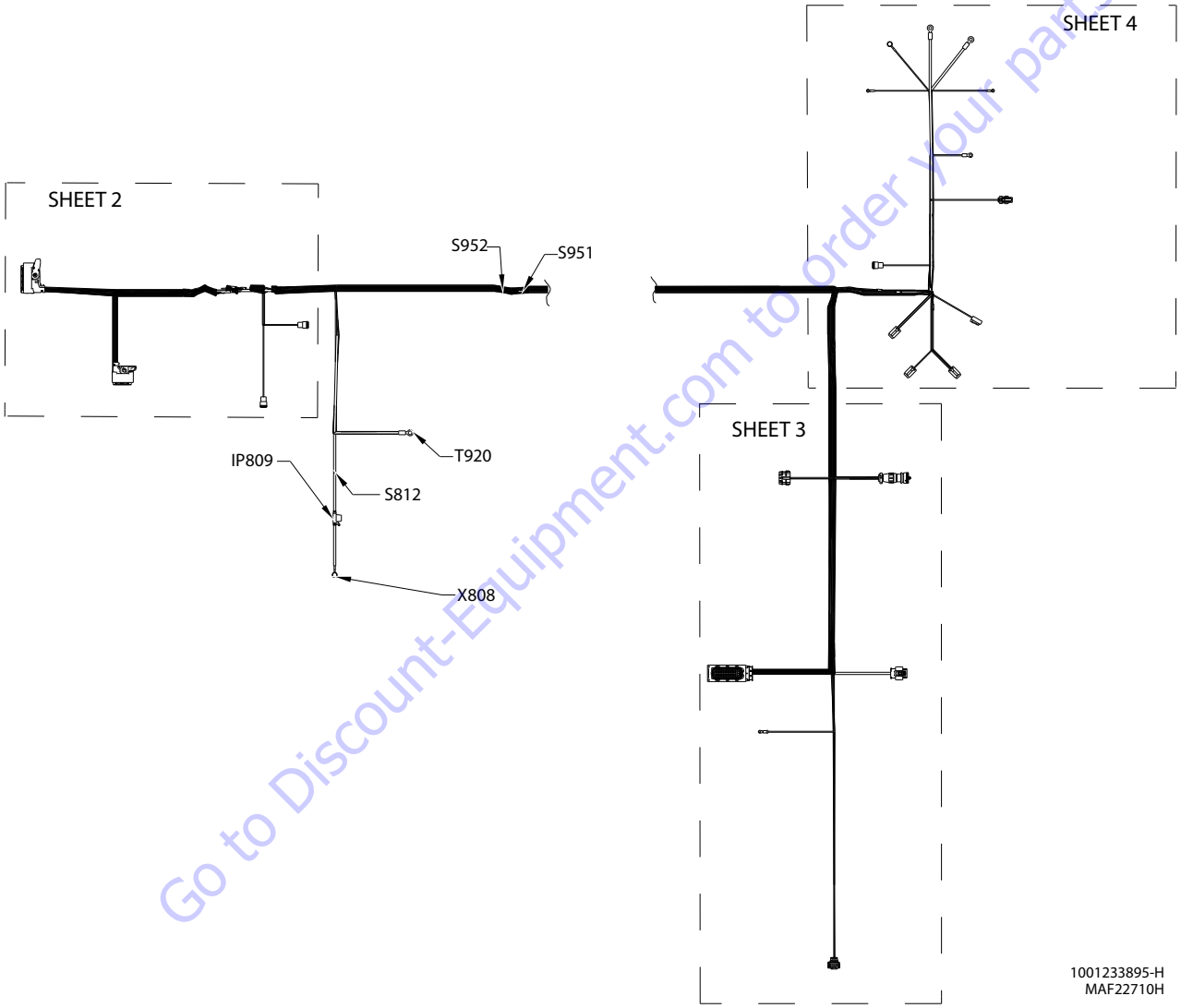


Figure 7-46. Deutz T4F Engine Harness - Sheet 1 of 5

IP809 ECM PWR 30A					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-148-135-2 ECM PWR	12 AWG	GXL	S812 (1)
2	RED	1-148-135-2 ECM PWR	12 AWG	GXL	X808 (1)

T920 ENGINE GROUND					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-148-246 ECM GND	8 AWG	GXL	S945 (1)
1	BLK	000-48-1 ENG GND	14 AWG	GXL	X941 (4)
1	BLK	000-48-2 ENG GND	18 AWG	GXL	X950 (B)
1	BLK	000-48-3 GND	18 AWG	GXL	X999 (2)

X808 BATTERY PWR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-148-135-2 ECM PWR	12 AWG	GXL	IP809 (2)

S951					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	S953 (2)
2	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	X901 (3)
2	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	X950 (M)

S952					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	GRN	CAN 1 LO CUSTOMER CAN LOW	20 AWG	J1939 CABLE	S954 (2)
2	GRN	CAN 1 LO CUSTOMER CAN LO	20 AWG	J1939 CABLE	X901 (4)
2	GRN	CAN 1 LO CUSTOMER CAN LO	20 AWG	J1939 CABLE	X950 (F)

S812					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-148-135-2 ECM PWR	12 AWG	GXL	IP809 (1)
2	RED	1-148-135 ECM PWR	8 AWG	GXL	S944 (1)

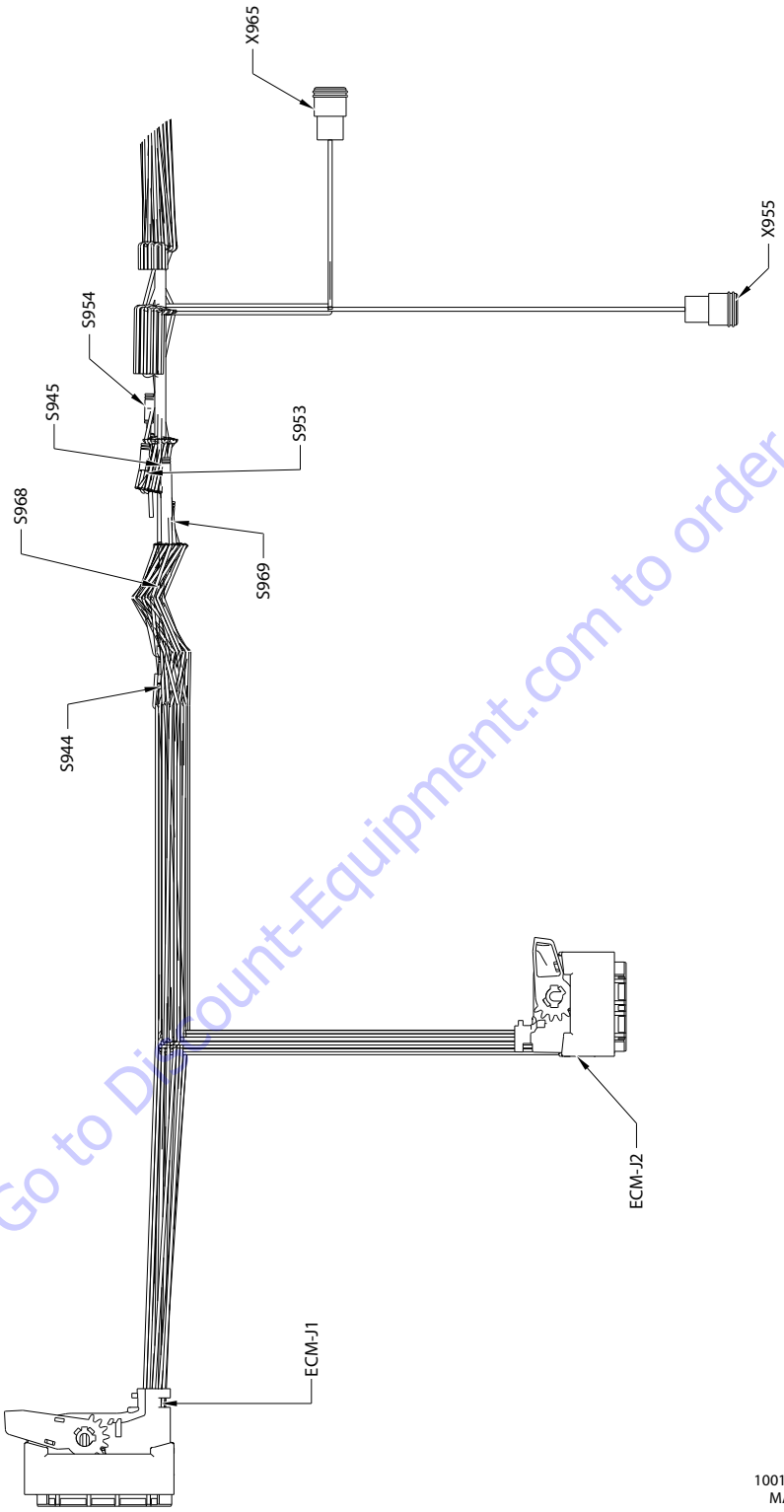


Figure 7-47. Deutz T4F Engine Harness - Sheet 2 of 5

ECM-J1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	148-1 ECM PWR	2.5 mm²	FLRYW	S944 (2)
2	BLK	148-2 ECM GND	2.5 mm²	FLRYW	S945 (2)
3	RED	148-3 ECM PWR	2.5 mm²	FLRYW	S944 (2)
4	BLK	148-4 ECM GND	2.5 mm²	FLRYW	S945 (2)
5	RED	148-5 ECM PWR	2.5 mm²	FLRYW	S944 (2)
6	BLK	148-6 ECM GND	2.5 mm²	FLRYW	S945 (2)
7					
8					
9					
10					
11					
12					
13	BLK	148-13 COOLANT LEVEL SIG	0.75 mm²	FLRYW	SN939 (3)
14					
15	BLK	148-15-68 CLUTCH SWITCH	0.75 mm²	FLRYW	ECM-J1 (68)
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26	BLK	148-26 FUEL PUMP RELAY CTRL GND	0.75 mm²	FLRYW	RL930 (2)
27					
28	BLK	148-28 START RTN	0.75 mm²	FLRYW	EIC (2)
29	BLK	148-29 COOLANT LEVEL PWR	0.75 mm²	FLRYW	SN939 (1)
30					
31					
32					
33					
34					
35	BLK	148-35-2 START	0.75 mm²	FLRYW	S1001 (1)
36					
37					
38	BLK	148-38 THROTTLE FLAP 4	0.75 mm²	FLRYW	EIC (52)
39					
40					
41					
42					
43					
44	BLK	148-44 EHXAUST GAS RECIRCULATION	0.75 mm²	FLRYW	EIC (50)
45					
46					
47					
48					
49					
50					
51					
52					
53	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	S968 (1)
54	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	S953 (1)
55					
56	BLK	148-56 AIR INLET TEMP	0.75 mm²	FLRYW	EIC (34)
57	BLK	148-57 WATER IN FUEL SW RTN	0.75 mm²	FLRYW	X941 (2)
58					
59					
60					
61	BLK	148-61 FUEL LOW PRESSURE	0.75 mm²	FLRYW	EIC (17)
62					
63					
64	BLK	148-64 WATER IN FUEL SW	0.75 mm²	FLRYW	X941 (1)
65					
66					
67					
68	BLK	148-15-68 CLUTCH SWITCH	0.75 mm²	FLRYW	ECM-J1 (15)
69					
70					
71					
72	BLK	148-72 THROTTLE FLAP 3	0.75 mm²	FLRYW	EIC (49)
73	BLK	148-73 START SIGNAL	0.75 mm²	FLRYW	EIC (3)
74					
75	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	S969 (1)
76	GRN	CAN 1 LO CUSTOMER CAN LOW	20 AWG	J1939 CABLE	S954 (1)

77					
78					
79					
80					
81					
82	BLK	148-82 EHXAUST GAS RECIRCULATION	0.75 mm^2	FLRYW	EIC (51)
83					
84					
85	BLK	148-85 EHXAUST GAS RECIRCULATION	0.75 mm^2	FLRYW	EIC (46)
86					
87	BLK	148-87 COOLANT LEVEL GND	0.75 mm^2	FLRYW	SN939 (2)
88	BLK	148-88 IGNITION	0.75 mm^2	FLRYW	S946 (2)
89					
90					
91					
92					
93					
94					
NC	SHLD	CAN 1 SHLD CUSTOMER CAN SHIELD	20 AWG	J1939 CABLE	X901 (6)

S954					
CONN POS	**WIRE COLOR**	**WIRE LABEL**	**GAUGE**	**JACKET**	**TO**
1	GRN	CAN 1 LO CUSTOMER CAN LOW	20 AWG	J1939 CABLE	ECM-J1 (76)
2	GRN	CAN 1 LO CUSTOMER CAN LOW	20 AWG	J1939 CABLE	S952 (1)
2	GRN	CAN 1 LO CUSTOMER CAN LOW	20 AWG	J1939 CABLE	X955 (B)

S953					
CONN POS	**WIRE COLOR**	**WIRE LABEL**	**GAUGE**	**JACKET**	**TO**
1	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	ECM-J1 (54)
2	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	S951 (1)
2	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	X955 (A)

ECM-J2					
CONN POS	**WIRE COLOR**	**WIRE LABEL**	**GAUGE**	**JACKET**	**TO**
1					
2	BLK	248-2 INJECTOR 3	1.5 mm^2	FLRYW	EIC (61)
3	BLK	248-3 INJECTOR 2	1.5 mm^2	FLRYW	EIC (41)
4	BLK	248-M4 PROP ACTUATOR	1.5 mm^2	FLRYW	EIC (19)
5	BLK	248-M5 PROP ACTUATOR	1.5 mm^2	FLRYW	EIC (20)
6					
7	BLK	248-7 RAIL PRESSURE FUEL	0.75 mm^2	FLRYW	EIC (32)
8					
9					
10					
11					
12					
13					
14					
15					
16	BLK	248-16 INJECTOR 1	1.5 mm^2	FLRYW	EIC (35)
17					
18	BLK	248-18 INJECTOR 4	1.5 mm^2	FLRYW	EIC (37)
19	BLK	248-19 EXHAUST GAS RECIRCULATION	1.5 mm^2	FLRYW	EIC (47)
20	BLK	248-20 EXHAUST GAS RECIRCULATION	1.5 mm^2	FLRYW	EIC (48)
21					
22					
23	BLK	248-23 GLOW SENSE	0.75 mm^2	FLRYW	MS932 (E)
24	BLK	248-24 BOOST PRESSURE / TEMP	0.75 mm^2	FLRYW	EIC (22)
25	BLK	248-25 RAIL PRESSURE FUEL	0.75 mm^2	FLRYW	EIC (31)
26	BLK	248-26 RAIL PRESSURE FUEL	0.75 mm^2	FLRYW	EIC (25)
27	BLK	248-27 BOOST PRESSURE / TEMP	0.75 mm^2	FLRYW	EIC (29)
28	BLK	248-28 COOLING TEMPERATURE	0.75 mm^2	FLRYW	EIC (24)
29	BLK	248-29 OIL PRESSURE	0.75 mm^2	FLRYW	EIC (27)
30					
31					
32	BLK	248-32 INJECTOR 3	1.5 mm^2	FLRYW	EIC (38)
33	BLK	248-33 INJECTOR 1	1.5 mm^2	FLRYW	EIC (62)
34					

35	BLK	248-35 GLOW RELAY CONTROL GN D	0.75 mm^2	FLRYW	RL553-85 (1)
36					
37	BLK	248-37 ENGINE SPEED CAMSHAFT	18 AWG	CABLE	EIC (14)
38	SHLD	248-38 ENGINE SPEED CRANKSHAFT	20 AWG	CABLE	EIC (1)
39	BLK	248-39 ENGINE SPEED CRANKSHAFT	18 AWG	CABLE	EIC (15)
40	BLK	248-40 AIR INLET TEMP	0.75 mm^2	FLRYW	EIC (28)
41					
42					
43	BLK	248-43 OIL PRESSURE	0.75 mm^2	FLRYW	EIC (23)
44	BLK	248-44 OIL PRESSURE	0.75 mm^2	FLRYW	EIC (26)
45					
46	BLK	248-46 INJECTOR 2	1.5 mm^2	FLRYW	EIC (40)
47					
48	BLK	248-48 INJECTOR 4	1.5 mm^2	FLRYW	EIC (42)
49					
50					
51					
52	WHT	248-52 ENGINE SPEED CAMSHA FT	18 AWG	CABLE	EIC (13)
53	SHLD	248-5E3 ENGINE SPEED CAMSHA FT	20 AWG	CABLE	EIC (9)
54	WHT	248-54 ENGINE ENGINE SPEED CRANKSHA FT	18 AWG	CABLE	EIC (21)
55					
56					
57					
58					
59					
60					

S969					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	ECM-J1 (75)
2	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	S964 (1)
2	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	X965 (A)

S968					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	ECM-J1 (53)
2	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	S963 (1)
2	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	X965 (B)

S945					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-148-246 ECM GND	8 AWG	GXL	T920 (1)
2	BLK	148-2 ECM GND	2.5 mm^2	FLRYW	ECM-J1 (2)
2	BLK	148-4 ECM GND	2.5 mm^2	FLRYW	ECM-J1 (4)
2	BLK	148-6 ECM GND	2.5 mm^2	FLRYW	ECM-J1 (6)

S944					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-148-135 ECM PWR	8 AWG	GXL	S812 (2)
2	RED	148-1 ECM PWR	2.5 mm^2	FLRYW	ECM-J1 (1)
2	RED	148-3 ECM PWR	2.5 mm^2	FLRYW	ECM-J1 (3)
2	RED	148-5 ECM PWR	2.5 mm^2	FLRYW	ECM-J1 (5)

X955					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	S953 (2)
B	GRN	CAN 1 LO CUSTOMER CAN LOW	20 AWG	J1939 CABLE	S954 (2)
C					

X965					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	S969 (2)
B	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	S968 (2)
C					

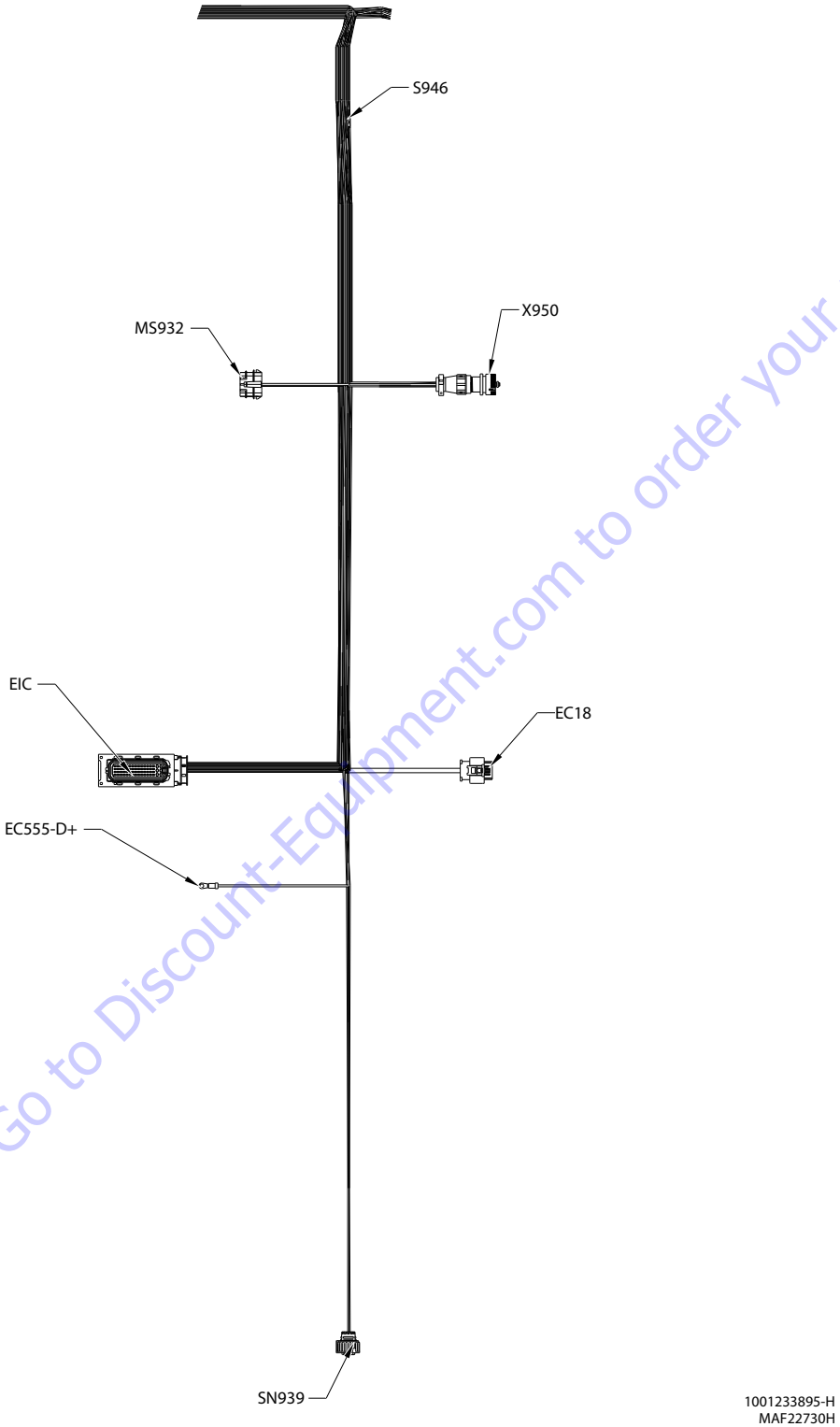


Figure 7-48. Deutz T4F Engine Harness - Sheet 3 of 5

EIC					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	SHLD	248-38 ENGINE SPEED CRANKSHAFT	20 AWG	CABLE	ECM-J2 (38)
2	BLK	148-28 START RTN	0.75 mm^2	FLRYW	ECM-J1 (28)
3	BLK	148-73 START SIGNAL	0.75 mm^2	FLRYW	ECM-J1 (73)
4					
5					
6					
7					
8					
9	SHLD	248-53 ENGINE SPEED CAMSHAFT	20 AWG	CABLE	ECM-J2 (53)
10					
11					
12					
13	WHT	248-52 ENGINE SPEED CAMSHAFT	18 AWG	CABLE	ECM-J2 (52)
14	BLK	248-37 ENGINE SPEED CAMSHAFT	18 AWG	CABLE	ECM-J2 (37)
15	BLK	248-39 ENGINE SPEED CRANKSHAFT	18 AWG	CABLE	ECM-J2 (39)
16					
17	BLK	148-61 FUEL LOW PRESSURE	0.75 mm^2	FLRYW	ECM-J1 (61)
18					
19	BLK	248-4 MPROP ACTUATOR	1.5 mm^2	FLRYW	ECM-J2 (4)
20	BLK	248-5 MPROP ACTUATOR	1.5 mm^2	FLRYW	ECM-J2 (5)
21	WHT	248-54 ENGINE SPEED CRANKSHAFT	18 AWG	CABLE	ECM-J2 (54)
22	BLK	248-24 BOOST PRESSURE / TEMP	0.75 mm^2	FLRYW	ECM-J2 (24)
23	BLK	248-43 OIL PRESSURE	0.75 mm^2	FLRYW	ECM-J2 (43)
24	BLK	248-28 COOLING TEMPERATURE	0.75 mm^2	FLRYW	ECM-J2 (28)
25	BLK	248-26 RAIL PRESSURE FUEL	0.75 mm^2	FLRYW	ECM-J2 (26)
26	BLK	248-44 OIL PRESSURE	0.75 mm^2	FLRYW	ECM-J2 (44)
27	BLK	248-29 OIL PRESSURE	0.75 mm^2	FLRYW	ECM-J2 (29)
28	BLK	248-40 AIR INLET TEMP	0.75 mm^2	FLRYW	ECM-J2 (40)
29	BLK	248-27 BOOST PRESSURE / TEMP	0.75 mm^2	FLRYW	ECM-J2 (27)
30					
31	BLK	248-25 RAIL PRESSURE FUEL	0.75 mm^2	FLRYW	ECM-J2 (25)
32	BLK	248-7 RAIL PRESSURE FUEL	0.75 mm^2	FLRYW	ECM-J2 (7)
33					
34	BLK	148-56 AIR INLET TEMP	0.75 mm^2	FLRYW	ECM-J1 (56)
35	BLK	248-16 INJECTOR 1	1.5 mm^2	FLRYW	ECM-J2 (16)
36					
37	BLK	248-18 INJECTOR 4	1.5 mm^2	FLRYW	ECM-J2 (18)
38	BLK	248-32 INJECTOR 3	1.5 mm^2	FLRYW	ECM-J2 (32)
39					
40	BLK	248-46 INJECTOR 2	1.5 mm^2	FLRYW	ECM-J2 (46)
41	BLK	248-3 INJECTOR 2	1.5 mm^2	FLRYW	ECM-J2 (3)
42	BLK	248-48 INJECTOR 4	1.5 mm^2	FLRYW	ECM-J2 (48)
43					
44					
45					
46	BLK	148-85 EHXAUST GAS RECIRCULATION	0.75 mm^2	FLRYW	ECM-J1 (85)
47	BLK	248-19 EHXAUST GAS RECIRCULATION	1.5 mm^2	FLRYW	ECM-J2 (19)
48	BLK	248-20 EHXAUST GAS RECIRCULATION	1.5 mm^2	FLRYW	ECM-J2 (20)
49	BLK	148-72 THROTTLE FLAP 3	0.75 mm^2	FLRYW	ECM-J1 (72)
50	BLK	148-44 EHXAUST GAS RECIRCULATION	0.75 mm^2	FLRYW	ECM-J1 (44)
51	BLK	148-82 EHXAUST GAS RECIRCULATION	0.75 mm^2	FLRYW	ECM-J1 (82)
52	BLK	148-38 THROTTLE FLAP 4	0.75 mm^2	FLRYW	ECM-J1 (38)
53					
54					
55					
56					
57					
58					
59					
60					
61	BLK	248-2 INJECTOR 3	1.5 mm^2	FLRYW	ECM-J2 (2)
62	BLK	248-33 INJECTOR 1	1.5 mm^2	FLRYW	ECM-J2 (33)

S946					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-48-1 IGNITION	16 AWG	GXL	MS932 (H)
1	YEL	2-48-2 IGNITION	18 AWG	GXL	X950 (A)
2	BLK	148-88 IGNITION	0.75 mm^2	FLRYW	ECM-J1 (88)
2	YEL	2-48-3 IGNITION	18 AWG	GXL	RL553-86 (1)
2	YEL	2-48-4 IGNITION	18 AWG	GXL	RL930 (1)

EC18					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	48-14 GLOW	8 AWG	GXL	RL553-30 (1)
2	RED	48-13 GLOW	8 AWG	GXL	RL553-30-1 (1)

X950 DEUTZ DIAGNOSTIC					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	2-48-2 IGNITION	18 AWG	GXL	S946 (1)
B	BLK	000-48-2 ENG GND	18 AWG	GXL	T920 (1)
C					
D					
E					
F	GRN	CAN 1 LO CUSTOMER CAN LO	20 AWG	J1939 CABLE	S952 (2)
G	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	S963 (2)
H	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	S964 (1)
J					
K					
L					
M	YEL	CAN 1 HI CUSTOMER CAN HIG	H20 AWG	J1939 CABLE	S951 (2)

MS932					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A					
B					
C					
D					
E	BLK	248-23 GLOW SENSE	0.75 mm	FLRYW	ECM-J2 (23)
F	ORG	248-23-1 GLOW SENSE	18 AWG	GXL	RL553-30-2 (1)
G	YEL	2-1-99 IGNITION	18 AWG	GXL	X902 (1)
H	YEL	2-48-1 IGNITION	16 AWG	GXL	S946 (1)

EC555-D+					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE JACKET		TO
1	RED	47-8 ALT EXCITE	16 AWG	GXL	X901 (5)

SN939					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	148-29 COOLANT LEVEL PWR	0.75 mm^2	FLRYW	ECM-J1 (29)
2	BLK	148-87 COOLANT LEVEL GND	0.75 mm^2	FLRYW	ECM-J1 (87)
3	BLK	148-13 COOLANT LEVEL SIG	0.75 mm^2	FLRYW	ECM-J1 (13)
4					

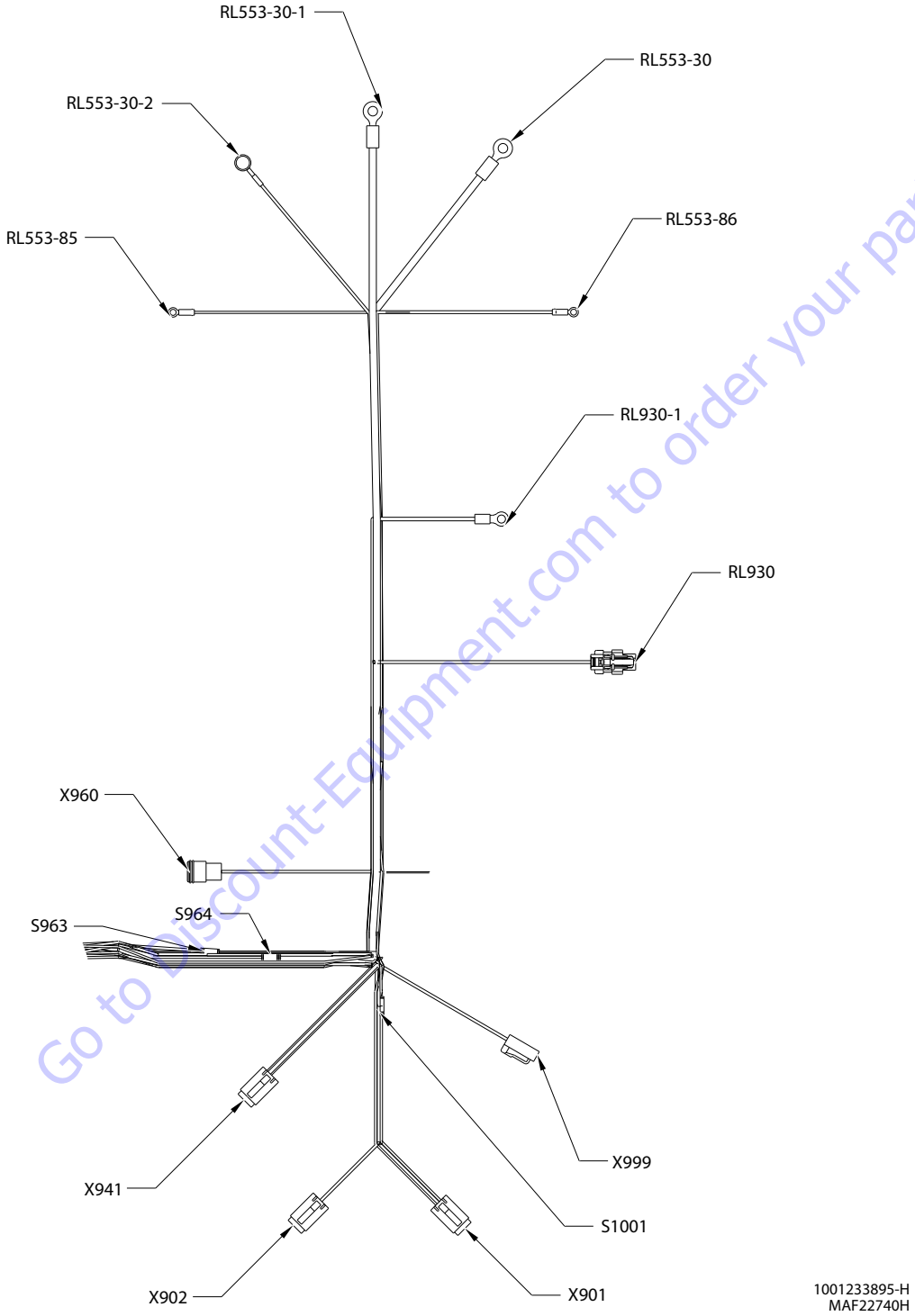


Figure 7-49. Deutz T4F Engine Harness - Sheet 4 of 5

X941					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	148-64 WATER IN FUEL SW	0.75 mm^2	FLRYW	ECM-J1 (64)
2	BLK	148-57 WATER IN FUEL SW RTN	0.75 mm^2	FLRYW	ECM-J1 (57)
3	WHT	48-96 FUEL PUMP	14 AWG	GXL	RL930-1 (1)
4	BLK	000-48-1 ENG GND	14 AWG	GXL	T920 (1)

X902					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-1-99 IGNITION	18 AWG	GXL	MS932 (G)
2					
3					
4					
5					
6					
7					
8					

X901					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	BLK	148-35-1 START	18 AWG	GXL	S1001 (2)
3	YEL	CAN 1 HI CUSTOMER CAN HIGH	20 AWG	J1939 CABLE	S951 (2)
4	GRN	CAN 1 LO CUSTOMER CAN LO	20 AWG	J1939 CABLE	S952 (2)
5	RED	47-8 ALT EXCITE	16 AWG	GXL	EC555-D+ (1)
6	SHLD	CAN 1 SHLD CUSTOMER CAN SHIELD	20 AWG	J1939 CABLE	ECM-J1 (NC)

S963					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	X960 (B)
2	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	S968 (2)
2	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	X950 (G)

S964					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	S969 (2)
1	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	X950 (H)
2	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	X960 (A)

S1001					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	148-35-2START	0.75 mm^2	FLRYW	ECM-J1 (35)
1	BLK	148-35-3	18 AWG	GXL	X999 (1)
2	BLK	148-35-1START	18 AWG	GXL	X901 (2)

X999					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	148-35-3	18 AWG	GXL	S1001 (1)
2	BLK	000-48-3 GND	18 AWG	GXL	T920 (1)

RL553-85					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	248-35GLOW RELAY CONTROL GND	0.75 mm^2	FLRYW	ECM-J2 (35)

RL553-30-2					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	ORG	248-23-1 GLOW SENSE	18 AWG	GXL	MS932 (F)

RL553-30-1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	48-13 GLOW	8 AWG	GXL	EC18 (2)

RL553-30					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	48-14 GLOW	8 AWG	GXL	EC18 (1)

RL553-86					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-48-3 IGNITION	18 AWG	GXL	S946 (2)

RL930-1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	48-96 FUEL PUMP	14 AWG	GXL	X941 (3)

RL930					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	2-48-4 IGNITION	18 AWG	GXL	S946 (2)
2	BLK	148-26 FUEL PUMP RELAY CTRL GND	0.75 mm^2	FLRYW	ECM-J1 (26)

X960					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 2 HI DIAG CAN HIGH	20 AWG	J1939 CABLE	S964 (2)
B	GRN	CAN 2 LO DIAG CAN LOW	20 AWG	J1939 CABLE	S963 (1)
C					

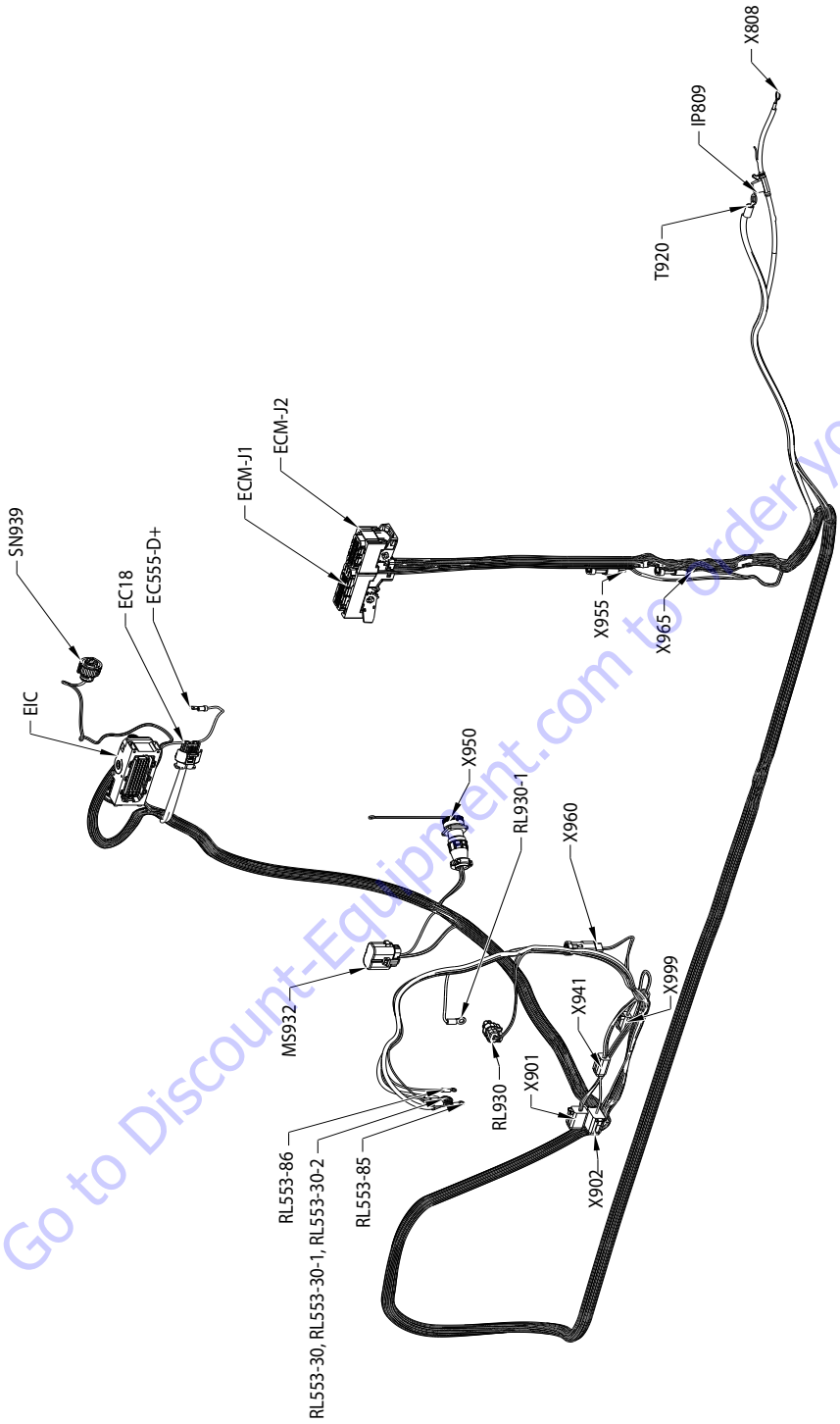


Figure 7-50. Deutz T4F Engine Harness - Sheet 5 of 5

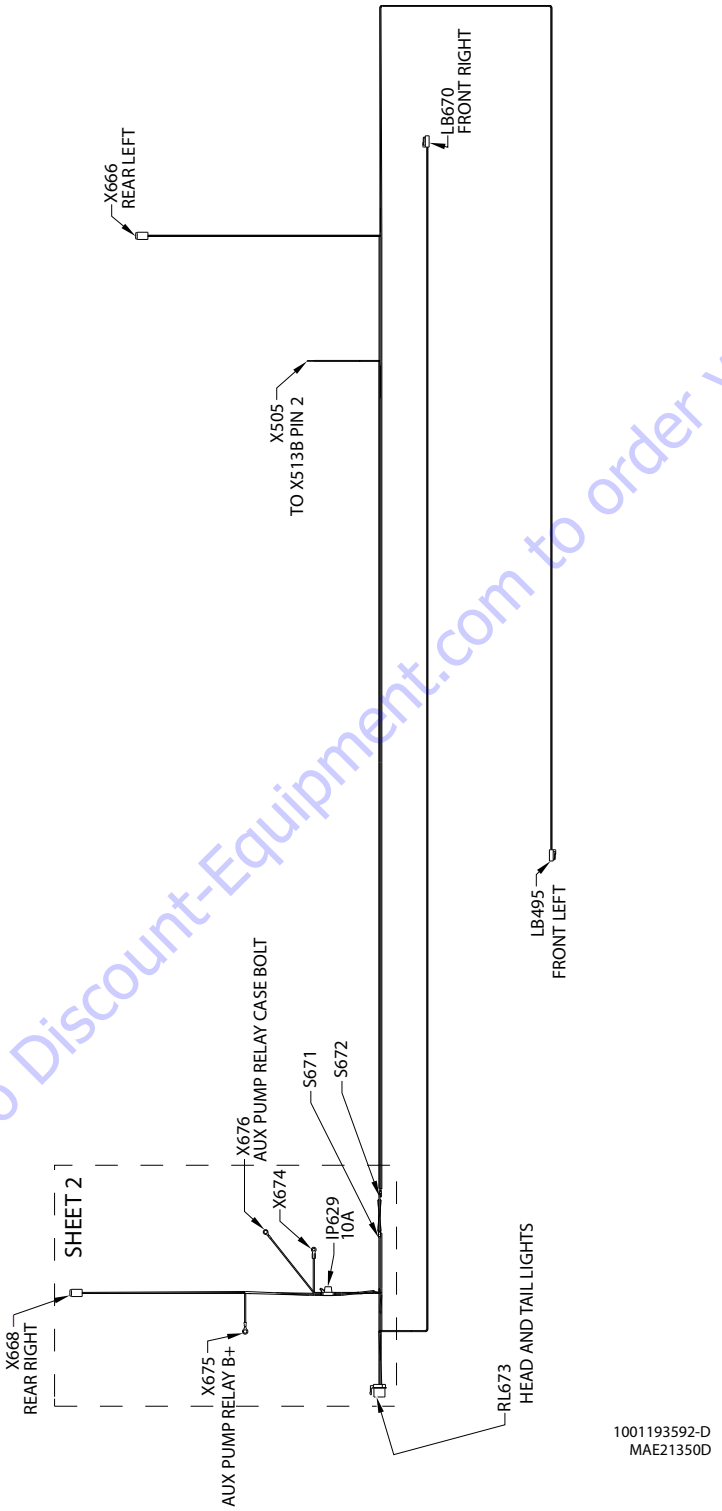


Figure 7-51. Chassis Head and Tail Lights Harness - Sheet 1 of 2

X505					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-145	18 AWG	GXL	RL673 (5)

LB670 FRONT RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-29 GND	16 AWG	GXL	S672 (1)
2	WHT	6-29 12V+	16 AWG	GXL	S671 (1)

LB495 FRONT LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-11 GND	16 AWG	GXL	S672 (1)
2	WHT	6-11 12V+	16 AWG	GXL	S671 (1)

X666 REAR LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	BLK	000-60-12 GND	16 AWG	GXL	S672 (2)
3	WHT	6-13 12V+	16 AWG	GXL	S671 (2)
4					

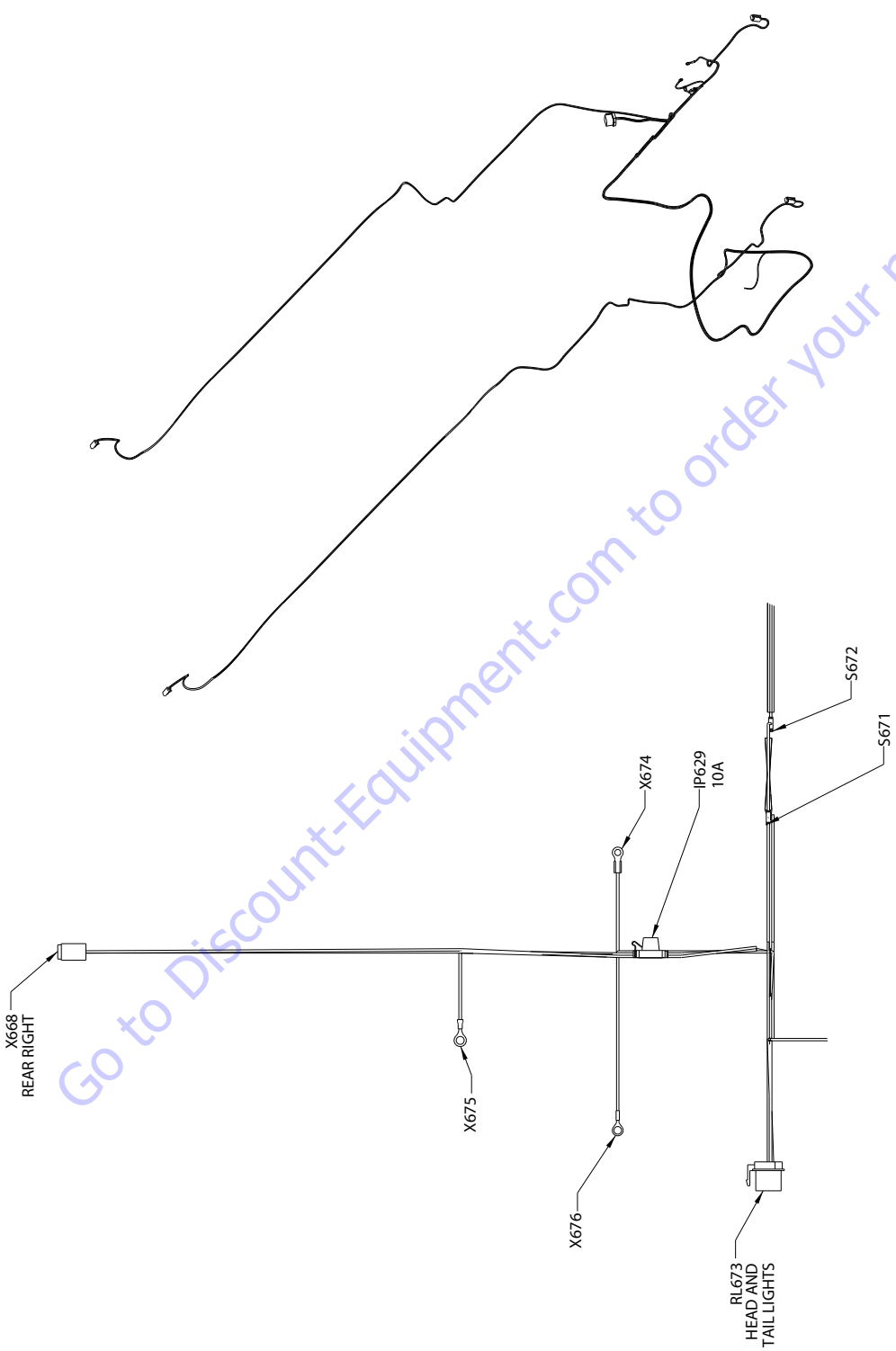


Figure 7-52. Chassis Head and Tail Lights Harness - Sheet 2 of 2

IP629 10A					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-146	14 AWG	GXL	X675 (1)
2	WHT	4-146	14 AWG	GXL	RL673 (1)

RL673 HEAD AND TAIL LIGHTS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-146	14 AWG	GXL	IP629 (2)
2	BLK	000-40-109 GND	16 AWG	GXL	X676 (1)
3					
4	WHT	6-8 12V+	14 AWG	GXL	S671 (2)
5	WHT	4-145	18 AWG	GXL	X505 (1)

X676					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-40-109 GND	16 AWG	GXL	RL673 (2)

X675					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-146	14 AWG	GXL	IP629 (1)

X668 REAR RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	BLK	000-60-30 GND	16 AWG	GXL	S672 (2)
3	WHT	6-30 12V+	16 AWG	GXL	S671 (2)
4					

X674					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	4-122	14 AWG	GXL	S672 (2)

S671					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-11 12V+	16 AWG	GXL	LB495 (2)
1	WHT	6-29 12V+	16 AWG	GXL	LB670 (2)
2	WHT	6-13 12V+	16 AWG	GXL	X666 (3)
2	WHT	6-30 12V+	16 AWG	GXL	X668 (3)
2	WHT	6-8 12V+	14 AWG	GXL	RL673 (4)

S672					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-11 GND	16 AWG	GXL	LB495 (1)
1	BLK	000-60-29 GND	16 AWG	GXL	LB670 (1)
2	BLK	000-60-12 GND	16 AWG	GXL	X666 (2)
2	BLK	000-60-30 GND	16 AWG	GXL	X668 (2)
2	BLK	4-122	14 AWG	GXL	X674 (1)

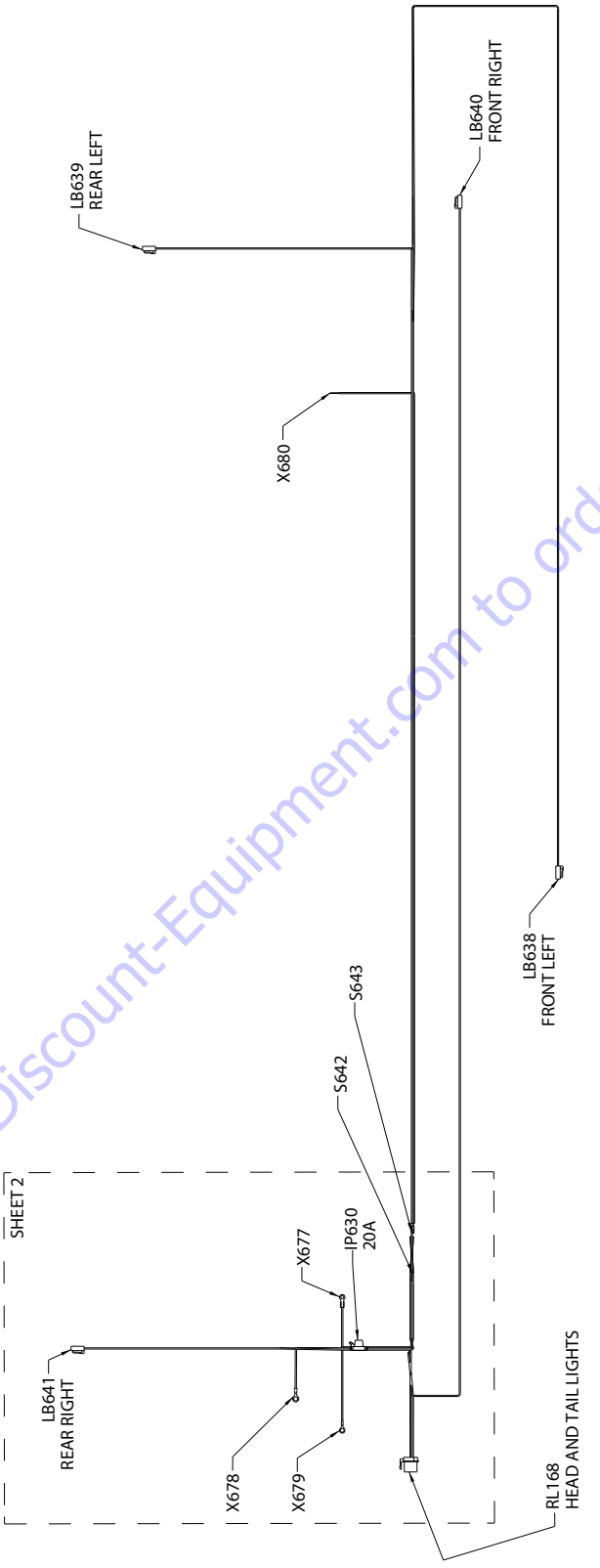


Figure 7-53. Chassis Work Lights Harness - Sheet 1 of 2

LB638 FRONT LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-3 GND	16 AWG	GXL	S643 (1)
2	WHT	6-4 12V+	16 AWG	GXL	S642 (1)

LB640 FRONT RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-5 GND	16 AWG	GXL	S643 (1)
2	WHT	6-6 12V+	16 AWG	GXL	S642 (1)

X680					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-28	16 AWG	GXL	RL168 (5)

LB639 REAR LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-4 GND	16 AWG	GXL	S643 (2)
2	WHT	6-5 12V+	16 AWG	GXL	S642 (2)

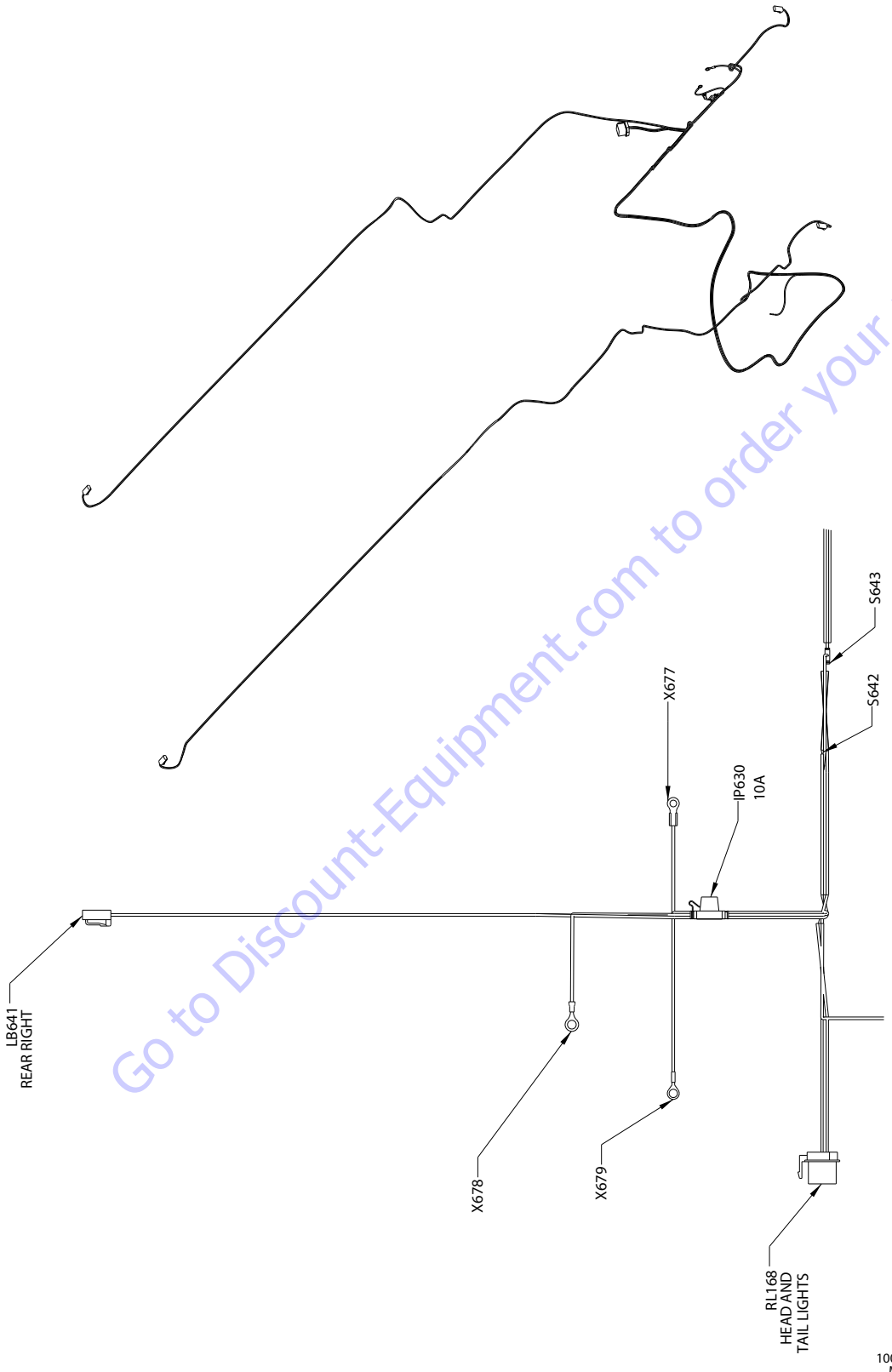


Figure 7-54. Chassis Work Lights Harness - Sheet 2 of 2

X678					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-70	14 AWG	GXL	IP630 (1)

X679					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-40-9 GND	16 AWG	GXL	RL168 (2)

RL168 HEAD AND TAIL LIGHTS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-70	14 AWG	GXL	IP630 (2)
2	BLK	000-40-9 GND	16 AWG	GXL	X679 (1)
3					
4	WHT	6-8 12V+	14 AWG	GXL	S642 (2)
5	WHT	4-28	16 AWG	GXL	X680 (1)

IP630 20A					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	4-70	14 AWG	GXL	X678 (1)
2	WHT	4-70	14 AWG	GXL	RL168 (1)

X677					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-40-17	14 AWG	GXL	S643 (2)

S642					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	6-4 12V+	16 AWG	GXL	LB638 (2)
1	WHT	6-6 12V+	16 AWG	GXL	LB640 (2)
2	WHT	6-5 12V+	16 AWG	GXL	LB639 (2)
2	WHT	6-7 12V+	16 AWG	GXL	LB641 (2)
2	WHT	6-8 12V+	14 AWG	GXL	RL168 (4)

LB641 REAR RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-6 GND	16 AWG	GXL	S643 (2)
2	WHT	6-7 12V+	16 AWG	GXL	S642 (2)

S643					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	000-60-3 GND	16 AWG	GXL	LB638 (1)
1	BLK	000-60-5 GND	16 AWG	GXL	LB640 (1)
2	BLK	000-40-17	14 AWG	GXL	X677 (1)
2	BLK	000-60-4 GND	16 AWG	GXL	LB639 (1)
2	BLK	000-60-6 GND	16 AWG	GXL	LB641 (1)

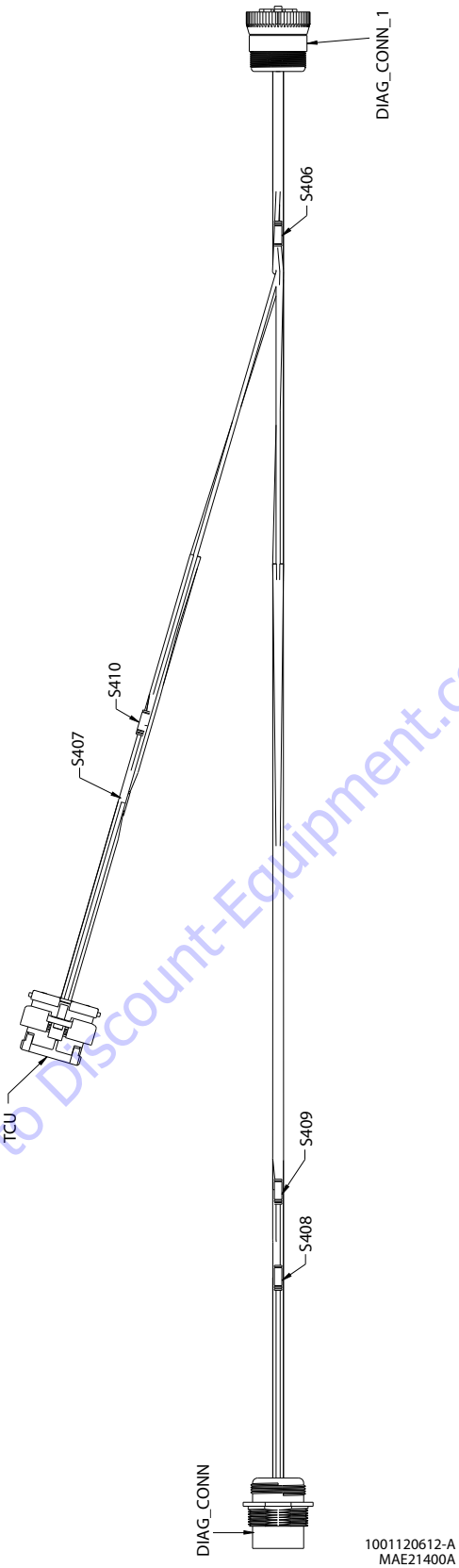


Figure 7-55. ClearSky Harness

S406					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-100-1 GND	16 AWG	GXL	TCU (16)
1	BLK	0-100-2 GND	16 AWG	GXL	DIAG_CONN (A)
2	BLK	0-100-3 GND	16 AWG	GXL	DIAG_CONN_1 (A)

S407					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-100-2 B+	16 AWG	GXL	DIAG_CONN (B)
1	RED	1-100-3 B+	16 AWG	GXL	DIAG_CONN_1 (B)
2	RED	1-100-1 B+	16 AWG	GXL	TCU (23)

S408					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	4-100-1 CAN HI	18 AWG	GXL	TCU (7)
1	YEL	4-100-3 CAN HI	18 AWG	GXL	DIAG_CONN_1 (C)
2	YEL	4-100-2 CAN HI	18 AWG	GXL	DIAG_CONN (C)

S409					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	GRN	3-100-1 CAN LO	18 AWG	GXL	TCU (22)
1	GRN	3-100-3 CAN LO	18 AWG	GXL	DIAG_CONN_1 (D)
2	GRN	3-100-2 CAN LO	18 AWG	GXL	DIAG_CONN (D)

S410					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL/RED	2-100-2 IGN	18 AWG	GXL	DIAG_CONN (H)
2	YEL/RED	2-100-1 IGN	18 AWG	GXL	TCU (15)
2	YEL/RED	2-100-3 IGN	18 AWG	GXL	DIAG_CONN_1 (H)

DIAG_CONN_1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	BLK	0-100-3 GND	16 AWG	GXL	S406 (2)
B	RED	1-100-3 B+	16 AWG	GXL	S407 (1)
C	YEL	4-100-3 CAN HI	18 AWG	GXL	S408 (1)
D	GRN	3-100-3 CAN LO	18 AWG	GXL	S409 (1)
E					
F					
G					
H	YEL/RED	2-100-3 IGN	18 AWG	GXL	S410 (2)
J					

DIAG_CONN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	BLK	0-100-2 GND	16 AWG	GXL	S406 (1)
B	RED	1-100-2 B+	16 AWG	GXL	S407 (1)
C	YEL	4-100-2 CAN HI	18 AWG	GXL	S408 (2)
D	GRN	3-100-2 CAN LO	18 AWG	GXL	S409 (2)
E					
F					
G					
H	YEL/RED	2-100-2 IGN	18 AWG	GXL	S410 (1)
J					

TCU					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3					
4					
5					
6					
7	YEL	4-100-1CAN HI	18 AWG	GXL	S408 (1)
8					
9					
10					
11					
12					
13					
14					
15	YEL/ RED	2-100-1 IGN	18 AWG	GXL	S410 (2)
16	BLK	0-100-1 GND	16 AWG	GXL	S406 (1)
17					
18					
19					
20					
21					
22	GRN	3-100-1 CAN LO	18 AWG	GXL	S409 (1)
23	RED	1-100-1 B+	16 AWG	GXL	S407 (2)

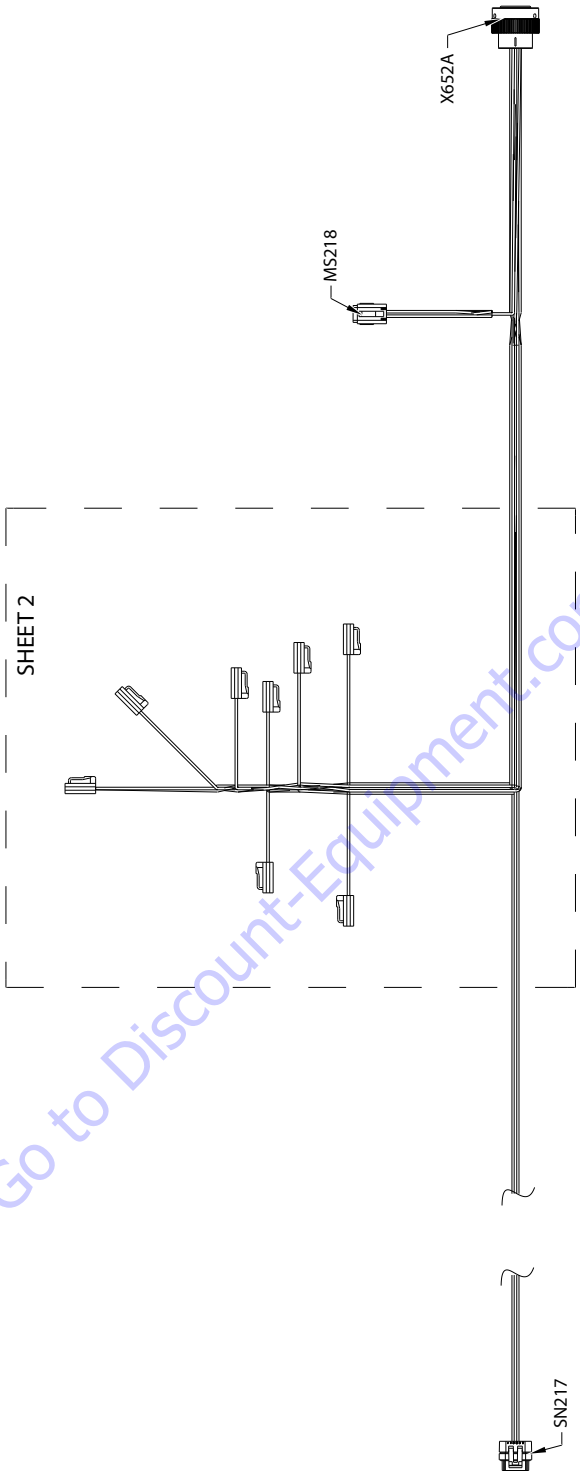


Figure 7-56. Platform Valve w/Jib Harness - Sheet 1 of 3

X652A					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	12-3 PLAT VLV-	18 AWG	GXL	MS218 (2)
2					
3	WHT	90-1 HI PRS DUMP	18 AWG	GXL	HV215 (1)
4	WHT	88-1-2 LEVEL UP	18 AWG	GXL	HV195 (1)
5	WHT	89-1-2 LEVEL DOWN	18 AWG	GXL	HV194 (1)
6					
7					
8	YEL-BLK	18-6 1060780	18 AWG	CABLE	SN217 (C)
9	BRN-BLK	18-6 1060780	18 AWG	CABLE	SN217 (D)
10	ORG-BLK	18-6 1060780	18 AWG	CABLE	SN217 (B)
11	BLU-RED	18-6 1060780	18 AWG	CABLE	SN217 (F)
12	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	HV216 (1)
13	WHT	86-3 ROTATE LEFT	18 AWG	GXL	HV197 (1)
14	WHT	87-3 ROTATE RIGHT	18 AWG	GXL	HV196 (1)
15	WHT	82-3 JIB UP	18 AWG	GXL	HV183 (1)
16	WHT	83-3 JIB DOWN	18 AWG	GXL	HV184 (1)
17					
18					
19					
20	BLK-RED	18-6 1060780	18 AWG	CABLE	SN217 (E)
21	BLU-BLK	18-6 1060780	18 AWG	CABLE	SN217 (A)

MS218 VLV BANK GND BUSS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2	BLK	12-3 PLAT VLV-	18 AWG	GXL	X652A (1)
3	BLK	12-3-1 PLAT VLV-	18 AWG	GXL	HV216 (2)
4	BLK	12-3-2 PLAT VLV-	18 AWG	GXL	HV215 (2)
5	BLK	12-3-3 PLAT VLV-	18 AWG	GXL	HV184 (2)
6	BLK	12-3-4 PLAT VLV-	18 AWG	GXL	HV183 (2)
7	BLK	12-3-5 PLAT VLV-	18 AWG	GXL	HV196 (2)
8	BLK	12-3-6 PLAT VLV-	18 AWG	GXL	HV197 (2)
9	BLK	12-3-7 PLAT VLV-	18 AWG	GXL	HV194 (2)
10	BLK	12-3-8 PLAT VLV-	18 AWG	GXL	HV195 (2)
11					
12					

SN217 PLATFORM ANGLE SNSR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLU-BLK	18-6 1060780	18 AWG	CABLE	X652A (21)
2	ORG-BLK	18-6 1060780	18 AWG	CABLE	X652A (10)
3	YEL-BLK	18-6 1060780	18 AWG	CABLE	X652A (8)
4	BRN-BLK	18-6 1060780	18 AWG	CABLE	X652A (9)
5	BLK-RED	18-6 1060780	18 AWG	CABLE	X652A (20)
6	BLU-RED	18-6 1060780	18 AWG	CABLE	X652A (11)

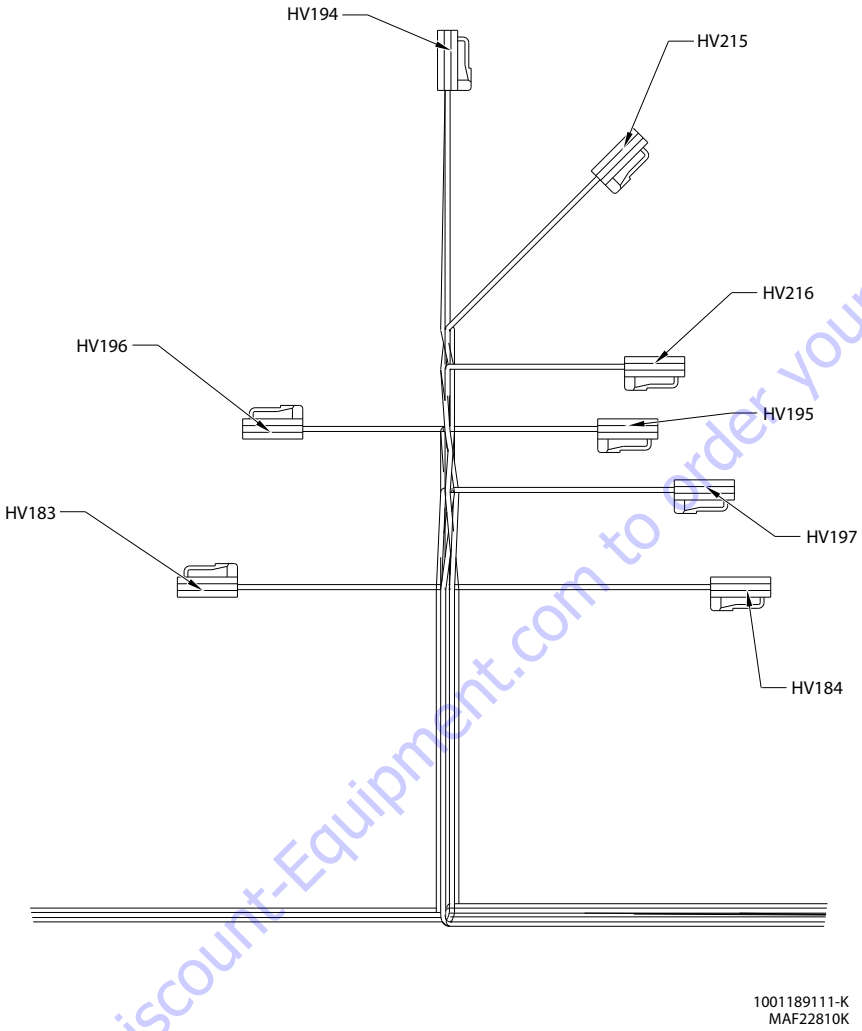


Figure 7-57. Platform Valve w/Jib Harness - Sheet 2 of 3

HV195 LEVEL UP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	88-1-2 LEVEL UP	18 AWG	GXL	X652A (4)
2	BLK	12-3-8 PLAT VLV-	18 AWG	GXL	MS218 (10)

HV183 JIB UP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	82-3 JIB UP	18 AWG	GXL	X652A (15)
2	BLK	12-3-4 PLAT VLV-	18 AWG	GXL	MS218 (6)

HV196 ROTATE RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	87-3 ROTATE RIGHT	18 AWG	GXL	X652A (14)
2	BLK	12-3-5 PLAT VLV-	18 AWG	GXL	MS218 (7)

HV194 LEVEL DOWN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	89-1-2 LEVEL DOWN	18 AWG	GXL	X652A (5)
2	BLK	12-3-7 PLAT VLV-	18 AWG	GXL	MS218 (9)

HV215 HI PRS DUMP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-1 HI PRS DUMP	18 AWG	GXL	X652A (3)
2	BLK	12-3-2 PLAT VLV-	18 AWG	GXL	MS218 (4)

HV216 LOW PRS DUMP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	X652A (12)
2	BLK	12-3-1 PLAT VLV-	18 AWG	GXL	MS218 (3)

HV197 ROTATE LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	86-3 ROTATE LEFT	18 AWG	GXL	X652A (13)
2	BLK	12-3-6 PLAT VLV-	18 AWG	GXL	MS218 (8)

HV184 JIB DOWN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	83-3 JIB DOWN	18 AWG	GXL	X652A (16)
2	BLK	12-3-3 PLAT VLV-	18 AWG	GXL	MS218 (5)

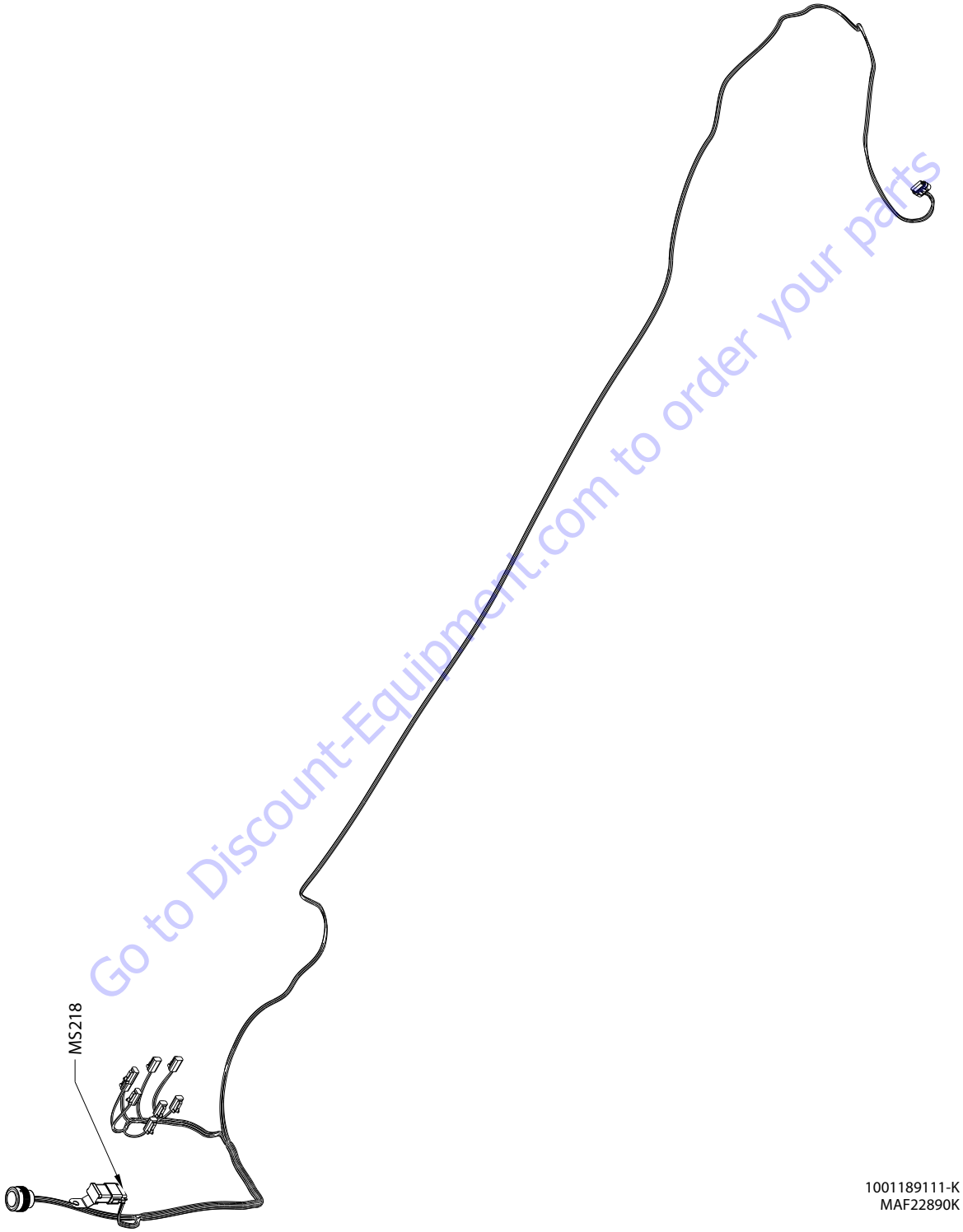


Figure 7-58. Platform Valve w/Jib Harness - Sheet 3 of 3

Figure 7-59. Skyguard GEN2 Platform Interface Harness

X5B - INTERFACE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	P2	18 AWG	GXL	IP114 (1)
2	WHT	P6	18 AWG	GXL	X500 (2)
3					
4	WHT	P1	18 AWG	GXL	RL503 (87)
5	WHT	P3	18 AWG	GXL	RL502 (87)
6					

RL503 - SKYGUARD RELAY #1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
30	WHT	P9-1	18 AWG	GXL	IP114 (1)
85	WHT	P5-1	18 AWG	GXL	S191 (1)
86	WHT	P4-1	18 AWG	GXL	S192 (1)
87	WHT	P1	18 AWG	GXL	X5B (4)
87A					

RL502 - SKYGUARD RELAY #2					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
30	WHT	P9-2	18 AWG	GXL	IP114 (1)
85	WHT	P5-2	18 AWG	GXL	S191 (1)
86	WHT	P4-2	18 AWG	GXL	S192 (1)
87	WHT	P3	18 AWG	GXL	X5B (5)
87a					

S192					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	P4-1	18 AWG	GXL	RL503 (86)
1	WHT	P4-2	18 AWG	GXL	RL502 (86)
2	WHT	P4	18 AWG	GXL	X500 (3)

S191					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	P5-1	18 AWG	GXL	RL503 (85)
1	WHT	P5-2	18 AWG	GXL	RL502 (85)
2	WHT	P5	18 AWG	GXL	X500 (4)

X500 - PLATE SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	P10	18 AWG	GXL	IP114 (2)
2	WHT	P6	18 AWG	GXL	X5B (2)
3	WHT	P4	18 AWG	GXL	S192 (2)
4	WHT	P5	18 AWG	GXL	S191 (2)

IP114					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	P2	18 AWG	GXL	X5B (1)
1	WHT	P9-1	18 AWG	GXL	RL503 (30)
1	WHT	P9-2	18 AWG	GXL	RL502 (30)
2	WHT	P10	18 AWG	GXL	X500 (1)

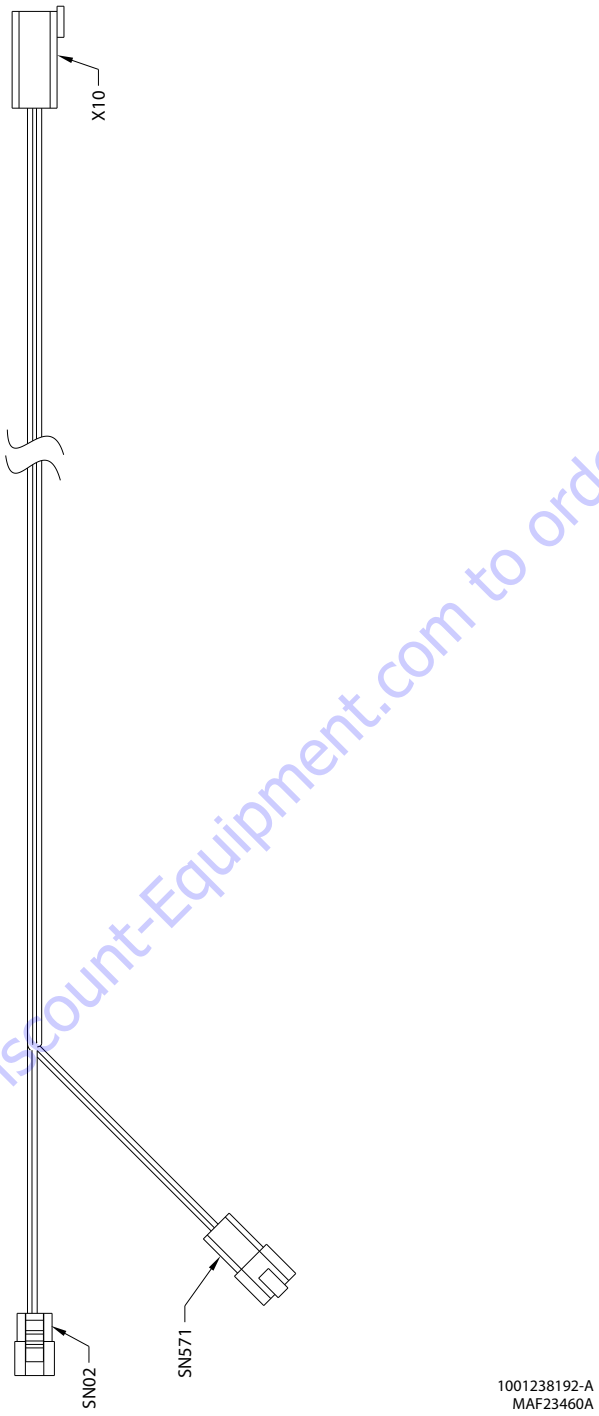


Figure 7-60. Boom Sensor Harness

SN02 CAPACITYLENGTH NO 1					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL-BLK	1	18 AWG	TFFN	X10 (1)
2	ORG-BLK	2	18 AWG	TFFN	X10 (2)
3	BRN-BLk	3	18 AWG	TFFN	X10 (3)

SN571 CAPACITY LENGTH NC 2					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLU-RED	4	18 AWG	TFFN	X10 (4)
2	BLU-RED	5	18 AWG	TFFN	X10 (5)
3	BLU-BLK	6	18 AWG	TFFN	X10 (6)

X10 FULL EXTENSION					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL-BLK	1	18 AWG	TFFN	SN02 (1)
2	ORG-BLK	2	18 AWG	TFFN	SN02 (2)
3	BRN-BLK	3	18 AWG	TFFN	SN02 (3)
4	BLU-RED	4	18 AWG	TFFN	SN571 (1)
5	BLK-RED	5	18 AWG	TFFN	SN571 (2)
6	BLU-BLK	6	18 AWG	TFFN	SN571 (3)

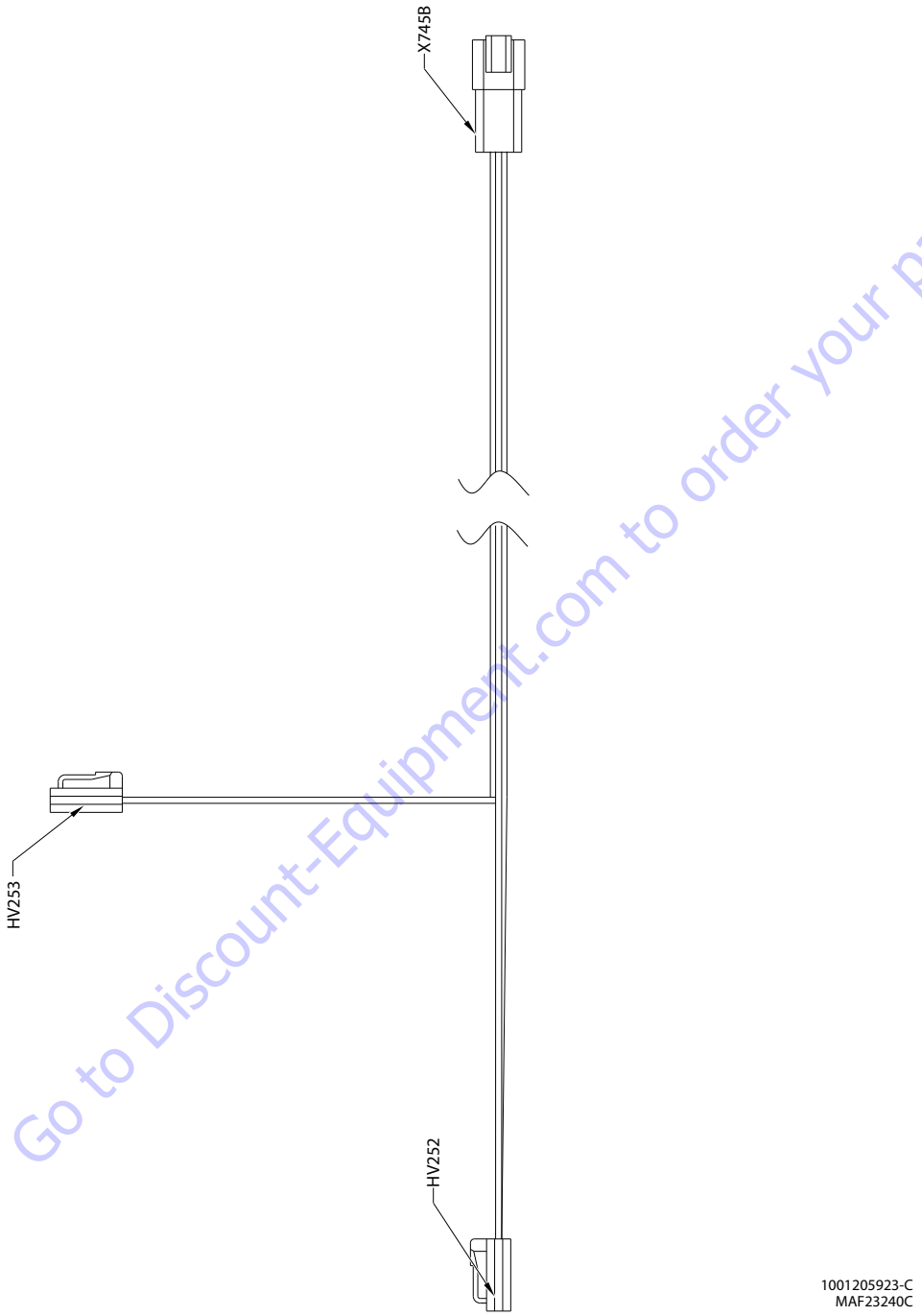


Figure 7-61. Main Lift Harness

HV252 BOOM LIFT DOWN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-1 BOOM LIFT DN	18 AWG	GXL	X745B (1)
2	WHT	50-4-1 LIFT RTN	18 AWG	GXL	X745B (3)

HV253 BOOM LIFT DN ENBL/AUX					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-2 BOOM LIFT DN ENBL/AUX	18 AWG	GXL	X745B (2)
2	WHT	50-5 LIFT DN ENBL/ AUX RTN	18 AWG	GXL	X745B (4)

X745B TO MAIN VALVE HARNESS					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-1 BOOM LIFT DN	18 AWG	GXL	HV252 (1)
2	WHT	77-2 BOOM LIFT DN ENBL/AUX	18 AWG	GXL	HV253 (1)
3	WHT	50-4-1 LIFT RTN	18 AWG	GXL	HV252 (2)
4	WHT	50-5 LIFT DN ENBL/ AUX RTN	18 AWG	GXL	HV253 (2)

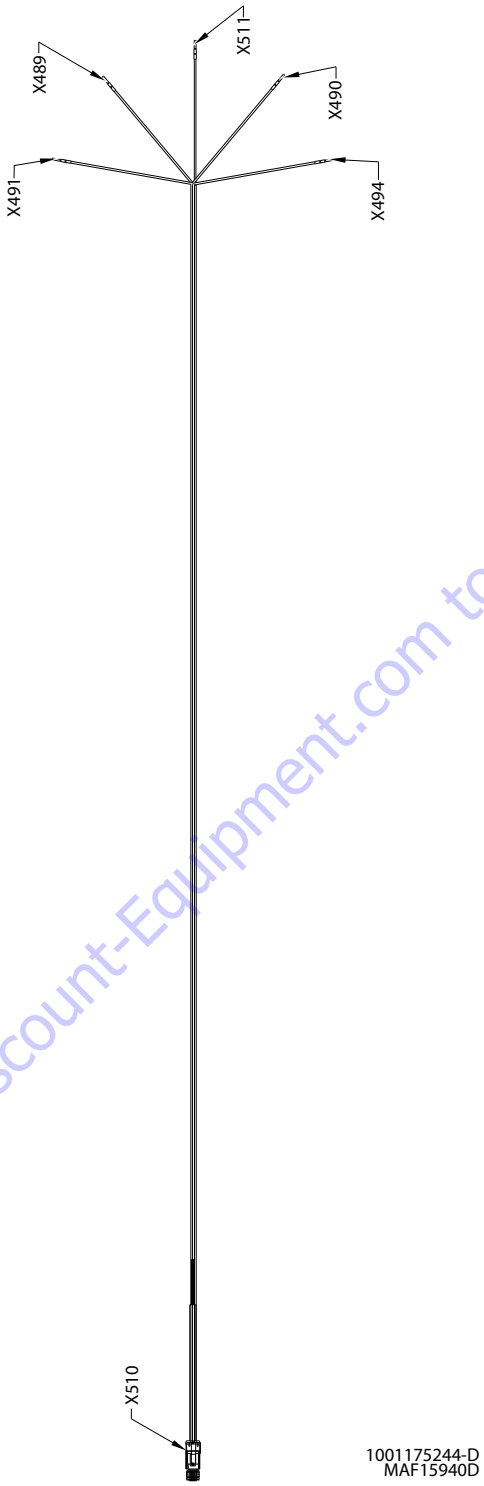


Figure 7-62. LSS Harness

X511 CAN SHIELD					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	SLR	SHLD	22 AWG	SHLD	X510 (1)

X491 LSS CAN LO					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLU	CAN_LO	24 AWG	GXL	X510 (5)

X489 LSS POWER					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	POWER	22 AWG	GXL	X510 (2)

X490 LSS CAN HI					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	CAN_HI	24 AWG	GXL	X510 (4)

X494 LSS GROUND					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	V-	22 AWG	GXL	X510 (3)

X510					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
2	RED	POWER	22 AWG	GXL	X489 (1)
4	WHT	CAN_HI	24 AWG	GXL	X490 (1)
5	BLU	CAN_LO	24 AWG	GXL	X491 (1)
3	BLK	V-	22 AWG	GXL	X494 (1)
1	SLR	SHLD	22 AWG	SHLD	X511 (1)

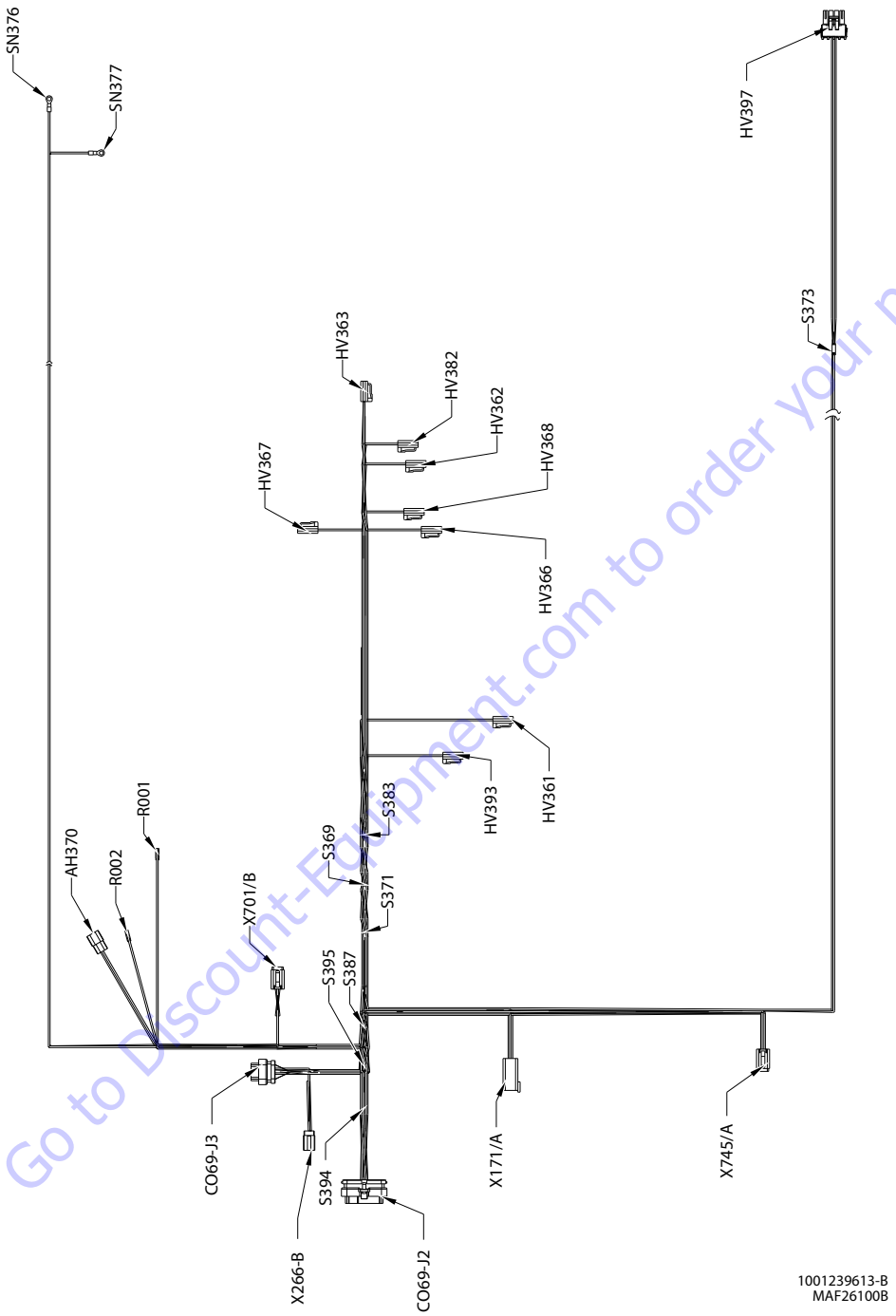


Figure 7-63. Crawler Main Valve Harness - Sheet 1 of 4

X745/A TO LIFT DOWN HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	77-1 BOOM LIFT DN	18 AWG	GXL	C069-J2 (22)
2	WHT	77-2 BOOM LIFT DN ENBL/ AUX	18 AWG	GXL	C069-J2 (21)
3	WHT	50-4-1 LIFT RTN	18 AWG	GXL	S387 (1)
4	WHT	50-5 LIFT DN ENBL/AUX RTN	18 AWG	GXL	C069-J3 (5)

HV397 RIGHT TRACK DRIVE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	WHT	27-2 DRIVE FWD	18 AWG	GXL	C069-J2 (19)
B	WHT	50-6-2 RHT TRK DRV RTN	18 AWG	GXL	S373 (1)
C	WHT	50-6-1 RHT TRK DRV RTN	18 AWG	GXL	S373 (1)
D	WHT	28-2 DRIVE REV	18 AWG	GXL	C069-J2 (8)

SN377 FUEL SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-16 FUEL SNSR-	18 AWG	GXL	C069-J2 (6)

SN376 FUEL SENSOR					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	104-0 FUEL SENSOR	18 AWG	GXL	C069-J2 (25)

S373					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-6-1 RHT TRK DRV RTN	18 AWG	GXL	HV397 (C)
1	WHT	50-6-2 RHT TRK DRV RTN	18 AWG	GXL	HV397 (B)
2	WHT	50-6 RHT TRK DRV RTN	18 AWG	GXL	C069-J3 (2)

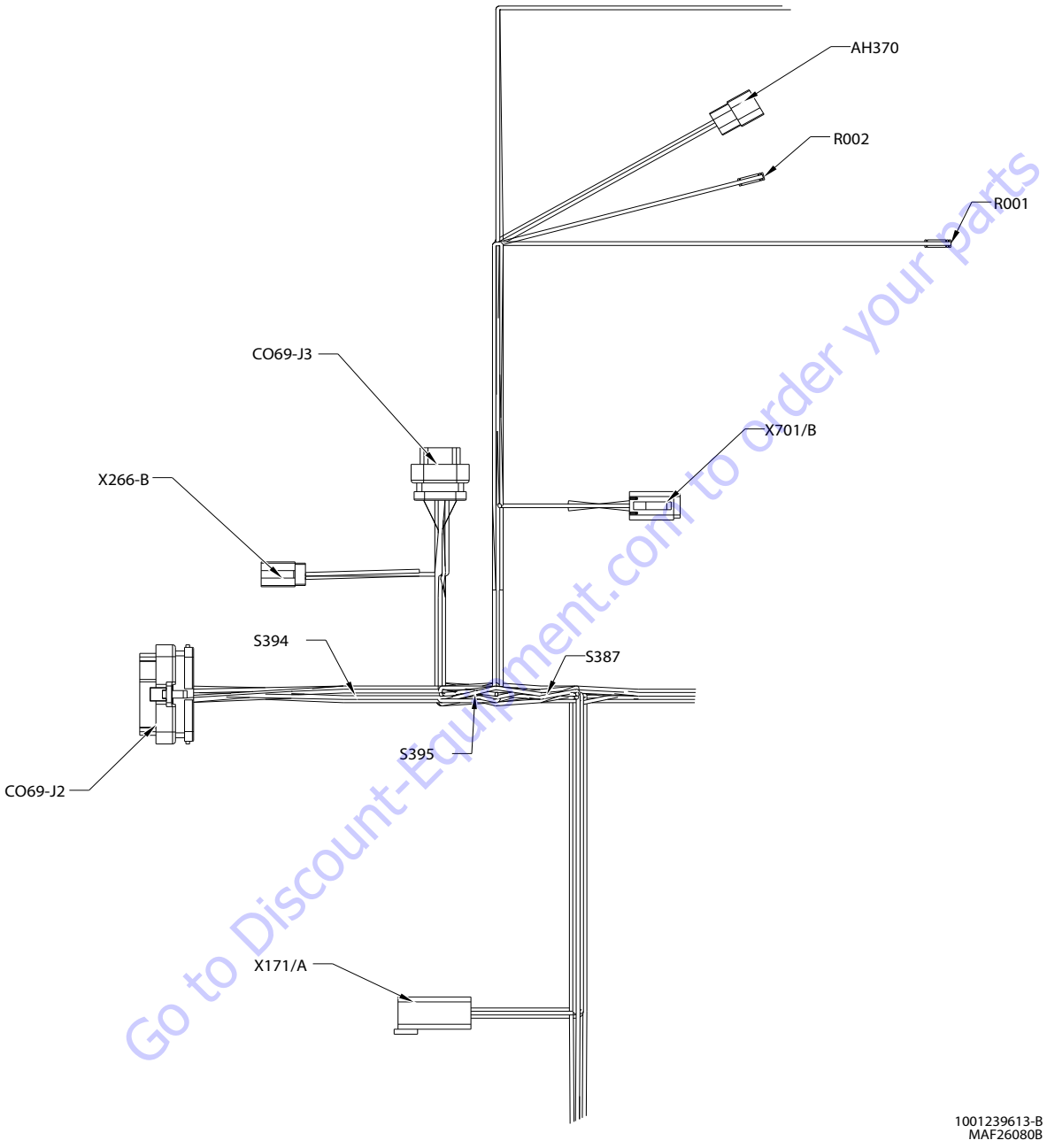


Figure 7-64. Crawler Main Valve Harness - Sheet 2 of 4

C069-J2 GRAY					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1					
2					
3	WHT	90-1 HI PRS DUMP	18 AWG	GXL	X701/B (1)
4	WHT	90-3 BYPASS DUMP	18 AWG	GXL	HV393 (1)
5	WHT	88-1-1 LEVEL UP	18 AWG	GXL	R001 (2)
6	WHT	16-16 FUEL SNSR-	18 AWG	GXL	SN377 (1)
7	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	R002 (2)
8	WHT	28-2 DRIVE REV	18 AWG	GXL	HV397 (D)
9	WHT	78-1 BOOM TELE IN	18 AWG	GXL	HV362 (1)
10					
11	WHT	76-1 BOOM LIFT UP	18 AWG	GXL	HV366 (1)
12					
13	WHT	90-5 MAIN DUMP	18 AWG	GXL	HV361 (1)
14					
15					
16					
17					
18					
19	WHT	27-2 DRIVE FWD	18 AWG	GXL	HV397 (A)
20	WHT	79-1 BOOM TELE OUT	18 AWG	GXL	HV363 (1)
21	WHT	77-2 BOOM LIFT DN ENBL/ AUX	18 AWG	GXL	X745/A (2)
22	WHT	77-1 BOOM LIFT DN	18 AWG	GXL	X745/A (1)
23	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	X701/B (2)
24	WHT	16-10-2 CONFIG -	18 AWG	GXL	S394 (2)
25	WHT	104-0 FUEL SENSOR	18 AWG	GXL	SN376 (1)
26	WHT	500-0 HEAD&TAIL LT	18 AWG	GXL	X171/A (2)
27	WHT	94-0 ALARM SIGNAL	18 AWG	GXL	AH370 (B)
28					
29	BLK	16-10 ALARM/CONFIG-	18 AWG	GXL	S394 (2)
30	BLK	16-14 DUMP-	18 AWG	GXL	S383 (2)
31	WHT	90-4 BOOM TELE DUMP	18 AWG	GXL	HV382 (1)
32					
33					
34	WHT	70-1 SWG LEFT	18 AWG	GXL	HV368 (1)
35	WHT	71-1 SWG RHT	18 AWG	GXL	HV367 (1)

C069-J3 BLACK					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-1 DRV RTN	18 AWG	GXL	X171/A (1)
2	WHT	50-6 RHT TRK DRV RTN	18 AWG	GXL	S373 (2)
3	BLK	16-12 SERVICE CABLE-	18 AWG	GXL	X266-B (3)
4	WHT	50-2 SWG RTN	18 AWG	GXL	S371 (2)
5	WHT	50-5 LIFT DN ENBL/AUX RTN	18 AWG	GXL	X745/A (4)
6	WHT	50-5 BOOM TELE RTN	18 AWG	GXL	S369 (2)
7	YEL	14-5 ALARM/CRIB+	18 AWG	GXL	S395 (2)
8	WHT	95-0 SERVICE CABLE	18 AWG	GXL	X266-B (2)
9	WHT	506-0 CRIBBING	18 AWG	GXL	X171/A (3)
10	WHT	54-7 NO CAPCITY LNTH 18	18 AWG	GXL	X171/A (5)
11					
12					
13					
14	WHT	50-4 LIFT RTN	18 AWG	GXL	S387 (2)

X266-B SERVICE CABLE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-11 SERVICE CABLE+	18 AWG	GXL	X171/A (4)
2	WHT	95-0 SERVICE CABLE	18 AWG	GXL	C069-J3 (8)
3	BLK	16-12 SERVICE CABLE-	18 AWG	GXL	C069-J3 (3)

S394					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-10-1 ALARM-	18 AWG	GXL	AH370 (C)
2	BLK	16-10 ALARM/CONFIG-	18 AWG	GXL	C069-J2 (29)
2	BLK	16-10-2 CONFIG -	18 AWG	GXL	C069-J2 (24))

AH370 ALARM					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	14-5-1 ALARM+	18 AWG	GXL	S395 (1)
B	WHT	94-0 ALARM SIGNAL	18 AWG	GXL	C069-J2 (27)
C	BLK	16-10-1 ALARM-	18 AWG	GXL	S394 (1)

X701/B TO TURNTABLE HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-1 HI PRS DUMP	18 AWG	GXL	C069-J2 (3)
2	WHT	90-2 LOW PRS DUMP	18 AWG	GXL	C069-J2 (23)
3	WHT	88-1-1 LEVEL UP	18 AWG	GXL	R001 (1)
4	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	R002 (1)

R002					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	X701/B (4)
2	WHT	89-1-1 LEVEL DOWN	18 AWG	GXL	C069-J2 (7)

R001					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	89-1-1 LEVEL UP	18 AWG	GXL	X701/B (3)
2	WHT	89-1-1 LEVEL UP	18 AWG	GXL	C069-J2 (5)

X171/A TO TURNTABLE HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-1 DRV RTN	18 AWG	GXL	C069-J3 (1)
2	WHT	500-0 HEAD&TAIL LT	18 AWG	GXL	C069-J2 (26)
3	WHT	506-0 CRIBBING	18 AWG	GXL	C069-J3 (9)
4	YEL	14-11 SERVICE CABLE+	18 AWG	GXL	X266-B (1)
5	WHT	54-7 NO CAPCITY LNTH	18 AWG	GXL	C069-J3 (10)
6	YEL	14-5-2 CRIB+	18 AWG	GXL	S395 (1)

S387					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-4-1 LIFT RTN	18 AWG	GXL	X745/A (3)
1	WHT	50-4-2 LIFT RTN	18 AWG	GXL	HV366 (2)
2	WHT	50-4 LIFT RTN	18 AWG	GXL	C069-J3 (14)

S395					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	14-5-1 ALARM+	18 AWG	GXL	AH370 (A)
1	YEL	14-5-2 CRIB+	18 AWG	GXL	X171/A (6)
2	YEL	14-5 ALARM/CRIB+	18 AWG	GXL	C069-J3 (7)

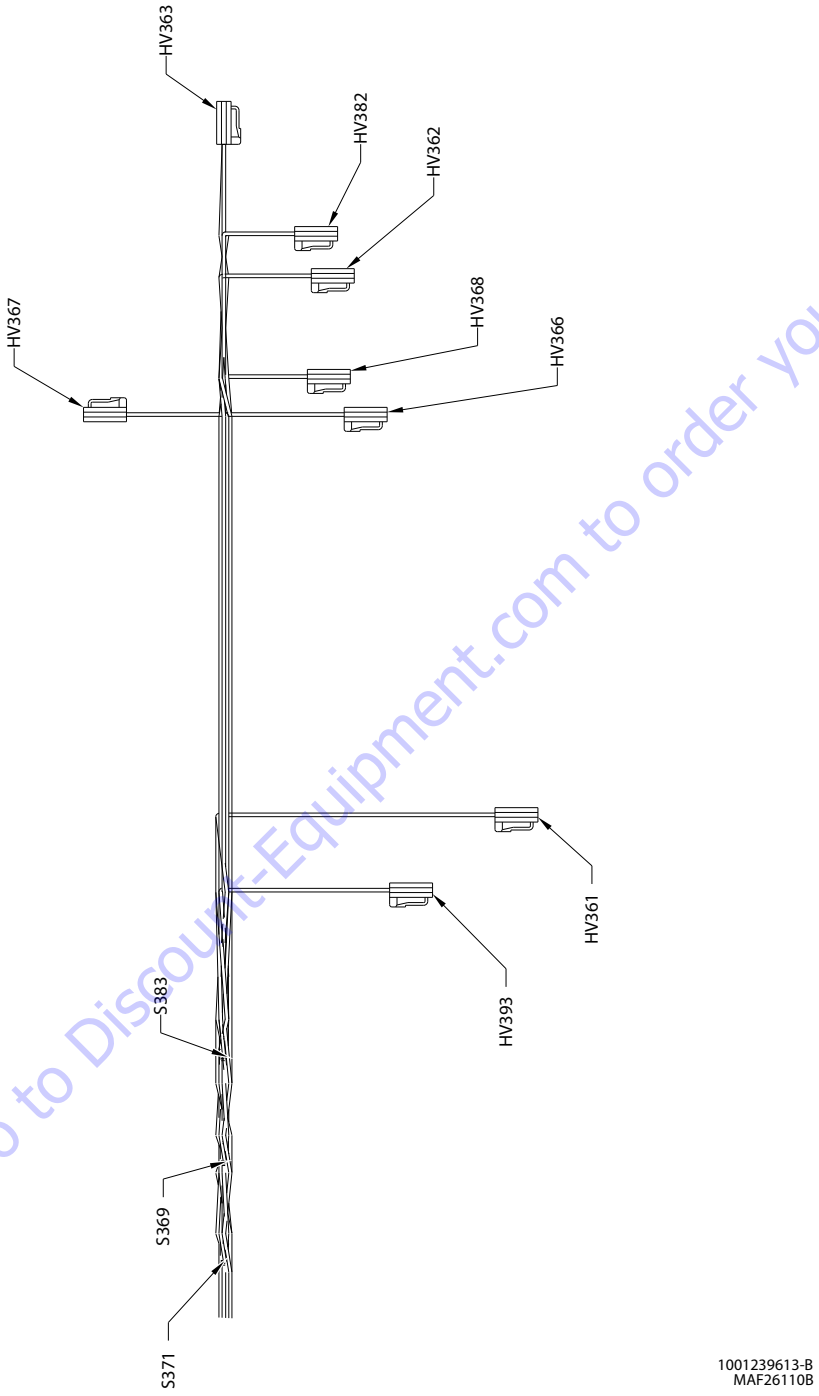


Figure 7-65. Crawler Main Valve Harness - Sheet 3 of 4

HV393 BYPASS DUMP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-3 BYPASS DUMP	18 AWG	GXL	C069-J2 (4)
2	BLK	16-14-1 DUMP	18 AWG	GXL	S383 (1)

HV361 MAIN DUMP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-5 MAIN DUMP	18 AWG	GXL	C069-J2 (13)
2	BLK	16-14-3 DUMP-	18 AWG	GXL	S383 (1)

HV367 SWING RIGHT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	71-1 SWG RHT	18 AWG	GXL	C069-J2 (35)
2	WHT	50-2-1 SWG RTN	18 AWG	GXL	S371 (1)

HV366 BOOM LIFT UP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	76-1 BOOM LIFT UP	18 AWG	GXL	C069-J2 (11)
2	WHT	50-4-2 LIFT RTN	18 AWG	GXL	S387 (1)

HV368 SWING LEFT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	70-1 SWG LEFT	18 AWG	GXL	C069-J2 (34)
2	WHT	50-2-2 SWG RTN	18 AWG	GXL	S371 (1)

HV362 BOOM TELE IN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	78-1 BOOM TELE IN	18 AWG	GXL	C069-J2 (9)
2	WHT	50-5-2 BOOM TELE RTN	18 AWG	GXL	S369 (1)

HV382 TELESCOPE DUMP					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	90-4 BOOM TELE DUMP	18 AWG	GXL	C069-J2 (31)
2	BLK	16-14-2 DUMP-	18 AWG	GXL	S383 (1)

HV363 BOOM TELE OUT					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	79-1 BOOM TELE OUT	18 AWG	GXL	C069-J2 (20)
2	WHT	50-5-1 BOOM TELE RTN	18 AWG	GXL	S369 (1)

S369					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-5-1 BOOM TELE RTN	18 AWG	GXL	HV363 (2)
1	WHT	50-5-2 BOOM TELE RTN	18 AWG	GXL	HV362 (2)
2	WHT	50-5 BOOM TELE RTN	18 AWG	GXL	C069-J3 (6)

S371					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	WHT	50-2-1 SWG RTN	18 AWG	GXL	HV367 (2)
1	WHT	50-2-2 SWG RTN	18 AWG	GXL	HV368 (2)
2	WHT	50-2 SWG RTN	18 AWG	GXL	C069-J3 (4)

S383					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	16-14-1 DUMP-	18 AWG	GXL	HV393 (2)
1	BLK	16-14-2 DUMP-	18 AWG	GXL	HV382 (2)
1	BLK	16-14-3 DUMP-	18 AWG	GXL	HV361 (2)
2	BLK	16-14 DUMP-	18 AWG	GXL	C069-J2 (30)

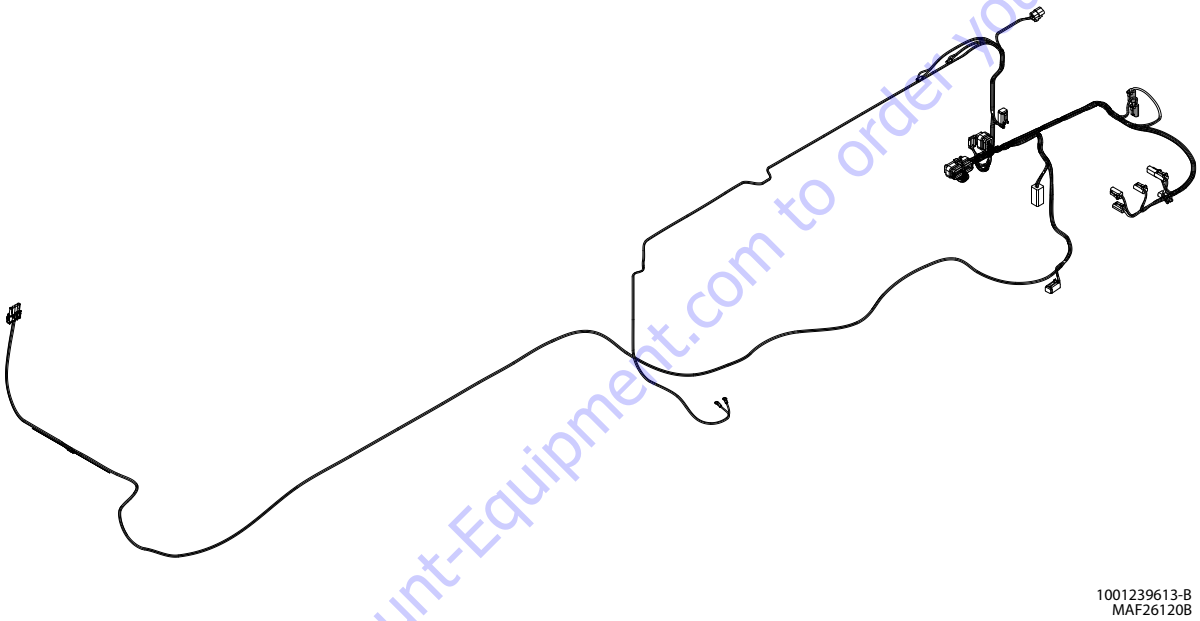


Figure 7-66. Crawler Main Valve Harness - Sheet 4 of 4

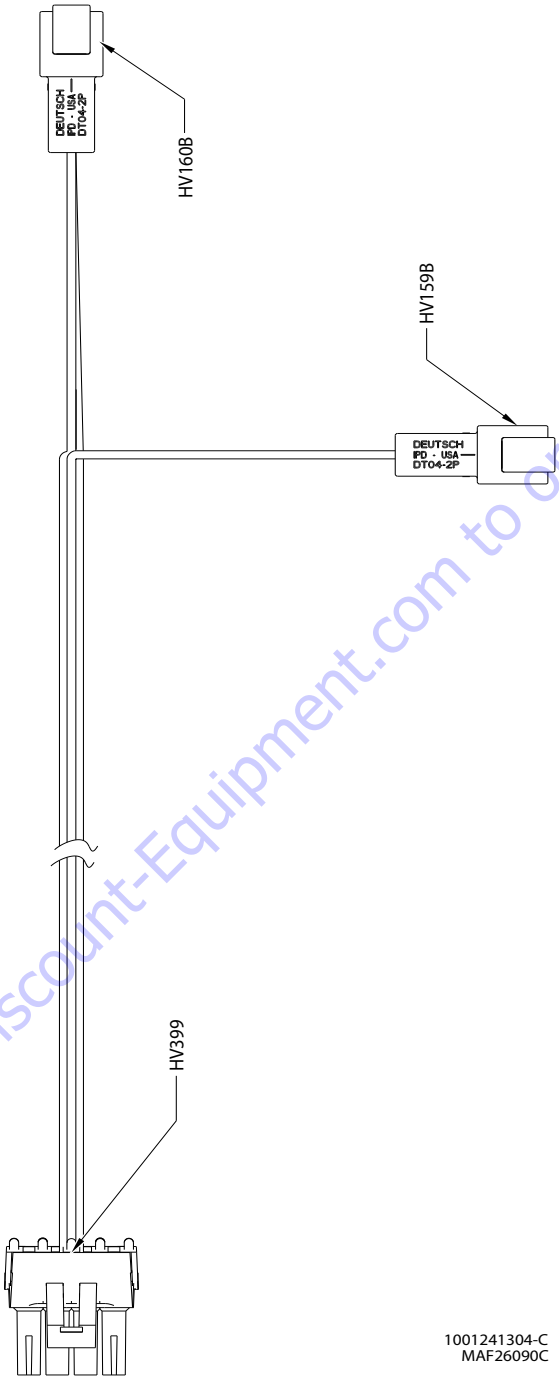


Figure 7-67. Crawler Turntable Adapter Harness

HV399 LEFT TRACK DRIVE					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	WHT	27-1 DRV FWD	18 AWG	GXL	HV159B (1)
B	WHT	50-1-2 DRV RTN	18 AWG	GXL	HV159B (2)
C	WHT	50-1-1 DRV RTN	18 AWG	GXL	HV160B (2)
D	WHT	28-1 DRV REV	18 AWG	GXL	HV160B (1)

HV160B TO HYD VLV HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	WHT	28-1 DRV REV	18 AWG	GXL	HV399 (D)
B	WHT	50-1-1 DRV RTN	18 AWG	GXL	HV399 (C)

HV160B TO HYD VLV HARN					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	WHT	27-1 DRV FWD	18 AWG	GXL	HV399 (A)
B	WHT	50-1-2 DRV RTN	18 AWG	GXL	HV399 (B)

7.10 ELECTRICAL SCHEMATICS

SHEET 2: PLATFORM

Platform Box Harness

SHEET 3: PLATFORM AND BOOM COMPONENTS

LSS Harness 450/400
Boom Control Cable With Jib, TT
Tele in Prox Switches
Cable, Boom Sensor Cable Harness,
Boom Sensor Harness,
Boom Sensor Cable,
Boom Angle Sensor Cable

SHEET 4: CHASSIS, TURNTABLE

Turntable Harness
UGM Main Ground

SHEET 5: MAIN VALVE/GROUND CONTROLS

Ground Control Panel Harness
Platform Valve With Jib
Lift Cylinder Harness

SHEET 6: ENGINE SCHEMATIC DEUTZ - T4I

Deutz T4i Engine Harness
T4i Eng Pos, T4i Eng Neg
Pos Battery, Aux To Aux

SHEET 7: ENGINE SCHEMATIC DEUTZ - T4F

Deutz T4F Engine Harness
T4F Eng Pos, T4F Eng Neg

SHEET 8: NOT APPLICABLE

SHEET 9: OPTIONS

Chassis Head And Tail Lights
Chassis Work Lights, Clear Sky
Skyguard, GEN 2 Platform Interface

SHEET 10: NOT APPLICABLE

SHEET 11: CRAWLER

Crawler Main Valve Harness
Crawler Turntable Adapter

SHEET 12: GENERATOR HARNESS

SHEET 13: NOT APPLICABLE

SHEET 14: NOT APPLICABLE

SHEET 15: NOT APPLICABLE

SHEET 1of 19

1001238404-D

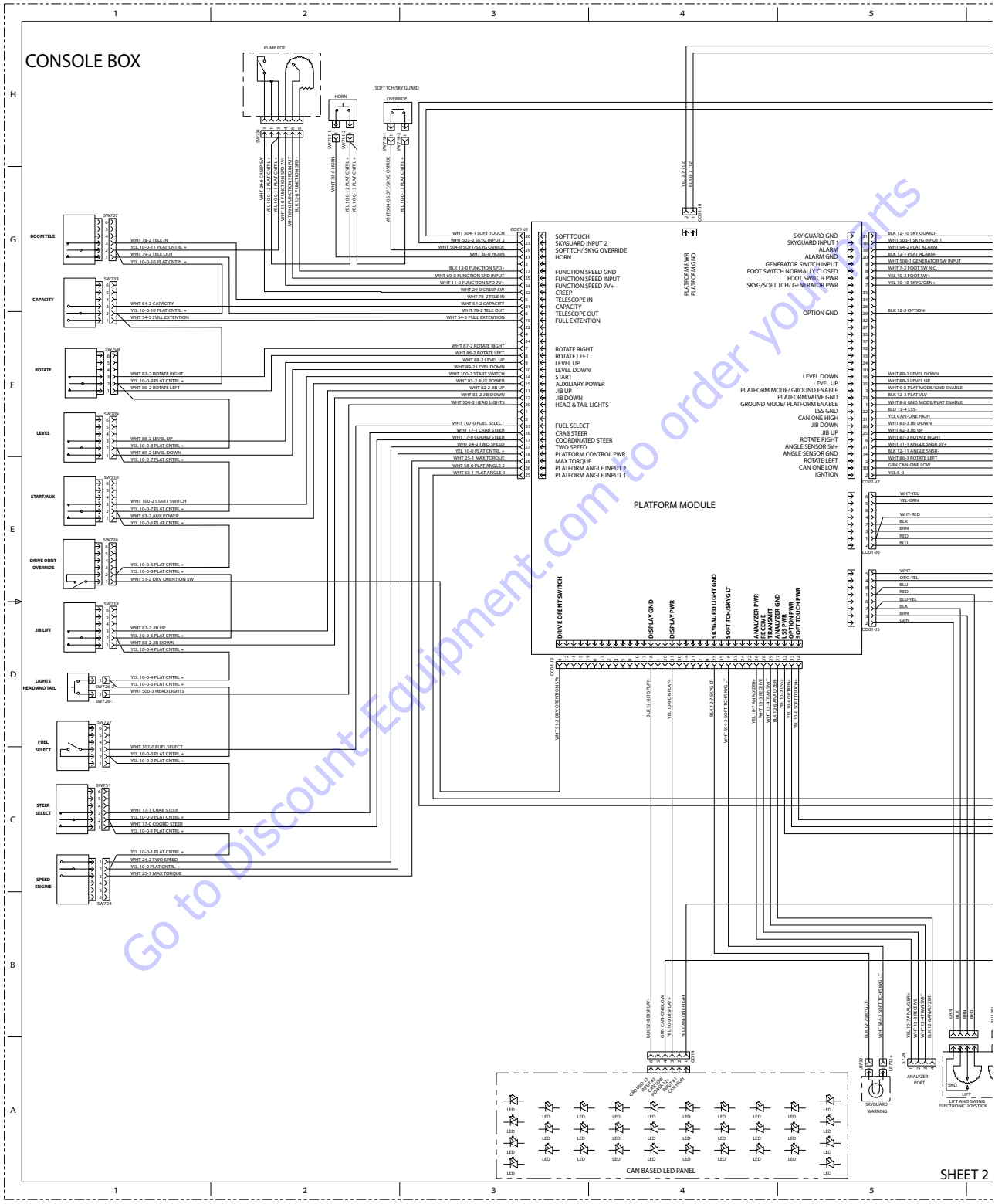
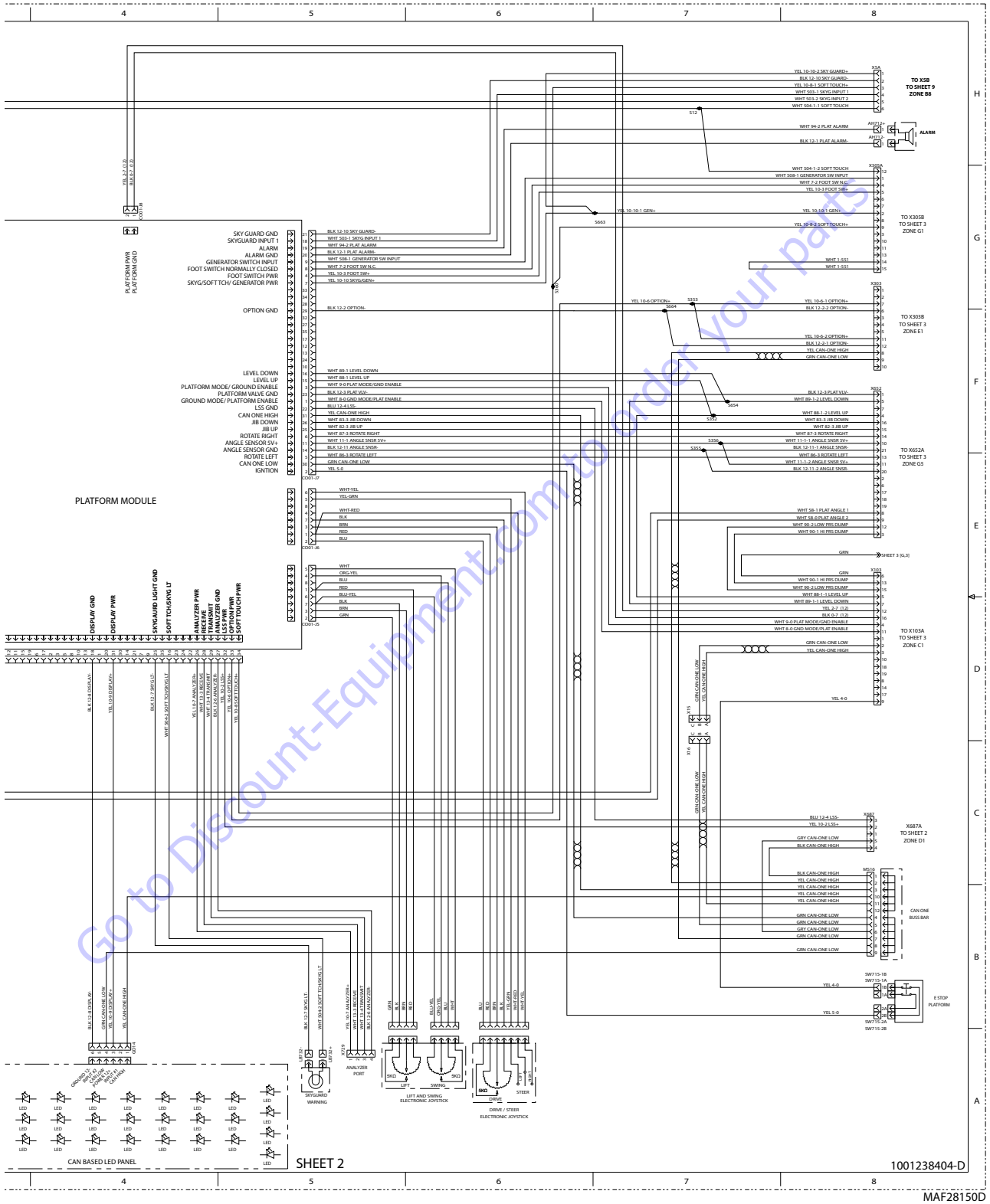


Figure 7-68. Electrical Schematic - Sheet 2 of 19



MAF28150D

Figure 7-69. Electrical Schematic - Sheet 3 of 19

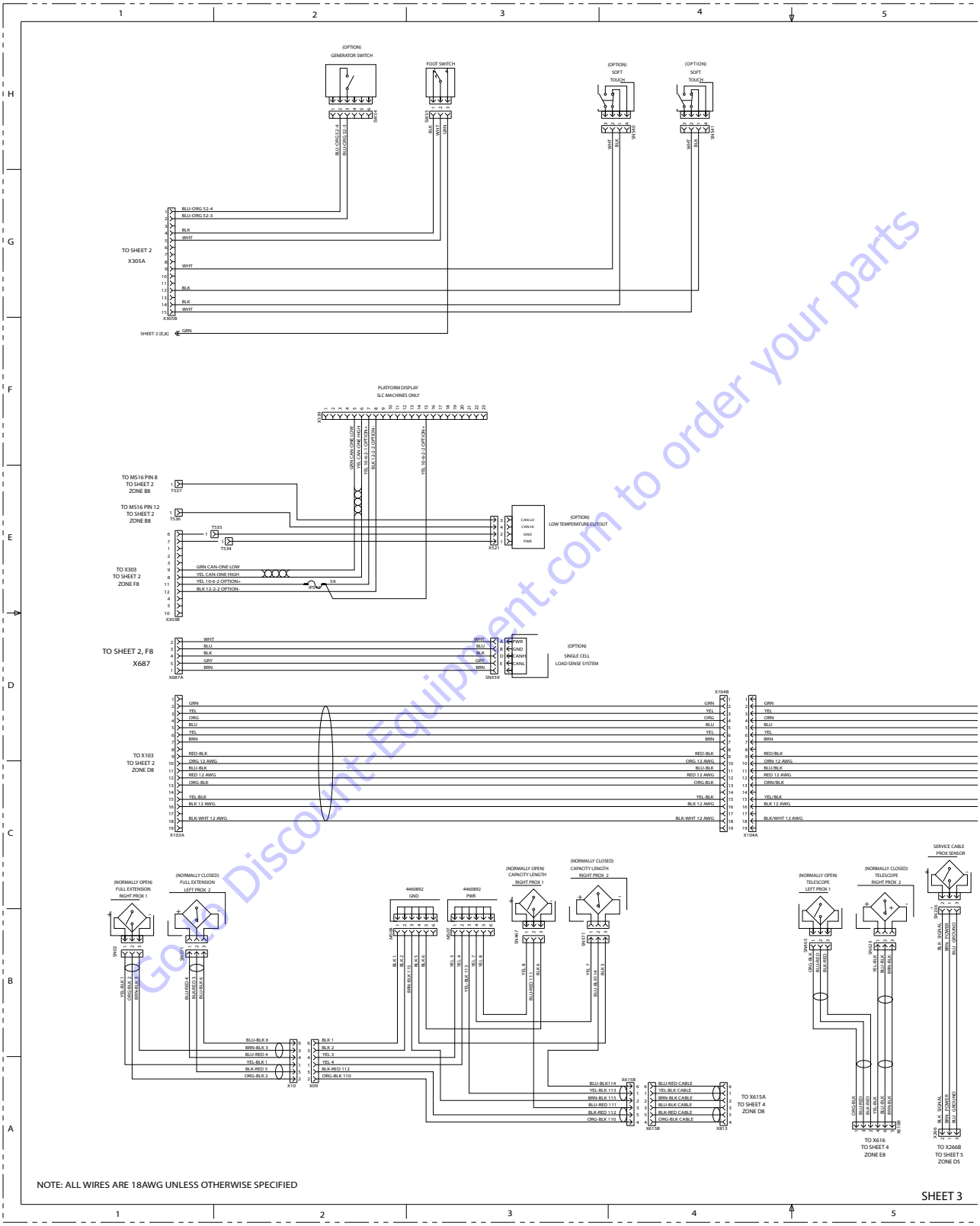


Figure 7-70. Electrical Schematic - Sheet 4 of 19

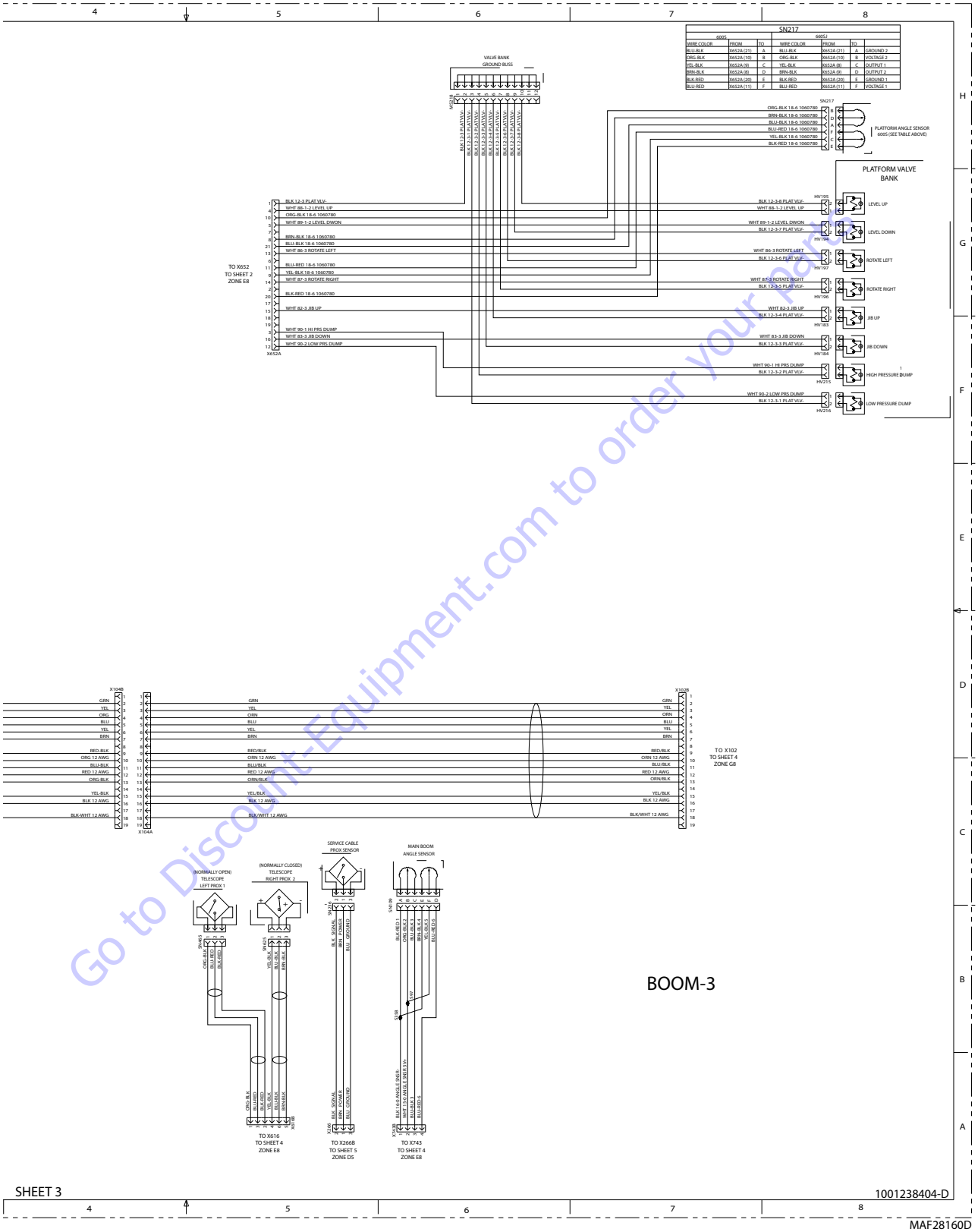


Figure 7-71. Electrical Schematic - Sheet 5 of 19

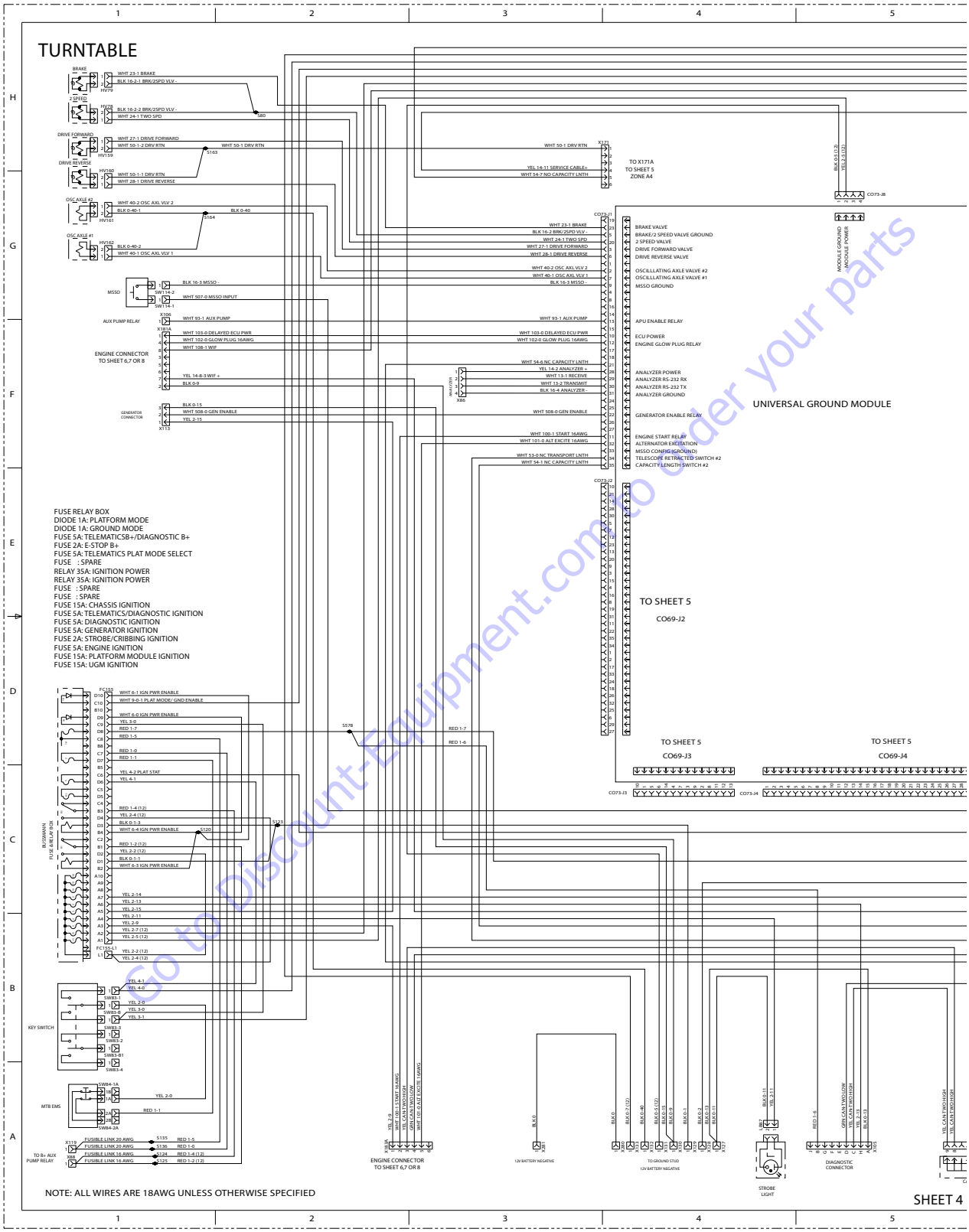


Figure 7-72. Electrical Schematic - Sheet 6 of 19

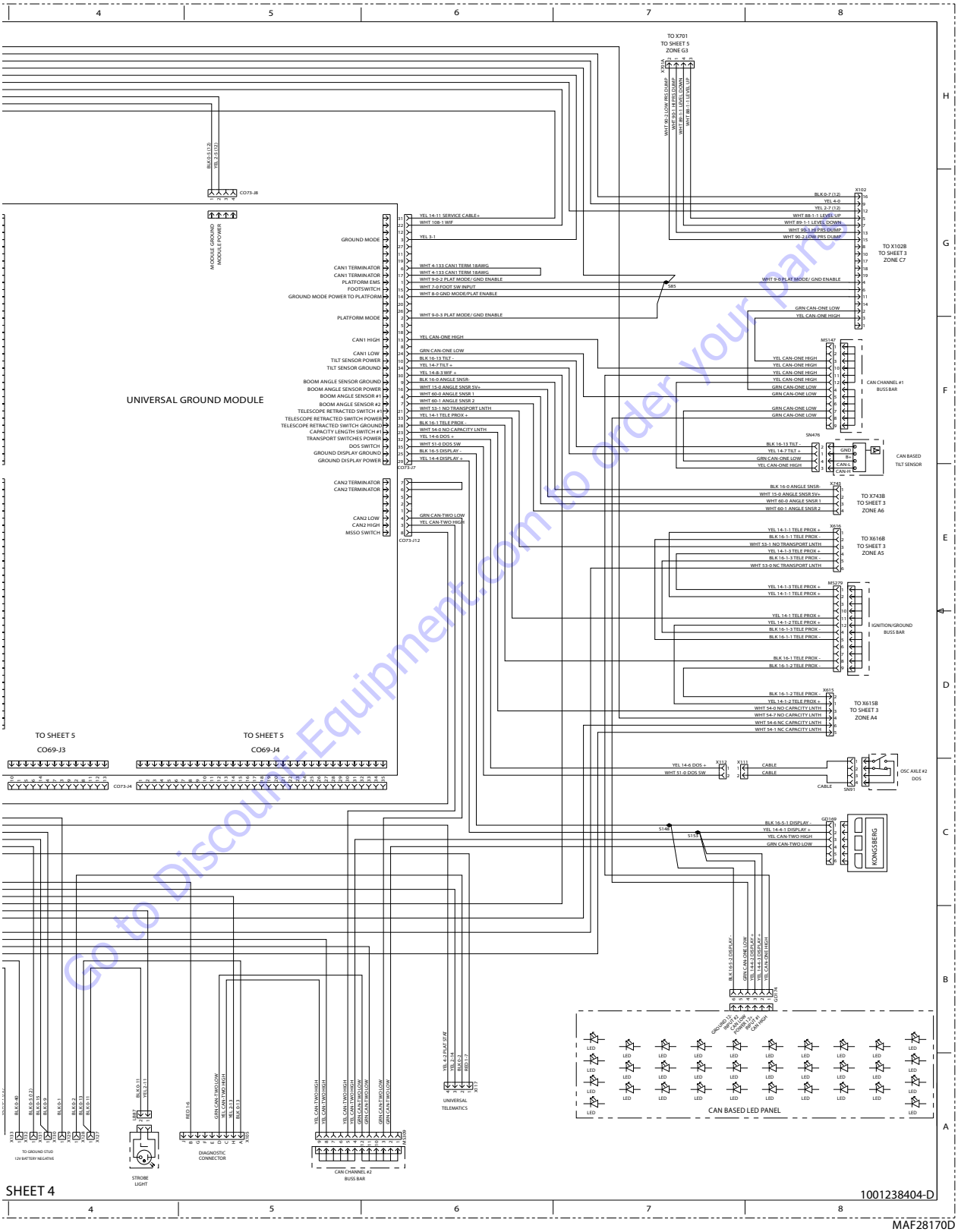


Figure 7-73. Electrical Schematic - Sheet 7 of 19

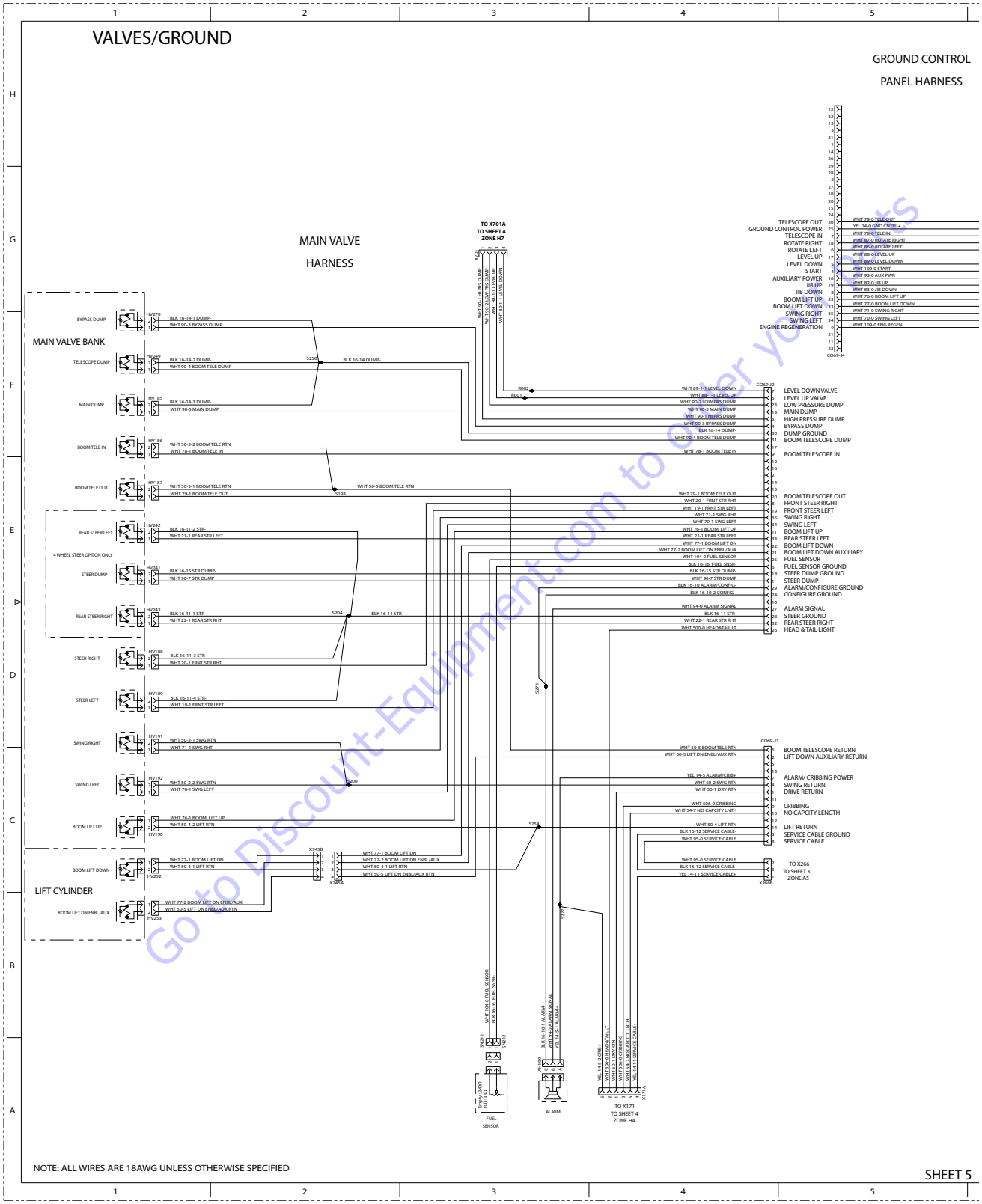


Figure 7-74. Electrical Schematic - Sheet 8 of 19

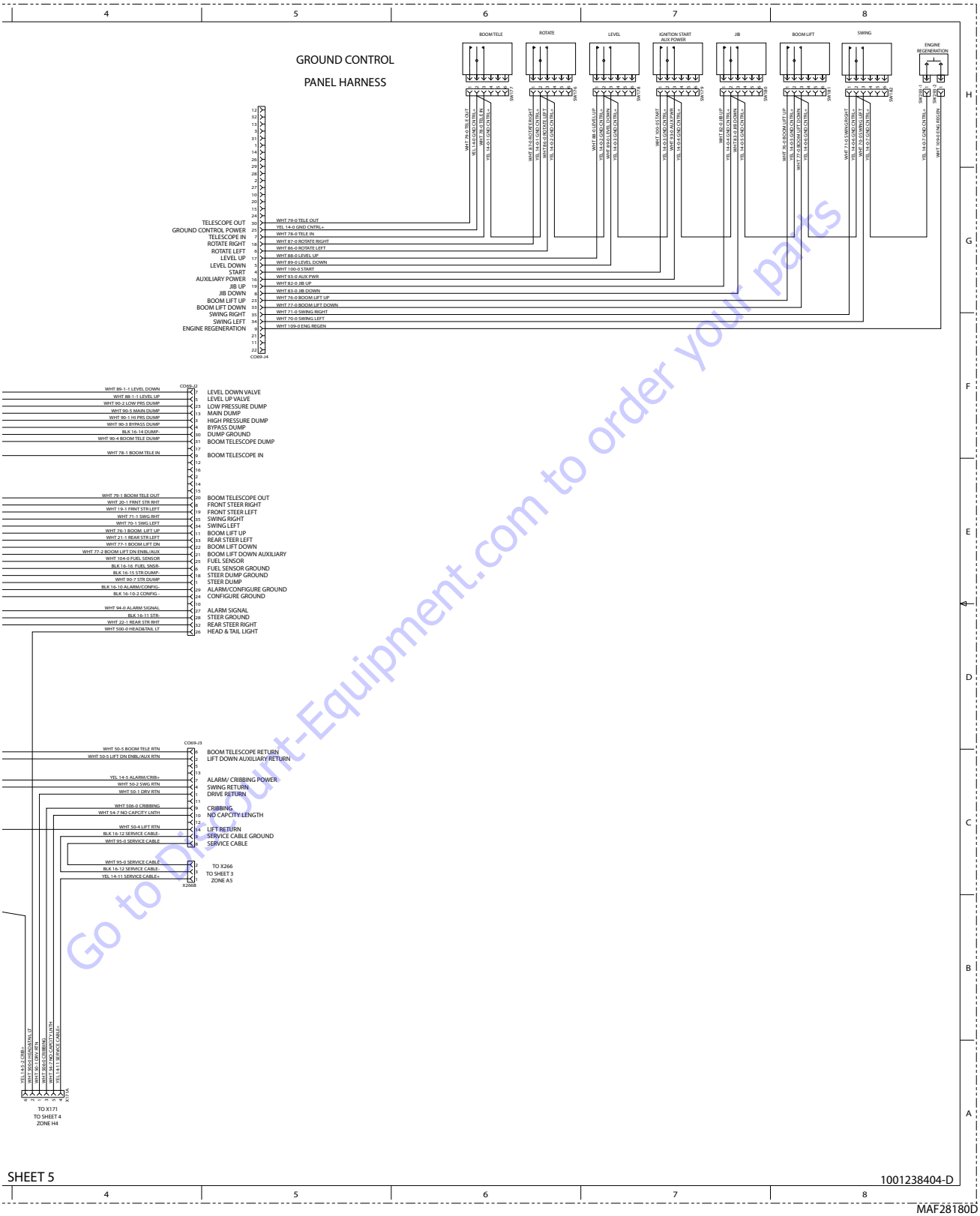


Figure 7-75. Electrical Schematic - Sheet 9 of 19

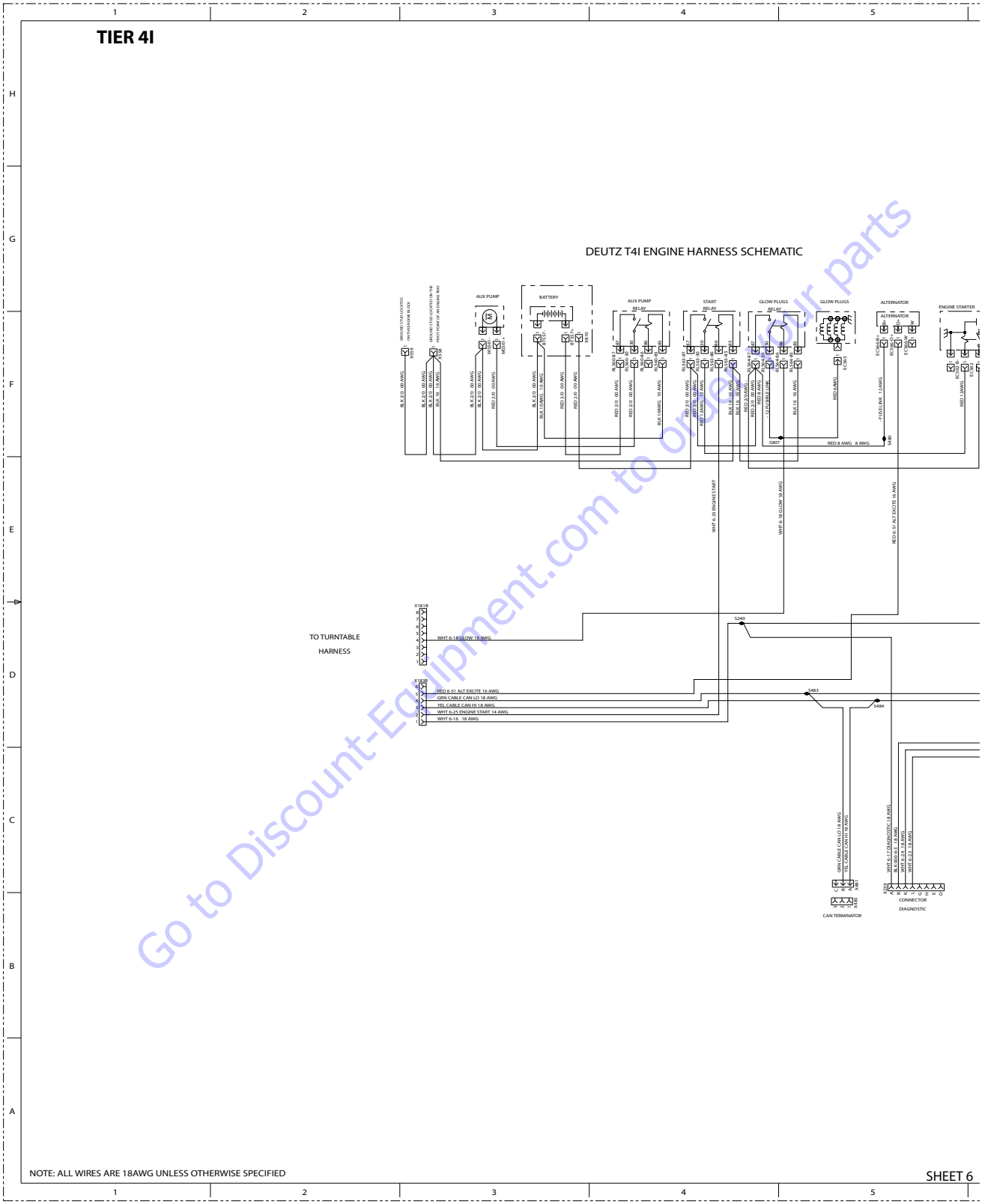


Figure 7-76. Electrical Schematic - Sheet 10 of 19

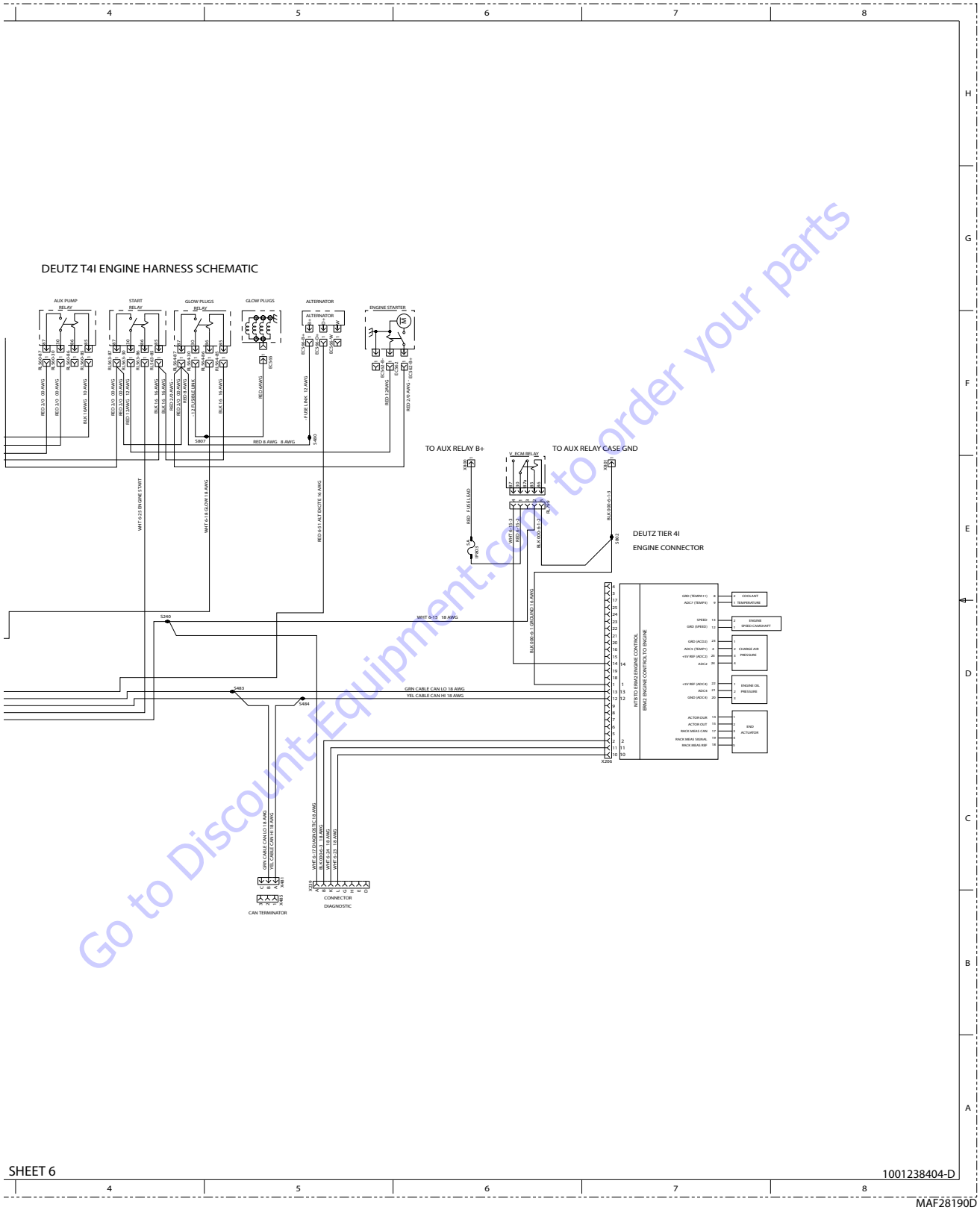


Figure 7-77. Electrical Schematic - Sheet 11 of 19

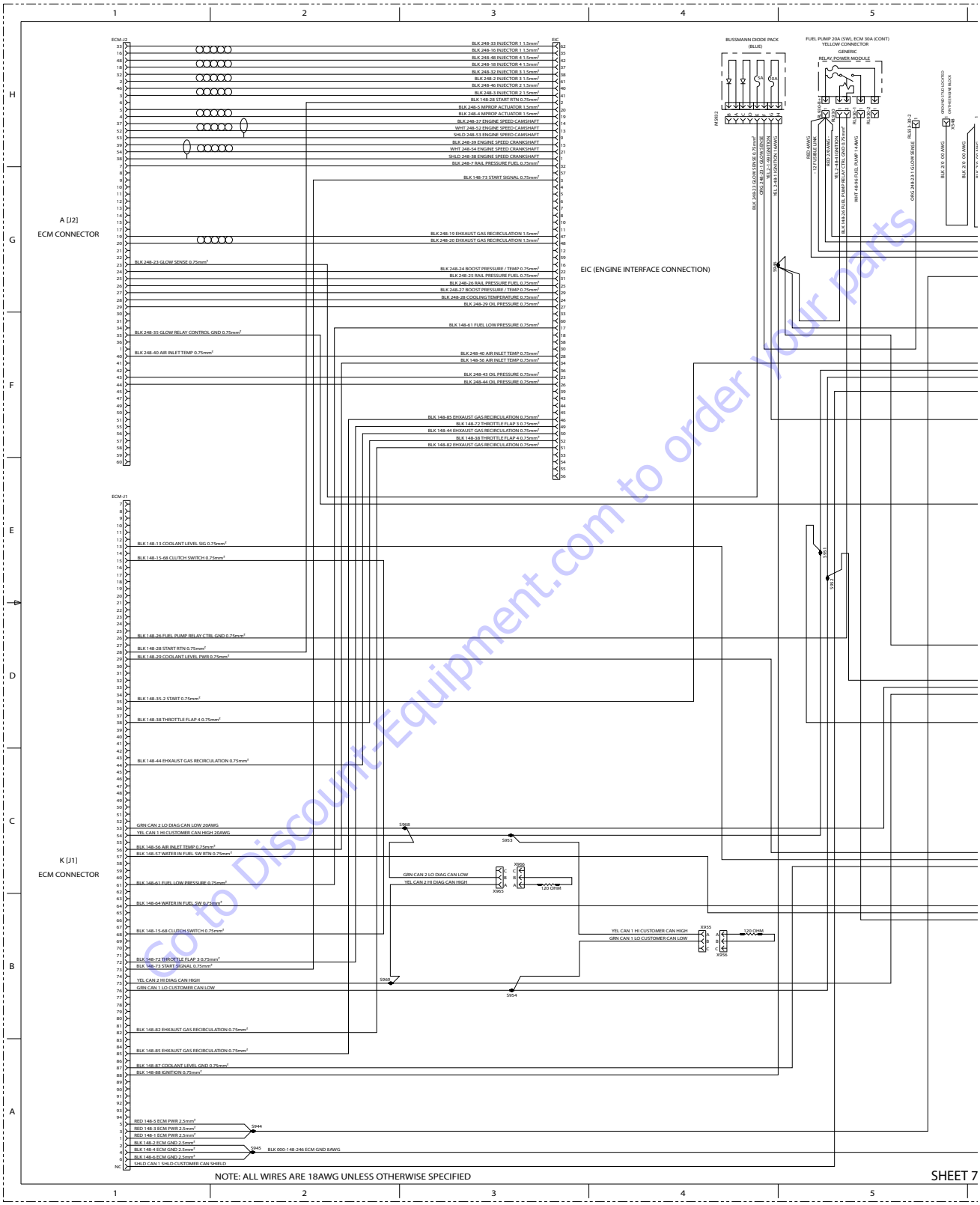


Figure 7-78. Electrical Schematic - Sheet 12 of 19

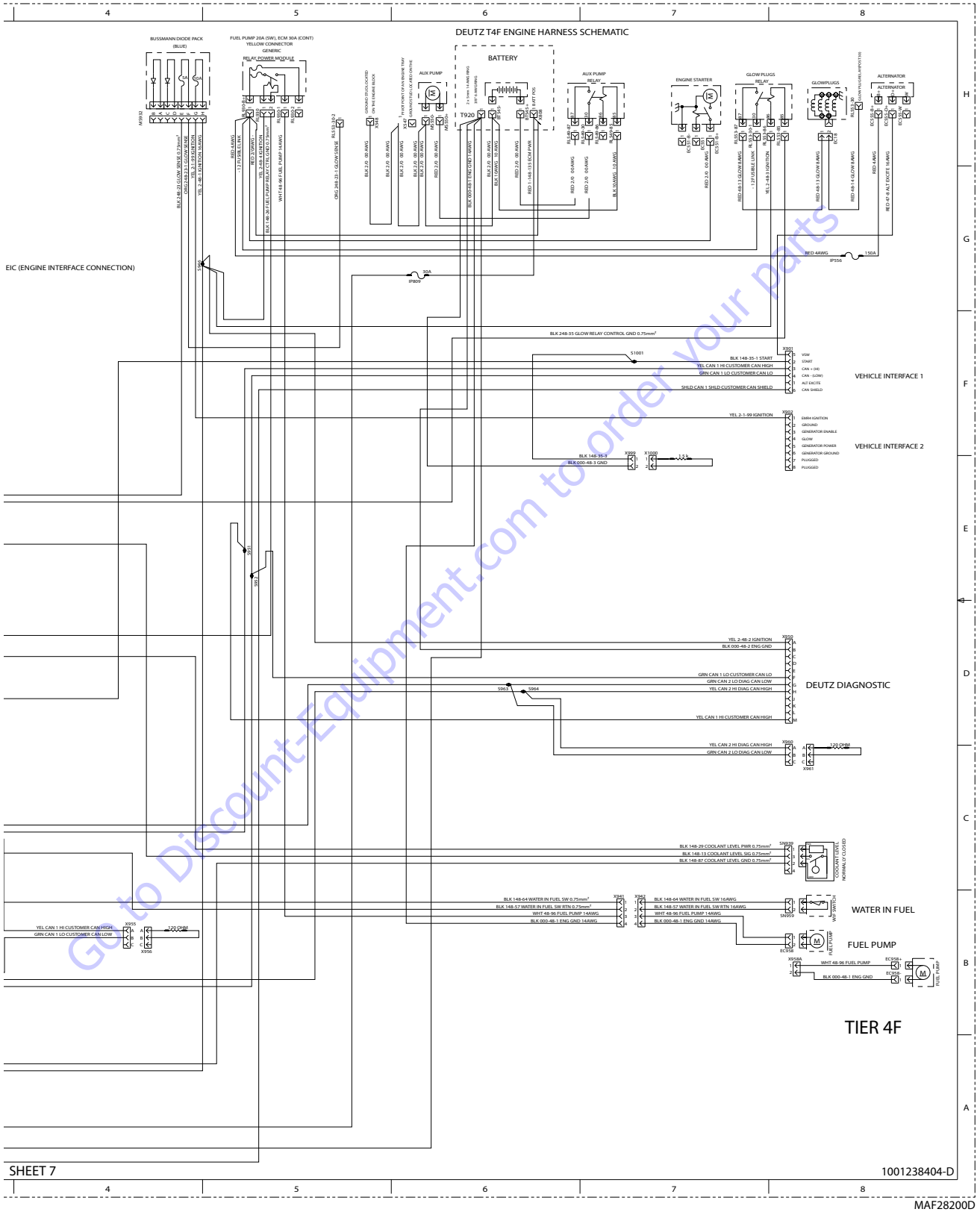


Figure 7-79. Electrical Schematic - Sheet 13 of 19

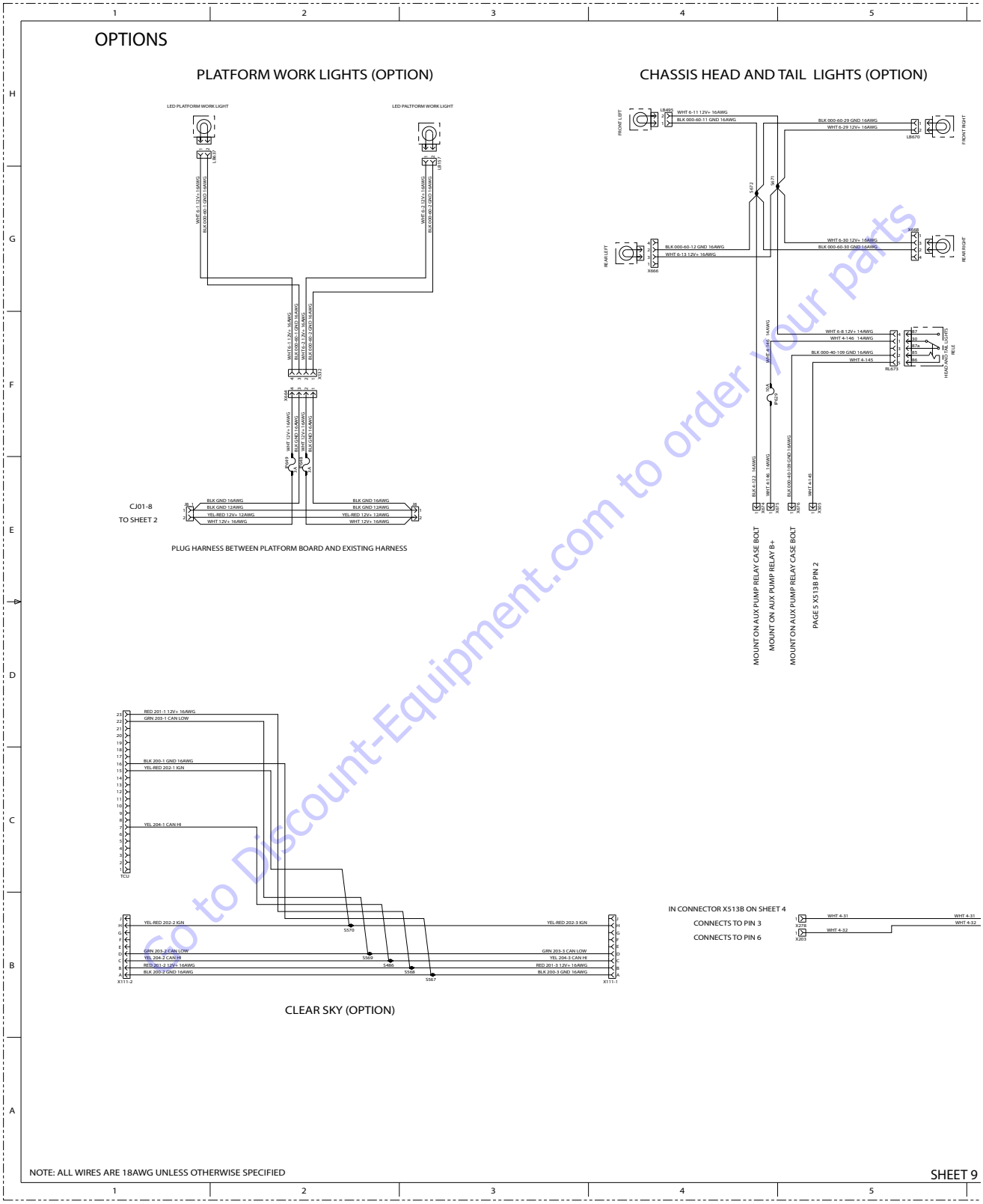


Figure 7-80. Electrical Schematic - Sheet 14 of 19

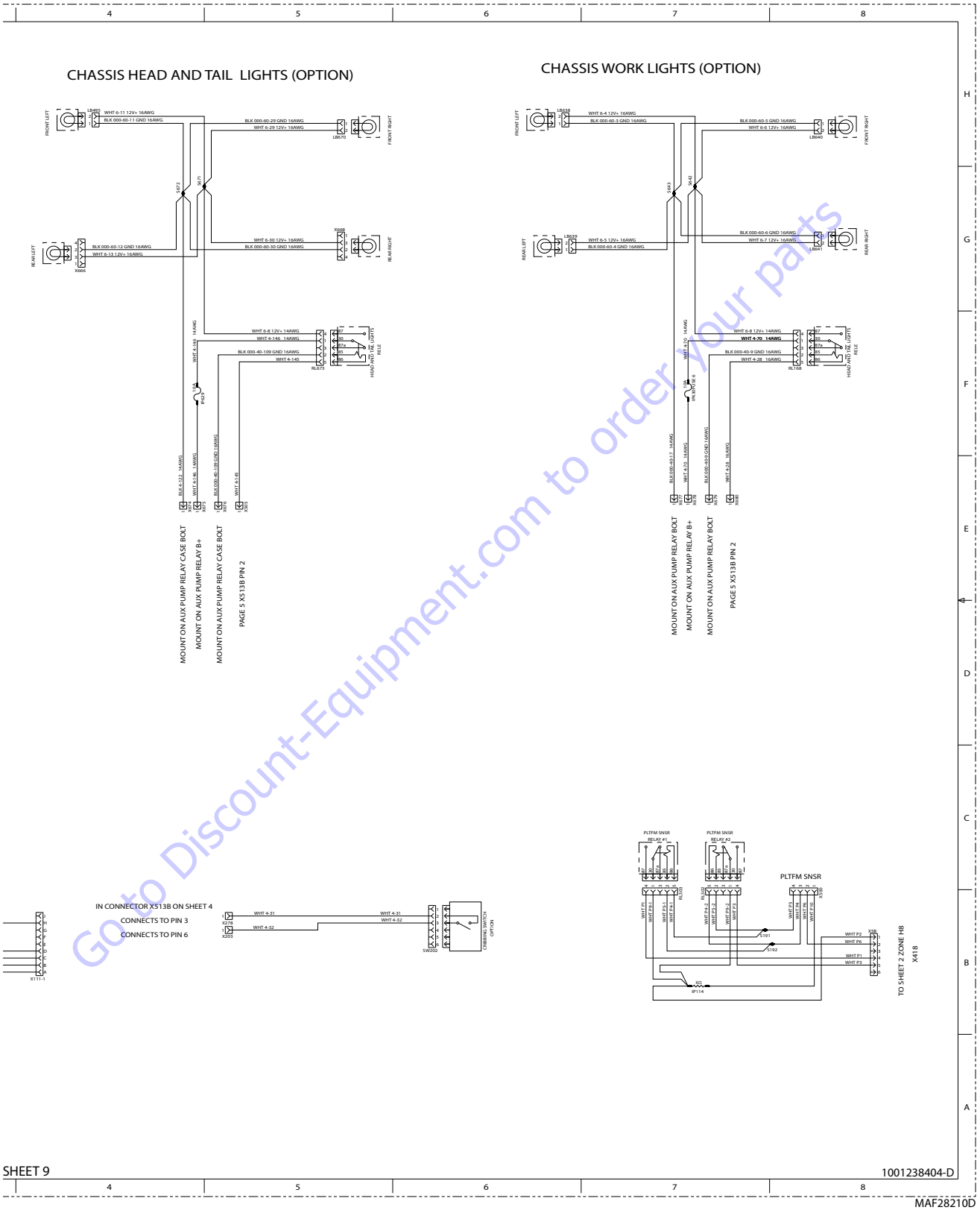


Figure 7-81. Electrical Schematic - Sheet 15 of 19

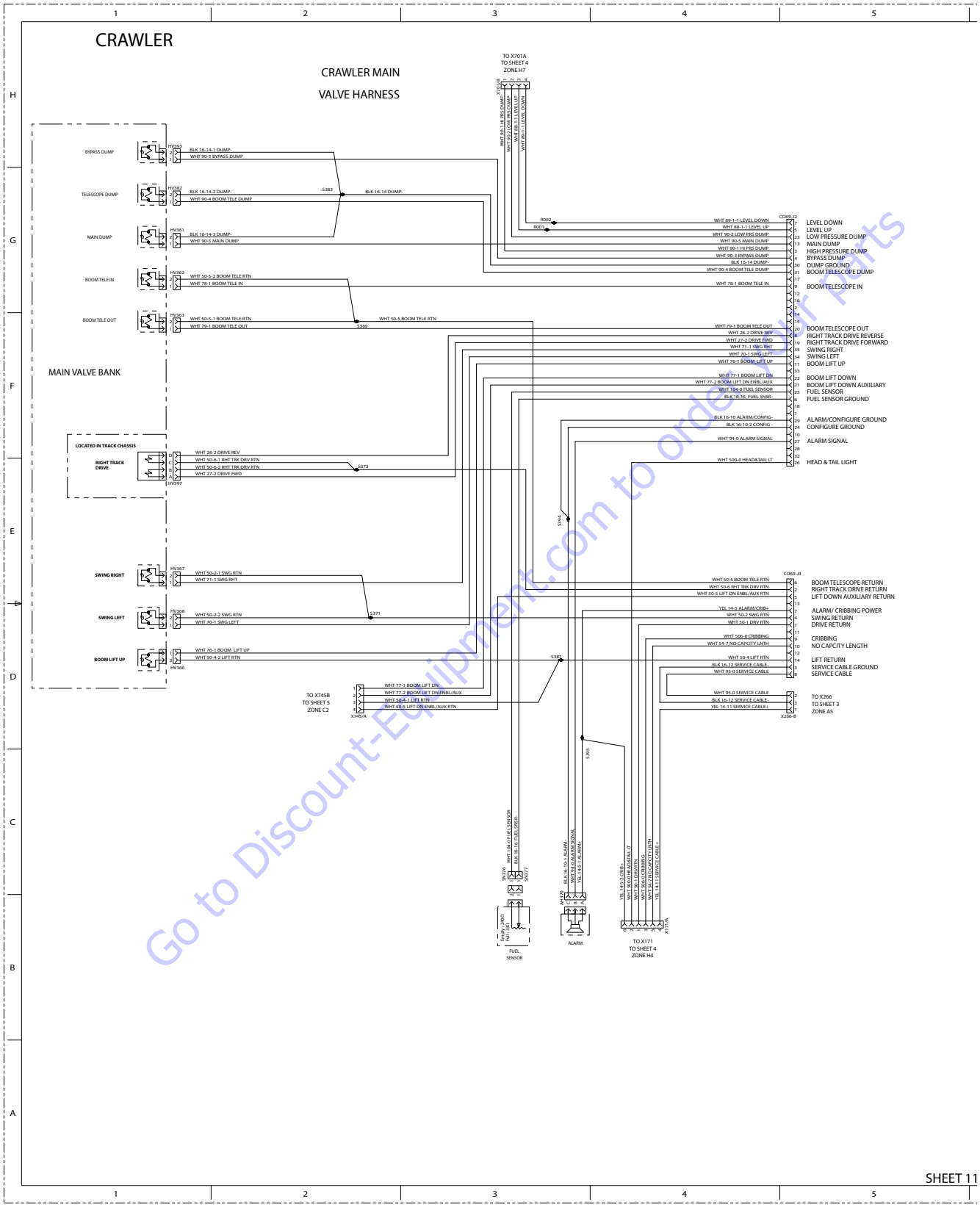


Figure 7-82. Electrical Schematic - Sheet16 of 19

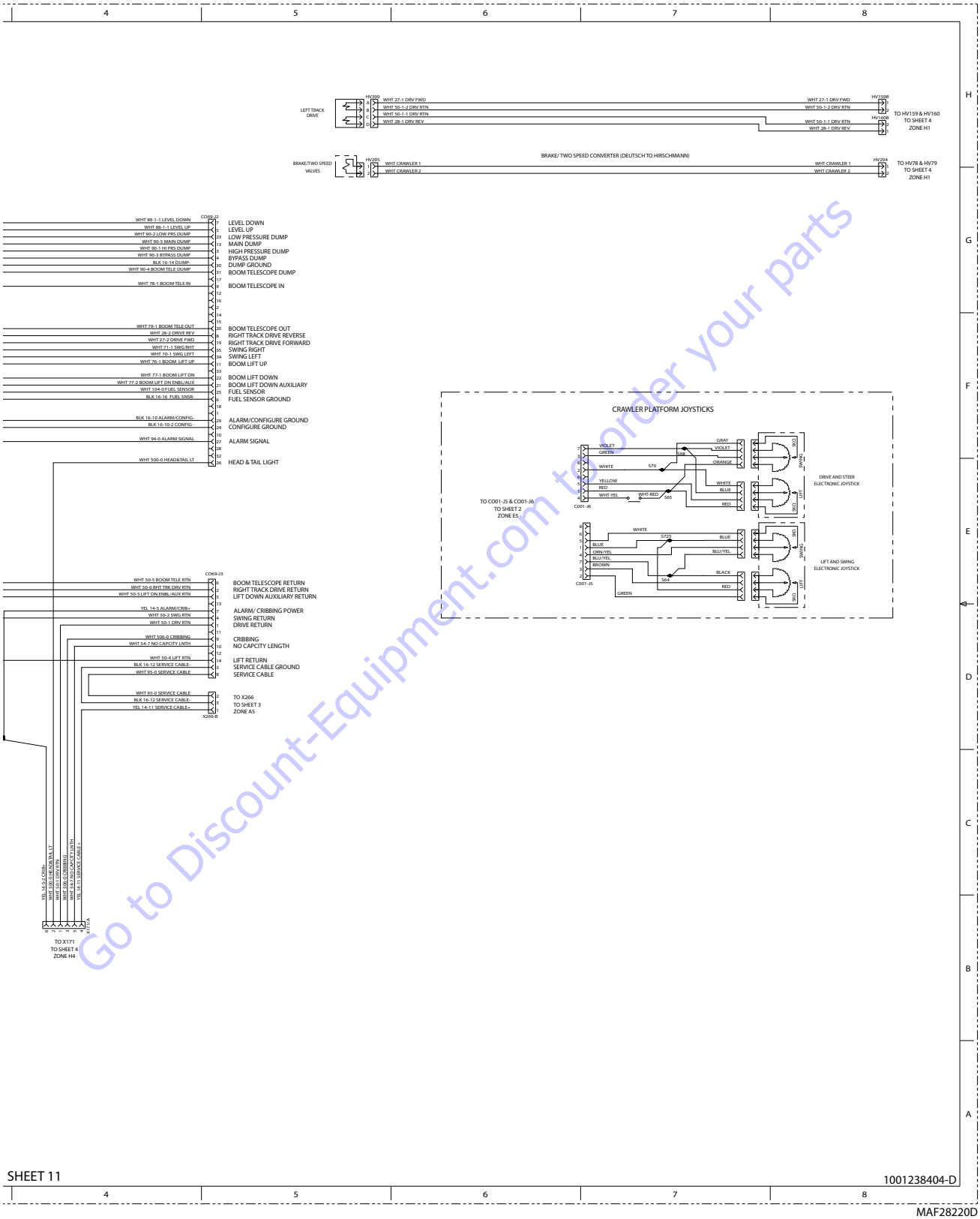


Figure 7-83. Electrical Schematic - Sheet 17 of 19

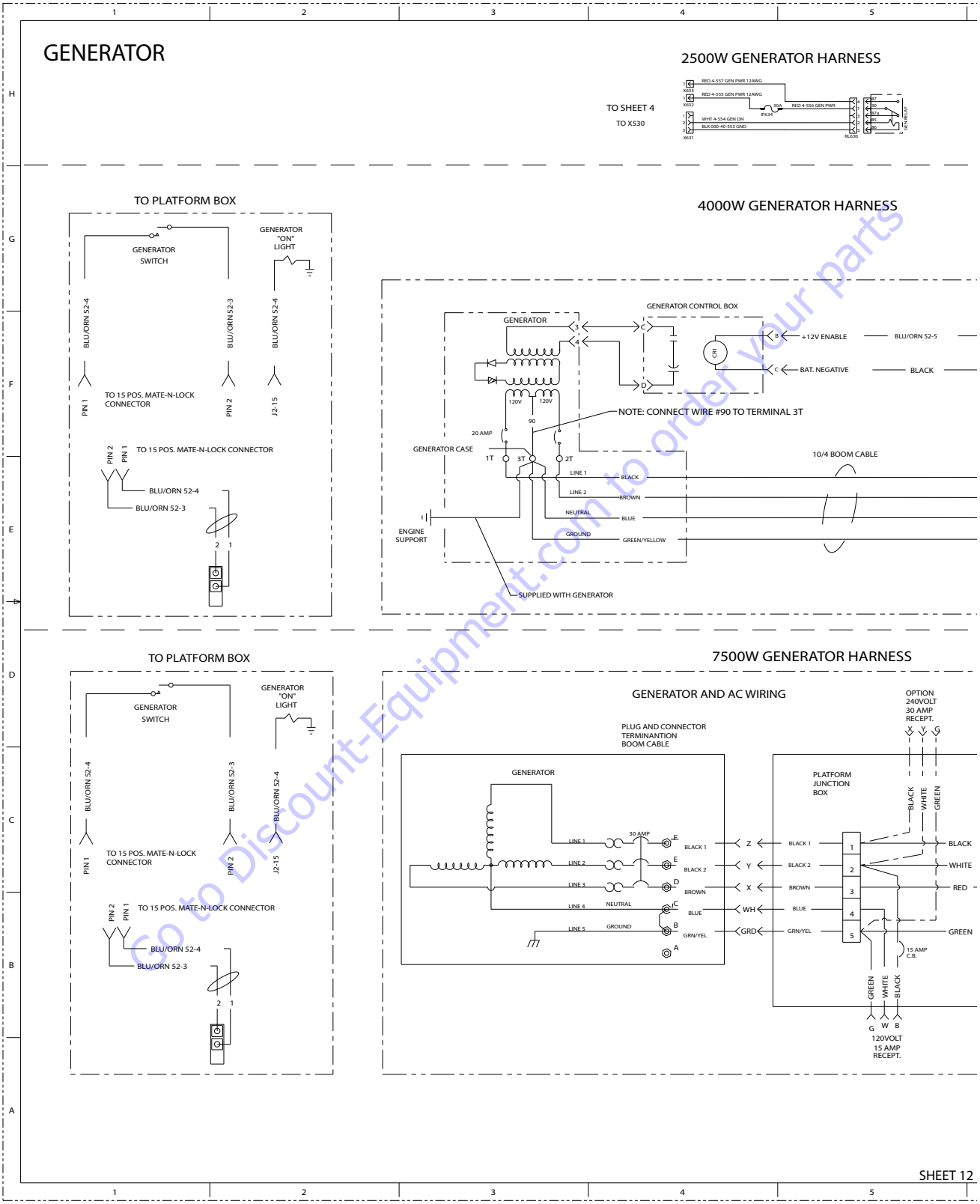


Figure 7-84. Electrical Schematic - Sheet 18 of 19

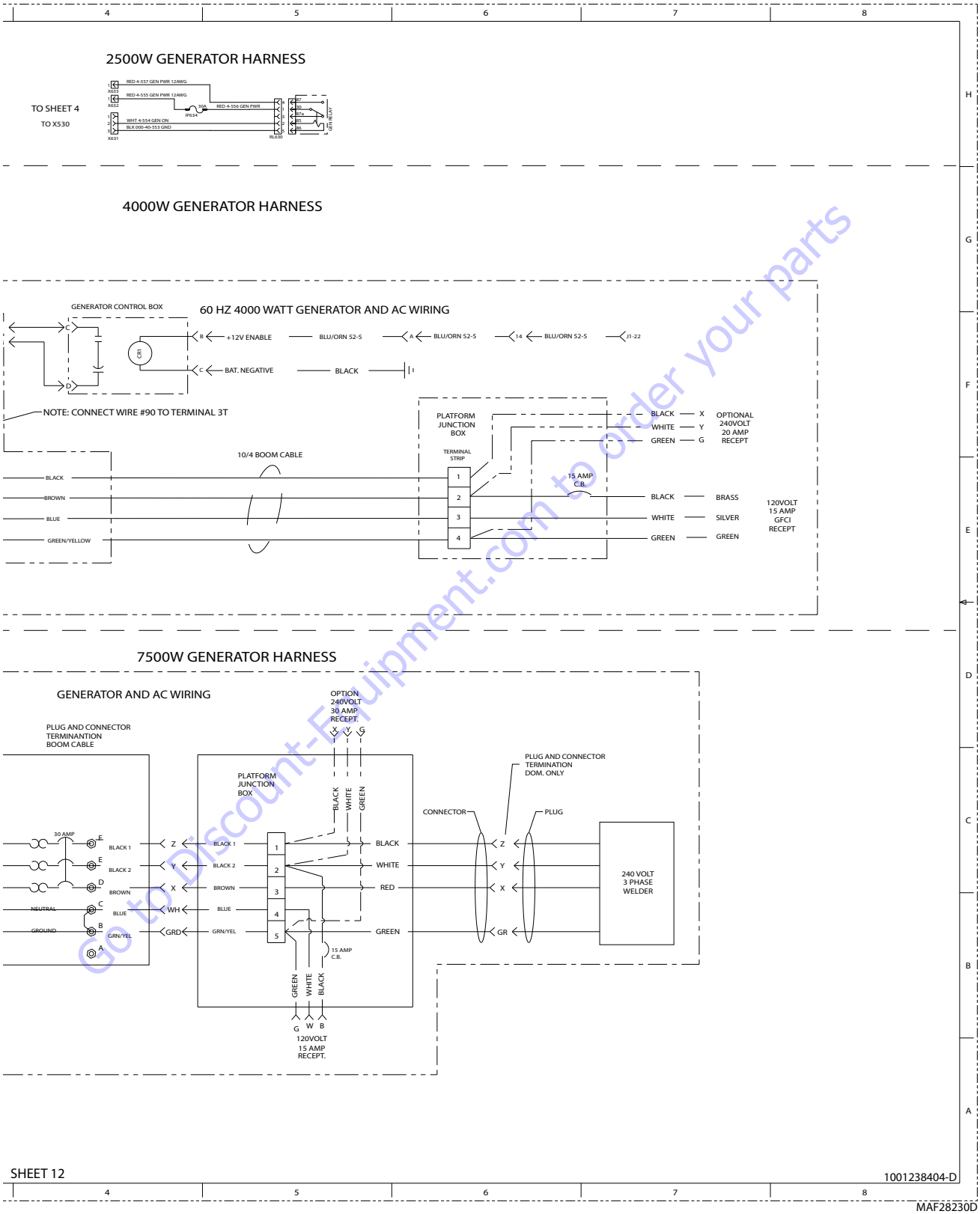


Figure 7-85. Electrical Schematic - Sheet 19 of 19

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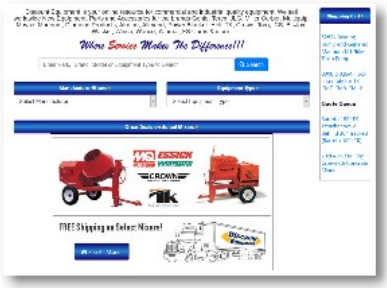

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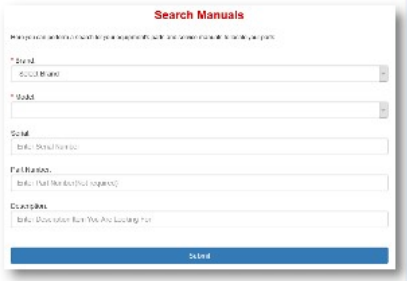

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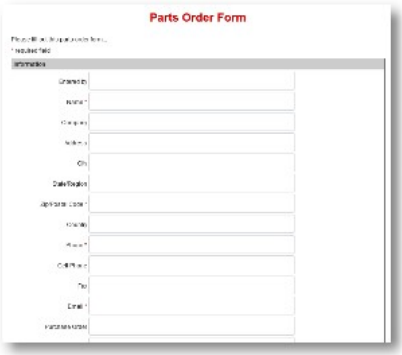

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