Service and Maintenance Manual

Model
1850SJ

3121619

May 27, 2019 - Rev K

ANSI

AS/NZS

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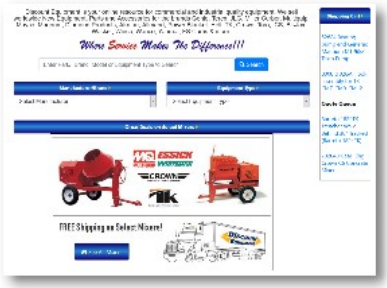

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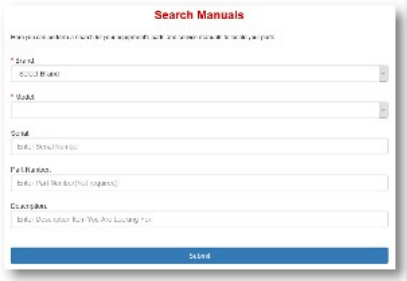

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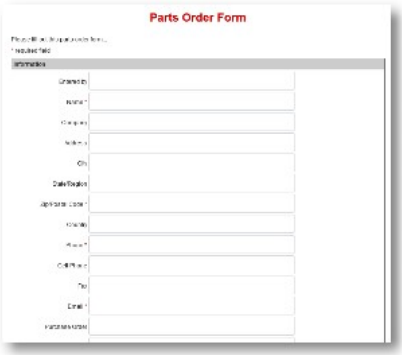

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SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A GENERAL

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

⚠ WARNING

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

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

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

⚠ WARNING

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

B HYDRAULIC SYSTEM SAFETY

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

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

C MAINTENANCE

⚠ WARNING

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

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

REVISON LOG

Original Issue	A - June 18, 2014
Revised	B - September 25, 2014
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Revised	G - November 8, 2016
Revised	H - May 23, 2017
Revised	I - May 30, 2018
Revised	J - June 29, 2018 - Revised Covers
Revised	K - May 27, 2019

SECTION NO. **TITLE** **PAGE NO.**

SECTION 7 - BASIC ELECTRICAL INFORMATION & ELECTRICAL SCHEMATICS

SECTION NO. ***TITLE*** ***PAGE NO.***

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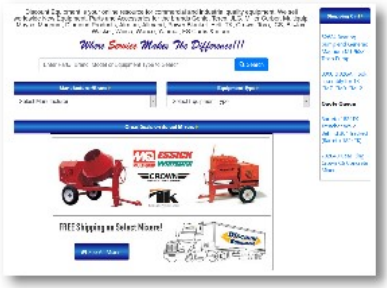

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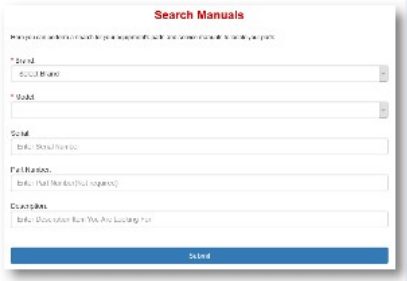

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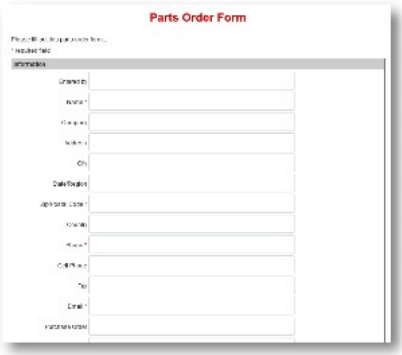

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SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

Capacity - ANSI Unrestricted Restricted	 500 lbs (227 kg) 1000 lbs (454 kg)
Capacity - CE & Australia Unrestricted Restricted	 500 lbs (230 kg) 1000 lbs (450 kg)
Maximum Travel Grade, stowed Position (Gradeability)	40%
Maximum Travel Grade, stowed Position (Side Slope)	5° 4° - CE/Aus
Drive Speed	2.8 mph (4.5 kph)
Drive Speed at Elevation	0.3 mph (0.48 kph)
Gross Machine Weight - Approximate	59,900 lb. (27170 kg.)
Ground Bearing Pressure - Maximum	119.6 psi (8.41 kg/cm^2)
Maximum Wind Speed	28 mph (12.5 m/s)
Maximum Manual Force	90 lbs (400N)
Maximum System Voltage	12 volts
Maximum Main Relief Hyd. Pressure	5000 psi (345 Bar)

1.2 DIMENSIONAL DATA

Table 1-2. Dimensional Data

Turning Radius (Axles Retracted) Outside Inside	 31 ft. 2.75 in. (9.52 m) 23 ft. 4.25 in. (7.12 m)
Turning Radius (Axles Extended) Inside Outside	 7 ft. 6.75 in. (2.3 m) 21 ft. 7.75 in. (6.6 m)
Machine Height (stowed)	10 ft. 0.5 in. (3.06 m)
Machine Length (stowed)	47 ft. 9.5 in. (14.57 m)
Platform Height (500 lb./230 kg. capacity)	185 ft. 7 in. (56.56 m)
Platform Height (1000 lb./450 kg. capacity)	165 ft. 2 in. (50.34 m)
Horizontal Reach from centerline of rotation Unrestricted Capacity Restricted Capacity	 80 ft. (24.38 m) 68 ft. 11 in. (21.01 m)

Table 1-2. Dimensional Data

Horizontal Reach over end Unrestricted Capacity Restricted Capacity	 70 ft. 6 in. (21.50 m) 59 ft. 6 in. (18.13 m)
Horizontal Reach over side Unrestricted Capacity Restricted Capacity	 71 ft. 9 in. (21.86 m) 60 ft. 8 in. (18.49 m)
Overall Width Axles Retracted Axles Deployed	 8 ft. 2 in. (2.48 m) 16 ft. 6.5 in. (5.04 m)
Wheelbase Axles Retracted Axles Deployed	 17 ft. 1.5 in. (5.22 m) 15 ft. 0.5 in. (4.59 m)
Tailswing	7 ft. 7.5 in. (2.32 m)
Ground Clearance (Axle)	9.75 in. (0.25 m)
Ground Clearance (Chassis)	1 ft. 4.25 in. (0.41 m)

1.3 CAPACITIES

Table 1-3. Capacities

Hydraulic Oil Tank	75.1 Gal. (284.2 L)
Fuel Tank	45 Gal. (170 L)
Drive Hub	2.6 quarts (2.5 liters)
Swing Gearbox	3 qt. (2.8 L)

1.4 TIRES

Table 1-4. Tire Specifications

Size	445/50D710
Load Range	N
Ply Rating	24
Foam Fill	Polyurethane HD (55 Durometer) Foam
Diameter	46.45 in. (117.9 cm)
Width	16.81 in. (427 mm)
Rim Size	15x28
Tire & Wheel Weight	1025 lbs. (465 kg)
Max Tire Load	36000 lbs. (16,329 kg)

1.5 ENGINE DATA

Table 1-5. Engine Data - Deutz TCD 3.6L

Type	Turbo-charged Diesel
Number of Cylinders	4
Bore	3.9 in. (98 mm)
Stroke	4.7 in. (120 mm)
Total Displacement	221 cu.in. (3.6 L)
Firing Order	1-3-4-2
Output	99.8 hp (74.4 kW)
Low Idle Engine RPM	1000 ±50
High Engine RPM	2300±50
Average Fuel Consumption	2.73 gph (10.3 lph)
Acceptable Fuel Grades HRC LRC	Ultra Low Sulfur (15 ppm) Up to 5% BioDiesel Max Sulfur Content (2000 ppm)

1.6 MAJOR COMPONENT WEIGHTS

⚠ WARNING

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

Table 1-6. Critical Stability Weights

Components	LBS.	KG.
Tire & Wheel	1025	465
Drive Hub & Motor	337	153
Swing Drive	223	101.2
Engine Assembly	822	373
Complete Boom (including jib & platform)	23,600	10705
Main Boom Assembly	21,600	9798
Jib Assembly	1493	677

1.7 HYDRAULIC OIL

Table 1-7. Hydraulic Oil

Hydraulic System Operating Temperature Range	S.A.E. Viscosity Grade
+0° to + 180° F (-18° to +83° C)	10W
+0° to + 210° F (-18° to +99° C)	10W-20, 10W30
+50° to + 210° F (+10° to +99° C	20W-20

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

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

OIL SAMPLING

This machine is equipped with an oil sampling valve to allow for verification of hydraulic oil condition. Refer to Section 5 - Hydraulics for Oil Sampling procedures.

Table 1-8. Mobilfluid 424 Specs

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

Table 1-9. Mobil DTE 10 Excel 32 Specs

ISO Viscosity Grade	#32
Pour Point, Max.	-54°C (-65°F)
Flash Point, Min.	250°C (482°F)
Viscosity	
at 40° C	32.7 cSt
at 100° C	6.6 3 cSt
at 100° F	32.7 cSt
at 212° F	6.63 cSt
cp at -30° F	-
Viscosity Index	164
Density (Kg/l) @ 15°C	0.8468
Density (lb/in^3) @ 60°F	0.0305

Table 1-10. Mobil EAL H 46 Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	46
Density @15°C	0.874
Pour Point	-49°F (-45°C)
Flash Point	500°F (260°C)
Operating Temp.	-20 to 200°F (-29 to 93°C)
Viscosity	
at 40° C	48.8 cSt
at 100° C	7.8 cSt
Viscosity Index	145

Table 1-11. Exxon Univis HVI 26 Specs

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

Table 1-12. Quintolubric 888-46

Density	0.92 g/cm^3
Pour Point	<-30°C (<-22°F)
Flash Point	300°C (572°F)
Fire Point	360°C (680°F)
Autoignition Temperature	>450°C (842°F)
Viscosity	
at 0° C (32°F)	320 cSt
at 20° C (68°F)	109 cSt
at 40° C (104°F)	47.5 cSt
at 100° C (212°F)	9.5 cSt
Viscosity Index	190

Table 1-13. Mobil SHC 46 Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	46
Density @15°C	0.93
Pour Point	-27°F (-33°C)
Flash Point	568°F (298°C)
Operating Temp.	-20 to 200°F (-29 to 93°C)
Viscosity	
at 40° C	43.3
at 100° C	7.7
Viscosity Index	149

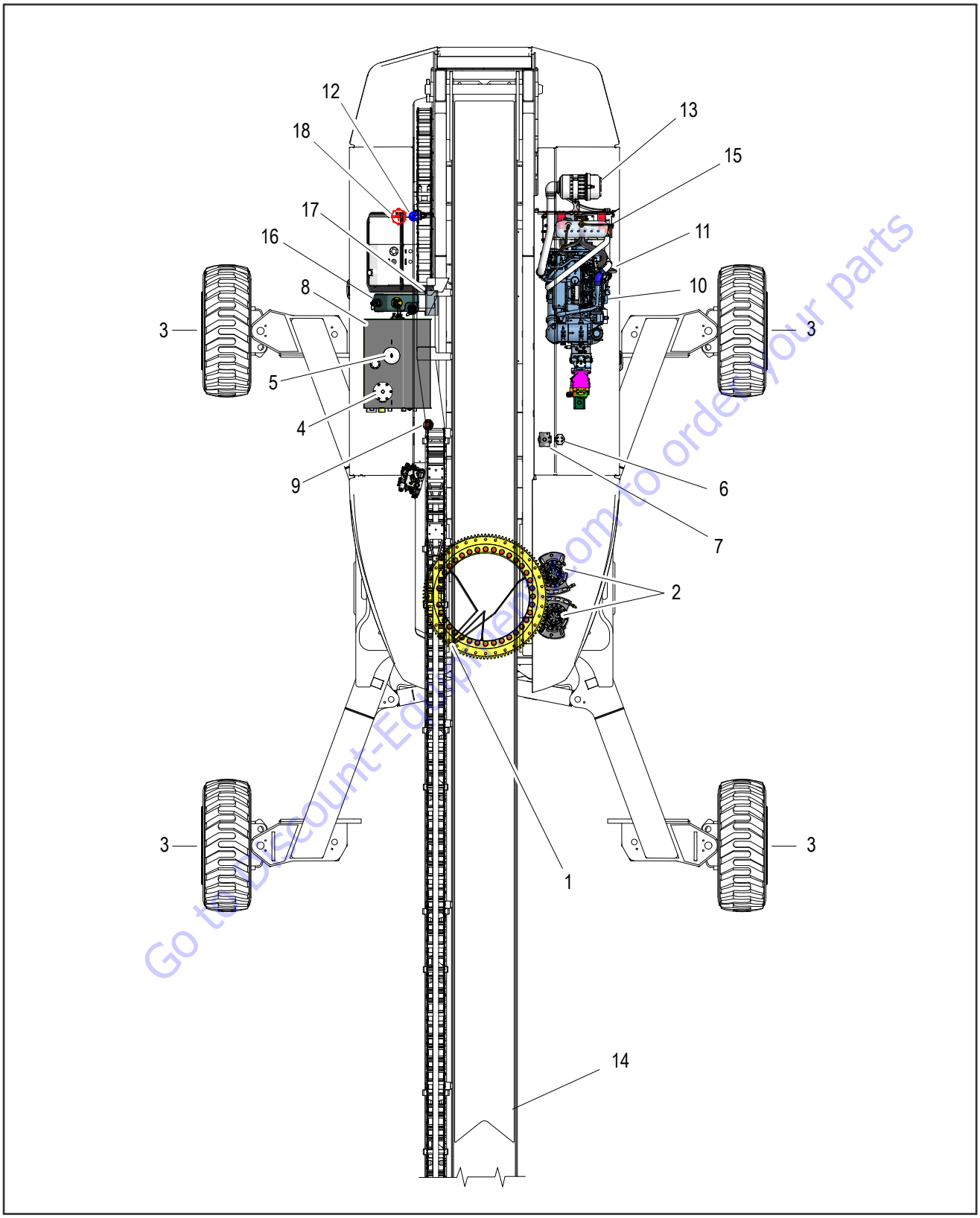


Figure 1-1. Maintenance and Lubrication Diagram

1.8 MAINTENANCE AND LUBRICATION

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

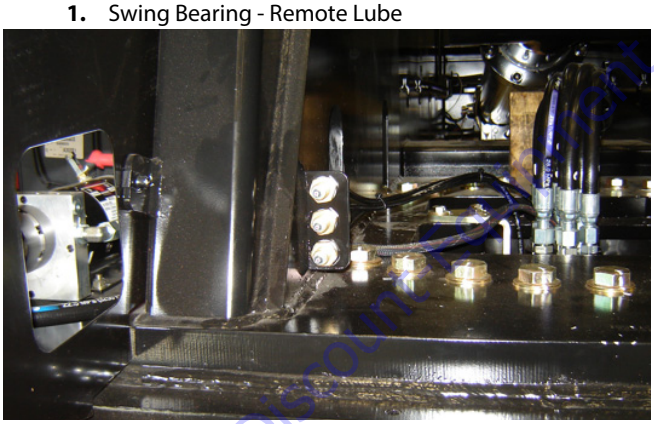
Table 1-14. Lubrication Specifications

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. API service classification GL-3, e.g. Mobilfluid 424
EO	Engine (crankcase) API CJ-4

NOTICE

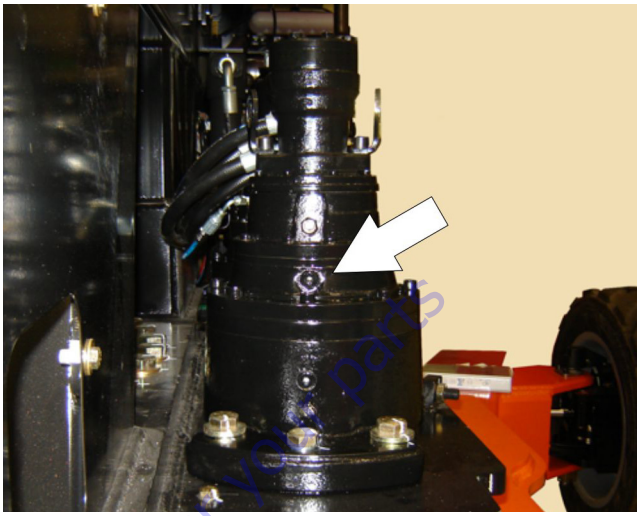
LUBRICATION INTERVALS ARE BASED ON MACHINE OPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTI-SHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

1. Swing Bearing - Remote Lube



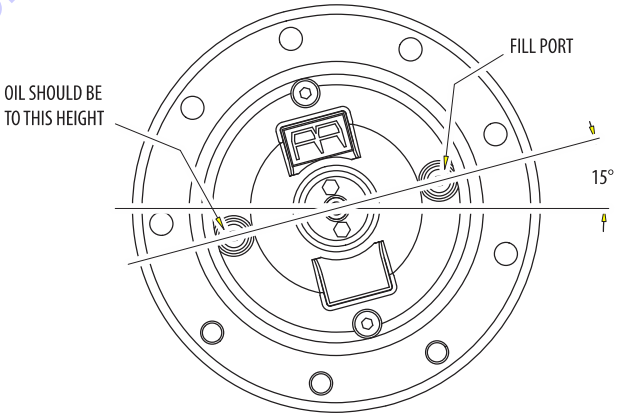
Lube Point(s) - 3 Grease Fitting
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hours of operation
Comments - Apply grease and rotate in 45 degree intervals until bearing is completely lubricated.

2. Swing Gearbox



Lube Point(s) - Fill Plug
Capacity - 3 qt. (2.8 L)
Lube - GL-5
Interval - Check level every 150 hrs/Change every 1200 hours of operation. Fill to cover ring gear.

3. Wheel Drive Hub



Lube Point(s) - Level/Fill Plug
Capacity - 2.6 quarts (2.5 liters) ± 10%
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation

4. Hydraulic Return Filter

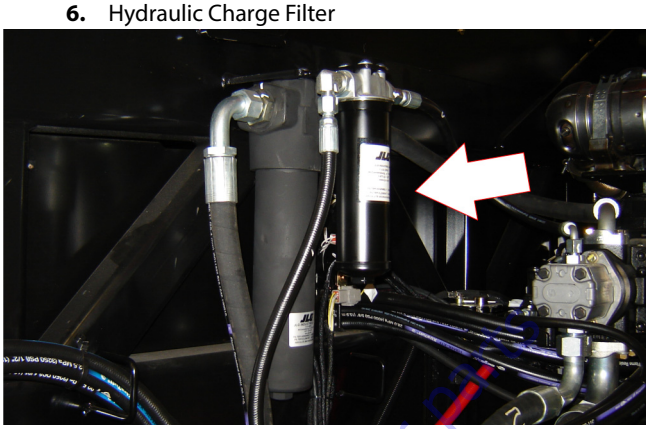
Lube Point(s) - Replaceable Element
Interval - Change after first 50 hours and every 6 months or 300 hours thereafter.

5. Hydraulic Tank Breather

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

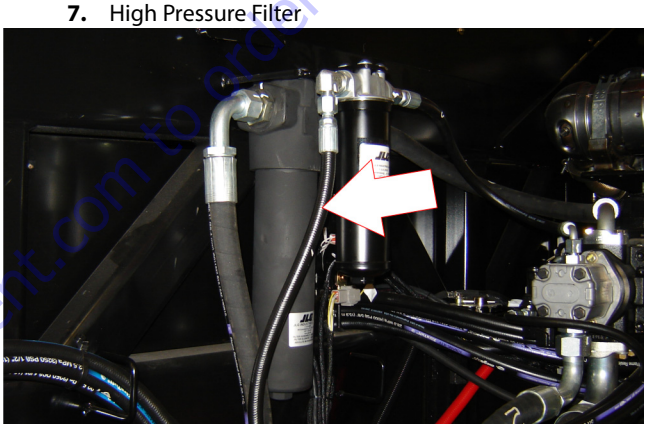
Comments - Remove wing nut and cover to replace. Under certain conditions, it may be necessary to replace on a more frequent basis.

6. Hydraulic Charge Filter



Lube Point(s) - Replaceable Element
Interval - Change after first 50 hours and every 6 months or 300 hours thereafter.

7. High Pressure Filter

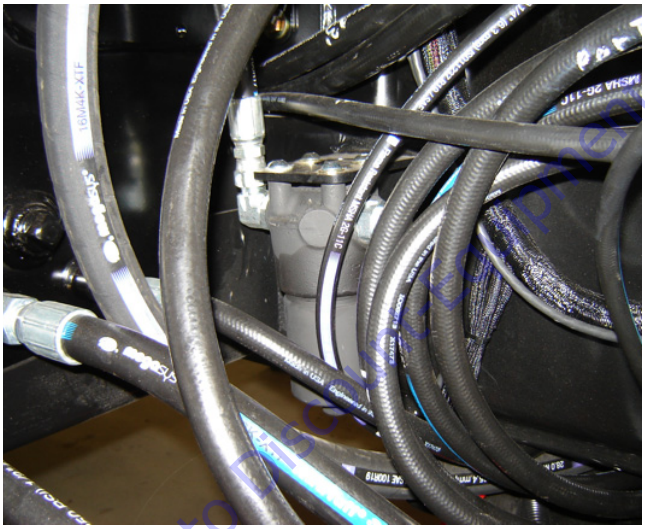


Lube Point(s) - Replaceable Element
Interval - Change after first 50 hours and every 6 months or 300 hours thereafter.

8. Hydraulic Oil

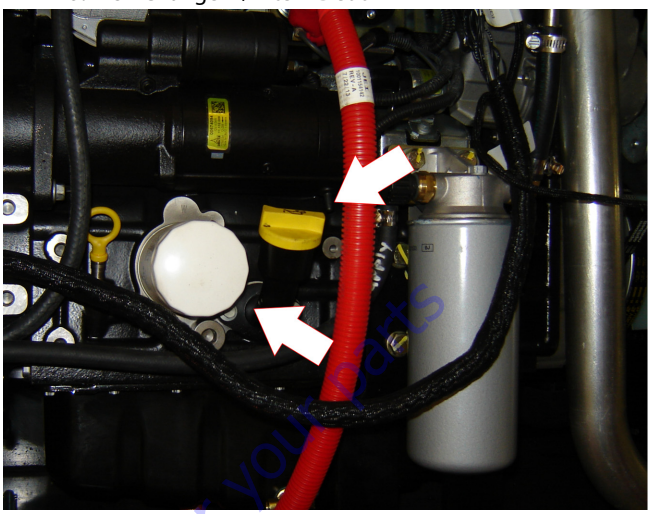
Lube Point(s) - Fill Cap
Capacity - 75 Gallons (208 liters) Tank to Full Mark
82 Gallons (310.4 L) System
Lube - HO
Interval - Check level daily. Change every 2 years or 1200 hours of operation.

9. Main Valve Filter



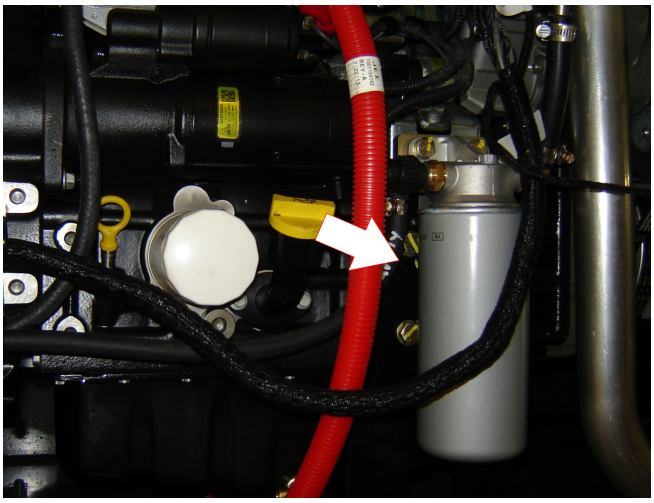
Lube Point(s) - Replaceable Element
Interval - Change after first 50 hours and every 6 months or 300 hours thereafter.

10. Oil Change w/Filter - Deutz



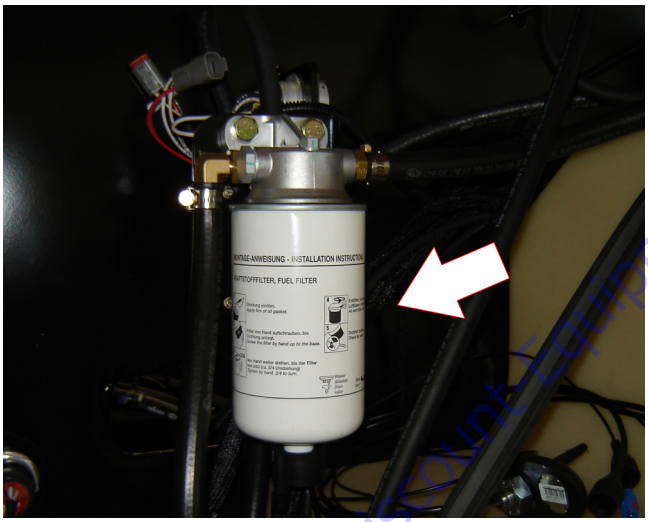
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 9.6 Quarts (9.1 L)
Lube - EO
Interval - Check level daily; change every 500 hours or yearly, whichever comes first. Adjust final oil level by mark on dipstick.

11. Fuel Filter - Deutz



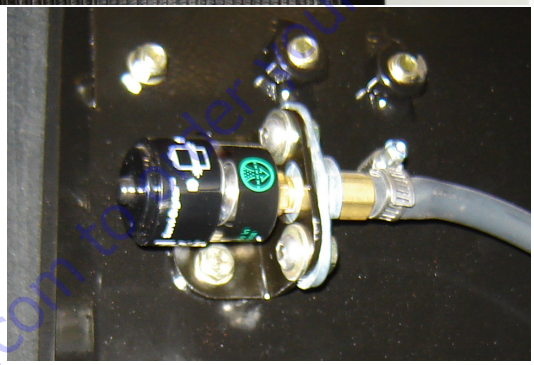
Lube Point(s) - Replaceable Element
Interval - Every year or 500 hours of operation

12. Fuel Pre-Filter



Lube Point(s) - Replaceable Element
Interval - Every year or 500 hours of operation

13. Air Filter



Lube Point(s) - Replaceable Element
Interval - Every 6 months or 300 hours of operation or as indicated by the condition indicator
Comments - Check dust valve for dirt daily

14. Boom

Lube Point(s) - Apply to wear pad contact paths
Lube - Super Lube®
Interval - As needed. Refer to the Service Manual for detailed procedures

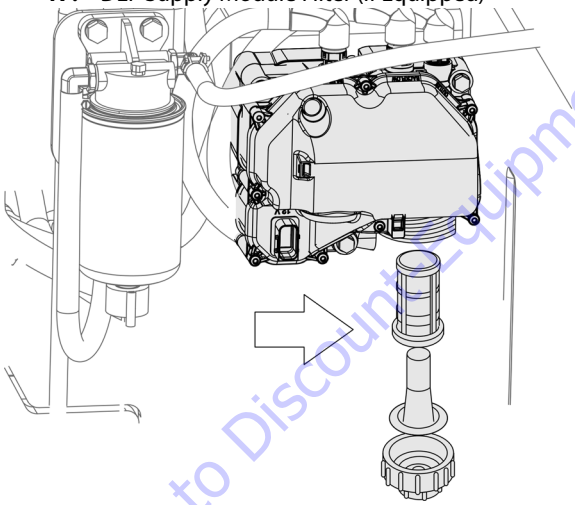
15. Radiator

Lube Point(s) - Fill Cap
Lube - Anti-Freeze Coolant (Refer to Engine Manual for compatible coolants)
Capacity - 13.2 qt. (12.5 L)

16. Diesel Exhaust Fluid (DEF) (If Equipped)

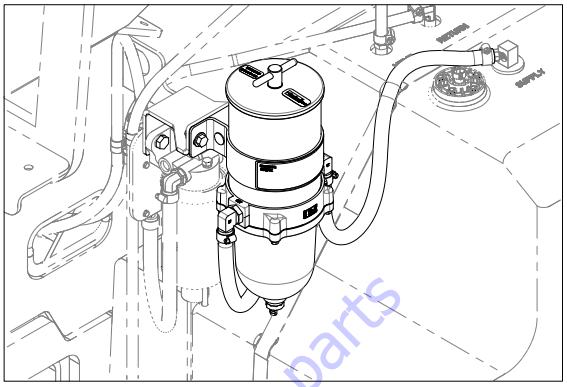
Lube Point - Fill Cap
Lube - DEF
Capacity - 5.7 gal. (21.5 L)

17. DEF Supply Module Filter (If Equipped)



Interval - 500 hours or 2 years, whichever comes first

18. Optional Fuel Filter/Water Separator



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NO. 5000059 REV. K

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

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

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

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

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

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

NO. 5000059 REV. K

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

PARTS FINDER

Search Website by Part Number

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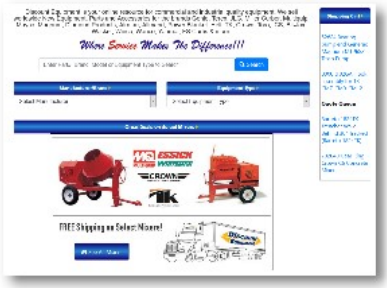

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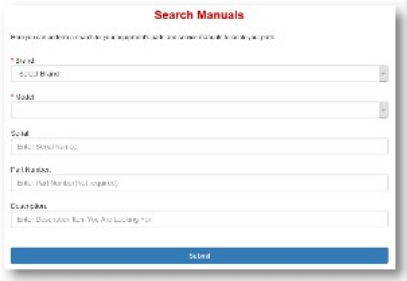

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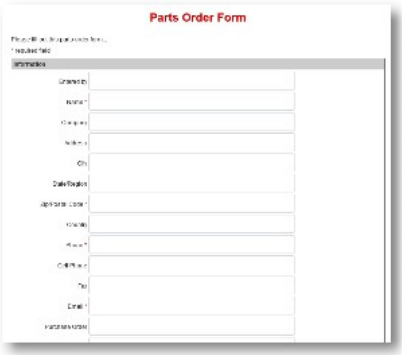

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber,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

SECTION 2. GENERAL

2.1 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

General

This section provides the necessary information needed by those personnel that are responsible to place the machine in operation readiness and maintain its safe operating condition. For maximum service life and safe operation, ensure that all the necessary inspections and maintenance have been completed before placing the machine into service. With proper care, maintenance, and inspections performed per JLG's recommendations, and with any and all discrepancies corrected, this product will be fit for continued use.

Preparation, Inspection, and Maintenance

It is important to establish and conform to a comprehensive inspection and preventive maintenance program. The following table outlines the periodic machine inspections and maintenance recommended by JLG Industries, Inc. Consult your national, regional, or local regulations for further requirements for aerial work platforms. The frequency of inspections and maintenance must be increased as environment, severity, and frequency of usage requires.

Pre-Start Inspection

It is the User's or Operator's primary responsibility to perform a Pre-Start Inspection of the machine prior to use daily or at each change of operator. Reference the Operator's and Safety Manual for completion procedures for the Pre-Start Inspection. The Operator and Safety Manual must be read in its entirety and understood prior to performing the Pre-Start Inspection.

Pre-Delivery Inspection and Frequent Inspection

The Pre-Delivery Inspection and Frequent Inspection shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

The Pre-Delivery Inspection and Frequent Inspection procedures are performed in the same manner, but at different times. The Pre-Delivery Inspection shall be performed prior to each sale, lease, or rental delivery. The Frequent Inspection shall be accomplished for each machine in service for 3 months or 150 hours (whichever comes first); out of service for a period of more than 3 months; or when purchased used. The frequency of this inspection must be increased as environment, severity and frequency of usage requires.

Reference the JLG Pre-Delivery and Frequent Inspection Form and the Inspection and 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 the Inspection and Preventive Maintenance Schedule for items requiring inspection during the performance of this inspection. Reference the appropriate areas of this manual for servicing and maintenance procedures.

For the purpose of receiving safety-related bulletins, it is important that JLG Industries, Inc. has updated ownership information for each machine. When performing each Annual Machine Inspection, notify JLG Industries, Inc. of the current machine ownership.

Preventive Maintenance

In conjunction with the specified inspections, maintenance shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

Reference the 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 the date of the prior inspection.	Owner, Dealer, or User	Factory-Trained Service Technician (Recommended)	Service and Maintenance Manual and applicable JLG inspection form.
Preventive Maintenance	At intervals as specified in the Service and Maintenance Manual.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual

2.2 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

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

Cleanliness

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

Components Removal and Installation

1. Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (chains, cables, etc.) should be parallel to each other and as near perpendicular as possible to top of part being lifted.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90 degrees.
3. If a part resists removal, check to see whether all nuts, bolts, cables, brackets, wiring, etc., have been removed and that no adjacent parts are interfering.

Component Disassembly and Reassembly

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

Pressure-Fit Parts

When assembling pressure-fit parts, use a molybdenum disulfide base compound or equivalent to lubricate the mating surface.

Bearings

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

Gaskets

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

Bolt Usage and Torque Application

NOTICE

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

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

Hydraulic Lines and Electrical Wiring

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

Hydraulic System

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

Lubrication

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

Battery

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

Lubrication and Servicing

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

2.3 LUBRICATION AND INFORMATION

Hydraulic System

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc., to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient system warm-up or leaks in the pump supply (suction) lines.

2. The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. Hydraulic system filters should be checked, cleaned, and/or replaced as necessary, at the specified intervals required in the Lubrication Chart in Section 1. Always examine filters for evidence of metal particles.

3. Cloudy oils indicate a high moisture content which permits organic growth, resulting in oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.

4. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

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

Hydraulic Oil

1. Refer to Section 1 for recommendations for viscosity ranges.

Changing Hydraulic Oil

1. Filter elements must be changed after the first 50 hours of operation and every 300 hours (unless specified otherwise) thereafter. If it is necessary to change the oil, use only those oils meeting or exceeding the specifications appearing in this manual. If unable to obtain the same type of oil supplied with the machine, consult local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils.

2. Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the service container. Always clean the mesh element of the filter and replace the cartridge any time the system oil is changed.

3. While the unit is shut down, a good preventive maintenance measure is to make a thorough inspection of all hydraulic components, lines, fittings, etc., as well as a functional check of each system, before placing the machine back in service.

Lubrication Specifications

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

2.4 CYLINDER DRIFT

Theory

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

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

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

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

Cylinder Leakage Test

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

Measure drift at cylinder rod with a calibrated dial indicator.

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

Cylinder leakage is acceptable if it passes this test.

Table 2-2. Cylinder Drift

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

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

Cylinder Thermal Drift

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

2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

1. Pinned joints should be disassembled and inspected if the following occurs:
   a. Excessive sloppiness in joints.
   b. Noise originating from the joint during operation.
2. Filament wound bearings should be replaced if any of the following is observed:
   a. Frayed or separated fibers on the liner surface.
   b. Cracked or damaged liner backing.
   c. Bearings that have moved or spun in their housing.
   d. Debris embedded in liner surface.
3. Pins should be replaced if any of the following is observed (pin should be properly cleaned prior to inspection):
   a. Detectable wear in the bearing area.
   b. Flaking, pealing, scoring, or scratches on the pin surface.
   c. Rusting of the pin in the bearing area.
4. Re-assembly of pinned joints using filament wound bearings.
   a. Housing should be blown out to remove all dirt and debris...bearings and bearing housings must be free of all contamination.
   b. Bearing / pins should be cleaned with a solvent to remove all grease and oil...filament wound bearing are a dry joint and should not be lubricated unless otherwise instructed (i.e. sheave pins).
   c. Pins should be inspected to ensure it is free of burrs, nicks, and scratches which would damage the bearing during installation and operation.

2.6 WELDING ON JLG EQUIPMENT

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

Do the Following When Welding on JLG Equipment

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

Do NOT Do the Following When Welding on JLG Equipment

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

NOTICE

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

NOTE: *Refer the Operation and Safety Manual for completion procedures for the Pre-Start Inspection.*

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	Inspections	
	Pre-Delivery[1] or Frequent [2] (Quarterly) Inspection	Annual[3] (Yearly) Inspection
Boom Assembly		
Boom Weldments	1, 2	1, 2
Hose/Cable Carrier Installations	1, 2	1, 2
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[4]	1, 2	1, 2
Platform Assembly		
Railing	2	2
Gate	1, 2, 3	1, 2, 3
Floor	2	2
Rotator	1, 2, 3, 4	1, 2, 3, 4
Lanyard Anchorage Point	1, 2, 6	1, 2, 6
Turntable Assembly		
Swing Bearing or Worm Gear	1[50], 2	1[50], 2
Oil Coupling	4	4
Swing Drive System	1, 4	1, 4
Turntable Lock	1, 2, 3	1, 2, 3
Hood, Hood Props, Hood Latches	3	3
Chassis Assembly		
Tires	1, 2	1, 2
Wheel Nuts/Bolts	1[50]	1[50]
Wheel Bearings		1, 2, 4, 5
Oscillating Axle/Lockout Cylinder Systems		1, 2, 4, 5
Extendable Axle Systems	3	3
Steer Components		1, 2
Spindle Thrust Bearing/Washers		1, 2
Drive Hubs	1, 4	1, 4

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	Inspections	
	Pre-Delivery[1] or Frequent[2] (Quarterly) Inspection	Annual[3] (Yearly) Inspection
Functions/Controls		
Platform Controls return to neutral/off when released	1, 3, 6, 9	1, 3, 6, 9
Ground Controls return to neutral/off when released	1, 3, 6, 9	1, 3, 6, 9
Function Control Locks, Guards, or Detents	1, 3, 9	1, 3, 9
Footswitch (shuts off function when released)	1, 3, 9	1, 3, 9
Emergency Stop Switches (Ground & Platform) arrest all platform movement	1, 3, 6	1, 3, 6
Function Limit or Cutout Switch Systems	1, 3, 9	1, 3, 9
Capacity Indicator	1, 3, 9	1, 3, 9
Drive Brakes	1, 3, 9	1, 3, 9
Swing Brakes	1, 3, 9	1, 3, 9
Auxiliary Power	1, 3, 9	1, 3, 9
Power System		
Engine Idle, Throttle, and RPM	1, 3, 7	1, 3, 7
Engine Fluids: Oil	4	4
Engine Fluids: Coolant	1, 4, 7	1, 4, 7
Air Filter	1, 4	1, 4
Fuel Filter(s)	1, 5	1, 5
Drain Oil Build Up in 2-Stage Vaporizer (LP Only)	1, 4	1, 4
Exhaust System	1, 4	1, 4
Batteries	1, 4	1, 4
Battery Fluid	4	4
Battery Charger	1, 3	1, 3
Intake System	1, 2	1, 2
Glow Plug (Diesel Only)	1, 2, 3	1, 2, 3
Serpentine Belt, Tensioner, Pulleys	1, 2, 3	1, 2, 3
Fuel Reservoir, Cap, and Breather	1, 2, 4	1, 2, 4
Hydraulic/Electric System		
Hydraulic Pumps	1, 2, 4	1, 2, 4
Hydraulic Cylinders	1, 2, 4, 5	1, 2, 4, 5
Cylinder Attachment Pins and Pin Retainers	1, 2	1, 2
Hydraulic Hoses, Lines, and Fittings	1, 2, 4	1,2,3,4
Hydraulic Reservoir, Cap, and Breather	1, 2, 3, 4, 5	1, 2, 3, 4, 5
Hydraulic Filter(s)	1, 4, 5	1, 4, 5
Hydraulic Fluid	4, 5	4, 5
Electrical Connections	1, 2	1, 2
Instruments, Gauges, Switches, Lights, Horn		1, 3

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	Inspections	
	Pre-Delivery[1] or Frequent [2] (Quarterly) Inspection	Annual[3] (Yearly) Inspection
General		
All Decals/Placards Installed, Secure, Legible	9	9
Annual Machine Inspection Due		9
No Unauthorized Modifications or Additions	9	9
All Relevant Safety Publications Incorporated	9	9
General Structural Condition and Welds	2	2
All Fasteners, Pins, Shields, and Covers	1, 2	1, 2
Grease and Lubricate to Specifications	9	9
Function Test of All Systems	9	9
Paint and Appearance	5	5
Stamp Inspection Date on Frame		9
Notify JLG of Machine Ownership		9

Footnotes:

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

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

[3] Annually, no later than 13 months from the date of the prior inspection, Includes all daily and quarterly inspections, mandated by regulating body

[4] Replace every 12 years or 7,000 hours

[50] Indicates a 50 hour interval required to perform task after initial use of machine. This only occurs once in machine life

[250] Indicates a 250 hour interval required to perform task after initial use of machine. This only occurs once in machine life

Performance Codes:

1 - Check for proper and secure: installation, adjustment, or torque
2 - Visual inspection for damage: (cracks, corrosion, abrasions, distortion, excessive wear, broken welds, gouges, chafing and threads showing)
3 - Proper operation
4 - Check for proper sealing, signs of leakage and fluid level
5 - Clean and free of debris
6 - Decals installed and legible
7 - Check for proper tolerances, routing, and lubrication
8 - Fully Charged
9 - Verify/Perform

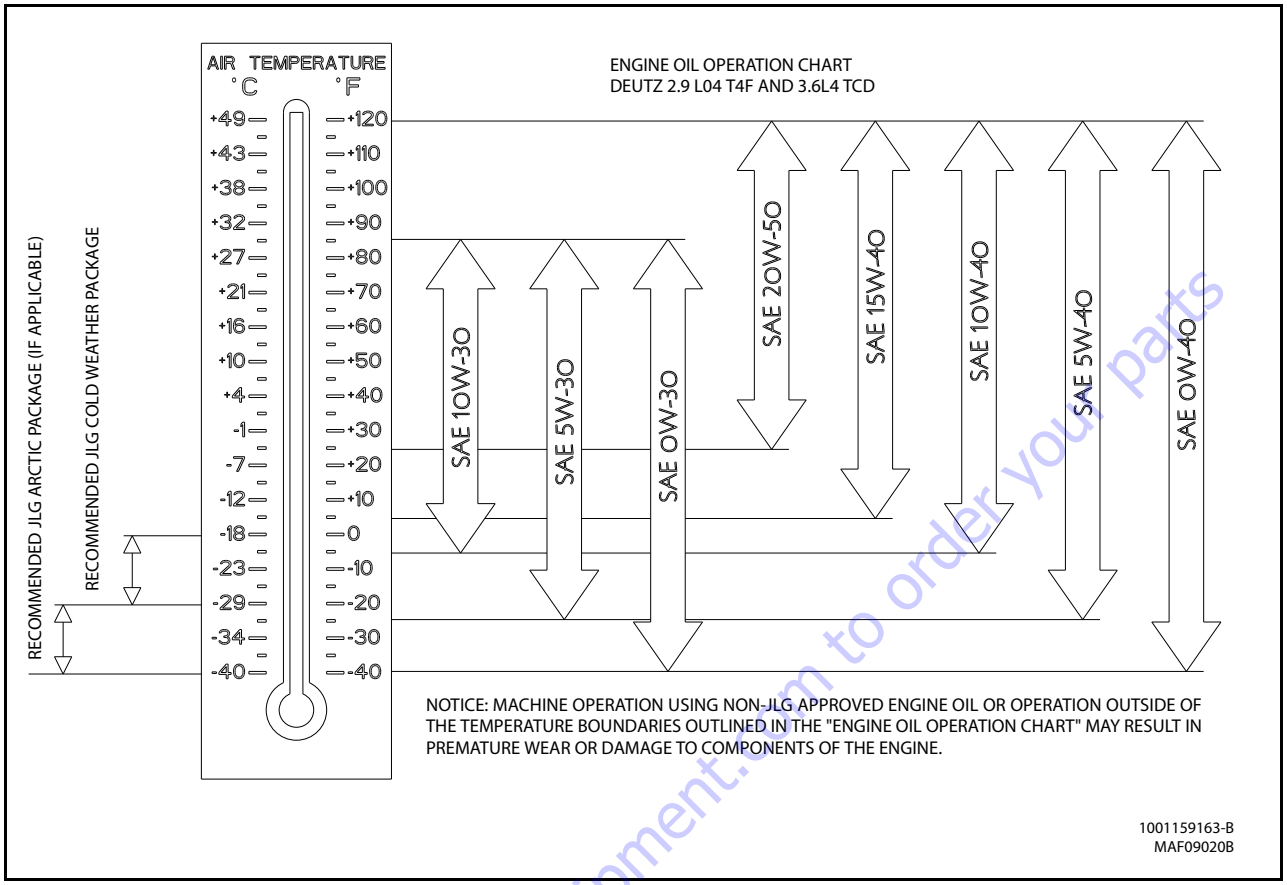
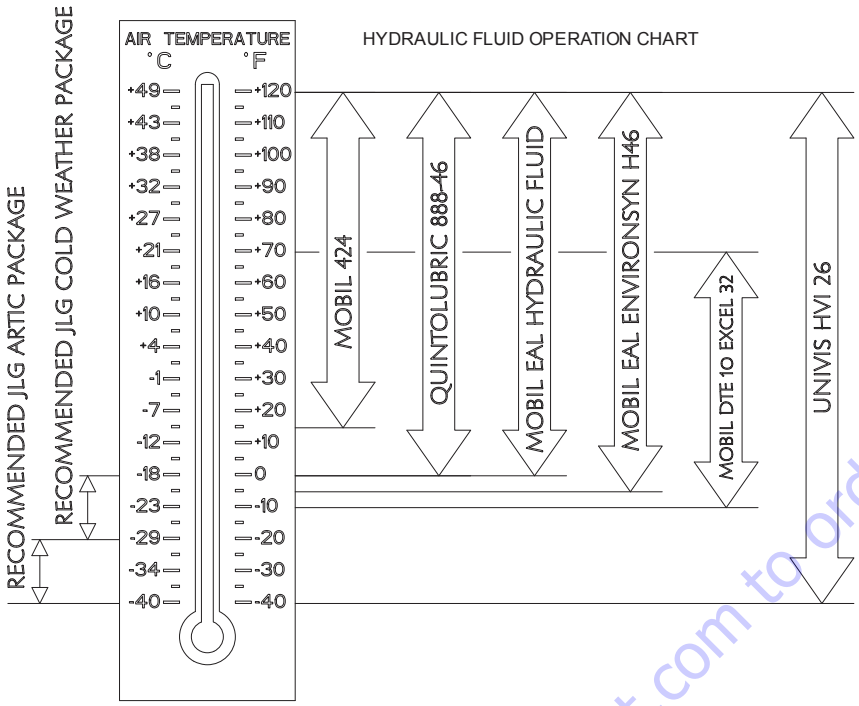


Figure 2-1. Engine Operating Temperature Specifications - Deutz



NOTICE:

MACHINE OPERATION USING NON-JLG APPROVED HYDRAULIC FLUIDS OR OPERATION OUTSIDE OF THE TEMPERATURE BOUNDARIES OUTLINED IN THE "HYDRAULIC FLUID OPERATION CHART" MAY RESULT IN PREMATURE WEAR OR DAMAGE TO COMPONENTS OF THE HYDRAULIC SYSTEM.

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	164	X					X	
Univis HVI 26	26	376	X						
Mobil EAL Hydraulic Oil	47	176		X			X	X	
Mobil EAL 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

4150740 B

Figure 2-2. Hydraulic Oil Operating Temperature Specifications

PARTS FINDER

Search Website by Part Number

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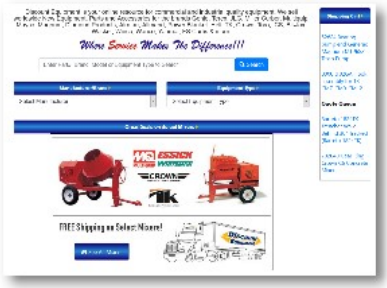

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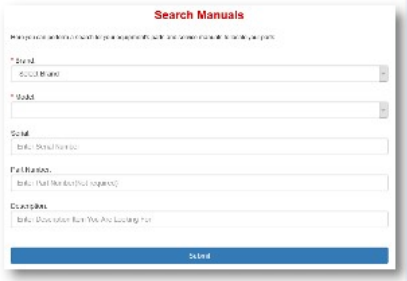

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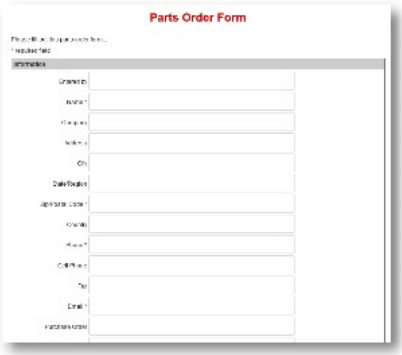

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SECTION 3. CHASSIS & TURNTABLE

3.1 TIRES AND WHEELS

Tire Damage

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

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

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

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

Wheel and Tire Replacement

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

Wheel Installation

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

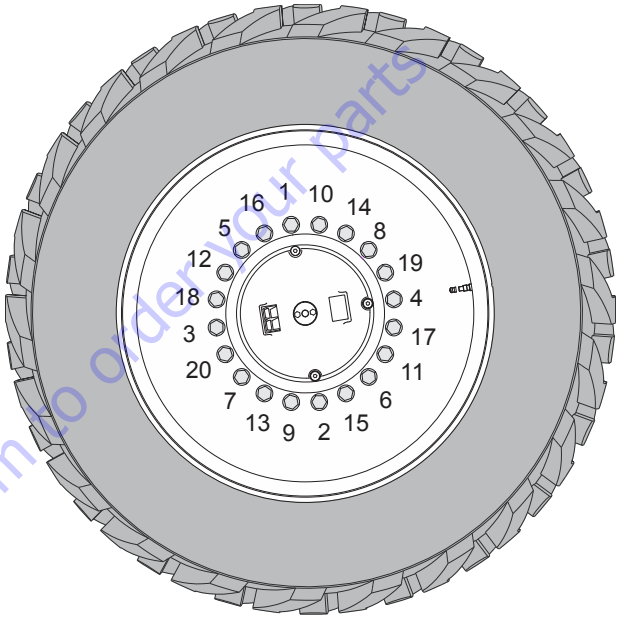
⚠ WARNING

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

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

The proper procedure for attaching wheels is as follows:

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



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

Table 3-1. Wheel Torque Chart

TORQUE SEQUENCE		
1st Stage	2nd Stage	3rd Stage
35 ft. lbs. (45 Nm)	80 ft. lbs. (100 Nm)	140 ft. lbs. (185 Nm)

NOTE: *Ensure all mating surface are clean and free from damage or debris.*

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

3.2 AXLE EXTENSION SYSTEM

NOTE: *The boom must be oriented between the rear wheels to extend or retract the axles.*

The Axle Extension System allows each of the four axles to be extended and retracted together while maintaining full steering control as the machine is driven. The system allows the axles to extend or retract only while the boom is in the transport position (see Transport Position Sensing System in Section 4) and in order to minimize wheel scrubbing during axle movement, a minimum drive speed must be attained before axle extension/retraction will be permitted. The system uses four linear sensors (one at each axle) to sense when the axles are fully extended. If any of the linear sensors detect an out of range value for axle set, the control system considers the axles retracted. To extend/retract the axles, the user engages the axle extend/retract switch on the platform console and the drive control at the same time. The axle set indicator will be off when the axles are not fully extended and the axle extend/retract switch is not engaged. It will flash while the axles are extending or retracting and will be on constantly when the axles are fully extended. With the axles not fully extended, the boom is restricted to operation within the transport position (see Transport Position Sensing System in Section 4). If a signal from any axle linear sensor is lost when the boom is beyond the transport position, the axle set indicator will flash and drive/steer functions will be disabled until the boom is brought back into the transport position. The steering angle will be automatically limited to +/- 20 degrees anytime the axles are not fully extended. If the wheel angle is more than +/- 20 degrees when the axle retract command is engaged, the control system will automatically reduce the wheel angle to 20 degrees during axle retraction.

3.3 DRIVE ORIENTATION SYSTEM

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

3.4 STEERING CONTROL SYSTEM

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

Figure 3-1. Crab Steer

Figure 3-2. Coordinated Steer

Figure 3-3. Conventional Two Wheel Steer

Each wheel has its own steer cylinder, wheel angle sensor, axle extend linear sensor, and proportional valve, allowing the control system to position each wheel to the ideal angle for all steering modes and all steering commands. This is done whether the axle is retracted, extended, or somewhere in between. Changes in steering modes while drive is engaged requires the operator to return the joystick to the neutral position before the steer cylinders are adjusted. Once the footswitch is depressed and drive or steer is engaged, the wheels automatically adjust to the appropriate angle for the selected steering mode based on the position of the inside front wheel. If the steer select switch is changed without the footswitch depressed or the EMS is off, the wheels will not move until the footswitch is depressed and a steering or drive command has been initiated. The steering angles are limited to +/- 20 degrees anytime the axles are not fully extended. See the Axle Extension System for interaction with the axle extension system. If a wheel cannot achieve its commanded angle within a specified time, it is considered jammed. When a wheel is considered jammed during steering, a fault is reported and the remaining wheels will continue to their commanded position. The fault is cleared when the footswitch is cycled. If a wheel is jammed making it significantly out of position, with regard to the other wheels, the drive motors are restricted to their maximum displacement (slow speed). Wheel angle sensor failures will result in an approximated steering control logic that will allow the operator to move the machine until it can be repaired. The wheel at the failed sensor will be driven based on the information available from the other sensors. This wheel will not track perfectly and will become farther out of position over time. When the wheel becomes prohibitively out of position, the wheels can be resynchronized by fully steering against the mechanical stops.

Axle extend sensor failures will result in an approximated steering control logic that will allow the operator to move the machine until it can be repaired. The axle at the failed sensor will be driven based on the information available from the other sensors. This axle will not track perfectly and will become farther out of position over time. When the wheel becomes prohibitively out of position, the wheels can be resynchronized by fully steering against the mechanical stops. Coordinated and crab steer modes are limited to low speed drive, regardless of speed select switch position.

3.5 DRIVE/STEERING SPEED CONTROL

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

3.6 TRACTION CONTROL SYSTEM

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

3.7 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.

3.8 JIB LIFT END OF STROKE DAMPENING

The jib lift cylinder is outfitted with a linear position sensor and end of stroke dampening is achieved through the electronic control system. This system slows the jib speed within the last 5° before minimum and maximum jib elevation. This reduction in speed occurs only while approaching the end of stroke limits. Speeds in the opposite direction are not altered.

3.9 GROUND CONTROL ENABLE SYSTEM

The ground controls include the use of a function enable system for the operation of directional functions from the ground control panel. To operate any directional function, the function enable switch must be held in combination with the directional function switch. This switch doubles as the auxiliary power switch. When the engine is not running, activating this switch will operate auxiliary power. When the engine in running, activating this switch will enable directional functions. Releasing this switch during function commands will stop the function movement. Unlike the platform enable, no timer or sequence logic is imposed on the use of the function enable.

3.10 HYDRAULIC SYSTEM WARM UP

For optimal life and performance of the hydraulic system in extremely cold temperatures, the control system monitors the hydraulic system temperature and automatically limits the function speeds of the high demand functions.

While the system is cold and in the warm up mode, the main lift and main telescope functions are limited to creep speeds and is indicated to the operator by flashing the creep light on the platform control panel.

Operating the machine while in the warm up mode will generate sufficient heat to bring the hydraulic temperature up to allowable temperatures and the warm up mode will be automatically turned off.

This system is activated when the hydraulic oil temperature in the main valve is below 30°F (-1°C) and the engine coolant temperature is below 150°F (65°C). In warm up, the engine operates at mid engine speed and a valve is energized which loads the pump to build heat. This valve is active only when no function is selected. Warm up ends when the main valve temperature reaches 50°F (10°C) or the engine coolant reaches 150°F (65°C). Functions being operated when the warm up mode turns off will remain in the creep speed until the function is re-initiated.

3.11 FUNCTION SPEED CONTROL SYSTEM

The platform controls for the platform rotate, jib lift, main boom telescope and jib telescope functions are controlled through a common variable speed control knob. This knob allows 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. Full counter-clockwise rotation of this knob to the detent position places all functions into creep speed including lift, swing, and drive.

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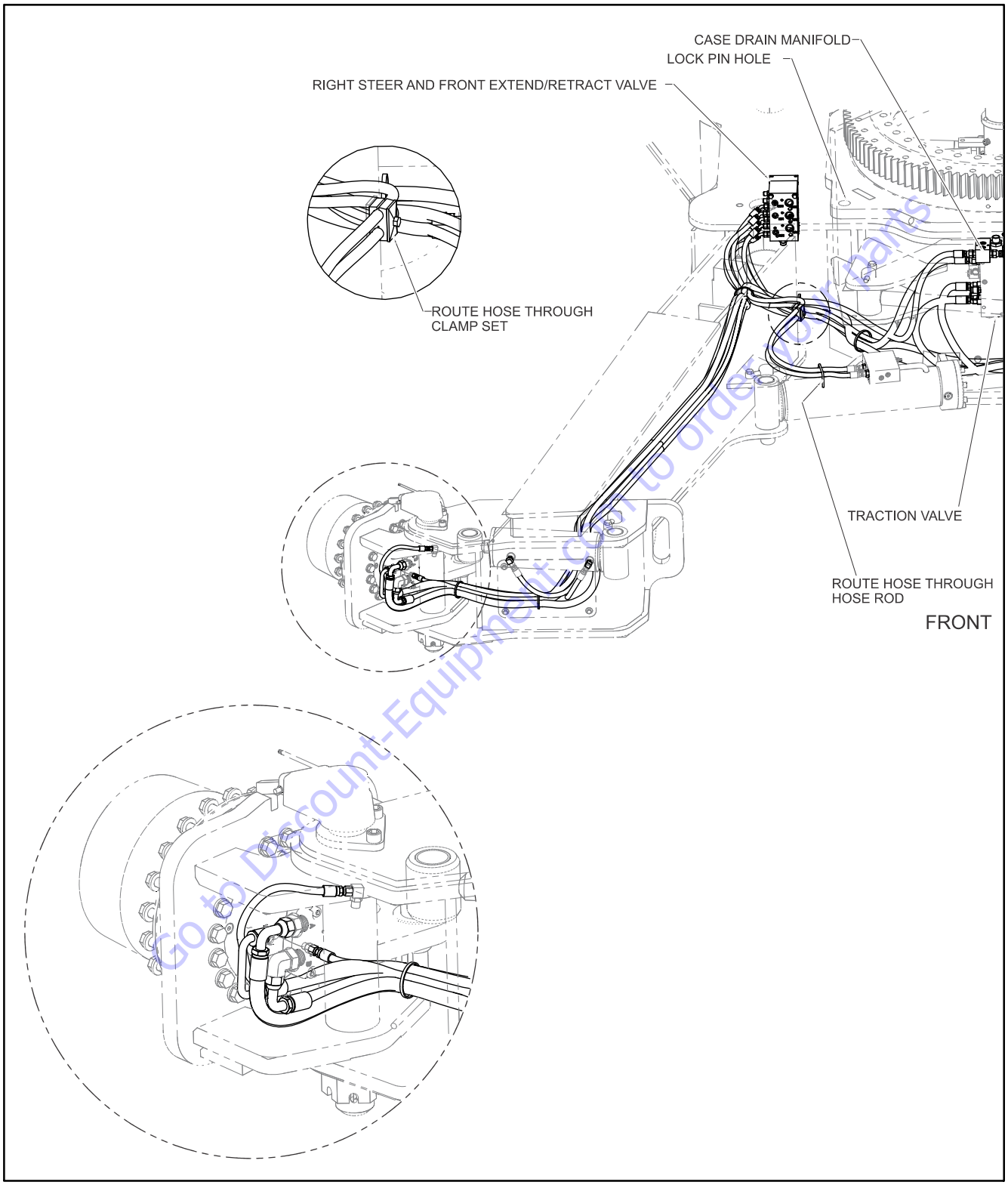


Figure 3-4. Axle Hose Routing - Sheet 1 of 2

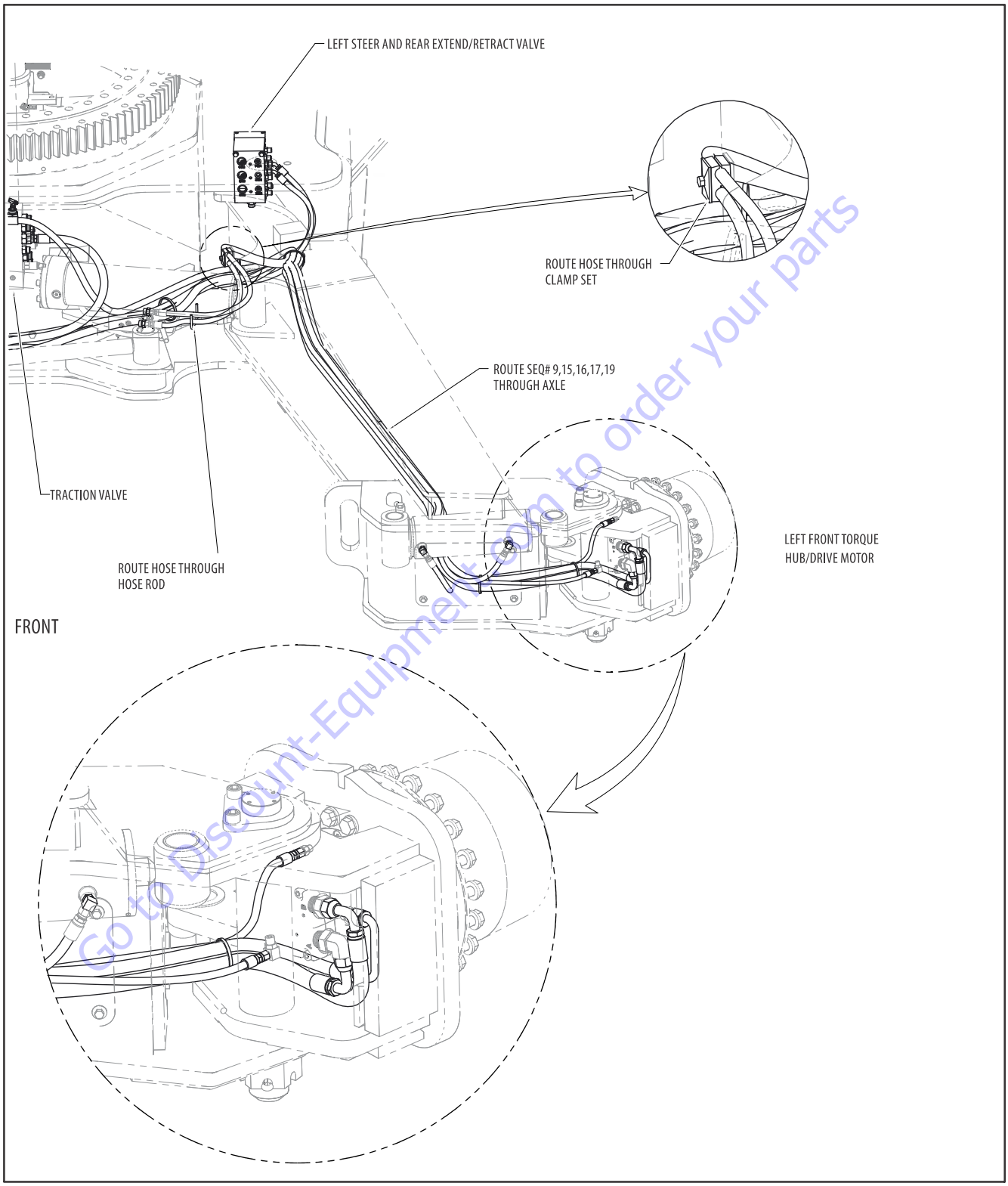


Figure 3-5. Axle Hose Routing - Sheet 2 of 2

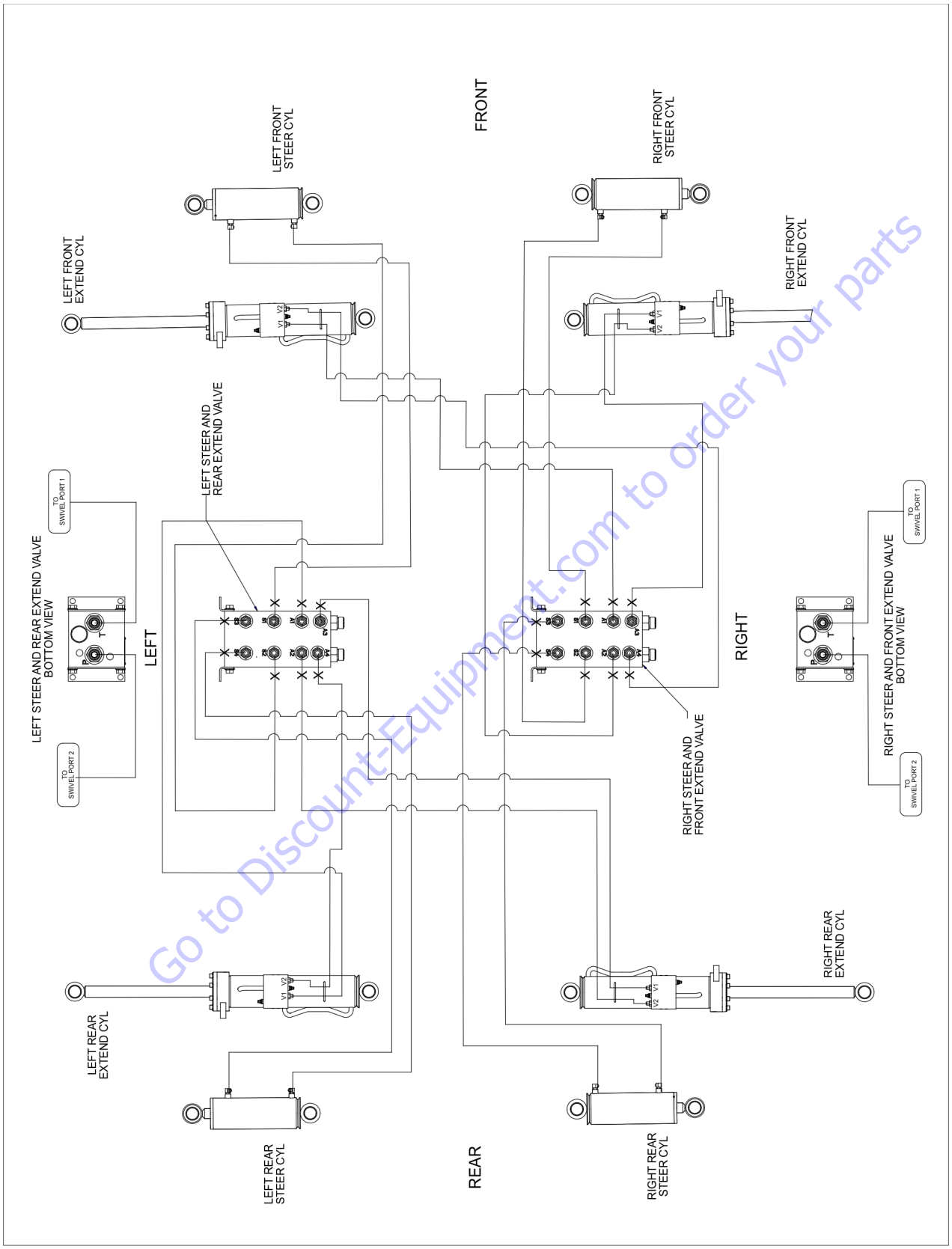


Figure 3-6. Steering/Axle Hydraulic Circuit

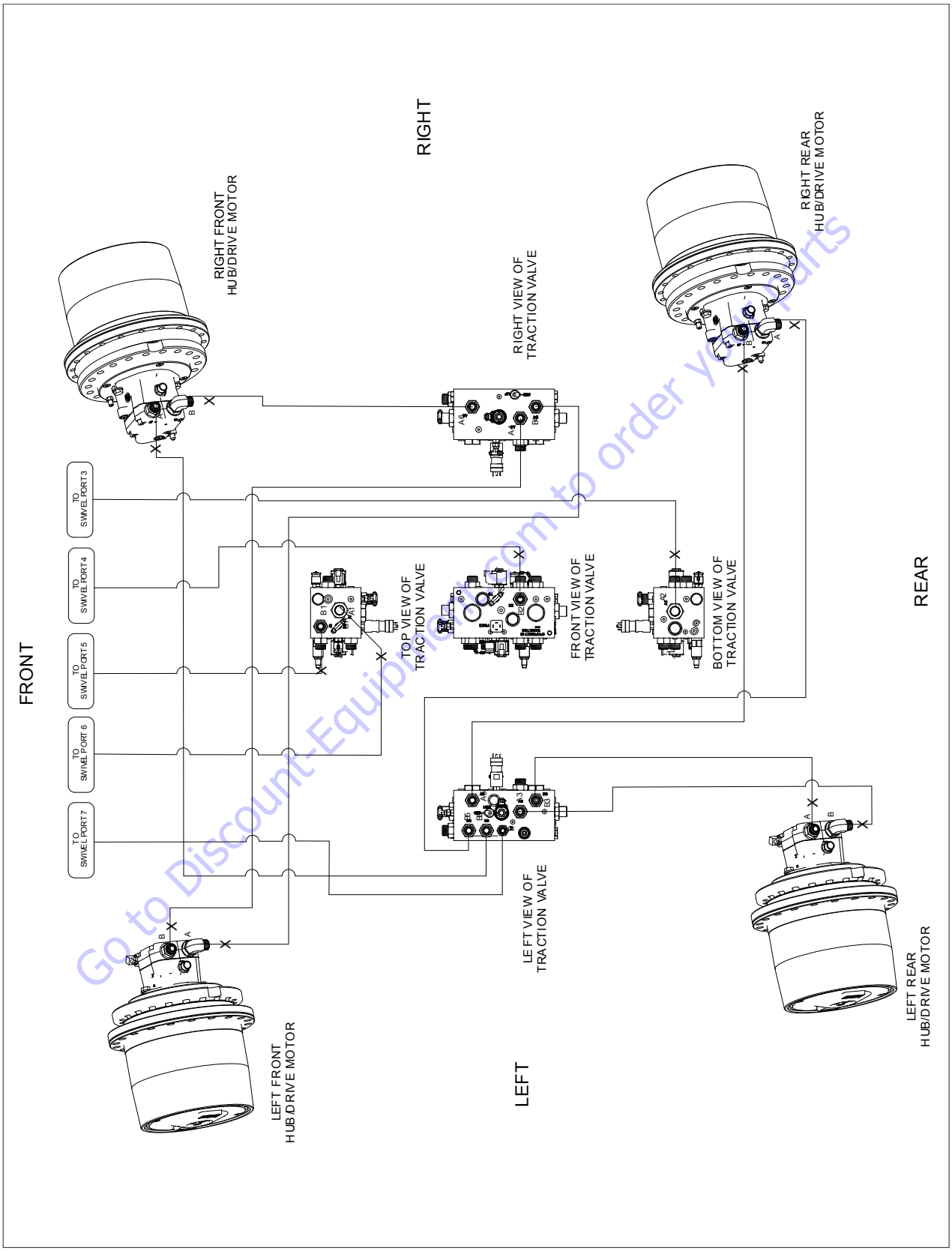


Figure 3-7. Drive System Hydraulic Circuit - Sheet 1 of 2

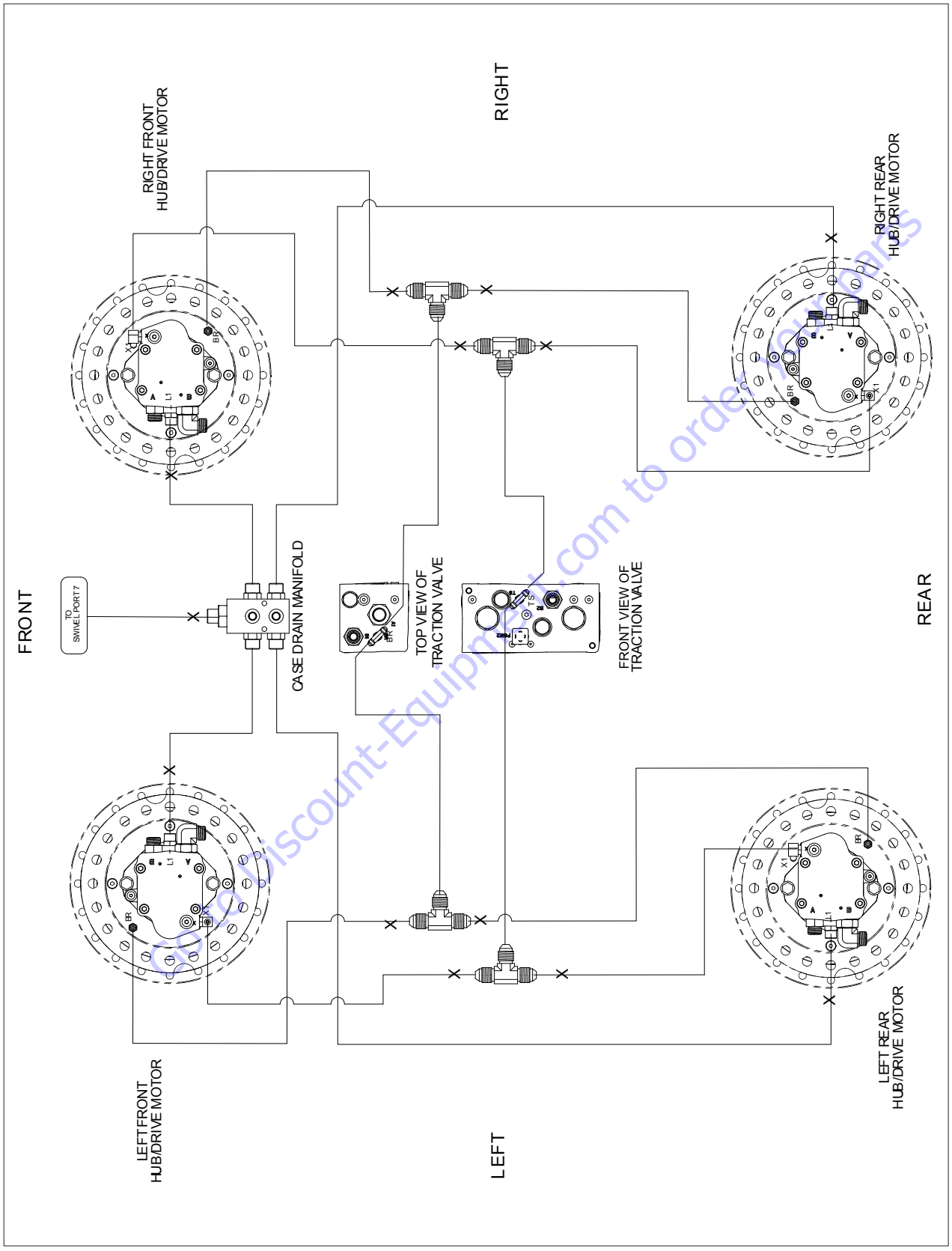


Figure 3-8. Drive System Hydraulic Circuit - Sheet 2 of 2

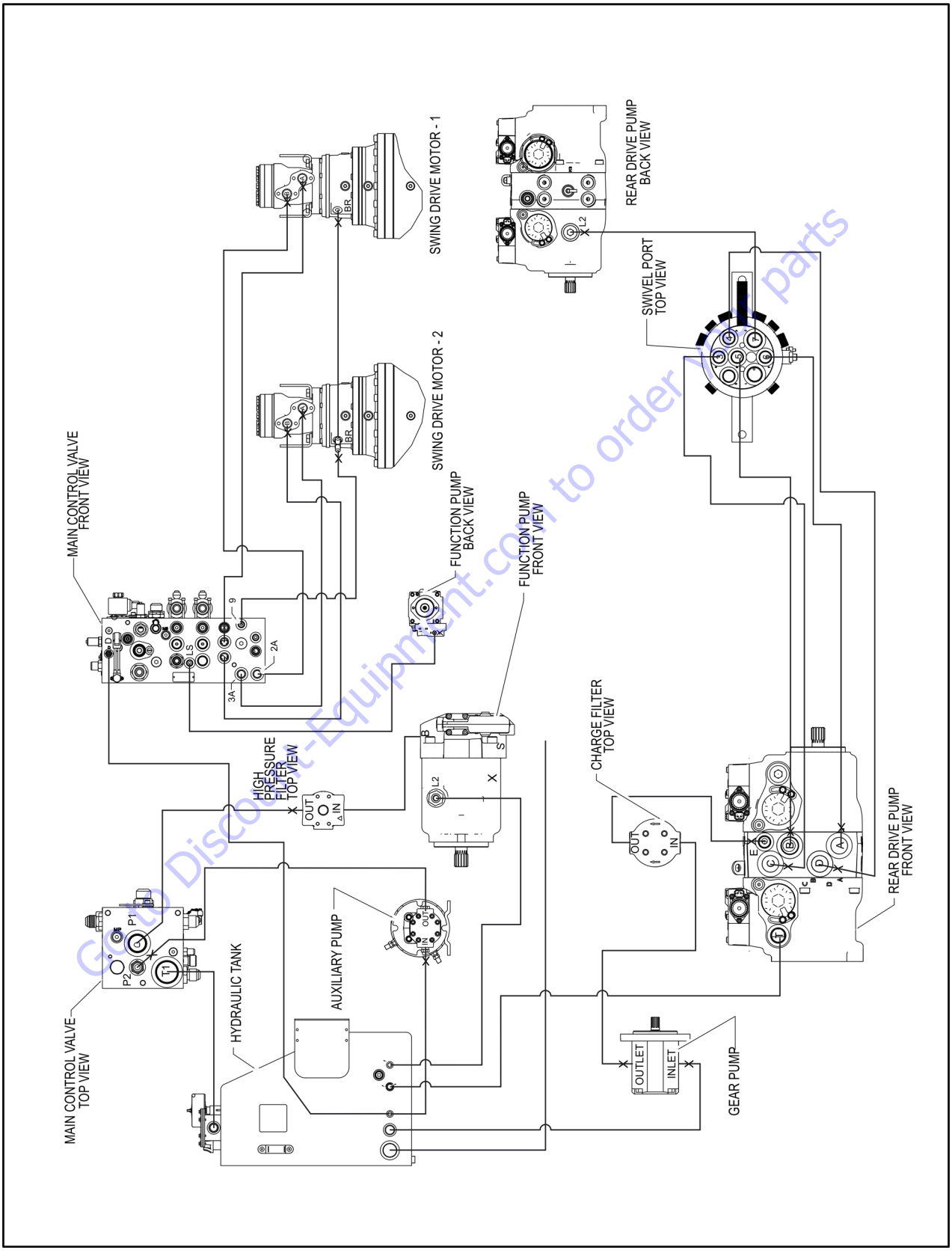
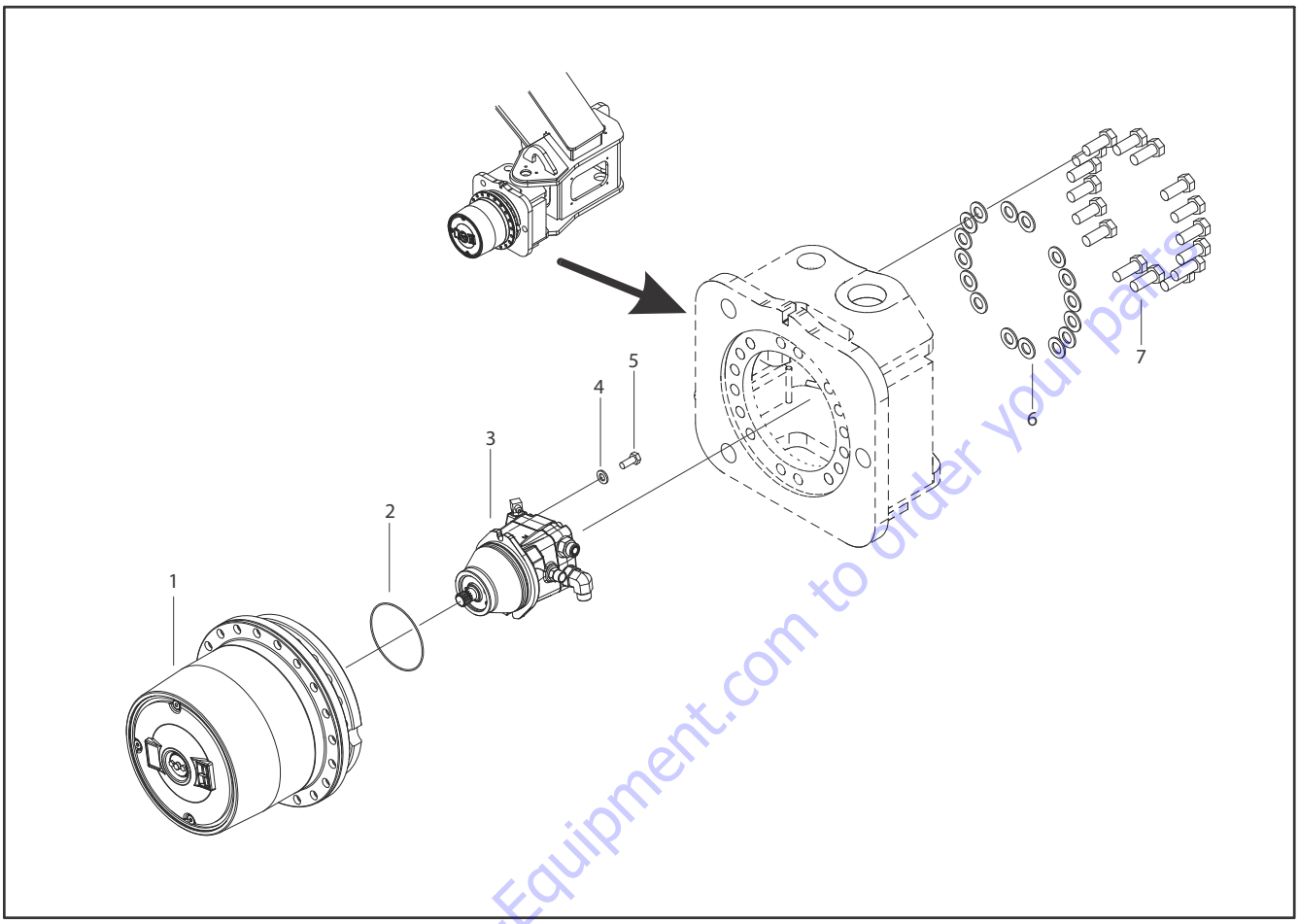


Figure 3-9. Turntable Hydraulic System

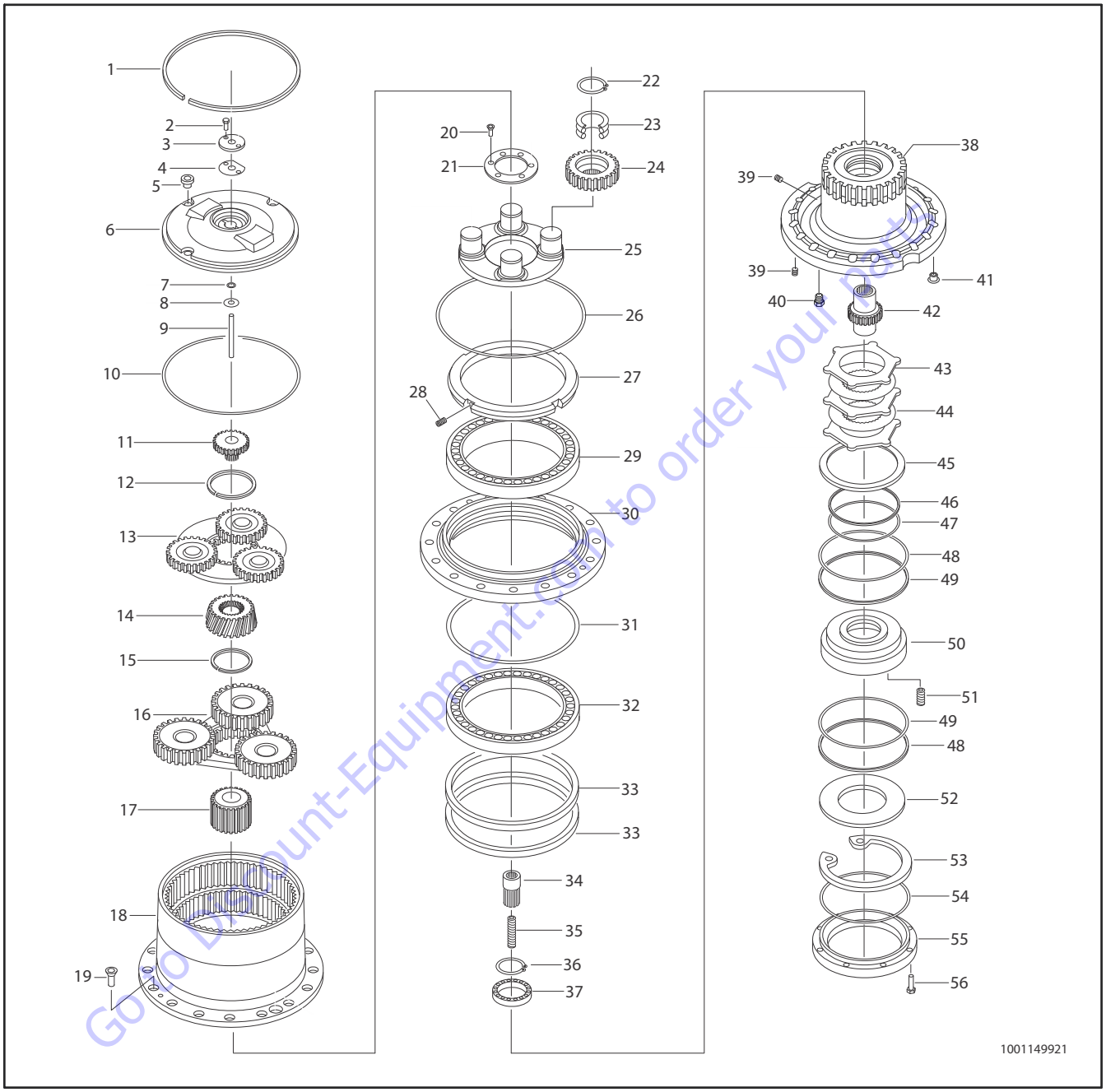
3.12 DRIVE ASSEMBLY



1. Drive Hub
2. O-Ring
3. Drive motor
4. Washer
5. Bolt
6. Washer
7. Bolt

Figure 3-10. Drive Assembly

3.13 DRIVE HUB

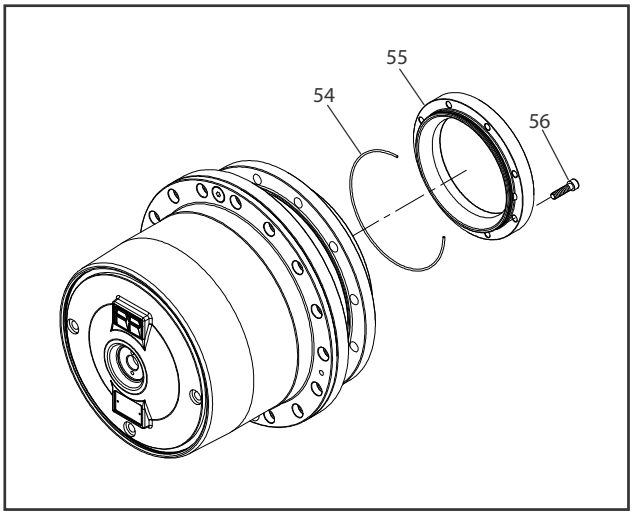


1.	Ring	9.	Pin	17.	Pinion	25.	Flange	33.	Seal	41.	Plastic Plug	49.	O-Ring
2.	Screw	10.	O-Ring	18.	Hub Housing	26.	O-Ring	34.	Coupling	42.	Input Shaft	50.	Brake Piston
3.	Cover	11.	Pinion	19.	Screw	27.	Ring Nut	35.	Spring	43.	Iron Disc	51.	Brake Spring
4.	Gasket	12.	Retaining Ring	20.	Screw	28.	Set Screw	36.	Retaining Ring	44.	Brake Disc	52.	Spacer
5.	Plug	13.	Gear Reduction Assy	21.	Plug	29.	Bearing	37.	Bearing	45.	Spacer	53.	Retaining Ring
6.	Cover	14.	Pinion	22.	Retaining Ring	30.	Hub Support	38.	Axle	46.	Seal	54.	O-Ring
7.	O-Ring	15.	Ring	23.	Bearing	31.	O-Ring	39.	Plug	47.	O-Ring	55.	Motor Support
8.	Shim	16.	Gear Reduction Assy	24.	Planet Wheel	32.	Bearing	40.	Plug	48.	Seal	56.	Screw

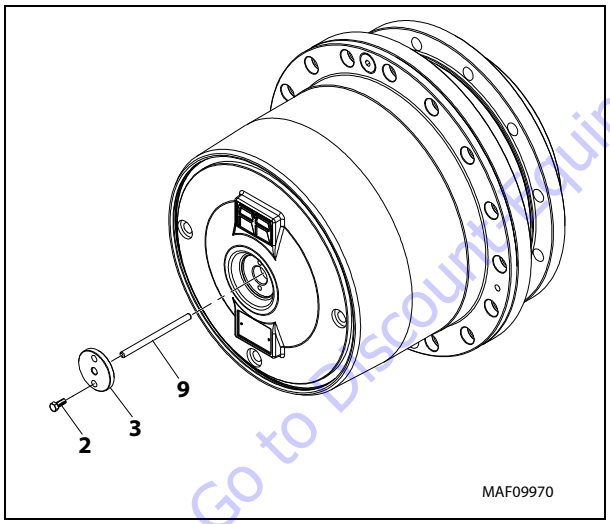
Figure 3-11. Drive Hub

Disassembly

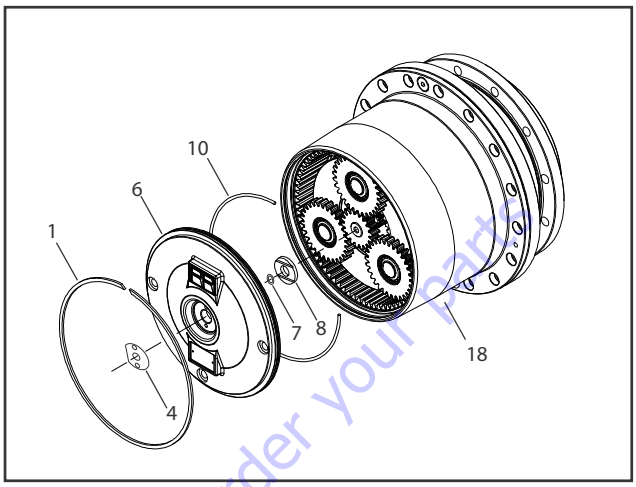
1. Remove plugs (5) and pour lubricant in a container. Reinstall plugs.
2. Remove six screws (56), motor flange(55), and O-Ring (54). Do not damage O-Ring.



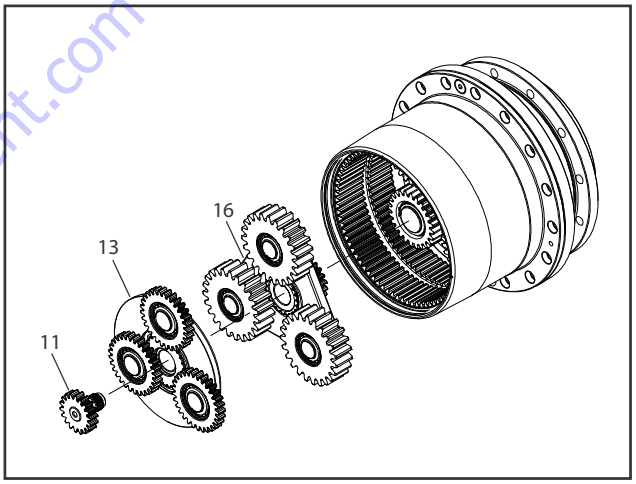
3. Remove two screws (2), cover (3), and pin (9).



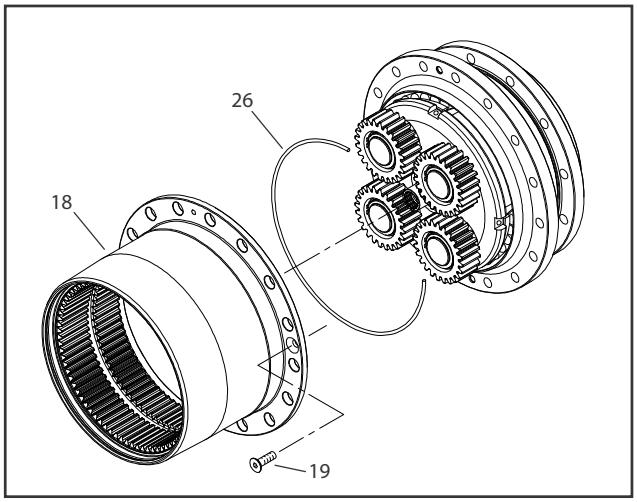
4. Remove, Ring (1), Cover (6), O-Ring (7), Shim (8) and O-Ring (10). Do not damage O-Rings. Check and remove Gasket (4) if damaged.



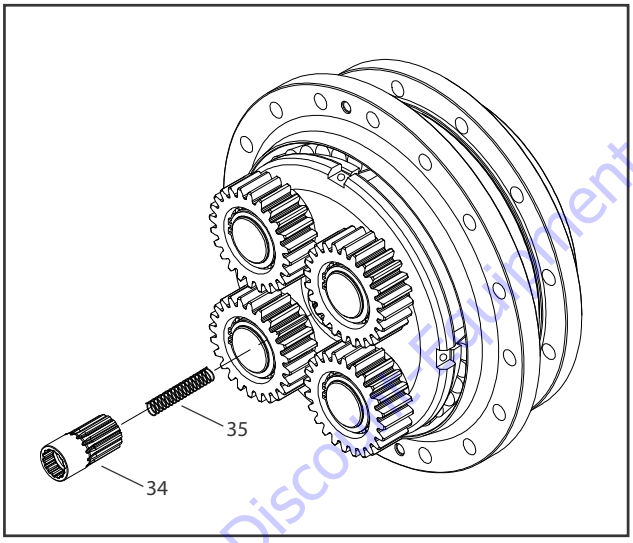
5. Remove Pinion (11), Gear Reduction Assembly (13) and Gear Reduction Assembly (16).



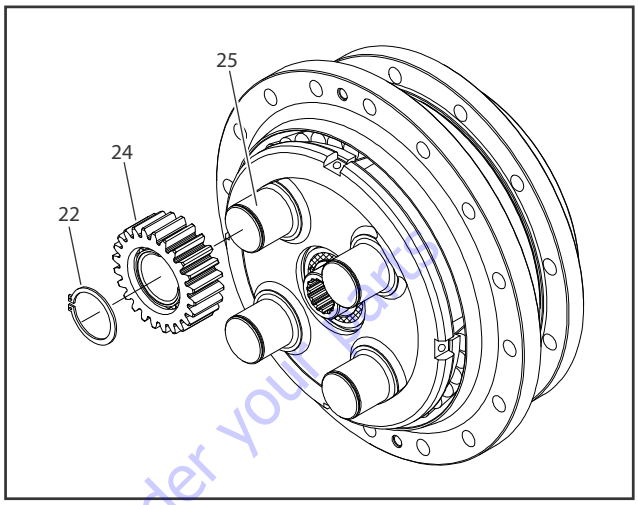
6. Remove two Screws (19), Hub Housing (18) and O-Ring (26). Do not damage O-Ring.



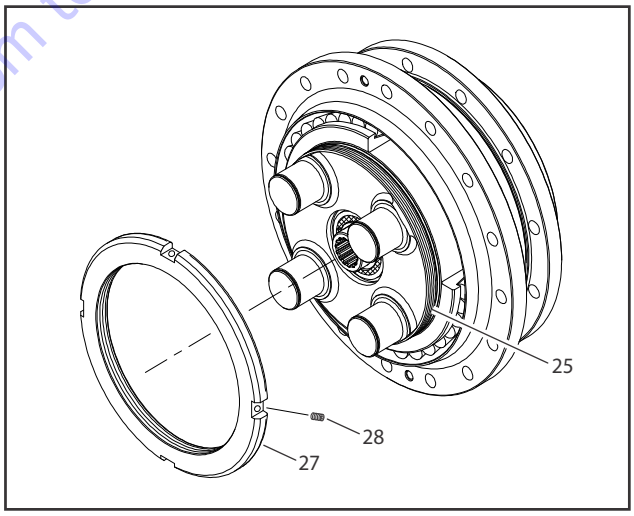
7. Remove Coupling (34) and Spring (35).



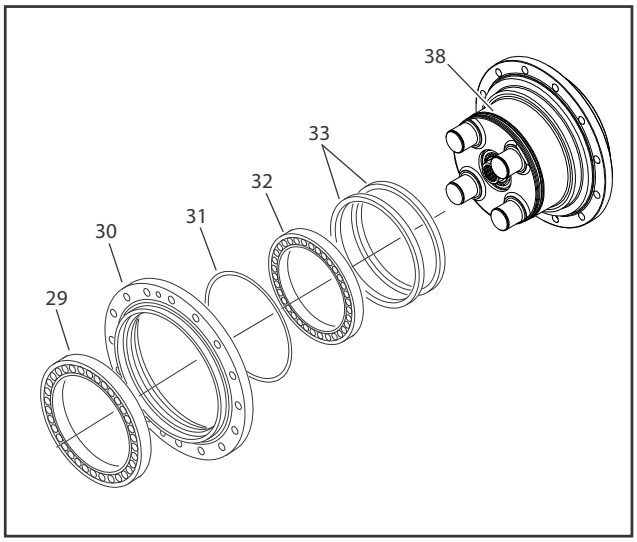
8. Remove three snap rings (22) and planet wheel (24) from spindles on Flange (25).



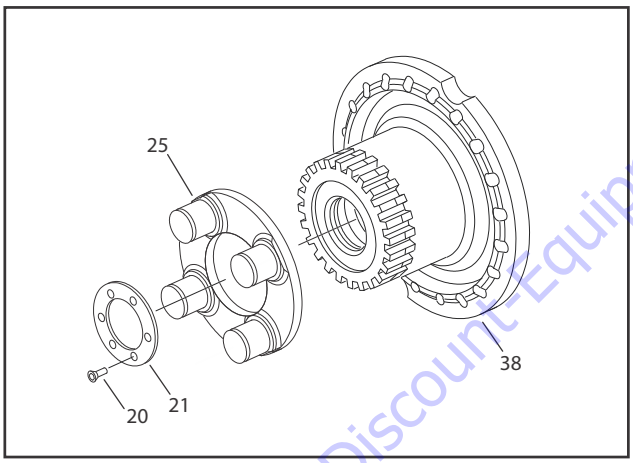
9. Remove two Set Screws (28) from Ring Nut (27). Remove Ring Nut from Flange (25).



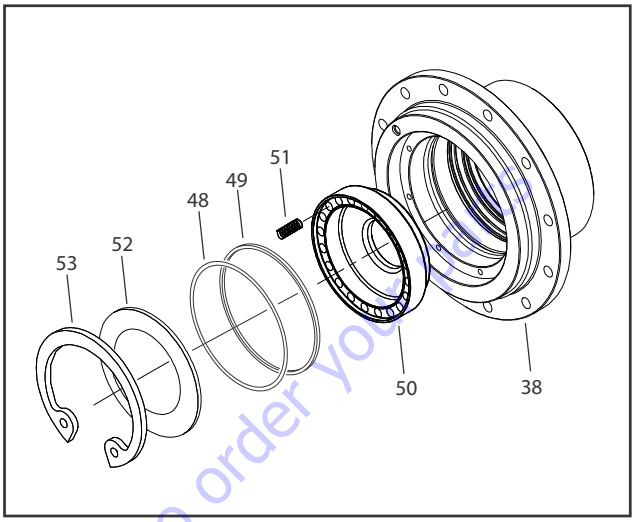
10. Remove Hub Support (30), Bearing (29), O-Ring (31), Bearing (32), and two Seals (33) from Axle (38).



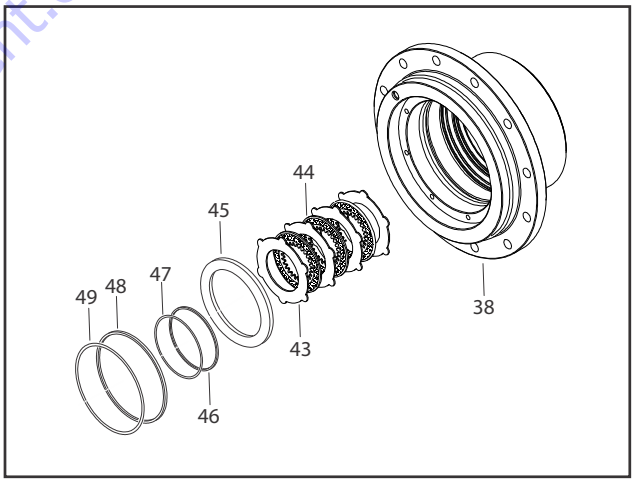
11. Remove six screws (20), Plug (21), and Flange (25) from Axle (38).,



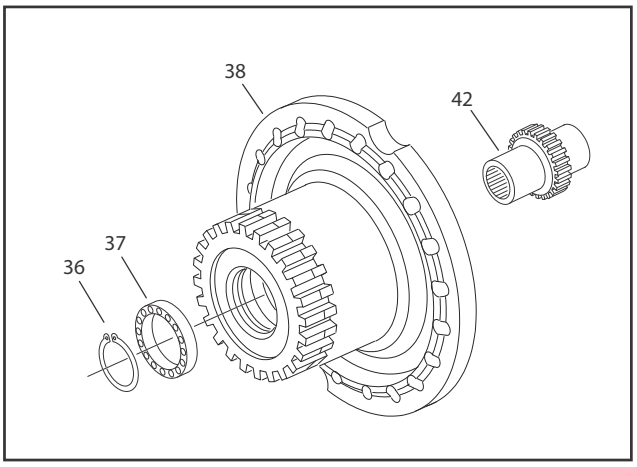
12. Remove Snap Ring (53), Spacer (52), Seal (48), O-Ring (49), and Brake Piston (50) from Axle (38). Remove five Brake Springs (51) from Brake Piston (50). Use compressed air to remove Brake Piston from Axle.



13. Remove O-Ring (49), Seal (48), O-Ring (47), Seal (46), Spacer (45), nine Brake Discs (44) and eight Iron Discs (43) from Axle (38).



14. Remove Split Ring (36), Input Shaft (42), and Bearing (37) from Axle (38).

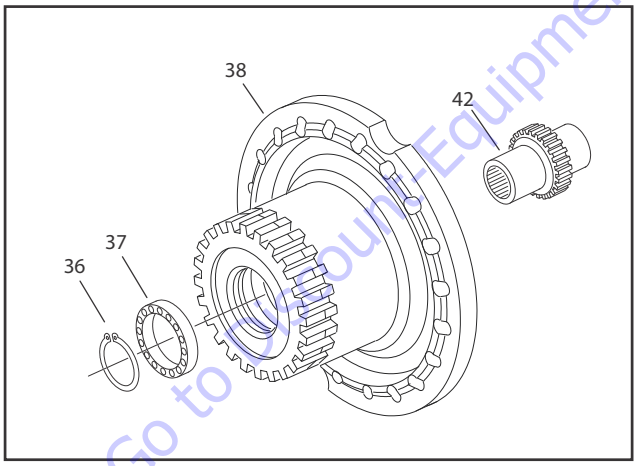


Assembly

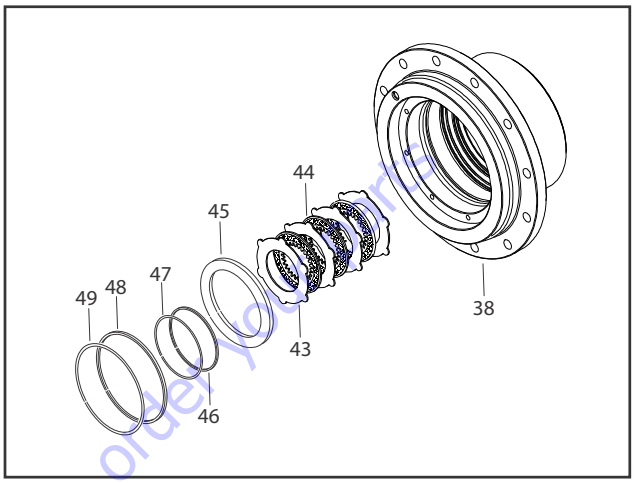
NOTE: *Thoroughly clean and coat all parts with grease before assembling.*

1. Check parts are free of damage, burrs, or other defects.

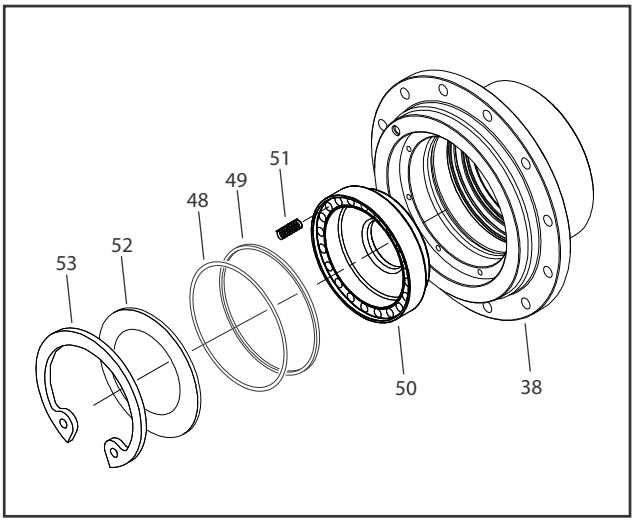
2. Install Bearing (37) in Axle (38). Install Input Shaft (42) in Axle and Bearing. Secure with Split Ring (36).



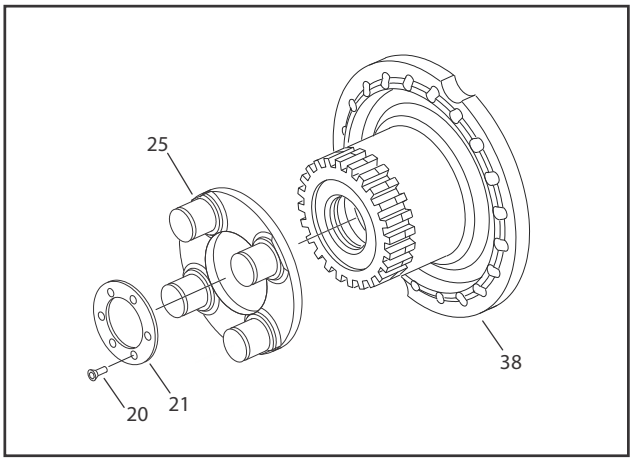
3. Install Seal (46), O-Ring (47), Seal (48), and O-Ring (49) in Axle (38). Starting with Brake Disk (44) alternate with Iron Disk (43) until a total of eight Brake Disks and nine Iron Discs are installed on Input Shaft (42 - not shown) in Axle.



4. Install Brake Piston (50) in Axle (38). Install five Brake Springs (51) Piston holes. Install O-Ring (49) and Seal (48) in Axle. Install Spacer (52) against Piston and secure with Split Ring (53).

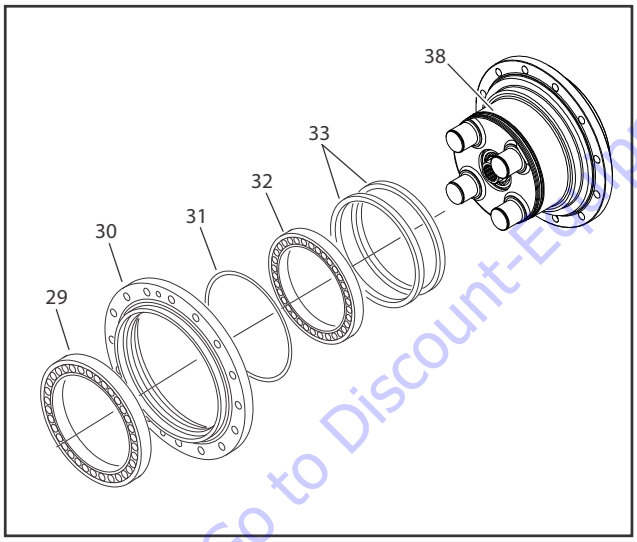


5. Install Flange (25) on Axle (38), with Plug (21) and six screws (20).



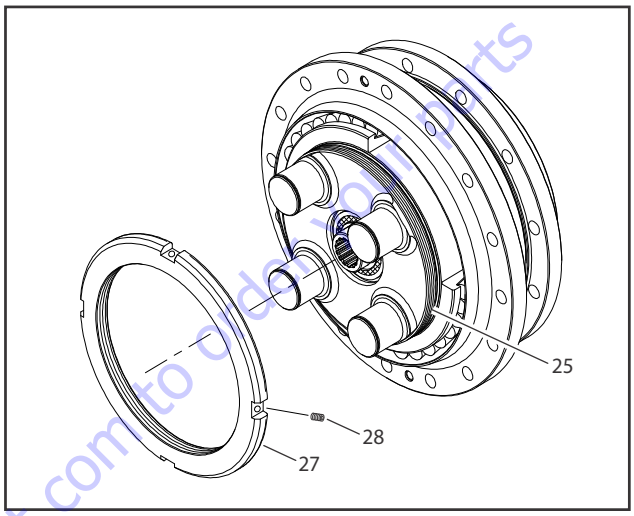
NOTE: *Flat surface of bearings face toward inside of Hub Support.*

6. Install two seals (33) on Axle (38). Install O-Ring (31) in Hub Support (30). Install Bearing (32) and Bearing (29) in Hub Support. Install assembled Hub Support on Axle as shown below.

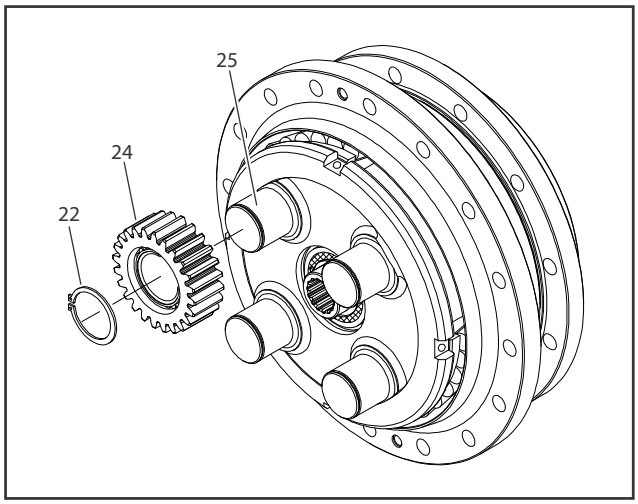


NOTE: *Install Ring Nut with convex part facing bearing.*

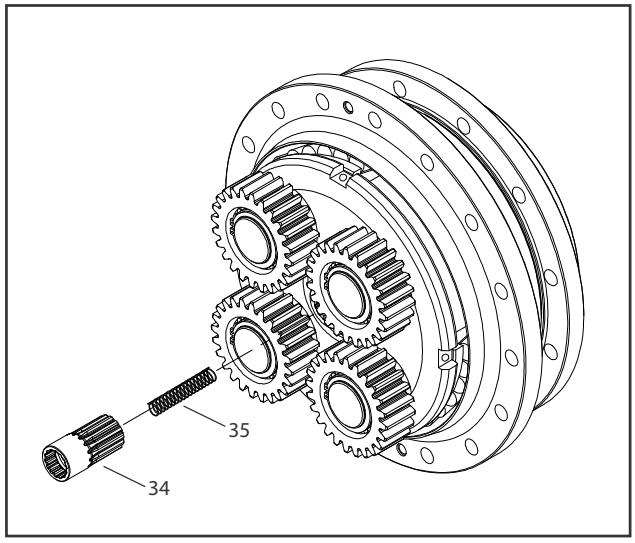
7. Install Ring Nut (27) on Flange (25). Prevent Flange from turning and torque Ring Nut to 295 ft-lb (400 Nm). Tighten and back off two times to completely seat bearings. Tighten to final torque of 221 ft-lb (300 Nm). Check roll torque with seal is within 7 - 11 ft-lb (10 - 15 Nm). Apply JLG Threadlocker or equivalent to two Setscrews (28). Install and torque Setscrews to 7.4 ft-lb (10 Nm).



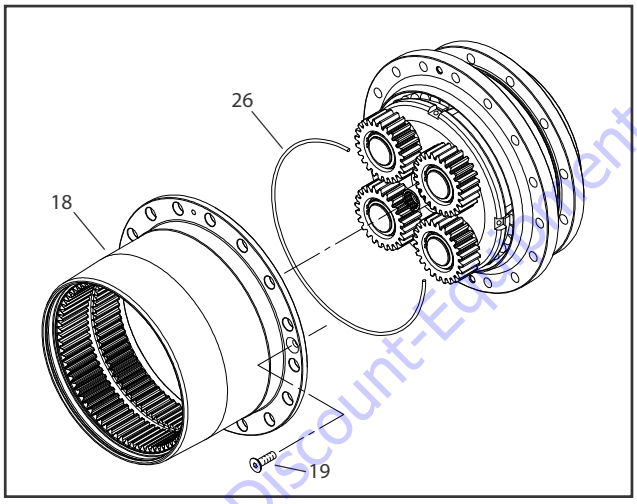
8. Install three planet wheel (24) on Flange spindles (25). Secure with Snap Rings (22). Lubricate planetary gear bearings.



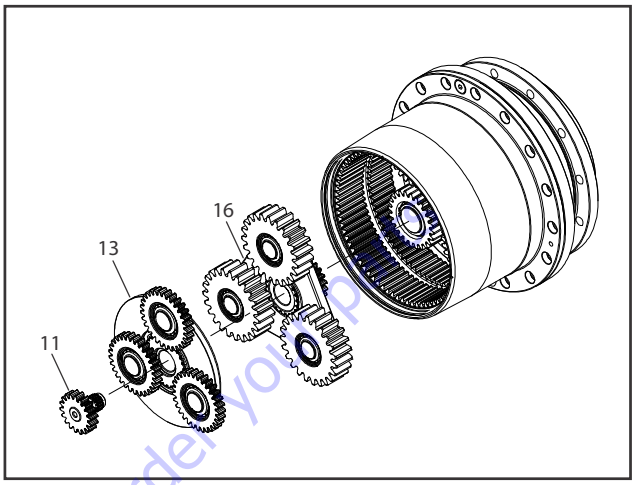
9. Install Spring (35) and Coupling (34).



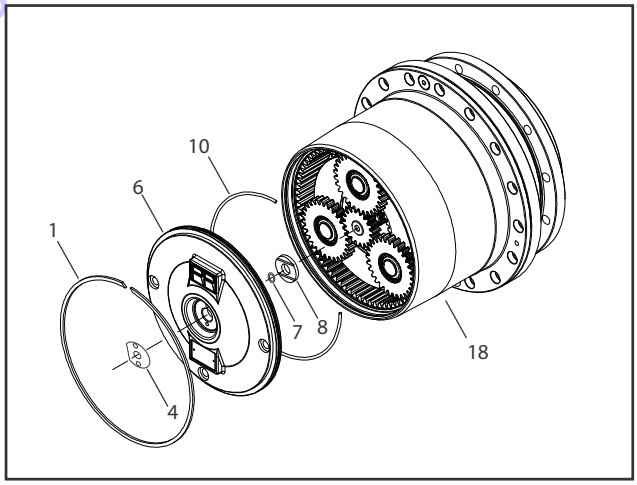
10. Install O-Ring (26). Install Planet wheel (18) with two Screws (19). Torque Screws to 36.8 ft-lb (50 Nm).



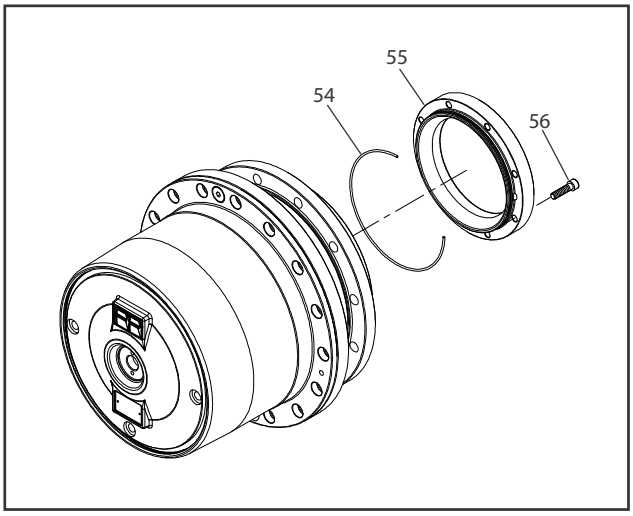
11. Install Gear Reduction Assembly (16), Gear Reduction Assembly (13), and Pinion (11) in Planetary Housing. Lubricate all bearings.



12. Install O-Ring (7) and O-Ring (10) in Cover (6). Liberally coat Shim (8) with grease and center on hole at center of Cover. Install Cover on Planetary Ring Assembly (18) and secure with Ring (1). Replace Gasket (4) as needed.

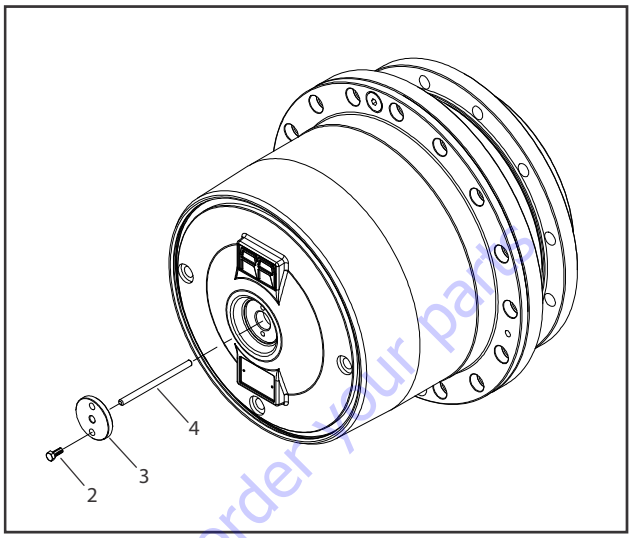


13. Install O-Ring (54) and Motor Support (55). Apply JLG Threadlocker or equivalent to six Screws (56). Install and torque Screws to 177 ft-lb (240 Nm).



14. Check completed Drive Hub assembly rotates freely.

15. Install Pin (9) and Cover (3). Secure with two Screws (2). Torque to 7 ft-lb (10 Nm).



⚠ WARNING

FAILURE TO PROPERLY FILL DRIVE HUB WITH OIL BEFORE OPERATION WILL RESULT IN EQUIPMENT FAILURE AND COULD CAUSE DEATH, SERIOUS INJURY, OR DAMAGE TO PROPERTY AND EQUIPMENT.

16. Follow oil change procedures and refill Drive Hub before operating equipment.

3.14 FREE WHEELING OPTION

Disengage Drive Motors & Brakes for Towing, etc. (Free Wheel)

1. Chock wheels.
2. Removing screws and invert cover so center tip presses on disengagement pin in hub. Reinstall screws.
3. Remove chocks.

Engage Drive Motors & Brakes (Normal Operation)

1. Chock wheels.
2. Removing screws and invert cover so center tip faces out. Reinstall screws.
3. Remove chocks.

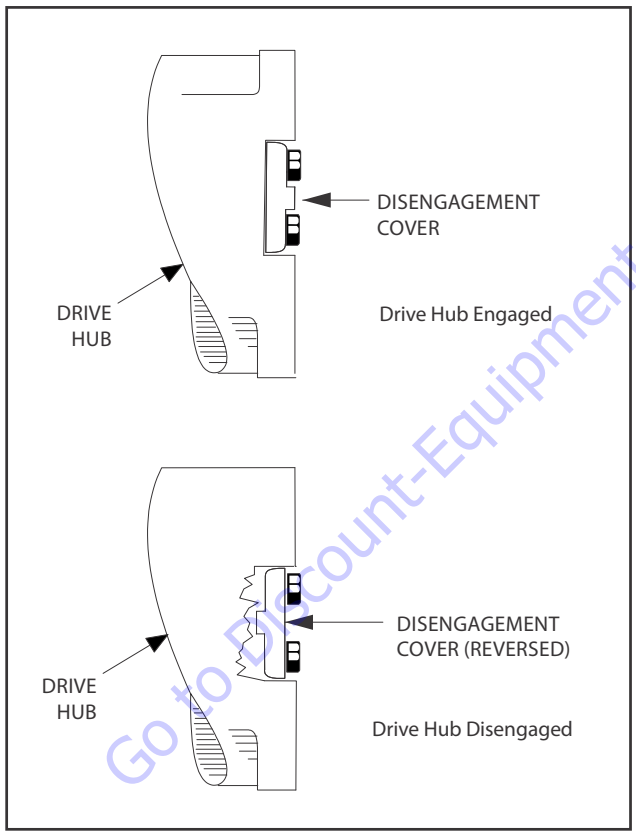


Figure 3-12. Disengaging Drive Hubs

3.15 GEAR HUB OIL SERVICE

Check Oil Level

1. Position hub as shown in Figure 3-13.
2. Remove Level Plug (3) and check oil is level with plug opening. Add oil as needed.
3. Reinstall plug.

Change Gear Hub Oil

NOTE: *Change oil when reduction gear is hot.*

1. Position hub as shown in Figure 3-13.
2. Place suitable tray underneath to collect waste oil.
3. Remove three plugs.
4. Flush gear hub with appropriate solvent.
5. Reinstall Drain Plug (2).
6. Fill with oil until level reaches level hole.
7. Reinstall Level Plug (3) and Fill Plug (1).l

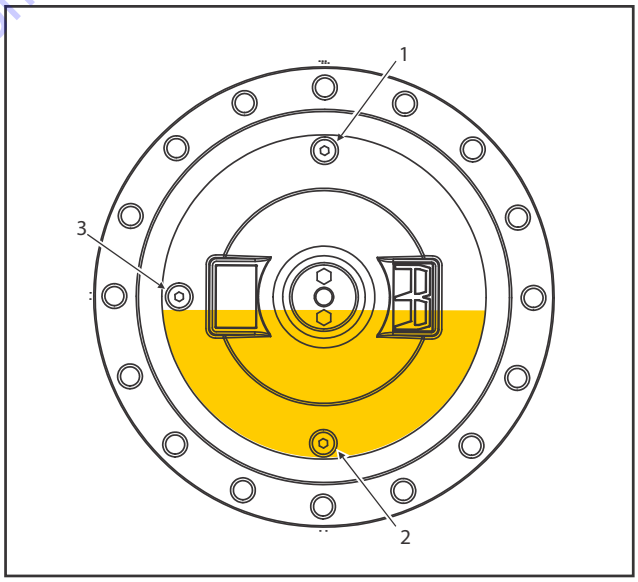
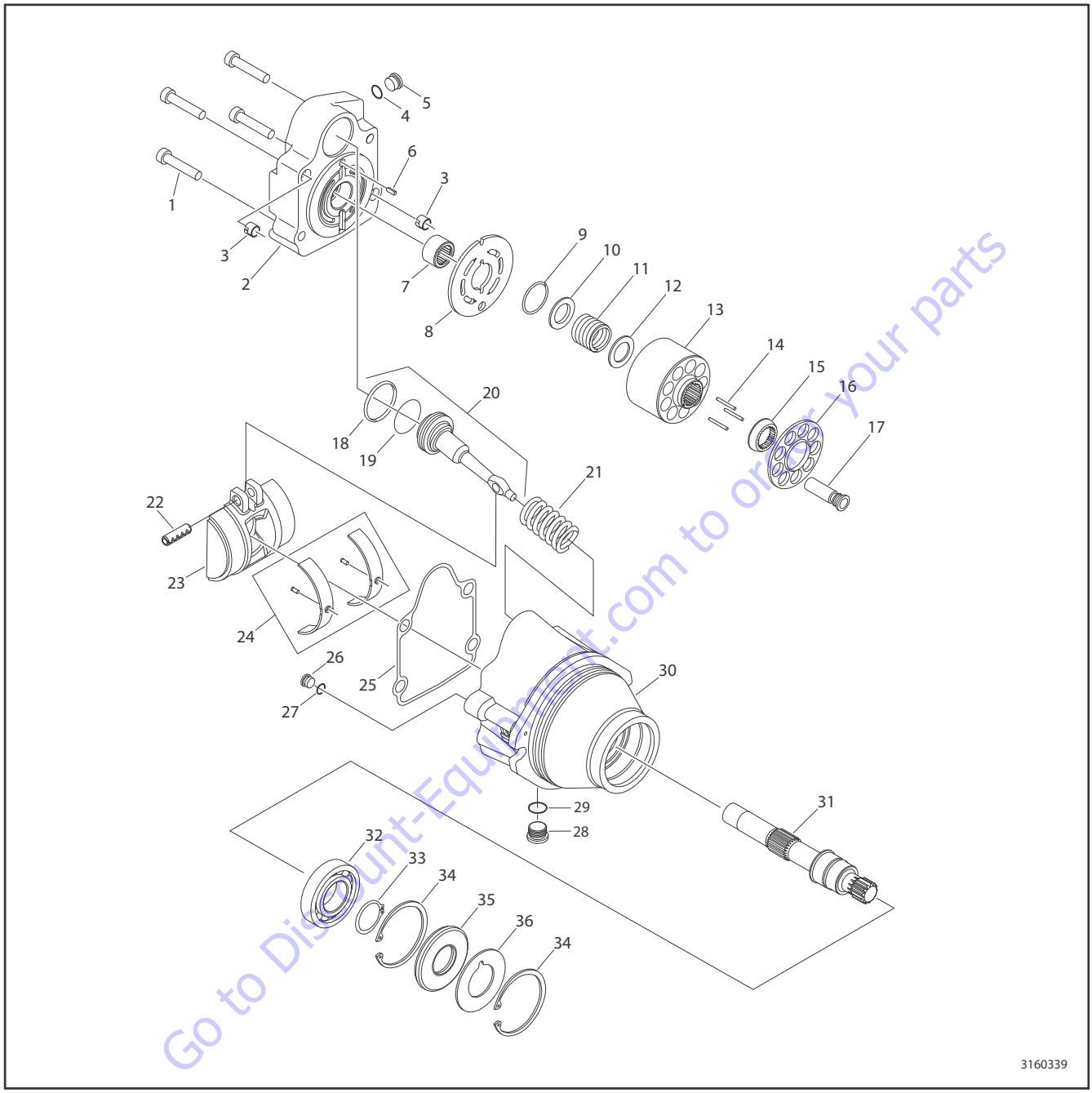


Figure 3-13. Gear Hub Oil Fill and Drain



1. Bolt
2. Motor End cap
3. Locating Pin
4. O-Ring
5. Plug
6. Dowel Pin
7. Needle Bearing
8. Valve Plate
9. Snap Ring
10. Spring Retainer
11. Spring
12. Washer
13. Cylinder Block
14. Slipper Pin
15. Guide
16. Slipper Retainer
17. Cylinder Piston
18. Piston Ring
19. O-Ring
20. Servo Piston
21. Spring
22. Pin
23. Swashplate
24. Bearing Kit
25. Gasket
26. Plug
27. O-Ring
28. Plug
29. O-Ring
30. Housing
31. Shaft
32. Bearing
33. Snap Ring
34. Snap Ring
35. Seal
36. Seal Support Washer

Figure 3-14. Drive Motor

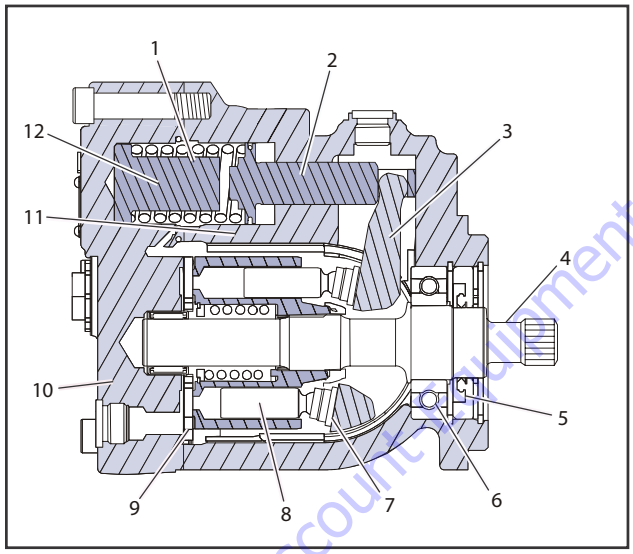
3.16 DRIVE MOTOR

NOTE: *Drive motor servicing is similar for all Series 45 hydraulic motors. The physical appearance of your motor may be slightly different than shown.*

Description

Drive motors are low to medium power, two-position axial piston motors incorporating an integral servo piston. They are designed for operation in open and closed circuit applications. The standard control is a direct acting single line hydraulic control. The integral servo piston controls motor displacement.

Motors are spring biased to maximum displacement and hydraulically shifted to minimum displacement. Minimum and maximum displacement can be set with fixed internal stops. The large diameter servo piston allows smooth acceleration and deceleration with relatively large circuit orificing.



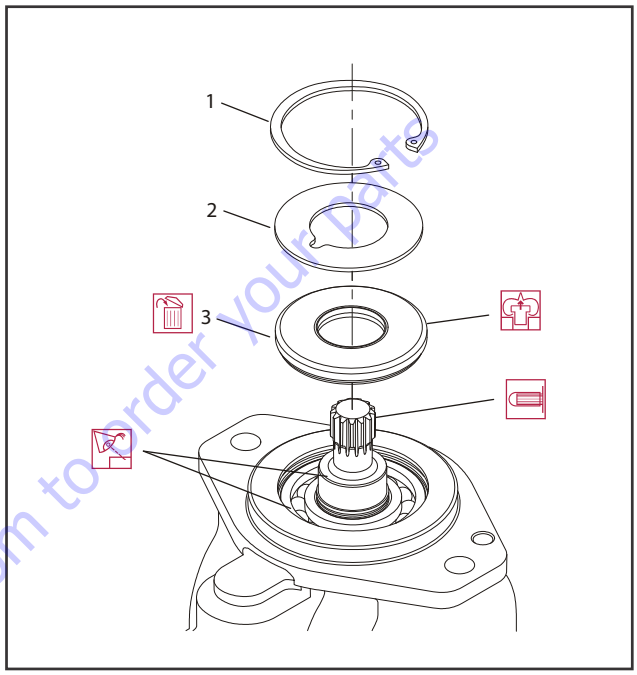
37. Bias Spring
38. Servo Piston
39. Swashplate
40. Output Shaft
41. Shaft Seal
42. Bearing
43. Slipper
44. Piston
45. Valve Plate
46. End Cap
47. Cylinder Block
48. Minimum Angle Stop

Figure 3-15. Drive Motor Cross Section

Shaft Seal Replacement

REMOVAL

1. Remove snap ring (1) retaining shaft seal, and support washer.



1. Snap Ring
2. Support Washer
3. Shaft Seal

Figure 3-16. Removing Shaft Seal

2. Remove support washer (2).
3. Carefully pry out shaft seal (3).

NOTE: *To avoid damaging shaft during removal, install a large sheet metal screw in chuck of a slide hammer. Drive screw in seal surface and use slide hammer to pull seal.*

4. Discard seal.

INSPECTION

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

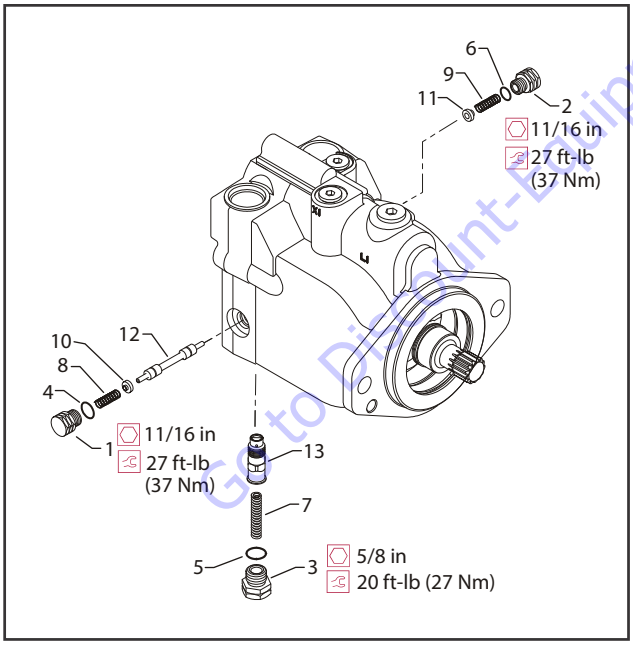
INSTALLATION

1. Cover shaft splines with an installation sleeve to protect shaft seal during installation.
2. Install new shaft seal with cupped side facing motor. Press seal into housing until it bottoms out. Press evenly to avoid binding and damaging the seal.
3. Install seal support washer.
4. Install snap ring.
5. Remove installation sleeve.

Loop Flushing Valve

REMOVAL

1. Using a 11/16 in internal hex wrench remove plug (1) and (2).



1. Plug
2. Plug
3. Plug
4. O-ring
5. O-ring
6. O-ring
7. Spring
8. Spring
9. Spring
10. Washer
11. Washer
12. Shift Spool
13. Orifice Poppet

Figure 3-17. Loop Flushing Spool

2. Using a 1/4 in hex wrench remove plug (3).
3. Remove O-rings (4, 5, and 6).
4. Using pliers, remove centering springs (7, 8, and 9).
5. Remove spring retaining washers (10 and 11).
6. Remove shift spool (12).
7. Remove orifice poppet (13).

INSPECTION

1. Inspect new O-rings and the sealing area for rust, wear, or contamination.
2. Check springs and poppet for wear.

INSTALLATION

1. Install orifice poppet (13).
2. Install shift spool (12).
3. Install spring retaining washers on springs (10 and 11).
4. Carefully install centering springs (7, 8, and 9).
5. Install new O-rings (6, 4, and 5).
6. Using a 1/4 in hex wrench torque plug (3) to 20 ft. lbs. (27 Nm).
7. Using a 11/16 in internal hex, torque plugs (2 and 1) to 27 ft.lbs. (37 Nm).

Troubleshooting

Table 3-2. Excessive Noise and/or Vibration

Item	Description	Action
Check oil level in reservoir and oil supply to motor.	Insufficient hydraulic fluid could lead to cavitation that would cause system noise.	Fill reservoir to proper level. Ensure oil supply to motor is adequate and lines are unobstructed.
Check for air in system.	Air trapped in system lines or motor could result in cavitation that would cause system noise.	Ensure all system lines and components are purged of air.
Inspect output shaft couplings.	A loose or incorrect shaft coupling will produce vibrations that could result in system noise.	Ensure correct coupling is used and that it fits properly on shaft.
Inspect output shaft alignment.	Misaligned shafts create excessive frictional vibration that could result in system noise.	Ensure shafts are properly aligned.
Hydraulic oil viscosity above limits.	Viscosity above acceptable limits will result in cavitation that would lead to system noise.	Replace hydraulic oil with appropriate fluid for operating conditions.

Table 3-3. System Operating Hot

Item	Description	Action
Check oil level in reservoir and oil supply to pump.	Insufficient amount of hydraulic fluid will not meet system cooling demands.	Fill reservoir to proper level.
Inspect heat exchanger, (if equipped).	If heat exchanger fails, or becomes obstructed, it may not meet system cooling demands.	Ensure heat exchanger is receiving adequate air flow and is in good operating condition. Repair or replace as necessary.
Check system relief valves.	If a system relief valve becomes unseated for an extended period of time or fails for any other reason, system could become overheated.	Repair or replace any malfunctioning relief valves as applicable and verify loads on machine are not excessive.

Table 3-4. Won't Shift or Slow to Start

Item	Description	Action
Check signal line to servo control port.	Obstructed or restricted flow through servo control signal lines could result in slow shift or no shift motor conditions.	Ensure signal lines are not obstructed or restricted and signal pressure is adequate to shift motor.
Check correct supply and drain orifices are properly installed and not obstructed.	Supply and drain orifices determine motor shift. The smaller the orifice, the longer the time it takes to shift the motor. Obstruction also increases shift times.	Ensure proper control orifices are installed in motor and not obstructed. Clean or replace as necessary.

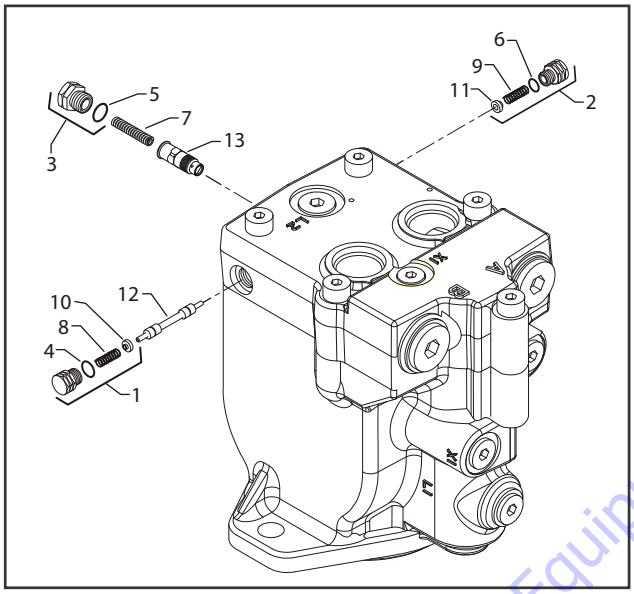
Disassembly

NOTE: *Removal of endcap voids warranty.*

During assembly, coat all moving parts with a film of clean hydraulic oil. This ensures parts will be lubricated during start-up.

Replace all O-Rings and gaskets.

It is recommended that all O-rings be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly.



1. Plug
2. Plug
3. Plug
4. O-ring
5. O-ring
6. O-ring
7. Spring
8. Spring
9. Spring
10. Washer
11. Washer
12. Shift Spool
13. Orifice Poppet

Figure 3-18. Loop Flushing Spool

1. Using a 11/16 in wrench remove plug (1) and (2).

2. Using a 5/8 in hex wrench remove plug (3).

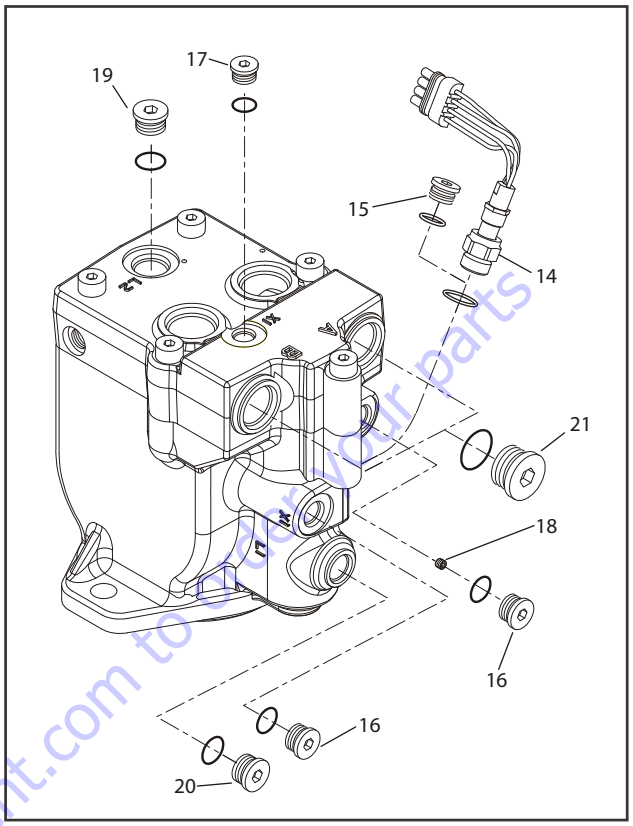
3. Remove O-rings (4, 5, and 6).

4. Using pliers, remove centering springs (7, 8, and 9).

5. Remove spring retaining washers (10 and 11).

6. Remove shift spool (12).

7. Remove orifice poppet (13).



14. Lock Nut
15. O-ring Plug
16. Control Line Plug
17. Control Line Plug
18. Cavity Plug
19. Drain Plug
20. Drain Plug
21. Work Port Plug

Figure 3-19. Plugs, Fittings, and Speed Sensor

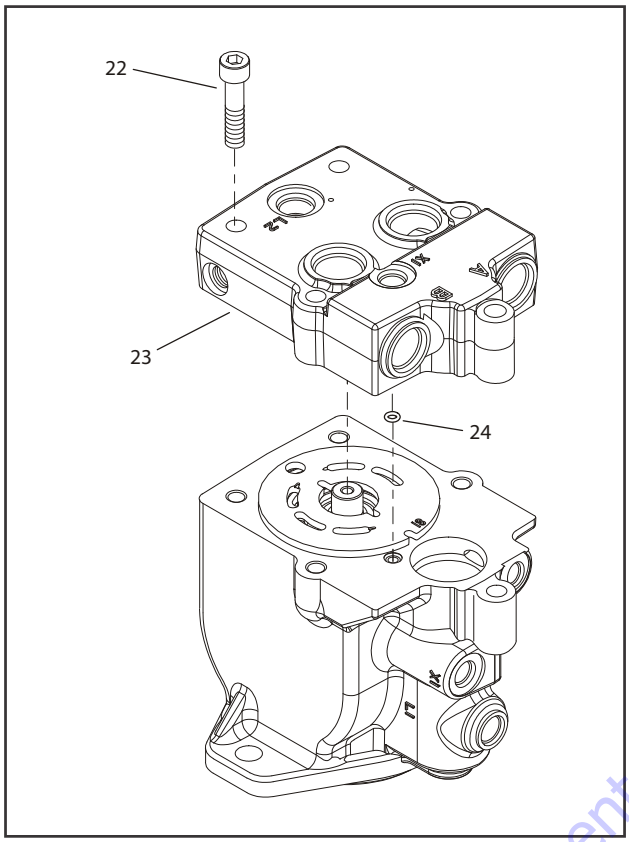
8. Remove all fittings from unit. Discard any O-rings on fittings.

9. Using an 11/16 inch hex wrench, loosen speed sensor lock nut (14) if equipped. Remove speed sensor using a Vi inch hex wrench. Units without speed sensor have an O-ring plug (15) installed in that location; remove it with a Va inch internal hex wrench.

10. Using a 1/4 inch internal hex wrench, remove control line plugs (16, 17). Discard O-rings. Using a 3 mm hex wrench, remove cavity plug (18, if equipped with two-line control) from X2 cavity.

11. Using a 5/16 inch internal hex wrench, remove drain plugs (19, 20). Discard O-rings.

12. Using a 9/16 inch internal hex wrench, remove work port plugs (21, if equipped with axial ports). Discard O-rings.

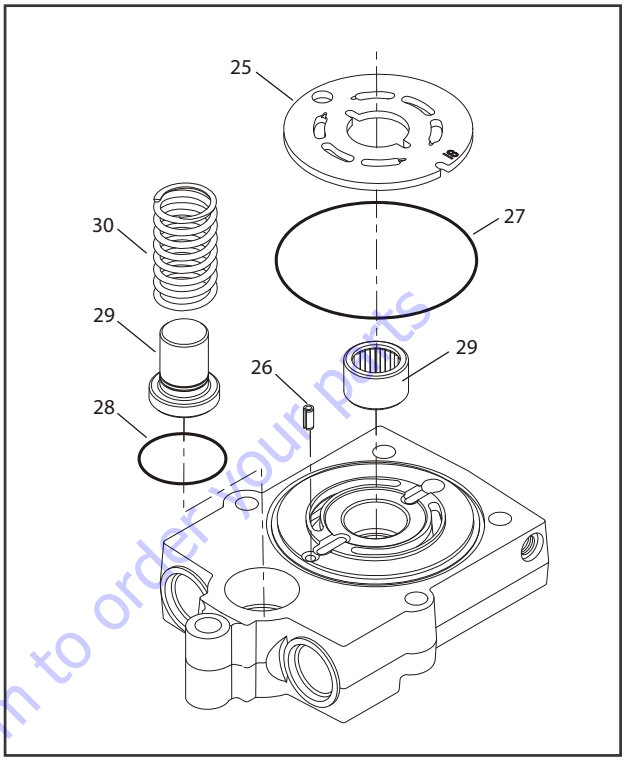


22. Screw
23. End Cap
24. O-ring

Figure 3-20. End Cap

13. Using an 8 mm internal hex wrench, remove endcap screws (22).

14. Remove endcap (23). Remove O-ring (24) from housing or endcap. When endcap screws are removed, pressure from servo spring will cause endcap to bind on shaft. Press down on portion of endcap covering servo piston and hold endcap level while removing.



25. Valve Plate
26. End Cap
27. O-ring
28. O-ring
29. Angle Stop
30. Servo Spring

Figure 3-21. Valve Plate & Rear Shaft Bearing

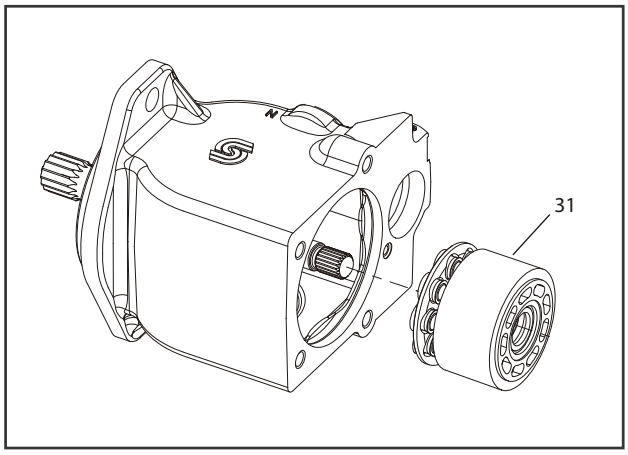
NOTICE

DO NOT SCRATCH VALVE PLATE SURFACE. DO NOT DRIVE BEARING PAST REAR SHAFT JOURNAL. BEARING MAY BECOME TRAPPED ON SHAFT AND DAMAGED.

15. Remove valve plate (25) and timing pin (26) from endcap. Each displacement has a unique valve plate. For identification, the last two digits of the valve plate part number are stamped on its surface.

16. Remove and discard O-rings (27, 28).

17. Remove rear shaft bearing from end cap with a bearing puller. Bearing may be difficult to remove with a puller. Try this as an alternative: Pack bearing cavity with heavy grease. After shaft is removed, insert it into bearing cavity and tap splined end lightly with a soft mallet. Grease will force the bearing out. Remove minimum angle stop (29) and servo spring (30) from housing.



31. Cylinder Kit Assembly

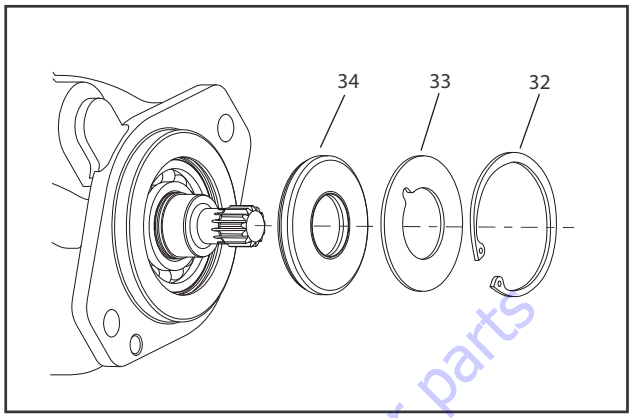
Figure 3-22. Cylinder Kit

18. Turn housing on its side and remove cylinder kit assembly (31). Set assembly aside. Do not to scratch running surface.

NOTE: *Grooves on surface of cylinder kit identify its displacement:*

Table 3-5. Displacement Identifiers

# of Grooves	Frame L	Frame K
1	25	38
2	30	45
3	35	--



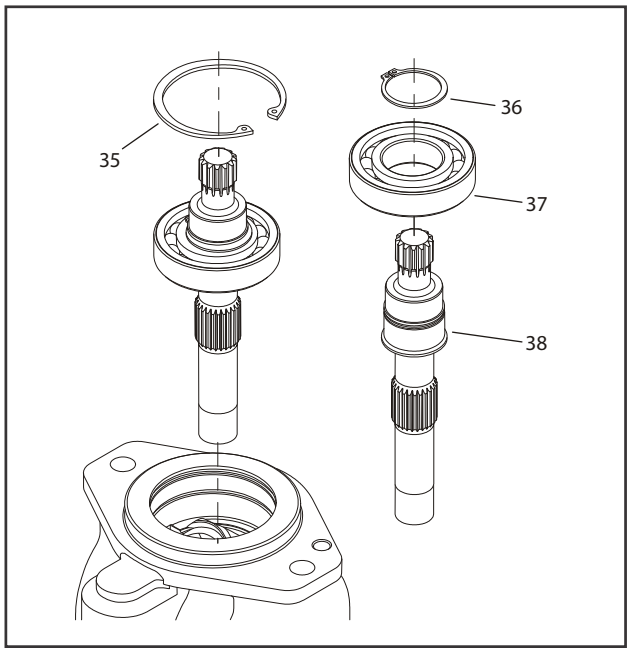
32. Snap Ring
33. Support Washer
34. Shaft Seal

Figure 3-23. Shaft Seal

NOTICE

TO AVOID DAMAGING SHAFT DURING SEAL REMOVAL, INSTALL A LARGE SHEET METAL SCREW IN CHUCK OF SLIDE HAMMER. DRIVE SCREW INTO SEAL SURFACE AND USE SLIDE HAMMER TO PULL SEAL.

19. Turn housing over and remove snap ring (32) retaining shaft seal and support washer. Remove support washer (33) and carefully pry out shaft seal (34). Discard seal.

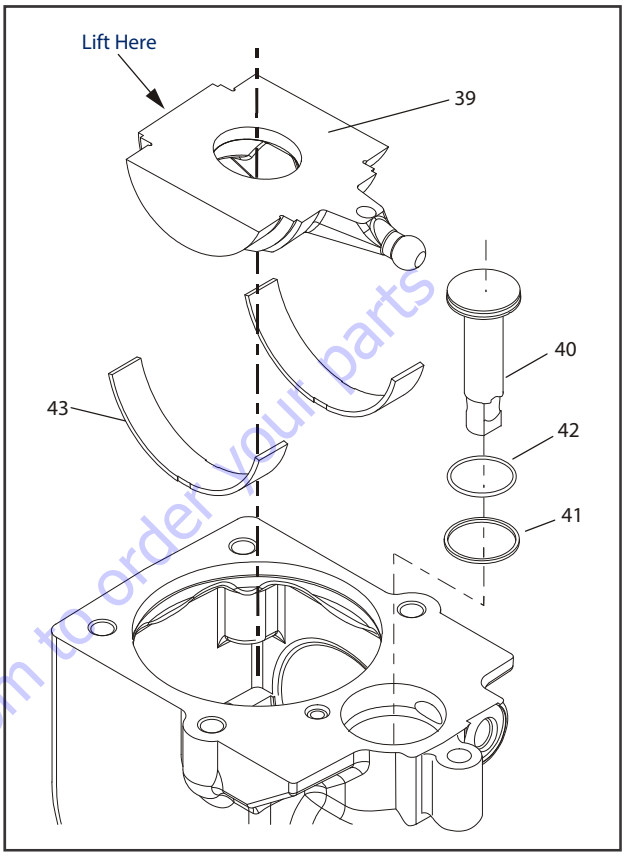


35. Inner Snap Ring
36. Snap Ring
37. Bearing
38. Shaft

Figure 3-24. Shaft & Front Bearing

20. Remove inner snap ring (35) and shaft/bearing assembly.

21. Remove snap-ring (36) retaining shaft front bearing. Pull bearing (37) off shaft (38).



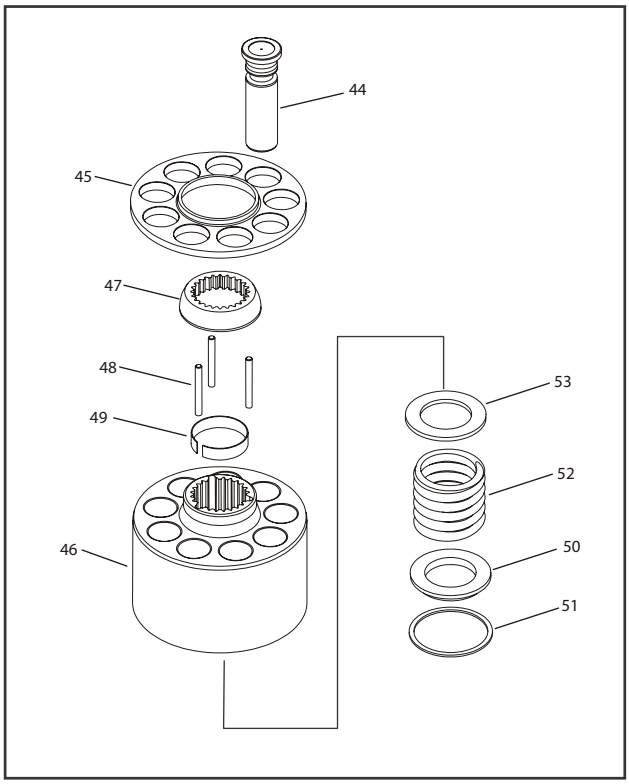
39. Swashplate
40. Servo Piston
41. Piston Seal
42. O-ring
43. Journal Bearings

Figure 3-25. Swash Plate & Servo Piston

22. Turn housing over and remove swashplate (39) by lifting on end opposite servo lever.

23. Remove servo piston (40). Remove piston seal (41) and O-ring (42) from servo piston. Discard seal and O-ring.

24. Remove journal bearings (43) from housing. Note location and orientation of each bearing for reassembly.



44. Piston
45. Slipper Retainer
46. Cylinder Block
47. Ball Guide
48. Holddown Pins
49. Retaining Ring
50. Block Spring Washer
51. Spiral Retaining Ring
52. Block Spring
53. Inner Block Spring Washer

Figure 3-26. Cylinder Kit Disassembly

25. Remove pistons (44) and slipper retainer (45) from cylinder block (46).

NOTE: *Pistons are not selectively fitted. However, units with high hourly usage may develop wear patterns. Number pistons and bores for reassembly if they are to be reused.*

26. Remove ball guide (47), hold-down pins (48), and retaining ring (49) from cylinder block.

NOTE: *Most repairs do not require block spring removal. Perform this procedure only if you suspect problems with the block spring.*

⚠ WARNING

RISK OF PERSONAL INJURY: COMPRESSING THE BLOCK SPRING REQUIRES FORCE OF ABOUT 80 TO 90 LBF (350 TO 400 N). USE A PRESS SUFFICIENT TO MAINTAIN THIS FORCE WITH REASONABLE EFFORT. ENSURE THE SPRING IS SECURE BEFORE ATTEMPTING TO REMOVE THE SPIRAL RETAINING RING. RELEASE THE PRESSURE SLOWLY AFTER THE RETAINING RING IS REMOVED.

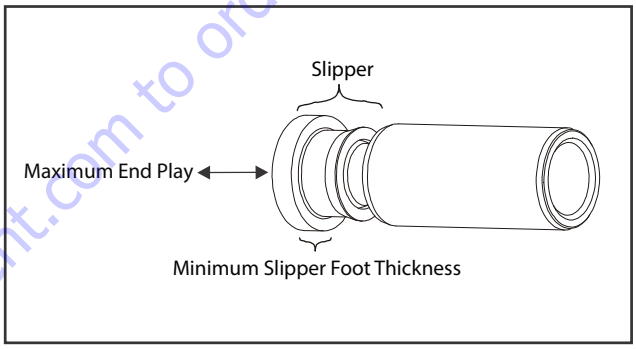
27. Turn block over. Using a press, apply pressure on block spring washer (50) to compress block spring. Compress spring enough to safely remove spiral retaining ring (51). While maintaining pressure, unwind spiral retaining ring (51). Carefully release pressure and remove outer block spring washer (50), block spring (52), and inner block spring washer (53) from cylinder block.

Inspection

After disassembly, wash all parts (including end-cap and housing) thoroughly with clean solvent and allow to air dry. Blow out oil passages in housing and endcap with compressed air. Conduct inspection in a clean area and keep all parts free from contamination. Clean and dry parts again after any rework or resurfacing.

PISTON

Inspect pistons for damage and discoloration. Discolored pistons may indicate excessive heat; do not reuse.



SLIPPERS

Inspect slipper running surfaces. Replace piston assemblies with scored or excessively rounded slipper edges. Measure slipper foot thickness. Replace piston assemblies with excessively worn slippers. Check slipper axial end-play. Replace piston assemblies with excessive end-play.

Table 3-6. Slipper Foot Thickness & End Play

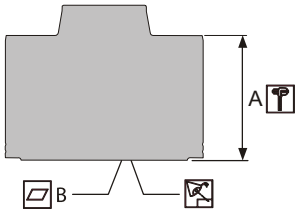
Measurement	L Frame	K Frame
Slipper Foot Thickness	2.71 mm (0.11 in.)	4.07 mm (0.16 in.)
Piston/Slipper End Play	0.15 mm (0.006 in.)	

CYLINDER BLOCK

Measure cylinder block height. Replace blocks worn beyond minimum height specification. Inspect cylinder block running surface. Replace or resurface worn or scratched blocks. Blocks may be resurfaced to specifications shown in the drawing, provided resurfacing will not reduce block height below minimum specification. Table 3-7, Cylinder Block Measurements.

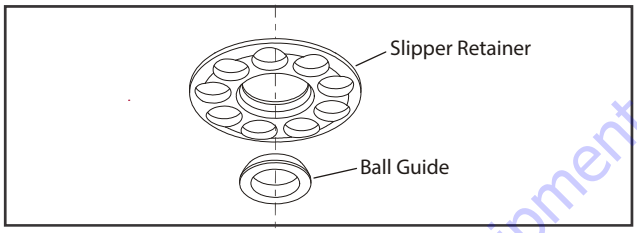
Table 3-7. Cylinder Block Measurements

Measurement	L25	L30	L35	K38	K45
Minimum Cylinder Block Height (A)	50.8 (2.00)	50.8 (2.00)	50.8 (2.00)	54.4 (2.14)	54.4 (2.14)
Cylinder Block Surface Flatness	0.002 (0.0000079)	0.002 (0.0000079)	0.002 (0.0000079)	0.002 (0.0000079)	0.002 (0.0000079)



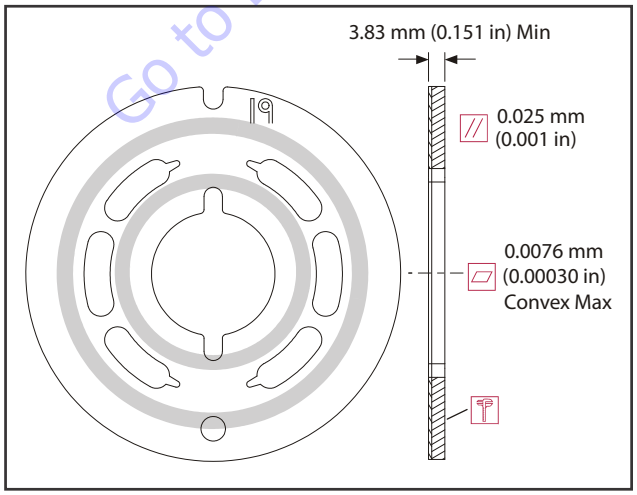
BALL GUIDE AND SLIPPER RETAINER

Inspect ball guide and slipper retainer for damage, discoloration, or excessive wear. A discolored ball guide or slipper retainer indicates excessive heat. Do not reuse.



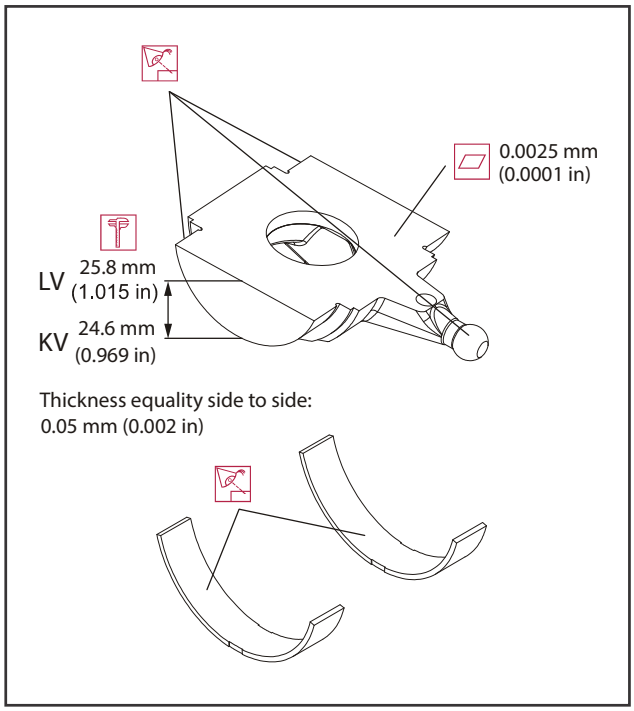
VALVE PLATE

Valve Plate condition is critical to efficiency of the motor. Inspect valve plate surfaces carefully for excessive wear, grooves, or scratches. Replace or resurface grooved or scratched valve plates. Measure valve plate thickness and replace if worn beyond minimum specification. Valve plates may be resurfaced, provided resurfacing will not reduce thickness below minimum specification.



SWASHPLATE AND JOURNAL BEARINGS

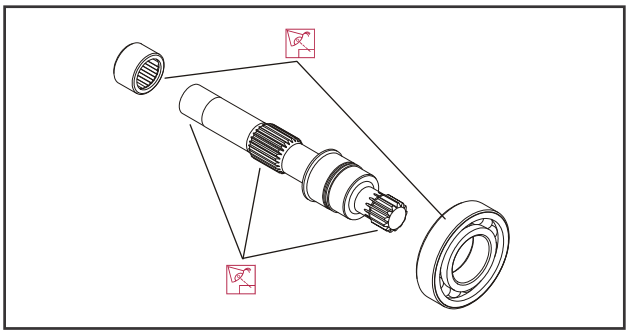
Inspect running face, servo ball-joint, and swashplate journal surfaces for damage or excessive wear. Some material transfer may appear on these surfaces and is acceptable if surface condition meets specifications shown. Measure swashplate thickness from journals running face. Replace swashplate if damaged or worn beyond minimum specification. Replace swashplate if difference in thickness from one side to the other exceeds specification.



Inspect journal bearings for damage or excessive wear. Replace journal bearings if scratched, warped, or excessively worn. Polymer wear layer must be smooth and intact.

SHAFT BEARINGS

Inspect bearings for excessive wear or contamination. Rotate bearings while feeling for uneven movement. Bearings should spin smoothly and freely. Replace bearings that appear worn or do not rotate smoothly.

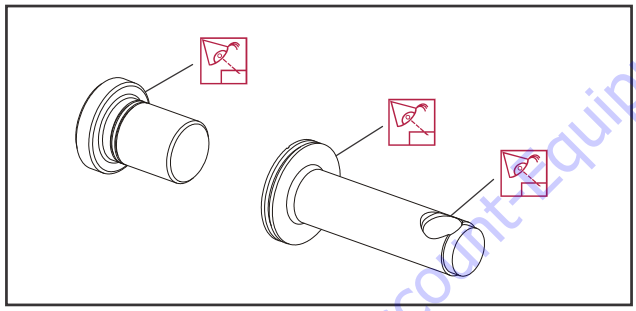


SHAFT

Inspect motor shaft for damage or excessive wear on output and block splines. Inspect bearing surfaces and sealing surface. Replace shafts with damaged or excessively worn splines, bearing surfaces, or sealing surfaces.

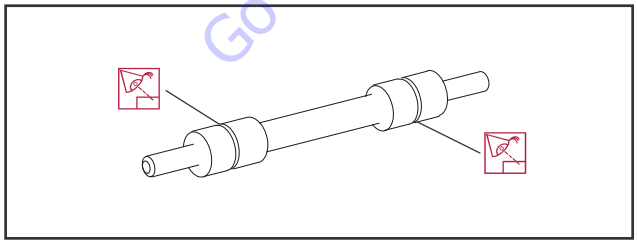
SERVO PISTON AND MINIMUM ANGLE STOP

Inspect minimum angle stop, servo piston head, and servo piston ball-socket for damage or excessive wear. Replace as required.



LOOP FLUSHING SPOOL

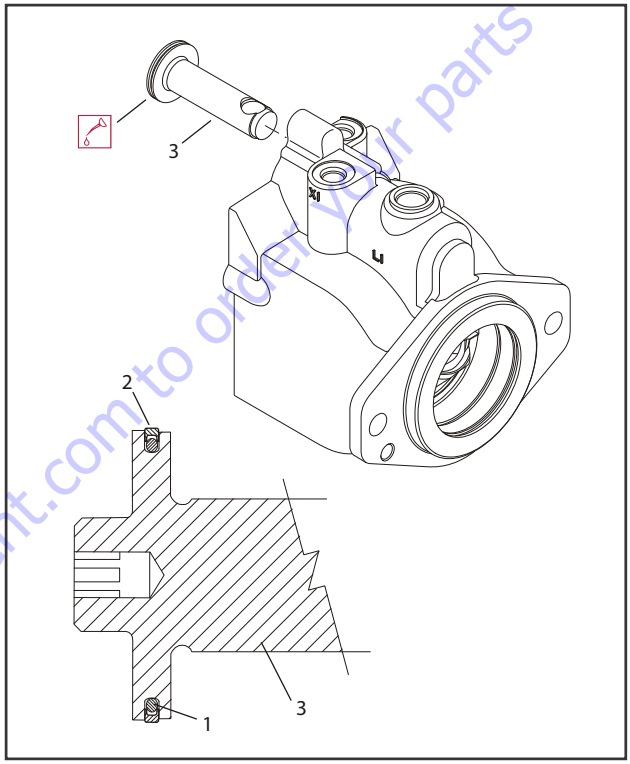
Inspect loop flushing spool for cracks or damage. Replace as required.



Assembly

1. Install new O-ring (1) and piston seal (2) to servo piston (3). Install piston seal over O-ring.

NOTE: *Installing piston seal stretches it, making it difficult to install servo piston in its bore. Allow 30 minutes for seal to relax after installation. To speed up seal relaxation, compress seal by installing piston head in end-cap servo cavity and let it stand for at least five minutes.*



1. O-ring
2. Piston Seal
3. Servo Piston

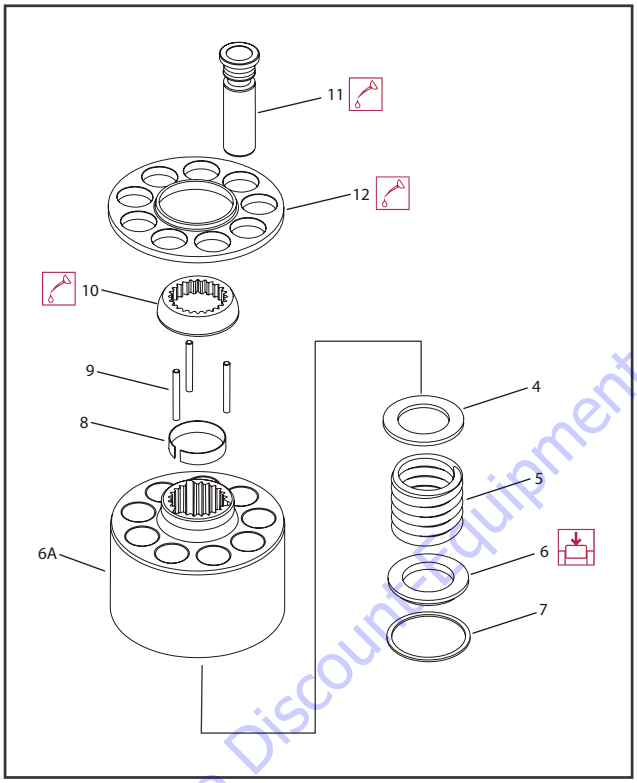
Figure 3-27. Servo Piston

2. After piston seal has relaxed, lubricate and install servo piston in housing bore. Align piston with ball socket facing inside of housing.

⚠ CAUTION

RISK OF PERSONAL INJURY: COMPRESSING THE BLOCK SPRING REQUIRES ABOUT 80 TO 90 LBF (350 TO 400 N) OF FORCE. USE A PRESS SUFFICIENT TO MAINTAIN THIS FORCE WITH REASONABLE EFFORT. ENSURE SPRING IS SECURE BEFORE ATTEMPTING TO INSTALL THE SPIRAL RETAINING RING. RELEASE PRESSURE SLOWLY AFTER RETAINING RING IS INSTALLED.

3. Install inner block spring washer (4), block spring (5), and outer washer (6) in cylinder block (6A). Using a press, compress block spring enough to expose retaining ring groove. Wind spiral retaining ring (7) in cylinder block groove.

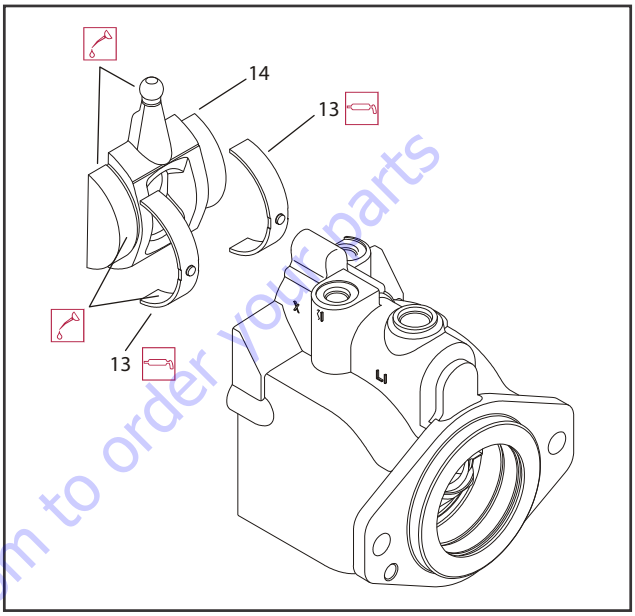


4. Block Spring Washer
5. Block Spring
6. Outer Washer
6A. Cylinder Block
7. Spiral Retaining Ring
8. Retaining Ring
9. Holddown Pins
10. Ball Guide
11. Piston
12. Slipper Retainer

4. Turn block over and install retaining ring (8), hold-down pins (9), and ball guide (10) to cylinder block.

5. Install pistons (11) to slipper retainer (12). Install piston/retainer assembly in cylinder block. Ensure concave surface of retainer seats on ball guide. If reusing pistons, install them in original block bores. Lubricate pistons, slippers, retainer, and ball guide before assembly. Set cylinder kit aside on a clean surface until needed.

6. Install journal bearings (13) in housing seats. Use assembly grease to keep bearings seated during assembly. Ensure locating nubs drop into seat cavities. If reusing bearings, install in original location and orientation. Lubricate journal bearings.

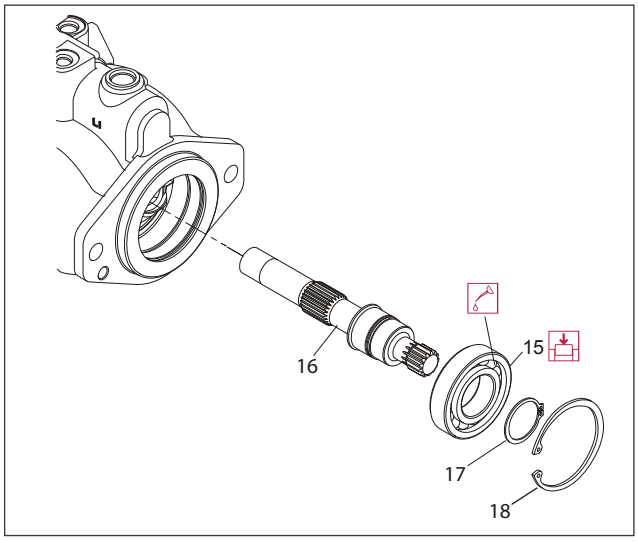


13. Journal Bearings
14. Swash Plate

Figure 3-28. Swash Plate and Journal Bearing

7. Install swashplate (14) in housing. Tilt swashplate and guide servo lever ball into its socket in the servo piston rod. Ensure swashplate seats into journal bearings and moves freely. Lubricate running surface of swashplate.

8. Press front shaft bearing (15) on shaft (16). Press bearing on shaft with lettering facing out. Lubricate bearing rollers. Install snap-ring (17) on shaft.

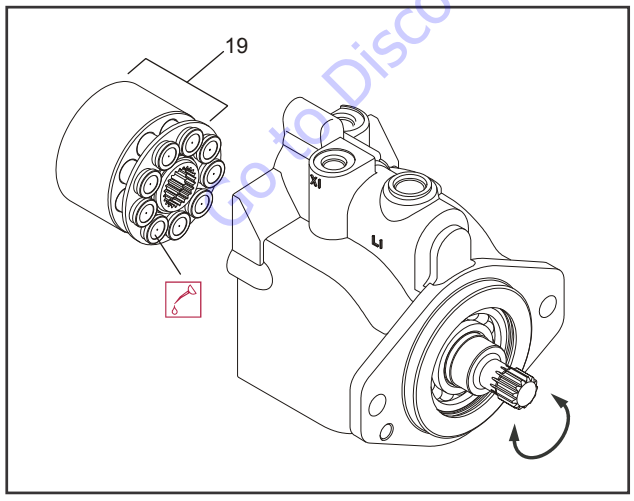


15. Front Shaft Bearing
16. Shaft
17. Snap Ring
18. Snap Ring

Figure 3-29. Shaft and Front Bearing

9. While holding swashplate in place, turn housing on its side. Install the install shaft/bearing assembly into housing from flange end. Install snap-ring (18).

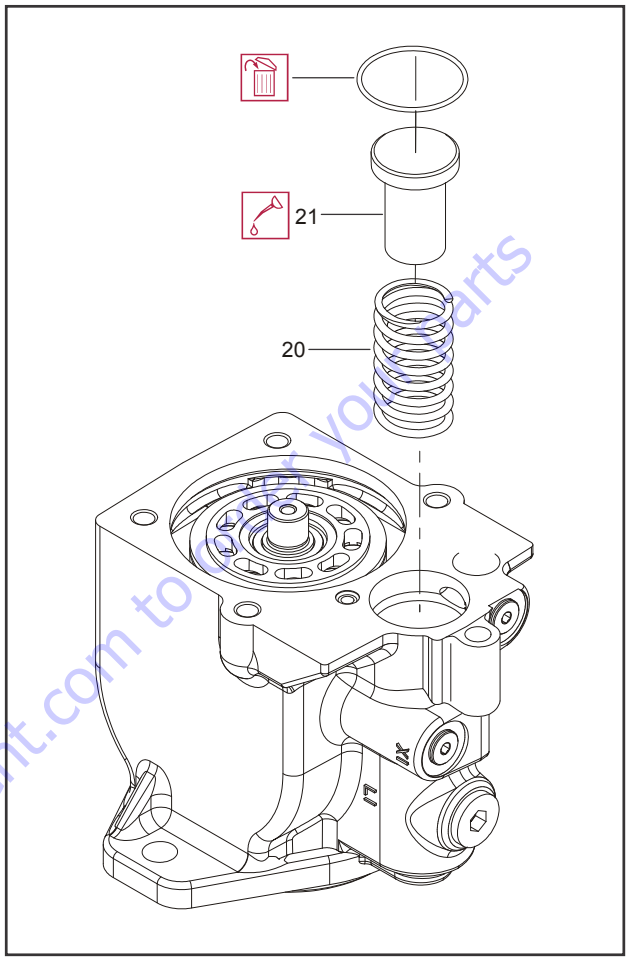
10. Verify swashplate and bearings are properly seated. Install cylinder kit (19) on shaft. Install with slippers facing swashplate. Rock the shaft to align block splines and slide cylinder kit into place. Orient motor with shaft pointing downward and verify cylinder kit, swashplate, journal bearings, and servo piston are properly installed.



19. Cylinder Kit

Figure 3-30. Cylinder Kit Installation

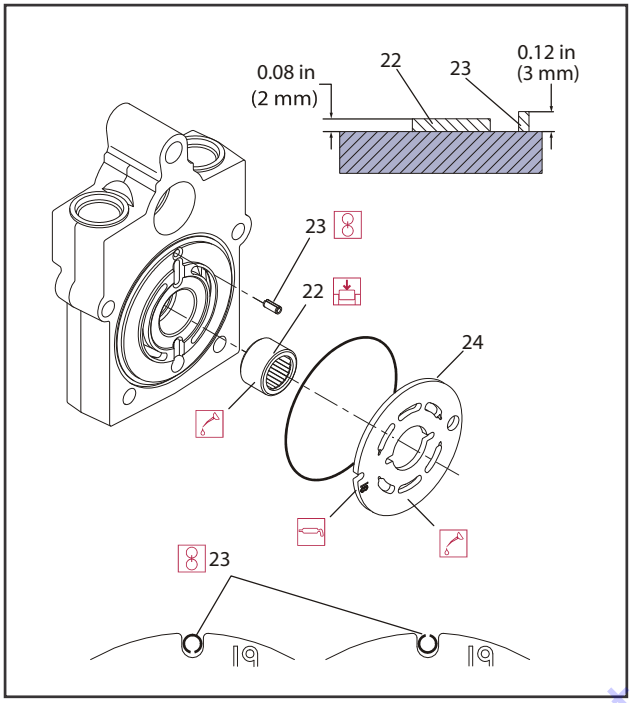
11. Lubricate and install servo spring (20) and minimum angle stop (21) in housing bore.



20. Servo Spring
21. Minimum Angle Stop

Figure 3-31. Servo Spring and Minimum Angle Stop

12. Press rear shaft bearing (22) in endcap. Install bearing with letters facing out. Press until bearing surface is 0.08 ±0.01 in (2 ±0.25 mm) above endcap surface.



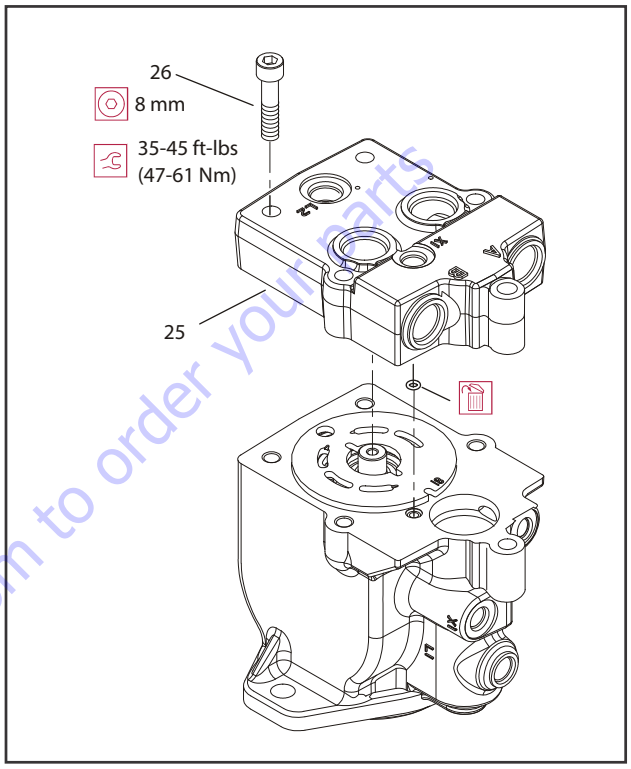
22. Rear Shaft Bearing
23. Timing Pin
24. Valve Plate

Figure 3-32. Valve Plate and Rear Bearing

13. Install timing pin (23) into its bore in the endcap. Install pin with groove facing toward or away from shaft. Press pin until end protrudes 0.12 ±0.01 in (3 ±0.25 mm) above endcap surface.

14. Install valve plate (24) on endcap. Install valve plate with yellow surface toward cylinder block. Align slot in valve plate with timing pin. Apply a liberal coat of assembly grease to endcap side of valve plate to keep it in place during installation.

15. Install endcap (25) on housing with endcap screws (26). Ensure endcap will properly seat to housing without interference. Improper assembly of internal components may prevent endcap from seating properly. Ensure O-rings seat properly when installing endcap.



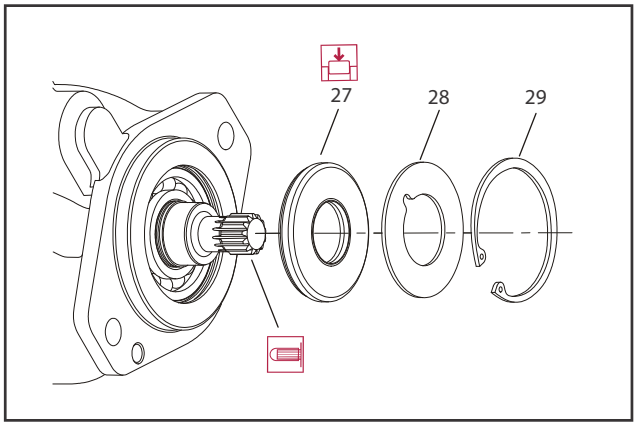
25. End Cap
26. Screw

Figure 3-33. End Cap

16. Using an 8 mm internal hex wrench, tighten endcap screws. Tighten screws in opposite corners slowly and evenly to compress the servo spring and properly seat the endcap. Torque endcap screws 35-45 ft-lb (47-61 Nm).

17. Before installing shaft seal, ensure shaft turns smoothly with less than 120 in-lb (13.5 Nm) of force. If shaft does not turn smoothly within specified maximum force, disassemble and check unit.

18. Cover shaft splines with an installation sleeve. Install a new shaft seal (27) with cup side facing motor. Press seal in housing until it bottoms out. Press evenly to avoid binding and damaging seal. Install seal support washer (28) and snap ring (29).



27. Shaft Seal
28. Seal Support Washer
29. Snap Ring

Figure 3-34. Shaft Seal

19. Install remaining plugs and fittings to housing. Refer to drawing below for wrench sizes and installation torques.

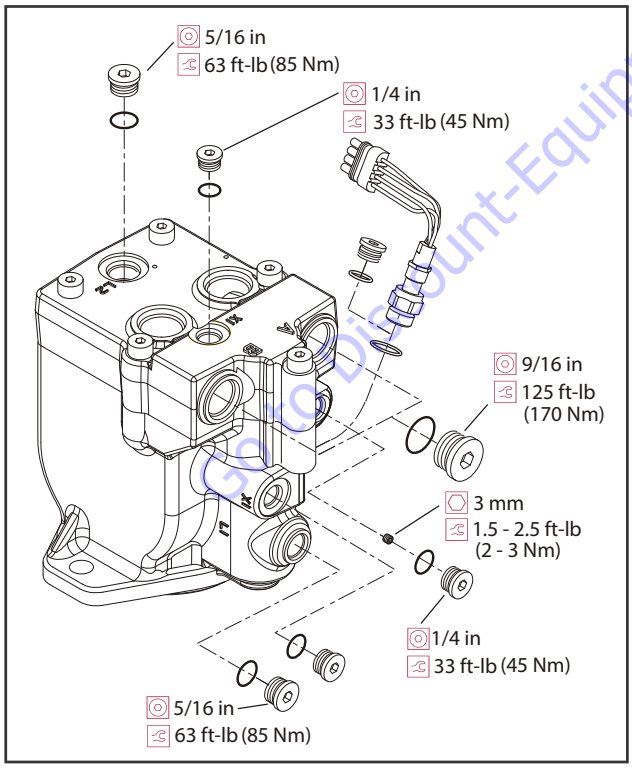
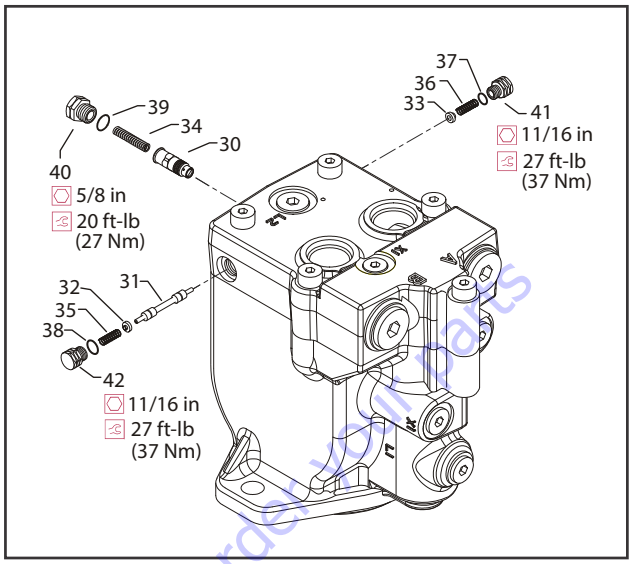


Figure 3-35. Plugs and Fittings Installation

20. Install orifice poppet (30).



30. Orifice Poppet
31. Shift Spool
32. Spring
33. Spring
34. Spring
35. Spring
36. Spring
37. O-ring
38. O-ring
39. O-ring
40. Plug
41. Plug
42. Plug

Figure 3-36. Loop Flushing Spool

21. Install shift spool (31).

22. Install spring retaining washers on springs (32 and 33).

23. Carefully install centering springs (34, 35, and 36).

24. Install new O-rings (37, 38, and 39).

25. Using a 5/8 in wrench torque plug (40) to 20 ft-lb (27 Nm).

26. Using a 11/16 in wrench, torque plugs (41 and 42) to 27 ft-lb (37 Nm).

Initial Start-up

Follow this procedure when starting-up a new motor or when installing a motor that has been removed.

NOTICE

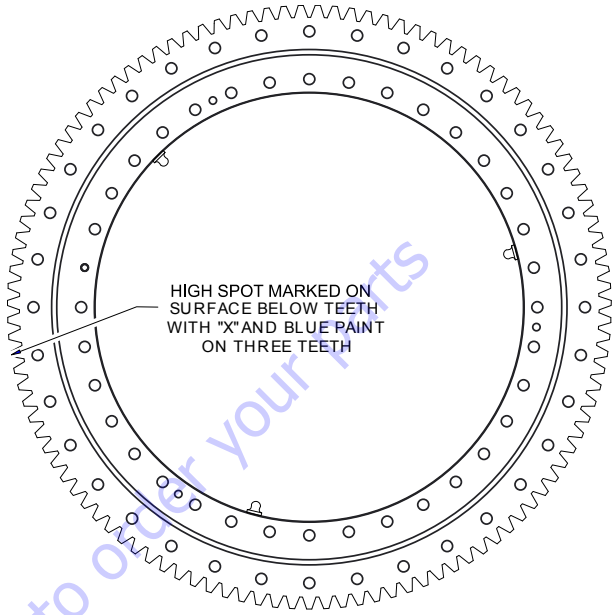
INSPECT MOTOR FOR DAMAGE BEFORE INSTALLATION. MAKE CERTAIN ALL SYSTEM COMPONENTS (RESERVOIR, HOSES, VALVES, FITTINGS, HEAT EXCHANGER, ETC.) ARE CLEAN BEFORE FILLING WITH FLUID.

1. Fill reservoir with recommended hydraulic fluid. Always filter fluid through a 10 micron filter when pouring into the reservoir. Never reuse hydraulic fluid.
2. Fill inlet line leading from pump to reservoir. Check inlet line for properly tightened fittings and be certain it is free of restrictions and air leaks.
3. Fill pump and motor housing with clean hydraulic fluid. Pour filtered oil directly in upper most case drain port.
4. To ensure pump and motor stay filled with oil, install case drain lines in upper most case drain ports.
5. Install a 0 to 500 psi (0 to 35 bar) gauge in charge pressure gauge port of pump to monitor system pressure during start up.
6. Watching pressure gauge and run engine at lowest possible speed until system pressure builds to normal levels (minimum 160 psi [11 bar]). Once system pressure is established, increase to full operating speed. If system pressure is not maintained, shut down engine, determine cause, and take corrective action.
7. Operate hydraulic system for at least fifteen minutes under light load conditions.
8. Check and adjust control settings as necessary after installation.
9. Shut down engine and remove pressure gauge. Replace plug at charge pressure gauge port.

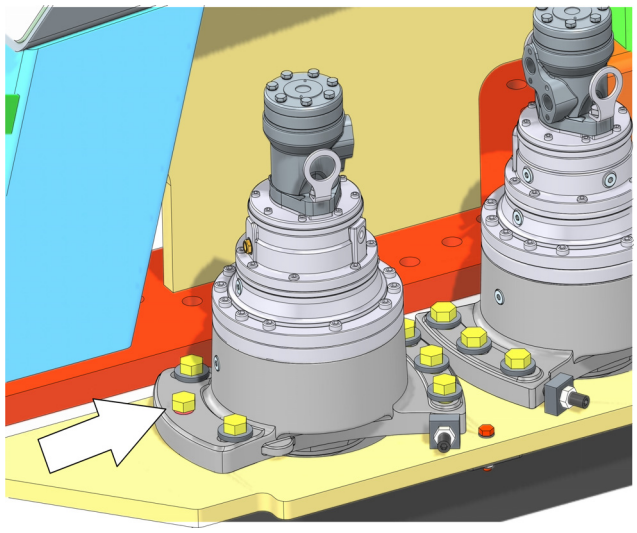
3.17 SETTING SWING GEAR BACKLASH

Set backlash 0.10 to 0.15" (0.254 to 0.381 mm) using the following procedure.

1. Place machine on firm, level ground.
2. Place shim between pinion and bearing on bearing high spot.



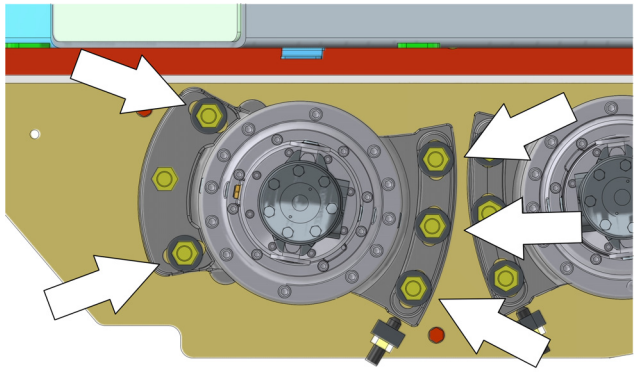
3. Apply JLG Thread locking compound P/N 0100019 to bolt. Torque pivot spacer screw to 340 ft-lb (47 kgm).



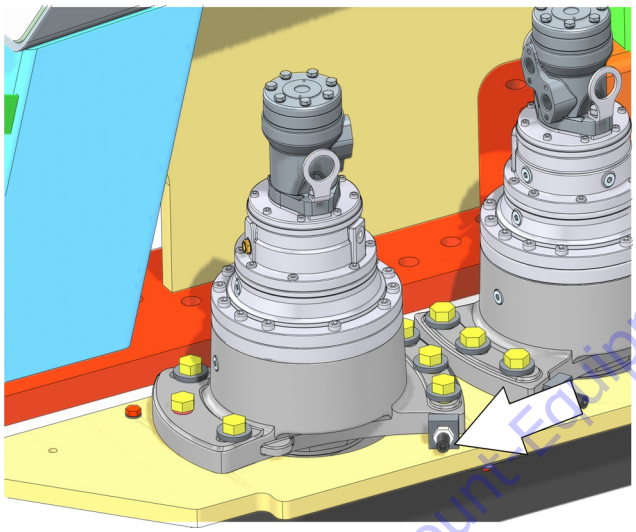
NOTE: *Make sure turntable is properly supported during the following step. The turntable can swing a few degrees when turntable lock is removed if turntable is not balanced.*

4. Remove turntable lock pin.

5. Apply JLG Thread locking compound P/N 0100019 to the bolts. Pre-torque the five bolts to 45 ft-lb (6 kgm).



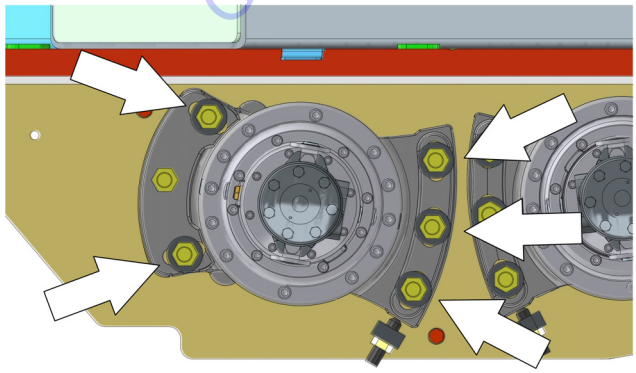
6. Tighten setscrew until pinion is completely snug against shim and bearing. Back off setscrew.



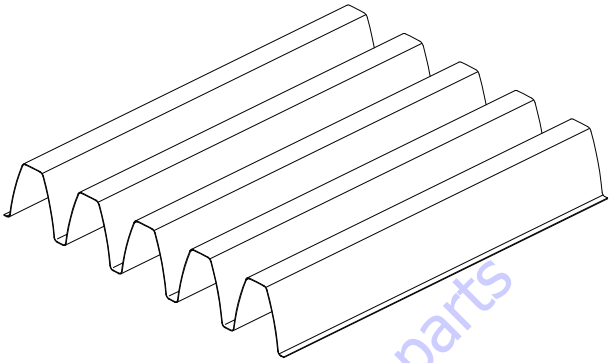
7. Torque setscrew to 50 ft-lb (7 kgm).

8. Apply JLG Thread locking compound P/N 0100019. Tighten jam nut.

9. Torque bolts to 340 ft-lb (47 kgm).



10. Discard shim.



11. Rotate bearing high spot 15° to the second drive hub. Repeat procedure.

Turntable Bearing Mounting Bolt Condition Check

NOTICE

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

NOTE: *This check is designed to replace the existing bearing bolt torque checks on JLG Lifts in service. This check must be performed after the first 50 hours of machine operation and every 600 hours of machine operation thereafter. If during this check any bolts are found to be missing or loose, replace missing or loose bolts with new bolts and torque to the value specified in the torque chart, after applying JLG Threadlocker PN 0100019 to the bolt threads. After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.*

1. Check the frame to bearing attach bolts as follows:

   a. Fully elevate the main boom. See Position 2, Figure 3-39.

   b. At the position indicated on Figure 3-39., try to insert a 0.0015" feeler gauge between the bolt and hardened washer at the arrow indicated position.

c. Ensure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.

d. Swing the turntable 90 degrees, and check some selected bolts at the new position.

e. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

2. Check the turntable to bearing attach bolts as follows:

a. Elevate the fully retracted main boom to full elevation.

b. At the position indicated on Figure 3-37. try to insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

c. Lower the boom to horizontal and fully extend the boom.

d. At the position indicated on Position 1, Figure 3-39., try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

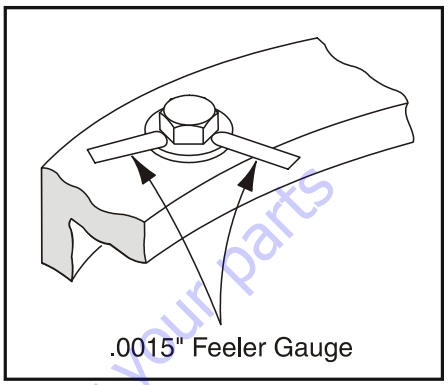


Figure 3-37. Swing Bolt Feeler Gauge Check

3.18 SWING BEARING TORQUE VALUES

1. Outer Race - 708 ft.lbs. (960 Nm) w/ JLG Threadlocker P/N 0100019.

2. Inner Race - 708 ft.lbs. (960 Nm) w/ JLG Threadlocker P/N 0100019.

3. See Swing Bearing Torquing Sequence.

⚠ WARNING

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

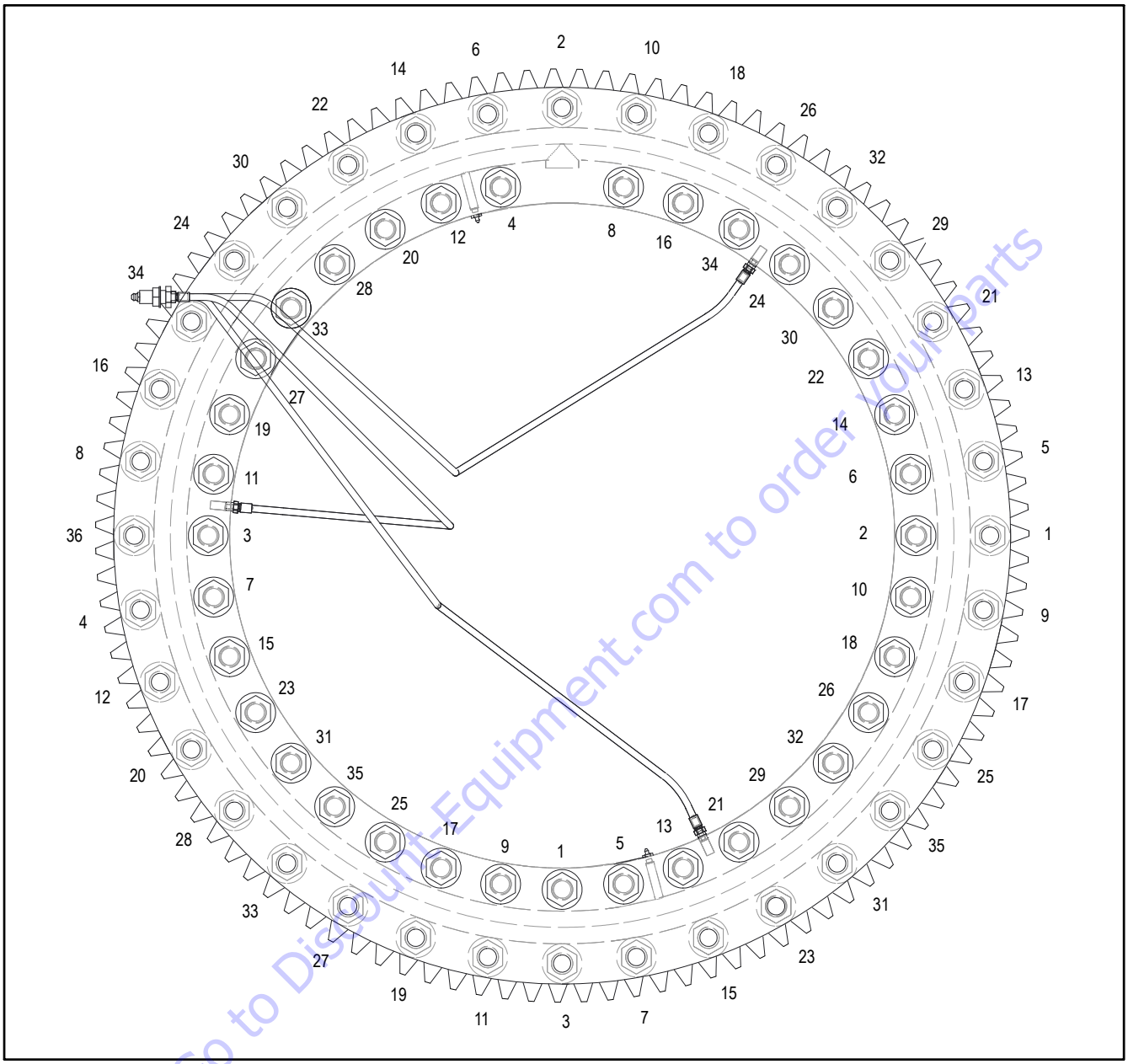


Figure 3-38. Swing Bearing Torquing Sequence

3.19 SWING BEARING WEAR TOLERANCE

See Figure 3-39., Swing Bearing Wear Tolerance.

1. Position the machine as follows and as seen in Figure 3-39., Swing Bearing Wear Tolerance, Position 1:
   - **a.** Ensure the axles are extended
   - **b.** The turntable needs to be centered between the rear wheels
   - **c.** Fully elevate the tower boom
   - **d.** Lower the main boom to be horizontal
   - **e.** Extend the main boom until it stops
   - **f.** Lower the jib to horizontal
   - **g.** Keep the jib and platform centered and unloaded
2. Set up a dial indicator as follows:
   - **a.** The dial indicator location is to be at the front center of the machine, next to the bearing, opposite of the tower pivot pin.
   - **b.** The magnetic base of the indicator should be positioned on the frame

   - **c.** The indicator point needs positioned to measure the turntable base plate 2.5 inches from the root of the gear tooth. Refer to Figure 3-39., Swing Bearing Wear Tolerance.
3. Zero the dial indicator.
4. Check dial indicator accuracy once positioned, using a feeler gauge and ensure the dial indicator reading, is the same as the feeler gauge thickness.
5. Position the machine as follows and as seen in Figure 3-30., Swing Bearing Wear Tolerance, Position 2:
   - **a.** Do not rotate the turntable
   - **b.** The tower boom needs to be stowed
   - **c.** Raise the main boom to be fully elevated and retracted
   - **d.** Raise the jib to be fully elevated and centered
   - **e.** Center the platform and keep it unloaded
6. Verify the dial indicator has not shifted. Record the value for bearing play.
7. Return the machine to Figure 3-39., Swing Bearing Wear Tolerance, Position 1. The dial indicator should to return to zero. If the dial indicator does not return to zero, take corrective action and repeat the test.
8. If the measurement is more than 0.165 in. (4.2 mm), replace the bearing. If the measurement is less than 0.165 in. (4.2 mm), and any of the following conditions exist, the bearing should be removed, disassembled, and inspected.
   - **a.** Metal particles in the grease.
   - **b.** Increased drive power required.
   - **c.** Noise.
   - **d.** Rough rotation.
9. If bearing inspection shows no defects, reassemble and return to service.

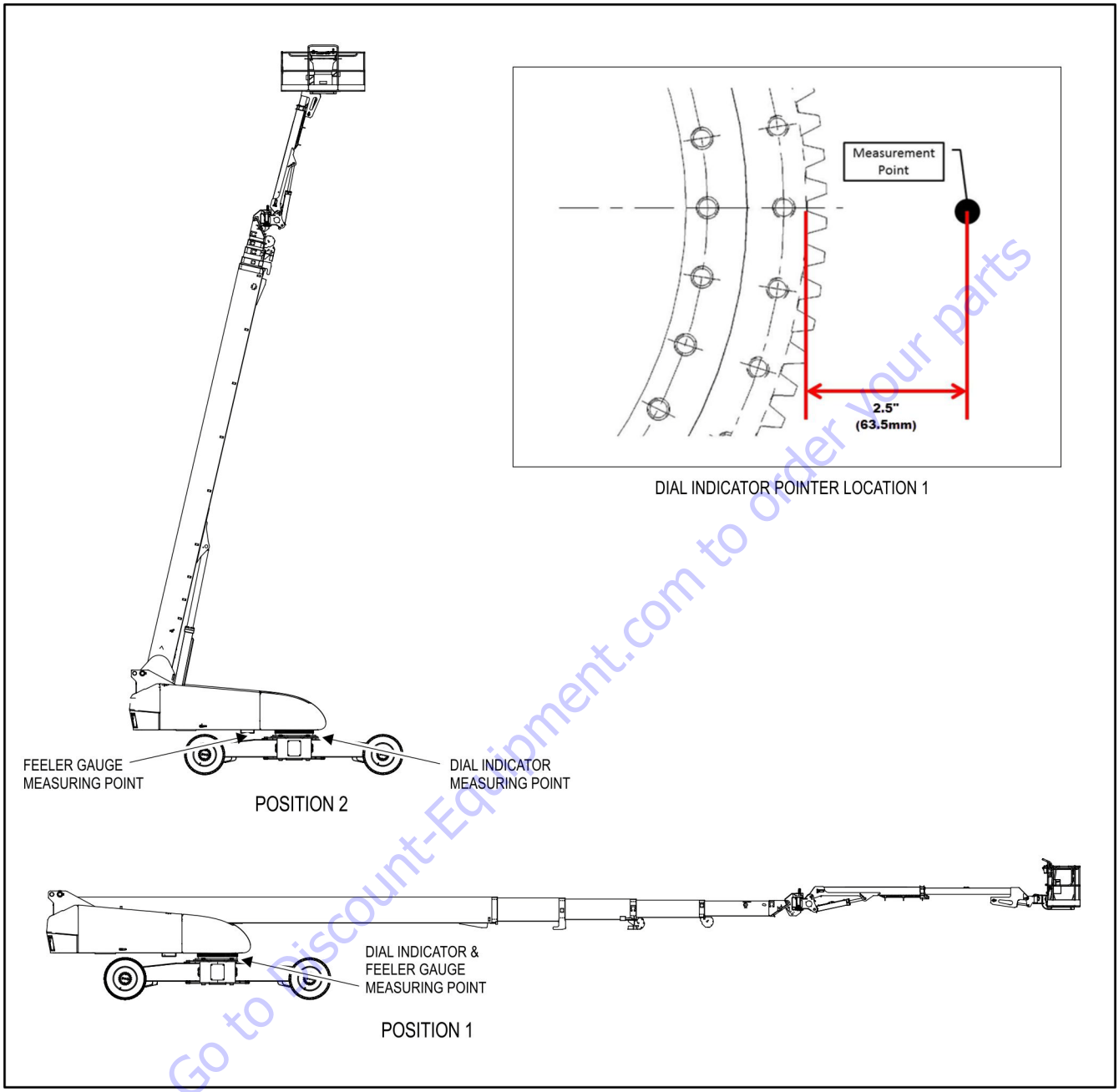


Figure 3-39. Swing Bearing Wear Tolerance

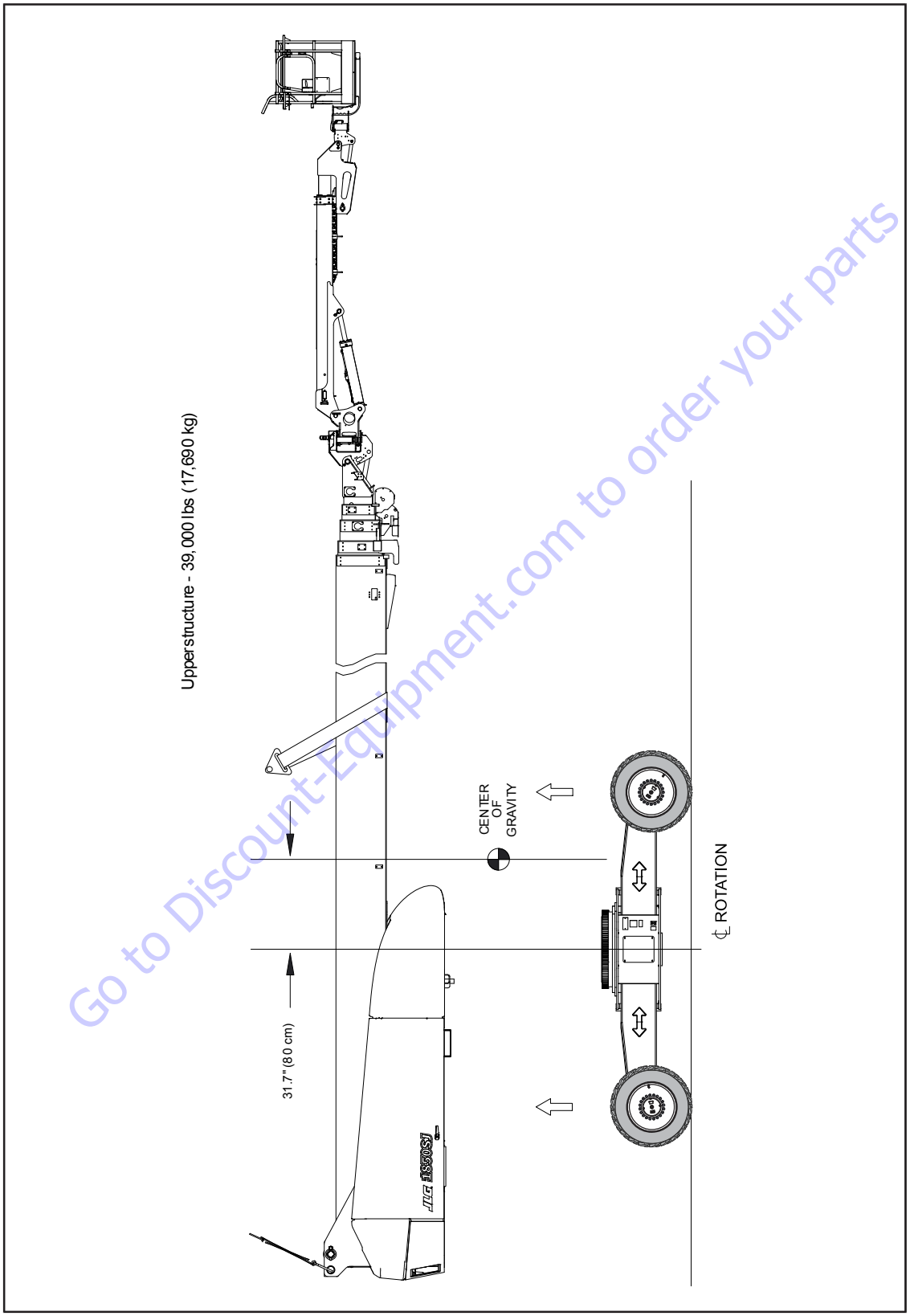


Figure 3-40. Swing Bearing Removal - Sheet 1 of 4

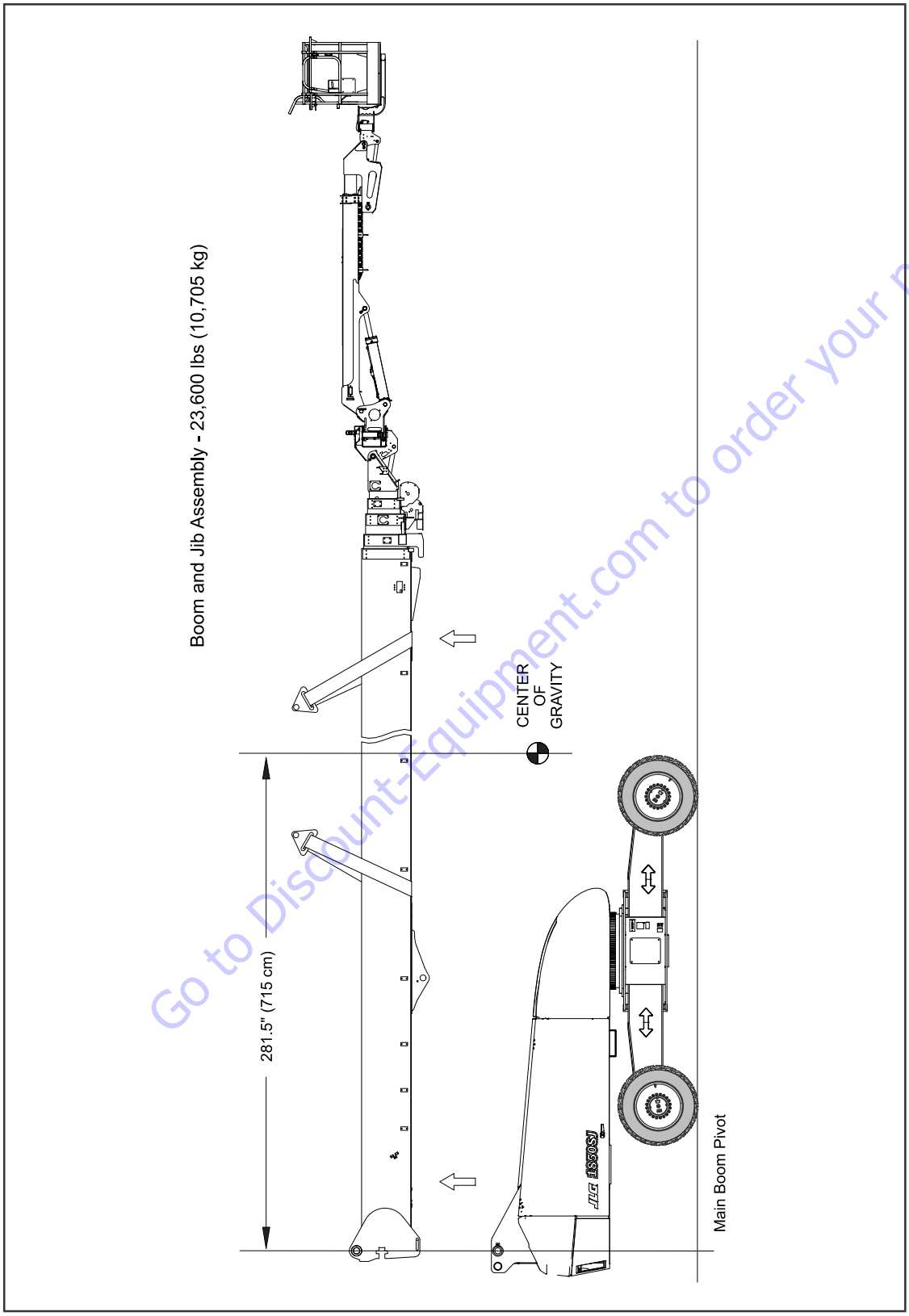


Figure 3-41. Swing Bearing Removal - Sheet 2 of 4

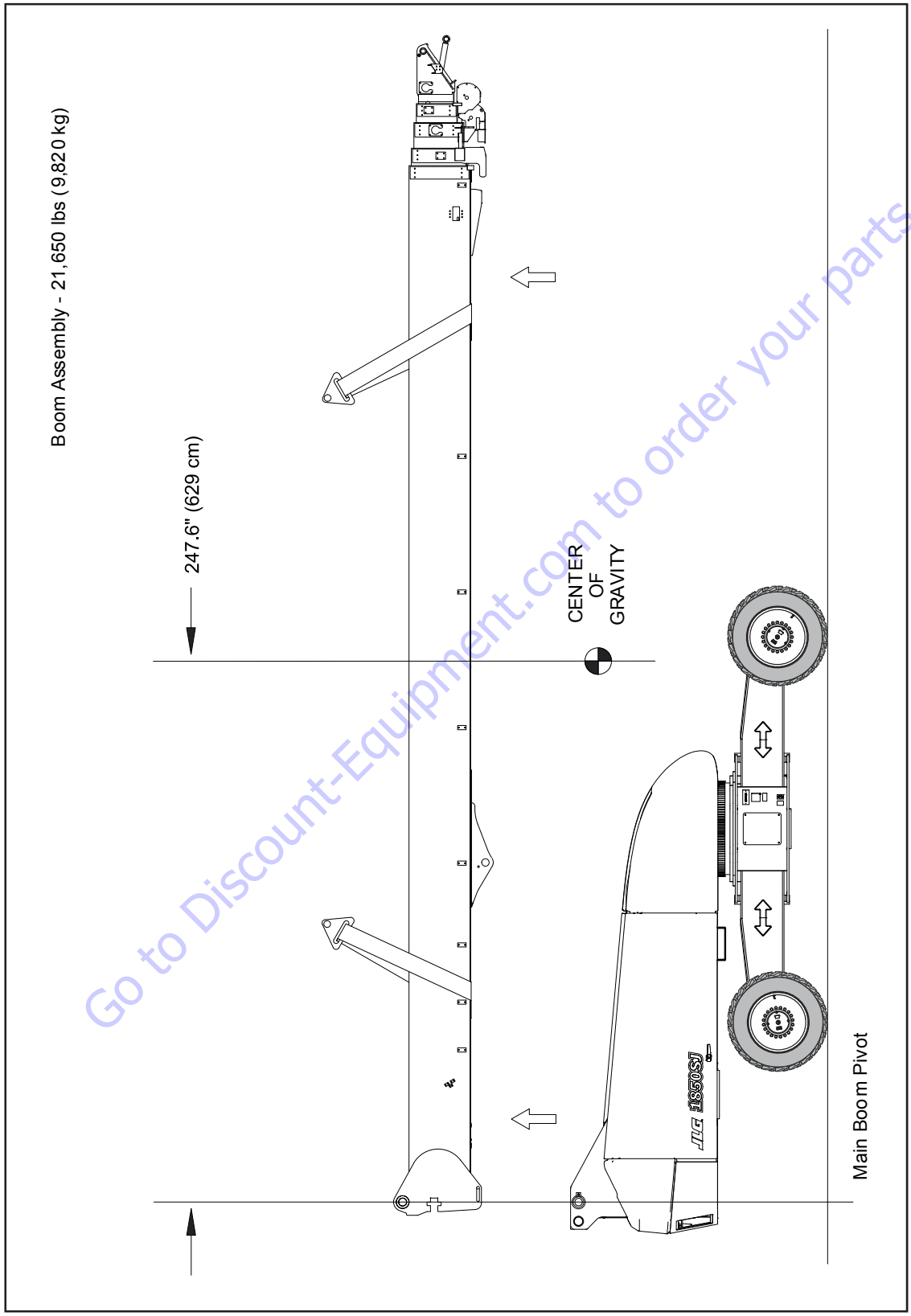


Figure 3-42. Swing Bearing Removal - Sheet 3 of 4

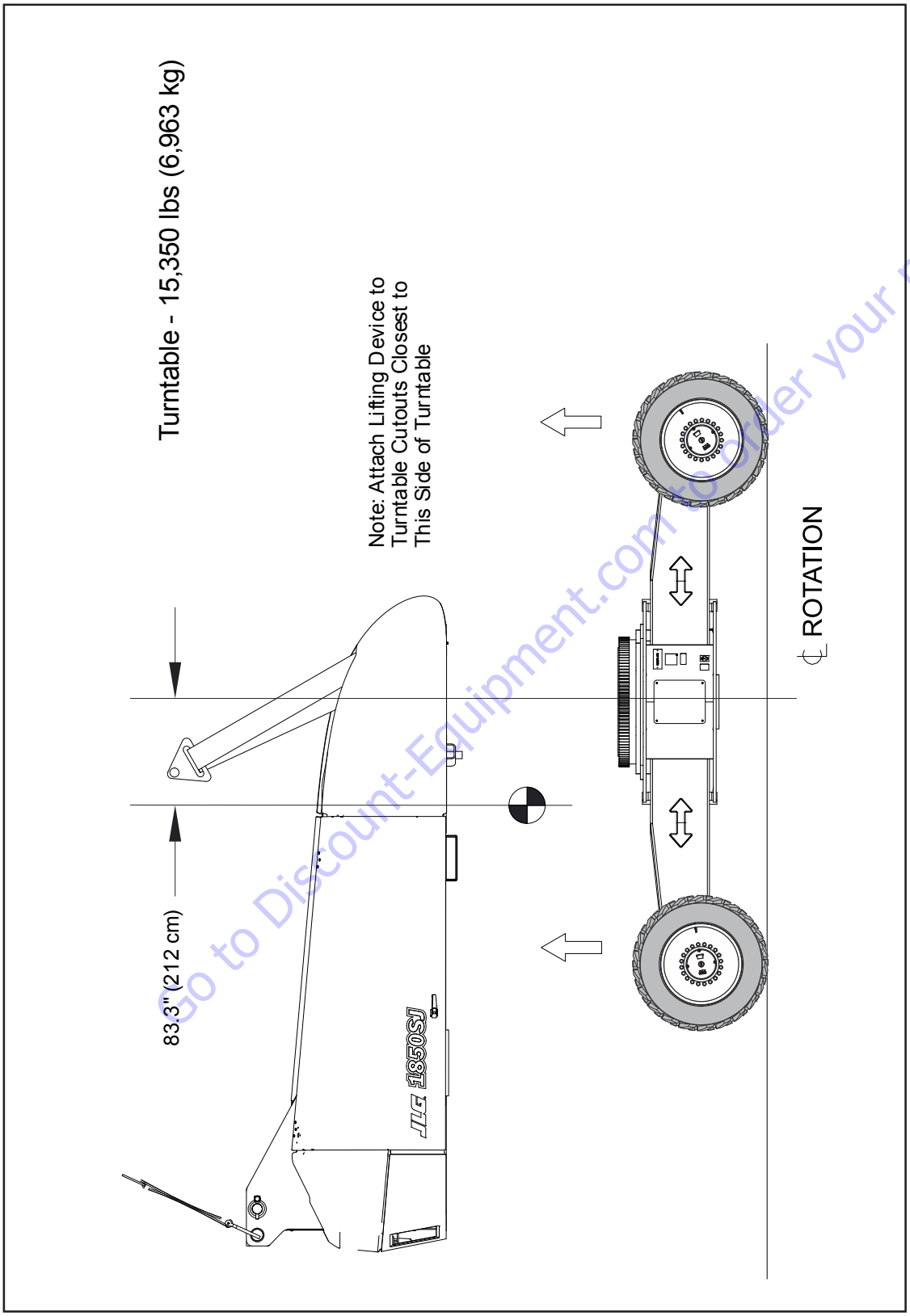


Figure 3-43. Swing Bearing Removal - Sheet 4 of 4

3.20 SWING CONTROL SYSTEM

The swing control system uses the turntable swing angle sensor in addition to the DOS proximity switch to prevent turntable swing while the axles are retracted. Swing will be allowed to +/- 35 degrees (before the DOS proximity switch trips) to facilitate positioning the turntable for transport of the machine. Attempts to swing past this position will be disallowed by the control system and the operator will be prompted via the LCD display to swing in the opposite direction to return the boom behind the rear wheels. Once the axles are extended the boom has 360 degree continuous turntable swing. If the turntable is swung past +/- 35° when the boom is lowered into the transport position, the operator will have to swing the turntable back within the rear wheels before attempting to retract the axles. The DOS will work as described below when the axles are extended.

3.21 CHASSIS TILT INDICATOR SYSTEM

The Chassis Tilt Indicator System measures the turntable angle with respect to level ground. The tilt sensor (mounted to a bracket on the side of the turntable near the boom pivot pin) has three settings; 3.0° side tilt, 5.0 degree omni directional tilt, and an 8.0° omni directional tilt.

The 5.0° omni directional angle setting is used for the purpose of warning the operator by means of the chassis tilt light in the platform display panel. Additionally when used in conjunction with the Beyond Transport - Drive Speed Cutback System, the tilt sensor will cause an alarm to sound and automatically put all functions in the creep speed mode and drive will be cut out. With the exception of the drive being cut out, this is a warning system only indicating to the operator that the machine has reached the out of level limit. The machine will continue to function. The operator is responsible to prevent the machine from attaining an unstable position.

The 3.0° side tilt setting is used in conjunction with the main boom length and when exceeded, imposes the same functionality as the 5.0° omni directional setting plus prevents boom telescope out. The side tilt setting is ignored when the main boom length is less than 1477.7 inches in the 500 lb mode or 1442.8 inches in the 1000 lb mode.

The 8.0º angle is used exclusively for the purpose of automatically shifting the drive motors to the maximum displacement position (slow speed).

The control system responds to indicated angle readings 0.3º smaller than the required angles to account for calibration and sensor variation.

3.22 AUXILIARY POWER SYSTEM

The auxiliary power system is intended as a secondary means of moving the boom in the event of primary power loss. This system uses an electric motor/pump unit powered by two12V batteries capable of operating all functions except drive, controlled arc, controlled boom angle, and envelope tracking.

During main lift up or down functions, no other functions are permitted and during main lift up functions, automatic platform leveling is not active but jib leveling is active. To reduce the demand on the battery and therefore extend the run time of the system, the auxiliary power functionality differs from the primary power functionality. The auxiliary power main lift down function supplies pilot pressure to the main lift cylinder. This allows gravity to lower the boom. The system redirects discharge oil from the main lift cylinder to retract the main telescope cylinder. At high main boom angles the envelope may be encroached during lift down requiring the operator to use main telescope in.

When the main boom is retracted to the transport length, the main telescope in valve is dropped out and lift down is operated alone allowing the platform to reach the ground. This not only greatly reduces the power required for these functions but also lowers the boom within the envelope regardless of starting position. Jib lift down function may then be operated allowing the platform to reach ground level. Envelope control and moment control remain active during the auxiliary power function.

3.23 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 a 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.

3.24 DEUTZ TURBOCHARGER OPERATION

Good engine operating procedures are essential to prolong turbocharger life.

Particular attention to oil system and air system will eliminate the two main causes of turbocharger failure. To prevent this Operators/Owners must ensure that:-

1. Air and oil filters are checked regularly to the manufacturer's specifications.
2. Engine maintenance intervals are adhered to.
3. Engine and equipment are operated in such a way that is not harmful to the life of the turbocharger.

Operating Practices

Operators and owners can get maximum service life from their turbochargers if a few good practices are followed:

START UP

When starting the engine use minimum throttle and run in idle mode for approximately one minute. Full working oil pressure builds up within seconds but it is useful to allow the turbocharger moving parts to warm up under good lubricating conditions. Revving the engine within the first few seconds of start up causes the turbocharger to rotate at high speeds with marginal lubrication which can lead to early failure of the turbocharger.

AFTER SERVICING

After servicing the engine or turbocharger, ensure the turbocharger is pre-lubed by adding clean engine oil into the turbocharger oil inlet until full. After pre-lubing, crank the engine without firing (engine/fuel pump stop out) to allow oil to circulate through the full system under pressure. On starting the engine, run at idle for a few minutes to ensure the oil and bearing systems are operating satisfactorily.

LOW AIR TEMPERATURES & INACTIVE OPERATION

If the engine has been inactive for some time or the air temperature is very low, crank the engine first and then run at idle. This allows the oil to circulate throughout the full system before high loads and speeds are applied to engine and turbocharger.

SHUT DOWN

Before shutting the engine down, let the turbocharger cool down. When an engine runs at maximum power/high torque, the turbocharger is operating at very high temperatures and speeds. Hot shut down can cause reduced service life which is avoidable by a minute or two of idling. Most mobile equipment applications include an adequate cooling period during parking or mooring procedures.

Allow the engine to idle for 1-5 minutes to allow the high temperatures and speed to reduce and thus prolong the life of the turbocharger.

ENGINE IDLE

Avoid running the engine for long periods in idle mode (greater than 20-30 minutes). Under idling conditions low pressures are generated in the turbocharger which can cause oil mist to leak past seals into the two end housings. Although no real harm is done to the turbocharger, as load is applied temperatures increase and the oil will start to burn off and cause blue smoke emission problems.

In the picture above you can see discoloration on the shaft caused only by heat. If the engine is allowed to Idle for a period of time, lube oil will continue to flow cooling the turbine shaft.

You can also see spots on the turbo where grooves have been “worn” in to the turbine shaft at the point where the radial bearing sits. Dirty oil/contaminates in the oil can become trapped in between the radial bearing and the surface of the shaft becoming abrasive and ultimately grinding away the material.

3.25 DIESEL EXHAUST FLUID (DEF) TANK

Refer to Figure 3-44. and Figure 3-45.

Diesel exhaust fluid (DEF) is a urea solution consisting of 32.5% urea and 67.5% deionized water. DEF is used in selective catalytic reduction (SCR) to lower nitrogen oxide (NOx) concentration in exhaust emissions.

DEF is temperature sensitive in storage. If stored between 75°F (24°C) and 12°F (-10°C), it can be stored for 2 years. In the machine's DEF tank, the storage life is 4 months. After 4 months, the DEF must be drained from the tank, properly disposed of, and the tank cleaned and flushed. If the machine has been idle in an extreme cold environment (-40° to 32°F [-40° to 0°C]), the interval is reduced to 2 months.

NOTE: *DEF freezes at 12°F (-11°C).*

Cleaning and Flushing the Tank

If contaminated fluid or foreign material is found in the tank, the tank must be cleaned. Use the following procedure for cleaning.

1. Remove the DEF tank drain plug, and drain any fluid into a suitable container. Dispose of fluid properly.
2. Clean the header with a mixture of warm water and a light petroleum based soap.
3. Clean DEF tank with a high pressure washer, or flush tank with hot water for five minutes and drain water.
4. If DEF fluid lines are contaminated, tag and remove the lines from the DEF pump module and flush with a mixture of warm water and a light petroleum based soap.
5. Refill DEF tank with water until it overflows. Completely flush tank with water.
6. Empty DEF tank, and dispose of contaminated water properly.
7. Rinse the tank and all soap residue with deionized or distilled water and allow to air dry.

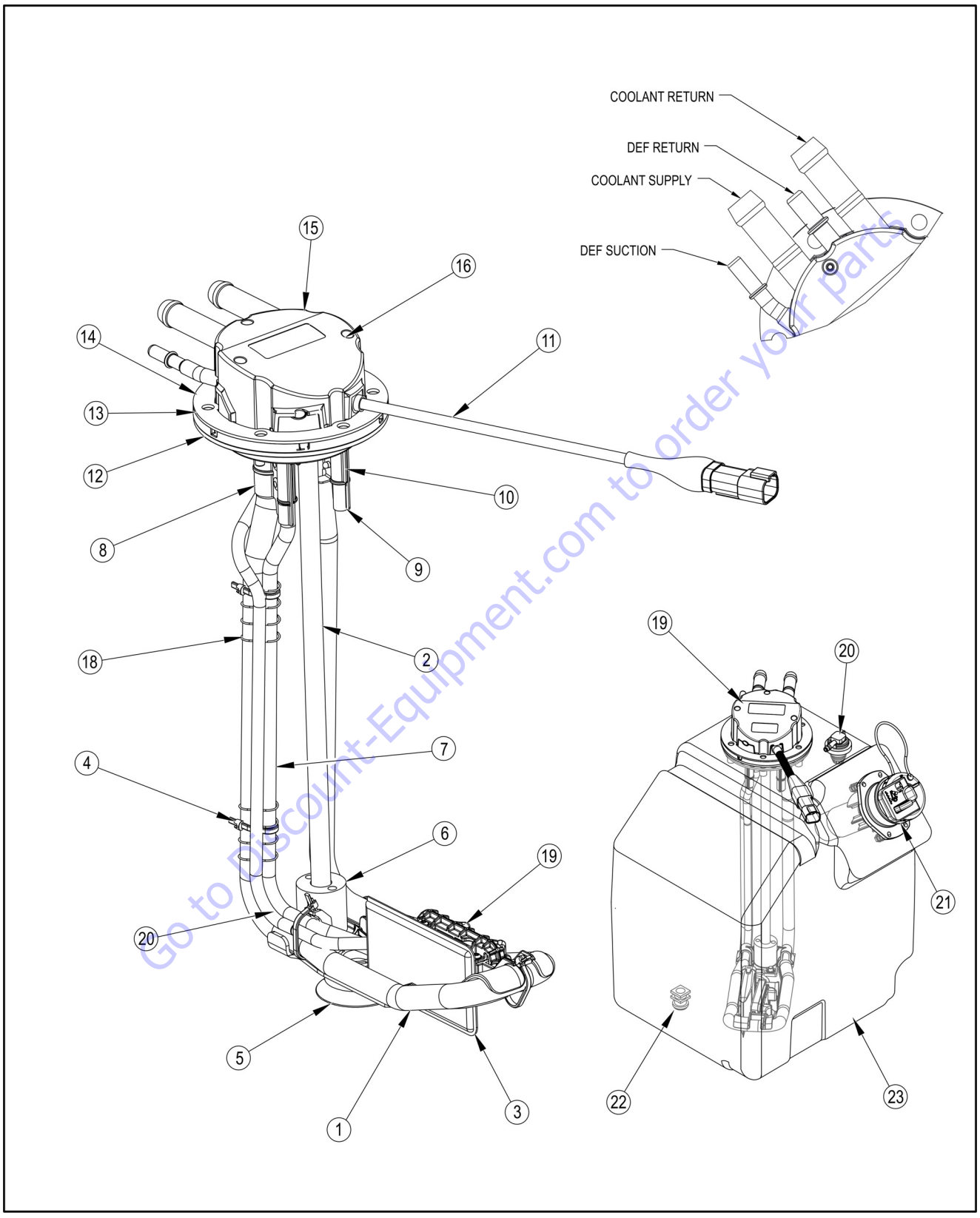
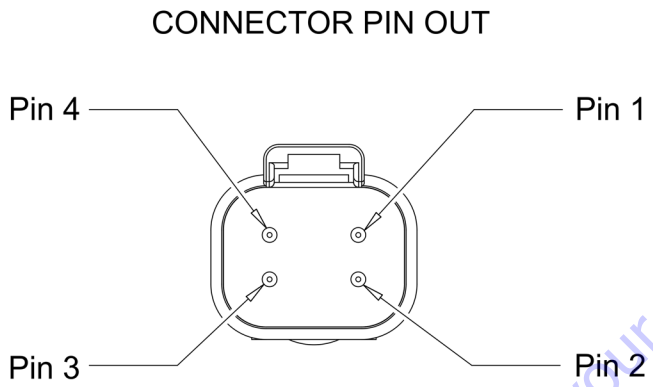
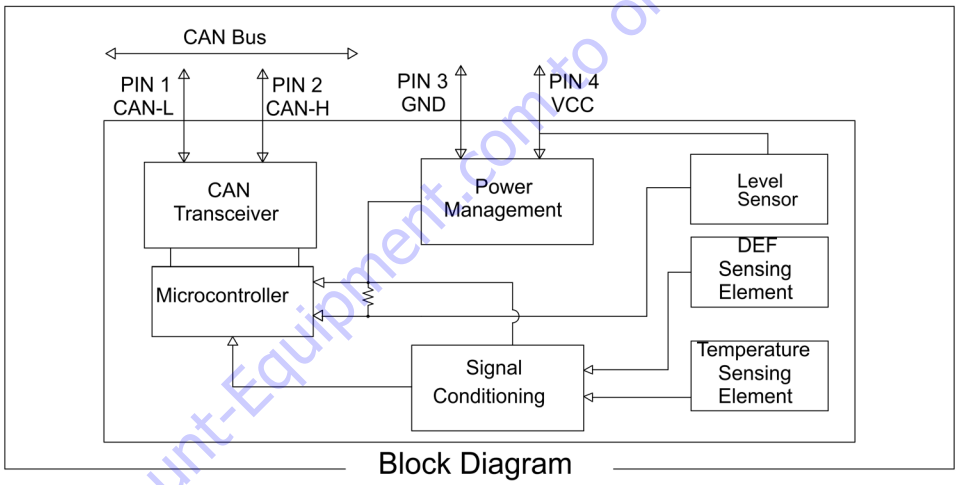


Figure 3-44. Diesel Exhaust Fluid (DEF) Tank - Sheet 1 of 2





1. Coolant Tube
2. Level Tube
3. DEF Filter
4. Tie-Wrap
5. Rubber Bushing
6. Float Assembly
7. Suction Tube
8. Suction Strengthening Plate
9. Return Tube
10. Return Strengthening Plate
11. Connector
12. Rubber Header
13. Header
14. Metallic Flange
15. Cover
16. Screw
17. Spring Tube
18. Urea Quality Sensor
19. DEF Electric Assembly
20. Breather
21. Cap
22. Drain Plug
23. Tank

Figure 3-45. Diesel Exhaust Fluid (DEF) Tank - Sheet 2 of 2

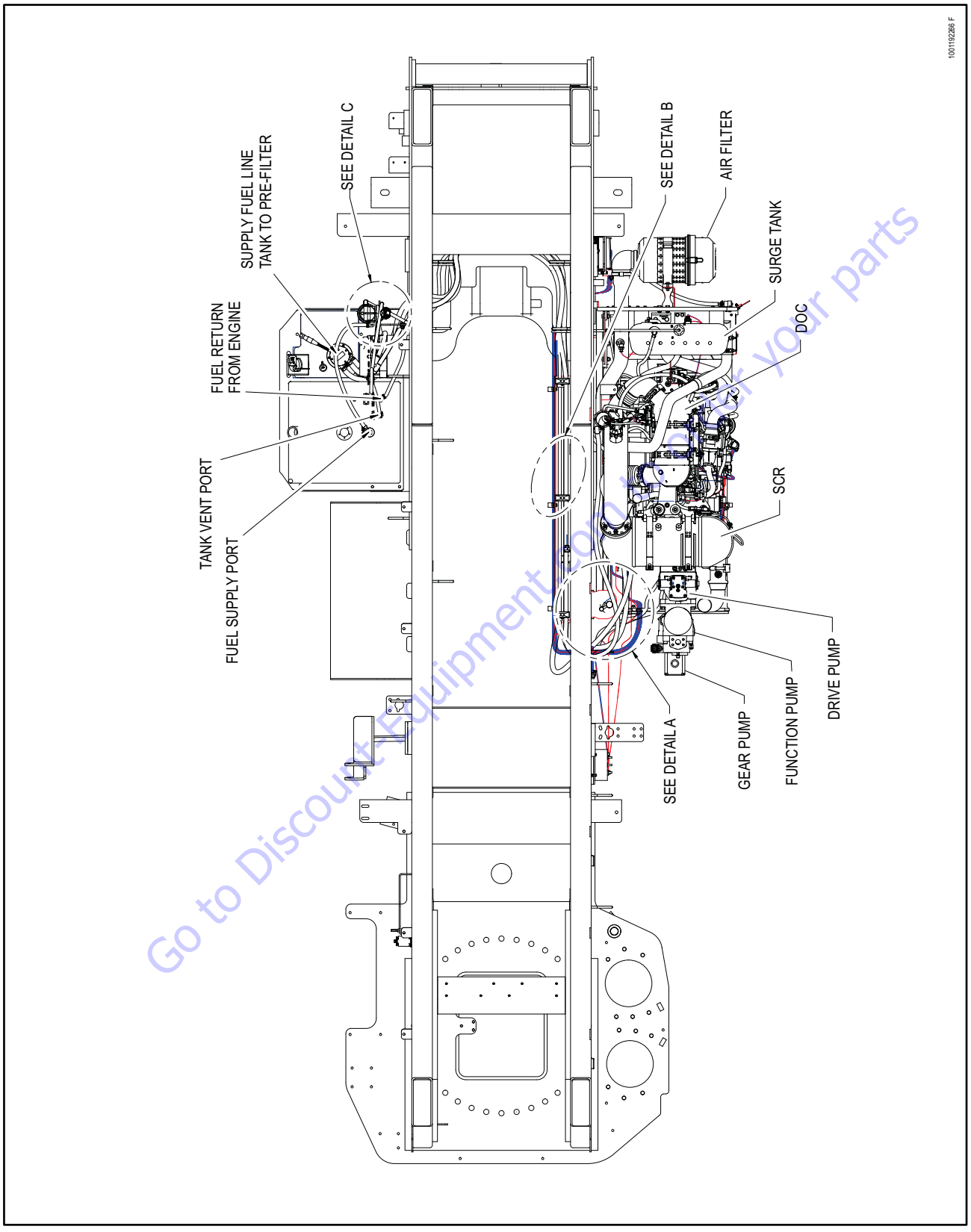


Figure 3-46. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 1 of 8

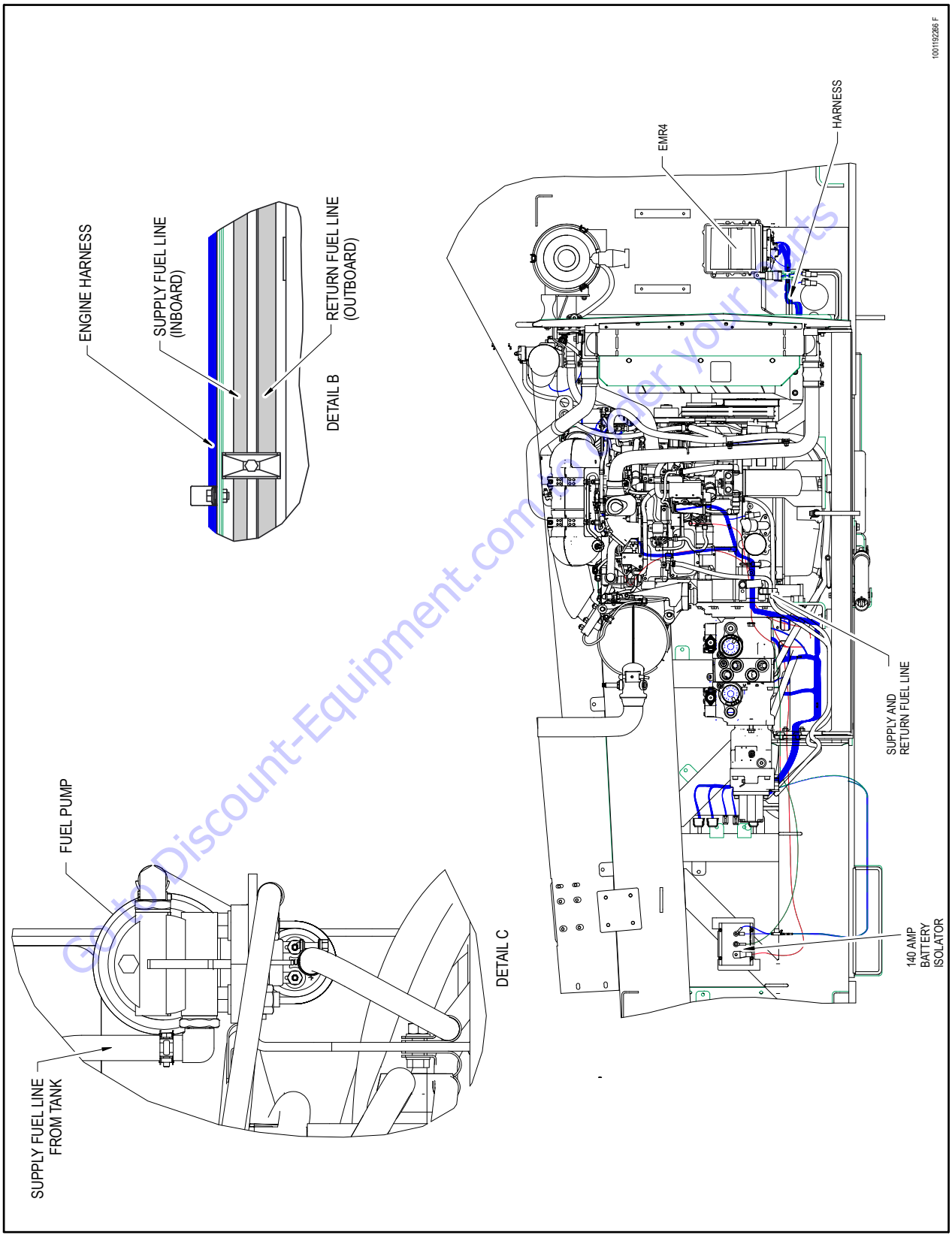


Figure 3-47. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 2 of 8

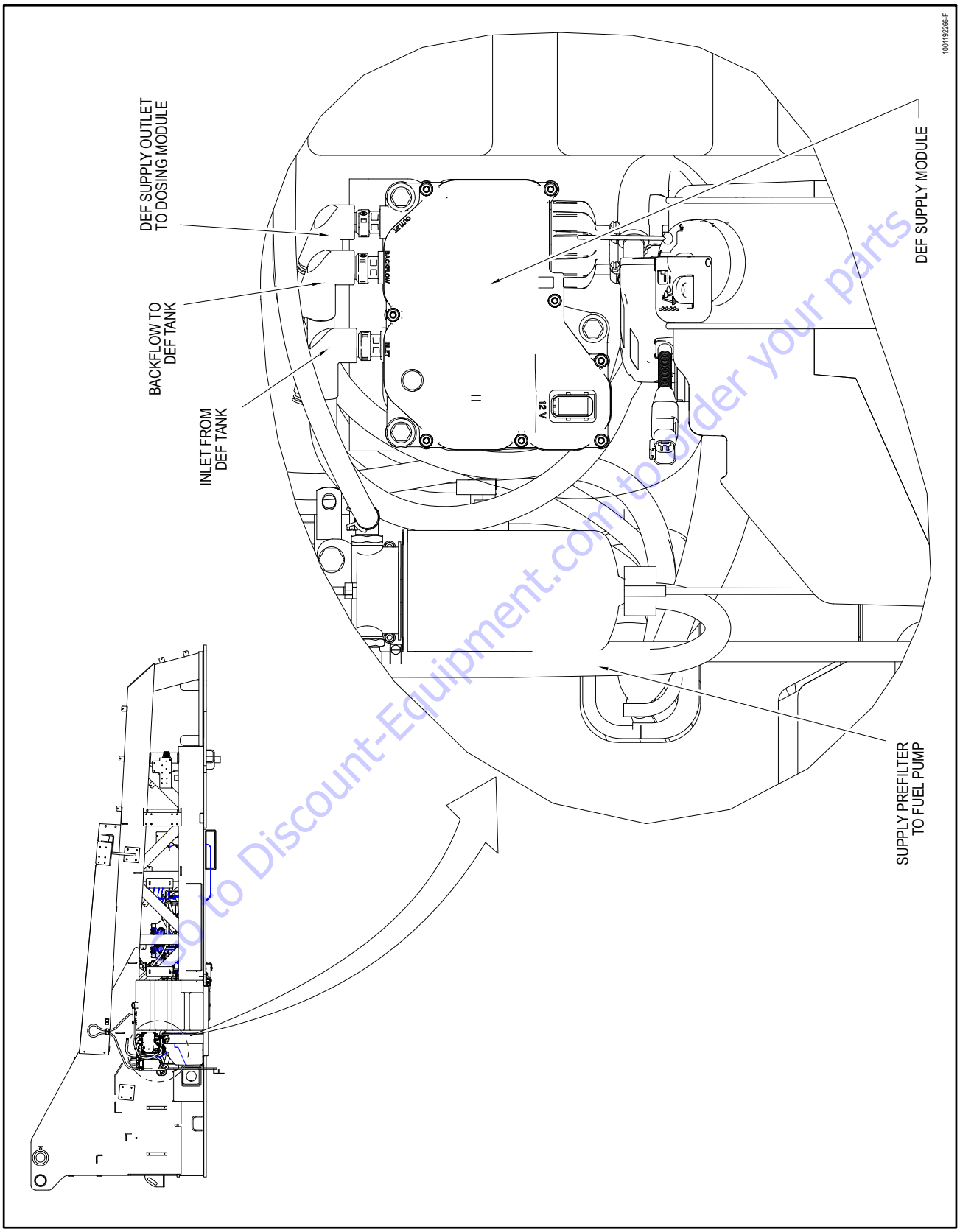


Figure 3-48. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 3 of 8

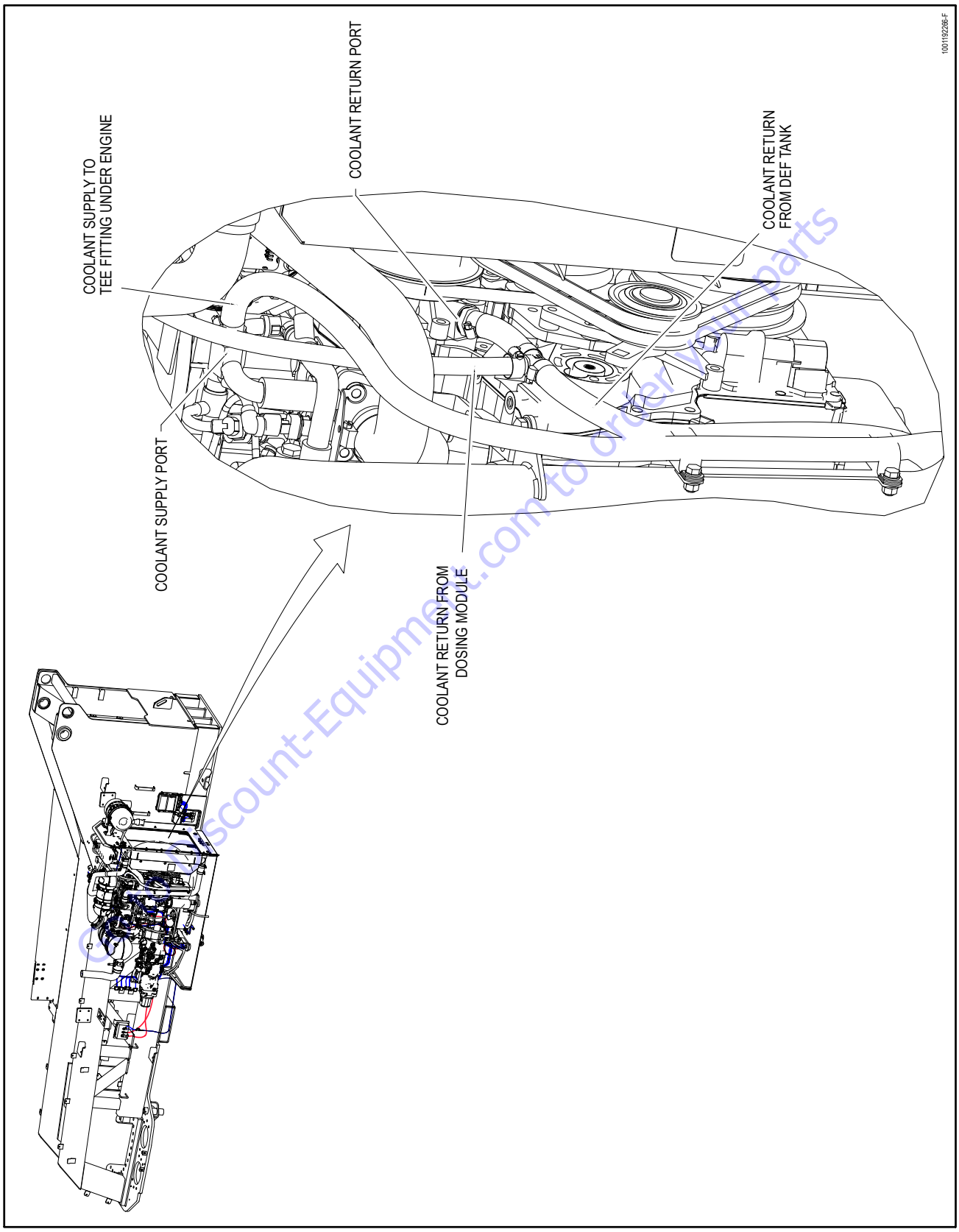


Figure 3-49. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 4 of 8

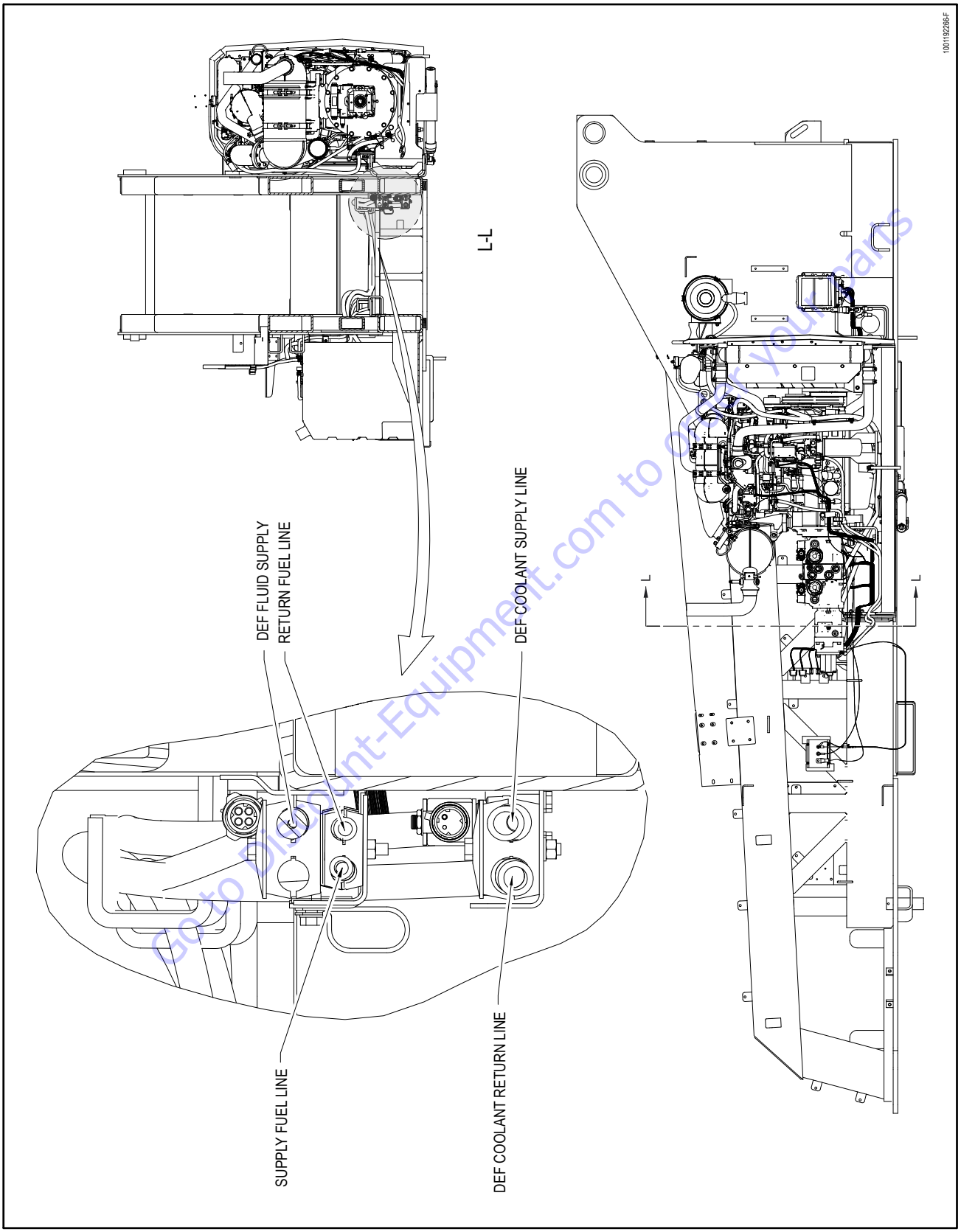


Figure 3-50. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 5 of 8

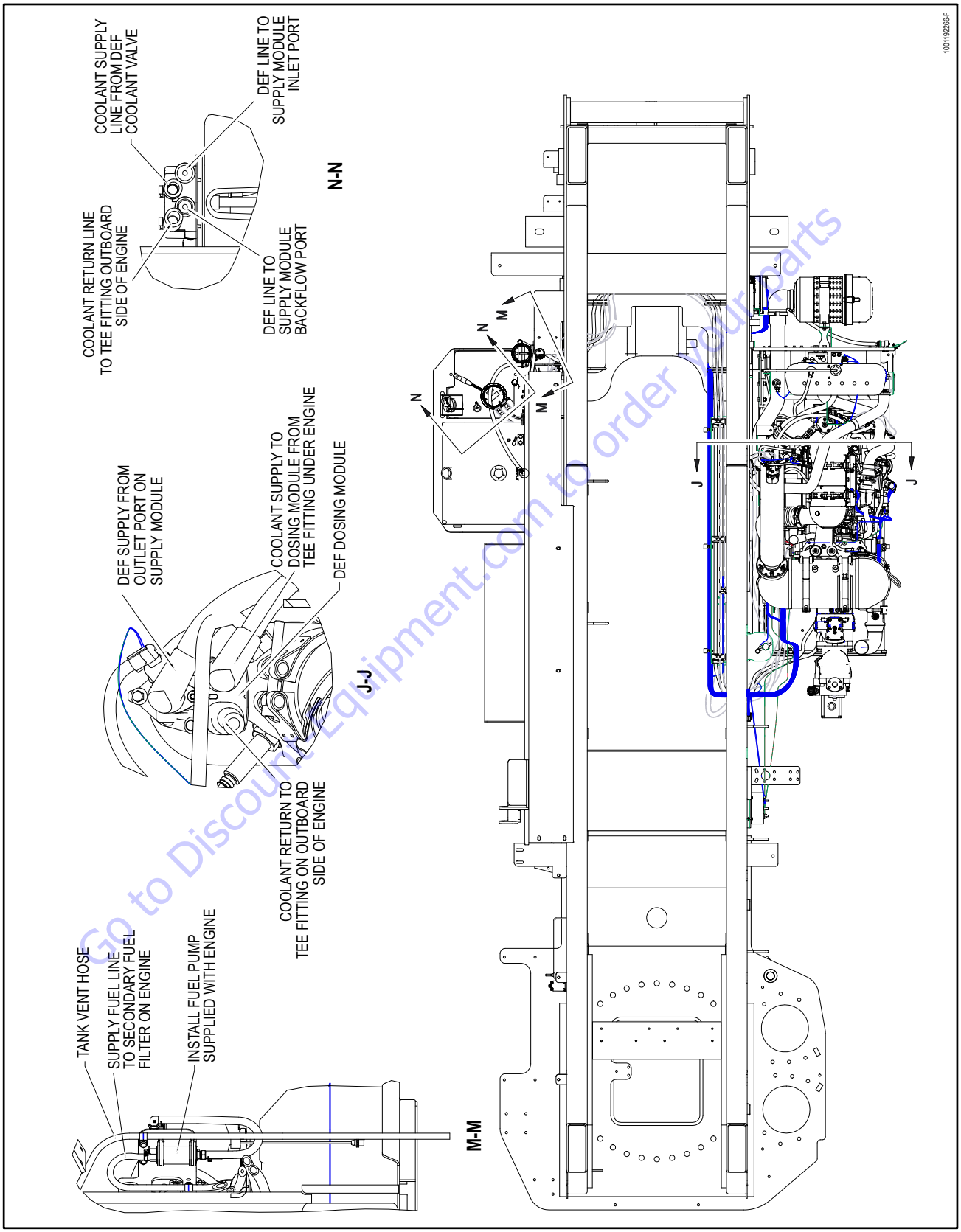


Figure 3-51. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 6 of 8

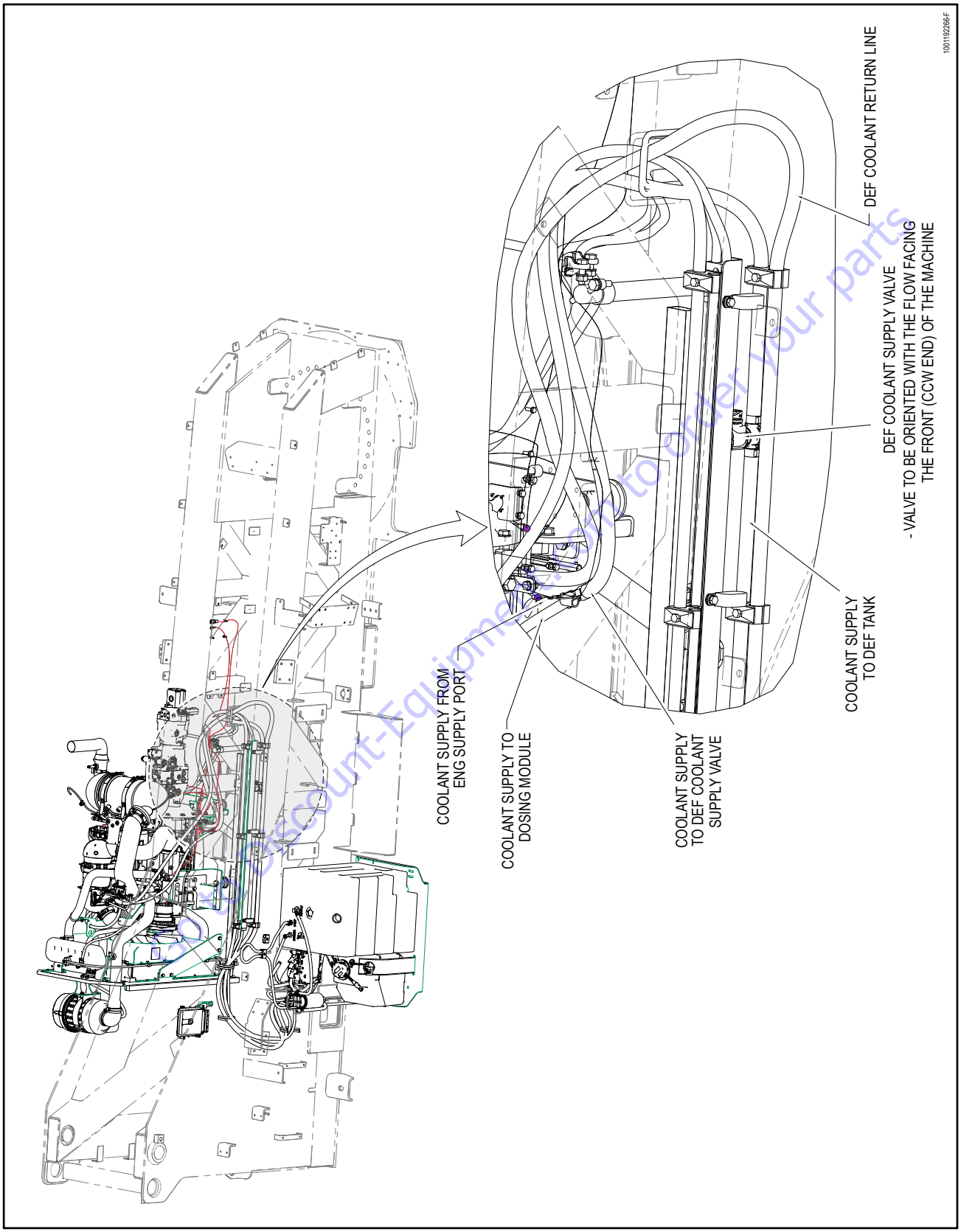


Figure 3-52. Engine Installation and Diesel Exhaust Fluid (DEF) System - Sheet 7 of 8

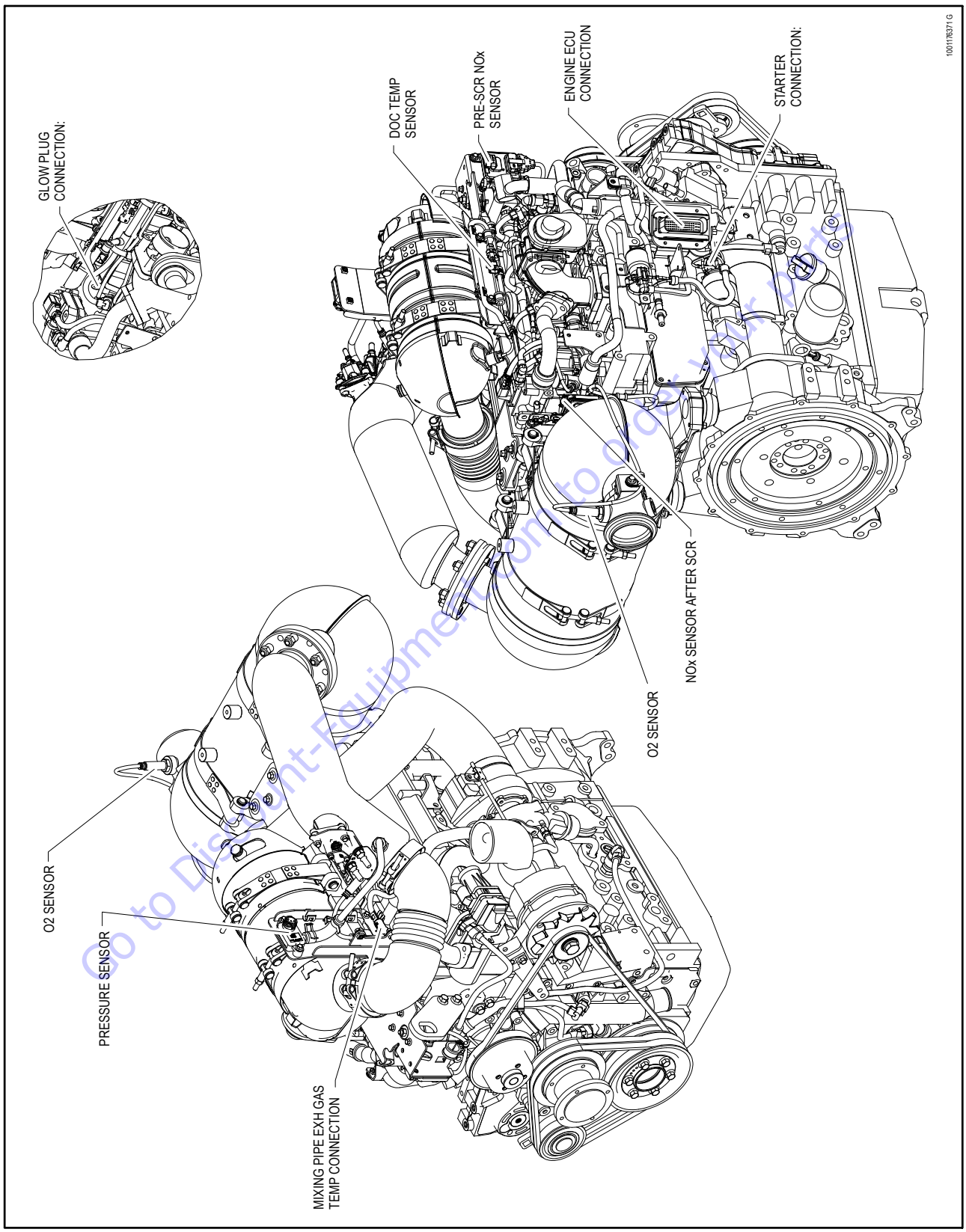


Figure 3-53. Diesel Exhaust Fluid (DEF) System - Sheet 8 of 8

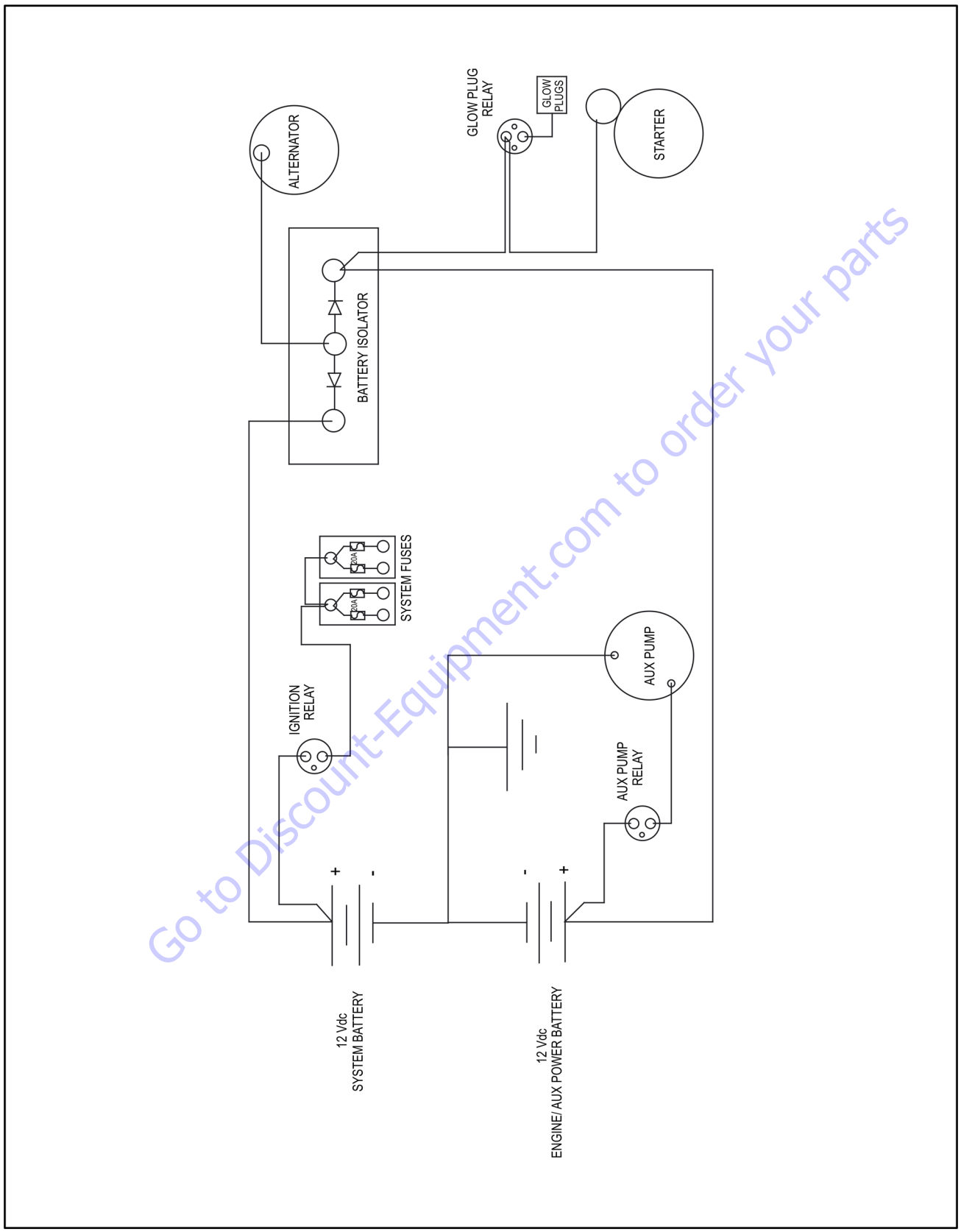


Figure 3-54. Engine Electrical Circuit

3.26 DEUTZ ENGINE WITH DIESEL EXHAUST FLUID (DEF)

Engine Oil

Engines equipped with Exhaust After Treatment (EAT) systems require the use of low-ash engine lubricating oils.

Lubricating oil that is not "low-ash" rated can contain sulphate and oxide ashes from metal-organic additives which will significantly shorten the life span of diesel particle filters. Phosphor from wear-protection additives as well as sulphur and sulphur compounds negatively influence the catalyst activity in exhaust gas post-treatment systems.

NOTICE

LOW-ASH ENGINE LUBRICATING OILS ARE RECOMMENDED FOR SCR EXHAUST AFTER TREATMENT SYSTEMS.

NOTICE

USE OF NON-APPROVED LUBRICATING OIL WILL RESULT IN VOIDED WARRANTY COVERAGE.

Diesel Fuel

Engines equipped with an SCR system (Selective Catalytic Reduction) may only be operated with sulphur-free diesel fuels (EN 590, ASTM D975 Grade 2-D S15, ASTM D975 Grade 1-D S15 or heating oil in EN 590 quality). Otherwise compliance with the emission requirements and durability is not guaranteed.

In a warranty case the customer must prove by a certificate from the fuel supplier that a released fuel was used.

HIGH SULPHUR CONTENT IN THE FUEL

Fuels with a sulphur content > 0.5% (m/m) (5,000 mg/kg) demand a shorter lubricating oil change interval. Fuels with a high sulphur content may not be used in engines with exhaust gas after-treatment. Fuels with a sulphur content > 1.0% (m/m) are not permissible due to high corrosion and considerable shortening of the engine life. Low-ash / low SAPS engine lubricating oils (sulphate ash max. 1.0% (m/m)) may only be used in engines without exhaust after-treatment systems if the sulphur content in the fuel does not exceed 50 mg/kg. However, low-ash lubricating oils may be used in engines without exhaust gas after-treatment systems up to sulphur contents of 500 mg/kg if the base number (TBN) is at least 9 mg KOH/g.

WINTER OPERATION WITH DIESEL FUEL

Special demands are placed on the cold behavior (temperature limit value of the filtrability) for winter operation. Suitable fuels are available in winter.

Mixing with petrol is not permissible for safety and technical reasons (cavitation in the injection system).

Diesel fuels up to -44 °C are available for an Arctic climate. The addition of flow improvers to the diesel fuel is only allowed in exceptional cases. The choice of a suitable additive and the necessary dosing and mixing procedure must be discussed with the fuel supplier. If only summer diesel fuel is available, petroleum or kerosene can be added to the diesel fuel up to 30% (V/V) at low temperatures as shown in the diagram below.

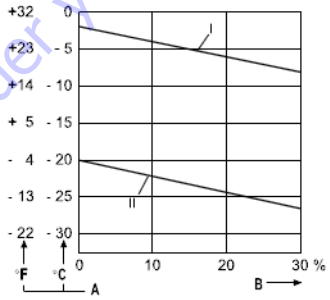


Figure 3-55. Mixing Petroleum With Summer Diesel Fuel

The mixing should take place in the engine tank. First pour in the necessary amount of petroleum or kerosene, and then add the diesel fuel.

3.27 SELECTIVE CATALYTIC REDUCTION (SCR) - MACHINES USING DIESEL EXHAUST FLUID (DEF)

Selective Catalytic Reduction (SCR) is an emissions control used in diesel engines and requires operator interaction to ensure proper operation of the system.

The system injects liquid through a special catalyst into the exhaust stream of a diesel engine. The liquid is automotive-grade urea, otherwise known as Diesel Exhaust Fluid (DEF). The DEF sets off a chemical reaction that converts nitrogen oxides into nitrogen, water and carbon dioxide (CO2), which is then expelled through the engine exhaust pipe.

For peak operation, the SCR system must be cleaned using one of two methods, Standstill Cleaning and Maintenance Standstill Cleaning. Standstill Cleaning is any cleaning requested by the engine outside of the regular maintenance window (for example, if the system detects crystallization in the DEF solution). Maintenance Standstill Cleaning is cleaning requested by the engine on the regular maintenance interval.

SCR technology is designed to permit nitrogen oxide (NOx) reduction reactions to take place in an oxidizing atmosphere. It is called “selective” because it reduces levels of NOx using ammonia as a reductant within a catalyst system. The chemical reaction is known as “reduction” where the DEF is the reducing agent that reacts with NOx to convert the pollutants into nitrogen, water and tiny amounts of CO2. The DEF can be rapidly broken down to produce the oxidizing ammonia in the exhaust stream. SCR technology alone can achieve NOx reductions up to 90 percent.

NOTE: *The system will reset the maintenance interval back to 0 hours after Standstill or Maintenance Standstill cleaning events are performed.*

Standstill Cleaning

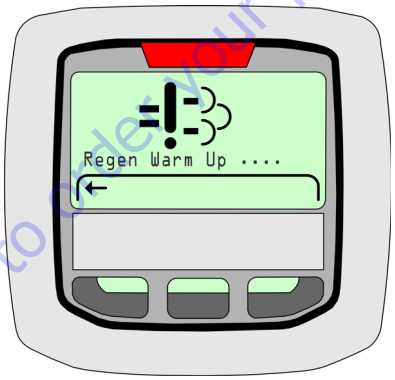
The following conditions must be met to perform Standstill Cleaning.

- Machine must be stationary
- Boom in the stowed position
- No personnel in platform
- Engine must be idling
- Coolant temperature must be above 167° F (75° C)
- Diesel Exhaust Fluid (DEF) tank must not be frozen
- Machine in Ground Station mode

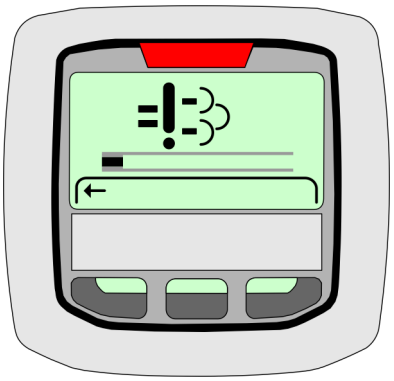
NOTE: *Every standstill regenration slightly dilutes the engine oil with fuel.The number of standstill regenration is therefore monitored.*

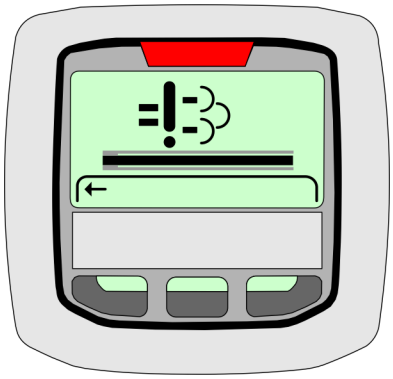
1. The Selective Catalytic Reduction Indicator will flash when standstill cleaning is required.

2. Move the machine to an suitable area free of flammables and personnel that could be exposed to hot exhaust. Launch the cleaning process by pressing the SCR button on the Ground Console for 3 seconds. The Indicator Gauge will display the following screen.



3. The Main Cleaning process will begin and last for approximately 30 to 60 minutes. The following screen will show that the process has begun and includes a status bar that indicates the progress of the cleaning process.





4. After the cleaning process is complete, the engine will run for approximately 5 minutes to allow the Engine and Exhaust After Treatment (EAT) to cool down. The Indicator Gauge will display the “Regen Complete" screen as shown and the HEST indicator will no longer be illuminated.

Maintenance Standstill Cleaning Initiation Methods

Maintenance Standstill Cleaning can be started by one of two methods, by using the Analyzer or SCR button on the Ground Console. All the same conditions as outlined under Standstill Cleaning must be met.

Cancelling Maintenance Standstill

Maintenance Standstill Cleaning will be stopped immediately if:

- The Platform/Ground Select switch is switched from Ground to Platform mode
- Function switch is enabled to perform a boom function
- The Engine is powered down

If Maintenance Standstill Cleaning is interrupted, it must be re-initiated.

If Maintenance Standstill Cleaning is interrupted, it must be re-initiated and the Indicator Gauge will display the "Regen Failed” screen as shown.

Unsuccessful Cleaning Event

If there is an unsuccessful cleaning event, The SCR icon will show on the display gauge. Possible causes of an Unsuccessful Cleaning Event are:

- Engine is not warmed up
- DEF tank is frozen
- Machine functions operated during cleaning event in progress
- Other engine faults are active

The Indicator Gauge will display the “Regen Failed” screen as shown. If the cleaning event has failed, it must be run again.

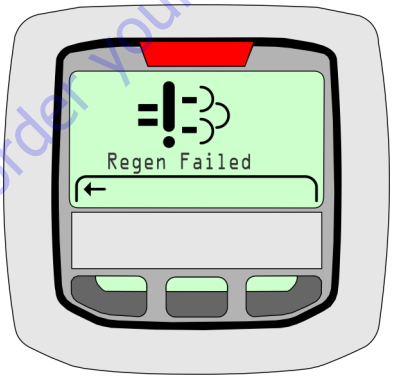


Table 3-8. Maintenance Standstill Cleaning

Standstill Cleaning Levels		Machine Hours Since Last Cleaning	System Distress Light	SCR Cleaning Light	Derate	Comments
0	Normal Operation	0-500 500-1000	--	--	None	Between 500 and 1000 hours, cleaning cycle can be initiated with JLG analyzer.
1	Standstill Required	1000-1100	--	 0.5 Hz	None	Engine coolant temperature must be >40°C and DEF should be thawed before cleaning can be initiated.
2	Warning Level	1100-1125	 Continuous	 0.5 Hz	Machine placed in Creep and DTC active	
3	Shut Off Level	>1125	 Blinking	 3 Hz	Idle Lock. Boom Functions Locked Out and Trapped in Transport.	Contact Deutz Dealer.

Table 3-9. Cleaning When Crystallization is Detected During SCR

Crystallization Levels	Machine Hours after Crystallization	Cleaning Initiation Methods	System Distress Light	SCR Cleaning Light	Derate
Normal Operation	No Crystallization Detected	--	--	--	None
Crystallization Detected Standstill Required	0-5	SCR Switch or Analyzer	--	 0.5 Hz	None
Crystallization Detected Warning Level 1	5-600	SCR Switch or Analyzer	 Continuous	 0.5 Hz	Machine placed in Creep and DTC active
Crystallization Detected Shut Off Level	>600	Contact Deutz Dealer.	 Blinking	 3 Hz	Idle Lock. Boom Functions Locked Out and Trapped in Transport.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523927	3	40	7-3-3	UB5; Short circuit to battery error of actuator relay 5. Short circuit to battery error of actuator relay 5. Components on Pin A04, A05 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A04, A05 Because the assignment of PINs is different between the engine series, check the connected loads in the motor circuit diagram.	Check wiring harness and connected loads on pins A04, A05.
523924	4	42	1-6-7	UB2; Short circuit to ground actuator relay 2. Components on Pin A01, K74 and K91 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A01, K74 and K91. Because the assignment of PINs is different between the engine series, check the connected loads in the motor circuit diagram.	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pins A04, A05. If error is still present, exchange ECU.
523925	4	43	7-3-1	Short circuit to ground actuator relay 3 Components on Pin A88 and K57 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A88 and K57. Because the assignment of PINs is different between the engine series, check the connected loads in the motor circuit diagram .	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pinsA88, K57. If error is still present, exchange ECU.
523926	4	44	7-3-2	UB4; Short circuit to ground actuator relay 4. Components on Pin A90 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A90 Because the assignment of PINs is different between the engine series, check the connected loads in the motor circuit diagram.	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pin A90. If error is still present, exchange ECU.
168	3	45	3-1-8	Battery voltage: the voltage measured by ECU is out of the target range, system reaction is initiated.	Battery voltage above warning threshold (~38,9Volt), Short cut to battery possible.	Check wiring harness and connected alternator.
168	4	46	3-1-8	Battery voltage: the voltage measured by ECU is out of the target range, system reaction is initiated.	Battery voltage below warning threshold, Short cut to ground.	Check wiring harness and connected alternator.
168	2	47	3-1-8	Battery voltage: the voltage measured by ECU is out of the target range, system reaction is initiated.	If Batteryvoltage (Ubatt_U) > 17V or 31V for mor than =0.5sec a warning is generated. Battery voltage above warning threshold.	Check wiring harness and connected alternator.
523912	4	73	7-2-2	@ engines < 4l: 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.	The sensed raw voltage value is below the minimum threshold.	The sensed raw voltage value DPM_uRawBrnDVDsP is above the minimum threshold DPM_SRCBrnDVDsP.uMin_C @ CRT < 4l: check throttle valve @ engines with Burner T4i: check back-pressure valve.
639	14	84	2-7-1	CAN bus 0: the ECU is not allowed to send messages, because the status "BusOff" is detected.	CAN Bus Off error; CAN 0 (Customer CAN).	Threshold for error detection is an internal ECU threshold. Bus Off bit for CAN A node is set. Check wiring of CAN bus and if necessary repair it, check connection cable and if necessary repair or replace it, check resistance in CAN lines (120 Ohm).
1231	14	85	2-7-1	CAN bus 1: the ECU is not allowed to send messages, because the status "BusOff" is detected Warning, no diagnostic with SERDIA2010 possible.	CAN Bus Off error; CAN 1 (Diagnostic CAN)	Threshold for error detection is an internal ECU threshold. Bus Off bit for CAN B node is set. Check wiring of CAN bus and if necessary repair it, check connection cable and if necessary repair or replace it, check resistance in CAN lines (120 Ohm).
1235	14	86	2-7-1	CAN bus 2: the ECU is not allowed to send messages, because the status "BusOff" is detected. Warning, depends on engine, EAT.	CAN Bus Off error; CAN 2 (Engine CAN)	Threshold for error detection is an internal ECU threshold. BusOff bit for CAN C node is set. Check wiring of CAN bus and if necessary repair it, check connection cable and if necessary repair or replace it, check resistance in CAN lines (120 Ohm).

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
102	2	89	2-2-3	Charge air pressure messured by sensor is above the shut off threshold.	Charge air pressure above shut off threshold.	Check waste gate system if necessary replace TC, check CAC if all channels are clean, check charge air piping if necessery.!! If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!
110	1	93	2-2-5	Coolant temperature sensor: the voltage of the sensor measured by ECU is out of the target range.	Suspected components: wiring harness, coolant temperature sensor.	Check wiring harness and connected Coolant Temp Sens.
110	3	96	2-2-5	Coolant temperature sensor: the voltage of the sensor measured by ECU is out of the target range (signal range check high)	Short cut to power supply or open load.	Check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
110	4	97	2-2-5	Coolant temperature sensor: the voltage of the sensor measured by ECU is out of the target range (signal range check low)	Voltage Surveillance has found shortcut to Ground at Coolant Temperatur Sensor.	Check sensor and if necessary replace it, check connection cable and if necessary repair or replace it Measure Voltage at Coolant Temperature Sensor and renew harness if needed.
110	0	98	2-3-2	Coolant temperature: the coolant temperature calculated by ECU is above the target range; the ECU activates a system reaction	Cooling temperature too high. Coolant temperature above warning threshold	Clean radiator, check fan drive, check coolant level, check cooling system in general, check thermostat function, check water pump
110	0	99	2-3-2	Coolant temperature: the coolant temperature calculated by ECU is above the target range. The ECU activates a system reaction	Coolant temperature above shut off threshold.	Clean radiator, check fan drive, check coolant level, check cooling system in general, check thermostat function, check water pump
111	1	101	2-3-5	Coolant level: the coolant level calculated by ECU is underneath the allowed minimum.	Coolant level too low, leakage in cooling system, sensor defective, wiring damaged.	Check coolant level, inspect cooling system for leakage and if necessary repair it, check sensor and wiring
3224	9	130	5-9-7	Timeout Error of CAN-Receive-Frame AT1IG1Vol; NOX sensor (SCR-system upstream cat; DPF-system downstream cat)	Failure of the CAN Bus message	NOX sensor and sensor connection check
3234	2	138	1-1-4	DLC Error of CAN-Receive-Frame AT1O1Vol NOX Sensor (SCR-system downstream cat; DPF-system downstream cat); length of frame incorrect	Failure of the CAN Bus message	NOX downstream sensor and sensor connection check
3234	9	139	1-1-7	Timeout Error of CAN-Receive-Frame AT1OG1Vol; NOX sensor (SCR-system downstream cat; DPF-system downstream cat)	Failure of the CAN Bus message	NOX downstream sensor and sensor connection check
523942	9	141	7-6-7	Timeout Error (BAM to BAM) for CAN-Receive-Frame AT1OGCVol2 information, Calibration message 1 of the after catalyst NOx sensor has failed. Factors & Sensorcalibration for NOX Sensor (SCR-system downstream cat, DPF-system downstream cat)	Defective Nox sensor, faulty parameterization.	NOX downstream sensor and sensor connection check.
523943	9	142	7-6-7	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1OGCVol2 information; factors & Sensorcalibration for NOX Sensor (SCR-system downstream cat; DPF-system downstream cat)	The fault is detected when a timeout error in packet 2 of NOxSenVol2Rx frame occurs.	NOX downstream sensor and sensor connection check
523211	9	164	3-3-1	Timeout Error of CAN-Receive-Frame EBC1	not used	not used
523704	12	167	6-1-5	Timeout Error of CAN-Transmit-Frame EEC3	Timeout Error (Missing CAN Bus message)	Check wiring harness and customer nodes

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523935	12	168	7-6-3	Timeout Error of CAN-Transmit-Frame EEC3V0L1; Engine send messages	Fault is detected if a TimeOut of the EEC3V0L1 frame has occured.	Check wiring harness and customer nodes
523936	12	169	7-6-4	Timeout Error of CAN-Transmit-Frame EEC3V0L2; Engine send messages	Timeout Error (Missing CAN Bus message)	Check wiring harness and customer nodes
523240	9	179	5-2-7	Timeout CAN-message FunModCtl; Function Mode Control	Timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
523216	9	198	3-3-7	Timeout Error of CAN-Receive-Frame PrHtEnCmd; pre-heat command, engine command	Timeout Error (Missing CAN Bus message)	Check wiring harness and customer devices
523766	9	281	1-1-8	Timeout Error of CAN-Receive-Frame Active TSC1AE	not used	not used
523769	9	284	1-1-9		not used	No detail informationen!
523776	9	291	1-1-9	Timeout Error of CAN-Receive-Frame TSC1TE - active	Timeout Error (Missing CAN Bus message)	Threshold for error detection is an internal ECU threshold. Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
523777	9	292	1-1-9	Message TSC1-TE has been missing (passive)	Passive timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus scheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range, check actuator
523778	9	293	1-1-8	Timeout Error of CAN-Receive-Frame TSC1TR; control signal	Timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus scheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range, check actuator
523779	9	294	1-1-8	Message TSC1-TR has been missing (passive)	Passive timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus scheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range, check actuator
523605	9	300	1-1-8		No detail informationen!	No detail informationen!
523982	1	361	7-3-7	Powerstage diagnosis disabled; Indicating that battery voltage is to low.	Powerstage diagnostic can be deactivated due to too low battery voltage.	Check wiring, check alternator, check cables and repair or replace if necessary.
630	12	376	2-8-1	Internal hardware monitoring: the ECU finds an error during the access to its EEPROM memory or works with an alternative value	Section could not be erased	Threshold for error detection is an internal ECU threshold. There is no healing possible for the error. In the every new initialization phase, the debounce level is set to zero. If not programmed, EEPROM is defect --> ECU is defect, reprogramm ECU and if necessary replace it.
630	12	377	2-8-1	Internal hardware monitoring: the ECU finds an error during the access to its EEPROM memory or works with an alternative value	Minimum 3 blocks could not be readed, EEPROM has Checksum Error	Threshold for error detection is an internal ECU threshold. There is no healing possible for the error. In the every new initialization phase, the debounce level is set to zero. If not programmed, EEPROM is defect -->ECU is defect, reprogramm ECU and if necessary replace it
630	12	378	2-8-1	Internal hardware monitoring: the ECU finds an error during the access to it's EEPROM memory or works with an alternative value	Block could not be written for minimum 3 times	Threshold for error detection is an internal ECU threshold. If not programmed, EEPROM is defect --> ECU is defect, reprogramm ECU and if necessary replace it.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
411	4	381	6-9-3	Range check cannot be done or interrupted.	Defect EGR differential Pressure sensor or defect wiring	Check wiring harness and connected EGR. !!!If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!
523612	12	387	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Injector shut off demand for the ICO coordinator	Threshold for error detection is an internal ECU threshold. Caution ! Sequence error, check error memory for other errors.
190	0	389	2-1-4	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Overspeed monitoring during 1 level of FOC (Failure overrun condition) if engine speed was over Limit.	Check powertrain settings regarding overspeed
190	11	390	2-1-4	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Overspeed monitoring during 2 level of FOC (Failure overrun condition) if engine speed was over limit.	Check powertrain settings regarding overspeed
190	14	391	2-1-4	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Overspeed monitoring during ORC (Override conditions) if engine speed was over limit	Check powertrain settings regarding overspeed
171	3	417	3-1-2	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check high	open loop to sensor	Check cabling, if environment temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
190	8	419	2-1-2	Camshaft speed sensor: the ECU receives no signal and uses the signal from crankshaft speed sensor as alternative to calculate the engine speed	When disturbed camshaft signal detected. Error in sensor or wiring.	Threshold for error detection is an internal ECU threshold, occurs by disturbed camshaft signal. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Camshaft Sensor or wiring.
190	2	421	2-1-3	ECU measures a deviation between camshaft and crankshaft angle to target.	Offset error between crankshaft and camshaft.	Threshold for error detection is an internal ECU threshold, occurs by offset between crankshaft and camshaft. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Camshaft and Crankshaft senor or wiring.
190	8	422	2-1-2	Sensor crankshaft speed; disturbed signal	Error in sensor or wiring. Crankshaft sensor defect.	Threshold for error detection is an internal ECU threshold, occurs by disturbed crankshaft signal. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Crankshaft Sensor or wiring.
190	12	423	2-1-2	Crankshaft speed sensor: the ECU receives no signal and uses the signal from camshaft speed sensor as alternative to calculate the engine speed.	Error in sensor or wiring.	Threshold for error detection is an internal ECU threshold, occurs by disturbed or no Crankshaft signal. Check increment wheel position, clean and adjust if necessary, check Crankshaft sensor postition or wiring.
97	3	464	2-2-8	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range	Check of wiring and water in fuel sensor. Check cabling, if charge Water in Fuel sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
97	4	465	2-2-8	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range.	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range.	Check wiring, sensor, ECU
94	3	472	2-1-6	Low fuel pressure sensor: the voltage of sensor measured by ECU is out of the target range	cable break or short circuit, sensor defective, connection cable damaged Short cut to battery or open loop	Check cabling, if sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
94	4	473	2-1-6	Low fuel pressure sensor: the voltage of sensor measured by ECU is out of the target range	cable break or short circuit, sensor defective, connection cable damaged short cut to ground	Check cabling, if sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
94	1	474	2-1-6	Low fuel pressure: the low fuel pressure calculated by ECU is underneath the target range; the ECU activates a system reaction	Fuel pressure below warning threshold	Check low fuel pressure system (fuel feed pump, relay, fuse, wiring, sensor) and if necessary repair or replace it.
676	11	543	2-6-3	Cold start device relay error	Relay defect or wire harness problem	Threshold for error detection is an internal ECU threshold. check wire harness, replace relay
676	11	544	2-6-3	Cold start aid relay open load	Relay or wire harness	Threshold for error detection is an internal threshold. check wire harness, replace relay
729	5	545	2-6-3	The cold start aid relay is according to wiring faulty.	Relay defect or wire harness problem	Threshold for error detection is an internal ECU threshold. Electrical error, check wires
729	3	549	2-6-3	Intake Air Heater Device; Short circuit to battery	wiring to the intake air heater device is faulty.	Threshold for error detection is an internal ECU threshold. Electrical error, Check wiring to the intake air heater device.
729	4	551	2-6-3	Air intake heater; Short circuit to ground error for powerstage on CJ945.	Relay (for cold start aid) cable break or short to ground.	Threshold for error detection is an internal ECU threshold. Electrical error, check wiring to the air intake heater.
523895	13	559	1-5-8	Missing or wrong injector adjustment value programming (IMA) injector 1 (in firing order).	Missing or wrong injector adjustment value for cyl. 1.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA). Use SERDIA UseCase to check it.
523896	13	560	1-5-8	Missing or wrong injector adjustment value programming (IMA) injector 2 (in firing order).	Missing or wrong injector adjustment value for cyl. 2	Threshold for error detection is an internal ECU threshold. check dataset and flash correct injector adjustement value (IMA). Use SERDIA UseCase to check it.
523897	13	561	1-5-8	Missing or wrong injector adjustment value programming (IMA) injector 3 (in firing order).	Missing or wrong parametrisation of injector adjustment cyl. 3.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA). Use SERDIA UseCase to check it.
523900	13	564	1-5-8	Missing or wrong injector adjustment value programming (IMA) injector 6 (in firing order).	Missing or wrong injector adjustment value for cyl. 6.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA). Use SERDIA UseCase to check it.
523350	4	565	1-5-1	Injector cylinder bank 1: the current drop measured by ECU is above the target range	Short circuit injection bank 1 (all injectors of this bank can be affected)	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
523352	4	566	1-5-2	Injector cylinder bank 2: the current drop measured by ECU is above the target range	Short circuit injection bank2 (all injectors of this bank can be affected)	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
523354	12	567	1-5-3	Internal hardware monitoring: the ECU detects an error of its injector high current output. Chip of CY33x defect power stage components	Defective powerstage in ECU	Threshold for error detection is an internal ECU threshold. If error is not removable, change ECU.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
651	5	568	1-5-4	Injector cyl. 1: interruption of electrical connection	Interruption of electronic connection Injector cyl. 1	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
652	5	569	1-5-5	Injector cyl. 2: interruption of electrical connection	Interruption of electronic connection Injector cyl. 2	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
653	5	570	1-5-6	Injector cyl. 3: interruption of electrical connection	Interruption of electronic connection Injector cyl. 3	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
654	5	571	1-6-1	Injector cyl. 4: interruption of electrical connection	Interruption of electronic connection Injector cyl. 4	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
655	5	572	1-6-2	Injector cyl. 5: interruption of electrical connection	Interruption of electronic connection Injector cyl. 5	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
656	5	573	1-6-3	Injector cyl. 6: interruption of electrical connection	Interruption of electronic connection Injector cyl. 6	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
651	3	580	1-5-4	Injector cyl. 1: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 1 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
652	3	581	1-5-5	Injector cyl. 2: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 2 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
653	3	582	1-5-6	Injector cyl. 3: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 3 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
654	3	583	1-6-1	Injector cyl. 4: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 4 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
655	3	584	1-6-2	Injector cyl. 5: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 5 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
656	3	585	1-6-3	Injector cyl. 6: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 6 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
523615	5	592	1-3-5	Detecting an open load fault in the metering unit	wiring harness defective, cable break	Threshold for error detection is an internal ECU threshold.Check wiring harness and metering unit if necessary repair/replace it.
523615	3	594	1-3-5	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to battery high side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523615	4	595	1-3-5	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to ground high side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
523615	3	596	1-3-5	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to battery low side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
523615	4	597	1-3-5	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to ground low side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
523615	4	599	1-3-5	Metering unit, short circuit to ground	not used	not used
523612	12	612	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory.	Plausibility check failed (MoCADC_uNTP_mp is higher than MoCADC_uNTPMax_C).	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	613	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Analysis of test voltage (Value is out of the target -> ECU internal error)	Threshold for error detection is an internal ECU threshold. Check wiring, check connected sensors actuators. If error is still present, exchange ECU.
523612	12	614	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Analysis of the ratiometric correction (Value is out of the target -> ECU internal error)	Threshold for error detection is an internal ECU threshold. Check wiring, check connected sensors actuators. If error is still present, exchange ECU.
523612	12	618	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Too less bytes received by monitoring memory from CPU as response (ECU internal error). Loss of synchronization sending bytes to the monitoring memory from CPU	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	619	5-5-5	Injection system, electrical error injectors	Suspected components: Injector ECU wiring harness/connector	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	620	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error trying to set MM Response time (ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	621	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error detected in the internal ECU communication, Too many SPI errors during MoCSOP execution	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	623	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error in the check of the shut-off path test of the under voltage detection (ECU internal error). Diagnostic fault check to report the error in undervoltage monitoring	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	624	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error in the check of the shut-off path of the monitoring module (ECU internal error).	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	625	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Time out error trying to set or cancelling the alarm task (ECU internal error). Failure setting the alarm task period	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	630	5-5-5	Impermissible offset between the engine speed of level 2 and level 1	Calculated engine speed in level 1/2 implausible (-> ECU internal error).	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523612	12	631	5-5-5	Diagnostic fault check to report the plausibility error between level 1 energizing time and level 2 information	Implausible injection energizing time for either PiIx or MI1 or PoIx.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	632	5-5-5	Error in the plausibility of the start of energising angles	Implausible start of energising of either PiIx or MI1 or PoIx.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	633	5-5-5	Error in the plausibility of the energising times of the zero fuel quantity calibration	The energising times of the zero fuel quantity calibration ZFC is out of the target. (-> ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	634	5-5-5	Error in the plausibility of PoI2 efficiency.	Error in the plausibility of PoI2 efficiency.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	635	5-5-5	Error in the PoI2 shut-off.	Error in the PoI2 shut-off.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	636	5-5-5	Error in the plausibility of PoI3 efficiency.	Error in the plausibility of PoI3 efficiency.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	637	5-5-5	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Error in the plausibility of current energising time with maximum permitted energising time. Diagnostic fault check to report the error due to Over Run	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	638	5-5-5	Error in the plausibility of the wave correction parts	Error in the plausibility of the wave correction parts	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	639	5-5-5	Plausibility error of the Rail pressure sensor	In case the gradient of rail pressure is larger than the max threshold or lesser than the min threshold. Rail metering unit defect. Leakge in the Rail System.	Threshold for error detection is an internal ECU threshold. Check metering unit or cable. Check Rail pressure. Check the Rail System of leakage.
523612	12	640	5-5-5	Error in the torque comparison between permissible engine torque and current actual torque	Error in the torque comparison between the permissible inner engine torque and the current plausible actual torque.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	12	641	5-5-5	Diagnosis of curr path limitation forced by ECU monitoring level 2	The torque comparison is not plausible with the torque monitoring.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
523612	3	644	5-5-5	supply voltage to high	not used	Threshold for error detection is an internal ECU threshold.
523612	4	646	5-5-5	supply voltage to low	not used	Threshold for error detection is an internal ECU threshold.
523612	12	714	5-5-5	Error report "WDA wire is active" due to a defect query/response communication	Error detection by monitoring module	Threshold for error detection is an internal ECU threshold. Software reset.
523612	12	715	5-5-5	Error report "ABE wire is active" due to undervoltage detection	The reason is that a slow dropping of the vehicle electrical system voltage (defective autobattery) should not lead the ECU OCWDA's diagnose to enter an error in the fault memory due to an undervoltage recognition.	Threshold for error detection is an internal ECU threshold. Software reset.
523612	12	716	5-5-5	Error report "ABE wire is active" due to overvoltage detection	If the ABE/WDA powerstage shut-off is active due to an overvoltage detection.	Threshold for error detection is an internal ECU threshold. software reset.
523612	12	717	5-5-5	Error report "ABE/WDA active" due to an unknown reason	The reason is that a slow dropping of the vehicle electrical system voltage (defective autobattery) should not lead the ECU OCWDA's diagnose to enter an error in the fault memory due to an undervoltage recognition.	Threshold for error detection is an internal ECU threshold. Software reset.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
100	3	732	2-2-4	Oil pressure sensor: the voltage of sensor measured by ECU is out of the target range	short circuit to battery or cable break	check battery and wiring Check cabling. If sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
100	4	733	2-2-4	Oil pressure sensor: the voltage of sensor measured by ECU is out of the target range	Short circuit to ground	The sensed raw voltage value Oil_uRawPSwmp is above Oil_SRCPSwmp.uMin_C Check cabling, if sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
100	0	735	2-3-1	High oil pressure; shut off threshold exceeded	not used	not used
100	1	736	2-3-1	Oil pressure is below the target range (warning threshold)	Oilpressure too low (pressure below warning threshold)	Threshold for error detection is an internal ECU threshold. Check oil level, check engine for oil leckage, measure oil pressure external to evaluate sensor value
100	1	737	2-3-1	Oil pressure is below the target range (shut off threshold)	Oilpressure too low (pressure below shut off threshold).	Threshold for error detection is an internal ECU threshold. Check oil level, check engine for oil leckage, measure oil pressure external to evaluate sensor value.
107	3	750	1-3-6	short circuit to battery or cable break	No detail informationen!	If the signal PAirFltD_uRaw is below the applicatable threshold PAirFltD_uSRCMax_C, a signal range violation is reset after the healing debouncing. No detail informationen!
107	0	751	1-3-6	short circuit to ground	No detail informationen!	If the signal PAirFltD_uRaw is above the applicatable threshold PAirFltD_uSRCMin_C, a signal range violation is reset after the healing debouncing No detail informationen!
107	0	752	1-3-6	Air filter differential pressure: the pressure difference of the intake air between the filter inlet and outlet calculated by ECU is above the target range and the ECU activates a system reaction	Pressure loss above target range, air filter clogged or defective, sensor not working, connection cable damaged Pressure value above warning threshold	Check airfilter and if necessary clean or renew it, check cabling, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
102	2	772	2-2-3	Deviation between sensed intake manifold pressure is not plausible compared to environment pressure. Which sensor is not okay can not be said.	deviation between ambient pressure sensor and charge air pressure sensor at not running engine to high	1) Exchange boost pressure sensor 2) Exchange ECU
102	1	774	2-2-3	charge air pressure below lower limit	measured charge air pressure below the threshold.	Check complete air system of engine for massive leakage, especially from compressor to intake air manifold. Check air filter. Exchange charge air presure sensor.
102	3	776	2-2-3	Charge air pressure sensor: the measured voltage of sensor by ECU is out of the target range	The Sensor Voltage is above the Threshold.	Check cabling, if charge air pressure/temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
102	4	777	2-2-3	Charge air pressure sensor: the measured voltage of sensor by ECU is out of the target range.	The Sensor Voltage is below the Threshold.	Check cabling, if charge air pressure/temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
411	3	795	6-9-3	The sensed raw voltage Air_uRawPEGRDeltaP is above the maximum threshold.	EGR Delta pressure Sensor defect	Check cabling, if charge EGR Delta pressure sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
411	4	796	6-9-3	The sensed raw voltage value Air_uRawPEGRDeltaP is above the minimum threshold.	EGR Delta pressure Sensor defect	Check cabling. If charge EGR Delta pressure sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
3253	2	807	6-9-2	The difference pressure sensor value exceeds an applicable not plausible threshold.	sensed differential pressure across DPF > limit	Check tubes from exhaust line to sensor => course strictly rising Could sensor be frozen? Cold enough? => Warm-up engine and check whether failure heals (needs ignition cycle) Water in sensor or lines to sensor? => dry & Re-Check system Exchange differental pressure sensor. Trigger Conditions: If the differential pressure sensor over the DOC + DPF system detects a pressure difference higher than 18hPa AND ignition is off for more than 2s AND engine is not in cranking this diagnostic will detect an error.
3251	0	809	6-9-2	The difference pressure sensor value exceeds an applicable upper shutoff limit	sensensed differential pressure across DPF > high limit f(exhaust volume flow)	Check soot load level. DPF Check DPF condition. Check DPF differential sensor . If still allowed run stand-still If failure healed after stand-still check engine regarding too high soot emissions at engine out: Check complete air path of engine => Turbocharger, throttle, EGR-Valve, EGR-Cooler, all pipes. If stand-still is not allowed to run check engine regarding too high soot emissions at engine out Replace DPF! ! If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!
3251	0	810	6-9-2	The difference pressure sensor value exceeds an applicable upper warning threshold.	sensed differential pressure across DPF > warning high limit f(exhaust volume flow)	Check soot load level. Check DPF condition. Check DPF differential sensor. If still allowed run stand-still If failure healed after stand-still check engine regarding too high soot emissions at engine out: Check complete air path of engine => Turbocharger, throttle, EGR-Valve, EGR-Cooler, all pipes If stand-still is not allowed to run check engine regarding too high soot emissions at engine out Replace DPF !! If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
3251	1	812	6-9-2	The difference pressure sensor value exceeds an applicable lower shutoff threshold.	sensed differential pressure across DPF < shut-off low limit f(exhaust volume flow)	Check tubes from exhaust line to DPF differential sensor Check flange between DOC & DPF for leakage Check Exhaust pipe upstream DPF for leakage Check engine exhaust mass flow / exhaust volume flow Visual inspection of dismounted DPF exchange DPF differential sensor exchange DPF
3251	1	813	6-9-2	The difference pressure sensor value drops below an applicable warning threshold.	sensed differential pressure across DPF< warning low limit f(exhaust volume flow)	Check tubes from exhaust line to DPF differential sensor Check flange between DOC & DPF for leakage Check Exhaust pipe upstream DPF for leakage Check engine exhaust mass flow / exhaust volume flow Visual inspection of dismounted DPF exchange DPF differential sensor exchange DPF
3253	3	814	6-9-2	Electrical error differential pressure B58 (DPF) The measured voltage is above the preset upper limit value.	sensor voltage > high limit	Check wiring (terminal diagram engine side). Exchange differential sensor DPF.
3253	4	815	6-9-2	Electrical error differential pressure (DPF) The measured voltage is below the set lower limit value. Short circuit to ground	sensor voltage < low limit	Check wiring Exchange differential sensor DPF
523009	9	825	2-5-3	The pressure relief valve (PRV) has reached the number of allowed activations.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Replace pressure relief valve (PRV) and reset fault with Serdia.
523470	2	826	1-4-6	The pressure relief valve (PRV) has been opened due to excessive pressure.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Threshold for error detection is an internal ECU threshold. Reset the fault and at reappearance check injection system.
523470	2	827	1-4-6	The pressure relief valve (PRV) has been opened due to excessive pressure.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Threshold for error detection is an internal ECU threshold. Reset the fault and at reappearance check injection system.
523470	12	828	1-4-6	Rail pressure relief valve: is open. Shutoff conditions.	Shut Off after PRV Open	Threshold for error detection is an internal ECU threshold. Check PRV opening counter and if necessary replace PRV, check rail-pressure sensor for plausibility and if necessary replace it, check FCU and if necessary replace it.
523470	12	829	1-4-6	Rail pressure relief valve is open. Warning conditions.	Warning PRV open	Threshold for error detection is an internal ECU threshold. Check PRV opening counter and if necessary replace PRV, check rail-pressure sensor for plausibility and if necessary replace it, check FCU and if necessary replace it.
523470	14	830	1-4-6	Rail pressure relief valve is open. (PRV)	Open PRV	Threshold for error detection is an internal ECU threshold. Only after ECU reset. Check PRV opening counter and if necessary replace it, check rail-pressure sensor for plausibility and if necessary replace it, check FCU and if necessary replace it.
523470	11	831	1-4-6	Rail pressure relief valve can not be opened due to the railpressure.	Railpressure out of tolerance range (PRV can not be opened by a pressure peak in this operating point)	Threshold for error detection is an internal ECU threshold. Check railpressure, check rail pressure sensor for plausibility, check FCU.
523470	11	832	1-4-6	Rail pressure is out of the expected average range. The PRV can not be opened at this operating point with a pressure shock.	Averaged rail pressure is outside the expected tolerance range.	Threshold for error detection is an internal ECU threshold. Check PRV and replace if necessary.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523009	10	833	2-5-3	The pressure relief valve (PRV) has reached the allowed opening time.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Replace pressure relief valve (PRV) and reset fault with Serdia.
1176	0	847	1-3-9	Pressure above upper limit. Pressure sensor upstream turbine, Physical Range Check high. The physical value is above the set threshold.	sensed pressure upstream turbine > limit	Check function of waste gate => tube connected / actuator okay Check exhaust pipe blockage Check for crystallisation downstream of DEF injector Check EGR-Valve functionality Check rail pressure & injectors: injector stuck? Check free rotation of turbocharger
1176	3	849	1-4-1	Signal range check (SRC) with the pressure sensor has exceeded the upper limit of the voltage signal.	Short cut to battery. Damaged Turbine upstream sensor.	Check cabling, check turbine upstream pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
1176	4	850	1-4-1	In signal range check (SRC) has the voltage signal of the pressure sensor the lower limit below.	Short cut to ground. Damagedturbine upstream pressure sensor.	Check cabling, check turbine upstream pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
523613	0	856	1-3-4	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	Pressure governor deviation exceeds the limiting value based on the engine speed.	Threshold for error detection is an internal ECU threshold. (A) Check for leakage (B) Check fuel-primary pressure (C) Change components, check sensor and if necessary replace it, check fuel system and if necessary repair it
523613	0	857	1-3-4	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	maximum positive deviation of rail pressure exceeded concerning set flow of fuel.	Threshold for error detection is an internal ECU threshold. (A) Check for leakage (B) Check fuel-primary pressure (C) Change components, check sensor and if necessary replace it, check fuel system and if necessary repair it
523613	0	858	1-3-4	Rail pressure: the fuel pressure in rail calculated by ECU is above the target range which is dependant on the engine speed.	leakage is detected based on fuel quantity balance.	Threshold for error detection is an internal ECU threshold. (A) Check backflow pressure (B) Check Injector function with SerDia (C) Change components (metering unit, injector) if necessary
523613	0	859	1-3-4	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	Maximum negative rail pressure deviation with metering unit on lower limit is exceeded.	Threshold for error detection is an internal ECU threshold. (A) Check backflow pressure (B) Check Injector function with SerDia (C) Change components (metering unit, injector) if necessary
523613	1	861	1-3-4	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	Rail pressure falls below the limiting value based on the engine speed.	Threshold for error detection is an internal ECU threshold. (A) Check backflow pressure (B) Check Injector function with SerDia (C) Change components (metering unit, injector) if necessary

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523613	0	862	1-3-4	Rail pressure: the fuel pressure in rail calculated by ECU is above the target range.	Rail pressure exceeds the limiting value.	(A) Check backflow pressure (B) Check pressure relief valve and metering unit. (C) Change components if necessary
523613	2	864	1-3-4	Rail pressure metering unit, Setpoint of metering unit in overrun mode not plausible.	Pressure pump delivery quantity in overrun exceeds the threshold based on the pressure.	Threshold for detection is an internal ECU threshold. (A) Check backflow pressure (B) Check pressure relief valve and metering unit. (C) Change components if necessary
523470	7	876	1-4-6	Rail pressure is out of the expected average range.	Rail pressure is out of the expected average range. PRV can not be opened.	(A) Check railpressure relief valve and replace if necessary. (B) Check high pressure pumps, pressure relief valve and metering unit. (C) Change components if necessary
157	3	877	1-4-7	Rail pressure sensor: the voltage of sensor measured by ECU is out of the target range.	Short cut to battery. Damaged rail pressure sensor.	Check cabling, check rail pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
157	4	878	1-4-7	Rail pressure sensor: the voltage of sensor measured by ECU is out of the target range.	Short cut to ground. Damaged rail pressure sensor.	Check cabling, check rail pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
523720	8	925	1-4-8	Supply module heater: Duration of switch on is too long.	Duty cycle for temperature readout from supply module heater to the control unit is out of range; Supply modul defect, fault in the wiring.	When the received supply module heater temperature duty cycle SCR_rSMT is out of the failurerange (SCR_rSMFailMax_C < SCR_rSMHtrT < SCR_rSMFailMin_C) Supply module check and replace if necessary. Check the wiring.
523720	8	926	1-4-8	Supply module heater: Dutycycle timing over error threshold.	Duty cycle for temperature readout from supply module heater to the control unit is not valid. Supply modul defect, fault in the wiring.	When the received supply module heater duty cycle SCR_rSMHtrT is in the valid range (SCR_r-Supply module check and replace if necessary. Check the wiring.
523721	11	927	6-8-9	Supply module heater: temperature measurement not available.	Duty cycle for temperature readout from supply module heater to the control unit is not available. Supply modul defect, fault in the wiring.	Threshold for detection is an internal ECU threshold. No erasing in the current driving cycle. Supply module check and replace if necessary. Check the wiring.
523722	8	928	6-9-1	Supply module heater: PWM time periode out of valid range.	PWM signal for temperature readout from supply module to the control unit is out of range. Supply modul defect, fault in the wiring.	The Time period of the received PWM signal SCR_tiSMPerPwm is within the specified range of150ms to 250ms Supply module check and replace if necessary. Check the wiring.
523722	8	929	6-9-1	Supply module heater: Faulty PWM signal from supply module.	PWM Signal for temperature readout from supply module to the control unit is not valid. Supply modul defect, fault in the wiring.	Threshold for error detection is an internal ECU threshold. When valid Sync followed by temperature information signal is received AND valid sync and temperaturesignal for both information is received one after the other. Supply module check and replace if necessary. Check the wiring.
523721	8	930	6-8-9	Supply module heater: Dutycycle timing over error threshold.	Duty cycle for temperature readout from supply module to the control unit is out of range. Supply modul defect, fault in the wiring.	Supply module check and replace if necessary. Check the wiring.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523721	8	931	6-8-9	Supply module heater: Dutycycle timing out of valid range.	Duty cycle for temperature readout from supply module to the control unit is not valid. Supply modul defect, fault in the wiring.	When the received supply module duty cycle SCR_rSMT is in the valid range (SCR_rSMTVld-Min_C <= SCR_rSMT <= SCR_rSMTVldMax_C), OR in the failure range (SCR_rSMFailMin_C <=SCR_rSMT <= SCR_rSMFailMax_C) Supply module check and replace if necessary. Check wiring.
29	3	932	1-2-6	Analog accelerator pedal 2 (hand pedal): the voltage measured by ECU is out of the target range.	"Sensor defect. Short cut to battery or open loop."	If the signal is below the applicatable threshold APP_uRawSRCHiHTLIS_C, the signal range violation is reset after the healing debouncing. In case when the CCP is active (CCP_stActive = 1)and the reading from the EEPROM memory is successful, the signal is below the threshold APP_uHTLISCCPHi[1], a signal range violation is reset after debouncing.
91	3	935	2-2-6	Analog accelerator pedal sensor 1 or double accelerator pedal sensor: the voltage measured by ECU is out of the target range or the calculated pedal position is implausible compared with the position of the second pedal	Sensor defect. Short cut to battery or open loop.	Check cabling, check accelerator pedal sensor and if necessary replace it, check connection cable and if necessary repair or replace it. If the signal is below the applicatable threshold APP_uRaw1SRCHigh_C, the signal range violation is reset after the healing debouncing.
29	4	937	1-2-6	Analog accelerator pedal 2 (hand pedal): the voltage measured by ECU is out of the target range.	Sensor defect. Short circuit to Ground.	If the signal exceeds the applicatable threshold APP_uRawSRCLoHTLIS_C, the signal range violation is reset after the healing debouncing. In case when the CCP is active (CCP_stActive = 1)and the reading from the EEPROM memory is successful, the signal exceeds the threshold APP_uHTLISCCPLo[1], a signal range violation is reset after debouncing.
91	4	940	2-2-6	Analog accelerator pedal 1: the voltage measured by ECU is out of the target range.	Sensor defect. Short circuit to Ground.	Check cabling, check accelerator pedal sensor and if necessary replace it, check connection cable and if necessary repair or replace it If the signal exceeds the applicatable threshold APP_uRaw1SRCLow_C, the signal range violation is reset after the healing
3532	3	943	1-2-7	DEF tank level sensor: the voltage measured by ECU is out of the target range.	Short circuit to battery, broken wiring	DEF tank level sensor check, wiring check The sensed raw voltage value SCR_uRawUTnkLvl is below SCR_SRCUTnkLvl.uMax_C
3532	4	945	1-2-7	DEF tank level sensor: the voltage measured by ECU is out of the target range.	Short circuit to ground	The sensed raw voltage value SCR_uRawUTnkLvl is above SCR_SRCUTnkLvl.uMin_C DEF tank level sensor check, wiring check

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
1079	13	946	2-8-2	Internal hardware monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 1.	Suspected components EDC17cv52 Pin A19: DEF press / Exh.PressBeforeTurb (P3) / Air Pump PresS/BrnFuelPressAfterDV2Pin K19: Fan Speed Sensor Pin A21: LDF6T / OilPress / LowFuelPressPin A17: Rail Pressure Sensor Suspected components EDC17cv54 Pin A21: CAM speedPin K44: Delta Press Venturi / Poti EGR or Inlet Throttle Pin A24: LDF6T / OilPress / LowFuelPressPin K43: Reserve 5V Sensor Supply Pin A09: second footpedal Suspected components EDC17cv56 Pin A21: Cam speedPin K44: DEF press / Air FilterDiffPress Pin A24: LDF6T / OilPress / LowFuelPressPin K43: second footpedal Pin A09: Delta Press Venturi	Check cabling of external components, check working voltage and if necessary correct it, check connection cable and if necessary repair or replace it, if error is not removable, change ECU.
1080	13	947	2-8-2	Internal hardware monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 2.	Suspected components EDC17cv52 Pin K16: second footpedal Pin K18: Pressure DS DPF Pin A20: Exh.PressAfterTurb/DPFDiffPress/ BrnDV1Press/HClPressDV1DV2 Suspected components EDC17cv54 Pin K45: DPF Diff Press / Exh. Press After Turb / Fan Speed Sensor Pin A46: first footpedal Suspected components EDC17cv56 Pin A22: Fan Speed Sensor Pin K45: Position EGR or Intake throttle flap Pin K46: First footpedal	Check cabling of external components, check working voltage and if necessary correct it, check connection cable and if necessary repair or replace it, if error is not removable, change ECU.
523601	13	948	2-8-2	Internal hardware monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 3.	Suspected components EDC17cv52 Pin A18: DeltaPressVenturi / Position intake throttle flap Pin K20: First footpedal Pin K21: Air FilterDiffPress Suspected components EDC17cv54 and cv56 Pin A07: Rail pressure	Check cabling of external components, check working voltage and if necessary correct it, check connection cable and if necessary repair or replace it, if error is not removable, change ECU.
677	3	956	5-1-2	Start relay (high side power stage): the current drop measured by ECU is above the target range.	Short cut HighSide-output to battery.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
677	4	957	5-1-2	Start relay (high side power stage): the current drain measured by ECU is above the target range.	Shortcut HighSide-output to ground.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
677	5	958	5-1-2	Start relay (low side power stage): the current drop measured by ECU is above the target range	Open circuit/disconnection LowSide-Output.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
677	3	960	5-1-2	Start relay (low side power stage): the current drain measured by ECU is above the target range.	Shortcut LowSide-Output to battery.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
677	4	961	5-1-2	Start relay (low side power stage): the current drop measured by ECU is above the target range.	Shortcut LowSide-Output to ground.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable of terminal 50 and if necessary repair or replace it.
523612	14	973	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory.	Visibility of Softwareresets in DSM	Threshold for error detection is an internal ECU threshold.
523612	14	974	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory.	Visibility of Softwareresets in DSM	Threshold for error detection is an internal ECU threshold.
523612	14	975	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Visibility of SoftwareResets in DSM	Threshold for error detection is an internal ECU threshold. If possible the software update has to be done. Replace the ECU.
91	11	976	2-2-6	Diagnostic fault check of synchronism of single potentiometer and Low idle switch(LIS.	Measured voltage of accelerator pedal 1 is out of plausible range.	Threshold for error detection is an internal ECU threshold. Check cabling, check accelerator pedal and pedal sensor and if necessary replace it, check connection cable and if necessary repair or replace it. When the PWM period APP_tiPWMPer is in between APP_tiSRCLoPWMPer_C and APP_tiSRCHiPWMPer_C.
29	2	978	1-2-6	Diagnostic fault check of synchronism of hand throttle and Low idle switch(LIS).	Plausibility error between sensor and idle switch	Threshold for error detection is an internal ECU threshold. The accelerator pedal must have detected full load and idle plausibility at least once.
523550	12	980	5-1-5	Terminal 50 was operated for more than 2 minutes. This may happen due to short to battery or wrong usage of Terminal 50. Starter control is disabled until this error is healed.	Startinformation to Starter (T50-switch) erratic/defect.	Threshold for error detection is an internal ECU threshold. Check cabling, if sensor not working, check start switch and if necessary replace it, check connection cable and if necessary repair or replace it.
105	3	994	1-2-8	Charge air temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to battery. sensor voltage > limit	The sensor raw signal Air_uRawTCACDs (voltage) > Air_SRCTCACDs.uMin_C. Check CAC-sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
105	4	995	1-2-8	Charge air temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to ground or open load. sensor voltage <limit.	The sensor raw signal Air_uRawTCACDs (voltage) is below Air_SRCTCACDs.uMin_C. Check CAC-sensor and if necessary replace it, check connection cable and if necessary repair or replace it

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
105	0	996	2-3-3	Charge air temperature downstream calculated by ECU is above the target range. The ECU activates a system reaction.	Charge air temperature (downstream) over warning threshold.	Check CAC system and clean it. Check fan functionality. Check cooling perfomance with temperature measurement. !! If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!
105	0	997	2-3-3	Charge air temperature downstream calculated by ECU is over the shut off threshold. The ECU activates a system reaction.	Charge air temperature (downstream) over the shut off threshold.	Check CAC system and clean it. Check fan functionality. Check cooling perfomance with temperature measurement. !! If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!
412	3	1007	6-8-2	EGR downstream temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to battery. sensor voltage > limit	Check wiring harness to TEGR-sensor. Exchange TEGR-sensor.
412	4	1008	6-8-2	EGR downstream temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to ground or open load. sensor voltage <limit	Check wiring harness to TEGR-sensor. Exchange TEGR-sensor.
523960	0	1011	7-7-1	Physical range check high for EGR cooler downstream temperature.	Sensed temperature downstream EGR-cooler > limit.	EGR-Valve blocked open EGR-Valve actuator defect EGR-cooler defect (check for coolant water) Reed Valve defect Intake throttle blocked in closed position Exhaust pressure too high Check Nox-sensor upstream SCR catalyst dp venturi sensor defect !! If an error occurs, always check the delta P sensor and the Venturi tube for damage or contamination because problems at this point can lead to this result error.!!
5763	6	1014	5-9-4	Actuator error EGR-Valve. Signal range check high.	Short cut to batterie.	Check wiring and repair or replace if necessary, check actuator with SERDIA test for EGR and if necessary replace it.
520521	5	1015	5-9-4	Actuator error EGR-Valve. Signal range check low.	Short cut to ground.	Check wiring and repair or replace if necessary, check actuator with SERDIA test for EGR and if necessary replace it.
5763	7	1016	5-9-4	Actuator position for EGR valve is not plausible, internal error, angular misalignement of the flap.	Position error of throttle flap (deviation > 7%).	Threshold for error detection is an internal ECU threshold. Threshold for error detection, deviation from setpoint > 7%. Troubleshooting with SERDIA 2010 Use Case "EGR Diagnostic".
5763	6	1022	5-9-4	Actuator error EGR-Valve; signal range check high, measured current by ECU is over target	Short circuit to battery or open circuit.	Check cabling, actuator defect, check actuator and if necessary replace it, check connection cable and if necessary repair or replace it.
5763	5	1023	5-9-4	Actuator error EGR-Valve; signal range check low, measured current is below target	Short circuit to ground.	Check wiring, check cabels and repair or replace if necessary, check actuator with SERDIA 2010 test for EGR and if necessary replace it.
5763	3	1024	5-9-4	Actuator of the external EGR valve: the ECU detects a short circuit to battery or open load.	Short cut to battery or open loop.	Check cabling, actuator defect, check actuator and if necessary replace it, check connection cable and if necessary repair or replace it.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
5763	4	1025	5-9-4	Actuator of the external EGR valve: the ECU detects a short circuit to ground.	Short cut to ground	Check cabling, actuator defect, check actuator and if necessary replace it, check connection cable and if necessary repair or replace it.
4769	2	1026	6-8-4	Static plausibility check: The exhaust temperature value from the sensor after DOC, the exhaust temperature value from the sensor before DOC, the temperature value from the sensor before SCR-Cat-Cat, the environment temperature and the coolant engine temperature their ratios to each other exceed their related thresholds. (difference temprature between sensor befor DOC and sensor after DOC > threshold 1 difference temperature between sensor after DOC and sensor before SCR >threshold 2 difference temperature between sensor befor DOC and sensor befor SCR < threshold 3 difference temperature between sensor befor DOC and sensor environment < threshold 4 difference temperature betweenengine temperature and environment < threshold 5) Dynamic plausibility check with exhaust temperature sensor value before DOC: The difference between the exhaust temperature sensor befor- and after DOC is large	static plausibility check: sensed temperature downstream DOC differ too much from sensed temperature upstream DOC or sensed temperature upstream SCR catalyst=> check is done if difference temperature of EngDa_tEngAir_tAFS < limit & Exh_tOxiCatUs-SCR_tAdapUCatUsT < Limit& Exh_tOxiCatUs-Air_tAFS < Limit & SCR_stWrmUpLstDrvCyc = 1 & TOxiCatDs_stStatChkEna_mp = 1 in words: engine cold start and EAT-system had reached SCR-dosing-state at least once in the last driving cycle before that start or dynamic plausibility check against environmental temperature: engine running and sensed temperature downstream DOC > ambient temperature + offset TOxiCatDs_tDsEnvOffsThres_C or dynamic plausibility check of temperature difference across DOC: Exh_tSensTOxiCatDs-Exh_tOxiCatUs > limit, separate limits for nomal mode, heatmode or Stand-still. Engine must be in operation. Which conditions sets the D	Check ambient temaperature => value plausible? T downstream DOC sensor mounted within exhaust line? T downstream DOC sensor physically mounted in correct position downstream DOC? (not upstream SCR or upstream DOC?) Other T-sensors show plausible values? No errors on them? Check temperature difference across DOC by Exh_tSensOxiCatDs-Exh_tSensOxiCatUs: < 100 K? Check exhaust pipe downstream turbo charger for oil? Too many hydrocarbons in exhaust? White smoke (at hot EAT system, not at cold start)? Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger, Piping for leakage and correct function check injectors: is an injector got stuck?
4766	0	1029	6-8-4	The exhaust temperature value from the sensor after DOC is above an applicable upper shutoff threshold	Sensed temperature downstream DOC > threshold	Check temperature difference across DOC by Exh_tSensOxiCatDs-Exh_tSensOxiCatUs: < 100 K? Check exhaust pipe downstream turbo charger for oil? Too many hydrocarbons in exhaust? White smoke (at hot EAT system, not at cold start)? Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injectors: is an injector got stuck? Exchange temperature sensor downstream DOC
4766	0	1030	6-8-4	The exhaust temperature value from the sensor after DOC is above an applicable upper warning threshold	Suspected Components: Sensor after DOC defect Problems in the exhaust path before DOC DOC is defect	Check temperature sensor after DOC Check the exhaust path before DOC Check the DOC
4769	3	1034	6-8-4	Sensor error exhaust gas temperature downstream (DOC); signal range check high	The sensed raw voltage value Exh_uRawTOxiCatDs > Exh_SRCTOxiCatDs.uMax_C Shortcut to battery	Check wiring harness to temperature sensor downstream DOC Exchangetemperature sensor downstream DOC
4769	4	1035	6-8-4	Sensor error exhaust gas temperature downstream (DOC); signal range check low	The sensed raw voltage value Exh_uRawTOxiCatDs < Exh_SRCTOxiCatDs.uMin_C Shortcut to ground	Check wiring harness to temperature sensor downstream DOC Exchangetemperature sensor downstream DOC

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
4768	2	1036	6-8-3	Static plausibility check: The exhaust temperature value from the sensor before DOC, the exhaust temperature value from the sensor after DOC, the temperature value from the sensor before SCR-Cat, the environment temperature and the coolant engine temperature their ratios to each other exceed their related thresholds. Dynamic plausibility check with environment temperature sensor value: The exhaust temperature value from the sensor before DOC is lower than an applicable environment temperature threshold	Static plausibility check: The exhaust temperature value from the sensor before DOC, the exhaust temperature value from the sensor after DOC, the temperature value from the sensor before SCR-Cat, the environment temperature and the coolant engine temperature their ratios to each other exceed their related thresholds. (difference between temperature after DOC and temperature before DOC > Threshold 1 difference between temperature befor DOC and before SCR > Threshold 2 difference between temperature after DOC and before SCR < Threshold 3 difference between temperature after DOC and ambinet temperature < Threshold 4 differnece between temperatur ambient temperature and engine temperature < Threshold 5) Dynamic plausibility check with environment temperature sensor value: The exhaust temperature value from the sensor before DOC is lower than an applicable environment tempe	Check ambient temperature => value plausible? upstream DOC sensor mounted within exhaust line? T upstream DOC sensor physically mounted in correct position upstream DOC? (not upstream SCR or downstream DOC?) Check T upstream DOC sensor Check other T-sensors within EAT-system (Exh_tOxiCatDs & UCatUsT_tFlt_mp show plausible values? No errors on them?
4765	0	1039	6-8-3	The exhaust temperature value from the sensor befor DOC is above an applicable upper shutoff threshold TOxiCatUs_tShOffThresHiAds_C = Threshold 1 in Normal and Heatmodes (TOxiCatUs_tShOffThresHiRgn_C = Threshold 2 in stand-still)	sensed temperature upstream DOC > shut-off limit	Check air path of engine: EGR-Valve, Intake-Throttle, Check Turbocharger and Piping each for leakage and correct function Check injectors: is an injector got stuck? Exchange temperature sensor upstream DOC
4765	0	1040	6-8-3	The exhaust temperature value from the sensor befor DOC is above an applicable upper warning threshold TOxiCatUs_tWarnThresHi_C = Threshold	Sensed temperature upstream DOC > warning limit	Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injectors: is an injector got stuck? Exchange temperature sensor upstream DOC
4768	3	1044	6-8-3	Oxidation catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	The sensed raw voltage value Exh_uRawTOxiCatUs is above Exh_SRCTOxiCatUs.uMax_C Shortcut to battery	Check wiring harness to temperature sensor upstream DOC Exchangetemperature sensor upstream DOC
4768	4	1045	6-8-3	Oxidation catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	The sensed raw voltage value Exh_uRawTOxiCatUs is below Exh_SRCTOxiCatUs.uMin_C Shortcut to ground	Check wiring harness to temperature sensor upstream DOC Exchangetemperature sensor upstream DOC

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
4360	0	1069	6-6-8	The filtered DEF cat upstream temperature is greater than an applicable maximum temperature threshold	Sensed temperature upstream SCR > physical high limit	Check temperature difference across DOC (Exh_tOxiCatDs-Exh_TOxiCatUs) at higher engine load => high difference > 100 K? If yes, the engine emitts too many Hydrocarbons => check injectors: is an injector got stuck? => Check EGR Valve If difference normal the exhaust out of the engie itself is too hot: => Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function If that error was set while stand-still operation the error source could be exothermal soot burn off in DPF (which should not happen) => Dismount DPF and check it visually exchange temperature sensor upstream SCR
4361	3	1072	6-6-8	DEF catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	Voltage of temperature sensor upstream SCR catalyst > maximum limit Short circuit to battery	Check sensor Check wiring Replace UCatUsT-sensor
4361	4	1073	6-6-8	DEF catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	Voltage of temperature sensor upstream SCR catalyst < minimum limit Short circuit to ground	Check sensor Check wiring Replace UCatUsT-sensor
3361	6	1075	6-7-7	DEF dosing valve: the currentmeasured value by ECU at the end of the injection is too high	Fault in the wiriing Defect DEF dosing injection valve	Check wiring Check the DEF dosing injection valve
3361	3	1077	6-7-7	DEF dosing valve (low side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Threshold for error detection is an internal ECU threshold See substitute function Check the wiring
3361	3	1078	6-7-7	DEF dosing valve (high side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Threshold for error detection is an internal ECU threshold Check the wiring
3361	4	1079	6-7-7	Urea dosing valve (low side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Check the wiring
3361	4	1080	6-7-7	DEF dosing valve (high side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Threshold for error detection is an internal ECU threshold Check the wiring
4345	5	1090	6-7-4	DEF backflow line heater: the current drain measured by ECU is above the target range	Open load Broken wiring, broken heating element in backflow line If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
4345	3	1092	6-7-4	DEF backflow line heater: the current drain measured by ECU is above the target range	Shortcut to battery Short cut to battery or broken wiring, broken heating element in backflow line If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
4345	4	1093	6-7-4	DEF backflow line heater: the current drain measured by ECU is above the target range	Shortcut to ground Short cut to ground or broken wiring, broken heating element in backflow line If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check heating element

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
4343	5	1094	6-7-3	DEF pressure line heater: the current drain measured by ECU is above the target range	Open load Broken wiring, broken heating element in pressure line If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
4343	3	1096	6-7-3	DEF pressure line heater: the current drain measured by ECU is above the target range	shortcut to battery broken heating element in pressure line If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
4343	4	1097	6-7-3	DEF pressure line heater:the current drain measured by ECU is above the target range	Shortcut to ground Short cut to ground or broken wiring, broken heating element in pressure line If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
523718	5	1098	6-7-6	tank heating valve: the current drain measured by ECU is above the target range	Open load Broken wiring, broken Valve If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Test tank heating valve Check cabling, if necessary replace relay.
523718	3	1100	6-7-6	DEF heater relay: the current drain measured by ECU is above the target range	Shortcut to battery Broken wiring, broken relay If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check SCR main relay
523718	4	1101	6-7-6	DEF heater relay: the current drain measured by ECU is above the target range	Shortcut to ground Broken wiring, broken relay If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check SCR main relay
4341	5	1102	6-7-5	DEF heater supply line: the current drain measured by ECU is above the target range	Open load Broken wiring If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wire harness Check supply line
4341	3	1104	6-7-5	DEF heater supply line: the current drain measured by ECU is above the target range	Shortcut to battery Broken wiring If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wire harness Check supply line
4341	4	1105	6-7-5	DEF heater supply line: the current drain measured by ECU is above the target range	short cut to ground Broken wiring If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wire harness Check supply line
523719	5	1106	6-7-2	DEF supply module heater: the current drain measured by ECU is above the target range	Open load Broken wiring Heating element in supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check cabling, if necessary replace supply module
523719	3	1108	6-7-2	DEF supply module heater: the current drain measured by ECU is above the target range	Short circuit to battery Broken wiring Heating element in supply module defect If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check cabling, if necessary replace supply module

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523719	4	1109	6-7-2	DEF supply module heater: the current drain measured by ECU is above the target range	Shortcut to ground Broken wiring Heating element in supply module defect If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check cabling, if necessary replace supply module
4366	5	1110	6-7-1	DEF tank heating valve: the current drain measured by ECU is above the target range	Open load Broken wiring Urea tank heating valve defect If this error detected during the heating phase KWP 1089 can be a result error	Threshold for error detection is an internal ECU threshold Check wiring Check urea tank heating valve
523632	11	1117	6-6-6	Urea supply module pump: the current drain measured by ECU is above the target range	When the pump motor does not switch to pump actuation mode after temperature measurement has been carried out.	Threshold for error is an internal ECU threshold
4375	5	1118	6-6-6	Urea supply module pump: the ECU can not measure any reaction during pump control	Open load Broken wiring Pump in urea supply module defect	Threshold for error detection is an internal ECU threshold The hardware detects the presence of load on the PWM output power stage for the urea pump module actuator. Check wiring. Check pump in the urea supply module
4375	3	1120	6-6-6	Urea supply module pump: the current drain measured by ECU is above the target range	Shortcut to battery If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Pump in urea supply module defect	Threshold for error detection is an internal ECU threshold The hardware detects absence of any short circuit to battery on the PWM output power stage for the urea pump module actuator Check wiring. Check pump in the urea supply module
523632	3	1127	6-6-5	Urea supply module pressure sensor: the current drain measured by ECU is above the target range	Shortcut to battery Broken wiring Pressure sensor in DEF supply module defect	Check wiring Check pressure sensor in urea supply module
523632	4	1128	6-6-5	Urea supply module pressure sensor: the current drain measured by ECU is above the target range. The sensed raw voltage value SCR_uRawUPmpP is above SCR_SRCUPmpP.uMin_C	Shortcut to ground Broken wiring Pressure sensor in urea supply module defect	Check wiring Check pressure sensor in DEF supply module
4376	5	1129	6-6-7	Urea supply module reversal valve: the current drain measured by ECU is above the target range	Open load Fault in the wiring Reversal valve in the DEF supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea supply modul

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
3031	0	1135	6-6-9	DEF temperature in DEF tank is to high.The DEF tank temperature sensor detects a value above the maximum allowed threshold	Sensed urea tank temperature > physical range high limit	Case "CANBUS sensor": Check urea tank temperature: really hot? Check CANBus-messageof DEF sensor urea tank temperature Com_dRxSCR2Byt2 Compare it to Com_dRxSCR1Byt1 (urea temperature at quality sensor) identical? Tank heater permantly on? Check wiring of DEF-quality sensor Case "analog DEF T & Level sensor": Check urea tank temperature: really hot? Check urea tank temperature SCR_tSensUTnkT Compare urea tank temperature to EnvT_t or to SCR_tSMT (the urea temperature inside the supply module) identical? Tank heater permantly on? Check wiring of analog DEF T & Level sensor
3031	1	1136	6-6-9	The urea tank temperature sensor detects a value lower than the minimum allowed threshold.	sensed urea tank temperature < physical range low limit	Case "CANBUS sensor": Check ambient temperature EnvT_t => About -40 °C? If yes Error could be plausible Check CANBus-message of DEF sensor urea tank temperature Com_dRxSCR2Byt2 Compare it to Com_dRxSCR1Byt1 (urea temperature at quality sensor) identical? Check wiring of DEF-quality sensor Check quality sensor Case "analog DEF T & Level sensor": Check urea tank temperature: really that cold? Check ambient temperature EnvT_t => About -40 °C? If yes Error could be plausible Check urea tank temperature SCR_tSensUTnkT Check wiring of analog DEF T & Level sensor Check analog DEF T & Level sensor
4365	3	1138	6-6-9	Urea tank temperature sensor: he current drain measured by ECU is above the target range.	Shortcut or open load.	Threshold for error detection is an internal ECU threshold. The Sensed raw voltage value SCR_uRawUTnkT is below SCR_SRCUTnkT.uMax_C. Check wiring.
4365	4	1139	6-6-9	Urea tank temperature sensor: he current drain measured by ECU is above the target range.	Shortcut or open load.	Threshold for error detection is an internal ECU threshold. The sensed raw voltage value SCR_uRawUTnkT is above SCR_SRCUTnkT.uMin_C. Check wiring.
523612	12	1170	5-5-5	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error during positive test(ECU internal error). Diagnostic fault check to report that the positive test failed	Threshold for error detection is an internal ECU threshold. Reflash ECU. If error is still activ replace ECU.
168	1	1181	3-1-8	Battery voltage: the voltage measured by ECU is out of the target range	Battery voltage below limit	Check alternator, cabling, contact resistance, safety fuses, too high load in energy system, check battery and if necessary replace it, check battery pole and if necessary c

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
5763	4	1229	5-9-4	Actuator EGR-valve: short cut to battery on ECU pin is detected	Short-Circuit to ground on component	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case
5763	6	1230	5-9-4	Actuator error EGR-valve; Overload by short-circuit	Short Circuit over Load	Threshold for error detection is an internal ECU threshold. Check wiring, component
5763	11	1231	5-9-4	Actuator error EGR valve (2.9;3.6) or throttle valve (4.1;6.1;7.8); Power stage overtemperature due to high current 3.6) throttle valve (4.1;6.1;7.8); Power stage overtemperature due to high current;	Temperature dependent Over Current	Threshold for error detection is an internal ECU threshold. Check wiring, component
5763	4	1232	5-9-4	_Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); Voltage below threshold 3.6) Drosselklappe (4.1;6.1;7.8); Voltage below threshold;	Monitoring for CY146 Under Voltage.	Threshold for error detection is an internal ECU threshold. Check wiring, component
523984	3	1239	7-8-8	UB7; Short circuit to battery error of actuator relay 7Components onPin A03 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A03 Because the assignment of PINs is different between the engine series, check the connected loads in the motor circuit diagram	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pin A03. If error is still present, exchange ECU.
523986	4	1241	1-7-6	UB6; Short circuit to ground actuator relais 6 Components onPin A04 and A05 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A04 and A05 Because the assignment of PINs is different between the engine series, check the conected loads in the motor circuit diagram	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pin A04 and A05. If error is still present, exchange ECU.
523987	4	1242	7-9-1	UB7; Short circuit to ground actuator relay 7 Components onPin A03 cannot be activated. Internal ECU power stage switched off.	Suspected Components: ECU PIN A03 Because the assignment of PINs is different between the engine series, check the connected loads in the motor circuit diagram	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pin A03. If error is still present, exchange ECU.
2797	4	1337	5-6-5	Injector diagnosis: Timeout of Injetor detection cylinder bank 0	Short-Circuit to ground on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
2798	4	1338	5-6-6	Injector diagnosis: Timeout of Injetor detection cylinder bank 1	Short-Circuit to ground on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
2797	4	1339	5-6-5	Injector test: Short cut to ground on cylinder bank 0	Short-Circuit to ground on component wiring	Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
2798	4	1340	5-6-6	Injector test: Short cut to ground on cylinder bank 1	Short-Circuit to ground on component wiring	Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
164	2	1381	8-3-9	Rail pressure control: error during afterrun (appears only at 2000 bar system)	Rail pressure is still above threshold.	Threshold for error detection is an internal ECU threshold. Reset the fault and at reappearance check ECU and injection system
1136	0	1398	6-8-1	ECU internal temperature; temperature measured by ECU is out of the target range	Short-Circuit in ECU, ECU heated by hot air	Close warm air circuits, replace ECU

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
3711	12	1455	7-1-1	Temperature Phy_tPfWgh, the weighted DPF temperature < Threshold 1 Temperature Phy_tPfWgh, the weighted DPF temperature > Threshold 2 towards the end of the stand-still main phase.	temperature Phy_tPfWgh, the weighted DPF temperature, is below or above the target temperature towards the end of the stand-still main phase.	Check temperature upstream DOC Exh_tSensOxiCatUs within Stand-still: > 450 °C? If not: => Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check temperature difference across DOC by Exh_tSensOxiCatDs - Exh_tSensOxiCatUs within Stand-still: < 100°C? If not: Check exhaust pipe downstream turbo charger for oil? check injectors: is an injector got stuck? Too many hydrocarbons in exhaust? White smoke (at hot EAT system, not at cold start)? Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check exhaust gas temperature sensors within EAT-system: T upstream DOCC, T downstream DOC & T upstream SCR catalyst all three of them can influence Phy_tPfWgh
524057	2	1505	8-4-3	Low fuel pressure: the low fuel pressure calculated by ECU is underneath the target range; the ECU activates a system reaction	Fuel pressure below warning threshold	Threshold for error detection is an internal ECU threshold. Check low fuel pressure system (fuel feed pump, relay, fuse, wiring, sensor) and if necessary repair or replace it.
524074	9	1533	2-4-6	Open load sensor internally at NOx-sensor downstream SCR	Open load sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor downstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration. Check wiring harness Exchange sensor
524075	11	1534	2-4-7	Short circuit sensor internally at NOx-sensor downstream SCR	Short circuit sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor downstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration? Rearrange if critical and possible Check wiring harness Exchange sensor

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524076	9	1535	2-4-8	Open line sensor internally at NOx-sensor downstream SCR NOx Sensors are CAN Sensors --> no HW Pin on the ECU	Open line sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor upstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration. Check wiring harness Exchange sensor
524077	11	1536	2-4-9	Short circuit sensor internally at NOx-sensor downstream SCR NOx Sensors are CAN Sensors --> no HW Pin on the ECU	Short circuit sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor upstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration. Check wiring harness Exchange sensor
524078	9	1537	2-5-5	Lambda value of NOx-Sensor downstream SCR is out of range. When the filtered Lambda concentration value at the sensor (ComRxSCR_rFltLamDs_mp) is greater than the physical range check max. lambda threshold	sensed lambda value of Nox-sensor downstream SCR catalyst is > physical high limit ComRxSCR_rCanLamDs_mp > threshold	Check whether NOx-sensor downstream SCR catalyst is physically mounted within the exhaust line Check Lambda values of NOx-sensor downstream SCR catalystat at idle conditions, ComRxSCR_rCanLamDs_mp > threshold? Compare to ComRxSCR_rCanLamUs_mp. Values must be almost identical Check CANBus of NOx-sensor downstream SCR catalyst Check NOx-sensor downstream SCR catalyst wiring Check NOx-sensor downstream SCR catalyst itself Replace NOx-sensor downstream SCR catalyst
524079	9	1538	2-5-6	sensed lambda value of NOx-sensor downstream SCR catalyst is < physical low limit ComRxSCR_rCanLamDs_mp < threshold	sensed lambda value of NOx-sensor downstream SCR catalyst is < physical low limit ComRxSCR_rCanLamDs_mp < threshold	Compare to ComRxSCR_rCanLamUs_mp.ComRxSCR_rCanLamDs_mp must be almost identical! If almost identical, Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injection system of engine. Injector stuck? if sensed lambda upstream SCR higher (ComRxSCR_rCanLamUs_mp) : Diesel in Urea-tank? Check CANBus of NOx-sensor downstream SCR catalyst Check NOx-sensor downstream SCR catalyst wiring Check NOx-sensor downstream SCR catalyst itself Replace NOx-sensor downstream SCR catalyst

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524080	9	1539	2-5-7	sensed lambda value of Nox-sensor upstream SCR catalyst is > physical high limit ComRxSCR_rCanLamUs_mp > Threshold	sensed lambda value of Nox-sensor upstream SCR catalyst is > physical high limit ComRxSCR_rCanLamUs_mp > Threshold	Check whether NOx-sensor upstream SCR catalyst is physically mounted within the exhaust line Check Lambda values of NOx-sensor upstream SCR catalystat at idle conditions, ComRxSCR_rCanLamUs_mp < Threshold? Compare to ComRxSCR_rCanLamDs_mp. Must be almost identical Check CANBus of NOx-sensor upstream SCR catalyst Check NOx-sensor upstream SCR catalyst wiring Check NOx-sensor upstream SCR catalyst itself Replace NOx-sensor upstream SCR catalyst
524081	9	1540	2-5-8	sensed lambda value of Nox-sensor upstream SCR catalyst is < physical low limit ComRxSCR_rCanLamUs_mp < Threshold	sensed lambda value of Nox-sensor upstream SCR catalyst is < physical low limit ComRxSCR_rCanLamUs_mp < Threshold	Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injection system of engine. Injector stuck? Check CANBus of NOx-sensor upstream SCR catalyst Check NOx-sensor upstream SCR catalyst wiring Check NOx-sensor upstream SCR catalyst itself Replace NOx-sensor upstream SCR catalyst
524063	5	1557	8-6-9	Urea pressure line heater: broken wiring detected Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Open load on wiring to component	Check wiring, component
524063	3	1558	8-6-9	SCR heater mainrelay; short circuit to battery Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Short-Circuit to battery on wiring to component	Check wiring, component
524063	4	1559	8-6-9	Connection between heating valve (Y31) on the control unit Pin A:92 and Load side SCR heater main relay (K31) is a short cut to ground. Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Faulty wiring, faulty heater relay (K27-K31), defective heating valve (Y31), broken element in heating.	Disconnect plug from heating valve (Y31) and reset fault. If fault is still present you have to look in the wiring of Y31 to the control unit Pin A:92. If error is no longer present, you have to check the wiring of Y31 via relay K31 and possibly the heating cables and relay (K27-K30).
524063	5	1560	8-6-9	SCR relay for suction line not connected Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	relay defect relay not connected wiring harness broken problems with supply voltage	Check wiring, component
524065	4	1570	8-9-2	voltage of pressure sensor upstream SCR< voltage low limit	voltage of pressure sensor upstream SCR< voltage low limit	Check wiring of pressure sensor upstream SCR catalyst. Check pressure sensor upstream SCR catalyst. Exchange pressure sensor upstream SCR catalyst

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524065	2	1598	8-9-2	Comparison of urea cat upstream exhaust gas- and environment pressure, the difference should not exceed a certain limit abs(UCatUsP_pDiffEnvCat_mp) > Threshold	absolut value of difference between sensed pressure upstream SCR catalyst and environmental pressure > limit abs(UCatUsP_pDiffEnvCat_mp) > Threshold	Check electric connector: 4h pin open / new connector type used? pressure exchange from inside electrical connector with the environemt possible? water in sensor? sensor frozen? Check wiring of pressure sensor upstream SCR catalyst Exchange pressure sensor upstream SCR catalyst Check intake manifold pressure sensor (Air_pCACDs) Check ambient pressure sensor (EnvP_p)
1761	14	1655	1-3-8	The urea tank volume ratio is below the threshold of <5%	actual urea tank level SCRUTnk_rVol_mp [%] is below applicable threshold 5%	Check urea level => if empty, then fill in urea Check DEF level sensor. If there is urea in the tank, then move the floater of the level sensor. The floater must be free. If you lift the sensor body, then SCRUTnk_rVol_mp must change. Exchange DEF level sensor, if no change of valueor it's implausible.
2791	7	1752	4-1-5	EGR actuator is mechanically blocked.	EGR actuator faulty or blocked.	Threshold for error detection is an internal ECU threshold. Check the EGR actuator and EGR valve to mechanical blockage / clean. Check for free movement of the valve. If it'S blocked, then exchange the EGR valve.
2791	2	1753	4-1-5	corrupted CAN communication with actuator.	CAN bus error or faulty EGR actuator.	Threshold for error detection is an internal ECU threshold. Check other CAN bus components. If no message is sent, fix the wiring. If o.k. exchange EGR actuaror.
2791	13	1754	4-1-5	EGR actuator can not learn stop positions. Possibly only second failure if other EGRTV failures occure.	Error detection during the learning process.	Threshold for error detection is an internal ECU threshold. Start Serdia Usecase to reset EGR actuator. Check EGR valve and mounting situation. If o.k. change EGR actuator.
2791	12	1755	4-1-5	Internal electrical fault of EGR actuator.	Internal damage of EGR actuator due to high temperature or electrical wiring issue.	Threshold for error detection is an internal ECU threshold. Exchange EGR actuator.
2791	13	1756	4-1-5	EGR actuator can not learn stop positions because procedure was interrupted.	Interruption of learning process due to mechanical damage.	Threshold for error detection is an internal ECU threshold. Start Serdia Usecase to reset EGR actuator.
2791	6	1757	4-1-5	Overcurrent to EGR actuator.	High voltage from battery. EGR actuator is blocked or moving very hard.	Check battery voltage. Check if EGR is blocked or not running smoothly. If everything is o.k. change EGR actuator.
2791	3	1758	4-1-5	Overvoltage at EGR actuator.	High voltage from the battery	Check battery voltage.
2791	4	1759	4-1-5	Undervoltage at EGR actuator.	Low voltage from the battery.	Check battery voltage.
2791	13	1760	4-1-5	Stop positions of EGR valve not o.k.	Mechanical damage of EGR actuator. EGR valve is blocked or moving very hard.	Threshold for error detection is an internal ECU threshold. Start Serdia Usecase to reset EGR actuator.
2791	7	1761	4-1-5	EGR actuator spring broken.	mechanical damage of spring due to overstress.	Threshold for error detection is an internal ECU threshold. Exchange EGR actuator.
2791	16	1762	4-1-5	Internal actuator temperature above threshold.	overheating of EGR actuator	Let EGR actuator cool down, check heat accumulation during worst case operation.
2791	0	1763	4-1-5	Internal actuator temperature is above threshold.	Overheating of EGR actuator during operation.	Let EGR actuator cool down and check heat accumulation during worst case operation.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
523612	12	1857	5-5-5	Fault in the monitoring during the engine start. Start requested in level 1, but not released in level 2 which leads to no fuel injection.	wiring is not according DEUTZ requirements engine start conditions are not observed low battery voltage during start malfunction of starter	Threshold for error detection is an internal ECU threshold. check other active errors and fix them. check all needed engine start conditions, e.g. neutral switch. check the engine speed during starting of the engine. If it's too low, then check the battery voltage and then check the starter for malfunction.
524147	7	1858	9-6-6	During Afterrun and draining of DEF lines, the reverting valve in the DEF supply module is opened but the urea pump pressure increases instead of decrease, which means that the reverting valve is not working.	Urea pressure sensor is defect. Reverting valve is blocked. Urea injector is blocked.	Run SERDIA use-case "injection test" to ensure the urea injector works properly. Run SERDIA use-case "pressure test" to ensure the lines are filled with urea and supply module is working Run SERDIA use-case "empty service". The urea pump ressure, SCR_pAbsAdapUPmpP,must decrease below the urea pump pressure before the reverting valve was opened. Observe SCR_pAbsAdapUPmpP & SCR_stURevVlv (0 = closed, 1 = open) & SCR_rDycUdosVlv The error heals each time after SCR system status "emptying" (64) is successfully ended => debounce time 30 s. If the error is still active, then exchange supply module.
524175	0	1859	9-9-3	Tailpipe Nox-emissions are higher than NTE-Limit (2 g/kWh) and/or NRTC-Limit (0.9 g/kWh)	- no DEF injection ijection of DEF with low qual -ity (normal quality = 32.5%) - injection of non-DEF fluid	- Check DEF level in tank which should be higner than 12%. - Check DEF quality ComRxSCR_rAdBlu which shall be above 32.5%. If it's below 24, then it's diluted urea in tank or even water => Exchange the fluid in the tank with right DEF quality. -Check DEF supply module: perform pressure test => Replace supply module -Check DEF dosing valve => perform injector test => Clean injector with water => Repeat injector test => Replace injector -Check NOx sensor downstream SCR catayst: check wiring and sensor itself. At warm engine and warm EAT-system (SCRT_tCatAvrgExhGs > 250°C) in steady state, check sensed Nox-values: at ComRxSCR_stNOxRdyUs &ComRxSCR_stNOxRdyDs, ComRxSCR_rNOxUs must be > ComRxSCR_rNOxDs. ComRxSCR_rNOxDs shall be< 100 ppm in steady state operation. => Exchange NOx-Sensor downstream of SCR catalyst -Check engine air path: dp venturi sensor, EGR cooler, EGR-Valve, Intake

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524178	7	1864	9-9-6	The urea pump is not able to control the urea pressure between 9bar and 11 bar.	The urea pump controller is not able to control the urea pressure between 9bar and 11 bar due to malfunction in the SCR system. Suspected components: DEF pump broken Reverting valve continously open Urea suction line, backflow line broken or connection swapped PWM Powerstage has a defect Pump Pressure sensor broken	Make sure that DEF lines, pump and tank are not frozen. Check for DEF level in the tank Check DEF lines: All lines connected? The right lines connected to the correct places? Suction line blocked? Is there any leakage? Not also urea to the outside but also air into the lines, especially in the suction line! Perform SERDIA usecase "pressure test": Does the DEF pump work properly? => check wiring harness & PWM signal for pump Does the DEF pressure rise? Is the error healed? If still unsuccessful so far: Check DEF pressure sensor: At ignition on and SCR system state = 0 ("Init check"), SCR_pAbsAdapUPmpP shall be identical to EnvP_p. Fulfilled: Sensor okay! Check reverting valve Check DEF pump filter:dirt inside? Suspected components: DEF pump broken Reverting valve continously open DEF suction line, backflow line broken or connection swapped PWM Powerstage has a defect
4360	2	1865	6-6-8	Error at static plausibility check: absolut temperature difference of sensed temperature upstream SCR catalyst and ambient temperature > as static plausibility limit at engine cold start (engine was off for at least 8 h), temperature upstream of SCR catalyst is expected to be identical to ambient temperature => see enable conditions for details. Error at dynamic plausibility check: temperature difference of sensed temperature upstream SCR catalyst and ambient temperature < as dynamic plausibility limit dynamic check is blocked if static plausibility check is already faulty => Temperature upstream SCR catalyst must be by 40°C higher than ambient temperature if engine runs and a certain delay time has expired.	Error at static plausibility check: absolut temperature difference of sensed temperature upstream SCR catalyst and ambient temperature > as static plausibility limit at engine cold start (engine was off for at least 8 h), temperature upstream of SCR catalyst is expected to be identical to ambient temperature => see enable conditions for details. Error at dynamic plausibility check: temperature difference of sensed temperature upstream SCR catalyst and ambient temperature < as dynamic plausibility limit dynamic check is blocked if static plausibility check is already faulty => Temperature upstream SCR catalyst must be by 40°C higher than ambient temperature if engine runs and a certain delay time has expired.	Check whether temperature sensor upstream of SCR catalyst is physically mounted within exhaust pipe If cold start condition can be made sure (engine was off for at least 8 h)compare values of EnvT_t, EngDa_tEng,Exh_TOxiCatUs, Exh_tOxiCatDs and SCR_tSensUCatUsT at ignition on, without starting the engine. All identical? Compare values of Exh_TOxiCatUs, Exh_tOxiCatDs and SCR_tSensUCatUsT after 15 min in constant operation point: show all similar values (30 K tolerance width). Are ambient temperature and (EnvT_t), cooling water temperature (EngDa_tEng) plausible? Sensor coated with urea crystalls? Dismount urea injector and inspect temperature sensor upstream SCR catalyst visually Check wiring of sensor Replace sensor
524067	2	1867	8-9-4	absolute diference of sensed temperature of supply module heater temperature and ambient temperature UPmpT_tDiffPmpHtrAmb_mp >threshold	absolute diference of sensed temperature of supply module heater temperature and ambient temperature UPmpT_tDiffPmpHtrAmb_mp > threshold	Compare SCR_tSMT with SCR_tSMHtrT, EnvT_t and CEngTds_tand SCR_tAdapUTnkT => All identical? If not: Has the machine been brought from cold environment into a warm one or vice versa without engine running, e.g. at workshop? Environment temperature sensor defect Coolant temperature sensor defect Supply module temperature sensor defect Problem at Supply module unit (broken?) => exchange supply module

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524067	2	1868	8-9-4	absolute diference of sensed temperature of supply module temperature and ambient temperature> threshold	absolute diference of sensed temperature of supply module temperature and ambient temperature UPmpT_tDiffPmpAmb_mp > threshold	Compare SCR_tSMT with SCR_tSMHtrT, EnvT_t and CEngTds_tand SCR_tAdapUTnkT => All identical? If not: Has the machine been brought from cold environment into a warm one or vice versa without engine running, e.g. at workshop? Environment temperature sensor defect Coolant temperature sensor defect Supply module temperature sensor defect Problem at Supply module unit (broken?) => exchange supply module
1761	2	1869	1-2-9	In the case the system is calucalating an DEF injection demand and the filling level of the tankdoesn´t change, the diagnostic function will detect an implausible behavior.	Suspected components: - suction unit sensor defect - mechanical defect at the float gauge	Check the suction unit sensor for communicated values on CAN bus. Check the level sensor for plausible values. Check mechanical damage on the floater of the level gauge.
524152	2	1874	9-7-1	CAN message is not received for a definite time => error is set. As soon as the message is received the error heals.	CAN message is not received for a definite time => error is set. As soon as the message is received the error heals.	Check eletrical connection oif urea quality sensor Check engine CAN bus Check urea quality sensor itself Exchange urea quality sensor
524153	2	1875	9-9-7	CAN message is not recieved for a definite time => error is set. As soon as the message is received again the error is healed.	CAN message is not received for a defined time => error is set. As soon as the message is received again the error is healed.	Check electrical connection of suction unit sensor (combined sensor with tank level and tank temperature) Check engine CAN bus Check level sensor itself Exchange suction unit
4768	2	1881	6-8-3	At engine cold start conditions the sensedexhaust gas temperature downstream DOC (Exh_tSensTOxiCatDs) has exceeded the sum of ambient temperature (EnvT_t) + offset (40°C) earlier than the sensed exhaust gas temperature upstream of DOC (Exh_tSensTOxiCatUs). The check is only performed once each ignition cycle and only if the start is judged a cold start. Error status is frozen for that ignition cycle. No healing possible.	Difference temperature of exhaust gas temperature downstream DOC and fixed ambient temperature at ignition on exceeds a certain limit earlier than the difference temperature of exhaust gas temperature upstream DOC and fixed ambient temperature at ignition on.	Check whether all exhaust gas temperature sensors within the EAT system are mounted properly: Within the exhaust line and at correct positions. Check the position of the sensor upstream SCR which might be physically mounted in the wrong position. If cold start condition can be made sure (engine was off for at least 8 h) compare values of EnvT_t, EngDa_tEng,Exh_TOxiCatUs, Exh_tOxiCatDs and SCR_tSensUCatUsT at ignition on, without starting the engine. All identical? Then the sensors itself are okay. Check exhaust piping for leakage. Check wiring of sensors Replace sensors Check DOC => physicallly intact?
524190	14	1891	2-7-2	Inducement level 1 activ Not enough urea in tank or low urea quality or hardware tampering failure is detected or hardware failure is detected	Low DEF tank level Low DEF quality Hardware Tampering is active Hardware Failure is active	Check DEF level in tank. If there is no DEF, refill up to volume above the warning threshold. Check the DEF quality in the tank. If wrong fluid is filled, refill with proper DEF. Check other errors based on hardware malfunctions.
524191	14	1892	2-7-3	Inducement level 2 activ. A low DEF tank level or a low DEF quality is detected or hardware tampering(system components are pinched off) or hardware failures as shortcut to battery, shortcut to ground etc. are detected.	Low DEF tank level Low DEF quality Hardware Tampering is active Hardware Failure is active	Threshold for error detection is an internal ECU threshold. Check the DEF level in tank. If there is no DEF, refill up above the warning level. Check DEF quality filled in the tank. Check other errors based on hardware tampering or failure.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524193	8	1893	2-7-5	The total time in standstill-regeneration mode exceeds the long-limit threshold within last 500h total engine run time. The error is activated if the engine runs to many times in Standstill regeneartion. Change oil and reset counter.	Stand-still mode is very often aborted by the operator. Stand-still mode does not reach required temperature level and regeneration level is therefore reached after a short time again	Read out stand-still statistics => see service manual: Stand-still operation finished or often interrupted by driver / engine shut-off? => Run stand-still and instruct operator Stand-still operation required often by soot load =>Check dp DPF pressure sensor Stand-still mode does not reach required temperature level: Check engine air path: Intake Trottle, EGR-Valve and turbocharger okay? Any leakage in engine air intake sytem or exhaust gas system? Check temperature sensors within exhaust system: upstream DOC, downstream DOC If soot load level of DPF allow it: Perform Stand-still and check reached temperature level upstream and downstream DOC: T upstream DOCin the range of 480-550°C?Downstream DOC after 25 min stand-still main phase 590°C are reached? Temerature traces are steady and even? Temperature downstream DOC higher than upstream DOC but difference does not exceed100 K?
524194	8	1894	2-7-6	The total time in standstill-regeneration mode exceeds the long-limit threshold: 2,5h stand-still operation within 50h total motor run time. The error is activated if the engine runs to much time in short Standstill regeneartion. Change oil and reset counter.	Stand-still mode is aborted / interrupted too often by the operator Stand-still is required too often due to miscalculation in the soot model Stand-still mode does not reache temperature level and regeneration level is therefore reached after a short time again.	Read out stand-still statistics => see service manual: Stand-still operation finished or often interrupted by driver / engine shut-off? => Run stand-still and instruct operator Stand-still operation required often by soot load =>Check dp DPF pressure sensor Stand-still mode does not reach required temperature level: Check engine air path: Intake Trottle, EGR-Valve and turbocharger okay? Any leakage in engine air intake sytem or exhaust gas system? Check temperature sensors within exhaust system: upstream DOC, downstream DOC If soot load level of DPF allows it: Perform Stand-still and check reached temperature level upstream and downstream DOC: T upstream DOCin the range of 480-550°C?Downstream DOC after 25 min stand-still main phase 590°C are reached? Temerature traces are steady and even? Temperature downstream DOC higher than upstream DOC but difference does not exceed100 K?

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
3519	12	1895	2-7-7	The integrated temperature sensor of the Urea Quality Sensor measures higher temperature than threshold	Temperature sensor inside the UQS defect. CAN Communication corrupted. Overheating of the DEF tank due to malfunction of the heating valve. Flow direction is of coolant is wrong due to mixed up the hoses routed to the heating valve. Overheating of the DEF tank due to heat transfer from neighbor parts.	Check the temperature sensor signal for plausibility. In case of improper signal, exchange the suction unit in the tank. Check CAN bus communication for proper signal. In case of improper signal, exchange the suction unit in the tank. Check the function of heating valve and routing of the hoses. The coolant flow through the heating valve must be observed according to the shown arrow. In case all actions above are OK, check the real temperature in the DEF tank during worst case condition and improve the installation of the DEF tank.
3520	3	1896	2-7-8	The integrated diagnostic of the DEF quality Sensor recognized a short circuit to battery	wiring harness of UQS corrupted CAN Communication corrupted	Threshold for error detection is an internal ECU threshold. Check the wiring harness from the ECU to the suction unit of the DEF tank Check the CAN bus communication. If the signal is corrupt, then exchange the suction unit.
3520	4	1897	2-7-8	The integrated diagnostic of the Urea Quality Sensor recognized a short circuit to ground.	wiring harness to the suction unit in the DEF tank is corrupted CAN Communication corrupted	Threshold for error detection is an internal ECU threshold. Check the wiring to the suction unit in the DEF tank. Check the CAN bus communication. In case the communication is corrupt, exchange the suction unit in the DEF tank.
3519	3	1898	2-7-7	The integrated diagnostic of the temperature sensor of the Urea Quality Sensor recognized a short circuit to battery. The UQS Sensor is an combined sensor of tank temperature, filling grade and DEF quality and it is also an CAN sensor --> no PIN	Wrong diagnostic of the short circuits logic inside the temperature sensor of the UQS CAN Communication corrupted	Check the wiring to the suction unit in the DEF tank. Check the CAN bus communication of the suction unit. In case the communication is corrupt, exchange the suction unit.
3519	4	1899	2-7-7	The integrated diagnostic of the temperature sensor of the Urea Quality Sensor recognized a short circuit to ground	DEF quality sensor in the suction unit of the DEF tank is defect CAN Communication corrupted	Check the wiring to the suction unit of the DEF tank.Check the CAN bus communication from the suction unit. In case the signal is corrupt, exchange the suction unit in the DEF tank.

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524195	14	1900	2-7-9	The standstill request of detected crystallization is ignored for more than 5h(>300min) This will be activated if there is a standstill request activated by Crystalisation Monitoring.	Back pressure upstream SCR catalyst has reached a level which indicates crystallisation inside of exhaust line. The error detection depends on the sensed pressure upstream of the SCR catalyst and the calculated exhaust volume flow through the mixer pipe. In case of error is set, but no crystallisation can be found in the mixing pipe, a possible reason can be the defect sensors: - exhaust pressure & temperature upstream of the SCR catalyst, - the ambient pressure - the exhaust mass flow => Check air path system at the engine.	Dismount urea injector from exhaust line and inspect visually the injector andthe exhaust line for urea crystallisation upstream of SCR catalyst: If crystallisation can be clearly seen, then stand-still must be processed. Has the engine been operated in low load for longer time? If yes, then it could be the reaoson for crystallisation. Does the NOx-Sensors work properly? Compare ComRxSCR_rNOxUs to ComRxSCR_rNOxDs, when ComRxSCR_stNOxRdyUs = 1 & ComRxSCR_stNOxRdyDs = 1 (Warm engine and EAT-system, SCRT_tCatAvrgExhGs_mp > 250°C, SCR_stStatus = "Dosing" = 8): sensed NOx upstream of SCR catalyst must be higher than downstream of SCR catalyst. Go to idle and wait until SCR system enters status "stand-by" (no dosing), SCRT_tCatAvrgExhGs_mp < 225°C: ComRxSCR_rNOxUs = ComRxSCR_rNOxDs Clean urea injector: rinse it thourougly under water Check EGR-Path: difference pressure sensor at venturi tub
3520	13	1907	2-7-8	Urea quality at UQS out of range the specified thresholds; invalid quality of the urea qualiy	Suspected components DEF quality sensor DEF	Check DEF quality and/or DEF quality sensor
3519	13	1908	2-7-7	Temperature at UQS out of range the specified thresholds; invalid quality of the temperature	Suspected Components Tank heater DEF sensor	Check temperature system and/or DEF quality sensor
3532	3	1911	1-2-7	The DEF level value from the sensor is higher than the maximum physical range threshold Comment: tank level, temperature and quality are measured by the UQS sensor	Suspected Components: UQS defect	Check DEF quality and/or sensor.
3532	4	1912	1-2-7	The urea quality value from the sensor is lower than the minimum physical range threshold.	Suspected Components: UQS defect	Check DEF quality and/or Sensor.
4365	3	1914	6-6-9	Internal error of DEF qualitysensor.	Suspected componentes: DEF qualitysensor Wiring harness	Check wiring harness and DEF qualitysensor
4365	4	1915	6-6-9	Internal error of DEF qualitysensor.	Suspected componentes: DEF qualitysensor Wiring harness	Check wiring harness and DEF qualitysensor
3936	14	1917	2-8-6	Standstill escalation by time.In case the standstill request will not be released within 50 h by the driver this fault code will be set.	Stand-still request ignored by the operator. Display / stand-still request lamp broken.	Perform Stand-still. If soot load level of DPF has increased too high already call service to perform stand-still. In case the DPF soot load level remove DPF => Exchange DPF.
3936	14	1918	2-8-6	Standstill escalation by time.In case the standstill request will not be released within 75h by the driver this fault code will be set and the next step for power reduction (50% power reduction) will be activated. Debounce Time: 0ms		

Table 3-10. Engine Fault Codes

SPN	FMI	Deutz Code	Blink Code	Description	Possible Cause	Action
524267	14	2007	2-8-7	Announcement triggers the Inducement Level 2	not used	not used
524025	8	2008	8-4-5	Max. launch time for stand still exceeded (60min).	not used	not used
4171	2	2011	6-6-8	Dynamic temperatur check of temp before SCR	not used	not used
524147	13	2013	9-9-6	Set together with DFC_SCRCoBldUpLoPres. DFC_SCRCoBldUpLoPresRst is only used for inducement purposes. It ensures that legal inducement is working correctly.	Look at KWP 1639 (DFC_SCRCoBldUpLoPres)	See KWP 1639 (DFC_SCRCoBldUpLoPres) In addition for See DFC_SCRCoBldUpLoPresRst: Fix supply module. DFC_SCRCoBldUpLoPres & See DFC_SCRCoBldUpLoPresRst heal by themselfs if proper urea pressure was build up once If that is not possible for some reason run service routine number 216 to reset all DFC2Restore-blocks

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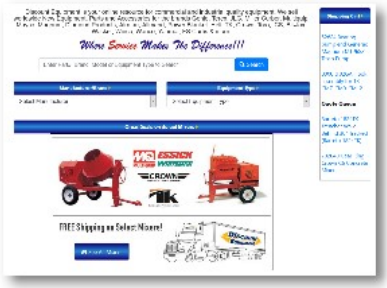

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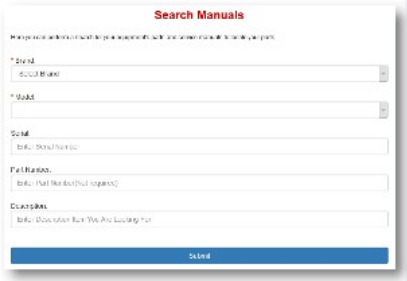

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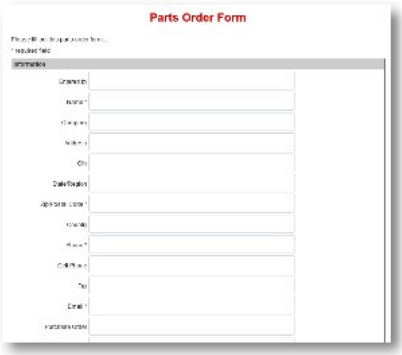

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SECTION 4. BOOM & PLATFORM

4.1 BOOM SYSTEMS

Broken Cable Indicator System

The boom on this model is a 5 section proportionally driven telescopic boom. Section #2 is driven directly by the telescope cylinder. Section #3, #4, and #5 (fly boom) are each driven by separate wire rope systems. Each rope system contains redundant ropes that are capable of allowing the operator to unknowingly continue use of the machine with a single rope failure. These kinds of failures with the extend ropes are self revealing to the operator so proper action can be taken. Failures within section #4 and section #5 extend ropes are self revealing as they are exposed on the exterior of the boom where a broken rope would be obvious. Failures within section #3 ropes require the addition of the Broken Cable Indicator System in order to be self-revealing to the operator. This system uses a proximity sensor to detect excessive movement of the sensed rope as would be expected with a rope failure.
A broken rope detection results in illuminating the Cable Break indicator on the platform control panel. No restrictions are made to the functionality of the control system. It is the responsibility of the operator to take the appropriate action.

Transport Position Sensing System

The transport position sensing system uses the main boom angle sensors, the main boom length sensor mounted in the pivot end of the main section #1boom in addition to the boom length switch mounted on the platform end of the main base boom and transport proximity switches mounted to the jib fly boom to sense when the main boom and jib boom are in the position associated with high speed travel. Above transport angle is recognized when the main boom (using the cylinder angle sensors) is more than 5° with respect to the turntable and resets to within transport position when both main boom angle sensors read less than 3° with respect to the turntable. Transport length is recognized when the main boom length switch and main boom length sensor read less than 17" extension for the main boom. Transport position is also determined when the jib boom length switches indicate the jib is fully retracted. During failures of either the main boom length transport switch or the main boom length sensor the main boom transport length will be determined by the remaining sensor or switch. In addition, for a failure of either jib transport length switch, jib length will be determined by the remaining switch.

This system is used to control the following systems:

- Beyond Transport - Drive Speed Cutback System
- Drive/Steer - Boom Function Interlock System - CE Only
- Jib Stow System
- Axle Extension System

Beyond Transport - Drive Speed Cutback System

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

Drive/Steer - Boom Function Interlock System (CE/AUS ONLY)

The Drive/Steer - Boom Function Interlock System uses the Transport Position Sensing System to sense when the boom and jib are out of the transport position. All controls are simultaneously functional when the booms are within the transport position as on the standard machine. When the boom/jib are beyond the transport position, the control functions are interlocked to prevent simultaneous operation of any boom function with drive/steer. The first function set to be operated in this mode, becomes the master function set. In other words, while operating drive/steer functions the boom functions are inoperable. Likewise, while operating boom functions drive/steer functions are inoperable.

Jib Stow System

The machine's stowed length can be reduced to facilitate transportation on standard trailers by swinging the jib to the right using the hydraulic power of the jib stow rotator. The control system will prevent swinging the jib unless the axles are retracted, the boom and jib are in the transport position. If the transport criteria are met and the operator commands jib swing right via the jib swing function switch. The control system will retract the jib lock pin and begin to swing the jib into the stowed position. When the jib is stowed, automatic platform leveling is disabled, the boom is restricted to the transport position, and axle extension is disabled. This system is functional only in the 500# mode of the Dual Capacity System. Jib telescope function will resume when the jib is nearly fully stowed alongside the main boom. Conversely, the jib must be retracted into the transport position before the jib is allowed to swing left into the locked position. Once the jib reaches the inline position, and the operator is maintaining the jib swing left function switch the control system will attempt to lock the jib lock pin. If successful, the jib lock pin lamp will illuminate continuously after the operator releases jib swing function switch.

Envelope Control System

The Envelope Control System is the primary means of controlling the stability of the machine by restricting the working envelope of the main boom. The envelope shape, is such that, positions of stability and structural integrity can be controlled including the restriction of forward and rearward reach of the platform. This system uses the two main boom angle sensors, the main boom length sensor, and the main boom transport length switch to continuously measure the position of the main boom and control its position within the predetermined envelope. The two main boom angle sensors measure the angle of the main boom relative to gravity and are continuously monitored for mutual agreement. The main boom length sensor measures the length of the main boom and is monitored for response to main telescope command and for agreement with the fixed position length switch (Main boom length transport switch). Violations of the main boom position to allowable envelope positions will result in reduced function speeds, BCS warning light illumination, and restriction of functions. The platform alarm will sound and the BCS light will flash with attempts to operate restricted functions. The restricted functions due to envelope violations related to forward reach are disallowing main lift down, main telescope out, swing, drive and steer. The restricted functions due to envelope violations related to backward reach are disallowing main lift up, main telescope in, swing, drive, and steer. Recognized failures within this system will result in control by the Moment Control System, reduced function speeds, and BCS warning light illumination. The unit will be restricted from leaving the transport position until the failure is resolved.

Moment Control System

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

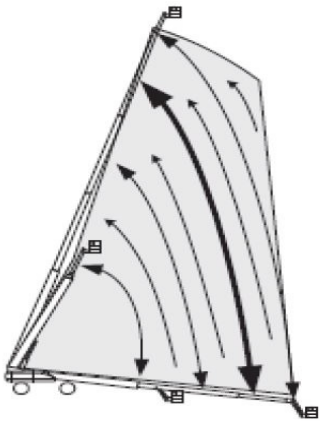
Boom Control System (BCS) Functional Check (Push to Test) System

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

Controlled Arc System

The Controlled Arc System uses the envelope control sensors to enhance the control of the main boom within the working envelope. The purpose of the controlled arc system is to minimize the interaction of lift functions with envelope edges and to increase user efficiency. This minimizes the effect of a long boom working in a comparatively narrow envelope. Because the boom is permitted to extend to longer lengths at high angles than at it is low angles, lift commands would normally cause the boom to violate the permitted envelope while lifting down or conversely require the operator to frequently command telescope out while lifting to high heights. The controlled arc system optimizes the envelope shape by automatically introducing telescope in or out during “lift only” commands. Telescope flow is regulated during lift commands to maintain a constant percentage of available boom length (0% is always fully retracted, 100% is variable as the permitted length changes when the boom is raised). The target percentage will be maintained throughout the lift command whether it is maintaining 0%, 100%, or any percentage in between. The target percentage is established at the start of lift command or

end of manual telescope commands when using multiple functions with lift. The telescope command can be used independently or in combination with other functions. Manual introduction of telescope will override the controlled arc system and result in conventional control. Controlled arc will be disabled with any sensor failure, any moment violation, any envelope violation, or with auxiliary power functions. The controlled arc functionality can be turned off using the manual position of the boom control select switch.When selected, this system active at all boom angles and lengths.



Controlled Arc Boom Movements

Controlled Boom Angle System

The Controlled Boom Angle System uses the envelope control sensors to enhance the control of the boom by minimizing the interaction of swing and drive functions with the envelope edges. This interaction is due to two factors. First, the envelope is controlled relative to gravity regardless of ground slope and second, the turntable/boom mounting is effected by swing and drive functions when the ground slope varies. This can cause the boom position to vary within the envelope or even violate the envelope edges when swinging or driving without intentionally moving the boom. The controlled boom angle system minimizes this effect by automatically introducing lift up or down during swing and drive commands to maintain a constant boom angle relative to gravity for all boom angles greater than 8 degrees. Controlled boom angle is disabled with any envelope or moment violations or failures. The controlled boom angle functionality can be turned off using the manual position of the boom control select switch.

Envelope Tracking

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

Slow Down System

When the main boom approaches the edges of the working envelope, all functions (except jib and platform functions, telescope in or out on the rearward edge and telescope in on the forward edge) are automatically slowed down by the control system to reduce the machine dynamics and improve operator control. The slow down starts within 4 feet of all edges and is at the fully reduced speeds 2 feet from all edges. The control system indicates to the operator this automatic introduction of slow down by flashing the creep light on the platform display panel. This feature applies to both platform and ground controls, however, no indication is made on the ground control panel. This is not adjustable using the analyzer.

Dual Capacity System

The Dual Capacity System on this machine is a multiple envelope control system as opposed to an indication system. The control system changes the working envelope and moment limits to match the capacity select mode to either the 500# mode or the 1000# mode. It then displays the capacity mode on the platform and ground display panel and controls the positions of the boom within the allowable envelope for that mode. This mode is selectable by the operator with the dual capacity select switch on the platform control panel. The 500# mode has the largest envelope. The 1000# mode has a smaller envelope and requires the jib to be retracted fully. To select the 1000# mode the boom must already be in the smaller 1000# envelope. When the operator selects the 1000# mode and this condition is met, the capacity light changes from 500# to 1000# and the envelope and permitted moment values are changed accordingly. When the operator selects the 1000# mode and this condition is not met, both capacity lights will flash, the platform alarm will sound, and all functions will be disabled until the capacity select switch is put back into the 500# position.

Swing Speed Proportioning

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

Platform Load Sensing System

The Platform Load Sensing System (LSS) consists of 1 load cell and 2 linkages mounted to the platform rotator and replaces the platform support on machines that get this optional installation. The load cell includes a sealed circuit and is connected directly to a CAN-based platform control panel within the platform box. This system compares the capacity mode (500# or 1000#) recognized by the dual capacity system to the measured weight in the platform. When the 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 controls (except auxiliary power) will be disabled. For CE Market, the ground controls are also affected.

Electronic Platform Leveling

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

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

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

Boom Control Select

The boom control select switch is mounted on the platform control panel and allows the operator the ability to select between two different modes of boom control functionality: automatic and manual. While in either mode, the envelope control system and moment control system remains active.

When the boom control is selected to the automatic boom control position, lift and telescope movements are coordinated by the control system as described in the controlled arc, controlled boom angle, and envelope tracking descriptions. These systems will remain active to automatically assist the operator in keeping the boom within the envelope boundaries. When operating in the automatic mode, the following functionality characteristics should be noted.

- While operating Lift Up, the boom may also telescope out (controlled arc)
- While operating Lift Down, the boom may also telescope in (controlled arc)
- While operating Swing or Drive, the boom may lift up or lift down (controlled boom angle)
- While operating Telescope In, the boom may lift down when at high boom angles and the creep light is flashing (envelope tracking)

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

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

Platform Control Enable System

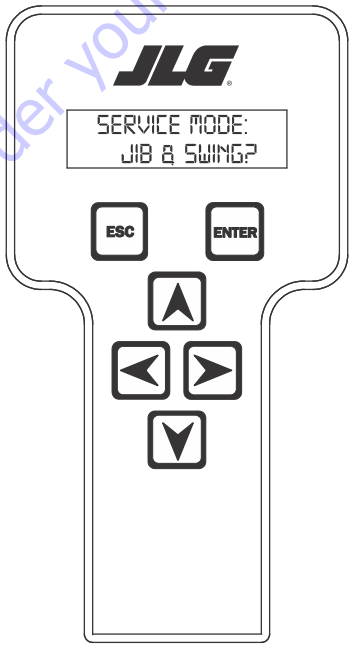
The platform controls make use of a time dependent enable circuit to limit the time availability of "live" or enabled controls. To operate any directional function, the footswitch must be depressed before activation of the function. When the footswitch is depressed, the controls are enabled and the operator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

Boom Recovery Mode

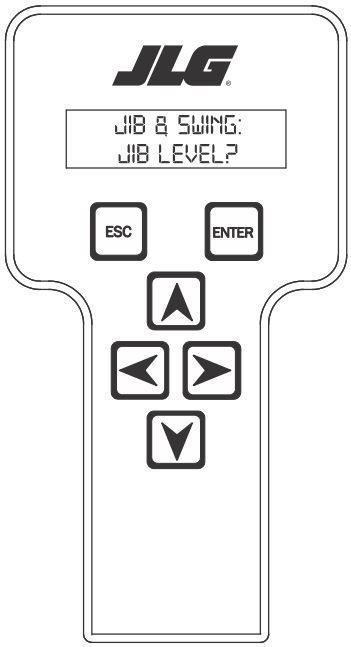
Boom Recovery Mode allows the boom to be lifted down and telescoped in, in the event CAN bus communication is lost to both the Jib Control Module and the Platform Module.

Boom Recovery Override is only available in the event the ground module loses CAN communication with both the Jib Control Module and the Platform module, in the case of a severed boom cable for example. This mode allows the boom to be lifted down and telescoped in.

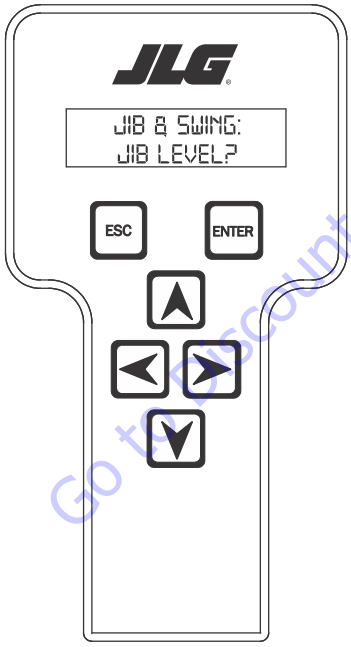
Boom Recovery override is accessible in Access Level 1. Using the Left and Right arrow keys until the screen shown below is reached.



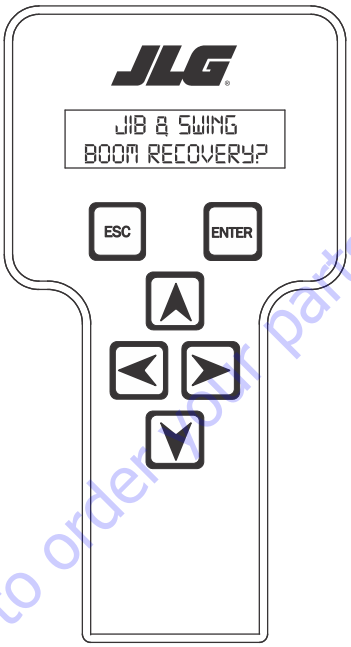
Press ENTER, the screen should read:



To enable the override mode 58237 must be entered as the code. When the code is entered, the screen will show:



Use the Left or Right arrow key until you see:



Press Enter. Once Enter is pressed using the Up or Down arrow key will turn the boom recovery on or off. Once turned on, main boom lift down will be enabled and main telescope in will be enabled to recover the boom. After the boom is brought down it will be trapped into transport. Reset or turning it off is achieved by escaping out of the service mode, by cycling power to the machine, or re-entering the service mode and manually turning it off.

4.2 PLATFORM

Platform/Support Removal

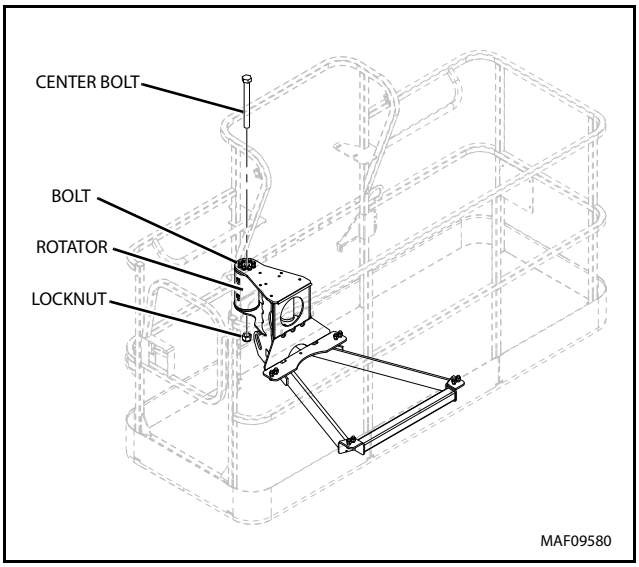
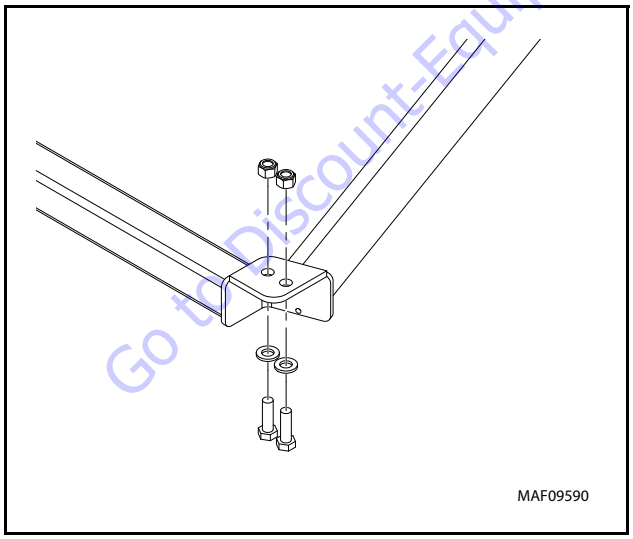


Figure 4-1. Location of Components

1. Disconnect electrical cable from control console.

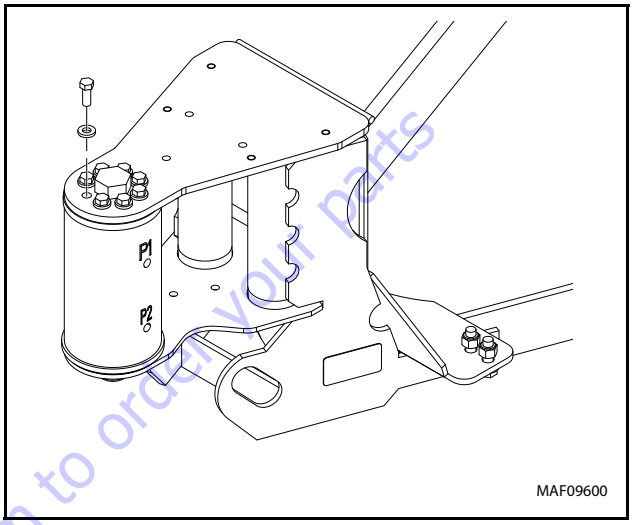
NOTE: *The platform weighs approximately 441 lbs. (200 kg).*

2. Remove the bolts securing the platform to the platform support, then remove the platform.

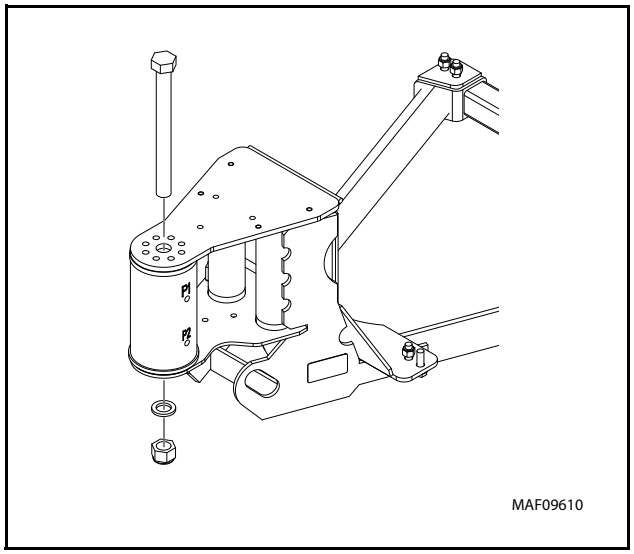


NOTE: *The platform support weighs approximately 125 lbs. (56.8 kg).*

3. Using a suitable device, support the platform support.
4. Remove the bolts and locknuts securing the support to the rotator.



5. Using a suitable brass drift and hammer, remove the center bolt and locknut.

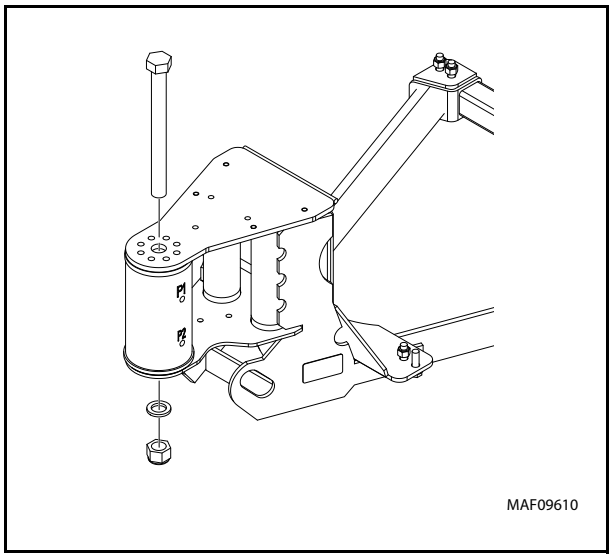


6. Remove the platform support from rotator.

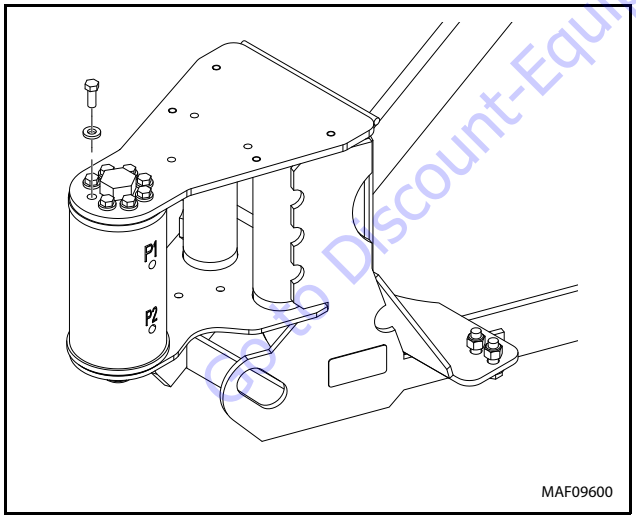
Platform/Support Installation

NOTE: *The platform support weighs approximately 125 lbs. (56.8 kg).*

1. Using a suitable device, support the platform support and position it on the rotator.
2. Install the rotator center bolt and locknut.



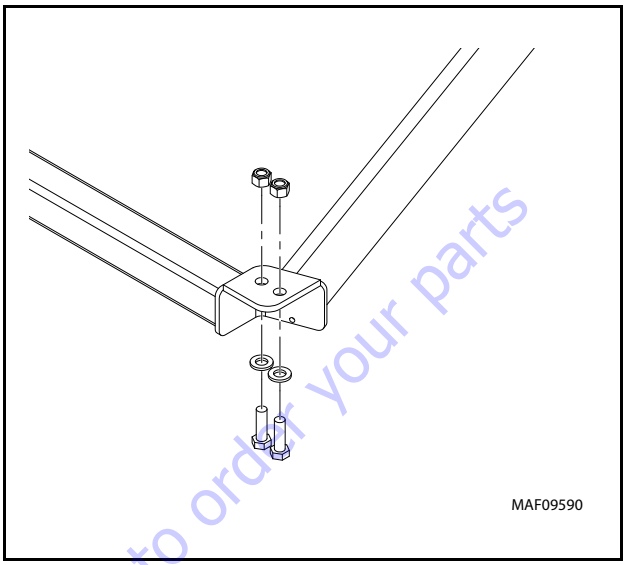
3. Apply JLG Threadlocker P/N 0100011 to the eight bolts securing the support to the rotator and install the bolts.



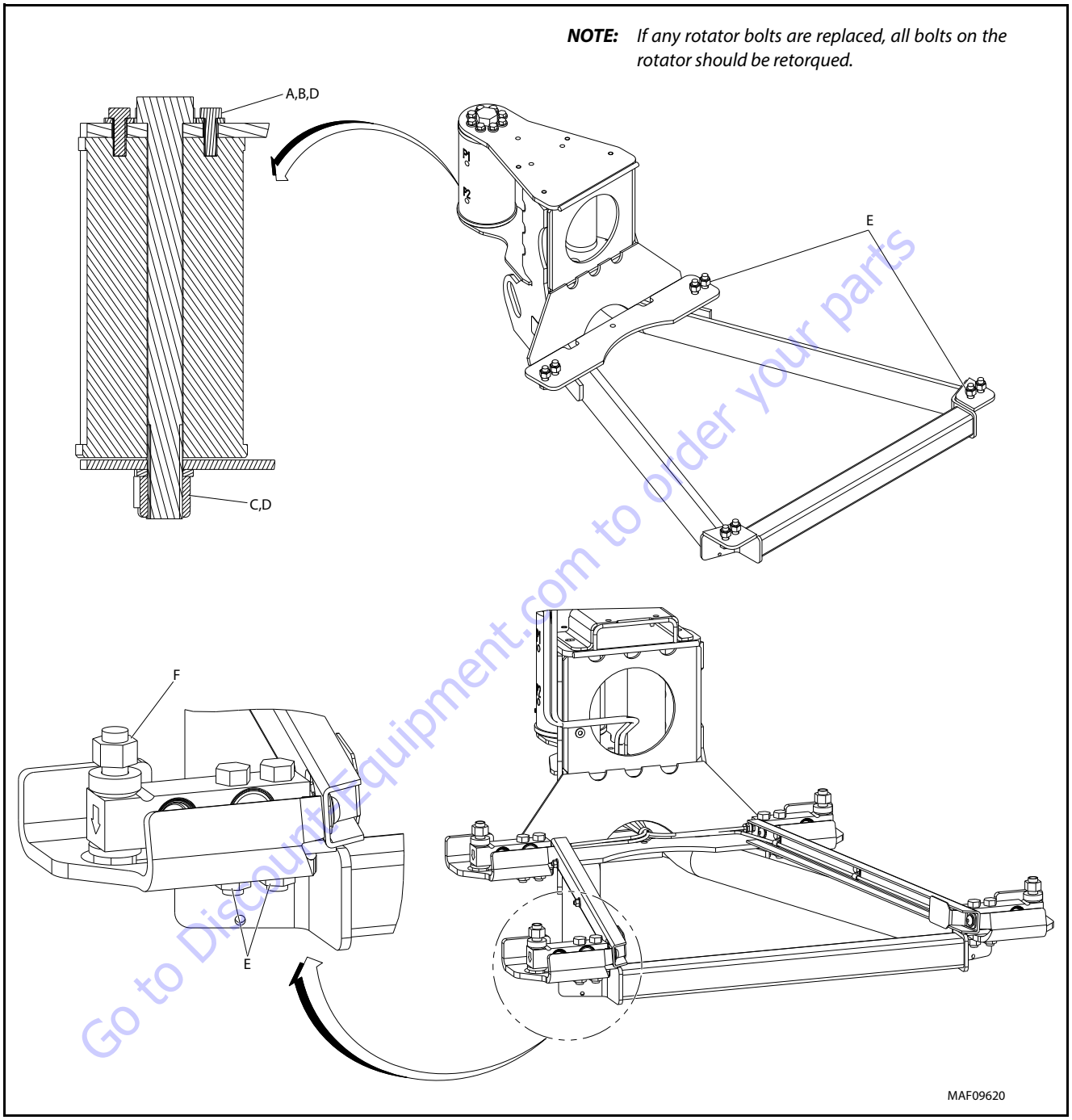
4. Torque the nut on the rotator center bolt and the retaining bolts. See Figure 4-2. and Figure 4-3.

NOTE: *The platform weighs approximately 441 lbs. (200 kg).*

5. Using a suitable lifting device., position the platform on the platform support and install the bolts securing the platform to the platform support. See Figure 4-2. and Figure 4-3.



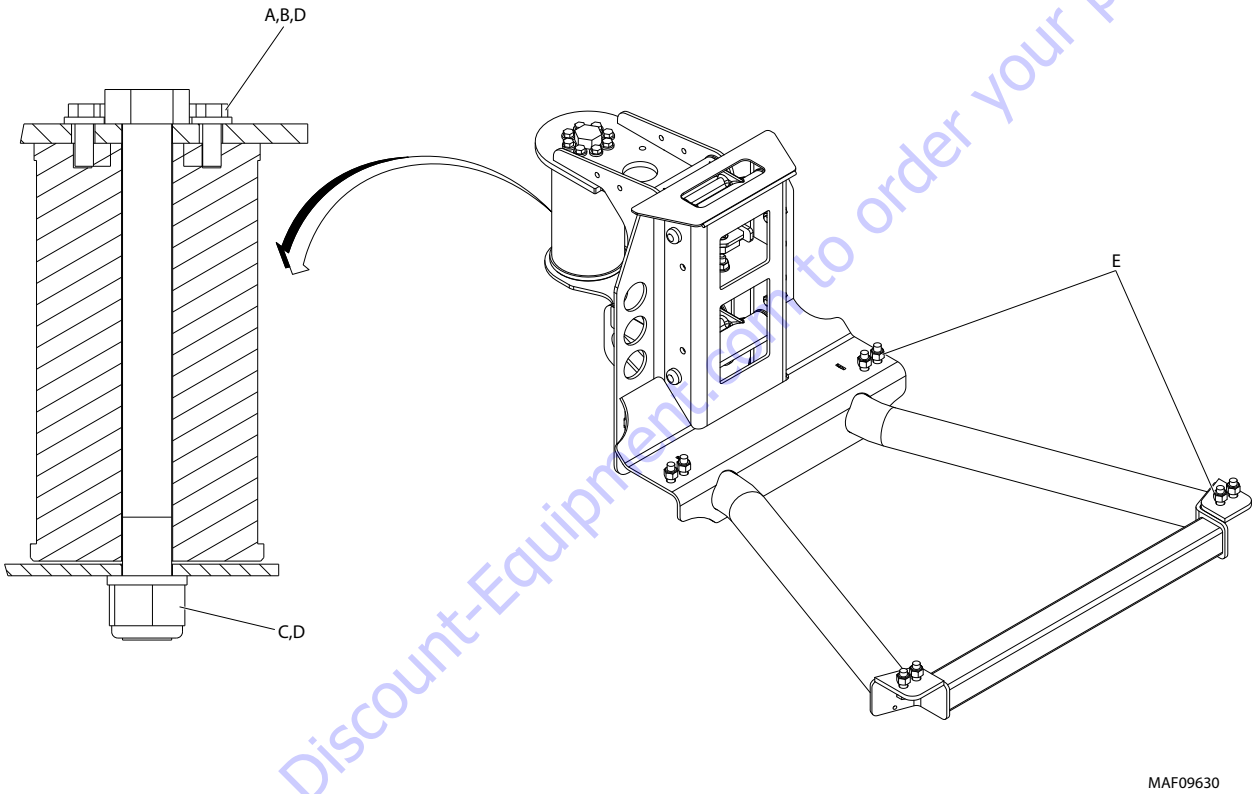
6. Connect the electrical cable to the platform control console.



A Torque to 35 ft. lbs. (50 Nm)
B JLG Threadlocker P/N 0100011
C Torque to 480 ft. lbs. (651 Nm)
D Check torque every 150 hours of operation
E Torque to 85 ft. lbs. (116 Nm)
F Torque to 50 ft. lbs. (68 Nm)

Figure 4-2. Platform Support Torque Values (without LSS and with 4 Cell LSS)

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



A Torque to 35 ft. lbs. (50 Nm)
B JLG Threadlocker P/N 0100011
C Torque to 586 ft. lbs. (795 Nm)
D Check torque every 150 hours of operation
E Torque to 74 ft. lbs. (100 Nm)

Figure 4-3. Platform Support Torque Values (with 1 Cell LSS)

4.3 ROTATOR

Removal

1. Remove the Platform and Platform Support. Refer to Section 4.2, Platform.
2. Tag and disconnect hydraulic lines to rotator. Use suitable container to retain any residual hydraulic fluid. Cap or plug all openings of hydraulic lines and ports.

NOTE: *The rotator approximately weighs 230 lbs. (104 kg).*

NOTE: *The jib lift cylinder approximately weighs 194.7 lbs. (87.6 kg).*

3. Supporting the rotator and jib lift cylinder, remove hardware from pin #1. Using a suitable brass drift and hammer remove pin #1.
4. Remove the hardware from pin #2. Using a suitable brass drift and hammer, remove pin #2 and remove the rotator.

Installation

NOTE: *The rotator approximately weighs 230 lbs. (104 kg).*

NOTE: *The jib lift cylinder approximately weighs 194.7 lbs. (87.6 kg).*

1. Supporting the rotator and jib lift cylinder, align rotator with jib lift cylinder and jib. Using a soft head mallet, install pin #1 to the jib assembly. Install hardware securing pin #1.
2. Using a soft head mallet install pin #2 to jib assembly and install the rotator. Install hardware securing pin #2.
3. Install the platform and platform support. Refer Section 4.2, Platform.
4. Remove cap or plugs from openings of hydraulic lines and ports and connect hydraulic lines to the rotator as tagged during removal.

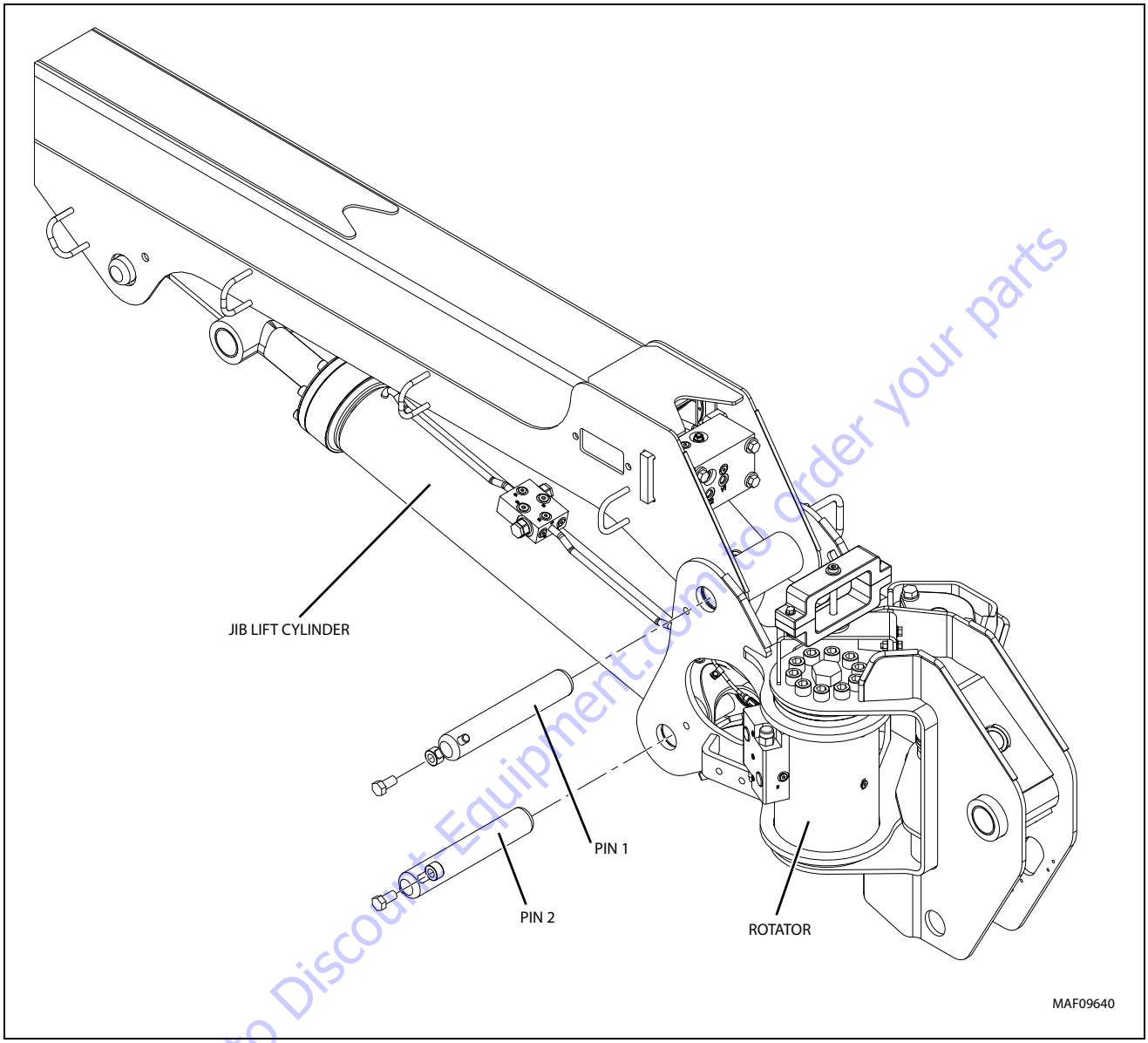
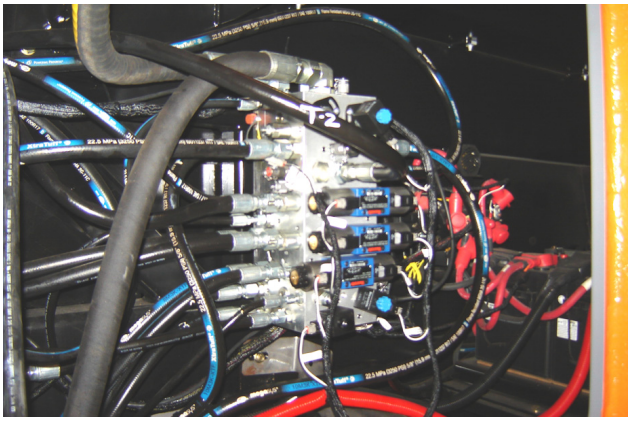


Figure 4-4. Rotator Removal/Installation

4.4 BOOM REMOVAL AND INSTALLATION

Removal

1. If necessary, remove the platform.
2. If necessary, remove the jib.
3. Tag and disconnect hoses T2 T3, 7, 8, and Pressure Filter lines from the main valve. Cap or plug all openings.



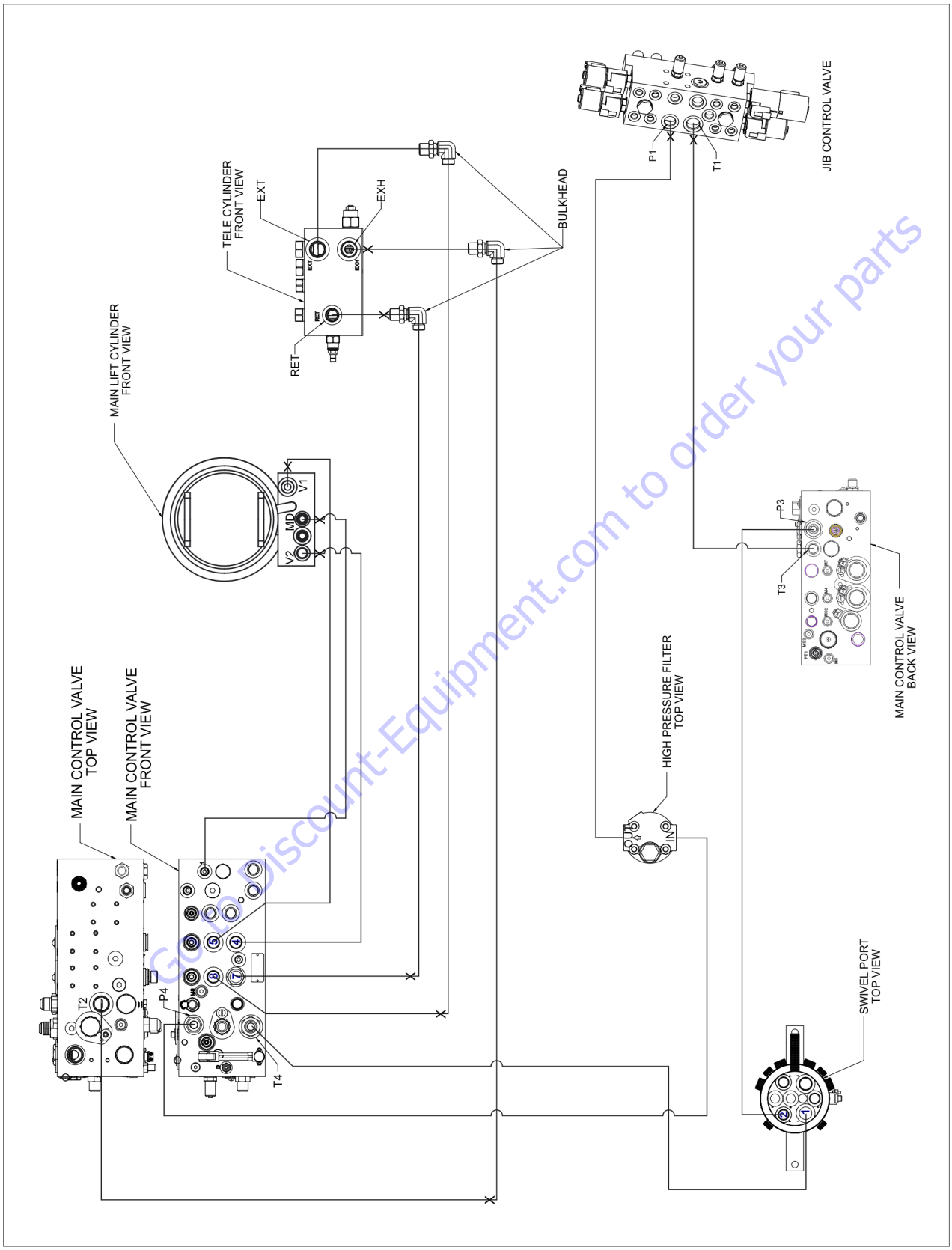
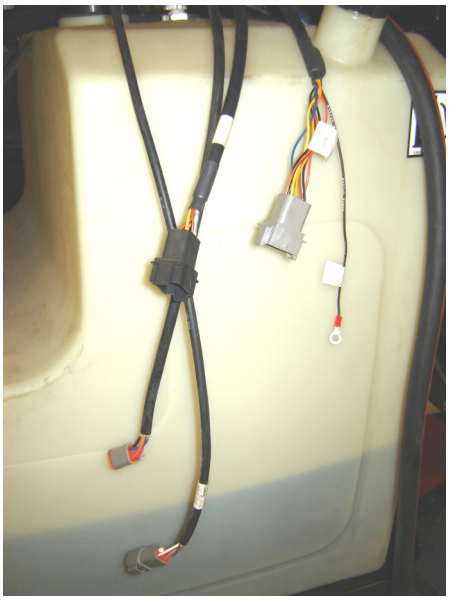


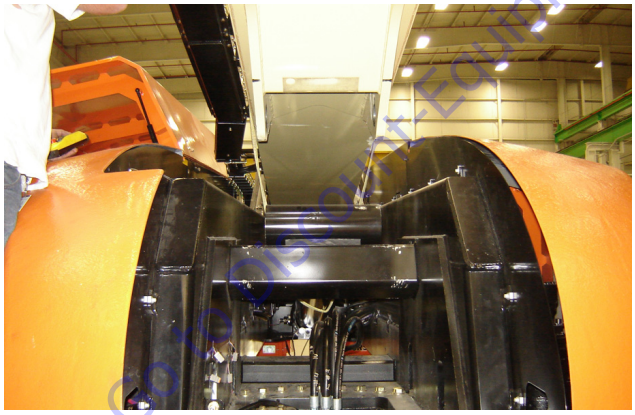
Figure 4-5. Boom Hydraulic System

4. Tag and disconnect all electrical lines from the limit switches and generator that go to from the turntable to the powertrack.



5. Elevate the boom enough to remove the upper lift cylinder pin. Use an overhead crane or similar lifting device to support the weight of the boom.

6. Using an adequate lifting device, support the weight of the lift cylinder and remove the lift cylinder pin. Lower the lift cylinder down until it rests on the boom rest.



7. Use an overhead crane or similar lifting device to support the rear of the boom.

8. Remove the boom pivot pin.

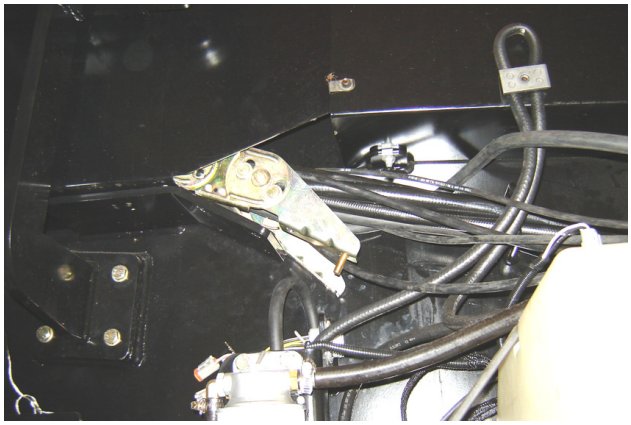
9. Carefully lift the boom from the machine, taking care to feed the hydraulic and electrical lines up alongside the boom as it is raised.

Installation

1. Lift the boom almost into position.

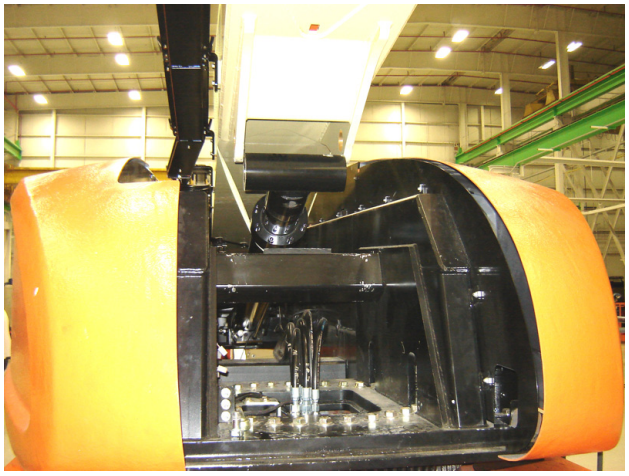
2. Feed the hydraulic hoses and electrical lines down alongside the hood.

3. Loosely connect the powertrack end. Remember to tighten the bolts the rest of the way when installation is complete.



4. Lower the boom into position and install the boom pivot pin.

5. Raise the front of the boom enough to allow connection of the lift cylinder.



6. Attach a lifting strap to the lift cylinder. Raise the lift cylinder into place and install the lift cylinder pin.

7. Connect the hydraulic lines as tagged during removal.
8. Connect the electrical lines as tagged during removal.
9. If removed, install the jib.
10. If removed install the platform.

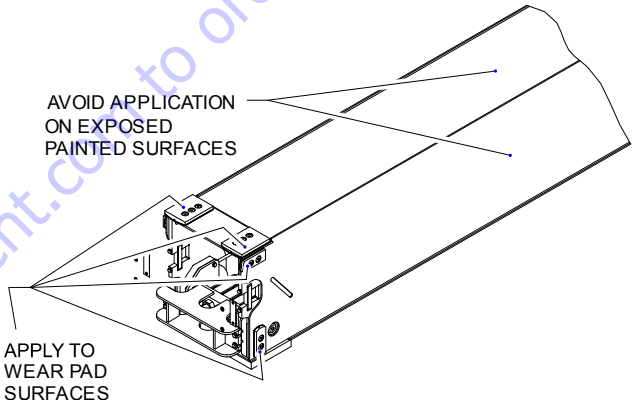
4.5 BOOM ASSEMBLY

Assembly

NOTE: *Throughout this procedure, boom sections are identified numerically, 1-5. Boom Section 1 is at the base, Boom Section 5 is the fly.*

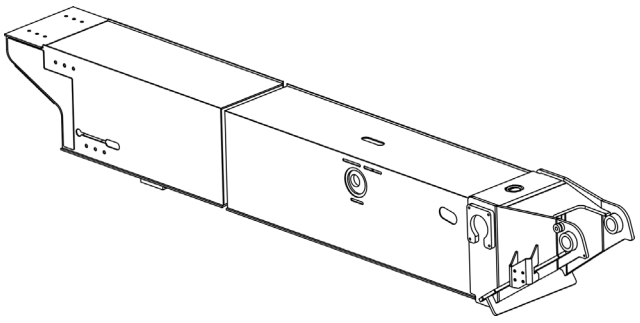
NOTE: *During Assembly, Super Lube® lubricant (JLG p/n 3020042) is to be moderately applied to all four inner surfaces of both ends of each boom section to a minimum depth of three to four feet and also to the end of section 5 that is inserted into section 4.*

NOTE: *During Assembly, Super Lube® lubricant (JLG p/n 3020042) is to be moderately applied to all outer surfaces of interior wear pads after they are assembled to the insertion end of boom sections. Care should be taken to avoid application on exposed painted surfaces of the fully extended boom.*



NOTE: *Boom section 5 weighs approximately 1682 lbs. (763 kg).*

1. Place boom section 5 on a proper supporting device.



2. Install the side rear wear pads and shims. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 40.5 ft.lbs. (55 Nm).

3. Install the top and bottom rear wear pads and shims. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 40.5 ft.lbs. (55 Nm).

4. Install the section 5 retract ropes to into the holes in the side of section 5. Place tape over the holes to keep the cables in place during assembly as shown.

5. Install the section 5 extend ropes into the mounting holes in the bottom of section 5. Place tape over the holes to keep the cables in place during assembly as shown.

NOTE: *Boom section 4 weighs approximately 1898 lbs. (861 kg).*

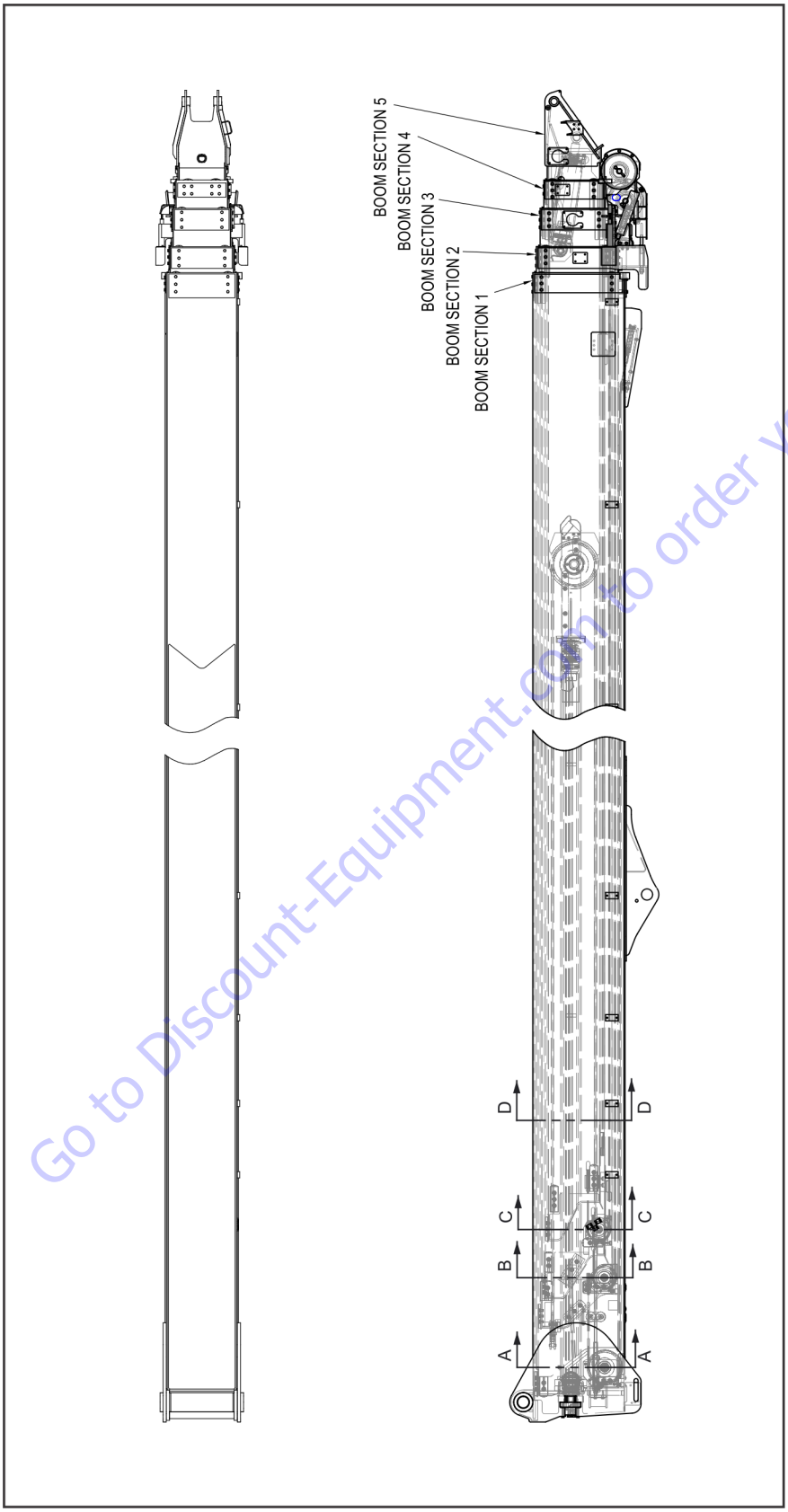


Figure 4-6. Boom Assembly - Sheet 1 of 9

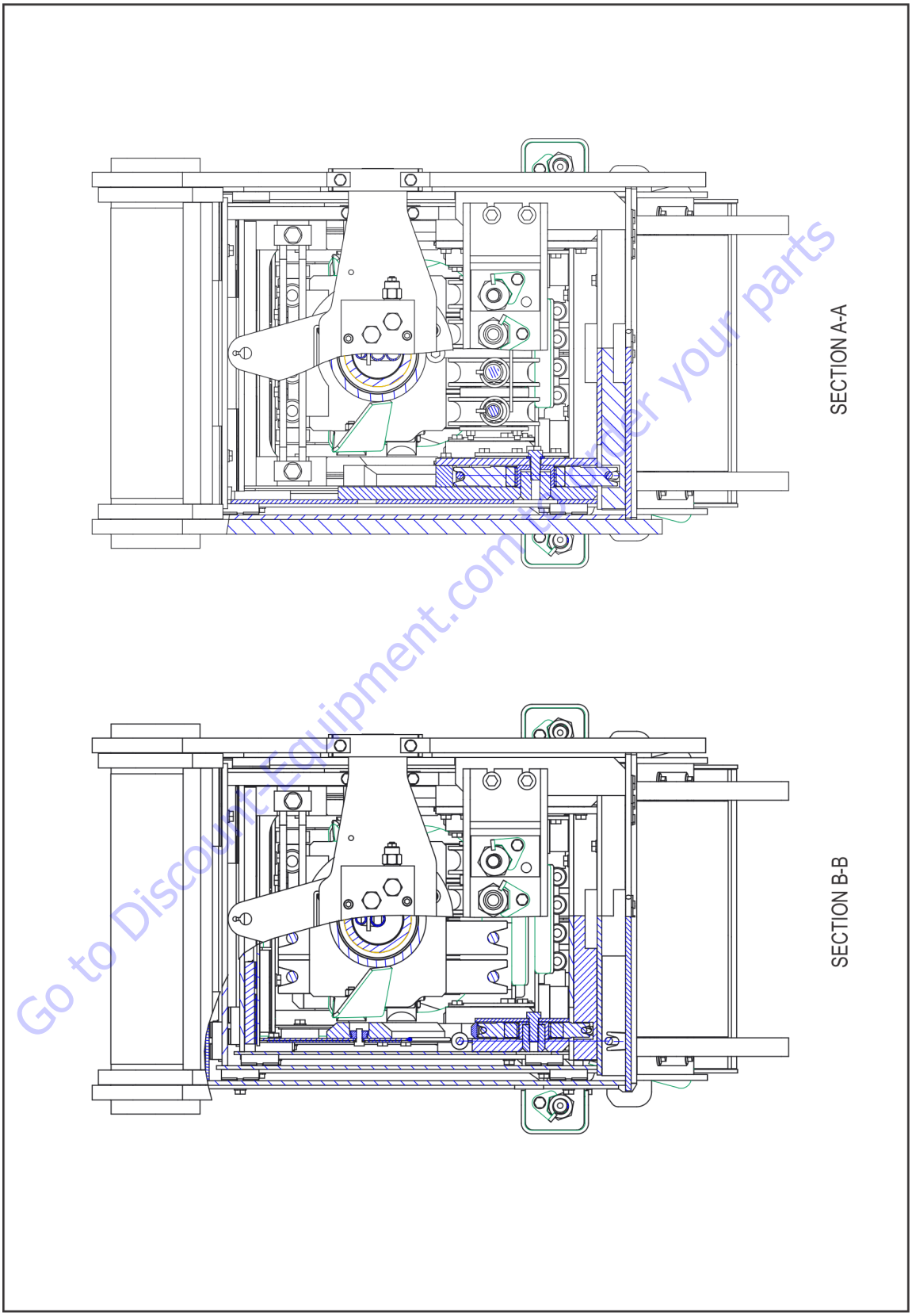


Figure 4-7. Boom Assembly - Sheet 2 of 9

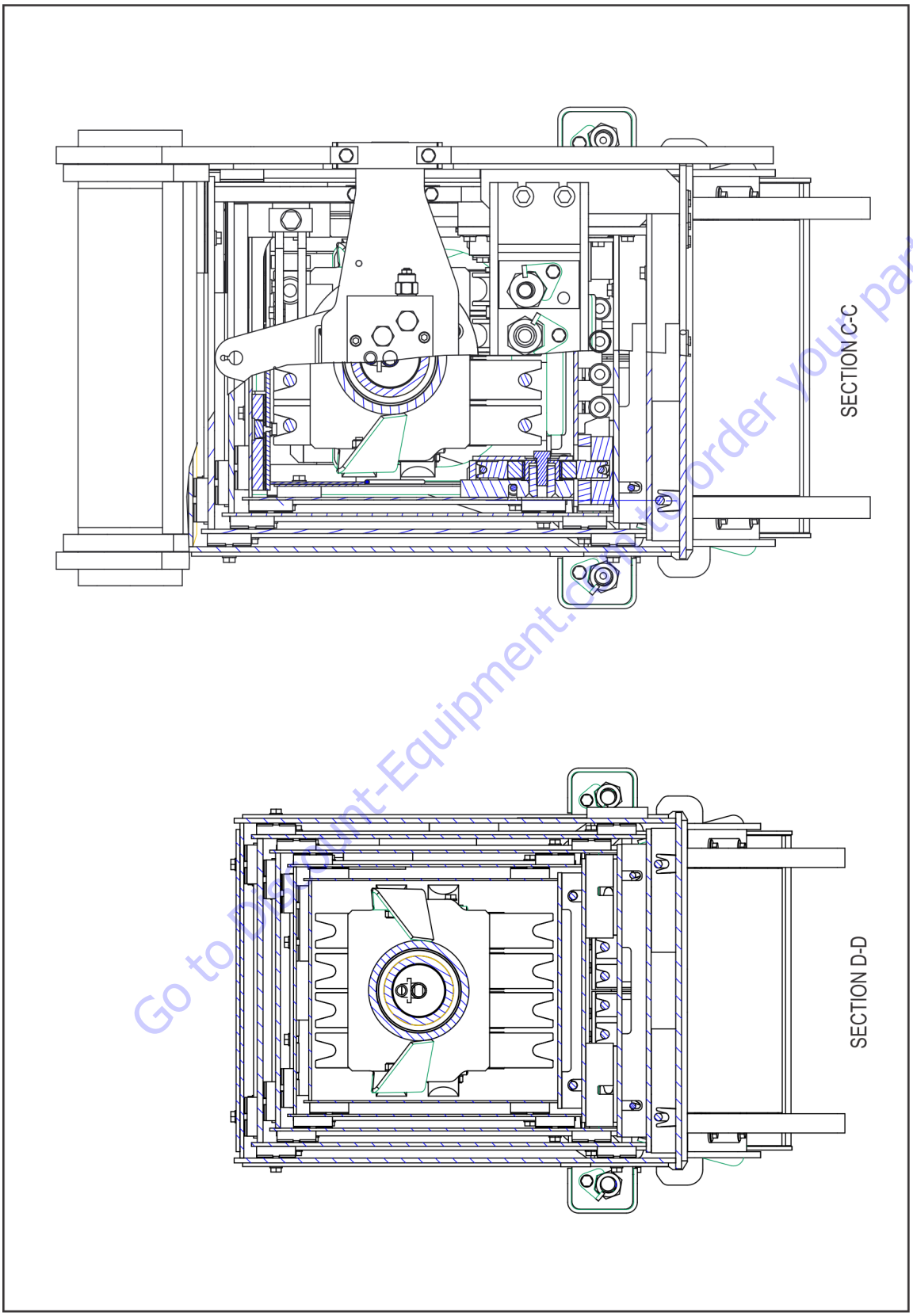


Figure 4-8. Boom Assembly - Sheet 3 of 9

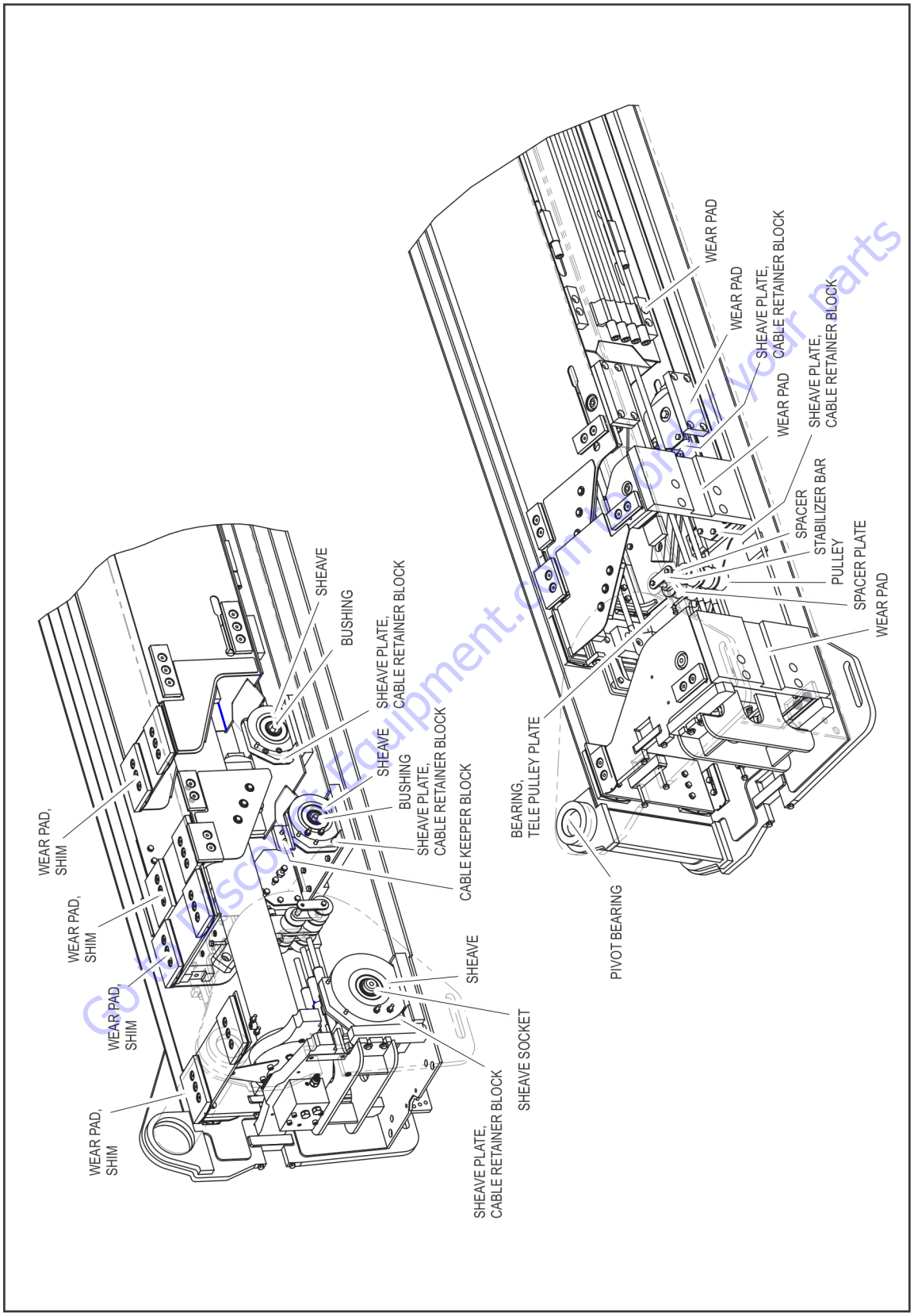


Figure 4-9. Boom Assembly - Sheet 4 of 9

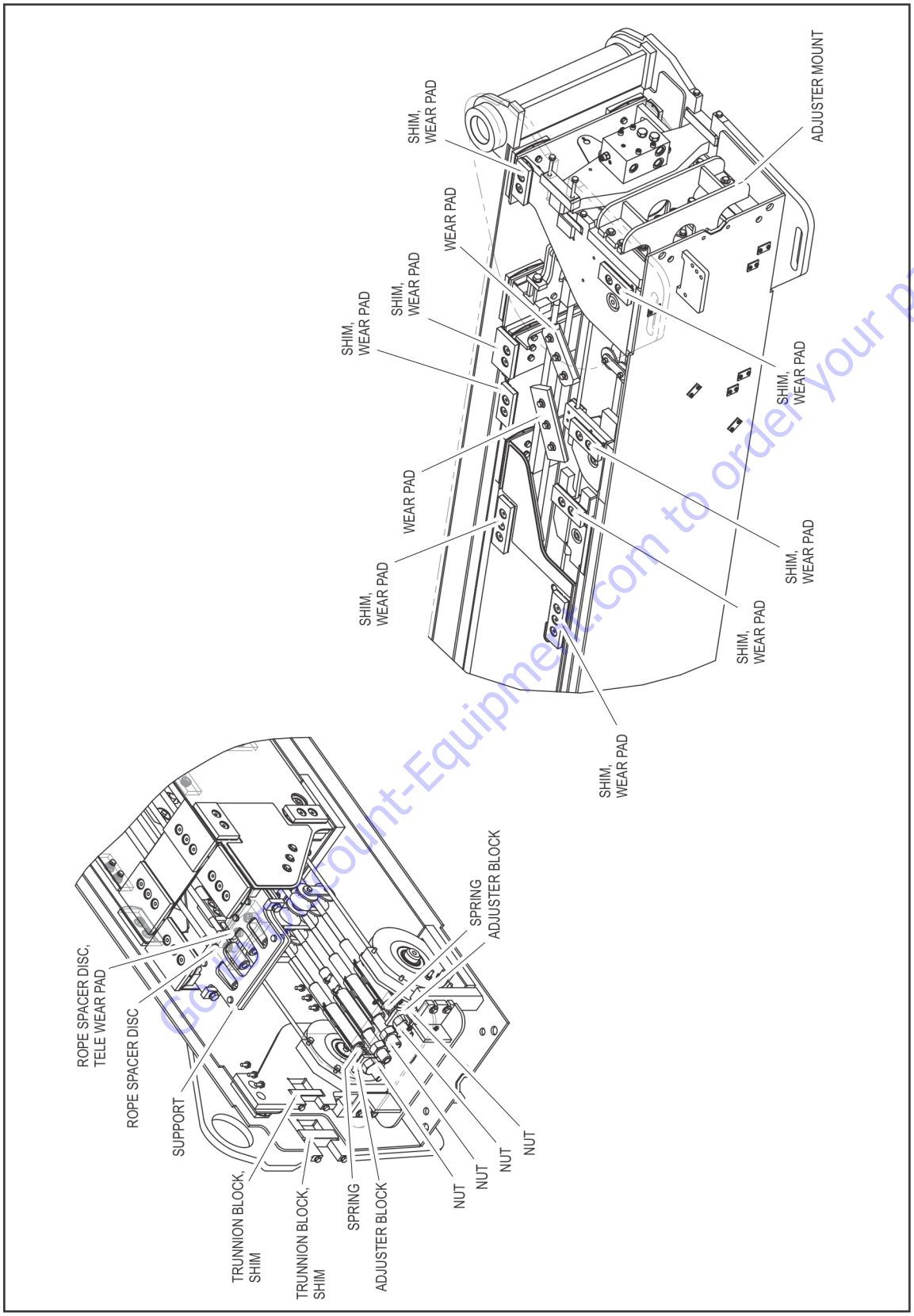


Figure 4-10. Boom Assembly - Sheet 5 of 9

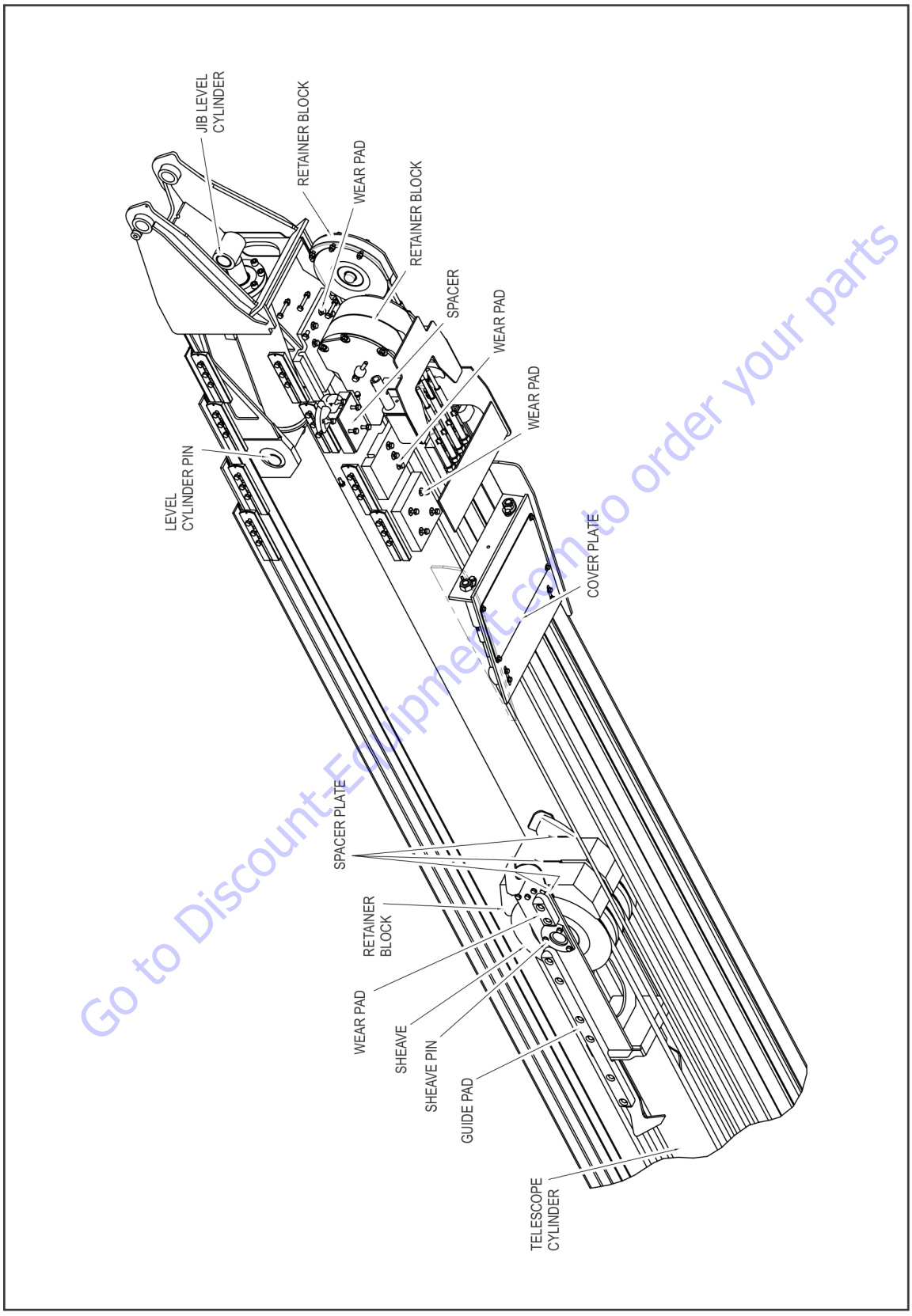


Figure 4-11. Boom Assembly - Sheet 6 of 9

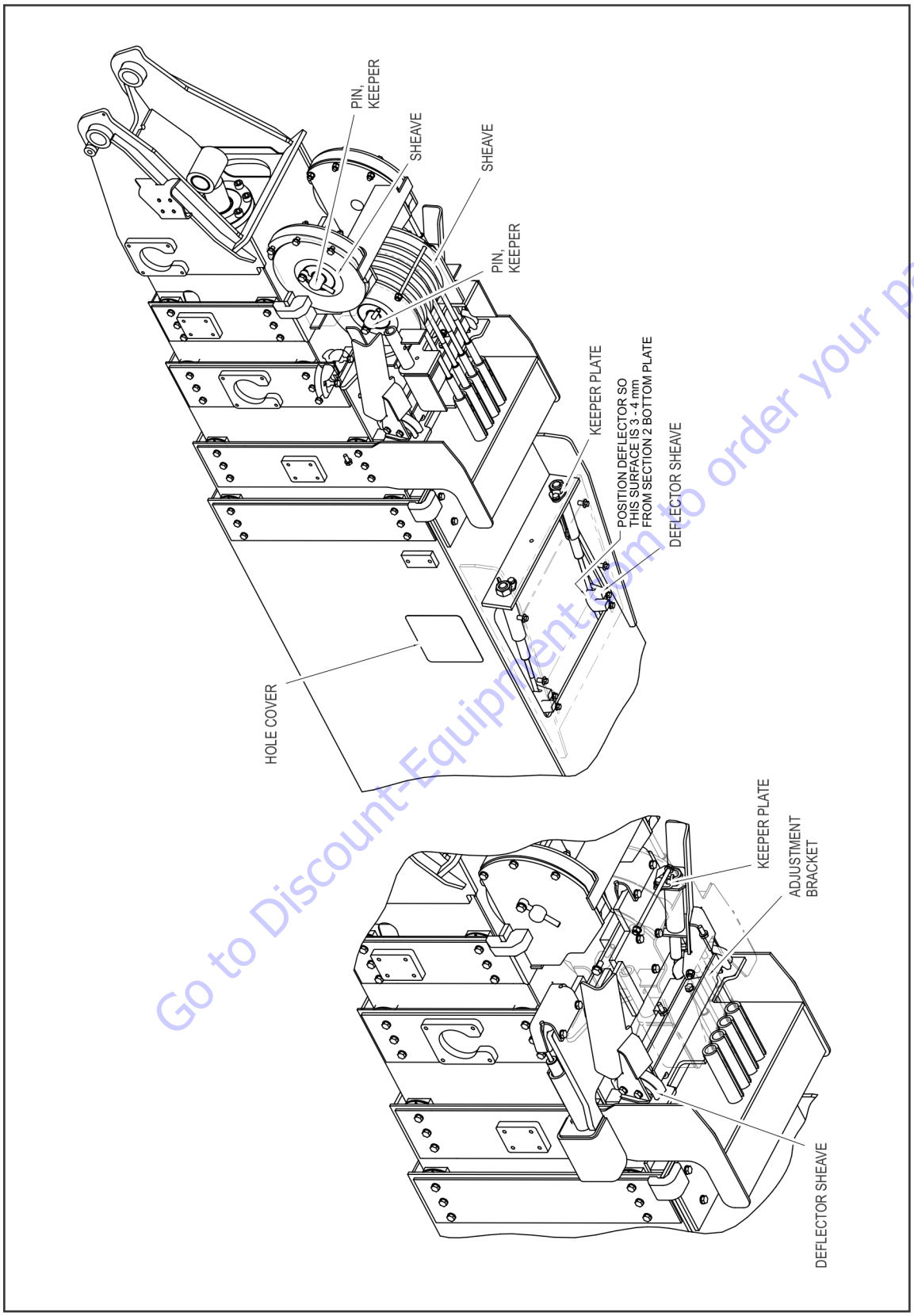


Figure 4-12. Boom Assembly - Sheet 7 of 9

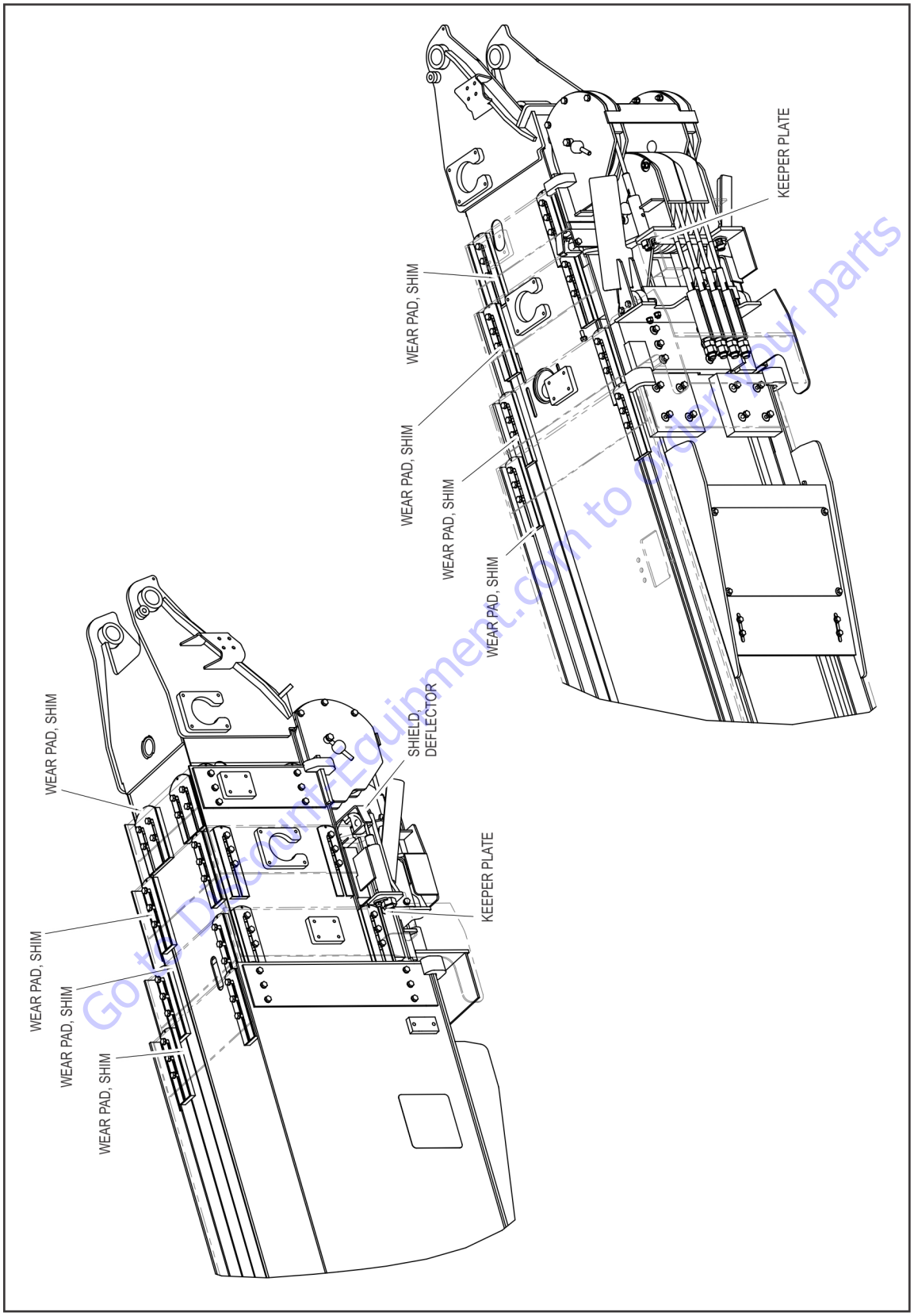


Figure 4-13. Boom Assembly - Sheet 8 of 9

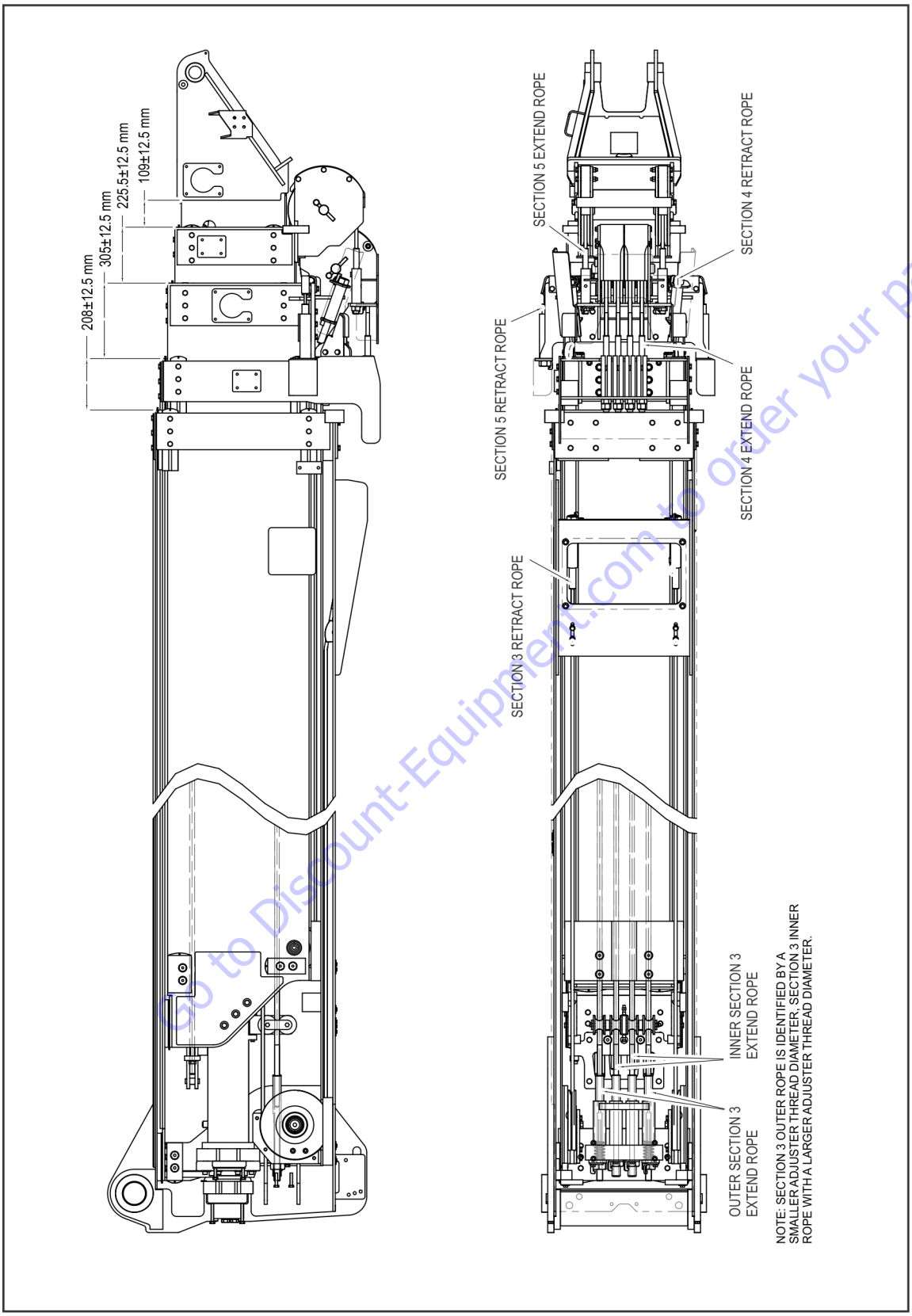


Figure 4-14. Boom Assembly - Sheet 9 of 9

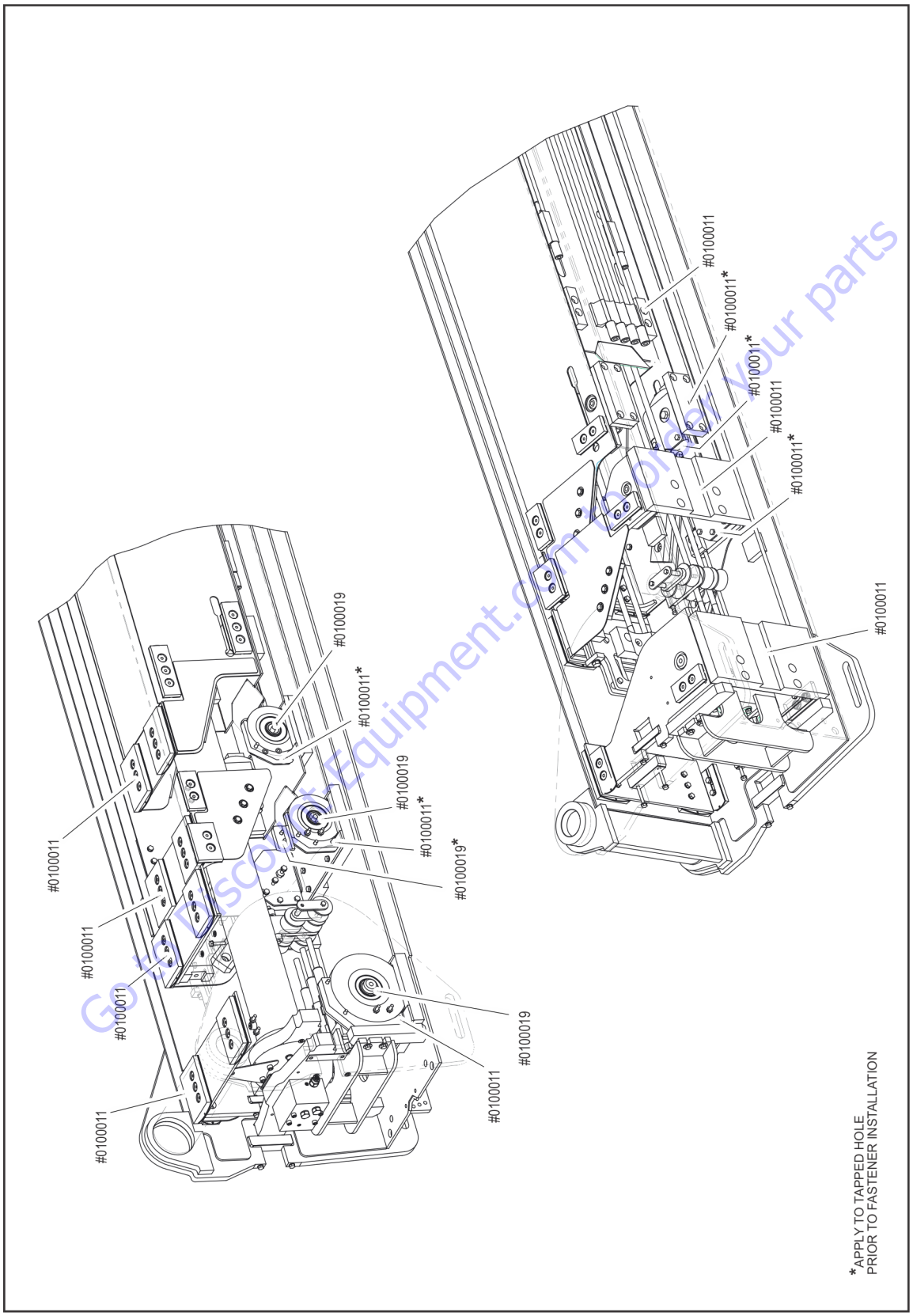


Figure 4-15. Locations for Threadlocker Application - Sheet 1 of 5

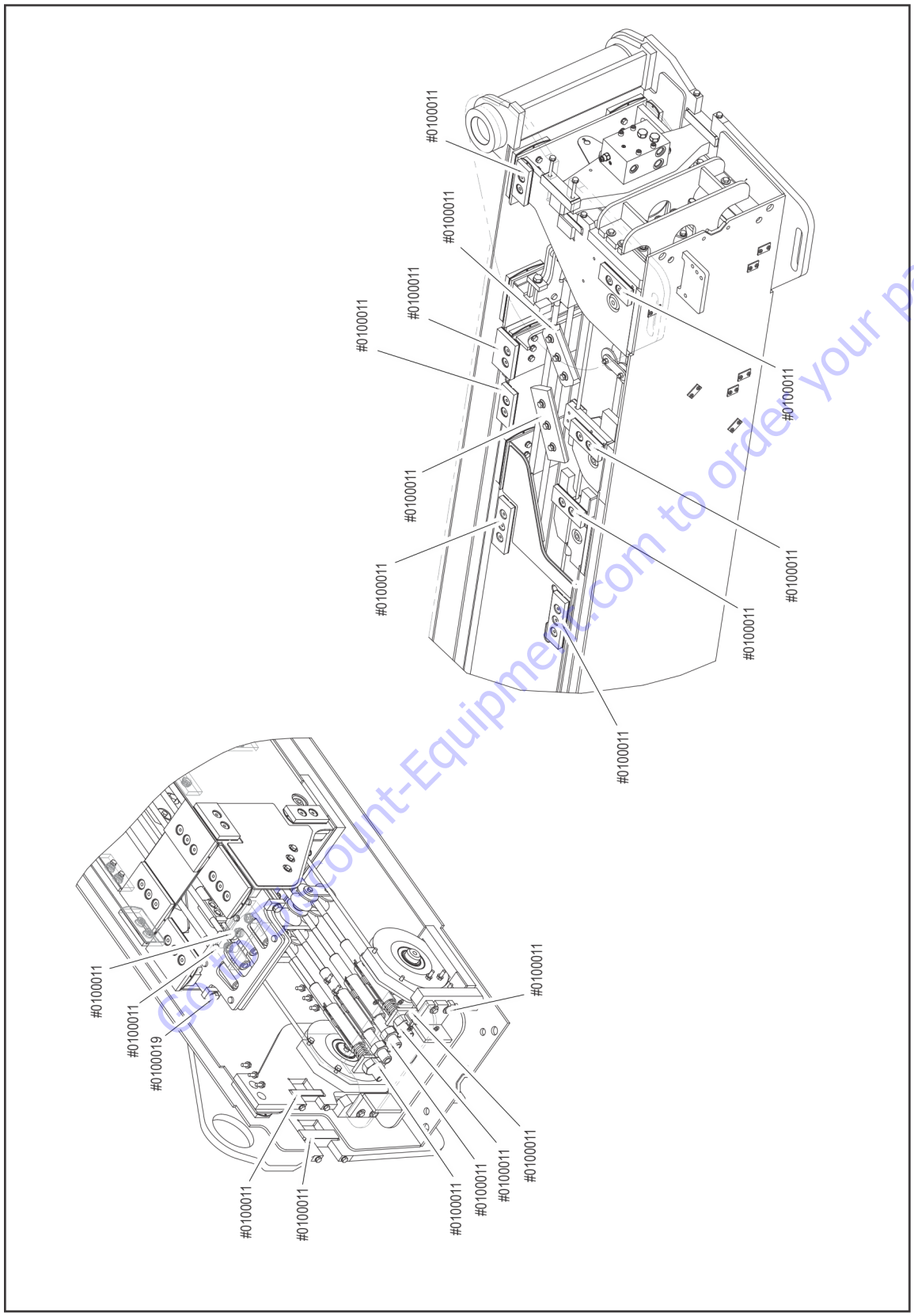


Figure 4-16. Locations for Threadlocker Application - Sheet 2 of 5

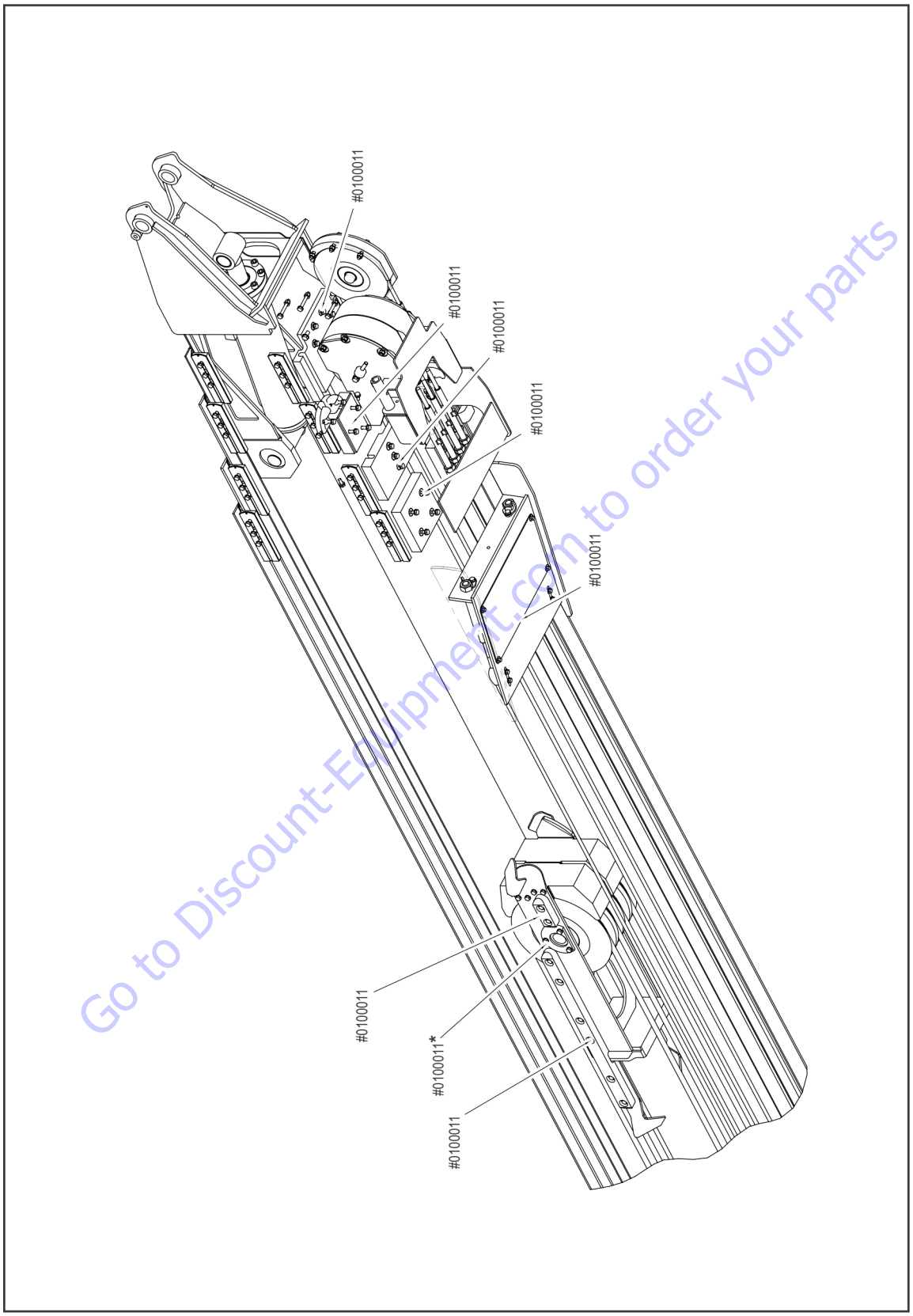


Figure 4-17. Locations for Threadlocker Application - Sheet 3 of 5

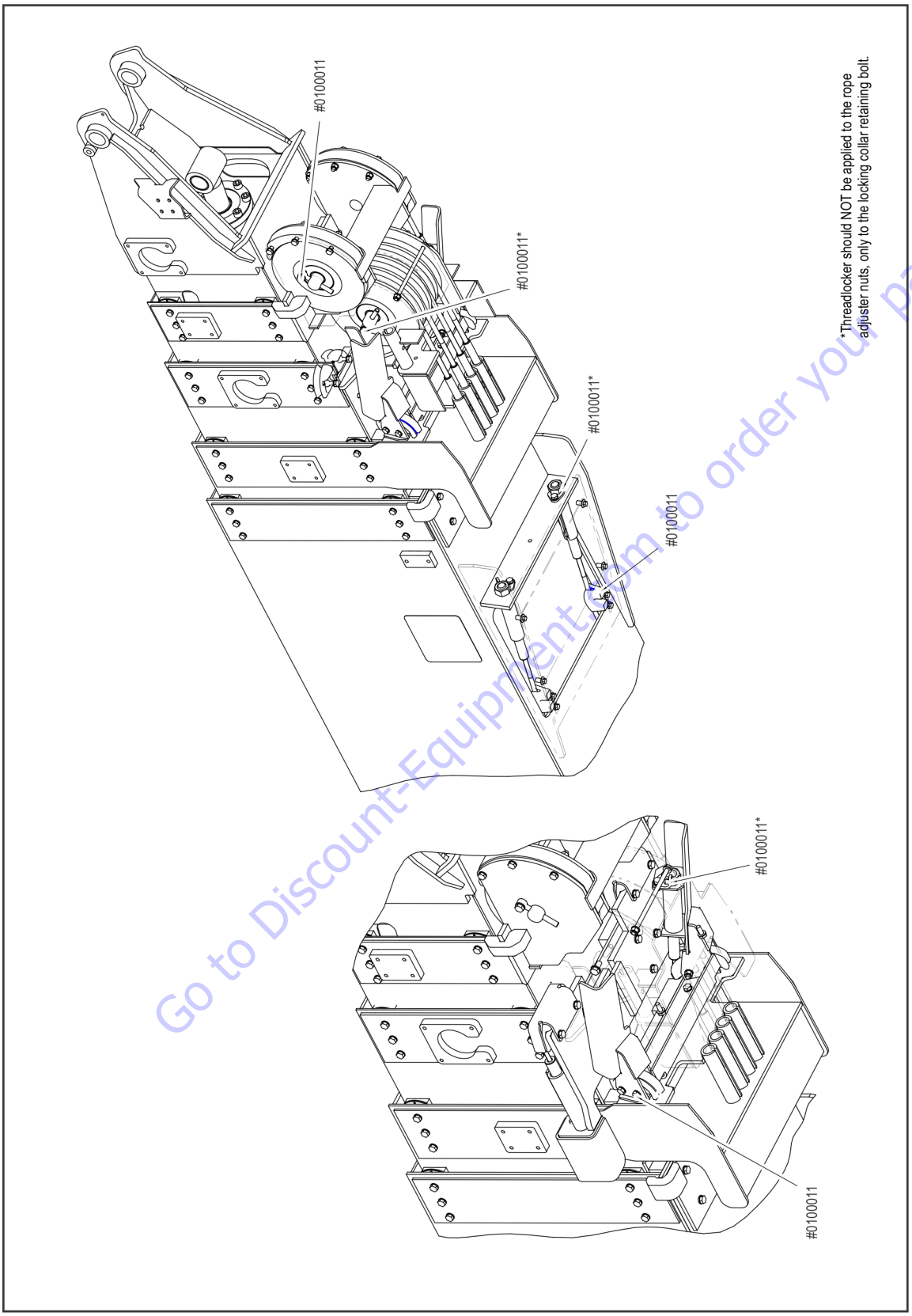


Figure 4-18. Locations for Threadlocker Application - Sheet 4 of 5

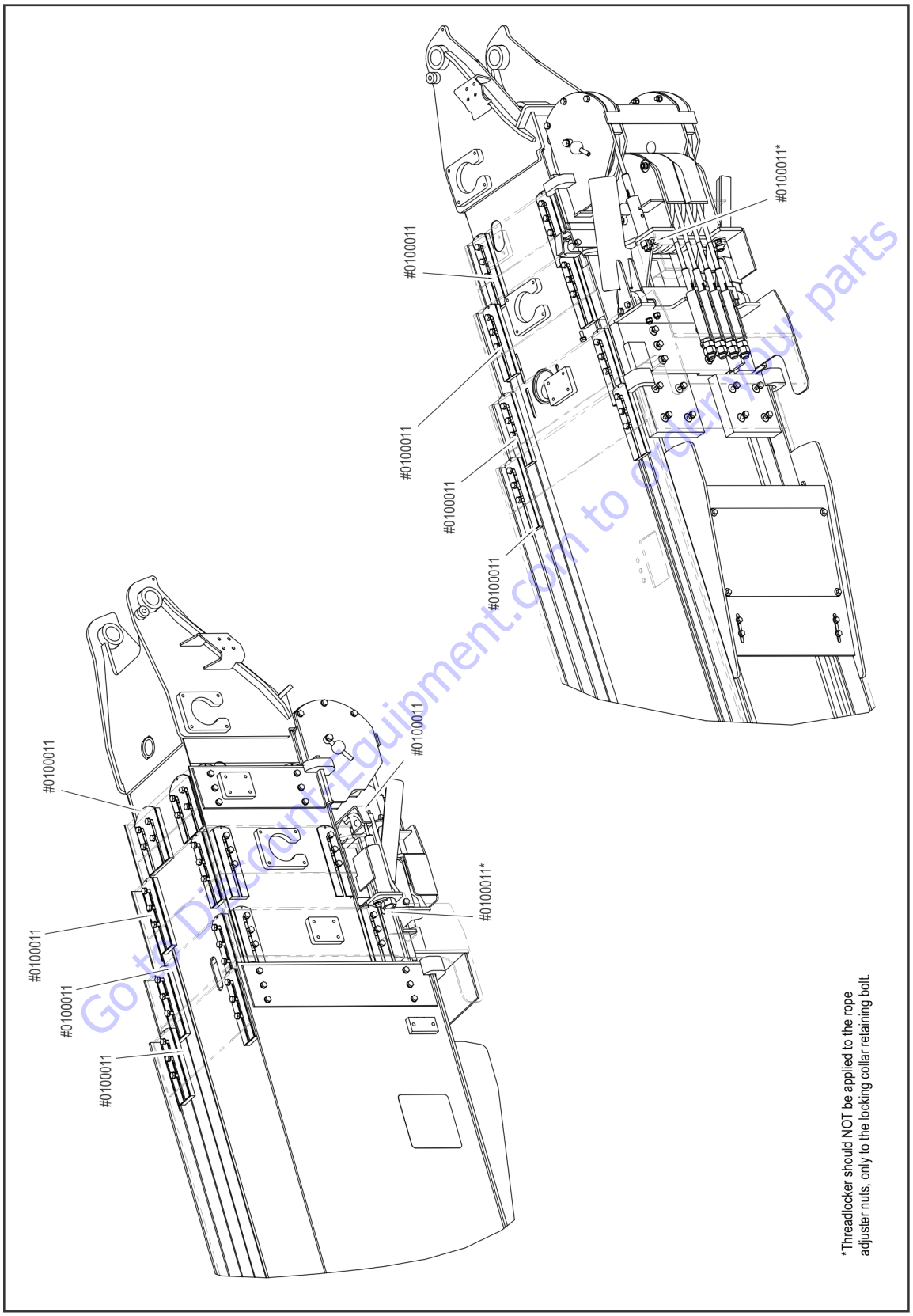


Figure 4-19. Locations for Threadlocker Application - Sheet 5 of 5

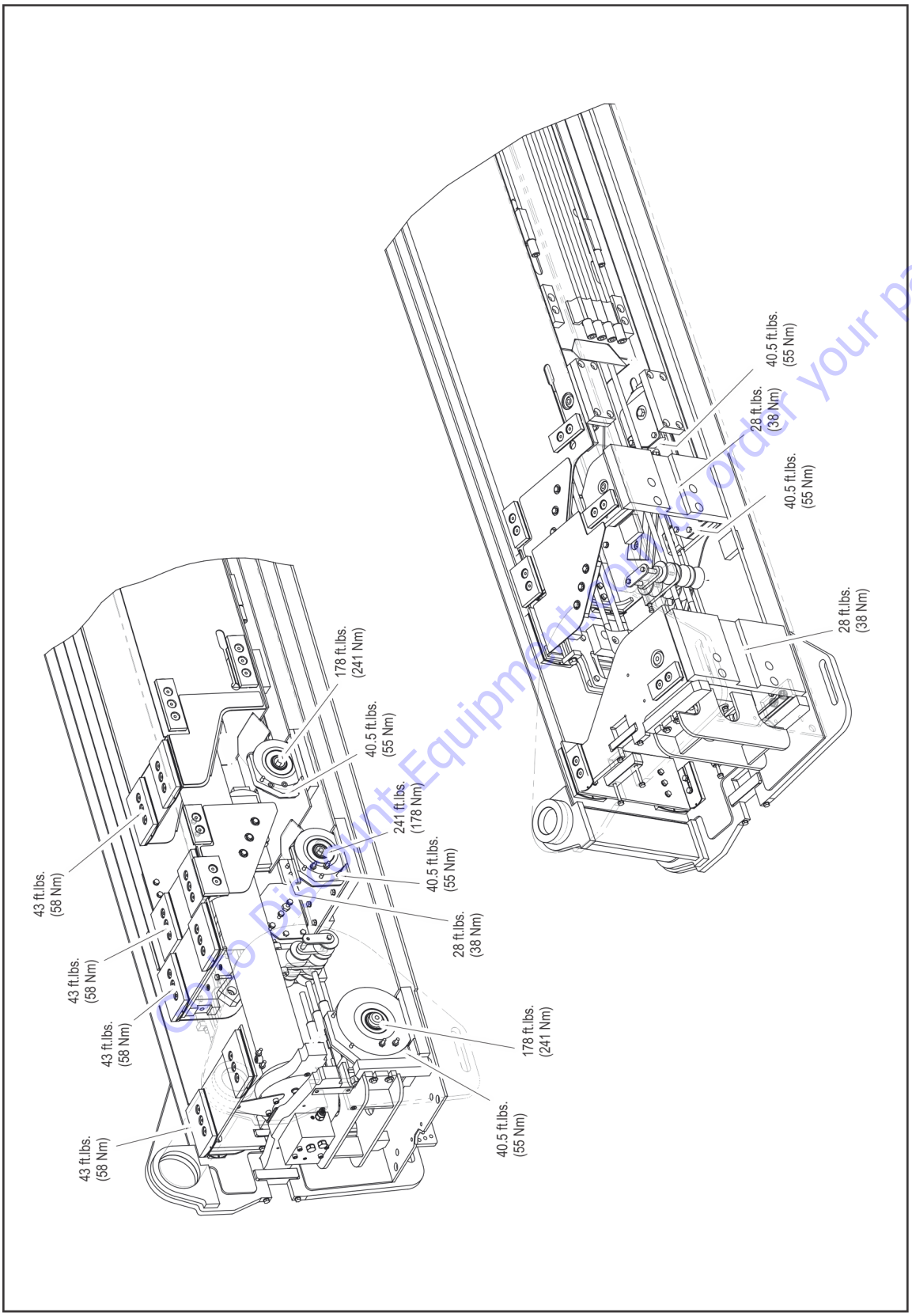


Figure 4-20. Boom Assembly Torque Values - Sheet 1 of 4

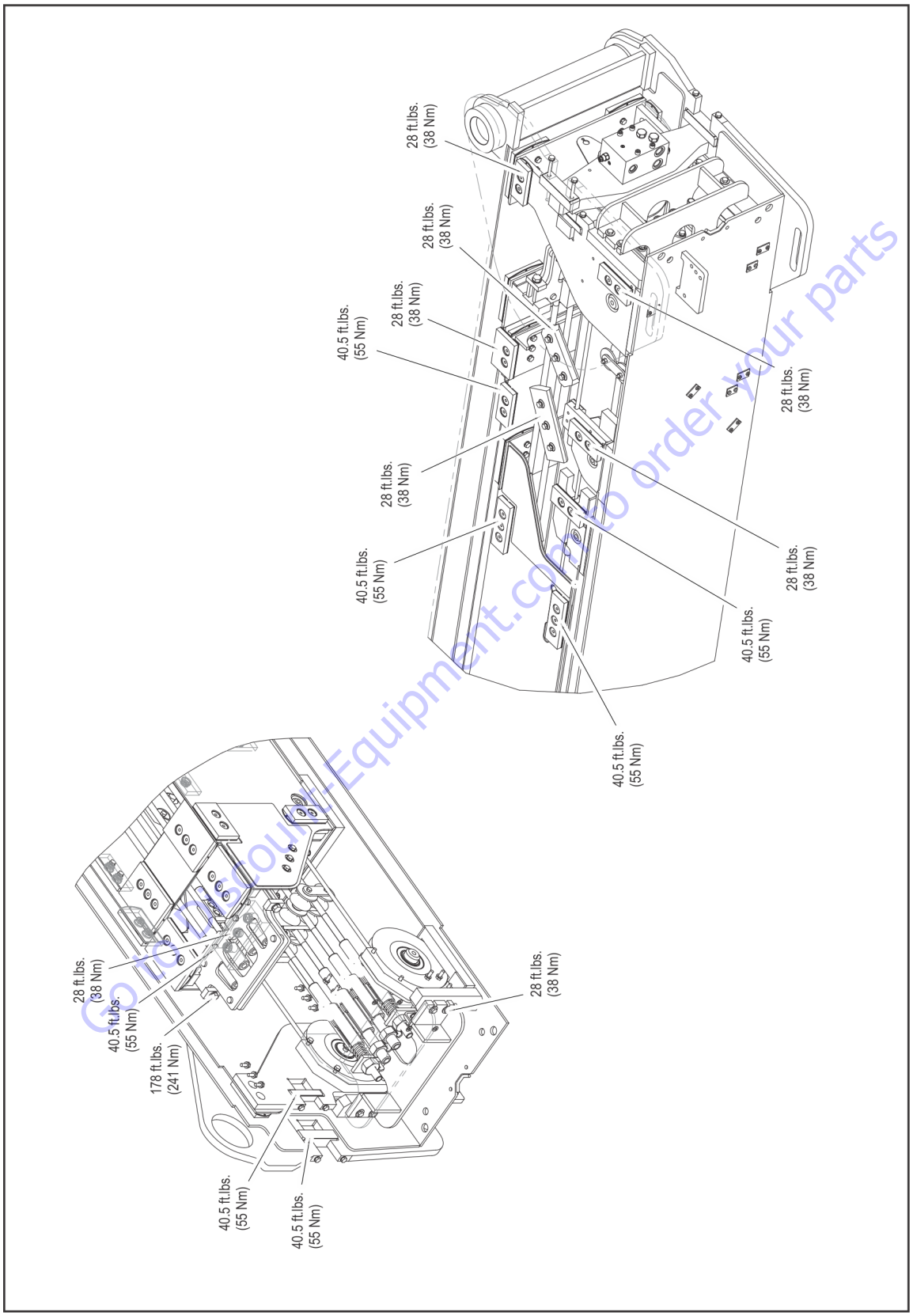


Figure 4-21. Boom Assembly Torque Values - Sheet 2 of 4

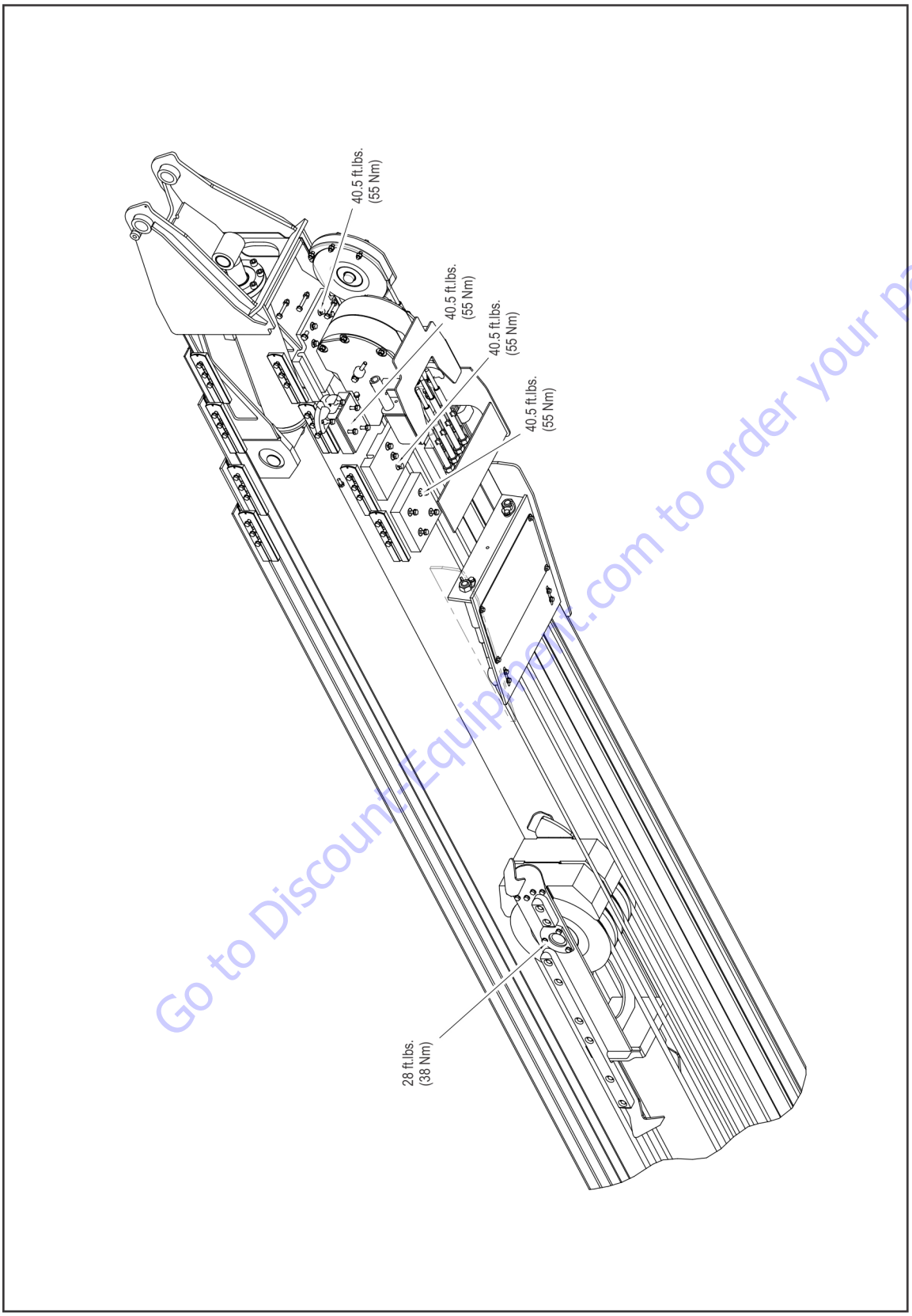


Figure 4-22. Boom Assembly Torque Values - Sheet 3 of 4

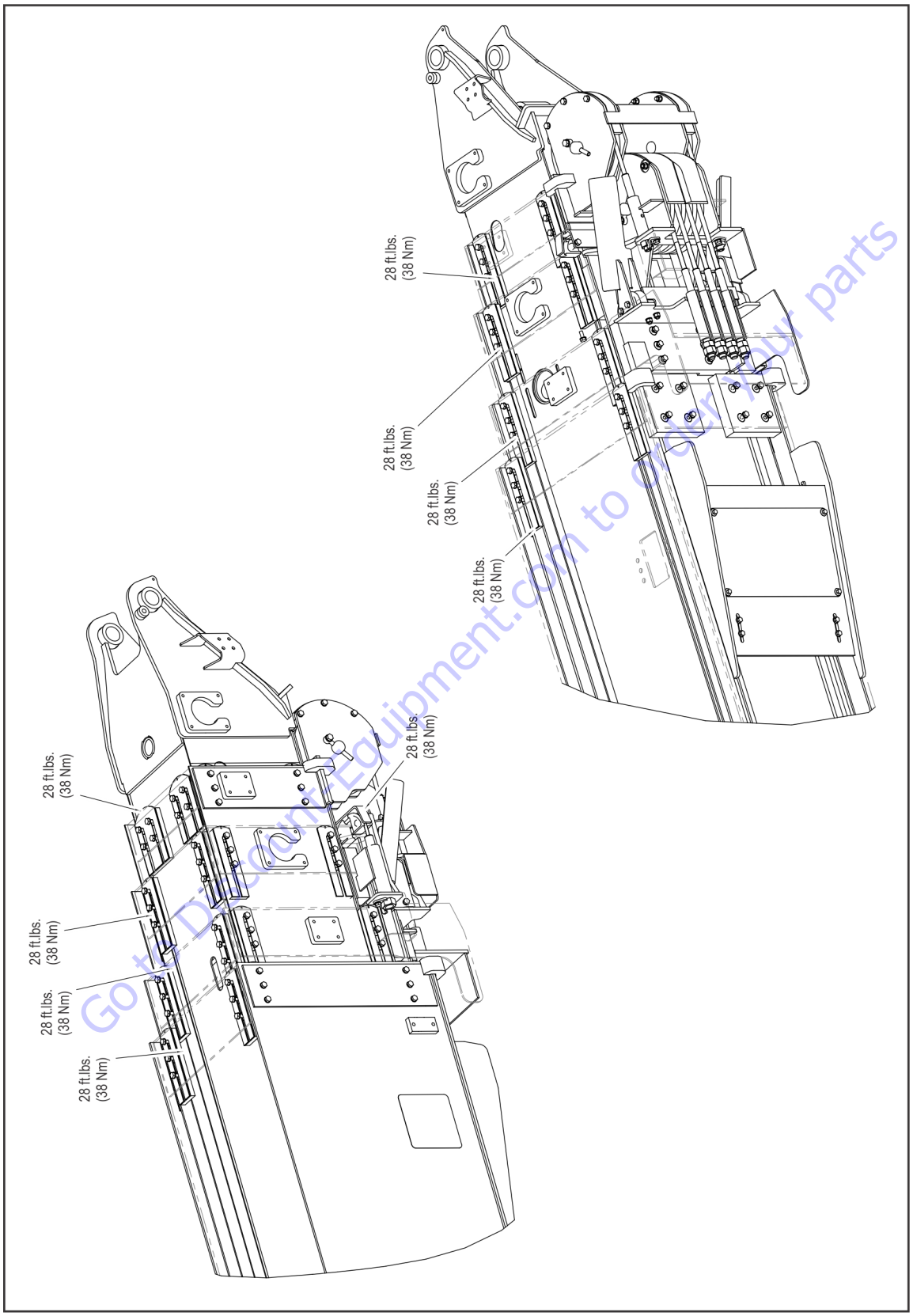
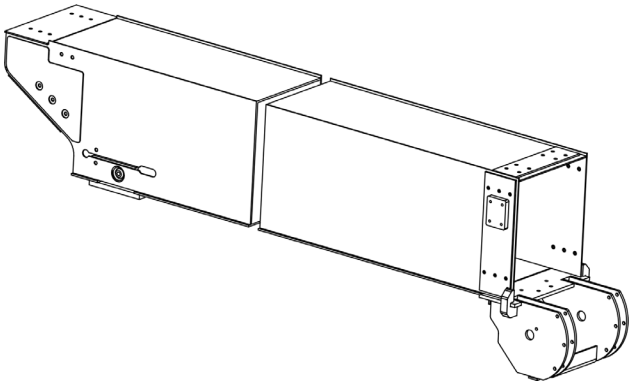


Figure 4-23. Boom Assembly Torque Values - Sheet 4 of 4

6. Place boom section 4 on a proper supporting device.



7. Apply Super Lube® lubricant (JLG p/n 3020042) to all 4 sides of the boom approximately 3 to 4 feet on both ends. Apply Super Lube® to section 5 on the end that will go into section 4 only. Apply super lube to all outer surfaces of interior wear pads after they are installed.

8. Avoid getting super lube on painted surfaces. Slide section 5 into section 4 using adequate lifting equipment.

NOTE: *Apply a thin coat of moly paste (JLG P/N 3020039) on the inside diameter of the sheave bearing before installation of sheaves.*

NOTE: *Ensure the wire ropes remain untwisted through boom section 4.*

9. Install the sheaves to the front of section 4. Apply JLG threadlocking compound P/N 0100011to the bolts and use the bolts, pins, keepers, and washers to secure the sheaves. Route the wire rope around the sheaves.

10. Install the wire rope retainer blocks to the front of section 4 boom using the washers, bolts, and nuts.

11. Install the bottom front wear pads and shims to section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 43 ft.lbs. (58 Nm).

12. Install the front side wear pads and shims to section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 28 ft.lbs. (38 Nm).

13. Install the front bottom wear pad and shims to section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 28 ft.lbs. (38 Nm).

14. Install the front top wear pads and shims to section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 28 ft.lbs. (38 Nm).

15. Install the rear top wear pads and shims to section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 28 ft.lbs. (38 Nm).

16. Install the section 4 retract wire ropes to the rear of section 4.

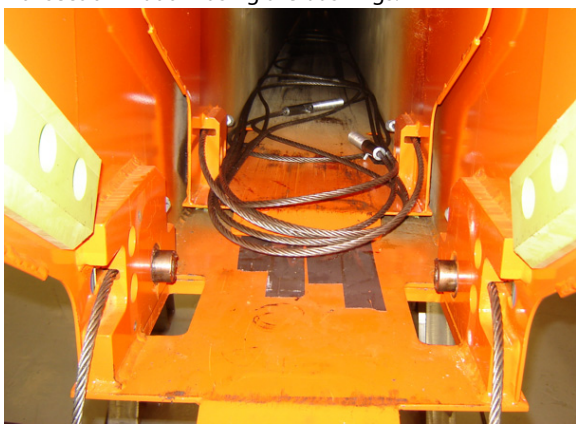
NOTE: *The retract wire ropes must be installed before side wear pads are installed.*

17. Install the rear side wear pads and shims to the outside of section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 40.5 ft.lbs. (55 Nm).

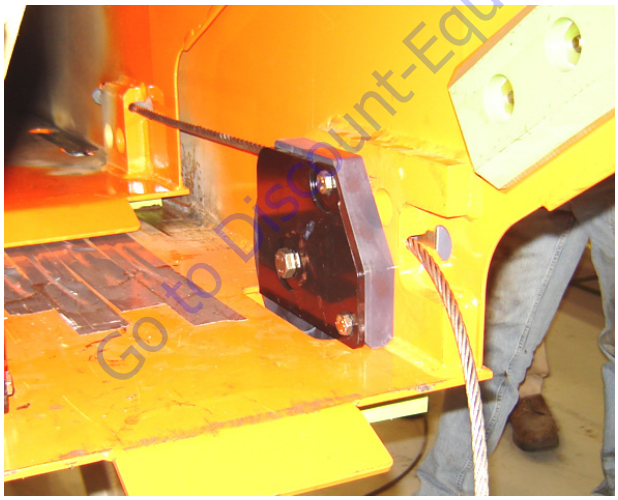
18. Install the rear side wear pads to the inside of section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 28 ft.lbs. (38 Nm).

19. Install the rear bottom wear pads to the outside of section 4. Coat the retaining bolts with JLG threadlocking compound P/N 0100011 and secure the wear pads with the bolts and washers. Torque the bolts to 28 ft.lbs. (38 Nm).

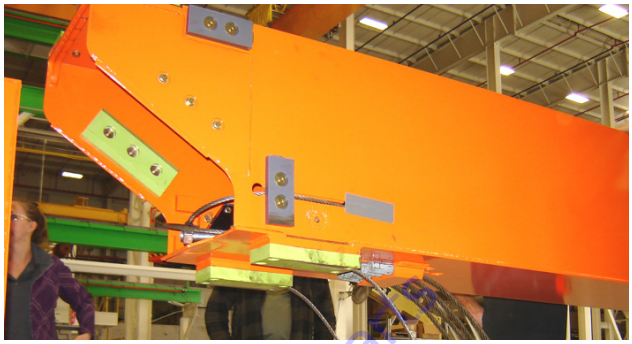
20. Coat the inside diameter of the sheave bushings with moly paste and install the wire rope sheaves to the rear of section 4 boom using the bushings.



21. Coat the sheave retaining bolts with JLG Threadlocker P/N 0100019 and the sheave plate/retainer block retaining bolts with JLG Threadlocker P/N 0100011. Install the sheave plate and rope retainer blocks to the rear of section 4 using the retaining bolts. Torque the sheave retaining bolts to 178 ft.lbs. (241 Nm). Torque the sheave plate/retainer block bolts to 40.5 ft.lbs. (55 Nm)

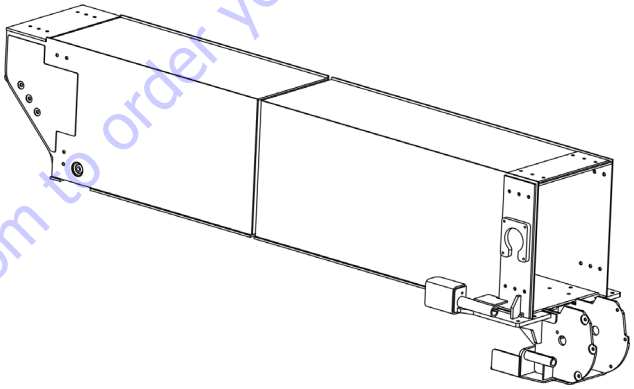


22. Install the section 4 extend ropes to section 4.



NOTE: *Boom section 3 weighs approximately 2632 lbs. (1194 kg).*

23. Place boom section 3 on a proper supporting device.

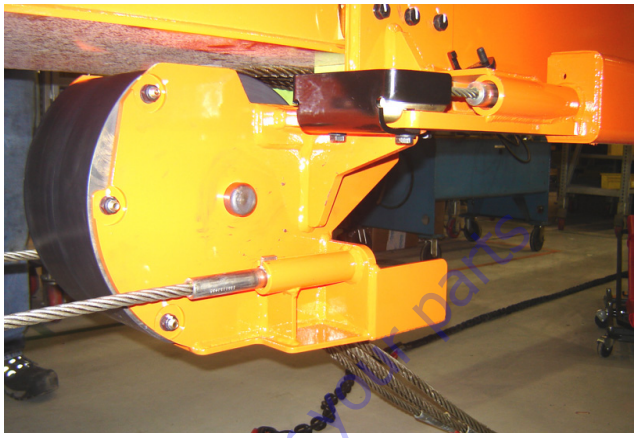


24. Apply Super Lube® lubricant (JLG p/n 3020042) to all 4 sides of the boom approximately 3 to 4 feet on both ends. Apply Super Lube® only to the insertion end of section 4. Apply Super Lube® to all outer surfaces of interior wear pads after they are installed. Avoid getting Super Lube® on painted surfaces. Slide the section 4/section 5 assembly into section 3 using proper lifting procedures. The section 5 end of the section 4/5 assembly must be raised after section 4 is inserted in section 3 to allow the four extend rope anchors to clear the top of the four extend sheave mounts at the section 5 end of section 3.

25. Install the fixed sheave shields, and deflector sheaves using the retaining bolts and washers. Coat the bolts with JLG Threadlocker P/N 0100011 before installation. Torque the bolts to 28 ft.lbs. (38 Nm).

26. Coat the bolts with JLG Threadlocker P/N 0100011 and install the section 5 retract ropes to section 3 using the nuts, keeper plates, bolts, and washers.

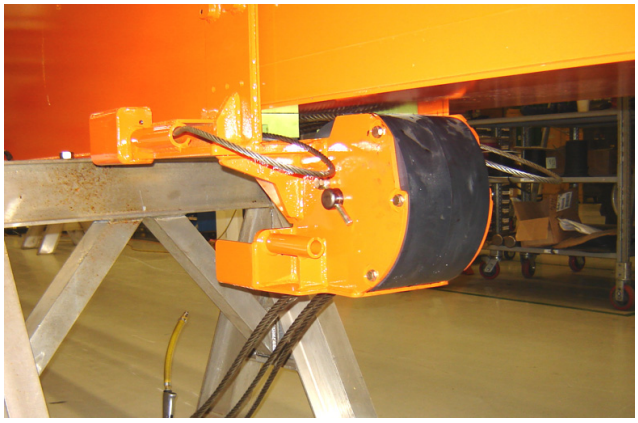
27. Coat the bolts with JLG Threadlocker P/N 0100011 and install the section 5 extend ropes to section 3 using nuts, keeper plates, bolts, and washers.



28. Coat the bolts with JLG Threadlocker P/N 0100011 and install the front bottom wear pads to section 3 using washers, bolts, and shims. Torque the bolts to 43 ft.lbs. (58 Nm)

29. Apply a thin coat of moly paste on I.D. of sheave bearings. Coat the bolts with JLG Threadlocker P/N 0100011 and install the sheaves to the front of section 3 using the pin, keeper, bolt, and washer.

30. Coat the bolts with JLG Threadlocker P/N 0100011. Install the rope retaining blocks to the front of section 3 using washers, bolts, and nuts.



31. Coat the bolts with JLG Threadlocker P/N 0100011. Install the front side wear pads to section 3 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm).

32. Coat the bolts with JLG Threadlocker P/N 0100011. Install the front upper wear pads to section 3 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm))

33. Coat the bolts with JLG Threadlocker P/N 0100011. Install the rear upper wear pads to section 3 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm).

34. Coat the bolts with JLG Threadlocker P/N 0100011. Install the outer rear side wear pads to section 3 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm).

35. Coat the bolts with JLG Threadlocker P/N 0100011. Install the rear inner side wear pads to section 3 using washers, and bolts. Torque the bolts to 28 ft.lbs. (38 Nm)

36. Coat the bolts with JLG Threadlocker P/N 0100011. Install the bottom rear wear pad to section 3 using washers and bolts. Torque the bolts to 28 ft.lbs. (38 Nm).

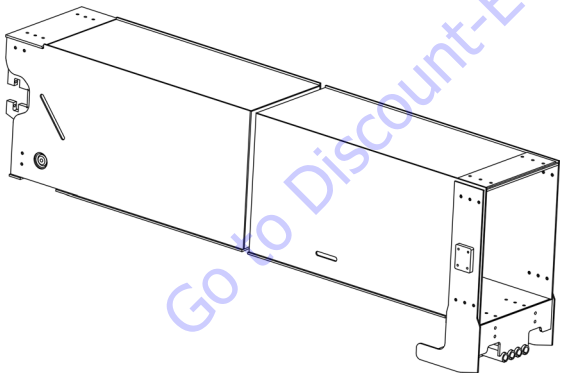
37. Apply moly paste to the I.D. of the sheave bearings. Install the sheaves to section 3.

38. Coat the two sheave center bolts with JLG Threadlocker P/N 0100019 and the sheave plate retaining bolts with JLG Threadlocker P/N 0100011. Install the sheave plates and rope retainer blocks to section 3 using the retaining bolts. Torque the sheave center bolts to 178 ft.lbs. (241 Nm). Torque the sheave plate retaining bolts to 41 ft.lbs. (55 Nm)

39. Coat the bolts with JLG Threadlocker P/N 0100011. Install the section 3 retract ropes to the rear of section 3 using washers, bolts, and pads. Torque the bolts to 28 ft.lbs. (38 Nm).

NOTE: *Boom section 2 weighs approximately 3755 lbs. (1703 kg).*

40. Place boom section 2 on a proper supporting device.



41. Apply Super Lube® lubricant (JLG p/n 3020042) to all 4 sides of the boom approximately 3 to 4 feet on both ends. Apply Super Lube® to section 3 on the end that will go into section 2 only. Apply super lube to all outer surfaces of interior wear pads after they are installed. Slide sections 3,4, and 5 as an assembly into section 2 using proper lifting procedures.

42. Coat the bolts with JLG Threadlocker P/N 0100011. Install the wear pads to section 2 using the bolts and washers. Torque the bolts to 43 ft.lbs. (58 Nm).

43. Install the adjustment nuts and lock nuts to the section 4 extend ropes.

44. Install the rope adjustment bracket to section 2 using washers, bolts, and nuts as shown.

45. Coat the bolts with JLG Threadlocker P/N 0100011. Install the section 4 return ropes to the rope adjustment bracket on section 2 using washers, bolts, keepers, and nuts.

46. Coat the bolts with JLG Threadlocker P/N 0100011. Install the sheave deflectors to the rope adjustment bracket on section 2 using nuts, bolts, and washers.

47. Coat the bolts with JLG Threadlocker P/N 0100011. Install the front side wear pads to section 2 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm)

48. Coat the bolts with JLG Threadlocker P/N 0100011. Install front top wear pads to section 2 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm)

49. Coat the bolts with JLG Threadlocker P/N 0100011. Install the rear top wear pads to section 3 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm).

50. Coat the bolts with JLG Threadlocker P/N 0100011. Install the rear side wear pads to section 2 using washers, bolts, and shims. Torque to 28 ft.lbs. (38 Nm).

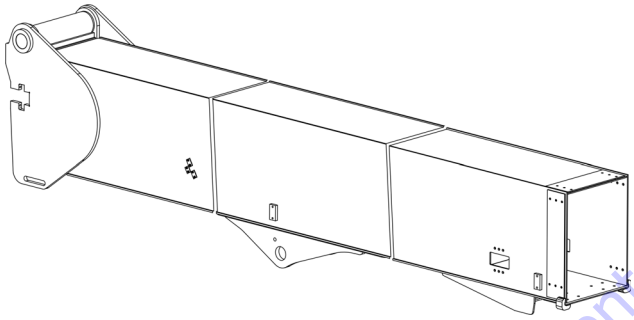
51. Apply moly paste to the I.D. of the sheave bearings. Install the sheaves to section 2 boom.

52. Coat the two sheave center bolts with JLG Threadlocker P/N 0100019 and the sheave plate retaining bolts with JLG Threadlocker P/N 0100011. Install the sheave plates and rope retainer blocks to section 2 using the retaining bolts. Torque the sheave center bolts to 178 ft.lbs. (241 Nm). Torque the sheave plate retaining bolts to 41 ft.lbs. (55 Nm)

53. Coat the bolts with JLG Threadlocker P/N 0100011. Install the bottom rear wear pad to section 2 using washers, and bolts. Torque the bolts to 28 ft.lbs. (38 Nm)

NOTE: *Boom section 1 weighs approximately 6045 lbs. (2742 kg).*

54. Place boom section 1 on a proper supporting device.



55. Apply Super Lube® lubricant (JLG p/n 3020042) to all 4 sides of the boom approximately 3 to 4 feet on both ends. Apply Super Lube® to section 2 on the end that will go into section 1 only. Apply super lube to all outer surfaces of interior wear pads after they are installed. Slide sections 2.3,4, and 5 as an assembly into section 1 using proper lifting procedures.

NOTE: *Position the deflectors so the surface is 3-4 mm from the section 2 bottom plate.*

56. Coat the bolts with JLG Threadlocker P/N 0100011. Install the section 3 retract ropes to section 1 using deflectors, bolts, nuts, washers, and keepers.

57. Coat the bolts with JLG Threadlocker P/N 0100011. Install the front bottom wear pads to section 1 using washers, bolts, and shims. Torque the bolts to 41 ft.lbs. (55 Nm).

58. Coat the bolts with JLG Threadlocker P/N 0100011. Install the front side wear pads to section 1 using washers, bolts, and shims. Torque the bolts to 43 ft.lbs. (58 Nm).

59. Coat the bolts with JLG Threadlocker P/N 0100011. Install the front top wear pads to section 1 using washers, bolts, and shims. Torque the bolts to 28 ft.lbs. (38 Nm).

60. Coat the bolts with JLG Threadlocker P/N 0100011. Install the cover to the section 1.

NOTE: *Center the cover over the hole in section 1.*

61. Install the cover to side section 1 boom.

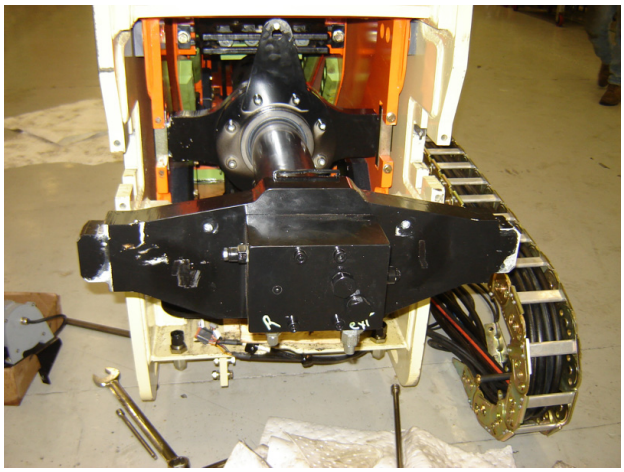
62. Coat the bolts with JLG Threadlocker P/N 0100011 and install the boom length bracket.

63. Route cables and hose's out thru the power track.

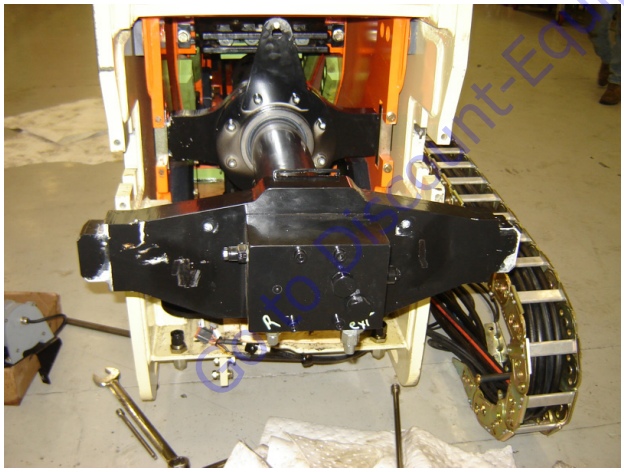
4.6 TELESCOPE CYLINDER

Removal

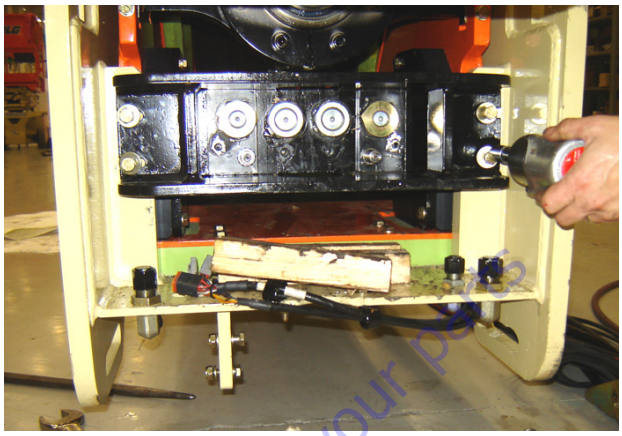
1. Remove the boom from the machine. Refer to Section - Boom Recovery Mode.
2. Remove the bolts and shims securing the telescope cylinder rod trunnion blocks to boom section 1 and remove the trunnion blocks. Using a hydraulic power supply, extend the telescope cylinder out of boom section 1.



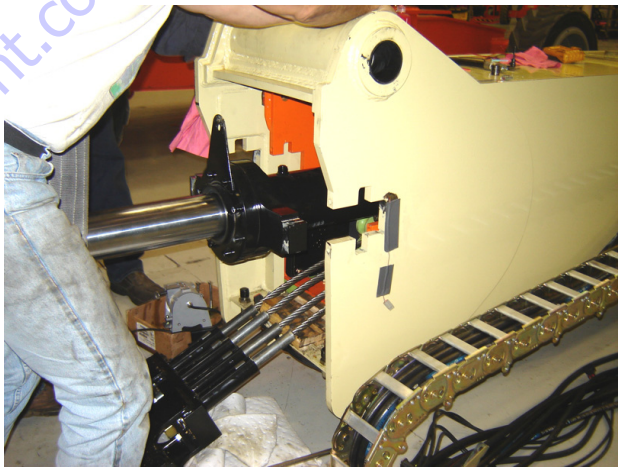
3. Remove the bolts and shims securing the telescope cylinder barrel trunnion blocks to boom section 2 and remove the trunnion blocks.

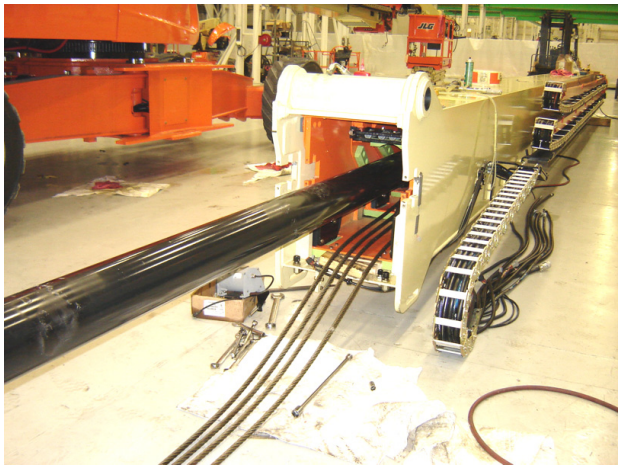


4. Remove the bolts securing the adjustment mount and disconnect the adjustment mount from boom section 1.

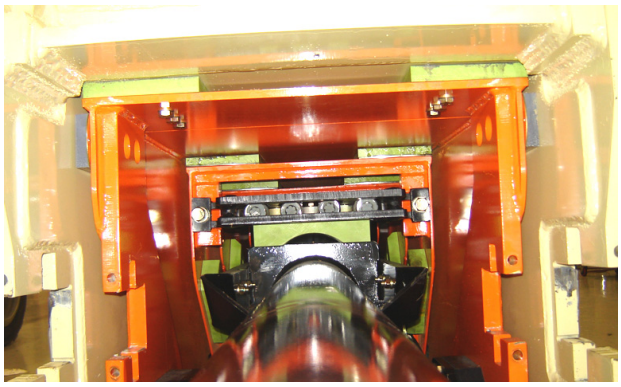


5. Carefully pull the cylinder and ropes from the boom assembly until there is access to the extend rope support. As the cylinder and ropes are removed from the assembled boom, do not allow slack to accumulate in the ropes between the rope support and the sheaves on the cylinder assembly. The rope adjuster mount must travel at twice the rate the cylinder is extracted to control slack.

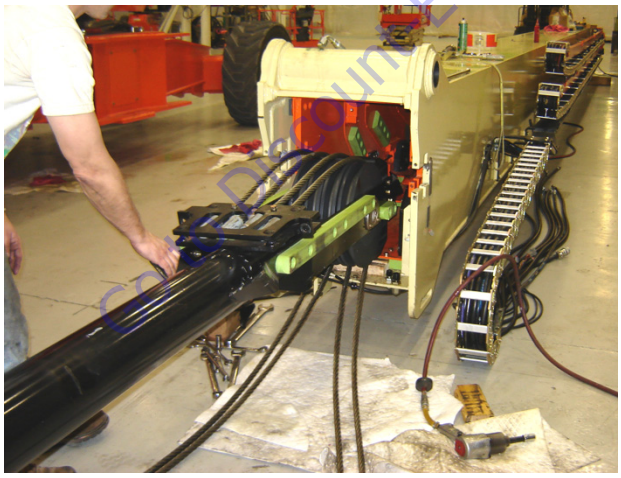




6. Remove the bolts securing the extend rope support and disconnect the support from boom section 3.



7. Carefully remove the telescope cylinder and ropes from the boom assembly.



4.7 BOOM SHIMMING PROCEDURE

NOTE: *Throughout this procedure, boom sections are identified numerically, 1-5. Boom Section 1 is at the base, Boom Section 5 is the fly.*

1. Measure and record any sweep dimension and direction of Boom Section 5 per spec drawing 1280284 and record in Quality logbook. Measure and record the inside width and inside height of the Boom Section 4 opening.

2. Install the Internal Side wear pads on the Section 5 sides and shim as required to match the corresponding dimension recorded in step 1 within plus or minus 1/32". Shims should be divided as evenly as possible between the side pads unless corrections are needed to compensate for any sweep recorded in step 1. If the sweep is to the left the internal side pads on the right should have more shims than the left side pads and vice-versa.

NOTE: *When installing wear pads in the following steps, the wear pad bolt lengths may need to be adjusted as shim thicknesses are adjusted. Bolt lengths should be flush to one thread below the surface of the insert.*

3. Install the bottom wear pad(s) on Section 5 boom as specified on the boom assembly drawing.

4. Install the top wear pad(s) on Section 5 boom and shim as required to obtain the total dimension 0" to1/16" under the corresponding dimension in step 1.

5. Slide Section 5 into Section 4 with 2 to 6 feet exposed.

6. Install the bottom wear pad(s) onto the end of Section 4 as specified on the boom assembly drawing.

7. Temporarily insert the External Side pads on one side and slide Section 5 boom to that side. Insert the other side pads using shims measure how many will be required to fill the remaining space. Once this is established, install the total amount of shims as evenly as possible between the two sides unless corrections are needed to compensate for out of square booms or for additional corrections for any sweep recorded in step 1. Care should be taken to keep the bottom pads evenly loaded while shimming the side pads. If the sweep is to the left the external side pads on the left should have more shims than the right side pads and vice-versa.

NOTE: *Do not use a wedge to install more shims than will fit with the use of a pry bar. This may result in a boom being shimmed too tight. The use of pry bars should only be used to finish installing a shim that can be installed by hand more than ½ of its length.*

8. Install the top wear pads and shims into the end of Section 4 leaving a gap of 0" to 1/16" between the top of the Section 5 and the pad inside Section 4.

9. Repeat steps 1-7 above to install the Section 5/4 assembly into boom Section 3.

10. Repeat steps 1-7 above to assemble the Section 5/4/3 assembly into Section 2.

11. Repeat steps 1-7 above to assemble the Section 5/4/3/2 assembly into Section 1.

12. Complete the boom and machine assembly. The boom should be functionally tested and evaluated for boom sweep. If necessary, the boom may be re-shimmed by moving shims from one side to the other to further correct any remaining boom sweep. There may be some instances where no shims are used under a given side pad to pass the criteria for boom sweep at final inspection of machine.

4.8 BOOM LUBRICATION APPLICATION

This procedure applies to booms after assembly or as necessary using Super Lube® lubricant (JLG p/n 3020042).

NOTE: *This procedure should also be performed when the telescope in or telescope out functions are not operating smoothly.*

1. Position the boom on the boom rest using the 500lb capacity setting.

2. Telescope main boom section as far as it will extend at this position, approximately 3 ft. (0.9 m).

3. From the front of the machine (boom pivot end), moderately apply lubricant to the interior surfaces of boom sections 1, 2, 3, and 4. To prevent misdiagnosis of hydraulic leaks, take care to prevent excessive application of lubrication.

4. At the rear of the machine, apply lubricant to the side, top and bottom surfaces of boom sections 5, 4, 3, and 2 specifically to wear pad contact paths. To prevent misdiagnosis of hydraulic leaks, take care to prevent excessive application of lubrication.

5. After application of the lubricant is complete, cycle the boom through its full range of travel 2 times.

4.9 BOOM CLEANLINESS GUIDELINES

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

1. JLG recommends the use of the JLG Hostile Environment Package if available to keep the internal portions of a boom cleaner and to help prevent dirt and debris from entering the boom. This package reduces the amount of contamination which can enter the boom but does not eliminate the need for more frequent inspections and maintenance when used in these types of environments.

2. JLG recommends that you follow all guidelines for servicing your equipment in accordance with the instructions outlined in the JLG Service & Maintenance Manual for your machine. Periodic maintenance and inspection is vital to the proper operation of the machine. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.

3. Debris and foreign matter inside of the boom can cause premature failure of components and should be removed. Methods to remove debris should always be done using all applicable safety precautions outlined in the JLG Service & Maintenance Manuals.

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

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

6. If neither pressurized air nor washing of the boom dislodges and removes the debris, then disassemble the boom in accordance to the instructions outlined in the JLG Service & Maintenance Manual to remove the debris.

4.10 HOSE ADJUSTMENT PROCEDURE

1. Load the hoses and cables into the powertracks and push tubes according to Figure 4-56., Powertrack Hose Installation - Sheet 4 of 4.

2. Adjust the hose and cable lengths at the fly nose clamp (Location A) per their respective drawings and install clamp. Tighten the clamp at the end of the top push tube (Location B). Each clamp is considered tight when the contained hoses and cables cannot be moved.

3. With clamp B set, pull the hoses and cables until they are resting against the flat bars on the outside radius of the power track. Force additional hydraulic hose slack into the power track by pushing the hoses from the Location C. Tighten the clamp at location C.

4. While maintaining the hose and cable configuration listed in Figure 4-56., Powertrack Hose Installation - Sheet 4 of 4, insert a tool to ensure the minimum bend radius of 4 inches is not being violated as the hoses are routed into the push tube at location C. Once adjusted, tighten the clamp at Location D and remove the tool.

5. With clamp D set, pull the hoses and cables until they are resting against the flat bars on the outside radius of the power track. Force additional hydraulic hose slack into the power track by pushing the hoses from the Location E. Tighten the clamp at location E.

6. While maintaining the hose and cable configuration shown in Figure 4-56., Powertrack Hose Installation - Sheet 4 of 4, insert a tool to ensure the minimum bend radius of 4 inches is not being violated as the hoses are routed into the trays at location E. Once adjusted, tighten the clamp at Location F and remove the tool. Check additional lengths of the hoses and cables against the pull lengths listed on their respective drawings.

7. Attach all hydraulic hoses and pressurize the hoses by dead heading a function. Check hose clearance in both power tracks. There should be clearance between the hoses and the inside rollers or flat bars. Release the function.

8. If the hoses were in contact, loosen the clamps and pull additional length from the lower clamp (additional length at location B should be pulled through clamp C, additional length at location D should be pulled through clamp E). Steps 3 thru 7 should be followed when adjusting the hoses.

9. Repeat steps 7 and 8 until there is no contact between the hoses and the inside radius of the power track.

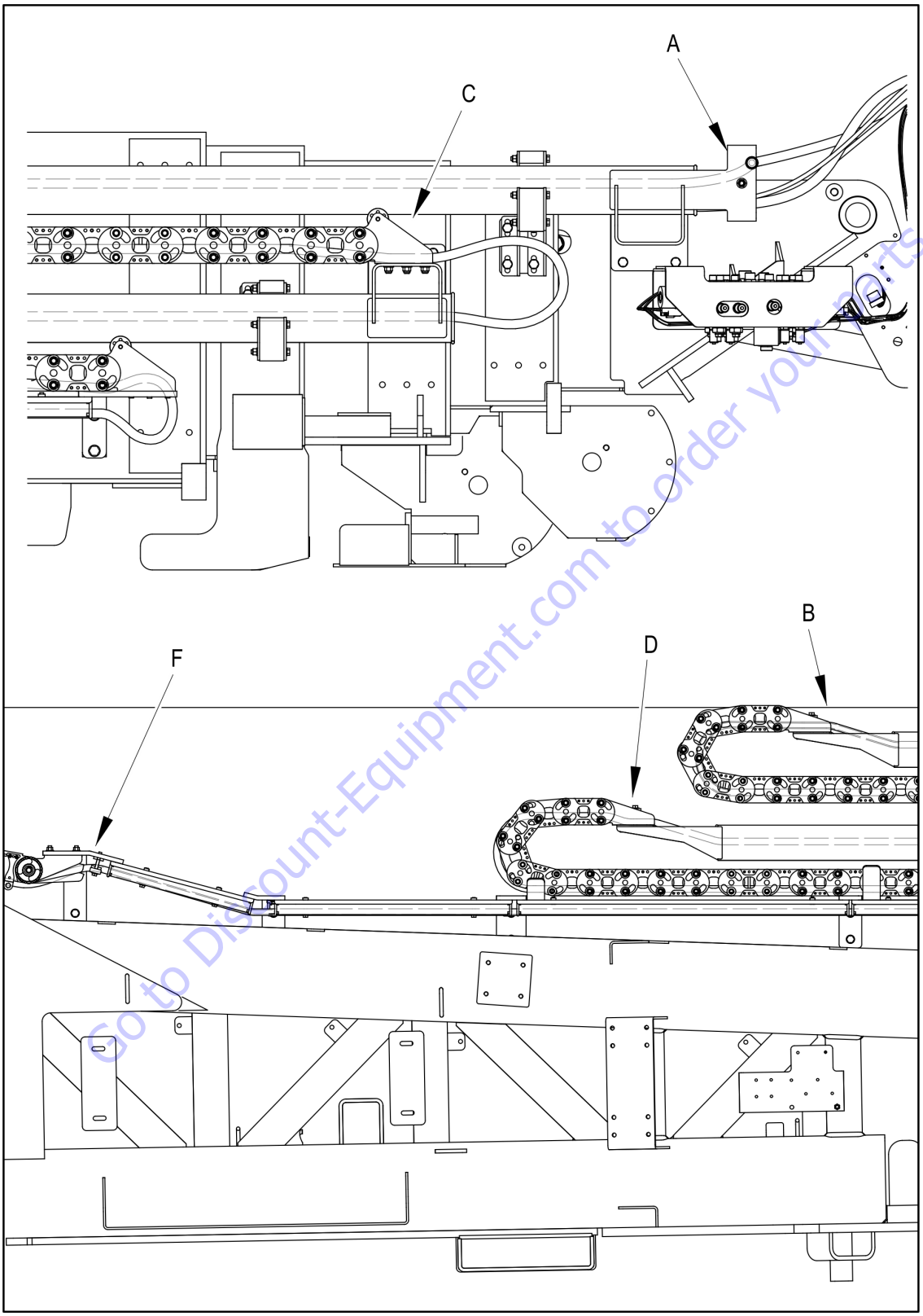


Figure 4-24. Hose Adjustment

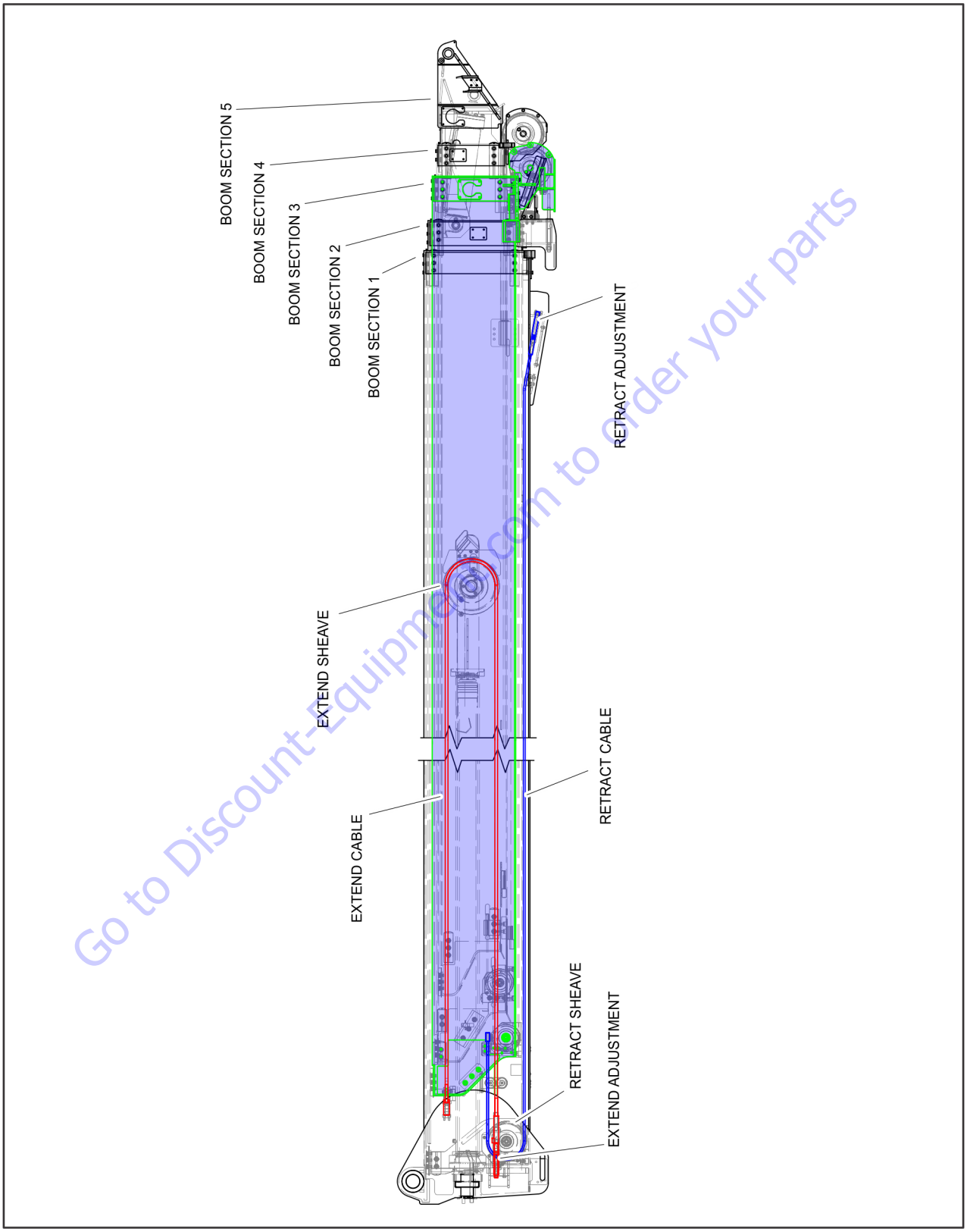


Figure 4-25. Section 3 Boom Cables

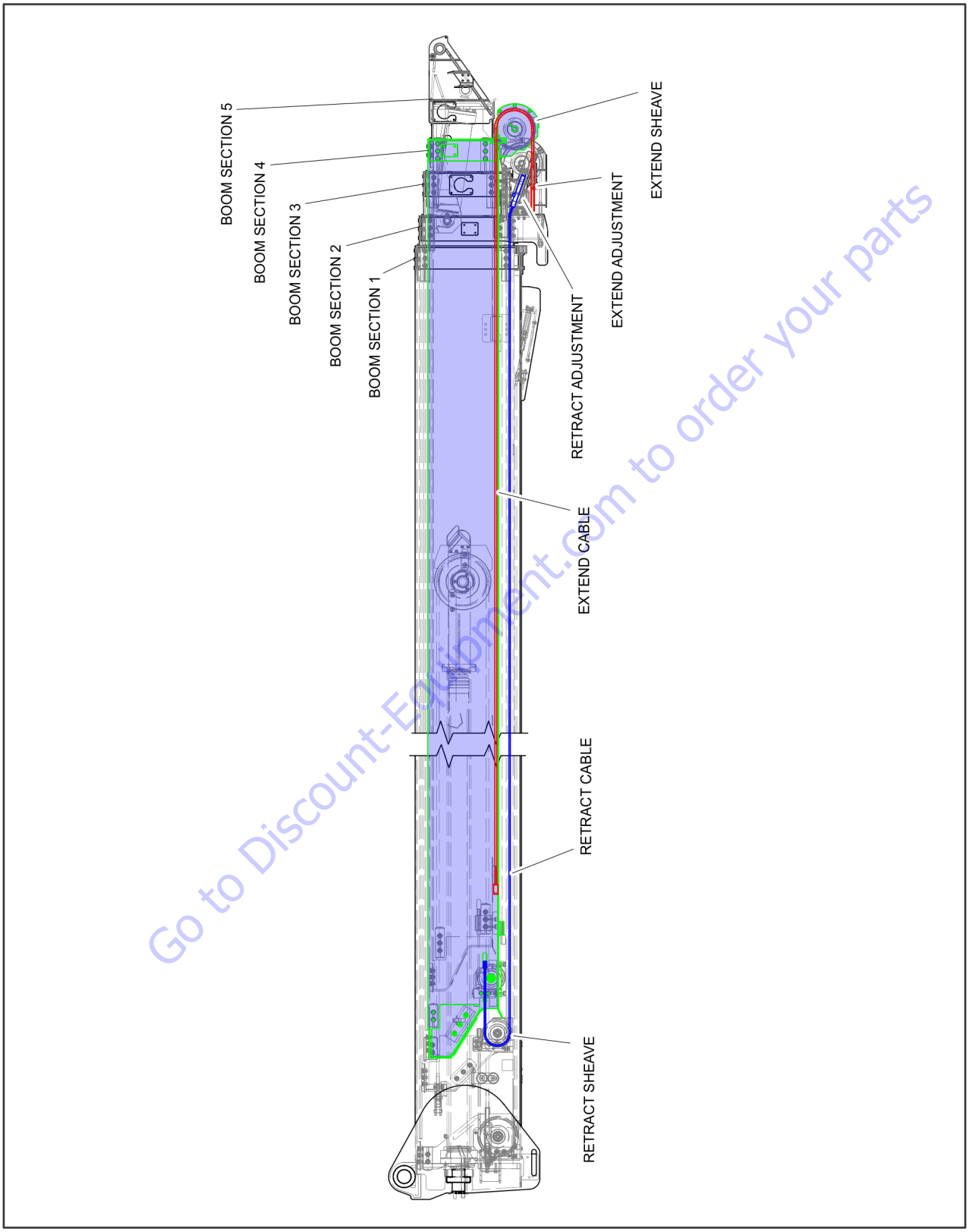


Figure 4-26. Section 4 Boom Cables

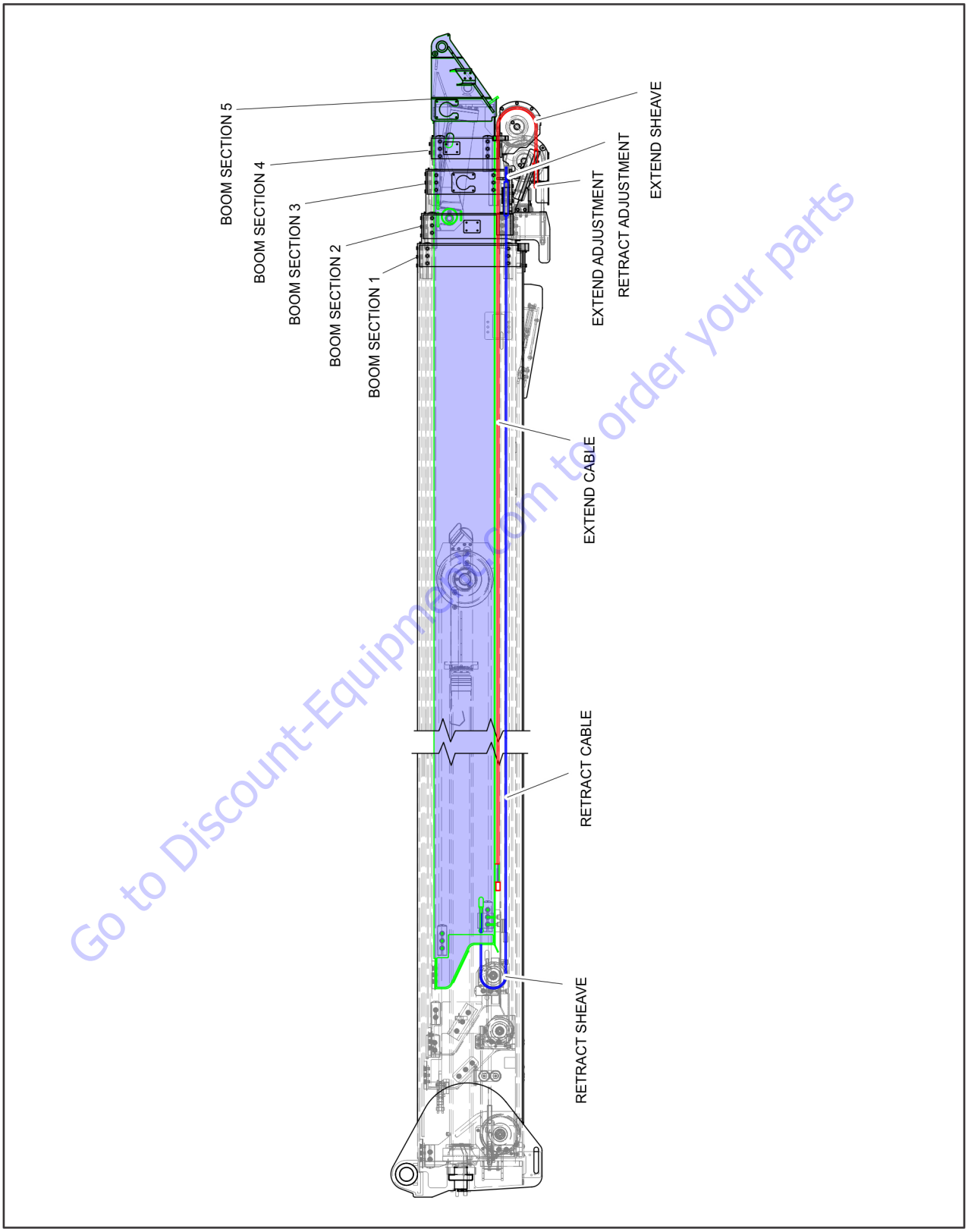


Figure 4-27. Section 5 Boom Cables

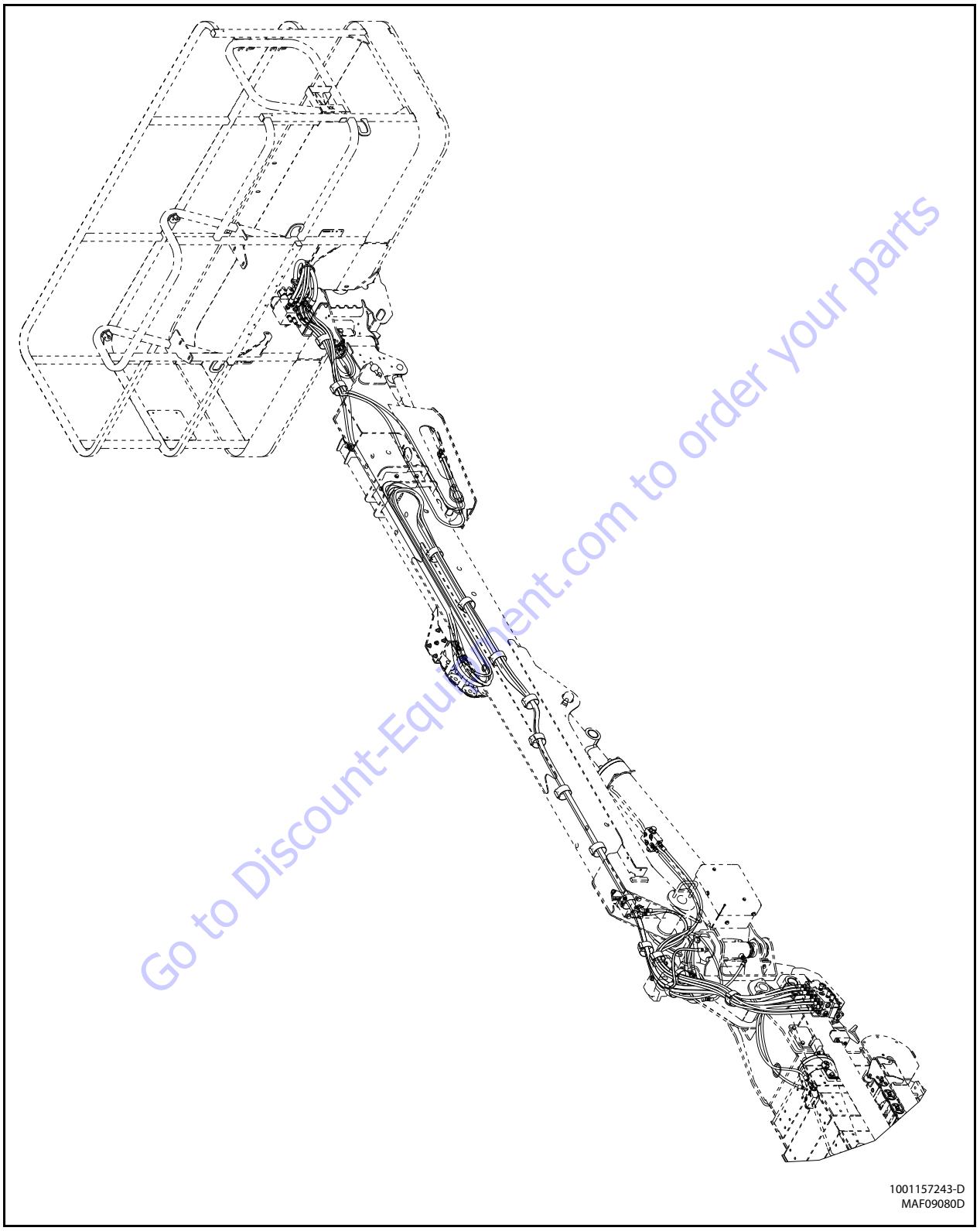


Figure 4-28. Jib Hydraulics - Sheet 1 of 7

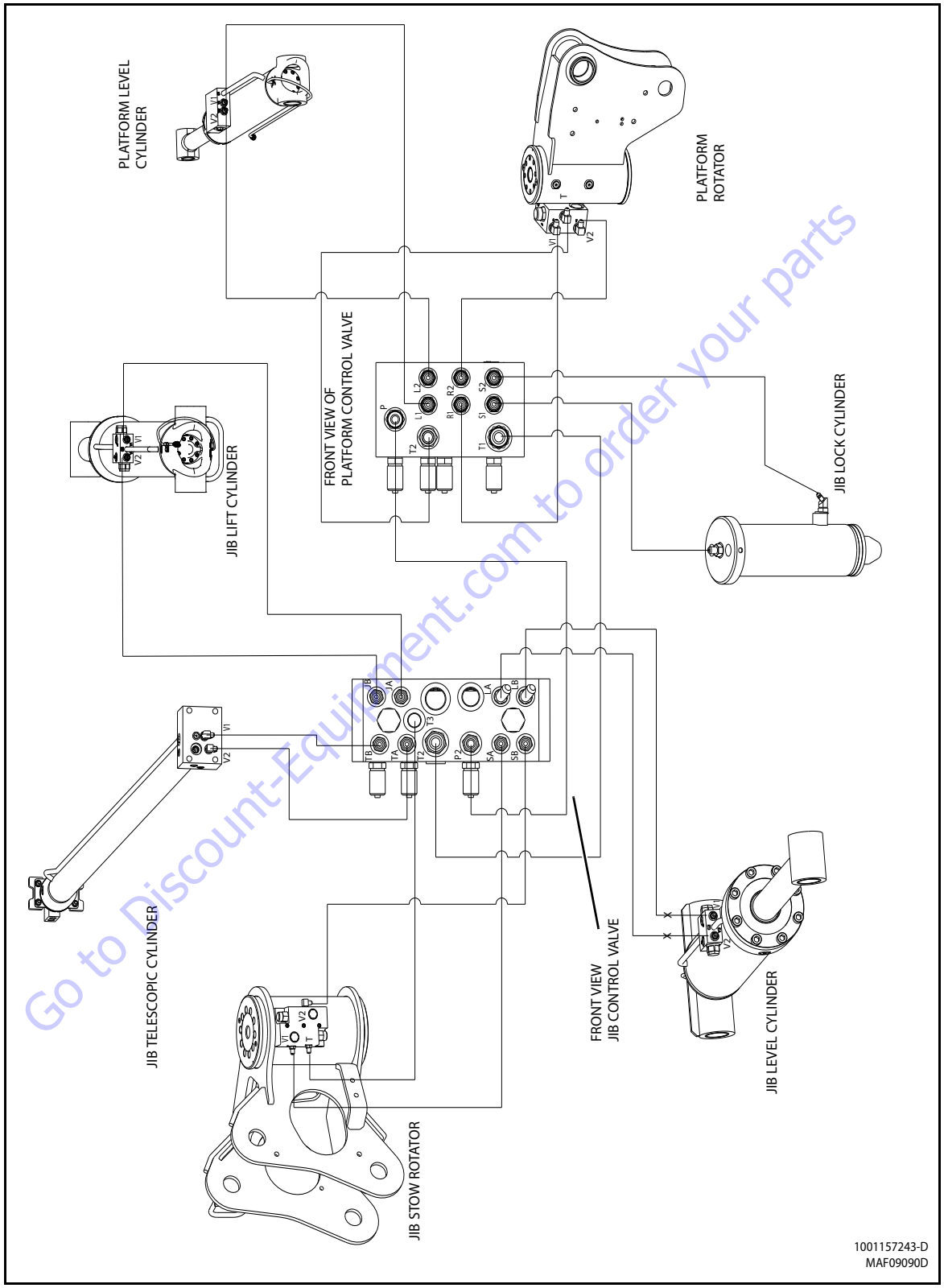


Figure 4-29. Jib Hydraulics - Sheet 2 of 7

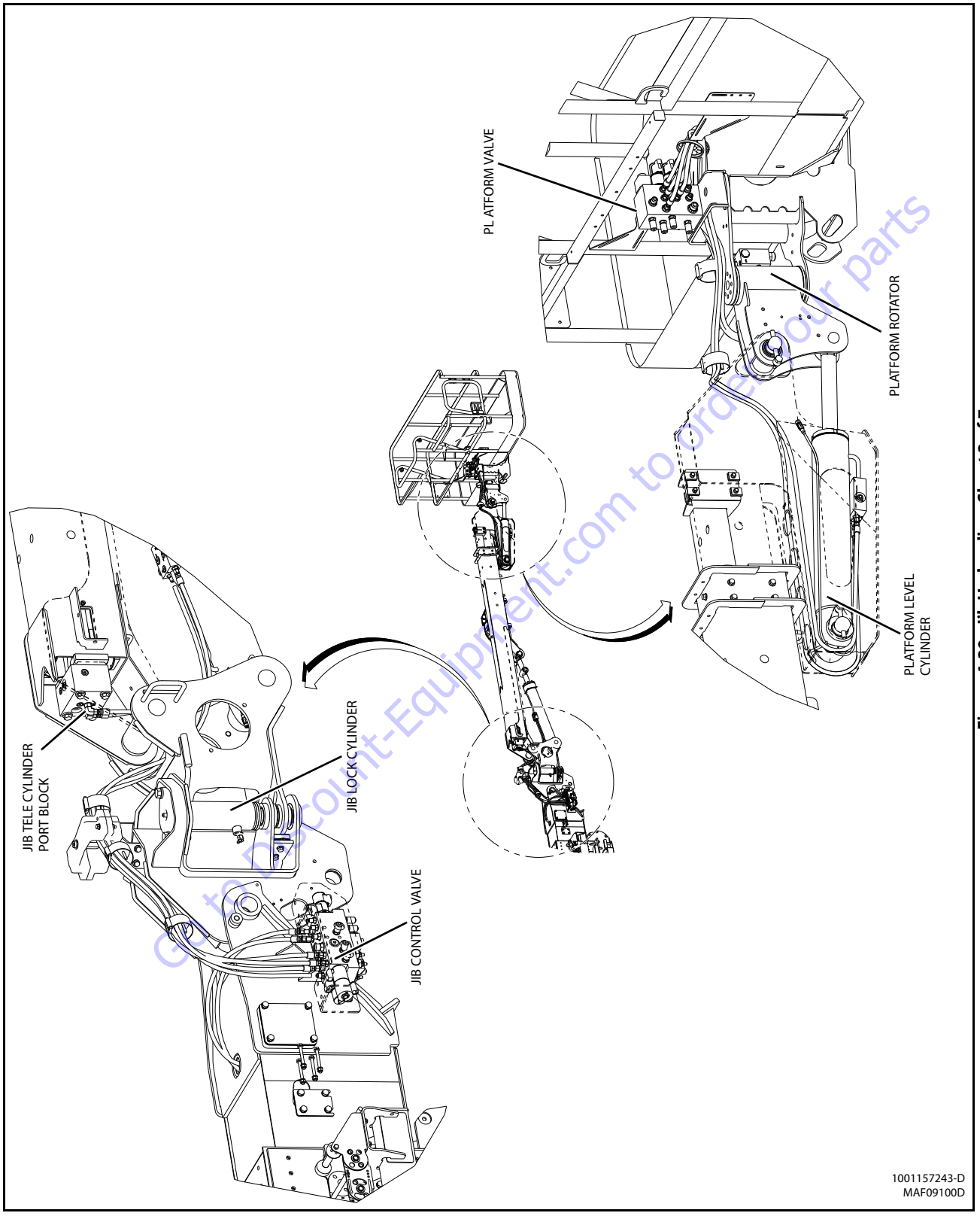


Figure 4-30. Jib Hydraulics - Sheet 3 of 7

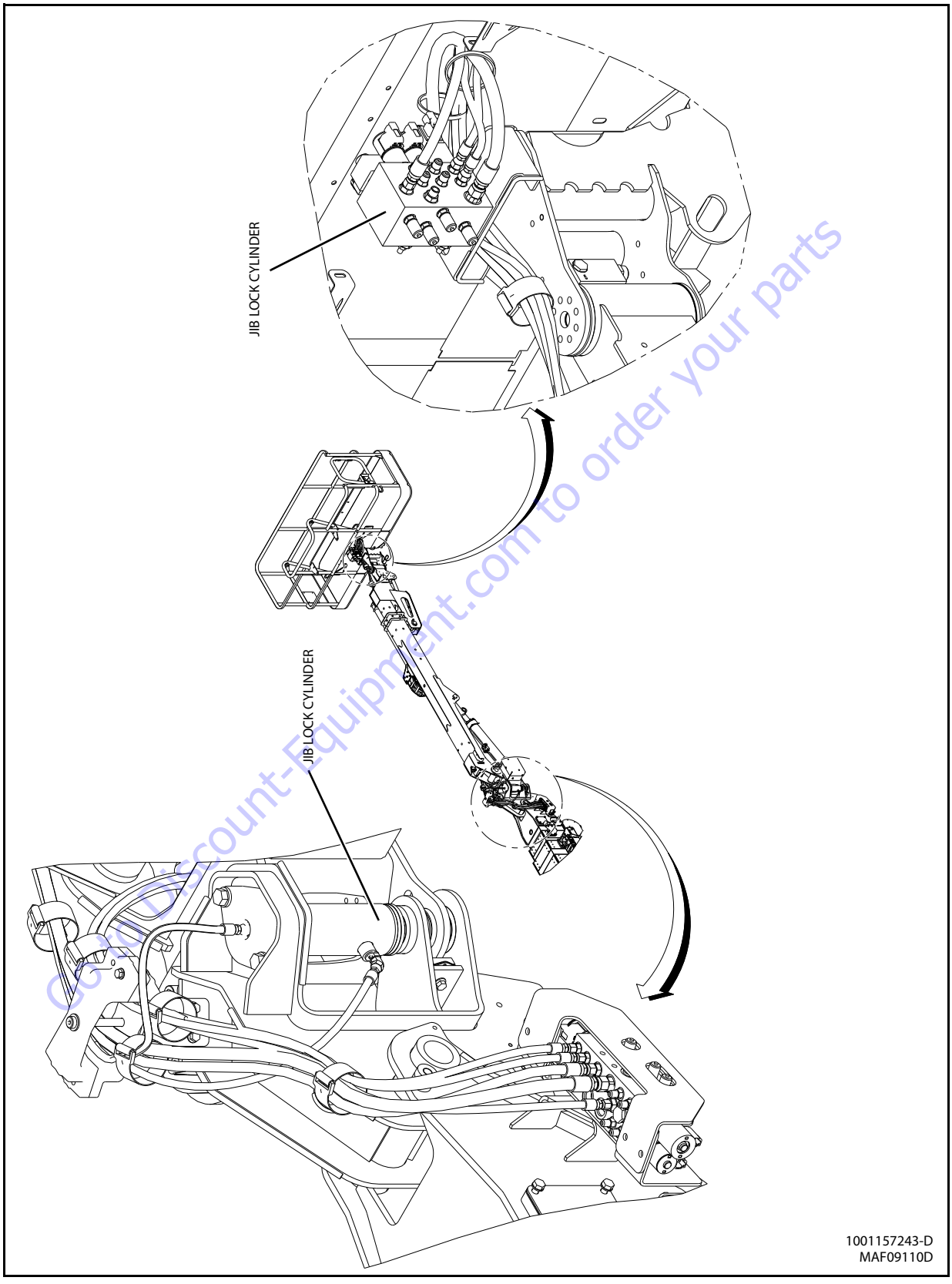


Figure 4-31. Jib Hydraulics - Sheet 4 of 7

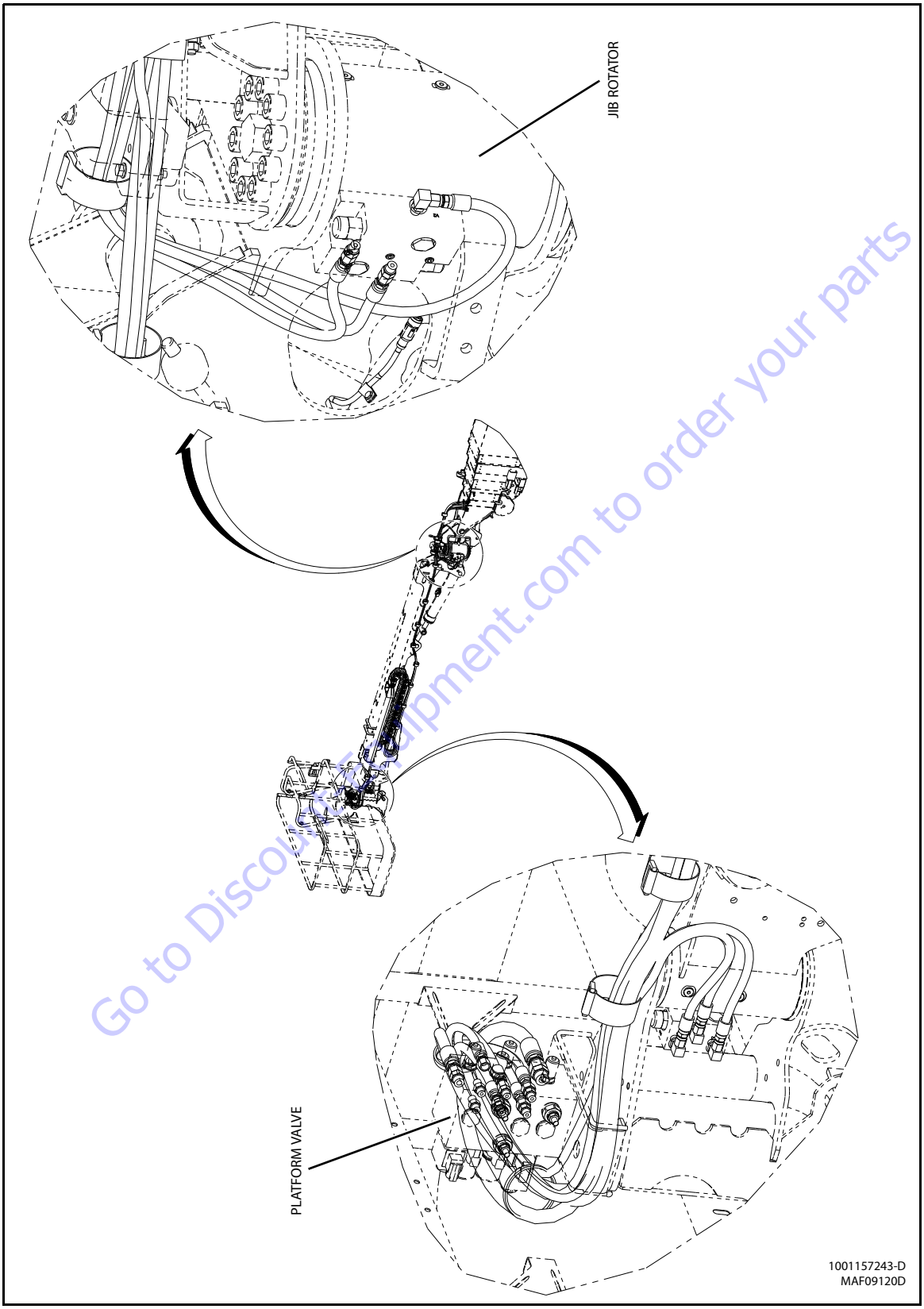


Figure 4-32. Jib Hydraulics - Sheet 5 of 7

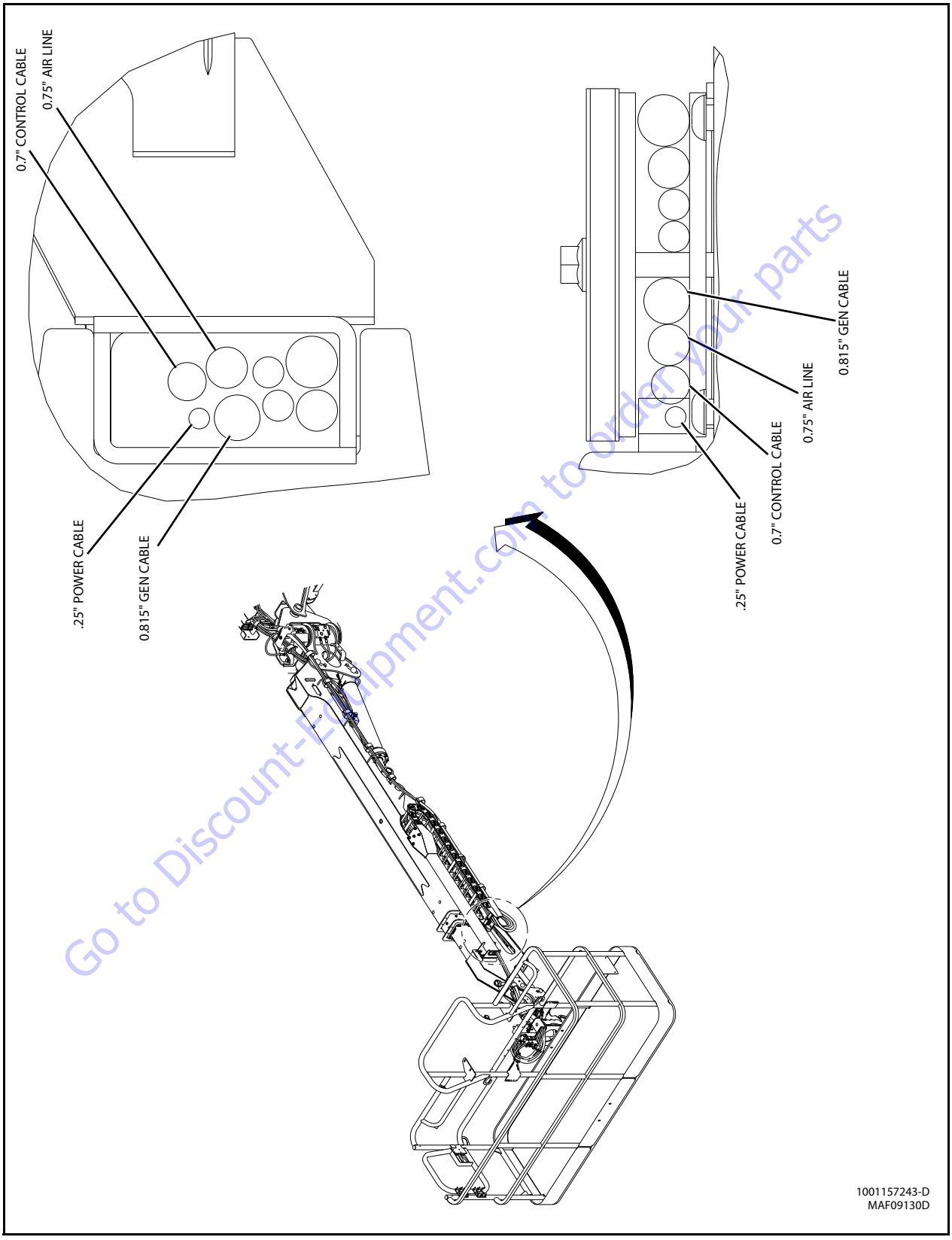


Figure 4-33. Jib Hydraulics - Sheet 6 of 7

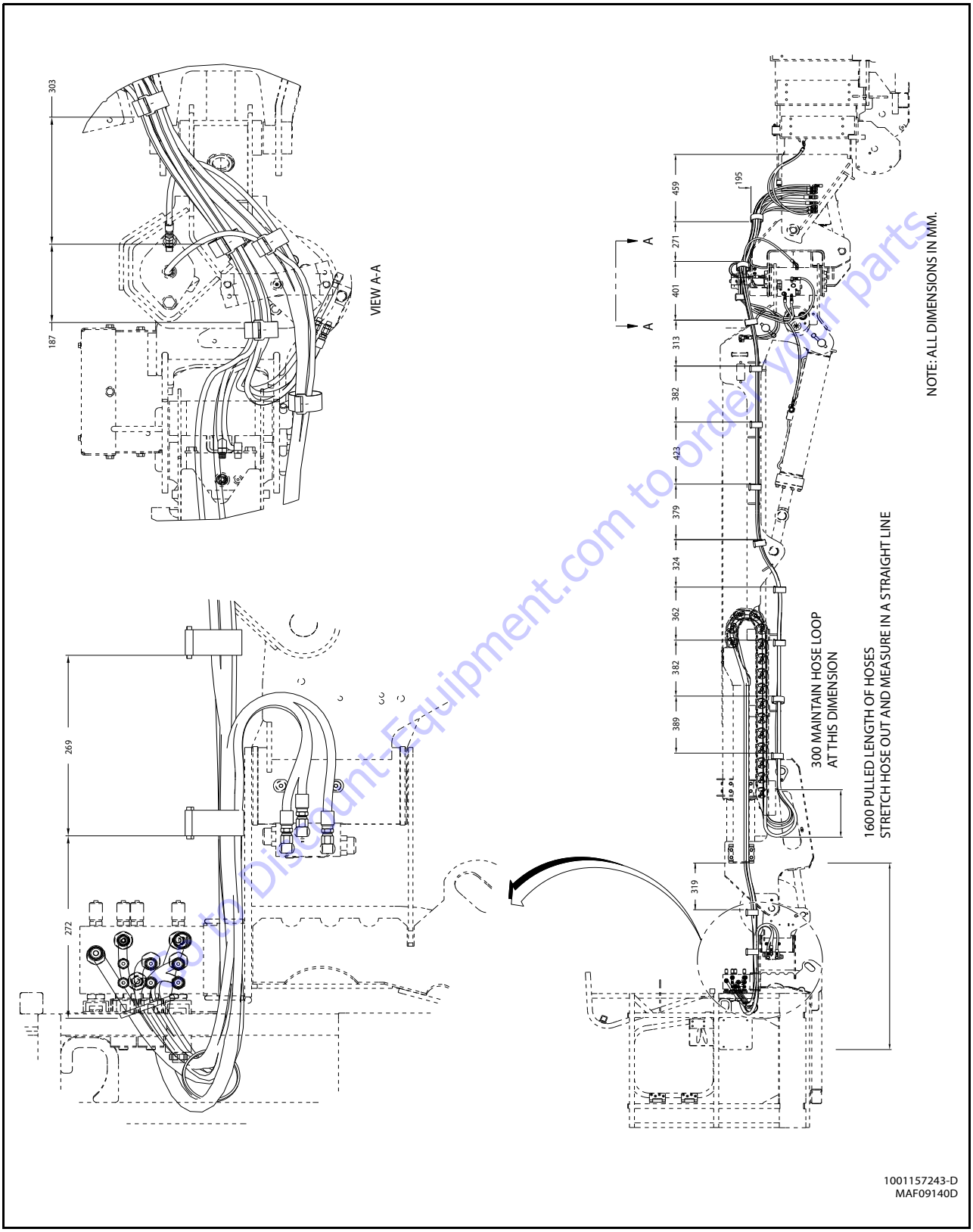
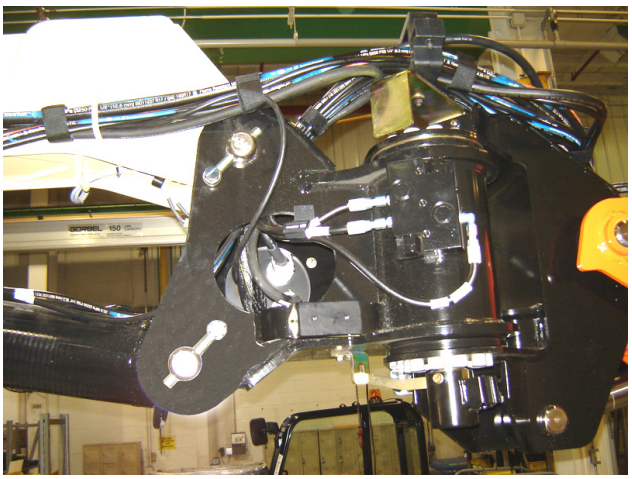


Figure 4-34. Jib Hydraulics - Sheet 7 of 7

4.11 JIB

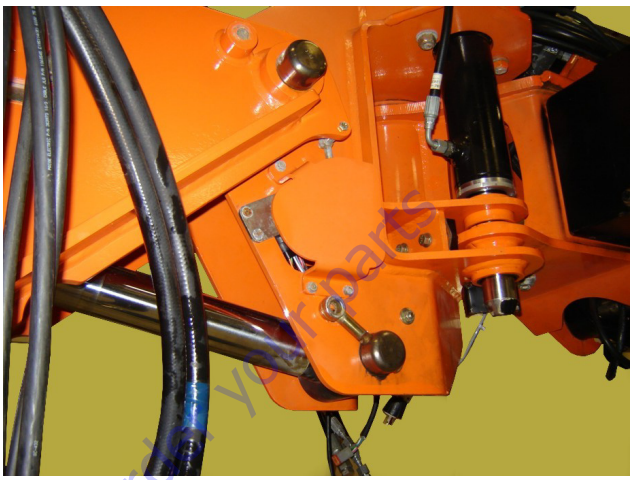
Removal

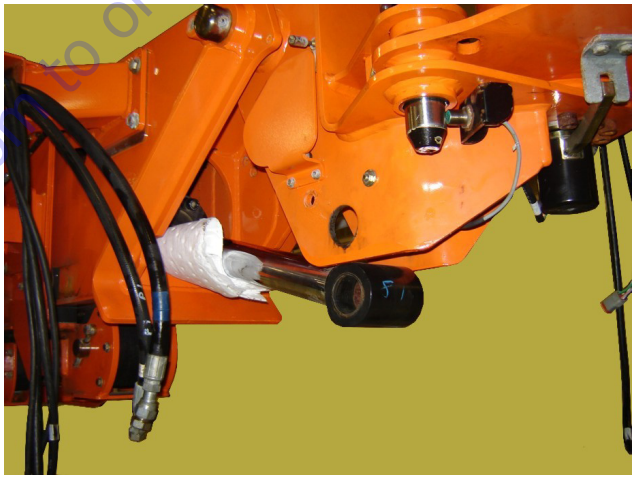
1. Lower the platform to the ground or onto blocking to support the weight of the jib.
2. Tag and disconnect the electrical harnesses that run to the jib. If necessary, loosen the guide block to allow the harnesses and hoses to move more freely.



3. Remove the jib valve protection plate.
4. Have a container or absorption material ready to catch residual hydraulic fluid. Tag and disconnect the hydraulic hoses that run from the boom to the jib control valve. It may be necessary to disconnect additional lines to gain access to certain fittings. Cap or plug all openings.
5. Unbolt the valve from the boom.
6. Lay the jib control valve aside on the jib. Secure it in place so it does not fall.
7. Disconnect the jib protractor sensor linkage from the boom.

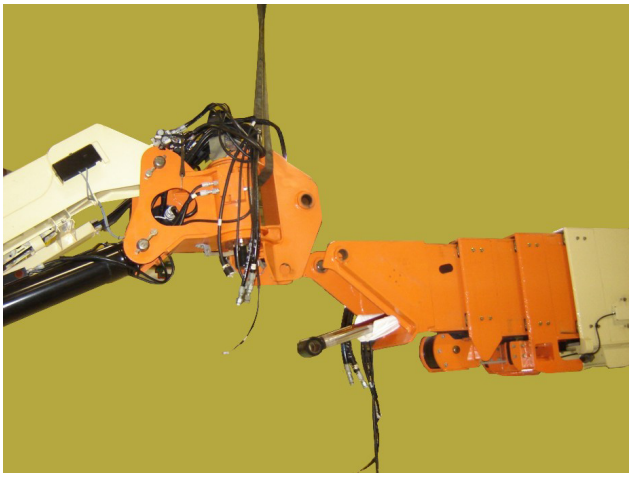
8. Remove the bolt and keeper pin securing the jib level pivot pin and remove the pin. Place blocking under the cylinder rod or a soft material under the cylinder rod to protect the rod from being scratched.





NOTE: *The jib and platform assembly weighs approximately 2100 lbs. (953 kg.).*

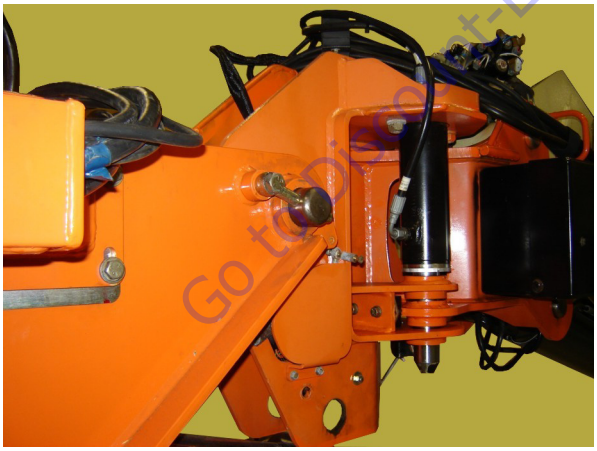
9. Attach an adequate supporting device to the jib to support its weight. Remove the bolt and keeper pin securing the jib pivot pin and remove the pin.



10. Remove the jib and platform assembly from the boom.

Installation

1. Attach an adequate lifting device to the jib and position it in front of the boom.
2. Place something under the front of the jib that will allow it to slide or move along the ground easily. Attach a lifting device to the rear of the jib, allowing the front to pivot on the ground.
3. Lift the jib into position on the boom fly section and install the jib pivot pin. Secure the pin in place with the keeper pin and bolt.



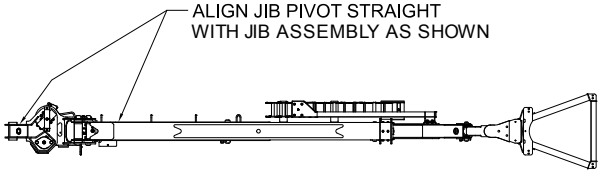
4. Attach a lifting device to the front of the jib and align the jib level cylinder attachment fittings. Install the pivot pin. Apply JLG Threadlocker P/N 0100019 to the bolt threads and secure the pin in place with the keeper pin and bolt. Torque the bolt to 165 ft.lbs. (224 Nm).

5. Place the mounting bracket on the jib valve and bolt the jib valve to the fly boom section.
6. Install the wiring harnesses and hydraulic hoses on the jib valve as tagged during removal.
7. Install the jib valve protection plate.
8. Perform a boom calibration as described in Section 6 under Calibrating the Boom Sensors.

4.12 JIB SHIMMING PROCEDURES

Jib Straight Shimming Procedure

1. Install the Jib Lock Cylinder and fully extend the rod through the bearing housings in the jib rotator and jib pivot.
2. Alight the jib pivot straight with the jib assembly.
3. Insert shims (16 and 20 gauge) between the wear pad and the pivot pad mount.
4. Add enough shims as required to fill the gap between the wear pad and the edge of the bottom plate of the jib rotator.
5. Only shim until the thinnest shim can not fit. Do not over shim. This will cause jib pivot and jib assembly misalignment.
6. When shimmed properly, the jib pivot should line up straight with the jib assembly as shown below.



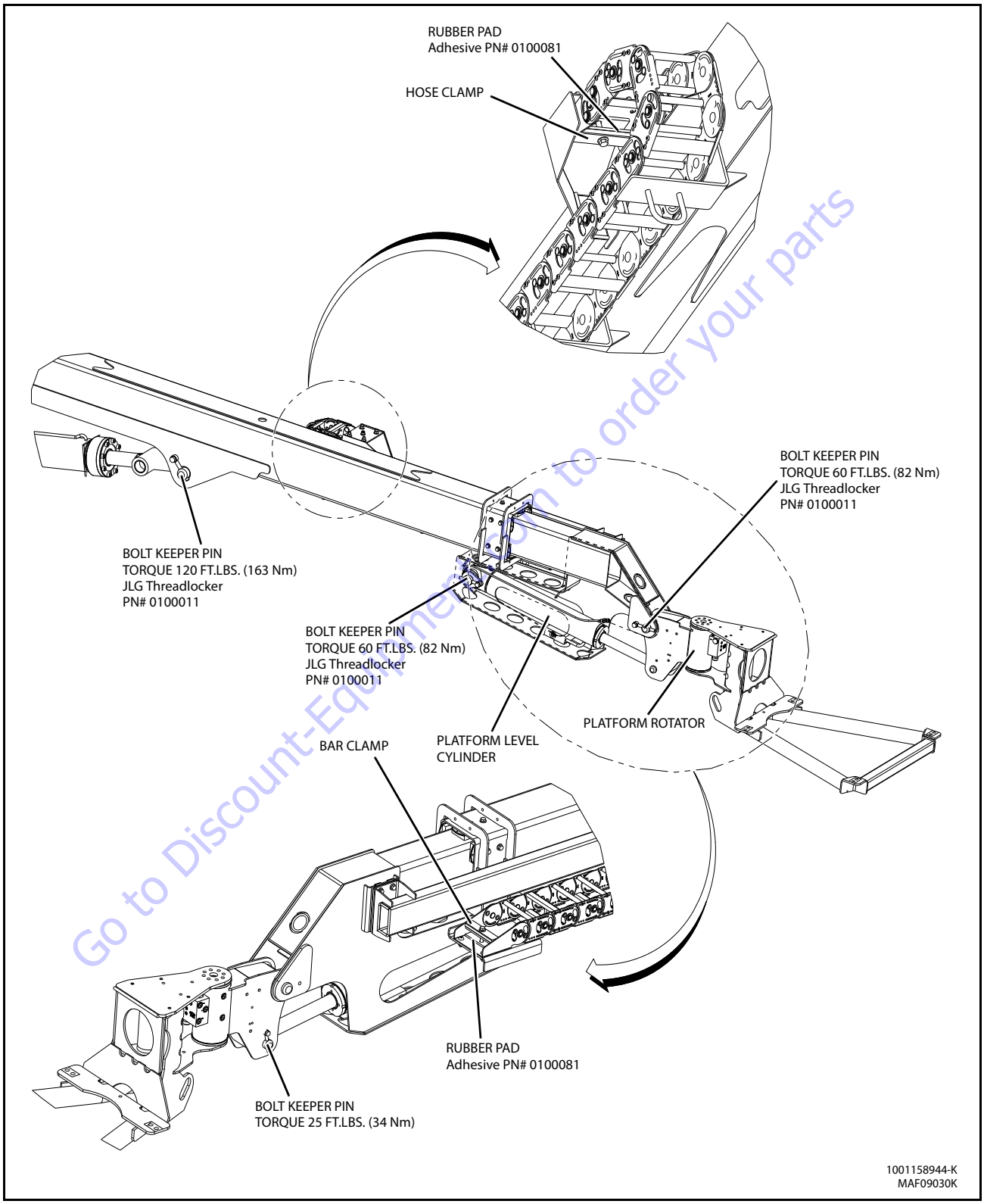


Figure 4-35. Jib Assembly - Sheet 1 of 4

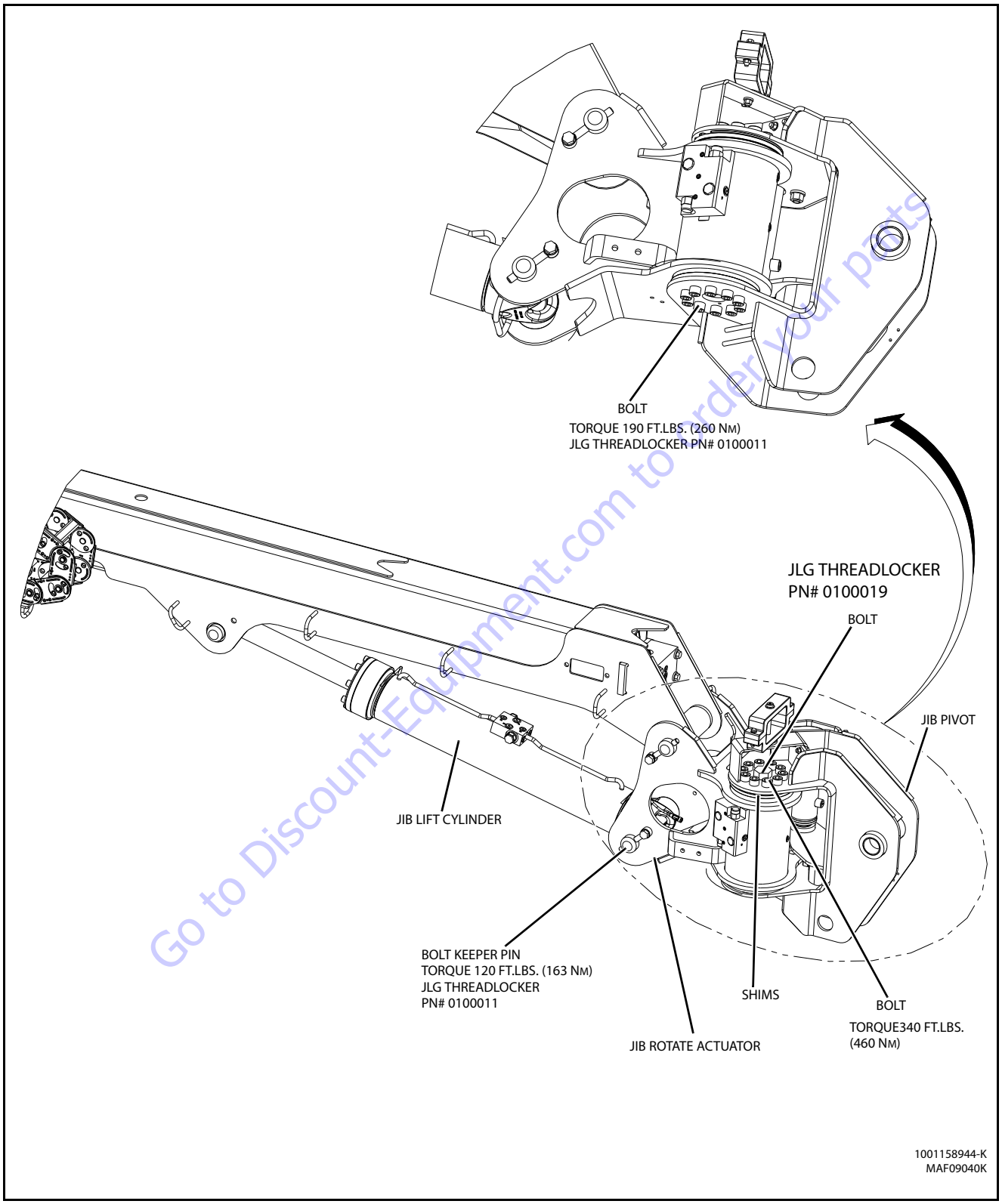


Figure 4-36. Jib Assembly - Sheet 2 of 4

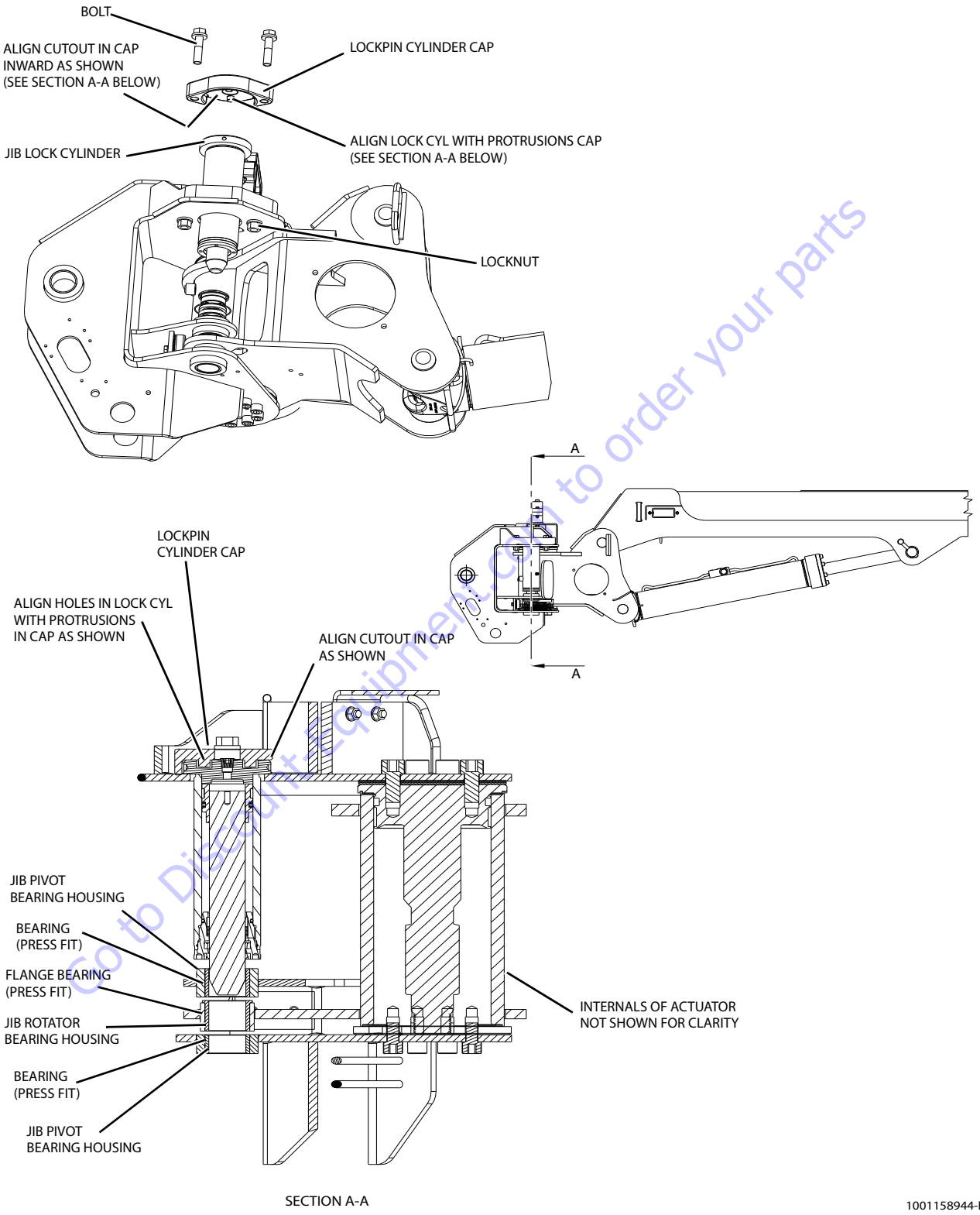


Figure 4-37. Jib Assembly - Sheet 3 of 4