Service and Maintenance Manual

Models
600SC
660SJC

SN *0300236299 to Present*

PN - 3121776

November 30, 2018 - Rev C

ANSI

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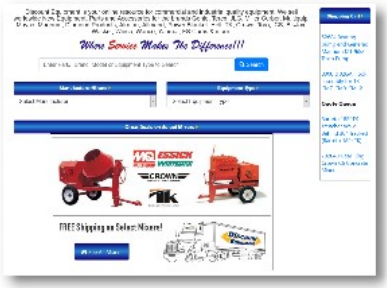

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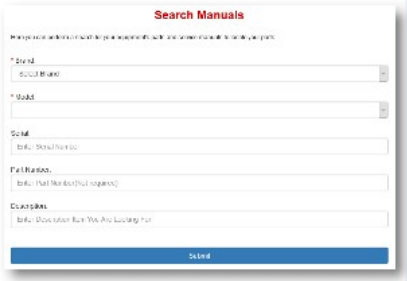

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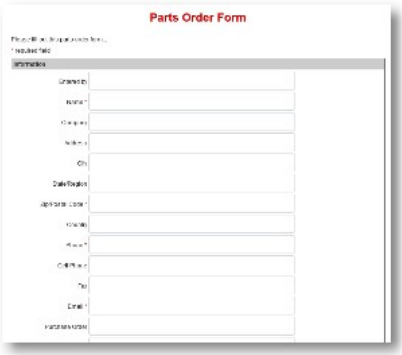

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SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A GENERAL

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

⚠ WARNING

MODIFICATION OR ALTERATION OF 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 maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure adequate support is provided.

⚠ WARNING

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

B HYDRAULIC SYSTEM SAFETY

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

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

C MAINTENANCE

⚠ WARNING

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

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

REVISON LOG

Original Issue	A - October 25, 2017
Revised	B - June 29, 2018 - Revised Covers
Revised	C - November 30, 2018

SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

Maximum Work Load (Capacity) - 600SC*	
Unrestricted:	600 lbs. (272 kg)
Restricted:	1000 lbs. (454 kg)
Maximum Work Load (Capacity) - 660SJC*	
Unrestricted:	550 lbs. (250 kg)
Restricted:	750 lbs. (340 kg)
Maximum Travel Grade (Gradeability)	55%
Maximum Travel Grade (Side Slope)	5°
Maximum Manual Force (600SC)	90 lbs. (400 N)
Maximum Manual Force (660SJC)	100 lbs. (445 N)
Maximum Wind Speed	28 mph (12.5 m/s)
Ground Bearing Pressure	
600SC	9.45 psi (0.66 kg/cm^2)
660SJC	11.28 psi (0.79 kg/cm^2)
Maximum Drive Speed	1.6 MPH (2.57 Km/hr.)
Electrical System	12V DC
Gross Machine Weight (Approximate)	
600SC	25942 lbs (11767 kg)
660SJC	29339 lbs (13308 kg)

** Maximum Work Load (Capacity) can be affected by the addition of the Soft Touch option. If equipped with Soft Touch, refer to Section 6 and the decal on your machine for these values.*

1.2 DIMENSIONAL DATA

Table 1-2. Dimensional Data

Machine Height (Stowed)	8 ft. 2.4 in. (2.5 m)
Machine Length (Stowed)	
600SC	28 ft. 7 in. (8.71 m)
660SJC	35 ft. 4.7 in. (10.79 m)
Machine Width	8 ft. 2 in. (2.49 m)
Wheelbase	9 ft. 0.7 in. (2.76 m)
Ground Clearance	
600SC	1 ft. 11.2 in (0.59 m)
660SJC	1 ft. 4.3 in. (0.42 m)
Platform Height	
600SC	59 ft. 5 in. (18.11 m)
660SJC	65 ft. 7 in. (19.99 m)
Horizontal Reach	
600SC	50 ft. 3 in. (15.31 m)
660SJC	57 ft. 0.6 in. (17.39 m)
Horizontal Reach from center of rotation - 600SC	
600 lbs (272 kg) Zone	50 ft. 3 in. (15.31 m)
1000 lbs (454 kg) Zone	41 ft. 1.7 in. (12.53 m)
Horizontal Reach over end - 600SC	
600 lbs (272 kg) Zone	44 ft. 7.8 in. (13.61 m)
1000 lbs (454 kg) Zone	35 ft. 6.4 in. (11.01m)
Horizontal Reach over side - 600SC	
600 lbs (272 kg) Zone	46 ft. 2 in. (14.07 m)
1000 lbs (454 kg) Zone	37 ft. 0.6 in. (11.29 m)
Horizontal Reach from center of rotation - 660SJC	
550 lbs (250 kg) Zone	57 ft. 0.6 in. (17.39 m)
750 lbs (340 kg) Zone	47 ft. 11.5 in. (14.618 m)
Horizontal Reach over end - 660SJC	
550 lbs (250 kg) Zone	51 ft. 5.4 in. (15.68 m)
750 lbs (340 kg) Zone	42 ft. 4.3 in. (12.91 m)
Horizontal Reach over side - 660SJC	
550 lbs (250 kg) Zone	52 ft. 11.6 in. (16.14 m)
750 lbs (340 kg) Zone	43 ft. 10.5 in. (13.37 m)
Tail Swing	4 ft. (1.22 m)

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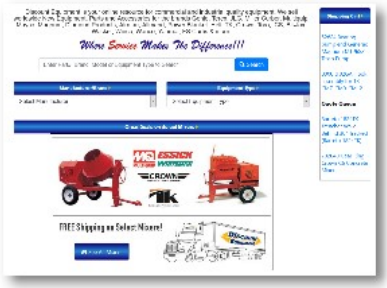

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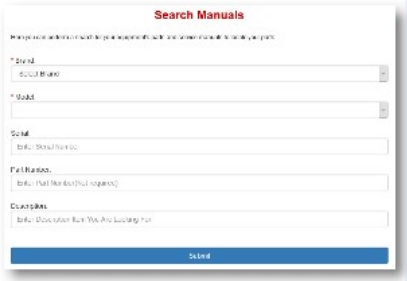

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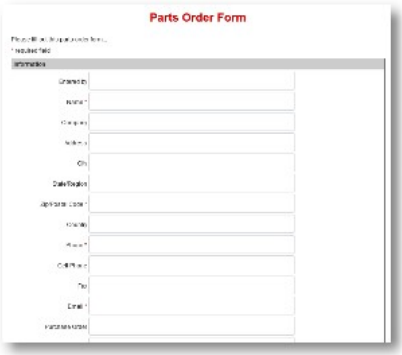

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1.3 CAPACITIES

Table 1-3. Capacities

Fuel Tank	31 Gallons (117 L)
Hydraulic Oil Tank	25 Gallons (94.6 L)
Hydraulic System (Including Tank)	40 Gallons (151.4 L)
Final Drive	2.1 Gallons (7.9 L)
*Fill torque hubs half (1/2) full of lubricant.	

1.4 ENGINE DATA

Table 1-4. Deutz TD 2.9 L4 Tier 4 Final

Fuel	Ultra Low Sulfur Diesel (15 ppm allowable sulfur content)
Max Output (Power)	67 hp (50kW) @ 2600 RPM
Max Output (Torque)	173 ft. lbs. (234 Nm) @ 1800 RPM
Engine Oil Capacity	9.6 Quarts (9.1 L) w/filter
Coolant Capacity (System)	3.3 gal (12.5L)
Average Fuel Consumption	2.7 GPH (10.24 lph)
Low RPM	1200 ± 50 RPM
High RPM	2600 ± 50 RPM
Alternator	95 Amp

Table 1-5. Deutz D2011L04 Specifications

Fuel	Diesel (15-10000 ppm allowable sulfur content)
Max Output (Power)	61.6 hp (46kw) @ 2600 RPM
Engine Oil Capacity Cooling System Crankcase Total Capacity	 5 Quarts (4.7 L) 11 Quarts (10.4 L) w/Filter 16 Quarts (15.1 L)
Idle RPM	1000 ± 50 RPM
High RPM	2600 ± 50 RPM
Alternator	60 Amp
Battery	950 Cold Cranking Amps, 205 Minutes Reserve Capacity, 12 VDC
Fuel Consumption	1.93 gph (7.32 Lph)

Table 1-6. Deutz TD 2.9 L4 GUO III Specifications

Fuel	Low Sulfur Diesel (500 ppm allowable sulfur content)
Max Output (Power)	67 hp (50 kW)
Max Output (Torque)	173 ft. lbs. (234 Nm) @ 1800 RPM
Engine Oil Capacity	8.5 Quarts (8.0 L) w/filter
Coolant Capacity (System)	12.8 Quarts (12.1 L)
Average Fuel Consumption	1.06 GPH (4.02lph)
Low RPM	1200 ± 50 RPM
High RPM	2600 ± 50 RPM
Alternator	95 Amp

1.5 CRITICAL STABILITY WEIGHTS

⚠ WARNING

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

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

1.6 HYDRAULIC OIL

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

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

NOTE: *When temperatures remain below 20°F (-7°C), JLG Industries recommends the use of Mobil DTE 10 Excel 32.*

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

Table 1-8. Mobilfluid 424

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

Table 1-9. Mobil DTE 10 Excel 32

ISO Viscosity Grade	#32
Specific Gravity	0.877
Pour Point, Max	-129°F (-54°C)
Flash Point, Min.	482°F (250°C)
Viscosity	
at 40° C	32.7 cSt
at 100° C	6.63 cSt
cp at -30° F	6200
Viscosity Index	164

Table 1-10. Quintolubric 888-46

Density	0.92 @ 15°C (59°F)
Pour Point	<-22°F (<-30°C)
Flash Point	572°F (300°C)
Fire Point	680°F (360°C)
Auto Ignition Temperature	>842°F(>450°C)
Viscosity	
at 0° C (32° F)	320 cSt
at 20° C (104° F)	109 cSt
at 40° C (104° F)	47.5 cSt
at 100° C (150° F)	9.5 cSt
Viscosity Index	190

Table 1-11. Mobil EAL 224 H

Type	Biodegradable Vegetable
ISO Viscosity Grade	32/46
Specific Gravity	0.922
Pour Point	-25°F (-32°C)
Flash Point	428°F (220°C)
Operating Temp.	0 to 180°F (-17 to 82°C)
Viscosity	
at 40° C	37 cSt
at 100° C	8.4 cSt
Viscosity Index	213

Table 1-12. Mobil EAL Envirosyn H 46

Type	Synthetic Biodegradable
ISO Viscosity Grade	46
Density	0.874 @ 15°C (59°F)
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 1-13. Exxon Univis HVI 26 (Arctic)

Specific Gravity	0.89
Pour Point	-76°F (-60°C)
Flash Point	217°F (103°C)
Viscosity	
at 40° C	25.8 cSt
at 100° C	9.3 cSt
Viscosity Index	376
NOTE:	*Mobil/Exxon recommends this oil be checked on a yearly basis for viscosity.*

1.7 TORQUE REQUIREMENTS

Table 1-14. Torque Requirements

Description	Torque Value (Dry)	Interval Hours
Bearing To Chassis	18X	
Bearing To Turntable	18X	
Wire Rope	15 ft. lbs (20 Nm)	150
Engine Mounting Bolts M12 M16	 84.8 ft.lbs (115 Nm) 206.5 ft.lbs (280 Nm)	
*Check swing bearing bolts after first 50 hours of operation and every 600 hours thereafter. (See Section 3.3, Swing Bearing).		

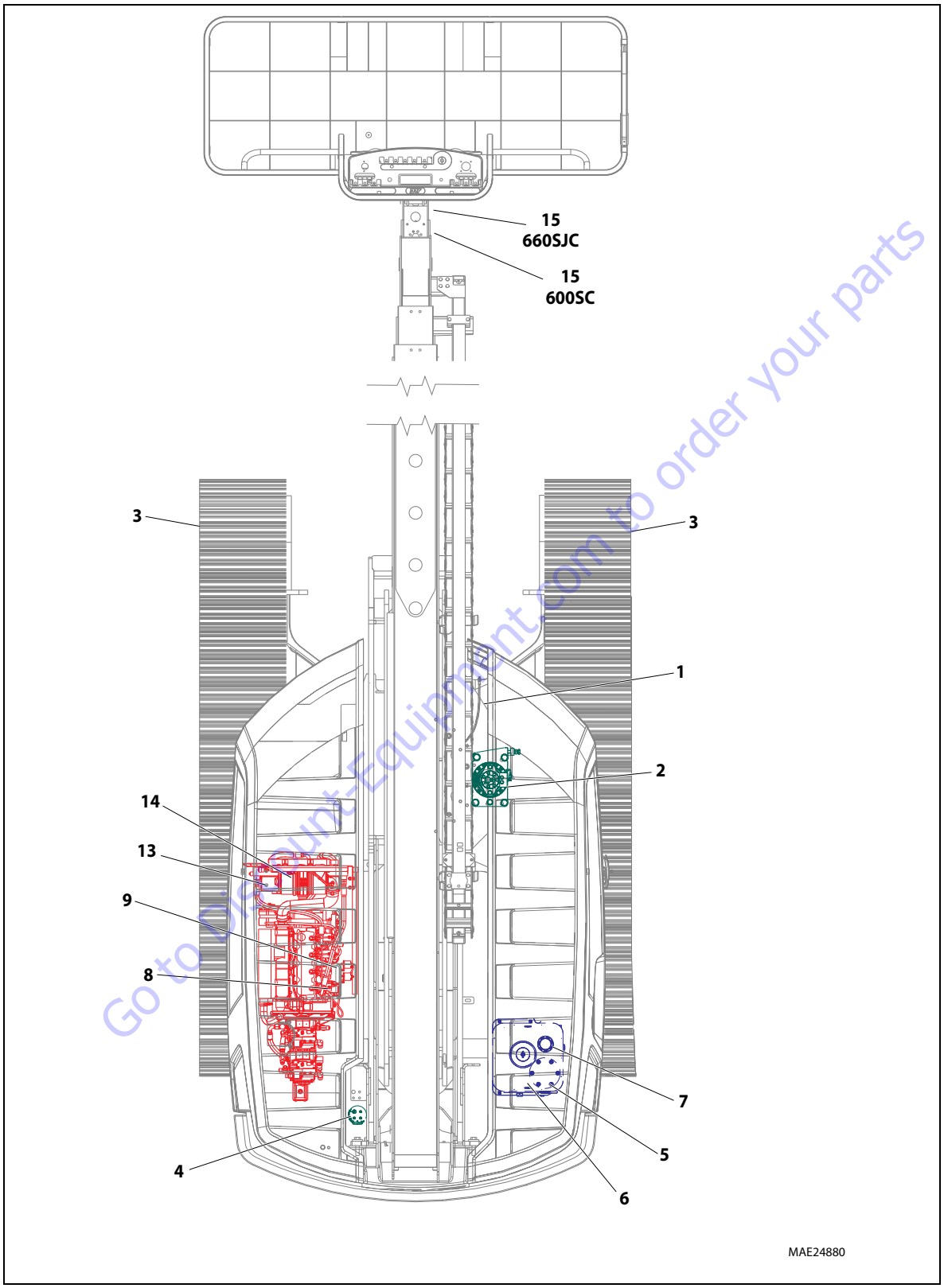


Figure 1-1. Maintenance and Lubrication Diagram - Deutz D2011L04

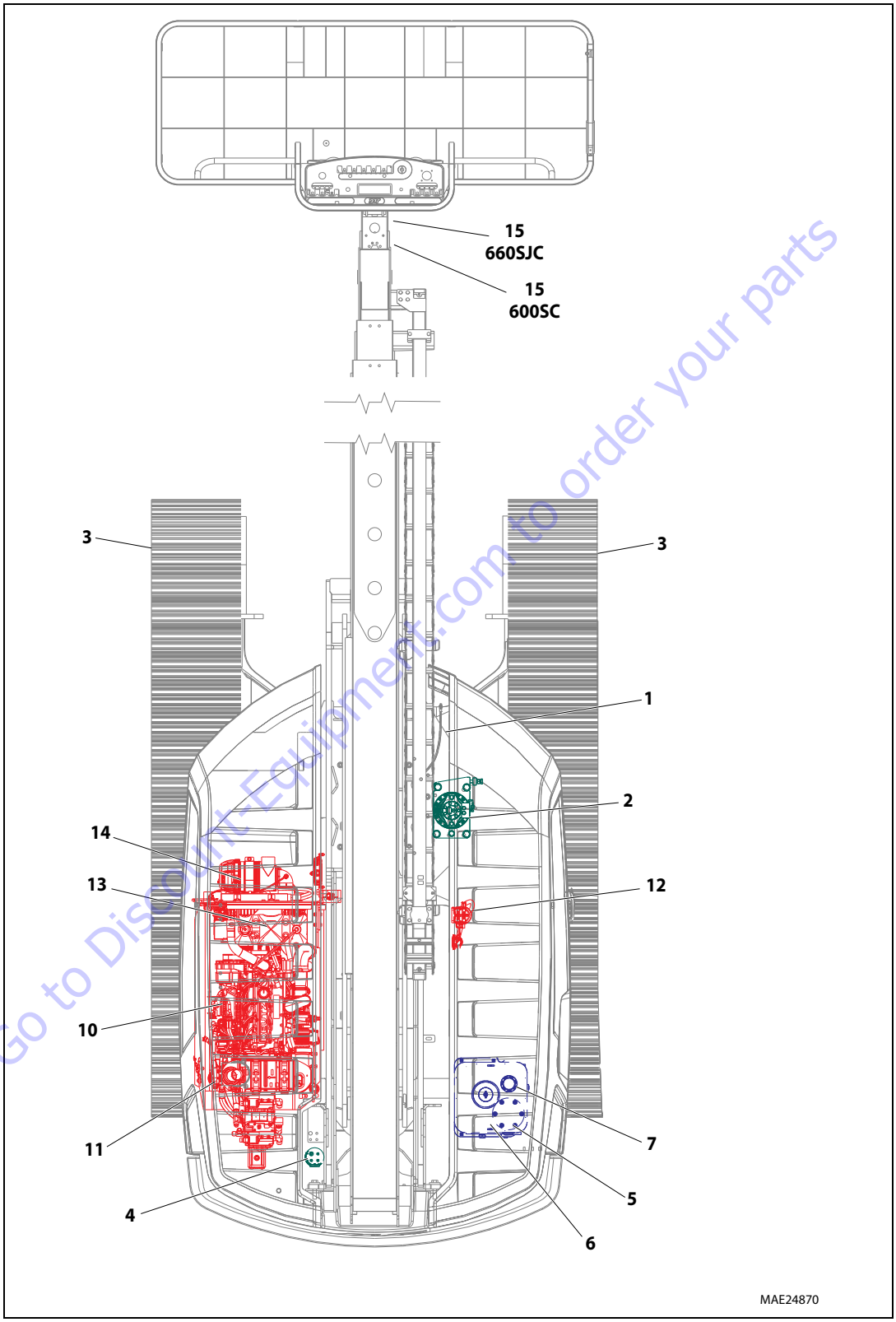


Figure 1-2. Maintenance and Lubrication Diagram - Deutz TD 2.9 and TD 2.9 L4 GUO III

1.8 MAINTENANCE AND LUBRICATION

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

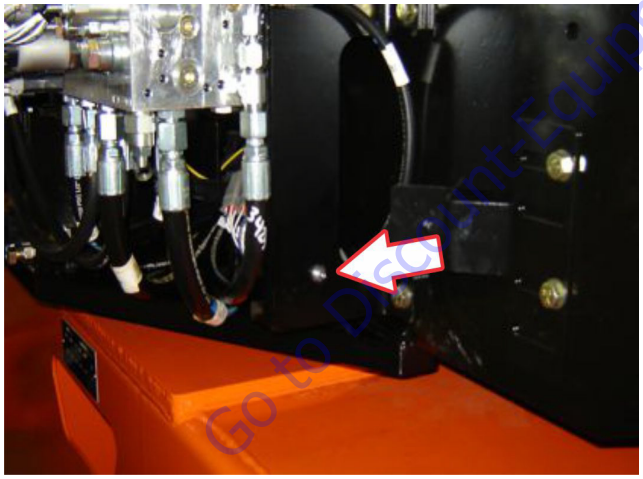
Table 1-15. Lubrication Specifications.

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

NOTICE

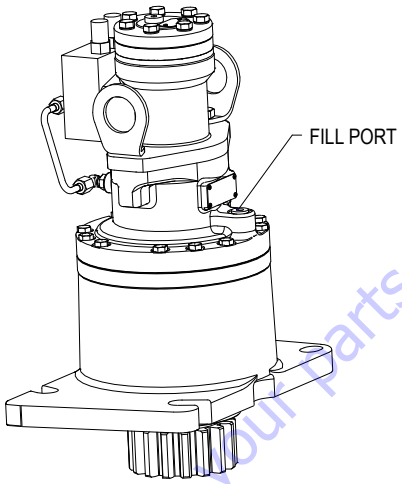
LUBRICATION INTERVALS ARE BASED ON MACHINE OPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTI-SHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

1. Swing Bearing



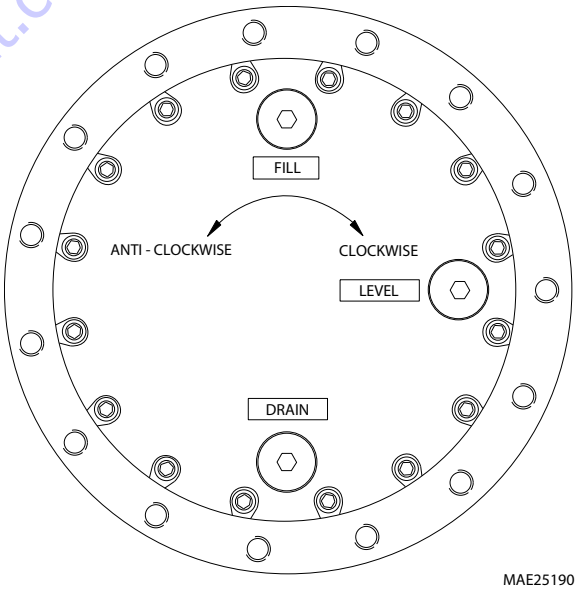
Lube Point(s) - 1 Grease Fittings
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hrs of operation
Comments - Remote Access. Apply grease and rotate in 90 degree intervals until bearing is completely lubricated.

2. Swing Drive Hub



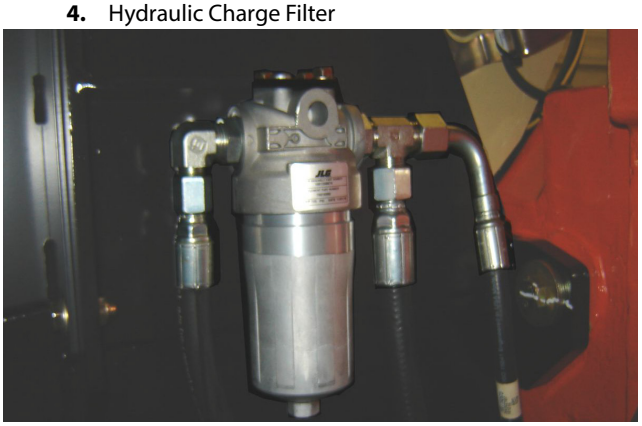
Lube Point(s) - Level/Fill Plug
Capacity - 32 oz. (0.95 L)
Lube - 80w90 Gear Oil
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation.

3. Drive Hub



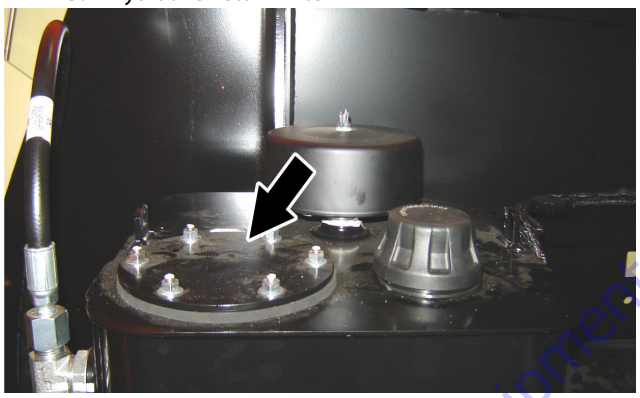
Lube Point(s) - Level/Fill Plug
Capacity - 24 oz. (0.7 L)
Lube - 80w90 Gear Oil
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation.

4. Hydraulic Charge Filter



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

5. Hydraulic Return Filter

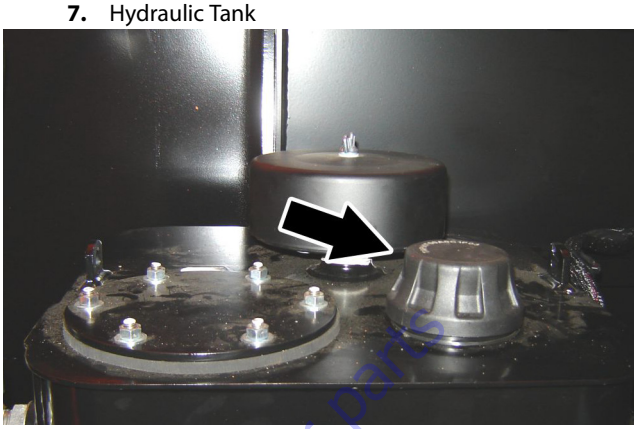


Interval - Change after first 50 hrs. and every 6 months or 300 hrs.

6. Hydraulic Tank Breather

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

7. Hydraulic Tank

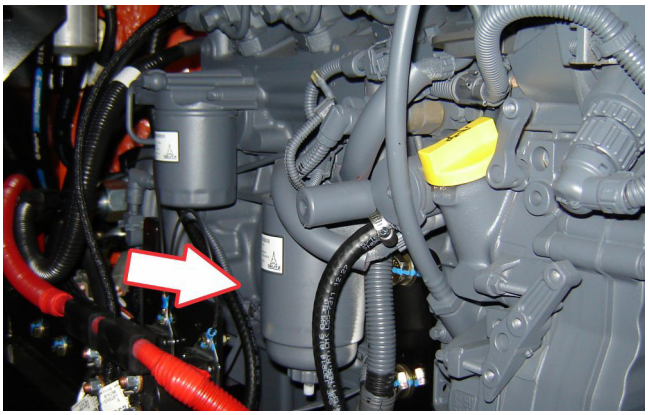


Lube Point(s) - Fill Cap Capacity - 21 gal tank (79.5 L) 40.0 gal system (151 L) Lube - HO Interval - Check Level daily; Change every 2 years or 1200 hours of operation
Comments - On new machines, those recently overhauled, or after changing hydraulic oil, operate all systems a minimum of two complete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

8. Oil Change w/Filter - Deutz D2011

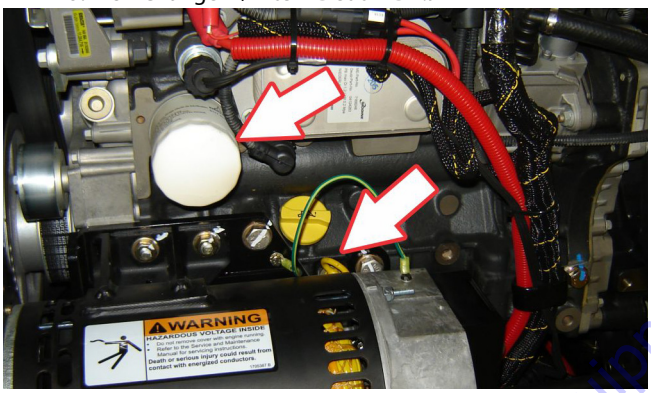
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 11 Quarts (10.4 L) Crankcase;
5 Quarts (4.7 L) Cooler
Type - Deutz approved engine oil.
Lube - EO
Interval - Every Year or 1200 hours of operation
Comments - Check level daily/Change in accordance with engine manual. Use Deutz approved engine oil type.

9. Fuel Filter - Deutz D2011L04



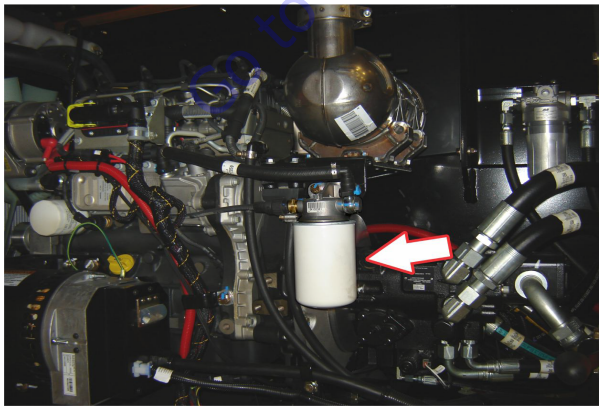
Lube Point(s) - Replaceable Element
Interval - Every Year or 600 hours of operation.

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



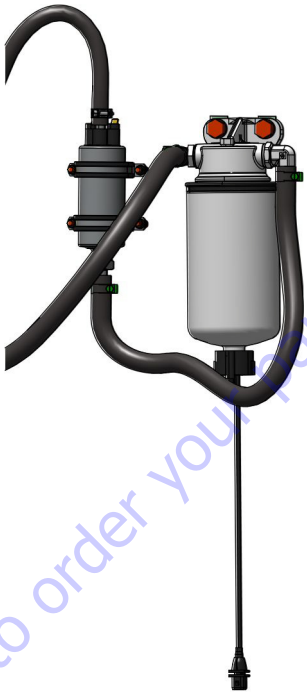
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 9.6 Quarts (9.1 L) Crankcase;
Type - Deutz approved engine oil
Lube - EO
Interval - Every Year or 600 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

11. Fuel Filter - Deutz TD2.9



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

12. Fuel Pre-Filter - Deutz TD2.9

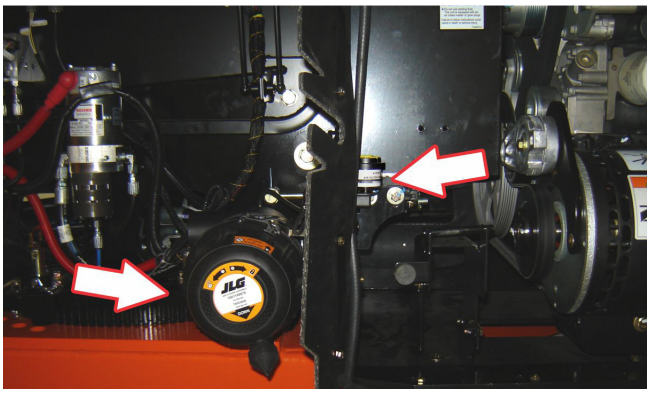


Lube Point(s) - Replaceable Element
Interval - Drain water daily;
Filter must be replaced every year or 600 hours of operation (whichever comes first).

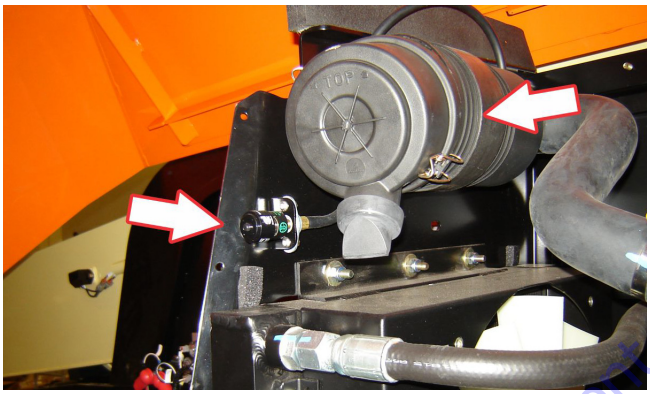
13. Engine Coolant - Deutz TD2.9

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

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



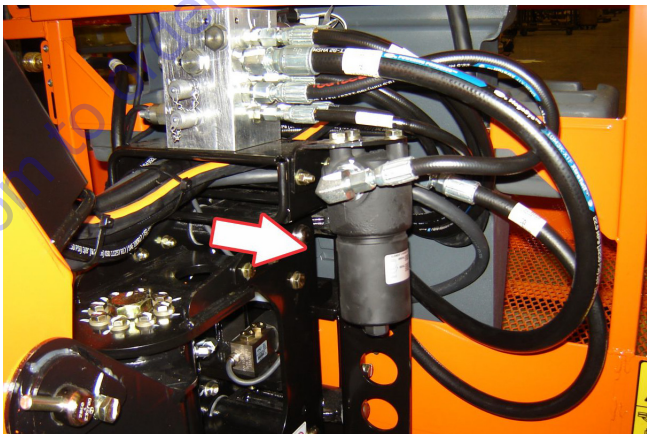
B. Air Filter - Deutz D2011L04



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

15. A. Platform Filter - 600SC

B. Platform Filter - 660SJC



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

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

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

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

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

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

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

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

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

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

NO. 5000059 REV. K

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.

Figure 1-6. Torque Chart (SAE Fasteners - Sheet 4 of 5)

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

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

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

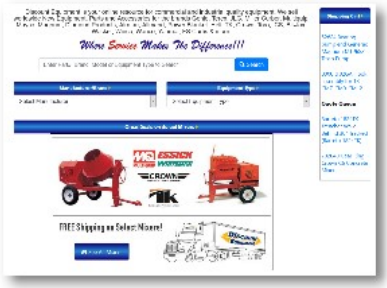
4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

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

PARTS FINDER

Search Website by Part Number

Discount Equipment



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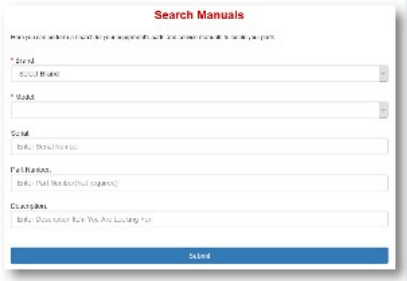

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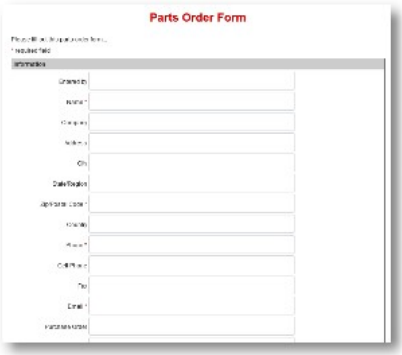

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, 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 with any and all discrepancies corrected, this product will be fit for continued use.

Preparation, Inspection, and Maintenance

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

Pre-Start Inspection

It is the User's or Operator's primary responsibility to perform a Pre-Start Inspection of the machine prior to use daily or at each change of operator. Reference the 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. Frequency of this inspection must be increased as environment, severity and frequency of usage requires.

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

Annual Machine Inspection

The Annual Machine Inspection must be performed on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. JLG Industries recommends this task be performed by a Factory-Trained Service Technician. JLG Industries, Inc. recognizes a Factory-Trained Service Technician as a person who has successfully completed the JLG Service Training School for the subject JLG product model. Reference the machine Service and Maintenance Manual and appropriate JLG inspection form for performance of this inspection.

Reference the JLG Annual Machine Inspection Form and Inspection and Preventive Maintenance Schedule for items requiring inspection. Reference appropriate areas of this manual for servicing and maintenance procedures.

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

Preventive Maintenance

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

Reference the Preventive Maintenance Schedule and the appropriate areas of this manual for servicing and maintenance procedures. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.

Table 2-1. Inspection and Maintenance

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

2.2 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

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

Cleanliness

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

Components Removal and Installation

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

Component Disassembly and Reassembly

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

Pressure-Fit Parts

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

Bearings

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

Gaskets

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

Bolt Usage and Torque Application

NOTICE

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

1. Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
2. Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See 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 high moisture content which permits organic growth and causes oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.
4. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

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

Hydraulic Oil

1. Refer to Section 1 for recommendations for viscosity ranges.
2. JLG recommends Mobil 424 hydraulic oil, which has an SAE viscosity of 10W and a viscosity index of 140.

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

Changing Hydraulic Oil

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

Lubrication Specifications

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

2.4 CYLINDER DRIFT

Theory

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

- Normal leakage of load holding valves or malfunction of load holding valves. See Cylinder Leakage Test and 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 joint during operation.
2. Filament wound bearings should be replaced if any of the following is observed:
   a. Frayed or separated fibers on the liner surface.
   b. Cracked or damaged liner backing.
   c. Bearings that have moved or spun in their housing.
   d. Debris embedded in liner surface.
3. Pins should be replaced if any of the following is observed (Clean pin before inspection):
   a. Detectable bearing area wear.
   b. Flaking, peeling, scoring, or scratches on pin surface.
   c. Rusting of pin in bearing area.
4. Re-assembly of pinned joints using filament wound bearings:
   a. Blow out housing using compressed air to remove all dirt and debris. Bearings and bearing housings must be free of all contamination.
   b. Clean bearings and pins with solvent to remove all grease and oil.
   c. Inspect pin to ensure it is free of burrs, nicks, and scratches which can damage bearing during installation and operation.

2.6 WELDING ON JLG EQUIPMENT

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

Do the Following When Welding on JLG Equipment:

- Disconnect the battery.
- Ground only to structure being welded.
- Unplug all pressure transducers (Refer to Section 6 - JLG Control System.

Do NOT Do the Following When Welding on JLG Equipment

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

NOTICE

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

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL	
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection
Boom Assembly		
Boom Weldments	1,2,4	1,2,4
Hose/Cable Carrier Installations	1,2,9,12	1,2,9,12
Pivot Pins and Pin Retainers	1,2	1,2
Sheaves, Sheave Pins	1,2	1,2
Bearings	1,2	1,2
Wear Pads	1,2	1,2
Covers or Shields	1,2	1,2
Extend/Retract Chain or Cable Systems	1,2,3	1,2,3
Boom Assembly		14
Platform Assembly		
Platform		1,2
Railing	1	1,2
Gate	1,5	1,5
Floor	1	1,2
Rotator	9,5,15	9,5,15
Lanyard Anchorage Point	1,2,10	1,2,10
Turntable Assembly		
Swing Bearing	1,2,14	1,2,3,13,14
Oil Coupling	9	9
Swing Drive System	11	11
Turntable Lock	1,2,5	1,2,5
Hood, Hood Props, Hood Latches	5	1,2,5
Chassis Assembly		
Spindle Thrust Bearing/Washers		1,2
Drive Hubs	11	11
Functions/Controls		
Platform Controls	5,6	5,6
Ground Controls	5,6	5,6
Function Control Locks, Guards, or Detents	1,5	1,5
Footswitch	5	5
Emergency Stop Switches (Ground & Platform)	5	5
Function Limit or Cutout Switch Systems	5	5

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL	
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection
Swing Brakes	5	5
Auxiliary Power	5	5
Power System		
Engine Idle, Throttle, and RPM	3	3
Engine Fluids (Oil, Coolant, Fuel)	9,11	9,11
Air/Fuel Filter	1,7	1,7
Exhaust System	1,9	1,9
Batteries	1,9	1,9,19
Battery Fluid	11	11
Battery Charger	5	5
Fuel Reservoir, Cap, and Breather	1,2,5	1,2,5
Hydraulic/Electric System		
Hydraulic Pumps	1,2,9	1,2,9
Hydraulic Cylinders	1,2,7,9	1,2,7,9
Cylinder Attachment Pins and Pin Retainers	1,2,9	1,2,9
Hydraulic Hoses, Lines, and Fittings	1,2,9,12	1,2,9,12
Hydraulic Reservoir, Cap, and Breather	1,2,5,9	1,2,5,9,24
Hydraulic Filter	1,7,9	1,7,9
Hydraulic Fluid	7,11	7,11
Electrical Connections	1,20	1,20
Instruments, Gauges, Switches, Lights, Horn		5,23
General		
Operation and Safety Manuals in Storage Box	21	21
ANSI and AEM Manuals/Handbooks Installed (ANSI Markets Only)	21	21
Capacity Decals Installed, Secure, Legible	21	21
All Decals/Placards Installed, Secure, Legible	21	21
Annual Machine Inspection Due	21	21
No Unauthorized Modifications or Additions	21	21
All Relevant Safety Publications Incorporated	21	21
General Structural Condition and Welds	2,4	2,4
All Fasteners, Pins, Shields, and Covers	1,2	1,2
Grease and Lubricate to Specifications	22	22
Function Test of All Systems	21, 22	21, 22
Paint and Appearance	7	7

Table 2-3. Inspection and Preventive Maintenance Schedule

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

Footnotes:

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

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

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

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

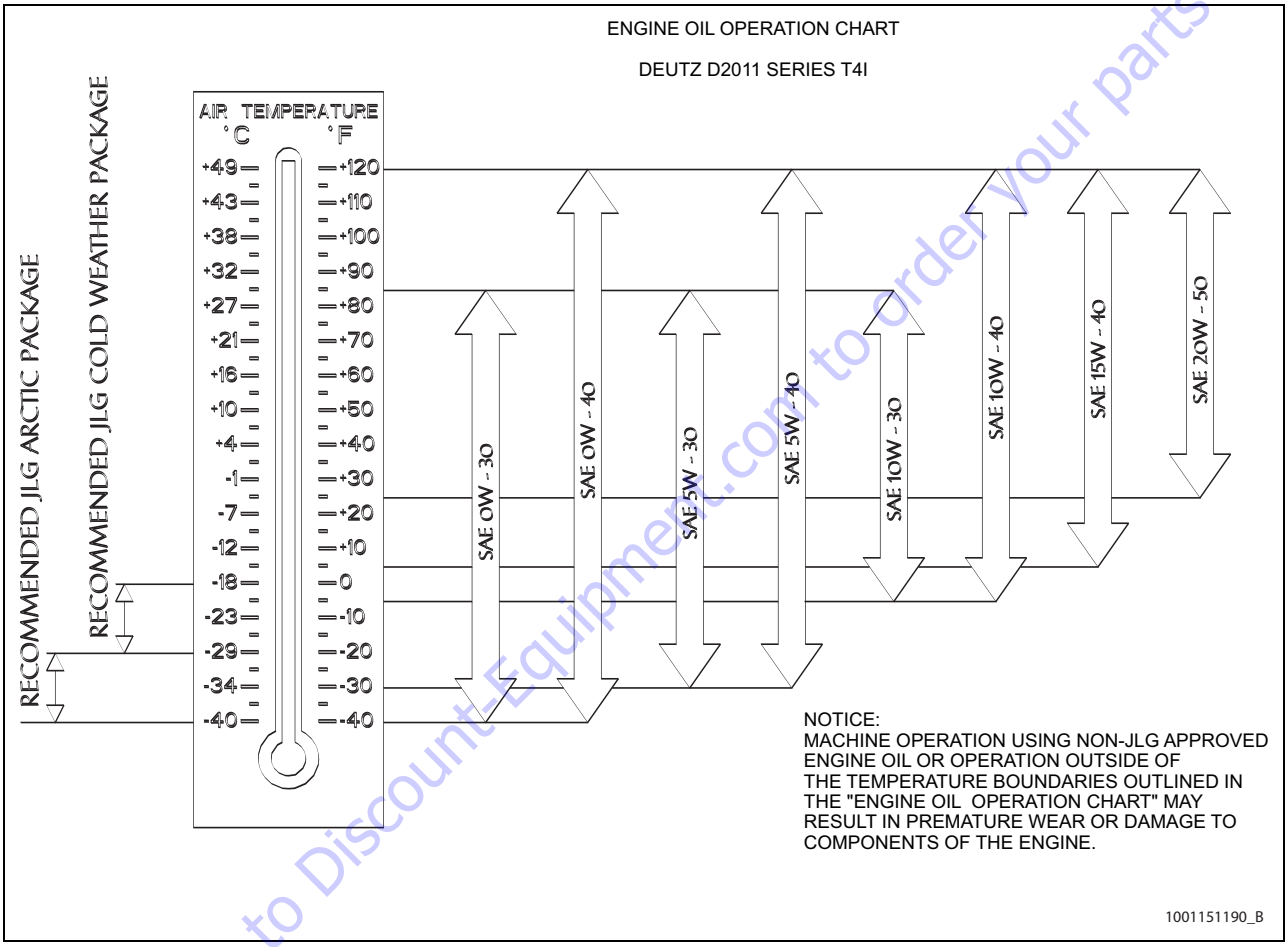


Figure 2-1. Engine Operating Temperature Specifications - Deutz D2011L04

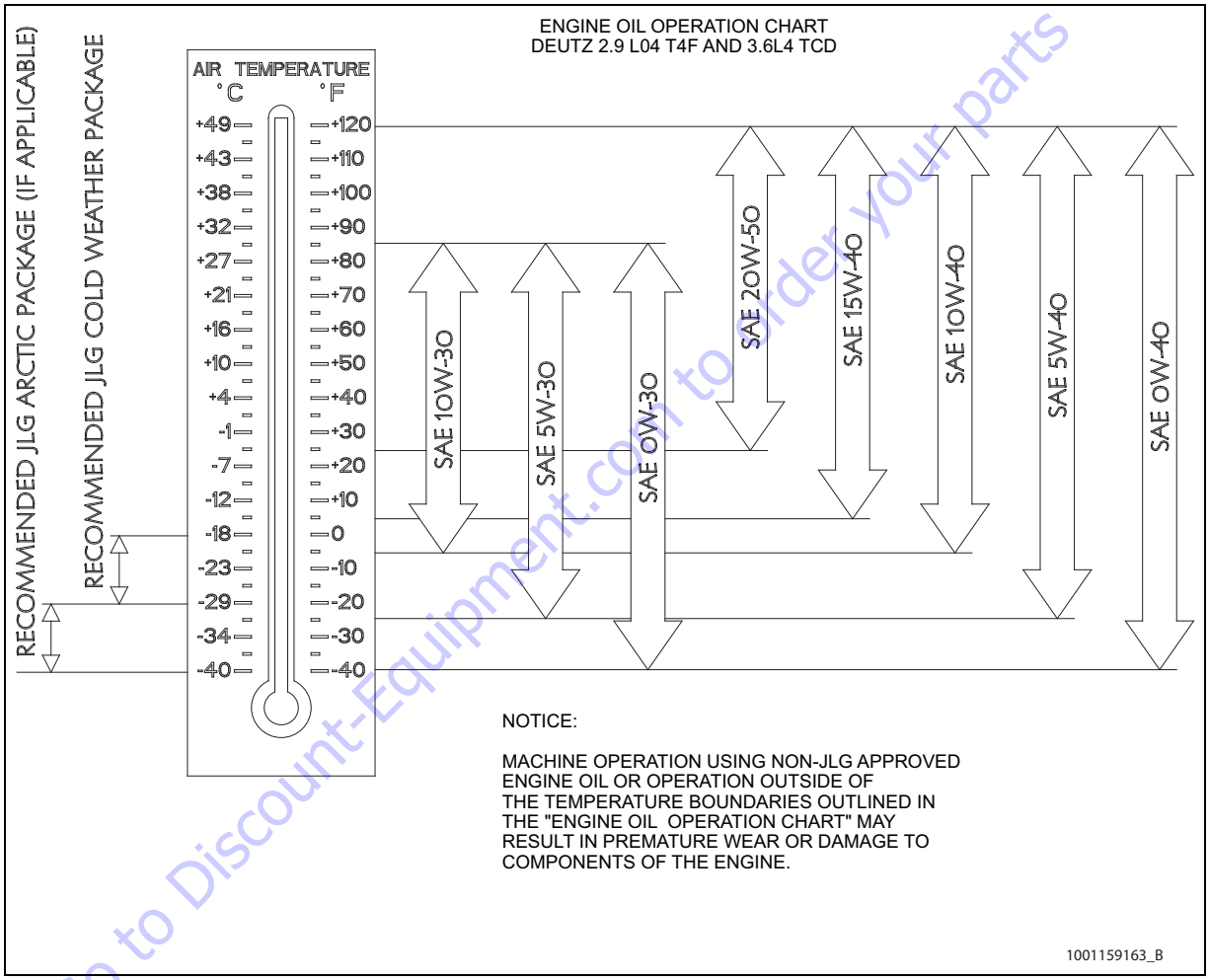
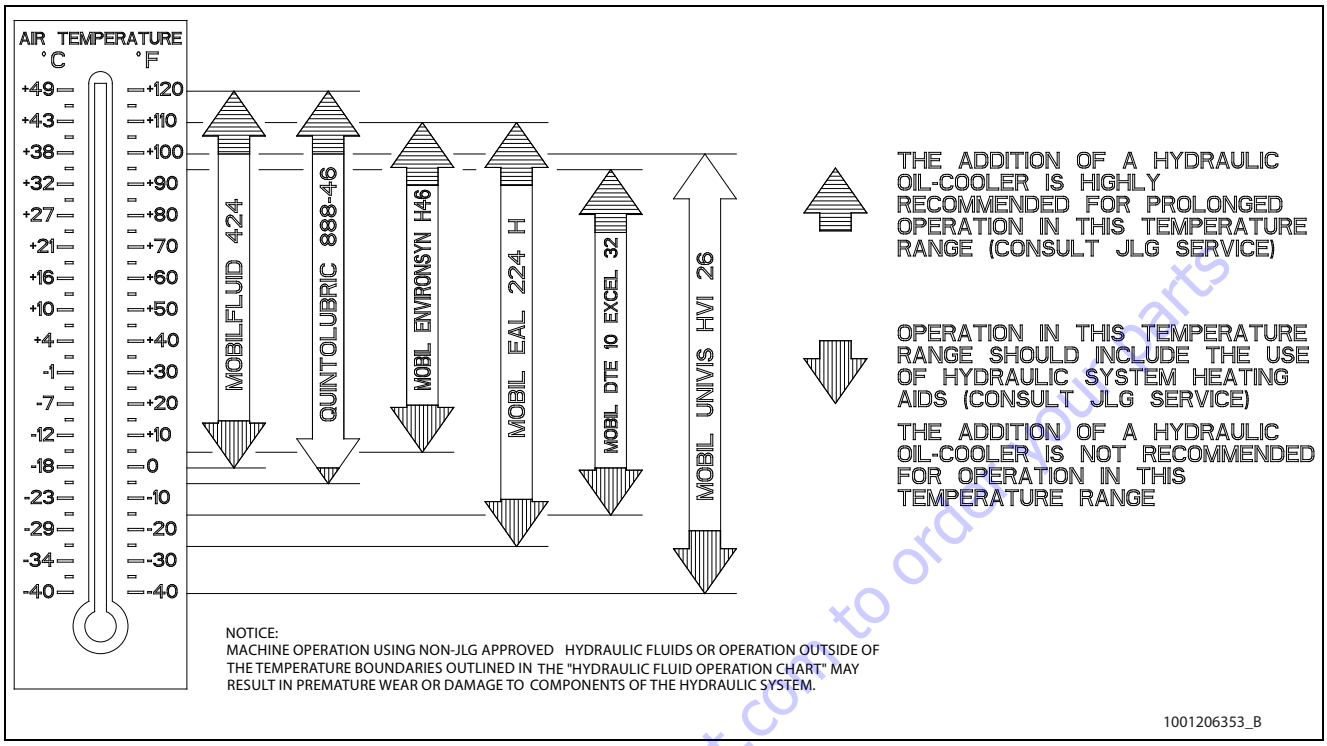


Figure 2-2. Engine Operating Temperature Specifications - Deutz TD2.9



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

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

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

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

Figure 2-3. Hydraulic Oil Operating Temperature Specifications

PARTS FINDER

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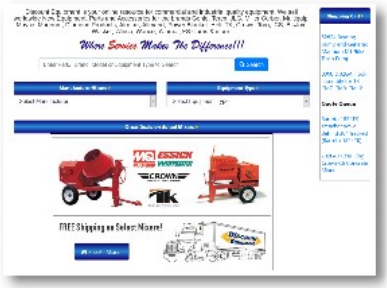
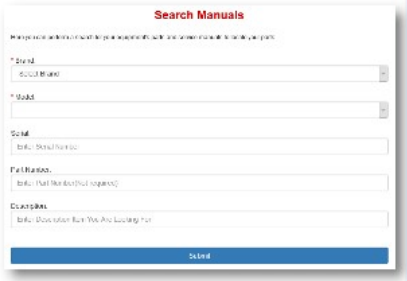


Search Manual Library For Parts Manual & Lookup Part Numbers – Purchase or Request Quote



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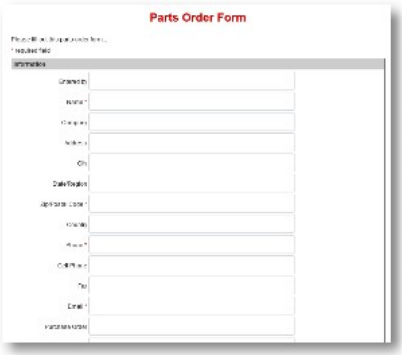

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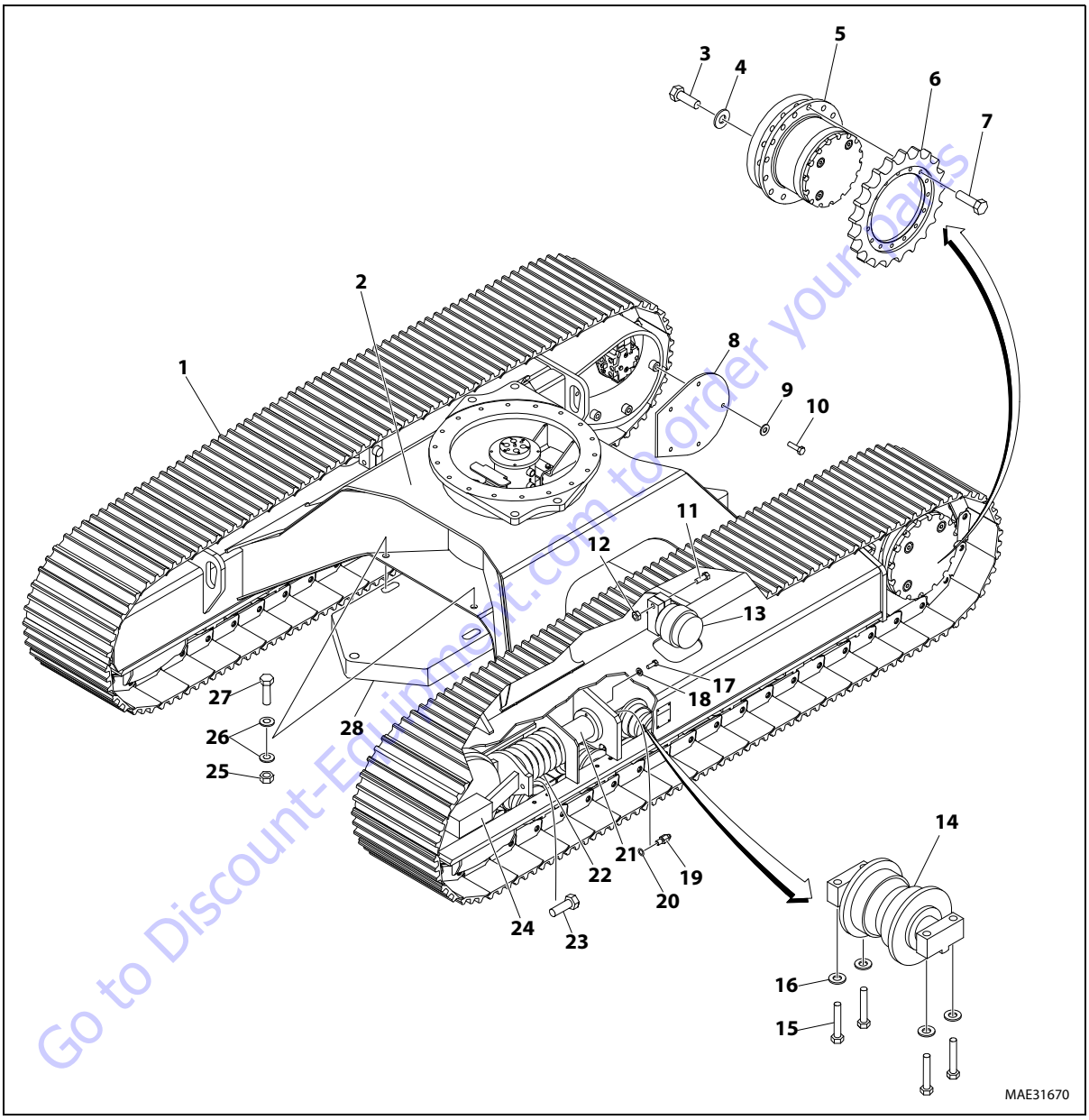
SECTION 3. CHASSIS & TURNTABLE

3.1 CHASSIS COMPONENTS AND SERVICING



1. Track Chain Assembly
2. Undercarriage
3. Bolt
4. Flat Washer
5. Drive Assembly
6. Drive Sprocket
7. Flanged Bolt
8. Cover Plate
9. Lock washer
10. Bolt
11. Bolt
12. Locknut
13. Carrier Track Roller
14. Bottom Track Roller
15. Bolt
16. Flat Washer
17. Bolt
18. Lock washer
19. Grease Fitting
20. Seal
21. Shock Assembly
22. Spring Assembly
23. Capscrew
24. Idler Assembly
25. Nut
26. Flat Washer
27. Bolt
28. Counterweight (660SJC)

Figure 3-1. Chassis Assembly

Service Notes

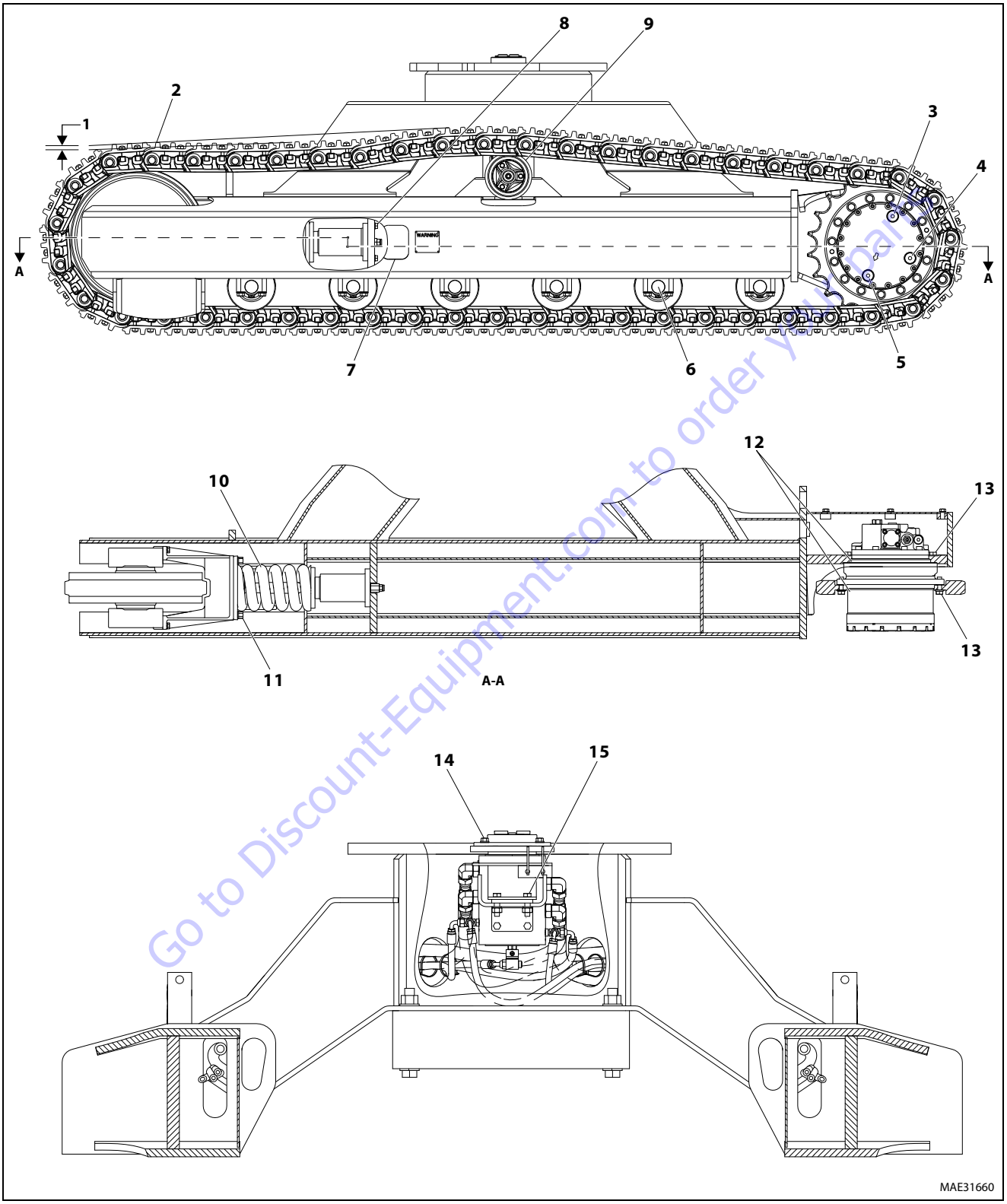
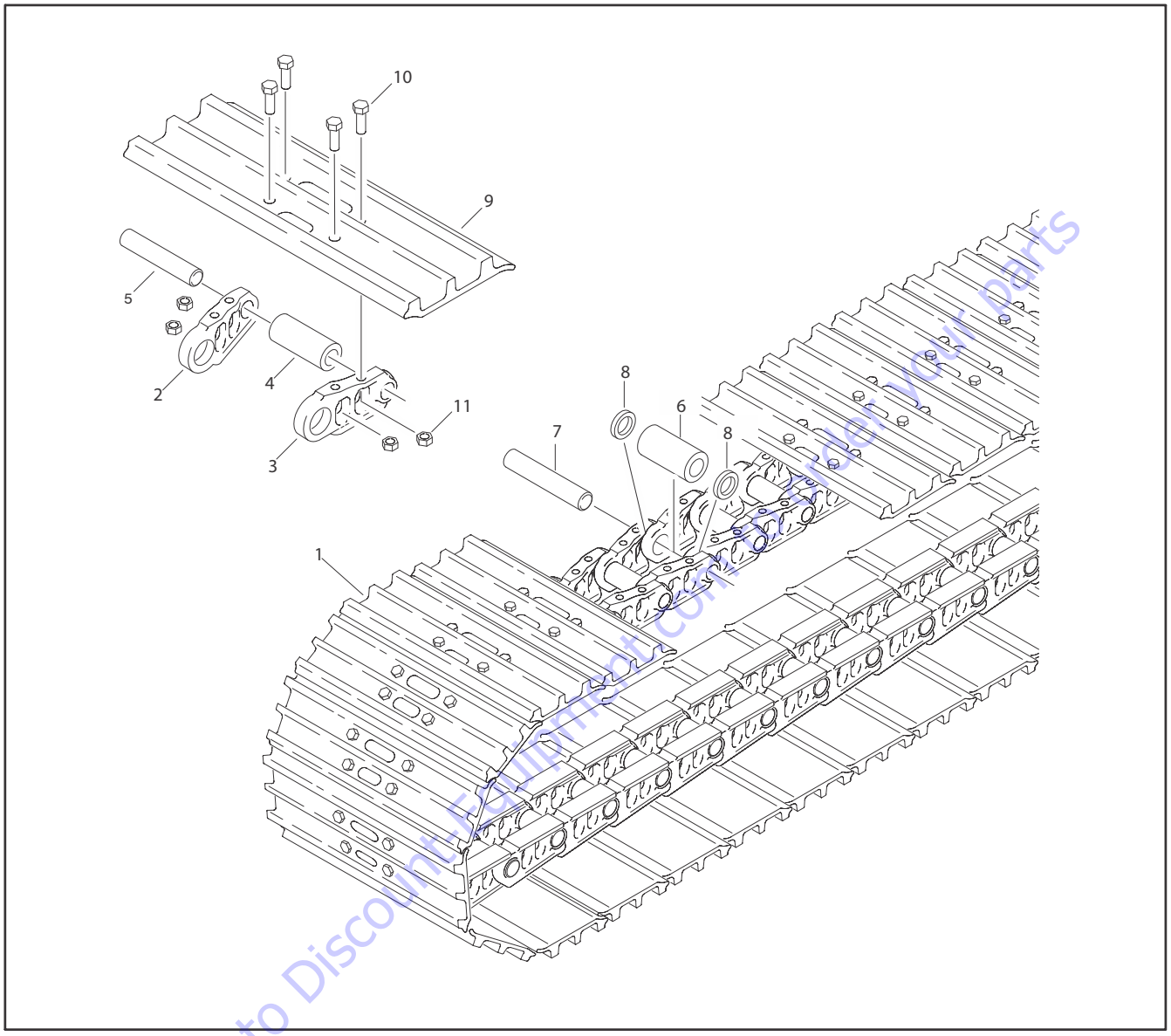


Figure 3-2. Chassis Service Notes - 1 of 2

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

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

Track and Chain



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

Figure 3-4. Track and Chain

TRACK SHOES

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

TRACK PIN

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

TRACK BUSHING (BEARING)

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

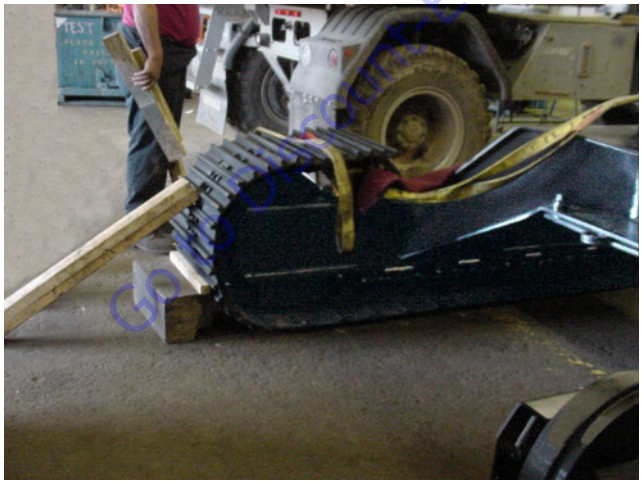
Replace Track

REMOVE TRACK

⚠ WARNING

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

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



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

LINKS, PIN, AND BUSHING WEAR MEASUREMENT

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

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

INSTALL TRACK

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

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

NOTICE

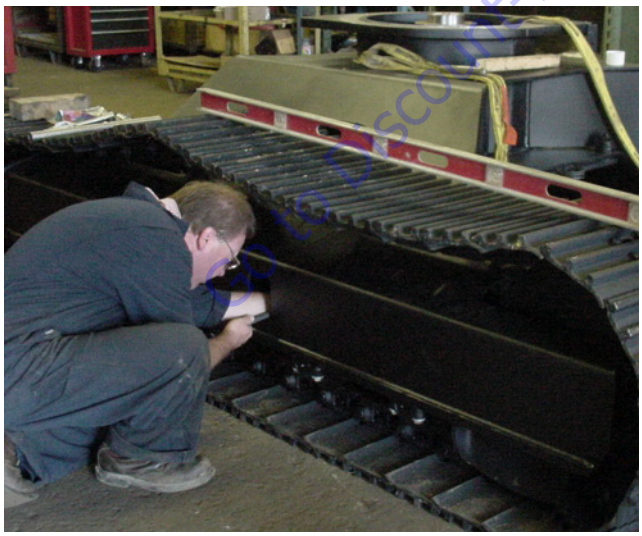
PINS AND BUSHINGS MUST BE WELL LUBRICATED DURING ASSEMBLY.

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

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

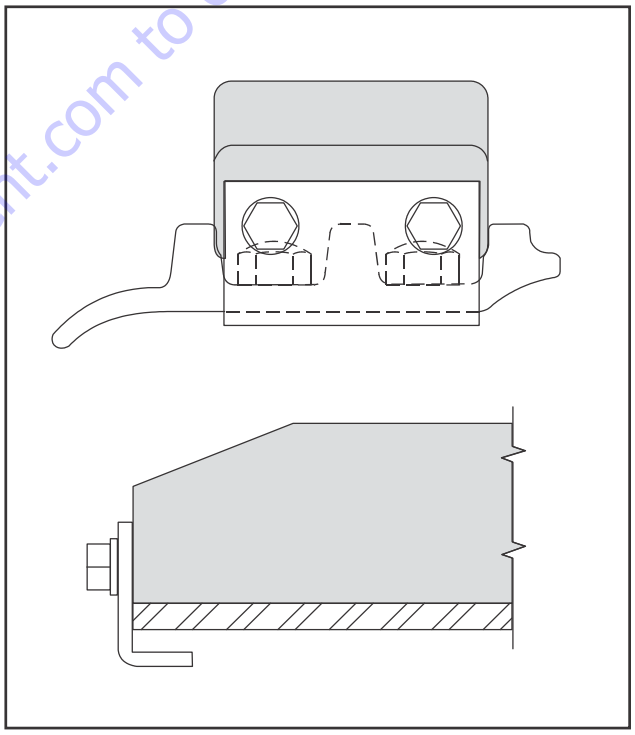
Track tensioning

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

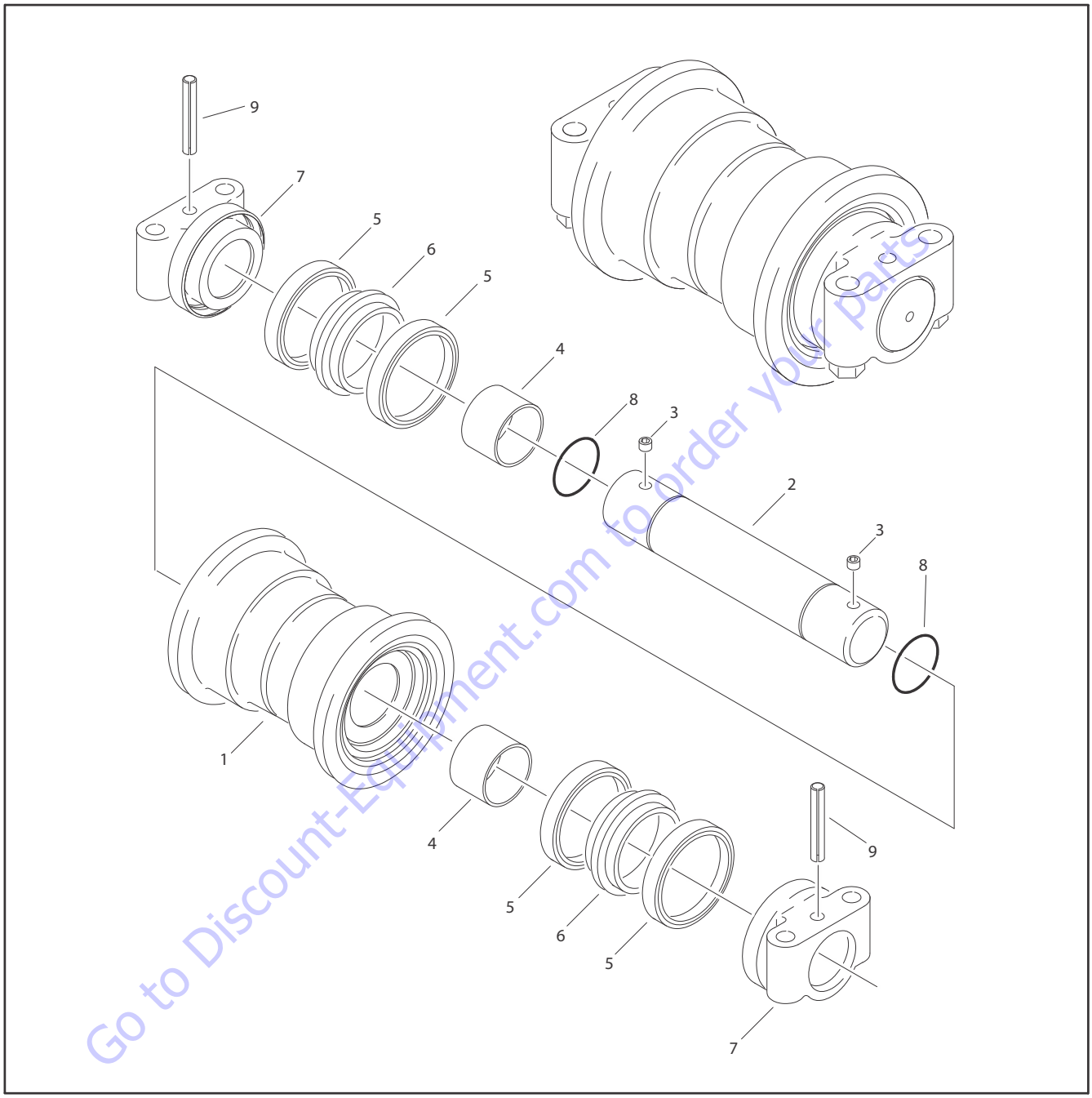


2. Check for 0.781 in (19.8 mm) tension between idler & carrier roller with level and gage. Remove special fitting.

Rubber Track Pad Installation

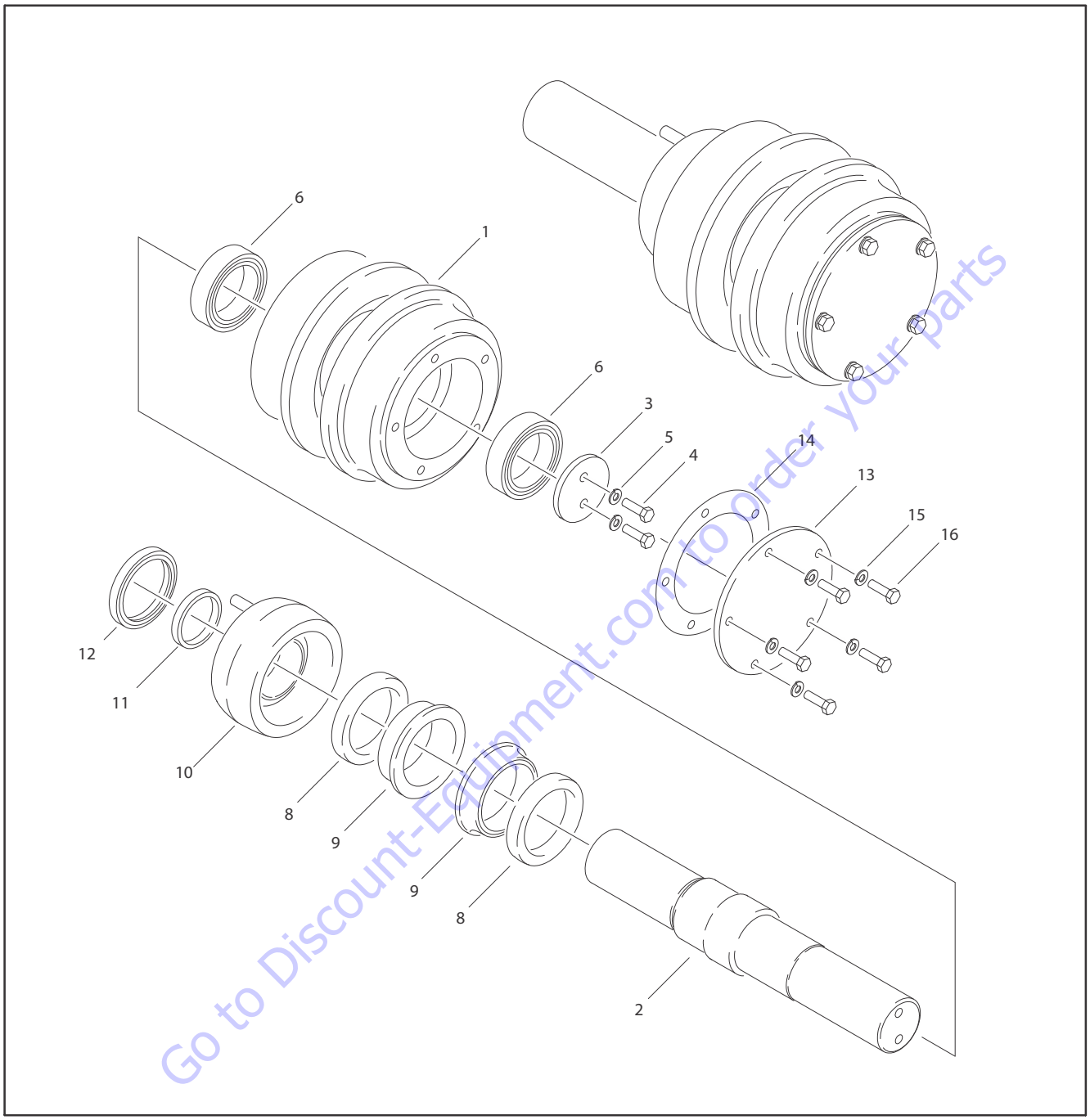


1. Seat rubber track pad over center rib of steel track.
2. Apply JLG Thread Locking Compound PN 0100011 to retaining plate bolts. Install bolts and flat washers to end of rubber pad.
3. Torque bolts to 70 ft-lb (97 Nm).



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

Figure 3-5. Bottom Track Roller Assembly



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

Figure 3-6. Upper Carrier Track Roller Assembly

Rollers

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

ROLLER SEALS

NOTICE

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

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

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

TRACK ROLLER DISASSEMBLY

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

TRACK ROLLER ASSEMBLY

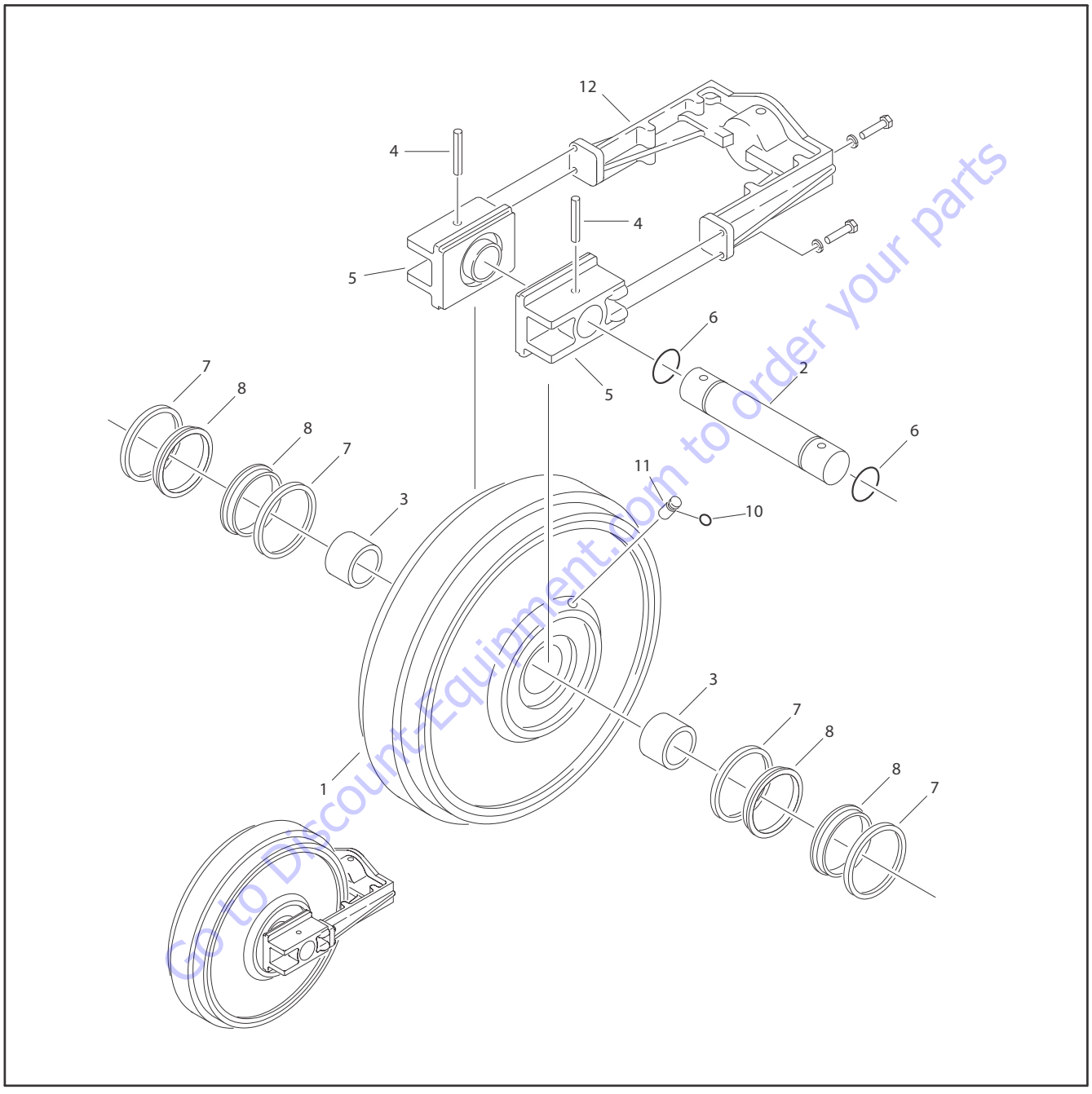
1. Install bushings in roller shell.
2. Install collar to roller shaft.
3. Install dowel pin through collar and shaft.
4. Install O-ring in roller shaft.
5. Install seal group in roller shell seal seat.
6. Insert collar and shaft into shell until collar bottoms to the seal group.
7. Invert roller 180°.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

BOTTOM TRACK ROLLER INSTALLATION

1. Blow out roller mounting holes With air gun. Wipe mounting surfaces clean with rag. Threads must be clean of grease and oil.
2. Apply JLG Thread Locking Compound PN 0100011 to four bolts. Align roller on frame and secure with four washers and bolts.
3. Torque bolts to 200 ft-lb +15-0 (280 Nm, +21 -0).
4. Use a low pressure pump with a nozzle that will fit through idler body fill hole. Fill with SAE 30 or SAE 40 oil at capacities for your machine.

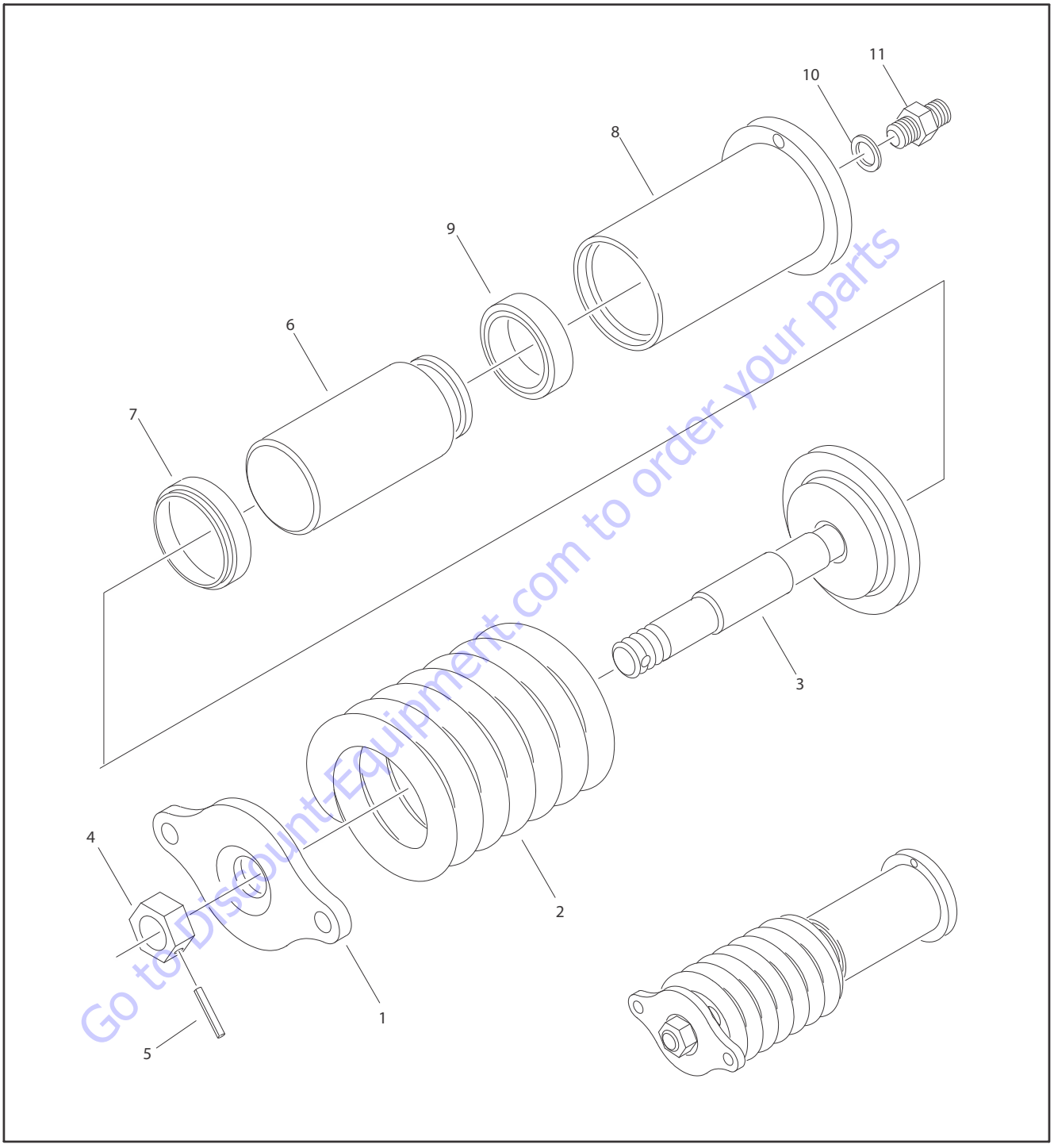
Idler Roller Assembly

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



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

Figure 3-7. Idler Assembly



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

Figure 3-8. Spring & Shock Assembly

TRACK TENSION AND IDLER ROLLER DISASSEMBLY

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

TRACK TENSION AND IDLER ROLLER REASSEMBLY

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

IDLER ROLLER DISASSEMBLY

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

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

IDLER ROLLER ASSEMBLY

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

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

IDLER ROLLER AND TRACK TENSIONER REMOVAL AND REPLACEMENT TO SIDE FRAME

⚠ WARNING

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

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

INSTALL SHOCK

1. Assemble shock assembly in position. Secure with bolts, washers, and JLG Thread Locking Compound PN 0100011. Torque to 65 ft-lb +10-0 (91 Nm, +15 -0).
2. Using an adequate lifting device, pick up spring assembly upright onto idler assembly. Install using bolts, washers, and JLG Thread Locking Compound PN 0100011. Torque to 165 ft-lb +15-0 (231 Nm, +21 -0).
3. Reference offset in idler spring from centerline of idler (to be oriented down). Using gantry crane and sling, pick up and slide spring/idler assembly into pre-greased slider area. Use nylon sledge hammer lightly to assemble.
4. Push idler assembly against seat. Using special adapter, pump in grease to expand shock assembly just enough to inspect for proper assembly.

3.2 SWING DRIVE HUB

Removal

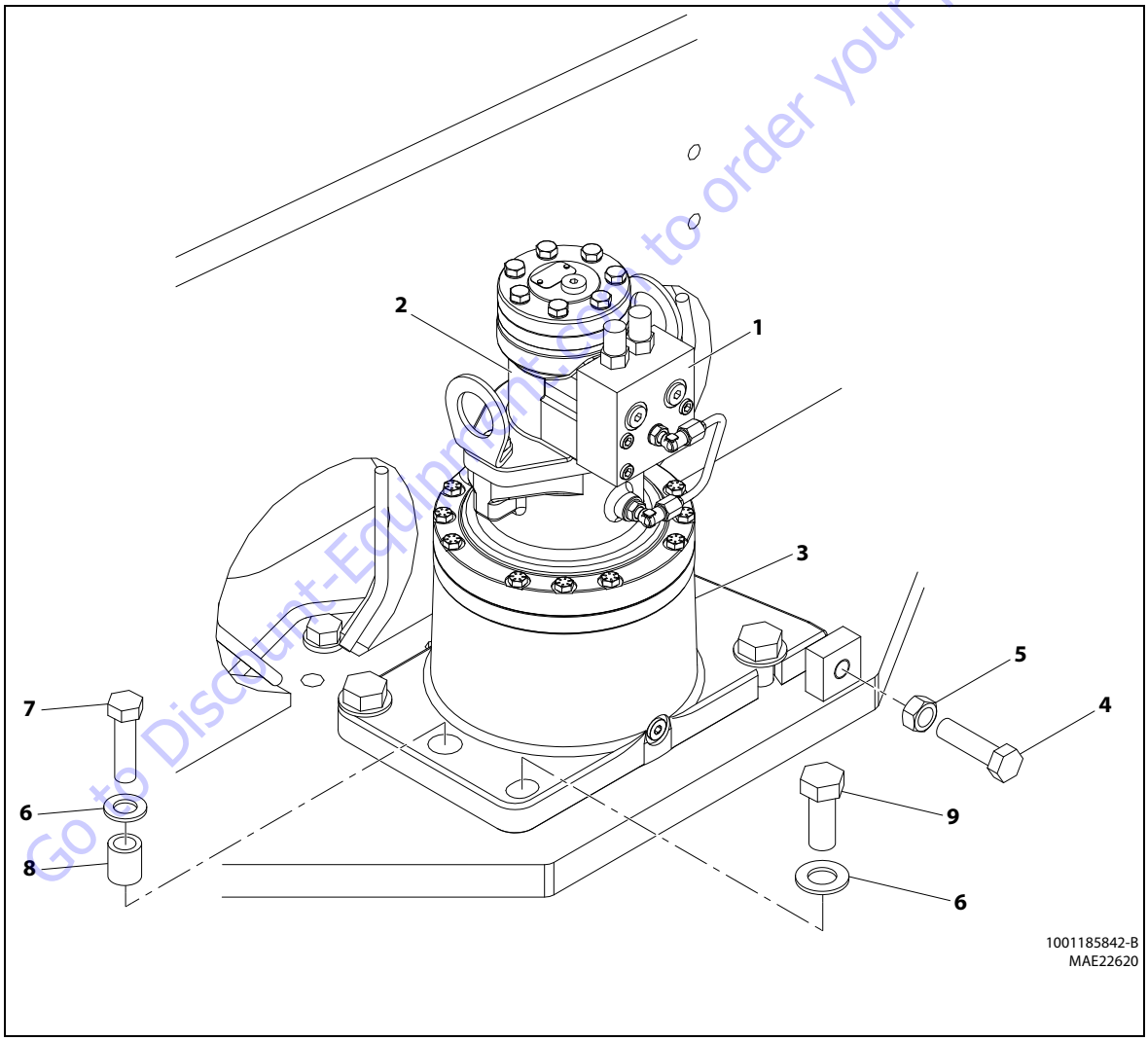
1. Gently loosen the jack bolt (4). Do not remove.
2. Remove the pivot bolt (7).
3. Remove the mounting bolts (9) securing swing drive hub to the turntable.
4. Using the suitable lifting device, remove the swing drive hub from mounting plate without damaging the swing gear.
5. Place swing drive hub in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

Assembly/Disassembly

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

Installation

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



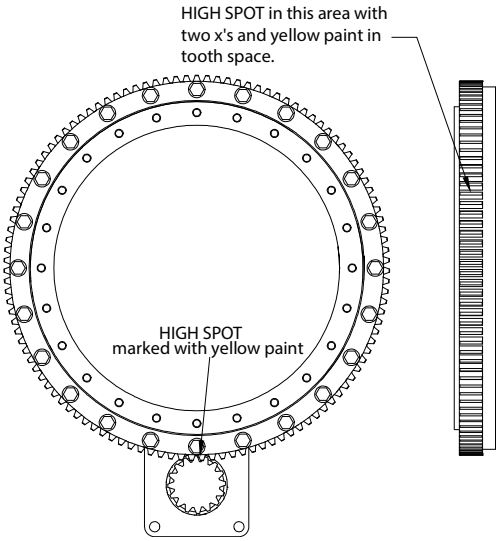
1. Motor Control Valve
2. Swing Motor
3. Swing Hub Assembly
4. Jack Bolt
5. Nut
6. Washer
7. Pivot Bolt
8. Spacer
9. Bolt

Figure 3-9. Swing Drive Installation

Procedure For Setting Swing Gear Backlash

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

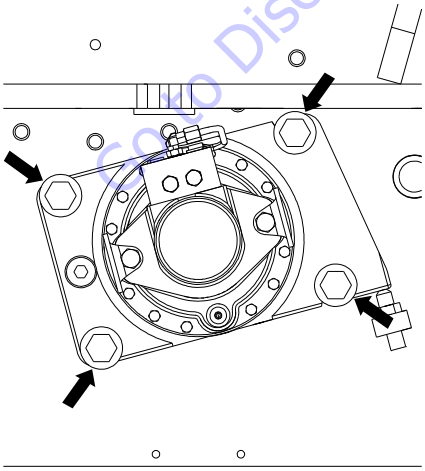
1. Place the machine on firm, level ground.
2. Place shim between pinion and bearing at bearing high spot (shown below).



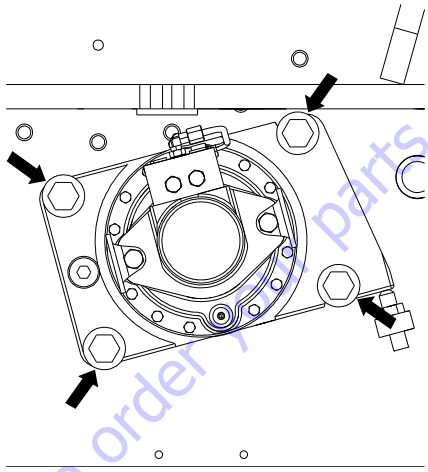
3. Apply JLG Threadlocker P/N 0100019 and torque pivot bolt to 205 ft. lbs. (280 Nm).

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

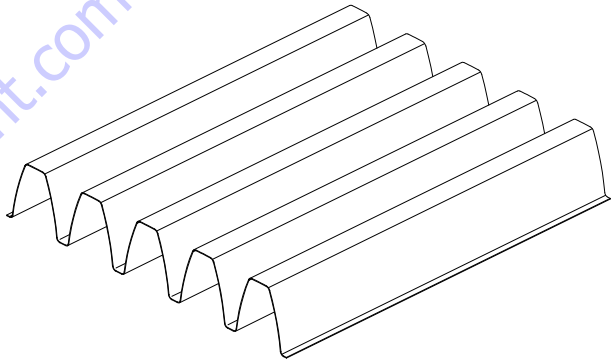
4. Remove turntable lock pin.
5. Apply JLG Threadlocker P/N 0100019 and pre-torque swing drive mounting bolts to 30 ft. lbs. (40 Nm).



6. Tighten jack bolt until pinion is completely snug against shim and bearing then loosen jack bolt.
7. Apply JLG Threadlocker P/N 0100019 and torque jack bolt 50 ft. lbs. (68 Nm).
8. Apply JLG Threadlocker P/N 0100019 and tighten jam nut.
9. Torque mounting bolts to 340 ft. lbs. (Nm).

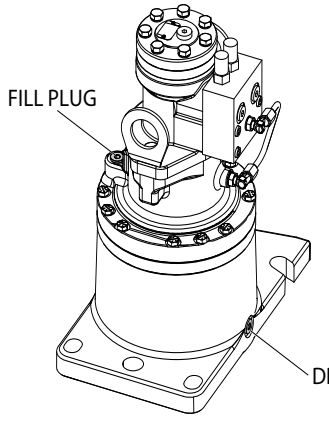


10. Remove shim and discard.



Swing Drive Lubrication

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



3.3 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

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

1. Check frame to bearing. Attach bolts as follows:
   - **a.** Elevate fully retracted main boom to 70 degrees (full elevation).
   - **b.** At the positions indicated on (See Figure 3-10.), try and insert the 0.0015 inch (0.0381 mm) feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   - **c.** Assure that the 0.0015 inch (0.0381 mm) feeler gauge will not penetrate under the bolt head to the bolt shank.
   - **d.** Swing turntable 90 degrees and check some selected bolts are at the new position.
   - **e.** Continue rotating turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.
2. Check the turntable to bearing. Attach bolts as follows:
   - **a.** Elevate the fully retracted boom to 70 degrees (full elevation).
   - **b.** Try and insert the 0.0015" feeler gauge between bolt head and hardened washer at position shown in (See Figure 3-10.).
   - **c.** Lower the boom to horizontal and fully extend the boom.
   - **d.** Try and insert the 0.0015" feeler gauge between bolt head and hardened washer at position shown in (See Figure 3-10.).

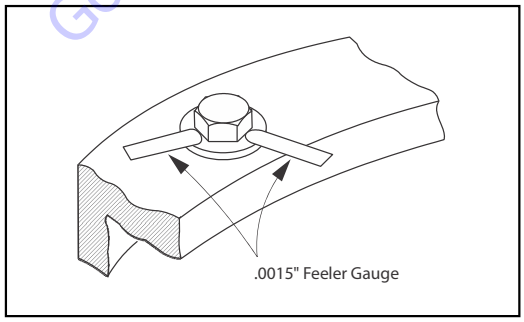


Figure 3-10. Swing Bearing Bolt Feeler Gauge Check

Wear Tolerance

1. From underside of the machine, at rear center, with the boom fully elevated and fully retracted, as shown in Figure 3-12., Swing Bearing Tolerance Measurement Location & Boom Placement A, using a magnetic base dial indicator, measure and record distance between swing bearing and turntable as shown in Figure 3-11., Swing Bearing Tolerance Measuring Point.
2. At the same point, with the boom horizontal and fully extended, as shown in the Figure 3-12., Swing Bearing Tolerance Measurement Location & Boom Placement B, using a magnetic base dial indicator, measure and record distance between swing bearing and turntable as shown in Figure 3-11., Swing Bearing Tolerance Measuring Point.
3. If difference is greater than 0.079 inch (2.00 mm), is determined, the swing bearing should be replaced.
4. If a difference less than 0.079 inch (2.00 mm) is determined, and any of the following conditions exist, the bearing should be removed, disassembled, and inspected for the following:
   - **a.** Metal particles in grease.
   - **b.** Increased drive power required.
   - **c.** Noise.
   - **d.** Rough rotation.
5. If bearing inspection shows no defects, reassemble and return to service.

NOTICE

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

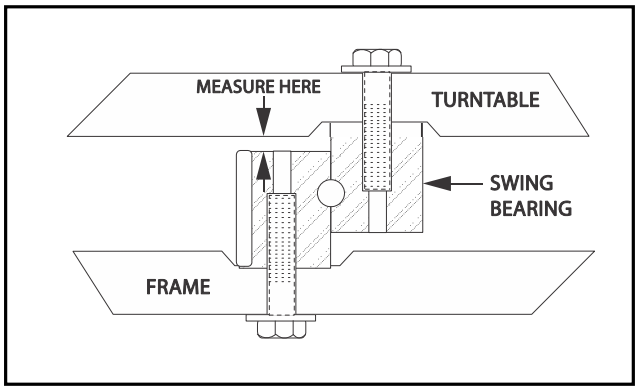


Figure 3-11. Swing Bearing Tolerance Measuring Point

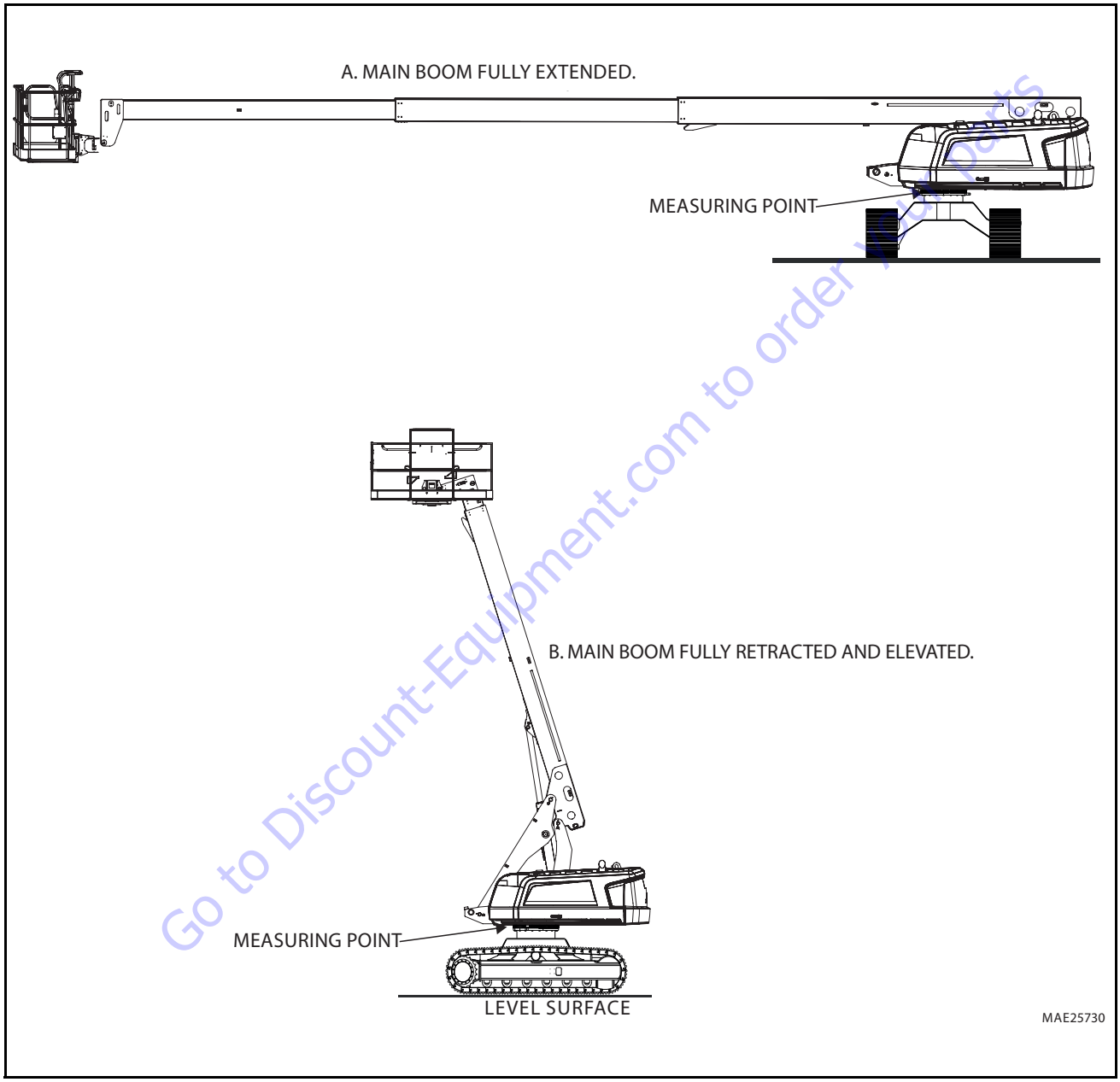


Figure 3-12. Swing Bearing Tolerance Measurement Location & Boom Placement

Swing Bearing Replacement

REMOVAL

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

⚠ WARNING

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

2. Adequately secure the boom to the rear of the turntable, as shown in Figure 3-14., Swing Bearing Removal - 600SC and Figure 3-15., Swing Bearing Removal - 660SJC.
3. Using the front lifting eyes in the turntable and a location on the boom equidistant from the center of gravity, as shown in Figure 3-14., Swing Bearing Removal - 600SC and Figure 3-15., Swing Bearing Removal - 660SJC, secure the turntable assembly with adequate lifting equipment.
4. From inside turntable, remove mounting hardware attaching rotary coupling retaining yoke brackets to turntable.

NOTICE

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

5. Tag and disconnect hydraulic lines from the fittings on the top of the rotary coupling. Use a suitable container to retain any residual hydraulic fluid. Immediately cap lines and ports.
6. Use a suitable tool to scribe a line on the inner race of the swing bearing and on the underside of the turntable. This will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the turntable to the bearing inner race. Discard the bolts.
7. Use the lifting equipment to carefully lift the complete turntable assembly from the bearing. Ensure that no damage occurs to the turntable, bearing or frame-mounted components.
8. Carefully place the turntable on a suitably supported trestle.
9. Use a suitable tool to scribe a line on the outer race of the swing bearing and the frame. This line will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the outer race of the bearing to the frame. Discard the bolts. Use suitable lifting equipment to remove the bearing from the frame, then move the bearing to a clean, suitably supported work area.

INSTALLATION

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

⚠ CAUTION

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

2. Apply a light coating of JLG Threadlocker P/N 0100019 to the new bearing bolts, and loosely install the bolts and washers through the frame and outer race of bearing.

⚠ CAUTION

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

3. Refer to the Torque Sequence diagram as shown in Figure 3-13., Swing Bearing Torque Sequence, Swing Bearing Torque Sequence Clean any residue off the new bearing bolts, then apply a light coating of JLG Threadlocker P/N 0100019 and install the bolts and washers through the frame and outer race of the bearing. Tighten the bolts to an initial torque of 190 ft. lbs. (260 Nm) w/Loctite.
4. Remove the lifting equipment from the bearing.
5. Using suitable lifting equipment, carefully position the turntable assembly above the machine frame.
6. Carefully lower the turntable onto the swing bearing, ensuring that the scribed line of the inner race of the bearing aligns with scribed line on the turntable. If a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft center line of the turntable.
7. Clean any residue off the new bearing bolts, then apply a light coating of JLG Threadlocker P/N 0100019 and install the bolts and washers through the turntable and inner race of the bearing.
8. Following the Torque Sequence diagram shown in Figure 3-13., Swing Bearing Torque Sequence, tighten the bolts to a torque of 190 ft. lbs. (260 Nm) w/Loctite.
9. Install the rotary coupling retaining yoke brackets, apply a light coating of JLG Threadlocker P/N 0100011 to the attaching bolts and secure the yoke to the turntable with the mounting hardware.
10. Connect the hydraulic lines to the rotary coupling as tagged prior to removal.

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

Swing Bearing Torque Values

1. Outer Race - 190 ft-lb (260 Nm) w/Loctite.
2. Inner Race - 190 ft-lb (260 Nm) w/Loctite.
3. See Figure 3-13., Swing Bearing Torque Sequence.

⚠ WARNING

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

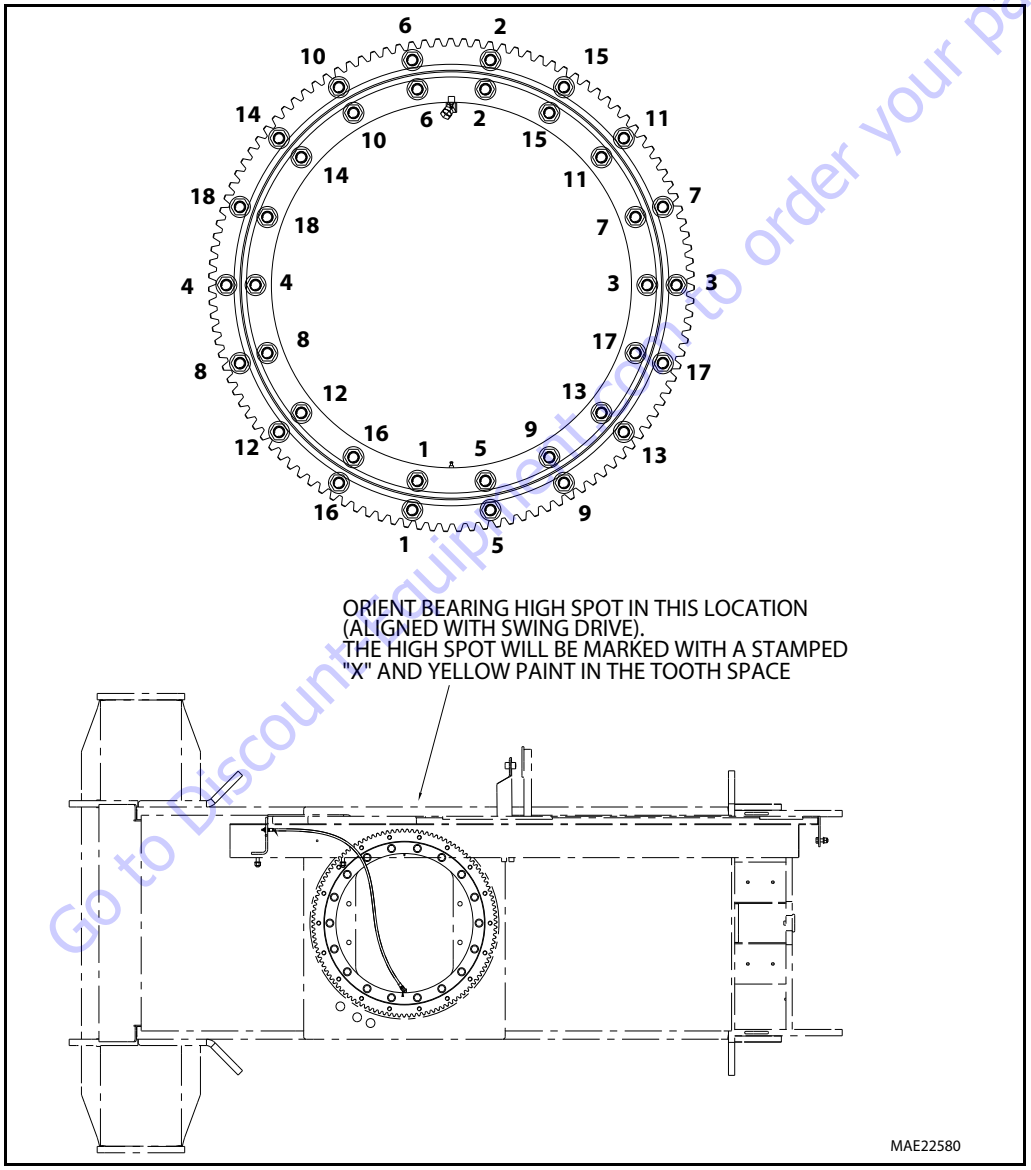


Figure 3-13. Swing Bearing Torque Sequence

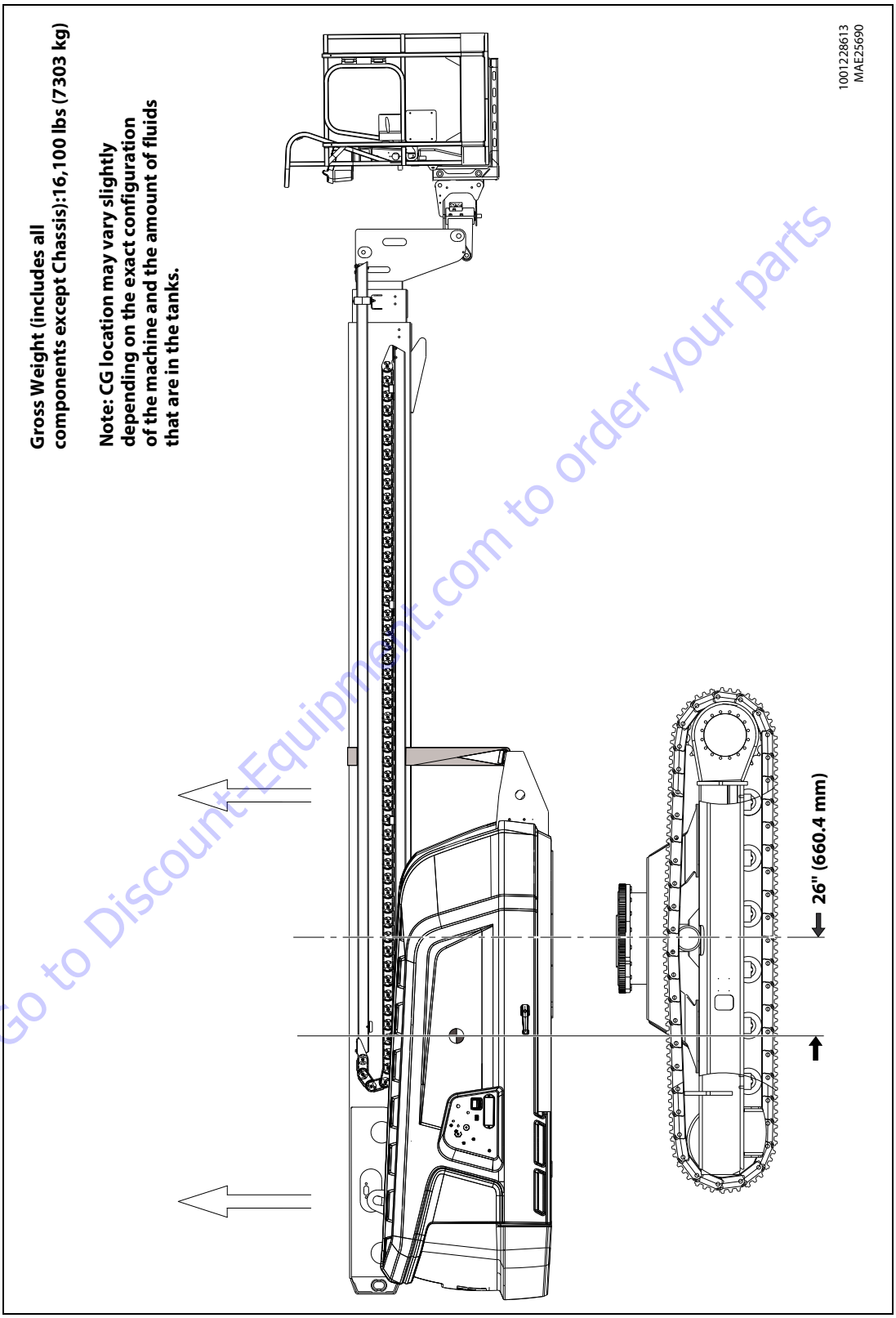


Figure 3-14. Swing Bearing Removal - 600SC

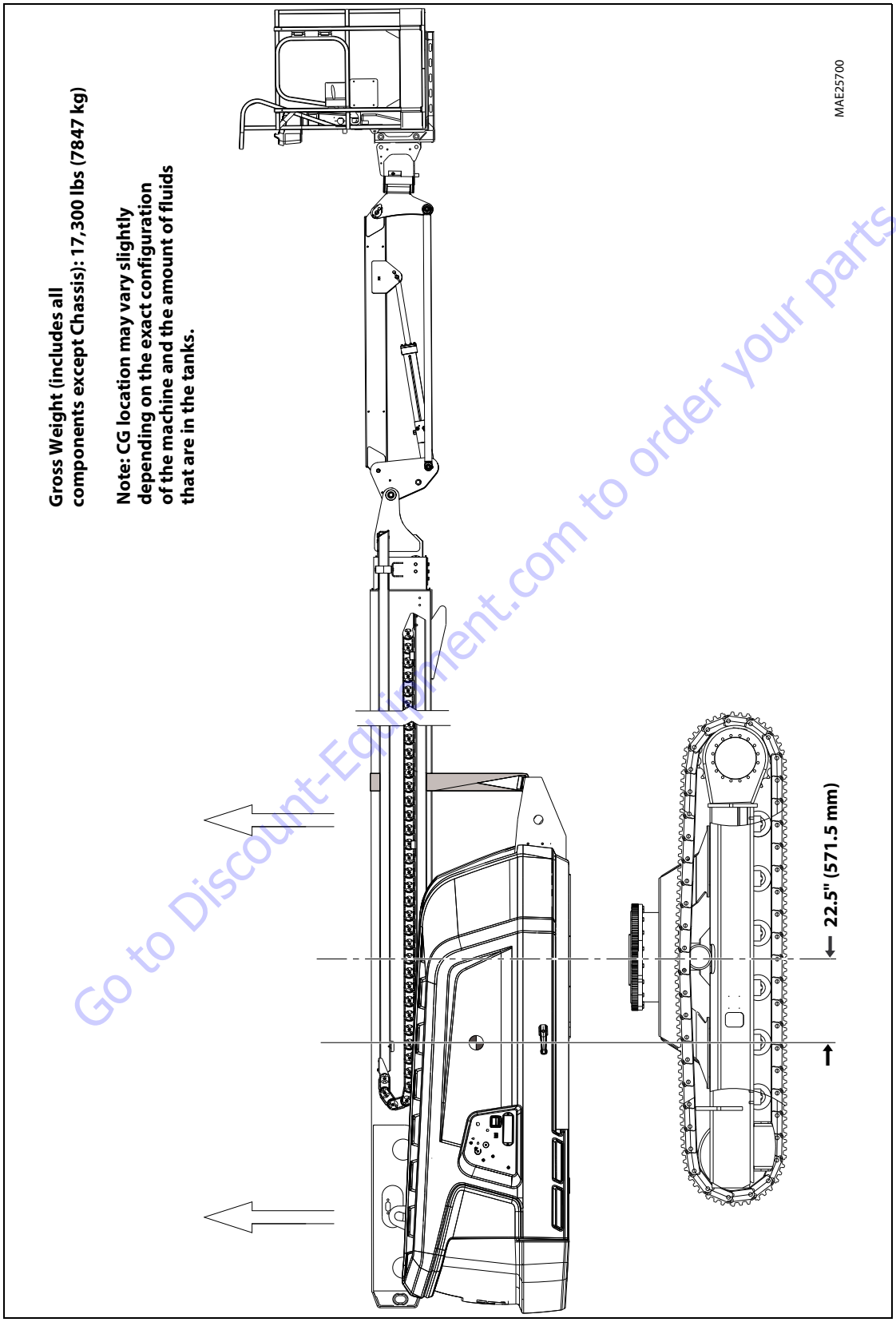
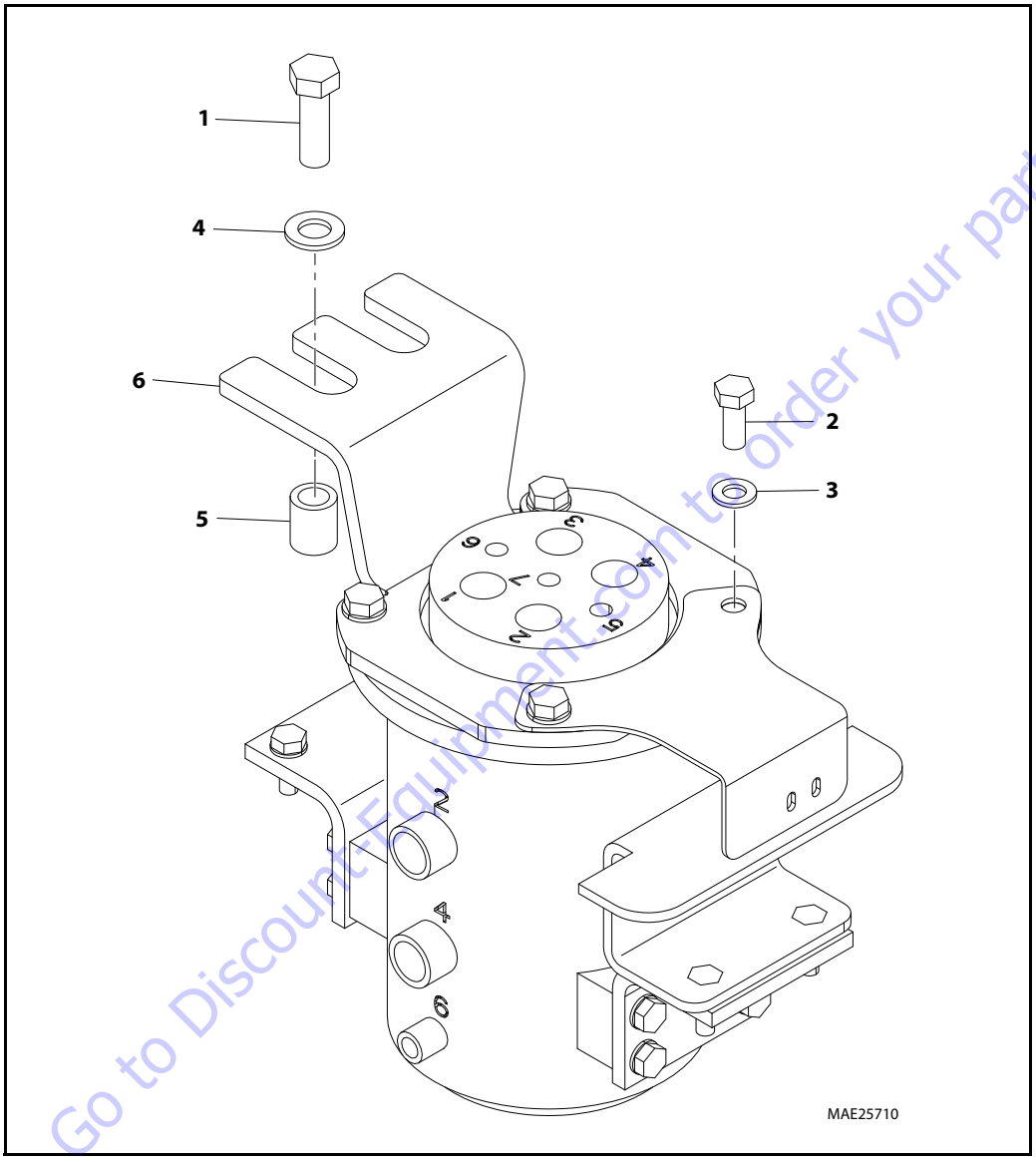


Figure 3-15. Swing Bearing Removal - 660SJC

3.4 ROTARY COUPLING

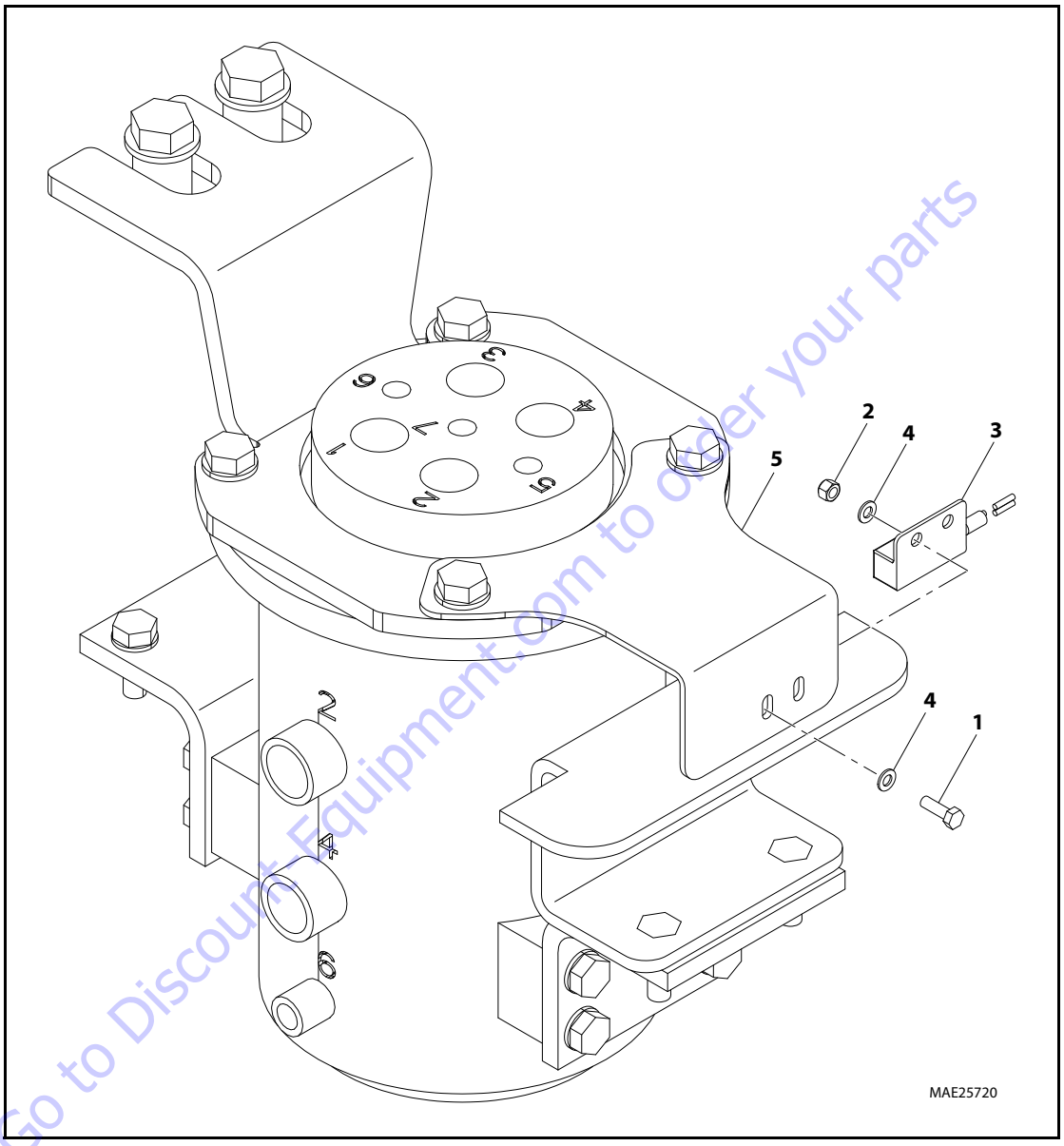
Assembly/Disassembly

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



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

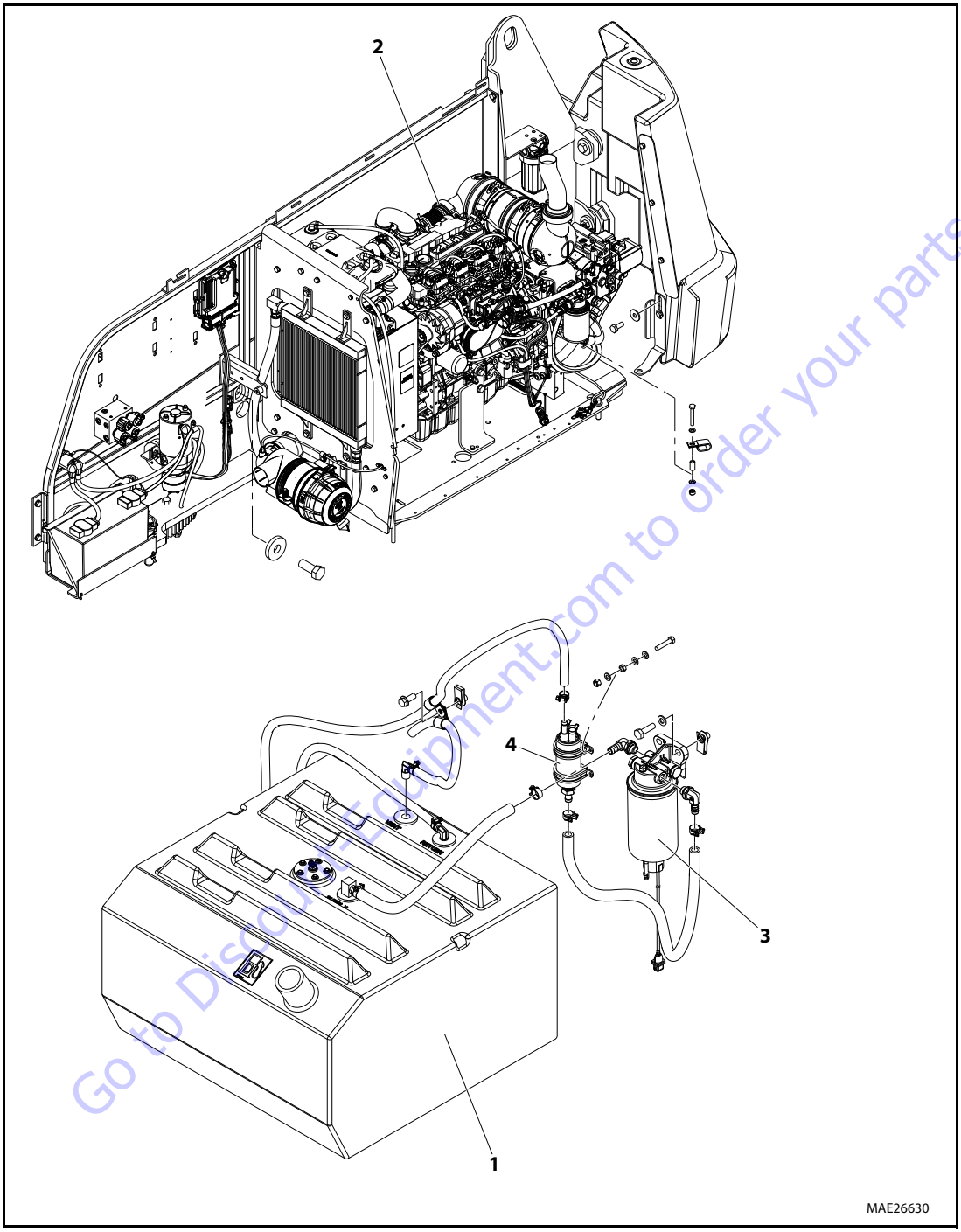
Figure 3-16. Rotary Coupling Installation



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

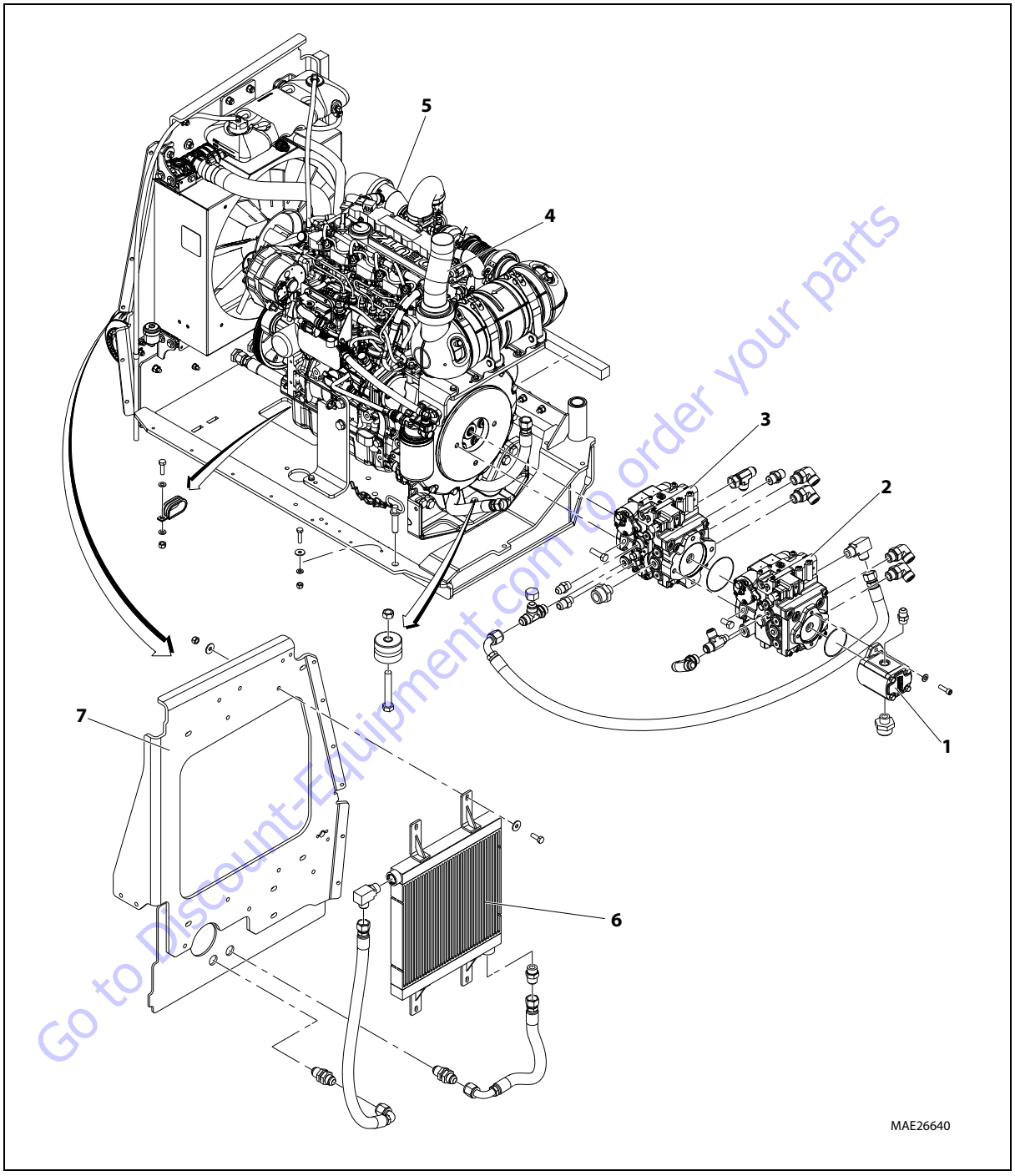
Figure 3-17. Rotary Coupling - Drive Orientation

3.5 DEUTZ TD2.9 L4 ENGINE



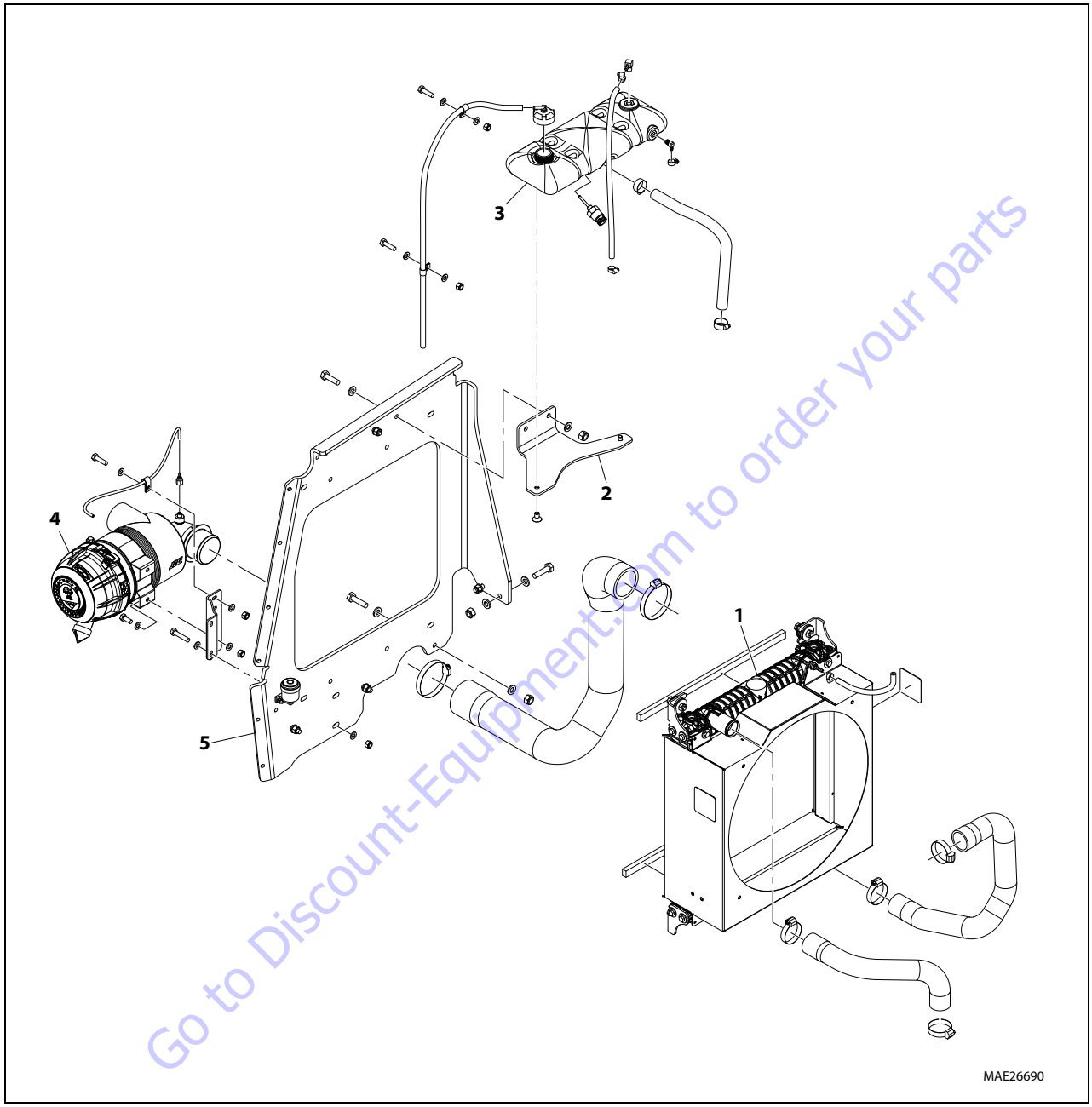
1. Fuel Tank
2. Deutz TD2.9L4 Engine and Pump Assembly
3. Fuel Filter
4. Fuel Supply Pump

Figure 3-18. Deutz TD2.9 L4 Engine Installation



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

Figure 3-19. Deutz TD2.9 L4 Engine and Pumps Sub-Assembly



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

Figure 3-20. Deutz TD2.9 L4 Engine Assembly - Sheet 1 of 2

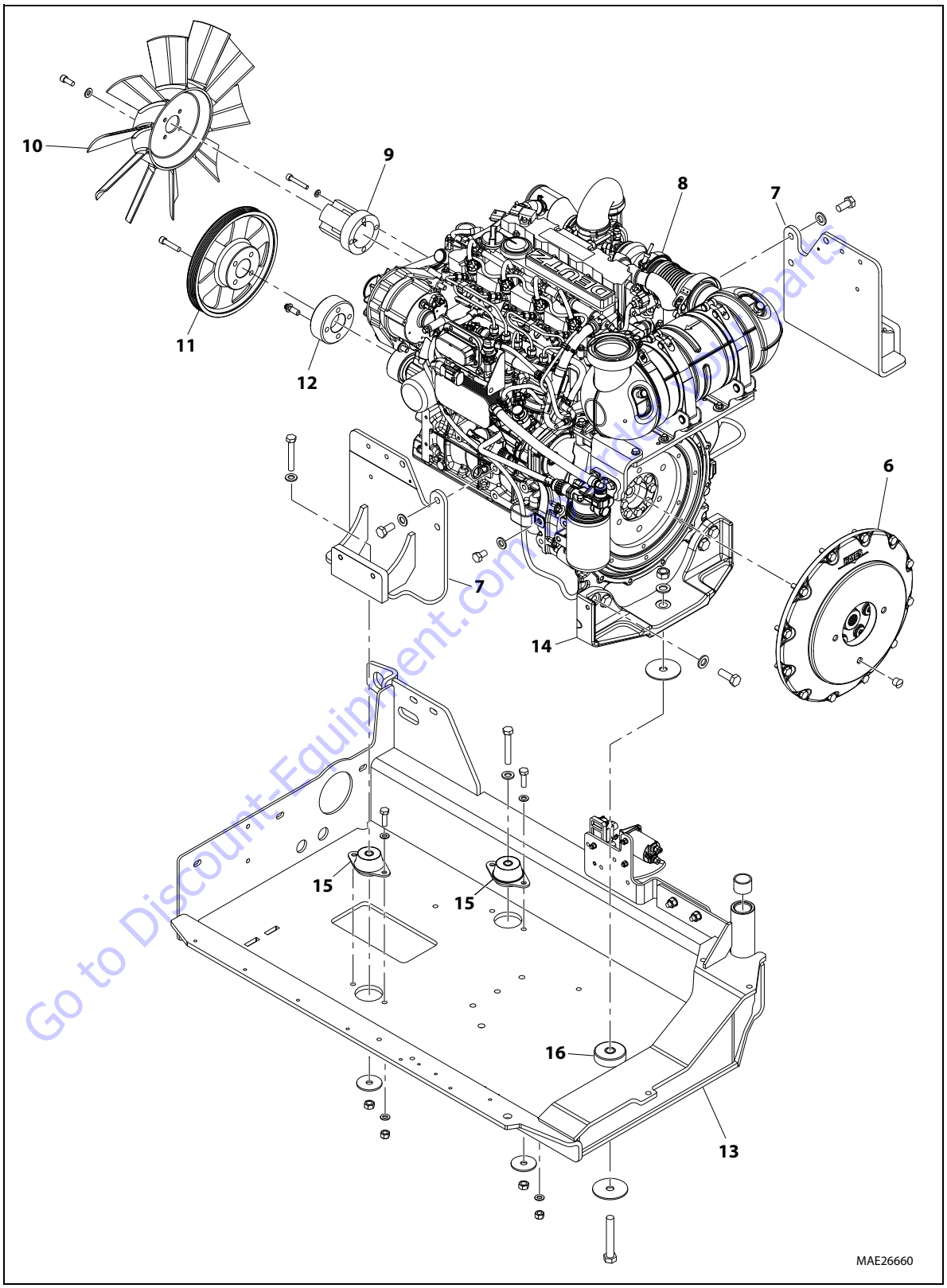


Figure 3-21. Deutz TD2.9 L4 Engine Assembly - Sheet 2 of 2

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

Check Oil Level

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

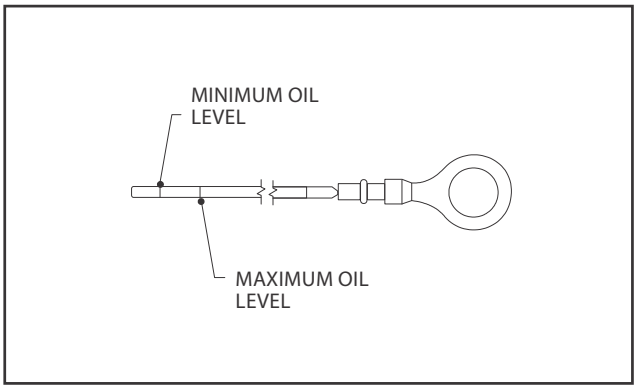


Figure 3-22. Deutz 2.9 T4F Dipstick Markings

5. Replace dipstick until fully seated.

Change Engine Oil

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

⚠ CAUTION

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

NOTICE

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

4. Open oil drain valve and drain oil.
5. Close oil drain valve.
6. Pour in new engine oil. Refer to Section 1 for capacity and Figure 3-23., Engine Oil Viscosity.

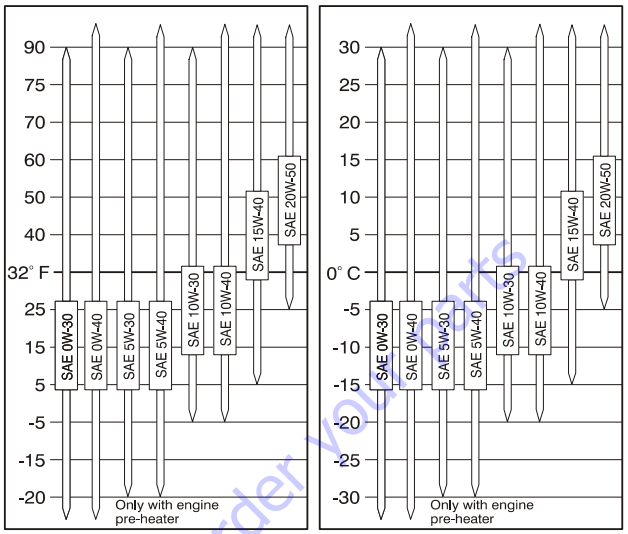
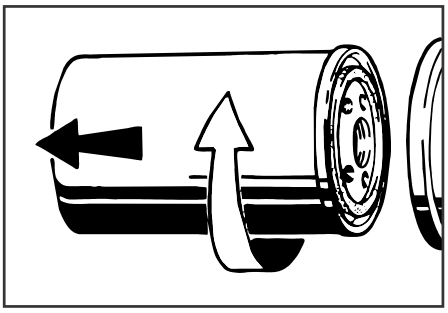


Figure 3-23. Engine Oil Viscosity

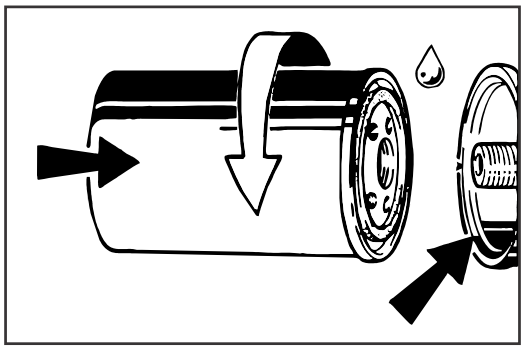
Change Oil Filter

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



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

7. Hand-tighten filter another half-turn.



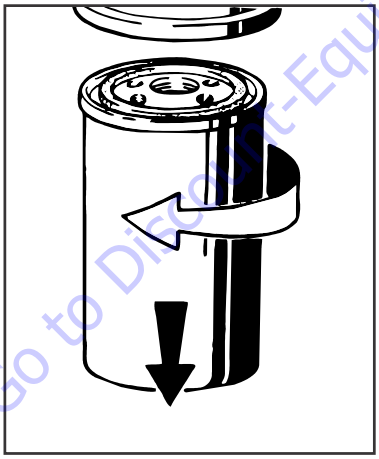
8. Check oil level.
9. Check oil pressure.
10. Check oil filter cartridge for leaks.

Change Fuel Filters

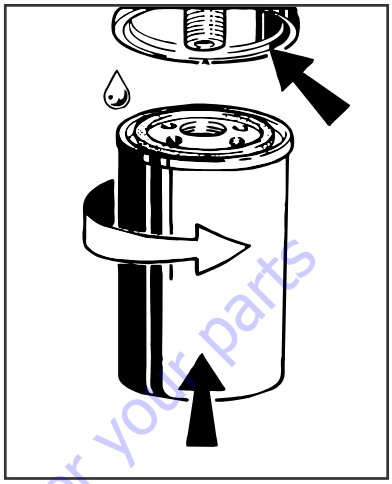
⚠ WARNING

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

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



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



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

Spark Arrester Cleaning Instructions

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

Glow Plugs

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SPN	FMI	Error Identification
523612	12	Diagnosis fault check to report the demand for normal mode due to an error in the Pol2 quantity
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the Pol2 shut-off
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the Pol3 efficiency factor
523612	12	Internal ECU monitoring detection reported error
523612	12	Monitoring of Fuel Quantity Correction
523612	12	Diagnostic fault check to report the plausibility error in rail pressure monitoring
523612	12	Diagnostic fault check to report the error due to torque comparison
523612	12	Diagnosis of curr path limitation forced by ECU monitoring level 2
523612	12	Diagnosis of lead path limitation forced by ECU monitoring level 2
523612	12	Diagnosis of set path limitation forced by ECU monitoring level 2.
523612	3	Reported Over Voltage of Supply
523612	4	Reported Under Voltage of Supply
523612	12	Diagnostic fault check to report WDA active due to errors in query-/response communication
523612	12	Diagnostic fault check to report ABE active due to under voltage detection
523612	12	Diagnostic fault check to report ABE active due to overvoltage detection
523612	12	Diagnostic fault check to report WDA/ABE active due to unknown reason
523612	14	Software reset CPU SWReset_0
523612	14	Software reset CPU SWReset_1
523612	14	Software reset CPU SWReset_2
523612	12	Internal software error ECU
523612	12	Engine starter, plausibility error of starter release condition
523613	0	Rail pressure metering unit, Positive governor deviation.
523613	0	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure exceeded.
523613	0	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure in metering unit exceeded (RailMeUn1).
523613	0	Rail pressure metering unit, Rail pressure below the target range (RailMeUn2) Rail system leakage detected. (RailMeUn10)
523613	1	Rail pressure metering unit, Minimum rail pressure exceeded (RailMeUn3) Negative deviation of rail pressure second stage (RailMeUn22)
523613	0	Rail pressure metering unit, Maximum rail pressure exceeded.
523613	2	Rail pressure metering unit, Set point of metering unit in overrun mode not plausible.
523613	0	Set point of metering unit in overrun mode not plausible
523615	5	Metering unit (Fuel-System); open load
523615	12	Metering unit (Fuel-System); power stage over temperature
523615	3	Metering unit (Fuel-System); short circuit to battery high side
523615	4	Metering unit (Fuel-System); short circuit to ground high side
523615	3	Metering unit (Fuel-System); short circuit to battery low side
523615	4	Metering Unit (Fuel-System); short circuit to ground low side
523615	3	Metering unit, short circuit to battery
523615	4	Metering unit, short circuit to ground
523618	3	Gearbox oil temperature; Short circuit to battery or broken harness
523618	4	Gearbox oil temperature; Short circuit to ground
523619	2	Physical range check high for exhaust gas temperature up stream (SCR-CAT)
523632	16	Pump pressure SCR metering unit too high.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

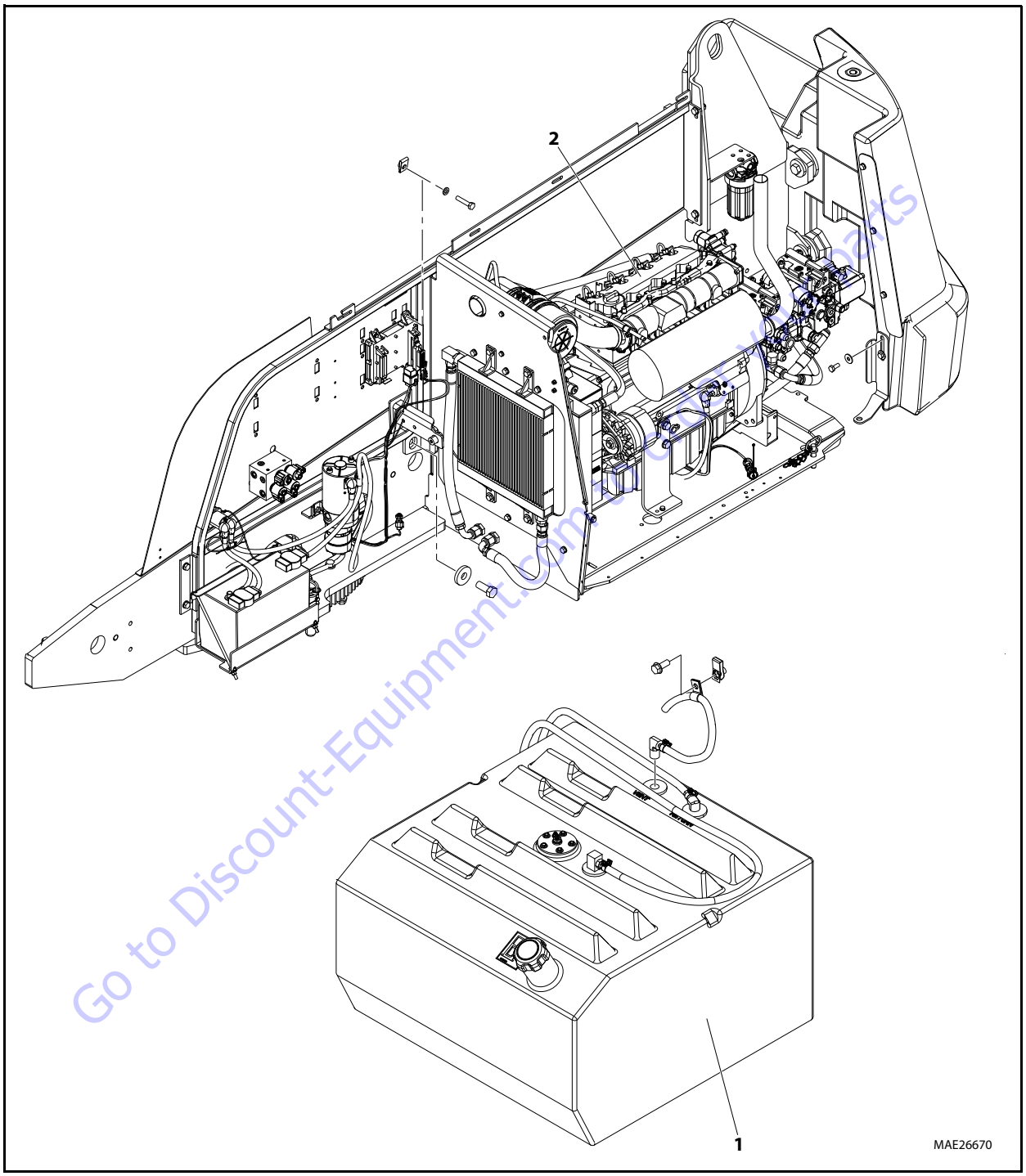
Table 3-1. Deutz Trouble Codes (TD2.9 L4 Engine)

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

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

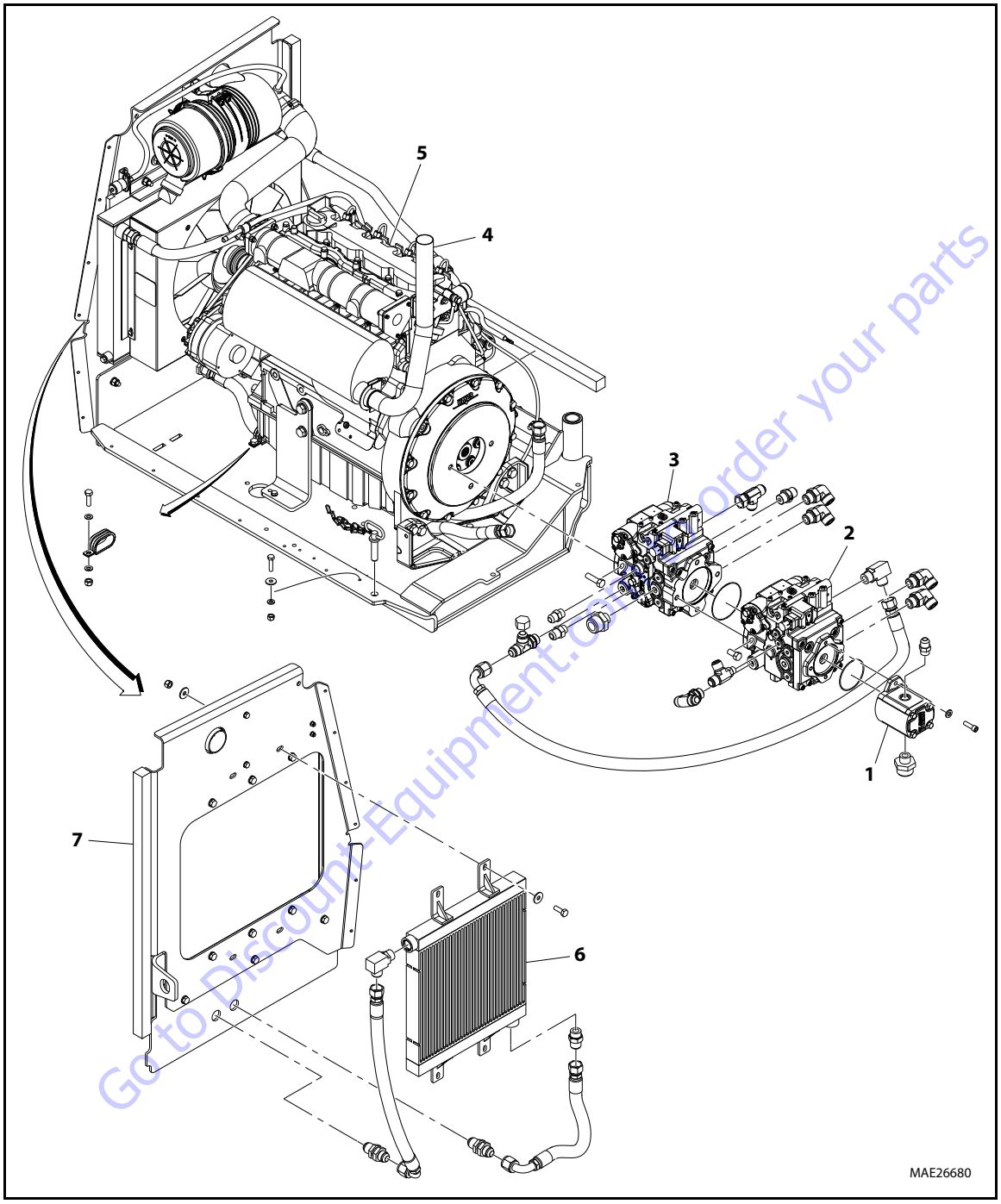
SPN	FMI	Error Identification
524205	11	SCR Co2Off failure is in master ECU active.
524206	11	SCR disable DEF dosing failure is in master ECU active.
524230	11	Inducement HW Failure Slave.
524231	11	Inducement SCR Tamp. Slave
524232	11	Inducement DEF Quality in Slave ECU
524239	11	SCR regeneration failure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

3.6 DEUTZ D2011L04 ENGINE



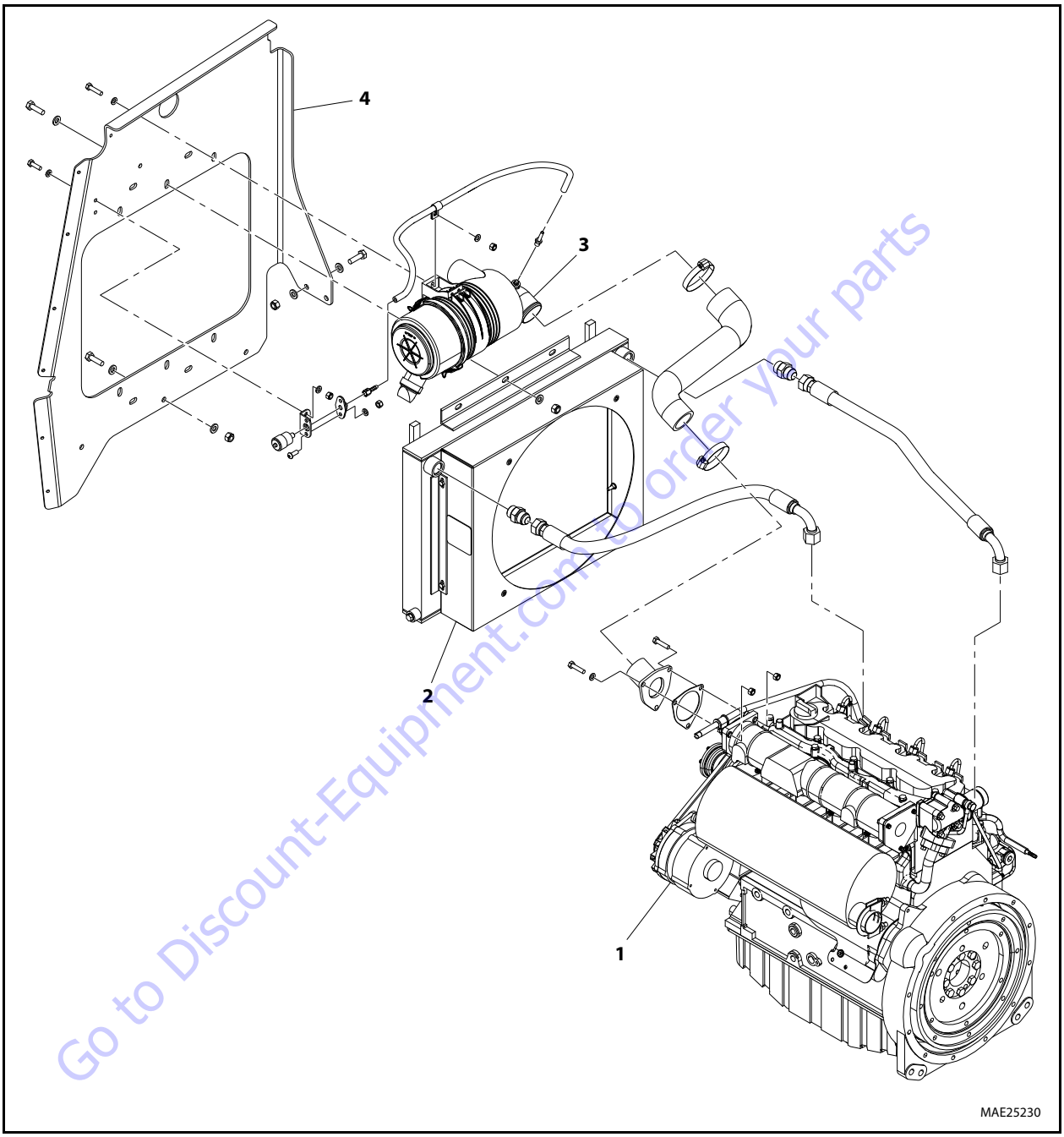
1. Fuel Tank
2. Deutz D2011 Engine and Pumps Sub-Assembly

Figure 3-24. Deutz D2011 Engine Installation



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

Figure 3-25. Deutz D2011 Engine and Pumps Sub-Assembly



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

Figure 3-26. Deutz D2011 Engine Assembly - Sheet 1 of 2

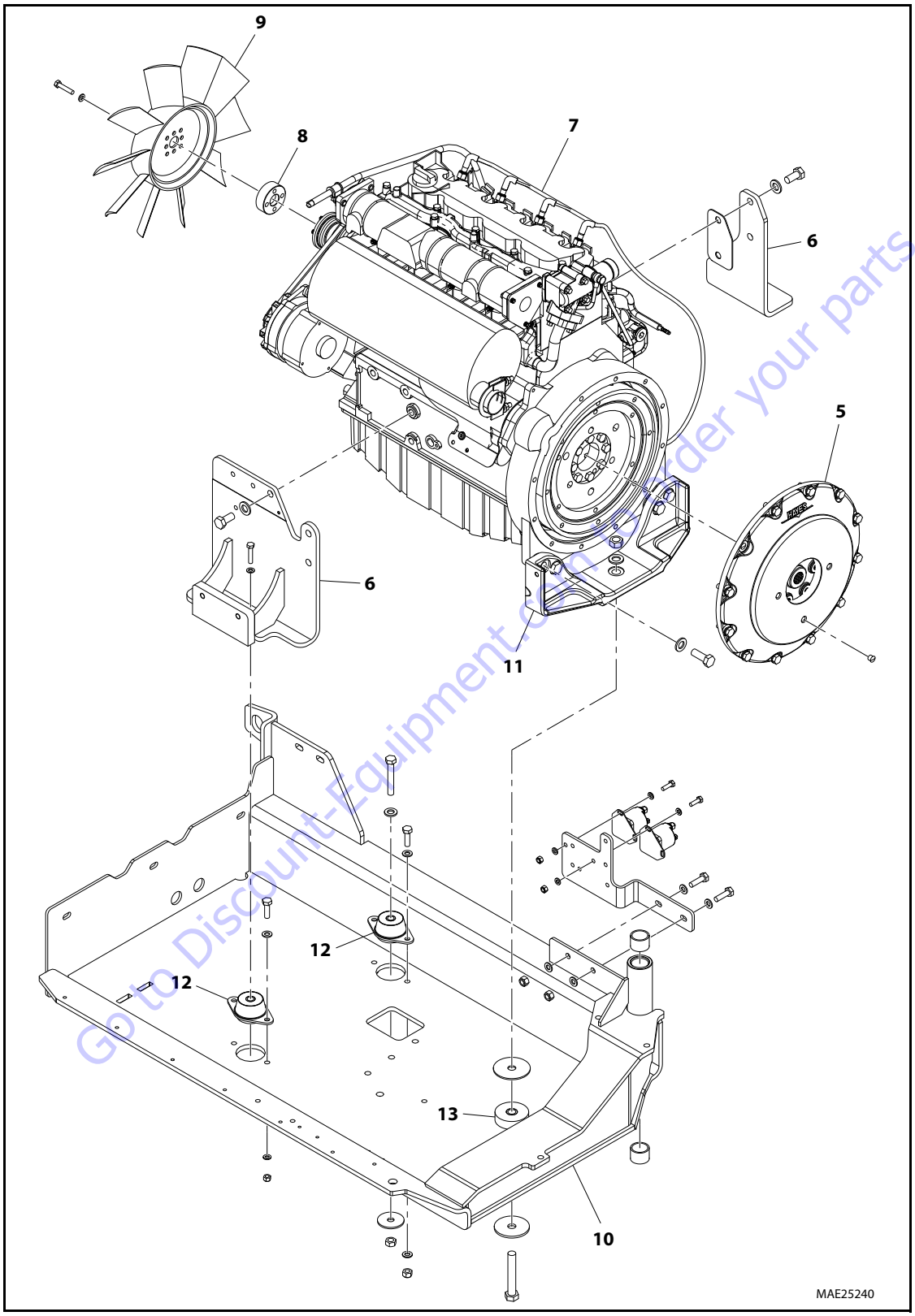


Figure 3-27. Deutz D2011 Engine Assembly - Sheet 2 of 2

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

Checking Oil Level

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

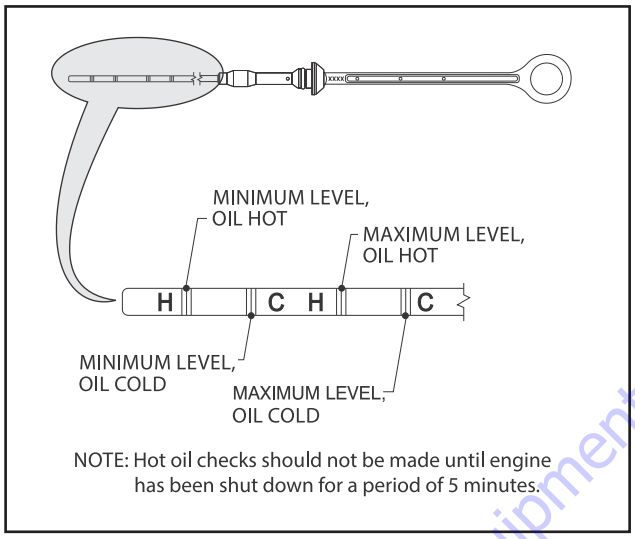


Figure 3-28. Deutz Dipstick Markings

5. Replace dipstick until fully seated.

Changing Engine Oil

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

⚠ CAUTION

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

NOTICE

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

4. Open oil drain valve and drain oil.
5. Close oil drain valve.
6. Pour in new engine oil. Refer to Section 1 for capacity and Figure 3-29., Engine Oil Viscosity.

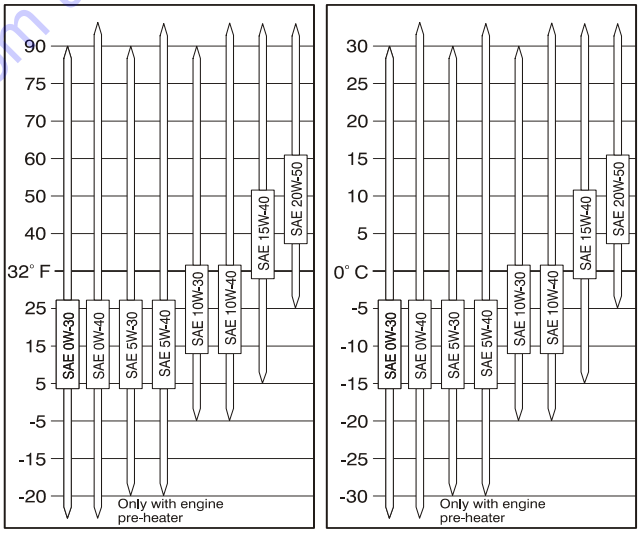
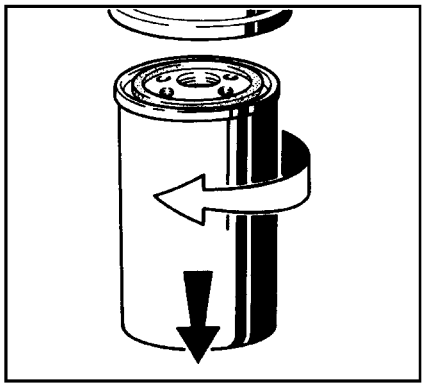


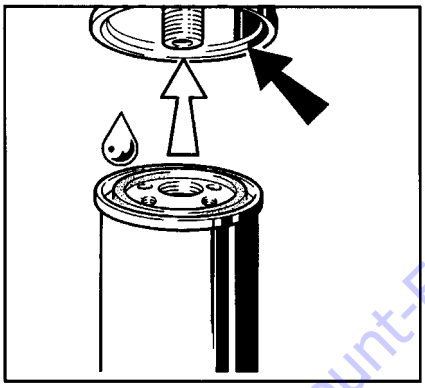
Figure 3-29. Engine Oil Viscosity

Changing Oil Filter

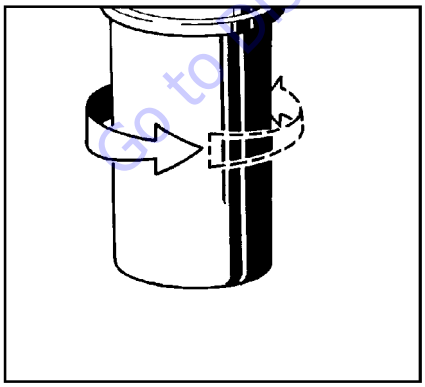
1. Wipe area around filter to clean any dirt from area.
2. Using a suitable oil filter removal tool, loosen lube oil filter cartridge and spin off.



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



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



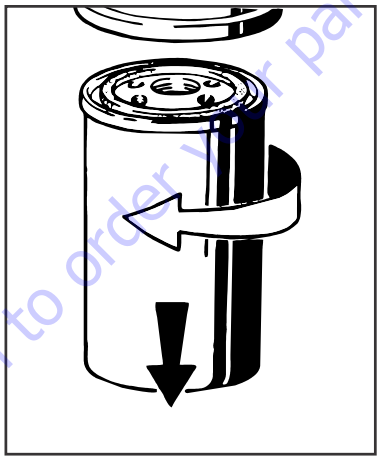
7. Hand-tighten filter another half-turn.
8. Check oil level.
9. Check oil pressure.
10. Check oil filter cartridge for leaks.

Replace Fuel Filter

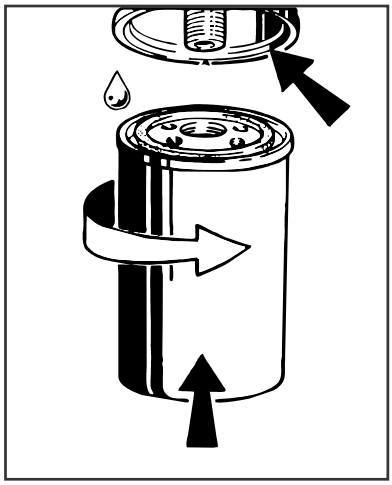
⚠ WARNING

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

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



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



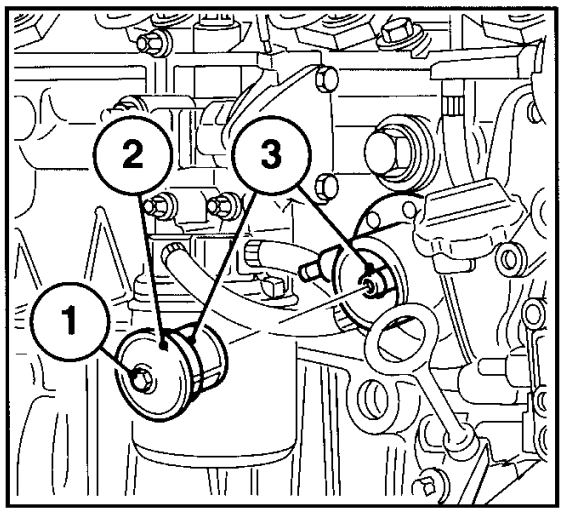
6. Open fuel shut-off valve.
7. Check for leaks.

Clean Fuel Strainer

⚠ WARNING

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

1. Unscrew hexagonal nut (1).



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

3.7 SPARK ARRESTER CLEANING INSTRUCTIONS

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

3.8 GLOW PLUGS

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

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

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

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

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

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

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

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

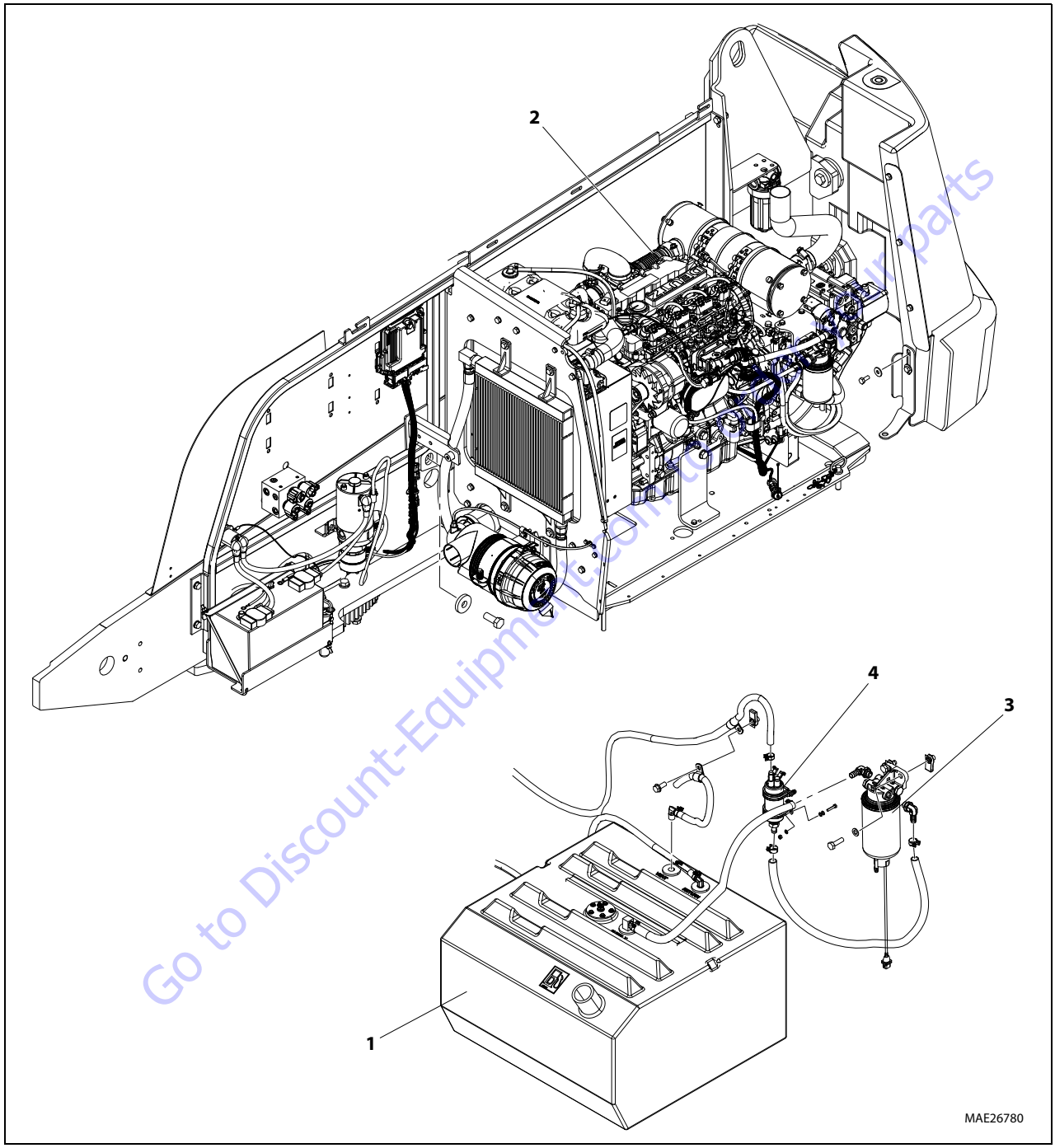
FAULT GROUP	FAULT NO. (IN SERDIA)	FAULT LOCALITY/ FAULT DESCRIPTION	SPN	FMI	CAUSE	REMARKS	HELP
Actuator	50	Feedback	S ID 24	1 2	Actuator not connected. Fault in actuator confirmation.	Emergency switch-off. Actuator cannot be operated.	Check actuator, replace if required. Check cable, check fault limits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

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

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

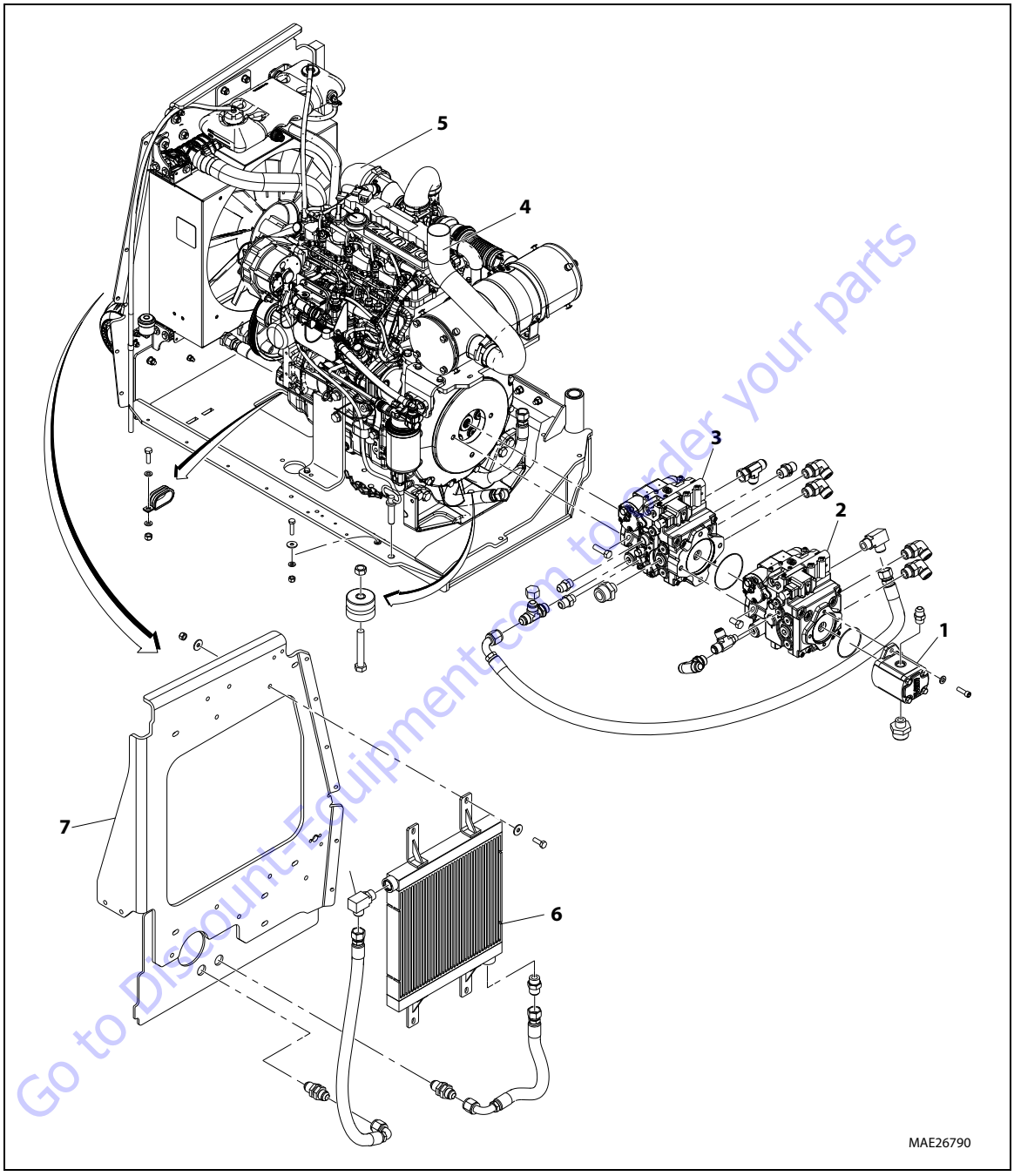
NOTE: *SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.*

3.9 DEUTZ TD 2.9 L4 GUO III ENGINE



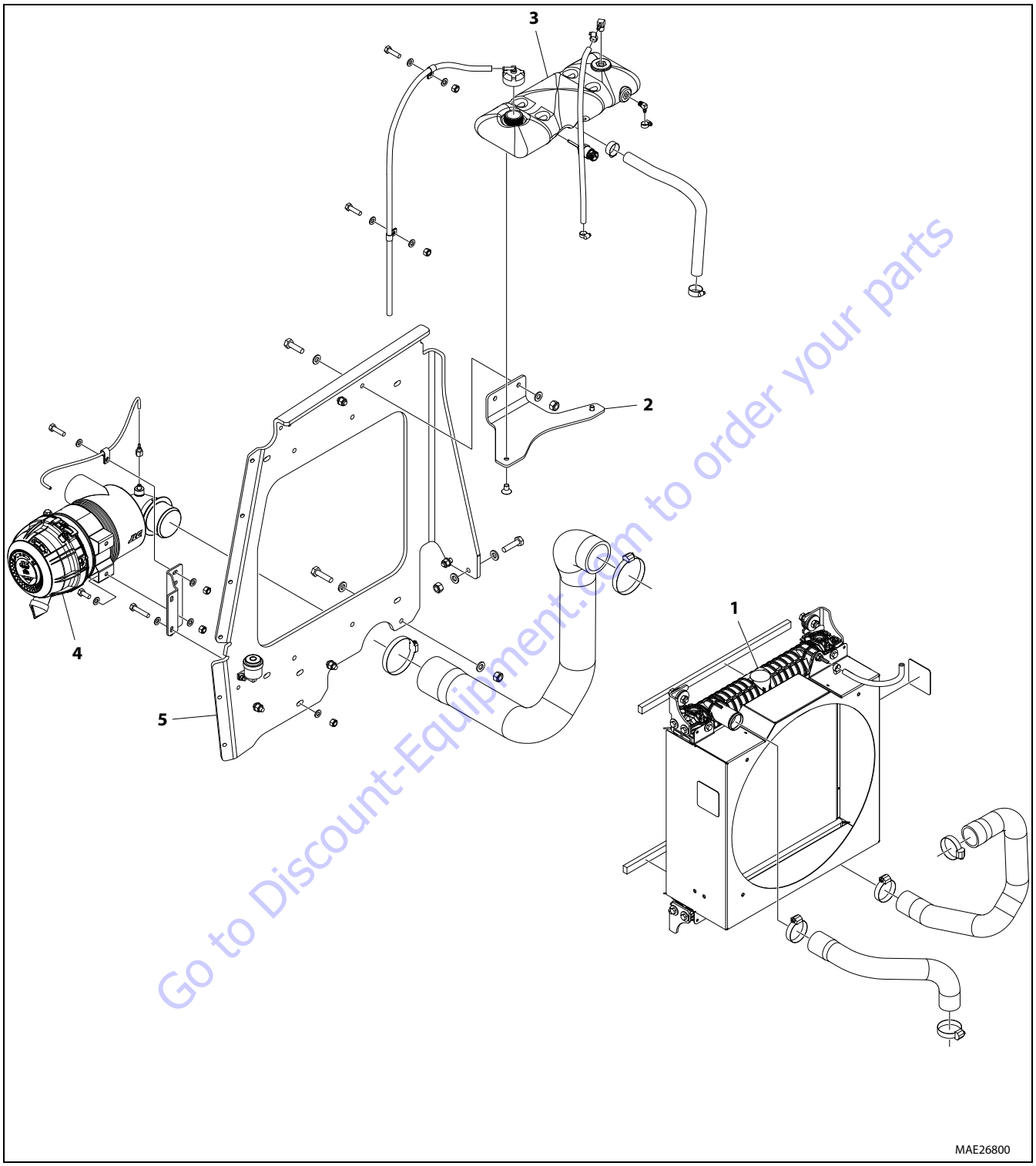
1. Fuel Tank
2. Deutz TD2.9L4 Engine and Pump Assembly
3. Fuel Filter
4. Fuel Supply Pump

Figure 3-30. Deutz TD 2.9 L4 GUO III Engine Installation



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

Figure 3-31. Deutz TD 2.9 L4 GUO III Engine and Pumps Sub-Assembly



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

Figure 3-32. Deutz TD 2.9 L4 GUO III Engine Assembly - Sheet 1 of 2

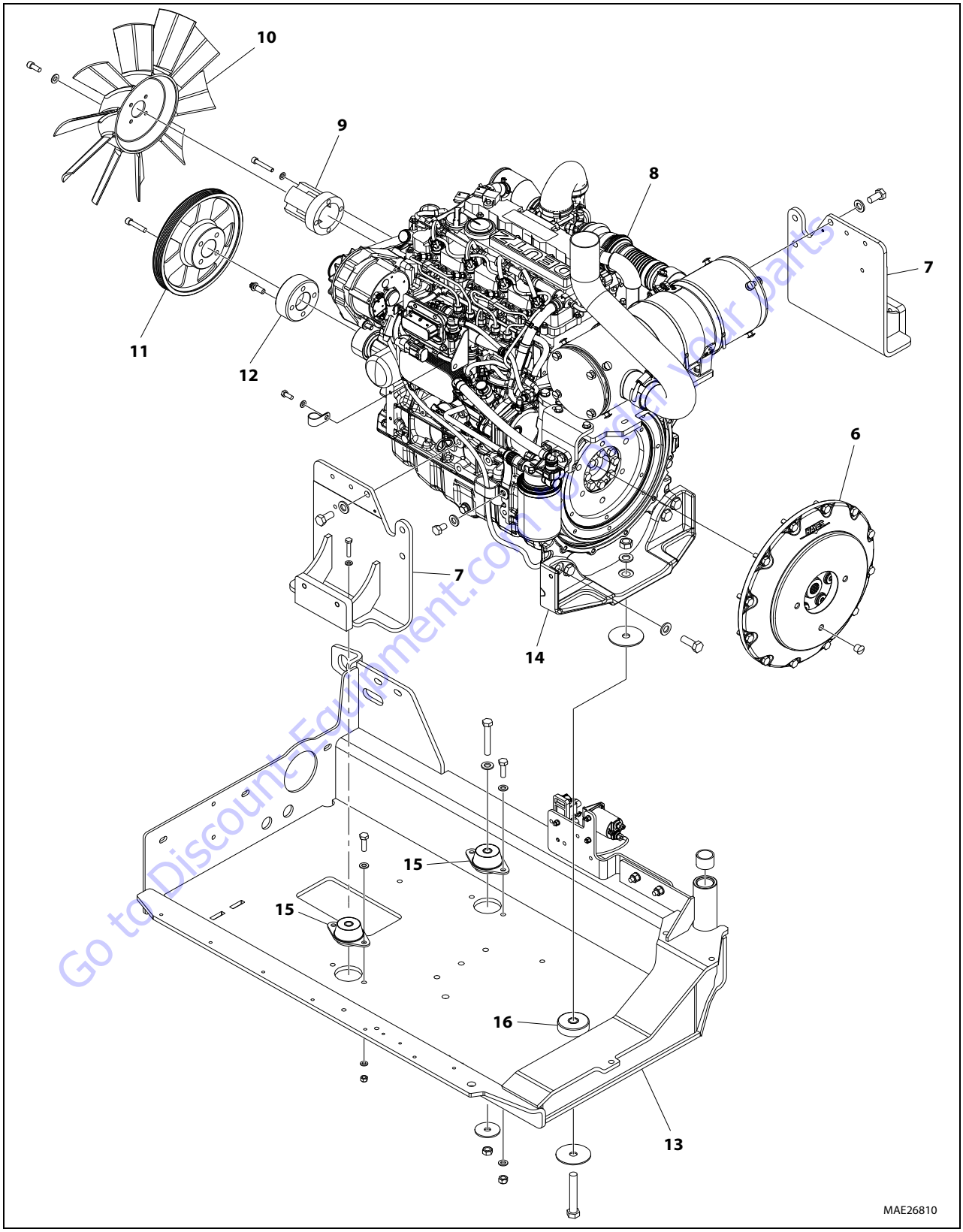
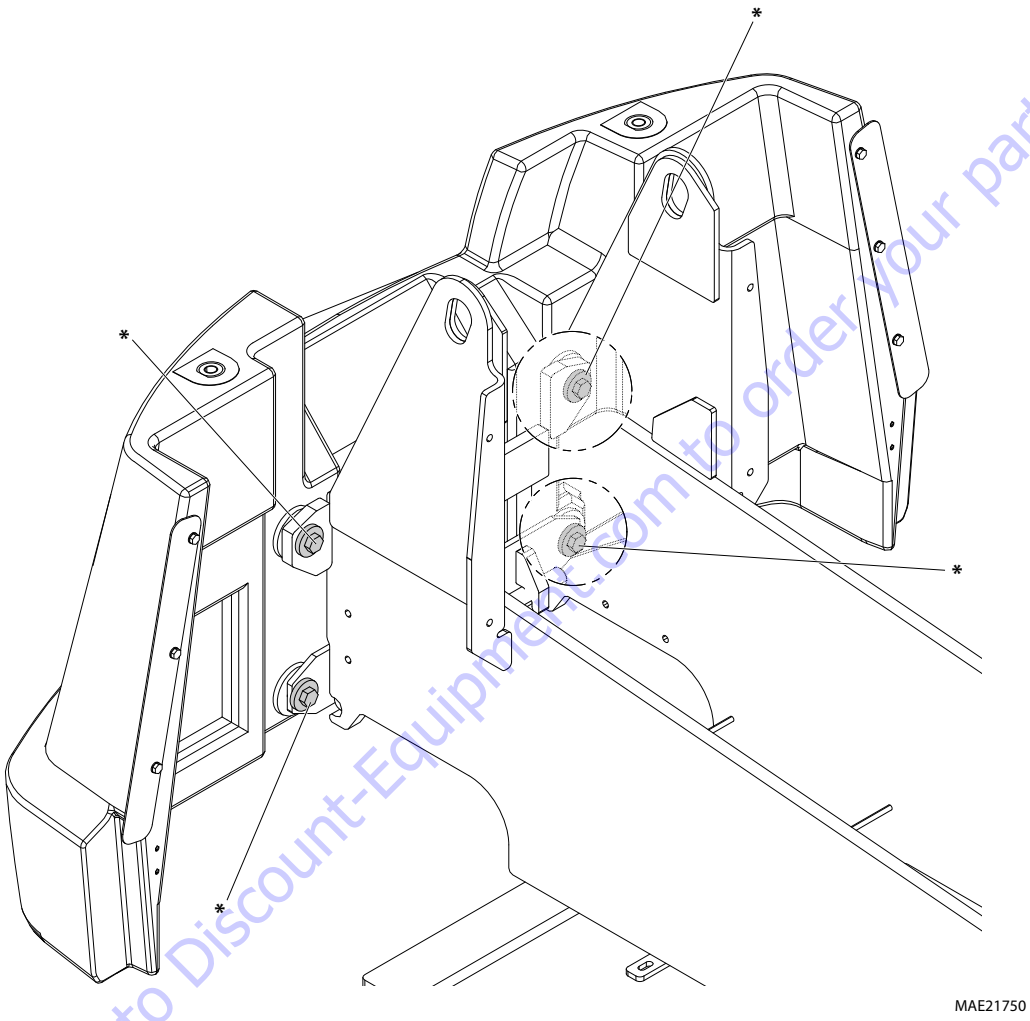


Figure 3-33. Deutz TD 2.9 L4 GUO III Engine Assembly - Sheet 2 of 2

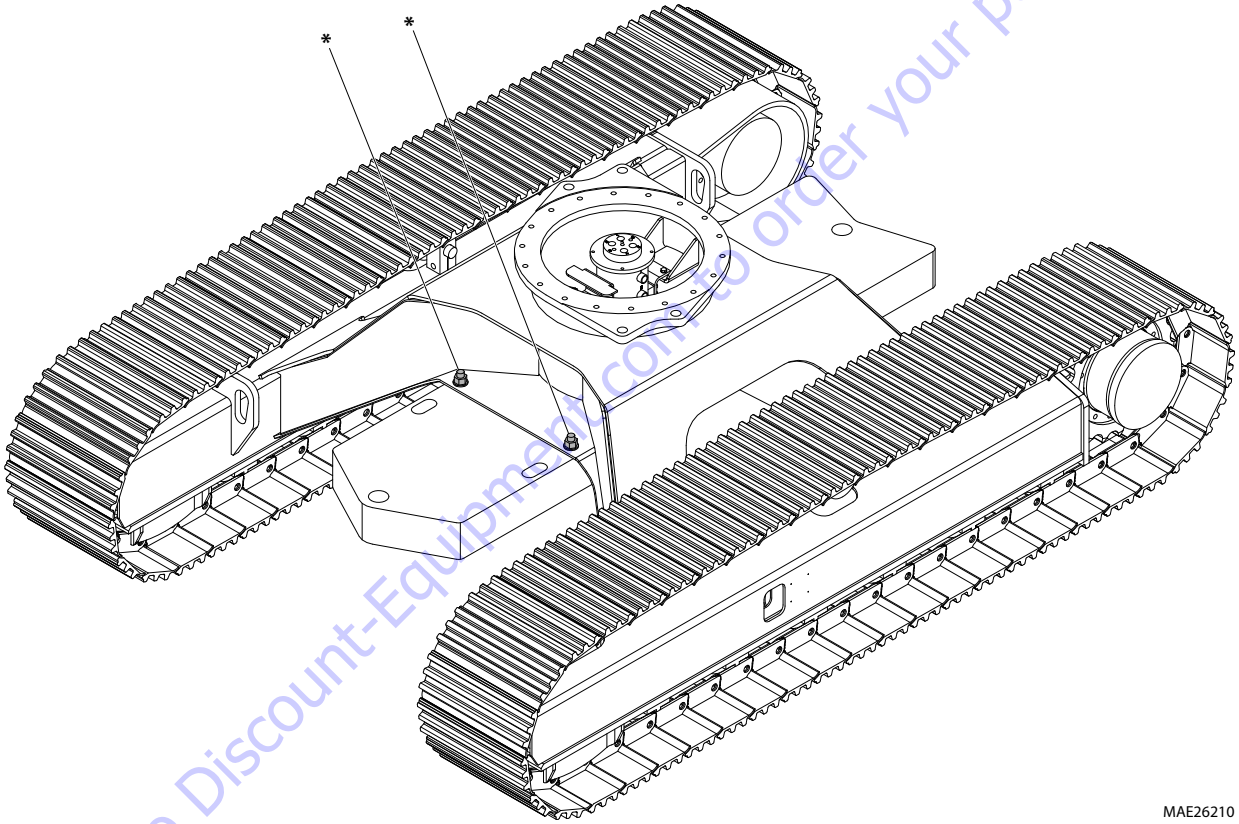
3.10 COUNTERWEIGHT

If the counterweight has been removed, ensure the retaining bolts are torqued to the proper value as shown in Figure 3-34., Counterweight Bolt Torque.



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

Figure 3-34. Counterweight Bolt Torque



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

Figure 3-35. Counterweight Bolt Torque - Crawler (660SJC)

3.11 GENERATOR

Every 250 hours

Check drive belt tension every 250 hours of operation,.

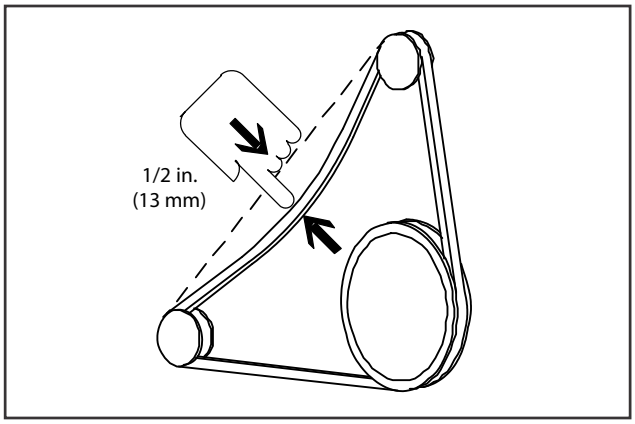


Figure 3-36. Generator Belt Tension

Every 500 hours

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

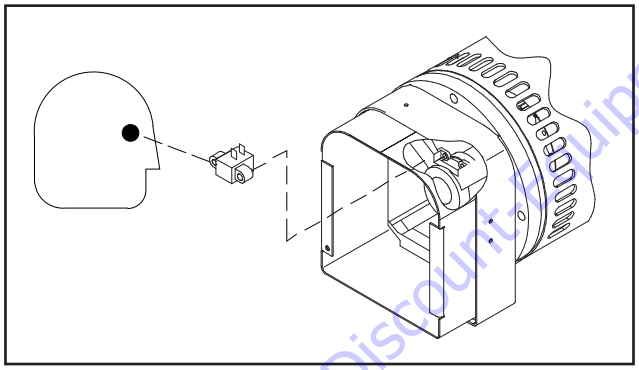


Figure 3-37. Generator Brushes and Slip Rings

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

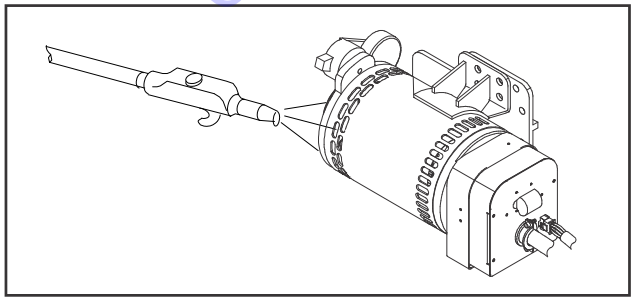


Figure 3-38. Generator Cleaning

Overload Protection

⚠ CAUTION

STOP ENGINE WHENEVER CHECKING OR INSPECTING CIRCUIT BREAKER.

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

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

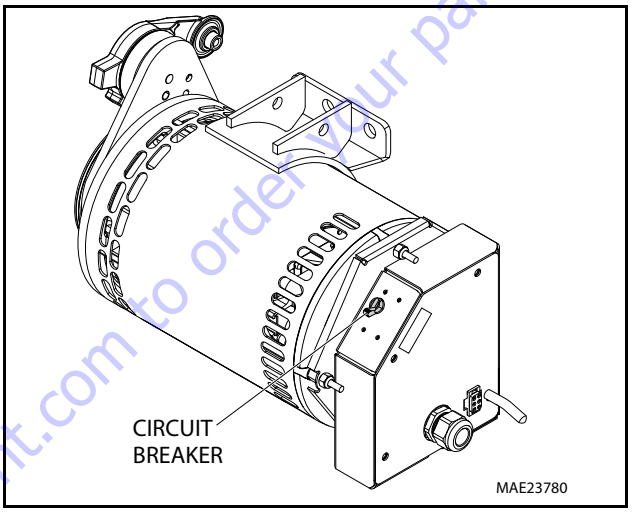


Figure 3-39. Generator Circuit Breaker Location (If Equipped with 4000W)

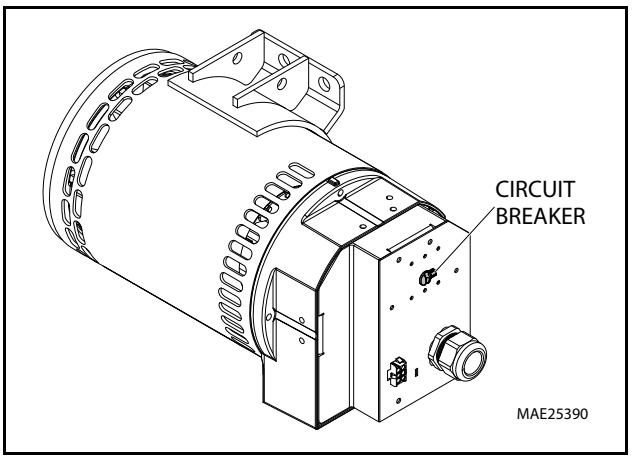


Figure 3-40. Generator Circuit Breaker Location (If Equipped with 7500W)

Inspecting Brushes, Replacing Brushes, and Cleaning Slip Rings

INSPECTING BRUSH POSITION

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

INSPECTING BRUSHES

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

CLEANING SLIP RINGS

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

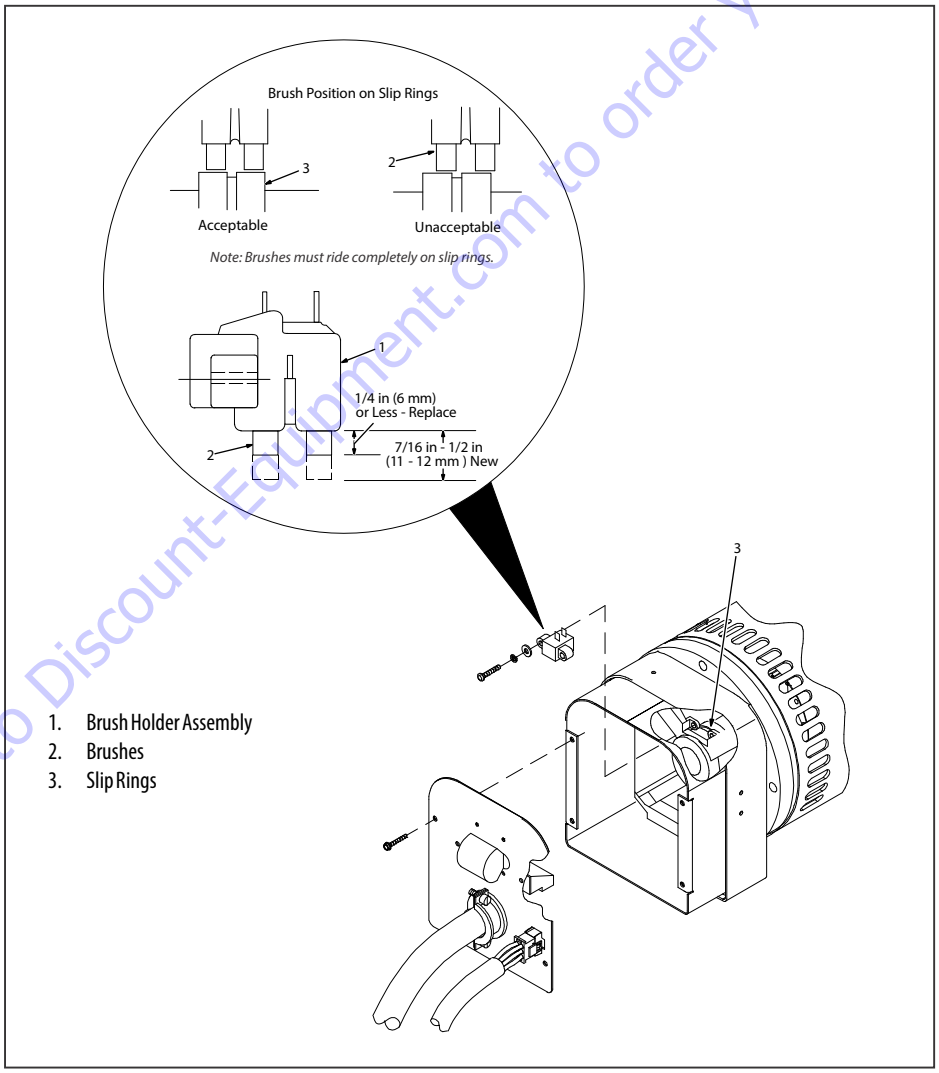
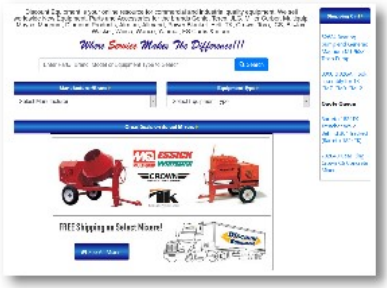


Figure 3-41. Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings

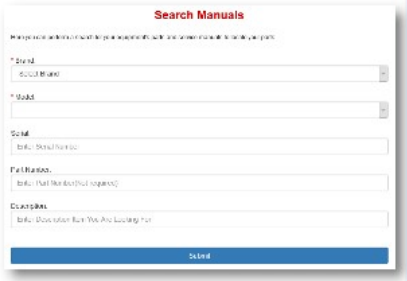
PARTS FINDER

Search Website by Part Number

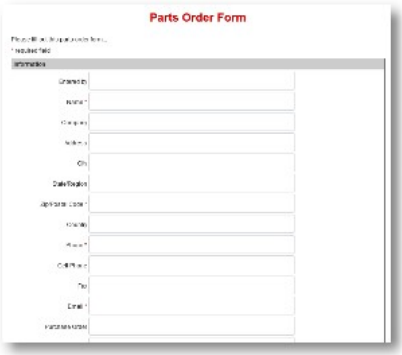
Discount Equipment



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



Can't Find Part or Manual? Request Help by Manufacturer, Model & Description



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SECTION 4. BOOM & PLATFORM

⚠ WARNING

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

4.1 TRANSPORT POSITION SENSING SYSTEM

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

4.2 BEYOND TRANSPORT - DRIVE SPEED CUTBACK SYSTEM

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

4.3 DUAL CAPACITY SYSTEM

The dual capacity selection and indicator system consists of a capacity mode toggle switch at the platform control box, a set of redundant proximity sensors to detect boom extension, and a main boom angle sensor. The operator selects the mode to work in:
600SC: 600 lb (270 kg) unrestricted, 1000 lb (450 kg) restricted
660SJC: 550 lb (250kg) unrestricted, 750 lb (340 kg) restricted.
The light indicator in the platform control box will change to match the selected mode, unless there is a system DTC that forces the machine into the restricted mode. The system uses the boom extension proximity sensors and boom angle sensor to prevent the platform from entering the unrestricted zone if the restricted mode is selected. When the dual capacity switch is in the restricted position, the platform will move but stop at the boundaries of the restricted zone. The platform will not be able to enter the unrestricted zone. When the machine control system senses the platform is already on the boundaries of the restricted zone, it only allows the retraction of the boom or lifting up of the boom as these movements place the platform further away from the unrestricted zone. In case the platform is already inside the restricted zone and the dual capacity switch is flipped to the unrestricted position at that time, the machine will only allow the boom to retract and will only allow the boom to lift up, as these movements will bring the platform towards the restricted zone. When the dual capacity switch is in the unrestricted position, the platform can go anywhere within the whole boundaries.

4.4 PLATFORM LOAD SENSING SYSTEM

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

4.5 ELECTRONIC PLATFORM LEVELING

The Electronic Platform Leveling System simulates a conventional master/slave cylinder arrangement by adjusting the leveling cylinder stroke based on the boom angle changes during the lift operation. The system uses two rotary angle sensors (Internally Redundant Hall Effect Sensors), one to measure the main boom angle relative to the tension link and one to measure the platform angle relative to the main boom.
The first angle sensor is mounted concentric with the pin that connects the base boom to the tension link. As the boom rises or lowers the sensor sends a signal to the UGM which determines, through an algorithm that considers the boom linkage geometry, the required angle at the second sensor.
For 600SC, that second sensor is mounted concentric with the pin that connects the platform rotator to the fly boom. For 660SJC, the sensor is mounted with the pin between fly boom and jib pivot. As the level cylinder in the fly boom is activated to adjust the angle between the platform and the fly boom the angle sensor signal is sent to the UGM. Once the required platform to fly boom angle (as determined by the UGM based on the first sensors input) is reached the movement of the level cylinder is stopped. This leveling system operates like a conventional master/slave cylinder system, meaning that it will not correct level relative to gravity but maintain the platform angle relative to gravity as it was manually set by the operator prior to activation of the lift function.

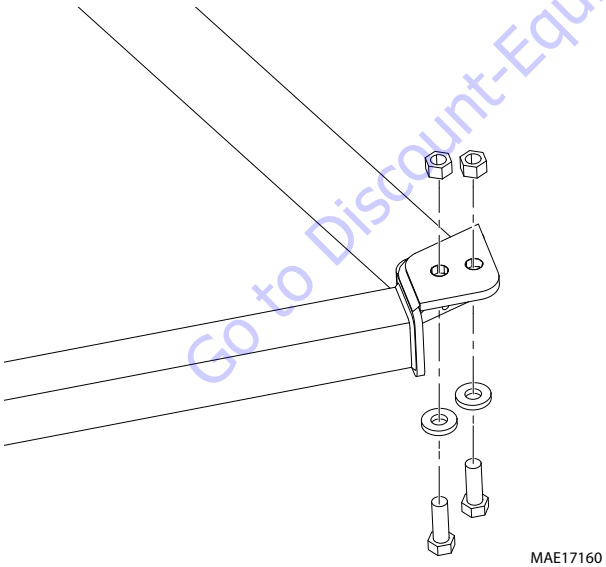
4.6 FUEL LEVEL CUTOUT SYSTEM

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

4.7 PLATFORM

Support Removal

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

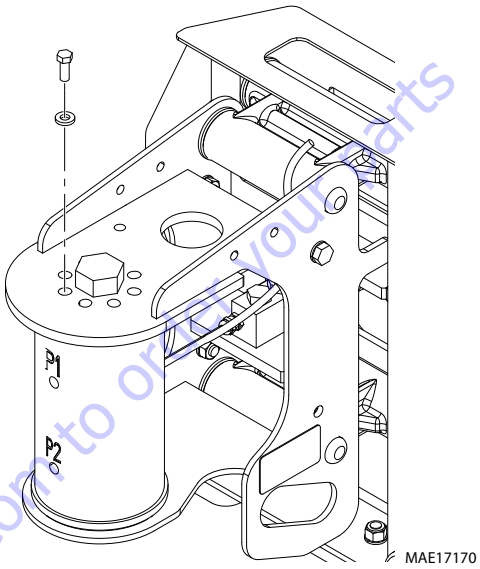


MAE17160

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

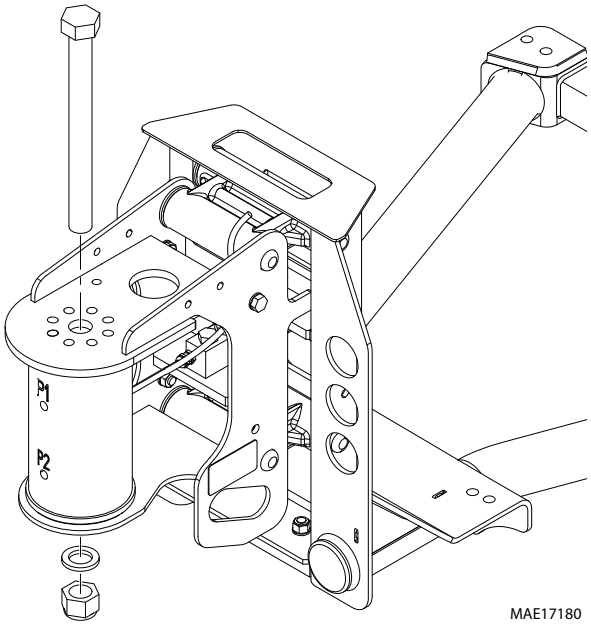
NOTE: *The platform support weighs approximately 125 lbs. (56.7 kg).*

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



MAE17170

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



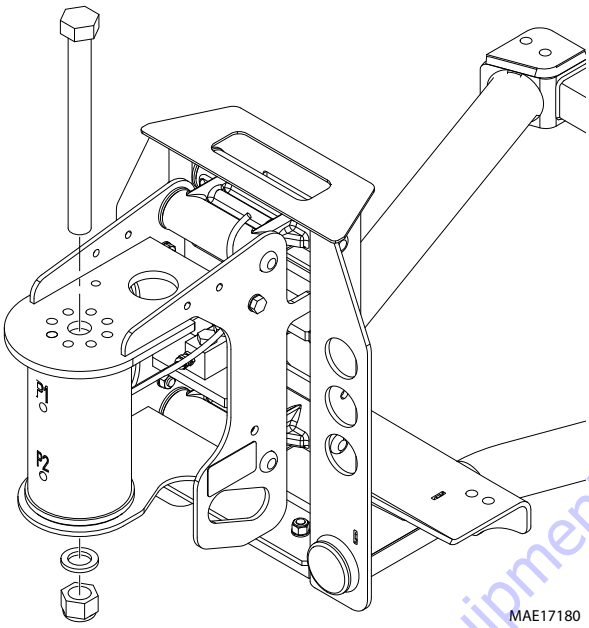
MAE17180

Support Installation

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

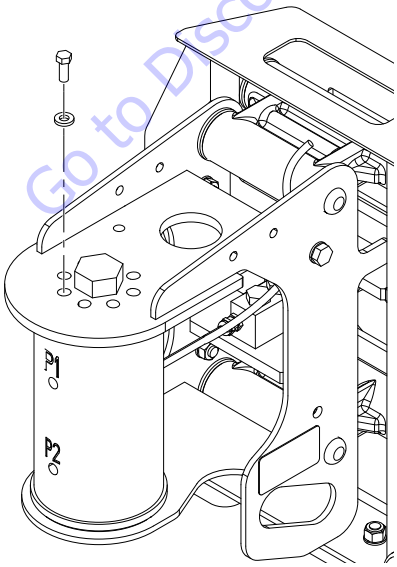
NOTE: *The platform support weighs approximately 125 lbs. (56.7 kg).*

NOTE: *Install the rotator center bolt.*



MAE17180

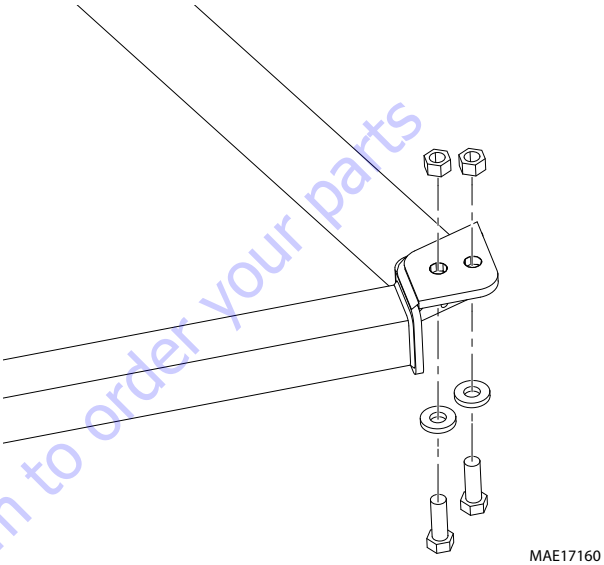
2. Apply JLG Threadlocker P/N 0100011 to the bolts and washers securing the support to the rotator and install the bolts and washers.



MAE17170

3. Torque the nut on the rotator center bolt to 586 ft. lbs. (795 Nm). Torque the retaining bolts to 40 ft. lbs. (55 Nm).

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


MAE17160

5. Remove tag and reconnect the hydraulic lines to the rotator.

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

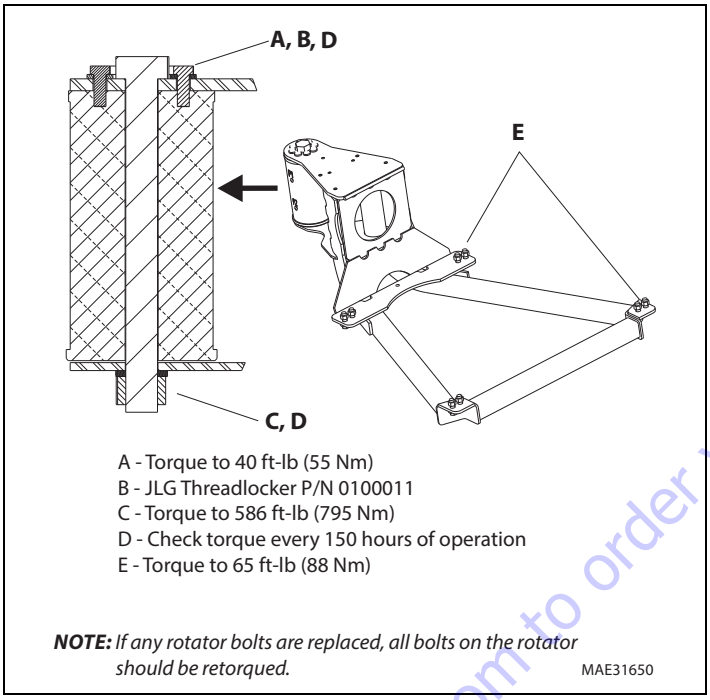


Figure 4-1. Platform Support Torque Values

4.8 ROTATOR AND SLAVE CYLINDER

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

Removal

600SC

1. Tag and disconnect hydraulic lines from the rotator. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
2. Supporting the rotator, remove hardware from pin (1). Using a suitable brass drift and hammer remove pin (1) from the fly boom.
3. Remove the hardware from pin (2). Using a suitable brass drift and hammer, remove pin (2) from the fly boom and remove the rotator.
4. Supporting the slave cylinder, remove the hardware from pin (3). Using a suitable brass drift and hammer remove pin (3) from the fly boom.

660SJC

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

Assembly/Disassembly

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

Installation

600SC

1. Support the slave cylinder. Using a suitable brass drift and hammer, install pin (3) to the fly boom.
2. Support the rotator. Using a suitable brass drift and hammer, install pin (2) to the fly boom and install the rotator.
3. Using a suitable brass drift and hammer, install pin (1) to the rotator.
4. Remove tag and reconnect the hydraulic lines to the rotator and the slave cylinder.

660SJC

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

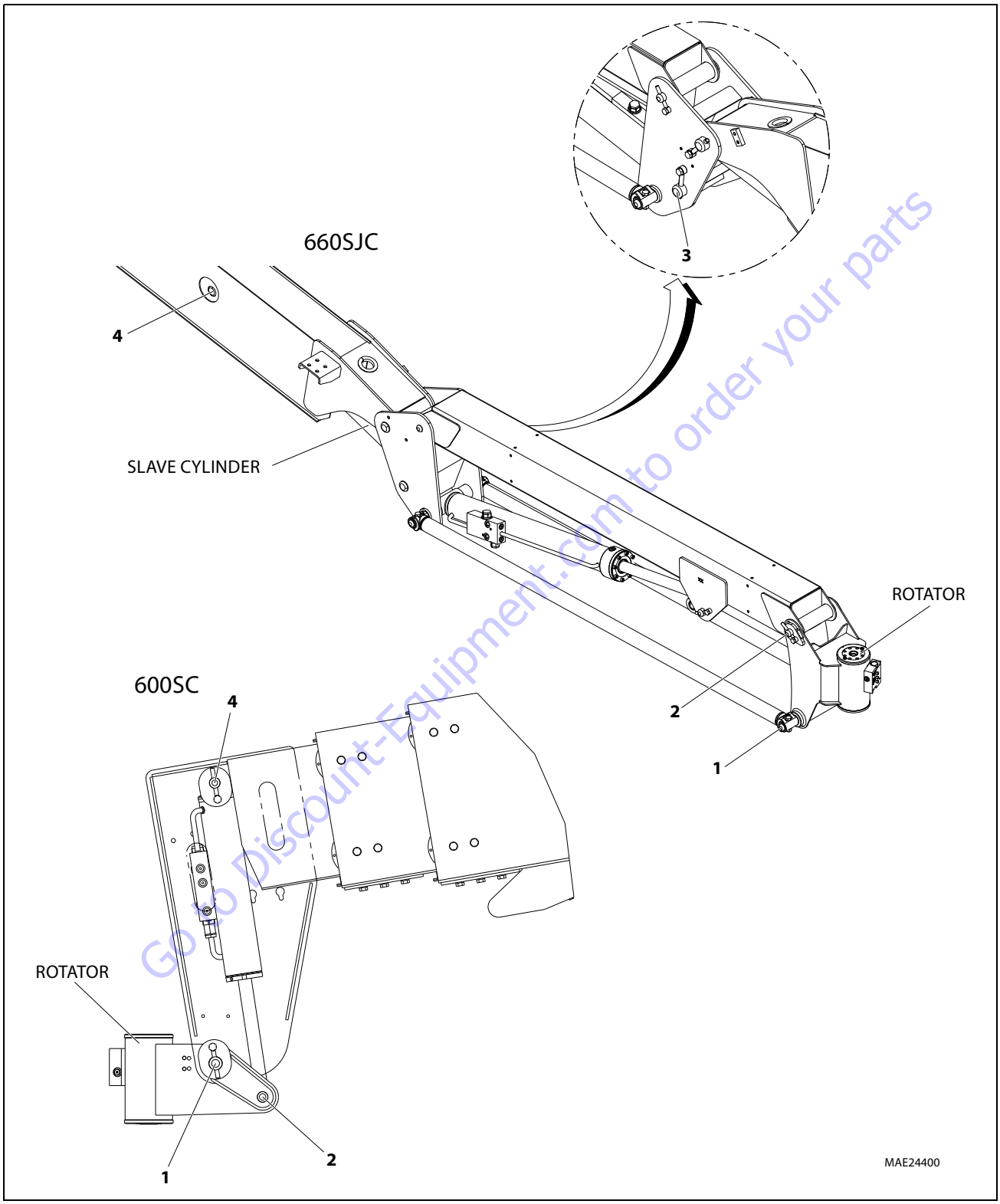


Figure 4-2. Removal of Components - Rotator and Slave Cylinder

4.9 MAIN BOOM ASSEMBLY

Removal

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

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

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

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

NOTICE

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

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

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

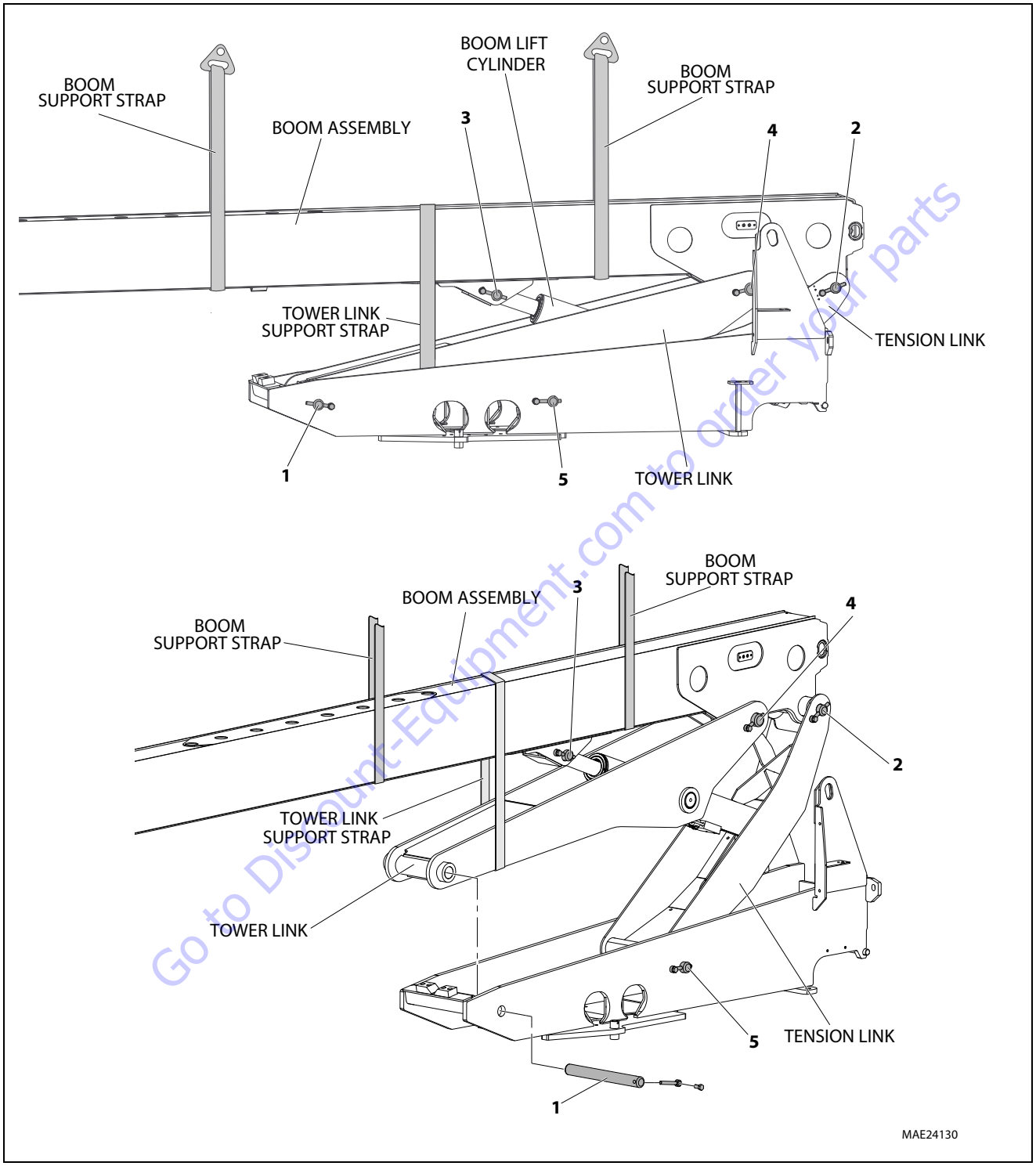
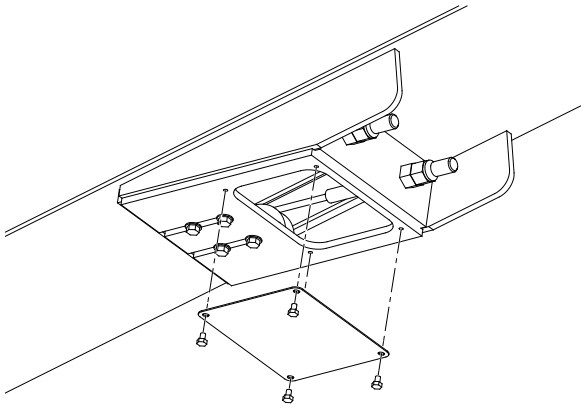


Figure 4-3. Boom Assembly Removal and Installation

Boom Disassembly

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

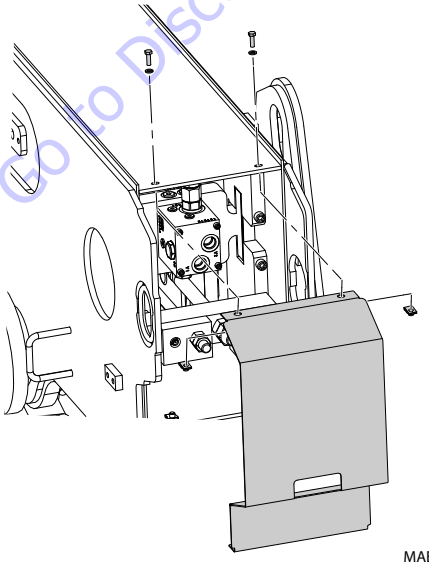
NOTE: *Do not allow wire rope to rotate. This may damage the wire rope. Clamp both threaded ends of wire rope to prevent rotation.*



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

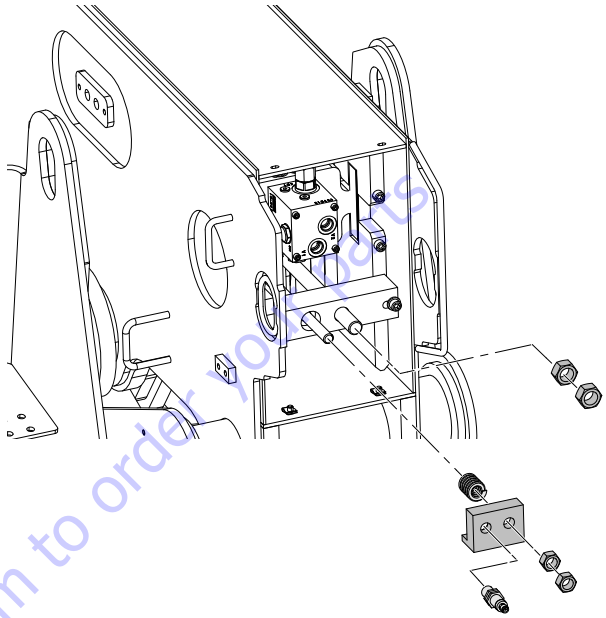
NOTE: *Do not clamp on threads. Remove jam nuts and nuts which secure the wire rope adjustments to the bottom front of the base boom section.*

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



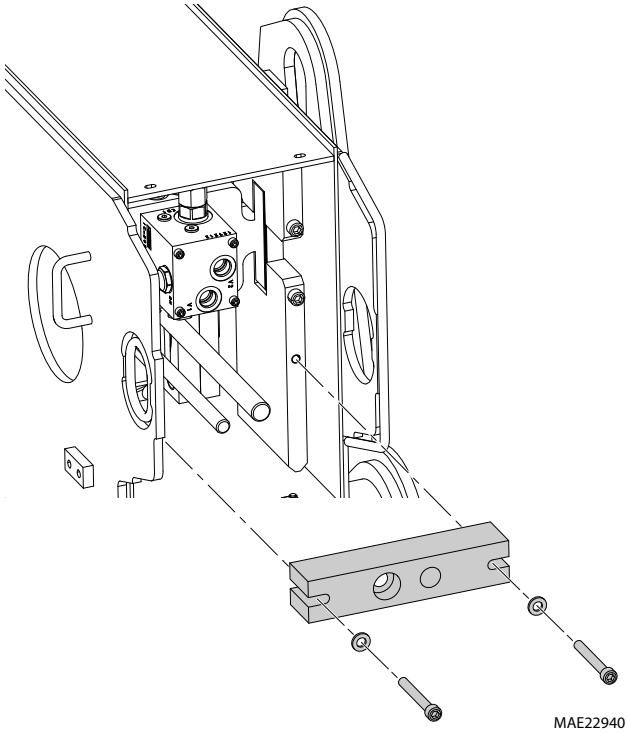
MAE22920

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



MAE22930

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



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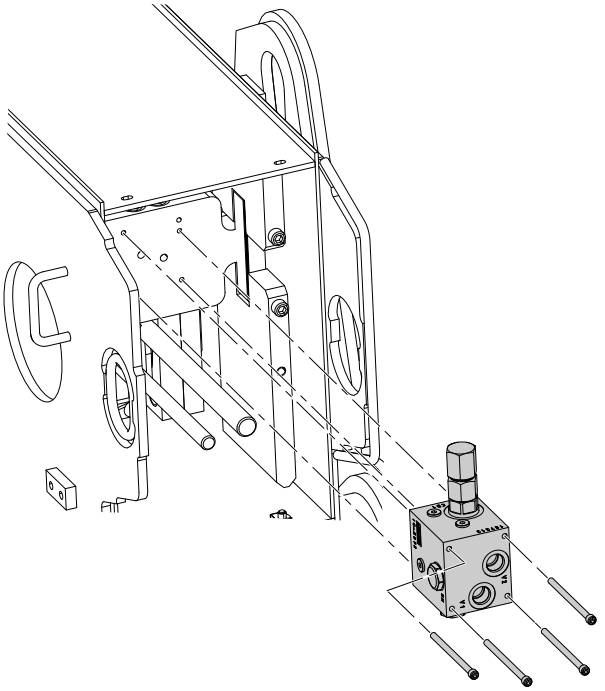
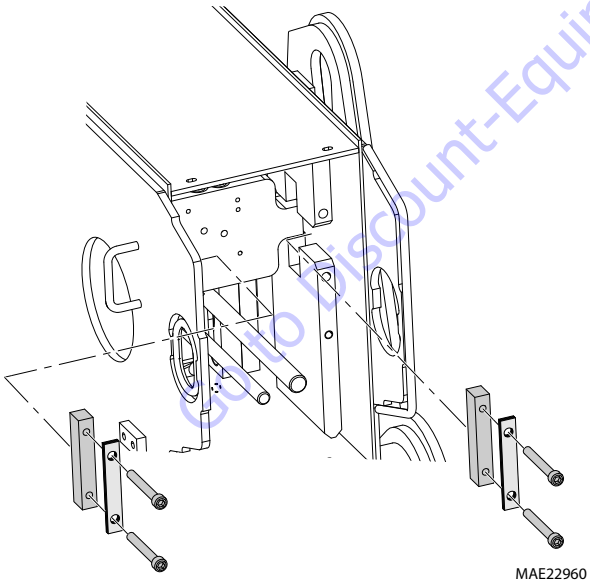
7. Remove hardware securing valve to telescope cylinder. Remove the valve assembly.



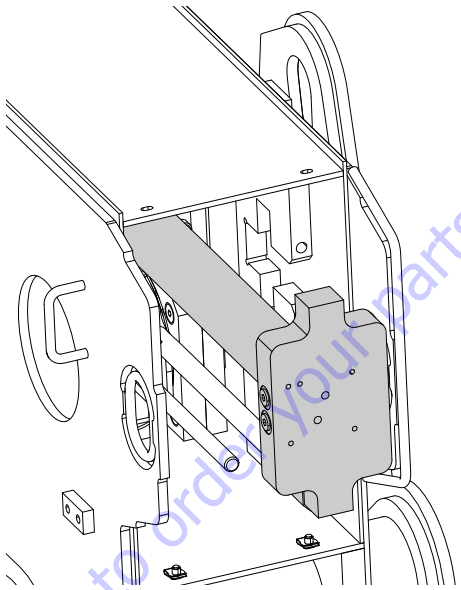
MAE22950

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



MAE22960

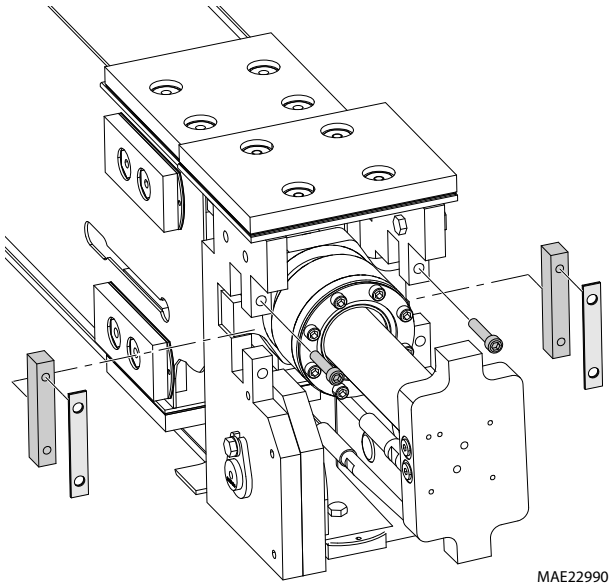
9. Attach an auxiliary hydraulic power source to the telescope cylinder and extend the cylinder rod enough to turn the trunnion in a vertical position.



MAE22970

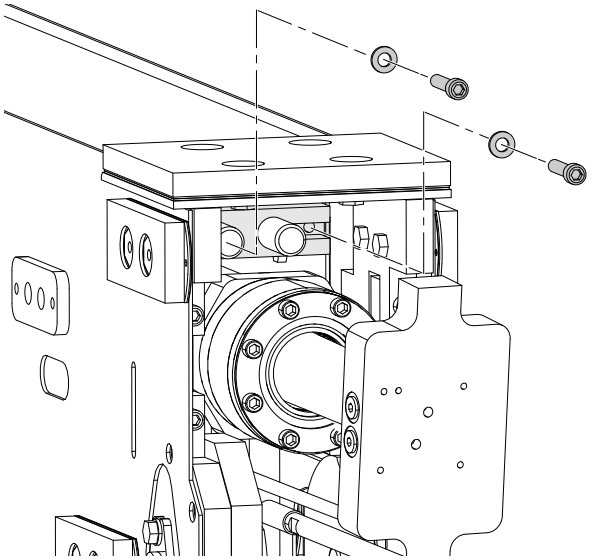
10. Pull the mid and fly boom sections from the base boom section. Use additional lifting device and lifting straps as necessary as the sections are withdrawn. It will be helpful during this step to pull the mid retract cable out from the front of the boom section as the other sections are being pulled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

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



MAE22990

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

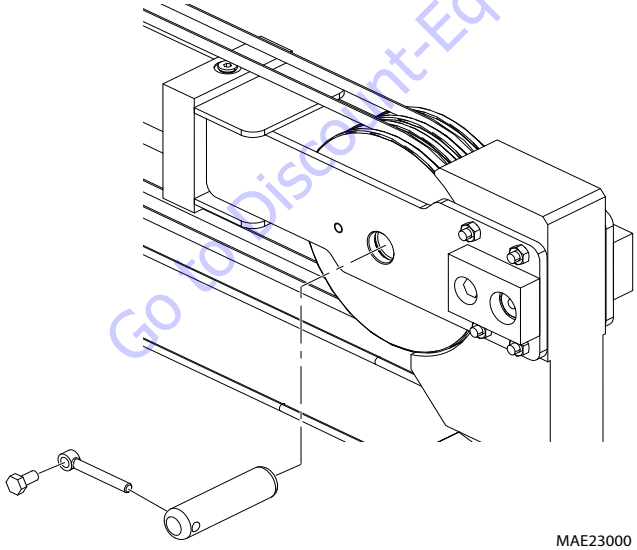


MAE23020

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

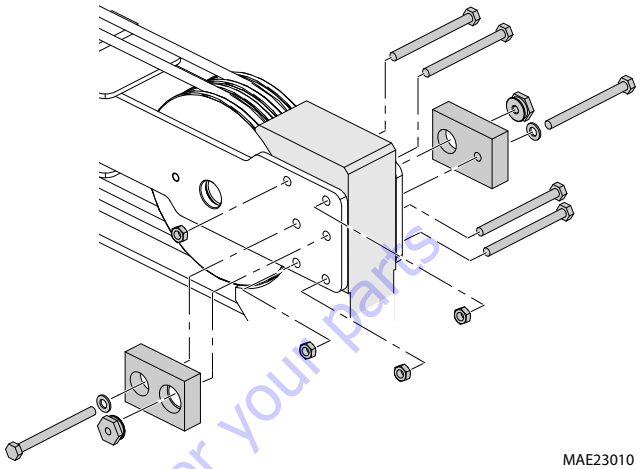
14. Remove extent block and cable from the telescope cylinder.

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



MAE23000

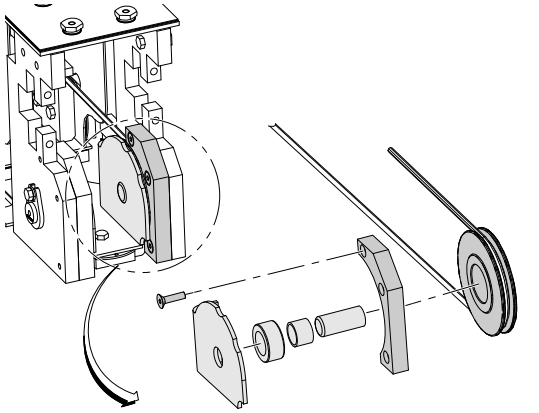
16. Remove spacer and hardware that secure sheave guard to the telescope cylinder.



MAE23010

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

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



MAE23030

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

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

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

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

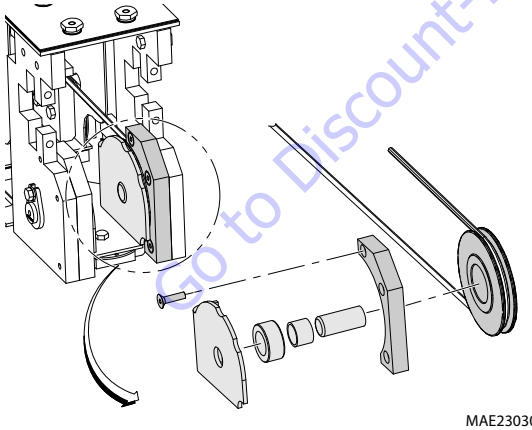
22. Remove the fly boom retract cables from the bottom of the fly boom sections.

23. Thoroughly clean the boom sections.

Assembly

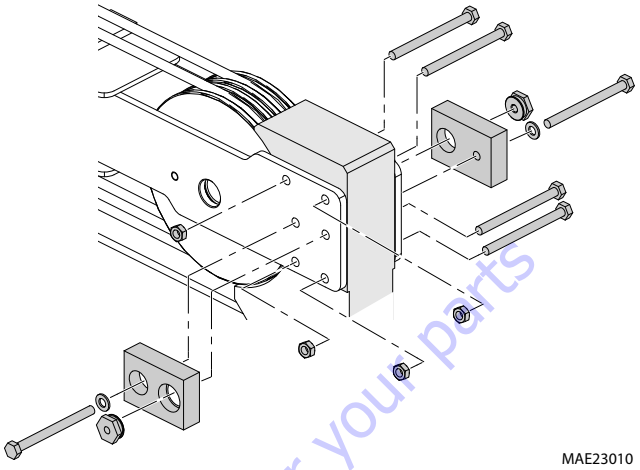
NOTE: *When installing fly section wear pads, install same number and thickness of shims as were removed during disassembly.*

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



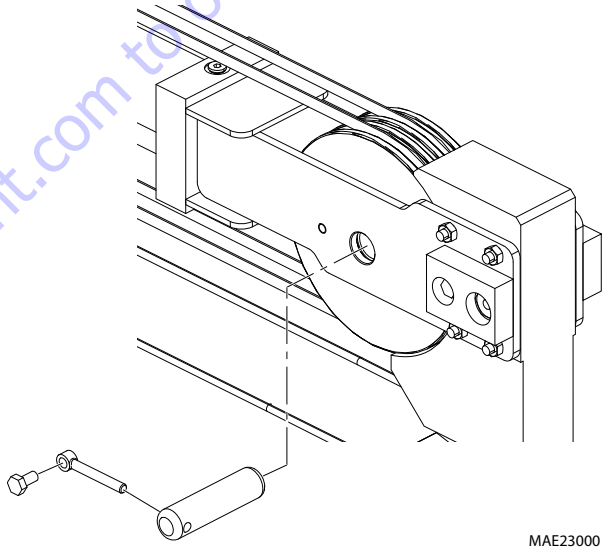
MAE23030

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



MAE23010

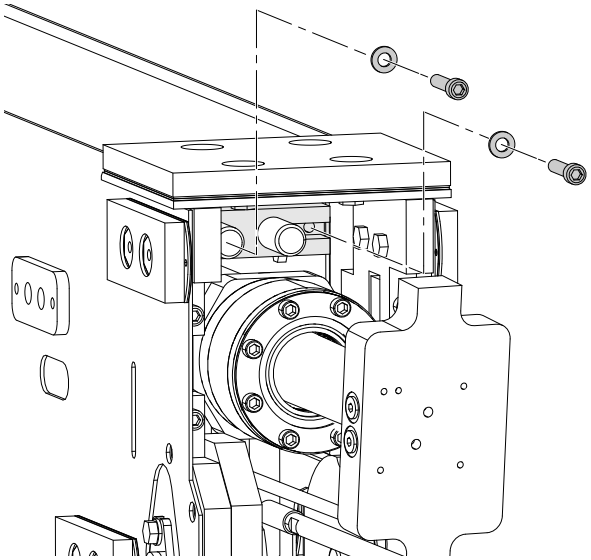
10. Route the cables around the sheave on the cylinder and install the sheave guard.



MAE23000

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

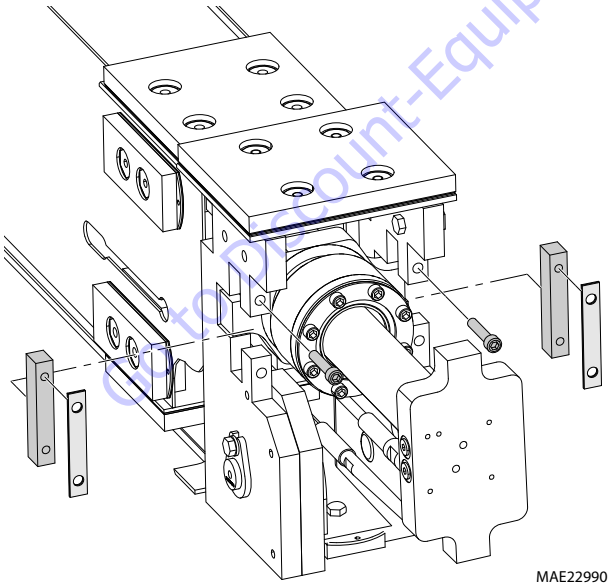
12. Install end of the extend cables into the extend rope block.



MAE23020

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

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



MAE22990

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

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

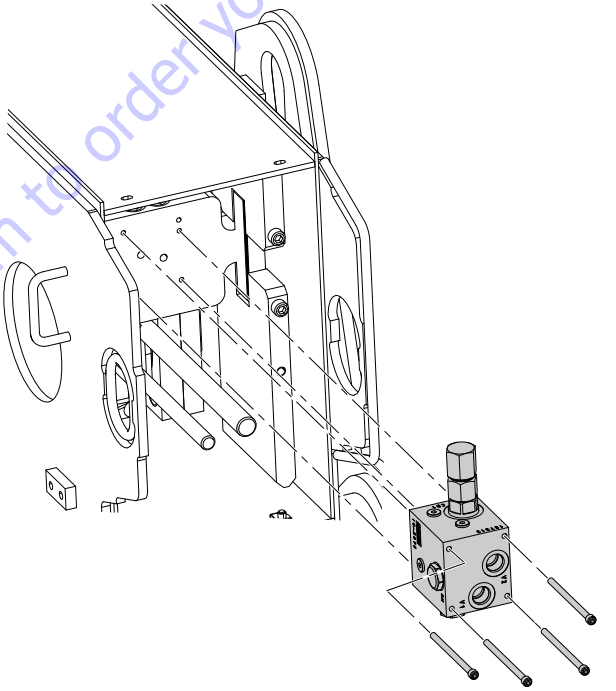
17. Insert the mid, fly and Tele cylinder assembly way into the boom base section enough to be able to pull the outer mid retract cables out through the hole at the bottom front of the boom base section.

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

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

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

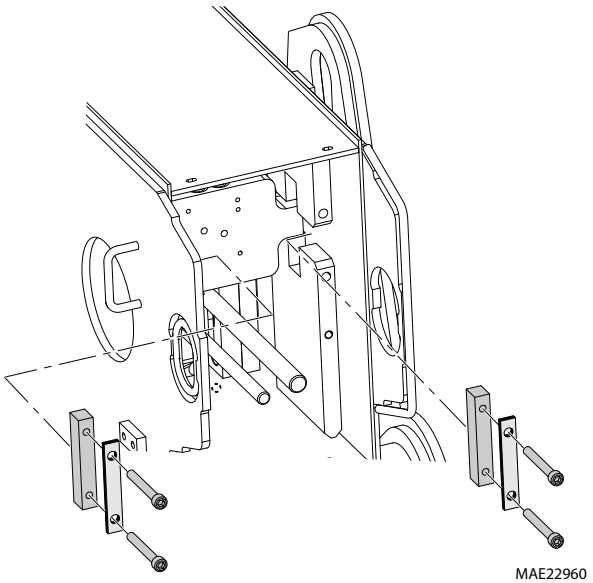
21. Install hardware securing valve to telescope cylinder. Install the valve assembly. Torque the bolts to 42.8 ft. lbs. (58 Nm).



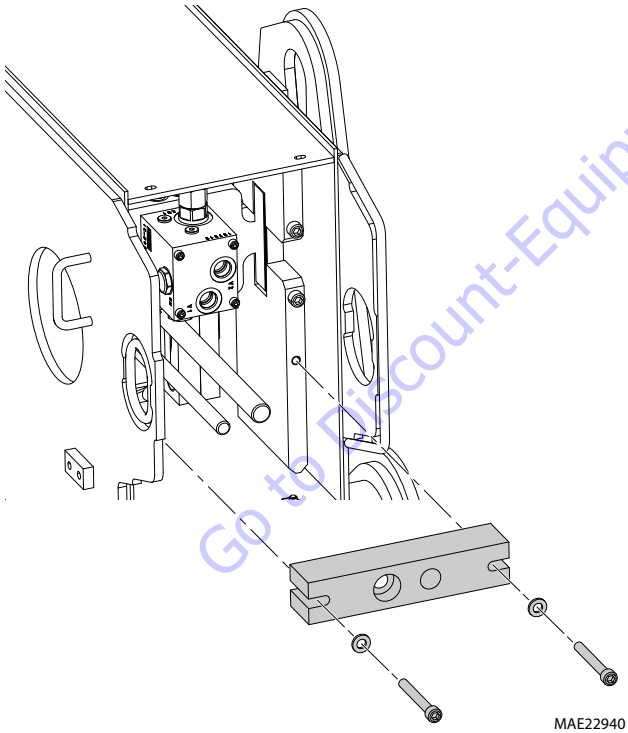
MAE22950

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

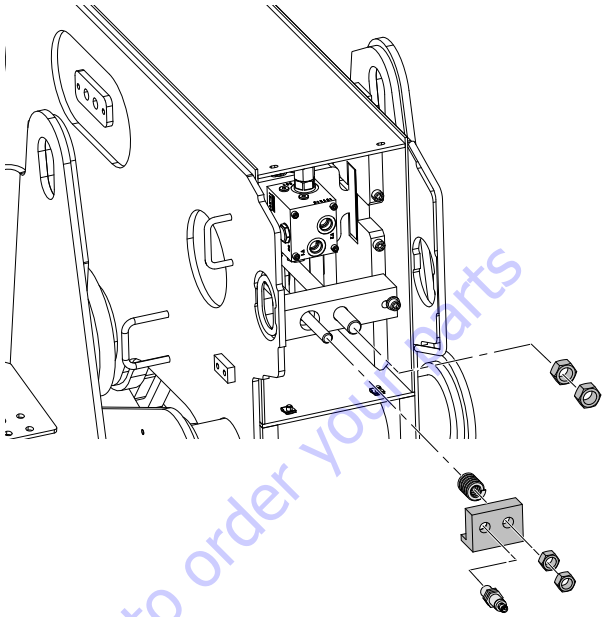
23. Install the four bolts, shims, and bars that secure the telescope cylinder rod to the boom base section. Torque the bolts to 40.6 ft. lbs. (55 Nm).


MAE22960

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

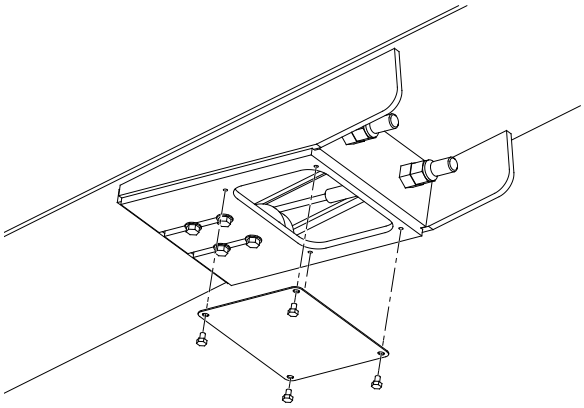

MAE22940

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


MAE22930

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

27. Install the cover plate and sheave blocks.



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

29. Adjust the boom cables. Refer to Section 4.13, Wire Rope Tensioning Adjustment.

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

Installation

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

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

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

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

3. Install pin, keeper pin, and retaining bolt (5) securing tension link to the turntable. Apply JLG Threadlocker (PN 0100011) and torque to 346 ft.lbs. (469 Nm).

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

4. Place the tower link with boom lift cylinder on the proper support.
5. Use an adequate lifting device, lift the boom assembly and install pin, keeper pin, and retaining bolt (4) securing the tower link to the boom assembly. Apply JLG Threadlocker (PN 0100011) and torque to 346 ft.lbs. (469 Nm).
6. Install pin, keeper pin, and retaining bolt (3) securing lift cylinder rod end pin to main boom assembly. Apply JLG Threadlocker (PN 0100011) and torque to 346 ft.lbs. (469 Nm).
7. Using an adequate lifting device, lift and position the boom assembly with tower link and boom lift cylinder on turntable so that the pivot holes of boom assembly and tension link are aligned.
8. Install boom pivot pin, keeper pin, and retaining bolt (2), ensuring that location of hole in pin is aligned with attach point on tension link.
9. Lift and move forward the boom and tower link assembly.
10. Remove metal rod from the turntable lifting eye holes and level the boom assembly to normal position.
11. Install pin, keeper pin, and retaining bolt (1) securing tower link to turntable. Apply JLG Threadlocker (PN 0100011) and torque to 346 ft.lbs. (469 Nm).
12. Reconnect all hydraulic lines as tagged during removal.
13. Reconnect all electrical connections to the boom assembly as tagged during removal.
14. If necessary, adjust retract and extend cables to the proper torque. Refer to Section 4.13, Wire Rope Tensioning Adjustment for wire rope torque procedures.
15. Using all applicable safety precautions, raise and extend boom fully, then retract and lower boom. Check for proper operation and hydraulic leaks.

4.10 MAIN BOOM LIFT CYLINDER

Removal

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

1. Remove main boom assembly with tower link and lift cylinder from the machine and place it on a suitable support. Refer to Section 4.9, Main Boom Assembly for removal procedure.
2. Place blocking under the lift cylinder to prevent it from falling when the attaching hardware is removed.
3. Attach an adequate lifting device and sling to the main lift cylinder.

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

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

Installation

1. Using an adequate lifting device, position the lift cylinder in tower link in the same manner that it was removed.
2. Install trunnion pins (1), hardware and bearings securing boom lift cylinder to the tower link.
3. Install main boom assembly with tower link and lift cylinder to the turntable. Refer to Section 4.9, Main Boom Assembly for Install procedure.

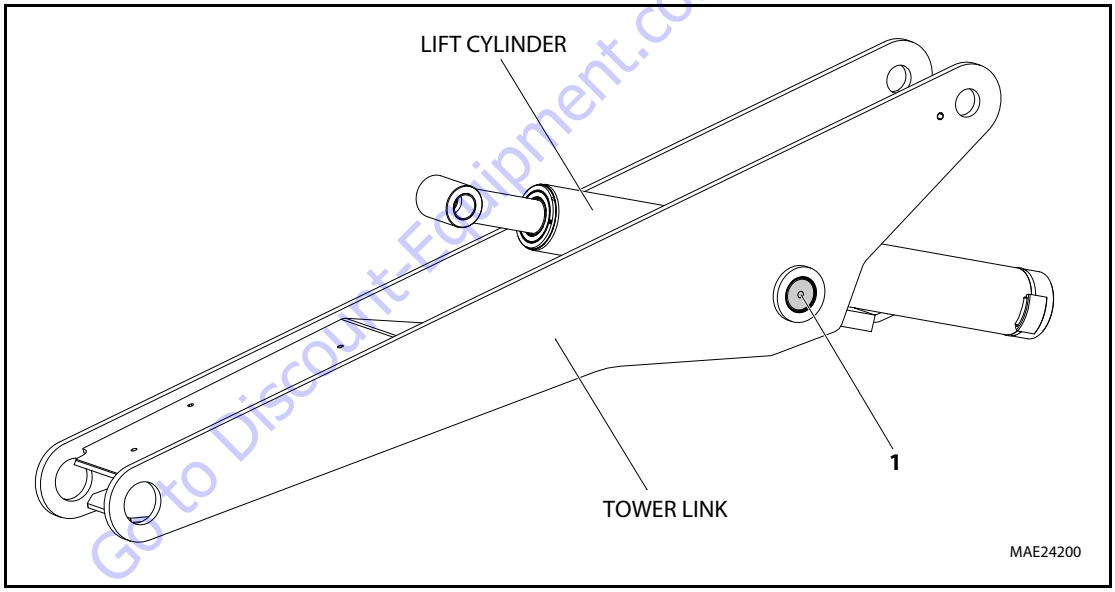


Figure 4-4. Main Boom Lift Cylinder Removal and Installation

4.11 MAIN BOOM POWERTRACK

Removal

1. Disconnect wiring harness from ground control box.

NOTICE

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

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

Installation

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

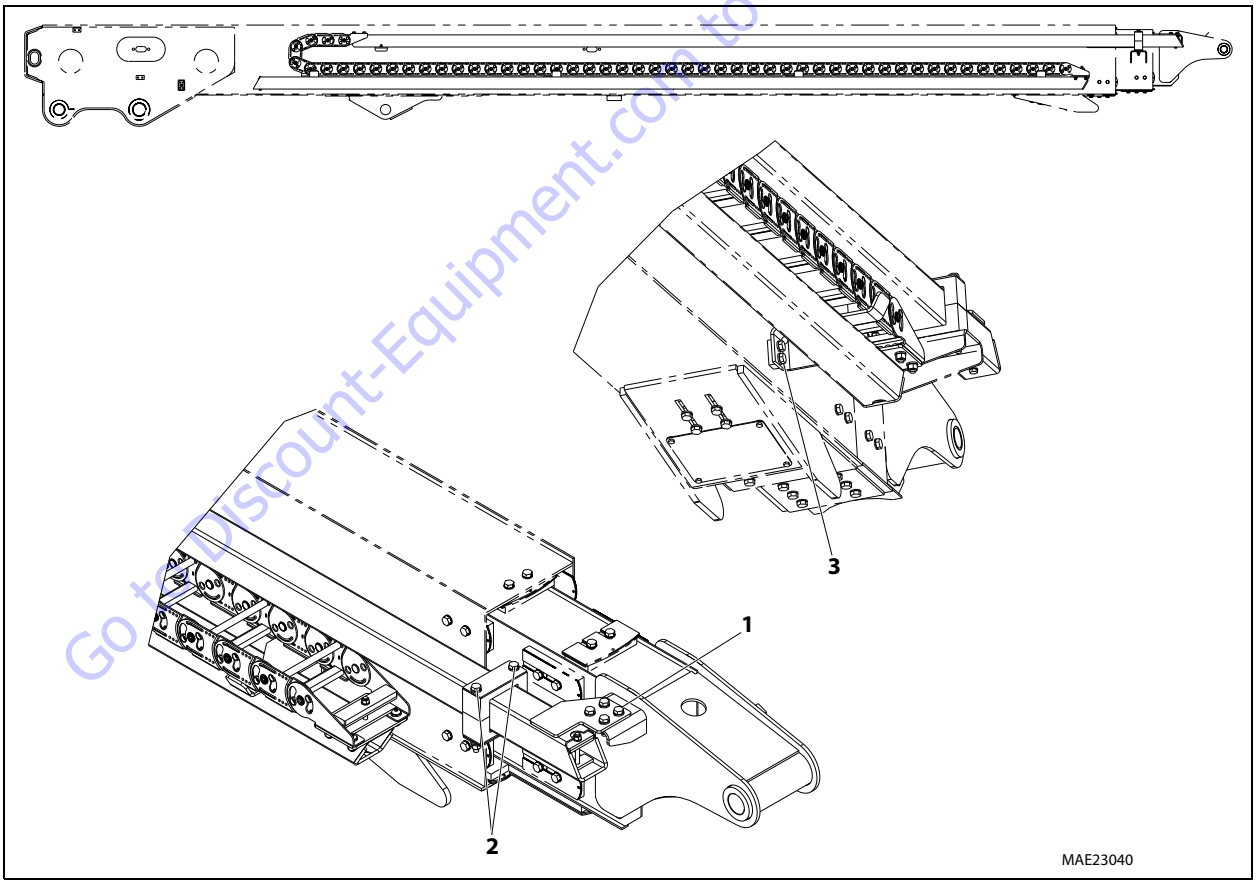
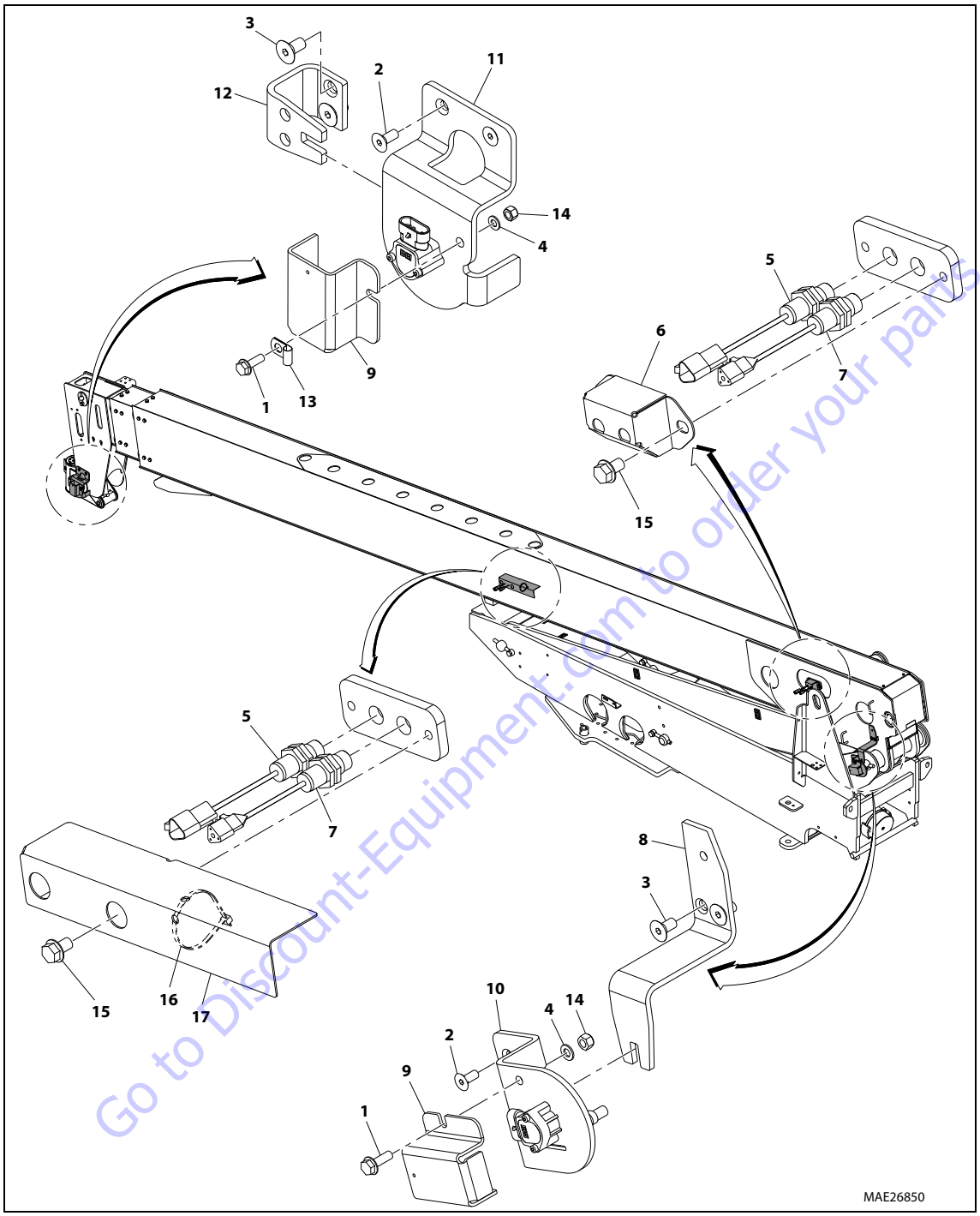
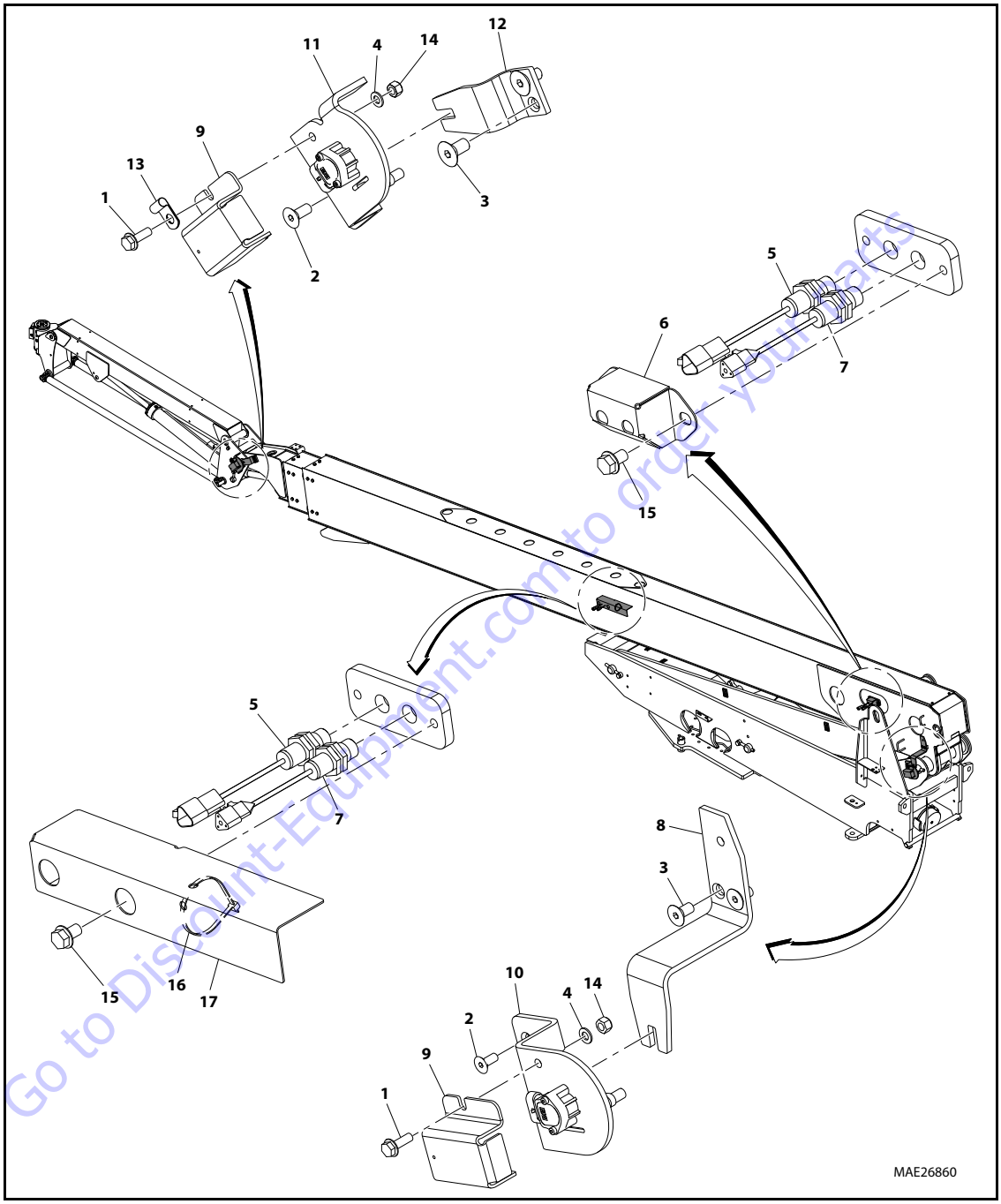


Figure 4-5. Powertrack Components



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

Figure 4-6. Boom Sensors Installation - 600SC



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

Figure 4-7. Boom Sensors Installation - 660SJC

4.12 WIRE ROPE

⚠ WARNING

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

⚠ CAUTION

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

Each day before using machine:

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

Inspection

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

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

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

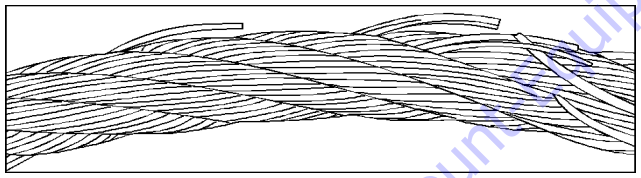


Figure 4-8. Wire Rope Wire Breaks

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

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

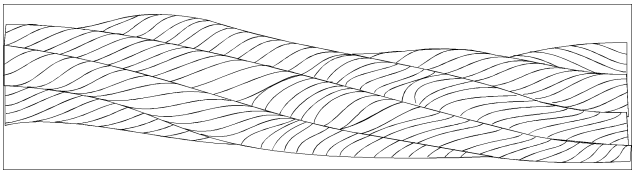


Figure 4-9. Wire Rope Kink

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

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

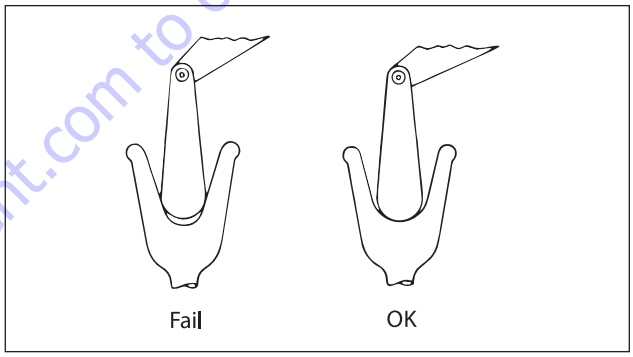


Figure 4-10. Sheave Groove Wear

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

Three Month Inspection

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

Additional Inspection Required If:

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

12 Year or 7000 Hour Replacement

1. Mandatory wire rope and sheave replacement.

Additional Replacement Criteria

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

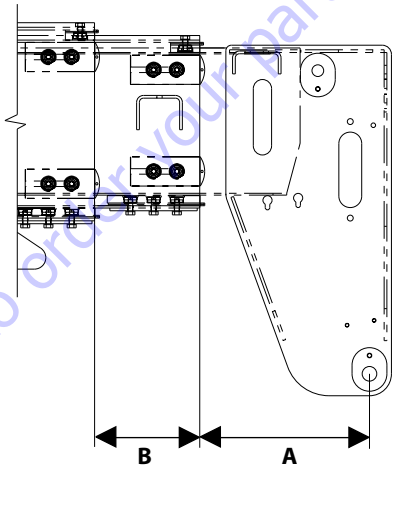
1. Rusted or corroded wire ropes.
2. Kinked, "bird caged", or crushed ropes.
3. Ropes at end of adjustment range.
4. Sheaves failing wearout gage inspection.
5. Ropes with 6 total broken wires in one rope lay, 3 in one strand in one rope lay, 1 valley break, or 1 break at any end termination.

4.13 WIRE ROPE TENSIONING ADJUSTMENT

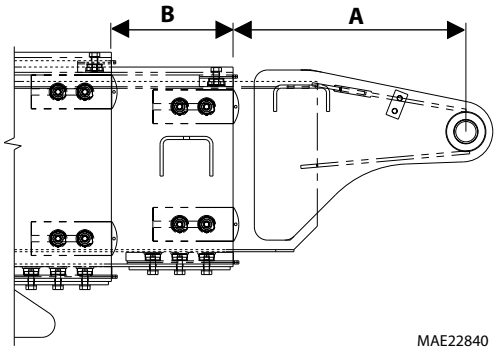
Wire Rope Tensioning Procedure

1. Position boom in fully down and retracted position.

Model	600SC	660SJC
Dim. A	14.6" (37.1cm)	17" (44cm)
Dim. B	9" (23cm)	9" (23cm)



600SC



660SJC

Figure 4-11. Dimensions of Boom Sections

NOTICE

DO NOT CLAMP ON THREADS OR THREADS MAY BE DAMAGED.

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

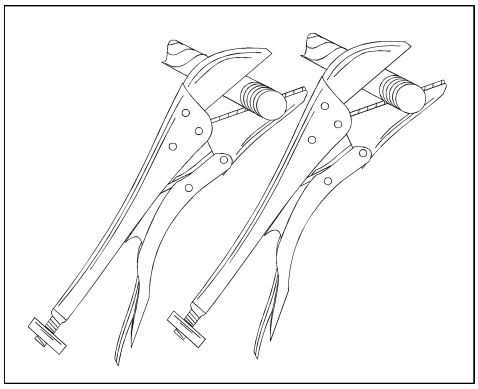


Figure 4-12. Clamping Wire Ropes

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

NOTE: *Step #8 and #9 may need to be repeated to equalize the torque on all 4 wire ropes.*

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

4.14 WIRE ROPE SERVICE INDICATOR

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

4.15 JIB (IF EQUIPPED)

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

Removal

1. For platform and support removal see Section 4.7 - Platform.
2. Position the articulating jib boom level with ground.

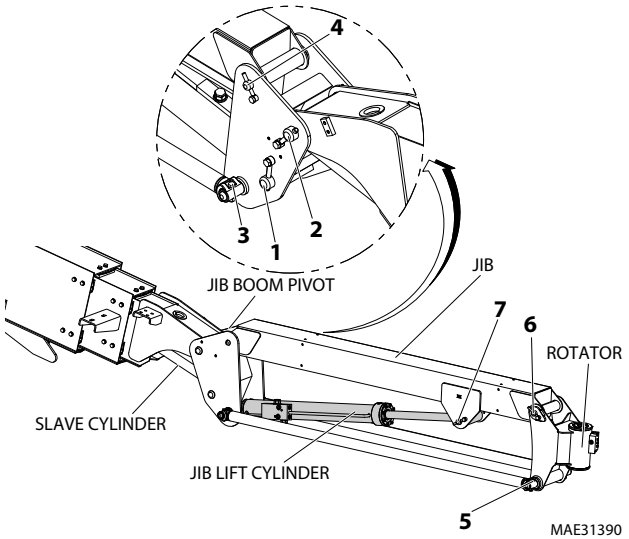
NOTICE

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

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

Disassembly

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



Inspection

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

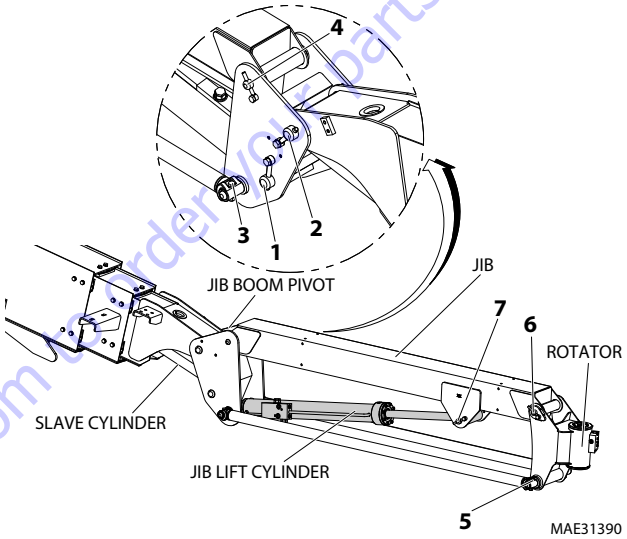
1. Inspect fly boom pivot pin for wear, scoring, tapering and ovality, or other damage. Replace pins as necessary.
2. Inspect fly boom pivot attach points for scoring, tapering and ovality, or other damage. Replace pins as necessary.
3. Inspect inner diameter of fly boom pivot bearings for scoring, distortion,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

Assembly

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

Installation

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



4.16 BOOM CLEANLINESS GUIDELINES

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

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

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

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

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

4.17 FOOT SWITCH ADJUSTMENT

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

⚠ WARNING

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

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

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

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

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

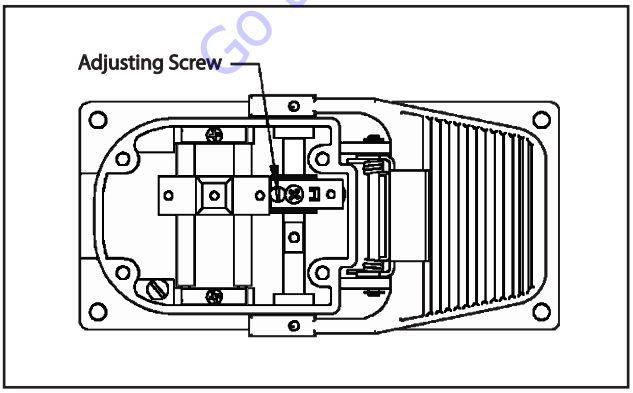


Figure 4-13. Foot Switch Adjustment

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

4.18 PLATFORM CONTROL ENABLE SYSTEM

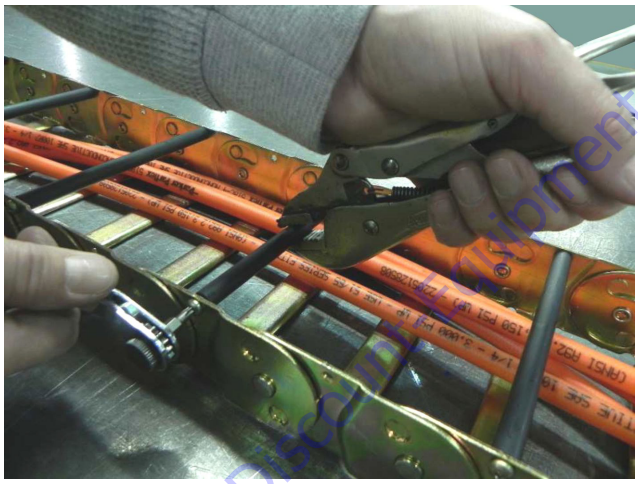
The platform controls use a time dependant enable circuit to limit the time availability of "live" or enabled controls. When the footswitch is depressed, the controls are enabled and the operator has 7 seconds to operate any control. The controls will remain enabled as long as the operator continues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

4.19 POWERTRACK MAINTENANCE

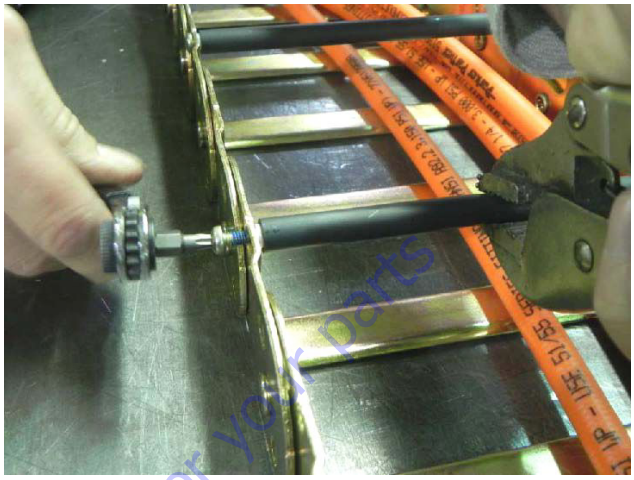
Remove Link

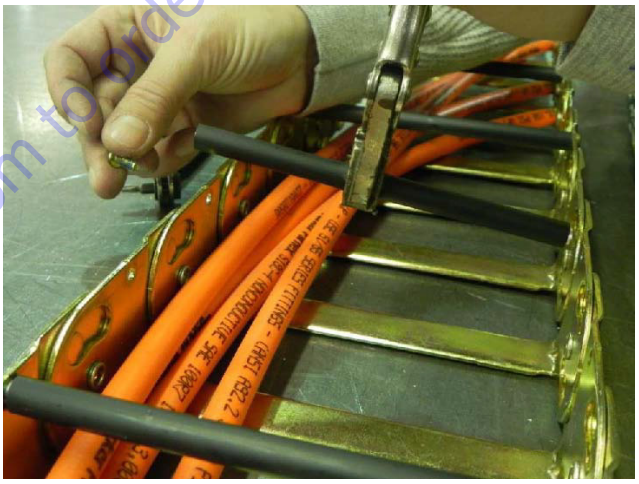
NOTE: *Hoses shown in powertrack are for example only. Actual hose and cable arrangements are different.*

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



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

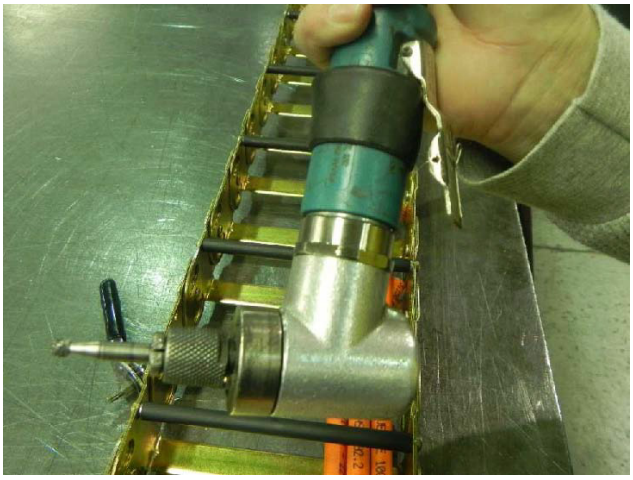




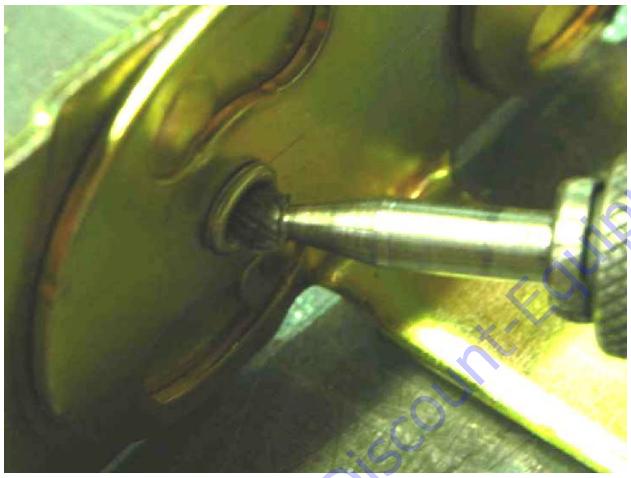
NOTICE

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

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

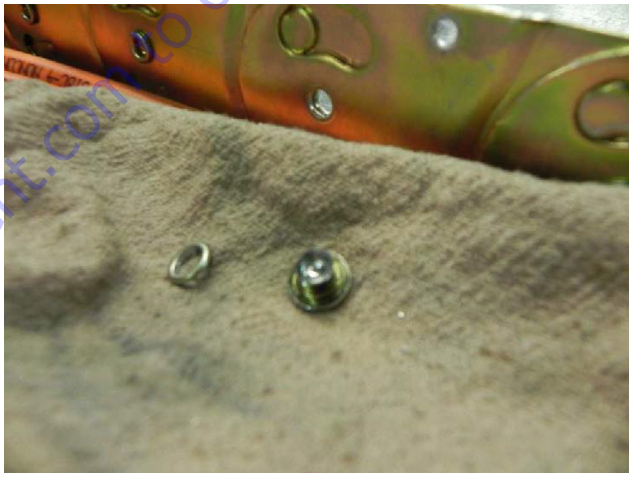


4. insert tool into rolled over end of rivet. Grind out middle of rivet until rolled over part of rivet falls off. Repeat for all rivets to be removed.

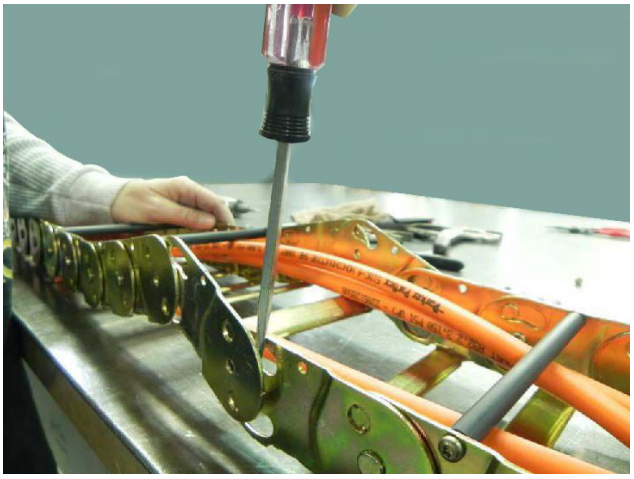


5. After grinding it may be necessary to use a center punch with a hammer to remove rivet.

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



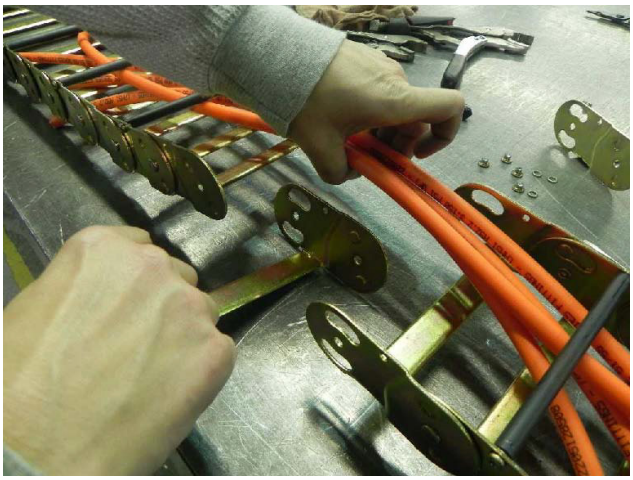
6. Insert flat head screwdriver between links. Twist and pull links apart.



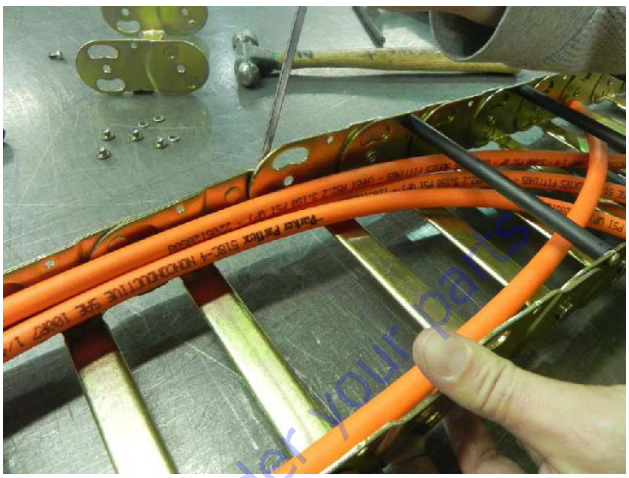
7. Remove link from other section of powertrack using screwdriver.

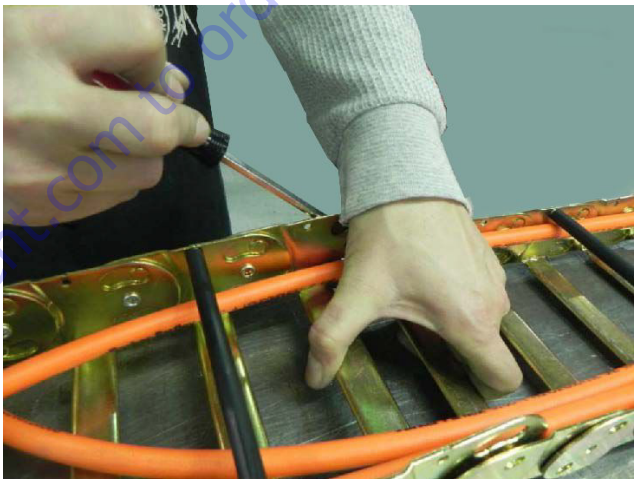
Install New Link

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

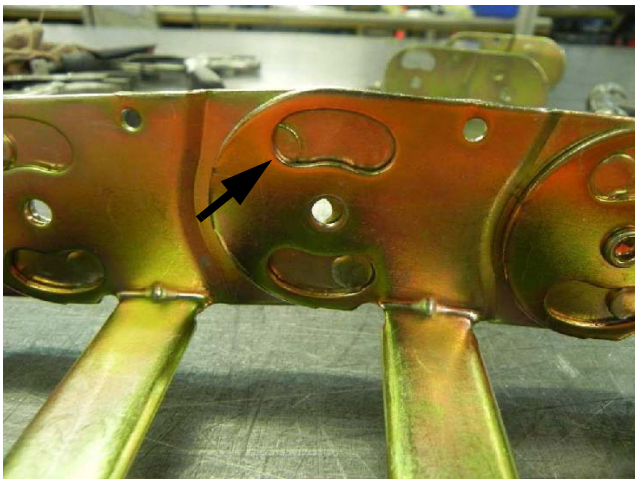


2. Spread half-shear (female) end of new link and slide cut-out end of track section into it. Use screwdriver if necessary.

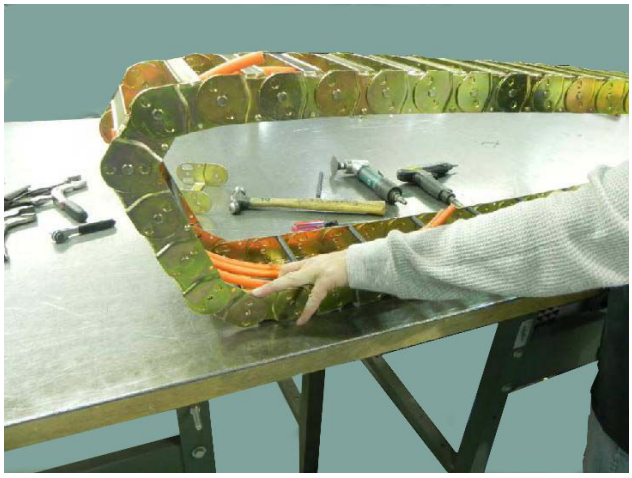




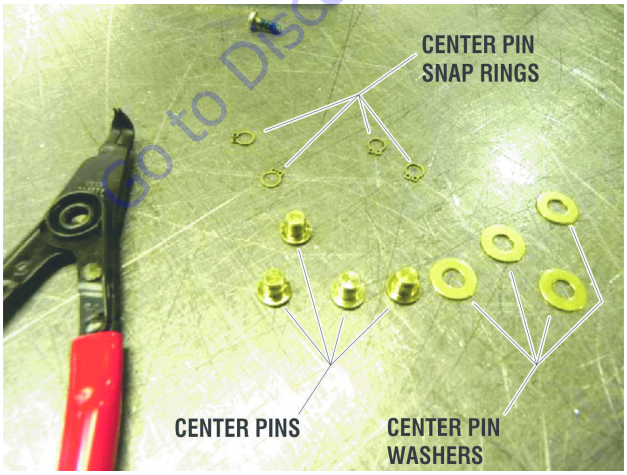
3. Round half-shears will not fit properly in cut-outs after new link is installed.



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



5. Parts shown below connect new link to powertrack.

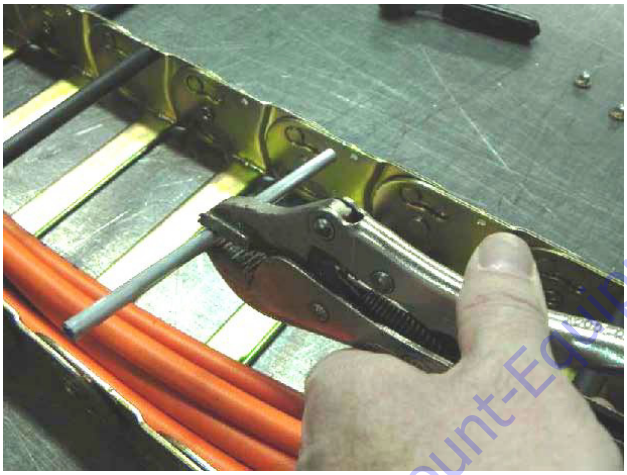


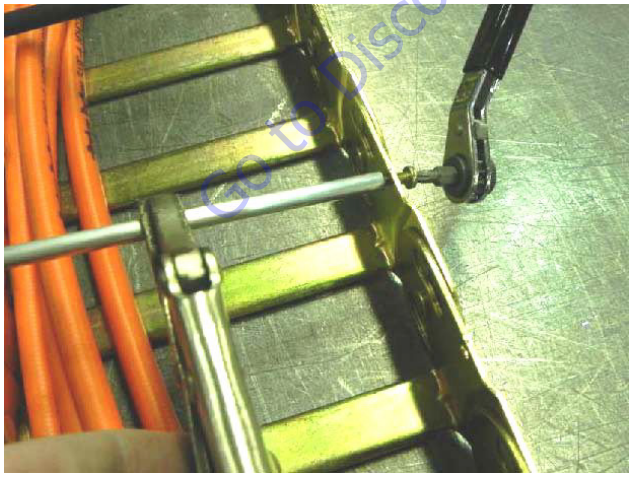
6. Push pin through center hole. Slide washer on pin.

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

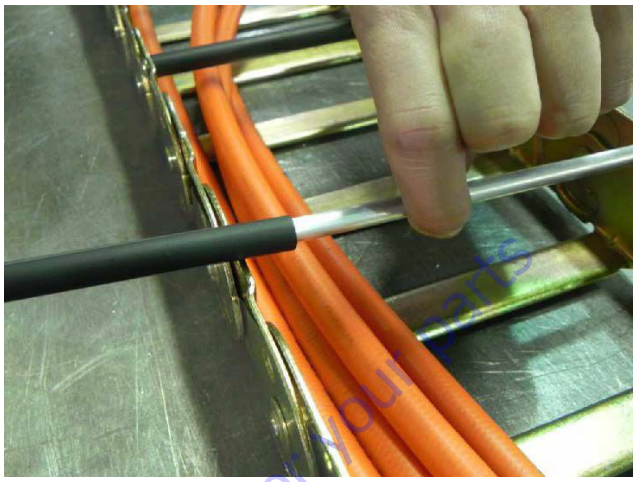
NOTE: *Make sure snap rings are seated in pin groove and closed properly.*

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

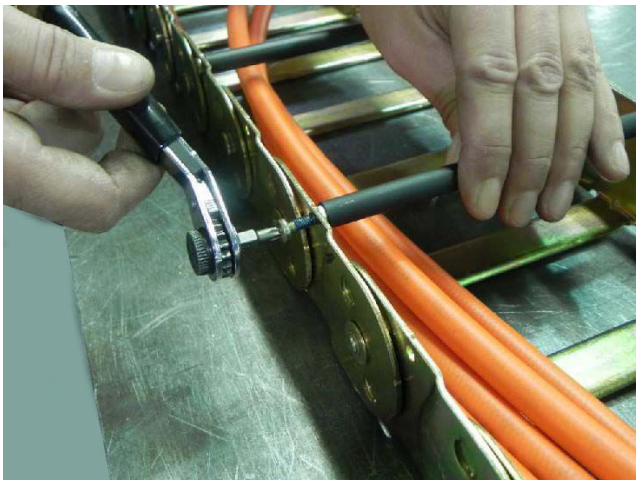




2. Pull up on other end of round bar. Slide new poly roller on bar.

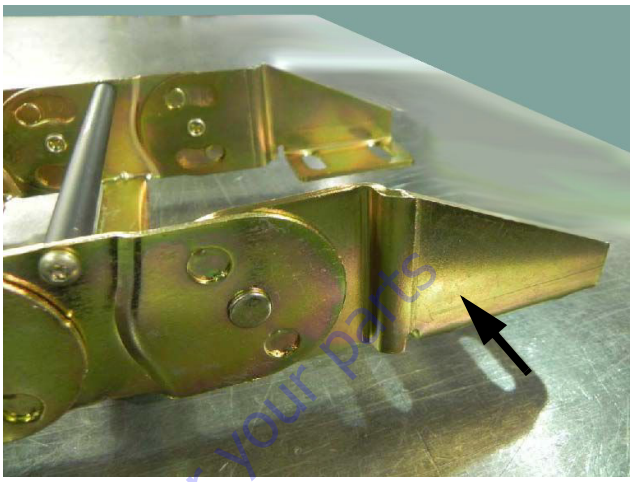


3. Install new 8-32 x 0.500 self threading screw on other side. Torque to 18-20 in-lb (2-2.25 Nm).



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

Replace Fixed End Brackets



NOTICE

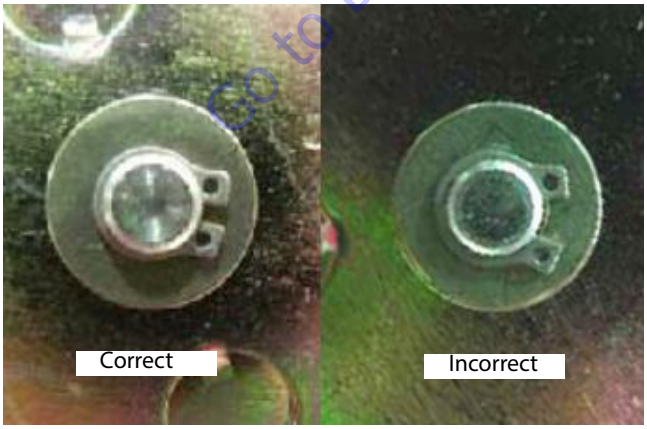
REPOSITION CABLES/HOSES. KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

1. Remove rivets as shown in link removal instructions.

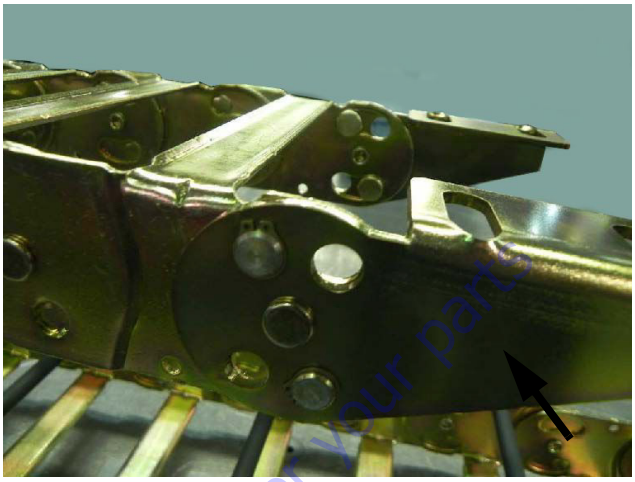
2. Parts used: Bracket Center Pin and Center Pin Snap Ring.

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

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



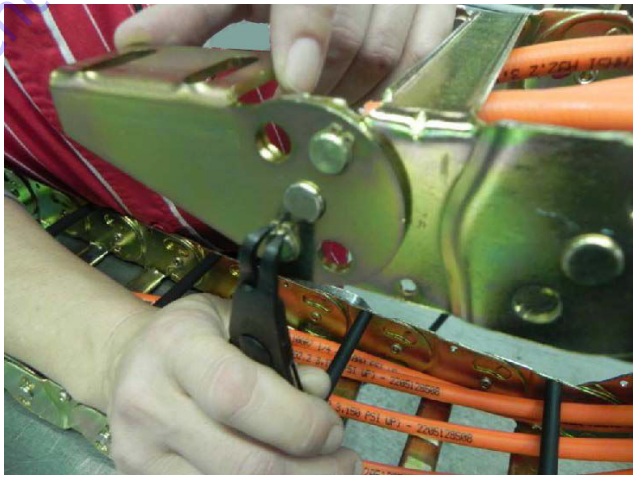
Replace Moving End Brackets



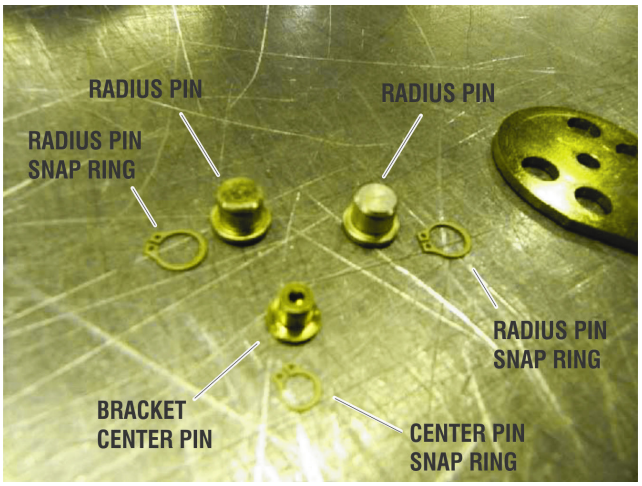
NOTICE

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

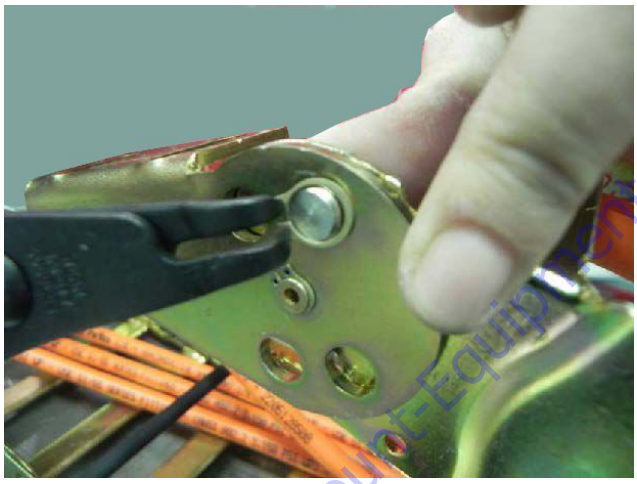
1. Remove existing pins and center rivet. Remove rivet as shown in link removal instructions on page 4-25. Repeat on other bracket if replaced.



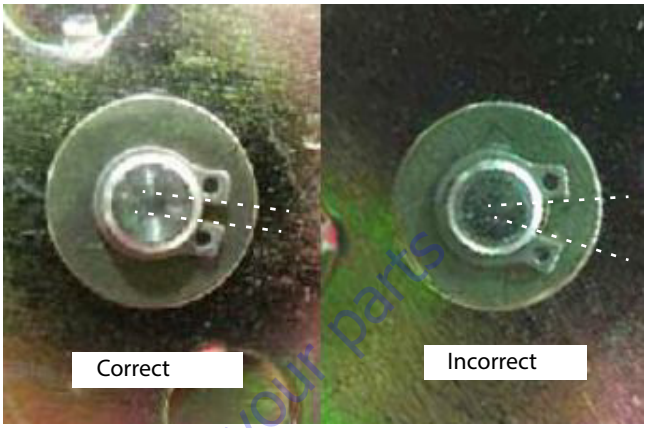
2. Install center pin with snap ring in new bracket.



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



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



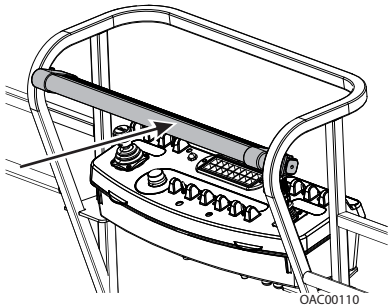
4. Make sure both brackets rotate correctly.

4.20 SKYGUARD

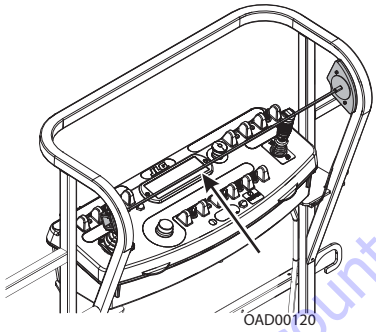
Operation

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

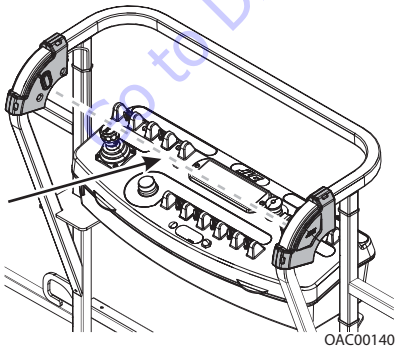
Consult the following illustrations to determine which type of SkyGuard the machine is equipped with. Regardless of the type, SkyGuard function according to the SkyGuard Function Table does not change.



SkyGuard



SkyGuard SkyLine™



SkyGuard SkyEye™

⚠ WARNING

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

Function Test

SKYGUARD ONLY

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

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

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

In Ground Mode:

Operation is allowed regardless of SkyGuard activation.

SOFT TOUCH ONLY

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

SKYGUARD NOT SELECTED IN MACHINE SETUP

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

Diagnostics & Troubleshooting

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

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

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

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

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

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

FAULT CODES

Refer to Table 6-14 for more fault code information

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

Table 4-1. SkyGuard Function Table

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

PARTS FINDER

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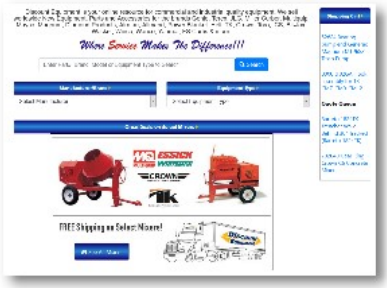

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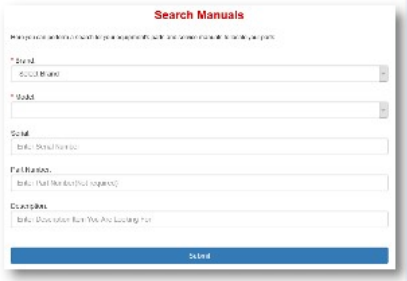

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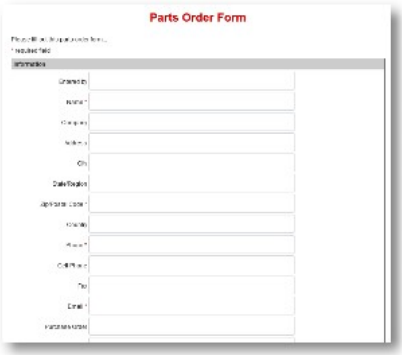

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SECTION 5. BASIC HYDRAULICS INFORMATION & SCHEMATICS

5.1 LUBRICATING O-RINGS IN THE HYDRAULIC SYSTEM

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

NOTE: *All O-ring fittings must be pre-lubricated with hydraulic oil prior to assembly.*

Cup and Brush

The following is needed to correctly oil the o-ring in this manner:

- Small container for hydraulic oil
- Small paint brush

1. Hold the fitting in one hand while using the brush with the other hand to dip into the container. Remove excess hydraulic oil from the brush so an even film of oil is applied on the o-ring.

2. Holding the fitting over the hydraulic oil container, brush an even film of oil around the entire o-ring in the fitting, making sure the entire o-ring is completely saturated.

3. Turn the o-ring on the other side of the fitting and repeat the previous step, ensuring the entire o-ring is coated with hydraulic oil.

Dip Method

NOTE: *This method works best with Face Seal o-rings, but will work for all o-ring fitting types.*

The following is needed to correctly oil the o-ring in this manner:

- A small leak proof container
- Sponge cut to fit inside container
- A small amount of hydraulic oil to saturate sponge.

1. Place sponge inside container and add hydraulic oil to the sponge until fully saturated.
2. Dip the fitting into the sponge using firm pressure. Upon lifting the fitting, a small droplet will form and drip from the bottom of the fitting. This should signify an even coating of oil on the fitting.

3. O-ring Boss type fittings will require more pressure in able to immerse more of the fitting into the saturated sponge. This will also cause more oil to be dispersed from the sponge.

Spray Method

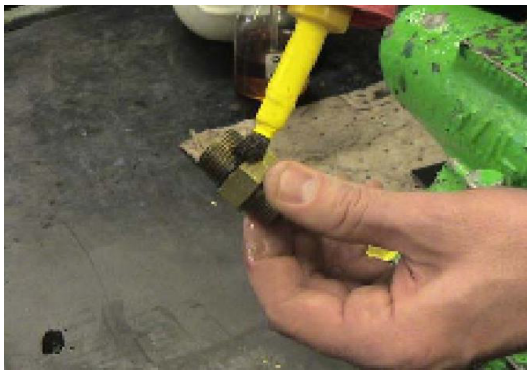
This method requires a pump or trigger spray bottle.

1. Fill the spray bottle with hydraulic oil.
2. Hold the fitting over suitable catch can.
3. Spray entire o-ring surface with a medium coat of oil.

Brush-on Method

This method requires a sealed bottle brush.

1. Fill the bottle with hydraulic oil.
2. Using slight pressure to the body of the spray bottle, invert the bottle so the brush end is in the downward position.
3. Brush hydraulic oil on the entire o-ring, applying an even coat of oil.



5.2 HYDRAULIC CONNECTION ASSEMBLY AND TORQUE SPECIFICATION

Tapered Thread Types

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

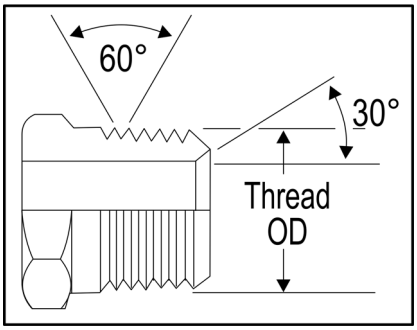


Figure 5-1. NPTF Thread

BSPT = British standard pipe tapered per ISO7-1

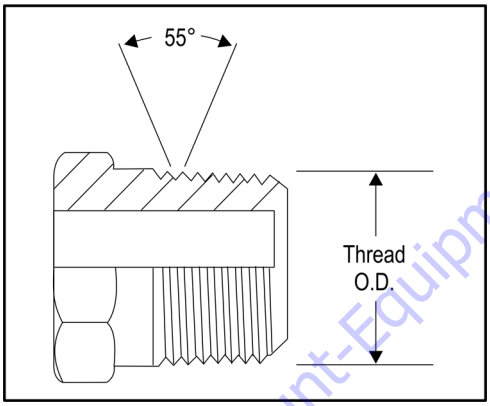


Figure 5-2. BSPT Thread

Straight Thread Types, Tube and Hose Connections

JIC = 37° flare per SAE J514

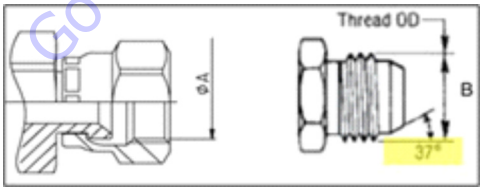


Figure 5-3. JIC Thread

SAE = 45° flare per SAE J512

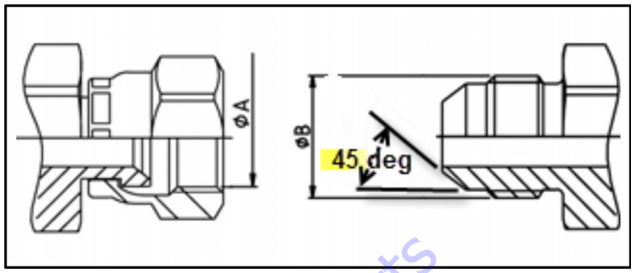


Figure 5-4. SAE Thread

ORFS = o-ring face seal per SAE J1453

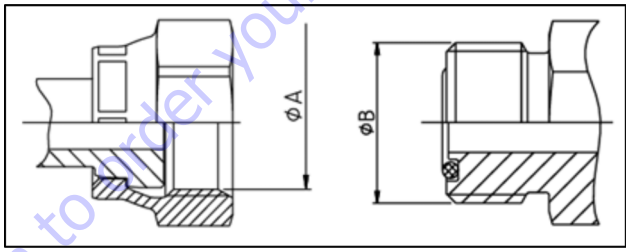


Figure 5-5. ORFS Thread

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

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

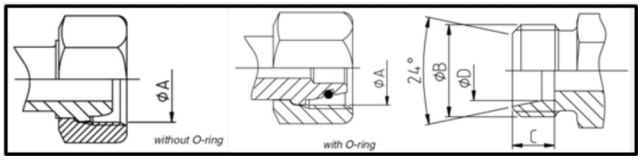


Figure 5-6. MTBL-MBTS Thread

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

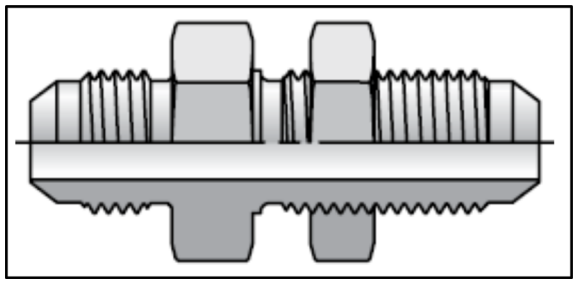


Figure 5-7. Bulkhead Thread

Straight Thread Types, Port Connections

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

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

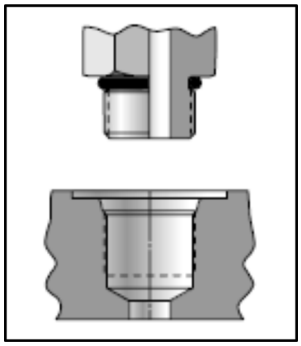


Figure 5-8. ORB-MPP Thread

MFF = metric flat face port per ISO 9974-1

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

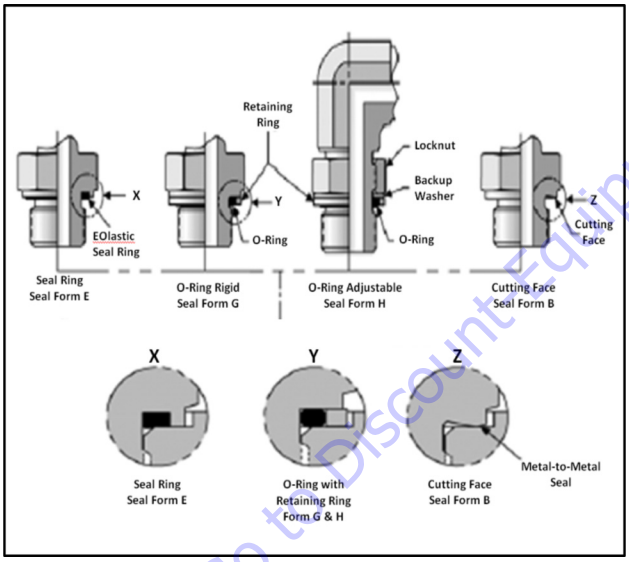


Figure 5-9. MFF-BSPP Thread

Flange Connection Types

FL61 = code 61 flange per SAE J518, ISO 6162

FL62 = code 62 flange per SAE J518, ISO 6162

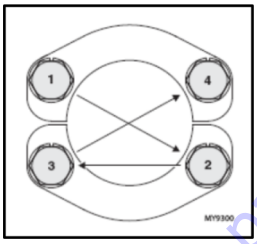


Figure 5-10. FL61-FL62

Tightening Methods

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

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

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

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

Assembly And Torque Specifications

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

GENERAL TUBE TYPE FITTING ASSEMBLY INSTRUCTIONS

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

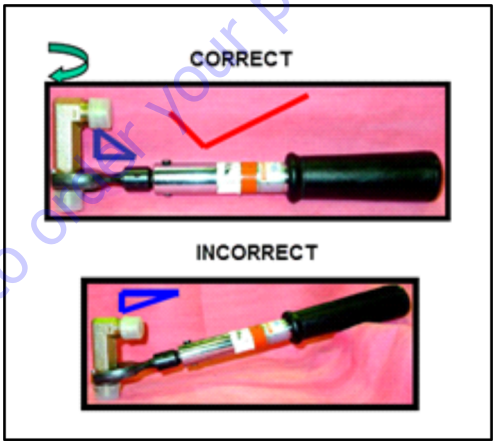


Figure 5-11. Torque Wrench Angle

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

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

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply a suitable thread sealant, such as Loctite 567, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

⚠ CAUTION

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

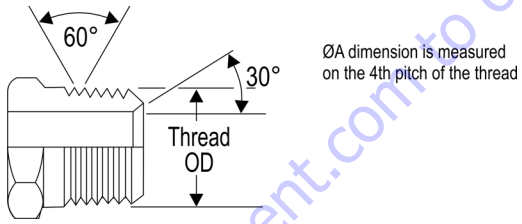
NEVER BACK OFF (LOOSEN) PIPE THREADED CONNECTORS TO ACHIEVE ALIGNMENT. MEET THE MINIMUM REQUIRED TURNS AND USE THE LAST TURN FOR ALIGNMENT.

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

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

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

Table 5-1. NPTF Pipe Thread



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

* ØA thread dimension for reference only.

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

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

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply a suitable thread sealant, such as Loctite 567, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

⚠ CAUTION

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

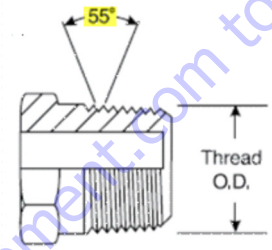
NEVER BACK OFF (LOOSEN) PIPE THREADED CONNECTORS TO ACHIEVE ALIGNMENT. MEET THE MINIMUM REQUIRED TURNS AND USE THE LAST TURN FOR ALIGNMENT.

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

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

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

Table 5-2. BSPT Pipe Thread



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

* ØA thread dimension for reference only.

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

Assembly Instructions for 37° (JIC) Flare Fittings

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

⚠ CAUTION

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

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

⚠ CAUTION

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

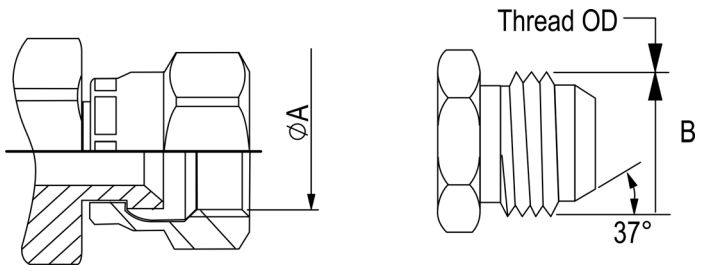
3. Torque assembly to value listed in Table 5-3, 37° Flare (JIC) Thread - Steel or Table 5-4, 37° Flare (JIC) Thread - Aluminum/Brass while using the Double Wrench Method per Double Wrench Method. Refer to FFWR and TFFT Methods for procedure requirements if using the FFWR method.

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

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

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

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

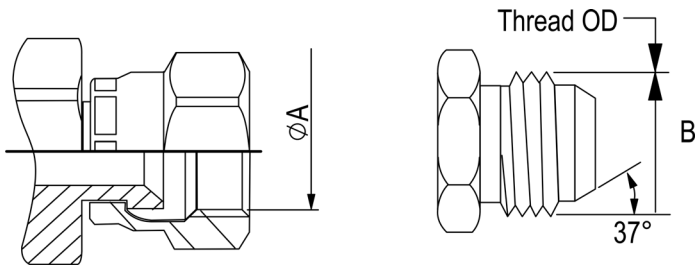


TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	6	7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

* ØA and ØB thread dimensions for reference only.

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

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



TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	4	4	5	5	6	7	--
	3	3/8-24	0.34	8.60	0.37	9.50	5	6	7	7	8	9	--
	4	7/16-20	0.39	10.00	0.44	11.10	8	9	9	11	12	13	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	9	10	10	12	13	14	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	14	15	16	19	20	21	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	27	29	30	37	39	41	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	39	41	43	53	56	58	1 to 1-1/2
	12	11/16-12	0.97	24.60	1.06	27.00	55	57	60	74	78	81	1 to 1-1/2
	14	13/16-12	1.11	28.30	1.19	30.10	65	68	72	88	93	97	1 to 1-1/2
	16	15/16-12	1.23	31.30	1.31	33.30	77	81	84	104	109	114	3/4 to 1
	20	15/8-12	1.54	39.20	1.63	41.30	109	115	120	148	155	163	3/4 to 1
	24	17/8-12	1.80	45.60	1.87	47.60	127	133	139	172	180	189	3/4 to 1
	32	21/2-12	2.42	61.50	2.50	63.50	172	181	189	234	245	257	3/4 to 1

* ØA and ØB thread dimensions for reference only.

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

Assembly Instructions for 45° SAE Flare Fittings

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

⚠ CAUTION

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

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

⚠ CAUTION

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

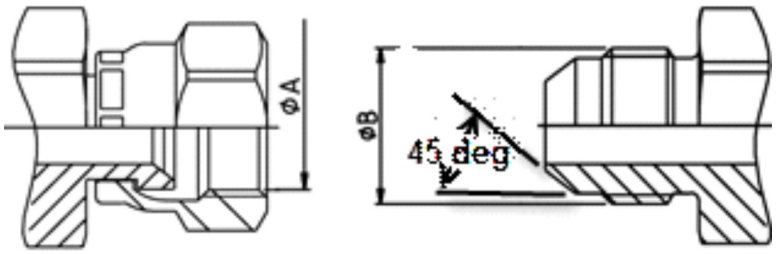
4. Torque fitting to value listed in Table 5-5, 45° Flare (SAE) - Steel and Table 5-6, 45° Flare (SAE) - Aluminum/Brass while using the Double Wrench Method outlined in this section. Refer to FFWR and TFFT Methods for procedure requirements if using the TFFT method.

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

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

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

Table 5-5. 45° Flare (SAE) - Steel

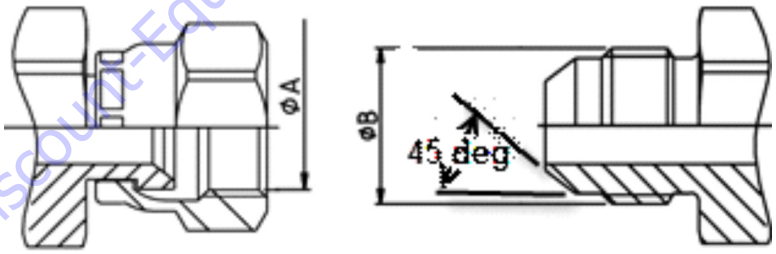


TYPE/FITTING IDENTIFICATION							Torque						Turns From Finger Tight (TFFT)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	13	14	14	18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

* ØA and ØB thread dimensions for reference only.

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

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



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

* ØA and ØB thread dimensions for reference only.

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

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

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

⚠ CAUTION

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

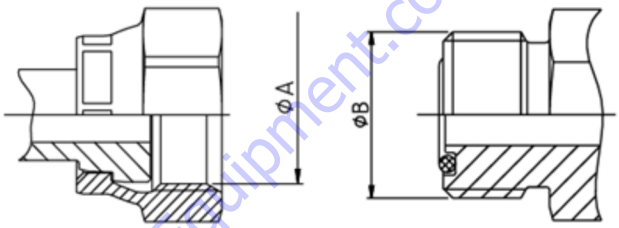
3. Pre-lubricate the O-ring with Hydraulic Oil.
4. Place the tube assembly against the fitting body so that the flat face comes in contact with the O-ring. Hand thread the nut onto the fitting body.
5. Torque nut to value listed in Table 5-7, O-ring Face Seal (ORFS) - Steel or Table 5-8, O-ring Face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

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

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

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

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

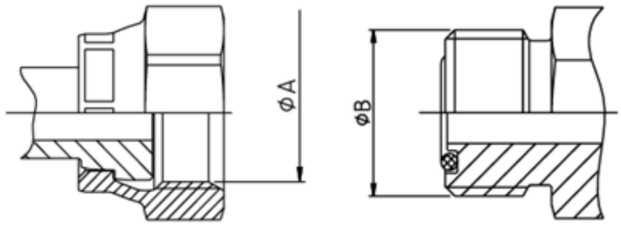


TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**	
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18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

* ØA and ØB thread dimensions for reference only.

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

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



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

* ØA and ØB thread dimensions for reference only.

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

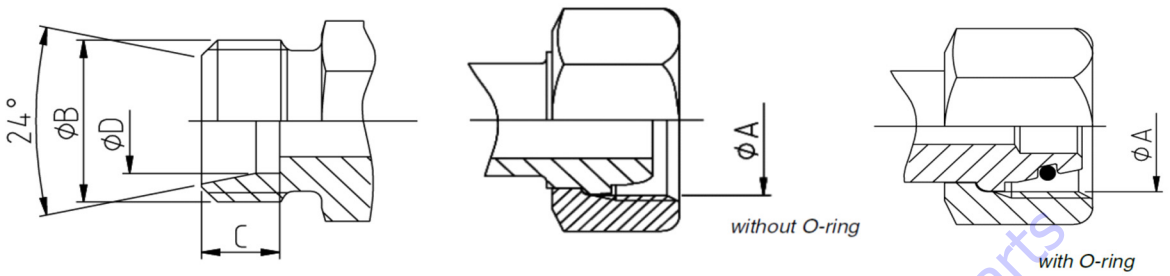
Assembly Instructions for DIN 24° Flare Bite Type Fittings (MBTL and MBTS)

⚠ CAUTION

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

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

Table 5-9. DIN 24° Cone (MBTL & MBTS)



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

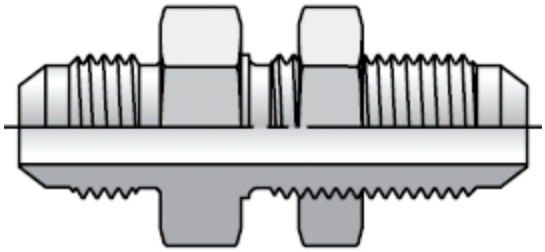
* ØA, ØB, C, & ØD thread dimensions for reference only.

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

Assembly Instructions for Bulkhead (BH) Fittings

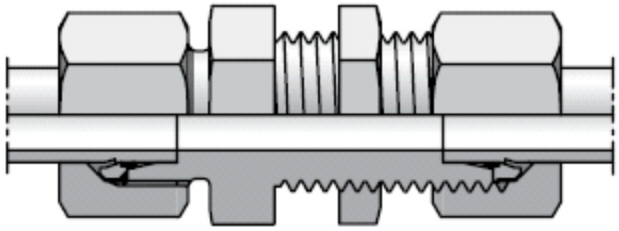
1. Ensure threads and surface are free of rust, weld and brazing splatter, splits, burrs or other foreign material. If necessary replace fitting or adapter.
2. Remove the locknut from the bulkhead assembly.
3. Insert the bulkhead side of the fitting into the panel or bulkhead bracket opening.
4. Hand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

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



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

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



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

Assembly Instructions for O-Ring Boss (ORB) Fittings

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

⚠ CAUTION

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

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

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

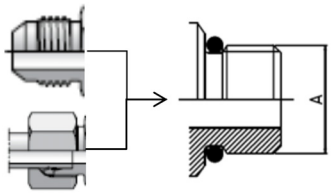
NOTE: *Torque values provided in Table 5-12 thru Table 5-17, O-RING BOSS (ORB) are segregated based on the material configuration of the connection.*

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

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

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

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



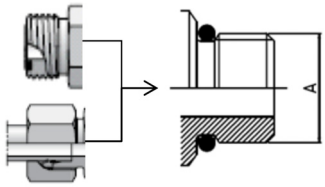
TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS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

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

* ØA Thread OD dimension for reference only.

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

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



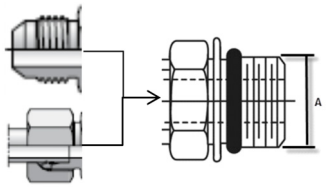
TYPE/FITTING IDENTIFICATION					STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	26	27	28	35	37	38
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	11/16-12	1.06	27.00	135	142	149	185	193	202
	14	13/16-12	1.19	30.10	175	184	193	235	249	262
	16	15/16-12	1.31	33.30	200	210	220	270	285	298
	20	15/8-12	1.63	41.30	250	263	275	340	357	373
	24	17/8-12	1.87	47.60	305	321	336	415	435	456
	32	21/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	17	18	18	23	24	24
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	11/16-12	1.06	27.00	88	93	97	119	126	132
	14	13/16-12	1.19	30.10	114	120	126	155	163	171
	16	15/16-12	1.31	33.30	130	137	143	176	186	194
	20	15/8-12	1.63	41.30	163	171	179	221	232	243
	24	17/8-12	1.87	47.60	198	208	218	268	282	296
	32	21/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

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

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



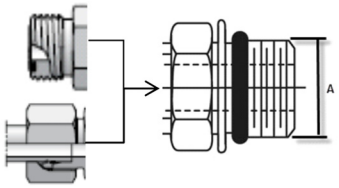
TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24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

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

* ØA Thread OD dimension for reference only.

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

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



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

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

* ØA Thread OD dimension for reference only.

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

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

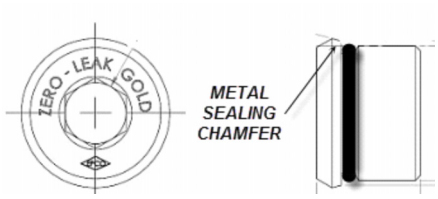
TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
					Ft-Lb or (in-lb)			[N-m]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(30)	(32)	(33)	3	4	4
	3	3/8-24	0.37	9.52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

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

* ØA Thread OD dimension for reference only.

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

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



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

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

* ØA Thread OD dimension for reference only.

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

Assembly Instructions for Adjustable Port End Metric (MFF) Fittings

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

⚠ CAUTION

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

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

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

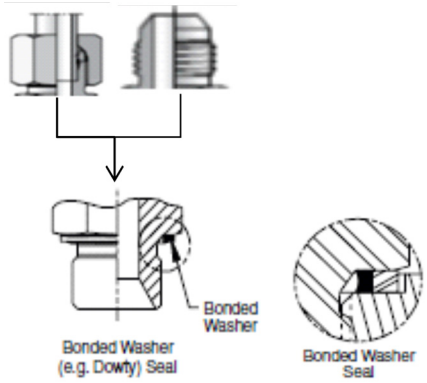
NOTE: *Torque values provided in Table 5-18, Table 5-19, Table 5-20,* Metric Flat Face Port (MFF) - L Series *and Table 5-21, Table 5-22, and Table 5-23,* Metric Flat Face Port (MFF) - S Series *are segregated based on the material configuration of the connection.*

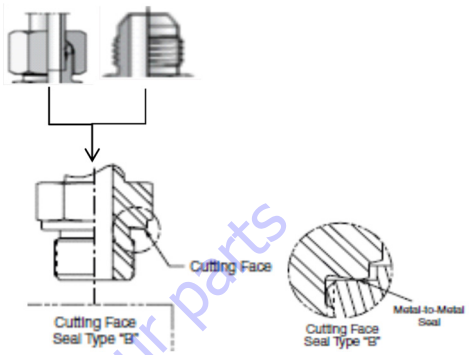
'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

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

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

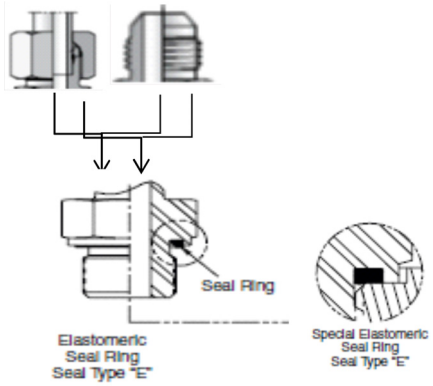
Table 5-18. Metric Flat Face Port (MFF) - L Series - Table 1 of 3

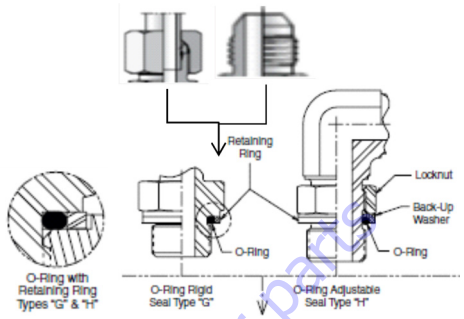




TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]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

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





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

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

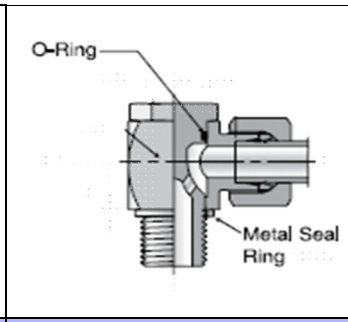
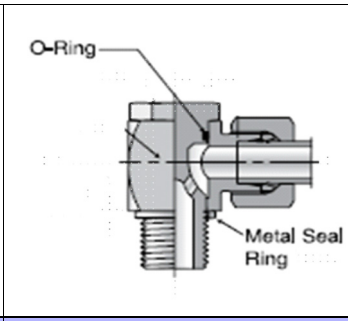
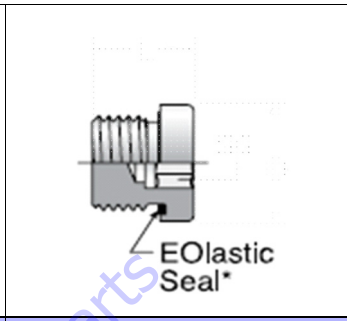
																				
TYPE/FITTING IDENTIFICATION			**BANJO FITTINGS with L series DIN (MBTL) opposite end**						**HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end**						**FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS**					
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	14	18	19	19	9	10	10	12	14	14
	M12x1.5	8	26	28	29	35	38	39	33	35	36	45	47	49	18	19	20	25	26	27
	M14x1.5	10	37	39	41	50	53	56	41	43	45	55	58	61	26	28	29	35	38	39
	M16x1.5	12	44	46	48	60	62	65	59	62	65	80	84	88	41	43	45	55	58	61
	M18x1.5	15	59	62	65	80	84	88	74	78	81	100	106	110	48	51	53	65	69	72
	M22x1.5	18	89	94	98	120	127	133	103	108	113	140	146	153	66	70	73	90	95	99
	M27x2	22	96	101	106	130	137	144	236	248	260	320	336	353	100	105	110	135	142	149
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	166	175	183	225	237	248
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	266	280	293	360	380	397
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	266	280	293	360	380	397
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	M12x1.5	8	17	18	19	23	24	26	21	22	23	28	30	31	12	13	13	16	18	18
	M14x1.5	10	24	26	27	33	35	37	27	28	29	37	38	39	17	18	19	23	24	26
	M16x1.5	12	29	30	31	39	41	42	38	40	42	52	54	57	27	28	29	37	38	39
	M18x1.5	15	38	40	42	52	54	57	48	51	53	65	69	72	31	33	34	42	45	46
	M22x1.5	18	58	61	64	79	83	87	67	70	73	91	95	99	43	45	47	58	61	64
	M27x2	22	62	66	69	84	89	94	153	161	169	207	218	229	65	69	72	88	94	98
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	108	114	119	146	155	161
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	173	182	190	235	247	258
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	173	182	190	235	247	258

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

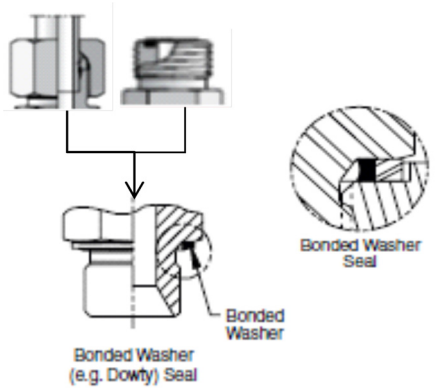
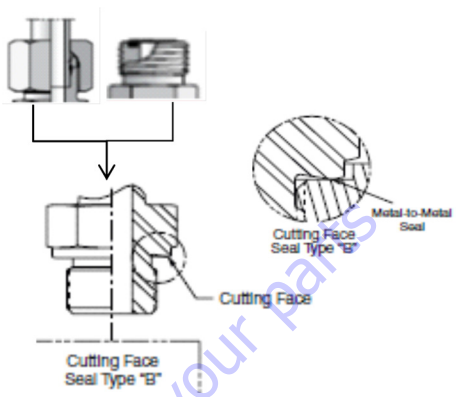
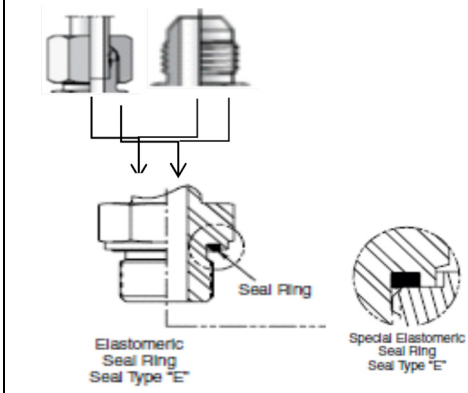
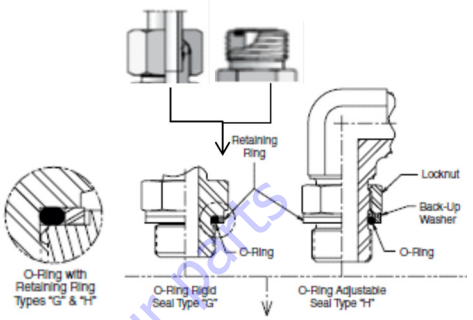
														
TYPE/FITTING IDENTIFICATION			**FORM A (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end**						**FORM B (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end**					
MATERIAL	**Thread M Size**	**Connecting Tube O.D.**	**Torque**						**Torque**					
			[Ft-Lb]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

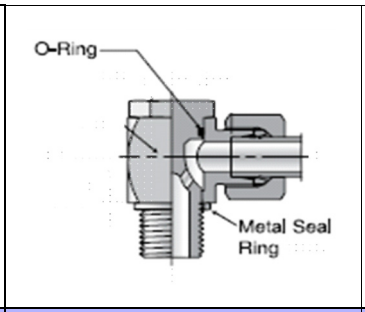
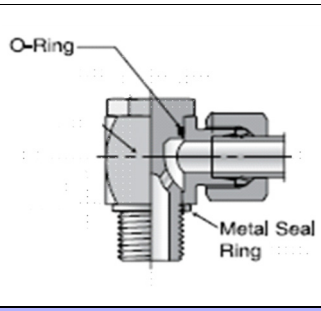
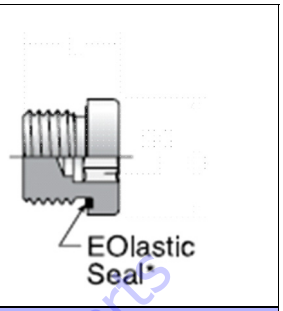
Table 5-22. Metric Flat Face Port (MFF) - S Series - Table 2 of 3





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

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

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

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

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

⚠ CAUTION

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

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

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

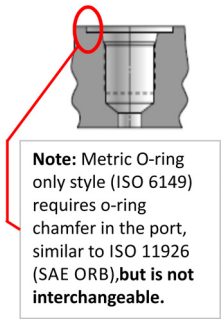
NOTE: *Torque values provided in Table 5-24*, Metric Pipe Parallel O-ring Boss (MPP) *are segregated based on the material configuration of the connection.*

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

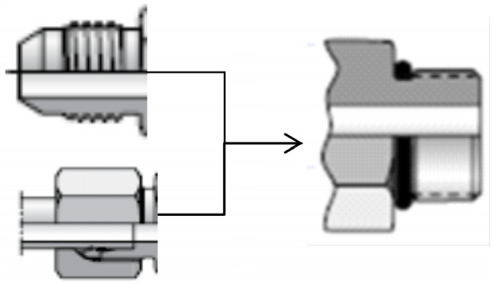
- **a.** STEEL fittings with ALUMINUM or BRASS mating components.
- **b.** ALUMINUM or BRASS fittings with STEEL mating components.
- **c.** ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

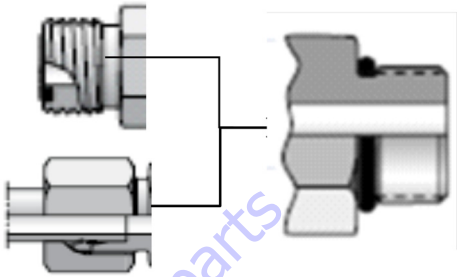
7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

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



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





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

Assembly instructions for Adjustable Port End (BSPP) Fittings

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

⚠ CAUTION

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

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

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

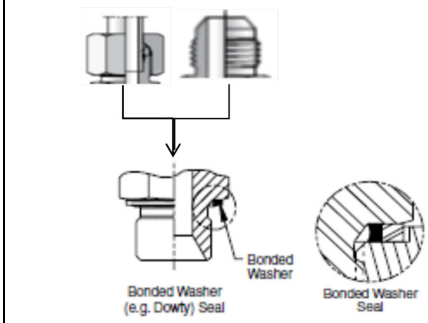
NOTE: *Torque values provided in Table 5-25, Table 5-26, Table 5-27,* British Standard Parallel Pipe Port (BSPP) - L Series *and Table 5-28, Table 5-29, Table 5-30,* British Standard Parallel Pipe Port (BSPP) - S Series *are segregated based on the material configuration of the connection.*

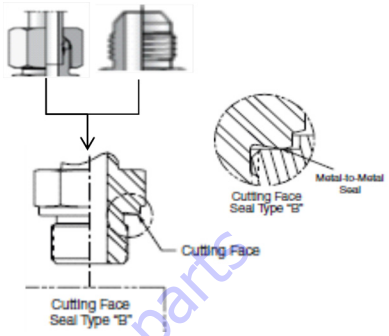
'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

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

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

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





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

* Typical for JLG Straight Male Stud Fittings.

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

*** Typical for JLG Adjustable Fittings.

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

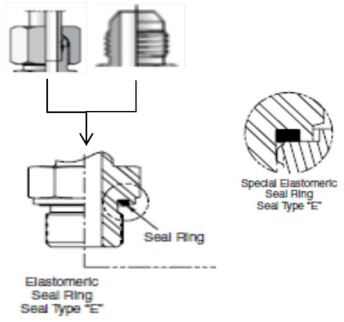
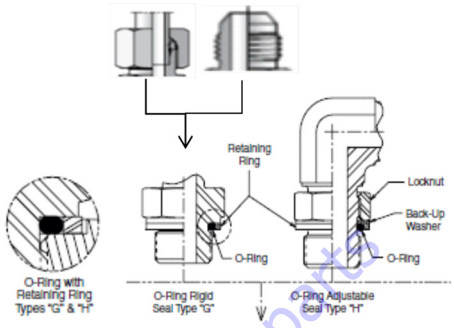
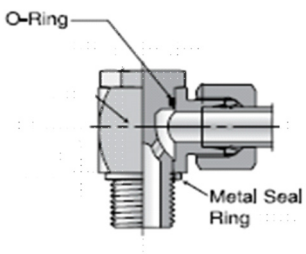
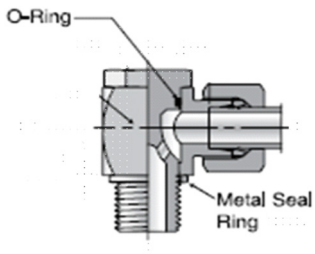
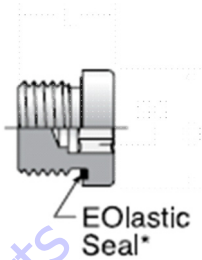
														
TYPE/FITTING IDENTIFICATION			**FORM E* (EOLASTIC SEALING RING) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end**						**FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end**					
MATERIAL	**BSPP Thread G Size**	**Connecting Tube O.D.**	**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19
	G1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G3/8A	12	52	55	57	70	75	77	52	55	57	70	75	77
	G1/2A	15	66	70	73	90	95	99	66	70	73	90	95	99
	G1/2A	18	66	70	73	90	95	99	66	70	73	90	95	99
	G3/4A	22	133	140	146	180	190	198	133	140	146	180	190	198
	G1A	28	229	241	252	310	327	342	229	241	252	310	327	342
	G1-1/4A	35	332	349	365	450	473	495	332	349	365	450	473	495
	G1-1/2A	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	**BSPP Thread G Size**	**Connecting Tube O.D.**	**Torque**						**Torque**					
			[Ft-Lb]			**[N-m]**			**[Ft-Lb]**			**[N-m]**		
	(metric)	**(mm)**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**	**Min**	**Nom**	**Max**
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12
	G1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G3/8A	12	34	36	37	46	49	50	34	36	37	46	49	50
	G1/2A	15	43	45	47	58	61	64	43	45	47	58	61	64
	G1/2A	18	43	45	47	58	61	64	43	45	47	58	61	64
	G3/4A	22	86	91	95	117	123	129	86	91	95	117	123	129
	G1A	28	149	157	164	202	213	222	149	157	164	202	213	222
	G1-1/4A	35	216	227	237	293	308	321	216	227	237	293	308	321
	G1-1/2A	42	259	272	285	351	369	386	259	272	285	351	369	386
* Typical for JLG Straight Male Stud Fittings.														
** Non typical for JLG Straight Male Stud Fittings, reference only.														
*** Typical for JLG Adjustable Fittings.														

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

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

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

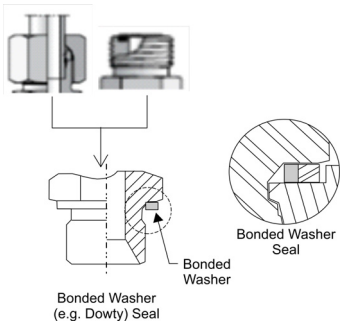
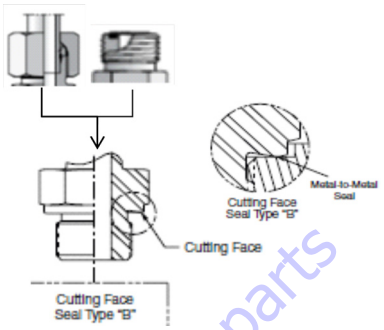
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED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

* Typical for JLG Straight Male Stud Fittings.

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

*** Typical for JLG Adjustable Fittings.

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

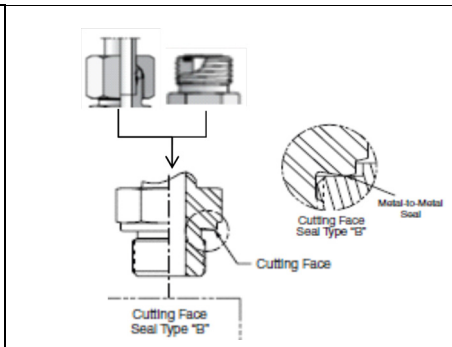
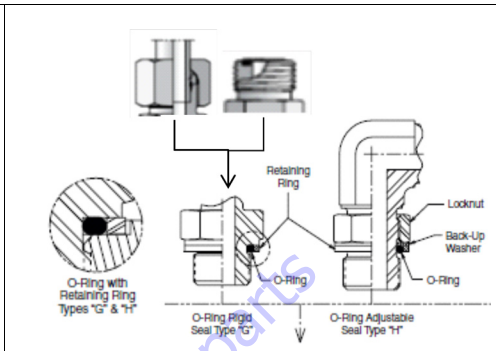
TYPE/FITTING IDENTIFICATION			FORM A** (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end						FORM B** (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	26	28	29	35	38	39	41	43	45	55	58	61
	G1/4A	8	26	28	29	35	38	39	41	43	45	55	58	61
	G3/8A	10	33	35	36	45	47	49	66	70	73	90	95	99
	G3/8A	12	33	35	36	45	47	49	66	70	73	90	95	99
	G1/2A	14	48	51	53	65	69	72	111	117	122	150	159	165
	G1/2A	16	48	51	53	65	69	72	96	101	106	130	137	144
	G3/4A	20	66	70	73	90	95	99	199	209	219	270	283	297
	G1A	25	111	117	122	150	159	165	251	264	276	340	358	374
	G1-1/4A	30	177	186	195	240	252	264	398	418	438	540	567	594
	G1-1/2A	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	17	18	19	23	24	26	27	28	29	37	38	39
	G1/4A	8	17	18	19	23	24	26	27	28	29	37	38	39
	G3/8A	10	21	22	23	28	30	31	43	45	47	58	61	64
	G3/8A	12	21	22	23	28	30	31	43	45	47	58	61	64
	G1/2A	14	31	33	34	42	45	46	72	76	79	98	103	107
	G1/2A	16	31	33	34	42	45	46	62	66	69	84	89	94
	G3/4A	20	43	45	47	58	61	64	129	136	142	175	184	193
	G1A	25	72	76	79	98	103	107	163	171	179	221	232	243
	G1-1/4A	30	115	121	127	156	164	172	259	272	285	351	369	386
	G1-1/2A	38	139	146	153	188	198	207	335	352	369	454	477	500

* Typical for JLG Straight Male Stud Fittings.

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

*** Typical for JLG Adjustable Fittings.

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

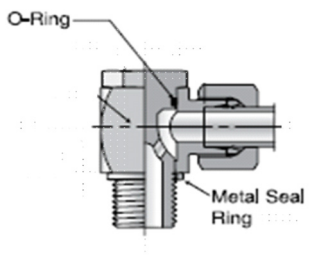
TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	41	43	45	55	58	61	26	28	29	35	38	39
	G 1/4A	8	41	43	45	55	58	61	26	28	29	35	38	39
	G 3/8A	10	59	62	65	80	84	88	52	55	57	70	75	77
	G 3/8A	12	59	62	65	80	84	88	52	55	57	70	75	77
	G 1/2A	14	85	90	94	115	122	127	66	70	73	90	95	99
	G 1/2A	16	85	90	94	115	122	127	66	70	73	90	95	99
	G 3/4A	20	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	25	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	30	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	38	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	27	28	29	37	38	39	17	18	19	23	24	26
	G 1/4A	8	27	28	29	37	38	39	17	18	19	23	24	26
	G 3/8A	10	38	40	42	52	54	57	34	36	37	46	49	50
	G 3/8A	12	38	40	42	52	54	57	34	36	37	46	49	50
	G 1/2A	14	55	58	61	75	79	83	43	45	47	58	61	64
	G 1/2A	16	55	58	61	75	79	83	43	45	47	58	61	64
	G 3/4A	20	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	25	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/4A	30	216	227	237	293	308	321	216	227	237	293	308	321
	G 1-1/2A	38	259	272	285	351	369	386	259	272	285	351	369	386

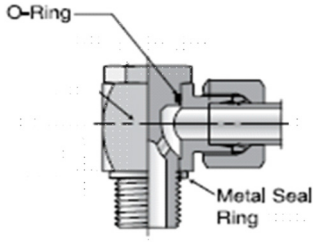
* Typical for JLG Straight Male Stud Fittings.

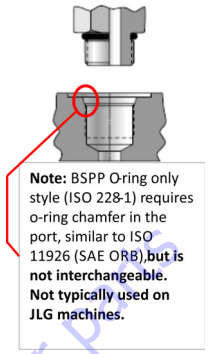
** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings.

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







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

* Typical for JLG Straight Male Stud Fittings.

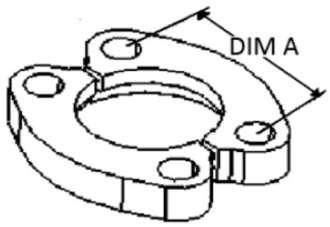
** Non typical for JLG Straight Male Stud Fittings, reference only.

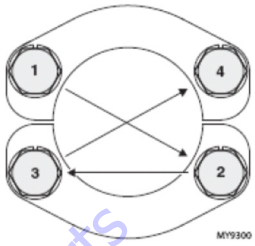
*** Typical for JLG Adjustable Fittings.

Assembly Instructions for Flange Connections: (FL61 and FL62)

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

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

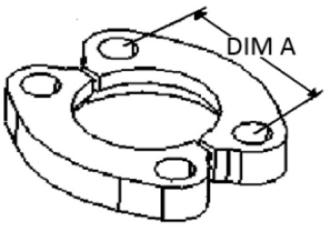


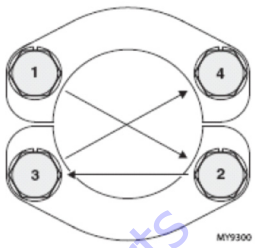


TYPE/FITTING IDENTIFICATION						STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)													
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws						
							[Ft-Lb]			[N-m]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

* A dimension for reference only.

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





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

* A dimension for reference only.

Double Wrench Method

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

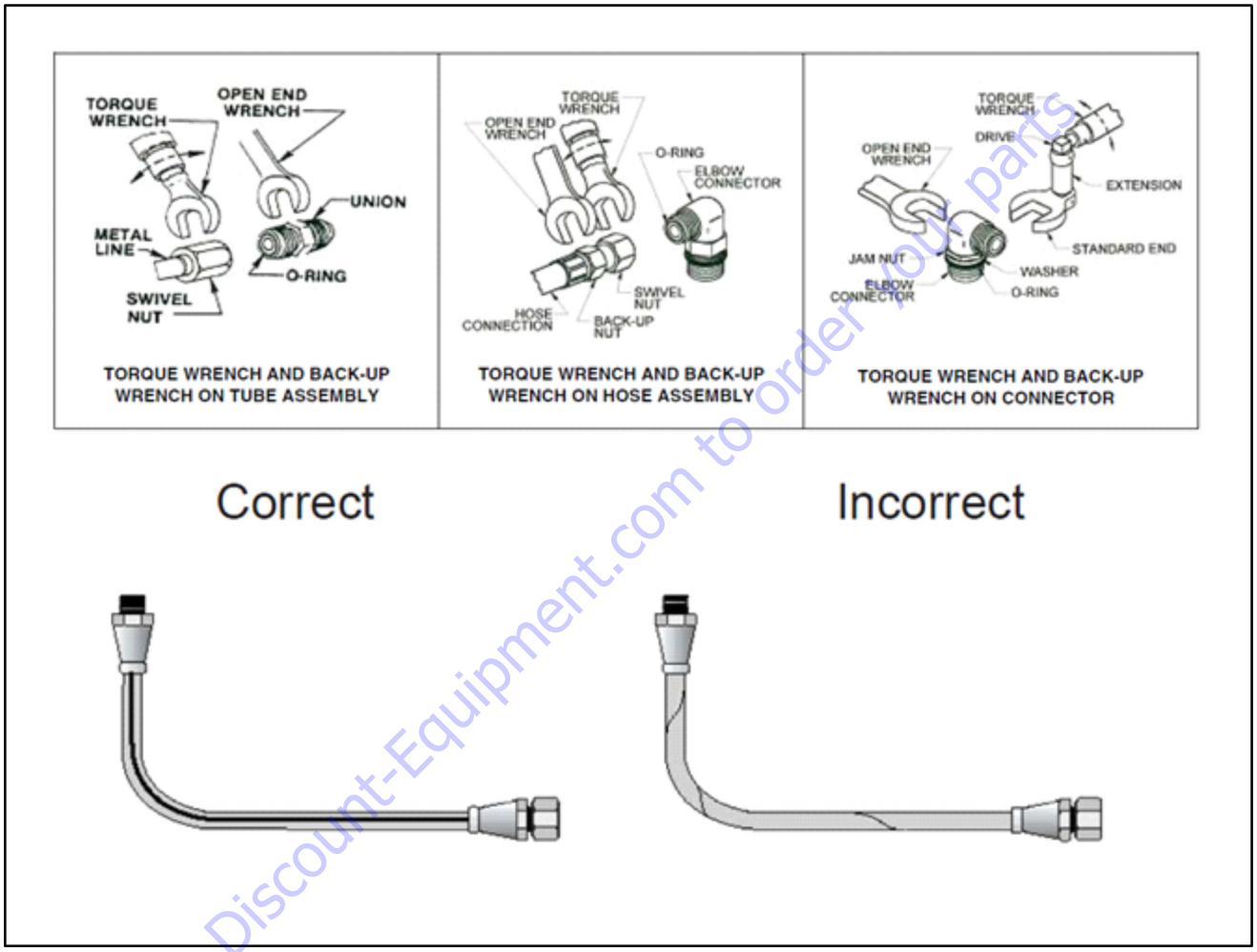


Figure 5-12. Double Wrench Method

FFWR and TFFT Methods

FFWR (FLATS FROM WRENCH RESISTANCE METHOD)

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

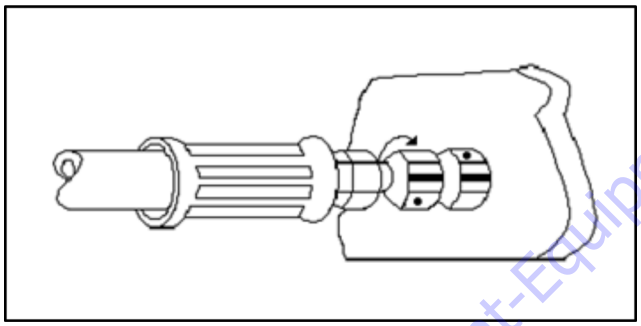


Figure 5-13. FFWR Method

TFFT (TURNS FROM FINGER TIGHT METHOD)

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

Adjustable Stud End Assembly

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

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

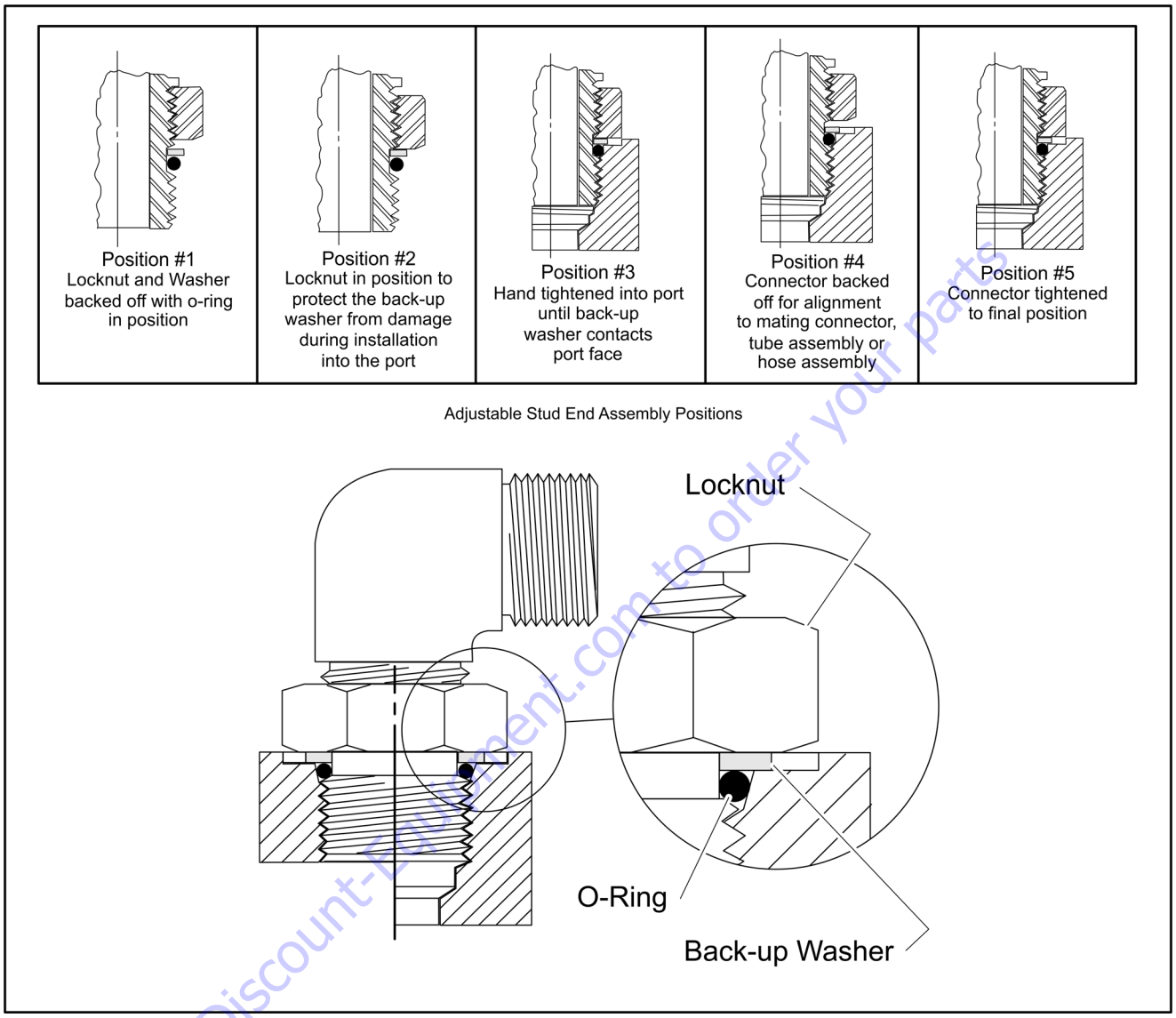


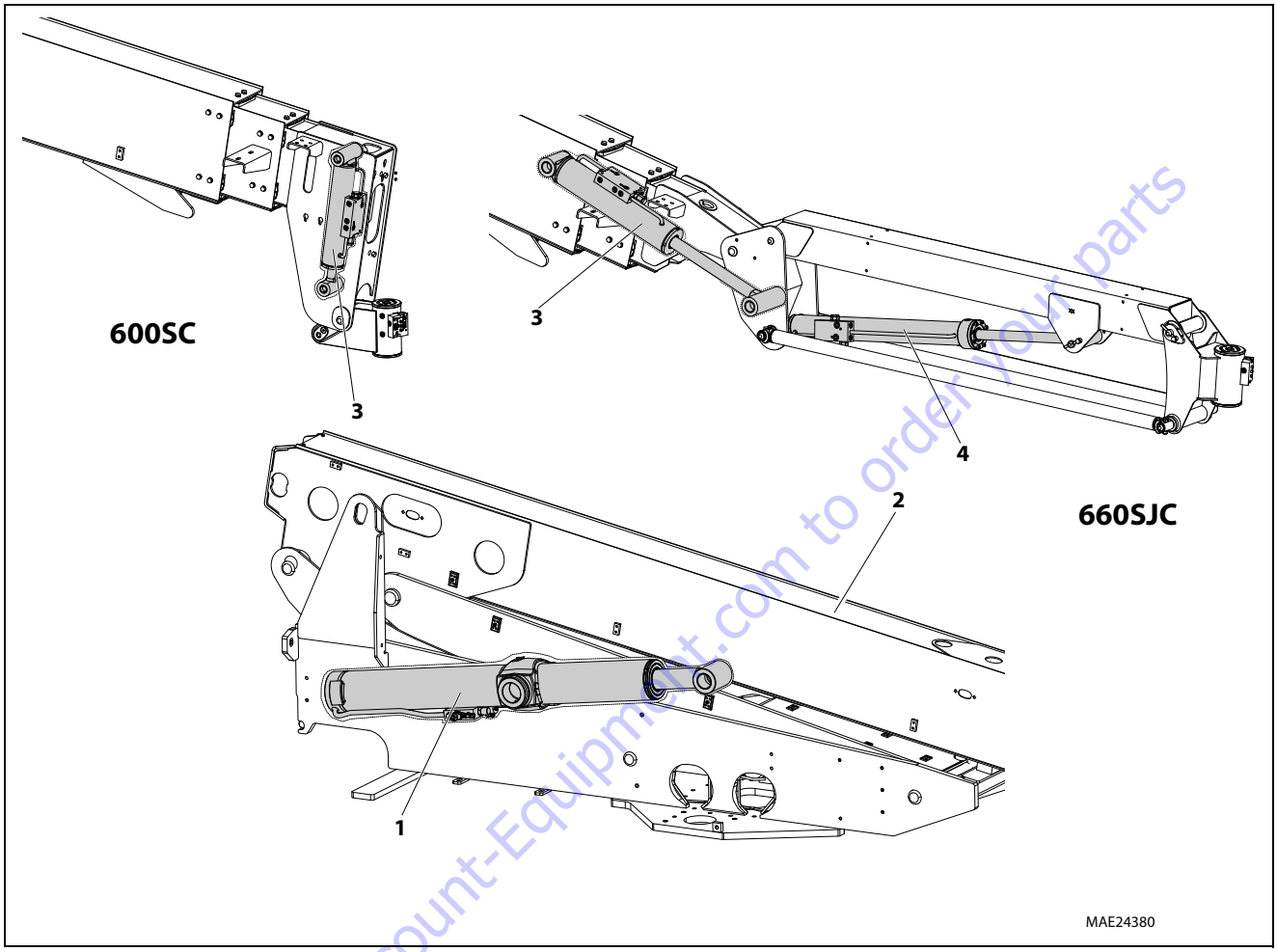
Figure 5-14. Adjustable Stud End Assembly

O-ring Installation (Replacement)

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

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

Cylinder Locations



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

Figure 5-15. Hydraulic Cylinder Locations

Main Lift Cylinder

DISASSEMBLY

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

NOTICE

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

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

⚠ WARNING

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

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

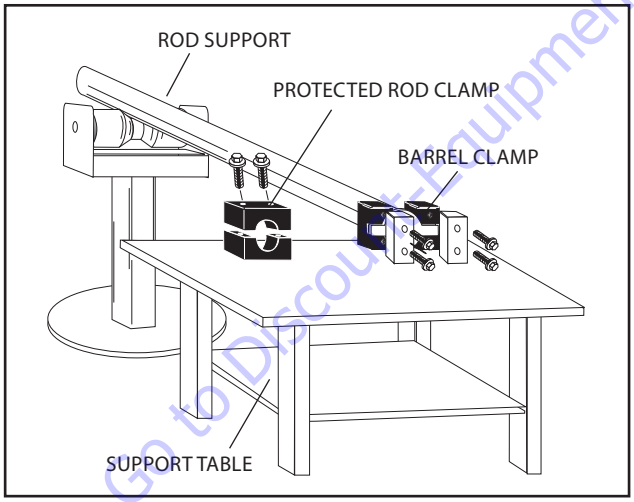


Figure 5-16. Cylinder Barrel Support

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

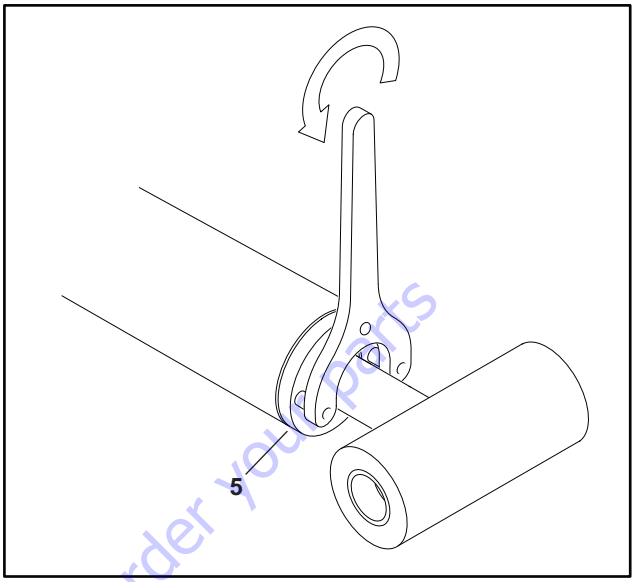


Figure 5-17. Cylinder Head Removal

NOTICE

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

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

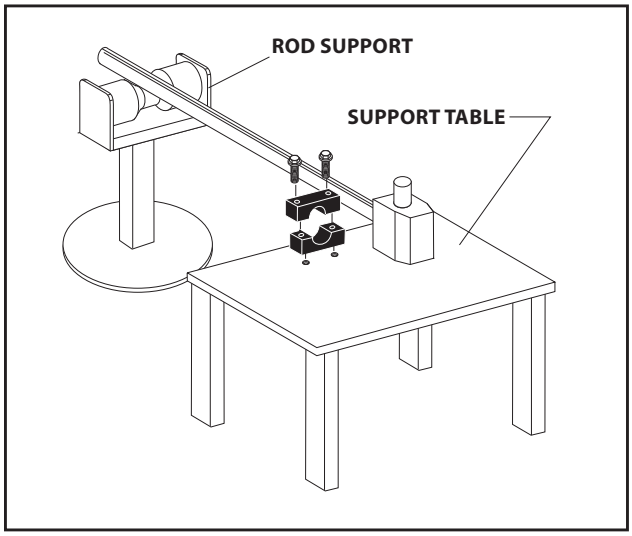
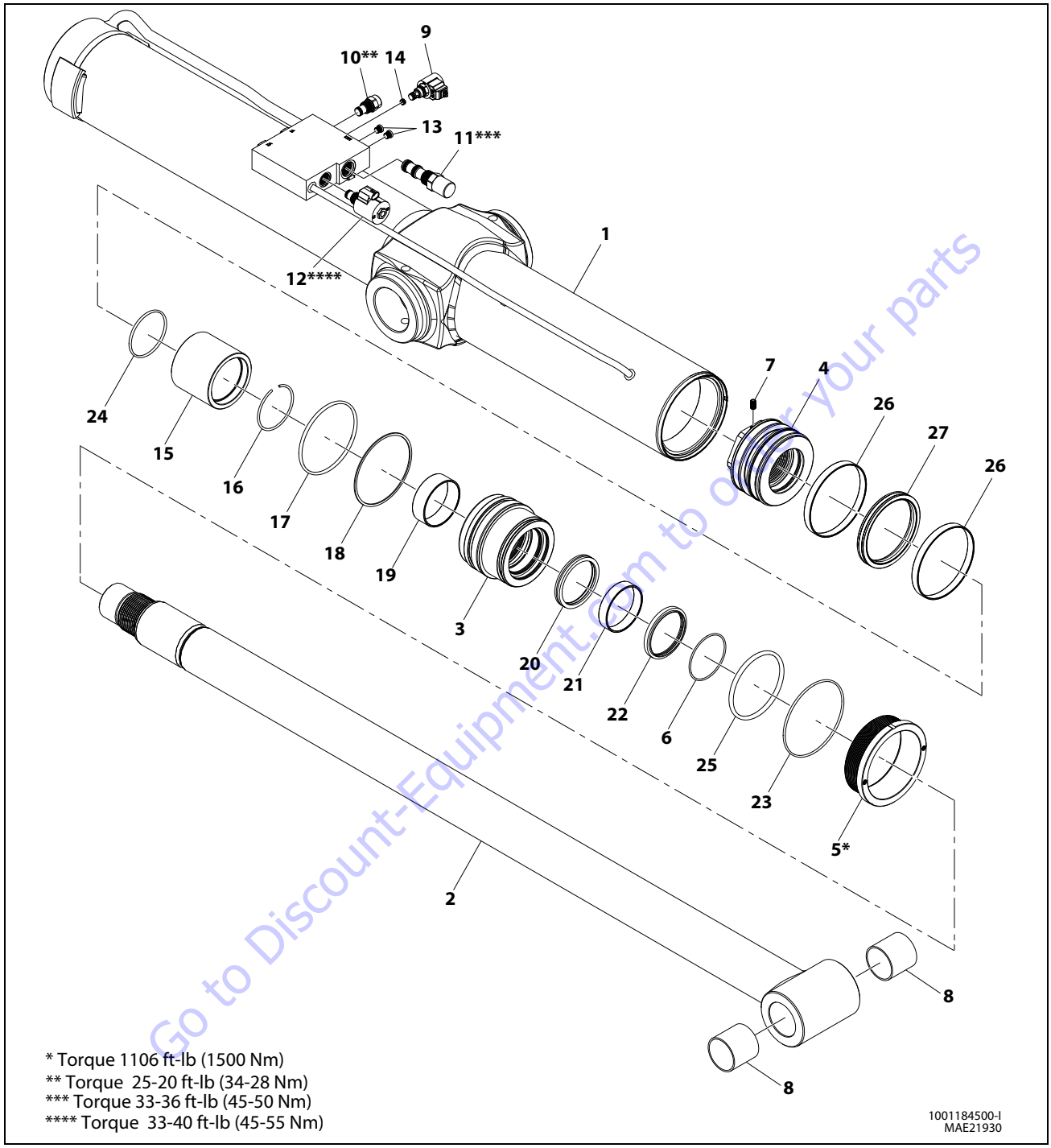


Figure 5-18. Cylinder Rod Support



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

Figure 5-19. Main Lift Cylinder

NOTICE

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

8. Loosen setscrew (7) in piston (4).
9. Screw piston counterclockwise and remove from rod.
10. Remove and discard O-ring (24), bearing rings (26) and seal (27).

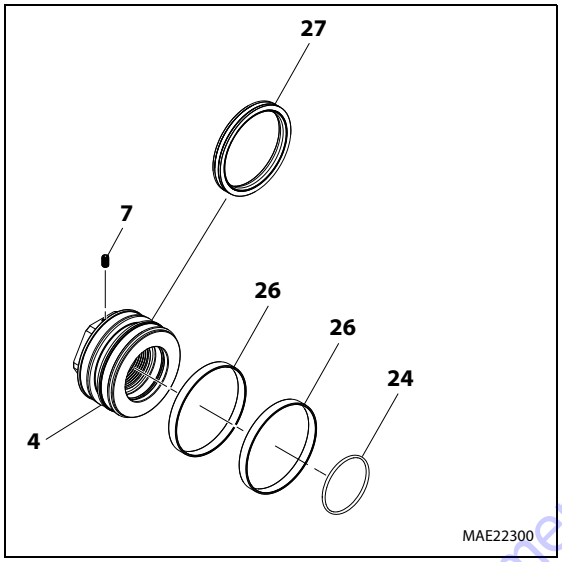


Figure 5-20. Piston Disassembly

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

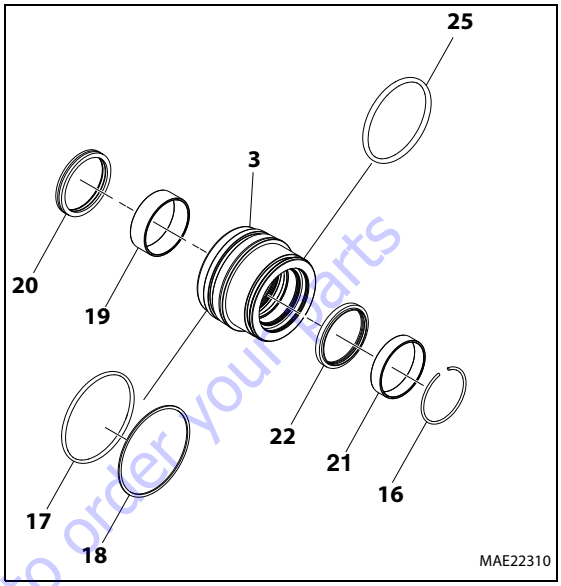


Figure 5-21. Cylinder Head Disassembly

CLEANING AND INSPECTION

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

11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

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

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

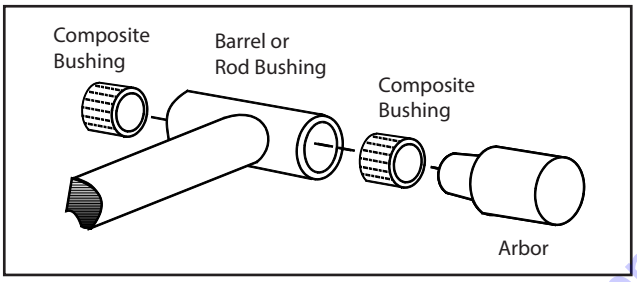


Figure 5-22. Composite Bushing Installation

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

ASSEMBLY

NOTICE

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

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

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

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

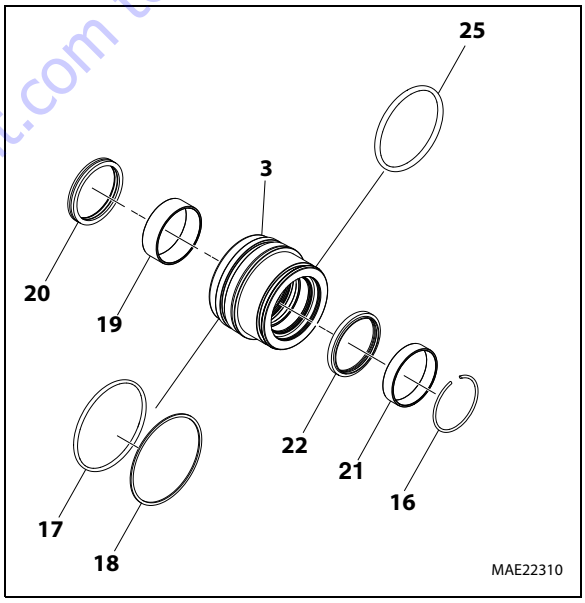


Figure 5-23. Cylinder Head Assembly

5. Install two seals (27) and O-rings (24) on piston.
6. Apply loctite 243 (Loxeal 55-03) to piston threads. Install piston on rod. Torque to 1475 ft-lb (2000 Nm).
7. Install setscrew (7).

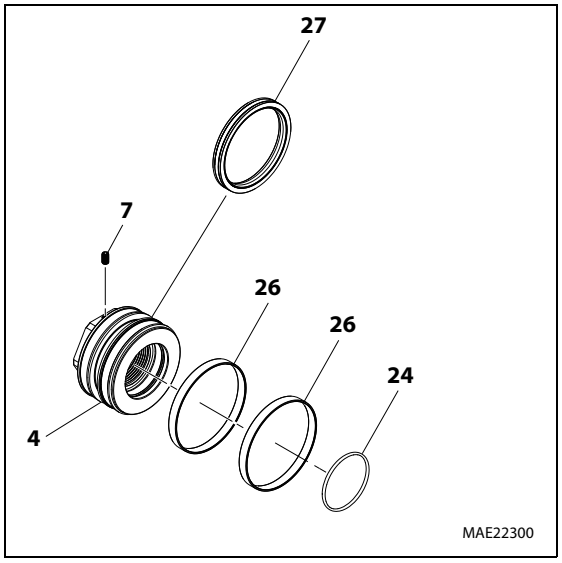


Figure 5-24. Piston Assembly

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

NOTICE

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

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

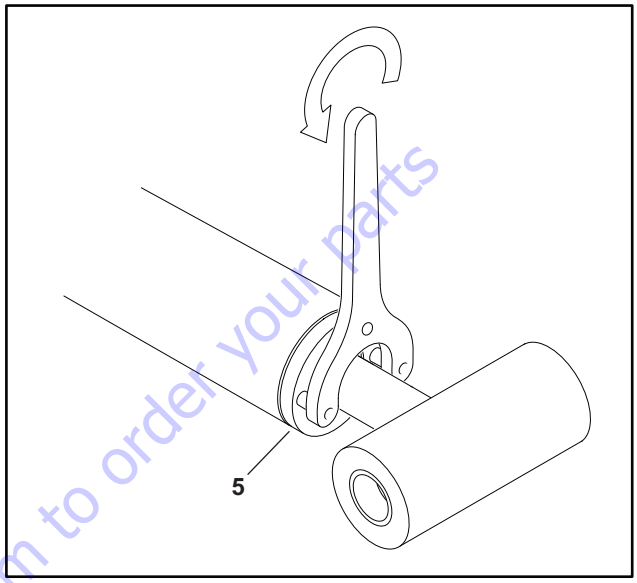


Figure 5-25. Cylinder Head Installation

Telescope Cylinder

DISASSEMBLY

NOTE: *Refer to Figure 5-30. Telescope Cylinder (SN 0300245151 to Present including 0300237157.*

NOTICE

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

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

⚠ WARNING

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

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

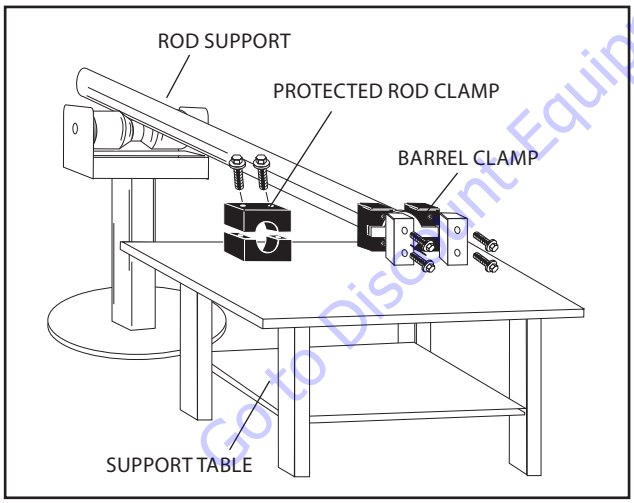


Figure 5-26. Cylinder Barrel Support

5. Mark cylinder head (3) and barrel (13) with center punch marks (A) for later realignment. Remove eight cylinder head capscrews (9).

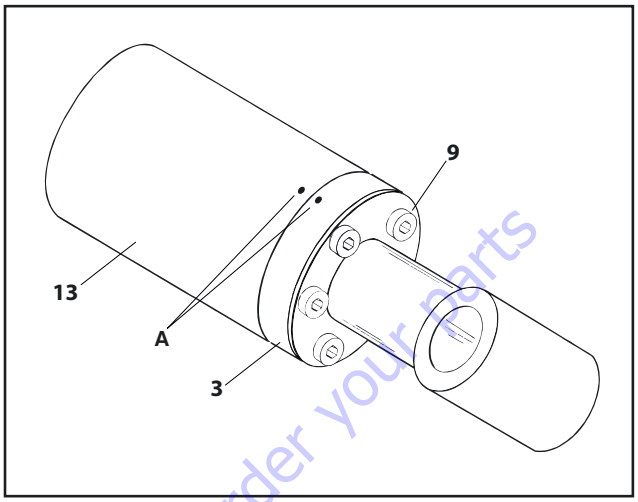


Figure 5-27. Marking Cylinder for Alignment

NOTICE

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

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

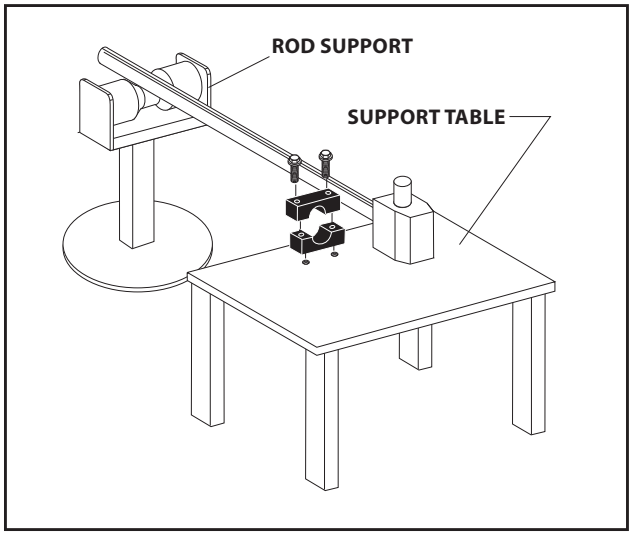
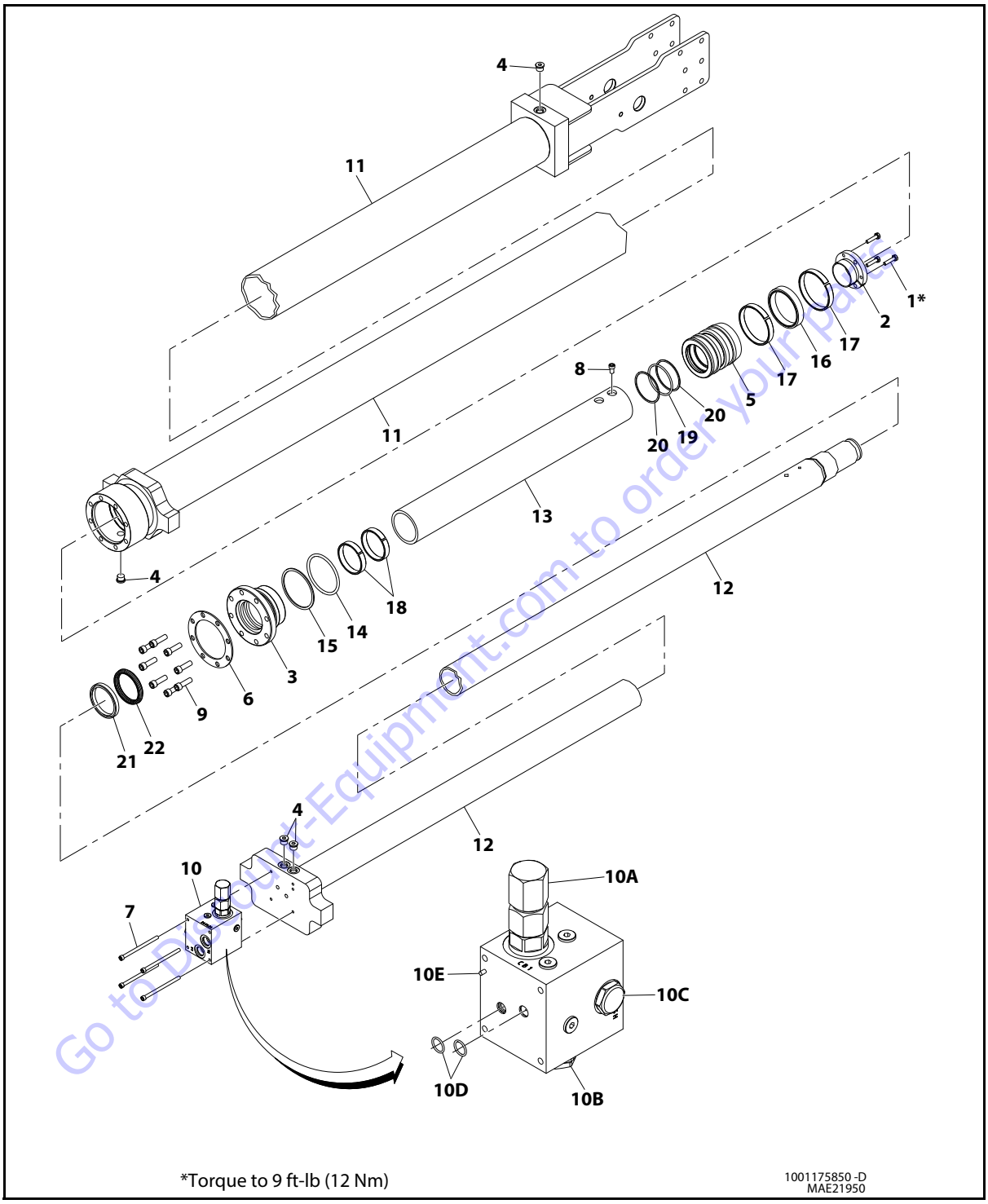
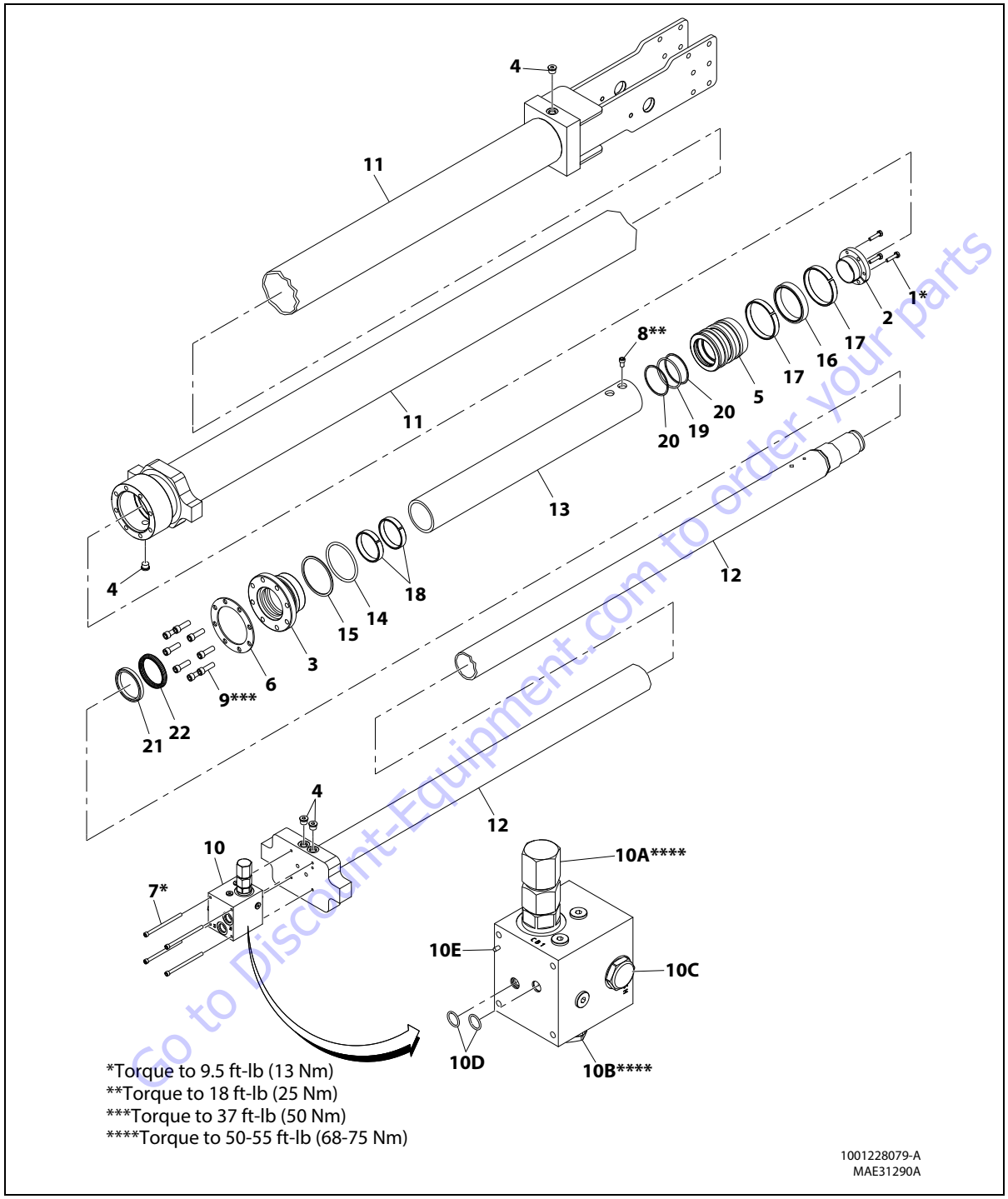


Figure 5-28. Cylinder Rod Support



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

Figure 5-29. Telescope Cylinder (SN 0300236299 to 0300245150 excluding 0300237157



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

Figure 5-30. Telescope Cylinder (SN 0300245151 to Present including 0300237157

8. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
9. Loosen and remove nut attaching piston to rod. Remove piston.
10. Loosen and remove capscrew(s), if applicable, attaching tapered bushing to piston.
11. Insert capscrew(s) in threaded holes in outer piece of tapered bushing. Progressively tighten capscrew(s) until bushing is loose on piston.
12. Remove tapered bushing from piston.
13. Screw piston counterclockwise by hand and remove from cylinder rod.

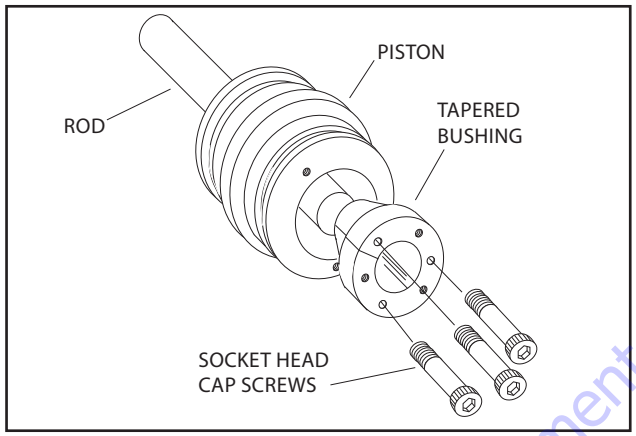


Figure 5-31. Tapered Bushing Removal

14. Remove and discard piston O-rings, seal rings, and backup rings.
15. Remove piston spacer, if applicable, from rod.
16. Remove rod from holding fixture. Remove cylinder head gland and retainer plate, if applicable. Discard O-rings, backup rings, rod seals, and wiper seals.

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

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

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

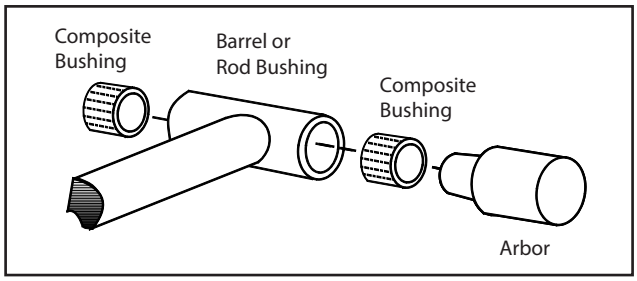


Figure 5-32. Composite Bushing Installation

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

ASSEMBLY

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

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

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

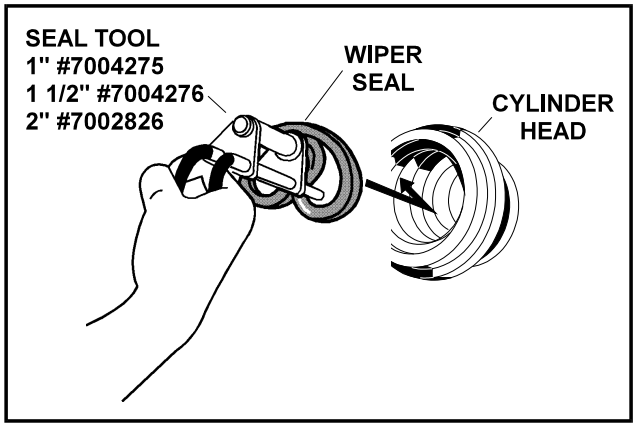


Figure 5-33. Rod Seal Installation

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE 'POLY-PAK' PISTON SEALS ARE PROPERLY INSTALLED. REFER TO WIPER SEAL INSTALLATION FOR CORRECT SEAL ORIENTATION.

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

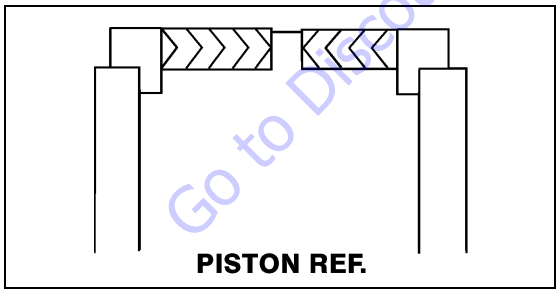


Figure 5-34. Poly-Pak Piston Seal Installation

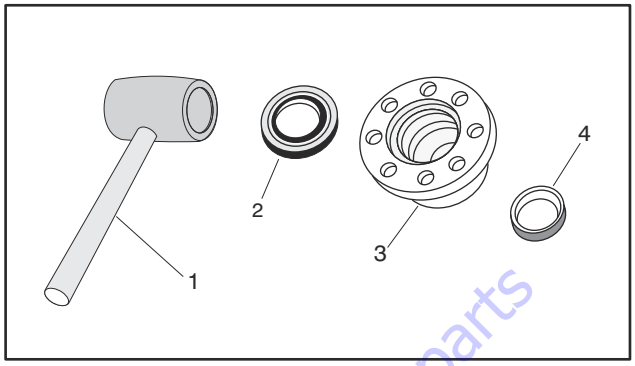


Figure 5-35. Wiper Seal Installation

3. Place new O-ring and backup seal in applicable outside diameter groove of cylinder head.

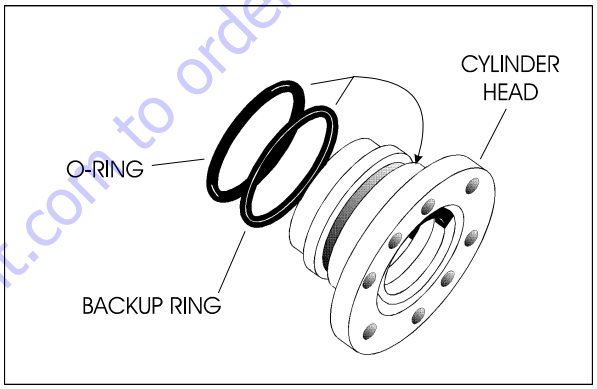


Figure 5-36. Head Seal Kit Installation

4. Install washer ring on rod. Carefully install head gland on rod. Do not damage or dislodge wiper and rod seals. Push head along rod to rod end, as applicable.

5. Carefully slide piston spacer on rod.

NOTE: *Upper telescope cylinder piston has an O-ring installed inside spacer.*

6. If applicable, place new O-ring and backup rings in inner piston diameter groove.

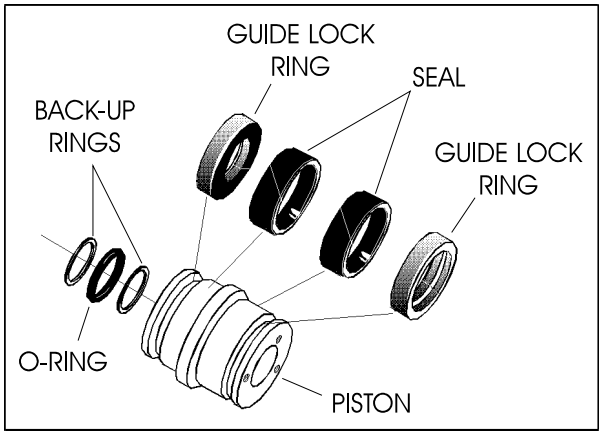


Figure 5-37. Piston Seal Kit Installation

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

8. Carefully thread piston on cylinder rod hand tight, Ensure O-ring and backup rings are not damaged or dislodged.

NOTE: *Piston and mating end of rod must be free of oil when installing tapered bushing.*

9. Thread piston onto rod until it aligns with spacer end and install tapered bushing.

NOTE: *Apply JLG Threadlocker P/N 0100011 or equivalent to tapered bushing bolts when rebuilding slave, lift, and telescope cylinders.*

10. Install bolts in tapered bushing using JLG Threadlocker P/N 0100011

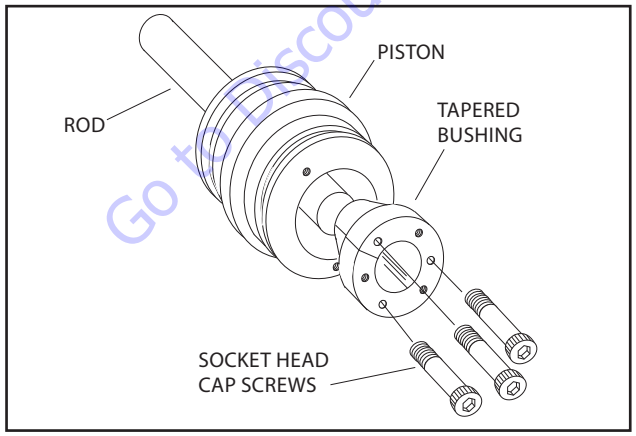


Figure 5-38. Tapered Bushing Installation

11. Remove cylinder rod from holding fixture.

12. Place new guide locks and seals in applicable outside diameter grooves of cylinder piston. (See Figure 5-37. Piston Seal Kit Installation.)

13. Position cylinder barrel in a suitable holding fixture.

NOTICE

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

14. Clamp barrel clamped securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston loading O-ring and seal ring.

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

16. Secure cylinder head gland using washer ring and socket head bolts.

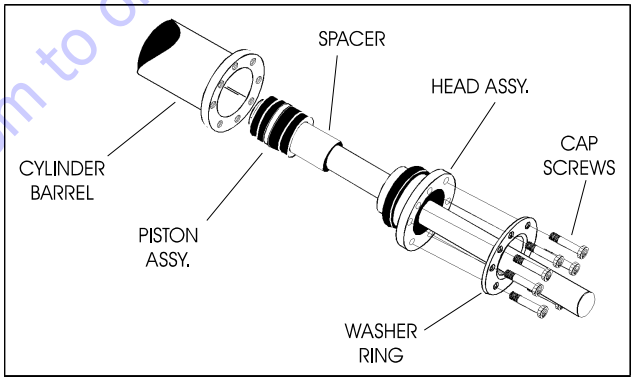


Figure 5-39. Rod Assembly Installation

Platform Level (Slave) Cylinder

DISASSEMBLY

NOTE: *Refer to Figure 5-43. Platform Level (Slave) Cylinder - 600SC and Figure 5-44. Platform Level (Slave) Cylinder - 660SJC.*

NOTICE

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

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

⚠ WARNING

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

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

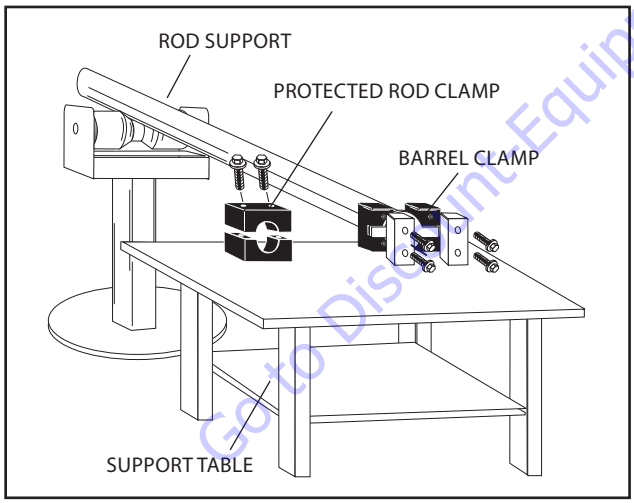


Figure 5-40. Cylinder Barrel Support

5. Unscrew cylinder head with hook spanner wrench.

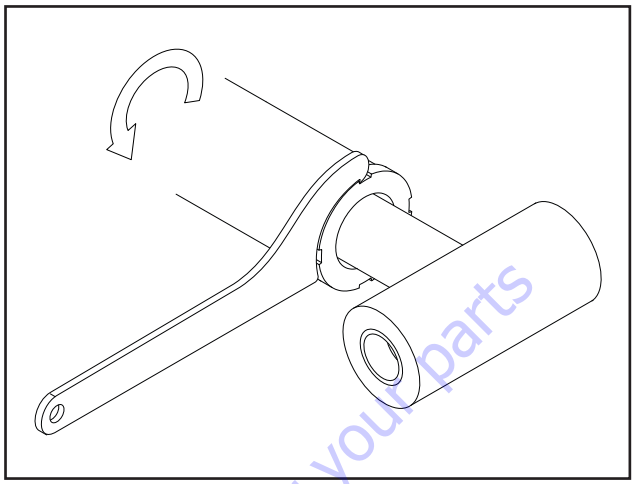


Figure 5-41. Marking Cylinder for Alignment

NOTICE

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

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

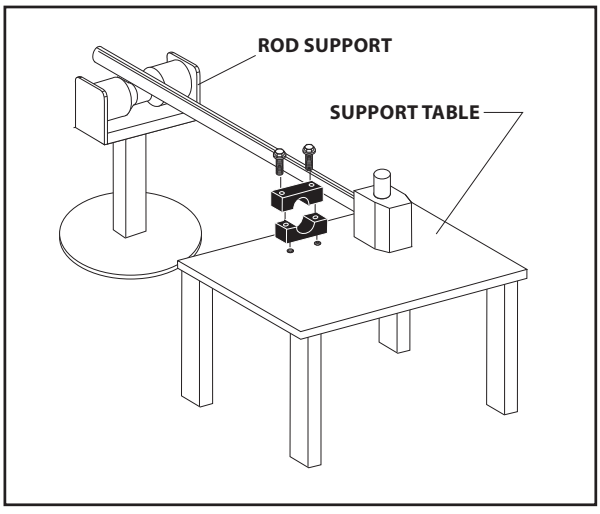
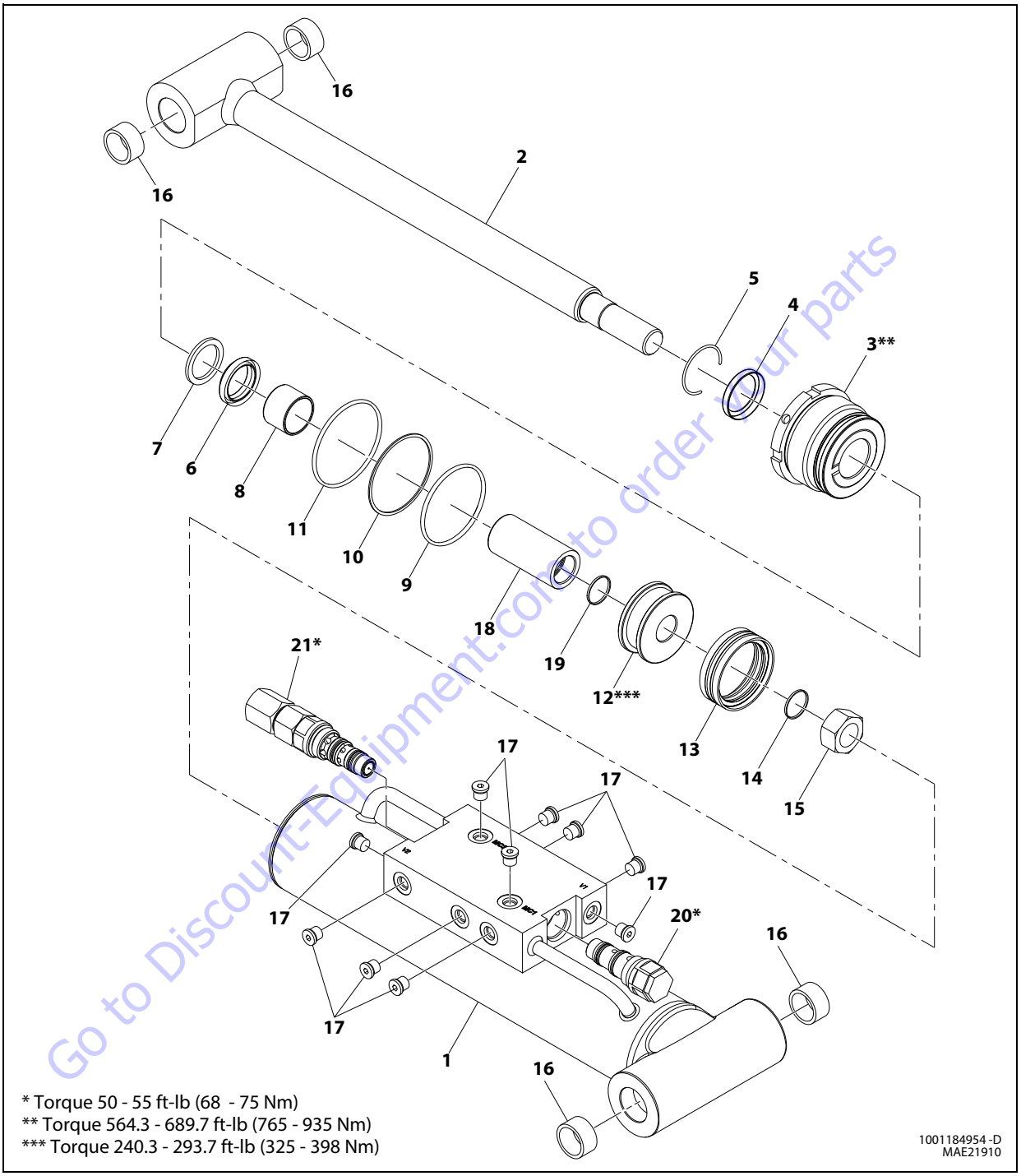
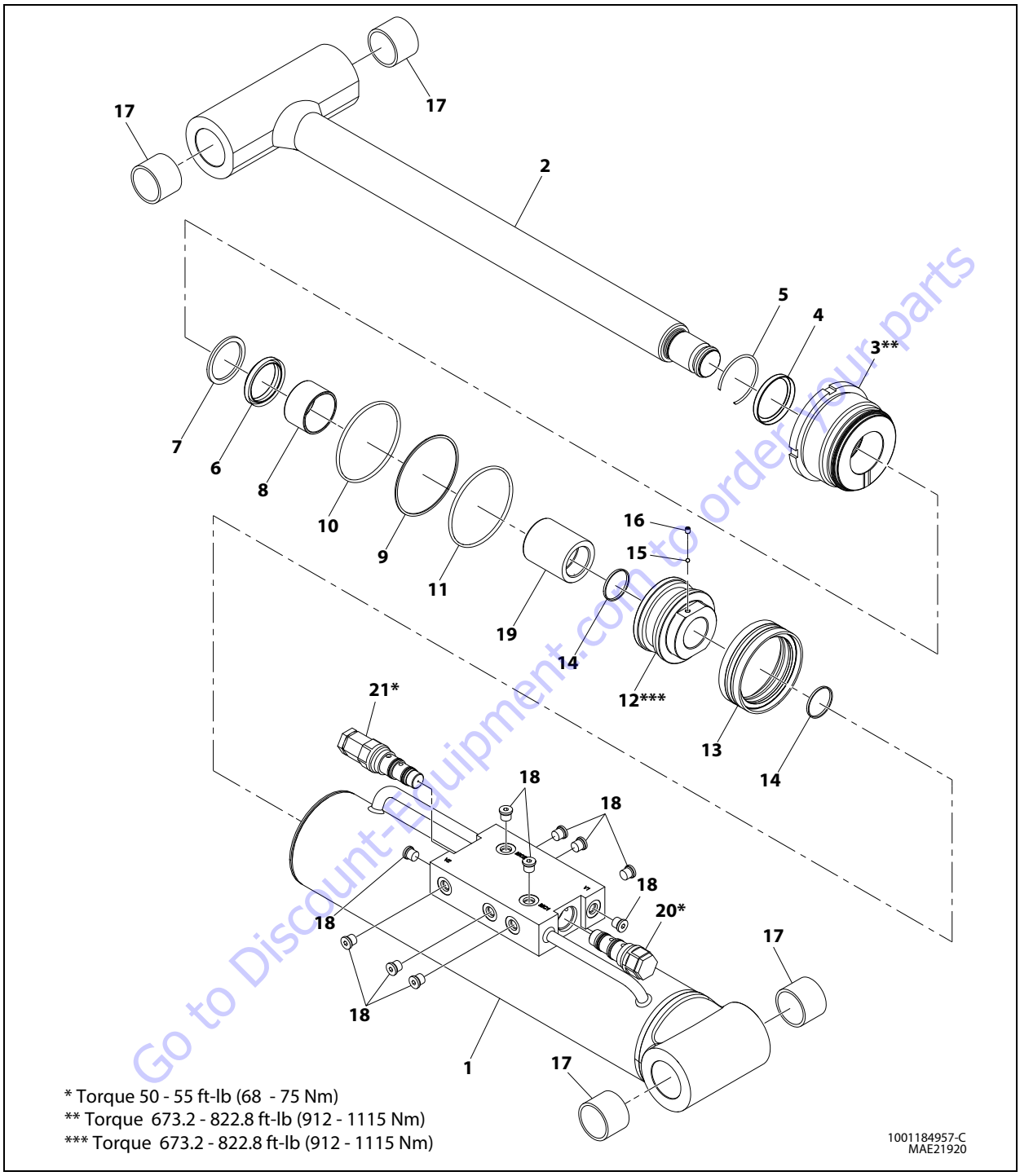


Figure 5-42. Cylinder Rod Support



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

Figure 5-43. Platform Level (Slave) Cylinder - 600SC



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

Figure 5-44. Platform Level (Slave) Cylinder - 660SJC

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

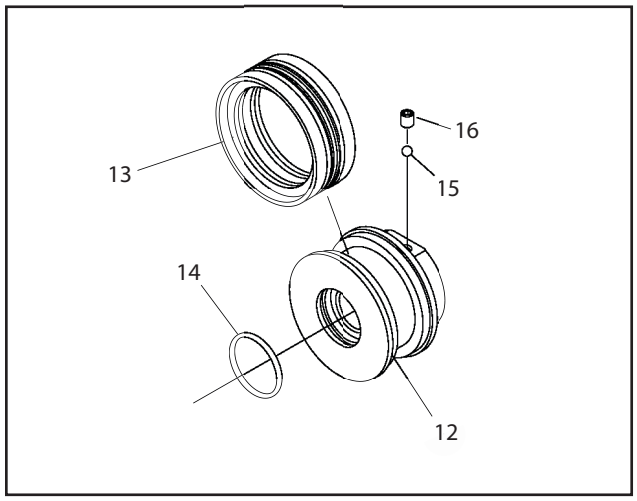


Figure 5-45. Piston Disassembly

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

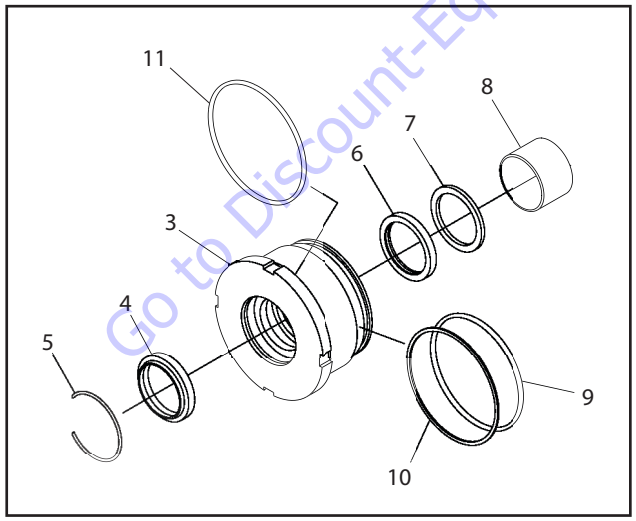


Figure 5-46. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.
    d. Press composite bushing into barrel or rod bushing with correct size arbor.

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

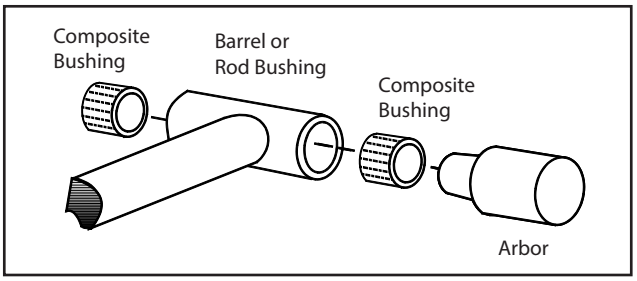


Figure 5-47. Composite Bushing Installation

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

ASSEMBLY

NOTICE

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

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

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

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

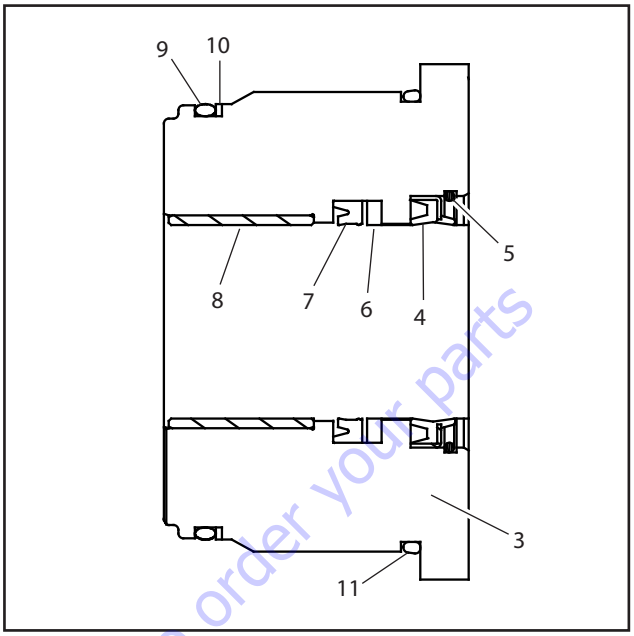


Figure 5-48. Cylinder Head Seal Installation

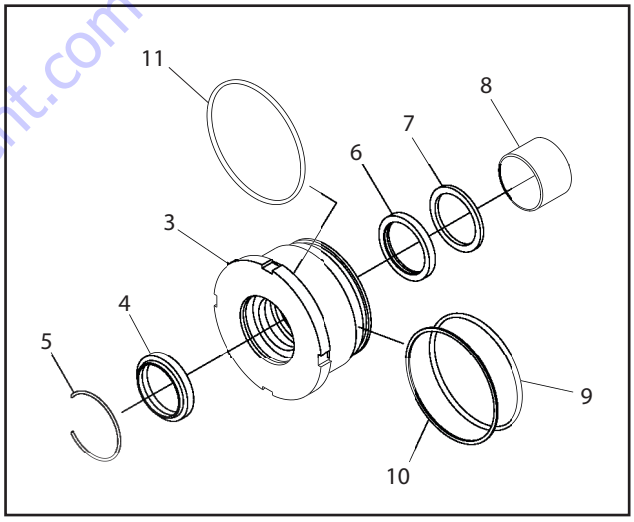


Figure 5-49. Cylinder Head Assembly

7. Install O-ring (14) in piston (12).
8. Install seal (16) on piston.
9. Apply JLG thread locking compound (P/N 0100011) to piston threads. Install piston on rod.
10. Install ball (15) and setscrew (16).

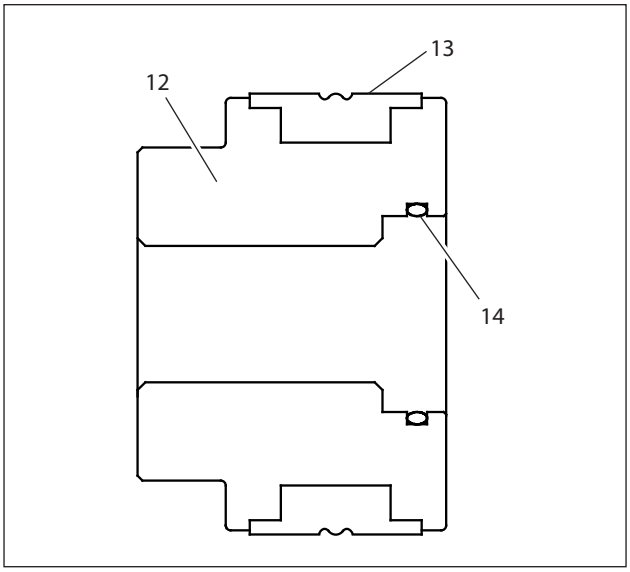


Figure 5-50. Piston Seal Installation

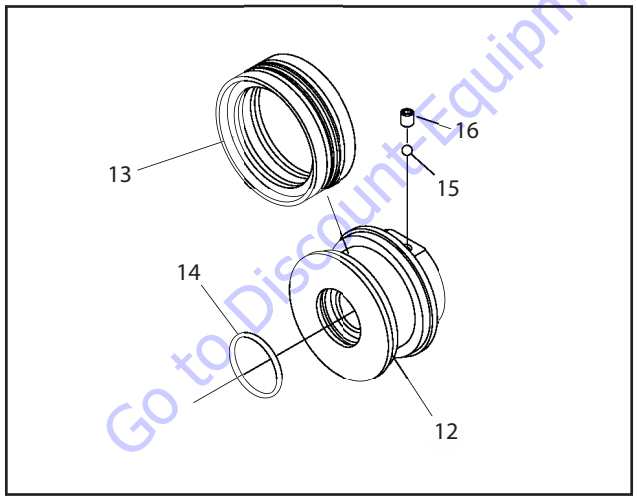


Figure 5-51. Piston Assembly

11. Position cylinder barrel in a suitable holding fixture.

NOTICE

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

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

NOTICE

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

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

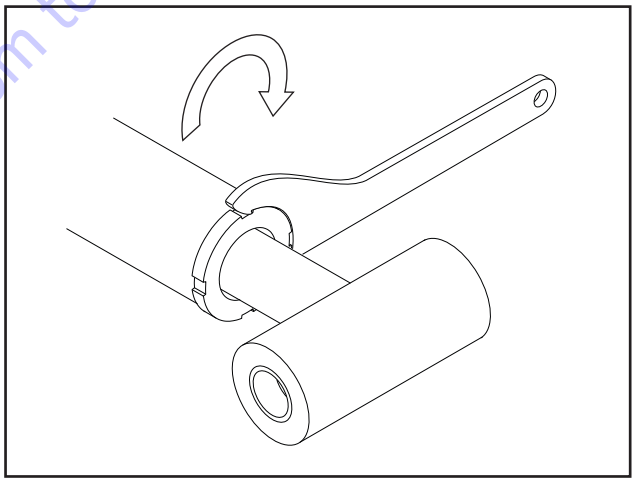


Figure 5-52. Cylinder Head Installation

Jib Lift Cylinder (660SJC Only)

DISASSEMBLY

NOTE: *Refer to Figure 5-56. Jib Lift Cylinder Assembly (660SJ).*

NOTICE

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

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

⚠ WARNING

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

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

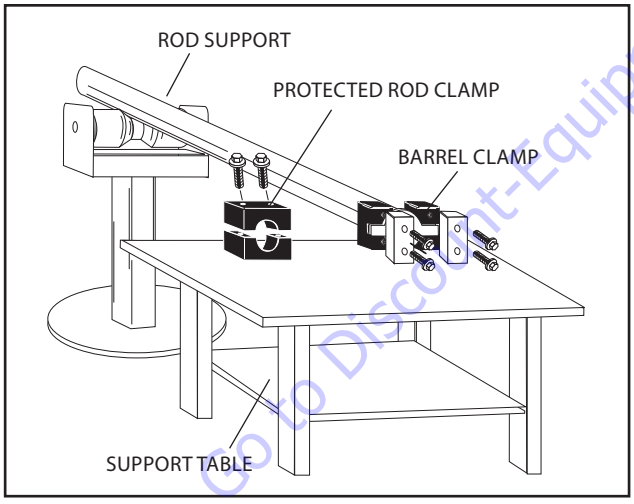


Figure 5-53. Cylinder Barrel Support

5. Mark cylinder head (1) and barrel (2) with center punch marks (3) for later realignment. Remove eight cylinder head capscrews (4).

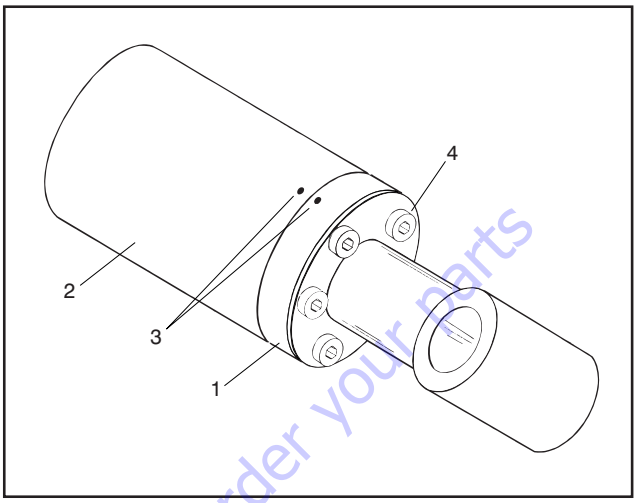


Figure 5-54. Marking Cylinder for Alignment

NOTICE

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

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

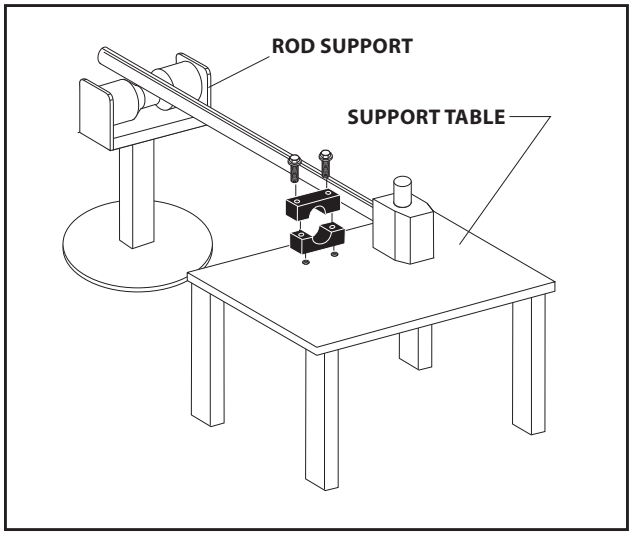
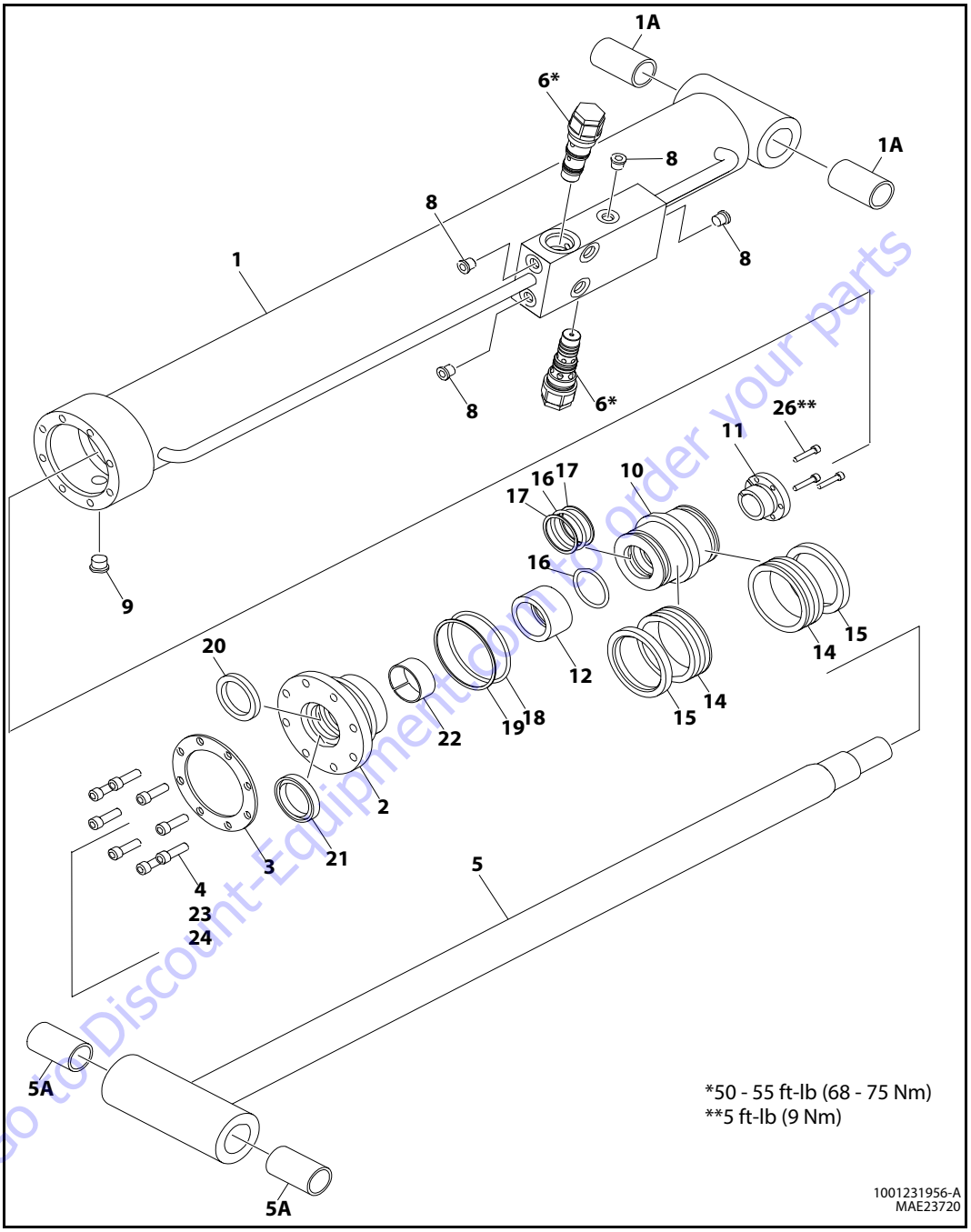


Figure 5-55. Cylinder Rod Support



1.	Barrel	5.	Rod	9.	O-Ring Plug	14.	Seal	19.	Wiper	24.	Locking Primer
1A.	Bushing	5A.	Bushing	10.	Piston	15.	Lock Ring	20.	Wear Ring	25.	Not Used
2.	Head	6.	Cartridge Valve	11.	Tapered Bushing	16.	O-Ring	21.	Wiper	26.	Bolt
3.	Ring Washer	7.	Not Used	12.	Spacer	17.	Backup Ring	22.	Wear Ring		
4.	Capscrew	8.	O-Ring Plug	13.	Not Used	18.	Rod Seal	23.	Locking Compound		

Figure 5-56. Jib Lift Cylinder Assembly (660SJ)

8. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
9. Loosen and remove nut attaching piston to rod. Remove piston.
10. Loosen and remove capscrew(s), if applicable, attaching tapered bushing to piston.
11. Insert capscrew(s) in threaded holes in outer piece of tapered bushing. Progressively tighten capscrew(s) until bushing is loose on piston.
12. Remove tapered bushing from piston.
13. Screw piston counterclockwise by hand and remove from cylinder rod.

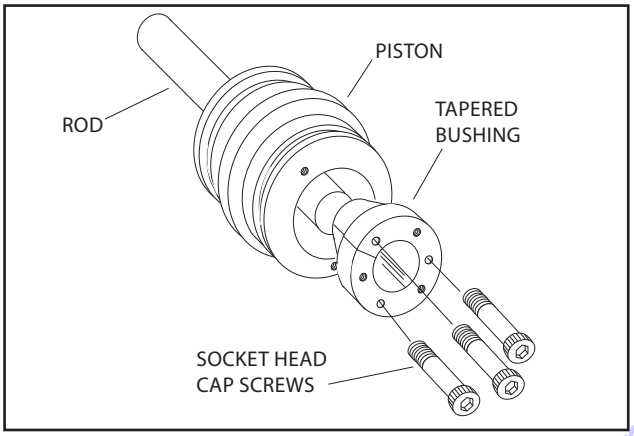


Figure 5-57. Tapered Bushing Removal

14. Remove and discard piston O-rings, seal rings, and backup rings.
15. Remove piston spacer, if applicable, from rod.
16. Remove rod from holding fixture. Remove cylinder head gland and retainer plate, if applicable. Discard O-rings, backup rings, rod seals, and wiper seals.

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

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

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

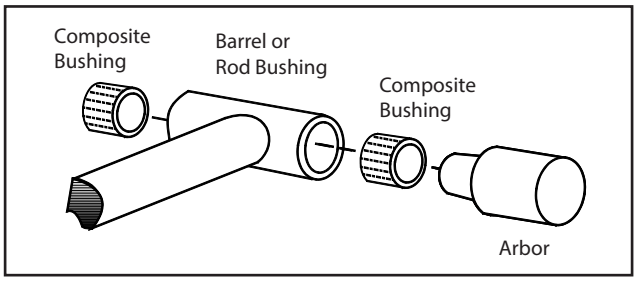


Figure 5-58. Composite Bushing Installation

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

ASSEMBLY

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

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

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

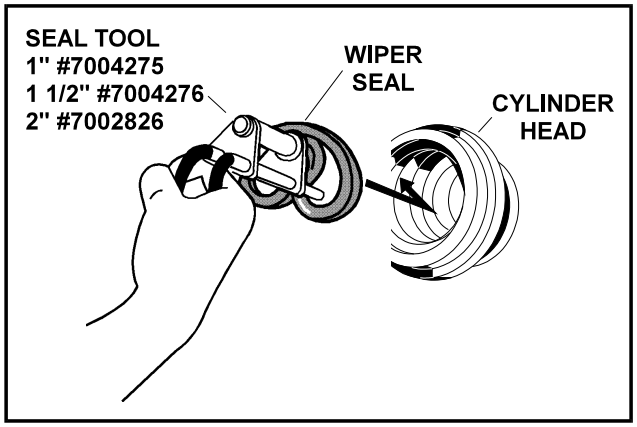


Figure 5-59. Rod Seal Installation

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE 'POLY-PAK' PISTON SEALS ARE PROPERLY INSTALLED. REFER TO WIPER SEAL INSTALLATION FOR CORRECT SEAL ORIENTATION.

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

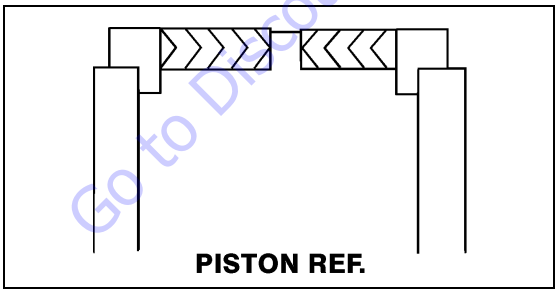


Figure 5-60. Poly-Pak Piston Seal Installation

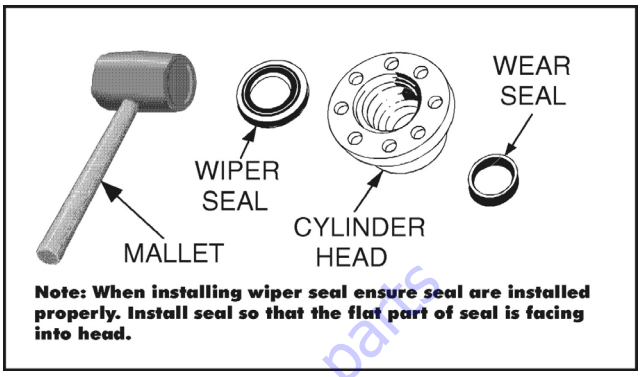


Figure 5-61. Wiper Seal Installation

3. Place new O-ring and backup seal in applicable outside diameter groove of cylinder head.

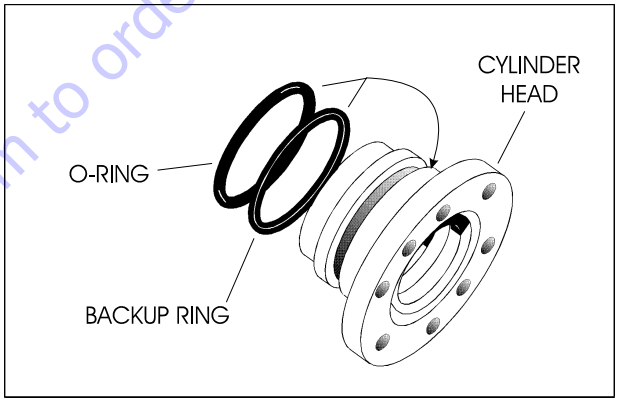


Figure 5-62. Head Seal Kit Installation

4. Install washer ring on rod. Carefully install head gland on rod. Do not damage or dislodge wiper and rod seals. Push head along rod to rod end, as applicable.
5. Carefully slide piston spacer on rod.

NOTE: *Upper telescope cylinder piston has an O-ring installed inside spacer.*

6. If applicable, place new O-ring and backup rings in inner piston diameter groove.

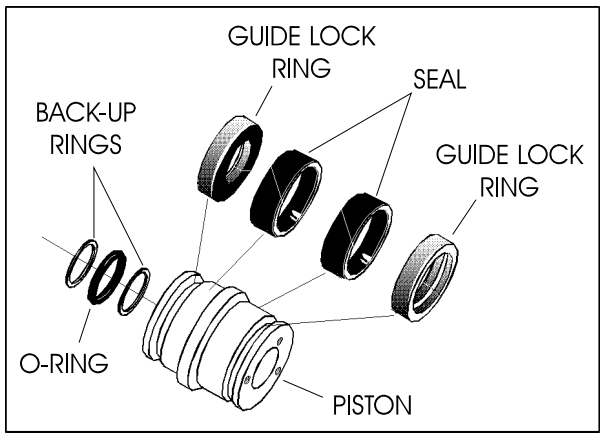


Figure 5-63. Piston Seal Kit Installation

7. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
8. Carefully thread piston on cylinder rod hand tight, Ensure O-ring and backup rings are not damaged or dislodged.

NOTE: *Piston and mating end of rod must be free of oil when installing tapered bushing.*

9. Thread piston onto rod until it aligns with spacer end and install tapered bushing.

NOTE: *Apply JLG Threadlocker P/N 0100011 or equivalent to tapered bushing bolts when rebuilding slave, lift, and telescope cylinders.*

10. Install bolts in tapered bushing using JLG Threadlocker P/N 0100011

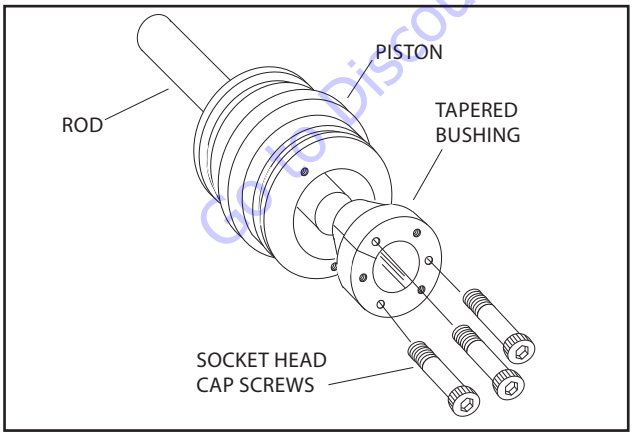


Figure 5-64. Tapered Bushing Installation

11. Remove cylinder rod from holding fixture.
12. Place new guide locks and seals in applicable outside diameter grooves of cylinder piston. (See Figure 5-63. Piston Seal Kit Installation.)
13. Position cylinder barrel in a suitable holding fixture.

NOTICE

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

14. Clamp barrel clamped securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston loading O-ring and seal ring.
15. Continue pushing rod into barrel until cylinder head gland can be inserted into barrel cylinder.
16. Secure cylinder head gland using washer ring and socket head bolts.

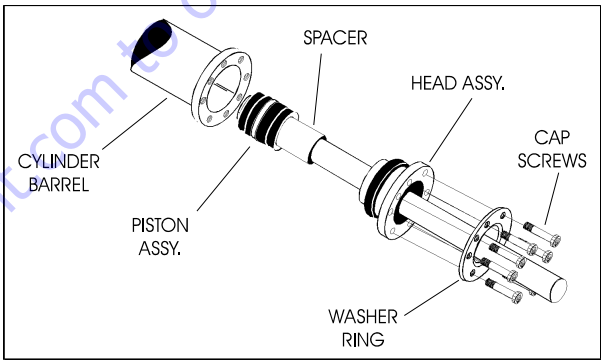


Figure 5-65. Rod Assembly Installation

5.3 HYDRAULIC PUMP (GEAR)

Removal

⚠ WARNING

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

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

NOTICE

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

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

Assembly/Disassembly

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

Installation

NOTICE

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

1. Check for gear teeth on shaft for scoring, pitting tapering and damage. If damaged need to be replaced with a new assembly completely.
2. Apply thin film of spline grease on the gear shaft.
3. Carefully insert the shaft into the piston pump and secure the gear pump using two bolts and washers. Apply JLG Threadlocker P/N 0100011 to end of bolts. Torque bolts to 20-24 ft.lbs (27-33 Nm).
4. Remove cap from the hydraulic hoses and re-connect to their original locations.

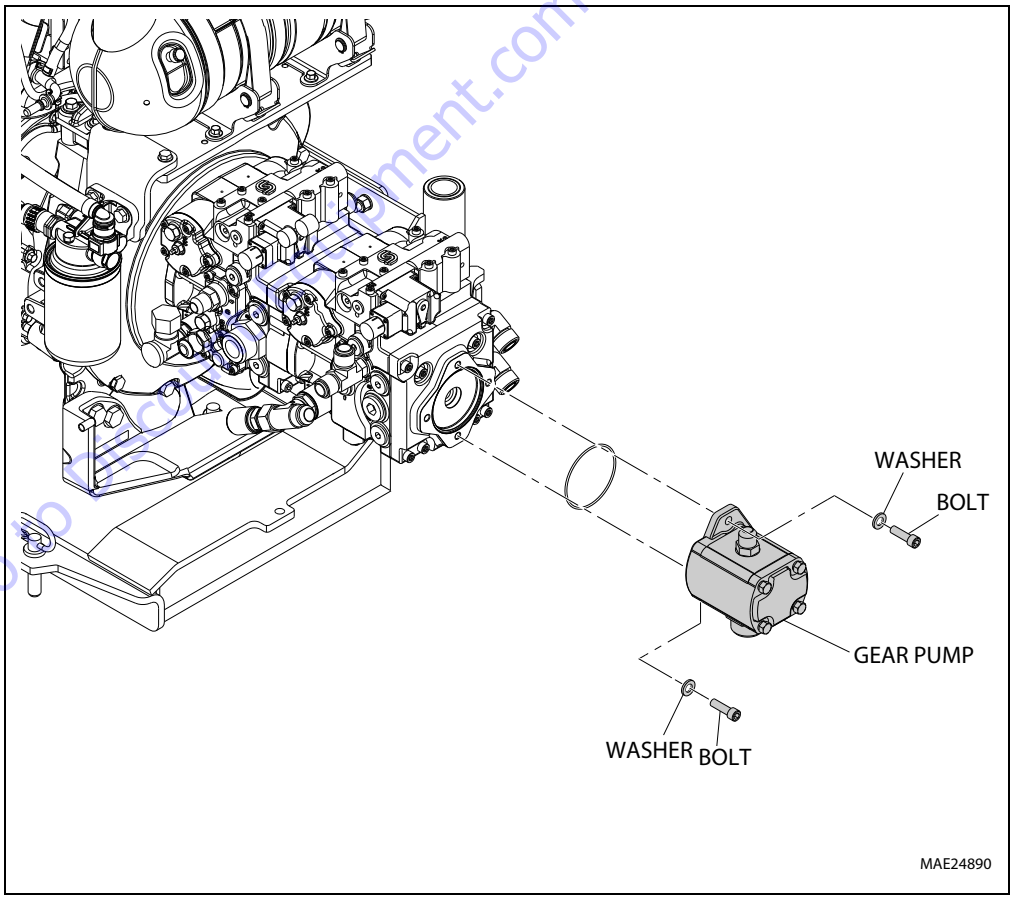


Figure 5-66. Hydraulic Pump Installation

5.4 VARIABLE PUMP

Removal

⚠ WARNING

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

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

NOTICE

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

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

Assembly/Disassembly

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

Installation

NOTICE

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

1. Check for gear teeth on shaft for scoring, pitting tapering and damage. If damaged need to be replaced with a new assembly completely.
2. Apply thin film of spline grease on the gear shaft.
3. Carefully insert the shaft of front variable pump into the engine and secure it using two bolts. Apply JLG Threadlocker P/N 0100011 to end of bolts. Torque bolts to 46-56 ft.lbs (62-76 Nm).
4. Carefully insert the shaft of rear variable pump into the front piston pump and secure it using two bolts. Apply JLG Threadlocker P/N 0100011 to end of bolts. Torque bolts to 46-56 ft.lbs (62-76 Nm).
5. Remove cap from the hydraulic hoses and re-connect to their original locations.

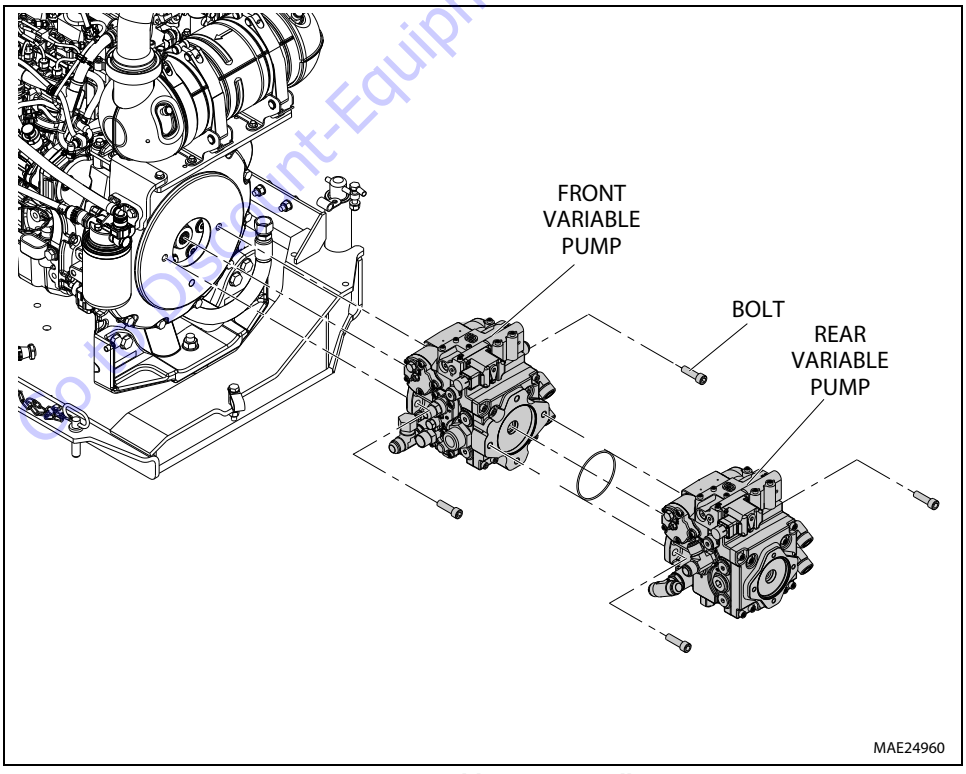


Figure 5-67. Variable Pump Installation

5.5 MAIN VALVE BLOCK PRESSURE SETTING PROCEDURE

Refer to Figure 5-68. Main Control Valve Block.

NOTICE

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

Load Sense Compensator

1. Install a pressure gauge at port MP1 of the main control valve capable of reading pressures up to 1000 psi (70 bar).
2. Start the Engine.
3. Adjust Load Sense Compensator (1) to 450 - 500 psi (31 - 34.5 bar). Turn adjuster clockwise to increase or counterclockwise to decrease pressure.

Main Relief Valve

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

Load Sense Relief Valve

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

Turntable Swing Relief Valve

1. Install a pressure gauge at port MJ of the main control valve.
2. The turntable should be locked in place with the turntable lock pin. Activate swing right.
3. Adjust Relief Valve (8) to 1700 - 1750 psi (117 - 12.5 bar).
4. One adjustment will take care of both directions. Swing left will be approximately 50 psi - 100 psi (3.5 bar - 7 bar) lower. Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.

5.6 MAIN VALVE BLOCK PRESSURE SETTING PROCEDURE

Refer to Figure 5-68. Main Control Valve Block.

NOTICE

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

Load Sense Compensator

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

Main Relief Valve

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

Load Sense Relief Valve

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

Turntable Swing Relief Valve

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

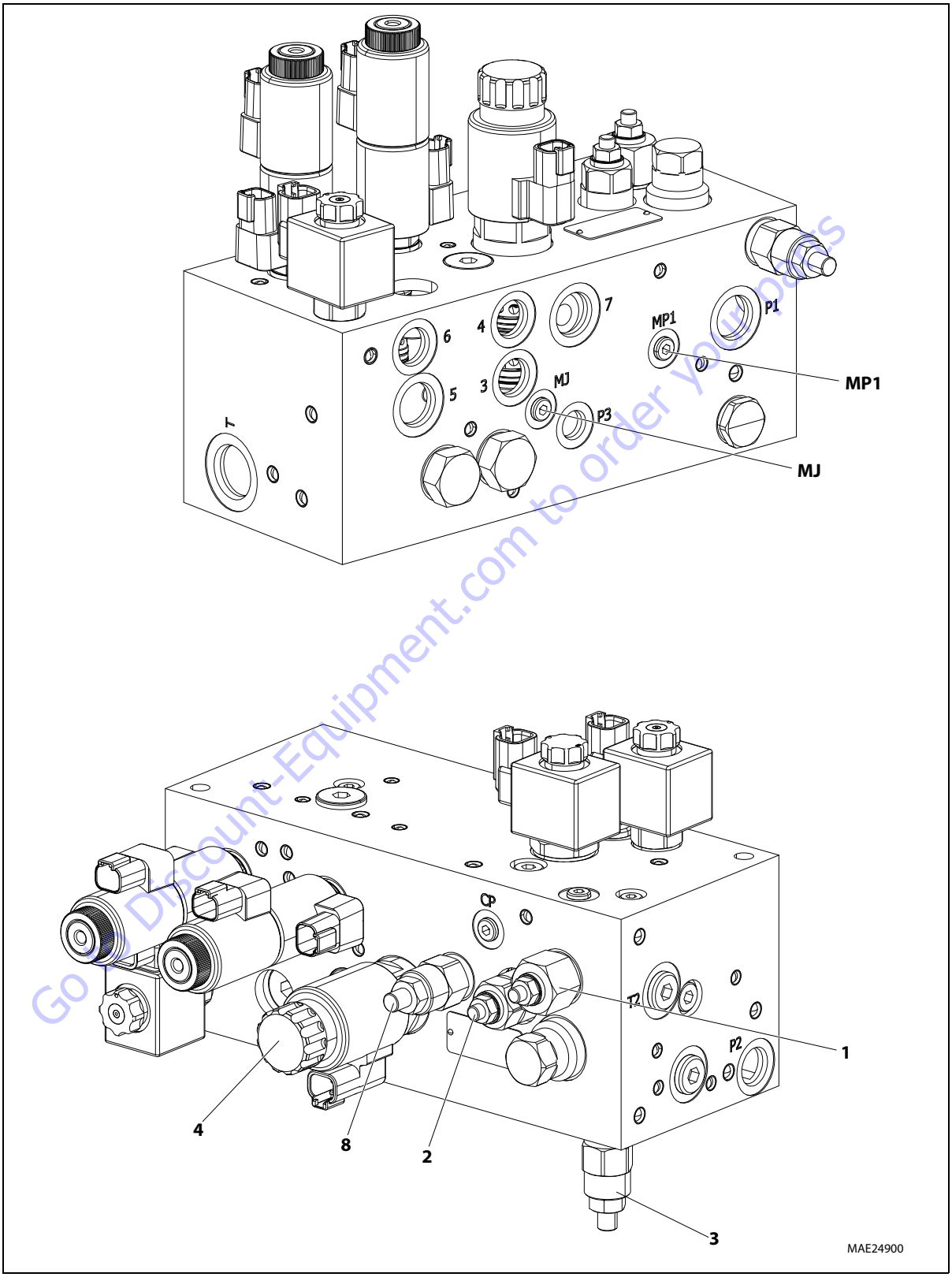


Figure 5-68. Main Control Valve Block

5.7 PLATFORM VALVE BLOCK PRESSURE SETTING PROCEDURE

Refer to Figure 5-69. Platform Control Valve Block.

Main High Pressure Relief Valve

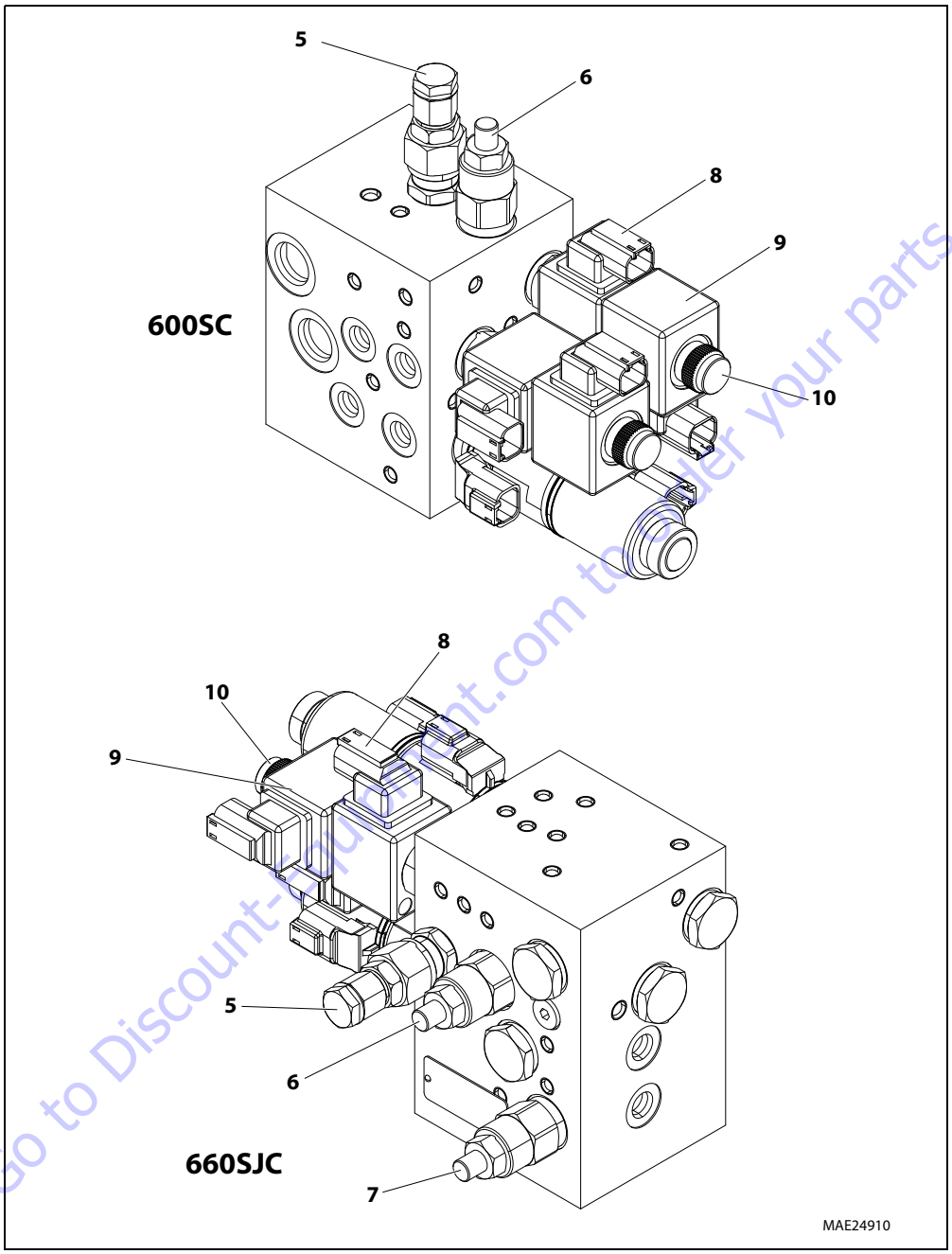
1. Install a pressure gauge at port MP1 of the platform control valve capable of reading pressures up to 5000 psi (345 bar).
2. Activate platform right or left to the end of stroke and hold.
3. Adjust Relief Valve (5) to 2950 - 3000 psi (204.5 - 207 bar). Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.

Low Pressure Relief Valve

1. Install a pressure gauge at port MP1 of the platform control valve capable of reading pressures up to 5000 psi (345 bar).
2. To check or set this adjustment locate the dump directional valve (10) at the platform manifold (12). Flip the wires between the two solenoid coils. After the relief has been set, flip the wires back to their original place.
3. Activate rotate right or left to the end of stroke.
4. Adjust Relief Valve (6) to 2200 ± 50 psi (152 ± 3.5 bar). Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.

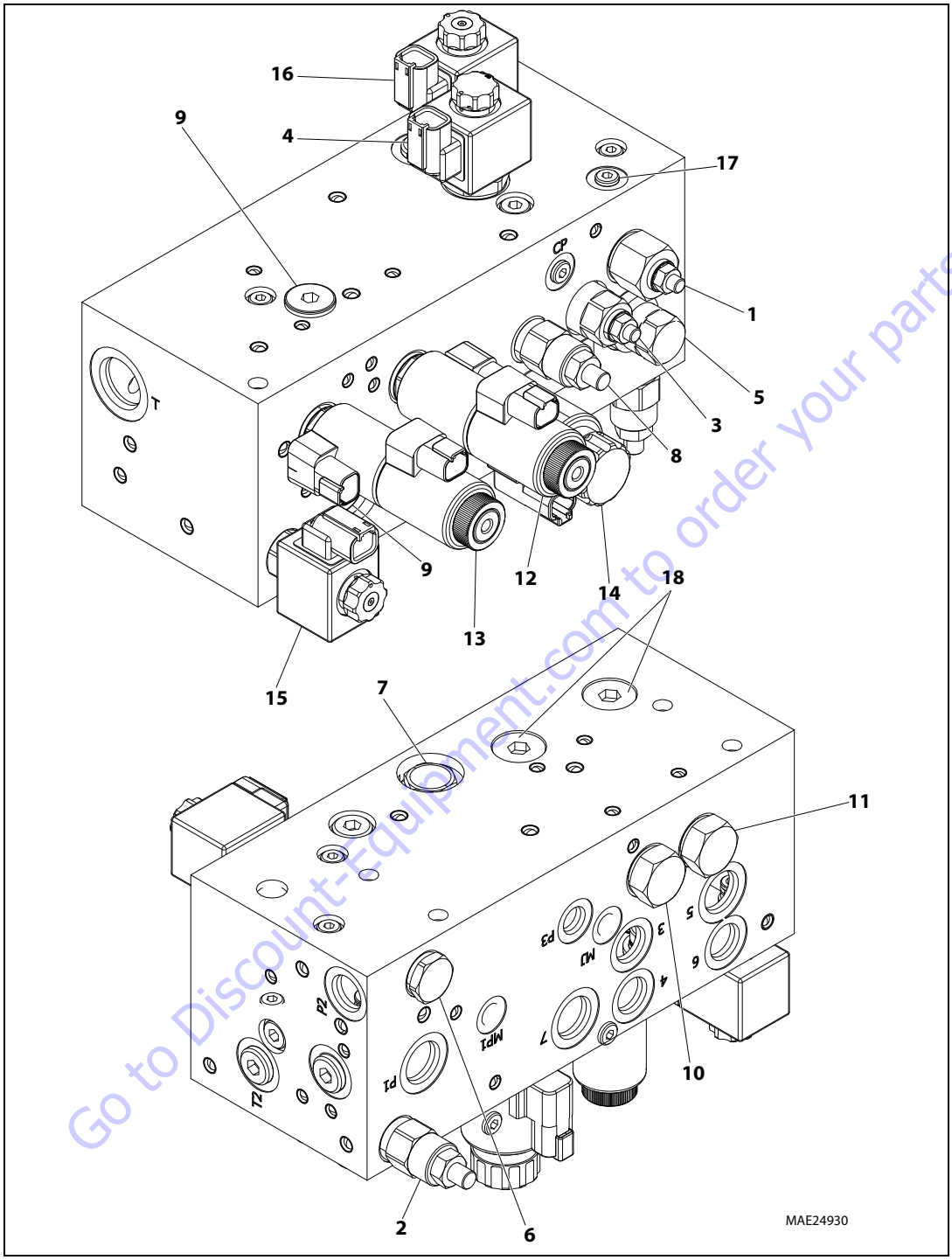
Platform Jib Down Relief Valve

1. Install a pressure gauge at port M5-6 of the platform control valve capable of reading pressures up to 5000 psi (345 bar).
2. Activate jib down to the end of stroke and hold.
3. Adjust Relief Valve (7) to 1600 - 1650 psi (110 - 113.5 bar).
4. This one adjustment will take care of jib up and down. Jib up will automatically be approximately 50 - 100 psi (3.5 - 7 bar) higher than jib down. Turn adjuster clockwise to increase pressure or counterclockwise to decrease pressure.



5. Main High Pressure Relief Valve
6. Low Pressure Relief Valve
7. Jib Relief Valve
8. Low Pressure Relief Solenoid
9. High Pressure Relief Solenoid
10. Dump Directional Valve

Figure 5-69. Platform Control Valve Block



1. Load Sense Compensator
2. Relief Valve
3. Relief Valve
4. Solenoid Valve
5. Priority Flow Control Valve
6. Check Valve
7. Flow/Pressure Control Valve
8. Relief Valve
9. Shuttle Valve
10. Pressure Compensator Valve
11. Pressure Compensator Valve
12. Solenoid Valve
13. Solenoid Valve
14. Solenoid Valve
15. Solenoid Valve
16. Solenoid Valve
17. Orifice Plug
18. Check Valve

Figure 5-70. Main Control Valve

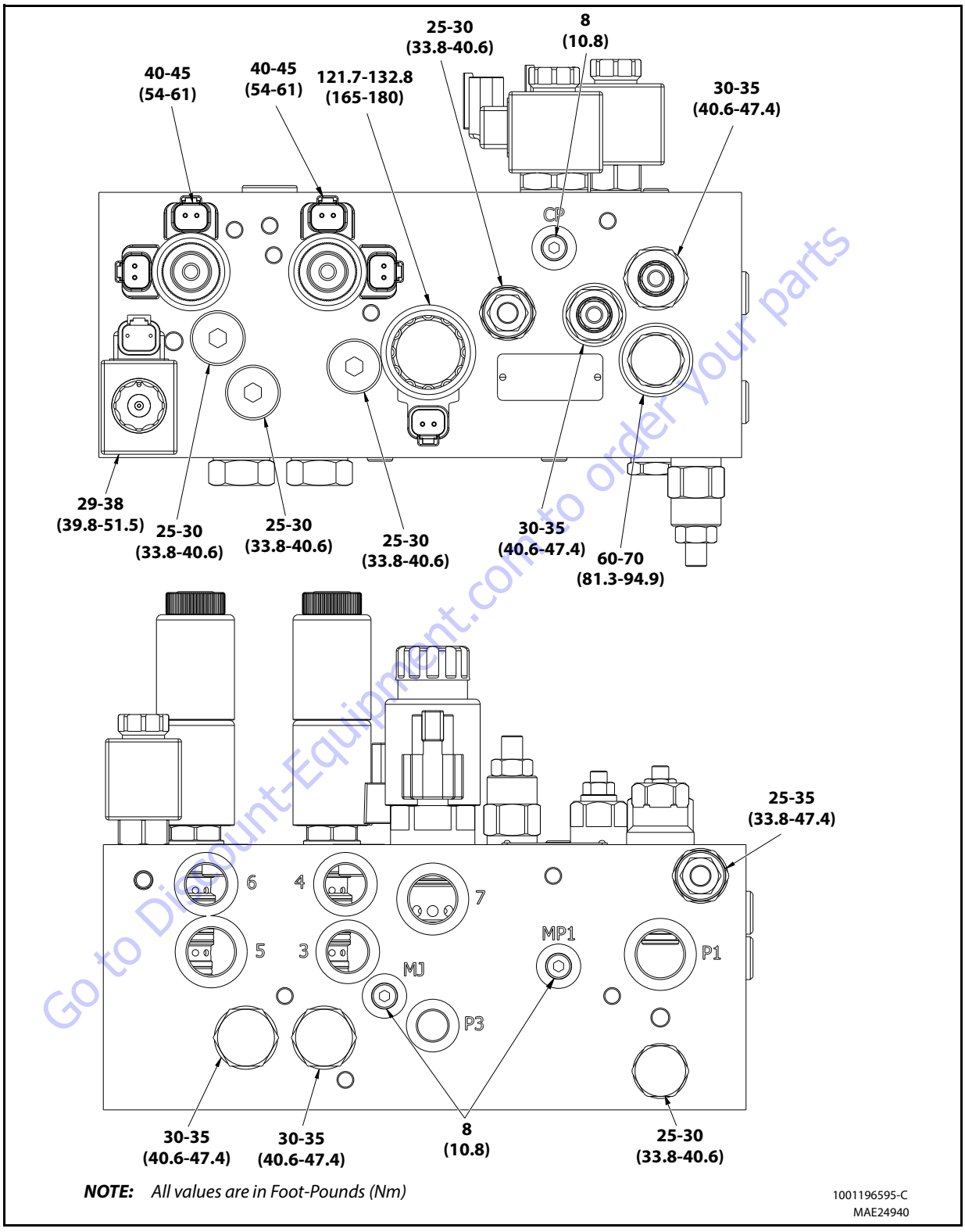


Figure 5-71. Main Control Valve Torque Values - Sheet 1 of 2

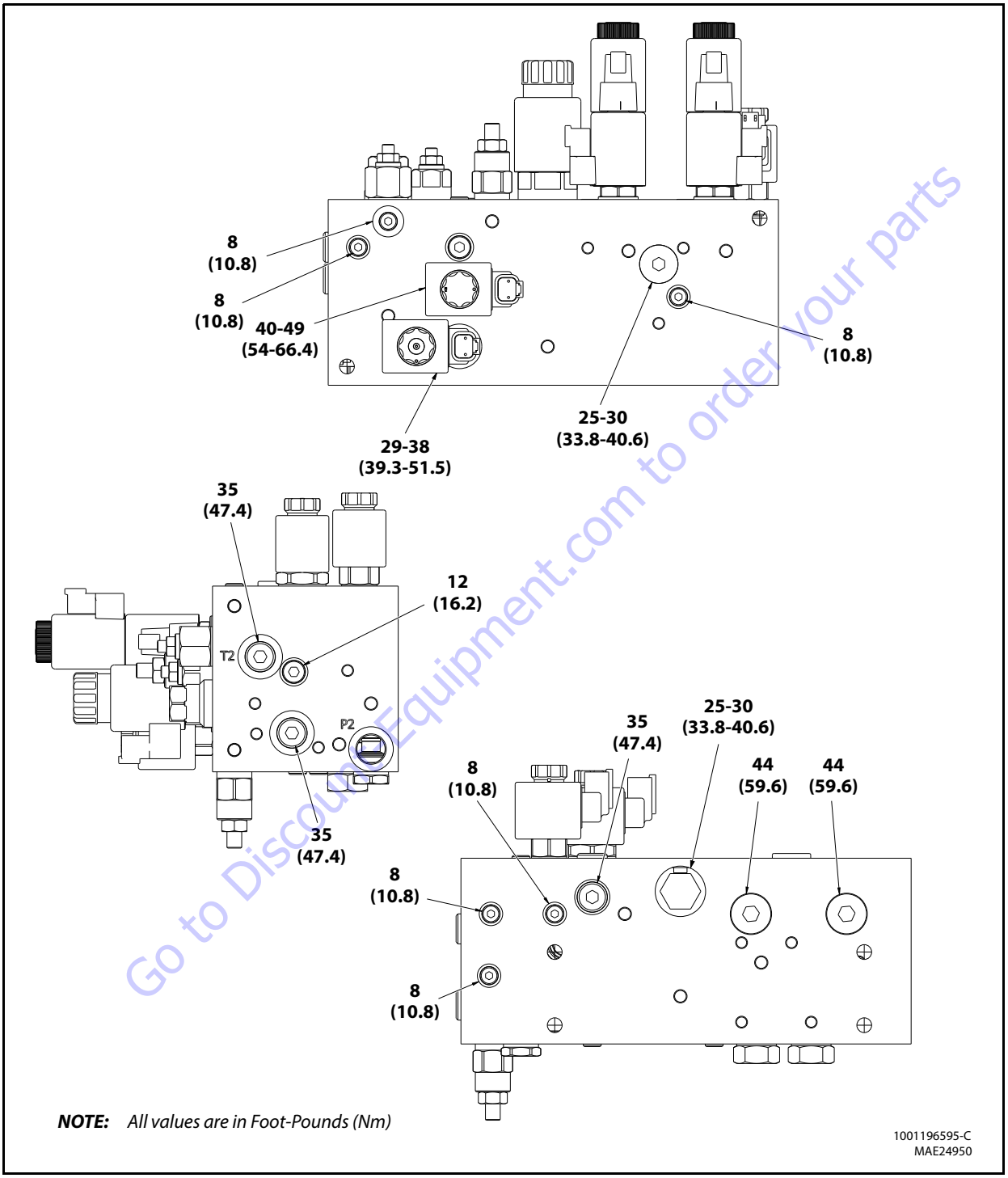


Figure 5-72. Main Control Valve Torque Values - Sheet 2 of 2

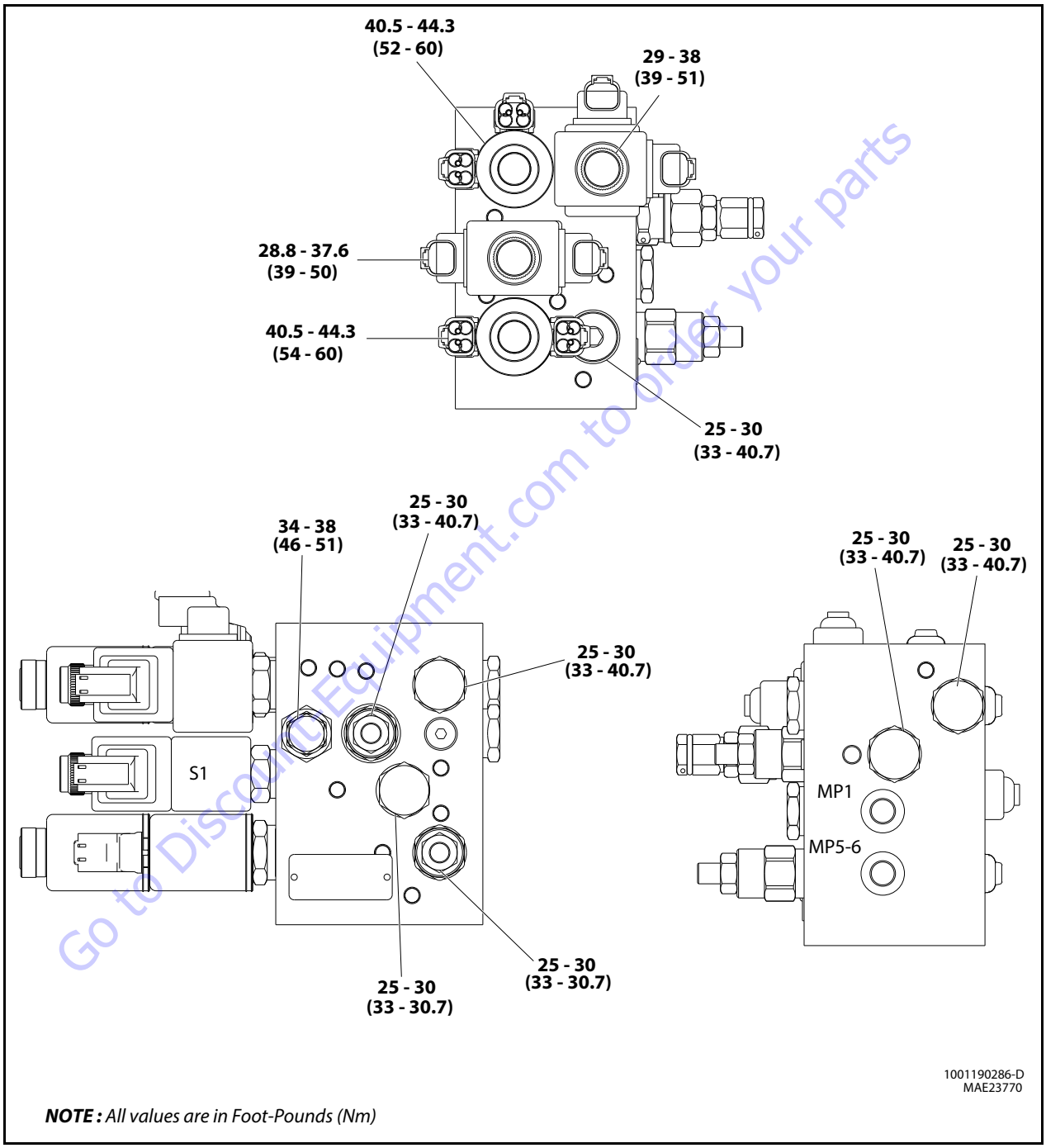


Figure 5-73. Platform Valve Torque Values

5.8 HYDRAULIC SCHEMATICS

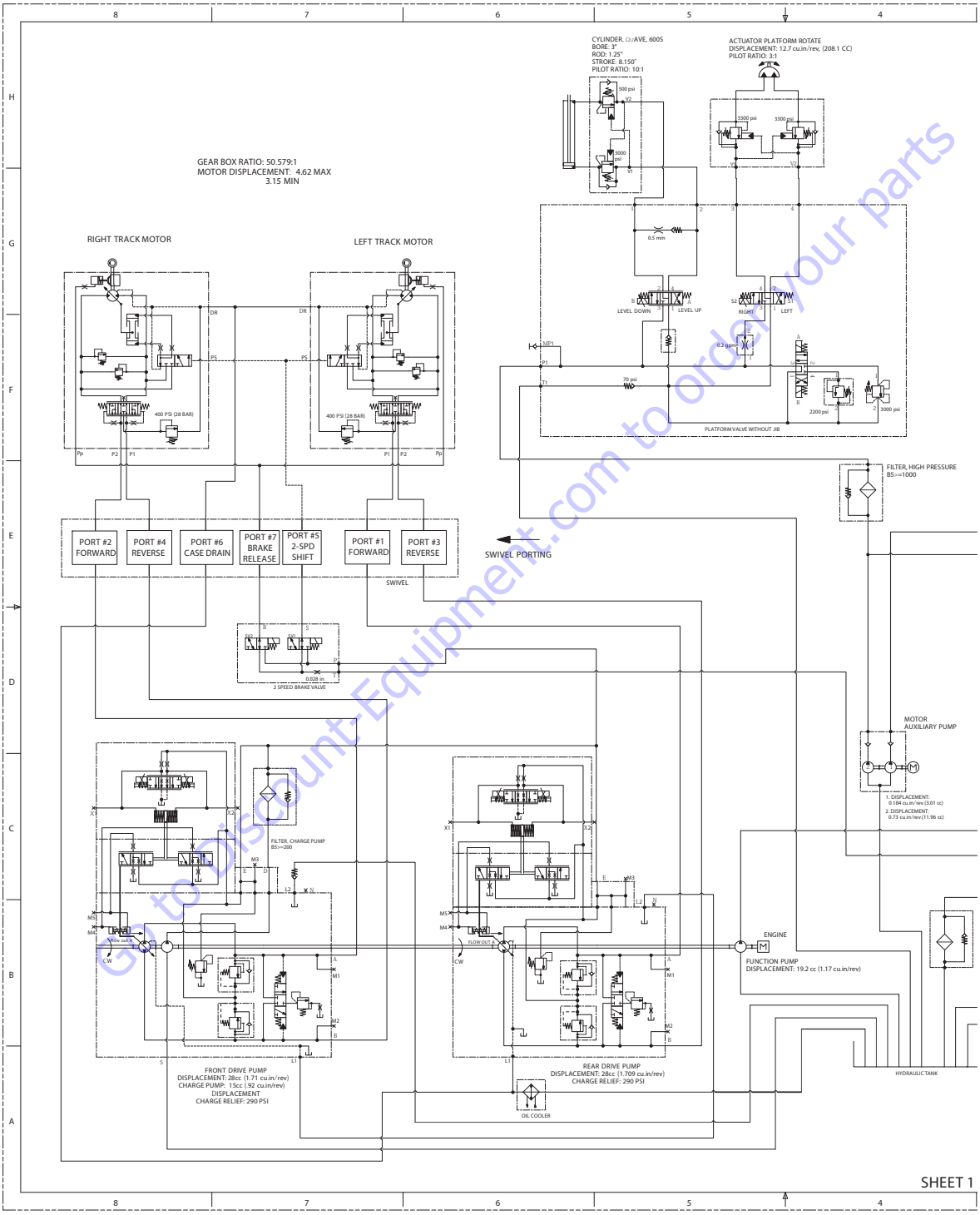


Figure 5-74. Hydraulic Schematic (600SC) - Sheet 1 of 2

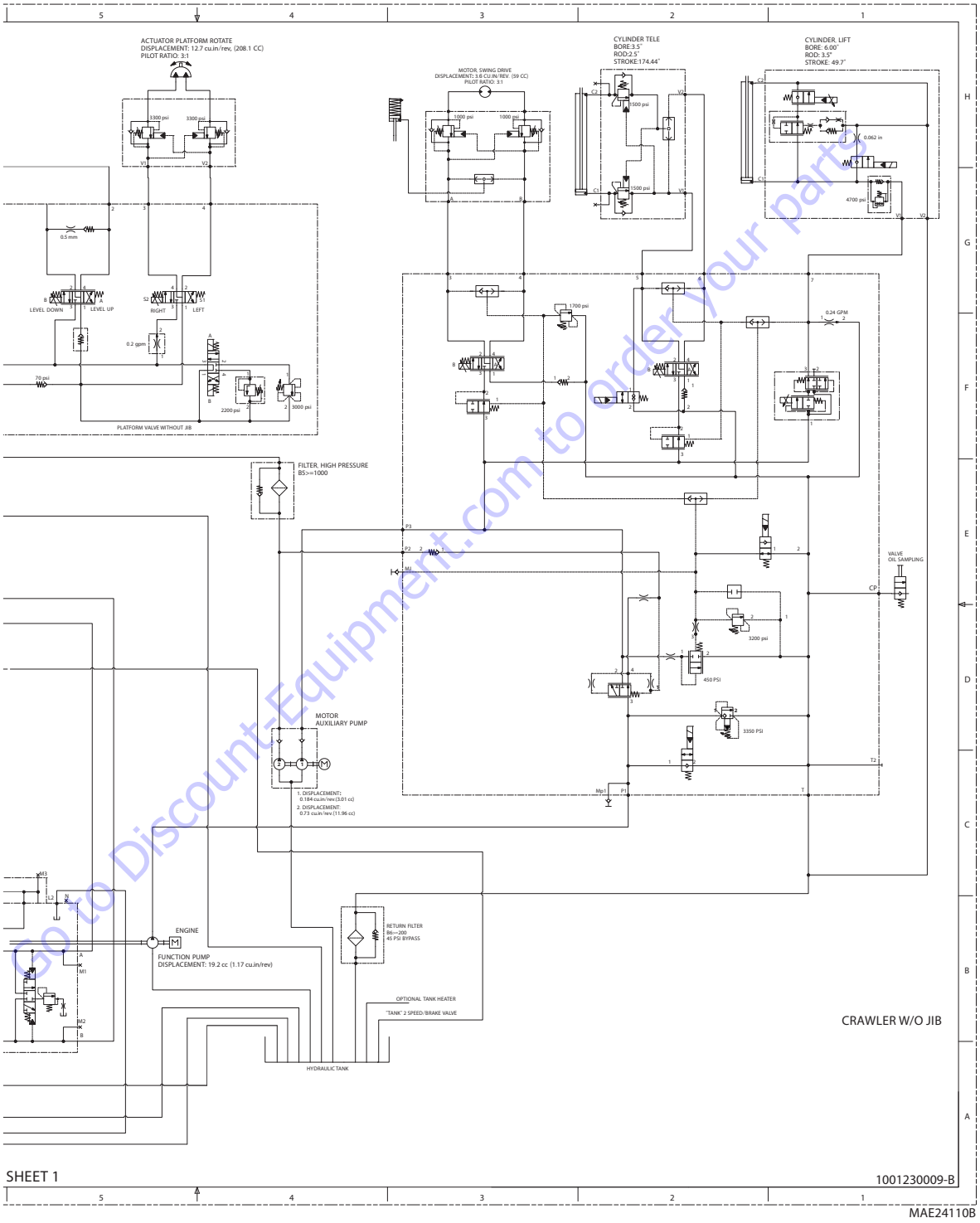


Figure 5-75. Hydraulic Schematic (600SC) - Sheet 2 of 2

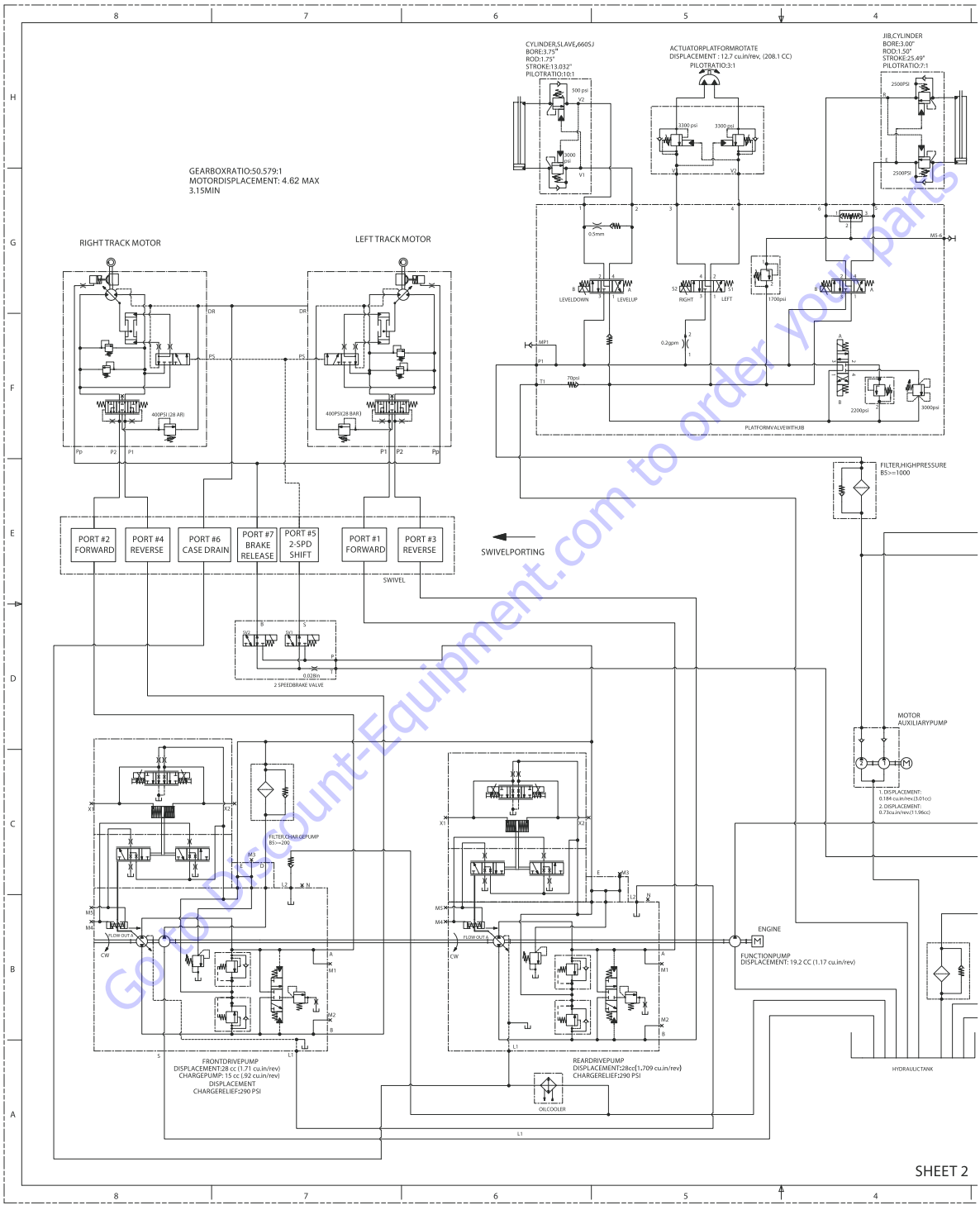


Figure 5-76. Hydraulic Schematic (660SJC) - Sheet 1 of 2

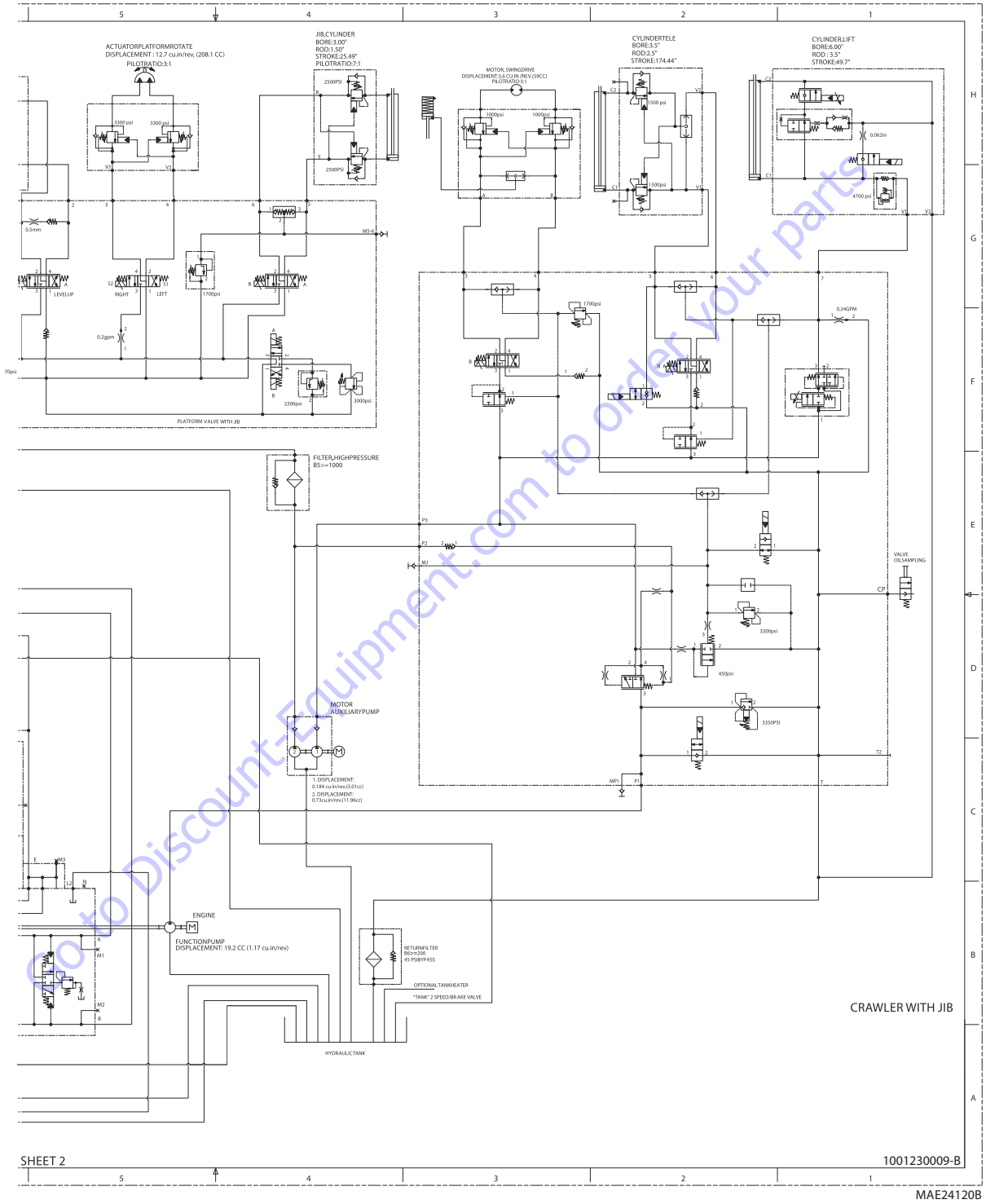


Figure 5-77. Hydraulic Schematic (660SJC) - Sheet 2 of 2