Service and Maintenance Manual

Models
400SC
460SJC

PVC 2001

31215019

January 02, 2020 - Rev A

ANSI

CE

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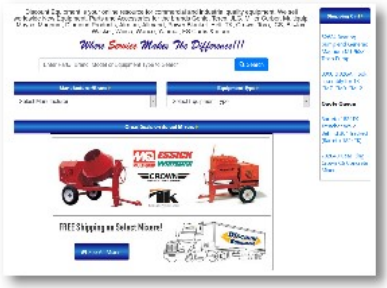

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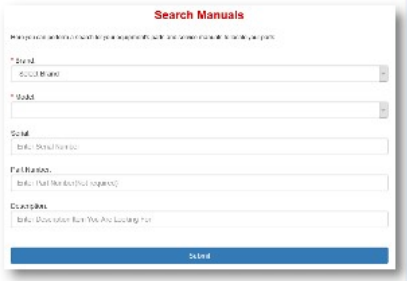

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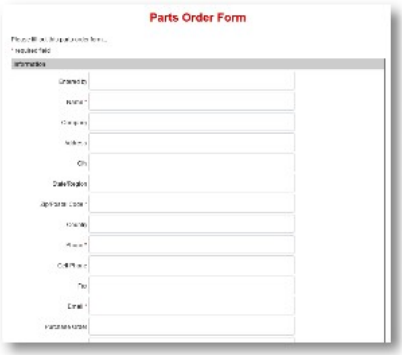

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SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A GENERAL

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

⚠ WARNING

MODIFICATION OR ALTERATION OF A MOBILE ELEVATING WORK PLATFORM SHALL BE MADE ONLY WITH WRITTEN PERMISSION FROM THE MANUFACTURER.

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

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

⚠ WARNING

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

B HYDRAULIC SYSTEM SAFETY

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

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

C MAINTENANCE

⚠ WARNING

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

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

REVISON LOG

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SECTION 5 - HYDRAULICS AND HYDRAULIC SCHEMATICS

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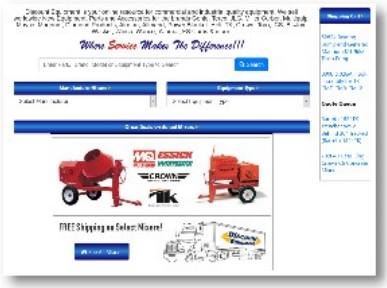

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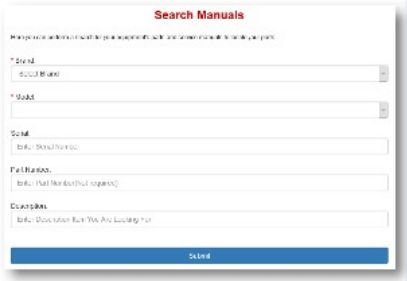

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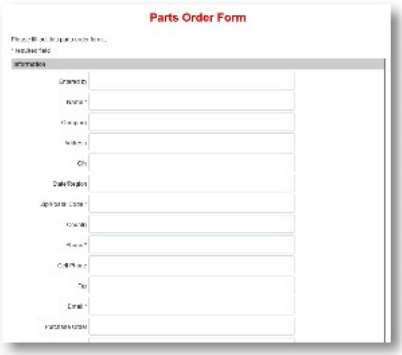

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SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Machine Specifications - 400SC

Maximum Work Load (Capacity): Unrestricted (CE) Restricted (CE)	 272 kg (600 lb) 454 kg (1000 lb)
Maximum Operating Slope	5°
Maximum Travel Grade, Stowed Position (Gradeability)	51%
Maximum Travel Grade, Stowed Position (Side Slope)	5°
Platform Height: With out Turntable Spacer With Turntable Spacer	 11.89 m (39 ft) 12.05 m (39 ft-6.5 in)
Horizontal Platform Reach:	10 m (33 ft)
Turning Radius (Outside)	0
Turning Radius (Inside)	0
Overall Width	2.23 m (7 ft-4 in)
Stowed Height: With out Turntable Spacer With Turntable Spacer	 2.16 m (7 ft-1 in) 2.32 m (7 ft-7.5 in ft)
Stowed Length	7.57 m (24ft-10 in)
Wheelbase	2.25 m (7 ft-4.8 in)
Ground Clearance	0.32 m (12.5 in)
Ground Bearing Pressure: With out Turntable Spacer With Turntable Spacer	 3626 kg/m^2 (5.16 psi) 3661kg/m^2 (5.21 psi)
Travel Speed	2.57 km/h (1.6 mph)
Rubber and Steel Track GVW: Without Turntable Spacer With Turntable Spacer	 6,542 kg (14,422 lb) 6,604 kg (14,559 lb)
Maximum Rubber Track Load	5769 kg (12,718 lb)
Maximum System Voltage	12V
Max. Hydraulic System Operating Pressure	207 bar (3000 psi)
Manual Force (CE) (Force applied by work platform occupant on fixed structure)	400 N (90 lb)
Maximum Wind Speed	12.5 m/s (28 mph)
Tailswing	0.96 m (3.14 ft)

Machine Specifications - 460SJC

Maximum Work Load (Capacity):	272 kg (600 lb)
Maximum Operating Slope	5°
Maximum Travel Grade, Stowed Position (Gradeability)	51%
Maximum Travel Grade, Stowed Position (Side Slope)	5°
Platform Height: With out Turntable Spacer With Turntable Spacer	 13.72 m (45 ft) 13.88 m (45 ft-6.5 in)
Horizontal Platform Reach:	12 m (39 ft)
Turning Radius (Outside)	0 m (0 ft)
Turning Radius (Inside)	0 m (0 ft)
Track Width	0.4 m (1.31 ft)
Overall Width	2.23 m (7 ft-4 in)
Stowed Height: With out Turntable Spacer With Turntable Spacer	 2.16 m (7 ft-1 in) 2.33 m (7 ft-7.2 in ft)
Stowed Length	8.9 m (29ft-3 in)
Wheelbase	2.25 m (7 ft-4.8 in)
Ground Clearance	0.32 m (12.5 in)
Tailswing	0.96 m (3.14 ft)
Ground Bearing Pressure: With out Turntable Spacer With Turntable Spacer	 5702 kg/m^2 (8.11 psi) 5870 kg/m^2 (8.35 psi)
Maximum Travel Speed	2.9 km/h (1.8 mph)
Rubber and Steel Track GVW: Without Turntable Spacer With Turntable Spacer	 8,102 kg (17,862 lb) 8,184 kg (17,998 lb)
Maximum Rubber Track Load	5,769 kg (12,718 lb)
Maximum System Voltage	12V
Max. Hydraulic System Operating Pressure	207 bar (3000 psi)
Manual Force (CE) (Force applied by work platform occupant on fixed structure)	400 N (90 lb)
Maximum Wind Speed	12.5 m/s (28 mph)

1.2 CAPACITIES

Fuel Tank (Usable)	83.3 L (22 Gal)
Hydraulic Tank (Usable)	136.28 L (36 Gal)
Final Drive Hub	1 L (33.8 oz)

1.3 ENGINE DATA

NOTE: *RPM Tolerances are ± 100.*

Table 1-1. Deutz D2011L03

Engine Type	Four-stroke Diesel
Fuel	Diesel
No. of Cylinders	3
Bore	94 mm (3.7 in)
Stroke	112 mm (4.4 in)
Displacement	2331 cm^3 (142 cu. in)
Oil Capacity Crankcase Cooler Total Capacity	 6 L (6.3 qt) 3.5 L (3.7 qt) 9.5 L (10 qt)
Low RPM	1200
Mid RPM Boom Lift, Telescope Swing, Basket Level, Basket Rotate	 1800 1500
High RPM	2800
Fuel Consumption (Average)	3.2 L/hr (0.85 Gal/hr)

Table 1-2. Deutz 2.9L4

Engine Type	Four-stroke Diesel
Fuel	Diesel
No. of Cylinders	3
Bore	92 mm
Stroke	110 mm
Displacement	2925 cm^3 (178 cu. in)
Oil Capacity	8.9 L (9.5 qt)
Coolant Capacity	11.3 L (12 qt.)
Low RPM	1200
High RPM	2600
Max Output Power	34.4 kW (48.8 hp)
Acceptable Fuel Grades	Ultra Low Sulfur (15 ppm) Up to 5% Bio Diesel
Fuel Consumption (Average)	2.6 L/hr (0.70 Gal/hr)
Max Output Torque	147 Nm (108 ft.lb.)

1.4 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 must have anti-wear qualities at least to API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service. JLG Ind. recommends Standard UTTO fluid, which has an SAE viscosity index of 152.*

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

NOTE: *Machines may be equipped with Mobil EAL224H biodegradable and non-toxic hydraulic oil. This is Vegetable oil based and possesses the same antiwear and rust protection characteristics as mineral oils, but will not adversely affect the ground water or the environment when spilled or leaked in small amounts. Mobil EAL-224H has a viscosity of 34 cSt at 40° C. and viscosity index of 213. The operating temperature range of this oil is -18° C to +83° C.*

NOTE: *Aside from JLG recommendations, it is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. If use of hydraulic oil other than Standard UTTO is desired refer Figure 2-3., Hydraulic Oil Operating Temperature Specifications.*

Table 1-3. Mobilfluid 424 Specs

SAE Grade	10W-30
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 1-4. Mobil DTE 13M Specs

ISO Viscosity Grade	#32
Specific Gravity	0.877
Pour Point, Max	-40°C (-40°F)
Flash Point, Min.	166°C (330°F)
Viscosity	
at 40° C	33cSt
at 100° C	6.6 cSt
at 100° F	169 SUS
at 210° F	48 SUS
cp at -20° F	6,200
Viscosity Index	140

Table 1-5. UCon Hydrolube HP-50/46

Type	Synthetic Biodegradable
Specific Gravity	1.082
Pour Point, Max	-50°C (-58°F)
pH	9.1
Viscosity	
at 0° C (32° F)	340 cSt (1600SUS)
at 40° C (104° F)	46 cSt (215SUS)
at 65° C (150° F)	22 cSt (106SUS)
Viscosity Index	170

Table 1-6. Mobil EAL 224H Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	32/46
Specific Gravity	.922
Pour Point, Max	-32°C (-25°F)
Flash Point, Min.	220°C (428°F)
Operating Temp.	-17 to 162°C (0 to 180°F)
Weight	0.9 kg/L (7.64 lb/gal)
Viscosity	
at 40° C	37 cSt
at 100° C	8.4 cSt
Viscosity Index	213
NOTE: *Must be stored above 14°C (32°F)*	

Table 1-7. Mobil EAL H 46 Specs

Type	Synthetic Biodegradable
ISO Viscosity Grade	46
Specific Gravity	.910
Pour Point	-42°C (-44°F)
Flash Point	260°C (500°F)
Operating Temp.	-17 to 162°C (0 to 180°F)
Weight	0.9 kg/L (7.64 lb/gal)
Viscosity	
at 40° C	45 cSt
at 100° C	8.0 cSt
Viscosity Index	153

Table 1-8. Exxon Univis HVI 26 Specs

Specific Gravity	32.1
Pour Point	-60°C (-76°F)
Flash Point	103°C (217°F)
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.*

1.5 CRITICAL STABILITY WEIGHTS

Component	lb	kg
Battery	66	30
Counterweight (400SC) - Turnable	1060	4812
Counterweight (460SJC) - Turnable	2700	1225
Counterweight (400SC) - Chassis (Front)	1200	544
Counterweight (400SC) - Chassis (Rear)	1210	549
Counterweight (460SJC) - Chassis (Front)	1773	804
Counterweight (460SJC) - Chassis (Rear)	1787	810.5
Rubber Track (Each) - Excavator Tracks	580	263
Rubber Track (Each) - Carrier Tracks	565	256
Rubber Track (Each) - Non-Marking	560	254
Steel Track - Each	747.5	339
Track Pad - Each	7.7	3.5
Platform and Console - 30 x 60	170	77
Platform and Console - 36 x 72	209	95
Platform and Console - 36 x 96	240	109

1.6 MAINTENANCE AND LUBRICATION

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

Table 1-9. Lubrication Specifications

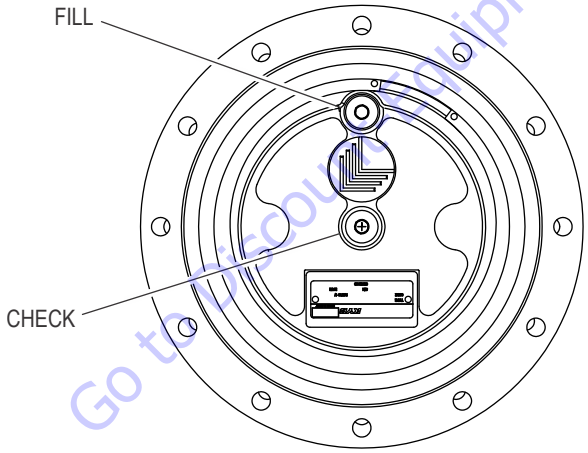
KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350° F (177° C). Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105
HO	Hydraulic Oil. API service classification GL-3, e.g. Standard UTTO fluid.
EO	Engine (crankcase). Gas (5W30) - API SN, -Arctic ACEA AI/BI, A5/B5 - API SM, SL, SJ, EC, CF, CD - ILSAC GF-4. Diesel (15W40, 5W30 Arctic) - API CJ-4.
OGL	Open Gear Lubricant - Mobiltac 375 or equivalent.

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.

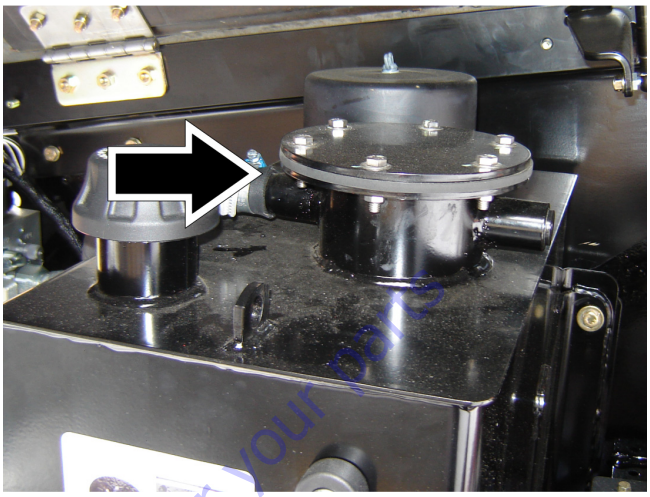
NOTE: *It is recommended as a good practice to replace all filters at the same time.*

1. Final Drive Hub



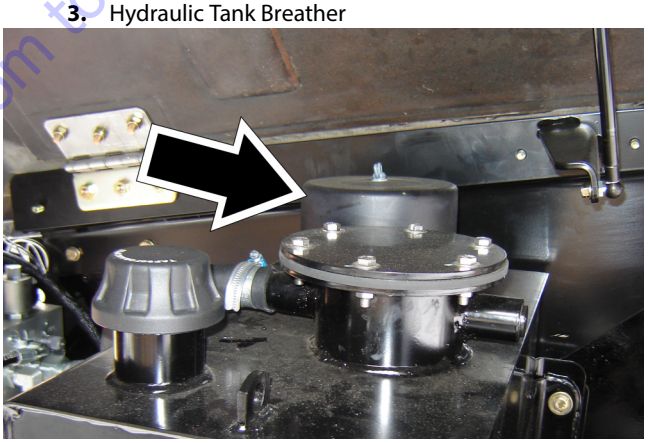
Lube Point(s) - Level/Fill Plug
Capacity - 33.8 oz (1 L)(1/2 Full)
Lube - EPGL
Interval - Check level every 3 months or 150 hours of operation; change every 2 years or 1200 hours of operation

2. Hydraulic Return Filter



Interval - Change after first 50 hours and every 6 months or 300 hours thereafter or whenever Charge Filter is replaced

3. Hydraulic Tank Breather



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

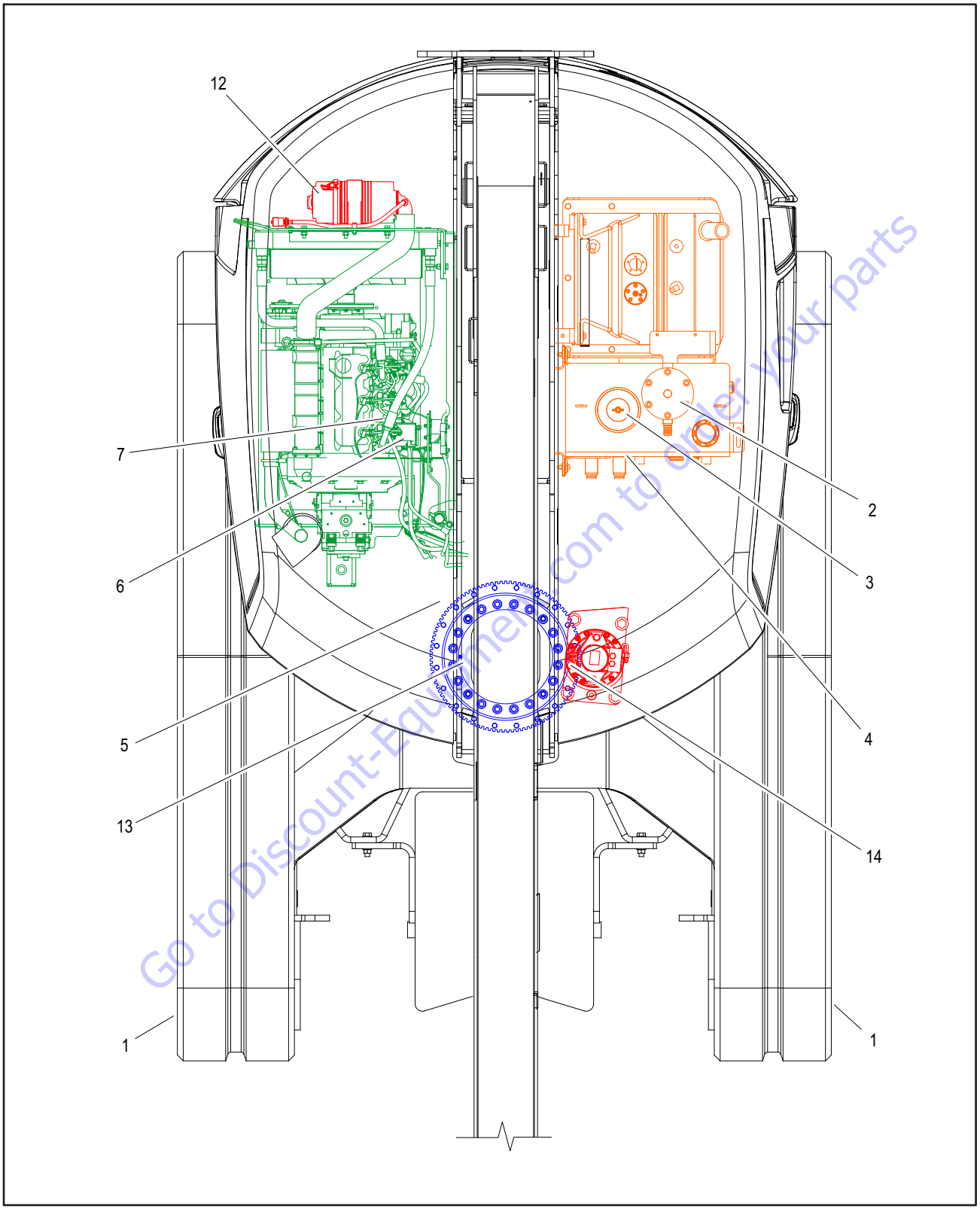


Figure 1-1. Maintenance and Lubrication Diagram - Deutz D2011L03

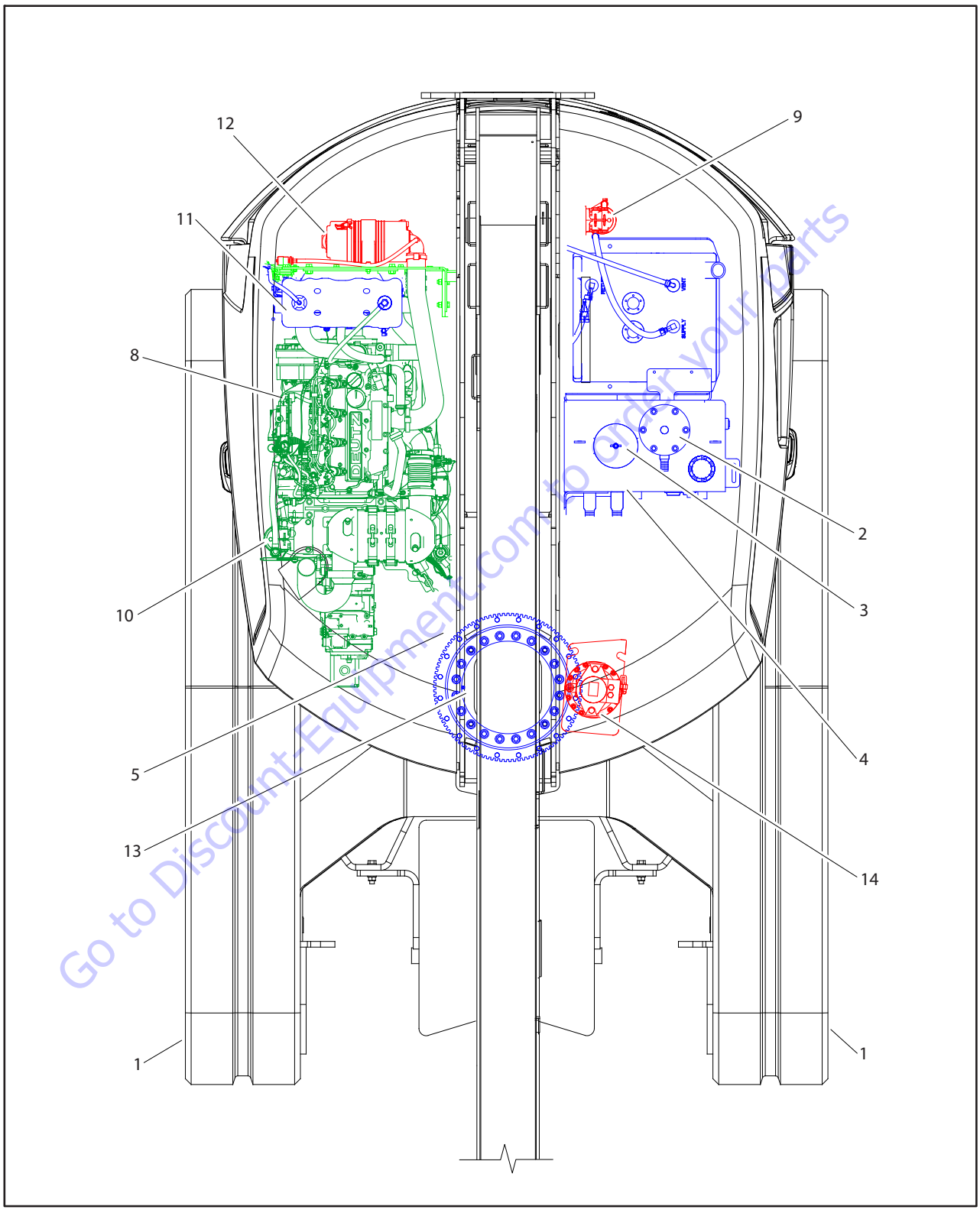
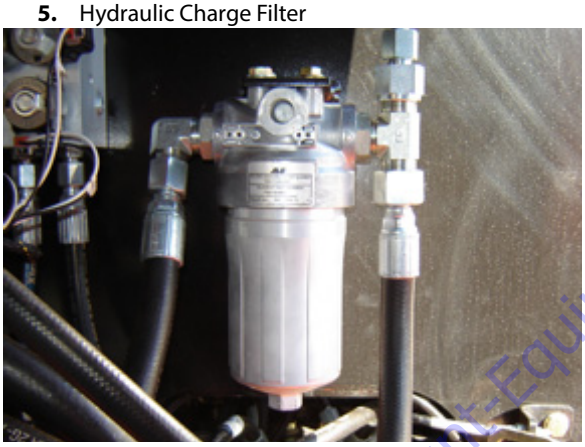


Figure 1-2. Maintenance and Lubrication Diagram - Deutz 2.9L4

4. Hydraulic Tank

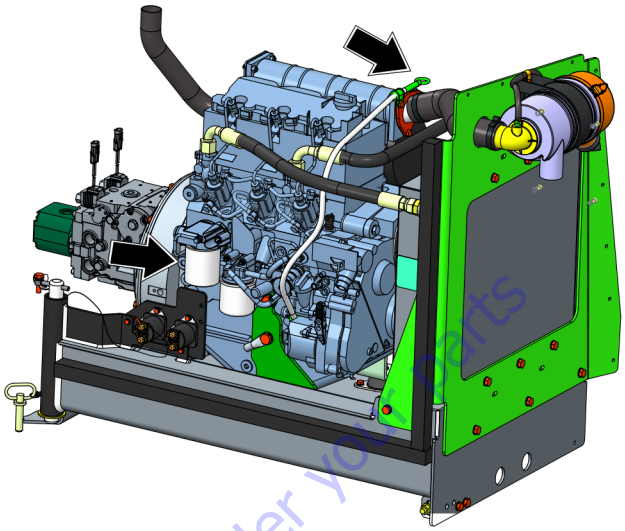
Lube Point(s) - Fill Cap
Capacity - 32.5 gal tank (123 L) 40.0 gal system (151 L)
Lube - HO
Interval - Check Level daily; Change every 2 years or 1200 hours of operation

5. Hydraulic Charge Filter



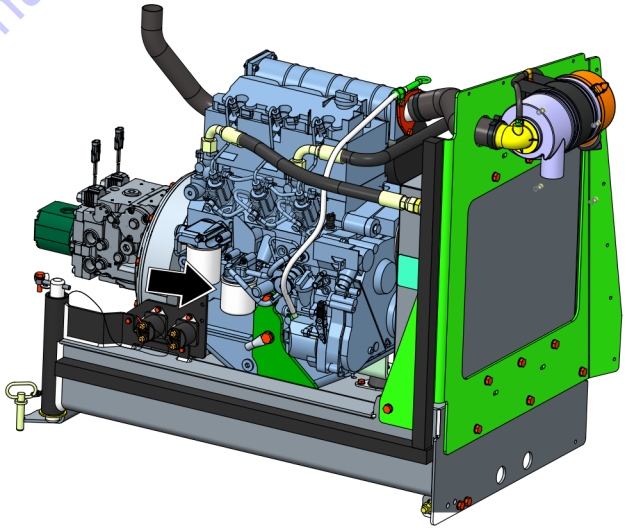
Interval - Change after first 50 hours and every 6 months or 300 hours thereafter or as indicated by Condition Indicator

6. Oil Change w/Filter - Deutz D2011



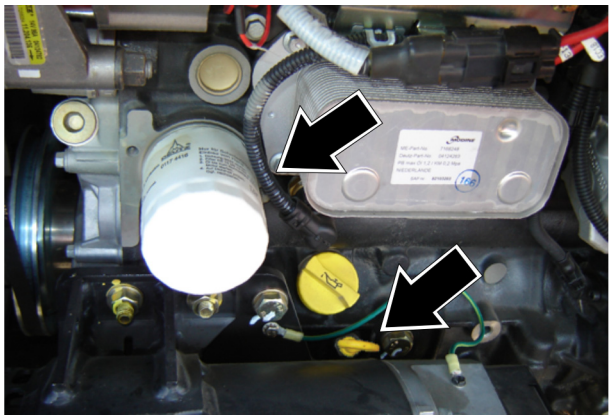
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 10 qt (9.5 L) w/Filter
Lube - EO
Interval - Check level daily; change every 500 hours or six months, whichever comes first. Adjust final oil level by mark on dipstick.

7. Fuel Filter - Deutz D2011



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

8. Oil Change w/Filter - Deutz 2.9L4

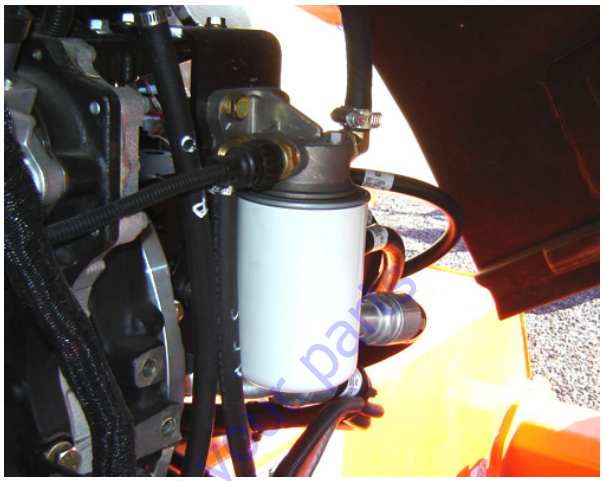


Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 9.5 qt (8.9 L) w/Filter
Lube - EO
Interval - Check level daily; change every 500 hours or six months, whichever comes first. Adjust final oil level by mark on dipstick.

9. Fuel Pre-Filter D2.9L4

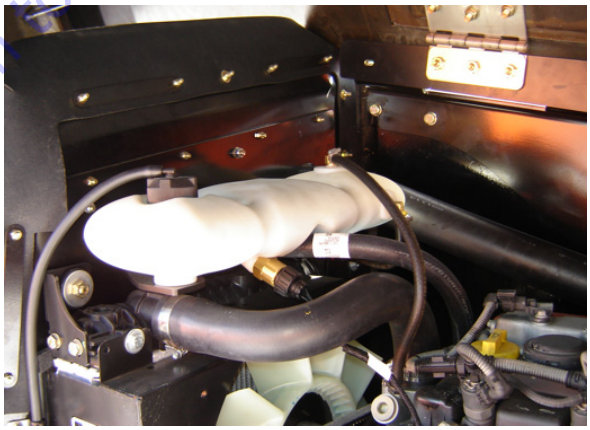
Lube Point(s) - Replaceable Element
Interval - Drain water daily. Change every year or 500 hours of operation

10. Fuel Filter - Deutz 2.9L4



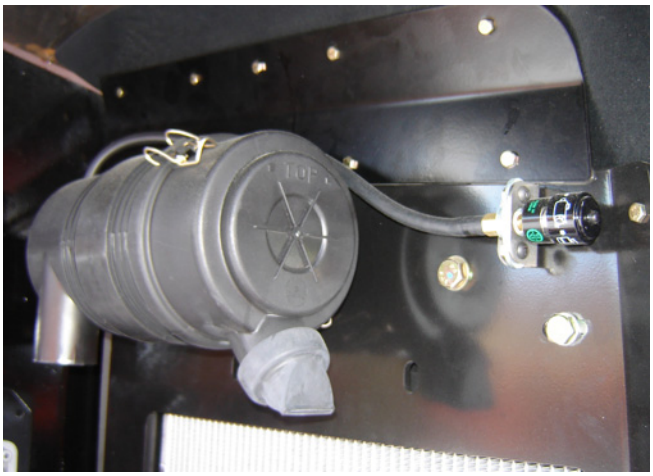
Lube Point(s) - Replaceable Element
Interval - Every year or 500 hours of operation

11. Radiator Coolant Deutz 2.9L4



Lube Point(s) - Fill Cap
Capacity - 2.9 Gallon (11.3L)
Lube - Anti-Freeze
Interval - Check level daily; change every 1000 hours or 2 years, whichever comes first

12. Air Filter

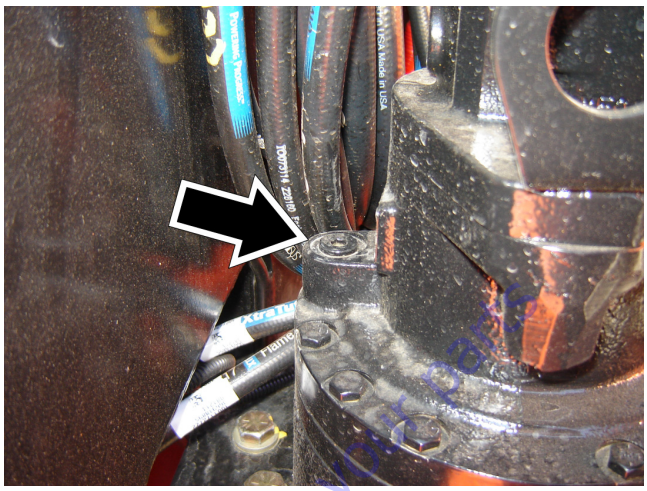


Lube Point(s) - Replaceable Element
Interval - Every 6 months or 300 hours of operation or as indicated by condition Indicator
Comments - Check Dust Valve daily

13. Swing Bearing - Internal Ball Bearing

Lube Point(s) - 2 Grease Fittings
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hours of operation
Comments - Fittings in center of bearing: Remote Access is optional: Apply grease and rotate in 90 degree intervals until bearing is completely lubricated

14. Swing Drive Hub



Lube Point - Level/Fill Plug
Capacity - 40 oz (1.2 L)
Lube - 90w80 Gear Oil
Interval - Check level every 3 months or 150 hours of operation; change after first 50 hours and every 2 years or 1200 hours of operation thereafter

1.7 THREADLOCKING COMPOUND

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

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

1.8 TORQUE CHARTS

SAE Fastener Torque Chart

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)												
SAE GRADE 5 BOLTS & GRADE 2 NUTS												
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry)		Torque Lubricated		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140)		Torque (Loctite® 262™ or Vibra-TITE™ 111)	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	8	0.9	6	0.7				
	48	0.1120	0.00661	420	9	1.0	7	0.8				
6	32	0.1380	0.00909	580	16	1.8	12	1.4				
	40	0.1380	0.01015	610	18	2.0	13	1.5				
8	32	0.1640	0.01400	900	30	3.4	22	2.5				
	36	0.1640	0.01474	940	31	3.5	23	2.6				
10	24	0.1900	0.01750	1120	43	4.8	32	3.5				
	32	0.1900	0.02000	1285	49	5.5	36	4				
1/4	20	0.2500	0.0318	2020	96	10.8	75	9	105	12		
	28	0.2500	0.0364	2320	120	13.5	86	10	135	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	17	23	13	18	19	26	16	22
	24	0.3125	0.0580	3700	19	26	14	19	21	29	17	23
3/8	16	0.3750	0.0775	4940	30	41	23	31	35	48	28	38
	24	0.3750	0.0878	5600	35	47	25	34	40	54	32	43
7/16	14	0.4375	0.1063	6800	50	68	35	47	55	75	45	61
	20	0.4375	0.1187	7550	55	75	40	54	60	82	50	68
1/2	13	0.5000	0.1419	9050	75	102	55	75	85	116	68	92
	20	0.5000	0.1599	10700	90	122	65	88	100	136	80	108
9/16	12	0.5625	0.1820	11600	110	149	80	108	120	163	98	133
	18	0.5625	0.2030	12950	120	163	90	122	135	184	109	148
5/8	11	0.6250	0.2260	14400	150	203	110	149	165	224	135	183
	18	0.6250	0.2560	16300	170	230	130	176	190	258	153	207
3/4	10	0.7500	0.3340	21300	260	353	200	271	285	388	240	325
	16	0.7500	0.3730	23800	300	407	220	298	330	449	268	363
7/8	9	0.8750	0.4620	29400	430	583	320	434	475	646	386	523
	14	0.8750	0.5090	32400	470	637	350	475	520	707	425	576
1	8	1.0000	0.6060	38600	640	868	480	651	675	918	579	785
	12	1.0000	0.6630	42200	700	949	530	719	735	1000	633	858
1 1/8	7	1.1250	0.7630	42300	800	1085	600	813	840	1142	714	968
	12	1.1250	0.8560	47500	880	1193	660	895	925	1258	802	1087
1 1/4	7	1.2500	0.9690	53800	1120	1518	840	1139	1175	1598	1009	1368
	12	1.2500	1.0730	59600	1240	1681	920	1247	1300	1768	1118	1516
1 3/8	6	1.3750	1.1550	64100	1460	1979	1100	1491	1525	2074	1322	1792
	12	1.3750	1.3150	73000	1680	2278	1260	1708	1750	2380	1506	2042
1 1/2	6	1.5000	1.4050	78000	1940	2630	1460	1979	2025	2754	1755	2379
	12	1.5000	1.5800	87700	2200	2983	1640	2224	2300	3128	1974	2676

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

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

3. * ASSEMBLY USES HARDENED WASHER

SAE Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)										
SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263) K=0.20		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.18		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474	1320	43	5				
10	24	0.1900	0.01750	1580	60	7				
	32	0.1900	0.02000	1800	68	8				
1/4	20	0.2500	0.0318	2860	143	16	129	15		
	28	0.2500	0.0364	3280	164	19	148	17		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	25	35	20	25	20	25
	24	0.3125	0.0580	5220	25	35	25	35	20	25
3/8	16	0.3750	0.0775	7000	45	60	40	55	35	50
	24	0.3750	0.0878	7900	50	70	45	60	35	50
7/16	14	0.4375	0.1063	9550	70	95	65	90	50	70
	20	0.4375	0.1187	10700	80	110	70	95	60	80
1/2	13	0.5000	0.1419	12750	105	145	95	130	80	110
	20	0.5000	0.1599	14400	120	165	110	150	90	120
9/16	12	0.5625	0.1820	16400	155	210	140	190	115	155
	18	0.5625	0.2030	18250	170	230	155	210	130	175
5/8	11	0.6250	0.2260	20350	210	285	190	260	160	220
	18	0.6250	0.2560	23000	240	325	215	290	180	245
3/4	10	0.7500	0.3340	30100	375	510	340	460	280	380
	16	0.7500	0.3730	33600	420	570	380	515	315	430
7/8	9	0.8750	0.4620	41600	605	825	545	740	455	620
	14	0.8750	0.5090	45800	670	910	600	815	500	680
1	8	1.0000	0.6060	51500	860	1170	770	1045	645	875
	12	1.0000	0.6630	59700	995	1355	895	1215	745	1015
1 1/8	7	1.1250	0.7630	68700	1290	1755	1160	1580	965	1310
	12	1.1250	0.8560	77000	1445	1965	1300	1770	1085	1475
1 1/4	7	1.2500	0.9690	87200	1815	2470	1635	2225	1365	1855
	12	1.2500	1.0730	96600	2015	2740	1810	2460	1510	2055
1 3/8	6	1.3750	1.1550	104000	2385	3245	2145	2915	1785	2430
	12	1.3750	1.3150	118100	2705	3680	2435	3310	2030	2760
1 1/2	6	1.5000	1.4050	126500	3165	4305	2845	3870	2370	3225
	12	1.5000	1.5800	142200	3555	4835	3200	4350	2665	3625

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

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

3. * ASSEMBLY USES HARDENED WASHER

SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SAE GRADE 5 BOLTS & GRADE 2 NUTS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry) K=0.17		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	7	0.8				
	48	0.1120	0.00661	420	8	0.9				
6	32	0.1380	0.00909	580	14	1.5				
	40	0.1380	0.01015	610	14	1.6				
8	32	0.1640	0.01400	900	25	2.8				
	36	0.1640	0.01474	940	26	2.9				
10	24	0.1900	0.01750	1120	36	4.1				
	32	0.1900	0.02000	1285	42	4.7				
1/4	20	0.2500	0.0318	2020	86	9.7	80	9		
	28	0.2500	0.0364	2320	99	11.1	95	11		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	15	20	14	19	15	20
	24	0.3125	0.0580	3700	15	20	15	21	15	20
3/8	16	0.3750	0.0775	4940	25	35	25	34	25	34
	24	0.3750	0.0878	5600	30	40	28	38	25	34
7/16	14	0.4375	0.1063	6800	40	55	40	54	35	48
	20	0.4375	0.1187	7550	45	60	44	60	40	54
1/2	13	0.5000	0.1419	9050	65	90	60	82	55	75
	20	0.5000	0.1599	10700	75	100	71	97	65	88
9/16	12	0.5625	0.1820	11600	90	120	87	118	80	109
	18	0.5625	0.2030	12950	105	145	97	132	90	122
5/8	11	0.6250	0.2260	14400	130	175	120	163	115	156
	18	0.6250	0.2560	16300	145	195	136	185	125	170
3/4	10	0.7500	0.3340	21300	225	305	213	290	200	272
	16	0.7500	0.3730	23800	255	345	238	324	225	306
7/8	9	0.8750	0.4620	29400	365	495	343	466	320	435
	14	0.8750	0.5090	32400	400	545	378	514	355	483
1	8	1.0000	0.6060	38600	545	740	515	700	480	653
	12	1.0000	0.6630	42200	600	815	563	765	530	721
1 1/8	7	1.1250	0.7630	42300	675	920	635	863	595	809
	12	1.1250	0.8560	47500	755	1025	713	969	670	911
1 1/4	7	1.2500	0.9690	53800	955	1300	897	1219	840	1142
	12	1.2500	1.0730	59600	1055	1435	993	1351	930	1265
1 3/8	6	1.3750	1.1550	64100	1250	1700	1175	1598	1100	1496
	12	1.3750	1.3150	73000	1420	1930	1338	1820	1255	1707
1 1/2	6	1.5000	1.4050	78000	1660	2260	1560	2122	1465	1992
	12	1.5000	1.5800	87700	1865	2535	1754	2385	1645	2237

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

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

3. * ASSEMBLY USES HARDENED WASHER

SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263) K=0.17		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474	1320	37	4				
10	24	0.1900	0.01750	1580	51	6				
	32	0.1900	0.02000	1800	58	7				
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	20	25	20	25	20	25
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	410	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

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

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

3. * ASSEMBLY USES HARDENED WASHER

5000059K

SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SOCKET HEAD CAPSCREWS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K=0.17		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) or Precoat® 85 K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474							
10	24	0.1900	0.01750							
	32	0.1900	0.02000							
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	20	25	20	25	20	25
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	415	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

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

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

3. * ASSEMBLY USES HARDENED WASHER

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

SAE Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*										
SOCKET HEAD CAPSCREWS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K=0.17		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) or Precoat® 85 K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474							
10	24	0.1900	0.01750							
	32	0.1900	0.02000							
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	20	25	20	25	20	25
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	415	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

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

5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

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

Metric Fastener Torque Chart

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

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

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Metric Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS, CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAPSCREWS M3 - M5*						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.20	Torque (Lube or Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.18	Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	3.13			
3.5	0.6	6.78	4.22			
4	0.7	8.78	5.47			
5	0.8	14.20	8.85			
6	1	20.10	12.5			
7	1	28.90	18.0	25	23	19
8	1.25	36.60	22.8	37	33	27
10	1.5	58.00	36.1	70	65	55
12	1.75	84.30	52.5	125	115	95
14	2	115	71.6	200	180	150
16	2	157	97.8	315	280	235
18	2.5	192	119.5	430	385	325
20	2.5	245	152.5	610	550	460
22	2.5	303	189.0	830	750	625
24	3	353	222.0	1065	960	800
27	3	459	286.0	1545	1390	1160
30	3.5	561	349.5	2095	1885	1575
33	3.5	694	432.5	2855	2570	2140
36	4	817	509.0	3665	3300	2750
42	4.5	1120	698.0	5865	5275	4395

NOTES:

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5000059K

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Metric Fastener Torque Chart (Continued)

Values for Magni Coated Fasteners (Ref 4150701)*						
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.17	Torque (Lube or Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.16	Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.1	1.1	1.0
3.5	0.6	6.78	2.95	1.8	1.7	1.5
4	0.7	8.78	3.82	2.6	2.4	2.3
5	0.8	14.20	6.18	5.3	4.9	4.6
6	1	20.10	8.74	9	8.4	7.9
7	1	28.90	12.6	15	14	13
8	1.25	36.60	15.9	22	20	19
10	1.5	58.00	25.2	43	40	38
12	1.75	84.30	36.7	75	70	66
14	2	115	50.0	119	110	105
16	2	157	68.3	186	175	165
18	2.5	192	83.5	256	240	225
20	2.5	245	106.5	362	340	320
22	2.5	303	132.0	494	465	435
24	3	353	153.5	627	590	555
27	3	459	199.5	916	860	810
30	3.5	561	244.0	1245	1170	1100
33	3.5	694	302.0	1694	1595	1495
36	4	817	355.5	2176	2050	1920
42	4.5	1120	487.0	3477	3275	3070

NOTES:

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Metric Fastener Torque Chart (Continued)

Values for Magni Coated Fasteners (Ref 4150701)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS, CLASS 12.9 SOCKET HEAD CAPSCREWS M6 AND ABOVE*						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.17	Torque (Lube or Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.18	Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	3.13			
3.5	0.6	6.78	4.22			
4	0.7	8.78	5.47			
5	0.8	14.20	8.85			
6	1	20.10	12.5	13	12	11
7	1	28.90	18.0	21	20	19
8	1.25	36.60	22.8	31	29	27
10	1.5	58.00	36.1	61	58	55
12	1.75	84.30	52.5	105	100	95
14	2	115	71.6	170	160	150
16	2	157	97.8	265	250	235
18	2.5	192	119.5	365	345	325
20	2.5	245	152.5	520	490	460
22	2.5	303	189.0	705	665	625
24	3	353	222.0	905	850	800
27	3	459	286.0	1315	1235	1160
30	3.5	561	349.5	1780	1680	1575
33	3.5	694	432.5	2425	2285	2140
36	4	817	509.0	3115	2930	2750
42	4.5	1120	698.0	4985	4690	4395

NOTES:
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SECTION 2. GENERAL

2.1 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

General

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

Preparation, Inspection, and Maintenance

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

Pre-Start Inspection

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

Pre-Delivery Inspection and Frequent Inspection

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

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

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

Annual Machine Inspection

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

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

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

Preventive Maintenance

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

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

Table 2-1. Inspection and Maintenance

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

2.2 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

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

Cleanliness

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

Components Removal and Installation

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

Component Disassembly and Reassembly

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

Pressure-Fit Parts

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

Bearings

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

Gaskets

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

Bolt Usage and Torque Application

NOTICE

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

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

Hydraulic Lines and Electrical Wiring

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

Hydraulic System

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

Lubrication

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

Battery

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

Lubrication and Servicing

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

2.3 LUBRICATION AND INFORMATION

Hydraulic System

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

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

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

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

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

Hydraulic Oil

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

Changing Hydraulic Oil

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

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

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

Lubrication Specifications

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

2.4 CYLINDER DRIFT

Theory

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

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

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

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

Cylinder Leakage Test

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

Measure drift at cylinder rod with a calibrated dial indicator.

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

Cylinder leakage is acceptable if it passes this test.

Table 2-2. Cylinder Drift

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

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

Cylinder Thermal Drift

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

2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

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

2.6 WELDING ON JLG EQUIPMENT

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

Do the Following When Welding on JLG Equipment

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

Do NOT Do the Following When Welding on JLG Equipment

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

NOTICE

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

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

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	Inspections	
	Pre-Delivery[1] or Frequent[2] (Quarterly) Inspection	Annual[3] (Yearly) Inspection
Boom Assembly		
Boom Weldments	1, 2	1, 2
Hose/Cable Carrier Installations	1, 2	1, 2
Pivot Pins and Pin Retainers	1, 2	1, 2
Sheaves, Sheave Pins	1, 2	1, 2
Bearings	1, 2	1, 2
Wear Pads	1, 2	1, 2
Covers or Shields	1, 2	1, 2
Platform Assembly		
Railing	2	2
Gate	1, 2, 3	1, 2, 3
Floor	2	2
Rotator	1, 2, 3, 4	1, 2, 3, 4
Lanyard Anchorage Point	1, 2, 6	1, 2, 6
Turntable Assembly		
Swing Bearing or Worm Gear	1[50], 2	1[50], 2
Oil Coupling	4	4
Swing Drive System	1, 4	1, 4
Turntable Lock	1, 2, 3	1, 2, 3
Hood, Hood Props, Hood Latches	3	3
Chassis Assembly		
Spindle Thrust Bearing/Washers	1, 2	1, 2
Drive Hubs	1, 4	1, 4
Functions/Controls		
Platform Controls return to neutral/off when released	1, 3, 6, 9	1, 3, 6, 9
Ground Controls return to neutral/off when released	1, 3, 6, 9	1, 3, 6, 9
Function Control Locks, Guards, or Detents	1, 3, 9	1, 3, 9
Footswitch (shuts off function when released)	1, 3, 9	1, 3, 9
Emergency Stop Switches (Ground & Platform) arrest all platform movement	1, 3, 6	1, 3, 6
Function Limit or Cutout Switch Systems	1, 3, 9	1, 3, 9
Capacity Indicator	1, 3, 9	1, 3, 9
Swing Brakes	1, 3, 9	1, 3, 9
Auxiliary Power	1, 3, 9	1, 3, 9

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	Inspections	
	Pre-Delivery[1] or Frequent [2] (Quarterly) Inspection	Annual[3] (Yearly) Inspection
Power System		
Engine Idle, Throttle, and RPM	1, 3, 7	1, 3, 7
Engine Fluids: Oil	4	4
Engine Fluids: Coolant	1, 4, 7	1, 4, 7
Air Filter	1, 4	1, 4
Fuel Filter(s)	1, 5	1, 5
Drain Oil Build Up in 2-Stage Vaporizer (LP Only)	1, 4	1, 4
Exhaust System	1, 4	1, 4
Batteries	1, 4	1, 4
Battery Fluid	4	4
Battery Charger	1, 3	1, 3
Intake System	1, 2	1, 2
Glow Plug (Diesel Only)	1, 2, 3	1, 2, 3
Serpentine Belt, Tensioner, Pulleys	1, 2, 3	1, 2, 3
Fuel Reservoir, Cap, and Breather	1, 2, 4	1, 2, 4
Hydraulic/Electric System		
Hydraulic Pumps	1, 2, 4	1, 2, 4
Hydraulic Cylinders	1, 2, 4, 5	1, 2, 4, 5
Cylinder Attachment Pins and Pin Retainers	1, 2	1, 2
Hydraulic Hoses, Lines, and Fittings	1, 2, 4	1, 2, 3, 4
Hydraulic Reservoir, Cap, and Breather	1, 2, 3, 4, 5	1, 2, 3, 4, 5
Hydraulic Filter(s)	1, 4, 5	1, 4, 5
Hydraulic Fluid	4, 5	4, 5
Electrical Connections	1, 2	1, 2
Instruments, Gauges, Switches, Lights, Horn	1, 3	1, 3
General		
All Decals/Placards Installed, Secure, Legible	9	9
Annual Machine Inspection Due	-	9
No Unauthorized Modifications or Additions	9	9
All Relevant Safety Publications Incorporated	9	9
General Structural Condition and Welds	2	2
All Fasteners, Pins, Shields, and Covers	1, 2	1, 2
Grease and Lubricate to Specifications	9	9
Function Test of All Systems	9	9

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	Inspections	
	Pre-Delivery[1] or Frequent [2] (Quarterly) Inspection	Annual[3] (Yearly) Inspection
Paint and Appearance	5	5
Stamp Inspection Date on Frame	-	9
Notify JLG of Machine Ownership	-	9

Footnotes:

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

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

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

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

Performance Codes:

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

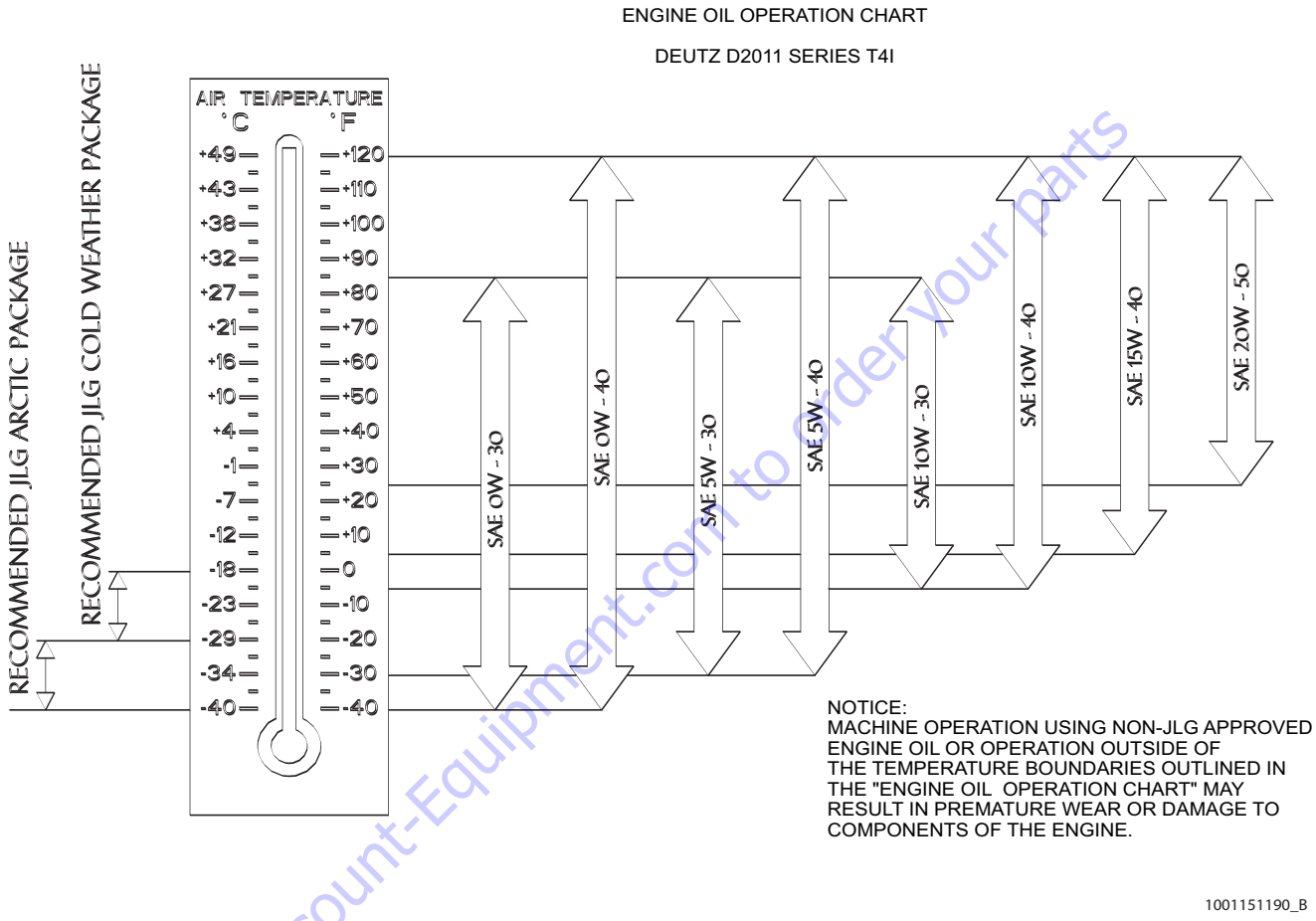


Figure 2-1. Engine Operating Temperature Specifications - Deutz D2011

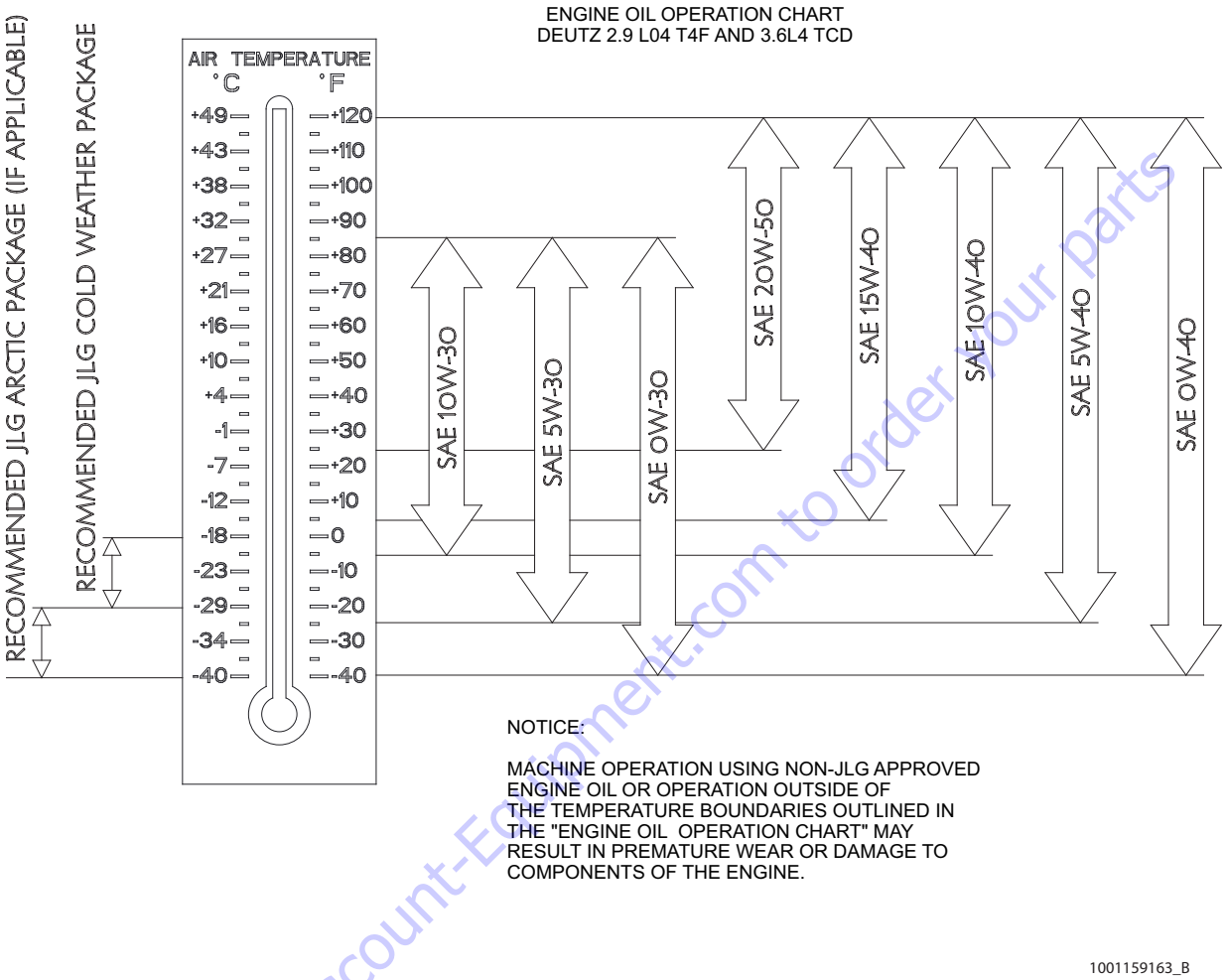
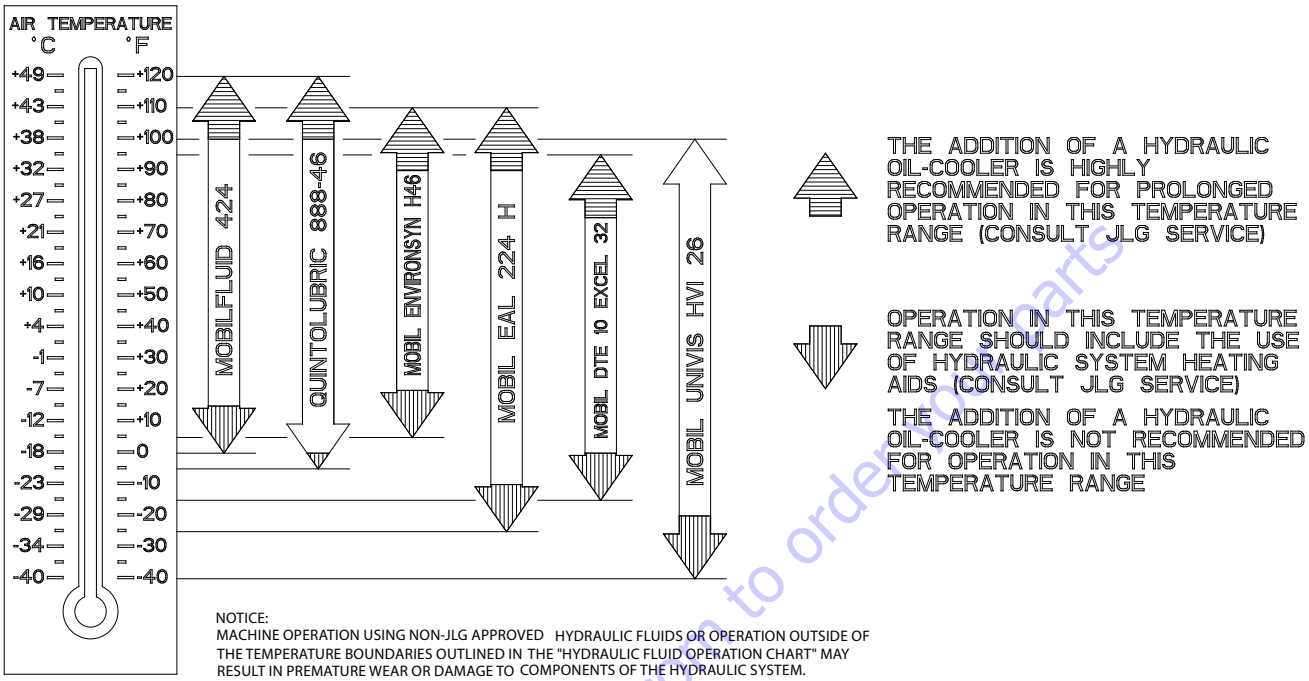


Figure 2-2. Engine Operating Temperature Specifications - Deutz 2.9 L04



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

1001206353_B

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

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

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

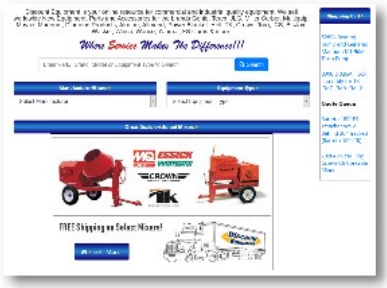
*** Fire Resistant classification indicates Factory Mutual Research Corp. (FMRC) Approval

Figure 2-3. Hydraulic Oil Operating Temperature Specifications

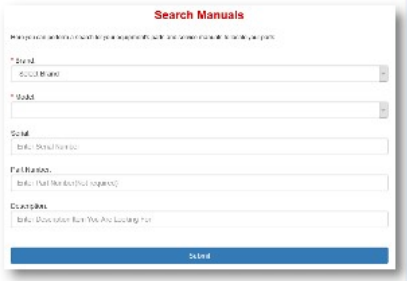
PARTS FINDER

Search Website by Part Number

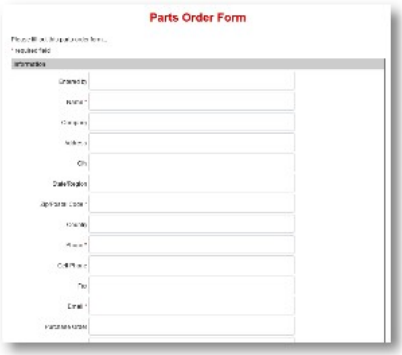
Discount Equipment



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



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



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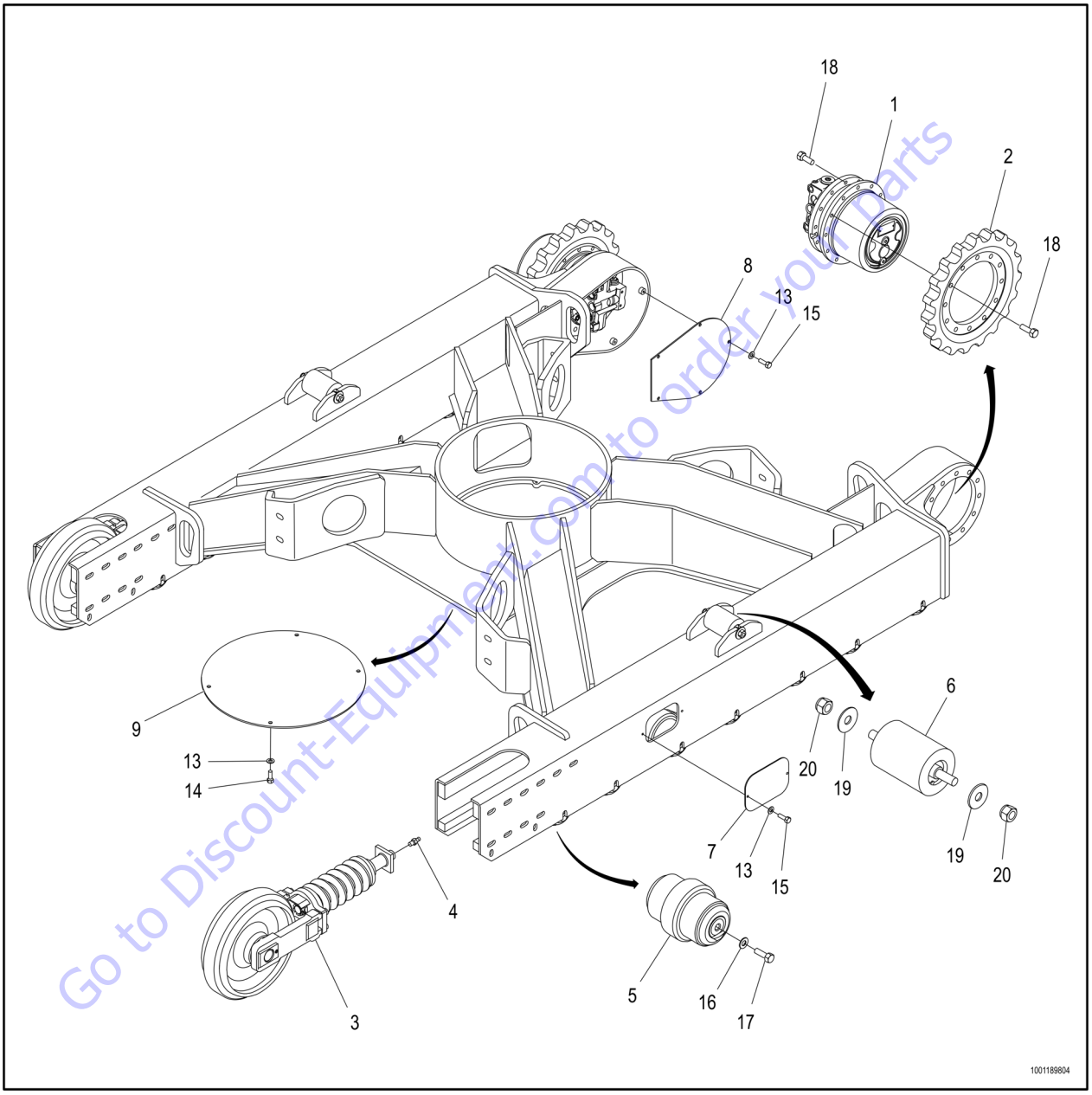
We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target,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

SECTION 3. CHASSIS & TURNTABLE

3.1 CHASSIS COMPONENTS AND SERVICING



1.	Drive Hub	5.	Lower Track Roller	9.	Bottom Cover PLat	13.	Washer	17.	Bolt
2.	Drive Sprocket	6.	Upper Track Roller	10.	Not Used	14.	Bolt	18.	Bolt
3.	Idler Assembly	7.	Side Frame Cover Plate	11.	Not Used	15.	Bolt	19.	Washer
4.	Tension Grease Fitting	8.	Drive Motor Cover Plate	12.	Not Used	16.	Washer	20.	Nut

Figure 3-1. Basic Chassis Assembly

Track Tension

Refer to Figure 3-1.

NOTE: *Always check rubber or steel track tension with track off ground.*

1. Remove two bolts (17), washers (13) and side frame cover plate (7) from frame.

⚠ CAUTION

DO NOT UNSCREW GREASE FITTING MORE THAN 1-1/2 TURN. GREASE IS UNDER PRESSURE. FITTING COULD FLY OFF AND CAUSE INJURY.

2. Use grease gun with appropriate fitting to tension track or slowly unscrew fitting to release track tension.

Figure 3-2. Tensioning Track

3. Make sure grease fitting is tight. Re-install cover plate.

RUBBER TRACK

NOTE: *Always check rubber track tension with track off ground.*

1. Locate the ? mark on inside of track towards the edge.

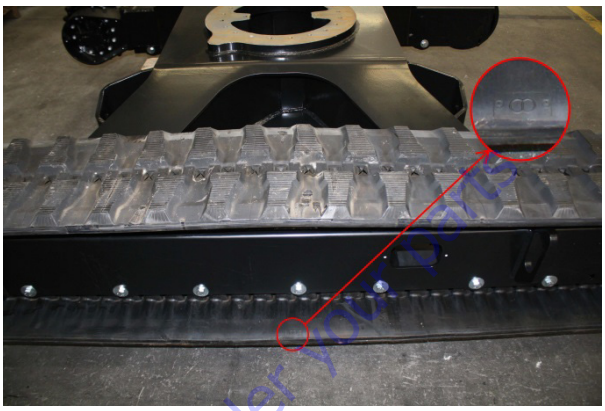
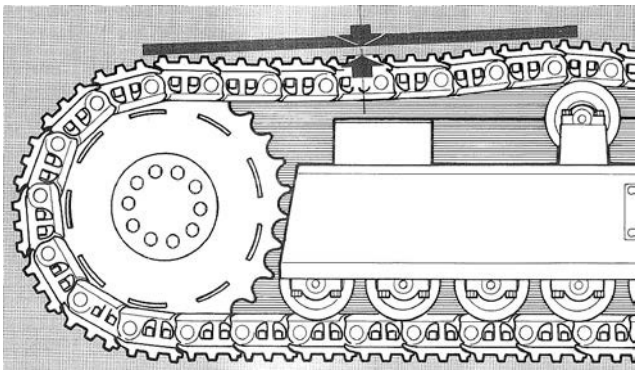


Figure 3-3. Rubber Track Tension Mark

2. Positioned ? mark at the lower part of the undercarriage centered between sprocket and idler.
3. Measure clearance between roller and rubber tracks near the ? mark.
4. Rubber track is correctly tensioned if measurement is 1 - 1.45 cm (0.393-0.59 in).

STEEL TRACK

1. Place a straight-edge on top of the track at location shown below.



2. Measure deflection between straight-edge and track.
3. Steel track is correctly tensioned when chain bend is approximately 2 cm (0.787 in).

Replace Rubber Track

1. Thoroughly wash entire chassis and all components.

Note: *Rubber track assemblies weigh 263 kg (580 lb) each.*

2. Position machine on a firm level surface near an overhead lifting device. Ensure boom is in the lowered and stowed position.

3. Rotate turntable as needed for unrestricted access to side of chassis having track replaced.

⚠ CAUTION

DO NOT REMOVE GREASE FITTING COMPLETELY UNTIL TRACK TENSION IS RELEASED. GREASE IS UNDER PRESSURE. FITTING COULD FLY OFF AND CAUSE INJURY.

4. Remove track tensioner coverplate. Unscrew grease valve until grease starts to come out of slot, then unscrew three more turns.

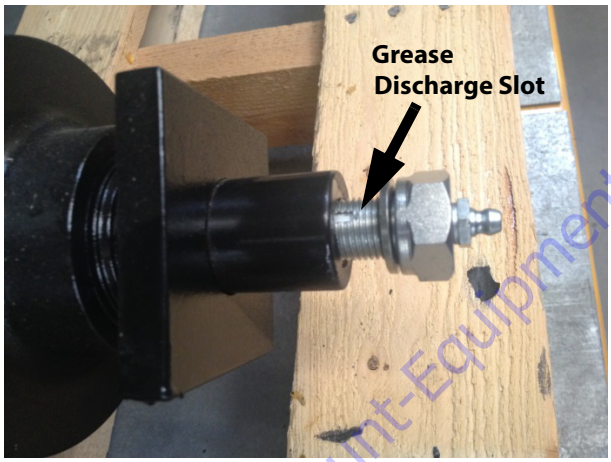


Figure 3-4. Grease Valve

5. Place a hydraulic floor jack beneath front chassis extension nearest idler wheel.

Figure 3-5. Floor Jack Location

6. Jack up chassis to remove weight from lower rollers.

7. Attach a sling through top of the track and lift. This will compress the idler cylinder assembly.

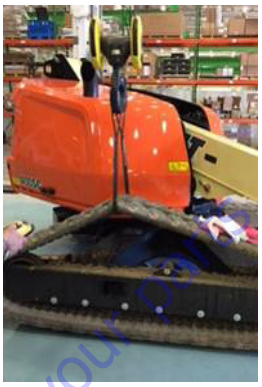


Figure 3-6. Lift Track and Compress Idler Cylinder

8. With idler cylinder compressed, lower track.

9. Remove rubber track starting at idler using large pry bar. Move forward to drive sprocket until entire track is removed.

Figure 3-7. Remove Rubber Track

10. Position new rubber track in correct direction of travel.

Figure 3-8. Rubber Track Direction of Travel

11. Attach a board or other long, rigid object to top of tread as shown below and lift into position along frame.

Figure 3-9. Preparation for Installation

12. Position rubber tracks around drive sprocket. Core metal of the rubber track must be in sprocket grooves.

Figure 3-10. Install on Drive Sprocket

13. Place a spacer close to the upper roller and bring the rubber track close to idler.

Figure 3-11. Aligning Track on Frame

14. Use a crowbar to complete installing over idler. Idler must engage correctly with rubber track.

Figure 3-12. Install Track on Idler

15. Adjust track tension. Refer to "Track Tension" on page 3-2.

16. Re-check track tension after first 10 hours of operation.

Replace Steel Track

1. Thoroughly wash entire chassis and all components.

Note: *Steel track assemblies weigh 340 kg (748 lb) each.*

2. Position machine on a firm level surface near an overhead lifting device. Ensure boom is in the lowered and stowed position.
3. Rotate turntable as needed for unrestricted access to side of chassis having track replaced.

⚠ CAUTION

DO NOT REMOVE GREASE FITTING COMPLETELY UNTIL TRACK TENSION IS RELEASED. GREASE IS UNDER PRESSURE. FITTING COULD FLY OFF AND CAUSE INJURY.

4. Remove track tensioner coverplate. Unscrew grease valve until grease starts to come out of slot, then unscrew three more turns.

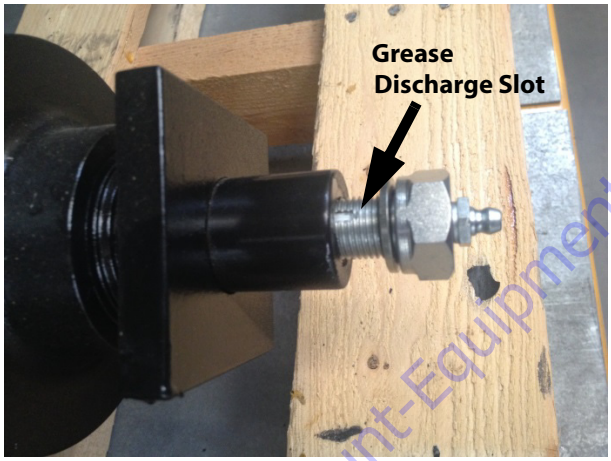


Figure 3-13. Grease Valve

5. Place a hydraulic floor jack beneath front chassis extension nearest idler wheel.

Typical Illustration

Figure 3-14. Floor Jack Location

6. Lift chassis 200 mm (8 in) above floor.

⚠ WARNING

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

7. If equipped, remove rubber pads from the steel track assembly.
8. Use wood blocking or other device to prevent track and chain assembly from falling uncontrolled to ground.

Figure 3-15. Brace Steel Track

9. Press out main pin with hydraulic press and C-clamp, and separate track. Remove track.
10. Place new steel track assembly next to chassis. If track is not already separated, press out main pin with hydraulic press and C-clamp, and separate track. If track is already separated, locate or remove pin if partially installed in track.

11. Check track direction of travel. Lay out track next to chassis with end of track under drive sprocket.

12. Slide track under chassis and under rollers, drive sprocket, and idler wheel.

13. Lower chassis until rollers and idler wheel are in contact with track.

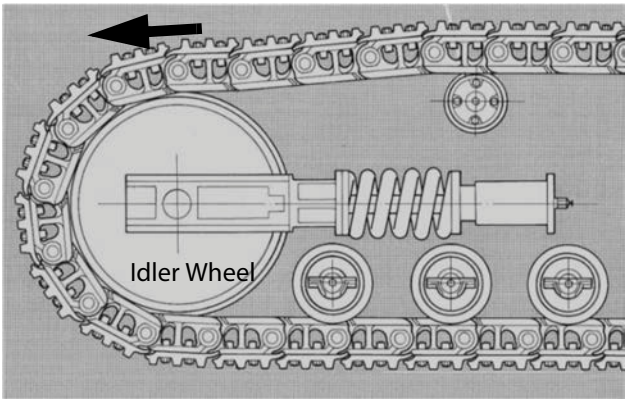


Figure 3-16. Track Direction of Travel

14. Pull track over idler wheel to drive sprocket. Roll track around drive sprocket until track bushings engage upper sprocket grooves. Position track so at least two links remain free as shown below.

Figure 3-17. Installing Track

15. Remove triple grouser shoe from first and last chain links.

Figure 3-18. Grouser Shoes Removed

16. Attach track chain block plate (6) using two M12-1.75 x 40 bolts (7) in place of grouser shoes on lower track segment.

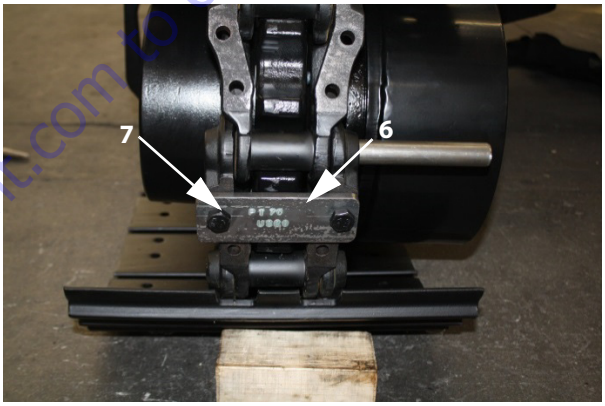


Figure 3-19. Track Chain Block Plate

17. Clean chain link holes. Lubricate chain link holes and master pin with PTFE BC 101 grease or equivalent.

18. Overlap chain links and hold in place with rod or large screwdriver. Insert master pin and drive into place with hydraulic press or similar method.

Figure 3-20. Installing Master Pin

Note: *Chassis must be lifted off ground when tensioning track.*

19. Lift chassis far enough for track to clear ground. Re-check correct position of track bushings in sprocket grooves.

20. Make sure tensioning grease valve is closed and tight. Use grease gun and extension to tension track.

Figure 3-21. Track Tensioning

21. Track is correctly tensioned when track deflection at position indicated in Figure 3-22. is approximately 20 mm (0.787 in).

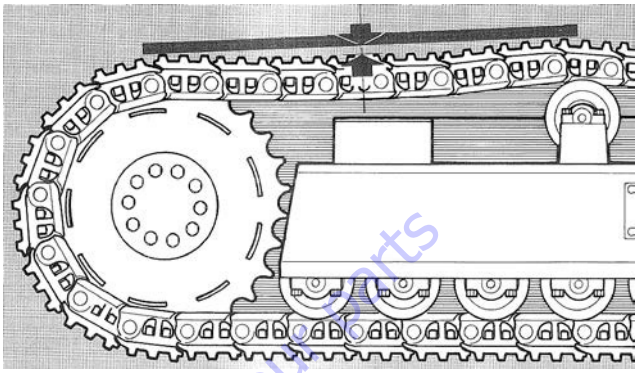


Figure 3-22. Track Tension

22. Lower chassis to ground.

23. Remove two bolts and track chain block plate.

24. Install two removed triple grouser shoes using original hardware. Torque to 147.1 Nm (108.5 ft-lb).

Figure 3-23. Reinstall Triple Grouser Shoes

NOTE: *Re-check track tension after first 10 hours of operation. Idler tensioning valve may have allowed air bubbles in cylinder which can cause track to become loose.*

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.

Sprocket Wear

Replace sprocket when wear reaches 4mm (.157 in). Wear is never even. Always measure the point where wear is greatest.

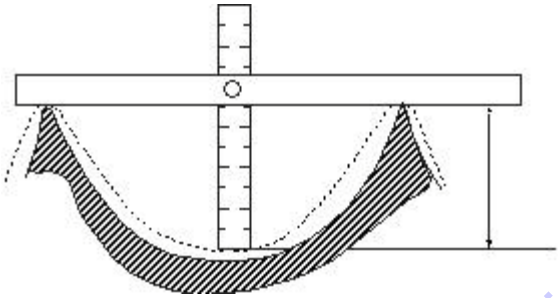


Figure 3-24. Sprocket Wear Measurement

3.2 CHASSIS TILT INDICATOR SYSTEM

The Chassis Tilt Indicator System measures the turntable angle with respect to level ground. The control system reads the reading and compares it to a pre-set turntable tilt angle value.

When the machine is in transport position, it can travel at up to maximum speed until it tilts more than 8.0°, then the system will limit the drive speed to maximum displacement mode (slow drive speed).

However, when the machine is out of transport position and the turntable tilts more than the pre-set valve, the boom functions and drive functions are disabled. The operator must return the machine into transport mode in order to continue.

Refer Table 6-2, Machine Configuration Programming Information (Software Version P2.10) for details.

3.3 SWING DRIVE HUB

Users of this manual should note that each part mentioned is followed by an identification number enclosed in parentheses. These part numbers may be referred to in the Parts List and Assembly Drawing sections of this manual.

Specialized tools used to assemble this unit are noted in the assembly procedures and diagrammed in the Assembly Tools section.

Users should familiarize themselves with the procedures for roll and leak testing, as well as bolt tightening and torquing found on the following pages before starting any repairs.

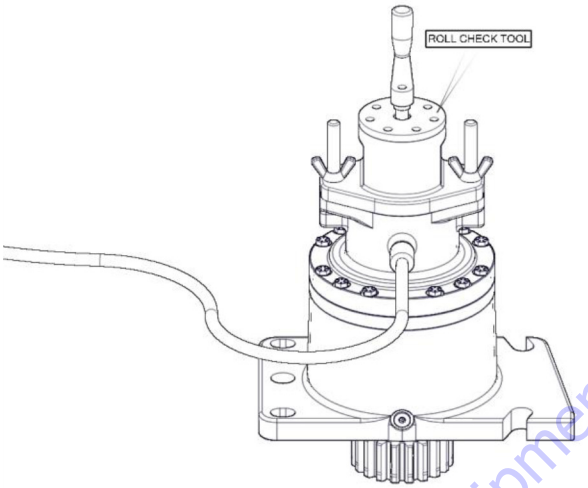
Standard safety practices should be followed during the disassembly and assembly procedures described. Safety glasses and safety shoes should be worn, and heavy, heat resistant gloves should be used when handling heated components. Be especially alert when you see the word CAUTION. This indicates that a particular operation could cause personal injury if not performed properly or if certain safety procedures are not followed. The word NOTE is used to bring attention to certain procedures or helpful hints that will aid in the disassembly and assembly process.

Brake Test

Prior to brake check remove Motor, Tubing and Elbow as per Motor disassembly instructions in the following subsections. To perform a brake check, use a 7/16-20 thread fitting. Install a hydraulic hand pump with pressure gauge into brake port in Brake Housing using thread fitting.

Place ROLL TEST Tool into Sun gear (8).

Apply 25 in-lb (29 kgcm) torque. While trying to rotate tool, pump the handle on the hydraulic hand pump and increase the pressure until the brake releases. The brake is released when you are able to rotate the tool.



Record the release pressure. If brake does not release within limits shown in Table 3-1, Brake Chart, check to see if it has the proper number of springs using the SPRING CHECKING PROCEDURE.

Increase to maximum pressure (refer to Table 3-1) and hold at that pressure for one minute. If the brake does not leak or lose pressure, the unit has passed the brake test. If brake loses pressure, attempt to repair leak using the leak repair procedure at the end of this procedure.

While brake is still released, roll check the unit for one revolution of the output member by rotating the tool. Bleed off pressure slowly while rotating the ROLL TEST Tool.

Record the pressure at which the brake locks up. Using a clean rag, wipe off excess fluid from around brake port and install the pipe plug.

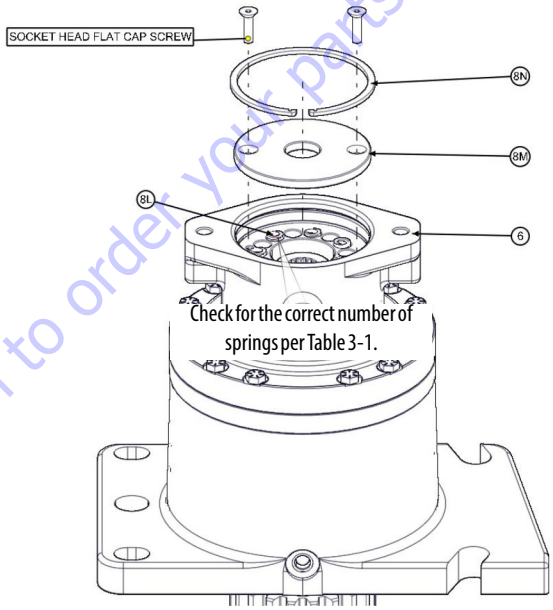
Table 3-1. Brake Chart

Number Of Springs	Release Pressure Minimum (psi)	Release Pressure Maximum (psi)	Full Release Pressure (psi)	Maximum Release Pressure (psi)	Brake Torque (in-lbs)
7	75	124	140	2000	472

Spring Checking Procedure

Install two Flat Socket Head Capscrews 0.250-20 UNC, 1/2" length into holes in brake piston. Tighten bolts evenly to ensure that brake piston remains straight while being compressed into brake cavity of brake housing.

Carefully remove retaining ring from brake housing. Slowly remove bolts evenly from the input brake. Remove the pressure plate from the end of the input brake and check the number of springs in brake. If incorrect, correct the count.



Install the Pressure Plate using two 0.250-20 UNC flat Socket Head Capscrews. Tighten bolts evenly to ensure that Pressure Plate (8M) does not get wedged to the Brake Cylinder.

Install the large retaining ring into groove in Housing making sure that it is seated properly. Remove all bolts from the brake piston and discard.

NOTE: *Use caution when removing bolts as they are subject to spring pressure. Make sure the retaining ring is secured before removing bolts.*

Re-test input brake. If release and/or lockup pressures still do not match the brake chart contact JLG Service Department.

Grease and install O-ring onto motor pilot. Place motor into brake pilot and line up holes. Check timing marks. Assemble lift lugs onto hex bolts and assemble hex bolts with lugs through the motor and brake against the motor flange. Torque to 80-100 ft-lb (108-136 Nm).

Re-test input brake. If release and/or lockup pressures still do not match the brake chart contact JLG Service Department.

Brake Leak Repair Procedure

Remove brake piston from housing using the Brake Disassembly Procedure.

Check O-rings, Backup Rings, and brake cavity in Brake Housing for damage. If no damage is found, then reinstall Input Brake according to Input Brake Installation Procedure under Main Assembly procedure and perform pressure test again. If brake still leaks, contact the service department.

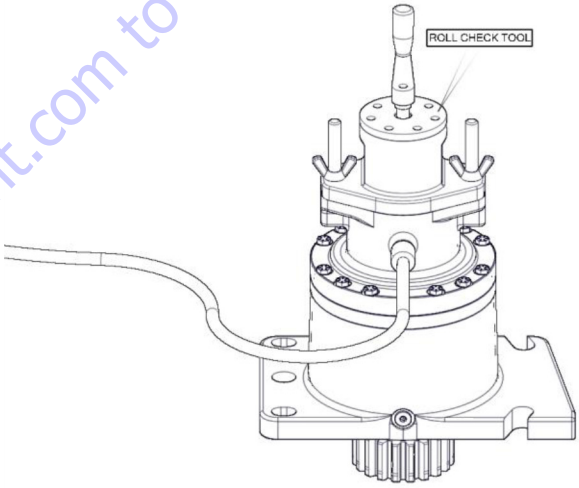
NOTE: *Failure to perform this test may result in damaged or ineffective brake parts.*

Roll and Leak Test

Torque-Hubs should always be roll and leak tested before disassembly (if possible) and after assembly to make sure the gears, bearings, and seals are working properly. The following information briefly outlines what to look for when performing these tests.

THE ROLL TEST

The purpose of the roll test is to determine if the unit gears are rotating consistently, easily and properly. Remove Motor and release the brake by applying 400 psi to the brake port. To perform a roll test, use the recommended tool from table below (or something equivalent) to apply constant rotational force to the input of the gearbox. If more drag is felt in the gears only at certain points, then the gears are not rolling consistently and easily and should be examined for improper installation or defects. Some gear packages roll with more difficulty than others. Do not be concerned if the gears in the unit seem to roll hard as long as they roll with consistency. Rotate the gearbox 36 revolutions both clockwise and counterclockwise.



THE LEAK TEST

The purpose of a leak test is to make sure the unit is airtight. To perform a leak test, use the leak test fixture from the table below. If the tool is not available, the gearbox must be sealed to perform the test. This can be accomplished by assembling the sealed input device onto the gearbox at the input end and replace one of the oil plugs with an air chuck.

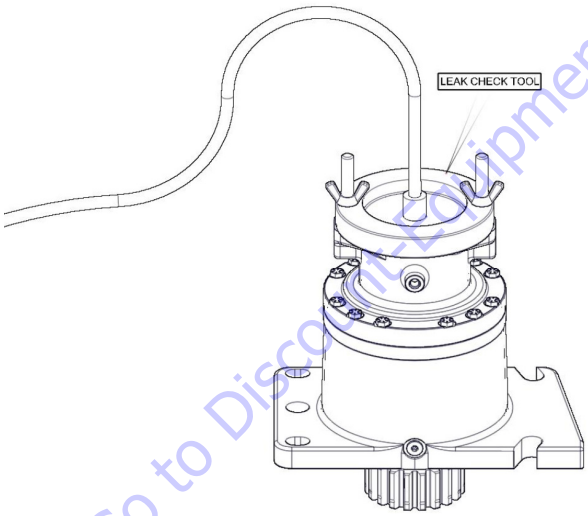
NOTICE

DO NOT EXCEED 10 PSI PRESSURE DURING LEAK TEST.

Higher pressure will create a false sealing effect in assemblies with lip-seals. The unit has a leak if the pressure gauge reading on your leak check fitting starts to fall after the gearbox has been pressurized and allowed to equalize.

Leaks will most likely occur at the pipe plugs, the main seal or wherever O-rings or gaskets are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where O-rings or gaskets meet on the exterior of the unit and then checking for air bubbles.

If a leak is detected in a seal, O-ring, or gasket, the part must be replaced and the unit rechecked. Leak test at 10 psi for 20 minutes.



Tightening and Torquing Bolts

If an air impact wrench is used to tighten bolts, extreme care should be taken to ensure the bolts are not tightened beyond their specified torque. The following steps describe how to tighten and torque bolts or socket head capscrews in a bolt circle.

1. Tighten (but do not torque) bolt A until snug.

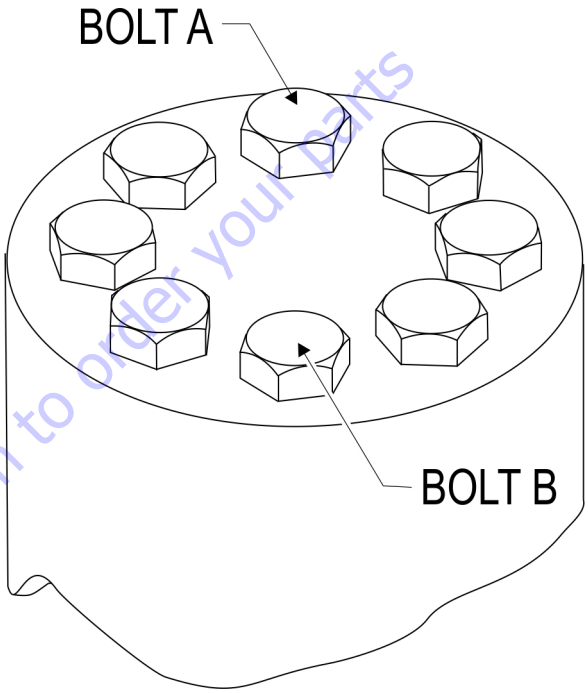


Figure 3-25. Bolt Tightening Sequence

2. Go to the opposite side of the bolt circle and tighten bolt B until equally snug.
3. Crisscross around the bolt circle and tighten the remaining bolts.
4. Use a torque wrench to apply the specified torque to bolt A.
5. Using the same sequence, crisscross around the bolt circle and apply an equal torque to the remaining bolts.

Lubrication Information

GENERAL PROPERTIES

Lubricant should be petroleum based gear fluid containing anti-oxidation, anti-foaming, and extreme pressure additives. The lubricant should have a minimum viscosity index of 95 cst and maintain a minimum viscosity of 40 cst under normal operating conditions. Some applications require special considerations; consult the JLG Service Department for additional information.

The table below lists recommended viscosities for various ambient operating temperatures. Recommendations are based on temperature rise of 50° to 100°F at normal operating conditions.

Table 3-2. Recommended Viscosities

Ambient Temperature	Differential Planetary		Simple Planetary	
	ISO Index	AGMA Lubricant Number	ISO Index	AGMA Lubricant Number
-40° to -5° F(1)	VG100	3EP	VG100	3EP
-5° to 40° F	VG150	4EP	VG100	3EP
40° to105° F	VG220/VG320	5EP/6EP	VG150/VG220	4EP/5EP
105° to 150° F(2)	VG460	7EP	VG320	6EP

Footnotes
1. For operation in this ambient temperature range, synthetic oil is recommended with a pour point of 10°F lower than the minimum ambient temperature.
2. For operation in this ambient temperature range, synthetic oil is recommended for proper lubricant life at elevated temperatures.

MAINTENANCE

Oil amounts for each series of Torque-Hub drives are indicated in the appropriate series literature. An initial oil change should be made after the first 50 hours of operation. Subsequent oil changes should be made at 1,000 hour intervals or annually, whichever comes first.

Oil temperatures should be not higher than 71° to 82°C (160° to 180°F) for continuous operation, and no higher than 93°C (200°F) for intermittent operation. For special applications, consult the JLG Service Department.

Motor Removal

Refer to Figure 3-26. and Figure 3-27.

1. Place unit on bench with motor end up.
2. Remove magnetic Pipe Plug (1P) and drain oil from gearbox.

NOTE: *Record oil condition and volume.*

3. Remove Hydraulic Tubing Assembly (35) by loosening fittings on both ends of tube with a wrench.
4. Using a wrench, loosen jam nuts on Elbow Fittings (30) and remove fittings from Brake Housing (6) and Motor Control Valve (32).
5. Remove O-ring Pipe Plugs (23) from Motor Control Valve (32).
6. Remove Motor Control Valve (32) from Motor (31) by removing the four Bolts (21) and washers (22).
7. Remove O-ring (99) between Motor Control Valve (32) and Motor (31). Discard O-ring.
8. With unit resting on bench with Motor (31) end up, loosen Hex Bolts (29) and remove Lift Lugs (28) from the Motor (31).
9. Pull Motor (31) straight up and remove Motor (31) from Brake Housing (6).
10. Remove O-ring (26) from between Motor (31) and Brake Housing (6). Discard O-ring.

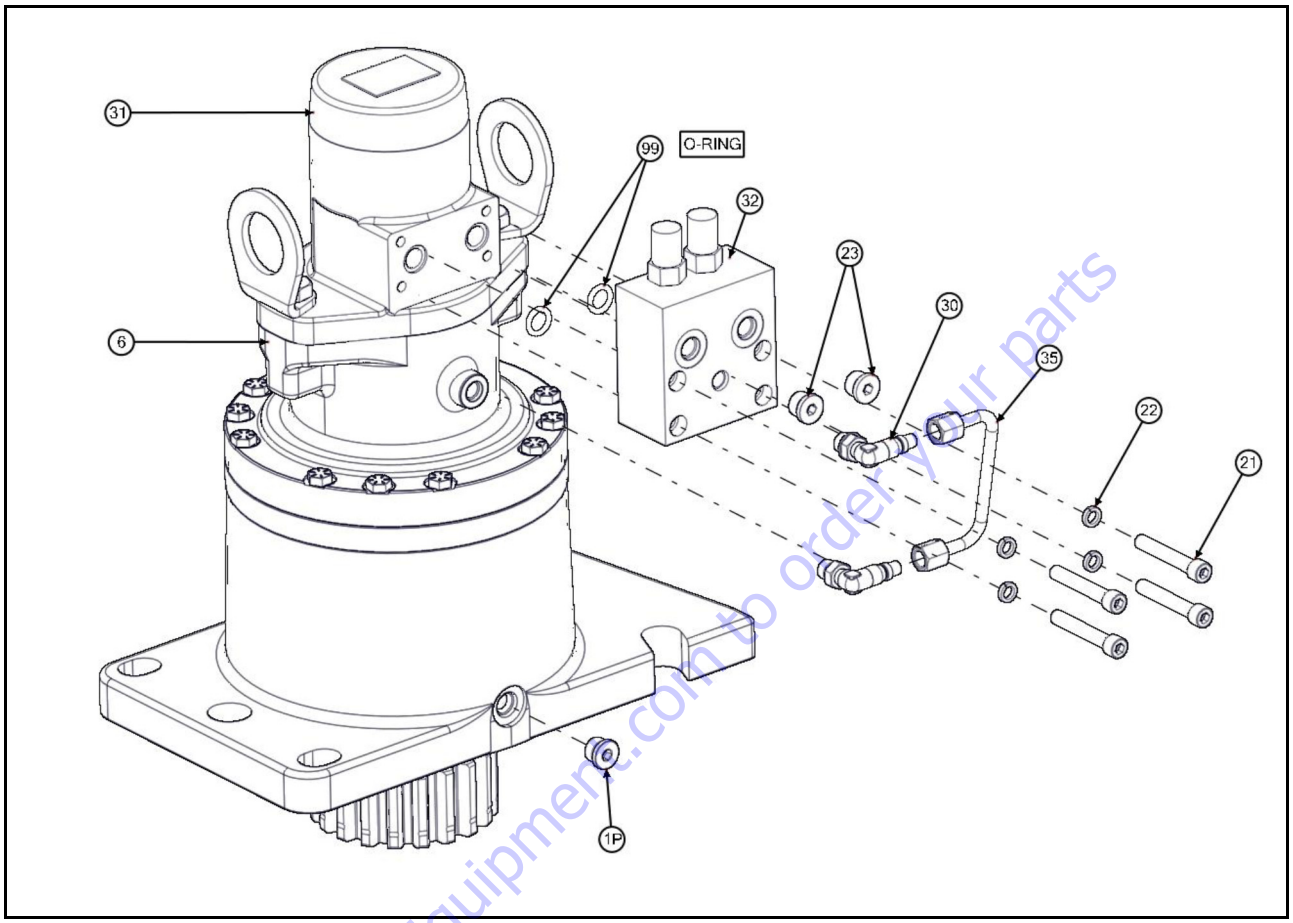


Figure 3-26. Swing Motor Valve Removal

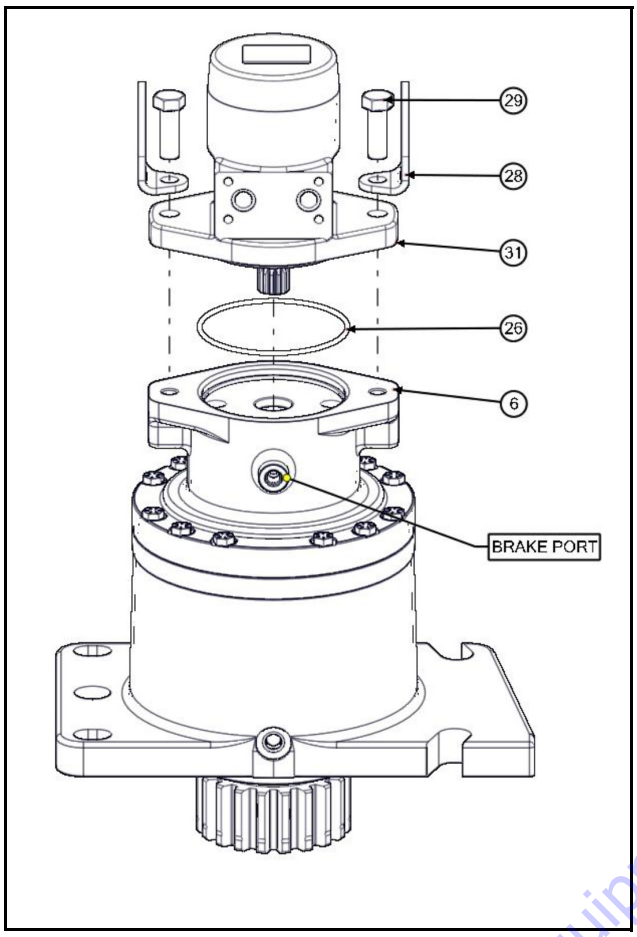


Figure 3-27. Swing Motor Removal

Input Brake Disassembly

Refer to Figure 3-28.

1. Insert and tighten 0.250-20 UNC flat Socket Head Capscrews through the Pressure Plate (8M) and into the Brake Piston (8A) to compress springs and relieve pressure on the Retaining Ring (8N).

⚠ CAUTION

SAFETY GLASSES MUST BE WORN DURING THESE NEXT STEPS.

NOTE: *Ensure Step 1 is completed before doing this next step.*

2. Using retaining ring pliers, remove Retaining Ring (8N) holding Brake Piston assembly in place.
3. Lift Brake Piston Assembly (8A) out of Brake Housing (6). If Brake Piston assembly (8A) will not lift out, apply no more than 50 psi air to the Brake port to remove Brake Piston (8A). Remove Inner (Rotor) (8J) and Outer (Stator) Plates (8K) from inside Brake Housing (6).
4. Remove O-rings (8D, 8F) and Backup Rings (8E, 8H) from the Brake Housing (6).

   Discard O-rings and Backup Rings.
5. Remove 0.250-20 UNC flat Socket Head Capscrews and lift the Pressure Plate (8M) from the Brake Piston (8A).

NOTE: *Record number of springs and mark locations before removing from brake piston.*

6. Remove Springs (8L) from Brake Piston (8A).

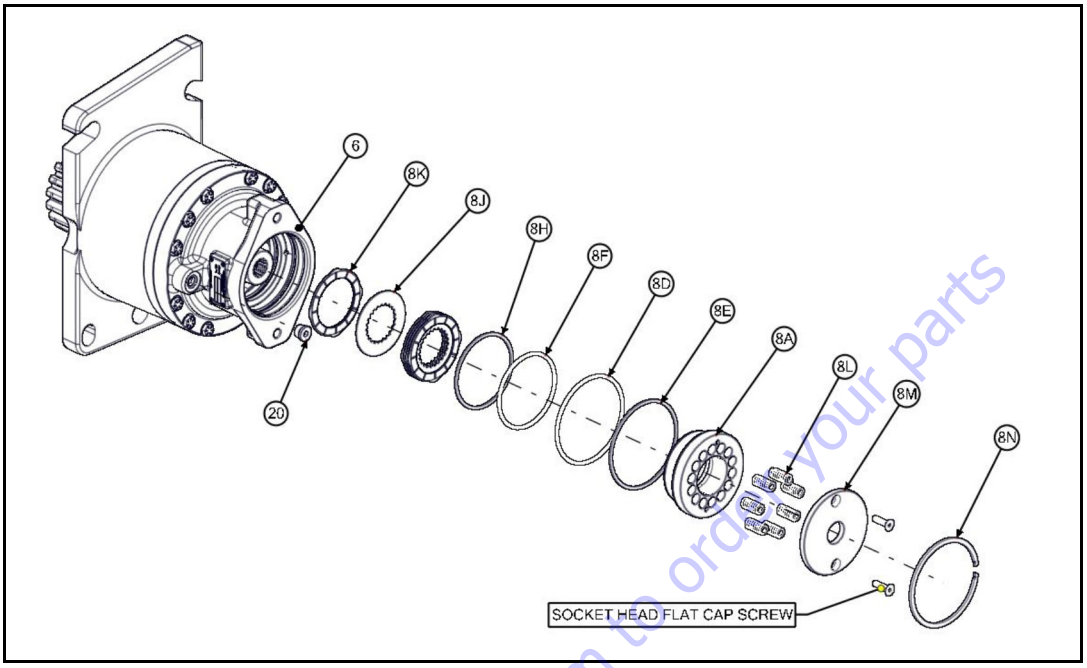


Figure 3-28. Input Brake Disassembly

Main Disassembly

Refer to Figure 3-29.

⚠ CAUTION

SAFETY GLASSES MUST BE WORN DURING THESE NEXT STEPS.

1. Remove Sun Gear (8).
2. With unit resting on the Output Shaft (Pinion) (1A), remove Bolts (12) from Brake Housing (6).
3. Remove Brake Housing (6) from main assembly.
4. Remove O-ring (5A) between Brake Housing (6) and Ring Gear (4). Discard O-Ring.
5. Remove Thrust Washer (11) between Brake Housing (6) and Carrier Sub-Assembly.
6. Remove Ring Gear (4) from Housing (1G).
7. Remove O-ring (5) between Ring Gear (4) and Housing (1G), discard O-ring.
8. Remove Carrier Sub-Assembly.
9. Remove Thrust Washer (11) between Carrier Sub-assembly and Internal Gear (2).
10. Remove Internal Gear (2).

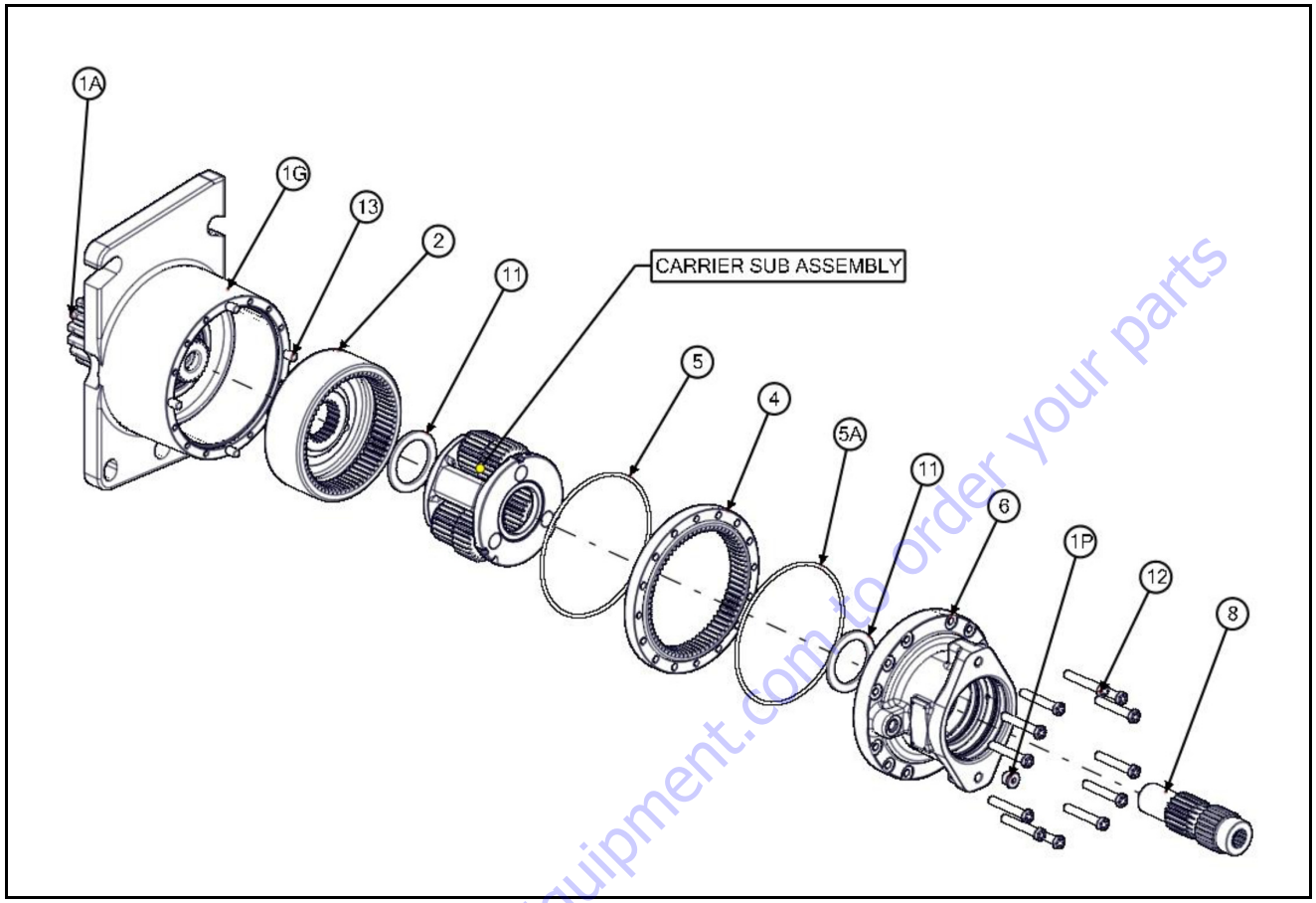


Figure 3-29. Main Disassembly

Housing-Shaft Disassembly

Refer to Figure 3-30.

1. Set unit on a bench with Housing (1G) flange down.

⚠ CAUTION

SAFETY GLASSES MUST BE WORN DURING THESE NEXT STEPS.

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

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

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

NOTE: *Lip Seal (1B) will be pressed out of Housing (1G) by the Bearing Cone (1D) during this step.*

5. Remove Bearing Cone (1E) from Housing (1G).
6. Use a bearing puller to remove Bearing Cone (1D) from Shaft (1A).
7. Bearing Cups (1C & 1F) will remain in Housing (1G).

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

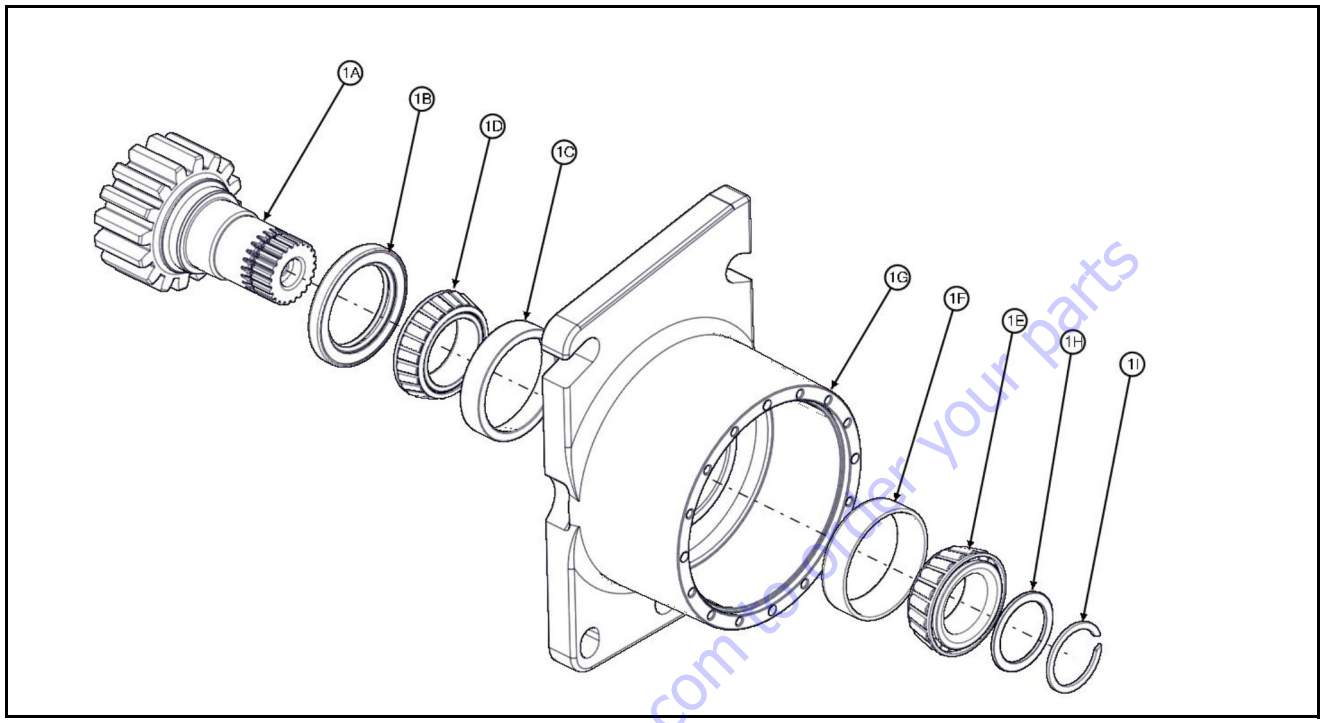


Figure 3-30. Housing Shaft Disassembly

Carrier Disassembly

Refer to Figure 3-31.

1. Drive Planet Shaft (3E) out of carrier pin holes; forcing Roll Pin (3G) to sheer off.
2. Hold Planet Gear (3F) and push Planet Shaft (3E) out of Carrier (3A). Thrust Washers (3B) will slide off shaft as it is removed.
3. Slide Planet Gear (3F) and two Thrust Washers (3B) out of Carrier (3A).
4. Using a hammer and punch, drive pieces of Roll Pin (3G) out of Planet Shaft (3E) and Carrier (3A).
5. Remove both rows of Needle Bearings (3C) and Spacer (3D) from bore of Planet Gear (3F).
6. Repeat Steps 1 thru 5 for remaining two Cluster Gears (3F).

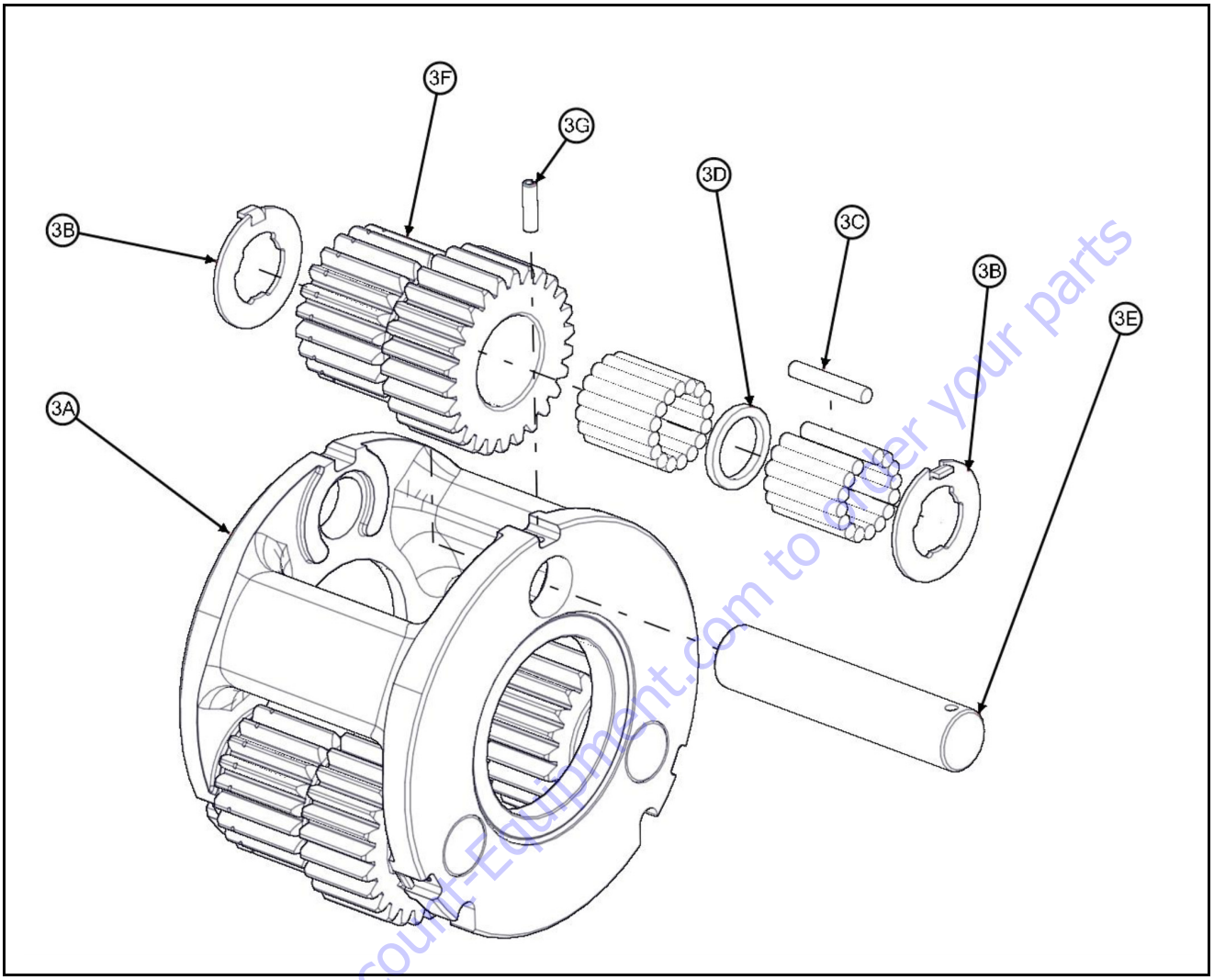


Figure 3-31. Carrier Disassembly

Carrier Assembly

Refer to Figure 3-32.

1. Apply a liberal coat of grease to the bore of Cluster Gear (3F). This will enable the Needle Rollers (3C) to be held in place during assembly.
2. Install one half of the inside of the Cluster Gear (3F) with 16 Needle Rollers (3C).

NOTE: *Last roller installed must be installed end-wise. That is, the end of the last roller must be placed in between the ends of the two rollers that form the space, and then slid parallel to the other rollers into place.*

3. Place one Spacer (3D) on top of Needle Rollers (3C) inside Planet Gear (3F).
4. Install other half of Cluster Gear (3F) with16 Needle Rollers (3C).
5. Place Carrier (3A) into tool fixture so that one of the roll pin holes is straight up.
6. Start Planet Shaft (3E), with end opposite roll pin hole first, through planet shaft hole in carrier (3A). Ensure roll pin hole with large chamfer in planet shaft is straight up.
7. Using ample grease to hold them in position, locate Thrust Washer (3B) on each side of interior carrier wall with tangs located in Carrier Pad slots.

8. With large end of Cluster Gear (3F) facing roll pin hole in Carrier, place Cluster Gear in position in Carrier (3A). Push Planet Shaft (3E) through Cluster Gear (3F) without going all the way through the carrier (3A).

9. Finish sliding Planet Shaft (3E) in Carrier (3A) until roll pin holes of planet shaft and carrier are aligned. Align roll pin hole using a 1/8 inch diameter punch.

NOTE: *Chamfer on Roll Pin hole should face towards roll pin hole in Carrier.*

10. Drive roll pin (3G) through Carrier (3A) and into Planet Shaft (3E) until flush with the bottom of cast slot in Carrier (3A) outside diameter at Thrust Washer (3B) tang. Use a 1/4" pin punch to make sure roll pin (3G) is flush in the slot.

11. Repeat Steps 6 through 10 for remaining two Cluster Gears (3F).

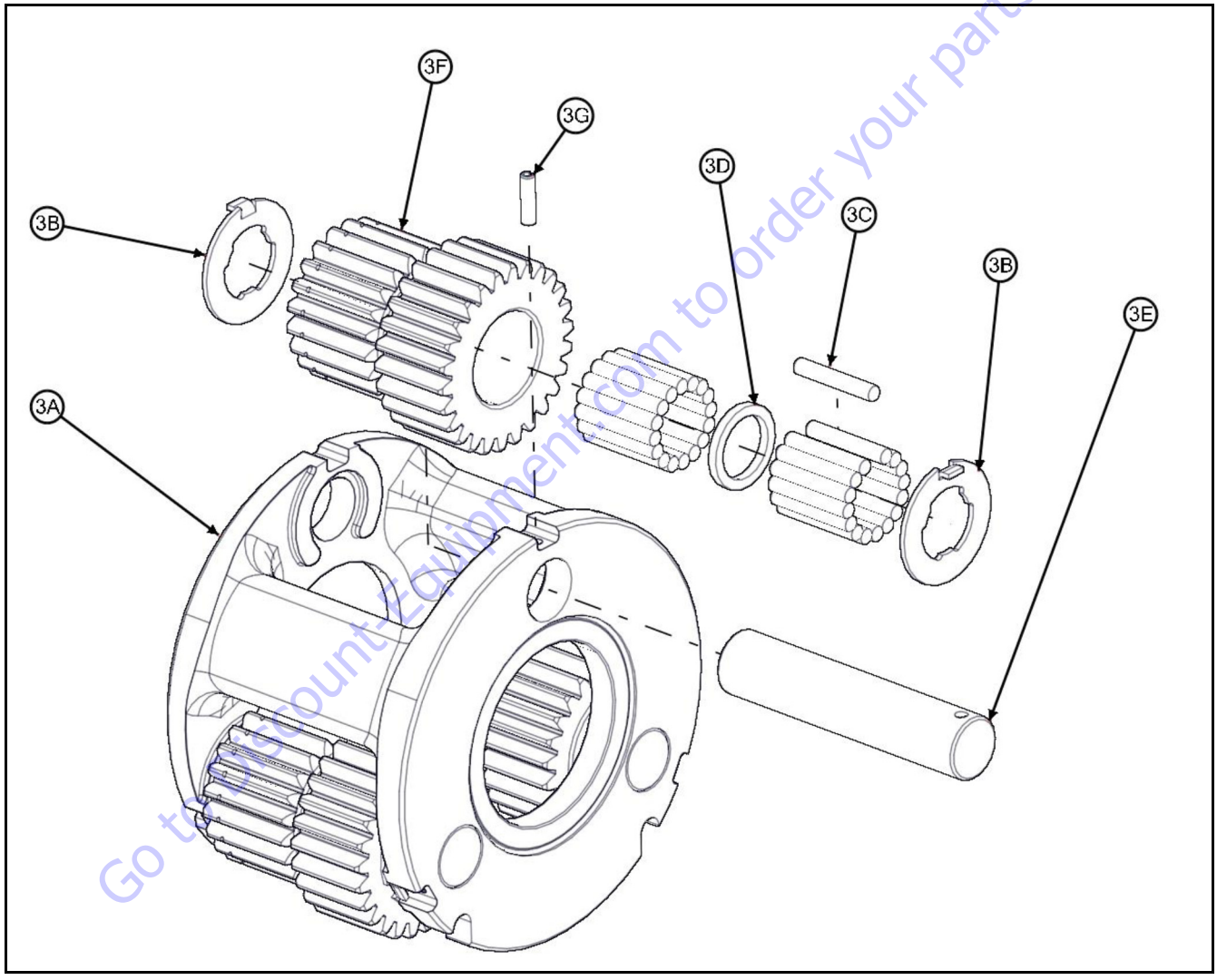


Figure 3-32. Carrier Assembly

Housing - Shaft Assembly

Refer to Figure 3-33.

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

1. Press Bearing Cup (1C) in Housing (1G). Ensure cup starts square with bore of Hub (1G).
2. Place Bearing Cone (1D) in Bearing Cup (1C) in Housing (1G).
3. Press Seal (1B) in counterbore of Housing (1G) until flush with Housing (1G) face. Ensure Seal (1B) is installed (smooth face up). Apply oil to rubber portion of seal.
4. Invert Hub (1G) and press Bearing Cup (1F) into counterbore of Housing (1G).
5. Carefully lower Housing (1G) on Output Shaft (1A) until Bearing Cone (1D) contacts Output Shaft (1A).
6. Press on small end of the Bearing Cone (1D), being careful not to contact the bearing cage, until Bearing Cone (1D) seats on shoulder of Output Shaft (1A).
7. Start Bearing Cone (1E) on Output Shaft (1A).
8. Press or tap Bearing Cone (1E) on Output Shaft (1A) until it is just seated in Bearing Cup (1F), while rotating Housing (1G).
9. Install Bearing Spacer (1H) on Output Shaft (1A) against Bearing Cone (1F).
10. Install Retaining Ring (1I) into groove of Output Shaft (1A). This Retaining Ring (1I) should never be reused in a repair or rebuild.

⚠ CAUTION

WEAR EYE PROTECTION DURING THIS PROCEDURE.

11. Tap Retaining Ring (1I) with a soft metal punch to ensure Retaining Ring (1I) is completely seated in groove of Output Shaft (1A).

⚠ CAUTION

WEAR EYE PROTECTION DURING THIS PROCEDURE.

12. Install O-ring Plug (1P). Torque to 23 to 24 ft-lb (31 to 32.5Nm).

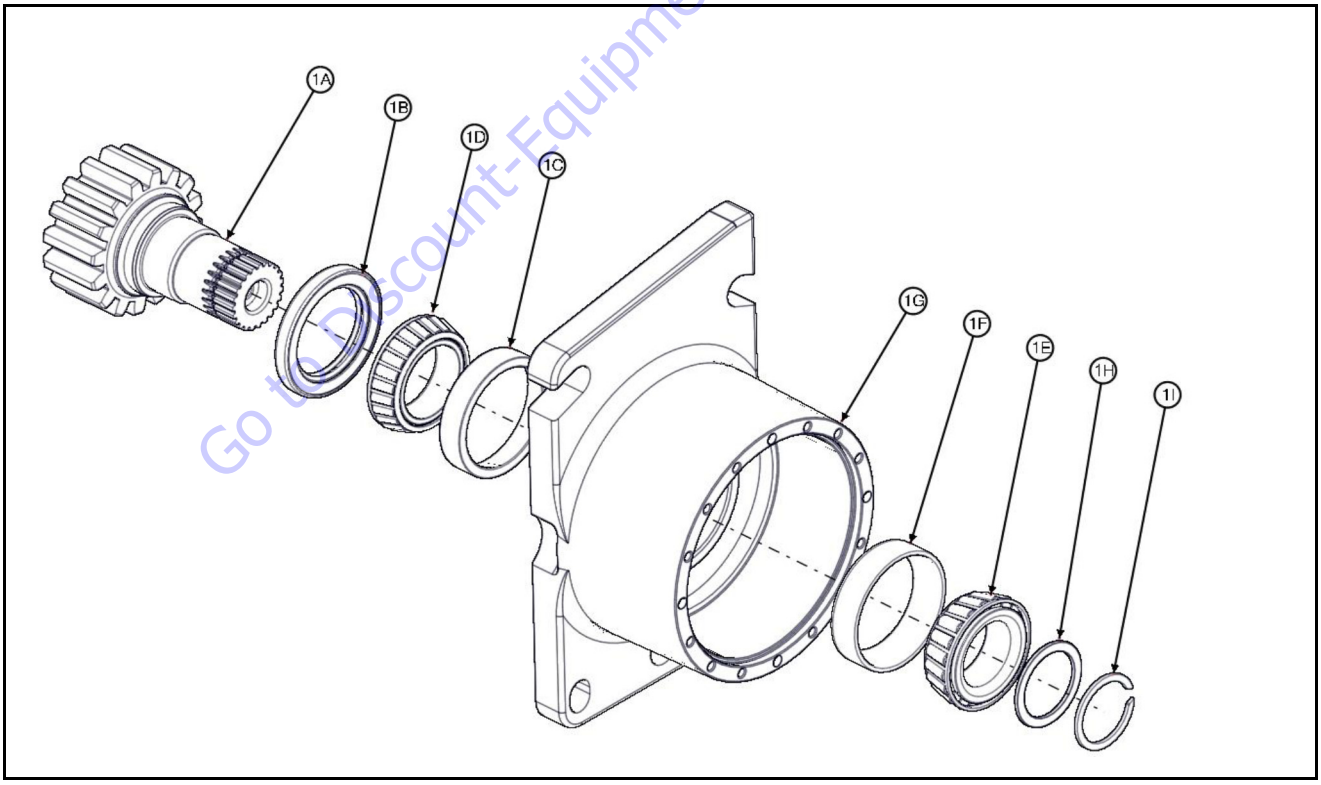


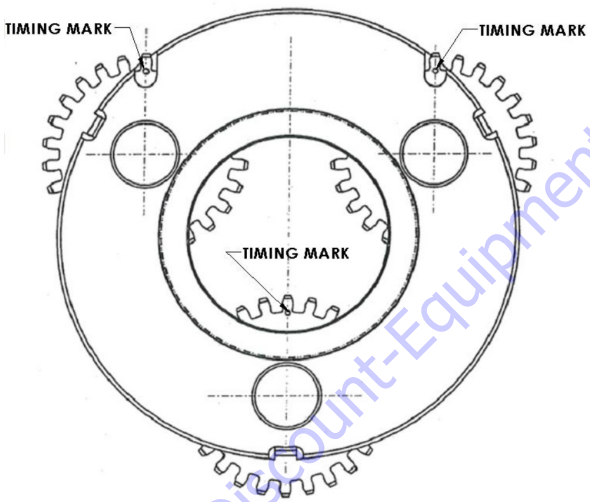
Figure 3-33. Housing - Shaft Assembly

Main Assembly

Refer to Figure 3-34.

1. Slightly tap Internal Gear (2) with spline side down onto Output Shaft (1A) splines to ensure Internal Gear (2) is properly seated.
2. Grease and install O-ring (5) on Housing (1G) O-ring groove.
3. Grease and install Thrust Spacer (11) into counterbore of Carrier Sub-assembly on smaller diameter cluster gear side. The grease should hold the Thrust Spacer (11) in place for assembly.
4. Place Carrier Sub-assembly on table oriented as shown below, with large end of Cluster Gear (3F) facing up. Position all three punch-marks on face of the large gears at 12 o'clock.

   Timing marks on the two upper Cluster Gears will be visible through slots in the Carrier if Cluster Gears are correctly marked. Secure gear teeth using timing fixture.



5. Place Ring Gear (4) in to large end of Cluster Gear to secure timing.
6. Remove Carrier sub-assembly and Ring Gear (4) from the table and assemble into the Internal gear (2) being careful to keep the ring gear, or sun gear, in mesh with the cluster gears.
7. After engaging internal gear teeth and before rotating carrier, look at the Carrier sub-assembly in the main assembly and ensure the timing is correct by locating the timing marks in the slots in the carrier and at 12 o'clock on the gear that the timing mark is visible in the carrier bore.
8. Grease and install O-ring (5A) onto Brake Housing (6) counterbore.
9. Install Brake Housing (6) onto Ring Gear (4) by aligning the bolt holes in brake housing with ring gear holes.
10. Ensure the pipe plugs in Housing (1G) and Brake Housing (6) are timed as shown.
11. Pull one Cover Bolt (12) and place into the bolt hole and repeat for remaining bolts.
12. Torque Bolts (12) in star pattern to 23-27 ft-lb (31-36.5 Nm).
13. Install Input Shaft (8) with spline side up into housing bore. Ensure the input shaft gear teeth and planet gears are engaged.
14. Install O-ring plugs (1P) into Brake Housing (6) and Housing (1G). Torque 23 to 24 ft-lb (31 to 32.5Nm).
15. Perform leak and roll check per instructions in this section.
16. Fill oil through opening in Brake Housing (6) with 43 oz (1.3 L) of 80W90 gear oil.

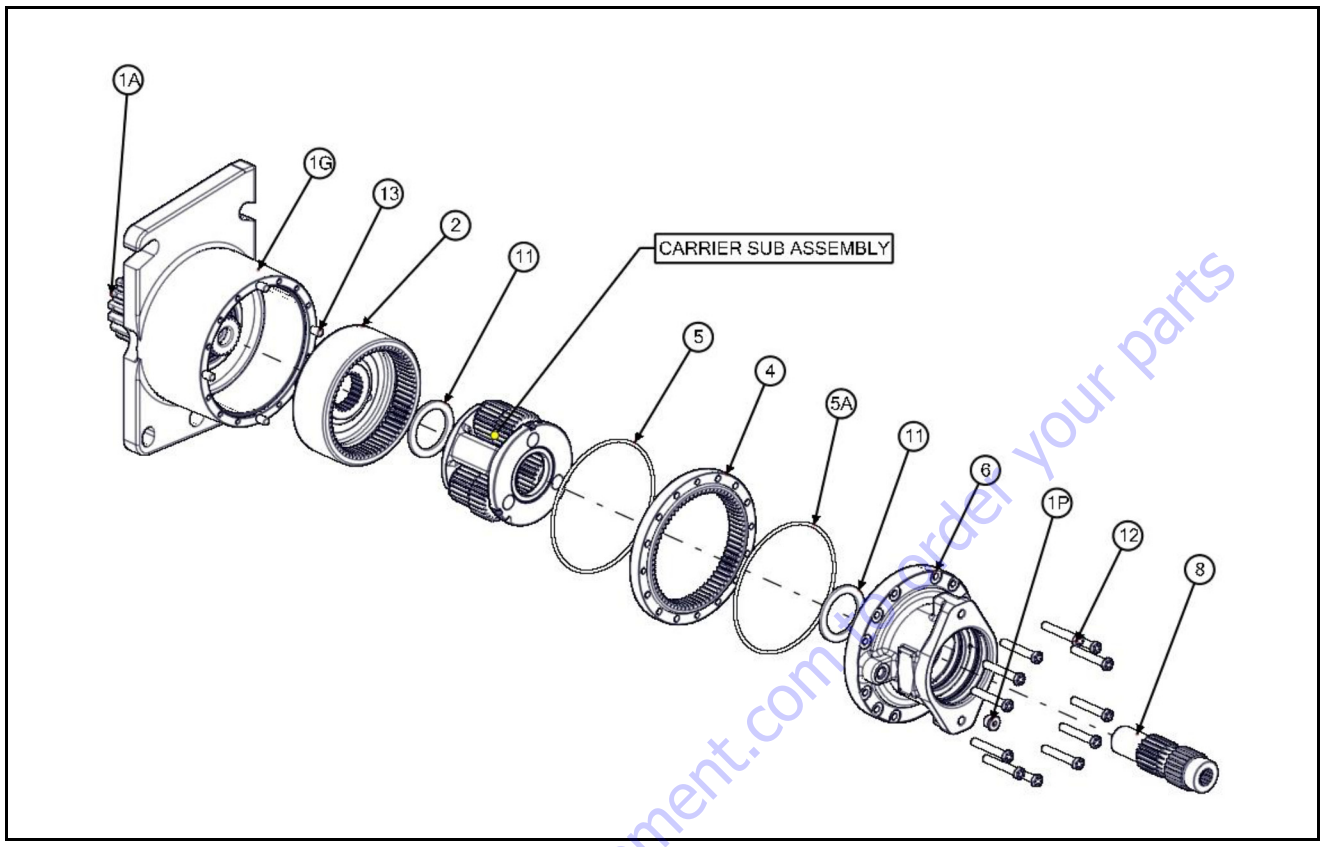


Figure 3-34. Main Assembly

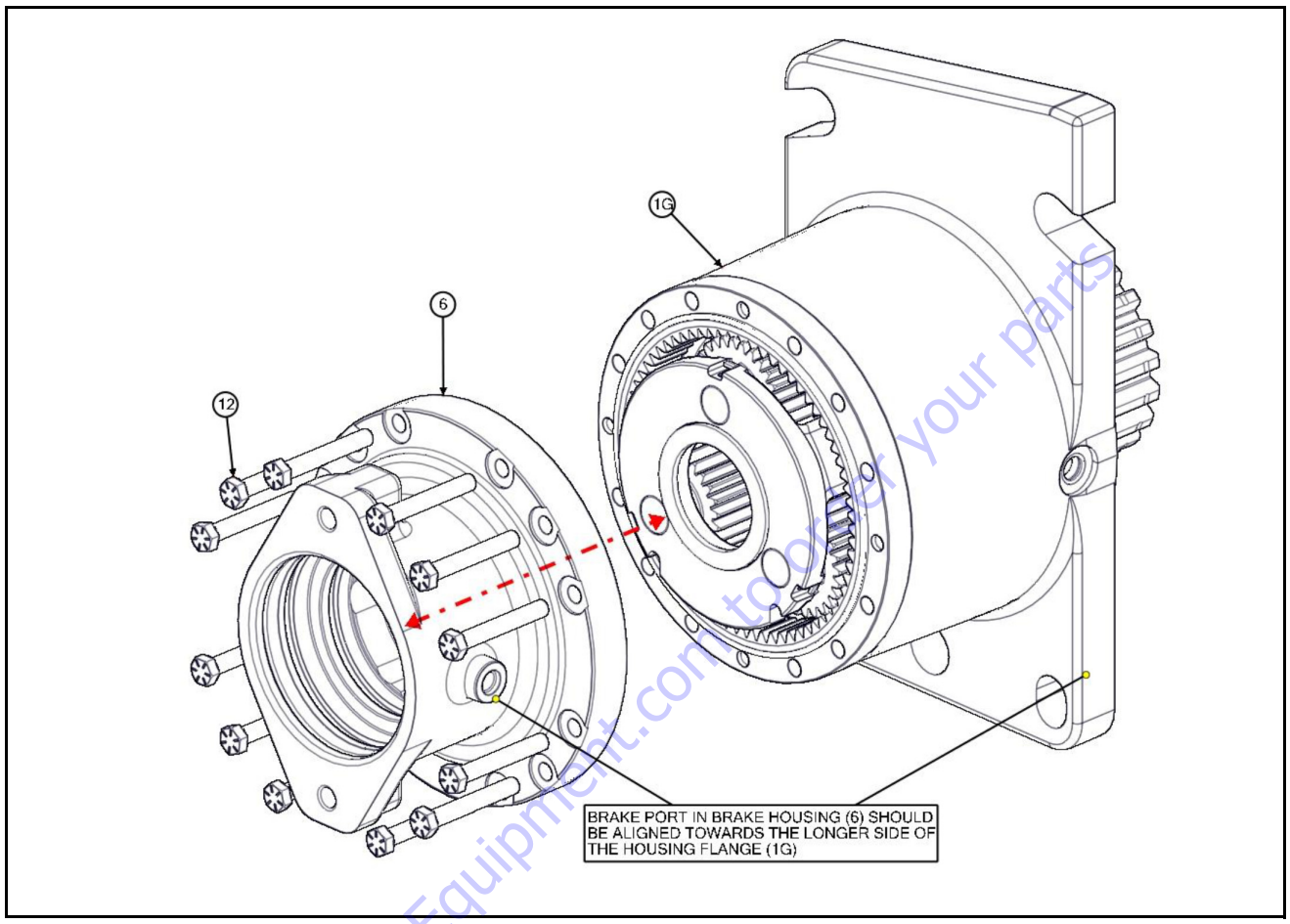


Figure 3-35. Brake Port Alignment

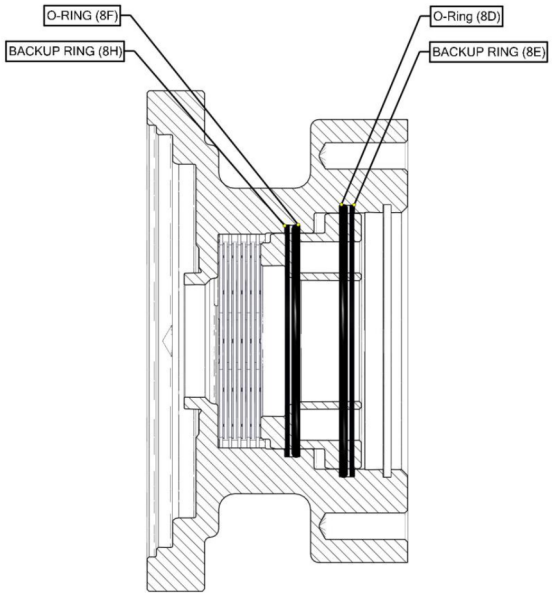
Motor and Brake Assembly

1. Starting with a Stator (8K), alternately stack and install Stators (8K) into Lobes of Brake Housing (6) and Rotors (8J) (internal splines) onto splines of Sun Gear (8).

NOTE: *There should always be a Stator on top and bottom of the stack.*

2. Insert Brake Piston (8A) completely into Brake Housing (6) without O-rings (8D, 8F) and Backup Rings (8E, 8H) to check fit of brake. The Brake Piston (8A) should slide into Brake Housing (6) without being forced. If Brake Piston (8A) does not fit, check for burrs or size problems before proceeding.
3. Grease O-rings (8D, 8F) and install smaller diameter O-Ring (8F) into smaller diameter O-Ring groove in Brake Housing (6) and install larger diameter O-Ring (8D) into larger diameter O-Ring groove in Brake Housing (6).
4. Insert smaller diameter Solid Backup Ring (8H) into smaller groove in Brake Housing (6) between O-Ring (8F) and side of groove towards Output Shaft (1A).
5. Insert larger diameter Solid Backup Ring (8E) into groove in Brake Housing (6) between O-Ring (8D) and side of groove towards Motor (31).

NOTE: *Refer to figure below for installing O-Rings (8D), (8F) and Backup Rings (8E), (8H).*



6. Lightly grease cylinder walls of Brake Housing (6) and install Brake Piston (8A) into Brake Housing (6). If necessary, place T-134711 on top of brake and lightly tap until Brake Piston (8A) contacts brake disk stack.

7. Insert 8 Springs (8L) into Brake Piston (8A) spring holes.

8. Install Pressure Plate (8M) into Brake Housing (6) bore and onto top of Springs (8L).

9. Insert and tighten the 0.250-20 UNC Flat Head Capscrews through the Pressure Plate (8M) and into the Brake Piston (8A) to compress the springs. Tighten Socket Head Capscrews incrementally to evenly compress Springs (8L)

⚠ CAUTION

SAFETY GLASSES MUST BE WORN DURING THESE NEXT STEPS.

10. Using retaining ring pliers, install large Retaining Ring (8N) into groove in Brake Housing (6) making sure that it is seated properly.

NOTE: *Use caution when installing retaining ring (8N) into Brake Housing (6). It may cause injury if it slips out of retaining ring pliers.*

11. Remove Flat Head Capscrews from Brake Piston (8A) incrementally to release slowly release spring tension. Discard Flat Head Capscrews.

12. Perform brake test following instructions in this section.

13. Grease and install O-Ring (26) in Motor (31) pilot.

14. Install Motor (31) in Brake Housing (6). Ensure motor valve mounting face is aligned with radial brake release port in Housing (1G).

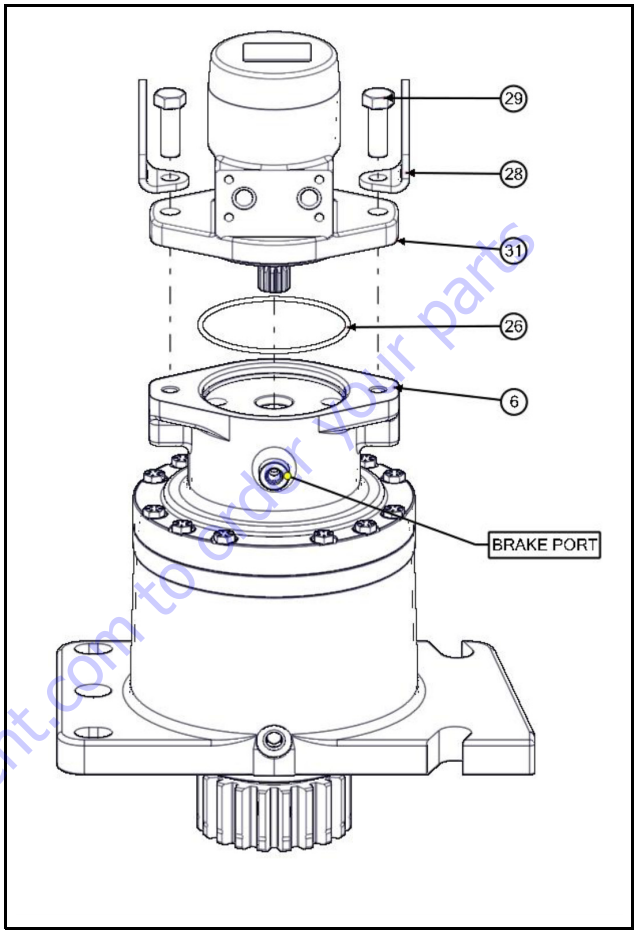


Figure 3-36. Swing Motor Installation

15. Install Bolts (29) in Brake Housing (6) through Lifting Lugs (28) and Motor (31) flange. Torque bolts to 80-100 ft-lb (108.5-135.5 Nm).

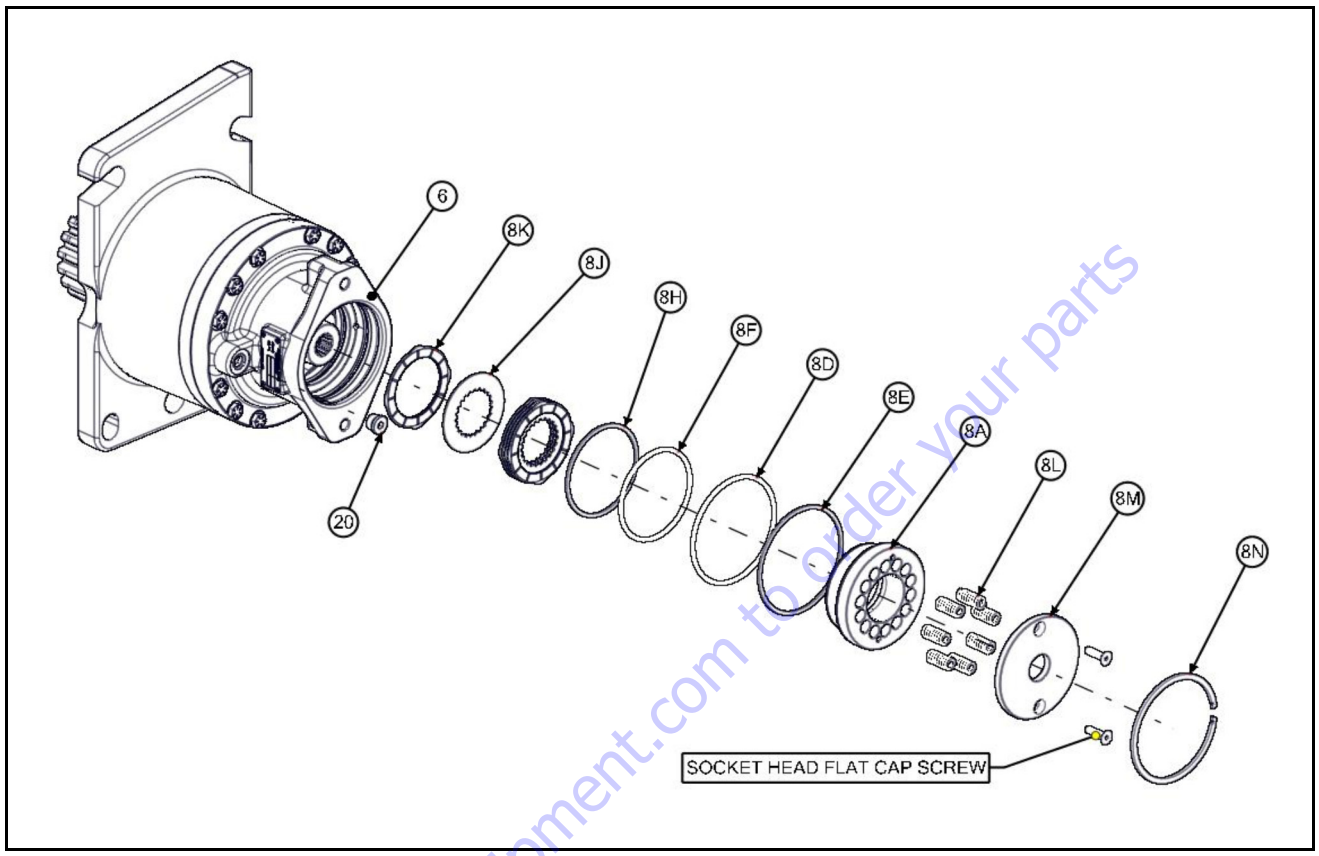


Figure 3-37. Motor and Brake Assembly

Motor Control Valve Installation

NOTE: *Verify o-rings are located in between the motor and valve.*

1. Install O-Rings (99) into counterbore on Motor Valve face.
2. Install Motor Control Valve (32) on Motor (31) using Bolts (21) and Washers (22). Torque Bolts to 18-20 ft-lb (24.5-27 Nm). Ensure holes in Motor Control Valve (32) are aligned with holes in Motor (31).
3. Install Elbow Fitting (30) into Brake Housing (6). Ensure the thread fitting O-ring seats onto the Brake Housing (6). Rotate the Elbow Fitting (30) to horizontal position as shown in picture.
4. Install Elbow Fitting (30) into Motor Valve (32). Ensure the thread fitting O-ring seats onto the Motor Valve (32). Rotate the Elbow Fitting (30) to horizontal position as shown in picture.
5. Install Tube Assembly (35) to elbow fittings as shown in picture. Torque tube assembly nut to 13-15 ft-lb (17.5- 20 Nm). Tighten Jam Nut on Elbow Fitting (30) into 13-15 ft-lb (17.5- 20 Nm). torque.
6. Install one O-Ring Plug (23) onto Motor Control Valve (32). Torque to 18-20 ft-lb (24.5-27 Nm).
7. Install hydraulic test fitting into the other control valve O-ring Plug (23) hydraulic port.
8. Perform pressure decay test at "MAXIMUM PRESSURE". Hold pressure for 1 minute. If pressure does decay, remove the pressure and inspect connections and retest.
9. Remove hydraulic test fitting.
10. Install O-ring plug (23) onto motor control valve (32). Torque to 18-20 ft-lb (24.5-27 Nm).

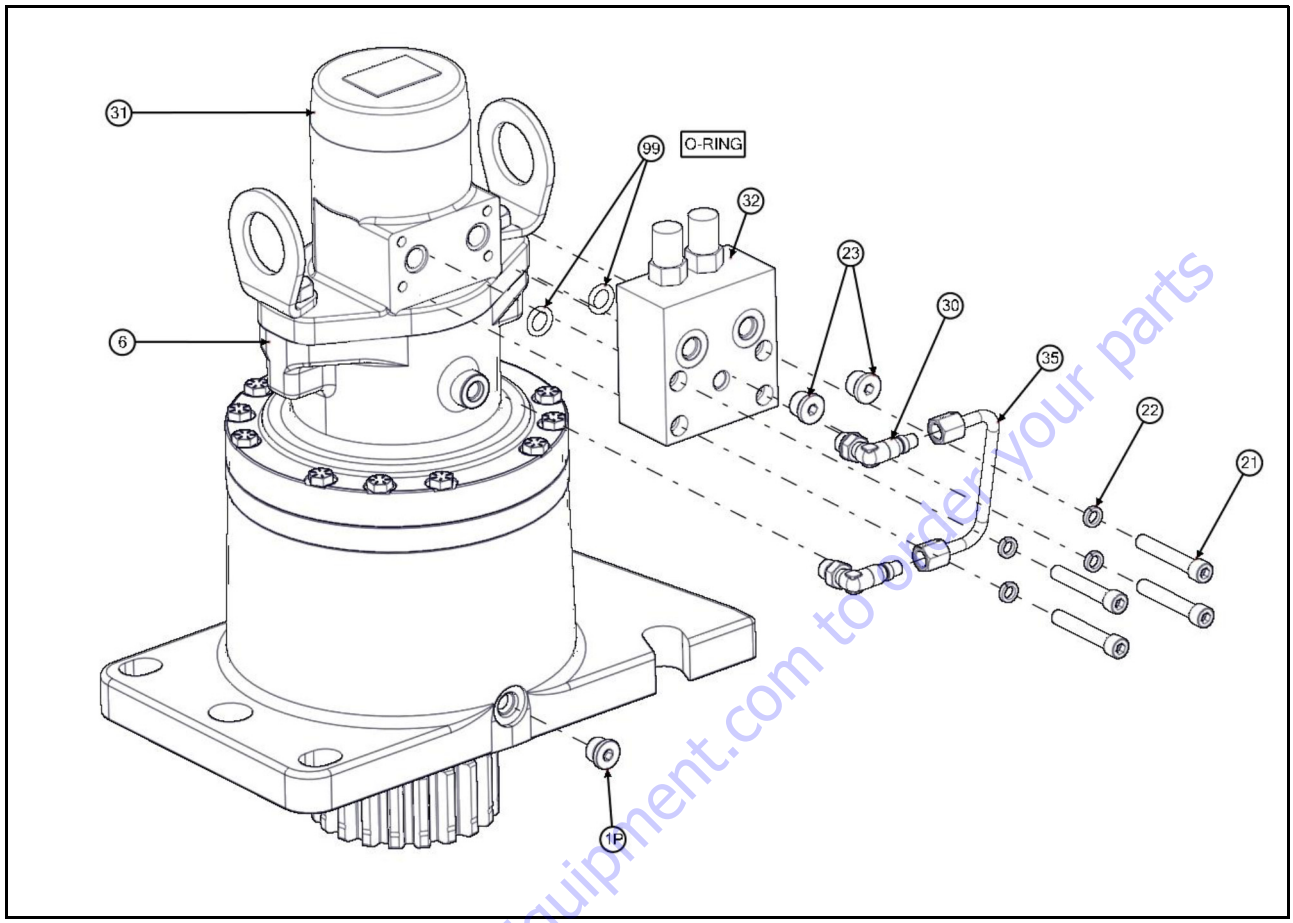


Figure 3-38. Swing Motor Valve Installation

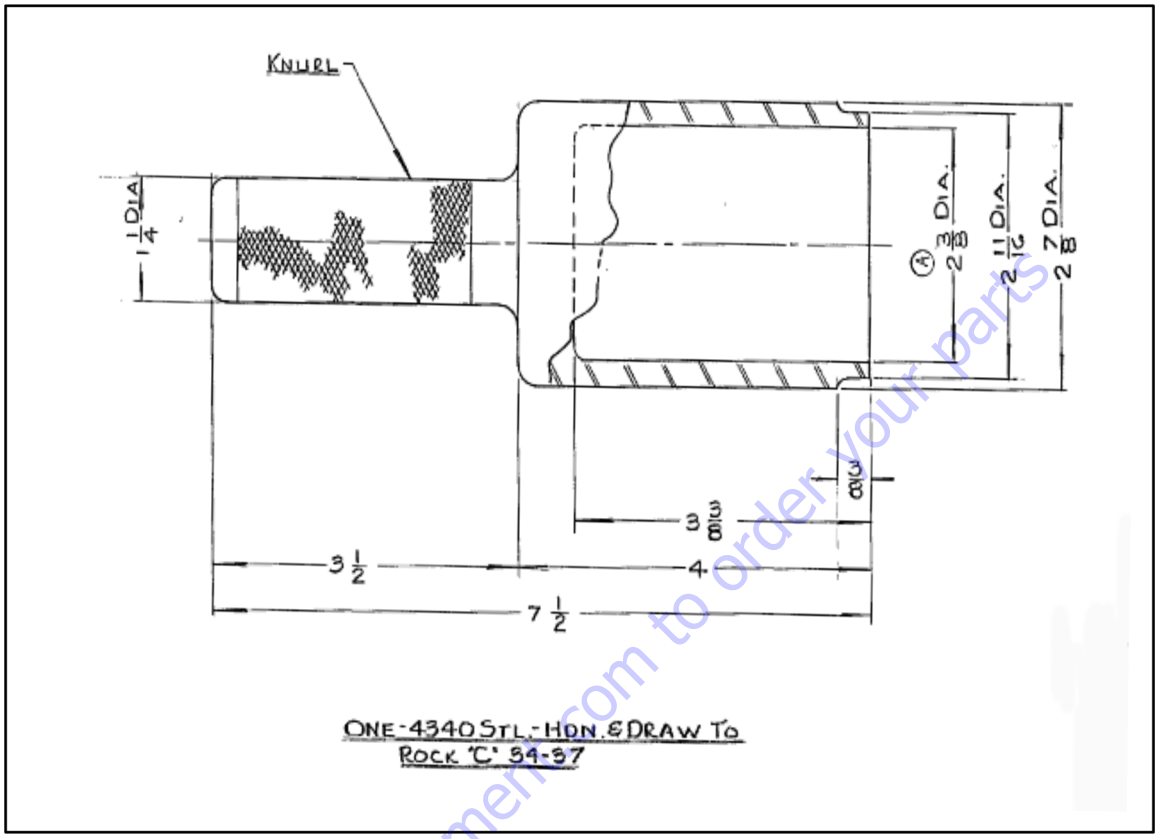


Figure 3-39. Bearing Cone Press Tool

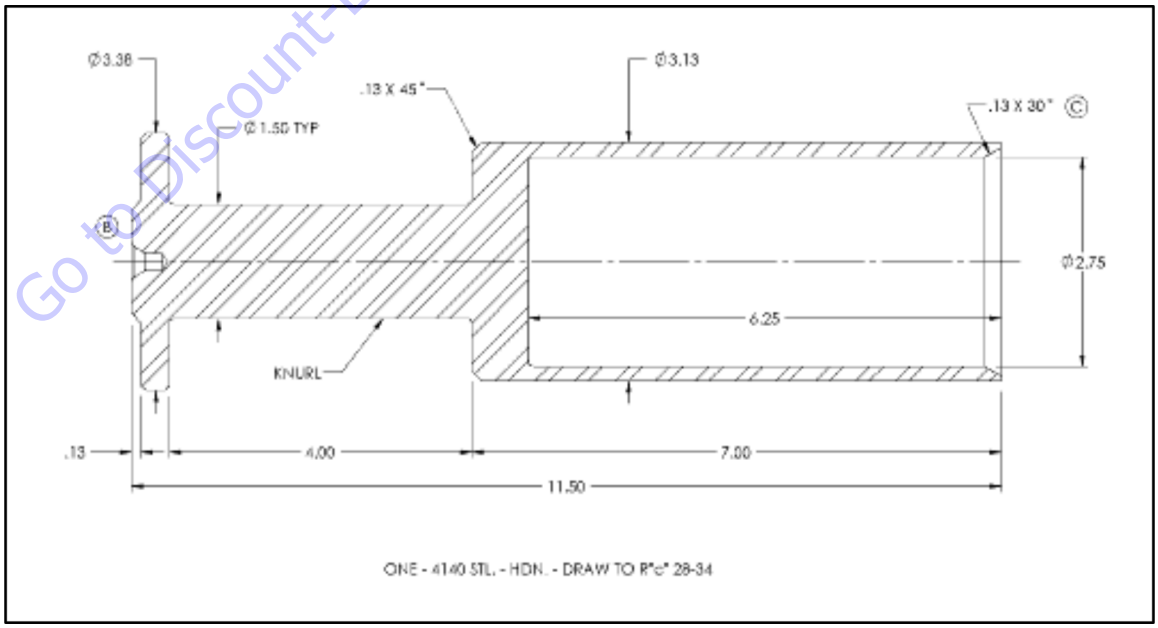


Figure 3-40. Bearing Cone Press Tool

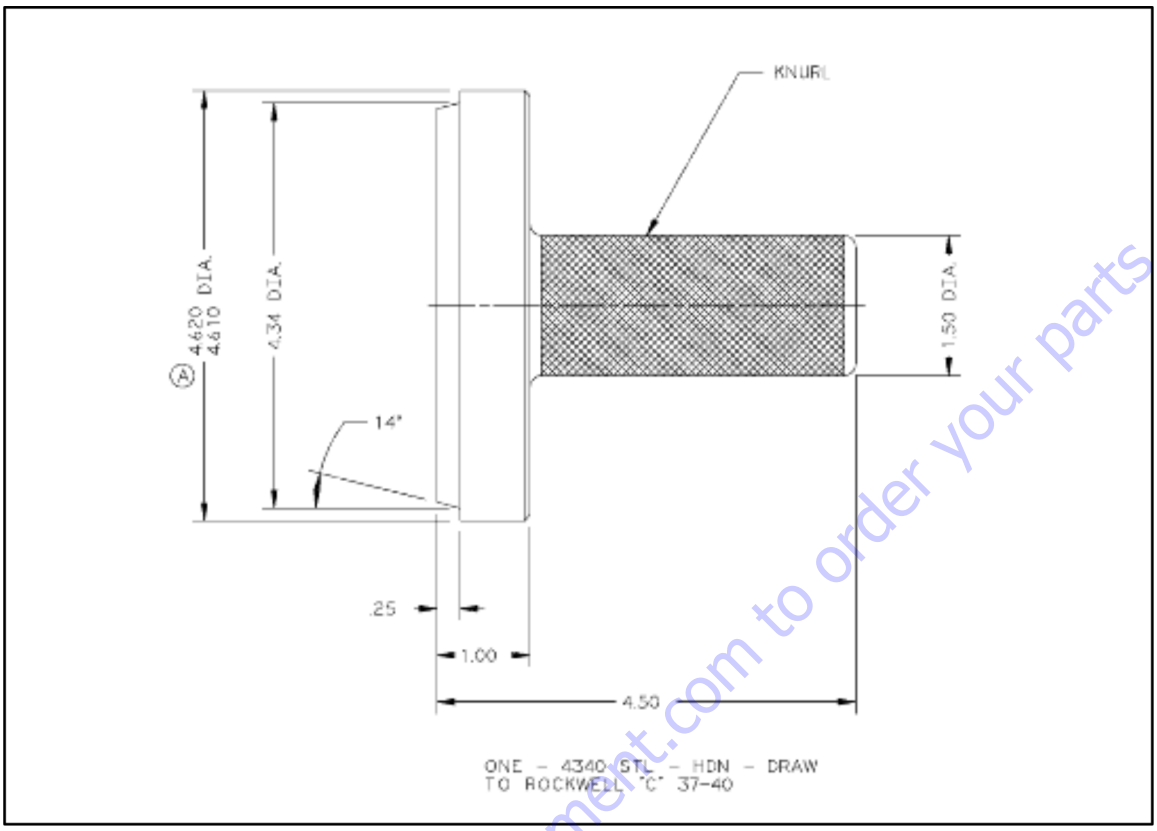


Figure 3-41. Bearing Cup Press Tool

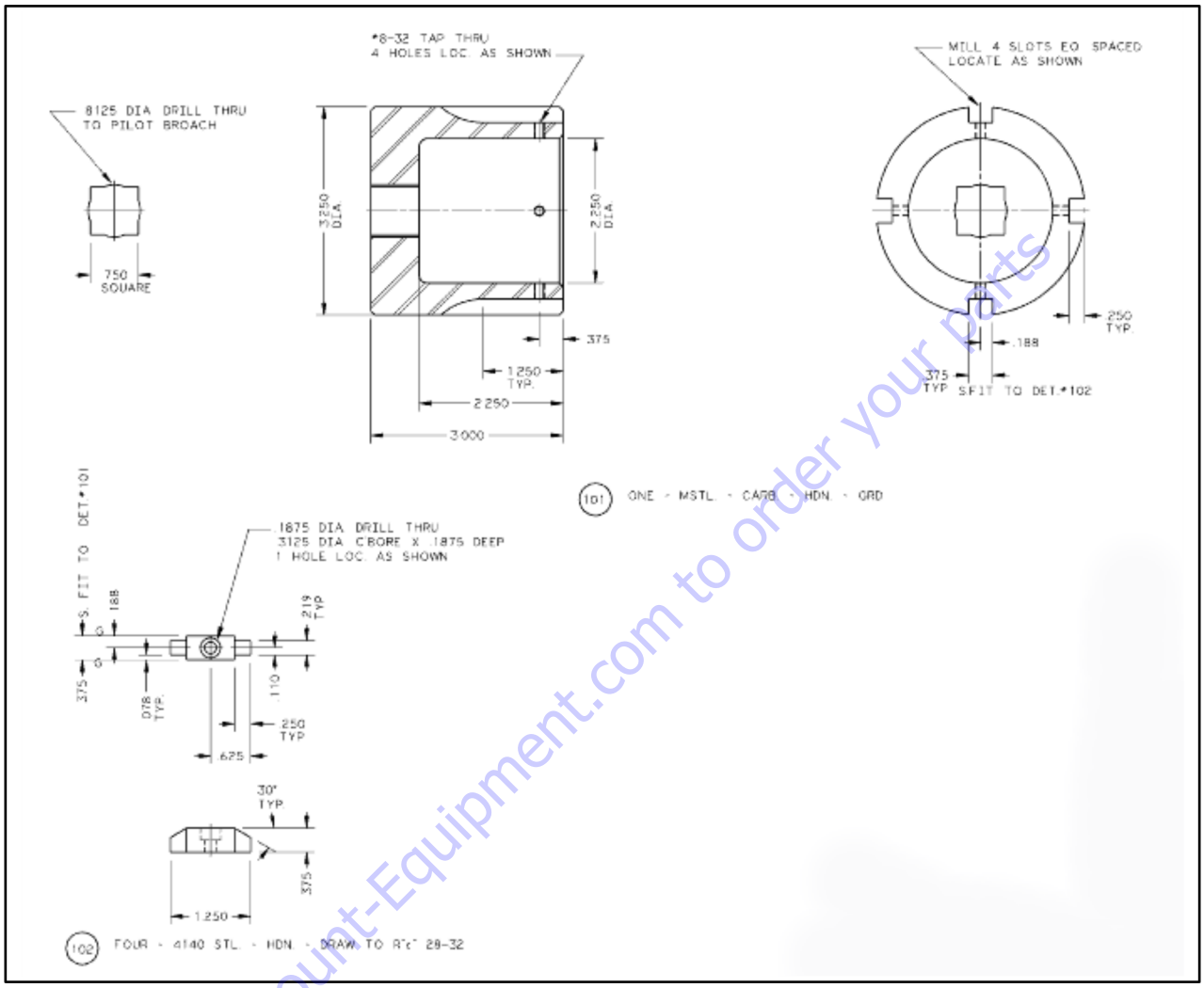


Figure 3-42. Lockout Wrench Tool

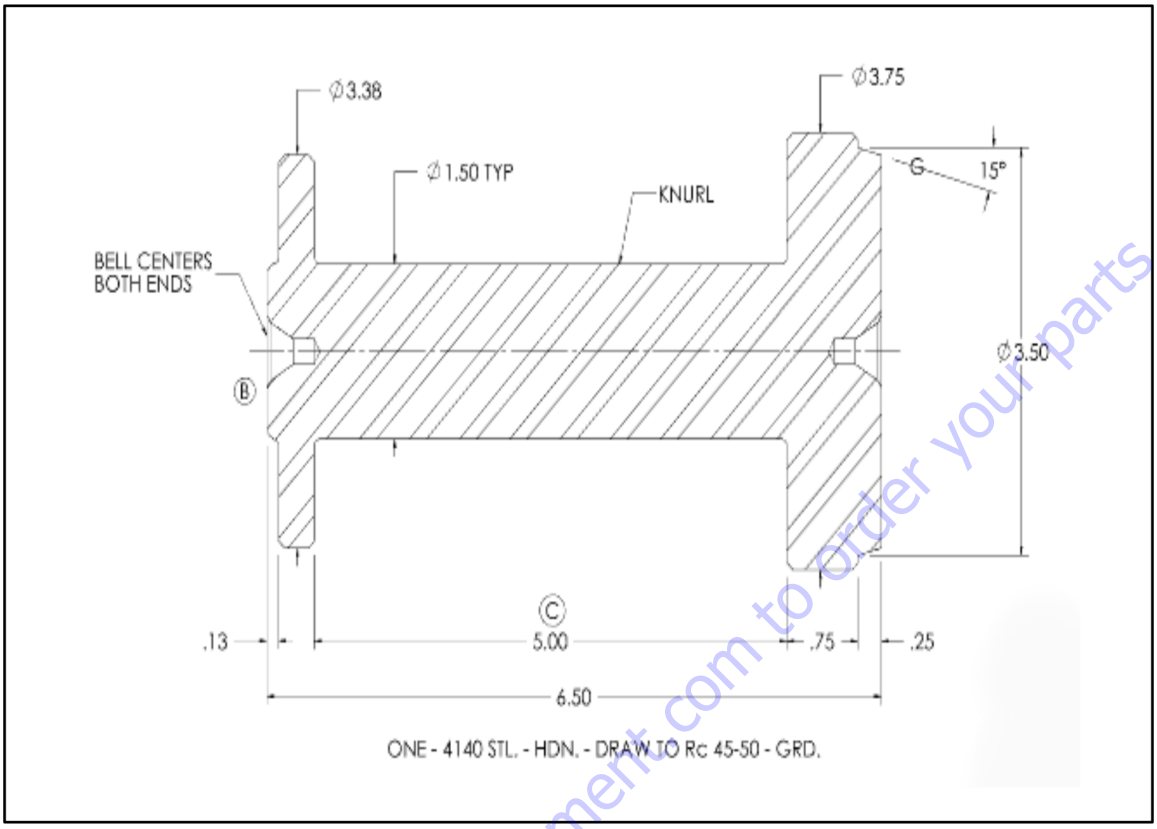


Figure 3-43. Bearing Cup Press Tool

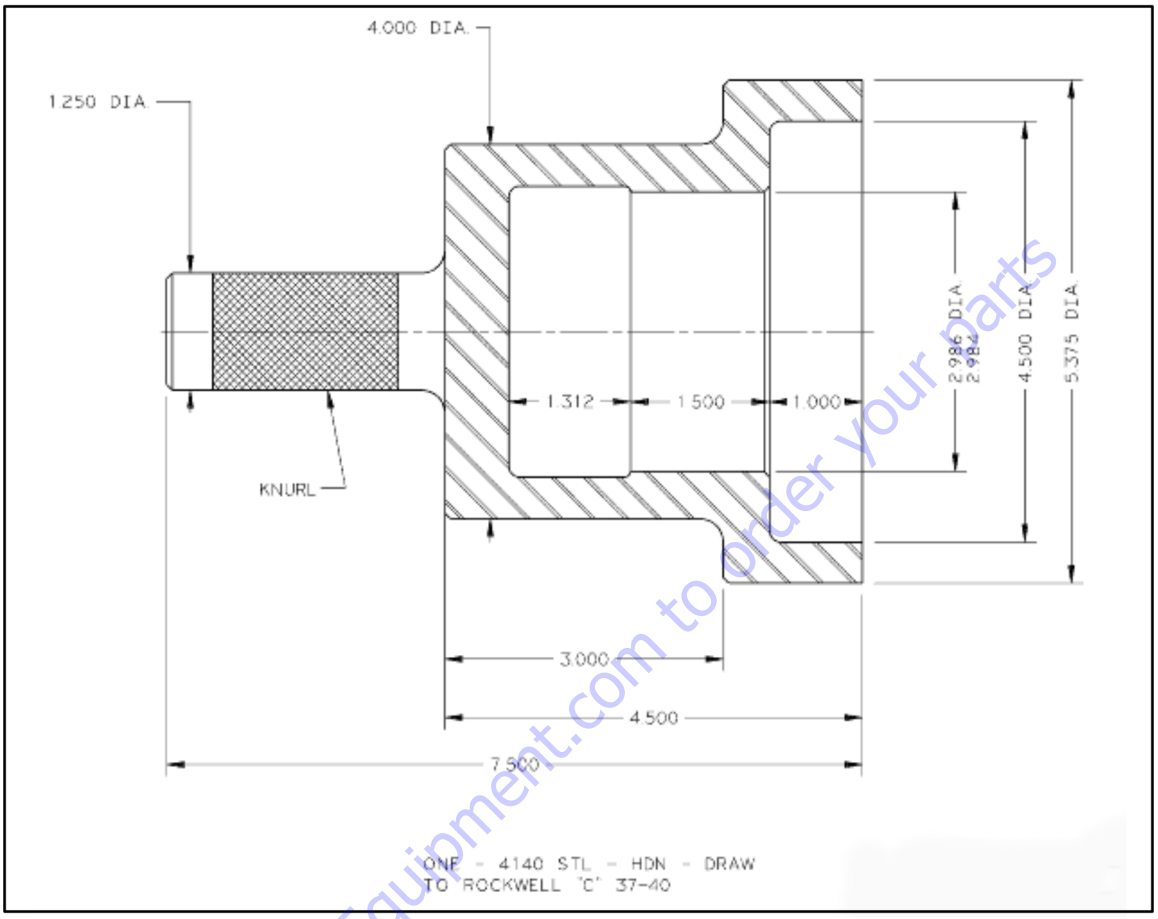


Figure 3-44. Seal Press Tool

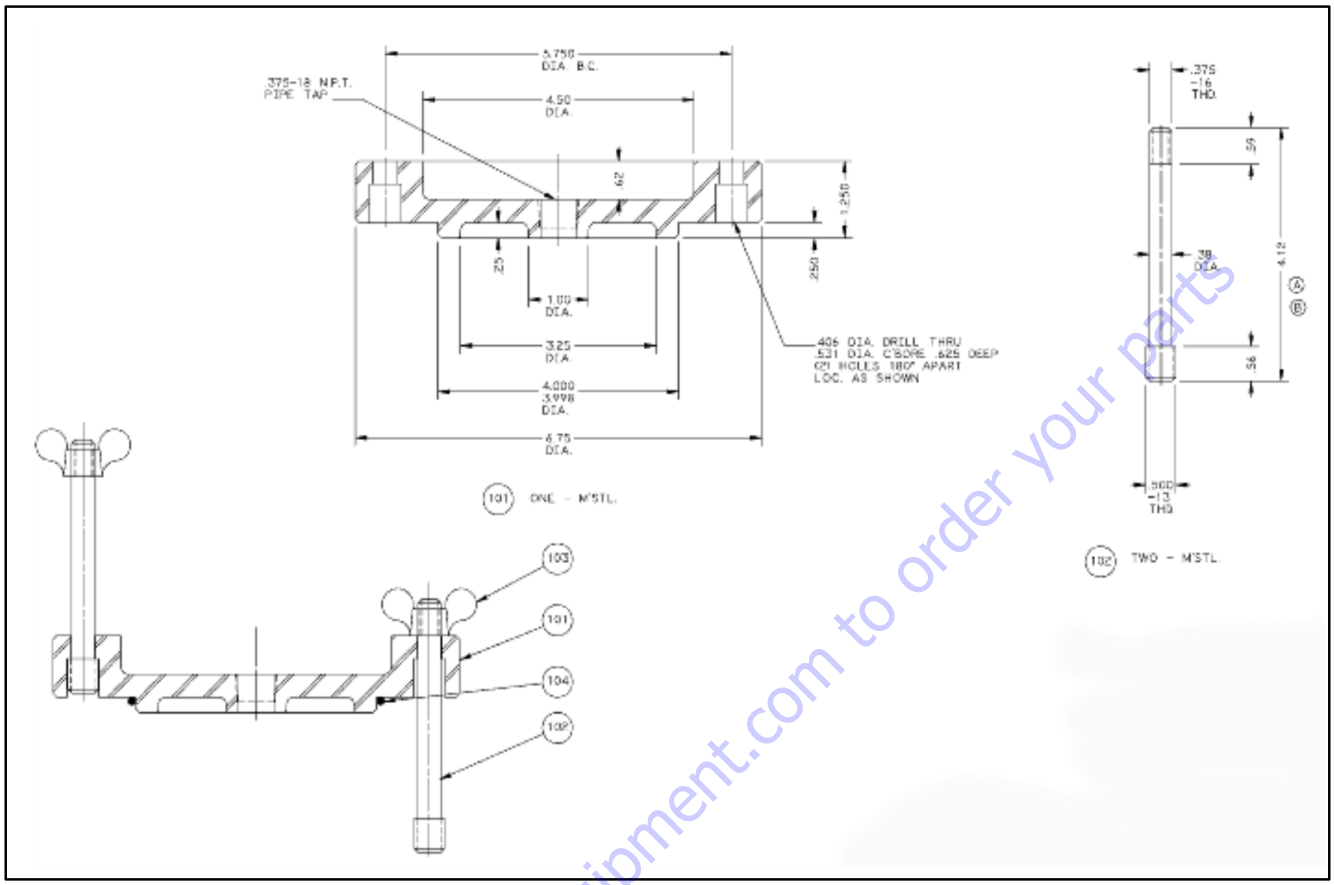


Figure 3-45. Leak Test Adapter Plate

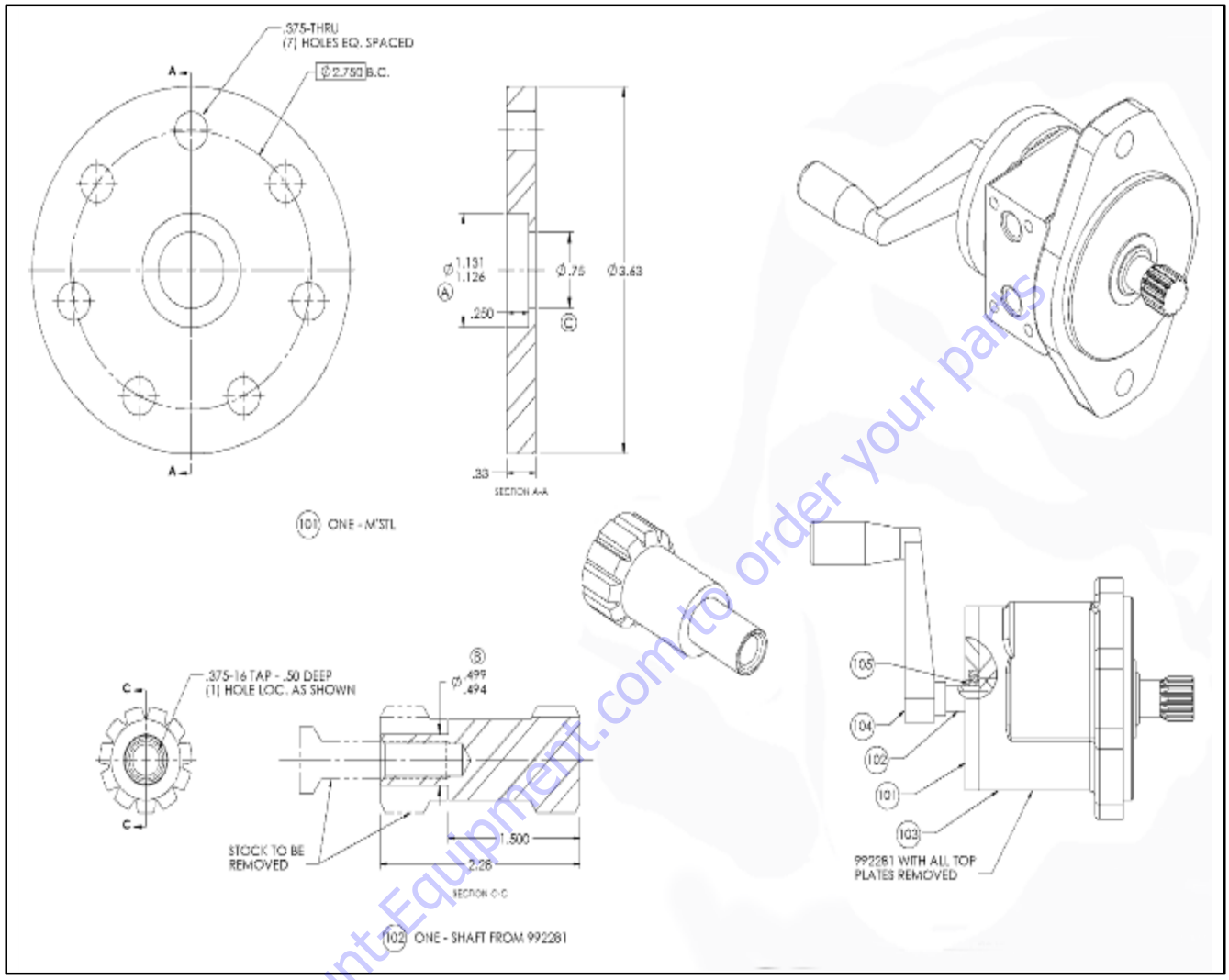
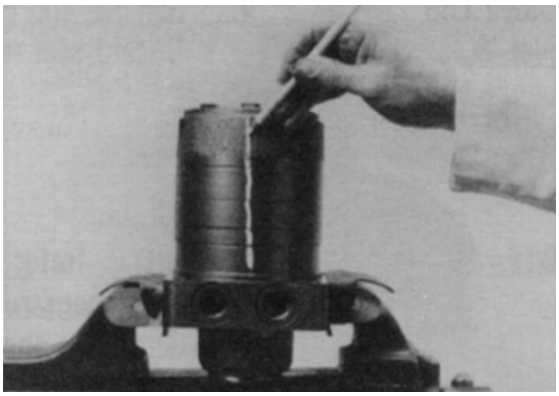


Figure 3-46. Swing Drive Test Plate

3.4 SWING MOTOR

Disassembly and inspection

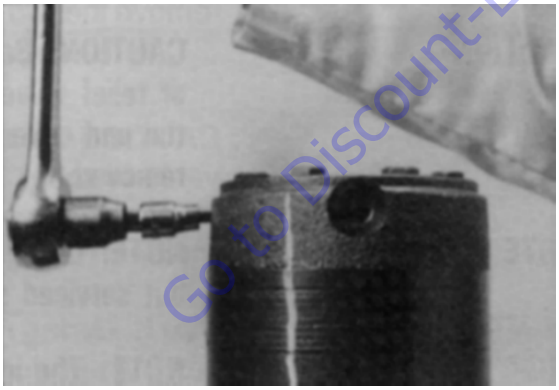
1. Place Torqlink™ in a soft jawed vice, with coupling shaft (12) pointed down and vise jaws clamping firmly on sides of housing (18) mounting flange or port bosses. Remove manifold port O-Rings (18A) if applicable.

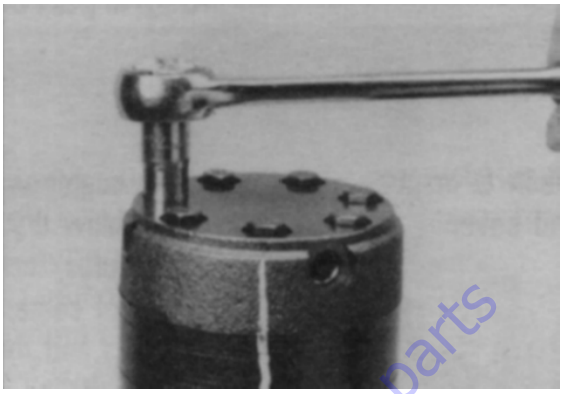


⚠ WARNING

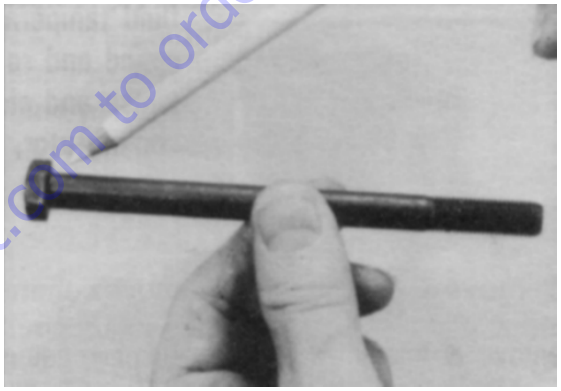
IFTHETORQLINK™ IS NOT FIRMLY HELD IN THE VISE, IT COULD BE DISLODGED DURINGTHE SERVICE PROCEDURES, CAUSING INJURY.

2. Scribe an alignment mark down and across the Torqlink™ components from end cover (2) to housing (18) to facilitate reassembly orientation where required. Loosen two shuttle or relief valve plugs (21) for disassembly later if included in end cover. 3/16 or 3/8 inch Allen wrench or 1 inch hex socket required.

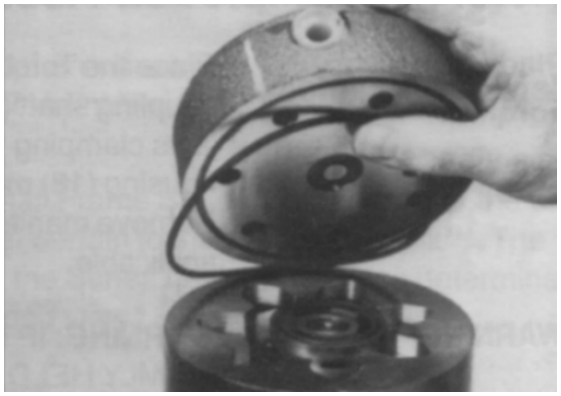




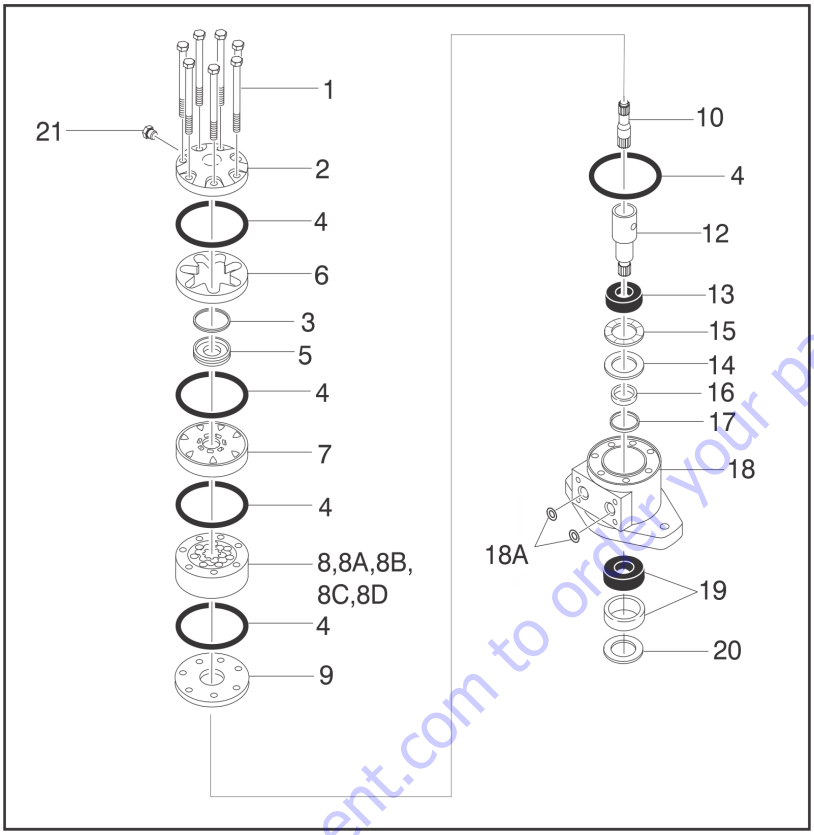
3. Remove five, six, or seven special ring head bolts (1) using a 1/2 or 9/16 inch size socket. Inspect bolts for damaged threads or sealing rings under the bolt head. Replace damaged bolts.



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



NOTE: *Refer to appropriate "alternate cover construction" on the exploded view to determine end cover type being serviced.*



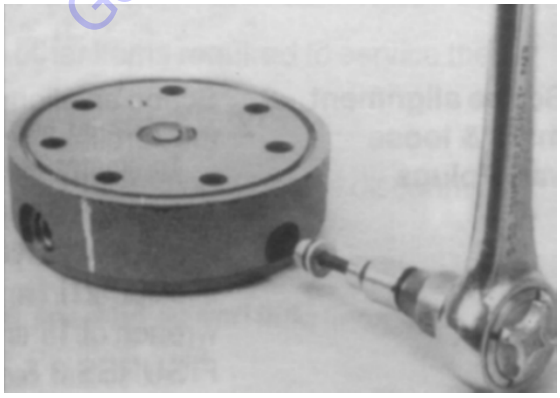
1. Special Bolts
2. End Cover
3. Seal Ring-Commutator
4. Seal Ring
5. Commutator Ring
6. Commutator Ring
7. Manifold
8. Rotor Set

8A. Rotor
8B. Stator or Stator Vane
8C. Vane
8D. Stator Half
9. Wear Plate
10. Drive Link
11. Not Used
12. Coupling Shaft
13. Bearing/Bushing, Inner
14. Thrust Washer
15. Thrust Bearing
16. Seal
17. Backup Washer
18. Housing

18A. O-Ring
19. Bearing/Bushing, Outer
20. Dirt & Water Seal
21. Plug

Figure 3-47. Swing Drive Motor

5. If end cover (2) is equipped with shuttle valve components, remove two previously loosened plugs (21).

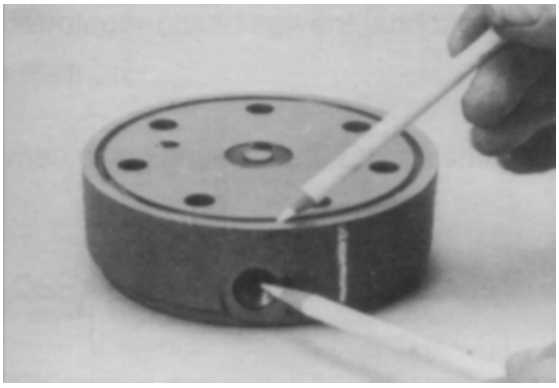


NOTICE

BE READY TO CATCH THE SHUTTLE VALVE OR RELIEF VALVE COMPONENTS THAT FALL OUT OF END COVER VALVE CAVITY WHEN PLUGS ARE REMOVED.

NOTE: *Do not remove the insert (and orifice plug if included) in the end cover (2). They are serviced as an integral part of the end cover.*

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



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

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

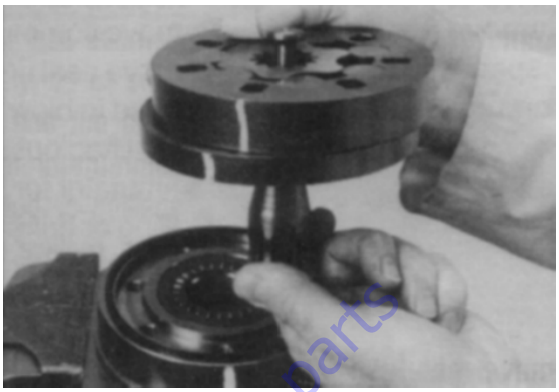
8. Remove commutator (5) and seal ring (3) Remove seal ring from commutator, using an air hose to blow air into ring groove until seal ring is lifted out and discard seal ring. Inspect commutator for cracks or burrs, wear, scoring, spalling or brinelling. If any of these conditions exist, replace commutator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

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

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

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

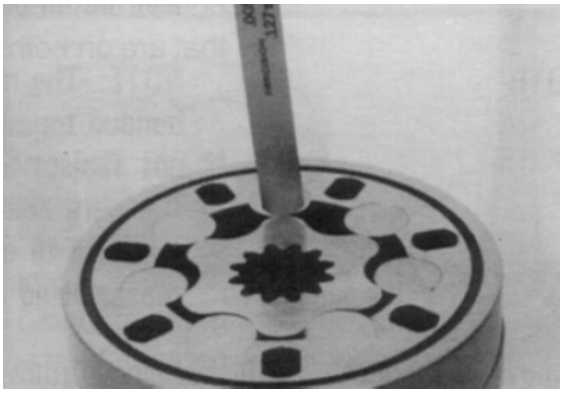
NOTE: *Rotor set (8) components may become disassembled during service procedures. Marking surface of rotor and stator that is facing UP, with etching ink or grease pencil before removal from Torqlink™ will ensure correct reassembly of rotor into stator and rotor set into Torqlink™. Marking all rotor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



NOTE: *Series TG Torqlinks™ may have a rotor set with two stator halves (8B) with a seal ring (4) between them and two sets of seven vanes (8C). Discard seal ring only if stator halves become disassembled during the service procedures.*

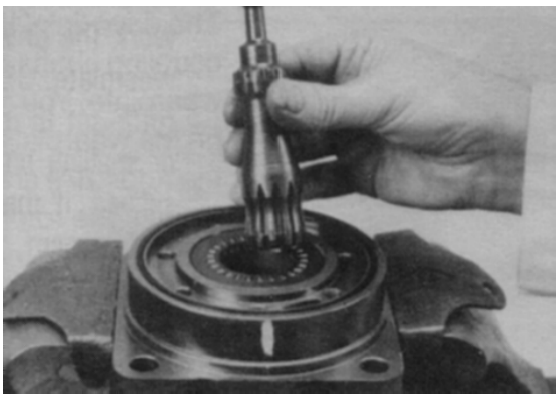
NOTE: *A polished pattern on wear plate from rotor rotation is normal.*

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



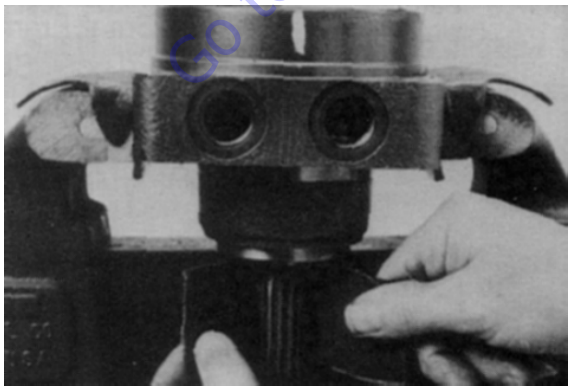
NOTE: *If rotor set (8) has two stator halves (8B & 8D) and two sets of seven vanes (8C & 8E) as shown in the alternate construction TG rotor set assembly view, check the rotor lobe to roller vane clearance at both ends of rotor.*

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

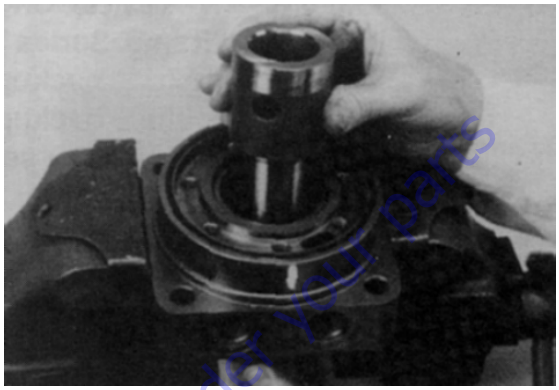


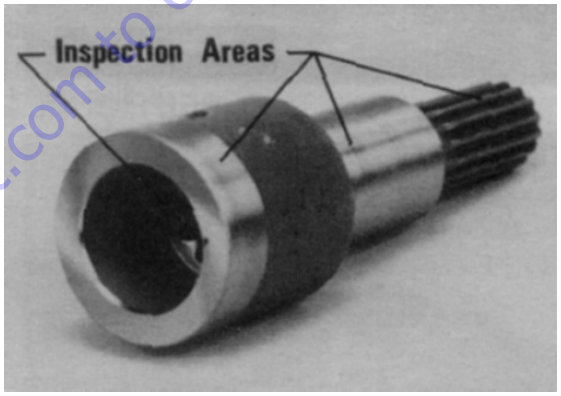
13. Remove thrust bearing (11) from top of coupling shaft (12). Inspect for wear, brinelling, corrosion and a full complement of retained rollers.

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



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



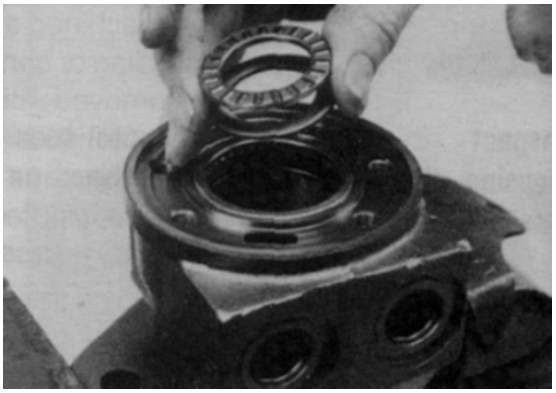


NOTE: *Minor shaft wear in seal area is permissible. If wear exceeds 0.020 inches (0.51 mm) diametrically, replace coupling shaft.*

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

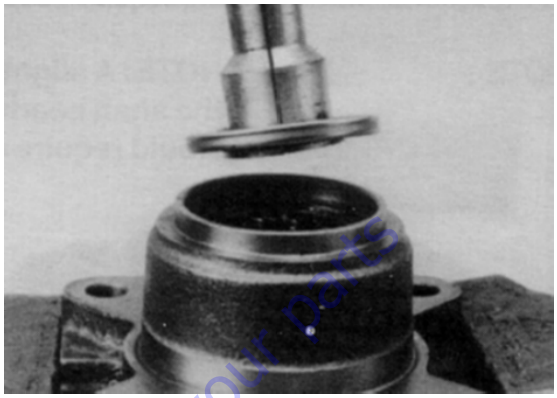
16. Remove and discard seal ring (4) from housing (18).

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

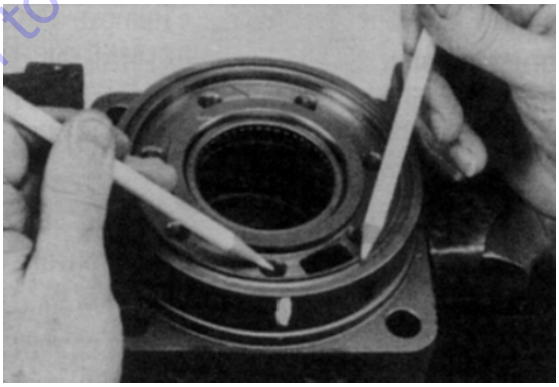


18. Remove and discard seal (16) and backup washer (17) from Small Frame housing (18).

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

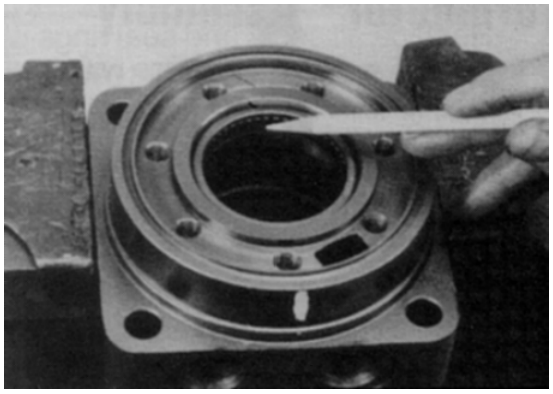


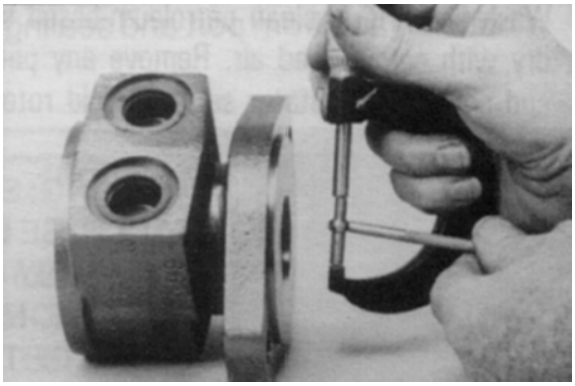
20. Inspect housing (18) assembly for cracks and machined surfaces for nicks, burrs, brinelling, or corrosion. Remove burrs that can be removed without changing dimensional characteristics. Inspect tapped holes for thread damage. Discard housing assembly if damaged.



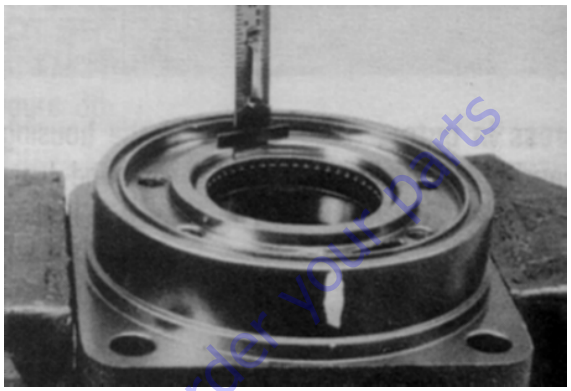
21. If housing (18) assembly has passed inspection to this point, inspect housing bearings/bushings (19) and (13) and if they are captured in the housing cavity the two thrust washers (14) and thrust bearing (15). The bearing rollers must be firmly retained in the bearing cages, but must rotate and orbit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

replaced. If the housing has passed this inspection the disassembly of the Torqlink™ is completed.

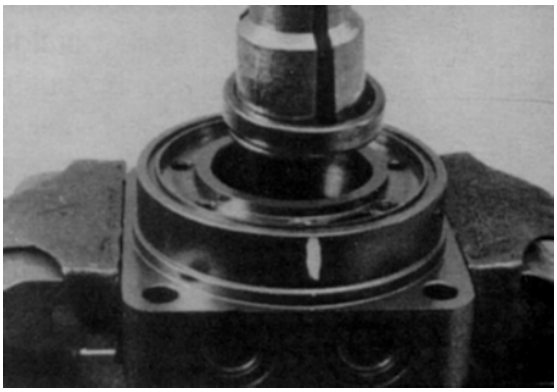


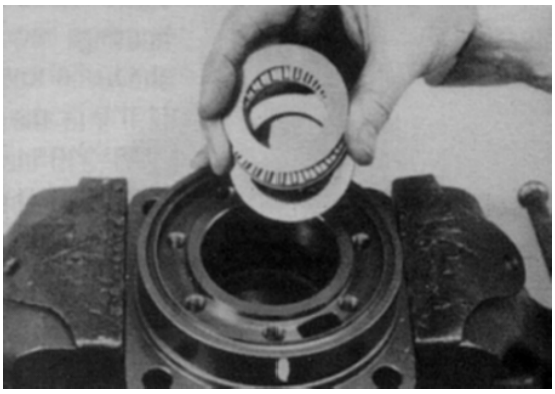


NOTE: *Depth or location of bearing/bushing (13) in relation to the housing wear plate surface and the depth or location of bearing/bushing (19) in relation to the beginning of bearing/bushing counterbore should be measured and noted before removing the bearings/ bushings. This will facilitate the correct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



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





Assembly

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

NOTE: *Individual seals and seal rings as well as a complete seal kit are available. The parts should be available through most OEM parts distributors or Parker approved Torqlink™ distributors. (Contact your local dealer for availability).*

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

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

⚠ WARNING

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

⚠ WARNING

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

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

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

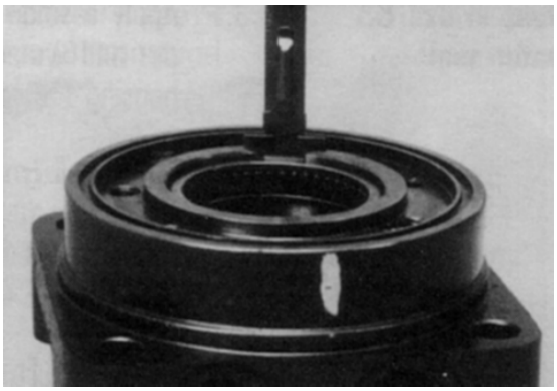
NOTE: *Bearing mandrel must be pressed against lettered end of bearing shell. Take care housing bore is square with press base and bearing/bushing is not cocked when pressing a bearing/bushing into the housing.*

NOTICE

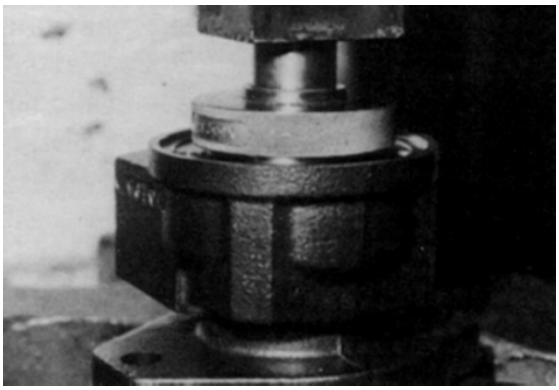
IF BEARING MANDREL SPECIFIED IN "TOOLS AND MATERIALS REQUIRED FOR SERVICING" SECTION IS NOT AVAILABLE AND ALTERNATE METHODS ARE USED TO PRESS IN BEARING/BUSHING (13) AND (19), BEARING/BUSHING DEPTHS SPECIFIED MUST BE ACHIEVED TO ENSURE ADEQUATE BEARING SUPPORT AND CORRECT RELATIONSHIP TO ADJACENT COMPONENTS WHEN ASSEMBLED.

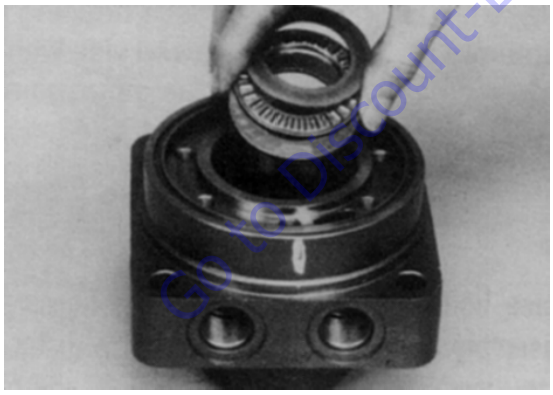
NOTICE

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



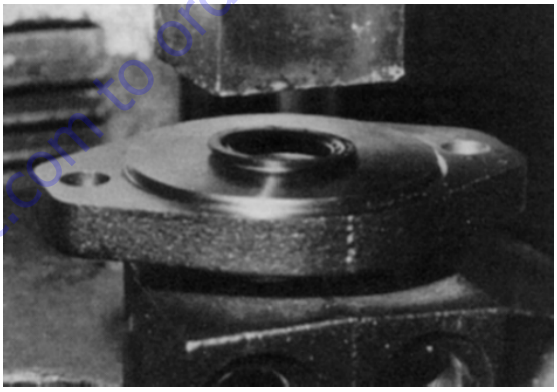
2. The Torqlink™ inner housing bearing/bushing (13) can now be pressed into its counterbore in housing (18) flush to 0.03 inch (.76 mm) below the housing wear plate contact face. Use the opposite end of the bearing mandrel that was used to press in the outer bearing/ bushing (19).

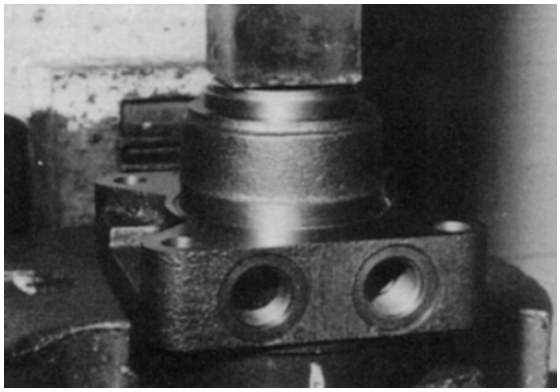




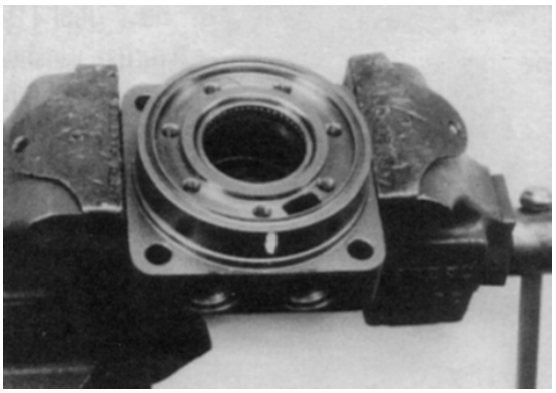
3. Press a **new** dirt and water seal (20) into the housing (18) outer bearing counterbore.

The Torqlink™ dirt and water seal (20) must be pressed in until its flange is flush against the housing.

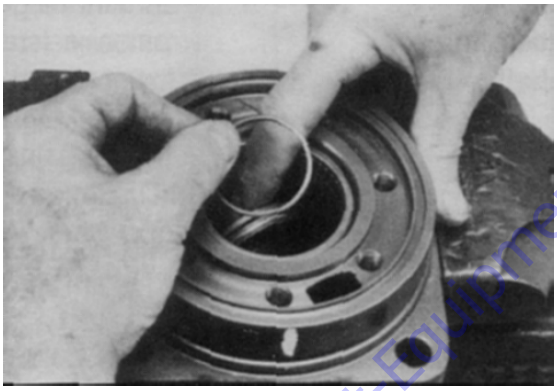


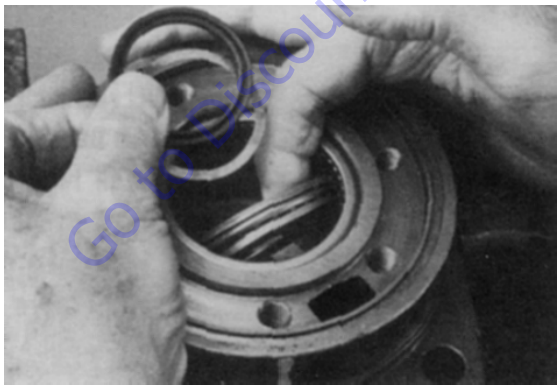


4. Place housing (18) assembly into a soft jawed vise with coupling shaft bore down, clamping against the mounting flange.



5. On the Torqlinks™ assemble a **new** backup washer (17) and **new** seal (16) with the seal lip facing toward the inside of Torqlink™, into their respective counterbores in housing (18) if they were not assembled in procedure 2.

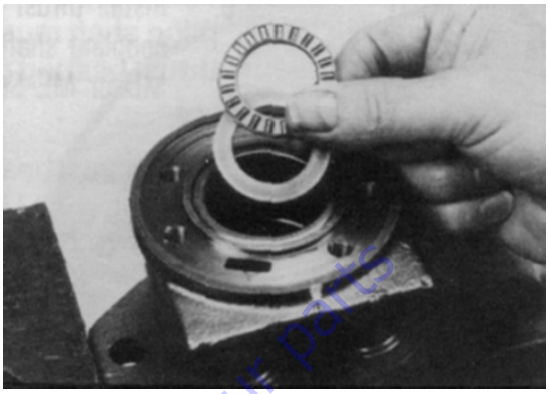




NOTICE

ORIGINAL DESIGN LARGE FRAME, TF & TG TORQLINKS™ THAT DO NOT HAVE BACKUP WASHER (25) WHEN DISASSEMBLED MUST BE ASSEMBLED WITH A NEW BACKUP WASHER (17), NEW BACKUP WASHER (25), AND NEW SEAL (16).

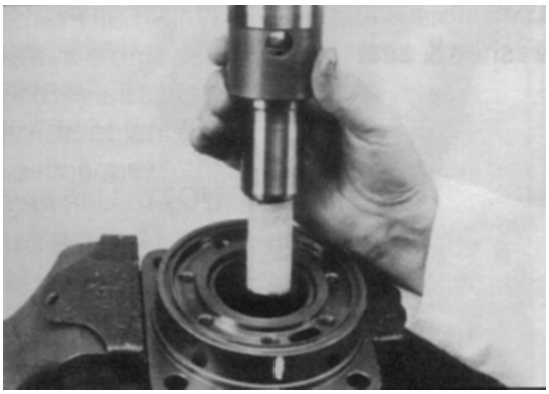
6. Assemble thrust washer (14) then thrust bearing (15) that was removed from the Torqlink™.



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

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

8. Apply a generous amount of clean corrosion resistant to lower (outer) housing bearing/bushing (19). Install coupling shaft (12) in housing (18), seating it against thrust bearing (15) in housings.



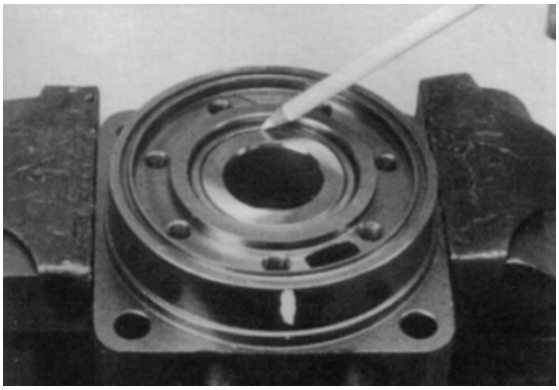
NOTICE

OUTER BEARING (19) IS NOT LUBRICATED BY SYSTEM HYDRAULIC FLUID. BE SURE IT IS THOROUGHLY PACKED WITH RECOMMENDED GREASE, PARKER GEAR GREASE SPECIFICATION #045236, E/M LUBRICANT #K-70M.

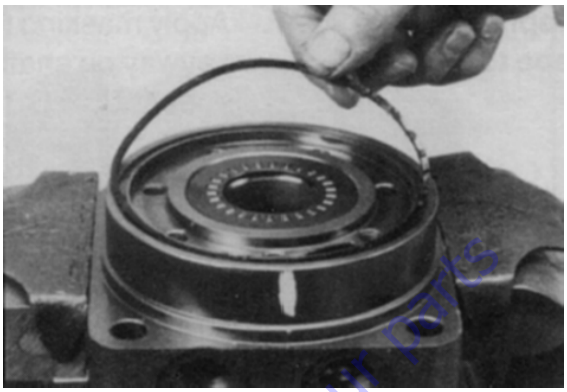
NOTE: *Mobil Mobilith SHC ® 460*

NOTE: *A 102Tube (PN 406010) is included in each seal kit.*

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

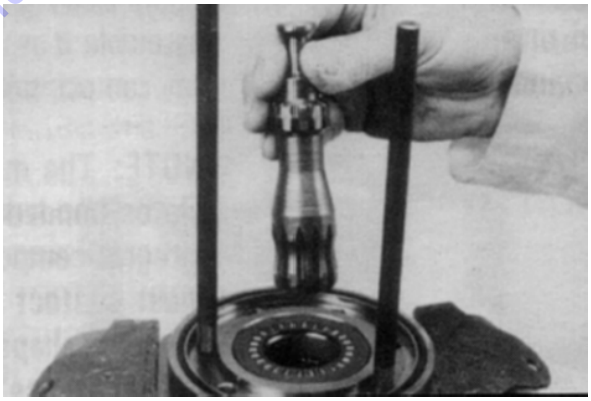


9. Apply a small amount of clean grease to a **new** seal ring (4) and insert it in housing (18) seal ring groove.



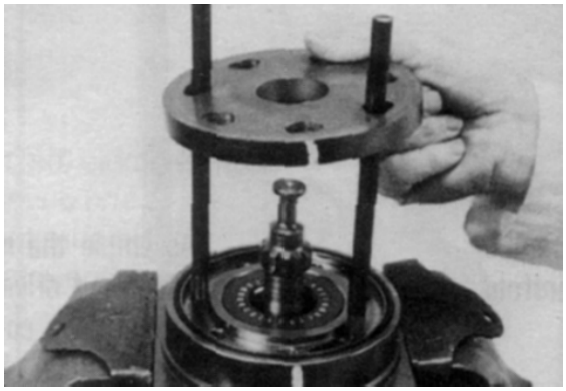
NOTE: *One or two alignment studs screwed finger tight into housing (18) bolt holes, approximately 180 degrees apart, will facilitate the assembly and alignment of components as required in the following procedures.The studs can be made by cutting off the heads of either 3/8-24 UNF 2A or 5/16-24 UNF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

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

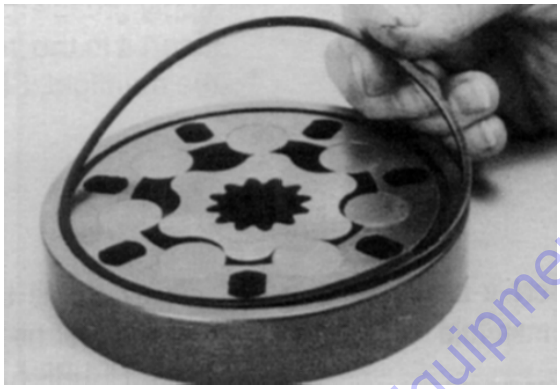


NOTE: *Use any alignment marks on coupling shaft and drive link to assemble drive link splines in their original position in the mating coupling shaft splines.*

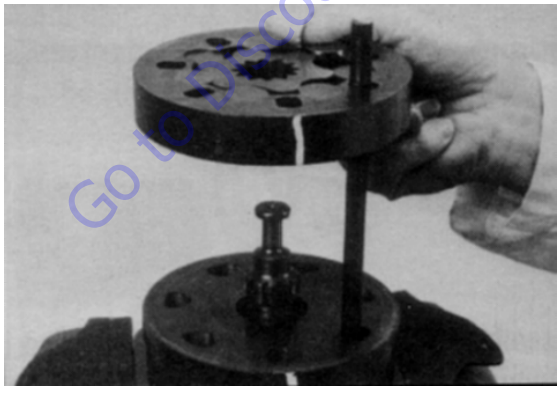
11. Assemble wear plate (9) over drive link (10) and alignment studs to housing (18).



12. Apply a small amount of clean grease to a new seal ring (4) and assemble it into the seal ring groove on the wear plate side of the rotor set stator (8B).



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

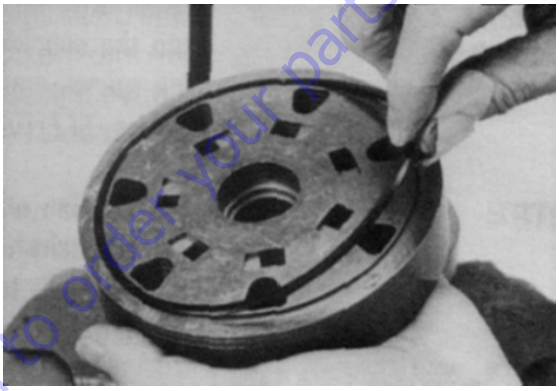


NOTE: *It may be necessary to turn one alignment stud out of the housing (18) temporarily to assemble rotor set (8) or manifold (7) over the drive link.*

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

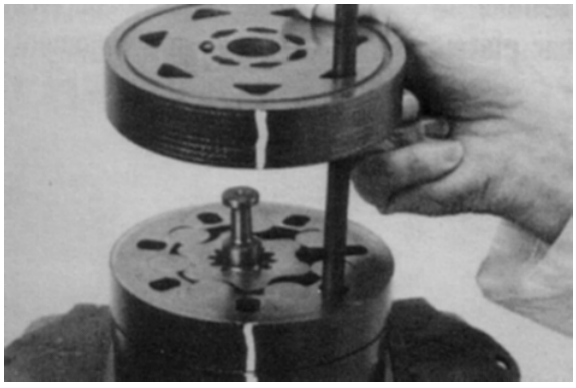
NOTE: *Rotor set rotor counterbore side must be against wear plate for drive link clearance and to maintain original rotor-drive link spline contact. A rotor set without a counterbore that was not etched before disassembly can be reinstalled using drive link spline pattern on rotor splines to determine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

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

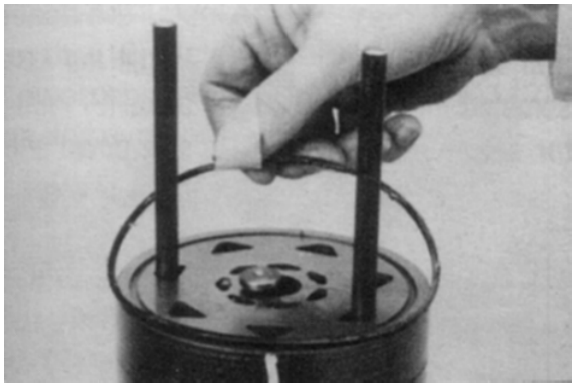


NOTE: *The manifold (7) is made up of several plates bonded together permanently to form an integral component.The manifold surface that must contact the rotor set has it's series of irregular shaped cavities on the largest circumference or circle around the inside diameter.The polished impression left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

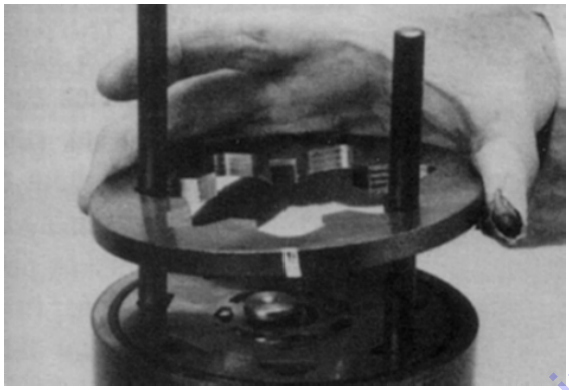
15. Assemble manifold (7) over alignment studs and drive link (10) onto the rotor set. Ensure correct manifold surface is against rotor set.



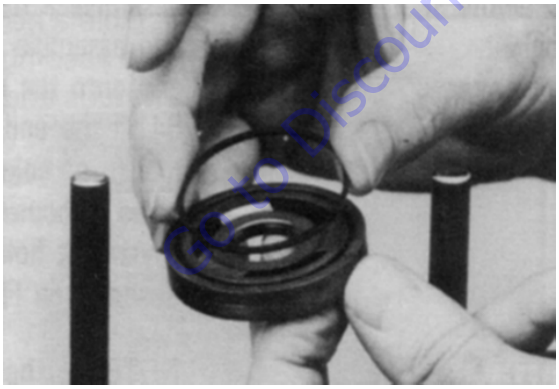
16. Apply grease to a **new** seal ring (4) and insert it in the seal ring groove exposed on the manifold.

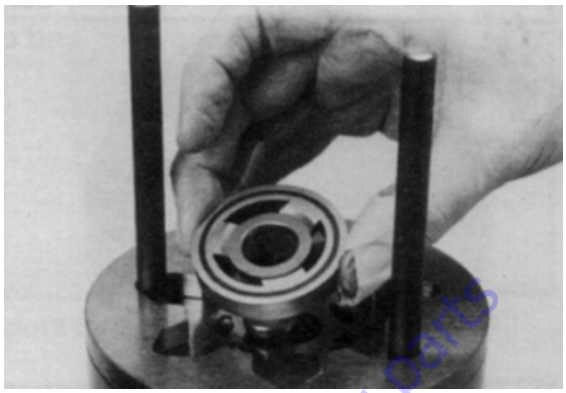


17. Assemble commutator ring (6) over alignment studs onto the manifold.



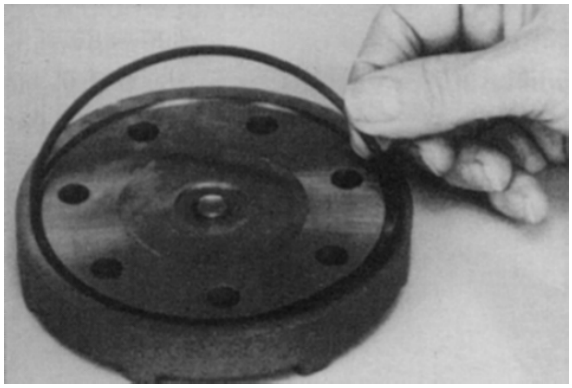
18. Assemble a **new** seal ring (3) flat side up, into commutator (5) and assemble commutator over the end of drive link (10) onto manifold (7) with seal ring side up.

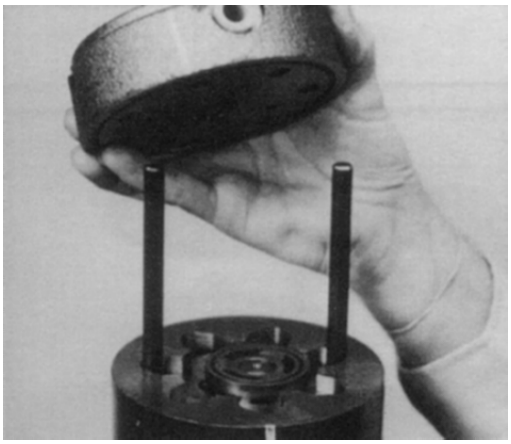


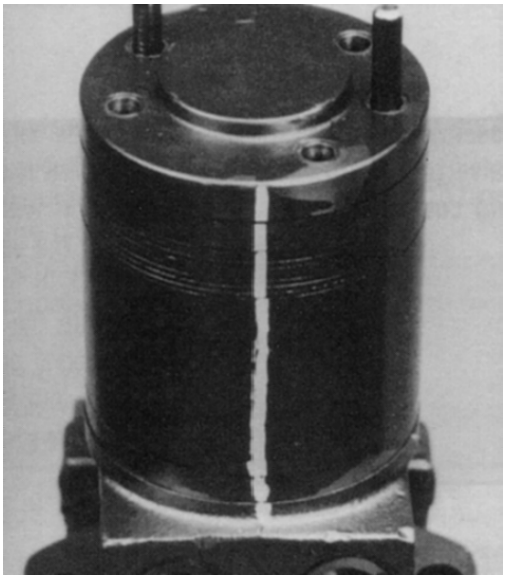


19. If shuttle valve components items #21, were removed from end cover (2) turn a plug (21), loosely into one end of the valve cavity in the end cover. A 3/16 inch Allen wrench is required.

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

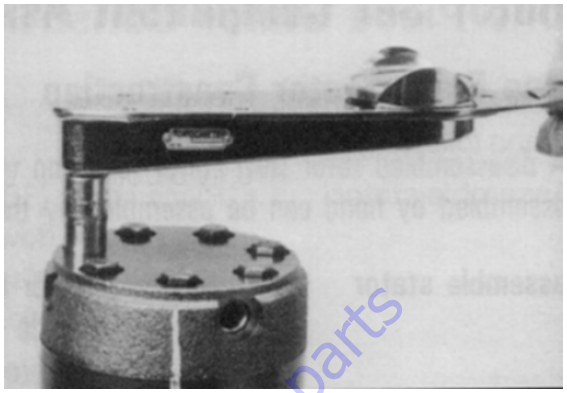


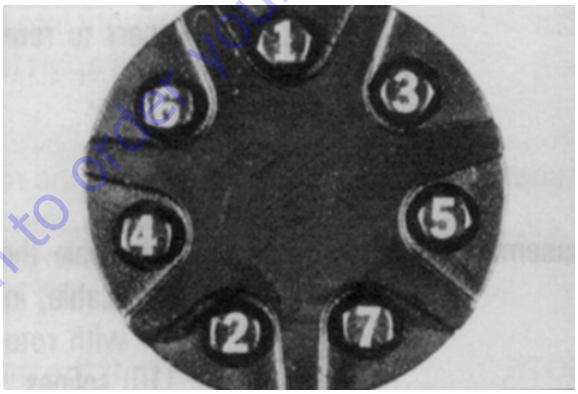




NOTE: *If end cover has a valve (24) or has five bolt holes, use the line previously scribed on the cover to radially align end cover into its original position.*

21. Assemble five or seven special bolts (1). Screw in finger tight. Remove and replace the two alignment studs with bolts after the other bolts are in place. Alternately and progressively tighten the bolts to pull the end cover and other components into place with a final torque of 22-26 ft.-lbs., (30-35 Nm) 45-55 ft.-lbs. (61-75 Nm) for the seven 3/8-24 threaded bolts.

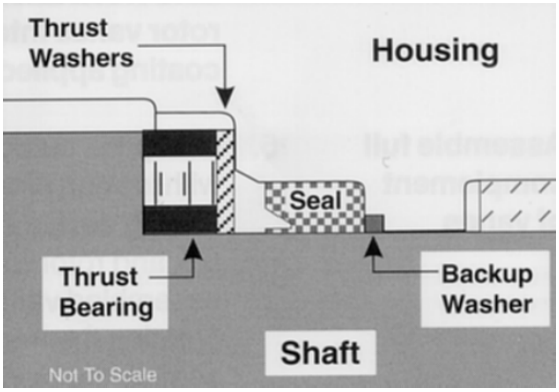




NOTE: *Special bolts required for use with the relief or shuttle valve (24) end cover assembly (2) are longer than bolts required with standard and cover assembly. Refer to individual service parts lists or parts list charts for correct service part number if replacement is required.*

22. Torque two shuttle valve plug assemblies (21) in end cover assembly to 9-12 ft-lb (12-16 Nm) if cover is so equipped.

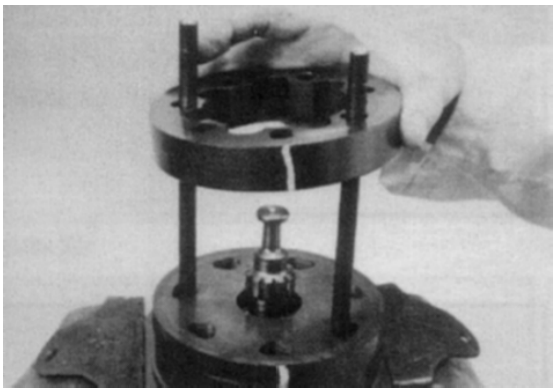
Torque two relief valve plug assemblies (21) in end cover assembly to 45-55 ft-lb (61-75 Nm) if cover is so equipped.



One Piece Stator Construction

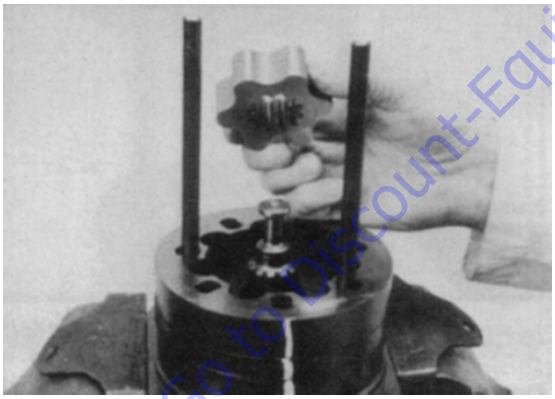
A disassembled rotor (8A) stator (8B) and vanes (8C) that cannot be readily assembled by hand can be assembled by the following procedures.

1. Place stator (8B) onto wear plate (9) with seal ring (4) side down, after following Torqlink™ assembly procedures 1 through 13. Be sure the seal ring is in place.



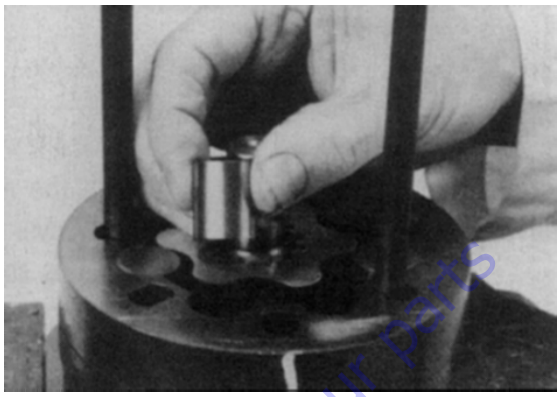
2. If assembly alignment studs are not used, align stator bolt holes with wear plate and housing bolt holes and turn two bolts (1) finger tight into bolt holes approximately 180 degrees apart to retain stator and wear plate stationary.

3. Assemble rotor (8A), counterbore down if applicable, into stator (8B), and onto wear plate (9) with rotor splines in mesh with drive link (10) splines.



NOTE: *If manifold side of rotor was etched during Torqlink disassembly, this side should be up. If rotor is not etched and does not have a counterbore, use drive link spline contact pattern on rotor splines to determine rotor side that must be against the wear plate.*

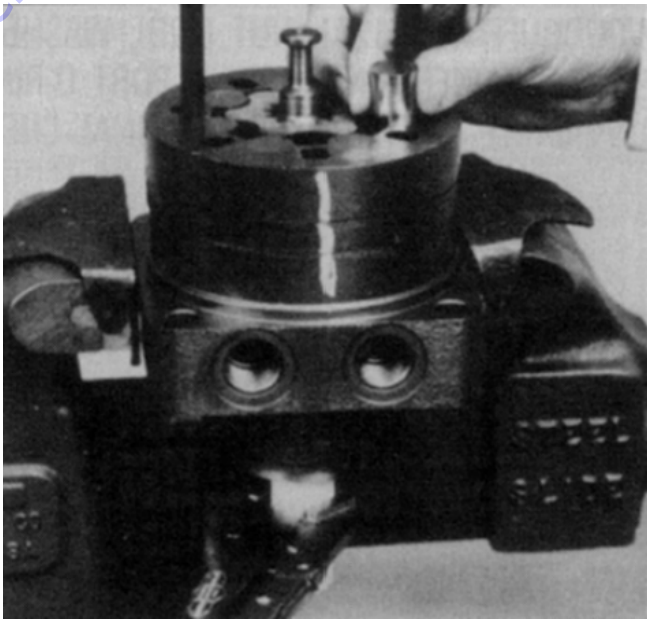
4. Assemble six vanes (8C), or as many vanes that will readily assemble into the stator vane pockets.



NOTICE

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

5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes (8C) into stator (8B), creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.



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

3.5 SWING BEARING

Swing Bearing Wear Tolerance

See Figure 3-49., Swing Bearing Wear Tolerance.

1. Position the machine as follows and as seen in Figure 3-49., Swing Bearing Wear Tolerance, Position 1:
   a. The turntable needs to be centered between the rear wheels.
   b. Lift the boom to horizontal and fully extend the main boom
   c. Lift the jib to be horizontal
   d. Keep the jib and platform centered and unloaded
2. Set up a dial indicator as follows:
   a. The dial indicator location is to be at the front center of the machine, next to the bearing, opposite of the tower pivot pin.
   b. The magnetic base of the indicator should be positioned on the frame

   c. The indicator point needs positioned to measure the turntable base plate 2 in. (51 mm) from the root of the gear tooth. Refer to Figure 3-49., Swing Bearing Wear Tolerance.
3. Zero the dial indicator.
4. Check dial indicator accuracy once positioned, using a feeler gauge and ensure the dial indicator reading, is the same as the feeler gauge thickness.
5. Position the machine as follows and as seen in Figure 3-49., Swing Bearing Wear Tolerance, Position 2:
   a. Do not rotate the turntable
   b. Raise the main boom to be fully elevated and retracted
   c. Raise the jib to be fully elevated and centered
   d. Center the platform and keep it unloaded
6. Verify the dial indicator has not shifted. Record the value for bearing play.
7. Return the machine to Figure 3-49., Swing Bearing Wear Tolerance, Position 1. The dial indicator should to return to zero. If the dial indicator does not return to zero, take corrective action and repeat the test.
8. If the measurement is more than 0.10 in. (4.2 mm), replace the bearing. If the measurement is less than 0.10 in. (4.2 mm), and any of the following conditions exist, the bearing should be removed, disassembled, and inspected.
   a. Metal particles in the grease.
   b. Increased drive power required.
   c. Noise.
   d. Rough rotation.
9. If bearing inspection shows no defects, reassemble and return to service.

Turntable Bearing Mounting Bolt Condition Check

NOTICE

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

NOTE: *This check is designed to replace the existing bearing bolt torque checks on JLG Lifts in service. This check must be performed after the first 50 hours of machine operation and every 600 hours of machine operation thereafter. If during this check any bolts are found to be missing or loose, replace missing or loose bolts with new bolts and torque to the value specified in the torque chart, after lubricating the bolt threads with High Strength Threadlocking Compound.*

NOTE: *After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.*

1. Check the frame to bearing. Attach bolts as follows:
   - **a.** Elevate the fully extended main boom to horizontal as shown in Figure 3-50.
   - **b.** At the positions indicated on Figure 3-49. try and insert the 0.0015 in. feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   - **c.** Assure that the 0.0015 in. feeler gauge will not penetrate under the bolt head to the bolt shank.
   - **d.** Swing the turntable 90 degrees, and check some selected bolts at the new position.
   - **e.** Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.
2. Check the turntable to bearing. Attach bolts as follows:
   - **a.** Elevate the fully retracted main boom to full elevation as shown in Figure 3-50.
   - **b.** At the positions indicated on Figure 3-49. try and insert the 0.0015 in. feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   - **c.** Lower the boom to horizontal and fully extend the boom.
   - **d.** At the position indicated on Figure 3-49. try and insert the 0.0015 in. feeler gauge between the bolt head and hardened washer at the arrow indicated position.

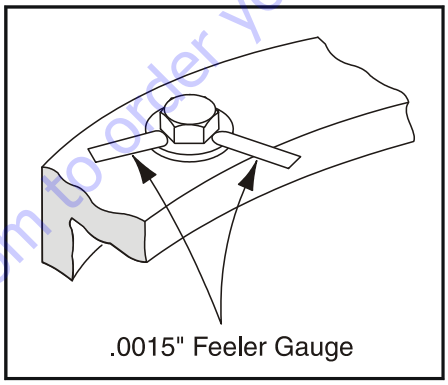


Figure 3-48. Swing Bolt Feeler Gauge Check

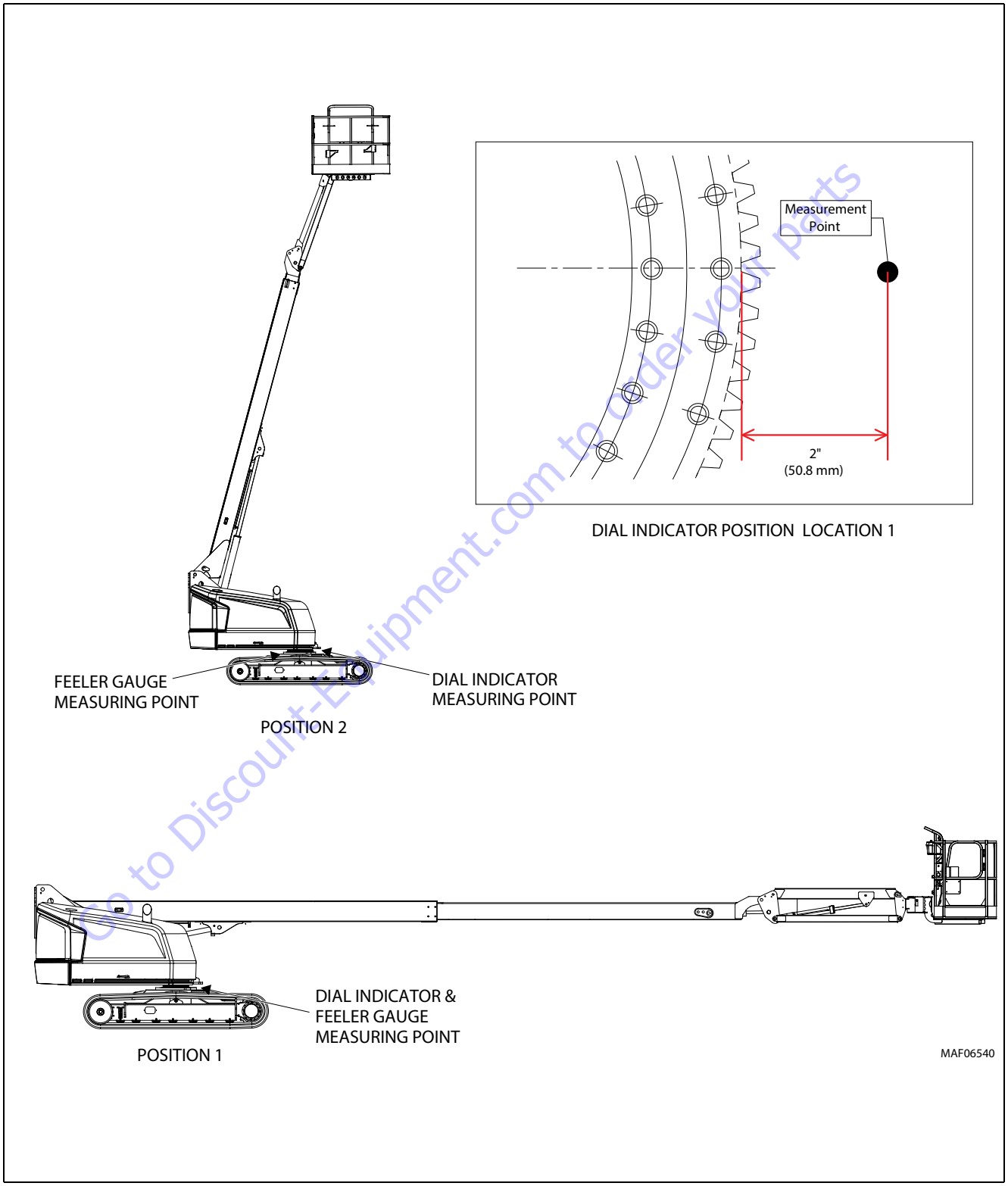


Figure 3-49. Swing Bearing Wear Tolerance

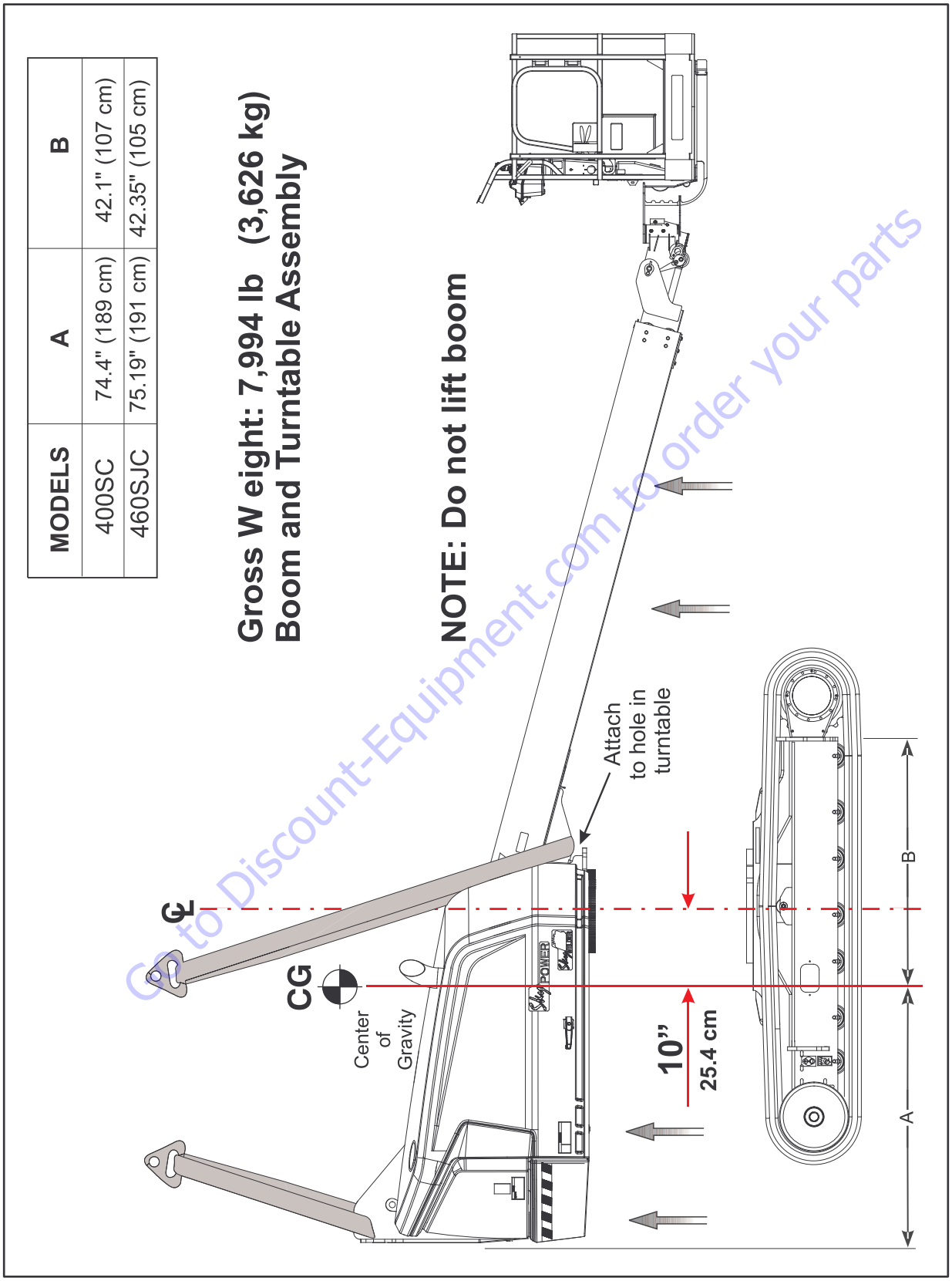


Figure 3-50. Swing Bearing Removal

Swing Bearing Removal

1. From ground control station, operate the boom adequately to provide access to frame opening to rotary coupling.

⚠ WARNING

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

2. Attach an adequate support sling to the boom and draw all slack from sling. Prop or block the boom if feasible.
3. From inside turntable, remove mounting hardware from rotary coupling mount bracket.
4. Tag and disconnect the hydraulic lines from the fittings on the top of the rotary coupling. Use a suitable container to retain any residual hydraulic fluid. Cap or plug all openings of hydraulic lines and port.
5. Disconnect wiring harness connected to the rotary coupling and tag and disconnect remote grease fitting line (if equipped).
6. Attach suitable overhead lifting equipment to the base of the turntable weldment. See Figure 3-50., Swing Bearing Removal.
7. 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.
8. 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.
9. Carefully place the turntable on a suitably supported trestle.

NOTE: *The swing bearing approximately weighs 138 lb (55 kg).*

10. 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.

Swing Bearing Installation

NOTE: *The swing bearing approximately weighs 138 lb (55 kg).*

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 THAT 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 THAT SUCH REPLACEMENT HARDWARE MEETS JLG SPECIFICATIONS. USE OF GENUINE JLG HARDWARE IS HIGHLY RECOMMENDED.

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

NOTICE

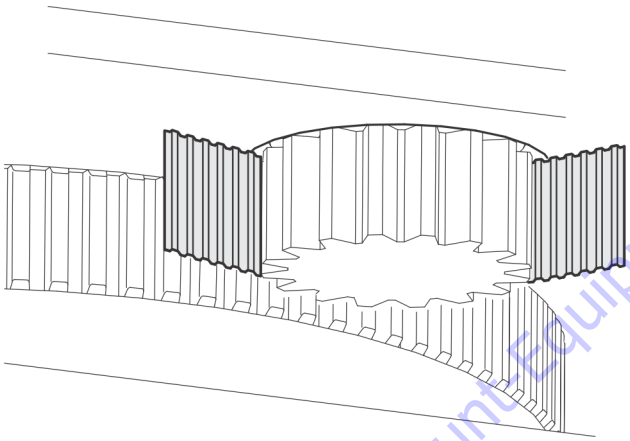
IF COMPRESSED AIR OR ELECTRICALLY OPERATED IMPACT WRENCH IS USED FOR TIGHTENING THE BEARING ATTACHMENT BOLTS, THE TORQUE SETTING ACCURACY OF THE TOOL SHOULD BE CHECKED PRIOR TO USE.

3. Refer to the Torque Sequence diagram as shown in Figure 3-51., Swing Bearing Torque Sequence. Clean any residue off the new bearing bolts, then apply a light coating of High Strength Threadlocking Compound and install the bolts and washers through the frame and outer race of the bearing. Tighten the bolts to an initial torque of 190 ft. lbs. (258 Nm) w/High Strength Threadlocking Compound.
4. Remove the lifting equipment from the bearing.
5. Using suitable lifting equipment, carefully position the turntable assembly above the machine frame.
6. Carefully lower the turntable onto the swing bearing, ensuring that the scribed line of the inner race of the bearing aligns with scribed line on the turntable. If a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft center line of the turntable.
7. Clean any residue off the new bearing bolts, then apply a light coating of High Strength Threadlocking Compound and install the bolts and washers through the turntable and inner race of the bearing.
8. Following the Torque Sequence diagram shown in Figure 3-51., Swing Bearing Torque Sequence, tighten the bolts to a torque of 190 ft. lbs. (258 Nm).
9. Remove the lifting equipment.

10. Install the rotary coupling mount bracket, apply a light coating of Medium Strength Threadlocking Compound to the attaching bolts and secure the mount bracket to the turntable with the mounting hardware.
11. Connect the hydraulic lines, electrical harness and remote grease fitting line (if equipped) to the rotary coupling as tagged prior to removal.
12. At ground control station, use boom lift control to lower boom to stowed position.
13. Using all applicable safety precautions, activate the hydraulic system and check the swing system for proper and safe operation.

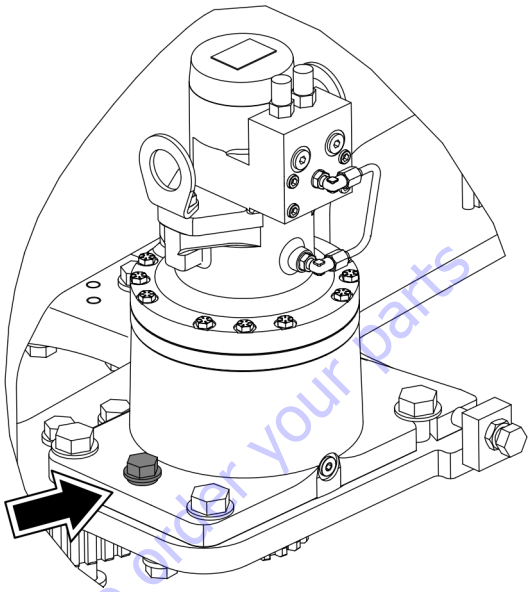
3.6 SETTING SWING GEAR BACKLASH

1. Set swing gear backlash to 0.005 - 0.010 in (0.127 - 0.254 mm).
2. Place shim (JLG PN 1001190964) between pinion and bearing on high spot.

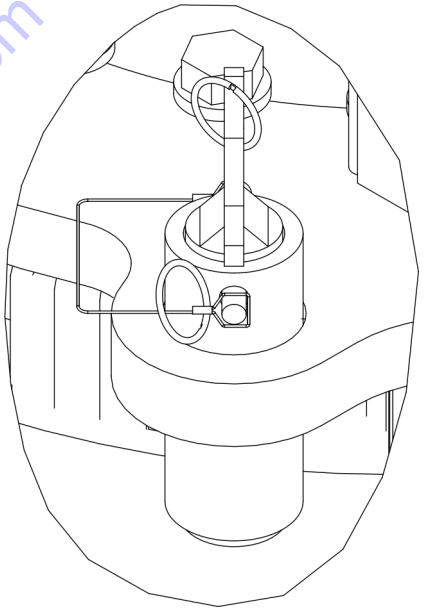


NOTE: *High spot is marked with yellow paint.*

3. Apply High Strength Threadlocking Compound to pivot bolt. Torque to 205 ft-lb (280 Nm).

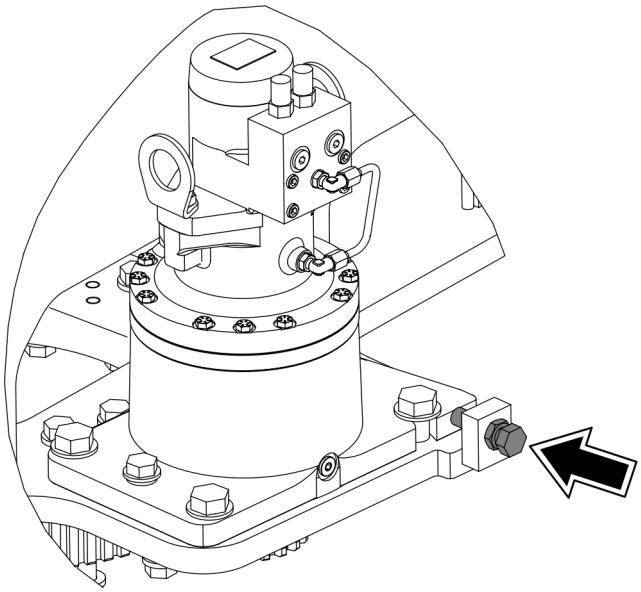


4. Remove turntable lock pin.

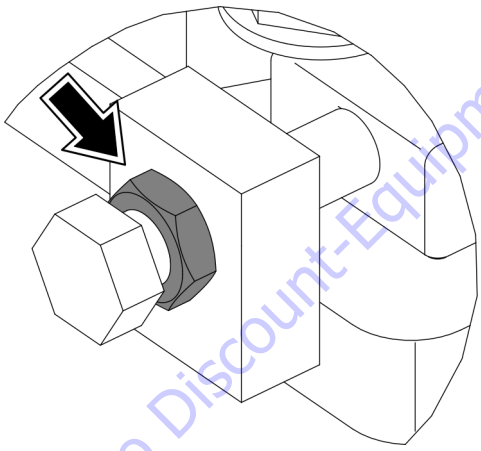


5. Apply High Strength Threadlocking Compound to remaining swing drive mounting bolts. Torque to 30 ft-lb (40 Nm).

6. Tighten jack bolt until pinion is completely snug against shim and bearing. After pinion is snug, loosen jack bolt.



7. Apply High Strength Threadlocking Compound to jack bolt and jam nut. Torque jack bolt to 50 ft-lb (68 Nm).
8. Tighten jam nut.



9. Torque remaining swing drive retaining bolts to 405 ft-lb (550 Nm).
10. Remove and discard shim.

3.7 SWING BEARING TORQUE VALUES

1. Outer Race - 190 ft-lb (258 Nm) with High Strength Threadlocking Compound.
2. Inner Race - 190 ft-lb (258 Nm) with High Strength Threadlocking Compound.
3. See Swing Bearing Torque Sequence.

⚠ WARNING

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

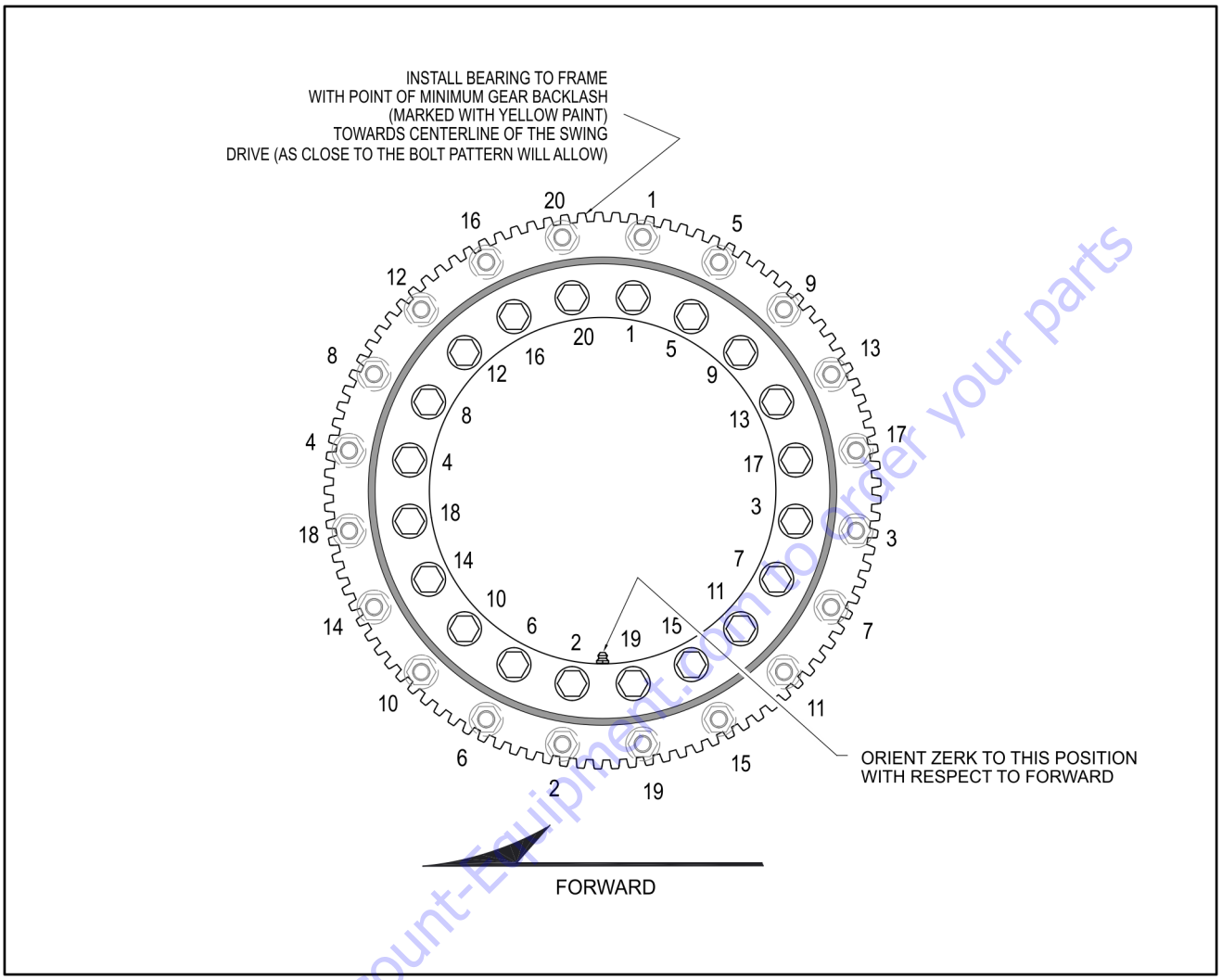


Figure 3-51. Swing Bearing Torque Sequence

3.8 ROTARY COUPLING

Use the following procedure to install the seal kit.

1. If not already removed, remove the axle oscillation valve from the cylinder barrel. The Shaft of the valve protrudes into the barrel and will damage the Shaft and seals if left in place.
2. Remove retaining ring (5) from end.
3. Remove thrust ring (4) from the same end.
4. Remove center body (2) from housing (1).
5. Cut off old Seals (6, 8, 9).
6. Remove proximity switch.
7. Assemble seals (3) in direction shown in Figure 3-52., Rotary Coupling Seal Installation.
8. Reassemble O-ring (8).
9. Heat cap seals (9) in hydraulic oil for 5 minutes at 300° F (149° C).
10. Assemble cap seals over O-rings
11. Reinsert center body into housing (lube with hydraulic oil).
12. Replace Spacer and snap ring.

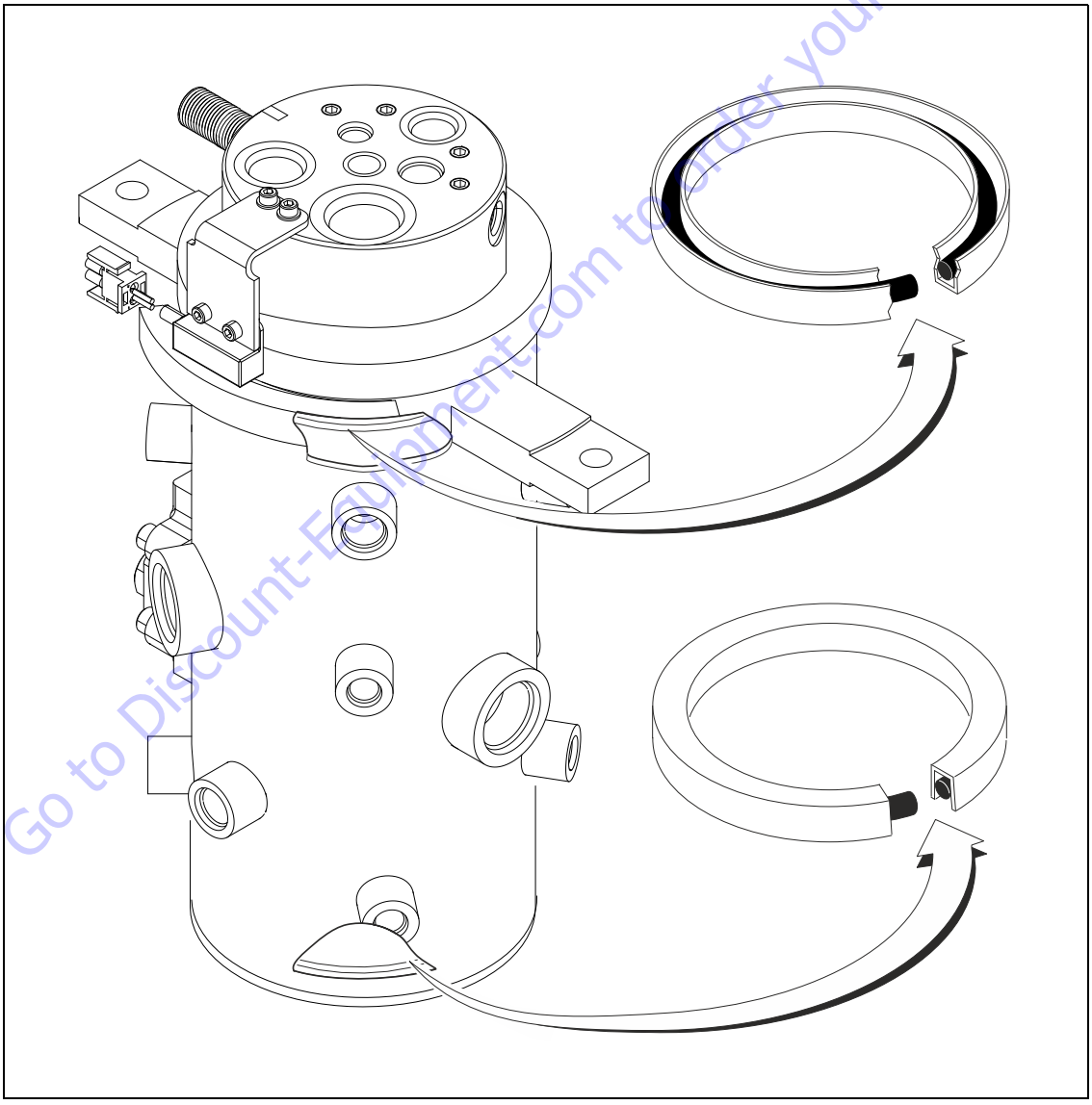
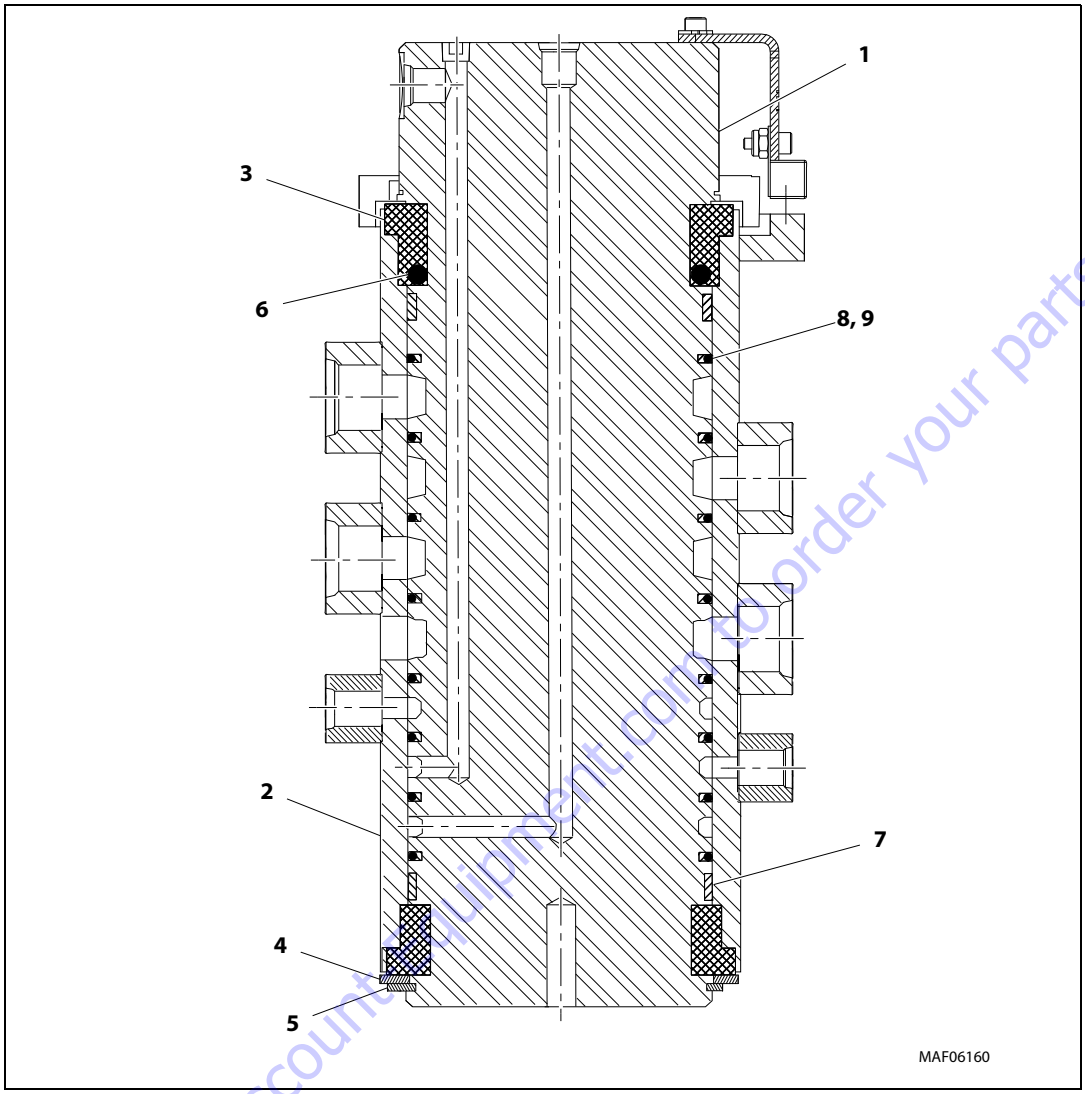
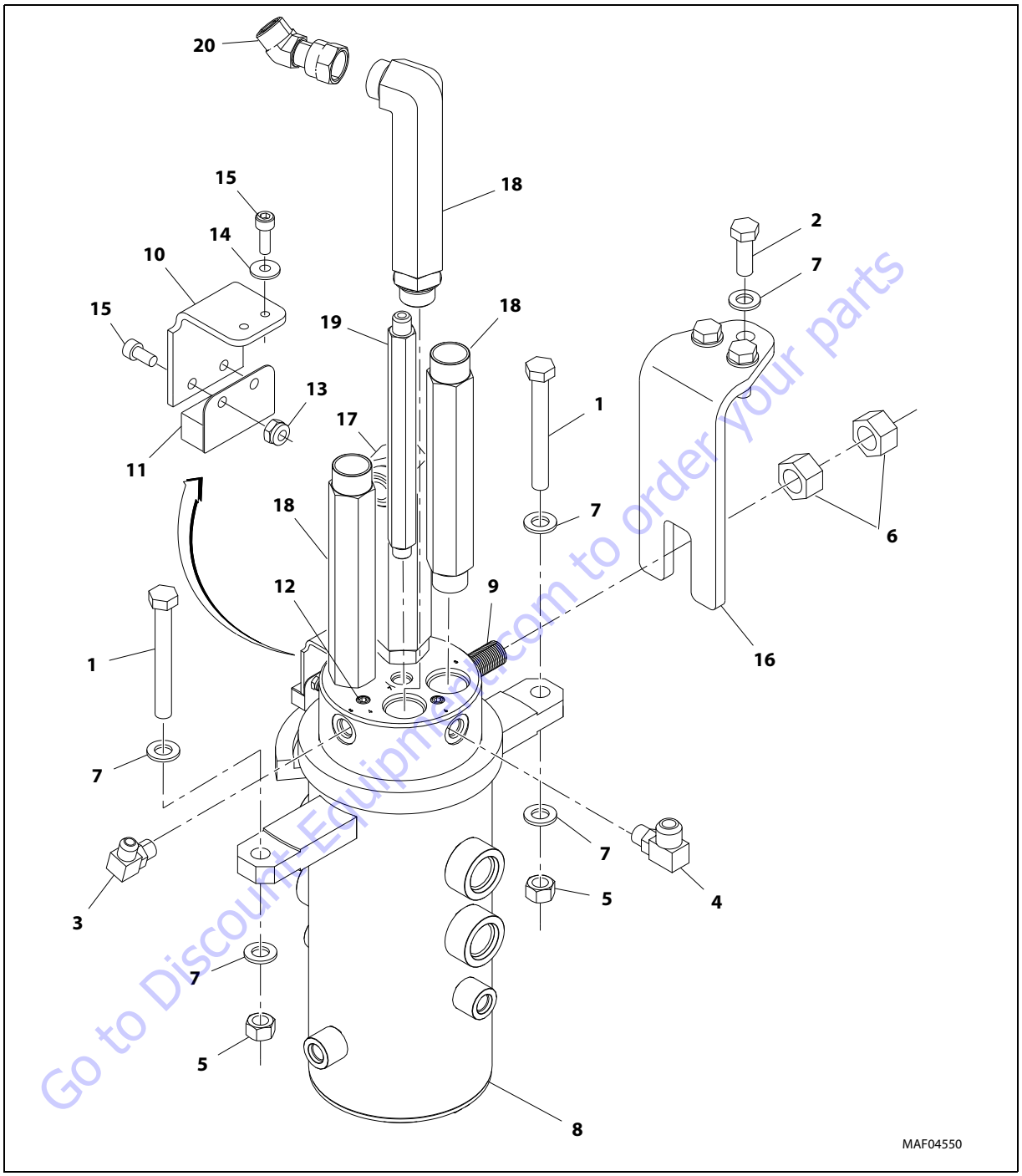


Figure 3-52. Rotary Coupling Seal Installation



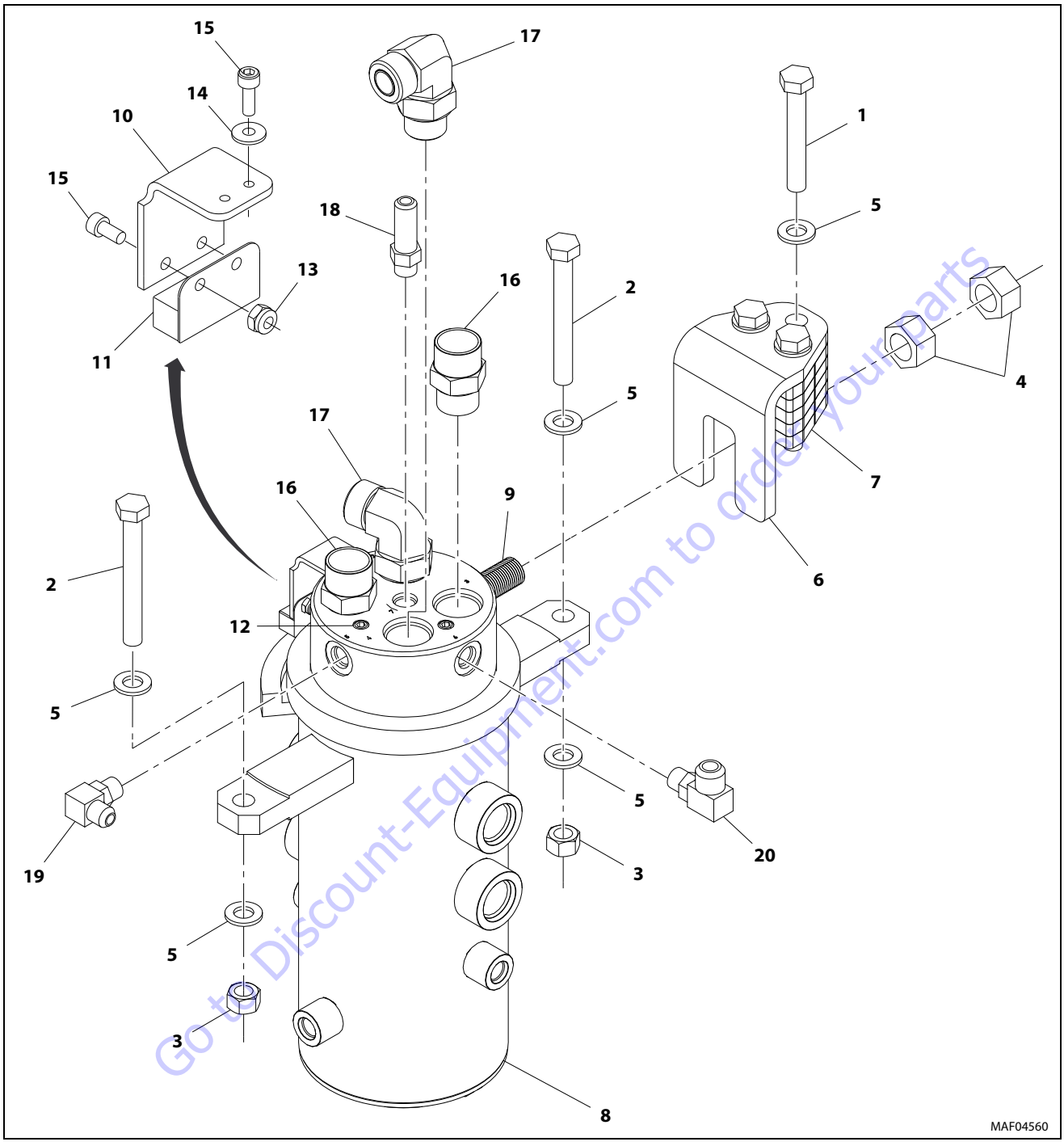
1. Body
2. Housing
3. Seal
4. Thrust Ring
5. Retaining Ring
6. O-Ring
7. Bearing
8. O-Ring
9. Seal

Figure 3-53. Rotary Coupling Cutaway



1. Bolt
2. Bolt
3. Fitting
4. Fitting
5. Nut
6. Nut
7. Washer
8. Rotary Coupling
9. Lug
10. Switch Mounting Bracket
11. Proximity Switch
12. Plug
13. Locknut
14. Washer
15. Screw
16. Mounting Bracket
17. Fitting
18. Fitting
19. Fitting
20. Swivel Elbow Nut

Figure 3-54. Rotary Coupling Installation (With Turntable Bearing Spacer)



1.	Bolt	5.	Washer	9.	Lug	13.	Locknut	17.	Fitting
2.	Bolt	6.	Swivel Mount	10.	Switch Mounting Bracket	14.	Washer	18.	Fitting
3.	Nut	7.	Swivel Mount Shim	11.	Proximity Switch	15.	Screw	19.	Fitting
4.	Nut	8.	Swivel 7 Port Coupling	12.	Plug	16.	Adapter	20.	Fitting

Figure 3-55. Rotary Coupling Installation (Without Turntable Bearing Spacer)

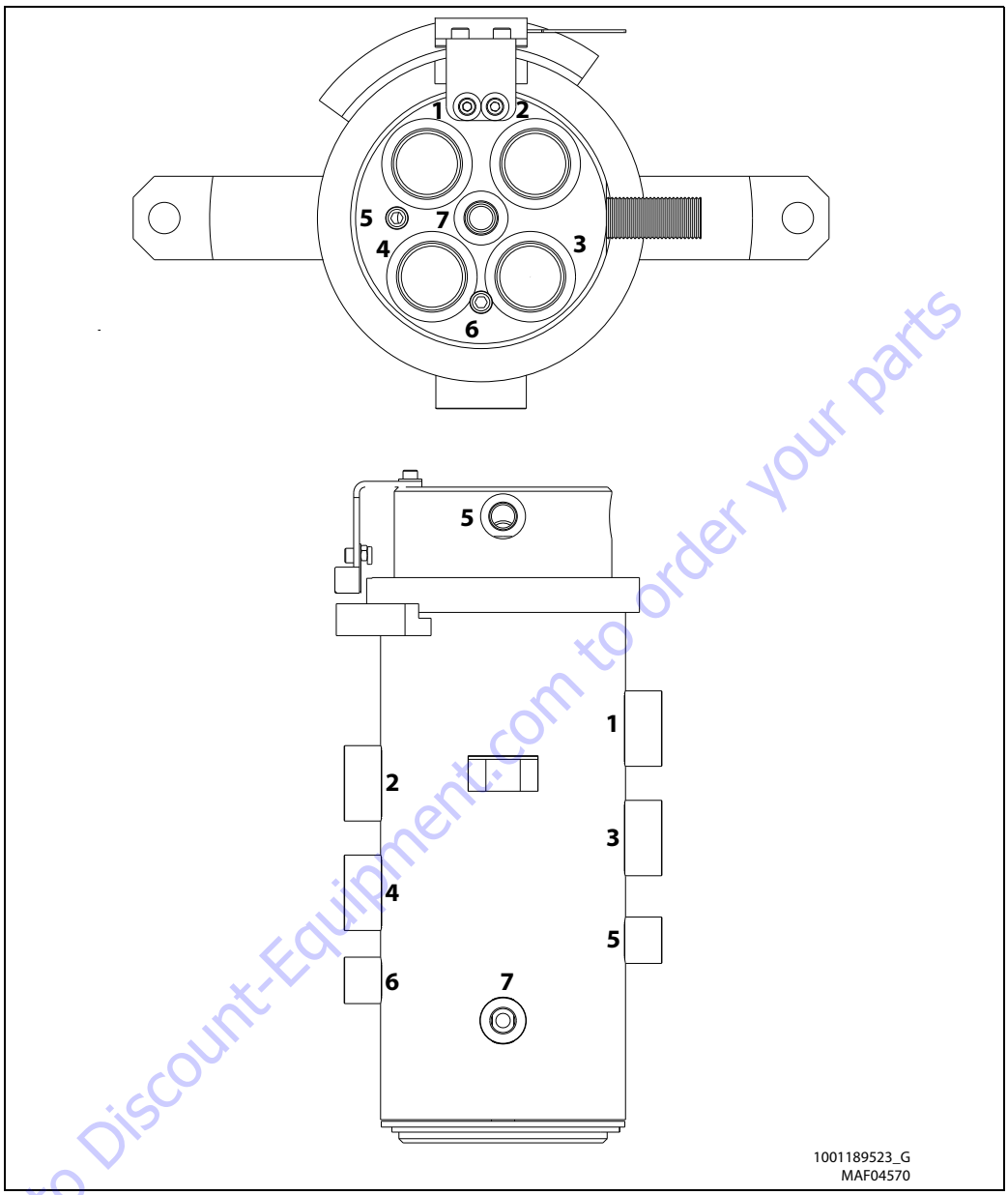


Table 3-3. Coupling Port Information - 7 Port

Port No.	Port Size	Description	Max Rated Pressure PSI (Bar)	Proof Pressure PSI (Bar)
1	-12 SAE	Right Drive, FWD	5000 (345)	7500 (517)
2	-12 SAE	Left Drive, FWD	5000 (345)	7500 (517)
3	-12 SAE	Right Drive, Reverse	5000 (345)	7500 (517)
4	-12 SAE	Left Drive, Reverse	5000 (345)	7500 (517)
5	-6 SAE	2 Speed Shift	500 (34)	750 (52)
6	-6 SAE	Case Drain	375 (26)	563 (39)
7	-6 SAE	Brake Release	500 (34)	750 (52)

Figure 3-56. Rotary Coupling Port Location

3.9 GENERATOR

⚠ WARNING

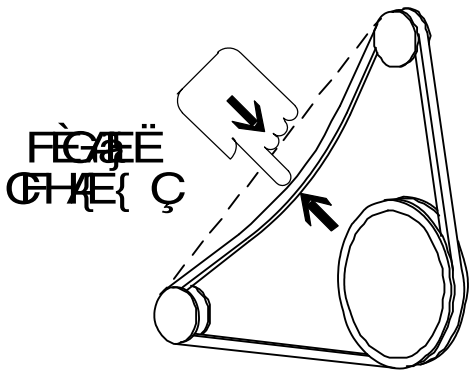
STOP ENGINE BEFORE CARRY OUT SCHEDULE MAINTENANCE.

NOTE: *Do often service, if operating in hostile environment.*

Maintenance Schedule

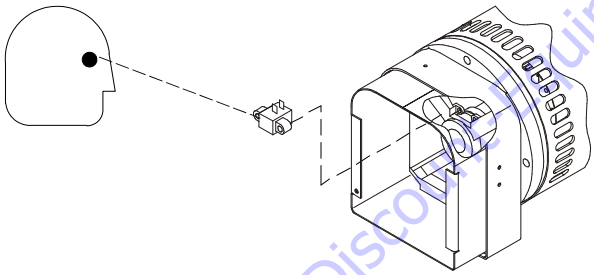
EVERY 250 HOURS

Every 250 hours of operation, check the drive belt for proper tension.

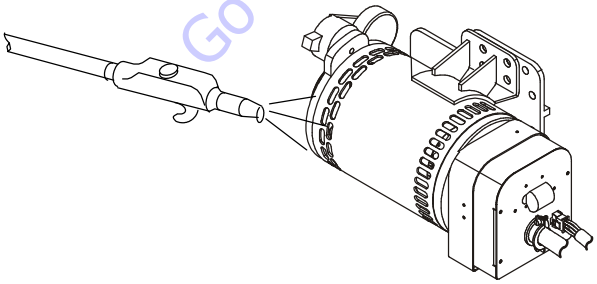


EVERY 500 HOURS

Every 500 hours of operation, service the generator brushes and slip rings. Hostile environments may require more frequent service.



Every 500 hours of service, blow out the inside of the generator. If operating in a hostile environment, clean monthly.

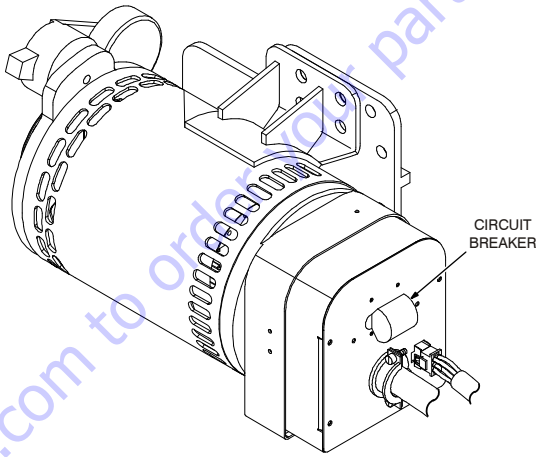


Overload Protection

⚠ WARNING

STOP THE ENGINE WHENEVER CHECKING OR INSPECTING THE CIRCUIT BREAKER.

The circuit breaker protects the generator windings from overload. If the circuit breaker opens, generator output stops. If the circuit breaker continues to open, check for faulty equipment connected to the platform receptacles.



Inspecting Brushes, Replacing Brushes and Cleaning Slip Rings

Refer to Figure 3-57., Inspecting Generator Brushes, Replacing Brushes and Cleaning Slip Rings.

INSPECTING BRUSH POSITION

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

INSPECTING BRUSHES

Remove the end panel. Inspect the wires. Remove the brush holder assembly. Pull the brushes from the holders.

Replace the brushes if damaged, or if the brush is at or near minimum length.

CLEANING SLIP RINGS

Visually inspect the slip rings. Under normal use, the rings turn dark brown.

If the slip rings are corroded or their surface is uneven, remove the belt to turn the shaft by hand for cleaning.

Clean the rings with 220 grit emery paper. Remove as little material as possible. If the rings are deeply pitted and do not clean up, consult generator factory service.

Reinstall the belt, brush holder assembly and end panel.

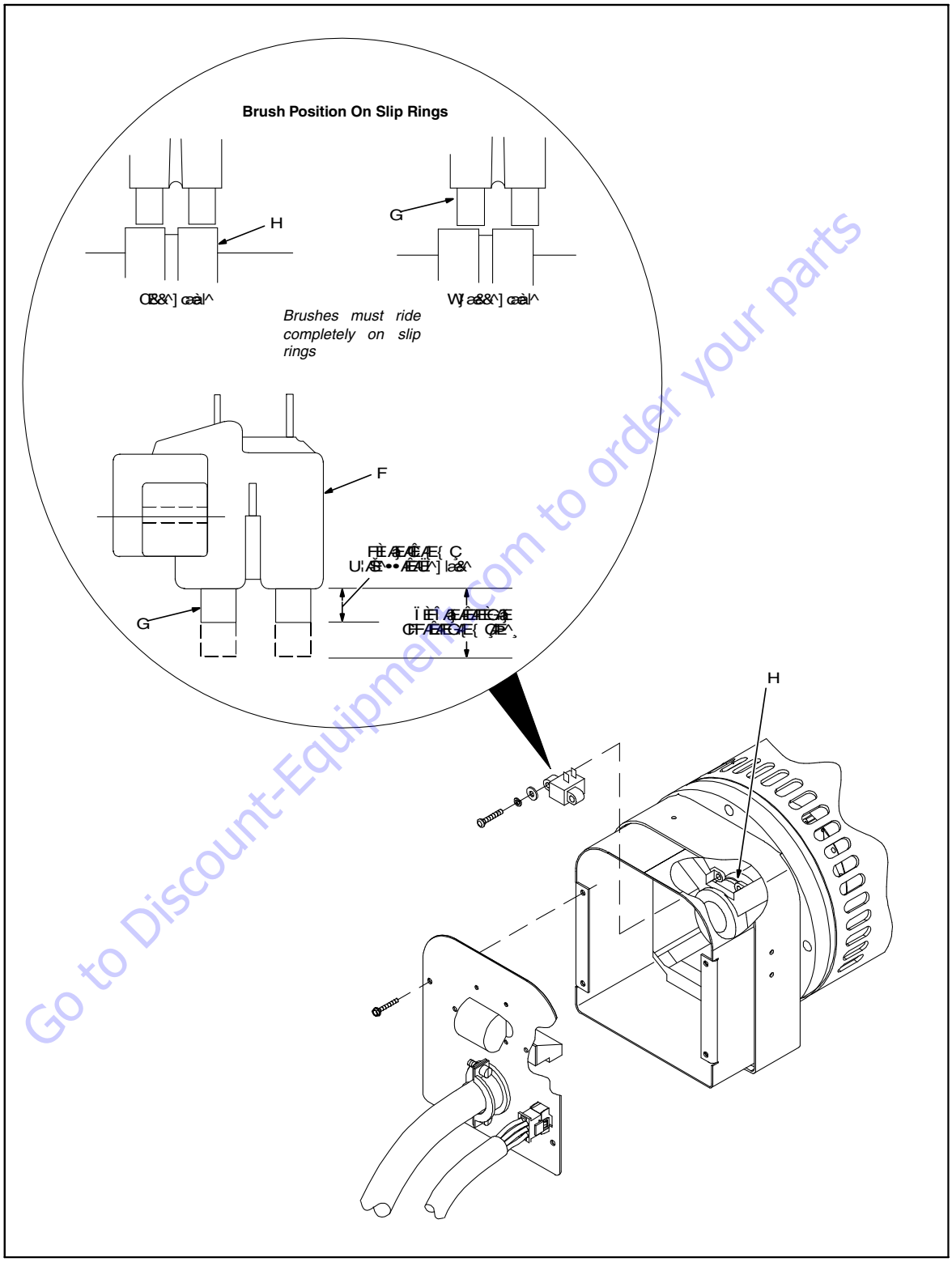


Figure 3-57. Inspecting Generator Brushes, Replacing Brushes and Cleaning Slip Rings

Generator Disassembly and Assembly

Refer to Figure 3-59. and Figure 3-60. to determine if trouble is in stator, rotor, control box, or combination of these components.

1. Rotor
2. Stator Assembly

⚠ CAUTION

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

DISASSEMBLY

1. Mark and disconnect all electrical leads, secure using cable ties.
2. Remove brush holder assembly.
3. Disassemble generator parts shown in Figure 3-58.
4. Clean all parts with approved solvent and dry with compressed air, If applicable.
5. Inspect all part for damage. Replace if necessary.

ASSEMBLY

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

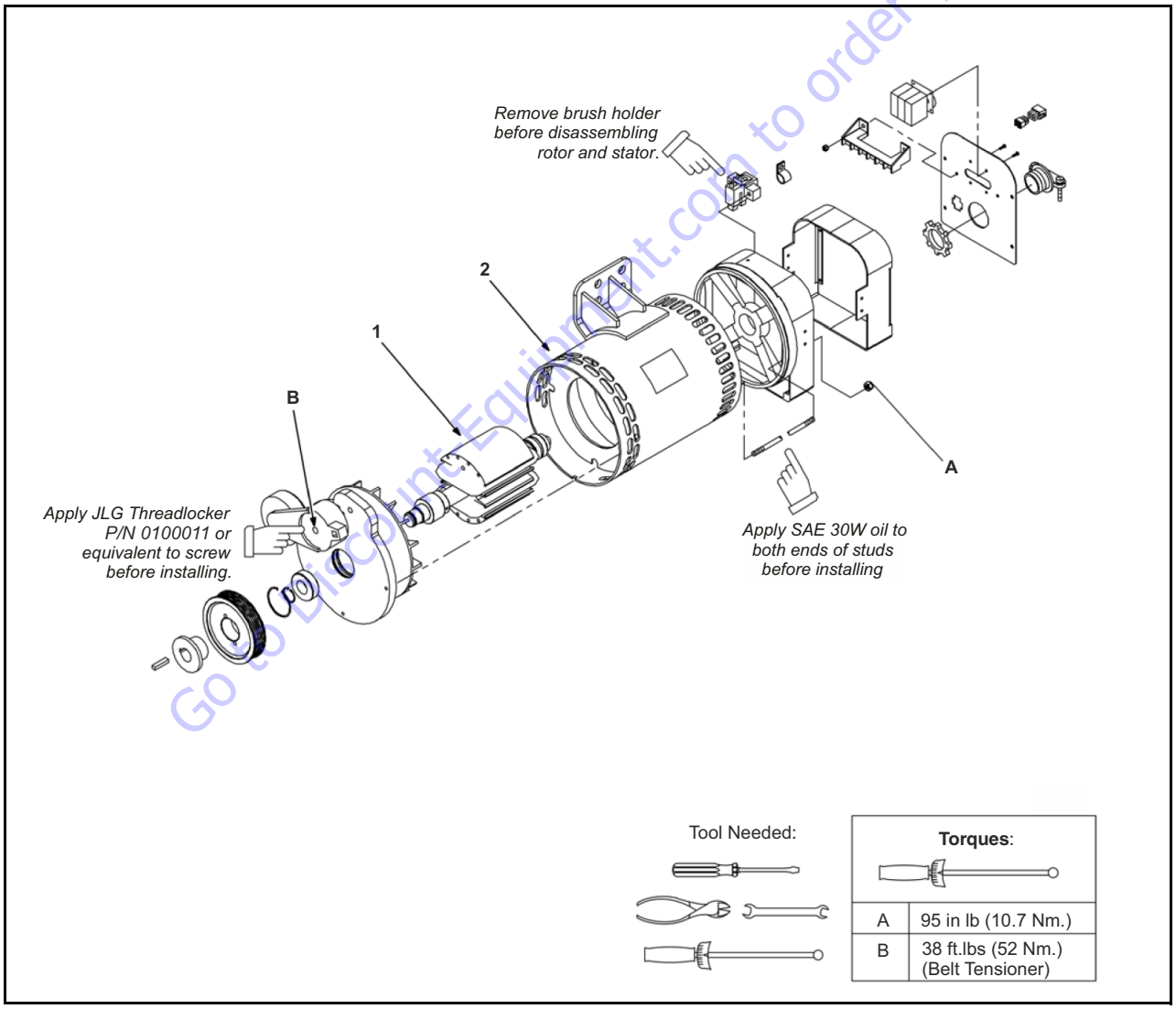


Figure 3-58. Generator Disassembly and Assembly

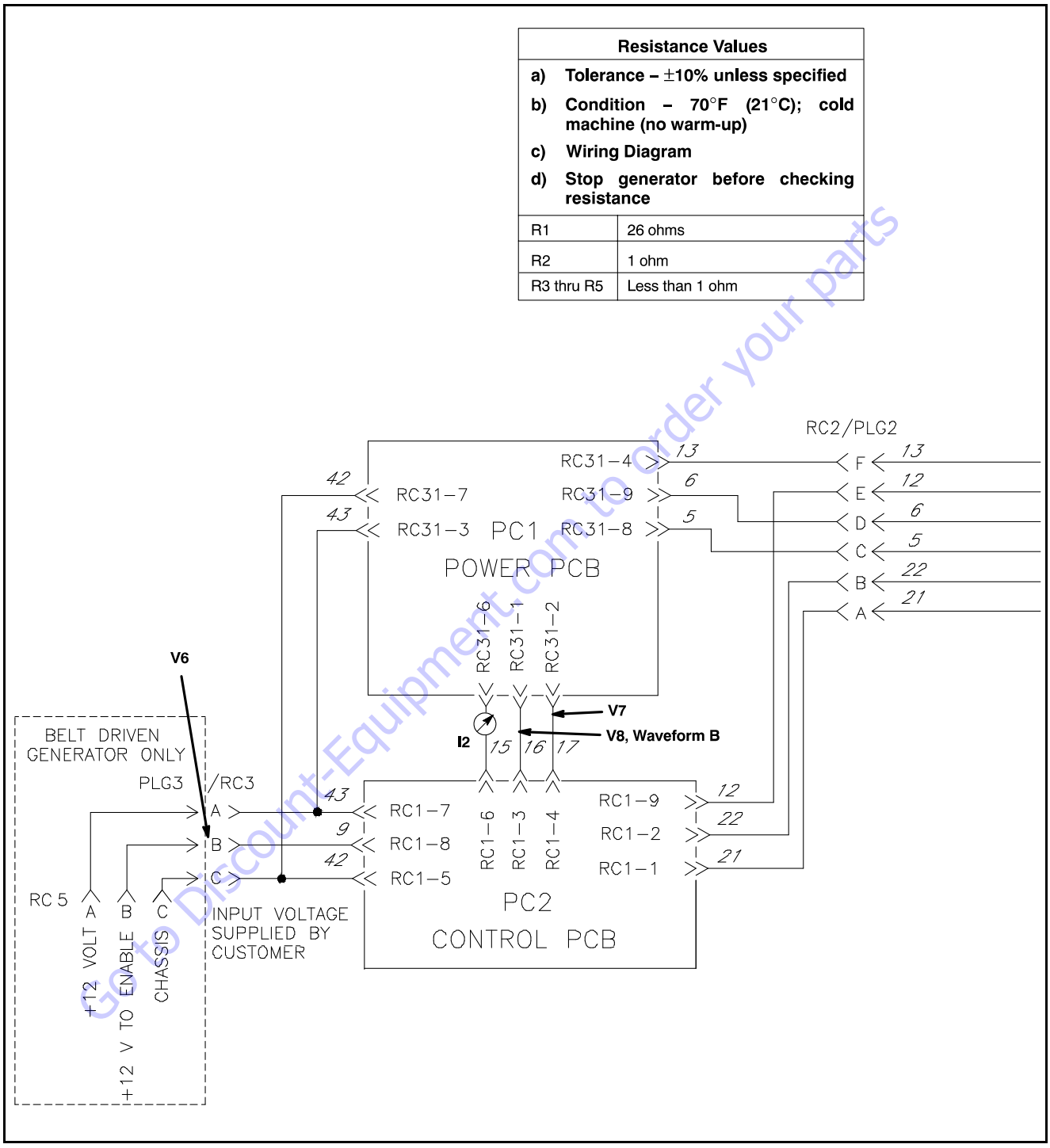


Figure 3-59. Generator Troubleshooting Circuit Diagram - Sheet 1 of 2

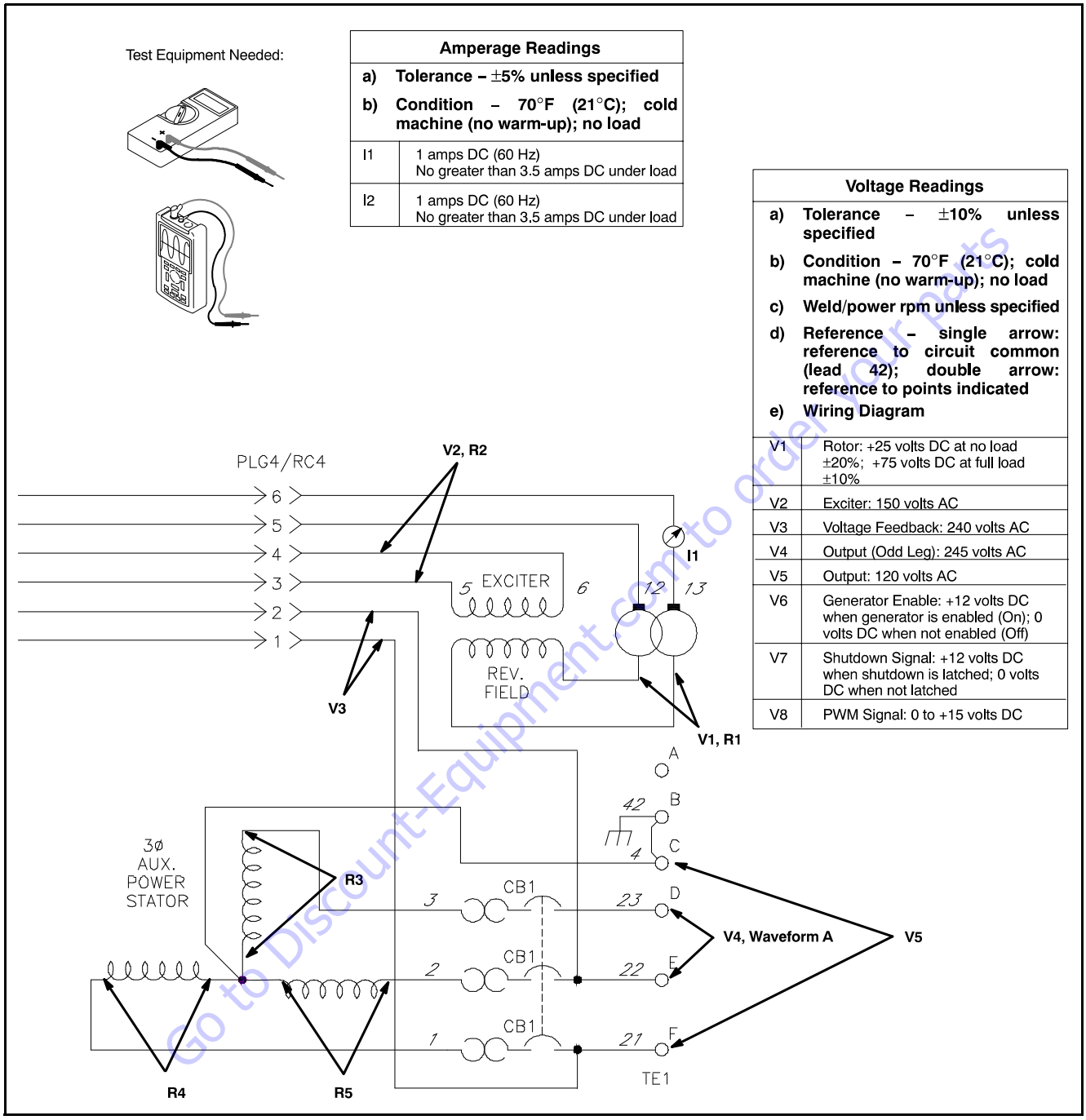


Figure 3-60. Generator Troubleshooting Circuit Diagram - Sheet 2 of 2

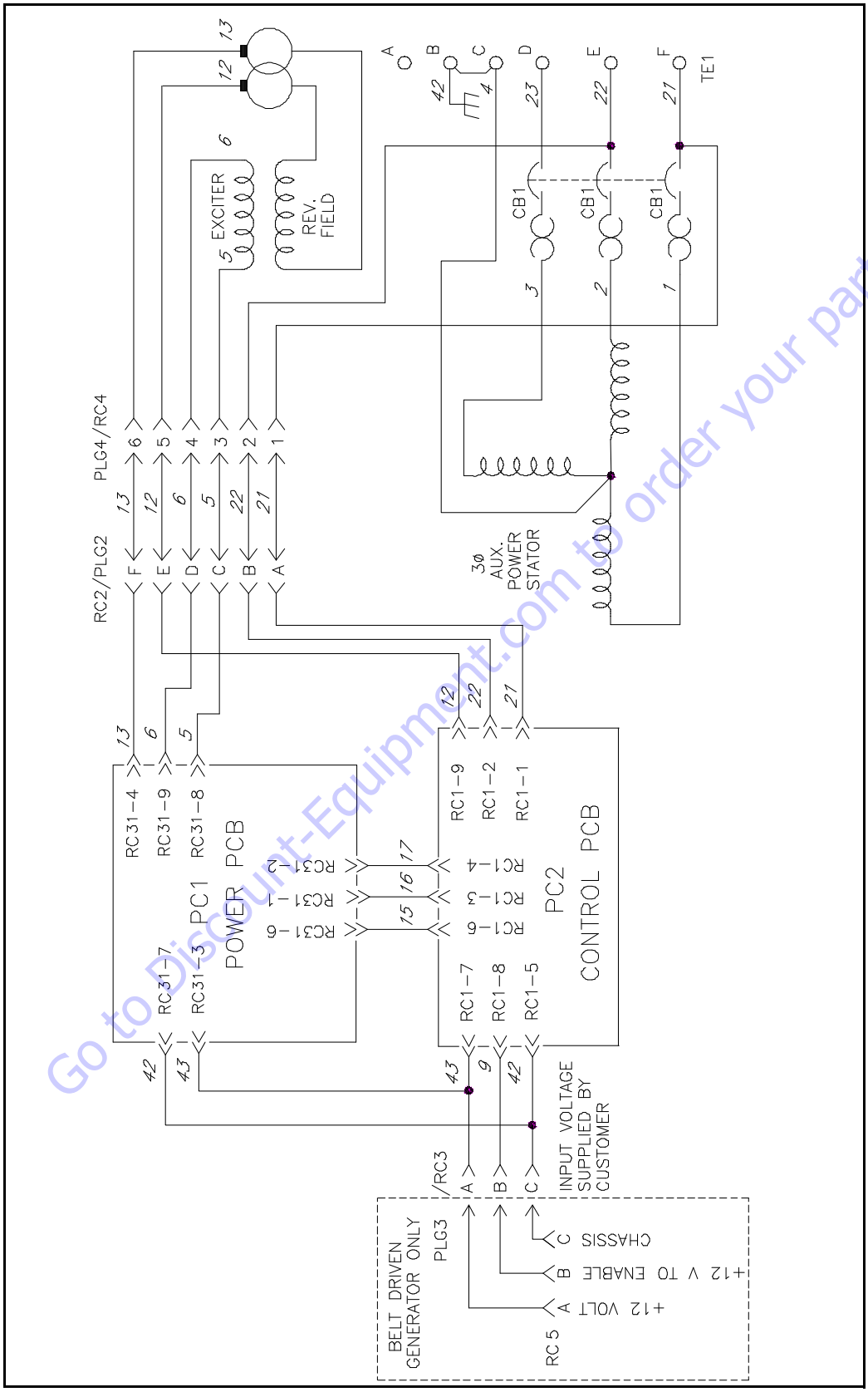


Figure 3-61. Generator Electrical Circuit Diagram

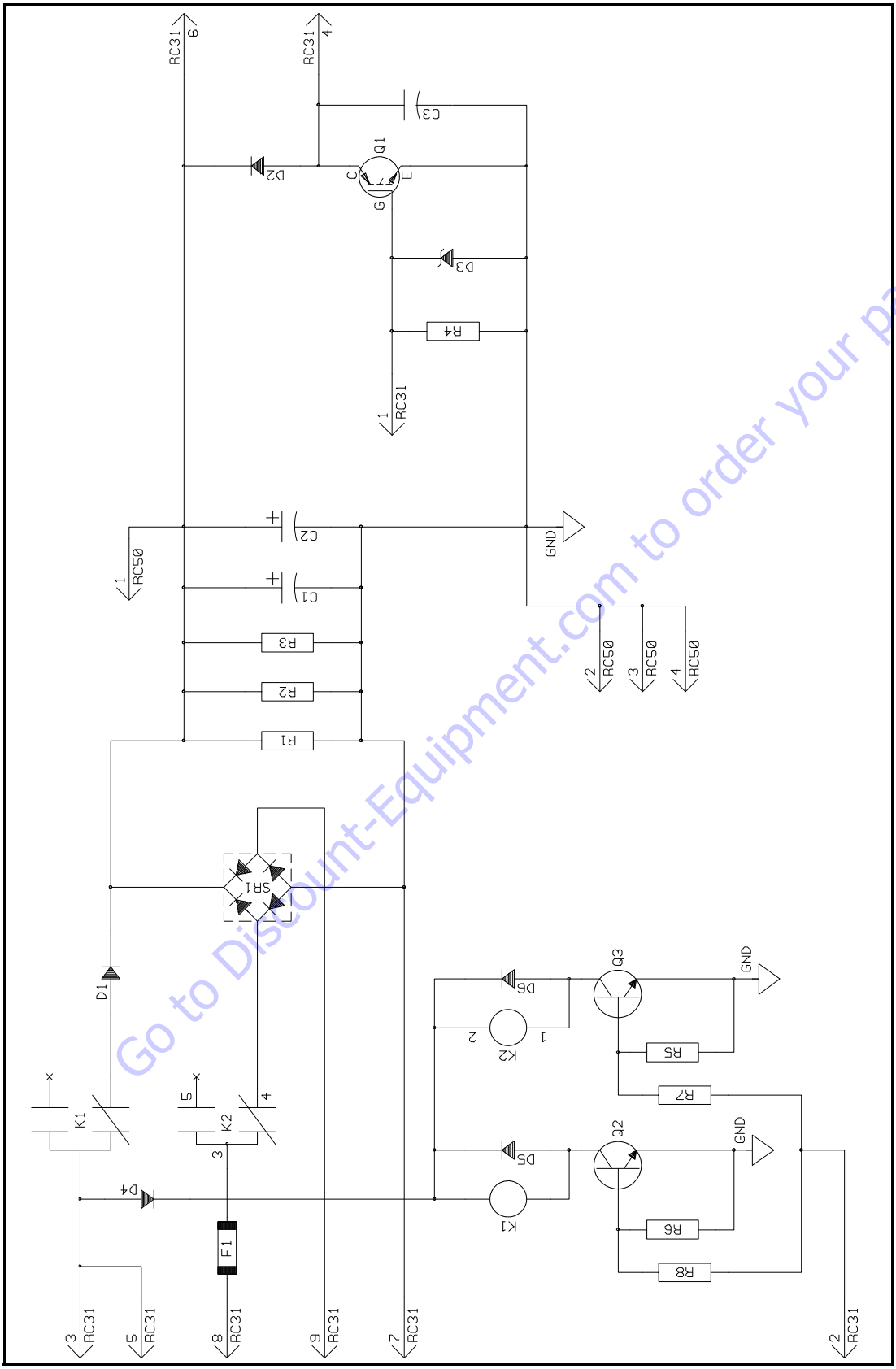


Figure 3-62. Power Board PC1 Electrical Circuit Diagram

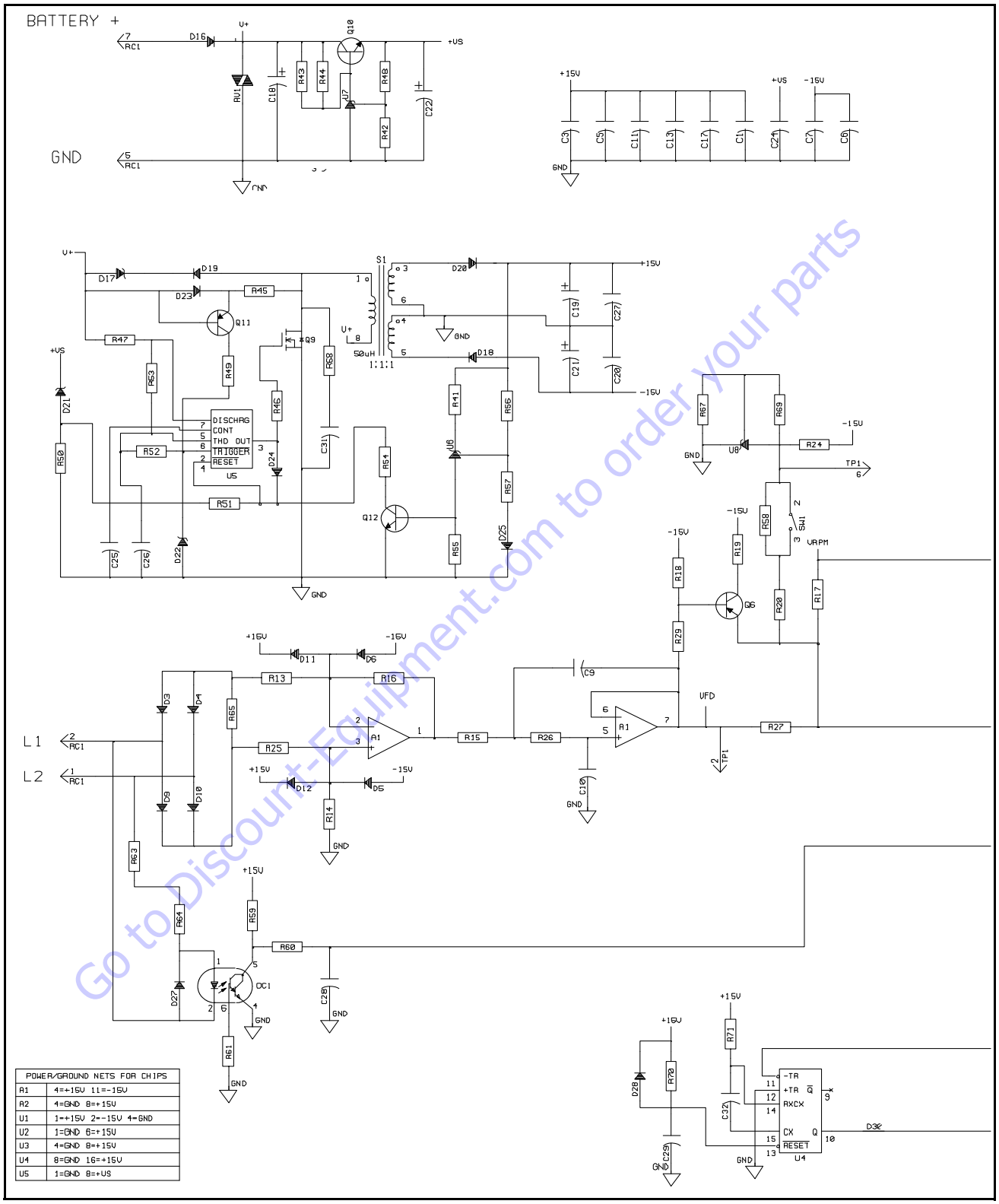


Figure 3-63. Power Board PC2 Electrical Circuit Diagram - Sheet 1 of 2

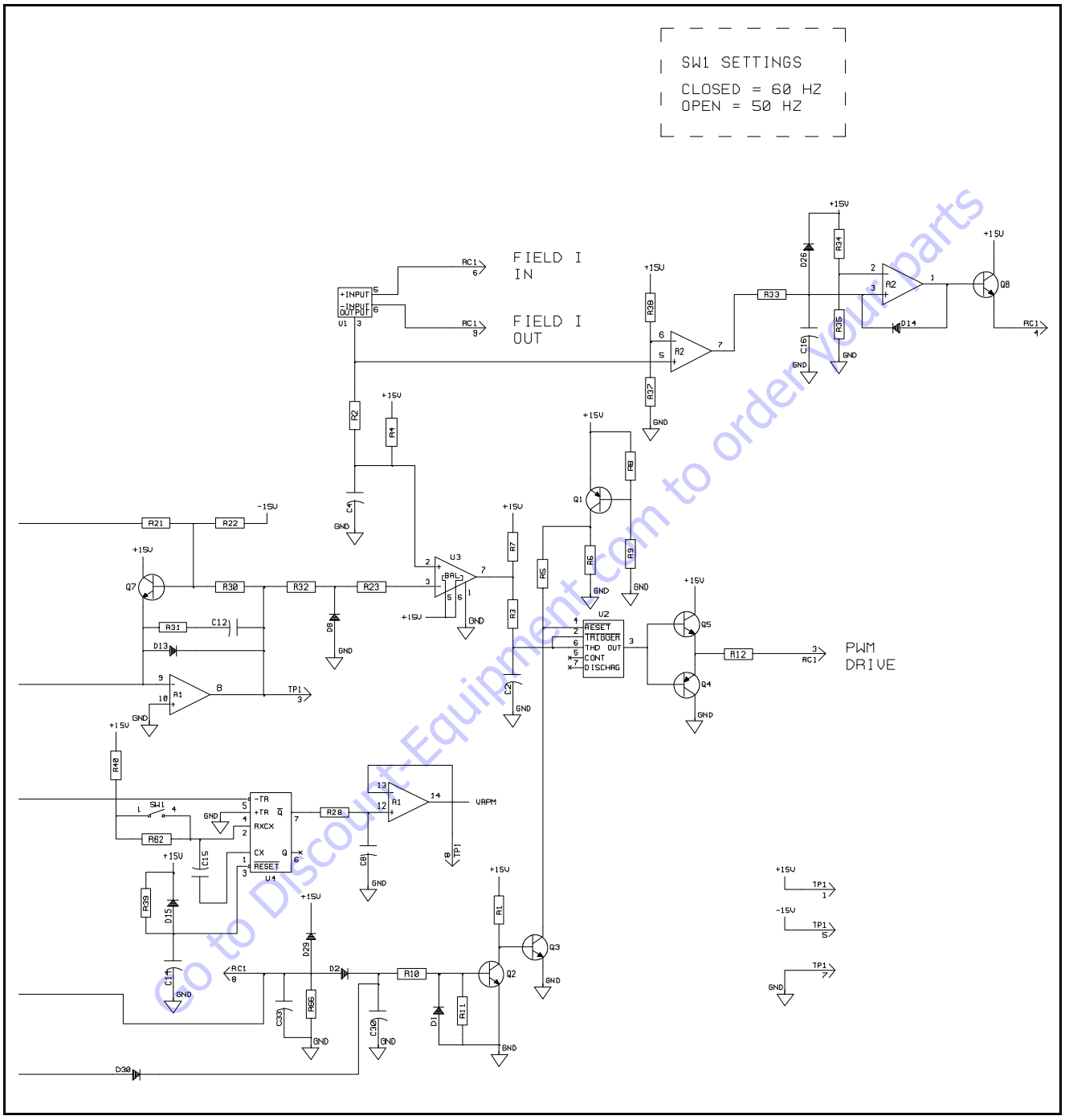


Figure 3-64. Power Board PC2 Electrical Circuit Diagram - Sheet 2 of 2

Lead Connection List for Generator

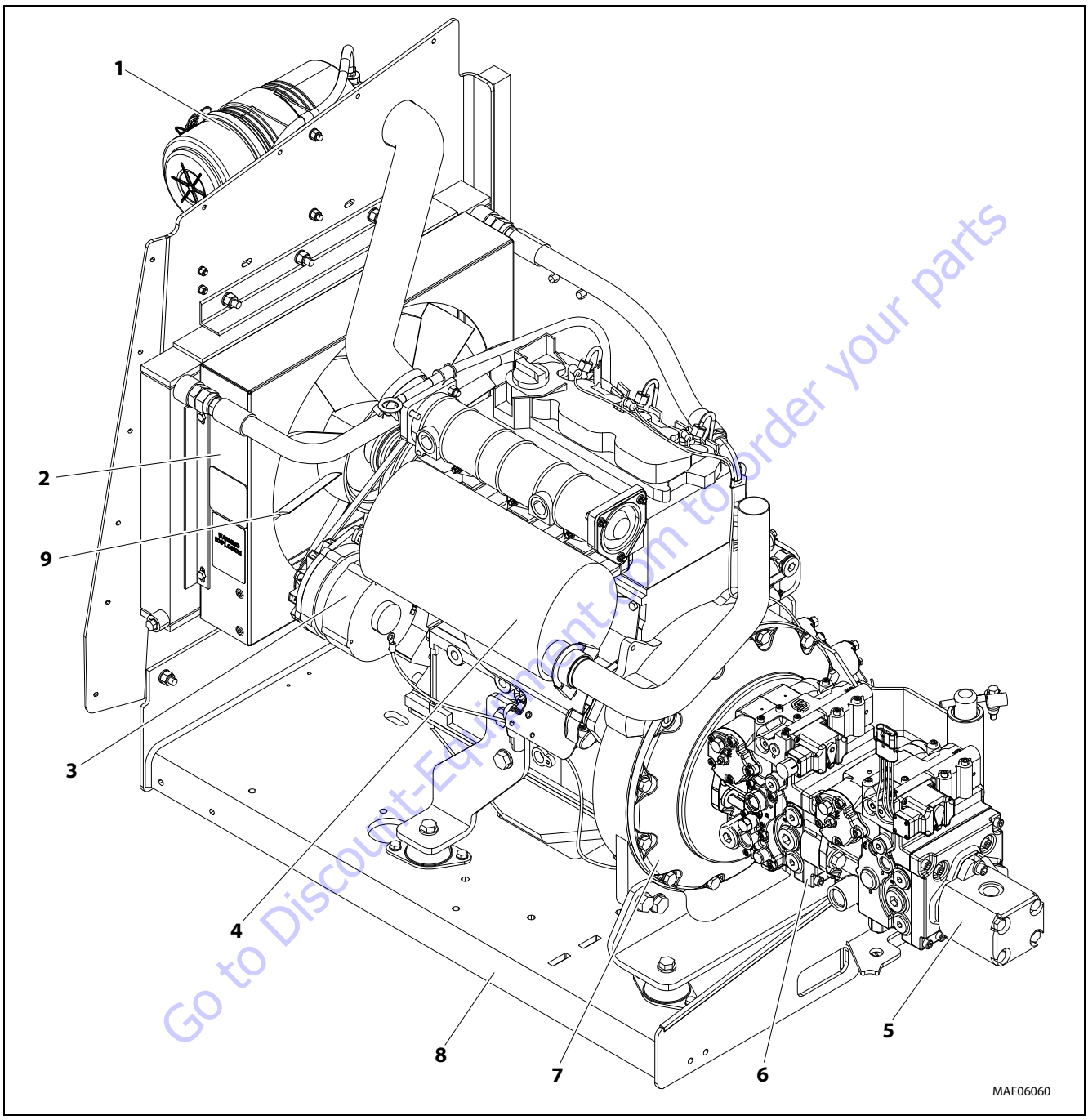
NOTE: *Table shows physical lead connections and should be used with circuit diagram (table replaces wiring diagram).*

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

Table 3-4. Lead Connection List for Generator

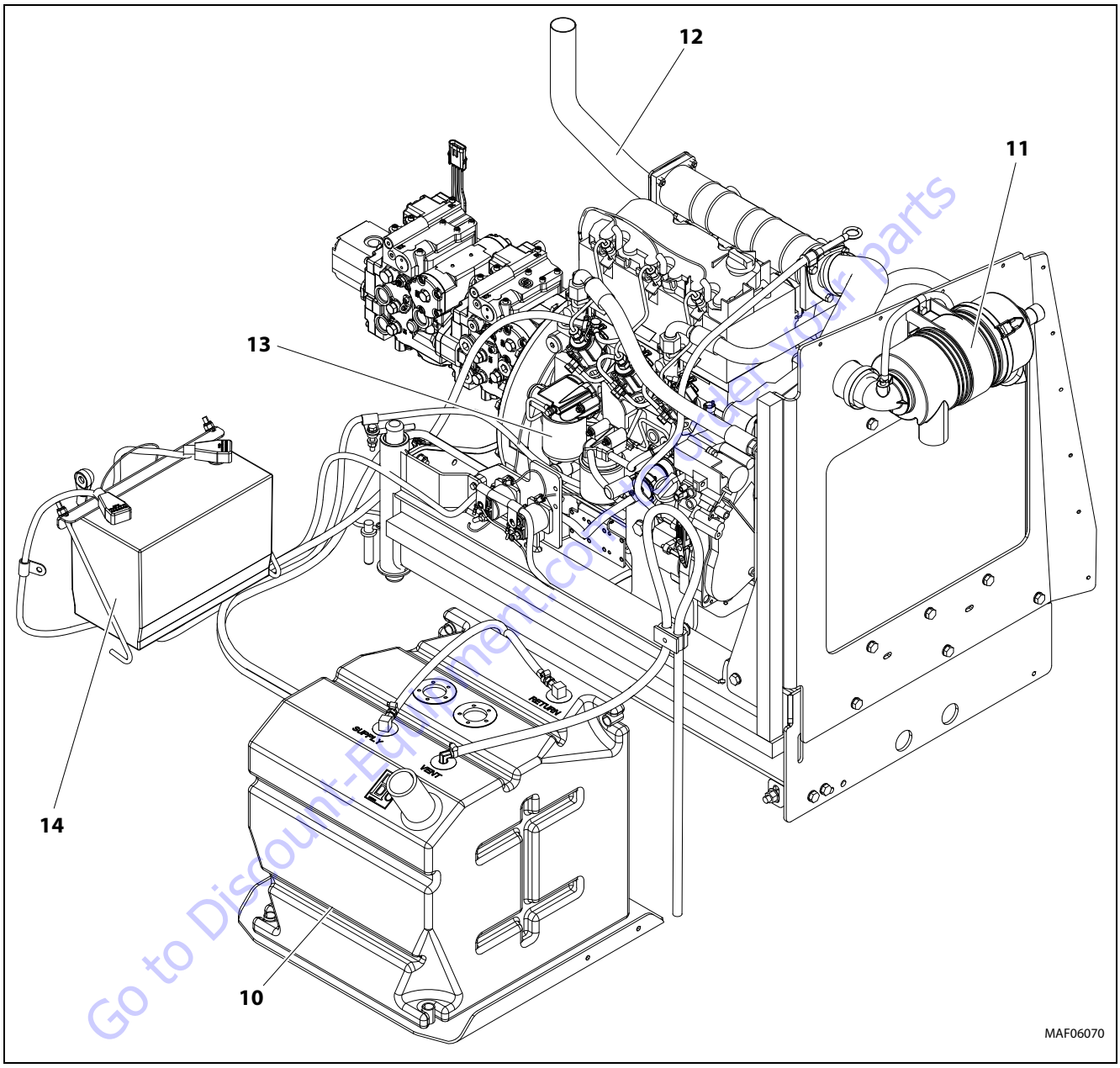
Leads	Connections
1A	STATOR TO CB1
2A	STATOR TO CB1
3A	STATOR TO CB1
4A	STATOR TO TE1 (C)
5A	STATOR TO RC4 (3)
5B	PLG2 (C) TO PLG4 (3)
5C	RC2 (C) PLG31 (8)
6A	STATOR TO RC4 (4)
6B	PLG2 (D) TO PLG4 (4)
6C	RC2 (D) PLG31 (9)
9A	RC5 (B) TO PLG3 (B) (Customer Supplied)
9B	RC3 (B) PLG1 (8)
12A	PLG2 (E) TO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

3.10 DEUTZ ENGINE (D2011L03) - T4I



1. Air Filter
2. Radiator
3. Alternator
4. Muffler
5. Gear Pump
6. Piston Pump
7. Pump Coupling
8. Tray
9. Fan

Figure 3-65. Deutz Engine (D2011L03) - T4i (Sheet 1 of 4)



10. Fuel Tank
11. Air Filter
12. Muffler
13. Oil Filter
14. Battery

Figure 3-66. Deutz Engine (D2011L03) - T4i (Sheet 2 of 4)

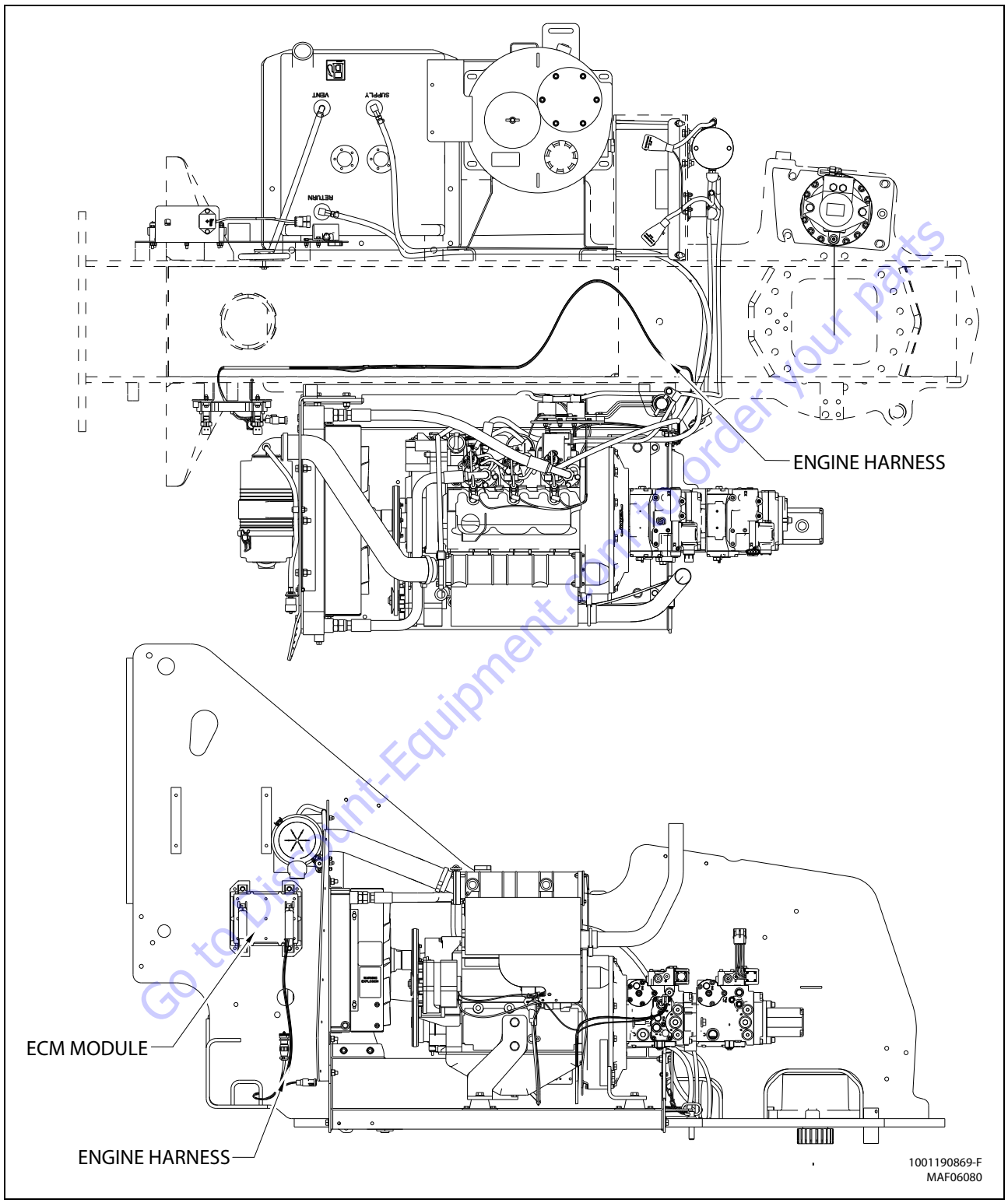


Figure 3-67. Deutz Engine (D2011L03) - T4i (Sheet 3 of 4)

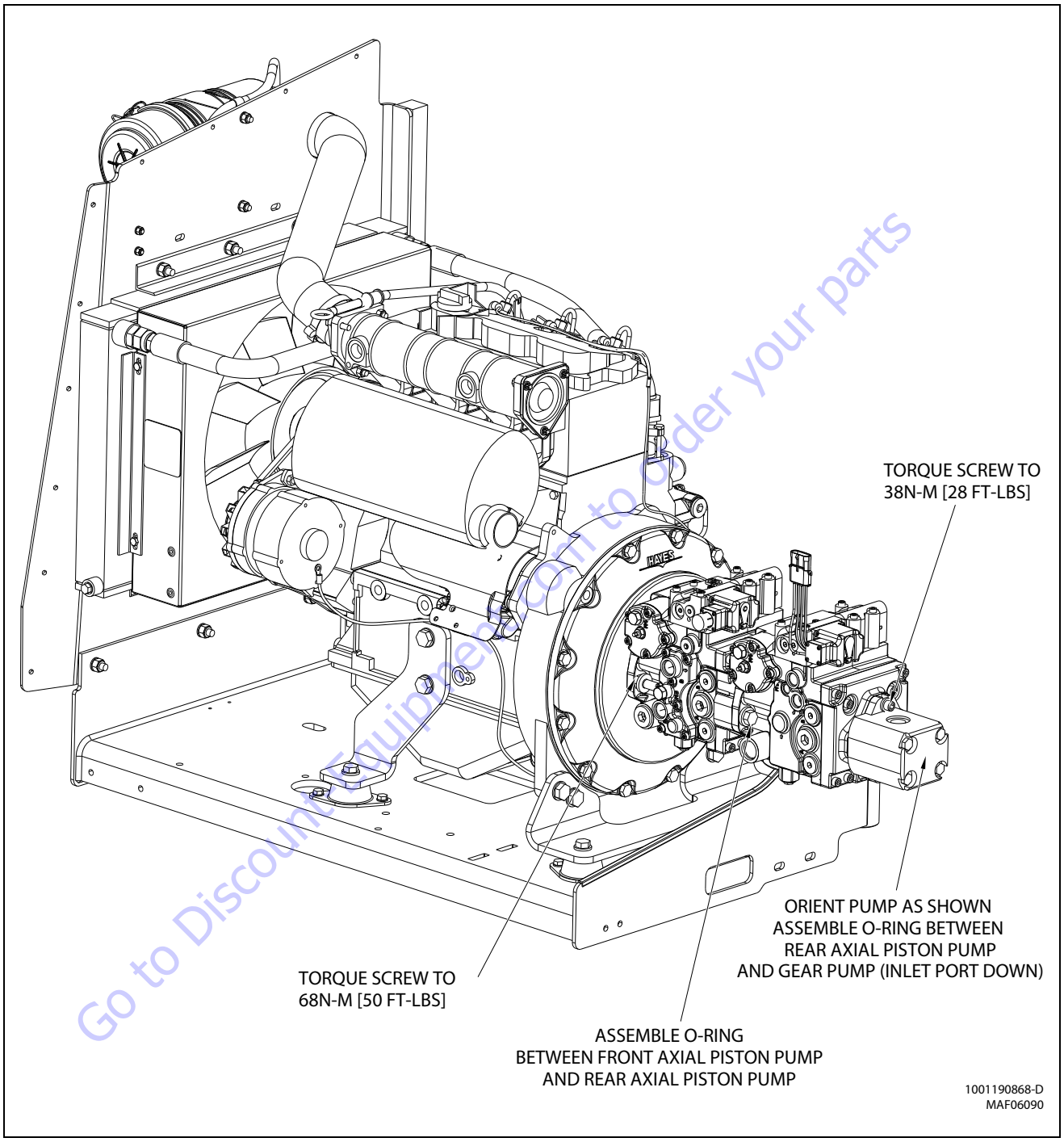


Figure 3-68. Deutz Engine (D2011L03) - T4i (Sheet 4 of 4)

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.

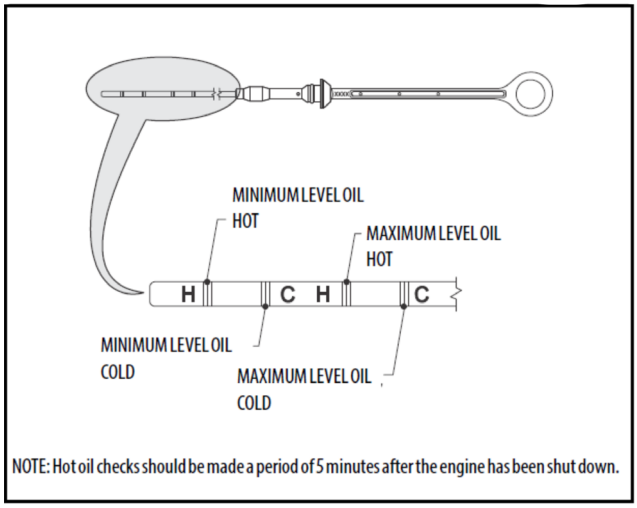


Figure 3-69. Deutz D2011L03 T4Fi Dipstick Markings

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 3-70., Engine Oil Viscosity.

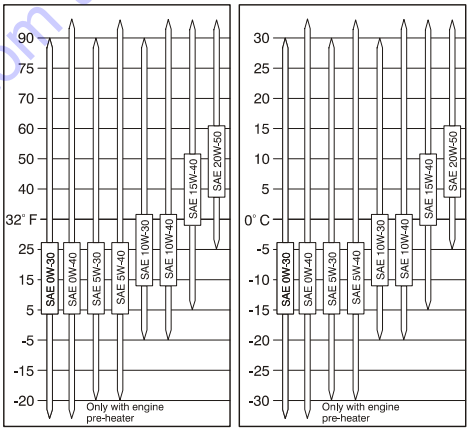
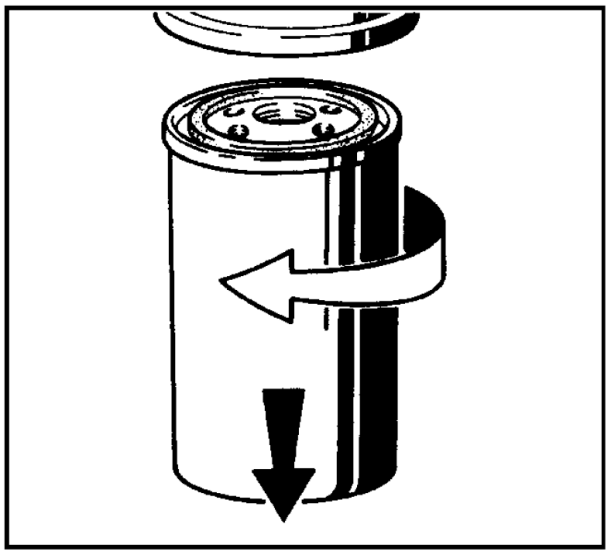


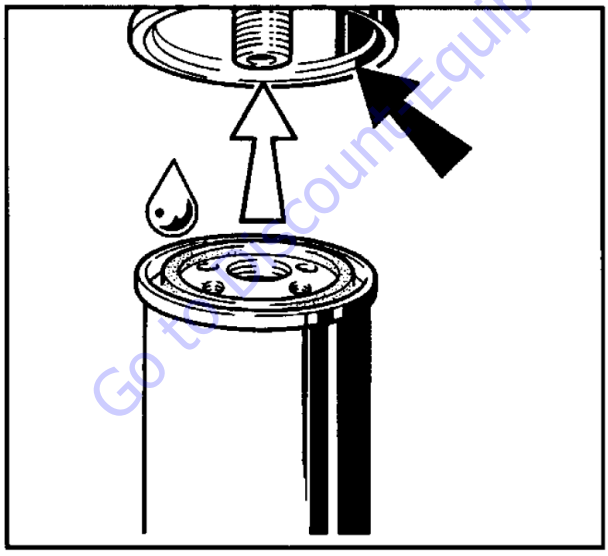
Figure 3-70. Engine Oil Viscosity

Changing Oil Filter

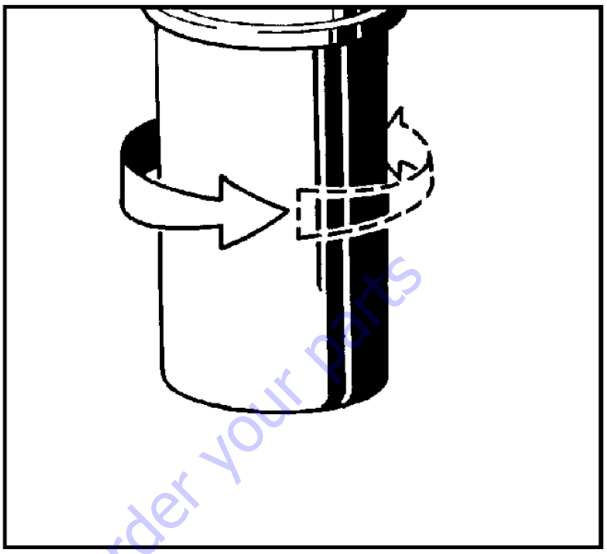
1. Wipe area around filter to clean any dirt from area.
2. Using a suitable oil filter removal tool, loosen lube oil filter cartridge and spin off.



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.

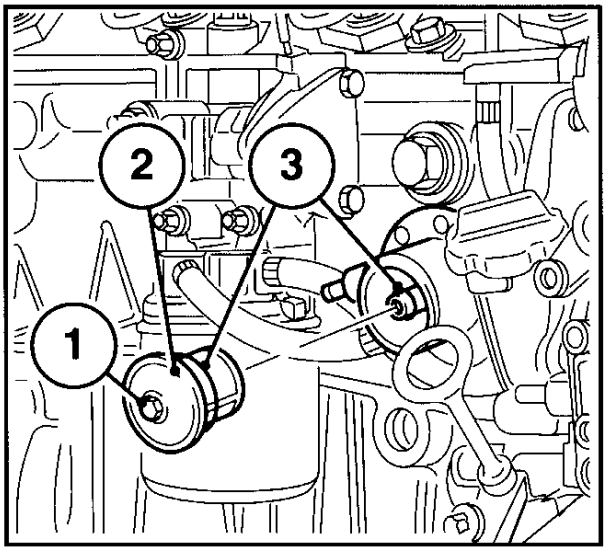
1. Wipe area around filter to clean any dirt from area.
2. Remove fuel filter cartridge. Catch any escaping fuel.
3. Clean dirt from filter carrier sealing surface.
4. Apply light film of oil or diesel fuel to rubber gasket of new filter cartridge.
5. Screw in new filter by hand until gasket is flush. hand tighten filter another half-turn.
6. Open fuel shut-off valve.
7. Check for leaks.

Clean Fuel Strainer

⚠ WARNING

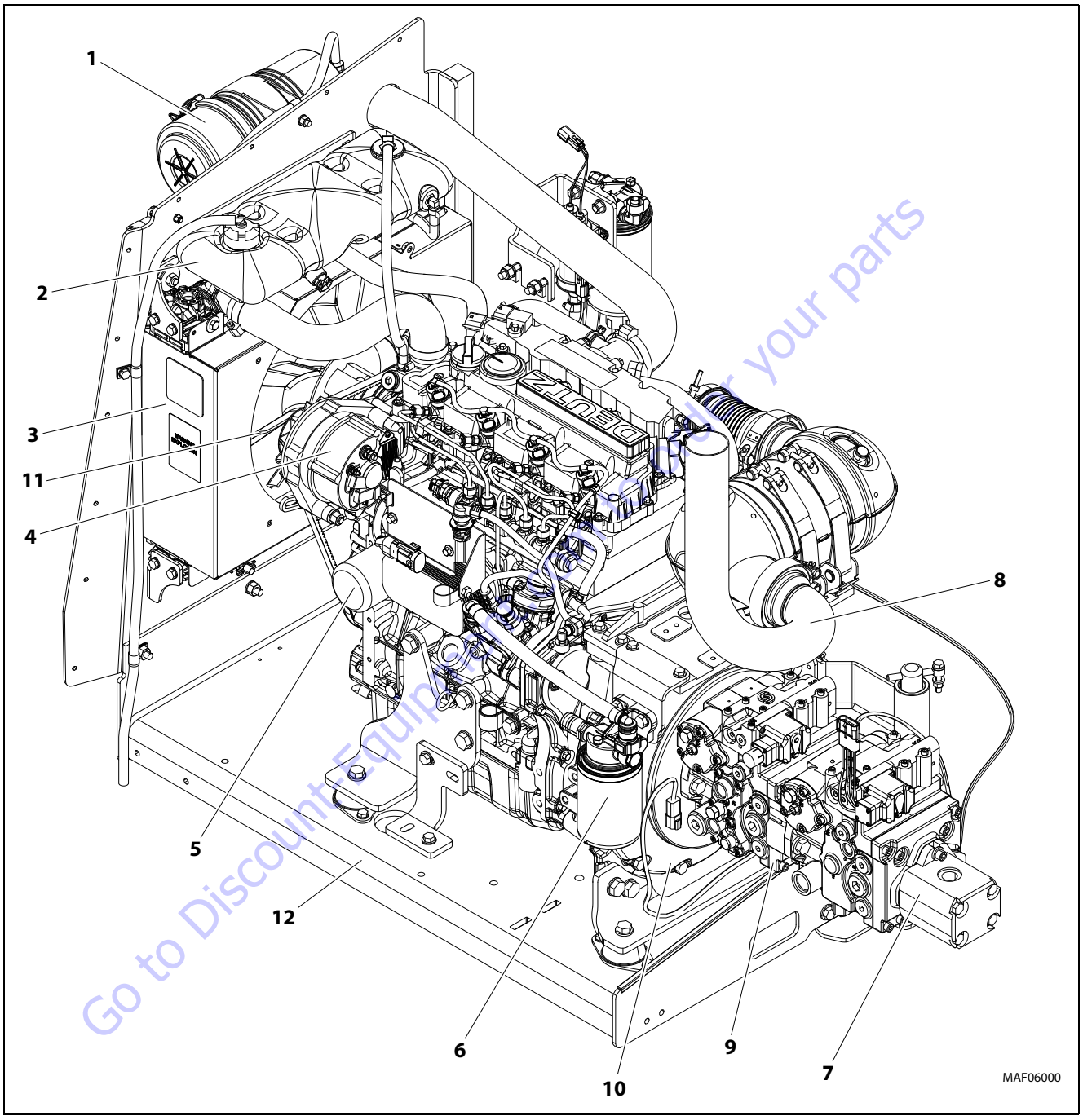
FUEL IS FLAMMABLE AND CAN CAUSE DEATH OR SERIOUS INJURY. MAKE SURE NO OPEN FLAMES OR SPARKS ARE IN THE AREA WHEN WORKING ON FUEL SYSTEM. DO NOT SMOKE WHEN WORKING ON THE FUEL SYSTEM.

1. Unscrew the hexagonal nut (1).



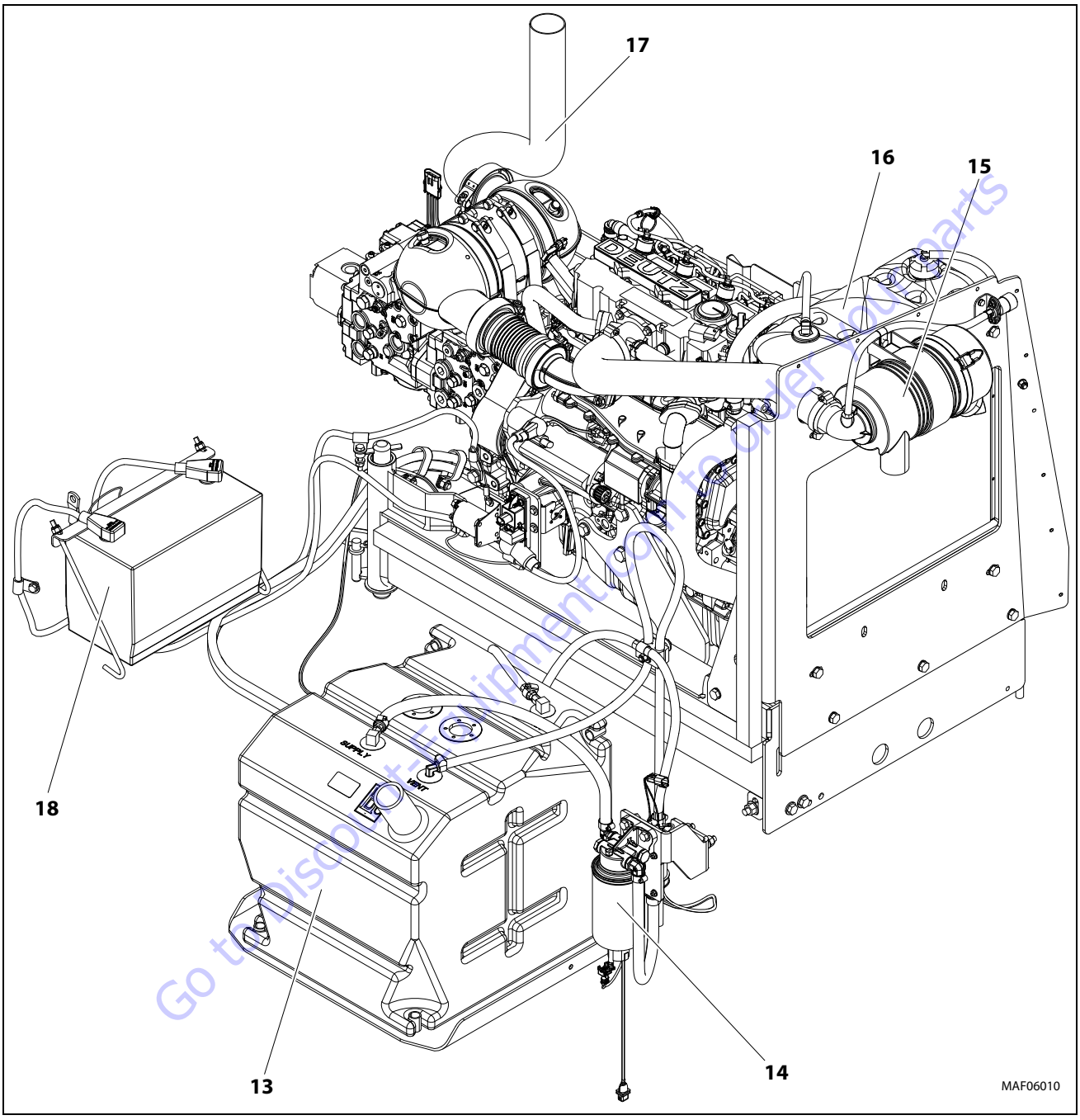
2. Remove the fuel strainer cover (2).
3. Clean fuel strainer with diesel fuel and replace as needed.
4. Place the seal (3) in position.
5. Install fuel strainer cover (2). Tighten screw (1).
6. Check for leaks.

3.11 DEUTZ ENGINE (D2.9L4) - T4F



1.	Air Filter	4.	Alternator	7.	Gear Pump	10.	Pump Coupling
2.	Radiator Coolant Tank	5.	Oil Filter	8.	Exhaust System	11.	Fan
3.	Radiator	6.	Fuel Primary Filter	9.	Piston Pump	12.	Tray

Figure 3-71. Deutz Engine (D2.9L4) - T4F (Sheet 1of 4)



13. Fuel Tank
14. Fuel Pre-Filter
15. Air Filter
16. Coolant Expansion Tank
17. Exhaust Pipe
18. Battery

Figure 3-72. Deutz Engine (D2.9L4) - T4F (Sheet 2 of 4)

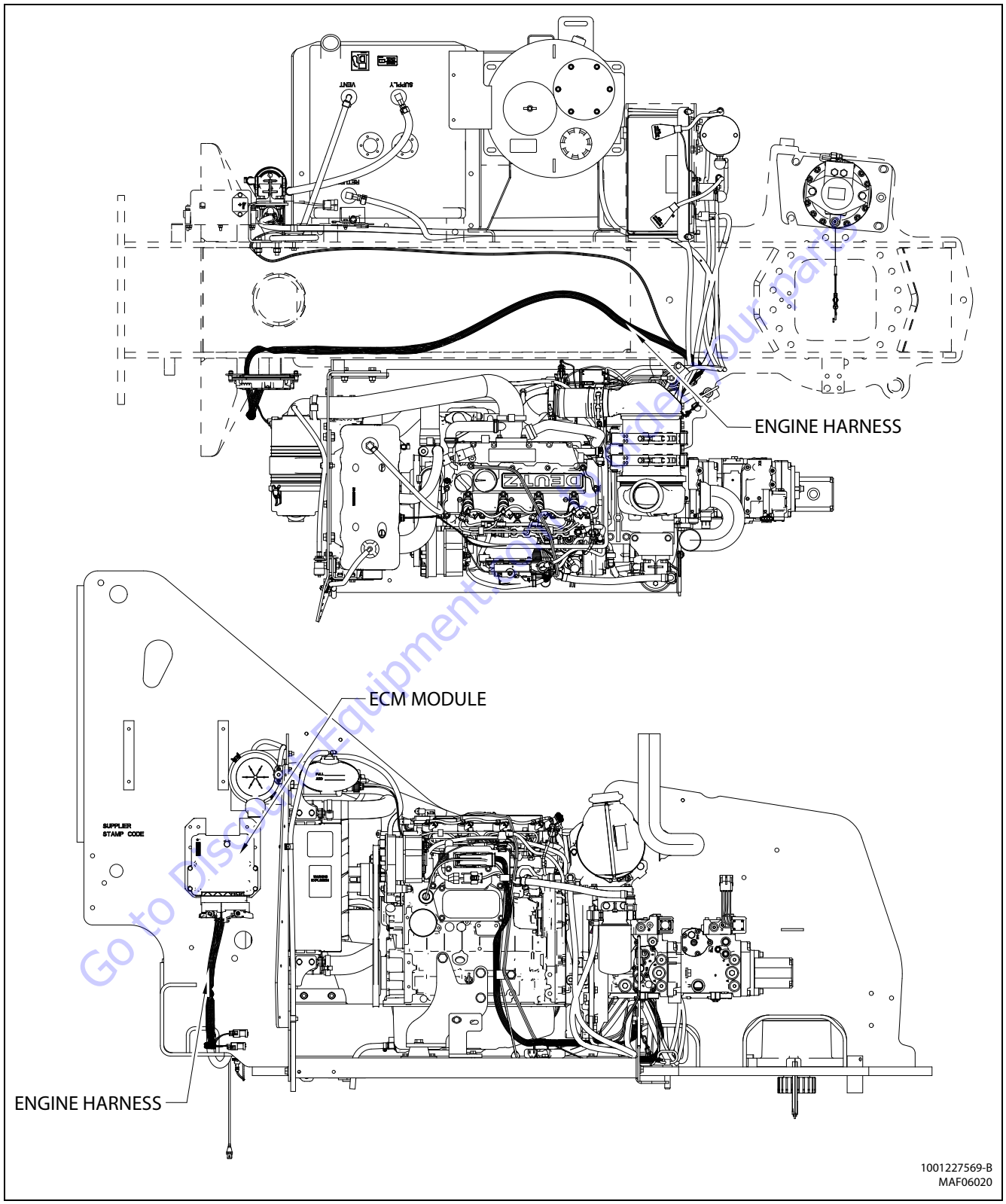


Figure 3-73. Deutz Engine (D2.9L4) - T4F (Sheet 3 of 4)

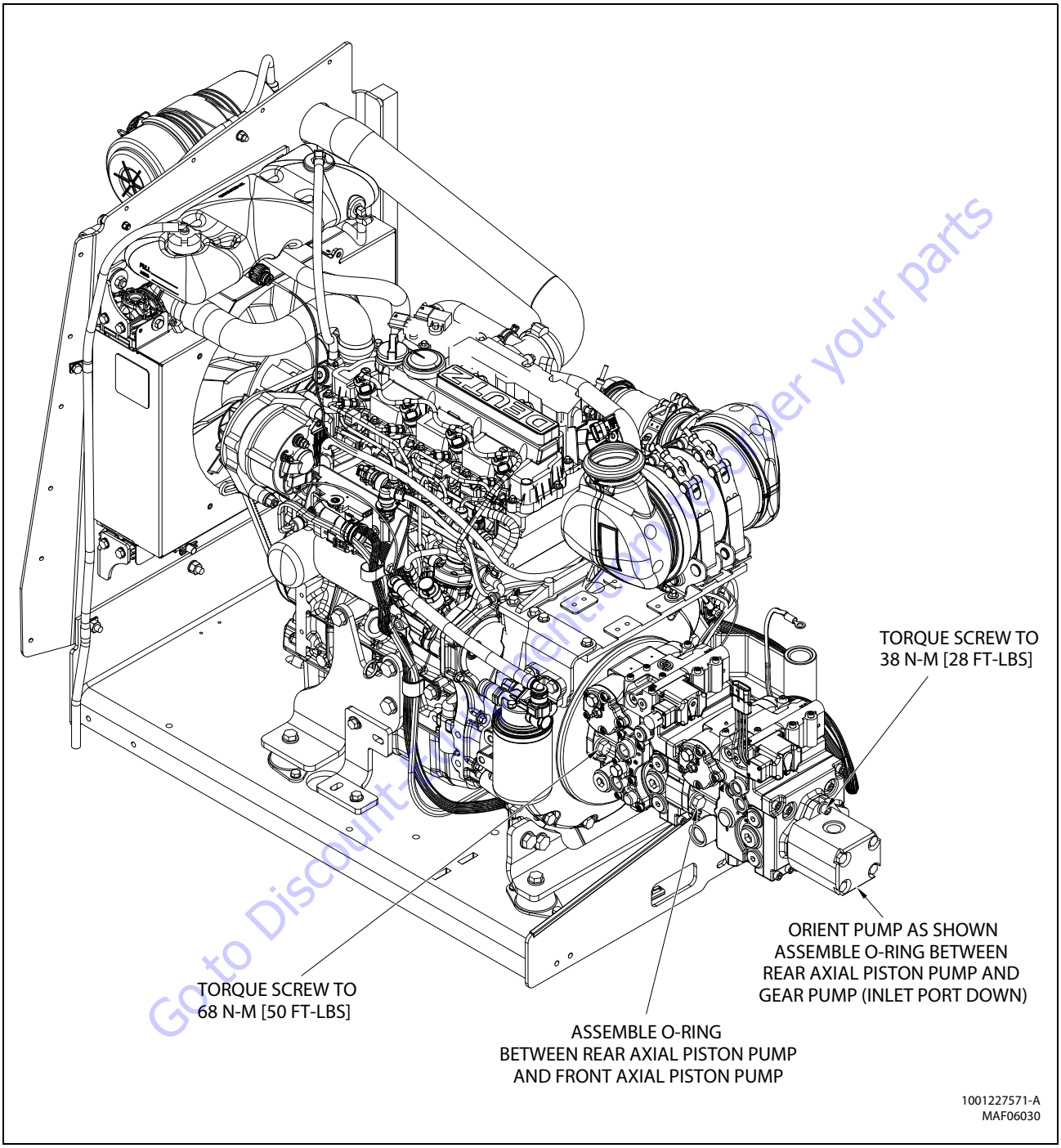


Figure 3-74. Deutz Engine (D2.9L4) - T4F (Sheet 4 of 4)

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.

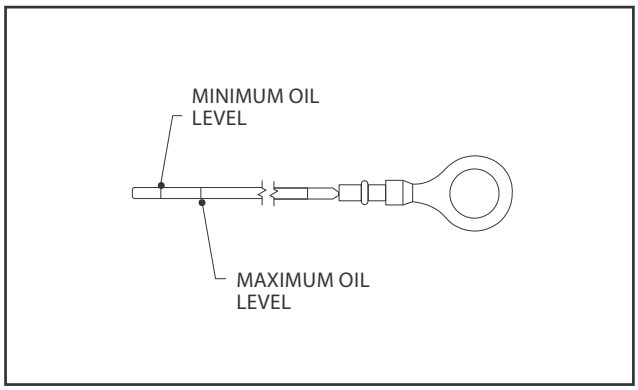


Figure 3-75. Deutz 2.9 T4FDipstick Markings

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 3-76., Engine Oil Viscosity.

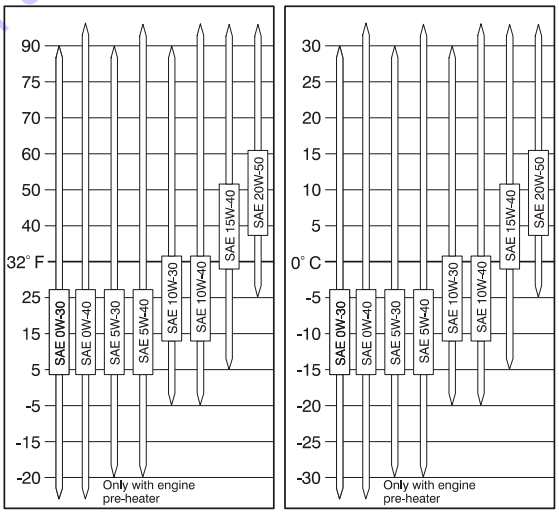
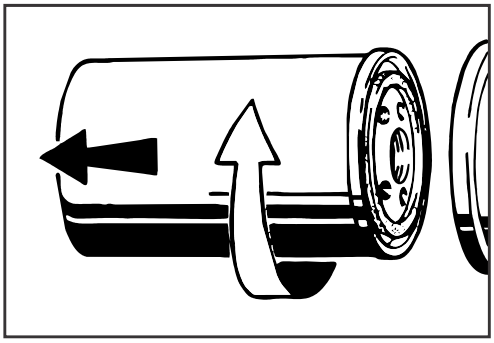


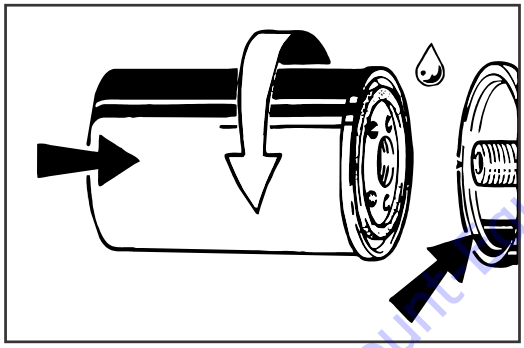
Figure 3-76. Engine Oil Viscosity

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.



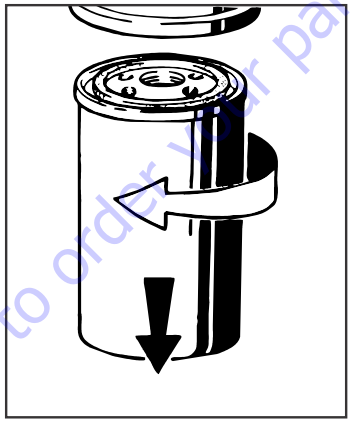
8. Check oil level.
9. Check oil pressure.
10. Check oil filter cartridge for leaks.

Change Fuel Filters

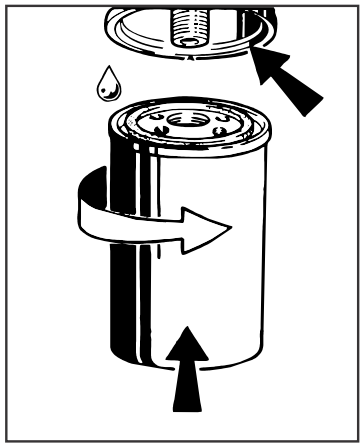
⚠ WARNING

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 THE FUEL SYSTEMS.

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.

3.12 ENGINE FAULT CODES

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
16	0	No detail information
16	0	BusOff error CAN; No detail information
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.
29	3	Hand throttle idle validation switch; short circuit to battery
29	4	Hand throttle; short circuit to ground
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	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 (A02)
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground (A67)
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground
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	7	Intake Throttle Flap, H-Bridge, position of actuator not plausible (deviation from set point more than 7%)
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	1	Low fuel pressure; warning threshold exceeded
94	1	Low fuel pressure; shut off threshold exceeded
94	3	Sensor error low fuel pressure; signal range check high
94	4	Sensor error low fuel pressure; signal range check low
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	0	High oil pressure; warning threshold exceeded.

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
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
100	3	Sensor error oil pressure; signal range check high
100	4	Sensor error oil pressure sensor; signal range check low
102	1	Pressure downstream charge air cooler, pressure below lower physical threshold
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	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	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	1	Charged Air cooler down stream temperature. Temperature below lower physical threshold.
105	3	Electrical error charged air temperature. Signal range check high.(SRC)
105	4	Electrical error charged air temperature. Signal range check low.
105	11	Diagnostic fault check for charged air cooler downstream temperature sensor; No detail information
107	0	Sensor error air filter differential pressure; short circuit to ground
107	0	Air filter differential pressure; air filter clogged.
107	3	Sensor error air filter differential pressure; short circuit to battery
108	3	Sensor error ambient air pressure; signal range check high
108	4	Sensor error ambient air pressure; signal range check low
108	11	DFC for CAN message
110	0	Physical Range Check high for Coolant temperature
110	0	High coolant temperature; warning threshold exceeded
110	0	Coolant temperature; system reaction initiated
110	1	Physical Range Check low for Coolant temperature.

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
110	2	Defect fault check for Absolute plausibility test No detail information
110	3	Sensor error coolant temperature; signal range check high
110	4	Sensor error coolant temperature; signal range check low
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	0	Physical range check high for battery voltage
168	1	Physical range check low for battery voltage
168	2	High battery voltage; warning threshold exceeded
168	2	High battery voltage; shot off threshold exceeded
168	3	Sensor error battery voltage; signal range check high.
168	4	Sensor error battery voltage; signal range check low
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	0	air temperature within air filter box above maximum physical value
172	1	Air inlet filter sensor out of physical range check
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
174	11	DFC for fuel temperature plausibility check function No detail information
175	0	High oil temperature; warning threshold exceeded

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
175	0	High oil temperature; shut off threshold exceeded
175	2	Customer oil temperature: signal unplausible
175	3	Sensor error oil temperature; signal range check high
175	4	Sensor error oil temperature; signal range check low
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	2	Offset angle between crank- and camshaft sensor is too large.
190	8	Sensor camshaft speed; disturbed signal
190	8	Sensor crankshaft detection; out of range, signal disrupted; disturbed signal
190	11	Engine speed above warning threshold (FOC-Level 2)
190	12	Sensor camshaft detection; out of range, signal disrupted; no signal
190	12	Speed detection; out of range, signal disrupted Sensor crankshaft speed; no signal
190	14	Engine speed above warning threshold (Overrun Mode)
190	14	Camshaft- and Crankshaft speed sensor signal not available on CAN
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	Physical range check low for EGR differential pressure
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	3	SVS lamp; short circuit to battery
624	4	SVS lamp; short circuit to ground
624	5	SVS lamp; open load
624	12	SVS lamp: power stage over temperature

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
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	3	Injector 1 (in firing order); short circuit
651	5	Injector 1 (in firing order); interruption of electric connection
652	3	Injector 2 (in firing order); short circuit
652	5	Injector 2 (in firing order); interruption of electric connection
653	3	Injector 3 (in firing order); short circuit
653	5	Injector 3 (in firing order); interruption of electric connection
654	3	Injector 4 (in firing order); short circuit
654	5	Injector 4 (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)
655	5	Injector 5 (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)
656	5	Injector 6 (in firing order); interruption of electric connection
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	3	Starter relay low side short circuit to battery.
677	4	Starter relay high side short circuit to ground.
677	4	Starter relay low side short circuit to ground.
677	5	Starter relay low side no load error.
677	12	Starter relay power stage over temperature.
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.
729	5	Cold start aid relay open load

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
729	12	Cold start aid relay; over temperature error
898	9	Timeout Error of CAN-Receive-Frame TSC1TE; Set point
975	3	PWM-Signal Fan, short-circuit to plus
975	4	PWM-Signal Fan, open load or short circuit to ground
975	5	PWM-Signal Fan, Open load or short-circuit 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	0	Physical range check high for exhaust gas temperature upstream turbine
1180	1	Physical range check low for exhaust gas temperature upstream turbine
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
1188	0	Turbocharger wastegate, temperature critical high
1188	2	Wastegate; status message from ECU missing
1188	2	Turbocharger wastegate, CAN Error
1188	3	Turbocharger wastegate, supply voltage above maximum threshold
1188	4	Turbocharger wastegate, supply voltage below minimum threshold
1188	6	Turbocharger wastegate, current above maximum threshold
1188	7	Wastegate actuator; blocked
1188	7	Turbocharger wastegate, mechanical blocking detected
1188	7	Turbocharger wastegate, broken spring detected
1188	11	Wastegate actuator; internal error
1188	11	Wastegate actuator; EOL calibration not performed correctly
1188	11	Wastegate actuator; over temperature (> 135°C)

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
1188	11	Wastegate actuator; operating voltage error
1188	12	Turbocharger wastegate, internal electrical error
1188	13	Wastegate actuator calibration deviation too large, re-calibration required
1188	13	Turbocharger wastegate, EOL calibration error
1188	13	Turbocharger wastegate, learning process aborted
1188	13	Turbocharger wastegate, learning process out of range
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	
1323	12	Too many recognized misfires in cylinder 1 (in firing order)
1323	12	
1323	12	
1323	12	
1323	12	
1323	12	
1346	0	Misfire detection monitoring No detail information
1638	2	Hydraulic oil temperature check for Shut off condition
1639	0	Sensor error fan speed; signal range check high or engine speed resp. fan speed too high
1639	1	Sensor error fan speed; signal range check low or fan speed too low
1639	12	Fan speed sensor; electrical error or signal disturbed or very low fan speed
1761	0	DEF tank, DEF level above upper physical threshold
1761	1	DEF tank, DEF level below lower physical threshold
1761	2	DEF tank level, plausibility error
1761	14	DEF tank level; warning threshold exceeded
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

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
1761	14	DEF tank, DEF level below second warning threshold
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	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	2	Exhaust Gas Recirculation AGS Sensor; signal not plausible
2659	2	Exhaust Gas Recirculation AGS Sensor; Temperature of EGR mass not plausible
2659	12	Exhaust Gas Recirculation AGS Sensor; plausibility error, AGS sensor has not passed the burn off process
2791	0	EGR actuator, temperature critical high
2791	2	EGR actuator, CAN error
2791	3	EGR actuator supply voltage is above the maximum threshold
2791	4	EGR actuator supply voltage is below minimum threshold
2791	6	EGR actuator current is above maximum threshold
2791	7	EGR actuator, actuator blocked
2791	7	EGR actuator, broken spring detected
2791	12	Actuator EGR Valve; power stage over temperature
2791	12	EGR Actuator, internal electrical fault
2791	13	EGR actuator, EOL calibration error
2791	13	EGR actuator, learning process aborted
2791	13	EGR actuator, learning process out of range
2791	16	EGR actuator, temperature 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

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
3031	2	Urea tank temperature outside of plausible thresholds
3219	2	DFC SAE J1939 error No detail information
3224	1	DFC for plausibility error Max for NOx sensor upstream of SCR Cat
3224	2	DLC Error of CAN-Receive-Frame AT1IG1 NOX Sensor (SCR-system upstream cat; DPF-system downstream cat); length of frame incorrect
3224	2	DLC Error of CAN-Receive-Frame AT1IG1Vol NOX sensor
3224	9	Timeout Error of CAN-Receive-Frame AT1IG1; NOX sensor upstream
3224	9	Timeout Error of CAN-Receive-Frame AT1IG1Vol; NOX sensor
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	2	DLC Error of CAN-Receive-Frame AT1O1Vol NOX
3234	9	Timeout Error of CAN-Receive-Frame AT1OG1; NOX sensor (SCR-system downstream cat; DPF-system downstream cat)
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	2	Sensor 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.
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