JLG®

An Oshkosh Corporation Company

Service and Maintenance Manual

Model
600A
600AJ

S/N 0300080000 to 0300177361,
S/N B300000100 to Present

P/N - 3121201

October 23, 2017

ANSI

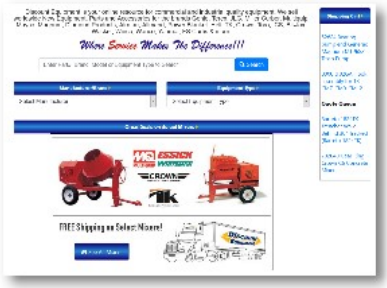
CE

AS/NZS

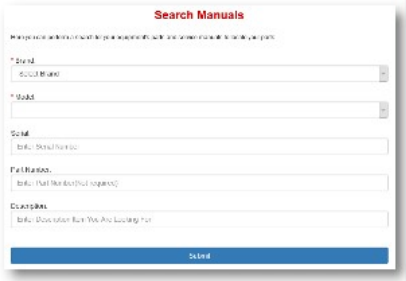
PARTS FINDER

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

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: 561-964-4949 Outside Florida TOLL FREE: 877-690-3101

Need parts?

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

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

SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A GENERAL

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

⚠ WARNING

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

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

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

⚠ WARNING

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

B HYDRAULIC SYSTEM SAFETY

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

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

C MAINTENANCE

⚠ WARNING

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

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

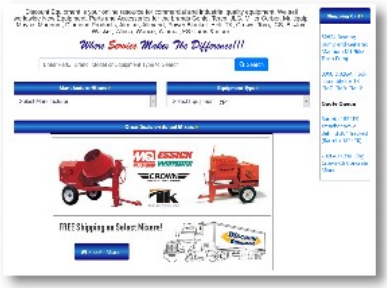
REVISON LOG

Original Issue	- October 15, 2004
Revised	- June 10, 2005
Revised	- October 6, 2005
Revised	- March 2, 2006
Revised	- December 4, 2007
Revised	- April 1, 2008
Revised	- December 10, 2012
Revised	- October 23. 2017

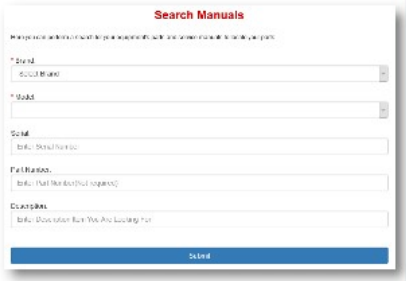
PARTS FINDER

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

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: 561-964-4949 Outside Florida TOLL FREE: 877-690-3101

Need parts?

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

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

SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications - SN 0300080000 through SN 0300140400

Maximum Work Load (Capacity)	
Unrestricted:	500 lbs. (230kg)
Restricted:	1000 lbs. (450kg)
Maximum Travel Grade (Gradeability)	
2WD	30%
4WD	45%
Maximum Travel Grade (Side Slope)	5°
Turning Radius - (outside)	
2WS	17 ft. 8 in. (5.38 m)
4WS	11 ft. 8 in. (3.56 m)
Turning Radius -(outside) narrow chassis	
2WS	16 ft. 6 in. (5.03 m)
4WS	11 ft. 2 in. (3.4 m)
Turning Radius - (inside)	
2WS	11 ft. 5 in. (3.48 m)
4WS	5 ft. 6 in. (1.68 m)
Turning Radius - (inside) narrow chassis	
2WS	12 ft. 2 in. (3.71 m)
4WS	5 ft. 7 in. (1.7 m)
Maximum Tire Load:	11,500 lbs. (5227 kg)
Ground Bearing Pressure	
600A	77 psi (5.4 kg/cm^2)
600AJ	75 psi (5.3 kg/cm^2)
600A - narrow chassis	94 psi (6.6 kg/cm^2)
600AJ - narrow chassis	94 psi (6.6 kg/cm^2)
Maximum Drive Speed - A Models	
2WD	3.6 MPH (5.80 Km/hr)
4WD	4 MPH (6.44 Km/hr)
Gross Machine Weight (Approximate)	
600A	21,500 lbs. (9,752 kg)
600AJ	22,200 lbs. (10,025kg)
600A - narrow chassis	23,900 lbs. (10,841kg)
600AJ - narrow chassis	24,000 lbs. (10,886kg)

Table 1-2. Operating Specifications - SN 0300140401 through SN 0300177361, SN B300000100 to Present

Maximum Work Load (Capacity)- ANSI	
Unrestricted:	500 lbs. (227 kg)
Restricted:	1000 lbs. (454 kg)
Maximum Work Load (Capacity) - CE & Australia	
Unrestricted:	500 lbs. (230 kg)
Restricted:	1000 lbs. (450 kg)
Maximum Travel Grade (Gradeability)	
2WD	30%
4WD	45%
Maximum Travel Grade (Side Slope)	5°
Turning Radius - (outside)	
2WS	17 ft. 8 in. (5.38 m)
4WS	11 ft. 8 in. (3.56 m)
Turning Radius-(outside) narrow chassis	
2WS	16 ft. 6 in. (5.03 m)
4WS	11 ft. 2 in. (3.4 m)
Turning Radius - (inside)	
2WS	11 ft. 5 in. (3.48 m)
4WS	5 ft. 6 in. (1.68 m)
Turning Radius - (inside) narrow chassis	
2WS	12 ft. 2 in. (3.71 m)
4WS	5 ft. 7 in. (1.7 m)
Maximum Tire Load:	11,500 lbs. (5216 kg)
Ground Bearing Pressure	
600A	77 psi (5.4 kg/cm^2)
600AJ	75 psi (5.3 kg/cm^2)
600A - narrow chassis	94 psi (6.6 kg/cm^2)
600AJ - narrow chassis	94 psi (6.6 kg/cm^2)
Maximum Drive Speed - A Models	
2WD	3.6 MPH (5.80 Km/hr)
4WD	4 MPH (6.44 Km/hr)
Gross Machine Weight (Approximate)	
600A	21,500 lbs. (9,752 kg)
600AJ	22,200 lbs. (10,025kg)
600A - narrow chassis	23,900 lbs. (10,841kg)
600AJ - narrow chassis	24,000 lbs. (10,886kg)

1.2 CAPACITIES

Table 1-3. Capacities

Fuel Tank	30 U.S. Gallons (113.6 L)
Hydraulic Oil Tank	30.6 Gallons (115.8 L) with 10% air space
Hydraulic System (Including Tank)	36.72 Gallons (139 L)
Torque Hub, Drive*	17 ounces (0.50 L)
Engine Crankcase Ford LRG-425 Gas w/Filter Ford LRG-423 Gas w/Filter Deutz F4M1011F Diesel w/Filer Deutz F4M2011F Diesel w/Filer Deutz D2011L04 Continental TMD27 Diesel w/Filter Caterpillar 3044C Diesel w/Filer GM	 4.5 quarts (4.25L) 5.0 quarts (4.73 L) 11 quarts (10.5 L) 11 quarts (10.5 L) 11 quarts (10.5 L) 7.0 quarts (6.65 L) 10.6 quarts (10 L) 4.5 qts. (4.25 L) w/Filter
Cooling System	16 Quarts (15.14 L)
*Torque hubs should be one half full of lubricant.	

1.3 COMPONENT DATA

Engine Data

Table 1-4. Continental TMD27 Specifications

Fuel	Diesel
Oil Capacity w/Filter w/o Filter	 7.00 Quarts (6.65 L) 6.00 Quarts (5.7 L)
Low RPM	1800
High RPM	2800
Alternator	63 Amps, Belt Drive
Battery	85 Amphour, 550 Cold Cranking Amps, 12 VDC
Fuel Consumption Low RPM High RPM	 1.80 GPH (6.81 lph) 2.30 GPH (8.71 lph)
Horsepower	66.5 @ 3000 RPM
Coolant	3.8 Gallons (3.6 l)

Table 1-5. Ford LRG-423 Specifications

Fuel	Gasoline
Crankcase Capacity w/Filter w/o Filter	 5.00 Quarts (4.73 L) 4.00 Quarts (3.79 L)
Idle RPM	1000
Low RPM	1800
High RPM	2800
Alternator	40 Amp, Belt Drive
Battery	85 Amphour, 550 Cold Cranking Amps, 12 VDC
Fuel Consumption Low RPM High RPM	 3.45 GPH (13.06 lph) 4.60 GPH (17.41 lph)
Horsepower	54 @ 2400 RPM, full load
Cooling System	16 Quarts (15.14 L)
Spark Plug	AWSF-52-C
Spark Plug Gap	0.044 in. (1.117 mm)

Table 1-6. Ford LRG-425 Specifications

Fuel	Gasoline
Crankcase Capacity	4.5 Quarts (4.25 L) w/Filter
Idle RPM	1000
Low RPM	1800
High RPM	2800
Alternator	40 Amp, Belt Drive
Battery	85 Amphour, 550 Cold Cranking Amps, 12 VDC
Fuel Consumption Low RPM High RPM	 3.45 GPH (13.06 lph) 4.60 GPH (17.41 lph)
Horsepower	54 @ 2400 RPM, full load
Cooling System	16 Quarts (15.14 L)
Spark Plug	AWSF-52-C
Spark Plug Gap	0.044 in. (1.117 mm)

Table 1-7. Deutz F4M1011F/F4M2011 Specifications

Fuel	Diesel
Oil Capacity Cooling System Crankcase w/Filter Total Capacity	 5 Quarts (4.5 L) 11 Quarts (10.5 L) 16 Quarts (15 L)
Idle RPM	1000
Low RPM	1800
High RPM	2800
Alternator	60 Amp, belt drive
Battery	950 Cold Cranking Amps, 205 Minutes Reserve Capacity, 12 VDC
Fuel Consumption Low RPM High RPM	 1.90 GPH (7.19 lph) 2.50 GPH (9.46 lph)
Horsepower	65

Table 1-8. Deutz D2011L04 Specifications

Fuel	Diesel
Oil Capacity Cooling System Crankcase Total Capacity	 5 Quarts (4.5 L) 11 Quarts (10.5 L) w/Filter 16 Quarts (15 L)
Idle RPM	1000
Low RPM	1800
High RPM	2500
Alternator	60 Amp, belt drive
Battery	950 Cold Cranking Amps, 205 Minutes Reserve Capacity, 12 VDC
Fuel Consumption Low RPM High RPM	 1.90 GPH (7.19 lph) 2.50 GPH (9.46 lph)
Horsepower	49

Table 1-9. Caterpillar 3044C/3.4

Type	Four Stroke Cycle
Cylinders	4 in-line
Bore	3.70 in. (94 mm)
Stroke	4.72 in. (120 mm)
Aspiration	turbocharged
Compression ratio	19:1
Displacement	203 in^3 (3.33 L)
Firing Order	1-3-4-2
Rotation (viewed from flywheel)	Counterclockwise
Oil Capacity (w/filter)	10.6 quarts (10 L)
Cooling System (Engine Only)	5.8 quarts (5.5 L)
Idle RPM - 3044C	1000
Idle RPM - 3.4	1200
Low RPM	1800
High RPM	2600
Alternator	60 Amp, belt drive
Battery	930 Cold Cranking Amps, 205 Minutes Reserve Capacity, 12 VDC

Table 1-10. GM 3.0L

Fuel	Gasoline or Gasoline/LP Gas
No. of Cylinders	4
BHP Gasoline LP	 83 hp @ 3000 rpm 75 hp @ 3000 rpm
Bore	4.0 in. (101.6 mm)
Stroke	3.6 in. (91.44 mm)
Displacement	181 cu.in. (3.0 L, 2966 cc)
Oil Capacity w/filter	4.5 qts. (4.25 L)
Minimum Oil Pressure at idle Hot	 6 psi (0.4 Bar) @ 1000 rpm 18 psi (1.2 Bar) @ 2000 rpm
Compression Ratio	9.2:1
Firing Order	1-3-4-2
Max. RPM	2800

Tires

Table 1-11. Tire Specifications

Size	14 x 17.5	14 x 17.5	14 x 17.5
Load Range	G	G	*
Ply Rating	14	14	N/A
Tire Pressure	90 PSI (6 Bar)	Foam-Filled	Air-Boss
* Load Capacity - 11,800 lbs. (5353 kg) - Static			

Size	IN355/55D 625	IN355/55D 625
Load Range*	G	G
Ply Rating	14	14
Tire Pressure	100 PSI (7 Bar)	Foam-Filled
* Load Capacity - 12,000 lbs. (5443 kg) - Static		

Size	18-625
Load Range*	H
Ply Rating	16
Tire Pressure	90 PSI (6 Bar)
* Load Capacity - 12,300 lbs. (5579 kg) - Static	

Dimensional Data

Table 1-12. Dimensional Data

Machine Height (Stowed)	8 ft. 3.75 in. (2.53 m)
Machine Length (Stowed) 600A Over Drive Axle 600AJ Over Drive Axle	 26 ft. 5 in. (8.05 m) 28 ft. 11.4375 in. (8.82 m)
Machine Width Standard Narrow Chassis	 8 ft. (2.44 m) 7 ft. (2.13 m)
Wheelbase	8 ft. 0 in. (2.44 m)
Boom Elevation - 600A	+60 ft. 5 3/8 in. (18.42 m) -11 in. (0.28 m)
Boom Elevation - 600AJ	+60 ft. 6 3/4 in. (18.46 m) -2 ft. 8 13/16 in. (0.83 m)

Drive System

Table 1-13. Drive System

Drive Motor Displacement	2.8 cu. in. max. 1.1 cu. in. min. (46 cm^3 max. 18 cm^3 min.)
Drive Hub Ratio	39.96:1
Drive Brake	Automatic spring applied, hydraulically released disc brakes

Swing System

Table 1-14. Swing System

Swing Motor Displacement	4.62 cu. in. (75 cm^3)
Swing Brake	Automatic spring applied hydraulically released disc brakes
Swing Hub Ratio	50:1
Hydraulic Gear Pump @ 1800 RPM	7.9 GPM (29.90 lpm)
Pump Displacement	1.02 cu. in. (16 cm^3)
Rotation	Clockwise

Pumps

Table 1-15. Pumps

Hydraulic Gear Pump	
Output @ 1800 RPM	7.9 GPM (29.90 lpm)
Displacement	1.02 cu. in. (16 cm^3)
Rotation	Clockwise
Auxiliary Power Pump	
Output	2.6 gpm 1200 psi (9.8 lpm @82.7 bar)
Pump Displacement	0.244 cu. in. (14 cm^3)
Motor Type	DC
Rotation	Clockwise

Hydraulic Filters

Table 1-16. Pumps

Return - Bypass Type	10 Microns Absolute
Charge	10 Microns Absolute
Hydraulic Strainers (In Tank)	30 Microns

1.4 TORQUE REQUIREMENTS

Table 1-17. Torque Requirements

Description	Torque Value (Dry)	Interval Hours
Bearing To Chassis	190 ft. lbs. (260 Nm) See Note	50/600*
Bearing To Turntable	190 ft. lbs. (260 Nm) See Note	50/600*
Wire Rope	15 ft. lbs. (20 Nm)	150
Wheel Lugs	170 ft. lbs. (231 Nm)	150
Engine Mounting Bolts	165 ft. lbs. (231 Nm)	A/R
Engine Manifold Mounting Bolts	30 ft. lbs. (42 Nm)	A/R
*Check swing bearing bolts for security after first 50 hours of operation and every 600 hours thereafter. (See Swing Bearing in Section 3.)		
NOTE: *When maintenance becomes necessary or a fastener has loosened, refer to the Torque Chart to determine proper torque value.*		

1.5 LUBRICATION

Hydraulic Oil

Table 1-18. Hydraulic Oil

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE	SAE VISCOSITY GRADE
+0° to +180° F (-18° C to +83° C)	10W
+0° F to +210° F (-18° C to +99° C)	10W-20, 10W-30
+50° F to +210° F (+10° C to +210° 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 Industries recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity index of 152.*

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

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 Kendall Hyken 052 or Mobilfluid 424 is desired, contact JLG Industries for proper recommendations.

Table 1-19. Mobilfluid 424 Specs

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

Table 1-20. Mobil DTE 10 Excel 32 Specs

ISO Viscosity Grade	#32
Gravity API	
Pour Point, Max	-65.2°F (-54°C)
Flash Point, Min.	482°F (250°C)
Viscosity	
at 40° C	32.7 cSt
at 100° C	6.6 cSt
at 100° F	32.7 cSt
at 212° F	6.6 cSt
cp at -30° F	
Viscosity Index	164
Density@ 15°C	0.85 Kg/l
Density@ 60°F	0.03 lb/in^3

Table 1-21. Exxon Univis HVI 26 Specs

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

Table 1-22. Quintolubric 888-46

Density	0.91 @ 15°C (59°F)
Pour Point	<-20°C (<-4°F)
Flash Point	275°C (527°F)
Fire Point	325°C (617°F)
Autoignition Temperature	450°C (842°F)
Viscosity	
at 0° C (32°F)	360 cSt
at 20° C (68°F)	102 cSt
at 40° C (104°F)	46 cSt
at 100° C (212°F)	10 cSt
Viscosity Index	220

Table 1-23. Mobil EAL 224H Specs (USA Build machine)

ISO Viscosity Grade	32/46
Specific Gravity	0.922
Pour Point	-25°F (-32°C)
Flash Point	428°F (220°C)
Operating Temperature	0 - 180°F (-17°-162°C)
Viscosity	
at 40° C	37 cSt
at 100° C	8.4 cSt
Viscosity Index	213

Table 1-24. Mobil EAL Envirosyn H46 Specs

ISO Viscosity Grade	#46
Pour Point	-49°F (-45°C)
Flash Point, Min.	500°F (260°C)
Viscosity	
at 40° C	48.8 cSt
at 100° C	7.8 cSt
Viscosity Index	145
Density@15°C	0.874

Table 1-25. Mobil SHC Hydraulic EAL 46 Specs

ISO Viscosity Grade	#46
Pour Point	-27°F (-33°C)
Flash Point, Min.	568°F (298°C)
Viscosity	
at 40° C	43.3 cSt
at 100° C	7.7 cSt
Viscosity Index	149
Density@15°C	0.93

1.6 PRESSURE SETTINGS

Table 1-26. Pressure Settings

Main Relief	3000 PSI (206.85 Bar)
Main Boom Lift Down	1200 PSI (83 Bar)
Swing	1700 PSI (117.2 Bar)
Platform Level Forward	2800 PSI (193 Bar)
Platform Level Backward	1800 PSI (124 Bar)
Steer (2WS)	1800 PSI (124 Bar)
Steer Reliefs - 4WS Front & Rear	2500 PSI (172 Bar)
Jib Boom Up	1500 PSI (103 Bar)
Jib Boom Down	1200 PSI (83 Bar)

1.7 CYLINDER SPECIFICATIONS

Table 1-27. Cylinder Specifications - 600A

DESCRIPTON	BORE in. (mm)	STROKE in. (mm)	ROD DIA. in. (mm)
Tower Lift	6.5 (165.1)	34.0625 (865.2)	2.5 (63.5)
Tower Telescope	3 (76.2)	63.75 (1619.3)	2 (50.8)
Upright Level	6 (152.4)	34.625 (879.5)	3 (76.2)
Main Lift	4 (101.6)	36.13 (917.7)	2.5 (63.5)
Main Telescope	3 (76.2)	177.74 (4514.9)	2 (50.8)
Steer (2WD/2WS)	2.5 (63.5)	8.812 (204.7)	1.25 (31.8)
Steer (4WD/2WS)	2.5 (63.5)	10.75 (273.1)	1.25 (31.8)
Lockout (2WD)	5 (127)	4 (101.6)	3.5 (88.9)
Lockout (4WD)	3.5 (88.9)	3.875 (98.4)	2.5 (63.5)
Master	3 (76.2)	8.5 (215.9)	1.5 (38.1)
Slave	3 (76.2)	8.5 (215.9)	1.5 (38.1)

Table 1-28. Cylinder Specifications - 600AJ

DESRIPTON	BORE	STROKE	ROD DIA.
Tower Lift	6.5 (165.1)	34.0625 (865.2)	2.5 (63.5)
Tower Telescope	3 (76.2)	63.75 (1619.3)	2 (50.8)
Upright Level	6 (152.4)	34.625 (879.5)	3 (76.2)
Main Lift	4 (101.6)	36.625 (930.3)	2.5 (63.5)
Main Telescope	3 (76.2)	134.36 (3413.1)	2 (50.8)
Steer (2WD/2WSI	2.5 (63.5)	8.812 (204.7)	1.25 (31.8)
Steer (4WD/2WS)	2.5 (63.5)	10.75 (273.1)	1.25 (31.8)
Lockout (2WD)	5 (127)	4 (101.6)	3.5 (88.9)
Lockout (4WD)	3.5 (88.9)	3.875 (98.4)	2.5 (63.5)
Master	3.5 (88.9)	13.068 (331.8)	1.5 (38.1)
Slave	3.5 (88.9)	13.062 (331.8)	1.5 (38.1)
Lift (Jib Boom)	3 (76.2)	25.5 (647.7)	1.5 (38.1)

1.8 MAJOR COMPONENT WEIGHTS

Table 1-29. Major Component Weights - 600A

	LB.	KG.
Platform Control Console	250	113
Platform Level Cylinder	46	21
Main Boom (Includes Lift Cyl., Rotator, and Support)	1832	831
Upright including Master Cylinder	547	248
Upright Level Cylinder	316	143
Tower Boom Complete	1218	553
Turntable Complete (including engine)	9240	4191
Chassis Complete (w/pneumatic tires)	6834	3100
Chassis Complete (w/foam-filled tires)	7918	3592
Pneumatic Tire & Wheel Assembly	235	107
Foam-filled Tire & Wheel Assembly	440	200
Segmented Tire & Wheel Assembly	320	145.5
Machine Complete (GVW) - 2WD w/pneumatic tires	20700	9390
Machine Complete (GVW) - 4WD w/pneumatic tires	21150	9594

Table 1-30. Major Component Weights - 600AJ

	LB.	KG.
Platform Control Console	250	113
Platform Level Cylinder	60	27
Main Boom (Includes Lift Cyl., Rotator, and Support)	1685	764
Upright including Master Cylinder	547	248
Upright Level Cylinder	316	143
Tower Boom Complete	1218	553
Turntable Complete (including engine)	9740	4418
Chassis Complete (w/pneumatic tires)	6834	3100
Chassis Complete (w/foam-filled tires)	7918	3592
Pneumatic Tire & Wheel Assembly	235	107
Foam-filled Tire & Wheel Assembly	440	200
Segmented Tire & Wheel Assembly	320	145.5
Machine Complete (GVW) - 2WD w/pneumatic tires	22100	10025
Machine Complete (GVW) - 4WD w/pneumatic tires	22295	10113

1.9 CRITICAL STABILITY WEIGHTS

⚠ WARNING

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

Table 1-31. Critical Stability Weights - 600A

		LB.	KG.
Tire and Wheel (Ballasted Only)	Size (14-17.5)	165	75
Engine	Ford	460	209
	Deutz	534	242
	Continental	558	253
Counterweight	Weight	5700	2586
Platform	6 ft. (1.83 M)	205	93
	8 ft. (2.44 M)	230	105

Table 1-32. Critical Stability Weights - 600AJ

		LB.	KG.
Tire and Wheel (Ballasted Only)	Size (14-17.5)	165	75
Engine	Ford	460	209
	Deutz	534	242
	Continental	558	253
Counterweight	Weight	6200	2812
Platform	6 ft. (1.83 M)	205	93
	8 ft. (2.44 M)	230	105

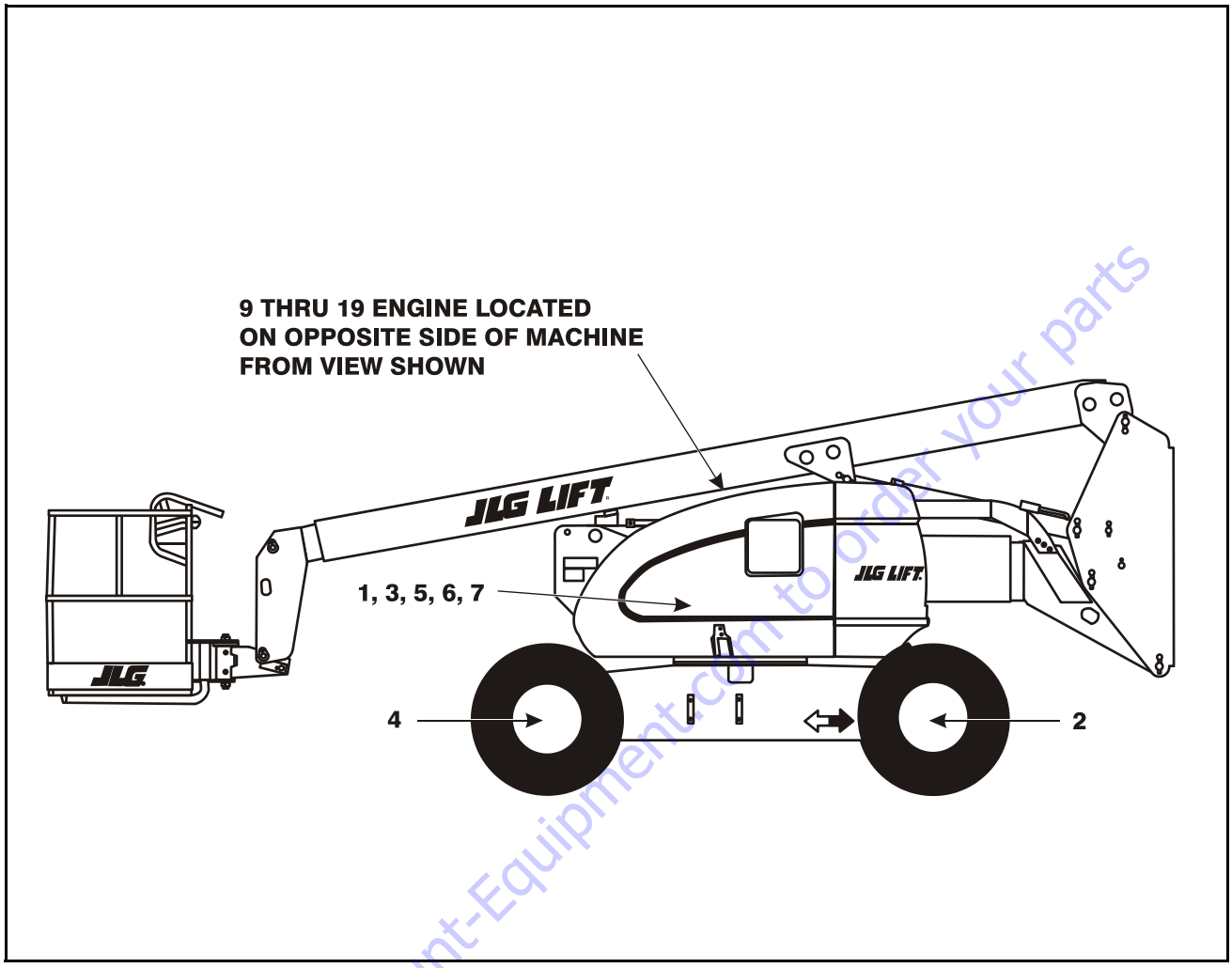


Figure 1-1. Maintenance and Lubrication Diagram

1.10 OPERATOR MAINTENANCE

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

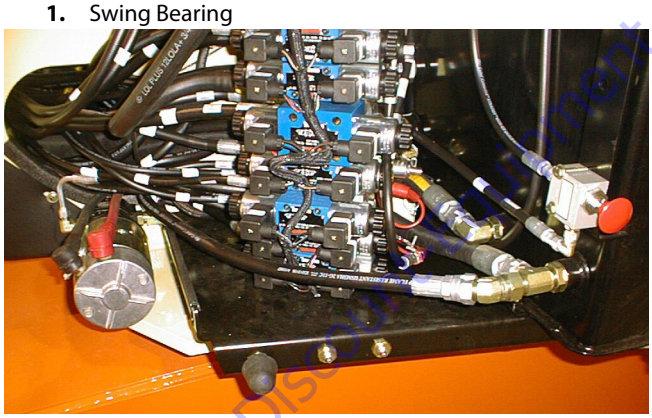
Table 1-33. Lubrication Specifications

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350° F (177° C). Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.
HO	Hydraulic Oil. API service classification GL-3, e.g. Mobilfluid 424.
EO	Engine (crankcase) Oil. Gas - API SF, SH, SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C.

NOTICE

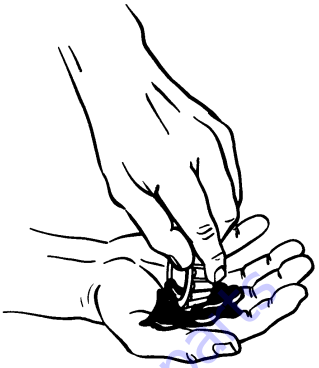
LUBRICATION INTERVALS ARE BASED ON MACHINE OPERATION UNDER NORMAL CONDITIONS. FOR MACHINES USED IN MULTI-SHIFT OPERATIONS AND/OR EXPOSED TO HOSTILE ENVIRONMENTS OR CONDITIONS, LUBRICATION FREQUENCIES MUST BE INCREASED ACCORDINGLY.

1. Swing Bearing



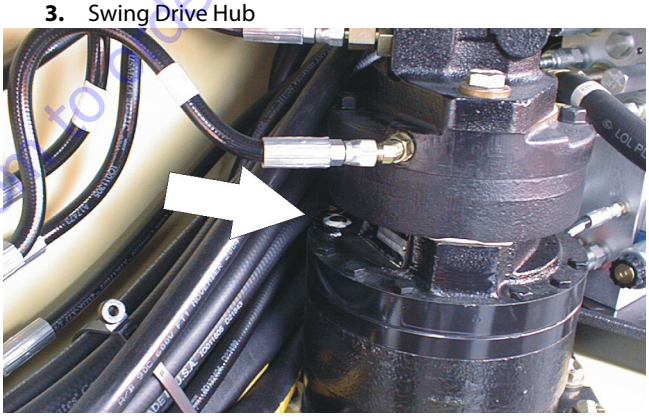
Lube Point(s) - 2 Grease Fittings
Capacity - A/R
Lube - MPG
Interval - Every 3 months or 150 hrs of operation
Comments - Remote Access

2. Wheel Bearings



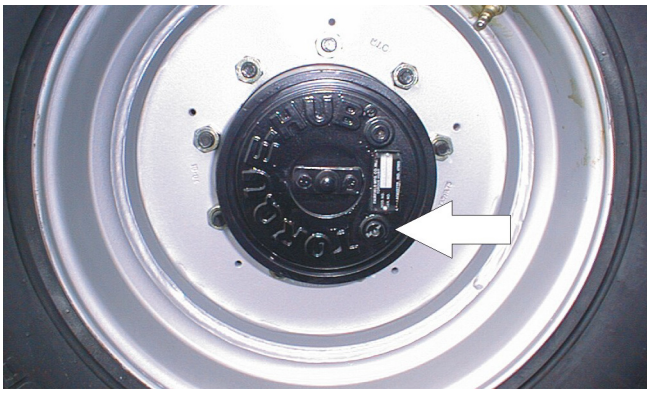
Lube Point(s) - Repack
Capacity - A/R
Lube - MPG
Interval - Every 2 years or 1200 hours of operation

3. Swing Drive Hub



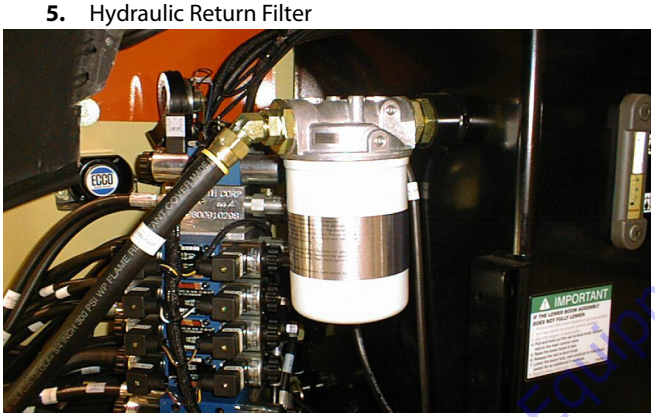
Lube Point(s) - Level/Fill Plug
Capacity - 17 oz. (1/2 Full)
Lube - EPGL
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation.

4. Wheel Drive Hub



Lube Point(s) - Level/Fill Plug
Capacity - 17 oz. (1/2 Full)
Lube - EPGL
Interval - Check level every 3 months or 150 hrs of operation; change every 2 years or 1200 hours of operation.

5. Hydraulic Return Filter

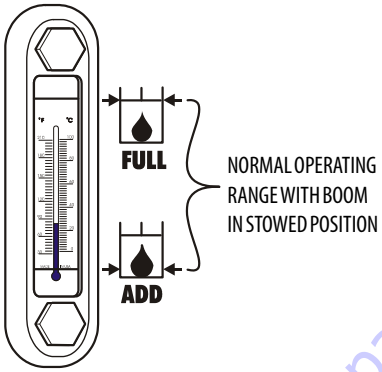


Interval - Change after first 50 hrs and every 6 months or 300 hrs thereafter or as indicated by Condition Indicator.

6. Hydraulic Charge Filter

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

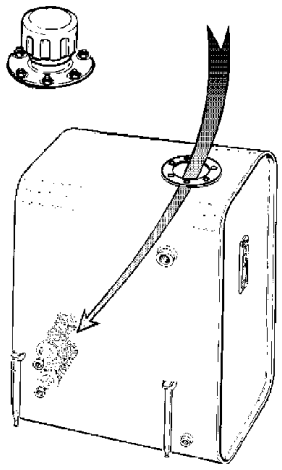
7. Hydraulic Tank



Lube Point(s) - Fill Cap
Capacity - 31 gal. (117.3 L) Tank; 37.2 gal. (140.8 L) System
Lube - HO
Interval - Check Level daily; Change every 2 years or 1200 hours of operation.

8. Suction Strainers (in tank)

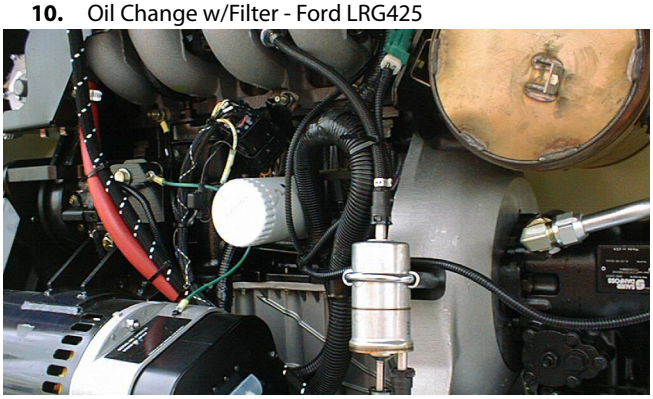
REMOVE FILL CAP PLATE FROM TANK TO GAIN ACCESS TO STRAINERS



Lube Point(s) - 2
Interval - Every 2 years or 1200 hours of operation, remove and clean at time of hydraulic oil change.

9. Oil Change w/Filter - Ford LRG423
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 5 Quarts
Lube - EO
Interval - 3 Months or 150 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

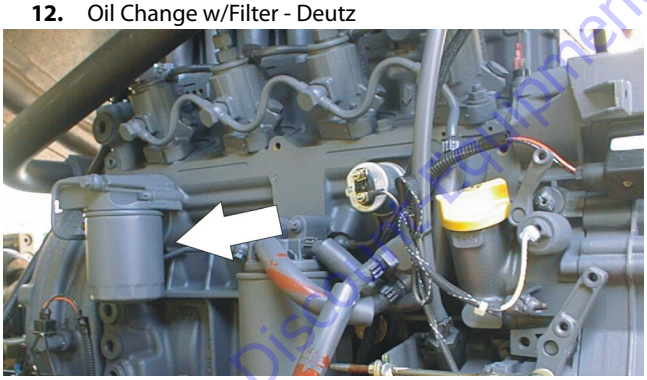
10. Oil Change w/Filter - Ford LRG425



Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 4.5 Quarts
Lube - EO
Interval - 3 Months or 150 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

11. Oil Change w/Filter - Continental
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 6 Quarts
Lube - EO
Interval - 3 Months or 150 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

12. Oil Change w/Filter - Deutz

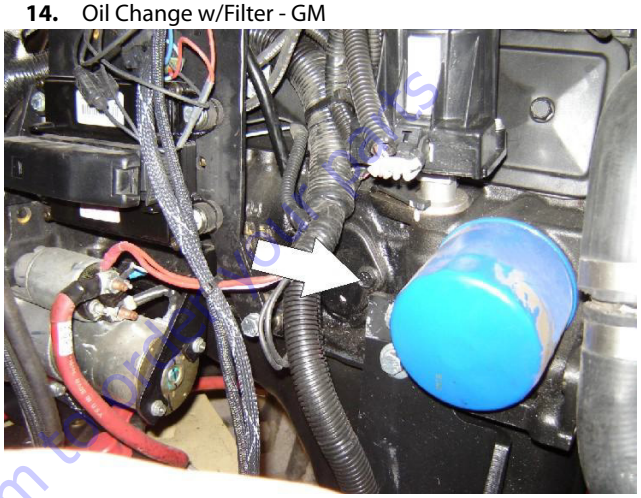


Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 11 Quarts Crankcase; 5 Quarts Cooler
Lube - EO
Interval - Every Year or 1200 hours of operation
Comments - Check oil level, fill oil to max marking on the dipstick. Check level daily/Change in accordance with engine manual.

13. Oil Change w/Filter - Caterpillar

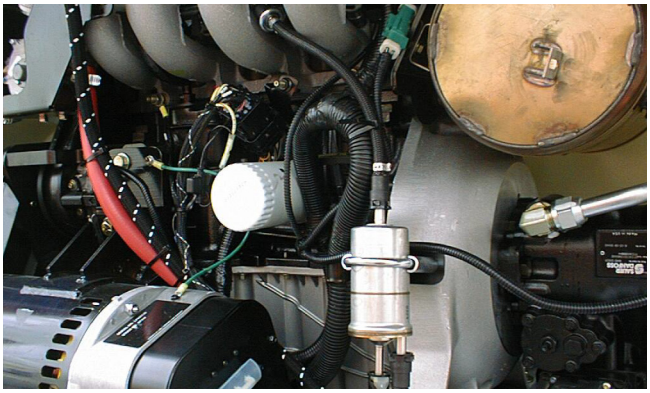
Lube Point(s) - Fill Cap/Spin-on Element
Capacity - 10.6 Quarts
Lube - EO
Interval - 3 Months or 150 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

14. Oil Change w/Filter - GM



Lube Point(s) - Fill Cap/Spin-on Element
(JLG P/N 7027965)
Capacity - 4.5 qt. (4.25 L) w/filter
Lube - EO
Interval - 3 Months or 150 hours of operation
Comments - Check level daily/Change in accordance with engine manual.

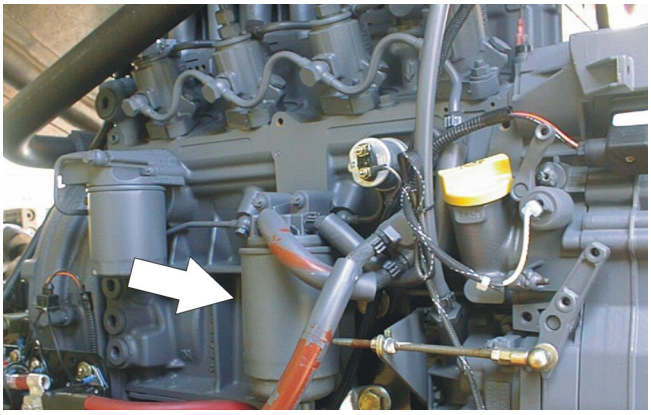
15. Fuel Filter - Ford



Lube Point(s) - Replaceable Element
Interval - Every Year or 1200 hours of operation

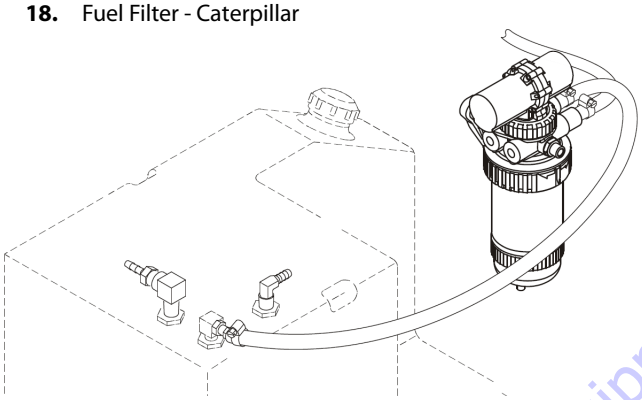
16. Fuel Filter - Continental
Lube Point(s) - Replaceable Element
Interval - Every Year or 600 hours of operation

17. Fuel Filter - Deutz



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

18. Fuel Filter - Caterpillar



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

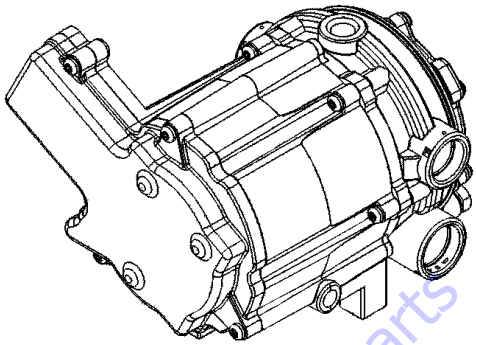
19. Fuel Filter (Gasoline) - GM

Lube Point(s) - Replaceable Element
Interval - Every 6 months or 300 hours of operation

20. Air Filter

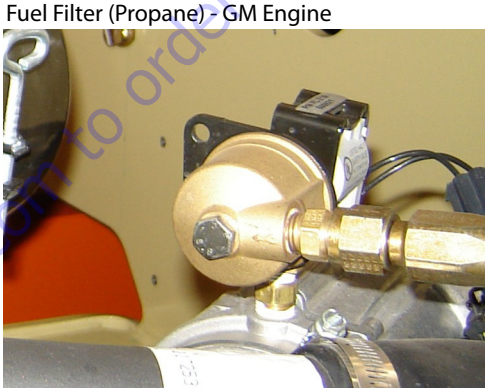
Lube Point(s) - Replaceable Element
Interval - Every 6 months or 300 hours of operation or as indicated by the condition indicator

21. Electronic Pressure Regulator (LP only)



Interval - 3 Months or 150 hours of operation
Comments - Drain oil build up. Refer to Draining Oil Build Up from the Propane Regulator (Prior to SN 0300132529).

22. Fuel Filter (Propane) - GM Engine



Interval - 3 Months or 150 hours of operation
Comments - Replace filter. Refer to Propane Fuel Filter Replacement.

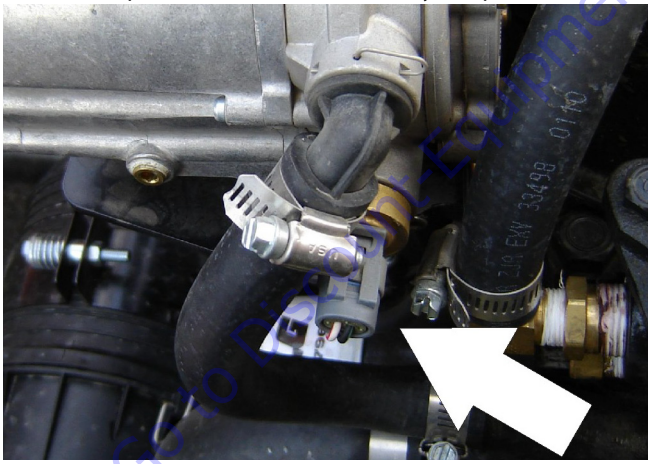
1.11 DRAINING OIL BUILD UP FROM THE PROPANE REGULATOR (PRIOR TO SN 0300132529)

During the course of normal operation oils may build inside the primary and secondary chambers of the propane pressure regulator. These oils may be a result of poor fuel quality, contamination of the fuel supply chain, or regional variation in the make up of the fuel. If the build up of the oil is significant this can effect the operation of the fuel control system. Refer to Section 1.10, Operator Maintenance for maintenance intervals. More frequent draining may be required if the fuel supply has been contaminated.

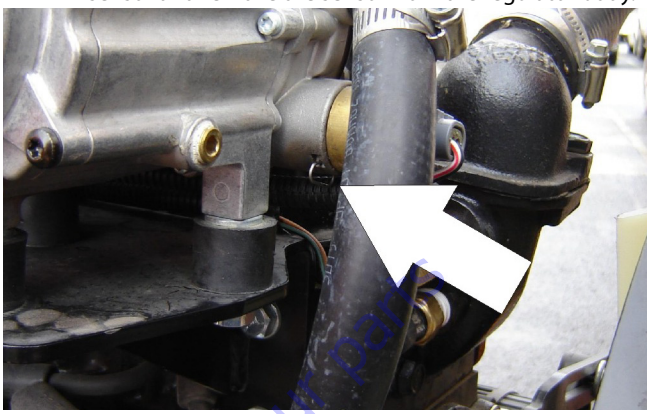
NOTICE

FOR BEST RESULTS WARM THE ENGINE TO OPERATING TEMPERATURE BEFORE DRAINING. THIS WILL ALLOW THE OILS TO BE LIQUID AND FLOW FREELY FROM THE REGULATOR.

1. Move the equipment to a well ventilated area. Ensure there are no external ignition sources.
2. Start the engine and bring to operating temperature.
3. With the engine running, close the manual tank valve and run the engine out of fuel.
4. Push in the Emergency Switch once the engine stops.
5. Disconnect the electrical connection to the LPG fuel temperature sensor in the auxiliary fuel port of the EPR.



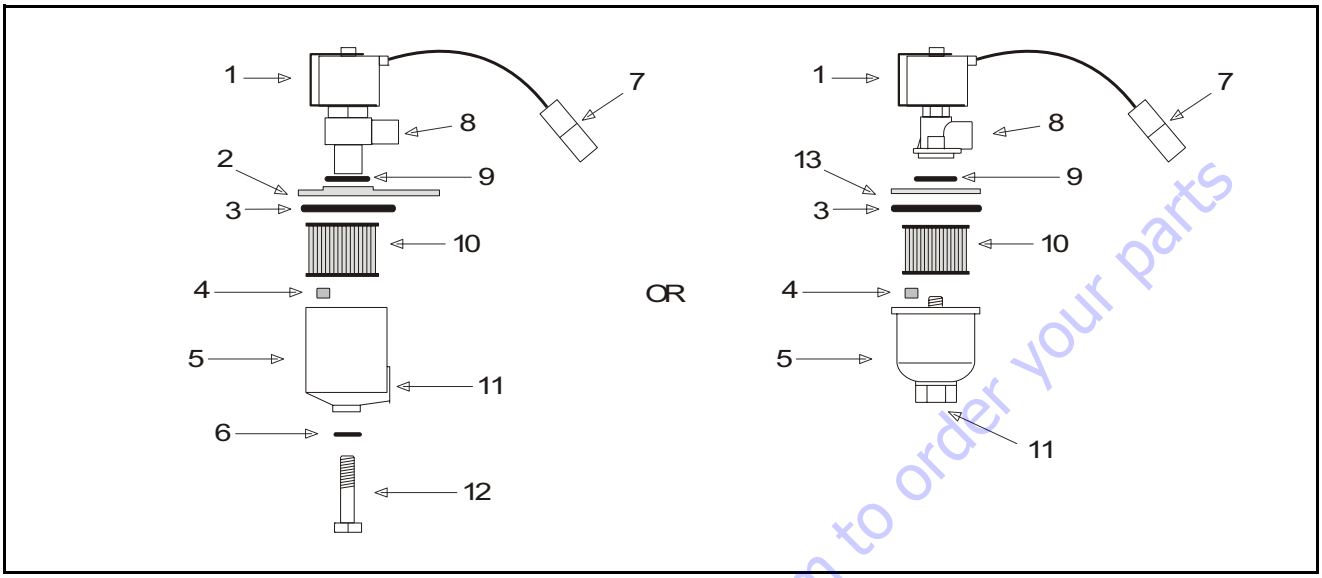
6. Remove the retainer clip for the LPG fuel temperature sensor and remove the sensor from the regulator body.



NOTE: *Have a small container ready to collect oil that will drain freely from the regulator at this point.*

7. Once all of the oil has been drained, reinstall the LPG fuel temperature sensor and reconnect the electrical connector.
8. Open the fuel tank manual valve.
9. Start the engine and verify all connections are secure.
10. Dispose of any drained oil in a safe and proper fashion.

1.12 PROPANE FUEL FILTER REPLACEMENT



1. Electric Lock Off Solenoid
2. Mounting Plate
3. Housing Seal
4. Filter Magnet
5. Filter Housing
6. Seal
7. Electrical Connector
8. Fuel Outlet
9. O-ring
10. Filter
11. Fuel Inlet
12. Retaining Bolt
13. Ring

Figure 1-2. Filter Lock Assembly

Removal

1. Relieve the propane fuel system pressure. Refer to Propane Fuel System Pressure Relief.
2. Disconnect the negative battery cable.
3. Slowly loosen the Filter housing and remove it.
4. Pull the filter housing from the Electric lock off assembly.
5. Remove the filter from the housing.
6. Locate Filter magnet and remove it.
7. Remove and discard the housing seal.
8. If equipped, remove and discard the retaining bolt seal.
9. Remove and discard mounting plate to lock off O-ring seal.

Installation

NOTICE

BE SURE TO REINSTALL THE FILTER MAGNET INTO THE HOUSING BEFORE INSTALLING NEW SEAL

1. Install the mounting plate to lock off O-ring seal.
2. If equipped, install the retaining bolt seal.
3. Install the housing seal.
4. Drop the magnet into the bottom of the filter housing.
5. Install the filter into the housing.
6. If equipped, install the retaining bolt into the filter housing.
7. Install the filter up to the bottom of the electric lock off.
8. Tighten the filter bowl retainer to 106 in.lbs. (12 Nm).
9. Open manual shut-off valve. Start the vehicle and leak check the propane fuel system at each serviced fitting. Refer to Propane Fuel System Leak Test.

1.13 PROPANE FUEL SYSTEM PRESSURE RELIEF

⚠ CAUTION

THE PROPANE FUEL SYSTEM OPERATES AT PRESSURES UP TO 312 PSI (21.5 BAR). TO MINIMIZE THE RISK OF FIRE AND PERSONAL INJURY, RELIEVE THE PROPANE FUEL SYSTEM PRESSURE (WHERE APPLICABLE) BEFORE SERVICING THE PROPANE FUEL SYSTEM COMPONENTS.

To relieve propane fuel system pressure:

1. Close the manual shut-off valve on the propane fuel tank.
2. Start and run the vehicle until the engine stalls.
3. Turn the ignition switch OFF.

⚠ CAUTION

RESIDUAL VAPOR PRESSURE WILL BE PRESENT IN THE FUEL SYSTEM. ENSURE THE WORK AREA IS WELL VENTILATED BEFORE DISCONNECTING ANY FUEL LINE.

1.14 SERIAL NUMBER LOCATIONS

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

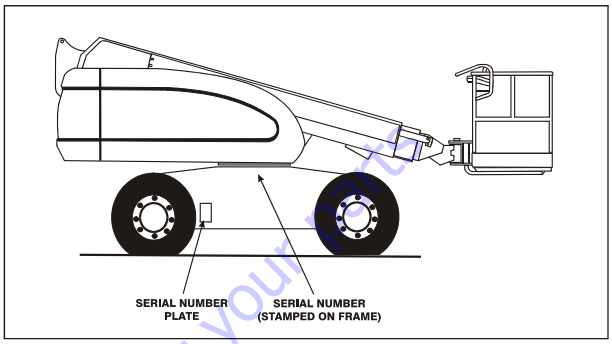


Figure 1-3. Serial Number Locations

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

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

NO. 5000059 REV. K

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

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

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

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

NO. 5000059 REV. K

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

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

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

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

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

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

NO. 5000059 REV. K

Figure 1-6. Torque Chart (SAE Fasteners - Sheet 3 of 5)

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

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

NO. 5000059 REV. K

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

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

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

Figure 1-7. Torque Chart (SAE Fasteners - Sheet 4 of 5)

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

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

NO. 5000059 REV. K

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

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

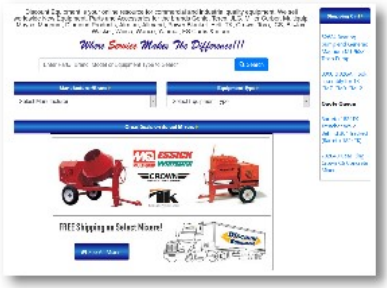
4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

Figure 1-8. Torque Chart (SAE Fasteners - Sheet 5 of 5)

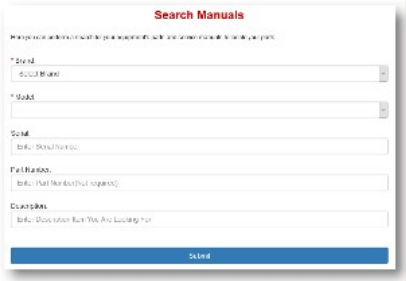
PARTS FINDER

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

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: 561-964-4949 Outside Florida TOLL FREE: 877-690-3101

Need parts?

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

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

SECTION 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.

Preparation, Inspection, and Maintenance

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

Pre-Start Inspection

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

Preventative Maintenance

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

Reference the 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	Operator 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.
Preventative 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.
2. JLG recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152.

NOTE: *Start-up of hydraulic system with oil temperatures below -15 degrees F (-26 degrees C) is not recommended. If it is necessary to start the system in a sub-zero environment, it will be necessary to heat the oil with a low density, 100VAC heater to a minimum temperature of -15 degrees F (-26 degrees C).*

3. The only exception to the above is to drain and fill the system with Mobil DTE 13 oil or its equivalent. This will allow start up at temperatures down to -20 degrees F (-29 degrees C). However, use of this oil will give poor performance at temperatures above 120 degrees F (49 degrees C). Systems using DTE 13 oil should not be operated at temperatures above 200 degrees F (94 degrees C) under any condition.

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 TEST

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 "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: *The information is based on 6 drops per minute cylinder leakage.*

Cylinder Thermal Drift

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

2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

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

2.6 WELDING ON JLG EQUIPMENT

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

Do the Following When Welding on JLG Equipment

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

Do NOT Do the Following When Welding on JLG Equipment

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

NOTICE

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

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL		
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection	Every 2 Years
Boom Assembly			
Boom Weldments	1,2,4	1,2,4	
Hose/Cable Carrier Installations	1,2,9,12	1,2,9,12	
Pivot Pins and Pin Retainers	1,2	1,2	
Sheaves, Sheave Pins	1,2	1,2	
Bearings	1,2	1,2	
Wear Pads	1,2	1,2	
Covers or Shields	1,2	1,2	
Extend/Retract Chain or Cable Systems	1,2,3	1,2,3	
Boom Assembly	1,2,3,4,5	1,2,3,4,5,7,9,14	
Platform Assembly			
Platform		1,2	
Railing	1	1,2	
Gate	1,5	1,5	
Floor	1	1,2	
Rotator	5,9,15	5,9,15	
Lanyard Anchorage Point	1,2,10	1,2,10	
Turntable Assembly			
Swing Bearing	1,2,14	1,2,3,13,14	
Oil Coupling	9	9	
Swing Drive System	11	11	
Turntable Lock	1,2,5	1,2,5	
Hood, Hood Props, Hood Latches	5	1,2,5	
Chassis Assembly			
Tires	16,17,18	16,17,18	
Wheel Nuts/Bolts	15	15	
Wheel Bearings			14,24
Oscillating Axle/Lockout Cylinder Systems	5,8	5,8	
Extendable Axle Systems	5,8	5,8	
Steer Components	1,2	1,2	
Spindle Thrust Bearing/Washers	1,2	1,2	
Drive Hubs	11	11	

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL		
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection	Every 2 Years
Functions/Controls			
Platform Controls	5,6	6	
Ground Controls	5,6	6	
Function Control Locks, Guards, or Detents	1,5	5	
Footswitch	5	5	
Emergency Stop Switches (Ground & Platform)	5	5	
Function Limit or Cutout Switch Systems	5	5	
Drive Brakes	5	5	
Swing Brakes	5	5	
Auxiliary Power	5	5	
Power System			
Engine Idle, Throttle, and RPM	3	3	
Engine Fluids (Oil, Coolant, Fuel)	9,11	11	
Air/Fuel Filter	1,7	7	
Exhaust System	1,9	9	
Batteries	1,9	19	
Battery Fluid	11	11	
Battery Charger	5	5	
Fuel Reservoir, Cap, and Breather	1,2,5	1,5	
Hydraulic/Electric System			
Hydraulic Pumps	1,2,9	1,2,9	
Hydraulic Cylinders	1,2,7,9	1,2,9	
Cylinder Attachment Pins and Pin Retainers	1,2,9	1,2	
Hydraulic Hoses, Lines, and Fittings	1,2,9,12	1,2,9,12	
Hydraulic Reservoir, Cap, and Breather	1,2,5,9	1,5	24
Hydraulic Filter	1,7,9	7	
Hydraulic Fluid	7,11	7,11	
Electrical Connections	1,20	20	
Instruments, Gauges, Switches, Lights, Horn	1	5,23	
General			
Operation and Safety Manuals in Storage Box	21	21	
ANSI and AEM Manuals/Handbooks Installed (ANSI Markets Only)		21	
Capacity Decals Installed, Secure, Legible	21	21	
All Decals/Placards Installed, Secure, Legible	21	21	

Table 2-3. Inspection and Preventive Maintenance Schedule

AREA	INTERVAL		
	Pre-Delivery[1] or Frequent[2] Inspection	Annual[3] (Yearly) Inspection	Every 2 Years
Annual Machine Inspection Due		21	
No Unauthorized Modifications or Additions	21	21	
All Relevant Safety Publications Incorporated	21	21	
General Structural Condition and Welds	2,4	2,4	
All Fasteners, Pins, Shields, and Covers	1,2	1,2	
Grease and Lubricate to Specifications	22	22	
Function Test of All Systems	21	21,22	
Paint and Appearance	7	7	
Stamp Inspection Date on Frame		22	
Notify JLG of Machine Ownership		22	

Footnotes:

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

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

[3] Annually, no later than 13 months from the date of the prior inspection

Performance Codes:

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

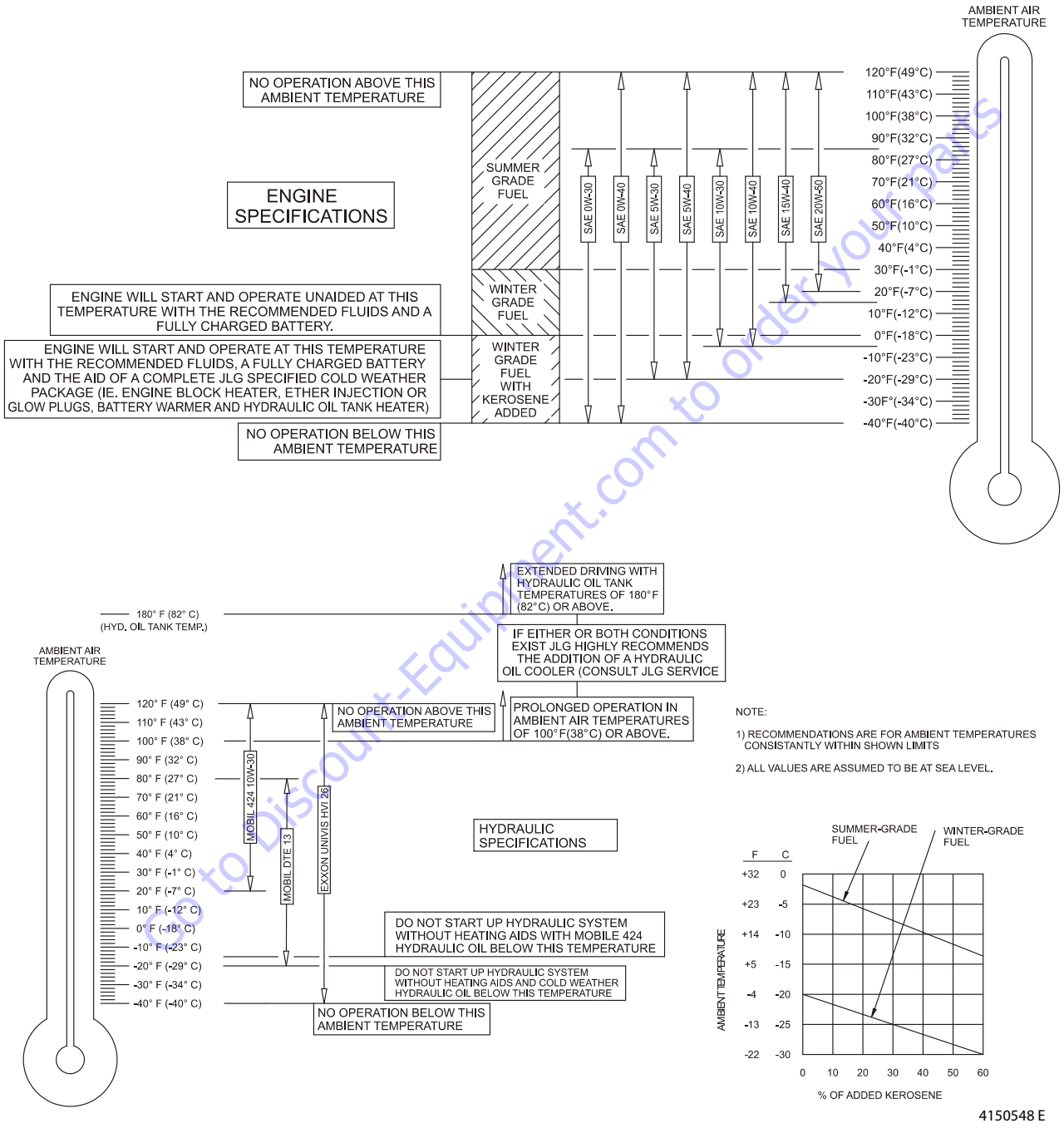


Figure 2-1. Engine Operating Temperature Specifications - Deutz

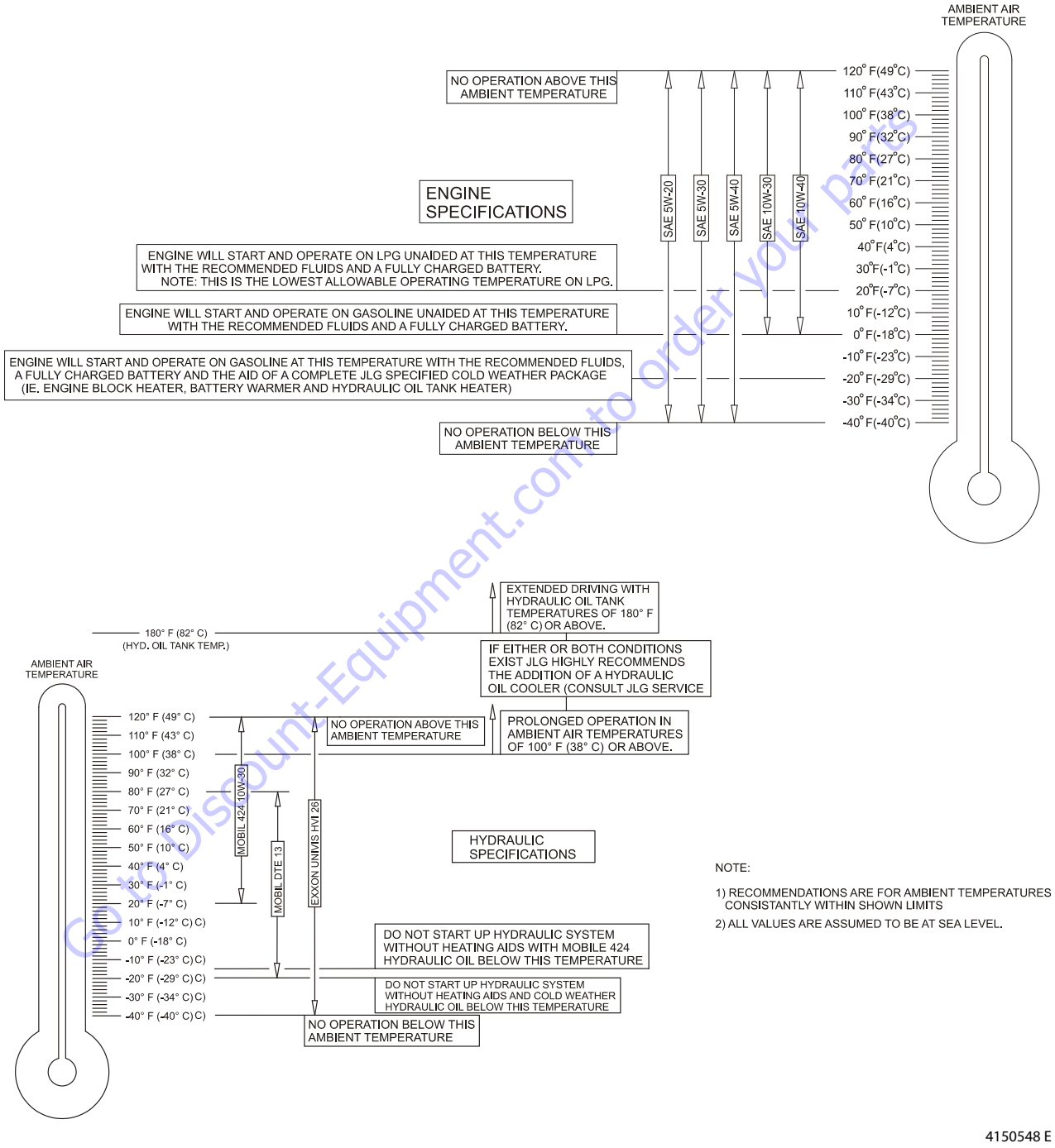


Figure 2-2. Engine Operating Temperature Specifications - Ford

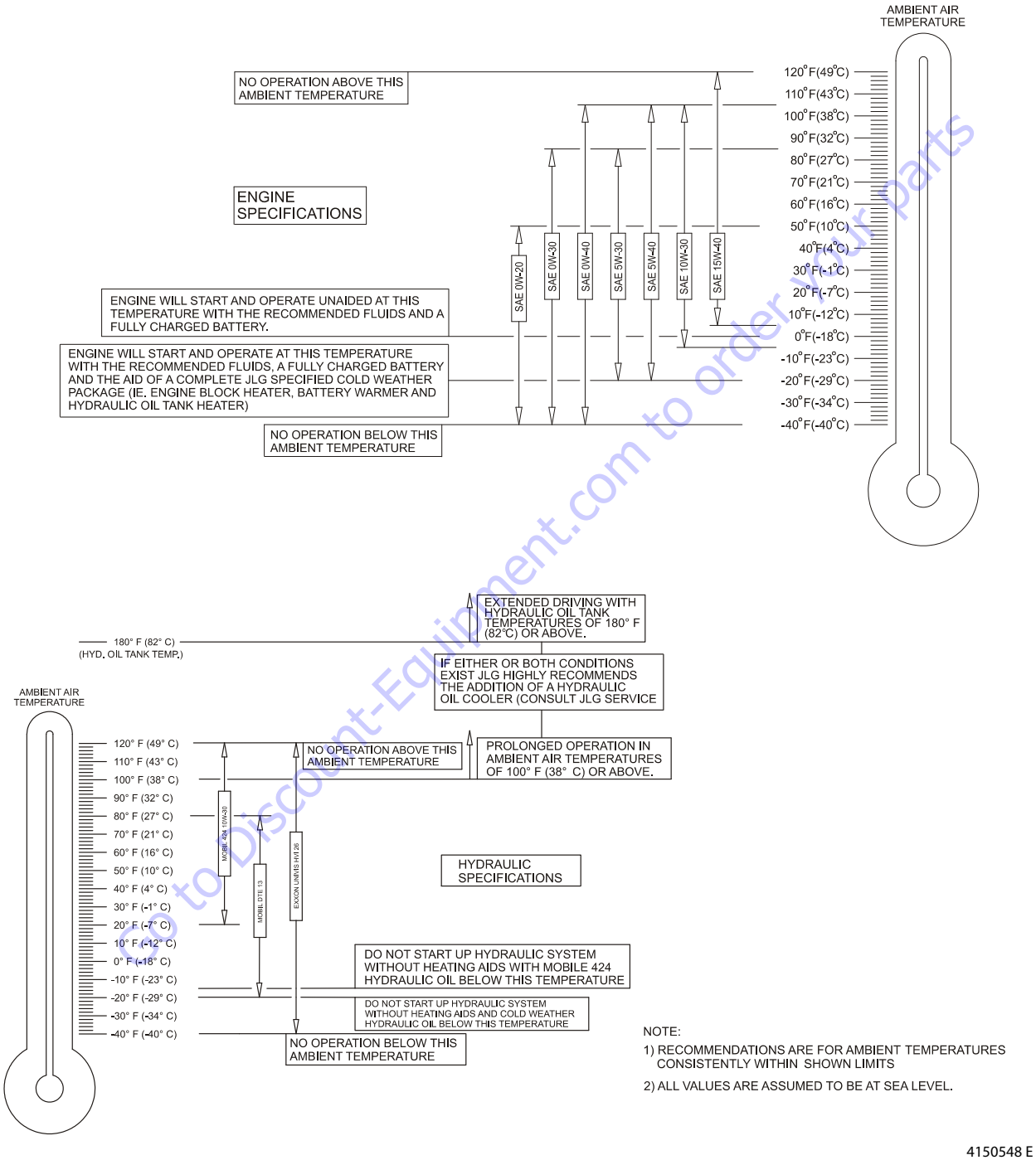


Figure 2-3. Engine Operating Temperature Specifications - Caterpillar

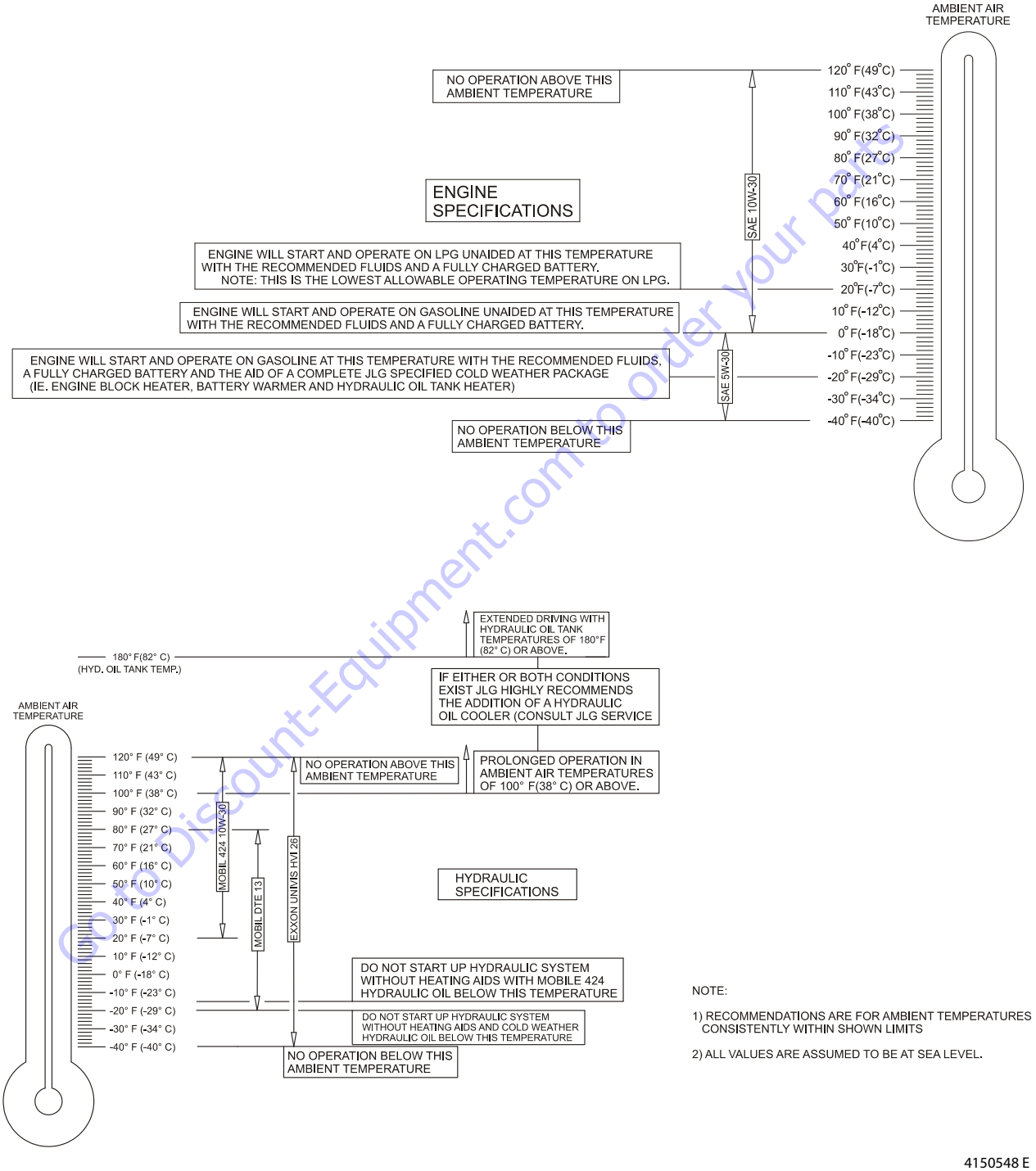
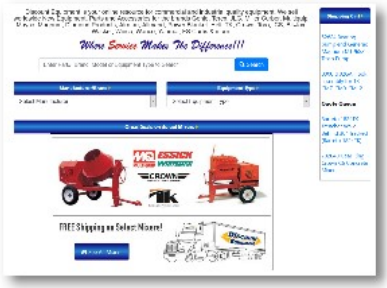


Figure 2-4. Engine Operating Temperature Specifications - GM

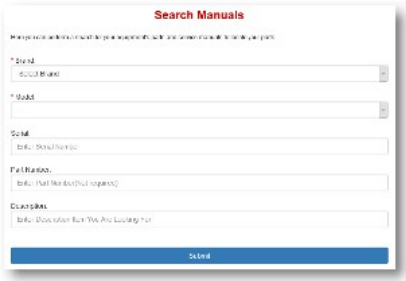
PARTS FINDER

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

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: 561-964-4949 Outside Florida TOLL FREE: 877-690-3101

Need parts?

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

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

SECTION 3. CHASSIS & TURNTABLE

3.1 TIRES & WHEELS

Tire Inflation

The air pressure for pneumatic tires must be equal to the air pressure that is stenciled on the side of the JLG product or rim decal for safe and proper operational characteristics.

Tire Damage

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

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

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

If a tire is damaged but is within the above noted criteria, the tire must be inspected on a daily basis to ensure the damage has not propagated beyond the allowable criteria.

Tire Replacement

JLG recommends a replacement tire be the same size, ply and brand as originally installed on the machine. Please refer to the JLG Parts Manual for the part number of the approved tires for a particular machine model. If not using a JLG approved replacement tire, we recommend that replacement tires have the following characteristics:

- Equal or greater ply/load rating and size of original.
- Tire tread contact width equal or greater than original.
- Wheel diameter, width, and offset dimensions equal to the original.

Unless specifically approved by JLG Industries Inc. do not replace a foam filled or ballast filled tire assembly with a pneumatic tire. When selecting and installing a replacement tire, ensure that all tires are inflated to the pressure recommended by JLG. Due to size variations between tire brands, both tires on the same axle should be the same.

Wheel Replacement

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

Wheel Installation

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

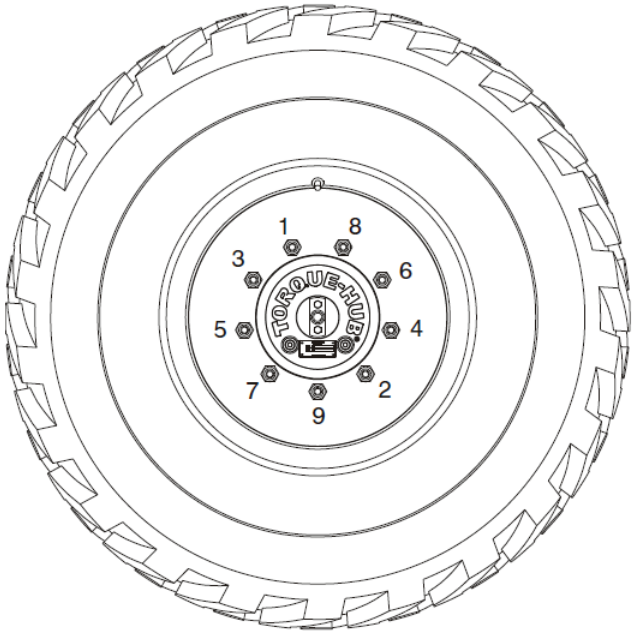
⚠ WARNING

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

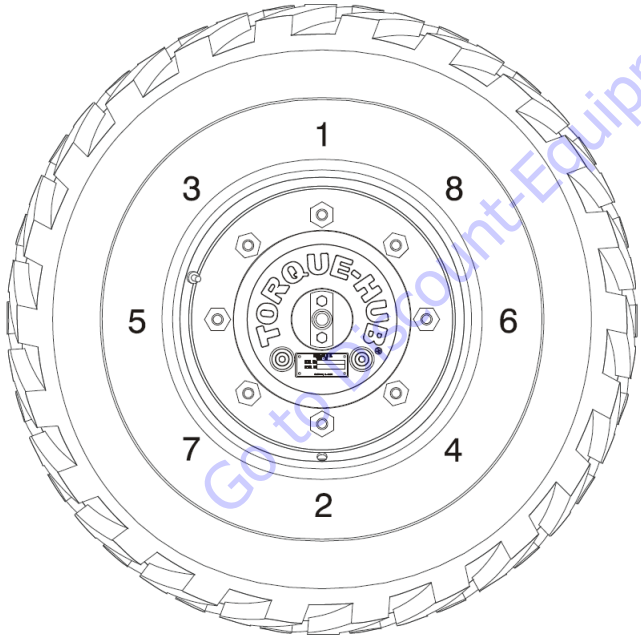
Tighten the lug nuts to the proper torque to prevent wheels from coming loose. Use a torque wrench to tighten the fasteners. If you do not have a torque wrench, tighten the fasteners with a lug wrench, then immediately have a service garage or dealer tighten the lug nuts to the proper torque. Over-tightening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

1. Start all nuts by hand to prevent cross threading. DO NOT use a lubricant on threads or nuts.

2. Tighten nuts in the following sequence.



9 LUG PATTERN



8 LUG PATTERN

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

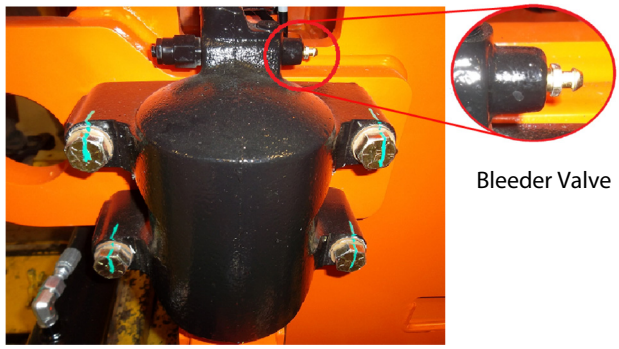
Table 3-1. Wheel Torque Chart

TORQUE SEQUENCE		
1st Stage	2nd Stage	3rd Stage
40 ft. lbs. (55 Nm)	95 ft. lbs. (130 Nm)	170 ft. lbs. (230 Nm)

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

3.2 LOCKOUT CYLINDER BLEEDING

1. Start the engine.
2. Position the turntable to the normal stowed position.
3. Attach clear tubing to bleeder valve nipple.
4. Position a small bucket/bottle in front of the lockout cylinder bleeder valve and insert clear tubing.
5. Using a 3/8 in. wrench, loosen the bleeder valve, turning counterclockwise slowly. Bleed air from the top of lockout cylinder. Capture hydraulic oil until a steady unbroken stream of hydraulic oil is viewed. Tighten/close the bleeder valve while stream of hydraulic oil is running.
6. Locate the bleeder valve on the opposite side lockout cylinder. Repeat the process.



Bleeder Valve

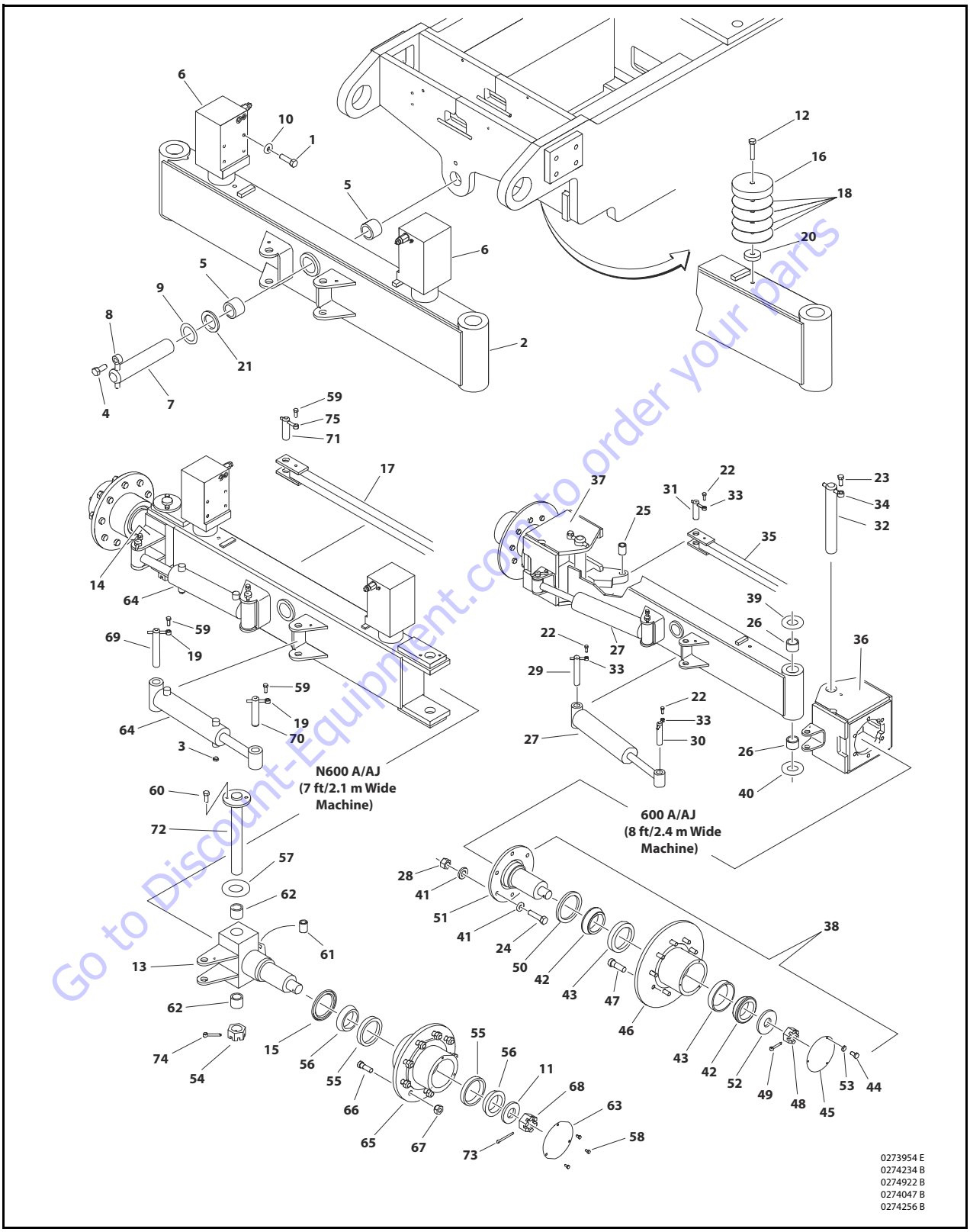


Figure 3-1. 2WD Front Axle And Steering Installations

1. Compound Locking
2. Wide Machine with Tow Package
3. Plug
4. Bolt
5. Bushing
6. Lockout Cylinder Assembly
7. Pivot Pin
8. Keeper Pin
9. Thrust Washer
10. Flatwasher
11. Hardened Flatwasher
12. Bolt
13. Spindle (Left Side)
14. Spindle (Right Side)
15. Seal
16. Stop Plate
17. Tie-Rod
18. Shim
19. Keeper Pin
20. Spacer
21. Shim
22. Bolt
23. Bolt
24. Bolt
25. Bushing
26. Bushing
27. Steer Cylinder Assembly
28. Nut
29. Pin
30. Pin
31. Pin
32. Kingpin
33. Keeper Pin
34. Keeper Pin
35. Tie-Rod
36. Spindle (Left Side)
37. Spindle (Right Side)
38. Hub Assembly
39. Thrust Washer
40. Thrust Washer
41. Flatwasher
42. Bearing Cone
43. Bearing Cup
44. Screw
45. Hub cap
46. Hub
47. Wheel Stud
48. Slotted Nut
49. Cotter Pin
50. Seal
51. Spindle Adapter
52. Hardened Flatwasher
53. Lockwasher #10
54. Slotted Nut
55. Bearing Cup
56. Bearing Cone
57. Thrust Washer
58. Bolt
59. Bolt
60. Bolt
61. Bushing
62. Bushing
63. Hub Cap
64. Steer Cylinder Assembly
65. Hub
66. Wheel Stud
67. Wheel Nut
68. Slotted Nut
69. Pin
70. Pin
71. Pin
72. Kingpin
73. Cotter Pin
74. Cotter Pin

Figure 3-2. 2WD Front Axle And Steering Installations

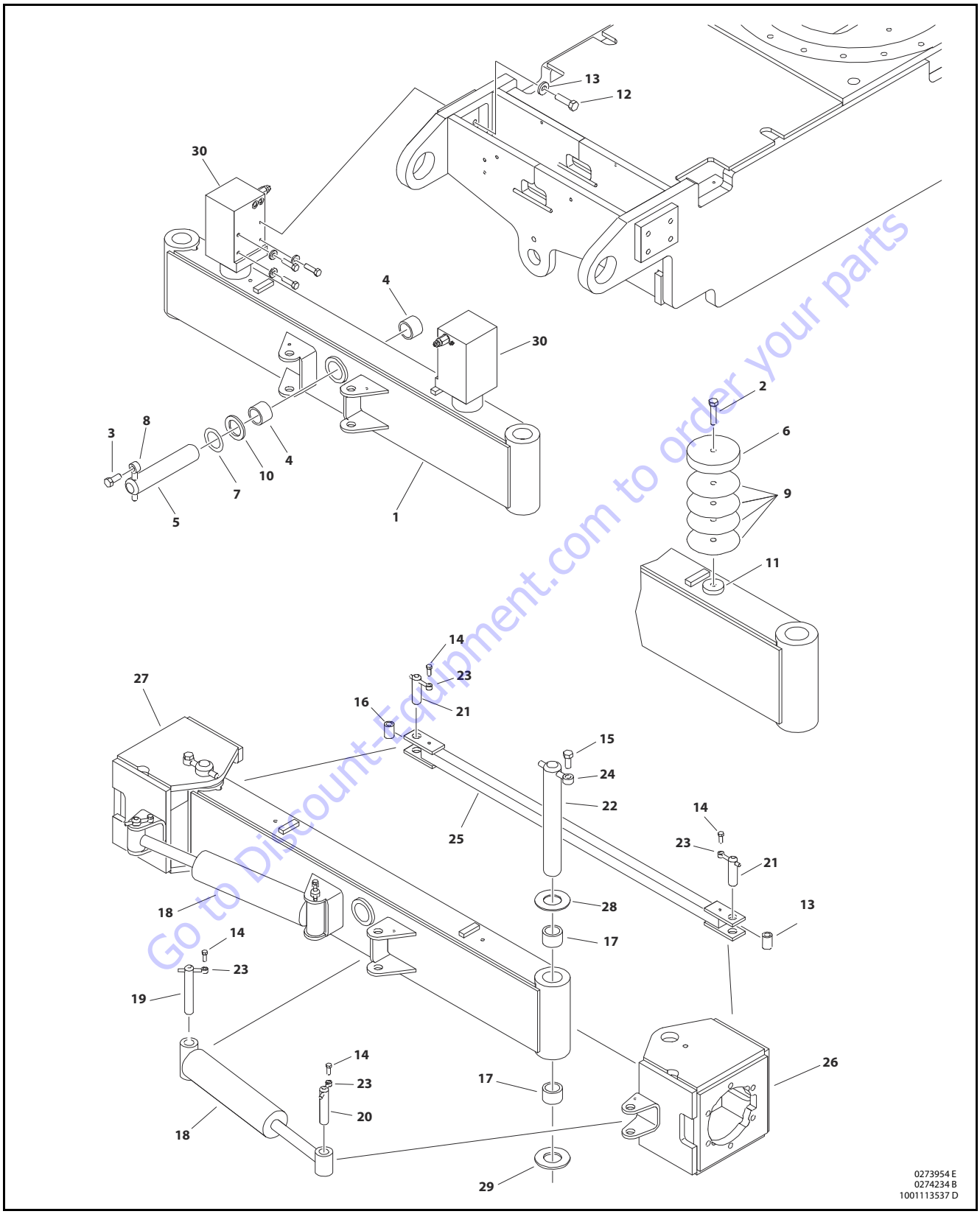
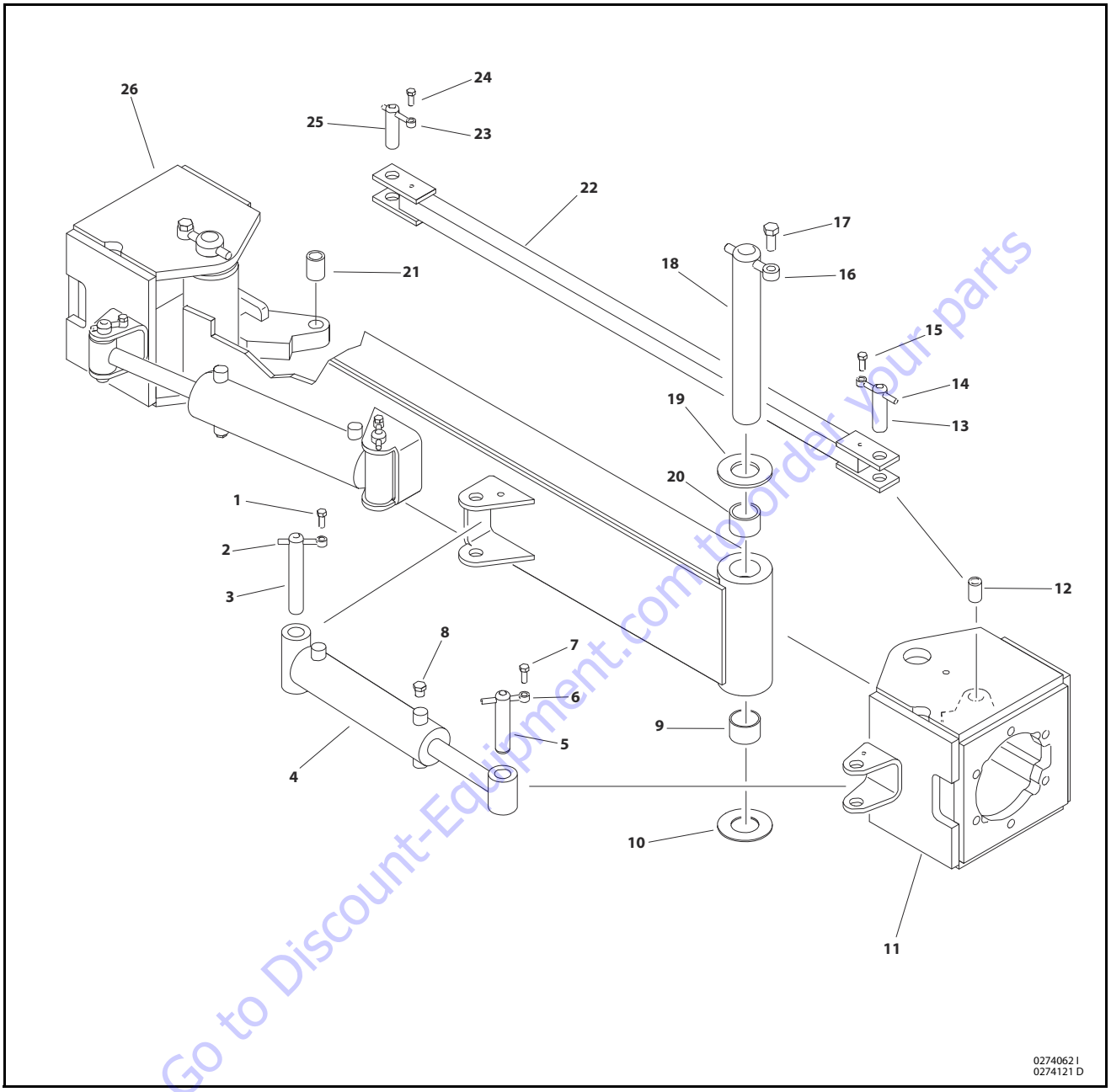


Figure 3-3. 4WD Front Axle And Steering Installations

1. Axle Weldment
2. Bolt
3. Bolt
4. Bushing
5. Pivot Pin
6. Stop Plate
7. Shim
8. Keeper Pin
9. Shim
10. Thrust Washer
11. Spacer
12. Bolt
13. Flatwasher
14. Bolt
15. Bolt
16. Bushing
17. Bushing
18. Steer Cylinder Assembly
19. Pin
20. Pin
21. Pin
22. Kingpin
23. Keeper Pin
24. Keeper Pin
25. Tie-Rod
26. Spindle (Left Side)
27. Spindle (Right Side)
28. Thrust Washer
29. Thrust Washer
30. Lockout Cylinder Assembly

Figure 3-4. 4WD Front Axle And Steering Installations



1. Bolt
2. Keeper
3. Pin
4. Steer Cylinder
5. Pin
6. Keeper
7. Bolt
8. Plug
9. Bushing
10. Thrust Washer
11. Spindle (Left Side)
12. Bushing
13. Pin
14. Keeper
15. Bolt
16. Keeper
17. Bolt
18. Kingpin
19. Thrust Washer
20. Bushing
21. Bushing
22. Tie-Rod
23. Keeper
24. Bolt
25. Pin
26. Spindle (Right Side)

Figure 3-5. 4WS Rear Steering Installations

3.3 OSCILLATING AXLE LOCKOUT TEST

NOTICE

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

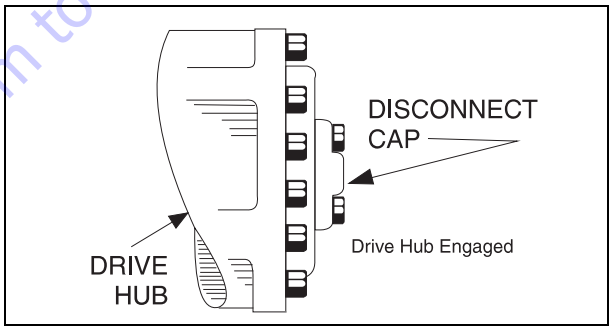
NOTE: *Ensure boom is fully retracted, lowered, and centered between drive wheels prior to beginning lockout cylinder test.*

1. Place a 6 in. (15.2 cm) high block with ascension ramp in front of left front wheel.
2. From platform control station, activate machine hydraulic system.
3. Place FUNCTION SPEED CONTROL and DRIVE SPEED/ TORQUE SELECT control switches to their respective LOW positions.
4. Place DRIVE control lever to FORWARD position and carefully drive machine up ascension ramp until left front wheel is on top of block.
5. Carefully activate SWING control lever and position boom over right side of machine.
6. With boom over right side of machine, place DRIVE control lever to REVERSE and drive machine off of block and ramp.
7. Have an assistant check to see that left front wheel remains locked in position off of ground.
8. Carefully activate SWING control lever and return boom to stowed position (centered between drive wheels). When boom reaches center, stowed position, lockout cylinders should release and allow wheel to rest on ground, it may be necessary activate DRIVE to release cylinders.
9. Place the 6 in. (15.2 cm) high block with ascension ramp in front of right front wheel.
10. Place DRIVE control lever to FORWARD and carefully drive machine up ascension ramp until right front wheel is on top of block.
11. Carefully activate SWING control lever and position boom over left side of machine.
12. With boom over left side of machine, place DRIVE control lever to REVERSE and drive machine off of block and ramp.
13. Have an assistant check to see that right front wheel remains locked in position off of ground.
14. Carefully activate SWING control lever and return boom to stowed position (centered between drive wheels). When boom reaches center, stowed position, lockout cylinders should release and allow wheel to rest on ground, it may be necessary activate DRIVE to release cylinders.
15. If lockout cylinders do not function properly, have trained personnel correct the malfunction prior to any further operation.

3.4 FREE WHEELING OPTION

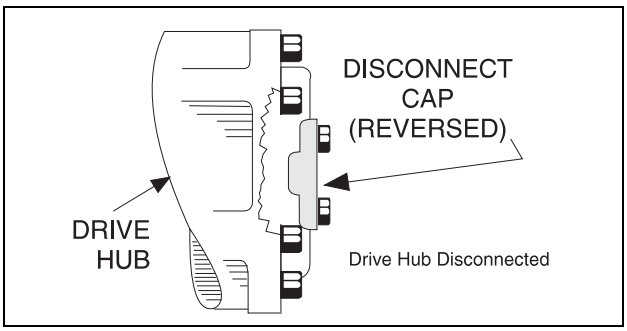
To Disengage Drive Motors and Brakes (Free Wheel) for Emergency Towing

1. Chock wheels securely if not on flat level surface.
2. Disconnect both drive hubs by reversing the disconnect caps in the center of the hubs.
3. If equipped, move steer/tow selector valve to float (tow) position by pulling control knob out.



To Engage Drive Motors and Brakes (Normal Operation)

1. If equipped, move steer/tow valve to steer position by pushing valve knob in.
2. Connect both drive hubs by inverting disconnect cap in center of hub.
3. Remove chocks from wheels as required.



3.5 WHEEL DRIVE ASSEMBLY

Removal

NOTE: *The drive motor can be removed through the axle flange as part of the wheel drive assembly or they can be removed separately through the bottom of the frame while leaving the torque hub bolted to the axle.*

1. Use a jack to lift the frame enough so the tire and wheel assembly is off of the ground. Place blocking strong enough to support the weight of the machine under the frame and remove the jack.

NOTE: *The pneumatic tire & wheel assembly weighs approximately 269 lbs. (122 kg). The foam-filled tire & wheel assembly weighs approximately 544 lbs. (247.25 kg).*

2. Remove the tire and wheel assembly.
3. Through the access holes in the axle, tag and disconnect the hydraulic lines running to the drive motor. Cap or plug all openings to ensure no dirt enters the hydraulic system.

NOTE: *The torque hub and drive motor assembly weighs approximately 270 lbs. (122 kg).*

4. Use a supporting device capable of handling the weight of the torque hub and drive motor and unbolt the torque hub from the frame. Remove the entire assembly from the machine.
5. Remove the bolts and washers that secure the drive motor to the torque hub and remove the drive motor. Remove and discard the o-ring between the drive motor and torque hub.

Installation

1. Install a new o-ring between the drive motor and torque hub. Install the bolts and washers to secure them together and torque to 110 ft. lbs. (149 Nm).
2. Place the torque hub flange against the mounting flange on the axle and fasten it in place with the bolts and washers. Torque the bolts to 170 ft. lbs. (298 Nm).
3. Install the tire and wheel assembly.

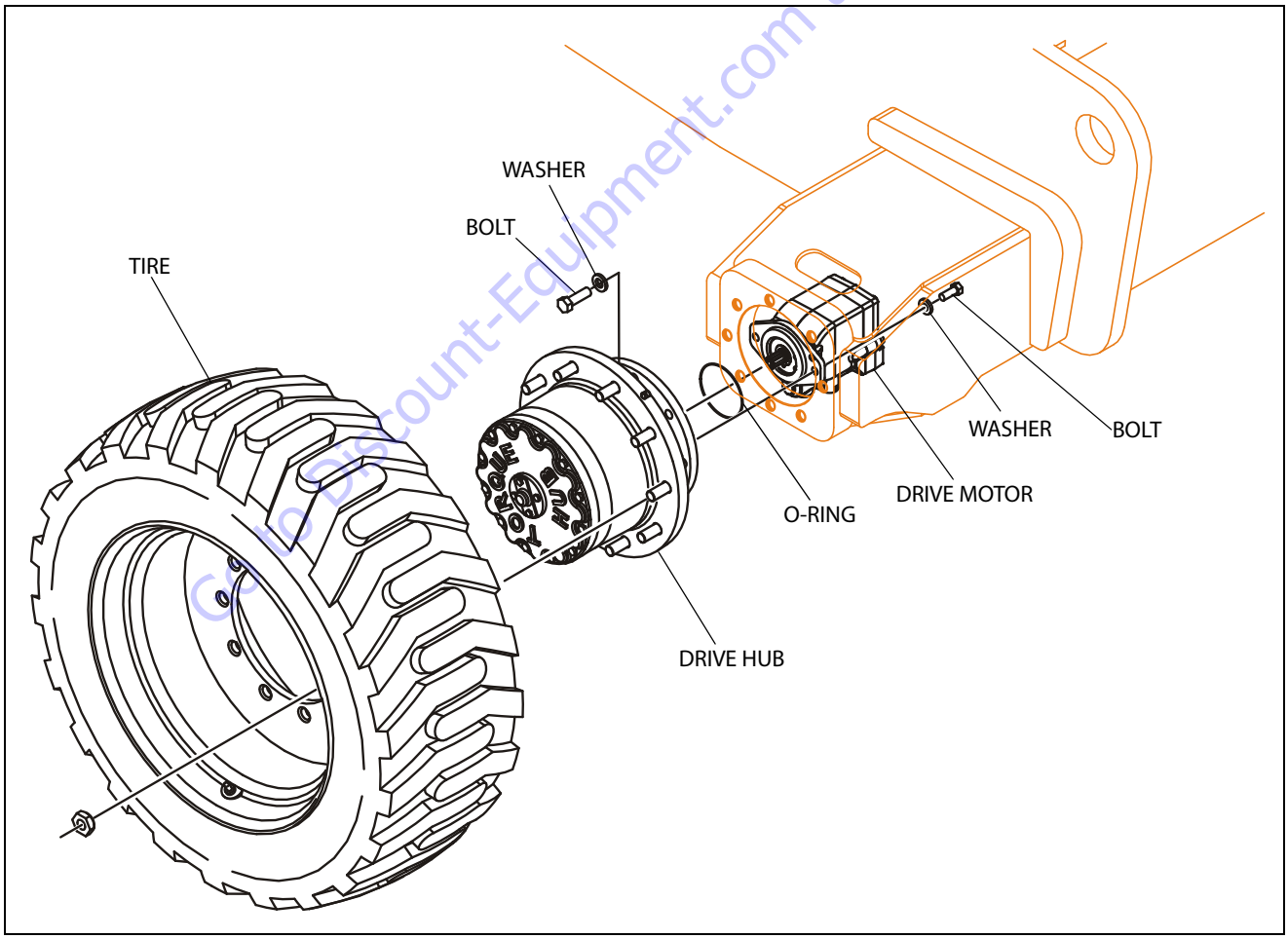


Figure 3-6. Wheel Drive Assembly

3.6 DRIVE HUB

ROLL, LEAK AND BRAKE TESTING

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

NOTE: *The brake must be released before performing the roll test. This can be accomplished by either pressurizing the brake using the Brake Leak Test procedure below or by tightening the bolts into the piston through the end plate (See Brake Disassembly Procedure).*

NOTE: *Bolts must be removed while performing brake release test.*

THE ROLL TEST

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

THE LEAK TEST (MAIN UNIT)

The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your leak checking fitting starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings or gaskets are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where the o-rings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, o-ring or gasket, the part must be replaced, and the unit rechecked. Leak test at 10 psi (0.7 bar) for 20 minutes.

THE BRAKE TEST

Reference: Sample Model 7HBE01F0B30057. The underlined letter is the brake option. Options are A, B, C, D, E or X.

A Input Brake	2,200 in. lbs. (248 Nm) Static, 280 psi (19.3 bar) Full Release 3000 psi (207 bar) maximum o-ring check.
B Input Brake	1,900 in. lbs. (215 Nm) Static, 240 psi (16.5 bar) Full Release 3000 psi (207 bar) maximum o-ring check.
C Input Brake	1,600 in. lbs. (181 Nm) Static, 200 psi (13.8 bar) Full Release 3000 psi (207 bar) maximum o-ring check.
D Input Brake	1,400 in. lbs. (158 Nm) Static, 180 psi (12.4 bar) Full Release 3000 psi (207 bar) maximum o-ring check.
E Input Brake	1,250 in. lbs. (141 Nm) Static, 160 psi (11.0 bar) Full Release 3000 psi (207 bar) maximum o-ring check.
X – No Brake	

If brake does not release at these pressure values, brake has to be inspected, repaired or replaced.

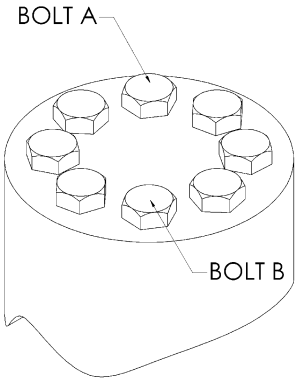
NOTE: *Failure to perform this test may result in damaged or ineffective brake parts.*

TIGHTENING AND TORQUING BOLTS

If an air impact wrench is used to tighten bolts, extreme care should be taken to ensure that the bolts are not tightened beyond their specified torque.

The following steps describe how to tighten and torque bolts or socket head capscrews in a bolt circle.

1. Tighten (but do not torque) bolt "A" until snug.
2. Go to the opposite side of the bolt circle and tighten bolt "B" until equally snug.
3. Crisscross around the bolt circle and tighten remaining bolts.
4. Now use a torque wrench to apply the specified torque to bolt "A".
5. Using the same sequence, crisscross around the bolt circle and apply an equal torque to the remaining bolts.



Main Disassembly

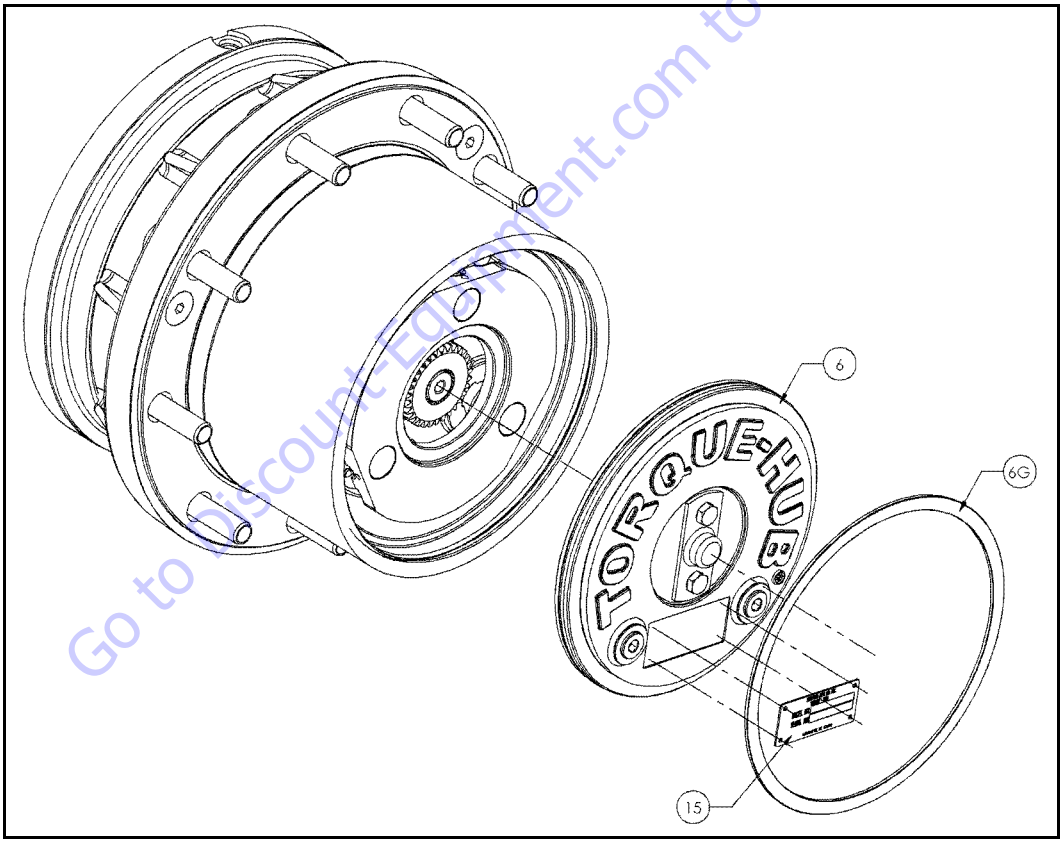
1. Perform roll check, leak check and brake check if applicable prior to disassembling the unit.
2. Drain oil from unit. Note the condition and volume of the oil.
3. Remove retaining ring (6G) by prying the open end of retaining ring out of the groove in the ring gear (1E) with a screwdriver, then grasp the loose end with pliers and pull the retaining ring completely out of the groove.
4. Remove the cover subassembly (6) from the unit. The unit can be carefully pressurized with air to pop the cover out of the unit.
5. Remove the first stage sun gear (10) if applicable.

NOTE: *On units with ratios greater than 36:1 numerically, there will not be a separate first stage sun gear (10), as the gear teeth will be integral to the input shaft (9).*

6. Remove the Input carrier subassembly (3).
7. Remove the input shaft (9).
8. Remove the second stage sun gear (11).

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

9. Loosen and remove the three flat head bolts (19) that retain the ring gear (1E) to the housing (1G).
10. Lift the ring gear (1E) off of the housing (1D).
11. Remove the O-ring (18) from between the housing (1D) and the ring gear (1E).
12. Using a 1/8 in. (3.175 mm) diameter punch, drive the roll pin (4G) into the planet shaft (4G) until it bottoms against the spindle (1A).
13. Grasp the roll pin (4G) using needle nosed pliers or some sort of hooked tool, and pull the planet shaft (4E) out of the spindle (1A).



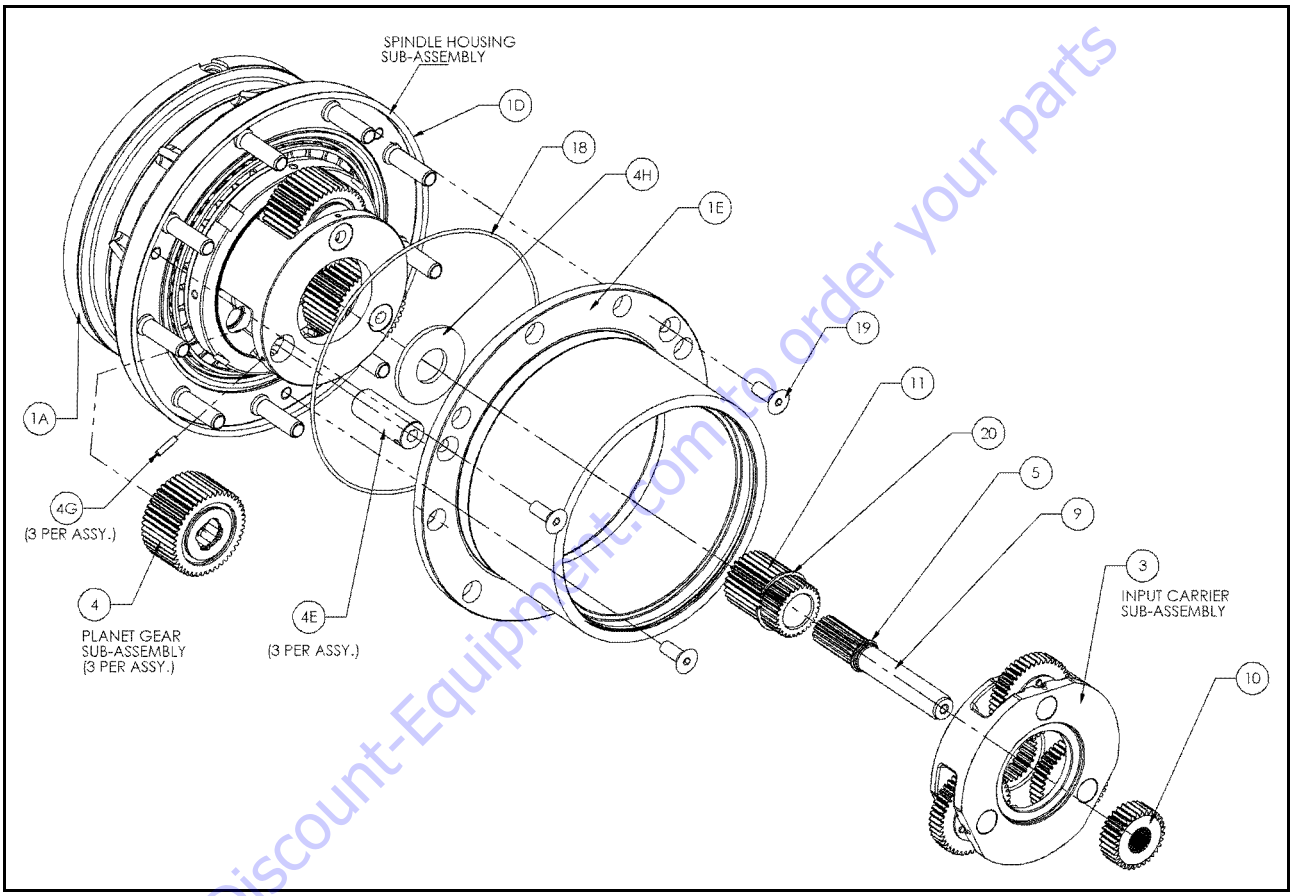
6. Cover
6G. Retaining Ring
15. ID Plate

Figure 3-7. Main Disassembly

14. Using a 1/8 in. (3.175 mm) diameter punch, drive the roll pin (4G) out of the planet shaft (4E).

NOTE: *The roll pins (4G) should not be reused when reassembling the unit.*

15. Slide the planet gear subassembly (4) out of the spindle (1A) being careful to not drop the needle bearings (4C) in the process.



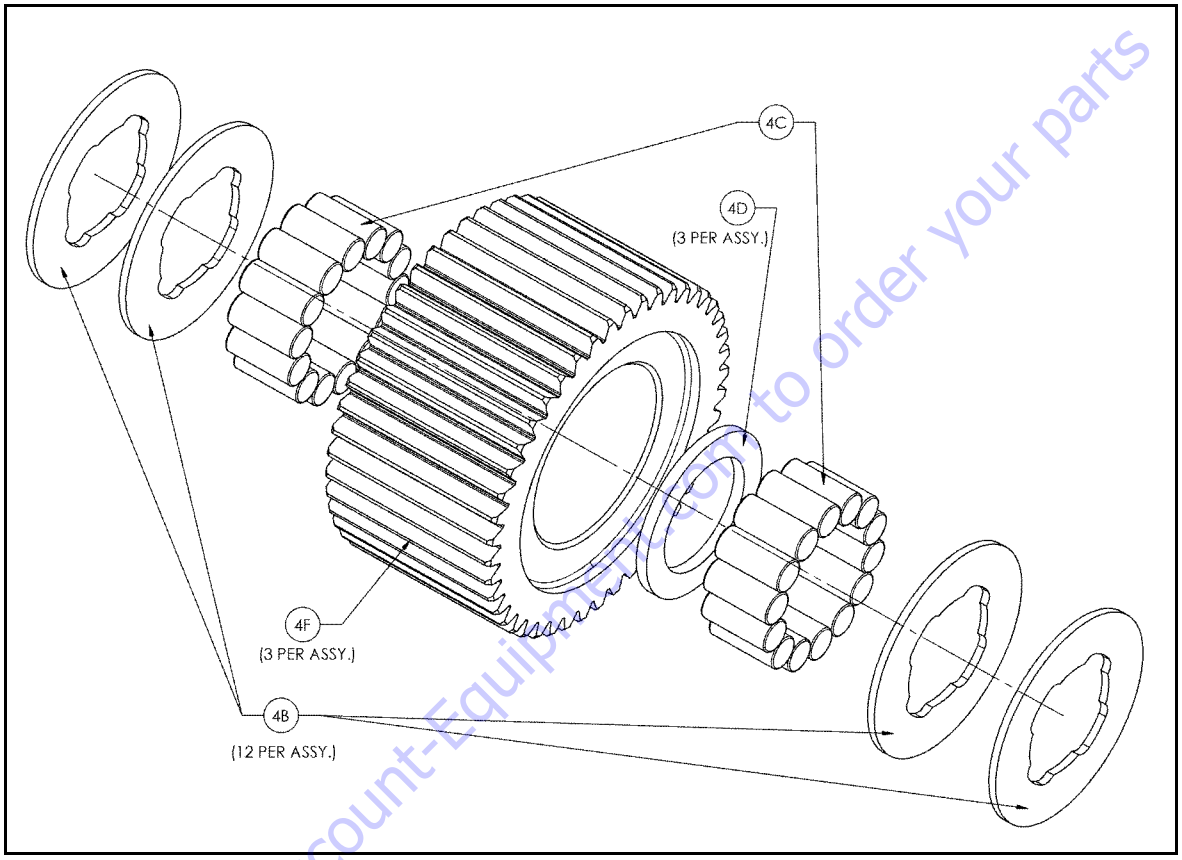
1A. Spindle
1D. Housing
1E. Ring Gear
3. Input Carrier
4. Planet Gear
4E. Planet Shaft
4G. Roll Pin
4H. Thrust Washer
5. Retaining Ring
9. Input Shaft
10. First Stage Sun Gear
11. Second Stage Sun Gear
18. O-ring
19. Bolt
20. Retaining Ring

Figure 3-8. Input Carrier

16. Remove 4 Thrust Washer (4B), 28 needle rollers (4C) and the thrust spacer (4D) from the second stage planet gear (4F).

17. Repeat Steps 12 though 16 for the remaining two planet gears (4F).

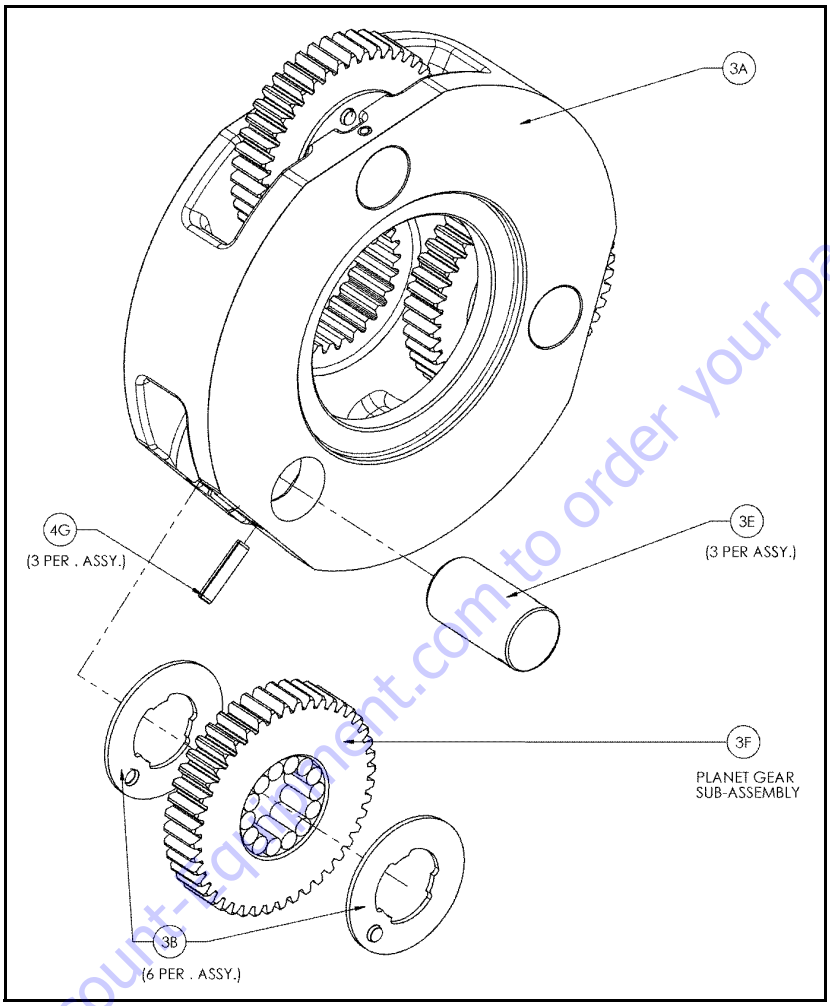
18. Remove the Thrust Washer (4H) from the counterbore in the spindle (1A).



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

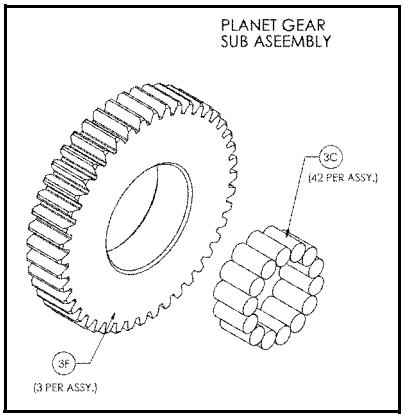
Figure 3-9. Planet Gear Sub Assembly

Input Carrier Disassembly



3A. Carrier
3B. Thrust Washer
3E. Planet Shaft
3F. Planet Gear
4G. Roll Pin

Figure 3-10. Input Carrier



3C. Needle Bearing
3F. Planet Gear

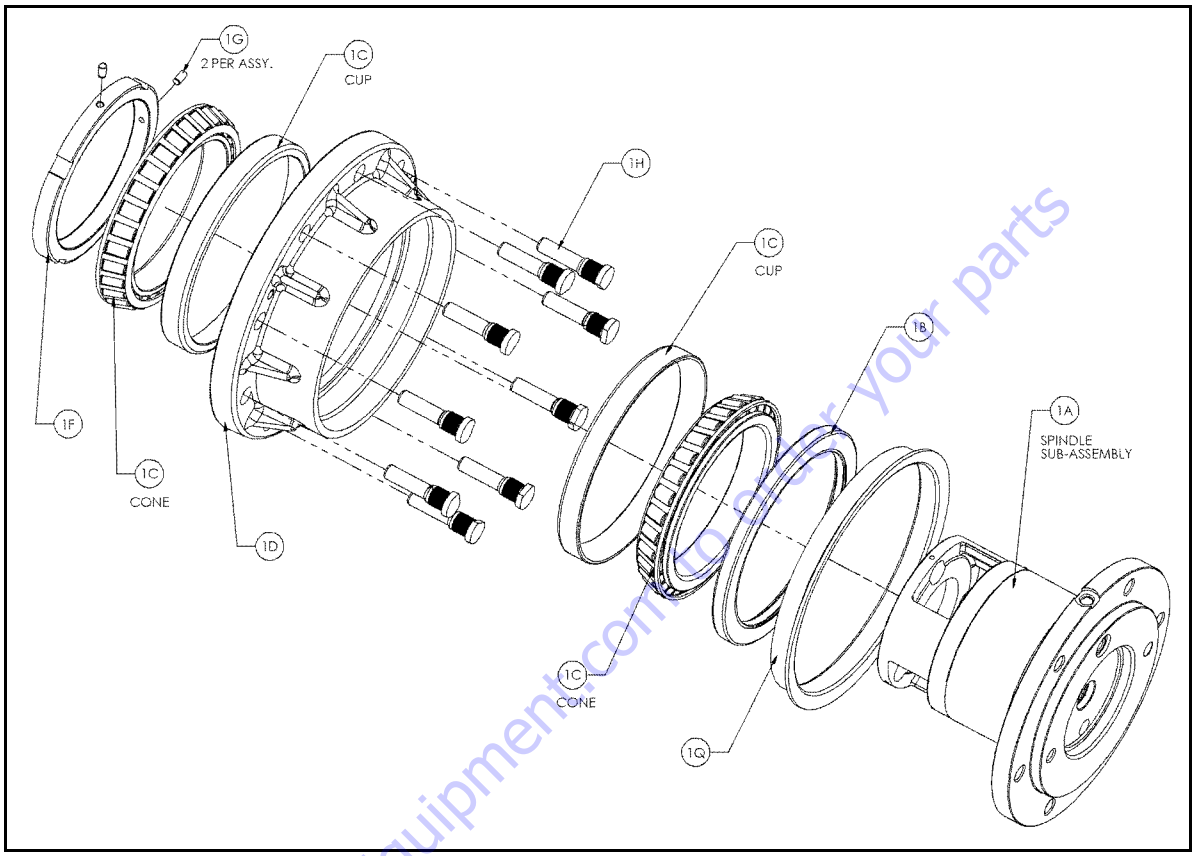
Figure 3-11. Planet Gear Subassembly

1. Using a 1/8 in. (3.175 mm) diameter punch, drive the roll pin (4G) into the planet shaft (3E) until it bottoms against the carrier (3A).
2. Using a soft face hammer, tap the planet shaft (3E) out of the carrier (3A).
3. Using a 1/8 in. diameter punch, drive the roll pin (4G) out of the planet shaft (3E).

NOTE: *The roll pins (4G) should not be reused when reassembling the unit.*

4. Slide the planet gear (3F) and the two Thrust Washers (3B) out of the carrier (3A).
5. Remove the 14 needle bearings (3C) from the bore of the planet gear (3F).
6. Repeat steps 1 through 5 for each of the two remaining planet gears.

Hub-Spindle Disassembly



1A. Barrel	1F. Bearing Nut
1B. Seal	1G. Setscrew
1C. Bearing Cone	1H. Stud
1D. Hub	1Q. Boot Seal

Figure 3-12. Hub Spindle

1. Place unit on bench with spindle (1A) end down.
2. Remove 2 set screws (1G) and bearing nut (1F) using T-206569.

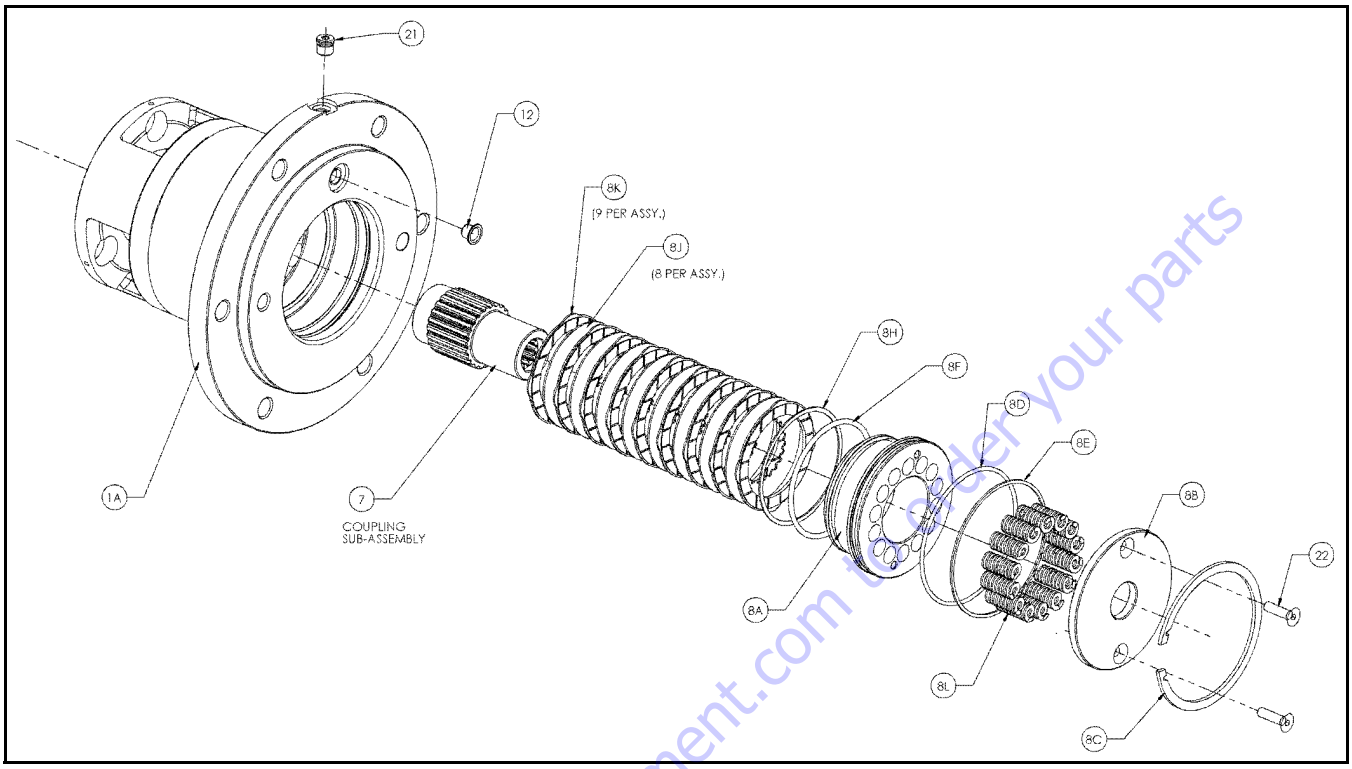
NOTE: *The holes in the bearing nut (1F) for the set screws (1G) were staked for retention of the set screws (1G). The holes will need to be cleaned up prior to removing the set screws.*

3. Remove "A" position bearing cone (1C) from bearing cup (1C) in hub (1D).
4. While supporting the unit on hub (1D) flange, press spindle (1A) out of hub (1D).
5. Lift Hub (1d) off of Spindle (1A). Remove boot seal (1Q) from hub (1D) if applicable.
6. If necessary, press 9 Studs (1H) out of hub (1D). Locate hub (1D) on seal (1B) end.
7. Remove seal (1B) from hub (1D).

NOTE: *The seal (1B) should NOT be reused when reassembling the unit.*

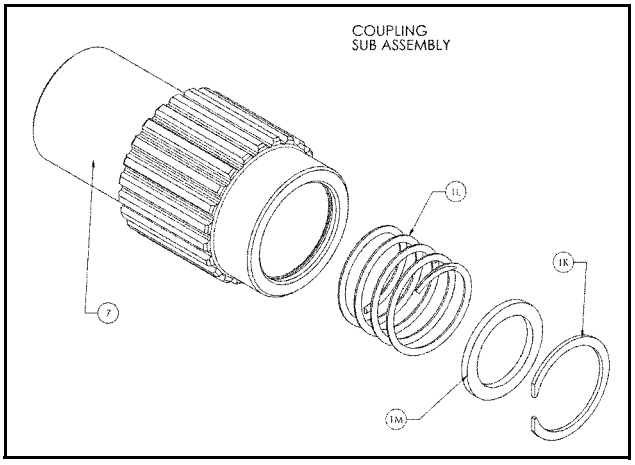
8. Remove "B" position bearing cone (1C) from bearing cup (1C) in hub (1D).
9. Remove "B" position bearing cone (1C) from hub (1D).
10. Using a soft steel rod, knock both bearing cups (1C) out of hub (1D).

Spindle-Brake Disassembly



1A. Spindle
7. Coupling Subassembly
8A. Piston
8B. Pressure Plate
8C. Retaining Ring
8D. O-Ring
8E. Backup Ring
8F. O-Ring
8H. Backup Ring
8J. Rotor
8K. Stator
8L. Compression Spring
12. Plastic Plug
21. Pipe Plug
22. Flat Head Capscrew

Figure 3-13. Spindle Brake



1K. Retaining Ring
1L. Spring
1M. Spacer
7. Coupling

Figure 3-14. Coupling Subassembly

NOTE: *This procedure applies only to units with integral Input brake (8).*

⚠ CAUTION

EYE PROTECTION MUST BE WORN WHILE PERFORMING THE STEPS 1-3 IN THIS PROCEDURE.

1. Compress the compression springs (8I) by installing two 1/4-20 x 5/8 in. flat head capscrews (22) through pressure plate (8B) and into piston (8A) and tightening incrementally until spring force has been taken off of the retaining ring (8C).

NOTE: *Flat Head capscrews (22) are removed prior to shipping new units since they are for transit and service only. They are included in most brake repair kits.*

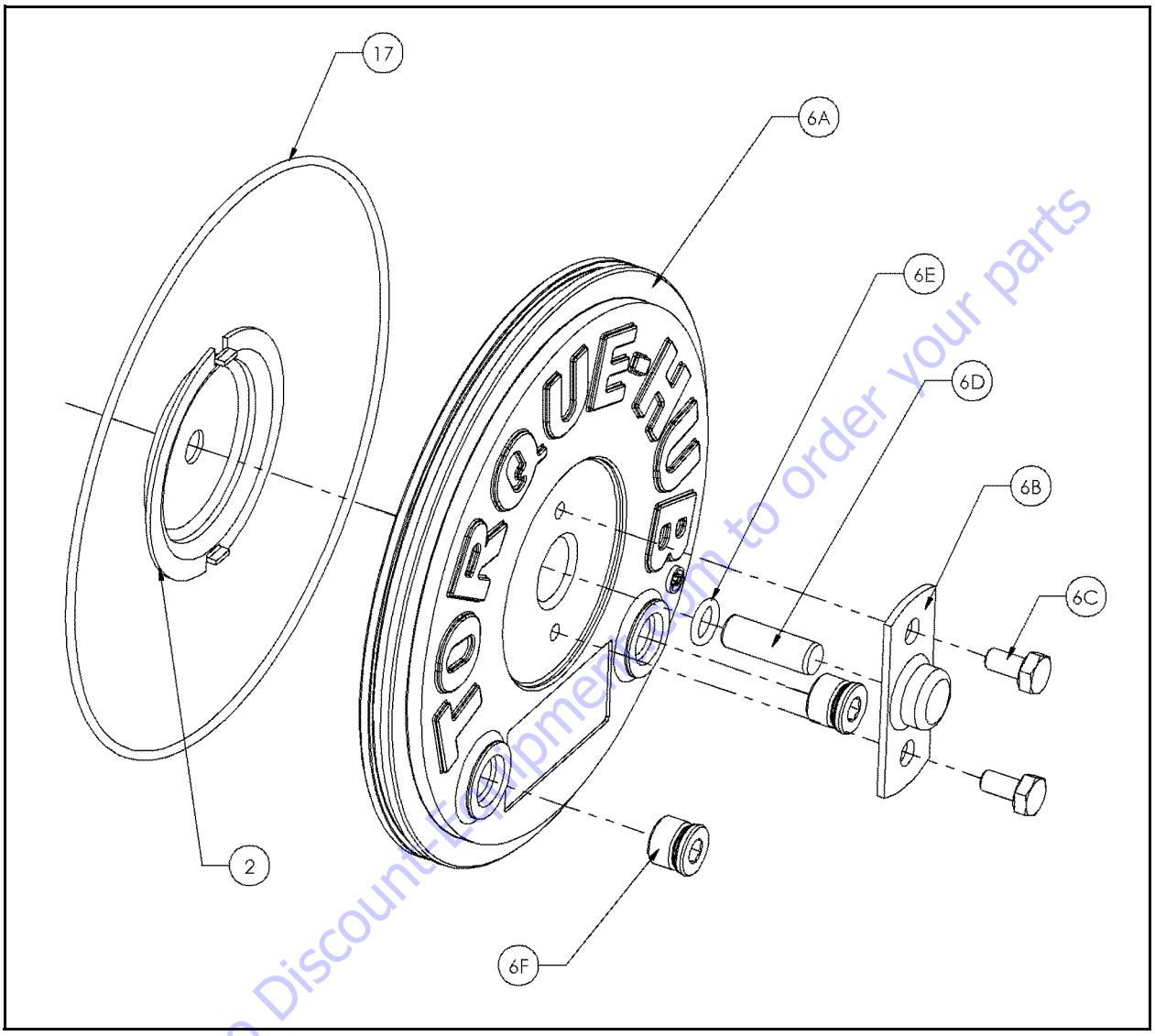
2. Using retaining ring pliers, remove retaining ring (8C) from the groove in the spindle (1A).
3. Back Flat Head capscrews (22) incrementally out of piston (8A) until spring force is relieved from the Pressure Plate (8B). Then, remove flat head capscrews (22) and pressure plate (8B) from brake cavity in spindle (1A).
4. Remove compression springs (8L) from piston (8A).

⚠ CAUTION

EYE PROTECTION MUST BE WORN WHILE PERFORMING THE NEXT STEP IN THIS PROCEDURE.

5. Using an air hose, slowly and carefully pressurize the brake port in the spindle (1A) until the piston (8A) comes out of piston bore of spindle (1A), then pull the piston (8A) the rest of the way out of the spindle (1A) by hand.
6. Remove backup rings (8E) & (8H) and O-rings (8D) & (8F) from grooves in piston (8A).
7. Remove rotors (8J) and stators (8K) from brake cavity in spindle (1A).
8. Remove coupling subassembly (7) from brake cavity in spindle (1A).
9. Remove retaining ring (1K) out of the internal groove using appropriate tool.
10. Remove the spacer (1M) & spring (1L) out of the bore of coupling (7).
11. Remove plastic plug (12) & pipe plug (21) from spindle (1A) if applicable.

Cover Disassembly



2. Thrust Washer	6D. Disengage Rod
6A. Cover	6E. O-Ring
6B. Disengage Cap	6F. Pipe Plug
6C. Bolt	17. O-Ring

Figure 3-15. Cover

1. Remove O-ring (17) from groove in cover (6A).
2. Remove thrust washer (2) from cover (6A) pockets.
3. Unscrew two hex head bolts (6C) and remove disengage cap (6B) from cover (6A).
4. Pull disengage rod (6D) out from cover (6A).
5. Use appropriate tool to remove O-ring (6E) from internal groove in cover (6A).
6. Remove two O-ring pipe plugs (6F) from cover (6A).

Input Carrier Sub-Assembly

1. Apply a liberal coat of grease to the bore of one Input planet gear (3F).
2. Line the inside of the planet gear (3F) with 14 needle rollers (3C).

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

3. Set carrier (3A) in an upright position.
4. Insert a planet shaft (3E) into the planet shaft hole in the end of the carrier (3A) opposite the splined end. The end of the planet shaft that does NOT have the roll pin hole should be inserted into the carrier FIRST.
5. Place one thrust washer (3B) onto the end of planet shaft (3E). Make sure the flat faces towards the inside of the carrier and make sure the button fits in the pocket on the inside of the carrier (3A) towards the OD.
6. Following the thrust washer, place planet gear (3F) with needle rollers, onto planet shaft (3E).
7. Following the planet gear, place one more thrust washer (3B) onto planet shaft (3E). Align the thrust washer (3B) in the same manner described in Step 5.
8. Now insert planet shaft (3E) through the opposite planet shaft hole on carrier (3A). Use an alignment punch or similar tool to align the roll pin holes on carrier (3A) and planet shaft (3E).

NOTE: *Be sure not to hit the Planet Gears (3F) when driving in the Roll Pins (4G).*

9. Drive roll pin (4G) down into the aligned roll pin holes. pin should be flush with the flat of carrier.
10. Repeat steps 1-9 for the installation of the two remaining planet gears (3F).

NOTE: *Some grease may need to be applied to the thrust washers (3B) to hold them in place while installing the planet gears.*

Output Planet Gear Sub-Assembly

1. Apply a liberal coat of grease to the bore of one Output planet gear (4F).
2. Line the inside of the planet gear (4F) with 14 Needle rollers (4C).

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

3. Place spacer (4D) into the bore of the output planet (4F).
4. Repeat Step 2 to put in second roll of needle rollers (4C).
5. Apply grease to hold two thrust washers (4B) together and onto output planet gear (4F) counterbore. Do the same to the other side.
6. Repeat steps 1-5 to finish the assembly of the two remaining output planet gears (4F).

Spindle - Brake Sub-Assembly

1. Place spindle (1A) such that the flange side is up.
2. Place stator (8K) into the spindle (1A) scallop cuts.
3. Place rotor (8J) on top of stator (8K).
4. Repeat steps 2 & 3 until there are a total of 9 stators (8K) and 8 rotors (8J) installed.
5. Place piston (8A) such that the smaller O.D. end is facing upward. Grease the two O-rings and the two backup rings.
6. Install large backup ring (8E) in the large-diameter groove at the bottom of the piston (8A).
7. Install large O-ring (8D) in the large-diameter groove at the bottom of the piston (8A), on top of the large backup ring (8E).
8. Install small O-ring (8F) in the small-diameter groove near the top of the Piston (8A). Make sure the O-ring is seated on the bottom of the groove.
9. Install small backup ring (8H) in the small-diameter groove near the top of the piston (8A), on top of the small O-ring (8F).
10. Insert piston (8A) into spindle (1A) until it contacts the stator (8K).
11. Insert the appropriate number of springs (8L), based on the assembly print, into piston (8A) counterbore.
12. Place spring (1L) into coupling (7) counterbore. Place the pressure plate (1M) on top of spring (1L).
13. Use appropriate tool to install retaining ring (1K) into the retaining ring groove in the coupling (7) counterbore.
14. Insert coupling sub-assembly (7) through rotors (8J).
15. Place pressure plate (8B) on top of springs (8L).
16. Use two ¼ -20 x 0.625 in. flat head capscrews (22) by bolting the pressure plate (8B) and piston (8A) together or some other appropriate tools to install retaining ring on top of pressure plate (8B) until retaining ring (8C) is seated.

NOTE: *Remove 2 Screws from units when done, otherwise brake will not function.*

17. Install pipe plug (21) if applicable.

Hub-Spindle Sub-Assembly

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 of part (1C), position "A", into hub using T-158422 pressing tool.
2. Turn hub over and press Bearing cup of part (1C), position "B", into hub using T-158422 pressing tool (T).
3. Place bearing cone of part (1C), into bearing cup of part (1C), position "B".
4. Grease seal (1B) lip and press seal into hub (1D) using appropriate tool until seal is flush with end of hub (T).
5. Place Hub (1D) into pressing base. Press nine Studs (1H) into Hub.

NOTE: *Use enough pressure to press in studs. Don t use excessively high pressure to press in studs or hub may crack.*

6. Set spindle assembly (1A) on the bench with the flange down. Turn Hub (1D) over and lower onto Spindle (5). Install boot (21) if applicable.
7. Install bearing cone of part (1C) into bearing cup, position "A".
8. Apply Loctite 243 on Bearing Nut (1F) thread. Screw nut (1F) on top of bearing cone of part (1C) leave 0.003-0.005 in. (0.7-1.3 mm) end play to check the initial rolling torque with the unit tied down. Then torque bearing nut (1F) until rolling torque is 40-50 in. lbs. (4.5-5.5 Nm) greater than initial rolling torque. Using tool T-206569 for the bearing nut.

NOTE: *Final torque is initial rolling torque plus 40-50 in. lbs.* (4.5-5.5 Nm). *E.g., if the initial rolling torque is 30 in. lbs. (3.4 Nm), the final rolling torque is between 70-80 in. lbs. (8-9 Nm). Be sure to rotate hub as the torque is applied to properly seat the bearing. Be sure the torque wrench is tangent to the hub (1D) OD.*

9. Using appropriate tool, install two set screws (1G) into bearing nut (1F) threaded holes. Make sure set screw is driven into the spindle thread. Tighten the set screws to damage the thread and stake the edge of the nut around the set screws (1G) so the nut will not loosen.
10. Place thrust washer (4H) into counterbore of spindle (1A).
11. Place planet gear sub-assembly (4) into spindle (1A) through gap between two studs (1H). Align the planet gear bore with one of the planet shaft holes on the spindle (1A) assembly using T-209919.
12. Insert a planet shaft (4E) into the planet shaft hole described in step (11) on spindle (1A). The end of the planet shaft that does not have the roll pin hole should be inserted into the spindle FIRST.
13. Now insert planet shaft (4E) through the first set of thrust washers (4B), planet gear, then the second set of washers (4B). Use an alignment punch or similar tool to align roll pin holes on spindle (1A) and planet shaft (4E).

NOTE: *Be sure not to hit the planet gears (4F) when driving in roll pins (4G).*

14. Drive roll pin (4G) down into the aligned roll pin holes. Pin should be flush with OD of spindle.
15. Repeat Steps (11-14) for the installation of the two remaining planet gears (4F).

Cover Sub-Assembly

1. Grease O-ring (6E) and insert into internal groove in cover (6A).
2. Assemble disengage cap (6B) onto cover (6A) using two hex head bolts (6C). Torque bolts to 70-80 in. lbs. *(8-9 Nm)*.
3. Insert disengage rod (6D) into hole in cover (6A) until it touches the inside of the disengage cap (6B).

NOTE: *The disengage rod can be inserted either end first.*

4. Grease Face of thrust washer (2) and place in cover (6A) making sure that tangs on washer seat into pockets in cover.
5. Install O-ring pipe plugs (6F) into cover (6A). The plugs should be hand tight.

Main Assembly

NOTE: *All components should receive a generous amount of lubricant oil as they are being assembled.*

1. Place hub-spindle sub-assembly on the bench.
2. Grease O-ring (18) and place it into groove of hub (1D).
3. Place ring gear (1E) onto hub (1D). Align the three shipping capscrew holes on hub (1D) and ring gear (1E).
4. Install three shipping capscrewcapscrews (19) into ring gear and hub. Torque them to 15-20 ft. lbs. (20-27 Nm).
5. Place external retaining ring (5) over 13T spline to the retaining groove on input shaft (9).

NOTE: *For ratio 48:1, assemble output sun gear (11) over input shaft (9) first, then install external retaining ring (5).*

6. Using appropriate tool to install retaining ring (20) into groove on output sun (11).
7. Place input shaft (9) spline end into mesh with internal coupling (7) splines.

8. With the modified spline end facing up, place the output gear (11) into mesh with the planet gears from the hub-spindle sub-assembly.
9. Place input carrier sub-assembly (3A) onto output sun gear (11) splines. Drop input sun (10) into mesh with planet gears for specific ratios, if required. (No timing required).
10. Grease O-ring (17) and insert into groove in cover sub-assembly (6).
11. Install cover sub-assembly (6) into ring gear (1E) counterbore and install retaining ring (6G) into groove in ring gear (1E).
12. Attach ID tag (15) onto unit using drive screws (16).
13. Check disconnect, roll and air check unit, leak check brake, and record release pressure.
14. Insert plastic plug (12) into place if applicable.

Integral Brake Check

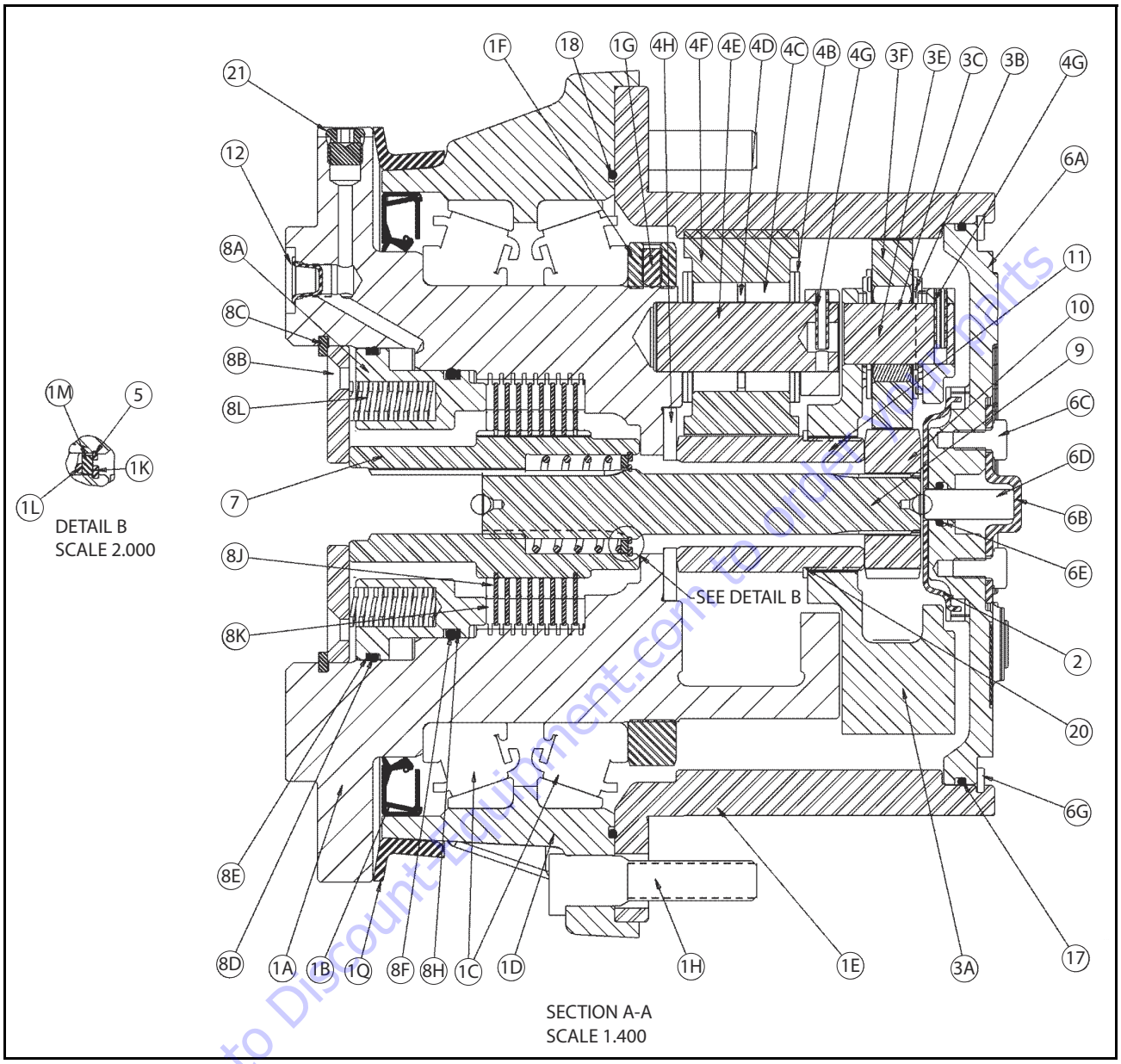
1. Using appropriate fittings, connect hydraulic line from hand pump to brake port.
2. Check to see that brake is set by trying to rotate input shaft (9). This can be accomplished by installing an appropriate tool (any tool that can locate on the splines of the input coupling (7), such as a mating splined shaft) into input coupling (7).
3. Bleed brake. Increase hydraulic pressure gradually while trying to rotate the input until brake just starts to release. Note this pressure. Make sure the pressure falls into the appropriate range below.

BRAKE CODE	JUST RELEASE PRESSURE RANGE	
	PSI	BAR
A	200-260	13.7-17.9
B	170-220	11.7-15.1
C	140-185	9.6-12.7
D	130-155	8.9-10.6
E	115-145	7.9-9.9

4. Increase pressure to 1,000 psi (69 bar) and hold for 30 seconds to check for leaks. Repair leaks if necessary.

NOTE: *Make sure that brake re-engages when pressure is released.*

NOTE: *When done, make sure input coupling (7) is centered in spindle (1A) to make installation of motor possible without release of brake.*



1A. Spindle
1B. Lip Seal
1C. Tapered Bearing
1D. Housing
1E. Ring Gear
1F. Bearing Nut
1G. Setscrew
1H. Stud
1K. Retaining Ring
1L. Spring
1M. Thrust Washer
1Q. Seal Boot
2. Thrust Spacer
3A. Carrier
3B. Thrust Washer
3C. Needle Bearing
3E. Planet Shaft
3F. Planet Gear
4B. Thrust Washer
4C. Needle Bearing
4D. Thrust Spacer
4E. Planet Shaft
4F. Planet Gear
4G. Roll Pin
4H. Thrust Washer
5. Retaining Ring
6A. Cover
6B. Disengage Cap
6C. Bolt
6D. Dowel Pin
6E. O-Ring
6F. Pipe Plug
6G. Retaining Ring
7. Coupling
8A. Brake Piston
8B. Pressure Plate
8C. Retaining Ring
8D. O-Ring
8E. Backup Ring
8F. O-Ring
8H. Backup Ring
8J. Brake Rotor
8K. Brake Stator
8L. Spring
9. Input Shaft
10. Sun Gear
11. Sun Gear
12. Plastic Plug
15. ID Plate
16. Drive Screw
17. O-Ring
18. O-Ring
19. Bolt
20. Retaining Ring
21. O-Ring Plug

Figure 3-16. Hub Assembly

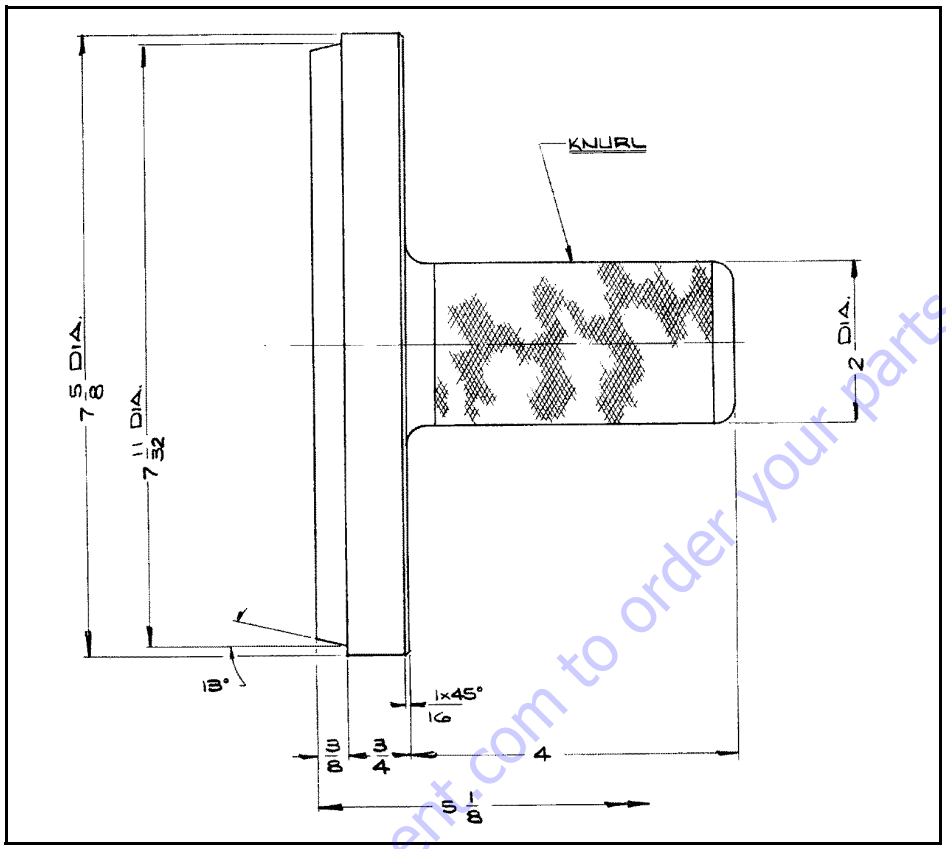


Figure 3-17. Bearing Cup Pressing Tool

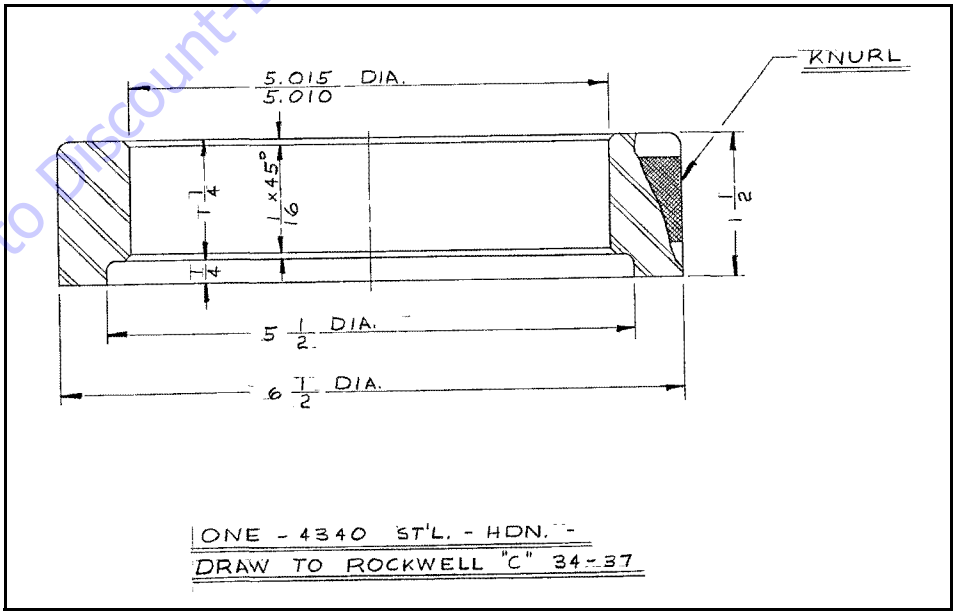


Figure 3-18. Seal Pressing Tool

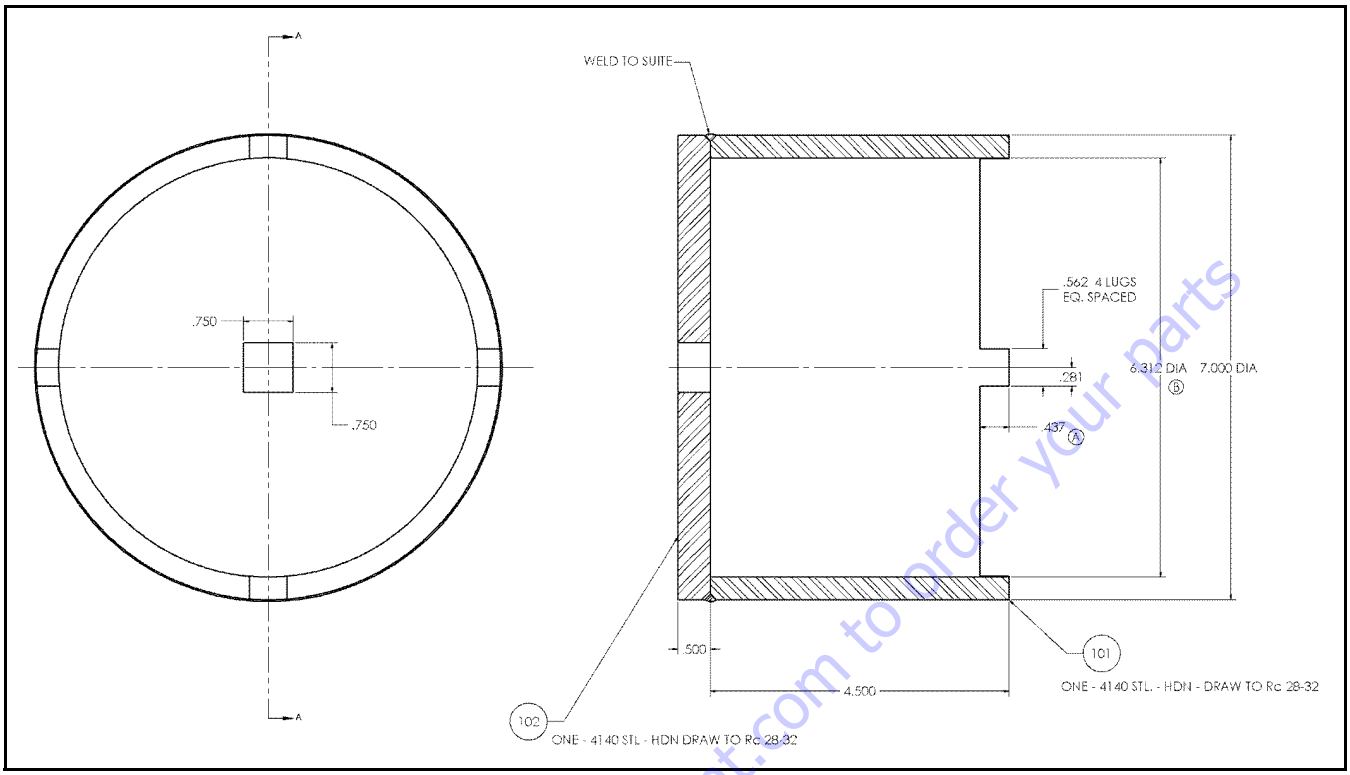


Figure 3-19. Bearing Cup Pressing Tool

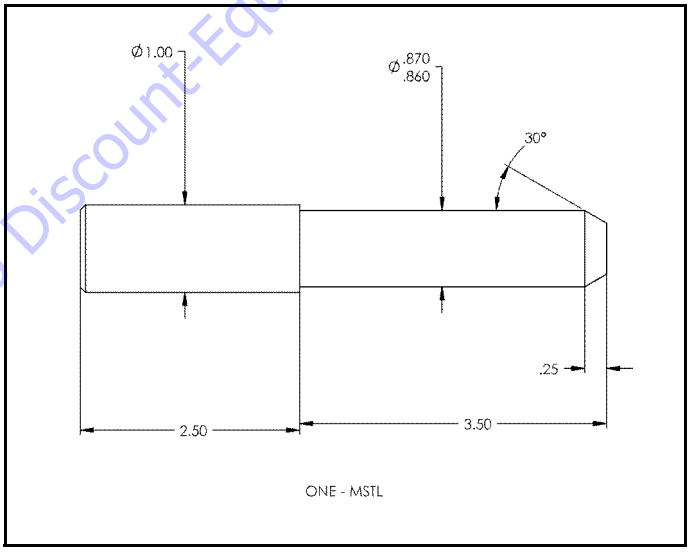


Figure 3-20. Drift Pin for Lining Up Thrust Washers with Output Planet Gear

3.7 DRIVE BRAKE

Disassembly

1. Remove pressure plate (3) from cover plate (16) by removing capscrews (1) and washers (2).

⚠ CAUTION

PRESSURE PLATE IS UNDER SPRING TENSION OF APPROXIMATELY 907 KGF (2000 IBS). THE TWO CAPSCREWS MUST BE LOOSENED EVENLY TO RELIEVE THIS FORCE. IF A HYDRAULIC PRESS IS AVAILABLE, 1361 KGF (3000 IBS) MINIMUM, THE PRESSURE PLATE CAN BE HELD IN POSITION WHILE REMOVING THE CAPSCREWS. COVER PLATE (16) MUST BE SUPPORTED AS SHOWN IN FIGURE 3-21.

2. Remove case seal (4) from cover plate (16).
3. Remove piston (7) from pressure plate (3).
4. Remove O-ring (5), backup ring (6), O-ring (8) and backup ring (9) from piston (7).
5. Remove stator disc (11), rotor disc (12) and return plate (13) from cover (16).
6. Not all models use the same number of springs or spring pattern.
7. Remove dowel pins (15) and springs (14) from cover plate (16). Record this information for assembly purposes.
8. Remove retaining ring (19) from cover plate (16).
9. Remove shaft (10) by pressing or using a soft mallet on male end of shaft (10).
10. Cover plate (16) must be supported as shown in Figure 3-21.
11. Remove retaining ring (20) from cover plate (16) and press out oil seal (17) and bearing (18) if required.
12. Cover plate (16) must be supported as indicated in Figure 3-21.

Assembly

NOTICE

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Use an alkaline wash to clean parts before assembly.
2. Press oil seal (17) into cover plate (16) until it is flush with bearing shoulder. Note direction of seal.
3. Press bearing (18) into position until it bottoms out on bore step.

NOTE: *Cover plate (16) must be supported as indicated in Figure 3-7.*

4. Install retaining ring (20) in cover plate (16).
5. Press shaft (10) into bearing (18) until it bottoms on shoulder.

NOTE: *Bearing (18) inner race and cover plate (16) must be supported as indicated in Figure 3-7. during this operation.*

6. Install retaining ring (19) on shaft (10).
7. Insert dowel pins (15) and springs (14) in cover plate (16).

NOTE: *Be sure to use the same number of springs and spring pattern as recorded during disassembly.*

8. Position return plate (13) on springs (14).

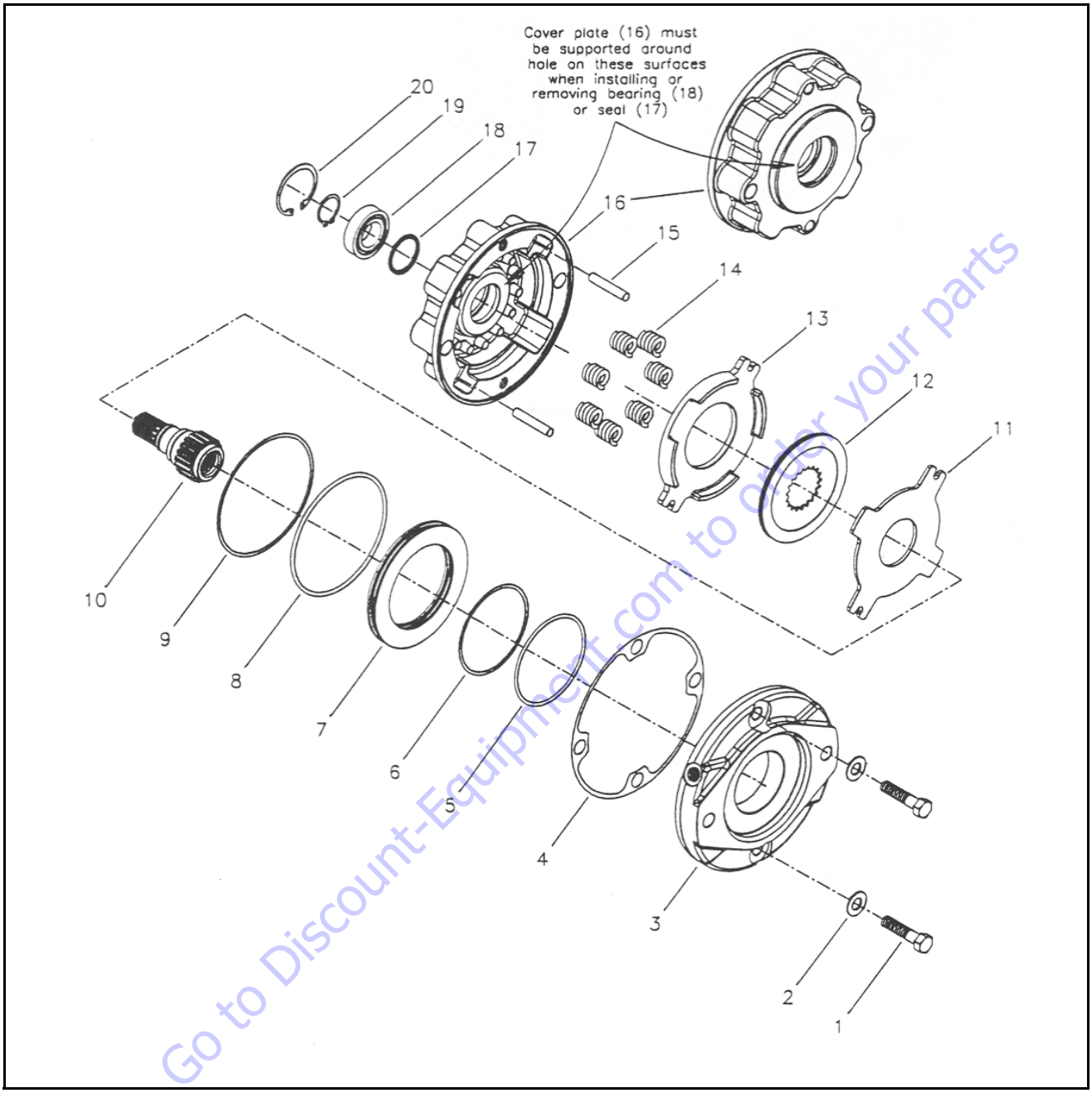
NOTE: *Discs (11) & (12) and return plate (13) must remain dry during installation. No oil residue must be allowed to contaminate disc surfaces.*

9. Install rotor disc (12) and stator disc (13).
10. Install o-ring (5), backup ring (6), O-ring (8) and backup ring (9) on piston (7). Note order of O-rings and backup rings. Insert piston (7) into pressure plate (3).

NOTE: *Be careful not to shear O-rings or backup rings. Be careful not to scratch or mar piston.*

11. Install new case seal (4) in cover plate (16).
12. Position pressure plate (3) on cover plate (16) aligning dowel pins (15) with holes in pressure plate.
13. Install capscrews (1) and washers (2) and tighten evenly to draw pressure plate (3) to cover plate (16). Torque capscrews 48-50 ft. lbs. (65.1-67.8 Nm).

NOTE: *A hydraulic press will simplify installation of pressure plate on cover. Clamp pressure plate in position while tightening the capscrews. Cover plate (16) must be supported as indicated in Figure 3-21.*



1. Capscrew
2. Washer
3. Pressure Plate
4. Case Seal
5. O-ring
6. Backup Ring
7. Piston
8. O-ring
9. Backup Ring
10. Shaft
11. Stator Disc
12. Rotor Disc
13. Return Plate
14. Springs
15. Dowel Pin
16. Cover Plate
17. Oil Seal
18. Bearing
19. Retaining Ring
20. Retaining Ring

Figure 3-21. Drive Brake

Bleeding

1. Install brake in system and connect pressure lines.
2. Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 100 psi (6.9 bar) during bleeding.
3. Apply sufficient pressure to release brake and check for proper operation in system.

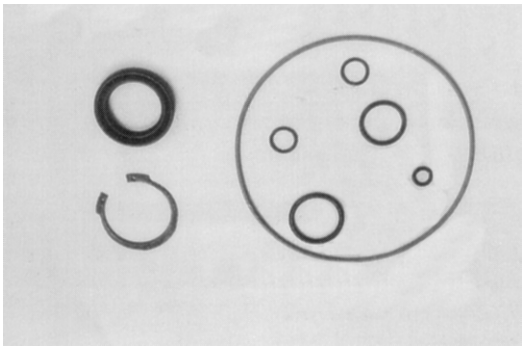
Table 3-2. Troubleshooting

PROBLEM	CAUSE	EXPLANATION	ACTION
Brake slips	Excessive pressure in hydraulic system	If there is back pressure in the actuation line of the brake, holding torque will be reduced.	Check filters, hose size, restrictions in other hydraulic components.
	Oil in brake if designed for dry use	Wet linings generate 67% of the dry torque rating. If the brake has oil in it, check the type of oil hydraulic or gearbox. 1. Gearbox oil 2. Hydraulic oil	Replace oil seal in brake. Check motor seal Check piston seals ***NOTE:*** *Internal components will need to be inspected, cleaned and replaced as required.*
	Disc plates worn	The thickness of the disc stack sets the torque level. A thin stack reduces torque.	Check disc thickness.
	Springs broken or have taken a permanent set	Broken or set springs can cause reduced torque - a rare occurrence.	Check release pressure. (See spring replacement).
Brake drags or runs hot	Low actuation pressure	The brake should be pressurized to minimum of 1.38 bar (20 psi) over the full release pressure under normal operating conditions. Lower pressures will cause the brake to drag thus generating heat.	Place pressure gauge in bleed port & check pressure with system on.
	Bearing failure	If the bearing should fail, a large amount of drag can be generated.	Replace bearing.
Brake will not release	Stuck or clogged valve	Brakes are designed to come on when system pressure drops below stated release pressure. If pressure cannot get to brake, the brake will not release.	Place pressure gauge in bleed port - check for adequate pressure. Replace inoperative line or component.
	Bad o-rings	If release piston will not hold pressure, brake will not release.	Replace o-rings.
	Discs frozen	These brakes are designed for only limited dynamic braking. A severe emergency stop or prolonged reduced release pressure operation may result in this type of damage.	Replace disc stack.

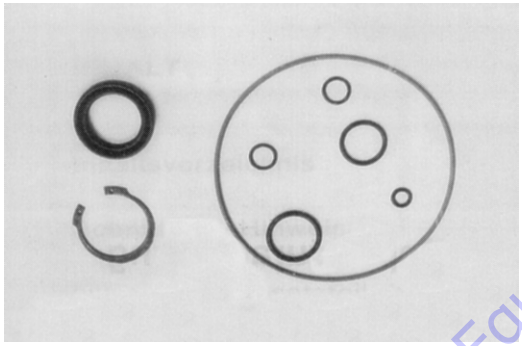
3.8 DRIVE MOTOR - 4WD (SN 0300087000 THROUGH 0300098765)

Spare Parts Kits

1. Sealing kit, existing spare parts: shaft sealing ring, 6 different O-rings and a circlip (sealing mat: perbunan).

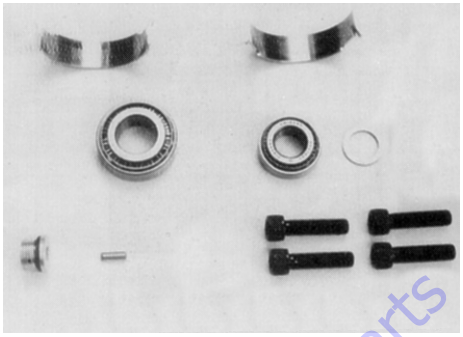


2. Same sealing kit like shown above only seal material changed to Viton.

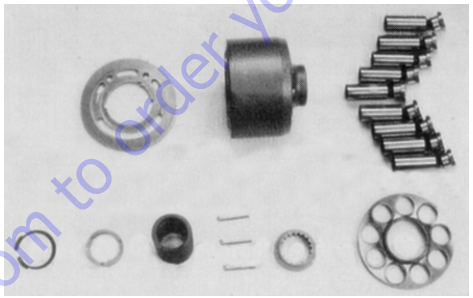


3. Drive shaft.

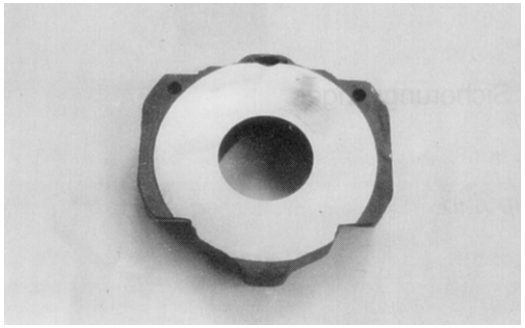
4. Bearing set/miscellaneous parts .



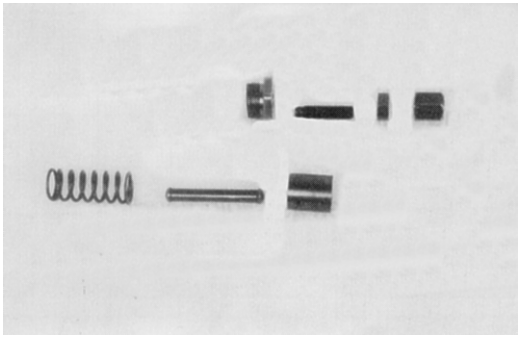
5. Rotary group complete 9 pistons, cylinder subassembly, valve plate (cw or ccw corresponding to the order) retaining plate and retaining ball.



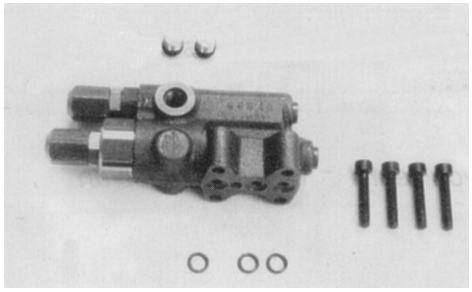
6. Swash Plate.



7. Parts of the control device: control piston, piston rod, plug, spring stopper max flow, hex. nut, and hex. head nut.

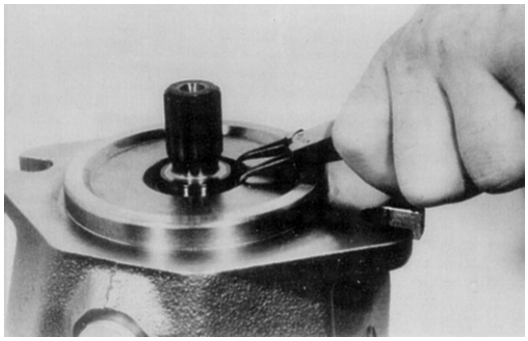


8. Spare parts kit DFR pilot valve.



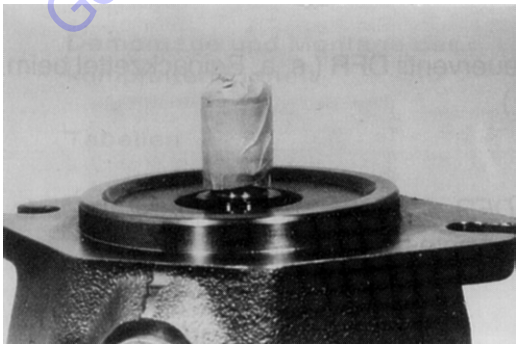
Replacing the Drive Shaft Seal

1. Remove the snap ring.

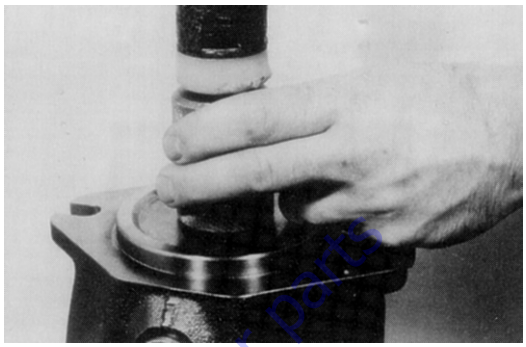


2. Change the shaft seal and check its sliding surface (drive shaft) and housing, grease the sealing ring.

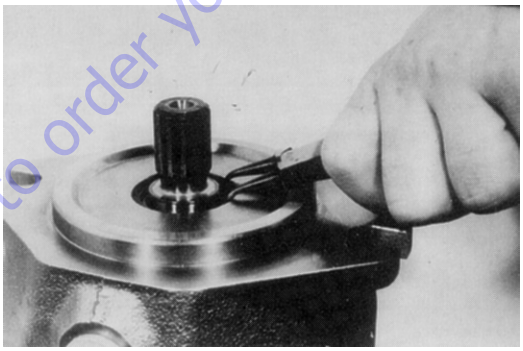
3. Be careful while you seal the drive shaft, use an adhesive tape to protect the splines.



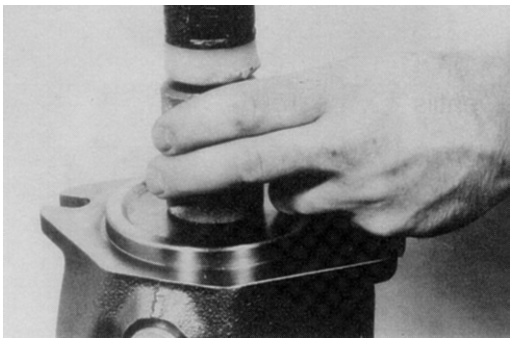
4. Assemble the sealing ring. The fitting tool will hold the sealing ring in the correct position in the pump housing.



5. Assemble the snap ring.

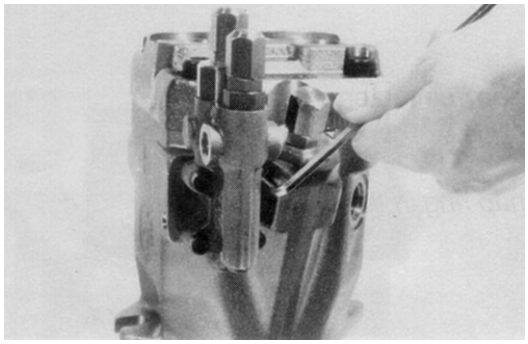


6. Assemble the snap ring in the correct position.

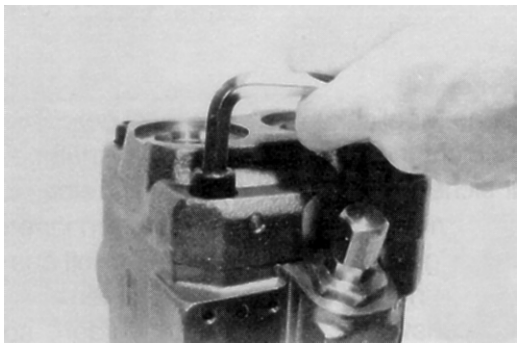


Disassembly and Assembly

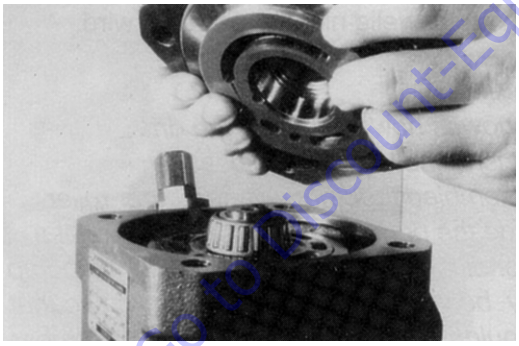
1. Disassemble the pilot valve.



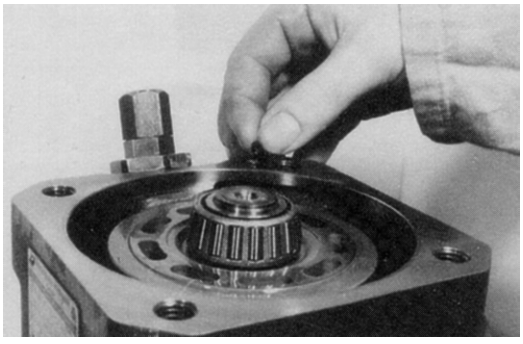
2. Mark the position of the port plate and remove the socket screw from the port plate.



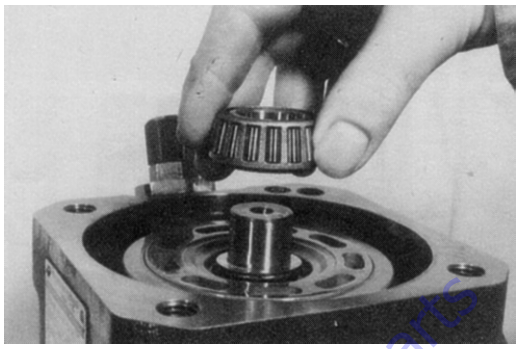
3. Remove the port plate together with the valve plate (hold the valve plate so that the plate can't fall down).



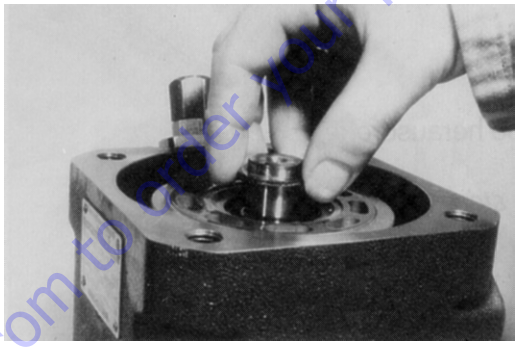
4. Remove the O-ring.



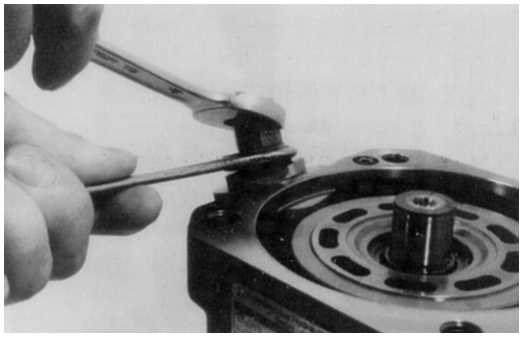
5. Disassemble the taper roller bearing.



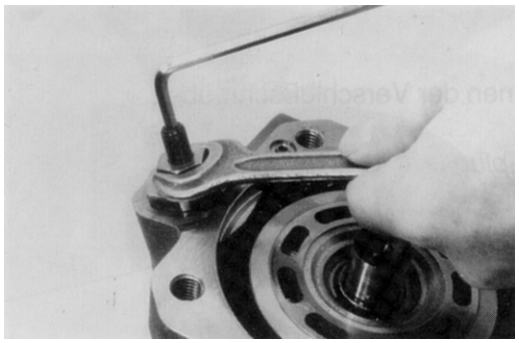
6. Remove the adjustment shim.



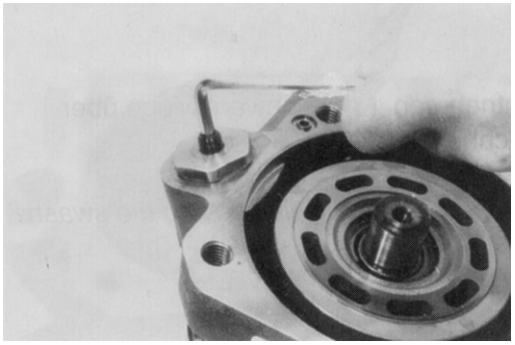
7. Unscrew the cap nut and remove it.



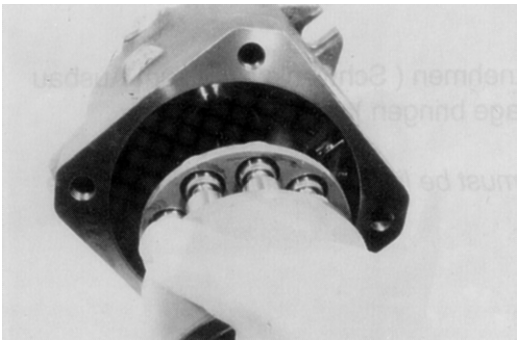
8. Loosen the retaining nut of the stopper max flow and remove it.



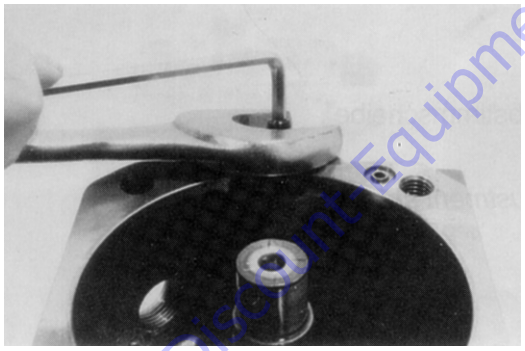
9. Turn in the stopper max flow to get swivel angle zero.



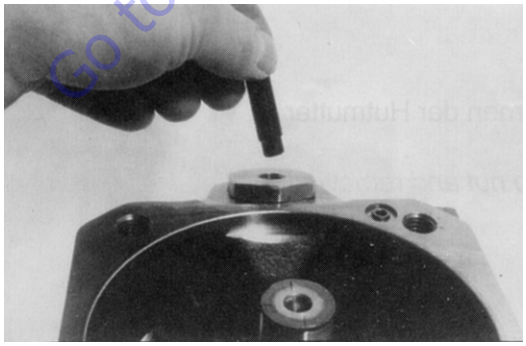
10. Disassemble the rotary group in horizontal position.



11. Disassemble the stopper - max. flow.

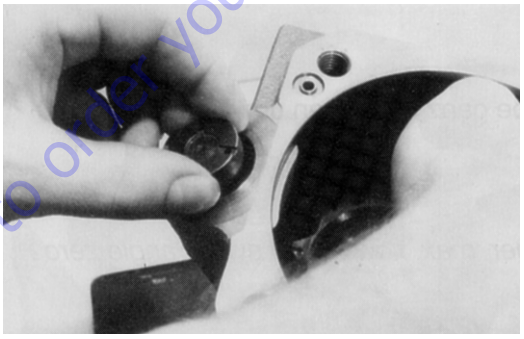


12. Remove the threaded pin (stopper - max.flow).

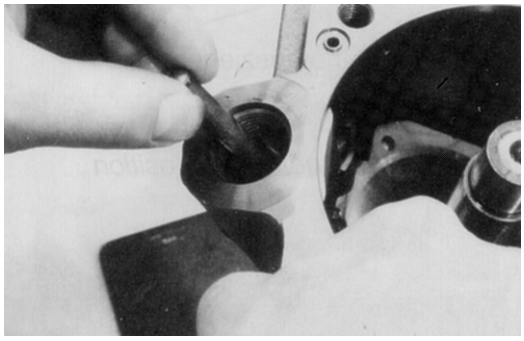


13. Disassemble the plug.

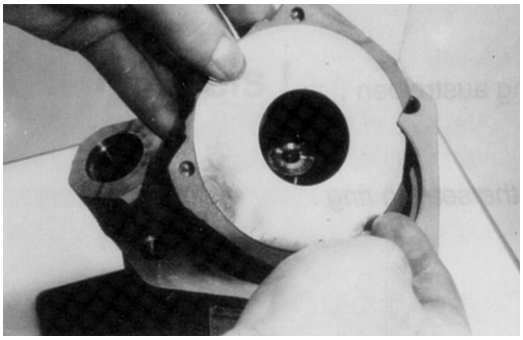
14. Disassemble the control piston while moving the swash plate.



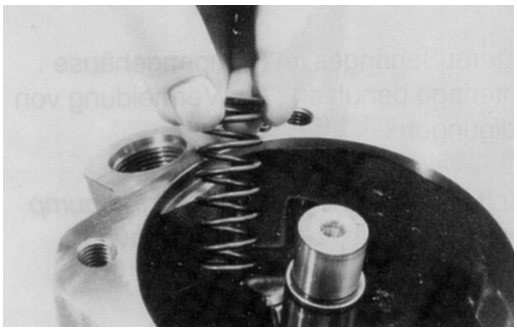
15. The swash plate must be lifted a little bit to disassemble the piston rod.



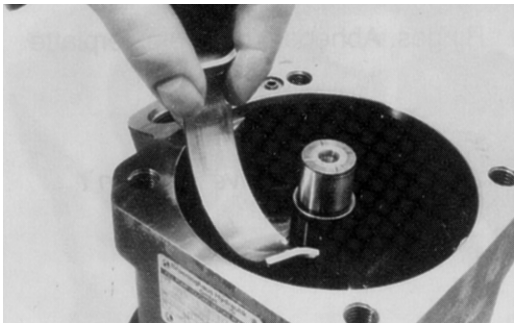
16. Disassembly of the swash plate.



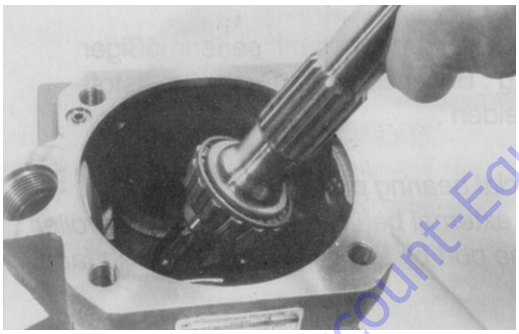
17. Remove the spring.



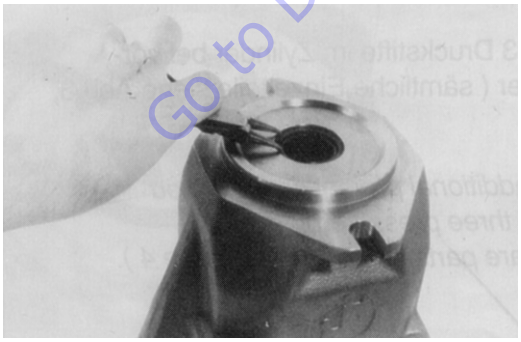
18. Remove both bearing shells.



19. Remove the drive shaft.

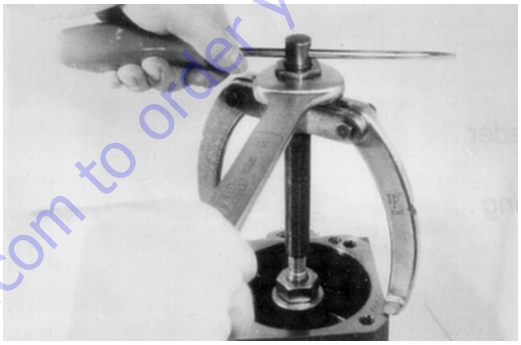


20. Remove the snap ring.

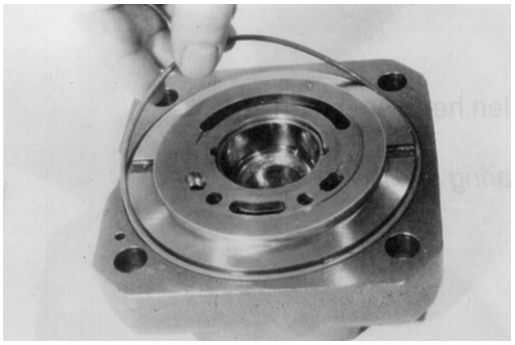


21. Disassemble the sealing ring.

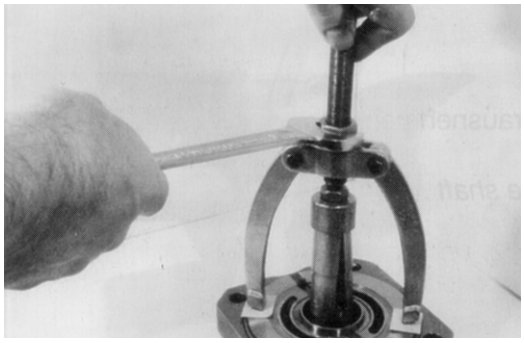
22. The external front bearing ring is pulled out of the pump housing.



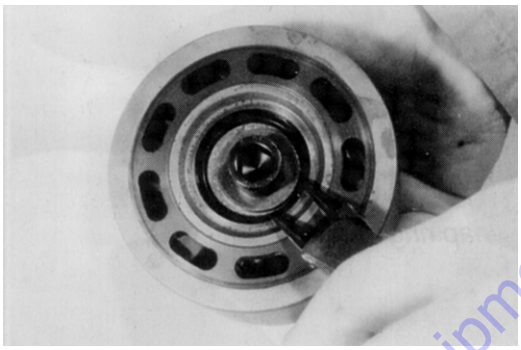
23. Remove the O-ring (Lifting of the valve plate is not shown).



24. A usual commercial bearing puller is used to disassemble the external bearing ring of the taper roller bearing inside the port plate. Take care not to damage the surface of the port plate.

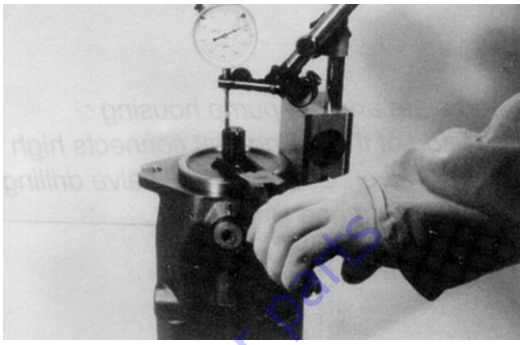


25. The spring has additional pretension while you disassemble the three pressure pins inside the cylinder.

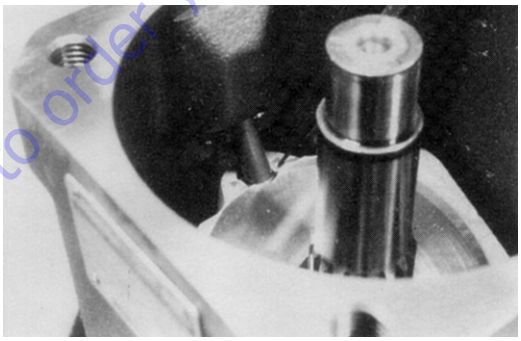


Assembly Notes

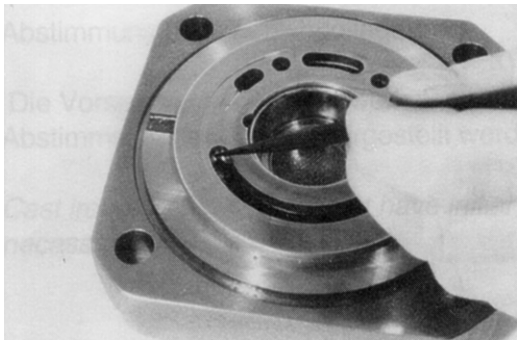
1. Measurement of the taper roller bearing pretension.



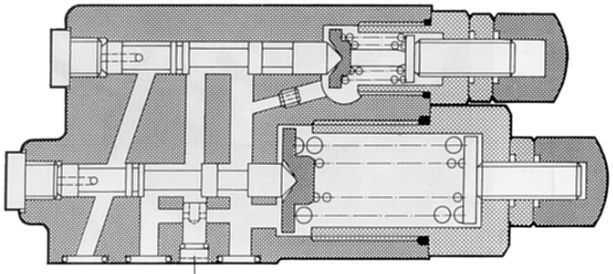
2. Note that there is a correct connection of the piston rod and the swash plate.



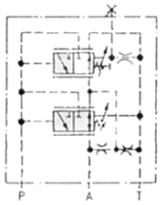
3. Pumps clockwise driven must have a position to the valve plate 4 degrees out of center in the same direction de-centered like drive direction. (Note spare parts exist as cw and ccw valve plates).



all valves shown here do have open position of the orifice (see picture below "pos. of orifice").



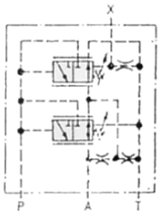
orifice 0,6mm

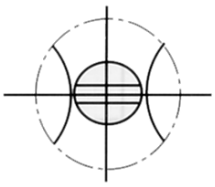


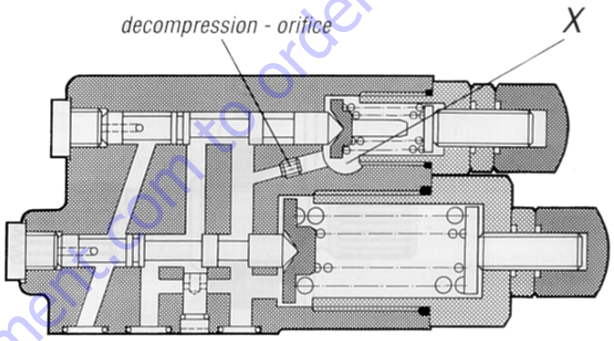
position of the orifice Ø 0,6

pressure compensator DR

Both X- ports are pluged .
Flow control blocked.

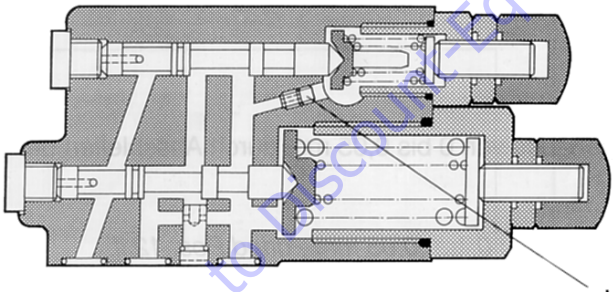


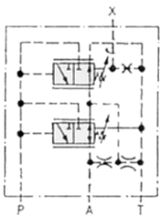




pressure compensator and flow control DFR

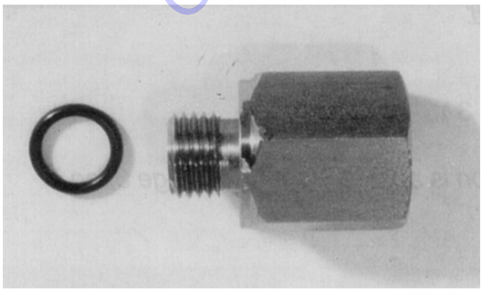
One X - port is plugged .





pressure compensator and flow control DFR 1

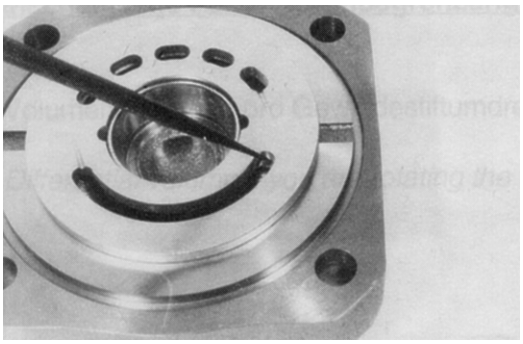
One X - port is pluged . Decompression orifice X-T is pluged by the plug.



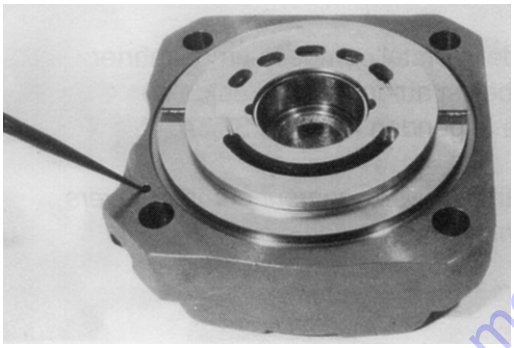
Adapter without orifice of the DFR-pilot valve , if you use a metric pilot pipe connection X .

Figure 3-22. Flow Control Pilot Valves

4. Pumps counterclockwise driven must have a position of the valve plate 4 degrees de-centered in ccw position.

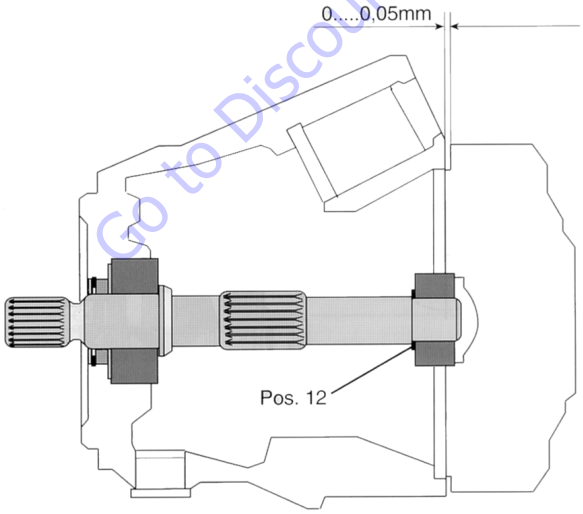


5. Assembly of the port plate and the pump housing: Note the correct position of the drilling that connects high pressure to the control valve. Check control valve drill position at the pump housing and fit together.



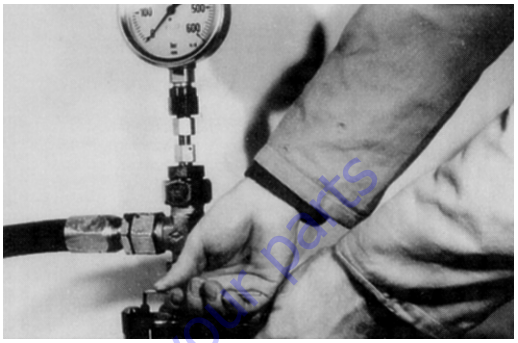
Taper Roller Bearing Initial Tension

1. Cast iron pump housing must have initial tension of the bearings: 0.....0,05 mm, grind Pos. 12 if necessary.

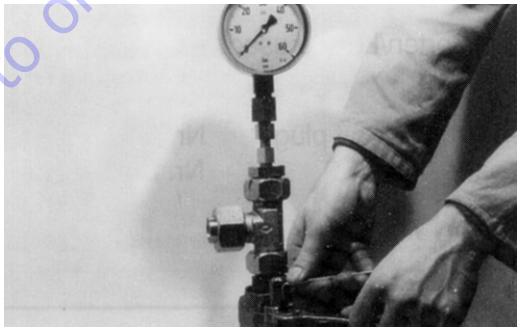


Testing and Setup

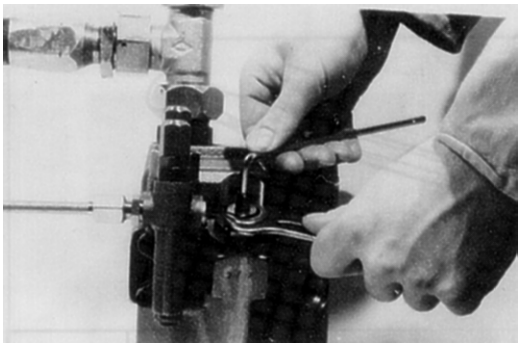
1. DR: When pressure line is closed adjust the pressure of the controller (if it's DFR design then open the adjustable orifice and increase force of the spring - FR).



2. FR: If swivel angle is in the mid position adjust differential pressure 14 bar (203 psi) adjustable orifice is partly closed).



3. Mechanical flow limiter: While screwing in the threaded pin you will be able to reduce the flow from Vg max to 50% of Vg max.



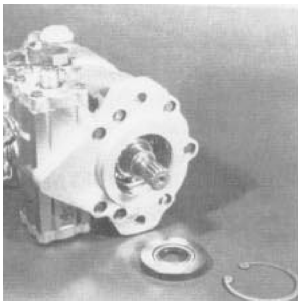
3.9 DRIVE MOTOR - 2WD (SN 0300087000 THROUGH 0300098765)

Shaft Seal Replacement

Lip type shaft seals are used an the drive motors. These seals can be replaced without major disassembly of the unit. However, replacement of the shaft seal requires removal of the pump or motor from the machine.

1. Remove the retaining ring from the housing.

Carefully remove the seal from the housing bore. The face of the seal may be punctured with a sharp instrument (such as a screw driver) to aid in prying the seal out, or a slide hammer type puller may be used to remove the seal. Care must be taken not to damage the housing bore or shaft. Once removed the seal is not reusable.



Prior to installing the new seal, inspect the sealing area on the shaft for rust, wear, or contamination. Polish the sealing area on the shaft if necessary.

Wrap the spline or key end of shaft with thin plastic to prevent damage to the seal lip during installation. Lubricate the inside diameter of the new seal with petroleum jelly.

NOTE: *The outside diameter of the seal may be lightly coated with a sealant (such as Loctite High Performance Sealant #59231) prior to installation This will aid in preventing leaks caused by damage to the housing seal bore.*

Slide the new seal over the shaft and press it into the housing bore. Be careful not to damage seal. A seal installer tool can be made to aid in installing the seal.

Reinstall the seal retaining ring.

3.10 DRIVE MOTOR (USA BUILT MACHINE AND CHINA BUILT MACHINE, SN 0300098766 TO PRESENT AND SN B300000100 TO PRESENT)

Description

1. The drive motors are low to medium power, two-position axial piston motors incorporating an integral servo piston. They are designed for operation in both open and closed circuit applications. The standard control is a direct acting single line hydraulic control. The integral servo piston controls motor displacement.
2. The motors are spring biased to maximum displacement and hydraulically shifted to minimum displacement. Minimum and maximum displacement can be set with fixed internal stops. The large diameter servo piston allows smooth acceleration and deceleration with relatively large circuit orificing.

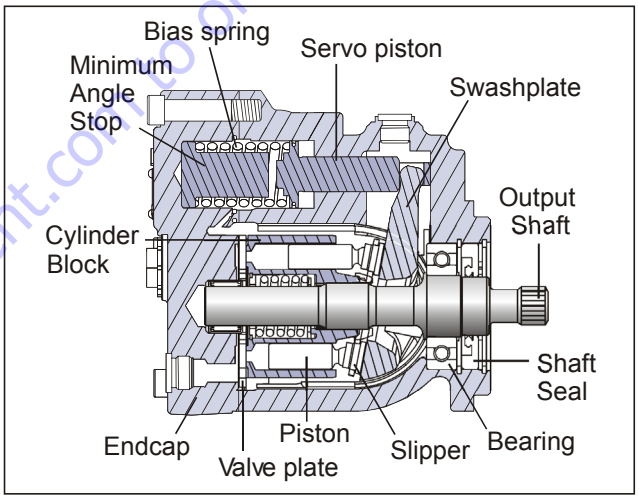


Figure 3-23. Drive Motor Cross Section

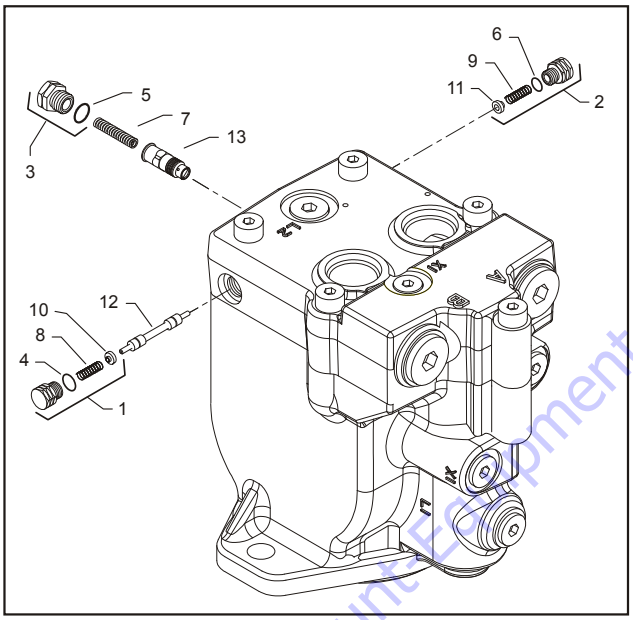
Disassembly

NOTE: *Removal of the endcap voids warranty.*

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

Replace all O-rings and gaskets.

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



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

Figure 3-24. Loop Flushing Spool

1. Using a 11/16 in. (17.46 mm) wrench remove plug (1) and (2).

2. Using a 5/8 in. (15.87 mm) hex wrench remove plug (3).

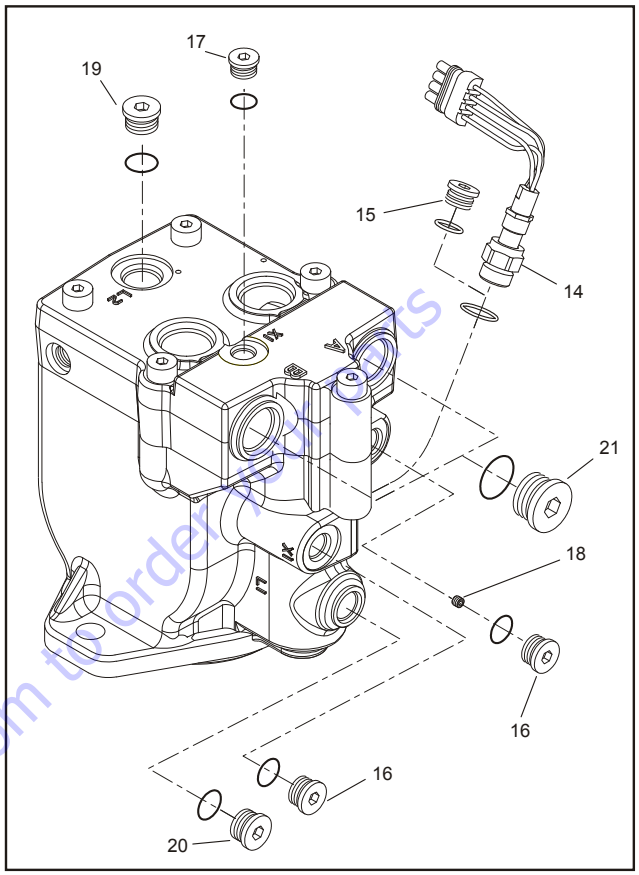
3. Remove O-rings (4, 5 and 6).

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

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

6. Remove shift spool (12).

7. Remove orifice poppet (13).



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

Figure 3-25. Plugs, Fittings, and Speed Sensor

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

9. Using an 11/16 in. (17.46 mm) hex wrench, loosen the speed sensor lock nut (14) if equipped. Then remove the speed sensor using a Vi in. hex wrench. Units without speed sensor have an O-ring plug (15) installed in that location; remove it with a Va in. internal hex wrench.

10. Using a 1/4 in. (6.35 mm) internal hex wrench, remove control line plugs (16, 17). Discard O-rings. Using a 3 mm hex wrench, remove cavity plug (18, if equipped with two-line control) from X2 cavity.

11. Using a 5/16 in. (7.93 mm) internal hex wrench, remove drain plugs (19, 20). Discard O-rings.

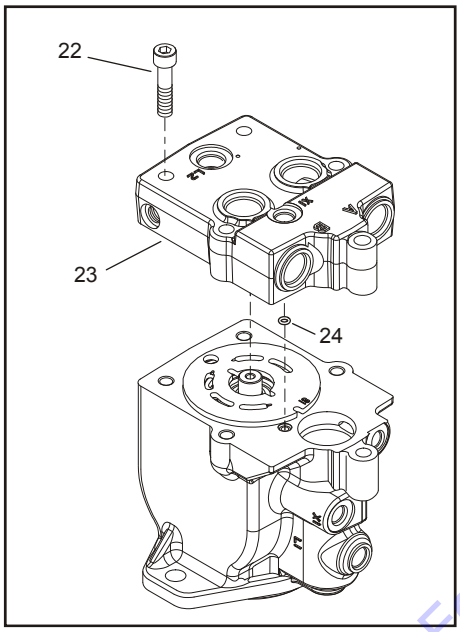
12. Using a 9/16 in. (14.28 mm) internal hex wrench, remove work port plugs (21, if equipped with axial ports). Discard O-rings.

13. Using an 8 mm internal hex wrench, remove the endcapscrews (22).

14. Remove the endcap (23). Remove O-ring (24) from the housing or endcap.

⚠ CAUTION

WHEN THE ENDCAPSCREWS ARE REMOVED, PRESSURE FROM THE SERVO SPRING WILL CAUSE THE ENDCAP TO BIND ON THE SHAFT. PRESS DOWN ON THE PORTION OF THE ENDCAP COVERING THE SERVO PISTON AND HOLD THE ENDCAP LEVEL WHILE REMOVING.



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

Figure 3-26. End Cap

15. Remove the valve plate (25) and timing pin (26) from the endcap.

NOTE: *Each displacement has a unique valve plate. For identification, the last two digits of the valve plate part number are stamped on its surface.*

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

17. Remove the rear shaft bearing (29) from the endcap with a bearing puller.

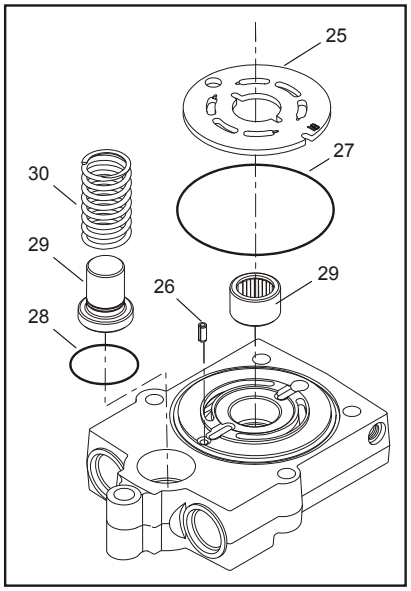
⚠ CAUTION

THE BEARING MAY BE DIFFICULT TO REMOVE WITH A PULLER. TRY THIS AS AN ALTERNATIVE: PACK THE BEARING CAVITY WITH HEAVY GREASE. AFTER THE SHAFT IS REMOVED, INSERT IT INTO THE BEARING CAVITY AND TAP LIGHTLY WITH A SOFT MALLET ON THE SPLINED END. THE GREASE WILL FORCE THE BEARING OUT. USE CAUTION NOT TO DRIVE THE BEARING PAST THE REAR SHAFT JOURNAL AS THE BEARING MAY BECOME TRAPPED ON THE SHAFT AND DAMAGED.

18. Remove minimum angle stop (29) and servo spring (30) from the housing.

⚠ CAUTION

TAKE CARE NOT TO SCRATCH THE SURFACE OF THE VALVE PLATE.



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

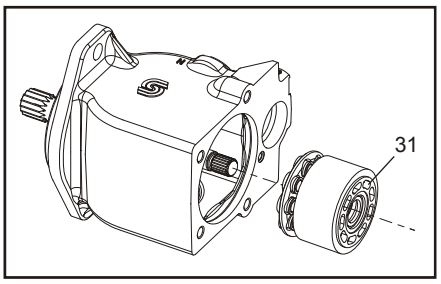
Figure 3-27. Valve Plate & Rear Shaft Bearing

19. Turn the housing on its side and remove the cylinder kit assembly (31). Set the assembly aside, being careful not to scratch the running surface.

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

Table 3-3. Displacement Identifiers

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



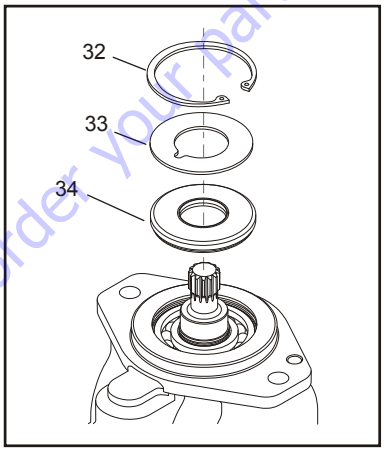
31. Cylinder Kit Assembly

Figure 3-28. Cylinder Kit

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

⚠ CAUTION

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

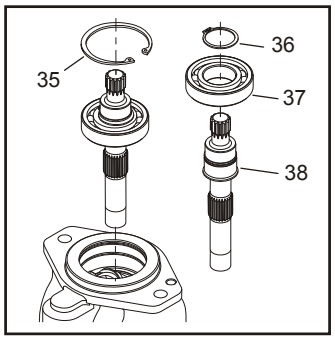


32. Snap Ring
33. Support Washer
34. Shaft Seal

Figure 3-29. Shaft Seal

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

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



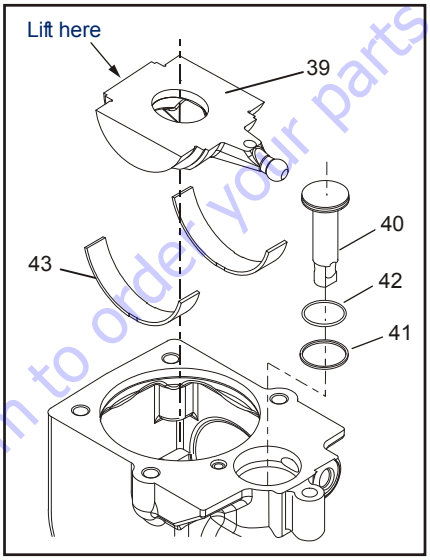
35. Inner Snap Ring
36. Snap Ring
37. Bearing
38. Shaft

Figure 3-30. Shaft & Front Bearing

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

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

25. Remove the journal bearings (43) from the housing. If the bearings are to be reused, note the location and orientation of each bearing for reassembly.



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

Figure 3-31. Swash Plate & Servo Piston

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

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

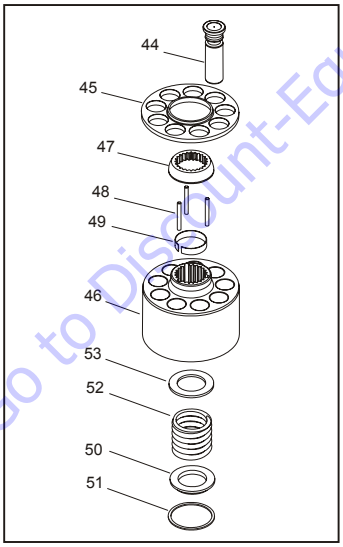
27. Remove the ball guide (47), hold-down pins (48), and retaining ring (49) from the cylinder block.

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

⚠ WARNING

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

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



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

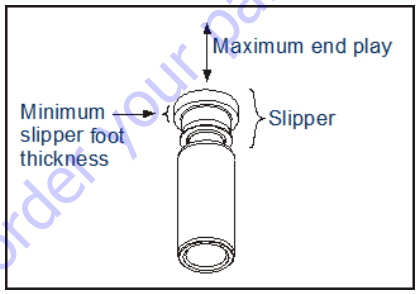
Figure 3-32. Cylinder Kit Disassembly

Inspection

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

PISTON

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



SLIPPERS

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

Minimum slipper foot thickness and maximum axial end-play are given in the table below.

Table 3-4. Slipper Foot Thickness & End Play

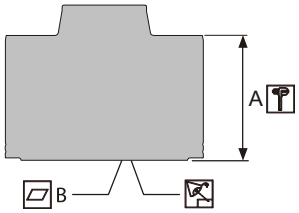
Measurement	L Frame mm (in.)	K Frame mm (in.)
Slipper Foot Thickness	2.71 (0.11)	4.07 (0.16)
Piston/Slipper End Play	0.15 (0.006)	

CYLINDER BLOCK

Measure the cylinder block height. Replace blocks worn beyond the minimum height specification. Inspect the running surface of the cylinder block. Replace or resurface worn or scratched blocks. Blocks may be resurfaced to the specifications shown in the drawing, provided resurfacing will not reduce the block height below the minimum specification. Table 3-5, Cylinder Block Measurements.

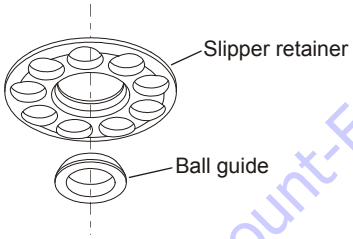
Table 3-5. Cylinder Block Measurements

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



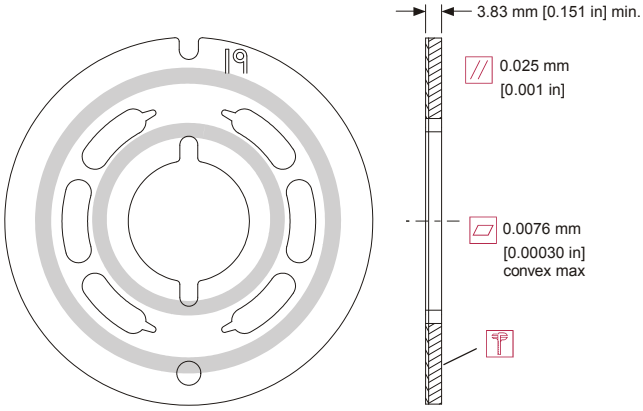
BALL GUIDE AND SLIPPER RETAINER

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



VALVE PLATE

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

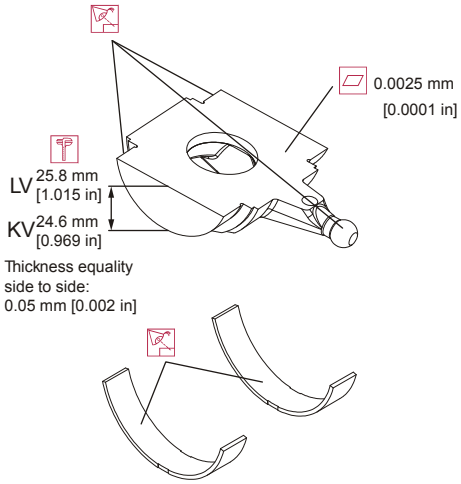


SWASHPLATE AND JOURNAL BEARINGS

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

SERVO PISTON AND MINIMUM ANGLE STOP

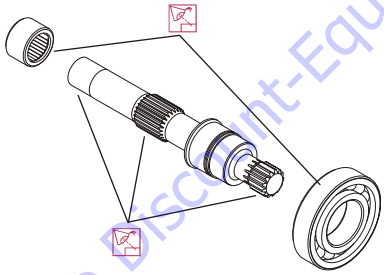
Inspect the minimum angle stop, servo piston head, and servo piston ball-socket for damage or excessive wear. Replace swashplate if the difference in thickness from one side to the other exceeds specification.



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

SHAFT BEARINGS

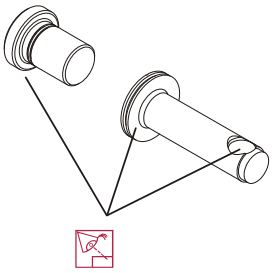
Inspect bearings for excessive wear or contamination. Rotate the bearings while feeling for uneven movement. Bearings should spin smoothly and freely. Replace bearings that appear worn or do not rotate smoothly.



SHAFT

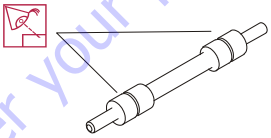
Inspect the motor shaft. Look for damage or excessive wear on the output and block splines. Inspect the bearing surfaces and sealing surface. Replace shafts with damaged or excessively worn splines, bearing surfaces, or sealing surfaces.

Replace if necessary.



LOOP FLUSHING SPOOL

Inspect the loop flushing spool. Check for cracks or damage. Replace if necessary.



Assembly

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

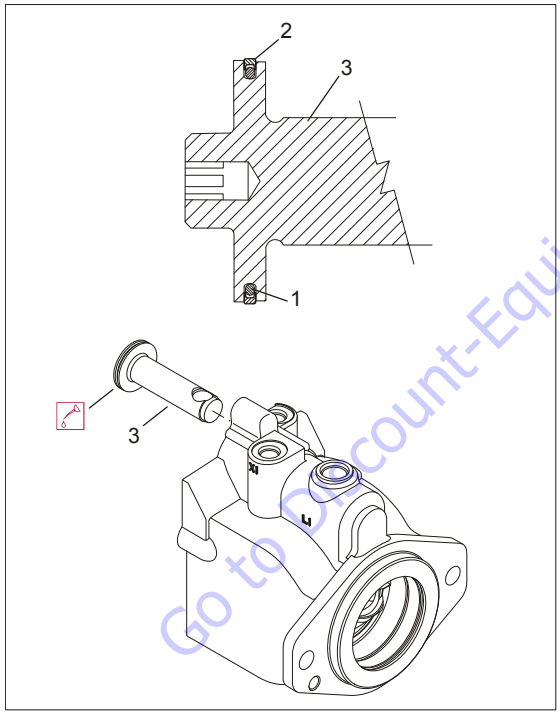
NOTICE

INSTALLING THE PISTON SEAL STRETCHES IT, MAKING IT DIFFICULT TO INSTALL THE SERVO PISTON IN ITS BORE. ALLOW 30 MINUTES FOR THE SEAL TO RELAX AFTER INSTALLATION. TO SPEED UP SEAL RELAXATION, COMPRESS THE SEAL BY INSTALLING THE PISTON HEAD INTO THE SERVO CAVITY IN THE END-CAP AND LET IT STAND FOR AT LEAST FIVE MINUTES.

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

⚠ WARNING

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



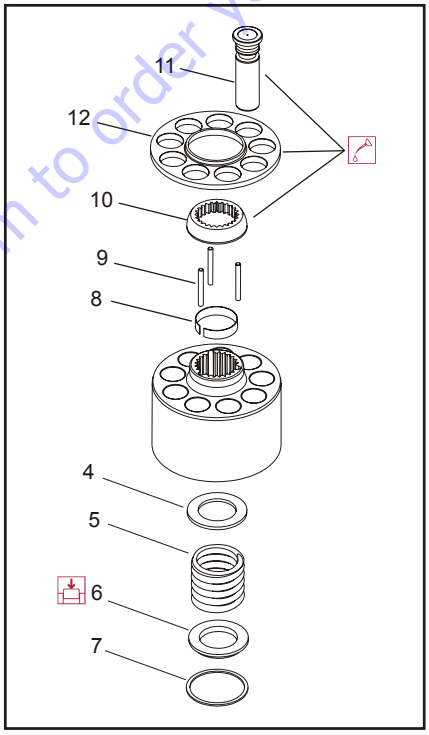
1. O-ring
2. Piston Seal
3. Servo Piston

Figure 3-33. Servo Piston

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

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

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

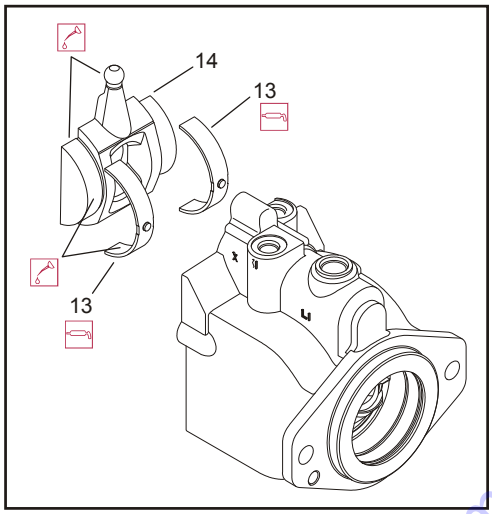


4. Block Spring Washer
5. Block Spring
6. Outer Washer
7. Spiral Retaining Ring
8. Retaining Ring
9. Holddown Pins
10. Ball Guide
11. Piston
12. Slipper Retainer

Figure 3-34. Cylinder Kit Assembly

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

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

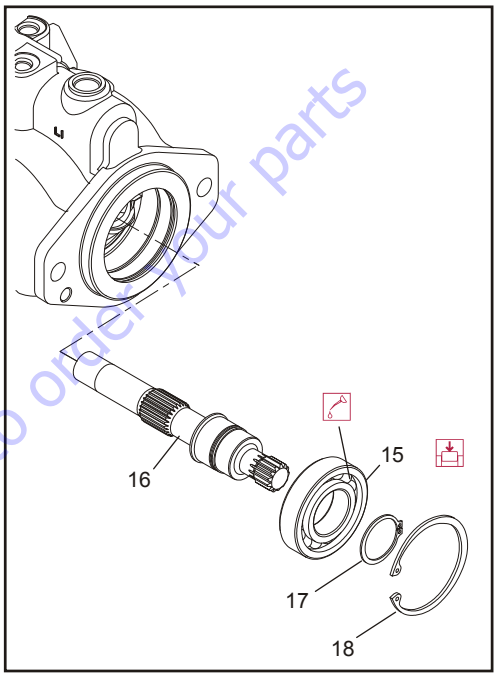


13. Journal Bearings
14. Swash Plate

Figure 3-35. Swash Plate and Journal Bearing

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

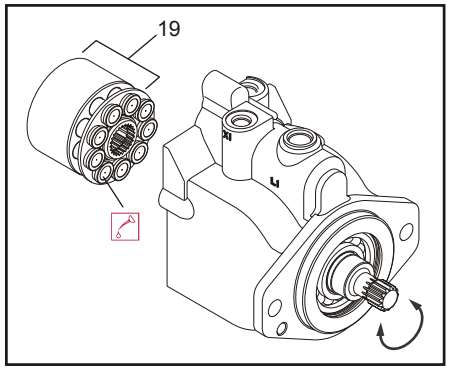
9. While holding the swashplate in place, turn the housing on its side. Install the install shaft/bearing assembly into housing from the flange end. Install the snap-ring (18).



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

Figure 3-36. Shaft and Front Bearing

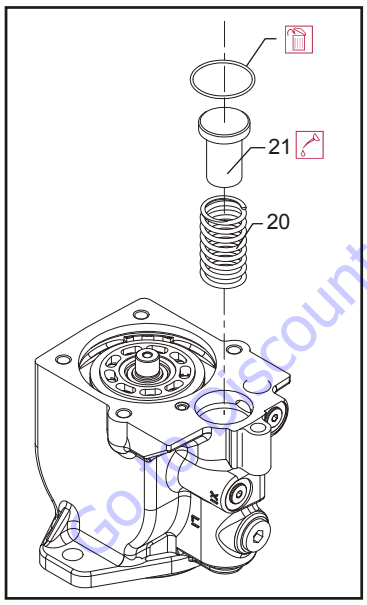
10. Verify swashplate and bearings are properly seated. Install the cylinder kit (19) onto the shaft. Install with the slippers facing the swashplate. Rock the shaft to align the block splines and slide the cylinder kit into place. Orient the motor with the shaft pointing downward and verify the cylinder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



19. Cylinder Kit

Figure 3-37. Cylinder Kit Installation

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



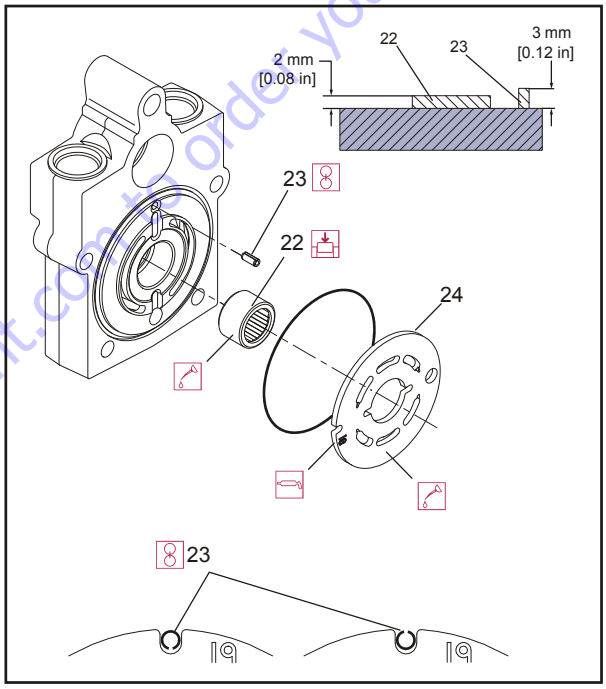
20. Servo Spring
21. Minimum Angle Stop

Figure 3-38. Servo Spring and Minimum Angle Stop

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

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

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

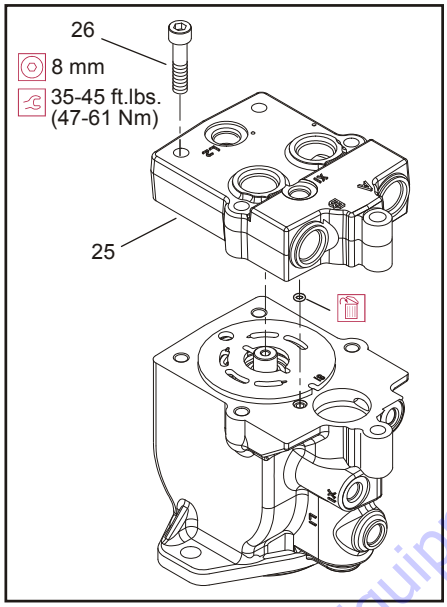


22. Rear Shaft Bearing
23. Timing Pin
24. Valve Plate

Figure 3-39. Valve Plate and Rear Bearing

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

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

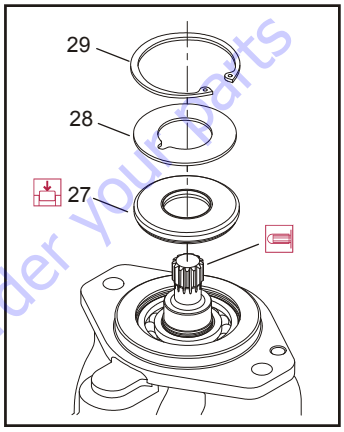


25. End Cap
26. Screw

Figure 3-40. End Cap

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

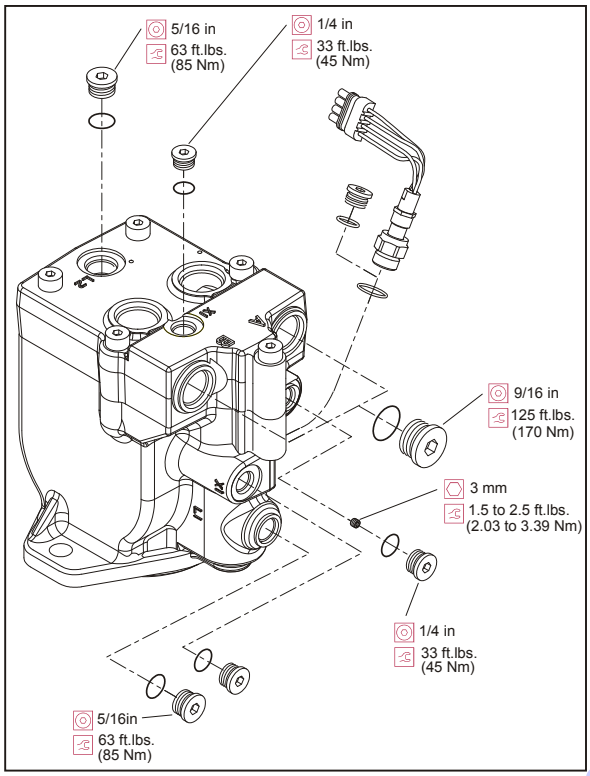
18. Cover shaft splines with an installation sleeve. Install a new shaft seal (27) with the cup side facing the motor. Press seal into housing until it bottoms out. Press evenly to avoid binding and damaging the seal. Install seal support washer (28) and snap ring (29).



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

Figure 3-41. Shaft Seal

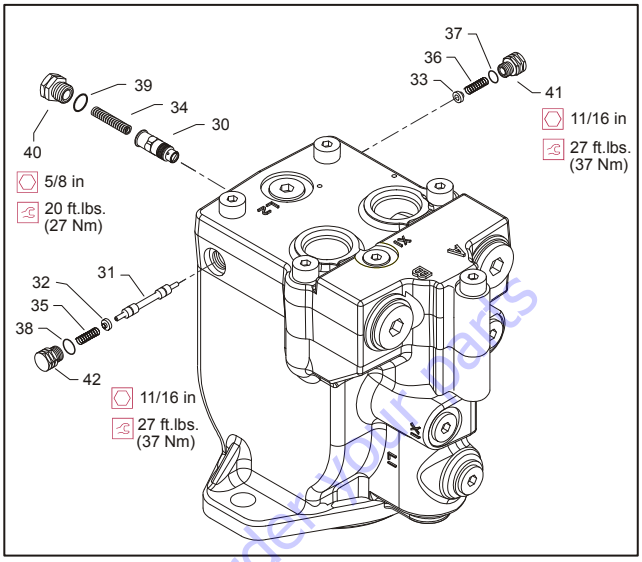
19. Install remaining plugs and fittings to the housing. Refer to the Figure 3-42., Plugs and Fittings Installation for wrench sizes and installation torques.



30. Shaft Seal
31. Seal Support Washer
32. Snap Ring

Figure 3-42. Plugs and Fittings Installation

20. Install orifice poppet (30).



33. Orifice Poppet
34. Shift Spool
35. Spring
36. Spring
37. Spring
38. Spring
39. Spring
40. O-ring
41. O-ring
42. O-ring
43. Plug
44. Plug
45. Plug

Figure 3-43. Loop Flushing Spool

21. Install shift spool (31).

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

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

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

25. Using a 5/8 in. (15.87 mm) wrench torque plug (40) to 20 ft. lbs. (27 Nm).

26. Using a 11/16 in. (17.46 mm) wrench, torque plugs (41 and 42) to 27 ft. lbs. (37 Nm).

Initial Start-up Procedures

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

Prior to installing the motor, inspect for damage incurred during shipping. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

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

Troubleshooting

Table 3-6. Excessive Noise and/or Vibration

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

Table 3-7. System Operating Hot

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

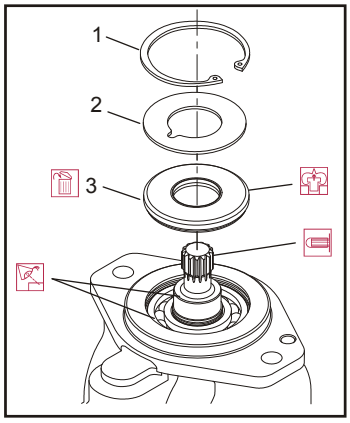
Table 3-8. Won't Shift or Slow to Start

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

Shaft Seal Replacement

REMOVAL

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



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

Figure 3-44. Removing the Shaft Seal

2. Remove the support washer (2).
3. Carefully pry out the shaft seal (3). To avoid damaging the shaft during removal, install a large sheet metal screw into the chuck of a slide hammer. Drive the screw into the seal surface and use the slide hammer to pull the seal.
4. Discard the seal.

INSPECT THE COMPONENTS

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

INSTALLATION

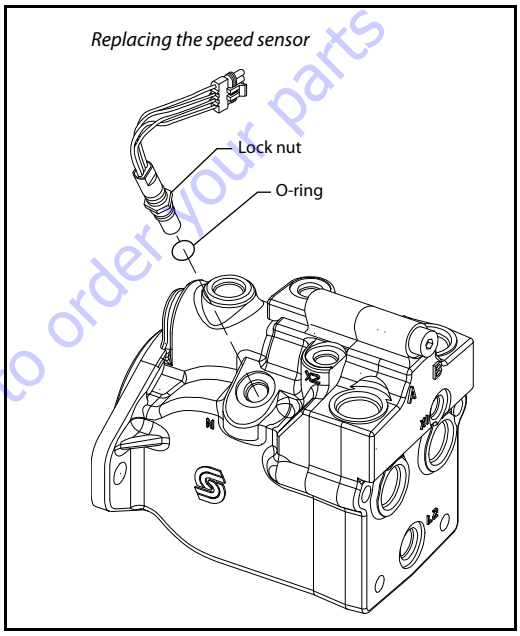
1. Cover the shaft splines with an installation sleeve to protect the shaft seal during installation.
2. Install a new shaft seal with the cupped side facing the motor. Press seal into housing until it bottoms out. Press evenly to avoid binding and damaging the seal.
3. Install seal support washer.
4.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

Remove the installation sleeve.

Speed Sensor Replacement

REMOVAL

1. Disconnect the speed sensor electrical connector.
2. Using an 11/16 in. wrench, loosen the locknut.
3. Using a 1/2 in. wrench, remove the speed sensor and o-ring from the motor.



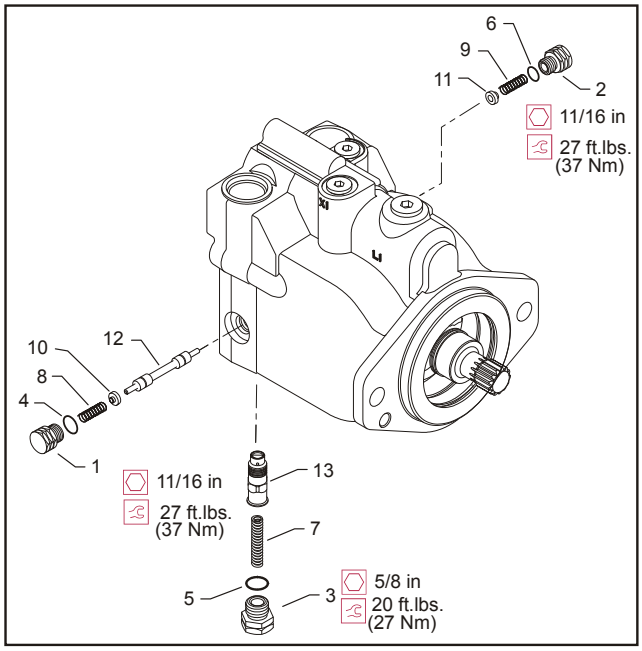
INSTALL THE NEW SPEED SENSOR

1. Turn speed sensor with O-ring in (CW) by hand until bottom end gently touches the speed ring.
2. Back out speed sensor (CCW) 1/4 turn. Continue backing out until the flats are 22 degree either side of the motor shaft center line (20-30 degree is acceptable). Do not back out more than 3/4 turn from touching bottom.
3. Using a 1/2 in. wrench to hold the speed sensor, torque the lock nut to 10ft. lbs. (13 Nm) with an 11/16 in. wrench.
4. Plug in electrical connection and start machine to test for proper operation.

Loop Flushing Valve

REMOVAL

1. Using a 11/16 in. (17.46 mm) internal hex wrench remove plug (1) and (2).



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

Figure 3-45. Loop Flushing Spool

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

INSPECT THE COMPONENTS

Inspect new O-rings and the sealing area for rust, wear, or contamination. Also check springs and poppet for wear.

INSTALLATION

1. Install orifice poppet (13).
2. Install shift spool (12).
3. Install spring retaining washers onto springs (10 and 11).
4. Carefully install centering springs (7, 8 and 9).
5. Install new O-rings (6, 4, and 5).
6. Using a 1/4 in. (6.35 mm) hex wrench torque plug (3) to 20 ft. lbs. (27 Nm).
7. Using a 11/16 in. internal hex, torque plugs (2 and 1) to 27 ft. lbs. (37 Nm).

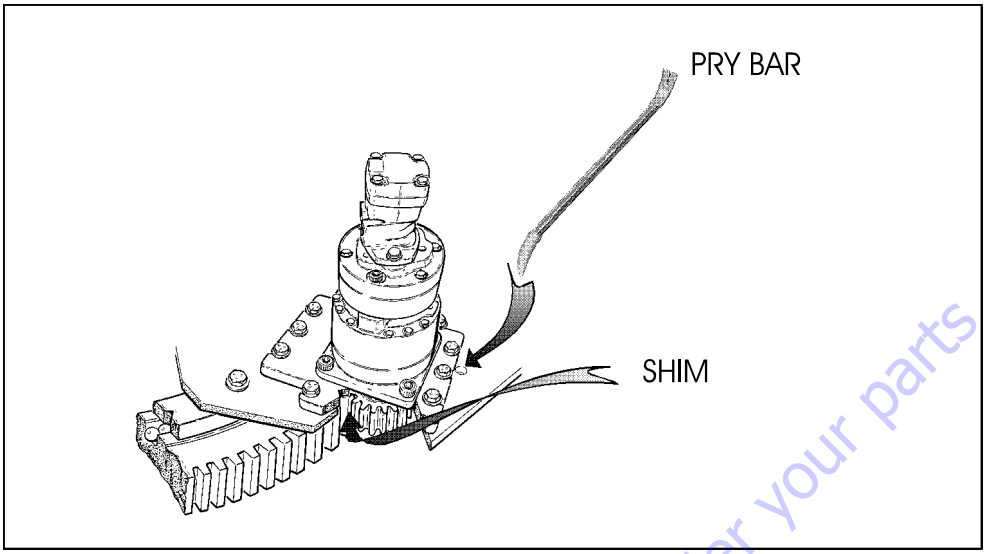


Figure 3-46. Swing Torque Hub Adjustment

3.11 SWING HUB (SN 0300087000 THROUGH 0300137452)

Adjustment Procedures

NOTE: *The swing bearing high spot is usually marked with a colored paint.*

1. Ensure swing drive is located on bearing gear max eccentric tooth (high spot).
2. With mounting free to slide, shim between pinion and bearing gear teeth to achieve 0.008 - 0.012 in. (0.20 - 0.30 mm) backlash.
3. Install a pry bar into hole in turntable base plate and pry swing hub back tight against shim and bearing.
4. Torque bolts according to the torque chart in Section 1.

Disassembly

1. Loosen all 12 cover bolts (12) & (13) and drain the oil from the unit.
2. Remove the 12 cover bolts (12) & (13) and lift off the cover (6). Remove and discard the O-ring (5) from the counterbore of the cover (6).
3. Remove the input gear (8) and thrust washer (10).
4. Lift out the carrier assembly (3) and top thrust washer (11). The thrust washer (11) may stick to the inside of the carrier (3).
5. Remove the input thrust spacer (9).
6. Lift out the internal gear (2) and thrust washer (11). The thrust washer (11) may stick to the under side of the cover (3).
7. Remove the retaining ring (1I) from the output shaft (1A) and discard.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING (1I) REMOVAL.

8. Remove bearing shim (1H) from the output shaft (1A).
9. The output shaft (1A) may now be pressed out of the hub (1G).
10. The bearing cups (1C) & (1E) will remain in hub (1G) as will bearing cone (1F). Bearing cone (1D) will remain on the same output shaft (1A). The seal (1B) will be automatically removed during this procedure.

NOTE: *If bearing replacement is necessary, the bearing cups can be removed with a slide hammer puller driven out with a punch.*

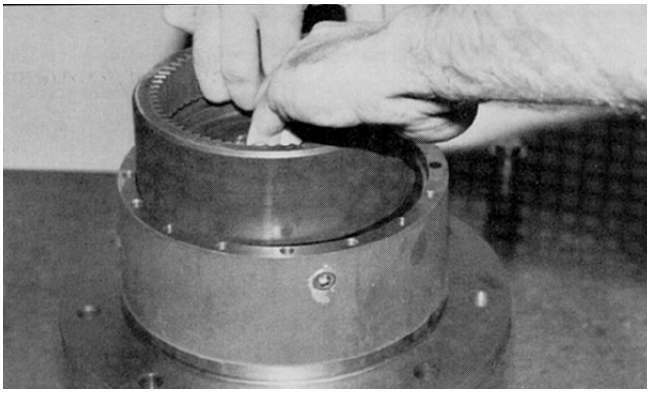
11. To remove the cluster gears (3F) from the carrier (3A), drive the anti-roll pin (3G) into the planet shaft (3E). The planet shaft (3E) may now be tapped out of the carrier. After planet shaft (3E) has been removed the roll pin (3G) can be driven out.
12. The cluster gear (3F) can now be removed from the carrier (3A). The thrust washers (3B) will be removed with the cluster gear (3F).
13. The needle rollers (3C) and spacer (3D) are now removed from the cluster gear (3F).

NOTICE

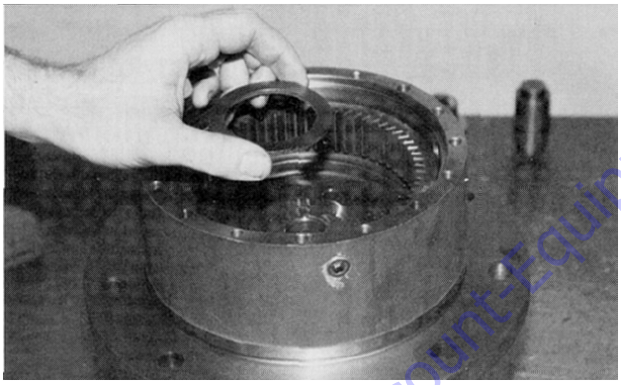
WHEN REBUILDING OR REPAIRING THE UNIT, THE RETAINING RING (1I), O-RINGS (5) AND SEAL (1B) SHOULD ALWAYS BE REPLACED.

Main Assembly Procedure

1. With the hub shaft sub-assembly resting on the shaft (1A) install internal gear (2). The spline of the internal gear (2) bore will mesh the spline of the output shaft (1A).



2. Thrust Washer (11) is installed on the face of the output shaft (1A). Sufficient grease or petroleum jelly should be used to hold thrust washer in place.

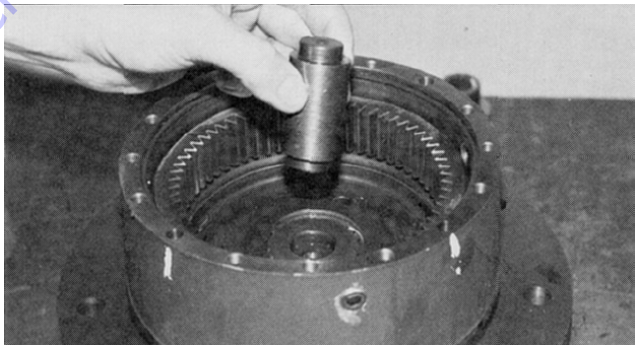


3. Place O-ring (5) into hub counterbore. Use petroleum jelly to hold O-ring in place. Also at this time locate and mark the 4 counter beamed holes in the face of the hub (1G). This is for identification later in the assembly.

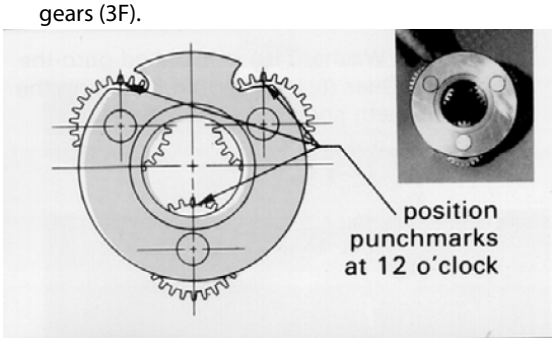
⚠ CAUTION

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

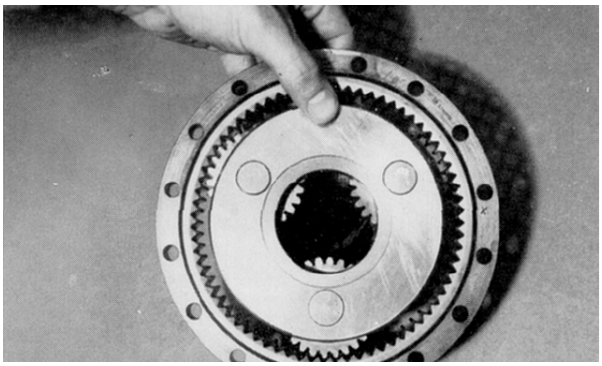
4. Thrust spacer (9) is installed into the bore of the output shaft (1A). This should be a slip fit and thrust spaces should rotate in this location.



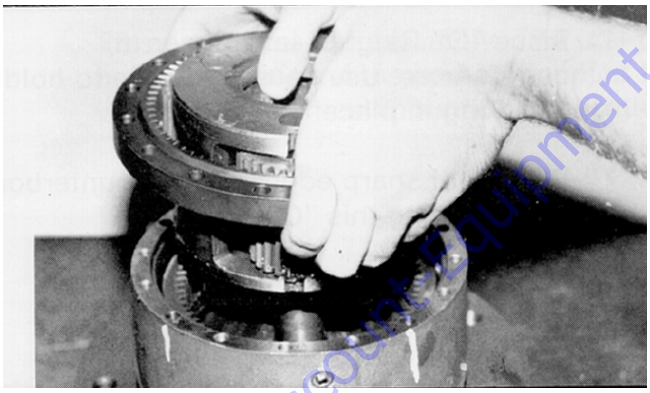
5. Place carrier assembly (3) on a flat surface with the large gears (3F) up and positioned as shown. Find the punch marked tooth on each large gear (3F) and locate at 12 o'clock (straight-up) from each planet pin. Marked tooth will be located just under the carrier (3A) on upper two gears (3F).



6. With shoulder side of ring gear (4) facing down, place ring gear over (into mesh with) large gears. Be sure that punch marks remain in correct location during ring gear installation. The side of the ring gear with an "X" stamped on it should be up.

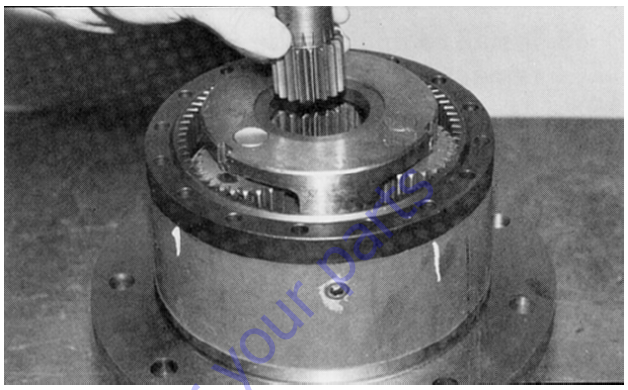


7. While holding ring gear (4) and cluster gears (3F) in mesh, place small side of cluster gears (3F) into mesh with the internal gear (2) and input gear (13). On the ring gear locate the hole marked "X" over one of the marked counterbore holes (step 3) in hub (1G).

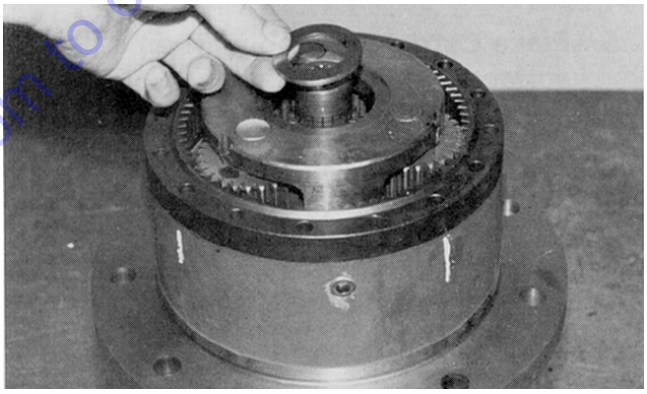


NOTE: *If gears do not mesh easily or carrier assembly does not rotate freely, then remove the carrier and ring gear and check the cluster gear timing.*

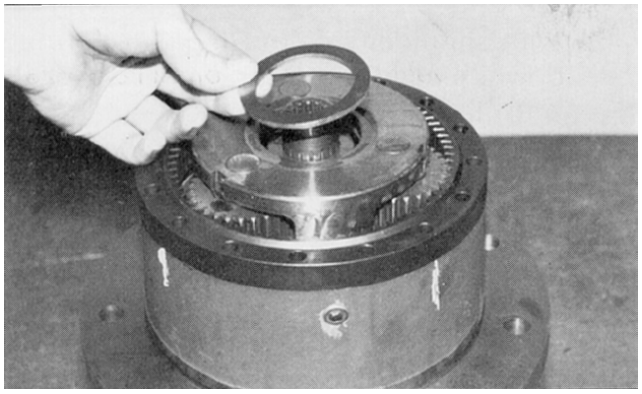
8. Input gear (8) is installed, meshing with teeth of the large diameter cluster gear (3F). The counterbore on the input gear (8) locates on the shoulder of the thrust spacer (9). This is to be a slip fit and operate freely.



9. Thrust Washer (10) is installed onto the input gear (8) and should locate on the gear teeth shoulder.



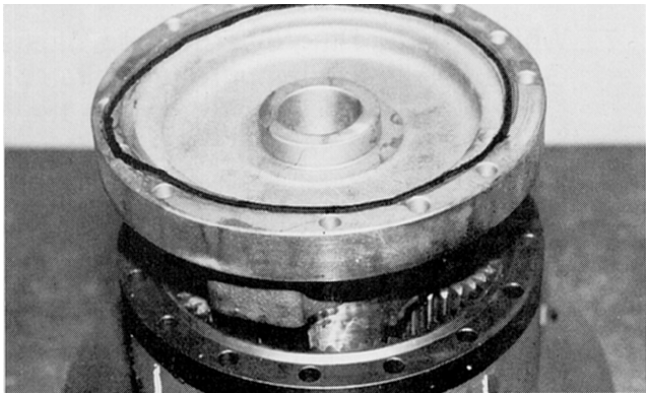
10. Thrust Washer (11) is installed into the counterbore of the carrier (3).



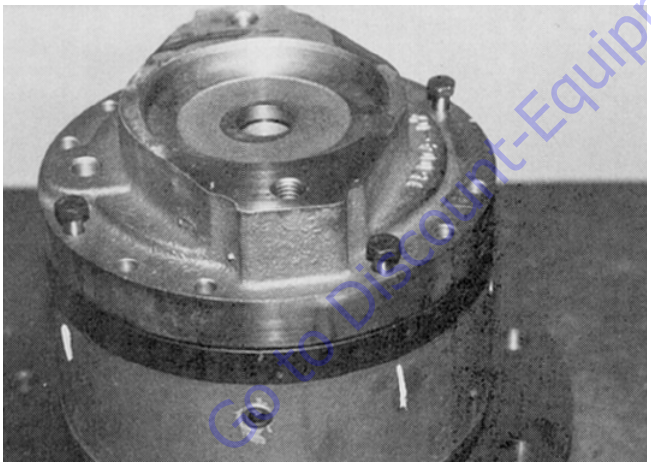
11. Place O-ring (5) into cover (6) counterbore. Use petroleum jelly to hold O-ring in place.

⚠ CAUTION

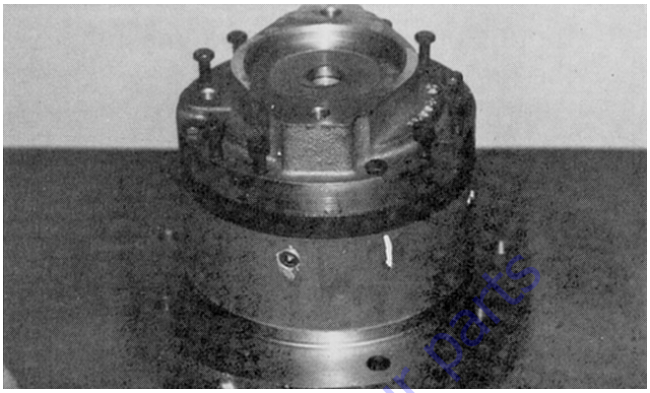
BEWARE OF SHARP EDGES OF THE COUNTERBORE WHILE SEATING THIS O-RING.



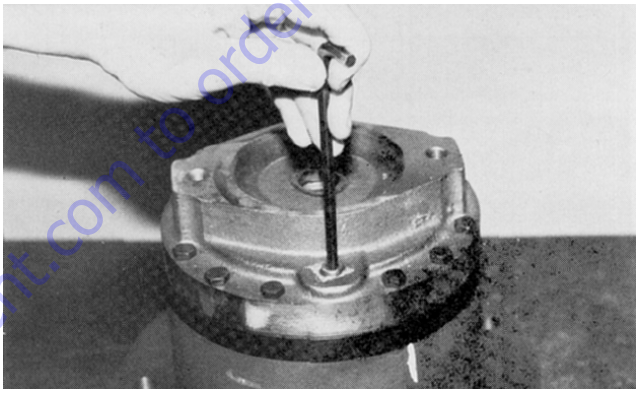
12. The cover (6) is now installed on this assembly. Taking care to correctly align pipe plug hole (20) with those in the hub (1J), usually 90° to one another. Locate the 4 counterbore holes in hub (1G) (marked in step 3) and install 4 shoulder bolts (13). A slight tap with a hammer may be necessary to align shoulder bolt with hub (1G) counterbore.



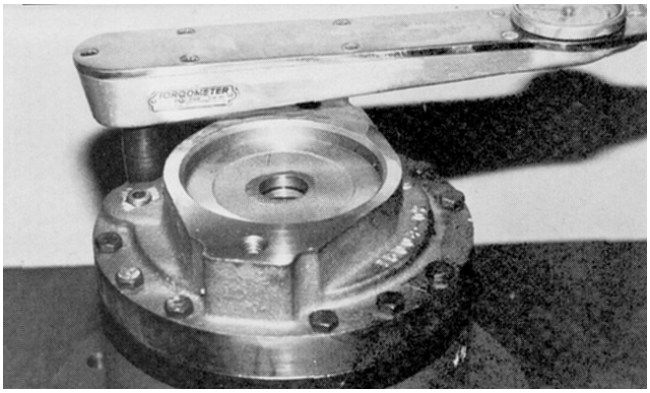
13. Install regular grade 8 bolts (12) into remaining holes.



14. Pipe plugs (20) are to be installed into cover (6) using a lubricant of some sort.



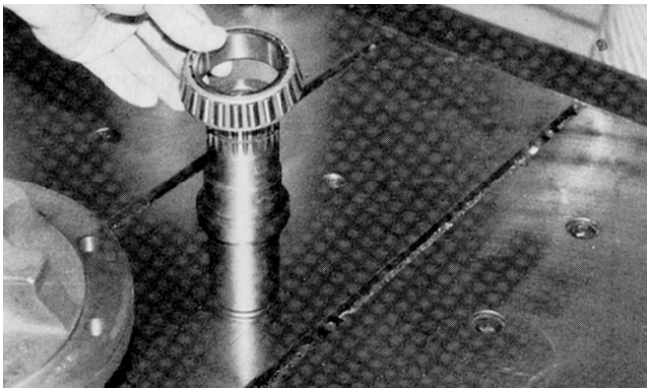
15. Torque shoulder bolts (13) to 23-27 ft. lbs. (31-37 Nm) and regular grade 8 bolts (12) to 23-27 ft. lbs. (31-37 Nm).



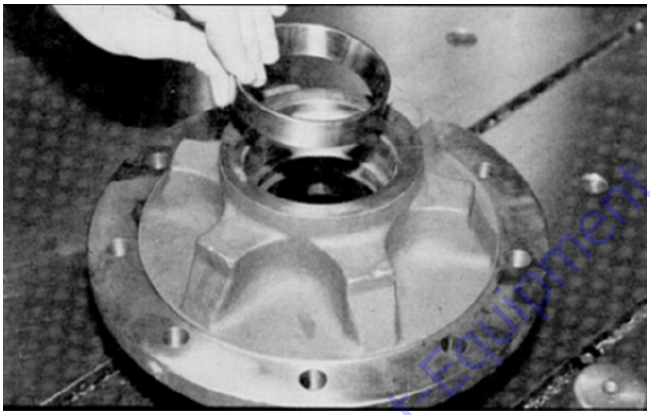
This completes the assembly. The unit must be filled one-half full of EP 90 lubricant before operation if the unit is mounted horizontally, and completely filled if mounted vertically. In vertical mounting application case oil circulation is recommended.

Hub Shaft Sub-Assembly

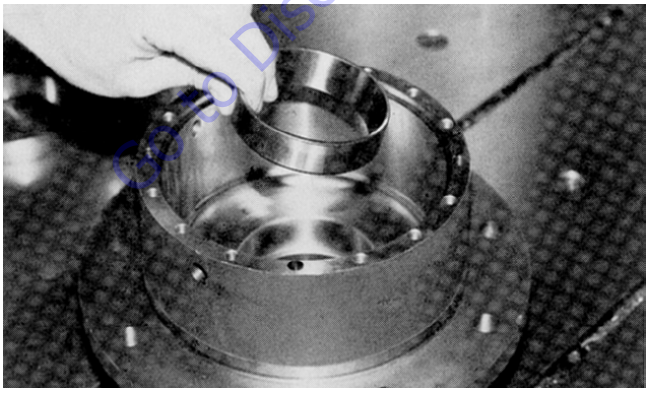
1. Press bearing cone (1D) onto shaft (1A).



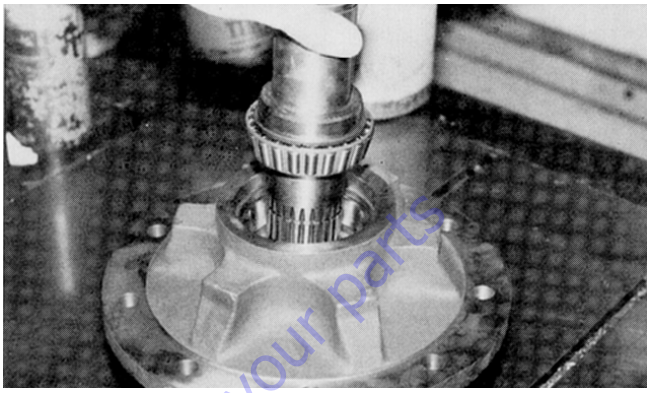
2. Press bearing cup (1C) into hub (1G) taking care to ensure cup start square with the bore of the hub.



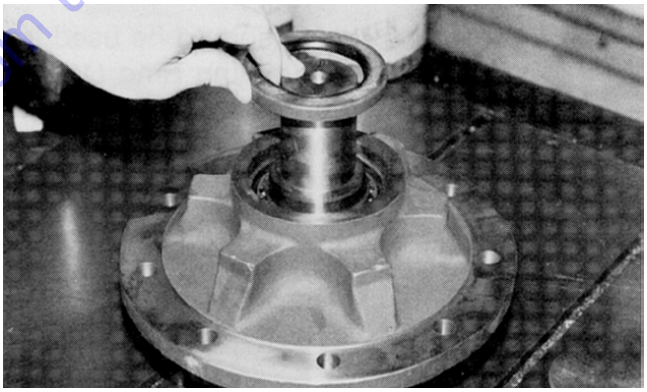
3. Invert hub (1G) and press bearing cup (1E) into intercounterbore of hub (1G).



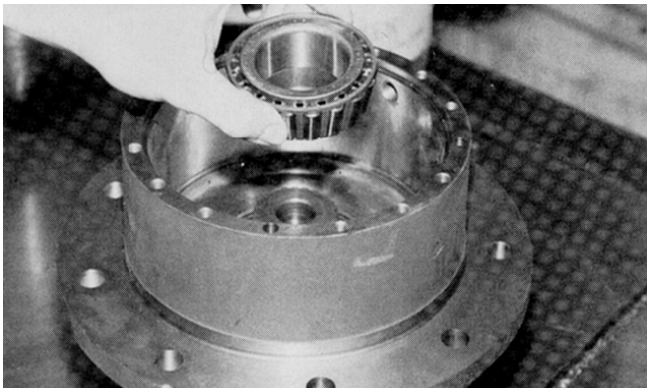
4. Returning the hub (1G) to locate on the large diameter end, the output shaft (1A) is carefully installed into the hub (1G).



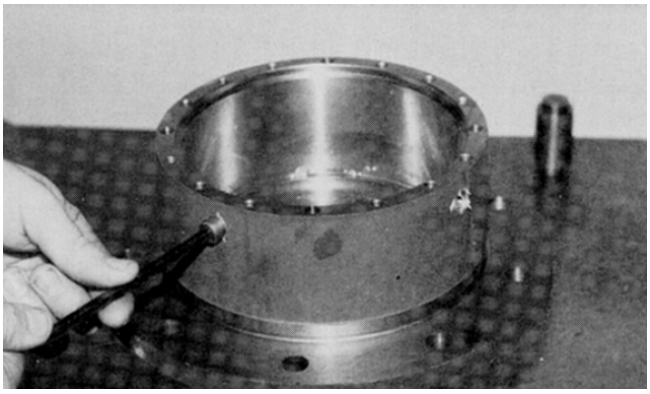
5. The shaft seal (1B) is installed over the output shaft (1A) and into the counterbore of the hub (1G). Care should be taken to ensure the seal (1B) is being correctly installed (smooth face up and located just flush with the counterbore face).



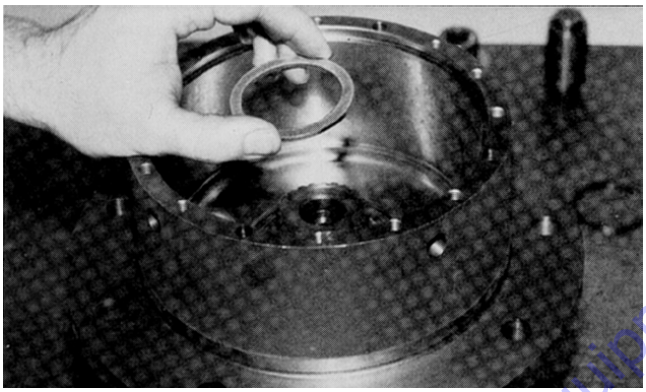
6. The bearing cone (1F) is an interference fit and has to be pressed or tapped on.



7. Pipe plugs (1J) & (1K) should be checked and/or installed at this time in the assembly.



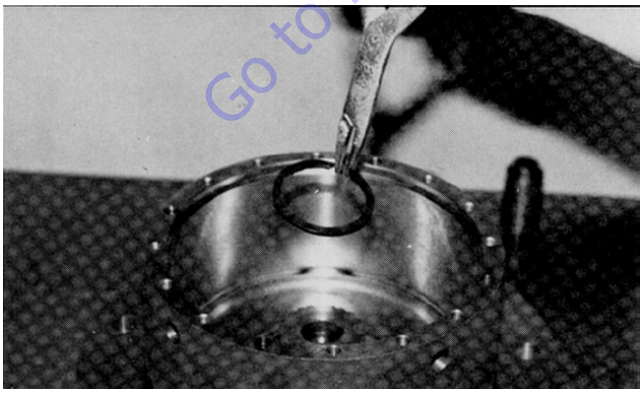
8. Bearing spacer (1H) is installed around the output shaft (1A) and locates on bearing cone (1F).



9. Retaining ring (1I) installed into groove provided in the output shaft (1A). This retaining ring (1I) should never be reused in a repair or rebuild.

⚠ CAUTION

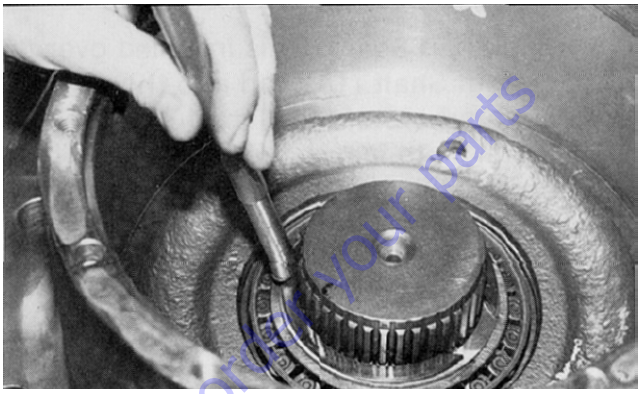
EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.



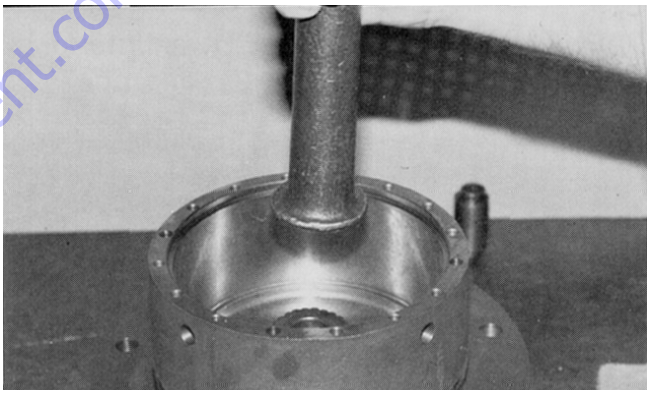
10. A soft metal punch should be used to ensure that this retaining ring (1I) is completely seated in the groove of the output shaft (1A).

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.



11. Upon completion of step 10, rap the internal end of the output shaft (1A) twice with a piece of soft metal rod. This will release the preload which was on the bearings.

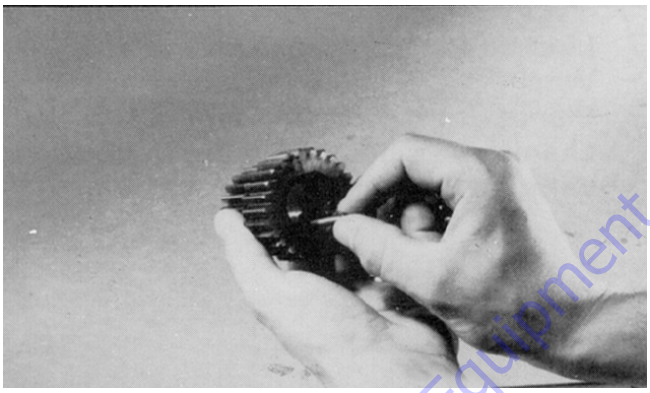


This completes the hub shaft sub-assembly-items (1A) through (1J). If this assembly is not going to be used right away, it should be oiled and covered to help prevent rusting.

Carrier Sub-Assembly

1. Apply a coat of grease or petroleum jelly to cluster gear bore.

2. Place sixteen needle rollers into cluster gear bore.

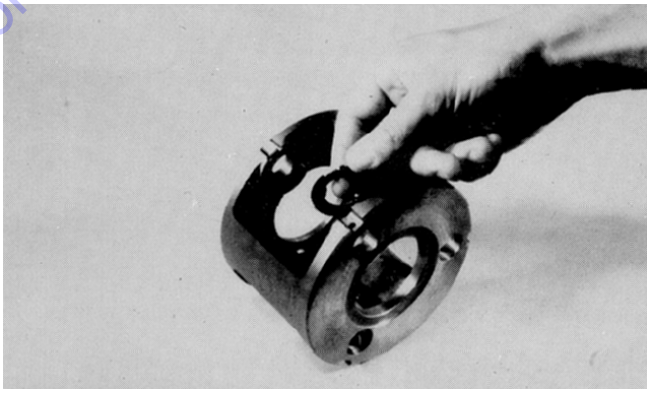


3. Place spacer washer into opposite side of cluster gear and against needle rollers.

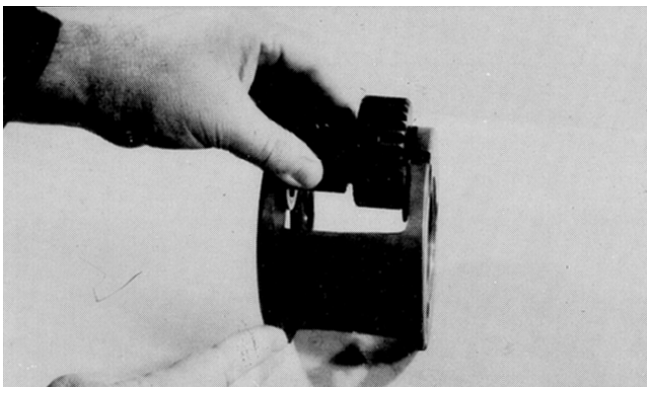
4. Place second set of sixteen needle rollers into cluster gear.

5. Apply grease or petroleum jelly to the tang side of two thrust washers. Place thrust washers against bosses in carrier with washer tang fitting into slot in carrier outside diameter.

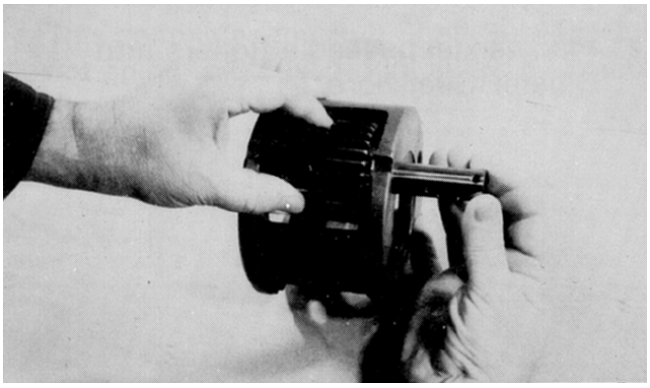
NOTE: *Some old style carriers will not have slots and tangs should be located inside boss relief.*



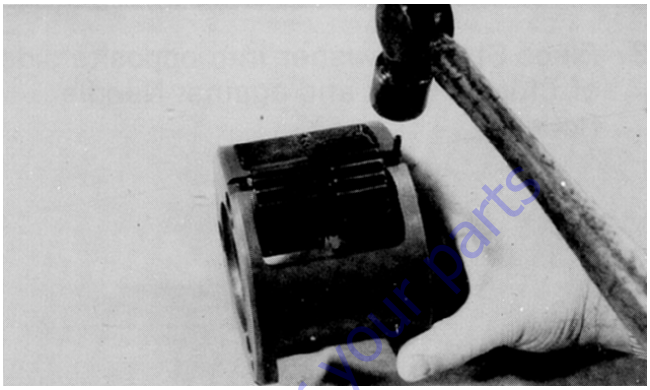
6. While keeping thrust washers in place, slide cluster gear into carrier with the larger gear on the side with the small pin hole.



7. Line up cluster gear and thrust washer with hole in carrier and slide planet shaft through. Line up chamfered side of hole in planet shaft with pin hole in carrier.



8. Drive anti-roll pin flush into carrier hole, thereby locking planet shaft into place.
Repeat these steps for remaining two cluster gears to complete carrier assembly.



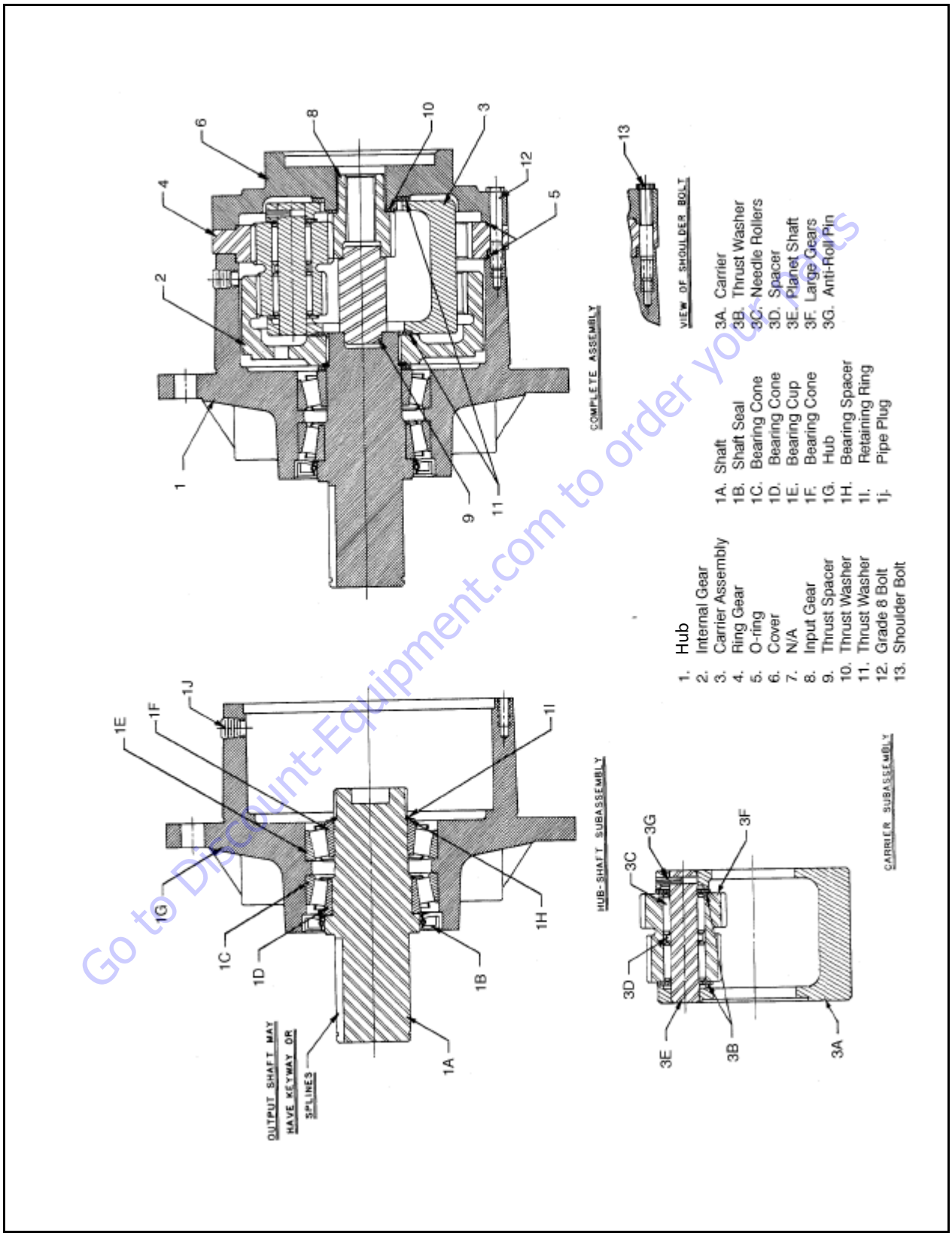


Figure 3-47. Swing Hub

3.12 SWING HUB (USA BUILT MACHINES AND CHINA BUILT MACHINES, SN 0300137453 THROUGH 0300177361 AND SN B300000100 TO PRESENT)

Roll, Leak And Brake Testing

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

NOTE: *The brake must be released before performing the roll test. This can be accomplished by either pressure testing using the Brake Leak Test procedure below or by tightening the 12 bolts into the piston through the end plate (See Brake Disassembly Procedure).*

NOTE: *Bolts must be removed while performing brake release test.*

Roll Test

The purpose of the roll test is to determine if the unit's gears are rotating freely and properly. You should be able to rotate the gears in your unit by applying constant force to the roll checker. If you feel more drag in the gears only at certain points, then the gears are not rolling freely and should be examined for improper installation or defects. Some gear packages roll with more difficulty than others. Do not be concerned if the gears in your unit seem to roll hard as long as they roll with consistency. Release the pressure at the Brake Housing (6) and remove the test fixtures.

Leak Test (Main Unit)

The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your air checker starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings or gaskets are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where the o-rings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, o-ring or gasket, the part must be replaced, and the unit rechecked. Leak test at 10 psi (0.7 bar) for 20 minutes.

Brake Test

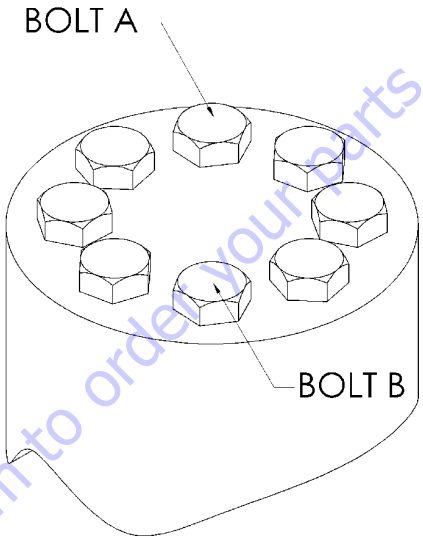
The brake test must be performed with the Motor removed and the Brake Test Plate (T-214404) installed. Install the Hex Bolts through Brake Test Plate and torque to 80 - 100 ft. lbs. (108-135 Nm). Install Roll Checking Tool (T-212731) and apply 210 psi (14 bar) to the o-ring port in the side of the Brake Housing. The roll checking fixture should roll freely. Increase the pressure to 3000 psi (207 bar) and perform the Roll Test.

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

Tightening and Torquing Bolts

If an air impact wrench is used to tighten bolts, extreme care should be taken to ensure that the bolts are not tightened beyond their specified torque.

The following steps describe how to tighten and torque bolts or socket head capscrews in a bolt circle.

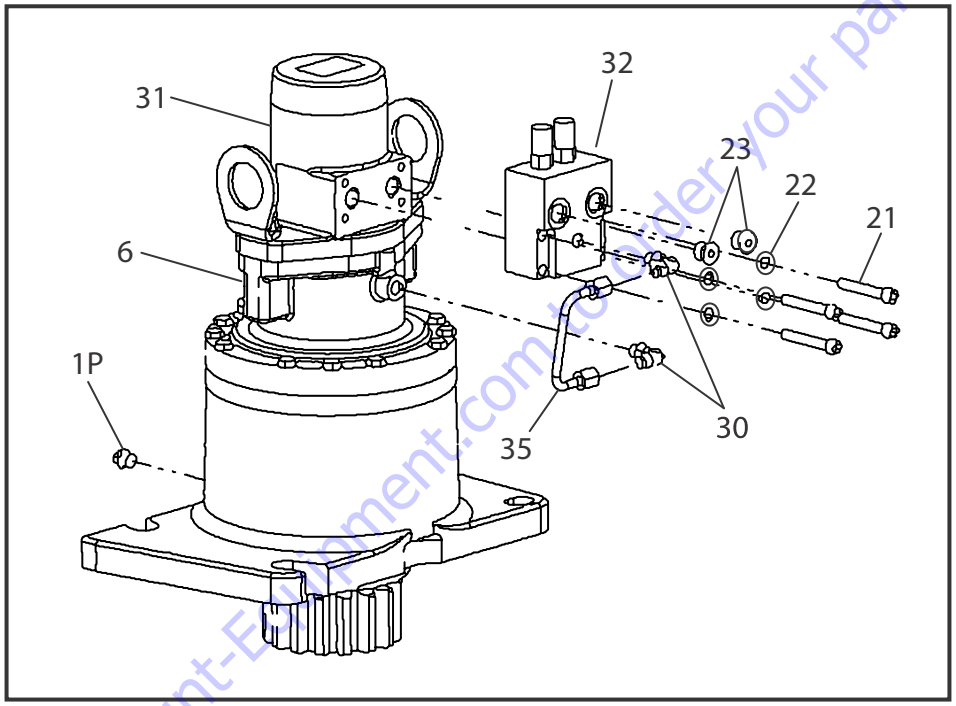


1. Tighten (but do not torque) bolt “A" until snug.
2. Go to the opposite side of the bolt circle and tighten bolt “B” until equally snug.
3. Crisscross around the bolt circle and tighten remaining bolts.
4. Now use a torque wrench to apply the specified torque to bolt “A”.
5. Using the same sequence, crisscross around the bolt circle and apply an equal torque to the remaining bolts.

Motor Control Valve Disassembly

NOTE: *Refer to Figure 3-48.*

1. Place unit on bench with the motor end up.
2. Remove O-ring plug (1P) and drain the oil from the gearbox.
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 (6) and Motor control valve (32).
5. Remove O-ring 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).



1P. O-ring Plug
6. Hydraulic Brake
21. Hex Bolt
22. Lockwasher
23. Plug
30. Elbow Fitting
31. Hydraulic Motor
32. Motor Control Valve
35. Hydraulic Tubing

Figure 3-48. Motor Control Valve

Motor and Brake Disassembly

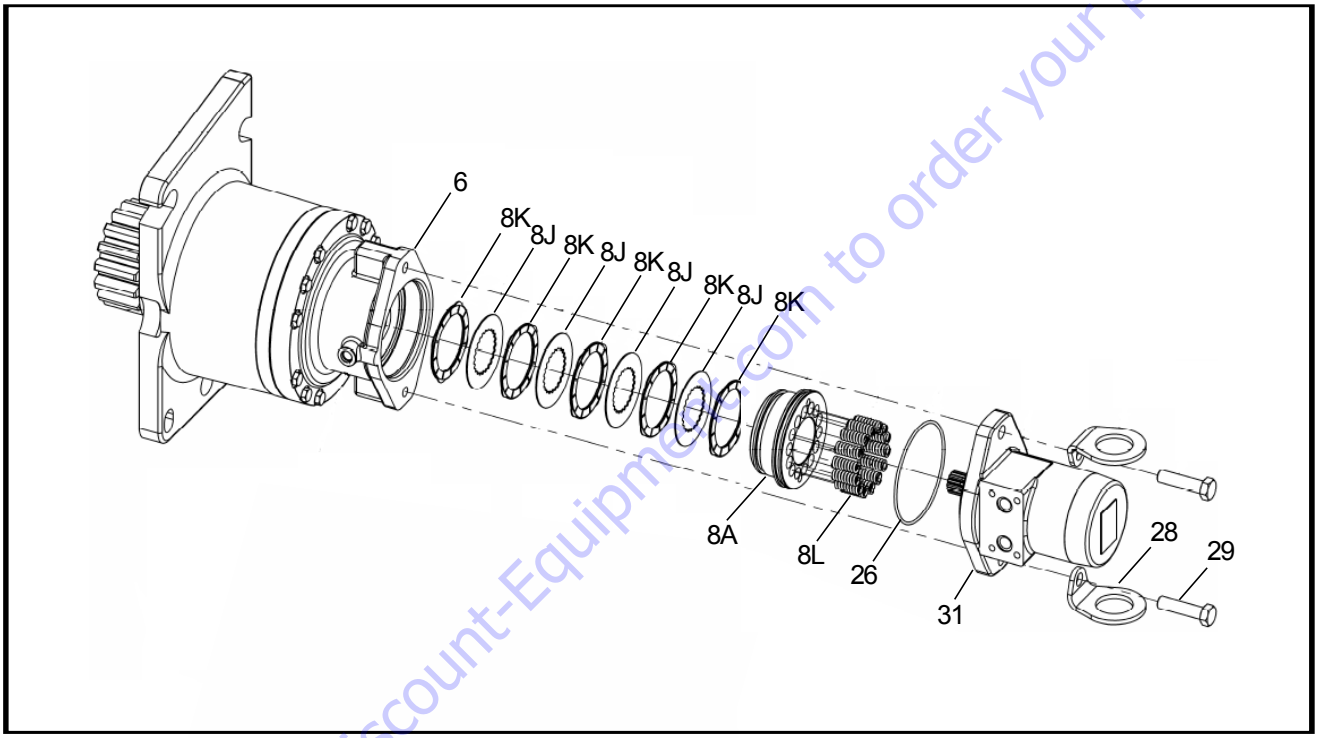
NOTE: *Refer to Figure 3-49.*

1. With unit resting on bench with motor (31) end up, loosen hex bolts (29) and remove lift lugs (28) from the motor (31).
2. Pull Motor (31) straight up and remove motor (31) from brake housing (6).
3. Remove O-ring (26) from between motor (31) and Brake Housing (6).
4. Remove the springs (8L) from the piston.
5. Apply less than 50 psi (3.45 bar) air to the "brake port" to remove Brake Piston (8A).

⚠ CAUTION

THE PISTON MAY MOVE QUICKLY. EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

6. Remove rotors (8J) and stators (8K) from Brake Housing (6).



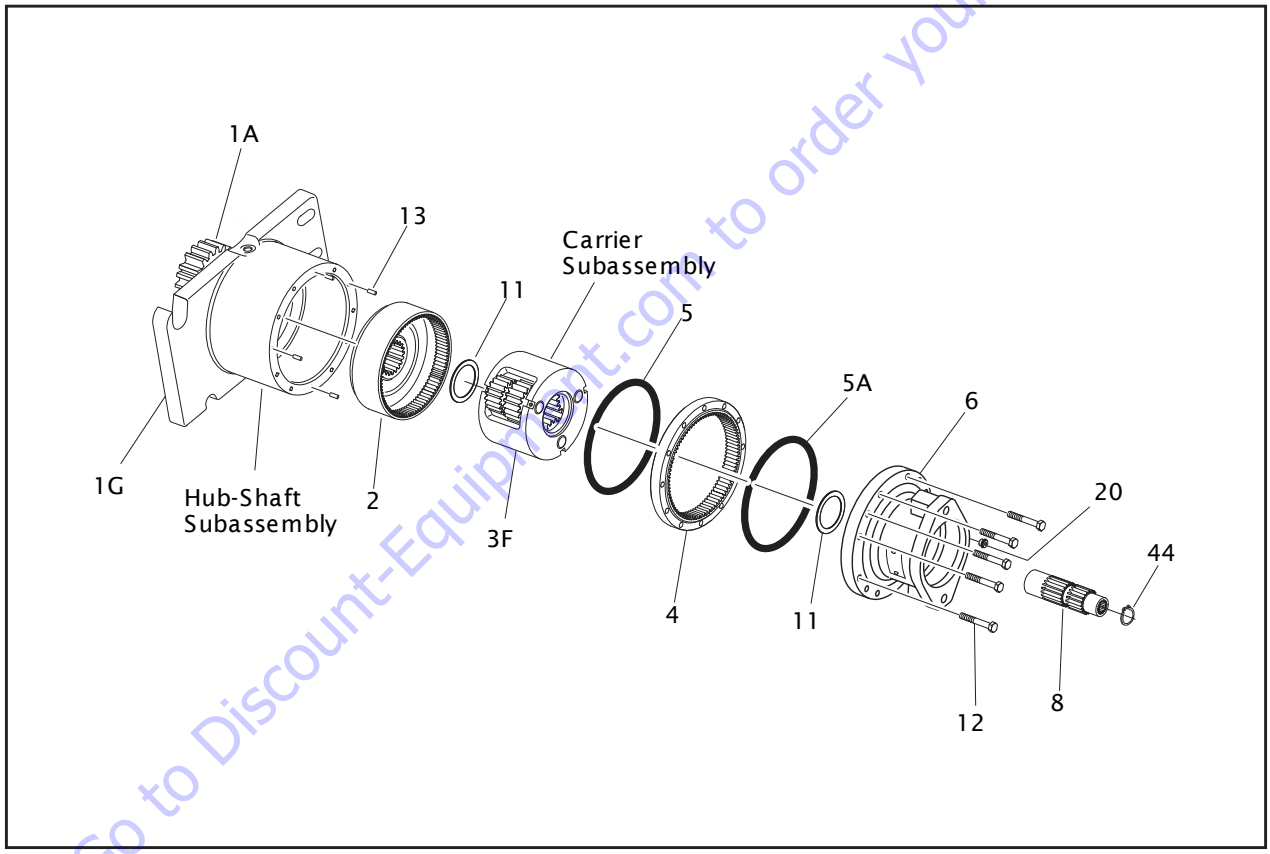
6. Brake Housing
8A. Brake Piston
8L. Spring
8J. Rotors
8K. Stator
26. O-ring
28. Lift Lug
29. Hex Bolt
31. Motor

Figure 3-49. Motor and Brake

Main Drive Disassembly

NOTE: *Refer to Figure 3-50.*

1. Remove sun gear (8) with retaining ring (44) inside.
2. With the unit resting on the output shaft (pinion) (1A), remove the bolts (12) from the brake housing (6).
3. Remove the brake housing (6) from the main assembly.
4. Remove O-ring (5A) from between brake housing (6) and Ring Gear (4).
5. Remove thrust washer (11) from between brake housing (6) and carrier subassembly.
6. Remove ring gear (4) from housing (1G).
7. Remove O-ring (5) from between ring gear (4) and housing (1G).
8. Remove carrier sub-assembly.
9. Remove thrust washer (11) from between carrier subassembly and internal gear (2).
10. Remove internal gear (2).



1A. Output Shaft (Pinion)
1G. Housing
2. Internal Gear
3F. Carrier subassembly
4. Ring Gear
5. O-ring
5A. O-ring
6. Brake Housing
8. Sun Gear
11. Thrust Washer
12. Bolt
13. Dowel Pin
20. Pipe Plug
44. Ring

Figure 3-50. Main Drive Assembly

Hub-Shaft Disassembly

NOTE: *Refer to Figure 3-51.*

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

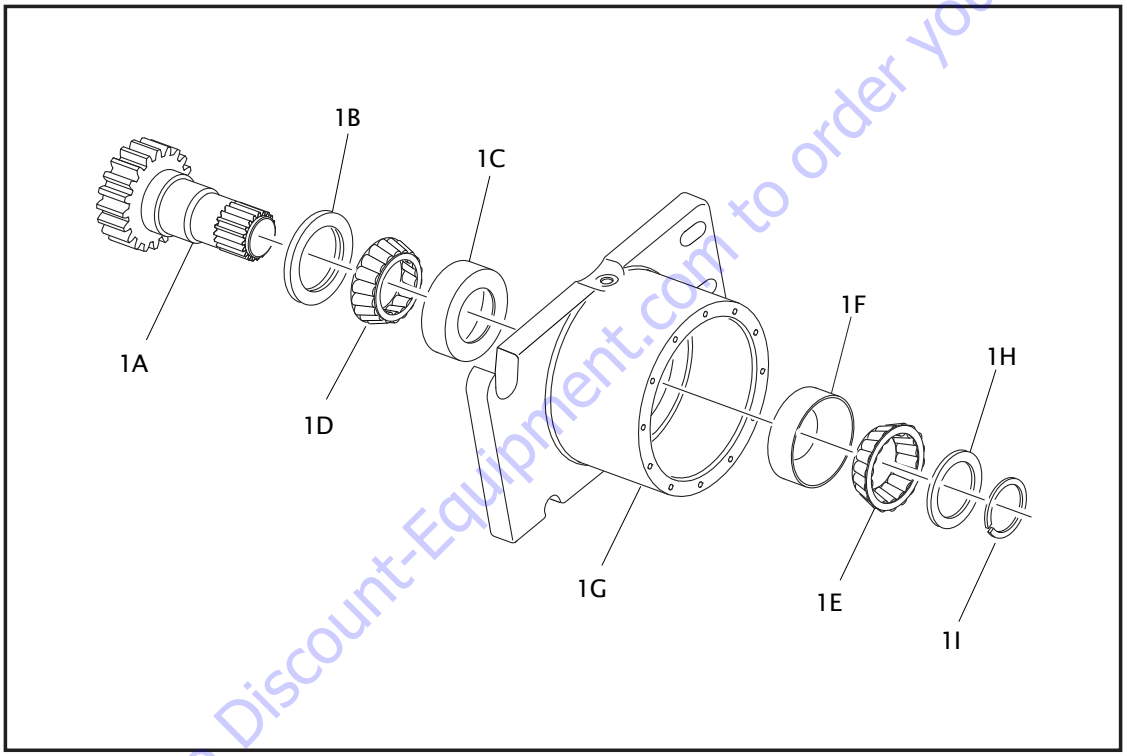
⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

2. Remove thrust washer (1H).
3. While supporting the housing (1G) on the output shaft (1A) end, press the output shaft (1A) out of the housing (1G).

NOTE: *The lip seal (1B) will be pressed out of the housing (1G) by the bearing cone (1D) during this step.*

4. Remove the bearing cone (1E) from the housing (1G).
5. Use a bearing puller to remove the bearing cone (1D) from the shaft (1A).
6. Bearing cups (1C) & (1F) will remain in housing (1G).



1A. Output Shaft
1B. Lip Seal
1C. Bearing Cup
1D. Bearing Cone
1E. Bearing Cone
1F. Bearing Cup
1G. Housing
1H. Thrust Washer
1I. Retaining Ring

Figure 3-51. Hub-Shaft

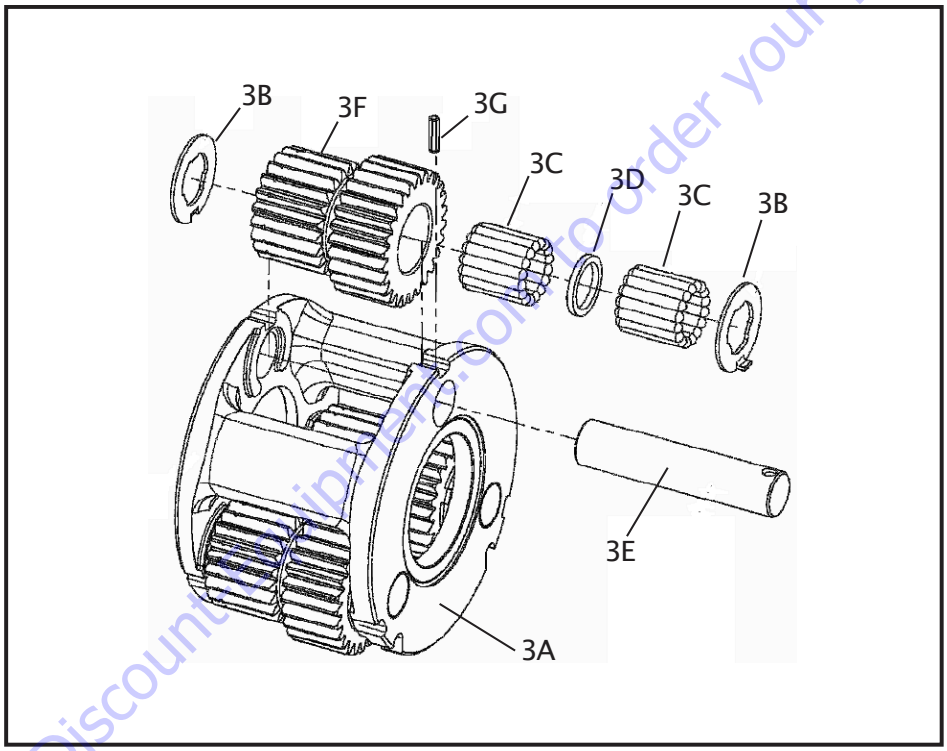
Carrier Disassembly

NOTE: *Refer to Figure 3-52.*

1. Using a 3/16 in. punch drive the roll pin (3G) which holds the planet shaft (3E) in the carrier (3A) down into the planet shaft (3E) until it bottoms.

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

2. Remove the planet shaft (3E) from the carrier (3A). Use a small punch to remove the roll pin (3D) from the planet shaft (3E).
3. Slide the planet gear (3F), the two thrust washers (3B) out of the carrier (3A).
4. Remove both rows of needle bearings (3C) and the spacer (3D) from the bore of the planet gear (3F).
5. Repeat Steps 1 thru 4 for the remaining two cluster gears (3F).



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

Figure 3-52. Carrier

Hub-Shaft Assembly

NOTE: *Refer to Figure 3-51.*

1. Press bearing cup (1C) into housing (1G) taking care to ensure cup starts square with the bore of hub (1G).
2. Place bearing cone (1D) in bearing cup (1C) in housing (1G).
3. Press or tap seal (1B) into the counterbore of housing (1G) to the point where it becomes flush with the housing (1G) face. Care should be taken to ensure seal (1B) is being correctly installed (smooth face up). Apply grease to the rubber portion of the seal bore.
4. Invert hub (1G) and press bearing cup (1E) into counterbore of housing (1G).
5. Carefully lower housing (1G) onto the output shaft (1A) until bearing cone (1D) contacts the output shaft (1A).
6. Press on the small end of the bearing cone (1D), being careful not to contact the bearing cage, until the bearing cone (1D) seats on the shoulder of the output shaft (1A).
7. Start the bearing cone (1F) onto the output shaft (1A).
8. Press or tap the bearing cone (1F) onto the output shaft (1A) until it is just seated in the bearing cup (1E). while rotating the housing (G).
9. Install bearing spacer (1H) onto output shaft (1A) and against bearing cone (1F).
10. Install retaining ring (1I) into the groove in the output shaft (1A). This retaining ring (1I) should never be reused in a repair or rebuild.

⚠ WARNING

EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

11. Tap the retaining ring (1I) with a soft metal punch to ensure that the retaining ring (1I) is completely seated in the groove of the output shaft (IA).

⚠ WARNING

EYE PROTECTION SHOULD BE WORN DURING THIS PROCEDURE.

12. Install O-ring plug (1P) and torque to 23-24 ft. lbs. (31 - 32 Nm).

Carrier Assembly

NOTE: *Refer to Figure 3-52.*

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 the first row of needle rollers (3C) into the bore of cluster gear (3F).
3. Insert spacer (3D) into bore of cluster gear (3F) on top of the needle rollers (3C).
4. Place second row of needle rollers (3C) into bore of cluster gear (3F) against spacer (3D).
5. Place carrier (3A) so that one of the roll pin holes is straight up.
6. Start planet shaft (3E) through the hole in carrier (3A). Using ample grease to hold it in position, slide one thrust washer (3B) over the planet shaft (3E) with the tang resting in the cast slot of the carrier (3A).
7. With large end of cluster gear (3F) facing the roll pin hole in the Carrier, place the Cluster Gear into position in carrier (3A) and push planet shaft (3E) through the cluster gear (3F) without going all the way through.
8. Slide the second thrust washer (3B) between the cluster gear (3F) and the carrier (3A) with the tang of the washer located in the cast slot of the carrier (3A). Finish sliding the planet shaft (3E) through the thrust washer (3B) and into the carrier (3A).
9. Position the non-chamfered side on the planet shaft (3E) roll pin hole so that it is in line with the hole in the carrier (3A) using a 1/8 in. (3 mm) diameter punch.
10. After using a 3/16 in. (5 mm) punch to align the two roll pin holes. Drive the roll pin (3G) through carrier (3A) and into the planet shaft (3E) until the roll pin (3G) is flush with the bottom of the cast slot in the carrier (3A) outside diameter at the thrust washer (3B) tang. Use a 1/4 in. (6 mm) pin punch to make sure the roll pin (3G) is flush in the slot.
11. Repeat Steps 1 thru 10 for the remaining two cluster gears(3F).

Main Drive Assembly

NOTE: *Refer to Figure 3-50.*

1. With the hub shaft sub-assembly resting on the shaft (1A) install internal gear (2). The spline of the internal gear (2) bore will mesh with the spline of the output shaft (1A). This will be a tight fit.
2. Inspect the location of the internal gear (2) on the output shaft (1A). The portion of the output shaft (1A) should protrude through the Internal gear (2) bore.
3. Install 4 dowel pins (13) into counter bore holes in hub (IG).
4. Install thrust washer (11) in counter bore of carrier sub-assembly (small cluster-gear end). Use grease to hold in place.
5. Place O-ring (5) into Hub counter-bore. Use grease to hold O-ring in place.

⚠ WARNING

BEWARE OF SHARP EDGES OF THE COUNTER BORE WHILE SEATING THIS ORING.

6. Place carrier sub-assembly on bench with the large end of cluster gears (3F) facing up with one at the 12 o'clock position. Find the punch marked tooth on each gear at the large end and locate at 12 o'clock (straight up) from each planet pin. Marked tooth will be located just under the Carrier on upper two gears. Check the timing through the slots in the carrier (See carrier sub-assembly).
7. With large shoulder side of ring gear (4) facing down, place ring gear (4) over (into mesh with) cluster gears (3F). Be sure that cluster gear timing marks (punch marks) remain in correct location during ring gear (4) installation. The side of the ring gear (4) with an "X" or punch mark stamped on it should be up.
8. While holding ring gear (4) and cluster gears (3F) in mesh, place small end of cluster gears (3F) into mesh with the Internal Gear (2). On the ring gear (4) locate the hole marked "X", or punch marked, over one of the marked counter-bored holes (Step 5) in hub (1G). Check timing through the slots in the carrier. Rotate carrier in assembly to check for freedom of rotation.

NOTE: *If gears do not mesh easily or carrier assembly does not rotate freely, then remove the carrier and ring gear and check the cluster gear timing.*

9. Install thrust washer (11) into the counter-bore on the face of the carrier. Use grease to hold in place.
10. Place O-ring (5A) into counter-bore or brake housing (6). Use grease to hold O-Ring in place.

⚠ CAUTION

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

11. Install the brake housing (6), taking care to correctly align pipe plug (20) with those in the hub (I G).
12. Install bolts (12) through the brake housing (6) into the hub (1G) and torque to 23-27 ft. lbs. (31-37 Nm).
13. With gearbox standing on the pinion end fill gearbox with 43 oz. of ISO VG150/VG220 gear Oil.
14. Install retaining ring (44) into the groove in the sun gear (8).
15. Install the sun gear (8) into mesh with the planet gears (3F).
16. Install pipe plug (20) into cover (6) torque to 23-24 ft. lbs. (31-32 Nm).

Motor and Brake Assembly

NOTE: *Refer to Figure 3-49.*

1. Alternate stators (8K) (O.D. lobes) with rotors (8J) (I.D. splines) into bore of brake housing (6). starting with a stator (8K) and ending with a stator (8K).
2. Grease the O-rings (8F) & (8D) and backup rings (8H) & (8E). and place them in their respective grooves in the brake housing (6) and piston (8A). Make sure the backup rings are correctly positioned.
3. Apply grease sparingly to the piston O.D. (8A) and the bore of the brake housing (6). Insert piston (8A) into brake housing (6) be sure not to damage the O-rings.
4. Install springs (8L) into the spring pockets of the piston (8A).
5. Test the brake and perform the roll test. Remove the brake test plate.
6. Install the O-ring (26) onto the pilot of the motor (31), use grease to keep the O-ring in place.
7. Place motor (31) into Brake pilot, and line up holes.
8. Assemble lift lugs (28) onto hex bolts (29). Assemble hex bolts (29) with lift lugs (28) through the motor (31) and brake (6) against Motor flange. Torque to 80-100 ft. lbs. (108-136 Nm).

Motor Control Valve Assembly

NOTE: *Refer to Figure 3-48.*

1. Lay assembly down with motor ports facing up. Remove the two plastic plugs in the motor ports, being careful not to lose the O-ring in each port. Assemble the motor control valve (32) onto the motor (31) with bolt (21) and lock washers (22). Torque bolts (21) to 23-27 ft. lbs. (31-37 Nm).

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

2. Install elbow fittings (30) into brake (6). Do not tighten jam nuts.
3. Install elbow fittings (30) into motor control valve (32). Do not tighten jam nuts.
4. Assemble tube (35) into elbow fittings (30) and torque to 13-15 ft. lbs. (18-20 Nm). Tighten the jam nuts on the elbow fittings (30) and torque to 13-15 ft. lbs. (18-20 Nm).
5. Install one O-ring plug (23) into motor control valve (32) and torque to 30-31 fl.lbs. (41-42 Nm).
6. Pressure test brake, tube and control valve connections by applying 3000 psi (207 bar) pressure to the open port in the Motor Control Valve (32) and holding lor 1 minute. Check lor leaks at the control-valve-motor interface and the tube connections. Release pressure and install the remaining O-ring plug (23) into motor control valve (32) and torque to 30-31 ft. lbs. (41-42 Nm).

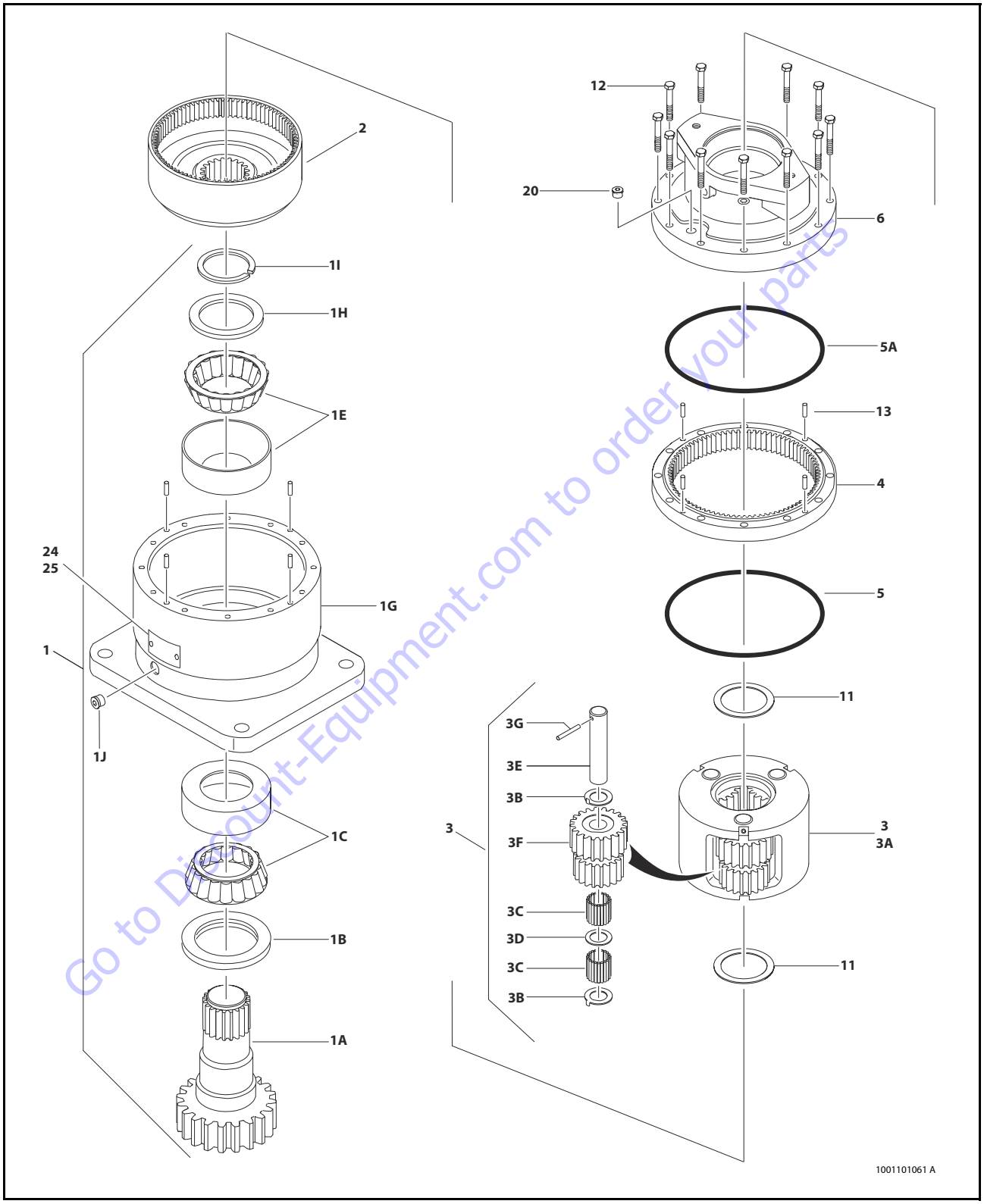


Figure 3-53. Swing Motor/Brake/Hub Assembly (USA Built Machines and China Built Machines, SN 0300137453 through 0300177361 and SN B300000100 to Present) - Sheet 1 of 3

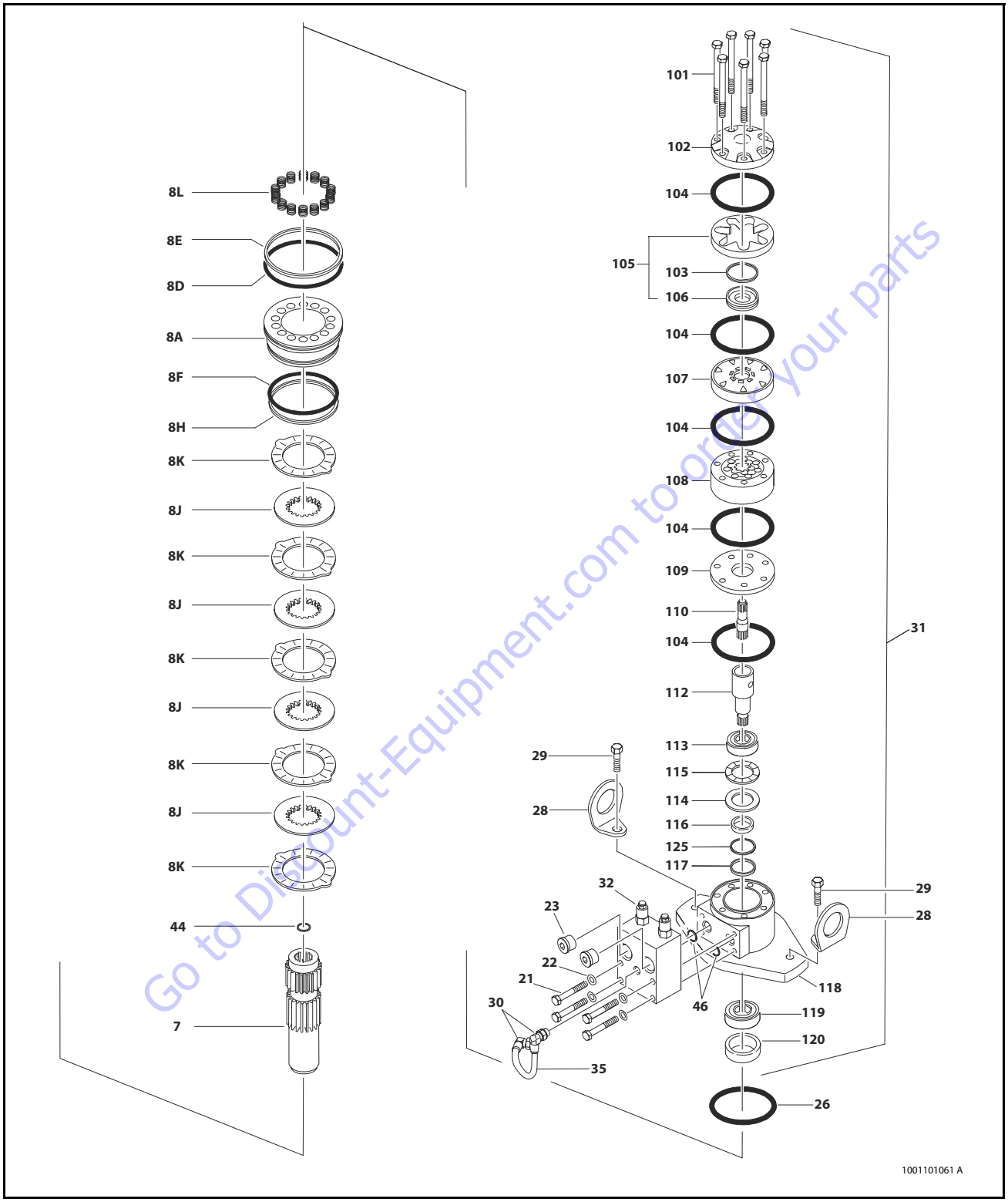
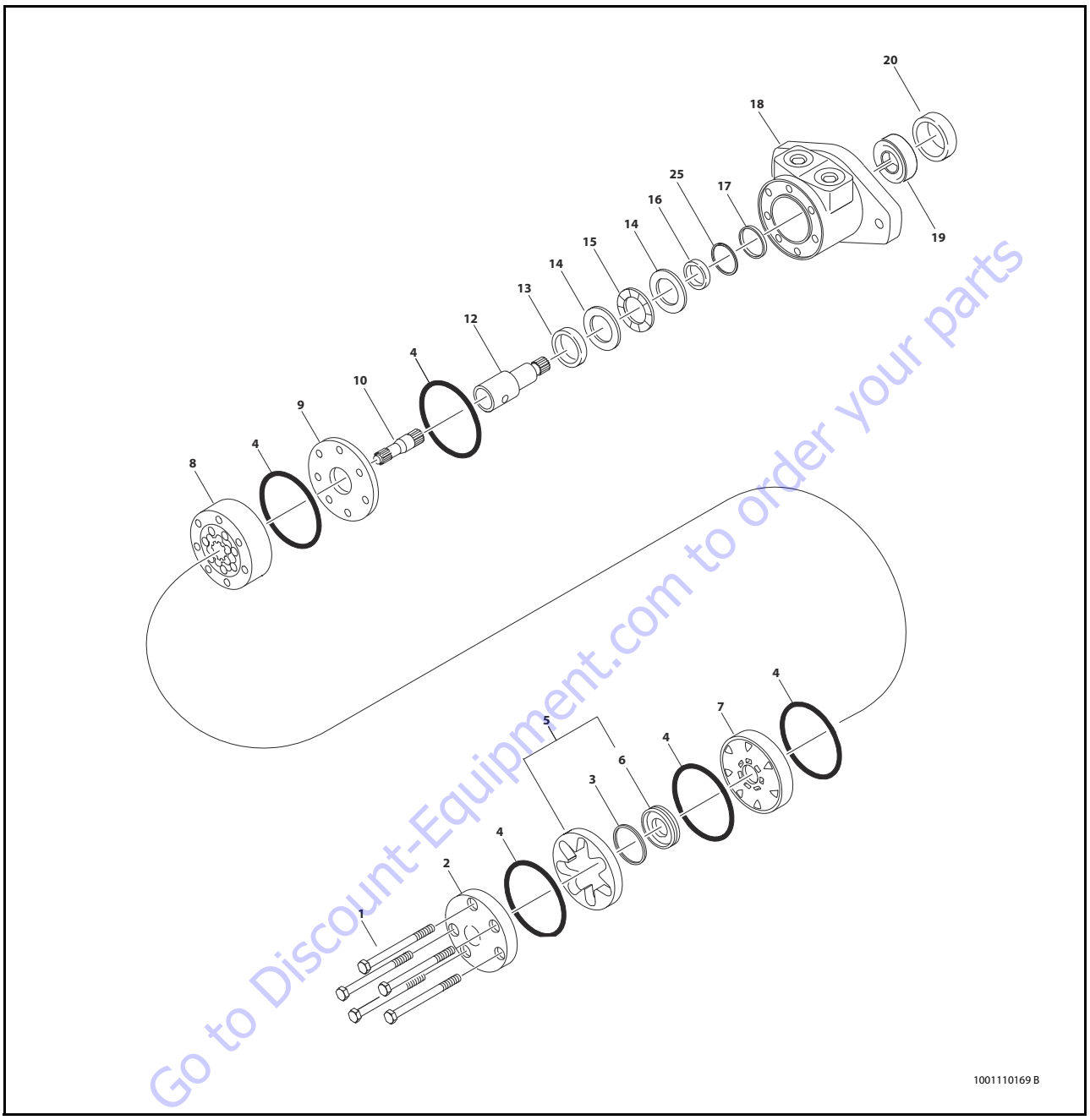


Figure 3-54. Swing Motor/Brake/Hub Assembly (USA Built Machines and China Built Machines, SN 0300137453 through 0300177361 and SN B300000100 to Present) - Sheet 2 of 3

1. Housing/Shaft Assembly
1A. Output Shaft
1B. Lip Seal
1C. Bearing Ki
1E. Bearing Kit
1G. Housing
1H. Thrust Washer
1I. Retaining Ring
1J. Pipe Plug
2. Internal Gear
3. Carrier Assembly
3A. Carrier
3B. Tanged Washer
3C. Bearing Needle
3D. Thrust Washer
3E. Planet Shaft
3F. Cluster Gear
3G. Roll Pin
4. Gear Ring
5. O-ring (Black)
5A. O-ring (White)
6. Brake Housing
7. Sun Gear
8. Brake Components
8A. Piston Brake
8D. O-ring
8E. Backup Ring
8F. O-ring
8H. Backup Ring
8J. Rotor Brake
8K. Stator Brake
8L. Spring Brake
11. Thrust Washer
12. Bolt
13. Dowel Pin
20. Pipe Plug
21. Bolt
22. Lock Washer
23. Pipe Plug
24. I D Plate
25. Screw Drive
26. O-ring
28. Lifting Lug
29. Bolt
30. Elbow
31. Motor Assembly
32. Valve
33. Pipe Plug
35. Tube
44. Retaining Ring
46. O-ring
101. Bolt
102. Cover End
103. Commutator Seal
104. Ring Seal
105. Assembly
106. Ring
107. Manifold
108. Rotor Set
109. Wear Plate
110. Drive Link
112. Shaft Coupling
113. Bronze Bushing
114. Thrust Washer
115. Thrust Bearing
116. Inner Seal
117. Backup Washer
118. Housing
119. Bearing
120. Seal
125. Backup Washer

Figure 3-55. Swing Motor/Brake/Hub Assembly (USA Built Machines and China Built Machines, SN 0300137453 through 0300177361 and SN B300000100 to Present) - Sheet 3 of 3



1. Bolt
2. End Cover
3. Commutator Seal
4. Ring Seal
5. Assembly
6. Ring
7. Manifold
8. Rotor Set
9. Wear Plate
10. Drive Link
12. Shaft Coupling
13. Bronze Bushing
14. Thrust Washer
15. Thrust Bearing
16. Inner Seal
17. Backup Washer
18. Housing
19. Bearing
20. Seal
25. Washer

Figure 3-56. Swing Motor Assembly

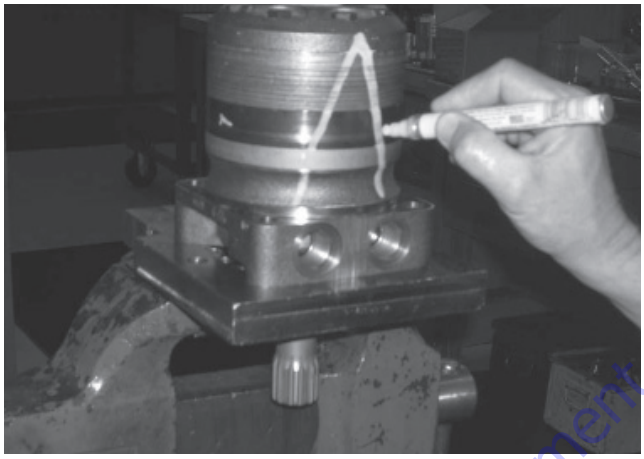
3.13 SWING MOTOR

Disassembly and inspection

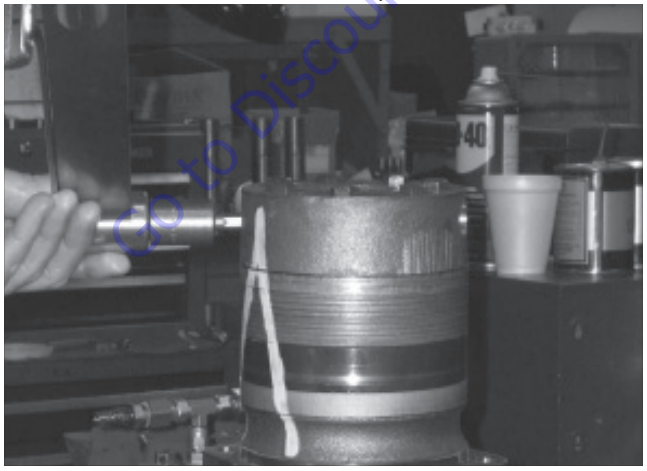
1. Place the Torqmotor™ in a soft jawed vice, with coupling shaft (12) pointed down and the vise jaws clamping firmly on the sides of the housing (18) mounting flange or port bosses. Remove manifold port O-Rings (18A) if applicable.

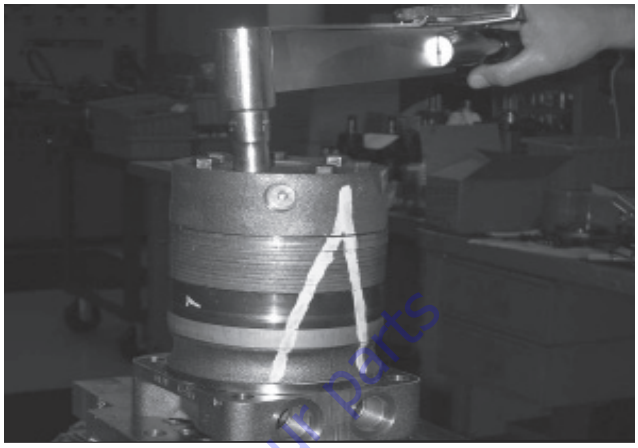
⚠ WARNING

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

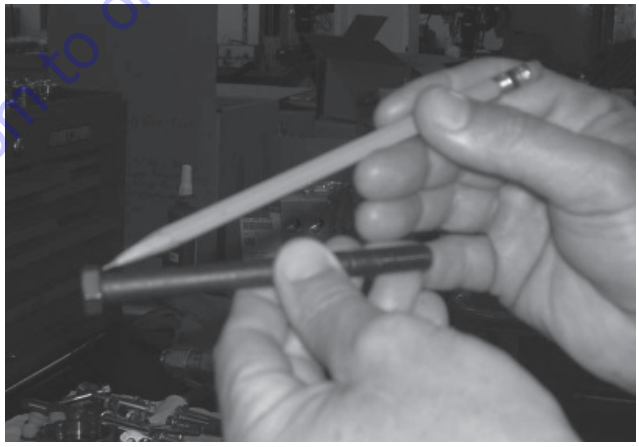


1. Scribe an alignment mark down and across the Torqmotor™ components from end cover (2) to housing (18) to facilitate reassembly orientation where required. Loosen two shuttle or relief valve plugs (21) for disassembly later if included in end cover. 3/16 or 3/8 in. Allen wrench or 1 in. hex socket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



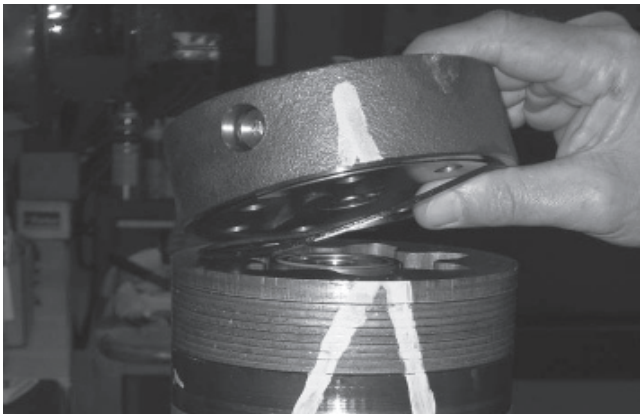


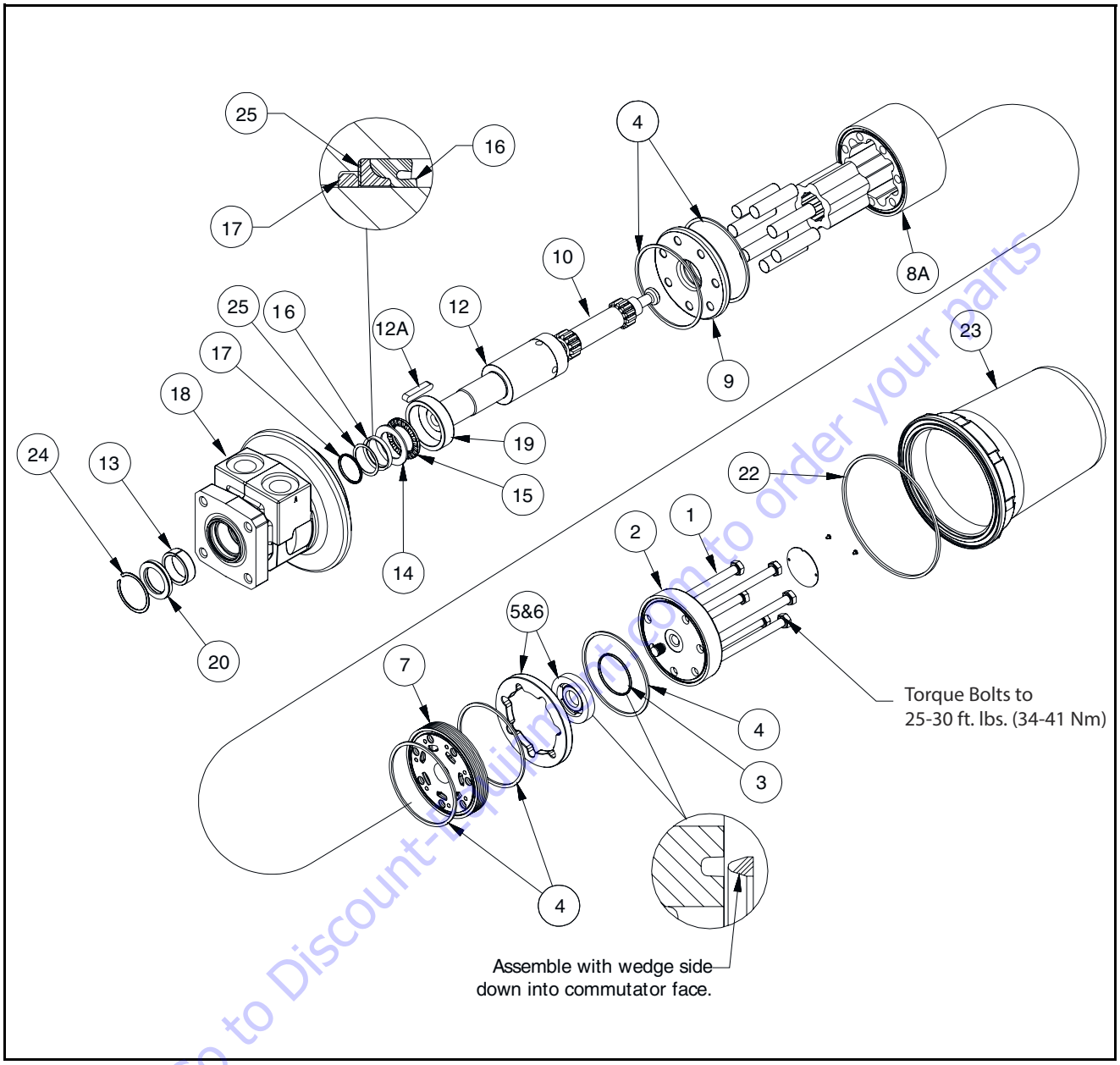
2. Remove the five, six, or seven special ring head bolts (1) using an appropriate 1/2 or 9/16 in. size socket. Inspect bolts for damaged threads, or sealing rings, under the bolt head. Replace damaged bolts.



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

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





1. Special Bolts
2. Special Bolts
3. Special Bolts
4. Special Bolts
5. Commutator
6. Commutator Ring
7. Manifold
8A. Rotor
8B. Stator or Stator Vane
8D. Stator Half
9. Wear Plate
10. Drive Link
12. Coupling Shaft
12A. Key
13. Inner Bearing/Bushing
14. Thrust Washer
15. Thrust Bearing
16. Seal
17. Backup Ring
18. Housing
19. Outer Bearing/Bushing
20. Dirt & Water Seal
22. O-ring
23. Spring
24. Valve (Shuttle or Relief)
25. Backup Ring

Figure 3-57. Swing Drive Motor

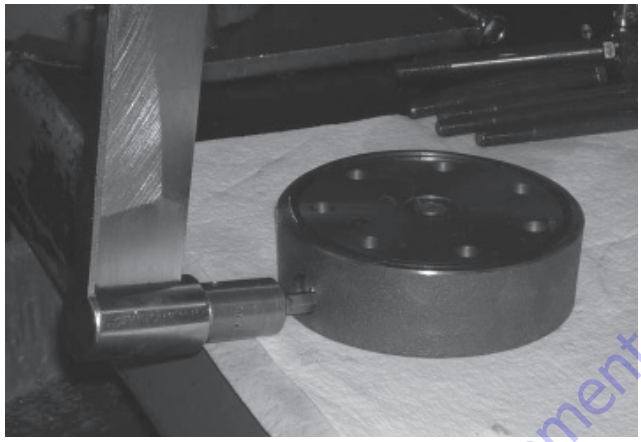
5. If the end cover (2) is equipped with shuttle valve components, remove the two previously loosened plugs (21).

⚠ CAUTION

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

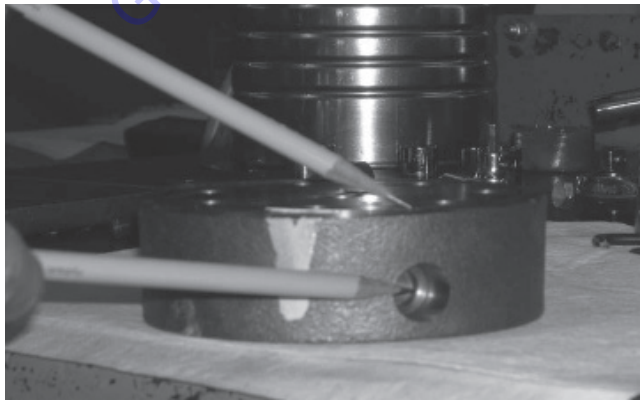
NOTE: *O- ring is not included in seal kit but serviced separately, if required.*

NOTE: *The insert and if included the orifice plug in the end cover (2) must not be removed as they are serviced as an integral part of the end cover.*

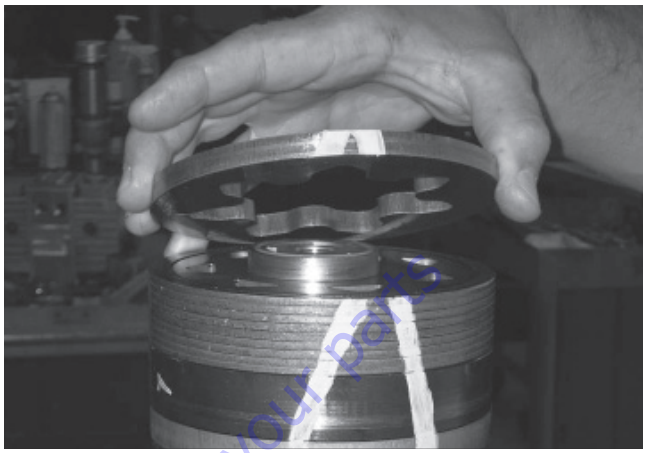


6. Thoroughly wash end cover (2) in proper solvent and blow dry. Be sure the end cover valve apertures, including the internal orifice plug, are free of contamination. Inspect end cover for cracks and the bolt head recesses for good bolt head sealing surfaces. Replace end cover as necessary.

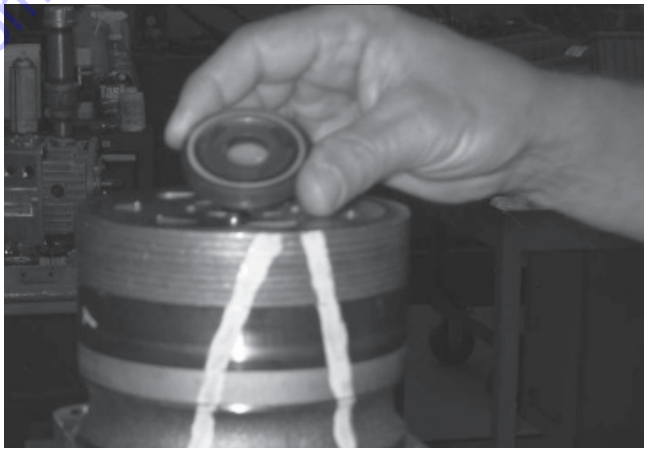
NOTE: *A polished pattern (not scratches) on the cover from rotation of the commutator (5) is normal. Discoloration would indicate excess fluid temperature, thermal shock, or excess speed and require system investigation for cause and close inspection of end cover, commutator, manifold, and rotor set.*

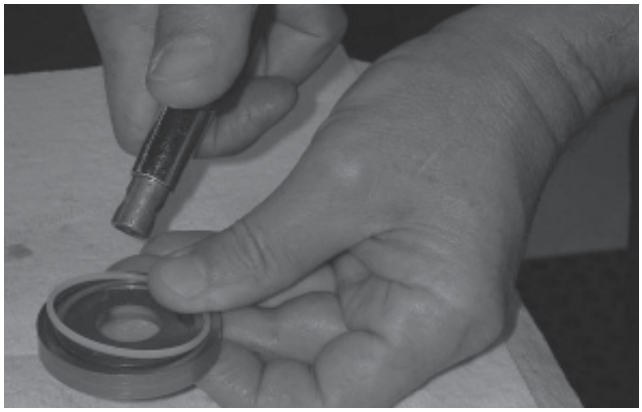


7. Remove commutator ring (6). Inspect commutator ring for cracks, or burrs.



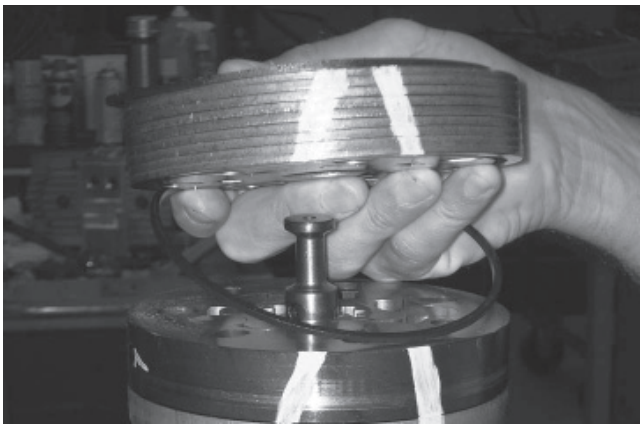
8. Remove commutator (5) and seal ring (3). Remove seal ring from commutator, using an air hose to blow air into ring groove until seal ring is lifted out and discard seal ring. Inspect commutator for cracks or burrs, wear, scoring, spalling or brinelling. If any of these conditions exist, replace commutator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

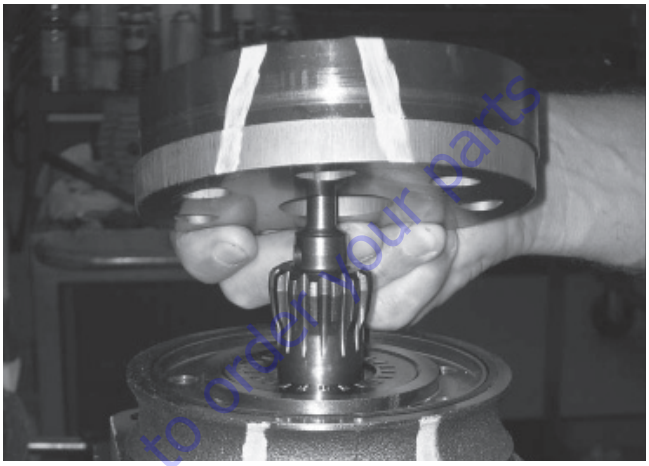


10. Remove rotor set (8) and warplane (9), together to retain the rotor set in its assembled form, maintaining the same rotor vane (8C) to stator (8B) contact surfaces. The drive link (10) may come away from the coupling shaft (12) with the rotor set, and wear plate.You may have to shift the rotor set 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 wear plate.

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

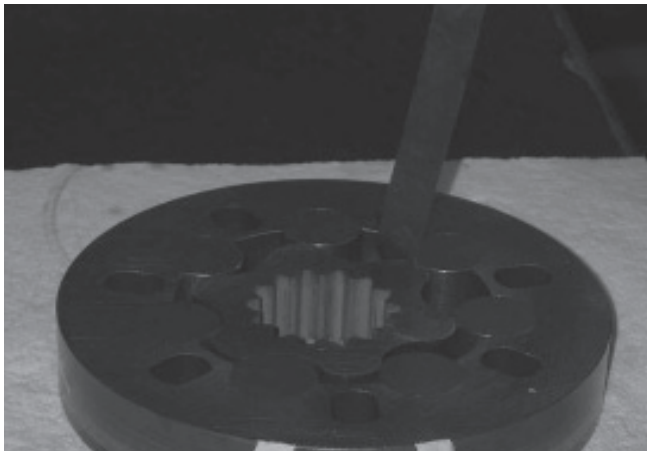
NOTE: *Series TG and TH may have a rotor set with two stator halves (8B & 8D) with a seal ring (4) between them and two sets of seven vanes (8C & 8E). Discard seal ring only if stator halves become disassembled during the service procedures.*

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

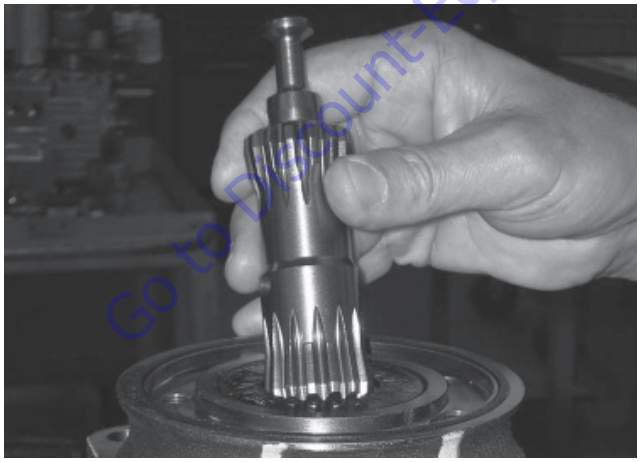


11. Place rotor set (8) and wear plate (9) on a flat surface and center rotor (8A) in stator (8B) such that two rotor lobes (180 degrees apart) and a roller vane (8C) centerline are on the same stator centerline. Check the rotor lobe to roller vane clearance with a feeler gage at this common centerline.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

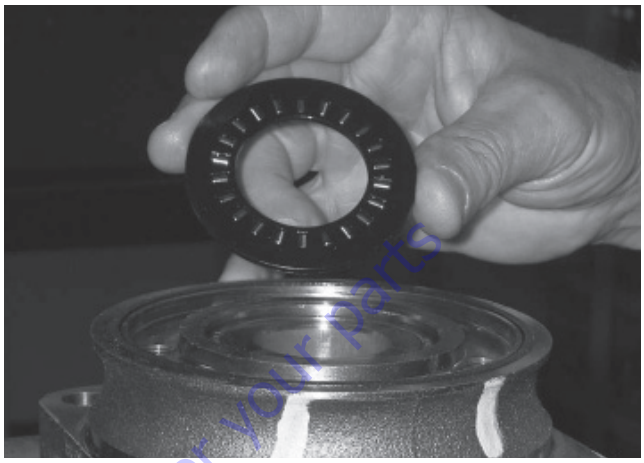
NOTE: *If rotor set (8) has two stator halves (8B & 8D) and two sets of seven vanes (8C & 8E) as shown in the alternate construction TG rotor set assembly view, check the rotor lobe to roller vane clearance at both ends of rotor.*



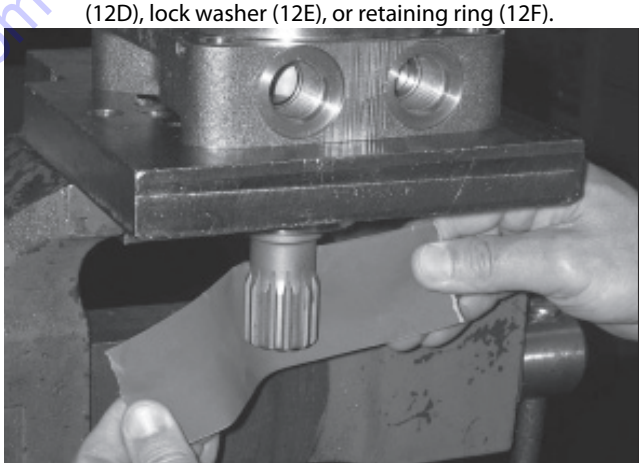
12. Remove drive link (10) from coupling shaft (12) if it was not removed with rotor set and wear plate. Inspect drive link for cracks and worn or damaged splines. No perceptible lash (play) should be noted between mating spline parts. Remove and discard seal ring (4) from housing (18).



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



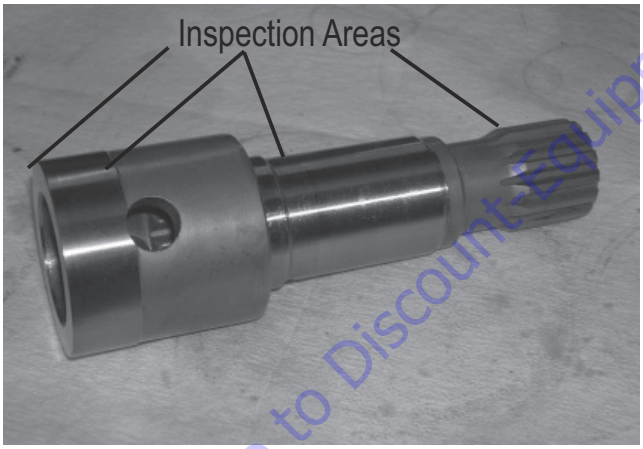
14. Check exposed portion of coupling shaft (12) to be sure you have removed all signs of rust and corrosion which might prevent its withdrawal through the seal and bearing. Crocus cloth or fine emery paper may be used. Remove any key (12A), nut (12B), washer (12C), bolt (12D), lock washer (12E), or retaining ring (12F).



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.*

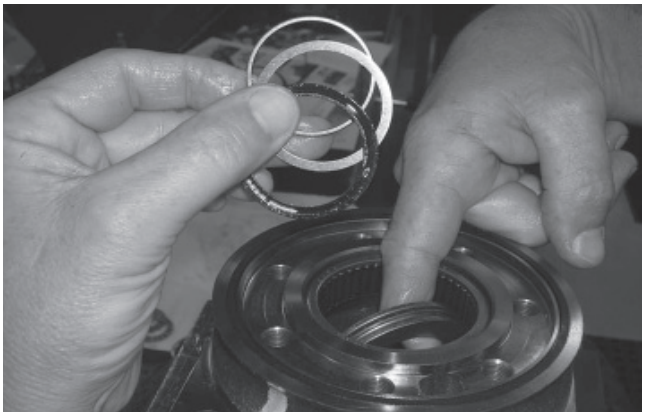
NOTE: *A slight "polish" is permissible in the shaft bearing areas. Anything more would require coupling shaft replacement.*



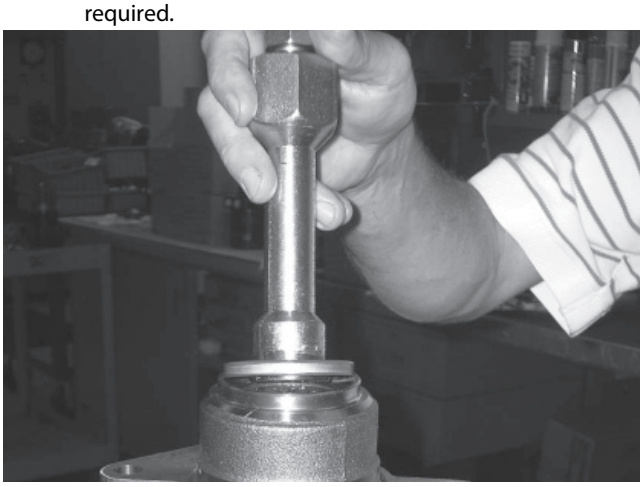
16. Remove and discard seal ring (4) from housing (18).

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

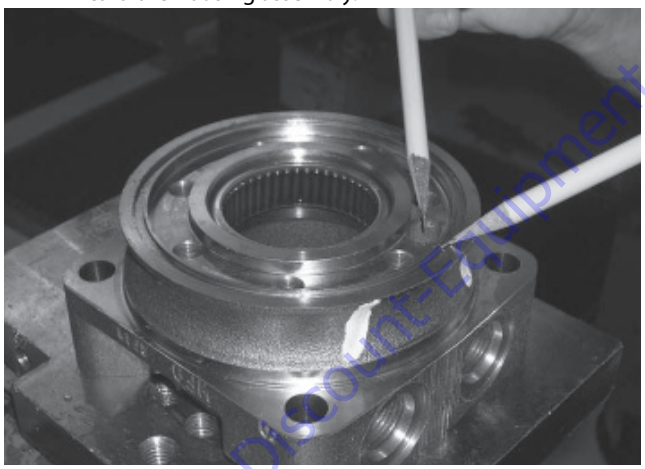
18. Remove seal (16) and backup ring (17) from housing (18) and backup washer. Discard both.



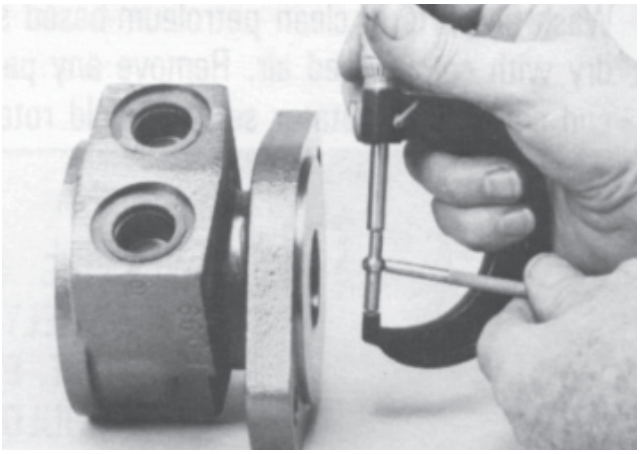
19. Remove housing (18) from vise, invert it and remove and discard seal (20). A blind hole bearing or seal puller is required.



20. Inspect housing (18) assembly for cracks, the machined surfaces for nicks, burrs, brinelling or corrosion. Remove burrs that can be removed without changing dimensional characteristics. Inspect tapped holes for thread damage. If the housing is defective in these areas, discard the housing assembly.

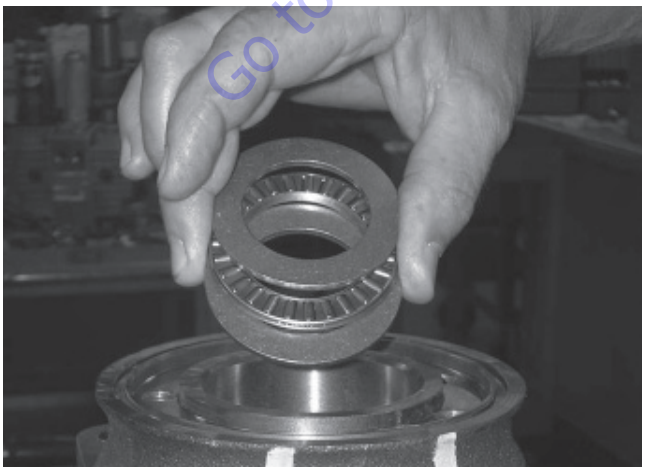


21. If the housing (18) assembly has passed inspection to this point, inspect the housing bearings/bushings (19) and (13) and if they are captured in the housing cavity the two thrust washers (14) and thrust bearing (15). The bearing rollers must be firmly retained in the bearing cages, but must rotate 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 in. (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 Torqmotor™ is completed.



NOTE: *The 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 counter bore should be measured and noted before removing the bearings/ bushings. This will facilitate the correct reassembly of new bearings/bushings.*

22. If the 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 they were previously retained in the housing by bearing (13).



Assembly

Replace all seals and seal rings with new ones each time you reassemble the Torqmotor™ 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 Torqmotor™ 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.

⚠ DANGER

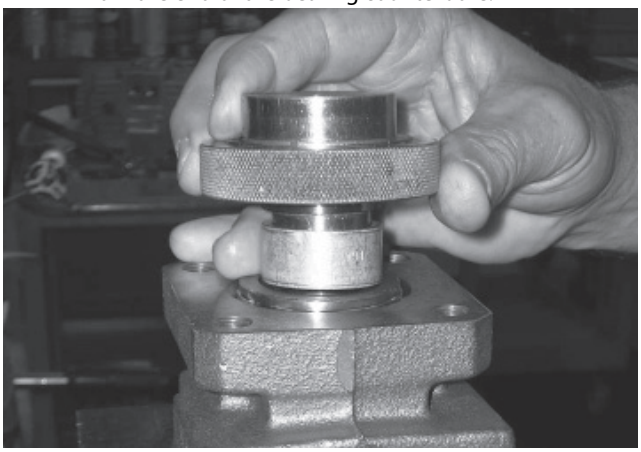
SINCE THEY ARE FLAMMABLE, BE EXTREMELY CAREFUL WHEN USING ANY SOLVENT. EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.

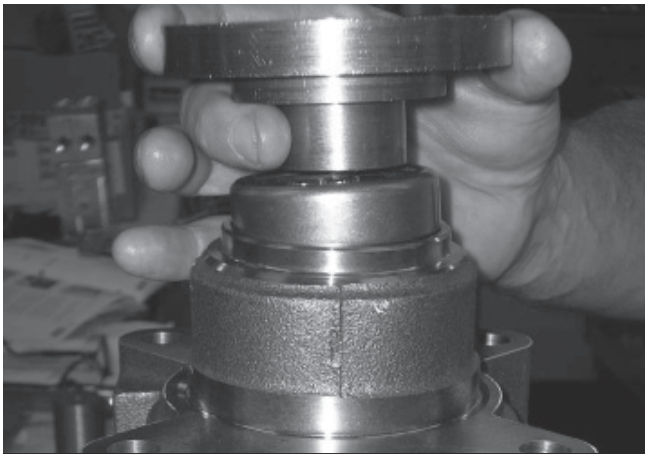
⚠ WARNING

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.

Torqmotor™ 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.





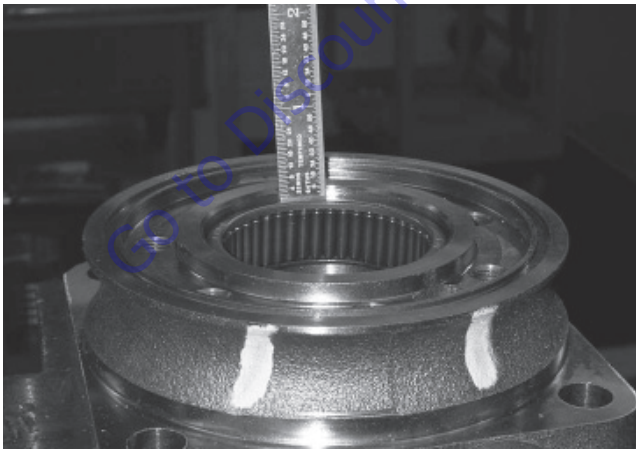
NOTE: *Bearing mandrel must be pressed against the lettered end of bearing shell. Take care that the housing bore is square with the press base and the bearing/bushing is not cocked when pressing a bearing/bushing into the housing.*

NOTICE

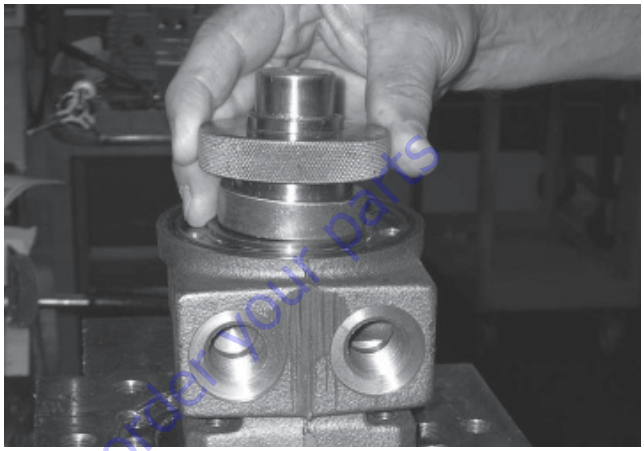
IF THE BEARING MANDREL SPECIFIED IN THE "TOOLS AND MATERIALS REQUIRED FOR SERVICING" SECTION IS NOT AVAILABLE AND ALTERNATE METHODS ARE USED TO PRESS IN BEARING/BUSHING (13) AND (19) THE BEARING/BUSHING DEPTHS SPECIFIED MUST BE ACHIEVED TO INSURE ADEQUATE BEARING SUPPORT AND CORRECT RELATIONSHIP TO ADJACENT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

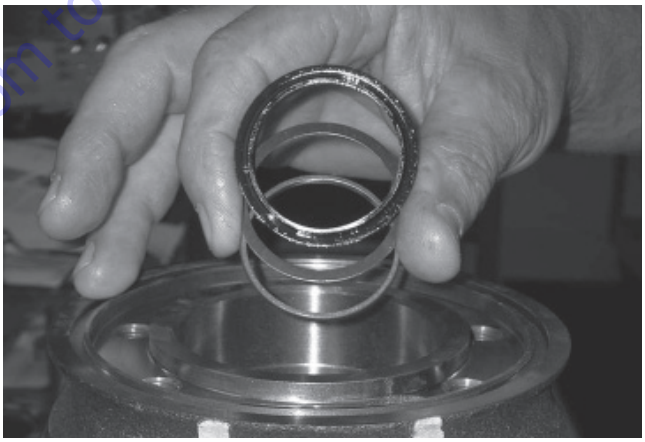
NOTICE

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.



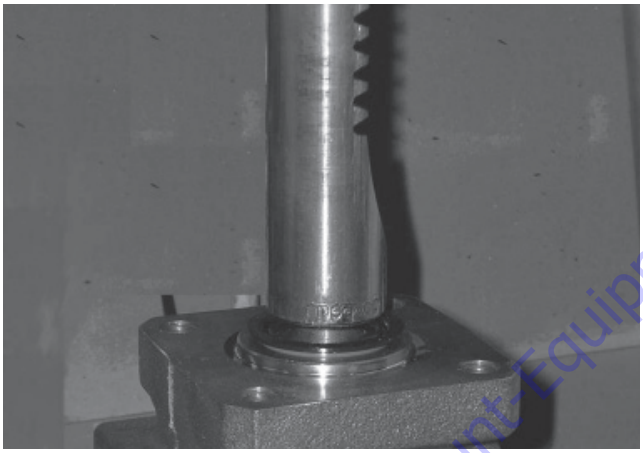
2. The Torqmotor™ inner housing bearing/bushing (13) can now be pressed into its counterbore in housing (18) flush to 0.03 in. (.76 mm) below the housing wear plate contact face. Use the opposite end of the bearing mandrel that was used to press in the outer bearing/ bushing (19).

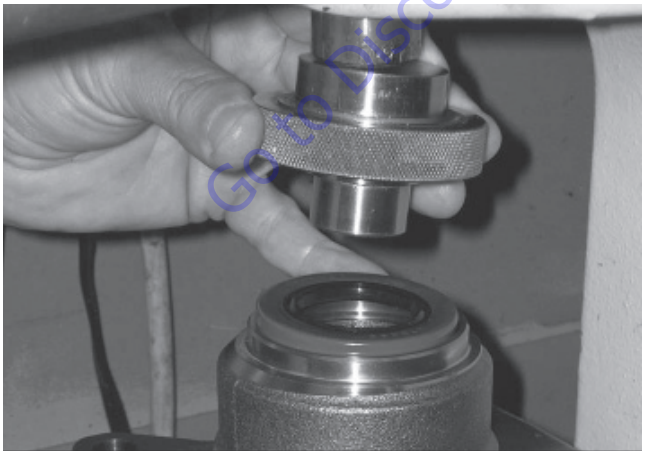




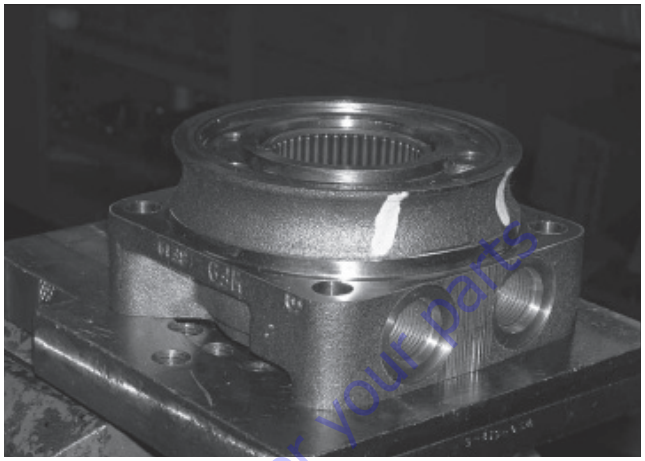
3. Press a new dirt and water seal (20) into the housing (18) outer bearing counterbore.

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





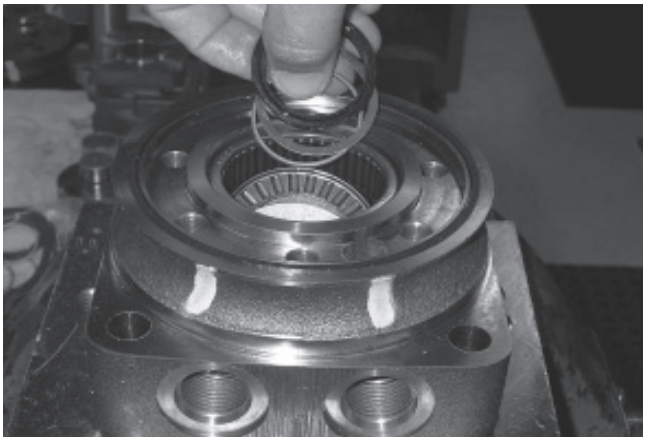
4. Place housing (18) assembly into a soft jawed vise with the coupling shaft bore down, clamping against the mounting flange.



5. On the Torqmotor™ assemble a new backup ring (17), new backup washer (25) and new seal (16) with the seal lip facing toward the inside of Torqmotor™, into their respective counterbores in housing (18) if they were not assembled in procedure 2.

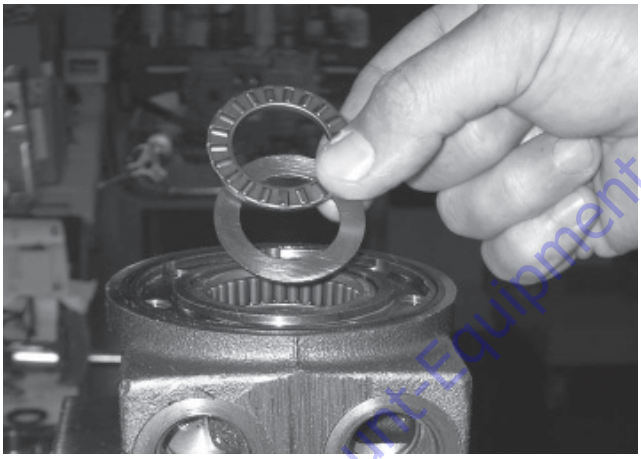
⚠ CAUTION

ORIGINAL DESIGN LARGE FRAME, TF & TG TORQMOTORS™ 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).

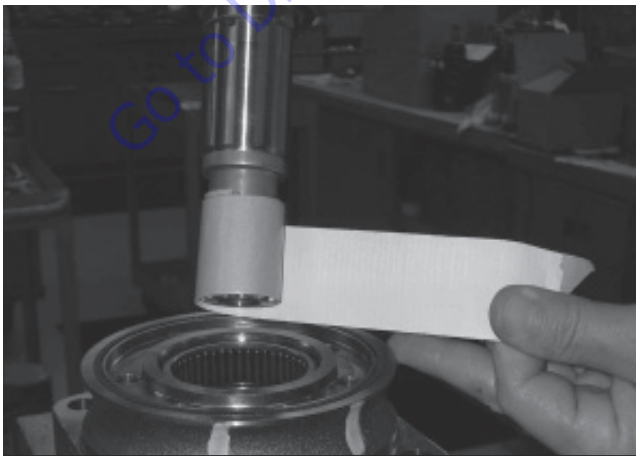


6. Assemble thrust washer (14) then thrust bearing (15) that was removed from the Torqmotor™.

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



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

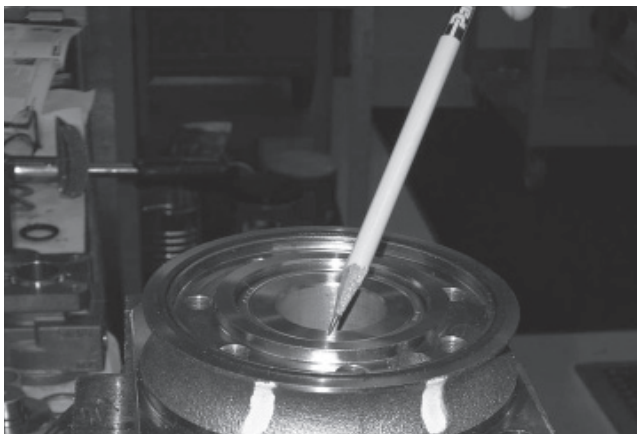


8. Be sure that a generous amount of clean corrosion resistant grease has been applied to the lower (outer) housing bearing/bushing (19). Install the coupling shaft (12) into housing (18), seating it against the thrust bearing (15) in the housings.

⚠ CAUTION

THE OUTER BEARING (19) IS NOT LUBRICATED BY THE SYSTEM'S HYDRAULIC FLUID. BE SURE IT IS THOROUGHLY PACKED WITH THE RECOMMENDED GREASE, PARKER GEAR GREASE SPECIFICATION #045236, E/M LUBRICANT #K-70M OR MOBIL MOBILITH SHC ® 460.

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



9. Install thrust bearing (11) onto the end of the coupling shaft (12).

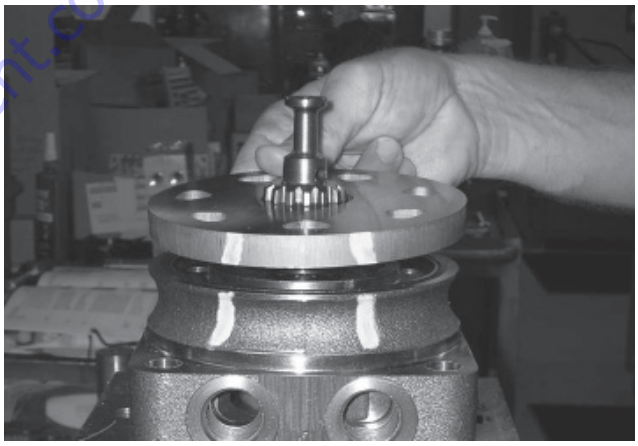
10. Apply a small amount of clean grease to a new seal ring (4) and insert it into the housing (18) seal ring groove.

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 in. (12.7 mm) longer than the bolts (1) used in the Torqmotor™.*

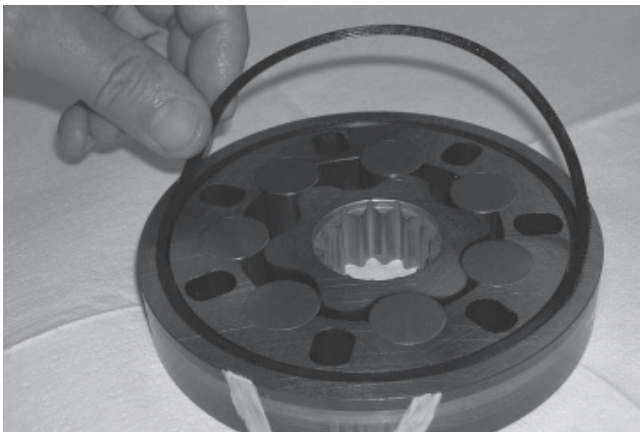
11. Install drive link (10) the long splined end down into the coupling shaft (12) and engage the drive link splines into mesh with the coupling shaft splines.

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

12. Assemble wear plate (9) over the drive link (10) and alignment studs onto the housing (18).



13. 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).



14. 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.

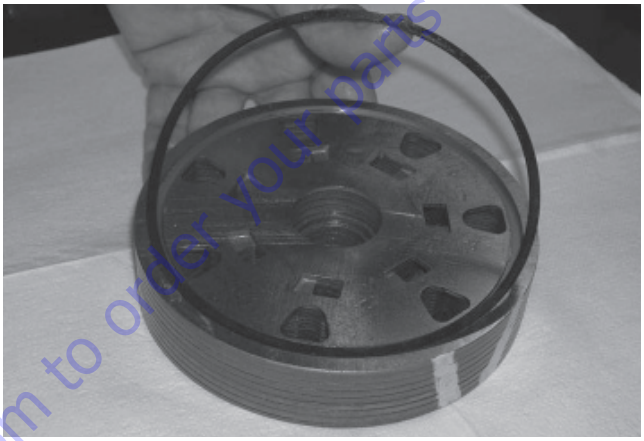
NOTE: *It may be necessary to turn one alignment stud out of the housing (18) temporarily to assemble rotor set (8) or manifold (7) over the drive link.*

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

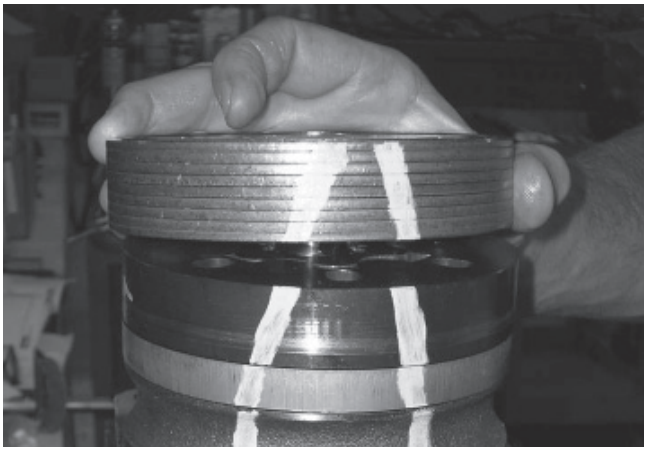
NOTE: *The rotor set rotor counterbore side must be down against wear plate for drive link clearance and to maintain the original rotor-drive link spline contact. A rotor set without a counterbore and that was not etched before disassembly can be reinstalled using the drive link spline pattern on the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

15. 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).

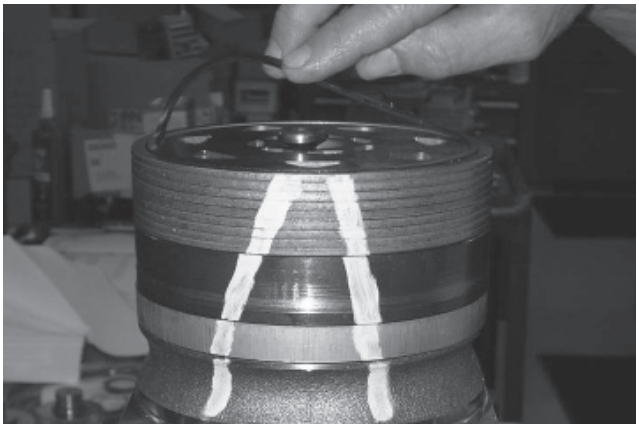
NOTE: *The manifold (7) is made up of several plates bonded together permanently to form an integral component. The manifold surface that must contact the rotor set has it's series of irregular shaped cavities on the largest circumference or circle around the inside diameter. The polished impression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



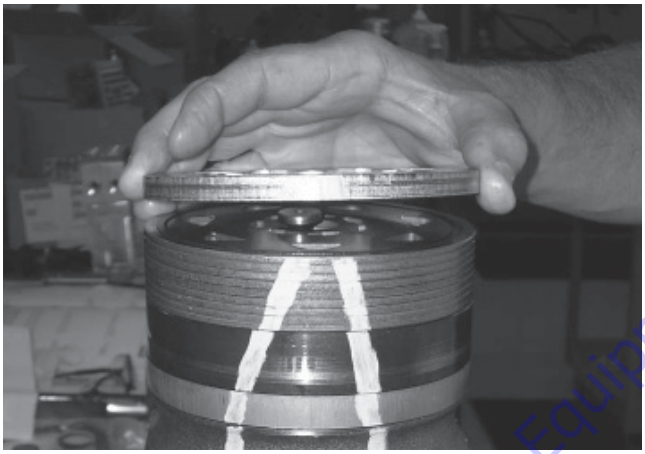
16. Assemble the manifold (7) over the alignment studs and drive link (10) and onto the rotor set. Be sure the correct manifold surface is against the rotor set.



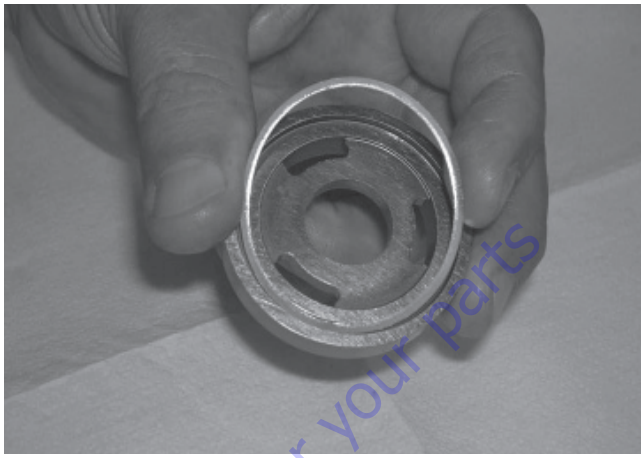
17. Apply grease to a new seal ring (4) and insert it in the seal ring groove exposed on the manifold.

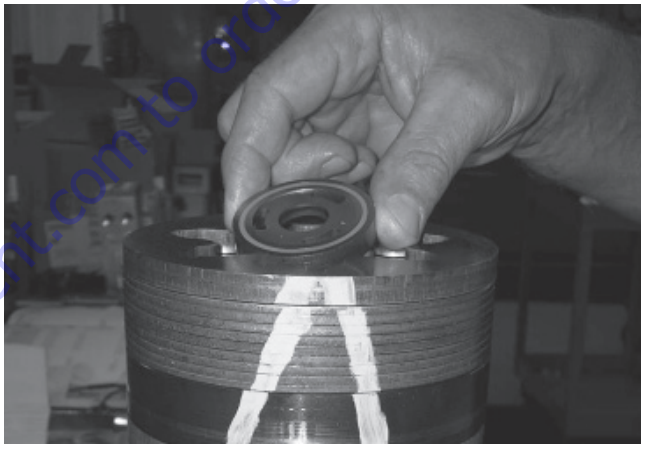


18. Assemble the commutator ring (6) over alignment studs onto the manifold.

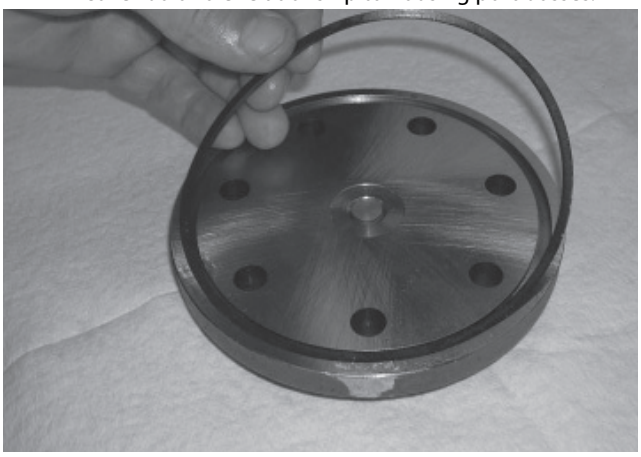


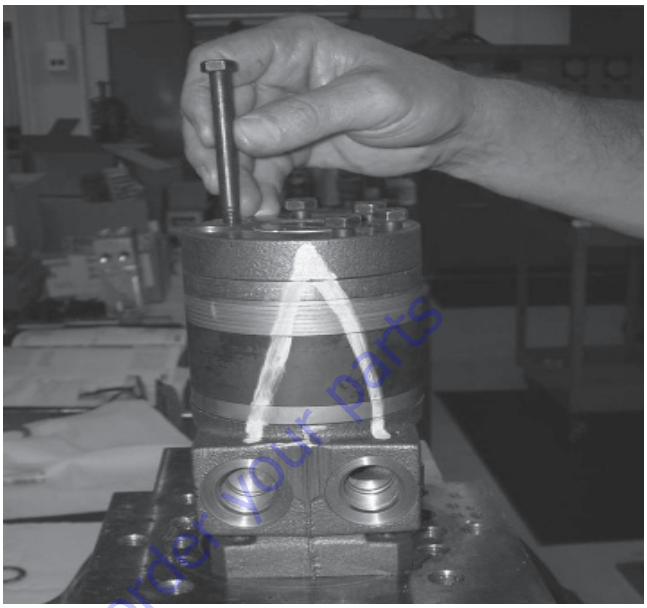
19. Assemble a new seal ring (3) flat side up, into commutator (5) and assemble commutator over the end of drive link (10) onto manifold (7) with seal ring side up.

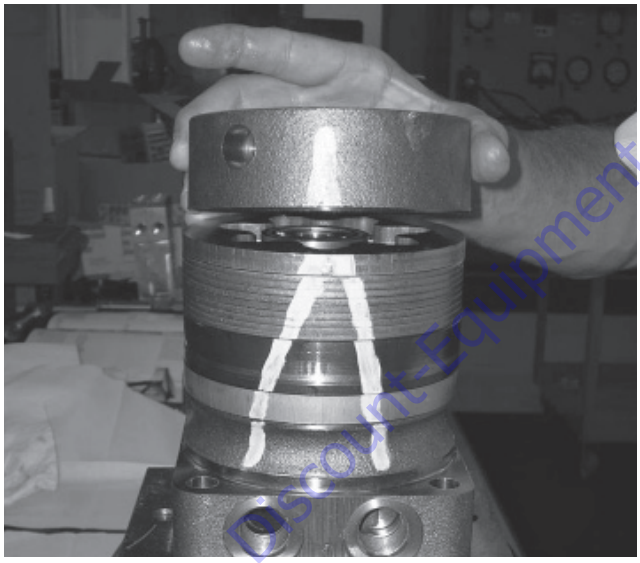




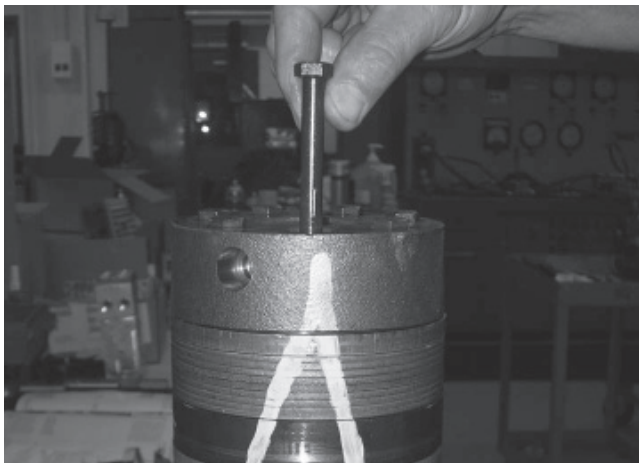
20. Assemble a new seal ring (4) into end cover (2) and assemble end cover over the alignment studs and onto the commutator set. If the end cover has only 5 bolt holes be sure the cover holes are aligned with the 5 threaded holes in housing (18).The correct 5 bolt end cover bolt hole relationship to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

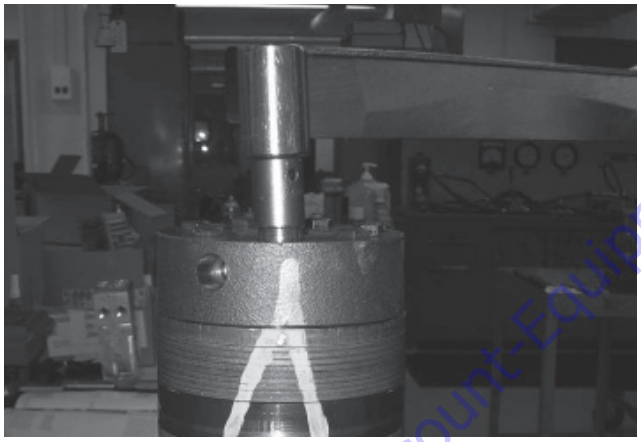


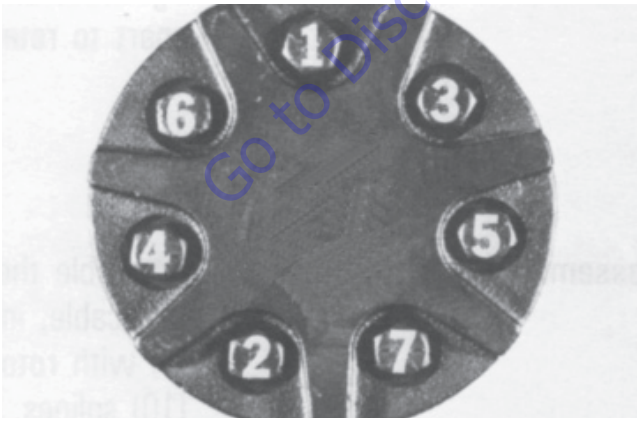




21. Assemble the 5 or 7 special bolts (1) and screw in finger tight. Remove and replace the two alignment studs with bolts after the other bolts are in place. Alternately and progressively tighten the bolts to pull the end cover and other components into place with a final torque of 50-55 ft. lbs.(68-75 N m) for the seven 3/8-24 threaded bolts.



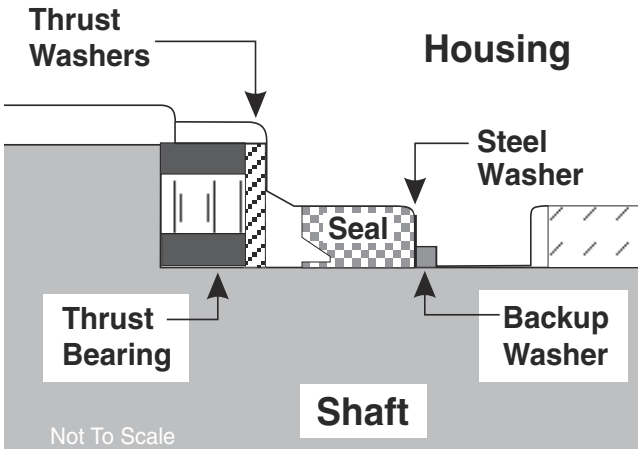




NOTE: *The special bolts required for use with the relief or shuttle valve (24) end cover assembly (2) are longer than the bolts required with standard and cover assembly. Refer to the individual service parts lists or parts list charts for correct service part number if replacement is required.*

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

Torque the two relief valve plug assemblies (21) in end cover assembly to 45-55 ft. lbs.(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 Torqmotor™ assembly procedures 1 through 13. Be sure the seal ring is in place.

2. If assembly alignment studs are not being utilized, 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.

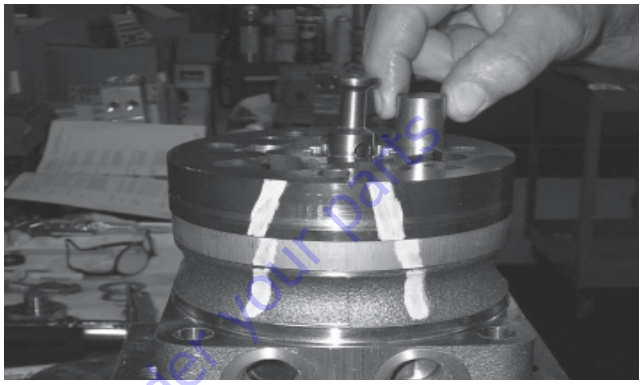
3. Assemble the rotor (8A), counterbore down if applicable, into stator (8B), and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.

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

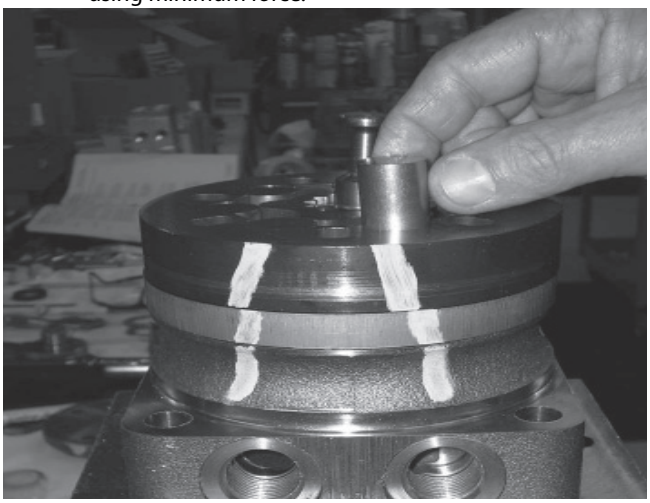
4. Assemble six vanes (8C), or as many vanes that will readily assemble into the stator vane pockets.

⚠ CAUTION

EXCESSIVE FORCE USED TO PUSH THE ROTOR VANES INTO PLACE COULD SHEAR OFF THE COATING APPLIED TO THE 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 the two assembled bolts (1) if used to retain stator and wear plate.

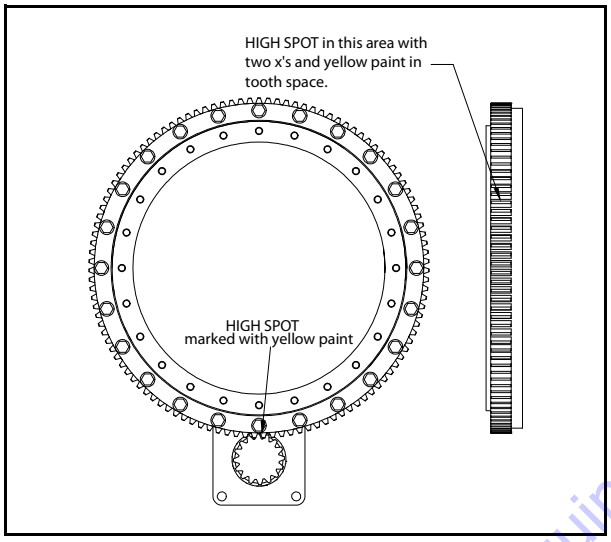
3.14 SWING HUB INSTALLATION

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

Procedure For Setting Swing Gear Backlash

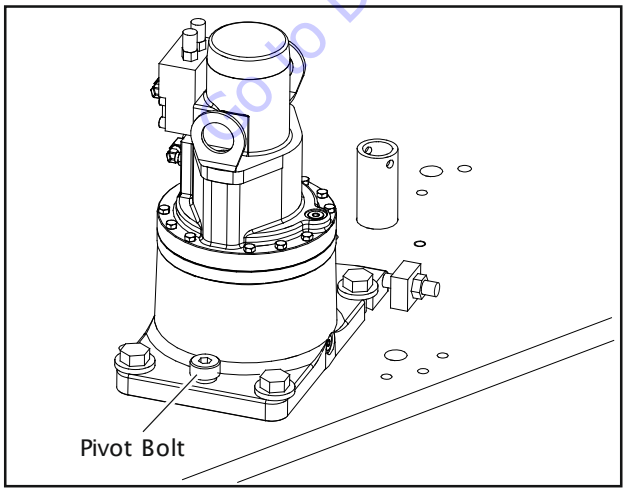
Set backlash to 0.010 in. to 0.015 in. (0.254 mm - 0.381 mm) using the following procedure:

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

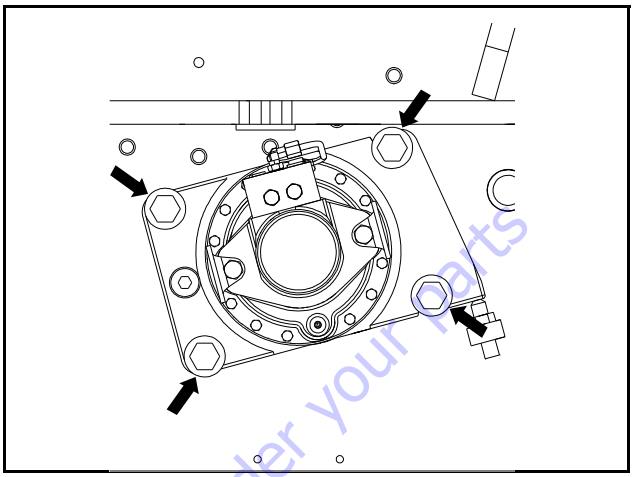


3. Apply JLG Threadlocker P/N 0100019 and torque pivot bolt to 205 ft. lbs. (280 Nm) (shown below).

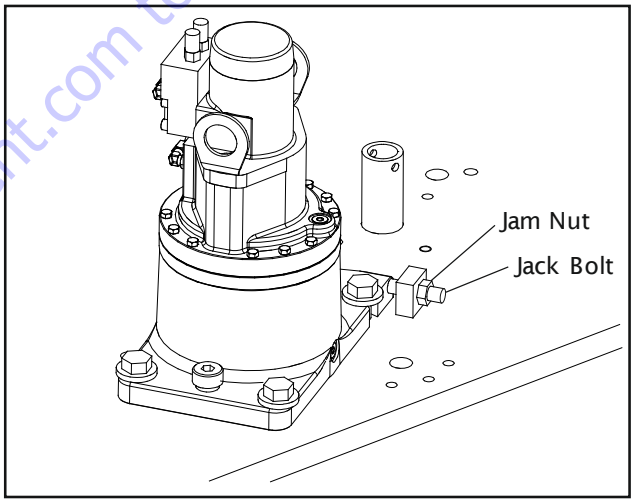
NOTE: *Make sure the turntable is properly supported during the following step. The turntable can swing a few degrees when the turntable lock is removed if the turntable is not balanced properly.*



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

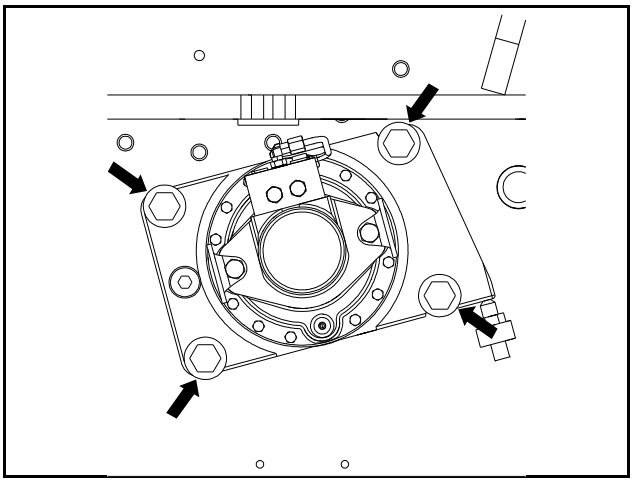


6. Tighten jack bolt until pinion is completely snug against shim and bearing then loosen jack bolt.

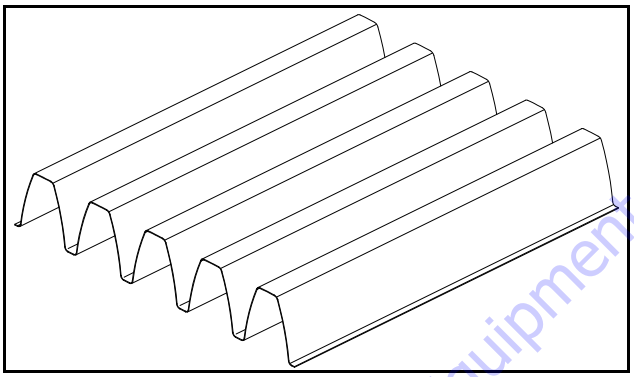


7. Apply JLG Threadlocker P/N 0100019 and torque jack bolt 50 ft. lbs. (68 Nm).
8. Apply JLG Threadlocker P/N 0100019 and tighten jam nut.

9. Torque mounting bolts to 340 ft. lbs. (Nm).

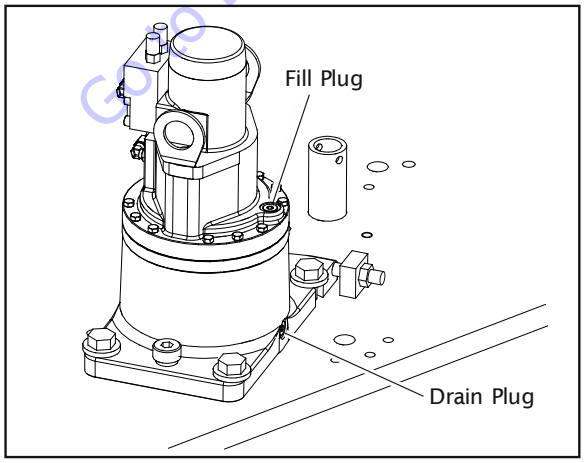


10. Remove shim and discard..



Swing Drive Lubrication

Fill Swing Drive Gearbox with 43 oz (1.27 L) 90w80gear oil with EP additives. Oil should cover the ring gear. Torque pipe plug to 23-25 ft.lbs (31- 33 Nm).

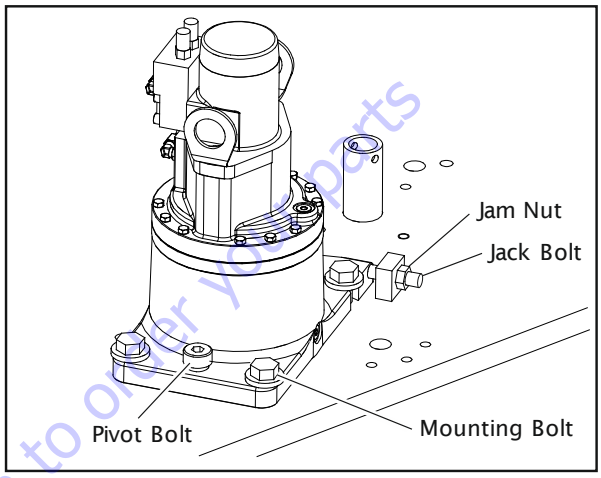


3.15 SWING HUB REMOVAL

1. Disconnect all wiring harness terminals connected to the swing motor.

2. Gently loosen the set screw. Do not remove.

3. Remove the pivot bolt using Allen Wrench.



4. Remove the mounting bolts securing swing drive hub to the turntable.

5. Using the suitable lifting device, remove the swing drive hub from mounting plate without damaging the swing gear.

6. Place swing drive hub in the clean area.

7. Refer to Section , for swing drive maintenance.

3.16 SWING BEARING

Turntable Bearing Mounting Bolt Condition Check

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

1. Check the frame to bearing. Attach bolts as follows:
   - **a.** Elevate the fully retracted boom to 70 degrees (full elevation).
   - **b.** At the positions indicated on Figure 3-58. try and insert the 0.0015 in. (0.0381 mm) feeler gauge between the bolt head and hardened washer at the arrow indicated position.
   - **c.** Assure that the 0.0015 in. (0.0381 mm) 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 boom to 70 degrees (full elevation).
   - **b.** At the positions indicated on Figure 3-58. try and insert the 0.0015 in. (0.0381 mm) 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 3-58. try and insert the 0.0015in. (0.0381 mm) feeler gauge between the bolt head and hardened washer at the arrow indicated position.

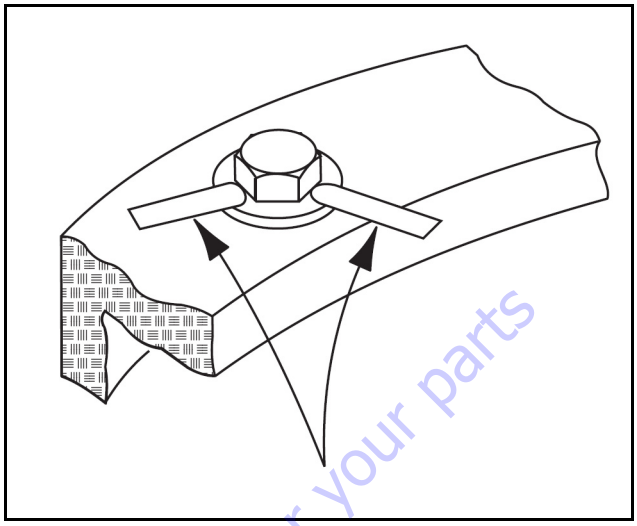


Figure 3-58. Swing Bearing Bolt Feeler Gauge Check

Wear Tolerance

1. From the underside of the machine, at rear center, with the boom fully elevated and fully retracted, as shown in and Figure 3-59., Swing Bearing Tolerance Boom Placement - Swing Bearing Tolerance Boom Placement) A, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable. (Figure 3-60., Swing Bearing Tolerance Measuring Point).
2. At the same point, with the boom at horizontal and fully extended, and the tower boom fully elevated as shown in (Figure 3-59., Swing Bearing Tolerance Boom Placement - Swing Bearing Tolerance Boom Placement) B, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable. (Figure 3-59., Swing Bearing Tolerance Boom Placement).
3. If a difference greater than 0.079 in. (2.00 mm) is determined, the swing bearing should be replaced.
4. If a difference less than 0.079 in. (2.00 mm) is determined, and any of the following conditions exist, the bearing should be removed, disassembled, and inspected for the following:
   - **a.** Metal particles in the grease.
   - **b.** Increased drive power required.
   - **c.** Noise.
   - **d.** Rough Rotation.

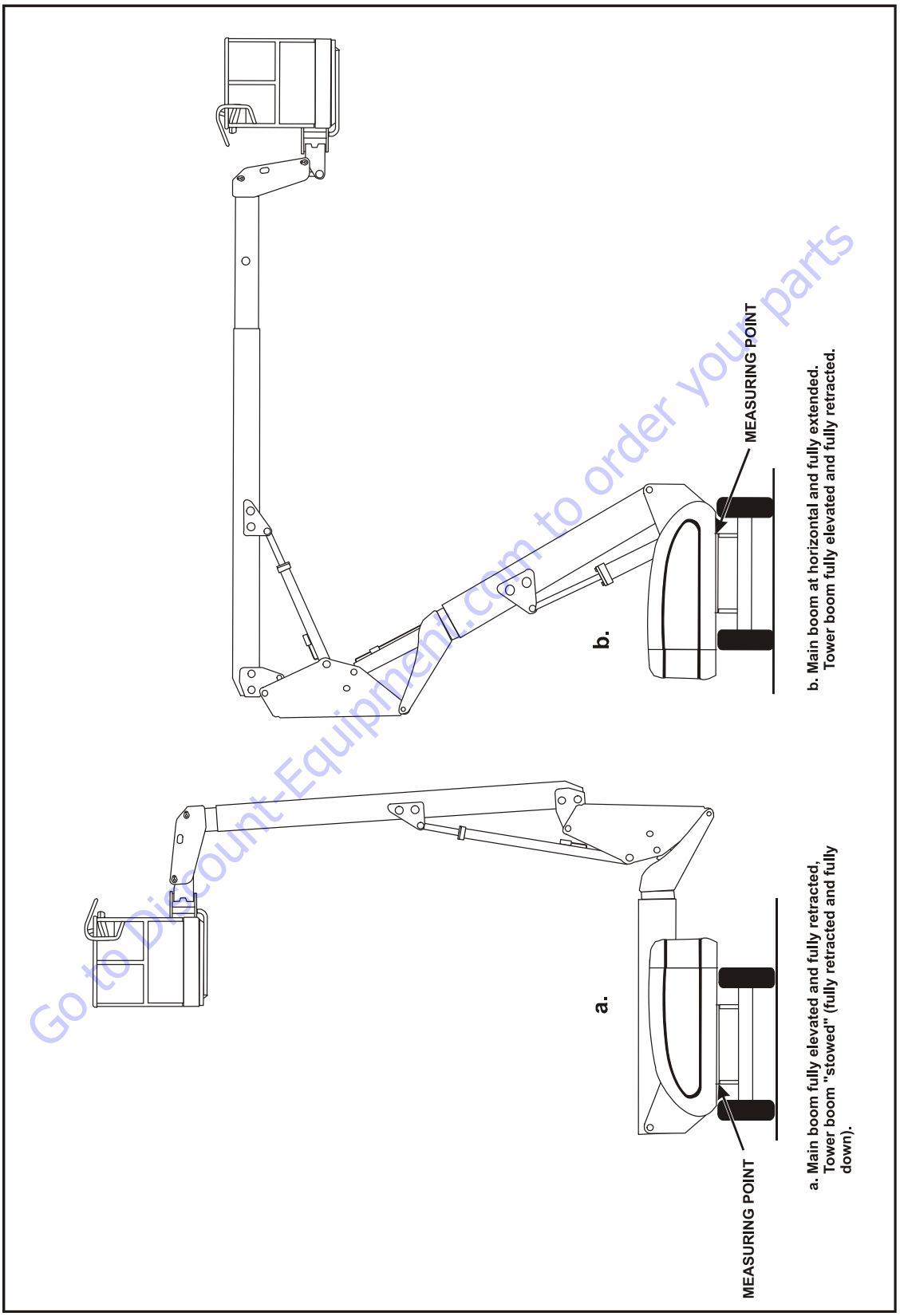


Figure 3-59. Swing Bearing Tolerance Boom Placement

5. If bearing inspection shows no defects, reassemble and return to service.

NOTICE

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

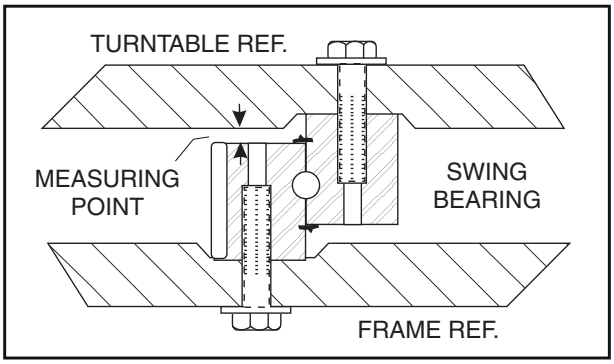


Figure 3-60. Swing Bearing Tolerance Measuring Point

Swing Bearing Replacement

REMOVAL.

1. From Ground Control station, operate the boom adequately to provide access to frame opening or, if equipped, 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 which attach rotary coupling retaining yoke brackets to turntable.

NOTICE

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

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. Immediately cap lines and ports.

5. Attach suitable overhead lifting equipment to the base of the turntable weldment.

6. Use a suitable tool to scribe a line on the inner race of the swing bearing and on the underside of the turntable. This will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the turntable to the bearing inner race. Discard the bolts.

7. Use the lifting equipment to carefully lift the complete turntable assembly from the bearing. Ensure that no damage occurs to the turntable, bearing or frame-mounted components.

8. Carefully place the turntable on a suitably supported trestle.

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

INSTALLATION

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

⚠ CAUTION

JLG INDUSTRIES RECOMMENDS 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 Loctite #271 to the new bearing bolts, and loosely install the bolts and washers through the frame and outer race of bearing.

⚠ CAUTION

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

3. Refer to the Torque Sequence diagram as shown in Figure 3-61., Swing Bearing Torque Sequence. Clean any residue off the new bearing bolts, then apply a light coating of Loctite #271 and install the bolts and washers through the frame and outer race of the bearing. Tighten the bolts to an initial torque of 190 ft. lbs. (260 Nm) w/Loctite.

4. Remove the lifting equipment from the bearing.

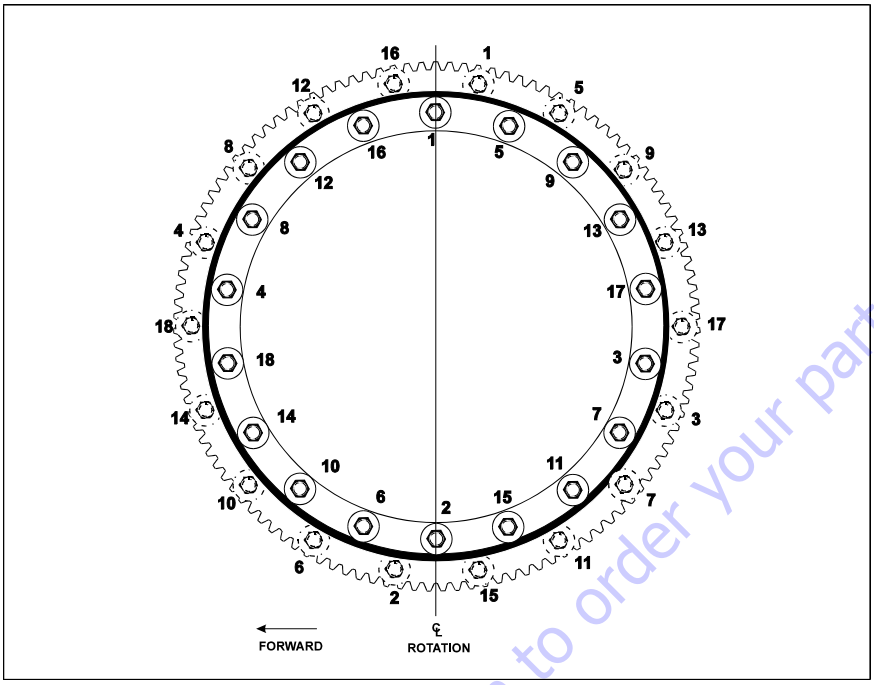


Figure 3-61. Swing Bearing Torque Sequence

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 Loctite #271 and install the bolts and washers through the turntable and inner race of the bearing.
8. Following the Torque Sequence diagram shown in Figure 3-61, Swing Bearing Torque Sequence, tighten the bolts to a torque of 190 ft. lbs. (260 Nm) w/Loctite.
9. Remove the lifting equipment.
10. Install the rotary coupling retaining yoke brackets, apply a light coating of Loctite #242 to the attaching bolts and secure the yoke to the turntable with the mounting hardware.
11. Connect the hydraulic lines 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.

Swing Bearing Torque Values

1. Outer Race - 190 ft. lbs. (260 Nm) w/Loctite.
2. Inner Race - 190 ft. lbs. (260 Nm) w/Loctite.
3. See Swing Bearing Torquing Sequence.

⚠ WARNING

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

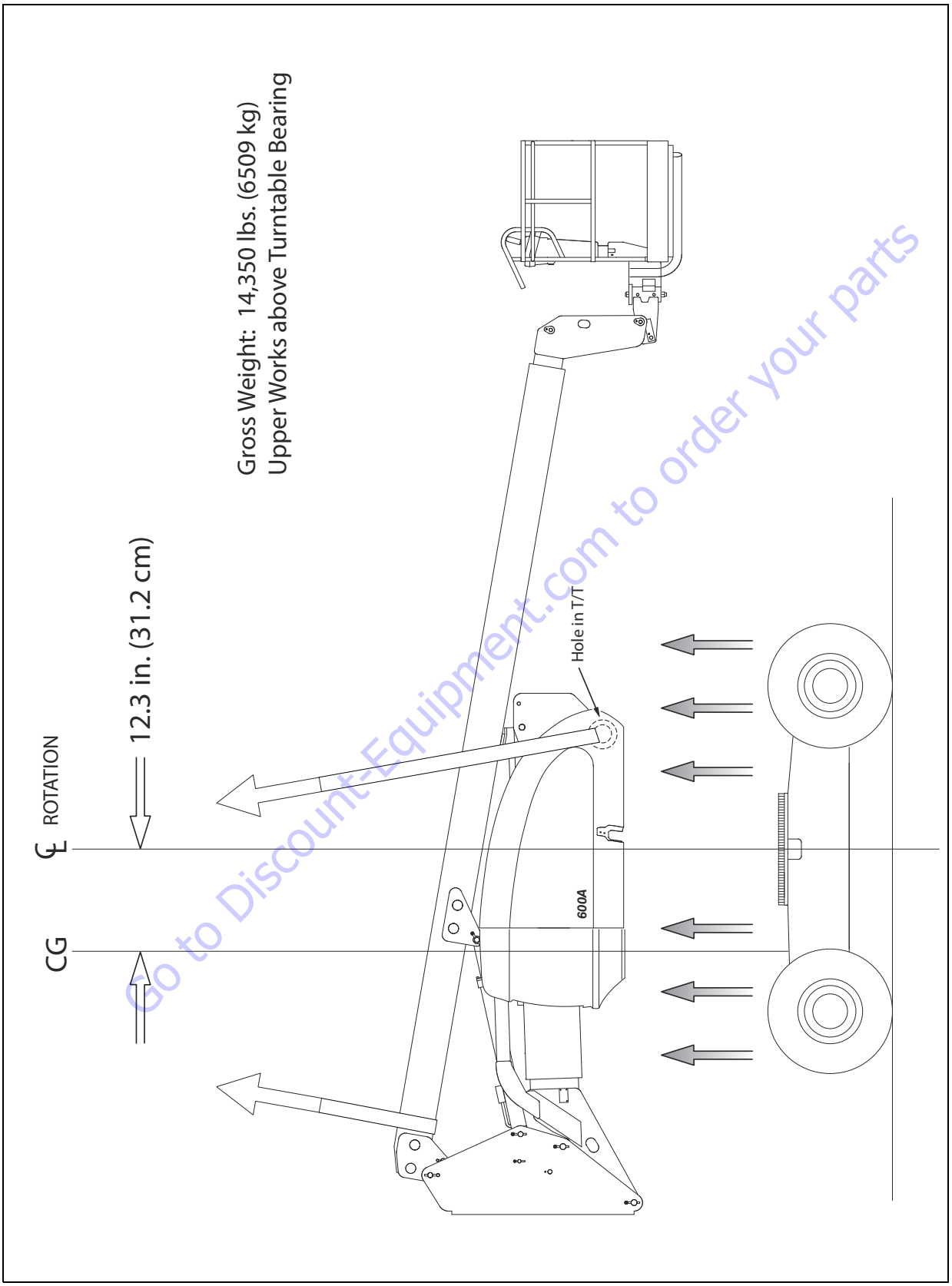


Figure 3-62. Swing Bearing Removal - 600A

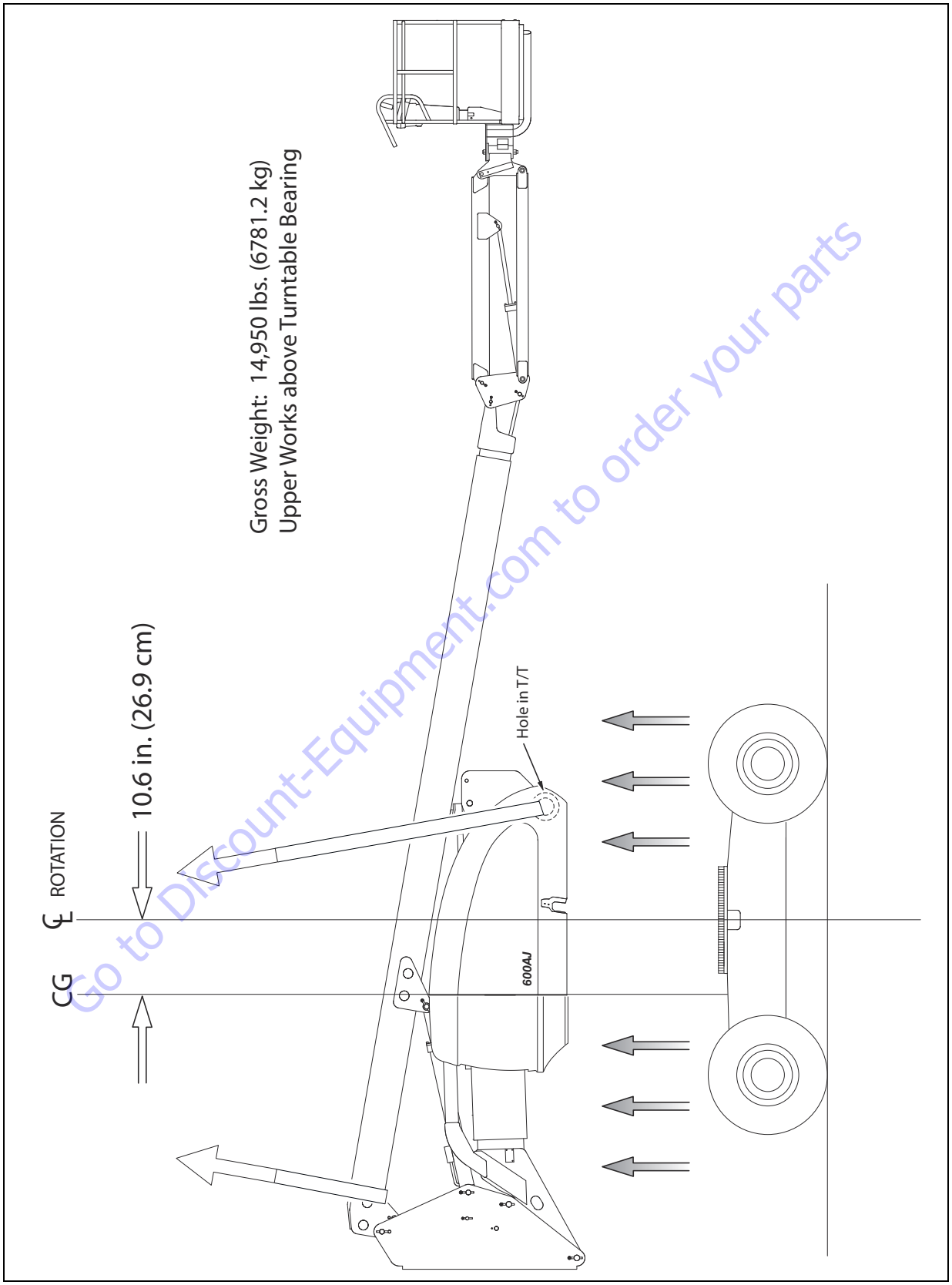


Figure 3-63. Swing Bearing Removal - 600AJ

3.17 SWING BRAKE - (USA BUILT MACHINES, SN 0300087000 THROUGH 0300137452)

Disassembly

1. Remove pressure plate (2) from cover (16) by removing washer head capscrew (1).

⚠ CAUTION

PRESSURE PLATE IS UNDER SPRING TENSION APPROXIMATELY 2000 LBS (907 KGF). THE TWO WASHER HEAD CAPSCREWS MUST BE LOOSENED EVENLY TO RELIEVE THIS FORCE. IF A HYDRAULIC PRESS IS AVAILABLE 3000 LBS (1361 KGF) MINIMUM, THE PRESSURE PLATE CAN BE HELD IN POSITION WHILE REMOVING THE WASHER HEAD CAPSCREW.

2. Remove case seal (3) from cover (16).
3. Remove piston (6) from pressure plate (2).
4. Remove O-ring (4), backup ring (5), O-ring (7) and backup ring (8) from piston (6).
5. Remove stack assembly, consisting of stator disc (10), rotor disc (11) and return plate (12) from cover (16).
6. Remove dowel pins (15), springs (13) and spring retainer (14) from cover (16).

NOTE: *Not all the models use will use same number of springs or spring pattern. Record this information for assembly purposes.*

7. Remove retaining ring (19) from cover (16).
8. Remove shaft by pressing or using a soft mallet on male end of shaft (9).
9. Remove retaining ring (20) from cover (16) and press out oil seal (17) and bearings (18), if required.

Inspection

1. Clean all parts thoroughly.
2. Closely inspect all parts for excessive wear, cracks and chips. Replace parts as necessary.
3. Discard seals and O-rings.
4. Closely inspect bearings and bearing contact surfaces. Replace as necessary.

NOTE: *Bearings may be reused if, after thorough inspection, they are found to be in good condition.*

Assembly

NOTE: *Lubricate all rubber component from repair kit with clean type of fluid used in the system.*

1. Use an alkaline wash to clean the parts before assembly.
2. Press oil seal (17) into cover (16) until it is flush with the bearing shoulder. Note direction of seal.
3. Press bearing (18) into position until it bottoms out on borestep.
4. Install retaining ring (20) into cover (16).
5. Press Shaft (9) into bearing (18) until bottoms out on shoulder. Bearing (18) inner shoulder must be supported during this operation.
6. Install retaining ring (19) on shaft (9).
7. Insert dowel pins (15), spring retainer (14) and spring (13) into cover (16).

NOTE: *Be sure that to use same number of spring and spring pat tern as recorded during disassembly.*

8. Position plate (12) on spring (13).

NOTE: *Discs (10) & (11) and plate (12) must remain dry during installation. No oil residue must be allowed to contaminate the disc surface.*

9. Install rotor disc (11) and stator disc (10).
10. Install O-ring (4), backup ring (5), O-ring (7) and backup ring (8) on piston (6). Note order of O-rings and backup rings. Insert pressure (6) into pressure plate (2).

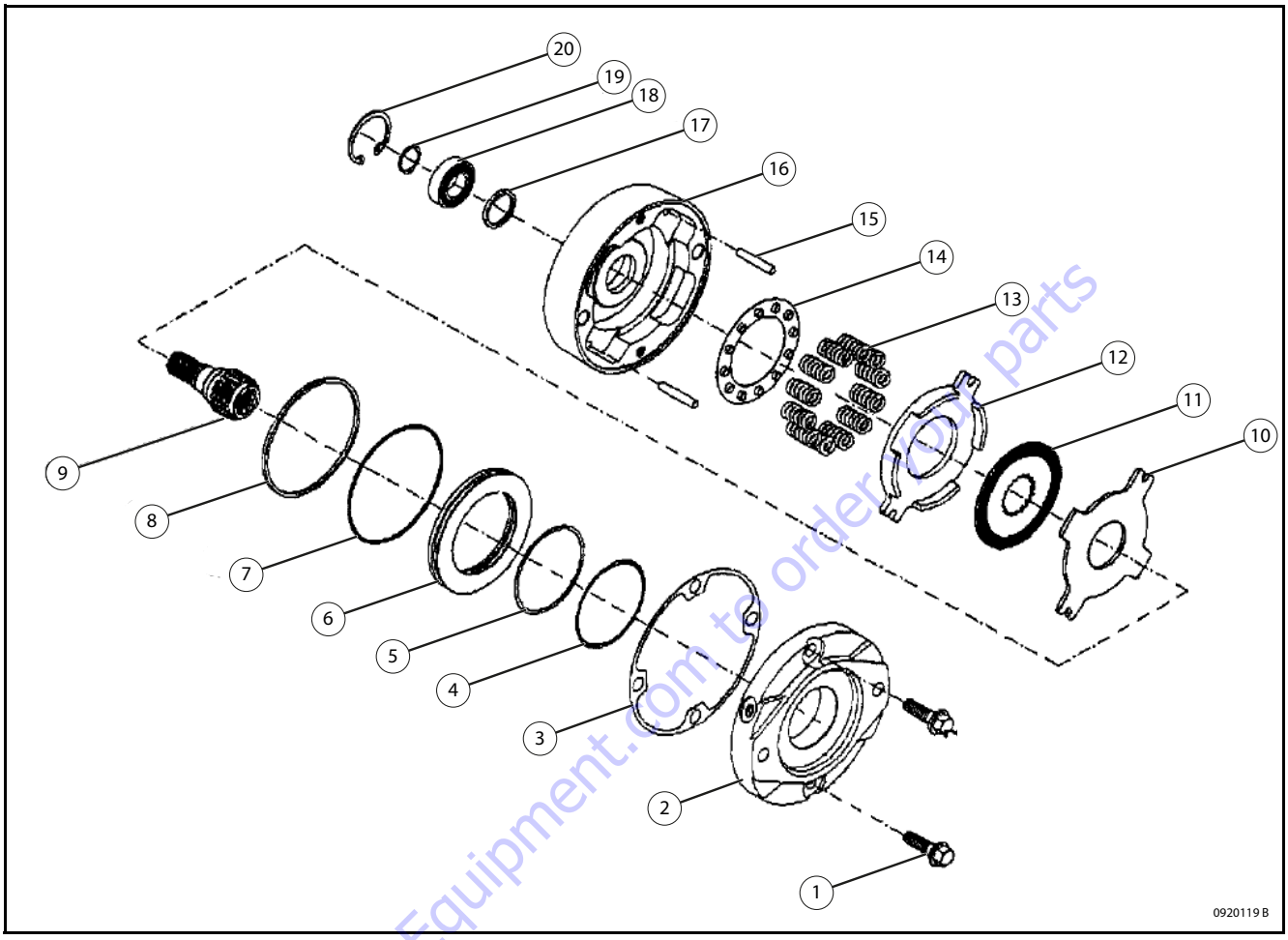
NOTE: *Be careful not to share O-rings or backup rings. Be careful not to scratch piston.*

11. Install new case seal (3) in cover (16).
12. Position pressure plate (2) on cover (16) aligning dowel pins (15) with holes in pressure plate (2).
13. Install washer head capscrew (1) and tight evenly to draw pressure plate (2) to cover (16). Torque washer head capscrew to 55 ft. lbs. (75 Nm).

NOTE: *A hydraulic press will simplify installation of pressure plate on cover. Clamp pressure plate in position while tightening the washer head capscrew.*

⚠ CAUTION

IF HYDROSTATIC BENCH IS PERFORMED ON BRAKE ASSEMBLY. RELEASE PRESSURE MUST NOT EXCEED 2000 PSI (137.9 BAR) UNLESS TWO ADDITIONAL BOLTS ARE USED FOR SUPPLEMENTARY CLAMPING.



1. Capscre
2. Pressure Plate
3. Seal Case
4. O-ring
5. Backup Ring
6. Piston
7. O-ring
8. Backup Ring
9. Shaft
10. Stator Disc
11. Rotor Disc
12. Return Plate
13. Spring
14. Spring Retainer
15. Dowel pin
16. Cover
17. Oil Seal
18. Bearing
19. Retaining Ring
20. Retaining Ring

Figure 3-64. Swing Brake Assembly - (USA Built Machines, SN 0300087000 through 0300137452)

Bleeding

1. Install brake in system and connect pressure lines.
2. Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 6.9 bar (100 psi) during bleeding.
3. Apply sufficient pressure to release brake and check for proper operation in system.

Table 3-9. Troubleshooting

PROBLEM	CAUSE	EXPLANATION	ACTION
Brake slips	Excessive pressure in hydraulic system	If there is back pressure in the actuation line of the brake, holding torque will be reduced.	Check filters, hose size, restrictions in other hydraulic components.
	Oil in brake if designed for dry use	Wet linings generate 67% of the dry torque rating. If the brake has oil in it, check the type of oil hydraulic or gearbox. 1 . Gearbox oil 2. Hydraulic oil	Replace oil seal in brake. Check motor seal Check piston seals ***NOTE:*** *Internal components will need to be inspected, cleaned and replaced as required.*
	Disc plates worn	The thickness of the disc stack sets the torque level. A thin stack reduces torque.	Check disc thickness.
	Springs broken or have taken a permanent set	Broken or set springs can cause reduced torque - a rare occurrence.	Check release pressure. (See spring replacement).
Brake drags or runs hot	Low actuation pressure	The brake should be pressurized to minimum of 1.38 bar (20 psi) over the full release pressure under normal operating conditions. Lower pressures will cause the brake to drag thus generating heat.	Place pressure gauge in bleed port & check pressure with system on.
	Bearing failure	If the bearing should fail, a large amount of drag can be generated.	Replace bearing.
Brake will not release	Stuck or clogged valve	Brakes are designed to come on when system pressure drops below stated release pressure. If pressure cannot get to brake, the brake will not release.	Place pressure gauge in bleed port - check for adequate pressure. Replace inoperative line or component.
	Bad o-rings	If release piston will not hold pressure, brake will not release.	Replace o-rings.
	Discs frozen	These brakes are designed for only limited dynamic braking. A severe emergency stop or prolonged reduced release pressure operation may result in this type of damage.	Replace disc stack.

3.18 ROTARY COUPLING - (USA BUILT MACHINES, SN 0300087000 THROUGH 0300138648)

Use the following procedure to install the seal kit.

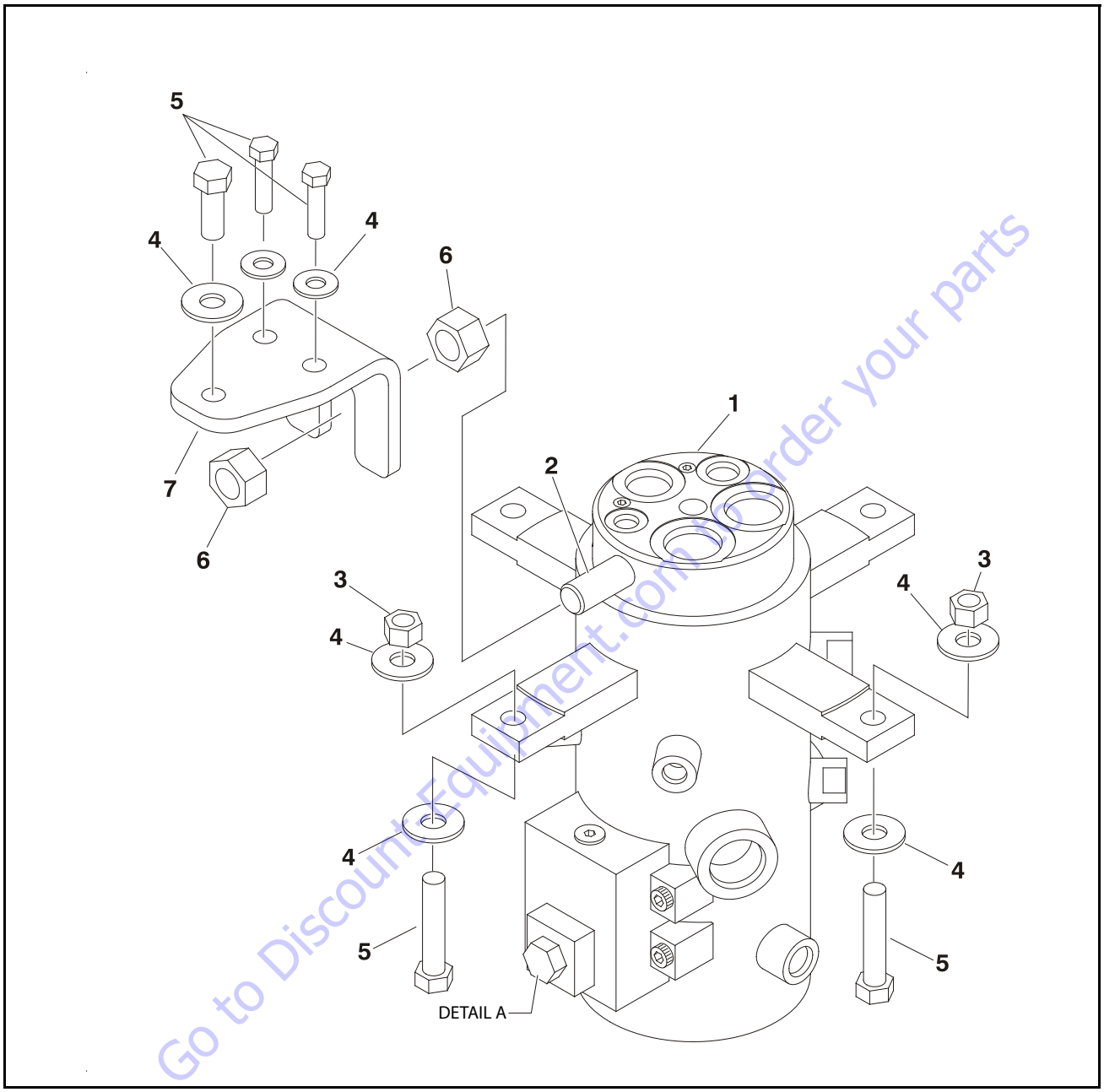
1. If not already removed, remove the axle oscillation valve from the cylinder barrel. The spool of the valve protrudes into the barrel and will damage the spool and seals if left in place.
2. Remove snap ring (12) from end.
3. Remove thrust ring (13) from the same end.
4. Remove center body (10) from housing (11).
5. Cut off old seals (14,15,17 and 18).
6. Assemble lip seals (14) in direction shown in Figure 3-66., Rotary Coupling (USA Built Machines, SN 0300087000 through 0300138648) - Sheet 2 of 2.
7. Reassemble O-ring (18).
8. Heat cap seals (17) in hydraulic oil for 5 minutes at 300° F (149° C).
9. Assemble cap seals over O-rings
10. Reinsert center body into housing (lube with hydraulic oil).
11. Replace thrust ring and snap ring.

Table 3-10. Coupling Port Information Table - 2WS

Port No.	Outlet	Port Size	Description	Operating Pressure PSI (Bar)	Proof Pressure PSI (Bar)
1	1	-8	Brake	450 (31)	675 (47)
2	2	-6	2 Speed	4500 (310)	6750 (465)
3	1	-6	Steer	2500 (172)	3750 (259)
4	1	-6	Steer	2500 (172)	3750 (259)
5	2	1-6, 1-16	Drive Reverse	4500 (310)	6750 (465)
6	1	-16	Drive Forward	4500 (310)	6750 (465)
7	3	2-8, 1-6	Drain	250 (17)	375 (26)

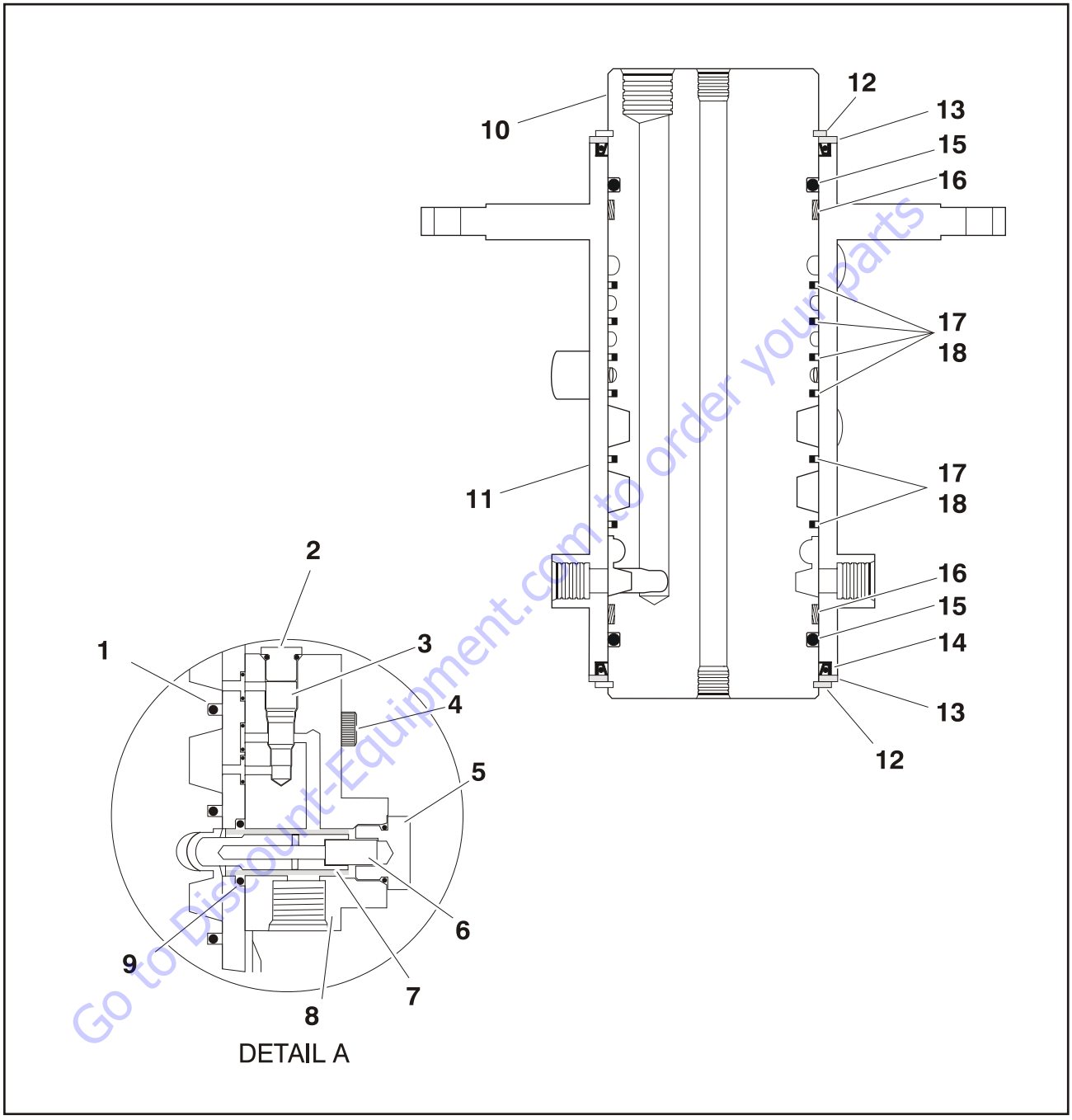
Table 3-11. Coupling Port Information Table - 4WS

Port No.	Outlet	Port Size	Description	Operating Pressure PSI (Bar)	Proof Pressure PSI (Bar)
1	1	-8	Brake	450 (31)	675 (47)
2	2	-6	2 Speed	4500 (310)	6750 (465)
3	1	-6	Steer	2500 (172)	3750 (259)
4	1	-6	Steer	2500 (172)	3750 (259)
5	2	1-6, 1-16	Drive Reverse	4500 (310)	6750 (465)
6	1	-16	Drive Forward	4500 (310)	6750 (465)
7	3	2-8, 1-6	Drain	250 (17)	375 (26)
8	1	-6	Steer	2500 (172)	3750 (259)
9	1	-6	Steer	2500 (172)	3750 (259)



1. Rotary Coupling
2. Torque Lug
3. Locknut
4. Flatwasher
5. Bolt
6. Nut
7. Bracket

Figure 3-65. Rotary Coupling (USA Built Machines, SN 0300087000 through 0300138648) - Sheet 1 of 2



1. O-ring
2. Plug
3. Check Valve
4. Screw
5. Plug
6. Spring
7. Valve Block Plunger
8. Valve Block
9. O-ring
10. Body
11. Housing
12. Retaining Ring
13. Ring
14. Oil Seal
15. O-ring
16. Bearing
17. Cap Seal
18. O-ring

Figure 3-66. Rotary Coupling (USA Built Machines, SN 0300087000 through 0300138648) - Sheet 2 of 2

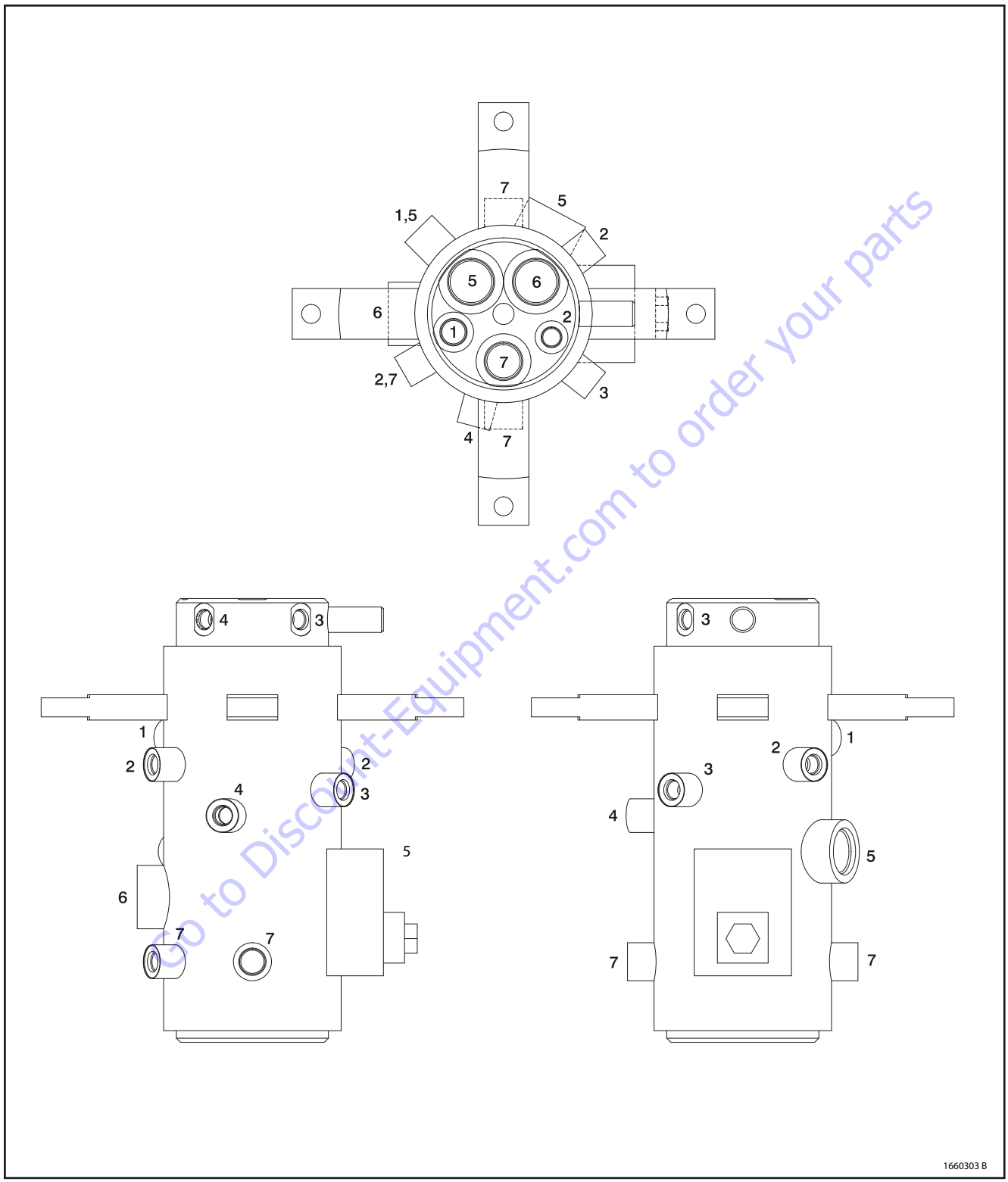


Figure 3-67. Rotary Coupling Port Location (USA Built Machines, SN 0300087000 through 0300138648) - 2WS

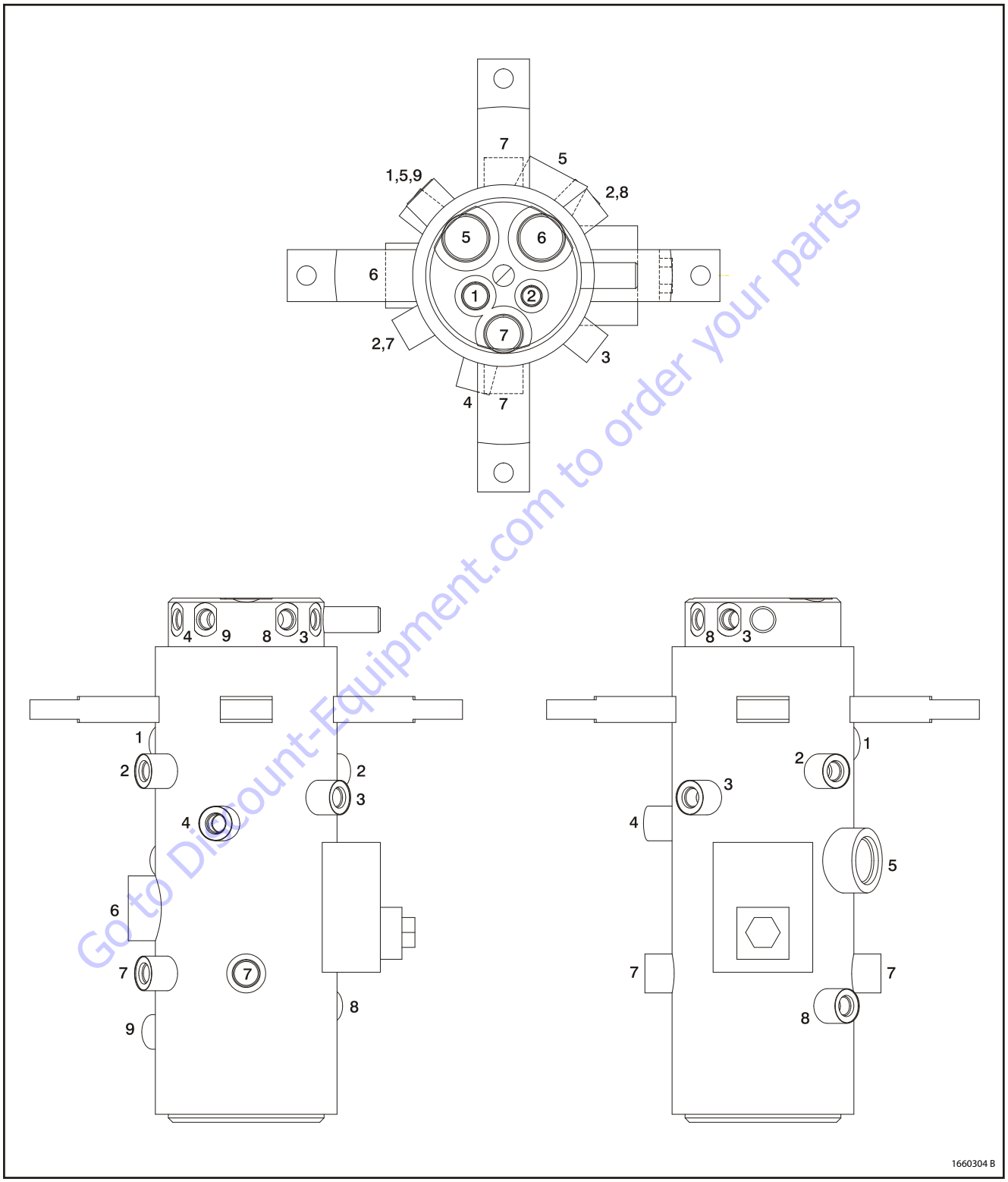


Figure 3-68. Rotary Coupling Port Location (USA Built Machines, SN 0300087000 through 0300138648) - 4WS

3.19 ROTARY COUPLING - (USA BUILT MACHINES AND CHINA BUILT MACHINES, SN 0300138649 TO PRESENT AND SN B300000100 TO PRESENT)

Use the following procedure to install the seal kit.

1. If not already removed, remove the axle oscillation valve from the cylinder barrel. The spool of the valve protrudes into the barrel and will damage the spool and seals if left in place.
2. Remove snap ring (7) from end.
3. Remove thrust ring (6) from the same end.
4. Remove center body (1) from housing (3).
5. Cut off old seals (2, 4, 5).
6. Remove proximity switch.
7. Assemble lip seals (2) in direction shown in Figure 3-69., Rotary Coupling Seal Installation (USA Built Machines and China Built Machines, SN 0300138649 to Present and SN B300000100 to Present).
8. Reassemble O-ring (4).
9. Heat cap seals (5) 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 thrust ring and snap ring.
13. Install proximity switch as shown in Figure 3-73.

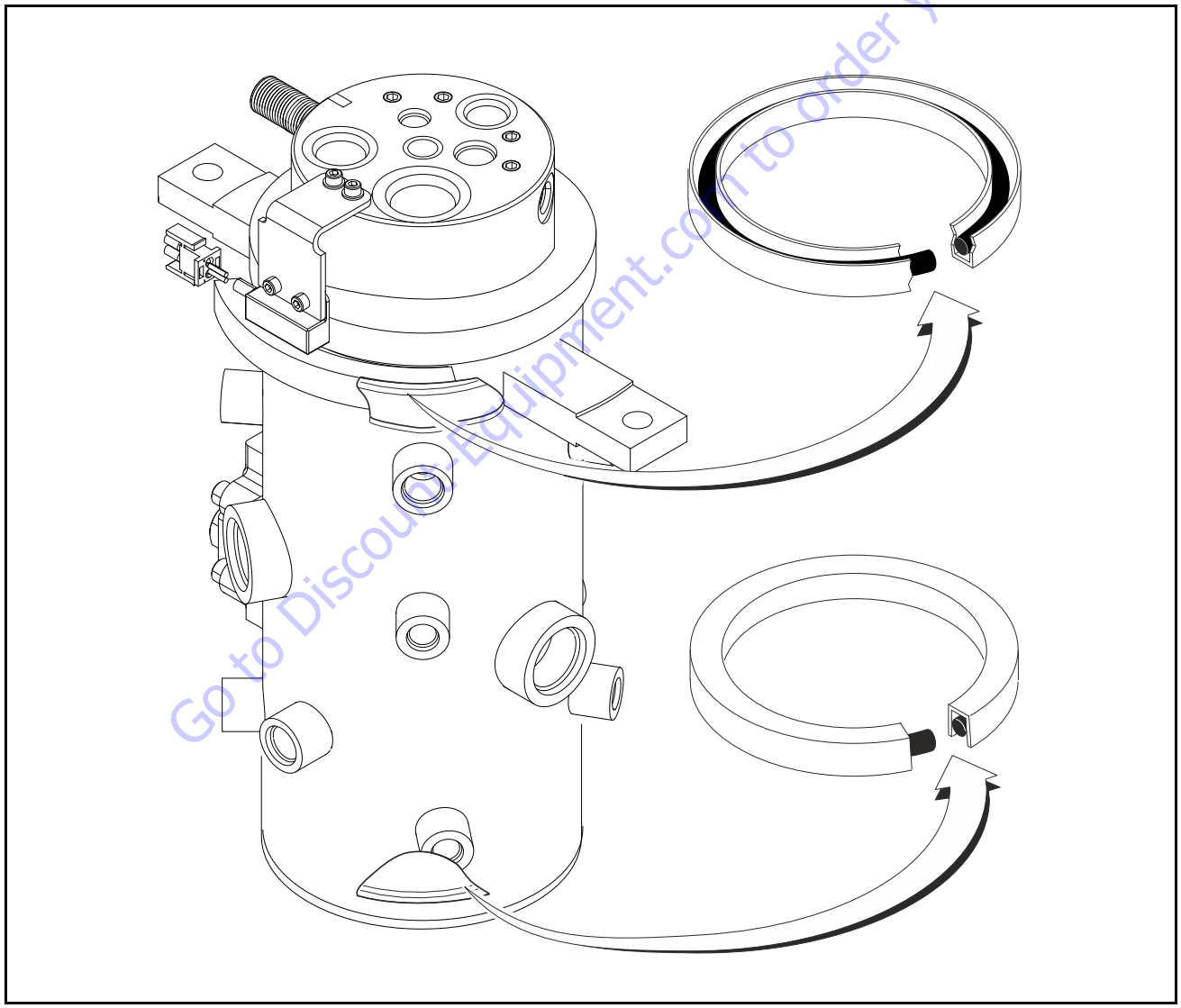
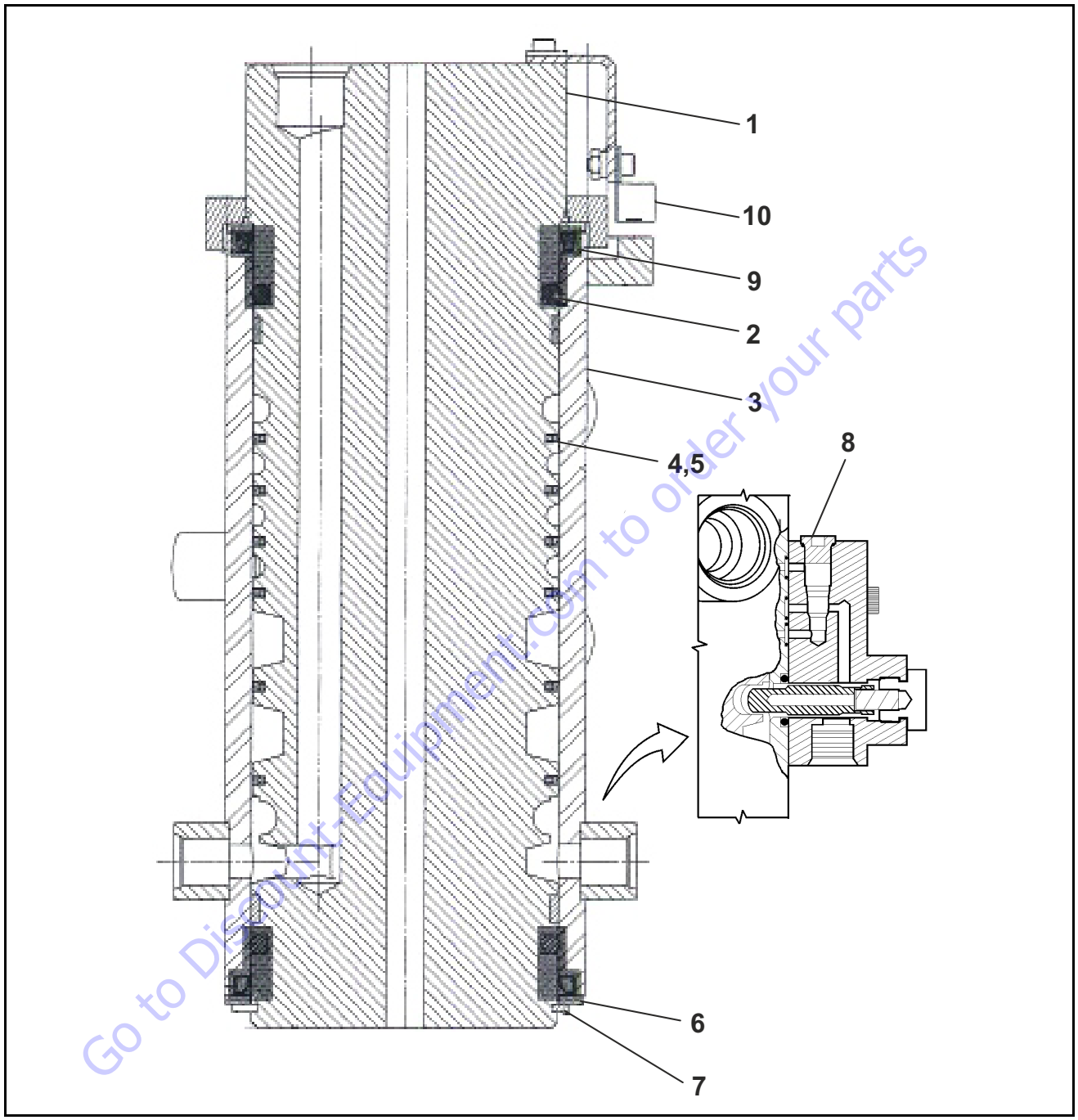


Figure 3-69. Rotary Coupling Seal Installation (USA Built Machines and China Built Machines, SN 0300138649 to Present and SN B300000100 to Present)



1. Center Body
2. Seal
3. Housing
4. O-ring
5. Seal
6. Thrust Ring
7. Snap Ring
8. Valve Block (Axle Oscillation)
9. O-ring
10. Proximity Switch

Figure 3-70. Rotary Coupling Cutaway (USA Built Machines and China Built Machines, SN 0300138649 to Present and SN B300000100 to Present)

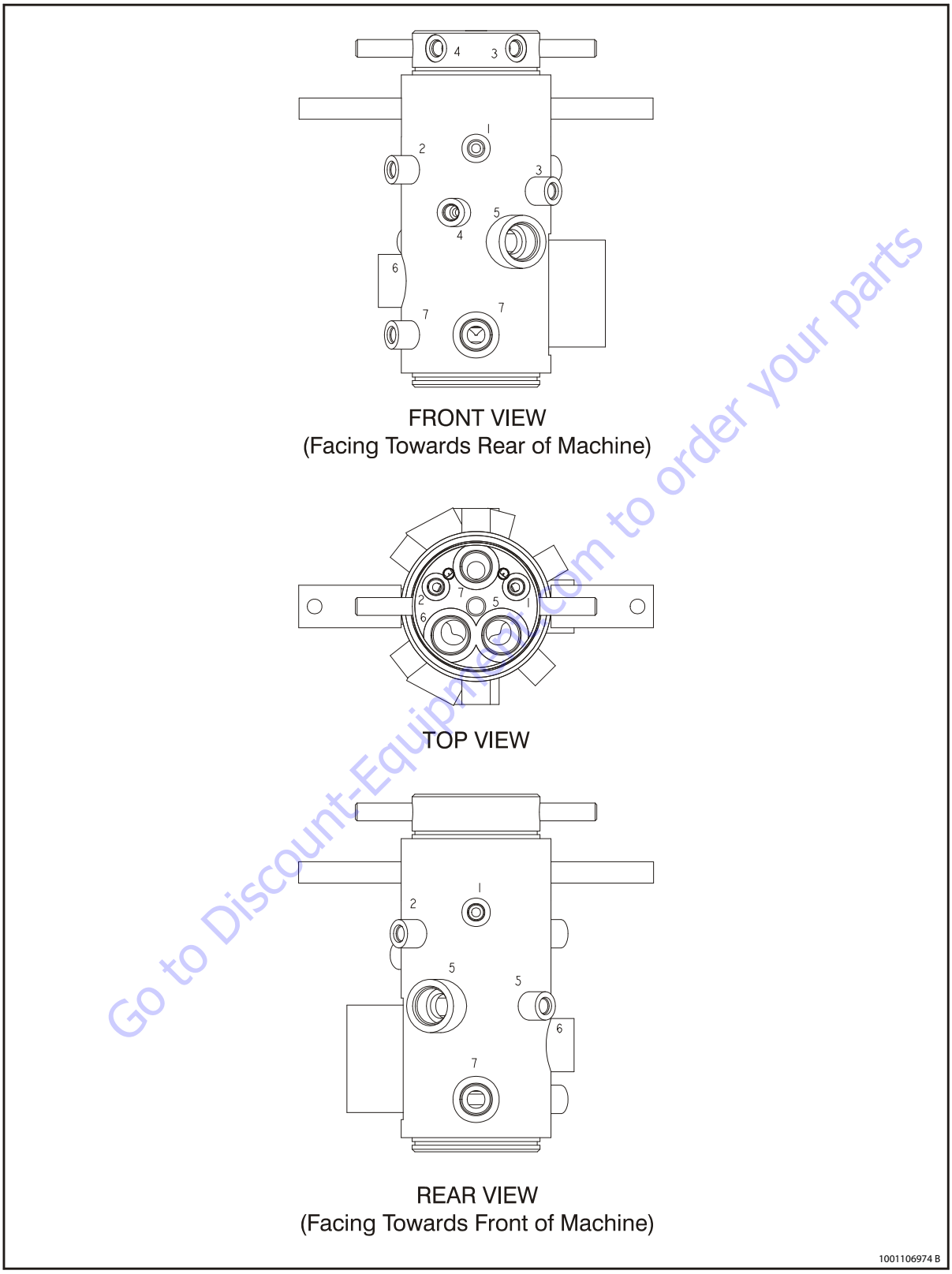


Figure 3-71. Rotary Coupling Port Location (7 Port) (USA Built Machines and China Built Machines, SN 0300138649 to Present and SN B300000100 to Present)

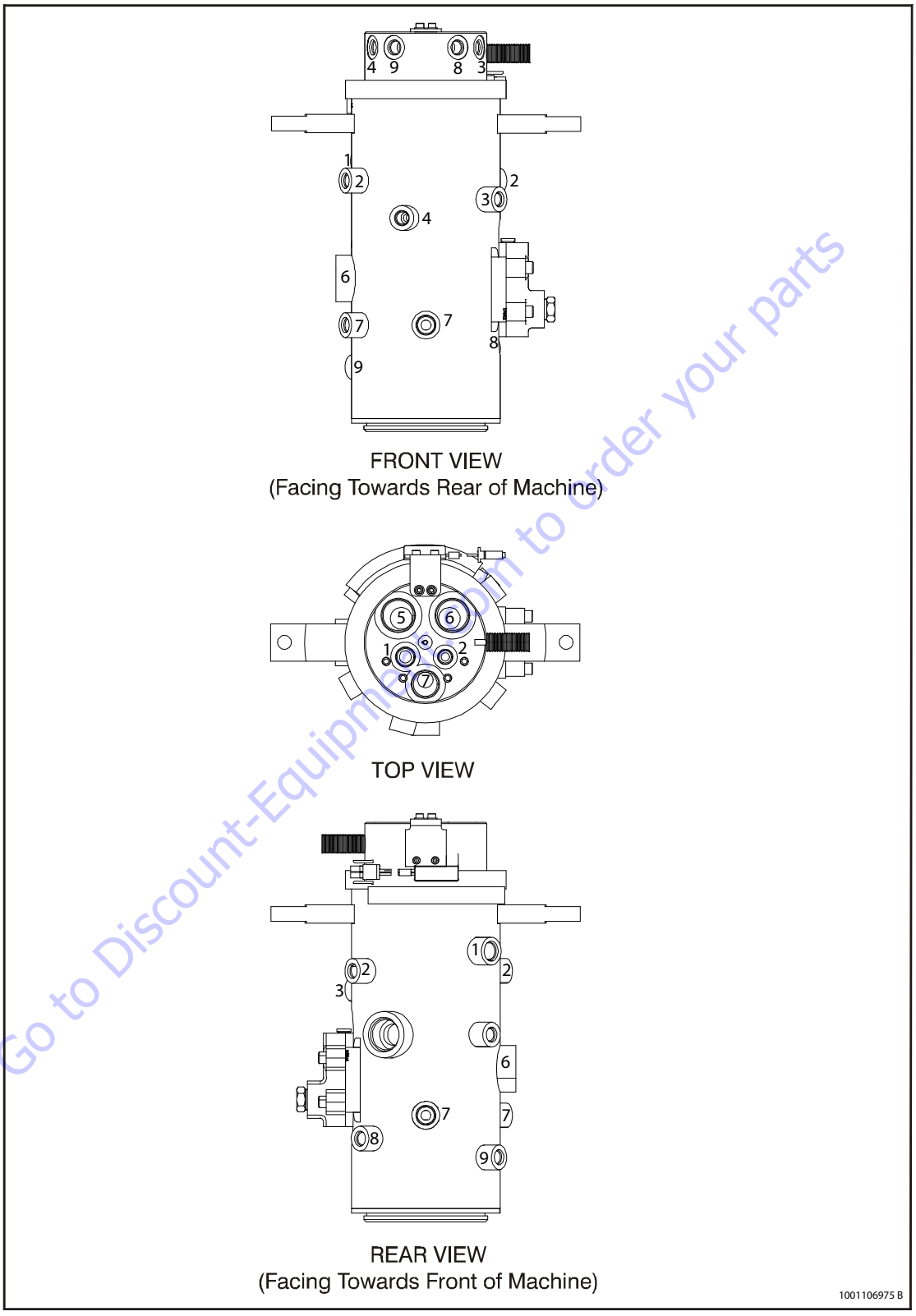
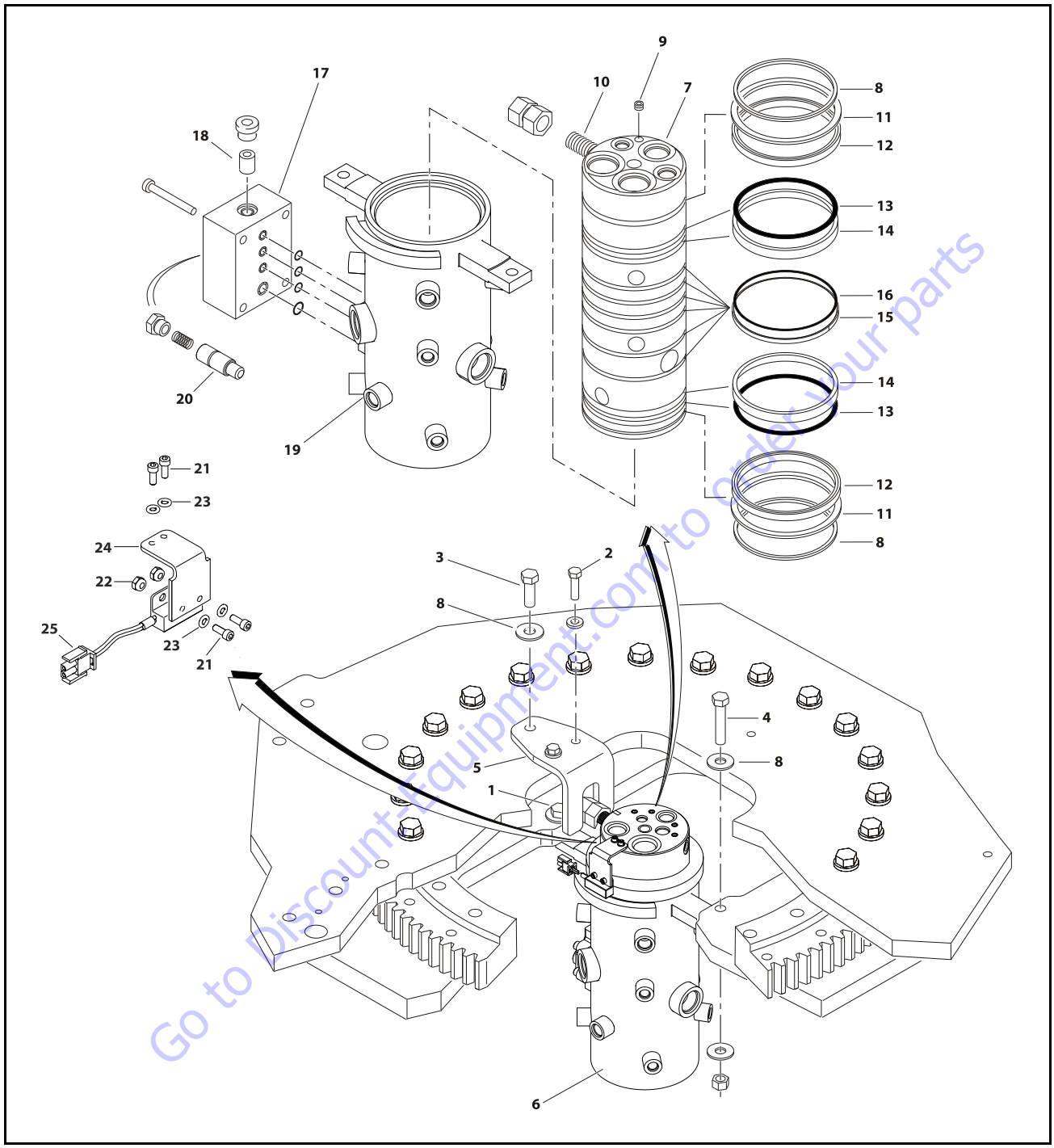


Figure 3-72. Rotary Coupling Port Location (9 Port) (USA Built Machines and China Built Machines, SN 0300138649 to Present and SN B300000100 to Present)



1.	JLG Threadlocker	6.	Rotary Coupling	11.	Ring	16.	O-ring	21.	Bolt
2.	Bolt	7.	Spool	12.	Seal	17.	Valve	22.	Nut
3.	Bolt	8.	Retaining Ring	13.	O-ring	18.	Check Valve	23.	Washer
4.	Bolt	9.	Plug	14.	Bearing	19.	Case	24.	Bracket
5.	Bracket	10.	Torque Lug	15.	Cap Seal	20.	Plunger Valve	25.	Proximity Switch

Figure 3-73. Rotary Coupling Installation (USA Built Machines and China Built Machines, SN 0300138649 to Present and SN B300000100 to Present)

Table 3-12. Coupling Port Information Table (7 port)

Port No.	Outlets	Port Size	Description	Operating Pressure PSI (Bar)	Proof Pressure PSI (Bar)
1	1	-8	Brake	450 (31)	675 (46.5)
2	2	-6	2 Speed	4500 (310)	6750 (465)
3	1	-6	Steer	2500 (172)	3750 (258.5)
4	1	-6	Steer	2500 (172)	3750 (258.5)
5	2	1-6, 1-16	Drive Reverse	4500 (310)	6750 (465)
6	1	-16	Drive Forward	4500 (310)	6750 (465)
7	3	2-8, 1-6	Drain	250 (17)	375 (26)

Table 3-13. Coupling Port Information Table (9 port)

Port No.	Outlets	Port Size	Description	Operating Pressure PSI (Bar)	Proof Pressure PSI (Bar)
1	1	-8	Brake	450 (31)	675 (46.5)
2	2	-6	2 Speed	4500 (310)	6750 (465)
3	1	-6	Steer	2500 (172)	3750 (258.5)
4	1	-6	Steer	2500 (172)	3750 (258.5)
5	2	1-6, 1-16	Drive Reverse	4500(310)	6750(465)
6	1	-16	Drive Forward	4500 (310)	6750 (465)
7	3	2-8, 1-6	Drain	250 (17)	375 (26)
8	1	-6	Steer	2500 (172)	3750 (258.5)
9	1	-6	Steer	2500(172)	3750 (258.5)

3.20 ENGINE

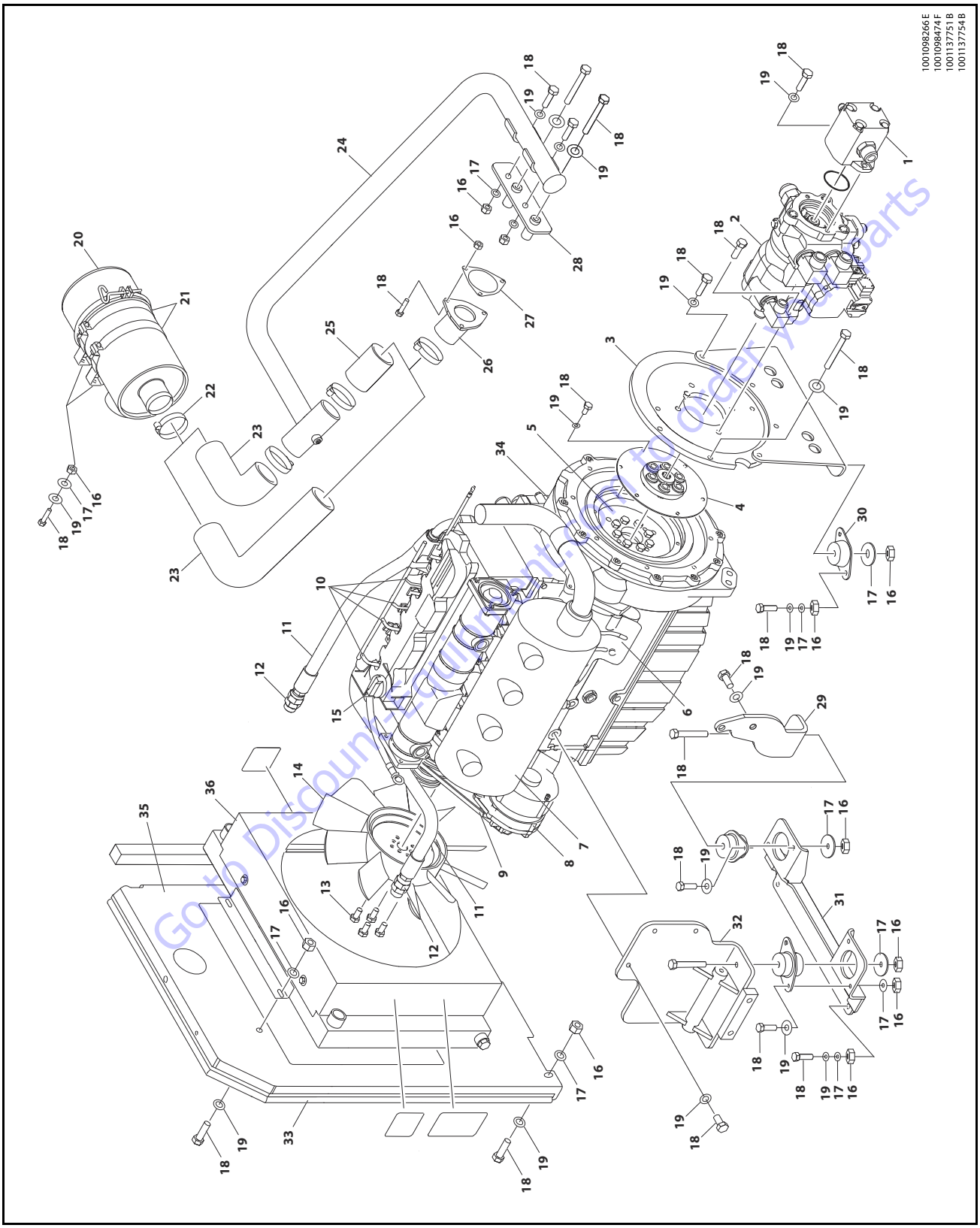


Figure 3-74. Deutz Engine - Sheet 1 of 4

1. Gear Pump
2. Piston Pump
3. Rear Engine Mounting Plate
4. Hayes Coupling
5. Gear Rim
6. Starter
7. Muffler
8. Alternator
9. V-Belt
10. Fuel Injector
11. Oil Cooler Hose
12. Fitting
13. Bolt
14. Fan
15. Filler Cap
16. Nut
17. Washer
18. Bolt
19. Washer
20. Air Cleaner
21. Air Cleaner Band
22. Clamp
23. Elbow Pipe
24. Tube
25. Air Cleaner Hose
26. Air Intake Adapter
27. Air Intake Gasket
28. Resonator Support
29. Engine Mounting Plate
30. Motor mount
31. Engine mounting Plate
32. Engine mounting Plate
33. Seal
34. Engine
35. Radiator Mounting Plate
36. Radiator

Figure 3-75. Deutz Engine - Sheet 2 of 4

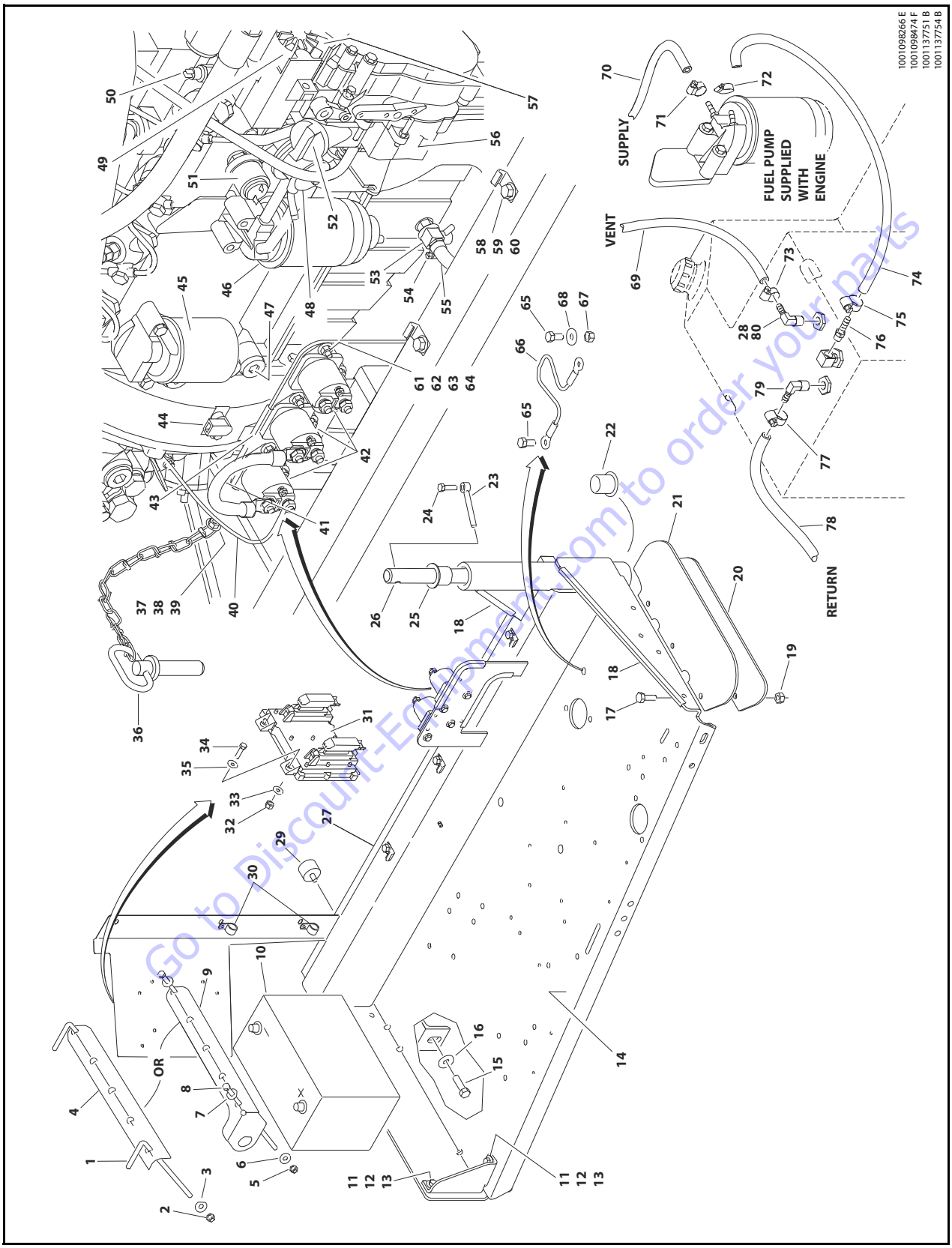


Figure 3-76. Deutz Engine - Sheet 3 of 4

1. Bolt
2. Locknut
3. Flatwasher
4. Battery Hold Down
5. Locknut
6. Flatwasher
7. Flatwasher
8. Bolt
9. Battery Hold Down
10. Battery
11. Flatwasher
12. Bolt
13. Locknut
14. Engine Tray
15. Bolt
16. Flatwasher
17. Bolt
18. Flex Trim
19. Locknut
20. Support Plate
21. Rubber Panel
22. Flanged Bushing
23. Pin Keeper
24. Bolt
25. Flanged Bushing
26. Pivot Pin
27. Seal
28. Sealant Pipe
29. Bumper
30. Clamp
31. Module Controller
32. Locknut
33. Flatwasher
34. Bolt
35. Bolt
36. Hitch Pin
37. Bolt
38. Locknut
39. Flatwasher
40. Harness
41. Jumper Cable
42. Relay
43. Trim Flex
44. Speed Sensor
45. Oil Filter
46. Fuel Filter
47. Thermo stat and Spring
48. Hand Pump
49. Throttle Actuator
50. Temperature Transmitter
51. Oil Pressure Sensor
52. Filler Cap
53. Oil Drain valve
54. Hose Clamp
55. Oil Drain Hose
56. Seal
57. Start Solenoid
58. Bolt
59. J-Clip
60. Air Cleaner
61. Starwasher
62. Flatwasher
63. Locknut
64. Bolt
65. Bolt
66. Lanyard Cable
67. Nut
68. Flatwasher
69. Hose
70. Hose
71. Hose Clamp
72. Hose Clamp
73. Hose Clamp
74. Hose
75. Hose Clamp
76. Fitting
77. Hose Clamp
78. Hose
79. Fitting
80. Fitting

Figure 3-77. Deutz Engine - Sheet 4 of 4

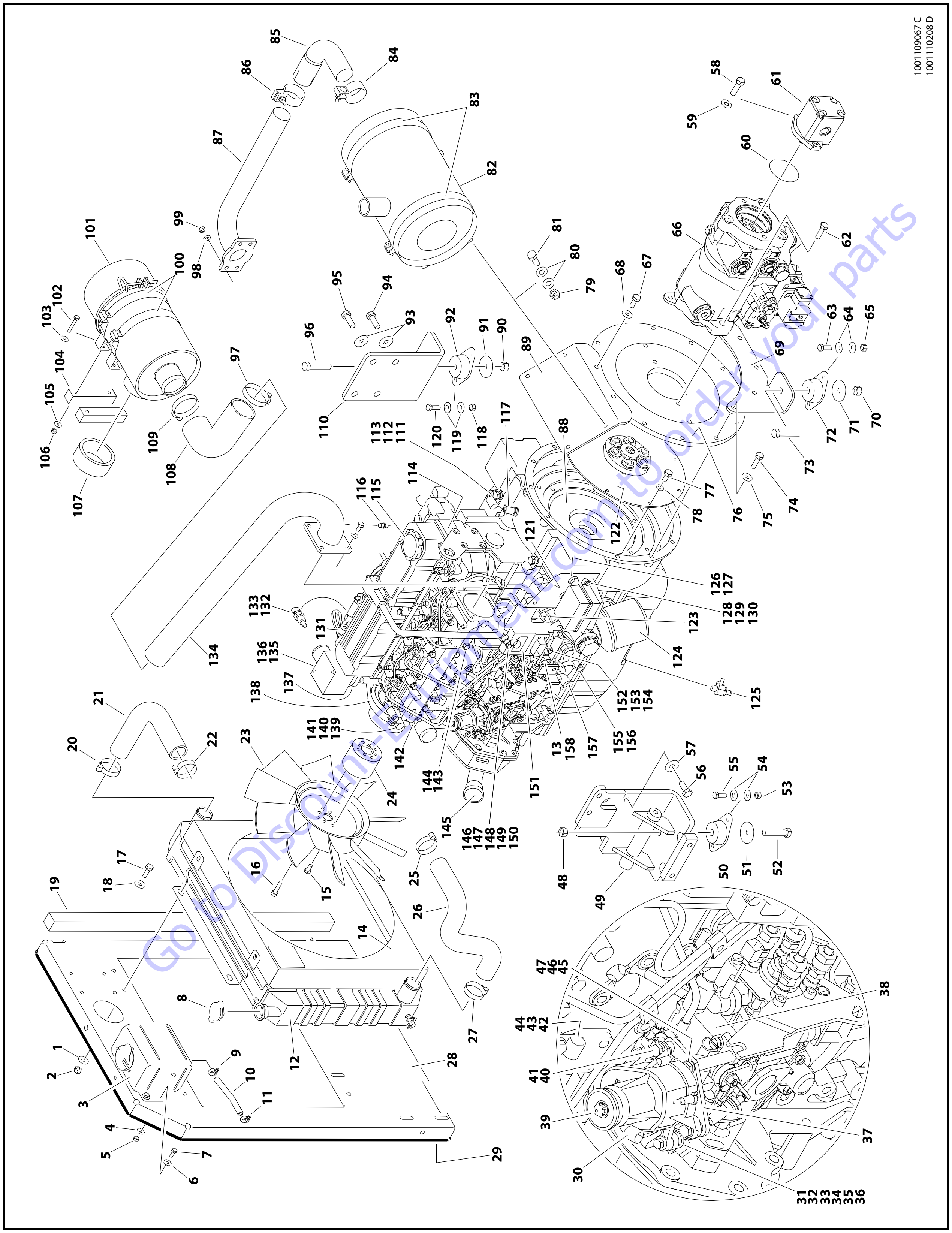


Figure 3-78. Caterpillar Engine - Sheet 1 of 4

1. Flatwasher
2. Locknut
3. Coolant Overflow Container
4. Flatwasher
5. Locknut
6. Flatwasher
7. Bolt
8. Cap
9. Hose clamp
10. Hose
11. Hose clamp
12. Radiator
13. Oil Pressure Switch
14. Fan Shroud
15. Bolt
16. Bolt
17. Bolt
18. Flatwasher
19. Foam Gasket seal
20. Hose Clamp
21. Radiator Hose (Top)
22. Hose Clamp
23. Fan
24. Fan Spacer Adapter
25. Hose Clamp
26. Radiator Hose (Bottom)
27. Hose Clamp
28. Radiator Mounting Plate
29. Hood Seal
30. Cable Clamp
31. Locknut
32. Flatwasher
33. Flatwasher
34. Bolt
35. Bearing
36. Spacer
37. Bracket
38. Fuel Injection Pump
39. Actuator
40. Flatwasher
41. Capscrew
42. Tube Clip
43. Flatwasher
44. Bolt
45. Flatwasher
46. Bolt
47. Bolt
48. Locknut
49. Engine/Generator Mount (Left)
50. Engine Mount
51. Snubbing Washer
52. Bolt
53. Locknut
54. Flatwasher
55. Bolt
56. Bolt
57. Flatwasher
58. Bolt
59. Flatwasher Hardened
60. O-ring
61. Gear Pump Assembly
62. Bolt
63. Bolt
64. Flatwasher
65. Locknut
66. Piston Pump Assembly
67. Bolt
68. Flatwasher
69. Engine Mount Plate (Rear)
70. Locknut
71. Snubbing Washer
72. Engine Mount
73. Bolt
74. Bolt
75. Flatwasher
76. Pump Mounting Plate
77. Bolt
78. Lockwasher
79. Locknut
80. Flatwasher
81. Bolt
82. Spark Arresting Muffler (Standard)
83. Muffler Band
84. Clamp
85. Exhaust Tube
86. Clamp
87. Exhaust Tube Weldment
88. Flywheel
89. Muffler Bracket
90. Locknut
91. Snubbing Washer
92. Engine Mount
93. Flatwasher
94. Bolt
95. Bolt
96. Bolt
97. Hose Clamp
98. Flatwasher
99. Nut
100. Mounting Band
101. Air Cleaner Assembly
102. Bolt
103. Flatwasher
104. Spacer Block
105. Flatwasher Regular
106. Locknut
107. Air Cleaner Seal
108. Rubber Elbow
109. Hose Clamp
110. Motor Mount Plate
111. Flatwasher
112. Tube Clip
113. Bolt
114. Cylinder Head
115. Cap Oil Filler
116. Valve Crankcase Actuator
117. Speed Sensor
118. Locknut
119. Flatwasher
120. Bolt
121. Bracket
122. Pump Coupling
123. Dipstick Oil level
124. Oil Filter
125. Oil Drain Valve
126. Bolt
127. Flatwasher
128. Bolt
129. Flatwasher
130. Bumper
131. Alternator
132. Temperature Sensor
133. Coolant Sensor Washer
134. Intake Tube
135. Caterpillar Tier IVi Engine Assembly
136. Caterpillar Tier IVi Engine Assembly
137. Gasket
138. V-Belt
139. Cable Clamp
140. Flatwasher
141. Bolt
142. Water Pump
143. Flatwasher
144. Bolt
145. Filler Cap
146. Spacer
147. Bumper
148. Flatwasher
149. Cable Clamp
150. Screw
151. ECM
152. Bolt
153. Flatwasher
154. Bumper
155. Bolt
156. Flatwasher
157. Oil Pressure Relief Valve
158. Thread Sealant

Figure 3-79. Caterpillar Engine - Sheet 2 of 4

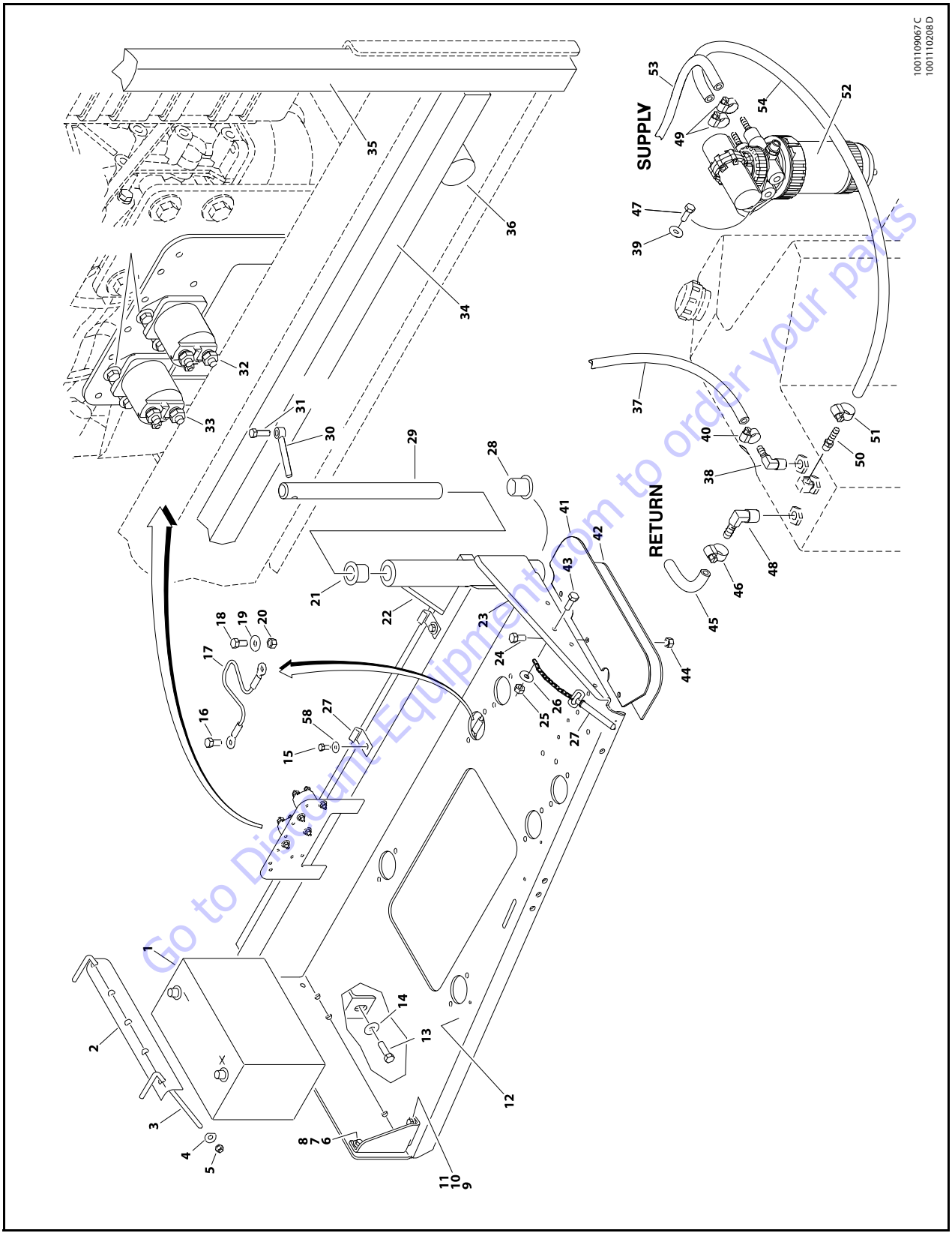


Figure 3-80. Caterpillar Engine - Sheet 3 of 4

1. Battery
2. Battery Hold-Down
3. Hold-Down Rod
4. Flatwasher
5. Locknut
6. Flatwasher
7. Locknut
8. Bolt
9. Flatwasher
10. Locknut
11. Bolt
12. Engine TRay
13. Bolt
14. Flatwasher
15. Bolt
16. Bolt
17. Lanyard
18. Bolt
19. Flatwasher
20. Nut
21. Flange Bearing
22. Flex Trim
23. Flex Trim
24. Bolt
25. Locknut
26. Flatwasher
27. Hitch Pin
28. Flange Bearing
29. Coolant Overflow Container
30. Pump Coupling
31. Bolt
32. Solenoid Assembly Relay
33. Solenoid Assembly Relay
34. Foam Gasket Seal
35. Foam Gasket Seal
36. Rubber Bumper
37. Hose
38. 90 Fitting
39. Flatwasher
40. Hose Clamp
41. Rubber Panel
42. Support Plate
43. Bolt
44. Locknut
45. Hose
46. Clamp Hose
47. Bolt
48. Fitting
49. Hose Clamps
50. Fitting
51. Hose Clamp
52. Fuel Pump Retaining Ring
53. Hose
54. Hose

Figure 3-81. Caterpillar Engine - Sheet 4 of 4

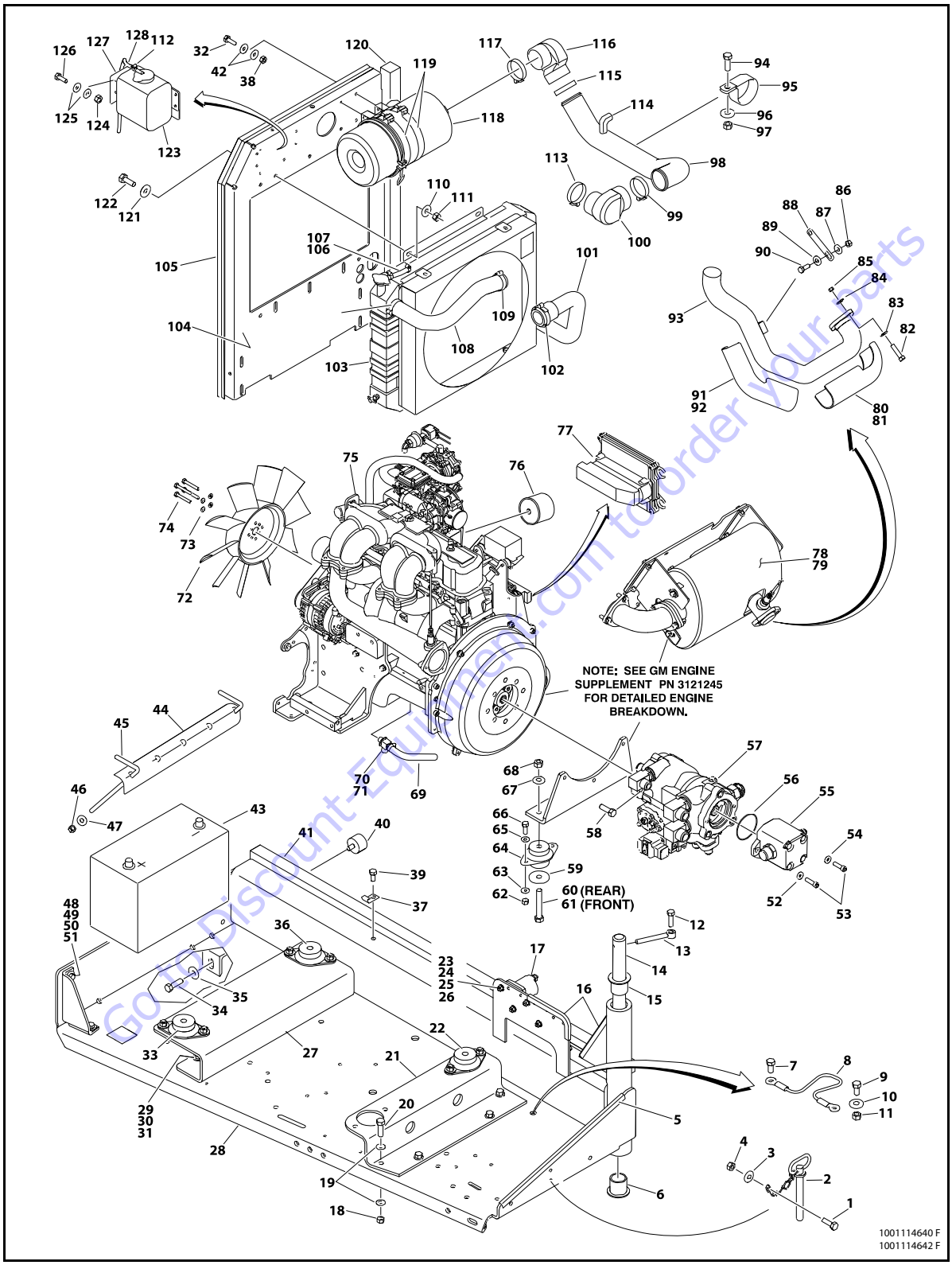


Figure 3-82. GM Engine - Sheet 1 of 4

1. Bolt
2. Hitch Pin
3. Flatwasher
4. Locknut
5. Seal
6. Flanged Bearing
7. Bolt
8. Lanyard Cable
9. Bolt
10. Flatwasher
11. Locknut
12. Bolt
13. Keeper
14. Pin
15. Flanged Bearing
16. Seal
17. Relay
18. Locknut
19. Flatwasher
20. Bolt
21. Engine Mount PLate
22. Engine Mount
23. Bolt
24. Flatwasher
25. Starwasher
26. Locknut
27. Engine Mount (Front)
28. Engine Tray
29. Bolt
30. Locknut
31. Flatwasher
32. Bolt
33. Engine Mount
34. Bolt
35. Flatwasher Regular
36. Engine Mount
37. Clamp
38. Locknut
39. Bolt
40. Bumper
41. Seal
42. Flatwasher
43. Battery (Wet)
44. Battery Hold Down Angle
45. Battery Hold Down Bolt
46. Locknut
47. Flatwasher
48. Battery Heater
49. Bolt
50. Locknut
51. Flatwasher
52. Flatwasher Hardened
53. Bolt
54. Flatwasher Hardened
55. Gear Pump Assembly
56. O-ring
57. Piston Pump Assembly
58. Bolt
59. Snubbing Flatwasher
60. Bolt (Rear)
61. Bolt (Front)
62. Locknut
63. Flatwasher
64. Engine Mount
65. Flatwasher
66. Bolt
67. Flatwasher
68. Locknut
69. Hose
70. Clamp
71. Oil Drain Valve
72. Fan
73. Lockwasher
74. Bolt
75. Engine GM
76. Oil Filter
77. Control Module
78. Safety Wire
79. Muffler Insulation
80. Insulation Exhaust Elbow
81. Safety Wire
82. Bolt
83. Flatwasher
84. Flatwasher
85. Locknut
86. Locknut
87. Flatwasher
88. Exhaust Strap Bracket
89. Flatwasher
90. Bolt
91. Insulation Exhaust
92. Safety Wire
93. Exhaust Pipe
94. Bolt
95. Clamp
96. Flatwasher
97. Locknut
98. Intake Tube
99. Clamp
100. Fitting
101. Radiator Hose (Bottom)
102. Clamp
103. Radiator
104. Radiator Mounting Plate
105. Seal
106. Hose
107. Clamp
108. Radiator Hose (Top)
109. Clamp
110. Flatwasher
111. Locknut
112. Clamp
113. Clamp
114. Fitting
115. Clamp
116. Fitting
117. Clamp
118. Air Cleaner Assembly
119. Mounting Band
120. Seal
121. Flatwasher
122. Bolt
123. Coolant Overflow Container
124. Locknut
125. Flatwasher
126. Bolt
127. Bracket
128. Hose

Figure 3-83. GM Engine - Sheet 2 of 4

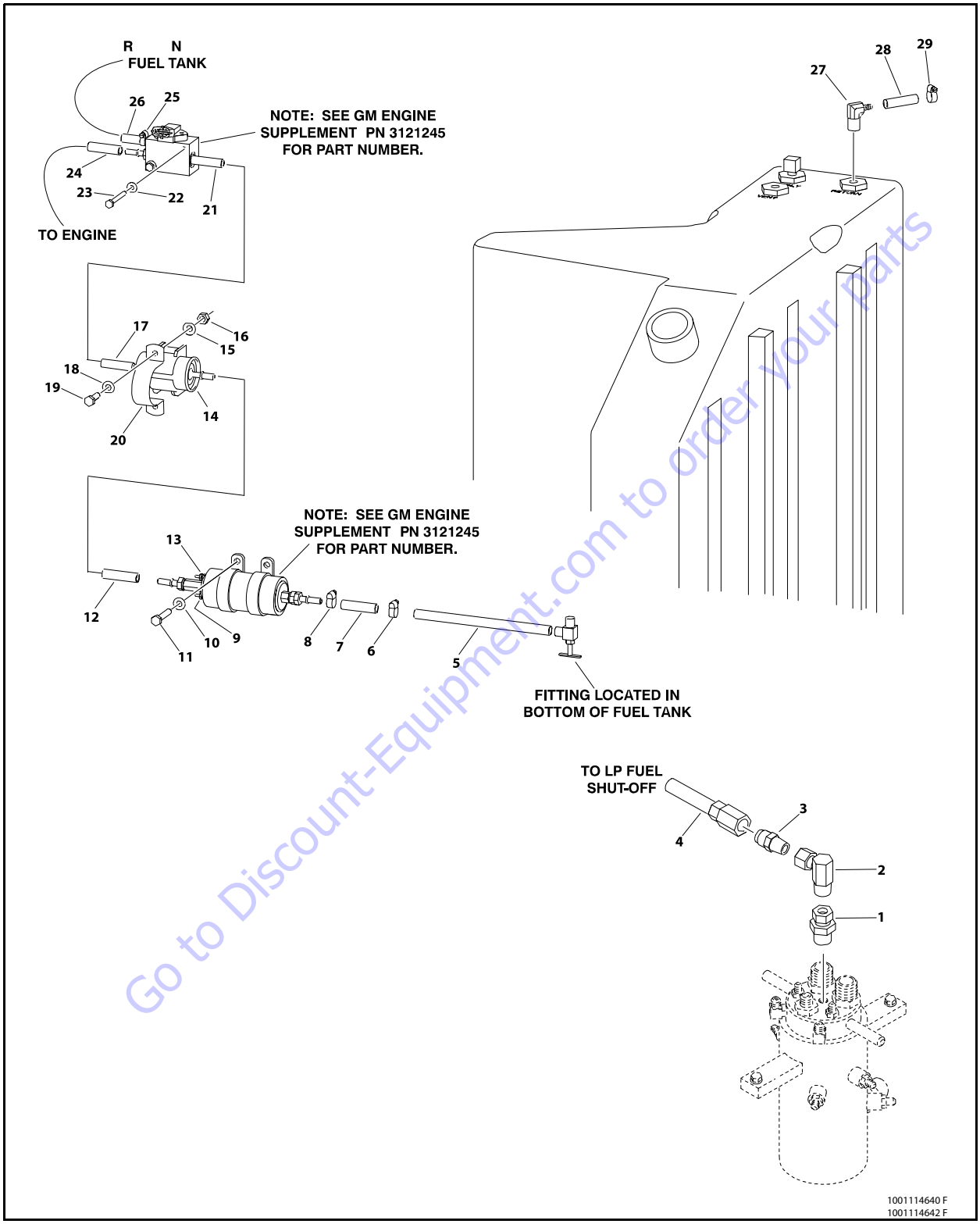


Figure 3-84. GM Engine - Sheet 3 of 4

1. Straight Fitting
2. Adapter Fitting
3. Straight Fitting
4. LP Hose
5. Fuel Line Tube
6. Fuel Line Clamp
7. Fuel Line Hose
8. Fuel Line Clamp
9. Locknut
10. Flatwasher
11. Bolt
12. Hose
13. Locknut
14. Fuel Filter
15. Flatwasher
16. Locknut
17. High Pressure Fuel Line Hose
18. Flatwasher
19. Bolt
20. Clamp
21. High Pressure Fuel Line Hose
22. Flatwasher
23. Bolt
24. Hose
25. Fuel Line Clamp
26. Fuel Line Hose
27. 90 Fitting
28. Fuel Line Hose
29. Fuel Line Clamp

Figure 3-85. GM Engine - Sheet 4 of 4

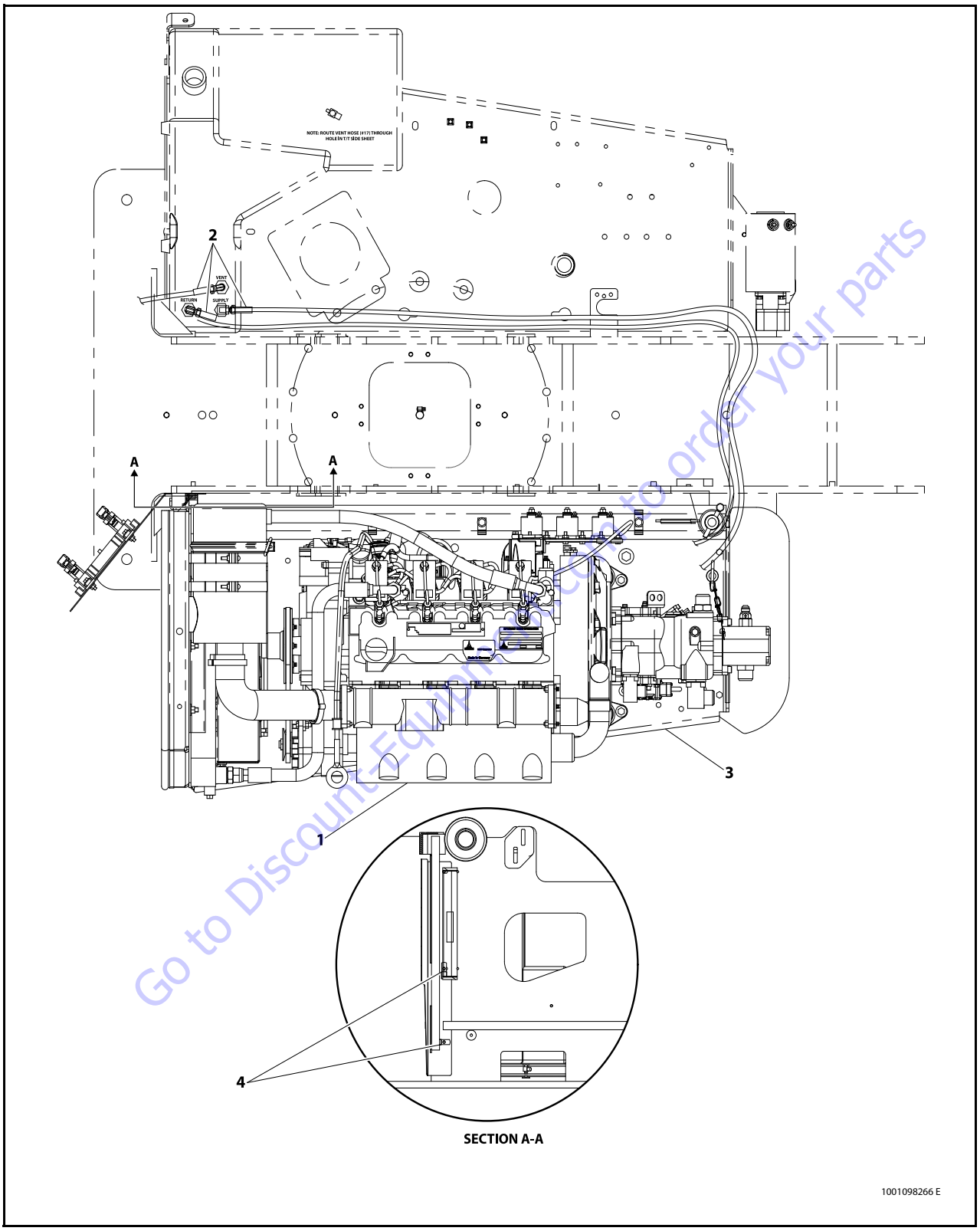
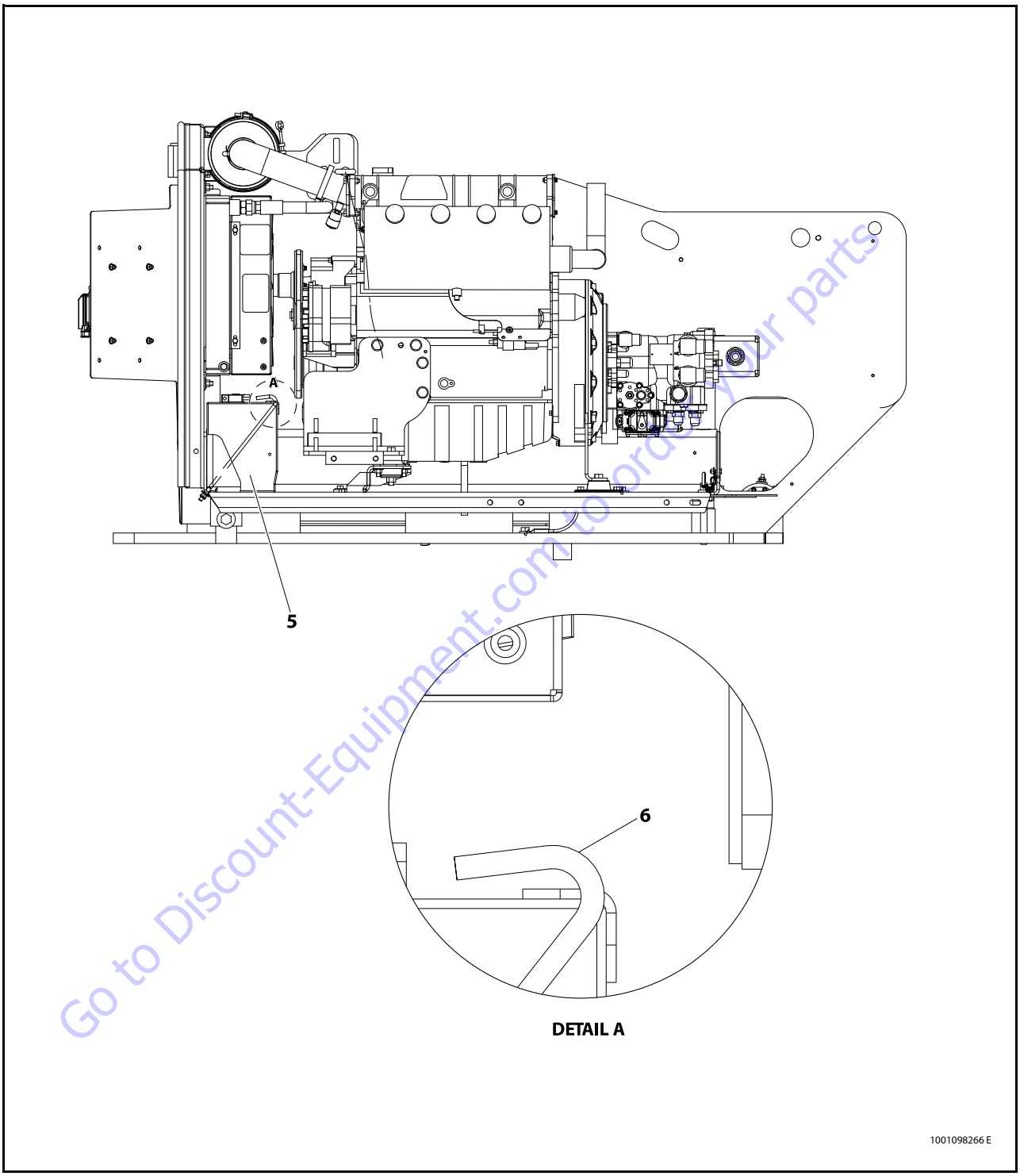


Figure 3-86. Deutz Engine Installation - Sheet 1 of 2



1. Engine
2. Fuel Line
3. Engine Tray
4. P-Clamp
5. Battery
6. J-Bolt

Figure 3-87. Deutz Engine Installation - Sheet 2 of 2

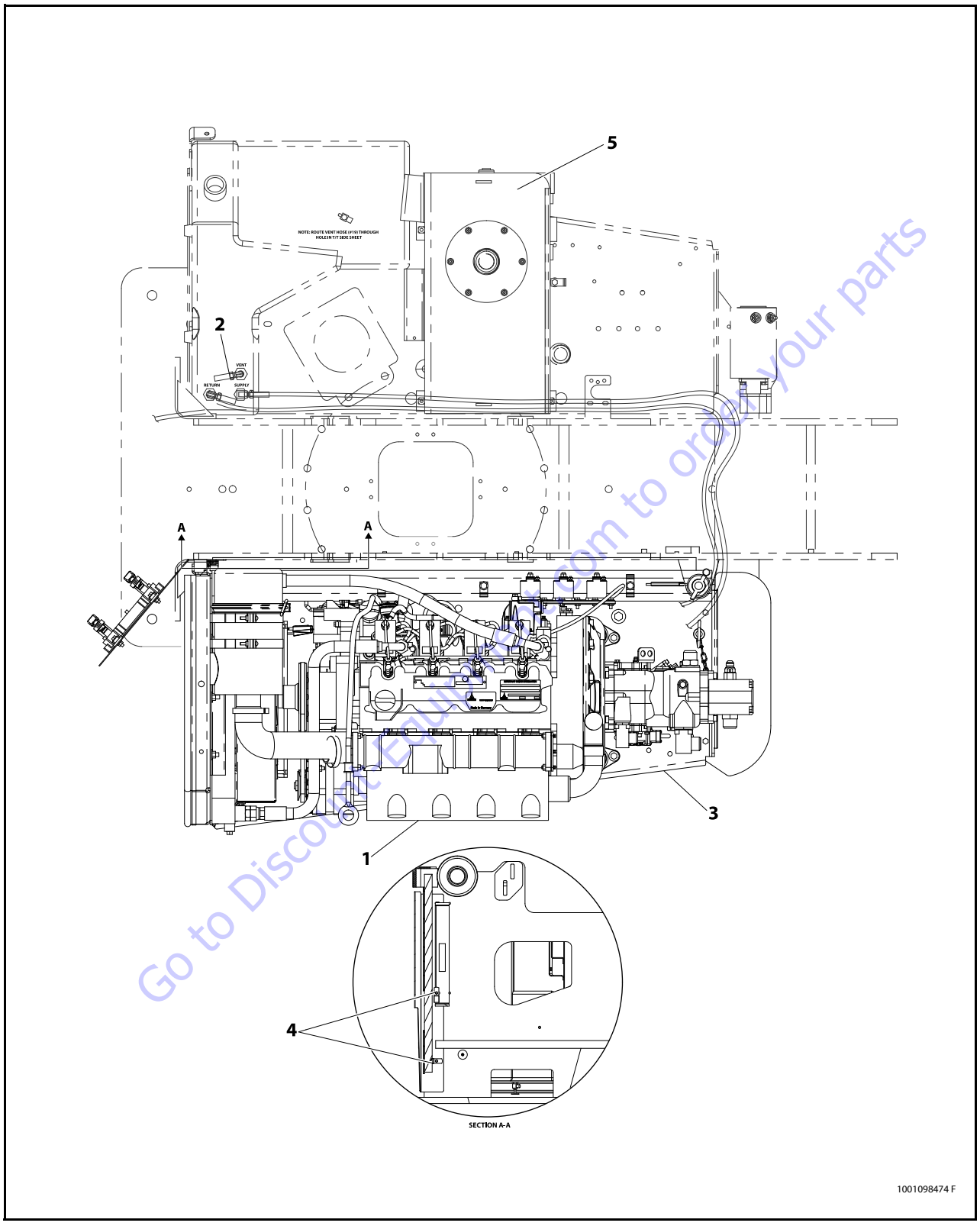
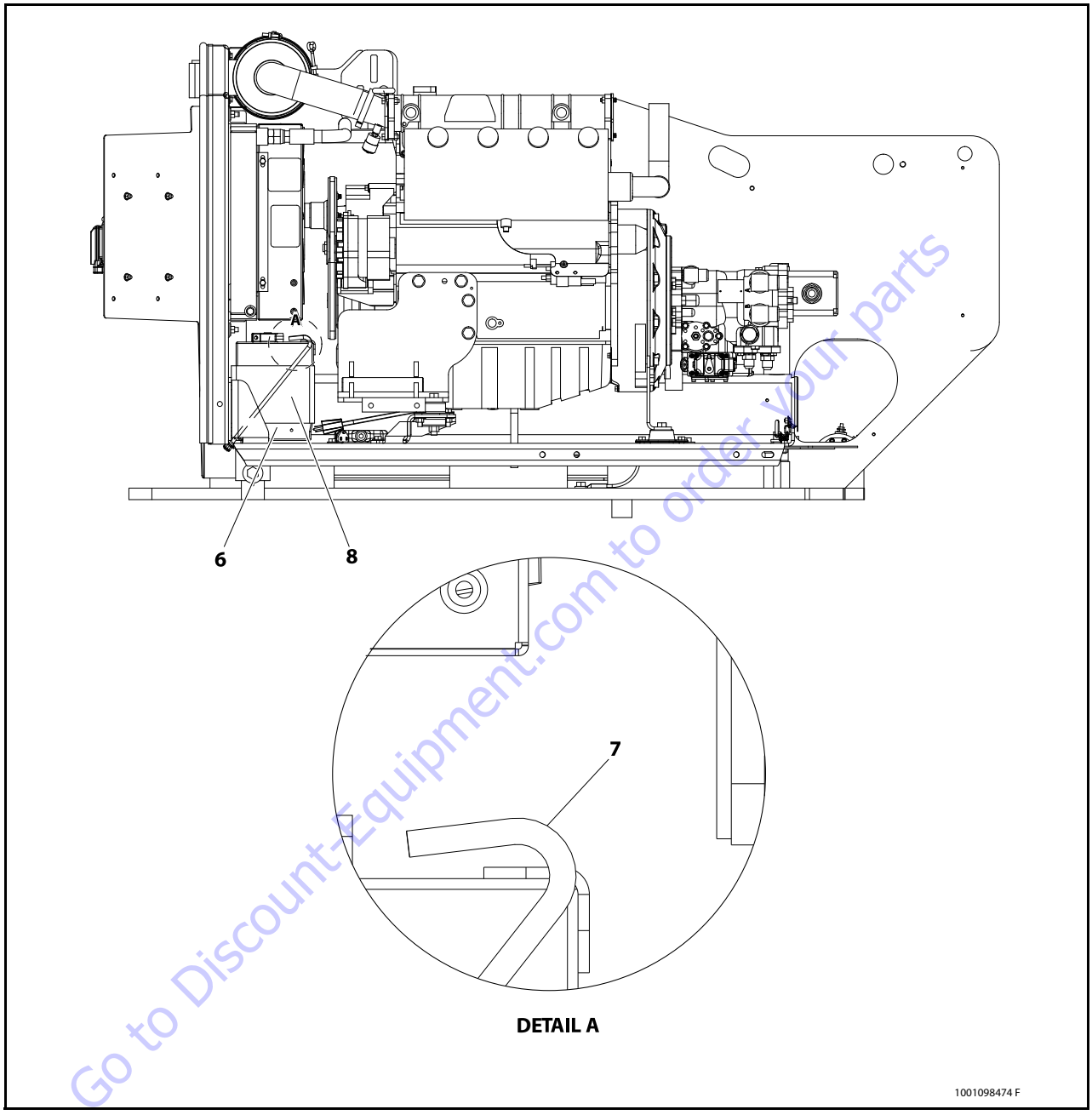
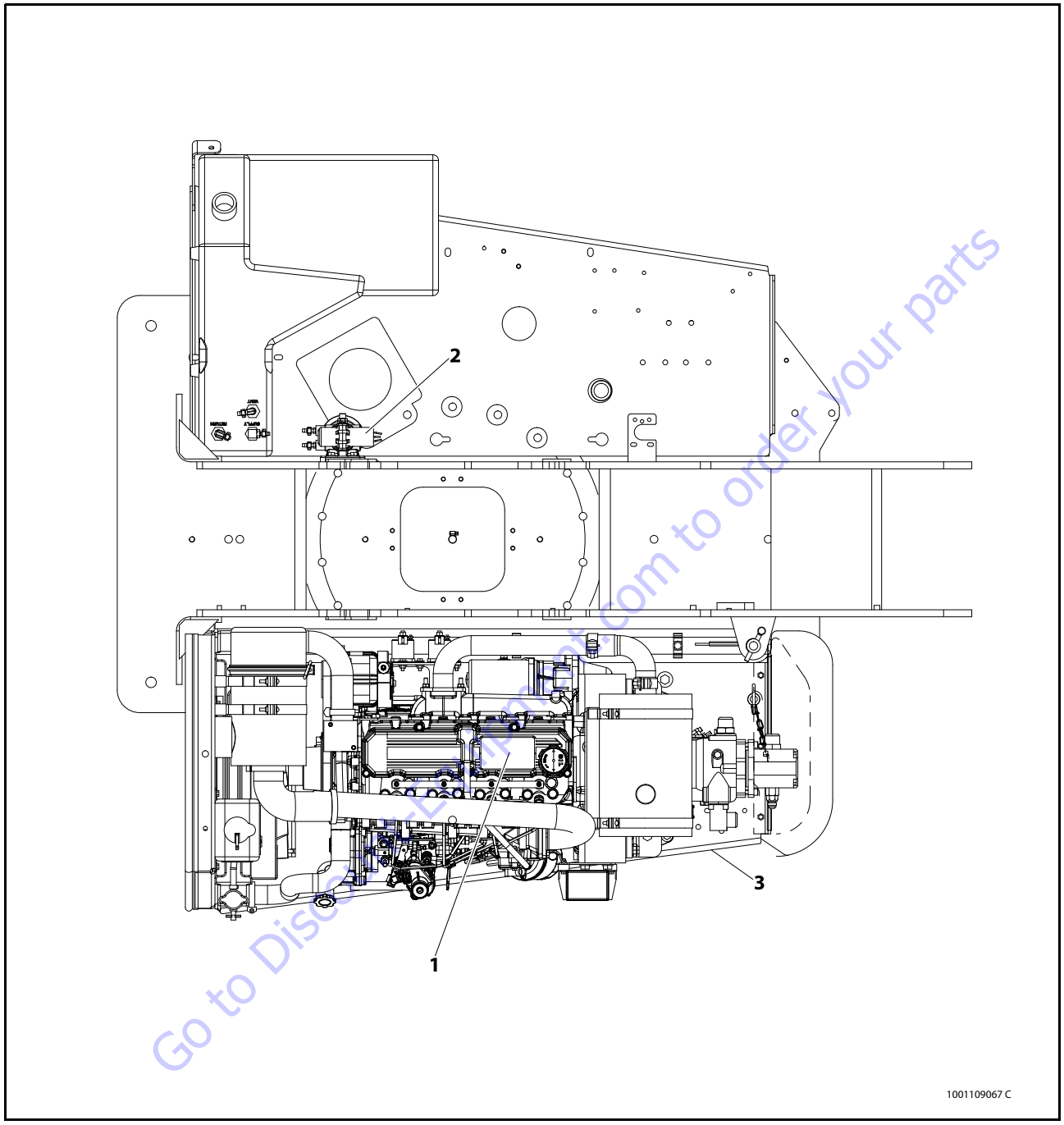


Figure 3-88. Arctic Deutz Engine Installation - Sheet 1 of 2



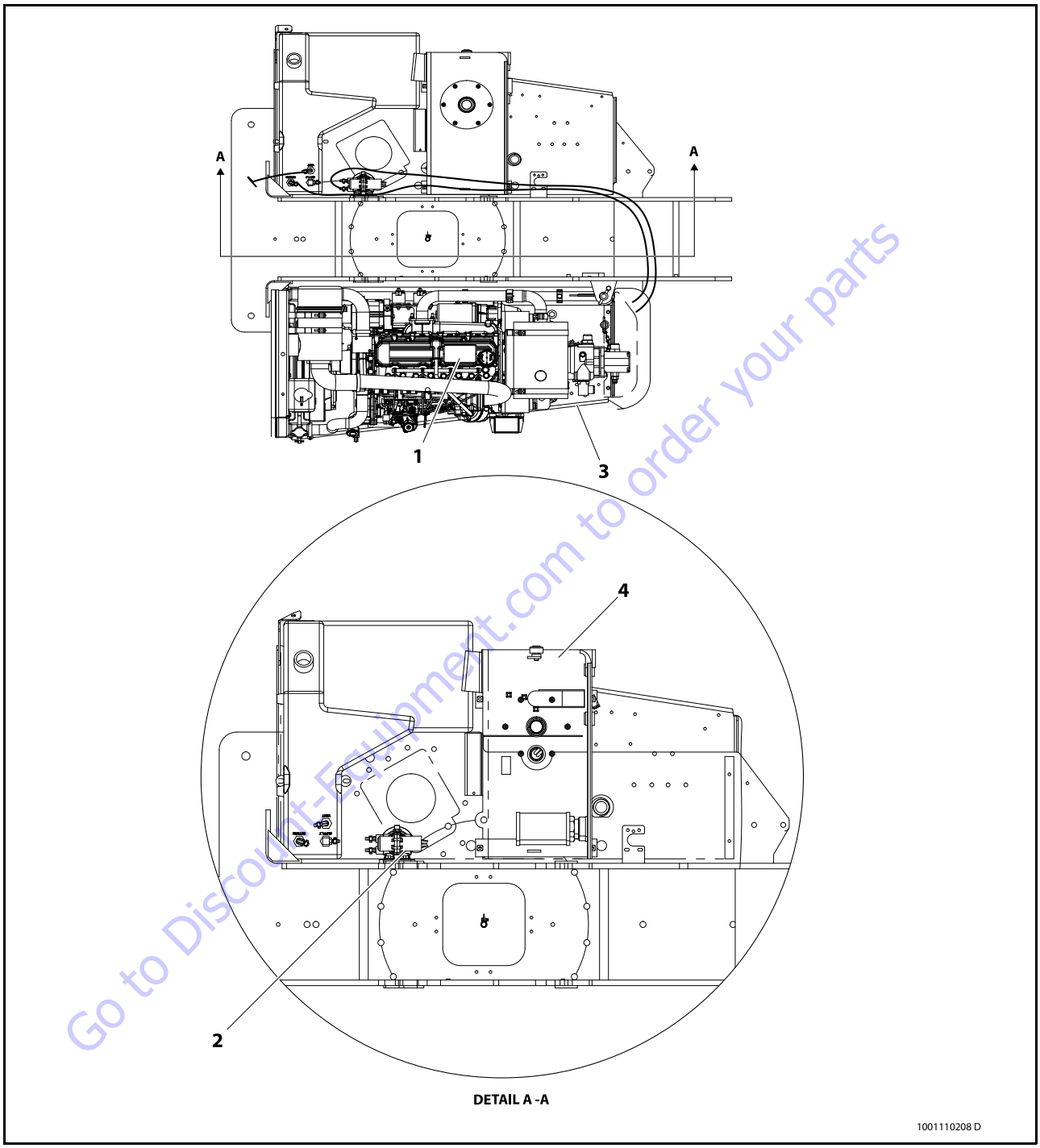
1. Engine
2. Fuel Line
3. Engine Tray
4. P - Clamp
5. Fuel Tank
6. Battery
7. J - Bolt
8. Battery heater

Figure 3-89. Arctic Deutz Engine Installation - Sheet 2 of 2



1. Engine
2. Fuel Pump
3. Engine Tray

Figure 3-90. CAT Engine Installation



1. Engine
2. Fuel Pump
3. Engine Tray
4. Heater

Figure 3-91. Arctic CAT Engine Installation

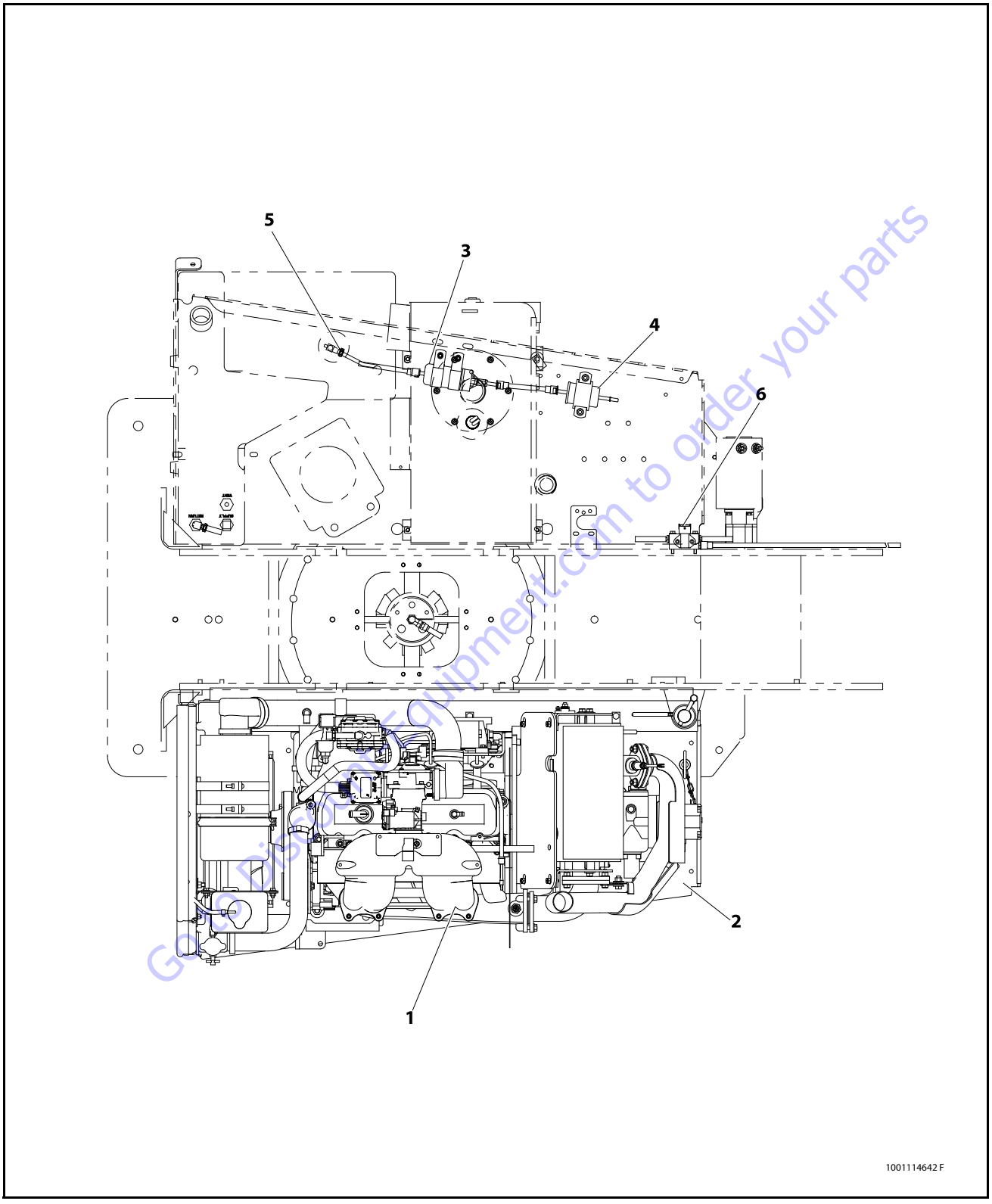
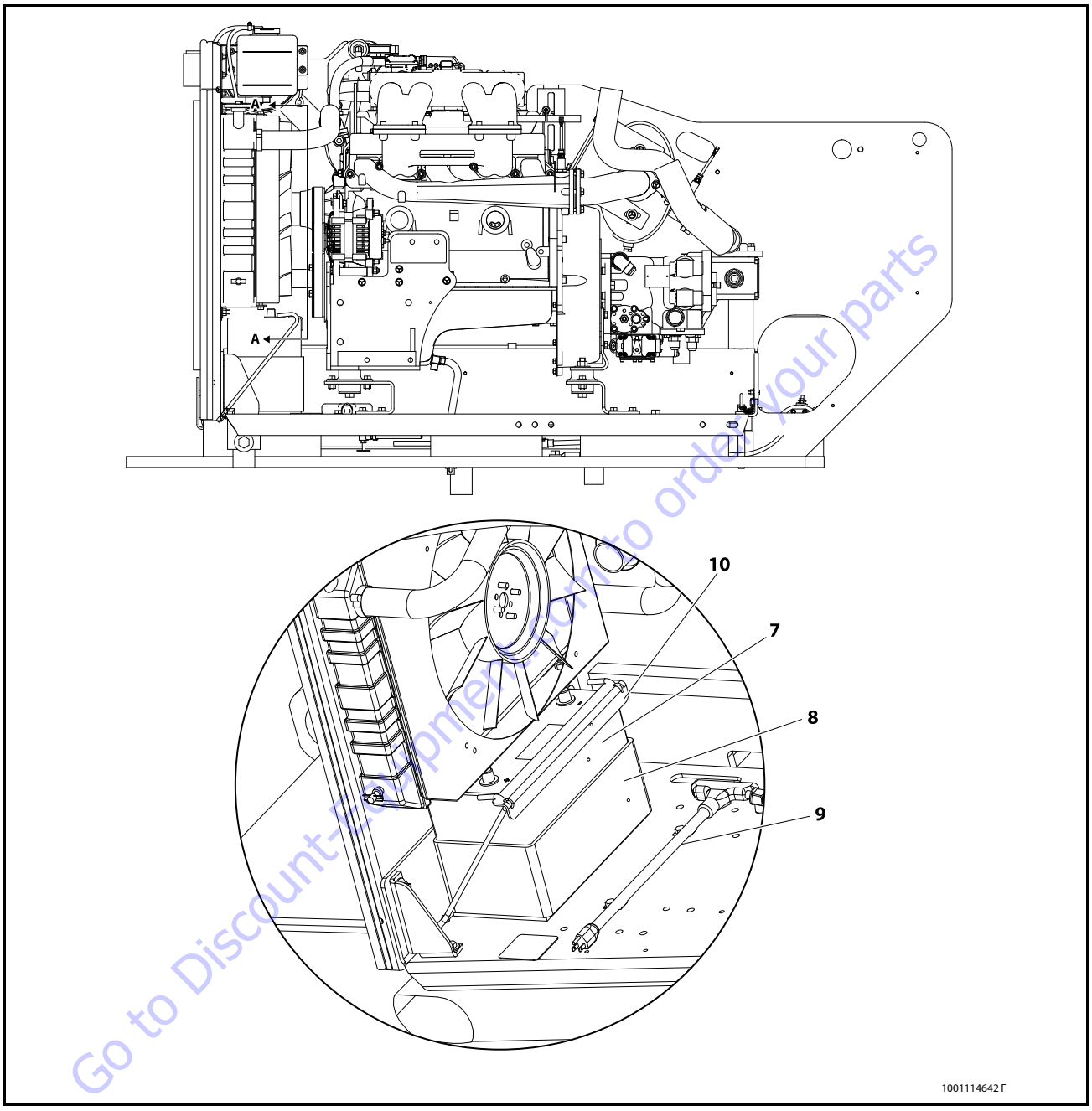


Figure 3-92. Arctic GM Engine Installation - Sheet 1 of 2



1. Engine
2. Engine Tray
3. Fuel Pump
4. Fuel Filter
5. Fuel Line
6. Fuel Regulator Valve
7. Battery
8. Battery Heater
9. Cord 3 Way Extension
10. Battery Bracket

Figure 3-93. Arctic GM Engine Installation - Sheet 2 of 2

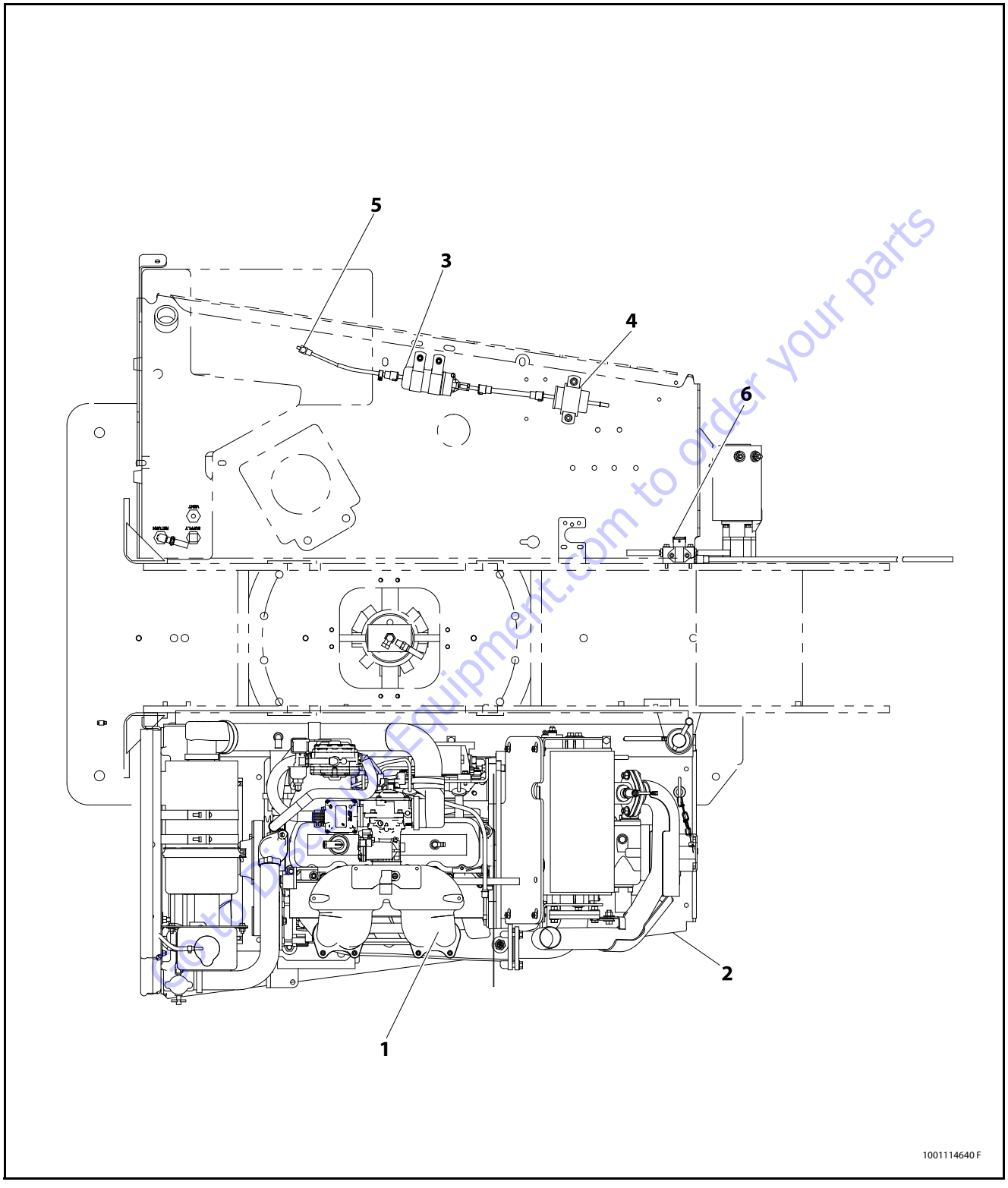
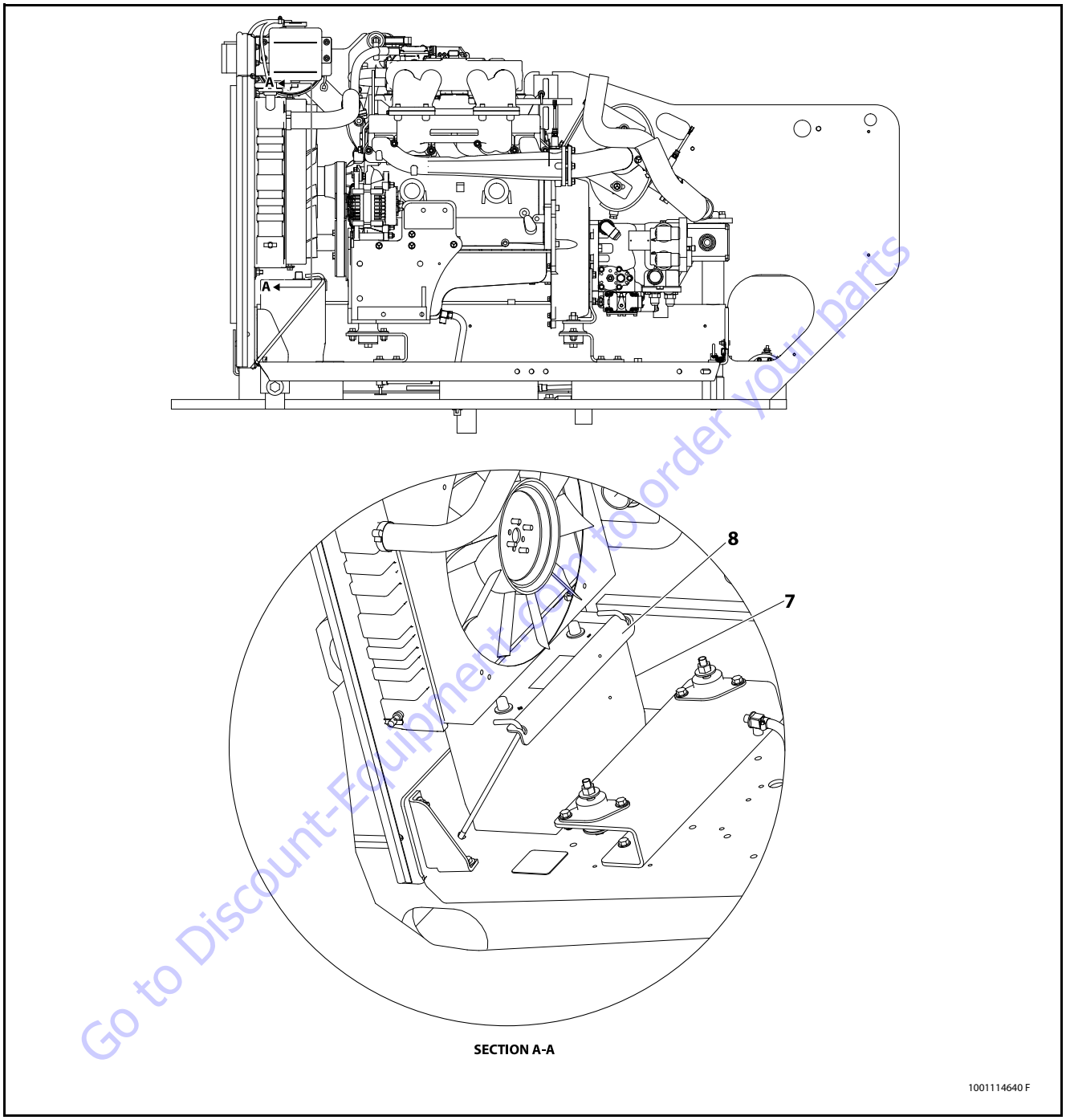


Figure 3-94. GM Engine Installation - Sheet 1 of 2



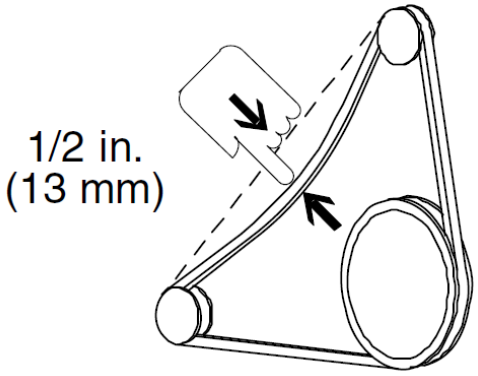
1. Engine
2. Engine Tray
3. Fuel Pump
4. Fuel Filter
5. Fuel Line
6. Fuel Regulator Valve
7. Battery
8. Battery Bracket

Figure 3-95. GM Engine Installation - Sheet 2 of 2

3.21 GENERATOR

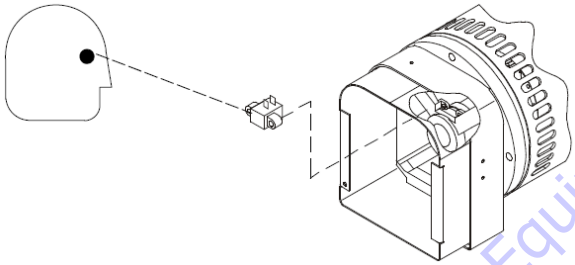
Every 250 hours

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

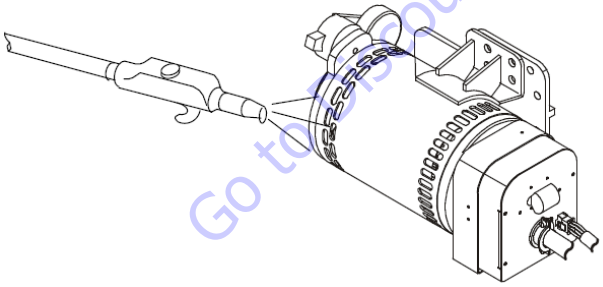


Every 500 hours

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.

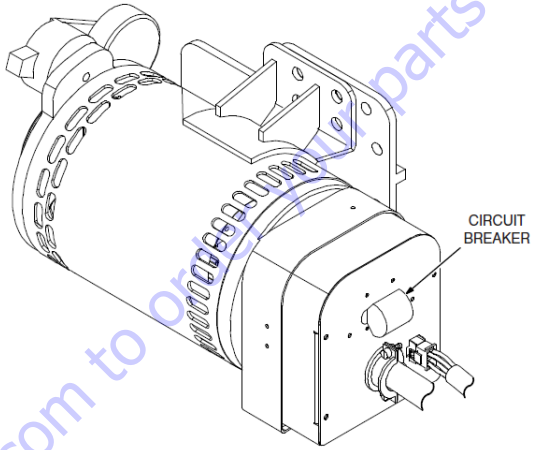


Overload Protection

⚠ CAUTION

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 3-96., 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.

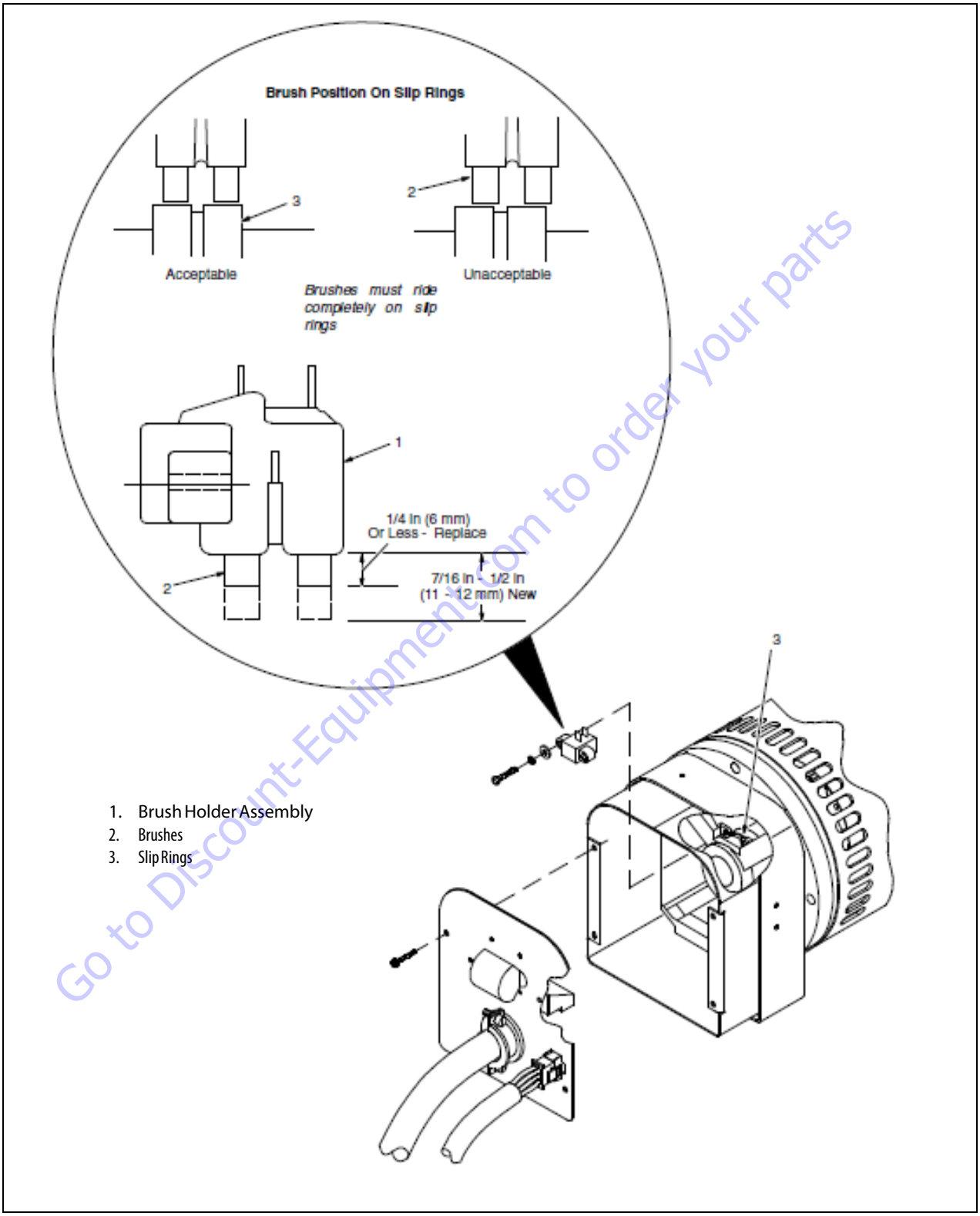


Figure 3-96. Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings

Table 3-14. Troubleshooting

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

3.22 SPARK ARRESTER CLEANING INSTRUCTIONS

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

3.23 DUAL FUEL SYSTEM (GAS ENGINE ONLY)

⚠ CAUTION

IT IS POSSIBLE TO SWITCH FROM ONE FUEL SOURCE TO THE OTHER WITHOUT ALLOWING THE ENGINE TO STOP. EXTREME CARE MUST BE TAKEN AND THE FOLLOWING INSTRUCTIONS MUST BE FOLLOWED.

Changing from Gasoline to LP Gas

1. Start the engine from the ground control station.
2. Open the hand valve on the LP gas supply tank by turning counterclockwise.
3. While engine is operating on GASOLINE under a no load condition, place FUEL SELECT switch at Platform Control to LP position.

Changing from LP Gas to Gasoline

1. With engine operating on LP under a no-load condition, position FUEL SELECT switch at Platform Control Station to GASOLINE position.
2. Close hand valve on LP gas supply tank by turning clockwise.

3.24 FORD EFI ENGINE

Performing Diagnostics

1. Verify the complaint and determine if it is a deviation from normal operation.
2. Once the complaint has been verified, preliminary checks can be done. Conduct a thorough visual inspection, be alert for unusual sounds or odors, and gather diagnostic trouble code information.
3. Perform a system check that will verify the proper operation of the system in question and check for recent information updates.
4. If a diagnostic trouble code (DTC) is stored, contact a JLG distributor to make an effective repair.
5. If no DTC is stored, select the symptom from the symptom tables and follow the diagnostic path or suggestions to complete the repair.
6. After the repair has been made and validated for proper operation, the old part should be momentarily re-installed to verify that it was indeed the source of the problem.
7. If no matching symptom is available, analyze the complaint and develop a plan for diagnostics utilizing the wiring diagrams, technical assistance, and repair history.
8. Intermittent conditions may be resolved by using a check sheet to pinpoint the circuit or electrical system component. Some diagnostic charts contain Diagnostic Aids which give additional information about a system. Be sure to use all of the information that is available to you.

Visual/Physical Engine Inspection Check

Perform a careful visual and physical engine inspection before performing any diagnostic procedure. Perform all necessary repairs before proceeding with additional diagnosis, this can often lead to repairing a problem without performing unnecessary steps. Use the following guidelines when performing a visual/physical inspection check.

- Inspect engine for modifications or aftermarket equipment that can contribute to the symptom; verify that all electrical and mechanical loads or accessory equipment is “OFF” or disconnected before performing diagnosis.
- Inspect engine fluids for correct levels and evidence of leaks.
- Inspect vacuum hoses for damage, leaks, cracks, kinks and improper routing, inspect intake manifold sealing surface for a possible vacuum leak.
- Inspect PCV valve for proper installation and operation.