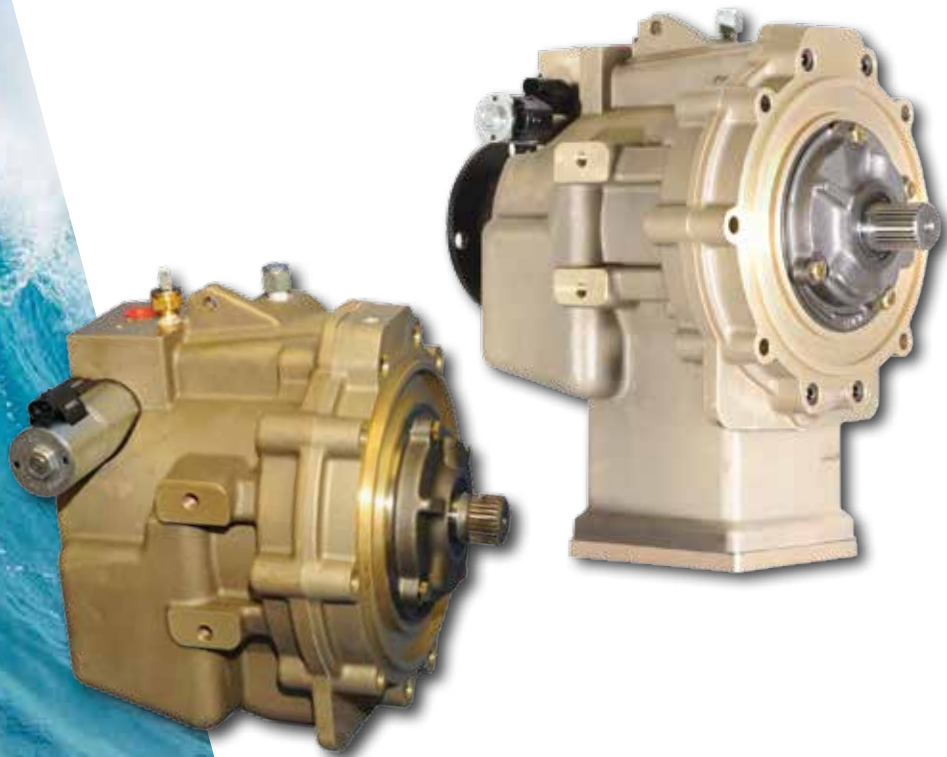


Marine Transmission
Service Manual
71L & 72L Series



A Regal Brand

REGAL

Models Covered In This Manual

Transmission Assembly Number	Family Group	Transmission Ratios		Comments
		Forward	Reverse	
3007000M01	72L	1:1	1.10:1	MANUAL SHIFT
3007000E01	72L	1:1	1.10:1	ELECTRIC SHIFT
3008000M01	72LV	1.50:1	1.65:1	MANUAL SHIFT V-DRIVE (FRONT MOUNT)
3008000M02	72LV	1.25:1	1.37:1	MANUAL SHIFT V-DRIVE (FRONT MOUNT)
3008000M03	72LV	2.00:1	2.20:1	MANUAL SHIFT V-DRIVE (FRONT MOUNT)
3008000MT1	72LVTS	1.50:1	1.65:1	MANUAL SHIFT V-DRIVE (THRU SHAFT)
3008000MT2	72LVTS	1.25:1	1.37:1	MANUAL SHIFT V-DRIVE (THRU SHAFT)
3008000MT3	72LVTS	2.00:1	2.20:1	MANUAL SHIFT V-DRIVE (THRU SHAFT)
3008000E01	72LV	1.50:1	1.65:1	ELECTRIC SHIFT V-DRIVE (FRONT MOUNT)
3008000E02	72LV	1.25:1	1.37:1	ELECTRIC SHIFT V-DRIVE (FRONT MOUNT)
3008000E03	72LV	2.00:1	2.20:1	ELECTRIC SHIFT V-DRIVE (FRONT MOUNT)
3008000ET1	72LVTS	1.50:1	1.65:1	ELECTRIC SHIFT V-DRIVE (THRU SHAFT)
3008000ET2	72LVTS	1.25:1	1.37:1	ELECTRIC SHIFT V-DRIVE (THRU SHAFT)
3008000ET3	72LVTS	2.00:1	2.20:1	ELECTRIC SHIFT V-DRIVE (THRU SHAFT)
3009000M01	72LHP	1:1	1.10:1	MANUAL SHIFT
3009000M06	72LHP	1:1	1.10:1	MANUAL SHIFT MERC 6 CLOSE COUPLE
3009000E01	72LHP	1:1	1.10:1	ELECTRIC SHIFT
3009000E06	72LHP	1:1	1.10:1	ELECTRIC SHIFT MERC 6 CLOSE COUPLE
3010000M01	72LH	1:1	1.10:1	MANUAL SHIFT
3010000M06	72LH	1:1	1.10:1	MANUAL SHIFT MERC 6 CLOSE COUPLE
3010000E01	72LH	1:1	1.10:1	ELECTRIC SHIFT
3010000E06	72LH	1:1	1.10:1	ELECTRIC SHIFT MERC 6 CLOSE COUPLE
3011000M01	72LX	1:1	1.10:1	MANUAL SHIFT
3011000M06	72LX	1:1	1.10:1	MANUAL SHIFT MERC 6 CLOSE COUPLE
3011000E01	72LX	1:1	1.10:1	ELECTRIC SHIFT
3011000E06	72LX	1:1	1.10:1	ELECTRIC SHIFT MERC 6 CLOSE COUPLE
3018000M01	71LV	1.5	1.5	MANUAL SHIFT V-DRIVE (FRONT MOUNT)
3018000M02	71LV	1.25	1.25	MANUAL SHIFT V-DRIVE (FRONT MOUNT)
3018000MT1	71LVTS	1.5	1.5	MANUAL SHIFT V-DRIVE (THRU SHAFT)
3018000MT2	71LVTS	1.25	1.25	MANUAL SHIFT V-DRIVE (THRU SHAFT)
3018000E01	71LV	1.5	1.5	ELECTRIC SHIFT V-DRIVE (FRONT MOUNT)
3018000E02	71LV	1.25	1.25	ELECTRIC SHIFT V-DRIVE (FRONT MOUNT)
3018000ET1	71LVTS	1.5	1.5	ELECTRIC SHIFT V-DRIVE (THRU SHAFT)
3018000ET2	71LVTS	1.25	1.25	ELECTRIC SHIFT V-DRIVE (THRU SHAFT)
3019000M01	71LV	1:1	1:1	MANUAL SHIFT
3019000E01	71LV	1:1	1:1	ELECTRIC SHIFT

Table of Contents

SEGMENT A: 71L & 72L / 71LV & 72LV

Section	Page
I Description	
Introduction	5
Theory of Operation	5
II Inspection	
General	8
Scheduled Inspection	8
III Maintenance	
General	9
Lubrication	9
IV Troubleshooting	
General	11
Guidelines	11
V Overhaul	
General	14
Disassembly	14
Cleaning	14
Inspection	14
Repair	14
Assembly	15
VI Installation	25
VII Specification	34
VIII Propeller Shaft Alignment & Five Inch Flange Specifications	36

SEGMENT B: V-DRIVES

Section	Page
I General	39
II Repair Kits	43

SEGMENT C: 72LH & 72LHP

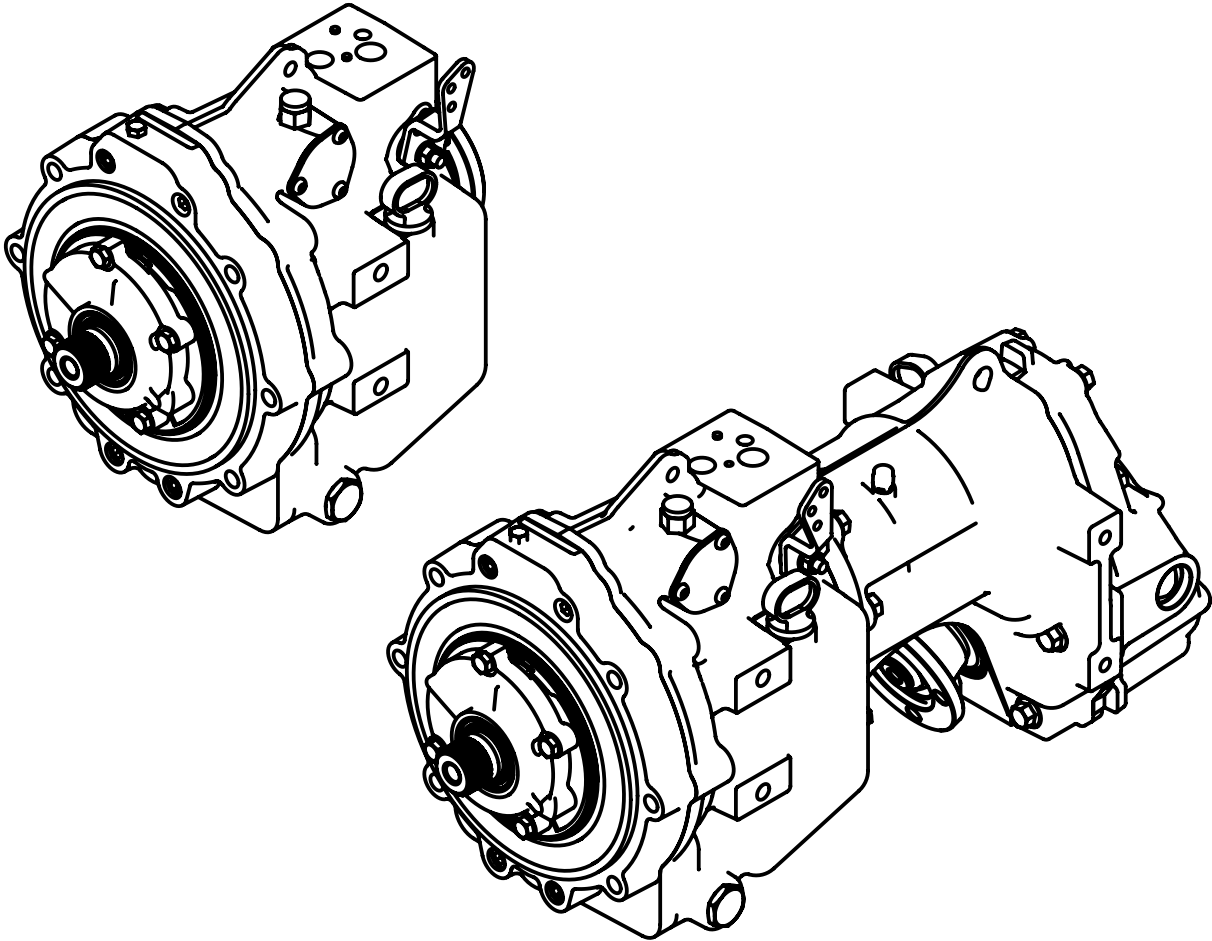
Section	Page
I Overhaul	45
Assembly	46
II Installation	55
III Specification	56
IV Propeller Shaft Alignment Rebuild Kits	36 61

Table of Contents

Title	Page
List of Tables	
1 Technical Specifications Models 3007, 3008, 3011, 3018 & 3019.....	34
Technical Specifications Models 3009 & 3010.....	56
2 Scheduled Inspections	8
3 Troubleshooting	11
4 Bolt and Fastener Torques (Non-Lubricated).....	34 & 56
5 Test Pressures Models 3007, 3008, 3011, 3018 & 3019	34
Test Pressures Models 3009 & 3010	56

SEGMENT A

71L & 72L / 71LV & 72LV



The following international symbols are used in this service manual.

⚠ WARNING This symbol warns of possible personal injury

⚠ CAUTION This symbol warns of possible damage to transmissions.

OEM Original Equipment Manufacturer (Boat/Engine Manufacturer)

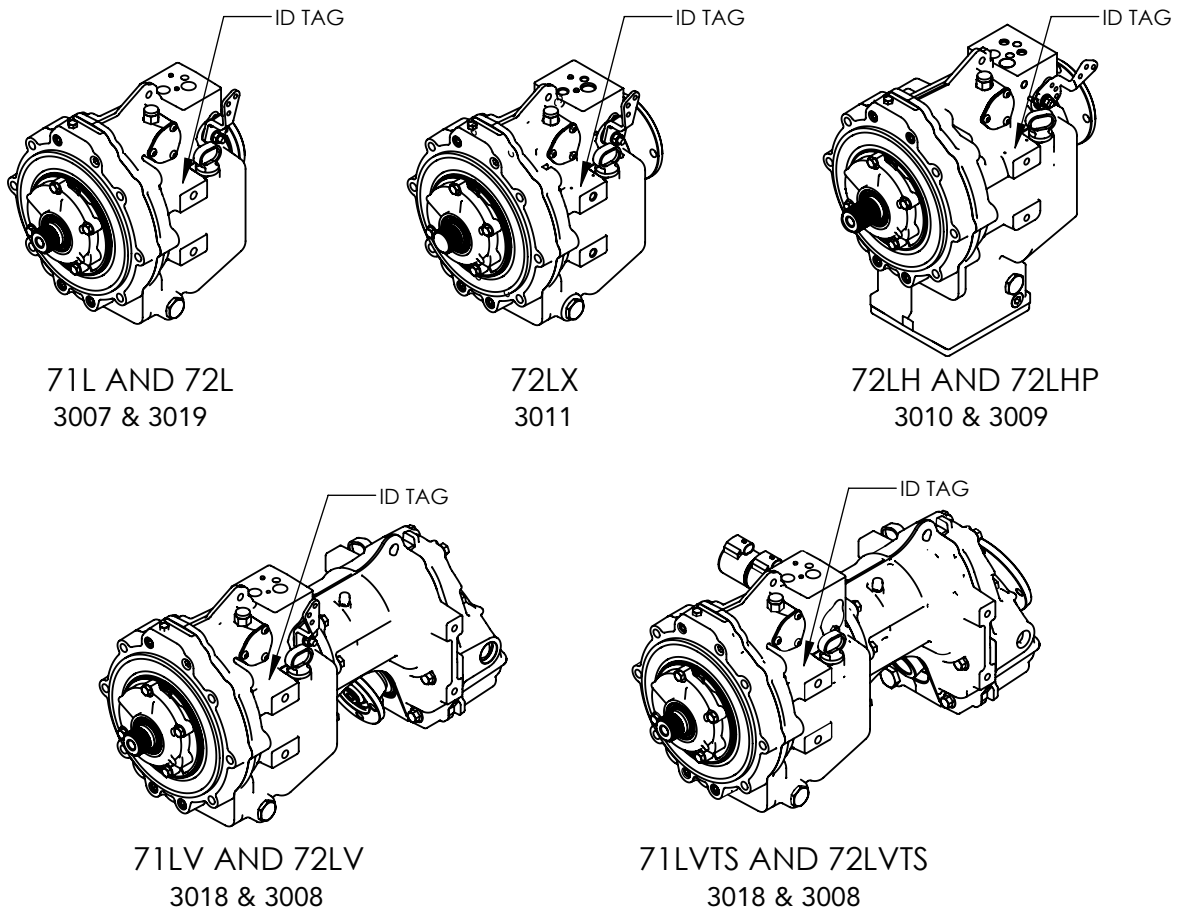


Figure 1. 71L & 72L Transmission Assembly

INTRODUCTION (see figure 1)

The 71L and 72L transmissions consist of a planetary gear set and multiple disc clutches. The input and output shafts are in line.

Hydraulic pressure is provided by a crescent type pump. The pump is driven at engine speed by the input shaft. Oil from the pump is sent to the control valve. The positions on the control valve are forward-neutral-

reverse. An internal regulator valve controls system pressure. Oil discharged by the regulator valve is sent to the oil cooler.

THEORY OF OPERATION

General: Forward is direct drive. A planetary gear set (1.1 to 1.0 ratio for 72L and 1.0 to 1.0 ratio for 71L) is used to obtain reverse.

Table 1. Technical Specifications

Description	Model 71L	Model 72L	Model 71LV & 71LVTS	Model 72L & 72LVTS	Model 72LX	Model 72LH	Model 72LHP
Speeds	Fwd. and Rev.	Fwd. and Rev.	Fwd. and Rev.	Fwd. and Rev.	Fwd. and Rev.	Fwd. and Rev.	Fwd. and Rev.
Approx. Wt.	67	71	113	117	71	85	87

The transmission oil pump is driven by the input shaft. It supplies oil pressure to operate the clutch packs, lubricate parts, and provide cooling.

A damper plate is bolted to the engine flywheel. The damper plate is splined to connect to the input shaft. The damper plate reduces torsional vibrations to the transmission from the engine (see figure 2).

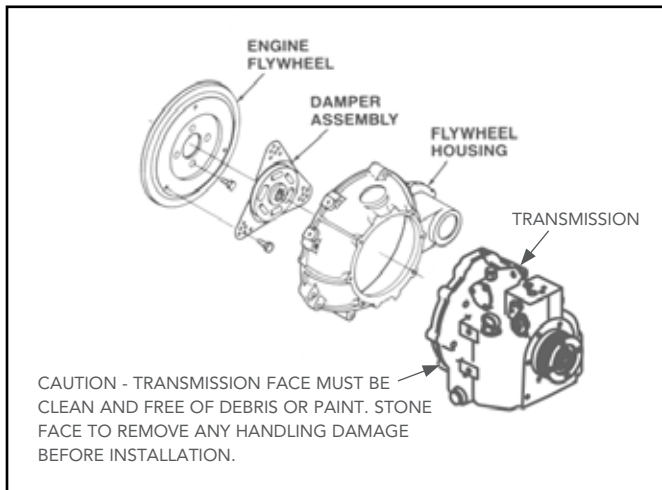


Figure 2. Typical Assembly

Forward: The forward clutch is applied hydraulically when the shift lever is placed in the forward position. This connects the input shaft to the output shaft. The unit then transmits power at a 1 to 1 speed ratio in the same direction of rotation as the engine (see figure 3).

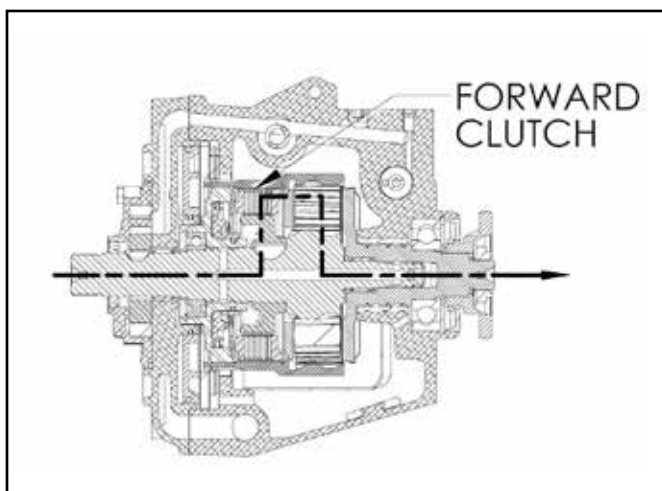


Figure 3. Forward Power Flow

Reverse: The reverse clutch is applied hydraulically when the shift level is placed in the reverse position (see figure 4). The applied clutch holds the ring gear. The input shaft and sun gear, driven by the engine, drive pinions, which drive the carrier output shaft. The output shaft turns opposite to engine rotation at a 1.1 to 1 speed reduction ratio for model 72L and 1 to 1 speed ratio for model 71L.

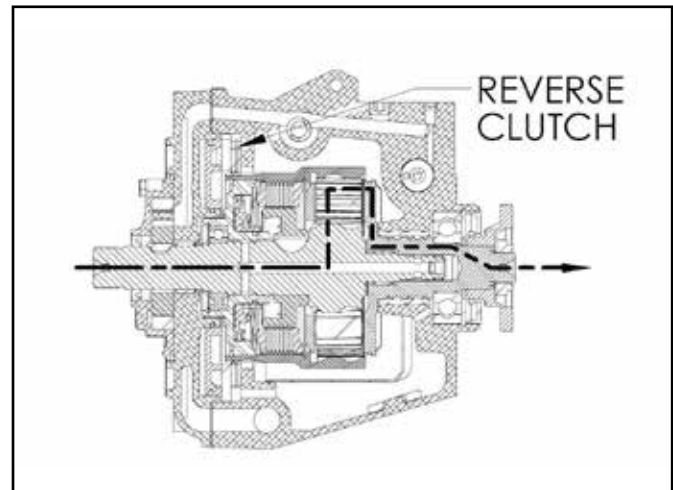


Figure 4. Reverse Power Flow

Hydraulic Circuit: Oil from the sump enters the pump suction passage and is directed to the pump (see figure 5). The pump supplies oil under pressure through passages to the control and regulator valves.

Oil pressure on the end of the regulator valve moves the valve, compressing the spring. This movement allows oil to flow to the cooler.

Selector Valve: The selector valve shifts the transmission from neutral to forward or reverse. When selector valve is placed in the forward position, oil is directed to the forward clutch. When the selector valve is placed in reverse position, oil is fed to the reverse clutch. When one clutch is engaged the other is exhausted by a slot in the selector valve. Electric shift versions forward and reverse are controlled by an electric solenoid.

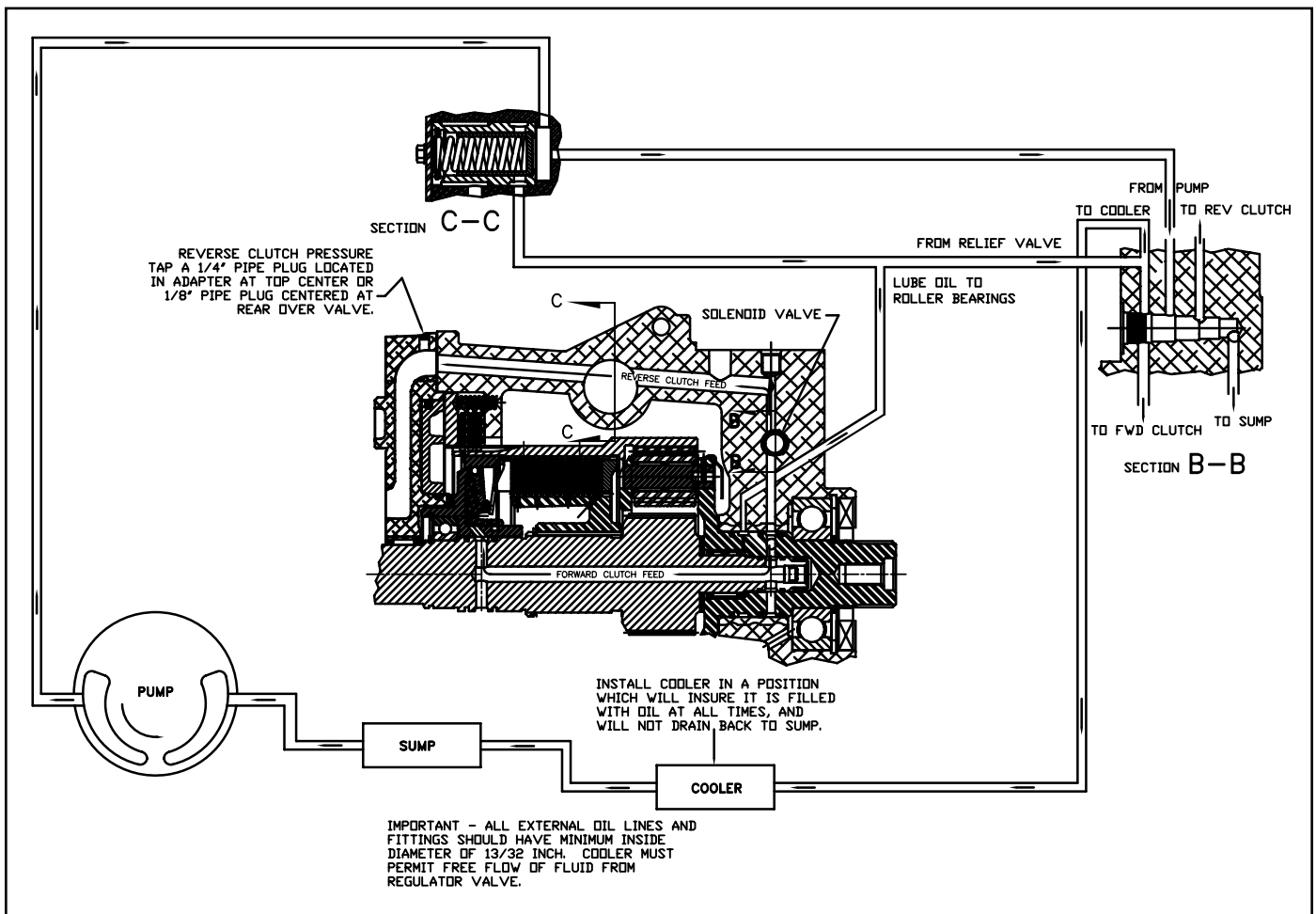


Figure 5. Hydraulic Circuit Schematic
Model 71L & 72L (Electric Shift Shown)





GENERAL

The transmission, cooler, cooler lines, and control linkage should be inspected at regular intervals. Regular inspections will ensure proper operation and help detect minor problems that can be corrected before they cause a transmission failure.

SCHEDULED INSPECTIONS (see table 2)

The following recommended inspection intervals are based on normal operating conditions. Intervals should be adjusted for extremes of temperature or other adverse operating conditions.

Table 2. Scheduled Inspections

Inspection Task	Inspection Interval		
	Weekly	Periodic (1 month or 100 hours, whichever comes first)	Safety (annual or 1000 hours, whichever comes first)
<p>GENERAL</p> <p> WARNING: Failure to perform these inspections at required intervals can result in injury to personnel.</p> <p>Inspect control linkage and shift lever for operation. There should be no sticking, binding, or looseness.</p>		X	X
<p>OIL COOLER AND LINKS</p> <p> CAUTION: Failure to perform these inspections at required intervals can result in transmission failure.</p> <p>Inspect cooler for signs of leakage, damage, or loose mounting bolts.</p> <p>Inspect all connection points for signs of leakage.</p>		X X	X X
<p>TRANSMISSION</p> <p>Inspect for damage or signs of leakage around housing and/or bolts.</p> <p> CAUTION: If oil is discolored or has been overheated (above 190°F) it must be replaced.</p> <p>Remove dipstick. Check oil for signs of water or other contaminants. Check (smell) oil for signs of burnt oil (overheating). If found, replace fluid. See Maintenance.</p> <p> CAUTION: Check mounting bolts for tightness. If loose, tighten to torque specified in OEM manual.</p>	X	X	X

GENERAL

Maintenance to the transmission will normally consist of the following items.

- Checking oil level or changing oil. Regular scheduled oil changes are an important part of the transmission.

⚠ WARNING **WARNING: Manual Shift Only. Shift linkage must be adjusted for proper operation of transmission.**

When properly adjusted detent ball must be seated into shift handle holes.

- Checking pressure in each circuit (if a problem is detected).

⚠ CAUTION **CAUTION: Transmission mounting bolts should be checked and tightened to torque specified in OEM manual. Do not overtighten! Damage to the transmission can result.**

LUBRICATION

Due to the various installation angles and oil cooler set-ups, it may be necessary to adjust your oil level.

⚠ WARNING **WARNING: Do not remove dipstick with engine running. Hot oil can cause burns.**

⚠ CAUTION **CAUTION: Clean around the area of the dipstick before removing. Small particles of dirt can cause damage to internal components and cause valves to stick.**

Check Oil Level

The transmission should be at operating temperature (180° max.) to get an accurate oil level reading. Oil will expand when it is heated. Oil will drain back from the cooler. Expansion and drainback can significantly affect oil level.

Warm Oil Level Check

When the transmission is at operating temperature, place selector lever in neutral. Shut off engine. Carefully remove transmission dipstick. Immediately insert clean dipstick (Do not screw into housing to check level) and read oil level.

NOTE: Oil level must be checked immediately after engine shut-down to prevent an incorrect reading. Oil drains back into transmission from the cooler and cooler lines.

Add or remove oil if necessary. Repeat the above checking procedure as required until oil is at the dipstick mark.

Cold Oil Level Check

For ease of checking the oil prior to engine start-up, a cold oil level mark can be made. To find the cold oil level mark, the oil level must first be set according to the warm oil level checking procedure. Then, let the boat sit overnight. Insert clean dipstick and read oil level.

Put a mark on the dipstick at the cold oil level reading.

You can use the new mark to check the oil level when cold. If oil level adjustment is needed, add oil to the new mark.

Approved Transmission Fluid

General Motors Dexron III fluids are recommended, but any of the following automatic transmission fluids are suitable for use in the 71L-72L transmissions. Approved Specifications are:

1. General Motors Dexron III or Dexron VI
2. Ford Mercon

Do not mix different brands or types of transmission fluid.

⚠ CAUTION **CAUTION: If the transmission oil temperature has exceeded 190° F or the alarm sounds, the oil must be changed in the transmission and cooler system.**

Changing Oil

Oil in transmission, cooler, and cooler lines should be changed every 500 hours of operation or annually.

⚠ CAUTION **CAUTION: Severe service conditions or high operating temperatures may require more frequent changes.**

- Place selector lever in neutral. Run engine for five minutes at 1500 RPM. Shut down engine.

CAUTION CAUTION: Clean around the area of drain plug before removing. Small particles of dirt can cause damage to internal components and cause valves to stick.

- Drain oil from transmission, cooler and cooler lines into suitable container.

- Check oil for signs of metal or rubber particles

CAUTION CAUTION: A few small metal particles are normal. However, if large metal chips or a large number of particles are found, this could be an early sign of transmission failure. The transmission should be disassembled and inspected for internal damage.

NOTE: Particles of rubber can indicate cooler line wear. Each line should be inspected for cracks or fraying and should be replaced if damaged.

- Fill transmission with new oil.

NOTE: The amount of oil required will vary based on length of cooler lines. Use an amount equal to about three-fourths of the quantity removed.

- Screw in and tighten dipstick. Run engine for two minutes to fill cooler and cooler lines with oil. Set oil level according to procedure at start of section 3, Page 9, Lubrication.

GENERAL

Before troubleshooting the transmission, do the following.

- Check oil level and condition of oil. See maintenance section for details.
- Check transmission, oil cooler and oil cooler lines for physical damage or leakage. Correct any problem.
- Check that engine, damper plate, or drive train alignment are not causing the problem.

Refer to shaft alignment section on Page 78 of this manual.

Perform all pressure checks at normal operating temperature. Refer to specification section for details. Pressure gauges used should have a range of 0-300 psi. They must be accurate.

GUIDELINES

When troubleshooting, shift into each selector position to determine when noise or problem occurs. Determine which parts are moving. This will help pinpoint the cause. Use the following information as a guide to common problems.

Damper Plate. Some transmission problems are damper plate related. Check and/or replace damper plate when the following problem occurs.

- Transmission “knocks” at idle or low RPM, then stops at 1,000 RPM or higher.

If the damper plate springs are too soft, the sides of the windows will wear. If the springs are too hard, the splines will wear. Consult engine OEM for correct damper plate recommended.

Clutches. Check and/or replace clutches if the following problem occurs.

- Excessive engine RPM (over the rated RPM). This can indicate a slipping clutch. The slipping clutch will usually squeal.



WARNING: Do not operate transmission if the following condition is suspected. Failure to comply can result in personal injury because transmission cannot be disengaged.

The slipping clutch will normally overheat. This can result in warped plates. In severe overheating, plates can weld together. This will cause a tie up condition in transmission when the other clutch is applied.

Problem	Cause	Correction
LEAKS		
1. At pump or output shaft seal	Faulty seal	Replace
	Misalignment	Correct
	Rough shaft	Replace
2. Between seal and bore	Rough housing bore	Replace seal
3. At gasket(s)	Loose bolts	Torque bolts properly
	Defective gaskets	Replace gaskets
	Face(s) not flat	Replace defective parts
4. Loss of oil with no trace of missing oil	Oil leaking from cooler or cooler lines	Replace cooler, or cooler lines that are defective
5. Oil out of breather	Oil has been overheated (lost anti-foam additive)	Replace oil
	High or low oil level	Correct oil level
	Water in oil	Change oil
MALFUNCTION IN BOTH FORWARD AND REVERSE		
1. At pump or output shaft seal	Regulator valve jammed	Clean and polish
	Internal leakage	Replace defective sealing rings
	Low oil level	Add oil
	Pump defective	Replace pump
2. No oil pressure	Regulator valve jammed	Clean and polish
	Internal leakage	Replace defective parts
	Pump defective	Replace pump
	No oil	Add oil
	Pump incorrectly indexed	Rotate pump to correct position
3. High oil temperature	Regulator valve jammed	Clean and polish
	Cooler line defective	Replace cooler line
	Oil cooler too small	Install larger cooler
	Restrictions in cooler lines or cooler	Back flush to remove restrictions
	Defective cooler	Replace cooler
	Defective temperature sensor	Replace sensor
4. No power, noise	Broken gear teeth – gears not meshed	Replace defective parts
5. No line pressure	Heavy weight oil (90 weight)	Remove and use proper weight oil
	Pump incorrectly indexed	Rotate pump to correct position
	Oil inlet shield or screen blocked	Inspect and clean
6. Noisy in forward and reverse	Misalignment of damper plate with engine, or misalignment of output shaft components	Align drive train components
	Damaged gears	Replace damaged gears

Problem	Cause	Correction
MALFUNCTION IN FORWARD OR REVERSE		
1. Clutch drags or does not release	Warped clutch plate	Replace defective parts
	Mechanical failure	Replace defective parts
	Tight pack clearance	Increase clearance to specification
2. Clutch does not apply	Low pressure	See low oil pressure
	Defective parts	Replace defective parts
3. Harsh engagement	High pressure - valve sticking	Clean and polish regulator valve
	Engine idle too fast	Adjust engine idle
	Linkage binding or misadjusted	Repair as required and adjust to OEM spec.
4. Soft engagement	Low pressure	See low oil pressure
5. Won't move or sluggish	Forward clutch seized	Replace defective parts
	Worn or broken sealing rings	Replace defective parts
MISCELLANEOUS PROBLEMS		
1. Hydraulic noise or buzz	Low oil level or air in hydraulic circuit	Check oil level and fill if low. Operate engine in neutral at 1200 RPM to remove air.
	Regulator valve sticking	Clean and polish
2. Gear noise in forward	Broken, pitted or cracked gear teeth	Replace defective parts
3. Gear noise in reverse	Broken, pitted or cracked gear teeth	Replace defective parts
MALFUNCTION IN NEUTRAL		
1. Drives in forward direction	Broken sealing rings or bushings	Replace defective parts
	Warped forward clutch plates or mechanical failure of clutch	Replace defective parts
	Exhaust blocked in control valve	Clean control valve
2. Drives in reverse direction	Warped reverse clutch plates or mechanical failure of clutch	Replace defective parts
	Exhaust blocked in control valve	Clean control valve
3. Noisy in neutral only	Low oil pressure. Pump gears worn	Replace pump assembly
	Oil level low	Add oil
4. Transmission overheating	Oil level low. Cooler too small or restricted lines	Add oil. All external oil lines should have minimum inside dia. of 13/32". Cooler must permit free flow of oil.
	Pump pressure low – worn or damaged pump	Check pressures. If low, inspect pump. If worn or damaged, replace.
	Clutches slipping	Check sealing rings. Replace if damaged.
	Internal leakage bypassing cooler	Locate and fix leak
	Temperature sensor defective	Replace sensor
	Incorrect type of oil	Drain, flush and replace with correct type of oil
	Regulator valve sticking	Clean and polish

GENERAL

Before removal and disassembly, review the following procedures. Use the proper hand tools, slings, or hoists for the job.

⚠ WARNING **WARNING:** Keep work area, tools, and transmission clean. Wipe up any spilled transmission fluid to prevent accidents. As required, wear safety glasses, safety shoes and a hard hat to prevent personal injury.

DISASSEMBLY

NOTE: Read OEM vehicle manual for specific removal instructions.

Before starting disassembly, review the exploded view shown in Figure 8. The transmission can be disassembled following the index numbers shown in Figure 8.

Seals. Remove O-rings, sealing rings and oil seals carefully to prevent damage if they must be reused. It is best to replace these items.

Bearings. Do not remove bearings unless replacement is required, or cleaning can not be done properly.

- Keep matched parts or sets together. Do not reverse or mix them.

CLEANING

⚠ WARNING **WARNING:** Cleaning solvents can be toxic, flammable, an irritant to the skin, or give off harmful fumes. Avoid prolonged contact, inhalation of vapors, or smoking. Failure to comply can result in injury or death to persons.

- Rinse all metal parts in solvent to remove dirt, grease and transmission fluid.
- Take special care to remove solvent from all parts.
- Air dry clutch plates.
- If O-rings are to be reused, air dry them.

INSPECTION

Case. Inspect for cracks. Check sealing surfaces for nicks, scratches, or burrs that can cause leaks. Inspect output shaft bore for signs of wear on one side. This can indicate misalignment of prop shaft.

Gears. Inspect for unusual wear patterns, chipped, cracked, or broken teeth.

Bearings. Inspect for chips, cracks, galling, or missing bearings. Check for signs of overheating.

Threaded Parts. Inspect for stripped, damaged threads, or burrs.

Springs. Inspect for distortion, cracks or other damage. Check springs against dimensions in specification section.

REPAIR

- Remove scratches, burrs or minor surface defects with very fine emery cloth.
- Threaded holes can be retapped using the same size tap. Do not make the hole oversized.
- Repair or replace all damaged parts.

Assembly

⚠ CAUTION **CAUTION:** Threaded plugs, screws, bolts and coupling nuts must be tightened to the torques shown in Table 4 to prevent premature failure of transmission.

- A new coupling nut must be used as assembly
- Prior to assembly, dip or coat internal parts with transmission fluid. Let excess fluid drain off.
- Use a light coat of vasoline to position or hold a gasket, O-ring or small part for assembly. Apply to sealing rings before assembly.

- Inspect assemblies pressed together for proper fit and position.
- Check that each snap ring is fully engaged in groove.
- Threaded plugs, screws and bolts should be tightened to the torques shown in Table 4.

NOTE: The following procedures are correct for most transmissions. Minor differences may be found on some models.

- Assemble the transmission using the following procedures. If a reduction unit is mounted to the transmission, refer to the correct section at the back of this manual for assembly procedures.

STEP 1. If removed, install the following parts in case. Tighten threaded parts to torque shown in Table 4.

Press bearing into back of case.

Apply loctite #565, or equivalent, to threads of pipe plugs and thread into side of case.

STEP 2. Install screen in case with slot facing bottom of case.

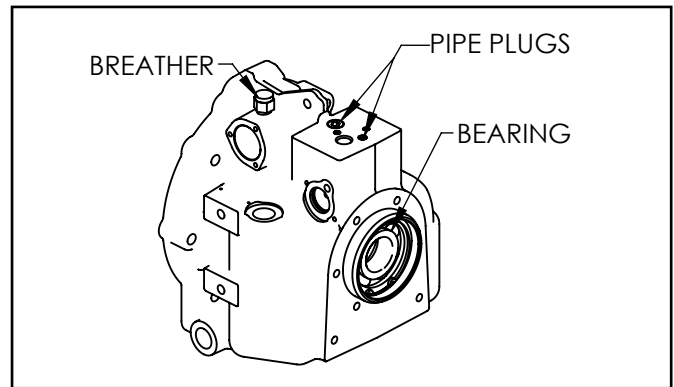
Thread bushing into side of case and tighten to torque shown in Table 4.

STEP 3. Install baffle in case. Place thrustwasher if used on face of housing bore. Notch in thrustwasher must align with notch in case.

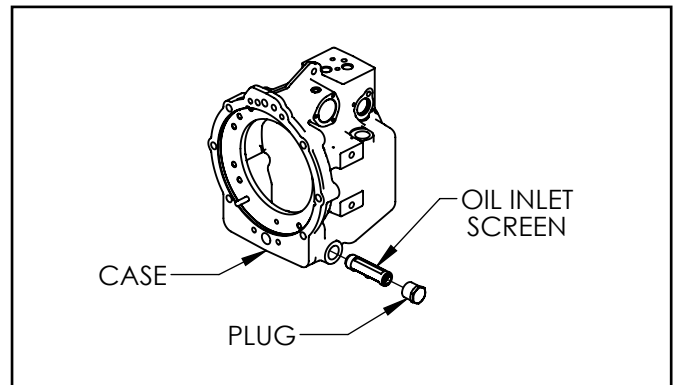
CAUTION CAUTION: Thrustwasher is used on some models. Close couple options only. (See Model Chart 71L and 72L Transmissions.)

STEP 4. Lubricate all sealing rings with vasoline.

If removed, press bearings into pinion carrier. Contact Velvet Drive for proper depth of bearings.



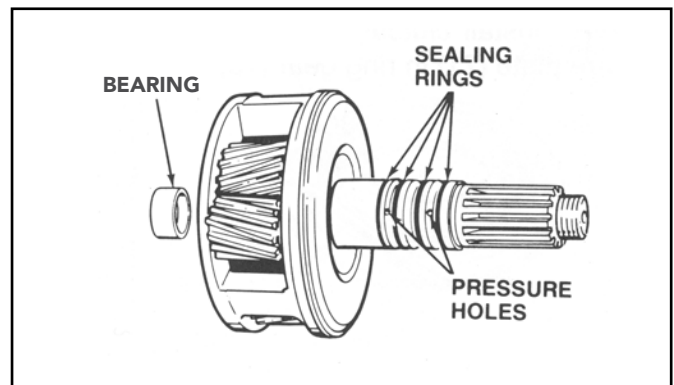
Case Assembly 1



Case Assembly 2

Install sealing rings in grooves of pinion carrier. Compress each sealing ring until it locks in place.

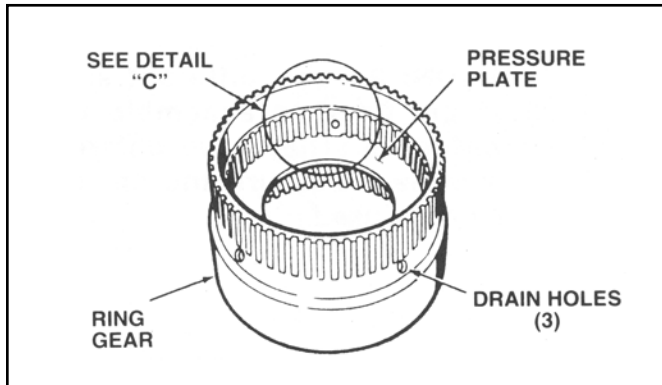
Install pinion carrier in case.



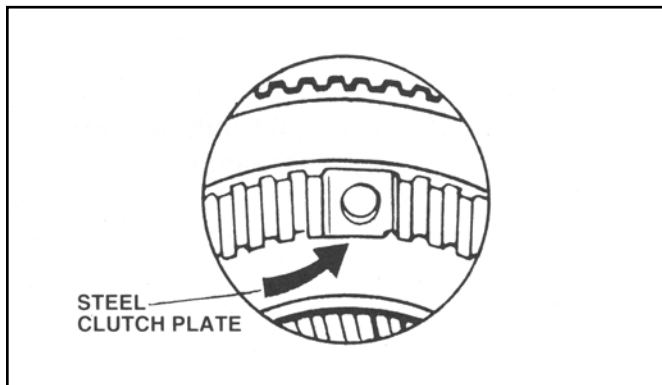
Pinion Carrier Assembly

STEP 5. Starting with a friction clutch plate, alternately stack friction clutch plates and steel clutch plates.

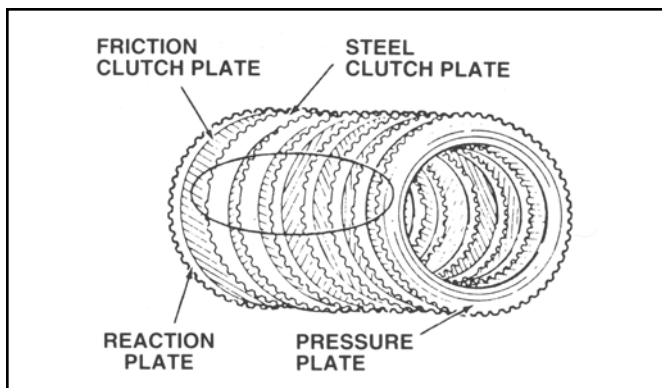
Friction clutch plates are designed with 3 missing teeth 120° apart. When installed in a ring gear, they should be installed with the missing teeth aligned with the 3 large drain holes as shown in detail "C".



Forward Clutch Pack Arrangement: Figure A

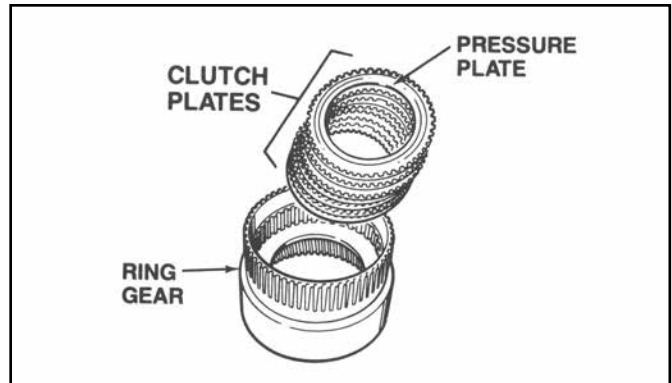


Detail C



Forward Clutch Pack Arrangement: Figure B

STEP 6. Install clutch plates and pressure plate in ring gear.

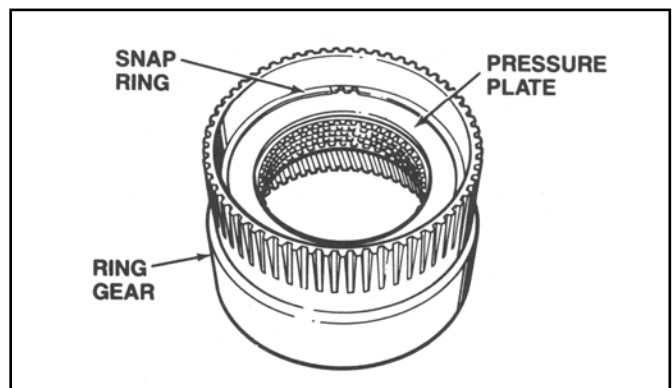


Forward Clutch Pack Assembly

STEP 7. Install spacer ring 4755 in ring gear.

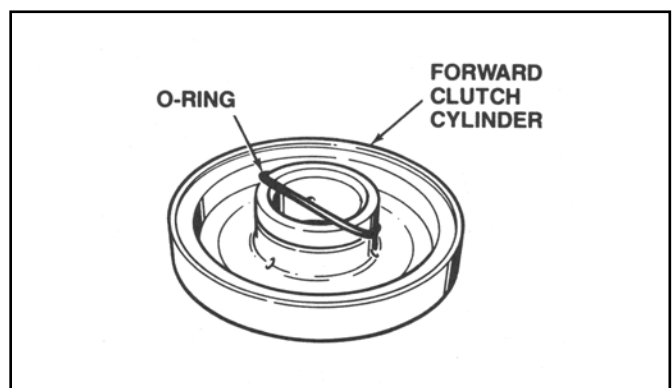


CAUTION: Several different snap rings are used to assemble the clutch group. They have different thickness. Be sure the correct snap ring is used.



Snap Ring Installation

STEP 8. Lubricate O-ring lightly with vasoline and install in groove of forward clutch cylinder.



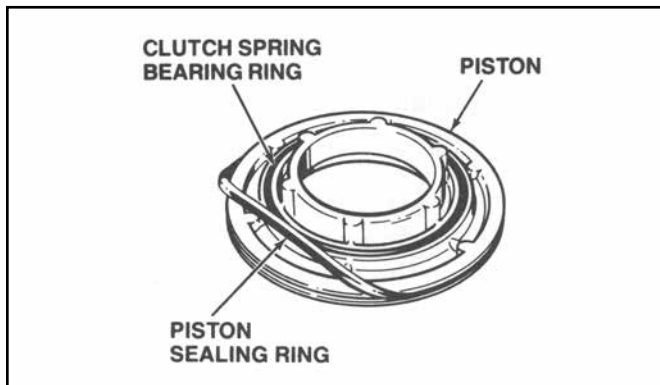
O-Ring Installation

STEP 9. Lubricate clutch spring bearing ring and piston sealing ring with vasoline.

Install clutch spring bearing ring in groove of piston.

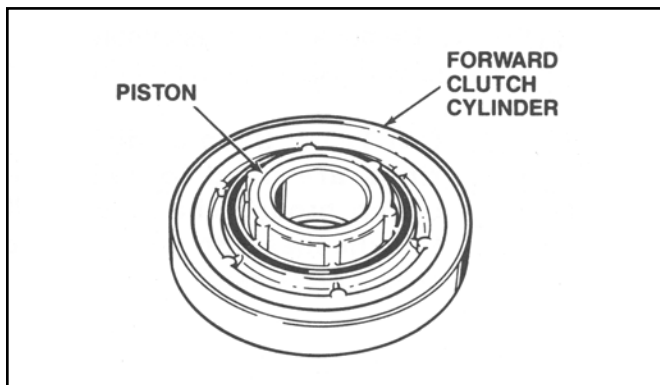
Install piston sealing ring in outer groove of piston.

NOTE: Check that piston sealing ring is not twisted, cut or deformed. Replace if damaged.



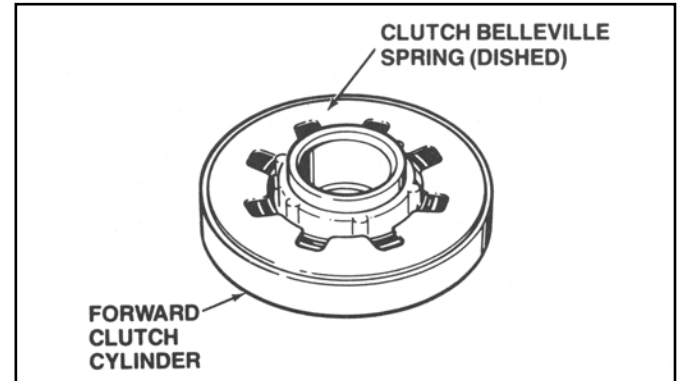
Clutch Ring Installation

STEP 10. Install piston in forward clutch cylinder. Be careful not to damage sealing ring during assembly.



Piston Installation

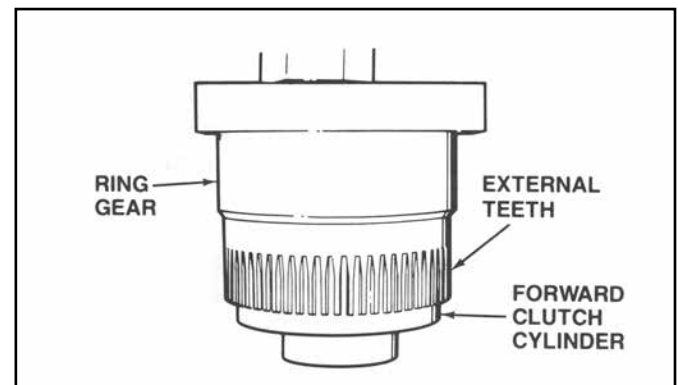
STEP 11. Place clutch Belleville (dish) spring inside rim of forward clutch cylinder. Spring is dished. The inside of the spring should be lower than the outside.



Clutch Spring Assembly

STEP 12. Install ring gear over forward clutch cylinder, with piston and spring facing up. Press ring gear down over forward clutch cylinder.

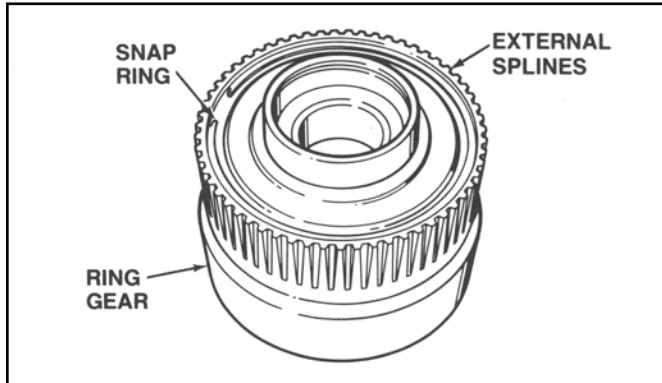
CAUTION CAUTION: Check to see that clutch spring bearing ring is still seated in the groove of clutch piston.



Forward Clutch Cylinder Installation

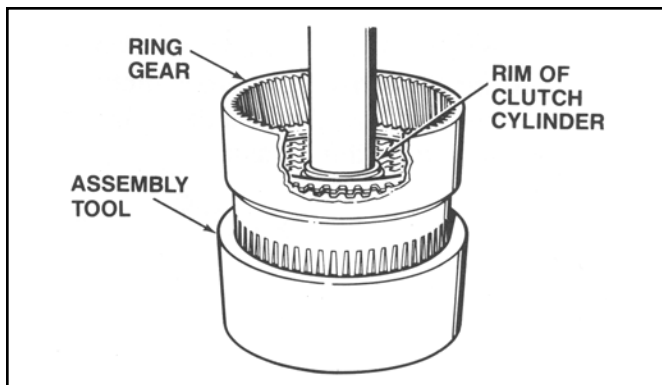
STEP 13. Remove clutch assembly from press. Install snap ring in groove of ring gear. (Snap ring 4822)

CAUTION CAUTION: Several different snap rings are used to assemble the clutch group. They have different thickness. Be sure the correct snap ring is used.



Snap Ring Installation

STEP 14. Place ring gear in press with external splines facing down. Assembly tool should support the ring gear only. The forward clutch cylinder should not be touching the assembly tool. Press forward clutch cylinder against snap ring. Remove clutch assembly from press.



Compressing Clutch Pack

STEP 15. The following instructions are for the 71L and 72L models.

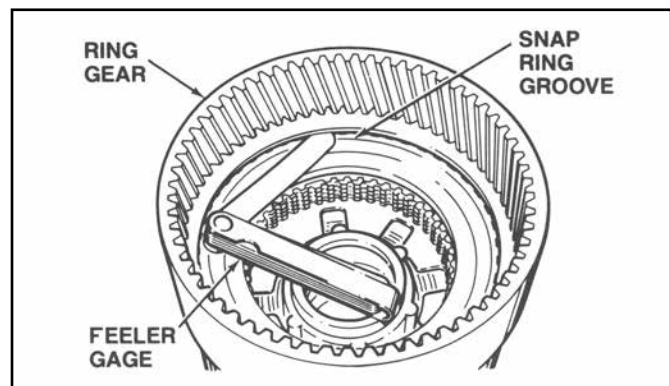
Push down, by hand, on clutch plates. Measure snap ring gap. Select proper thickness snap ring or combination of snap rings to set clutch pack clearance. Refer

to clutch end play chart. More than one snap ring may be required.

Clutch End Play Chart

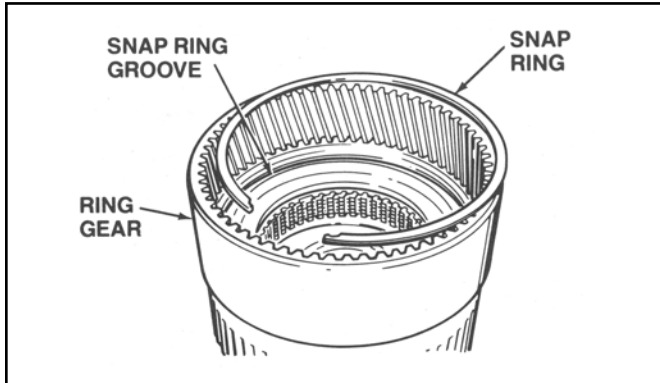
Model	Assembly Number	Clutch End Play
71L (all)	3018 and 3019	.018/.053
72L, 72LV (all)	3007 and 3008	.035/.055
72LX	3011	.035/.050

Part Number	Snap Ring Thickness	
	in.	mm
10-00-139-048	.033 - .037	.84 - .094
10-00-139-049	.050 - .054	1.27 - 1.37
4768	.050 - .054	1.3 - 1.4
10-00-139-018	.062 - .066	1.6 - 1.7
4768A	.074 - .078	1.9 - 2.0
4768B	.096 - .100	2.4 - 2.5



Snap Ring Selection

STEP 16. Install selected snap ring(s) in groove of ring gear. If selected snap ring does not result in proper end play, repeat this step. See Chart on Page 18.

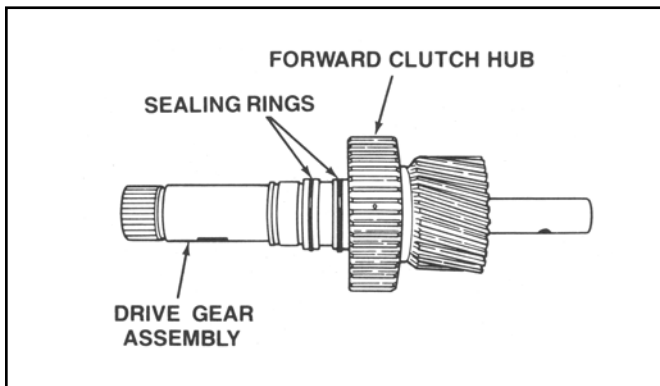


Snap Ring Assembly

STEP 17. If removed, install woodruff key in drive gear assembly. Slide forward clutch hub on drive gear assembly and align with woodruff key. Press forward clutch hub on drive gear assembly and against shoulder. NOTE: 3009, 3010 and 3011 models have a splined hub.

Install snap ring in groove of drive gear assembly.

Lubricate sealing rings with vasoline and install in grooves of drive gear assembly.

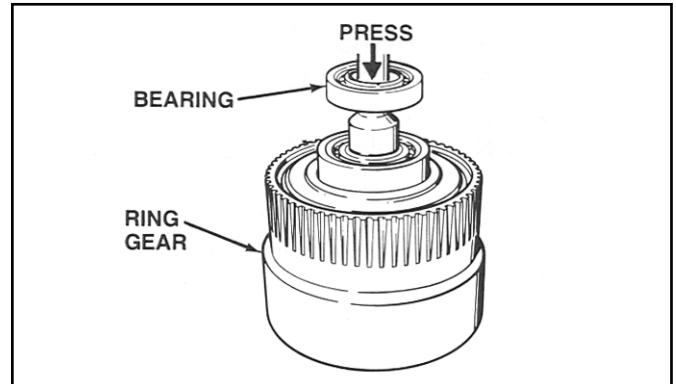


Sealing Ring Installation

Compress each sealing ring until it locks in place.

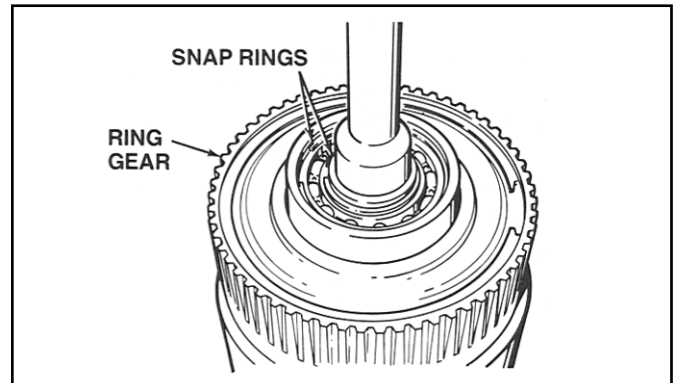
STEP 18. Install drive gear assembly in clutch assembly. Slide bearing down drive gear assembly.

Place complete assembly in press. Press bearing into drive gear assembly until seated against shoulder.



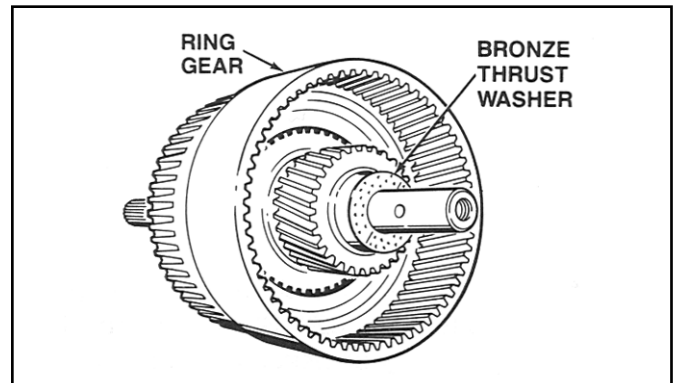
Bearing Installation

STEP 19. Install snap rings in grooves of drive gear assembly and forward clutch cylinder.



Snap Ring Installation

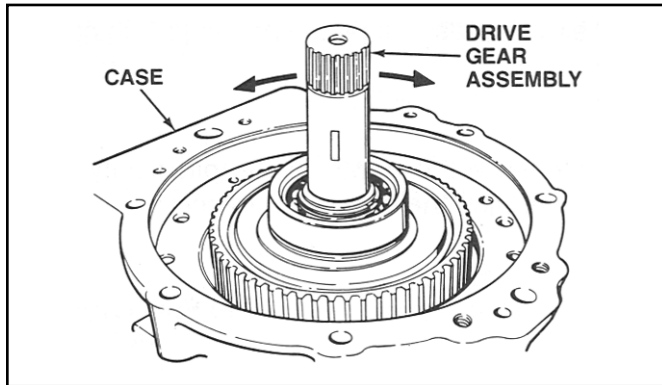
STEP 20. Apply vasoline to bronze thrustwasher. Install over end of shaft and against face of gear.



Thrustwasher Assembly

STEP 21. Install clutch and drive gear assembly in case.

Rotate clutch and drive gear assembly back and forth to engage ring gear teeth with pinion gear teeth.



Clutch and Drive Gear Installation

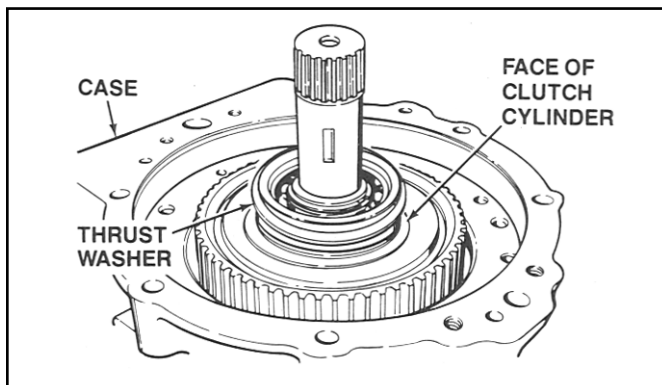
STEP 22. If original case and clutch cylinder are used, install thrustwasher on face of clutch cylinder.

On all model transmissions select new thrustwasher as follows:

Position case vertically as shown. Measure from face of case, without gasket, to face of clutch cylinder.

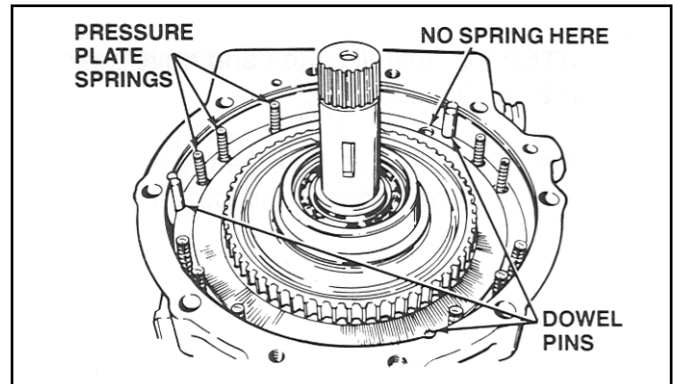
When dimension is 0.424 inch (10.77mm) or less, use 71-15B thrustwasher.

When dimension is greater than 0.424 inch (10.77mm), use 1016-193-001 thrustwasher.



Thrustwasher Installation

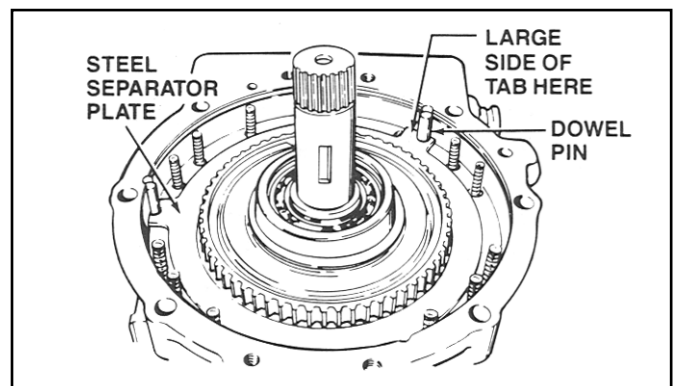
STEP 23. Install three dowel pins and eleven pressure plate springs in case.



Spring and Dowel Pin Installation

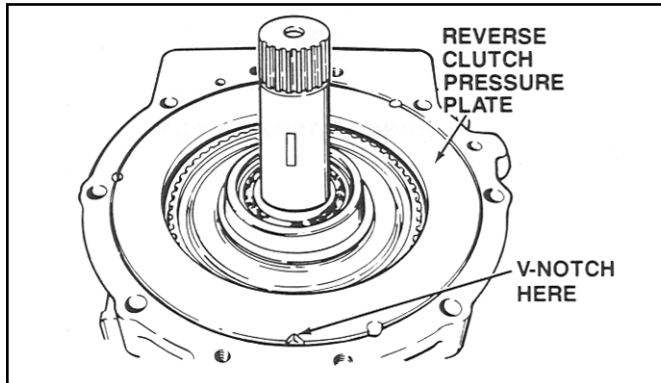
STEP 24. Install one steel separator plate in case with large part of tab to left of dowel pin.

Alternately stack remaining reverse clutch friction plates and steel separator plates in case (see page 34).



Reverse Clutch Pack Installation

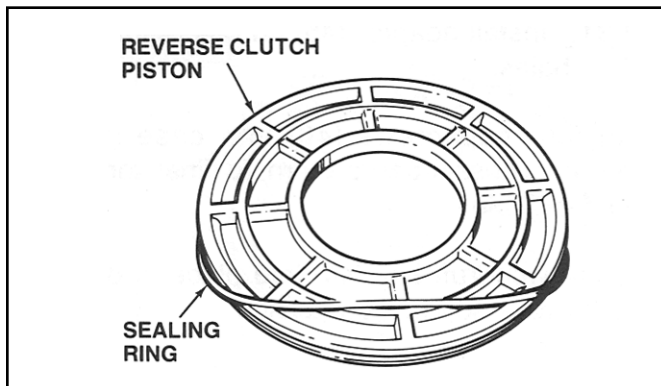
STEP 25. Install reverse clutch pressure plate in case with three half moons aligned with dowel pins. Be sure all springs are seated in their holes.



Pressure Plate Installation

STEP 26. Lubricate sealing ring with vasoline and install in groove of reverse clutch piston.

NOTE: be sure sealing ring is not twisted, cut or distorted. Replace if damaged.



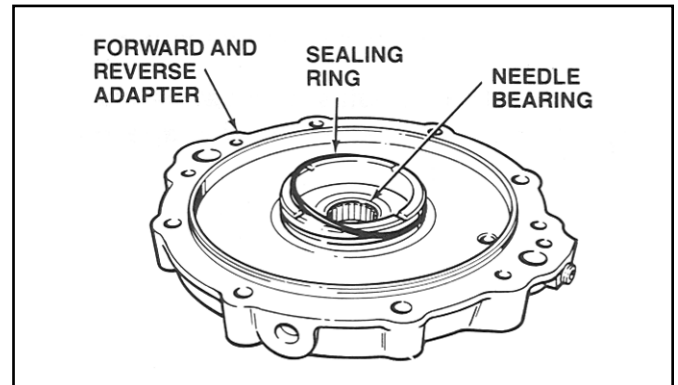
Sealing Ring Assembly

STEP 27. If removed, press needle bearing into adapter. Needle bearing must be installed against bore shoulder.

Lubricate O-ring with vasoline and install in groove of adapter.

NOTE: Be sure O-ring is not twisted, cut or distorted. Replace if damaged.

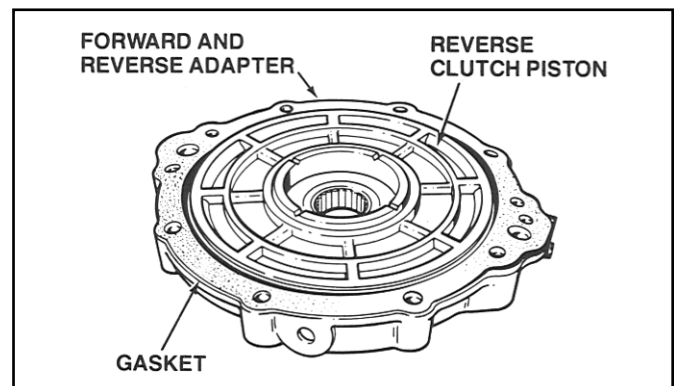
If removed, install dryseal plug in adapter.



Sealing Ring Installation

STEP 28. Install reverse clutch piston in adapter.

Lightly coat gasket with vasoline and place on adapter.



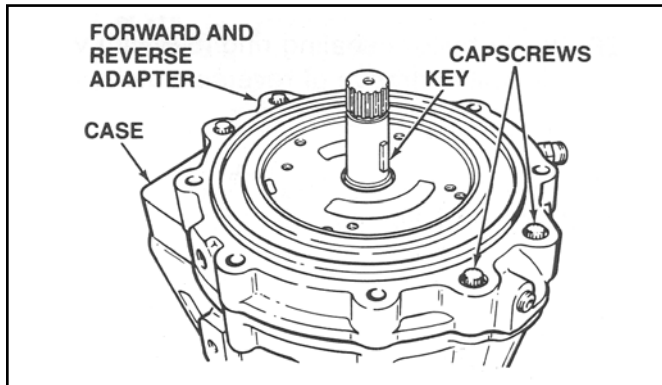
Reverse Clutch Piston Assembly

STEP 29. Install adapter on case and align bolt holes.

Thread four capscrews into case. Tighten in a criss-cross pattern to final torque specified in Table 4.

Lightly tap woodruff key into place in drive gear with a soft-faced mallet.

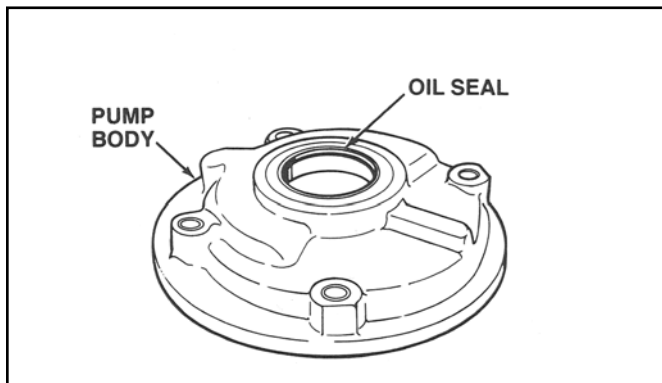
NOTE: Model 3009 uses a round dowel pin in place of a key.



Adapter Installation

STEP 30. Press oil seal into pump body against bore shoulder.

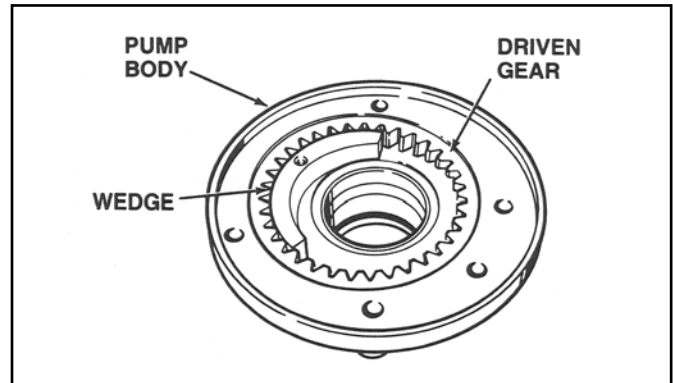
CAUTION CAUTION: Oil Seal must be installed dry. Lubricants can damage rubber coating.



Oil Seal Installation

STEP 31. Install driven gear in pump body.

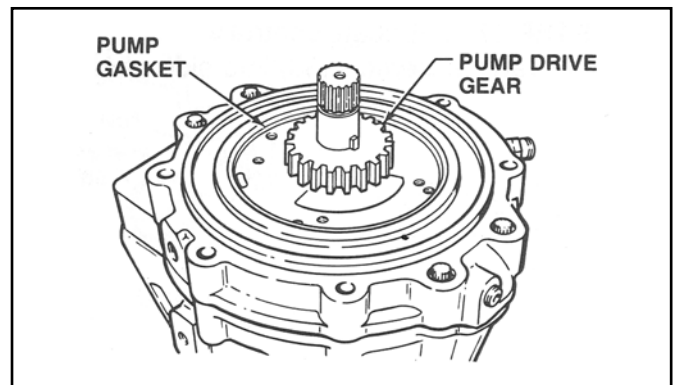
NOTE: Pump gear should be installed the same side down as removed.



Pump Driven Gear Assembly

STEP 32. Lubricate pump gasket with vasoline and install in groove of adapter.

Install pump drive gear onto input shaft. Check that pump drive gear locates freely on woodruff key and shaft.

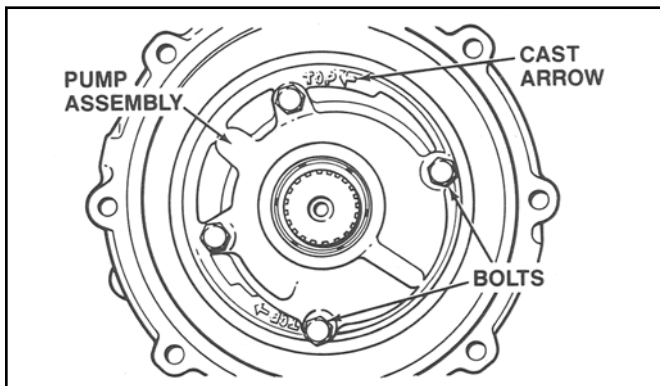


Pump Gasket Installation

STEP 33. Install pump assembly on top of adapter and align bolt holes. Apply thread locker to bolts - apply Loctite 242 or equivalent.

CAUTION **CAUTION:** Position pump housing with cast arrow at top pointing in the same direction as engine rotation.

Thread four bolts into adapter. Tighten in a criss-cross pattern to final torque specified in Table 4.

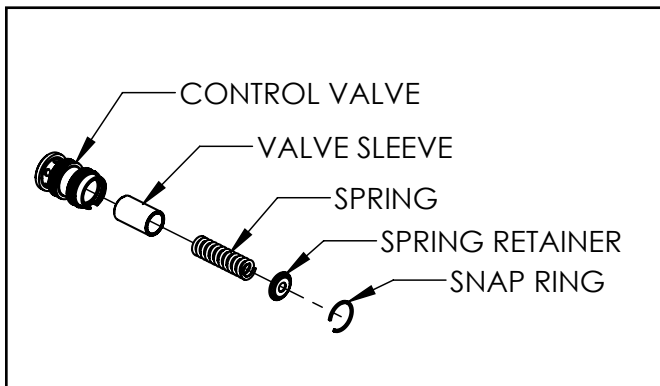


Pump Assembly Installation

STEP 34. Assemble pressure relief valve assembly. Refer to figure below.

Lubricate O-rings with vasoline and install on end of valve assembly.

NOTE: Gap in snap ring must be aligned with notch in control valve.



PRV Valve Assembly

STEP 35. Slide valve assembly into side of case.

STEP 36. Install valve cover as follows:

Position gasket on case. Place valve cover over gasket and align bolt holes.

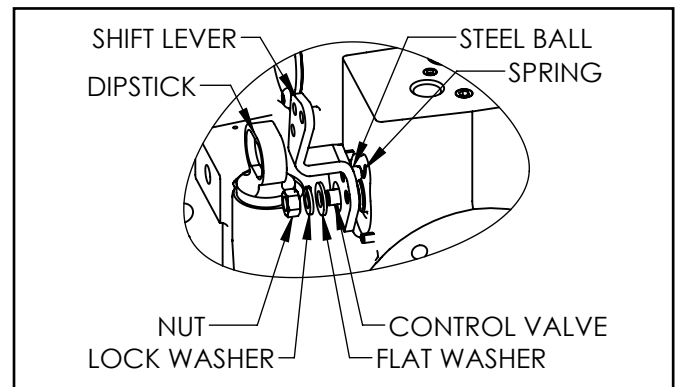
Thread three bolts into case. Tighten bolts in a criss-cross pattern to final torque specified in Table 4. Apply thread sealant to bolts. (Loctite 242 or equivalent)

STEP 37. Install shift lever as follows (manual shift only): Insert shift spool into housing. Lubricate o-ring before installation. Insert snap ring into housing to retain spool.

Lubricate poppet spring and hole in case with grease. Place poppet spring and steel ball in case.

Slide shift lever over end of control valve assembly and against steel ball. Rotate shift lever to engage steel ball in hole of shift lever.

Hold shift lever against steel ball. Install washers and thread nut on shifter spool assembly. Tighten nut to torque specified in Table 4.



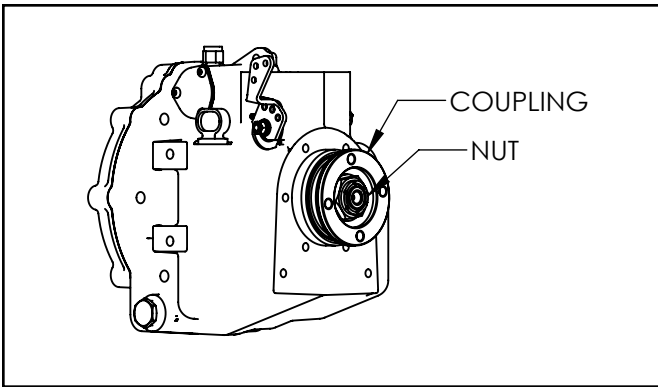
Shift Lever Assembly

STEP 37A. Electric Shift

Be sure cartridge screen is clean. Insert cartridge into port and torque to spec in Table 4.

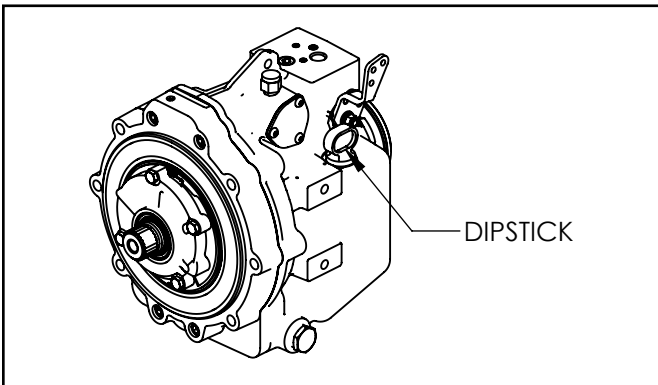
Slide coils over cartridge stem. Be sure you have the spacer washer between the 2 coils. Position coils as needed and tighten nut to spec in Table 4.

STEP 38. Slide coupling on output shaft. Thread nut on output shaft. Tighten nut to torque shown in Table 4.



Coupling Installation

STEP 39. Install dipstick in side of case. Turn handle until snug. Do not over tighten.



Dipstick Installation

CAUTION CAUTION: After a transmission failure, the cooler should be replaced and all lines flushed.

Align input shaft spline with damper plate.

Assemble transmission to engine and then install bolts. Do not use bolts to draw transmission against engine.

WARNING WARNING: Check the shift lever at the helm to see that forward position is also forward position at the transmission shift lever. (Transmission should not be running in reverse when boat is going forward.)

Adjust the shift cable so the holes in the shift lever are centered over the detent ball at each selector location. See figure 7A.

CAUTION CAUTION: If adjustment is not correct this could cause transmission failure.

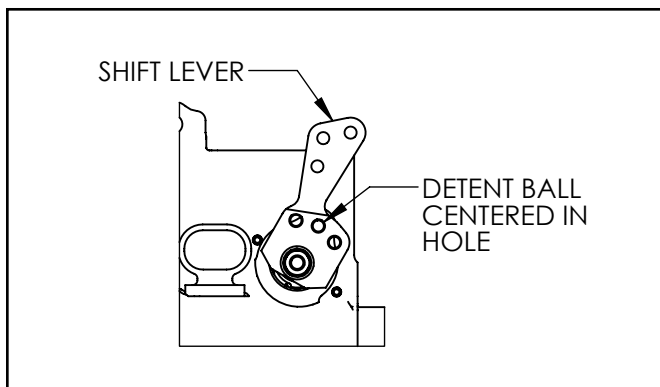


Figure 7A. Shift Cable Adjustment

Read OEM manual for complete installation instructions.

Connect oil line to oil to the cooler outlet. See Figure 7B.

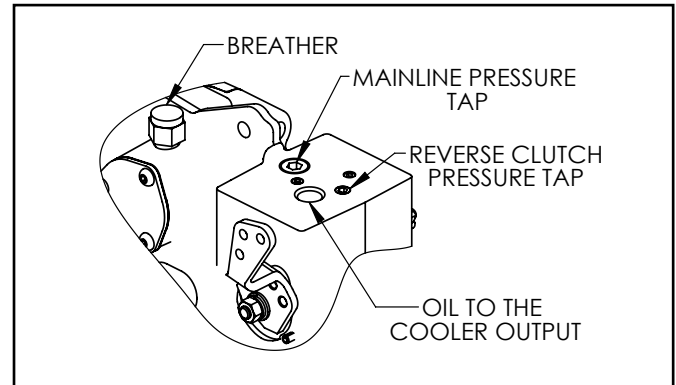


Figure 7B. Oil to Cooler Outlet

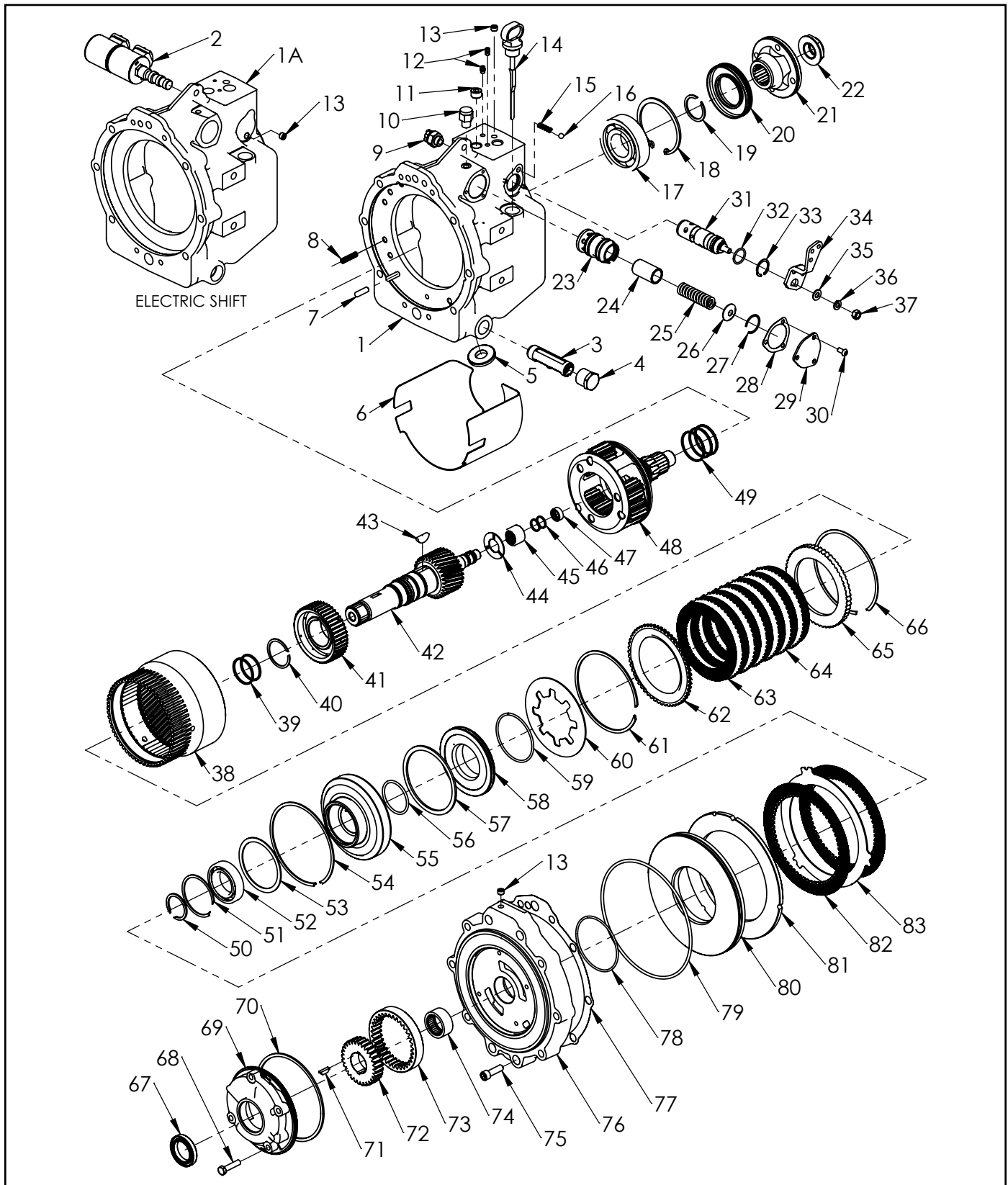


Figure 8. 71L and 72L Transmission Assembly

Item No.	Part Number	Description	Qty.
1	30-07-065-M01	MAIN CASE MANUAL SHIFT	1
1A	30-07-065-E01*	MAIN CASE ELECTRIC SHIFT	1
2	30-00-140-001*	SOLENOID	1
3	10-00-238-002	SCREEN	1
4	3000188001	THREAD REDUCER (SAE J1926-8 FITTING) 3/4-16 THD	1
4A	4885B	THREAD REDUCER (3/8-18 DRYSEAL THD)	1
5	4915	MAGNET	1
6	30-07-036-001	OIL BAFFLE	1
7	10-00-043-031	DOWEL PIN	3
8	71-97	PRESSURE PLATE SPRING	11
9	3000640001	NEUTRAL SWITCH - WIRE LEADS	1
9A	10-00-140-007	NEUTRAL SWITCH WITH SCREW LEADS	1
10	3000072001	BREATHER	1
11	444866	3/8 NPT PIPE PLUG	1
12	10-16-113-001	PLUG	2
13	444688	1/8 NPT PIPE PLUG	2
14	3007559001	DIPSTICK (3007, 3011, AND 3019 MODELS)	1
14A	3007559002	DIPSTICK (3008 AND 3018 MODELS)	1
15	71-42	SPRING - POPPET	1
16	453632	STEEL BALL (5/16)	1
17	20-00-130-001	BEARING - ANNULAR	1
18	30-06-139-002	RING - RETAINING	1
19	3008139001	SNAP RING (3008 AND 3018 MODELS ONLY)	1
20	30-07-044-001	OIL SEAL (3007, 3011, AND 3019 MODELS)	1
20A	30-08-044-001	OIL SEAL (3008 MODEL ONLY)	1
21	30-07-031-001	COUPLING - OUTPUT (3007 MODEL ONLY)	1
21A	3010031001	COUPLING - 5" (3011 MODEL OPTION ONLY)	1
21B	3010031002	COUPLING - 1350 FLANGE (3011 MODEL OPTION ONLY)	1
21C	3010031003	COUPLING - 1480 FLANGE (3011 MODEL OPTION ONLY)	1
21D	3019031001	COUPLING 4" (MODEL 3019 ONLY)	1
22	10-00-149-034	1-20 SPIRALOCK HEX NUT (3011 MODEL ONLY)	1
22A	4775L	1-20 LOCK HEX NUT (3007 AND 3019 MODELS ONLY)	1
23	3007239002	VALVE - SLEEVE	1
23A	3007739002	PRV VALVE ASSEMBLY	1
24	71-243	VALVE - PRESSURE REGULATOR	1
25	71-242	VALVE - SPRING	1
26	71-246	SPRING RETAINER	1
27	4821	SNAP RING	1
28	71-14	VALVE COVER GASKET	1
29	3006039001	VALVE COVER	1
30	433648	SCREW	3
31	3006239005	CONTROL VALVE	1
32	3006141001	O-RING	1
33	3006139001	SNAP RING	1
34	71-79B	SHIFT LEVER	1

* Optional electric shift components

Item No.	Part Number	Description	Qty.
35	103340	FLAT WASHER (5/16)	1
36	108579	LOCK WASHER (5/16)	1
37	9418892	HEX NUT (5/16-24)	1
38	10-16-162-001	RING GEAR	1
38A	71-6	RING GEAR (3018 AND 3019 MODELS ONLY)	1
39	4806J	SEALING RING	2
40	4495	SNAP RING	1
41	10-16-179-001	CLUTCH HUB (3007 AND 3008 MODELS ONLY)	1
41A	3011090001	CLUTCH HUB 3011 MODEL ONLY	1
41B	71-40	CLUTCH HUB (MODELS 3018 AND 3019 ONLY)	1
42	30-06-085-001	DRIVE GEAR (3007 AND 3008 MODELS)	1
42A	3011085001	DRIVE GEAR (3011 MODEL)	1
42B	3019085001	DRIVE GEAR (3018 AND 3019 MODELS ONLY)	1
43	124553	WOODRUFF KEY (3007 AND 3008 MODELS ONLY)	1
43A	218211	WOODRUFF KEY (3018 AND 3019 MODELS ONLY)	1
44	71-17	WASHER - THRUST	1
45	20-00-132-001	BEARING - 7/8 ID	1
		(2) REQ'D FOR 3018 AND 3019 MODELS ONLY	2
46	4806S	RING - OIL SEALING	2
47	20-00-132-200	BEARING - 5/8 ID	1
48	30-07-659-002	CARRIER ASSEMBLY (3007 MODEL ONLY)	1
48A	3008659002	CARRIER ASSEMBLY (3008 MODEL ONLY)	1
48B	3010659002	CARRIER ASSEMBLY (3011 MODEL ONLY)	1
48C	3018659002	CARRIER ASSEMBLY (3018 MODEL ONLY)	1
48D	3019659002	CARRIER ASSEMBLY (3019 MODEL ONLY)	1
49	20-00-016-050	SEALING RING	3
50	4559A	SNAP RING	1
50A	4734	SNAP RING (3018 AND 3019 MODELS ONLY)	1
51	4766B	SNAP RING	1
51A	R6A-7 1/2	SNAP RING (MODELS 3018 AND 3019 ONLY)	1
52	10-00-130-016	BEARING - ANNULAR	1
53	71-15B	WASHER - THRUST	1
	1016193001	WASHER - THRUST (OPTIONAL)	
54	4822	SNAP RING - RING GEAR	1
55	72-70	CLUTCH PISTON HOUSING (3007 AND 3008 MODELS)	1
55A	3011014001	CLUTCH PISTON HOUSING (3011 MODEL)	1
55B	71-70	CLUTCH PISTON HOUSING (3018 AND 3019 MODELS ONLY)	1
56	5M-122	O-RING	1
57	5L-36	PISTON SEALING RING (3007, 3008, 3018, AND 3019 MODELS ONLY)	1
57A	3009044001	PISTON SEALING RING (3011 MODEL)	1
58	10-16-124-001	PISTON - FORWARD CLUTCH (3007, 3008, 3018, & 3019 MODELS ONLY)	1
58A	3011124001	PISTON - FORWARD CLUTCH (3011 MODEL)	1
59	5C-33	CLUTCH PISTON WEAR RING	1
60	3-37	CLUTCH BELLEVILLE SPRING	1
61	4755	SNAP RING	1

* Optional electric shift components

Item No.	Part Number	Description	Qty.
62	3000166001	CLUTCH PRESSURE PLATE	1
63	3000166001	ASSY - INNER CLUTCH PLATE (MODEL 3007 AND 3008)	7
	3000166001	ASSY - INNER CLUTCH PLATE (MODEL 3018 AND 3019 ONLY)	5
63A	3009166001	PAPER CLUTCH PLATE MODEL 3011 ONLY	7
64	10-16-166-001	PLATE - OUTER CLUTCH	6
65	5L-67	REAR CLUTCH PRESSURE PLATE	1
66	4768	RING - SHIM (SELECTIVE FIT)	1
66A	4768A	RING - SHIM (SELECTIVE FIT)	
66B	4768B	RING - SHIM (SELECTIVE FIT)	
66C	1000139018	RING - SHIM (SELECTIVE FIT)	
66D	1000139019	RING - SHIM (SELECTIVE FIT)	
66E	1000139048	RING - SHIM (SELECTIVE FIT)	
67	10-00-044-014	OIL SEAL	1
68	10-00-183-021	BOLT, HEX - 5/16-18 X 1 3/8	3
69	71C-60	FRONT PUMP HOUSING	1
70	3-61	PUMP GASKET	1
71	4873	#9 KEY	1
72	71-64	FRONT PUMP DRIVE GEAR	1
73	3-63A	FRONT PUMP DRIVEN GEAR	1
74	4840D	NEEDLE BEARING	1
75	2000183017	SHCS 3/8-16X1.25	4
76	3006172001	ADAPTER - MACHINED	1
77	30-06-045-003	GASKET - CASE & ADAPTER	1
78	4804G	ADAPTOR O-RING	1
79	4805A	REV. PISTON SEALING RING	1
80	71-35	REVERSE CLUTCH PISTON	1
81	71-71	REVERSE CLUTCH PRESSURE PLATE	1
82	72-A66B	BRONZE REVERSE CLUTCH PLATE (STD)	2
82A	3000166002	BRONZE HEAVY DUTY REVERSE CLUTCH PLATE HARDEN (3011 MODEL)	2
82B	3009166002	PAPER HIGH PERFORMANCE REVERSE CLUTCH PLATE (OPTIONAL)	2
83	72-176	OUTER STEEL CLUTCH PLATE	1

* Optional electric shift components

NOTE: The following kits are available for Model 71L and 72L transmissions. Index numbers shown match the index numbers on the exploded view, Figure 8.

Forward Clutch Kit (Models 3007 & 3008 Only)

Index No.	Part Number	Description	Qty.
	A4867AB	FORWARD CLUTCH PACK KIT	
62	5C-175A	CLUTCH PRESSURE PLATE	1
64	10-16-166-001	STEEL CLUTCH PLATE	6
63	3000166001	FRICTION CLUTCH PLATE (BRONZE)	7
65	5L-67	CLUTCH PRESSURE PLATE	1

Forward Clutch Kit (Models 3018 & 3019 Only)

Index No.	Part Number	Description	Qty.
	A4867AE	FORWARD CLUTCH PACK KIT	
62	5C-175A	CLUTCH PRESSURE PLATE	1
64	10-16-166-001	STEEL CLUTCH PLATE	4
63	3000166001	FRICTION CLUTCH PLATE (BRONZE)	5
65	5L-67	CLUTCH PRESSURE PLATE	1

Forward Clutch Kit (Model 3011 Only)

Index No.	Part Number	Description	Qty.
	3011410002	FORWARD CLUTCH PACK KIT	
62	3009062001	CLUTCH PRESSURE PLATE	1
64	10-16-166-001	STEEL CLUTCH PLATE	6
63	3009166001	FRICTION CLUTCH PLATE (PAPER)	7
65	5L-67	CLUTCH PRESSURE PLATE	1

Gasket, Sealing Rings, O-Ring and Oil Seal Kit (Model 3011 Only)

Index No.	Part Number	Description	Qty.
	3011410001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57A	3009044001	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50	4559A	SNAP RING	1
51	4766B	SNAP RING	1
54	4822	SNAP RING	1
40	3009139001	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1

Gasket, Sealing Rings, O-Ring and Oil Seal Kit (Model 3008 Only)

Index No.	Part Number	Description	Qty.
	3008420002	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3008044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50	4559A	SNAP RING	1
51	4766B	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1
19	3008139001	SNAP RING	1

Gasket, Sealing Rings, O-Ring and Oil Seal Kit (Model 3007 Only)

Index No.	Part Number	Description	Qty.
	3007420001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50	4559A	SNAP RING	1
51	4766B	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1

Gasket, Sealing Rings, O-Ring and Oil Seal Kit (Model 3018 Only)

Index No.	Part Number	Description	Qty.
	3018420001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50A	4734	SNAP RING	1
51A	R6A-7 1/2	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	30081390012	SNAP RING	1
33	3006139001	SNAP RING	1

Gasket, Sealing Rings, O-Ring and Oil Seal Kit (Model 3019 Only)

Index No.	Part Number	Description	Qty.
	3019420001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50A	4734	SNAP RING	1
51A	R6A-7 1/2	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1

Reverse Plates Used in Each Model

Model Number	Steel Plates	Friction Plates
3007, 3008, 3011, 3018 & 3019	2	2
3009 & 3010	3	3

CAUTION CAUTION: Threaded plugs, screws, bolts and coupling nuts must be tightened to torque shown in this table to prevent premature failure of transmission or reduction unit. Recommend using Thread Locker Loctite 242 or equivalent to all fasteners.

Table 4. Bolt and Fastener Torque Specs. (Non-Lubricated)

Part Number	Description	FT-LB	Nm
MAIN HOUSING			
9418892	5/16-24 Shift Lever Nut	8-11	11-15
4775L	Coupling Nut	160-260	217-353
10-00-149-034	Coupling Nut	160-260	217-353
10-00-183-021	5/16-18 x 1" Hex Head Bolt	15-16	20-21
20-00-183-017	3/8-16 x 1-1/4 Capscrew	32-36	43-48
4885B	3/4-14 Dryseal Bushing	20-30	27-40
444688	1/8-27 Pipe Plug	7-12	9-16
10-00-640-004	Neutral Switch	20-22	27-29
30-00-064-001	Neutral Switch	20-22	27-29
433648	1/4-20 x Button Head Bolt	6-8	8-10
30-00-072-001	1/4-18 NPSF Breather	14-24	19-32
ELECTRIC SHIFT OPTION			
30-00-140-001	3/4-16 Solenoid Stem	25	34
	Coil Nut	5	7
V-DRIVE HOUSING			
30-08-183-001	3/8-16 Hex Head Bolt	32-36	43-48
30-08-183-002	3/8-16 Hex Head Bolt	32-36	43-48
30-08-183-003	3/8-16 Hex Head Bolt	32-36	43-48
30-08-052-001	3/4-14 NPT	20-30	27-40
10-00-052-021	1/2-14 NPSF	17-27	23-36

PIPE PLUGS

Thread Size	Torque FT-LB	Nm
1/8-27 DRYSEAL NPSF	7-12	9-16
1/4-18 DRYSEAL NPSF	14-24	19-33
3/8-18 DRYSEAL NPSF	17-27	23-36
3/4-18 DRYSEAL NPSF	25-35	34-48

CAUTION CAUTION: When changing a factory installed fastener, it is the responsibility of the person making the change to properly account for fastener grade, thread engagement, load, tightening torque and the means of torque retention.

Table 5. Spring Dimensions

Part Number	Where Used	Approx. Free Length		Approx. OD		Diameter of Wire		No. of Active Coils
		in.	mm	in.	mm	in.	mm	
71-242	Control Valve	2.66	67.6	0.78	19.8	0.14	3.6	12
71.42	Poppet	1.00	25.4	0.29	7.4	0.04	1.0	6
71.97	Pressure Plate	1.25	31.8	0.31	7.9	0.05	1.3	11

Table 7. Test Pressures: 71L, 72L, 72LX (Models 3007, 3008, 3011, 3018 & 3019)

Pressure Tap	Engine RPM	Typical Range		Typical Range	
		PSI	PSI	kPA	kPA
Neutral Line	600	130	185	896	1275
	2000	NOT USED	NOT USED	NOT USED	NOT USED
	3500	NOT USED	NOT USED	NOT USED	NOT USED
Reverse Clutch	600	130	185	836	1275
	2000	150	195	1034	1344
	3500	NOT USED	NOT USED	NOT USED	NOT USED
Reverse Main Line	600	130	185	896	1275
	2000	150	195	1034	1344
	3500	NOT USED	NOT USED	NOT USED	NOT USED
Forward Main Line	600	130	185	896	1275
	2000	150	195	1034	1344
	3500	150	215	1034	1482
		GPM	GPM	LPM	LPM
Reverse Cooler Flow	600	0	2.6	0	9.8
	2000	3.5	9.0	13.25	30.3
	3500	NOT USED	NOT USED	NOT USED	NOT USED
Forward Cooler Flow	600	0	2.6	0	9.8
	2000	3.5	9.0	13.25	30.3
	3500	6.0	12.5	22.7	47.3

NOTE: Pressures shown are typical at an oil temperature of 120 degrees F. Variations can occur due to plumbing, fittings and cooler differences.

NOTE: Forward clutch feed does not have an external tap for checking pressure. When selector is in "F" position, line pressure indicates clutch pressure. Pressure drop from "N" to "F" indicates leakage in forward clutch circuit.

PROPELLER SHAFT ALIGNMENT

The term "Propeller Shaft Alignment" is really a misnomer because we are really not aligning the prop shaft. We are aligning the engine and transmission as an assembly. We can reposition the prop shaft axially, but we cannot move it laterally. We must instead move the engine and transmission assembly to align with the prop shaft. The prop shaft is the boss.

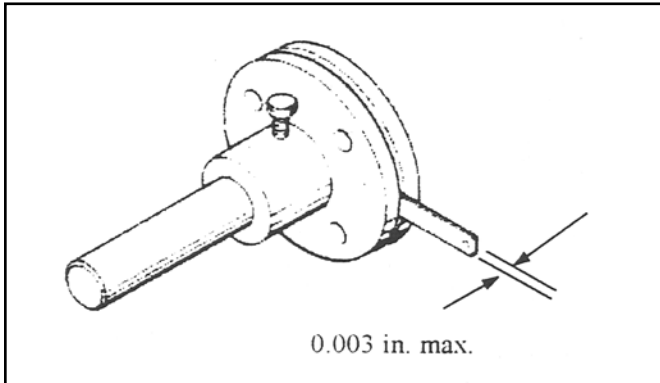


Figure 1. Flange and Coupler

The following are the three basic conditions that are at the root of all prop shaft alignment problems.

1. The face of the prop shaft coupler and/or transmission flange may not be perpendicular to the center line of its respective shaft (figure 2).

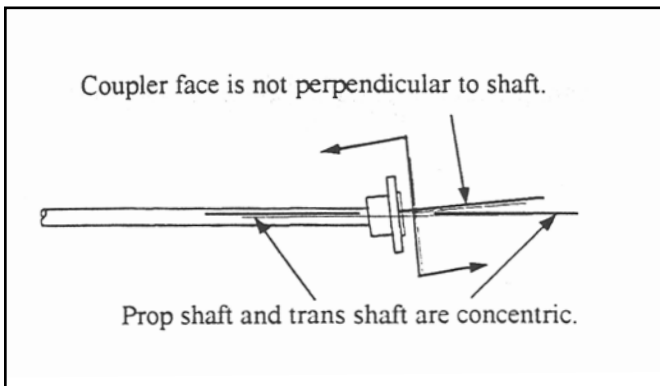


Figure 2. Coupler Perpendicularity

2. The shaft may be bent (figure 3). Place indicator in position "2" to determine coupler position relative to shaft.

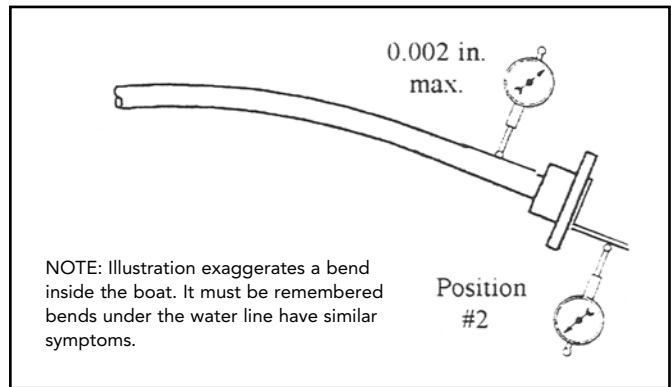


Figure 3. Bent Shaft (Exaggerated)

3. The center lines of the transmission output and propeller shafts are not concentric. Their center lines may be parallel or crossing (figure 4).

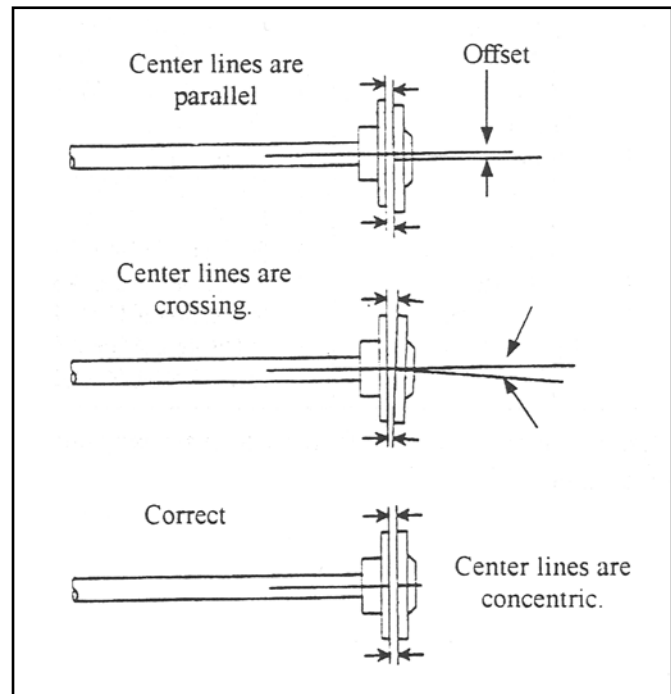


Figure 4. Shaft Concentricity

SHAFT ALIGNMENT PROCEDURE

Propeller shafts with a third or more of their total length protruding inside the boat should be supported in their best neutral position when disconnected from the transmission. If there is any doubt, support.

NOTE: It is most important the following steps be taken in order.

THE COUPLER AND/OR FLANGE FACES ARE NOT PERPENDICULAR TO THE SHAFT

Symptoms may include: Knocking noise, leaking stuffing box, leaking transmission rear seal, loose transmission output shaft nut, broken transmission shaft at output nut.

TRANSMISSION FLANGE FACE IS NOT PERPENDICULAR

The face and pilot bore are best checked with a dial indicator. Both readings should be within 0.002 inch (figure 5).

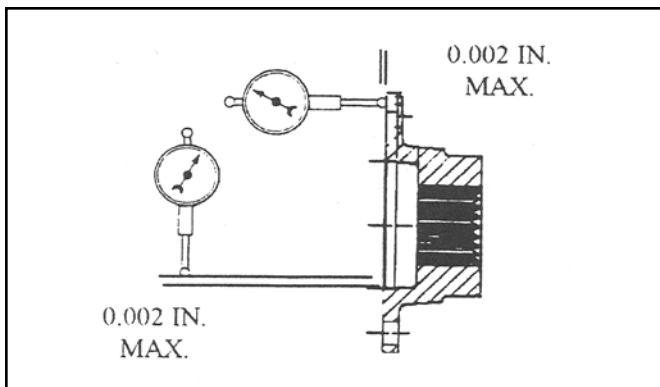


Figure 5. Determining Transmission Flange Runout

PROPELLER SHAFT COUPLER NOT PERPENDICULAR

The face of the coupler is best checked by taking four (4) feeler gauge readings at one location against the transmission flange and move the coupler in 90° increments for each reading (figure 6). Readings must be within 0.002 inch.

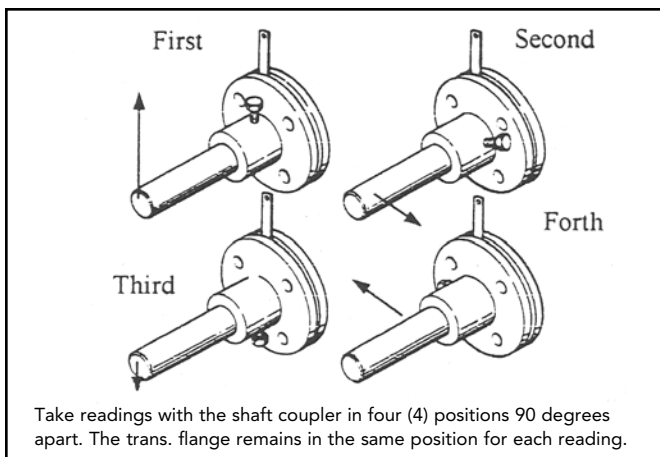


Figure 6. Determining Coupling Perpendicularity

BENT SHAFT

Symptoms may include: Knocking noise, leaking stuffing box, leaking transmission rear seal, loose transmission output shaft nut, broken transmission shaft at output nut.

Rotate shaft with a dial indicator held against its side (figure 3). Place indicator in position "2" to determine coupler position relative to shaft.

Reading must be within 0.002 inch. Replacement is the only cure for a bent shaft.

NOTE: It is imperative the transmission flange and propeller shaft coupler faces be perpendicular to their shaft center lines and the propeller shaft be free of bends below the water line as well as inside the boat, before continuing with this next step.

THE SHAFTS ARE NOT CONCENTRIC

Symptoms may include: knocking noise, squeal or moaning noise, leaking transmission rear seal.

This condition is corrected by moving the engine and transmission as an assembly until the male pilot on the shaft coupler enters the female pilot bore in the transmission flange without force and the flange faces meet with no more than a 0.003 inch space at any point around the circumference (figure 1).

FIVE INCH FLANGE

Velvet Drive five (5) inch flanges conform to the requirements of SAE 510 specifications. There are two features that make this flange unique to the industry. The female pilot bore is in the transmission flange and the bolt circle is a 4 ¼ inch diameter. No other SAE flange meets this criterion. See figure 7.

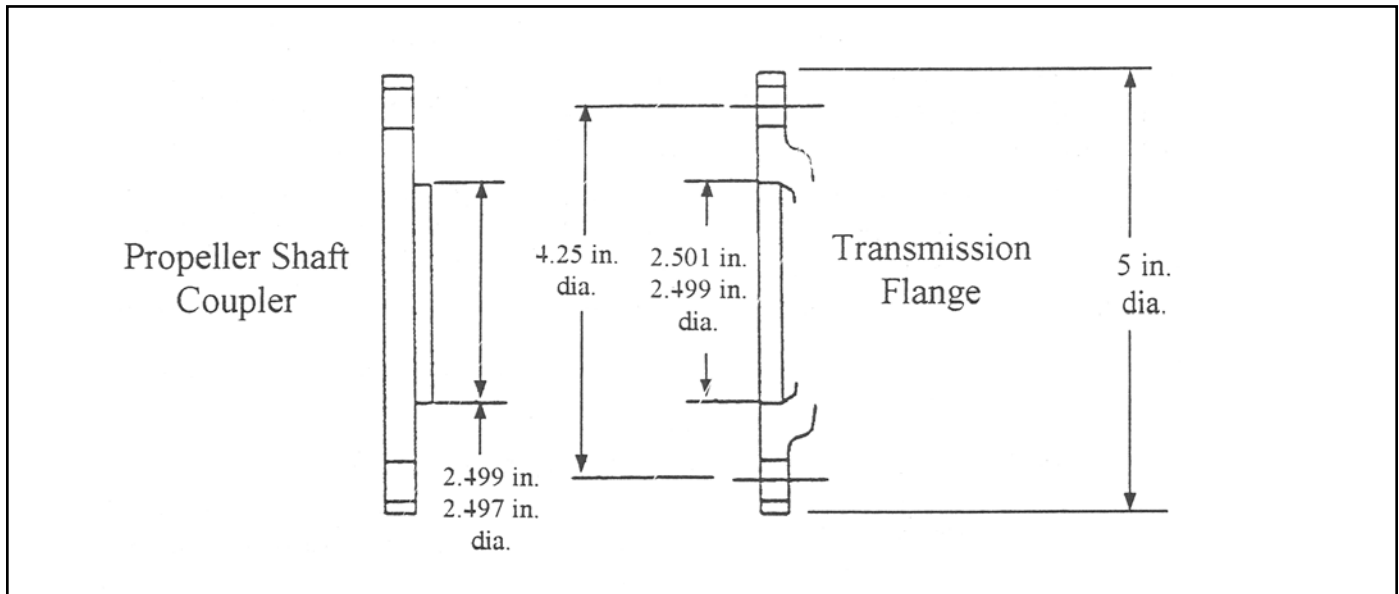
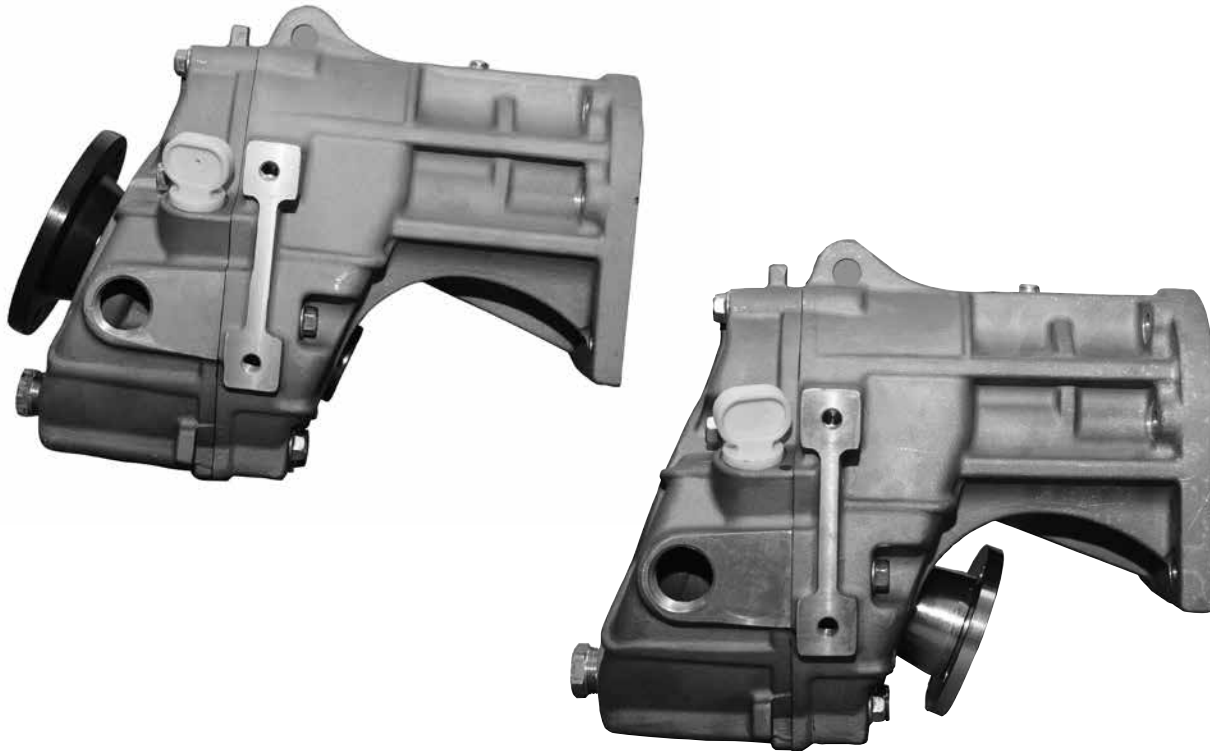


Figure 7. Five Inch Flange SAE 510

SEGMENT B

V-DRIVES

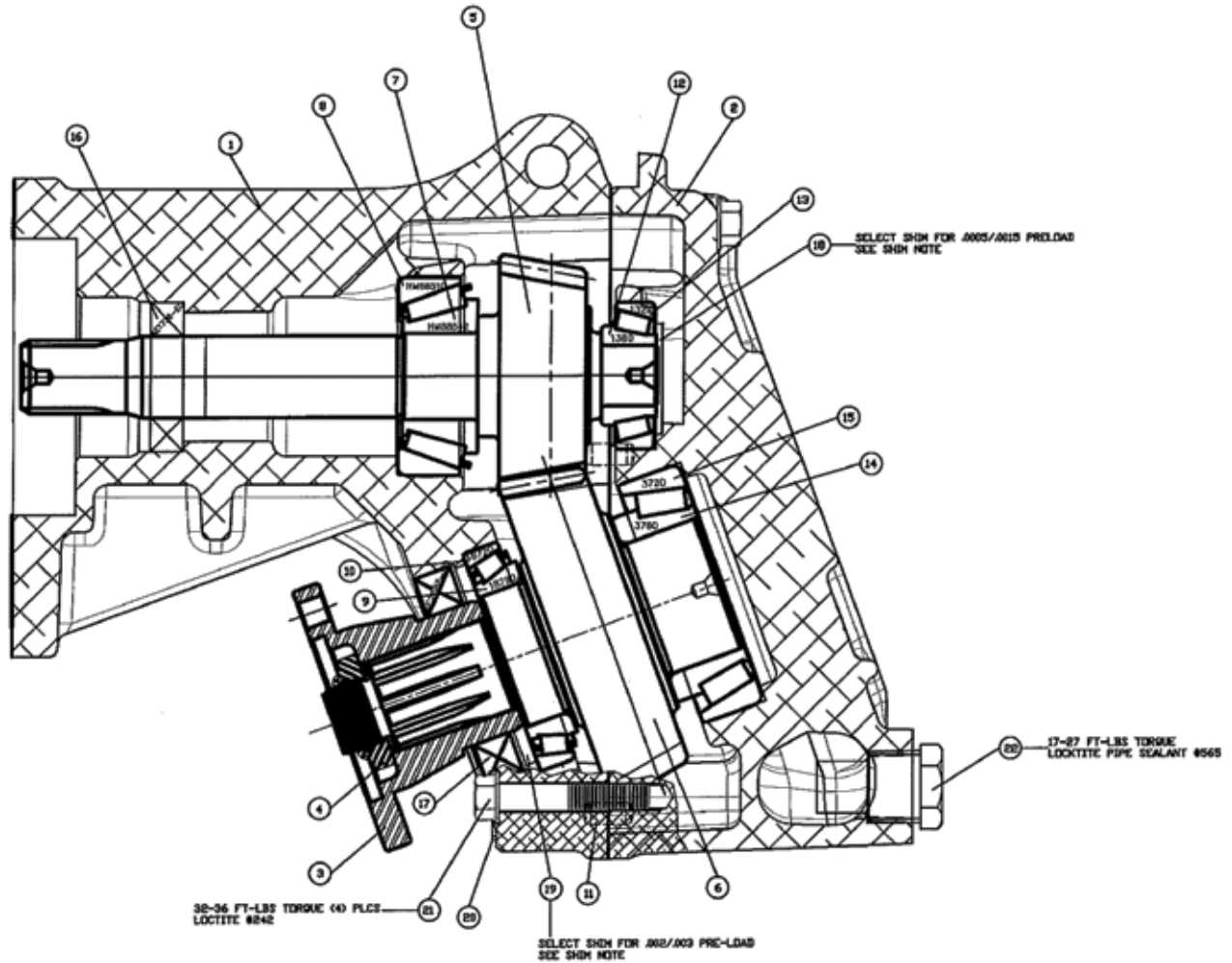


The following international symbols are used in this service manual.

⚠ WARNING This symbol warns of possible personal injury

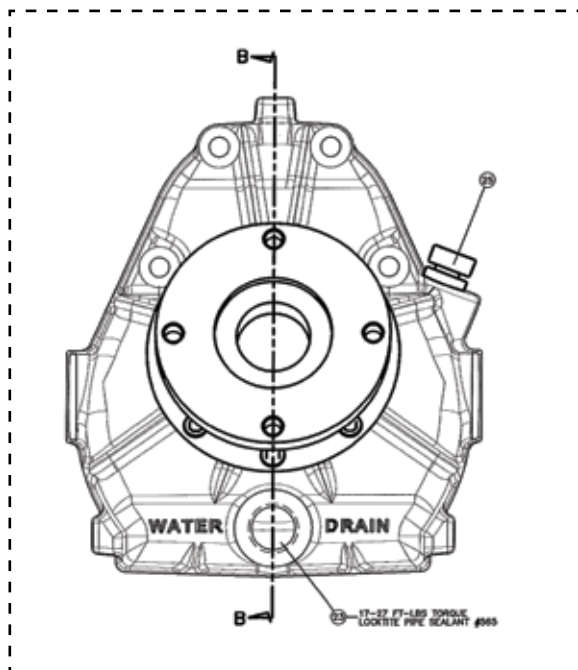
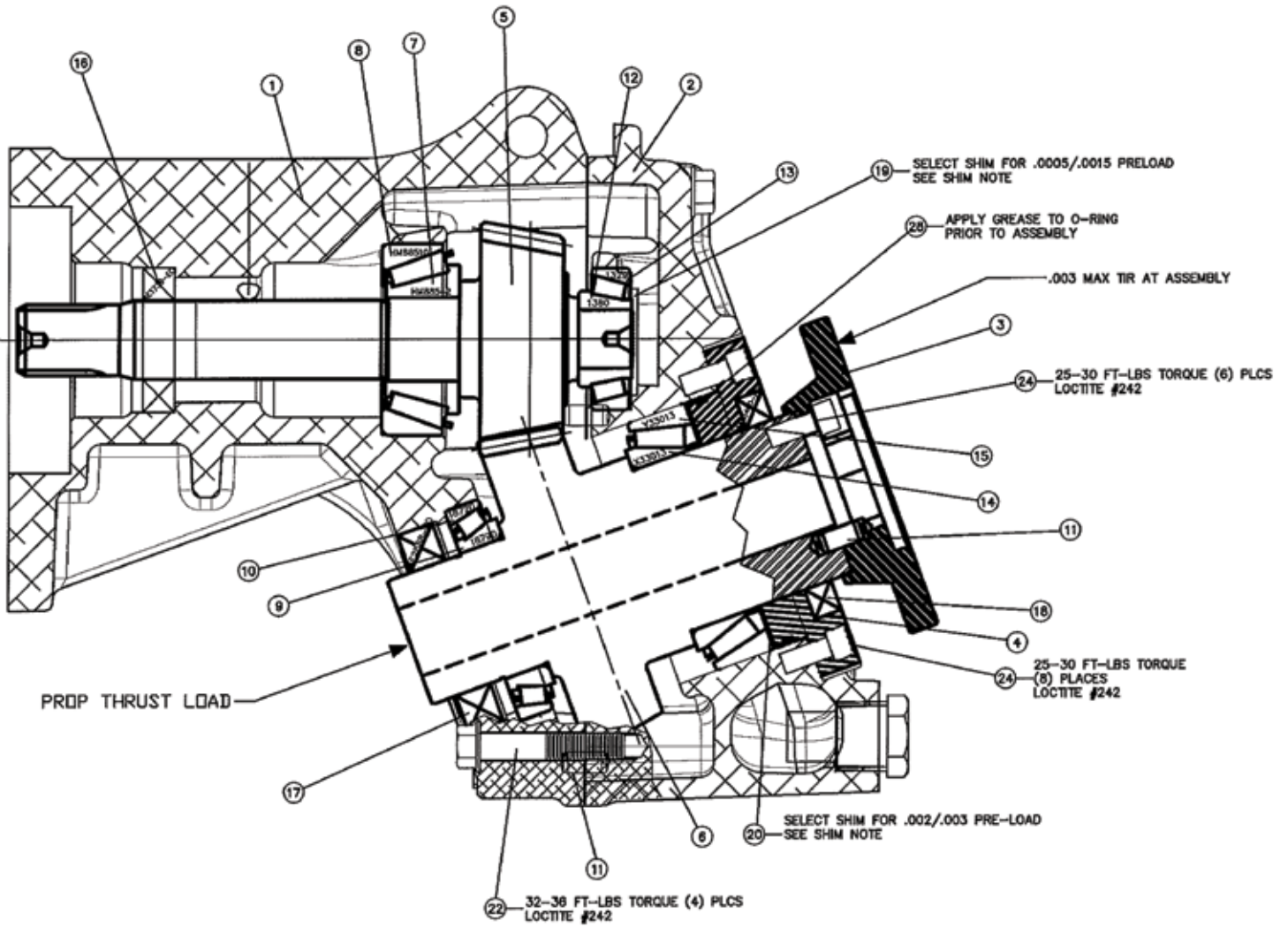
⚠ CAUTION This symbol warns of possible damage to transmissions.

OEM Original Equipment Manufacturer (Boat/Engine Manufacturer)



VIEW #	QTY	PART NUMBER	DESCRIPTION
1	1	30080650C1	CASE- FRONT HALF
2	1	30080650C2	CASE - BACK HALF
3	1	3008031001	OUTPUT FLANGE
4	1	4775L	LOCK NUT
5	1	3008085001	INPUT GEAR 1.5 RATIO
		3008085002	INPUT GEAR 1.25 RATIO
		3008085003	INPUT GEAR 2.0 RATIO
6	1	3008070001	OUTPUT GEAR 1.5 RATIO
		3008070002	OUTPUT GEAR 1.25 RATIO
		3008070003	OUTPUT GEAR 2.0 RATIO
7	1	2000133075	FRONT INPUT BEARING
8	1	2000133074	FRONT INPUT BEARING CUP
9	1	3000133003	FRONT OUTPUT BEARING
10	1	3000133005	FRONT OUTPUT BEARING CUP
11	2	2002043001	DOWEL PIN

VIEW #	QTY	PART NUMBER	DESCRIPTION
12	1	3000133001	REAR INPUT GEAR BEARING
13	1	3000133002	REAR INPUT GEAR BEARING CUP
14	1	3000133007	REAR OUTPUT GEAR BEARING
15	1	3000133006	REAR OUTPUT GEAR BEARING CUP
16	1	3005044001	INPUT GEAR SEAL
17	1	3005044002	OUTPUT GEAR SEAL
18	1	3005037006	INPUT GEAR BEARING SHIM KIT
19	1	3008037006	OUTPUT GEAR BEARING SHIM KIT
20	1	3008052002	PIPE PLUG (MAGNETIC)
21	8	3008183001	CASE BOLTS 3/8-16 X 2.25 LG.
22	1	3008052001	PIPE PLUG (ZINC ANODE)
23	1	3008559001	OIL DIP STICK
24	1	A4740G	BREATHER
25	1	3008045001	CASE GASKET



SHIM NOTE
NOTE: MIN. THICKNESS SHIM ADJACENT TO BEARING CUP.
MAX. THICKNESS SHIM ADJACENT TO COVER.

FINISHED ROLLING TORQUE - NO SEALS
15 - 30 IN.LBS. CHECKED THRU INPUT

72LVTS V-DRIVE

VIEW #	QTY	PART NUMBER	DESCRIPTION
1	1	30080650C1	CASE- FRONT HALF
2	1	3008065TC3	CASE - BACK HALF
3	1	3008031T01	OUTPUT FLANGE
4	1	3008039T01	OUTPUT SEAL PLATE
5	1	3008085001	INPUT GEAR 1.5 RATIO
		3008085002	INPUT GEAR 1.25 RATIO
		3008085003	INPUT GEAR 2.0 RATIO
		3008085004	INPUT GEAR 1.76 RATIO
6	1	3008070T01	OUTPUT GEAR 1.5 RATIO
		3008070T02	OUTPUT GEAR 1.25 RATIO
		3008070T03	OUTPUT GEAR 2.0 RATIO
		3008070T04	OUTPUT GEAR 1.76 RATIO
7	1	2000133075	FRONT INPUT BEARING
8	1	2000133074	FRONT INPUT BEARING CUP
9	1	3000133003	FRONT OUTPUT BEARING
10	1	3000133005	FRONT OUTPUT BEARING CUP
11	2	2002043001	DOWEL PIN
12	1	3000133001	REAR INPUT GEAR BEARING

VIEW #	QTY	PART NUMBER	DESCRIPTION
13	1	3000133002	REAR INPUT GEAR BEARING CUP
14	1	2000133073	REAR OUTPUT GEAR BEARING
15	1	2000133072	REAR OUTPUT GEAR BEARING CUP
16	1	3005044001	INPUT GEAR SEAL
17	1	3005044002	FRONT OUTPUT GEAR SEAL
18	1	2000044003	REAR OUTPUT GEAR SEAL
19	1	3005037006	INPUT GEAR BEARING SHIM KIT
20	1	3005037007	OUTPUT GEAR BEARING SHIM KIT
21	1	3008052002	PIPE PLUG (MAGNETIC)
22	8	3008183001	CASE BOLTS 3/8-16 X 2.25 LG.
23	1	3008052001	PIPE PLUG (ZINC ANODE)
24	12	3006183005	SEAL PLATE AND FLANGE BOLTS
			5/16-18 X .75 LONG
25	1	3008559001	OIL DIP STICK
26	1	A4740G	BREATHER
27	1	3008045001	CASE GASKET
28	1	2000141500	O-RING

71LVTS V-DRIVE

VIEW #	QTY	PART NUMBER	DESCRIPTION
1	1	30080650C1	CASE- FRONT HALF
2	1	3008065TC3	CASE - BACK HALF
3	1	3008031T01	OUTPUT FLANGE
4	1	3008039T01	OUTPUT SEAL PLATE
5	1	3018085001	INPUT GEAR 1.50 RATIO
		3018085002	INPUT GEAR 1.25 RATIO
6	1	3018070T01	OUTPUT GEAR 1.50 RATIO
		3018070T02	OUTPUT GEAR 1.25 RATIO
7	1	2000133075	FRONT INPUT BEARING
8	1	2000133074	FRONT INPUT BEARING CUP
9	1	3000133003	FRONT OUTPUT BEARING
10	1	3000133005	FRONT OUTPUT BEARING CUP
11	2	2002043001	DOWEL PIN
12	1	3000133001	REAR INPUT GEAR BEARING
13	1	3000133002	REAR INPUT GEAR BEARING CUP
14	1	2000133073	REAR OUTPUT GEAR BEARING

VIEW #	QTY	PART NUMBER	DESCRIPTION
13	1	3000133002	REAR INPUT GEAR BEARING CUP
14	1	2000133073	REAR OUTPUT GEAR BEARING
15	1	2000133072	REAR OUTPUT GEAR BEARING CUP
16	1	3005044001	INPUT GEAR SEAL
17	1	3005044002	FRONT OUTPUT GEAR SEAL
18	1	2000044003	REAR OUTPUT GEAR SEAL
19	1	3005037006	INPUT GEAR BEARING SHIM KIT
20	1	3005037007	OUTPUT GEAR BEARING SHIM KIT
21	1	3008052002	PIPE PLUG (MAGNETIC)
22	8	3008183001	CASE BOLTS 3/8-16 X 2.25 LG.
23	1	3008052001	PIPE PLUG (ZINC ANODE)
24	12	3006183005	SEAL PLATE AND FLANGE BOLTS
			5/16-18 X .75 LONG
25	1	3008559001	OIL DIP STICK
26	1	A4740G	BREATHER
27	1	3008045001	CASE GASKET
28	1	2000141500	O-RING

V-Drive Gasket and Seal Kit (Front Mount Coupling Only)

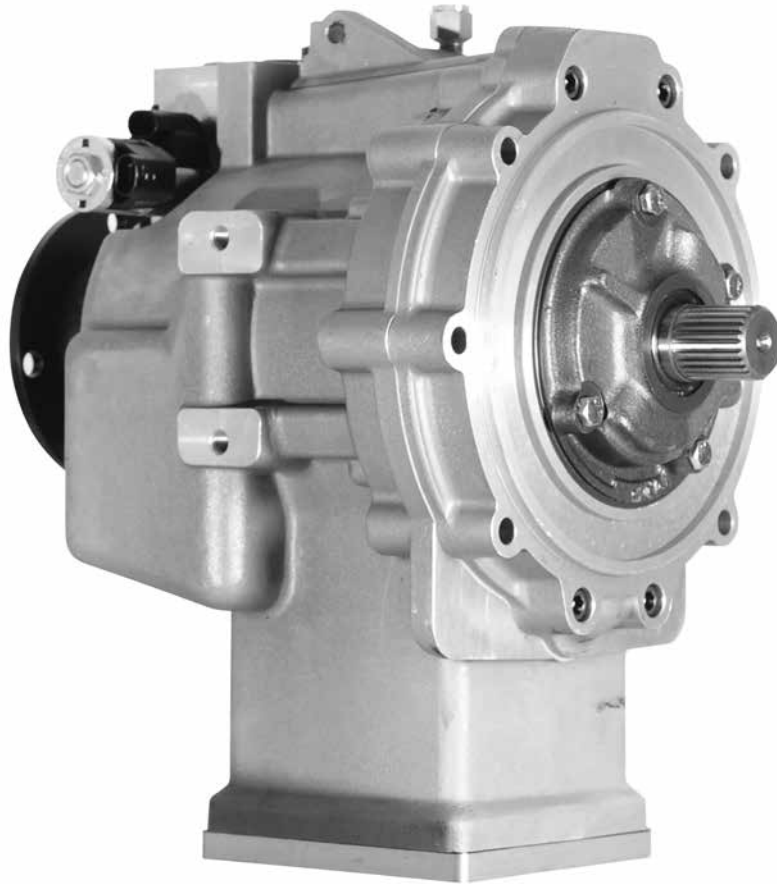
Index No.	Part Number	Description	Qty.
	3008420003	V-DRIVE GASKET AND SEAL KIT	
		MODEL 3008 AND 3019 MODELS ONLY	
	3008045001	GASKET	1
	3005044002	OUTPUT SEAL	1
	3005044001	INPUT SHAFT SEAL	1

V-Drive Gasket and Seal Kit (Thru Shaft Coupling Only)

Index No.	Part Number	Description	Qty.
	3008420003	V-DRIVE GASKET AND SEAL KIT	
		MODEL 3008 AND 3019 MODELS ONLY	
	3008045001	GASKET	1
	3005044002	FRONT OUTPUT SEAL	1
	2000144003	REAR OUTPUT SEAL	1
	3005044001	INPUT SHAFT SEAL	1

SEGMENT C

72LH & 72LHP



The following international symbols are used in this service manual.

⚠ WARNING This symbol warns of possible personal injury

⚠ CAUTION This symbol warns of possible damage to transmissions.

OEM Original Equipment Manufacturer (Boat/Engine Manufacturer)

STEP 1. If removed, install the following parts in case. Install orfis in back of housing under rear bearing. Press bearing into case and retain with retainer ring. Install all plugs and fittings into top of housing. See chart for torque specs.

NOTE: Apply Loctite 565 thread sealant to all plugs.

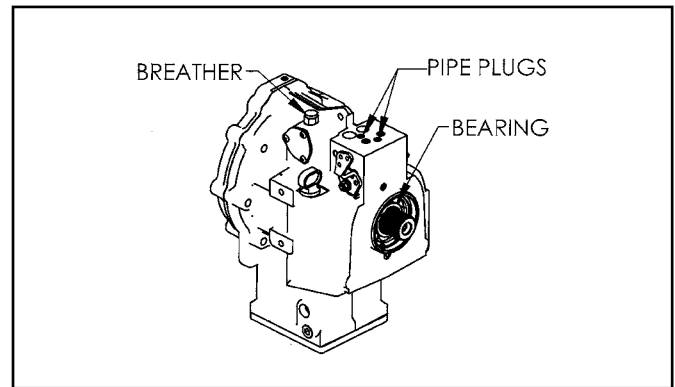
STEP 2. Install soil pick up scree. Use vasaline on o-ring prior to install insert oil pick up screen. Install cover gasket and install bottom plate.

Use loctite 242 on bolt thread and torque (8) bolts to spec. See chart for torque specs.

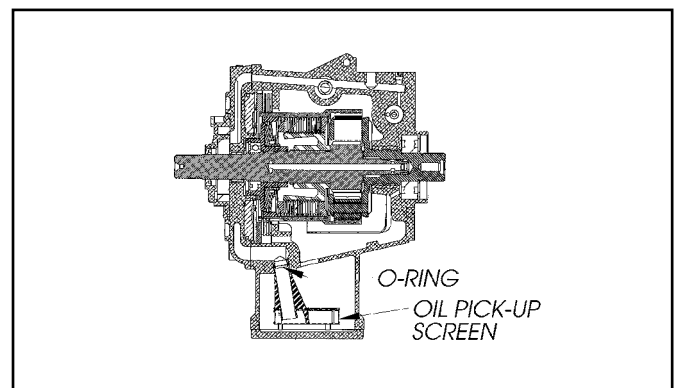
STEP 3. Install oil baffle in housing and retain with 2 screws.

STEP 4. Install pinion carrier assembly into housing. Lubricate sealing rings prior to assembly. Be sure sealing rings are locked into position. Oil sealing rings must spin freely in grooves. Once pinion carrier is pressed against bearing shoulder install retainer ring onto shaft. (72LHP Only)

NOTE: 72LH models Do not use a retainer ring on the output shaft. The carrier is retained by the output shaft coupling and nut.



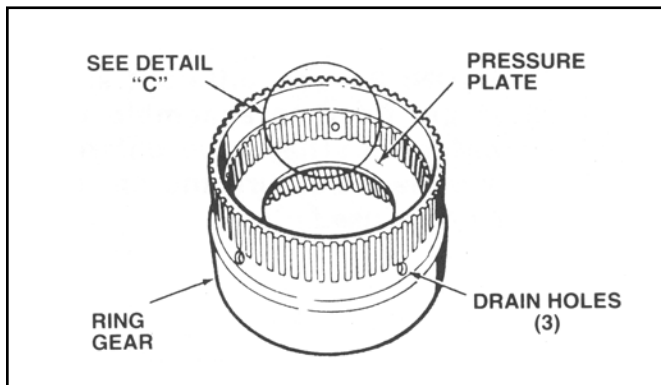
72LHP Case Assembly



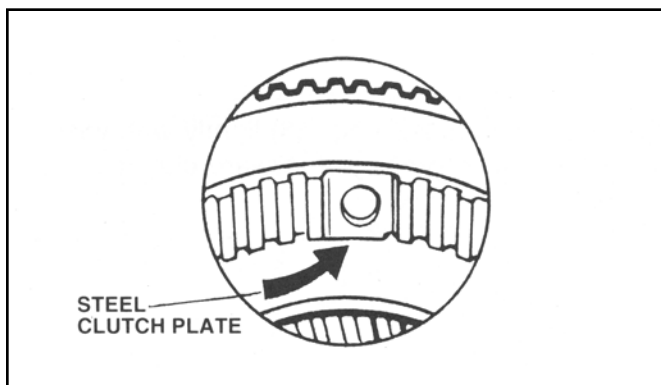
Oil Screen Assembly

STEP 5. Starting with a friction clutch plate , alternately stack friction clutch plates and steel clutch plates .

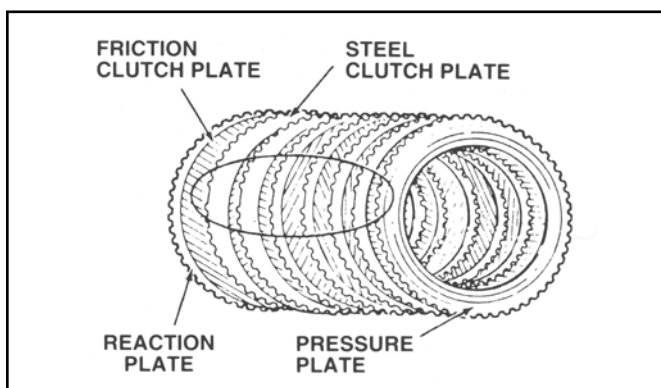
Steel clutch plates are designed with 3 missing teeth 120° apart. When installed in a ring gear, they should be installed with the missing teeth aligned with the 3 large drain holes as shown in detail "C".



Forward Clutch Pack Arrangement: Figure A

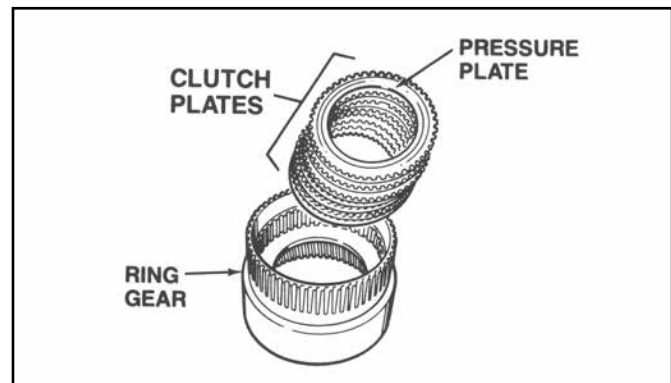


Detail C



Forward Clutch Pack Arrangement: Figure B

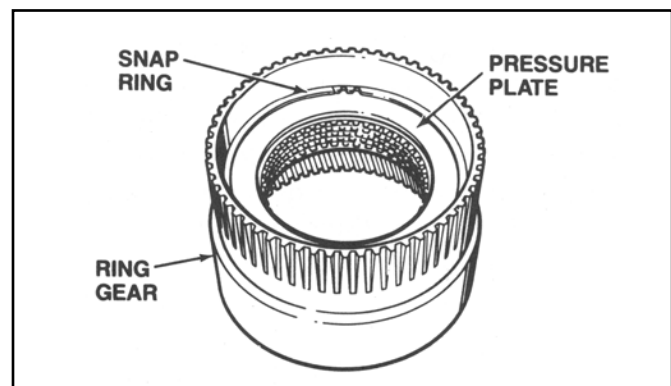
STEP 6. Install Clutch plates and pressure plate in ring gear.



Forward Clutch Pack Assembly

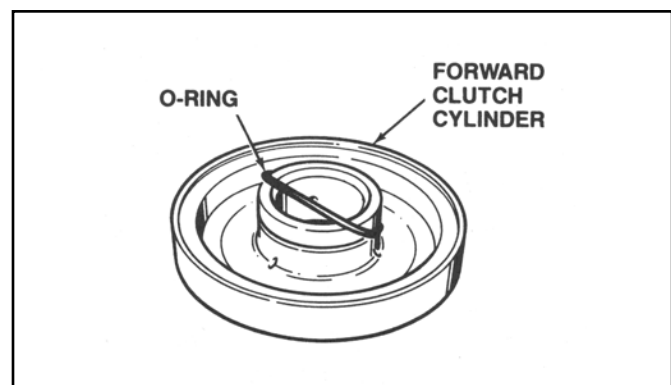
STEP 7. Install spacer ring 4755 in ring gear.

CAUTION: Several different snap rings are used to assemble the clutch group. They have different thickness. Be sure the correct snap ring is used.



Snap Ring Installation

STEP 8. Lubricate O-ring lightly with vasoline and install in groove of forward clutch cylinder.



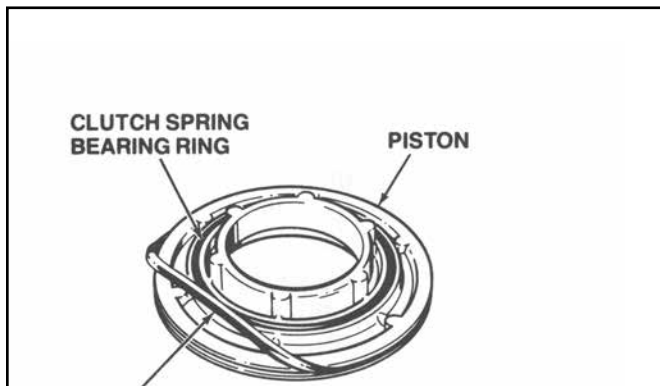
O-Ring Installation

STEP 9. Lubricate clutch spring bearing ring and piston sealing ring with vasoline.

Install clutch spring bearing ring in groove on piston face.

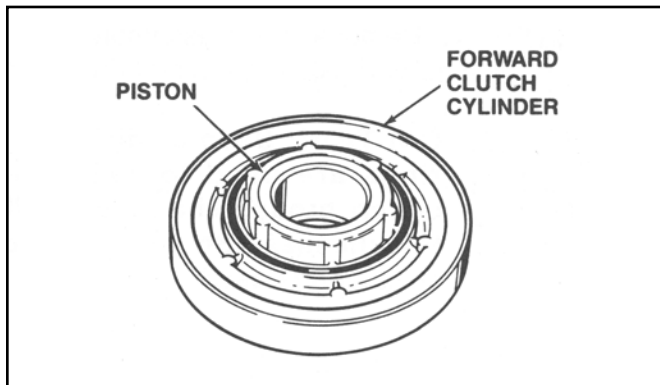
Install piston sealing ring in outer groove of piston.

NOTE: Check that piston sealing ring is not twisted, cut or deformed. Replace if damaged.



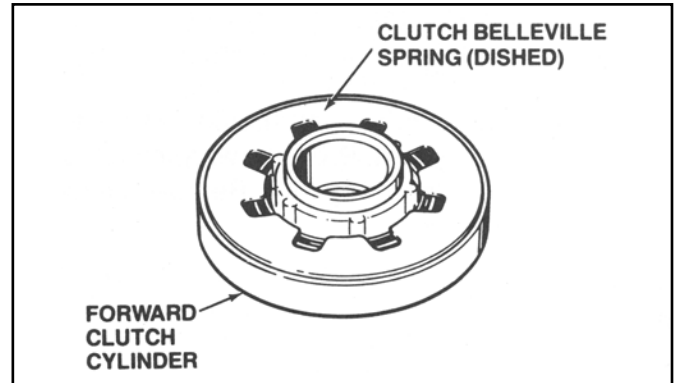
Clutch Ring Installation

STEP 10. Install piston in forward clutch cylinder.



Piston Installation

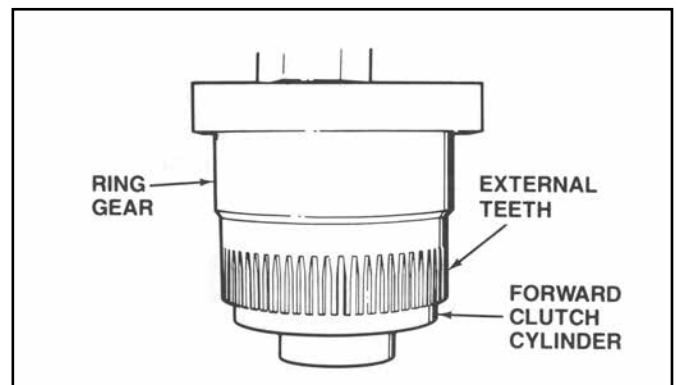
STEP 11. Place clutch Belleville (dish) spring inside rim of forward clutch cylinder. Spring is dished. The inside of the spring should be lower than the outside.



Clutch Spring Assembly

STEP 12. Install ring gear over forward clutch cylinder, with piston and spring facing up. Press ring gear down over forward clutch cylinder.

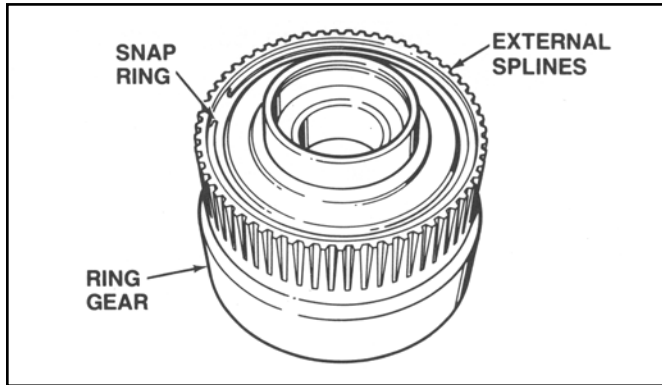
CAUTION: Check to see that clutch spring bearing ring is still seated in the groove of clutch piston.



Forward Clutch Cylinder Installation

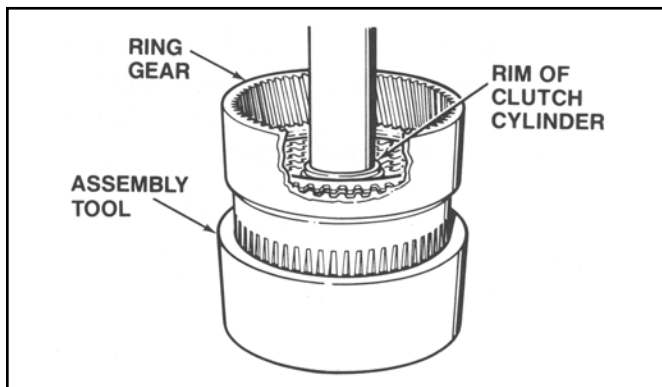
STEP 13. Remove clutch assembly from press. Install snap ring in groove of ring gear. (Snap ring 4822)

CAUTION CAUTION: Several different snap rings are used to assemble the clutch group. They have different thicknesses. Be sure the correct snap ring is used.



Snap Ring Installation

STEP 14. Place ring gear in press with external splines facing down. Assembly tool should support the ring gear only. The forward clutch cylinder should not be touching the assembly tool. Press forward clutch cylinder against snap ring. Remove clutch assembly from press.



Compressing Clutch Pack

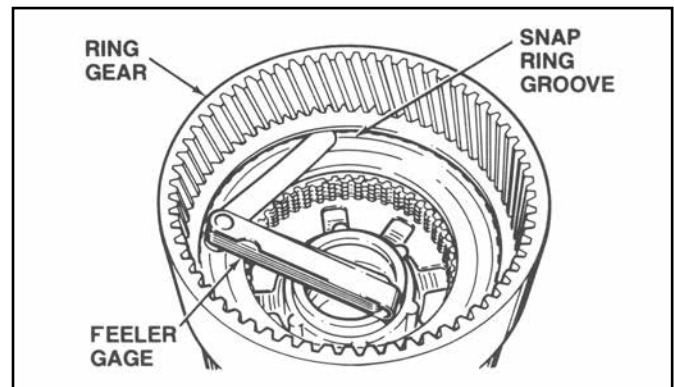
STEP 15. The following instructions are for the 72C models. Clutch pack clearance is not adjustable on 71C models. The clearances shown for 71C models are for reference only.

Push down, by hand, on clutch plates. Measure snap ring gap. Select proper thickness snap ring or combination of snap rings to set clutch pack clearance. Refer to chart below. More than one snap ring may be required.

Clutch End Play Chart

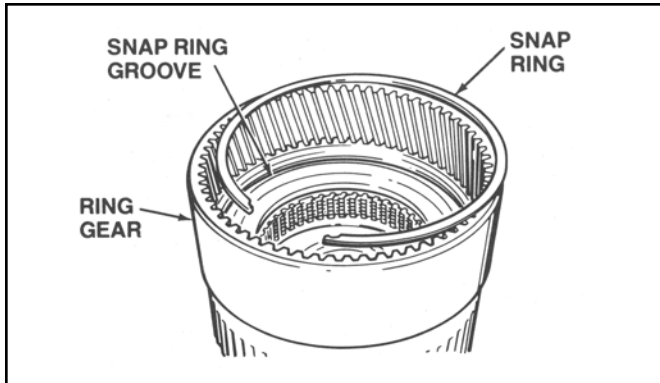
Model	Assembly Number	Clutch End Play
72LH	3010	.040/.055
72LHP	3009	.050/.060

Part Number	Snap Ring Thickness	
	in.	mm
10-00-139-048	.033 - .037	.84 - .094
10-00-139-049	.050 - .054	1.27 - 1.37
4768	.050 - .054	1.3 - 1.4
10-00-139-018	.062 - .066	1.6 - 1.7
4768A	.074 - .078	1.9 - 2.0
4768B	.096 - .100	2.4 - 2.5



Snap Ring Selection

STEP 16. Install selected snap ring(s) in groove of ring gear. Repeat step till proper clutch end play is achieved.



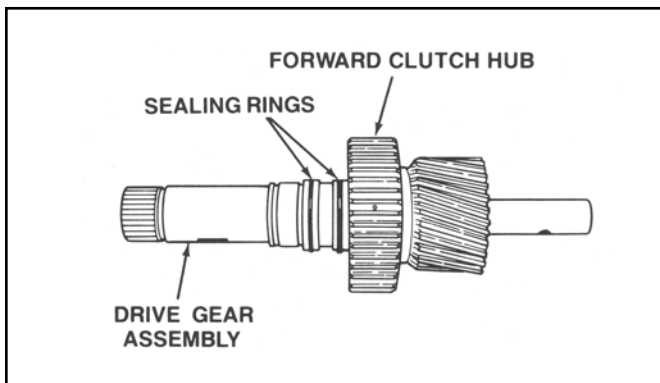
Snap Ring Assembly

STEP 17. If removed, press forward clutch hub on drive gear assembly and against shoulder.

Install snap ring in groove of drive gear assembly.

Lubricate sealing rings with vasoline and install in grooves of drive gear assembly.

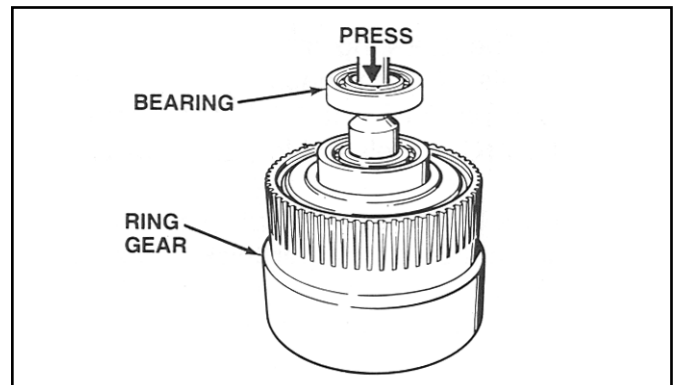
Compress each sealing ring until it locks in place.



Sealing Ring Installation

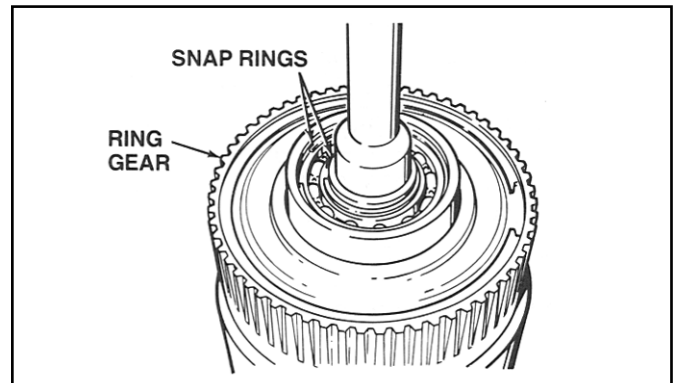
STEP 18. Install drive gear assembly in clutch assembly. Slide bearing down drive gear assembly.

Place complete assembly in press. Press bearing into drive gear assembly until seated against shoulder.



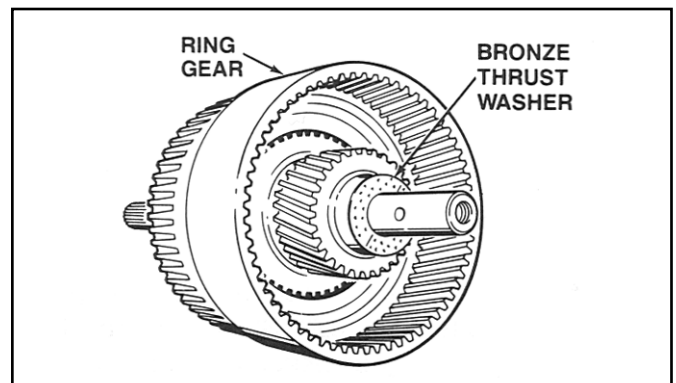
Bearing Installation

STEP 19. Install snap rings in grooves of drive gear assembly and forward clutch cylinder.



Snap Ring Installation

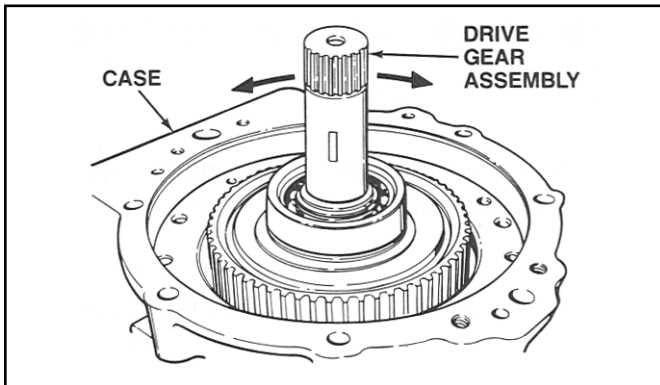
STEP 20. Apply vasoline to bronze thrustwasher. Install over end of shaft and against face of gear.



Thrustwasher Assembly

STEP 21. Install clutch and drive gear assembly in case.

Rotate clutch and drive gear assembly back and forth to engage ring gear teeth with pinion gear teeth.



Clutch and Drive Gear Installation

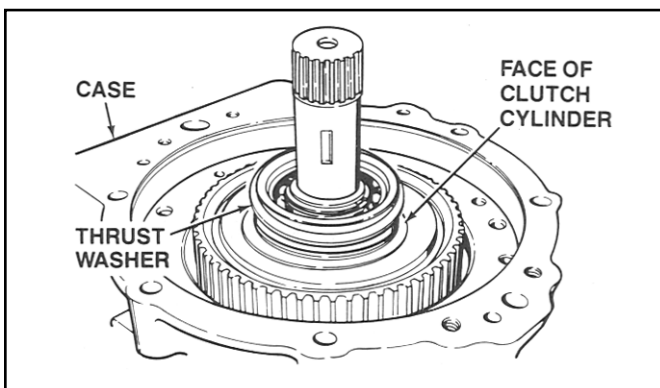
STEP 22. If original case and clutch cylinder are used, install thrustwasher on face of clutch cylinder.

If new components are used, measure to select proper thrustwasher.

Position case vertically as shown. Measure from face of case, without gasket, to face of clutch cylinder.

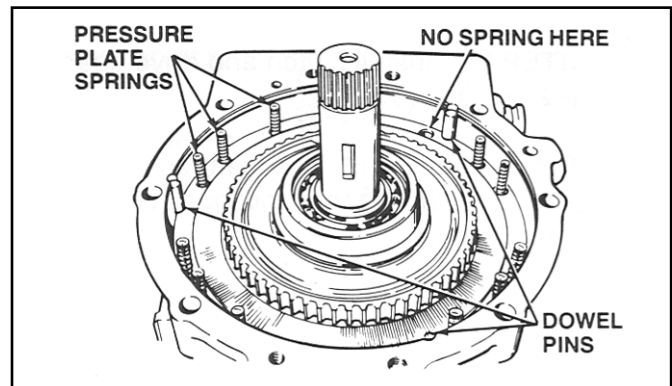
When dimension is 0.424 inch (10.77mm) or less, use 71-15B thrustwasher.

When dimension is greater than 0.424 inch (10.77mm), use 1016-193-001 thrustwasher.



Thrustwasher Installation

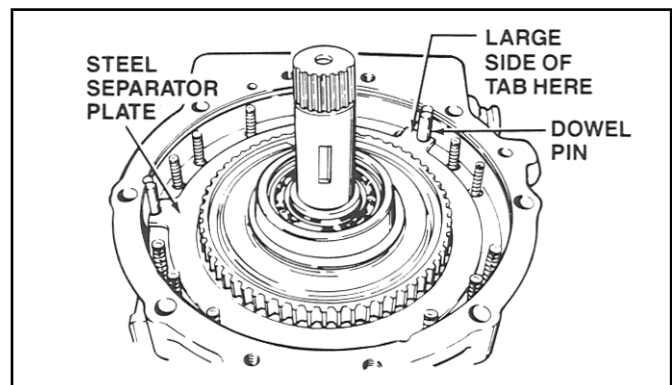
STEP 23. Install three dowel pins and eleven pressure plate springs in case.



Spring and Dowel Pin Installation

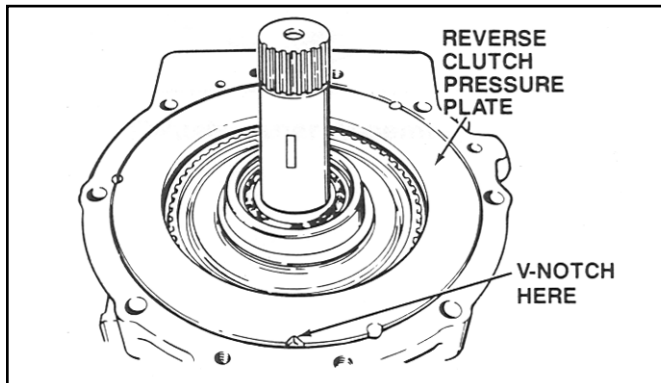
STEP 24. Install one steel separator plate in case with large part of tab to left of dowel pin.

Alternately stack remaining reverse clutch friction plates and steel separator plates in case (see page 34).



Reverse Clutch Pack Installation

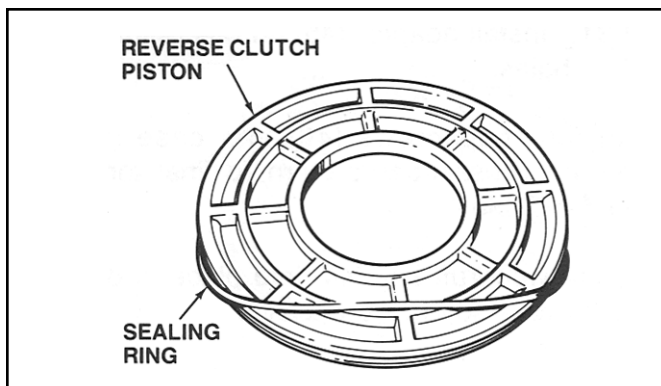
STEP 25. Install reverse clutch pressure plate in case with three half moons aligned with dowel pins. Be sure all springs are seated in their holes.



Pressure Plate Installation

STEP 26. Lubricate sealing ring with vasoline and install in groove of reverse clutch piston.

NOTE: be sure sealing ring is not twisted, cut or distorted. Replace if damaged.



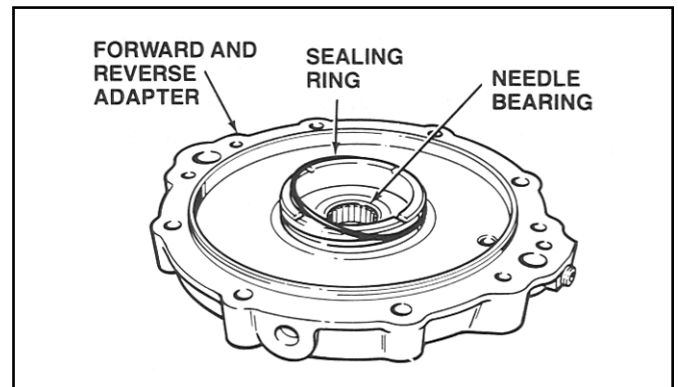
Sealing Ring Assembly

STEP 27. If removed, press needle bearing into adapter. Needle bearing must be installed flush against bore shoulder of adapter.

Lubricate O-ring with vasoline and install in groove of adapter.

NOTE: Be sure O-ring is not twisted, cut or distorted. Replace if damaged.

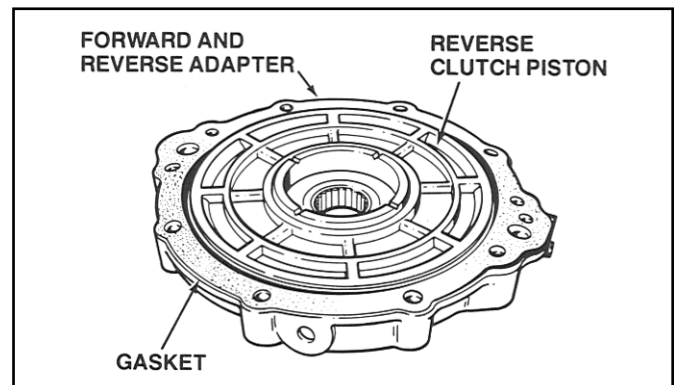
If removed, install dryseal plug in adapter.



Sealing Ring Installation

STEP 28. Install reverse clutch piston in adapter.

Lightly coat gasket with vasoline and place on adapter.

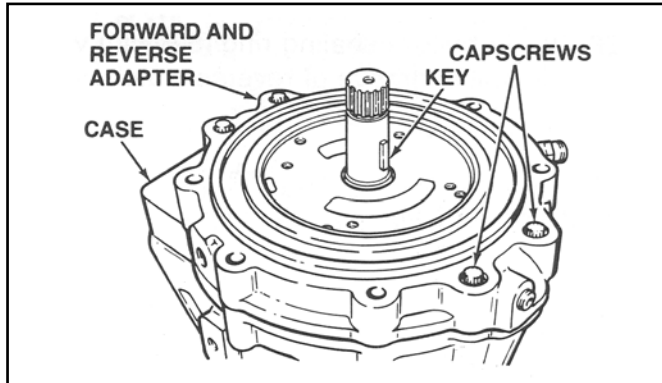


Reverse Clutch Piston Assembly

STEP 29. Install adapter on case and align bolt holes.

Thread four capscrews into case. Tighten in a criss-cross pattern to final torque specified in Table 4.

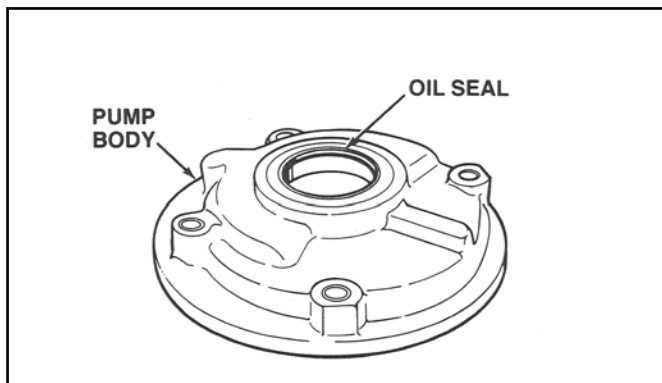
Lightly tap dowel key into place in drive gear with a soft-faced mallet.



Adapter Installation

STEP 30. Press oil seal into pump body. Due to seal retainer lip, seal must be pressed from back side.

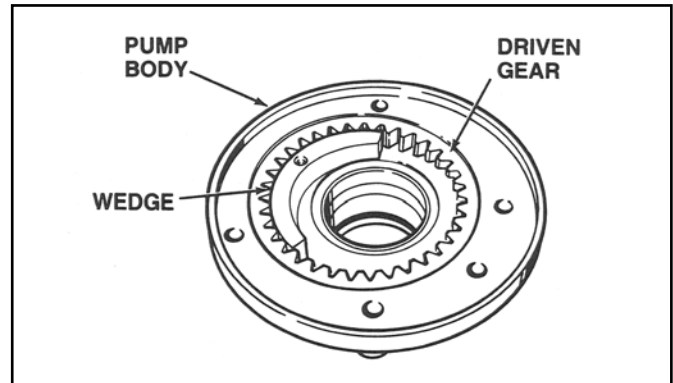
CAUTION: Oil Seal must be installed dry. Lubricants can damage rubber coating.



Oil Seal Installation

STEP 31. Install driven gear in pump body.

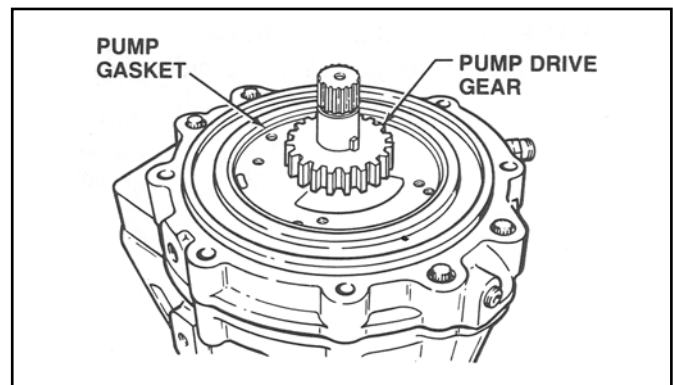
NOTE: Pump gear should be installed the same side down as removed. Fill cavity with ATF to lubricate gears.



Pump Driven Gear Assembly

STEP 32. Lubricate pump gasket with vasoline and install in groove of adapter.

Install pump drive gear onto input shaft. Check that pump drive gear locates freely on dowel key and shaft.

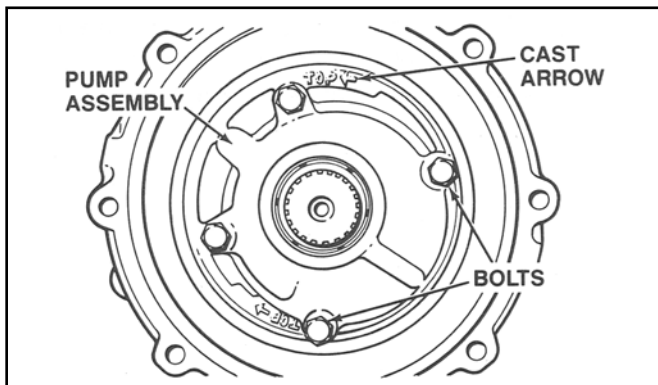


Pump Gasket Installation

STEP 33. Install pump assembly on top of adapter and align bolt holes.

CAUTION: Position pump housing with cast arrow at top pointing in the same direction as engine rotation.

Thread four bolts into adapter. Tighten in a criss-cross pattern to final torque specified in Table 4.

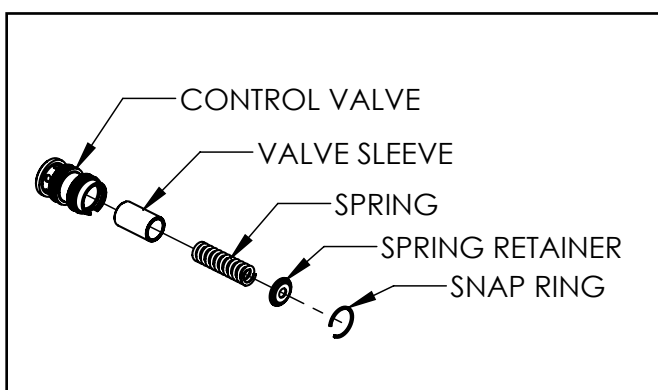


Pump Assembly Installation

STEP 34. Assemble pressure relief valve assembly. Refer to figure below.

Lubricate O-rings with vasoline and install on end of valve assembly.

NOTE: Gap in snap ring must be aligned with notch in control valve.



PRV Valve Assembly

STEP 35. Lubricate control valve O.D. Slide valve assembly into side of case.

STEP 36. Install valve cover as follows:

Position gasket on case. Place valve cover over gasket and align bolt holes.

Thread three bolts into case. Tighten bolts in a criss-cross pattern to final torque specified in Table 4.

If removed, lubricate O-ring with vasoline and install in groove of neutral switch. Thread neutral switch assembly into valve cover and tighten to torque specified in Table 4.

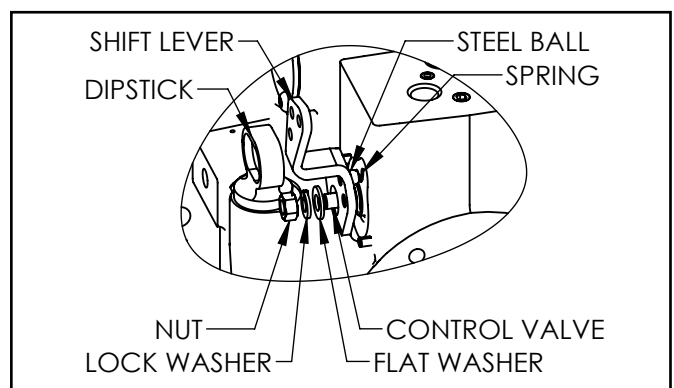
STEP 37. Manual Shift:

Install shift spool in housing. Lubricate O-ring before installing with spool in position insert retainer ring into groove in housing.

Lubricate poppet spring and hole in case with grease. Place poppet spring and steel ball in case.

Slide shift lever over end of control valve assembly and against steel ball. Rotate shift lever to engage steel ball in hole of shift lever.

Hold shift lever against steel ball. Install washers and thread nut on valve assembly. Tighten nut to torque specified in Table 4.



Shift Lever Assembly

STEP 37A. Electric Shift:

Be sure cartridge screen is clean. Insert cartridge into port and torque to spec in Table 4.

Slide coils over cartridge stem. Be sure you have the spacer washer between the 2 coils. Position coils as needed and tighten nut to spec in Table 4.

STEP 38. For 72LH Only. Slide coupling on output shaft. Thread nut on output shaft. Tighten nut to torque shown in Table 4.

For 72LHP. Slide coupling onto shaft. Insert alignment washer and bolt. See torque spec shown in Table 4.

STEP 39. Install dipstick in side of case. Turn handle until snug. Do not over tighten.

CAUTION CAUTION: After a transmission failure, the cooler should be replaced and all lines flushed.

Align input shaft spline with damper plate.

Assemble transmission to engine and then install bolts. Do not use bolts to draw transmission against engine.

WARNING WARNING: Check the shift lever at the helm to see that forward position is also forward position at the transmission shift lever. (Transmission should not be running in reverse when boat is going forward.)

Adjust the shift cable so the holes in the shift lever are centered over the detent ball at each selector location. See figure 7A.

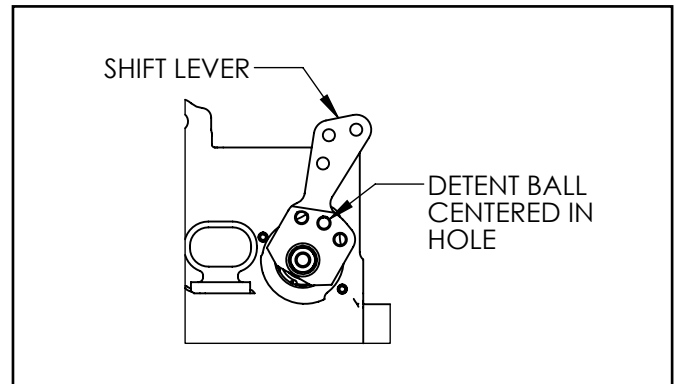
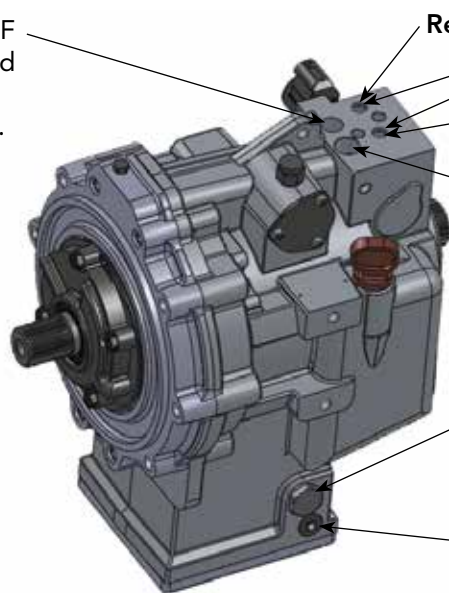


Figure 7A. Shift Cable Adjustment

Read OEM manual for complete installation instructions.

Connect oil line to oil to the cooler outlet. See Figure 7B.

Temp Sensor Port: 3/8-18 NPSF thread. Accommodates standard 3/8 NPT thread sensor. Can be used for mainline pressure port.



Pressure Sensor Ports: Plug if not using sensors. (SAE J1926-4 7/16-20 thd.)

Cooler Out Port: 1/2-14 NPSF thd. Accommodates standard 1/2-14 NPT fitting.

From Cooler Port: 1/2-14 NPT thd. Accommodates standard 1/2-14 NPT fitting.

Oil Drain Hole: 1/2-14 NPSF thd.

72LHP and 72LH (Models 3009 and 3010)

Pressure Readings

Pressures should read as follows with transmission temperature of 120° – 130°F.

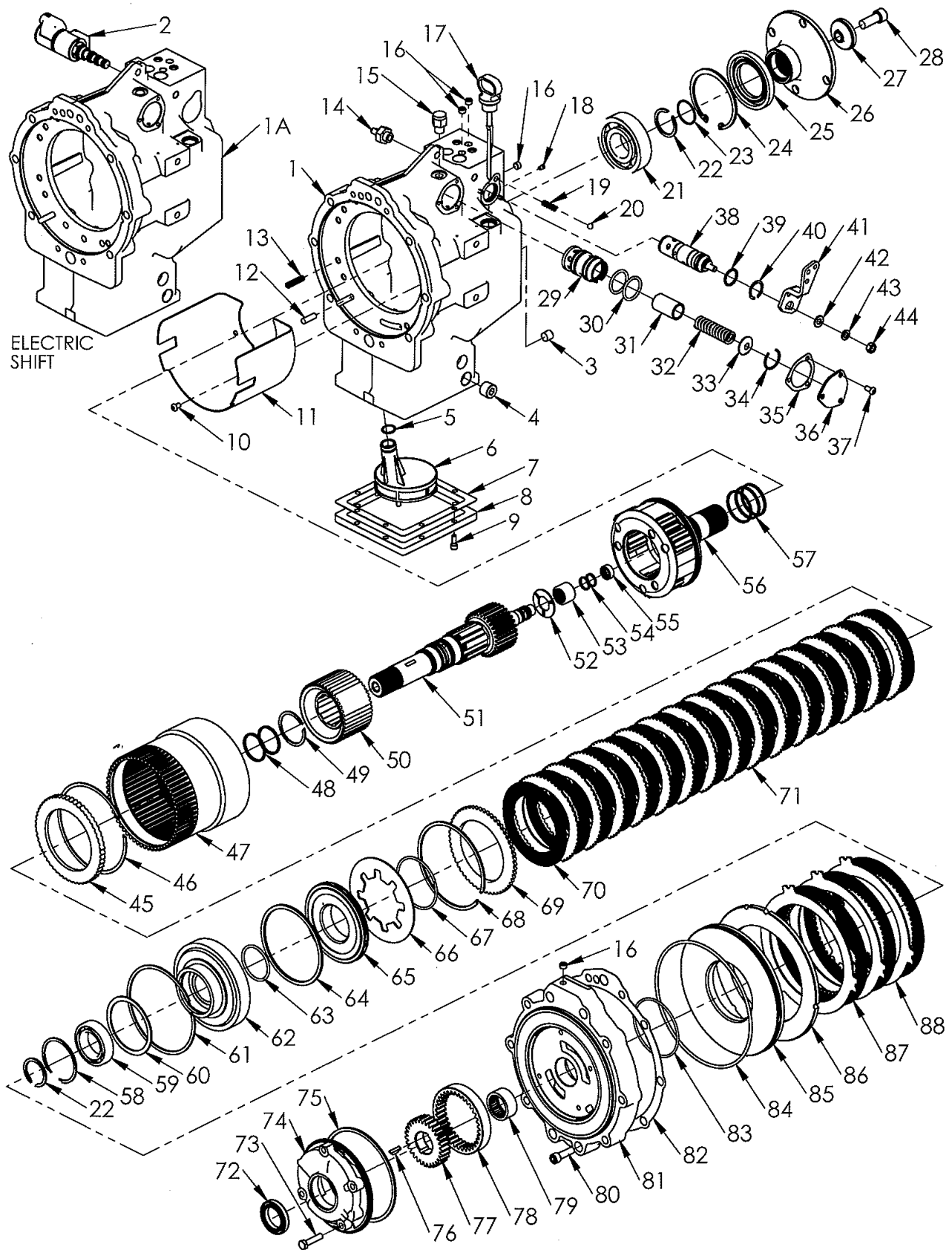
Engine RPM	Neutral Line		Reverse Clutch		Mainline Reverse Pressure		Mainline Forward Pressure		GPM Cooler Flow Reverse		GPM Cooler Flow Forward	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
700	160	215	140	225	140	205	145	210	.25	2.0	.25	2.0
2000	--	--	175	235	175	235	175	225	4.0	10.0	4.0	10.0
3500	--	--	--	--	--	--	190	245	--	--	8.0	13.5

TABLE 4. Bolt and Fastener Torque Specs. (Non Lubricated)

72LH and 72LHP (Models 3009 and 3010)

Part Number	Description	FT-LB	Nm
Main Housing			
9418892	5/16-24 Shift Lever Nut	8-11	11-15
3009183021	1/2-20 X 1.25 LG SOC HD CAP SCREW	120-130	162-176
10-00-149-034	Coupling Nut (3010 model only)	160-260	217-353
10-00-183-021	5/16-18 X 1" Hex Head Bolt	15-16	20-21
20-00-183-017	3/8-16 X 1-1/4 Capscrew	32-36	43-48
4885B	3/4-14 Dryseal Bushing	20-30	27-40
444688	1/8-27 Pipe Plug	7-12	9-16
10-00-640-004	Neutral Switch	20-22	27-29
30-00-064-001	Neutral Switch	20-22	27-29
433648	1/4-20 X Button Head Bolt	6-8	8-10
30-09-183-001	1/4-20 X .62 Socket HD Cap Screw	6-8	8-10
30-00-072-001	1/4-18 NPSF Breather	14-24	19-32
Electric Shift Option			
30-09-140-001	3/4-16 Solenoid Stem	20	27
	Coil Nut	5	7

Pipe Plugs		
Thread Size	Torque FT-LB	Nm
1/8-27 Dryseal NPSF	7-12	9-16
1/4-18 Dryseal NPSF	14-24	19-33
3/8-18 Dryseal NPSF	17-27	23-36
3/4-18 Dryseal NPSF	25-35	34-48



Item No.	Part Number	Description	Qty.
1	3009065MC1	MAIN CASE MANUAL SHIFT	1
1A	3009065ECI*	MAIN CASE ELECTRIC SHIFT	1
1B	3009065MC6	MAIN CASE MANUAL SHIFT MERC 6 BC	1
1C	3009065EC6	MAIN CASE ELECTRIC SHIFT MERC 6 BC	1
2	3009140001*	SOLENOID	1
3	413281	1/4-18 NPTF PIPE PLUG	1
4	3008052002	PIPE PLUG	1
5	4804M	O-RING	1
6	10-16-238-001	SUPM SCREEN	1
7	3009045001	GASKET - OIL PAN BOX COVER	1
8	30090130C1	OIL PAN COVER	1
9	3009183001	BOLT	8
10	433638	BOLT, HEX SOCKET 1/4-20 X 3/8	2
11	3009036001	OIL BAFFLE	1
12	10-00-043-031	DOWEL PIN	3
13	71-97	PRESSURE PLATE SPRING	11
14	3000640001	NEUTRAL SWITCH - WIRE LEADS	1
14A	10--00-140-007	NEUTRAL SWITCH WITH SCREW LEADS	1
15	3000072001	BREATHER	1
16	444688	1/8 NPT PIPE PLUG	4
17	3009559001	DIPSTICK	1
18	3009183004	ORIFICE	1
19	71-42	SPRING - POPPET	1
20	453632	STEEL BALL (5/16)	1
21	20-00-130-001	BEARING - ANNULAR	1
22	4559A	SNAP RING MODEL 3009 ONLY	2
23	3009141001	O-RING MODEL 3009 ONLY	1
24	30-06-139-002	RING - RETAINING	1
25	3009044002	OIL SEAL	1
26	3009031001	COUPLING - OUTPUT 3009 MODEL ONLY - 1480 FLANGE	1
26A	3009031002	COUPLING - OUTPUT 3009 MODEL ONLY - 1350 FLANGE	1
26B	3010031001	5" PROP SHAFT COUPLING MODEL 3010 ONLY	1
26C	3010031002	COUPLING - OUTPUT 3010 MODEL ONLY - 1350 FLANGE	
26D	3010031003	COUPLING - OUTPUT 3010 MODEL ONLY - 1480 FLANGE	
26E	1000149034	COUPLING NUT FOR MODEL 3010 ONLY	
27	3009047001	SPACER	1
28	3009183021	BOLT, 1/2-20 X 1.25	1
29	3009239002	VALVE - SLEEVE	1
29A	3009739002	VALVE ASSEMBLY	
30	3007141001	O-RING	2
31	71-243	VALVE - PRESSURE REGULATOR	1
32	71-242	VALVE - SPRING	1
33	71-246	SPRING RETAINER	1
34	4821	SNAP RING	1
35	71-14	VALVE COVER GASKET	1

Item No.	Part Number	Description	Qty.
36	3006039001	VALVE COVER	1
37	433648	SCREW	3
38	3006239005	CONTROL VALVE	1
39	3006141001	O-RING	1
40	3006139001	SNAP RING	1
41	71-79B	SHIFT LEVER	1
42	103340	FLAT WASHER (5/16)	1
43	108579	LOCK WASHER (5/16)	1
44	9418892	HEX NUT (5/16-24)	1
45	5L-67	REAR CLUTCH PRESSURE PLATE	1
46	4768	RING - SHIM (SELECTIVE FIT)	1
46A	4768A	RING - SHIM (SELECTIVE FIT)	
46B	4768B	RING - SHIM (SELECTIVE FIT)	
46C	1000139018	RING - SHIM (SELECTIVE FIT)	
46D	1000139019	RING - SHIM (SELECTIVE FIT)	
46E	1000139048	RING - SHIM (SELECTIVE FIT)	
47	3009162001	RING GEAR MODEL 3009 ONLY	1
47A	3010162001	RING GEAR MODEL 3010 ONLY	1
48	4806J	SEALING RING	2
49	3009139001	SNAP RING	1
50	3009090001	CLUTCH HUB MODEL 3009 ONLY	1
50A	3010090001	CLUTCH HUB MODEL 3010 ONLY	1
51	3009085001	DRIVE GEAR MODEL 3009 ONLY	1
51A	3010085001	DRIVE GEAR MODEL 3010 ONLY	1
52	71-17	WASHER - THRUST	1
53	20-00-132-001	BEARING - 7/8 ID	1
54	4806S	RING - OIL SEALING	2
55	20-00-132-200	BEARING - 5/8 ID	1
56	3009659002	CARRIER ASSEMBLY MODEL 3009 ONLY	1
57	20-00-016-050	SEALING RING	3
58	4766B	SNAP RING	1
59	10-00-130-016	BEARING - ANNULAR	1
60	71-15B	WASHER - THRUST	1
	1016193001	WASHER - THRUST (OPTIONAL)	
61	4822	SNAP RING - RING GEAR	1
62	3009014001	CLUTCH PISTON HOUSING	1
63	5M-122	O-RING	1
64	3009044001	PISTON SEALING RING	1
65	3009124001	PISTON - FORWARD CLUTCH	1
66	3-37	CLUTCH BELLEVILLE SPRING	1
67	5C-33	CLUTCH PISTON WEAR RING	1
68	4755	SNAP RING	1
69	3009062001	CLUTCH PRESSURE PLATE	1
70	3009166001	CLUTCH DISC (PAPER) MODEL 3009 ONLY	16
70A	3009166001	CLUTCH DISC (PAPER) MODEL 3010 ONLY	12
70B	3000166001	CLUTCH DISC (BRONZE) OPTIONAL	

Item No.	Part Number	Description	Qty.
71	10-16-166-001	PLATE - OUTER CLUTCH (MODEL 3009 ONLY)	15
71A	10-16-166-001	PLATE - OUTER CLUTCH (MODEL 3010 ONLY)	11
72	10-00-044-014	OIL SEAL	1
73	20-00-183-005	BOLT, HEX - 5/16-18 X 1 3/8	4
74	71C-60	FRONT PUMP HOUSING	1
75	3-61	PUMP GASKET	1
76	3009043001	DOWEL MODEL 3009 ONLY	1
76A	4873	KEY MODEL 3010 ONLY	1
77	71-64-1	FRONT PUMP DRIVE GEAR MODEL 3009 ONLY	1
77A	71-64	FRONT PUMP DRIVE GEAR MODEL 3010 ONLY	1
78	3-63A	FRONT PUMP DRIVEN GEAR	1
79	4840D	NEEDLE BEARING	1
80	2000183017	SHCS 3/8-16 X 1.25	4
81	3006172001	ADAPTER - MACHINED	1
82	30-06-045-003	GASKET - CASE & ADAPTER	1
83	4804G	ADAPTOR O-RING	1
84	4805A	REV. PISTON SEALING RING	1
85	71-35	REVERSE CLUTCH PISTON	1
86	71-71	REVERSE CLUTCH PRESSURE PLATE	1
87	3000166002	BRONZE HEAVY DUTY REVERSE CLUTCH PLATE (OPTIONAL)	3
87A	3009166002	PAPER HIGH PERFORMANCE REVERSE CLUTCH PLATE	3
88	72-176	OUTER CLUTCH PLATE	3

*OPTIONAL ELECTRIC SHIFT COMPONENTS

FORWARD CLUTCH KITS

FORWARD CLUTCH PACK KIT (3009 MODEL ONLY)

Item No.	Part Number	Description	Qty.
	3009410002	PAPER FWD CLUTCH PACK KIT (3009 MODEL ONLY)	
69	3009062001	CLUTCH PRESSURE PLATE	1
71	10-16-166-001	STEEL CLUTCH PLATE	15
70	3009166001	FRICTION CLUTCH PLATE (PAPER)	16
45	5L-67	REAR CLUTCH PRESSURE PLATE	1

FORWARD PAPER CLUTCH PACK KIT (3010 MODEL ONLY)

Item No.	Part Number	Description	Qty.
	3010410002	PAPER FWD CLUTCH PACK KIT (3010 MODEL ONLY)	
69	3009062001	CLUTCH PRESSURE PLATE	1
71	10-16-166-001	STEEL CLUTCH PLATE	11
70	3009166001	FRICTION CLUTCH PLATE (PAPER)	12
45	5L-67	REAR CLUTCH PRESSURE PLATE	1

FORWARD BRONZE CLUTCH PACK KIT (3010 MODEL ONLY)

Item No.	Part Number	Description	Qty.
	3010410B02	BRONZE FWD CLUTCH PACK KIT (3010 MODEL ONLY)	
69	3009062001	CLUTCH PRESSURE PLATE	1
71	10-16-166-001	STEEL CLUTCH PLATE	11
70	3000166001	FRICTION CLUTCH PLATE (BRONZE)	12
45	5L-67	REAR CLUTCH PRESSURE PLATE	1

REVERSE CLUTCH KITS

HIGH PERFORMANCE REVERSE CLUTCH

Item No.	Part Number	Description	Qty.
	3009410003	PAPER REVERSE CLUTCH KIT (3009 & 3010 MODELS)	
87	3009166002	PAPER REVERSE CLUTCH	3
88	72-176	STEEL PLATES	3

HEAVY DUTY REVERSE CLUTCH

Item No.	Part Number	Description	Qty.
	3000410008	HEAT TREATD BRONZE REVERSE CLUTCH KIT (3009 & 3010 MODELS)	
87	3000166002	HT BRONZE REVERSE CLUTCH	3
88	72-176	STEEL PLATES	3

GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT MODEL 3009 AND 3010 ONLY

Item No.	Part Number	Description	Qty.
	3009420005	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
		MODEL 3009 AND 3010 ONLY	
82	3006045003	GASKET, CASE/ADAPTOR	1
35	71-14	PRV VALVE COVER GASKET	1
7	3009045001	OIL PAN GASKET	1
72	1000044014	INPUT SHAFT PUMP SEAL	1
25	3009044002	OUTPUT SHAFT SEAL	1
84	4805A	SEALING RING	1
83	4804G	SEALING RING	1
75	3-61	PUMP GASKET SEAL	1
63	5M-122	SEALING RING	1
64	3009044001	PISTON SEALING RING	1
30	3007141001	PRV VALVE O-RING	2
54	4806S	SEALING RING	2
48	4806J	SEALING RING	2
57	2000016050	SEALING RING	3
32	3006141001	O-RING	1
5	4804M	O-RING	1
22	4559A	SNAP RING (3009 ONLY)	2
58	4766B	SNAP RING	1
61	4822	SNAP RING	1
49	3009139001	SNAP RING	1
24	3006139002	SNAP RING	1
40	3006139001	SNAP RING	1

GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT MODEL 3008 ONLY

Item No.	Part Number	Description	Qty.
	3008420002	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
		MODEL 3011 ONLY	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3008044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50	4559A	SNAP RING	1
51	4766B	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1
19	3008139001	SNAP RING	1

GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT MODEL 3007 ONLY

Item No.	Part Number	Description	Qty.
	3007420001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
		MODEL 3011 ONLY	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50	4559A	SNAP RING	1
51	4766B	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1

GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT MODEL 3018 ONLY

Item No.	Part Number	Description	Qty.
	3018420001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
		MODEL 3011 ONLY	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50A	4734	SNAP RING	1
51A	R6A-7 1/2	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	30081390012	SNAP RING	1
33	3006139001	SNAP RING	1

GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT MODEL 3019 ONLY

Item No.	Part Number	Description	Qty.
	3019420001	GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT	
		MODEL 3011 ONLY	
77	3006045003	GASKET, CASE/ADAPTOR	1
28	71-14	PRV VALVE COVER GASKET	1
67	1000044014	INPUT SHAFT PUMP SEAL	1
20	3007044001	OUTPUT SHAFT SEAL	1
79	4805A	SEALING RING	1
78	4804G	SEALING RING	1
70	3-61	PUMP GASKET SEAL	1
56	5M-122	SEALING RING	1
57	5L-36	PISTON SEALING RING	1
	3007141001	PRV VALVE O-RING	2
46	4806S	SEALING RING	2
39	4806J	SEALING RING	2
49	2000016050	SEALING RING	3
32	3006141001	O-RING	1
50A	4734	SNAP RING	1
51A	R6A-7 1/2	SNAP RING	1
54	4822	SNAP RING	1
40	4495	SNAP RING	1
18	3006139002	SNAP RING	1
33	3006139001	SNAP RING	1

GASKET, SEALING RINGS,O-RING AND OIL SEAL KIT MODEL 3019 ONLY

Item No.	Part Number	Description	Qty.
	3009420001	DANA 1480 COUPLER KIT	
26	3009031001	COUPLING	1
27	3009047001	PILOT SPACER	1
28	3009183021	BOLT 1/2-20 X 1.25 LG	1

Item No.	Part Number	Description	Qty.
	3009420003	DANA 1350 COUPLER KIT	
26	3009031002	COUPLING	1
27	3009047001	PILOT SPACER	1
28	3009183021	BOLT 1/2-20 X 1.25 LG	1

72LH AND 72LX COUPLING KIT ONLY (MODEL 3010 AND 3011)

Item No.	Part Number	Description	Qty.
	3010042004	5" PROP SHAFT COUPLING KIT	
26	3010031001	COUPLING	1
27	1000149031	COUPLING NUT	1

Item No.	Part Number	Description	Qty.
	3009420005	DANA 1350 COUPLER KIT	
26	3009031001	COUPLING	1
27	1000149031	COUPLING NUT	1

**SOLENOID SERVICE KITS
MODELS 3009 AND 3010 ONLY**

COIL KITS (COILS ONLY)

Item No.	Part Number	Description	Qty.
	3009140101	10 VOLT COILS	2
	3009140241	24 VOLT COILS	2

**SOLENOID O-RING AND SEAL KIT
MODELS 3009 AND 3010 ONLY**

Item No.	Part Number	Description	Qty.
	3009420006	FOR #8 SERIES ONLY	

**SOLENOID COIL PLUG CONNECTORS
ALL MODELS**

Item No.	Part Number	Description	Qty.
	3000140003	METRI-PAK MALE CONNECTOR WITH 12" LEADS	1

**OPTIONAL NEUTRAL SWITCH CONNECTORS
ALL MODELS**

Item No.	Part Number	Description	Qty.
	3000140004	METRI-PAK FEMALE CONNECTOR WITH 12" LEADS	1

MERC 6 ADAPTOR KIT FOR MODEL 3009 ONLY

Item No.	Part Number	Description	Qty.
	3009420002	MERC 6 ADAPTOR KIT CONSIST OF	
	3009045002	GASKET	1
	3009172001	MERC 6 ADAPTOR	1
	3009183003	BOLT 3/8-16 X 7/8 LG	3
	3009146001	STUD 7/16-14 X 4-1/8 LG	6
	179858	BOLT 7/16-14 X 1" LG	2
	3009149001	LOCK NUT 7/16-14 NYLON LOCK NUT	6
	03-0022-1	7/16 FLAT WASHER	6
	3009141002	O-RING	1
	3009141003	O-RING	1
	3009141004	O-RING	1

MERC 6 ADAPTOR KIT FOR MODEL 3010 AND 3011 ONLY

Item No.	Part Number	Description	Qty.
	3010420002	MERC 6 ADAPTOR KIT CONSIST OF	
	3009045002	GASKET	1
	3010172001	MERC 6 ADAPTOR	1
	3009183003	BOLT 3/8-16 X 7/8 LG	3
	3010146001	STUD 7/16-14 X 3-3/8	6
	179858	BOLT 7/16-14 X 1" LG	2
	3009149001	LOCK NUT 7/16-14 NYLON LOCK NUT	6
	03-0022-1	7/16 FLAT WASHER	6
	3009141002	O-RING	1
	3009141003	O-RING	1
	3009141004	O-RING	1

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Complete Line of Marine Transmissions - Electric Shift Available on Most Models

Series	Model	Description	Ratios Available
71C	1017	In-Line	1.00
71C	1017W	In-Line Wakeboard	1.00
72C	1018	High Capacity	1.00, 1.52, 1.88, 2.10, 2.57, 2.91
72V	1005	15 Degree V-Drive Cast Iron	1.21, 1.51, 1.99, 2.50
72L	3007	In Line/Wakeboard	1:1
72L-V	3008	V-Drive/Wakeboard	1.5:1, 1.25:1
72L-X	3011	High Capacity In-Line	1:1
72L-H	3010	High Performance	1:1
72L-HP	3009	High Performance	1:1
Liberty A	3001	8 Degree Down Angle Aluminum	1.00, 1.25, 1.50, 2.00, 2.50, 2.80
Liberty 6000A	3021	8 Degree Down Angle Aluminum	1.00, 1.25, 1.50, 2.00, 2.50, 2.80
Liberty V	2002	12 Degree V-Drive Aluminum	1.25, 1.51, 2.00, 2.50



1208 Old Norris Road
 Liberty, SC 29657
 PH: 864-843-9234
 FAX: 864-843-1276
 EMAIL: sales@velvetdrive.com

www.velvetdrive.com

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