SECTION 6. REPAIR OF EXTERNAL SUBASSEMBLIES



Figure 19. Exploded View of Oil Pump Assembly.

CAUTION:

Avoid contact with rotating output coupling and always shut down engine when doing even minor inspection or repair. Avoid contact with metal surfaces as operating temperature may exceed 200°

6.1 OIL PUMP

A. OIL PUMP DISASSEMBLY

1. Remove oil pump assembly and filter from main housing cover by removing cap screws and hoses.

2. Remove cap screws and lock washers securing pump cover, pump body and pump adapter.

3. Using a soft hammer, separate cover, body and adapter from spring pins. NOTE: FOR REASSEMBLY, PUNCH MARK ALONG SIDE OF COVER, BODY AND ADAPTER.

4. Remove pump gears resting in adapter

5. Remove dome nut and relief valve insert. NOTE: PRESSURE RELIEF SPRING IS UNDER TENSION

6. Unscrew and separate pressure relief screw from relief valve insert. Remove pressure relief spring and plunger.

B. CLEANING AND INSPECTION

1. Remove all permatex and clean all parts with good grade cleaning solvent or diesel fuel. Blow dry with compressed air.

2. Inspect gears and oil pump for damage or excess wear. See replacement wear limits chart.

3. Inspect cover and adapter for wear caused by gears. Note: If grooving does not exceed .030", both surfaces can be repaired by grinding smooth (.030" max cut).

4. Inspect bushings in cover for wear, out of round condition or burrs. If they are worn, damaged or loose, replace and ream to size: .749"/. 750".

NOTE: Cover may be ordered with bushings installed and reamed to size.

5. Inspect bushings (2) in adapter for wear out of round condition or burrs. If bushings are damaged, replace as necessary, and ream to size .749"/. 750".

NOTE: Adapter may be ordered with bushings installed and reamed to size.

6. Check relief plunger for free movement in adapter bore. Replace if necessary.

7. Inspect all mating surfaces for smoothness

8. Check to see that each oil passage is free from obstruction.

C. ASSEMBLY

1. Generously lubricate pump gears with lubriplate, Vaseline, or engine weight oil and position them in adapter. NOTE: BE SURE SPLINED ENDS (INSIDE DIAMETER OF PUMP GEARS) ARE TOWARD COVER.

2. To both mating surfaces of body, sparingly apply a very thin coat of "SUPER 300" permatex or equivalent. Too much sealer can prevent pump from functioning.

3. Place body on adapter and cover on body following punch marks. NOTE: if new body is used make sure sharp inside corners are filed smooth.

4. Secure cover and body to adapter with cap screws and lock washers finger tight.

5. Drive spring pins 92) down through cover into body and adapter until they bottom in adapter. Drive 2 or more spring pins into body until flush with top of cover.

Insert pump shaft through adapter into pump gear and revolve shaft to check ease of operation.

7. Tighten all six cap screws to 8 pounds-foot torque.

8. Remove any excess permatex from seams with solvent

9. Recheck for ease of operation, or severe damage to shaft may result.

10. Generously lubricate relief plunger with Vaseline or lubriplate and position cup end last in bore of adapter. Check to make sure plunger slides freely.

11. Insert pressure relief spring into cup of plunger.

12. Screw pressure relief screw into relief valve insert just enough to start threads.

13. Install washer and relief valve insert with pressure screw in place.

14. Tighten relief valve insert. Do not tighten relief screw.

15. Cap and lock pressure relief screw with dome nut and washer.

D. RE-INSTALLATION

NOTE: DO NOT use Teflon Tape. It may clog the pump

1. Flush canister and install in filter.

2. Apply joint compound to threads and install pipe nipples, bushing and oil filter to oil pump. CAUTION: FLOW ARROW ON FILTER MUST POINT TOWARD PUMP. SEE FIG. 20.



Fig. 20. Installation of OII Filter. Flow Arrow on Filter must point toward Pump.

3. Apply grease to bearing container and locate new oil pump gasket on container.

4. Install oil pump and filter on bearing container. Secure pump with cap screws and lock washers and torque to 62 lb-ft.

5. Install suction hose to tee and oil pump

6. On units with idler gear, connect hose from oil pump to idler shaft.

E. PUMP ROTATION

The direction of pump rotation is the same as engine rotation. If engine rotation is changed the plumbing to the pump must be changed. See cross section assembly drawing for details.

6.2 SELECTOR VALVE AND RELATED PARTS



Figure 21. Exploded View of Selector Valve Assembly.

A. REMOVAL

1.Disconnect hoses and control linkage from lever on selector valve.

2. Remove cap screws and lock washers. Lift off selector valve and base plate being very careful to keep gaskets in proper configuration for replacement (they may be fixed in position with wire. Etc.)

B. DISASSEMBLY

1. Remove snap ring from rotor shaft and note position of keyways on level to rotor (match mark if desired). Remove lever from rotor being careful not to lose indexing ball and spring.

2. Remove key from rotor shaft.

3. (Note position of cover). Remove cover, cover gasket, and rotor from block.

4. Remove safety relief adjustment end cap from base plate. Remove washers, spring and plunger. NOTE: SPRING IS UNDER TENSION.

5. Remove clutch timing parts (dome nut, jam nut, washers and set screw).

6. Remove commutator tubes from housing and discard o-rings.

C. CLEANING AND INSPECTION

1. Clean all parts thoroughly with oil and clean all oil ports. Blow dry with compressed air.

Inspect rotor and valve block for scoring.
 Excessive scoring indicates replacement.
 Valves are not repairable.

3. Inspect oil seal in cover. If it is worn or shows evidence of leaking, replace it.



Figure 22. Exploded view of Selector Valve, Baseplate and Related Parts.

D, ASSEMBLY

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NOTE: On all fittings use Permatex super 300 sealant, graphite paste, or equivalent. Caution: Do no use no.1 permatex or Teflon tape.

1.If necessary install new oil seal in cover. Press seal in until it bottoms in bore (rubber race out). Apply lubricant to seal.

2. Insert rotor shaft through oil seal in cover.

3. Set key in rotor shaft and install lever with indexing ball and spring. Make sure that keyway in rotor shaft remains toward the side of cover as shown in figure 21.

4. Tap control lever into position with a soft hammer and secure with snap ring.

5. Position new cover gasket on pilot face of cover.

6. Install rotor with cover into selector valve body. Secure cover with four cap screws. Tighten to 4 pounds foot torque. Check for correct assembly by moving lever back and forth.

7. Install safety relief adjustment parts in base plate.

8. Install clutch-timing parts in base plate

9. Install new o-rings in commutator and base plate. Install tubes in commutator.

10. Mount base plate gasket to correct position. Locate base plate and valve gasket properly (see fig. 22).

11. Install selector valve assembly with hex head cap screws and lock washers.

12. Connect pressure gauge, hose and control linkage.

SECTION 7. REPAIR OF INTERNAL SUBASSEMBLIES

CAUTION:

Avoid contact with rotating output coupling and always shut down engine when doing even minor inspection or repair. Avoid contact with metal surfaces as operating temperatures may exceed 200°F.

7.1 REMOVAL OF TRANSMISSION

1. Remove drain plug at rear of housing and drain oil from sump.

2. Disconnect all plumbing and wiring and disconnect control linkage.

3. Remove inspection covers.

4. Scribe alignment mark across outside diameter of flanges on output coupling for exact refit. Disconnect coupling.

5. Remove or push back propeller coupling to obtain maximum clearance and remove pilot ring resting between couplings. NOTE: Protect mating faces of couplings and pilot ring to insure proper refit and alignment.

6. Screw two 1/2 –13 UNC eye bolts into lifting holes on top of housing and connect hoist so it supports the weight of the transmission.

7. Remove cap screws and lock washers holding housing to oil dam.

 Insert screwdriver or similar object through side inspection hole to hold clutch assembly inside housing. Slowly move housing aft and away from oil dam. See fig. 23.

CAUTION

Clutch is loose! It must be secured in transmission housing to prevent failing



Figure 23. Maintaining Clutch in Housing during Removal of Transmission.

Capitol Gasket and Seal kit no. 1-10193-000 includes all of the gaskets, seals and o-rings needed for repairs.

The quad rings required for the bevel gear carrier must be purchased separately.

7.2 TABLE: REPLACEMENT WEAR LIMITS

ITEM	NEW DIME MINIMUM	NSIONS MAXIMUM	REPLACEMENT WEAR LIMIT	
BACKLASH — Reduction Gears	004	.008	.020	
PINION SHAFT				
O.D. At Forward Commutator	1.7450	1.7455	1.7440	
O.D. At Rear Commutator	3.1661	3.1668	3.1651	
O.D. At Rear Bearing	. 1.7721	1.7726	1.7711	
FORWARD COMMUTATOR BUSHING (IN CLUTCH)				
I.D	. 1.7495	1.7505	1.752	
REAR COMMUTATOR BUSHING				
1.D	. 3.169	3.170	3.174	
CLUTCH DISC THICKNESS				
Driving (External Teeth)	150	.160	.140	
Driven (Internal Teeth) Thin	085	.095	.075	
Driven (Internal Teeth) Thick	.160	.175	.150	
CLUTCH PACK THICKNESS - Clutch No. 1-00100-5004				
Forward Pack (Compressed)	. 1.485	1.540	1.365	
Reverse Pack (Compressed)	. 1.240	1.340	1.160	
CLUTCH PACK THICKNESS - Clutch No. 1-00100-3900				
Forward Pack (Compressed)	. 1.485	1.540	1.365	
Brake (Compressed)	470	.510	.440	
OIL PUMP		IF DEEP GROOVES ARE PRESENT, OR MORE THAN .006'' CLEARANCE EXISTS BETWEEN PUMP GEARS AND BODY		
SELECTOR VALVE		IF DEEP GROOVES ARE PRESENT (.025" DEEP)		
DRIVING DRUM SPLINES CLUTCH END FLANGE SPLINES		IF GI VERT	ROOVES ARE PRESENT TICAL TO THE SPLINE	
ALL SPLINED PARTS		REPL	ACE IF FIT IS NOT G.	

7.3 CLUTCH AND REVERSE GEARS

A) DISASSEMBLY (SEE FIG.25)

1. Remove socket head cap screws, lock washers (and Allen nuts) securing both clutch flanges to bevel gear carrier.

2. Lift off clutch flanges and clutch discs.

3. Press and remove bearings, driving gear and driven gear from forward and reverse clutch flanges,

4. Remove locknuts, clutch identification tag and cap screws from outer perimeter of cylinders.

5. Separate and remove cylinders.

6. Remove and discard quad rings from bevel gear carrier (always replace with new quad rings to avoid internal leaks).



Figure 24. Removing Basel Pinton Shaft with Puller.

7. Remove cap screws and locknuts securing pinion shafts in bevel gear carrier and remove bevel pinion shaft with puller. See fig. 24.

B) CLEANING AND INSPECTION

1.Inspect bevel pinions for wear, chips, and breaks or out of round condition. If there is any damage, we recommend replacing all of them as a set.

2. Check all bevel pinion bearings and thrust washers for distortion or rough operation.

3. Clean all parts with a good grade cleaning solvent or diesel fuel. Blow dry with compressed air. Coat bearings with light oil.

4. Inspect all oil passages in bevel gear carrier to see that they are free from obstruction.

5. Inspect bevel gear carrier for cracks chips or worn mounting surfaces. Pay special attention to quad rings grooves. Discard carrier if damaged.

6. Inspect forward commutator bushing for chips, heat scores, scratches, distortion or wear (see wear limits p.24). Repair or replace as necessary (see part c).

7. Inspect all hardware and springs for wear or distortion. Inspect return spring ring. Repair or replace as necessary.

8. Remove clutch discs from flanges or inspect discs for broken teeth, heat scores or wear (see wear limits pg.24). Replace as necessary.

9. Inspect driving gear and driven gear for wear, chips or cracks. If either one is damaged we recommend replacing both as a set.

10. Check both clutch flange ball bearings for wear, distortion or rough operation. Replace if necessary.

11. Inspect forward and reverse clutch end flanges for wear, cracks or distortion and make certain all oil passages are free from obstructions.

12. Inspect both clutch cylinders for cracks, distortions or scratches. Repair or replace as necessary.

C. ASSEMBLY

1. In order to install a new commutator bushing, either the bushing should be frozen or the bevel gear carrier heated. This will allow ease of fit and will help prevent scoring of the gear carrier bore. An anti-seize compound should be used on the bushing also.

NOTE:

Bushing may be frozen with a solution of alcohol and water or dry ice. Gear carrier may be heated in hot oil or water (200°F, 93°C maximum)

2. Line up holes in flanged end of bushing with roll pins in bevel gear carrier. Press in new bushing on side of carrier stamped "REV'. Until it seats in bore. The roll pins will lock the bushing in place and insure line up of oil holes in the bushing and bevel gear carrier.



Figure 25. Exploded View of Standard Clutch no. 1-00100-5004.



Figure 26. Installation of Bevel Pinlon Shaft using Protective Capscrew (%-20 NF).

3. Installation of bevel pinion shafts: (see fig.26)

A. Lay gear carrier flat on table.

B. Apply lubricant on shafts and bores to ease fit and prevent damage.

C. Insert protective cap screws on top of pinion shaft and tap shaft into carrier bore just enough to protrude slightly in to inner recess. Make sure holes will match.

D. Place bevel pinion with bearing on shaft. Tap shaft into bearing until holes in shaft and carrier match.

E. Insert socket head cap screw and nut. Torque to 8 lbs-ft.

4. Replacement of return springs, return spring ring and retainers (if necessary): insert return spring retainers through ring and into return springs and secure in gear carrier using cap screws. Tighten cap screws tentatively until top of spring retainer protrudes the specified distance from the face of the bevel gear carrier hub as shown in figure 27.

5. Without installing quad rings, place cylinders on bevel gear carrier by hand. There must be a uniform gap between cylinders of .015 to .025". See fig.27. Check with a feeler gauge. If necessary re-adjust return spring height and install locknuts.

6. Apply lube in quad ring grooves in bevel gear carrier and slip on four new quad rings avoiding twists in the rings.



Figure 27. Clutch Return Spring Height Adjustment.



Figure 28. Installing Clutch Cylinders on Bevel Gear Carrier.



- 7. To install cylinders:
 A) Apply a light coat of lubricant on inner walls of each clutch cylinder as well as on quad rings.
 - B) With forward size of bevel gear carrier up, press cylinder on by hand (see figure 28).

CAUTION:

To prevent twisting or damaging of quad rings, take care to slip cylinders on evenly and straight down.

C). Turn bevel gear carrier over (reverse side up) and press remaining cylinder on, checking to see that cap screw holes in both cylinders are aligned properly.

D) Insert cap screws and locknuts and tighten to 15 pounds foot torque.

8. Press ball bearing into forward clutch flange. Press bevel gear into ball bearing. See fig. 29



Figure 29. Clutch Flange, Roller Bearing and Bevel Gear.

9. Likewise press the other ball bearing into reverse clutch flange (see fig.29). Then press bevel gear into ball bearing. Check that ball bearings on both clutch flanges are well seated.

10. Arrange the driving friction discs (external tooth) with the steel driven discs (internal tooth) against the forward and reverse clutch flanges. Refer to the appropriate illustration in the parts information section.

11. Position reverse clutch flange and reverse clutch discs on reverse side of gear carrier (flange on commutator bushing is on reverse side). Position forward clutch flange with forward clutch discs and fasten both flanges to gear carrier. Tighten cap screws to 28 pounds foot torque.

12. Check for free movement of gears in clutch assembly.

NOTE: Clutch cylinder timing adjustment is illustrated on p.12

7.4 PINION SHAFT AND RELATED PARTS

A) <u>REMOVAL</u>

With adequate hoist tip transmission to rest engine end down.

1. Remove selector valve mounting bolts. Remove selector valve and base plate (be careful to keep gaskets in proper configuration).

2. Remove commutator tubes and discard orings

3. Remove cap screws securing junction block and remove junction block. Remove commutator tubes and discard o-rings.

4. Remove oil pump mounting bolts and remove oil pump. Discard gasket. Remove oil pump shaft.

MODELS WITH 2.04 A.E.R OR E.R RATIOS

The pinion shaft may be extracted from the housing without removing the output coupling and housing cover.

Attach a suitable hoist to the bearing retainer and hold the rear commutator so the pinion shaft may slide out freely (pinion shaft will accompany bearing retainer).

5. Remove output retainer plate from output coupling. With suitable puller remove output coupling from output shaft. See fig. 30.

6. Remove Cap screws and lock washers securing housing cover.

7. With hoist, lift cover (pinion included) from housing. Hold rear commutator so pinion shaft slides out freely. See fig 31.

NOTE:

Pinion and shaft repair kits are available for all ratio models. See page 51.



Figure 30. Pulling Output Coupling from Shaft Using Jack and Special Tool no. 1-90025-0000.



Figure 31, Removing Housing Cover and Pinion Shall. Commutator should be held so pinion shall slides feely.

B. DISASSEMBLY

1.Remove bearing locknut from the end of pinion shaft and remove keyed washer.

2. With suitable press extract pinion shaft out of bearing retainer. See fig.32.



Figure 32. Extracting Pinton Shaft from Bearing Betainer using Press.

C. CLEANING, INSPECTION AND REPAIR

1. Inspect pinion bearings for roughness of rotation, corrosion, scoring, scratches, burrs, cracks, pitted or chipped races and wear of rollers. If ONE of these conditions is found, replace the entire bearing set (5 pieces). Otherwise clean bearings thoroughly with solvent.

2. Inspect pinion teeth, threads and spline for damage. Inspect both commutatormating surfaces and inspect bearing mating surfaces for grooved, burred or galled conditions. If damage cannot be repaired with crocus cloth, pinion shaft must be replaced.

3. Clean pinion thoroughly. Flush all parts with solvent.

4. Inspect roller bearing mounted in housing bore for conditions mentioned in step 1. Clean bearing with solvent or replace as necessary.

5. Inspect rear commutator for damage or wear (see wear limits p.24) Discard if necessary. Other wise clean thoroughly.

6. Remove oil filter canister and clean element. Flush canister clean.

7. Flush clean all ports in selector valve base plate and junction block. Flush all commutator tubes.

D. REASSEMBLY

1. If necessary install new roller bearing in housing and secure with snap ring. See fig 33.



Figure 33. Installing Boller Bearing in Housing.

2. Apply lubricant to bearing surface on threaded end of pinion shaft.

NEW BEARING CUPS AND CONES COME IN MATCHED PAIRS. BE SURE NOT TO MIX PARTS.

3. Heat pinion bearing cones in hot oil (212°F, 100°C maximum)

4. (Refer to fig. 34) Press both bearing cups (A) into bearing retainer (B) snug against bearing spacer.

5. Apply Lubriplate grease or equivalent to outside diameter of bearing retainer and install bearing retainer in housing cover (C).

2.04 RATIO MODELS ONLY:

Since pinion diameter clears cover bore, the pinion bearing retainer assembly may be installed in the cover after the cover is on the housing.



Figure 34. Installing Pinion in Housing Cover.

6. Press heated bearing cone (D) on to pinion shaft and apply spacer (E).

7. Install housing cover (C) onto pinion shaft

8. Press* heated bearing cone (F) onto pinion shaft snug against bearing spacer (E). *NOTE: A protective spacer is recommended to prevent damage to bearing.

9. Locate keyed washer behind bearing cone (F).

10. Apply Loctite 242 or equivalent on threads of pinion shaft (Threads must be clean first). Locate bearing locknut on threads and tighten with spanner wrench to 220 lbs-ft. (Wrench should be resting on side of locknut opposite the split). Tighten locking cap screw.

11. Apply lubriplate or equivalent to o-ring grooves in rear commutator, junction block and selector valve base plate. Install new o-rings.

12. If new commutator or new pinion are being used check to see that fit between them is not too tight. Clearance must be .002" min. Otherwise assembly will be very difficult and commutator may freeze on shaft.

IF PINION PARTS SHOW WEAR OR DAMAGE THE TRANSMISSION HOUSING SHOULD BE FLUSHED CLEAN WITH SOLVENT. WEAR TO PINION PARTS INDICATES WEAR TO OUTPUT PARTS, IDLER (IF PRESENT) AND CLUTCH. WE

RECOMMEND A COMPLETE INSPECTION AT THIS TIME.

7.5 OUTPUT GEAR, IDLER, HOUSING AND RELATED PARTS

A. REMOVAL AND DISASSEMBLY

NOTE: PINION SHAFT PARTS SHOULD BE REMOVED PRIOR TO REMOVAL OF OUTPUT PARTS

1. Remove cap screws securing output retainer plate and remove plate from output shaft.

2. With engine end of transmission flat on table, pull output coupling from output shaft using suitable puller see fig.30.

3. Remove cap screws securing output shaft bearing retainer and remove bearing retainer. Discard oil seal. Take care not to damage shims and remove them.

4. Remove housing cover cap screws and remove housing cover. Use suitable hoist. See fig.31.

5. Remove idler gear assembly from housing (or cover) if present. If idler bearings are suspected of wear, remove snap rings and bearings.



Figure 35. Removing (or installing) Output Gear.

B.CLEANING INSPECTION AND REPAIR

1.Inspect tapered roller bearings on both ends of output shaft for; rough rotation, corrosion, scoring, scratches, burrs, cracks, pitted or chipped races and wear. If one of these conditions is found, discard bearing(s).

2. Inspect bearing cups in housing bore and cover for any sign of damage or wear. Discard if necessary.

NOTE: If bearing cup warrants replacement, the bearing cone should be replaced also- and vice versa.

3. Inspect output gear for nicks, burrs, scratches, damage or wear of any kind. Teeth may be repaired with a flat file or grinding wheel, otherwise gear must be replaced, clean gear with solvent.

4.Inspect idler gear if present for nicks, burrs, damage or wear. Check bearings for smooth rotation. If wear is suspected, remove snap rings and replace as necessary. Clean all parts including idler hose with solvent. Make sure internal oil passage in shaft is clear.

5. Inspect output coupling at bearing mating surface for nicks or burrs. File smooth or discard output coupling. Inspect oil seal surface for grooves. Discard coupling if it is grooved.

6. Inspect mating surfaces of output flange and propeller coupling and file smooth as necessary. Otherwise replace couplings.

7. Inspect housing cover bored and inspect all mating surfaces on both sides of cover. Repair nicks or burrs with file or crocus cloth; clean cover with solvent.

C. HOUSING AND RELATED PARTS

Housing should now be tipped upright:

1. Flush clean and inspect main housing. Inspect front and rear mating surfaces and repair with file or crocus cloth.

2. Inspect reverse clutch drum for deep scratches or wear. Repair or replace as necessary; clean with solvent.

3. Flush clean oil breather and suction hose (sump to filter). Flush all hoses.

4. If not already accomplished, thoroughly clean selector valve.

CAUTION: Housing and cover are line-bored as a set and should be replaced as a set only

D. RE-ASSEMBLY

1. To install new tapered roller bearings on output gear shaft, roller assemblies must be heated. Each assembly is then pressed on to shaft snug against shoulder of gear. See fig 36.



Figure 36. Pressing Roller Bearing onto Shaft-



Figure 37. Installing New Bearing Cup in Housing.



Figure 38. Locating Rear Commutator In Housing.

3. Using adequate hoist lower output gear with roller bearings on the shaft onto housing. See fig. 35.

4. MODELS WITH IDLER GEAR ONLY:

A. Press roller bearings in idler shaft snug against snap rings.

B. Install shaft and bearings into idler gear and secure with snap rings.

C. Install new o-ring on idler shaft.

D. Install idler assembly into housing bore. Tap lightly if necessary so that shaft bottoms in bore.

7.6 INSTALLATION OF PINION, COVER AND RELATED PARTS

1. If a new commutator and/or pinion shaft are being used the clearance between them must be checked. It has to be at least .002" or assembly will be very difficult and commutator may freeze on shaft.

2. With anti-rotation stud and new O-rings installed, rest rear commutator in place in housing. See fig. 38.

3. Apply new cover gasket to housing (a small amount of grease may be used to keep gasket in place).

4. If new pinion, idler gear or output gear are being installed apply marking compound to gear teeth. Apply compound to pinion only on non-idler 5. Using adequate hoist, install the assembly consisting of housing cover, bearing retainer with bearings and pinion shaft (see fig. 31) onto dowels in the housing cover mounting surface. Note: Rear commutator should be held by hand and may need to be jiggled while pinion shaft is tapped into it.

2.04 RATIO MODELS ONLY: Since the pinion is able to clear the housing cover bore; the cover alone may be installed first. The pinion bearing retainer assembly can then be lowered into the housing through cover.

6. Tap the cover evenly with a soft hammer until cover is 1/8" from housing. Locate cap screws and lock washers. Tap cover down firm and torque cap screws to 62 lb-ft. see fig.39



Figure 39. Installing Cover on Housing.



Figure 40. Installing Bearing Cup In Cover.



Figure 42. Applying Pliable Sealant to Junction Block.

7. Install oiled bearing cup in output bore in cover and tap it snug against roller assembly. See fig.40.

7.7 INSTALLATION OF COMMUTATOR, JUNCTION BLOCK, SELECTOR VALVE AND RELATED PARTS

1. Install commutator tubes in commutator see fig.41.



Figure 41. Installing Commutator Tubes in Commutator

2. With new O-rings installed in junction block apply a pliable sealant to mounting surface. See fig.42.

3. Install junction block making sure commutator tubes, enter holes in block. Secure junction block with cap screws. See figure 43.



Figure 43. Installing Junction Block. Use screwdriver (shown right) or ber to support rear commutator.

4. Slide commutator tubes through ports in housing and into commutator.

- 5. Apply base plate gasket in proper configuration (see fig. 22) to housing.
- 6. Install new O-rings with grease in base plate. Mount base plate see fig 44.



Figure 44. Locating Baseplate Gasket and Baseplate.

7. Locate selector valve gasket and selector valve (see fig 45) secure with cap screws and lock washers.



Figure 45. Locating Selector Valve Gasket and Selector Valve.

7.8 INSTALLATION OF OIL PUMP, OUTPUT COUPLING AND RELATED PARTS

1.Locate shims (old shims may be re-used if they are not damaged) on cover.



Figure 46. Pressing New Oll Scal in Bearing Cap Retainer.

2. Press in new oil seal in bearing cap retainer (see fig.46) and install bearing cap retainer in cover. Secure with cap screws and lock washers. Torque to 62 lbs-ft.

3. Check endplay in output shaft as follows: Connect eyebolt and hoist to end of output shaft. Mounting thousandths dial indicator with tip resting on end of shaft. Raise and lower output shaft with hoist. Twist shaft back and forth several times to seat rollers in bearing.

Figure 47 demonstrates the use of special tools to achieve the same result.

Endplay should be between .000" and .003". Otherwise remove bearing retainer and add or subtract shims as necessary. Check endplay again.



Figure 47. Checking End Play with Special Tool no. 1-90017 and 1-90026. Note: A small steel plate should be located over oil seal to protect it from damage by tool.

4. Heat output coupling in hot oil at 200F for at least $\frac{1}{2}$ hour before installation on output shaft.

5. Locate new oil pump gasket with a small amount of grease.

6. Install oil pump onto bearing retainer and secure with cap screws and lock washers. Tighten to 62 lbs-ft.



7. Install pipe nipple and oil filter. See fig 48. Use pipe joint compound on all threaded fittings. BE SURE FLOW ARROW ON FILTER POINTS TOWARD OIL PUMP OTHERWISE SEVERE DAMAGE MAY RESULT. 9. Install output retainer plate with hex head cap screws. Torque to 62 lbs-ft. see figure 50.



Figure 50. Installing Retainer Plate.

10. Install suction hose from housing to filter. Use joint compound fittings.



Figure 49. Installing Hot Output Coupling on Shaft.

8. Install heated output coupling on output shaft. Make sure coupling seats firmly against bearing. If it does not a soft hammer should be used while coupling is hot. See fig. 49.

Another means of securing the coupling on the shaft involves a jack and a special tool no 1-90026-0000 shown in figure 47. The stud is threaded so that a large nut may be placed on the end of it.

7.9 POST ASSEMBLY INSPECTION

Return housing to upright position

1. Check output flange for trueness of rotation as follows:

A. Pilot ring groove (see fig. 51) using a thousandths dial indicator as shown, rotate the output flange. Variation must not exceed .003" maximum.



Figure 51. Checking Output Flange Variation at Pilot

B. Mounting face (see fig.52) mount indicator as shown and rotate coupling. Variation must not exceed .003" maximum.



Figure 52. Checking Output Flange Variation at Mounting Face.

2. CHECKING BACKLASH

A.E.R MODELS (WITHOUT IDLER GEAR) Place hand on pinion shaft through engine end of housing and twist pinion back and forth (output gear should be stationary). There must be a slight amount of play between the teeth of the pinion and output gear.

E.R MODELS (WITH IDLER GEAR) Hold output gear stationary and reach through side inspection hole toward idler gear. Move idler gear gently back and forth. There must be a slight amount of play between the teeth of idler gear and other gears.

3. CHECKING TOOTH CONTACT (ALL MODELS)

If a new pinion and/or idler are installed, check for tooth contact with marking compound. Units without idler gear-apply compound to pinion. Units with idler gear – apply compound to idler gear.

7.10 ADDITIONAL ASSEMBLY

1.Install oil breather cap and oil dipstick

2. Install inspection covers and gasket

3. Connect hose from selector valve tee to oil pump.

4. Install oil drain plug.

5. On idler models, make sure hose is installed between idler shaft and oil pump

6. Make sure reverse clutch drum has been installed.



Figure 53. Adapter Parts

7.11 ADAPTER PARTS

1.Clean and inspect drive flange shaft, clutch and driving drum. Check splines for chips, deep grooves or wear. Replace parts as necessary.

2. Remove oil dam adapter. Remove and discard oil seal. Install new seal in oil dam adapter.

3. While oil dam is removed, inspect flywheel adapter and drive flange for distortion or rough mounting surfaces. Repair or replace as necessary.