

SECTION 6. REPAIR OF EXTERNAL SUBASSEMBLES

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 deg.

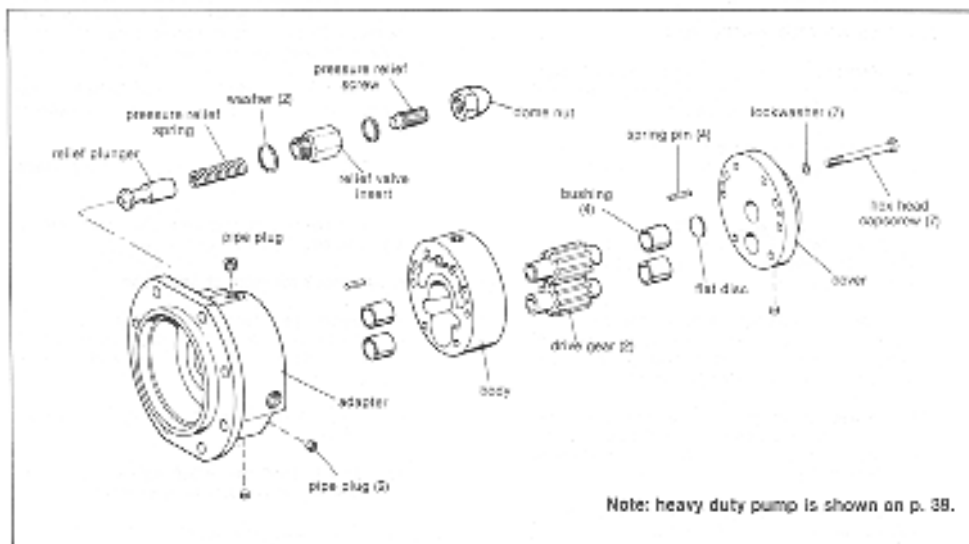


Fig. 15. Oil Pump Assembly (Pump no. 1-13041-1000 shown)

6.1 OIL PUMP

A. PRESSURE RELIEF ASSEMBLY

1. With oil pump in place on marine gear remove dome nut, relief valve insert with screw, spring and accompanying washers. NOTE: UNSCREW INSERT CAREFULLY BECAUSE PRESSURE RELIEF SPRINGS IS UNDER TENSION

2. Check relief plunger to see if it is free moving. If not, inspect plunger for burrs, heat scores, or distortions. Burrs may be removed with fine crocus cloth, otherwise plunger should be replaced.

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

4. Generously lubricate relief plunger with oil or Vaseline. Insert plunger, cup end last. Check plunger for free movement.

5. Insert pressure relief spring into cup of plunger.

6. Screw pressure relief valve insert just enough to start threads.

7. Apply washer and install relief valve insert with pressure relief screw. Tighten insert do not tighten relief screw.

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

B. 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 washer 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.

C. CLEAN 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 cause 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 (see wear limits p. 23), out of round condition or burrs. If they are worn, damaged or loose, replace and ream to size (see p. 23).

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 (see p. 23)

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.

D. 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 surface 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 filled smooth.

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

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

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

7. Tighten all six cap screws to 16 foot-pounds torque.

8. Remove any excess permatex from seams with solvent.

9. Recheck for ease of operation.

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 spring into cup 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.

16. Recheck for ease or operation.

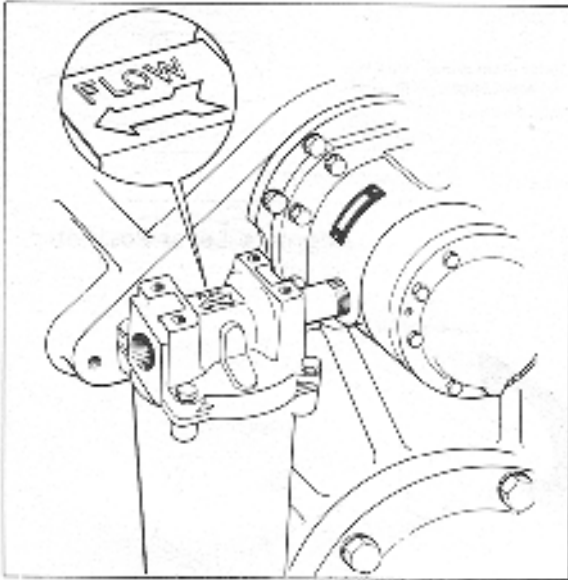
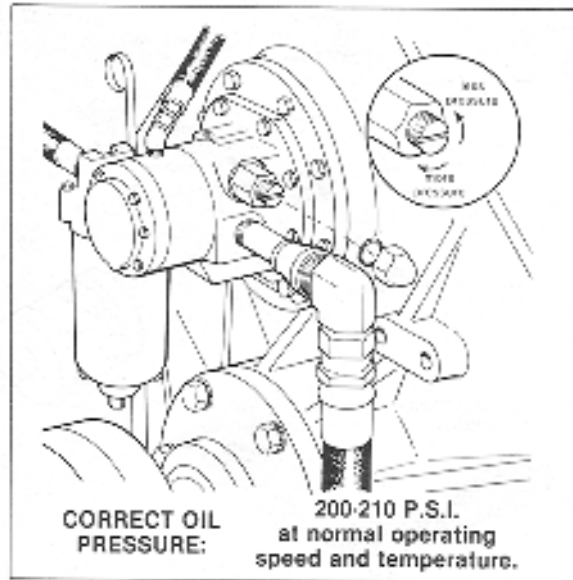


Fig. 16 CAUTION: Flow Arrow on Filter Must Point Away From Oil Pump.



CORRECT OIL PRESSURE: 200-210 P.S.I. at normal operating speed and temperature.

Fig. 17. Correct Operating Oil Pressure Should Be 200-210 P.S.I.

E. RE-INSTALLATION

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

1. Flush canister and install new filter element 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 AWAY FROM PUMP. SEE FIG. 16.
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 42 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.
7. Be sure to re-adjust oil pressure to correct operating level when engine is started up. See Fig. 17.

F. 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.

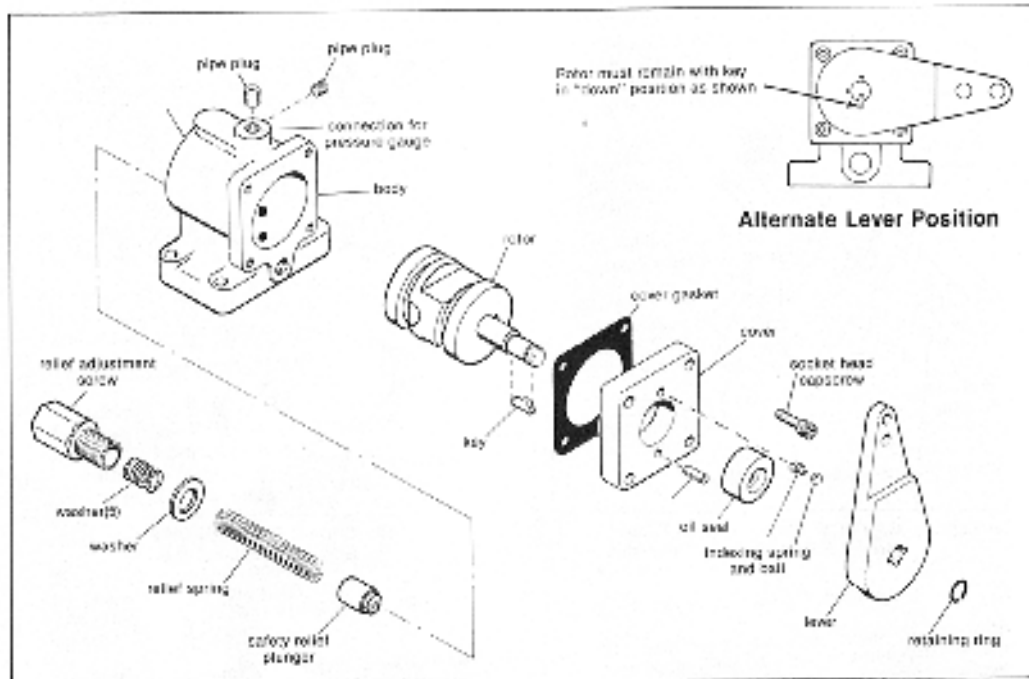


Fig. 18 Selector Valve Assembly

6.2 SELECTOR VALVE AND RELATED PARTS

A. REMOVAL

1. Disconnect hoses and control linkage from lever on selector valve.
2. Remove cap screws and lock washers and lift off selector valve and baseplate being very careful to keep gaskets in proper configuration for replacement. (They may be fixed in position with wire, etc.)

B. DISASSEMBLY

1. Remove retaining ring from rotor and note position of keyways on lever 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 screw, washer, spring and plunger. NOTE: SPRING IS UNDER TENSION.

C. CLEANING AND INSPECTION

1. Clean all parts thoroughly with oil and clean all ports. Blow dry with compressed air.
2. 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.

D. ASSEMBLY

NOTE: On all fittings use Permatex 'Super 300' sealant graphite paste, or equivalent. Caution: Do not use No. 1 Permatex or Teflon tape.

1. If necessary install new seal in cover. Press seal in until it bottoms in bore (rubber face 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 bottom of cover.
4. Tap control lever into position with a soft hammer and secure with retaining 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.

7. Install safety relief adjustment parts in rear of valve body.

8. Check for correct assembly by moving lever back and forth. Selector valve is now ready to be installed on main housing. See fig. 19.

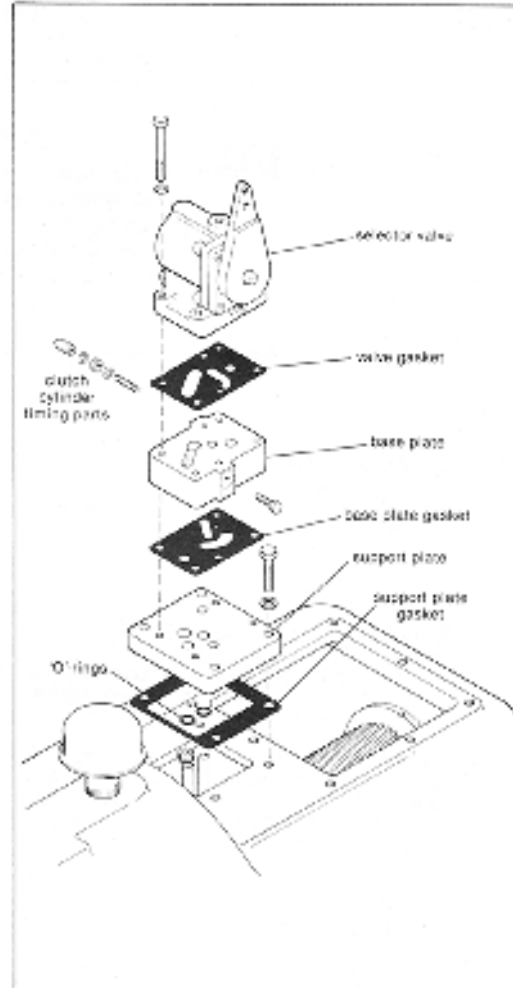


Fig. 19. Exploded View: Selector Valve and Related Parts.

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 REVERSE GEAR

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 member 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 ¾"-10 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
8. Insert screwdriver or similar object through side inspection hole to hold clutch assembly inside forward drum. Slowly move housing aft and away from oil dam. See fig 20.
9. Remove clutch from forward driving drum.

NOTE: See page 35 for adapter group repair

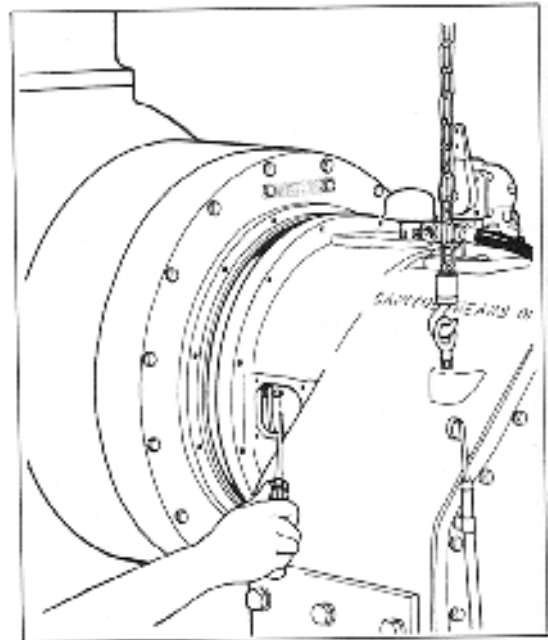


Fig. 20 Maintaining clutch in forward driving drum while removing housing.

Capitol Gasket and Seal kit no. 1-10190-0000 (HP-9400) and No. 1-10192-0000 (HP-10500) includes all gaskets, seals and o-rings needed for repairs.

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

7.2 TABLE: REPLACEMENT WEAR LIMITS

HP-9400 And HP 10500

ITEM	NEW DIMENSION MINIMUM	NEW DIMENSION MAXIMUM	REPLACEMENT WEAR LIMIT
Reduction Gears backlash	0.004	0.008	.020
PINION SHAFT O.D at Forward Commutator O.D at Forward Bearing O.D at Rear Commutator O.D At Rear Bearing	2.2450 3.1504 3.872 2.5010	2.2455 3.1511 3.873 2.5015	2.2440 3.1490 3.871 2.5000
Forward Commutator bushing I.D.	2.250	2.251	2.253
Rear Commutator bushing I.D.	3.876	3.877	3.881
Clutch Disc Thickness Driving (external teeth) Driven (Internal teeth)	.184 .085	.189 .095	.174 .075
Clutch Pack Thickness-Clutch no. 1-00100-2419 Forward pack (Compressed) Reverse pack (compressed)	2.152 1.883	2.272 1.946	1.992 1.743
Clutch pack thickness-Clutch no. 1-00100-2420 Forward pack (Compressed) Reverse pack (Compressed)	2.690 2.421	2.840 2.556	2.490 2.241
Clutch pack thickness-clutch no. 1-00100-4300 Forward Pack (compressed) Brake (Compressed)	2.690 .538	2.840 .568	2.490 .498
OIL PUMP			IF DEEP GROOVES ARE PRESENT, OR MORE THAN .006" CLEARANCE EXISTS BETWEEN PUMP GEARS AND BODY
OIL PUMP BUSHINGS, I.D	.751	.752	.754
SELECTOR VALVE			IF DEEP GROOVES ARE PRESENT (.025" DEEP).
DRIVING DRUM SPLINES CLUTCH END FLANGE SPLINES			IF DEEP GROOVES ARE PRESENT (.025" DEEP)
ALL SPLINED PARTS			REPLACE IF FIT IS NOT SNUG.

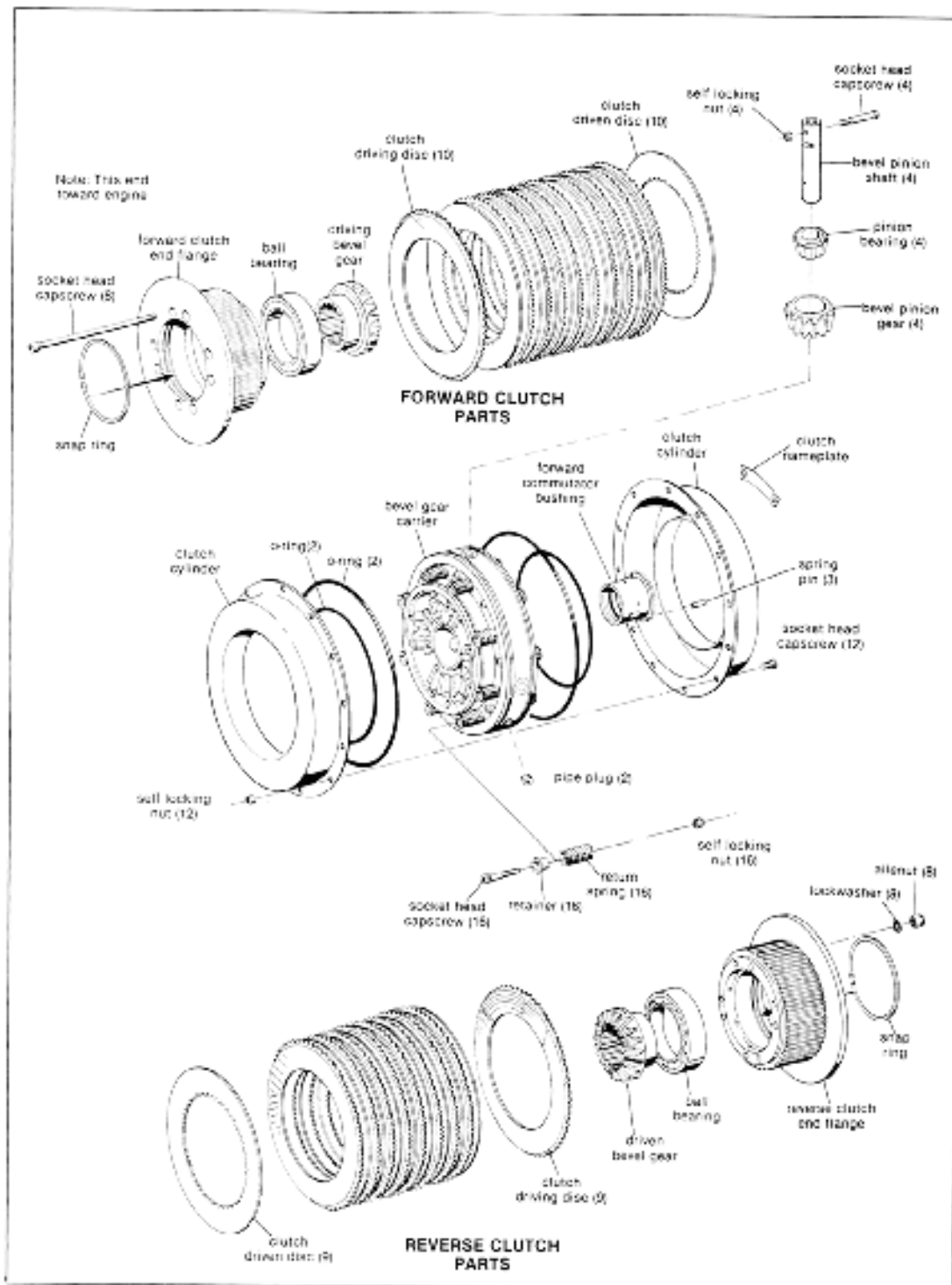


Fig. 21. Clutch Assembly (no. 1-00100-2420 is shown).

7.3 CLUTCH

A. DISASSEMBLY

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 bearing and driving gear from both 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 o-ring from bevel gear carrier. (Always replace with new o-rings to avoid internal leaks).

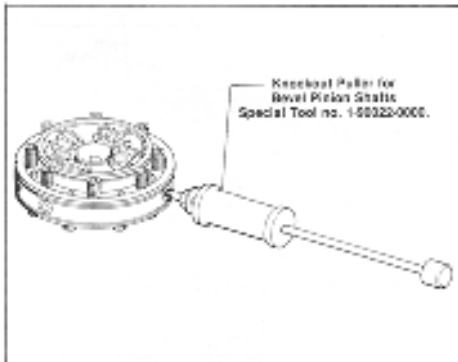


Fig. 22. Removing Bevel Pinion Shaft with Puller.

7. Remove cap screws and locknuts securing pinion shafts in bevel gear carrier and remove bevel pinion shaft with puller. See figure 22.

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 pinion bearings and washers for distortion or rough operation

3. Clean all parts with a good grade cleaning solvent or diesel fuel. Blow dry with compressed air, coating 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 seal ring grooves. Discard carrier if damaged.
6. Inspect forward commutator bushing for chips, heat scores, scratches, distortion or wear (see Wear Limits p.23). Repair or replace as necessary.
7. Inspect all hardware and springs for wear or distortion. Repair or replace as necessary.
8. Remove clutch discs from flanges and inspect discs for broken teeth, heat scores warp age or wear (see wear limits, page 23). 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 obstruction.
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 that 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.
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 lineup of oil holes in the bushing and bevel gear carrier.

3. Installation of pinion shafts: (see fig. 23).

A. Lay gear carrier flat on table

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

C. Insert protective cap screw in top of pinion shaft and tap shaft into carrier bore just enough to protrude slightly into 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 and retainers (if necessary): Insert return spring retainers 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 fig 24.

5. Without installing o-rings, place cylinders on bevel gear carrier by hand. There must be a uniform gap between cylinders of .015 to .025". See figure 24. Check with a feeler gauge. If necessary readjust return spring height and install locknuts.

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

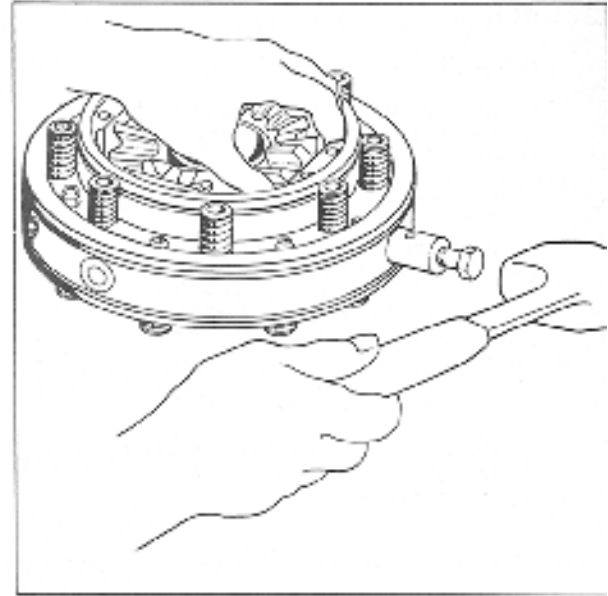


Fig. 23. Installation of Bevel Pinion Shaft Using Protective Capscrew (1/4-20 NF).

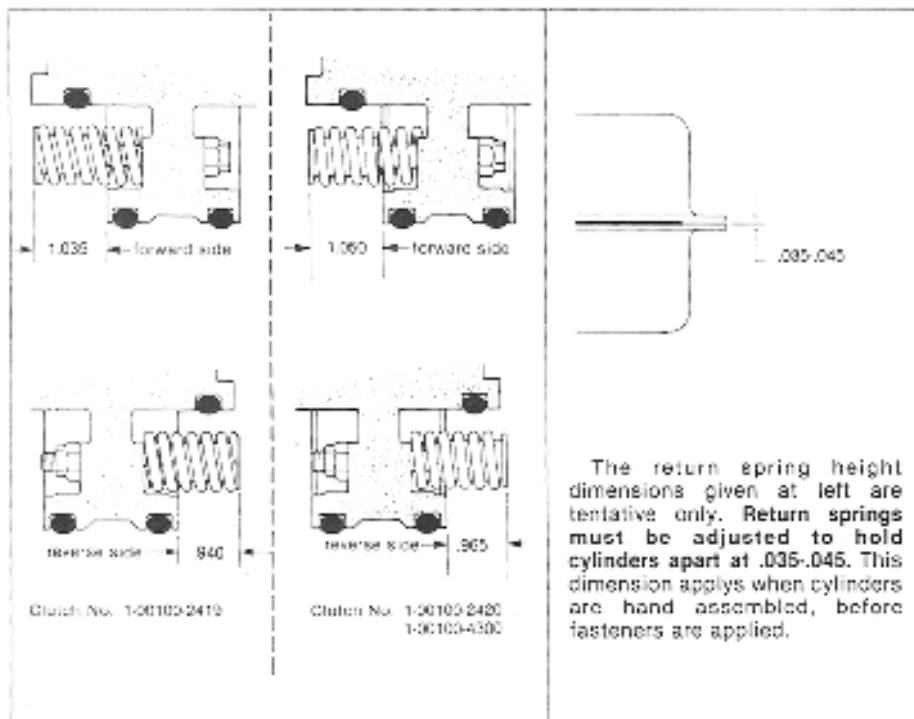


Fig. 24. Clutch Return Spring Height Adjustment.

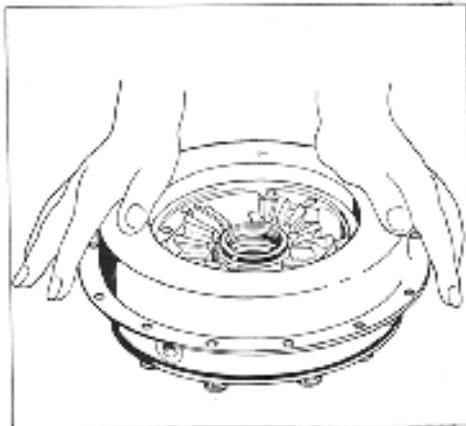


Fig. 25. Installing Clutch Cylinders on Bevel Gear Carrier

7. To install cylinders:

- a). Apply a light coat of lubricant on inner walls of each clutch cylinder as well as o-rings.
- b). With forward side of gear carrier up, press cylinder on by hand. (See fig.25)

Caution:
To prevent twisting or damaging of o-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 capscrew holes in both cylinders are aligned properly.
- d). Insert cap screws and locknuts and tighten to fifteen pounds-foot torque.

8. Press ball bearing into forward clutch flange. Press bevel gear into ball bearing. See fig. 26. Be sure to replace snap ring in innermost groove of forward flange.

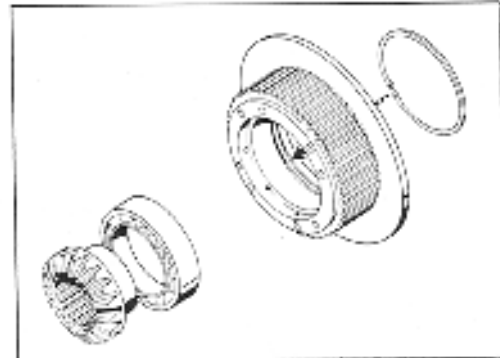


Fig. 27. Reverse Clutch Flange, Roller Bearing and Bevel Gear

9. Likewise press the other ball bearing into reverse clutch flange. Be sure to install snap ring in outermost groove of reverse flange (see fig.27). Then press bevel gear into ball bearing. Check that ball bearings on both 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 twenty-eight pounds foot torque.

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

Clutch assembly is now ready for installation

NOTE:
Clutch cylinder timing adjustment is illustrated on p.11

7.4 PINION SHAFT AND RELATED PARTS

A. REMOVAL

1. With adequate hoist tip unit to rest on engine end. Support sump housing properly (HP-10500 only).
2. Remove cap screws securing oil pump and remove oil pump and oil pump shaft.
3. Remove cap screws securing bearing container and remove bearing container (pinion shaft will accompany bearing container). Rear commutator should be held so that pinion shaft slides out freely. See fig 29.

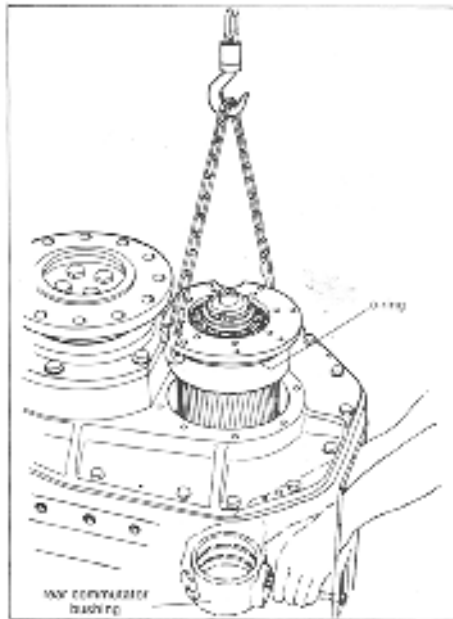


Fig. 28. Removing (or Installing) Pinion Shaft Assembly.

B. DISASSEMBLY

1. Release bearing locknut on pinion shaft by bending bearing lock washer. Remove bearing locknut with spanner wrench.
2. Remove keyed flat washer.
3. With suitable press extract pinion shaft out of bearing container. See figure 29.

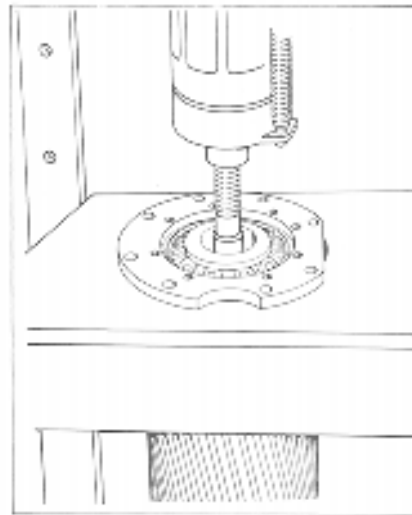


Fig. 29. Extracting Pinion Shaft from Bearing Container.

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 (3 pieces) see fig. 30. Clean bearings thoroughly with solvent. CAUTION: Because of close tolerance between shoulder of gear and bearing cone, the use of a puller will destroy the bearing.
2. Inspect pinion threads and splines for damage. Inspect both commutator surfaces and inspect bearing surfaces for grooved, burred or galled conditions. If damage cannot be repaired with crocus cloth, pinion shaft must be replaced.
3. Remove plugs in the end of pinion shaft and flush oil ports clean with solvent.
4. Inspect roller bearing mounted in housing bore for conditions mentioned in step 1. Clean bearing with solvent or replace if necessary.
5. Inspect rear commutator for damage or wear (see wear limits chart p.23). Replace if necessary. Clean commutator and commutator tubes and discard o-rings.
6. Remove oil filter cover and discard filter element. Flush canister clean with solvent.

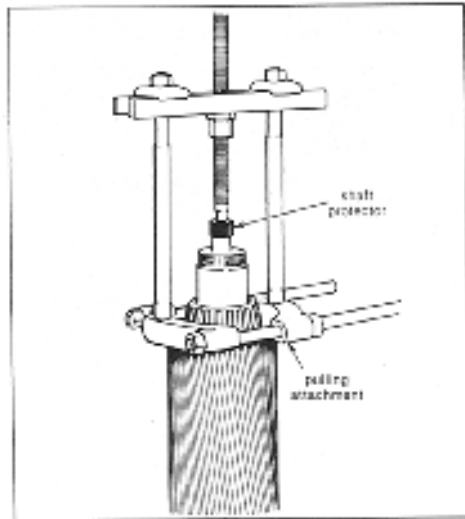


Fig. 30. Pulling Bearing Cone from Pinion Shaft.

D. RE-ASSEMBLY PINION SHAFT AND RELATED PARTS

1. Heat bearing cones in hot oil (or water) (200 deg F max).
2. Apply lubricant to bearing surface on threaded end of pinion shaft.
3. See fig 31. Install bearing cup (A) into bearing container (B).

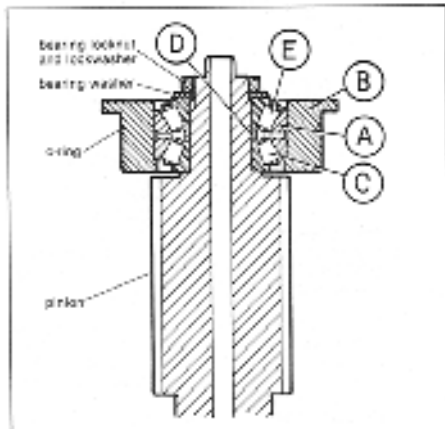


Fig. 31. Cross Section Showing Sequence of Assembly for Pinion Bearings.

4. Install heated bearing cone (C) onto pinion shaft and immediately install bearing container (B) onto bearing cone (C).

5. Bearing spacer (D) and heated cone (E) are now installed and cone is tapped snug.

6. Locate bearing washer and bearing lock washer on shaft.

7. Apply loctite 242 or equivalent on threads of pinion shaft.

8. Install bearing locknut on shaft and secure with lock washer.

9. Apply lubricant to o-ring groove in outside diameter of bearing container and install new o-ring.

10. Apply lubricant to o-ring grooves in rear commutator and install new o-rings. Install anti-rotation stud.

11. If new commutator or pinion is being used, check to see that fit between them is not too tight. Clearance must be .006", otherwise assembly will be very difficult and commutator may freeze on shaft.

IF PINION ONLY IS BEING REPAIRED OR REPLACED AND NOT OUTPUT GEAR PARTS THEN REFER TO E. INSTALLATION ON P.33.

7.5 OUTPUT GEAR AND RELATED PARTS

A. REMOVAL AND DISASSEMBLY

Transmission should be resting engine end down (See fig 33). Support housing if necessary. Pinion shaft should be removed prior to removal of output gear.

1. Remove cap screws securing retainer plate and remove retainer plate.
2. Remove and discard o-ring.
3. With suitable puller pull output coupling from output shaft (see fig.32).

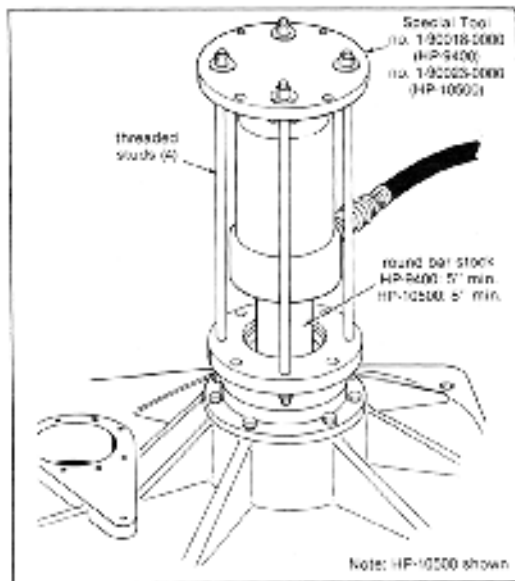


Fig. 32. Removing Output Coupling from Shaft.

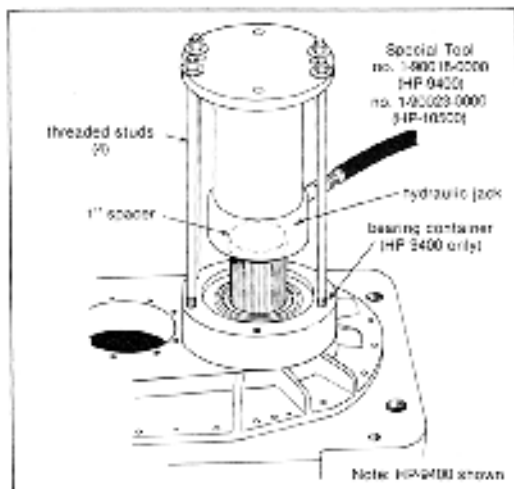


Fig. 33. Removing Cover from Housing.

4. Remove cap screws securing bearing retainer. Remove bearing retainer. Discard oil seal and bearing retainer gasket.

5. Remove housing cover cap screws and pull housing cover from housing (see fig.33).

HP-9400 Models: Do not remove bearing container before pulling cover.

6. Remove bearing container from cover and tap bearings from container.

7. Remove idler gear assembly from housing (or cover) if present.

8. Install lifting eyes and hoist output shaft and gear from housing (see fig.34).

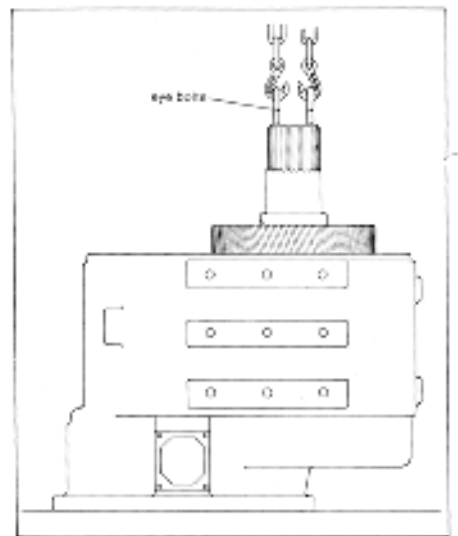


Fig. 34. Removing Output Gear and Shaft.

B. CLEANING, INSPECTION AND REPAIR

1. Inspect tapered roller bearings for rough rotation, corrosion, scoring, scratches, burrs, cracks, pitted or chipped races and wear of rollers. If one of these is found replace entire matched bearing set. Otherwise, clean bearings thoroughly with solvent.

2. Inspect roller bearing at threaded end of output shaft (HP-9400: Roller assembly is on shaft. HP-10500: Roller assembly is in housing). And bearing race for any of the conditions mentioned in step 1. Replace if necessary by removing bearing locknut, bearing lock washer and bearing washer (HP-10500 only). Otherwise clean bearing thoroughly.

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 output shaft splines for grooves or excess wear. Inspect bearing surfaces and shoulder (on splined end of shaft) for grooved, burred or galled conditions. If damage cannot be repaired with crocus cloth, shaft must be replaced. Otherwise clean shaft with solvent.

5. Inspect idler gear for nicks, burrs, damage or wear. Check bearings for smooth rotation. If wear is suspected remove snap ring(s) and replace as necessary. Clean all parts including idler hose with solvent.

6. Inspect output flange at bearing mating surface for nicks or burrs. File smooth or replace flange if necessary.

7. Inspect mating surfaces of output flange and propeller coupling and file smooth.

8. Inspect housing cover bores and front and rear mating surfaces for nicks and burrs. Repair if possible with file or crocus cloth. Clean cover with solvent.

HOUSING 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.

4. Clean oil suction tube and suction hose (sump to pump).

C.RE-ASSEMBLY OF OUTPUT PARTS

1. If output shaft or gear are new:

a). To create a better fit, gear and shaft must be lapped with lapping compound. Parts must then be thoroughly cleaned with solvent.

b). Key must have a slip fit in output gear. There must be at least .020" clearance between top of key and gear. File or grind key if necessary. Secure key to shaft with spring pin.

c). Heat gear in hot oil or water at 200F (93C) maximum.

d). Drop shaft in gear

2. Install bearing spacer on threaded end of output shaft.

3. (HP 9400 only) to install new roller bearing on threaded end of output shaft, roller assembly must be heated. Roller assembly is then tapped gently onto shaft snug against spacer. Tip housing to rest on engine end. Support housing if necessary. Install outer race so it seats firmly in housing bore. Install oil pan and bearing retainer and secure with capscrew.

4. (HP 10500 only) To install new roller bearing at threaded end of output shaft, inner race must be heated and tapped gently onto shaft snug against spacer. Install roller assembly so it seats firmly in housing bore. Install oil pan and secure with cap screws.

5. Place bearing lock washer on shaft

6. Apply lubrication to threads and install bearing locknut. Tighten locknut so that bearing spacer becomes tight against gear.

7. Using a punch, bend tang of lock washer into slot of locknut.

CAUTION: DO NOT ATTEMPT TO ASSEMBLE OUTPUT GEAR PARTS IN HOUSING. CREATE THE ASSEMBLY SHOWN IN FIGURE 35 BEFORE INSTALLATION IN HOUSING.

8. (HP-9400 only) see fig.35. Locate new bearing container gasket on cover and install bearing container in cover bore.

9. Heat output shaft bearing cones in hot oil (200 maximum).

10. See figure 35. Tap bearing cup (A) evenly into cover bore (HP 10500) or bearing container (HP-9400) make sure cup seats properly.

11. With threaded end of output shaft resting on table, lower cover on output shaft.

NOTE: BEARINGS ARE A MATCHED SET, DO NOT MIX PARTS.

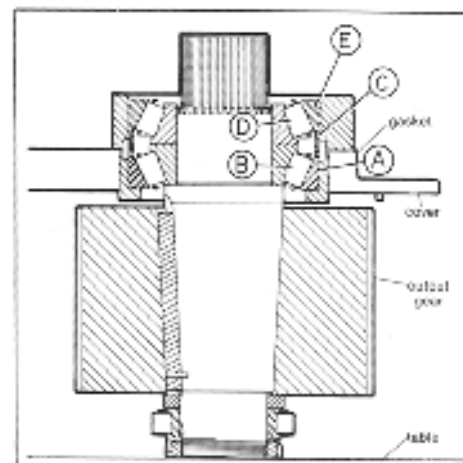


Fig. 35. Sequence of Assembly: Output Bearings.

12. Apply lubricant to bearing surface on shaft and install heated bearing cone (B) on shaft and snug against shoulder.

13. Install bearing spacer (C) and install second heated bearing cone (D) on shaft. Install bearing cup (E).

14. Heat output flange in hot oil or water at 200F (93C) maximum.

15. Press new oil seal evenly into bearing retainer.

16. Locate bearing retainer gasket and install bearing retainer. Secure retainer to cover assembly by alternately tightening cap screws. Torque to 130 lb-ft. (HP-9400) and 225 lb-ft (HP-10500).

17. Install heated output flange on splines of output shaft using match marks (10500 only). Flange may need securing with soft hammer.

With transmission housing engine side down:

18. Install forward pinion roller bearing in housing. Secure with snap ring.

D.INSTALLATION OF OUTPUT PARTS IN HOUSING

1. Install idler assembly, if present, in housing bore. Apply lubricant to o-ring groove on idler shaft. Install new o-ring and apply lubricant to o-ring.

2. If a new idler gear and or a new output gear are being installed apply marking compound to idler gear.

3. Secure new cover gasket in place with grease.

4. Using adequate hoist, carefully lower the cover/output gear assembly into place, see fig.36 or fig 37. A slow twisting of the output flange can aid in proper location of roller bearing. Secure cover in place with cap screws and lock washers. Tightening torque is 65-lb-ft.

5. TRANSMISSIONS WITH IDLER GEAR ONLY
If a new idler gear and or output gear have been installed they must be checked for backlash as follows:

- a.) Tip housing to rest in upright position
- b.) Locate thousandths dial indicator on housing with tip resting on side of idler tooth (similar to figure 40).
- c.) Stabilize output gear and twist idler back and forth

BACKLASH between idler gear teeth and output gear teeth must be NO LESS THAN .003" AND NO MORE THAN .010".

6. TRANSMISSIONS WITH IDLER GEAR ONLY
if a new idler gear and or output gear have been installed check for proper tooth contact with marketing compound.

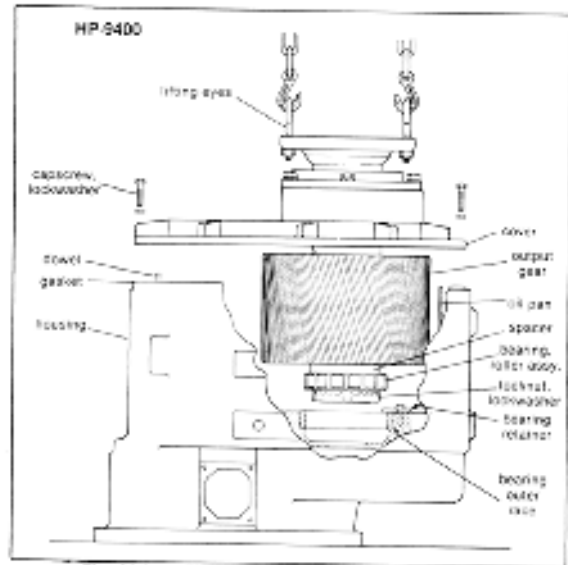


Fig. 36 Installing Output Gear and Cover: HP-9400

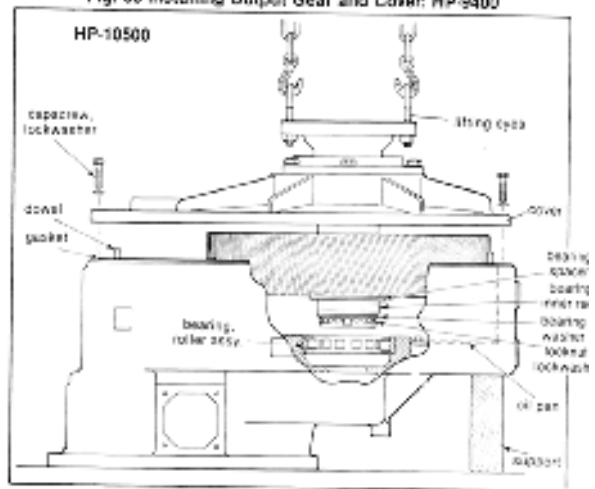


Fig. 37. Installing Output Gear and Cover: HP-10500.

7.4 (continued)
PINION SHAFT AND RELATED PARTS

E. INSTALLATION

1. If new pinion, output gear or idler are being installed, apply marking compound to pinion.
2. Apply lubricant to bearing container outside surface to ease fit in cover bore.
3. Apply lube to commutator I.D and rest commutator in place with stud protruding through selector valve opening in top of housing.
4. Attach suitable hoist to bearing container and lower pinion shaft assembly through cover bore gently into commutator, seating bearing container in cover bore (see fig. 28).

NOTE: Commutator may have be jigged with shaft assembly is tapped into it.

5. Apply cap screws and lock washers to bearing container. Torque to 42 lb ft.

F. INSTALLATION OF OIL PUMP AND RELATED PARTS

1. Install oil pump shaft into pinion shaft.
2. Apply joint compound to threads and install pipe nipples, bushing and oil filter to oil pump. **CAUTION: FLOW ARROW ON FILTER MUST POINT AWAY FROM PUMP SEE FIG.16.**

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 42 lb ft.

apply joint compound on all threaded fittings:

5. Install cleaned suction tube and tee at bottom of housing (see installation drawing for correct location).

6. Install suction hose to tee and oil pump. Connect hose from selector valve to oil pump.

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

Transmission housing should now be tipped up right with the aid of a hoist.

7.6 POST ASSEMBLY PROCEDURE

A. CHECK OUTPUT FLANGE FOR TRUENESS

Check output flange rotation as follows:

- a). With a thousandths dial indicator check the run out of the output flange pilot ring groove as shown in fig.38. Variation must not exceed .003" max.
- b). Dial indicates the output flange mounting face as shown in fig.39. Variation must not exceed .003" maximum.

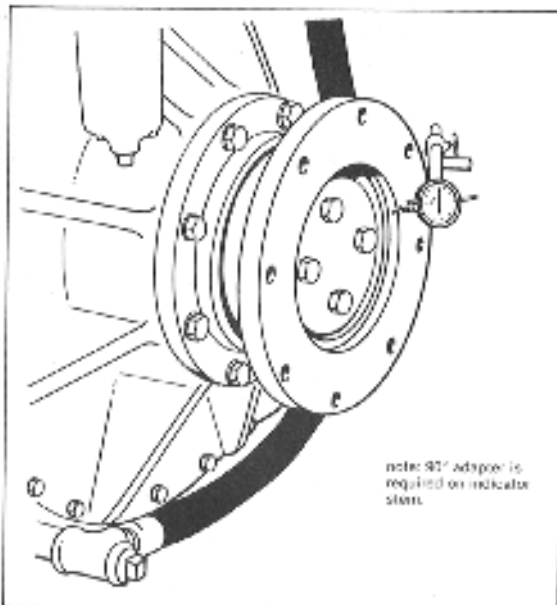


Fig. 38. Dial Indicating Output Flange Pilot Ring Groove

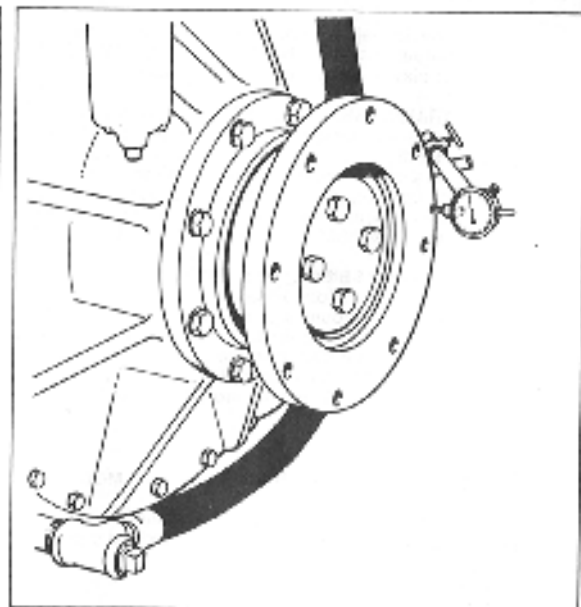


Fig. 39. Dial Indicating Output Flange Mounting Face

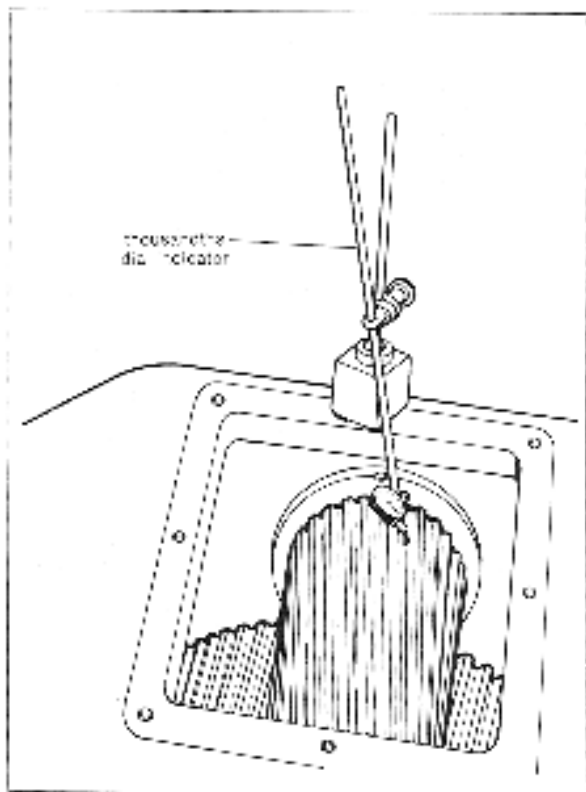


Fig. 40. Checking 'Backlash' with Thousandths Dial Indicator.

B. CHECKING BACKLASH

Transmissions requiring new pinion, idler or output gear must be checked for 'BACKLASH' or play between gear teeth as follows:

TRANSMISSIONS WITHOUT IDLER (A.E.R)

If a new pinion and or output gear have been installed, mount a thousandths dial indicator as shown so the tip is resting on the side of a pinion tooth. Stabilize the output gear and twist pinion back and forth. Backlash must be no less than .004" and no more than .016".

TRANSMISSIONS WITH IDLER (E.R):

IF a new pinion and or idler have been installed, mount a thousandths dial indicator as shown so the tip is resting on the side of a pinion tooth. Stabilize the idler gear and twist pinion back and forth. Backlash must be no less than .003" and no more than .010".

C. CHECKING TOOTH CONTACT (ALL MODELS)

If a new pinion and or idler are installed check for proper tooth contact with marking compound (applied to pinion).

D.MISCELLANEOUS ASSEMBLY

1. Install oil breather
2. Install oil drain plug
3. Install new o-rings in commutator and selector valve support plate and install tubes in commutator bushing.
4. Install selector valve parts including support plate, base plate and gaskets. Use fig. 19 as a reference.

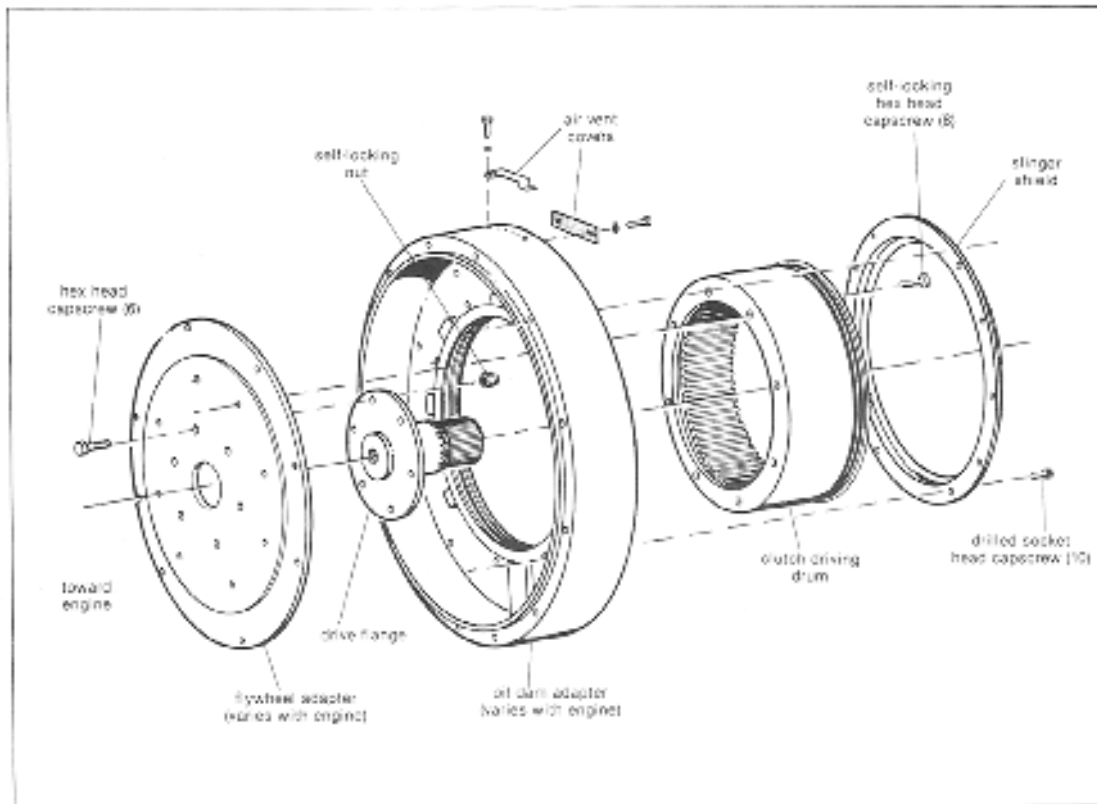


Fig. 41. Adapter Parts

7.7 ADAPTER PARTS

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

2. Remove oil dam adapter and inspect labyrinth oil seal on inside diameter. Repair or replace as necessary (wear or damage to seal indicates misalignment, check further.)

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

NOTE: Independent mounts are shown in exploded view on pages 58 and 60.