

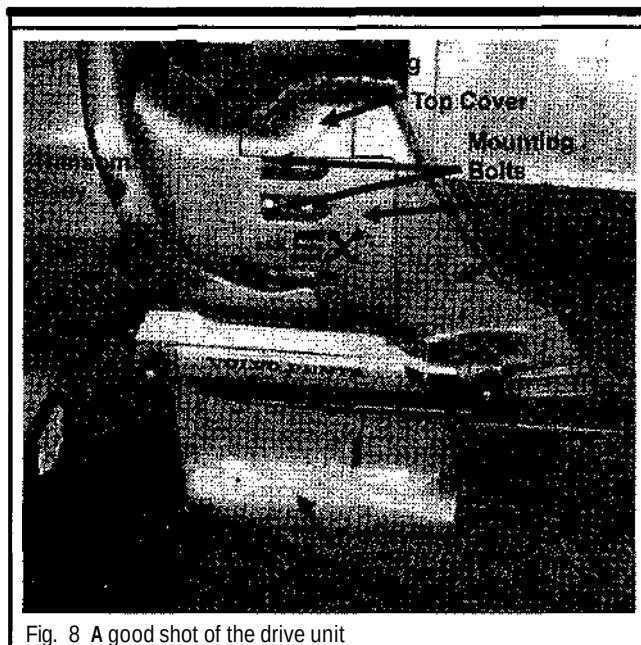


Fig. 8 A good shot of the drive unit

If you've gone through the trouble of removing the stern drive, we recommend this as a good time to perform some preventative, although not necessary maintenance—remove the U-joint and shaft seal and replace them as detailed in the B&H manual. Why not do the water hose also? Cheap insurance, so spend a few bucks and do it!

12. Inspect the condition of the water sealing seal and replace with a new seal if any doubts as to its condition.

13. Check the water hose and its fitting. Make sure the clamp nut is tightened to 96-120 inch lbs. (11-14 Nm).

14. Apply a light coating of OMC Triple Guard grease to the tapered end of the pinion bearing carrier. Make sure that the rubber sealing ring is seated properly in the groove of the pivot housing and then coat the edge of the U-joint bellows with grease.

15. Slide an alignment tool (# 3851083), splined end first, through the bellows and gimbal bearing and into the engine coupler. The tool should slide into the coupler very easily; if not, the engine is out of adjustment and will have to be moved as detailed in the Engine Alignment procedures given in the appropriate section for your engine.

If you are not sure of which way that the engine needs to be adjusted, coat the splines of the tool with grease and reinsert it again until it binds and then remove it very carefully. The pattern left on the alignment tool should tell you which way to adjust the engine.

16. Once the engine is aligned correctly, remove the tool and shift the drive into gear (either one) by moving the eccentric piston lever up or down.

17. Coat the 6 mounting studs with Drive Sealing compound.

18. Coat the splines on the driveshaft liberally with Moly Grease.

Lubricate 2 new shaft O-rings with clean engine oil and slide them onto the shaft until they are seated in their grooves. Do not get grease in the grooves.

19. Use a grease gun on the U-joint zerk fitting and top out the joints. Coat the surface of the U-joint coupler with grease.

20. Raise the unit off of the holding fixture with your hoist and move it into position in front of the transom. Carefully slide the unit forward while guiding the driveshaft into the engine coupler and the drive over the mounting studs. Wiggle the propeller slightly once the shaft splines make contact with the coupler until they engage properly and then slide the unit all the way forward until the case mates with the pivot housing.

21. Install 6 new locknuts and tighten them with a 5/8 in. swivel socket to 25 ft. lbs. (34 Nm) starting with the center nuts and then working back and forth in a criss-cross pattern. Now repeat the same sequence until they are tightened to 50 ft. lbs. (68 Nm).

22. Press the trim/tilt cylinder bushing into the boss on each side of the upper unit. Install bushings into the outer side of each cylinder, align the cylinder with the boss and press in the pivot pin very carefully. You may have to give it a few taps with a rubber mallet.

23. On cylinders with lock nuts, install the washers and then the nuts (new!). Tighten the nuts until there is an equal amount of threads exposed on each side of the pin and then tighten both nuts to 10-12 ft. lbs. (14-16 Nm). Replace the plastic caps.

24. Detach the lifting hoist.

25. Turn the drive over hard to port. Coat the end of the shift cable casing with grease and then slide it through the transom sleeve. Make sure the large and small seals are still in place on the cable and slide it into the housing. Swivel the anchor clamp into place in the groove on the cable and tighten the bolt securely.

26. Thread the cube onto the end of the shift cable about half way. Move the remote control handle to Neutral and then position the remote control lever on the eccentric piston in its neutral detent (lever should be level. Now turn the cube in or out until it is in alignment with the center of the slot in the crank.

27. Push the cube pin through the hole and then install the washer and a new cotter pin. Install the jam nut and tighten it securely against the cube.

28. Adjust the trim sending unit.

29. Install the shift cover and tighten the bolt(s) securely. Fill the unit with oil, screw in the dipstick, install the propeller(s) and connect the battery cables.



Fig. 9 Remove the 3 shift cover bolts...

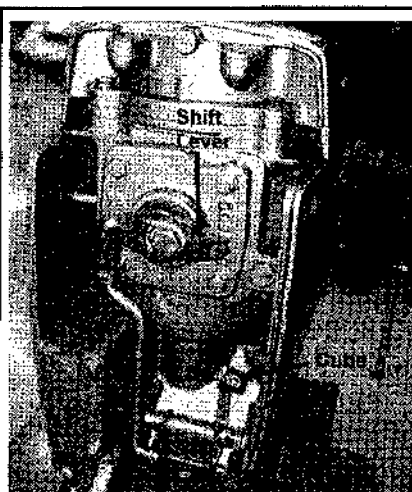


Fig. 10 ...and then disconnect the shift cable

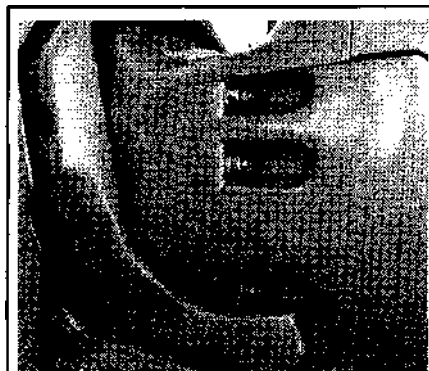


Fig. 11 There are 3 nuts on each side

12-6 STERN DRIVE – COBRA AND KING COBRA

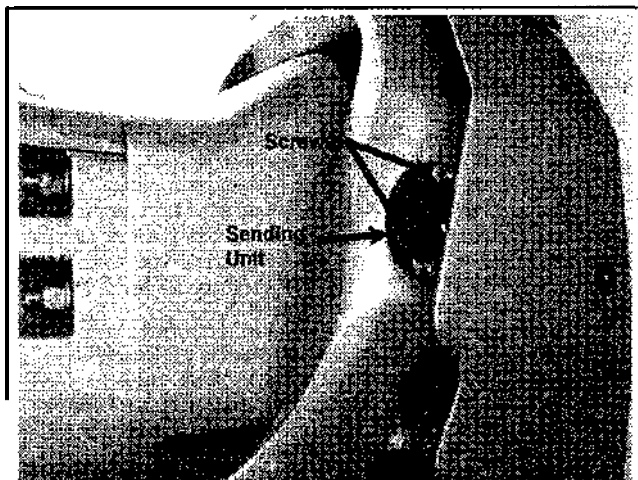


Fig. 12 The trim sending unit

TRIM SENDING UNIT ADJUSTMENT

◆ See Figure 12



1. Move the trim switch to the DOWN or IN position and confirm that the drive unit is in the full down position.
2. Turn the wheel hard over to port and then loosen the sending unit bolts on the starboard side of the gimbal ring.
3. Disconnect the sending unit plug in the harness, connect an ohmmeter and rotate the sending unit until the meter shows a reading of 10-12 ohms.
4. Tighten the sending units screws to 24 inch lbs. (2.7 Nm) and reconnect the plug.

UPPER GEAR HOUSING

Description

Output power from the engine is connected to the stern drive through a horizontal driveshaft. A coupler is bolted to the flywheel and has a splined hub in the center. The end of the horizontal driveshaft indexes with, and slides into, the center of the hub. Power from the engine is then transmitted through the horizontal driveshaft to a pinion gear set where power direction is changed from horizontal to vertical.

The upper driven gear is pressed onto the outside diameter of the upper driveshaft. The upper driveshaft is splined on the lower end. When the upper gear housing is mated to the lower unit, the end of the lower unit driveshaft indexes into the splined end of the upper driveshaft. Engine power is then transferred down into the lower gear unit.

The horizontal and vertical driveshafts are both mechanically connected. Therefore, anytime the engine is operating, the horizontal and vertical driveshafts are constantly rotating with engine rpm. A double yoke universal joint assembly in the horizontal driveshaft allows the stern drive to be raised, lowered or turned side-to-side to a required trim/tilt position (within limits), while the engine is operating.

Upper Gear Housing

REMOVAL & INSTALLATION

1986-93 Cobra Models

◆ See Figures 13, 14, 15 and 16



■ The upper gear housing may be removed after removing the entire stern drive unit from the vessel.

1. Disconnect the battery cables.
2. Remove the stern drive as previously detailed and position it in a support fixture.
3. Make a note of the of where the index mark is in relationship to the grid on the bottom of the trim tab and then remove the trim tab bolt and the tab. Make sure that you write the tab mark down somewhere!
4. Remove the bolt that was partially covered by the trim tab and then remove second bolt forward of this one. The middle bolt is for the anode and does not need to be removed.
5. Remove the 4 mounting bolts (2 on each side) from the sides of the lower unit.
6. Lift the housing off of the lower unit until the shift rod disengages the guide pin and then swivel it 90 degrees to port while lifting it completely off. Move it to an appropriate stand.

To install:

7. Thoroughly clean the upper case-to-lower housing mating surfaces.

8. Make sure that the nylon plug is positioned at the base of the splines inside the lower driveshaft. Coat the splines at both ends of the intermediate shaft with clean engine oil and insert the shaft into the lower driveshaft.

9. Rotate the shift rod head 90 degrees to port.

10. Install the plastic water tube into the recess in the bottom of the upper unit.

11. Position the upper unit over the lower unit and then slowly lower it while guiding the water tube and shaft into place. As the shift rod head begins to appear in the exhaust opening, swivel it forward until it can engage the guide pin. Wiggle the propeller shaft until the shaft splines engage those in the coupler and then lower the unit fully until it sits on the lower unit.

There may be a yellowish-green substance in the threads of the mounting bolts—this helps the bolts from coming loose and if not evident, they will need to be replaced with new ones.

12. Coat the threads of all bolts with Gasket Sealing compound. Install the bolts, 4 short ones (on the sides) and 2 longer ones (in the rear). Tighten them all to 22-24 ft. lbs. (30-33 Nm).

13. Position the trim tab so that the index mark lines up with the correct mark on the grid and then tighten the bolt to 28-32 ft. lbs. (38-42 Nm).

14. Install the drive unit.

1988-95 King Cobra Models

◆ See Figure 17



□ The upper gear housing may be removed after removing the entire stern drive unit from the vessel.

1. Disconnect the battery cables.
2. Remove the stern drive as previously detailed and position it in a support fixture.
3. Remove the 6 mounting bolts (3 on each side) from the sides of the lower unit and the 1 bolt at the rear of the plate.
4. Lift the housing off of the lower unit and move it to an appropriate stand. The water tube and/or shaft coupler may come off (or fall out) with the upper unit, so watch for them and reinstall them in the lower unit if necessary.

To install:

5. Thoroughly clean the upper case-to-lower housing mating surfaces.
6. Slide the small nylon support ring over the top of the driveshaft and into position in the recess.
7. Coat the new O-rings for the driveshaft retainer and oil passage with OMC Hi-Vis oil and then press them into their respective grooves.
8. Make sure that the tabs on the driveshaft retainer are aligned and in place with the nearest slots.
9. Install the intermediate shaft onto the driveshaft. Press the water supply tube into the grommet on the bottom of the housing.



Fig. 13 Remove the side bolts...

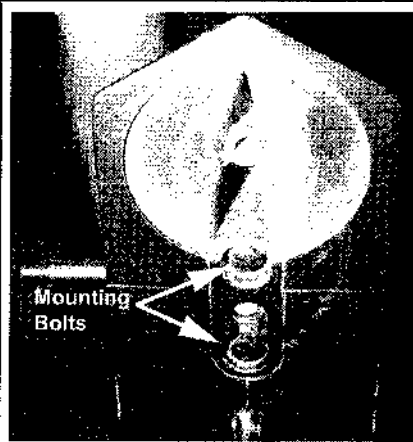


Fig. 14 ...the aft bolts

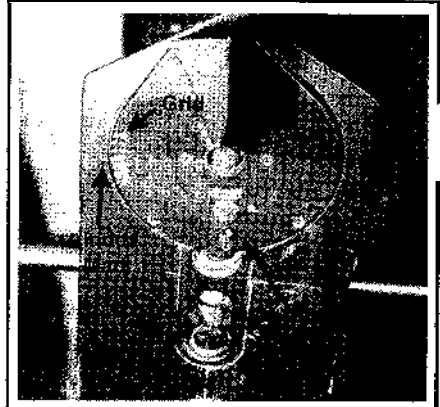


Fig. 15 Don't forget to note the trim tab position before removing it

10. Position the upper unit over the lower unit and then slowly lower it while guiding the water tube and intermediate shaft into place. Feed the impeller housing vent tube into the exhaust chamber on the lower unit. Wiggle the propeller shaft until the upper shaft splines engage those in the coupler and then lower the unit fully until it sits on the lower unit.

11. Coat the threads of all bolts with Gasket Sealing compound. Install the bolts and tighten them to 32-40 ft. lbs. (43-54 Nm).

12. Install the drive unit.

1994-98 Single Propeller Models (SPISXISX Cobra)

1996-98 Dual Propeller Models (DPIDP DuoProp)



◆ See Figures 8, 11, 12, 13, 14, 15 and 18 thru 22

□ The upper gear housing may be removed after removing the entire stern drive unit from the vessel.

1. Disconnect the battery cables.
2. Remove the stern drive as previously detailed and position it in a support fixture.

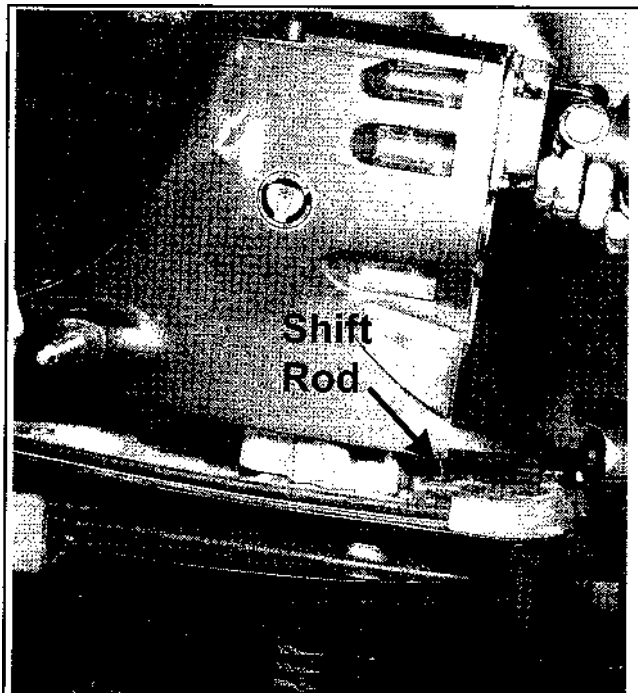


Fig. 16 Separating the upper gear housing

3. Remove the 4 mounting bolts (2 on each side) from the sides of the lower unit and the 2 bolts at the rear of the plate. DP drives units may use studs on the sides, so they will have nuts if this is the case.

4. Lift the housing off of the lower unit and move it to an appropriate stand. The water tube and/or shaft coupler may come off (or fall out) with the upper unit, so watch for them and reinstall them in the lower unit if necessary.

To install:

5. Thoroughly clean the upper case-to-lower housing mating surfaces.
6. Clean the oil screen thoroughly. Coat a new O-ring lightly with clean engine oil and press it into the groove. Install the oil screen.

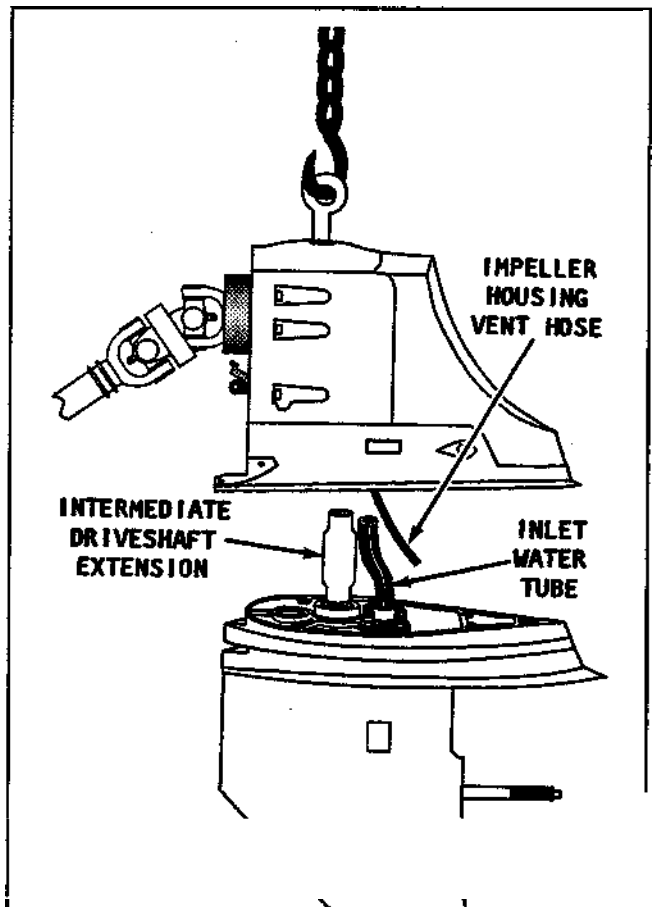


Fig. 17 Make sure that everything is lined up correctly when mating the upper and lower units

12-8 STERN DRIVE – COBRA AND KING COBRA

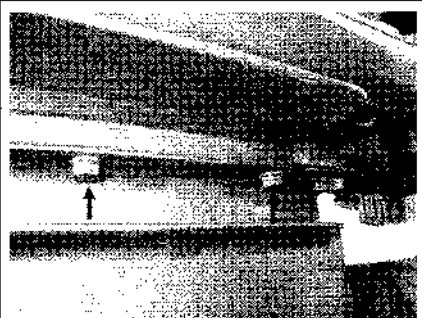


Fig. 18 Remove the two bolts on each side...

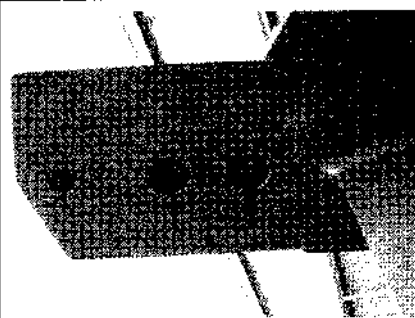


Fig. 19 ...the two rear bolts...



Fig. 20 ...and then separate the cases and lift off the upper unit

7. Make sure that the intermediate shaft coupler is installed correctly on the shaft with the groove facing upward.

8. Install the plastic water tube guide into the recess in the lower unit. Check the positioning of the upper and lower grommets on the tube, coat the lower grommet with sealing compound and position it into the recess and over the guide. Certain early models may use a retainer that is held in place with 4 screws, if you have one, tighten them to 10-12 ft. lbs. (14-16 Nm).

9. Replace any O-rings.

10. Position the upper unit over the lower unit and then slowly lower it while guiding the water tube and shaft coupler into place. Wiggle the propeller shaft until the upper shaft splines engage those in the coupler and then lower the unit fully until it sits on the lower unit.

11. Coat the threads of all bolts for studs with sealing compound. Install the bolts (or nuts) and tighten the 4 short ones (on the sides) to 22-24 ft. lbs (30-33 Nm) and the 2 longer ones (aft) to 32-40 ft. lbs. (43-54 Nm).

12. Install the drive unit.

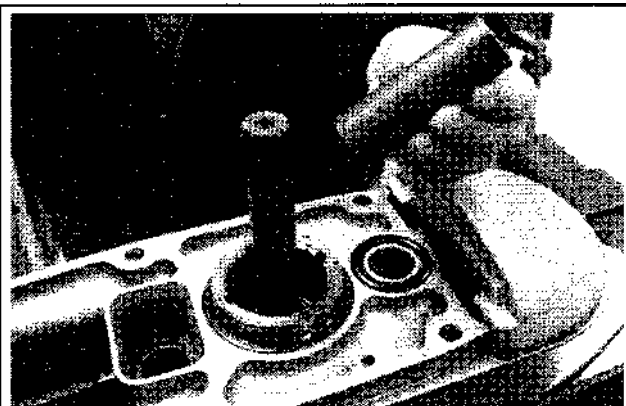


Fig. 21 Make sure you install the shaft sleeve with the groove facing the upper unit

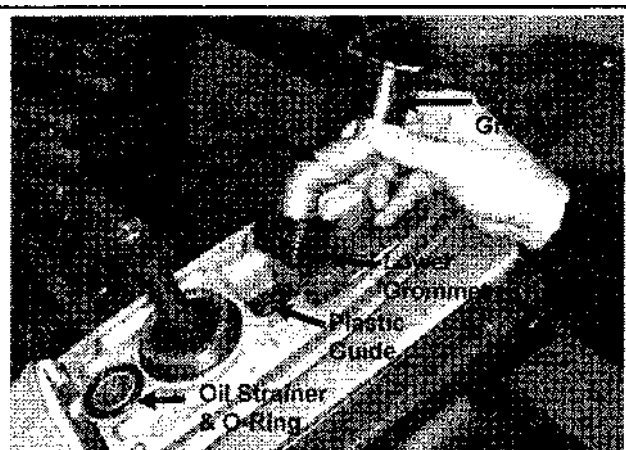


Fig. 22 Position the water tube before moving the upper unit into place

DISASSEMBLY & ASSEMBLY

1986-93 Cobra Models

1988-89 King Cobra Models

◆ See Figures 23 thru 50



■ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

OMC makes a special spline socket (# 311875) and holding fixture (# 912278) to hold and support the upper housing—we strongly recommend using these tools, as the unit must be held securely throughout the disassembly process.

1. Remove the upper housing and install it into an appropriate support fixture.
2. Remove the 3 mounting bolts and lift off the rear cover. Remove the 4 upper cover bolts and lift off the cover. Throw away the Large O-ring, but make sure that you keep the 4 bolts separate as they are the longest bolts in the upper unit and are important for securing the cover during drive lifting operations.
3. Remove the water pump and adapter as detailed in the Cooling System section.
4. Loosen and remove the 4 bearing carrier bolts. Insert 2 small prybars between the carrier and the housing and then lever the U-joint/carrier assembly out of the housing—have a friend or assistant help you by pulling out on the driveshaft. Save any shim material that is not damaged. Remove the 2 O-rings on the shaft and the one on the inner flange of the carrier and throw them away. Please refer to the U-Joints section for service procedures on the U-joints.

Be very careful not to press or strike the impeller shaft while removing the assembly.

5. Separate the U-joint shaft from the driveshaft at the yoke closest to the bearing carrier (see U-Joints section).

6. Clamp the flat side of a universal bearing separator below the small bearing on the shaft and position the assembly into a press. Slide a bearing remover (# 912269) over the impeller shaft so the small side is toward the bearing and then press off the bearing. Make sure you catch the shaft.

7. Cut a 2-7/16 in. length of 1 in. diameter pipe and press the piece through the yokes on the end of the shaft. Position the yoke (with support pipe) into a vise so the shaft is pointing up. Install a spanner wrench (# 912272) over the spanner nut, attach a breaker bar and remove the nut. This nut is secured with Ultra-Lock adhesive, so it may be necessary to heat the nut in order to break it loose.

8. Install a remover tool (# 912269) over the impeller shaft so the small end is toward the gear. Support the bearing carrier and press the shaft out. If the large bearing requires replacement, install a bearing separator between the gear and bearing so the curved side is facing the bearing. Insert a cup remover (# 912291) into the gear and remove the race.

□ Removal of the impeller shaft will damage the shaft—never remove the shaft unless necessary due to damage or wear.

9. The impeller shaft is pressed into the driveshaft. Remove requires drilling a hole through the shaft and installing a puller. On replacement, coat the new shaft lightly with engine oil, position the large end of an installer (# 912269) over the U-joint shaft and insert the new shaft into the tool. Press the shaft in until it is flush with the end of the tool.

10. Remove the O-ring from the bearing carrier if you didn't already do it while removing the assembly. Position the forward face of the carrier (the side the U-joint comes out of) down on a press. Insert the nose of an installer (# 912287) through the seal and then press it out of the carrier. Make sure that the carrier is face down, or you will damage the carrier during the removal process.

11. Sit the recessed side of a holding block on the top side of the carrier. Lay the base plate on the block and then install the puller (see pinion bearing carrier steps for part numbers) and remove the bearing race. Make sure that this is necessary, because you will damage the race on removal.

12. Insert a spanner tool (# 984330) into the upper bore and secure the arm to the mating surface with 2 of the upper cover bolts. Tighten them alternately until the tool is secure and seated in the retainer ring around the upper driven gear. Attach a breaker bar and loosen the ring; once loosened sufficiently, remove the tool and unscrew the ring. Remember that the tool will be under considerable tension so loosen the bolts a little at a time.

13. Wrap a wooden dowel or broom stick with a rag and insert it into the bore from the bottom (you may have to turn the unit over). Carefully tap the dowel with a rubber mallet until the pinion bearing carrier comes loose; remove the carrier. Remove all shim material from the lip of the carrier and inside the housing.

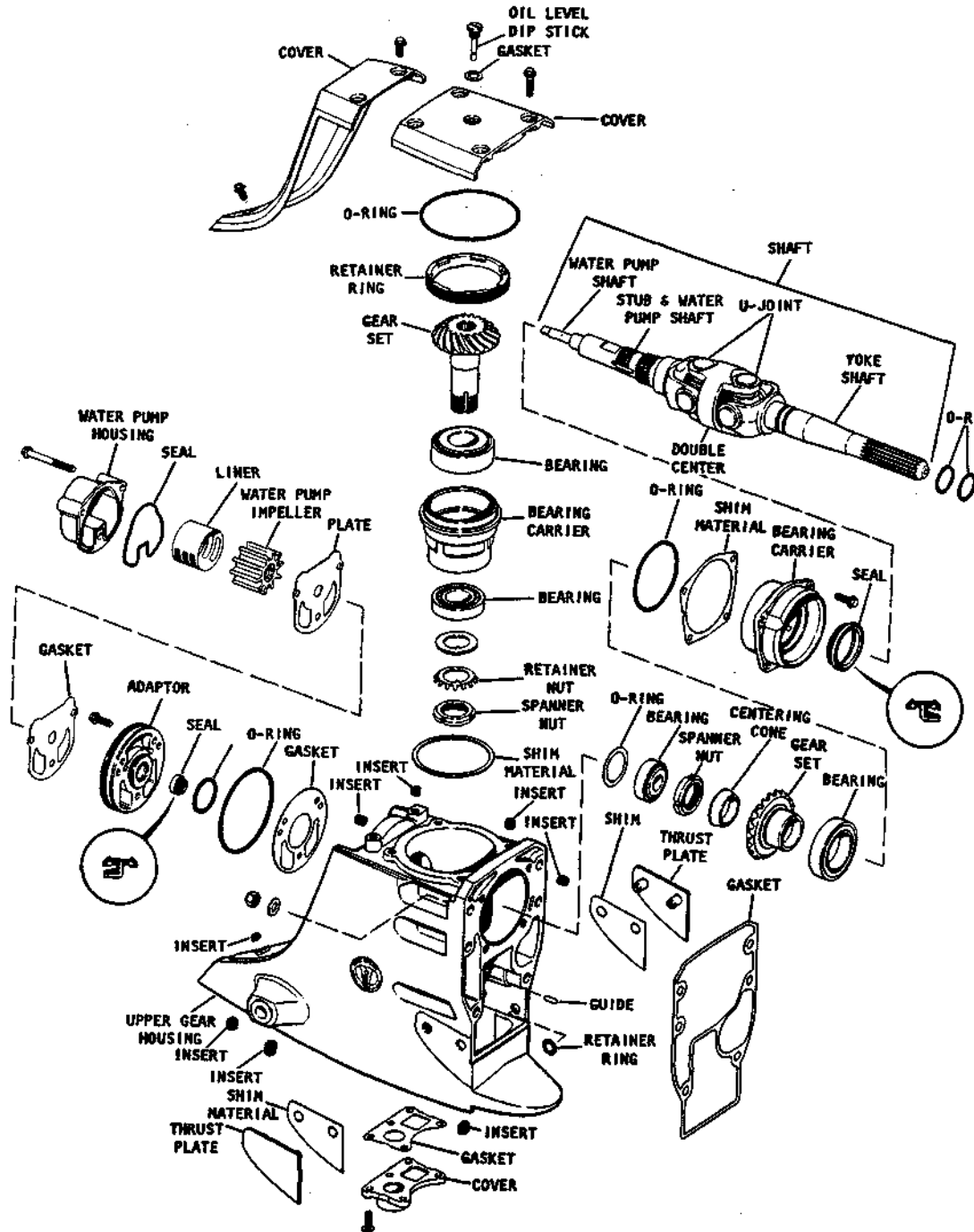


Fig. 23 Exploded view of the upper gear housing—1986-93 Cobra and 1988-89 King Cobra units

14. Turn the carrier over and bend back the locking tab holding the spanner nut in position. Clamp a spline socket (# 314438) in a vise and then slide the carrier onto it, gear side first. Position a spanner wrench (# 912272) over the nut, connect a 112 x 314 in. adapter to a 112 in. breaker bar and remove the nut, retainer and washer.

15. The gear and shaft are one piece and are pressed into the lower bearing. Position a holding block (# 912278) over 2 plates on your press so the recessed side is facing up. Position the retainer ring over the block and then sit the carrier on the assembly with the gear facing down. Press the shaft and gear free of the carrier.

16. If the pinion shaft bearing requires replacement, position the shaft into a universal bearing separator so the curved side of the tool is between the bearing and the gear. Place the assembly in a press and remove the bearing.

17. Position the carrier on a flat surface so the small bearing race is facing up. Sit a holding block (# 912278) on the carrier with the recessed side facing up. Lay the retainer ring over the block and then lay a base plate on the ring. Assemble a bridge assembly (#432127) and puller jaws (# 432129), install it on the components so the jaws are under the race, expand the jaws and remove the bearing race.

18. Now flip the carrier over and position a holding block so the recessed side is facing down. Lay a base plate on the block. Install the puller tool so the jaws are under the race, expand the jaws and remove the bearing race.

To assemble:

19. Replace all O-rings, gaskets and seals with new ones whenever possible. Clean all parts (except rubber or plastic) in solvent and dry them with compressed air.

20. Coat all metallic components with clean engine oil.

21. Check all gears and gear teeth carefully to be sure they are not chipped, cracked, nicked or otherwise damaged in any manner. Replacement gears always come in matched sets, so when you find a bad one, replace them all.

22. Inspect all bearings and bearing races for pits, grooves, burns or signs of uneven wear. Replace as necessary.

23. Check all shafts and shaft splines carefully to be sure they are not chipped, cracked, nicked or otherwise damaged in any manner.

24. Check the thrust plate dimensions again as detailed previously. Add shim material as necessary.

25. Coat both sides of a new water tube cover gasket with Gasket Sealing compound and then position into the housing so that the round opening is on the port side as you look at the housing from the rear. Install the cover and tighten the bolts to 12-14 ft. lbs. (16-19 Nm). Finally, press a new seal into the cover and then twist the water tube in until it seats.

26. Set the pinion bearing carrier on a press so the wider side is facing up. Position a new bearing race into the carrier and then lay an installer (# 912276) over the race so the A side is facing up. Press the race in until it seats completely.

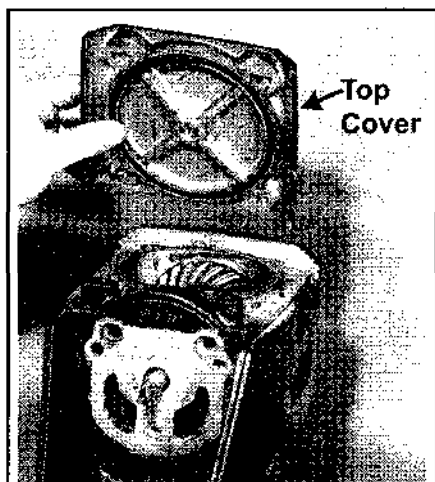


Fig. 24 Removing the top cover

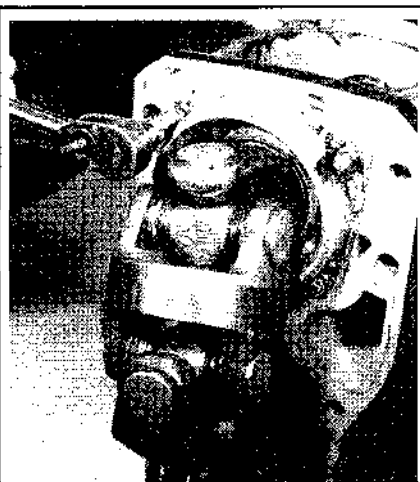


Fig. 25 Loosen and remove the 4 bolts...

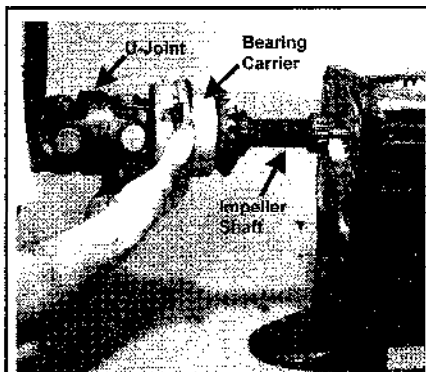


Fig. 26 ...pry or pull the carrier away from the housing...



Fig. 27 ...and remove any O-rings or shim material

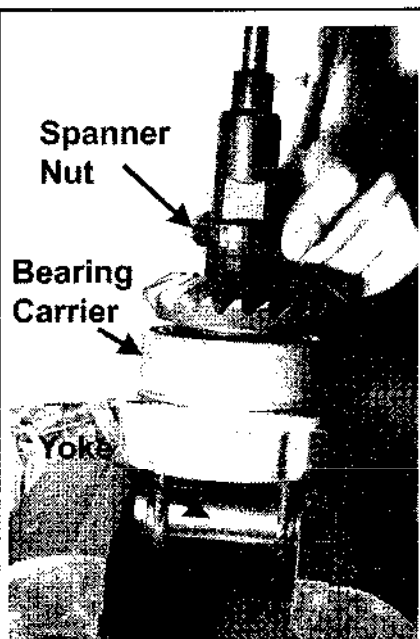


Fig. 28 Remove the spanner nut

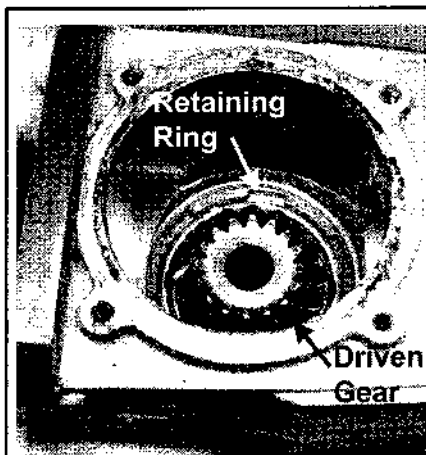


Fig. 29 The pinion bearing retainer ring has notches...

27. Turn the carrier over and repeat the previous step for the smaller bearing race.

28. If you removed the large pinion bearing, lay the **A** side of the installer on a press. Coat the inside of the bearing with oil, position it on the installer and insert the shaft. Press in the shaft until the gear seats itself on the bearing. If you removed the smaller bearing, turn the carrier over and repeat the procedure for this one.

29. Thread in the spline socket used during disassembly and mount the carrier assembly in a vise. Spray the shaft and spanner nut threads with Locquic Primer and allow them to dry completely. Slide the washer and tab retainer over the shaft. Apply OMC Ultra-Lock adhesive to the threads of the nut and then screw it on so the beveled edge is facing the carrier. Finger-tight only at this point please.

30. Install the spanner wrench and breaker bar and then tighten the nut while rotating the carrier body until there is no shaft end play evident. Remove the unit, install a holding block (# 912278) into the vise and insert the carrier with the gear side facing up. Connect a torque wrench to the top of the spline socket and check that the rolling torque is 3-9 inch lbs. (0.3-1.0 Nm) with 6 inch lbs (0.7 Nm) being the ideal. If rolling torque is too low, tighten the spanner nut until a recess in the nut has lined up with the next locking tab. Recheck the torque and continue this procedure until it falls within specifications. If the torque reading is too high, remove the nut,

retainer and washer. Turn the assembly over and position it in press so that you can exert enough pressure to move the shaft (just barely) slightly. Re-install the hardware and repeat the procedure until you can bring the rolling torque measurement into range.

31. Bend at least one locking tab over and into a recess on the spanner nut.

32. If you removed the drive gear bearing on the upper carrier, a new one must be installed. Coat the inside of the bearing lightly with oil and position it onto the gear. Move the assembly to a press and press the bearing onto the gear using an installer (#912276) with side **A** facing the bearing. If you also remove the race, coat the outer side of a new one with oil and press it in using the same procedure.

33. Install a new seal onto the stepped side an installer (# 912286) so that the protruding lip is facing away. Coat the metal casing of the seal with Gasket Sealing compound and then press the seal in until it seats fully. Coat the lip with Triple Guard grease. Once this is done, insert the carrier into the housing as a quick check for out-of-roundness—it should slide in freely, otherwise it will require replacement.

34. Sit the gear bearing assembly on a press (gear side down) and position the carrier onto the bearing. Coat the U-joint shaft splines and the rollers with engine oil and then insert the shaft into the gear, pressing it in until fully seated. Carrier movement of up to 1/8 in. is not unusual, so don't be concerned if the bearing is not tight in the carrier.



Fig. 30 ...insert the tool so it seats in them...

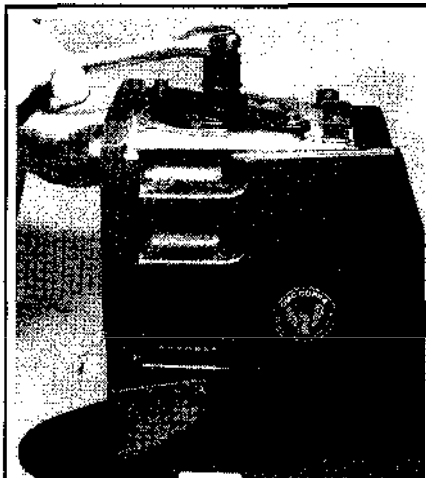


Fig. 31 ...and then loosen the ring...

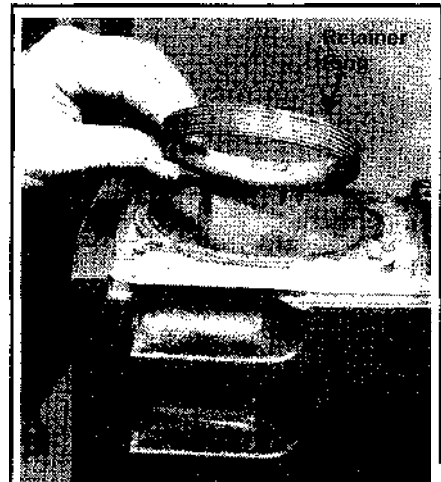


Fig. 32 ...until you can remove it

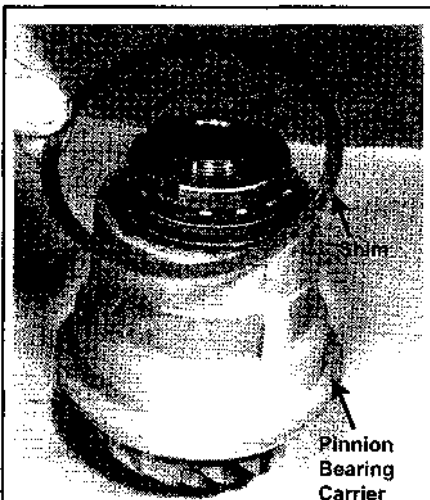


Fig. 33 Once the pinion bearing carrier is out, remove the shim material

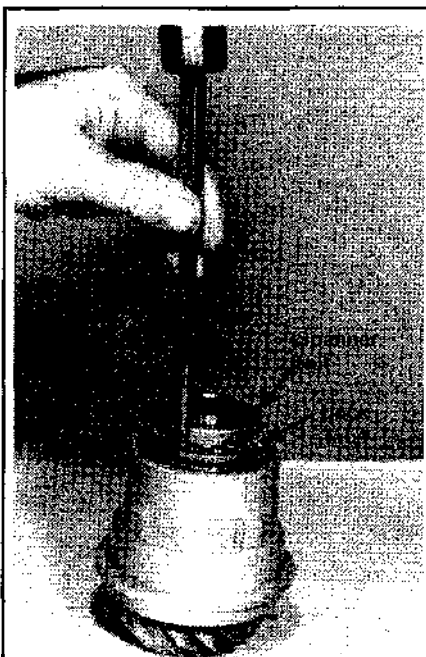


Fig. 34 Bend back the lock tabs...

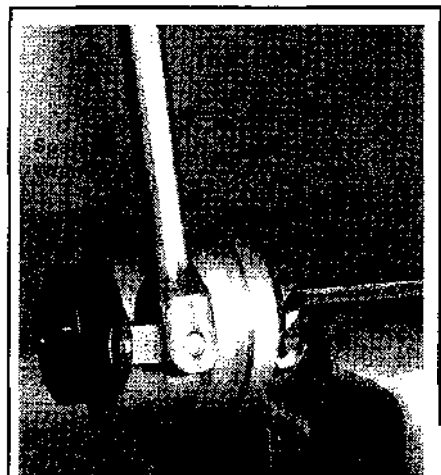


Fig. 35 ...and remove the spanner nut

12-12 STERN DRIVE – COBRA AND KING COBRA

35. Spray the threads of the spanner nut and shaft with OMC Locquic Primer and allow to air dry completely.

36. Find the piece of pipe you cut earlier and reinstall it into the yoke so that you can clamp the assembly in a vise with the gear side facing up. Slide the centering cone down over the shaft and set fully into the gear with a drift and plastic mallet.

37. Coat the exposed shaft threads evenly with OMC Ultra Lock adhesive and then thread on the spanner nut so the beveled edge is against the gear. Install the spanner wrench and a 90° torque wrench and tighten the nut to 200 ft. lbs. (271 Nm).

38. Install a bearing installer (# 912269) into the base of a press so the large opening is facing up. Coat the inside of the impeller bearing with engine oil and sit it in the opening on the tool. Now coat the impeller shaft lightly with Extreme Pressure grease and press the assembly into the bearing until it seats itself on the shaft.

39. Determining shimming needs for the carrier assembly will require a shim gauge kit (# 984329). Remove the O-ring from the carrier if you haven't already **done** so, slide the race over the rear bearing and then insert the kit's center adaptor. Do not install any of the original shims.

40. Position the assembly into the fixture frame, rotating the carrier until the bolt holes align and then install the 3 bolts provided with the kit. Tighten them securely. Tighten the pre-load screw on the end of the fixture until it just reaches the reference groove in the adaptor, thus setting the preload. Tighten the lock nut securely and then rotate the shaft at least 4 times to set the rollers.

41. Clamp the frame in a vise so the gear is pointing up. Check the carrier for a stamped gear ratio rating and then select the appropriate gauge rod from the kit. Attach the rod to the inner hole in the center adaptor and tighten the bolt securely.

42. Measure the clearance between the rod and a flat on top of one of the gear teeth; subtract this figure from 0.020 in. to determine the shim thickness needed behind the rear bearing race. Now remove the gauge rod and install the long gauge rod in the outer hole on the adaptor. Measure the clearance between the end of the rod and the carrier flange, add this figure to the shim thickness you decided on for the rear bearing and then **SUBTRACT** 0.020 in. This will provide you with the correct shim thickness for bearing pre-load.

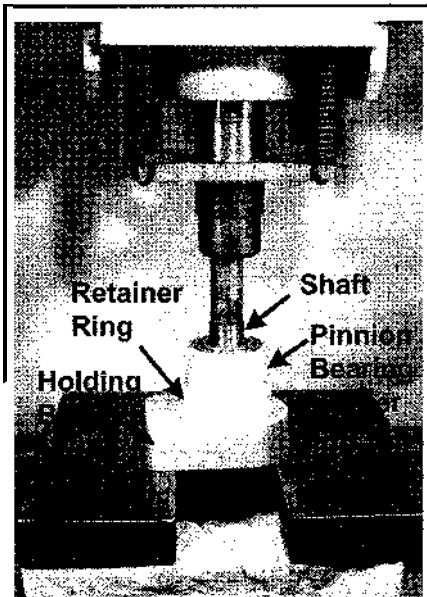


Fig. 36 Press out the gear and shaft...

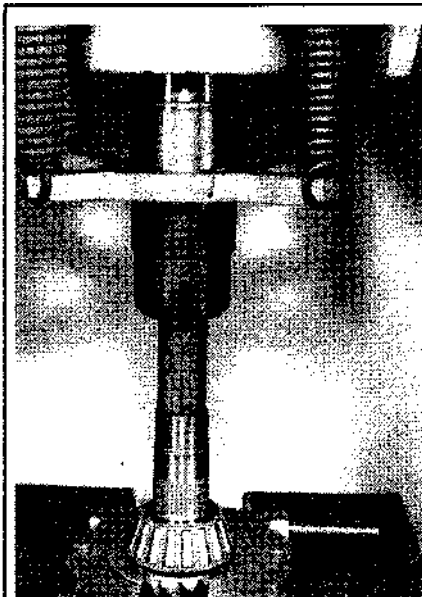


Fig. 37 ...and then separate the bearing from the gear

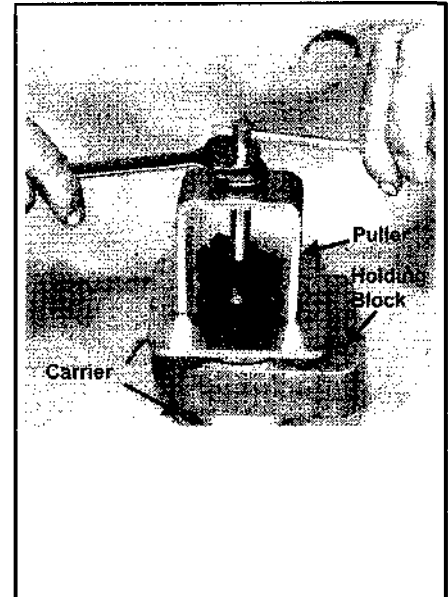


Fig. 38 Removing the small bearing race from the pinion carrier



Fig. 39 Forcing out the impeller shaft bearing race



Fig. 40 Installing the water tube cover



Fig. 41 A good shot of the pinion bearing carrier

43. OK, now that we've assembled all of the parts, let's put it all back together! Position a shim gauge onto the gear teeth flats on the pinion bearing carrier and measure the clearance between the arm of the gauge and the underside of the carrier rim. Subtract, you guessed it, 0.020 in. from this measurement. To determine the shim thickness needed for the carrier.

44. Install the appropriate amount of shims (previous step) onto the carrier seat in the housing and then install the carrier assembly. There are lugs on the side of the carrier housing which must align with the locating slots in the housing bore—the oil circulation slot visible inside the carrier is directly in line with one of the lugs so it makes for a good reference while sliding the carrier into the housing bore. Turn the housing on its side and then insert the carrier using the intermediate shaft to push it into place until the gear teeth tops are 3.10 in. (78.7mm) below the cover surface of the gear housing. You should also be able to see all of the retainer ring threads.

45. Spin the housing back into the upright position and then coat the retainer ring threads lightly with oil before tightening it down by hand. Once in place, install the spanner tool used during disassembly and tighten the ring to 145-165 ft. lbs. (197-224 Nm).

46. Slide a 5/8 in. ID flat washer onto a 5/8 in. x 3 in. bolt. Position the correct amount of shim material (as determined previously) into the bearing race seat, coat the rear bearing race with oil and then install it into the seat. Position a puller head (# 307636) into the water pump adapter housing recess so the flat side is against the case. Now position the installer (# 314429) into the race, insert the bolt through the puller and thread it into the installer. Tighten the bolt until the race seats itself fully.

47. Assemble the U-joints to the inner yoke and then slide the correct amount of shim material (as determined previously) over the shaft and against the inner flange of the carrier so the notches are all in alignment.

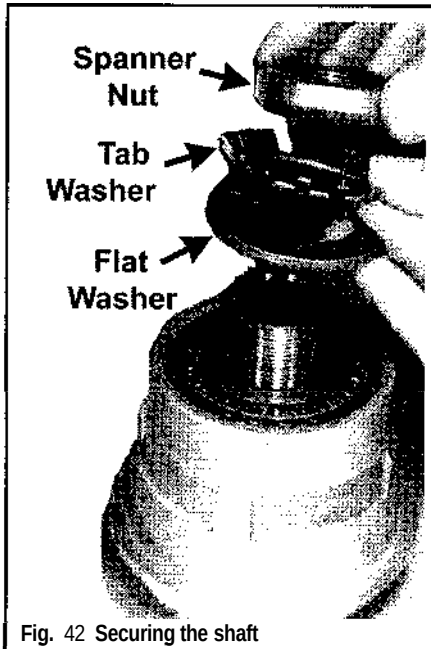


Fig. 42 Securing the shaft

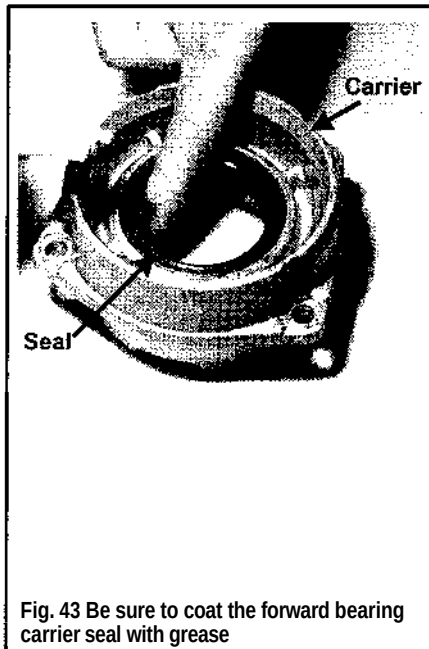


Fig. 43 Be sure to coat the forward bearing carrier seal with grease

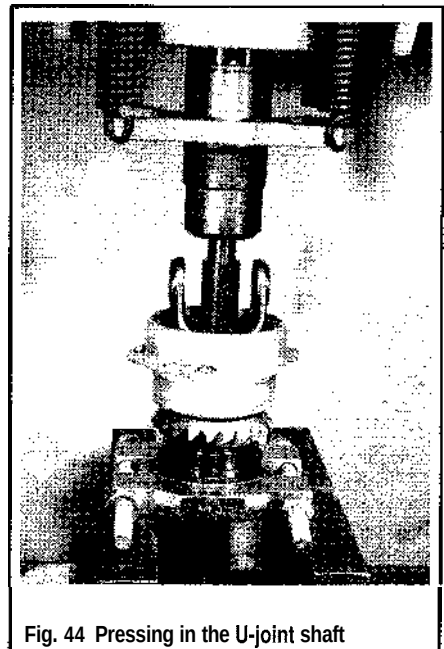


Fig. 44 Pressing in the U-joint shaft



Fig. 45 The gear ratio should be etched on the carrier housing

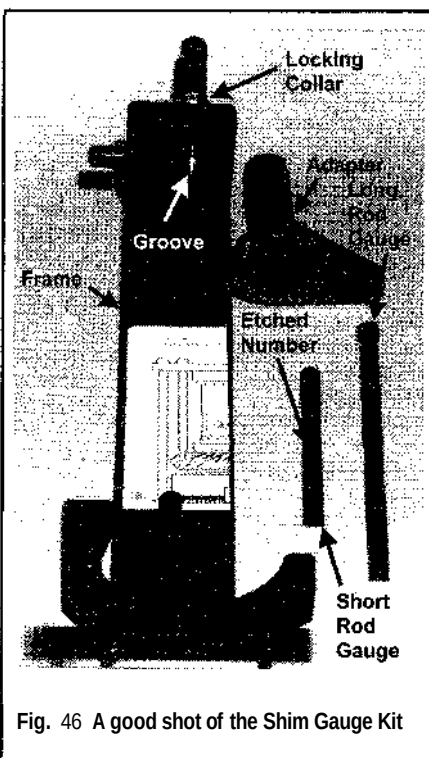


Fig. 46 A good shot of the Shim Gauge Kit

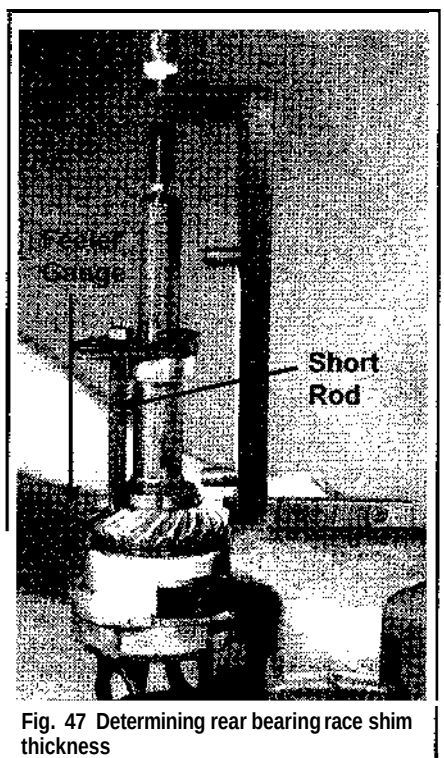


Fig. 47 Determining rear bearing race shim thickness



Fig. 48 Use this shim gauge to determine pinion bearing carrier shim thickness...



Fig. 49 ...and then install the carrier and shims

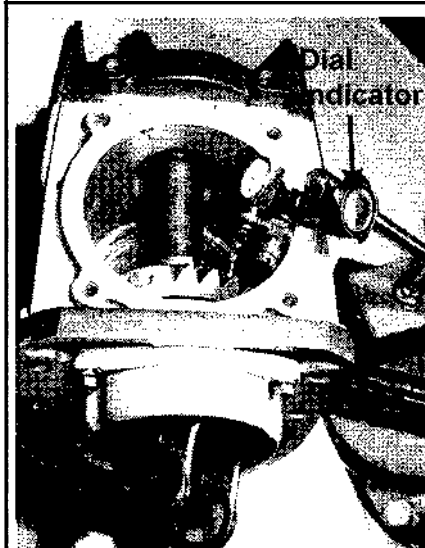


Fig. 50 Checking backlash with a dial indicator

Coat a new O-ring with Gasket Sealing compound and install it into the groove on the carrier.

48. Slide the entire assembly into the housing until the O-ring seats itself. Coat the threads of the 4 mounting bolts with Gasket Sealing Compound, install them and tighten to 12-14 ft. lbs. (16-19 Nm) in a crosswise pattern. Rotate the shafts at least 4 times to seat the bearing. Endplay must be Zero (0); if not, recheck all shimming measurements.

49. Attach a dial indicator to a stand of the front of the housing so that the indicator pin is resting against one of the forward gear teeth at a radius of about 1.580 in. from the centerline. Slowly rotate the shaft back and forth so that the teeth on the two gears just make contact in one direction and then again in the other direction. The dial indicator should read 0.009-0.015 in. (0.23-0.38mm). If outside this range, an equal amount of shim material will have to be added or removed at the rear bearing race, the upper bearing carrier and the pinion bearing carrier. Subtract the desired lash (0.012 in. is the mid-point of the range) from your actual lash reading (0.020 in.) to arrive at the amount of shim change that it necessary (0.020 - 0.012 = 0.008). Half of this figure (0.008 divided by 2 = 0.004) is the shim thickness that will have to be added or removed from the three locations. If you wish to decrease the lash, you would remove 0.004 in. of shims from the rear bearing race and the upper bearing carrier, and then you would add 0.004 in. of shim material to the pinion bearing carrier. If you had to increase the lash, you would add the figure to the first two locations and then remove that amount from the pinion bearing carrier. Always remember that no matter how you need to change the lash (increase or decrease) the upper carrier and the rear bearing race always have the same action, while the pinion bearing carrier will always be the opposite of those two—add to the first two, remove from the last one, or vice versa.

50. Almost done! Rotate the housing in the stand so the front edge is now down and the U-joint shafts are hanging (the bottom of the unit is now on the side). Insert the intermediate shaft into the bottom of the pinion bearing carrier. Slide on the spline socket and attach a torque wrench. Rotate the driveshaft fast enough so that you can get a steady reading on the torque wrench and check that it is 6-21 inch lbs. (0.7-2.4 Nm). This is the rolling torque; if it is out of the range, check the backlash again. If backlash is still OK, change the shim thickness under the upper bearing carrier; adding shims lower the rolling torque, while removing them will raise the figure.

51. Install the water pump and adapter.

52. Coat a new O-ring with Gasket Sealing compound, press it into the groove in the top cover and then install the cover. Coat the threads of the mounting bolts (remember these are unique!) with Gasket Sealing compound and then tighten them to 12-14 ft. lbs. (16-19 Nm).

53. Install the rear cover and tighten the bolts to 108-132 inch lbs. (12-15 Nm).

54. Install the upper housing to the lower unit.

1990-95 King Cobra Models

◆ See Figures 51 thru 74



□ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

□ OMC makes a special spline socket (# 3850598) and holding fixture (# 3850605) to hold and support the upper housing—we strongly recommend using these tools, as the unit must be held securely throughout the disassembly process.

1. Remove the upper housing and install it into an appropriate support fixture.
2. Loosen and remove the 4 u-joint bearing carrier bolts. Insert 2 small prybars between the carrier and the housing (there should be 2 slots) and lever the carrier assembly out of the housing—have a friend or assistant help you by pulling out on the driveshaft. Save any shim material that is not damaged. Remove the 2 O-rings on the shaft and the one on the inner flange of the carrier and throw them away. Please refer to the U-Joints section for service procedures on the U-joints.
3. Disconnect the bearing carrier yoke from the U-joint as detailed in the U-Joint section. Position the shaft and joint assembly out of the way.
4. Obtain a 1 in. diameter piece of pipe from your local home center and cut a piece 2 7/8 in. (73mm) long. Slide this piece of pipe through the holes in the end of the carrier yoke and then install the assembly in a vise so that the jaws are bearing on the ends of the pipe and the yoke.
5. The retaining bolt is a E16 Torx bolt and will be difficult to break loose. Once loosened, remove the bolt and retainer and then lift the carrier and pinion gear assembly off of the yoke. You may have to use a press and bearing separator if the yoke shaft does not come out freely.
6. Position a support tube (# 914747) into a press and stuff a small rag down into the tube. Lay the carrier on top of the tube so the gear is facing into the tube, insert the hex end of a bearing installer (# 914701) into the gear hub and press out the gear and bearing.
7. Examine the roller bearing and the race. Check for discoloration, chipped or damaged rollers, gouges or rough spots in the race. If both the bearing and race are in good shape, there is no need to separate the bearing and the gear. If there is a problem, or it must be removed for some other reason, use a universal bearing puller positioned between the bearing and gear. Put the unit in a press and press the gear off of the bearing. Be warned that you will probably damage the bearing during the removal process, so do not remove it unless necessary.

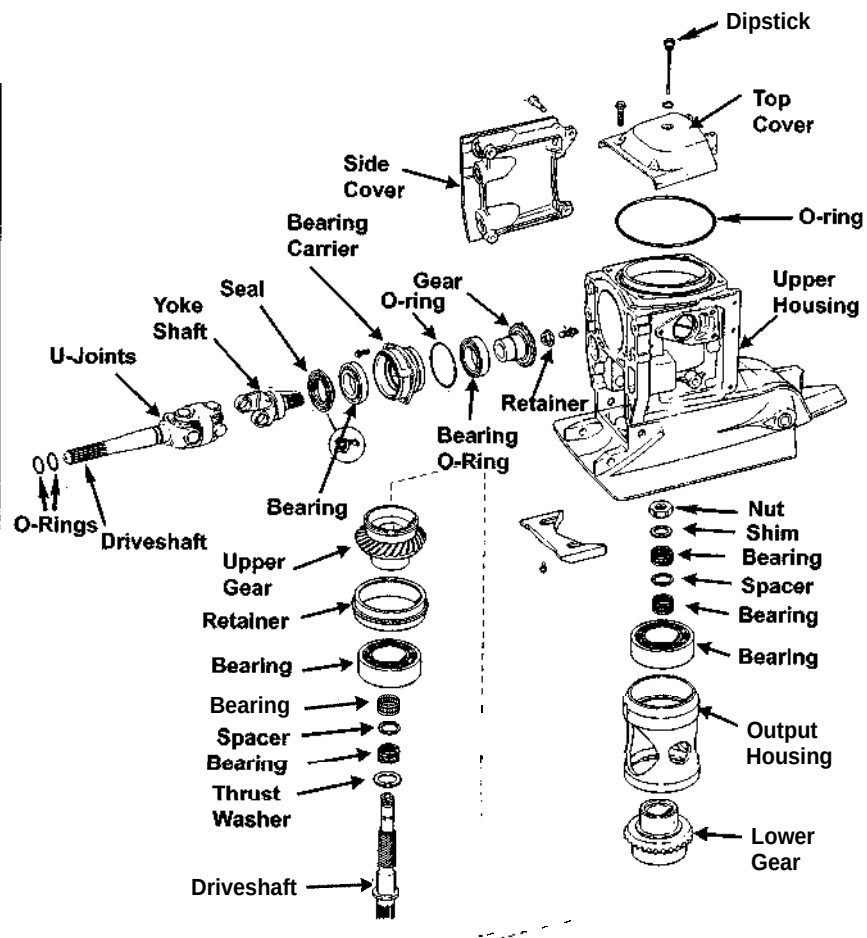


Fig. 51 Exploded view of the upper gear housing—1990-95 King Cobra units

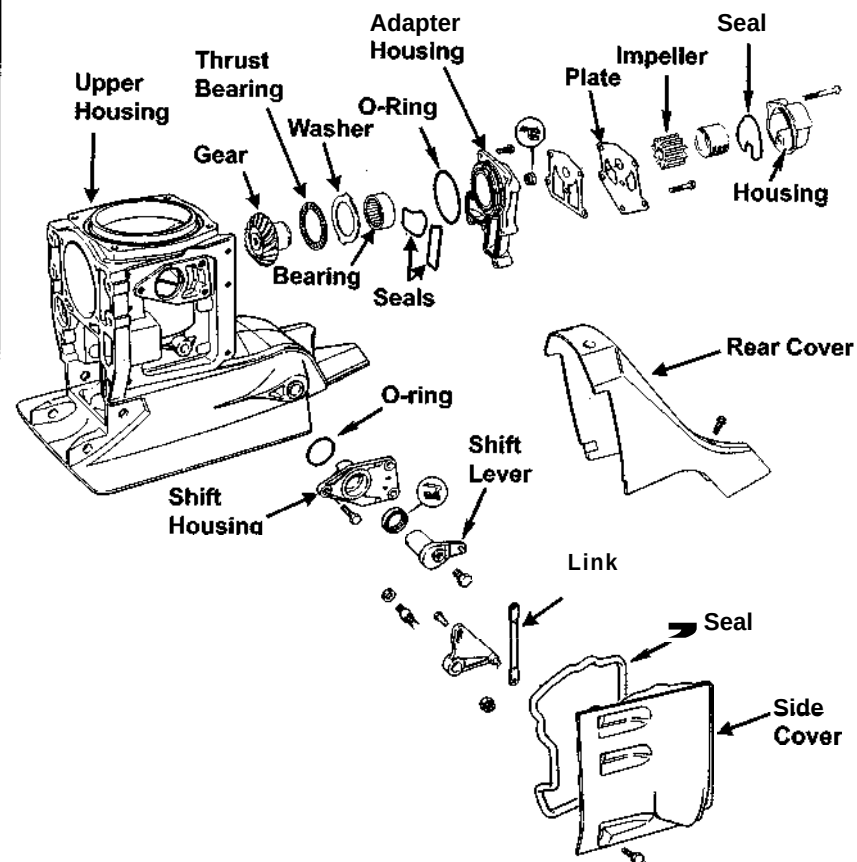


Fig. 52 Exploded view of the upper gear housing—1990-95 King Cobra units

8. Reach inside the carrier with a pair of snap ring pliers and remove the retaining ring. Position the carrier in a support tool (#914683) and place them on a press. Lay the large side of the removal tool (# 914748) on the bearing and press it and the seal out of the carrier.

9. Using a conventional 3-jawed puller, remove the inner bearing race from the u-joint side of the carrier. Now turn the carrier over, position it in the earlier support tool (# 914747) and place them on a press. Insert the larger side of a removal tool (# 914685) into the carrier so that it rests on the remaining race and then press out the race.

10. Remove the 3 mounting bolts and lift off the rear cover. Carefully pull the small drain hose off of the water pump housing nipple and tuck it out of the way. Remove the water pump and adaptor as detailed in the Cooling System section.

11. Remove the 6 mounting bolts for the port side cover and lift off the cover. Reach in with needle nosed pliers and pull out the cotter pin holding the shift lever link to the lever. Pull the link off of the lever, remove the 3 mounting bolts and carefully pull out the shift lever housing assembly.

12. Pull the shift shoe and spring out of the inner side of the housing. Remove and discard the O-ring. Carefully grab the roll pin and pull it out of the housing, then pull the roller and shaft tube out as well. Now you should be able to remove the shift lever. You should be able to pry out the inner seal with an awl, but if necessary, use the special bridge (# 431227) and puller (# 432129).

13. Pivot the bellcrank (below the shifter bore) forward as far as it will go without forcing it, lift up the clasp and remove the linkage pin. Pry the clasp off of the shift lever.

Not all models will use the linkage pin.

14. Now pivot the bellcrank as far back as it will go; rotate the bellcrank clockwise until the pivot pin is at the 6 o'clock position and pry it (carefully!) off the stud. Pull out the cotter pin and disconnect the link from the bellcrank, remove the washer. Remove the spring and retainer from the stud. Finally, remove the pivot pin cotter pin and disconnect the shift lever from the bellcrank.

15. Remove the 4 mounting bolts and lift off the upper housing top cover—again, you will probably have to tap it a few times with a rubber mallet and then pry it apart from the housing. Save any undamaged shim material and the oil deflector, but discard the cover seal (flat O-ring).

16. Fabricate a t-shaped removal tool using 3/8-16 x 1 1/2 in. threaded stock. Thread the tool into the top of the output gear housing and pull the housing out of the gearcase. If you have difficulty getting the housing out, use a slide hammer.

17. Lift out the driveshaft extension tube and then reach into the bore and remove all shim material; save them if they look to be in good shape.

18. Secure a spline socket (# 914699) in a vise and then slide the housing assembly into the socket. Attach a six-point socket and breaker bar to the upper retaining nut and remove the nut. THIS NUT HAS LEFT HAND THREADS, so turn it clockwise to loosen it. Lift off the nut and any shims underneath it.

19. Lift the housing and upper gear assembly off of the driveshaft and then reach into the upper gear and remove the needle bearings (2) and spacer. If you do not intend to replace the bearings, make sure you note their positions before removing them, as used bearings must be reinstalled in exactly the same positions relative of the driveshaft and each other.

20. Slide the bearing collar off of the end of the shaft and remove the shims from the base of the housing (or the top of the lower bearing retainer).

21. If you are going to reuse the clutch cone, it will need to go back in the same position from which it was removed so mark the top of the cone with an indelible marker. Spin the clutch cone up and off of the shaft.

22. Pull the lower gear assembly up and off the shaft and then spin the cone spring off of the shaft. Remove the 2 lower needle bearings and thrust washer, remembering to take note of their orientation if you intend to reuse them.

23. Pull off the remaining bronze thrust washer and remove the driveshaft from the spline socket.

24. If the upper or lower gear/bearing assemblies are to be disassembled, install a support tool (# 914747) in an arbor press and stuff a small rag into the tube. Position the assembly into the tube so the gear is facing down and then lay a removal tool (# 914707) onto the gear hub with the large diameter opening facing DOWN. Press the gear out of the bearing.

25. Some bearings are slip-fit, so see if you can remove the bearing from the retainer by hand. If not, then yours is pressed in and will require pressing it off for removal. Turn the bearing carrier over and place it back in the support tool on the press. So that the curved side of the retainer is facing

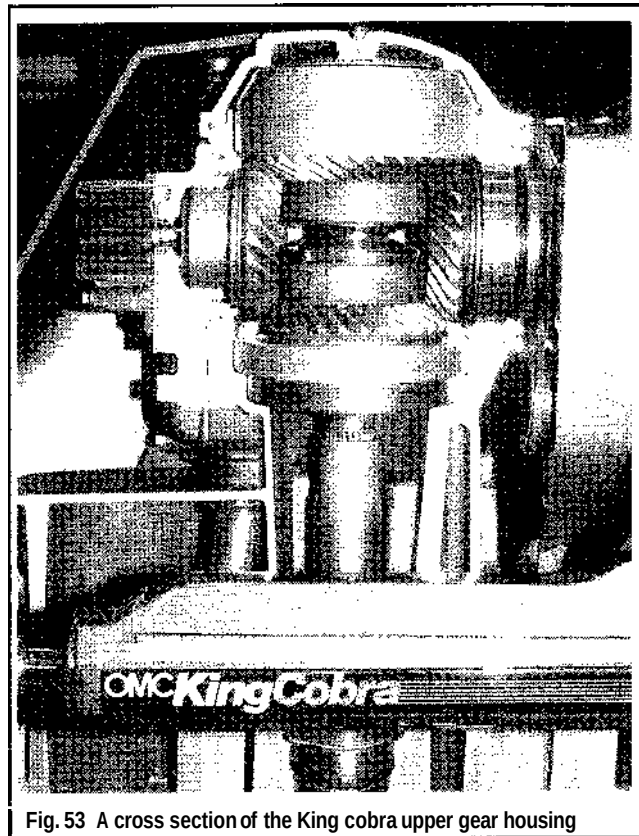


Fig. 53 A cross section of the King cobra upper gear housing

UP. Position a removal tool (# 914693) on the bearing and press the bearing out of the retainer. Remember that you will most likely damage the bearing during this process, so don't do it unless absolutely necessary.

26. Repeat the previous two steps if upper gear and bearing removal is necessary.

To assemble:

☐ It is imperative that the upper and lower gears are installed in the correct positions, relative to one another if they are being reused. Correct backlash adjustment and tooth contact will spread the load over a larger area of the gear tooth; preventing breakdown and abnormal wear and also ensuring quieter operation.

27. Replace all O-rings, gaskets and seals with new ones whenever possible. Clean all parts (except rubber or plastic) in solvent and dry them with compressed air.

28. Coat all metallic components with clean engine oil.

29. Check all gears and gear teeth carefully to be sure they are not chipped, cracked, nicked or otherwise damaged in any manner. Replacement gears always come in matched sets, so when you find a bad one, replace them all.

30. Inspect all bearings and bearing races for pits, grooves, burns or signs of uneven wear. Replace as necessary.

31. Check all shafts and shaft splines carefully to be sure they are not chipped, cracked, nicked or otherwise damaged in any manner.

32. Check the cone clutch/sliding sleeve for wear, heat or any other damage.

33. Coat the outside of a new lower bearing's case and the inner surface of the bearing retainer liberally with Ultra-HPF Gearcase Lube. If your bearing is a slip-fit, simply press it into the retainer so the side with a notch is facing UP. If press-fit, set the retainer on the base of a press and lay the bearing into it so the side with a notch is facing UP. Place the installer tools (# 914692 and # 914693) on top of the bearing (in that order) and then press it into the retainer.

34. Lay the recessed side of the special tool (#914691) on the base of a press. Turn over the assembly and place it on the tool with the bearing side down. Coat the hub of the lower gear and the inner surface of the bearing liberally with Ultra-HPF Gearcase Lube and then position the gear over the bearing. The beveled (closed) end of the retainer must be facing UP toward

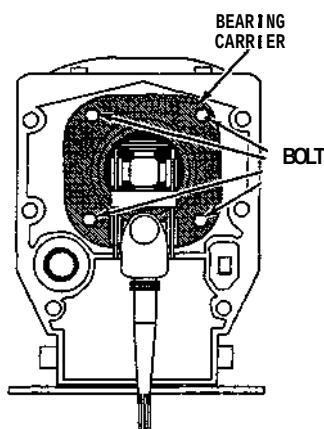


Fig. 54 Loosen the U-joint bearing carrier bolts...

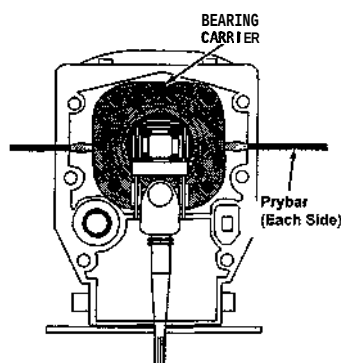


Fig. 55 ...pry the flange away from the housing...

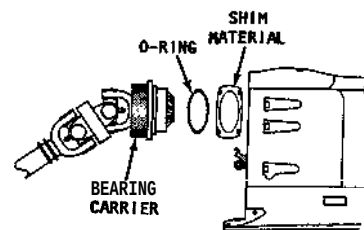


Fig. 56 ...and remove the assembly from the housing

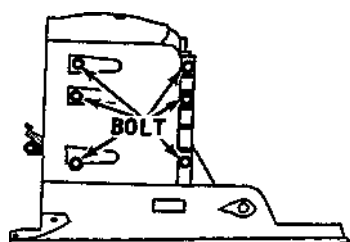


Fig. 57 Remove the port side cover to access the shift linkage

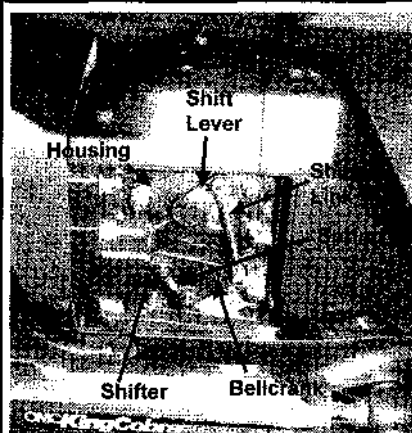


Fig. 58 A good look at the shifter and linkage

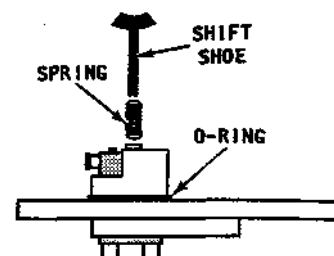


Fig. 59 Pull out the shift shoe and spring...

the bottom of the gear. Lay the larger end of the installer tool (# 914748) over the gear and press it into the bearing. Perform the Output Gear Shimming procedures.

35. Sit the bearing housing on the base of a press so the tapered side is facing UP. Coat the outside of a new upper bearing case and the inside of the housing bore liberally with Ultra-HPF Gearcase Lube and position the bearing on top of the housing so the side with the small notch is facing UP. Now lay the installer plate (# 914692) on the bearing so the stepped side is against the bearing and sit the other tool (# 914693) on top. Carefully press the bearing in until it just seats in the housing being careful not to apply too much pressure with the press.

36. Place the tool (# 914691), recessed side down, on the base of a press. Turn the bearing housing over so that the bearing is resting on the tool. Coat the gear hub and inner diameter of the bearing liberally with Ultra-HPF Gearcase Lube and position the gear in the bearing. Set an installer (# 914748) on the gear and press it in until it is fully seated. Perform the Output Gear Shimming procedures.

37. Clamp the spline socket in the vise again, insert the driveshaft and slide the bottom bronze washer over the shaft. Lubricate the lower needle bearing with Ultra-HPF Gearcase Lube and slide the lower bearing onto the shaft, followed by the small spacer and the upper bearing. Remember if you are using the old bearings that they must be installed in the same positions as they were removed; new bearings may be installed in any order you wish.

38. Position the tapered end of the cone spring over the top of the shaft and then pull out on the lower end while feeding the spring down and over the shaft until the bottom end is sitting in the recess above the bearing. Do this slowly and it will go much easier.

39. Slide the lower bearing assembly onto the shaft and slowly lower it down over the spring, retainer side down. Lift the bearing slightly while wiggling it back and forth until the spring is visible through the top of the bearing—once in place, the spring should lift and spin freely,

40. Install the clutch cone over the shaft. If reusing the old one, make sure that the marks made during disassembly are correct. If using a new clutch, there should be a T stamped in one of the valleys and this should be on the top.

41. Install the correct amount of shims onto the rim of the retainer as determined in the Upper Output Gear Shimming section. Slide the bearing collar onto the shaft and then lower the bearing housing into place so it rests on the shims.

42. Install the 2 upper needle bearings, separating them with the small spacer. Be careful that they are not damaged by catching the shaft shoulder. Remember if you are using the old bearings that they must be installed in the same positions as they were removed; new bearings may be installed in any order you wish. Use a small screwdriver and press down around the edge of the upper bearing to make sure they are fully seated.

43. Remove the arm from a shift fixture (# 986631) and position it upside down on top of the bearing. Measure the depth from the top of the arm to the top of the gear hub with a micrometer and record it as A. Next, measure the depth from the top of the arm to the top of the bearing collar. Record this as B.

44. Subtract dimension A from dimension B and record the new figure as dimension C. Compare your figure to the accompanying chart to determine the needed shim thickness. Coat the shim with Ultra-HPF Gearcase Lube and stick it to the bottom of the bearing retaining nut. Install the nut and shim, tightening to 140-160 ft. lbs. (190-217 Nm). If the lock patch on the nut has worn away, make sure you use a new nut. THE NUT IS LEFT HAND THREAD, so be sure that you tighten it in a counterclockwise direction.

45. Check your shimming by placing the bearing housing, splined shaft down, in a press support. Hold the retaining nut with just enough force to keep the shaft from turning. Attach a dial indicator in a manner that will allow the needle access to the upper bearing's case. Force the housing down until the indicator zeroes and then lift up on the housing while checking vertical

12-18 STERN DRIVE – COBRA AND KING COBRA

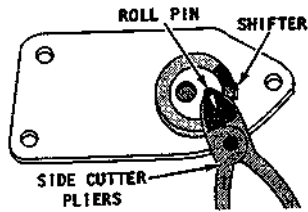


Fig. 60 ...remove the roll pin...

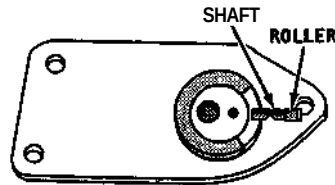


Fig. 61 ...and then the shaft

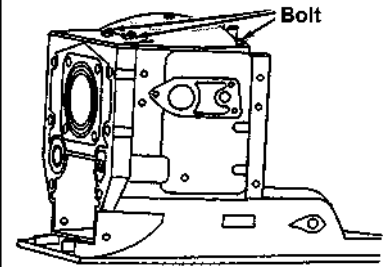


Fig. 62 Unbolt the top cover...

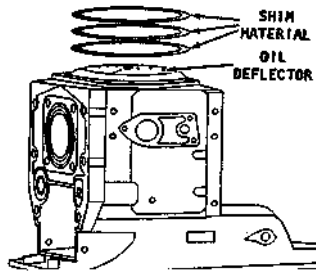


Fig. 63 ...and lift off the shims and oil deflector

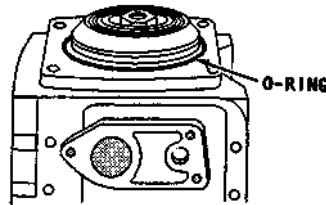


Fig. 64 Remove the O-ring and then...

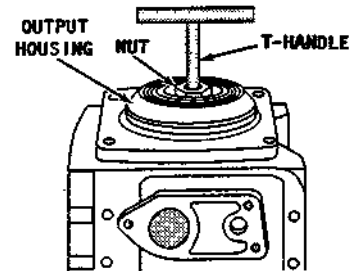


Fig. 65 '...thread in the T-handle to remove the bearing carrier

movement. If you figured your shims correctly in the previous steps, there will be 0.005-0.010 in. (0.13-0.25mm) of movement. If this is the case, you're done. If your check shows vertical movement outside the range, perform the next step.

46. To change the endplay, subtract 0.0075 in. (midpoint of the desired range) from the actual reading in the previous step to determine dimension C. Reducing endplay requires increasing the shim thickness, while increasing endplay requires decreasing shim thickness. If your vertical movement measurement was greater than the range, add dimension C to the shim thickness you originally installed. If the measurement was less than the desired range, subtract dimension C from the shim thickness you originally installed. Either way, check this figure against the chart to find the correct new shim, remove the retaining nut and original shim, and then install the nut with the new shim.

47. Install the driveshaft extension into the housing bore and then thread your fabricated tool into the top of the output gear housing assembly. Coat the housing case with Ultra-HPF Gearcase Lube and then lower the assembly into the bore so that the notches at the front are in alignment after you have engaged the driveshaft tube. The housing is a slip-fit in the bore and should not be forced, when correctly seated and aligned, the shift access hole on the port side of the housing will be lined up with the corresponding hole in the gearcase housing. Remove the T-handle.

48. Install the deflector on top of the output gear housing and then position the correct amount of shim material as determined in the Top Cover Shimming procedure. Coat a new top cover O-ring with Ultra-HPF Gearcase Lube and insert it into the groove in the top of the housing. Install the cover and tighten the bolts to 32-40 ft. lbs. (43-54 Nm), alternately and in a crosswise pattern.

49. Coat the hub of the pinion gear with Ultra-HPF Gearcase Lube. Support the bearing in the tool (# 914687), position the gear in the bearing and press it in with the installer tool (# 914708) until fully seated.

50. Position the nose of the U-joint bearing carrier in a support tool (# 914683) on the base of a press. Coat the outer case of the large bearing race with gear lube and place it on the carrier. Insert the small end of the installation tool (# 914690) into the cup and press in the race until fully seated. Turn the carrier over, coat the outer surface of the small bearing race with gear lube, and then place it into the carrier. Insert the smaller side of the installation tool into the race and press it into the carrier until fully seated.

51. Thread a nut onto an appropriately sized bolt, insert it through one of the flange bolt holes in the carrier (it doesn't matter which one) and then thread on another nut. Cinch the nuts against each side of the flange until the bolt is secure.

52. Position a support tool (# 914707) on the base of a press and then insert the gear and bearing assembly into the tool, gear side down. Coat the pinion gear hub with gear lube. Now drop the carrier onto the bearing and insert the yoke bearing so that it is resting on the end of the end of the gear inside the carrier. Lay the installation tool (#914687) over the top of the bearing and then cover the tool with a flat plate or something similar.

53. Connect a torque wrench to the bolt that you installed on the carrier and then slowly begin to press on the bearing until you get a rolling torque figure of 1-4 inch lbs. (0.11-0.45 Nm). Relieve the pressure from the press, hold the gear and recheck rolling torque. Although it is normal for the torque to decrease slightly when pressure is released, the rolling torque figure should still stay within the suggested range. If it does, remove the assembly and remove the bolt; if out of range on the low side, press the bearing again and recheck.

❑ Never press the bearing too far. If your rolling torque measurement is outside the range on the high side, remove the bearing, reinstall it and repeat the procedure.

54. Insert a depth gauge into the carrier and measure the distance between the back of the bearing and the end of the gear. This measurement will determine the correct amount of shims to use behind the U-joint coupler shaft; measure each shim separately and make sure that you use at least one, but not more than seven.

55. Coat the inner lip and outer case of a new oil seal with gear lube and insert it onto the installer (# 914689) so the side with the silver insert is facing up. Place the carrier, gear side down, onto a support tool (# 914707), insert the seal and installer and then press in the seal until it bottoms in the carrier.

56. Place the pinion bearing carrier on a workbench or other flat surface so the gear is facing upward. Install a shim gauge (# 914688) over the carrier so it is resting on the gear.

57. Use a flat blade feeler gauge and measure the gap between the gauge and the carrier. This figure is to be used when adding shims behind the carrier.

■ Do not take measurements at the corners of the carrier.

58. Coat the U-joint coupler shims lightly with oil and slide them over the shaft and up against the back of the coupler. Coat the shaft splines liberally with gear lube.

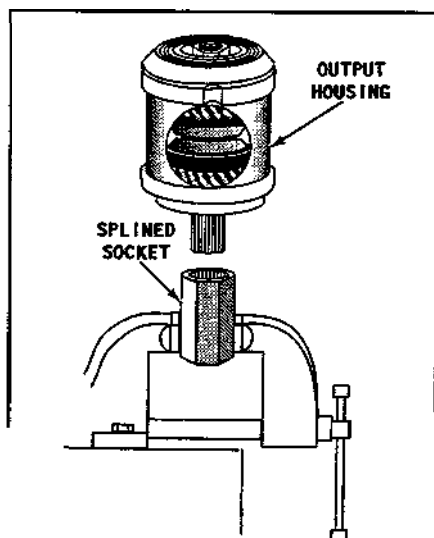


Fig. 66 Install the bearing carrier assembly in a spline socket...

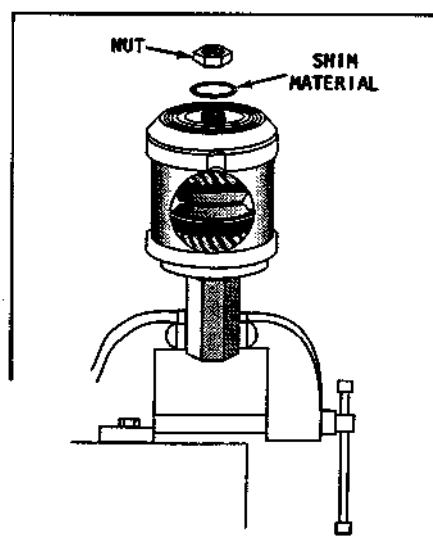


Fig. 67 ...remove the retaining nut and shims...

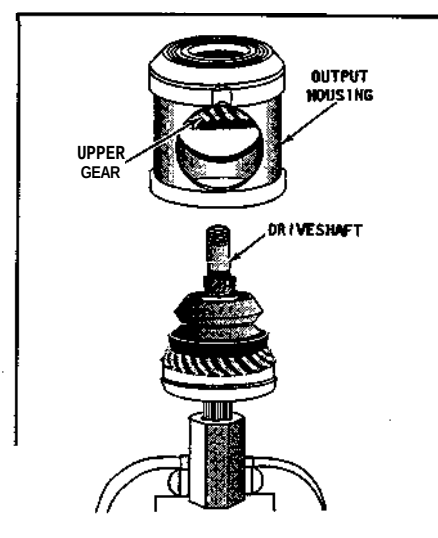


Fig. 68 ...and then pull the carrier and upper gear off of the lower gear and shaft

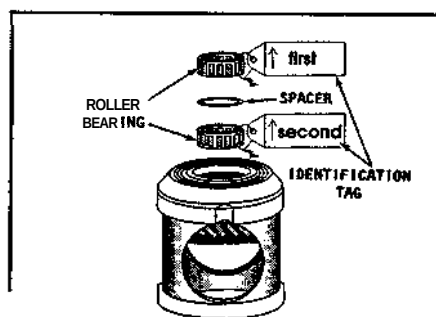


Fig. 69 Remove the needle bearings and make sure that you identify them for reuse...

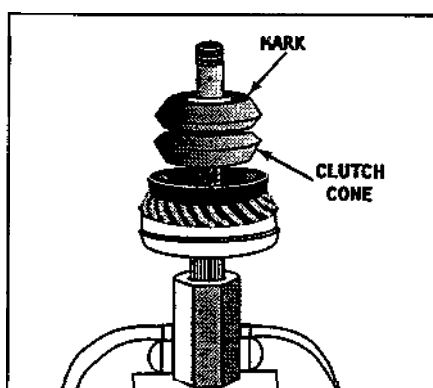


Fig. 70 ...and then slide up the cone clutch

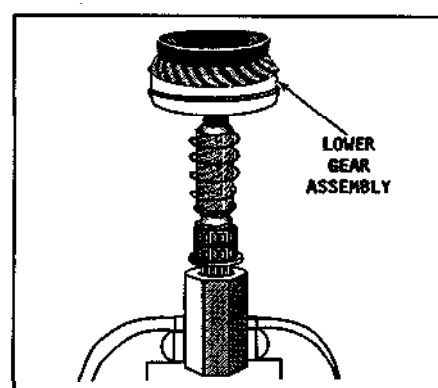


Fig. 71 Remove the lower gear...

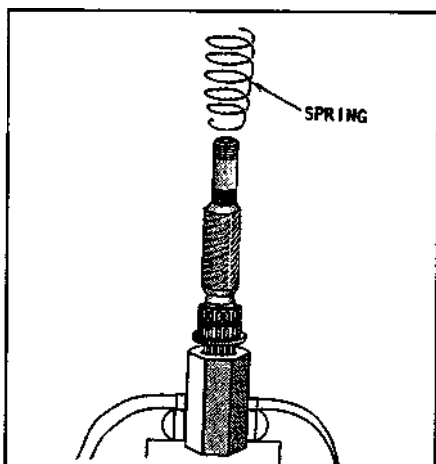


Fig. 72 ...and then spin off the spring

End Play Shim Chart

Dimension C (in.)	Shim #	Size (in.)
0.002-0.005	915167	0.063
0.006-0.009	915168	0.067
0.010-0.013	915103	0.071
0.014-0.017	915104	0.075
0.018-0.021	915105	0.079
0.022-0.025	915106	0.083
0.026-0.029	915107	0.087
0.030-0.033	915108	0.091
0.034-0.037	915109	0.095
0.038-0.041	915110	0.099

Fig. 73

Shifter Shim Chart

Clearance Measurement	Number of Shims R'qd.
0.000-0.008	2
0.009-0.018	3
0.019-0.028	4
0.029-0.038	5
0.039-0.048	6
0.049-0.058	7

Fig. 74

59. Place a support tool on the base of a press, rest the carrier on the tool with the gear down and then insert the coupler shaft into the gear hub. Press the shaft in until it seats fully.

60. Slide the support tube that you created previously in the disassembly procedure into the yoke holes and clamp the yoke in a vise. Slip the retainer into the end of the gear and then install the bolt, tightening it to 80-90 ft. lbs. (108-122 Nm).

61. Assemble and install the U-joints and drive shaft.

62. Slide the correct amount of shims over the pinion gear and up

against the carrier flange so that the notches in the shims and housing are lined up. Coat the assembly lightly with oil and then slide it into the housing. The bolt holes are not symmetrical, so use the oil circulation holes in the carrier and the housing to line everything up. Tap the carrier lightly with a rubber mallet to seat everything and then install the mounting bolts. Tighten them to 12-14 ft. lbs. (16-19 Nm) in cross-wise pattern.

63. Coat the metal case of a new shift housing seal with Gasket Sealing compound and place the seal on the large end of an installer tool (# 914685) so the open side of the tool is facing away from the tool. Rest the housing in

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a support on the base of a press and then position the seal and tool over the housing bore. Place a socket of sufficient size on the installer tool and press the seal in until the tool seats itself.

64. Insert the shift shaft all of the way into the housing and then rotate the lever until the tip is pointing at the upper index mark on the housing. Press in a new roll pin until it is protruding about 1/8 in. (3.2mm) above the shifter. Coat a new O-ring with gear lube and slide it into position around the base of the housing. Insert the spring and then the shift shoe into the shift shaft, making sure that the spring is fully seated inside the bore.

65. Install the water pump adaptor and water pump as detailed in the Cooling System section. Install the rear cover and tighten the bolts to 9-11 ft. lbs. (12-15 Nm).

66. Check the thrust plate dimensions as detailed in the Shimming section found later. Add shim material as necessary.

67. Remove the upper gear housing from the support tool and then install it on the lower unit.

68. Make sure that the small reference dot on the shift shoe is facing upward and the shift arm is at the upper index mark. Slide the housing into the bore and tighten the bolts to 12-14 ft. lbs. (16-19 Nm).

69. Wedge a small pry bar between the shift lever and one of the housing mounting bolts. Remove the lever bolt and any shim material. Remove the pry bar and move the lever until the end is pointing at the lower index mark on the housing.

70. Install the bolt and then slowly begin to tighten it as you rotate the propeller shaft. When you just begin to feel the eccentric high spot on the clutch cone, stop tightening the bolt and then check the clearance between the bolt head and shifter housing with a flat bladed feeler gauge. Record your measurement.

■ **If you have difficulty finding the high spot on the clutch cone, connect a torque wrench to the propeller shaft and use it to turn the shaft. When you notice the highest reading on the torque wrench, you've found the high spot.**

71. Shims are available in 0.010 in. (0.25mm) size only so compare your measurement to the accompanying chart to determine the correct amount of shims. You must use a minimum of 2 shims, but no more than 7. Rotate the propeller shaft until the clutch cone is off of the high spot and then remove the bolt.

72. Clean the threads of the bolt thoroughly, slide on the shim material and then coat the threads with Teflon pipe sealant. Thread in the bolt, secure the lever with the pry bar again and then tighten the bolt to 15-20 ft. lbs. (20-27 Nm).

73. Make sure that the lever is still pointing at lower index mark and rotate the propeller shaft again. If you can still feel the eccentric high spot on the clutch, the bolt will require more shims.

74. Coat the slot on the shifter bellcrank and the pivot pin lightly with gear lube grease and then insert the pin through the shift lever and bellcrank so that the flat head of the pin will be on the gearcase side of the bellcrank when installed. Install the washer and cotter pin.

75. Connect the spring to the retainer and then to the pivot pin. Coat the linkage pivot pin with grease and then connect the shift link to the bellcrank with the pin and a new cotter pin.

76. Coat the small bronze bushing in the bellcrank with Tripleguard grease. Insert the shift lever into the housing with the bellcrank linkage pin pointing straight down and slide the bellcrank onto the stud.

77. Slide the spring retainer over the stud and tighten the nut so that the retainer tab engages the notch in the bellcrank. Pivot the bellcrank all of the way forward and press the clasp onto the end of the shift lever, making sure that it snaps into position on both sides and pivots freely.

78. Dab a little grease on the bellcrank and shift lever pivot pins and also the overstroke slot. Connect the shift link to the shift lever with the washer and a new cotter pin.

79. Coat the inner edge of the side cover and a new foam seal with Scotch Grip Rubber Adhesive and then position the seal into the cover. Press the seal into place firmly so that the ribs on the seal and cover engage fully. Install the cover and tighten the bolts to 9-11 ft. lbs. (12-15 Nm) in a cross-wise pattern.

80. Install the drive unit.

Backlash And Shim Adjustments

The following procedures cover backlash and shim adjustments for the upper gear housing on 1990-95 King Cobra models only. The sequence of instructions is divided into sections and they all must be performed in the order given to ensure efficient and long life operation of the upper gear housing.

Output Gear Shimming



1. Position the lower gear/bearing assembly on a shim fixture (# 986631) so that the bearing/retainer is down and the end of the fixture arm is over the top of the gear teeth. Tighten the knob on the fixture securely.

2. Measure the clearance between the bottom of the arm and the top of the gear teeth with a flat bladed feeler gauge. This figure is the thickness of shim material to be positioned on the seat inside the housing.

3. Lay the upper gear/bearing assembly on a flat surface with the bearing/retainer facing down. Position a shim gauge (# 914721) over the gear.

4. Make sure that all previous shim material has been removed from the edge of the retainer and the lip inside the lower edge of the output gear housing. Position the gear housing over the gauge so that it is resting on the bearing retainer and then measure the clearance between the top of the shim gauge and the gear teeth. Note this measurement and then subtract it from 0.040 in.—this is the amount of shims you will need, gather them and set aside until called for in the assembly procedure.

Top Cover Shimming



◆ See Figures 75, 76 and 77

1. Position the deflector on top of the output gear housing and then lay a 0.096 in. (2.44mm) lower gearcase shim ring (# 913865) on top of the deflector.

2. Install the top cover (no bolts), thread a washer and nut onto your T-handle, insert it through the oil level hole in the top of the cover and thread it into the output housing shaft. Tighten the nut to 3-5 inch lbs. (0.3-0.6 Nm).

3. Measure the clearance between the bottom of the cover and the top of the gear housing at: a) the front of the housing as close to the center of the cover as you can, and b) the rear of the housing at the center of the cover. Take the average of these two readings and subtract it from the thickness of the lower gearcase shim ring (0.096 in.); call it A. Now add a pre-determined preload figure of 0.004 (0.10mm) to the result (A). This is the shim material thickness required to pre-load the output gear housing.

Backlash



◆ See Figures 78, 79, 80 and 81

This test will determine the relative clearance between the pinion and drive gears. We assume that you have already assembled the components as detailed up to this point in the Assembly procedures and that the unit is still in the holding fixture.

1. Mount a dial indicator holding bracket onto the support plate (or upper unit itself) and install a dial indicator so that the indicator needle is resting directly on the mid-point of a tooth on the lower gear. Zero the indicator and then wiggle the gear very slowly while observing the reading on the gauge. Do not wiggle the gear far enough so that the pinion gear begins to rotate the U-joint; just far enough so that the tooth on the lower gear comes in contact with the corresponding tooth on the pinion gear from either direction. Move the gauge away from the tooth, rotate the gear 180° and then set the indicator needle up as you did the last time. Wiggle the gear again and observe the reading.

2. Pull the gauge back away from the gear and slide it up the holding bracket so that you can perform the same sequence of measurements on the reverse (upper) gear. Observe and record each reading.

3. Backlash should be equal to the number stamped on the gear sleeve, plus or minus 0.002 in. (0.05mm). Remember that lash differences between the two gears are OK as long as they fall within the appropriate range. Shim calculations should be determined by subtracting the mid-point of the range (this is the number stamped on the gear) from the reading taken with the gauge; or, by subtracting the reading from the midpoint. Lash measurements that are out of specification will require multiple shimming changes—please refer to the Drive Gear Backlash Table when determining how to correct any shimming discrepancies. When using the table, pay close attention to the notes and remember that you must always follow the order of the positions as indicated.

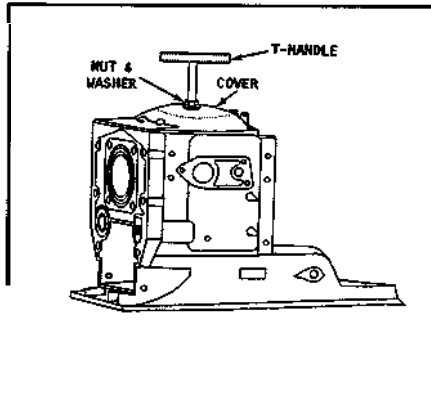


Fig. 75 Use the T-handle to load the top cover...

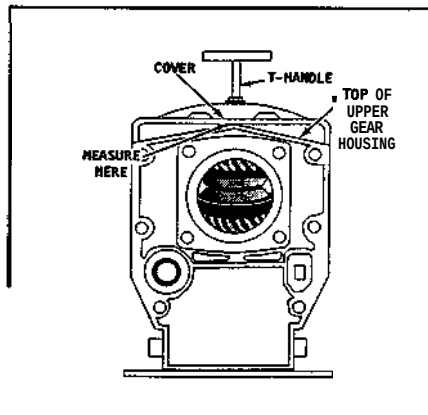


Fig. 76 ...and then take a measurement at the front...

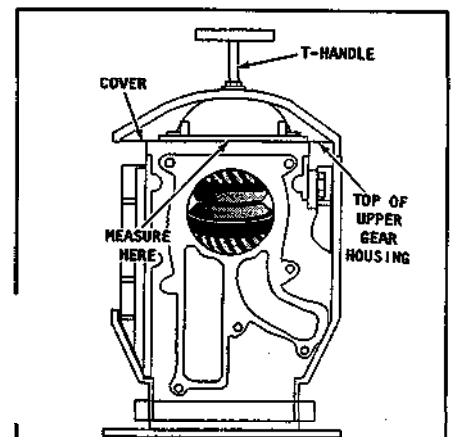


Fig. 77 ...and at the rear

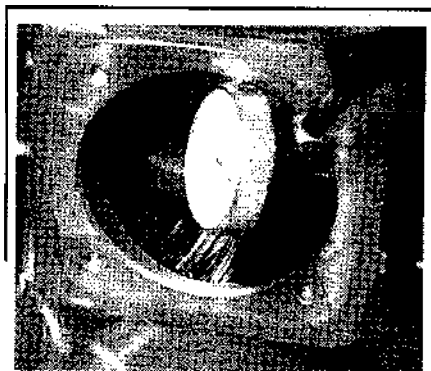


Fig. 78 Check backlash on the lower gear...

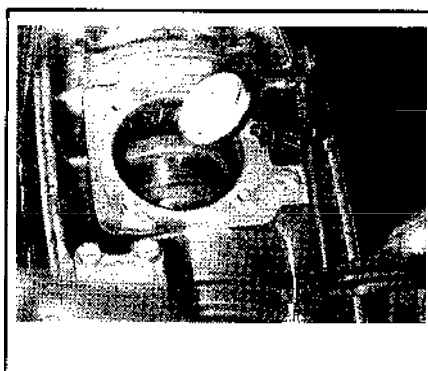


Fig. 79 ...and then the upper gear

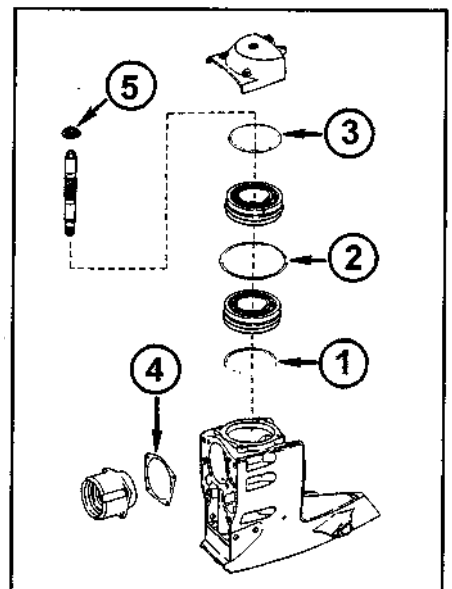


Fig. 80 When determining backlash shim changes, refer to this illustration for positioning when using the chart

□ The shim thickness-to-backlash ratio is approximately 2:1, therefore each 0.002 in. of backlash will be offset by 0.004 in. of shim material.

□ Any change to the bearing carrier shim (position 4) will affect lash on both drive gears. Any change to the upper bearing shim (position 2) will only impact lash on the upper bearing gear, while any changes to the lower bearing shims will impact the lower both gears.

Thrust Plate Shimming



◆ See Figures 82 and 83

1. Use a vernier caliper and measure the width across the thrust plates on the sides of the forward portion of the housing. Make sure there are not gaps between the thrust plates and housing before taking this measurement. Total width of this dimension should be 5.591-5.620 in. (14.20-14.27 cm). If your measurement is within this range, there is no reason to remove the thrust plates; if not, the thrust plates will need to be removed and shims material added or removed.

2. Pry out the retaining rings (2/side) and lift off the thrust plates. There should be a minimum of one shim under each plate and no more than four on either side. If there are more than 4 shims per side (or your measurement calls for adding more than 4), the thrust plates have been worn and will require replacement.

3. Shim material must be equal on each side—when adding or removing from one side, you must do the same on the opposite side. Shims are only available in thicknesses of 0.015 in. (0.38mm) and since they must be installed or removed in pairs (1/side), you will always be impacting the dimension by 0.030 in. (0.76mm).

4. Never exceed the maximum width (5.620 in.) as this will lead to interference between the upper housing and the transom assembly.

5. Once you have added (or removed) the correct amount of shim material, slip the thrust plate into position so the tab goes through the housing and then install the retainer rings over the stud with the concave sides facing the housing. Hold the inner side of the ring with a 1/2 in. wrench and then tap the plate with a rubber mallet until everything seats into the housing.

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Drive Gear Backlash Table

(Please refer to the illustration for shim positions)

Condition	Positions Requiring Shim Changes				
	1	2	3	4	5
One Gear In Spec, One Gear Out Of Spec ①					
Lower gear less than range, Upper gear within range	Remove shims	Add shims	NC	NC	Reshim
Lower gear above range, Upper gear within range	Add shims	Remove shims	NC	NC	Reshim
Upper gear less than range, Lower gear within range	NC	Add shims	Remove shims	NC	Reshim
Upper gear above range, Lower gear within range	NC	Remove shims	Add shims	NC	Reshim
Both Gears Out Of Spec By Same Amount ②③					
Upper gear above range, Lower gear less than range	Remove shims	NC	Add shims	NC	NC
Lower gear above range, Upper gear less than range	Add shims	NC	Remove shims	NC	NC
Lower gear less than range, Upper gear less than range	NC	NC	NC	Add shims	NC
Lower gear above range, Upper gear above range	NC	NC	NC	Remove shims	NC
Both Gears Out Of Spec By Different Amounts ③④					
Upper gear above range, Lower gear less than range	Remove shims	A/R	Reshim	NC	Reshim
Lower gear above range, Upper gear less than range	Add shims	A/R	Reshim	NC	Reshim
Lower gear less than range, Upper gear less than range	Remove shims	Add shims	Reshim	NC	Reshim
Lower gear above range, Upper gear above range	Add shims	Remove shims	Reshim	NC	Reshim

NC No change to shims required

A/C Add or remove shims as necessary

① Add or remove the same amount of shim material at each position indicated

② Add or remove the same amount of shim material at each position indicated

③ A change to shim 1 affects lash at both gears. A change to shim 2 affects lash at upper gear only.

④ Add or remove different amounts of shim material at each position indicated

Fig. 81

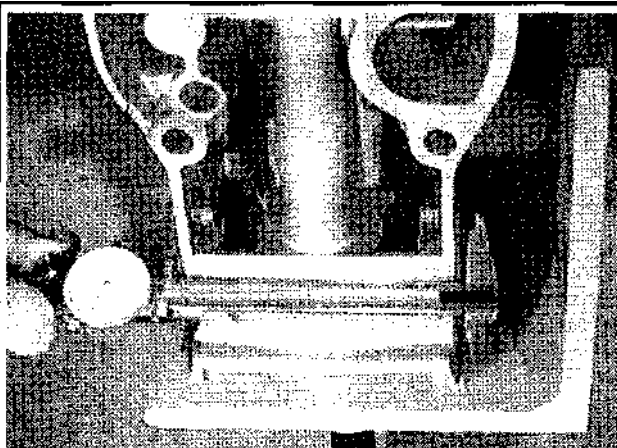


Fig. 82 Measure the housing dimension at the thrust plates

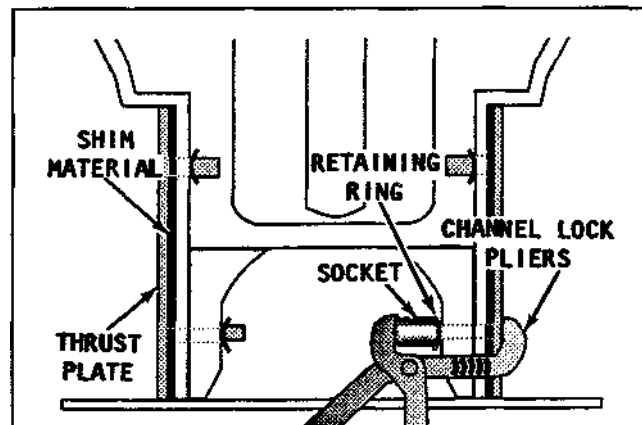


Fig. 83 Installing the thrust plate shim retaining ring

1994-98 Single Propeller Models (SPISXISX Cobra)

1996-98 Dual Propeller Models (DPIDP DuoProp)

◆ See Figures 84 thru 125



■ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

OMC makes a special spline socket (# 3850598) and holding fixture (# 3850605) to hold and support the upper housing—we strongly recommend using these tools, as the unit must be held securely throughout the disassembly process.

1. Remove the upper housing and install it into an appropriate support fixture.

2. Disconnect the shift link at the eccentric lever and then remove the shift mechanism as detailed in the Shift Mechanism section. Make sure that you take note of the position of the shift shoe as you are pulling out the assembly because you will need to know this during assembly.

3. Loosen and remove the 4 pinion bearing carrier bolts. Insert 2 small prybars between the carrier and the housing and lever the U-joint/carrier assembly out of the housing—have a friend or assistant help you by pulling out on the driveshaft. Save any shim material that is not damaged. Remove the 2 O-rings on the shaft and the one on the inner flange of the carrier and throw them away. Please refer to the U-Joints section for service procedures on the U-joints.

4. Remove the 4 mounting bolts and lift off the upper housing top cover—again, you will probably have to tap it a few times with a rubber mallet and then pry it apart from the housing. The aft bolts may be difficult to remove because of the lip on top of the cover. Save any undamaged shim material, but discard the cover seal (flat O-ring).

5. Secure the upper shaft if the unit is not already in the special fixture and then remove the upper shaft nut with a 30mm wrench. Remember, this nut is a LEFT HAND THREAD, so it is turned CLOCKWISE to loosen it—there should be an arrow with the loosening direction embossed in the top of the nut also.

□ This upper shaft nut also acts as a shim, thus it is available in 4 different sizes indicating the shoulder thickness of the particular nut.

6. Use a magic marker and mark a reference line across the top of the needle bearing cage and upper bearing so they may be installed with identical orientation. Pull out the needle bearing and then lift out the upper gearbearing; you may want to reach into the bearing carrier bore and push it up from the bottom. Pull out any shim material and set it aside if it is undamaged.

7. Reach into the top of the housing and pull out the cone clutch and spring.

8. Removing the bearing retainer ring cannot be done without the use of OMC/Volvo's special tool (# 3850604); a spanner wrench. Insert the tool into the top of the housing, over the shaft, and onto the retainer ring, rotating it slowly until the flange indexes with the cut-outs along the perimeter of the ring. Rotate the top flange to line up its holes with two on the top of the housing and then secure it with 2 top cover bolts, alternately tightening each bolt two turns at a time until it is tight.

9. Position a socket over the top of the tool and use a good sized breaker bar to loosen the retainer ring. Once loosened, loosen the top flange bolts slowly and alternately, and then remove the tool. Reach in and lift out the ring.

10. Now reach in and pull out the upper shaft and lower gearbearing assembly, setting it aside temporarily. Use a small pick and pry out any remaining shim material left in the bore.

11. The 2 lower bearing C-clips and spacer may have fallen out when you lifted out the shaft; if they did, remove them. If not, turn the assembly upside down and push up on the shaft until you can pop out the clips and then slide off the spacer.

12. Use a magic marker and mark reference lines across the needle bearing and roller bearing, and across the gear and bearing where they mate—if being re-used, they must be re-installed at the same orientation. Remove the needle bearing and the roller bearing/lower gear from the shaft.

13. If the upper or lower gearbearing assemblies are to be disassembled, install a bearing tool (# 3850606) in an arbor press with the large diameter opening facing UP. Position the bearing into the tool so it rests on the ring of the bearing sleeve and the gear is facing UP. Position the drift tool (# 884263) and press the sleeve off of the bearing.

14. Pull out the bearing assembly and position it back into the tool so the gear is facing down. Position the drift tool again and now press the gear off of the bearing. Repeat the procedure for the other gearbearing assembly.

15. Examine the spring retainer on the upper shaft. If everything is in good shape, skip this step. Otherwise, remove the circlip with a pair of circlip pliers and slide the retainer off the shaft.

16. Disconnect the pinion bearing carrier yoke from the U-joint as detailed in the U-Joint section. Position the shaft and joint assembly out of the way.

17. Obtain a 1 in. diameter piece of pipe from your local home center and cut a piece 2 7/8 in. long. Slide this piece of pipe through the holes in the end of the carrier yoke and then install the assembly in a vise so that the jaws are bearing on the ends of the pipe and the yoke.

18. The retaining bolt is a #50 Torx bolt and will be difficult to break loose. Once loosened, remove the bolt and retainer and then lift the carrier and pinion gear assembly off of the yoke.

19. Turn the carrier over and remove the C-clip with a pair of snap-ring pliers. Hold a cloth over the opening while compressing the ring, as it can cause damage if it slips off the pliers accidentally.

20. Position the special sleeve (# 884938) in a press with the larger diameter side facing upward. Position the carrier into the sleeve so the gear is facing down, place the driver tool (# 884266) on top of the gear and then press out the gear and roller bearing. Remove and discard the crush sleeve.

21. Examine the roller bearing and the race inside the carrier. Check for discoloration, chipped or damaged rollers, gouges or rough spots in the race. If both the bearing and race are in good shape, there is no need to separate the bearing and the gear. If there is a problem, or it must be removed for some other reason, use a universal bearing puller positioned between the bearing and gear. Put the unit in a press and press the gear off of the bearing.

22. Remove the small oil screen from the housing.

23. Although you would not normally remove the water passage plate unless looking for blockage or debris causing a restricted coolant flow, remove the 4 bolts and pry off the plate.

To assemble:

■ It is imperative that the drive and shift gears are installed in the correct positions, relative to one another. Correct backlash adjustment and tooth contact will spread the load over a larger area of the gear tooth; preventing breakdown and abnormal wear and also ensuring quieter operation.

24. Replace all O-rings, gaskets and seals with new ones whenever possible. Clean all parts (except rubber or plastic) in solvent and dry them with compressed air.

25. Coat all metallic components with clean engine oil.

26. Check all gears and gear teeth carefully to be sure they are not chipped, cracked, nicked or otherwise damaged in any manner. Replacement gears always come in matched sets, so when you find a bad one, replace them all.

27. Inspect all bearings and bearing races for pits, grooves, burns or signs of uneven wear. Replace as necessary.

28. Check all shafts and shaft splines carefully to be sure they are not chipped, cracked, nicked or otherwise damaged in any manner.

29. Check the cone clutch/sliding sleeve for wear, heat or any other damage.

30. Clean the oil screen thoroughly and press it into the recess until it seats completely and is flush with the housing surface.

31. Inspect the water passage for signs of blockage or debris; check the cover for distortion or corrosion and then replace the cover with a new gasket. Coat both sides of the gasket with sealing compound and tighten the screws to 60-84 inch lbs. (6.8-9.5 Nm).

32. Check the thrust plate dimensions as detailed in the Shimming section found later. Add shim material as necessary.

33. Position the bearing carrier into the special tool (#884938) with the large diameter upward. Lightly coat the outside surface of the small bearing race with synthetic gear lubricant and then position it into the carrier. Install the driver handle (# 9991801 and mandrel (# 884932) with the small side down and press the race into the carrier.

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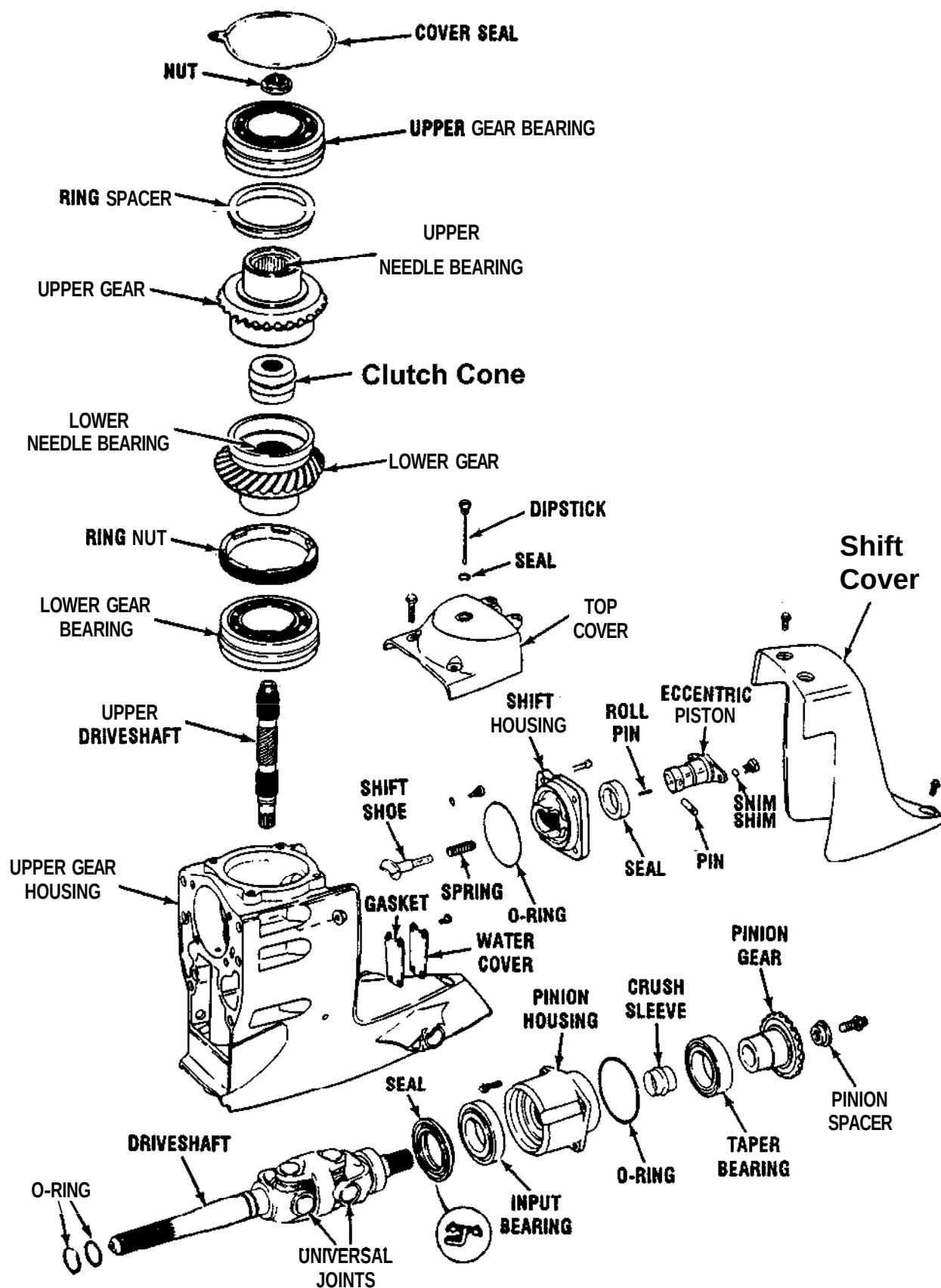


Fig. 84 Exploded view of the upper gear housing —SPISXISX Cobra and DP/DP DuoProp units

34. Turn the carrier over and install the bearing race for the large bearing. Coat the outside surface with synthetic gear oil and then press it into position with the tools from the previous step—this time though, the large side should face down.

35. Lubricate the outer diameter of the pinion gear hub with GL5 synthetic gear oil and then set it in a press. Position a new roller bearing over the hub, taper facing upward, and press it onto the gear with the installer tool (# 884263) until it seats against the gear.

36. With the gear/bearing still in place, slide a new crush sleeve over the input shaft. Lubricate both bearings again with the synthetic lube and then position the carrier (large opening up) over the gear and bearing.

37. Position the small bearing into the carrier and over the shaft. Use the driver (# 884263) and press it into place until there is approximately 0.040-0.060 in. (1.0-1.5mm) of end play in the bearing box. Be very careful not to press the bearing on so far as to distort the crush sleeve.

38. Coat the outside circumference of a new carrier seal with Gasket Sealing compound and then position the seal into the installation tool (# 3850607) so that the protruding lip fits into the recess in the tool. Press the seal into the carrier until it fully seats itself.

39. Carefully squeeze the retaining clip with circlip pliers and position it over the seal and into the recessed groove. Be very careful when releasing the ring from the pliers because if it slips, or is not in the groove, it will come out with extreme force. Make sure you are wearing eye protectors! Coat the exposed edge of the seal with water resistant grease.

40. Position the yoke shaft back into the vise so the shaft is pointing up and the vise jaws are clamped on the pipe support. Bring the carrier assembly down and over the shaft while feeding the shaft through the seal and into the splines on the pinion gear.

41. Once the shaft and gear splines are engaged correctly, coat the threads of a new pinion gear retainer bolt with Loctite Primer and allow it to dry completely. Install the retainer into the recess on the gear and then coat the bolt threads with Loctite. Thread the bolt in until it is finger-tight—its now time to check rolling torque. **DO NOT HURRY THESE NEXT STEPS!** Figure on at least a half hour and 6-8 separate checks before you get it right. If you go too fast, or too tight, you will distort the crush sleeve and have to rebuild the entire assembly again.

a.) With the assembly still secured in the vise by the yoke, tighten the pinion bolt while turning the carrier to seat the bearings. Do not turn the bolt more than 1116 of a turn at any one time!

b.) Remove the assembly from the vise and carefully clamp the vise jaws over the carrier body.

c.) Install a torque wrench on the pinion bolts and check to see at what reading the yoke shaft begins to rotate as you apply torque to the bolt. Optimum rolling torque should be 9-14 inch lbs. (1.0-1.6 Nm), although on new assemblies, we'd like to see it up around 13-14 inch lbs.

d.) Loosen the vise jaws and remount the assembly so the vise has the yoke again. Tighten the bolt another 1116th of a turn (or less) while rotating the carrier. Reposition the assembly in the vise and check the rolling torque again. Repeat these few steps, slowly, until you are confident the proper torque has been achieved and the crush sleeve has not been prematurely distorted. Bearing pre-load is now set.

42. Install the driveshaft/joint assembly into the yoke as detailed in the U-Joint section.

43. Position the lower gear into a press or holding tool so the gear is facing down. Coat the inside of the lower bearing with GL-5 synthetic gear lube and slide it over the flange and onto the gear so the numbered side is facing UP. Use the special drift (#884168) and press the bearing onto the flange until it is fully seated.

44. Repeat the previous step for the upper gear and bearing.

45. Place the support tool (# 884938) into a press so the large diameter opening is facing upward. Coat the inside of the adapter ring with GL-5 synthetic gear lube and sit the ring on top of the support so the flange is facing upward. Now position the upper gear into the tools so the gear is facing down, position a piece of flat stock over the assembly and then drive the sleeve into place with the installer tool (# 3850606).

46. Repeat the previous step for the lower gear.

Although they look identical, the upper and lower bearing sleeves are actually different thicknesses. Do not mix the two sleeves up.



Fig. 85 Remove the mounting bolts and pull out the shift mechanism

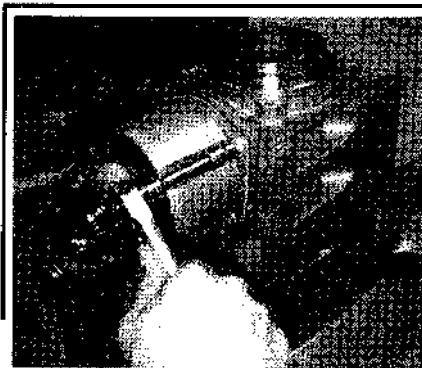


Fig. 86 Loosen and remove the 4 bolts...

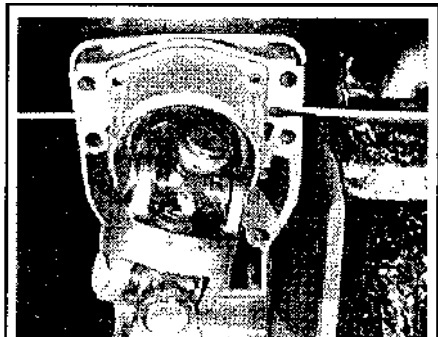


Fig. 87 ...pry the carrier away from the housing...

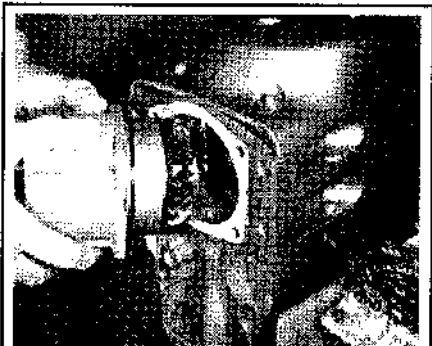


Fig. 88 ...and remove the assembly



Fig. 89 Remove the 4 mounting bolts...



Fig. 90 ...and lift off the top cover

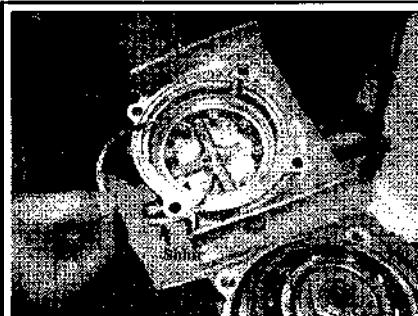


Fig. 91 Save any undamaged shims...

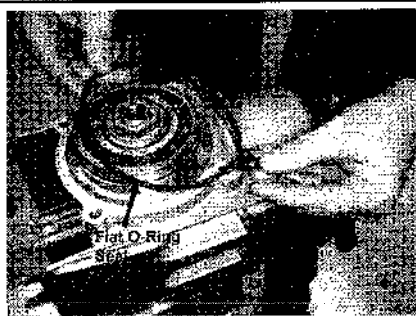


Fig. 92 ...but discard the flat O-ring seal

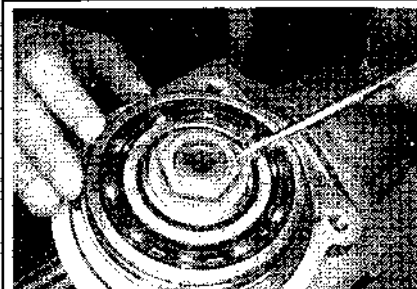


Fig. 93 The shaft nut should be marked with a shoulder size code and with a directional arrow

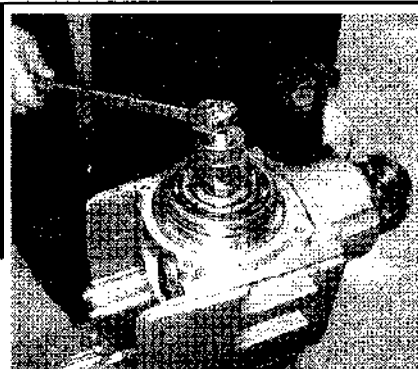


Fig. 94 Remove the shaft nut

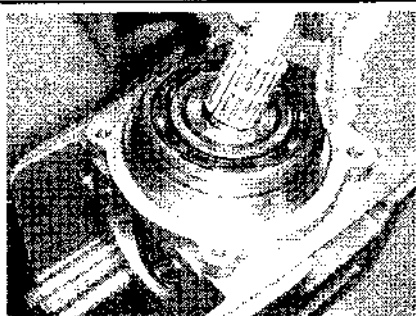


Fig. 95 Lift out the needle bearing...



Fig. 96 ...and the upper bearing gear assembly

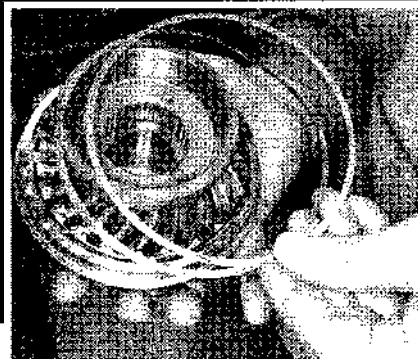


Fig. 97 Remove any old shim material...

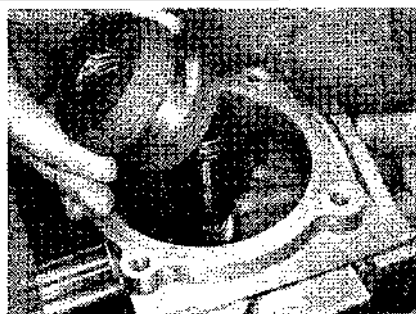


Fig. 98 ...lift out the cone clutch...



Fig. 99 ...and then the spring

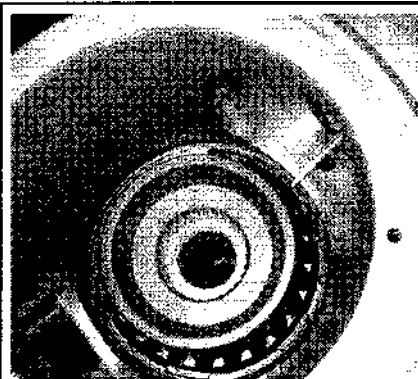


Fig. 100 Notice the cut-outs on the retainer ring flange



Fig. 101 Insert the special tool...

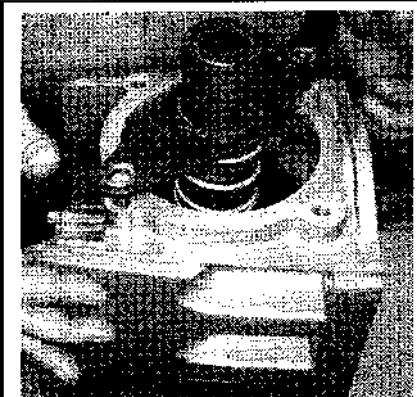


Fig. 102 Tighten the top flange with bolts from the cover

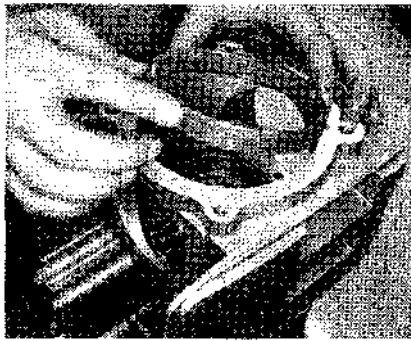


Fig. 103 Remove the retainer ring

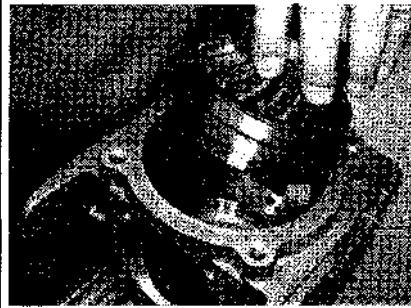


Fig. 104 Lift out the lower gear and bearing...

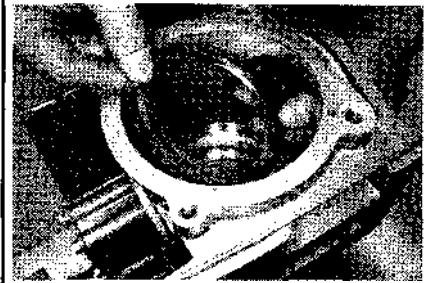


Fig. 105 ...and pry out the shims

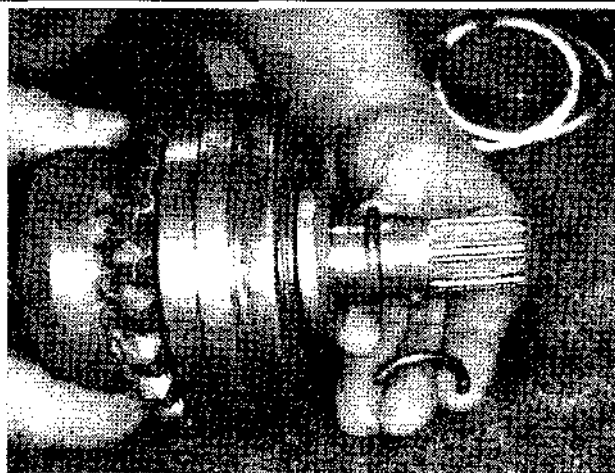


Fig. 106 Remove the C-clip and spacer...

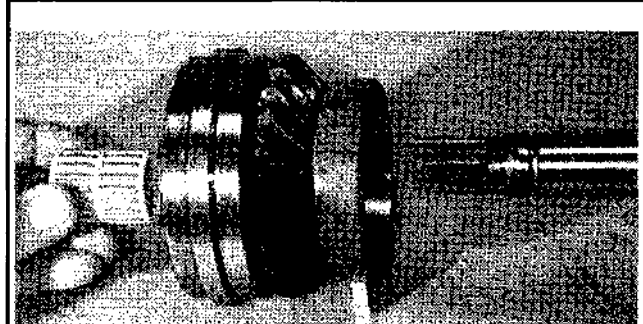


Fig. 107 ...and then slide the needle bearing and lower gear assembly from the upper shaft



Fig. 108 Press off the bearing ring..

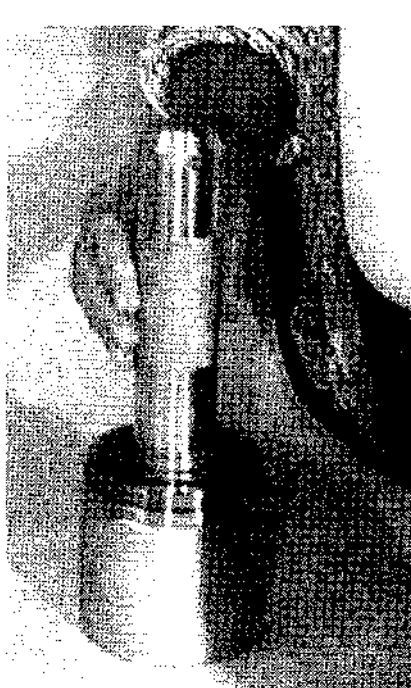


Fig. 109 ...and then separate the bearing from the gear

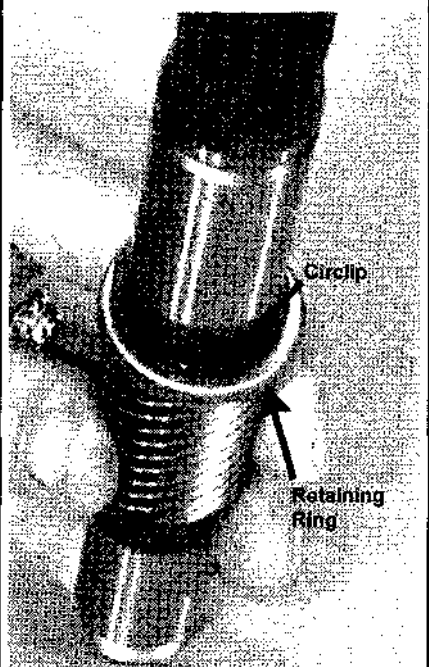


Fig. 110 Remove the circlip and retaining ring

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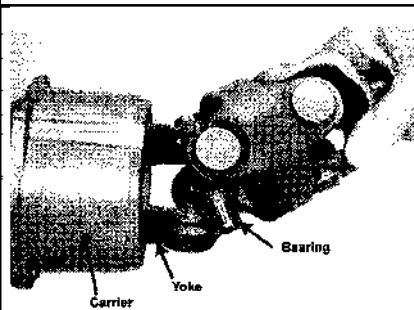


Fig. 111 Disconnect the U-joint assembly from the yoke...

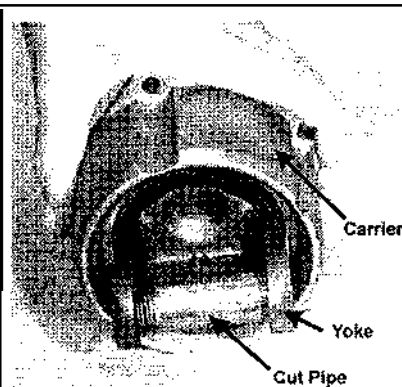


Fig. 112 ...and then install the piece of pipe before clamping the assembly in a vise

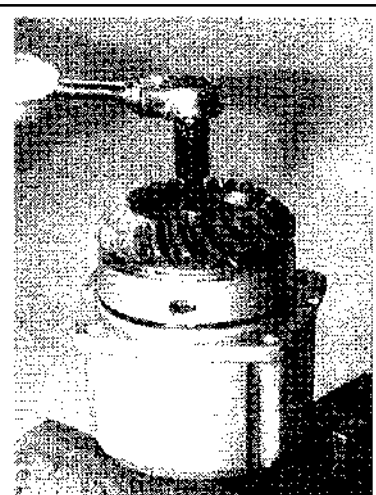


Fig. 113 Loosen the retaining bolt...



Fig. 114 ...and then remove it and the retainer



Fig. 115 Lift off the carrier assembly...

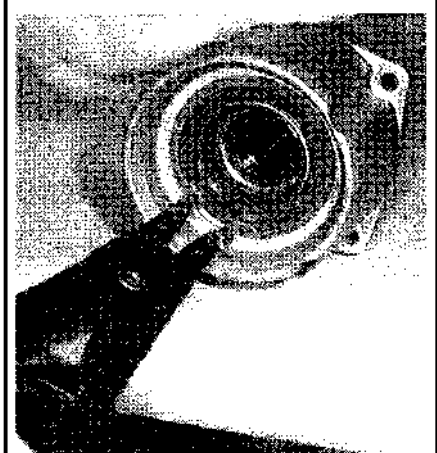


Fig. 116 ...and then remove the circlip

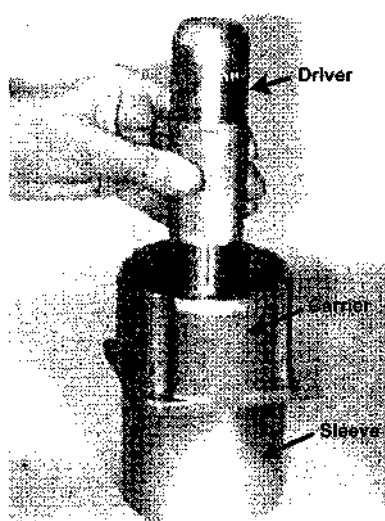


Fig. 117 Pressing off the gear and bearing

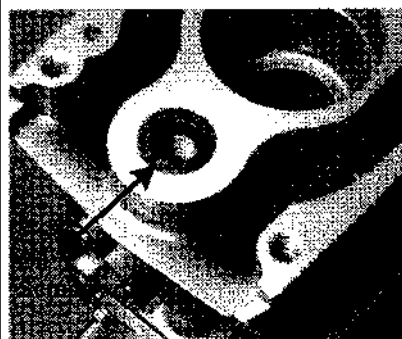


Fig. 118 Pull out the small oil screen

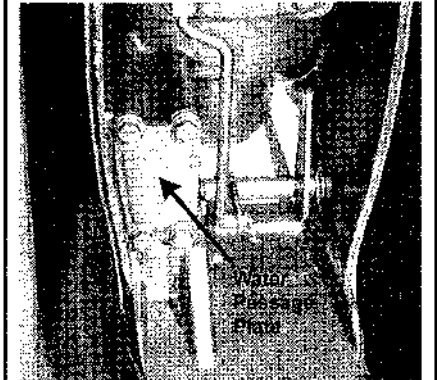


Fig. 119 Remove the water passage plate

47. Slide the spring retainer onto the splined end of the vertical shaft so that the recessed side is facing the helix (spiral on the shaft). Use a pair of snap-ring pliers and install the circlip in the groove above the retainer. Make sure you wear safety glasses and do not release the pliers until the circlip is fully seated in the groove.

48. Slide the splined end of the vertical shaft through the lower gear from the gear side, making sure that the groove in the shaft is on the side of the bearing. Coat needle bearings lightly with GL5 synthetic gear lube and then slide them onto the shaft and into the bearing and gear assembly. New bearings can be installed without concern for their orientation to one another; but if you are re-using the old ones, make sure the marks made during disassembly are in alignment.

49. Slide the ring spacer over the splined end of the shaft until it seats itself on the top of the lower bearing. Install the 2 circlips into the groove on the shaft and then pull the shaft down and through the gear/bearing until the clips seat into the recess in the ring. Hold the shaft on the helix side and shake it lightly a few times to confirm that the clips are seated correctly in the ring.

50. Reach into the top of the upper housing bore and clean off the shim ledge at the bottom of the bore. Position the correct amount of shim material on the ledge as determined in the Drive Gear Shimming section.

51. Insert the shaft and gear assembly through the bore, splined end first, until the bearing is sitting on the shim material. There is a chance that the vertical shaft can slide out of the gear, so adjust your support fixture so that it is supporting the shaft. Even a slight downward slide of the shaft will release the circlips, so be careful about not letting the shaft fall out.

52. Coat the bearing retaining ring with GL5 synthetic gear lube and then thread the ring in until it is hand-tight and fully seated—the top of the ring must be below the lower edge of the pinion bearing carrier bore. Install the spanner tool (# 3850604) into the bore so it mates with the ring, position the tension arm over two of the tor, cover holes and tighten it securely with 2 of the top cover bolts. Tighten the ring to 145-165 ft. lbs. (197-224 Nm) and then remove the tool.

53. Slide the clutch spring over and down the shaft until it is seated on the ring spacer. Slide the cone clutch over the shaft so that the TOP marking is facing upward. When the clutch hits the helix, rotate it clockwise so that it spins down the shaft until it is resting on the spring.

54. Position the correct amount of shim material (as determined in the Drive Gear Shimming procedures) onto the top mating surface of the upper housing so that it fits around the opening of the shaft bore. Position the upper gear and bearing assembly over the top of the vertical shaft and then press it into the housing bore until it seats on the top of the housing and over the shim material. Be very careful not to disturb the shims while centering the bearing in the housing bore; in fact, you may wish to loosen the support fixture so that centering the shaft assembly and bearing is easier.

55. Coat needle bearings lightly with GL5 synthetic gear lube and then slide them onto the shaft and into the bearing and gear assembly. New bearings can be installed without concern for their orientation to one another; but if you are re-using the old ones, make sure the marks made during disassembly are in alignment.

59. Install the shaft nut and tighten it to 96-110 ft. lbs. (130-149 Nm). Remember that the vertical shaft end play is controlled by the size of the shoulder on this nut, so perform the Vertical Shaft End Play procedure prior to installing the nut. Remember, this is a LEFT HAND thread nut and is tightened by turning it COUNTERCLOCKWISE.

57. Install the correct amount of shim material (as determined in the Pinion Bearing Carrier Shimming procedure) over the pinion gear and against the carrier flange. Install the carrier into the upper housing and tighten the bolts to 12-14 ft. lbs. (16-19 Nm). Do not install the O-ring at this time.

☐ The shim material will only fit onto the carrier so that they align with the mounting bolt holes in one direction. Do not force them, or allow mis-alignment of the holes.

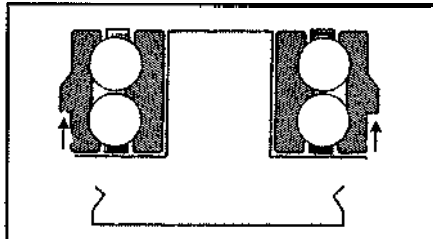


Fig. 120 Make sure the square step on the lower bearing faces the lower gear on 1998 and later drives

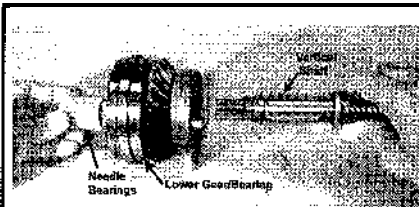


Fig. 121 Slide the vertical shaft through the lower bearing and then press in the needle bearings

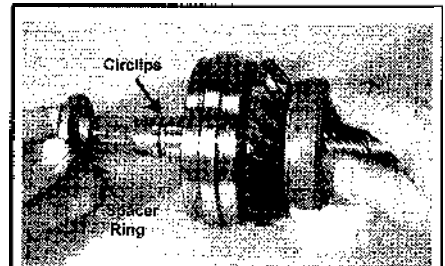


Fig. 122 Slide the spacer onto the shaft...

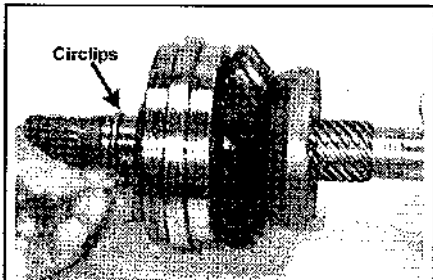


Fig. 123 ...and then install the circlips

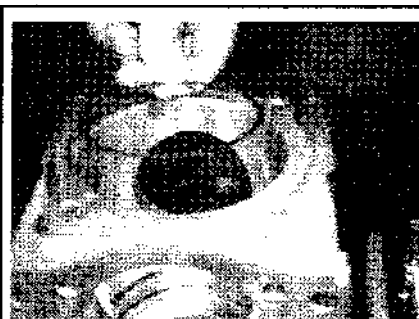


Fig. 124 Position the lower gear shims in the upper housing...

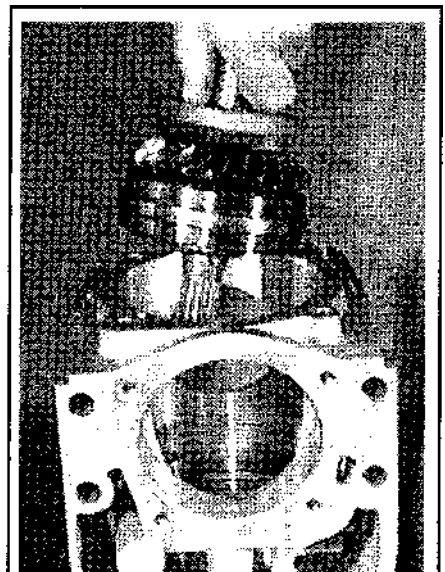


Fig. 125 ...and then insert the shaft and gear assembly

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58. Coat a new cover gasket with Gasket Sealing compound and position it on the upper unit mating surface so the tab with the hole in it is over the bolt hole with the oil circulating passage. Install the correct amount of shim material as determined in the Top Cover Shimming procedure. Install the top cover and tighten the cover bolts, alternately, to 16-18 ft. lbs. (22-24 Nm). Make sure that you coat the bolt threads with sealing compound also.

59. Loosen the mounting bolts and carefully pull the pinion bearing carrier out of the upper housing. Coat a new O-ring with GL5 synthetic gear lube and slide it onto the carrier flange so that it seats into the groove. Make sure that the shim material is positioned correctly and then install the assembly into the housing. Coat the mounting bolt threads with sealing compound and then tighten them to 12-14 ft. lbs. (16-19 Nm).

60. Install the shift mechanism.

Backlash And Shim Adjustments

The following procedures cover backlash and shim adjustments for the upper gear housing on 1994-98 Single Propeller Models and 1996-98 Dual Propeller Models only. The sequence of instructions are divided into sections and they all must be performed in the order given to ensure efficient and long life operation of the upper gear housing.

Thrust Plate Shimming

◆ See Figure 126



1. Use a vernier caliper and measure the width across the thrust plates on the sides of the forward portion of the housing. Make sure there are not gaps between the thrust plates and housing before taking this measurement. Total width of this dimension should be 5.007-5.036 in. (12.72-12.79 cm). If your measurement is within this range, there is no reason to remove the thrust plates; if not, the thrust plates will need to be removed and shims material added or removed.

2. Pry out the retaining rings (2/side) and lift off the thrust plates. There should be a minimum of one shim under each plate and no more than four on either side. If there are more than 4 shims per side (or your measurement calls for adding more than 4), the thrust plates have been worn and will require replacement.

3. Shim material must be equal on each side—when adding or removing from one side, you must do the same on the opposite side. Shims are only available in thicknesses of 0.015 in. (0.38mm) and since they must be installed or removed in pairs (1/side), you will always be impacting the dimension by 0.030 in. (0.76mm).

4. Never exceed the maximum width (5.036 in.) as this will lead to interference between the upper housing and the transom assembly.

5. Once you have added (or removed) the correct amount of shim material, slip the thrust plate into position so the tab goes through the housing and then install the retainer rings over the stud with the concave sides facing the housing. Hold the inner side of the ring with a 112 in. wrench and then tap the plate with a rubber mallet until everything seats into the housing.

Output Gear Shimming

◆ See Figures 127 and 128



All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

1. Both the upper and lower gears will have a factory etching on the collar which must be used in determining the proper shim thicknesses. This etching will have a + (plus) or - (minus) sign followed by a number—this number must be read in thousandths of an inch. In example, a +12 should be converted to 0.012 in., while a -5 should be read a -0.005 in. Check each gear for this number and mark it down for reference.

2. Lay the lower gear onto a clean, level surface so that the gear is facing down. Install a shim tool (# 3850701) over the gear, making sure that the tool is in full contact with the end of the gear. Use a flat blade feeler gauge and measure the gap between the outer edge of the bearing and the tool. Record this measurement.

3. The value shown on the etching must now be added or subtracted from the gap recorded in the previous step. A positive etched marking should be subtracted, while a negative number should be added. If our measured gap was 0.021 in. and the etching was +12, the shim thickness would be 0.009 in. (0.021 in. - 0.012 in. = 0.009 in.). If the etched mark was -5, the shim thickness would be 0.026 in. (0.021 in. + 0.005 in. = 0.026 in.). When selecting your shim material, make sure that it is clean and undamaged; and remember that you must use at least one shim and cannot use more than four shims.

□ If the etched marking on the gear's collar is 0, then the measured gap will be the shim thickness that you need to add. Sounds obvious, but you'd be surprised..

4. Repeat the previous two steps on the upper gear, taking your measurement this time between the tool and the lower edge of the adapter ring.

Pinion Bearing Carrier Shimming

◆ See Figure 129



All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

1. Just like the drive gears, the pinion gear has a number etched into it which must be used in determining the proper shim thicknesses. This etching will have a + (plus) or - (minus) sign followed by a number—this number must be read in thousandths of an inch. In example, a +12 should be converted to 0.012 in., while a -5 should be read a -0.005 in. Check each gear for this number and mark it down for reference.

2. Position the pinion bearing housing/carrier in a vise and secure it carefully with the gear facing upward.

3. On 1994-96 drives, use a depth gauge and measure the distance from the top of the teeth on the gear to the flange on the housing—take a few measurements in different positions and then average each of the readings to get your actual figure. Record this figure.

4. On 1997 and later drives, install a shimming fixture tool (# 3850600) onto the top of the gear and then use a depth gauge and measure the distance from the top of the tool to the flange on the housing—take a few measurements in different positions and then average each of the readings to get your actual figure. On 1995-98 models, subtract 0.500 in. from this figure and record the resulting figure.

5. On all models, the value shown on the etching must now be added or subtracted from the depth recorded in the previous step. A positive etched marking should be added, while a negative number should be subtracted. If our measured depth (minus the 0.500) was 2.045 in. and the etching was +12, the figure would be 2.057 in. (2.045 in. + 0.012 in. = 2.057 in.). If the etched mark was -5, the figure would be 2.040 in. (2.045 in. - 0.005 in. = 2.040 in.).

□ If the etched marking on the gear's collar is 0, then the measured depth will be the figure that you need to use.

6. Now, subtract the factory's nominal figure from the figure arrived at in the previous step. Use 1.898 in. for all drives with 1.97:1 ratios; all other ratios should use a nominal figure of 1.971 in. If our measured depth was 2.057 in. and the nominal figure being used was 1.971 in., the shim thickness would be 0.086 in. (2.057 in. - 1.971 in. = 0.086 in.). If the nominal figure was 1.898 in., the shim thickness would be 0.159 in. (2.057 in. - 1.898 in. = 0.159 in.).

□ Shims should only be placed between the bearing carrier and the upper housing. When selecting your shim material, make sure that it is clean and undamaged; and remember that you must use at least one shim and cannot use more than five shims.

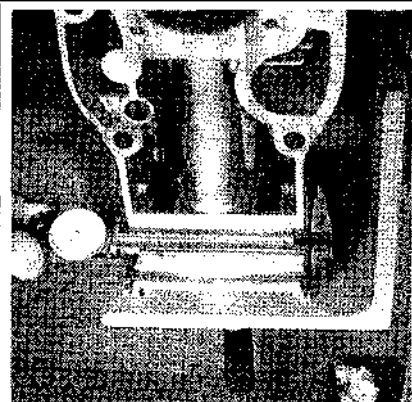


Fig. 126 Measure the housing dimension at the thrust plates

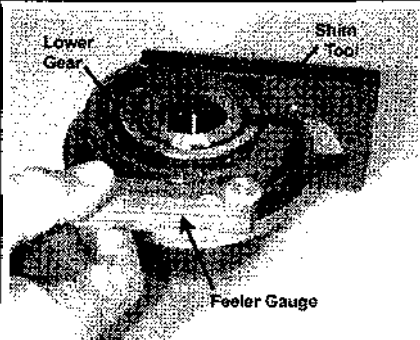


Fig. 127 Measure the distance between the tool and the top of the bearing...

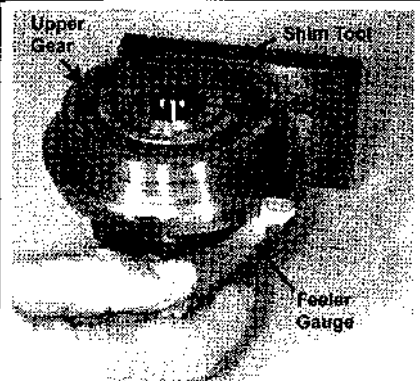


Fig. 128 ...and then between the edge of the adapter ring and the tool

Vertical Shaft End Play

† See Figures 130 and 131



Vertical movement (end play) of the upper shaft must fall within certain parameters and is controlled by the size of the shoulder on the upper driveshaft nut. There are 4 nuts available, each with a different thickness shoulder on the bottom of the nut. Each nut will have a number etched into the top surface that corresponds to the shoulder thickness. 0 has no shoulder; 2 has a shoulder thickness of 0.008 in.; 4 is 0.016 in. thick; and 6 is 0.024 in. thick. Another thing to remember is that this nut is a LEFT HAND THREAD, meaning it is tightened in a COUNTERCLOCKWISE direction. You should notice an arrow indicating this etched into the top of the nut also.

1. Lubricate the threads on the shaft with GL5 synthetic gear oil and spin the nut on in a counterclockwise direction. Make sure that the lower end of the shaft is clamped in the holding fixture and then tighten the nut to 96-110 ft. lbs. (130-149 Nm).

2. Once the nut is tight, push up on the shaft from the lower end and then insert a feeler gauge between the bottom of the nut's shoulder and the top of the upper bearing. Clearance should be 0.002-0.010 in. (0.05-0.25mm) and is adjusted by means of changing the nut. If the clearance is greater than specified, change to a nut with a thicker shoulder; if clearance is too low, install a nut with a thinner shoulder. After determining the correct nut, remove the old one and install a new one, tightening it to the correct torque figure.

3. If you are unable to bring the clearance into specifications with one of the 4 nuts, confirm that the upper gear, bearing and support ring are assembled correctly. If they are, the bearing is shot and will need to be replaced.

Top Cover Shimming

◆ See Figure 132



1. Position 0.040 in. of shim material onto the top of the upper bearing and then install the cover being careful not to disturb the shims. Do not install a new cover gasket at this time.

2. Press down lightly, and evenly, on the cover while using a flat blade feeler gauge to check the clearance between the bottom of the cover and the top of the upper bearing. Take this measurement in several places and record the average of your measurements.

3. Top cover clearance should be 0.002-0.004 in. (0.05-0.10mm); take the midpoint (0.003 in.) and add it to the initial shim thickness that you started with (0.040 in.). Record this figure (0.043 in.).

4. Now, subtract the figure arrived at in Step 2 from the figure in Step 3 and this will be the shim thickness to add to the existing shim material under the cover. You must always use at least one shim, and never more than four.

5. Lift off the cover and position the new shim material on top of the existing one(s). Reinstall the cover without disturbing the shims and tighten the bolts to 16-18 ft. lbs. (22-24 Nm).

Backlash



◆ See Figures 133, 134, 135 and 136

This test will determine the relative clearance between the pinion and drive gears. We assume that you have already assembled the components as detailed up to this point in the Assembly procedures and that the unit is still in the holding fixture.

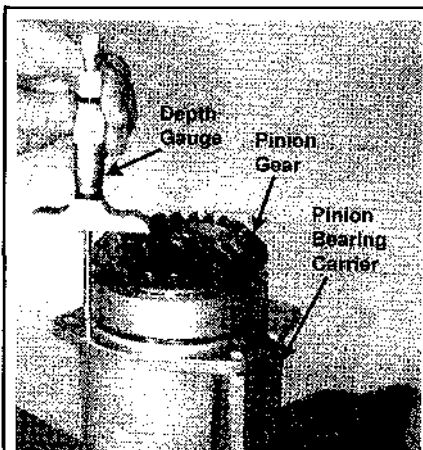


Fig. 129 Use a depth gauge to measure the depth. Later models must be measured from the top of a special tool

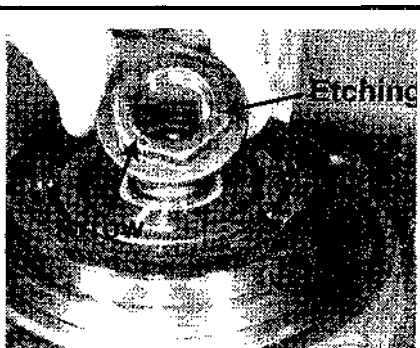


Fig. 130 The shaft nut is etched with a number corresponding to shoulder thickness



Fig. 131 Checking the vertical shaft end play

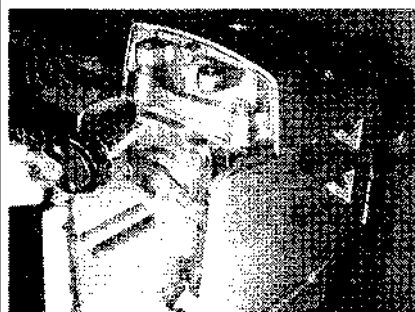


Fig. 132 Checking the top cover clearance

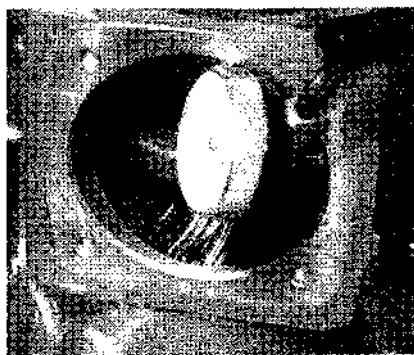


Fig. 133 Check backlash on the lower gear...

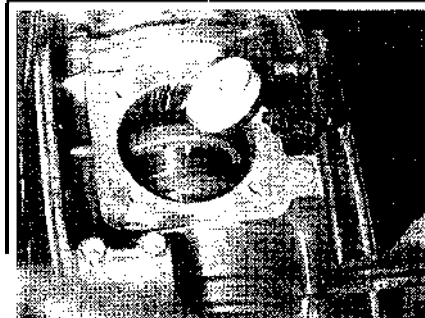


Fig. 134 ...and then the upper gear

Drive Gear Backlash Table

(Please refer to the illustration for shim positions)

Condition	Positions Requiring Shim Changes				
	1	2	3	4	5
One Gear In Spec, One Gear Out Of Spec ①					
Lower gear less than range, Upper gear within range	Remove shims	NC	NC	NC	Reshim w/new nut
Lower gear above range, Upper gear within range	Add shims	NC	NC	NC	Reshim w/new nut
Upper gear less than range, Lower gear within range	NC	Add shims	Reshim	NC	Reshim w/new nut
Upper gear above range, Lower gear within range	NC	Remove shims	Reshim	NC	Reshim w/new nut
Both Gears Out Of Spec By Same Amount ②					
Upper gear above range, Lower gear less than range	Remove shims	Remove shims	Reshim	NC	Reshim w/new nut
Lower gear above range, Upper gear less than range	Add shims	Add shims	Reshim	NC	Reshim w/new nut
Lower gear less than range, Upper gear less than range	NC	NC	NC	Add shims	NC
Lower gear above range, Upper gear above range	NC	NC	NC	Remove shims	NC
Both Gears Out Of Spec By Different Amounts ③					
Upper gear above range, Lower gear less than range	Remove shims	Remove shims	Reshim	NC	Reshim w/new nut
Lower gear above range, Upper gear less than range	Add shims	Add shims	Reshim	NC	Reshim w/new nut
Lower gear less than range, Upper gear less than range	Remove shims	Add shims	Reshim	NC	Reshim w/new nut
Lower gear above range, Upper gear above range	Add shims	Remove shims	Reshim	NC	Reshim w/new nut

NC No change to shims required

① Add or remove the same amount of shim material at each position indicated

② Add or remove the same amount of shim material at each position indicated

③ Add or remove different amounts of shim material at each position indicated

1. Mount a dial indicator holding bracket onto the support plate (or upper unit itself) and install a dial indicator so that the indicator needle is resting directly on the mid-point of a tooth on the lower gear. Zero the indicator and then wiggle the gear very slowly while observing the reading on the gauge. Do not wiggle the gear far enough so that the pinion gear begins to rotate the U-joint; just far enough so that the tooth on the lower gear comes in contact with the corresponding tooth on the pinion gear from either direction. Move the gauge away from the tooth, rotate the gear 180° and then set the indicator needle up as you did the last time. Wiggle the gear again and observe the reading.

2. Pull the gauge back away from the gear and slide it up the holding bracket so that you can perform the same sequence of measurements on the reverse (upper) gear. Observe and record each reading.

3. Backlash should be 0.006-0.011 in. (0.15-0.28mm) on each gear. Remember that lash differences between the two gears are OK as long as they fall within the appropriate range. Shim calculations should be determined by subtracting the mid-point of the range (0.0085 in.) from the reading taken with the gauge; or, by subtracting the reading from the midpoint. Lash measurements that are out of specification will require multiple shimming changes—please refer to the Drive Gear Backlash Table when determining how to correct any shimming discrepancies. When using the table, pay close attention to the notes and remember that you must always follow the order of the positions as indicated.

The shim thickness-to-backlash ratio is approximately 2:1, therefore each 0.002 in. of backlash will be offset by 0.004 in. of shim material.

■ Any change to the bearing carrier shim (position 4) will affect lash on both drive gears. Any change to the upper bearing shim (position 2) will only impact lash on the upper bearing gear, while any changes to the lower bearing shims will only impact the lower bearing gear.

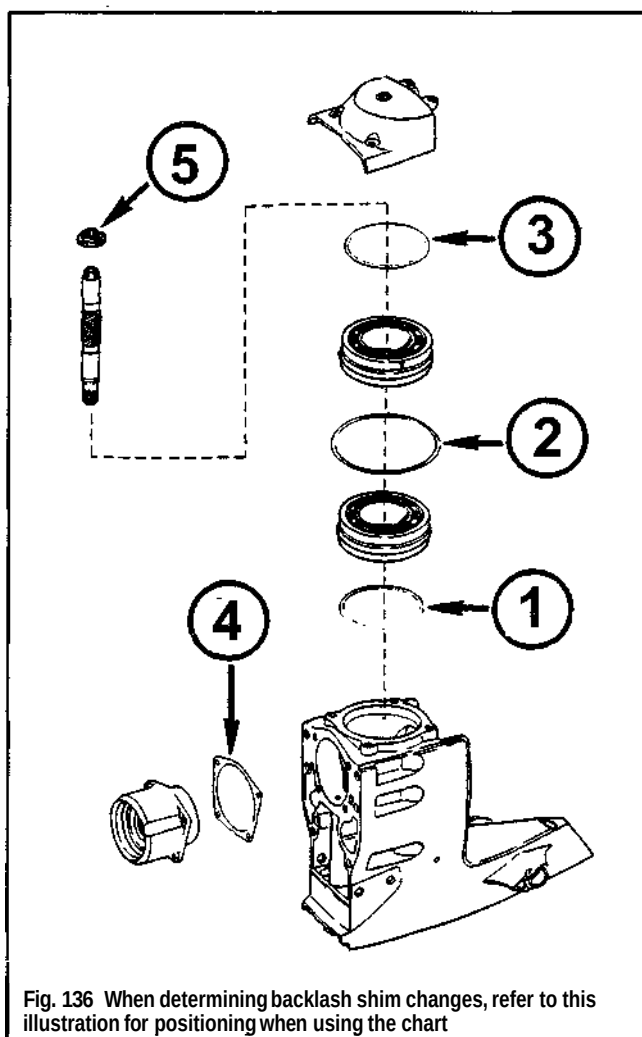


Fig. 136 When determining backlash shim changes, refer to this illustration for positioning when using the chart

U-Joint/Drive Shaft Assembly

REMOVAL & INSTALLATION

□ U-joint and driveshaft removal and installation procedures are an integral part of the Upper Gear Housing procedures. Please refer to this section for complete details on removal and installation of these components.

DISASSEMBLY & ASSEMBLY



◆ See Figures 137 thru 140

□ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

Although it is not necessary to remove the pinion bearing carrier/U-joint assembly for service, you may find it more convenient to remove it before performing the following procedures. Additionally, we recommend using the special tool provided by OMC (# T74-4635) when performing this procedure because it really is easier with the tool. That being said, it is certainly not necessary, so we have provided instructions with and without the tool.

1. Clean the assembly in solvent and allow it to dry thoroughly.
2. Inspect the splines on both yokes for wear or cracking, replacing anything if a problem is found.
3. Inspect the joints themselves for wear, knocking or too much side play. If problems are found, separate the joints.
4. On the inside of each U-joint arm there is a locking ring (circlip); drive each locking ring off the U-joint cross bearing with a small punch and hammer. Discard all rings as they are removed—do not consider re-using them! The locking rings may come off with considerable force, so hold a bunched-up shop cloth over them as you are pressing each one off the bearing and don't forget to wear eye protection.

Without the special tool:

5. Set the pinion carrier on a vise with the jaws open far enough that the bearing cap will be able to pass through.
6. Position a ball peen hammer with the ball on the top bearing cap and then tap it with another hammer until the lower bearing cap begins to come out of the yoke. Grab it with a pair of pliers and pull it all the way out of the yoke.
7. Rotate the U-joint assembly 180° and repeat the previous step until you can remove the cross-member (spider) from the yoke. Make sure that you take note of the positioning of the grease fitting in relation to the yoke.
8. Press the other bearings out in the same manner, as described in the previous steps.

With the special tool:

9. Clamp the U-joint in a vise so that one of the bearings is running north-south.

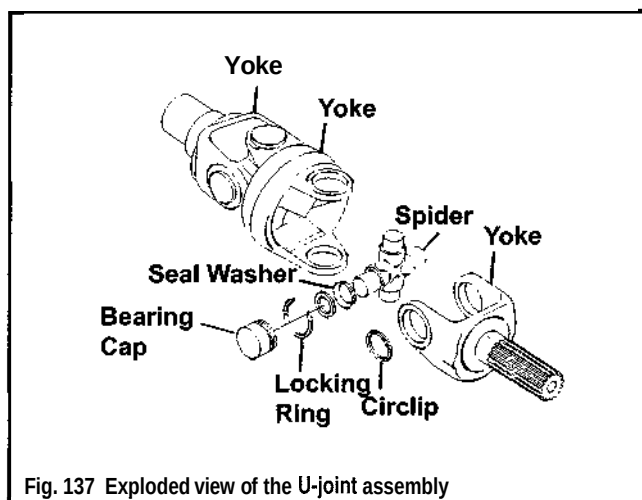


Fig. 137 Exploded view of the U-joint assembly

12-34 STERN DRIVE – COBRA AND KING COBRA

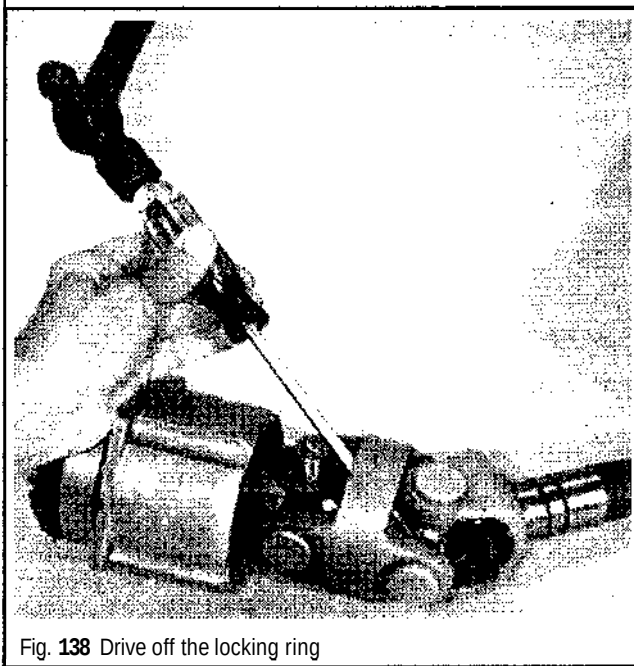


Fig. 138 Drive off the locking ring

10. Install the open adapter from the special tool kit into the open end of the removal tool. Position the tool over the bearing/caps and press the joint out of its yoke.

■ Never press a bearing cap all the way through the yoke. As soon as the pressure-side cap is most of the way through the yoke, remove the tool and pull off the cap with a pair of pliers.

11. Rotate the joint 180° and then re-clamp it in the vise. Install the tool again and repeat the previous step. Remove the bearing and cap. Make sure that you take note of the positioning of the grease fitting in relation to the yoke.

12. Press the other bearings out in the same manner, as described in the previous steps.

To assemble:

□ Spiders and needle bearings should only be replaced as a set—never install new bearing onto a used spider or vice-versa.

13. Install new seal washers onto each end of the spider and then position it into the yoke. Certain models may have spiders with grease fittings; make sure that they are facing positioned at a 45° angle to any two lobes so they will be accessible after installation. Now is a good time to use the fitting and fill it with grease until visible at each lobe.

14. Lubricate the U-joint bearing caps with a liberal amount of water-resistant bearing grease and then install the needle bearing so the grease holds them in position. Position two opposing caps and press them in as far as possible without forcing them; all you need to do is get it in far enough to allow installation of the locking ring.

15. Once the groove is visible, press in the new locking ring and then repeat the procedure on the remaining bearings. Always make sure that the spider pivots properly in the bearing caps and is not hanging up.

⚠ CAUTION

Never force the bearing caps onto the spider. If you are unable to press it in far enough to expose the locking ring groove, there is a good chance that one of the needles has come loose and lodged itself in the bottom of the cap. Remove the caps and spider, check the bearing positioning in the cap and start the process over again.

16. Install the bearing carrier if you removed it.

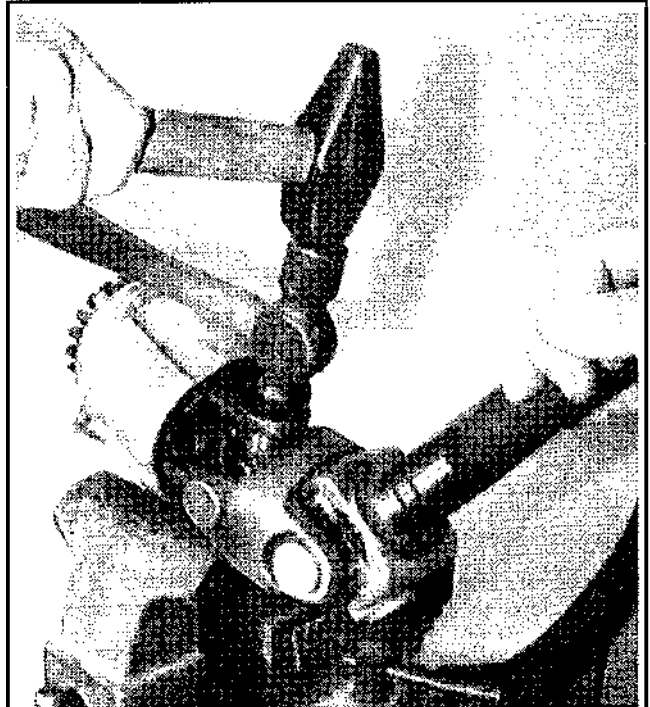


Fig. 139 Tap the bearing through until you can pull off the bearing cap

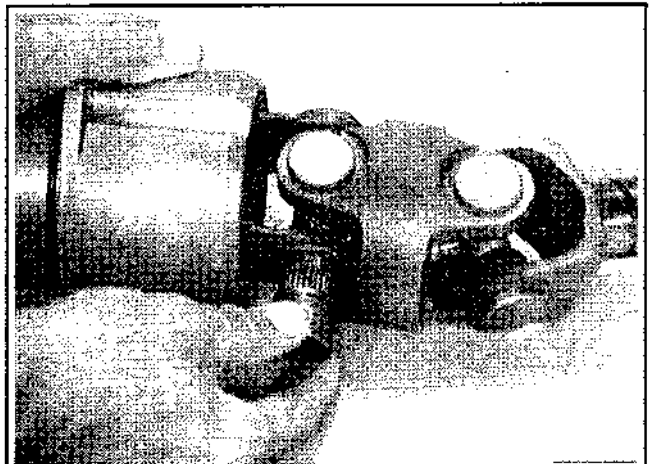


Fig. 140 A good shot of the cap and bearings

U-Joint Bellows

REMOVAL & INSTALLATION

Please refer to the Gimbal Housing section for complete U-joint bellows removal and installation procedures.

Exhaust Bellows

REMOVAL & INSTALLATION

Please refer to the Gimbal Housing section for complete U-joint bellows removal and installation procedures.

Shift Mechanism

REMOVAL & INSTALLATION

1994-98 Single Propeller Models (SPISXISX Cobra)

1996-98 Dual Propeller Models (DPIDP DuoProp)



◆ See Figures 141, 142 and 143

1. Using a pair of needle nose pliers, remove the cotter pin securing the shift link to the lever on the eccentric piston and move the link out of the way. Don't lose the washer.

2. Loosen and remove the 4 shift mechanism mounting bolts and then remove the assembly. Take note of the position of the shift shoe as you remove the assembly and make sure that you write it down to retrieve on assembly.

3. Remove and discard the O-ring.

4. Coat a new O-ring with GL5 synthetic gear lube and press it back into the groove on the mechanism.

5. Install the shift mechanism into the upper housing, making sure that the shift shoe is in the same position, and tighten the bolts to 60-84 inch lbs. (6.8-9.5 Nm).

6. Reconnect the shift lever with a new cotter pin.

DISASSEMBLY, ASSEMBLY & SHIMMING

1994-98 Single Propeller Models (SPISXISX Cobra)

1996-98 Dual Propeller Models (DPIDP DuoProp)



◆ See Figures 144, 145, 146 and 147

1. Remove the shift cover.

2. Remove the shift mechanism. It is not necessary to remove the drive unit, or even the upper housing to remove the mechanism.

✖ ✖ CAUTION

Be careful that the spring-loaded shift shoe does not fall out during removal.

3. Lift out the shift shoe and spring, making sure that you take note of the positioning of each.

4. Carefully position the assembly in a vise with soft jaws and then drive the tension pin into the piston with a small punch until you are able to pull out the piston pin with a pair of pliers.

5. Mark the piston positioning in the housing and then pull the eccentric piston out of the housing.

6. Turn the piston over and tap it a few times until the tension pin pops out.

7. Remove the O-ring from its recess on the inner side of the housing. Pry out the seal ring from the other side.

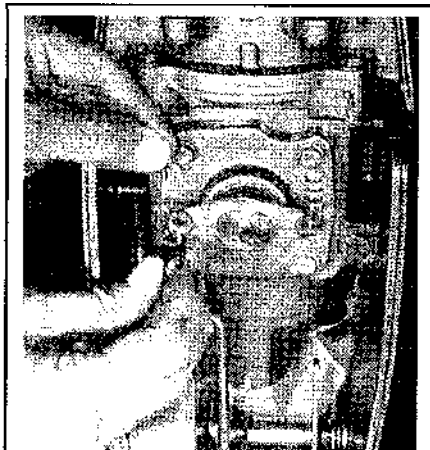


Fig. 141 Disconnect the shift link...

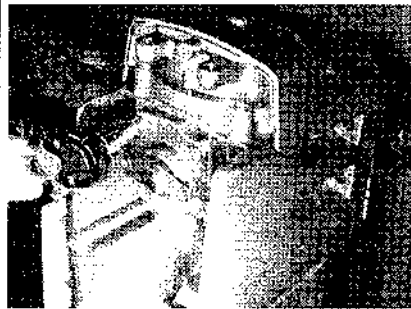


Fig. 142 ...remove the mounting bolts...



Fig. 143 ...and pull out the shift mechanism

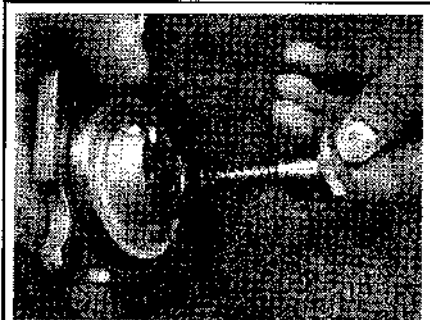


Fig. 144 Remove the shift shoe and spring

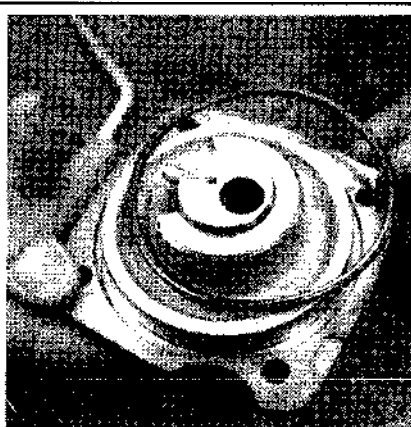


Fig. 145 Pry out the O-ring

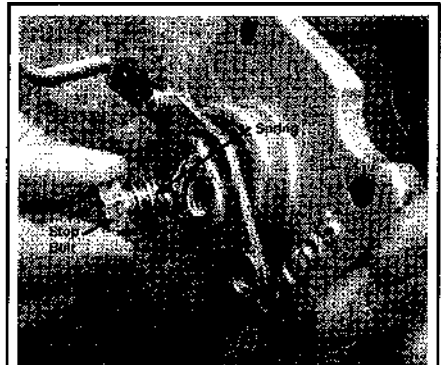


Fig. 146 Coat the stop bolt threads with sealant before installing it

12-36 STERN DRIVE – COBRA AND KING COBRA

To assemble:

8. Clean all components thoroughly and allow to dry completely. Check the piston for signs of scoring or other wear.

9. Coat a new sealing ring on the outside perimeter with Gasket Sealing compound and then press it into position in the housing so that the side with the smaller groove faces into the housing. Although it may be possible by hand, we suggest using a press and a drift (# 884259); position the drift (large diameter down) and press the seal in until the tool seats on the housing. Now you can coat the lips of the seal with Triple Guard grease.

10. Position the piston, through the seal and bushing, into the bore so that the offset screw is on the side of the housing with the notch in the top (starboard).

11. Insert the piston pin into the its hole so that the hole in the pin lines up with the tension pin hole. Insert the tension pin and drive it in until it is flush with the piston surface.

12. Slide the spring over the shift shoe shaft and then insert the shaft into the piston. Coat a new O-ring with GL5 synthetic gear lube and press it into its groove.

13. Coat the shift mechanism and housing mating surfaces with Permatex and then install the entire mechanism into the housing so that the stop bolt hole is on the starboard side and the longer side of the shoe is also on the starboard side. Tighten the mounting bolts securely.

14. Support the piston arm while removing the shift shoe stop bolt along with any shims underneath it.

15. Remove the upper and lower mounting bolts on the starboard side and then install the special bracket (#3850057) with the bolts that came with it. Tighten the 2 bolts to 60-84 inch lbs. (6.8-9.5 Nm).

16. Position the shift system for shimming by moving the piston lever until the starboard hole aligns with the hole in the bracket. Install the shoulder bolt supplied with the bracket and tighten it securely.

17. Reinstall the stop bolt (without shims!) and tighten it until you cannot rotate the vertical shaft. Now loosen the bolt very slowly, a little at a time, until the shaft just begins to turn freely without drag.

18. Insert a flat bladed feeler gauge between the underside of the bolt head and the piston lever. Record the measurement. Remove the bolt, coat

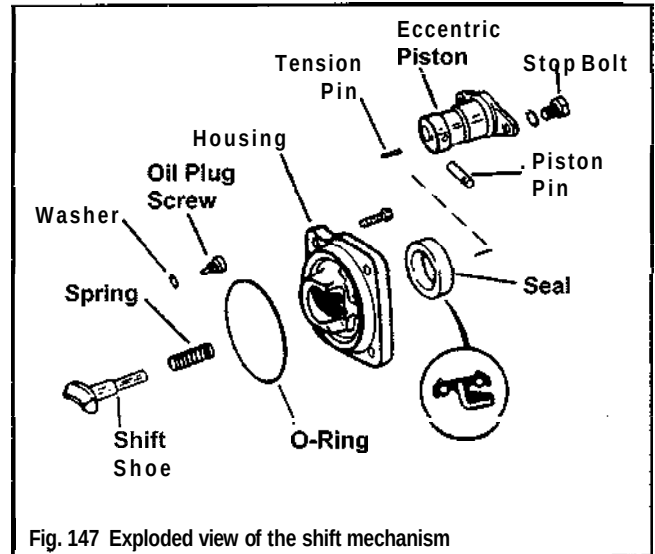


Fig. 147 Exploded view of the shift mechanism

the threads with Teflon pipe sealant, and add as many shims as it takes to get as close to this measurement WITHOUT going over it. You must use at least one shim, but not more than 4 shims. Install the bolt and tighten it to 10-12 ft. lbs. (14-16 Nm) and confirm that the vertical shaft turns freely; if not, repeat the procedure.

☐ Shift shoe stop bolt shims come in only one size.

19. Reconnect the shift rod and install the shift cover.

LOWER GEARCASE (LOWER UNIT)

Description

Power from the engine is transferred through a splined driveshaft (sometimes called the output shaft) and U-joint assembly to the upper gear housing. Splines on the forward end of the U-joint index with matching splines of the shaft connected to the engine in the flywheel housing.

From the U-joint, power is transferred through a pinion gear to the forward (lower) and reverse (upper) gears which are in constant mesh with the pinion gear. The pinion, forward and reverse gears are all helical cut and sold as a matched set.

As previously mentioned, a cone clutch is splined to the vertical driveshaft (except on the Cobra where it is on the propeller shaft) and engages the forward and reverse gear whenever the shift lever is moved to the appropriate position. When the clutch engages either gear, the power and rotational direction is then transferred to the vertical driveshaft. The forward and reverse gears change the direction of power 90° through the vertical driveshaft and intermediate coupling down to the lower unit.

On single propeller units, a pinion gear on the lower end of the vertical driveshaft transfers power again 90° through a matching gear on the propeller shaft. The pinion gear on the lower end of the shaft and the driven gear on the prop shaft may be changed, thus affecting final gear ratio. These gears are sold as matching sets only and must always be installed this way. Engine power is then transmitted through the propeller shaft and out to the propeller.

Duo-prop units operate similarly to the singles except that they have a matched set of three gears and dual propeller shafts. The lower pinion gear is splined to the vertical shaft and is in constant mesh with the two prop shaft gears. The forward gear is splined to the inner propeller shaft, while the aft gear is a machined part of the outer prop shaft. As the vertical shaft rotates, the forward gear and inner shaft is driven in one direction, while the aft gear and outer shaft is driven in the opposite direction (because it is engaged to the same pinion gear, but 180° opposite the inner shaft's gear). The final result? Each prop shaft and propeller rotate at the same speed, but in opposite directions.

Dual propellers provide a larger blade area than a stern drive with a single propeller. The counter-rotating propellers also provide a much higher torque load and a self-canceling "roll" force.

Lower Gear Housing (Lower Unit)

REMOVAL & INSTALLATION



The lower unit may be separated and removed from the upper gear housing while the stern drive remains attached to the boat or after the stern drive has been removed.

If you plan on disassembling the unit, remove the propeller from the lower gear housing as detailed elsewhere in this section.

If the unit is still on the boat, drain the drive oil as detailed in the Maintenance section. Allow the lubricant to drain into the container; as the lubricant drains, check the color. Dark brown to black indicates normal old lubricant, while a chalky white to cream color indicates the presence of water. The presence of any water in the gear lubricant is bad news. The unit must be completely disassembled, inspected, the cause of the problem determined and corrected. Close attention should be given to the seals on the propeller shaft, driveshaft and the bearing carrier O-ring. Examine the magnet on the end of the fill/drain plug for evidence of metal particles. The presence of tiny small metal dust like shavings indicates normal wear of the gears, bearings and shafts within the lower unit. Large metal chips or heavy fillings indicate extensive internal damage is taking place and the lower unit must be completely disassembled and inspected. All worn and/or damaged components must be replaced.

1986-93 Cobra Models



◆ See Figures 13, 14, 15 and 16

☐ The lower gear housing may be removed without removing the entire stern drive unit from the vessel.

If the drive has been completely removed from the boat, simply follow the upper gear housing removal procedures and lift it off the lower unit, otherwise:

1. Move the drive to the full down position and drain the oil.
2. Now move the drive to the full tilt up position.
3. Position an appropriate support fixture around or under the lower unit.
4. Disconnect the battery cables.
5. Make a note of the of where the index mark is in relationship to the grid on the bottom of the trim tab and then remove the trim tab bolt and the tab. Make sure that you write the tab mark down somewhere!
6. Remove the bolt that was partially covered by the trim tab and then remove second bolt forward of this one. The middle bolt is for the anode and does not need to be removed.
7. Remove the 4 mounting bolts (2 on each side) from the sides of the lower unit.
8. Carefully lower the housing down and away from the upper unit until the shift rod disengages the guide pin and then swivel it 90 degrees to port while lowering it completely away. Move it to an appropriate stand.

To install:

9. Thoroughly clean the upper case-to-lower housing mating surfaces.
10. Make sure that the nylon plug is positioned at the base of the splines inside the lower driveshaft. Coat the splines at both ends of the intermediate shaft with clean engine oil and insert the shaft into the lower driveshaft.
11. Rotate the shift rod head 90 degrees to port.
12. Install the plastic water tube into the recess in the bottom of the upper unit.
13. Position the lower unit under the upper unit and then slowly raise it while guiding the water tube and shaft into place. As the shift rod head begins to appear in the exhaust opening, swivel it forward until it can engage the guide pin. Wiggle the propeller shaft until the shaft splines engage those in the coupler and then raise the unit fully until it mates with the upper unit.

■ **There may be a yellowish-green substance in the threads of the mounting bolts—this helps the bolts from coming loose and if not evident, they will need to be replaced with new ones.**

14. Coat the threads of all bolts with Gasket Sealing compound. Install the bolts, 4 short ones (on the sides) and 2 longer ones (in the rear). Tighten them all to 22-24 ft. lbs. (30-33 Nm).

15. Position the trim tab so that the index mark lines up with the correct mark on the grid and then tighten the bolt to 28-32 ft. lbs. (38-42 Nm).

16. Install the drive unit if removed.

1988-95 King Cobra Models

◆ **See Figure 17**



■ **The lower gear housing may be removed without removing the entire stern drive unit from the vessel.**

If the drive has been completely removed from the boat, simply follow the upper gear housing removal procedures and lift it off the lower unit, otherwise:

1. Move the drive to the full down position and drain the oil.
2. Now move the drive to the full tilt up position.
3. Position an appropriate support fixture around or under the lower unit.
4. Disconnect the battery cables.
5. Remove the 6 mounting bolts (3 on each side) from the sides of the lower unit and the 1 bolt at the rear of the plate.
6. Lower the housing away from the upper unit and move it to an appropriate stand. The water tube and/or shaft coupler may come off (or fall out), so watch for them and reinstall them in the lower unit if necessary.

To install:

7. Thoroughly clean the upper case-to-lower housing mating surfaces.
8. Slide the small nylon support ring over the top of the driveshaft and into position in the recess.
9. Coat the new O-rings for the driveshaft retainer and oil passage with OMC Hi-Vis oil and then press them into their respective grooves.
10. Make sure that the tabs on the driveshaft retainer are aligned and in place with the nearest slots.
11. Install the intermediate shaft onto the driveshaft. Press the water supply tube into the grommet on the bottom of the upper housing.

12. Position the lower unit under the upper unit and then slowly raise it while guiding the water tube and intermediate shaft into place. Feed the impeller housing vent tube into the exhaust chamber on the lower unit. Wiggle the propeller shaft until the upper shaft splines engage those in the coupler and then raise the unit fully until it mates with the upper unit.

13. Coat the threads of all bolts with Gasket Sealing compound. Install the bolts and tighten them to 32-40 ft. lbs. (43-54 Nm).

14. Install the drive unit if removed.

1994-98 Single Propeller Models (SPISXISX Cobra)

1996-98 Dual Propeller Models (DPIDP DuoProp)



◆ **See Figures 11, 12, 13, 14, 22 and 148**

The lower gear housing may be removed without removing the entire stern drive unit from the vessel.

If the drive has been completely removed from the boat, simply follow the upper gear housing removal procedures and lift it off the lower unit, otherwise:

1. Move the drive to the full down position and drain the oil.
2. Position an appropriate support fixture around or under the lower unit.
3. Now move the drive to the full tilt up position.
4. Remove the 4 mounting bolts (2 on each side) from the sides of the lower unit and the 2 bolts at the rear of the plate. DP drives units may use studs on the sides, so they will have nuts if this is the case.
5. If your unit utilizes a trim tab, mark its position with a magic marker, remove the mounting bolt and then remove the tab.
6. Lower the lower unit and move it and the stand away from the drive. The water tube and/or shaft coupler may come off (or fall out) when the units are separated, so watch for them and reinstall them in the lower unit if necessary.

■ **If the drive unit was already off of the boat, simply remove the attaching bolts/nuts and lift off the upper unit.**

To install:

7. Thoroughly clean the upper case-to-lower housing mating surfaces.
8. Clean the oil screen thoroughly. Coat a new O-ring lightly with clean engine oil and press it into the groove. Install the oil screen.
9. Make sure that the intermediate shaft coupler is installed correctly on the shaft with the groove facing upward.
10. Install the plastic water tube guide into the recess in the lower unit. Check the positioning of the upper and lower grommets on the tube, coat the lower grommet with sealing compound and position it into the recess and over the guide. Certain early models, usually 1994, may use a retainer that is held in place with 4 screws, if you have one, tighten them to 10-12 ft. lbs. (14-16 Nm).
11. Replace any O-rings after first coating them with GL5 synthetic gear lube.

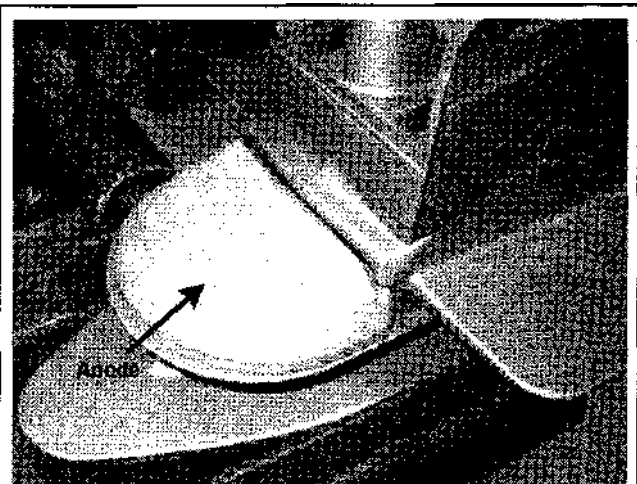


Fig. 148 Make sure you install the anode before mating the two cases

12. If removed, install the forward anode and tighten the 2 bolts to 60-84 inch lbs. (6.8-9.5 Nm).
13. Position the lower unit under the upper unit and then slowly raise it while guiding the water tube and shaft coupler into place. Wiggle the propeller shaft until the upper shaft splines engage those in the coupler and then lower the unit fully until it sits on the lower unit.
14. Coat the threads of all bolts (or studs) with Gasket Sealing compound. Install the bolts (or nuts) and tighten the 4 short ones (on the sides) to 22-24 ft. lbs. (30-33 Nm) and the 2 longer ones (aft) to 32-40 ft. lbs. (43-54 Nm).
15. Install the trim tab, if you removed it, so that the earlier marks are in alignment and tighten the bolt to 14-16 ft. lbs. (19-22 Nm).
16. Install the drive unit.

DISASSEMBLY & ASSEMBLY

1986-93 Cobra And 1988-89 King Cobra Models - Standard Rotation



◆ See Figures 149 thru 182

All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

DO NOT ATTEMPT THIS PROCEDURE WITHOUT THE SPECIAL TOOLS!! We know that most of us, whether professional technicians or shade-tree mechanics, hate spending money on special tools. Most of us don't want to spend the money, even if we had it, so we find ways to fabricate our own version of special tools. Be warned in advance that you will NOT be able to create these tools on your own. Please read through the following steps beforehand and make a list of the tools that you will need to acquire—if you are unwilling, or unable, to get your hands on them, take the drive to someone who already has them.

1. Remove the lower unit and support it in an appropriate stand.
2. Grasp the intermediate shaft and pull it out of the housing.
3. Pull out the plastic water tube guide; remove the water tube and seal if they came out with the guide.
4. Remove the 5 locknuts on the water passage housing, throw away the nuts but keep the washers. The housing will need to be persuaded, so insert a small prybar between the housing and mating surface near one of the two forward studs and then lever the housing up while wiggling it back and forth. Once loose, pull it up and over the driveshaft housing. Throw away the gasket and O-ring.
5. Remove the 4 driveshaft bearing housing mounting bolts, but do not remove the housing yet.
6. Remove the propeller if you haven't already done so. On all models but the 460 King Cobra and 1991-93 Cobra, remove the 4 propeller shaft bearing housing bolts and throw them away. On the 1991-93 Cobra and the 460, remove the 2 bolts running through the bearing housing, being careful to catch the retainers on the inside of the housing lip as they fall off of the end of the bolts.
7. On 2.3L and 3.0L engines, connect 2 puller bolts (# 316982) to a puller head (# 307636), insert the bolts through the head and then thread them into the bearing housing. Tighten the large center bolt in the puller head so that it presses against the propeller shaft and then continue tightening it to remove the bearing carrier housing. On all other 1986-90 engines, attach 2 puller legs (# 330278) to the same puller head and then position it so the legs are underneath the cross bars in the carrier housing. Tighten the center bolt and remove the carrier housing.
- On 1991-93 engine/drives, assemble two 10 in. 5116-18 threaded rods with flat washers and nuts to a puller body (# 307636). Attach a press bolt (# 307637) and handle (# 307638) and then position the assembly so that you can thread the other end of the long rods into the bearing housing. With the press bolt on the end of the propeller shaft, tighten it against the shaft, pulling the carrier out of the housing.
8. Inspect the bearing carrier anode for signs of deterioration. If the anode appears to be less than 50% in size, replace it. Why not replace it while you've got the carrier out anyway? Cheap insurance.

9. Carrier housing bearing should be replaced only if necessary. Insert a small prybar or awl and remove the 2 oil seals. Use the special tools (on 1986-90 drives, #391259 and #391010 - small bearing, or #391012 - large bearing; on 1991-93 drives, #432127 and # 432130) if you don't want to damage the bearings. But if you followed our advice at the start of this step, you wouldn't be removing the bearings unless they were already damaged, so the easy way is to insert a large drift or punch and drive each bearing out of the carrier.

10. Reach in and remove the 2 retaining rings with circlip pliers (# 331045) and then lift out the retaining plate, reverse gear, thrust bearing and thrust washer. Note that the 460 King Cobra and 1991-1993 Cobra do not utilize the 2 retaining rings or the retaining plate.

11. Getting a wrench on the pinion nut is tough—rotate the propeller shaft and at the same time pull upward on the shift rod, this will engage forward gear and provide a bit more clearance. Now reinsert the intermediate shaft into the top of the unit and install a spline socket (# 311875) over it. Insert a pinion nut holder (# 334455) into the propeller shaft bore and over the nut, connect a breaker bar to the spline socket and then turn the driveshaft to loosen the pinion nut. Remove the nut, socket and intermediate shaft. Lift off the driveshaft bearing housing (you removed the nuts already).

12. Remove all of the driveshaft housing O-rings and throw them away. Insert your finger and rotate the needle bearings to ensure freedom of movement. Check for any damage or corrosion. If you notice a problem of any kind, replace the housing as an assembly.

13. Wiggle the lower driveshaft back and forth while pulling it up and out of the gearcase; the thrust bearing, washer and shims should come out with it but if not, remove them also.

14. Removal of the lower driveshaft bearing will destroy the bearing, so refrain from this step unless you suspect a problem with the bearing. Remove the small Phillips screw from the starboard side of the gearcase near the water inlets on all but the 1990-93 Cobra. On the 1990-93 Cobra, the bearing is held in place by a small retaining ring that rides in a groove above the bearing; insert a small prybar through the looped end of the ring and pop it out of the groove. Assemble the special tool (# 391257) as detailed in the illustrations and then drive the bearing down and out the bottom on the 2.3L and 3.0L engines, or pull the bearing up and out the top on all other engines.

❑ Make sure that all loose needles are properly positioned in the bearing cage BEFORE attempting to remove the lower bearing.

15. Reach into the propeller shaft bore and remove the pinion gear and nut. Check to see if any needle bearings may also have fallen loose and remove them too.
16. Back on top of the case, remove the 2 anode bolts and lift it off of the case. Press down on the shift rod to allow the detent lever clearance inside the gearcase when the propeller shaft is removed. Unscrew the shift rod until it is free, but do not remove it from the cover yet. Remove the 6 shift rod cover mounting bolts and then lift off the cover and rod as an assembly. Remove and throw away the gasket. Do not remove the shift rod from the cover unless you intend to replace the small O-ring and wiper as they will be damaged by the rod's threads while pulling it through.
17. Pull out the propeller shaft with the forward gear and bearing housing assembly. Make sure that the fluid drain plug is removed or you may break the plug's tip during removal of the shaft.
18. Insert a small awl under one end of the clutch dog spring and pry it out of the groove while feeding it up and over the top of the clutch dog. Push the small pin out of the clutch dog, allowing the bearing housing assembly to separate from the clutch and both assemblies to come off of the propeller shaft.
19. If it hasn't already fallen off, pull the forward thrust bearing and washer out of the bearing housing. Push down on the detent shifter (arm) until it is all the way down and then pull out the shifter shaft and cradle. Now pull back up on the detent shifter until it pops back into the Neutral position. Push the pin out of the housing with a small pick and then reach into the front of the housing, remove the shifter from the detent and then remove the shifter through the bearing opening. Turn the detent shifter 90° in either direction and remove it from the housing

■ On 2.3L and 3.0L engines, rotate the detent shifter 90° to either side and then lift the shifter out through the top of the housing. Remove the shift lever through the same opening

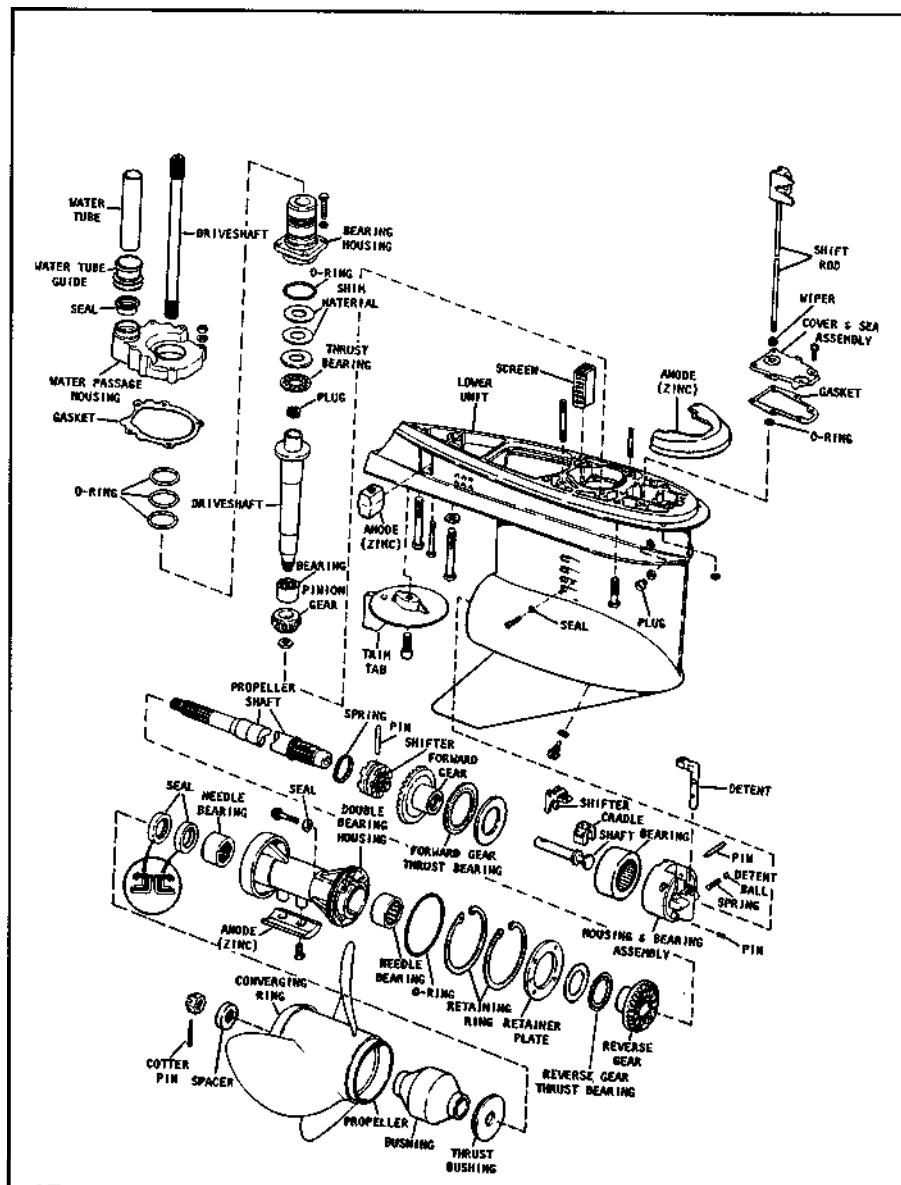


Fig. 149 Exploded view of the lower unit—1986-90 Cobra

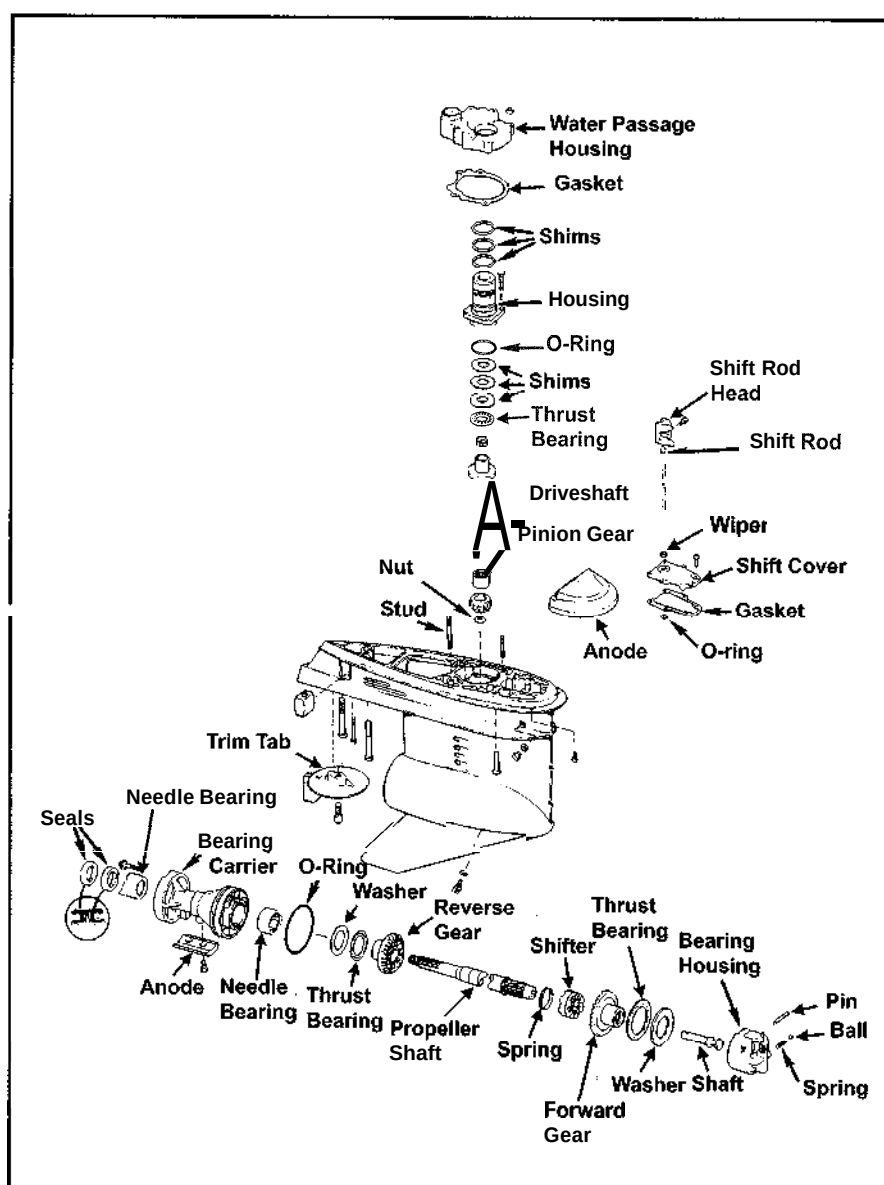


Fig. 150 Exploded view of the lower unit—King Cobra and 1991-93 Cobra

❖❖ CAUTION

Be careful, the detent ball and spring can come out of the housing with surprising force once the detent is removed.

20. By now, the needle bearings have probably fallen out on all units except those mated with the 2.3L and 3.0L engine (because they utilize captive needles)—make sure you have all 25 of them!

To assemble:

21. Wash all parts in solvent and blow them dry with compressed air. Remove all traces of seal and gasket material from all mating surfaces. Blow all water, oil passageways and screw holes clean with compressed air. After cleaning, apply a light coating of gear lubricant to the bright surfaces of all gears, bearings, and shafts as prevention against rusting and corrosion.

22. Use a fine file to remove burrs. Replace all O-rings, gaskets, and seals to ensure satisfactory service from the unit. Clean the corrosion from inside the housing where the bearing carrier was removed.

23. Check to be sure the water intake is clean and free of any foreign material.

24. Inspect the gear case, housings, and covers inside and out for cracks. Check carefully around screw and shaft holes. Check for burrs around machined faces and holes. Check for stripped threads in screw holes and traces of gasket material remaining on mating surfaces.

25. Check O-ring seal grooves for sharp edges, which could cut a new seal. Check all oil holes.

26. Inspect the bearing surfaces of the shafts, splines, and keyways for wear and burrs. Look for evidence of an inner bearing race turning on the shaft. Check for damaged threads. Measure the run-out on all shafts to detect any bent condition. If possible, check the shafts in a lathe for out-of-roundness.

27. Inspect the gear teeth and shaft holes for wear and burrs. Hold the center race of each bearing and turn the outer race. The bearing must turn freely without binding or evidence of rough spots. Never spin a ball bearing with compressed air or it will be ruined. Inspect the outside diameter of the outer races and the inside diameter of the inner races for evidence of turning in the housing or on a shaft. Deep discoloration and scores are evidence of overheating.

28. Inspect the thrust washers for wear and distortion. Measure the washers for uniform thickness and flatness.

29. Replace ALL seals, O-rings, and gaskets to ensure maximum service after the work is completed.

30. Coat the detent ball and spring lightly with Needle Bearing grease, insert the spring into the forward gear bearing housing, followed by the detent ball.

31. On 2.3L and 3.0L models, insert the detent shifter through the detent opening and into the housing. On all others, position the shifter end toward either side of the housing, depress the ball and spring and press the shifter into the housing. Once the shifter is past the detent ball, rotate the end of the lever to the back of the housing and then move it until the Neutral position is engaged.

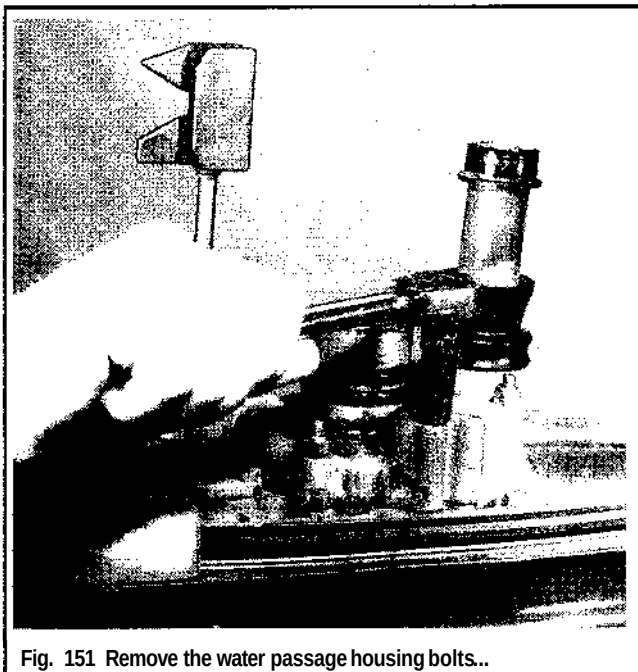


Fig. 151 Remove the water passage housing bolts...

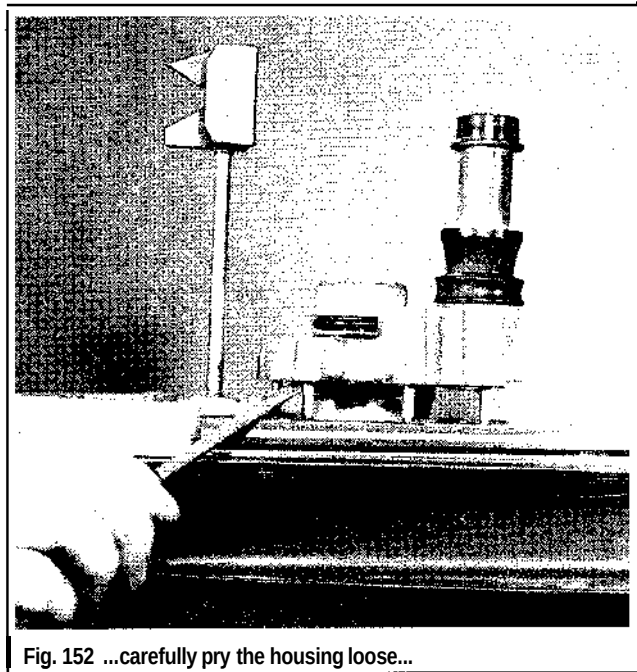


Fig. 152 ...carefully pry the housing loose...



Fig. 153 ...and then remove the housing and gasket

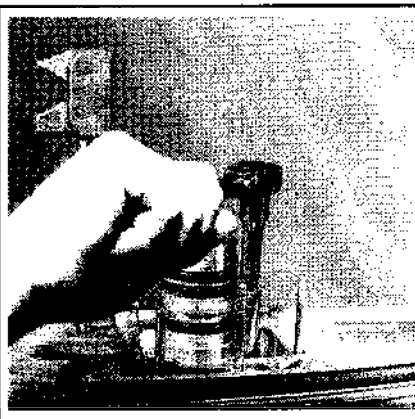


Fig. 154 Remove the driveshaft bearing housing bolts

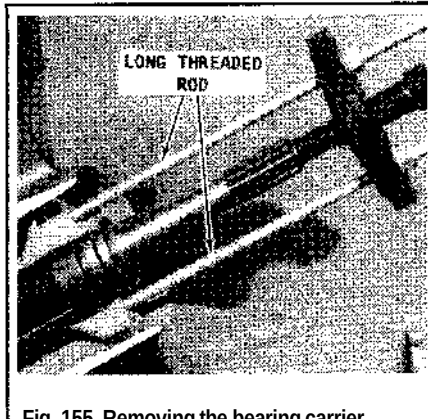


Fig. 155 Removing the bearing carrier housing on the 2.3L and 3.0L (others similar)

Do not push the detent shifter all of the way in at this time or you will jam it in the housing.

32. On models with loose needles, coat all 25 bearings with grease and install them into the cage if the bearing has not been replaced with a new one (in which case the new one is most likely a caged bearing with no loose needles).

33. Insert the shift lever so the side with the narrow arms is facing the detent shifter. Attach it to the neck on the detent shifter, align the pivot holes with those in the housing and then insert the pivot pin.

34. On 2.3L and 3.0L engines, rotate the detent shifter 90° to either side of the housing and then insert the shifter through the top of the housing. Install the shift lever and pivot pin as detailed in the previous step.

35. Press the detent shifter to its full down position, lay the cradle on the shifter shaft and then attach them both to the wider arms on the shift lever. While still holding the shift shaft in place, pull the detent shifter back up into the Neutral position.

36. Lay the thrust bearing on the back side of the forward gear and then position the washer on the bearing. Carefully insert the assembly into the bearing housing without disturbing the thrust bearing or any of the needle bearings.

37. Take a look at the clutch dog and identify the end with the part number embossed on it (it should also have "Prop end" etched on this same side); this is the end of the dog that must face the rear of the propeller shaft, that is to say it must face the propeller. Once located, slide this end onto the inner (forward) end of the propeller shaft so that the splines index properly and the retaining pin holes line up. Now insert the shift shaft into the propeller shaft until the retaining pin hole lines up with the other two holes and then press in the pin. Slide a new retaining spring down over the propeller shaft and position it so that at least 3 coils are covering each end of the retaining pin WITHOUT overlapping one another.

38. Obtain a driveshaft holding socket (# 314438) and clamp it in a vise. Slide the driveshaft into the socket and then set the pinion gear on the end of the shaft. Tighten the nut to 70-75 ft. lbs. (95-102 Nm), except on the 460 King Cobra models where it should be 100-110 ft. lbs. (136-149 Nm). Remove the shaft from the holder.

39. Position the thrust bearing, washer and driveshaft bearing housing on the other end of the driveshaft without any shims. Face the stepped side of an alignment plate (part of the shim gauge kit # 984329) away from the bearing housing, slide the plate over the shaft and seat it against the housing. Move the entire assembly into a shim fixture (# 984329). Tighten the tension screw on the fixture against the end of the driveshaft until the screw sleeve reaches the groove in the pointed end of the screw. Tighten the tension screw lock nut on the outside of the fixture until it is tight against the frame.

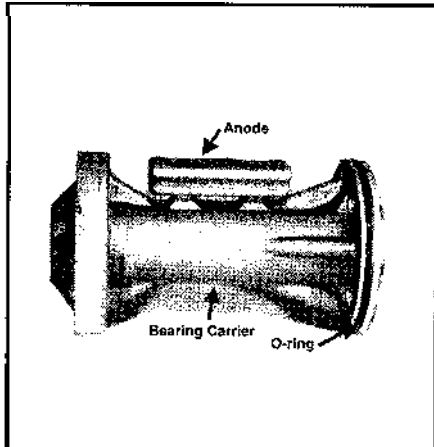


Fig. 156 A good look at the bearing carrier

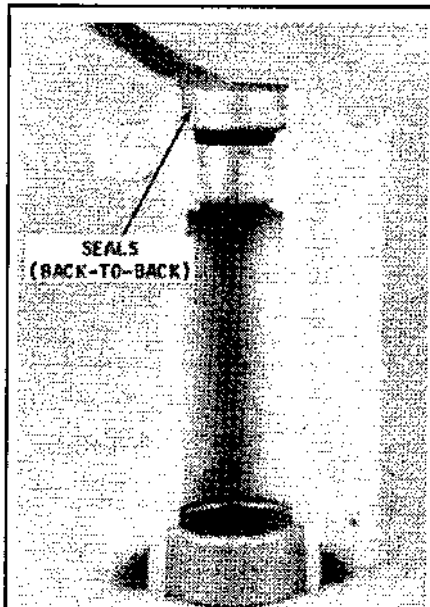


Fig. 157 Prying out the two oil seals

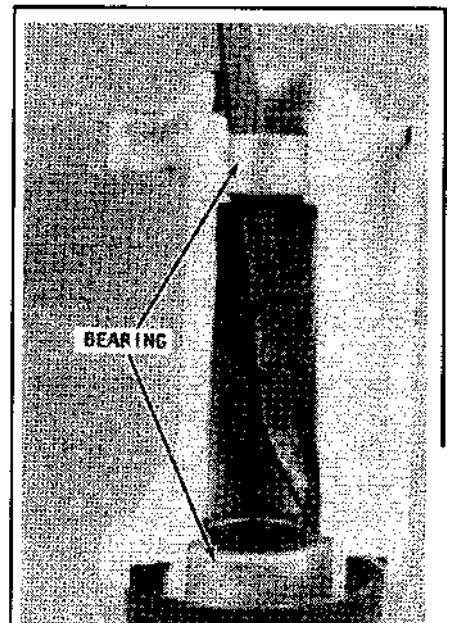


Fig. 158 Drive the bearings out with a drift

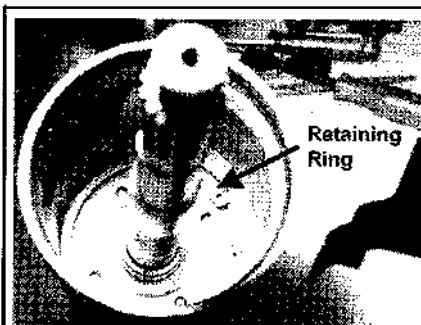


Fig. 159 Remove the retaining rings (except on the 460 and 1991-93 Cobra)

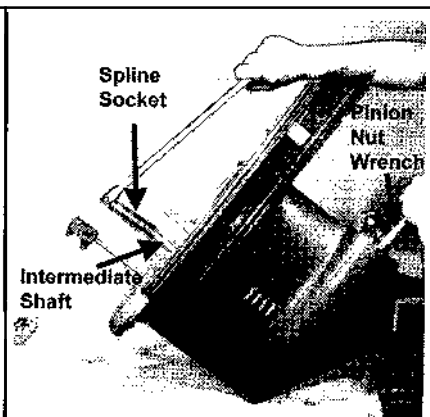
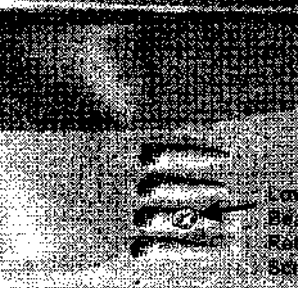


Fig. 160 Rotate the driveshaft to remove the pinion nut



Fig. 161 Lift off the bearing housing...

A black and white photograph showing the internal components of a boat's engine compartment. The image is labeled with three parts: 'BEARING HOUSING' with an arrow pointing to a central component, 'FORWARD GEAR' with an arrow pointing to a gear assembly on the right, and 'PROPELLER SHAFT' with an arrow pointing to a shaft extending from the bottom right. The background shows the engine block and various mechanical parts.



Lower Beating Retaining Screw

1/4 - 20 x 112 Hex Bolt

1 in. O.D. Washer

Plate (#391260)

Rod (#326582)

Remover (#326574)

114 - 20 x 1 1/2 Hex Bolt

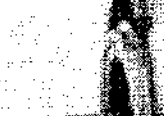
Diagram illustrating the removal tool assembly:

- Flange Nut (#326586)
- Plate (#391260)
- Rod (#326582)
- Remover (#326579)

A close-up photograph of a clutch "dog" pin, which is a small, cylindrical metal component with a series of longitudinal grooves or splines. It is shown in a dark, industrial setting.

Diagram illustrating the components of a shift lever assembly:

- SHIFT LEVER
- CRADLE
- DETENT SHIFTER
- SHIFT LEVER PIN
- SHIFTER SHAFT
- BEARING
- BALL
- SPRING
- PIN



Shift Lever Pin

Fig. 173 Press down on the detent shifter to remove the shift shaft...

40. Tilt the entire fixture back until it is resting on the support lugs. Select the following gauge bars depending upon your particular application

- 2 3L and 3 Q engines—# 328366
- V6 and V8 engines except the 460 King Cobra—# 328367
- 460 King Cobra—# 330224

41. Position the correct gauge into the fixture so the curved head is up and behind the pinion gear and the base is resting against the bearing housing. Hold the gauge tightly against the bearing housing and measure the clearance between the other end and the pinion gear. Make sure that you rotate the shaft a few times and take a few readings in different places. Take an average of your readings and then subtract this figure from 0.020 in to determine the correct amount of shims required to properly position the pinion gear. On 460 King Cobra models, use 0.030 in as the figure you subtract from.

42. Check your measuring accuracy by installing the shims and then checking the clearance again. If you come up with 0.020 in (0.030 in for the 460), then you measured correctly. Otherwise, repeat the last step and try it again. Once correct, remove the shaft from the fixture and disassemble the individual components.

43. If you removed the lower driveshaft bearing, use the same group of tools to press it back into the housing bore. Coat the outside of the bearing case lightly with Needle Bearing grease and then slide the bearing onto the tool so the side with letters on it is facing the installer. Position the assembly into the bore and drive it in until the driving rod is seated on the spacer.

44. On 1990-93 units, slide the retaining ring into the bore and make sure that it is fully seated into the recess. On all others, slide a new O-ring

over the small bearing retaining bolt and spray the threads with LocQuic Primer. Once dry, coat them with Nut Lock, install the bolt and tighten it to 48-84 inch lbs. (5-9 Nm).

45. Press down on the detent lever in the forward gear bearing housing until it engages the Reverse position (this is the lowest position in its travel). Tilt the top of the lower unit forward so that the propeller shaft bore is raised slightly and then insert the propeller shaft assembly into the bore so that the locating pin on the front side of the bearing housing engages the recess in the nose of the gear housing. Once the pin is properly fit into the recess, the detent lever will be centered (front to back) on the shift rod cavity.

46. Coat both sides of a new shift rod cover gasket with Gasket Sealing compound and lay it on the gear housing mating surface. Take a look down the bore to gauge the distance to the detent lever and slide the shift rod through the cover far enough so that you will be able to begin threading it into the detent without having the cover touch the new gasket. Position the cover and rod over the bore and thread the rod into the detent 4-5 full turns. Now you can position the cover on the gasket! Coat the threads of the mounting bolts with Gasket Sealing compound and tighten them alternately to 60-84 inch lbs. (7-9 Nm).

47. Slowly rotate the propeller shaft while pulling up on the shift rod so that you engage Forward gear. Look down through the driveshaft bore and confirm that the clutch dog is fully engaged with the lugs on the forward gear.

48. Install the anode and tighten the bolts securely.

49. Reach into the propeller shaft bore and hold the pinion gear under the lower driveshaft bearing while an assistant inserts the driveshaft into the gear from the top. Install the intermediate shaft and then slide a spline

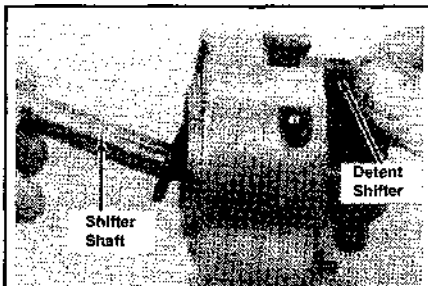


Fig. 174 ...and then press out the shifter pin

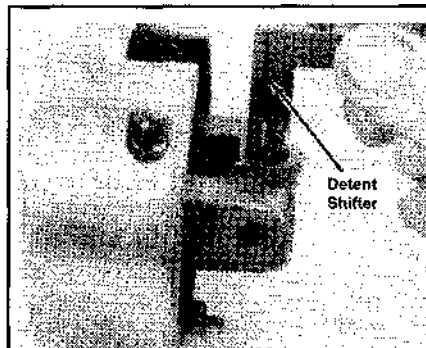


Fig. 175 Remove the detent shifter

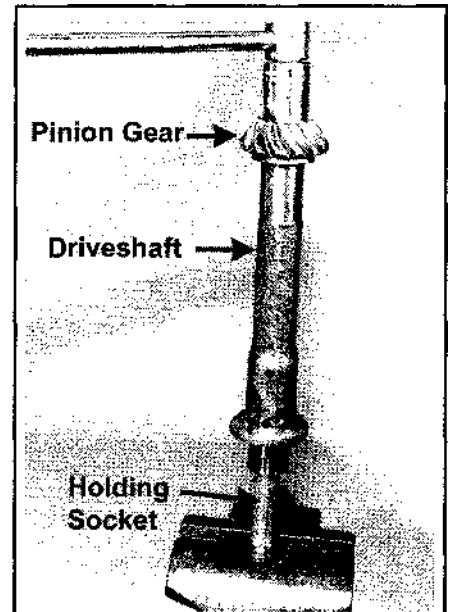


Fig. 176 Installing the pinion gear to the driveshaft

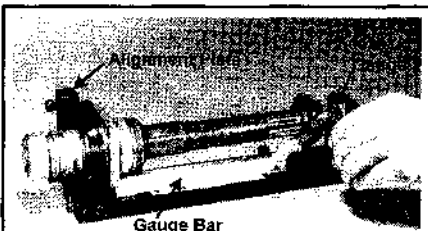


Fig. 177 Checking shim thickness on the pinion

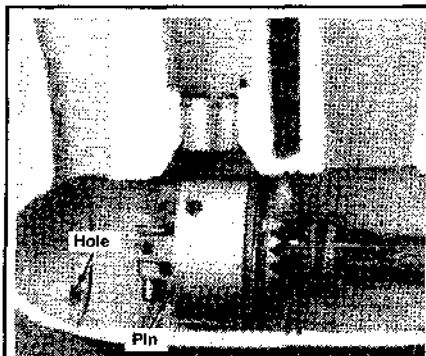


Fig. 178 Make sure that the locating pin lines up with the hole in the nose of the housing

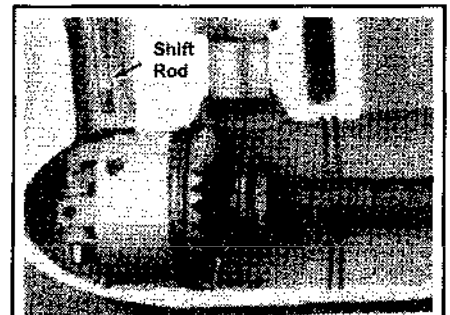


Fig. 179 Center the detent under the shift rod bore

12-44 STERN DRIVE – COBRA AND KING COBRA

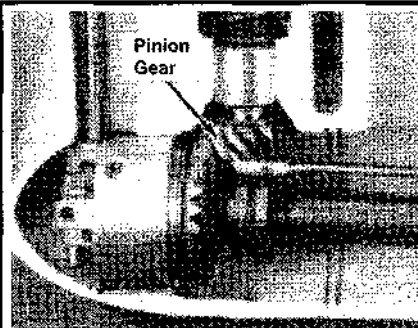


Fig. 180 Hold the pinion nut while turning the driveshaft from the top

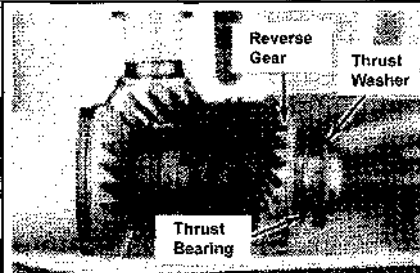


Fig. 181 Install the reverse gear and bearing...



Fig. 182 ...and then the retainer plate (not all models)

socket (# 311875) over the top splines. Position the pinion nut into a nut holder (# 334455) and hold it in place while rotating the shafts with a torque wrench attached to the spline socket. Tighten the nut to 70-75 ft. lbs. (95-102 Nm) except the 460 King Cobra which must be tightened to 100-110 ft. lbs. (136-149 Nm). Remove the socket and intermediate shaft.

50. Position the thrust bearing, thrust washer and shim material over the top of the driveshaft. Coat the small (new) O-ring with oil and slide it over the base of the driveshaft bearing housing. Next, coat the 3 larger exterior rings with Gasket Sealing compound and slide them over the top of the housing and into their recesses; position the upper ring first and then work down with the other two.

51. Coat the entire exterior surface (very lightly) of the housing with Gasket Sealing compound to reduce corrosion. Position the housing over the shaft so the bolt holes line up properly and then install the bolts and tighten them alternately to 14-16 ft. lbs. (19-22 Nm). Don't forget to coat the bolt threads with sealing compound.

52. Coat both sides of a new water passage cover gasket with Gasket Sealing compound and slide the gasket over the studs and into place on the mating surface. Position the cover itself over the studs and lightly tap it into place. Install new lock nuts and tighten them to 9-11 ft. lbs. (12-15 Nm).

53. If you replaced the large bearing on the propeller shaft bearing carrier, coat the outside of the case with oil. Position the housing in a holding fixture and then slide the bearing onto an installer (# 326562) so the side of the bearing with lettering is facing the large diameter side of the tool. Press the bearing into the housing until it is fully seated.

54. Repeat the previous step for the smaller bearing, but face the lettered side toward the smaller end of the tool. On V6 and V8 engines, you will need another installer (# 321517).

55. Coat the outer casing of 2 new seals with Gasket Sealing Compound. Position the inner seal on the stepped side of the installation tool so the lip is facing the housing. Turn the tool over and install the outer seal so the lip is facing away from the housing. Use # 326551 for the 2.3L and 3.0L models, and # 326690 or # 336311 (1990-93 Cobra) for all other engines. Make sure that the seal lips and inner cavity are coated with grease.

56. Make sure that the carrier anode is tightened to 5-7 ft. lbs. (7-9 Nm).

57. Lay the thrust bearing and then the washer over the hub in the back of the reverse gear. Slide the gear over the propeller shaft and into the bore. Don't forget the smaller forward washer on 1990-93 which rides on the face of the gear.

58. On all models except the 460 King Cobra and 1990-93 Cobra, slide the retainer plate over the propeller shaft and up against the reverse gear. Carefully grab a retaining ring with the appropriate pliers, position it over the inner groove and then release it so it seats fully in the groove. Repeat this with the second ring. Choose two holes in the retainer plate that are 180° apart and then thread in 2 guide pins (# 383175)—114 in. threaded rods of sufficient length will also work here.

59. On all models, install new O-rings coated with Triple Guard grease into their respective grooves on the carrier and then coat the O-ring flanges with Gasket Sealing compound.

60. On all models except the 460 King Cobra and the 1990-93 Cobra, slide the carrier housing onto the 2 guide pins and into the gear housing bore so that the UP marking on the rear flange of the carrier is, you guessed it...on top, positioning the drain slot at the bottom. Tap the carrier softly with a rubber mallet until it is seated below the hydrostatic rings. Coat the threads (and seals) of 4 new carrier bolts with Gasket Sealing compound, install 2 of them, remove the guide pins and then install the remaining 2 bolts. Tighten all four, alternately, to 10-12 ft. lbs (14-16 Nm).

61. On 460 King Cobra models, slide the carrier over the shaft and into the bore so the anode is on the bottom and the mounting bolt holes are in the vertical position. Tap the carrier lightly with a rubber mallet to seat the O-rings. Position a retainer behind the bolt hole and hold it there while threading in the bolt; repeat for the remaining bolt. The large end of the retainer must fit into the recess inside the propeller shaft bore, while the smaller end should fit between the bosses on the carrier housing. Tighten the bolts to 18-20 ft. lbs. (24-27 Nm).

■ If the bolt retainers on the 460 King Cobra have one side with rounded edges, make sure that the rounded edge is facing outward,

62. On 1990-93 Cobra models, slide the carrier over the shaft and into the bore so the anode is on the bottom and the mounting bolt holes are in the vertical position. Tap the carrier lightly with a rubber mallet to seat the O-rings. Install the 2 retaining tabs, thread in the bolts and then tighten the bolts to 20-24 ft. lbs. (27-33 Nm). Make sure that you coat the bolt threads with Locquic Primer and then UltraLock before installing them.

63. Position a shift rod height gauge (# 912277) on the upper mating surface of the gear housing. Now screw the rod (in or out) until the top of the shift rod head just contacts the upper arm of the gauge (about 7-13/64 in.). The notched side of the head must be facing forward, so it is acceptable if you have to turn the rod and additional 112 turn in either direction. That's it.

64. Make sure that the small nylon plug is in place inside the lower driveshaft. Coat the splines on each end of the intermediate shaft with gear oil and then insert the shaft into the top of the lower driveshaft.

65. Spin the shift rod head 90° to the port side and then install the water tube into the guide on top of the gear case.

66. Install the upper gear housing as detailed in the appropriate section and then install the drive unit if it was removed. Fill the drive unit with oil.

1986-93 Cobra And 1988-89 King Cobra Models - Counter-Rotation



◆ See Figures 151,152,153,154,160,161,162,163,164,165,166,170, 176,177 and 183

Procedures have changed on the 1993 Cobra lower unit, please refer to 1994-98 Single Propeller Unit section for disassembly and assembly on this unit.

□ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

□ DO NOT ATTEMPT THIS PROCEDURE WITHOUT THE SPECIAL TOOLS!! We know that most of us, whether professional technicians or shade-tree mechanics, hate spending money on special tools. Most of us don't want to spend the money, even if we had it, so we find ways to fabricate our own version of special tools. Be warned in advance that you will NOT be able to create these tools on your own. Please read through the following steps beforehand and make a list of the tools that you will need to acquire—if you are unwilling, or unable, to get your hands on them, take the drive to someone who already has them.