

Sterndrive service -- bellows replacement, impeller replacement, shift cable, etc.

Tools Specific to this work

- Mercruiser long socket for shift cable removal
- Motor alignment tool
- Hinge pin tool
- Bellows Expansion Tool
- A homemade rolling cart & workbench plywood fixture for working with the sterndrive.
The rolling cart will hold the entire sterndrive. The lower half of the drive can be held on the workbench by the plywood plate that attaches with wood screws and/or clamps to the top of the workbench and is braced with a 2x4 to the floor.

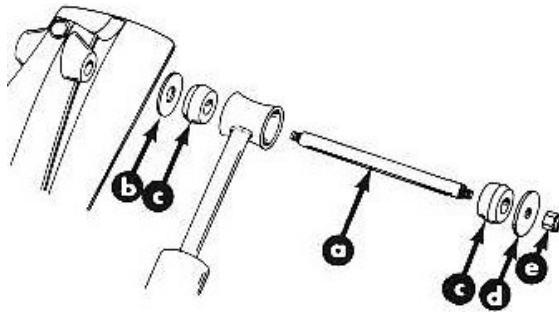


Greases, oils and other gooey stuff

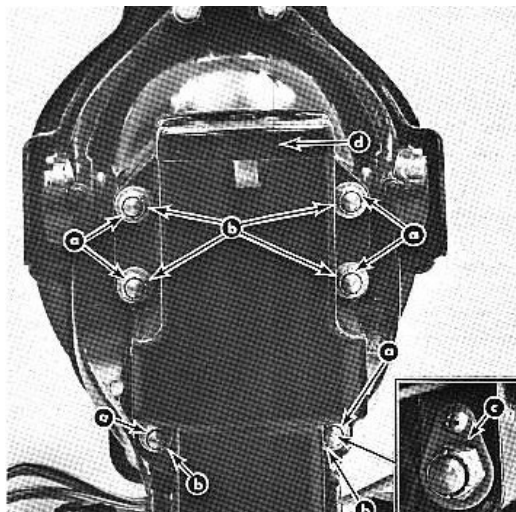
- Use spline grease on splines and 2-4-C to lightly lube O-rings
- Quicksilver Perfect Seal or Aviation form-a-gasket 3 or 3H (the redish stuff)
- Permatex thread sealant
- Loctite 7471 primer and Loctite 741 threadlock (red); Loctite blue threadlock
- It's okay to reuse nylon lock nuts several times before replacing them.
- Quicksilver or similar high performance SAE 90 gear lube (holds about 28 ounces -- not quite 2 qts).

Stern Drive Removal

1. Attach the plywood lower sterndrive work surface to workbench if case is to be split for maintenance. The plywood plate attaches with wood screws and/or clamps to the top of the workbench and is braced with a 2x4 to the floor.
2. Trim the sterndrive down and move the throttle to full forward position
3. Disconnect the battery
4. Drain the oil or not. Depends on the service to be done.
5. Lower the stern of the boat by jacking the trailer tongue so the sterndrive can slide off its six bolts and onto the homemade rolling cart. The bellhousing will be about 33" off the garage floor.



6. Detach the trim-tilt hydraulic cylinders from the gear housing by removing the 9/16" nuts securing them to the anchor pin. Remove the washers and rubber bushings from both sides, and pull each trim cylinder away from drive until it clears the pins. Remove the anchor pin by sliding it out It's best to tie up the cylinders so the oil lines are not stressed.
7. The sterndrive comes off by removing six 5/8" nylon lock nuts. Note the one with no washer is lower right, as shown in the illustration.



8. Slide the entire sterndrive onto the cart. **Once removed and on the cart:, split the upper and lower units, following the process listed below.** Leave the upper unit on the cart and place the lower unit in the workbench fixture. See photo on page 12.

- A. Use a 3/8" allen wrench to remove the bolt holding the anode under the back of drive – Use a marker to note the alignment of the anode's fin.
 - B. Use a 5/16" allen wrench to remove the bolt under the anode.
 - C. Remove the two nuts under the anode.
 - D. Remove the single nut closest to the stern using a 5/8" wrench.
 - E. Remove the two side bolts by loosening them and wiggling the upper unit to raise it, allowing room to remove the nuts.
9. Once separated, the lower unit can be placed in the workbench fixture.
 10. Inspect the exhaust openings on the back of the upper drive unit and be sure they are open.
 11. While the upper and lower drive halves are separated, inspect the inside of the upper unit. There is **a seal in the upper housing and a plastic water pocket cover that can be heat damaged.** If it looks damaged, remove the four stainless steel bolts and replace the cover.

Replacing the water pocket cover

1. If the upper section of the sterndrive is still attached to the boat, trim the sterndrive full up. You'll be reaching up into it to remove and reinstall the water pocket cover. Before doing anything else, **STUFF RAGS INTO THE CAVITY THAT IS BELOW THE COVER.** If you don't you will likely drop debris and a bolt or two into the cavity. That will likely mean removing the entire sterndrive from the transom to retrieve it. Stainless steel is not magnetic.
2. The cover comes off by removing four stainless steel bolts. Take care; some have written that their bolts break. I use my pick-up tool to hold each bolt so I can thread it in without dropping it.



3. The kit should come with new bolts, a washer, a cover and a rubber seal that goes inside the water pocket cover. **Be sure the rubber seal is inserted right-side up.** There's a rubber bump that goes inside of a hole. Right-side up is when the bump is toward the bottom of the seal.



4. Lightly grease the water pocket gasket (not the rubber seal) before installing it.
Torque water pocket bolts to 30-40 in lb.

Inspecting and replacing the impeller and water pump

1. It's important to inspect the driveshaft where the water pump base seals were riding. If the shaft is worn, grooved or pitted, then it should be replaced to prevent water damage.
 2. Clean the long lower unit shaft with kerosene.
 3. Remove seals from shaft (Some shafts have an o-ring at the top, some don't. Mine does not).
 4. Remove nuts and single screw from water pump housing (1/2" and 7/16" nuts and 5/16" screw)
 5. Remove housing from water pump by prying under edges. – NOTE THE IMPELLER DIRECTION
 6. Remove key from shaft and put it in safe place.
 7. Remove gaskets, **REMEMBERING THE ORDER AND WHICH SIDE IS UP.**
 8. Clean parts.
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If the Water pump base is to be replaced:

Best base unit video: http://www.sterndrive.info/alpha-one/water_pump.html

- A. Pry and rock to lift the pump body and slide it off.
 - B. Look for melting around the center of the pump base, where the drive goes through it. If it looks heat damaged, replace the entire base.
 - C. Clean thoroughly.
 - D. Prepare the water pump base for installation by first installing the correct gasket, making sure the water passage hole lines up correctly (It is easier to buy a base unit that is already fully assembled, with seals installed).
 - E. Apply a light coat of grease to the o-ring and seal.
 - F. Slide the base down over the driveshaft and firmly snap it down into place.
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9. Slide new gaskets into place. The gaskets go on dry. Some on the web say to use Perfect Seal or Aviation gasket. Some say to use very light coat of grease. I put them on dry, per the manual.
 10. Use light coat of grease to lubricate the inside of the new impeller housing.
 11. Grease the key and put it in place.
 12. Slide the impeller into place on the drive shaft (making sure the key lines up).
 13. Slide the housing onto the drive shaft.
 14. Twist the drive shaft clockwise to turn the housing onto the impeller.



15. Put on washers and nuts and tighten in a pattern. **Nuts to 60-90 inch lbs.**
16. Insert and tighten the screw to **30-40 inch lbs.**
17. Slide the slinger seal (fat o-ring) onto the shaft (Lightly grease it).
18. Install the copper water tube in the top half of the drive (in the water pocket cover).
19. Lightly lube the top end of the tube (first make sure the rubber grommet is in the housing).
20. **Slide the plastic tube guide into the water pump cover as shown.**



DO NOT forget to install the plastic Guide Tube shown at the left!!!



21. Heavily lube the SPLINES on the main shaft with spline grease and lightly lube the smaller shift shaft with spline grease.



22. Lightly grease the main shaft with 2-4-C.
23. Grease up all the studs on both drive housing halves. This will make it easier to do next year.
24. Clean both halves of the sterndrive, around where the oil seal goes.

25. Apply Perfect Seal or Aviation form-a-gasket 3 to the o-ring and insert it into the sterndrive, as shown below.

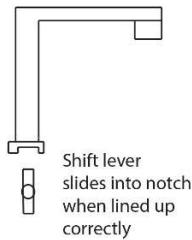


26. **Grease the back side of the shift shaft washer to keep it in place when joining the sterndrive upper and lower units.**
27. Put the 3/8" allen bolt in place loosely – the long bolt that attaches the anode.
28. Turn the shift-shaft clockwise until the prop locks when turned counter clockwise, as shown below.



29. Reattach the lower drive unit – **CHECK TO MAKE SURE THE WASHER IS IN PLACE BEFORE COMPLETELY JOINING THE HALVES.**
 Put the lower unit right-side up in the rolling cart and drop the upper unit down on it. Don't forget that the two side nuts need to go on before the halves are completely joined. It may help to temporarily put a clean spacer between the halves to keep them apart until ready to tighten the nuts in step 31.
The shift spline washer can fall out if you choose to drop the lower half onto the top half of the sterndrive, which is probably the easiest way to put the halves together (you heft the lightest half of the drive this way).
30. Also make sure to:
- Align the water tube with the **tube guide**.
 - Double check that the prop is still locked when turned **counterclockwise**.
 - Rotate the prop shaft counterclockwise slightly after the shift shaft splines have engaged. This helps the drive shaft splines enter the upper drive shaft splines.

- See that the upper shift shaft is in forward gear. The upper shift shaft must face fore and aft. That's forward! The prop should lock when turned counterclockwise.



31. **Install the two side nuts first – the case needs to be slightly split to fit the nuts.**
32. Install the two nuts under the anode & tighten the 3/8" allen screw -- **Do not install the anode.**
33. Put on the front nut.
Torque fasteners on housing to 35 ft lbs, except small allen, which is 28 lbs.
34. At this point, test that shifter works before the next step.
35. Go around and cinch up nuts and screws.
36. **Install the anode** – line it up to the mark made earlier.
37. Mechanics recommend pressure testing the sterndrive to 15 lbs with air BEFORE adding oil. The air should hold for about two minutes.
38. Inspect the bellhousing, bellows, exhaust, etc.
39. Attach the sterndrive to the bellhousing **following the directions beginning on page 34.**
40. Add new lubricant – Oil vent and oil drain plugs use a washer, part #31170.
With Oil vent and oil drain plugs removed, attach oil filler pump and pump in new oil until it begins to flow out of the top vent. CAPACITY = About 28 OUNCES (not quite 2 qts).
41. Test the motor with the hose muff and hose. Water should flow out of the prop and both sides of the exhaust.
42. Recheck the sterndrive oil level after running the motor for a bit.



Bellhousing maintenance – bellows, gimbal bearing, shift cable

Required tools

Rolling cart
Hinge Pin Tool
Bellows Expansion Tool
Mercruiser long socket (for the shift cable nut)
Slide Hammer Kit
Driver Head
Gimbal Bearing Collar Tool
Driver Rod
Engine Alignment Tool

Pulling out the gimbal bearing can be difficult if it's stuck. A good slide hammer kit is needed to remove the bearing. Three tools are needed to reinstall the bearing: A **driver head**, a **collar** and a **rod**. Installing the drive after the bearing has been installed is MUCH easier if you first align the gimbal bearing with the **Engine Alignment Tool**.

Parts



U-joint bellows GLM P/N 89050 replaces Mercury OEM 60932A4.
Compatible with 1973 - 1990 models (S/N 3472478 and up)



Complete aftermarket Mercruiser transom service kit -- P/N 21950. Includes: gimbal bearing, seal, exhaust bellows, shift boot, water hoses and mounting gasket kit.



Marine grade adhesive (Sierra #18-9031). Simply put, if you don't use adhesive you'll be doing this job all over again. Without it, as soon as you tilt / turn the drive all the way up the tubes will come loose. Make sure to use a liberal amount, and allow it to fully set.

Sierra spline grease or Mercury Extreme grease

Symptoms of a Leaking / Damaged U-Joint Boot

If water is leaking into the boat from the back sterndrive area, inspect the Mercruiser unit as soon as possible. With the Mercruiser sterndrive drive off the boat, look inside the drive shaft tunnel in the bell housing, and feel around the inside of the rubber tube. It should be dry and there should be no water or oil inside. Also inspect the front seal on the upper gear case for an oil leak. A leak in the rubber, depending on how long it has been leaking, can cause the u-joint assembly to rust and freeze into the gimbal bearing. It may also damage the gimbal bearing.

When turning the inside of the bearing, there should be no rough spots or sticking points.



If water is found in the sterndrive lower unit's oil

Check:

Prop seal

Water pump seals

The shift shaft seal and the main seal by the universals are also common spots for leaks. Could be as simple as a bad o-ring on the drain plug or as bad as a cut in the bellows letting water into the drive and destroying the main front seal. Check out: <http://www.mercstuff.com/index.htm>

Removing the bellhousing

Shift Cable Removal/Replacement Part One

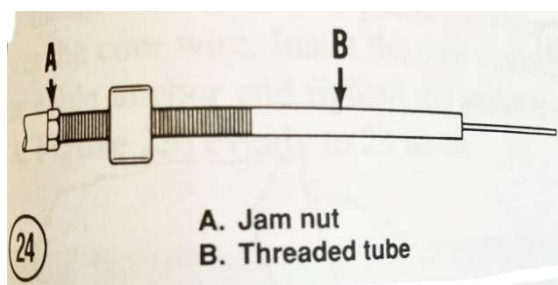
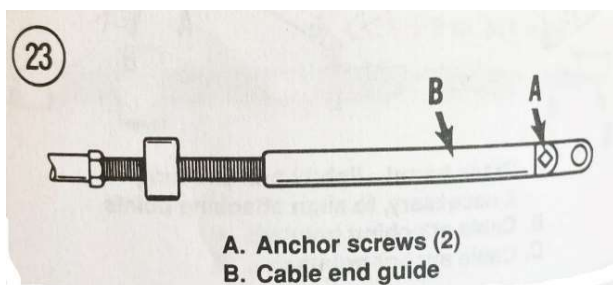
Part two is on page 26

With sterndrive removed (pages 12-14):

1. Inspect the bellhousing area (as exposed by removing the sterndrive).
 - A. Was there water in the U-joint bellows?
 - B. Is the u-joint assembly rusted?
 - C. Reach into the large hole and try to turn the gimbal bearing. Its center should turn easily and smoothly. If it's loose or stuck then replace it!
 - D. Clean any corrosion from the shift cable cavity – where the shift slide is protruding.

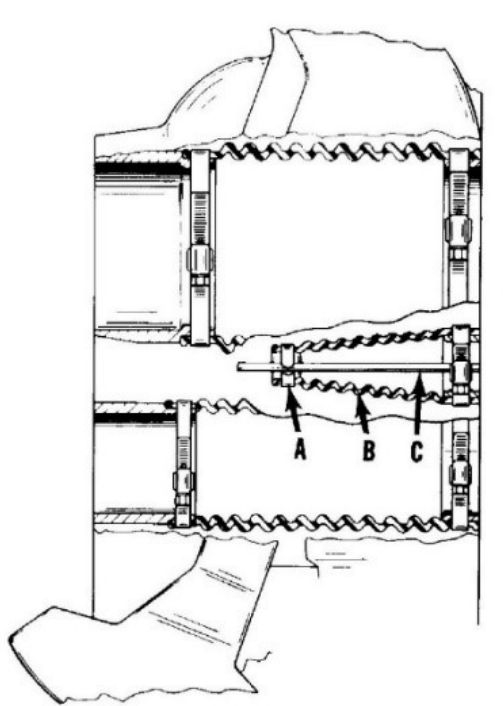


- E. The shift lever should be in good condition and the roller should spin freely.
- F. Most of the shift components in the shift cavity should be greased and clean.



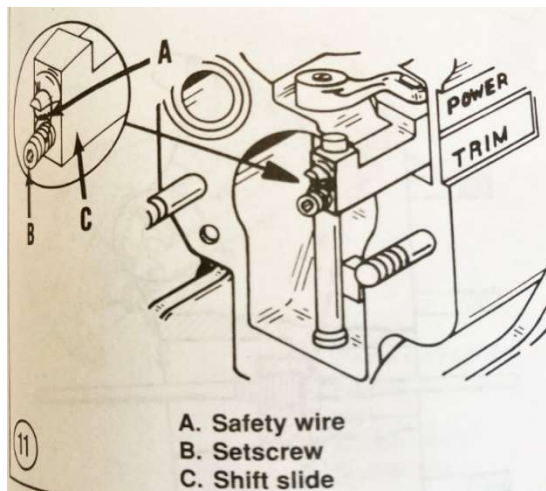
2. From inside the boat, disconnect the upper and lower shift cables from the engine shift plate.
 - A. Remove the two small set screws from the sides of the end of the lower shift cable and remove the black plastic cable end guide, per figure 23.
 - B. Loosen the brass lock-nut on the stainless tube and unscrew the stainless tube from the end of the cable sheath, per figure 24. ****Some cables have a support tube that needs to be cut off. See Mercruiser Manual #6, pages 326+ for more info.*

- C. Slide a hand down the cable sheath as far as possible. SOMETIMES you will feel a plastic spiral wrap on the cable sheath. This spiral wrap is to protect the cable from melting against the exhaust pipe. It must be removed or the cable can't be removed.
3. Turn the boat steering wheel to the left all the way.
 4. Go to the stern and look at the shift cable bellows. **Remove the clamp (or zip-tie) at the small (bellhousing) end of the bellows.**



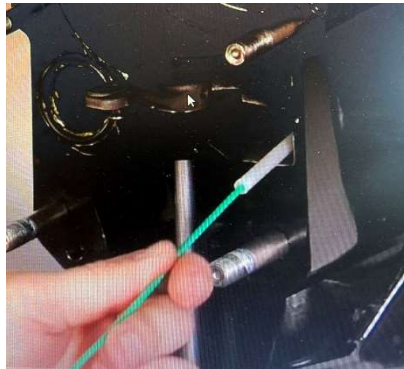
A. Crimp clamp
 B. Shift cable bellows
 C. Shift cable

5. Cut the set screw safety wire, A in figure 11 and remove the shift slide set screw, B.



A. Safety wire
 B. Setscrew
 C. Shift slide

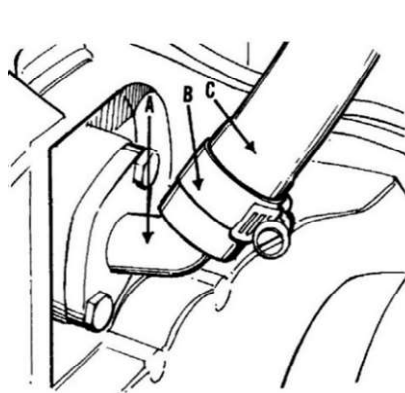
- Look closely at how the shift cable is routed. Take pictures. **Next, run a grass trimmer line or something similar through the shift cable, then tie it off in the engine compartment. It will guide the new cable into place.**



- Pull the cable inner core out of the cable from the stern of the boat, leaving the trimmer line in place, then remove the shift slide from the inner core wire.
- Use the Mercruiser shift cable socket to unthread the cable sheath from the bellhousing. After the cable is all the way unthreaded, pull on the cable sheath and it should slide right out. Don't worry about damaging the shift shaft bellows; it will be replaced if the cable is replaced.

Back to bellhousing removal

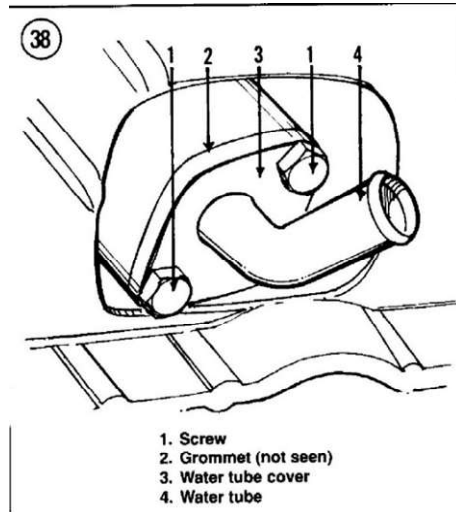
- Unclamp and disconnect the water inlet hose at the water tube. Slice the tube if necessary to remove it.



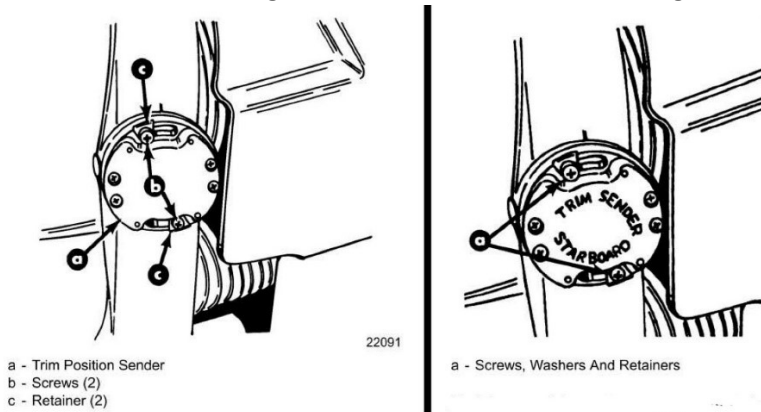
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A. Water tube
B. Hose clamp
C. Water inlet hose

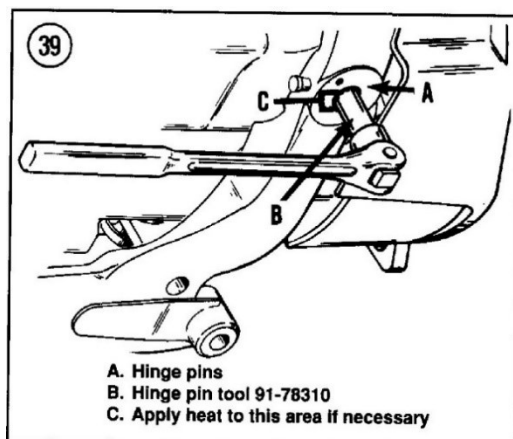
- Remove the water tube cover and rubber grommet. Push the water tube through the gimbal housing. Some people leave this in place and push the new hose on from the stern of the boat.



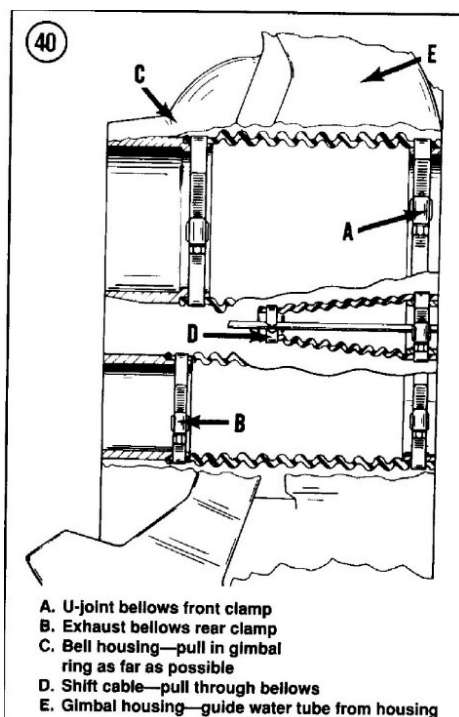
- Remove the trim sending units. Each has two screws. Hang the senders on the back of the boat.



- Use the hinge pin tool to unscrew the two pins that are found under the sending units. Depending on the last time they were removed, it may take considerable force to loosen them. In some instances, heat may be required to get them off.



- Remove the two large fiber washers found between the gimbal ring and bellhousing. **It is essential that these be reinstalled when putting the housing back on.**
- Note the orientation of the clamps**, then, loosen the u-joint bellows clamp on the transom side and the exhaust bellows clamp on bellhousing side. A and B in figure 40.
An alternative is to simply cut off the bellows and water hose. The wire in the u-joint bellows pulls out without needing to be cut.



The gimbal end exhaust bellows clamp is best installed so the screw can be turned from the port-side access hole. **NOT** as shown here.

- First, note the routing of the water hose**, then guide the water tube from the housing and remove the bellhousing. If a bellows does not come free from the housing easily, it's going to be replaced so it's okay to cut it off.

Disassembly of bellhousing once removed from boat

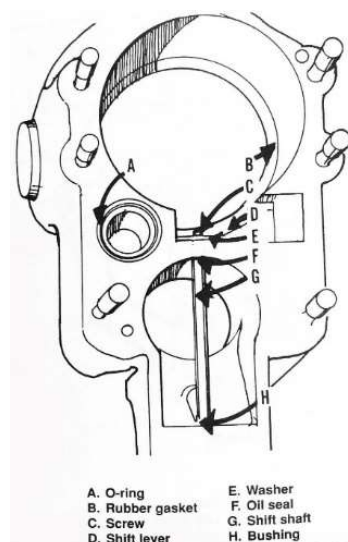
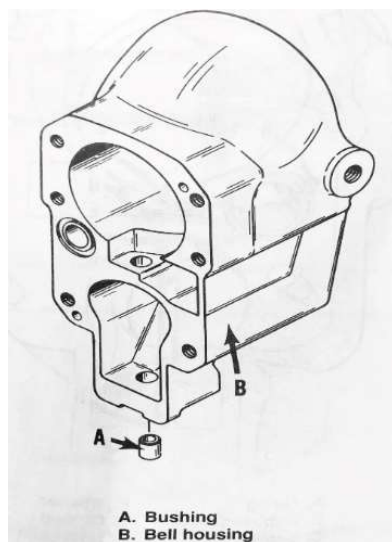
1. Remove and discard the bellhousing o-ring, round rubber seal and main gasket.
2. A. Unclamp and remove the u-joint bellows from the bellhousing
B. Unclamp and remove the exhaust bellows from the gimbal housing
C. Unclamp and remove the shift cable bellows from the gimbal housing
4. Unclamp and disconnect the water hose from the bellhousing. **Remove the connector.** Cut a few slits parallel to the length of the hose if it is difficult to remove from the fitting.
5. A. Clean all mounting flanges with sandpaper or a wire brush on a drill, then wipe with lacquer thinner.
B. Clean all other mounting surfaces on the bell and gimbal housings.
6. Check the condition of the shift cable. Most boat mechanics change the cable when doing a bellhousing service.

Reassembly of the bellhousing

Shift Cable Removal/Replacement Part Two – bellhousing removed

Part One is on page 21, Part three is on Page 31 and Part Four is on page 39

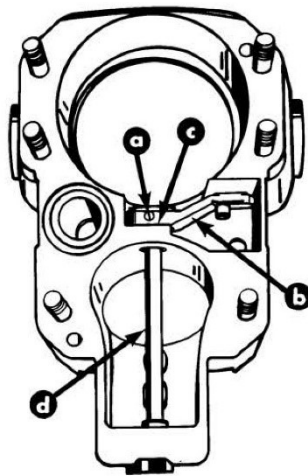
1. Use a small screwdriver to remove the little stainless set screw that is holding the shift lever in place. Sometimes this screw is stuck or stripped and you need heat it or take a chisel to crack the aluminum lever in two.
2. Slide the stainless shift shaft down and out. **Below that lever SHOULD be a white plastic washer.** If you forget that washer when you reassemble then the boat won't shift properly.



3. If the lower bushing was removed, reinstall a new bushing flush with the bottom of the housing. See Clymer page 540. **When pressing the new bushing into place, make sure to seal it with Loctite.**
4. **There is a small shift shaft seal where the shift shaft presses up into the bellhousing. Install a new shift shaft oil seal with its lip facing downward.** If necessary, stake the seal in place. If it leaks, water can enter the shift cable cavity and cause the cable to fail. **Always replace the shift shaft seal.** See Clymer manual pages 539-540 if more information is needed.

*MerCruiser changed the seal to a brass barrel shaped bushing which press fits up into the bellhousing and hangs down in the exhaust passage. It's about the diameter of a quarter and hangs down about one inch. **If the shift shaft seal is the old style, pop it out and knock out the upper brass bushing as well. Install a new style, dual lipped, brass shift shaft bushing assembly and seal.***

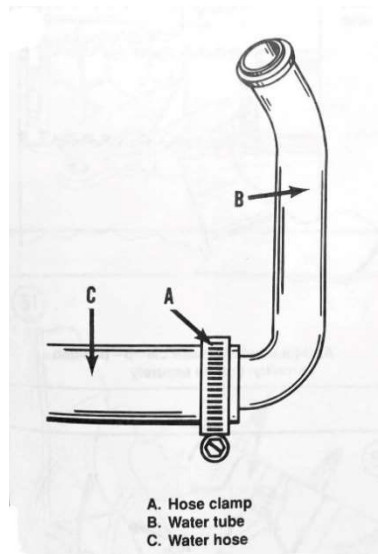
5. Clean the stainless steel shift shaft and grease it with 2-4-C.
 - A. Install the shaft and the white plastic washer.
 - B. Check the shift lever roller's condition and replace the entire shift lever assembly if necessary (If it's in a parts kit already purchased, replace it). **Install the new upper shift shaft lever set screw, using Loctite 271 (red) on the screw.** See Clymer 539-540 for more.



a - Upper Shift Shaft Lever Screw
 b - Upper Shift Shaft Lever
 c - Washer (Beneath Lever)
 d - Upper Shift Shaft

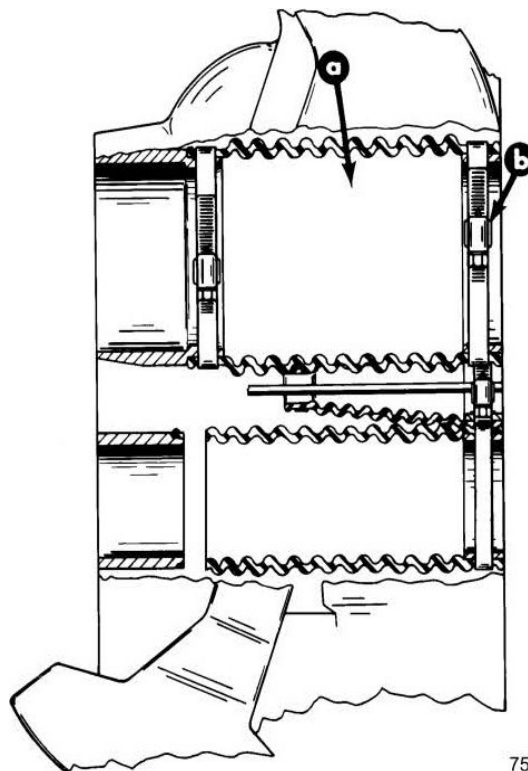
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6. Cut a new water hose to length (measure against the old one – one book says the Alpha One Gen One hose is 13" long).

7. Connect the water hose to the water tube and position it as shown below.



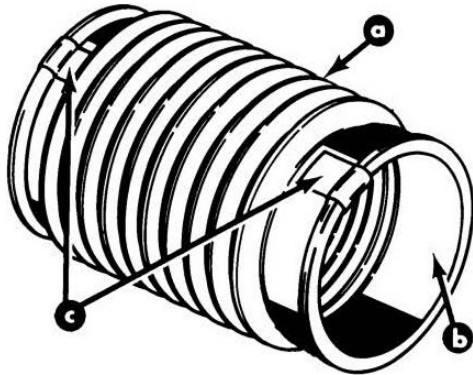
The water hose can get in the way of installing the bellows. It needs to be turned so the natural curve of the hose bends in the proper direction, it also needs to be the correct length so it doesn't get in the way. The u-joint bellows has a recess in it to allow some additional clearance for the hose. If the bellows is not turned properly, it will hit the hose.

8. **Wipe the water pipe bellhousing connector threads with Quicksilver Perfect Seal, Aviation form-a-gasket 3 or Permatex #4 and reinstall in the bellhousing.** Attach the new water hose to the connector and position the clamp screw with its head pointing in the direction of 7 o'clock. Tighten the clamp screw securely.
9. The u-joint bellows slips into a groove on each flange. Be sure the grooves are clean.

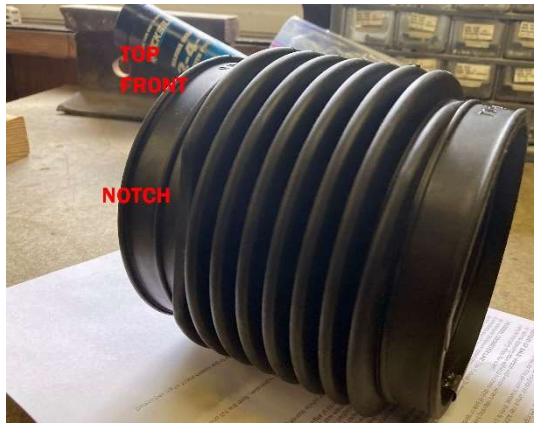


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10. **ALWAYS use bellows adhesive** when installing the new parts, **make sure to install the grounding clips (c) on both sides of the two main bellows and orient the clips correctly.** These clips ground the stainless steel clamps to prevent corrosion.



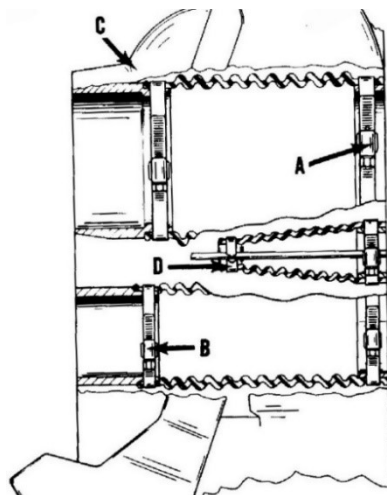
11. Begin by applying bellows adhesive to the inside mounting surface (b in the illustration on page 29), on the bellhousing end of the **u-joint bellows** and to the mounting flange on the bellhousing. Let the adhesive cure 10-15 min. **Follow the instructions on the adhesive packaging regarding letting it sit or applying the bellows right away.*



Note that the u-joint bellows has a top side and a notch that goes toward the gimbal housing, to give more room for the water hose.

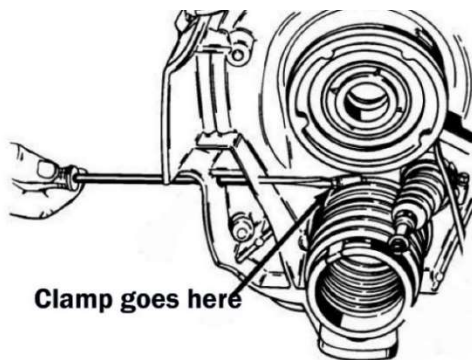
12. Slide a new clamp onto the bellhousing end of **the u-joint bellows** and install the bellows on the bellhousing flange. **Before tightening the clamp, make sure:**
- A. Grounding clips are installed on both ends of the bellows, as per the illustration above. The short end of the clip containing the two bumps should be installed on the inside of the bellows.
 - B. The point on the bellows **marked top is up and the notch is toward the gimbal housing.**
 - C. The fore and aft markings are correct
 - D. The bellows is snapped into its groove

- E. Double-check the top-bottom, fore-aft orientation
- F. **The clamp screw is on the starboard side, pointing down**, as shown below.



A. U-joint bellows front clamp
 B. Exhaust bellows rear clamp
 C. Bell housing—pull in gimbal ring as far as possible

13. The **exhaust and shift cable bellows** go on next.
- A. Apply adhesive to the gimbal end of the exhaust bellows, to the big end of the shift cable bellows and to their mounting flanges. Slide a clamp onto each at the gimbal housing end. Let the adhesive cure for 10-15 minutes.

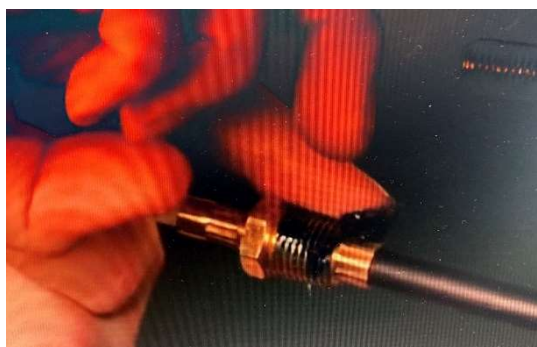


- B. Check the grounding clips and **orientation of the bellows**, then install the **exhaust bellows** to the **gimbal housing**. **Tighten the clamp** with the clamp screw at 12 o'clock, as per drawing above.
- C. Install the **shift cable bellows big end** to the gimbal mounting flange. Turn the mounting clamp so the screw is on the starboard side and aimed up, as shown above. **Tighten the clamp.**

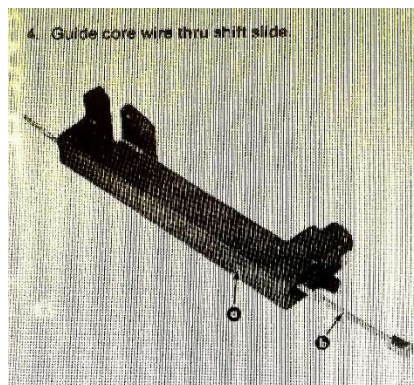
Shift cable removal/installation Part Three

Part Two is on Page 26, Part Three on 31 and Part Four is on Page 39

14. Using a new shift cable, separate the sheath from the inner cable.
15. Coat the unthreaded end of the cable with 2-4-C to help it slide through the new cable bellows.
16. Slide the cable end through the bellhousing and work it through the bellows, **using the trimmer line and a helper in the boat** to guide it. **DO NOT FORCE, KINK or BEND the cable. CLEAN THE IN-BOAT END OF THE CABLE AFTER PUSHING IT THROUGH THE TRANSOM.**
17. **Coat the brass threads** on the sheath with Perfect Seal or Aviation form-a-gasket, then have a helper **gently** pull on the cable while you use the Mercruiser 9/16" socket to thread the cable in. **Leave one thread showing.** ←Not sure about the 1 thread. The manuals don't mention this.

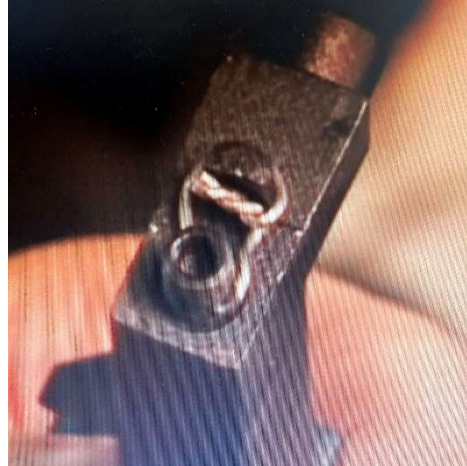
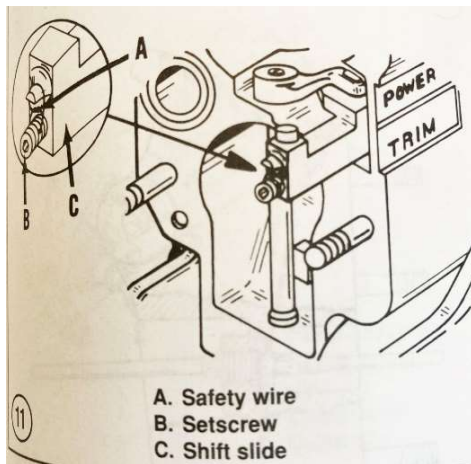


18. Install the spiral wrap on the sheath inside the boat, down low where the cable gets close to the exhaust pipe.
19. From the parts that came with the cable, find the new aluminum slide, the allen set screw, and the small piece of wire. **Take the cable core** and slide it into the aluminum slide. The lead end of the core will be recessed in the slide.

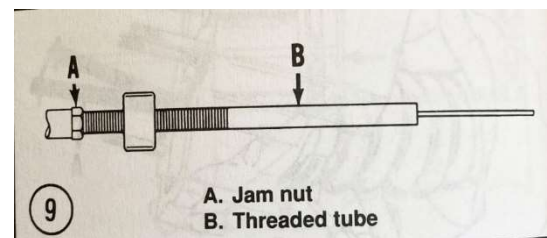


20. Thread the allen set screw into the slide until it **JUST BARELY TOUCHES the lead**. Back the set screw off 1/8 to 1/4 of a turn after it contacts the core wire anchor. The slide should have no end play but still spin freely on the core. If the allen screw is too tight, the drive wont shift properly.

21. Install a new safety wire by **running it through the hole in the allen screw** and wrapping in a figure eight and twisting. Cut off any excess wire. See figure 11.



22. **Slide the cable core slowly and carefully into the sheath from the stern of the boat.** If you kink the core, throw it out and buy a whole new cable assembly. **Do not grease the core.**
23. Take the other small pieces that came with the cable and prepare to attach the engine side of the shift cable. It requires a 7/16" end wrench, an adjustable wrench, channel lock pliers and a new small cotter pin.
24. Install the threaded tube into the end of the cable all the way to finger tight (until it bottoms) and then lock it down with the 7/16" jam nut, per figure 9.



25. Slide on the end guide and put in the core wire retainer pin, with the hole oriented so the wire will go through it, per the photo below. Look in the inspection hole to verify that the core is through the retainer pin, then lock down with the two set screws.

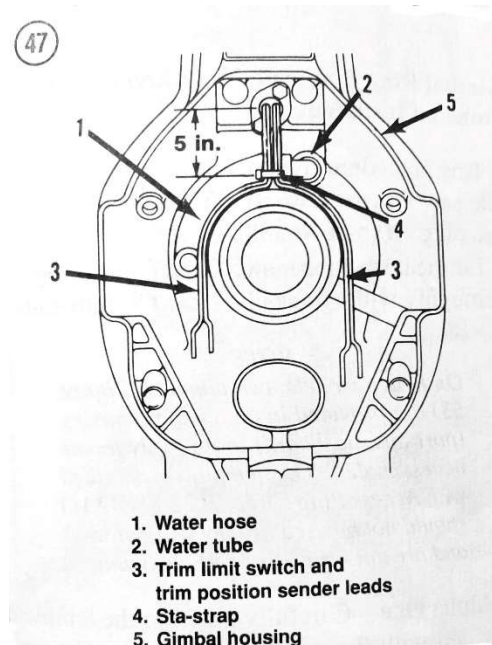


26. With the shift control in forward, temporarily install the cable to the shift plate mechanism. This will help hold the slide and shift shaft in the forward position for installing the drive.

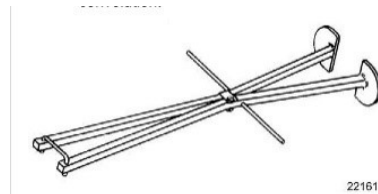
Final adjustment of the cable comes after the sterndrive is installed.

***** Some shift cables use an inner support tube on the core wire. Mercruiser Manual #6, pages 325+ have more information.**

27. Add adhesive to the unmounted ends of the u-joint and exhaust bellows and their mounting flanges. Let is set up for 10-15 minutes.
28. Insert the water tube through the gimbal housing, routing the water hose, trim limit and trim sender leads as shown.



29. Loosely slide new clamps onto each bellows (properly orienting the clamps).
30. Position the bellhousing in the gimbal housing and push it into place with a steady pressure so the u-joint bellows will slide onto the gimbal housing flange. The u-joint bellows should snap into the groove on the gimbal housing flange. This may take a couple attempts. May be able to use the bellows tool to push the u-joint bellows into place.
31. Use the bellows tool to pull the exhaust bellows onto the bellhousing mounting flange and tighten the clamp.



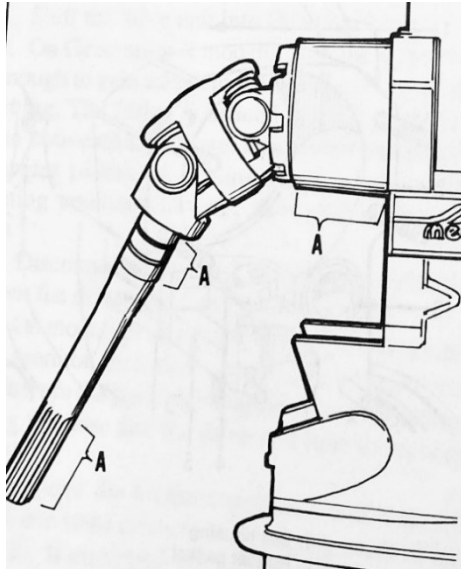
Alternatively, attach both the u-joint and exhaust bellows to the bellhousing and then use the bellows tool to push both bellows onto the gimbal housing mounting flanges. Reach through the hole provided in the bellhousing to tighten the exhaust bellows clamp.

32. Coat the hinge pin threads with Loctite 7471 and let dry, then apply Loctite 741 red.
 - A. **Insert the large washers between the bellhousing and gimbal housing.**
 - B. Install the hinge pins and tighten them to 95 ft.lbs.
33. Reinstall the trim position and trim limit switches, and then reinstall the sterndrive.

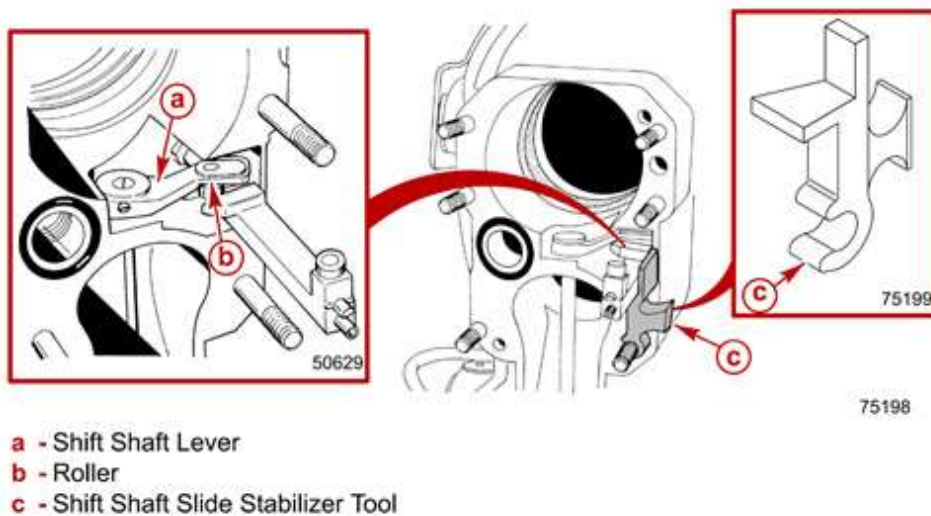
Sterndrive Installation

1. Check engine alignment with the alignment tool. The tool must slide freely all the way into the engine coupler splines.
2. Be sure:
 - A. The throttle is in the full forward position (maximum throttle).
 - B. The boat's main battery is disconnected.
3. Make sure the drive shaft, exhaust and shift cable bellows are clean and free of debris.

4. Coat the stern drive unit as shown below, using spline grease on the splines and 2-4-C on the rest.

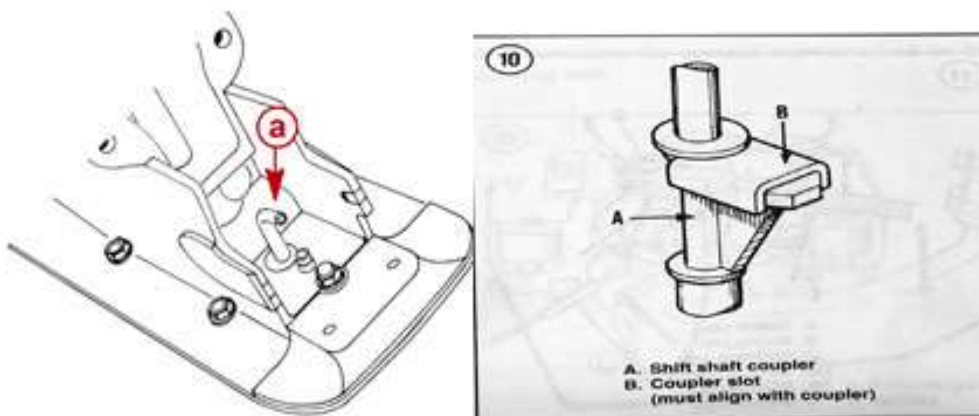


5. Make sure the sifting slide assembly is engaged with the shift shaft lever, as seen below on the left.



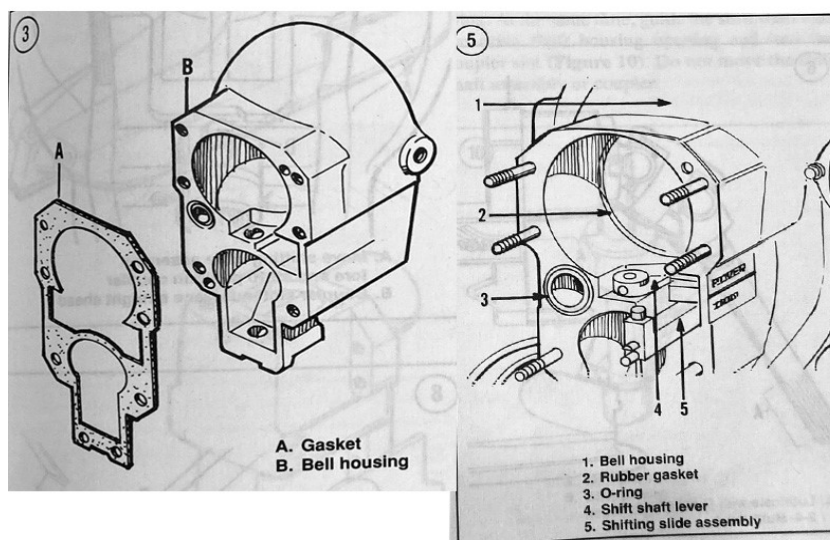
6. The shift slide assembly rotates on the core wire. Ensure that the shift slide remains upright and is properly engaged with the shift shaft lever roller by snapping on the shift shaft slide stabilizer tool as shown above on the right.
7. Lubricate the bell housing shift shaft coupler with 2-4-C and position it so that the slot in the coupler is straight fore and aft. (**see next page**)

Position drive unit shift shaft so that it is straight forward by turning shift shaft **CLOCKWISE** while simultaneously turning propeller shaft **COUNTERCLOCKWISE**.



a - Drive Unit Shift Shaft

8. Install a new bell housing round rubber gasket (2), O-ring (3) and bell housing gasket (A), as per Figure 3-5. Use a very thin coating of Quicksilver 2-4-C **on the faces** of the round rubber gasket and O-ring and both sides of the bellhousing gasket. **Many mechanics apply gasket adhesive to the back side of the new water passage o-ring and the large u-joint o-ring to hold them in place during installation.**
9. Lubricate the bell housing studs and shifting slide assembly with 2-4-C.

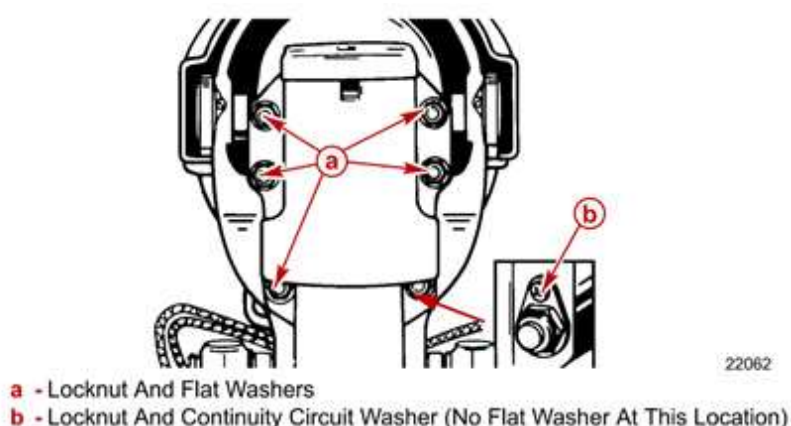


10. Slide the rolling cart to the back of the boat (having already positioned the boat trailer to drop the bell housing to about 33").
11. Lift the hydraulic trim cylinders up and hang them on bungies to keep them out of the way.
12. With the bell housing at 33", the cart should roll up to the boat and allow the stern drive to slide into the bell housing and through the gimbal bearing with minimal lifting (the drive unit weighs

about 75 pounds). The shift shaft must slide into the drive shaft housing as the stern drive is being pushed onto the bell housing studs.

The drive shaft may have to be rotated counterclockwise slightly until the splines slide in smoothly, while making sure the shift arm remains pointed straight ahead. NEVER FORCE THE SHAFT IN. IF IT DOESN'T GO IN SMOOTHLY, CHECK TO SEE WHAT IS NOT ALIGNED.

13. Once the shaft is through the main bearing, but before trying to push the stern drive all the way on, look under the boat to see if the shift assembly is still correctly located. Once the shift shaft is part way into the coupler slot, **the tool holding it in place must be removed**. The drive can now be pushed fully onto the bell housing.
14. Install washers and nuts with nylon inserts using 5/8" wrench or socket. Torque in crossing pattern to **50 lb.ft.** Do not use a washer on the grounded stud (b in the illustration below). Nylocks can be reused 2-3 times before replacing them.



| Description | Nm | lb-in. | lb-ft |
|-------------|----|--------|-------|
| Fasteners | 68 | | 50 |

15. If the shift cable bellows was replaced, now is the time to **trim the sterndrive full up and install a zip tie on the small end of the bellows (instead of installing a new crimp clamp)**. Use a Mercury outboard motor fuel line zip-tie – Mercruiser part 54-816311T. Should cost 30-50 cents each. The tie goes on the very end of the bellows.
Take caution when you clamp/wire tie that boot. The drive must be all the way up so that the boot is extended/stretched enough so when you let the drive down it doesn't wad up and damage the boot.
16. If the prop was removed, install it and torque to 55 lb.ft. and fasten the locking tab. Also see the following page.

Propeller Installation

⚠ WARNING

Be sure that remote control is in neutral position and ignition key is removed from switch.

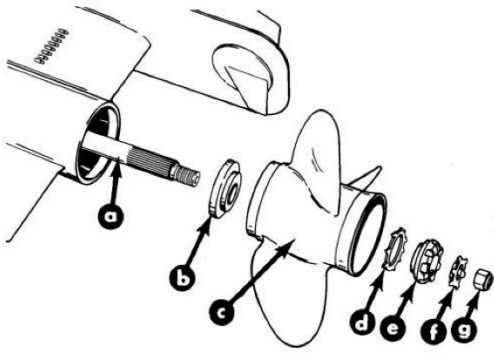
⚠ WARNING

Place a block of wood between the anti-ventilation plate and propeller to protect hands from propeller blades and to prevent propeller from turning.

1. To aid in future propeller removal, liberally coat the propeller shaft splines with one of the following lubricants. Install propeller as shown.

- Special Lubricant 101
- 2-4-C Marine Lubricant
- Perfect Seal

IMPORTANT: Installation is correct when at least 2 threads of propeller shaft are exposed through propeller nut.



22074

- a - Propeller Shaft
- b - Forward Thrust Hub
- c - Propeller
- d - Continuity Washer
- e - Spline Washer
- f - Tab Washer
- g - Propeller Nut

2. Tighten propeller nut until a torque of 55 lb. ft. (75 N·m) is obtained and continue until 3 tabs on tab washer align with grooves on spline washer. Bend tabs into spline washer.

Shift Cable Removal/Replacement Part Four
 Part Three is on Page 31

Adjusting the shift cable -- P528+ of the Clymer manual



← The finished shift control

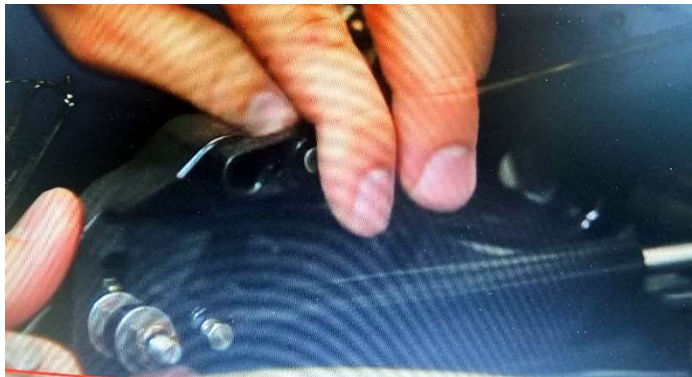
1. **Put the remote shifter in neutral** and remove the cable from the shift plate.
2. Push the lower drive cable inward while someone locks the prop in forward (prop locks counterclockwise). **It is important to make sure the prop fully locks.**
3. Measure the lower drive cable. While pushing the cable in (prop locked), it should measure 6" between the center of the hole at the end of the black rod and the center of the brass barrel. Adjust **the brass barrel** so it measures 6" center to center.



4. Make sure the **shift lever adjustable stud is at the bottom of the slot, as shown below. Then** secure the lower shift cable barrel in the shift assembly with a cotter pin. Secure the cable end guide with one washer on each side of the end guide and a locknut. Be careful not to move the 6" adjustment. **Once the nut is tight, back it off ¼ to ½ a turn.**



5. **For a standard rotation prop drive, put the boat in forward gear, wide open throttle.**
6. To install the upper cable onto the shift plate:
- Pull the cable slightly as it is installed.
 - As the upper unit is attached to its mounting point, push the lower cable bracket in to take up any slack. If the upper pin doesn't slide in, **adjust at the upper barrel.**



7. Remove the upper cable again. Rotate the barrel four turns away from the cable end guide (rotate the barrel clockwise). **Now put the boat in neutral** and lock down the upper cable with cotter pin on front and washer and nut on the back.



8. Do a static shift test. With the shifter in neutral, the prop should turn freely in both directions. **Next, put the remote shifter in forward.** The prop should lock in the counterclockwise direction and ratchet in the other. Take a notice of the ratchet tension. Finally, shift into reverse. The prop should lock in the clockwise direction.
9. If there's ratcheting at the prop – not full engagement – go to the shift bracket and adjust the lower cable stud that sits in the slot. Move it upward until there's a full lock on the prop.

The final test is how it shifts in the water. If the shift needs adjusting, ONLY adjust the DASH – or upper -- cable barrel. For additional assistance, see the Mercruiser Manual #6 pages that begin on page 42 of this document or the troubleshooting section of the Merc Manual.

And finally ...

1. **Fill the stern drive with oil**, per the procedure on page 8. It will use a little less than 2 qts.
2. Install the plastic cap that covers the allen bolt that holds the large anode.
3. Install the trim cylinders.
 - A. Coat anchor pin and threads with 2-4-C. **DO NOT apply oil or grease to rubber bushings.** If necessary, soap and water can be used on the rubber bushings to slide them on.
 - B. **Tighten until the locknuts bottom on the anchor pin shoulder.** See the illustration on the next page.
4. Return the throttle lever to neutral
5. Attach the battery
6. Test the shift and trim functions, go boating!