SECTION 6
LOWER UNIT

TABLE OF CONTENTS

OMC
SPECIAL TOOLS REQUIRED

SEAL INSTALLER	PART NUMBER 319928
PULLER	PART NUMBER 386631
SLIDE HAMMER	PART NUMBER 380658
TWO JAW PULLER	PART NUMBER 386661
TWO JAW PULLER	PART NUMBER 380657
BEARING REMOVER	PART NUMBER 319880
BEARING INSTALLER	PART NUMBER 319876
BEARING INSTALLER	PART NUMBER 319875
SEAL INSTALLER	PART NUMBER 319877
BEARING CUP INSTALLER	PART NUMBER 319929
DRIVE HANDLE	PART NUMBER 311880
BEARING INSTALLER	PART NUMBER 319878
BEARING INSTALLER	PART NUMBER 383173
BEARING INSTALLER	PART NUMBER 319931
SEAL INSTALLER	PART NUMBER 319930
BUSHING INSTALLER	PART NUMBER 304515
YOKE LOCATOR	PART NUMBER 319991

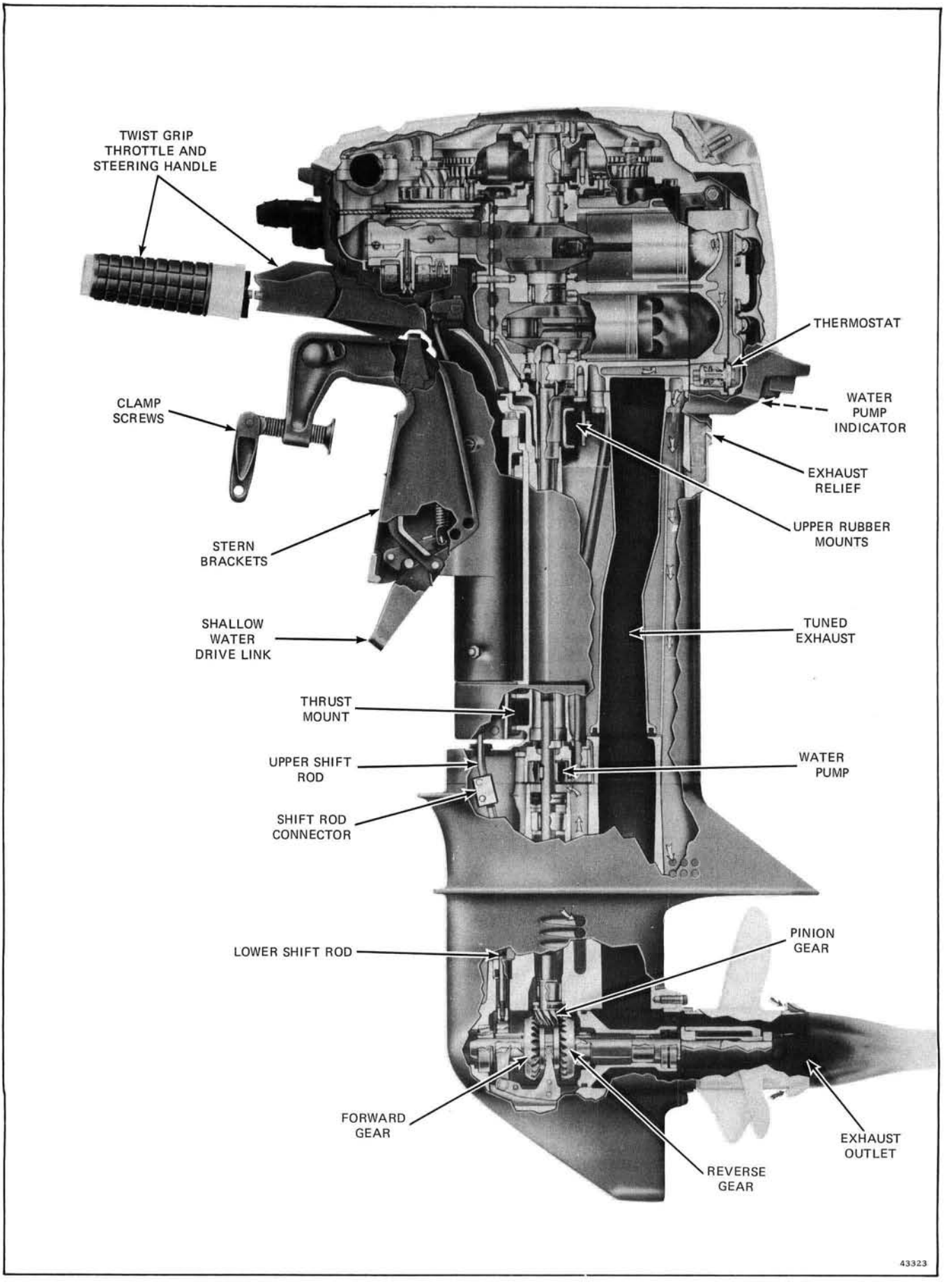


Figure 6-1. Cooling and Exhaust Systems

DESCRIPTION

EXHAUST HOUSINGS

This model features a "wet sleeve" exhaust system consisting of an inner and an outer housing with a water chamber in between. The inner housing is a tuned unit providing ideal exhaust scavenging throughout the power range. The water discharged from the engine cooling system fills the space between the exhaust housings and maintains a specified level when the engine is running. See Figure 6-1. The water drains out when the engine is stopped. This chamber of water serves as an effective silencer, quiets the exhaust relief, and cools the outer housing and lower rubber mounts.

Exhaust gases are discharged underwater through the propeller hub for efficient silencing and performance.

RUBBER MOUNTS

The isolation system incorporates two rubber mounts and one thrust mount immediately below the power head and two lower and one thrust rubber mount that are between the lower mount bracket and the exhaust housing. See Figure 6-1.

EXHAUST RELIEF

Normally, exhaust gases are conducted down through the inner exhaust tube and out through the underwater exhaust outlet. However, in starting, water in the underwater outlet creates back pressure. This can cause hard starting. Exhaust relief is provided by an outlet above the waterline. Since no water is discharged until after the motor is started, the exhaust gases will initially be discharged through the exhaust relief outlet. See Figure 6-1. After starting a small amount of water is discharged through the exhaust relief and water pump indicator hole located on the starboard aft end of the lower motor cover.

WATER PUMP

Water for cooling the power head is circulated by the water pump, located at the top of the upper gearcase and driven directly by the driveshaft. The pump consists of a synthetic rubber impeller which is keyed to the driveshaft, and the pump housing which is offset from center with respect to the driveshaft. Because the housing is offset, the impeller blades flex as they rotate, varying the space between them. The pump inlet port, located in the stainless steel plate which forms the lower part of the pump housing, is open to the blades when the space between them is increasing. The pump outlet port, in the impeller housing, is open to the blades when the space between them is decreasing. Thus at low speeds the impeller works as a displacement pump. At higher speeds, water resistance keeps the blades from contact with the housing, and the pump acts as a centrifugal pump. See Figure 6-2. Water circulation is shown on water flow diagram at back of manual. Heavy duty water pumps are available for service in extremely sandy or silty waterways.

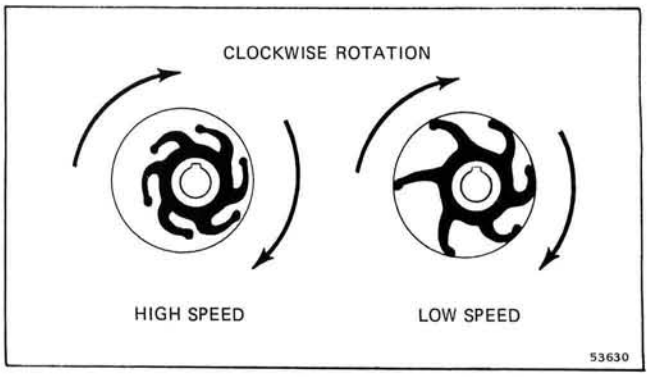


Figure 6-2. Impeller Positions as Viewed From Power Head

GEARCASE

The three functions of forward, neutral, and reverse operation are provided by the gear shift mechanism located in the lower gearcase. See Figure 6-1. The driveshaft pinion gear rotates constantly with the operation of the motor and drives two bevel gears which revolve freely on the propeller shaft. The clutch shifter dog is splined to the propeller shaft. In neutral operation, the shifter dog with detent spring and balls is centered between the two gears, which revolve in opposite directions, and remains motionless. In forward or reverse operation, the shift lever causes the shifter dog to engage either gear. Power is then transmitted from the rotating gear, through the shifter dog, to the propeller shaft and propeller.

GEARCASE REMOVAL

It is possible to remove the lower gearcase assembly without removing the power head from the motor. However, if disassembly of the exhaust housing is required, it is necessary first to remove the power head. See Section 5 for instructions.

The gearcase assembly may be removed from the exhaust housing and power head as follows:

a. Remove upper motor cover and disconnect spark plug wires.

b. Remove 6 screws attaching gearcase to exhaust housing or gearcase extension if used. See Figure 6-3.

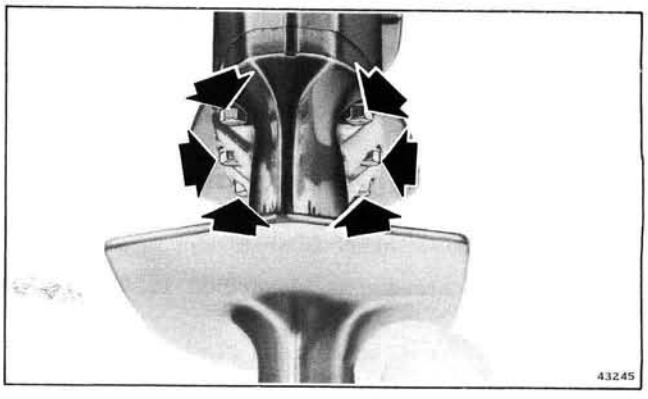


Figure 6-3. Gearcase Attaching Screws (Six)

c. Separate gearcase from exhaust housing enough to expose shift rod connector. Remove upper connector screw. See Figure 6-4.

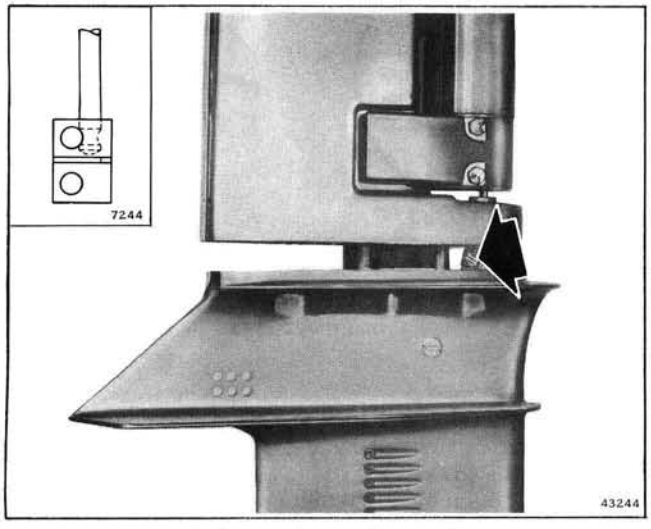


Figure 6-4. Shift Rod Connector Screw

d. Remove gearcase assembly from exhaust housing, taking care to avoid damaging driveshaft, which extends upward to the power head. Place gearcase on bench for disassembly. See Figure 6-5.

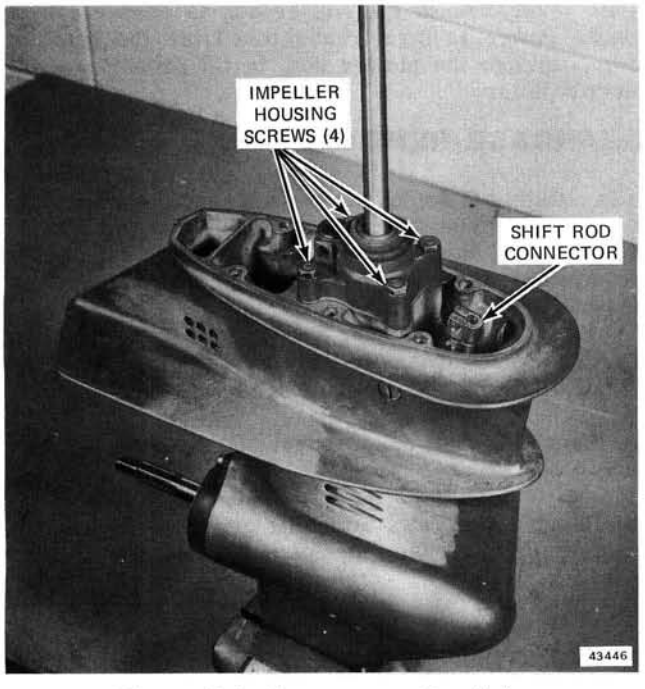


Figure 6-5. Gearcase on Bench for Disassembly

EXHAUST HOUSING AND PIVOT TUBE REMOVAL

1. Remove power head as described in Section 5.
2. Remove gearcase as described in "Gearcase Removal."
3. Remove vertical control shaft lever pin, vertical control shaft gear, and inner control shaft gear. See Figure 6-6.

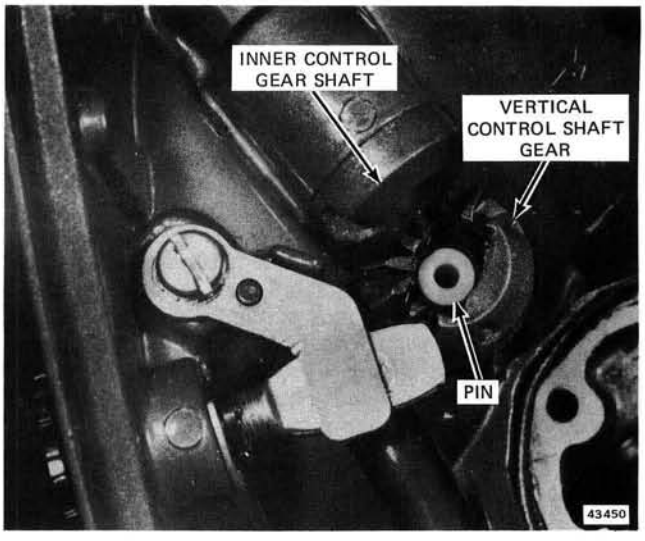


Figure 6-6. Vertical Control Shaft Lever Gears and Pin

4. Remove upper shift rod cotter pin and clevis pin. See Figure 6-7. On electric start model, remove cable and clamp from inside of port side stern bracket.

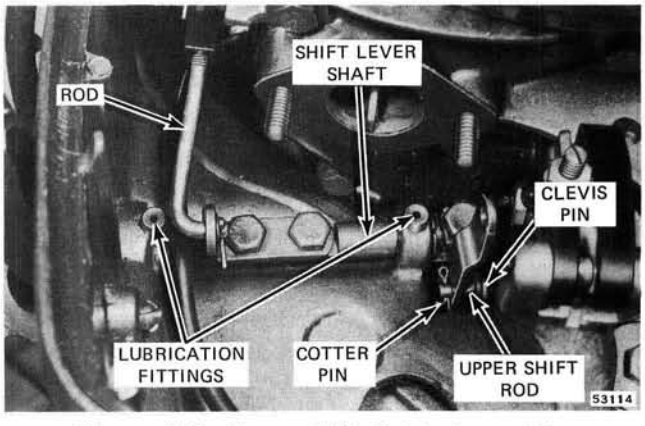


Figure 6-7. Upper Shift Rod to Lever Pin

5. Lift lower motor cover from exhaust housing.
6. Remove two lower mounting bracket screws and port and starboard mount brackets. See Figure 6-8. Remove lower lateral and thrust mounts. See Figure 6-9. Inspect for wear and replace if necessary.
7. Remove two screws and upper mount link. See Figure 6-10. This will free exhaust housing from steering bracket. Rubber mounts can be removed from inside of exhaust housing by removal of two screws port and starboard. See Figure 6-8.
8. Loosen swivel bracket friction adjustment screw and spring. See Figure 6-11.
9. Lift pivot tube and steering bracket from swivel bracket. Remove upper thrust washer, lower thrust washer, "O" ring and pivot tube bushing.

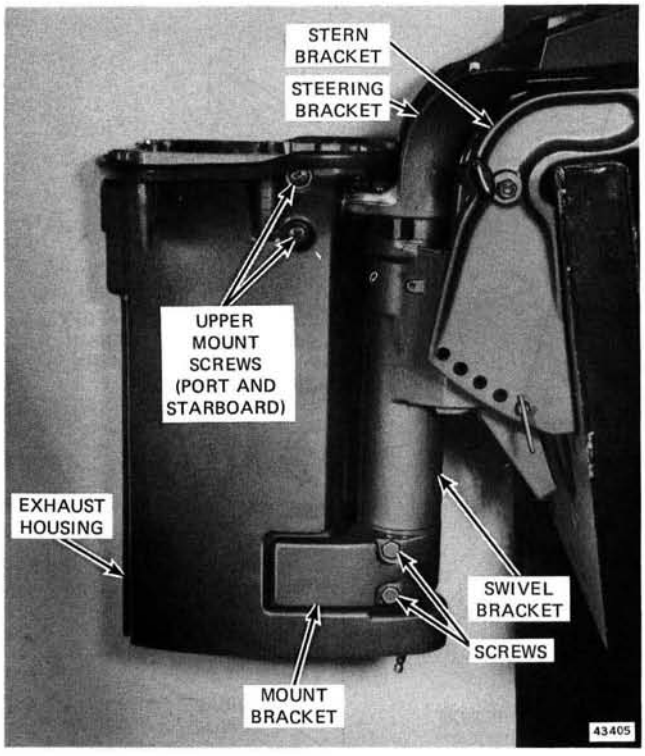


Figure 6-8. Lower Mount Bracket Screws

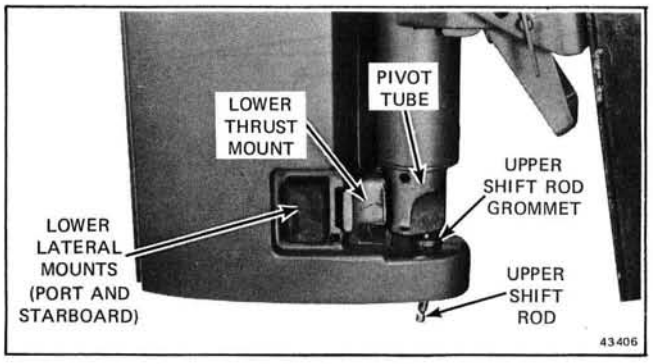


Figure 6-9. Lower Mounts

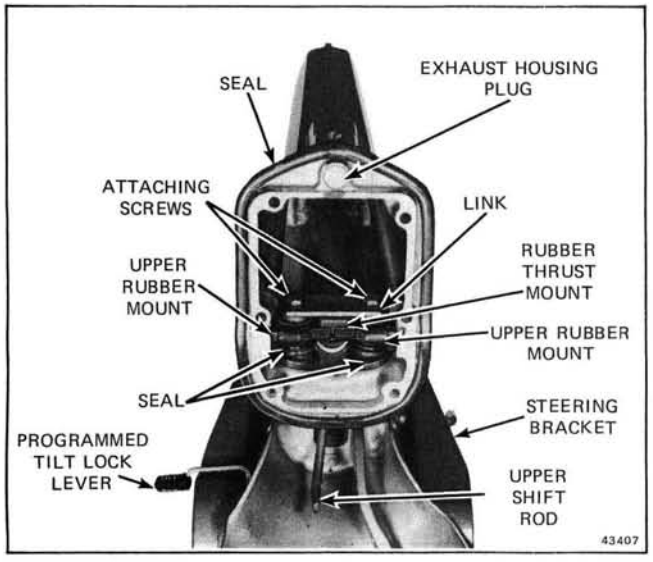


Figure 6-10. Upper Mounts

10. Using a long rod, drive out upper seal if damaged.

11. Upper swivel bracket liner is pinned in place. Remove by pushing pin from outside of swivel bracket. See Figure 6-11. Spacer and friction block can be removed after removal of swivel bracket liner.

12. Stern bracket can be disassembled by removal of thrust rod, tilt bolt nut, washer, spring, tilt bolt, conical washer, and stern bracket plate retained by two screws. See Figure 6-11.

CLEANING, INSPECTION AND REPAIR

1. Clean parts in solvent and dry.

2. Inspect all components for cracks, deterioration, wear and damage.

3. Inspect clamp screw assembly (Figure 6-12). Replace swivel plate if bent or loose. To install a new swivel plate remove screw and old plate. Apply OMC Locquic Primer (Part Number 384884) to the threads of the screw and allow it to dry four to five minutes. Then apply OMC Ultra Lock (Part Number 388517) to threads. Install new swivel plate with screw and tighten to torque specified in Section 2.

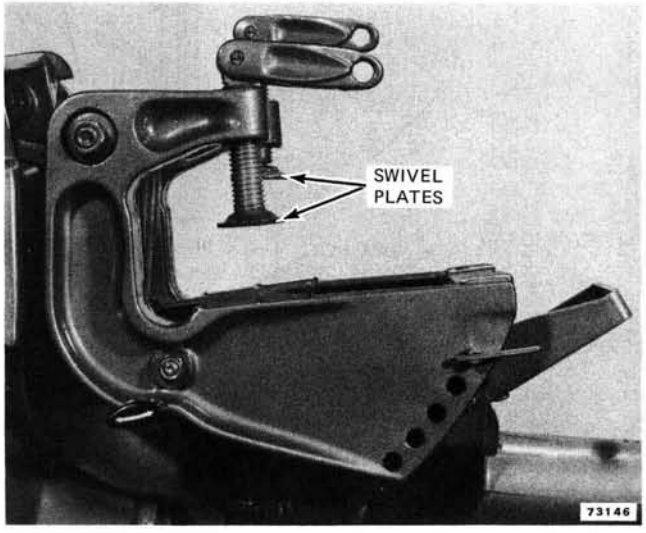


Figure 6-12. Clamp Screw Assembly

4. Inspect rubber mounts for cracks and deterioration. Replace if damaged.

5. Inspect upper mount seal for deterioration, tears, or holes. Replace if damaged.

6. Inspect seal around top of exhaust housing and replace if damaged.

7. Inspect exhaust housing plug for leakage. See Figure 6-10. If leakage is evident, remove plug and clean carbon from exhaust relief passage and outlet. Reseal with Gasoila (Part Number 200763) varnish.

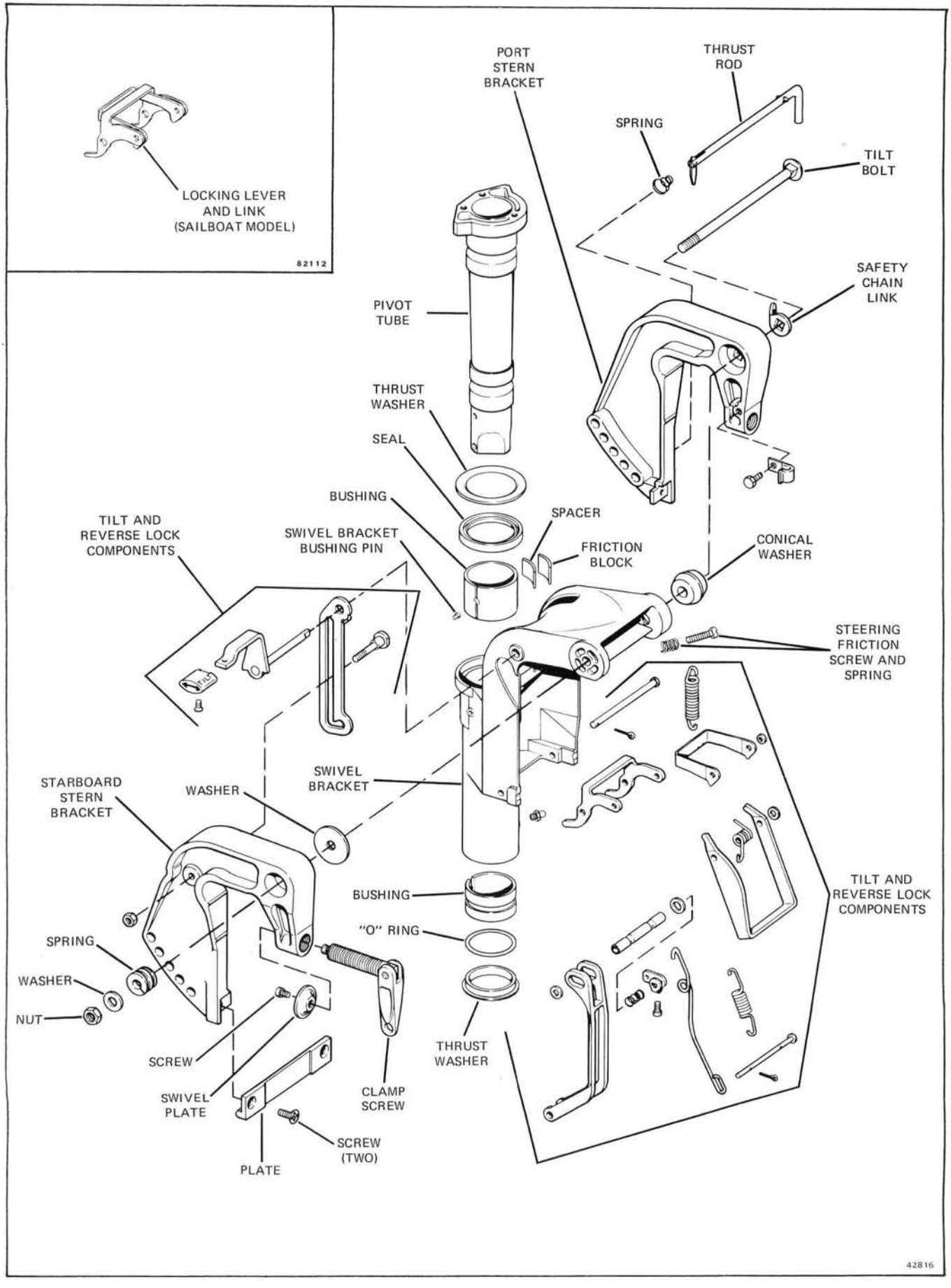


Figure 6-11. Stern and Swivel Brackets

8. Inspect exhaust housing for nicks on the machined surfaces. Remove nicks and re-surface faces on a surface plate. Start with No. 120 emery and finish with No. 180. Check parallelism on plate with a surface gage and scriber. See Figure 6-13. A drill press table will also serve, using the spindle as a gage. Do not attempt to straighten, replace if bent.

Figure 6-13. Checking Parallelism

NOTE

A bent exhaust housing may cause upper driveshaft splines to wear excessively, damage crankshaft splines, and break driveshaft.

9. Inspect exhaust housing upper shift rod grommet for wear or deterioration. Replace if necessary.

EXHAUST HOUSING AND PIVOT TUBE INSTALLATION

1. Using Seal Installer (Special Tool #319928), and an arbor press, press upper seal into swivel bracket. See Figure 6-14.

2. Install friction block, upper liner, spacer and pin in swivel bracket. See Figure 6-11.

3. Install lower bushing, "O" ring and thrust washer in swivel bracket. See Figure 6-15.

4. Coat bushings and "O" ring with OMC Anti-Corrosion Lube. Install pivot shaft in swivel bracket.

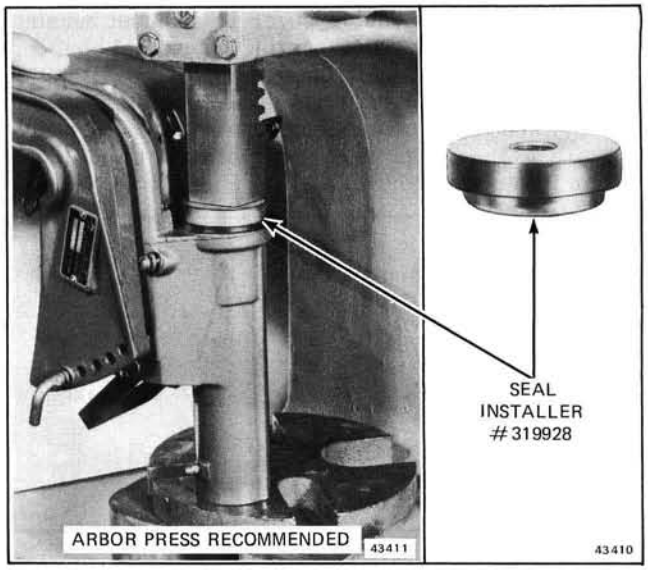


Figure 6-14. Installing Pivot Tube Seal

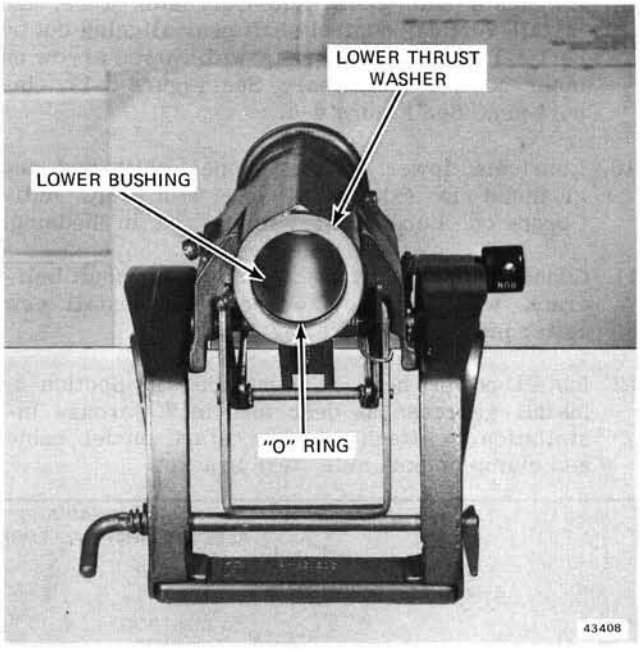


Figure 6-15. Lower Pivot Shaft Bushing

5. Install upper mounts with screws dipped in OMC Gasket Sealing Compound (Part Number 317201).

6. Place upper mount seal on steering bracket, and carefully install exhaust housing with link.

NOTE

Using extreme caution, install two screws. Be careful not to pinch or tear seal. See Figure 6-10.

Torque screws to specifications, Section 2.

7. Place lower mounts in position. Install port and starboard mount brackets with screws dipped in OMC Gasket Sealing Compound. Torque to specifications, Section 2.

8. Position lower motor cover on exhaust housing. Lubricate with OMC Anti-Corrosion Lube, and install control shaft inner gear. You will notice that the control shaft has three knobs that fit into notches in the control shaft inner gear. See Figure 6-16. Align inner gear with shaft and install in lower motor cover.

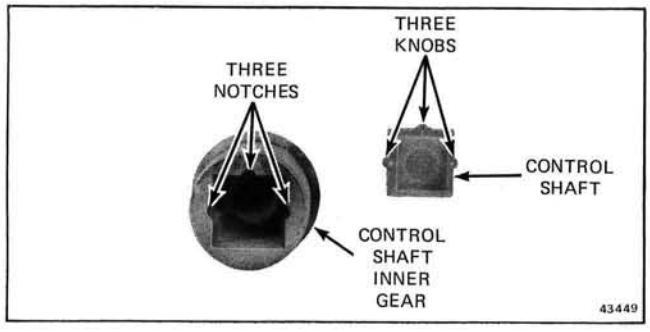


Figure 6-16. Aft Throttle Gear and Shaft Alignment

9. Lubricate with OMC Anti-Corrosion Lube, and install vertical control shaft gear aligning dot on vertical control shaft gear with raised arrow on inner control shaft gear. See Figure 6-17. Insert pin. See Figure 6-6.

10. Lubricate lower part of upper shift rod and grommet in exhaust housing with OMC Anti-Corrosion Lube. Insert shift rod in housing.

11. Connect upper shift rod to shift lever shaft bellcrank with pin, bow washer, and install new cotter pin. See Figure 6-7.

12. Install power head as described in Section 5. Install gearcase as described in "Gearcase Installation." Attach electric start model cable and clamp on port side stern bracket.

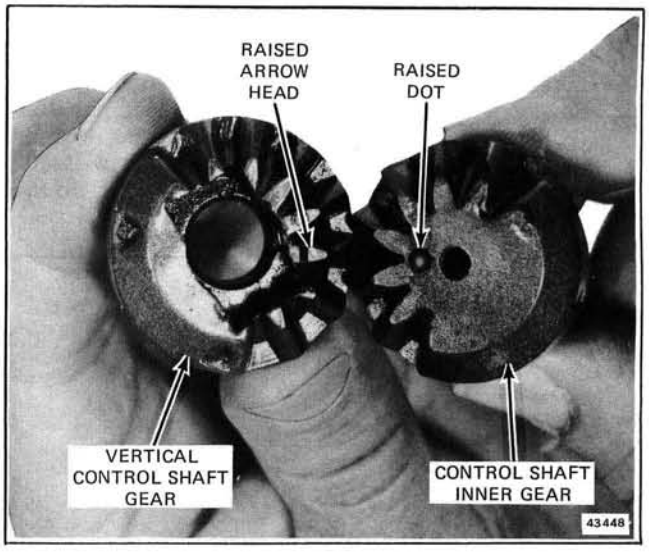


Figure 6-17. Gear Alignment Marks

STEERING HANDLE AND GEAR REMOVAL

Remove gear cover by prying four corners out of steering bracket and handle. See Figure 6-18. Loosen steering bracket nut. See Figure 6-19. Remove steering bracket screw, flat washer and bow washer, while holding nut. See Figures 6-18 and 6-19. Screw is threaded into handle. Carefully remove screw and washer from handle and steering bracket. See Figures 6-18 and 6-19.

NOTE

Steering handle need not be removed to service steering grip components. However, it must be disassembled to remove the gear and bushing assembly from steering bracket. See Figure 6-20.

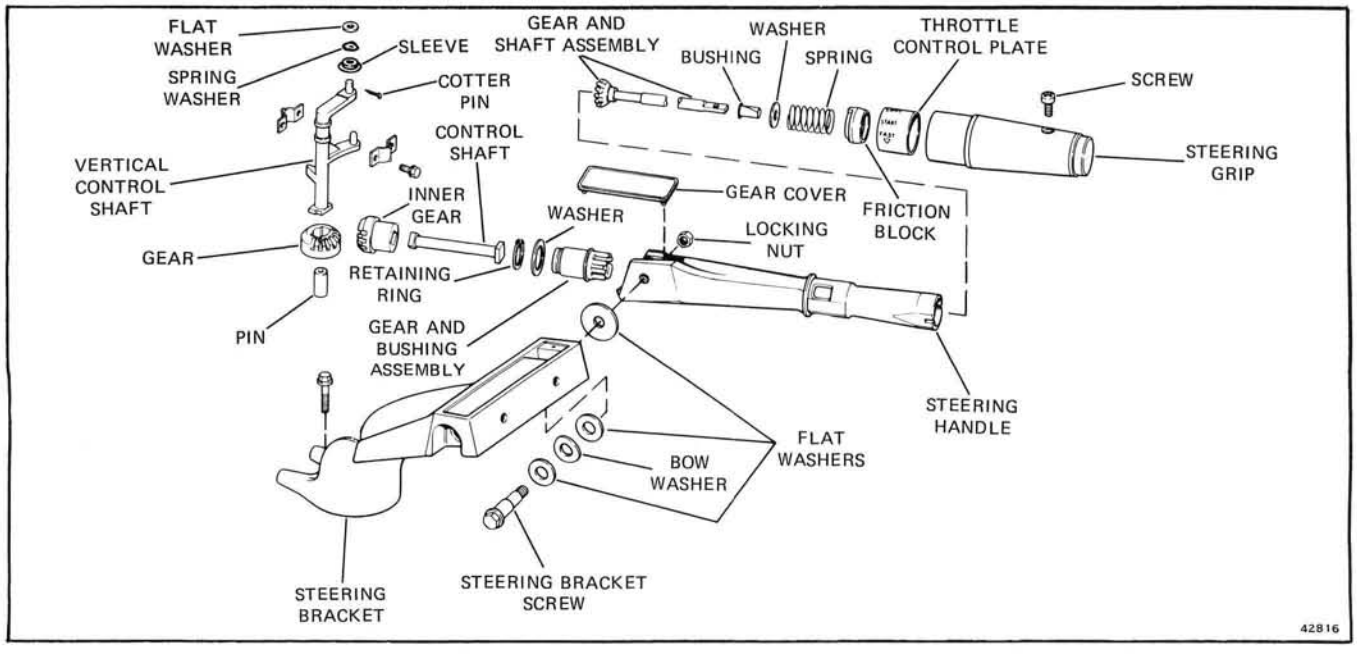


Figure 6-18. Steering and Throttle Components

STEERING HANDLE DISASSEMBLY

1. Disassemble steering handle by removing screw in twist grip. Remove grip, friction block, spring, and washer.

2. Tilt handle and pull out gear and shaft, and bushing. See Figure 6-18.

To remove gear and bushing assembly, remove retaining ring and washer. Gear slides out forward. See Figure 6-20.

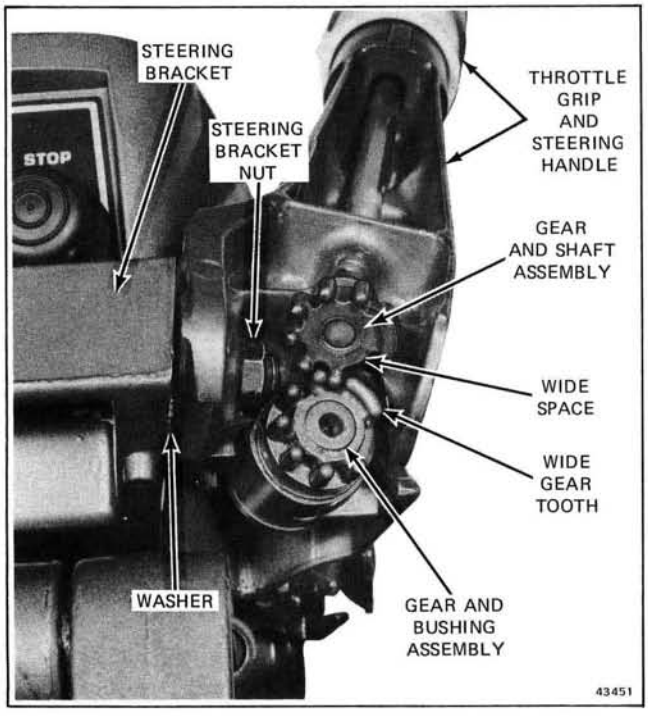


Figure 6-19. Throttle Shaft Gear Mesh

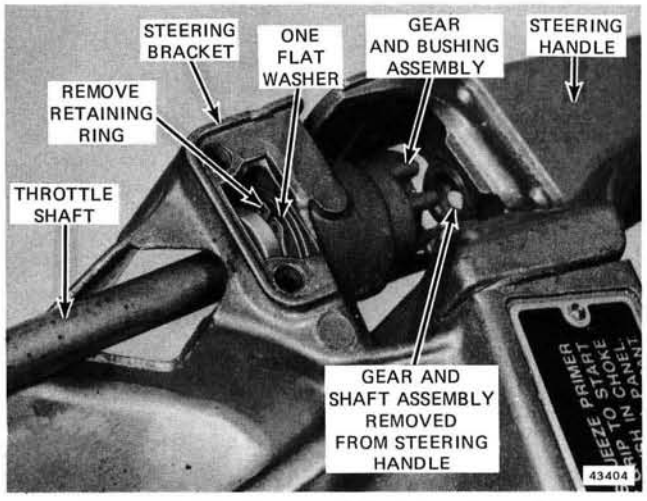


Figure 6-20. Gear and Bushing Assembly

CLEANING, INSPECTION AND REPAIR

Clean parts with cleaning solvent such as Solvasol and dry with compressed air.

1. Inspect all components for wear and damage. Replace all worn or damaged parts.
2. If steering bracket has received damage necessitating its replacement, it will be necessary to remove the power head and lower motor cover. See "Exhaust Housing Removal." Steering bracket is attached to the pivot tube with three screws. On Reassembly, dip attaching screws in OMC Nut Lock and torque to 8-10 ft. lbs. (11-14 N·m).

STEERING HANDLE ASSEMBLY

1. Lubricate steering handle gear and shaft assembly, and bushing with OMC Anti-Corrosion Lube and assemble to handle.
2. Lubricate washer, spring and friction block with Anti-Corrosion Lube and install on shaft. Align raised bosses on friction block with slots in steering handle.
3. Install throttle control plate on handle, if removed.
4. Install handle grip aligning screw hole with threaded hole in gear and shaft assembly. Torque screw to specifications. See Section 2.

STEERING HANDLE AND GEAR INSTALLATION

1. If gear and bushing assembly have been removed from steering bracket, lubricate with OMC Anti-Corrosion Lube and install with washer and retaining ring. See Figure 6-20. The gear aligns with the control shaft by means of two notches in the gear and two knobs on the shaft. See Figure 6-21.

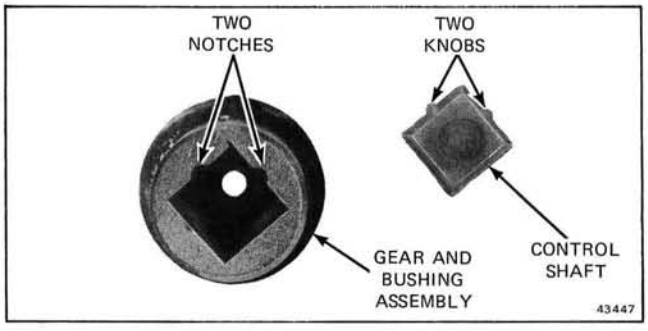


Figure 6-21. Gear and Shaft Alignment

2. To attach steering handle to steering bracket, the gears have mating teeth. See Figure 6-19. These must be aligned.
3. Clean threads of steering handle attaching screw and nut with OMC Locquic Primer. Apply OMC Screw Lock (Part Number 384848) to screw threads. Place one flat washer, bow washer, and flat washer on screw. Thread through steering bracket, flat washer, and into steering handle until sufficient threads appear to engage nut. Apply OMC Nut Lock (Part Number 384849) to threads in nut and thread onto screw. Turn screw into handle while holding nut until sufficient friction is reached to hold handle in any selected position. Then hold screw and tighten nut.

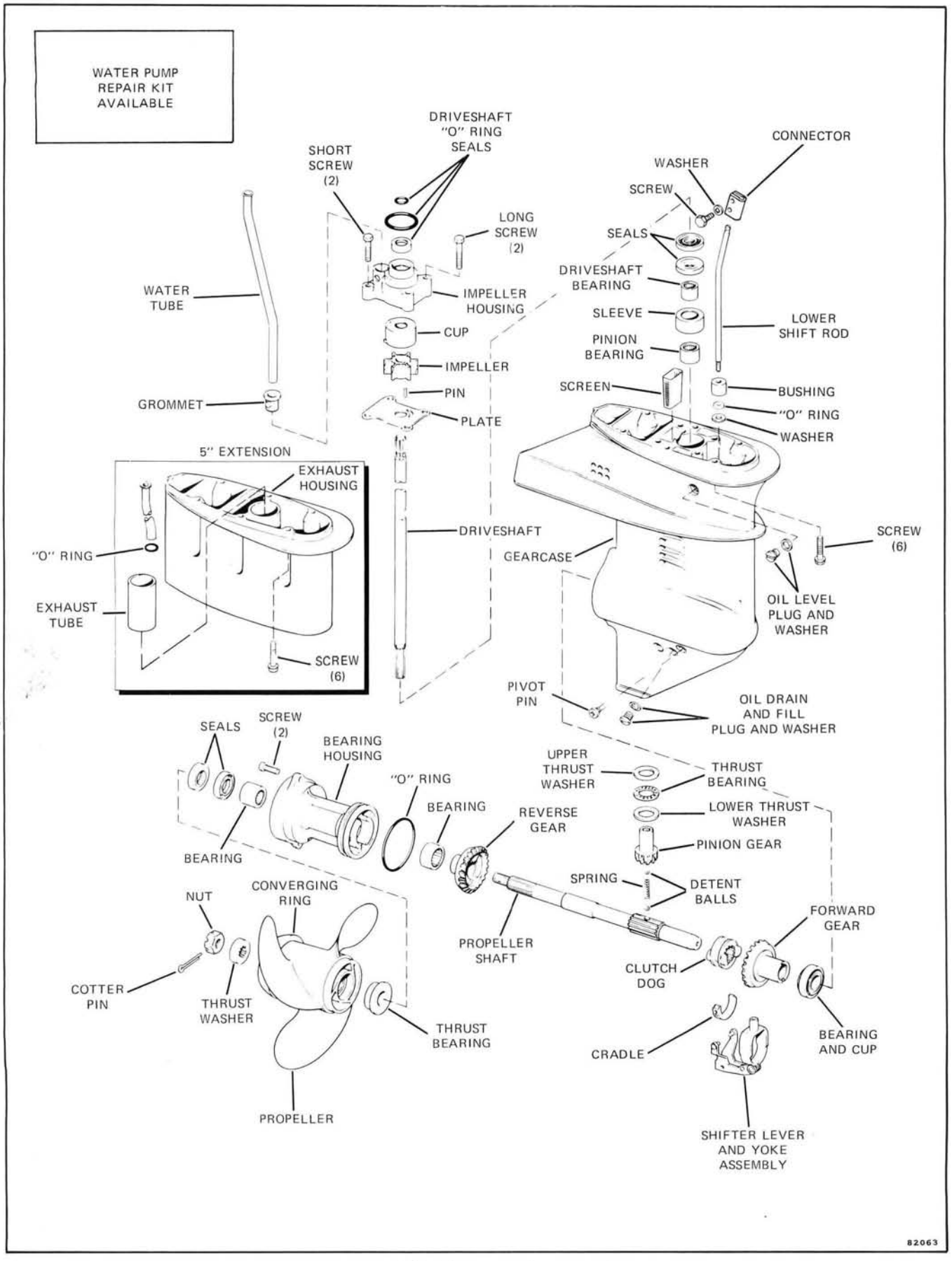


Figure 6-22. Gearcase Components

GEARCASE DISASSEMBLY

NOTE

See "GEARCASE REMOVAL."

1. Remove oil level and fill plug. Drain gearcase.
2. Remove cotter pin, nut, thrust washer, propeller, and thrust bushing. See Figure 6-22.
3. Remove driveshaft "O" ring, four screws and lift impeller housing, cup, impeller, pin, and impeller plate from gearcase. See Figure 6-23. Remove cup from impeller housing. See Figure 6-24.

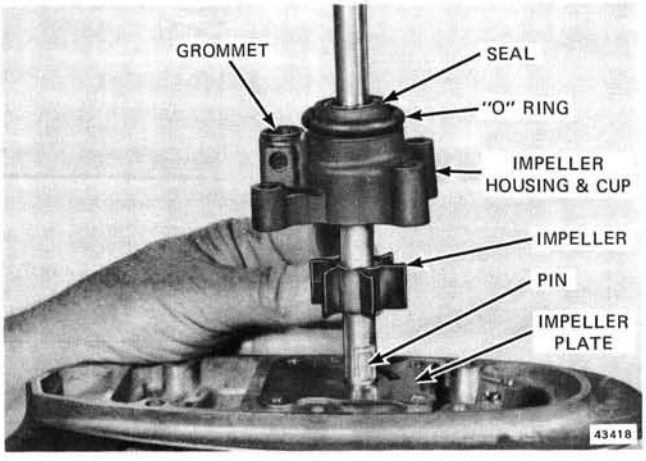


Figure 6-23. Removing Water Pump

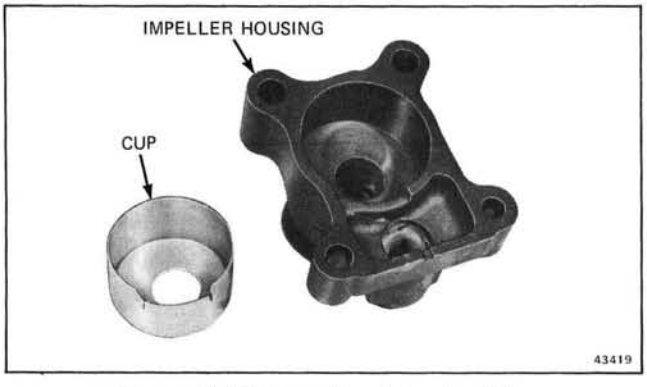


Figure 6-24. Impeller Housing Cup

4. Using a puller (Special Tool #386631), remove gearcase bearing housing. See Figure 6-25. Lift bearing housing from gearcase. Remove and discard "O" ring. See Figure 6-26.

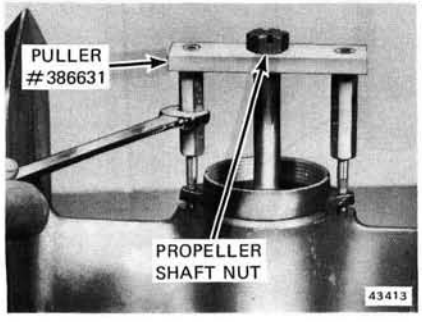


Figure 6-25. Pulling Bearing Housing

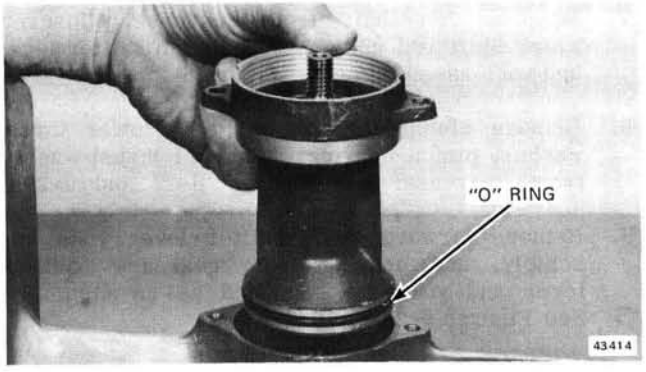


Figure 6-26. Removing Bearing Housing

5. Remove propeller shaft and reverse gear from gearcase. Avoid loss of two detent balls and spring. See Figure 6-27.

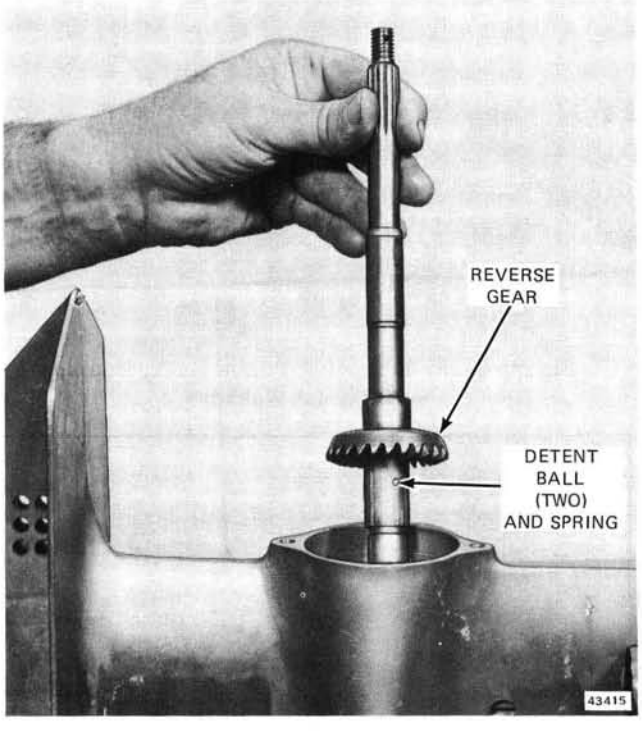


Figure 6-27. Removing Propeller Shaft and Reverse Gear

6. Remove pivot pin. See Figure 6-28.

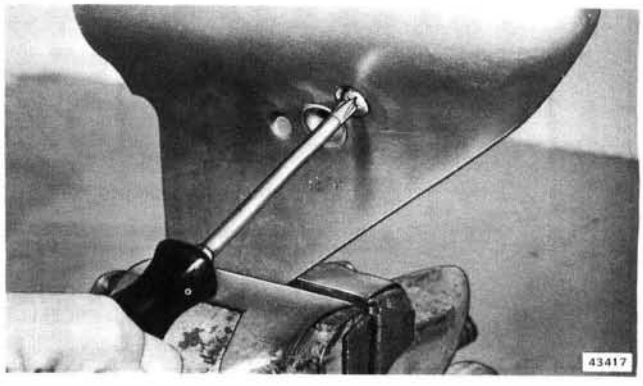


Figure 6-28. Removing Pivot Pin

7. Remove driveshaft from gearcase. Unscrew lower shift rod and connector from shifter lever and yoke assembly. See Figure 6-22.

8. Remove clutch dog, pinion gear, lower thrust washer, pinion bearing, and upper thrust washer from gearcase. See Figures 6-29 and 6-29A.

9. Remove forward gear, shifter lever yoke assembly, and bearing from gearcase. Shifter lever and yoke are serviced as an assembly. See Figures 6-29 and 6-29A.

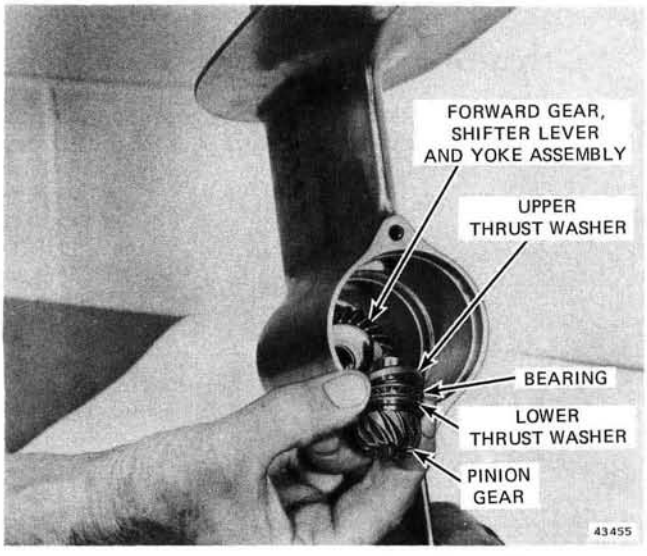


Figure 6-29. Removing Pinion Gear, Bearing and Thrust Washers

10. If shift rod bushing and "O" ring are worn, use slide hammer (Special Tool #380658) and a 1/4" diameter by 15" (380 mm) long rod threaded on both ends. Use a nut with corners ground to clear casting. Remove shift rod washer, "O" ring and bushing. See Figure 6-30.

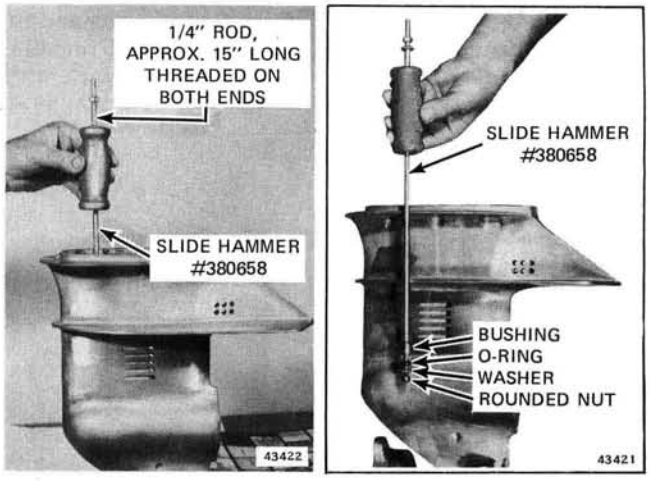


Figure 6-30. Pulling Shift Rod Bushing, O-Ring and Washer

11. If driveshaft seals and bearings are worn, use OMC Special Tool #386661 to pull driveshaft upper bearing seals from gearcase. See Figure 6-31. To remove driveshaft bearing, drive out with OMC Special Tool #319880. See Figure 6-31. Remove bearing sleeve using OMC Special Tool 386661. Invert gearcase and driveshaft bearing will fall out.

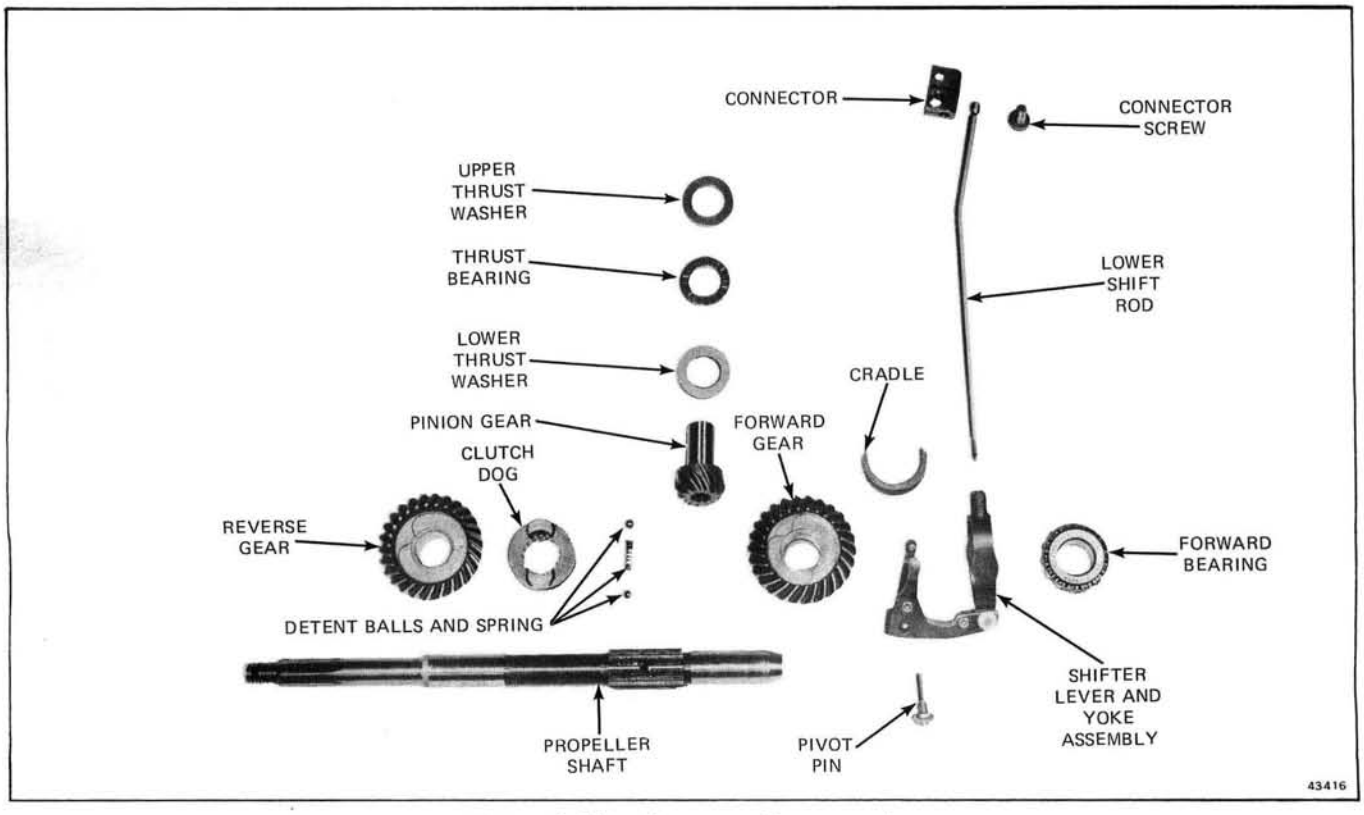


Figure 6-29A. Gearcase Components

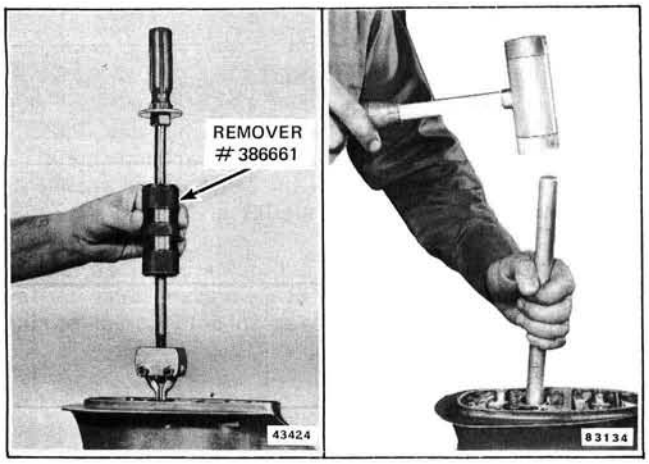


Figure 6-31. Pulling Driveshaft Upper Seals and Bearing

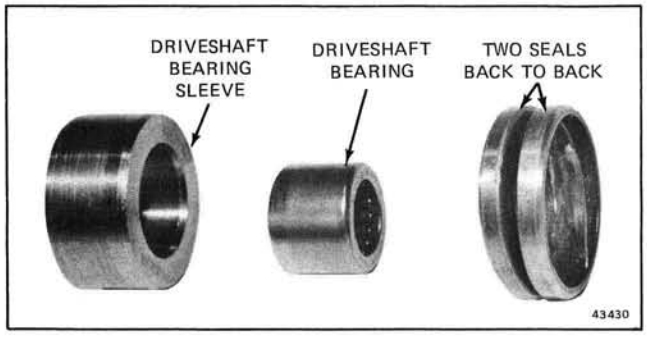


Figure 6-32. Driveshaft Upper Bearing Seals, Bearing and Sleeve

12. If forward roller bearing and cup are worn or pitted, use OMC Special Tool #386661 or #380657 and slide hammer #380658 to remove forward bearing cup. See Figure 6-33. Recesses are provided in gearcase to allow jaws of tool to engage cup.

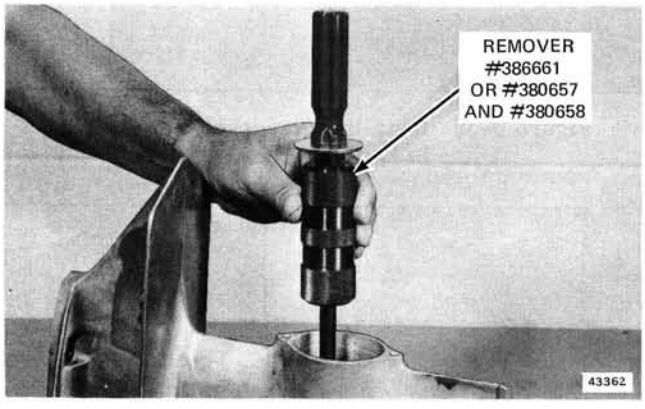


Figure 6-33. Removing Forward Bearing Cup

⚠ SAFETY WARNING

STRIKING A STEEL TOOL WITH A STEEL HAMMER MAY PRODUCE CHIPS WHICH CAN CAUSE SERIOUS DAMAGE TO EYES. SAFETY GLASSES MUST BE WORN TO PREVENT INJURY.

13. Using bearing remover (Special Tool #319880) drive driveshaft lower bearing out of gearcase. See Figure 6-34.

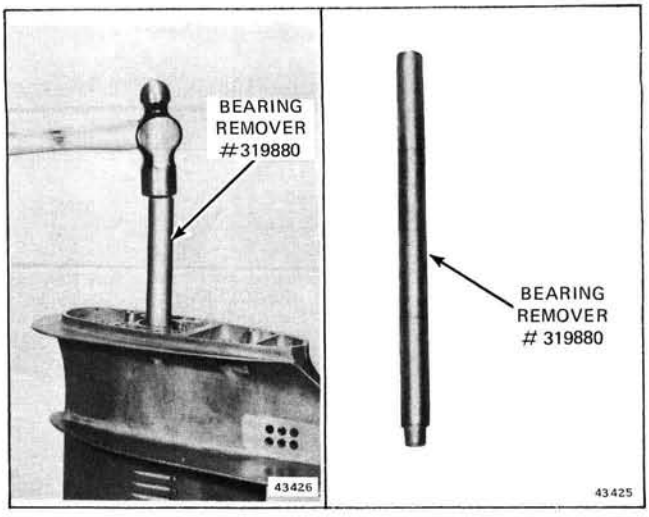


Figure 6-34. Removing Pinion Bearing

14. If bearing housing seals and bearings are worn, use OMC Special Tool #386661 to remove gearcase bearing housing seals (propeller end). See Figure 6-35. Using OMC Special Tool #386661, remove front bearing. See Figure 6-36.

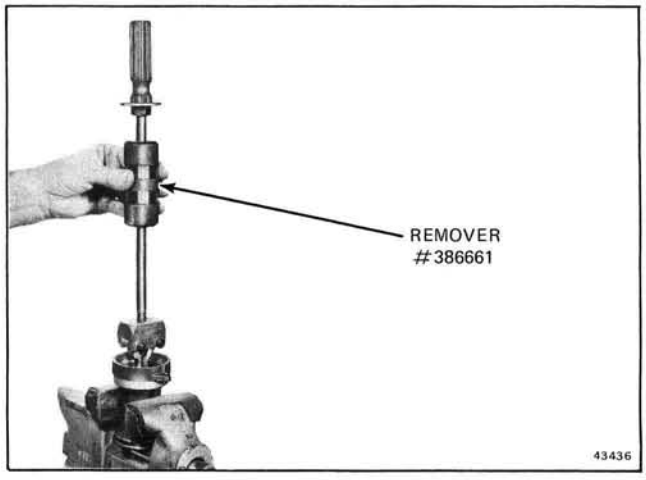


Figure 6-35. Removing Gearcase Bearing Housing Aft Seals

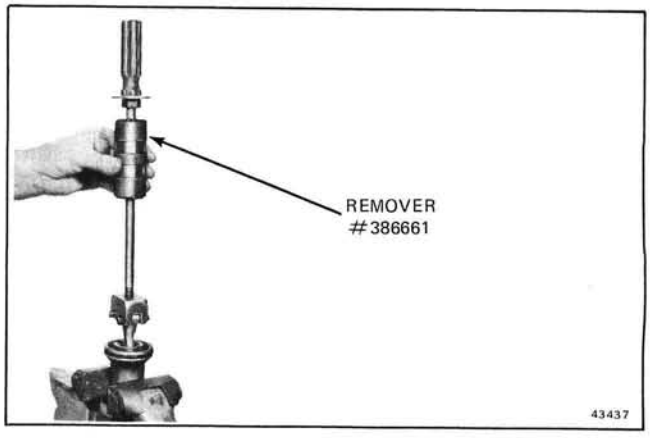


Figure 6-36. Removing Gearcase Bearing Housing Front Bearing

15. Using OMC Special Tool #319880, drive bearing out of bearing housing. See Figure 6-37.

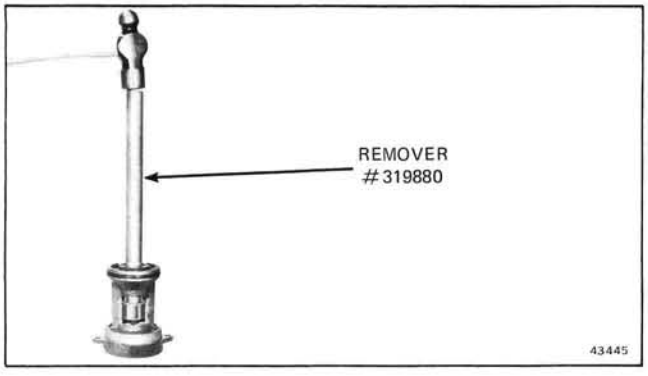


Figure 6-37. Removing Gearcase Bearing Housing Aft Bearing

16. Remove and discard impeller housing seals and grommet. See Figure 6-23.

CLEANING, INSPECTION, AND REPAIR

a. Clean all parts with cleaning solvent such as Solvasol and dry with compressed air.

b. Discard all oil seals, "O" rings, and gaskets. Discard driveshaft and bearing housing bearings if removed.

c. Inspect gearcase for nicks on the machined surfaces. Remove nicks and re-surface faces on a surface plate. Start with No. 120 emery and finish with No. 180.

d. Inspect water pump impeller, pump housing, cup, and impeller housing plate. Replace if worn or damaged.

e. Check water intake screen for deterioration or a plugged condition. Replace if badly corroded.

f. Inspect clutch dog, drive gears, pinion gear, pinion bearing, and thrust washers for wear. Replace if worn. If shifter dog and drive gear engagement surfaces are chipped or excessively rounded off, this may indicate improper shifting by operator of motor, or incorrect adjustment of remote controls.

g. Wash all bearings and cup in a clean solvent such as Solvasol and dry with compressed air. Replace if worn or pitted. Bearing and cup are serviced as an assembly.

h. Inspect propeller for nicks, broken blades, and cracks. DO NOT attempt to weld cracked or broken propellers. Remove minor nicks with a file. Note that the aft side of the propeller is flat while the other side is rounded. File blades accordingly to retain shape. Replace converging ring if damaged or missing. See Figure 6-22.

GEARCASE ASSEMBLY

⚠ SAFETY WARNING

STRIKING A STEEL TOOL WITH A STEEL HAMMER MAY PRODUCE CHIPS WHICH CAN CAUSE SERIOUS DAMAGE TO EYES. SAFETY GLASSES MUST BE WORN TO PREVENT INJURY.

NOTE

Use OMC Gasket Sealing Compound Part Number 317201 in bores or around metal case of all pressed in seals in gearcase bearing housing and impeller housing.

Make no dry assemblies. Lubricate bearings, shafts and gears with OMC HI-VIS Gearcase Lube. Use OMC Needle Bearing Grease to hold detent spring and balls in propeller shaft.

Assemble gearcase as follows:

1. If removed, install reverse gear bearing in bearing housing, using bearing installer (Special OMC Tool #319876) and an arbor press. Press against lettered side of case. See Figure 6-38. Install front bearing using bearing installer (Special OMC Tool #319875) and an arbor press. Press against lettered side of case. See Figure 6-39. Using seal installer (OMC Special Tool #319877) and an arbor press, press two seals (back to back) into the bearing housing. Install a new "O" ring. See Figure 6-40.

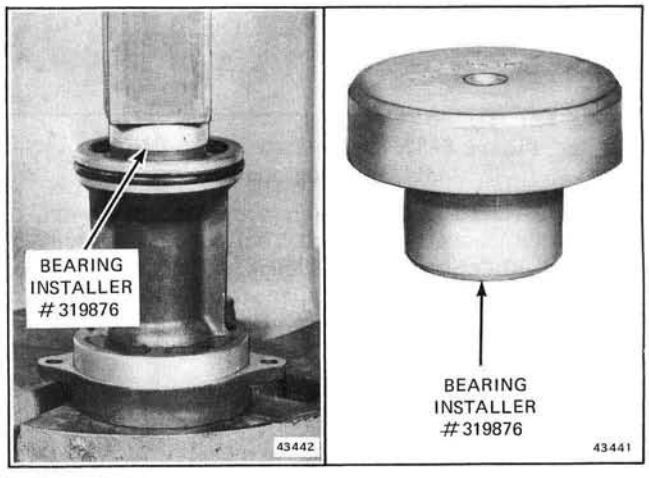


Figure 6-38. Installing Reverse Gear Bearing in Bearing Housing

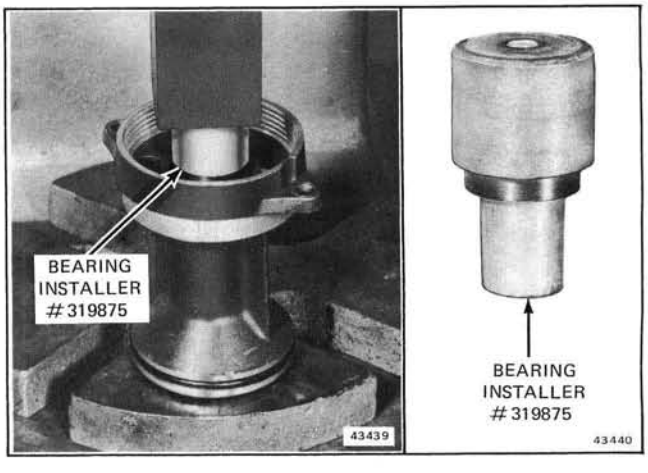


Figure 6-39. Installing Bearing in Bearing Housing

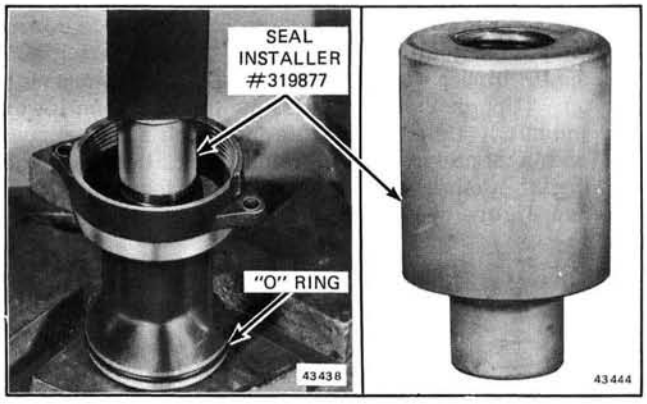


Figure 6-40. Installing Bearing Housing Seals

2. If removed, install forward bearing cup using bearing cup installer (OMC Special Tool #319929) and drive handle (OMC Special Tool #311880). See Figure 6-41.

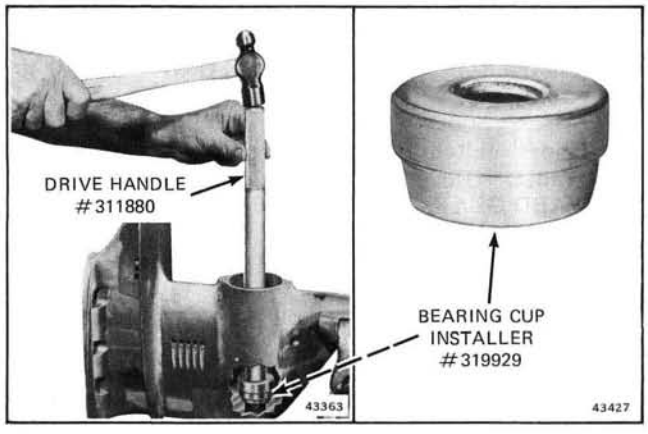


Figure 6-41. Installing Forward Bearing Cup

3. If removed, install driveshaft pinion bearing using bearing installer (OMC Special Tool #319878) and components from bearing installer (OMC Special Tool #383173). See Figure 6-42. Place bearing with lettered side against tool. Insert in gearcase. Thread components from OMC Special Tool #383173 into bearing installer (OMC Special Tool #319878). Pull bearing into gearcase.

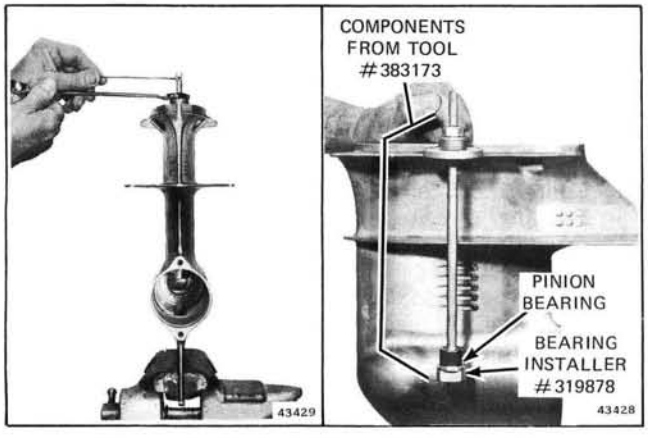


Figure 6-42. Installing Pinion Bearing

4. If removed, press driveshaft upper bearing into sleeve using bearing installer (OMC Special Tool #319931) and an arbor press. Press against lettered side of bearing. See Figure 6-43. Using OMC Special Tool #319931 and drive handle (OMC Special Tool #311880), drive driveshaft bearing and sleeve into gearcase. See Figure 6-44. Drive against lettered side of bearing. Install driveshaft seals back to back using seal installer (OMC Special Tool #319930) and drive handle #311880. See Figure 6-45.

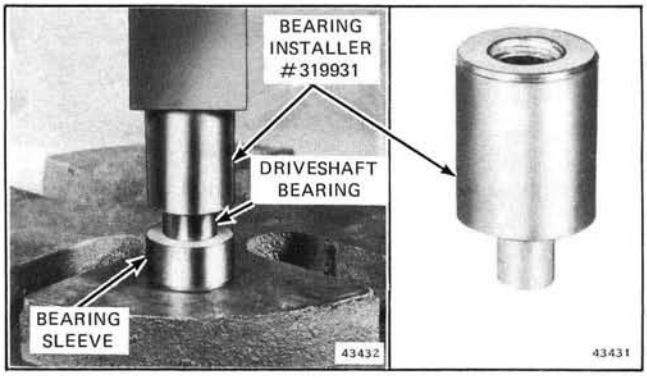


Figure 6-43. Installing Driveshaft Upper Bearing in Sleeve

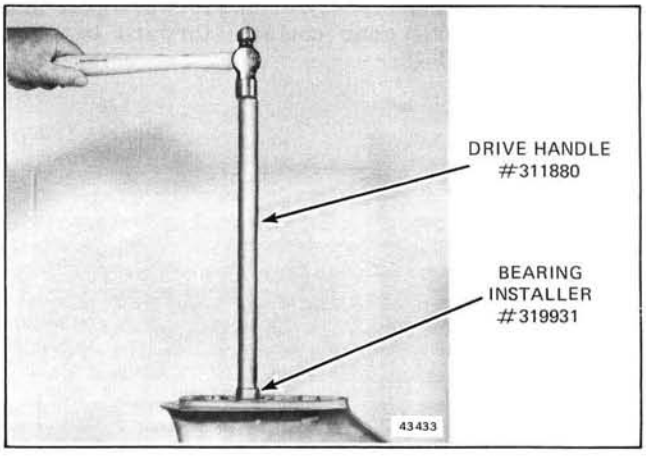


Figure 6-44. Installing Driveshaft Bearing and Sleeve

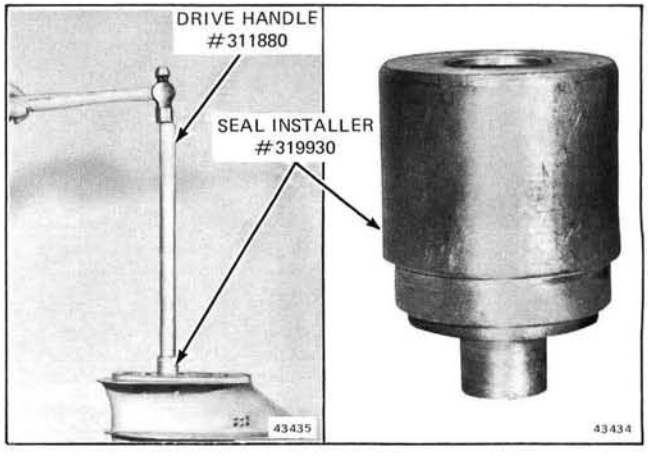


Figure 6-45. Installing Driveshaft Upper Seals

5. If removed, install new washer, "O" ring, and shift rod bushing using bushing installer (OMC Special Tool #304515). See Figure 6-46.

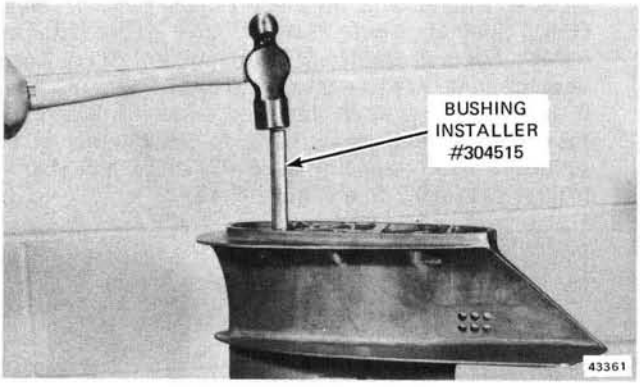


Figure 6-46. Installing Shift Rod Bushing, O-Ring and Washer

6. Install forward bearing in cup. Insert threaded end of yoke locator (OMC Special Tool #319991) through shift rod cavity and out propeller shaft end of gearcase. Thread tool into shifter lever and yoke assembly, and position forward gear in yoke. Install cradle on shifter lever. See Figure 6-47. Using a screwdriver or other suitable tool and yoke locator, guide shifter lever and yoke assembly, cradle and forward gear into gearcase until gear contacts forward bearing. See Figure 6-48.

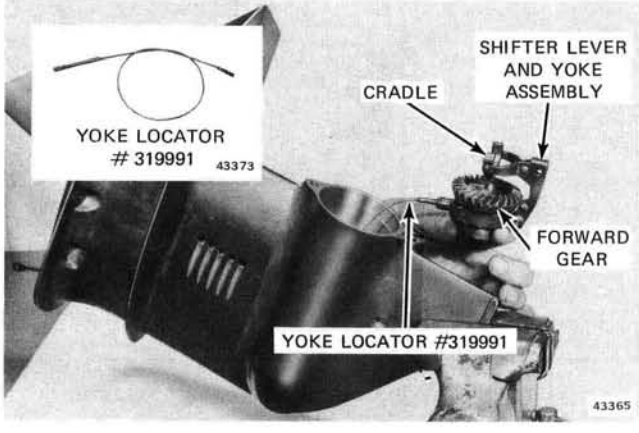


Figure 6-47. Installing Shifter Lever and Yoke Assembly

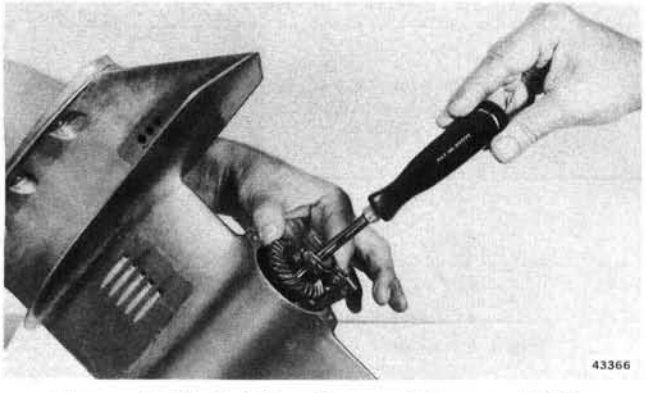


Figure 6-48. Guiding Forward Gear and Yoke Into Gearcase

7. Position lower thrust washer, chamfer side down, on pinion gear. Place pinion thrust bearing and upper thrust washer on gear O.D. chamfer side up. (Upper thrust washer is thicker than lower washer.) Using a suitable tool such as the thrust rod assembly, guide pinion gear, bearing, and thrust washers into the driveshaft lower bearing. See Figure 6-49.

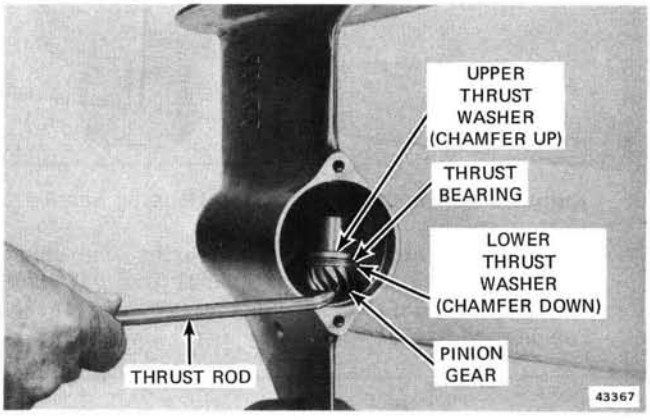


Figure 6-49. Installing Pinion Gear, Thrust Washers and Bearing

8. Insert clutch dog in gearcase and position in cradle. GROOVES ON DOG MUST FACE FORWARD GEAR. See Figure 6-50.

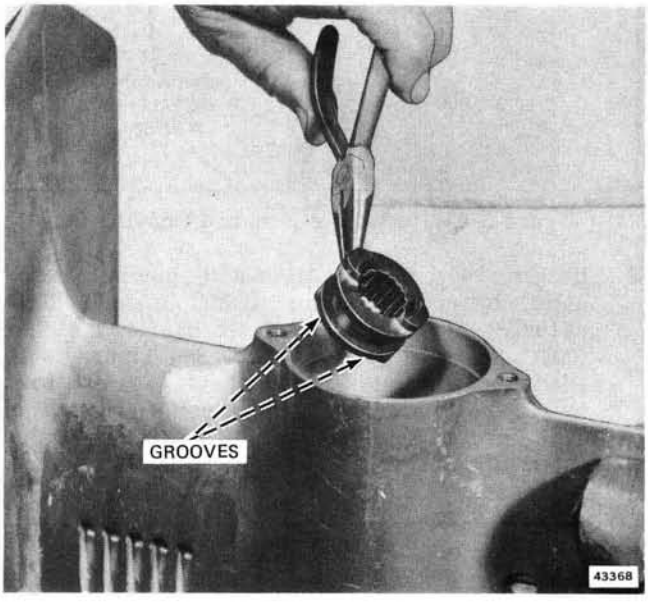


Figure 6-50. Installing Clutch Dog

9. Coat detent spring and balls with OMC Needle Bearing Grease to hold in place, and insert in propeller shaft. Align detent balls with ramps in clutch dog. Insert propeller shaft through clutch dog, forward gear, and into forward bearing. See Figure 6-51. Install reverse gear. See Figure 6-52. Lubricate bearing housing and "O" ring with oil and install bearing housing. See Figure 6-53. Dip screws in OMC Gasket Sealing Compound and tighten to torque specifications, Section 2.

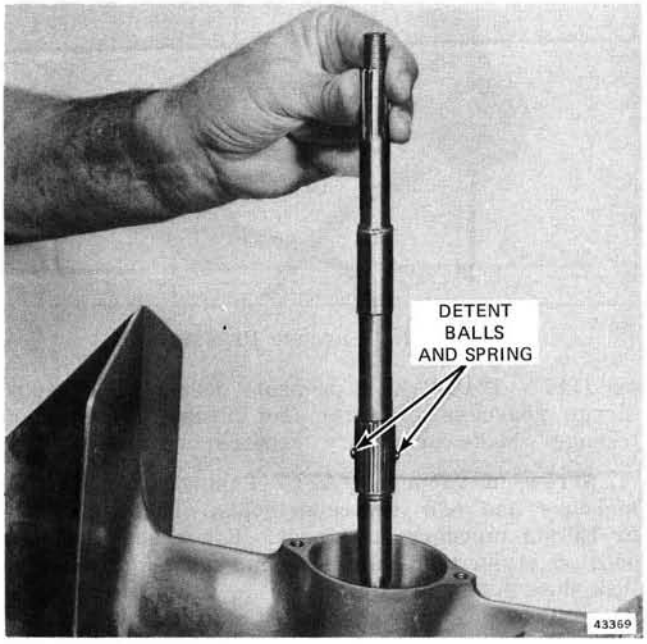


Figure 6-51. Installing Propeller Shaft, Spring and Detent Balls

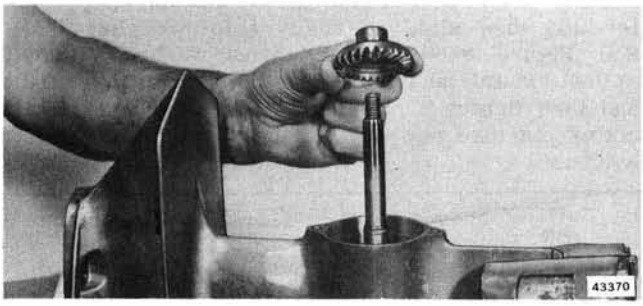


Figure 6-52. Installing Reverse Gear

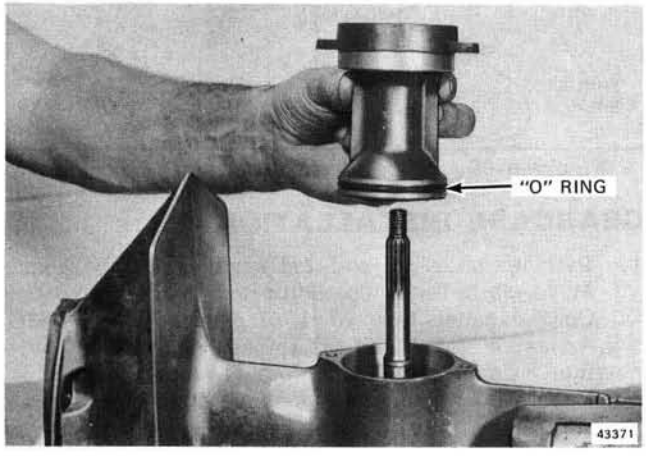


Figure 6-53. Installing Bearing Housing

10. Using yoke locator (OMC Special Tool #319991) install pivot pin dipped in OMC Gasket Sealing Compound. See Figure 6-54. Torque to specifications, Section 2.
11. Install driveshaft. Thread shift rod with connector into shifter lever yoke until seated. Then back out just enough so lever faces forward and flat surface on connector faces driveshaft. See Figure 6-55.

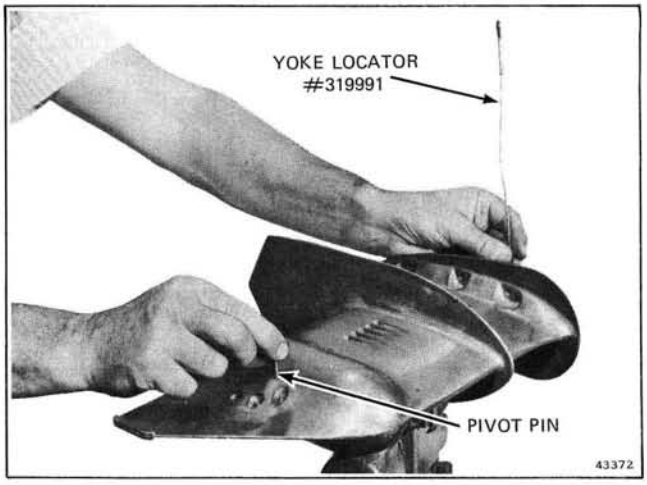


Figure 6-54. Installing Pivot Pin

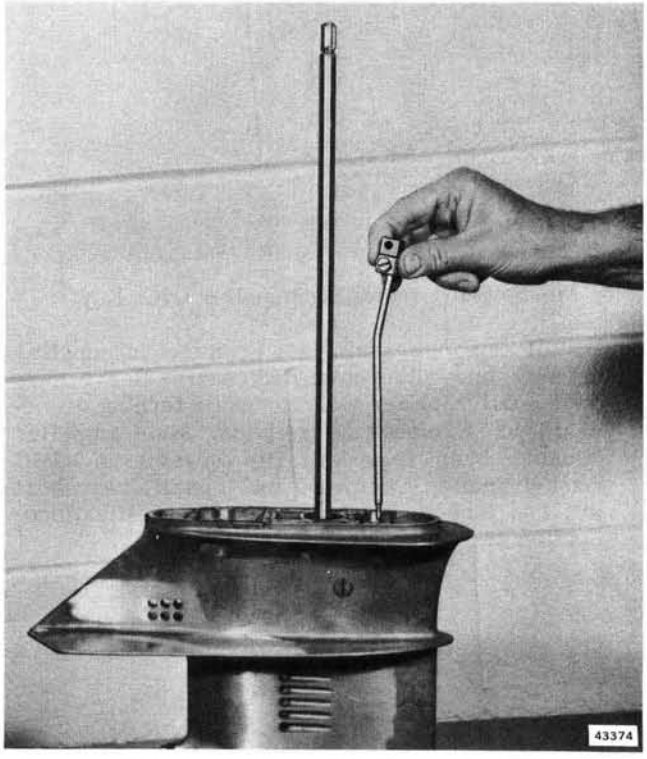


Figure 6-55. Installing Lower Shift Rod and Connector

NOTE

Find neutral gear. Measure from top edge of connector to flat surface on gearcase. This dimension should be between 5/16 inch (8.0 mm) minimum to 11/32 inch (8.7 mm) maximum. If necessary, unscrew shift rod as required to establish this dimension. See Figure 6-56.

12. Apply a fine bead of OMC Adhesive "M" to water pump impeller plate and install. Use OMC Needle Bearing Grease to hold impeller pin on flat spot of driveshaft. Slide impeller down driveshaft and over pin. See Figure 6-57.

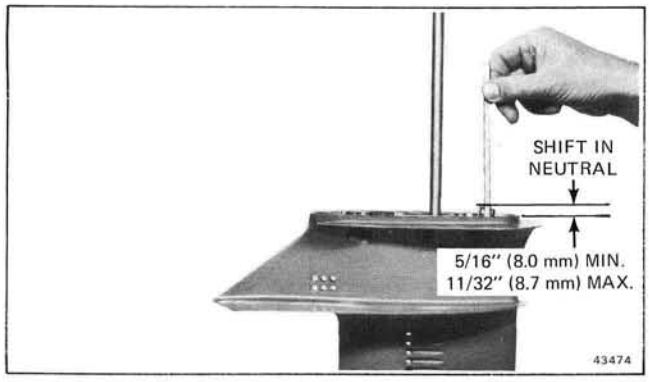


Figure 6-56. Measuring Shift Rod Height, Top of Connector to Gearcase

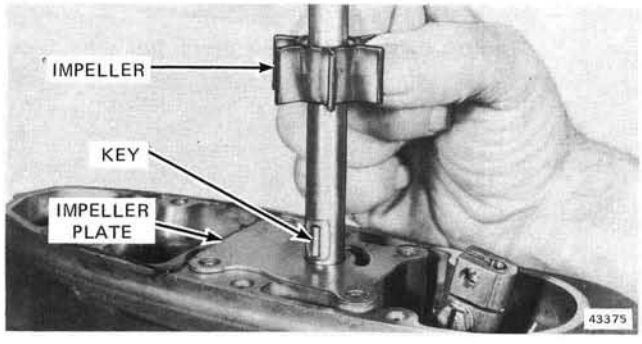


Figure 6-57. Installing Impeller Over Key

13. Install cup, new seals, and grommet in impeller housing and slide down driveshaft. See Figure 6-58. Oil impeller blades. While turning driveshaft in a clockwise rotation, slide impeller housing over impeller. Dip screws in OMC Gasket Sealing Compound and install, two short aft, two long forward. Torque to specifications, Section 2.

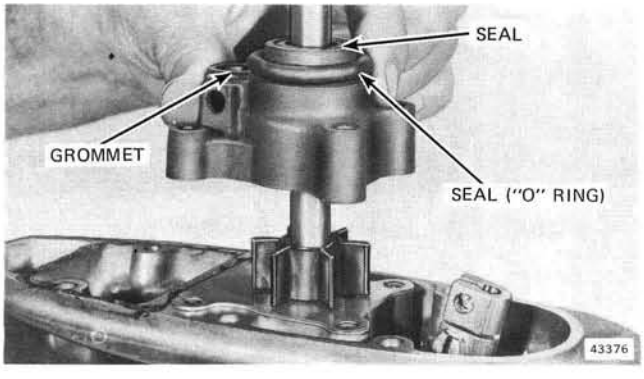


Figure 6-58. Installing Impeller Housing

GEARCASE PRESSURE TEST

To test gearcase sealing, proceed as follows:

a. Remove drain plug and screw in a pressure test gauge. See Figure 6-59. Stevens Experimental pressure test gauge illustrated.

b. Pump pressure up to 3-6 psi (21 - 42 kPa). If pressure gauge indicates leakage, submerge gearcase in water to determine source of leakage as evidenced by bubbles. If gearcase pressure gauge does not indicate leakage, increase pressure to 16-18 psi (110 - 124 kPa). If pressure does not hold, submerge gearcase in water and check for source of leakage. Make necessary repairs and repeat test.

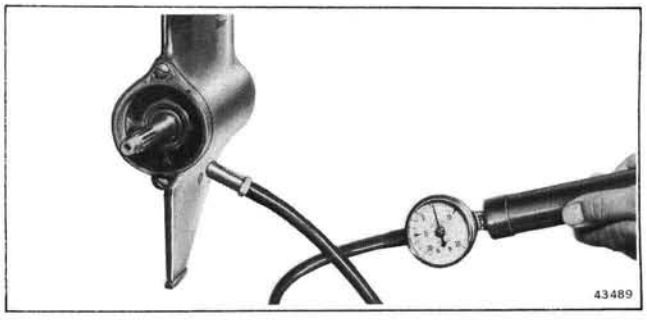


Figure 6-59. Gearcase Pressure Test

c. Screw in vacuum tester. Pump out to 3-5" of mercury and see if vacuum holds. Then pump out to 15" of mercury and check. If gearcase fails to hold on either test, put oil around suspected seal. If leak then stops or oil is drawn in, that seal is defective. When gearcase checks out ok, refill with lubricant. See Section 2, Lubrication Chart.

d. Coat propeller shaft splines with OMC Gasket Sealing Compound. Place thrust bushing in propeller and then slide assembly onto propeller shaft. See Figure 6-60. Install thrust washer on shaft spline. Install and tighten propeller nut finger tight and then tighten to align next cotter pin hole. Install cotter pin (use new pin if necessary), bending ends over nut.

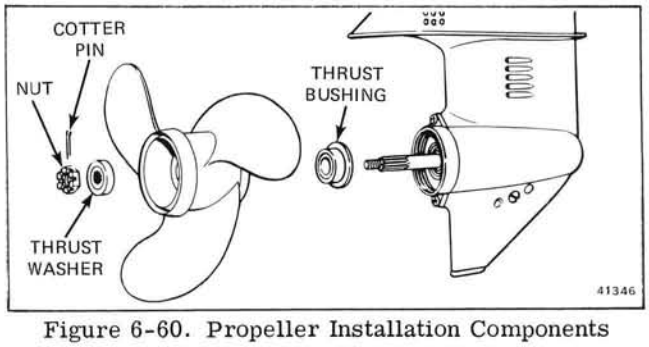


Figure 6-60. Propeller Installation Components

GEARCASE INSTALLATION

1. Pull up on shift rod and engage reverse gear. Move shift lever on motor to reverse position. Coat exhaust tube area of gearcase with OMC Adhesive "M," and oil impeller housing grommet. Coat driveshaft splines with OMC Moly Lube. Do not coat top surface of shaft as lubricant here may prevent seating of driveshaft in crankshaft. Carefully install gearcase making sure driveshaft splines engage crankshaft (rotate propeller slightly), water tube enters impeller housing grommet, and upper shift rod enters connector. See Figure 6-4. Insert upper connector screw and washer and tighten to torque specifications. See Section 2.
2. Dip the six gearcase screws in OMC Gasket Sealing Compound and attach gearcase to exhaust housing. Torque screws to specifications. See Section 2.

3. Fill gearcase with OMC HI-VIS Gearcase Lube. See Figure 6-61 and Section 2, page 2-4 for proper filling procedure.

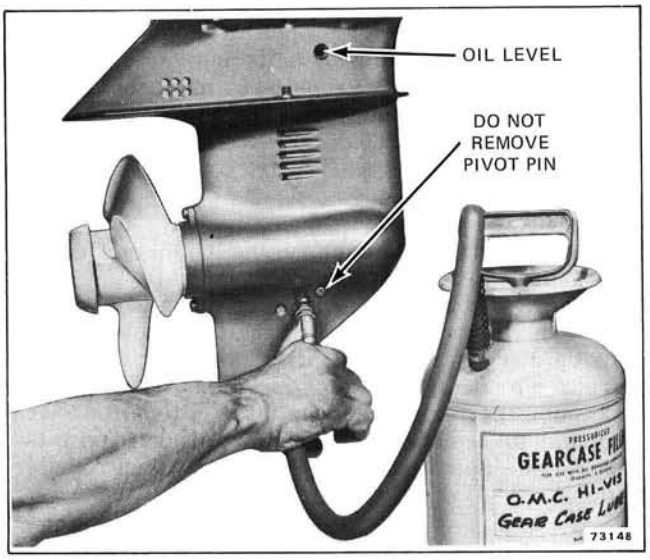


Figure 6-61. Filling Gearcase

ADJUSTMENTS

TILT FRICTION ADJUSTMENT

Use 9/16" wrench to tighten the tilt shaft nut only enough to control the return of the lower unit from TILT to RUN position. See Figure 6-62.

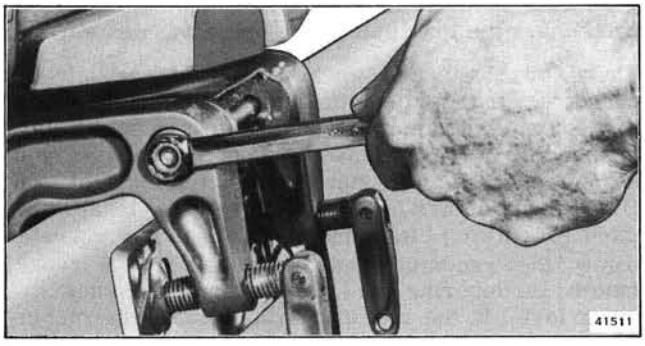


Figure 6-62. Tilt Friction Adjustment

NOTE

DO NOT overtighten, as doing so will increase the pressure required to tilt the motor when an obstruction is hit. Failure to tilt when hitting an obstruction can do serious damage to your motor. See Torque Specifications, Section 2.

STEERING FRICTION ADJUSTMENT

Adjust steering friction with motor mounted to boat by simply loosening or tightening screw with screwdriver as shown. Steering friction should be adjusted so that a slight drag is felt when turning. This will allow smooth steering. Minimum friction is required when remote steering is used. See Figure 6-63.

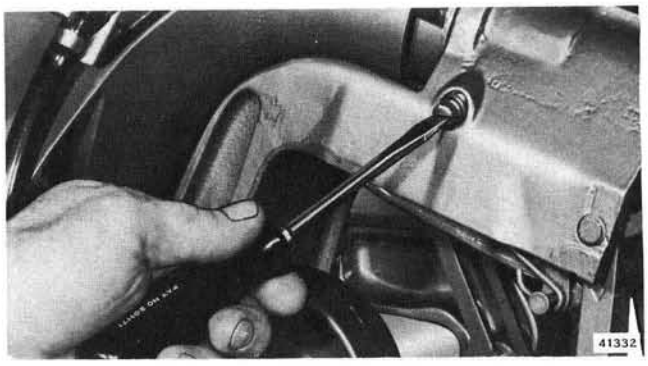


Figure 6-63. Steering Friction Adjustment

SAFETY WARNING

THE STEERING FRICTION ADJUSTMENT IS NOT INTENDED TO ALLOW "HANDS OFF" STEERING. LOSS OF CONTROL COULDRESULT.

SHIFT LEVER ADJUSTMENTS

The adjustment of the gearshift lever must be done in the following sequence:

1. Remove fuel hose on carburetor. See Figure 6-64.

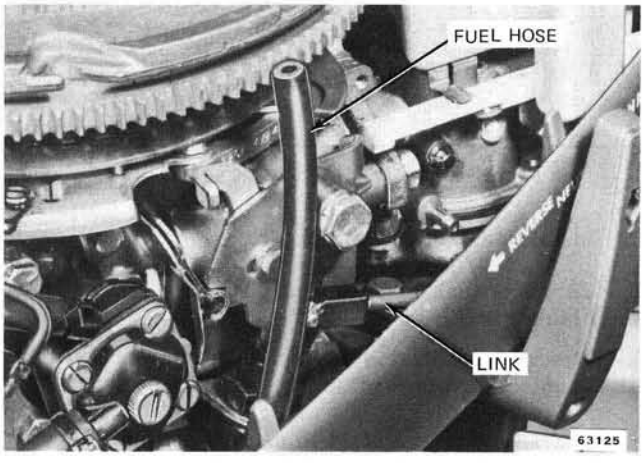


Figure 6-64. Disconnected Hose

2. Remove cotter pin and washer from shift lever to link. See Figures 6-65 and 6-66, hub assembly.

3. Place lever and hub assembly and shift lever in reverse position.

4. Adjust link to align with hole in shift lever. See Figures 6-65 and 6-66.

   Do not exert any pressure on shift lever while making this adjustment.

5. Shorten link one turn more for installation. Slight pressure will be necessary on shift lever when reinstalling link to shift lever. See Figure 6-66.

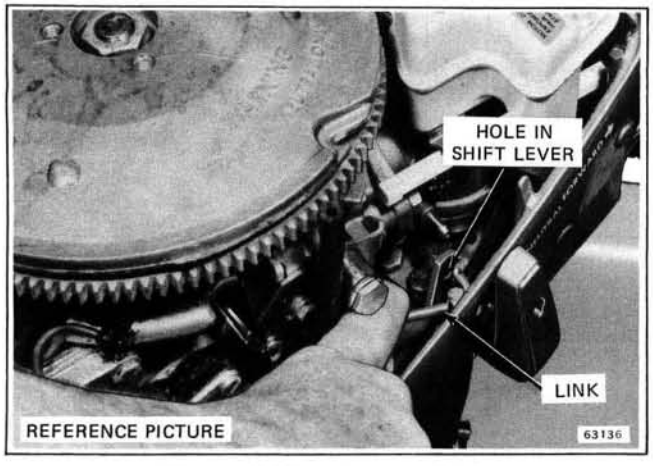


Figure 6-65. Adjusting Link

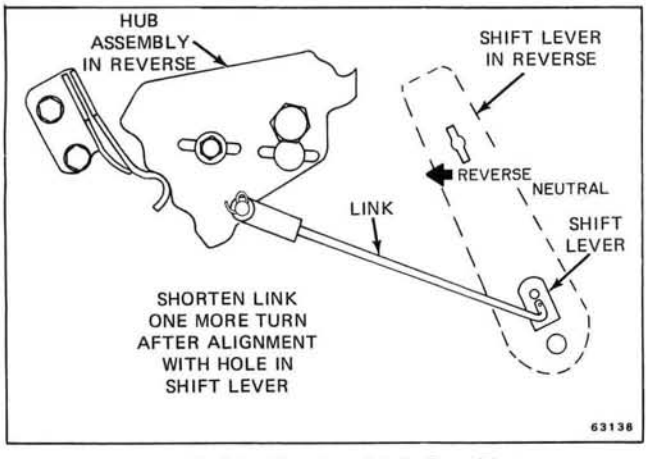


Figure 6-66. Shorten Link One Turn

6. Install washer and cotter pin.
7. Connect fuel hose to carburetor using a new clamp strap.
8. Check and adjust starter lockout pawl clearance as described in Section 8.
9. Check and adjust start in neutral switch (electric start models) as described in Section 7.

SHIFT LOCK STOP ADJUSTMENT

The shift lock stop is attached to the shift lock lever and hub assembly by two screws which regulates the engine speed in neutral and reverse gear. See Figure 6-67. In forward gear, full power should be available. The maximum speed in neutral should be between 3000 and 4000 rpm. In reverse, speed should range between 2500 to 3500 prm.

To adjust, loosen two screws and move stop fore or aft as required to achieve specified speed in neutral and in reverse. Tighten screws and re-check rpm. See Figure 6-67.

PROPELLER SELECTION

GENERAL

Selection of the correct propeller is one of the most critical factors in achieving satisfactory performance of boat and motor. Propellers must be custom selected to match the motor to the boat, load or application. (SELECTION OF AN INCORRECT PROPELLER CAN CAUSE SERIOUS DAMAGE TO THE MOTOR.)

When shipped from the factory, the motor is equipped with a propeller that will give satisfactory performance average conditions. However, since some boats have speed potentials that are quite high, or low, it may be necessary to install a propeller having an increased or decreased pitch and diameter to achieve maximum performance. Optional propellers are available to replace the propeller furnished with the motor. See Specifications, Section 2, for Propeller Options.

SELECTING THE CORRECT PROPELLER

Since propeller pitch and diameter determine motor RPM at a given boat speed, the importance of correct propeller selection cannot be over emphasized. The operation and performance of the motor depends on it. A tachometer is required to check motor rpm. Select a propeller that will allow the motor to run at the top limit of its full throttle operating range with the lightest load that boat will carry. (See Specifications, Section 2, Full Throttle Operating Range.) By selecting a propeller in this manner, rpm loss at full throttle will not, in most cases, drop below the low limit of the operating range.

There are instances where the propeller selected cannot cover the complete range of boat applications, for example, from water skiing to high speed performance. In such cases it may be necessary to change propellers to suit each particular situation. (Light load, higher pitch propeller; heavy load, lower pitch propeller.) Remember, if the motor operates below the recommended full throttle rpm range, motor is laboring and power and efficiency are being lost. If the motor operates above the recommended full throttle rpm range, motor speed is excessive and additional power and efficiency are not being gained. In either case, serious engine damage may result.

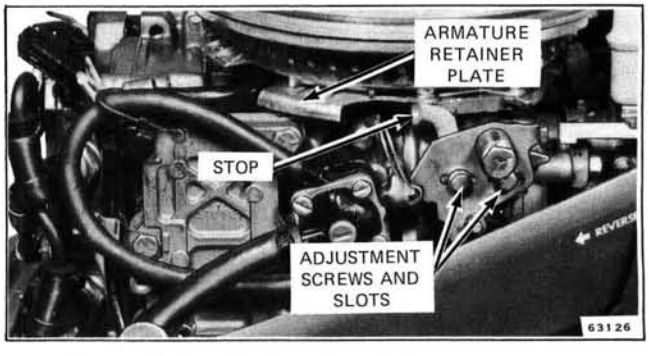


Figure 6-67. Neutral Speed Stop Adjustment

SECTION 7
ELECTRICAL SYSTEM

TABLE OF CONTENTS

7

DESCRIPTION

The Electric Starting Model electrical system is made up of the 5 amp flywheel alternator, ignition system, the starter system, and the storage battery. See Electrical System Schematic at end of Manual, Section 8.

SAFETY WARNING

IF MANUALLY STARTING AND OPERATING MOTOR WITHOUT A BATTERY IN THE SYSTEM, COVER BATTERY RED CABLE TERMINAL END WITH BOOT TO PREVENT DAMAGE TO ALTERNATOR AND DANGER OF ARCING. SPARKS COULD IGNITE GASOLINE FUMES.

TROUBLESHOOTING THE ELECTRICAL SYSTEM

Trouble in the electrical system often is first evidenced by failure of the starter to operate, and may be caused by failure of any one or more of the components covered in this section. A large percentage of electrical circuit as well as component failures are caused by loose or dirty electrical wiring connections. Starter system troubleshooting is included in the Trouble Check Chart in Section 2. Servicing of the starter and battery maintenance, are covered in this Section.

BATTERY SPECIFICATION

For best performance, we recommend a 12-volt battery with a minimum of 350 amps cold cranking rating at 0° F (-18° C) and 100 minutes reserve capacity rating at 80° F (27° C) (61 amp hour reference).

NOTE

For portable use, we recommend OMC Accessories battery part number 172799 and battery box part number 172800.

The important thing to remember is that a customer's complaint about poor electric starting may be traceable to a battery with specifications not conforming to these recommended specifications.

BATTERY TESTING

SAFETY WARNING

BATTERY ELECTROLYTE IS AN ACIDIC SOLUTION AND SHOULD BE HANDLED WITH CARE. IF ELECTROLYTE IS SPILLED OR SPLASHED ON ANY PART OF THE BODY, IMMEDIATELY FLUSH THE EXPOSED AREA WITH LIBERAL AMOUNTS OF WATER AND OBTAIN MEDICAL AID AS SOON AS POSSIBLE.

A. Visual Inspection

The first step in determining the condition of a battery should be a visual inspection. Conditions such as broken, cracked or distorted container or cover, loose terminals or evidence of electrolyte seepage may indicate improper care, installation or application of the battery.

Look for excessive corrosion on the battery terminals and cables. Check the battery cables for worn or frayed insulation. Replace cables if necessary.

Check the electrolyte level in each cell. If electrolyte level is below the plates, it is possible the battery is permanently damaged. Also look for dirt, oil or other contaminants floating in the electrolyte.

The sources of deficiencies noted in the visual inspection should be located and corrected before installation of a new battery.

B. Hydrometer

This test can only be used when there is sufficient electrolyte above the battery plates to fill the hydrometer tube. Do not, however, take readings immediately after refilling the cells with water.

Specify gravity will vary 4 points (.004) with every 10° F (6° C) temperature change. For each 10° F (6° C) below 80° F (27° C), subtract 4 points from hydrometer reading. For each 10° F (6° C) above 80° F (27° C), add 4 points to hydrometer reading.

After correcting to 80° F (26.7° C), interpret readings as follows:

1. All cell readings uniform and above 1.225 specific gravity. Battery is serviceable. May require charging.

2. All cell readings uniform and below 1.225 specific gravity. Recharge to full charge and retest.

NOTE

Disconnect positive cable when charging battery.

3. Variation of more than 30 points (0.030) specific gravity between any two cells. Battery condition is questionable. Recharge and retest before making replacement.

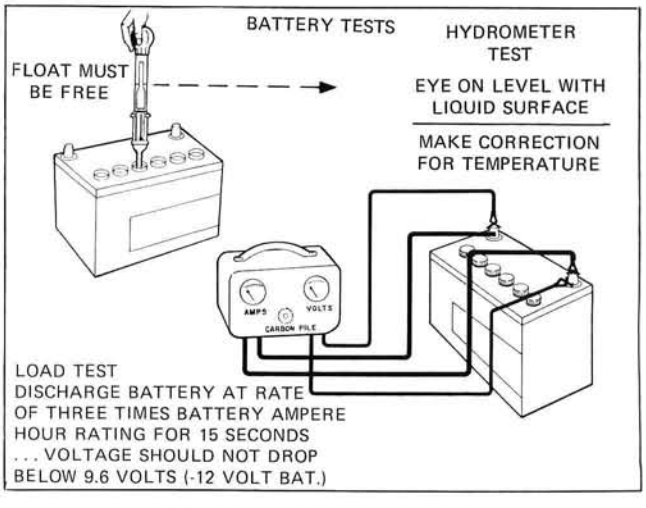


Figure 7-1. Testing Battery

C. Capacity Test

Satisfactory capacity tests can be made only when the battery electrolyte equals or exceeds 1.225 specific gravity at 80° F (27° C).

Terminal Voltage Test

1. Variable Load High Rate Discharge Tester (Recommended)

   Connect tester to battery terminal posts. Discharge at a rate of three times battery ampere hour rating for 15 seconds. If the voltage is 9.6 volts or higher for 12-volt batteries at the end of 15 seconds, the battery has good output capacity.

2. Fixed Resistance Tester

   This equipment has built-in load for high-rate discharge testing. Follow equipment manufacturer's instructions regarding test period and meter readings.

3. Engine Load For Resistance

   Disconnect 4 wire connector between armature plate and power pack. Connect a voltmeter across the battery. Crank engine for 15 seconds. If voltage is 9.6 volts or higher for 12-volt batteries at the end of 15 seconds, the battery has good output capacity.

BATTERY CHARGING

Boost charge 12-volt batteries at 50 amperes for 20 minutes (1000 ampere minutes). If the charger will not give this rate, charge for an equal number of ampere minutes at best rate available. DO NOT boost battery more than this amount for the "light load test."

If batteries are to be fully charged by means of a quick charger, the charge rate must be "tapered" (reduced to a safe limit) when the electrolyte temperature reaches 125° F (52° C), or when gassing becomes excessive. Failure to do so may harm the battery.

If the battery is to be slow charged, adjust electrolyte to proper level by adding water, then charge the battery at 5 amperes until fully charged. Full charge of the battery is indicated when all cell gravities do not increase when checked at three intervals of one hour and all cells are gassing freely. Plenty of time must be allowed for slow charging. Charge periods of 24 hours or more are often required.

BATTERY CARE

The battery should be kept charged at all times. The state of charge should be checked by making specific gravity readings with a battery hydrometer. It is suggested that specific gravity readings and checking for replacement of water be made every two weeks. If the battery has been standing for 30 days, it should be recharged before being placed into service to assure reliable starting. Charge battery to the specific gravity recommended by the battery manufacturer.

The specific gravity of the battery electrolyte should be checked with a battery hydrometer, preferably one that has a built-in thermometer and correction chart. No other method should be used to determine the charge condition of a battery. Note also that a hydrometer reading is not accurate if water has been recently added, due to the fact that the water has not had a chance to mix with the electrolyte.

The proper water level should be maintained at all times. If water is added in freezing weather, the battery should be charged to full charge at once. Only pure distilled water or water approved for battery use should be added to the battery to replace water lost through evaporation. Never add acid except when acid has been lost by spilling.

For mounting the battery, use a battery box securely fastened to the boat. A loose battery may shift in the boat, damaging itself or other equipment. Tighten hold-down nuts evenly until battery is secure. If hold-down nuts are too tight, distortion and damage to battery case will result.

Connect battery cables, making sure clamps are tight on battery posts to insure good contact. Apply a coat of petroleum jelly to exposed areas of the battery posts and clamp connectors to retard corrosion.

STARTER SYSTEM

DESCRIPTION

The electric starting system consists of the starter motor, starter switch, neutral start switch, and the necessary cables and wires with their connectors. The starter motor supplies cranking power to the motor, converting electrical energy from the battery into mechanical power which is transmitted through the drive pinion gear and the flywheel ring gear. The starter switch makes the circuit between the battery and starter motor, when shift lever is in neutral.

The starter motor drive pinion is disengaged when at rest and is made to mesh with the flywheel ring gear by the rotation of the starter motor armature. After the motor has started, the starter pinion is driven faster than the starter motor shaft and moves down the screw shaft out of mesh with the flywheel.

The neutral start switch opens the starter circuit, preventing accidental engaging of the starter motor, whenever the shift lever is in gear. The switch is operated by a plunger which rides on a cam operated by the shift lever. See Figure 7-13.

STARTER REMOVAL

Due to the construction of the starter motor, maintenance operations are generally limited to periodic checking for looseness of mounting. Unless it is certain that the starter motor requires attention, do not remove it for overhaul. A thorough check should be made of the battery, cables, neutral start switch and starter switch as outlined in the Trouble Check Chart in Section 2.

a. Disconnect battery leads from battery.

b. Remove two screws and starter from by-pass cover. See Figure 7-2.

c. Disconnect starter lead at bottom of starter. See Figure 7-2.

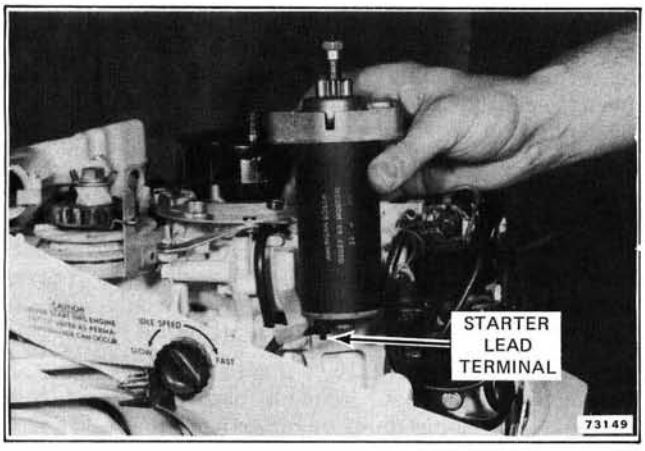


Figure 7-2. Removing Electric Starter

d. Check starter no load test. With 12.0 to 12.4 volts applied, maximum current draw should be 7 amps, speed 7000 to 9200 rpm. See Figure 7-4.

STARTER DISASSEMBLY

a. Remove two thru bolts. See Figures 7-3 and 7-5. Remove drive end cap assembly, and armature from frame and magnet assembly. Remove brush end cap assembly from frame.

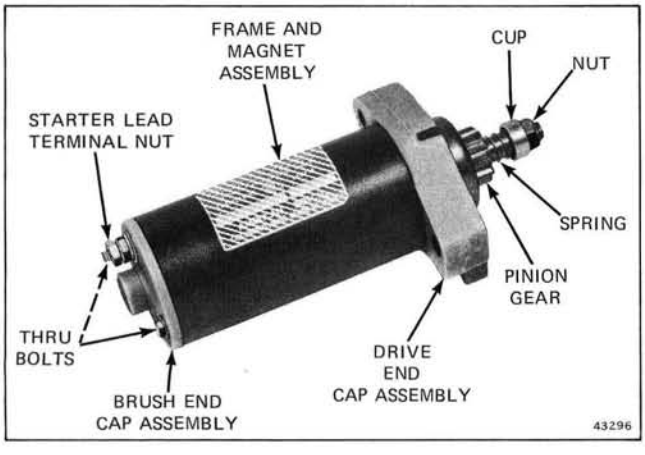


Figure 7-3. Starter Motor on Bench

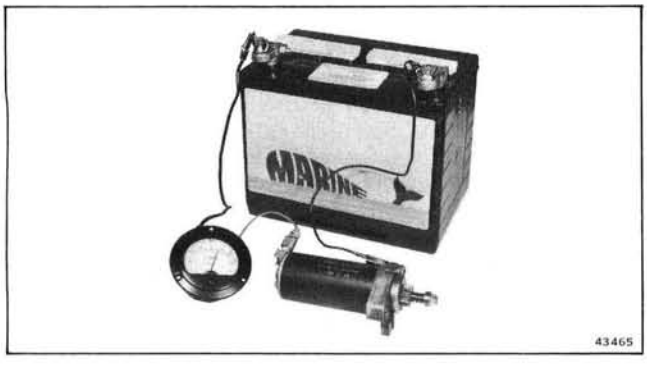


Figure 7-4. No Load Test

b. Remove pinion nut, spacer, spring, pinion gear, thin washer and drive end cap from armature. See Figure 7-5.

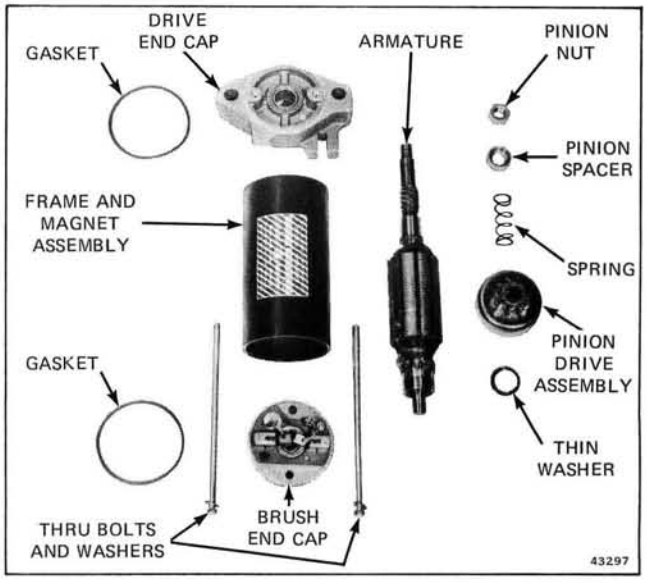


Figure 7-5. Starter Components

CLEANING, INSPECTION, AND REPAIR

a. Inspect the brushes; replace if one-half worn, damaged, or cracked. Replace brush springs if weak.

b. Clean commutator with Grade 00 sandpaper. If commutator surface is unevely worn or pitted, turn on a lathe. Remove any trace of oil from commutator.

c. Check the armature on a growler for shorted turns. See Figure 7-6. Check armature for grounding by using a test light or meter. See Figure 7-7. Inspect armature insulation for indications of overheating or damaged windings. Clean off any deposits of carbon or foreign matter which may contribute to later failure of the windings.

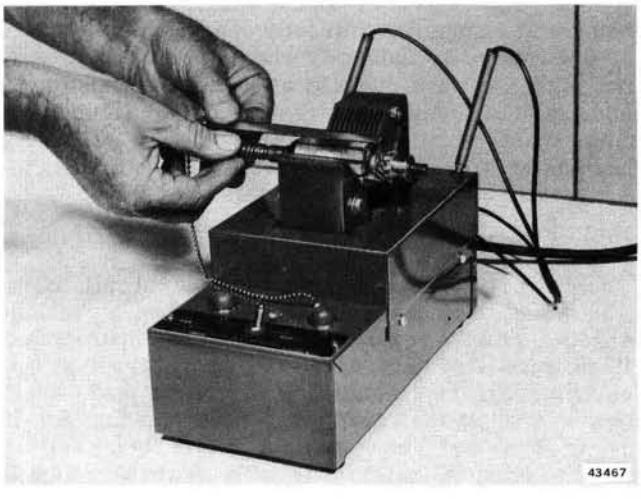


Figure 7-6. Checking for Shorted Turns

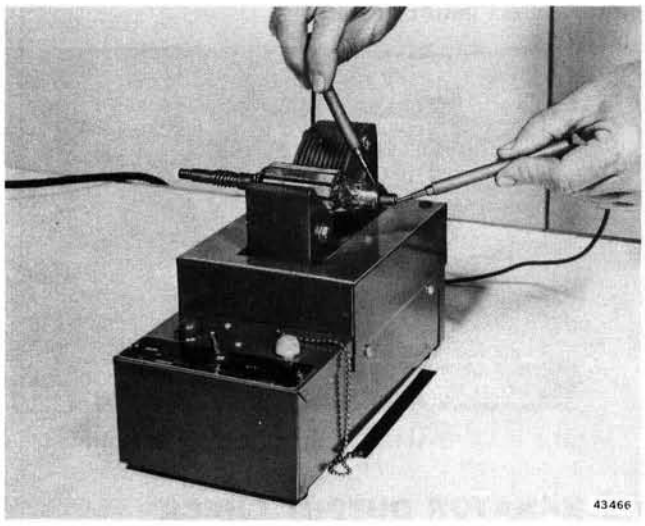


Figure 7-7. Checking for Grounding

d. Check permanent magnets. See Figure 7-8.

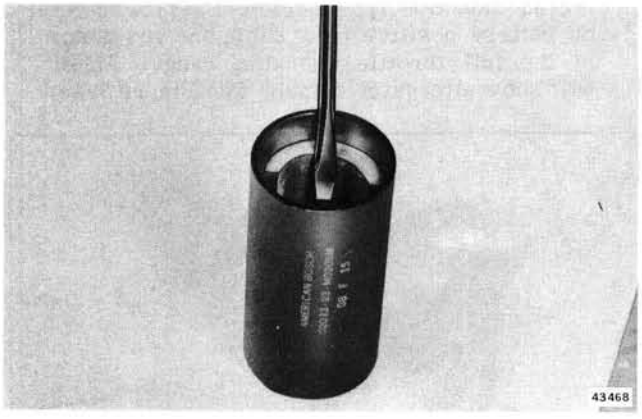


Figure 7-8. Checking Permanent Magnets

e. DO NOT clean the starter drive assembly while the starter motor and drive are installed on the power head. The cleaning agent will drain into the starter motor, washing dirt from the drive into the starter bearings, commutator, etc. After disassembling the drive, clean each part with a grease solvent and inspect for wear or distortion.

f. If the pinion does not properly engage the flywheel, the pinion and screw shaft assembly may be worn, distorted, or dirty. Locate cause of binding and correct before completing assembly.

STARTER REASSEMBLY

a. Lubricate the armature shaft with one drop of SAE No. 10 oil. Lubricate pinion gear helix on armature shaft with Anderol 766. See Lubrication Chart, Section 2.

b. Assemble brush end head with brushes and springs to armature shaft. See Figure 7-9. Position new gasket on end cap. Align brush end cap mark with marks on frame. Assemble to frame and field assembly. See Figure 7-10.

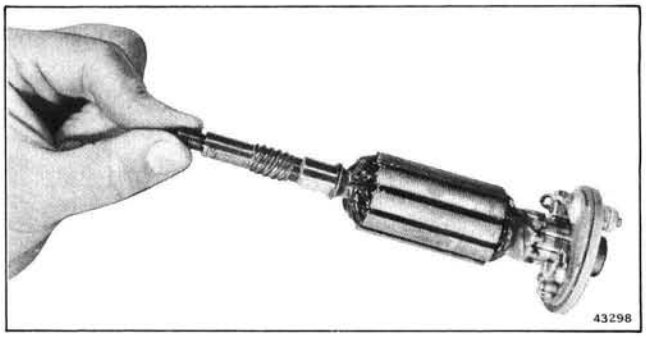


Figure 7-9. Brush End Head on Armature

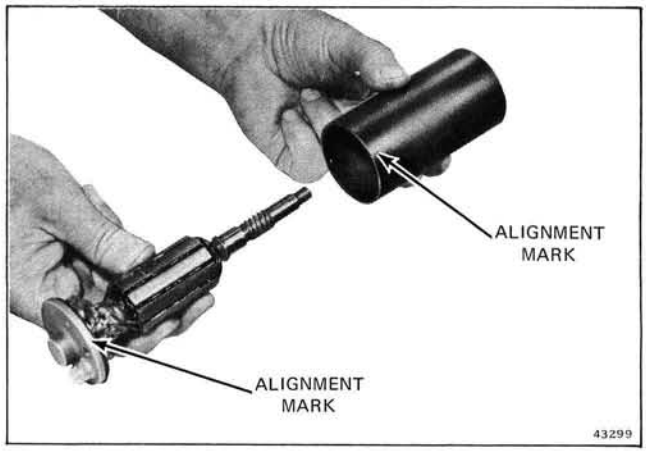


Figure 7-10. Assembling Armature to Frame

SAFETY WARNING

OBSERVE CAUTION WHEN INSERTING ARMATURE IN FRAME ASSEMBLY AS THE PERMANENT MAGNETS IN THE FRAME EXERT EXTREME PULLING FORCE ON THE ARMATURE WHICH COULD RESULT IN PINCHED FINGERS.

c. Place thin washer on armature shaft. See Figure 7-11. Place new gasket on drive end cap assembly. Install drive end cap aligning it with frame. (See alignment marks on frame and drive end cap assembly.) Secure assembly with thrubolts and washers and torque to specifications in Section 2.

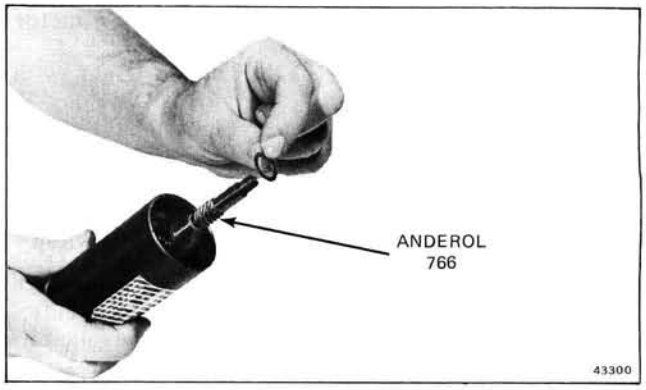


Figure 7-11. Installing Thin Washer

d. Assemble pinion drive, spring, spacer and nut to armature shaft. Torque nut to specifications in Section 2. See Figure 7-12.

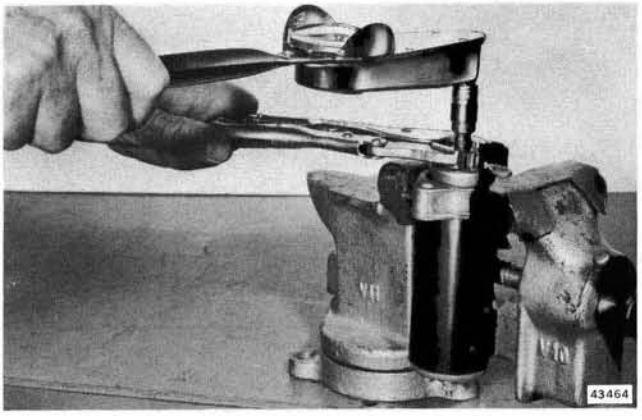


Figure 7-12. Torquing Pinion Nut to 150-170 Inch-Lbs (17-19 N·m)

e. Check starter for no load test. With 12.0 to 12.4 volts applied, maximum current draw should be 7 amps, speed 7000 to 9200 rpm. See Figure 7-4.

STARTER INSTALLATION

(Disconnect battery leads.)

1. Install red lead to starter. See Figure 7-2.

NOTE

When tightening terminal nut, make sure starter lead and terminal does not turn into a position where lead and terminal could contact and short out to starter or lower motor cover.

2. Install starter on by-pass cover. The electric starter motor must be held firmly against bracket while bolting it to the by-pass cover. Tighten screws to specified torque. See Section 2.

START IN NEUTRAL SWITCH ADJUSTMENT

The start in neutral switch adjustment is possible only if the manual interlock cam and the lockout lever and hub adjustments are correct. If these have been disturbed, see Adjustments, Section 6. Then proceed to adjust start in neutral switch as follows:

1. Shift into neutral. Disconnect starter motor red lead. See Figure 7-2, and disconnect battery cables at battery.
2. Connec. a continuity light between starter motor red lead and battery cable red lead.
3. Press starter button. Light should light with motor in neutral.
4. Shift to forward and reverse. Light should go out in forward and reverse.
5. If switch adjustment is required, remove and swing fuel pump out of way. Loosen start in neutral switch screws. Center plunger on switch with lobe on lockout lever (gearshift in neutral) and raise switch to depress plunger between .090 to .150 inch (2.29 - 3.81 mm). Tighten screws. See Figure 7-13. Press starter button and continuity light should light. Shift into forward and reverse. Light should go out before engaging forward or reverse.
6. Reconnect battery cables.

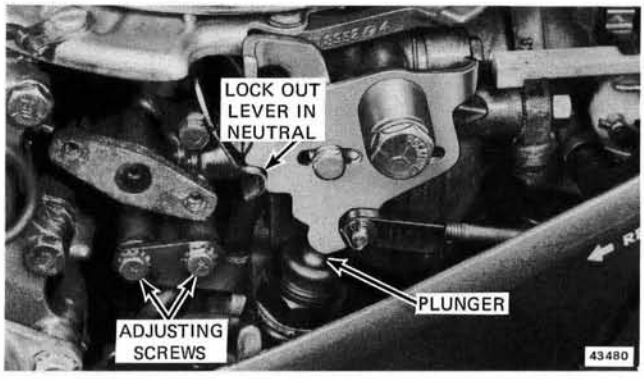


Figure 7-13. Start in Neutral Switch Adjustment

ALTERNATOR OUTPUT CHECK

NOTE

A quick alternator check can be made by using an induction type ammeter. Place meter on battery positive (red) cable and run motor in the full throttle operating range. Meter will show alternator output. See Figure 7-14.

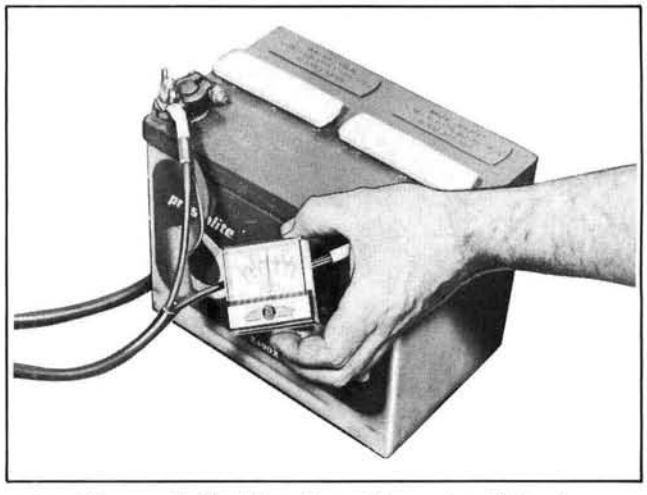


Figure 7-14. Checking Alternator Output

a. Remove terminal board screw connecting rectifier and motor cable red leads. See Figure 7-14A & 7-21.

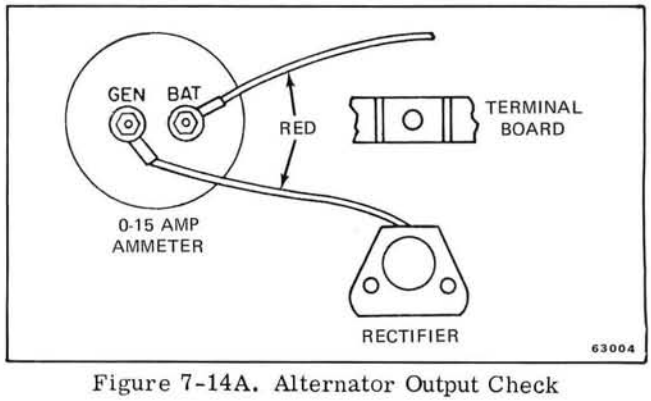


Figure 7-14A. Alternator Output Check

b. Connect rectifier red lead to the generator (GEN) terminal of an OMC Accessories 15 amp ammeter, or any 5 amp ammeter. Connect the other red lead to the ammeter battery terminal (BAT).

c. Start and run engine in its full throttle operating range. The ammeter should indicate the rated output of the alternator as specified in Section 2.

d. If no charge is indicated, test the alternator stator and the rectifier.

ALTERNATOR STATOR TEST

Refer to Figures 7-15 and 7-15A.

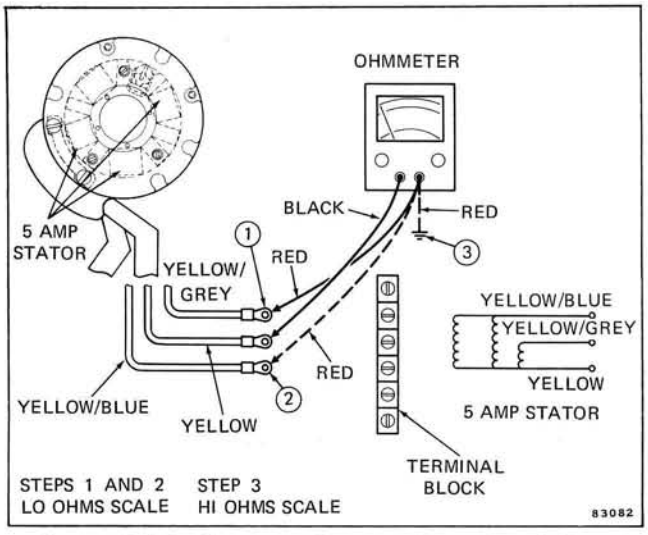


Figure 7-15. Checking 5 Amp Alternator Stator

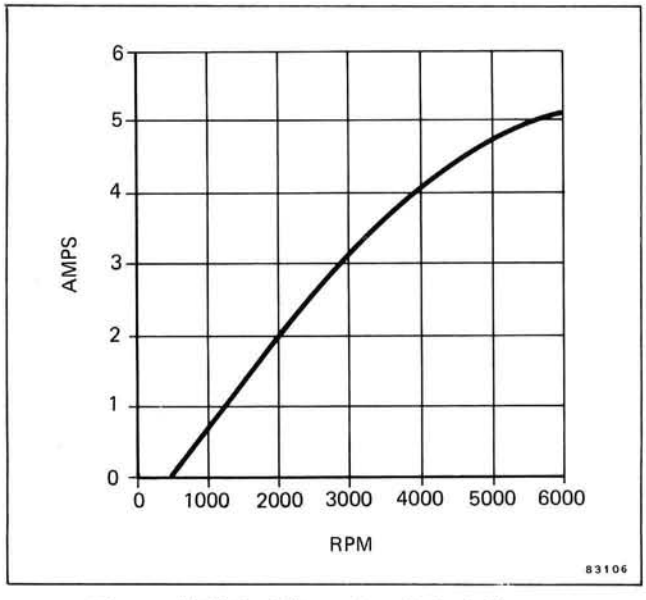


Figure 7-15A. Alternator Output Curve

NOTE

Set Ohmmeter on Low Ohms Scale.

1. Connect black ohmmeter lead to the yellow lead of stator.

   Connect red ohmmeter lead to the yellow with grey stripe lead of the stator. See Figure 7-16. Ohmmeter should read .35 ± .1 ohm.

2. Disconnect ohmmeter red lead from the stator yellow with grey stripe lead. (Leave ohmmeter black lead connected to yellow lead.)

   Connect the ohmmeter's red lead to the stator's yellow with blue stripe lead. See Figure 7-17. Ohmmeter should read .2 ± .1 ohm.

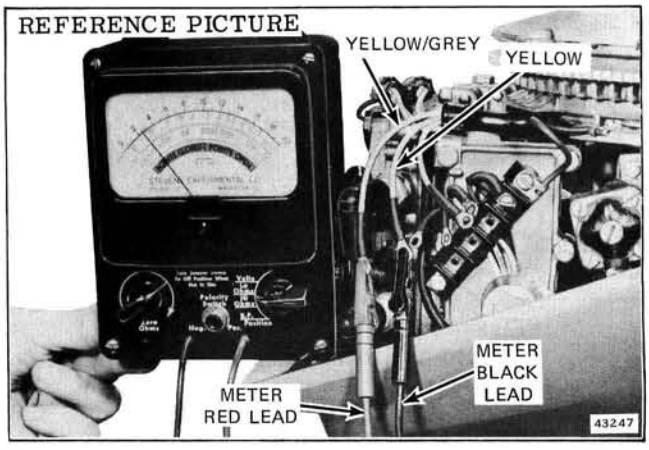


Figure 7-16. Black to Yellow, Red to Yellow/Grey (Step 1)

3. Disconnect red ohmmeter lead from the stator's yellow with blue stripe lead (leaving the ohmmeter's black lead connected to the yellow lead of stator).

NOTE

Set Ohmmeter Scale to Hi Ohms.

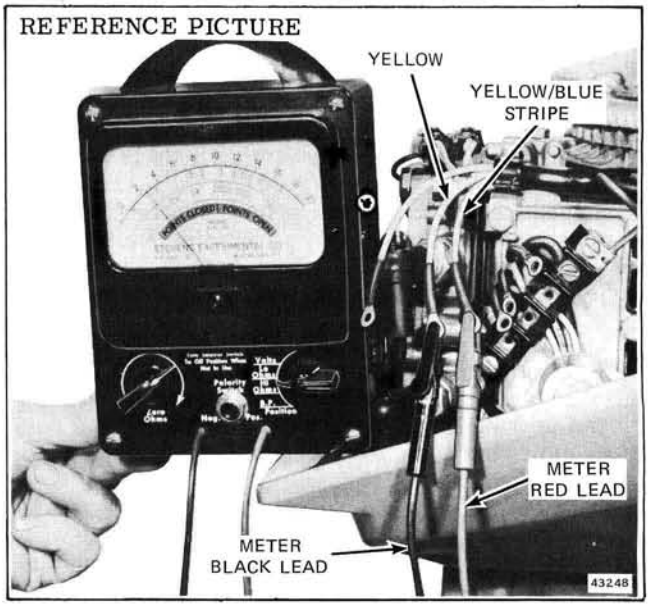


Figure 7-17. Black to Yellow, Red to Yellow/Blue (Step 2)

Connect the ohmmeter's red lead to ground. See Figure 7-18. Ohmmeter should show open circuit (infinity). If ohmmeter shows any reading, stator is shorting to ground.

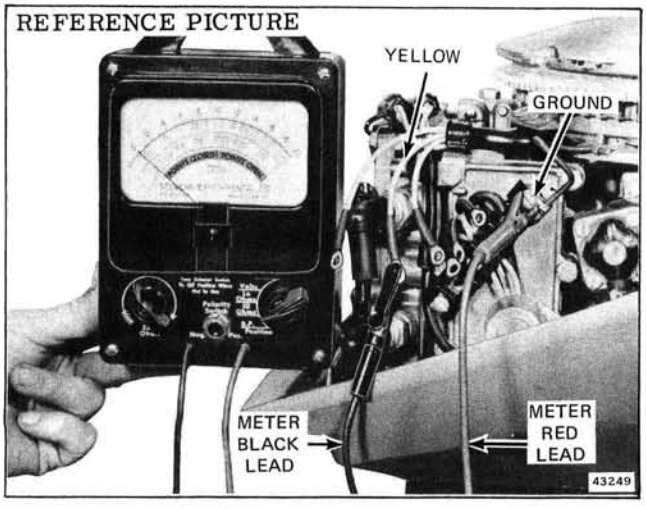


Figure 7-18. Black to Yellow, Red to Ground (Step 3)

RECTIFIER DIODE TEST

1. Connect one lead of ohmmeter to rectifier case (ground) and other lead to yellow/grey stripe lead of rectifier. Note reading. Reverse ohmmeter leads or press polarity button. Note reading. Reading on one check and no reading (infinity) on the other check - diode is good; both readings zero, diode is shorted. Both readings high, diode is (open) defective.

OHMMETER LEADS MUST BE REVERSED FOR EACH TEST OR PRESS POLARITY BUTTON

a. Repeat above test using yellow rectifier lead. Reading on one check and no reading (infinity) on the other check - diode is good; both readings high, diode is open; both readings zero, diode is shorted.

b. Repeat above test using yellow/blue stripe lead. Reading on one check and no reading (infinity) on the other check - diode is good; both readings high, diode is open; both readings zero, diode is shorted.

2. Repeat test procedure with ohmmeter between red lead of rectifier and yellow/grey stripe lead of rectifier. Reading on one check and no reading (infinity) on the other check - diode is good; both readings high, diode is open; both readings zero, diode is shorted.

a. Repeat test between red and yellow lead of rectifier. Reading on one check and no reading (infinity) on the other check - diode is good; both readings high, diode is open; both readings zero, diode is shorted.

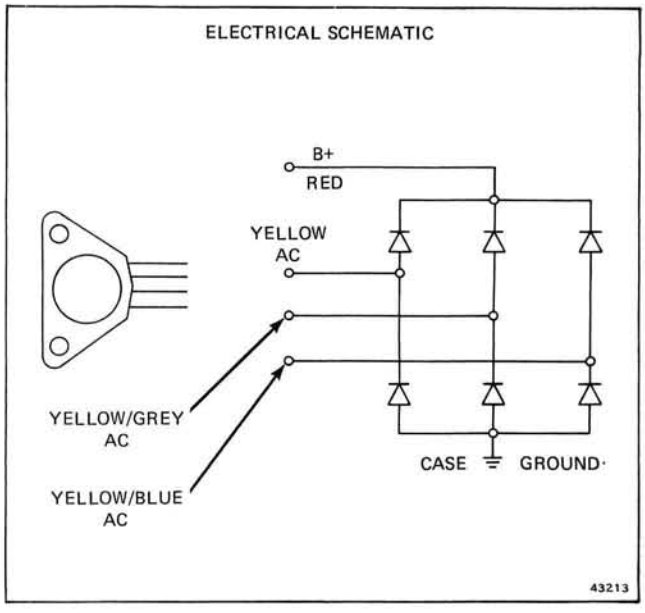


Figure 7-19. Three Phase Rectifier

b. Repeat test between red and yellow/blue stripe lead of rectifier. Reading on one check and no reading (infinity) on the other check - diode is good; both readings high, diode is open; both readings zero, diode is shorted.

ELECTRIC START SYSTEM CHECK

Battery must be fully charged. Check battery charge. Recharge battery if necessary. Check battery connections. They must be clean and tight.

STARTER WON'T CRANK MOTOR

1. Remove fuel pump for access to neutral start switch terminals. Place gearshift lever in neutral.

2. Connect a voltmeter to point (1) Figure 7-21 on neutral start switch. Press starter switch button. Battery voltage should be indicated. No voltage indicated, move meter to point (2) red lead on terminal block. If voltage is indicated, disconnect battery leads at battery. Disconnect starter switch leads at points (1) and (2). Check switch and leads for continuity and replace if defective. See continuity check below.

3. Move meter to point (3) starter motor to neutral start switch red lead. Make sure shift control lever is in neutral. Press starter switch button. Voltage should be indicated. If no voltage indicated, neutral start switch may be out of adjustment. Check switch by manually depressing switch button. If voltage does not indicate, check for loose connections and replace neutral start switch, if necessary. If voltage is indicated, adjust start in neutral switch. See "Start in Neutral Switch Adjustment" page 7-6.

4. Move meter to point (4). Press start switch button. Voltage should be indicated. If no voltage is indicated, lead is open between point (3) and (4).

5. If voltage is indicated at point (4) on starter motor and starter motor does not crank engine, remove and test starter motor. See starter motor removal and test pages 7-3 and 7-4.

CONTINUITY CHECK OF STARTER SWITCH AND LEAD ASSEMBLY

With ohmmeter set to low ohms scale, check continuity as follows:

NOTE

Battery leads must be disconnected at battery and starter switch leads disconnected at points (1) and (2), Figures 7-20 and 7-21.

1. Connect one lead of ohmmeter to point (1) and other lead of ohmmeter to point (2). Press starter switch button. Meter should show continuity. If meter does not show continuity, leads or switch are open and assembly must be replaced.

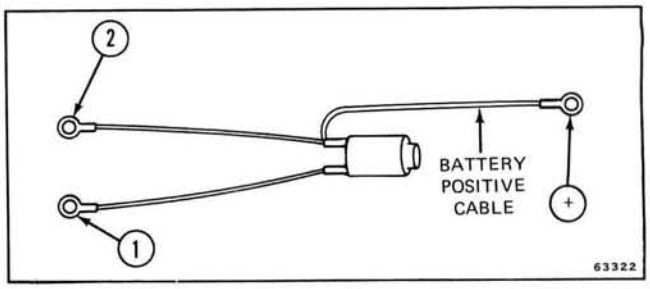


Figure 7-20. Switch Leads

2. Connect one lead of meter to point (1) and other lead of meter to point (+). Press starter switch button. Meter should show continuity. If meter does not show continuity, leads or switch are open and assembly must be replaced.

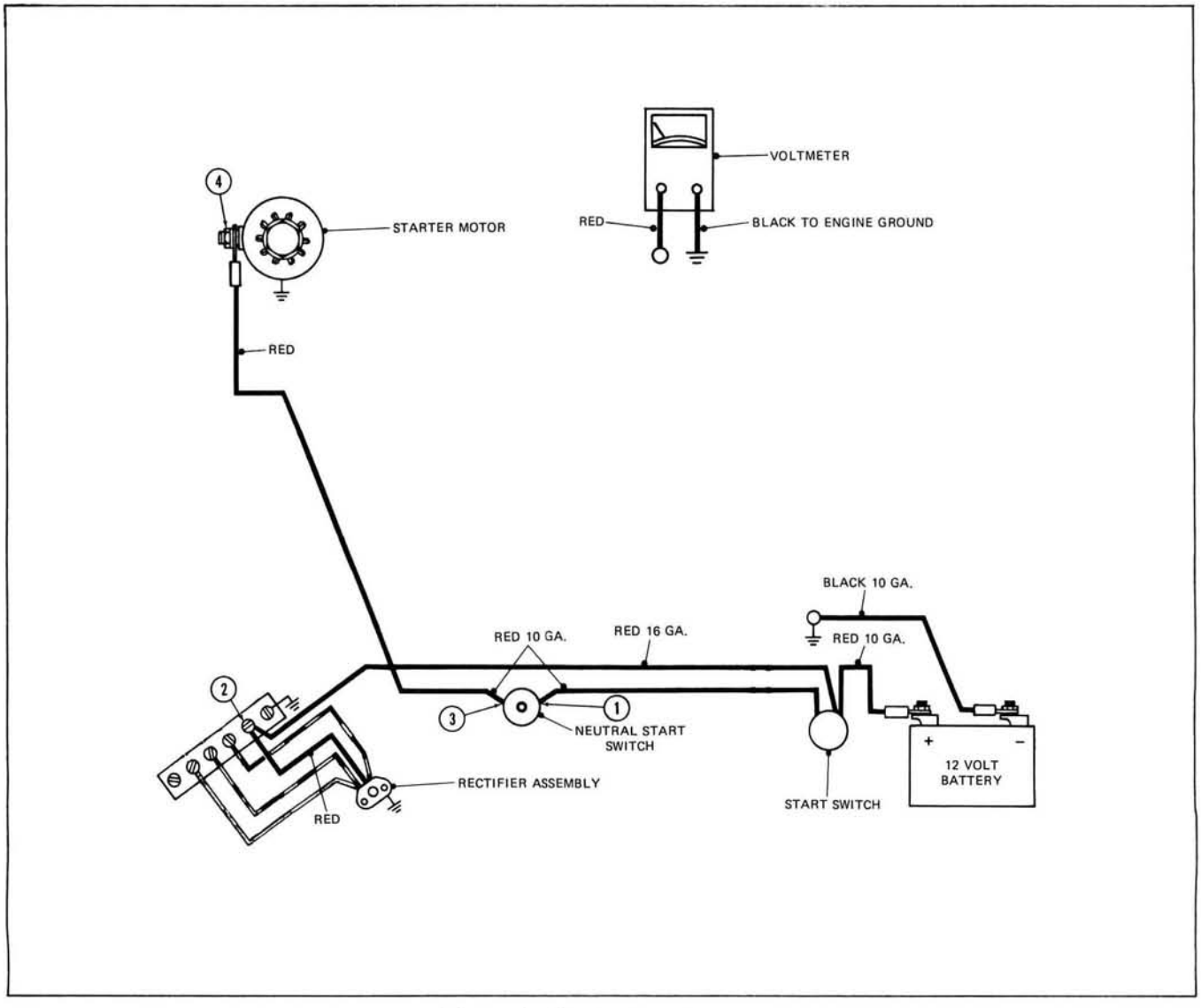


Figure 7-21. Starting Circuit

SECTION 8
MANUAL STARTER

TABLE OF CONTENTS

8

DESCRIPTION

The gear drive starter is a design employing the principles of automotive type starters. The nylon pinion gear slides upward and engages the flywheel ring gear as the starter rope is pulled, and automatically disengages when the motor starts. The ratio between the pinion gear and the ring gear has been selected to provide maximum cranking speed with minimum pulling effort to ensure fast, easy starting. See Figures 8-1 and 8-2. A lockout pawl linked to the cam follower prevents manual starter engagement if throttle is advanced beyond start position.

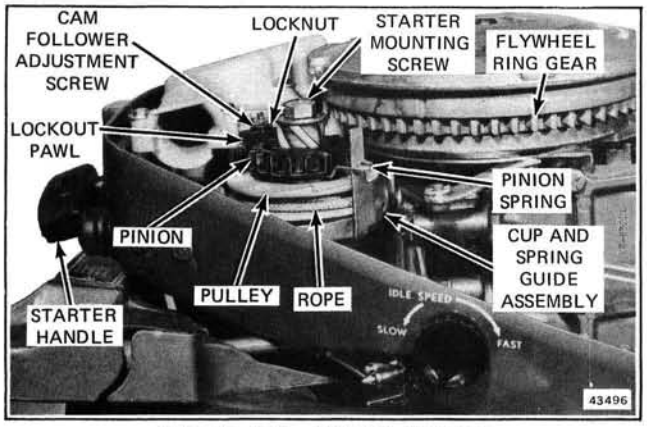


Figure 8-1. Manual Starter

STARTER REMOVAL

1. Pull out rope and tie a knot to relieve spring tension while removing starter handle. Remove rope anchor from handle, and disengage rope from anchor. See Figure 8-3.

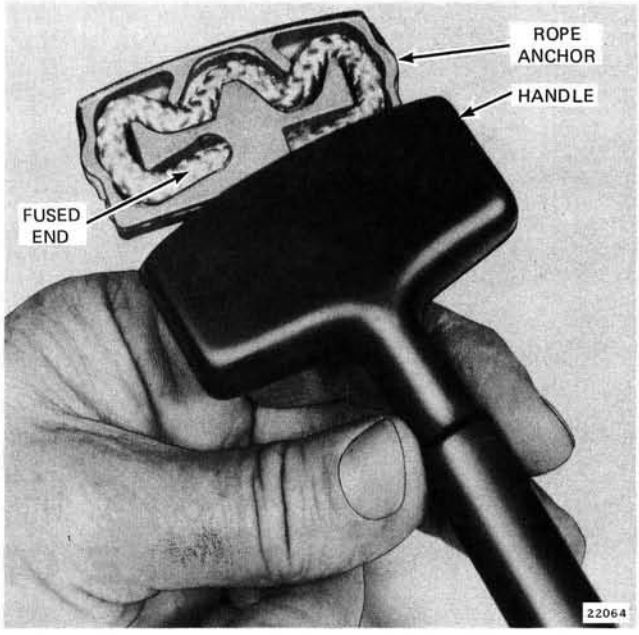


Figure 8-3. Removing Rope Anchor

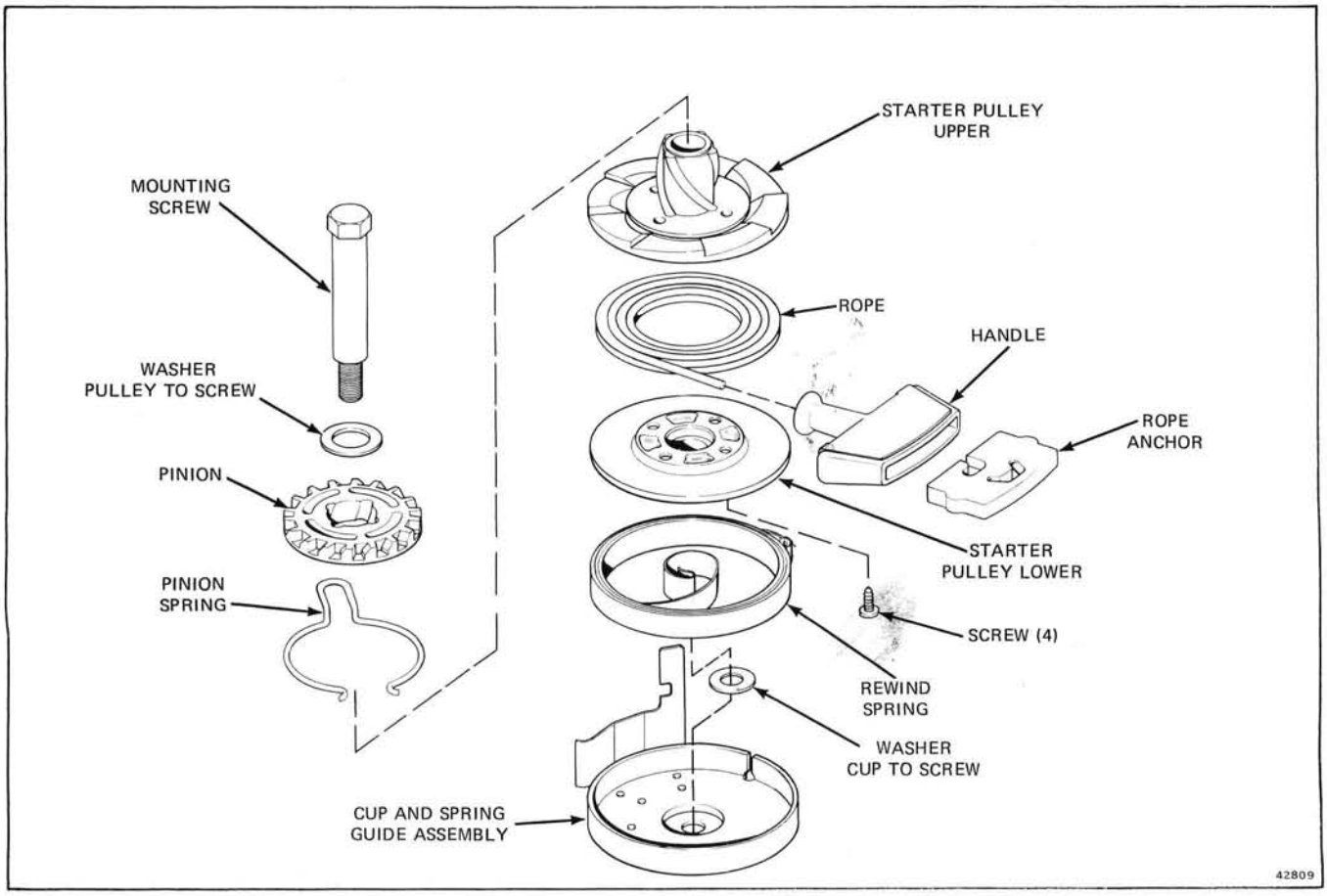


Figure 8-2. Starter Components

2. Remove handle and allow pulley to slowly rewind rope.

3. Loosen starter mounting screw, and back it out of manifold while holding pulley and cup together to retain rewind spring in cup. See Figure 8-4.

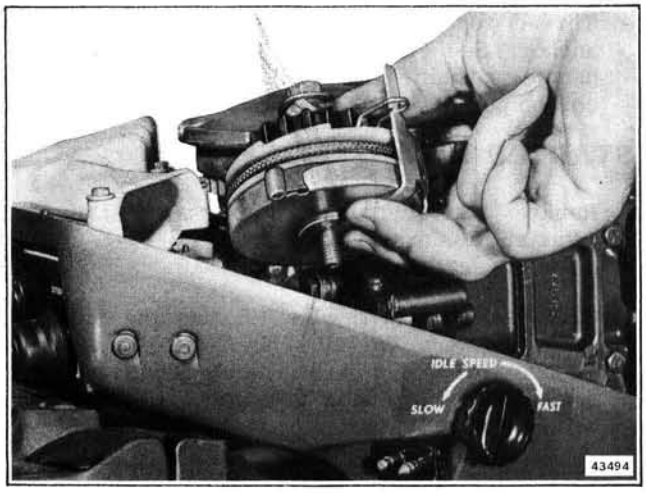


Figure 8-4. Removing Starter

SAFETY WARNING

BECAUSE OF TENSION RETAINED BY THE REWIND SPRING, YOU MUST PROTECT YOUR EYES BY WEARING SAFETY GLASSES WHILE DISASSEMBLING AND RE-ASSEMBLING MANUAL STARTER.

NOTE

If starter is not to be disassembled, thread a 3/8"-16 nut on end of mounting screw to retain pulley and spring in cup.

ROPE REPLACEMENT

1. Remove starter from manifold as described in "Starter Removal."
2. Remove mounting screw and washer. See Figure 8-5.
3. Remove pinion spring and pinion from pulley. See Figure 8-5.
4. Use a putty knife or other suitable tool to retain spring in cup, and remove pulley from cup. See Figures 8-6 and 8-7.
5. Remove four screws and separate pulley to remove rope. See Figures 8-7 and 8-8.

NOTE

If installing a new rope, cut length to 71-1/2 inches (1820 mm). Using a match or cigarette lighter, fuse nylon strands at each end for about 1/2 inch (12 mm). Rope ends must be fused to hold properly in anchor and pulley.

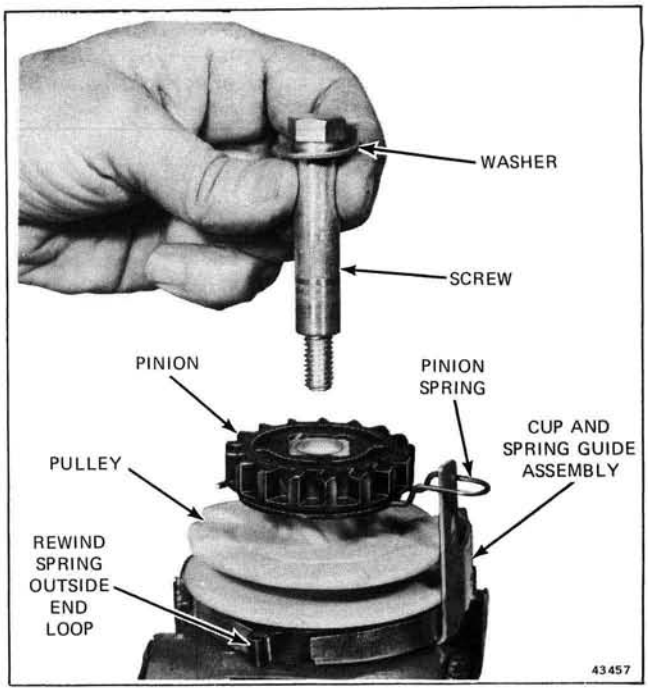


Figure 8-5. Removing Screw, Washer and Pinion

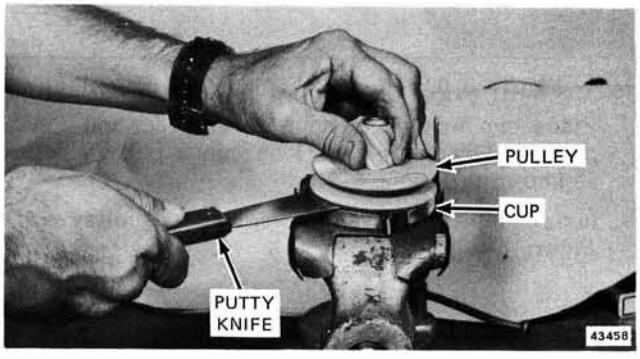


Figure 8-6. Removing Pulley From Cup and Spring

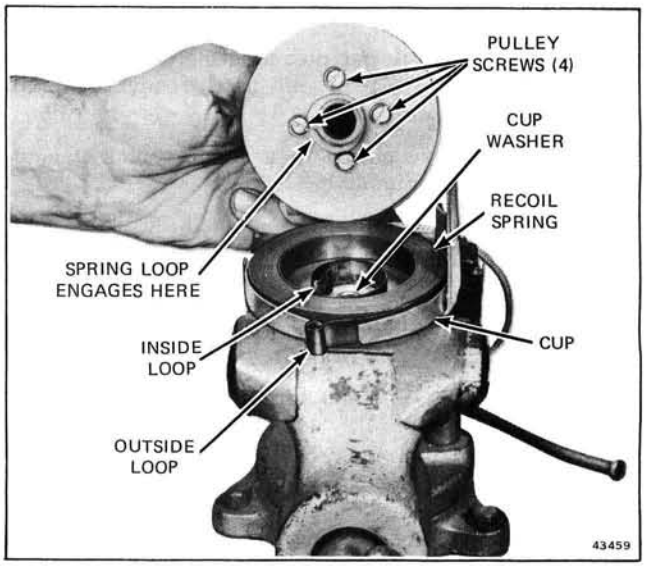


Figure 8-7. Pulley Removed

6. Tie knot in one end of rope (see Figure 8-8) and engage knot in pulley. See Figure 8-8A. Assemble pulley and torque screws to specifications. See Section 2.

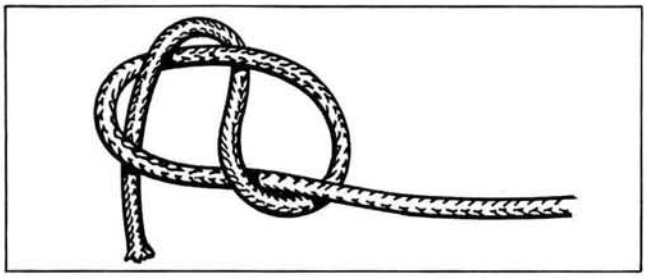


Figure 8-8. Rope Knot Formation

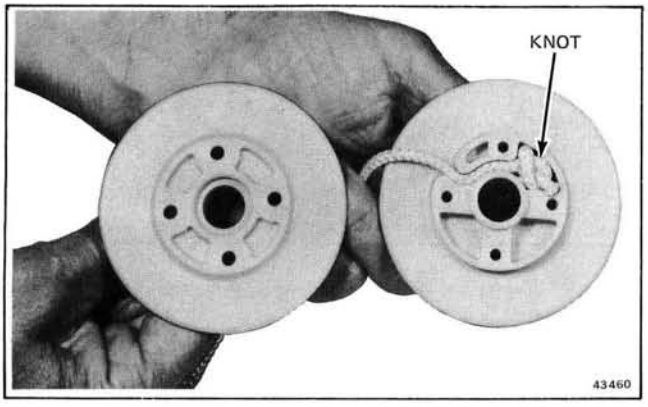


Figure 8-8A. Rope Knot Installed in Pulley

7. Place cup washer in cup, if removed, and install pulley. Rewind spring loop must engage pulley as shown in Figure 8-7.

8. Install pinion and pinion spring on pulley. See Figure 8-5.

NOTE

Do not lubricate pulley or pinion.

9. Lubricate mounting screw and washer with OMC outboard oil and install through pulley, cup washer, and cup.

10. Thread 3/8"-16 nut on mounting screw to hold pulley and spring in cup until ready to install starter on manifold.

11. Wind rope on pulley in a counterclockwise direction. See Figure 8-4.

STARTER INSTALLATION

1. If installed, remove 3/8"-16 nut from mounting screw.

2. Hold starter pulley and spring in cup, and position starter on manifold as shown in Figure 8-1. Thread mounting screw into manifold and torque to specifications. See Section 2.

3. Thread rope through lower motor cover, and pull rope out all the way. With rope fully extended, starter spring end must be free to extend a minimum of 1/2 inch (12.7 mm) from cup. If correction is necessary, allow rope to rewind on pulley. Unwind rope from pulley one turn or as necessary to relieve spring tension. Recheck, if okay, tie a temporary knot to relieve spring tension while installing handle.

4. Thread rope through handle, and install in rope anchor. See Figure 8-3. Press rope anchor into handle and untie knot. Allow rope to slowly recoil on pulley.

STARTER DISASSEMBLY

1. Remove starter from manifold as described in "Starter Removal," and thread a 3/8"-16 nut on mounting screw.

2. Clamp starter in a vise locating the mounting screw between the vise jaws. See Figure 8-9. Engage spring loop with a screwdriver, and pull spring out of cup until fully unwound. See Figure 8-9.

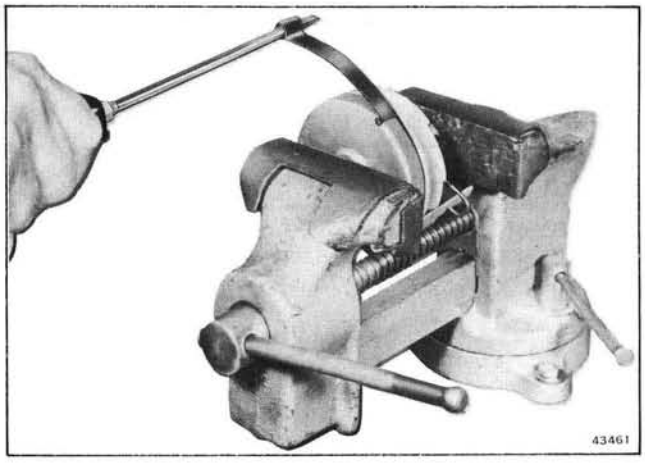


Figure 8-9. Pulling Spring From Cup

3. Remove starter from vise, and remove nut, mounting screw and washer.

4. Remove pinion, pinion spring, pulley, rewind spring, and cup washer.

5. Remove four screws, separate pulley halves, and remove rope. See Figure 8-7.

CLEANING, INSPECTION, AND REPAIR

1. Clean parts (except rope) in solvent such as Solvasol and dry with compressed air.

2. Inspect rewind spring and end loops. If weak, corroded or cracked, replace spring.

3. Inspect pinion and pulley for wear, chipped or broken teeth.

4. Inspect cup for corrosion or damage.

5. Inspect rope and replace if worn. Replace all worn or damaged components.

STARTER REASSEMBLY

1. Install rope in pulley as described in "Rope Replacement."

2. Lubricate rewind spring surface in cup lightly with OMC Type "A" Lubricant.

3. Position rewind spring in cup as shown in Figure 8-10. Place cup washer in cup. Install pulley making sure spring loop engages pulley as shown in Figures 8-7, 8-10.

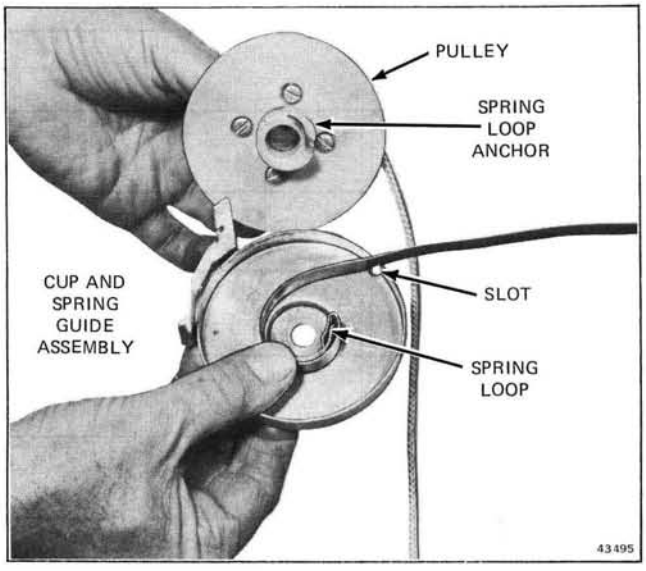


Figure 8-10. Spring Position in Cup

4. Install pinion on pulley. Lubricate mounting screw with OMC outboard oil. Insert screw and washer through pulley, cup washer, and cup. Thread 3/8"-16 nut on mounting screw.

5. While holding cup, use pulley to wind spring into cup in a counterclockwise direction as viewed from top of pulley. When excessive resistance is felt, feed spring into cup through slot to relieve spring tension. Continue to wind and feed until outside loop end of spring is drawn against cup. See Figures 8-7, 8-11.

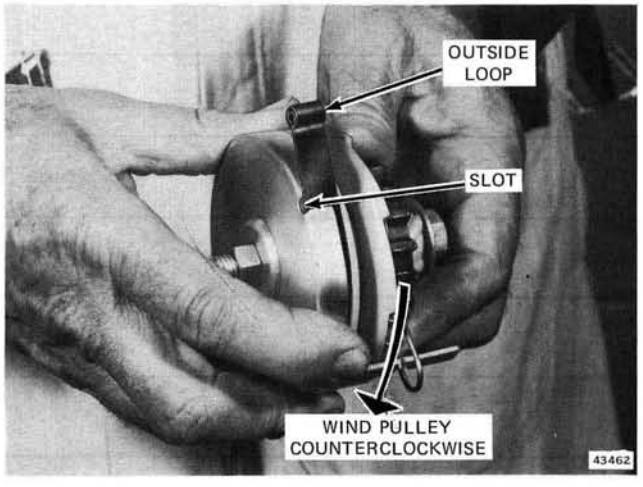


Figure 8-11. Winding Spring

6. Wind rope counterclockwise around pulley, and install pinion spring. Install starter on manifold as described in "Starter Installation."

7. Pull rope out as far as it will go. With rope fully extended, pull out loop end of starter spring, spring end must be free to extend a minimum of 1/2 inch (12.7 mm) from cup. See Figure 8-12.

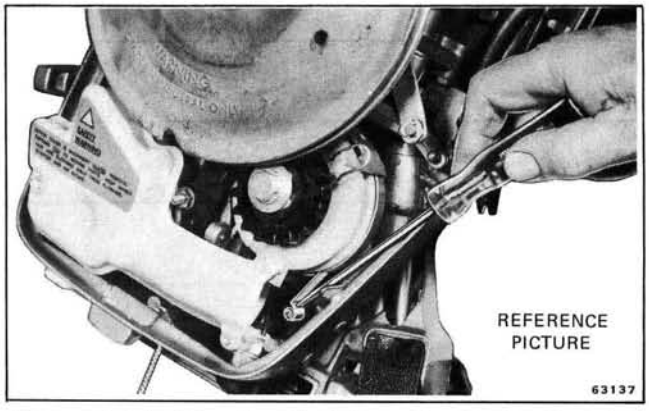


Figure 8-12. Checking for Excessive Spring Tension

STARTER ADJUSTMENTS

With the gearshift in neutral and throttle in START position, the lockout pawl should clear the highest point on the starter pulley by .050" to .110" (1.27 mm to 2.79 mm). See Figure 8-13. This is to allow the motor to be started in gear. To adjust, loosen locknut and turn adjustment screw in or out as required. Tighten locknut and check starter operation.

With gearshift in forward or reverse and throttle in START position, starter should crank engine. Move throttle to FAST position. Starter lockout pawl should prevent starter operation.

NOTE

To restart engine if running beyond throttle START position, turn throttle back to SLOW position and then advance to START position to remove lash from lockout linkage.

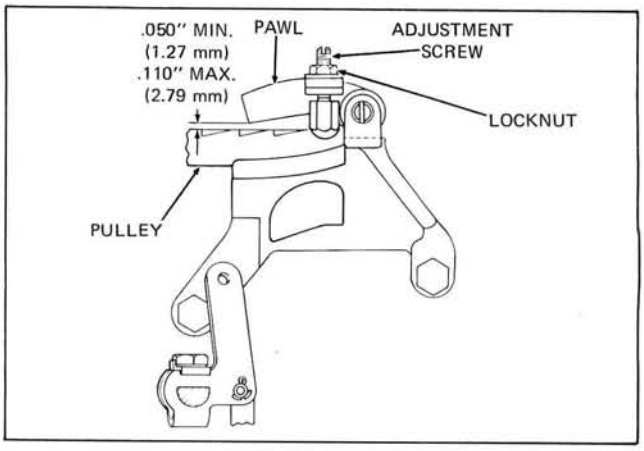
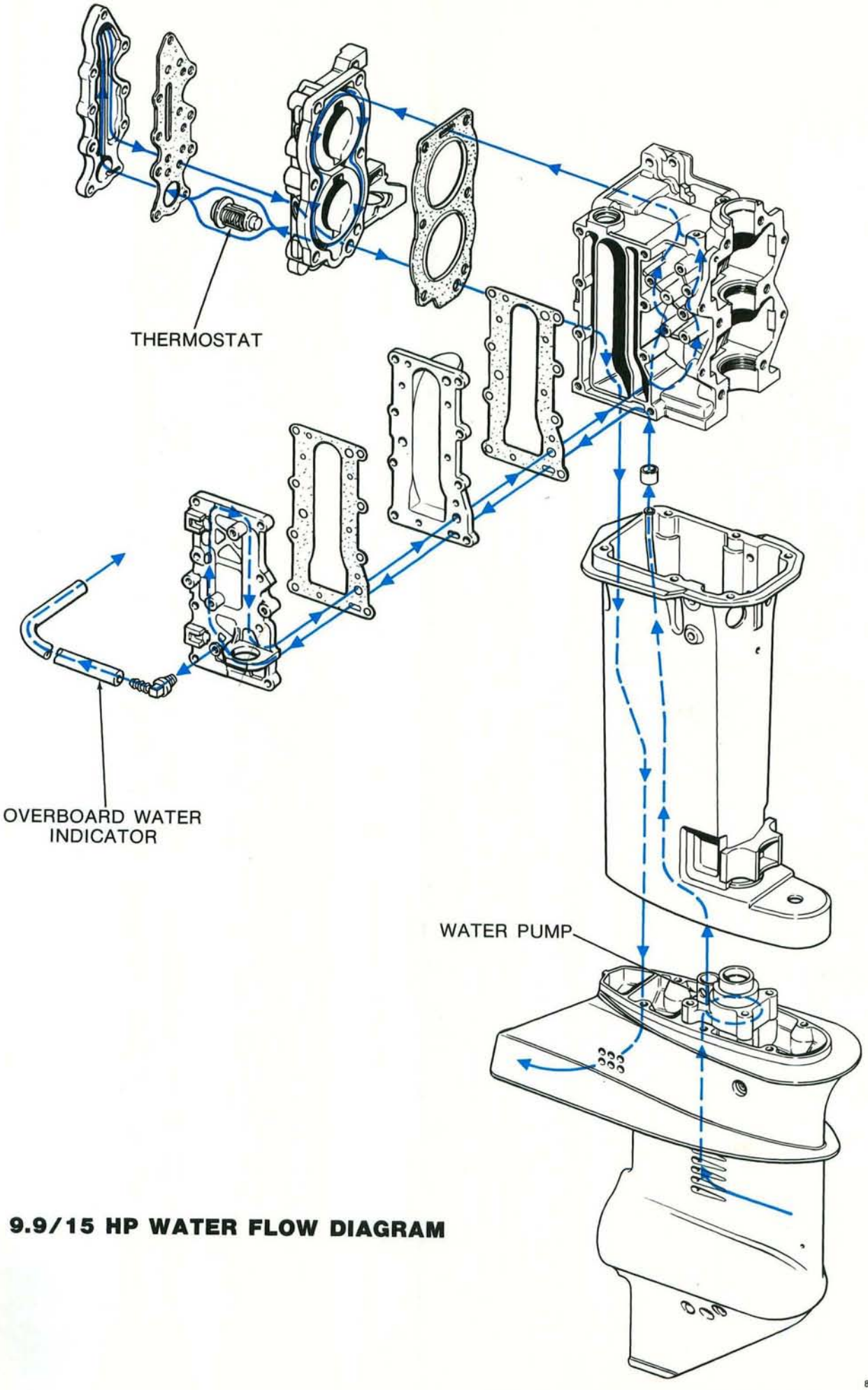


Figure 8-13. Starter Pawl Adjustment



9.9/15 HP WATER FLOW DIAGRAM

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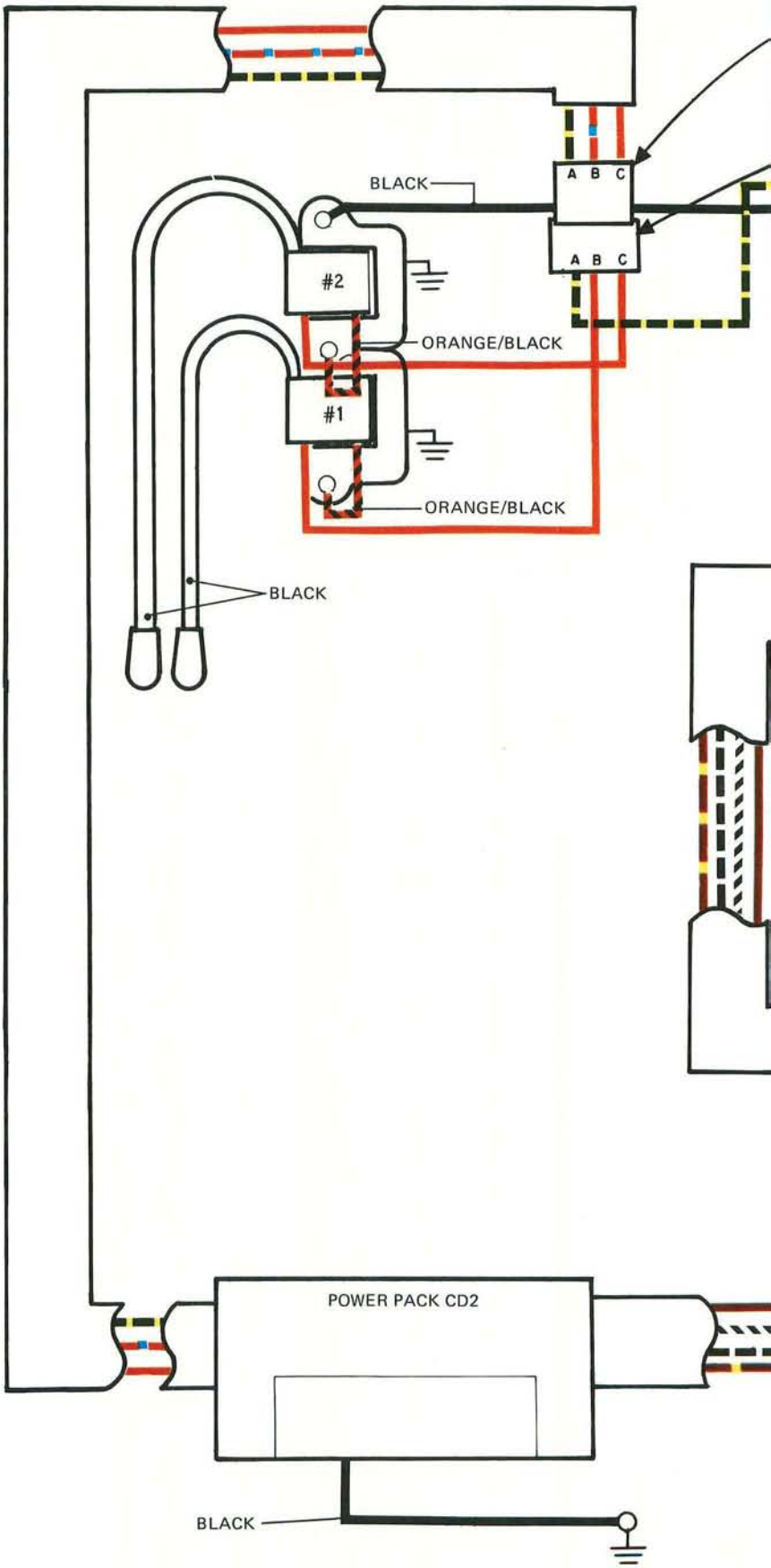
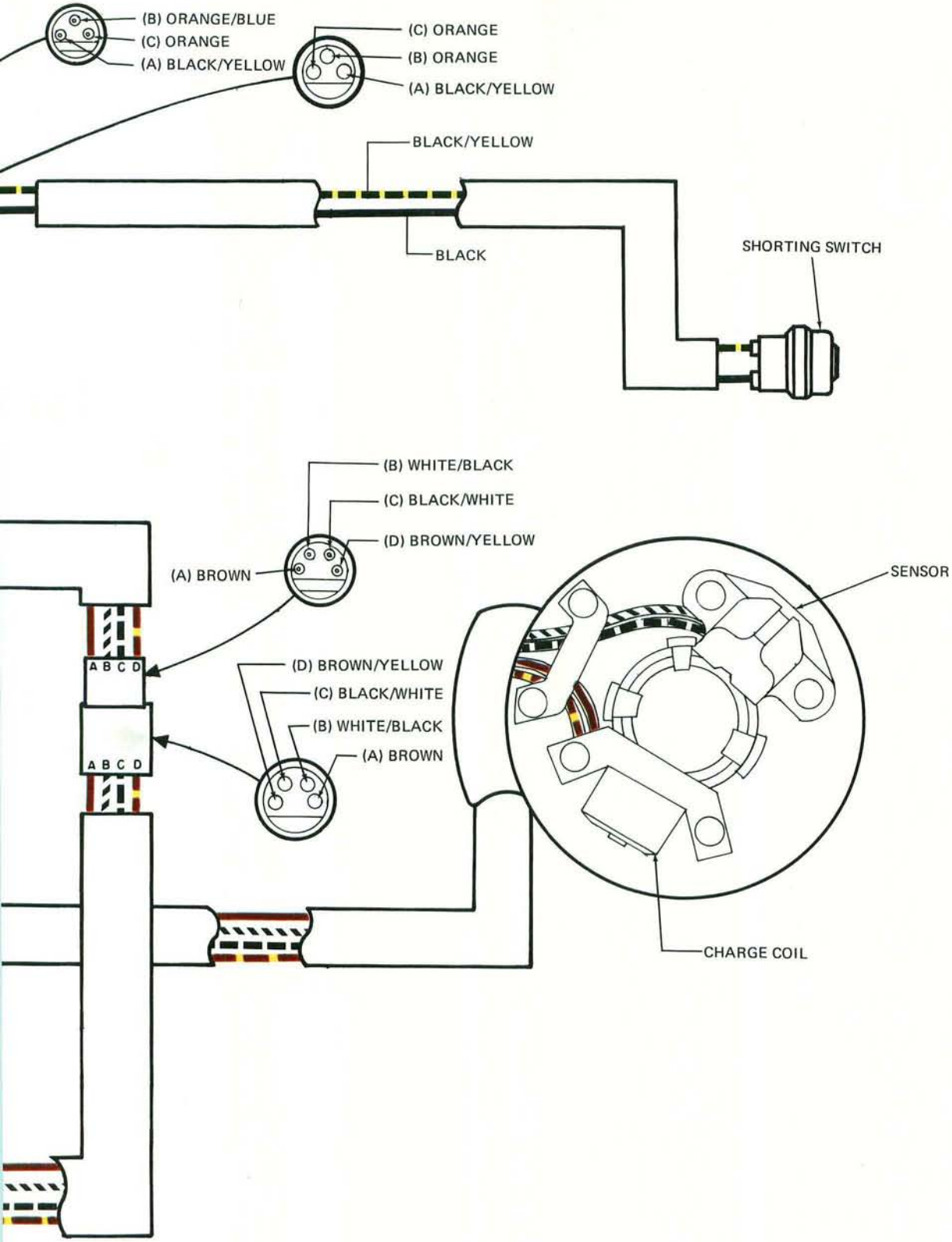
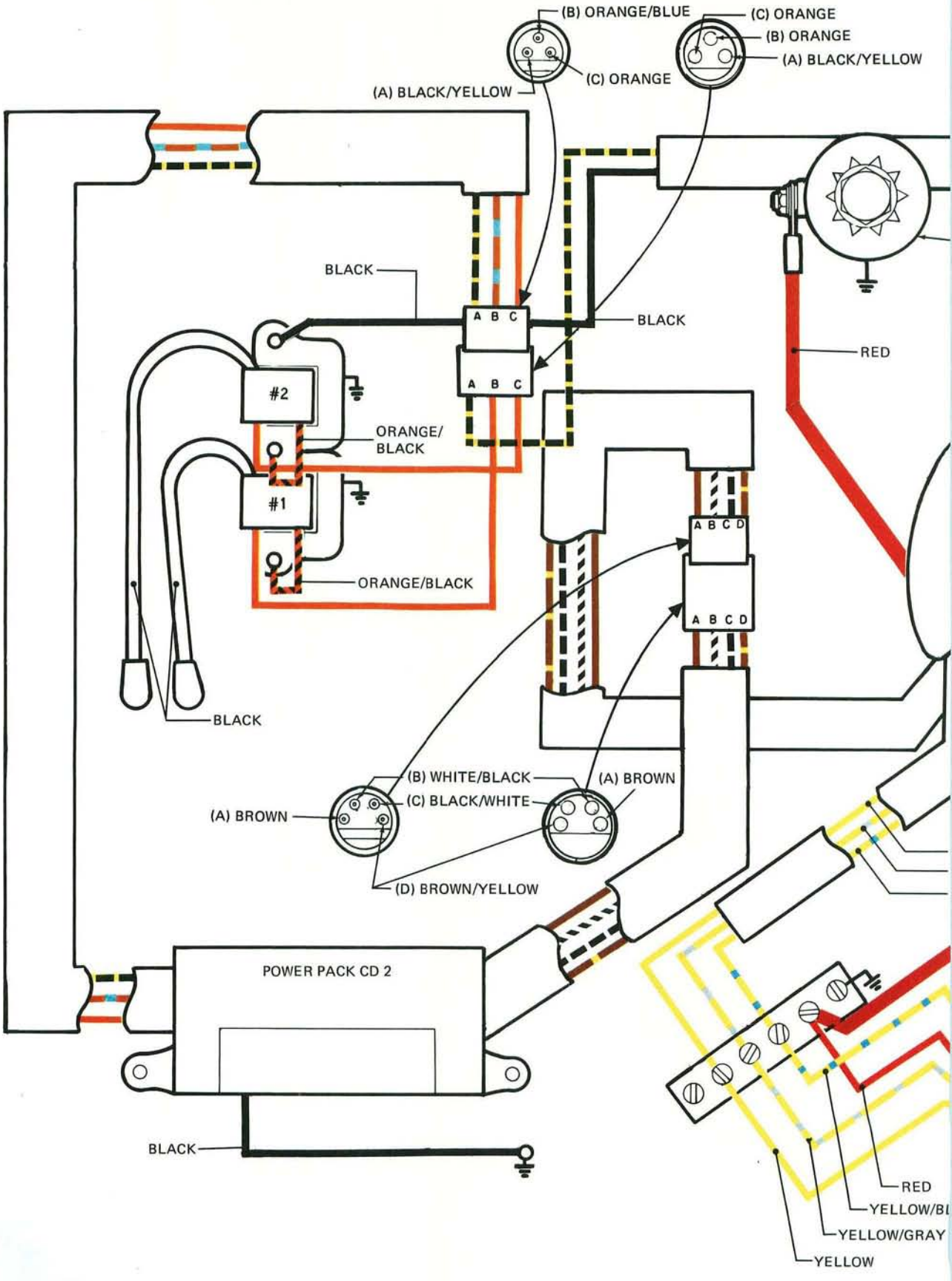
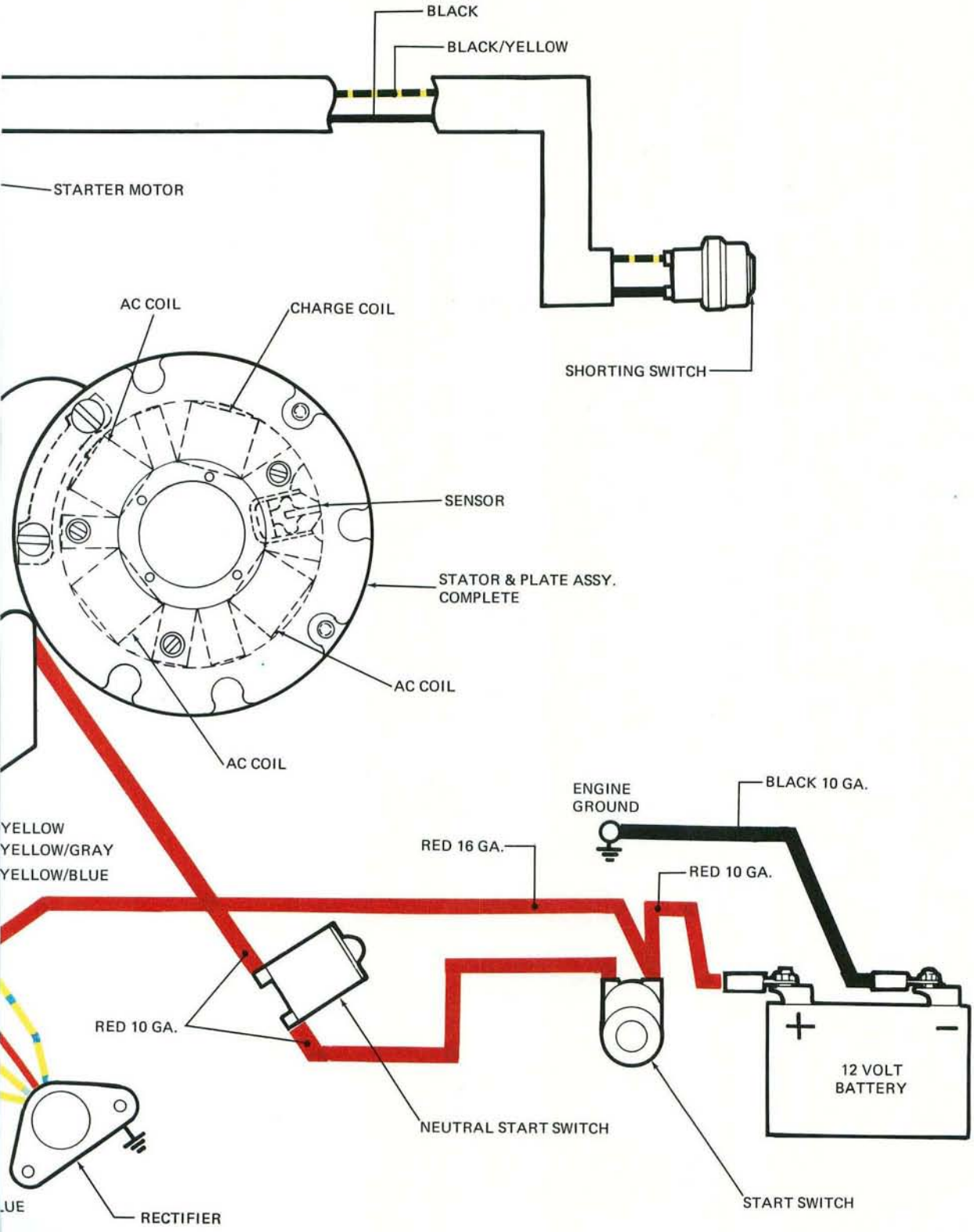

A B C
A B C
BLACK
#2
ORANGE/BLACK
#1
ORANGE/BLACK
BLACK
POWER PACK CD2
BLACK



9.9/15 H.P. MANUAL START

73121


(B) ORANGE/BLUE
(C) ORANGE
(B) ORANGE
(A) BLACK/YELLOW
(C) ORANGE
(A) BLACK/YELLOW
BLACK
A B C
BLACK
A B C
RED
#2
ORANGE/
BLACK
#1
ORANGE/BLACK
A B C D
A B C D
BLACK
(B) WHITE/BLACK
(A) BROWN
(C) BLACK/WHITE
(A) BROWN
(D) BROWN/YELLOW
POWER PACK CD 2
BLACK
RED
YELLOW/BL
YELLOW/GRAY
YELLOW



73122

9.9/15 H.P. ELECTRIC START

EVINRUDE 50 TO 1 OUTBOARD LUBRICANT

We recommend using EVINRUDE OUTBOARD LUBRICANT.

EVINRUDE OUTBOARD LUBRICANT is designed specifically for Evinrude outboard motor use at a 50 to 1 gasoline to lubricant ratio for engine break in and after break in, new and older models. This improved lubrication is formulated to provide additional benefits such as: exceptional lubrication, less varnish and combustion chamber deposits, better spark plug life, good mixability with gasoline even in cold weather, and reduction of pre-ignition.

NOTE

If Evinrude Outboard Motor Lubricant should not be available, see Lubrication Instructions Section 2.

USE ONLY THE RECOMMENDED LUBRICANT TO GASOLINE MIXTURE, REGARDLESS OF THE CLAIMS MADE FOR SOME OILS.

SAFETY WARNING

When replacement parts are required, use genuine OMC parts or parts with equivalent characteristics including type, strength, and material. Failure to do so may result in product malfunction and possible injury to the operator and/or passengers.

It is recommended that only genuine factory approved replacement parts and accessories be used. Replacement parts not manufactured nor approved by Evinrude Motors, should not be used.

Failure resulting from use of parts or accessories other than those manufactured or approved by Evinrude Motors, will not be covered under warranty.

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