

hardware to a torque value of 60 in lb (7Nm).

Attaching bolts **MUST** be tightened to the required torque value in three progressive stages, following the specified tightening sequence. Tighten all bolts to 1/3 the torque value, then repeat the sequence tightening to 2/3 the torque value. Finally, on the third and last sequence, tighten to the full torque value.

30- Install the cylinder block cover gasket and cover. Tighten the attaching bolts in the sequence shown in the accompanying illustration, to a torque value of 70 in lb (5Nm) for all except the 4-cylinder 75hp and larger powerheads. These units carry a torque value of 85 in lb (6.2Nm).

Attaching bolts **MUST** be tightened to the required torque value in three progressive stages, following the specified tightening sequence. Tighten all bolts to 1/3 the torque value, then repeat the sequence tightening to 2/3 the torque value. Finally, on the third and last sequence, tighten to the full torque value.

31- Apply a small amount of Anti-Corrosion Grease in the following areas to prevent corrosion damage:

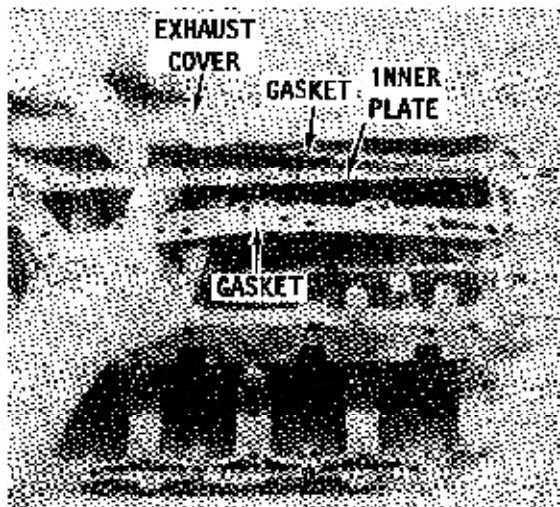
Onto each exhaust baffle gasket.

Into each baffle.

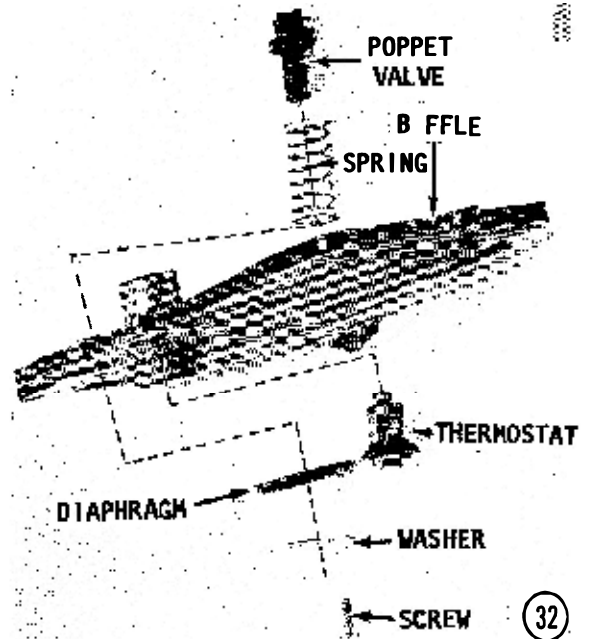
Onto all bolt threads.

Install the exhaust baffle gasket, the baffle, the cover gasket and the exhaust cover. Tighten the cover bolts to a torque value of 200 in lb (23Nm).

Attaching bolts **MUST** be tightened to the required torque value in three progressive stages, following the specified tighten-



Coat each surface of the exhaust baffle gasket, the baffle, the cover gasket, and the exhaust cover with anti-corrosion grease.

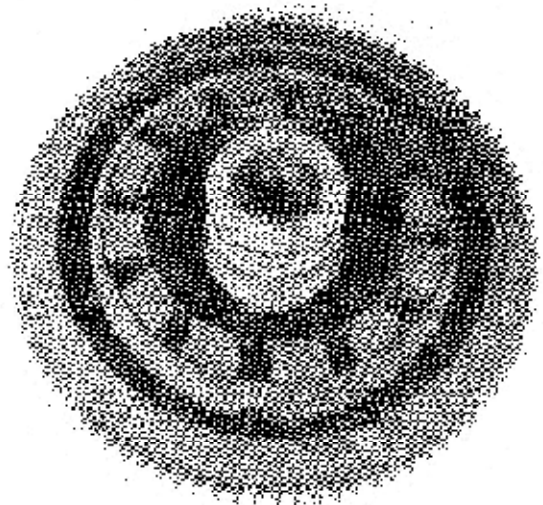


ing sequence. Tighten all bolts to 1/3 the torque value, then repeat the sequence tightening to 2/3 the torque value. Finally, on the third and last sequence, tighten to the full torque value.

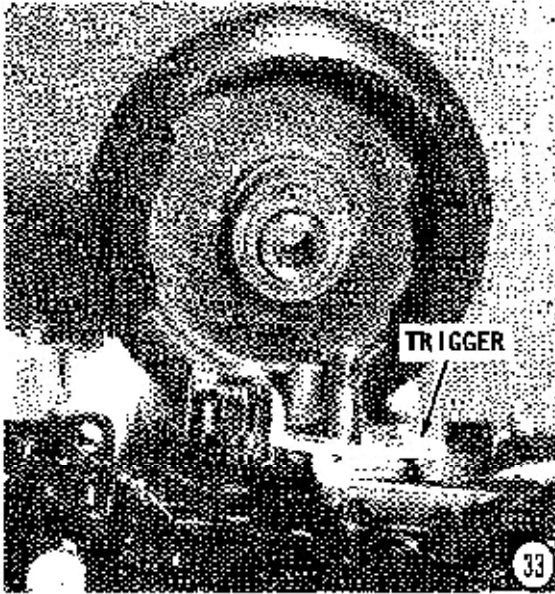
32- If the thermostat was removed, install the poppet valve, thermostat, and cover.

Tighten the attaching screws alternately to a torque value of 160 in lb (18Nm).

Position **NEW** gaskets onto the carburetor mounting studs. Install the carburetor assemblies onto the crankcase and tighten the nuts alternately to a torque value of 100 in lb (11Nm).



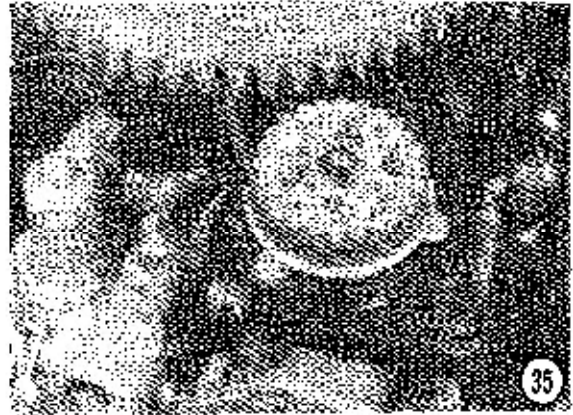
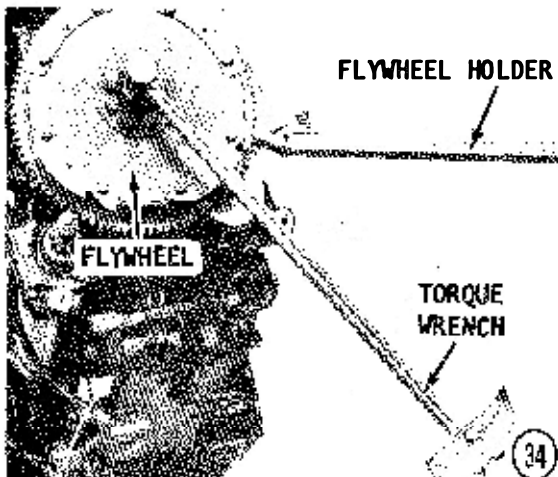
Always check the flywheel carefully to be sure particles of metal have not become stuck to the magnets.



Install the starter, fuel pump, and the switch box. If a distributor is used, install the distributor onto the crankcase and secure it with the two bolts. Tighten the attaching hardware to a torque value of 70 in lb (8Nm).

33- If a trigger assembly is used, place the assembly over the crankshaft onto the block. If a timing belt is used, be sure to install the belt before the stator is installed. Install the stator. Apply a coating of "Blue" Loctite, product No. 21, or equivalent, to the stator attaching screws, and then install the screws and tighten them to a torque value of 60 in lb (7Nm).

Insert the flywheel key in the crankshaft keyway. Check the inside rim of the flywheel to be sure metal particles are not stuck to the flywheel magnets. Check to be sure the inside taper of the flywheel and the taper on the crankshaft are clean of dirt or oil, to prevent the flywheel from "walking"



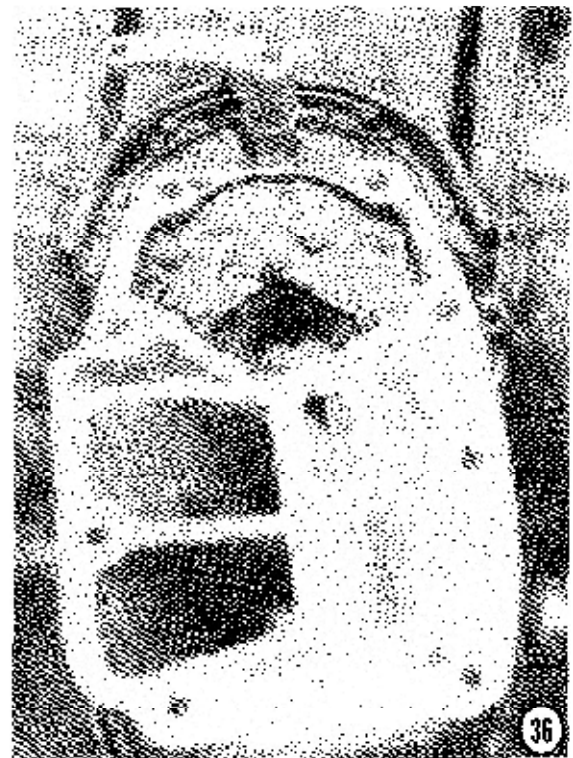
on the crankshaft during operation. Slide the flywheel down the crankshaft with the keyway in the flywheel aligned with the key on the crankshaft. Rotate the flywheel clockwise and check to be sure the flywheel does not contact any part of the magneto or the wiring. If a belt is used, work the flywheel pulley around the belt. Slide a flat washer onto the crankshaft, and then thread the flywheel nut onto the crankshaft.

34- Tighten the flywheel nut to the following torque value:

4-cyl. models 45, 50, 500, and 650
65 ft lb (88Nm)

3-cyl. models 50, 60, 70, 650, and 700
85 ft lb (115Nm)

4-cyl. models 75, 80, 800, and 850
100 ft lb (136Nm)



35- If a distributor is used, install the belt according to the procedures and specifications outlined in Chapter 6. After the belt is properly in place, per Chapter 6, install the pulley cover and attaching nut.

POWERHEAD INSTALLATION

36- Check to be sure old gasket material has been removed from the exhaust housing extension plate and the powerhead. These two mating surfaces **MUST** be clean. Position a **NEW** gasket in place.

37- Thread a lifting eye onto the end of the crankshaft as far as it will go. Use a suitable hoist and lower the power head onto the exhaust housing plate with the studs on the powerhead aligned with the holes in the exhaust housing. Use care to prevent the studs from damaging the gasket. As the powerhead is slowly lowered, it will probably be necessary to rotate the flywheel slightly to allow the splines of the drive-shaft to index with the crankshaft.

38- Thread the nuts onto the powerhead studs. Tighten the nuts alternately to the following torque value:

3- and 4-cyl. models 45, 50, 60, 70, 500,
700 and 650 -- 3-cyl. only

15 ft lb (20Nm)

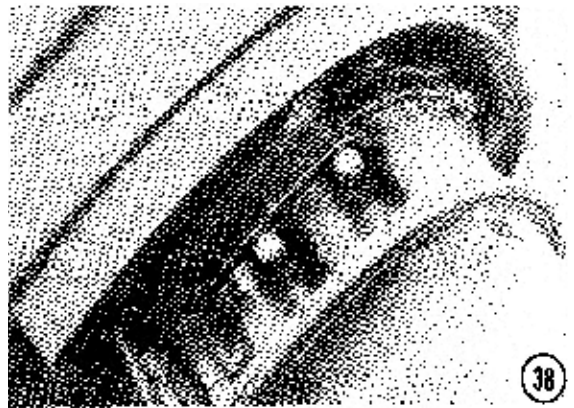
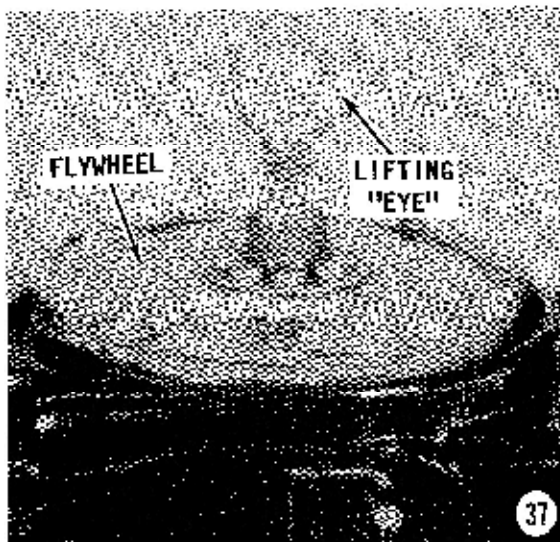
4-cyl. models 650

30 ft lb (40Nm)

4-cyl. models 75, 80, 800 and 850

45 ft lb (60Nm)

The nuts **MUST** be tightened to the required torque value in three progressive stages. Tighten all bolts to 1/3 the torque value, then repeat the sequence tightening to 2/3 the torque value. Finally, on the



third and last sequence, tighten to the full torque value.

Remove the lifting eye from the crankshaft.

39- Install the rear cowl bracket. Connect the water hose to the tattle-tale on the bracket. Connect the water hose to the exhaust extension plate connection. Connect the fuel line to the fuel pump. Connect the shift link. Install and tighten the nut to the shift bracket.

40- Connect the electrical wires to their proper terminals. Use the notes or photographs taken prior to disassembly as a guide. Refer to the wiring diagram in the Appendix for further assistance. Cover all connections with liquid Neoprene. Install all of the sta-straps to the wiring and fuel lines. Place the wire harness in its original position prior to disassembly.

41- Install the spark plugs and tighten them to a torque value of 17 ft lb (23Nm).



3-26 POWERHEAD

Connect the high-tension leads to the proper spark plugs.

42- Mount the engine in a test tank. Connect the fuel lines. Start the engine and follow the break-in procedures given after the caution.

CAUTION

Water must circulate through the lower unit to the powerhead anytime the powerhead is operating to prevent damage to the water pump in the lower unit. Just five seconds without water will damage the water pump impeller.

Break-in Procedures

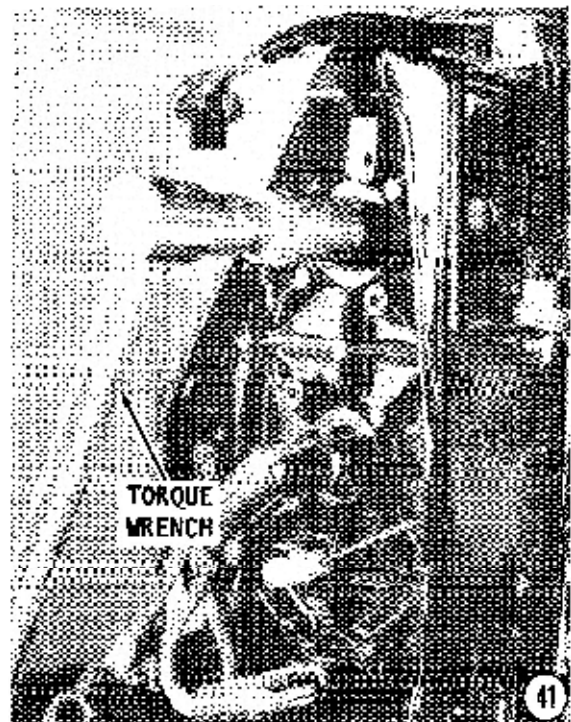
As soon as the engine starts, **CHECK** to be sure the water pump is operating. If the water pump is operating, a water mist will be discharged from the exhaust relief holes at the rear of the drive shaft housing.

During the first 10 hours of operation, **DO NOT** operate the engine at full throttle (except for **VERY** short periods). Perform the break-in as follows:

a- Operate at 1/2 throttle, approximately 2500 to 3500 rpm, for 2 hours.

b- Operate at any speed after 2 hours **BUT NOT** at sustained full throttle until another 8 hours of operation.

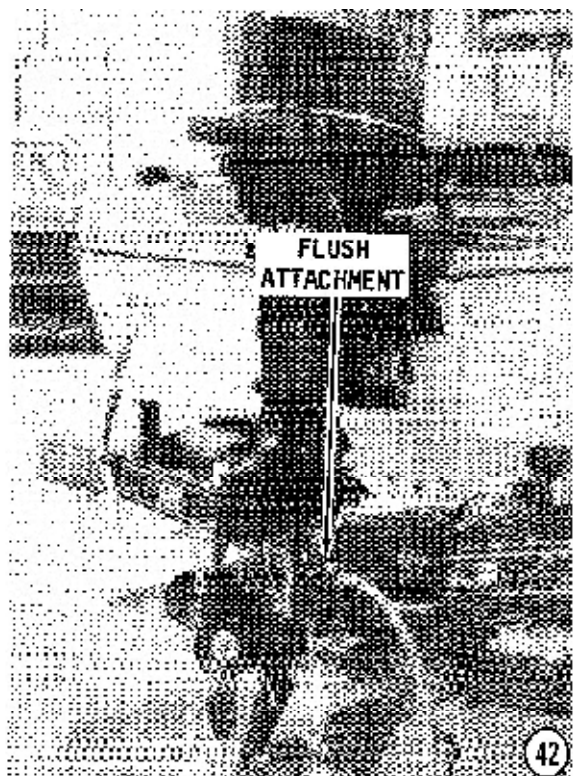
c- Mix gasoline and oil during the break-in period, total of 10 hours, at a ratio of 25:1.



d- While the engine is operating during the initial period, check the fuel, exhaust, and water systems for leaks.

e- Refer to Chapter 6 for synchronizing procedures.

After the test period, disconnect the fuel line. Remove the engine from the test tank. Install the engine cowl.



3-3 POWERHEAD SERVICE REDESIGNED MODEL

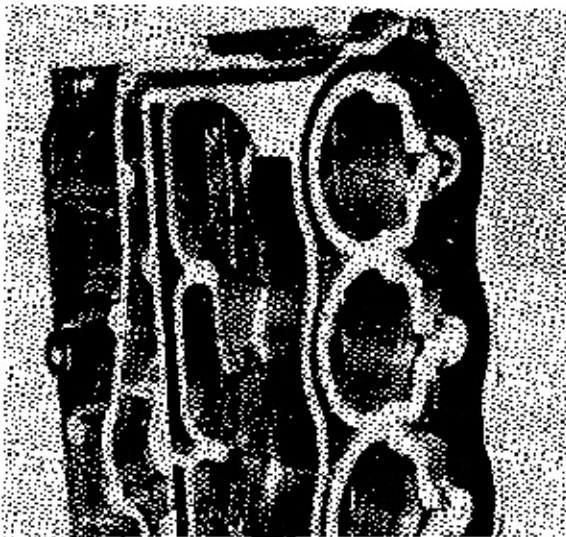
This Section describes the complete service of Mercury redesigned 3-, and 4-cylinder powerheads, as follows:

50hp	3-cyl.	1991 & On
60hp	3-cyl.	1991 & On
70hp	3-cyl.	1987-1989
75hp	3-cyl.	1990 & On
80hp	3-cyl.	1987-1989
90hp	3-cyl.	1987 & On
100hp	4-cyl.	1988 & On
115hp	4-cyl.	1989 & On

ADVICE

Before commencing any work on the powerhead, an understanding of two-cycle engine operation will be most helpful. Therefore, it would be well worth the time to study the principles of two-cycle engines, as outlined briefly in Section 3-1 of this chapter. A Polaroid, or equivalent instant-type camera is an extremely useful item, providing the means to accurately record the arrangement of parts and wire connections **BEFORE** the disassembly work begins. Such a record is most valuable during the assembly work.

In order to obtain the maximum results from the overhaul work, the instructions outlined in this section for removal, disassembly, assembling and installation should



Photograph of a "classroom" type cutaway redesigned larger bore block used on some 3- and 4-cylinder powerheads since 1988. The block and head are cast in one piece. Only the cylinder and exhaust covers are removable to gain access to the water jacket surrounding the cylinders.

be followed in the sequence given. If complete disassembly is not required, begin the assembling sequence at that point, after following the Cleaning and Inspecting procedures for the items disassembled. Cleaning and Inspecting procedures are given at the end of the chapter beginning on Page 3-66.

Complete disassembly of the powerhead is usually not necessary to perform some tasks, such as one or more of the following:

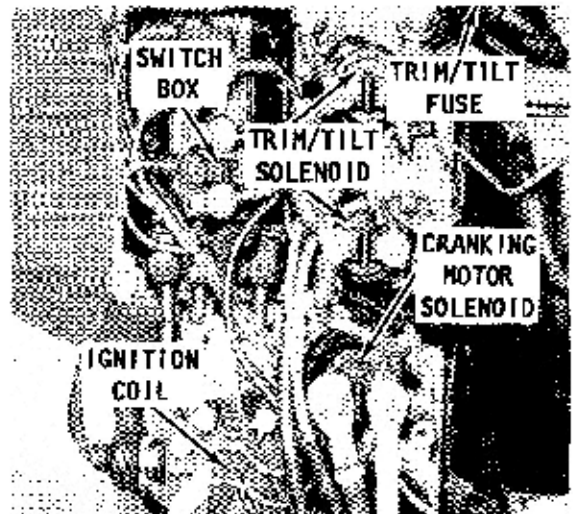
- a- To inspect the cylinder walls and pistons.
- b- Minor repairs on supporting components. Example, the ignition system, carburetors, and the reed blocks.
- c- Operational check of the thermostat and temperature sender.

POWERHEAD REMOVAL

The following procedures are accompanied by a series of captioned illustrations rather than sequential steps.

Disconnect the engine battery cables from the battery terminals. Disconnect the engine fuel line from the fuel tank. Remove the front engine cowling cover. Remove the port and starboard halves of the engine cowling. Separate the electrical extension harness connectors. Disconnect the remote control cables from the powerhead.

STOP, and carefully observe the wiring and hose connections before proceeding. Because there are so many different powerheads and the arrangement is slightly different on each, it is not possible to illustrate



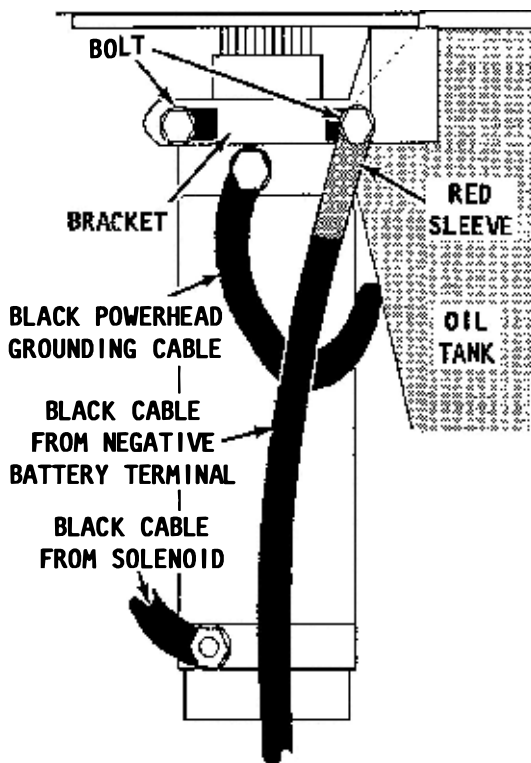
Take time to study and TAG any wire leads disconnected from the ignition plate and surrounding electrical components. The tags will help ensure the leads are reconnected to the proper terminals.

each and every one. Even if they were shown, the reader would not be able to identify the powerhead being serviced. Therefore, **TAKE TIME** to make notes and tag the wire leads and hoses. You may elect to follow the practice of many professional mechanics by taking a series of photographs of the powerhead, one from the top, and a couple from the sides showing the wiring and arrangement of parts.

50hp and 60hp Powerheads Only

Disconnect both leads from the battery. Disconnect the first Black cable from the lower terminal on the cranking motor. Disconnect the second large Black cable from the upper terminal on the cranking motor. Remove the two bolts securing the cranking motor bracket, the third large Black cable and the oil injection tank to the powerhead. Remove the bracket and cranking motor from the powerhead.

Disconnect the high tension leads from the spark plugs. **ALWAYS** use a pulling and twisting motion as a precaution against damaging the connection. Remove the spark plugs.

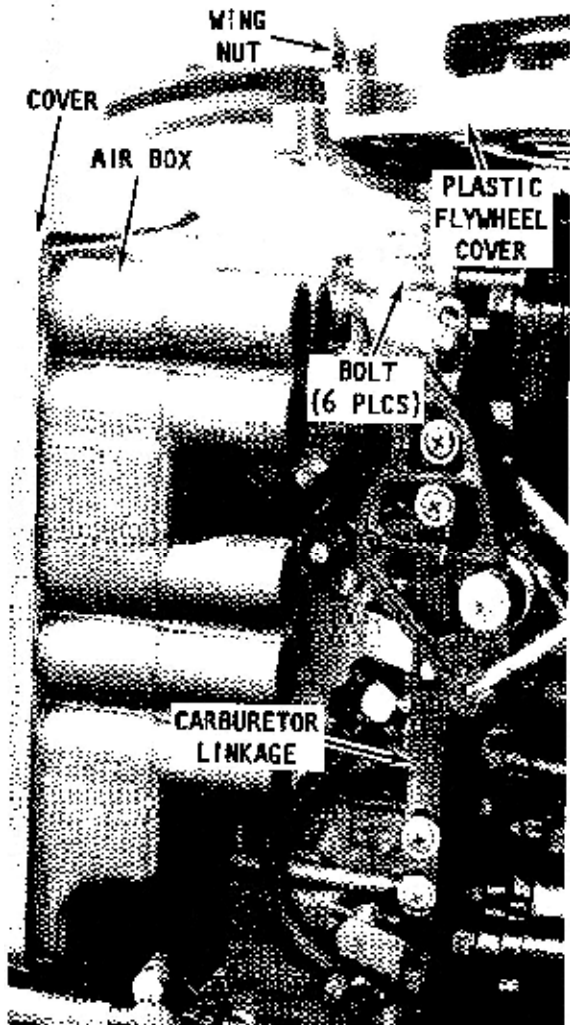


Identification of the three Black cables connected to the cranking motor on a 50hp or 60hp powerhead since 1991. One of the bracket securing bolts also secures the oil tank to the powerhead.

Remove the six bolts securing the cover to the electrical box. The ignition switch-box, ignition coil, fuse, starter solenoid, and rectifier/regulator are all mounted inside the electrical box. All these electrical components will be removed as an assembly when the box is removed. Disconnect the White/Black, Purple, Brown, and White leads between the electrical box and the stator and trigger assembly. Next, disconnect the wiring harness connector.

Locate the low oil warning module secured to the inside of the lower powerhead cover and disconnect the following leads: Tan, Purple, two Light Blue leads and a Black ground eyelet lead. Remove the two bolts securing the module to the cover and remove the module.

Remove the securing hardware and lift out the electrical box with all electrical components undisturbed.



The three carburetors, air box with cover, linkage and fuel lines are removed from the powerhead as an assembly.

Disconnect the Blue/White, Green/White, and Red/Black leads at the trim switch located on the side of the lower powerhead cover.

Remove the four screws securing the cover to the air box. Remove the six long bolts securing the three carburetors to the intake manifold. The carburetors are held together as an assembly by the two forward straps, throttle and choke linkage and fuel lines.

Disconnect the fuel supply line and the primer line, if equipped. Disconnect the fuel line between the enrichener valve and the fitting on the fuel bowl of the top carburetor, and the line between the valve and the fitting at the base of the oil pump. Lift off all three carburetors, as an assembly, with linkage and fuel lines between the carburetors still intact.

Disconnect the two Light Blue leads from the low oil sensor, located at the base of the oil tank, at their quick disconnect fittings. If the oil tank contains oil, make arrangements to plug the oil line once it is pulled free of the fitting, to prevent oil from spilling into the lower powerhead cover. Snip the tie wrap from the oil supply line, from the tank, at the oil injection pump. Ease the line free of the fitting on the pump and lift out the oil tank.

Disconnect the oil outlet line between the pump and the 2 psi check valve next to the fuel pump. Remove the two attaching bolts and remove the oil pump from the powerhead.

Snip the tie wraps around the inlet, outlet, and pulse lines at the fuel pump. Remove the two Phillips head screws securing the pump to the powerhead. Lift off the pump.

Remove the top bolt securing the barrel retainer over the control cable barrels. Swing the retainer down to clear both barrels.

Remove the locknuts and washers securing the throttle and shift cable ends to the throttle lever and shift actuator stud. Slide the cables and barrels away from the barrel receptacles cast into the block and lift both cables clear.

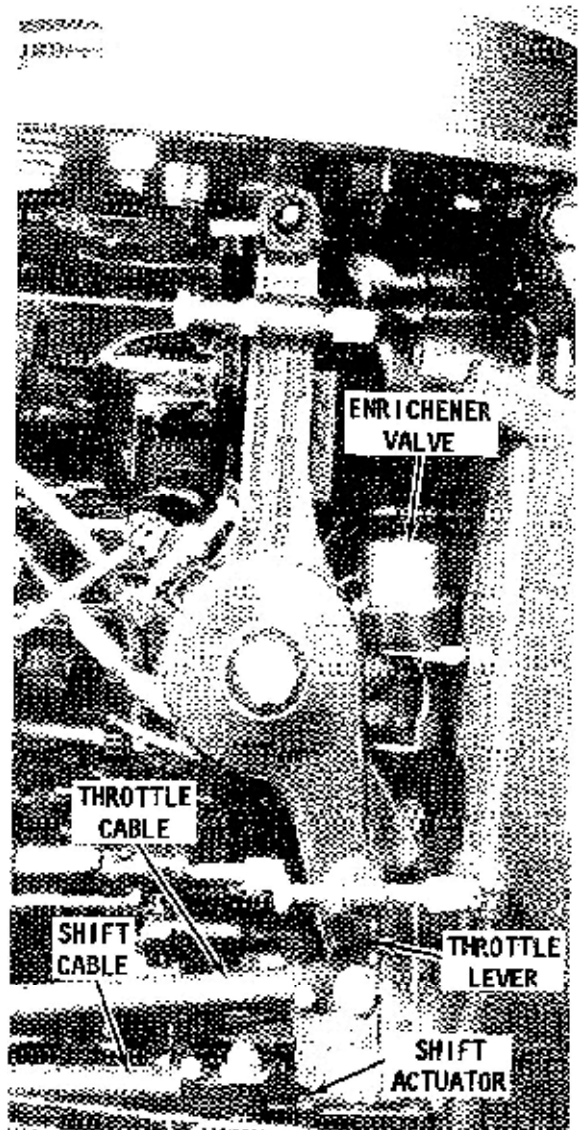
Make a final check to make sure no other leads or attachments will impede the removal of the powerhead.

Remove the four bolts securing the lower powerhead cover to the intermediate housing, and remove the cover.

Next, remove the six bolts securing the powerhead to the intermediate housing.

Remove the three wing nuts securing the plastic flywheel cover to the powerhead. Remove the plastic cap from the end of the crankshaft. Thread a lifting eye onto the end of the crankshaft as far as it will go. Using a suitable hoist, lift the powerhead assembly clear of the intermediate housing. Remove all traces of the base gasket.

Mount the powerhead onto some type of stand, to facilitate easy access to all parts. **NEVER** attempt to mount the powerhead in a stand secured in a vise. Such an attempt will only lead to damage of the powerhead and possible personal injury. Remove the lifting eye from the crankshaft.



Fuel system and control cable components on the portside of a 60hp powerhead.

3-30 POWERHEAD

70hp and Larger Powerheads

Snip the Sta-strap from the tattle-tale hose at the aft cowl support bracket.

Remove the bolts securing the bracket to the powerhead.

Remove the bolts securing the ignition plate cover to the powerhead.

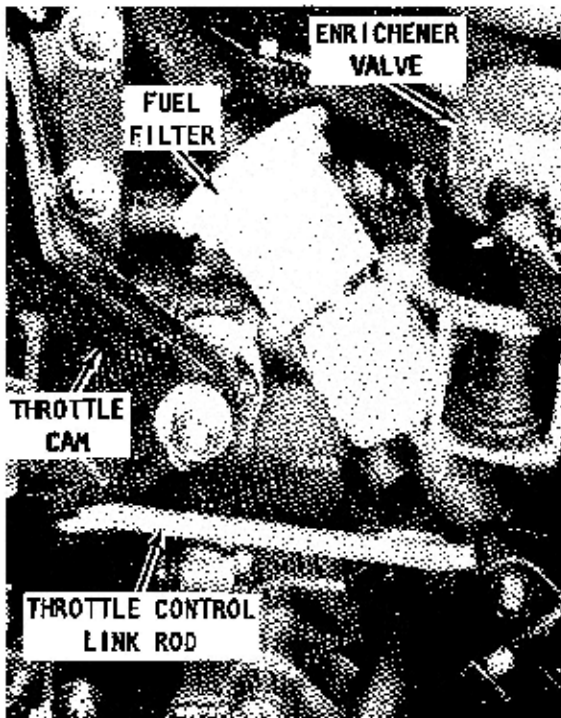
Disconnect the large Black lead from the cranking motor and the large Red lead from the cranking motor solenoid.

Unplug the power trim fuse mounted on the cranking motor.

Loosen, but do **NOT** remove the two Phillips head screws on the clamp securing the main harness to the powerhead. Slide the harness from its retaining clamp.

Disconnect the throttle cable from the throttle lever. Disconnect the shift cable and the shift arm from the shift bracket. Remove the two bolts and the bracket from the powerhead.

Remove a total of eight bolts securing the powerhead to the intermediate housing. Three nuts are located on each side of the powerhead and two more are located on the aft side.



Fuel system and throttle control components on the portside of a 70hp powerhead and larger.

Disconnect the oil inlet hose from the oil pump and plug the line quickly to prevent oil from draining from the oil reservoir. Remove the attaching hardware and lift the reservoir free of the powerhead.

Remove the three wing nuts securing the plastic flywheel cover to the powerhead.

Remove the plastic cap from the end of the crankshaft. Thread a lifting eye on the end of the crankshaft as far as it will go. Using a suitable hoist, lift the powerhead assembly clear of the intermediate housing. Remove all traces of the base gasket.

Disconnect the high tension leads from the spark plugs. **ALWAYS** use a pulling and twisting motion as a precaution against damaging the connection. Remove the spark plugs.

Mount the powerhead onto some type of stand, to facilitate easy access to all parts. **NEVER** attempt to mount the powerhead in a stand secured in a vise. Such an attempt will only lead to damage of the powerhead and possible personal injury. Remove the lifting eye from the crankshaft.

Disconnect the Tan and Black leads from the oil level warning horn at the terminal block on the ignition plate. If the powerhead is also equipped with an oil warning module, disconnect the Purple and Light Blue leads at their quick disconnect fittings. Disconnect the Black lead from the temperature sensor just below the thermostat.

Disconnect the large Yellow cable from the solenoid to the cranking motor.

Remove the four bolts securing the cranking motor to the powerhead and lift the motor free.

Remove the two cowl support bracket bolts from the top of the air box and the two bottom cowl support bracket bolts from the forward end of the powerhead.

Remove the bolt at the fuel joint support and remove the bottom cowling support bracket.

Remove the Phillips head screws securing the air box cover and remove the cover.

Remove the nuts and washers securing the air box to the powerhead, and then remove the air box.

Disconnect the fuel supply line from the fuel filter. Disconnect the inlet hose for the fuel enrichener valve at the "T" fitting between the No. 1 and No. 2 carburetors.

On 4-cylinder powerheads, disconnect the accelerator pump inlet hose from the "T" fitting between No. 1 and No. 2 carburetors. Disconnect the hoses from the accelerator pump to the No. 3 and No. 4 cylinder check valve fittings. Remove the bolts securing the pump to the block and lift the pump clear.

Snip the Sta-strap from the vapor return hose and remove the hose from the fitting next to the fuel pump.

All Powerheads

Pry the oil pump link rod from the ball joint on the No. 2 carburetor throttle lever.

The carburetors are now only held together with the throttle tie bar. Slide the entire carburetor assembly off the mounting studs.

Disconnect the throttle control link rod between the throttle cam and the throttle lever.

Remove the two hoses from the enricher valve at their fittings on the intake manifold. Disconnect the Black and Yellow/Black leads from the valve and remove the two securing bolts. Lift the valve, with hoses still attached free from the powerhead.

Hold the flywheel from turning with a flywheel strap or with a Flywheel Holder, C-91-52344. Remove the 5/16" flywheel nut and washer.

Install a crankshaft Protector Cap, C-91-24161, onto the end of the crankshaft. Install Flywheel Puller, C-91-73687A1 into the flywheel. These two items are necessary and may be obtained from the local dealer.

BAD NEWS

The crankshaft may very likely be damaged if the protector cap is not used between the crankshaft and the flywheel puller. **NEVER** attempt to use a puller which pulls on the outside edge of the flywheel, or the flywheel may be damaged. **NEVER** hammer on the end of the center bolt of the puller, because such action will surely cause damage either to the crankshaft, or the bearings, or both. **NEVER** use heat as an aid to removing the flywheel. Applying heat may actually seize the flywheel to the crankshaft.

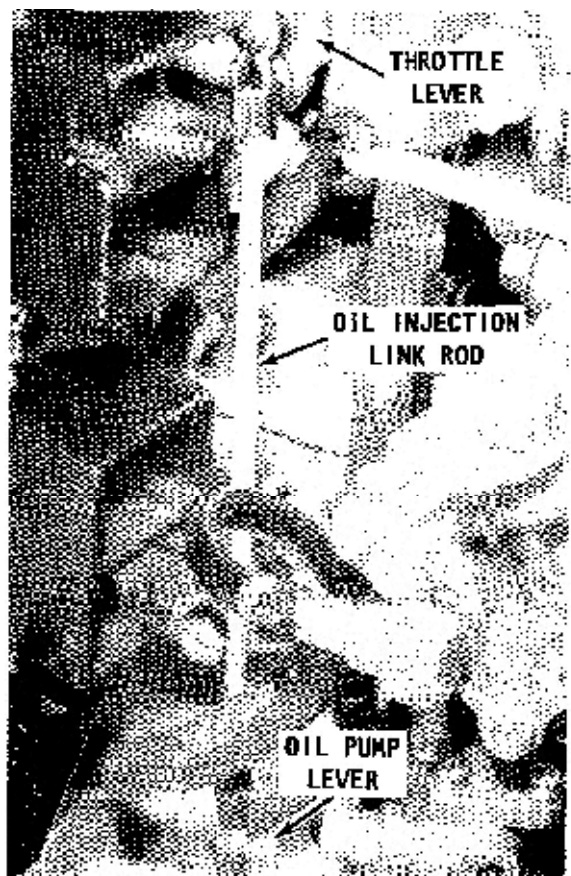
Take up on the puller until the flywheel breaks loose from the crankshaft. Remove the flywheel key from the crankshaft.

Disconnect the stator wires and trigger wires from the terminals of the switch boxes. Remove the stator assembly from the powerhead. The stator assembly attaching bolts have been secured in place with Loctite, therefore, they will not back out easily. Remove the locknut securing the trigger plate link rod to the upper end of the vertical throttle lever. Now, pull the link rod swivel clear of the throttle lever.

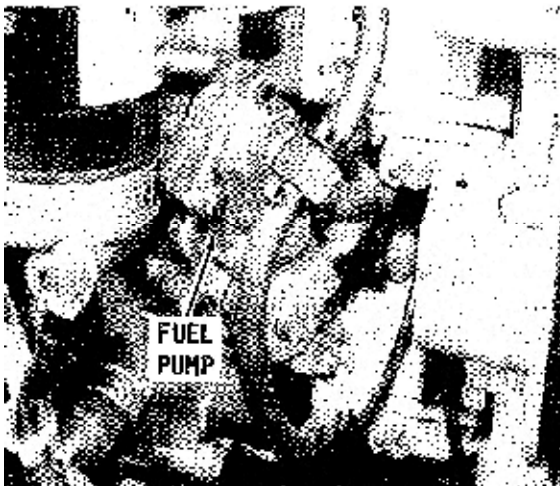
Remove the trigger and stator plate assembly from the upper end cap.

Remove the three bolts securing the ignition plate to the cylinder block. Lift the ignition plate, together with the electrical components, clear of the cylinder block.

Remove the locknut, and then the throttle cam and bushings from the reed block housing stud. Remove the pivot bolt, and then lift the vertical throttle lever from the cylinder block. **REMEMBER**, a flat washer is installed between the vertical throttle lever and the cylinder block.



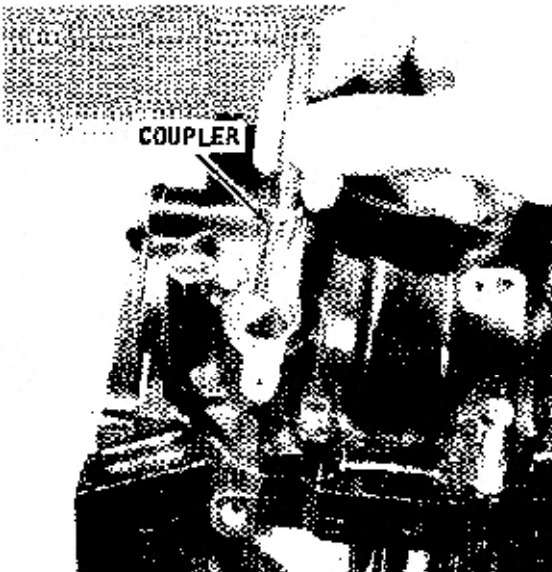
Make every effort not to disturb the length of the oil injection link rod, when removing the rod from the carburetor and oil pump lever ball joints.



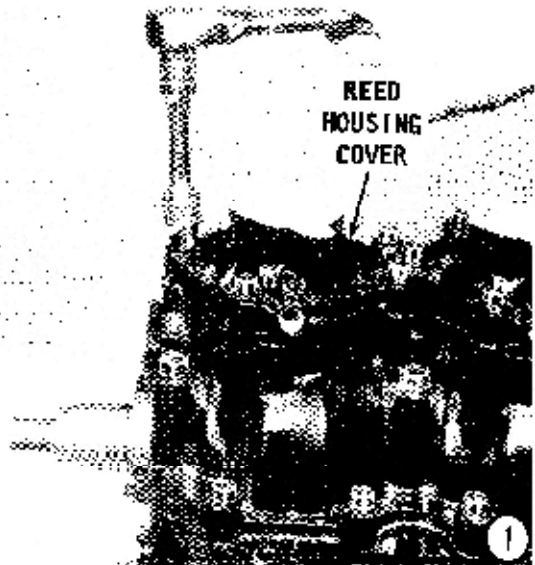
The fuel pump mounting bolts also hold various layers of the pump together. Hold the pump together firmly when removing these bolts.

Remove the attaching bolts securing the fuel pump assembly to the reed block housing. **TAKE CARE** not to separate the fuel pump components, and lift the fuel pump assembly from the reed block housing. Insert two of the attaching bolts back through the fuel pump assembly, and then thread a 10-32 nut onto each bolt to prevent the fuel pump parts from separating during the remainder of the powerhead disassembly work.

Disconnect the outlet hose from the oil pump. Plug the end of the hose to prevent foreign matter from entering. Remove the two retaining bolts from the oil pump. Lift the oil pump clear of the powerhead. Remove the O-ring from around the coupler. Reach into the block with a pair of needle nose pliers and withdraw the coupler. **TAKE CARE** not to lose the small plug and



Removing the oil pump coupler from the block.



the magnet from the recess in the coupler. Reach in again with the needle nose pliers, and grasp the oil pump shaft. Pull and rotate the shaft slightly **CLOCKWISE** to withdraw the shaft.

Disconnect the bleed hose from the No. 1 cylinder fitting and the lower end cap fitting.

CYLINDER BLOCK DISASSEMBLY

1- Remove the bolts securing the reed housing cover and reed housing to the powerhead.

2- Insert a flat blade screwdriver behind

