

ter lead to the female part of the Purple lead connection.

If the meter fails to register at least 9V, the electronic module is not receiving battery voltage and therefore cannot signal the warning horn to sound. The problem lies elsewhere, probably in the battery connections. Perform corrections as required.

If the meter registers at least 9V, but still the warning horn does not sound a self test "beep", turn the ignition switch off. Connect a jumper cable between the Black and Tan or Tan/Blue leads at the female end of the three prong connector. This action bypasses the electronic module. If the horn now emits a "beep", the electric module is defective and must be replaced.

If the horn still fails to sound, obtain and set an ohmmeter to the RX1000 scale. Check for electrical continuity between the Tan or Tan/Blue lead at the female end of the three prong connector and the Tan or Tan/Blue lead from the temperature switch at the terminal block on the powerhead.

If continuity is not indicated, check for an open in the circuit or loose, dirty or corroded connections, terminals, or connector pins along the length of the Tan or Tan/Blue lead. If continuity is indicated, but still the horn fails to sound a self test "beep", then the fault lies in the ground connection. A Black lead is used to ground the terminal block to the powerhead. This Black lead extends between the grounding screw on the powerhead and the three prong connector. Somewhere along the length of this Black lead there is an open in the circuit or a loose, dirty or corroded connection, terminal, or connector pin.

Warning Horn Sounds Continuously Powerhead Is Cold Or Not Operating Models W/Electronic Module

With the ignition key in the "ON" position, disconnect the three prong connector. If the horn is silent, the electronic module is defective and must be replaced. If the horn continues sounding, disconnect all three Tan or Tan/Blue leads at the terminal block on the powerhead.

If the horn continues to sound, the problem is not in the oil injection system but elsewhere, possibly in the remote control box.

The horn should now be silent. Connect the Tan or Tan/Blue leads one by one to determine which lead was grounded and activated the horn. Trace and replace the defective lead.

If the defective lead is the one to the temperature switch, the switch and lead are replaced as a unit.

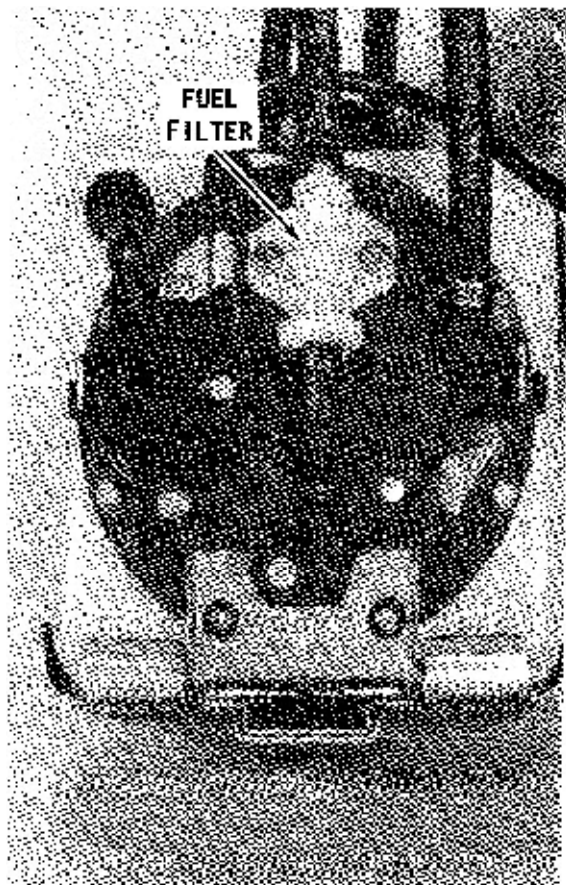
Warning Horn Sounds Continuously During Powerhead Operation Oil Level Is Satisfactory Models W/Electronic Module

GOOD WORDS

Perform this test with the powerhead **NOT** operating, even though the symptoms appear when the powerhead is operating.

Rotate the ignition key to the "ON" position. Disconnect the two prong connector at the "Auto Blend" unit. If the warning horn continues to sound, the electronic module is defective and **MUST** be replaced.

If the horn is now silent, the fault lies in the internal oil filter. Replace the filter.



The fuel filter is transparent allowing visual inspection for foreign material. The filter may be removed and installed without the use of special tools.

**STORAGE
"AUTO BLEND" SYSTEM**

Proper storage procedures are **CRITICAL** to ensure efficient operation when the unit is again placed in service.

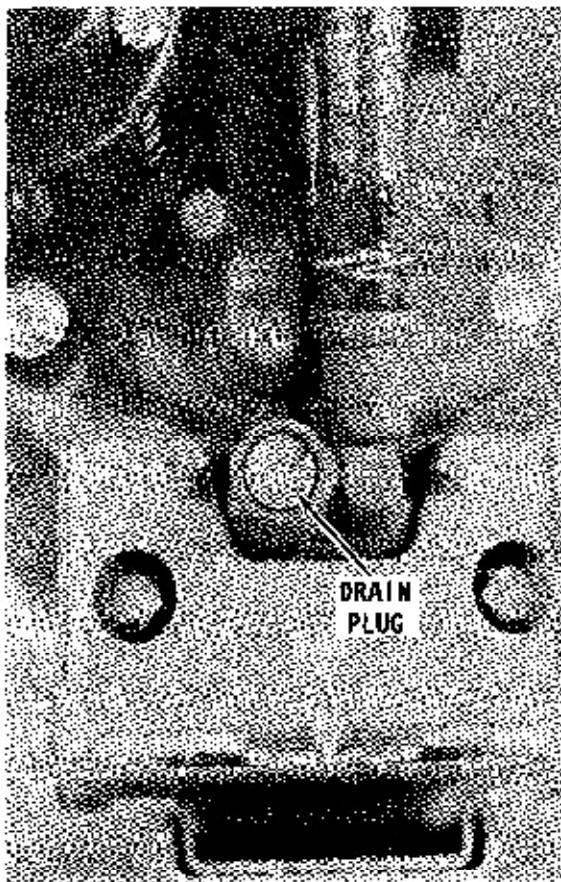
First, disconnect the battery leads from the battery.

Next, disconnect and plug the fuel lines at the fuel tank and powerhead.

Now, drain all fuel from the unit. Remove the front cover of the unit by simultaneously pushing in on the cutaway tabs located on both sides of the cover, and at the same time pulling the cover away from the unit. Remove the drain plug and allow at least 5-minutes for all fuel to drain from the pump. Install the drain plug and tighten it securely.

CRITICAL WORDS

All fuel **MUST** be drained from the oil injection fuel "pump". The percentage of alcohol in modern fuels seems to increase each year. This alcohol in the fuel is a definite enemy of the diaphragm in the "pump". Therefore, if any fuel is left in the



All fuel **MUST** be drained prior to placing the unit in storage, to prevent damage to the "pump" diaphragm.

"pump" during storage the diaphragm will most likely be damaged.

Install the front cover by aligning the cover openings on both sides of the unit, and then pushing in on the cover until it snaps into place.

Oil may remain in the oil injection tank during storage without any harmful effects.

**PREPARATION FOR USE
"AUTO BLEND" SYSTEM**

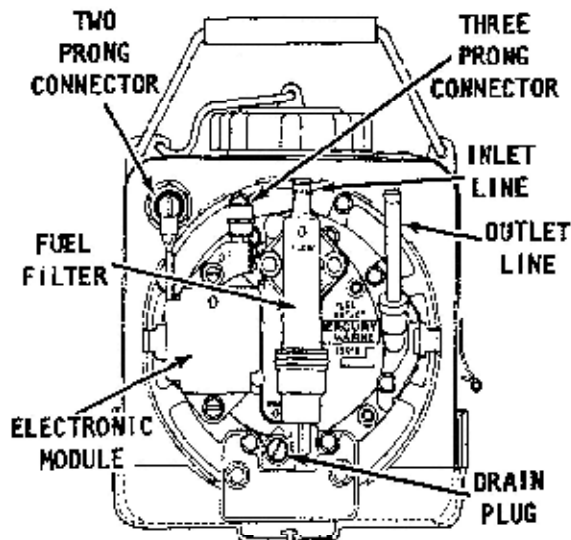
First, remove the front cover of the unit by simultaneously pushing in on the cutaway tabs located on both sides of the cover, and at the same time pulling the cover away from the unit. Check to be sure the fuel drain plug is tight. Replace the front cover by aligning the cover openings on both sides of the unit, and then pushing in on the cover until it snaps into place.

Next, fill the oil tank with 2-cycle out-board oil with a BIA rating of TC-W. Tighten the fill cap securely.

Remove any plugs in the fuel lines, and then connect the hoses to the fuel tank and the powerhead. Remember, the squeeze bulb **MUST** be in the hose between the oil injection unit and the fuel pump on the powerhead.

Connect the low oil warning wire harness to the battery. Connect the **RED** lead to the positive battery terminal and the **BLACK** lead to the negative battery terminal.

Check to be sure the low oil warning system is functioning correctly. First, veri-



Line drawing to clearly identify major parts of an Auto Blend unit.

fy the tank is full of oil, and then the fill cap is tightened securely. Now, turn the oil injection unit upside down. This position will allow the float to activate the horn.

If the horn sounds, immediately turn the unit rightside up and position it in the mounting bracket. Secure it in place with the strap and Velcro material.

If the horn does not sound, check the 0.5 amp fuse in the fuse holder of the positive battery lead. Check both the battery connections and the charge condition of the battery.

GOOD WORDS

The manufacturer recommends the fuel filter be replaced at the start of each season or at least once a year. The manufacturer also recommends oil be added to the fuel tank at the ratio of 50:1 for the first 6-gallons of fuel used after the unit is brought out of storage. The oil in the fuel tank plus the 50:1 oil mixture in the oil injection unit will deliver a mixture of 25:1 to the powerhead. This ratio will **ENSURE** adequate lubrication of moving parts which have been drained of oil during the storage period.

ADVANCED OIL INJECTION DESCRIPTION

Since introduction of the "Auto Blend" oil injection system covered in the previous section, engineers have strived to improve delivery of an oil/fuel mixture to the cylinders. The result of these efforts was introduction of a new system, we have labeled "Advanced Oil Injection".

As explained in the following paragraphs, an oil tank was mounted on the powerhead, and the oil pump was moved from the boat to the powerhead.

Components

The system consists of an oil tank, an oil injection pump, two sensors, a warning module, a warning horn, and the necessary electrical and hose connections for the system to operate properly. 3-cylinder models are also equipped with a warning horn test button. 4-cylinder models have no such feature, but are equipped with a warning module mounted on the starboard side of the powerhead.

Oil Tank

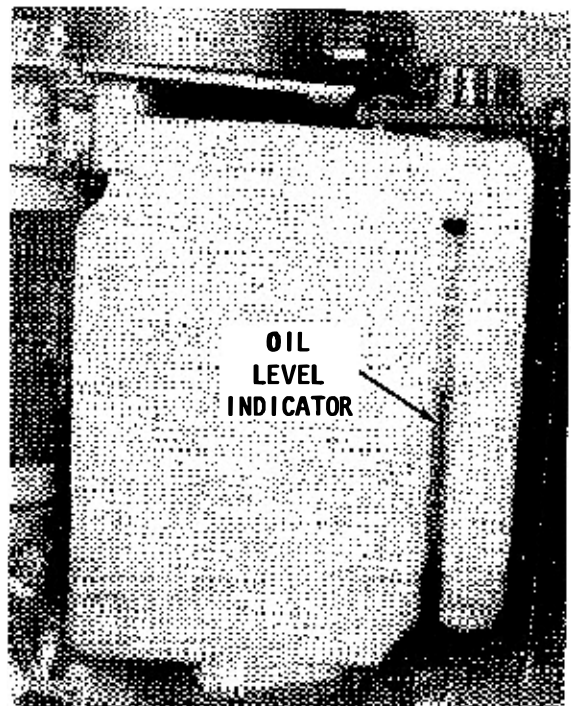
The oil tank is attached to the powerhead under the cowling and has a capacity of 3 quarts (2.8L) on 50hp and 60hp models (since 1991), or 1 Gal. (3.78L) on 70hp, 75hp, 80hp, and 90hp models, or 1.4 Gals. (5.3L) on 100hp and 110hp models.

Low Oil Sensor

The low oil sensor is installed in the top of the oil tank. This sensor operates on a magnetic float principle. As the oil level drops to the dangerous level, below 1 qt. (0.95L), a circuit is closed and the warning horn will sound. Oil is gravity fed to the oil pump mounted beneath the tank on the powerhead.

Powerhead Temperature Sensor

A powerhead temperature sensor is mounted on the only removable part of the cylinder head - the cover. The sensor is located at the hottest portion of a combustion chamber, next to a spark plug. A Black lead connects the sensor to a terminal block on the powerhead. If an overhead condition is detected by the sensor, a signal is sent to the warning horn to alert the operator of a possible problem with the system.



Since 1987, most powerheads are equipped with a single large oil tank mounted on the powerhead. The tank is provided with an oil level indicator which is visible through a window in the cowling.

Warning Module 50hp and 60hp 3-Cyl. Models (1991 and on) and 4-Cylinder Models Only

The warning module is connected electrically to the low oil sensor in the oil tank, and to the powerhead temperature sensor in the powerhead; to the switch in the remote control box; and to a 12-volt supply.

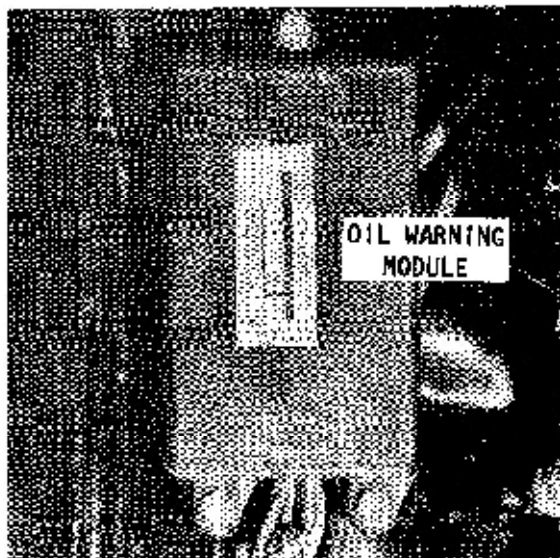
The module responds to signals from both sensors and completes the circuit to the warning horn. By having the module connected to the ignition switch, each time the switch is turned on and before the powerhead starts, the warning horn will sound because the motion sensor sends a signal to the module indicating the pump is not operating. The horn sounding also assures the boat operator the system is functioning properly.

Oil Pump

The oil pump is mounted on the powerhead and is driven by a gear and shaft arrangement off the crankshaft. Therefore, as soon as the crankshaft begins to rotate, even during the cranking process, the pump also rotates and begins to deliver oil to the fuel/oil mixer. The pump will meter oil for a mixture with the fuel of approximately 50:1 at wide open throttle and increases the ratio to 100:1 at idle speed.

OPERATION ADVANCED OIL INJECTION

On models **without** a warning module, when the key switch on the remote control



The oil warning module is clearly marked and is installed on the port side of the powerhead.

box is turned to the **ON** position, **AND** the test button on top of the oil tank is depressed, the warning horn will sound intermittently, indicating the warning horn circuit is functioning.

On models **with** a warning module, when the key switch on the remote control box is turned to the **ON** position, the warning horn will sound intermittently, indicating the warning horn circuit is functioning.

The oil is gravity fed downward from the powerhead mounted oil tank to the oil injection pump.

Because the oil injection pump is mechanically operated through a gear and shaft from the crankshaft, as soon as the crankshaft begins to rotate, even during cranking, the pump begins to rotate also.

The injection pump will meter oil at an oil/fuel ratio of approximately 100:1 at idle speed and at 50:1 ratio at WOT.

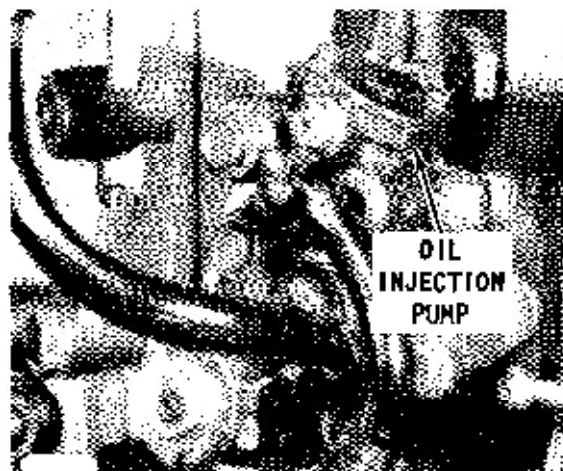
This metering is controlled through direct linkage to the carburetor linkage.

From the oil injection pump, the oil is mixed with fuel from the fuel pump and transferred to the top carburetor.

FILLING OIL INJECTION SYSTEM

There is nothing mysterious or difficult about working with the oil injection system. A few points need to be mentioned to ensure proper performance of the system.

The manufacturer recommends Quick-silver Formula 2-cycle Outboard Motor Oil. If this oil is not available in your area, a high quality 2-cycle outboard oil with a BIA rating of TCW may be substituted.



The oil injection pump is driven off the crankshaft and supplies oil to the fuel pump. The oil pump is gravity fed from the oil tank mounted high on the powerhead.

Remove the fill cap and add oil as required. Be sure to install the gasket and tighten the cap securely.

PURGING AIR (BLEEDING) ADVANCED OIL INJECTION SYSTEM

Air must be purged ("bled") from the system to ensure the proper amount of oil being delivered to the cylinders through the carburetors.

With the powerhead not operating, hold an absorbent cloth below the oil injection pump and be prepared to catch oil as it oozes from the bleed screw. Loosen the bleed screw three, maybe four full turns, and allow oil and any air to escape from the screw. When a steady stream of oil is observed with no sign of air, tighten the screw securely.

OIL PUMP ADJUSTMENT

Because the oil injection pump meters oil to mix with fuel for delivery to the carburetors, the pump is physically connected through linkage to the throttle shaft linkage. This arrangement ensures a change in oil metering as the throttle is opened and closed.

To adjust the oil injection pump, begin with the throttle linkage in the idle position and the powerhead **NOT** operating. Observe



At the first sign of trouble -- the oil warning horn sounding intermittently -- shut down the powerhead **AT ONCE** and check the supply of oil in the oil tank.

the mark on the oil injection arm and the mark on the pump casting. The two marks should be aligned.

If the marks are not aligned, adjust the oil injection link rod as shown in the accompanying illustration.

TROUBLESHOOTING OIL ADVANCED INJECTION SYSTEM

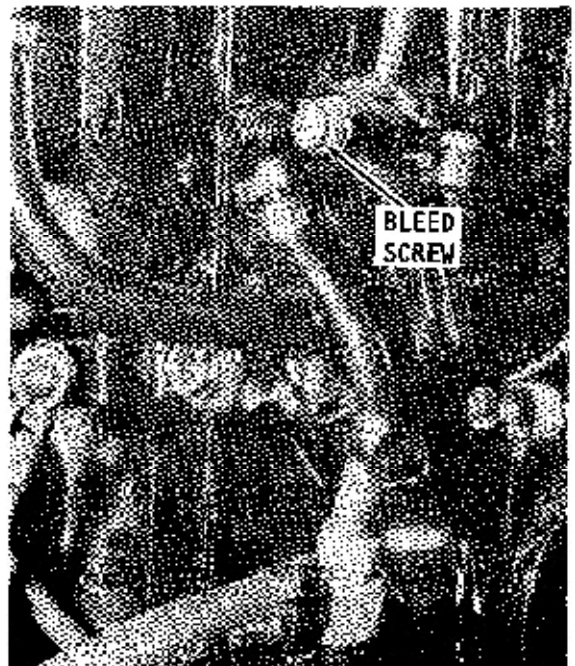
The first indication of a problem in the oil injection system will be indicated by the warning horn sounding intermittently. If the horn sounds while the powerhead is operating, shut the unit down **IMMEDIATELY**.

Open the cowling and make a visual inspection of the oil injection components. If the oil level in the tank is low, the horn was correct in sounding. Filling the tank with oil will **NOT** correct the problem. A determination must be made as to why the oil level is low.

WARNING

NEVER OPERATE THE POWERHEAD ON FUEL ONLY. IN AN EMERGENCY, ADD OIL FROM THE REMOTE TANK TO THE FUEL TANK. SERVICE THE OIL SYSTEM AT THE FIRST OPPORTUNITY.

Consult the **TROUBLESHOOTING** chart in this section for possible causes and corrective action to be taken to return the oil injection system to satisfactory operation.



The oil pump bleed screw is located on the port side and is easily accessible.

TROUBLESHOOTING

Warning Horn Fails To Sound When Ignition Key Is Turned To ON

Possible Cause

Faulty horn or open tan wire between horn and powerhead.

Warning module.

Corrective Action

Disconnect tan lead from powerhead wiring harness at terminal block on powerhead. Ground tan lead to powerhead ground. Warning horn should sound. If not, check tan wire between horn and powerhead for open circuit. Check horn.

Ensure all warning module leads are connected to harness leads. If so, warning module is defective.

Horn Sounds Continuously When Ignition Key Is Turned To ON

Possible Cause

Faulty powerhead overheat sensor.

Warning module.

Corrective Action

Disconnect overheat sensor and turn ignition key to **ON** position. If horn still sounds continuously, warning module is at fault. Replace module and retest. If horn does not sound, overheat sensor is faulty. Replace.

If horn sounds intermittently, with an adequate oil supply in the tank, warning module is faulty. Replace.

Warning Horn Sounds When Powerhead Is Operating Oil Level In Tank Adequate

Possible Cause

Faulty powerhead ignition system.

Defective low oil sensor in tank.

Corrective Action

Check ignition coil lead connections on ignition switch box. Determine the coil lead having the green wire from the warning module connected to it. Check the coil for correct voltage. If voltage to coil is correct, voltage to warning module is correct.

Disconnect Tan and Black low oil sensor leads from terminal connectors. Do not remove cap from reservoir. Connect ohmmeter between leads. If oil level in tank is between half full and full, the meter should indicate **NO** continuity. If continuity is present, sensor is faulty. If the oil level in the tank falls below 1 quart (0.95l), meter should indicate continuity. If the meter indicates **NO** continuity, sensor is faulty.

Defective oil pump drive system.

ENSURE unit will have adequate cooling water.

Use 50:1 fuel/oil mixture and start engine. Disconnect link rod between pump and carburetor linkage. Disconnect outlet hose of pump and observe if pump is discharging oil. If no oil, pump drive system is at fault.

Warning module.

If above tests check out OK, replace warning module.

SERVICING ADVANCED OIL INJECTION

The following procedures provide detailed illustrated steps to service components of the "Advanced Oil Injection System".

Perform only the steps required to return the system to satisfactory operation.

Keep the work area as clean as possible and strive to prevent contaminants from entering the system. One of the filter screens in the fuel filter has extremely small openings and can become quickly clogged with dust particles or other foreign material.

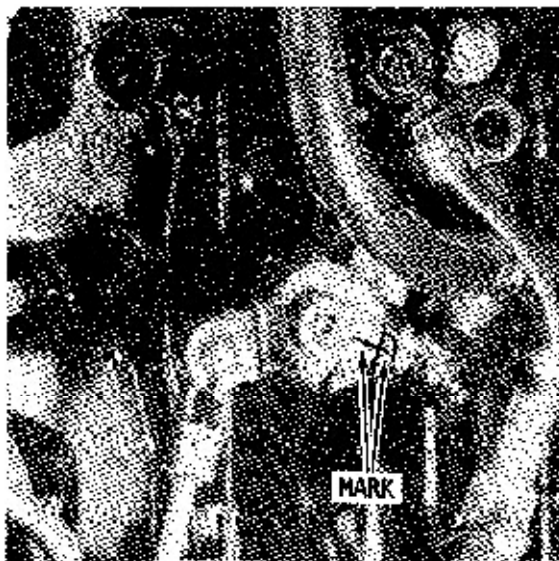
GOOD WORDS

The only purpose for disassembling oil injection pump is to locate a problem in oil delivery. For example, if the pump is frozen due to debris or rust, the pump can be disassembled and cleaned.

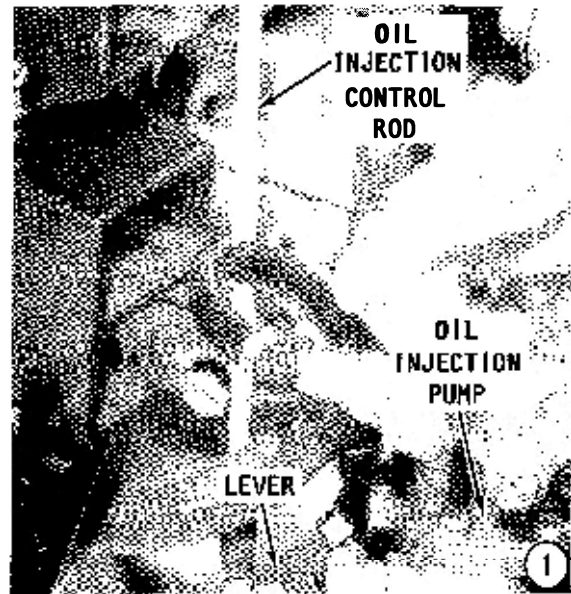
The manufacturer has made no provisions for rebuilding this pump. Spare parts are **NOT** available. If any part is found to be defective and no longer fit for service, other than O-rings, washers or possibly the spring, the pump must be replaced.

O-rings and washers can be matched and replaced, but the spring inside the pump is a component of the oil metering system. Therefore, the elasticity of the replacement spring must be evenly matched. Not an easy task.

SAVE the O-rings, even if they are defective. The old ring will be essential when purchasing a new ring to ensure the proper type and size is obtained.



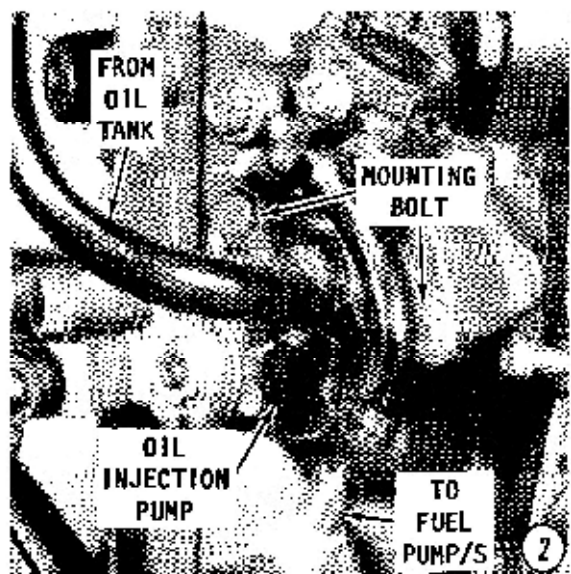
To adjust the oil pump, align the two marks according to the procedures outlined in the text.

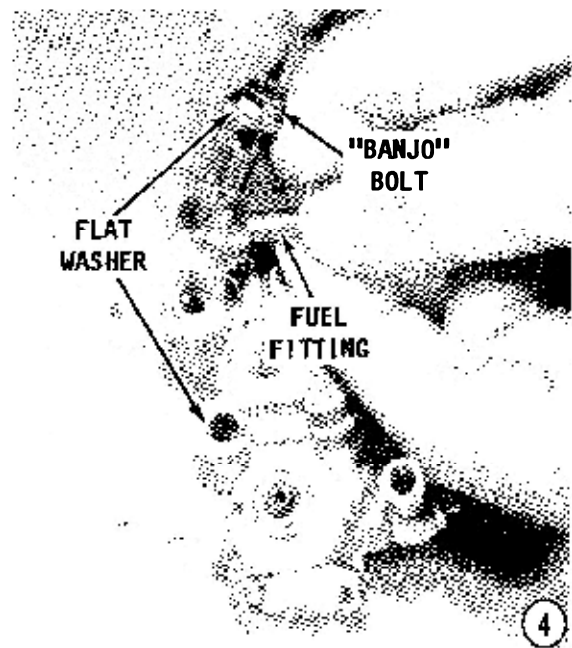
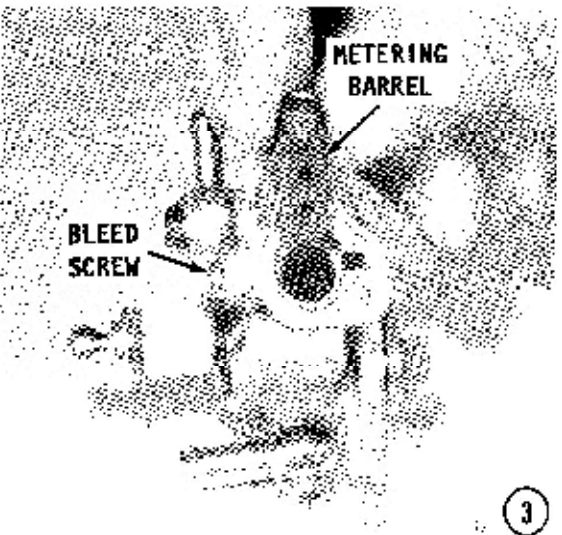
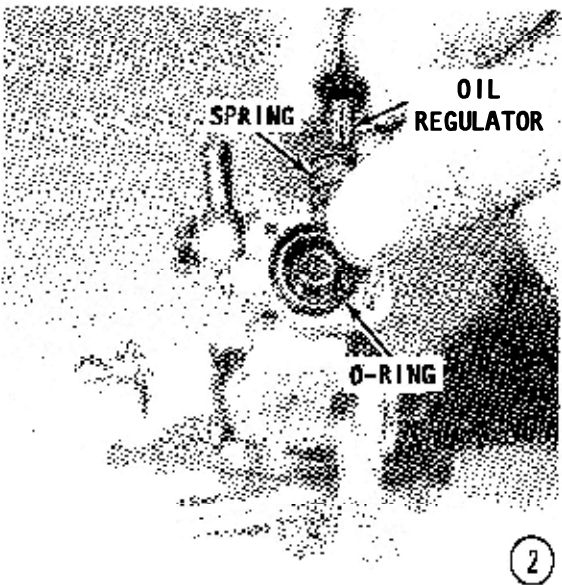
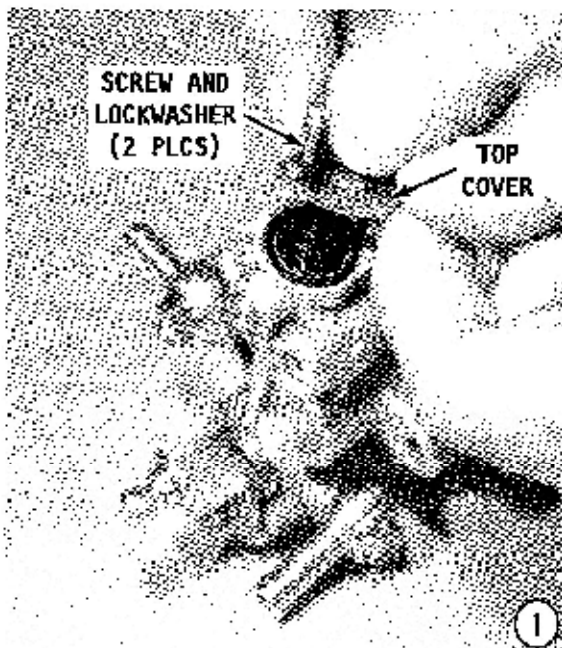


REMOVAL

1- Pry the oil injection link rod free of the ball joint on the injection pump lever. Take care not to alter the length of this rod. If the rod length is accidentally altered, procedures to adjust the length will be found on Page 4-59.

2- Position a suitable container as far as possible under the oil pump to receive oil drained from the tank. Snip the Sta-strap at the inlet fitting. Squeeze the oil supply line from the tank to the pump, to restrict the flow of oil while pulling it free of the fitting. Allow the contents of the tank to drain into the container. Pull the oil line free of the other oil pump fitting. Remove the two bolts securing the pump to the powerhead and lift the pump clear.





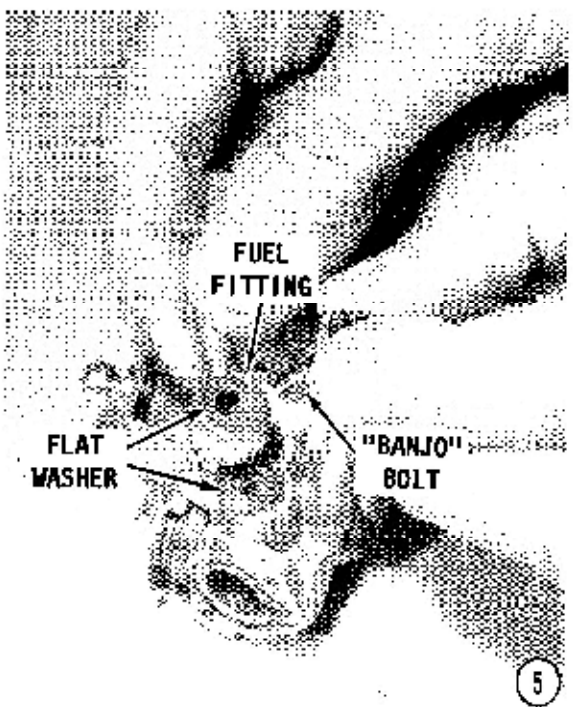
DISASSEMBLING

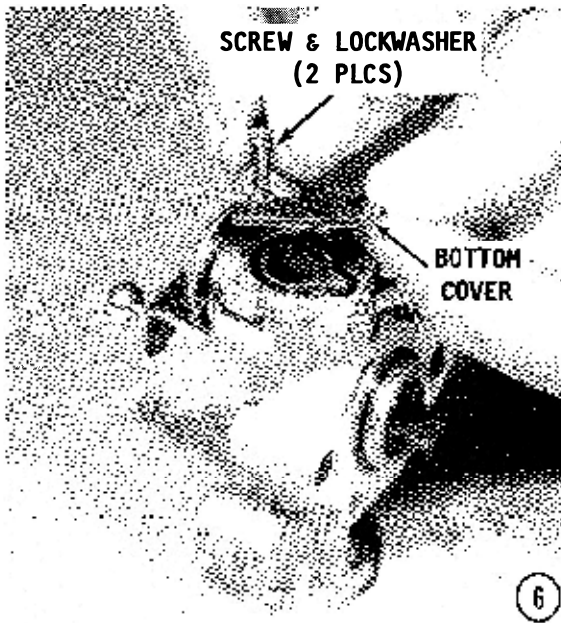
1- Remove the two Phillips head screws with captive lockwashers, and then remove the top cover.

2- Lift out the oil regulator and spring. Remove and save the O-ring.

3- Use a small pair of needle nose pliers and carefully pull out the metering barrel. Remove the bleed screw and gasket/washer.

4- Loosen and remove the "Banjo" bolt from the oil outlet fitting. The "Banjo" bolt is a very special bolt with a hole





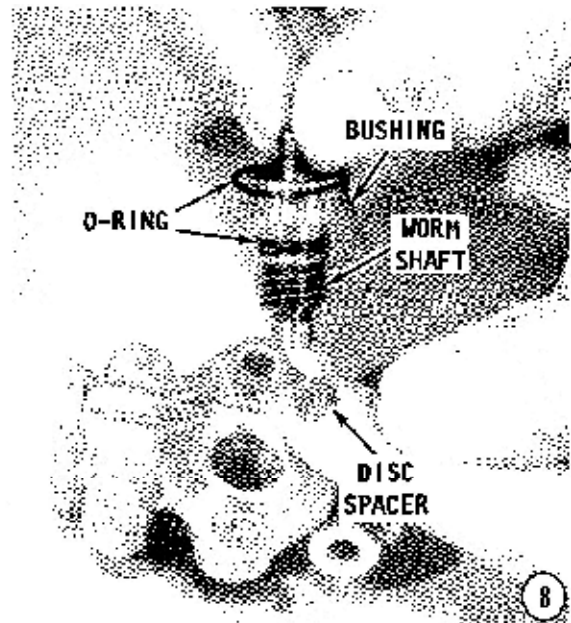
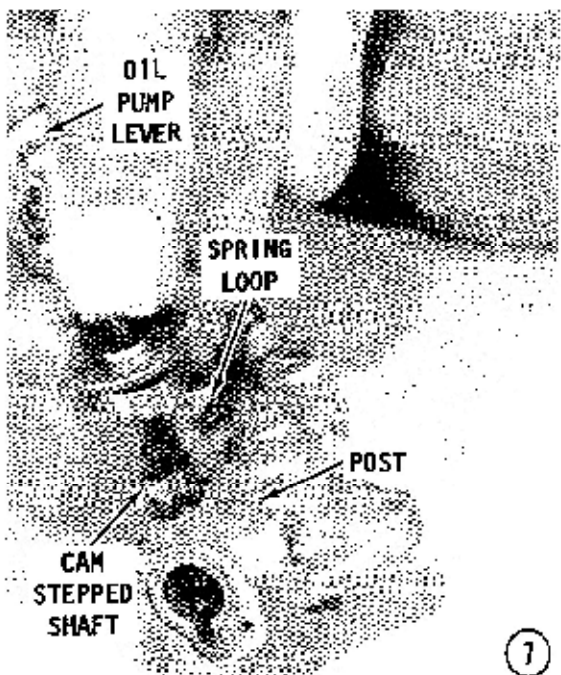
through the shank. The design allows the bolt to be used to secure the fitting and at the same time permit oil to pass through.

Remove the fuel fitting and the two flat washers, one on both sides of the fitting.

5- Remove the fuel inlet fitting in the same manner, as described in the previous step.

6- Remove the two Phillips head screws with captive lockwashers, and then remove the bottom cover. Save the O-ring.

7- Note the spring tension on the lever provided by the spring, as an aid during installation. Unhook the small spring loop from the post on the pump body and pull out



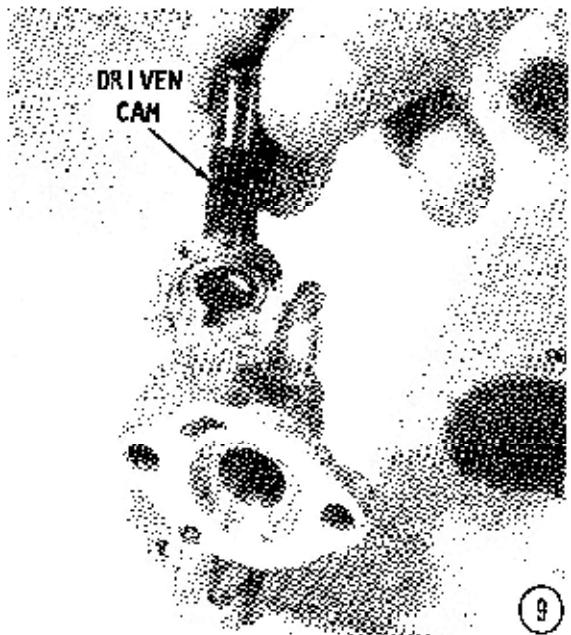
the oil pump lever and stepped cam shaft assembly. Save the O-ring.

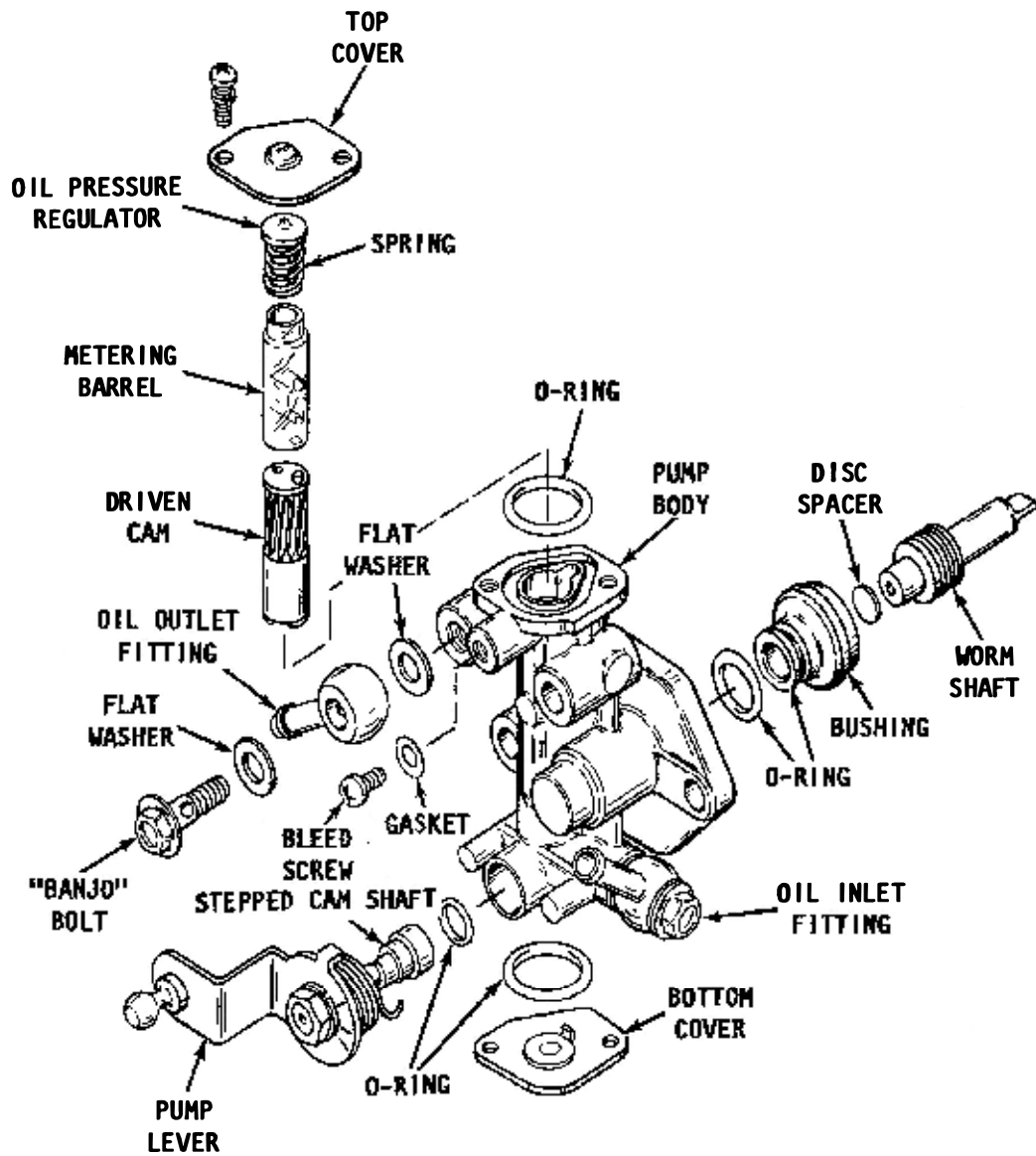
8- Pull out the worm gear shaft and bushing from the side of the pump. Take care not to loose the small disc spacer at the end of the shaft. Save the two O-rings.

9- Push out the driven cam from the pump.

CLEANING AND INSPECTING

Make certain all O-rings are removed from the body before emersing the pump in solvent as the solvent will cause the rubber to swell and ruin the sealing properties of the O-rings.





Exploded drawing of an oil injection pump with major parts identified.

Rinse the pump body and pump covers in solvent and then blow them dry with compressed air. Check all parts and passages to be sure they are not clogged or contain any deposits.

Inspect the condition of the worm shaft threads/teeth and also those on the driven cam for excessive wear or cross threading. Inspect the two coupling posts on the driven gear which engage the holes in the metering barrel. If these posts are sheared off, or the holes elongated, the amount of oil delivered to the powerhead will be greatly restricted. Such a condition will cause a serious lack of lubrication in the powerhead. Therefore, the pump **MUST** be replaced.

The metering barrel and the driven cam ride on the stepped cam at the base of the pump. The regulator rides inside the top of the metering barrel. The top of the regulator rests against the top cover. As the stepped cam is rotated, by action of the oil pump injection lever, the metering barrel and driven cam are raised up against the spring pressure of the regulator spring.

As the metering barrel rises, relative to the regulator, small oil passages are blocked off. Thus, the action of the oil injection pump lever, regulates the oil flow at the outlet fitting. At low rpm, the metering barrel and driven cam ride on the high point of the stepped cam, restricting the flow of oil. At high rpm, the metering barrel, coupled with the driven cam, ride on the low



The rings on this piston became stuck due to lack of adequate lubrication, incorrect timing, or overheating.

side of the stepped cam shaft. In this position, the regulator is completely clear of the passages in the metering barrel and maximum oil flow is obtained. Any obstruction in these passages will restrict oil flow and subsequently powerhead lubrication.

If the oil pump had a tendency to leak oil, a number of areas may be at fault. The first place, and most common, is the O-ring around the worm shaft. If this O-ring was distorted during installation, the pump would leak at this point.

The second place for leakage is the top and bottom pump covers. Missing or distorted O-rings will cause the pump to leak at the covers.

The third place for leakage is the inlet and outlet fittings on the pump. These fittings **MUST** have a flat washer on both sides of the fitting. If either washer is missing, an oil leak could develop at this point.

The fourth and last place for a leak is the gasket/washer under the bleed screw. Both of these items **MUST** be in place and in good condition.

Inspect the holes in the two "Banjo" bolts. These special type bolts **MUST** be used to secure the fittings. Obviously, a regular solid type bolt will fit, but will totally shut off the flow of oil through the fitting, with **DISASTEROUS** results to the powerhead.

Lightly oil all internal pump components before assembling.

ASSEMBLING

1- Slide the driven cam down into the bottom of the pump body, with the gear end

