OIL INJECTION SYSTEM - DI/FICHT MOTORS

General Information

Unlike 4-stroke engines, which contain a reservoir of oil that is re-circulated during engine operation, 2-stroke engines are predominantly lubricated by mixing engine oil with the fuel. The internal engine components of 2-stroke motors are lubricated as this fuel/oil mixture passes through the crankcase and the cylinder.

Generally speaking, there are 2 methods of adding oil to a 2-stroke outboard. The first is to pre-mix oil with the gasoline whenever the fuel tank is filled. The pre-mix method is generally used on smaller (lower horsepower) motors and on most commercial outboards. It is easiest to perform this on portable fuel tanks that can be agitated to ensure proper mixture, but it can be successfully accomplished on larger built-in tanks, as long as care is taken to properly measure the amounts of fuel/oil being added. However one MAJOR drawback to this method is that it cannot take into consideration the varying amounts of oil that an outboard would need for ideal service. As such, to protect the outboard, the recommended mixture is usually too rich for all but high speed operation, trading more easily fouled spark plugs and pollution for the safety against a destroyed (under-oiled) powerhead.

For ease of service and to ensure a constant supply of 2-stroke oil that is matched to engine operating conditions (meaning not only less pollutants, but less chance of fouled plugs) on all fuel injected motors, lubrication is completely controlled by the oil injection circuits of the DI/FICHT Fuel Injection system.

Description and Operation

◆ **See Figures 1 and 2**

All DI/FICHT motors are equipped with an Engine Management Module (EMM) controlled oil injection circuit. Components of the system include the boat mounted oil tank/reservoir with primer bulb and supply line oil filter, a diaphragm-displacement oil pump (similar in design and function to the fuel lift pump), an electronic oil injector and oil distribution manifold assembly, oil hoses and injection nozzles, a pressure regulator and a pressure switch.

On all these motors, oil from the tank is supplied to the pump through a 1/4 in. (6.35mm) oil supply line (and inline filter). Oil is drawn through the line by the pump and forced the short distance downstream to the oil injector.

Functioning in a similar fashion as a FICHT fuel injector, the 40-volt oil injector hammer pulses oil flow to achieve high-pressure oil injection. Like the fuel system, the oil injector requires specific oil system pressure to operate properly. The 5/16 in. (8mm) diameter oil return hose circuit controls system pressure through function of the pressure regulator. The oil pump should supply a sufficient amount of oil so the regulator can maintain a constant pressure of 15-20 psi (103-138 kPa). The regulator vents excess oil back to the boat's oil tank.

The EMM monitors the oil injector circuit and can detect if an open should occur. In the event of an open injector circuit, the EMM will actuate the S.L.O.W. warning system and store a trouble code. It will also illuminate the **NO OIL** warning light.

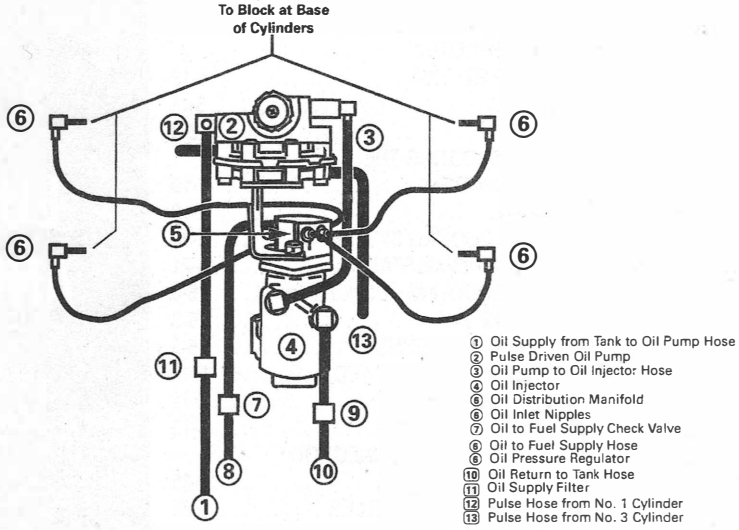


Fig. 1 Oil Injection system - 75-175 Hp V4/V6 DI/FICHT motors (NOTE: V4 shown, V6 similar, with additional distribution lines/oil inlet nipples and the 2nd pulse hose goes to Cyl #4 instead of #3

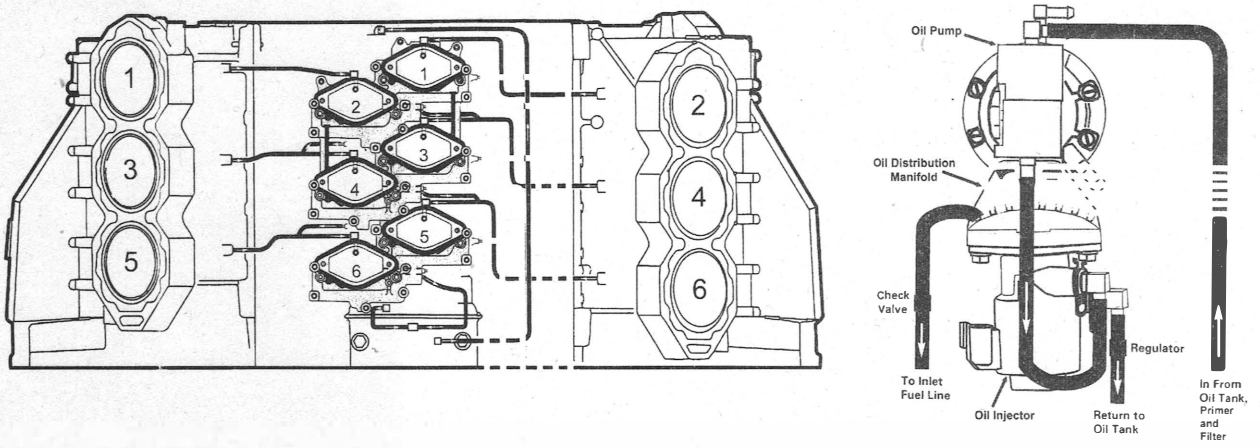


Fig. 2 Oil Injection and Recirculation system - 200-250 Hp V6 DI/FICHT motors

Though current tech materials do not confirm, traditionally special operational modes are used by the EMM to protect the powerhead. For instance, during startup a priming mode normally occurs where the EMM will rapidly actuate the injector for approximately 20 seconds to purge air and fill the oil lines from the distribution manifold. This mode occurs on the first time the engine reaches 1500 rpm after startup, but only on cold starts with engine temperatures below 104°F (40°C).

A special powerhead break-in mode can be actuated using the FFI diagnostic software. During break-in, the EMM will operate the oil injection system as normal below 2000 rpm, but will automatically double system output above 2000 rpm up to a maximum ration of 50:1 for the first 5 hours of powerhead operation.

■ **The DI/FICHT diagnostic software must be used to actuate the break-in mode whenever a powerhead is overhauled or replaced.**

An oil pressure switch that receives a voltage signal from the EMM is mounted to the oil pressure manifold where it can respond to oil pressure in the high-pressure injection circuit. The switch is normally open, but will close, completing the circuit and signaling the EMM that everything is ok once pressure reaches 53 psi (365 kPa). Should the pressure drop below 43 psi (296 kPa) the switch will reopen, causing the EMM to store a trouble code, actuate the S.L.O.W. system and illuminate the **NO OIL** warning light.

The oil distribution manifold is used to supply oil to the various points of the system. The manifold contains oil distribution lines, each equipped with some form of a check-valve to prevent oil drain-back when the injector is not actuated. The manifold utilizes one distribution outlet per cylinder and an additional outlet for the fuel supply system. The line for the fuel system connects to a "T" in the fuel supply line (located right before the lift pump).

These motors contain cylinder sleeves with pressed in nipples. Each cylinder oil supply line from the distribution manifold connects directly to a cylinder nipple and is used to inject oil directly into the cylinder sleeves (thereby reducing piston/cylinder wear).

In addition, these motors are also equipped with an oil recirculation system to go along with the cylinder sleeve oil injection.

For 75-175 hp models oil circulates from the low crankshaft bearing cavity to the upper cavity by means of a hose. A second hose connects the upper bearing cavity to the starboard intake manifold. When the engine is running, vacuum is used to pull oil from the lower bearing to the upper and then on to the intake manifold where it can be consumed. A check-valve is positioned in the hose connecting the 2 cavities to prevent drain-back whenever the engine is stopped. Additionally, the powerhead contains oil drain passages that connect the cylinders from top to bottom on each side of the cylinder block. In this way residual oil will move from the highest to the lowest cylinder during engine operation. A hose connects to a nipple at the lowest cylinder and passes oil through a check valve, back to the top cylinder. A separate system for this is utilized on both sides of the engine block.

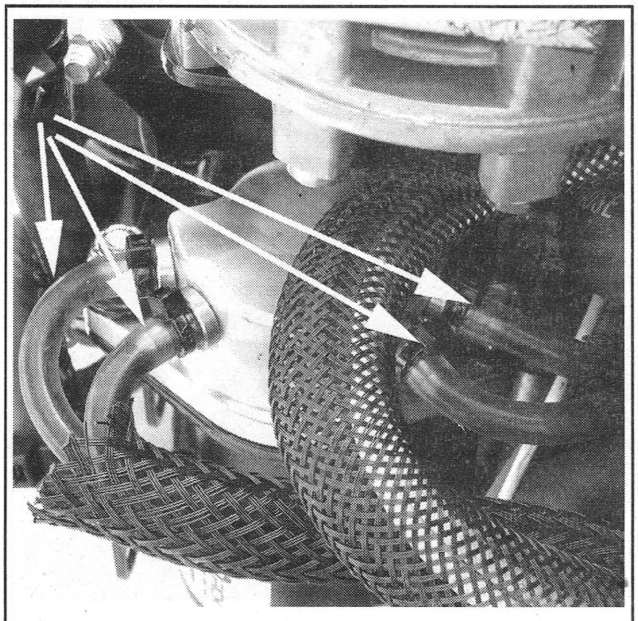


Fig. 3 Although the oil distribution lines are normally clear. . .

A similar, but slightly more complex version of the recirculation hoses are used on 200-250 hp models. For these motors each cylinder contains a hose which travels from a check valve mounted in the block to a point just above and behind the intake manifold. In addition for the lower 4 cylinders a drain line from the cylinder above T's into that line. The drain lines for the lower two cylinders proceed into a lower block fitting and a bottom block fitting connects with a fitting all the way back on top of the block. In this system residual oil will tend to move downward to the next lower cylinder for burning, eventually oil from the lowest cylinders moving back to the top cylinder.

Troubleshooting the DI/FICHT Oiling System

CHECKING THE OILING SYSTEM

◆ **See Figures 1 and 2**

Like the ignition system on these motors, the oil system is an integral of the DI/FICHT Fuel Injection system, overall system test procedures are provided here under Checking the Oiling System. If overall system testing leads you to component diagnosis (such as the oil injector circuit, regulator/check valve or pressure switch testing) refer to the Oil System Component Testing procedures, as also in this section.

■ **Be sure to check for any trouble codes before starting these test procedures. If possible, make repairs and clear all codes before proceeding.**

Unless otherwise instructed by a trouble code, symptom chart or other test, follow each of the test procedures in the order provided to ensure a complete verification of the oil injection system.

If over or under-oiling still occurs after the conclusion of these tests, perform the Pressure Testing the Oil Injector check found in the Oil System Component Testing procedures.

These tests are meant to help determine the cause of a **NO OIL** warning signal. If a **LOW OIL** light is illuminated, start by checking and filling the oil tank (or looking for problems with the sending unit).

Static System Verification

OEM ③ DIFFICULT

◆ **See Figures 3 and 4**

The Static System Verification test involves telling the EMM to actuate the oil injector while the engine is not running. Problem is the only way to do that is by using the Evinrude Diagnostic Software. If this is not available, you won't be able to perform this test.

1. Verify that the oil distribution hoses (from the manifold to the cylinders and fuel supply) are purged of air. Most hoses used on these

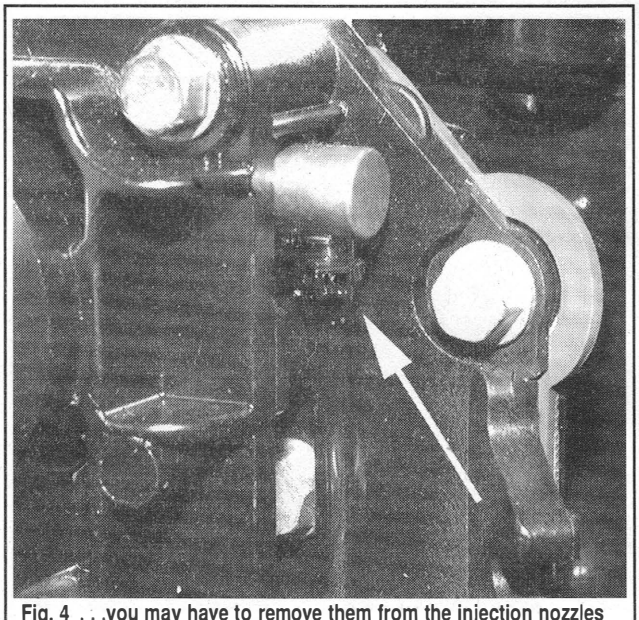


Fig. 4 . . .you may have to remove them from the injection nozzles to really tell if oil is flowing

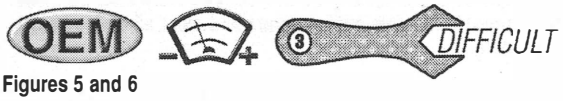
models are clear and you should be able to see bubbles. If in doubt (or if air must be purged), crank (or run) the engine while restricting (squeezing or kinking) the oil return line. Continue until oil is present at the injector nozzles.

■ If you cannot tell if oil is flowing in the next step, tag and disconnect the oil distribution hoses at the powerhead.

2. Using the Evinrude Diagnostic Software, initiate the Oil Injector Test, while manually pumping the oil system primer bulb (to keep the system supplied with oil in absence of oil lift pump operation). The oil injector should click (when activated by the EMM) and a small amount of oil should discharge from each injector hose/nozzle. Proceed as follows, depending upon the results:

- If the oil injector does NOT click, proceed with the Voltage Tests, in this section.
- If the injector DOES click, but there is no oil output, proceed with the Oil Flow Verification procedure in this section.
- If there is oil output, but ONLY on some nozzles, note the problem hoses and proceed with the Nozzle/Manifold Test in this section.
- If oil output seems good, verify that there is no blockages in the injector nipples, then proceed with the Pressure Testing the Oil Lift Pump (Oil Supply Verification) test, in this section.

Voltage Tests



◆ See Figures 5 and 6

Voltage readings during this test should be slightly less than about 12-volts (or battery voltage) as long as the keyswitch is **ON** and the powerhead is not running. HOWEVER, with the powerhead running the same circuits should show 34-42 volts on 75-175 hp models or 28-42 volts on 200-250 hp models. Voltage should, however, retain steady at a steady RPM.

✳✳ CAUTION

NEVER start and operate the outboard if the oil injector assembly has failed to operate during a static test.

1. Check the fuse in position No. 1 of the power distribution block (fuse box). If the fuse is in good shape, check for power on the circuit (to the fuse) with the keyswitch **ON**, but motor not running. There should be slightly less than battery voltage between that terminal and a good engine ground.

2. If there was no voltage in the previous test, check voltage on the 40 Volt alternator output wire of the Power Distribution Panel (PDP). The alternator output wire is the White/Red wire (Terminal **A** of the 4-pin PDP connector). If there is proper voltage check the 4-pin connector, then repair or replace the fault harness, connector or PDP. If however there is no or low voltage on the wire, verify alternator connection from the EMM to the wire harness. Repair the faulty connection. If necessary, refer to the Electrical System section for Stator testing procedures.

3. The next step is to check for voltage (Key ON, motor not running) at the EMM J2 connector, Pin **10** - Blue Wire (refer to the Fuel System section for more details on EMM connectors). Use a DVOM with a test probe (#342677 or equivalent) to carefully back-probe the EMM injector connector. There should be slightly less than battery voltage between that wire and a good engine ground. If there is, use the Evinrude Diagnostic Software to activate the oil injector, while monitoring voltage on Pin **10** still using the diagnostic probe.

4. If there was no voltage in the previous step, check for voltage at the oil injector (on the white/blue wire). You can disengage the connector in order to check (as usual the keyswitch must be ON). If there is voltage present here, suspect an open circuit in the blue wire or oil injector coil. Check resistance on the wire from the EMM J2 connector, pin **10** to the injector connector Pin **2** (Blue wire whole way). Also, perform a resistance check of the oil injector circuit, by following the Resistance Checking the Oil Injector procedure found later in this section.

5. If there was still no voltage present in the pervious step, suspect an open circuit in the white/blue wire (between pin **1** of the oil injector and fuse position 1 of the PDP) or a damaged PDP (fuse box).

Oil Flow Verification



A manual check can be performed first by disconnecting the oil return hose from the oil injection tank and directing it into a suitable container. Use the oil primer bulb to squeeze oil through the system. A small amount of oil should flow from the hose and there should be a decent amount of resistance on the primer bulb. You can either reconnect the hose to the oil tank (if you want to observe operational flow back into the tank) OR you can leave it disconnected and pointed into a suitable container (if you want to measure and verify the amount of oil flow during the operational check).

To perform and operational check (watching output of the system with the powerhead running), connect the engine to a suitable source of cooling water, then either direct the return hose into a suitable empty container for measurement or open the oil tank so that you can monitor return line oil flow. Start and run the engine while observing for return flow at the tank.

■ If measuring discharge the oil return hose should produce approximately 12 oz (355 mL) of oil in about 2 minutes.

If flow is good, but delivery problems are suspected, perform the Nozzle/Manifold Test in this section.

If there is no return oil flow, check for a problem with the oil pick-up assembly, kinked supply line, faulty oil pressure regulator or fittings, or

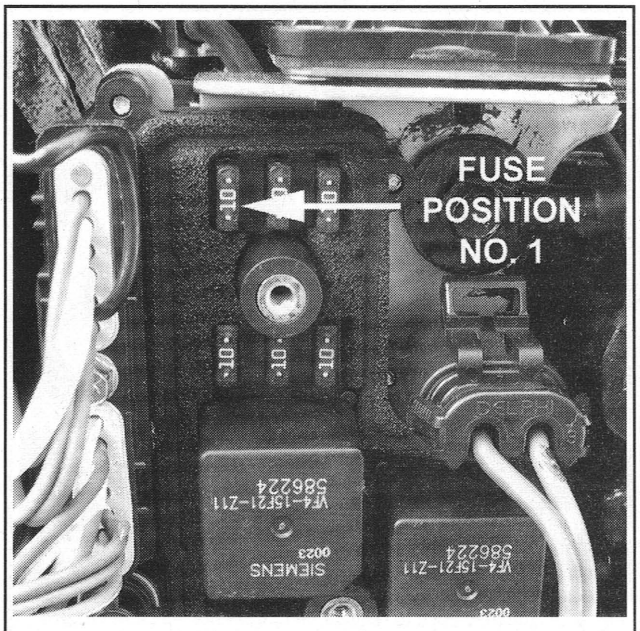


Fig. 5 Injector voltage supply fuse (position No. 1) of the PDP



Fig. 6 Injector control wire EMM J2 connector, Pin 10 (blue wire)

blockage in the oil injector. If there are no air leaks or restriction in the lines, suspect the oil lift pump (check pressure) or a restricted oil injector. Repair or replace components, as necessary.

Vacuum Testing the Oil Pick-Up Assembly

OEM ② MODERATE

◆ **See Figure 7**

If problems are suspected with the tank pickup assembly you can remove it from the tank and check it (using a hand vacuum/pressure pump) for restrictions or air leaks.

1. Loosen and remove the screws (usually 4) securing the oil pick-up assembly to the top of the oil tank, then remove the assembly (taking care to remove the old gasket).
2. Carefully disconnect the pickup filter, and then flush it with mild solvent to remove any contaminants. Install the filter again.
3. Gently disconnect the oil hose from the pickup and WAY at the other end, disconnect it from the oil lift pump on the powerhead. Direct the lift pump end of the hose into a suitable container to catch oil.
4. Using a regulated source of low-pressure compressed air (or a hand pressure pump), blow though the line toward the lift pump to purge oil from the hose. If there is a problem blowing through the hoses/fittings, check for and repair any restrictions.
5. Install a snug fitting plug (such as plug/holder #329661) into the pickup end of the hose, then attach the hand vacuum pump to the lift pump end of the oil supply hose.
6. Using the hand vacuum pump, draw 7 in. hg. (177.8mm hg.) of vacuum on the hose. It must hold for AT LEAST 5 minutes, otherwise you need to repair or replace the leaking components.
7. Remove the plug and reconnect the oil hose to the tank pickup and the other end to the lift pump.
8. Before installation double-check the height of the pickup assembly (measured from the gasket mating surface on the underside of the pickup to the bottom of the pickup tube (the plane along which the pickup filter mounts). Height will vary with tank size and should be:
   - 1.8 gallon oil tank - 6.84-6.96 in. (174-177mm)
   - 3.0 gallon oil tank - 8.74-8.86 in. (222-225mm)
9. Using a new gasket install the pickup assembly back to the oil tank and carefully tighten the retaining screws. Using the primer bulb, refill the oil supply hose.

Pressure Testing the Oil Lift Pump (Oil Supply Verification)

OEM ③ DIFFICULT

The oil tank, pickup, primer bulb and hose assembly (with inline filter) must provide the oil lift pump with unrestricted and leak free oil supply which also does not allow air into the system.

Before checking the lift pump output you must be certain the following components are in good condition:

- Oil hoses and pickup (you can vacuum test them as detailed earlier in this section).
- Primer bulb check valves (work if the bulb can deliver oil to the pump).
- Two filters (in-tank and inline, again these can be verified by manually pumping oil to the pump with the primer bulb).
- Oil tank and cap (the cap is vented and must allow air to enter the tank preventing a vacuum from building which could eventually overpower the lift pump). If the vent is working properly you'll never hear a psssssssssssst of air rushing into the tank when the cap is loosened.

After repairs, or if other tests lead you to verify the oil supply, proceed as follows:

1. Check for a sufficient oil level in the boat oil tank.
2. Remove the retainer clip that secures the oil inlet fitting to the oil injector. Install the oil pressure test adaptor (#350618) between the oil supply hose and the injector.
3. Connect a pressure gauge to the test adaptor.
4. Connect a source of cooling water to the powerhead.
5. With the engine running or cranking, system pressure should be regulated at 15-20 psi (103-138 kPa) at idle speeds. If pressure is within specification, perform the final test, Oil in Fuel Injection System Verification, in this section.
6. If pressure is below specification, check for the following potential causes:

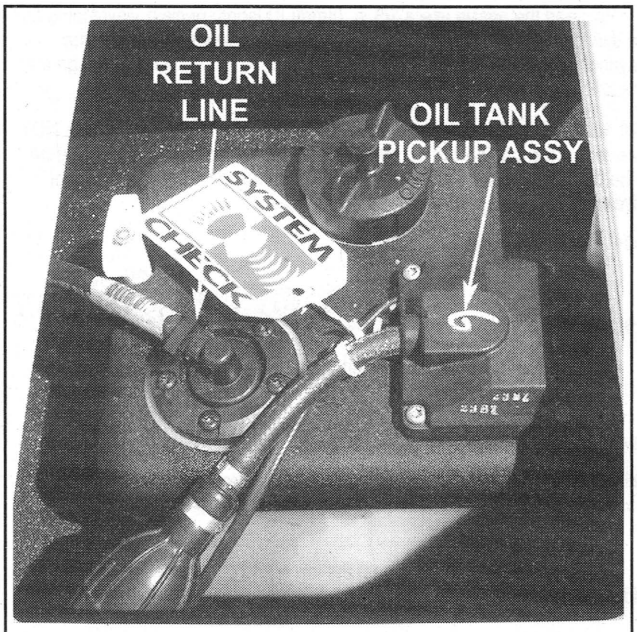


Fig. 7 Typical Evinrude oil tank pickup and return lines

- Restricted or leaking supply line (not supplying sufficient oil flow).
- Pressure regulator stuck open (allowing too much return flow).
- Faulty oil pump (not supplying sufficient flow).
- Faulty oil injector (stuck open, allowing oil to flow constantly through the distribution manifold hoses).

7. If pressure is ABOVE specification, check for a restricted return line, a stuck closed pressure regulator or an oil injector with a restriction (not allowing oil to outlet/oil return hose).

■ **HINT - excessive oil consumption and/or a smoking exhaust from the powerhead may be related to a kinked or otherwise restricted oil return line causing excessive pressure in the oil system.**

Oil in Fuel Injection System Verification

② MODERATE

During this test, you must maintain oil system pressure. You've got 2 options. The first is to run the engine (using the pump to maintain pressure). The second is to manually squeeze the oil primer bulb during the test.

1. Trace and disconnect the oil metering hose from the manifold to the fuel injection system fitting. The hose is connected to a T-fitting in the fuel lift pump (low pressure pump) supply line.
2. Verify that a small amount of oil discharges from the hose each time the oil injector clicks (when actuated using the Evinrude Diagnostic Software or by the EMM with the engine cranking for a few seconds).
3. Repair of replace any necessary oil system components if discharge does not occur. Suspect the hose or clogged fittings first.

OIL SYSTEM COMPONENT TESTING PROCEDURES

Nozzle/Manifold Testing

OEM ② MODERATE

◆ **See Figure 8**

If problems in the Static Verification Test cause you to suspect one or more cylinder oil hose circuits, disconnect the hose from the suspected nozzle and recheck (using the Static Verification Test again). If oil flows from the hose with it disconnected but not when it is attached to the fitting, clean or replace the injector nozzles. If no oil flows, compare the discharge to other fittings and check for kinked or restricted hoses. If none are found replace the oil injector and manifold assembly.

To clean the nozzle use a 1/8 in. (3mm) ID length of clear vinyl tubing and a syringe filled with isopropyl alcohol. Attach the length of tubing to the syringe and to the nozzle, then using the syringe force the fluid through the nozzle.

■ **Make sure the piston for the cylinder you are trying to clean is NOT covering the port in the oil cylinder sleeve. If necessary, slowly rotate the flywheel by hand (clockwise when looking down at the flywheel from above) to reposition the piston.**

Oil Injector (Nozzle) Testing

◆ **See Figure 9** OEM ② MODERATE

If the Pressure Testing the Oil Lift Pump (Oil Supply Verification) or Nozzle/Manifold Tests suggest that perhaps the internal nozzle in the oil injector housing leaking (not closing properly) it can be tested using a hand pressure pump.

■ **A sticking injector nozzle (one that is not closing properly) can cause excessive oil consumption, engine smoking or even rough running.**

1. Remove the retainers from the inline and outlet oil fittings on the oil injector. Then carefully disconnect the fittings.
2. Install inlet (#5000911) and outlet (#5000912) service fittings to the injector and secure with the retainers.
3. Cover the outlet fitting using a restrictive cap (#328074) and secure in place with a clamp.
4. Connect a hand pressure pump to the inlet fitting, and then pressurize the injector to 30 psi (207 kPa). The injector should hold about 24 psi (165 kPa) or more for about 5 minutes. If not, the injector must be replaced.

Oil Pressure Regulator Testing

OEM ② MODERATE

◆ **See Figure 10**

The oil pressure regulator is an inline check valve located in the oil return hose.

Like most check valves is can be tested using pressure and vacuum. Making sure it opens under the right pressure from one side or a vacuum from the other side (but would not allow flow in opposite directions).

1. Remove the valve from the hoses for testing.
2. Connect a pressure tester to the inlet side of the valve and slowly apply pressure. The valve must open by 6 psi (41 kPa) or sooner.
3. Remove the pressure tester and connect a vacuum pump to the outlet side of the valve. Begin to apply vacuum, the valve must open by 12 in. hg. (305mm hg.) or sooner.
4. Replace the valve if requires excessive amount of vacuum or pressure to open.

Check Valve Testing

◆ **See Figure 10** OEM ② MODERATE

An inline check valve is located in the oil supply hose between the distribution manifold and the fuel supply. It is used to make sure oil flows only in one direction (toward the fuel supply) and no fuel is pushed back through the oil lines.

Like most check valves is can be tested using pressure and vacuum. Making sure it opens under the right pressure from one side or a vacuum from the other side (but would not allow flow in opposite directions).

1. Use a Sharpie® or suitable permanent marker to mark the position of the oil hose in relation to the hose retainer (how deeply the hose was inserted). Then, disconnect the hose from the distribution manifold assembly (release the hose by pressing the outer ring of the retaining mechanism). Also, disconnect the hose from the fuel supply connection.
2. Connect a pressure tester to the inlet side of the hose to the check valve and slowly apply pressure. The valve must open by 3 psi (21 kPa) or sooner.
3. Remove the pressure tester and connect a vacuum pump to the outlet side of the hose to the check valve. Begin to apply vacuum, the valve must open by 6 in. hg. (152mm hg.) or sooner.
4. Replace the valve if requires excessive amount of vacuum or pressure to open.
5. When reconnecting the hose to the distribution manifold make SURE the hose support is in hose and properly positioned as noted during disassembly.

Resistance Testing the Oil Injector Circuit

◆ **See Figures 5 and 6** -+ ② MODERATE

■ **This test checks the entire circuit AND the injector coil itself all at once.**

Although Bombardier actually advises you to test this circuit by backprobing the EMM J2 connector at Pin 10 using the diagnostic probe # 342677, we recommend disconnecting the J2 connector to make sure there is no danger of shorting and damaging an EMM circuit with the meter.

The ignition must be OFF for this test.

Disconnect the EMM J2 connector from the back of the EMM. Locate Pin **10** (blue wire) and using a DVOM check resistance between that terminal, all the way through wiring harness from the J2 connector, through the injector and back through the injector power supply to Fuse Position 1 of the PDP.

Injector circuit resistance should be about 1 ohm (0.86-0.96 ohms). Remember however that this test must be conducted with a high quality DVOM, and that specifications will vary slightly with temperature. The specifications provided here are for components at an ambient room temperature of about 68-77°F (20-25°C). If the component is tested at higher or lower temperatures, expect the readings to vary slightly.

An infinite reading indicates an open somewhere in the circuit. If that occurs, isolate the faulty fuse, wiring, connection, injector coil or PDP which is at fault by checking around these components.

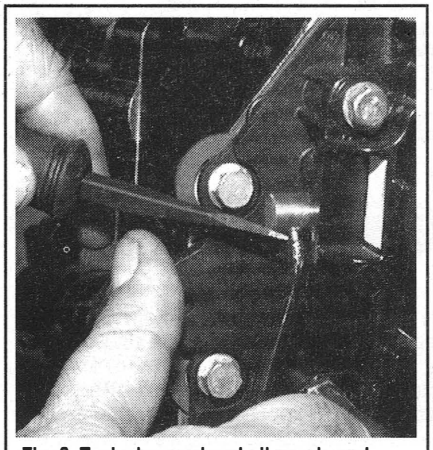


Fig. 8 Typical powerhead oil nozzle and hose from the distribution manifold

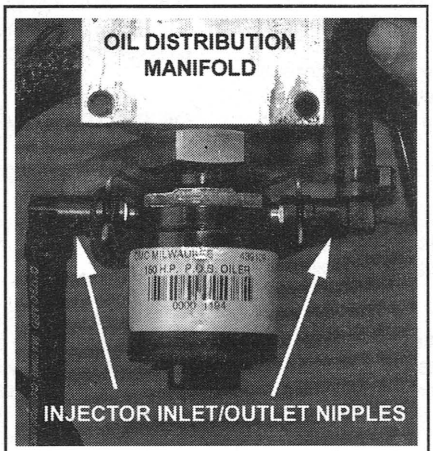


Fig. 9 Pressure testing the oil injector

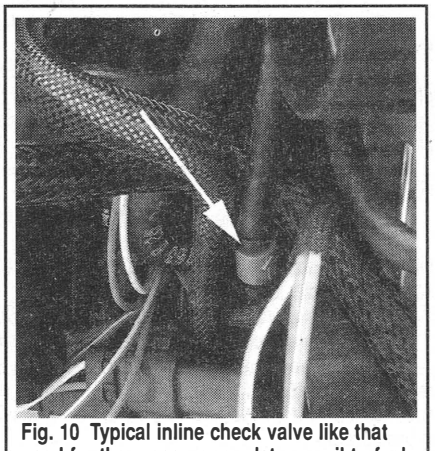


Fig. 10 Typical inline check valve like that used for the pressure regulator or oil-to-fuel circuit

A higher than expected reading, but still not infinite, indicates either a problem with the harness OR a bad injector coil. Check the coil directly (without the rest of the circuit first) to narrow it down, then repair/replace the faulty wiring, connections, PDP or injector coil, as applicable.

Oil Pressure Switch Testing

OEM

MODERATE

The oil pressure switch is mounted to the back of the oil manifold assembly. As noted earlier it is a normally OPEN switch which will close once there is about 53 psi (365 kPa) and reopen when pressure drops to about 43 psi (296 kPa). Using these figures, a length of hose, a pressure pump and an ohmmeter you should be able to remove the switch for testing/verification if necessary.

Evinrude suggests an even simpler test, involving the EMM (and assuming actual oil lift pump delivery pressure has already been verified). To check the system in this way, with the outboard running at idle, temporarily disconnect the electrical plug from the oil pressure switch. The warning horn should sound and the **NO OIL** warning LED should illuminate. Turn the keyswitch OFF (stopping the powerhead), then reconnect the wiring and restart the powerhead. The warning LED should go out after the self-check. If the system functions as noted, the switch and system are both good. If the **NO OIL** LED activates during the first part of the test but the warning horn does not sound, the horn, wiring or gauge may be faulty. If there is no warning at all, check the circuit (refer to Warning Systems in the Electrical System section). Make sure the tan/white wire is not grounded.

■ **To conduct this test you'll need an adapter made from a hose nipple and a 1/8 in. NPT pipe coupler. You'll also need a regulated source of pressure to apply 10 psi (69 kPa) to the switch itself. Absent a pressure tester, you can simply test the switch installed with the engine running, if an Oil Supply Verification Test has already shown system pressure to be at LEAST 6 psi (41 kPa).**

Oil Component Assembly

REMOVAL & INSTALLATION

MODERATE

◆ **See Figures 11, 12 and 13**

✳✳ CAUTION

The oil distribution hoses to the cylinders MUST all be the SAME LENGTH. DO NOT alter the length of the hoses. On all models the manifold to fuel supply fitting hose is 6 in. (153mm), but the manifold to cylinder hoses should be 23 in. (584mm) on 75-175 hp motors or 20 in. (508mm) on 200-250 hp motors.

Like the fuel components on these models the oil injection components are mounted together as an assembly. The oil pump, oil injector, oil distribution manifold and related lines are all easily removed as an assembly and then, the pump can be separated from the oil injector and distribution manifold. If only one or the other must be serviced, it may be possible to remove one (say the pump), leaving the injector and manifold behind. If that is desired, follow only the steps pertaining to disconnecting the component actually being removed. However, if the injector/manifold assembly requires replacement (as no service is possible), it is probably easiest just to remove all of the oil components as detailed and then separate the pump.

It is possible to only remove or replace oil distribution hoses, if so, refer to the appropriate steps of this procedure as it is important that they are marked before removal.

■ **The oil injector and oil distribution manifold should be serviced and replaced only as an assembly.**

✳✳ WARNING

NEVER substitute a fuel injector for the oil injector, otherwise oil flow will be disrupted.

1. Disconnect the negative battery cable for safety.
2. Remove the engine covers. For details, please refer to Engine Cover (Top and Lower Cases) in the Maintenance and Tune-Up Section.

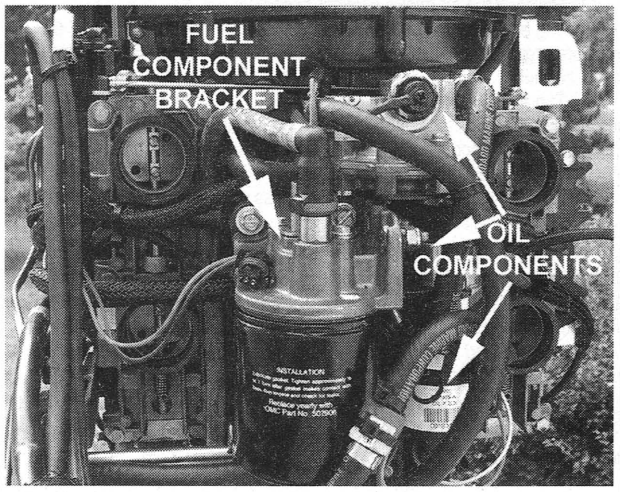


Fig. 11 The oil components are mounted to the powerhead and fuel component bracket (typical 75-175 hp shown, 200-250 similar, but mounted to side of powerhead)

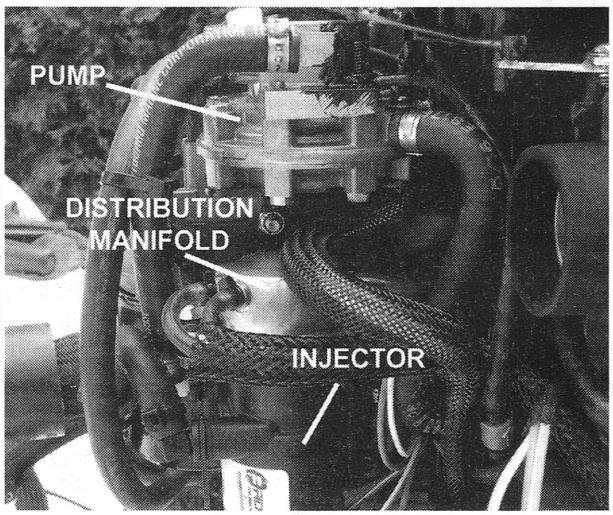


Fig. 12 The oil pump, distribution manifold and injector are all normally removed as an assembly

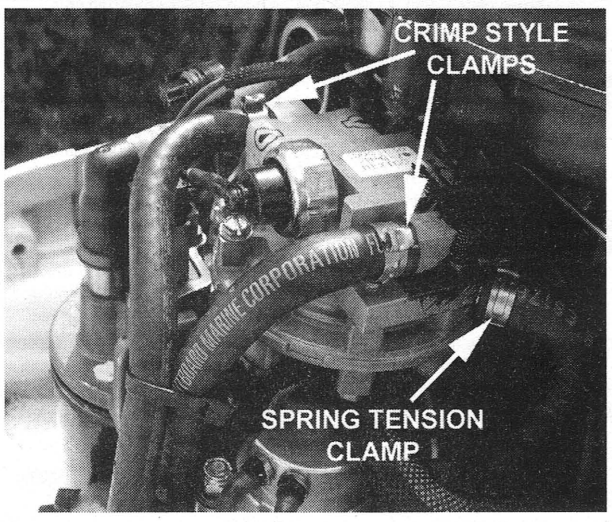


Fig. 13 Various types of clamps are used (try to avoid disconnecting crimp clamps unless you have replacement clamps and a proper crimping tool)

3. Remove the air intake silencer assembly.
4. Tag and disconnect the oil return hose from the outlet side of the pressure regulator. Plug the hose to prevent system contamination and minimize mess.
5. Tag and disconnect the oil supply hose from the inlet fitting on the oil pump. Plug the hose to prevent system contamination and minimize mess.
6. Tag and disconnect the upper and lower pulse hoses of the oil pump, either at the pump or the crankcase.
7. Tag and disengage the wiring harness connector at the oil pressure switch (on the oil distribution manifold).

■ **BE SURE to NOTE the oil distribution manifold hose routing (a digital camera is great for this) AND to tag the lines before disconnecting them. You may disconnect them from either the manifold or the crankcase, but the crankcase fittings are more straightforward. Also, keep in mind that replacement oil distribution manifold-injector assemblies normally come with the distribution lines attached.**

8. On 75-175 hp models, proceed as follows:
a. Remove the retainer from the fitting, then disconnect the oil supply hose from the side of the oil injector.
b. Remove the oil bracket retaining screws and the 2 locknuts. Be sure to note the position of the clamp securing the oil supply hose.
c. Tag and disengage the wiring harness connector at the oil injector.
d. Tag and disconnect the oil distribution hoses from the crankcase nozzles (this is more simple and less complicated than disconnecting them from the manifold, but IF removing them from the manifold is preferred, refer to the appropriate steps later in this procedure).
e. Remove the oil pump retaining screws.
9. On 200-250 hp models, proceed as follows:
a. For access, tag and disconnect the Power Distribution Panel (PDP) wiring, then remove the capacitor and bracket.
b. Remove the 4 oil injector manifold bracket retaining screws and washers.
c. Tag and disconnect the oil distribution hoses from the crankcase nozzles (this is more simple and less complicated than disconnecting them from the manifold, but IF removing them from the manifold is preferred, refer to the appropriate steps later in this procedure).
d. Tag and disengage the wiring harness connector at the oil injector.
e. Remove the oil injector and manifold bracket as an assembly.
f. Remove the 2 retaining screws and nuts used to fasten the injector and manifold assembly to the oil pump; however in order to accomplish this you may need to disconnect the oil outlet hose from the pump.
g. Remove the retainer, then disconnect the oil supply hose from the injector.
h. Remove the 4 retaining screws and nuts used to secure the oil pump to the mounting bracket. Be sure to note the location of the clamps used to position the oil distribution hoses.
i. Cut the Oetiker clamps and carefully disconnect the oil supply and return hoses.
10. If necessary, tag and remove the oil distribution lines as follows:
a. The oil distribution manifold has oil hose retainer mechanisms incorporated into the design. BEFORE removal use a Sharpie® or some other permanent marker to mark the position of the hose relative to the retaining mechanism (depth of mechanism in hose).
b. Release the hose by depressing the outer ring of the hose retaining mechanism.
c. Once the hose is removed from the manifold, make sure the hose support is in the end of the hose.
d. When replacing a hose pay CLOSE attention to the placement of the hose relative to the mechanism. If necessary, use replacement hose (#344249) or equivalent.
e. Insert the support into the end of the hose with the flanged end at the outside edge of the hose. DO NOT attempt to insert the hose into the manifold without the support. If necessary, transfer the mark from the old hose to the replacement hose (by aligning the ends of the hose and making a mark on the replacement at the same depth as the mark on the original).
f. Insert the hose fully into the manifold as guided by the mark. The insertion depth should be about 5/8 in. (16mm).

To install:

11. If removed, install the oil distribution hose(s) to the manifold paying close attention to the support mechanism and installed depth, as noted earlier in this procedure.
12. On 200-250 hp models, proceed as follows:
a. Position the oil pump on the oil injector and manifold bracket, then secure it using the 4 retaining screws.
b. Position the protective clamps and sleeves on the oil distribution hoses as noted during removal.
c. Install the clamps, washers and nuts to the oil pump retaining screws. Tighten the screw to 24-36 inch lbs. (2.7-4.1 Nm).
d. Double-check to make sure the oil hose protective clamps and sleeves are in position and all oil hoses are properly routed, again as noted during disassembly.
e. Position the oil injector and manifold assembly on the oil pump and insert the retaining screws through the oil pump and then the bracket. Install the 2 nuts on the screws and then tighten the screws to 24-36 inch lbs. (2.7-4.1 Nm).
f. Now, place the entire assembly on the powerhead and install the mounting screws. Tighten the screws to 60-84 inch lbs. (6.8-9.5 Nm).
g. Reconnect the wiring for the oil injector.
h. Reconnect the PDP wiring and install the capacitor (with bracket and screw). Tighten the screw to 24-36 inch lbs. (2.7-4.1 Nm).
13. On 75-175 hp models, proceed as follows:
a. Reconnect the wiring for the oil injector.
b. Position the oil pump on top of the oil bracket, install the retaining screws and tighten to 35-45 inch lbs. (4.0-5.1 Nm).
c. Place the oil bracket next to the fuel filter bracket, then install the oil bracket retaining screws (making sure the oil supply hose clamp is properly positioned on the front screw). Install the locknuts and tighten to 60-84 inch lbs. (6.8-9.5 Nm).
14. Properly route the oil distribution hoses and reconnect them to the crankcase fittings, securing them with new wire ties.
15. If removed, reconnect the oil pump outlet hose to the injector and secure using the retainer.
16. Reconnect the wiring to the oil pressure switch.
17. Reconnect the upper and lower pulse hoses to the oil pump or crankcase, depending upon from which fittings they were removed.
18. Using the primer bulb, purge air from the oil supply line (have small container and a rag handy at the end of the line to prevent a mess), then reconnect the line to the oil pump. Secure it using a new clamp.
19. Again using the primer bulb, purge air from the oil return line (squeezing oil through the line until it begins to come out the pressure regulator). Again, using a small container and rag to minimize the mess. Then connect the oil return hose to the pressure regulator outlet and secure using a new clamp.
20. If possible, use the Evinrude Diagnostic Software to perform the Static System Verification procedure to help prime the oil system and verify it is operating properly.

**** CAUTION**

If you DO NOT have access to the Evinrude Diagnostic Software, use a hose pincher to block off the oil return line during the initial cranking and startup of the powerhead. In this way you should purge/prime the rest of the oiling system. HOWEVER it is still critical that you are CERTAIN the system is operating properly before running the powerhead excessively.

21. Provide a suitable source of cooling water for the powerhead, then start and run the motor. Visually watch each oil distribution line to be sure it is purged of air. If necessary, continue to restrict the outlet for at least another 20 seconds to be certain, then eliminate the restriction and verify oil flow by checking for return oil discharge in the oil tank assembly.
22. To ensure the oil manifold is purged of air, proceed as follows:
a. Mark the position of the oil pressure switch relative to the retaining mechanism, then disconnect the wiring and remove the rubber switch retainer.
b. Depress the outer ring of the manifold-to-oil pressure switch retaining mechanism them remove the switch from the manifold.
c. Place some shop rags under the oil manifold to catch the mess, then momentarily pinch off the oil return hose and start the outboard (making sure speed does not go above idle). Shut the outboard OFF after oil flows from the manifold.
d. Install the pressure switch back to the manifold making sure the switch is inserted fully into the housing (meaning to a depth of about 5/8 in./16mm). Secure using the rubber retainer, then reconnect the wiring.
23. Run the outboard one more time to thoroughly inspect the system for fuel or oil leaks.
24. Install the air intake silencer assembly.
25. Install the engine covers. For details, please refer to Engine Cover (Top and Lower Cases) in the Maintenance and Tune-Up Section.