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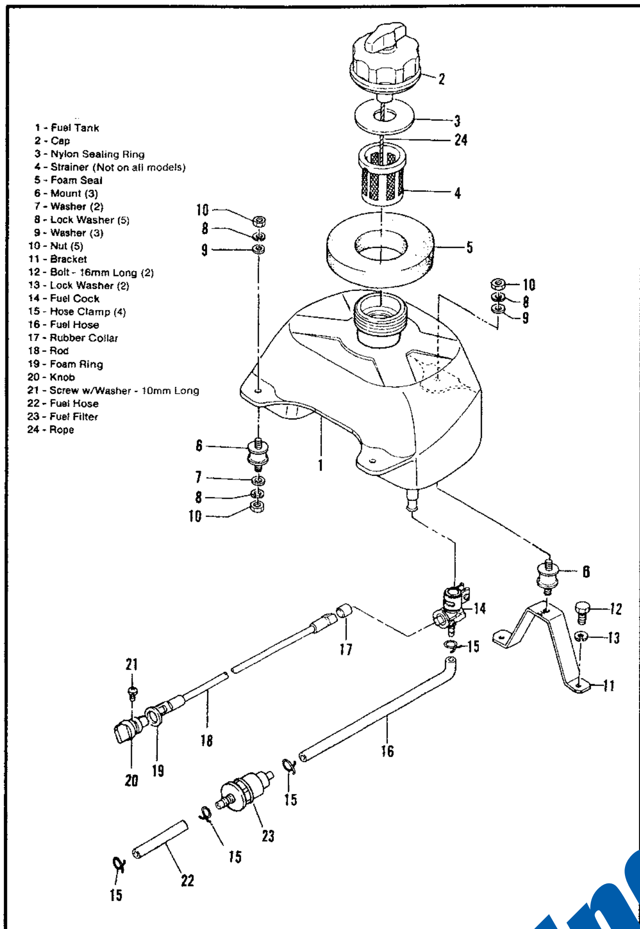

Fig. 10 Exploded view of a typical Mercury integral tank (hp motors shown)

To remove the tank, proceed as follows:

1. Remove the engine cover(s). For more information, please refer to Engine Covers (Top Cover and Cowling) in the Engine Maintenance section.
2. If equipped, make sure the fuel tank valve is shut.

■ **For models not equipped with a fuel tank mounted shut off valve, have a shop rag, large funnel and gas can handy to drain the fuel into when the hose is removed from the carburetor.**

3. Disconnect the fuel supply line from the fuel tank shut-off valve or trace the line down past the fuel pump or carburetor and disconnect it there, whichever your preference.
4. Remove the fasteners (usually nuts and lockwashers, but they may vary), flat washers fastening the tank to the powerhead, then make sure no other wires, components or brackets will interfere with tank removal.
5. Carefully lift the fuel tank from the powerhead.
6. Check the tank, filler cap, gasket and, if equipped, filler screen, for wear or damage. Replace any components as necessary to correct any leakage (if found.)
7. If cleaning is necessary, flush the tank with a small amount of solvent or gasoline, then drain and dispose of the flammable liquid properly.
8. If equipped, check the tank cushions for excessive deterioration, wear or damage and replace, as necessary.
9. When installing the tank, be sure all fuel lines are connected properly and that the retaining screws are securely bolted in place.
10. Refill the tank and pressure test the system by opening the fuel valve, then starting and running the engine.

Portable Fuel Tanks

Modern fuel tanks are vented to prevent vapor-lock of the fuel supply system, but some are vented by a one-way valve to prevent pollution through the evaporation of vapors. A squeeze bulb is used to prime the system until the powerhead is operating. Once the engine starts, the fuel pump, mounted on the powerhead pull fuel from the tank and feeds the carburetor(s) or fuel vapor separator tank (EFI). The pickup unit in the tank is usually sold as a complete unit, but without the gauge and float.

To disassemble and inspect or replace tank components, proceed as follows:

1. For safety, remove the filler cap and drain the tank into a suitable container.
2. Disconnect the fuel supply line from the tank fitting.
3. Fuel pick-up units are usually 1 of 2 possible types:
   a. Threaded fittings are mounted to the tops of tanks using a Teflon sealant or tape to seal the threads. They may contain right or left-hand threads, depending upon the tank manufacturer so care should be used when removing or installing the fitting. On many plastic tanks the pick-up itself cannot be removed and the tank must be replaced if damaged.
   b. Bolted fittings are used, predominantly on metallic portable tanks. To replace the pickup unit, first remove the screws (normally 4) securing the unit in the tank. Next, lift the pickup unit up out of the tank. On models with an integrated fuel gauge on the pickup, there are normally screws securing the gauge to the bottom of the pickup unit.

■ **If the pickup unit is not being replaced, clean and check the screen for damage. It is possible to add a new piece of screen material around the pickup and solder it in place without purchasing a complete new unit.**

4. If equipped with a fuel gauge assembly, check for smooth, and non-binding movement of the float arm and replace if binding is found. Check the float itself for physical damage or saturation and replace, if found.
5. Check the fuel tank for dirt or moisture contamination. If any is found use a small amount of gasoline or solvent to clean the tank. Pour the solvent in and slosh it around to loosen and wash away deposits, then pour out the solvent and recheck. Allow the tank to air dry, or help it along with the use of an air hose from a compressor.

CAUTION

Use extreme care when working with solvents or fuel. Remember that both are even more dangerous when their vapors are concentrated in a small area. No source of ignition from flames to sparks can be allowed in the workplace for even an instant.

To install:

6. For bolted fuel fittings:
   a. Attach the fuel gauge to the new pickup unit and secure it in place with the screws.
   b. Clean the old gasket material from fuel tank and, if being used, the old pickup unit. Position a new gasket/seal, then work the float arm down through the fuel tank opening, and at the same time the fuel pickup tube into the tank. It will probably be necessary to exert a little force on the float arm in order to feed it all into the hole. The fuel pickup arm should spring into place once it is through the hole.
   c. Secure the pickup and float unit in place with the attaching screws.
7. For threaded fuel fittings, carefully clean the threads on the fitting and the tank, removing any traces of old sealant or tape. Apply a light coating of Teflon plumbers tape or sealant to the threads, then carefully thread the fitting into position until lightly seated.
8. If removed, connect the fuel line to the tank, then pressurize the fuel system and check for leaks.

Boat Mounted Fuel Tanks

The other type of remote fuel tank sometimes used on these models (usually only on the larger models) is a boat mounted built-in tank. Depending on the boat manufacturer, built-in tanks may vary greatly in actual shape/design and access. All should be of a one-way vented valve type to prevent a vacuum lock, but capped to prevent evaporation design.

Most boat manufacturers are kind enough to incorporate some means of access to the tank should fuel lines, fuel pickup or floats require servicing. But, the means of access will vary greatly from boat-to-boat. Some might contain simple access panels, while others might require the removal of one or more minor or even major components for access. If you encounter difficulty, seek the advice of a local dealer for that boat builder. The dealer or his/her techs should be able to set you in the right direction.

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✱✱ CAUTION

Observe all fuel system cautions, especially when working in recessed portions of a hull. Fuel vapors tend to gather in enclosed areas causing an even more dangerous possibility of explosion.

Fuel Lines and Fittings

◆ **See Figure 11**

In order for an engine to run properly it must receive an uninterrupted and unrestricted flow of fuel. This cannot occur if improper fuel lines are used or if any of the lines/fittings are damaged. Too small a fuel line could cause hesitation or missing at higher engine rpm. Worn or damaged lines or fittings could cause similar problems (also including stalling, poor/rough idle) as air might be drawn into the system instead of fuel. Similarly, a clogged fuel line, fuel filter or dirty fuel pickup or vacuum lock (from a clogged tank vent as mentioned under Fuel Tank) could cause these symptoms by starving the motor for fuel.

If fuel delivery problems are suspected, check the tank first to make sure it is properly vented, then turn your attention to the fuel lines. First check the lines and valves for obvious signs of leakage, then check for collapsed hoses that could cause restrictions.

■ **If there is a restriction between the primer bulb and the fuel tank, vacuum from the fuel pump may cause the primer bulb to collapse. Watch for this sign when troubleshooting fuel delivery problems.**

✱✱ CAUTION

Only use the proper fuel lines containing suitable Coast Guard ratings on a boat. Failure to do so may cause an extremely dangerous condition should fuel lines fail during adverse operating conditions.

TESTING

◆ **See Figure 12**

A lack of adequate fuel supply will cause the powerhead to run lean or loose rpm. If a fuel tank other than the one supplied or recommended by Mercury is being used you should make sure the fuel cap has an adequate air vent. Also, verify the size of the fuel line from the tank to the engine is of sufficient size to accommodate the powerhead demands.

An adequate size line would be anywhere from 5/16-3/8 in. (7.94-9.52mm) Inner Diameter (ID).

■ **Mercury typically lists 5/16 in. (7.94mm) as the minimum ID for fuel hoses on their larger outboards.**

Check the fuel strainer on the end of the pickup in the fuel tank to be sure it is not tool small or clogged. Check the fuel pickup tube to make sure it is large enough and is not kinked or clogged. Be sure to check the inline filter to make sure sufficient quantities of fuel can pass through it.

If necessary, perform a Fuel Line Quick Check to see if the problem is fuel line or delivery system related.

Fuel Line Quick Check

◆ **See Figure 11**

Stalling, hesitation, rough idle, misses at high rpm are all possible results of problems with the fuel lines. A quick visual check of the lines for leaks, kinked or collapsed lengths or other obvious damage may uncover the problem. If no obvious cause is found, the problem may be due to a restriction in the line or a problem with the fuel pump.

If a fuel delivery problem due to a restriction or lack of proper fuel flow is suspected, operate the engine while attempting to duplicate the miss or hesitation. While the condition is present, squeeze the primer bulb rapidly to manually pump fuel from the tank to (and through) the fuel pump to the carburetors (or the vapor separator tank on fuel injected motors). If the engine then runs properly while under these conditions, suspect a problem with a clogged restricted fuel line, a clogged fuel filter or a problem with the fuel pump.

Checking Fuel Flow at Motor

◆ **See Figures 11 and 13 thru**

To perform a more thorough check of the fuel lines and isolate or eliminate the possibility of a restriction, proceed as follows:

1. For safety, disconnect the spark plug leads, then ground each of them to the powerhead to prevent sparks and to protect the ignition system.
2. Disconnect the fuel line from the engine (quick-connector on many models). For other models you may have to pick a fitting from which to disconnect the fuel line. You might choose the fuel pump, the filter or even the carburetor(s), but keep in mind that the further down the system you check, the more possible restrictions you're testing. If fuel flow is not adequate, you'll have to repeat the test further upstream (closer to the tank).
3. Place a suitable container over the end of the fuel line to catch the fuel discharged. If equipped with a quick-connector, insert a small screwdriver into the end of the line to hold the valve open.
4. Squeeze the primer bulb and observe if there is satisfactory fuel flow from the line. If there is no fuel discharged from the line, the check valve in the squeeze bulb may be defective, or there may be a break or obstruction in the fuel line.
5. If there is a good fuel flow, reconnect the tank-to-motor fuel supply line and disconnect the fuel line from the carburetor(s) or fuel injection vapor separator tank or even low-pressure electric boost pump (as applicable), directing that line into a suitable container. Crank the powerhead. If the fuel pump is operating properly, a healthy stream of fuel should pulse out of the line. If sufficient fuel does not pulse from the line, compare flow at either side of the inline fuel filter (if equipped) or check the fuel pump.
6. Continue cranking the powerhead and catching the fuel for about 15 pulses to determine if the amount of fuel decreases with each pulse or maintains a constant amount. A decrease in the discharge indicates a restriction in the line. If the fuel line is plugged, the fuel stream may stop. If there is fuel in the fuel tank but no fuel flows out the fuel line while the powerhead is being cranked, the problem may be in one of several areas:
7. Plugged fuel line from the fuel pump to the carburetor(s) or vapor separator tank (EFI)/boost pump (Optimax).

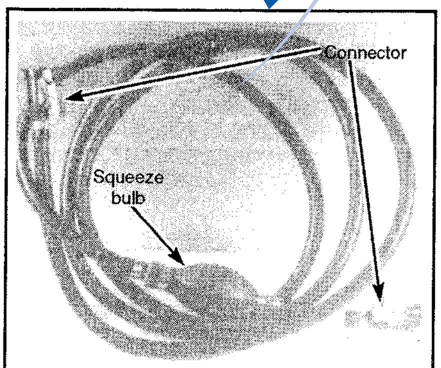

Fig. 11 Problems with the fuel lines or fittings can manifest themselves in engine performance problems, especially at WOT

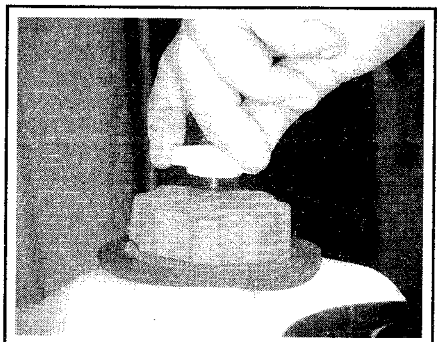

Fig. 12 One of the first things to check when troubleshooting a fuel delivery problem is the fuel tank vent (make sure it is open and not stuck closed)

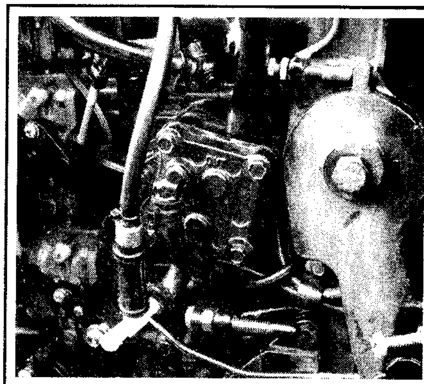

Fig. 13 Disconnect the fuel supply from fuel pump or engine quick-connect to check fuel flow. . .

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Carbureted V6 Ignition Systems and 2001 EFI Motor Ignition

■ **For ignition system schematics on these models, please refer to the Wiring Diagrams in this section.**

Carbureted V6 motors, as well as the 2001 EFI motors, both utilize a modular CDI system, similar to that used by smaller motors and utilize the following components:

- Flywheel
- Stator (charge coil)
- Trigger coil
- 1 CDM per cylinder
- 1 Spark plug per cylinder
- ECM or control module (to integrate warning and protection functions, as well as EFI control on fuel injected models)
- Ignition keyswitch for stop circuit control
- Shift interrupt switch (some models utilize this switch to ease shifting)

These models are equipped with a modular CDI system that utilizes one individual CDM per cylinder. The CDM functions as a combination ignition module/ignition coil.

A control module is utilizes to provide over-rev protection (carb models), bias control, shift stabilizer, idle stabilizer, injector timing (EFI models) and low oil warning functions.

Spark timing is achieved either by the movement of the trigger assembly (attached to the throttle/spark arm) for most 2.5L motors or is fully electronic on most 3.0L motors.

As with most Mercury ignition systems, the stop circuit works by grounding the stator output.

OptiMax Ignition Systems and 2002 or later EFI Motor Ignition

■ **For ignition system schematics on these models, please refer to the Wiring Diagrams in this section.**

All OptiMax motors, as well as 2002 or later EFI motors all utilize a battery driven, PCM controlled digital inductive ignition system. The systems are VERY similar to modular CDI, except that the power for ignition comes from the battery instead of directly from charge coil windings. And at least on the V6 OptiMax motors, the function of the CDMs has been split out again, to separate ignition coils and separate coil drivers. The PCM Digital Inductive ignitions utilize the following components:

- Battery (fed by a belt driven alternator)
- Flywheel teeth
- Crankshaft Position Sensor (CPS) which watches flywheel teeth
- 1 CDM per cylinder (EFI or 1.5L OptiMax motors) OR 1 coil driver per pair of cylinders with one ignition coil per cylinder (V6 OptiMax motors)
- 1 Spark plug per cylinder
- ECM (usually referred to as the Module Control Module/PCM on these motors)
- Ignition keyswitch for stop circuit control
- Shift interrupt switch (most all models utilize this switch to ease shifting)

These models are essentially equipped with a PCM run, battery voltage supplied modular CDI system that utilizes either one individual CDM per cylinder or one coil driver per pair of cylinders along with an individual coil per cylinder.

As with carbureted models, when equipped, the CDM functions as a combination ignition module/ignition coil.

The ECM however, performs a large number of functions on most models, including:

- Controls ignition timing and fuel timing/delivery functions based on sensor inputs including throttle position, manifold pressure and engine temperature.
- Controls the injectors (both regulator fuel injectors and direct injectors on OptiMax models).
- Controls all alarm horn and warning lamp functions.
- Supplies a tachometer signal to gauge
- Controls RPM limit function
- Monitors and reacts to shift interrupt switch
- Records engine running information

DESCRIPTION & OPERATION

CDI and Modular CDI Systems

◆ **See Figures 12, 13 and 14**

These systems are known as "alternator driven", non-distributor, capacitor discharge ignitions. The major components of the system are generally the flywheel, charge coil (stator), trigger or pulser coil(s), ignition module (switch box), ignition coil(s) and spark plug(s). As you can see most of these components are known by multiple possible names. For instance the Charge Coil, may also be called a Stator, the Ignition Module may also be called the Switch Box, CDI Unit, Power Pack etc.

The engine's flywheel contains magnets carefully positioned to create an electric current as they rotate past specially designed coils of wire (stator and trigger/pulser). Current is created by magnetic induction. Simply put, that means that a magnet moving rapidly near a conductor will induce electrical flow within the conductor.

Conversely, a wire that moves rapidly through a magnetic field will also generate electrical flow. This principle governs the working of electric motors, alternators and generators.

One of the coils under your flywheel is called a charge coil. As the flywheel magnets spin past this coil, they generate in it a fairly high-voltage alternating current that travels to your system's ignition module. This voltage is often in the region of 200 volts.

The other ignition system coil(s) found under the flywheel are called the sensor coils, pulser coils or trigger coils. They send an electrical signal to the ignition module to tell it which cylinder to work with at the correct time.

The ignition module uses the brains of the system and serves several functions. First, it converts the alternating current (AC) from the charge coil into usable direct current (DC). Next it stores the current in a built-in capacitor. The module also interprets the timing signal from the trigger coil. This changes constantly with engine speed and moving the trigger coil's position relative to the flywheel magnets brings about the change. The coil's movement is controlled by a device called a timing plate, to which both the charge coil and trigger coils are mounted. The timing plate moves in response to changes in throttle opening, to which it is mechanically linked. The ignition module also controls the discharge of the capacitor and sends this voltage to the primary winding of the ignition coil for the correct cylinder.

■ **Some motors, generally speaking ones equipped with "modular CDI ignitions" utilize one individual Capacitor Discharge Module (CDM) per cylinder. On these motors the CDM functions as a combination ignition module and ignition coil.**

Also (depending on the system) the module may incorporate electronic circuits that limit engine speed and prevent over-revving. Some modules even have a circuit that reduces engine speed if the engine begins to run too hot for any reason. Larger engines often have an automatic ignition advance for initial start-up and for when the engine is running at temperatures less than approximately 100°F.

Manufacturers commonly use one power pack or module for each bank of cylinders on carbureted V-type powerheads (unless they use a module CDI system with an individual CDM for each cylinder). One module will control the odd numbered cylinders and the other will service the even numbered cylinders.

The voltage from the module goes to the primary winding of the ignition coil or high-tension coil. You may know this type of coil as a step-up transformer. Here, the voltage is stepped up to between 15,000 and 40,000 volts. That's the 'kind of voltage needed to jump the air gap on the spark plug and ignite the air/fuel mixture in the cylinder. Your high-tension ignition coil has two sides, the primary side and the secondary side. It is really two coil assemblies combined into one neat, compact case.

The internal construction of a typical ignition coil includes primary and secondary windings. It also uses the principle of magnetic induction with the magnetism generated by the primary (lower-voltage) winding creating a magnetic field around the secondary winding, which has many more windings than the primary coil. The ignition module controls the rapid turning on and off of electrical flow in the primary winding, thereby turning this magnetic field on and off. The rapid movement of this magnetic field past the secondary windings induces electrical current flow. There are a greater the number of turns of wire in the secondary winding, the higher the voltage produced.

As this secondary voltage leaves the center tower of the ignition coil, it travels along the spark-plug wire, which is heavily insulated and designed to carry this high voltage.

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If all is well, the high voltage will jump the gap on the spark plug between the center electrode and the ground electrode. On larger engines with surface-gap plugs, the high voltage current will jump from the center electrode to the side of the plug assembly itself, completing a circuit to ground via the engine block.

Last but certainly not least, is the stop control. You need a means to shut your engine off and a good way is to stop the spark plugs from working. Depending on your engine, this may be accomplished by a simple stop button or a key switch on larger engines. This disables the whole ignition system. On most engines, an emergency stop button with an overboard clip and lanyard attachment is standard. This system is wired directly into the ignition module. It functions by creating a momentary short circuit inside the module, grounding the current intended for the high-tension coils and thus shutting off the ignition long enough to stop the engine. Faulty stop circuits are frequently the cause of a no spark condition.

PCM and Digital Inductive Systems

■ **For ignition system schematics on these models, please refer to the Wiring Diagrams in this section.**

The vast majority of EFI and all OptiMax motors are equipped with a battery driven electronic ignition system. On these motors, when the ignition key is turned to RUN battery voltage is applied to the main relay. If the control module (remember it's the PCM/ECM in this case) does not receive a signal from the Crankshaft Position Sensor (CPS) the relay will be turned off again.

When the module receives a CPS signal it will ground the main relay circuit, applying power from the battery (and belt-driven alternator once the motor is running) through a fuse (usually 20 amp) to the positive terminal of the individual ignition coil primary windings (there is normally one coil per cylinder).

The negative terminal of the coil primary circuit is connected to engine ground through the module (ECM). Actually, on most EFI models and on 1.5L OptiMax models Mercury states that the ignition coil itself contains an internal driver circuit (meaning it is a CDM unit like those found on the modular CDI ignitions, however wiring diagrams show separate coil drivers on V6 OptiMax models). In all cases, when the circuit is closed a magnetic field will build in the ignition coil. When the circuit is switched off the collapse of the magnetic field will cause the coil to fire on the secondary circuit with a charge as high as 50,000 volts.

A Crankshaft Position Sensor (CPS) is mounted on top of the powerhead, in a position to sense the differences in magnetic field caused by the teeth on the flywheel (54 teeth on most V6 models). This CPS signal is used by the PCM to determine the trigger signals (when to switch on the driver circuit for a given cylinder). When the motor is operated at lower engine RPM and load, most of these systems will repeat the spark plug firing process in quick succession resulting in a multi-strike spark for each combustion event (multiple spark plug firings on the same cycle for more power and a cleaner burn). Many of these motors use platinum spark plugs (especially OptiMax motors).

Although the name and location of these components appear slightly different than those used on CDI motors, their functions are nearly identical and operation is fundamentally the same.

TROUBLESHOOTING THE IGNITION SYSTEM

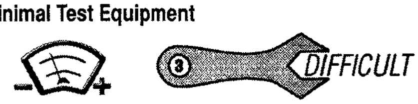
Spark Plugs & Checking for Spark

◆ **See Figures 15, 16 and 17**

The absolute first thing that you should check when an ignition problem is suspected is the spark plugs. You want to determine that the plugs (the most common wear item in an electronic system) are in good condition and are producing a good, strong spark. Likewise, a spark check should be conducted using some form of an inexpensive spark checking tool which either installs inline between the secondary ignition wire (spark plug wire) and the spark plug itself, OR substitutes for the spark plug.

1. Check the plug wires to be sure they are properly connected. Check the entire length of the wires from the plug(s) back to the coil(s). If a wire is to be removed from the spark plug, always use a pulling and twisting motion as a precaution against damaging the connection.
2. Attempt to remove the spark plug by hand. This is a rough test to determine if the plug is tightened properly. The attempt to loosen the plug by hand should fail. The plug should be tight and require the proper socket size tool. Remove the spark plug and evaluate its condition. Reinstall the spark plug and tighten to the proper specification.
3. Use a spark tester and check for spark. If a spark tester is not available (and for Pete's sake, they are cheap and can be found in almost all auto parts stores) hold the plug wire about 1/4 in. (6.4mm) from the engine (leave the plug in the engine for safety). Carefully operate the starter and check for spark. A strong blue spark over a wide gap must be observed when testing in this manner, because under compression a strong spark is necessary in order to ignite the air-fuel mixture in the cylinder. This means it is possible to think a strong spark is present, when in reality the spark will be too weak when the plug is installed. If there is no spark, or if the spark is weak (orange), the trouble is most likely under the flywheel.

Troubleshooting With Minimal Test Equipment



■ **Patterns of the following symptoms and causes conditions have been noted on Mercury motors in the past and should apply to many of the powerheads covered here. Much of these troubleshooting procedures are courtesy of our friends at CDI Electronics (256-772-3829).**

- **Intermittent Firing:** - This problem can be very hard to isolate. A good inductive tachometer can be used to compare the RPM on all cylinders up through wide open throttle. A big difference on one or two cylinders indicates a problem. Intermittent firing is often caused by a coil (stator, charge or even ignition) which shorts to ground under certain temperature or load conditions. However, it can also be caused by internal problems with the ignition control module or ECM. Troubleshooting should be conducted on components in an attempt to isolate parts of the system while attempting to narrow the problem, but remember that with an intermittent, the problem must be present at the moment of testing for the component to show bad. Otherwise the problem must be replicated. Also, since many intermittent problems only show at a certain temperature or load, static ohm tests on bad components will OFTEN still test within spec.

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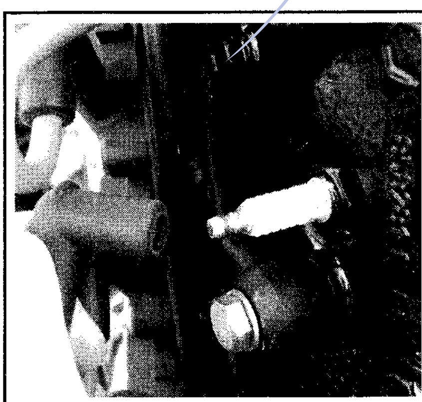

Fig. 15 Disconnect the spark plug wire. . .

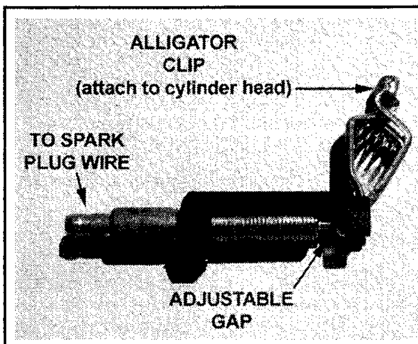

Fig. 16 . . . and check spark using a tester

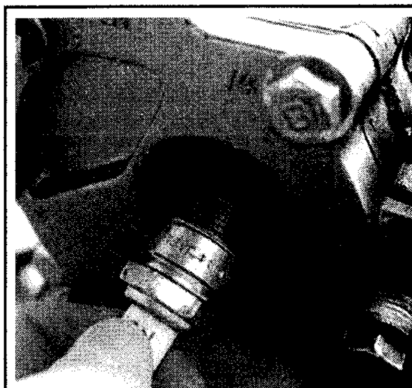

Fig. 17 Remove and inspect the spark plug

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thrust washer. Replace any damaged components. The bearing on these models is pressed into the carrier. If the bearing does not roll freely or shows any sign of corrosion, clamp the carrier in a vise equipped with soft jaws. Obtain and use Slide Hammer (91-34569A1) or an equivalent slide hammer with internal jawed puller to free the bearing from the carrier.

5. For 55/60 hp non-BF models, the reverse gear is pressed into the carrier. Check for damage. If the bearing or gear is damaged and requires replacement use a slide hammer with internal jaws or a suitable bearing puller (#91-27780). On these models, if the bearing requires replacement you'll need to use a press, universal bearing separator (like #91-37241) and a suitable driver (#91-37312) to separate the bearing from the gear.

6. Inspect the two seals and the condition of the bearing at the rear end of the carrier. If the seals have failed and have allowed water to enter the lower unit, the bearings are no longer fit for further service.

7. If only the seals are being replaced, use a small pry tool or seal extractor to carefully remove both seals. On most models these seals are installed back-to-back but double-check seal orientation before removal.

8. If both the bearing and seals are being removed you can drive or press them all out together. Obtain a Bearing Removal and Installation Kit (#91-31229A-7). Obtain a Driver Rod (#91-37323) and either Mandrel (#91-36569) for all except the 55/60 hp non-BF models or Mandrel (#91-37312) for the 55/60 hp non-BF models or another suitable substitute mandrel. Insert the removal tools into the forward end of the carrier and press or drive the needle bearing and seals together out the rear end of the carrier.

Propeller Shaft Disassembly

◆ **See Figures 130 thru 134**

To disassemble the propeller shaft for cleaning, inspection and/or parts replacement, proceed as follows:

1. Insert a thin blade screwdriver or an awl under the first coil of the cross-pin retainer spring and rotate the propeller shaft to unwind the spring from the sliding clutch. Take care not to over-stretch the spring.

2. Position the propeller shaft cam follower against a solid object. Push against the cam follower to depress the clutch spring and hold against the spring pressure during the next step.

3. Push the cross-pin out of the sliding clutch with a punch, then slide the clutch forward off the propeller shaft. Pull the shaft slowly back away from the solid object to gently release spring pressure.

4. Now, tip the propeller shaft and allow the cam follower and spring components to slide out of the propeller shaft. The components vary slightly by gearcase model as follows:

- For 55/60 hp non-BF models, remove the cam follower, then remove the guide block and the spring.
- For 60 hp BF model, as well as all 75 hp and larger models, remove the cam follower, then remove the 3 metal balls, the guide block and finally, the spring.

5. For all models, check the propeller shaft for straightness using a dial-gauge and a pair of v-blocks. Set the shaft in the blocks so it is resting on the bearing surfaces, then set and zero the dial gauge to check run-out right behind (toward the gearcase side) of the propeller splines. Shaft run-out must not exceed 0.006 in. (0.152mm) for 55/60 hp non-BF models or 0.009 in. (0.228mm) for all other models.

6. Inspect the oil seal surface for grooving or pitting. Mercury only provides specs for the surface of the shaft on 55/60 hp non-BF models, on which they say grooving must not exceed 0.005 in. (0.12mm).

Driveshaft and Bearings

◆ **See Figures 135 thru [illegible]2**

1. If not done already, remove the Water Pump assembly as detailed in the Lubrication and Cooling System section.

2. Remove the water pump base, as follows:

- For 55/60 hp non-BF models, use a small pr tool to carefully pry under the ears or in the slot(s) provided on either side of the housing. Once free, lift the base carefully off the driveshaft, then remove and discard the base O-ring. Check the condition of the seal and plate on the gearcase and, if necessary, remove them for replacement.
- For all except the 55/60 hp non-BF models, loosen and remove the 6 water pump base retaining bolts, then CAREFULLY pry at the tabs provided (one at the front and one at the rear of the base) to free the base from the gearcase. Lift the base carefully from the driveshaft, then remove and discard the base gasket.

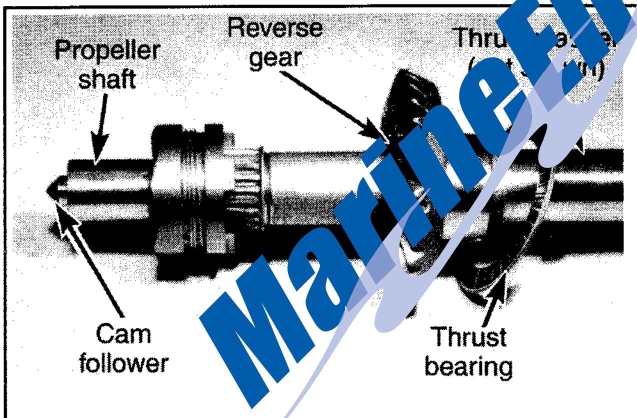

Fig. 130 Typical propeller shaft assembly

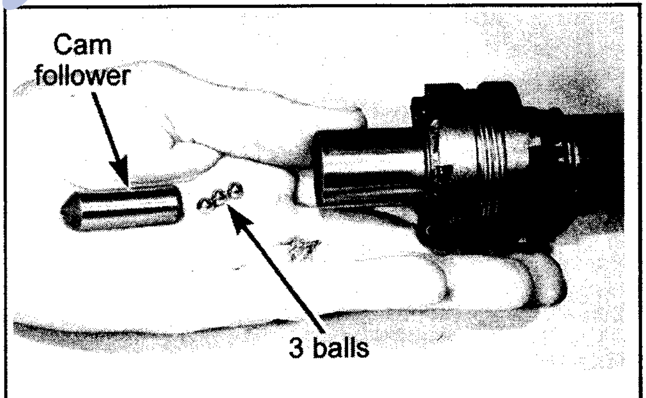

Fig. 131 On all Except 55/60 hp non-BF models there are 3 balls behind the cam follower

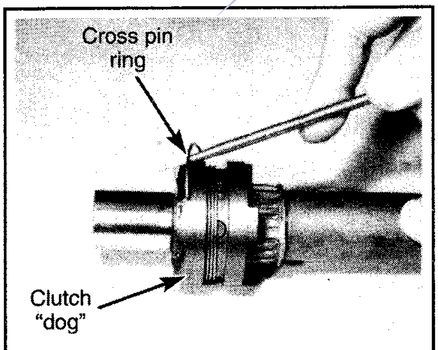

Fig. 132 To remove the sliding clutch, first remove the pin retaining spring. . .

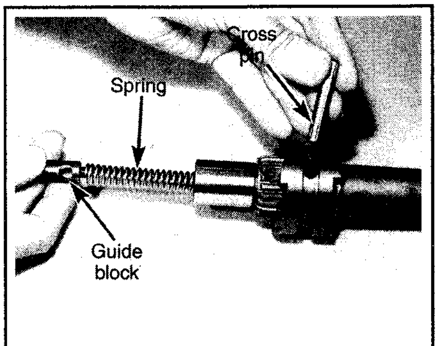

Fig. 133 . . .then remove the cross pin, guide block (if equipped) and spring. . .

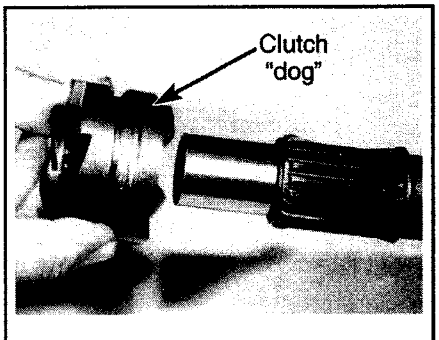

Fig. 134 . . .and slide the clutch dog from the shaft

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18. Apply a coating of 2-4-C Marine Lubricant with Teflon to the inner diameter of the water tube seal, to the shift shaft coupler and to the driveshaft splines. The water tube seal used on 75 hp and larger models should be installed with the labyrinth end facing the water tube in the driveshaft housing and the tapered end facing the water pump.

■ DO NOT put lubricant on the ENDS of the shafts, as it could prevent the shaft splines from fully seating in the shift coupler and the crankshaft.

19. Finish preparing the gearcase for installation, depending upon the model/gearcase, proceed as follows (not all gearcases require additional steps):

- For all except 55/60 non-BF models, apply a light bead of RTV 587 or equivalent silicone sealer to the top of the gearcase housing, along the seal area just behind the rear edge of the water pump housing.
- Some models are equipped with a mechanical reverse lock on the top of the shifter mechanism. When so equipped instead of a plain rounded shift shaft coupling on top of the gearcase, there will be a coupling that contains a small, semi-circular, almost triangular tab on the front of the spline. When so equipped, make sure the flat is positioned toward the front of the gear housing.

20. For all gearcases, apply a light coating of Loctite® 271 or equivalent threadlocking compound to the threads of the 4 gearcase fasteners (not on the locknut which goes under the anti-cavitation plate).

21. Carefully bring the gearcase into alignment with the exhaust housing and slowly insert it STRAIGHT UP and into position, while aligning the driveshaft, shift shaft and water tube seal.

■ It may be necessary to move the shift block (located under the engine cowl) slightly to help align the upper shift shaft splines with the shift shaft coupler splines during gearcase installation. Likewise, it may be helpful to slowly turn the propeller in the normal direction of rotation to align the driveshaft-to-crankshaft splines.

22. Thread the gearcase fasteners until they are all hand-tight, then alternately and evenly tighten the fasteners to 40 ft. lbs. (54 Nm).

23. If removed for access to the gearcase locknut and washer found underneath, reinstall the trim tab. Be sure to align the matchmarks made earlier to preserve trim tab adjustment, then tighten the tab retaining bolt to 22 ft. lbs. (30 Nm).

24. If the propeller was removed, install the propeller.

25. Reconnect the spark plug wires and/or the battery cables.

DISASSEMBLY

Unlike most of the smaller Mercury gearcases, the lower unit found on these models contains various shims for adjusting pinion height and forward/reverse gear backlash. Always keep track of the shims during removal, since if the gearcase or the shafts/bearings are being reused the shims should be returned to the same positions. If the gearcase and/or shafts/bearings are replaced, the shims [illegible] sometimes be used as a good starting point for the shimming procedures.

■ For gearcase exploded views, please refer to Cleaning & Inspection in this section.

Bearing Carrier Removal & Disassembly

◆ See Figures 127, 128 and 129

**** WARNING**

If you don't have access to the special Mercury mandrels designed to install bearings to the proper depth inside the bearing carrier, measure the installed height of all bearings before removal (except of course the reverse gear bearing, on 55/60 non-BF models where it is pressed directly onto the gear). Use the measured depths at installation time to ensure the bearings are positioned properly.

1. Remove the two bolts or nuts and washers securing the bearing carrier in the lower unit.

■ There are multiple ways to remove the bearing carrier on these models. The method recommended by Mercury (and therefore the preferred method) involves the use of a threaded puller with long internal jaws that will gently grab and pull the carrier off while pushing against the propshaft. We've listed a number of other possibilities, depending upon the tools at hand, however keep in mind that all of the alternatives involve some measure of risk to the gearcase and/or carrier assembly.

2. Free the bearing carrier assembly from the gearcase using one of the following methods:

a. Install an internal jaw puller (#91-46086A1) and a suitable drive bolt. Position the propeller [illegible] hub to maintain an outward pressure on the puller jaws. Tighten the puller bolt to break the seal and free the bearing carrier.

b. If the puller is having a problem freeing a frozen carrier, remove the puller bolt and connect a slide hammer (such as #91-34569A1 or equivalent) to the puller jaws (#91-46086A1). Use a few sharp quick blows with the slide hammer to hopefully break the gasket seal and free the bearing carrier.

c. If no puller jaws are available, CAREFULLY use a soft head mallet [illegible] the ears of the bearing carrier to offset the carrier from the housing. [illegible] opposite "ears" alternately and evenly on the back side to remove the carrier from the lower unit housing.

d. The final, and least desirable method is using a mallet to free a frozen carrier. Clamp the propeller shaft in a vise equipped with soft jaws in a horizontal position. Use a mallet and strike the lower unit with quick sharp blows midway between the anti-cavitation plate and the propeller shaft. This action will drive the lower unit off the bearing carrier. Take care not to drop the lower unit when the unit finally comes free of the carrier.

■ If the lower unit refuses to move, it may be necessary to carefully apply heat to the lower unit in the area of the carrier and at the same time attempt to move it off the carrier.

3. Once the seal is broken, remove the propeller shaft and bearing carrier from the gearcase. Be careful not to loose the cam follower from the shifter end of the propeller shaft (and the 3 check balls found in the shaft behind it for all by 55/60 non-BF models). Separate the propeller shaft and bearing carrier assembly, placing each aside for disassembly.

4. For all but the 55/60 hp non-BF models, the reverse gear should pull free of the carrier, so lift it from the carrier along with the thrust bearing and

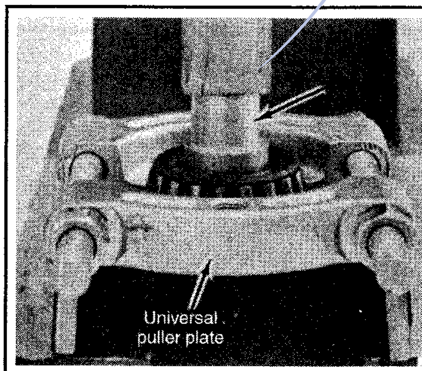

Fig. 127 Start by removing the 2 bearing carrier fasteners

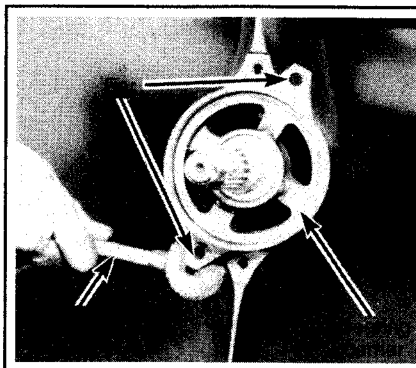

Fig. 128 If a puller is not available, use a soft mallet to turn the carrier slightly, then gently tap it out of the gearcase

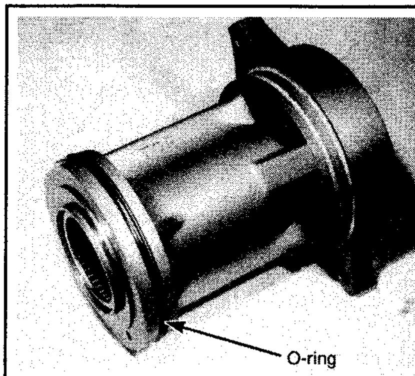

Fig. 129 Remove and discard the old carrier O-ring

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