

## 220 EFI

### A. Design Improvements

### B. Areas of Potential Concern

### C. Trouble-Shooting

#### A. DESIGN IMPROVEMENTS

The following design improvements are recommended for all 1987 220 EFI models to assure maximum reliability and performance. **MAKE THESE IMPROVEMENTS WHENEVER THE OUTBOARD IS SERVICED FOR ANY REASON AND BEFORE ATTEMPTING ANY TROUBLESHOOTING.** Some of the improvements were previously described in Service Bulletins and are so identified.

1. Vent vapor separator to the atmosphere. Service Bulletin 87-7, page 1, item 2, High Speed Surge.
2. Remove **white** injector filters. Service Bulletin 87-12

**NOTE:** The letter "F" or three centerpunch marks on the lower front of the fuel management system indicates the injector filters were removed. Figure 1 (22771).

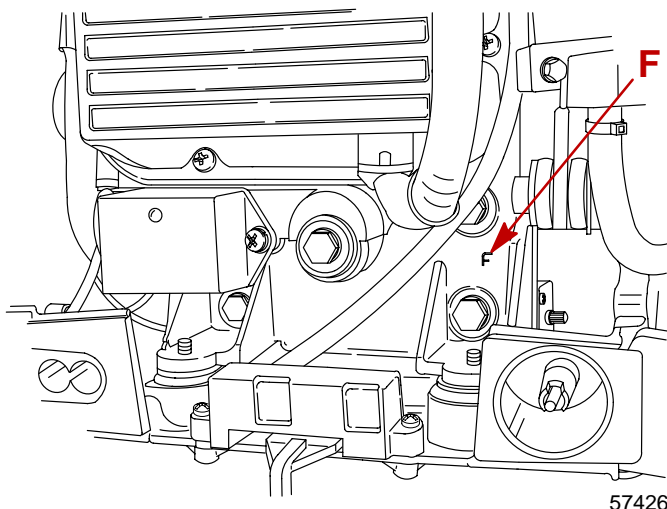


Figure 1.

3. Install water separating filter P/N 35-18458A1. Service Bulletin 87-12.
4. Replace the following gaskets between the powerhead and driveshaft housing: (The new material is lighter colored for easy identification).
  - 27-99177-1 driveshaft housing plate to exhaust plate
  - 27-99176-2 cylinder block to exhaust plate
  - 27-99173-1 driveshaft housing to plate
5. Install new fuel pump diaphragm kit P/N 21-42990A3. This kit has stronger plastic retainers for check valves and a sturdier diaphragm.
6. Loosen the detonation sensor (on port cylinder head) 1/2 turn and re-torque to 145 lbs. in.
7. Check tilt position leakdown. Service Bulletin 87-14.

#### B. AREAS OF POTENTIAL CONCERN

1. Battery Power – Some operating problems are related to low battery voltage. The alternator output is lower at slow engine speed and because many electrical accessories are used on typical boats, it is important to educate the boater about the ramifications of operating too many accessories during continuous slow speed operation.
2. Engine Temperature Sensor Wires – must be routed around the port side of the port cylinder head. If they are routed between the cylinder head and ignition coils the engine may not exceed 2200 R.P.M. because if the sensor wires pickup RFI signals it causes a rich fuel condition.
3. Water Separating Fuel Filter – an accessory filter mounted in the boat does LITTLE to protect the engine but may contribute to vapor lock and fuel starvation.
4. Sneezing At Idle – In most cases this is caused by incorrect engine set-up. If the ignition is too far retarded and if the air valves set to flow more air to compensate for the ignition timing. the engine may run too lean. Refer to Service Manual for correct Timing/Synchronizing/Adjusting. Also, refer to item 5 (under Trouble-Shooting) following.

5. 4500 R.P.M. Surge – Refer to Service Bulletin 87-7. page 2. number 5.
6. Engine Bogs Down Upon Acceleration – When the throttle is advanced **SLOWLY**, and the boat is not on plane, the throttle can be advanced to W.O.T. such that the engine never surpasses 2000 R.P.M. This condition is generally found on boats with extended transoms or engine brackets where the engine is subjected to submersion beyond the idle relief exhaust ports. Tests show this is not an E.F.I. related problem, but also occurs on other V-6 models. Corrective actions include Laser II propellers, higher engine mounting, drilling exhaust diffuser as described in Service Bulletin 87-17, and more rapid acceleration.
7. Throttle Position Indicator Failures – there have been instances where the TPI intermittently goes to the W.O.T. resistance (10,000 OHMS) causing a rich fuel condition at part throttle. To check, connect ohmmeter to TPI and rotate TPI shaft. The resistance should change linearly from 0 to 10,000 OHMS, and should never jump out of this range (i.e. 12,000 OHMS indicates a problem).

### C. TROUBLE-SHOOTING

1. Engine Down on Power (or R.P.M.)
  - Check if one or more cylinders are not working.
  - Remove spark plug leads, one at a time, and note R.P.M. drop.
  - No R.P.M. drop indicates a non-working cylinder.
  - Perform compression test.
  - Check for spark at that cylinder, and check ignition system.
  - If lack of fuel is suspected, squirt fuel into cylinder (through the fitting on the boost port, use a squirt bottle and tubing). If R.P.M. picks up, fuel starvation to that cylinder is the problem.
  - Possible causes of fuel starvation to one cylinder.
    - a. Clogged fuel injector filter.
    - b. Inoperative fuel injector.
    - c. Open circuit to fuel injector, or bad connection.

2. Engine Suspected of Running Too Rich
  - Disconnect leads to air temp sensor. and connect them together with a jumper. This leans out fuel flow by 10%.
  - Disconnect vacuum line from E.C.U. to manifold. and use a vacuum pump to pull a vacuum on the E.C.U. Typical vacuum at idle is about 4 in Hg, so by pulling a stronger vacuum the fuel flow will be reduced.
3. Engine Suspected of Running Too Lean
  - Disconnect leads to air temp sensor, 10% increase in fuel flow.
  - Disconnect lead to engine temp sensor on head. 35% increase in fuel flow.
  - At part throttle, disconnect TPI. roughly 20-40% increase in fuel flow.
4. Engine Surges Between 4000 and 5000, or Doesn't Produce Typical W.O.T. Power.
  - Detonation control may be working (or malfunctioning).
  - To check, disconnect white wire from knock sensor and operate.
  - In this mode, maximum spark timing is controlled by the spark arm (19° BTDC).
  - Lack of surge indicates the problem associated with the knock circuit or the engine was knocking.
  - To check effect on high speed operation, disconnect knock sensor, advance timing to 25° BTDC, operate at W.O.T., and note R.P.M.
  - If R.P.M. increased, problem was related to knock or knock protection.
  - Also, Throttle Position Indicator may be set too **lean**.
5. Engine Idles O.K., but is **rough and stumbles when** operated at off-idle speeds (800-2200 R.P.M.)
  - Check throttle linkage Set-Up — this is almost always the cause.
  - Idle timing must be set at 9° ATDC.
  - Line on throttle cam **MUST** be centered with the cam follower roller when throttle arm is fully back.

- Cam follower roller **MUST** be touching cam.
  - Throttle Position Indicator **MUST** be set with the E.F.I. tester.
  - Idle speed (in gear) should be 600–675 R.P.M.
  - If idle speed is outside of this range it must be adjusted by changing the air valve opening on the manifold, with the air valve adjustment screw. Do not adjust the throttle arm. Early models had no screw, and must be adjusted by bending the “STOP” tab on the throttle shaft.
  - If the air valve is adjusted, the Throttle Position Indicator must also be reset.
6. Engine idles for a few minutes and dies, or wants to shut off at cruise speed.
- Check pulse fuel pump (check valve retainers, diaphragms and gaskets).
  - Check for restrictions in fuel system between tank and engine.
7. Warning Horn Sounds Intermittently
- First, check if water sensor module light is on.
  - If **light** is on, check for water in filter.
  - If filter has no water, check to see if wire to sensor probe is somehow grounded, i.e. salt water path to ground.
  - If the water sensor light is not on, check the oil injection system.
  - Also, a faulty ignition system (incorrect voltage to warning module) may cause the warning horn to sound, giving a false warning.
8. Engine Stops For No Apparent Reason
- Check battery connections.
  - Check E.F.I. harness connector – the coupling ring may break, allowing the two halves of the 16 pin connector to separate slightly. Replacement coupling ring P/N 19049.
  - Check fuel pressure in high – pressure fuel circuit.
  - If it is low, check fuel level in vapor separator.
  - If fuel level is low, check outlet pressure of pulse pump
  - If pulse pump pressure is O.K., check operation of electric fuel pump.
  - If pulse pump pressure is low, check pump internals, and check fuel system to engine.
  - If vapor separator has sufficient supply of fuel and electric pump is working, check final filter for clogging, and check to see that pressure regulator is not passing any fuel – i.e. if pressure is low and regulator is passing fuel it means that the regulator is opening at too low a pressure and must have an internal malfunction. However, this would be a rarity.
  - If electric pump is not working, check it using service procedure outlined in the service manual.