## F-Series Powerstroke 1999 1/2

7.3 Power Stroke Diesel Engine Diagnostic Guide

-NOTE-
IF CONCERN IS FOUND, SERVICE AS REQUIRED. IF THIS CORRECTS THE CONDITION, IT IS NOT NECESSARY TO COMPLETE THE REMAINDER OF THE DIAGNOSTIC PROCEDURE.

| | |
|---|---|
| CUSTOMER NAME | |
| MODEL YEAR | VEHICLE SERIAL N0.(VIN) |
| CHASSIS STYLE | |

**Customer Concerns** (Please list in this box)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DEALER NAME | | | P & A CODE | | | | | 1863 CLAIM NUMBER | DATE |
| | ENGINE SERIAL NUMBER | | | | | | ODOMETER | TYPE OF SERVICE | |
| VEHICLE GVW | TRANSMISSION | AMBIENT TEMPERATURE | | | | | | PERSONAL ☐ | COMMERCIAL ☐ |

## Hard Start/No Start Diagnostics

**NOTE: A hard start/ No start concern with EOT Temp. below 60F perform step 10 first.**

**1. Visual Engine/Chassis Inspection** 6005E

*Fuel Oil Coolant Electrical Hoses Leaks*

| *Method* | *Check* |
|---|---|
| **Visual** | |

**2. Check Engine Oil Level** See Fig. C 6005E

- Check for contaminants (fuel, coolant).
- Correct Grade/Viscosity.
- Miles/Hours on oil ,correct level.
- Check level in reservoir.

| *Method* | *Check* |
|---|---|
| **Visual** | |

**3. Intake/Exhaust Restriction** See Fig. B & L 6005E

- Inspect air filter and ducts - exhaust system
- Inspect exhaust back pressure device

| *Method* | *Check* |
|---|---|
| **Visual** | |

**4. Sufficient Clean Fuel** See Fig. A 6005E 6

- Check if the WATER IN FUEL lamp has been illuminated.
- After verifying that there is fuel in the tank, drain a sample from fuel filter housing at key on.

***NOTE: Fuel pump will run for 20 sec. at key on.***

| *Method* | *Check* |
|---|---|
| **Visual** | |

**5. Electric Fuel Pump Pressure** See Fig. I 6005E 7

- Verify that the fuel pump has voltage and gnd. present at key on.
- Measure fuel pressure at the top of the right cylinder head with a (0-160 PSI) gauge at key on.

| *Instrument* | *Spec.* | *Measurement* |
|---|---|---|
| **0-160 PSI Gauge** | 45 PSI min. | |

***If pressure fails low, Go to step 8c on the Performance side of this sheet to identify cause.***

**6. Perform KOEO On Demand Test** See Fig. E 6005E 2

- Use the NGS Tester
- DTCs set during this test are current faults.

***Note: IDM DTCs displayed here could be current or historical faults.***

| | |
|---|---|
| Diagnostic Trouble Codes | |

**7. Retrieve Continuous Trouble Codes** See Fig. E 6005E 2

- DTCs retrieved during this test are historical faults.

***Note: IDM DTCs are cleared when codes are cleared***

| | |
|---|---|
| Diagnostic Trouble Codes | |

**8. KOEO Injector Electrical Self-Test** See Fig. E 6005E 3

- Use the NGS Tester.
- All injectors will momentarily buzz, then individual injectors will buzz in sequence 1 through 8.
- IDM DTCs may be transmitted after test is completed.

***Note: IDM DTCs may be historical if not cleared above.***

| | |
|---|---|
| Injector Trouble Codes | |

**9. NGS Tool - Data List Monitoring** See Fig. E 6005E 4

- NGS Tester may reset below 9.5 volts.
- Select the parameters indicated from the NGS parameter list and monitor while cranking engine.

| *Parameter* | *Spec.* | *Measurement* |
|---|---|---|
| ***V PWR*** | *8 volt min.* | |

You may need to use a outside power source for the NGS

| | | |
|---|---|---|
| **RPM** | 100 RPM minimum | |
| **ICP** | 500 PSI or 3.4mPa min. | |
| **FUEL PW** | 1 mS to 6 mS | |

**A** . **V PWR** - If indicating a low voltage condition, check battery voltage, charging system or power and ground circuits to the PCM.
GO TO PINPOINT TEST A

**B** . **RPM** - Low RPM could be an indication of starting/ charging system problems, No RPM indicated with the engine cranking - could be CMP circuit fault, check for Diagnostic Trouble Codes.
GO TO PINPOINT TEST DG

**C** . **ICP** - A minimum of 500 PSI (3.4 mPa) is required before the injectors are enabled. No or low oil in the reservoir, system leakage, injector O-Rings or faulty IPR could cause pressure loss.
**Go to section 4 step 9c in the PC/ED Manual for a detailed description on how to perform this test.**
***Note: If no RPM signal is received, IPR duty cycle will default to 14%***

**D** . **FUEL PW** - Even though a 1 to 6 mS FUEL PW is shown, its possible the IDM did not receive the signal due to a CI or FDCS circuit fault or internal IDM failure.

**10. Glow Plug System Operation** See Fig. E & G 6005E 5

**Relay Operation**

- Glow Plug ON time is dependent on oil temperature and altitude. The Glow Plug relay comes on between 1 and 120 sec. and does not come on at all if oil temp is above 131 F.
- Verify that B+ is being supplied on the large BK/W wire going to the Glow Plug relay.
- Install a voltmeter to the glow plug feed terminal (two brown wires or center terminal on the shunt).
- Using the NGS GPCTM and EOT pids, verify glow plug "on" time .
- Turn key to run position, measure voltage ("on"time) (Dependent on oil temperature and altitude)

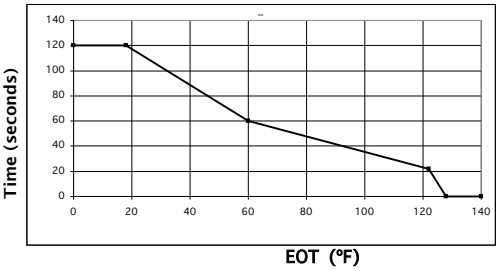
| *Relay on time* | *Spec.* | *Measurement* |
|---|---|---|
| 1 to 120 seconds | B + | |

***Note: Wait to Start Lamp "on" time (1 - 10 sec.) is independent from Glow Plug "on" time***

**Glow Plug Resistance**

- Remove both 9 pin connectors from valve covers
- Measure each Glow Plug resistance to Bat. ground.
- Measure engine harness resistance to relay.

| Glow Plug Number | Glow Plug to Ground .1 to 2 ohms | Connector to relay or GPCM connector 0 to 1 ohms |
|---|---|---|
| #1 | | |
| #3 | | |
| #5 | | |
| #7 | | |
| #2 | | |
| #4 | | |
| #6 | | |
| #8 | | |




- Add 5 seconds to glow plug on time when above 7000 feet in altitude, but not to exceed 120 seconds.

See PC/ED manual, Section 4A for more detail on all of the above test steps.

When troubleshooting a Hard Start/No Start or Performance concern, this form must be filled out to the point of repair and returned to receive warranty credit and diagnostic time for the following parts: Fuel Injectors (9E527), regulator-injection control pressure(9C968), pump assemblyhigh pressure oil (9A543), turbo charger assembly/pedestal (6K684), fuel pump (9350), IDM (12B599) and PCM (EEC)(12A650)

Labor operations listed more than once are a continuation of the diagnostic procedure and should be claimed only once.

What problems were found and what repairs were performed?

List Part Name, Number and Serial Number of parts replaced.

# F-Series Powerstroke 1999 1/2

7.3 Power Stroke Diesel Engine Diagnostic Guide

-NOTE-
IF CONCERN IS FOUND, SERVICE AS REQUIRED. IF THIS CORRECTS THE CONDITION, IT IS NOT NECESSARY TO COMPLETE THE REMAINDER OF THE DIAGNOSTIC PROCEDURE.

| | |
|---|---|
| CUSTOMER NAME | |
| MODEL YEAR | VEHICLE SERIAL N0.(VIN) |
| CHASSIS STYLE | |

**Customer Concerns** (Please list in this box)

| | | | |
|---|---|---|---|
| DEALER NAME | P & A CODE | 1863 CLAIM NUMBER | DATE |
| | ENGINE SERIAL NUMBER | ODOMETER | TYPE OF SERVICE |
| VEHICLE GVW | TRANSMISSION | AMBIENT TEMPERATURE | PERSONAL ☐ COMMERCIAL ☐ |

## Performance Diagnostics

### 1. Visual Engine/Chassis Inspection 6005F

- Verify that there are no fluid, vacuum or pressure leaks.
- Inspect all wire connections for damage.
- Inspect MAP, WGC hoses and intake manifolds for leaks.

*Fuel Oil Coolant Electrical Hoses Leaks*

| *Method* | *Check* |
|---|---|
| **Visual** | |

### 2. Sufficient Clean Fuel See Fig. A 6005F 13

- Check if WATER IN FUEL lamp has been illuminated.
- Drain sample from fuel filter housing at key on

***NOTE: Pump will run for 20 sec. at key on***

| *Method* | *Check* |
|---|---|
| **Visual** | |

### 3. Check Engine Oil Level See Fig. C 6005F

- Check for contaminants (fuel, coolant).
- Correct Grade/Viscosity.
- Miles/hours on oil, correct level.

| *Method* | *Check* |
|---|---|
| **Visual** | |

### 4. Intake Restriction See Fig. B 6005F 14

- Check filter minder or measure at WOT with magnehelic gauge.

| *Instrument* | *Spec.* | *Check* |
|---|---|---|
| **Magnehelic/ Filter Minder** | **2"-25" $H^20$** | |

### 5. Perform KOEO On Demand Test See Fig. E 6005F 1

- Use the NGS Tester.
- DTCs set during this test are current faults.

***Note: IDM DTCs displayed here could be current or historical faults.***

| | |
|---|---|
| **Diagnostic Trouble Codes** | |

### 6. Retrieve Continuous Trouble Codes See Fig. E 6005F 1

- Use the NGS Tester.
- DTCs retrieved during this test are historical faults.

***Note: IDM DTCs are cleared when codes are cleared***

| | |
|---|---|
| **Diagnostic Trouble Codes** | |

### 7. KOEO Injector Electrical Self-Test See Fig. E 6005F 2

- Use the NGS Tester.
- All injectors will momentarily buzz, then individual injectors will buzz in sequence 1 though 8.

***Note: IDM DTCs can be historical if not cleared above.***

| | |
|---|---|
| **Injector Trouble Codes** | |

### 8a. Fuel Pressure at the right head See Fig I. 6005F 16

- Verify that fuel is in the tank and the pump is being powered.
- Measure fuel pressure at the front of right cyl. head
- Road Test- engine at full load condition

| *Instrument* | *Spec.* | *Measurement* |
|---|---|---|
| **0-160 PSI Gauge** | 45 PSI min. | |

» ***If fuel pressure fails low, Go to step 8c.***
» ***If pressure is above min. spec, Go to step 8b.***

### 8b. Fuel Pressure at the left head See Fig. I 6005F 17

- Measure fuel pressure at the rear of left cyl. head

***CAUTION: Secure hose away from turbo and exhaust***

- Road Test- engine at full load condition

| *Instrument* | *Spec.* | *Measurement* |
|---|---|---|
| **0-160 PSI Gauge** | 45 PSI min. | |

» ***If fuel pressure is below min. spec, replace left check valve***
» ***If fuel pressure is above min. spec, Go to step 9.***

### 8c. Electric Fuel Pump Pressure See Fig. I 6005F 18

- Measure at fuel outlet from electric fuel pump.
- Road Test- engine at full load condition

| *Instrument* | *Spec.* | *Measurement* |
|---|---|---|
| **0-160 PSI Gauge** | 45-80 PSI | |

» ***If fuel pressure fails low, Go to step 8d.***
» ***If pressure is above min. spec, replace right check valve.***

### 8d. Electric Fuel Pump Inlet Restrictio See Fig. H 6005F 19

- Measure restriction at WOT at electric fuel pump inlet

| *Instrument* | *Spec.* | *Measurement* |
|---|---|---|
| **0-30 " Hg vacuum** | 6" Hg MAX | |

» ***If fuel line is restricted above 6" Hg, check for blockage between pump and fuel tank.***
» ***If fuel line is not restricted, inspect regulator valve condition and for debris, If OK replace pump***

### 9. Perform KOER On Demand Test See Fig. E 6005F 7

- This will test both ICP and EBP systems for fault.

| | |
|---|---|
| **KOER DTC** | |

### 10a. Injection Control Pressure Tests See Fig. E & D 6005F 7

**(Oil Aeration - Poor idle quality)**

- All acc. off, monitor ICP and RPM with NGS Tester
- Hold engine speed at 3400 RPM for 3 minutes.

| *Parameter* | *High RPM* | *Measurement* |
|---|---|---|
| **ICP** | 1800 PSI MAX @ 3400 RPM | |

» ***If ICP signal increases above 1800 PSI after 3 minutes anti-foam oil additives may have become depleted from oil, change oil and re-test.***

### 10b. Low Idle Stability (ICP Pressure) See Fig. E 6005F 8

- Check at low idle, EOT above 180 F
- Monitor ICP and RPM with the NGS Tester

| *Parameter* | *Spec. @ 670 RPM* | *Measurement* |
|---|---|---|
| **ICP** | 400 to 600 PSI | |
| Take reading before disconnecting ICP | | |

**If engine RPM is unstable, disconnect the ICP sensor**

» ***If RPM is still unstable, change IPR and re-test.***
» ***If RPM smoothes out, the ICP sensor is at fault.***
***Note: ICP will default to 725 PSI when disconnected***

### 11. Crankcase Pressure Test See Fig. J 6005F 9

- Verify engine is at normal operating temp.
- Measure at oil fill with adapter and orifice tool P.N. 5631 & 014-00743 installed.
- Block breather tube on left valve cover.
- Measure at WOT no load.

| *Instrument* | *Spec.* | *Measurement* |
|---|---|---|
| Magnehelic 0 to 60" $H^20$ | less than 3" $H^20$ | |

***If more then 3 " $H^20$, refer to base engine in Shop Manual***

### 12. Cylinder Contribution Test See Fig. E 6005F 10

- Verify that EOT is above 70 F
- Turn A/C and all accessories off.
- Select Cylinder Contribution from the test menu.

***NOTE: The test will run at a idle speed for about 120 sec. and no engine change will be felt during the test***

| | |
|---|---|
| CCT Trouble Codes | |

### 13. Exhaust Restriction See Fig. E & L 6005F 11

- Visually inspect exhaust system for damage
- Verify EBP device is open at WOT in park or neutral
- Monitor EBP with the NGS Tester with the engine
- temperature at 170 ° F minimum at 3400 RPM.

| *Parameter* | *Spec.* | *Measurement* |
|---|---|---|
| **EBP** | 34 PSI MAX @ 3400 RPM | |

### 14. Boost Pressure Test See Fig. E & J 6005F 12

- Verify that MAP hose is not damaged, plugged or pinched
- Verify that intercooler hoses or intake are not leaking.
- Verify that the green Wastegate hose is not plugged.
- Monitor MGP (manifold gauge pressure) and RPM with the NGS Tester.
- Road Test - select appropriate gear to obtain desired engine speed and full load on engine. Best accomplished climbing hill or truck fully loaded.

| *Parameter* | *Spec. PSI G* | *Measurement* |
|---|---|---|
| **MGP** | 15 PSI G MIN | |

See PC/ED manual, Section 4A for more detail on all of the above test steps.

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Labor operations listed more than once are a continuation of the diagnostic procedure and should be claimed only once.

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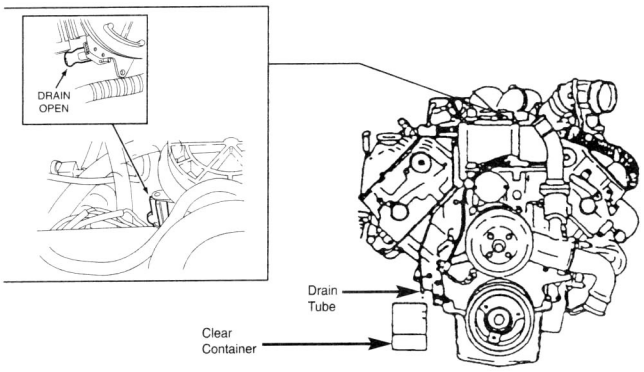
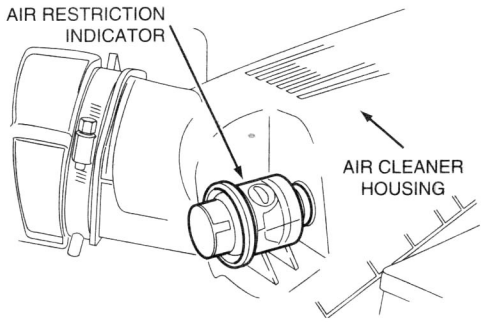
List Part Name, Number and Serial Number of parts replaced.

FIGURE A



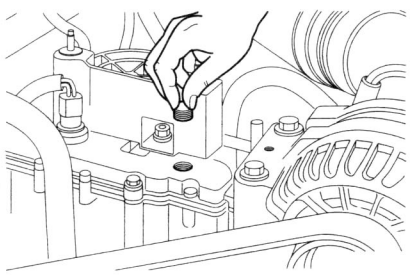

**SUFFICIENT CLEAN FUEL**

FIGURE B



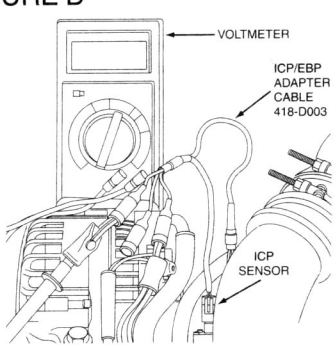

**INTAKE RESTRICTION (FILTER MINDER)**

FIGURE C



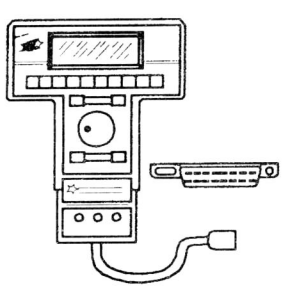
**CHECK ENGINE OIL (IN RESERVOIR)**

FIGURE D




**INJECTION CONTROL PRESSURE**

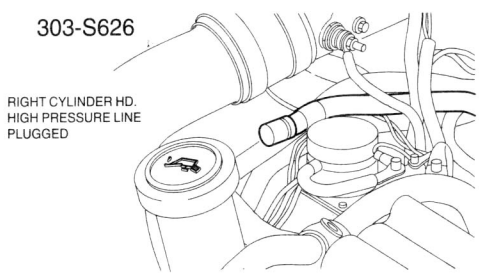
FIGURE E



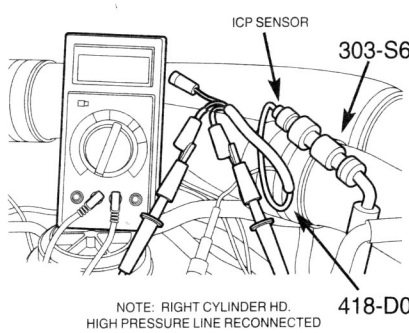
**DIAGNOSTIC TESTS WITH NEW GENERATION STAR SCAN TOOL**

**HIGH PRESSURE LEAKAGE TEST**

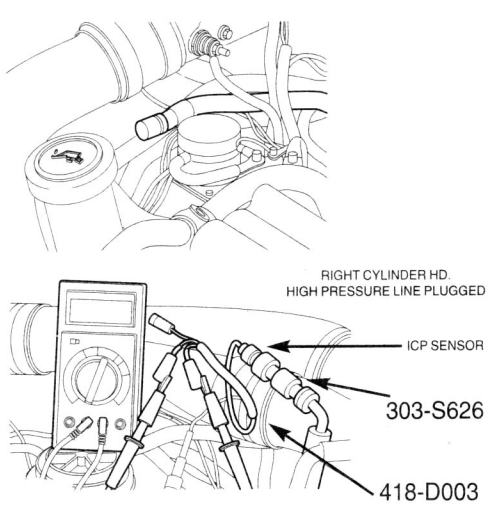
FIGURE F




**LEFT CYL. HEAD LEAK TEST**



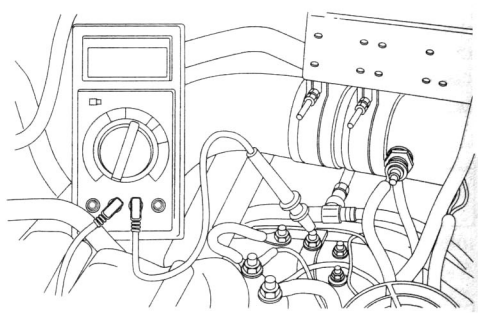

**RIGHT CYL. HEAD LEAK TEST**




**IPR & HIGH PRESSURE PUMP TEST**

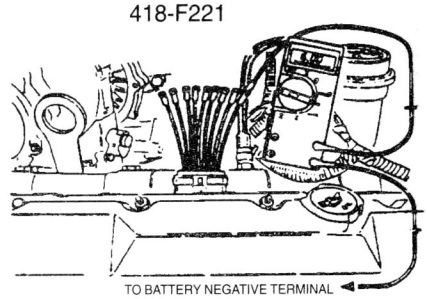
**GLOW PLUG SYSTEM OPERATION (NON GPCM EQUIPPED)**

FIGURE G

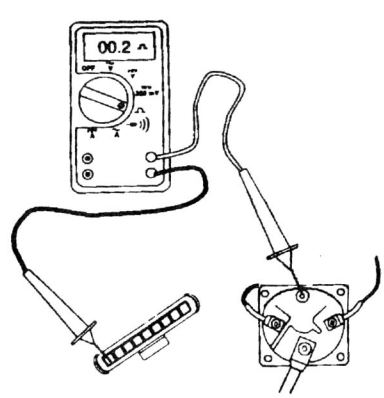


**GLOW PLUG "ON" TIME**

418-F221

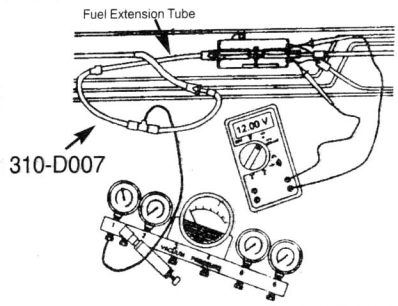



**GLOW PLUG RESISTANCE TO GND**



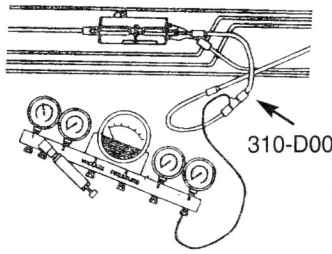

**GLOW PLUG HARNESS RESISTANCE**

FIGURE H

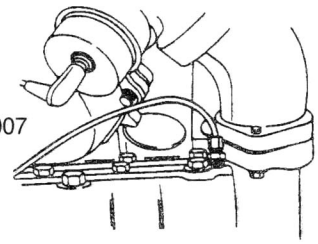



**FUEL PUMP RESTRICTION**

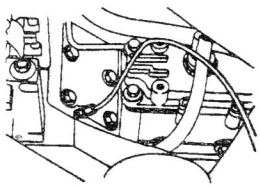
FIGURE I




**FUEL PUMP PRESSURE**



**FUEL PRESSURE (LEFT HEAD)**

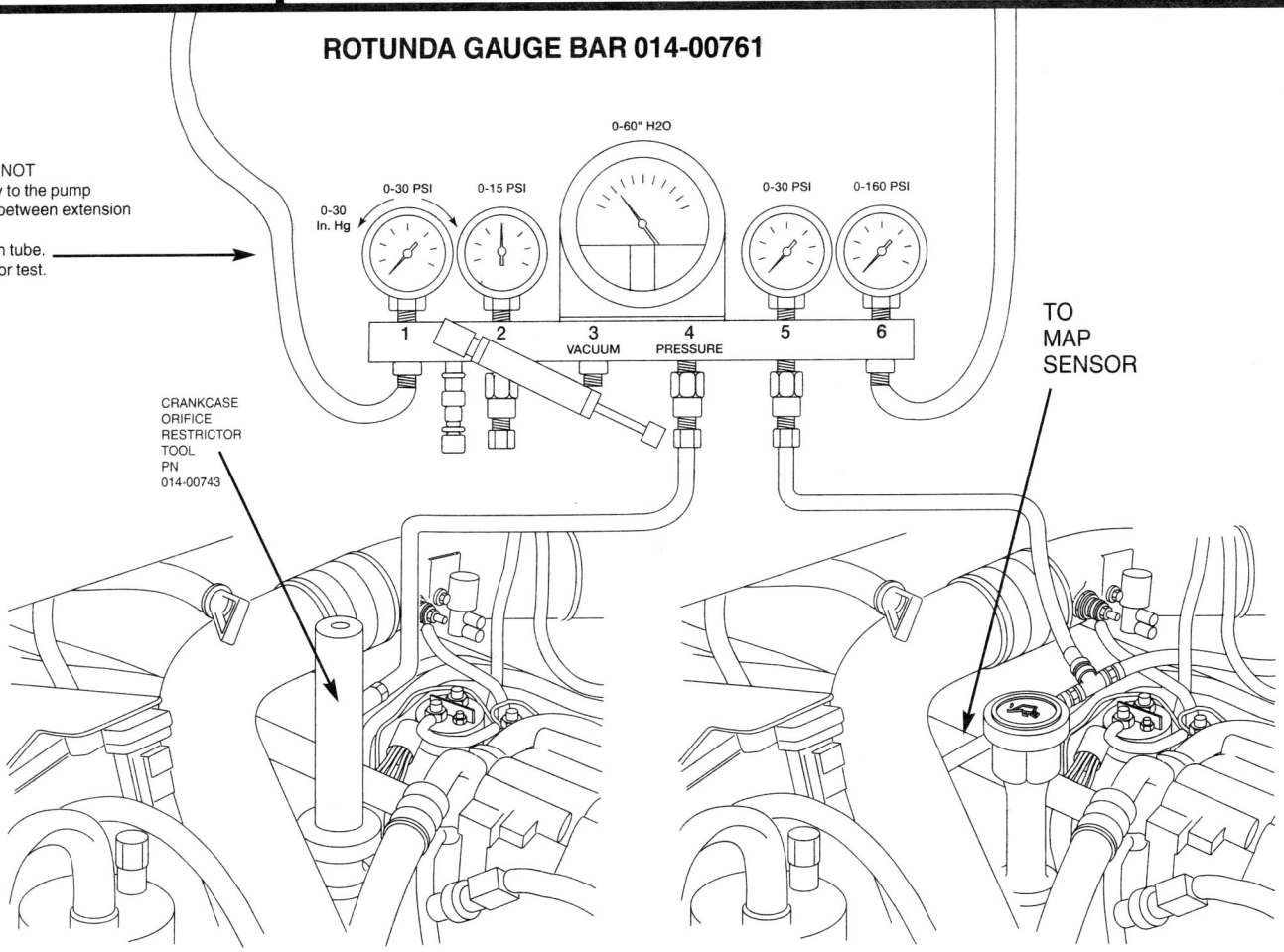


**FUEL PRESSURE (RIGHT HEAD)**

**ROTUNDA GAUGE BAR 014-00761**

FIGURE J

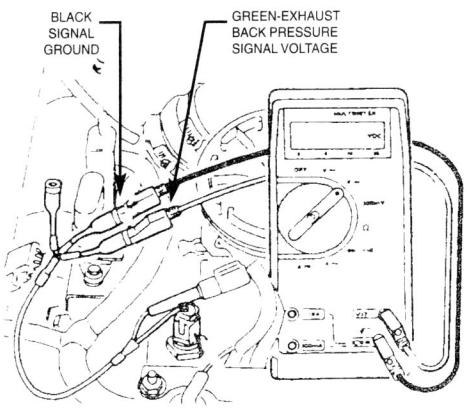
RESTRICTION test – DO NOT connect 310-D007 directly to the pump Test MUST be measured between extension tube and fuel feed line. Econoline is equipped with tube. F-Series needs this tube for test.




**CRANKCASE PRESSURE**

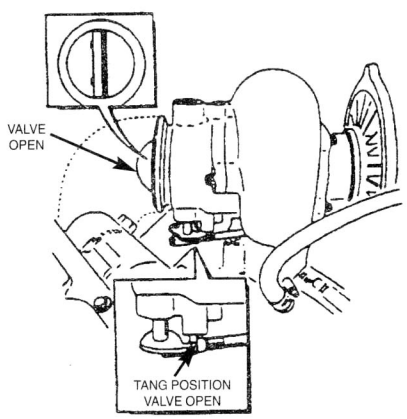
**BOOST PRESSURE**

FIGURE K




**EXHAUST BACK PRESSURE**

FIGURE L




**EXHAUST RESTRICTION**

October 2000