

## SUPPLEMENTAL DIAGNOSTIC ANALYSIS

### ROUGH IDLE DIAGNOSTICS

#### PROBABLE CAUSES

Engine oil (aerated, incorrect grade, low oil level, extended oil drain interval), defective injectors, injector shorts to ground, power cylinder problems, valve train problems, low fuel pressure, aerated fuel, exhaust system to cab/chassis ground outs, loose/worn engine mounts, electronic control system faults, poor fuel quality, injection control pressure system problems.

#### PROCEDURES

- **Verify Complaint**  
Confirm conditions when complaint is present, for example does the engine rough idle only when hot, cold, after high speed operation, does it misfire over whole speed range, is there chassis vibration are there any other conditions or observations present when the engine idles rough.
- **Inspect Exhaust System For Contact With Cab Or Bed**  
Many vehicles inspected have had contact between the flat exhaust pipe that comes off of the engine to the cab. This will transmit engine vibrations to the cab, especially on acceleration when the engine twists on it's mounts. It may be improperly diagnosed as a rough idle complaint. The other exhaust ground out area observed has been in the center of the box area if a fifth wheel has been installed, the underside bracket may sometimes rub on the driveline.
- **Complete all tests on the **Performance Diagnostic Sheet**.** Conditions are described below that can contribute to rough idle and why each test is being performed is listed below.

#### CHECK ENGINE OIL LEVEL

#### VERIFY CORRECT GRADE

Must meet CG-4 / SH specification.

#### PERFORM EST TOOL – ENGINE OFF TESTS

Intermittent CMP, IDM, ICP, Injector or wiring harness faults can affect engine idle conditions the

ECM may have detected and recorded these conditions.

#### PERFORM EST INJECTOR BUZZ TEST

This test will verify that the injectors are working electronically.

#### MEASURE TRANSFER PUMP PRESSURE

Low fuel pressure will cause the engine to misfire and will cause a loss of power.

- If pressure is low, remove canister mounted on fuel regulator and remove any debris on fuel screen. Remove fuel regulator from side of fuel filter and remove any material from screen protecting the fuel de-aeration orifice.

#### MEASURE TRANSFER PUMP INLET RESTRICTION

If fuel pressure is low, this test will determine if the cause is a restricted fuel inlet from the fuel tank.

#### PERFORM AIR IN FUEL AND FUEL RETURN FLOW TEST

This test consists of installing a clear line on the return fuel line. Observing the clear line will indicate if return fuel is present and/or if air is present in the return fuel.

#### PERFORM EST – ENGINE RUNNING TEST

This test will test the functionality of the ICP control system, the exhaust back pressure system. The engine must be up to operating temperature to perform this test.

#### PERFORM CYLINDER CONTRIBUTION TEST

This test will test the contributions of the individual power cylinders. It will only detect a cylinder that is contributing very little. It's primary function is to detect a bad injector, but it is possible it could detect a base engine problem such as broken rocker arm bolts, bent push tube, broken rings or bent connecting rod.

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## ROUGH IDLE DIAGNOSTICS (Continued)

### PERFORMANCE DIAGNOSTICS (Continued)

#### PERFORM INJECTION CONTROL PRESSURE TESTS

##### Oil Aeration Test with DVOM

Aerated oil will cause the engine to idle rough and possibly die upon de-acceleration. The most likely causes for aeration is insufficient oil level, incorrect oil grade, extended oil drain intervals and low pressure suction leaks.

*Before performing oil aeration tests, verify that the ICP sensor is reading correctly by monitoring the ICP voltage signal with a DVOM or the injection control pressure using the EST with the key on and engine off. The value displayed will measure between .15 to .25 volts with a DVOM or display 0 PSI on the EST.*

##### Oil Quality

If the oil is being aerated due to depletion of the anti-foaming agents in the oil, the problem will be most evident when the engine is hot and after prolonged operation at high engine speeds. During this test, oil aeration caused by engine oil will probably start at a low ICP signal level (1.4 to 1.5 volts or 1024 to 1060 PSI) and increase to a signal level above (1.75 volts or 1270 PSI) after 60 seconds of WOT engine operation.

#### **CHANGE OIL (CG-4) AND RE-TEST IF THIS TEST IS FAILED**

#### LOW PRESSURE SUCTION LEAKS

If a leak on the suction side is present, engine temperature will most likely have little effect on oil aeration. The ICP signal during this test will most likely immediately measure above 1.9 volts or 1400 PSI during the WOT test and the engine may not achieve a engine speed above 2000 RPM during this test. (It is important that all KOER and cylinder contribution tests have been performed prior to this test. A cylinder or injector not functioning will give similar test results.)

To confirm that a low side suction leak is occurring, over fill the engine crankcase with 3 quarts of engine oil, raise the rear wheels 10" off the ground and re-run this test. If a suction leak is present, (oil pickup tube or gasket leak) the added oil will seal the leak and the ICP signal should be in specification.

#### LOW IDLE STABILITY TEST

This test will help discern if erratic rail pressure and an associated low idle concern is caused by the ICP sensor or IPR valve. Disconnect engine harness connector at ICP sensor while engine is at idle. If engine rough idle smooths out, replace ICP sensor. If engine continues to idle rough with harness connector removed, refer to IPR and Injection Control Pressure system diagnostics.

#### PERFORM CRANKCASE PRESSURE TEST

The crankcase pressure test will determine the condition of the power cylinders and base engine.

#### INJECTION CONTROL PRESSURE BALANCE

Compare ICP Pressure of Right and Left Cylinder Head. Pressure differences between the right and left cylinder head have been found to cause poor idle and performance complaints. Install an additional ICP sensor in the right cylinder head, connect the EBP sensor connector (if vehicle is equipped with) to the additional sensor, install a breakout box and monitor the ICP signal on the left head and right head. (Use EBP signal pin) with two DVOM's installed. Compare the measured signal of the right and left cylinder head at low idle, high idle and under a load. The difference between each head should not exceed .2 volts.

To isolate if the pressure difference is caused by internal leakage in the cylinder head or by the high pressure pump, block the line feeding the right cylinder head and operate the on the left bank only. Then route the line feeding the left cylinder head to the right cylinder head. (The left high pressure line will reach the right head).

## SUPPLEMENTAL DIAGNOSTIC ANALYSIS

### ROUGH IDLE DIAGNOSTICS (Continued)

#### PERFORMANCE DIAGNOSTICS (Continued)

If there are pressure differences between the cylinder heads, leakage is occurring in the lower pressure head (e.g. loose or cross threaded oil gallery drains, injector "O" rings, bad injector).

If the pressure is the same on each cylinder head,

the initial pressure difference is caused by the high pressure pump.

#### COMPRESSION TEST

Perform compression test to verify base engine condition. (Figure 4.20.)

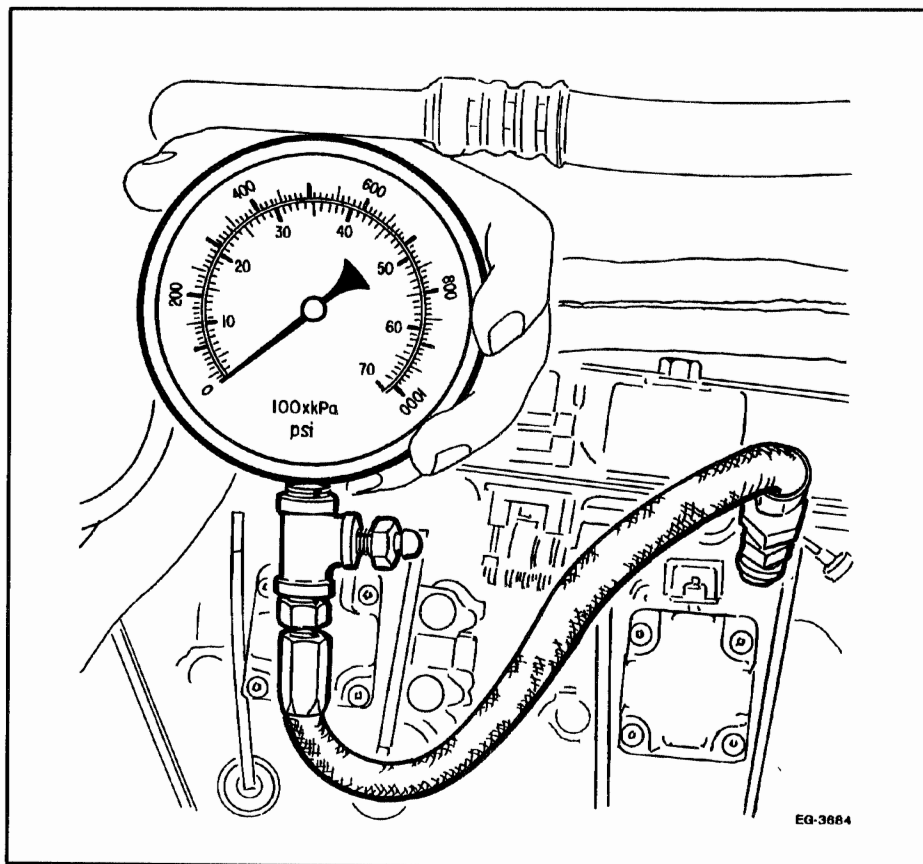


Figure 4.20. – Compression Test

- If no other faults found replace injectors.