SECTION B

SYMPTOMS

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BEFORE STARTING

Before using this section you should have performed the DIAGNOSTIC CIRCUIT CHECK and found out that:

1. The ECM and "Service Engine Soon" light are operating.
2. There are no trouble codes stored, or there is a trouble code but no "Service Engine Soon" light.

Verify the customer complaint, and locate the correct SYMPTOM below. Check the items indicated under that symptom.

If the ENGINE CRANKS BUT WILL NOT RUN, see CHART A-3.

Several of the symptom procedures below call for a careful visual check. This check should include:

- ECM grounds for being clean and tight.
- Vacuum hoses for splits, kinks, and proper connections, as shown on Emission Control Information label.
- Air leaks at throttle body mounting and intake manifold.
- Air leaks between MAF sensor and throttle body.
- Ignition wires for cracking, hardness, proper routing, and carbon tracking.
- Wiring for proper connections, pinches, and cuts.

The importance of this step cannot be stressed too strongly - it can lead to correcting a problem without further checks and can save valuable time.

INTERMITTENTS

Problem may or may not turn "ON" the "Service Engine Soon" light, or store a code.

DO NOT use the trouble code charts in Section "A" for intermittent problems. The fault must be present to locate the problem. If a fault is intermittent, use of trouble code charts may result in replacement of good parts.

- Most intermittent problems are caused by faulty electrical connections or wiring. Perform careful check as described at start of Section "B". Check for:
  - Poor mating of the connector halves, or terminals not fully seated in the connector body (backed out).
  - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed to increase contact tension.
  - Poor terminal to wire connection. This requires removing the terminal from the connector body to check. See "Introduction" to Section "6E".
- If a visual check does not find the cause of the problem, the car can be driven with a voltmeter connected to a suspected circuit. A "Scan" tool can also be used for monitoring input signals to the ECM to help detect intermittent conditions. An abnormal voltage, or "Scan" reading, when the problem occurs, indicates the problem may be in that circuit. If the wiring and connectors check OK and a trouble code was stored for a circuit having a sensor, except for Codes 43, 44, and 45, substitute a known good sensor and recheck.

An intermittent "Service Engine Soon" light with no stored code may be caused by:

- Ignition coil shorted to ground and arcing at spark plug wires or plugs.
- "Service Engine Soon" light wire to ECM shorted to ground. (CKT 419).
- Diagnostic "Test" terminal wire to ECM, shorted to ground.(CKT 451)
- ECM power grounds. See ECM wiring diagrams.
- Loss of trouble code memory. To check, disconnect TPS and idle engine until "Service Engine Soon" light comes "ON". Code 22 should be stored, and kept in memory when ignition is turned "OFF". If not, the ECM is faulty.
- Check for an electrical system interference caused by a defective relay, ECM driven solenoid, or switch. They can cause a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
- Check for improper installation of electrical options, such as lights, 2-way radios, etc.
- EST wires should be kept away from spark plug wires, distributor wires, distributor housing, coil, and generator. Wire from ECM to distributor (CKT 453) should be a good connection.
- Check for open diode across A/C compressor clutch, and for other open diodes (see wiring diagrams).

HARD START

Definition: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.

- Perform careful check as described at start of Section "B".
- Make sure driver is using correct starting procedure.
- **CHECK:**
  - TPS for sticking or binding or a high TPS voltage with the throttle closed (should read less than .700 volts).
  - High resistance in coolant sensor circuit or sensor itself. See Code 15 chart or with a "Scan" tool compare coolant temperature with ambient temperature on a cold engine.
  - Fuel pressure CHART A-7.
  - Water contaminated fuel.
  - EGR operation. Be sure valve seats properly and is not staying open. See CHART C-7.
  - Both injector fuses (visually inspect).
  - Ignition system - Check distributor for:
    - Proper output with ST-125.
    - Worn shaft.
    - Bare and shorted wires.

    Pickup coil resistance and connections.
    - Loose ignition coil ground.
    - Moisture in distributor cap.
- If problem exists in cold weather, check cold start valve. See CHART A-9 .

- A faulty in-tank fuel pump check valve will allow the fuel in the lines to drain back to the tank after the engine is stopped. To check for this condition:

  Perform Fuel System Diagnosis, CHART A-7.
- Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- If engine starts but then immediately stalls, open distributor by-pass line. If engine then starts and runs OK, replace pickup coil.
- If engine starts and stalls, disconnect MAF sensor. If engine then runs and sensor connections are OK, replace the sensor.

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. Can occur at all car speeds. Usually most severe when first trying to make the car move, as from a stop sign. May cause the engine to stall if severe enough.

- Perform careful visual check as described at start of Section "B".
- **CHECK:**
  - Fuel pressure. See CHART A-7. Also check for water contaminated fuel.
  - Air leaks at air duct between MAF sensor and throttle body.
  - Spark plugs for being fouled or faulty wiring.
  - PROM (2.8L) or MEM-CAL (5.0L & 5.7L) number. Also check service bulletins for latest MEM-CAL or PROM.
  - TPS for binding or sticking. Voltage should increase at a steady rate as throttle is moved toward WOT.
  - Ignition timing. See Emission Control Information label.
  - Generator output voltage. Repair if less than 9 or more than 16 volts.
  - HEI ground, CKT 453.
  - Canister purge system for proper operation. See CHART C-3.
  - EGR - See CHART C-7.
- Perform injector balance test CHART C-2A.

SURGES AND/OR CHUGGLE

Definition: Engine power variation under steady throttle or cruise. Feels like the car speeds up and slows down with no change in the accelerator pedal.

- Be sure driver understands transmission converter clutch and A/C compressor operation in Owner's Manual.
- Perform careful visual inspection as described at start of Section "B".
- **CHECK:**
  - TCC and 4th gear switch operation - See CHART C-8A.
  - Loose or leaking air duct between MAF sensor and throttle body.
  - Generator output voltage. Repair if less than 9 or more than 16 volts.
  - EGR - There should be no EGR at idle. See CHART C-7. Also check for plugged EGR solenoid filter.
  - Vacuum lines for kinks or leaks.
  - Ignition timing. See Emission Control Information label.
  - In-line fuel filter. Replace if dirty or plugged.
  - Fuel pressure while condition exists. See CHART A-7.
- Inspect oxygen sensor for silicone contamination from fuel, or use of improper RTV sealant. The sensor may have a white, powdery coating and result in a high but false signal voltage (rich exhaust indication). The ECM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
- Remove spark plugs. Check for cracks, wear, improper gap, burned electrodes, or heavy deposits. Also check condition of distributor cap, rotor, and spark plug wires.
- To help determine if the condition is caused by a rich or lean system, the car should be driven at the speed of the complaint. Monitoring block learn at the complaint speed will help identify the cause of the problem. If the system is runnig lean (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44. If the system is running rich (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.

LACK OF POWER, SLUGGISH, OR SPONGY

Definition: Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part way.

- Perform careful visual check as described at start of Section "B".
- Compare customer's car to similar unit. Make sure the customer's car has an actual problem.
- Remove air cleaner and check air filter for dirt, or for being plugged. Replace as necessary.
- **CHECK:**
  - For loose or leaking air duct between MAF Sensor and throttle body.
  - Ignition timing. See Emission Control Information label.
  - Restricted fuel filter, contaminated fuel or improper fuel pressure. See CHART A-7.
  - ECM ground circuits - See ECM wiring diagrams.
  - EGR operation for being open or partly open all the time - CHART C-7.
  - Exhaust system for possible restriction: See CHART B-1.
    - Inspect exhaust system for damaged or collapsed pipes.
    - Inspect muffler for heat distress or possible internal failure.
  - Generator output voltage. Repair if less than 9 or more than 16 volts.'
  - Engine valve timing and compression.
  - Engine for proper or worn camshaft. See Section "6A".
  - Secondary voltage using a shop ocilliscope or a spark tester J-26792 (ST-125) or equivalent.

DETONATION /SPARK KNOCK

Definition: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening. Sounds like popcorn popping.

- Check for obvious overheating problems:
  - Low coolant.
  - Loose water pump belt.
  - Restricted air flow to radiator, or restricted water flow thru radiator.
  - Inoperative electric cooling fan circuit. See CHART C-12.
- **CHECK:**
  - Ignition timing. See Vehicle Emission Control Information label.
  - EGR system for not opening - CHART C-7.
  - TCC operation - CHART C-8.
  - Fuel system pressure. See CHART A-7.
  - PROM or MEM-CAL - Be sure it's the correct one. (See Service Bulletins)
  - Valve oil seals for leaking.
- Check for incorrect basic engine parts such as cam, heads, pistons, etc.
- Check for poor fuel quality.
- Remove carbon with top engine cleaner. Follow instructions on can.
- Check ESC system (5.0L & 5.7L) See CHART C-5
- To help determine if the condition is caused by a rich or lean system, the car should be driven at the speed of the complaint. Monitoring block learn at the complaint speed will help identify the cause of the problem. If the system is runnig lean (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44. If the system is running rich (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

- Perform careful visual check as described at start of Section "B".
- Check for missing cylinder by:
  1. Disconnect IAC valve. Start engine. Remove one spark plug wire at a time using insulated pliers.
  2. If there is an rpm drop on all cylinders (equal to within 50 rpm), go to "ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING" symptom. Reconnect IAC valve.
  3. If there is no rpm drop on one or more cylinders, or excessive variation in drop, check for spark on the suspected cylinder(s) with J 26792 (ST-125) Spark Gap Tool or equivalent. If no spark, see Section "6D" for intermittent operation or miss. If there is spark, remove spark plug(s) in these cylinders and check for:
     - Cracks
     - Wear
     - Improper gap
     - Burned electrodes
     - Heavy deposits
- Perform compression check on questionable cylinder(s) found above. If compression is low, repair as necessary. See Section "6".
- Disconnect all injector harness connectors. Connect J-34730-2 injector test light or equivalent 6 volt test light between the harness terms, of each injector connector and note light while cranking. If test light fails to blink at any connector, it is a faulty injector drive circuit harness, connector, or terminal.
- Perform the injector balance test. See CHART C-2A.
- **CHECK:**
  - Spark plug wires by connecting ohmmeter to ends of each wire in question. If meter reads over 30,000 ohms, replace wire(s).
  - Fuel System - Plugged fuel filter, water, low pressure. See CHART A-7.
  - Valve timing.
  - Secondary voltage using a shop ocilliscope or a spark tester J-26792 (ST-125) or equivalent.
- Visually inspect distributor cap and rotor for moisture, dust, cracks, burns, etc. Spray cap and plug wires with fine water mist to check for shorts.
- A miss condition can be caused by EMI (Electromagnetic Interference) on the reference circuit. EMI can usually be detected by monitoring engine rpm with a "Scan" tool. A sudden increase in rpm with little change in actual engine rpm change, indicates EMI is present.
  If the problem exists, check routing of secondary wires, check all distributor ground circuits.
- Remove rocker covers. Check for bent pushrods, worn rocker arms, broken valve springs, worn camshaft lobes. Repair as necessary. See Section "6A".

BACKFIRE

Definition: Fuel ignites in intake manifold, or in exhaust system, making a loud popping noise.

- **CHECK:**
  - Loose wiring connector or air duct at MAF sensor.
  - Compression - Look for sticking or leaking valves.
  - EGR operation for being open all the time. See CHART C-7.
  - EGR gasket for faulty or loose fit .
  - Valve timing.
  - Output voltage of ignition coil using a shop ocilliscope or spark tester J-26792 (ST-125) or equivalent.
  - Spark plugs for crossfire also inspect (distributor cap, spark plug wires, and proper routing of plug wires).
  - Ignition system for intermittent condition. (See Section "6D").
  - Engine timing - see Emission Control Information label.
  - Perform fuel system diagnosis check, CHART A-7A.
  - Perform injector balance test, CHART C-2A.
  - Deceleration valve (2.8L manual/trans) - See Section "C6".
  - A.I.R. system check valves - See Section "C-6".

POOR FUEL ECONOMY

Definition: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this car at one time, as previously shown by an actual road test.

- Perform careful visual check as described at start of Section "B".
- **CHECK:**
  - Coolant level.
  - Engine thermostat for faulty part (always open) or for wrong heat range. See Section "6B".
  - Compression
  - Ignition timing. See Emission Control Information label.
  - TCC for proper operation. A "Scan" should indicate an rpm drop when the TCC is commanded "ON". See CHART C-8.
  - Induction system and crankcase for air leaks.
- Check for exhaust restriction. See CHART B-1.

DIESELING, RUN-ON

Definition: Engine continues to run after key is turned "OFF", but runs very roughly. If engine runs smoothly, check ignition switch and adjustment.

- Check injectors for leaking. See CHART A-7.

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: The engine runs unevenly at idle. If bad enough, the car may shake. Also, the idle may vary in rpm (called "hunting"). Either condition may be bad enough to cause stalling. Engine idles at incorrect speed.

- Perform careful visual check as described at start of Section "B".
- **CHECK:**
  - Throttle linkage for sticking or binding. Also check TPS adjustment. Refer to Section "C2".
  - Ignition timing. See Emission Control Information label.
  - ECM ground circuits.
  - IAC system. See CHART C-2C.
  - Generator output voltage. Repair if less than 9 or more than 16 volts.
  - P/N switch circuit. See CHART C-1A, or use "SCAN" tool.
  - Injector balance. See CHART C-2A.
  - PCV valve for proper operation by placing finger over inlet hole in valve end several times. Valve should snap back. If not, replace valve.
  - Evaporative Emission Control System. CHART C-3.
  - A/C signal to ECM terminal "B8" (5.0L & 5.7L). "Scan" tool should indicate A/C is being requested when ever A/C is selected and the pressure cycling switch is closed.
  - A/C system operation (2.8L) - See CHART C-10.
  - Minimum idle speed. See Section "C2".
  - Loose or damaged MAF sensor duct between sensor and throttle body.
  - Power Steering Pressure Switch (2.8L - See CHART C-1E.
  - Check AIR system. There should be no AIR to ports while in "Closed Loop". See CHART C-6.
  - EGR valve: There should be no EGR at idle.
- Run a cylinder compression check. See Section "6".
- Inspect oxygen sensor for silicon contamination from fuel, or use of improper RTV sealant. The sensor will have a white, powdery coating, and will result in a high but false signal voltage (rich exhaust indication). The ECM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
- Check for fuel in pressure regulator hose. If present replace regulator assembly.
- Check ignition system; wires, plugs, rotor, etc.
- Check for loose or damaged air duct between MAF sensor and throttle body.
- Disconnect MAF sensor and if condition is corrected replace sensor.
- Clean injectors.
- Monitoring block learn will help identify the cause of the problem. If the system is runnig lean (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44. If the system is running rich (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. Excessive odors do not necessarily indicate excessive emissions.

- Perform "Diagnostic Circuit Check."
- IF TEST SHOWS EXCESSIVE CO AND HC, (or also has excessive odors):
  - Check items which cause car to run RICH.
    - Make sure engine is at normal operating temperature.
- **CHECK:**
  - Fuel pressure. See CHART A-7.
  - Incorrect timing. See vehicle emission control information label.
  - Canister for fuel loading. See CHART C-3.
  - Injector balance. See CHART C-2A.
  - PCV valve for being plugged, stuck, or blocked PCV hose, or fuel in the crankcase.
  - Spark plugs, plug wires, and ignition components. See Section "6D".
  - Check for lead contamination of catalytic converter (look for removal of fuel filler neck restrictor).
  - Check for properly installed fuel cap.
- If the system is running rich, (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.
- IF TEST SHOWS EXCESSIVE NOx:
  - Check items which cause car to run LEAN, or to run too hot.
    - EGR valve for not opening. See CHART C-7.
    - Vacuum leaks.
    - Coolant system and coolant fan for proper operation. See CHART C-12.
    - Remove carbon with top engine cleaner. Follow instructions on can.
    - Check ignition timing for excessive base advance. See emission control information label.
- If the system is running lean, (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44.

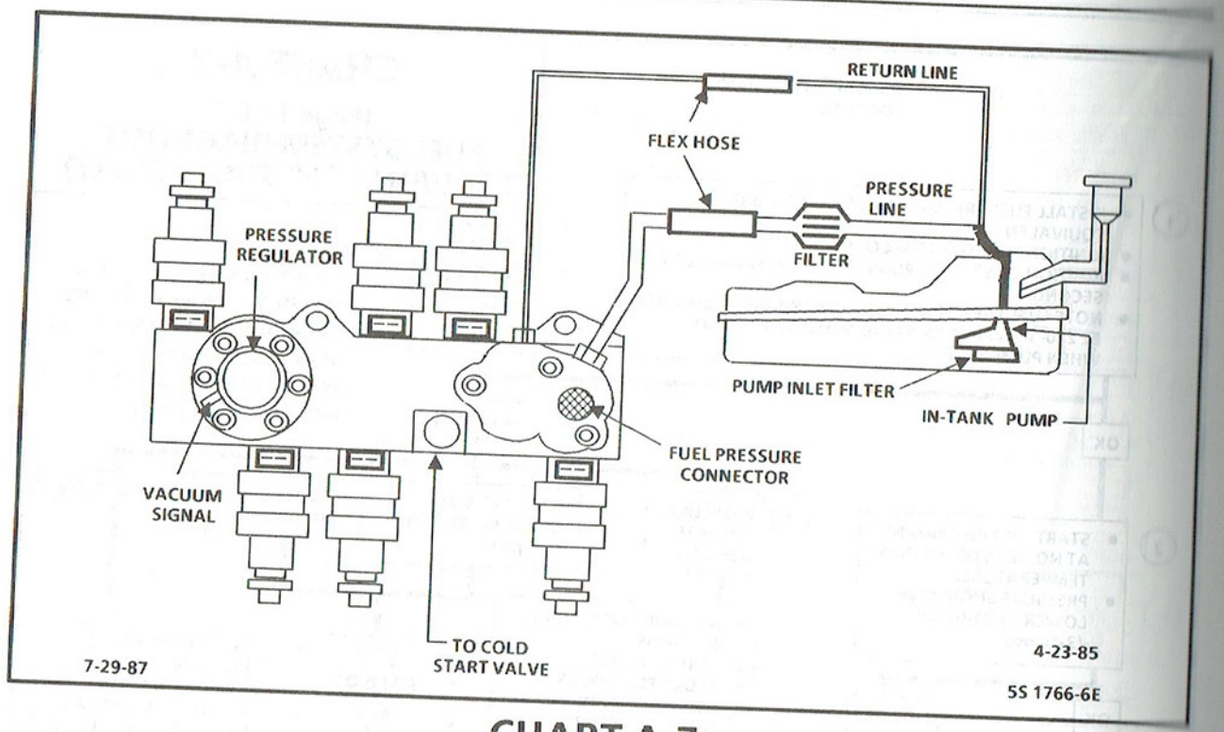


CHART A-7

(Page 2 of 2)
FUEL SYSTEM DIAGNOSIS 2.8L (VIN S) "F" SERIES (PORT)

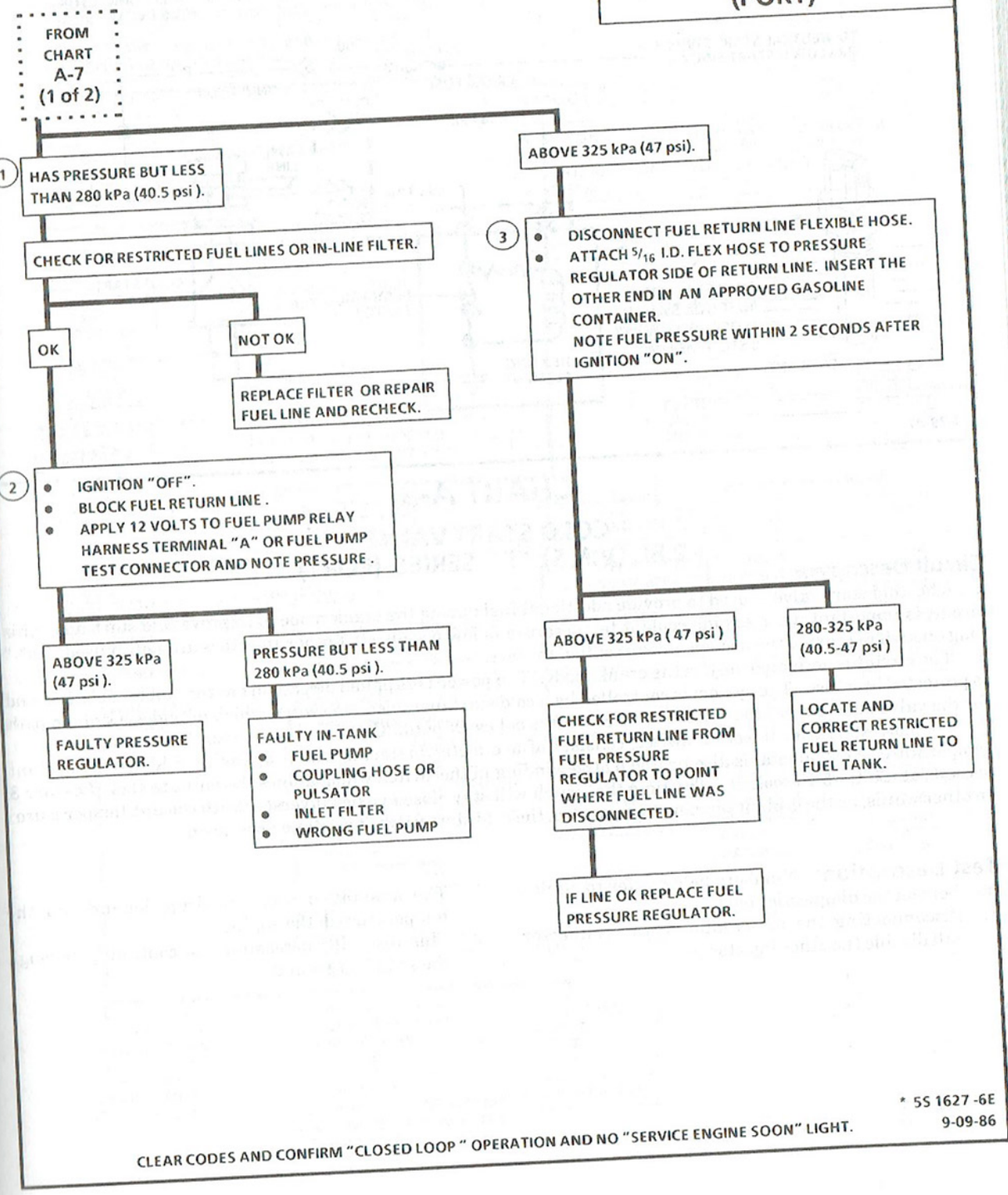
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Pressure but less than 280 kPa (40.5 psi) falls into two areas:
   - Regulated pressure, but less than 280 kPa (40.5 psi). Amount of fuel to injectors OK but pressure is too low. System will be lean running and may set Code 44. Also, hard starting cold and overall poor performance.
   - Restricted flow causing pressure drop - Normally, a vehicle with a fuel pressure of less than 165 kPa (24 psi) at idle will not be driveable. However, if the pressure drop occurs only while driving, the engine will normally surge then stop as pressure begins to drop rapidly.
2. Restricting the the fuel return line allows the fuel pump to develop its maximum pressure (dead head pressure). When battery voltage is applied to the pump test terminal, pressure should be above 414 kPa (60 psi).
3. This test determines if the high fuel pressure is due to a restricted fuel return line or a pressure regulator problem.

CHART A-7

(Page 2 of 2)
FUEL SYSTEM DIAGNOSIS 2.8L (VIN S) "F" SERIES (PORT)

NOTICE: *FUEL SYSTEM UNDER PRESSURE. TO AVOID FUEL SPILLAGE, REFER TO FIELD SERVICE PROCEDURES FOR TESTING OR MAKING REPAIRS REQUIRING DISASSEMBLY OF FUEL LINES OR FITTINGS.*



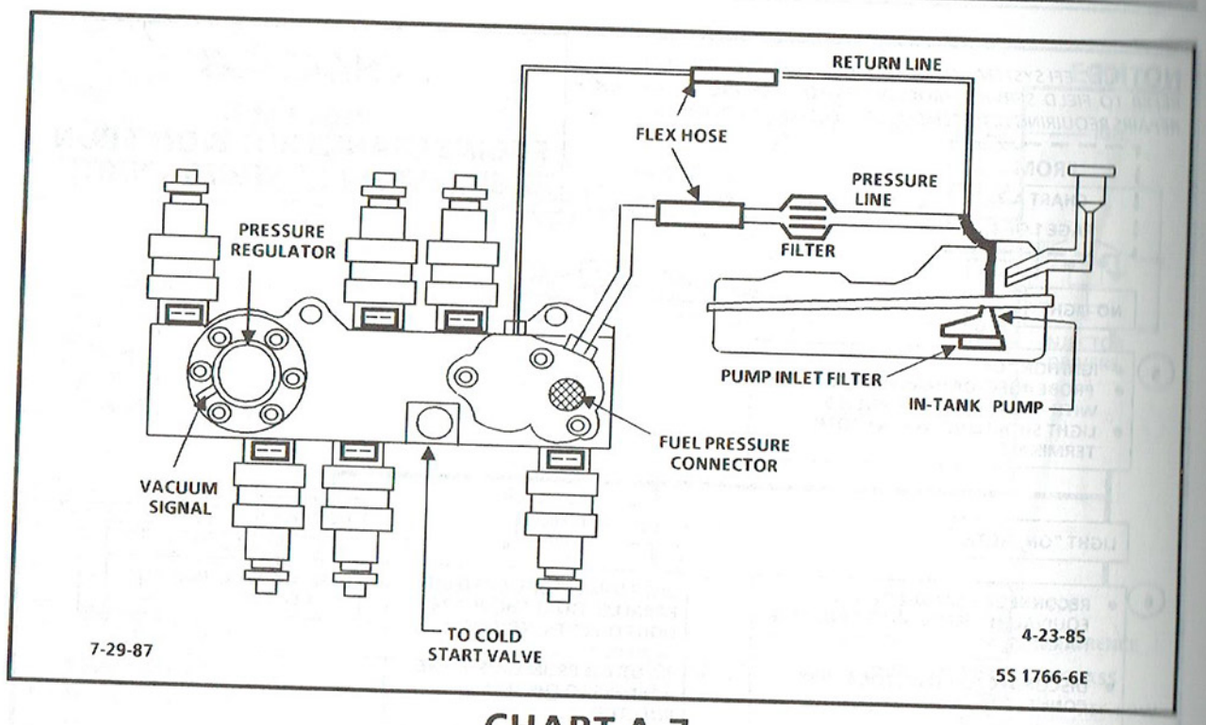


CHART A-7

(Page 1 of 2)
FUEL SYSTEM DIAGNOSIS
2.8L (VIN S) "F" SERIES (PORT)

Circuit Description:

When the ignition switch is turned "ON", the electronic control module (ECM) will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving HEI distributor reference pulses.

If there are no reference pulses, the ECM will shut "OFF" the fuel pump within 2 seconds after key "ON" or engine stopped.

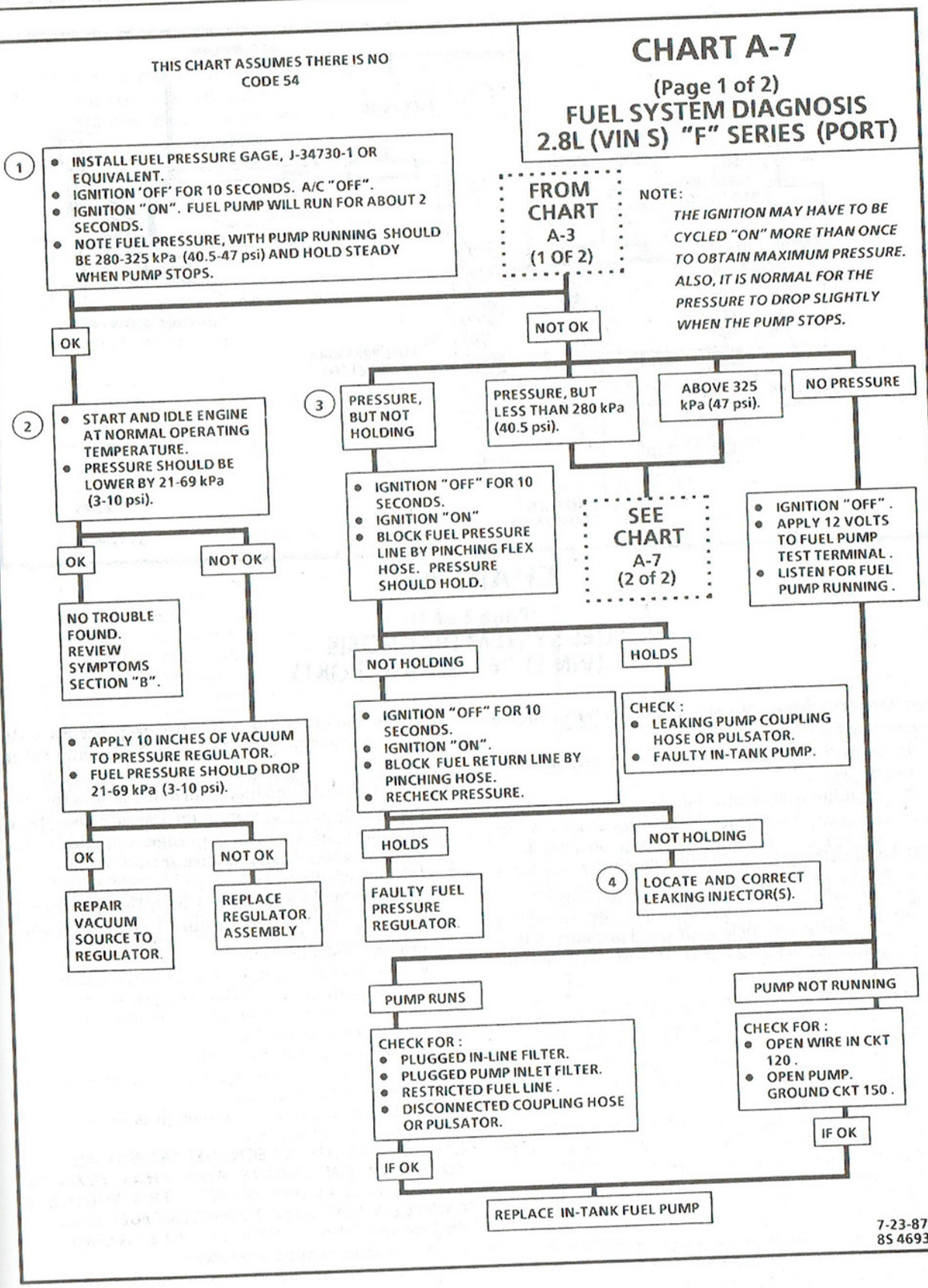
The pump will deliver fuel to the fuel rail and injectors, then to the pressure regulator, where the system pressure is controlled to about 234 to 317 kPa (34 to 46 psi). Excess fuel is then returned to the fuel tank.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Use pressure gage J-34730-1. Wrap a shop towel around the fuel pressure tap to absorb any small amount of fuel leakage that may occur when installing the gage.
   Ignition "ON", pump pressure should be 280-325 kPa (40.5-47 psi). This pressure is controlled by spring pressure within the regulator assembly.
2. When the engine is idling, the manifold pressure is low (high vacuum) and is applied to the fuel regulator diaphragm. This will offset the spring and result in a lower fuel pressure. This idle pressure will vary somewhat depending on barometric pressure, however, the pressure idling was less indicating pressure regulator control.
3. Pressure that continues to fall is caused by one of the following:
   - In-tank fuel pump check valve not holding.
   - Pump coupling hose or pulsator leaking.
   - Fuel pressure regulator valve leaking.
   - Injector sticking open.
4. An injector sticking open can best be determined by checking for a fouled or saturated spark plug(s). If a leaking injector can not be determined by a fouled or saturated spark plug the following procedure should be used.
   - Remove Plenum, cold start valve and remove fuel rail bolts. Follow the procedures in the fuel control section of this manual, but leave fuel lines connected.
   - Reconnect cold start valve.
   - Connect a hose to valve nozzle and insert into a gasoline container.
   - Lift fuel rail out just enough to leave injector nozzles in the ports.

CAUTION: ***BE SURE INJECTOR(S) ARE NOT ALLOWED TO SPRAY ON ENGINE AND THAT INJECTOR RETAINING CLIPS ARE INTACT. THIS SHOULD BE CAREFULLY FOLLOWED TO PREVENT FUEL SPRAY ON ENGINE WHICH WOULD CAUSE A FIRE HAZARD.***

   - Pressurize the fuel system.
   - Lift each side of rail up and observe for injector(s) leaking.



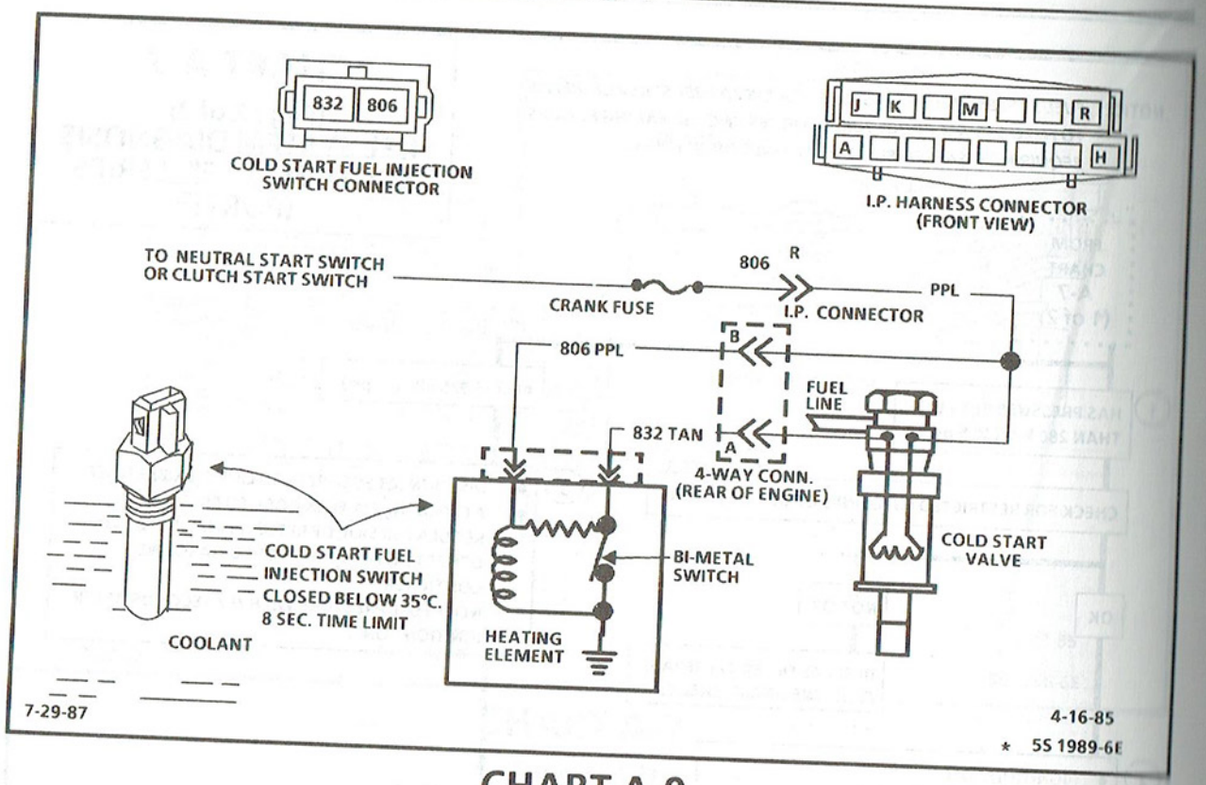


CHART A-9

COLD START VALVE
2.8L (VIN S) "F" SERIES (PORT)

Circuit Description:

The cold start valve is used to provide additional fuel during the crank mode to improve cold start-ups. This circuit is important when engine coolant temperature is low because the other injectors are not pulsed "ON" long enough to provide the needed amount of fuel to start.

The circuit is activated only in the crank mode. The power is supplied directly from the starter solenoid and is protected by a fuse. The system is controlled by a cold start fuel injection switch which provides a ground path for the valve during cranking when engine coolant is below 95°F (35°C).

The cold start fuel injection switch consists of a bimetal material which opens at a specified coolant temperature. This bimetal is also heated by the winding in the switch which allows the valve to stay "ON" for 8 seconds at -20°C (-5°F) coolant. The time the switch will stay closed varies inversely with coolant temperature. In other words, as the coolant temperature goes up, the cold start valve "ON" time goes down.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Disconnecting the distributor 4-way connector will disable the other injectors. The amount of pressure drop depends on the temperature of the engine.
2. This test will determine the continuity through the switch to ground.

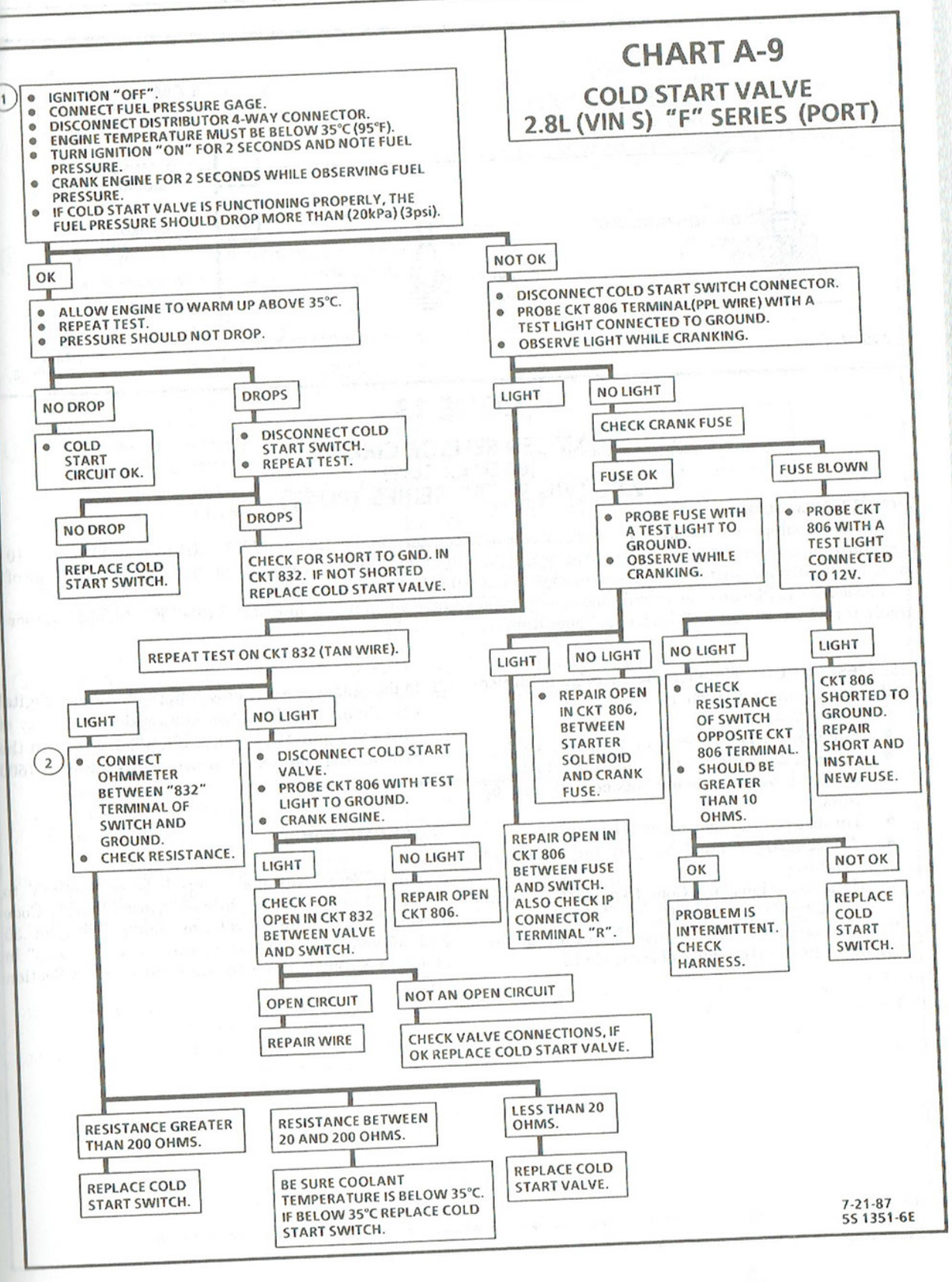


CHART B-1

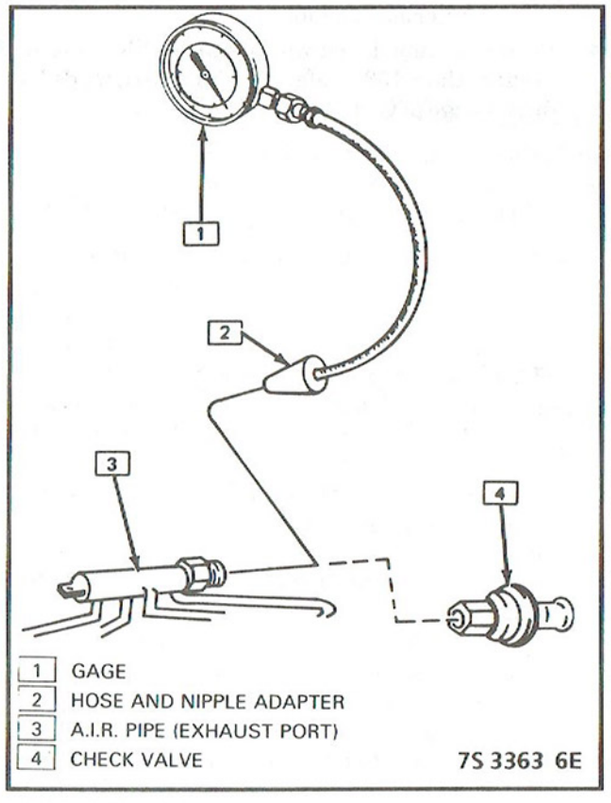
RESTRICTED EXHAUST SYSTEM CHECK

ALL ENGINES

Proper diagnosis for a restricted exhaust system is essential before any components are replaced. Either of the following procedures may be used for diagnosis, depending upon engine or tool used:

CHECK AT A. I. R. PIPE:

1. Remove the rubber hose at the exhaust manifold A.I.R. pipe check valve. Remove check valve.
2. Connect a fuel pump pressure gauge to a hose and nipple from a Propane Enrichment Device (J26911) (see illustration).
3. Insert the nipple into the exhaust manifold A.I.R. pipe.



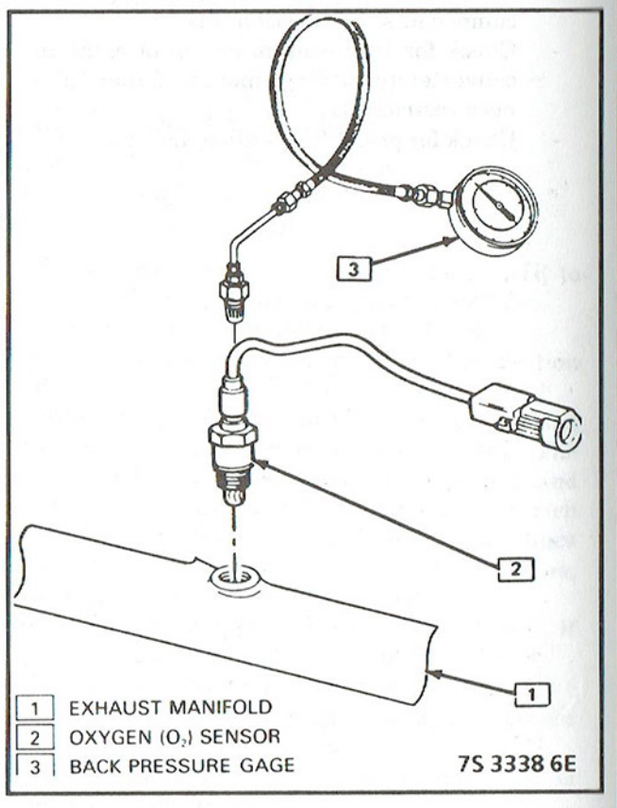
1 GAGE
2 HOSE AND NIPPLE ADAPTER
3 A.I.R. PIPE (EXHAUST PORT)
4 CHECK VALVE

7S 3363 6E

OR

CHECK AT O_2 SENSOR:

1. Carefully remove O_2 sensor.
2. Install Borroughs Exhaust Backpressure Tester (BT 8515 or BT 8603) or equivalent in place of O_2 sensor (see illustration).
3. After completing test described below, be sure to coat threads of O_2 sensor with anti-seize compound P/N 5613695 or equivalent prior to re-installation.



1 EXHAUST MANIFOLD
2 OXYGEN (O_2) SENSOR
3 BACK PRESSURE GAGE

7S 3338 6E

DIAGNOSIS:

1. With the engine idling at normal operating temperature, observe the exhaust system backpressure reading on the gauge. Reading should not exceed 1 ¼ psi (8.6 kPa).
2. Accelerate engine to 2000 RPM and observe gauge. Reading should not exceed 3 psi (20.7 kPa).
3. If the backpressure, at either RPM, exceeds specification, a restricted exhaust system is indicated.
4. Inspect the entire exhaust system for a collapsed pipe, heat distress, or possible internal muffler failure.
5. If there are no obvious reasons for the excessive backpressure, a restricted catalytic converter should be suspected and replaced using current recommended procedures.

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CHART C-2A

INJECTOR BALANCE TEST

The injector balance tester is a tool used to turn the injector on for a precise amount of time, thus spraying a measured amount of fuel into the manifold. This causes a drop in fuel rail pressure that we can record and compare between each injector. All injectors should have the same amount of pressure drop (± 10 kpa). Any injector with a pressure drop that is 10 kpa (or more) greater or less than the average drop of the other injectors should be considered faulty and replaced.

STEP 1

Engine "cool down" period (10 minutes) is necessary to avoid irregular readings due to "Hot Soak" fuel boiling. With ignition "OFF" connect fuel gauge J347301 or equivalent to fuel pressure tap. Wrap a shop towel around fitting while connecting gage to avoid fuel spillage.

Disconnect harness connectors at all injectors, and connect injector tester J-34730-3, or equivalent, to one injector. On Turbo equipped engines, use adaptor harness furnished with injector tester to energize injectors that are not accessible. Follow manufacturers instructions for use of adaptor harness. Ignition must be "OFF" at least 10 seconds to complete ECM shutdown cycle. Fuel pump should run about 2 seconds after ignition is turned "ON". At this point, insert clear tubing attached to vent valve into a suitable container and bleed air from gauge and hose to insure accurate gauge operation. Repeat this step until all air is bled from gauge.

STEP 2

Turn ignition "OFF" for 10 seconds and then "ON" again to get fuel pressure to its maximum. Record this initial pressure reading. Energize tester one time and note pressure drop at its lowest point (Disregard any slight pressure increase after drop hits low point.). By subtracting this second pressure reading from the initial pressure, we have the actual amount of injector pressure drop.

STEP 3

Repeat step 2 on each injector and compare the amount of drop. Usually, good injectors will have virtually the same drop. Retest any injector that has a pressure difference of 10kPa, either more or less than the average of the other injectors on the engine. Replace any injector that also fails the retest. If the pressure drop of all injectors is within 10kPa of this average, the injectors appear to be flowing properly. Reconnect them and review "Symptoms," Section "B".

NOTE: ***The entire test should not be repeated more than once without running the engine to prevent flooding. (This includes any retest on faulty injectors).***

CHART C-2A

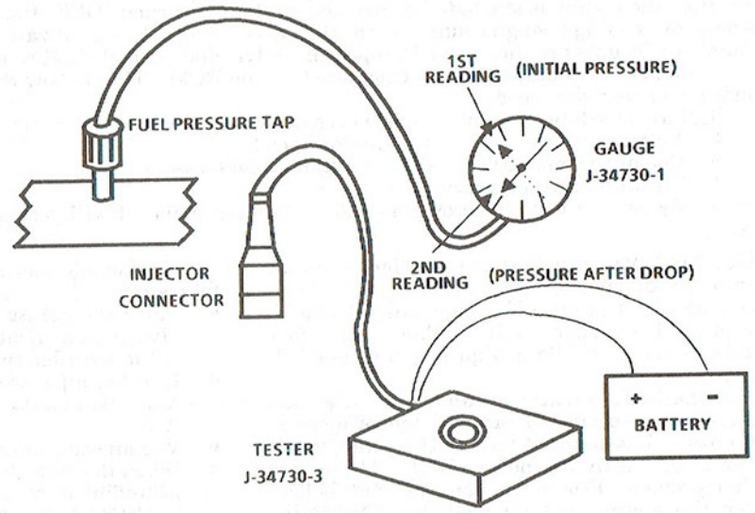
INJECTOR BALANCE TEST 2.8L (VIN S) "F" SERIES (PORT)

NOTE: **If injectors are suspected of being dirty, they should be cleaned using an approved tool and procedure prior to performing this test. The fuel pressure test in Section A, Chart A-7, should be completed prior to this test.**

Step 1. If engine is at operating temperature, allow a 10 minute "cool down" period then connect fuel pressure gauge and injector tester.
1. Ignition "OFF".
2. Connect fuel pressure gauge and injector tester.
3. Ignition "ON".
4. Bleed off air in gauge. Repeat until all air is bled from gauge.

Step 2. Run test:
1. Ignition "OFF" for 10 seconds.
2. Ignition "ON". Record gauge pressure. (Pressure must hold steady, if not see the Fuel System diagnosis, Chart A-7, in Section A).
3. Turn injector on, by depressing button on injector tester, and note pressure at the instant the gauge needle stops.

Step 3.
1. Repeat step 2 on all injectors and record pressure drop on each. Retest injectors that appear faulty (Any injectors that have a 10 kPa difference, either more or less, in pressure from the average). If no problem is found, review Symptoms Section B.



— EXAMPLE —

CYLINDER	1	2	3	4	5	6
1ST READING	225	225	225	225	225	225
2ND READING	100	100	100	90	100	115
AMOUNT OF DROP	125	125	125	135	125	110
	OK	OK	OK	FAULTY, RICH (TOO MUCH) (FUEL DROP)	OK	FAULTY, LEAN (TOO LITTLE) (FUEL DROP)

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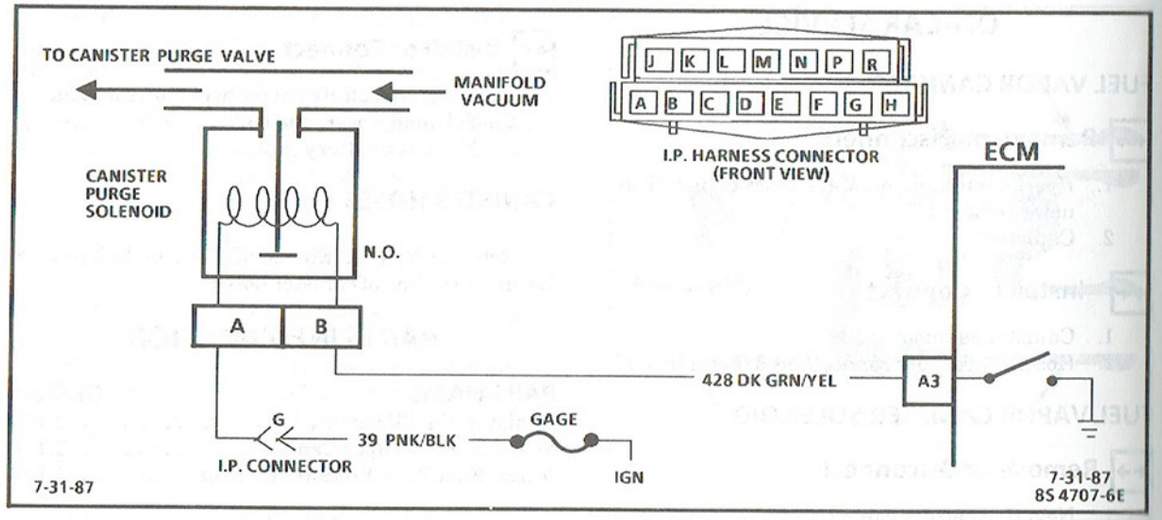


CHART C-3

CANISTER PURGE VALVE CHECK 2.8L (VIN S) "F" SERIES (PORT)

Circuit Description:

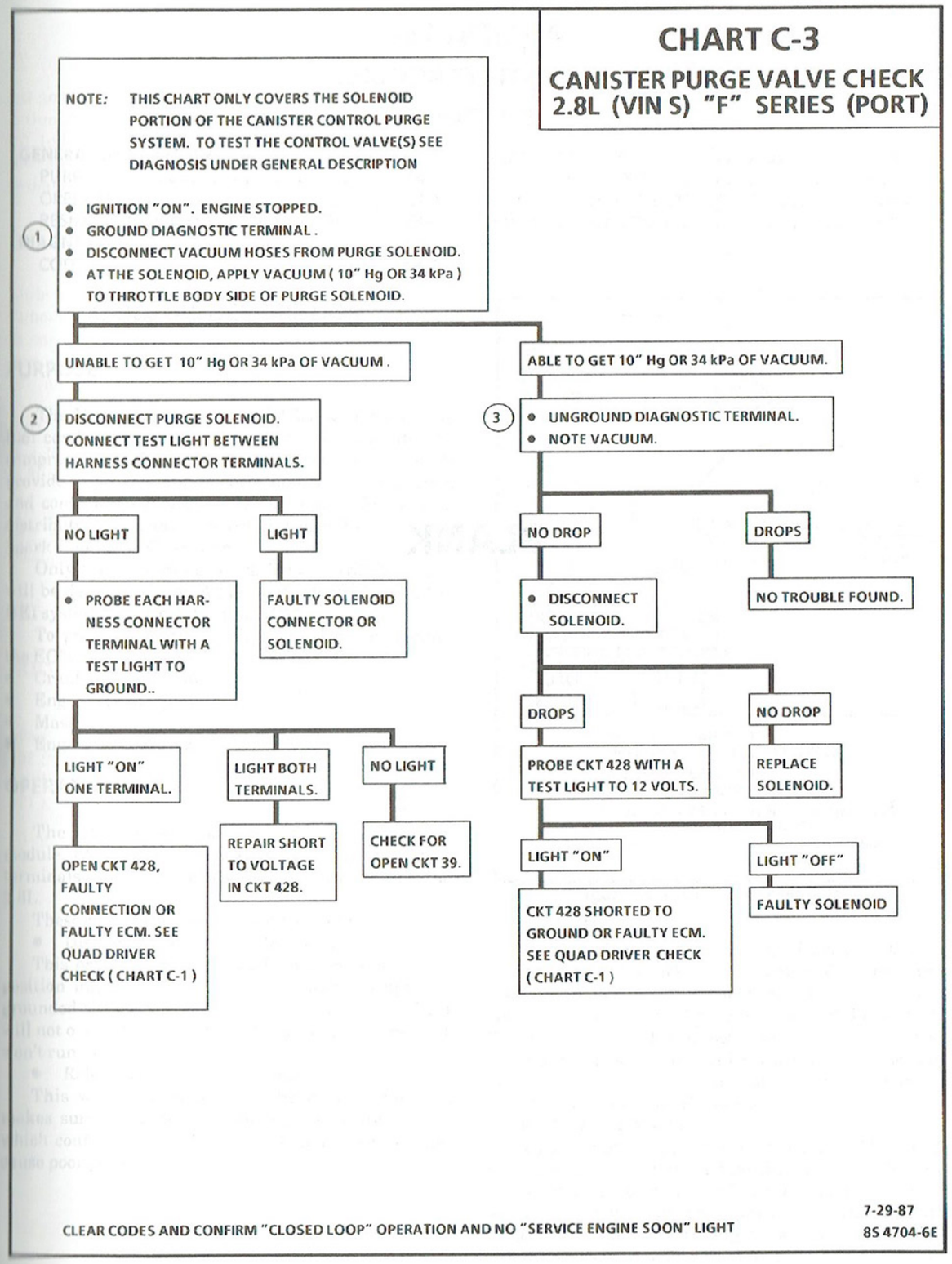
Canister purge is controlled by a solenoid that allows manifold vacuum to purge the canister when de-energized. The ECM supplies a ground to energize the solenoid (purge "OFF").

If the diagnostic test terminal is ungrounded with the engine stopped or the following is met with the engine running, the purge solenoid is de-energized (purge "ON").

- Engine run time after start more than 1 minute.
- Coolant temperature above 75°C.
- Vehicle speed above 15 mph.
- Throttle off idle.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Checks to see if the solenoid is opened or close. The solenoid is normally energized in this step; so it should be closed.
2. Checks for a complete circuit. Normally there is ignition voltage on CKT 39 and the ECM provides a ground on CKT 428. A shorted solenoid could cause an open circuit in the ECM.
3. Completes functional check by ungrounding test terminal. This should normally de-energize the solenoid and allow the vacuum to drop (purge "ON").



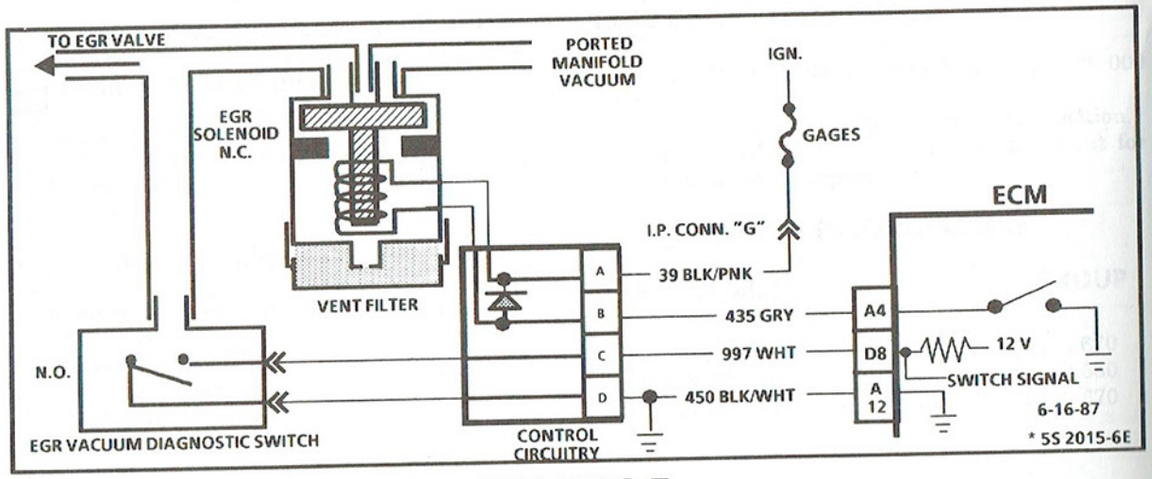


CHART C-7

EXHAUST GAS RECIRCULATION CHECK 2.8L (VIN S) "F" SERIES (PORT)

Circuit Description:

The EGR valve is controlled by a normally closed solenoid (allow a vacuum to pass when energized). The ECM energizes the solenoid to turn the EGR "ON", and monitors vacuum to the EGR with the EGR diagnostic switch. Code 32 will detect a faulty solenoid, vacuum switch or vacuum supply. CHART C-7 checks for plugged EGR passages, a sticking EGR valve, or a stuck open solenoid.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. With the ignition "ON" engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve.
2. Grounding the diagnostic terminal will energize the solenoid and allow vacuum to pass to valve.
3. Checks for pluged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
4. The EGR solenoid will not be energized in Park or Neutral. This test will determine if the Park/Neutral switch input is being received by the ECM.

CHART C-7

EXHAUST GAS RECIRCULATION CHECK 2.8L (VIN S) "F" SERIES (PORT)

ASSUMES NO CODE 32 IS STORED

1. DISCONNECT EGR SOLENOID VACUUM HARNESS.
   - ROTATE HARNESS AND REINSTALL ONLY THE EGR VALVE SIDE.
   - CHECK PORTED VACUUM SOURCE TO SOLENOID (IF NOT OK, REPAIR).
   - INSTALL A HAND HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EGR SOLENOID.
   - IGNITION "ON", ENGINE STOPPED.
   - DIAGNOSTIC TERMINAL NOT GROUNDED.
   - APPLY VACUUM.
   - OSBSERVE EGR VALVE.
   - VALVE SHOULD NOT MOVE.

- VALVE DOES NOT MOVE
  2. GROUND DIAGNOSTIC TERMINAL.
     - REPEAT TEST.
     - VALVE MOVES
       3. START AND IDLE ENGINE.
          - LIFT UP ON EGR VALVE AND OBSERVE IDLE.
          - IDLE ROUGHENS
            4. RECONNECT EGR SOLENOID.
               - CONNECT VACUUM GAGE TO VACUUM HARNESS AT EGR VALVE,
               - ENGINE AT NORMAL OPERATING TEMP.
               - IN DRIVE (AUTOMATIC TRANS.)
               - HOLD BRAKES AND ACCELERATE MOMENTARILY UP TO ABOUT 1800 RPM.
               - OBSERVE GAGE
               - SHOULD HAVE OVER 2" VACUUM BUT LESS THAN 10".
               - OK
                 - NO TROUBLE FOUND. EGR SYSTEM OK.
               - NOT OK
                 - OVER 10" VACUUM
                   - REPLACE EGR FILTER.
                 - NO VACUUM OR LESS THAN 2".
                   - IF THERE ARE NO RESTRICTIONS IN VACUUM LINES, PERFORM P/N SWITCH CHECK. CHART C-1A A/T ONLY.
          - NO CHANGE
            - REMOVE EGR VALVE.
            - CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED REPLACE EGR VALVE.
     - VALVE DOES NOT MOVE
       - REPLACE EGR VALVE.
- VALVE MOVES
  - DISCONNECT EGR SOLENOID ELECTRICAL CONNECTOR.
  - REPEAT TEST.
  - VALVE MOVES
    - REPLACE SOLENOID.
  - VALVE DOES NOT MOVE
    - CHECK CKT 435 FOR SHORT TO GROUND. IF NOT SHORTED, IT IS A FAULTY ECM. SEE ECM QUAD DRIVER CHECK (CHART C-1).

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

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