I - SYSTEM/COMPONENT TESTS

1998 Pontiac Bonneville

1998 ENGINE PERFORMANCE
General Motors Corp. - System & Component Testing - 3.8L

Buick; Le Sabre
Oldsmobile; LSS, Eighty Eight & Regency
Pontiac; Bonneville

MODEL IDENTIFICATION

Vehicle model is identified by fourth character of Vehicle Identification Number (VIN). VIN is stamped on metal pad on top of left end of instrument panel, near windshield.

INTRODUCTION

Before testing separate components or systems, perform all procedures listed in F - BASIC TESTING article. Since many computer-controlled and monitored components will set a diagnostic trouble code if they malfunction, it is also recommended self-diagnosis be performed. See G - TESTS W/CODES article.

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens.

COMPUTERIZED ENGINE CONTROLS

PCM POWER & GROUND CHECK

Ground Circuits

1) Using an ohmmeter, check for continuity to ground at PCM ground terminals. See POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D. table. Resistance should be zero ohms. If not, repair open to ground.

2) Using a voltmeter, connect negative lead of voltmeter to a good ground. Backprobe positive lead of voltmeter to each ground terminal. With vehicle running, voltmeter should indicate less than one volt. If voltmeter reading is more than one volt, check for open, short to voltage, corrosion or loose connection on ground circuit.

Power Circuits

1) Using a voltmeter, check for battery voltage between PCM continuous power terminal(s) and ground. See POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D. table. If battery voltage is not present, check for blown fuse or open fusible link. If okay, check for open in wire between PCM terminal and power source.

2) Turn ignition switch to RUN position. Using a voltmeter, check for battery voltage between PCM ignition power terminals and ground. If battery voltage is not present, check IGN fuse. If fuse is okay, check for an open in wire between battery and ignition switch, and between ignition switch and PCM terminal. If okay, check for a defective ignition switch.

3) Connect voltmeter between ground and PCM starter (crank) signal terminal. On vehicles with manual transmission/transaxle, depress clutch pedal. On vehicles with automatic transmission/transaxle, position gear shift lever in Park. On all vehicles, turn ignition switch to START position. Battery voltage

should be present only when ignition switch is in START position.

4) If voltage is not present, check CRANK fuse or fusible link between ignition switch and PCM terminal. If fuse or fusible link is okay, check for an open in wire between ignition switch and PCM terminal, or check for a defective ignition switch.

PCM Harness Resistance

Turn ignition switch to LOCK position. Disconnect PCM and appropriate component harness connectors. Check for open or short circuits between PCM harness connector terminal and component harness connector terminal. See POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D. table. See L - WIRING DIAGRAMS article. If harness is open or shorted, repair as necessary.

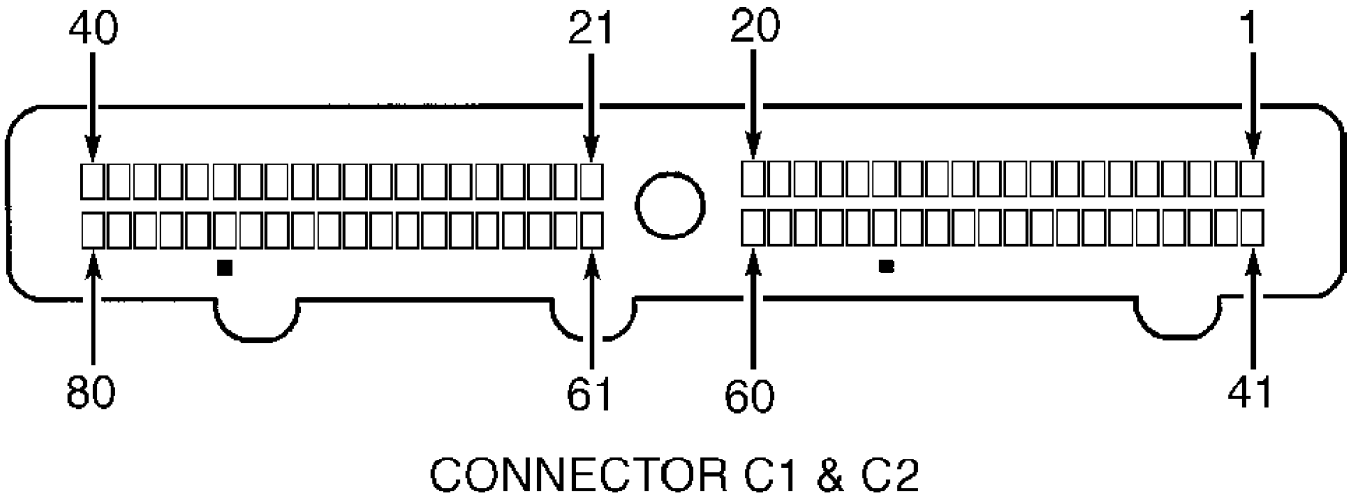

Fig. 1: Identifying Powertrain Control Module (PCM) Harness Connector Terminals
Courtesy of General Motors Corp.

POWERTRAIN CONTROL MODULE (PCM) CONNECTOR I.D. (1) TABLE

Connector	Terminal	Wire Color	Function
C1	66 1-3		Not Used
C1	4	LT GRN	1-2 Shift Solenoid Control
C1	5	DK BLU	Cooling Fan High Speed Control
C1	6	DK GRN	Cooling Fan Low Speed Control
C1	7	BLK	Camshaft Position Sensor Signal
C1	8	PPL/WHT	Crankshaft Position 3x Sensor Reference Signal
C1	9	LT BLU/BLK	Crankshaft Position 18x Sensor Signal
C1	10 & 11		Not Used
C1	12	BLK	Engine Coolant Temperature Sensor Ground
C1	13	ORN/BLK	Manifold Absolute Pressure Sensor

				Ground
C1	14			Not Used
C1	15	TAN		(2) Serial Data (UART)
C1	16	BLK/WHT		Powertrain Control Module Ground
C1	17	BLK		Intake Air Temperature Sensor Ground
C1	18			Not Used
C1	19	PNK		Powertrain Control Module Ignition Voltage
C1	20	ORG		Powertrain Control Module Battery Voltage
C1	21			Not Used
C1	22	PNK		Transmission Fluid Pressure Switch A Input
C1	23-27			Not Used
C1	28	TAN/WHT		Heated Oxygen Sensor No. 2 Signal Low
C1	29	TAN		Heated Oxygen Sensor No. 1 Signal Low
C1	30	PPL		Torque Converter Clutch Brake Switch Input
C1	31	BLK		EGR Pintle Position Sensor Ground
C1	32	GRY		EGR Valve Ground
C1	33	DK BLU		Bank No. 1 Knock Sensor Signal
C1	34	LT BLU		Bank No. 2 Knock Sensor Signal
C1	35-37			Not Used
C1	38	LT GRN/WHT		Idle Air Control Valve B High
C1	39-42			Not Used
C1	43	YEL/BLK		Fuel Injector No. 6 Control
C1	44	YEL/BLK		2-3 Shift Solenoid Control
C1	45			Not Used
C1	46	LT BLU/BLK		Fuel Injector No. 4 Control
C1	47	BLK/WHT		Fuel Injector No. 5 Control
C1	48	RED/BLK		Crankshaft Position 3X Sensor Reference Low
C1	49-52			Not Used
C1	53	TAN/BLK		Bypass Valve Control
C1	54	WHT		Ignition Control
C1	55	DK GRN/WHT		Vehicle Speed Sensor Signal Output
C1	56	BLK/WHT		Powertrain Control Module Ground
C1	57	BLK/WHT		Powertrain Control Module Ground
C1	58	PPL		Serial Data (Class II)
C1	59	PPL		(2) Serial Data (Class II)
C1	60	BLK/WHT		Powertrain Control Module Ground
C1	61	BLK		Throttle Position Sensor Ground
C1	62	DK BLU/WHT		Input Shaft Speed Sensor Low

C1	63	RED/BLK	Input Shaft Speed Sensor High
C1	64	YEL	Vehicle Speed Sensor High
C1	65	PPL	Vehicle Speed Sensor Low
C1	66 & 67		Not Used
C1	68	YEL	Transmission Range B Signal
C1	69	YEL	Mass Airflow Sensor Signal
C1	70	DK BLU	(2) Theft Deterrent Fuel Enable
C1	71	ORN/BLK	(2) Traction Control Desired Torque Input
C1	72	DK GRN	Cruise Control Disable Signal
C1	73	LT GRN/BLK	Fuel Injector No. 2 Control
C1	74 & 75		Not Used
C1	76	DK GRN/WHT	EVAP Canister Purge Valve Control
C1	77 & 78		Not Used
C1	79	BLK	Fuel Injector No. 1 Control
C1	80		Not Used
C2	1		Not Used
C2	2	WHT	EVAP Canister Vent Valve Control
C2	3	DK GRN/WHT	Fuel Pump Relay Control
C2	4	WHT	EGR Valve Control
C2	5	BRN/WHT	Malfunction Indicator Light Control
C2	6	BRN/WHT	(2) Low Oil Level Light Control
C2	7	LT BLU/WHT	Idle Air Control Valve A High
C2	8		Not Used
C2	9	TAN/BLK	(2) Traction Control Delivered Torque Control (VIN 1)
C2	10	PPL	Heated Oxygen Sensor No. 1 Signal
C2	11	PPL/WHT	Heated Oxygen Sensor No. 2 Signal
C2	12-15		Not Used
C2	16	WHT	Transmission Range Switch P Signal
C2	17	RED	Transmission Fluid Pressure Switch C
C2	18	BLK/WHT	Transmission Range Sensor D Signal
C2	19	TAN/BLK	(3) Engine Oil Pressure Sensor Signal
C2	20 & 21		Not Used
C2	22	DK GRN/WHT	A/C Request Signal
C2	23	PPL	Powertrain Control Module Ignition Voltage
C2	24	PNK	Powertrain Control Module Ignition Voltage (Crank Only)
C2	25	LT GRN	Manifold Absolute

				Pressure Sensor Signal
C2	26	YEL		Engine Coolant Temperature Sensor Signal
C2	27	RED/BLK		A/C Pressure Sensor Signal
C2	28	BRN		EGR Pintle Position Signal
C2	29	GRY		(2) Generator Terminal "F" Monitor
C2	30-32			Not Used
C2	33	GRY		Throttle Position Sensor Reference Voltage
C2	34	GRY		A/C Pressure Sensor Reference Voltage
C2	35	BLK		Fuel Tank Pressure Sensor Ground
C2	36-38			Not Used
C2	39	DK GRN/WHT		A/C Clutch Relay Control
C2	40 & 41			Not Used
C2	42	PNK/BLK		Fuel Injector No. 3 Control
C2	43			Not Used
C2	44	LT BLU/BLK		Idle Air Control Valve A Low
C2	45	RED/BLK		Pressure Control Solenoid High
C2	46	LT BLU/WHT		Pressure Control Solenoid Low
C2	47 & 48			Not Used
C2	49	LT GRN/BLK		Idle Air Control Valve B High
C2	50	TAN		Intake Air Temperature Sensor
C2	51-54			Not Used
C2	55	DK GRN		Fuel Tank Pressure Sensor Signal
C2	56	GRY		Transmission Range Sensor C
C2	57	DK BLU		Transmission Fluid Pressure Switch B
C2	58	BRN		Engine Oil Level Sensor Signal
C2	59	WHT		Cruise Control Status
C2	60			Not Used
C2	61	RED		Generator Terminal L Control
C2	62			Not Used
C2	63	YEL		Torque Converter Clutch Release Switch Input
C2	64 & 65			Not Used
C2	66	DK BLU		Throttle Position Sensor Signal
C2	67			Not Used
C2	68	YEL/BLK		Transmission Fluid Temperature Sensor
C2	69	PPL		Fuel Level Input
C2	70-75			Not Used
C2	76	YEL/BLK		Starter Enable Relay Control
C2	77	GRY		Boost Control

				Solenoid Control (VIN 1 Only)
C2	78	BRN		Torque Converter Clutch PWM Solenoid Control
C2	79 & 80			Not Used

(1) - See Fig. 1.
(2) - Not used on Bonneville, Eighty Eight, Le Sabre and Regency.

DIAGNOSTIC TROUBLE CODES

TROUBLE CODE DEFINITION TABLE

Code No.	Circuit Affected
P0101	MAF System Performance
P0102	MAF Sensor Circuit-Low Frequency
P0103	MAF Sensor Circuit-High Frequency
P0107	MAP Sensor Circuit-Low Voltage
P0108	MAP Sensor Circuit-High Voltage
P0112	IAT Sensor Circuit-Low Voltage
P0113	IAT Sensor Signal Voltage High
P0117	ECT Sensor Circuit Low Voltage
P0118	ECT Sensor Signal High Voltage
P0121	TP Sensor System Performance
P0122	TP Sensor Circuit-Low Voltage
P0123	TP Sensor Circuit-High Voltage
P0125	ECT Excessive Time To Closed Loop
P0131	HO2S Circuit Low Voltage-Sensor 1
P0132	HO2S Circuit High Voltage-Sensor 1
P0133	HO2S Slow Response-Sensor 1
P0134	HO2S Insufficient Activity-Sensor 1
P0135	HO2S Heater Circuit-Sensor 1
P0137	HO2S Circuit Voltage Low-Sensor 2
P0138	HO2S Circuit Voltage High-Sensor 2
P0140	HO2S Insufficient Activity-Sensor 2
P0141	HO2S Heater Circuit-Sensor 2
P0171	Fuel Trim System Lean
P0172	Fuel Trim System Rich
P0201	Injector No. 1 Control Circuit
P0202	Injector No. 2 Control Circuit
P0203	Injector No. 3 Control Circuit
P0204	Injector No. 4 Control Circuit
P0205	Injector No. 5 Control Circuit
P0206	Injector No. 6 Control Circuit
P0230	Fuel Pump Control Circuit
P0300	Engine Misfire Detected
P0325	Knock Sensor Module Circuit
P0327	Knock Sensor Circuit-Bank 1
P0332	Knock Sensor Circuit-Bank 2
P0336	18X Reference Signal Circuit
P0341	CMP Sensor Circuit Performance
P0403	EGR Solenoid Control Circuit
P0404	EGR Valve Pintle Stuck Open
P0405	EGR Pintle Position Sensor Circ. Low Voltage
P0420	TWC System Low Efficiency
P0440	EVAP System
P0442	EVAP System-Small Leak Detected
P0446	EVAP System Canister Vent Blocked
P0452	Tank Pressure Sensor Circuit Fault-Low Voltage

P0453 .... Tank Pressure Sensor Circuit Fault-High Voltage
P0506 ..... IAC System RPM Low
P0507 ..... IAC System RPM High
P0530 ..... A/C Refrigerant Pressure Sensor Circuit
P0560 ..... System Voltage
P0601 ..... PCM Memory
P0602 ..... PCM Not Programmed
P0705 (1) ..... Trans. Range Switch Circuit
P0706 (1) ..... Trans. Range Switch Performance
P1106 ..... MAP Sensor Circuit Intermittent High Voltage
P1107 ..... MAP Sensor Circuit Intermittent Low Voltage
P1111 ..... IAT Sensor Circuit Intermittent High Voltage
P1112 ..... IAT Sensor Circuit Intermittent Low Voltage
P1114 ..... ECT Sensor Circuit Intermittent Low Voltage
P1115 ..... ECT Sensor Circuit Intermittent High Voltage
P1121 ..... TP Sensor Intermittently High Voltage
P1133 ..... HO2S Insufficient Switching-Sensor 1
P1134 ..... HO2S Transition Time Ratio-Sensor 1
P1257 ..... Supercharger System Overboost
P1351 ..... IC Circuit Open
P1352 ..... By-Pass Line/Circuit Open
P1361 ..... IC Circuit Not Toggling
P1362 ..... By-Pass Circuit Shorted
P1374 ..... 3X Reference Circuit
P1380 ..... EBCM/EBTCM DTC Rough Road Data Unstable
P1381 ..... Misfire Detected, No EBCM/PCM/VCM Serial Data
P1404 ..... EGR Valve Pintle Stuck Open
P1441 ..... EVAP System Flow During Non-Purge
P1554 ..... Cruise Control Status Circuit
P1571 ..... TCS Desired Torque Circuit
P1573 ..... EBTCM/PCM Serial Data Circuit
P1619 ..... Engine Oil Life Monitor Reset Circuit
P1626 ..... Loss Of Serial Communication W/Theft
Deterrent Or Theft Deterrent System
Fuel Enable Circuit
P1629 ..... Theft Deterrent Crank Signal Malfunction
P1635 ..... 5-Volt Reference "A" Circuit
P1639 ..... 5-Volt Reference "B" Circuit
P1641 ..... A/C Relay Control Circuit
P1646 ..... Boost Control Solenoid Control Circuit
P1651 ..... Fan No. 1 Relay Control Circuit
P1652 ..... Fan No. 2 Relay Control Circuit
P1662 ..... Cruise Control Inhibit Control Circuit
P1665 ..... EVAP Vent Solenoid Control Circuit
P1667 ..... Fuel Pump PWM Control Circuit
P1671 ..... MIL Control Circuit
P1673 ..... Engine Hot Light Control Circuit
P1676 ..... EVAP Vent Solenoid Control Circuit

(1) - Covered in entirety in
AUTO TRANS DIAGNOSIS - 4T65-E article
in the AUTO TRANS DIAGNOSIS section.

ENGINE SENSORS & SWITCHES

NOTE: For additional sensor testing specifications, see
K - SENSOR RANGE CHARTS article.

Manufacturer does not provide many individual system and component testing. For sensor and switch testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in

G - TESTS W/CODES article.

CAUTION: DO NOT remove pressure cap from surge tank while engine is at normal operating temperature.

Engine Oil Level Sensor Diagnosis

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Using scan tool, observe engine oil level display. If scan tool does not display OK, go to next step. If scan tool displays OK, check for poor connections at sensor and PCM. If poor connection exists, repair as necessary. If poor connection does not exist, perform warning light diagnosis. See PCM CONTROLLED WARNING LIGHTS under MISCELLANEOUS CONTROLS.

3) Turn ignition switch to LOCK position. Disconnect PCM harness connectors. Using a test light connected to battery voltage, probe engine oil level sensor signal circuit (Brown wire) at PCM harness connector. If test light does not illuminate, go to next step. If test light illuminates, go to step 7).

4) Ensure ignition switch is in LOCK position. Connect PCM harness connectors. Turn ignition switch to RUN position. Raise and support vehicle. Disconnect engine oil level sensor harness connector. Measure voltage between engine oil level sensor harness connector terminals. If battery voltage does not exist, go to next step. If battery voltage exists, go to step 8).

5) Measure voltage at engine oil level signal circuit (Brown wire) at engine oil level sensor harness connector. If battery voltage exists, go to next step. If battery voltage does not exist, go to step 9).

6) Check engine oil level sensor signal circuit (Brown wire) for open, between PCM and engine oil level sensor harness connectors. If open exists, repair as necessary and go to step 12). If open does not exist, check for poor connections at sensor and PCM. If poor connection exists, repair as necessary. If poor connection does not exist, perform warning light diagnosis. See PCM CONTROLLED WARNING LIGHTS under MISCELLANEOUS CONTROLS.

7) Check for poor connections at PCM. If poor connection exists, repair as necessary and go to step 12). If poor connection does not exist, go to step 11).

8) Check for poor connections at engine oil level sensor. If poor connection exists, repair as necessary and go to step 12). If poor connection does not exist, go to step 10).

9) Locate and repair open in engine oil level sensor ground circuit (Black/White wire). After repair are complete, go to step 12).

10) Replace engine oil level sensor and go to step 12).

11) Replace PCM and go to next step.

12) Start engine and allow to warm to normal operating temperature. Turn ignition switch to LOCK position. Allow engine to cool for 15 minutes. Turn ignition switch to RUN position. Using scan tool, observe oil level display. If scan tool does not display OK, go to step 3). If scan tool displays OK, system is okay at this time.

Engine Oil Pressure Sensor Diagnosis

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Retrieve DTCs. If no DTCs exist, go to next step. If any DTCs exist, perform appropriate DTC(s) test. See G - TESTS W/CODES article.

3) Turn ignition switch to RUN position. If engine oil

pressure light illuminates, go to next step. If engine oil pressure light does not illuminate, go to step 16).

4) Check engine oil level. If oil level is okay, go to next step. If oil level is not okay, go to step 11).

5) Using a manual oil pressure gauge, check engine oil pressure. If engine oil pressure is correct, go to next step. If engine oil pressure is not correct, go to step 12).

6) Turn ignition switch to LOCK position. Disconnect engine oil pressure sensor harness connector. Turn ignition switch to RUN position. Using a test light connected to ground, probe engine oil pressure sensor input circuit (Tan/Black wire) at engine oil pressure sensor harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 9).

7) Using a test light connected to battery voltage, probe engine oil pressure sensor ground circuit (Black/White wire) at engine oil pressure sensor harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 10).

8) Check for poor connection at engine oil pressure sensor. If poor connection does not exist, go to step 13). If poor connection exists, repair as necessary and go to step 16).

9) Check for open or short to ground in engine oil pressure sensor input circuit (Tan/Black wire) between PCM and engine oil pressure sensor harness connectors. Also check for poor connection at PCM. If problem does not exist, go to step 15). If problem exists, repair as necessary and go to step 16).

10) Locate and repair open in engine oil pressure sensor ground circuit (Black/White wire) and go to step 16).

11) Determine cause of low oil level and repair as necessary. After repairs are complete, go to step 16).

12) Determine cause of low engine oil pressure and repair as necessary. After repairs are complete, go to step 16).

13) Check communication circuit for proper operation. If problem does not exist, go to next step. If problem exists, repair as necessary and go to step 16).

14) Replace engine oil pressure sensor and go to step 16).

15) Replace PCM and go to next step.

16) Check for proper operation of engine oil pressure light. If light operation is okay, system is okay at this time. If light operation is not okay, go to step 2).

Fuel Level Sensor Diagnosis

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Retrieve instrument panel-related DTCs. If no instrument panel DTCs exist, go to next step. If any instrument panel DTCs exist, perform appropriate DTC test. See G - TESTS W/CODES article.

3) Connect scan tool to data link connector. Turn ignition switch to RUN position. Using scan tool output control function, perform FUEL GAUGE SWEEP TEST. If fuel gauge sweeps through full range, go to next step. If fuel gauge does not sweep through full range, repair fuel gauge. See INSTRUMENT PANEL article in ACCESSORIES/SAFETY EQUIPMENT section.

4) Turn ignition switch to LOCK position. Raise and support vehicle. Disconnect fuel tank harness connector. Connect voltmeter between fuel level sensor input circuit (Purple wire) and fuel level sensor ground circuit (Black/White wire) at fuel level sensor harness connector. Turn ignition switch to RUN position. If voltage does not exist, go to next step. If voltage exists, go to step 6).

5) Check fuel level sensor input and ground circuit for open between fuel level sensor and PCM. If open does not exist, go to step 10). If open exists, repair as necessary and go to step 13).

6) If greater than 5 volts existed in step 4), go to step 11). If 5 volts or less existed in step 4), go to next step.

7) Measure voltage between fuel level sensor input circuit (Purple wire) and ground. If approximately 5 volts exists, go to next step. If approximately 5 volts does not exist, go to step 9).

8) Locate and repair open in fuel level sensor ground circuit (Black/White wire). After repairs are complete, go to step 13).

9) Check fuel level sensor input circuit (Purple wire) for open or short to ground. If problem does not exist, go to step 11). If problem exists, repair as necessary and go to step 13).

10) Replace fuel level sensor and go to step 13).

11) Locate and repair short to voltage in fuel level sensor input circuit (Purple wire). After repairs are complete, go to step 13).

12) Replace PCM and go to next step.

13) Recheck system for proper operation. If system is not operating properly, go to step 2).

MOTORS, RELAYS & SOLENOIDS

Manufacturer does not provide many individual system and component testing. For motor, relay and solenoid testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES under COMPUTERIZED ENGINE CONTROLS. See G - TESTS W/CODES article.

MOTORS

Idle Air Control (IAC) Motor
See IDLE CONTROL SYSTEM.

RELAYS

A/C Clutch Relay
See A/C-HEATER SYSTEM - MANUAL or A/C-HEATER SYSTEMS - AUTOMATIC article in AIR CONDITIONING & HEAT section.

Fuel Pump Relay
See F - BASIC TESTING article.

SOLENOIDS

All PCM-controlled solenoids should have at least 20 ohms of resistance when checked with positive ohmmeter lead connected to power supply terminal of solenoid and negative ohmmeter lead connected to ground terminal of solenoid. Some solenoids are equipped with internal diodes. On these solenoids, resistance values will differ if ohmmeter test leads are reversed.

FUEL SYSTEM

NOTE: For fuel system pressure testing, see F - BASIC TESTING article.

Manufacturer does not provide many individual system and component testing. For fuel system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in G - TESTS W/CODES article.

NOTE: Retrieve DTCs and perform appropriate DTC test before performing FUEL INJECTOR CIRCUIT DIAGNOSIS. See

G - TESTS W/CODES article. Also ensure all mechanical and ignition coil/module circuit malfunctions are repairs before performing FUEL INJECTOR CIRCUIT DIAGNOSIS.

Fuel Injector Balance Test

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) If fuel injector coil test has been performed, go to next step. If fuel injector coil test has not been performed, perform fuel injector coil test. See INJECTOR COIL TEST - ECT BETWEEN 50-95°F.

3) If engine coolant temperature is below 201°F (94°C), go to step 5). If engine coolant temperature is above 201°F (94°C), go to next step.

4) Allow engine to cool until coolant temperature is below 210°F (94°C), then go to next step.

5) Install fuel pressure gauge. Turn ignition switch to RUN position then to LOCK position. Bleed air from fuel pressure gauge. Using scan tool, energize fuel pump. If fuel pressure reading is 48-55 psi (3.4-3.9 kg/cm^2), go to next step. If fuel pressure reading is not within specification, perform fuel system diagnosis. See F - BASIC TESTING article.

6) Turn fuel pump off. Observe fuel pressure gauge. If fuel pressure remains constant, go to next step. If fuel system does not remain constant, perform fuel system diagnosis. See F - BASIC TESTING article.

NOTE: Perform step 7) on each injector.

7) Disconnect fuel injectors harness connector. Using appropriate fuel injector adapter, connect Fuel Injector Tester (J-39021) to fuel injector. Connect fuel injector tester power leads to appropriate battery terminals. Set amperage supply selector switch on fuel injector tester to Balance Test 2.5-amp position. Turn ignition switch to RUN position then to LOCK position. Record fuel pressure reading (first reading). Energize injector by depressing PUSH TO START TEST button on injector tester and hold until fuel pressure gauge stabilizes. Record fuel pressure reading (second reading). Subtract first reading from second reading (this result is pressure drop value). Add pressure drop value for each injector together and divide total by total number of injectors. If any injector's drop value is greater or less than average drop value by 1.5 psi, replace faulty injector(s) as necessary. If no injector's drop value is greater or less than average drop value by 1.5 psi, injector balance test is okay at this time.

WARNING: In order to prevent flooding of cylinder and possible engine damage, relieve fuel pressure before performing injector coil test procedure.

Injector Coil Test ECT Between 50-95°F

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Connect scan tool to data link connector. Using scan tool, check engine coolant temperature. If 50-95°F (10-35°C) is displayed, go to next step. If 50-95°F (10-35°C) is not displayed, perform INJECTOR COIL TEST - ECT NOT BETWEEN 50-95°F test.

NOTE: Perform step 3) on each injector.

3) Turn ignition switch to LOCK position. Relieve fuel pressure. Disconnect fuel injector harness connectors. Using appropriate fuel injector adapter, connect Fuel Injector Tester (J-39021) to fuel injector. Connect fuel injector tester power leads to appropriate battery terminals. Set amperage supply selector switch on fuel injector tester to Coil Test 0.5-amp position. connect DVOM to injector tester. Depress PUSH TO START TEST button. Record lowest voltage reading within first second of test. If any injector has erratic voltage reading or reading not 5.7-6.6 volts, go to next step. If no injector has erratic voltage reading or reading not 5.7-6.6 volts, perform injector balance test. See FUEL INJECTOR BALANCE TEST.

4) Replace faulty injector(s) and perform injector balance test. See FUEL INJECTOR BALANCE TEST.

WARNING: In order to prevent flooding of cylinder and possible engine damage, relieve fuel pressure before performing injector coil test procedure.

Injector Coil Test ECT Not Between 50-95°F

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Connect scan tool to data link connector. Using scan tool, check engine coolant temperature. If 50-95°F (10-35°C) is not displayed, go to next step. If 50-95°F (10-35°C) is displayed, perform INJECTOR COIL TEST - ECT BETWEEN 50-95°F test.

NOTE: Perform step 3) on each injector.

3) Turn ignition switch to LOCK position. Relieve fuel pressure. Disconnect fuel injector harness connectors. Using fuel injector adapter, connect Fuel Injector Tester (J-39021) to fuel injector. Connect fuel injector tester power leads to appropriate battery terminals. Set amperage supply selector switch on fuel injector tester to Coil Test 0.5-amp position. Connect DVOM to injector tester. Depress PUSH TO START TEST button. Record highest voltage reading other than those greater than 9.5 volts. Subtract any other voltage reading observed from highest voltage reading. If difference is greater than 0.6 volt, go to next step. If difference is not greater than 0.6 volt, perform injector balance test. See FUEL INJECTOR BALANCE TEST.

4) Replace any injector(s) that had any of the following results: initial reading greater than 9.5 volts, erratic reading or difference is greater than 0.6 volt. After repairs are complete, perform injector balance test. See FUEL INJECTOR BALANCE TEST.

IDLE CONTROL SYSTEM

Idle Air Control (IAC) System Diagnosis

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Connect scan tool to data link connector. Start engine. Turn all accessories off. Using scan tool, command idle up to 1500 RPM, then down to 650 RPM and then back up to 1500 RPM. If engine speed responded as commanded within 50 RPM, system is okay at this time. If engine speed did not respond as commanded within 50 RPM, go to next step.

3) Turn ignition switch to LOCK position. Connect IAC Driver (J-37027-A) to IAC valve. Set parking brake and block wheels. Start

engine and let idle. Using scan tool, command idle up to 1500 RPM, then down to 650 RPM and then back up to 1500 RPM, while observing noid lights on IAC driver. If noid lights do not cycle Red and Green or turn off, go to next step. If noid lights cycle Red and Green but never off, go to step 5).

4) Check IAC circuit between IAC valve and PCM for open. If open does not exist, go to step 10). If open exists, repair as necessary and go to step 12).

5) If low idle or rich condition exists, go to next step. If low idle or rich condition does not exist, go to step 7).

6) Check for the following conditions: throttle body damage, restricted intake system, collapsed air intake duct, clogged IAC passages in throttle body and intake leaks. If problem does not exist, go to step 8). If problem exists, repair as necessary and go to step 12).

7) Check for the following conditions: vacuum leaks, damaged throttle body, throttle linkage binding, misadjusted throttle cable, misadjusted cruise control cable and faulty PCV system. If problem exists, repair as necessary and go to step 12). If problem does not exist, go to next step.

8) Check for poor connection at IAC valve. If problem exists, repair as necessary and go to step 12). If problem does not exist, go to next step.

9) Replace IAC valve and go to step 12).

10) Check for poor connection at PCM. If problem does not exist, go to next step. If problem exists, repair as necessary and go to step 12).

11) Replace PCM and go to next step.

12) Clear all DTCs. Start engine. Ensure all accessories are off. Using scan tool, command idle up to 1500 RPM, then down to 650 RPM and then back up to 1500 RPM. If engine speed responded as commanded within 50 RPM, system is okay at this time. If engine speed did not respond as commanded within 50 RPM, go to step 3).

IGNITION SYSTEM

NOTE: For basic ignition system checks, see F - BASIC TESTING article.

For ignition system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in G - TESTS W/CODES article.

EMISSION SYSTEMS & SUB-SYSTEMS

NOTE: For emission and sub-system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in G - TESTS W/CODES article.

EVAP CONTROL SYSTEM DIAGNOSIS

NOTE: Ensure all vacuum line and EVAP system components are not damaged or missing before proceeding with this test.

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Turn ignition switch to LOCK position. Remove fuel filler cap. Connect scan tool to data link connector. Turn ignition switch to RUN position. Observe fuel tank pressure on scan tool. If fuel tank

pressure is zero in. H2O, go to next step. If fuel tank pressure is not zero in. H2O, perform DTC P0453 test. See G - TESTS W/CODES article.

3) Replace fuel filler cap. Using scan tool, command EVAP canister vent valve on. Connect EVAP Pressure/Purge Diagnostic Station (J-41413) to EVAP service port. Apply 5 in. H2O pressure to EVAP system while observing fuel tank pressure on scan tool. If fuel tank pressure is 5 in. H2O, go to next step. If fuel tank pressure is not 5 in. H2O, perform DTC P0452 test. See G - TESTS W/CODES article.

4) Monitor EVAP pressure gauge on diagnostic station while commanding EVAP canister vent valve off. If EVAP pressure decreases to zero in. H2O within 5 seconds, go to next step. If EVAP pressure does not decrease to zero in. H2O within 5 seconds, perform DTC P0446 test. See G - TESTS W/CODES article.

5) Start engine. Remove fuel filler cap. Using scan tool output test function, select SEAL SYSTEM and activate. Install fuel filler cap. Switch rotary switch on diagnostic station to PURGE. Run engine at idle while monitoring vacuum gauge on diagnostic station. If vacuum does not increase to greater than zero in. H2O, go to next step. If vacuum increases to greater than zero in. H2O, perform DTC P1441 test. See G - TESTS W/CODES article.

6) Using scan tool output test function, select SYSTEM PERF and activate. Switch rotary switch on diagnostic station to PURGE. Run engine at 2500 RPM for at least 10 seconds while monitoring vacuum gauge on diagnostic station. If vacuum increases to greater than -5 in. H2O, system is okay at this time. If vacuum does not increase to greater than -5 in. H2O, perform DTC P0440 test. See G - TESTS W/CODES article.

AIR INJECTION

AIR Pump (Belt-Driven)

Accelerate engine to approximately 1500 RPM and observe airflow from hoses. If airflow increases as engine is accelerated, pump is working properly. If airflow does not increase, check hoses, pump belt tension, leaky valves or defective air injection pump.

Check Valve

Detach check valve and blow through valve in direction of check valve flow (to cylinder head). Attempt to suck air back. Replace valve if airflow is allowed against the direction of flow.

EXHAUST GAS RECIRCULATION

WARNING: Use protective gloves, or allow exhaust system to cool, before work on exhaust system components.

Manufacturer does not provide many individual system and component testing. For EGR system testing not listed, perform related DTC testing procedure. See DIAGNOSTIC TROUBLE CODES in G - TESTS W/CODES article.

Exhaust System Check

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Remove heated oxygen sensor. Install exhaust backpressure tester in place of oxygen sensor. Start engine and let idle. If pressure reading is not 1.25 psi or greater, go to next step. If pressure reading is 1.25 psi or greater, go to step 4).

3) Increase engine speed to 2000 RPM. If pressure reading is greater than 3 psi, go to next step. If pressure reading is not

greater than 3 psi, go to step 6).

4) Check exhaust system for crushed pipe, internal muffler damage or heat distress. If problem does not exist, go to next step. If problem exists, repair as necessary and go to step 6).

5) Replace catalytic converter and go to next step.

6) Operate vehicle within conditions under which original symptom was noted. If system operate properly, system is okay at this time. If system does not operate properly, go to step 2).

FUEL EVAPORATION CONTROL

Fuel Tank Pressure Sensor Diagnosis

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Disconnect fuel tank pressure sensor harness connector. Measure voltage at reference voltage circuit (Gray wire) at fuel tank pressure sensor harness connector. If about 5 volts does not exist, go to next step. If about 5 volts exists, go to step 5).

3) Check for poor connection at PCM. If poor connection does not exist, go to next step. If poor connection exists, go to step 12).

4) Check fuel tank pressure sensor reference voltage circuit (Gray wire) for open between PCM and fuel tank pressure sensor harness connector. If open does not exist, go to step 8). If open exists, go to step 12).

5) Remove fuel filler cap. Using 2 fused jumper wires, connect reference voltage and signal circuits between fuel tank sensor and fuel tank pressure sensor harness connector. Measure voltage at ground terminal at fuel tank pressure sensor. If 1.3-1.7 volts exists, go to next step. If 1.3-1.7 volts does not exist, go to step 13).

6) Check fuel tank pressure sensor signal circuit (Dark Green wire) for poor connection at PCM. If poor connection does not exist, go to next step. If poor connection exists, go to step 11).

7) Check fuel tank pressure sensor signal circuit (Dark Green wire) for open and short between PCM and fuel tank pressure harness connectors. If open or short exists, go to step 12). If open or short does not exist, go to step 14).

8) Check fuel tank pressure sensor ground circuit (Black wire) for poor connection at PCM. If poor connection does not exist, go to next step. If poor connection exists, go to step 11).

9) Check fuel tank pressure sensor ground circuit (Black wire) for open between PCM and fuel tank pressure harness connectors. If open exists, go to step 12). If open does not exist, go to step 14).

10) Check for poor connection at fuel tank pressure sensor. If poor connection exists, go to next step. If poor connection does not exist, go to step 13).

11) Repair poor connections as necessary and go to step 15).

12) Repair open or short as necessary and go to step 15).

13) Replace fuel tank pressure sensor and go to step 15).

14) Replace PCM and go to next step.

15) Turn ignition switch to LOCK position. Remove gas cap. Connect scan tool to data link connector. Turn ignition switch to RUN position. Observe fuel tank pressure on scan tool. If zero in. H2O is displayed, go to next step. If zero in. H2O is not displayed, go to step 2).

16) Replace gas cap. Connect EVAP Pressure/Purge Diagnostic Station (J-41413) to EVAP service port. Using scan tool, command EVAP canister vent valve on. Using diagnostic station, pressurize EVAP system to 5 in. H2O. Observe fuel tank pressure on scan tool. If 5 in. H2O is displayed, system is okay at this time. If 5 in. H2O is not displayed, go to step 2).

POSITIVE CRANKCASE VENTILATION (PCV)

Required Service

The PCV system may require service for obstructions if any of the following conditions exist:

* Rough idle.
* Stalling or slow idle speed.
* Oil leaks.
* Oil in air cleaner.
* Sludge in engine.

A leaking PCV valve or hose could cause:

* Rough idle.
* Stalling.
* High idle speed.

If engine idles rough, check for clogged PCV valve or plugged or broken hoses BEFORE adjusting idle. Check PCV valve application to ensure correct valve is fitted. Replace PCV valve if required.

Checking PCV Valve Function

1) Remove PCV valve from rocker cover. Run engine at idle. Place thumb over open end of valve to check for vacuum. If there is no vacuum at valve, check for obstruction in manifold port, hoses or PCV valve. Repair or replace as necessary.

2) Turn engine off. Remove PCV valve. Shake valve and listen for rattle of check valve inside. If a clear rattle is not heard, replace PCV valve.

3) Visually inspect valve for varnish or deposits which may make PCV valve operation sticky or restricted, or cause incomplete seating of valve. Replace if necessary.

4) An engine must be sealed for PCV system to function as designed. If leakage, sludging or dilution of oil is noted and PCV system is functioning properly, check engine for cause and repair as required to ensure PCV system will continue to function properly.

5) An engine operating without any crankcase ventilation can be damaged, so it is important to replace PCV valve and air cleaner breather (if equipped) at regular intervals (at least every 30,000 miles). Check all hoses and clamps for failure or deterioration.

MISCELLANEOUS CONTROLS

NOTE: Although some of the controlled devices listed here are not technically engine performance components, they can affect driveability if they malfunction.

TRANSMISSION

NOTE: Computerized transmission controls are also covered in greater detail in TRANSMISSION SERVICING - A/T article in AUTOMATIC TRANS SERVICE section manual for domestic vehicles. For component circuit identification, see wiring diagram in L - WIRING DIAGRAMS article.

Converter Clutch Solenoid

Disconnect harness connector to Torque Converter Clutch (TCC) solenoid. Measure resistance between appropriate TCC solenoid terminals. Solenoid resistance should be greater than 20 ohms.

NOTE: Some solenoids may have an internal pressure switch in series with the solenoid winding and will not show continuity until that pressure switch is applied by transmission hydraulic pressure.

Converter Lock-Up Signal At Transmission

1) Warm engine to operating temperature. Raise vehicle and support drive wheels. Support suspension where necessary to prevent damage to drive axles.

2) Disconnect converter clutch connector at transmission. Connect a test light across appropriate converter clutch harness terminals. Start engine and place transmission in Drive. Accelerate vehicle to 45 MPH and note test light.

3) If test light is off, check solenoid power supply wire of harness for open or short to ground. Check ground circuit for open between harness connector and PCM. If harness is okay, see CONVERTER LOCK-UP SIGNAL FROM PCM.

Converter Lock-Up Signal From PCM

1) Warm engine to operating temperature. Raise vehicle and support drive wheels. Support suspension where necessary to prevent damage to drive axles.

2) Connect a test light to battery voltage. Touch TCC control driver terminal with test light. Accelerate vehicle to 45 MPH and note test light. If test light does not illuminate, problem is a faulty PCM connector or PCM.

PCM CONTROLLED TACHOMETER

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Check instrument cluster. See INSTRUMENT PANEL article in ACCESSORIES/SAFETY EQUIPMENT in section. If instrument panel is okay, go to next step.

3) Turn ignition switch to LOCK position. Disconnect PCM connector. Turn ignition switch to RUN position. Measure voltage between ground tachometer control circuit (White wire) at PCM harness connector. If battery voltage exists, go to next step. If battery voltage does not exist, go to step 7).

4) Set DVOM to 10-amp scale. Check current between ground and tachometer control circuit (White wire) at PCM harness connector. Monitor reading for about 2 minutes. DVOM should read less than .05 amps. If reading is as specified, go to step 12). If reading is not as specified, go to next step.

5) Turn ignition switch to LOCK position. Disconnect instrument cluster harness connectors, but leave PCM connector disconnected. Measure voltage between ground and tachometer control circuit (White wire) at PCM harness connector. If zero volts exists, go to step 17). If voltage exists, go to next step.

6) Locate and repair short to voltage in tachometer control circuit between instrument panel and PCM harness connectors. After repairs are complete, go to step 19).

7) Check ignition feed fuse for instrument panel cluster. If fuse is blown, go to next step. If fuse is okay, go to step 9).

8) Locate and repair short to ground in ignition feed circuit for instrument panel cluster. After repairs are complete. replace fuse and go to step 19).

9) Disconnect instrument cluster connectors. Turn ignition switch to RUN position. Measure voltage between ground and ignition feed circuit (Pink wire) at instrument cluster harness connector. If battery voltage exists, go to next step. If battery voltage does not

exist, go to step 16).
10) Check tachometer control circuit (White wire) for open or short to ground, between instrument cluster and PCM harness connectors. If open or short exists, repair as necessary and go to step 19). If open or short does not exist, go to next step.
11) Check tachometer and ignition feed circuits for poor connection at instrument panel cluster and PCM. If problem exists, repair as necessary and go to step 19). If problem does not exist, go to step 17).
12) Turn ignition switch to LOCK position. Connect PCM harness connectors. Disconnect instrument cluster connectors. Turn ignition switch to RUN position. Connect a test light between tachometer control circuit and ignition feed circuit at instrument panel harness connector. Start engine. If test light flashes, check for shorted component or circuit in the output driver circuit. Check for faulty instrument cluster. If test light does not flash, go to next step.
13) If test light illuminates constantly, go to next step. If test light does not illuminate, go to step 15).
14) Locate and repair the following circuit conditions:

* Short to ground in crankshaft position sensor feed circuit.
* Open in camshaft position sensor ground circuit.
* Poor connection at crankshaft position sensor.

After repairs are complete, go to step 19).

15) Check for poor connection at PCM. If problem does not exist, go to step 18). If problem exists, repair as necessary and go to step 19).
16) Locate and repair open in instrument cluster ignition feed circuit. After repairs are complete, go to step 19).
17) Repair or replace instrument cluster as necessary. After repairs, go to step 19).
18) Replace PCM and go to next step.
19) Start engine. Observe tachometer. If tachometer is operating properly, system is okay at this time. If tachometer is not operating properly, repair instrument cluster as necessary.

PCM CONTROLLED GENERATOR

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.
2) Turn ignition switch to RUN position. If charging light illuminates, go to next step. If charging light does not illuminate, go to step 4).
3) Start engine. If charging light does not go out, go to step 5). If charging light goes out, go to step 21).
4) Turn ignition switch to LOCK position. Disconnect generator harness connectors. Turn ignition switch to RUN position. If charging light illuminates, go to step 6). If charging light does not illuminate, go to step 7).
5) Turn ignition switch to LOCK position. Connect scan tool to data link connector. Turn ignition switch to RUN position. Ensure all accessories are off. Observe generator voltage on scan tool. If battery voltage is displayed, go to step 8). If less than battery voltage is displayed, go to step 9).
6) Using a test light connected to ground, probe charging light signal circuit at generator harness connector. If test light illuminates, go to step 10). If test light does not illuminate, go to step 11).
7) Replace or repair instrument cluster and/or charging light

bulb as necessary. After repairs are complete, go to step 21).

8) Using scan tool, check GEN F valve. If 5 percent is displayed, go to step 7). If 5 percent is not displayed, go to step 12).

9) Turn ignition switch to LOCK position. Disconnect generator harness connectors. Turn ignition switch to RUN position. Using a test light connected to battery voltage, probe charging light signal circuit at generator harness connector. If test light illuminates, go to step 13). If test light does not illuminate, go to step 14).

10) Locate and repair short to ground in charging light control signal circuit and go to step 21).

11) Replace generator and go to step 21).

12) Turn ignition switch to LOCK position. Disconnect generator harness connectors. Turn ignition switch to RUN position. Using a test light connected to battery voltage, probe generator field circuit at generator harness connector. If test light illuminates, go to step 15). If test light does not illuminate, go to step 16).

13) Locate and repair short to ground in field circuit and go to step 21).

14) Measure voltage at charging light signal circuit at generator harness connector. If 4.5 volts or greater exists, go to step 17). If 4.5 volts or greater does not exist, go to step 18).

15) Locate and repair short to ground in field circuit. After repairs are complete, go to step 21).

16) Locate and repair poor connection and/or open in field circuit. After repairs are complete, go to step 21).

17) Measure voltage at battery voltage supply circuit at generator harness connector. If battery voltage exist, go to step 11). If battery voltage does not exist, go to step 19).

18) Check for poor connection and/or open in battery voltage supply circuit. If poor connection and/or open does not exist, go to step 20). If poor connection and/or open exists, repair as necessary and go to step 21).

19) Locate and repair poor connection and/or open in battery voltage supply circuit. After repairs are complete, go to step 21).

20) Replace PCM and go to next step.

21) Operate vehicle under condition under which original symptom was noted. If system does not operate properly, go to step 2).

PCM CONTROLLED WARNING LIGHTS

Warning Light Diagnosis

1) If powertrain OBD system check has been performed, go to next step. If powertrain OBD system check has not been performed, perform powertrain OBD system check. See POWERTRAIN OBD SYSTEM CHECK in G - TESTS W/CODES article.

2) Check instrument cluster. See INSTRUMENT PANEL article in ACCESSORIES/SAFETY EQUIPMENT in section. If instrument panel is okay, go to next step.

3) Turn ignition switch to LOCK position. Disconnect PCM connector. Turn ignition switch to RUN position. Measure voltage between affected PCM output circuit at PCM harness connector and ground. See diagram in L - WIRING DIAGRAMS article. If battery voltage does not exist, go to step 7). If battery voltage exists, go to next step.

4) Set DVOM to 10-amp scale. Check current between affected PCM output circuit and ground. Monitor reading for about 2 minutes. DVOM should read .05-1.50 amps. If reading is as specified, go to step 12). If reading is not as specified, go to next step.

5) Turn ignition switch to LOCK position. Disconnect instrument cluster harness connectors, but leave PCM connector disconnected. Measure voltage between affected PCM output circuit and

ground. If zero volts exists, go to step 15). If voltage exists, go to next step.

6) Locate and repair short to voltage in affected PCM output circuit. After repairs are complete, go to step 17).

7) Check ignition feed fuse for instrument panel cluster indicator lights. If fuse is blown, go to next step. If fuse is okay, go to step 9),

8) Locate and repair short to ground in ignition feed circuit for instrument panel cluster indicator lights. Replace fuse and go to step 17).

9) Disconnect instrument cluster connectors. Turn ignition switch to RUN position. Measure voltage between ignition feed circuit for instrument panel cluster indicator lights and ground. If battery exists, go to next step. If battery voltage does not exist, go to step 14).

10) Check affected PCM output circuit for an open or short to ground. If open or short exists, repair as necessary and go to step 17). If open or short does not exist, go to next step.

11) Check affected PCM output circuit and ignition feed circuit for poor connection at instrument panel cluster and PCM. If problem exists, repair as necessary and go to step 17). If problem does not exist, go to step 15).

12) Turn ignition switch to LOCK position. Connect PCM harness connectors. Disconnect instrument cluster connectors. Turn ignition switch to RUN position. Connect a test light between affected PCM output circuit and ignition feed circuit at instrument panel harness connector. Using a scan tool, perform OUTPUT TESTS function to cycle affected warning light on and off. If test light flashes on and off, check for shorted component or circuit in the output driver circuit. Check for faulty instrument cluster. If test light does not flash on and off, go to next step.

13) Check affected PCM output circuit for poor connection to PCM. If problem exists, repair as necessary and go to step 17). If problem does not exist, go to step 16).

14) Locate and repair open in ignition feed circuit to instrument panel cluster indicator lights. After repairs are complete, go to step 17).

15) Repair or replace instrument cluster as necessary. After repairs, go to step 17).

16) Replace PCM and go to next step.

17) Using scan tool, operate affected warning light. If warning light does not operate properly, go to step 3).

A/C COMPRESSOR CLUTCH CONTROLS

NOTE: For A/C clutch circuit testing, see A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section. See wiring diagram in L - WIRING DIAGRAMS article for terminal and wire color identification.

To provide improved idle quality, improved Wide Open Throttle (WOT) performance and A/C system protection, the compressor clutch is controlled by PCM.

For proper control of cooling fans, compressor clutch and Idle Air Control (IAC) valve, a refrigerant pressure sensor is used. PCM uses signals provided by sensor to monitor high and low side refrigerant pressures. If PCM detects a fault in refrigerant pressure circuit, compressor clutch will be disabled.

The A/C clutch relay is controlled by PCM. This allows PCM to raise idle speed before engaging compressor clutch, or disable compressor clutch during WOT, high engine RPM, high power steering loads and hot engine restarts. PCM also disables compressor clutch if

coolant temperature becomes excessive. To locate A/C clutch relay, see A/C CLUTCH RELAY LOCATION table.

A/C CLUTCH RELAY LOCATION TABLE

Application	Location
"H" Body	Center Rear Of Engine Compartment, Below Right-Side Maxifuse Block

WARNING: Vehicles may be equipped with a PCM using an Electrically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM, the new PCM must be programmed.

NOTE: To help save diagnostic time, check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary.

ELECTRIC COOLING FAN CONTROL

NOTE: For electric cooling fan circuit testing, see AIR CONDITIONING & HEAT section. See wiring diagram in L - WIRING DIAGRAMS article for terminal and wire color identification.

All FWD and some RWD vehicles use an electric cooling fan. The electric cooling fan is used for radiator and A/C condenser cooling. Cooling fan operates when A/C is on and when engine coolant temperature exceeds a specific value. One or more cooling fan relays may be used. For cooling fan relay location, see COOLING FAN RELAY LOCATION table.

COOLING FAN RELAY LOCATION TABLE

Application	Location
"H" Body	Center Rear Of Engine Compartment, Below Right-Side Maxifuse Block

To help save diagnostic time, ALWAYS check for blown fuses or fusible links before proceeding with any testing. If fuses are blown, locate and repair short circuit before replacing fuses. Ensure all related relay and wire harness connections are clean and tight. Repair as necessary. For component location and terminal and wire color identification, see wiring diagram in L - WIRING DIAGRAMS article.

WARNING: Vehicles may be equipped with a PCM using an Electrically Erasable Programmable Read Only Memory (EEPROM). When replacing PCM, the new PCM must be programmed.

COMPONENT LOCATIONS

NOTE: Component location illustrations are only available for LeSabre 3.8L (VIN 1 and VIN K) vehicles. See Figs. 2-3.

COMPONENT LOCATIONS (VIN K & VIN 1) TABLE

Component	Location

A/C Compressor Relay	Right Side Of Engine Compartment, In Power Distribution Box
A/C Pressure Sensor	Right Side Of Engine Compartment, Below Accumulator
Camshaft Position (CMP) Sensor	Right Side Of Engine, Above Crankshaft Pulley
Crankshaft Position (CKP) Sensor	Lower Right Side Of Engine, At Crankshaft
Data Link Connector	Under Left Side Of Instrument Panel, Right Of Steering Column
EGR Valve	At Left Side Of Engine, Near Throttle Body
Engine Coolant Temperature (ECT) Sensor	Top Left Side Of Engine, Below Throttle Body
Engine Oil Level Sensor	Front Of Engine On Oil Pan, Near A/C Compressor
EVAP Canister Purge Solenoid	At Left Front Of Engine Compartment, On Top Of Canister
EVAP Canister Vacuum Switch	At Left Rear Of Engine
Fuel Injectors	In Intake Manifold
Fuel Pressure Regulator	Top Left Side Of Engine On Fuel Injector Rail
Fuel Pump Relay	Right Side Of Engine Compartment, In Power Distribution Box
Fuel Pump Speed Control Module	Left Center Of Trunk
Idle Air Control (IAC) Valve	Top Of Engine, Attached To Throttle Body
Ignition Control Module	Top Right Front Of Engine
Intake Air Temperature (IAT) Sensor	Left Side Of Engine Compartment, Attached To Air Intake Duct
Knock Sensors	At Front Of Engine Near Starter, Or At Lower Right Rear Of Engine
Manifold Absolute Pressure (MAP) Sensor	Top Rear Of Engine, On Intake Manifold
Mass Airflow (MAF) Sensor	Left Front Of Engine Compartment, In Air Intake Duct
Oxygen Sensors (O2S)	Rear Of Engine, In Exhaust Manifold & In Exhaust Pipe Rear Of Catalytic Converter
Power Distribution Box	Right Side Of Engine Compartment
Powertrain Control Module (PCM)	At Right Side Of Instrument Panel
Primary Cooling Fan Relay	Rear Center Of Engine Compartment
Secondary Cooling Fan Relay	Right Side Of Engine Compartment, In Power Distribution Box
Throttle Position (TP) Sensor	Top Of Engine, On Throttle Body
Transaxle Range Switch	Rear Left Side Of Engine Compartment, Mounted To Top Of Transaxle
Vehicle Speed Sensor	Lower Right Rear Of Engine, Attached To Transaxle

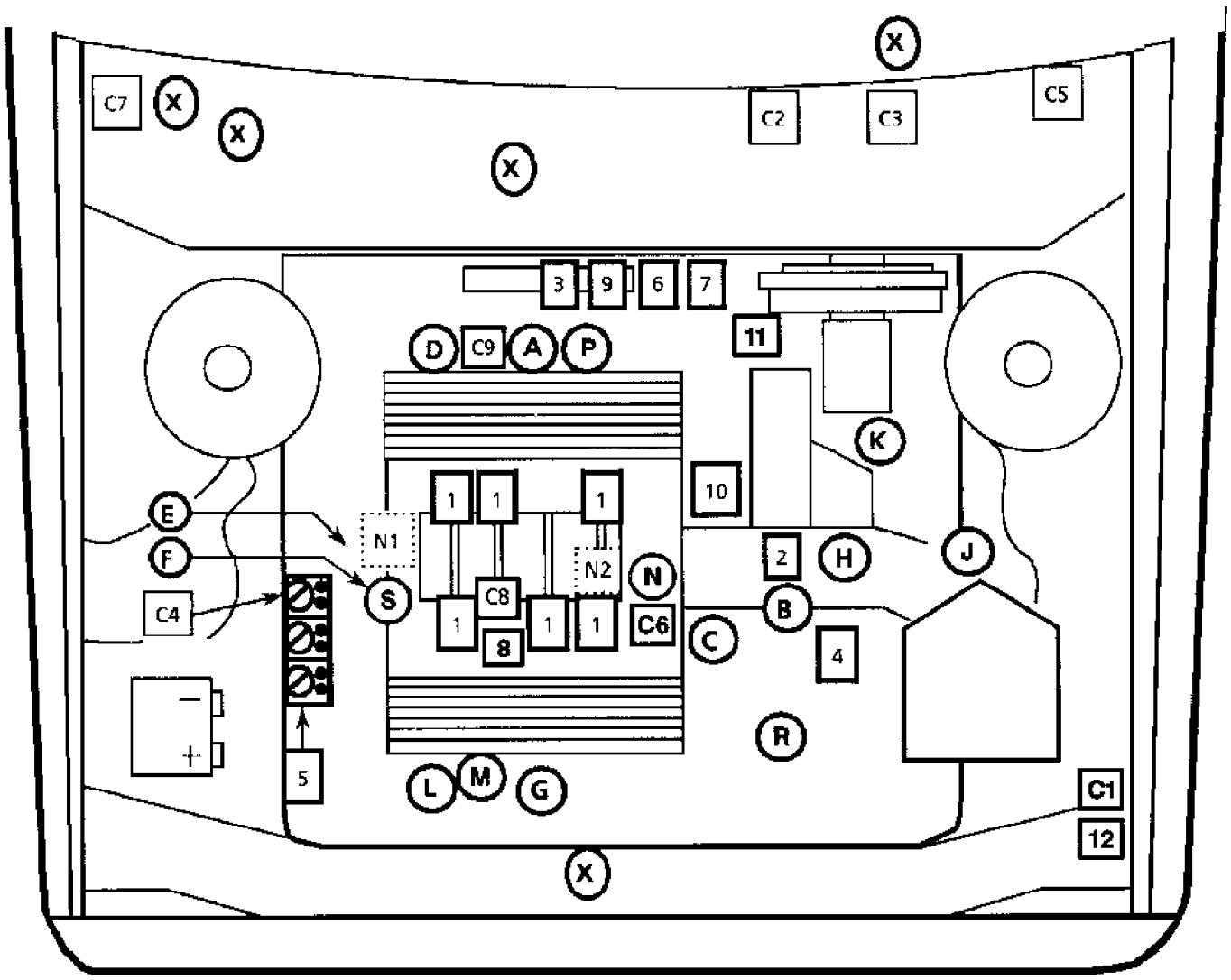

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Fig. 2: Component Locations (VIN K - Le Sabre)
Courtesy of General Motors Corp.

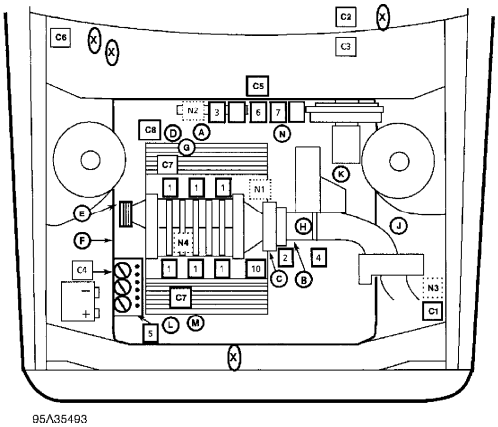

Fig. 3: Component Locations (VIN 1 - Le Sabre)
Courtesy of General Motors Corp.