GENERAL MOTORS COMPUTER COMMAND CONTROL

California S10 & S15 Pickups Equipped With 2.8L Engine

DESCRIPTION

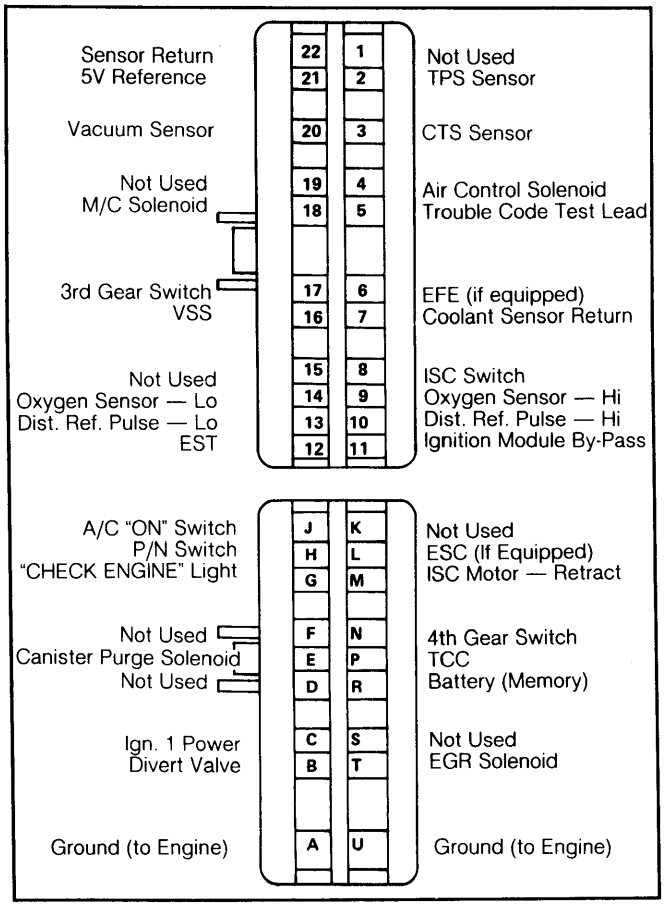
The Computer Command Control (CCC) system is used on all California Chevrolet S10 and GMC S15 trucks equipped with the 2.8L V6 engine.

CCC is an electronically-controlled exhaust emission system that monitors several engine/vehicle functions and controls various operations, including the transmission torque converter clutch. The CCC system aids in the control of exhaust emissions while maintaining good fuel economy and driveability.

The Electronic Control Module (ECM) is the "brain" of the CCC system. The ECM controls engine systems to maintain good vehicle performance under all normal driving conditions.

The CCC system is primarily an emission control system. The primary objective of the system is to maintain an air/fuel ratio of 14.7:1. With this ratio maintained, catalytic converter can effectively control nitrogen oxides (NOx), hydrocarbons (HC) and carbon monoxide (CO).

Fig. 1: ECM Terminal Identification



Not all terminals are used in all applications.

OPERATION

The CCC system consists of the following subsystems: Fuel Control, Data Sensors, Electronic Control Module (ECM), Spark Timing, Idle Speed Control (ISC), Emission Control, Torque Converter Clutch (TCC), Diagnostic System and Catalytic Converter.

FUEL CONTROL

California pickups are equipped with "feedback" carburetors which contain an electrically-operated Mixture Control (M/C) solenoid. The M/C solenoid operates single or dual metering rods in float bowl of carburetor.

A metering rod supplements fuel supply to idle and main systems, varying air/fuel ratio within a precalibrated range. The M/C solenoid also controls air/fuel ratio through use of an idle air bleed circuit that operates in conjunction with metering rod(s).

The ECM reacts to input from data sensors by constantly adjusting air/fuel mixture to maintain efficient engine performance. ECM controls M/C solenoid by providing a ground for solenoid.

When solenoid is energized, fuel flow through carburetor is reduced, providing a leaner mixture. When solenoid is de-energized, fuel flow through carburetor is increased, providing a richer mixture. The solenoid cycles (turns on and off) 10 times per second.

During closed loop operation, the ECM adjusts fuel mixture in response to signals received from oxygen sensor. Under certain operating conditions, ECM may ignore inputs from some sensors and use pre-programmed data to operate engine.

During cold engine starts (engine speed below 200 RPM), M/C solenoid is turned off by ECM so that a rich mixture can be provided. Certain operating conditions cause ECM to ignore oxygen sensor signals. CCC system then operates in open loop mode.

DATA SENSORS

Each sensor sends electronic impulses to ECM. The ECM computes ideal spark timing and fuel mixture ratio based on these signals. The function of each sensor is closely related to that of the other sensors. Operation of each sensor is as follows:

Oxygen Sensor

Sensor is mounted in engine exhaust stream. It supplies a low voltage (under ½ volt) when fuel mixture is lean (too much oxygen) and a higher voltage (up to 1 volt) when fuel mixture is rich (not enough oxygen). Oxygen sensor must be over 600°F (300°C) to function properly.

Oxygen sensor measures quantity of oxygen only. On some occasions, the oxygen sensor may cool off during idle, causing CCC system to go into open loop mode. Running the engine at fast idle will warm up oxygen sensor.

Oxygen sensor voltage output should not be measured. Current drain from voltmeter could permanently damage sensor, shift sensor calibration range and/or render sensor unusable. Do not connect jumper wire, test leads or other electrical connectors to sensor. Use these devices on ECM side of harness only, after disconnecting harness from sensor.

Coolant Temperature Sensor (CTS)

The CTS is located in the engine coolant stream. It supplies coolant temperature information to ECM. This information affects air/fuel ratio control (as coolant temperature varies during cold start), switching functions for emission controls and torque converter

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clutch, spark timing, and engine temperature warning light operation.

Vacuum Sensor

The vacuum sensor is mounted on left inner fender panel. Sensor signals to ECM indicate changes in manifold pressure (vacuum). Adjustments to air/fuel mixture and spark timing are made in response to these signals, as needed.

Throttle Position Sensor (TPS)

This sensor is mounted on the carburetor. It is a variable resistor, similar to fuel tank sending unit, which signals ECM of changes in throttle blade position from closed to wide open throttle.

Vehicle Speed Sensor (VSS)

This sensor is mounted behind the speedometer in instrument cluster. It provides a series of 8 volt pulses to ECM, indicating vehicle speed.

High Gear Switch

High gear switch is mounted on automatic transmissions. Switch opens when transmission has shifted into high gear, and closes under all other conditions. High gear switch information is used for emission control.

Park/Neutral (P/N) Switch

This switch is connected to transmission gear selector. It is closed when selector is in "P" or "N" positions and open when selector is in gear. This switch is used for ISC and TCC operations.

Air Conditioner (A/C) "ON" Switch

A/C "ON" switch is mounted in air conditioning compressor of some vehicles to signal ECM when air conditioner is operating. Switch supplies 12 volts with compressor engaged, and 0 volts when disengaged.

ELECTRONIC CONTROL MODULE (ECM)

The ECM is located in passenger compartment, above glove compartment. It controls all CCC system functions. The ECM consists of input/output devices, Central Processing Unit (CPU), power supply and memories. A brief description of each component follows:

Input/Output Devices

These devices (integral to ECM) convert electrical signals, as received from data sensors and switches, to digital signals for use by CPU.

Central Processing Unit (CPU)

Digital signals received by CPU are used to perform all mathematical computations and logic functions required to deliver proper air/fuel mixture. CPU also calculates spark timing and idle speed. The CPU commands operation of emission control, closed loop fuel control and diagnostic system.

Power Supply

Main source of power for ECM is from the battery, through No. 1 ignition circuit.

Memories

Three types of memories are used in the ECM. They are the Read Only Memory (ROM), Random Access Memory (RAM) and Programmable Read Only Memory (PROM). Function of each memory is as follows:

- **Read Only Memory (ROM)**
  The ROM is programmed information that can only be read by ECM. ROM program cannot be changed. If battery voltage is removed, ROM information will be retained.
- **Random Access Memory (RAM)**
  This memory is the decision making center for the CPU. Information can be read into or out of RAM memory; similar to a calculator. Data sensor information, diagnostic codes and results of calculations are temporarily stored in RAM. If battery voltage is removed, all information stored here is lost.
- **Programmable Read Only Memory (PROM)**
  This memory contains factory-programmed information concerning engine calibration data for each engine, transmission, body and rear axle ratio combination. The PROM is easily removed from ECM. If battery voltage is removed, PROM information will be retained.

SPARK TIMING

The Electronic Spark Timing (EST) system used on 2.8L engines consists of the ECM and a modified HEI distributor with 7-terminal HEI module. The EST distributor contains no vacuum or centrifugal advance.

The HEI distributor communicates to ECM through a 4-terminal connector containing 4 circuits: Distributor reference circuit, by-pass circuit, EST circuit and ground circuit.

Whenever pick-up coil signals HEI module to open primary circuit, spark timing signals are sent to ECM through reference line. When voltage on HEI by-pass line is 0 volts (engine cranking), HEI module switches to by-pass circuit.

In by-pass circuit, HEI module provides spark advance at base timing, disregarding spark advance signal from ECM. When voltage on HEI by-pass circuit is 5 volts (engine running), HEI module accepts spark timing signal provided by ECM.

The ECM monitors engine speed through HEI reference line and monitors engine operating conditions through data sensors and switches. From this information, ECM calculates proper spark advance and supplies signal to HEI distributor through EST line.

IDLE SPEED CONTROL (ISC)

The ISC is an electrically-driven actuator which opens or closes throttle (in idle position) according to commands from ECM. The ISC maintains low idle speeds, while preventing stalls due to engine load changes.

The ECM receives signals from A/C "ON" switch, Park-Neutral switch and ISC throttle switch. This information is used to determine idle speed required to prevent engine stalling. ECM controls idle speed switch by operating the ISC motor.

When engine is cold, ECM holds throttle valve open for longer period of time to provide faster warm-up. This function is by-passed when throttle is opened enough to bring TPS off its idle circuit. The ISC is located on side of carburetor.

EMISSION CONTROL

The ECM electrically controls the following emission systems: AIR Management (AIR), Early Fuel Evaporation (EFE), and Exhaust Gas Recirculation (EGR). A brief description of each system follows:

AIR Management

This system helps to reduce HC and CO content in exhaust gases and to quickly heat up catalytic converter and oxygen sensor during cold engine operation. This is accomplished by injecting air into exhaust port of each cylinder.

The ECM energizes an air control solenoid which permits air flow to air switching valve, directing air

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to exhaust ports. During warm engine (closed loop) operation, the ECM de-energizes air switching valve. This directs air to dual-bed converter, which lowers HC and CO emissions.

If air control valve detects rapid increase in manifold vacuum (deceleration condition), or ECM detects any failure in CCC system, air is diverted to air cleaner or dumped to atmosphere.

Early Fuel Evaporation (EFE)

The ECM controls EFE system by one of the following methods: Vacuum operated valve and actuator, or ceramic heater grid located underneath carburetor primary bore.

The vacuum operated valve and actuator is opened by a control solenoid mounted on valve cover. This solenoid controls vacuum to EFE valve by an electrical signal from the ECM.

The ceramic heater grid system is part of carburetor insulator. When ignition is turned on and engine coolant temperature is low, voltage is applied to EFE relay through ECM, energizing EFE heater. When coolant temperature increases, ECM de-energizes EFE relay, shuting off voltage to EFE heater.

Exhaust Gas Recirculation (EGR)

The ECM controls ported vacuum to EGR valve with an electrically operated solenoid valve. When engine is cold, solenoid is energized, blocking vacuum to EGR valve. When engine is warm, solenoid is de-energized and EGR operation is allowed.

CATALYTIC CONVERTER

Proper emission control is accomplished with a special 3-way catalytic converter which converts all 3 major pollutants. The converter is a dual-bed type. The "upstream" section of the converter contains a reducing-/oxidizing bed to reduce NOx while at the same time oxidizing HC and CO.

An air supply pipe from the AIR system introduces air between the dual beds (during closed loop operation) so that second bed can oxidize any remaining HC and CO, with a high conversion efficiency, to minimize overall emissions.

TORQUE CONVERTER CLUTCH (TCC)

The ECM controls a solenoid (mounted on automatic transmission) which allows torque converter to directly connect engine to transmission. When vehicle speed is high enough, ECM energizes TCC solenoid and engine is mechanically coupled to transmission.

When operating conditions indicate that transmission should operate as normal (during rapid acceleration or deceleration), solenoid is de-energized. The transmission also returns to normal automatic operation when brake pedal is depressed.

DIAGNOSTIC SYSTEMS

The ECM of the CCC system is equipped with a self-diagnosis system which detects system failures. When a malfunction occurs, the amber "CHECK ENGINE" light on instrument panel comes on and a corresponding trouble code is stored in ECM memory. Malfunctions are recorded as either "hard failures" or "intermittent failures".

"Hard failures" cause "CHECK ENGINE" light to come on, and stay on, until malfunction is repaired. When "CHECK ENGINE" light remains on during vehicle operation, cause of malfunction MUST be determined.

"Intermittent failures" cause light to flicker, and/or go out, 10 seconds after fault goes away. However, associated trouble code will be retained in ECM memory. "Intermittent failures" may be sensor related. If a sensor fails, ECM will use a substitute value in its calculations to continue engine operation.

In this condition, service is not mandatory; but driveability may suffer. If same or similar fault does not repeat within 50 ignition cycles, related trouble code will be erased from ECM memory.

As a bulb and system check, the "CHECK ENGINE" light will glow with ignition switch on and engine not running. When engine is started, light should go out within 4 seconds. If not, a malfunction has been detected in CCC system.

NOTE: Different codes require different time intervals to set. Some codes set in as little as 5 seconds, while others may require that the related sensor or switch operate for 5 minutes, or longer.

DIAGNOSIS & TESTING

CCC system diagnosis should be done in the following order:

1) Ensure that all engine systems NOT related to CCC are fully operational. Do not proceed with testing until all other systems have been checked and/or repaired as needed.

2) Enter diagnostic mode and record trouble codes flashed by "CHECK ENGINE" light. Exit diagnostic mode.

3) Distinguish between "hard" and "intermittent" trouble codes.

4) If trouble codes were displayed, go to Diagnostic Circuit Check chart. Follow instructions given there.

5) If no trouble codes were recorded, go to Drive Complaint Sheet and follow instructions given there.

6) After any repairs are made, perform System Performance Check. Clear any trouble codes.

RECALLING TROUBLE CODES

The ECM stores component failure information under related trouble codes which can be recalled for diagnosis and repair. When recalled, these codes will be displayed by flashes of "CHECK ENGINE" light.

Codes are displayed starting with lowest numbered code. Only codes in which a related malfunction has occurred will be displayed.

Codes are called out by flashes of the "CHECK ENGINE" light. For example, "FLASH", "FLASH", "FLASH", pause, "FLASH", "FLASH", followed by a longer pause, identifies trouble code "32".

First series of flashes indicates first digit of trouble code; second series of flashes indicates second digit of trouble code.

Entering Diagnostic Mode

1) Turn ignition on (engine off). "CHECK ENGINE" light should come on. Locate Assembly Line Data Link (ALDL) connector attached to ECM wiring harness under instrument panel. Insert jumper wire from terminal "A" to "B". *See Fig. 2*

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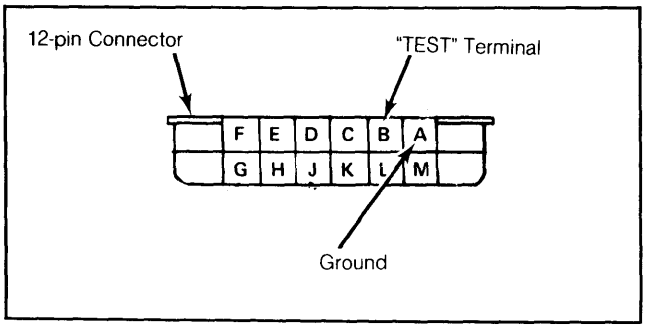
Fig. 2: ALDL Connector Terminal Locations



Insert jumper wire between terminals "A" and "B" when entering diagnostic mode.

2) "CHECK ENGINE" light should flash code "12" three consecutive times, followed by any trouble codes which may be stored in ECM memory.

3) If more than one code is stored, they will be displayed from the lowest numbered code to the highest. Each code will flash 3 times. After all codes have been displayed, the complete cycle will repeat. Repetition of cycle continues as long as the "TEST" terminal of ALDL connector is grounded.

CAUTION: When lug is inserted in terminals of ALDL connector, the "TEST" terminal is grounded. DO NOT start engine or turn on ignition while terminal is grounded.

ECM TROUBLE CODE IDENTIFICATION

Trouble Code	Circuit Affected
12	No reference pulse to ECM.
13	Oxygen Sensor Circuit
14	Shorted Coolant Sensor Circuit
15	Open Coolant Sensor Circuit
21	Throttle Position Sensor Circuit
23	Open or grounded M/C Solenoid Circuit
34	Vacuum Sensor Circuit
41	No distributor reference pulses at specific vacuum
42	Electronic Spark Timing circuit or By-Pass grounded or shorted
44	Lean Oxygen Sensor value
44 & 45	Faulty Oxygen Sensor circuit
45	Rich Oxygen Sensor value
51	Faulty PROM or improper PROM installation
54	Shorted M/C or faulty ECM
55	Grounded voltage reference, faulty oxygen sensor or ECM

Clearing Trouble Codes

To clear memory of trouble codes, turn ignition off and remove ECM fuse from fuse block for 10 seconds.

Exiting Diagnostic Mode

To exit diagnostic mode, turn ignition off and remove jumper wire from ALDL connector.

NOTE: The terms "enter diagnostics" and "exit diagnostics" will be used periodically throughout this section. Follow appropriate procedure for entering and exiting diagnostic mode when instructed to do so.

FAILURE CODE DETERMINATION

During any diagnostic procedure, "hard failure" codes MUST be distinguished from "intermittent failure" codes. Diagnostic charts CANNOT be used to analyze "intermittent failure" codes, except as noted under Diagnostic Procedure. To determine "hard failure" codes and "intermittent failure" codes, proceed as follows:

1) Turn ignition on and enter diagnostics. Read and record all stored trouble codes. Exit diagnostics and clear trouble codes.

2) Apply parking brake and place transmission in neutral (manual) or park (automatic). Block drive wheels. Start engine. "CHECK ENGINE" light should go out. Run warm engine at specified curb idle for 5 minutes and note "CHECK ENGINE" light.

NOTE: Grounding "TEST" terminal with engine running will force engine to operate in closed loop mode if engine is warm and oxygen sensor is hot. If "CHECK ENGINE " light does not glow while in closed loop, CCC system is operating properly.

3) If "CHECK ENGINE" light comes on, enter diagnostics. Read and record trouble codes. These are "hard failure" codes. Codes "13", "15", "24", "35", "44", "45" and "55" may require road test to reset "hard failure" after trouble codes were cleared.

4) If "CHECK ENGINE" light does not come on, all stored trouble codes were "intermittent failures", except as noted under Diagnostic Procedure.

NOTE: Trouble codes "13", "24", "44" and "45" require 5 minutes of part throttle engine operation at to be stored.

DIAGNOSTIC PROCEDURE

The CCC system may be considered a possible source of engine performance, fuel economy and exhaust emission problems, ONLY after normal checks (those which apply to vehicles without CCC) have been performed.

Diagnosis of CCC system consists of 3 types of check sheets: Diagnostic Circuit check, Driver Complaint sheet and system Performance check. Any check sheet may refer to another chart for locating source of problem, or indicate no problem and refer to another sheet.

If all check sheets refer to others, problem is not in CCC system. The check sheets and their procedures are as follows:

NOTE: If vehicle exhibits performance problems and no codes are set, refer to System Performance Chart. Components recorded by trouble codes are generally not the source of performance problems when no codes are stored in ECM memory.

SYSTEM CHECKS

Diagnostic Circuit Check

1) If complaint is "CHECK ENGINE" light related, this check will lead to most likely problem area (if malfunction exists). Enter diagnostics and record stored trouble codes. Begin diagnosis with lowest numbered

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code displayed and refer to appropriate trouble code chart.

2) If code "51" is displayed, refer to PROM removal and installation in this article for diagnossis of code.

3) If codes "51", "54" or "55" are displayed within another code, always refer to diagnostic chart for "50" series code first. Then proceed to next lowest numbered code.

4) If codes "13" and "21", "14" and "21" or "15" and "21" are displayed, start with code "21" first, then proceed to "13", "14" or "15".

5) On vehicles with manual transmissions, if codes "13" and "34", "14" and "34" or "15" and "34" are displayed, start with code "34" first, then proceed to code "13", "14" or "15".

6) If "intermittent failure" codes "13", "15", "24", "35", "44", "45" or "55" are displayed, use diagnostic chart for corresponding "hard failure" code.

Driver Complaint Sheet

1) If complaint is not "CHECK ENGINE" light related, this check will lead to most likely problem area. However, before beginning procedure, make checks that would normally be made for a similar complaint on a vehicle without CCC system.

2) Follow instructions in diagnostic chart and repair malfunction. After repair, perform System Performance Check.

System Performance Check

1) This check verifies that CCC system is functioning correctly. This check should be made after any repair on CCC system.

2) When performing check, always engage parking brake and block driving wheels. On engines equipped with Varajet carburetors (E2SE model), remove bowl vent line and plug hose at carburetor during check. Reconnect hose after check is complete.

3) In some cases, the oxygen sensor will cool off while engine is idling. This causes engine to enter open loop mode. To restore closed loop mode, run engine at part throttle for several minutes and accelerate from idle to part throttle several times.

NOTE: Although there are many charts connected with CCC diagnosis, only 2 are needed to prove proper system operation. Normally, only 3 charts are necessary to find an existing problem.

TOOLS REQUIRED

Diagnostic Tools

1) CCC system testing requires a dwell meter, tachometer, test light, ohmmeter, digital voltmeter (with 10 megohm resistance), vacuum pump, vacuum gauge and 6 jumper wires. Jumpers must be 6" long. One wire should have male connectors at both ends, one should have female connectors at both ends, and the others should be male at one end and female at the other.

2) A test light must be used in place of a voltmeter when specified by the diagnostic chart.

3) The dwell meter is used to check mixture control solenoid operation. It must be set on 6-cylinder scale and connected to Green connector near carburetor. DO NOT connect any other equipment to this lead. Do not allow lead to contact any ground source, including rubber hoses.

NOTE: If engine operation changes when dwell meter is connected, remove it and try a different meter. Some models affect system operation.

4) When engine is at operating temperature and idling, dwell meter needle will fluctuate between 10° and 50°. This indicates "Closed Loop" operation. If the needle does not move, "Open Loop" operation is indicated.

TEST CHARTS

DRIVER COMPLAINT SHEET

Engine performance problem (odor, surge, fuel economy). Emission problem.

If "CHECK ENGINE" light is not on, normal checks that would be performed on cars without CCC should be done first.

If generator or coolant light is on with the "CHECK ENGINE" light, diagnose those systems first.

Inspect for poor connections at coolant sensor, M/C solenoid, etc. Check for poor or loose vacuum hoses and connections. Repair as needed.

INTERMITTENT "CHECK ENGINE" LIGHT, BUT NO TROUBLE CODE STORED:

1) Check for intermittent connection in circuit from:
- Ignition coil to ground and arcing at spark plugs or wires.
- Battery to ECM terminals "C" and "R".
- ECM terminals "A" and "U" to engine ground.

2) Loss of long-term memory: Grounding dwell lead for 10 seconds with "test" lead ungrounded should give Code 23. Code should be retained after engine is stopped and ignition turned to "RUN" position. If it is not, ECM is defective.

3) EST wires should be kept away from spark plug wires, distributor housing, coil and generator. Wires from ECM Terminal 13 to distributor and the shield around EST wires should be a good ground.

4) Open diode across A/C compressor clutch.

DETONATION (SPARK KNOCK)

Check:
- Vacuum Sensor output.
- EGR operation.
- TPS enrichment operation.
- HEI operation.

POOR PERFORMANCE OR FUEL ECONOMY

See EST diagnosis.

POOR FULL THROTTLE PERFORMANCE

See Chart 4.

ALL OTHER COMPLAINTS

Make system performance check on warm engine (upper radiator hose hot).

Always perform system performance check after any repairs to the system have been made.

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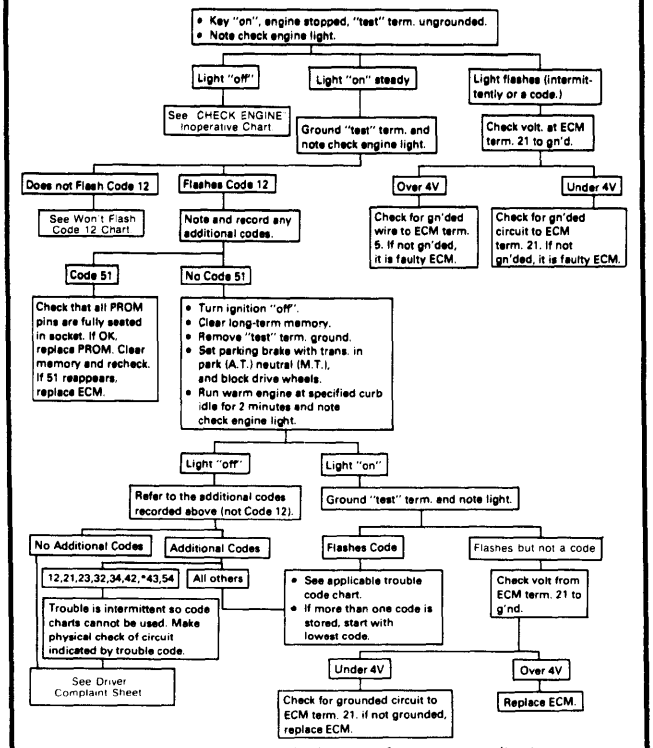
TEST CHARTS

DIAGNOSTIC CIRCUIT CHECK

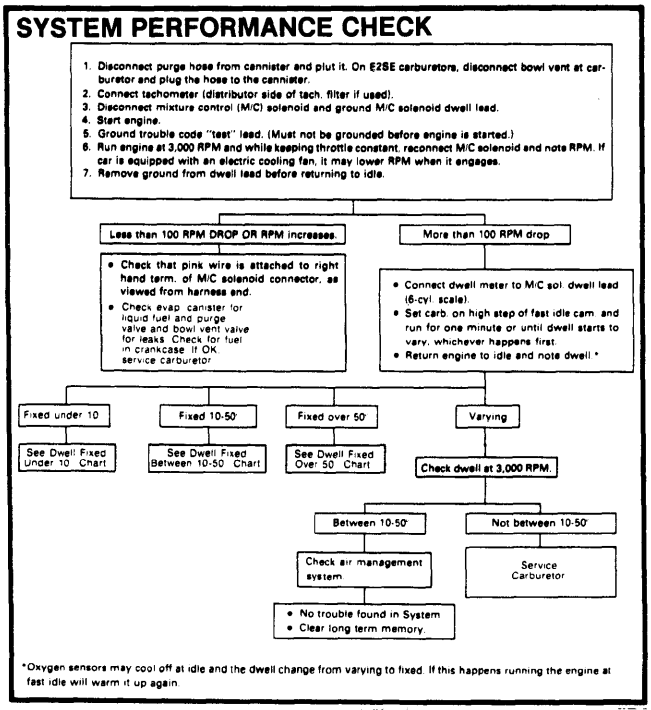


Before replacing an ECM, always check PROM for correct application and installation. Also, remove terminal(s) from ECM connector for circuit involved, clean terminal contact and expand it slightly to increase contact pressure and recheck to see if problem is corrected.

The system performance check should be performed after any repairs to the system have been made.

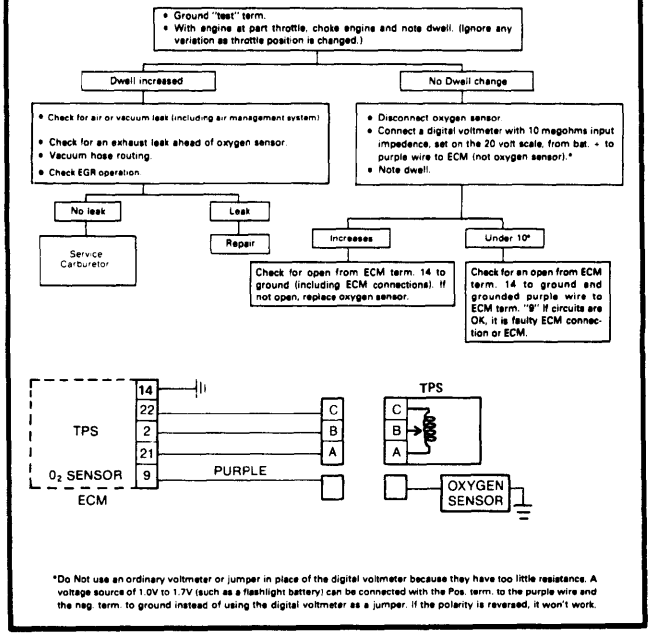
*It is possible to set a false Code 42 on starting, but the "CHECK ENGINE" lamp will not be on. No corrective action is required.

SYSTEM PERFORMANCE CHECK



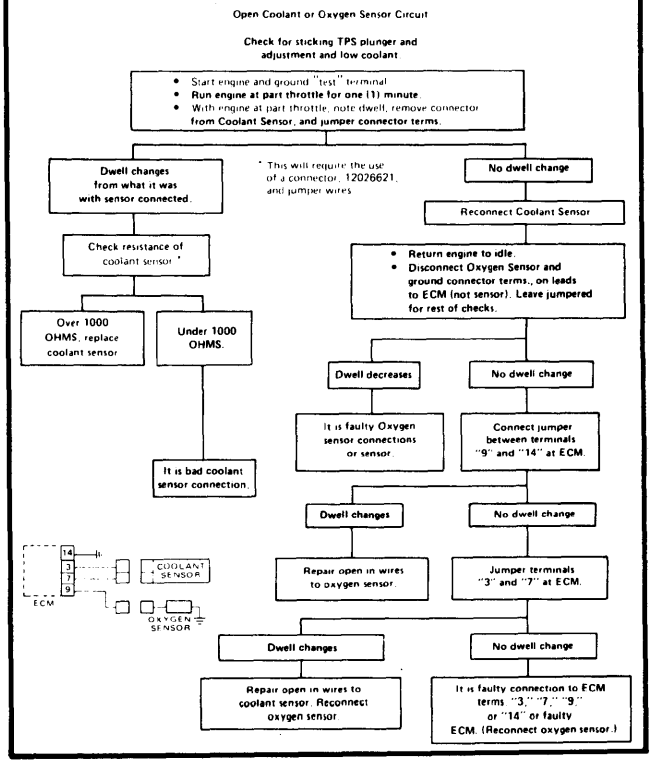
*Oxygen sensors may cool off at idle and the dwell change from varying to fixed. If this happens running the engine at fast idle will warm it up again.

DWELL FIXED UNDER 10°



*Do Not use an ordinary voltmeter or jumper in place of the digital voltmeter because they have too little resistance. A voltage source of 1.0V to 1.7V (such as a flashlight battery) can be connected with the Pos. term. to the purple wire and the neg. term. to ground instead of using the digital voltmeter as a jumper. If the polarity is reversed, it won't work.

DWELL FIXED AT 10-50°



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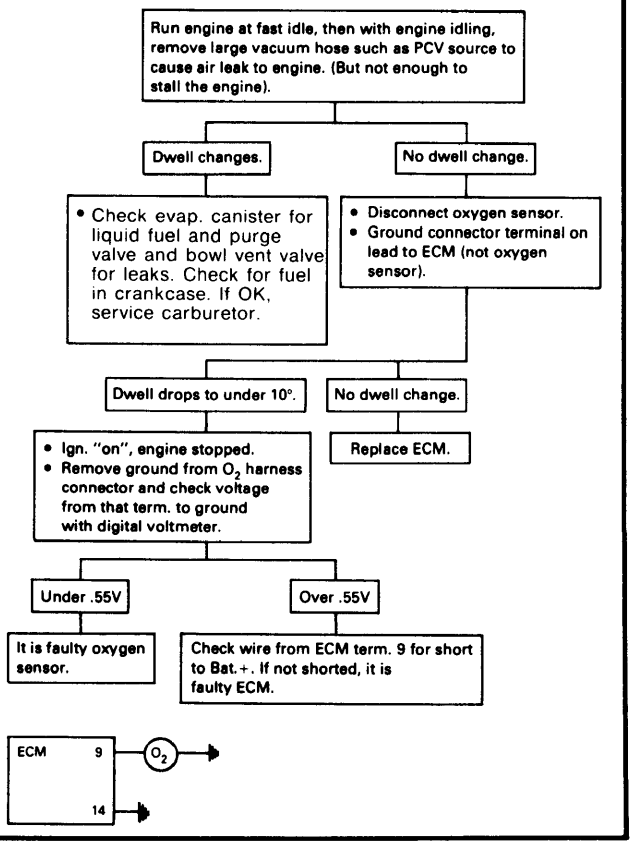
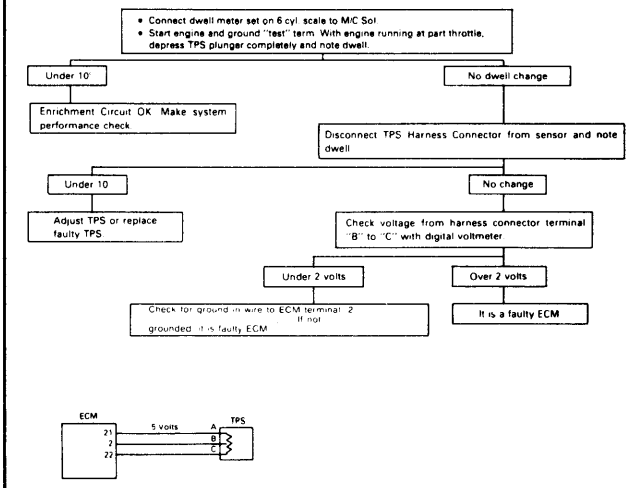
TEST CHARTS

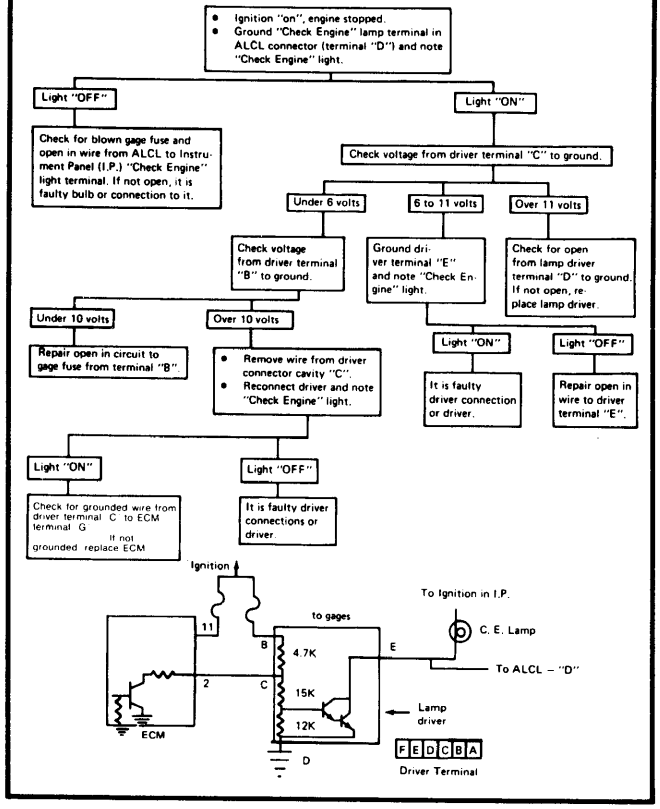
DWELL FIXED OVER 50°



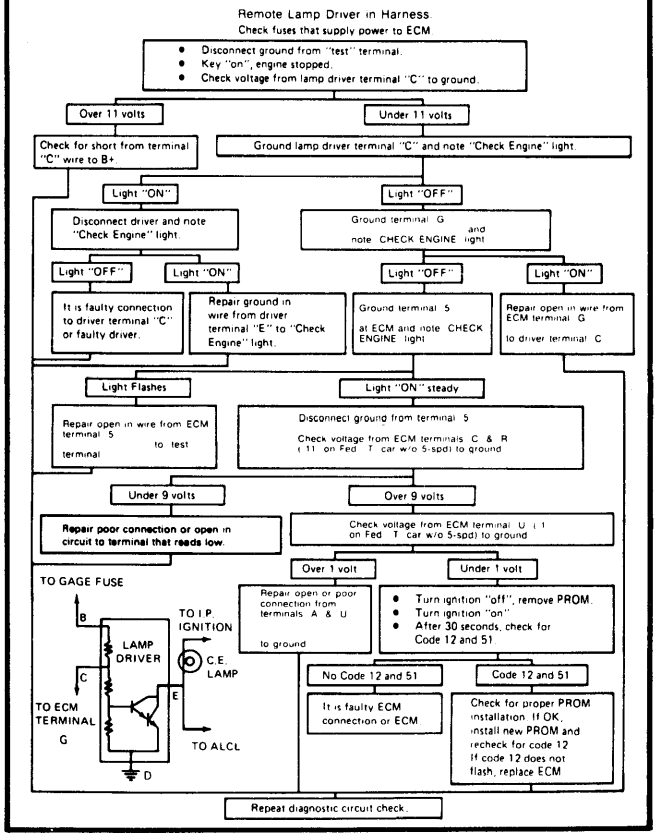
TPS ENRICHMENT CHECK



"CHECK ENGINE" LIGHT INOPERATIVE



WON'T FLASH CODE 12



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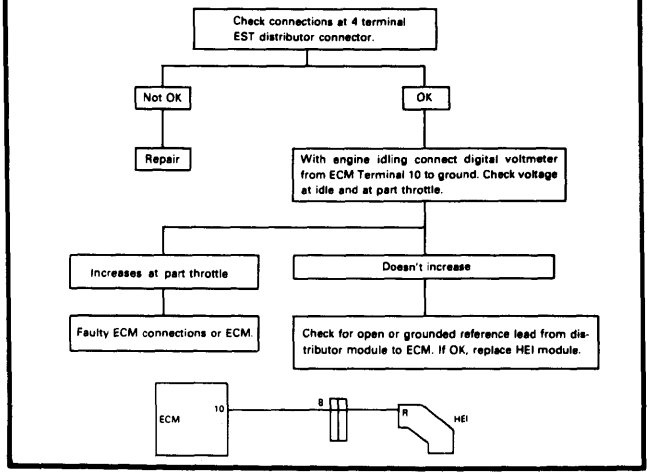
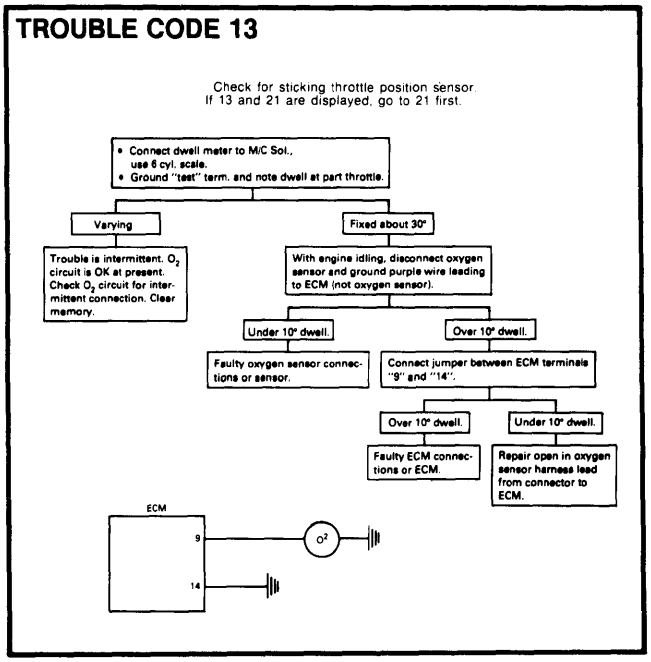
TEST CHARTS

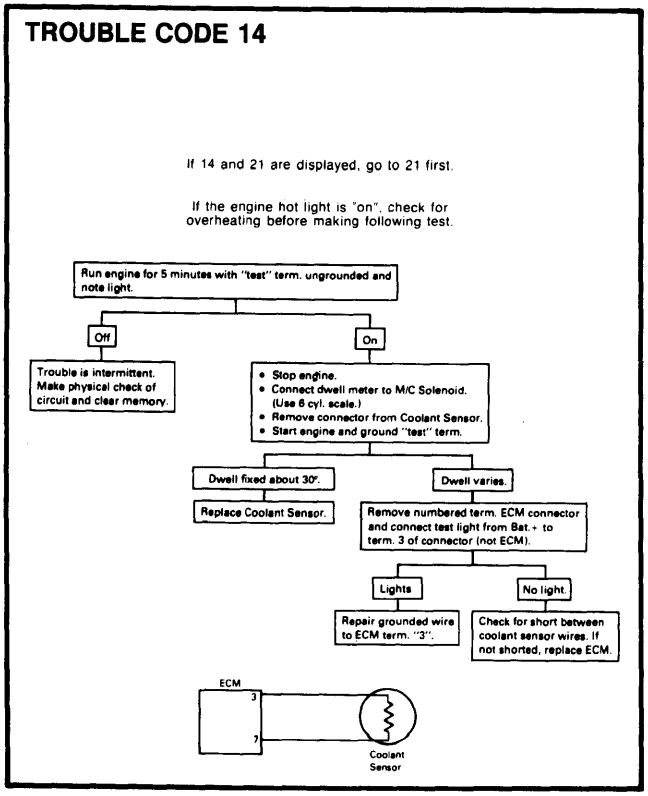
TROUBLE CODE 12



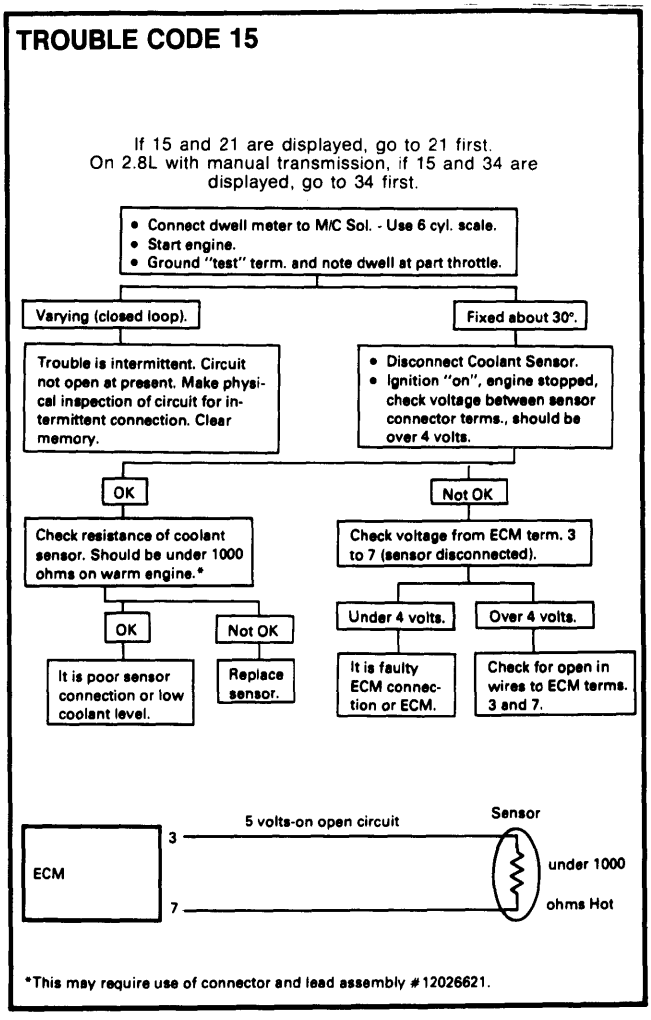
TROUBLE CODE 13



TROUBLE CODE 14



TROUBLE CODE 15



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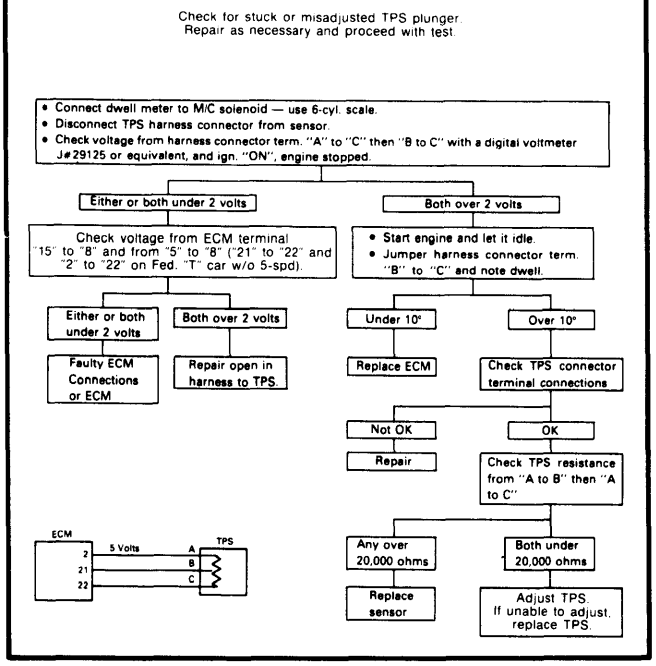
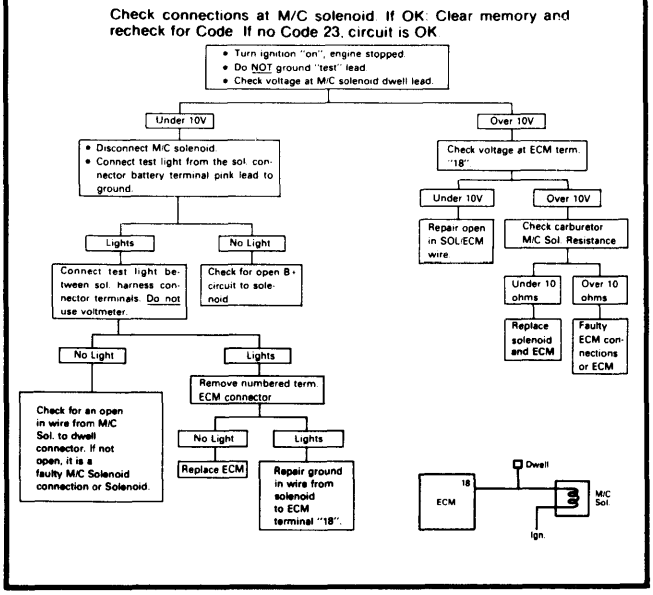
TEST CHARTS

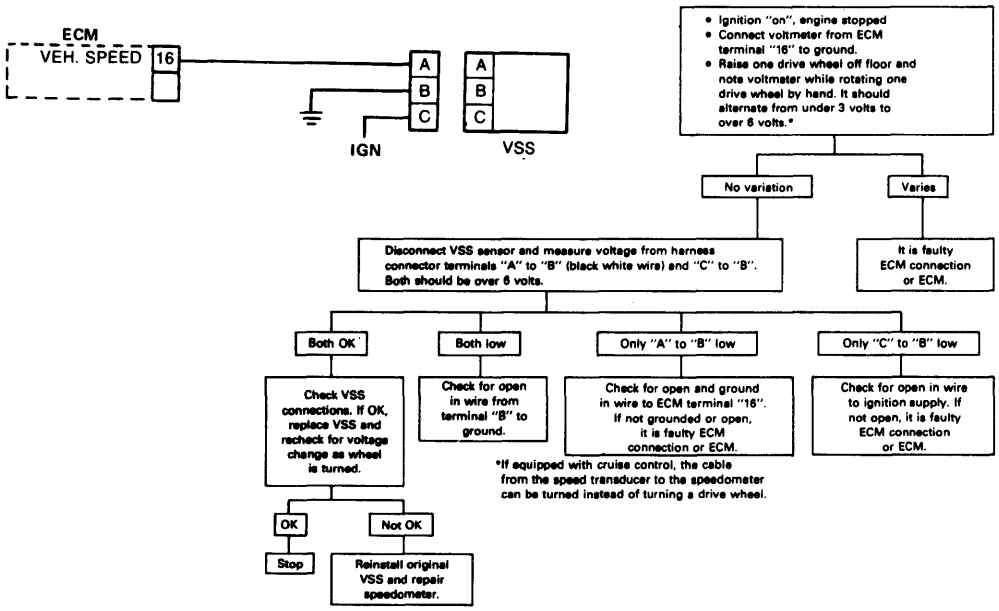
TROUBLE CODE 21



TROUBLE CODE 23



TROUBLE CODE 24



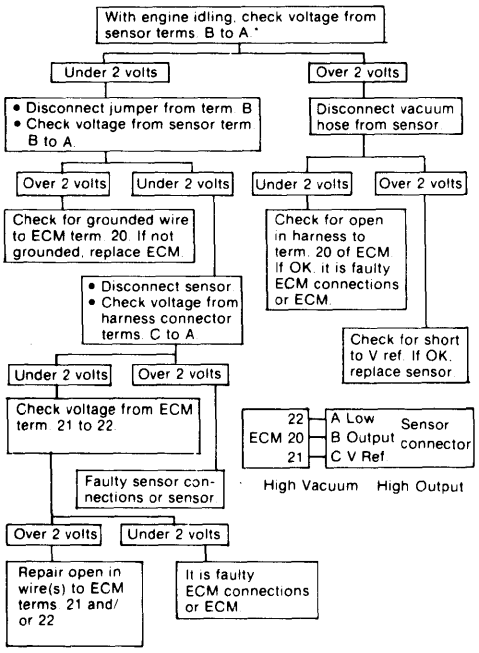
1982 Exhaust Emission Systems

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TEST CHARTS

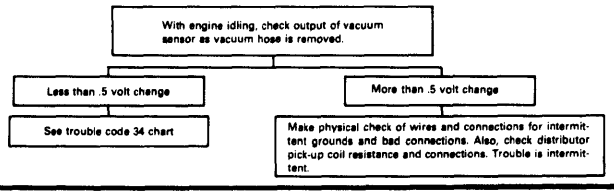
TROUBLE CODE 34 VACUUM SENSOR CIRCUIT

Check for over 10" of vacuum at sensor with engine idling. If not OK, repair.

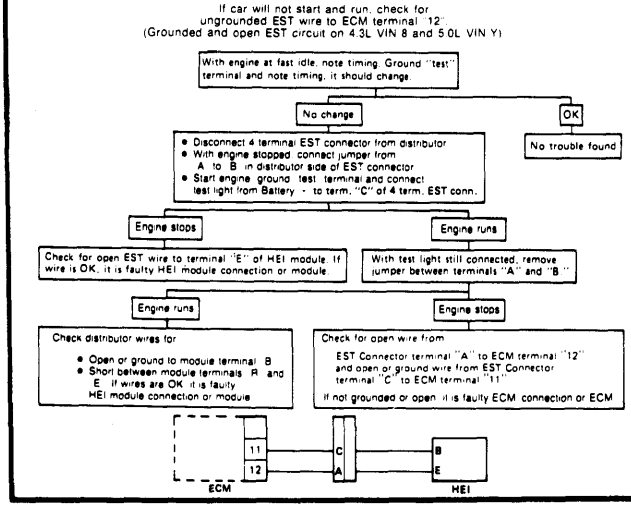


*This requires use of three jumpers between the sensor and the connector. They can be made using terminals 12014836 and 12014837.

TROUBLE CODE 41



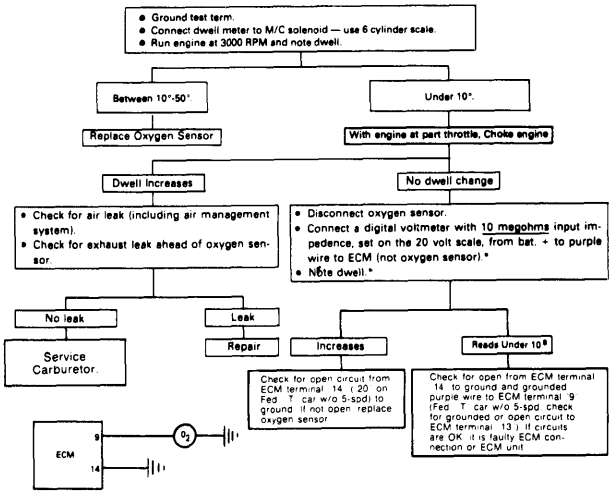
TROUBLE CODE 42



TROUBLE CODE 44 OR TROUBLE CODE 44 & 45 TOGETHER

If Code 44 and 55 are displayed, check resistance of circuit from ECM terminal "14"; it should be under 10 ohms (exc. Fed. "T" car w/o 5-spd).

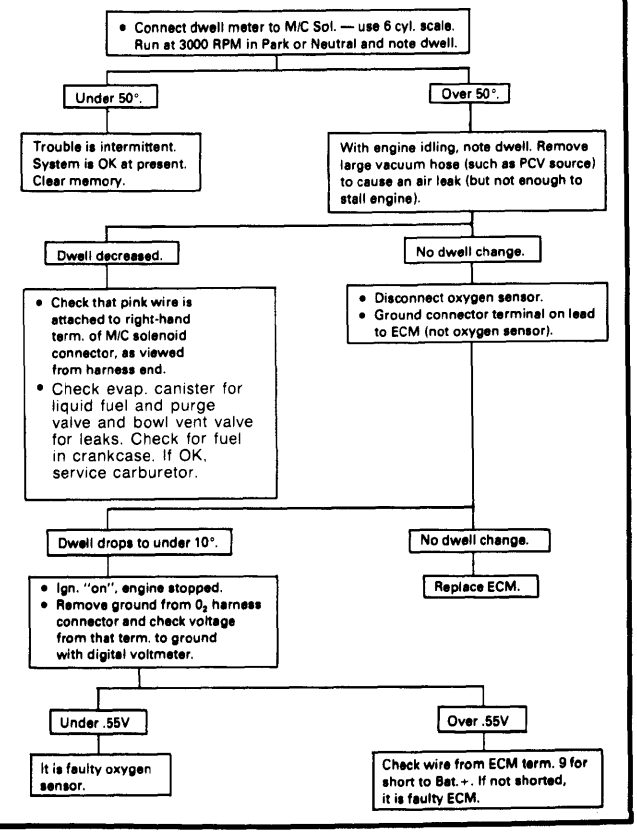
If M/C solenoid does not click with ignition "on" and "test" terminal grounded and there is no Code 23 or 54, check for sticking M/C solenoid.



*Do Not use an ordinary voltmeter or jumper in place of the digital voltmeter because they have too little resistance. A voltage source of 1.0V to 1.7V (such as a flashlight battery) can be connected with the Pos. term. to the purple wire and the neg. term. to ground instead of using the digital voltmeter as a jumper. If the polarity is reversed, it won't work.

TROUBLE CODE 45

If M/C solenoid does not click with ignition "on" and "test" terminal grounded and there is no Code 23 or 54, check for sticking M/C solenoid. If Code 54 is displayed, go to 54 first.



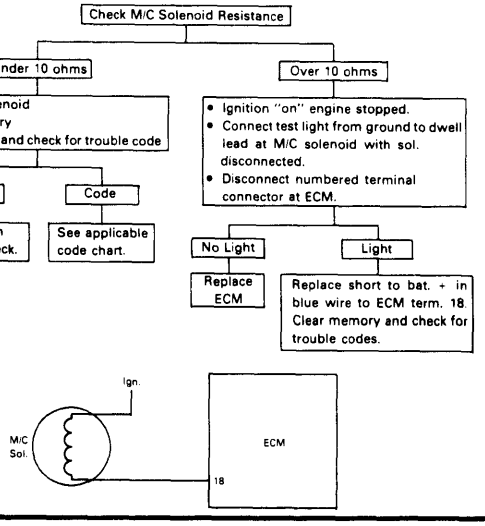
GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TEST CHARTS

TROUBLE CODE 51

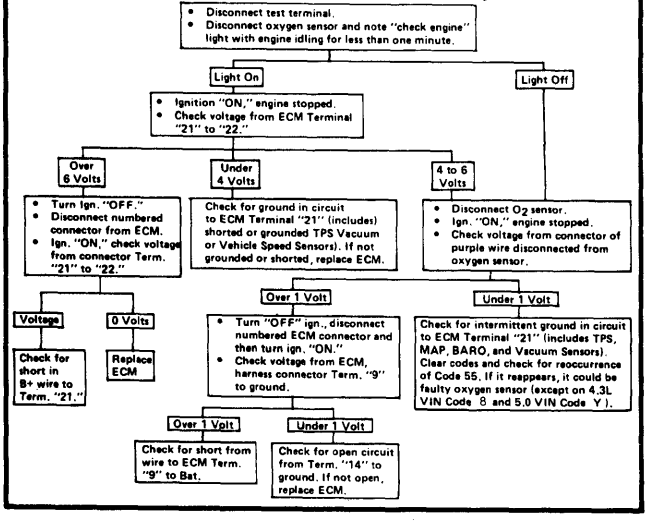
Check that all pins are fully inserted in the socket. If OK, replace PROM, clear memory, and recheck. If code 51 reappears, replace ECM.

TROUBLE CODE 54

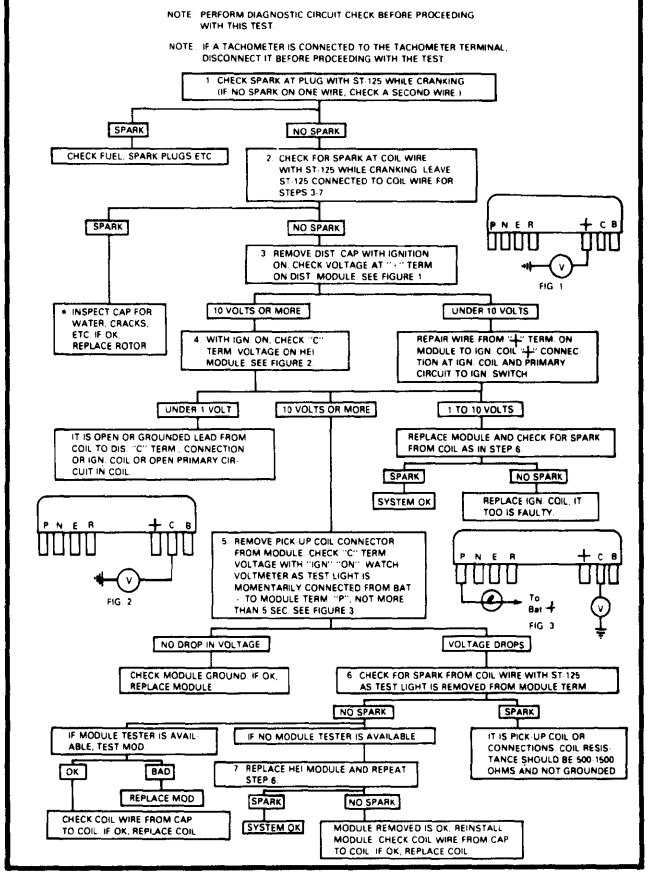


TROUBLE CODE 55

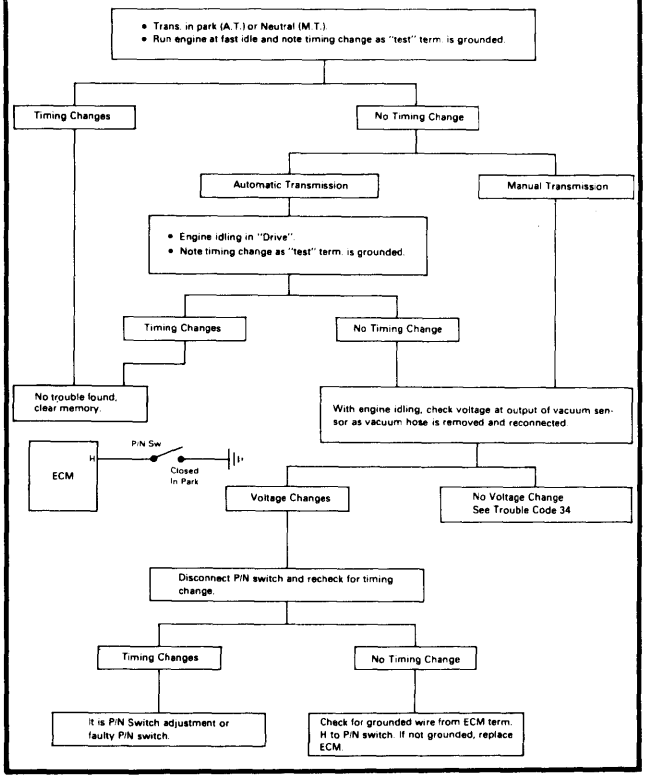
Check for corrosion at ECM edgeboard connectors and terminals. If present, check for coolant sensor, windshield or heater core leaks. Repair leak, clean connector terminals and replace ECM. Also check for 4 terminal EST harness being too close to electrical signals such as spark plug wires, generator, distributor housing, etc



ENGINE CRANKS BUT WILL NOT RUN



EST PERFORMANCE CHECK

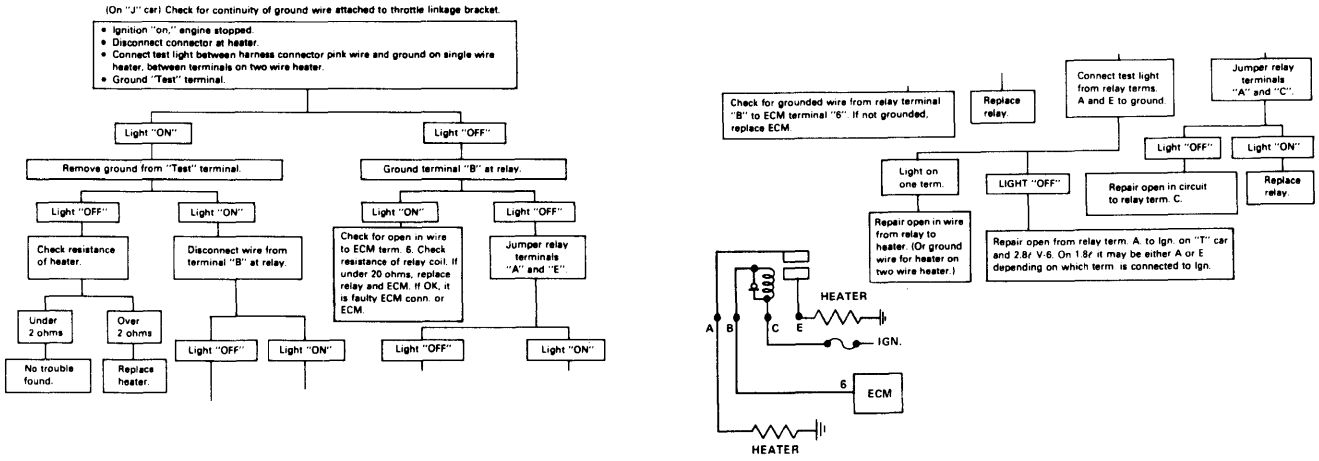


1982 Exhaust Emission Systems

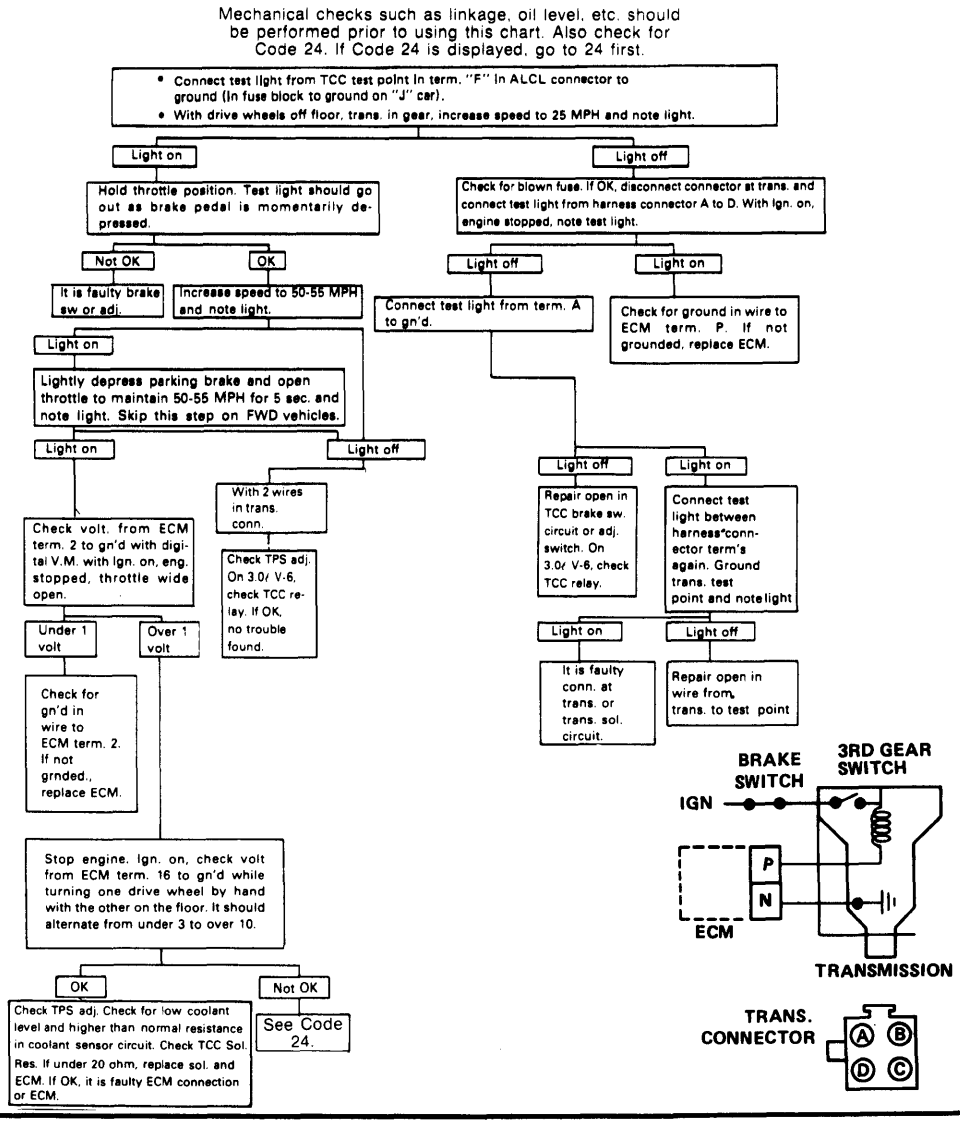
GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TEST CHARTS

EFE OPERATIONAL CHECK

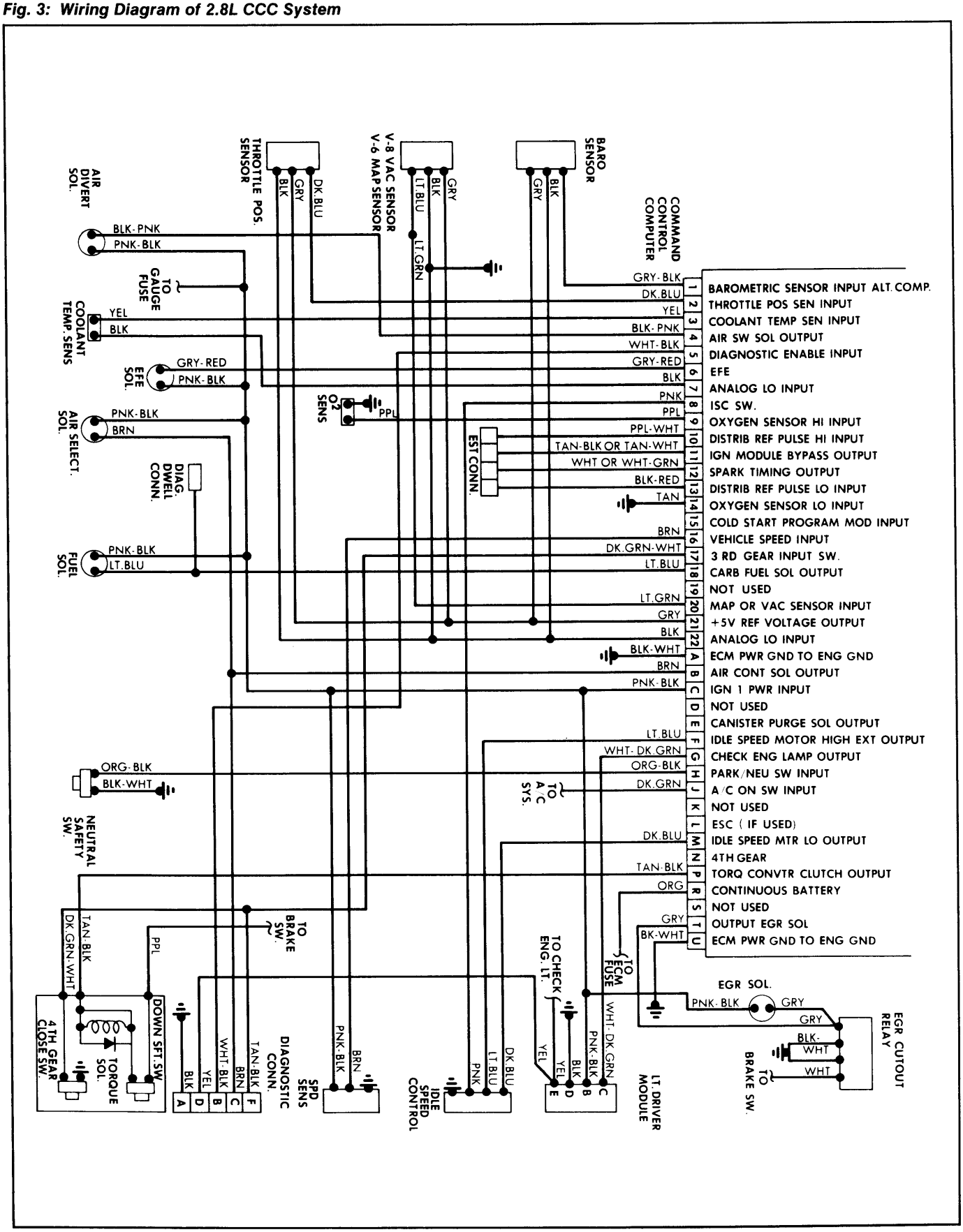


TRANSMISSION CONVERTER CLUTCH (TCC) ELECTRICAL DIAGNOSIS



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

Fig. 3: Wiring Diagram of 2.8L CCC System



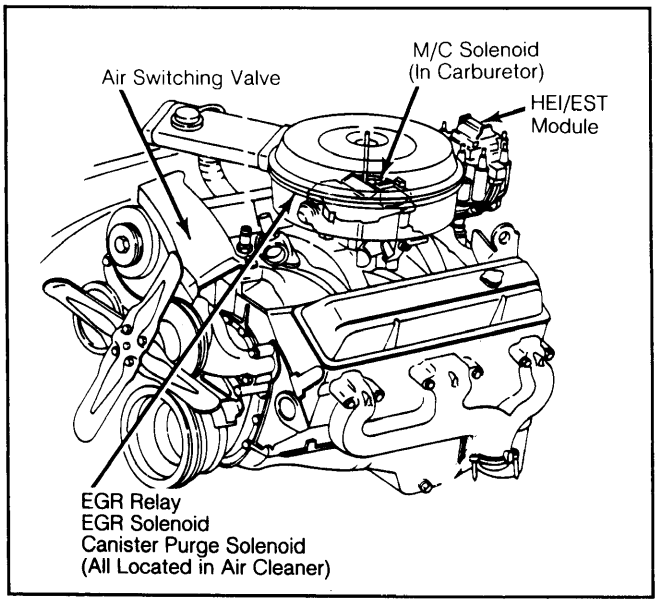
1982 Exhaust Emission Systems

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

MAINTENANCE

The CCC system does not require periodic maintenance. However, when vehicle is raised for other services, check general condition of catalytic converter and exhaust system.

Fig. 4: Location of CCC System Components



Oxygen sensor is located in right side exhaust manifold.

REMOVAL & INSTALLATION

ELECTRONIC CONTROL MODULE (ECM)

Removal & Installation

Remove ECM mounting hardware. Disconnect electrical connectors and ground strap. Remove ECM. To install ECM, reverse removal procedure and ensure ground strap is securely attached.

PROGRAMMABLE READ ONLY MEMORY

Removal

1) Remove ECM. Remove sheet metal screw holding access cover closed and remove acccess cover. Place blade of small, flat screwdriver at PROM carrier reference end between edge of opening in case and underside of protruding lip of carrier. Pry up side of carrier as far as possible.

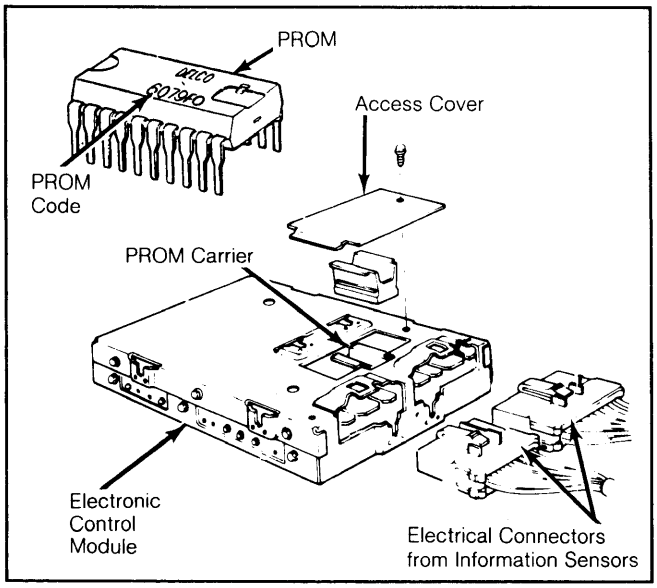
2) Repeat procedure on other reference end lip. Grasp carrier with thumb and forefinger. Gently rock carrier from side to side while applying upward force and remove PROM.

Installation

1) Before installing new PROM, ensure part number agrees with removed PROM. Molded "half-round" depression of PROM must be installed at same end as "squared-off" symmetrical end of carrier. Make sure that PROM is centered in carrier.

2) Position carrier squarely over PROM socket with "squared-off" symmetrical end of carrier aligned with small notch in socket. Press down firmly on top of carrier while pressing down on body of PROM with narrow, blunt tool. Squarely seat PROM in socket by alternately pressing down on either end of PROM.

Fig. 5: Replacing PROM in Electronic Control Module



PROM must be installed properly. If ignition is turned on with PROM installed incorrectly, the PROM will be destroyed.

3) Replace access cover and install ECM. Reconnect electrical connectors and start engine. Enter diagnostics and check for trouble code "51". If trouble code "51" does not appear, PROM is correctly installed.

4) If code "51" does appear, PROM is not fully seated, is installed backwards, has bent pins, or is defective. Remove ECM and fully seat PROM. If pins are bent, remove PROM, straighten pins and reinstall. If pins break or crack during straightening process, replace PROM. If PROM is installed backwards, it must be replaced.

OXYGEN SENSOR

Removal

Raise and support vehicle as needed. Disconnect electrical connector at harness. Spray threads of oxygen sensor with penetrating oil and allow to soak for 5 minutes. Carefully remove oxygen sensor.

NOTE: Oxygen sensor may be difficult to remove with engine temperature below 120°F (50°C). DO NOT use excessive force to remove sensor as damage to threads in exhaust manifold may result.

Installation

Install new oxygen sensor and torque to 30 ft. lbs. (41 N.m). When installing sensor, do not remove anti-seize compound from threads or add any type of sealant. Reconnect electrical connector. Ensure oxygen sensor boot is $\frac{5}{16}$" away from wrench fitting of sensor.

NOTE: Never attempt to reinstall a used oxygen sensor. Reinstallation of sensor without special glass bead thread coating can destroy complete exhaust system.

THROTTLE POSITION SENSOR (TPS)

TPS is serviced with carburetor. Carburetor removal is required to service sensor.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

VACUUM SENSOR

Removal & Installation

Vacuum sensor is located on left inner fender panel in engine compartment. Locate sensor. Remove connector and ground strap. Remove mounting screws and sensor. To install sensor, reverse removal procedure and reconnect ground strap (if equipped).

COOLANT TEMPERATURE SENSOR

Removal & Installation

Drain radiator until coolant level is below sensor. Disconnect electrical connector from sensor and remove sensor from block. Reverse removal procedure to install.

VEHICLE SPEED SENSOR (VSS)

Removal & Installation

Remove speedometer cluster and disconnect VSS connector. Remove mounting hardware and sensor. To install, reverse removal procedure.

EMISSION CONTROL SOLENOIDS

Removal & Installation

Remove electrical connector and hoses (if equipped). Remove solenoid. To install, reverse removal procedure.