

JEEP COMPUTER CONTROLLED CATALYTIC CONVERTER (C-4) SYSTEM

DESCRIPTION

The Computer Controlled Catalytic Converter (C-4) system is used on all California Jeep models equipped with 151" 4-cylinder engines. The C-4 system closely controls air/fuel ratio through a feedback system from an oxygen sensor mounted in the exhaust manifold. The major components of this system include an exhaust gas oxygen sensor, an electronic control module (ECM), a special electronically controlled carburetor (Rochester Model E2SE) and a three-way catalytic converter.

OPERATION

OXYGEN SENSOR

This unit is positioned in the exhaust manifold so it can sense exhaust gas composition as it comes from the engine. The sensor detects oxygen content in order to relay a signal to the ECM. This sensor is actually a (Zirconia) battery which reacts to oxygen levels by generating a voltage signal (100 to 900 millivolts) that is inversely proportionate to the amount of oxygen. If the oxygen content of exhaust gas is high (indicating a lean mixture), the voltage signal created by the sensor will be low. If oxygen content is low (indicating a rich mixture), the voltage signal to the ECM is high. The oxygen sensor should be replaced every 30,000 miles to ensure proper function.

ELECTRONIC CONTROL MODULE (ECM)

The ECM reads and computes the signal from the oxygen sensor. In response, it sends a proportionate signal to the mixture control solenoid (in carburetor), which creates either a lean or rich mixture, as required. The signal which is sent from the ECM to the mixture control solenoid is also modified by inputs from throttle position vacuum switches and coolant temperature sensor (CTS).

The ECM contains a replaceable integrated circuit "chip" which has stored data unique to each vehicle (i.e., axle ratio, body style, etc.). This is called a Programmable Read Only Memory (PROM). This PROM's memory system stores an average set of operating conditions with the ideal air/fuel ratio for these conditions. If any settings change from these stored conditions (as determined by engine sensors), the ECM will make necessary adjustments to bring engine back to the "ideal" set of conditions.

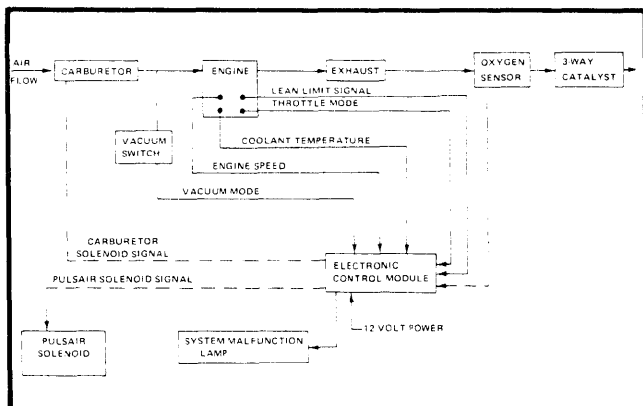


Fig. 1 Typical C-4 Flow Diagram Showing Operating Relationships

Before the ECM can begin in governing the air/fuel ratio, it is important to note that a minimum of 10 seconds must have elapsed after startup before any C-4 operation begins, engine coolant temperature must be above 150° F, and the oxygen sensor must be sufficiently hot (600° F) and putting out sufficient voltage before the ECM can react. During cold engine startup, the ECM is off-line and a fixed carburetor condition is maintained until proper warmup occurs.

CARBURETOR

Carburetors used in conjunction with the C-4 system are designed with an electrically operated solenoid in the fuel bowl. In the Rochester E2SE carburetor, this solenoid provides a controlled restriction to the main metering system. This solenoid responds to impulses (cycles) generated from the ECM to make the mixture leaner or richer, as determined by the system of engine sensors and switches.

NOTE — For additional information, including adjustments and specifications, see Rochester E2SE carburetor article in FUEL SYSTEMS section of this manual.

CATALYTIC CONVERTER

Proper emission control is accomplished with the special three-way catalytic converter which converts all 3 major pollutants (HC, CO and NOx). In order for this catalytic converter to be effective, precise control of the oxygen content of gases entering the converter is necessary, thus the need for the oxygen sensor, ECM and special carburetor.

ENGINE SENSORS & SWITCHES

Coolant Temperature Sensor (CTS) — The CTS senses engine coolant temperature and sends a proportionate signal to the ECM. It does not allow C-4 system operation (closed loop) while coolant temperature is below 150° F.

Wide Open Throttle (WOT) — This switch is used to detect full throttle condition. When activated, a signal from the WOT to ECM sets a temporary full rich mixture until throttle moves off wide open position. At which time, the C-4 system returns to pre-WOT operating conditions. This switch is closed at wide open throttle and opens with 5 in. Hg or more of ported vacuum.

Closed Throttle Switch — This switch detects closed or part throttle conditions and sends appropriate signal to ECM. This switch is used in conjunction with WOT to determine intermediate throttle positions. This switch is normally closed until 12 in. Hg or more manifold vacuum is present.

COMPONENT REPLACEMENT

OXYGEN SENSOR

Every 30,000 miles, it is necessary to replace oxygen sensor to prevent system failure. Replace sensor as follows:

Removal — Disconnect sensor electrical connector and spray sensor threads with suitable heat riser valve lube. Allow to soak for at least 5 minutes, then carefully unscrew oxygen sensor and remove.

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Installation - Coat threads of new sensor with anti-seize compound and carefully install. Tighten to 25 ft. lbs.

VACUUM SWITCHES

Removal & Installation - Note vacuum hose position and disconnect hoses from switch assembly. Disconnect electrical connectors. Remove switch and bracket assembly from fender panel. Replace vacuum switch assembly as a unit (both switches and bracket). Install by reversing removal procedure.

ELECTRONIC CONTROL MODULE

Removal & Installation - Remove ECM and mounting bracket as an assembly from left kick panel near parking brake. Disconnect electrical connectors. Remove ECM from mounting bracket. Install new ECM to mounting bracket, connect electrical connectors and install assembly to kick panel. DO NOT ground bracket. Bracket is insulated from vehicle ground.

PROGRAMMABLE READ ONLY MEMORY (PROM)

Removal - 1) Remove ECM from vehicle. Remove access cover screw and cover from ECM. PROM "chip" removal and insertion tool will be included with replacement unit. Remove tool from replacement kit.

2) Starting at opposite end from reference mark ("U2" stamped in ECM next to PROM and rectangular impression and paint stripe on PROM unit), gently work tang of removal tool beneath PROM unit with slight side to side rocking motion. DO NOT attempt to lift out PROM at this time. Remove extraction tool.

3) At reference end, push tang of tool beneath unit (above mating socket), making sure tang is completely under unit. Grasp PROM unit with thumb and forefinger and pull straight up and out.

Installation - 1) Place replacement PROM with leads pointing downward on a flat hard surface. Check part number of new unit to be sure it is the same as one being replaced.

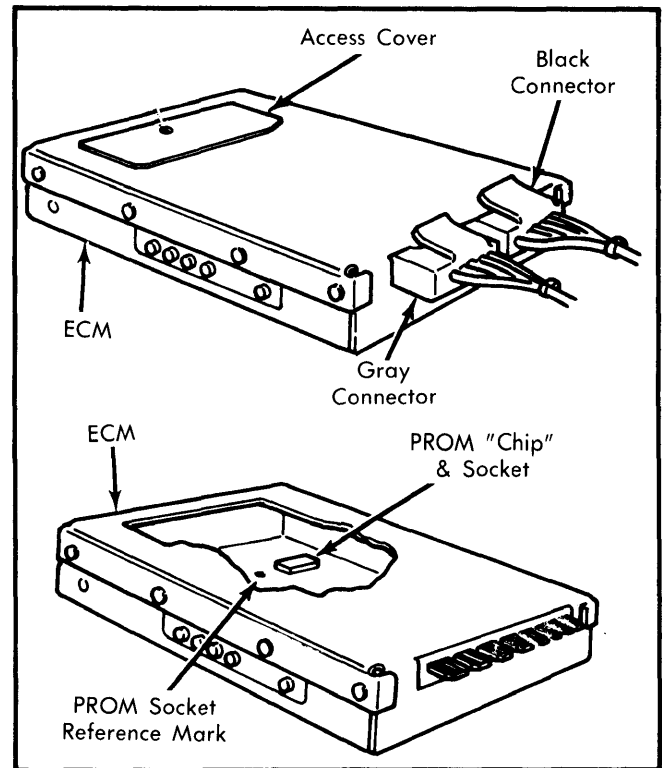


Fig. 2 PROM "Chip" Location

2) Press insertion tool firmly onto unit with reference paint stripe visible. Locate reference end of PROM to reference end of socket ("U2" stamped next to socket). Lightly mate unit with socket.

3) Inspect unit to be sure it is aligned properly and that no pins are bent. Now, fully install unit by pressing down firmly on insertion tool. Remove tool, install access cover and install ECM to vehicle. Start engine and observe "CHECK CARB" display for trouble codes.

NOTE - If trouble code 51 is present after replacement, new unit is either installed backwards, is defective, is not fully

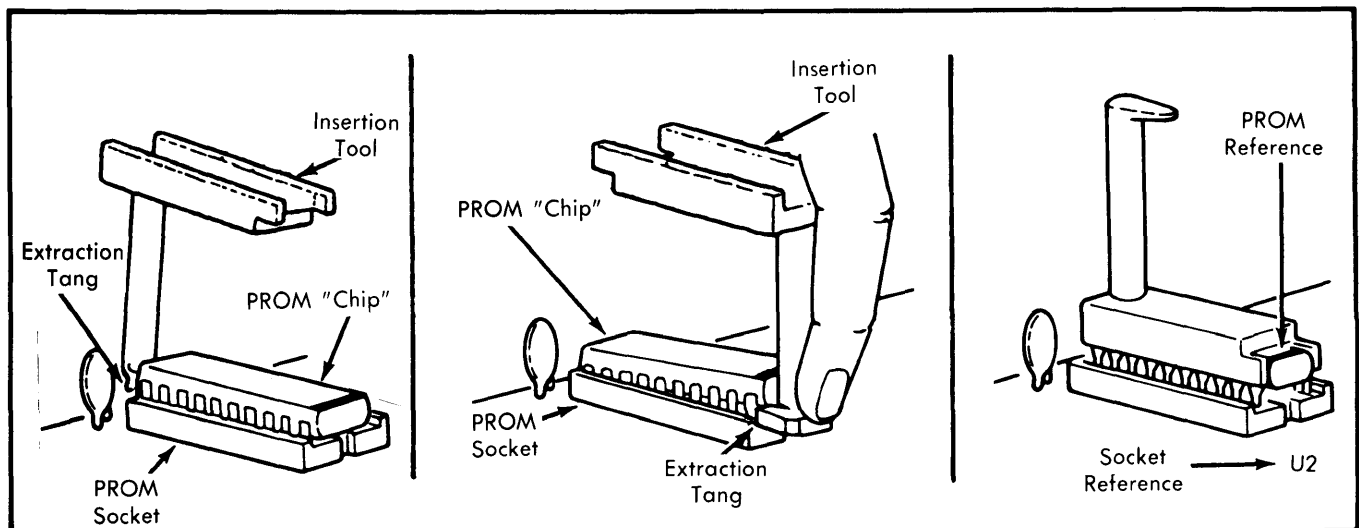


Fig. 3 PROM Removal and Installation Procedure Showing Insertion/Extraction Tool

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seated or has bent pins. Whenever PROM is installed backwards and ignition is switched on, unit will be destroyed. In this event, replace unit.

TESTING & DIAGNOSIS

C-4 DIAGNOSTICS

The C-4 system may be suspected when engine performance, fuel economy or exhaust emissions are improper. A built-in diagnostic system is likely to activate if a problem occurs in the system (however, there is the possibility of this not happening). If the C-4 system contains a problem, a "CHECK CARB" warning light will be activated on the instrument panel. If, however, the warning light is not activated, the following items should be checked before inspecting the C-4 system further:

- Ignition system (dist., timing, plugs, etc.)
- Air cleaner system
- Fuel evaporation system
- PCV system
- EGR valve
- Engine compression
- Intake manifold
- Vacuum hoses
- Carburetor mounting bolts
- Restricted exhaust

WARNING LIGHT CHECK

1) To test warning light and be sure the diagnostic system is operating, turn off the ignition switch, leave engine stopped and ground trouble code test lead located beneath dash (white wire with tracer, attached to ECM harness).

2) If the system is operating properly, when the ignition switch is turned to the "ON" position the "CHECK CARB" light will flash a code 12. Code 12 indicates proper operation of diagnostic system. The 12 will be flashed as follows: One flash, followed by a pause, and then two more flashes. After a longer pause, the code will repeat two more times.

NOTE — If fault is intermittent, "CHECK CARB" light may come on and then go out; however, fault problem will be stored in ECM memory so diagnosis can be performed.

TROUBLE CODES

C-4 diagnostic system is programmed to flash a series of codes through the "CHECK CARB" light. After light becomes activated by the system, it is necessary to ground the trouble code test lead, with engine running, so system can flash proper trouble code.

When "CHECK CARB" light comes on, trouble in C-4 system is indicated. A series of codes are programmed to assist in diagnosis and correction of problem. See C-4 SYSTEM DIAGNOSTIC TROUBLE CODES table for explanation.

Codes are flashed by "CHECK CARB" light after trouble code test lead is grounded. Codes will be flashed as follows: Light will flash 1, 2, 4 or 5 times to indicate first number of trouble code; then, it will (after a short pause) flash 1, 2, 3, 4 or 5 more times to indicate second number of code. After a longer pause, signal will repeat itself two more times.

FOR EXAMPLE — With trouble code test lead grounded and engine running, if problem is a shorted coolant sensor circuit, Code 14, light will flash one time, pause, then flash four times. A long pause, then repeat one-and-four flashes, a long pause and repeat again.

If more than one trouble spot is detected, one code series will flash, then the other code series will flash.

C-4 SYSTEM DIAGNOSTIC TROUBLE CODES	
Trouble Code	Area of Malfunction
12	No tach or reference signal to ECM.
13	Oxygen sensor circuit.
14	Shorted coolant sensor circuit.
15	Open coolant sensor circuit.
21 & 22	(At same time) Grounded WOT switch circuit.
22	Grounded closed throttle or WOT switch circuit.
23	Defective mixture control solenoid circuit.
44	Lean oxygen sensor.
44 & 45	(At same time) Faulty oxygen sensor.
45	Rich oxygen sensor.
51	Faulty PROM unit.
52 & 53	"CHECK CARB" light off — Intermittent ECM problem. "CHECK CARB" light on — Faulty ECM.
54	Faulty mixture control solenoid and/or ECM.
55	Faulty oxygen sensor circuit or ECM.

SYSTEM PERFORMANCE CHECK

Since it is not possible to store a code for every possible problem, one may develop in which the "CHECK CARB" light does NOT come on. If C-4 system is suspected, make a System Performance Check, using a dwell meter, ohmmeter, test light, voltmeter, tachometer, vacuum gauge and jumper wires. Refer to SYSTEM PERFORMANCE CHECK chart later in this article.

Connecting Dwell Meter — Set to 6-Cylinder position and connect dwell meter to mixture control solenoid test lead (green connector at carburetor). On normally operating engines, dwell at both idle and at part throttle will fluctuate between 10-50°. This is the "closed loop" system, meaning the dwell is varying due to reaction from the oxygen sensor through the ECM. At wide open throttle or cold engine dwell will be fixed (needle steady). This is "open loop" since oxygen sensor has no effect upon dwell.

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CAUTION - When attaching dwell meter, do not allow lead to touch ground. This includes hoses, since they are conductive.

DIAGNOSTIC PROCEDURES

Follow the sequence given in the following "Diagnostic Charts" until proper problem identification and correction can be made. Refer to wiring diagram in this article to aid in diagnosis.

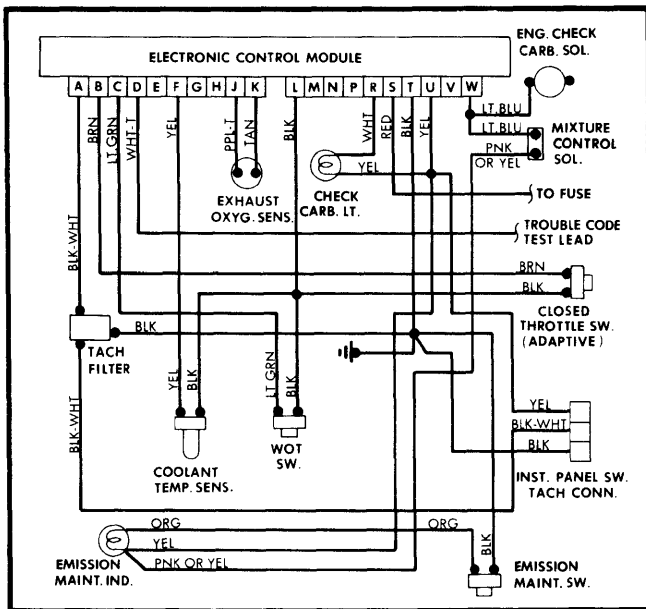
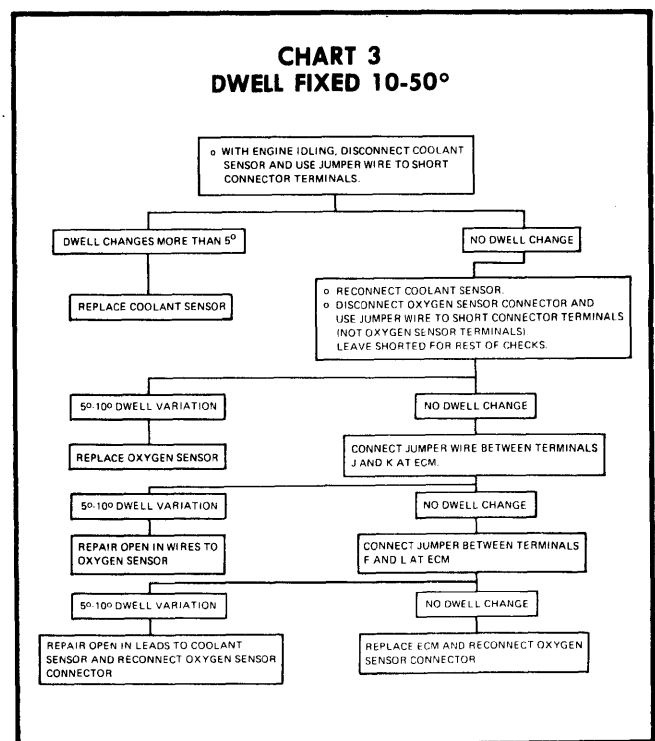
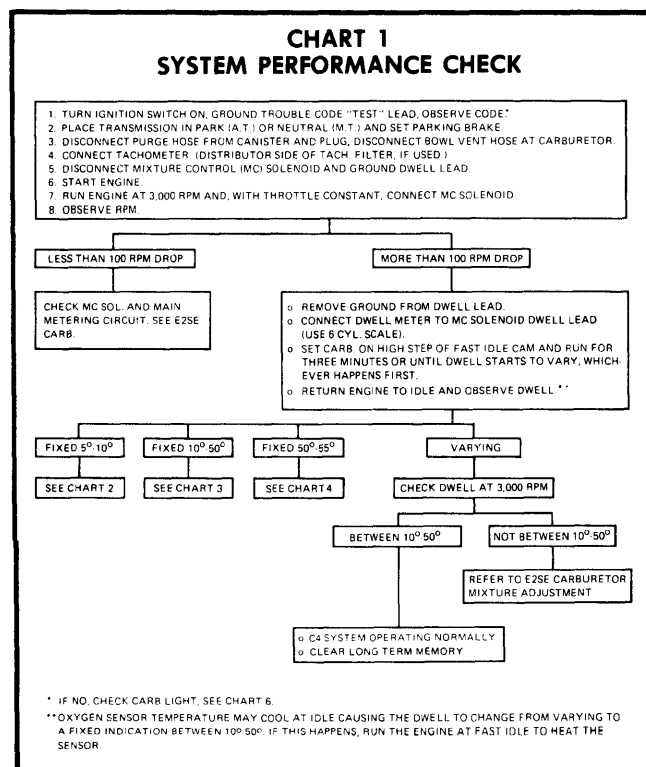
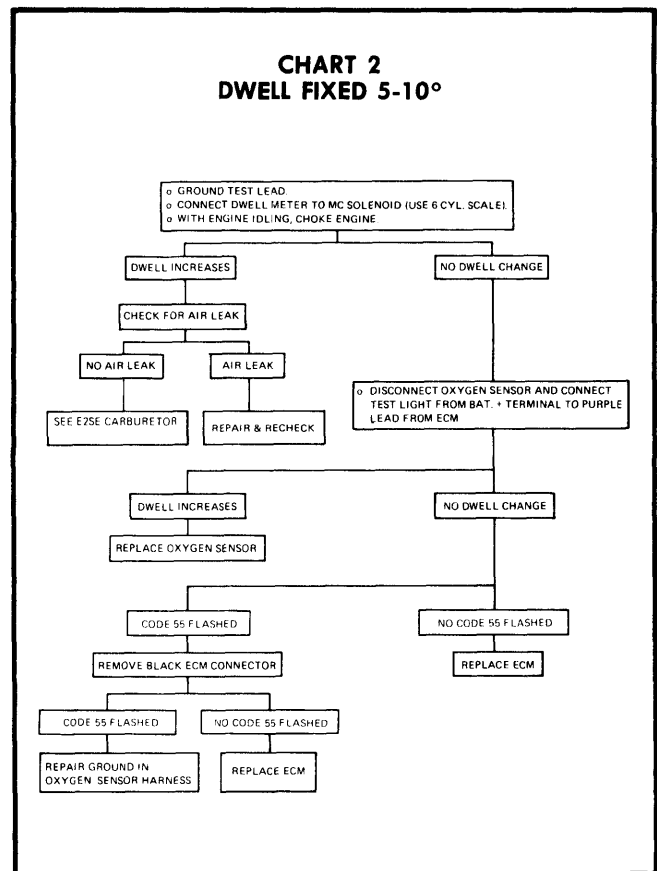
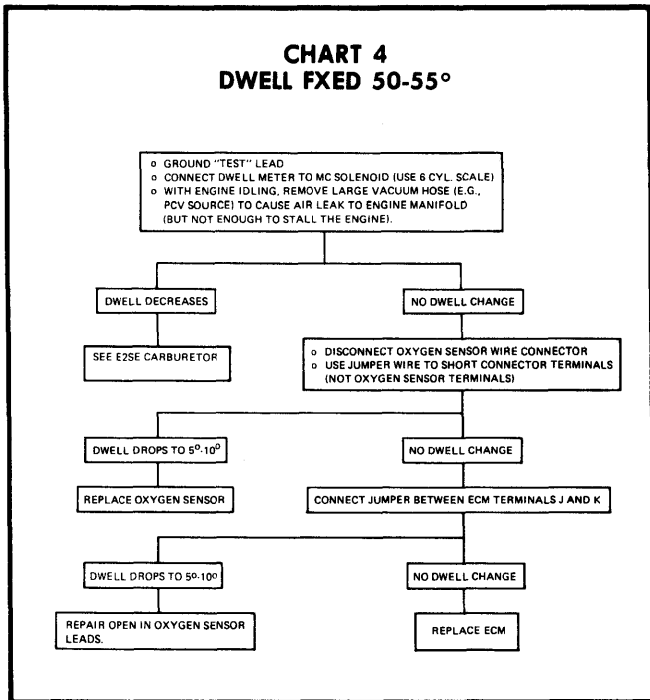


Fig. 4 C-4 System Wiring Diagram for 1981 California Jeep 4-Cylinder Models

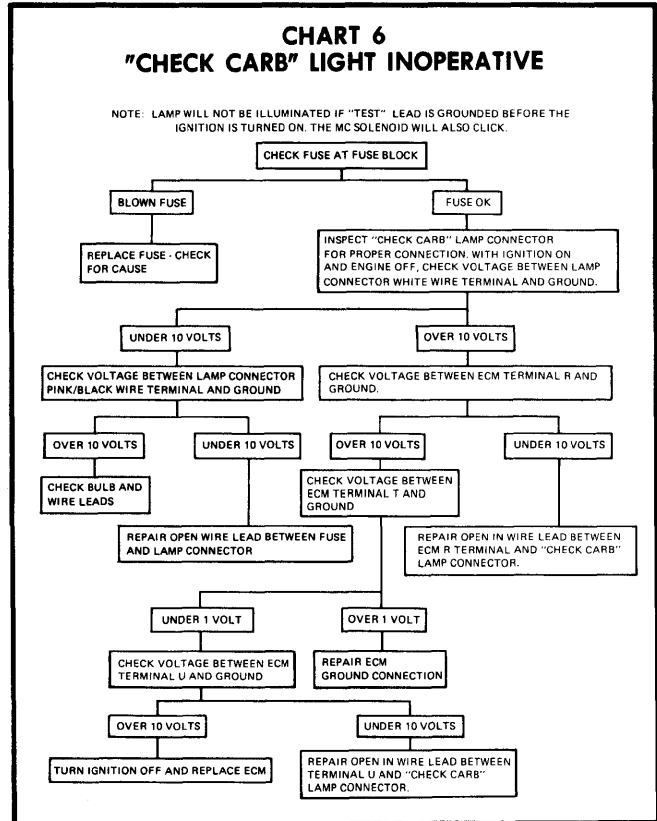


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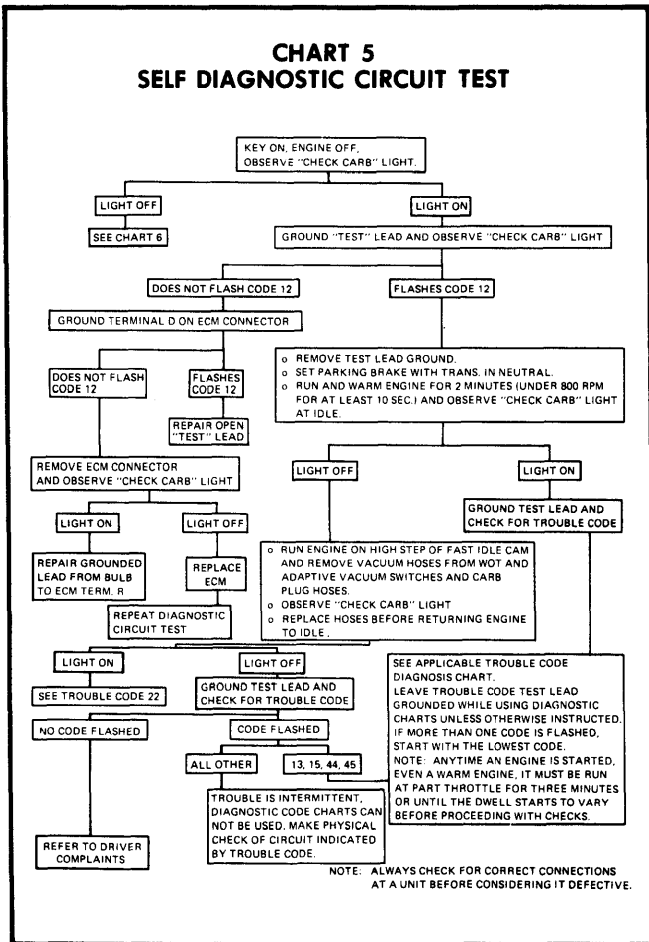
**CHART 4
DWELL FXED 50-55°**



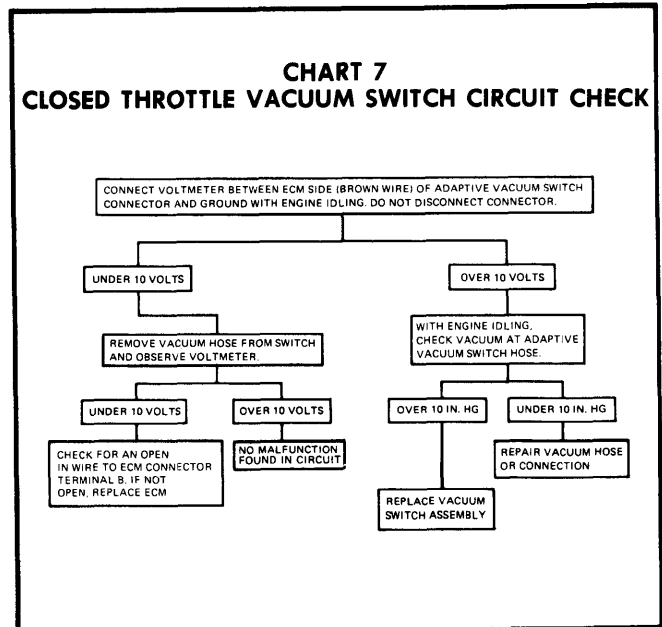
**CHART 6
"CHECK CARB" LIGHT INOPERATIVE**



**CHART 5
SELF DIAGNOSTIC CIRCUIT TEST**

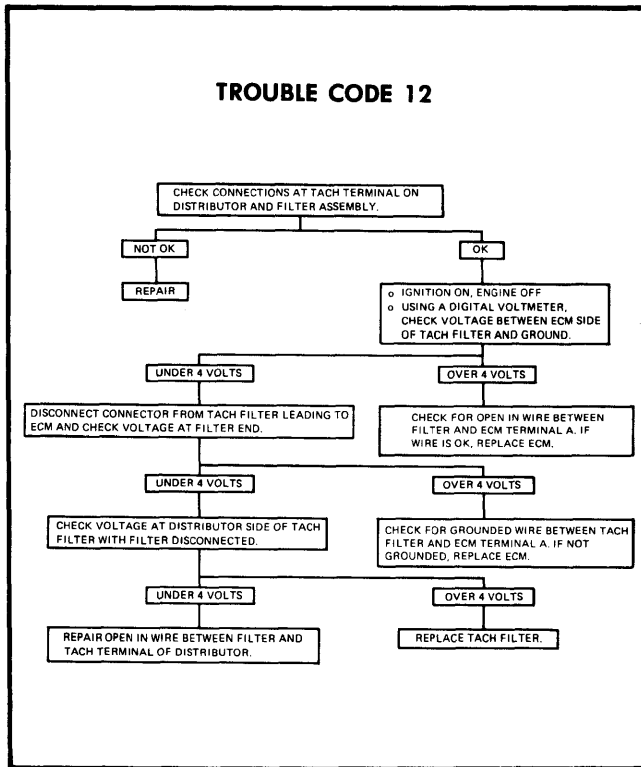


**CHART 7
CLOSED THROTTLE VACUUM SWITCH CIRCUIT CHECK**

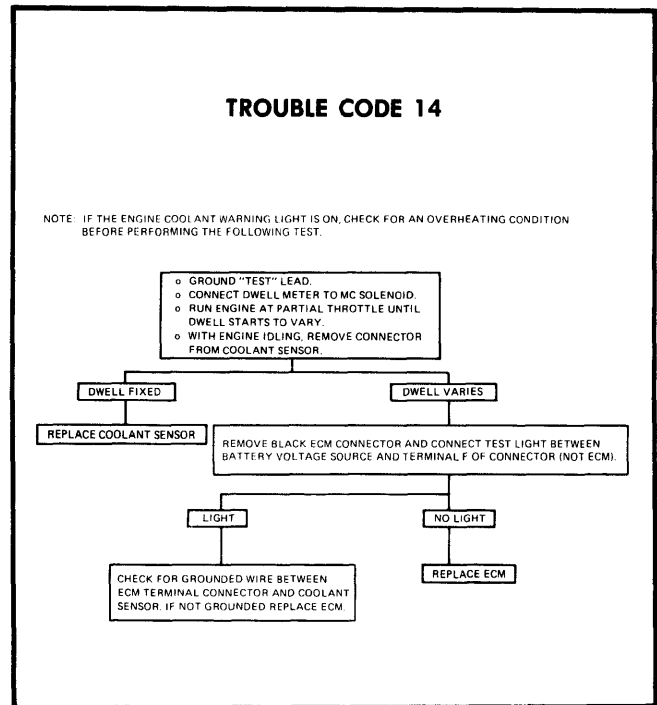


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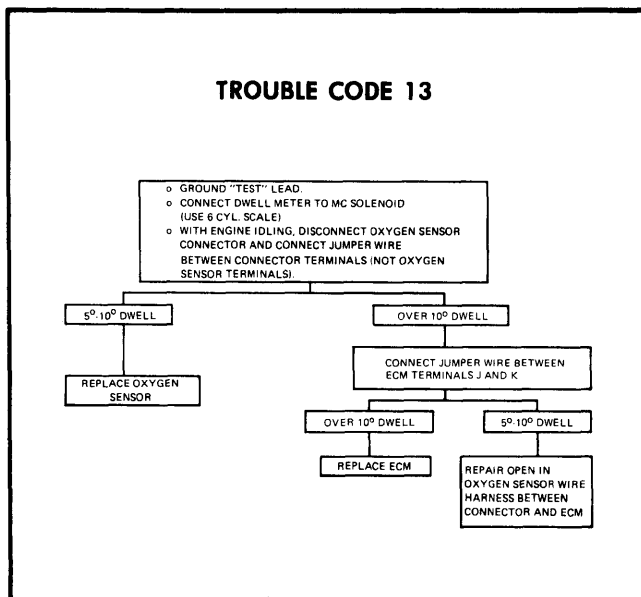
TROUBLE CODE 12



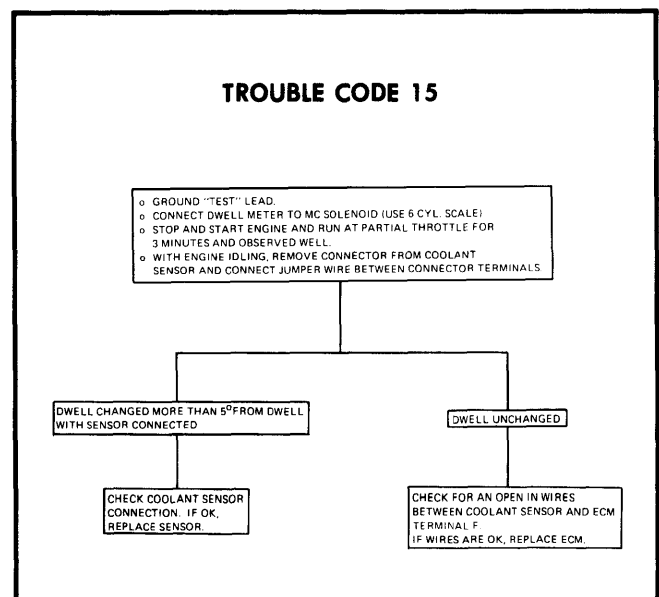
TROUBLE CODE 14



TROUBLE CODE 13

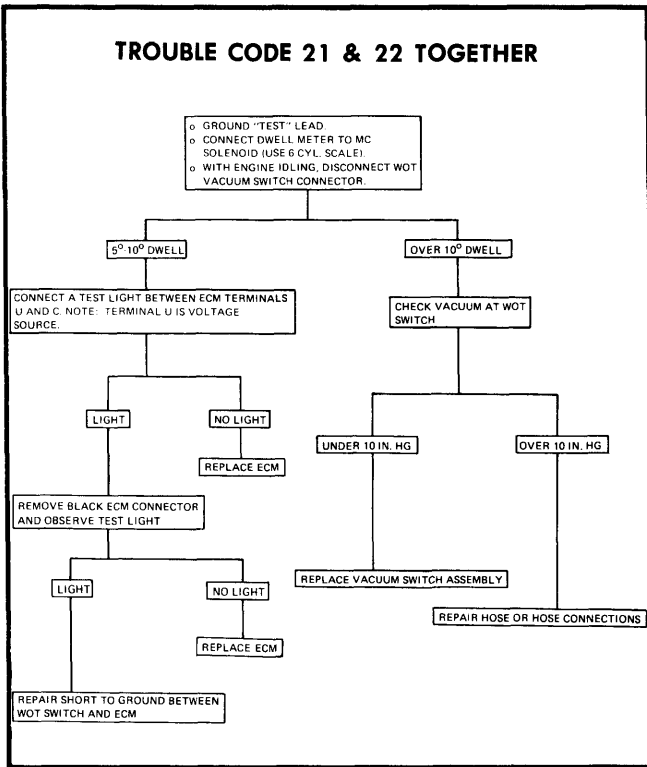


TROUBLE CODE 15

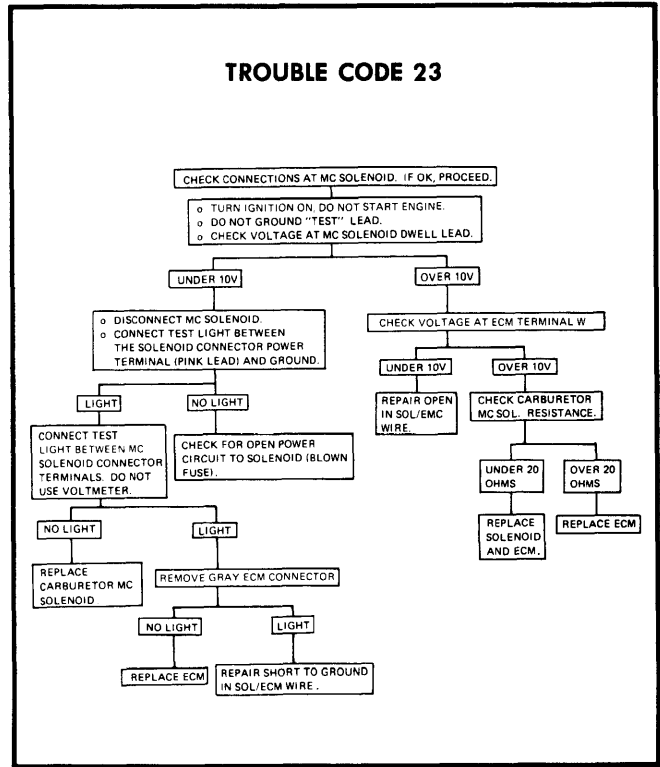


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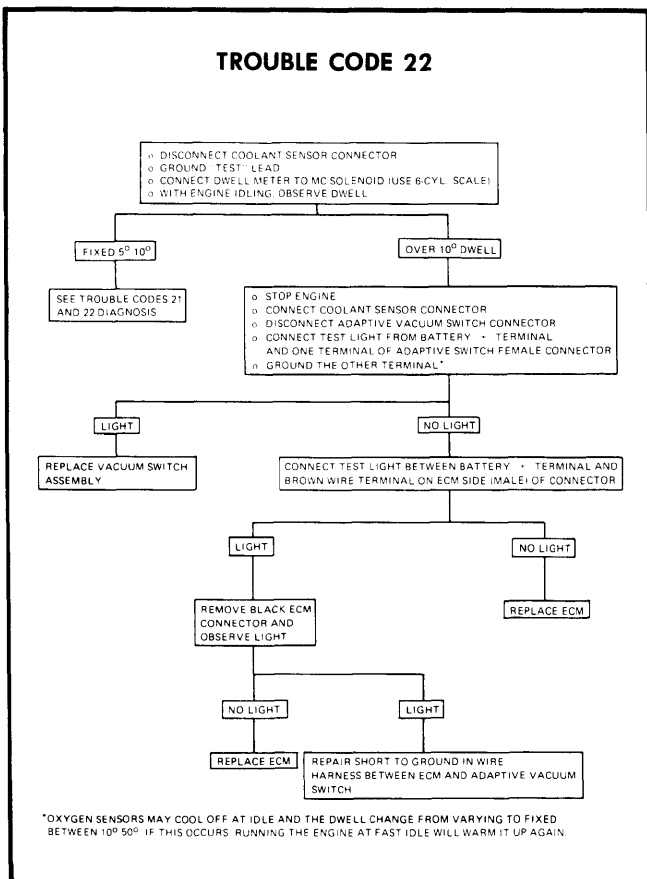
TROUBLE CODE 21 & 22 TOGETHER



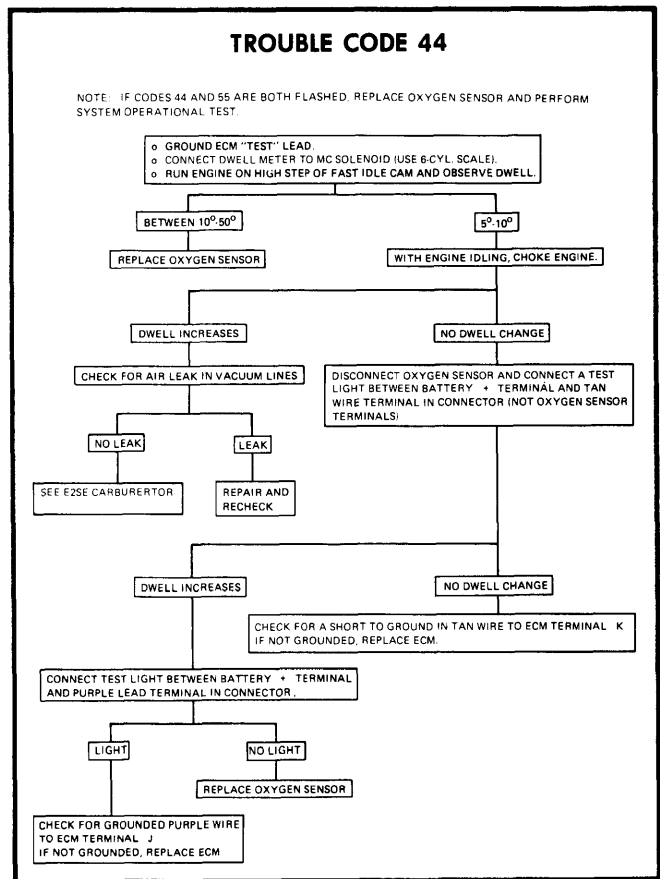
TROUBLE CODE 23



TROUBLE CODE 22



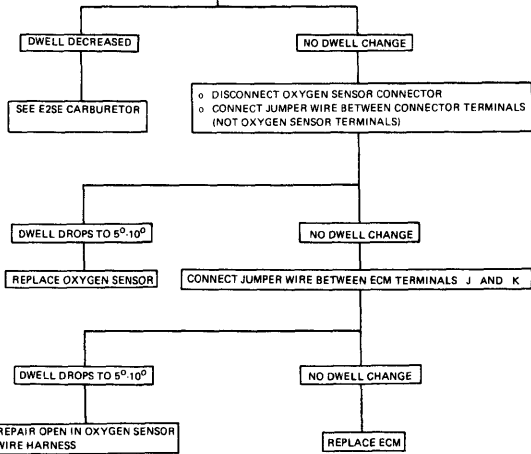
TROUBLE CODE 44



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TROUBLE CODE 45

- o GROUND ECM "TEST" LEAD.
- o CONNECT DWELL METER TO MC SOLENOID (USE 6-CYL. SCALE).
- o WITH ENGINE IDLING, REMOVE LARGE VACUUM HOSE (E.G., PCV SOURCE) TO CAUSE AN AIR LEAK (BUT NOT ENOUGH TO STALL ENGINE).



TROUBLE CODES 51-55

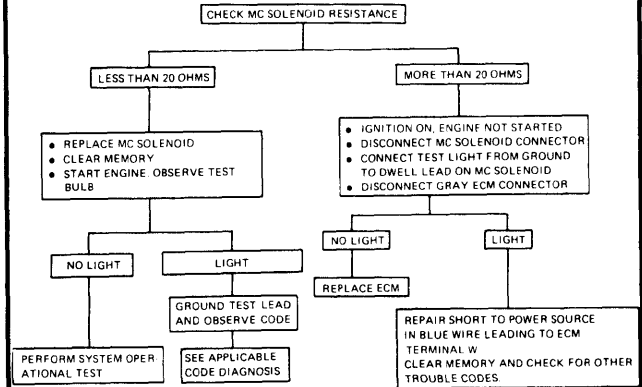
CODE 51

CHECK TO ENSURE ALL CALIBRATION UNIT PINS ARE FULLY INSERTED IN THE SOCKET AND ALIGNMENT IS CORRECT. IF OK, REPLACE ECM.

CODES 52 & 53

REPLACE ECM IF TEST BULB ILLUMINATED. NO TEST BULB LIGHT, INTERMITTENT ECM MALFUNCTION.

CODE 54



CODE 55

CHECK FOR AN OPEN IN OXYGEN SENSOR RETURN WIRE TO ECM TERMINAL K. IF OK, REPLACE ECM.