FEEDBACK CARBURETOR SYSTEM

1986 Isuzu Trooper II

1986 Computerized Engine Controls
ISUZU CLOSED LOOP EMISSION SYSTEM

P'UP, Trooper II

DESCRIPTION

The Closed Loop Emission control system is an electronically controlled system. It monitors various engine/vehicle functions to control engine operation and lower emissions while maintaining good fuel economy and driveability.

OPERATION

The objective of the system is to maintain an ideal air/fuel ratio of 14.7:1 under all operating conditions. When an ideal ratio is maintained, the catalytic converter can effectively control engine pollutants.

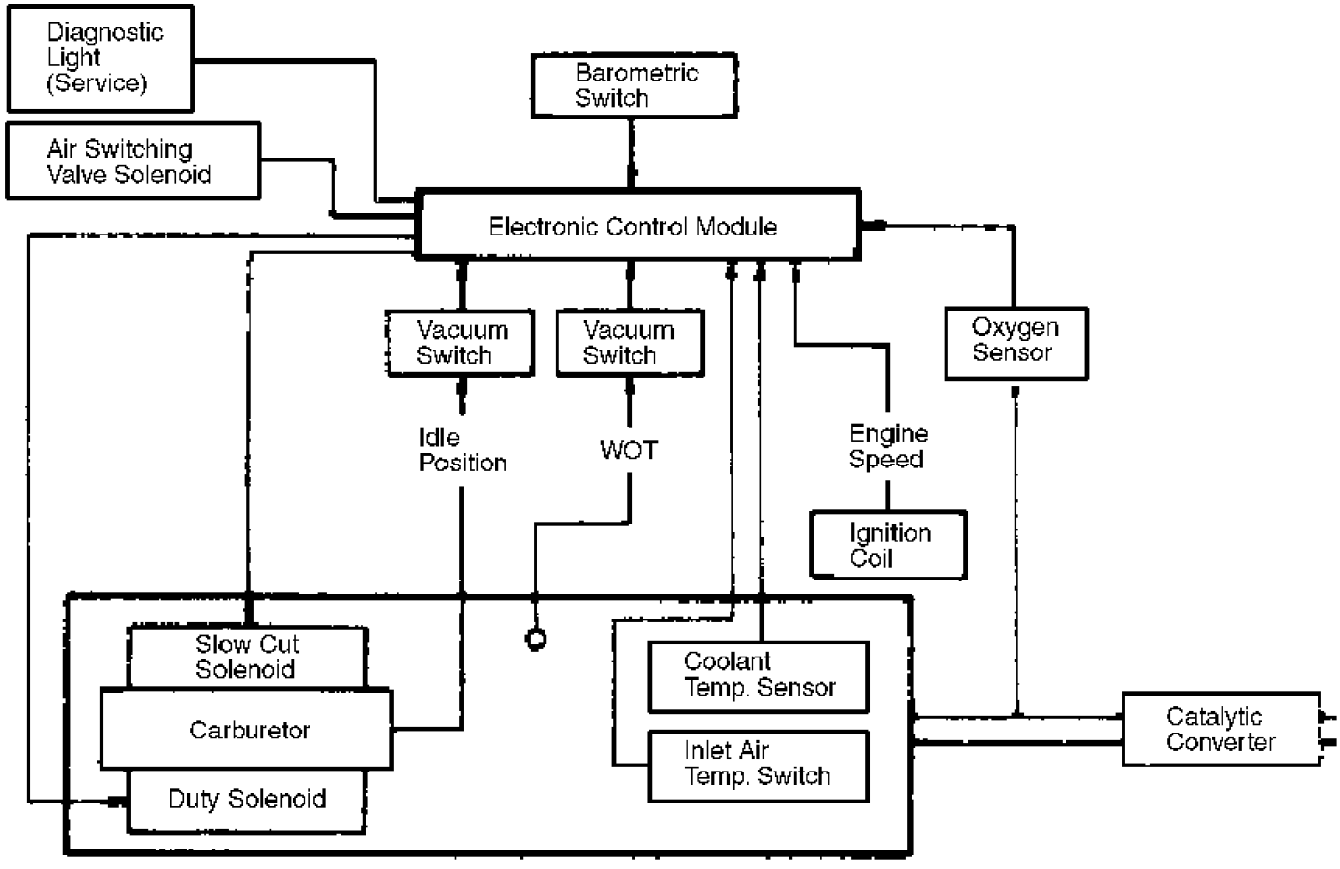


Fig. 1: Closed Loop Emission Control System

FUEL CONTROLS

The engine is equipped with a feedback carburetor. All

models use a Mixture Control (M/C) solenoid to adjust carburetor air/fuel ratio. The ECM responds to inputs from the system sensors and constantly adjusts the air/fuel ratio to maintain engine performance.

When the ECM responds to signals received from oxygen sensor, the system is in Closed Loop operation. Under certain operating conditions, the ECM may ignore inputs from various data sensors and use a pre-programmed setting to operate the engine under that particular condition.

During cold engine starts, the vacuum control or M/C solenoid is turned off by the ECM to provide a rich mixture. Operating conditions which cause the ECM to ignore oxygen sensor signals cause the system to operate in the open loop mode.

OXYGEN SENSOR

This sensor is mounted in the exhaust manifold. It supplies a low voltage when fuel mixture is lean (too much oxygen) and a higher voltage when fuel mixture is rich (not enough oxygen). Oxygen sensor must be hot to function properly. The oxygen sensor measures quantity of oxygen only.

NOTE: No attempt should be made to measure oxygen sensor voltage output. Current drain of 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 only on ECM side of harness after disconnecting from sensor.

COOLANT TEMPERATURE SENSOR (CTS)

The CTS is located in the engine coolant stream to supply coolant temperature information to ECM. This information is used by ECM to determine when system is ready to go into closed loop and to determine operation of the secondary air injection system.

IDLE POSITION SWITCH

This switch is a vacuum controlled switch mounted on a bracket on right side of engine compartment. This switch senses intake manifold vacuum and sends an electrical signal to ECM in relation to amount of manifold vacuum. The ECM uses this information to distinguish between closed throttle (idle) and open throttle positions.

WIDE OPEN THROTTLE SWITCH

This switch is mounted on the same bracket in the engine compartment as the idle position switch. This switch senses intake manifold vacuum and sends an electrical signal to the ECM when engine is at wide open throttle. This information is used by the ECM to distinguish between closed throttle (idle) and wide open throttle positions.

AIR SWITCHING VALVE

The air switching valve directs air from air injection pump into exhaust port. Air switching valve is controlled by ECM during closed loop operation. ECM opens air switching valve when coolant temperature is below a certain level or for a period of time after carburetor is operated at wide open throttle.

BAROMETRIC SWITCH

Barometric switch sends atmospheric pressure information to ECM. Barometric switch prevents "CHECK ENGINE" light from coming on during high altitude operation.

INLET AIR TEMPERATURE SWITCH

Inlet air temperature switch sends air cleaner inlet temperature information to ECM. Inlet temperature switch prevents "CHECK ENGINE" light from coming on during cold engine operation.

ELECTRONIC CONTROL MODULE

The ECM controls all functions of the closed loop system. The ECM sends an electrical signal to the vacuum control or M/C solenoid. This control signal is constantly cycling the solenoid on and off (duty cycle) as a function of the input voltages from the system sensors.

The control signal generated by the ECM is selected from 4 operational modes. These modes include: Inhibit Mode, Enrichment Mode, Open Loop Mode and Closed Loop Mode. A brief description of each mode is as follows:

Inhibit Mode

No electrical signals are sent to the vacuum control or M/C solenoid by the ECM in this mode.

Enrichment Mode

In this mode, a fixed pre-programmed duty cycle electrical signal is sent to the vacuum control or M/C solenoid by the ECM. This signal is sent to the solenoid when fuel enrichment is necessary for cold engine starts or sudden acceleration.

Open Loop Mode

In this mode, the ECM sends electrical signals to the vacuum control or M/C solenoid based on information stored within the ECM. This information has been calculated and used by the ECM to operate the engine at optimum efficiency for that particular operating condition of the engine, without any input from the sensors. Open loop mode is used when the engine has not reached operating temperature.

Closed Loop Mode

In this mode, the ECM sends an electrical signal to the vacuum control or M/C solenoid based on input from the oxygen sensor and other system sensors. In closed loop, the air/fuel mixture is controlled directly by the ECM in response to oxygen sensor signals.

During any operational mode, the ECM maintains the current duty cycle being used within its memory; for either idle or off-idle operation. When the ECM receives a change in idle position, the ECM retrieves data from its memory for optimum operation.

After the initial change in idle position, ECM controls the system in 1 of the 4 operational modes. The ECM also controls the operation of the slow cut solenoid valve incorporated in the carburetor. When the ECM senses a coasting condition, it opens the circuit to the slow cut solenoid valve (engine speed above a predetermined value).

The circuit to the slow cut solenoid valve is cut off only when the vacuum signal of the vacuum switch is below specified vacuum and the engine speed exceeds a predetermined speed.

DIAGNOSIS & TESTING

DIAGNOSTIC SYSTEM

The ECM of the Closed Loop Emission Control system is equipped with a self-diagnostic system which detects system failures or abnormalities. When a malfunction occurs, the ECM will light the amber "CHECK ENGINE" lamp located on the instrument panel. When a malfunction is detected and lamp is turned on, and a corresponding trouble code is stored in ECM memory.

As a bulb and system check, the "CHECK ENGINE" lamp will glow when ignition switch is on and engine is not running. When engine is started, the lamp should go out after 1-4 seconds. If not, a malfunction has been detected in the Closed Loop Emission system.

NOTE: Trouble codes will be recorded at various operating times. Some codes require operation of sensor or switch for 5 seconds; others require operation for 5 minutes or more.

Diagnosis of the Closed Loop Emission system is done in the following order:

1) Ensure all engine systems NOT related to the system are fully operational. Do not proceed with testing unless all other problems have been corrected. Ensure that all electrical and vacuum connections are correct and in good condition.

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

3) Distinguish between fixed or intermittent trouble codes.

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

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

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

TROUBLE CODES

The ECM stores component failure information under a related trouble code which can be recalled for diagnosis and repair. When recalled, these codes will be displayed by flashes of the "CHECK ENGINE" lamp. Codes start with lowest numbered code. Only codes in which a related malfunction has occurred will be displayed.

NOTE: An example of trouble codes is as follows: "FLASH", "FLASH", pause, "FLASH", "FLASH", "FLASH" followed by a longer pause identifies trouble code 23. First series of flashes indicates first digit of trouble code. Second series of flashes indicates second digit of trouble code.

DIAGNOSTIC PROCEDURE

Entering Diagnostic Mode

1) Turn ignition "ON". "CHECK ENGINE" lamp should glow. Locate diagnostic test leads taped to wire harness. Leads are near hood release latch on P'UP and behind right side of radio on Trooper II.

2) Connect terminals together and note "CHECK ENGINE" lamp. "CHECK ENGINE" light will flash trouble code 12 once, pause a short time, then code 12 will repeat 2 more times. This indicates that self-diagnostic system is working.

3) If any trouble codes are stored in ECM memory, the "CHECK

ENGINE" lamp will flash 2-digit codes. Trouble codes will be displayed from lowest to highest numbered code (3 times each) and be repeated as long as the diagnostic terminals are connected.

TROUBLE CODE ID

ECM TROUBLE CODE IDENTIFICATION

Code	Problem
12 (1)	No Ignition Reference Pulse to ECM
13	Oxygen Sensor Circuit
14	Shorted Coolant Sensor Circuit
15	Open Coolant Sensor Circuit
21	Idle Switch Circuit Open or WOT Switch Circuit Shorted
22	Fuel Cut Solenoid Circuit Open or Grounded
23	M/C Solenoid Circuit Open or Grounded
25	Air Switching Solenoid Circuit Open or Grounded
31 (2)	No Ignition Reference Pulse to ECM at Part Throttle, Under Road Load
44	Lean Oxygen Sensor Indication
45	Rich System Indication
51	Shorted Fuel Cut Solenoid Circuit and/or Faulty ECM
52	Faulty ECM (RAM Problem in ECM)
53	Shorted Air Switching Solenoid and/or Faulty ECM
54	Shorted M/C Solenoid and/or Faulty ECM
55	Faulty ECM (A/D Converter in ECM)

(1) - This code is not stored in memory and will only flash while fault is present.
(2) - This code will be stored in memory.

Clearing Trouble Codes

To clear memory of trouble codes, remove ECM fuse for 10 seconds.

Exiting Diagnostic Mode

To exit diagnostic mode, turn ignition off. Disconnect diagnostic terminals.

NOTE: The terms "Enter Diagnostics" and "Exit Diagnostics" will be used periodically throughout this section. Follow the procedure for entering diagnostic mode when instructed to "Enter Diagnostics". Follow the procedure for exiting diagnostic mode when instructed to "Exit Diagnostics".

Diagnostic Circuit Check

If complaint is "CHECK ENGINE" lamp 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 code which is displayed and refer to appropriate trouble code chart.

Driver Complaint Check

1) If complaint is not "CHECK ENGINE" lamp related, this check will lead to most likely problem area. However, first make checks that would normally be made for the complaint on vehicle

without Closed Loop Emission Control system.

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

System Performance Check

1) This check verifies that system is functioning properly. This check should always be made after any repair on the system.

2) When performing this check, always engage parking brake and block drive wheels. Transmission should be in Neutral (man. trans.) or Park (auto. trans.).

Diagnostic Tools

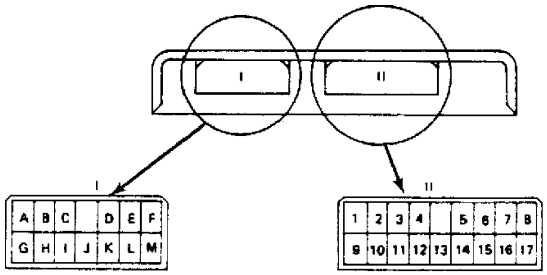
1) The Closed Loop Emission Control system does not require special tools for diagnosis. A dwell meter, tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance (minimum), vacuum pump, vacuum gauge and jumper wires are the only tools necessary for diagnosis.

2) A test light, rather than a voltmeter, must be used where indicated in diagnostic chart. A dwell meter is used to measure the time that the vacuum control solenoid circuit is on or off.

3) Set dwell meter on 4-cylinder scale. Connect positive lead of dwell meter to Bright Green connector in Closed Loop wiring harness. and negative lead to ground. The scale on the meter will show condition of the circuit.

4) When needle is at 10°, this indicates a rich mixture. A lean mixture will read near 54°. A varying needle indicates that system is in closed loop.

NOTE: If engine performance changes when dwell meter is connected to system, remove dwell meter and use another type. A few brands are not compatible with the electronic emission system.



PIN	FUNCTION
A	Vacuum Control Solenoid
B	Carb. Fuel Cut Solenoid
C	System Malfunction Lamp
D	Battery +
E	WOT Switch Ground
F	Battery + (Memory Back-Up)
G	Power Ground
H	Not Used
I	AIR Solenoid Output
J	Ignition Coil Tach. Input
K	Idle Position Switch Ground
L	Not Used
M	Control Ground
1	Oxygen Sensor Input
2	Coolant Temp. Sensor Input
3	Not Used

PIN	FUNCTION
4	Ground
5	Barometric Switch Input
6	Idle Position Switch Input
7	WOT Switch Input
8	Diagnose Decode
9	Inlet Air Temp. Switch & Barometric Switch Ground
10	Oxygen Sensor Ground
11	Coolant Temp. Sensor Ground
12	Not Used
13	Inlet Air Temp. Switch Input
14	Not Used
15	Not Used
16	Not Used
17	Oxygen Sensor Signal Monitor

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Fig. 2: Electronic Control Module Terminal Identification

DIAGNOSTIC CIRCUIT CHECK

DIAGNOSTIC CIRCUIT CHECK

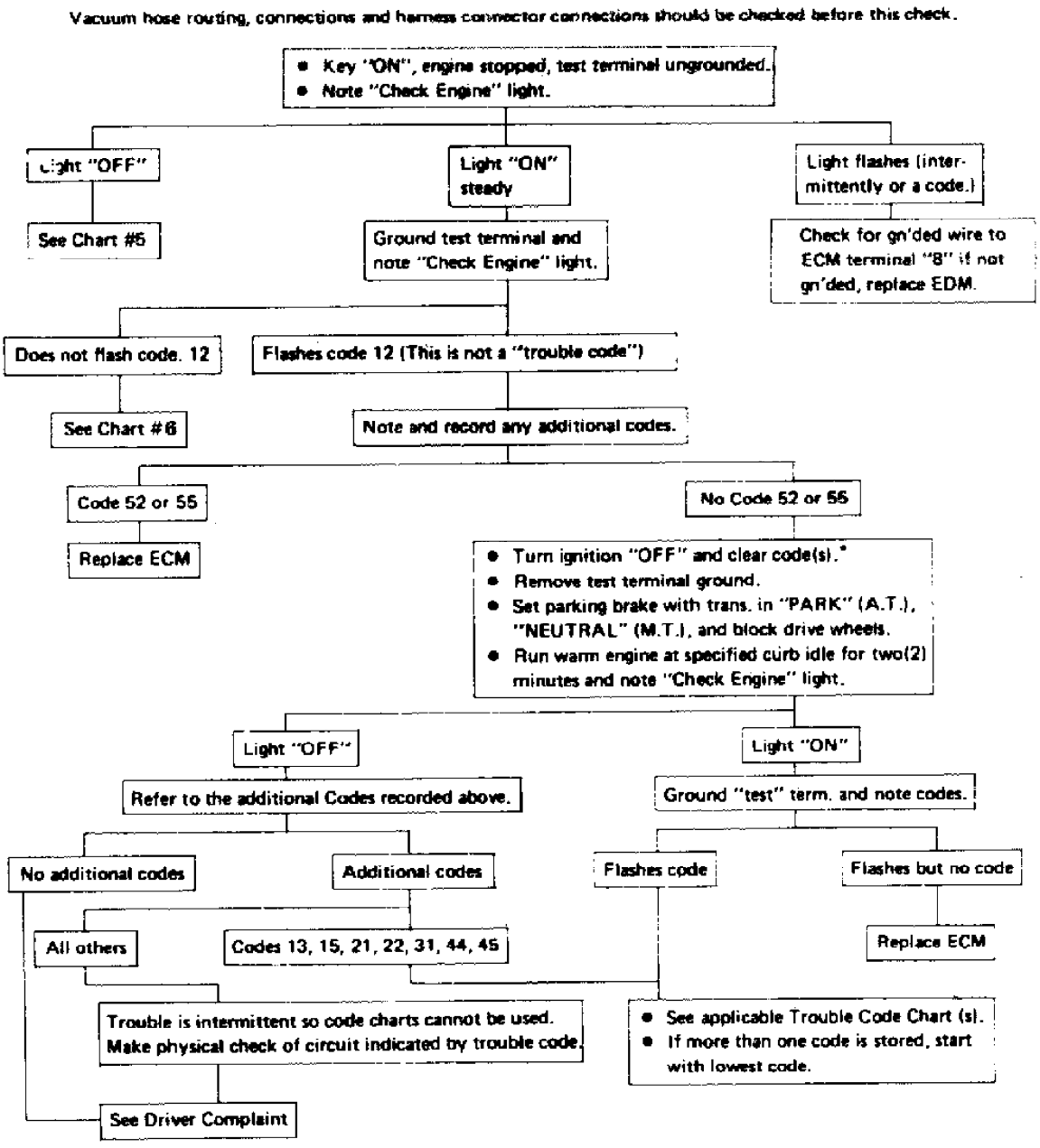

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Fig. 3: Diagnostic Circuit Check

DRIVER COMPLAINT

DRIVER COMPLAINT

Engine Performance Problem (Odor, Surge, Fuel Economy ...) Emission Problem

If the "CHECK ENGINE" light is not on, normal checks that would be performed on cars without Closed Loop Emission Control System should be done first.

If generator or coolant light is on with the "Check Engine" light, they should be diagnosed first.

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

- Intermittent check engine light but no Trouble Code stored:

  If for any reason engine rpm drops below 200, the check engine light will come on until rpm exceeds 200 and for 4 sec after rpm exceeds 200.

  Check for intermittent connection in circuit from:
  - Distributor to ECM terminal "J"
  - Battery to ECM terminal "F"
  - ECM terminal "G" to engine ground
  - ECM terminal "C" to Lamp Driver
  - ECM terminal "D" to Battery (including ECM Relay circuit)

  Low battery voltage (Under 9 Volts) at ECM

  Loss of trouble code memory

  Momentarily grounding dwell lead with engine idling should give code 23 which should be retained after engine is stopped and ignition turned to "on" position. If voltage is present at ECM term "F" but no code is stored, ECM is defective.

- Stalling, rough idle or improper idle speed

  Refer to idle speed adjustment procedure.

  Check – carburetor mixture control solenoid. (Fig. E–24).

- Detonation

  Check carburetor mixture control solenoid. See SYSTEMS PERFORMANCE CHECK.

- Surge

  Check idle switch and WOT switch assembly. See SYSTEMS PERFORMANCE CHECK.

- Poor performance and/or fuel economy

  Check carburetor mixture control solenoid. See SYSTEMS PERFORMANCE CHECK.

- Poor full throttle performance

  See chart #4 – vacuum switch enrichment circuit check.

  Check carburetor mixture control solenoid. See SYSTEMS PERFORMANCE CHECK.

- All other complaints

  Make "System Performance Check" on warm engine (upper radiator hose hot)

The "System Performance Check" should be performed after any repairs to the "System" have been made.

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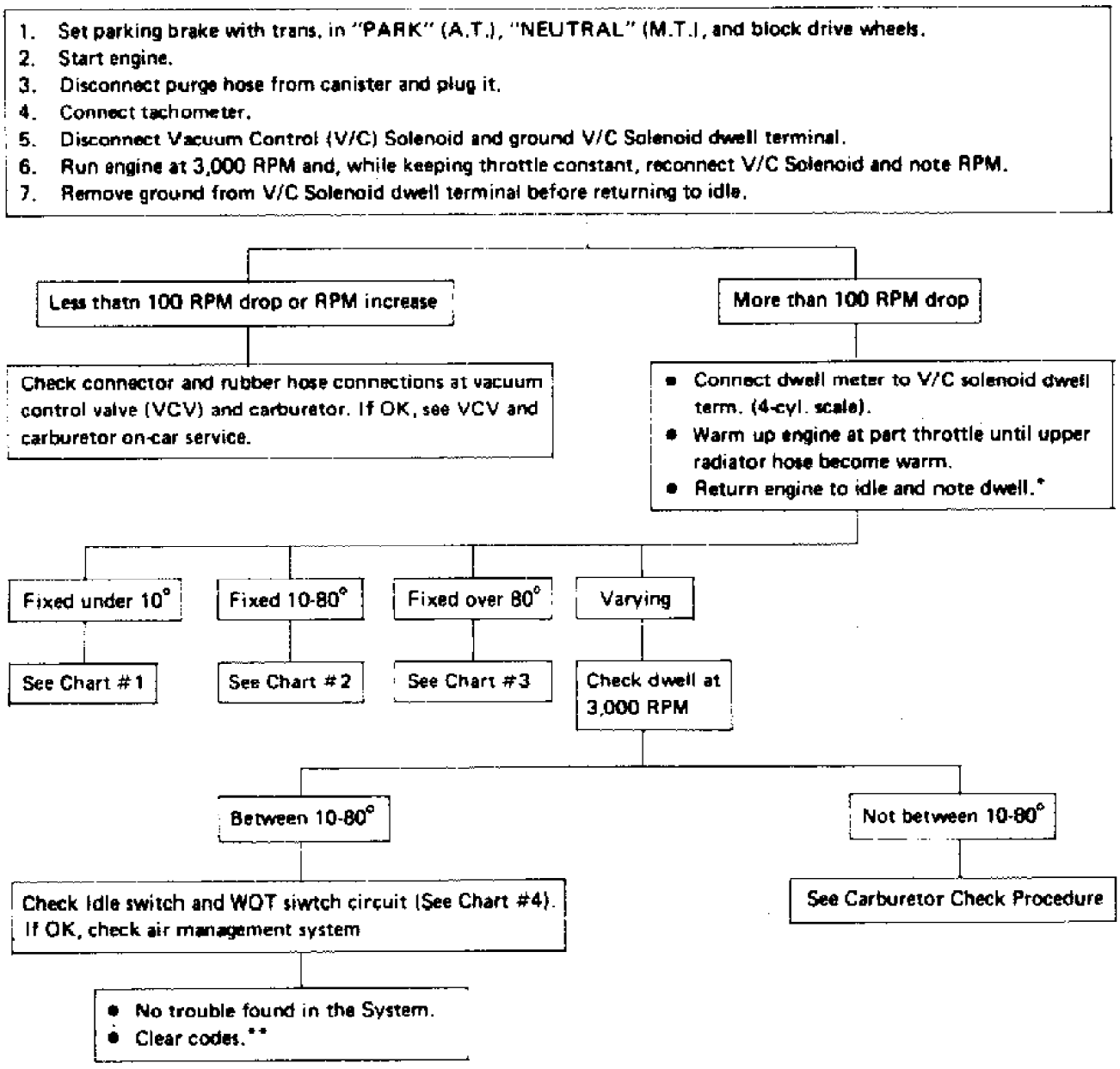
Fig. 4: Driver Complaint

SYSTEM PERFORMANCE CHECK

SYSTEM PERFORMANCE CHECK



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

** See Code(s) Clearing Procedure.

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Fig. 5: System Performance Check

CHART 1, DWELL FIXED UNDER 10

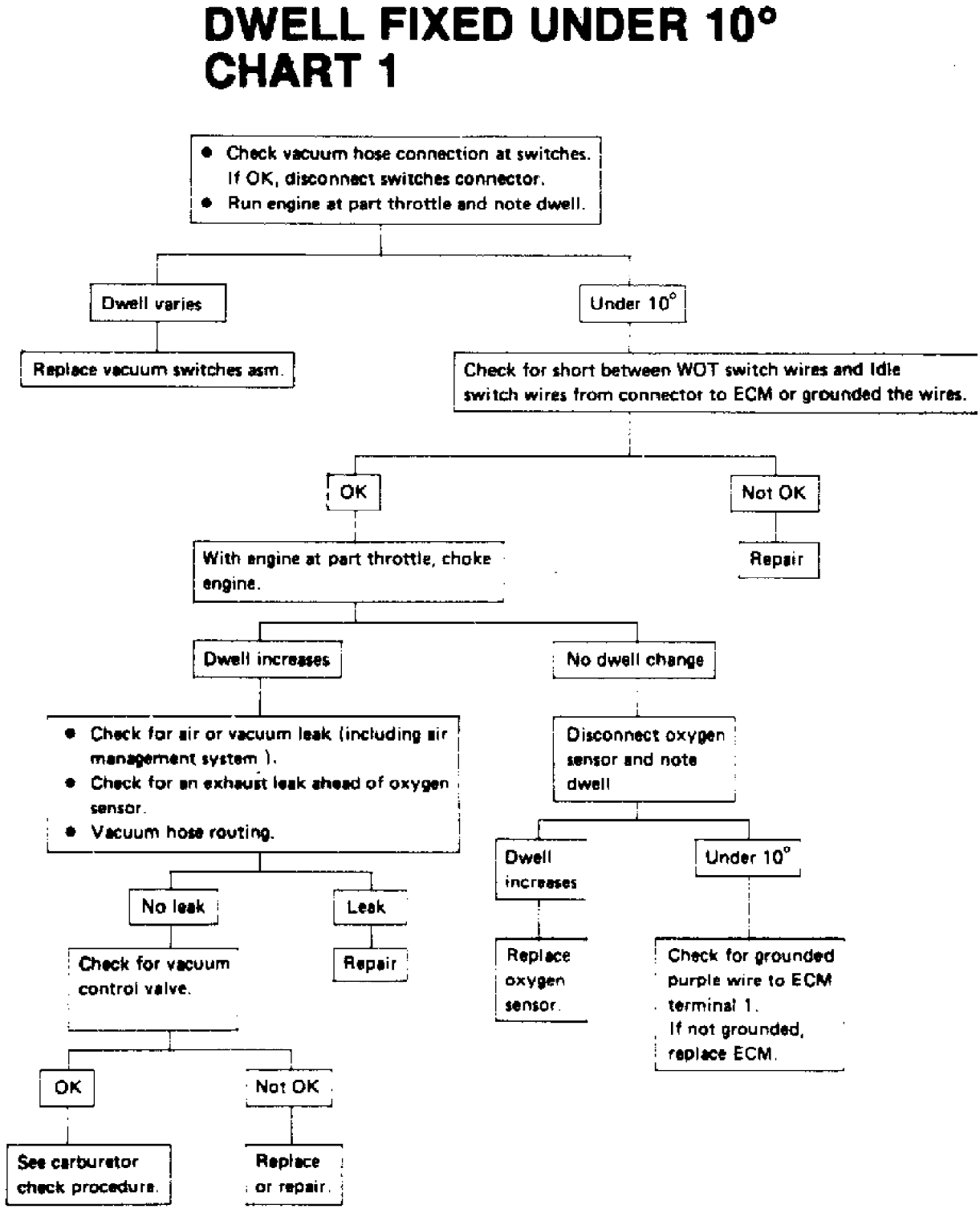

Fig. 6: Chart 1, Dwell Fixed Under 10°

CHART 2, DWELL FIXED BETWEEN 10-80

OPEN COOLANT SENSOR OR OXYGEN SENSOR CIRCUIT

DWELL FIXED BETWEEN 10-80° CHART 2

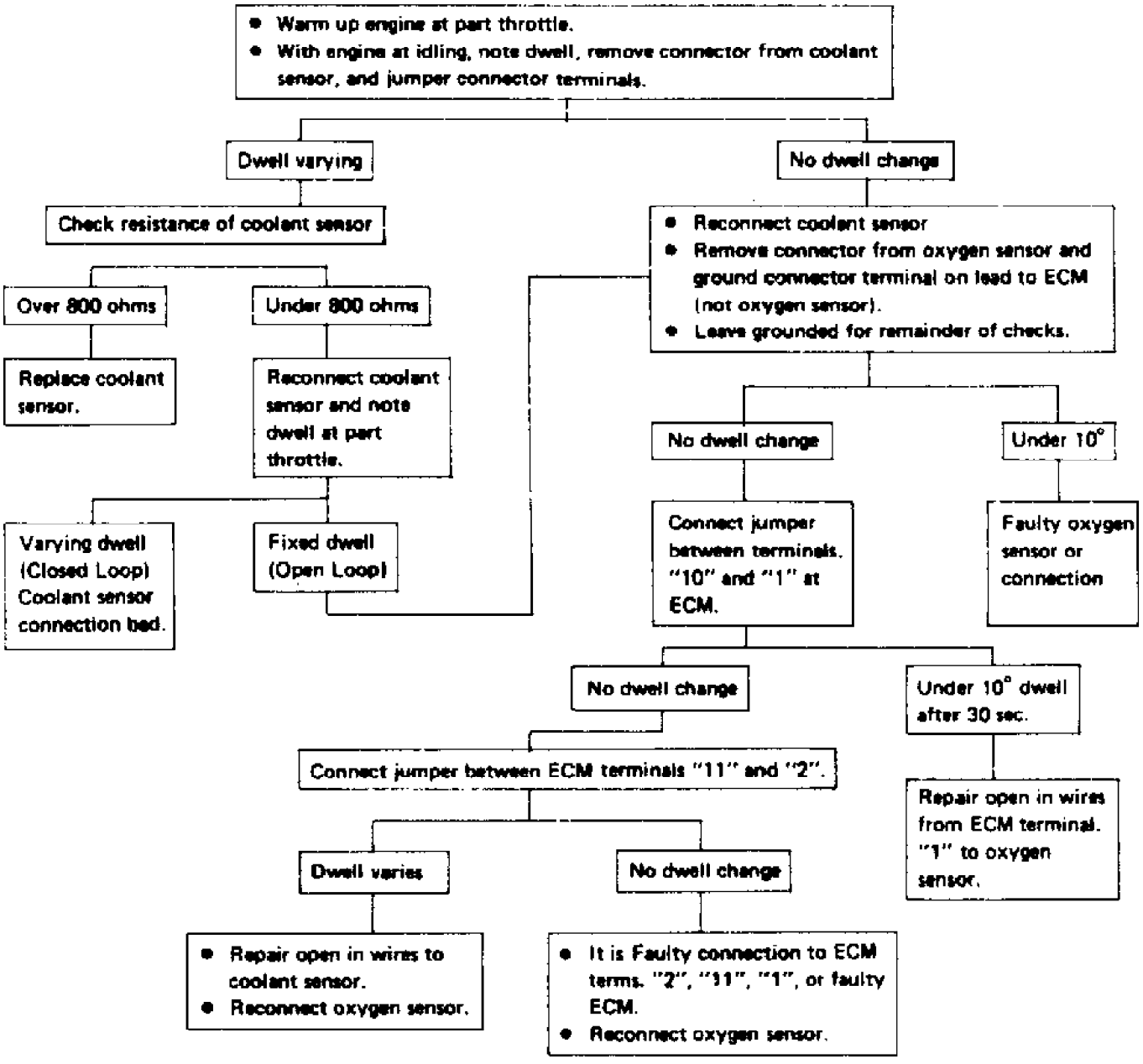

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Fig. 7: Chart 2, Dwell Fixed Between 10-80° (Open coolant sensor Or Oxygen Sensor Circuit)

CHART 3, DWELL FIXED OVER 80 RICH CONDITION INDICATION

DWELL FIXED OVER 80° CHART 3

Rich Engine Condition Indication

Note: A restricted air cleaner can cause a rich engine condition.

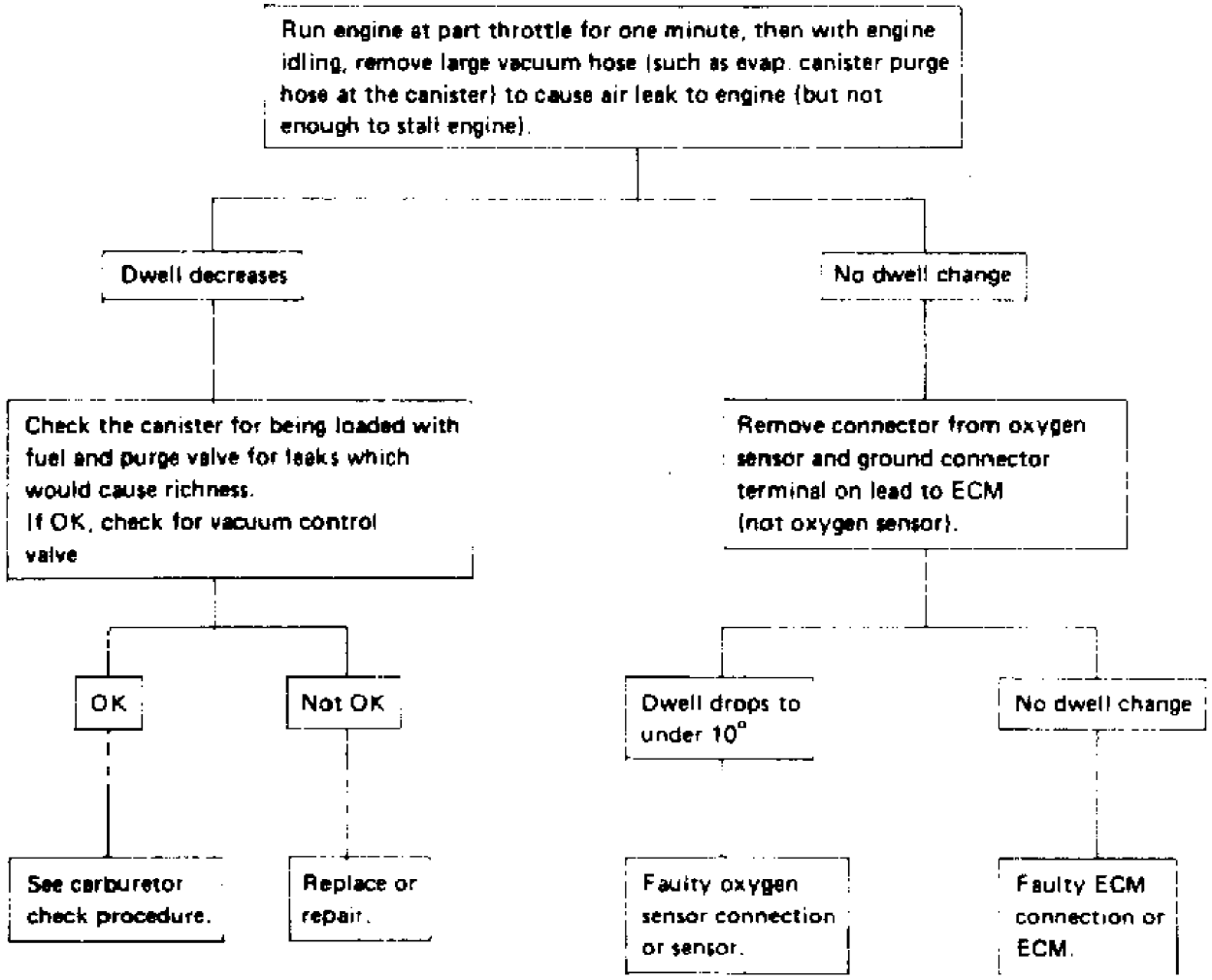

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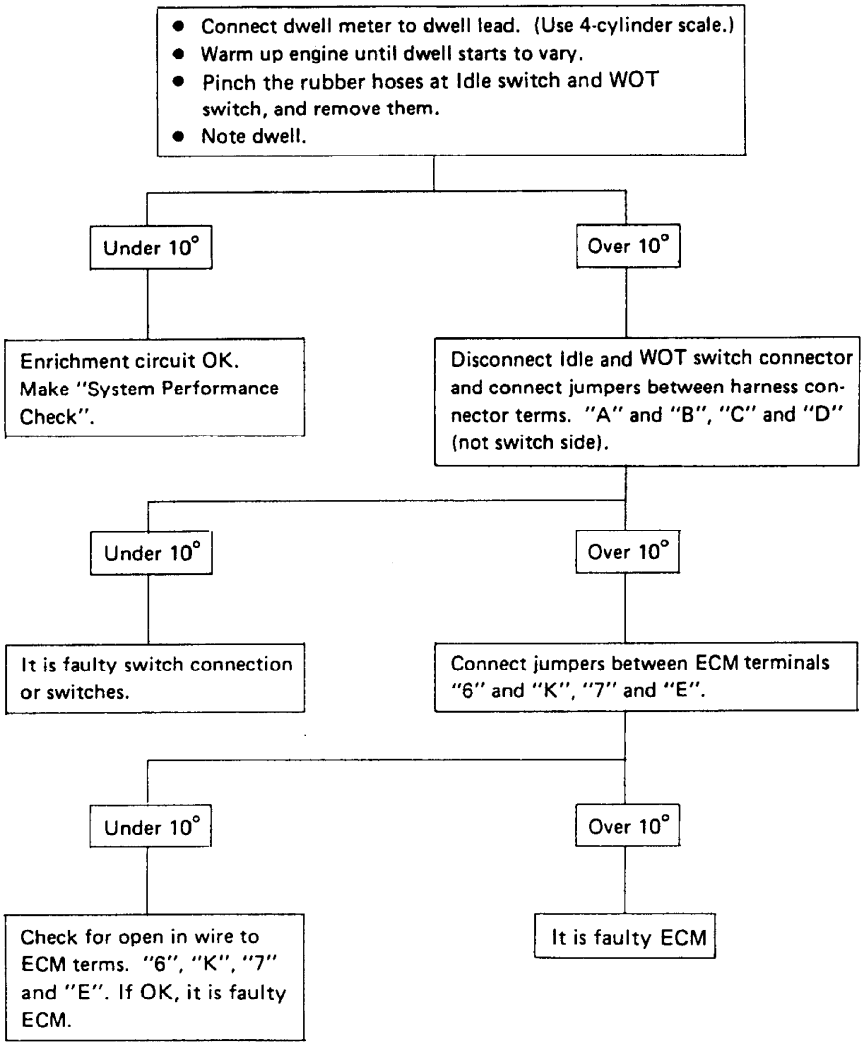
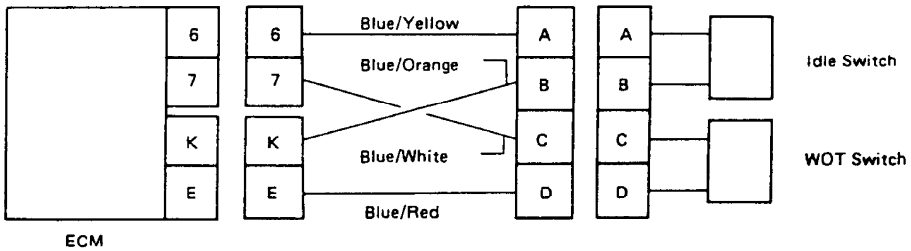
Fig. 8: Chart 3, Dwell Fixed Over 80° (Rich Condition Indication

CHART 4, IDLE SWITCH & WOT SW. CIRCUIT CHECK

CHART #4
IDLE SWITCH AND WOT SWITCH CIRCUIT CHECK





WOT : Wide Open Throttle
ECM : Electronic Control Module

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Fig. 9: Chart 4, Idle Switch & WOT Sw. Circuit Check

CHART 5, "CHECK ENGINE" LIGHT INOPERATIVE

"CHECK ENGINE" LIGHT INOPERATIVE CHART 5

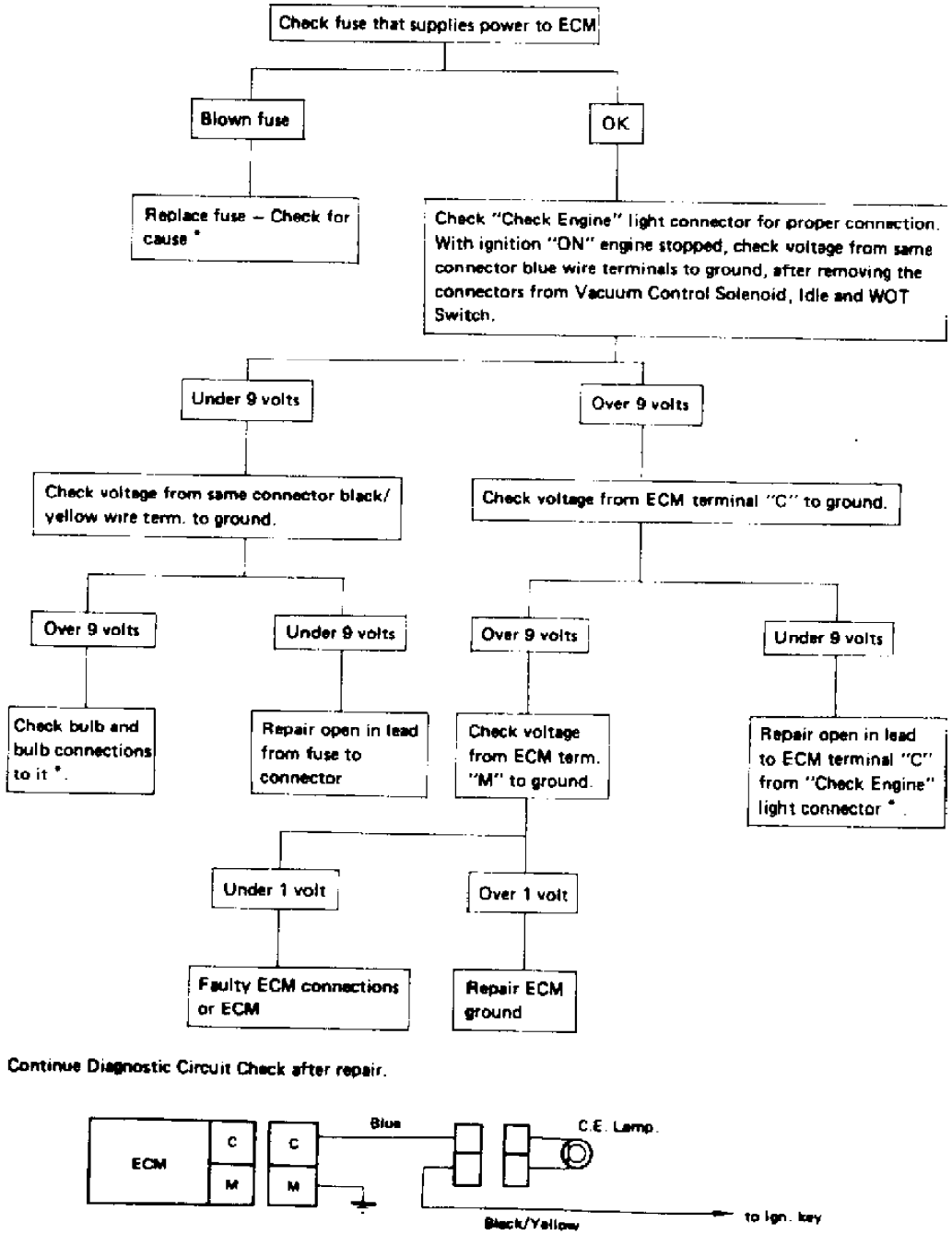

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Fig. 10: Chart 5, "CHECK ENGINE" Light Inoperative

CHART 6, NO CODE 12

WON'T FLAST CODE 12
CHART 6

Check fuse that supply power to ECM.

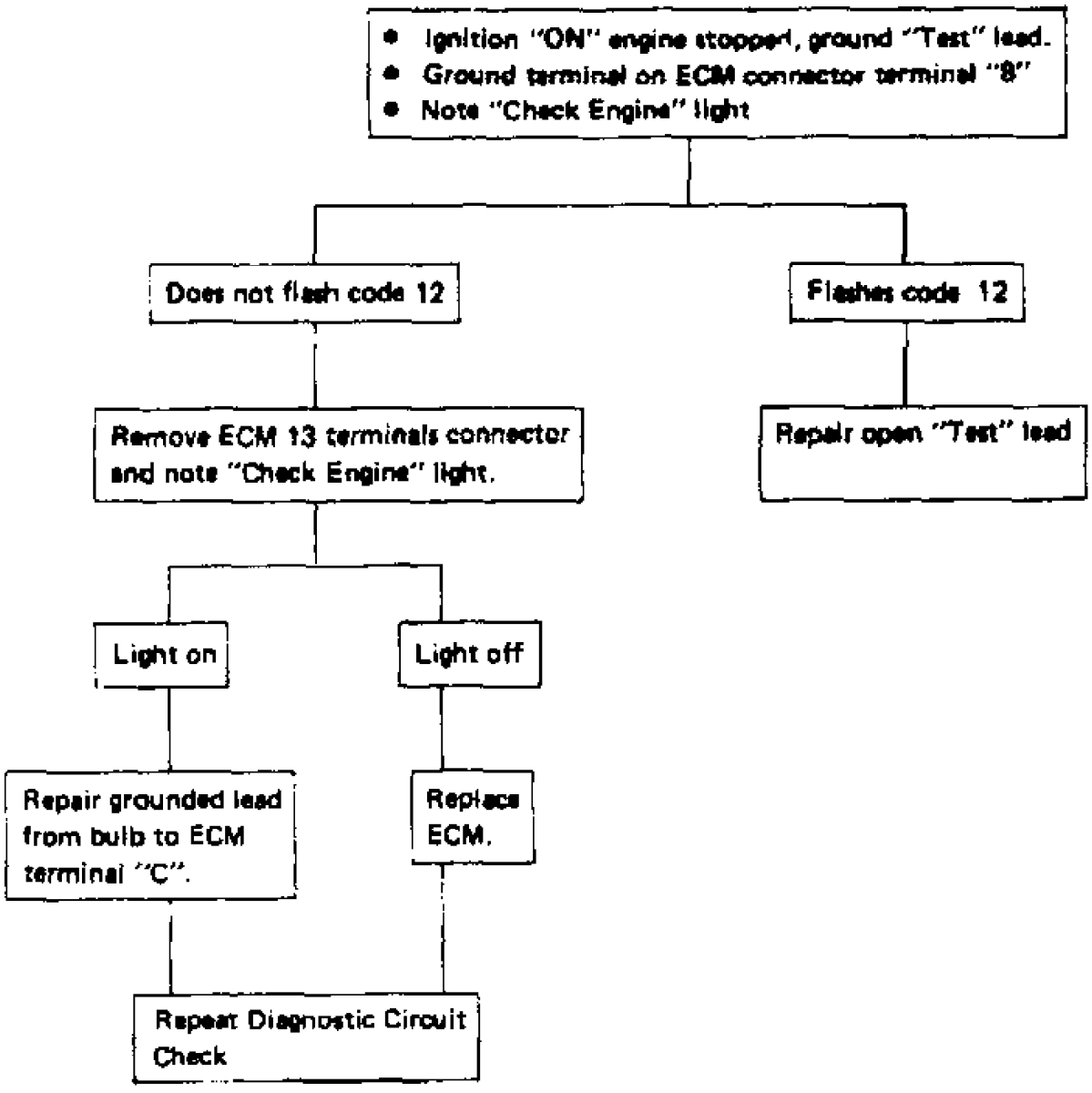

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Fig. 11: Chart 6, Won't Flash Code 12

CODE 12, NO REFERENCE PULSES TO ECM

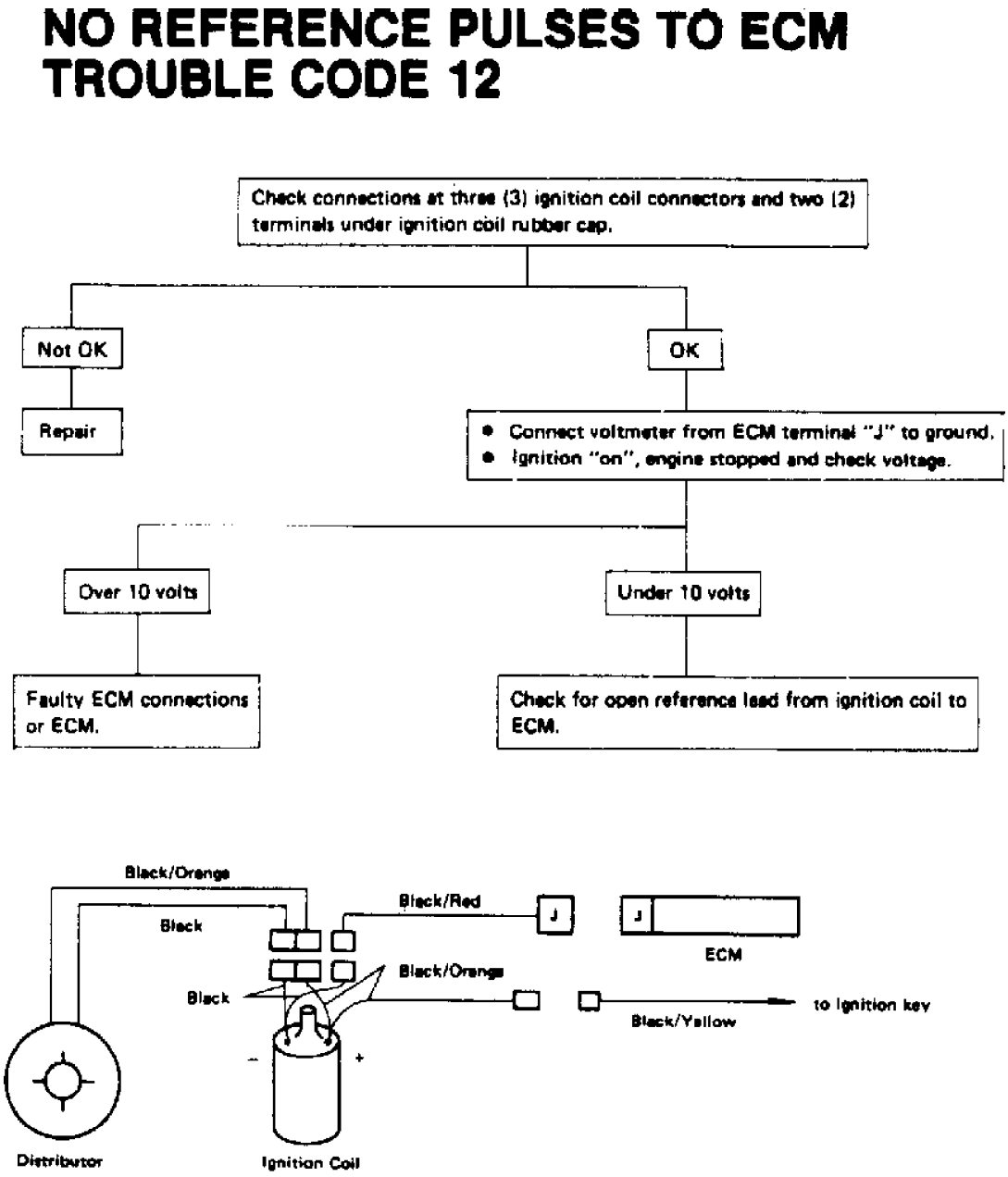

Fig. 12: Trouble Code 12, No Reference Pulses to ECM

CODE 13 - OPEN O2 SENSOR CIRCUIT

If 13 and 23 are displayed, go to Trouble Code 23 Chart first.

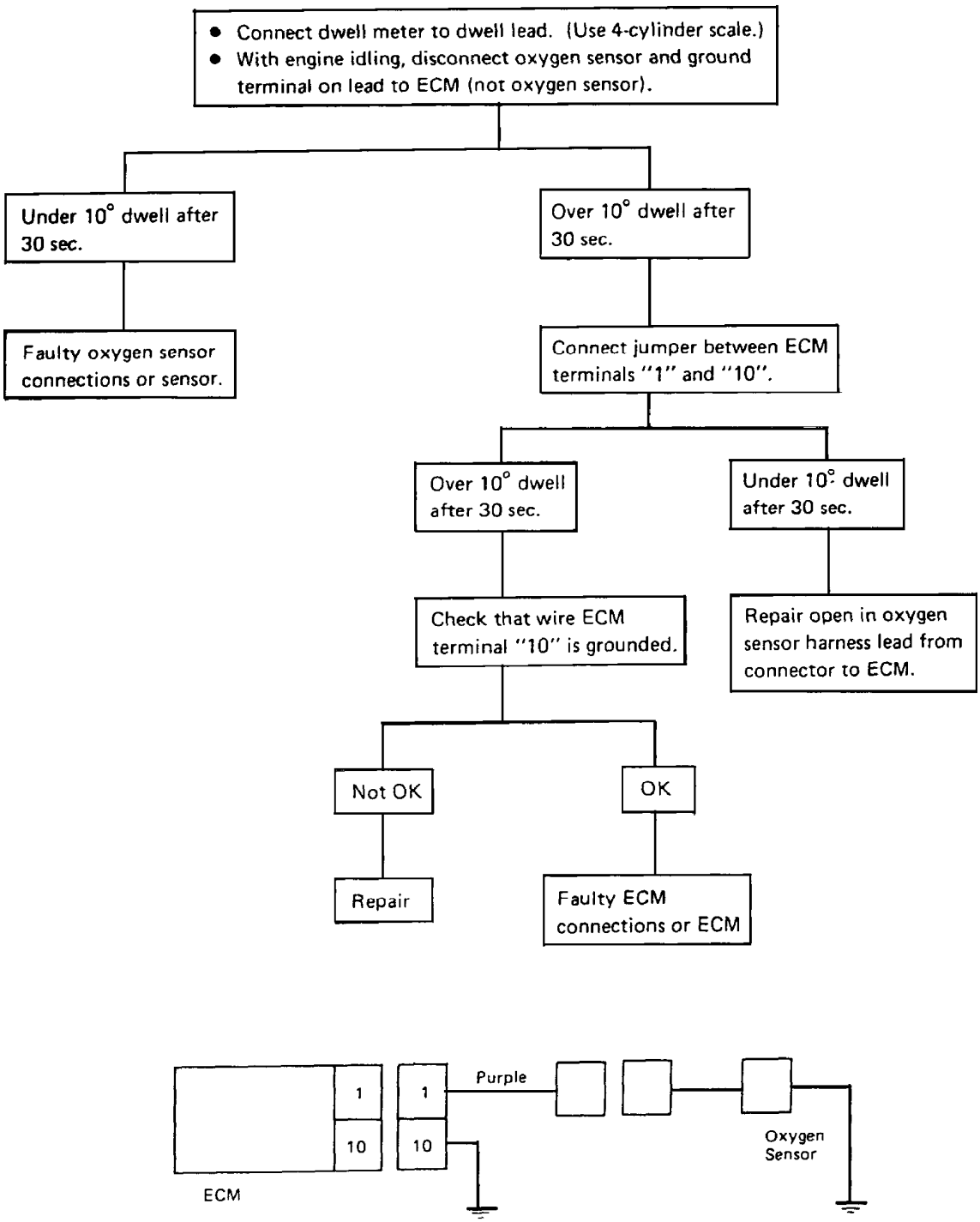

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Fig. 13: Trouble Code 13, Open Oxygen (O2) Sensor Circuit

CODE 14 - SHORTED COOLANT SENSOR CIRCUIT

SHORTED COOLANT SENSOR CIRCUIT TROUBLE CODE 14

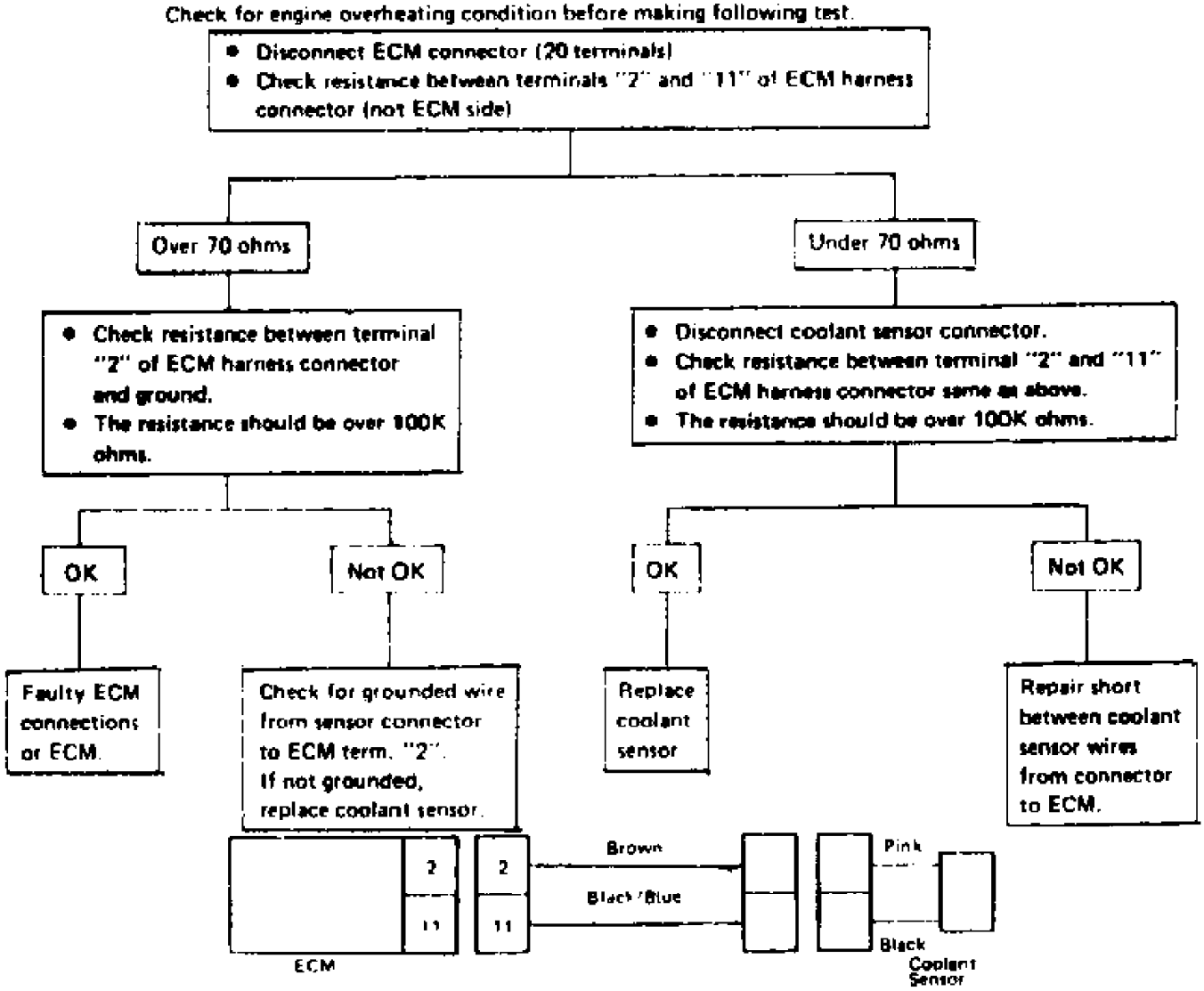

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Fig. 14: Trouble Code 14, Shorted Coolant Sensor Circuit

CODE 15 - OPEN COOLANT SENSOR CIRCUIT

OPEN COOLANT SENSOR CIRCUIT TROUBLE CODE 15

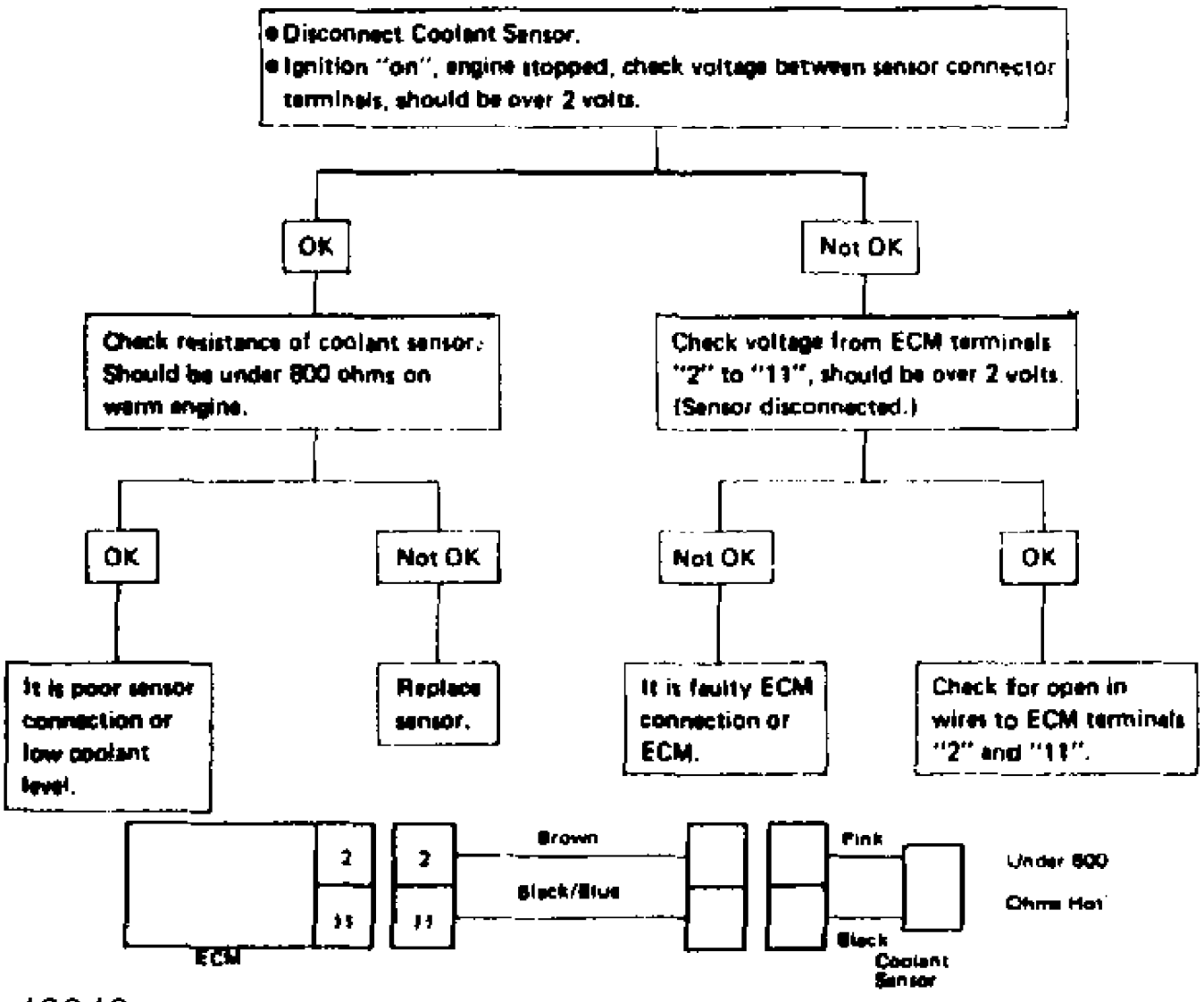

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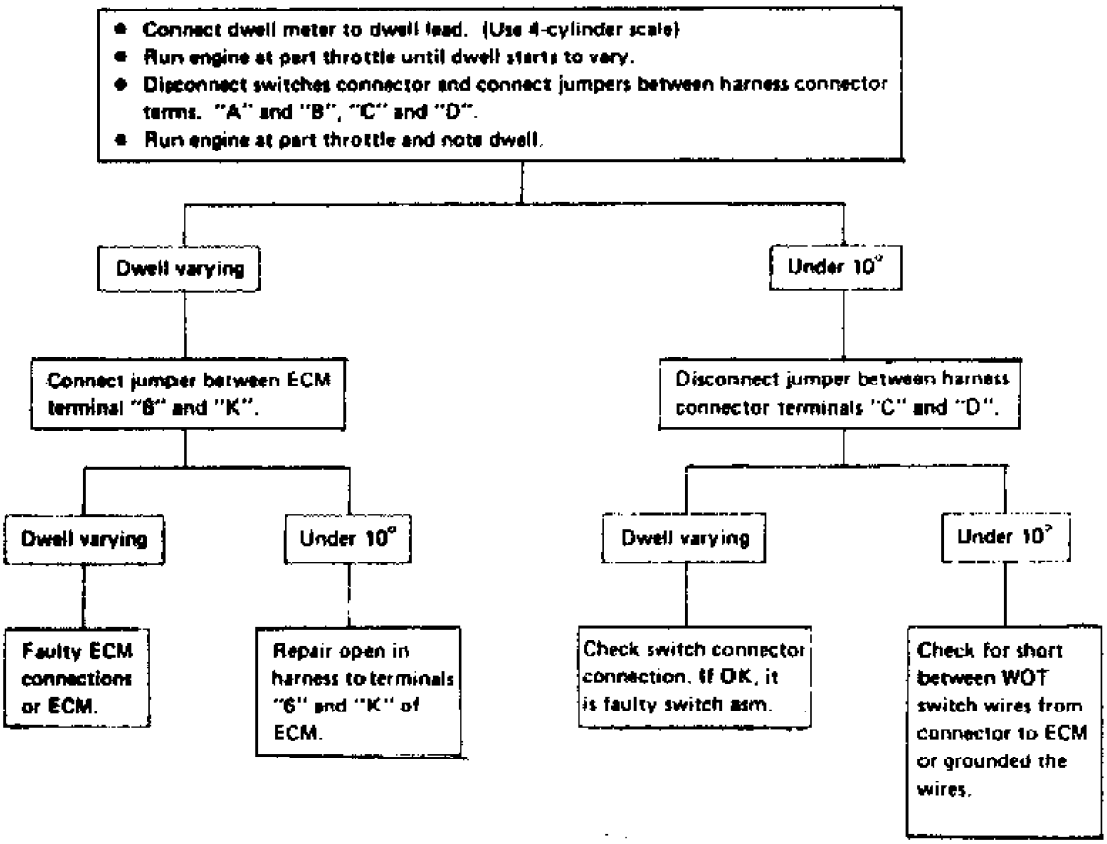
Fig. 15: Chart 10, Trouble Code 15, Open Coolant Sensor Circuit

CODE 21 - IDLE/WOT SWITCHES

IDLE SWITCH CIRCUIT OPEN OR WOT SWITCH CIRCUIT SHORTED

IDLE SWITCH CIRCUIT OPEN OR WOT SWITCH CIRCUIT SHORTED TROUBLE CODE 21

If 21 and 23 are displayed, go to Trouble Code 23 Chart first.



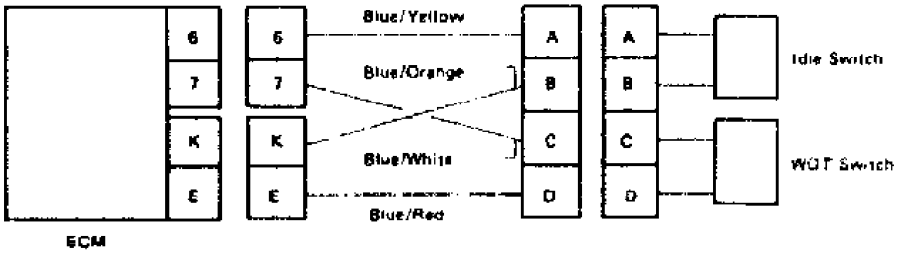


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Fig. 16: Chart 11, Trouble Code 21, Idle Switch Circuit Open Or WOT Switch circuit Shorted

CODE 22 - F/C SOLENOID CIRCUIT

FUEL CUT (F/C) SOLENOID CIRCUIT OPEN OR GROUNDED

FUEL CUT (F/C) SOLENOID CIRCUIT OPEN OR GROUNDED TROUBLE CODE 22

Check connection at carburetor F/C solenoid. If OK, clear code(s)* and recheck for code(s). If no code 22, circuit is OK.

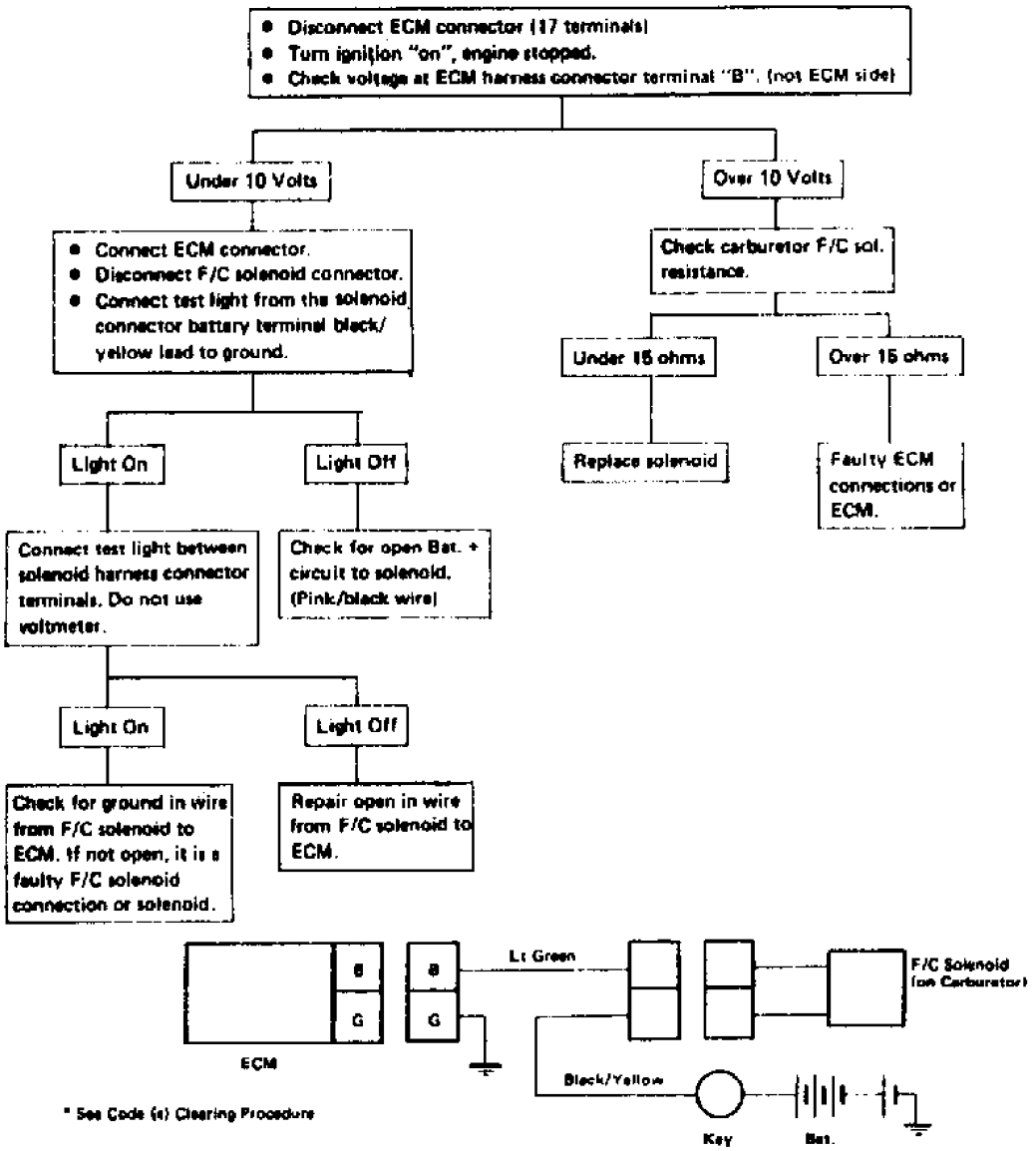

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Fig. 17: Chart 12, Trouble Code 22, Fuel Cut (F/C) Solenoid Circuit Open Or Grounded

CODE 23 - M/C SOLENOID CIRCUIT

MIXTURE CONTROL (M/C) SOLENOID CIRCUIT OPEN OR GROUNDED

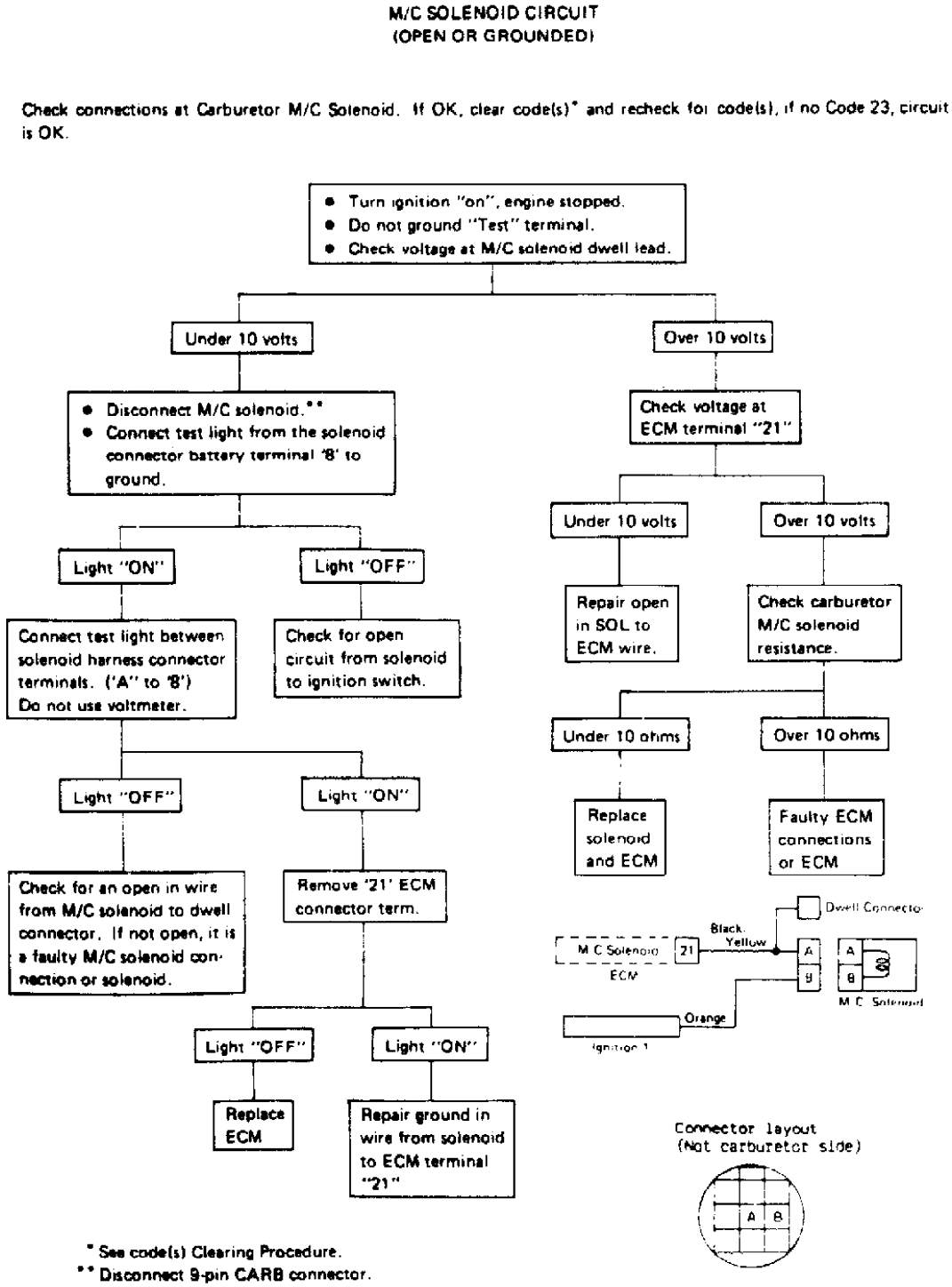
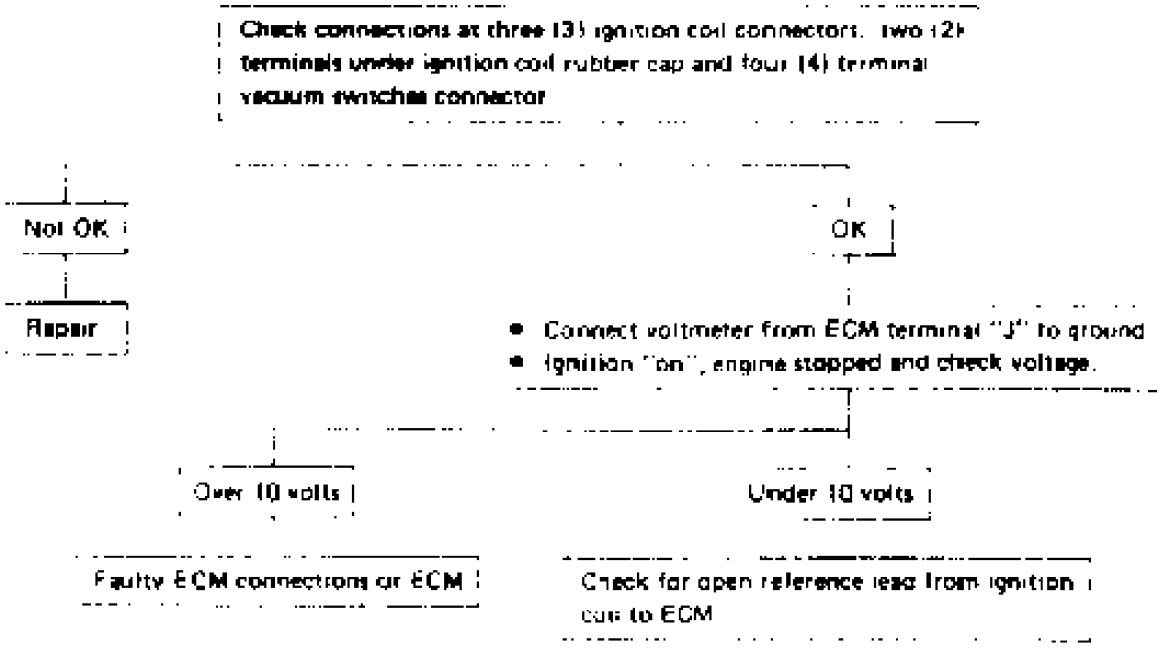


Fig. 18: Chart 13, Trouble Code 23, Mixture Control (M/C) Solenoid Circuit Open Or Grounded

CODE 31 - NO REFERENCE SIGNAL

NO REFERENCE SIGNAL TROUBLE CODE 31



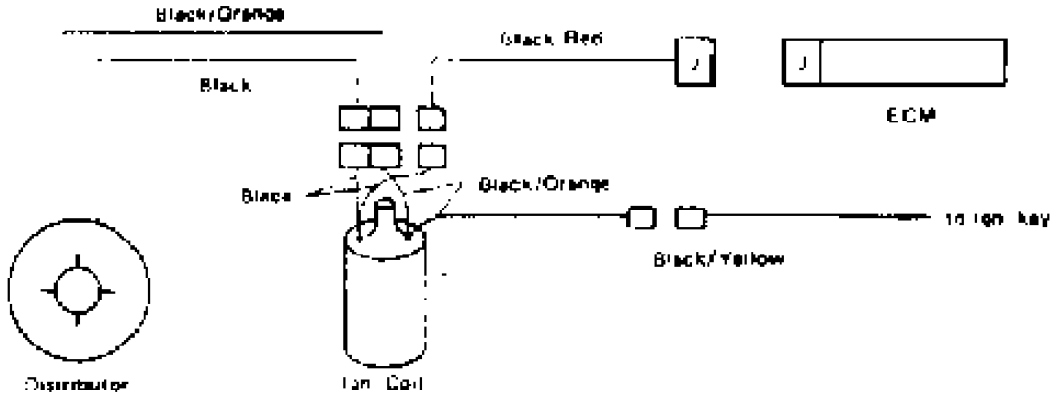


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Fig. 19: Trouble Code 31, No Reference Signal

CODE 25 - A/S SOLENOID

AIR SWITCHING (A/S) SOLENOID CIRCUIT OPEN OR GROUNDED

TROUBLE CODE 31
NO REFERENCE SIGNAL

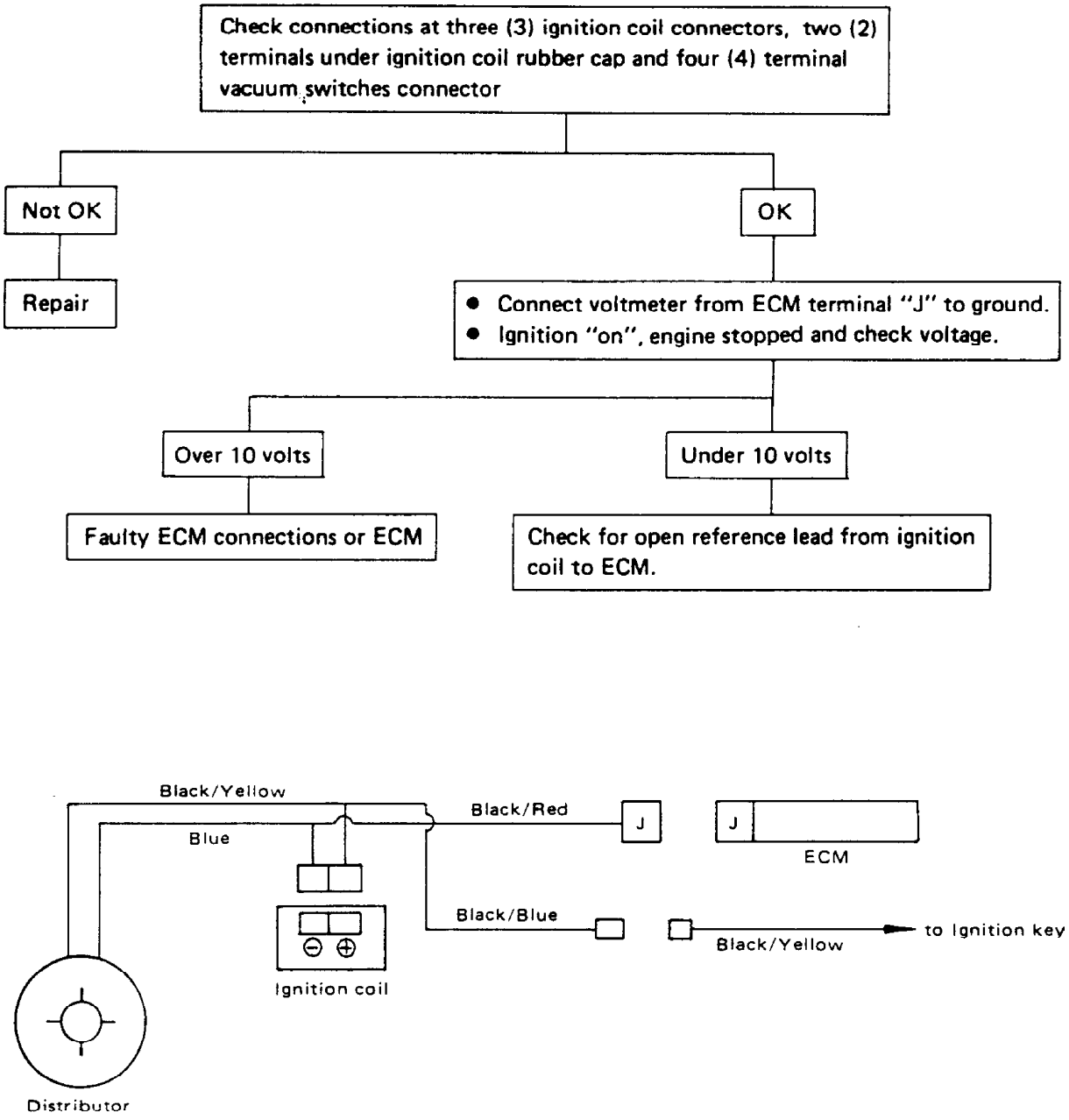

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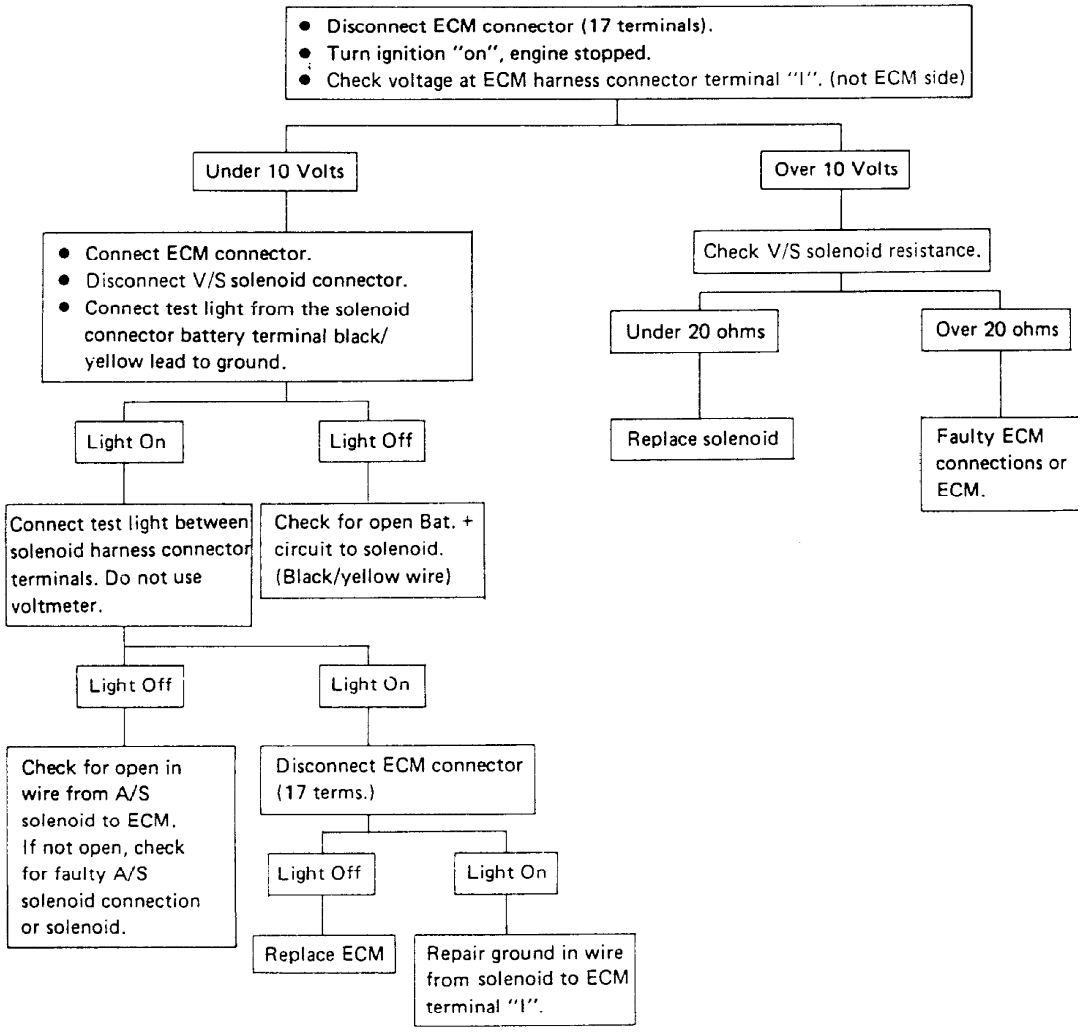
Fig. 20: Chart 15, Trouble Code 25, Air Switching (A/S) Solenoid Circuit Open Or Grounded

CODE 44 - O2 SENSOR LEAN

OXYGEN (O2) SENSOR - LEAN INDICATION

TROUBLE CODE 25
VACUUM SWITCHING (V/S) SOLENOID CIRCUIT OPEN OR GROUNDED

Check connection at V/S solenoid. If OK, clear code(s) and recheck for codes(s). If no code 25, circuit is OK.



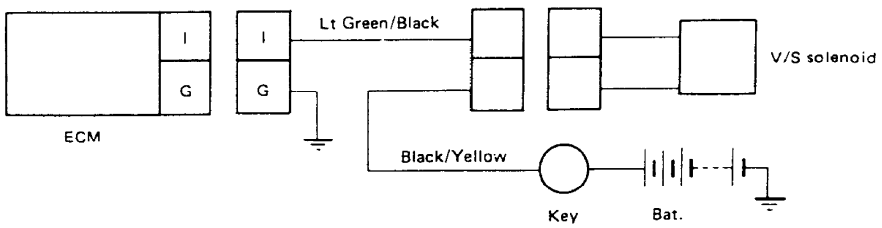


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Fig. 21: Chart 16, Trouble Code 44, Oxygen Sensor - Lean Indication

CODE 45 - O2 SENSOR RICH

OXYGEN (O2) SENSOR - RICH INDICATION

OXYGEN SENSOR — RICH INDICATION TROUBLE CODE 45

Note: A restricted air cleaner can cause a code 45.

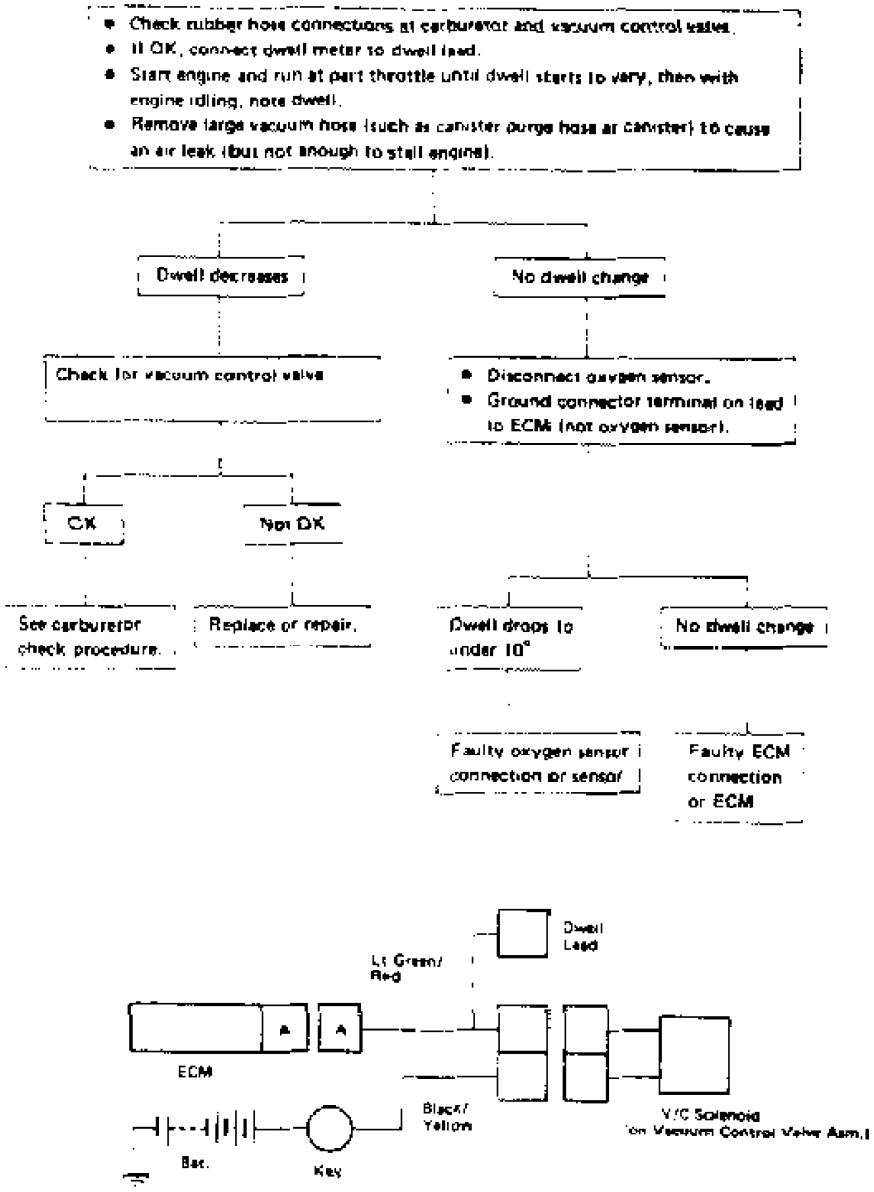

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Fig. 22: Chart 17, Trouble Code 45, Oxygen Sensor - Rich Indication

CODE 51 - F/C HIGH VOLTAGE

CONSTANT HIGH VOLTAGE FROM FUEL CUT (F/C) SOLENOID TO ECM

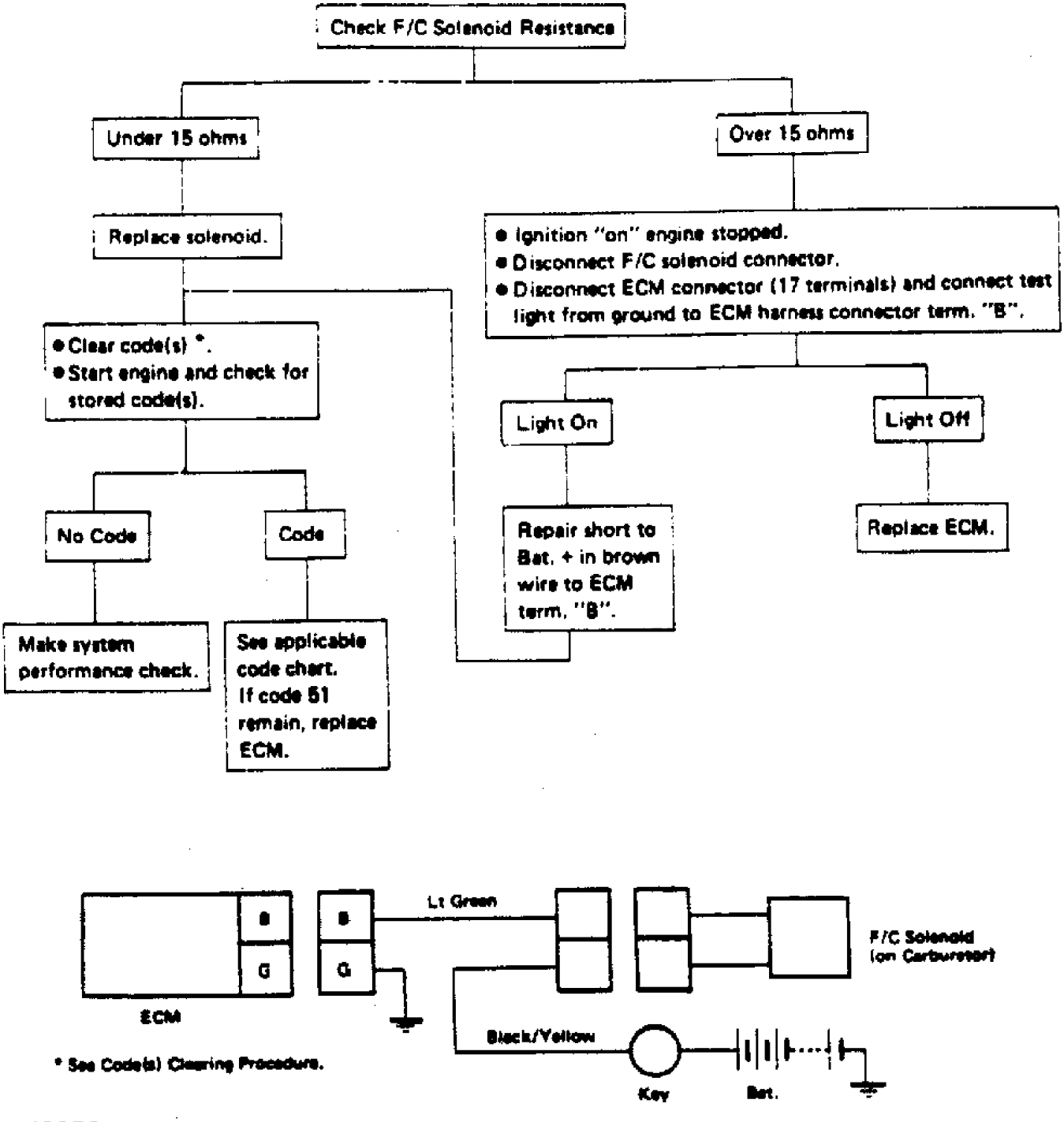

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Fig. 23: Chart 18, Trouble Code 51, Constant High Voltage From Fuel Cut (F/C) Solenoid to ECM

CODE 52 - RAM PROBLEM

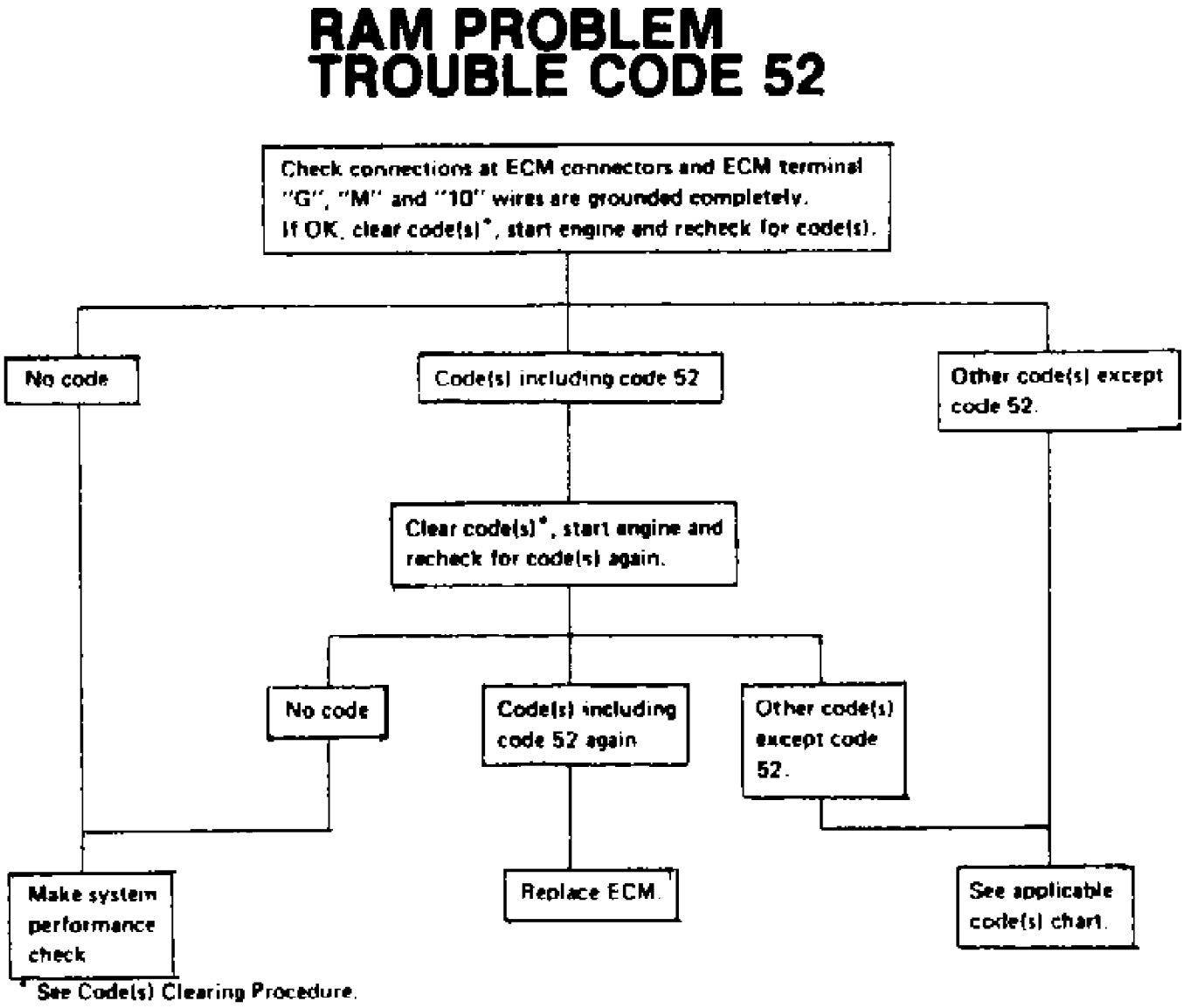
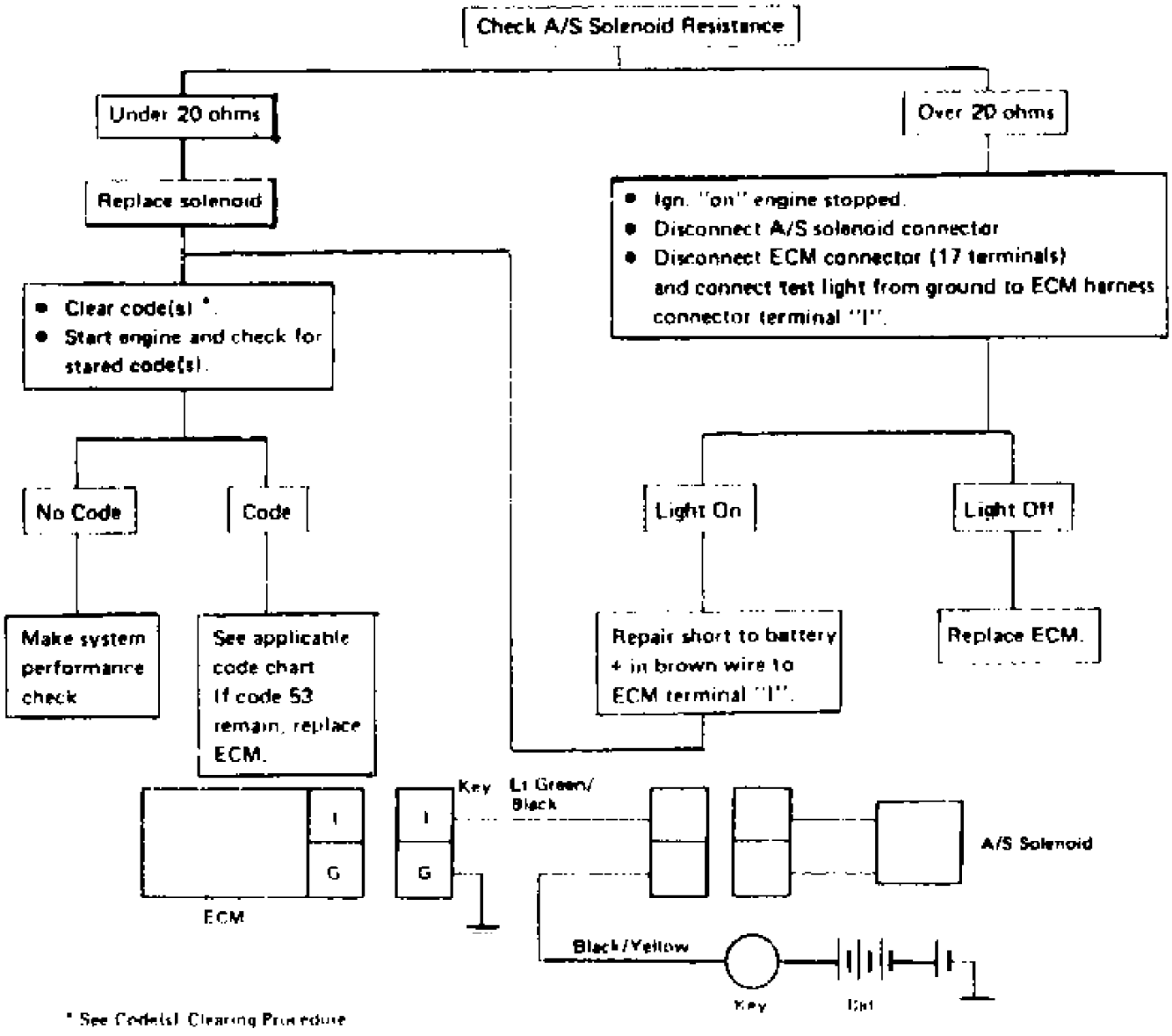


Fig. 24: Chart 19, Trouble Code 52, RAM Problem

CODE 53 - A/S HIGH VOLTAGE

CONSTANT HIGH VOLTAGE FROM AIR SWITCHING (A/S) SOLENOID TO ECM

CONSTANT HIGH VOLTAGE FROM AIR SWITCHING (A/S) SOLENOID TO ECM TROUBLE CODE 53



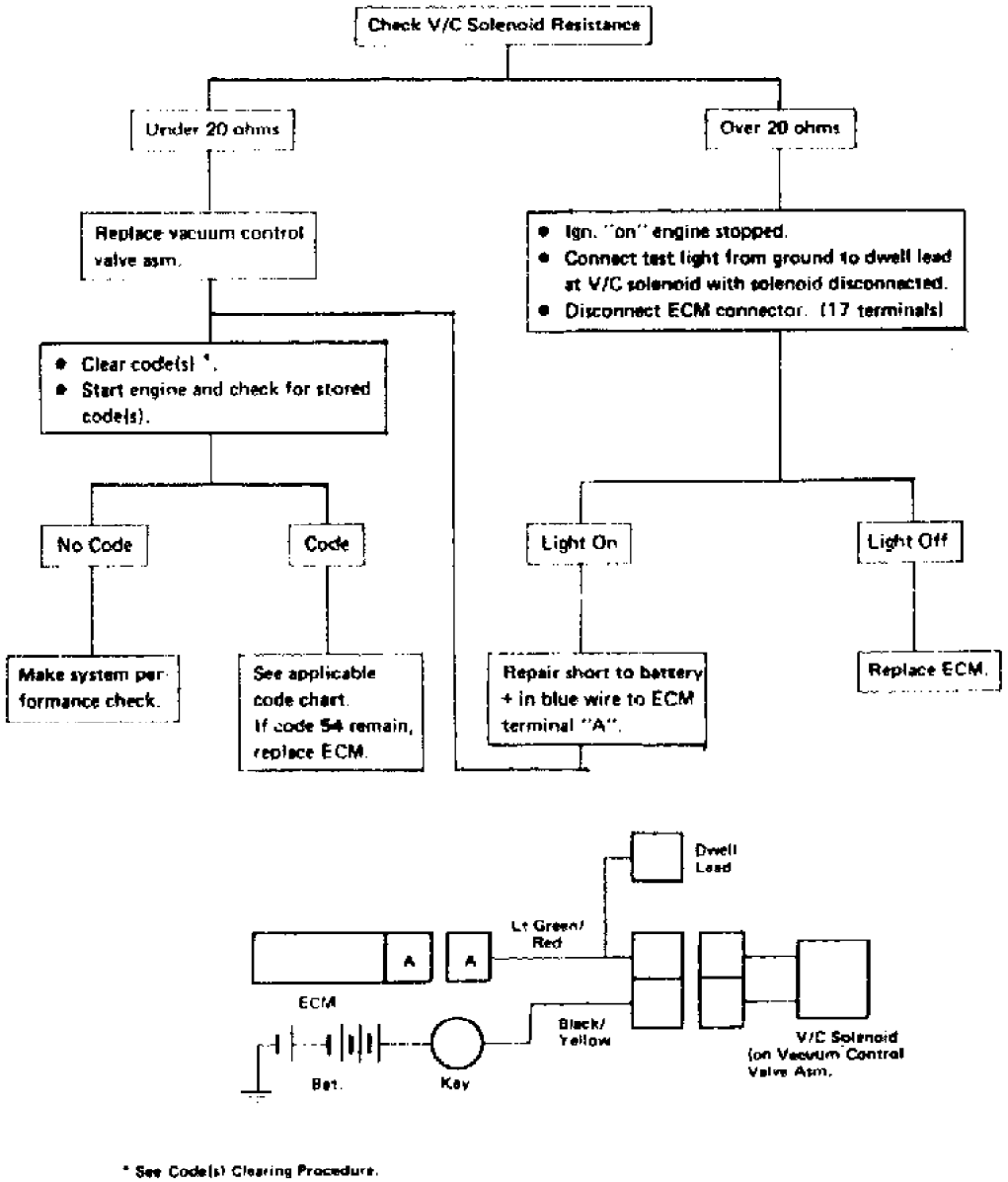
42058

Fig. 25: Chart 20, Trouble Code 53, Constant High Voltage From Air Switching (A/S) Solenoid to ECM

CODE 54 - M/C SOLENOID HIGH VOLTAGE

CONSTANT HIGH VOLTAGE FROM MIXTURE (M/C) SOLENOID TO ECM

CONSTANT HIGH VOLTAGE FROM VACUUM CONTROL (V/C) SOLENOID TO ECM TROUBLE CODE 54



* See Code(s) Clearing Procedure.

42059

Fig. 26: Chart 21, Trouble Code 54, Constant High Voltage From Mixture (M/C) Solenoid to ECM

IDLE/WOT SWITCH ASSEMBLIES CHECK

AIR MANAGEMENT CHECK

Check vacuum hose routing and connection for AIR System. Correct or repair as necessary.

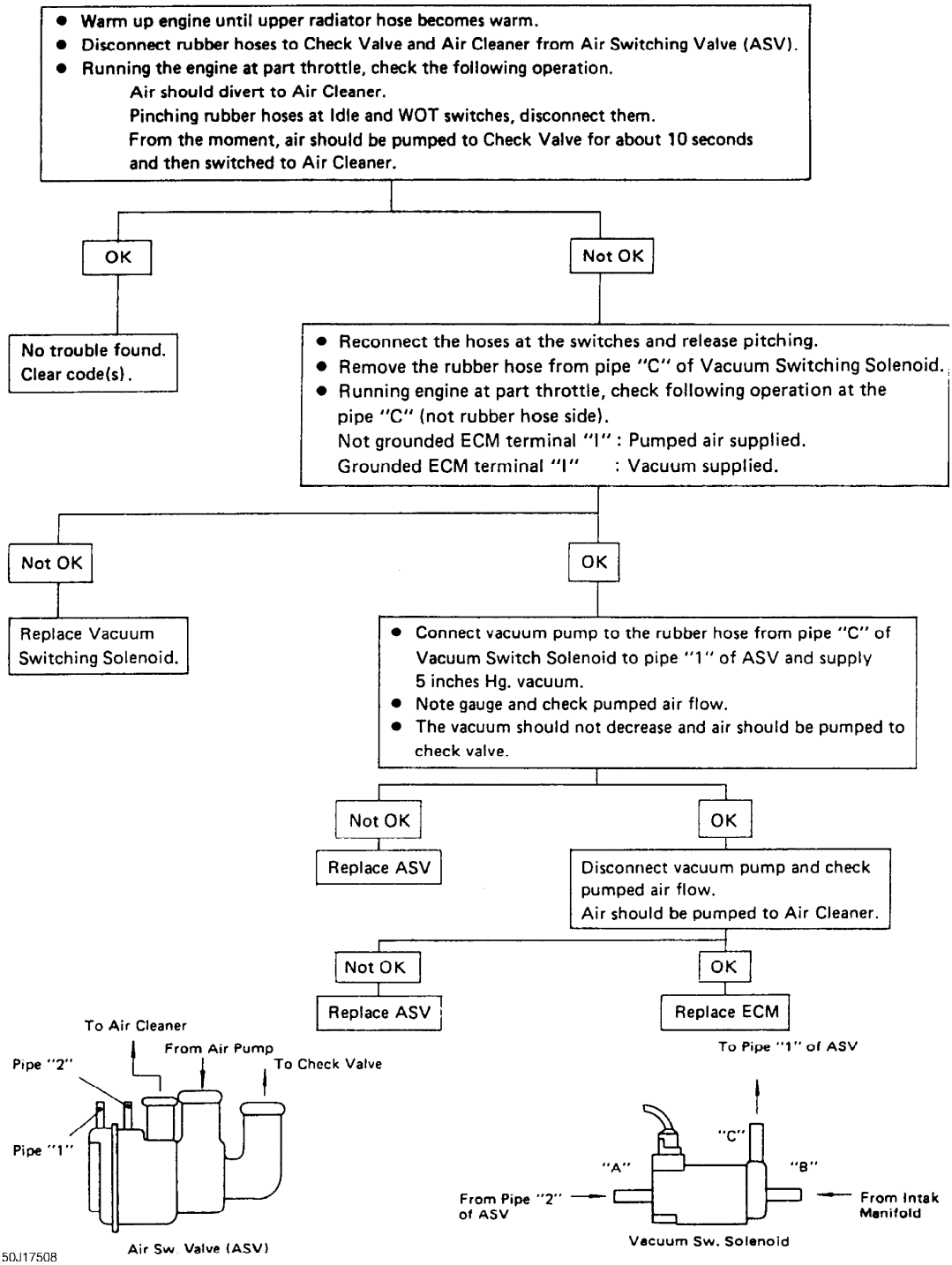
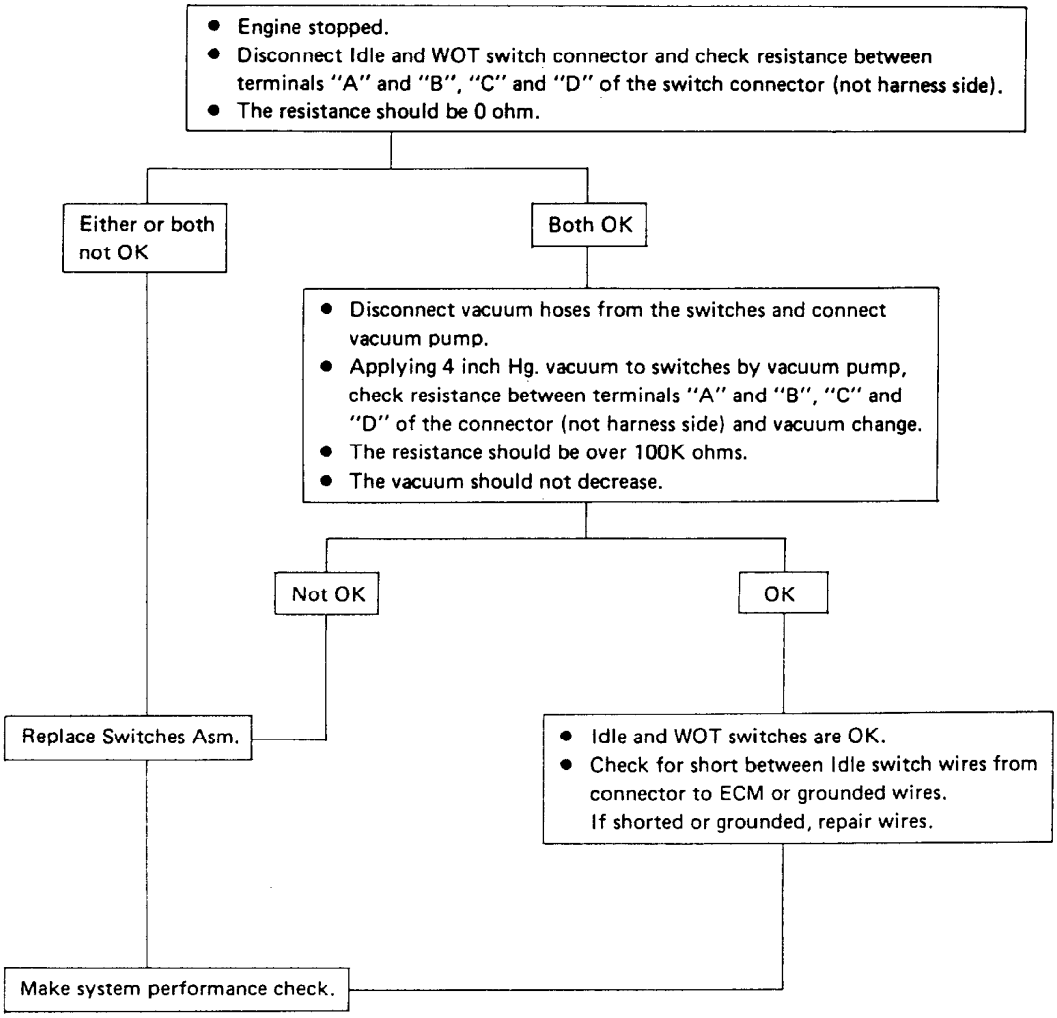
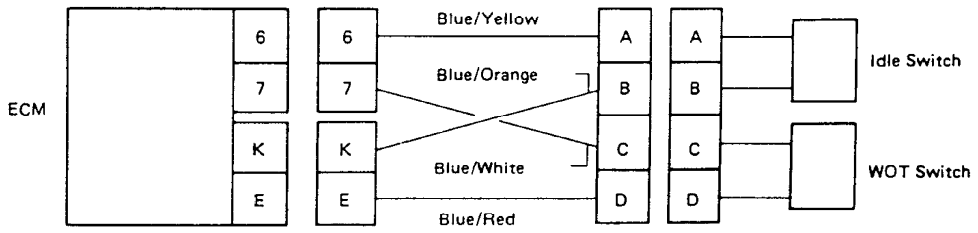


Fig. 27: Chart 22, Idle Switch & WOT Switch Assemblies Check

CODE 55 - A/C CONVERTER PROBLEM

IDLE AND WOT SWITCHES ASSEMBLY CHECK





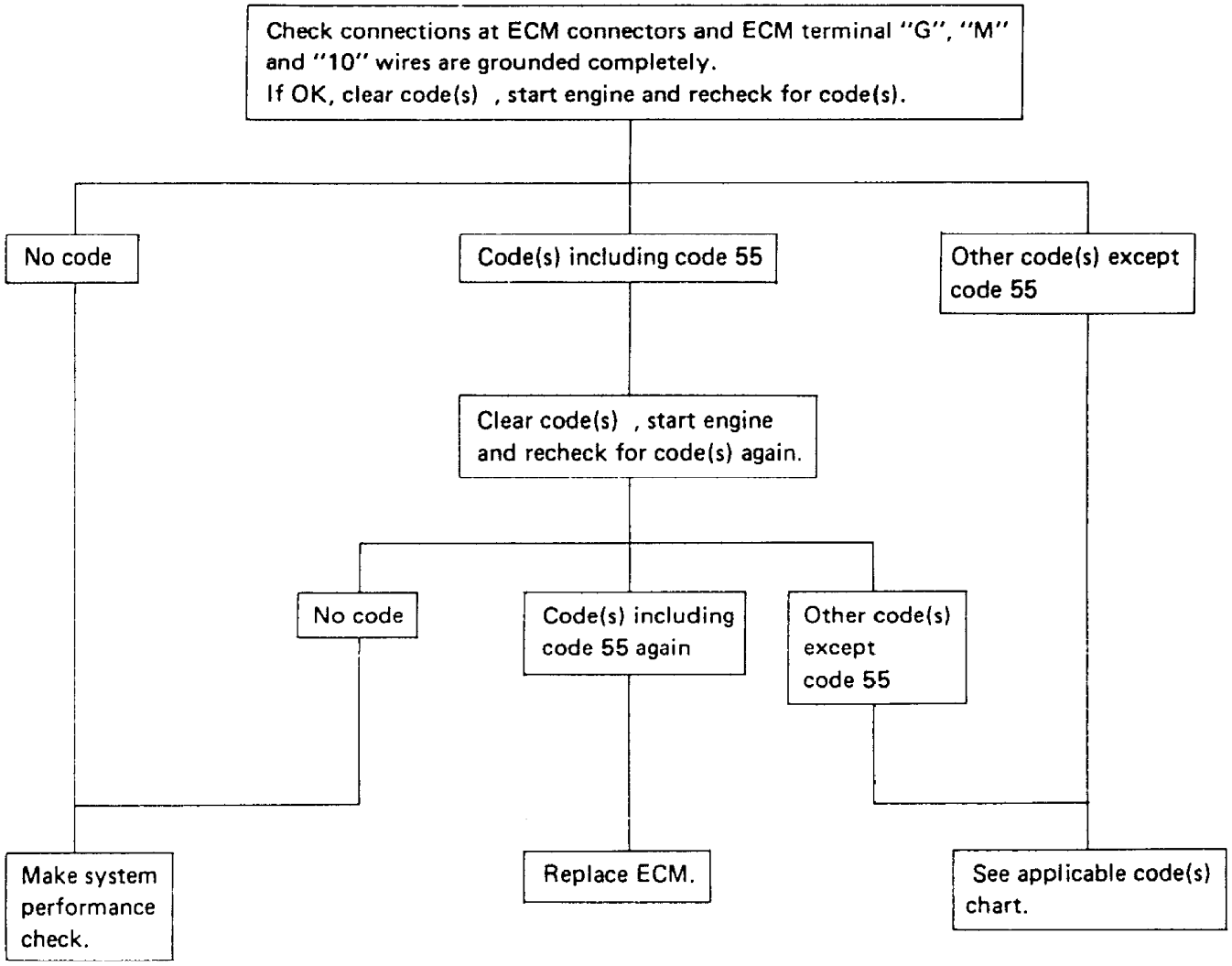
WOT : Wide Open Throttle
ECM : Electronic Control Module

50H17506

Fig. 28: Chart 23, Trouble Code 55, A/C Converter Problem

AIR MANAGEMENT CHECK

TROUBLE CODE 55
A/D CONVERTER PROBLEM



ECM : Electronic Control Module

50I17507

Fig. 29: Chart 24, Air Management Check

CARBURETOR MIXTURE CONTROL (M/C) SOLENOID CHECK

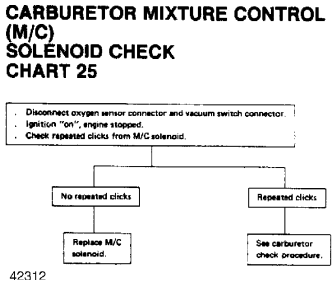


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Fig. 30: Chart 25, Carburetor Mixture Control (M/C) Solenoid Check

REMOVAL & INSTALLATION

COOLANT TEMPERATURE SWITCH

Removal & Installation
Disconnect electrical lead from temperature switch. Remove switch. Install new switch and tighten to 72 INCH lbs. (8.1 N.m). Connect electrical lead.

VACUUM CONTROLLER

Removal & Installation
Disconnect electrical lead. Disconnect vacuum hoses from vacuum regulator and solenoid. Remove vacuum controller. To install, reverse removal procedure.

M/C SOLENOID

Carburetor must be disassembled. See the appropriate article in the fuel systems section.

IDLE & WIDE OPEN THROTTLE SWITCHES

Removal & Installation
Disconnect electrical lead. Disconnect vacuum hoses from switch. Remove switch. To install, reverse removal procedure.

OXYGEN SENSOR

Oxygen sensor uses a permanently attached pig-tail and connector. The pig-tail should not be removed from sensor. Damage or removal of pig-tail or connector could affect proper operation of sensor. Care must be taken when handling sensor. The in-line electrical connector and louvered end must be kept free of grease or other contaminants. Do not use cleaning solvents of any type. Sensor may be difficult to remove when engine temperature is below 120°F (48°C). Excessive force may damage threads in exhaust manifold or pipe.

Removal
Disconnect electrical connector and any attaching hardware. Remove oxygen sensor.

Installation
1) If same sensor is being installed, coat threads of sensor with anti-seize compound. If new sensor is installed, it will be pre-coated with compound.
2) Install sensor and tighten to 30 ft. lbs. (41 N.m). Connect electrical lead and any attaching hardware.

ELECTRONIC CONTROL MODULE

The ECM is located on the right side of the instrument panel. Do not replace ECM unless diagnosis has determined fault in ECM.