

ISUZU & LUV CLOSED LOOP EMISSION SYSTEM

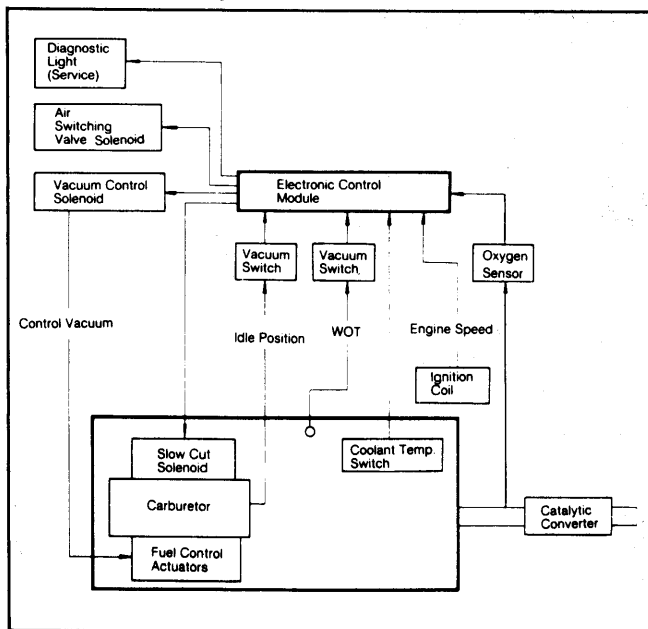
California Gasoline Models

DESCRIPTION

The Closed Loop Emission control system is an electronically controlled system that is used on California I-Mark, P'UP and LUV models with 1.8L engines. It monitors various engine/vehicle functions to control engine operation and lower exhaust emissions while maintaining good fuel economy and driveability.

The Electronic Control Module (ECM) is the brain of the system. The ECM controls the engine-related systems to constantly adjust engine operation to maintain good vehicle performance under all normal driving conditions. The system consists of the ECM, various data sensors, a fuel control system and a catalytic converter.

Fig. 1: Isuzu and LUV Closed Loop Emission Control System



OPERATION

The primary 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.

FUEL CONTROL SYSTEM

The engine is equipped with a feedback carburetor which contains vacuum-operated fuel control actuators. The ECM, responding to inputs from the data sensors, constantly adjusts the air/fuel ratio to maintain engine performance. The ECM sends electrical signals to a vacuum control valve. The vacuum control valve converts the ECM signals to vacuum signals to operate the actuators.

The vacuum control valve consists of a vacuum regulator and a vacuum control solenoid. The regulator changes the inconsistent vacuum levels from the intake manifold into constant vacuum levels. The solenoid, controlled by the ECM, uses the vacuum from the regulator to operate the fuel control actuators.

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 calibration control to operate the engine under that particular condition.

During cold engine starts, the vacuum control 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.

DATA SENSORS

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

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.

ELECTRONIC CONTROL MODULE

The ECM controls all functions of the closed loop system. The ECM sends an electrical signal to the vacuum control solenoid which controls the air/fuel mixture by vacuum signals. This control signal is constantly cycling the solenoid between "ON" and "OFF" time (duty cycle) as a function of the input voltages from the data 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:

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Inhibit Mode

No electrical signals are sent to the vacuum control 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 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 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 solenoid based on input from the oxygen sensor and other data 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, as signaled by the idle position switch or wide open throttle switch, the ECM retrieves data from its memory to operate the engine at the duty cycle last recorded for optimum operation.

After the initial change in idle position, the ECM then controls the system in one 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.

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, 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 instruction 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.

DIAGNOSIS & TESTING

DIAGNOSTIC PROCEDURE

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.

Entering Diagnostic Mode

1) Turn ignition "ON". "CHECK ENGINE" lamp should glow. Locate diagnostic terminal taped on wire harness near ECM. Start engine. Connect terminals together and note "CHECK ENGINE" lamp.

2) 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.

ECM TROUBLE CODE IDENTIFICATION

Code	Circuit Affected
12	Idle Position Switch - High Output
13	Idle Position Switch - Low Output
14	Wide Open Throttle Switch - High Output
15	Wide Open Throttle Switch - Low Output
21	Vacuum Control Solenoid - High Output
22	Vacuum Control Solenoid - Low Output
23	Incorrect Oxygen Sensor Reading
24	Incorrect Coolant Temperature Switch Reading
25	RAM Error

Clearing Trouble Codes

To clear memory of trouble codes, turn ignition "ON" and connect diagnostic terminals together. Turn ignition "OFF" and remove positive battery cable from battery. Disconnect diagnostic terminals.

Exiting Diagnostic Mode

To exit diagnostic mode, turn engine off and disconnect diagnostic terminals.

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NOTE: The term "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 Sheet

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 "P" (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.

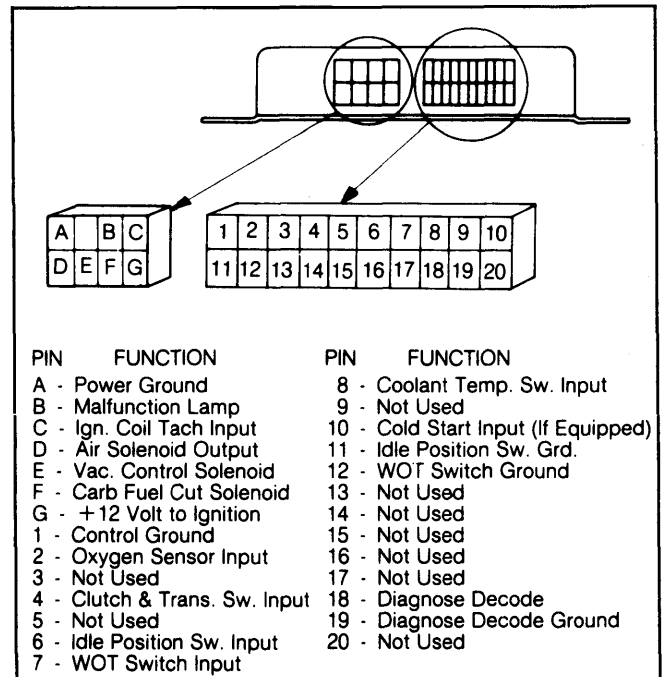
2) A test light, rather than a voltmeter, must be used where indicated in diagnostic chart. A dwell meter is used to measure the time that the vacuum control solenoid is on or off. This gives an indication of how the system is working and how rich or lean the mixture. The dwell meter is set for 4-cyl. scale.

3) Dwell meter is connected to Green connector located near carburetor. This connector will not be connected to any circuit EXCEPT when testing with the dwell meter. Do not allow terminal wire to come in contact with any ground source, including rubber hoses.

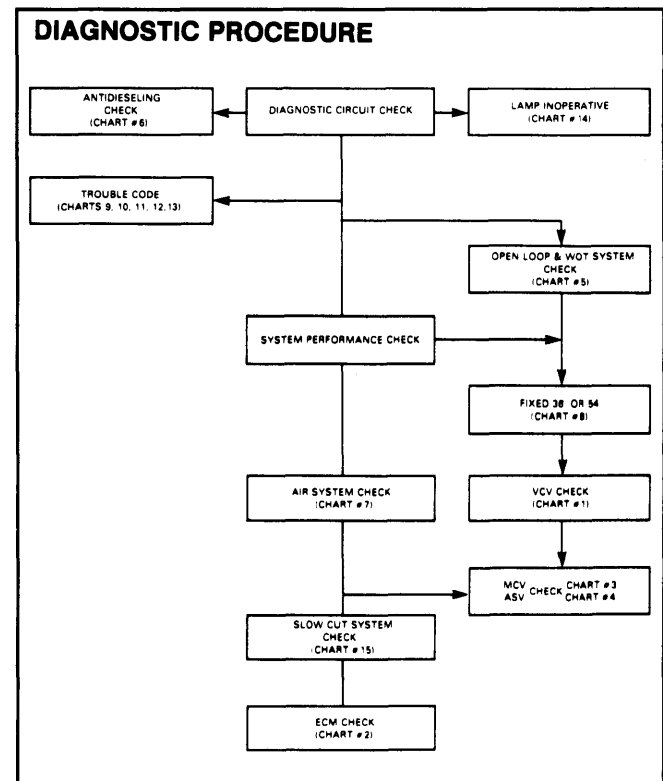
NOTE: If engine operation seems to change when dwell meter is connected to Green wire, remove dwell meter and use another type. A few brands are not compatible with the electronic emission system.

4) When engine is at operating temperature and idling, dwell meter needle will move up and down the scale. This indicates the system is in closed loop operation. If the needle does not move, the system is in open loop operation.

Fig. 2: Electronic Control Module Terminal Identification

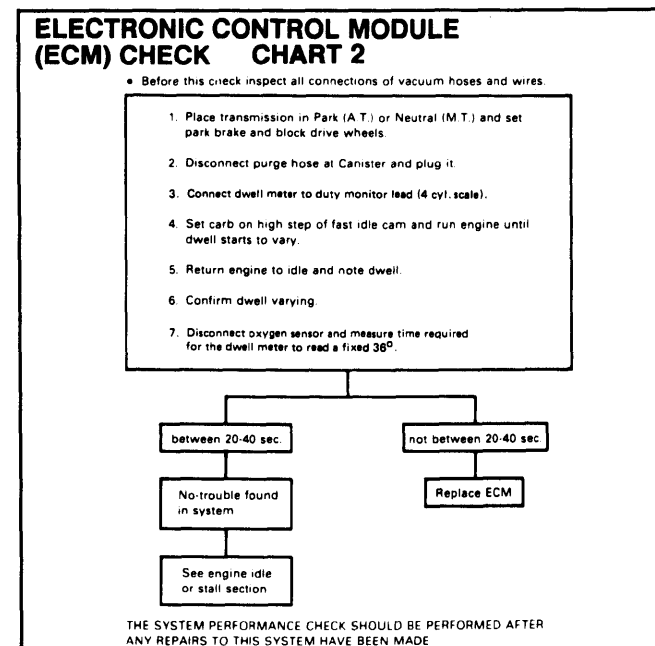
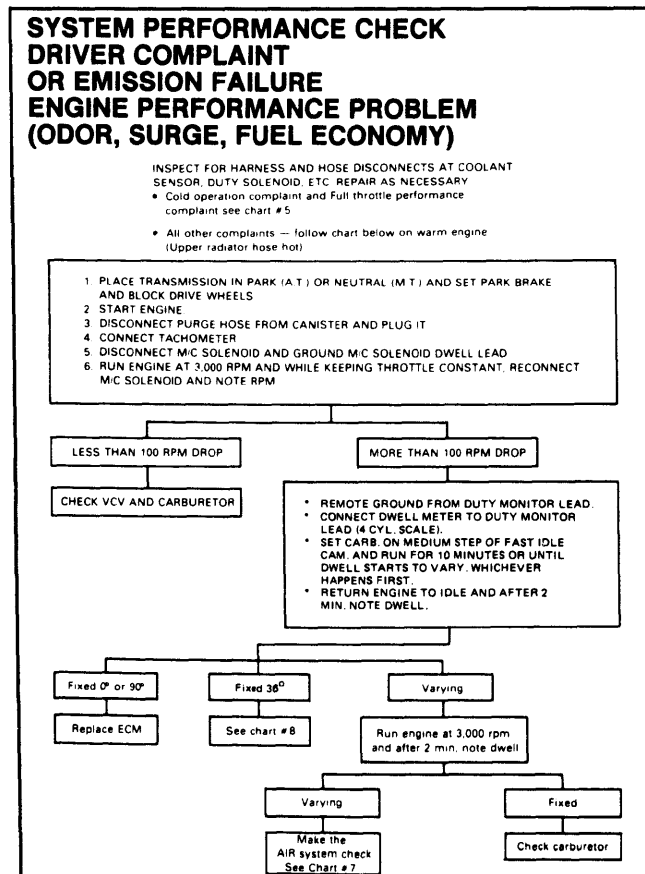
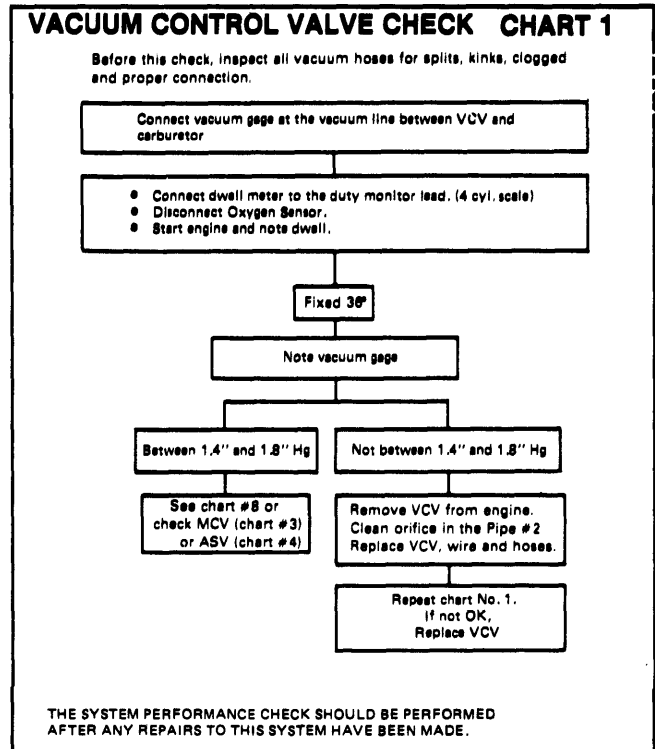
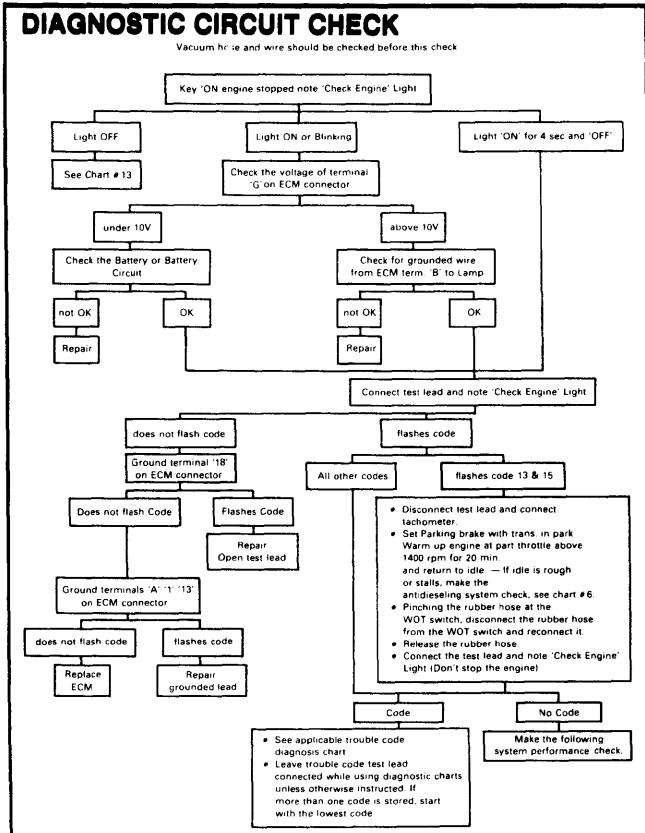


TEST CHARTS



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MIXTURE CONTROL VALVE CHECK CHART 3

Before this check, inspect the connection of vacuum hoses.

- Place transmission in park (A.T.) or neutral (M.T.) and set park brake and block drive wheels.
- Connect dwell meter to the duty monitor lead (4 cyl. scale).
- Connect tachometer.
- Close idle compensator vacuum line by bending vacuum hose.
- Start engine, let idle until dwell starts to vary.

Remove the vacuum hose and after a few seconds reconnect it and note engine speed.

Engine speed unchanged

Replace MCV

Engine speed dropped and recover or dropped to stall

- A. Momentarily accelerate the engine to 2000 to 3000 rpm and let return to idle.
 B. Note stabilized average dwell and rpm at idle.
 Repeat steps A and B five times.

Dwell variation is over 9° or engine speed variation is over 100 rpm

Replace MCV

Dwell variation is between 0 and 9° and engine speed variation is below 100 rpm

Plug the vacuum hose to the intake manifold and repeat steps A to C. Note average dwell and engine speed.

Changed over 9° or over 100 rpm.

Replace MCV

Changed under 9° or under 100 rpm.

Check ASV (See chart #4) or Carburetor

OPEN LOOP & WIDE OPEN THROTTLE (WOT) CHECK CHART 5

Before this check, confirm the operation of coolant temp switch and the proper connection of rubber hose and wire.

- Connect dwell meter to duty monitor lead use 4 cyl. scale.
- Disconnect the oxygen sensor.
- Start engine and note dwell.

Fixed 36°

other

Reconnect oxygen sensor and warm up engine for 10 min. Note dwell

Replace ECM

Fixed

See chart #8

Varying

- Stop engine
- Remove the connector from coolant temp sw and ground it
- Start engine and run at part throttle
- Note dwell and return to idle

Fixed

Remove the connector Note dwell

Fixed

See chart #8

Varying

Reconnect the connector to coolant temp sw

Check for open wire from ECM to coolant temp sw

OK

Replace ECM

not OK

Repair

After pinching the vacuum hose at WOT switch, disconnect the hose from WOT switch and note dwell

Fixed 0°

No trouble found in the open Loop mode and WOT enrichment check. Check the Carburetor and VCV.

Other

Replace ECM

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

AIR SWITCHING VALVE CHECK CHART 4

Before this check, inspect the vacuum hoses for splits, kinks and proper connections

- Place transmission in Neutral, set park brake and block drive wheels.
- Disconnect the vacuum hose from ports A and B
- Connect vacuum pump to port A
- Apply vacuum over 13.5 kPa (14" Hg)
- Note vacuum gage

holds

does not hold

Replace ASV

- Start engine
- Disconnect the vacuum hose from ASV to C/V and from ASV to A/C
- Check air switching function (Diaphragm chamber vacuum) (Air outlet) Supplied over 13.5 kPa (14" HG) From Port B' Atmosphere From Port A'

OK

not OK

Replace ASV

- Disconnect vacuum pump from port A and reconnect vacuum hoses to ports A and B
- Connect dwell meter to duty monitor lead (4 cyl. scale)
- Plug C/V and warm up engine until dwell starts to vary.
- With engine idling, note dwell.
- Connect the vacuum hose from ASV to C/V, note dwell.
- Compare dwell readings:

difference is over 9°

Replace ASV

difference is under 9°

Check MCV or Carburetor (See chart #3)

*ASV: Air Switching Valve
 C/V: Check Valve
 A/C: Air Cleaner

ANTI-DIESELING CHECK CHART 6

Turn ignition 'ON', engine stopped
 Check voltage at ECM term, 'F'

under 6 Volts

over 6 Volts

Remove the slow cut sol connector check for open in sol ECM wire

Check slow cut sol resistance

OK

not OK

Repair

between 30 and 40 ohms

Check the connection at ECM. If OK, replace ECM

not between 30 and 40 ohms

Replace Sol

Check voltage of Pnk wire

14 Volts

0 Volts

Check slow cut sol. resistance

Check for open B-circuit to sol.

between 30 and 40 Ohms

not between 30 and 40 Ohms

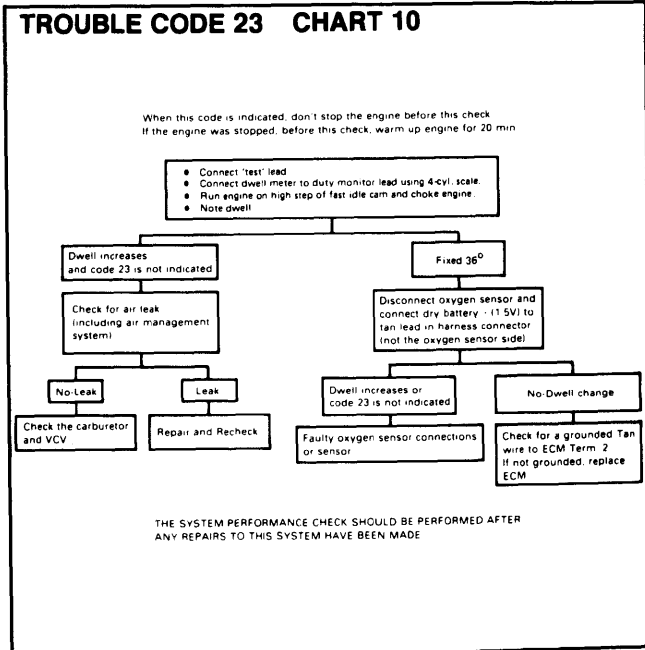
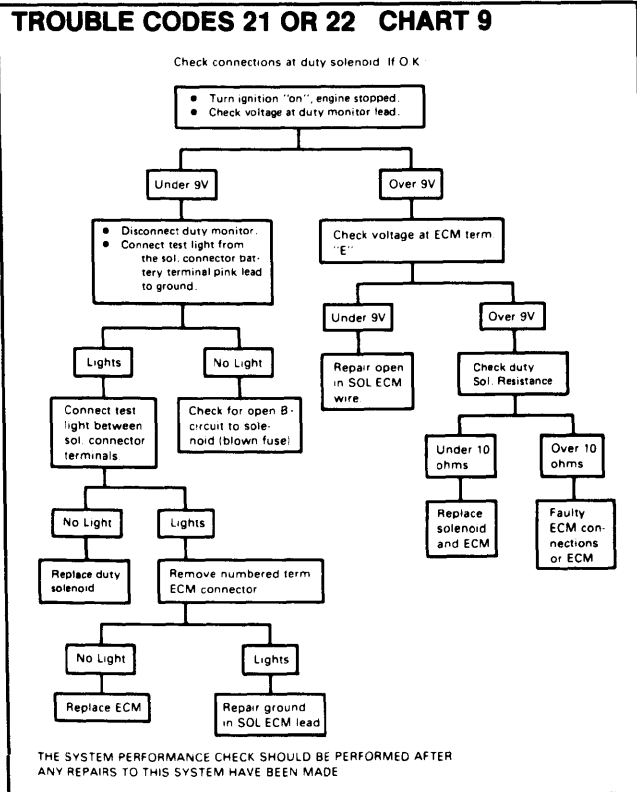
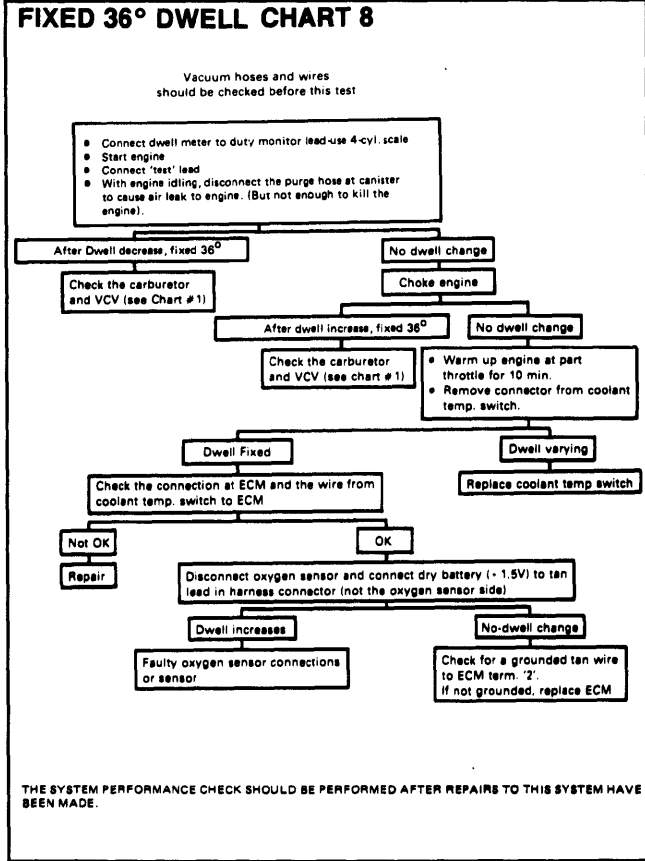
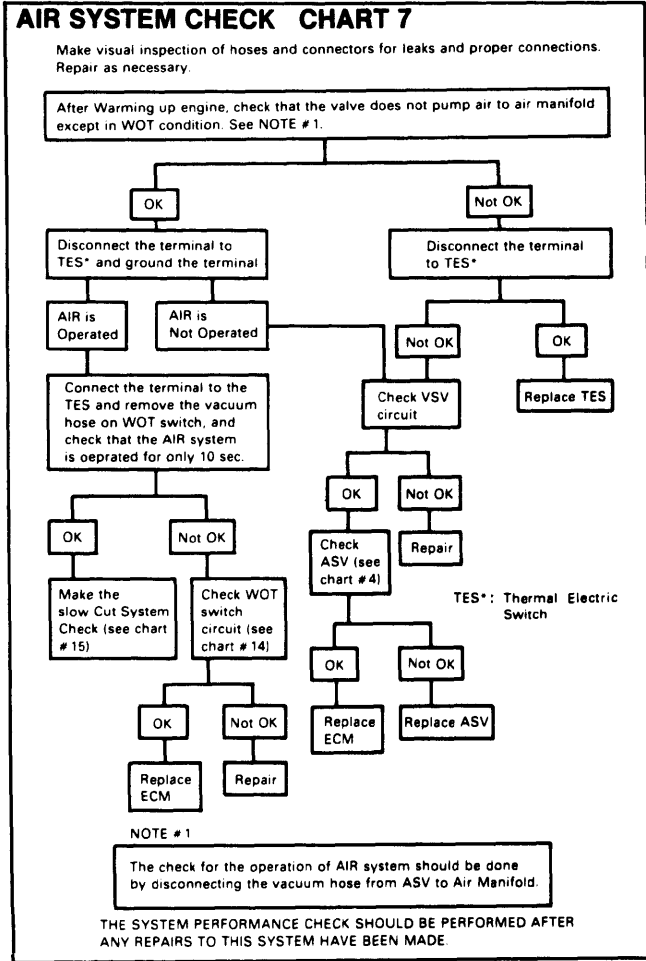
Check the following:
 • solenoid connection at ECM
 • connection at solenoid
 • If OK, replace ECM

Replace sol

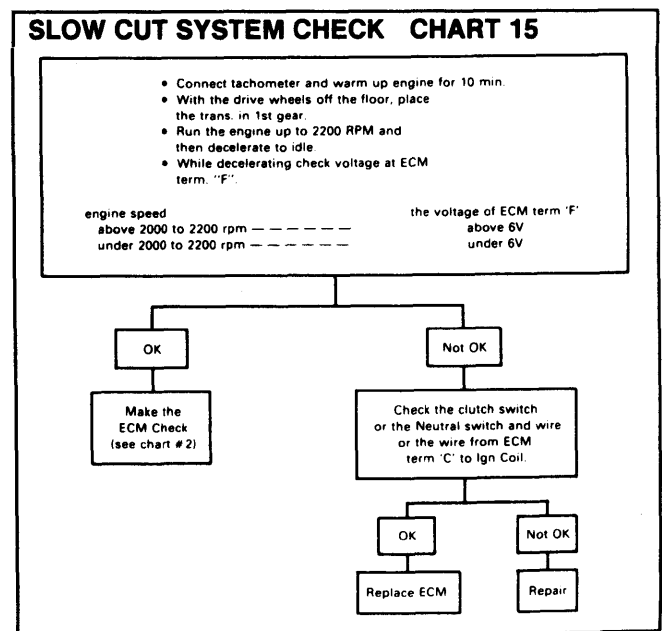
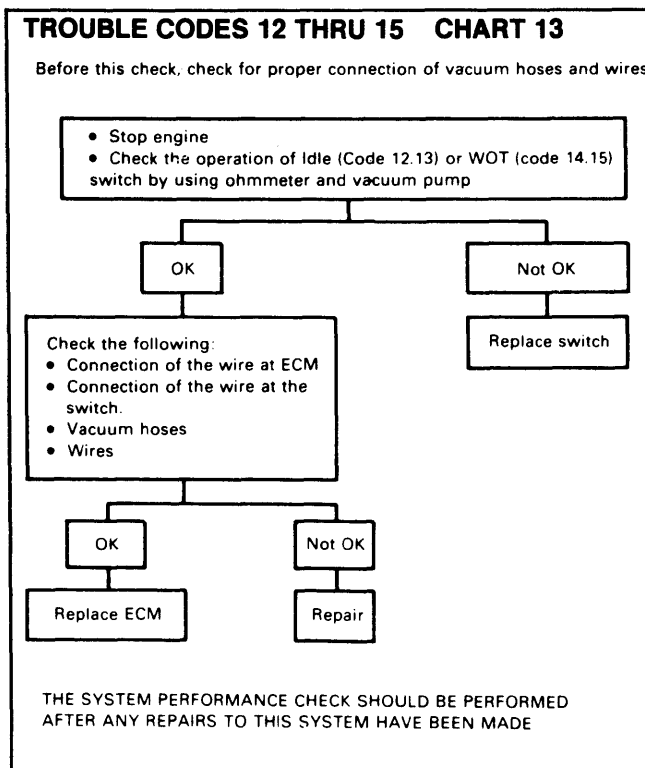
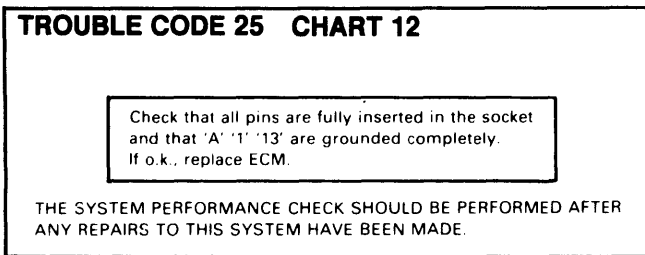
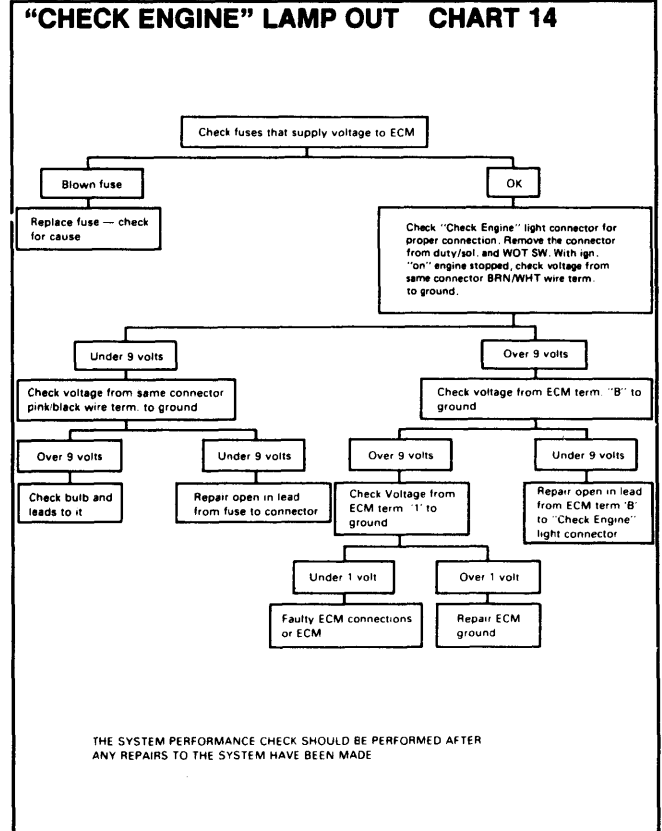
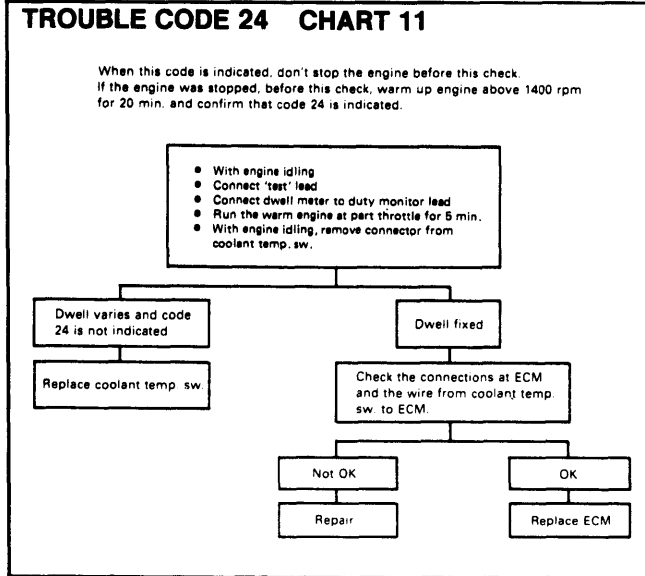
THE SYSTEM PERFORMANCE CHECK SHOULD BE PERFORMED AFTER ANY REPAIRS TO THIS SYSTEM HAVE BEEN MADE

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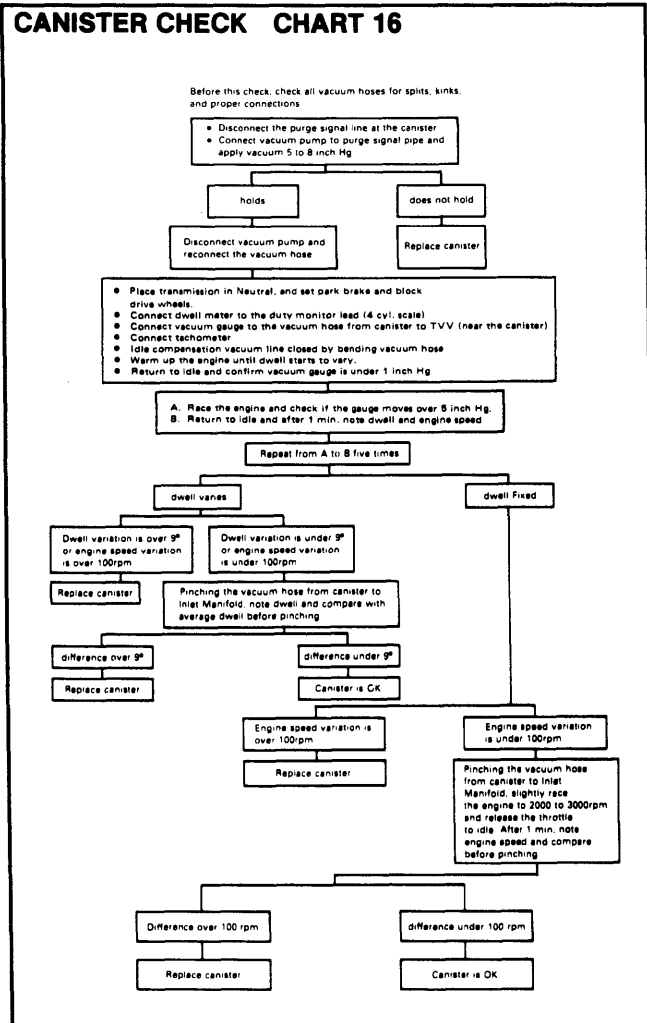
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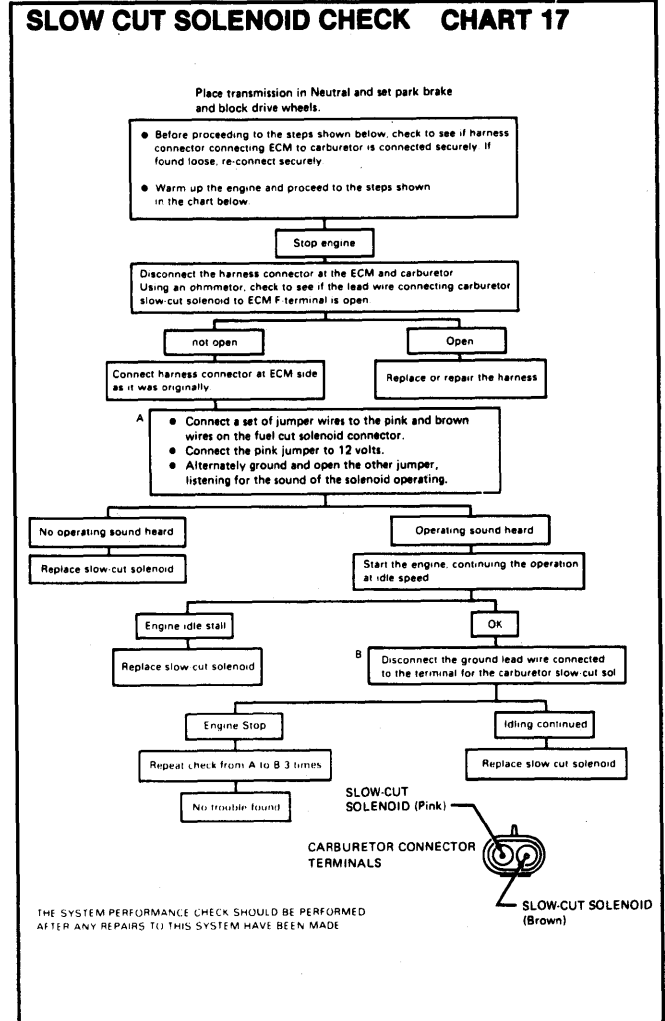
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CANISTER CHECK CHART 16



SLOW CUT SOLENOID CHECK CHART 17



REMOVAL & INSTALLATION

COOLANT TEMPERATURE SWITCH

Removal & Installation

Disconnect electrical connection from temperature switch. Remove switch. Install new switch and tighten to 72 INCH lbs. (8.1 N.m). Reconnect electrical connector.

VACUUM CONTROLLER

Removal & Installation

Disconnect electrical connector. Disconnect vacuum hoses from vacuum regulator and solenoid. Remove vacuum controller. To install, reverse removal procedures.

IDLE & WIDE OPEN THROTTLE SWITCHES

Removal & Installation

Disconnect electrical connectors. Disconnect vacuum hoses from sensors. Remove sensors. To install, reverse removal procedures.

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 connector and any attaching hardware.