2.5L CEC SYSTEM

1988 Jeep Cherokee

1988 Computerized Engine Controls
JEEP 4-CYLINDER 2.5L TBI COMPUTERIZED EMISSION CONTROL

Cherokee, Comanche

DESCRIPTION

The computerized engine control system, used on 2.5L models with throttle body fuel injection, is built around an electronic control unit (ECU). The ECU is a microprocessor-based computer.

The major function of the system is to reduce emissions. It accomplishes this through a series of 13 sensors or switches that constantly monitor several engine conditions. See Fig. 16.

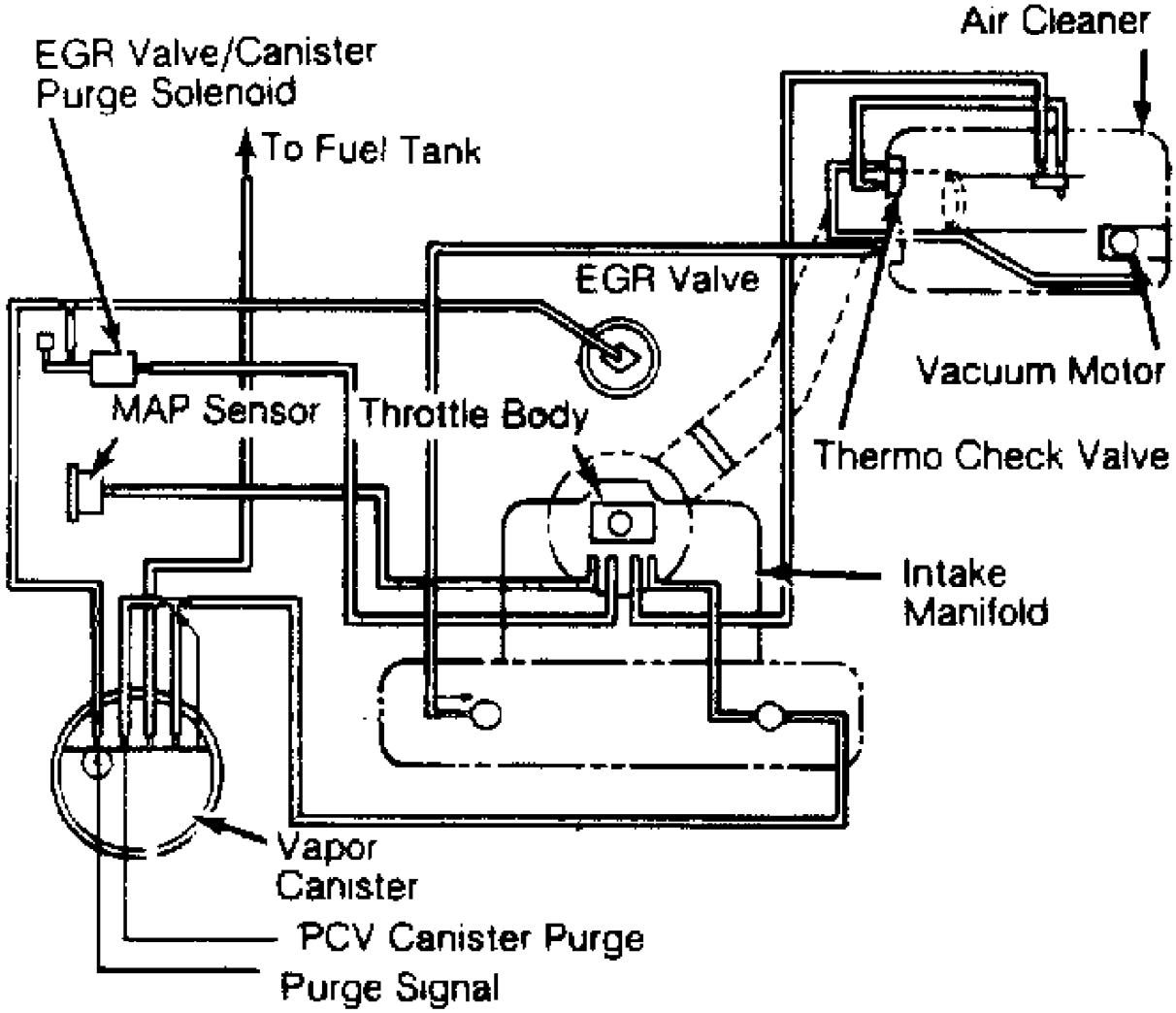


Fig. 1: Vacuum Diagram for Jeep 2.5L CEC System

The computer processes input information from the sensors to get an accurate picture of engine operation. It then provides output control signals to regulate air/fuel ratio, ignition, idle speed and

emission control devices. This permits optimum engine performance with minimum emissions.

OPERATION

The engine control system is divided into 6 sub-systems: electronic control unit (also called the ECU or computer), sensors and switches, fuel control, emission control, idle speed control, and ignition advance control.

ELECTRONIC CONTROL UNIT (ECU)

The ECU is located under the instrument panel, above the accelerator pedal. It receives information from the 13 engine sensors or switches to determine engine operating conditions at any particular moment. The ECU responds to these signals by sending a control signal to the fuel injector, fuel pump, ignition control module, idle speed actuator (ISA) motor, EGR solenoid, and canister purge solenoid. It also controls the Load Swap relay, and on Man. Trans. models, the up-shift indicator lamp.

SENSORS & SWITCHES

Exhaust Gas Oxygen (EGO) Sensor

The amount of oxygen in exhaust gases varies according to the air/fuel ratio of the intake charge. The exhaust gas oxygen sensor, located in the exhaust pipe, detects this content and transmits a low voltage signal to the ECU.

The outer surface of the sensor is exposed to exhaust gases, the inner surface to outside air. The difference in the amount of oxygen contacting the inner and outer surfaces of the sensor creates a pressure, which results in a small voltage signal. This signal, which is a measure of the unburned oxygen in the exhaust gas, is transmitted to the ECU.

If the amount of oxygen in the exhaust system is low (rich mixture), the sensor voltage signal will be high. If the mixture is lean, the oxygen sensor will generate a low voltage signal.

The sensor has a heating element that keeps the sensor at proper operating temperature during all operating modes.

Manifold Air/Fuel Temperature (MAT) Sensor

The manifold air/fuel temperature sensor is installed in the intake manifold. This sensor provides a voltage signal to the ECU representing the temperature of the air/fuel mixture in the intake manifold. The ECU compensates for air density changes during high temperature operation.

Coolant Temperature Sensor (CTS)

The coolant temperature sensor is located in the intake manifold coolant jacket. This sensor provides a voltage signal to the ECU. The ECU uses this signal to determine engine temperature. During cold engine operation, the ECU responds by enriching the air/fuel mixture delivered to the injector, compensating for fuel condensation in the intake manifold, controlling engine warm-up speed, increasing ignition advance, and inhibiting operation of the EGR system.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor detects absolute pressure in the intake manifold as well as ambient atmospheric pressure. This information is supplied to the ECU, through voltage signals, as an indication of engine load. The sensor is attached to the plenum chamber near the hood latch. A vacuum line from the throttle body supplies the sensor

with manifold pressure information.

Knock Sensor

The knock (detonation) sensor, located in the cylinder head, provides an input signal to the ECU whenever detonation occurs. The ECU then retards ignition advance to eliminate the detonation at the applicable cylinders.

Speed Sensor

The speed sensor (or crankshaft position sensor) is mounted at the flywheel/drive plate housing. The sensor detects the flywheel/drive plate teeth as they pass during engine operation and sends an electrical signal to the ECU, which calculates engine speed.

The flywheel/drive plate has a large trigger tooth and notch located 90° and 12 small teeth before each top dead center (TDC) position. When a small tooth or notch pass the magnetic core in the sensor, the build-up and collapse of the magnetic field induces a small voltage signal in the sensor pick-up windings.

The ECU counts these signals representing the number of teeth as they pass the sensor. When a larger trigger tooth and notch pass the magnetic core, a higher voltage signal is sent to the ECU. This indicates to the ECU that a piston will be at the TDC position 12 teeth later. The ECU either advances or retards ignition timing as necessary according to sensor inputs.

Battery Voltage

Battery voltage input to the ECU ensures that proper voltage is applied to the injector. The ECU varies voltage to compensate for battery voltage fluctuations.

Starter Motor Relay

The engine starter motor relay provides an input to the ECU, indicating the starter motor is engaged.

Wide Open Throttle (WOT) Switch

The WOT switch is mounted on the side of the throttle body. The switch provides a voltage signal to the ECU under wide open throttle conditions. The ECU responds to this signal by enriching the air/fuel mixture delivered to the injector.

Closed Throttle (Idle) Switch

This switch is integral with the idle speed actuator (ISA) motor. The switch provides a voltage signal to the ECU, which increases or decreases the throttle stop angle in response to engine operating conditions.

Transmission Gear Position Indicator

The gear position indicator is mounted on vehicles equipped with automatic transaxles. It provides a signal to the ECU to indicate that the transaxle is in a driving mode and not in Park or Neutral.

Power Steering Pressure Switch

The switch increases the idle speed during periods of high power steering pump load and low engine RPM.

A/C Switch

The A/C switch sends a signal to the ECU when the air conditioner is operating and when the compressor clutch must be engaged to lower the temperature. The ECU, in turn, increases engine speed to compensate for the added load of the air conditioner.

An electric in-tank fuel pump supplies fuel through the fuel filter located under the right rear floor pan to the throttle body, maintaining a constant operating pressure. Fuel enters the fuel bowl reservoir of the throttle body through the injector and overflow type fuel pressure regulator. The fuel pump is controlled by the ECU. A ballast resistor attached to the right side of the plenum chamber, reduces fuel pump speed after engine is running. The resistor is by-passed in the "Start" position.

The fuel injector and fuel pressure regulator are integral components of the throttle body. The injector is electronically-controlled by the ECU. See Fig. 15.

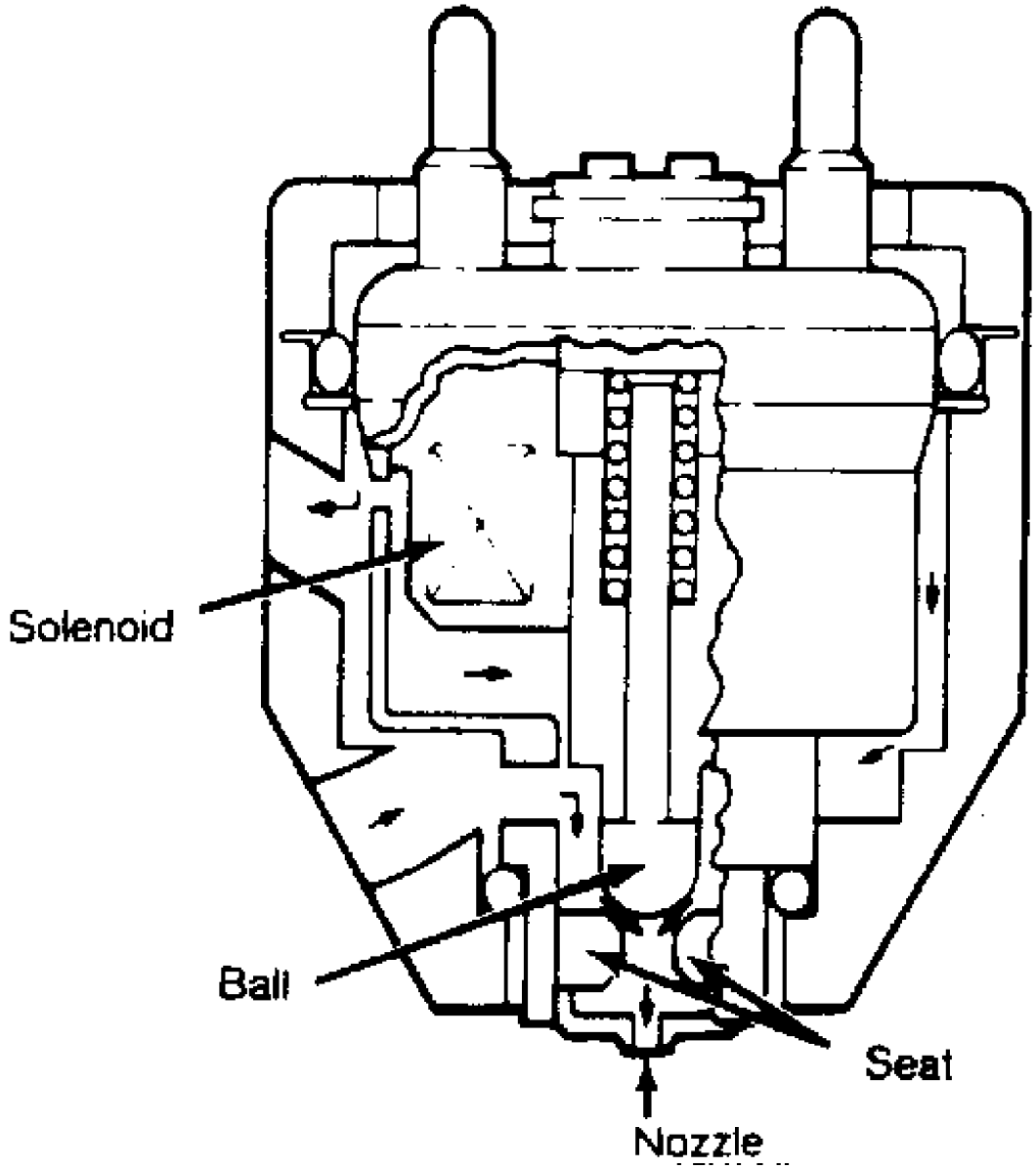


Fig. 2: Cross Section View of Injector

The fuel pressure regulator is a diaphragm-operated relief valve which maintains fuel pressure of 17.3 psi (1.2 kg/cm^2). See Fig. 16. Fuel in excess of this pressure is returned to fuel tank by a

fuel return line. The regulator is not controlled by the ECU. The regulator's spring chamber is vented to the same pressure as the tip of the injector.

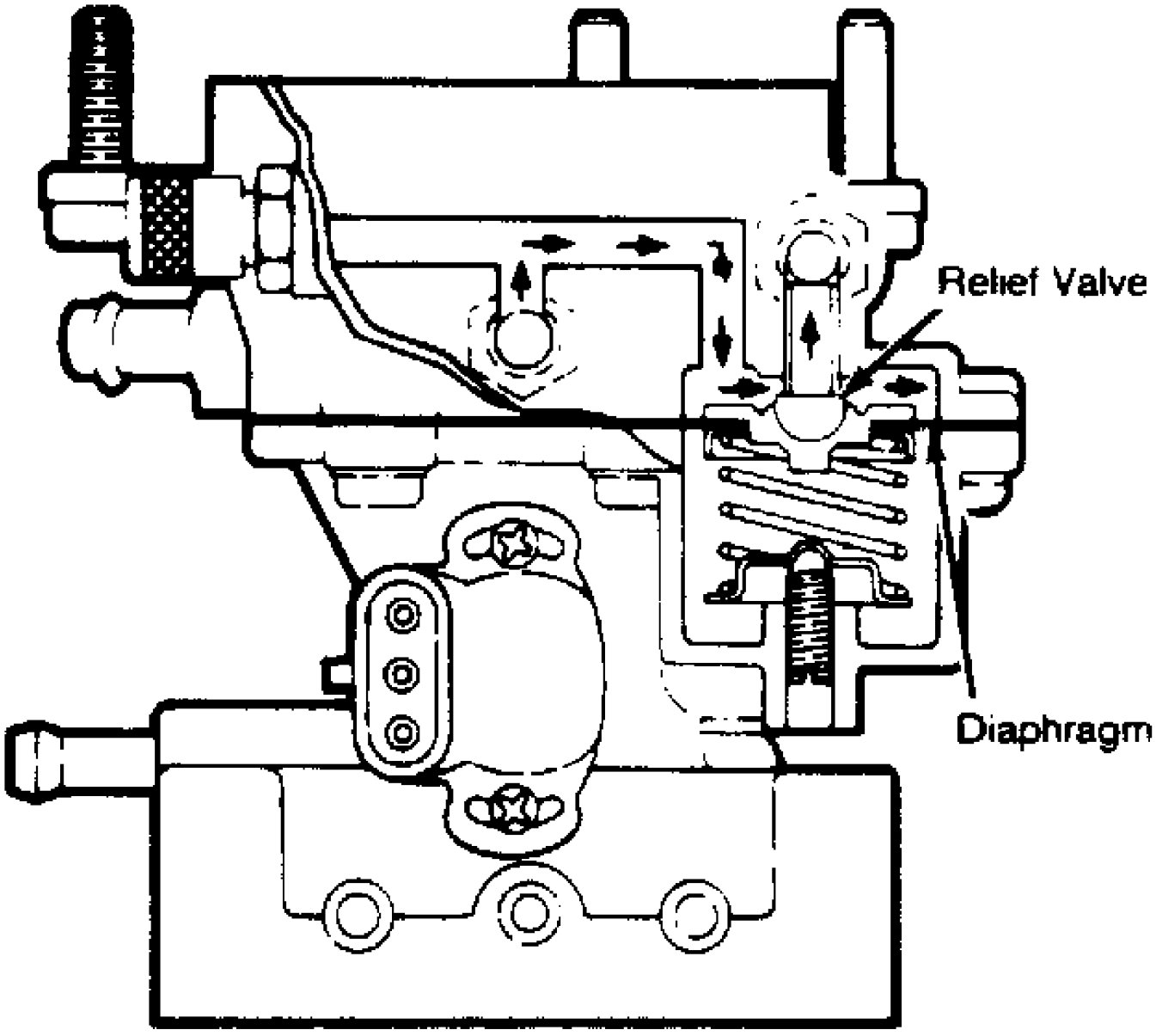


Fig. 3: Cross Section View of Fuel Pressure Regulator

Since fuel pressure at the injector is kept constant, the volume of fuel injected is dependent only on the length of time that the injector is energized. The injection time duration is based on engine operating conditions, which are provided to the ECU by the

input sensors. During engine start-up, the injector delivers an extra amount of fuel to aid in starting.

EMISSION CONTROL

Both EGR and canister purge operation are regulated by the ECU. Regulation of these 2 systems is accomplished through the use of an electrically-operated vacuum solenoid.

Whenever the solenoid is energized by the ECU, it prevents vacuum action on the EGR valve and canister. The solenoid is energized by the ECU during engine warm-up, improving cold driveability. It is also energized during closed throttle (idle), wide open throttle and during rapid acceleration or deceleration.

In this way the EGR is prevented from operating until the engine reaches a predetermined temperature. The canister purge does not operate until the oxygen sensor warms up and becomes operational. This prevents an over-rich mixture until the oxygen sensor can compensate for the extra fuel vapor.

IDLE SPEED ACTUATOR (ISA)

The ISA motor, located on the throttle body, is an electrically-driven actuator that changes the throttle stop angle by acting as a movable idle stop. The ECU commands the ISA to control engine idle speed and maintain a smooth idle during sudden engine deceleration. It does this by providing the appropriate voltage outputs to produce the idle speed or throttle stop angle required for the particular engine operating condition. There is no idle speed adjustment.

For cold engine starting, the throttle is held open for a longer period to provide adequate engine warm-up prior to normal operation. When starting a hot engine, the throttle is open for shorter time.

Under normal engine operating conditions, engine idle is maintained at a pre-programmed RPM, which may vary slightly due to engine operating conditions. Under certain engine deceleration conditions, the throttle is held slightly open.

IGNITION ADVANCE CONTROL

Under certain engine operating conditions, the predetermined ignition advance curve is modified. This is accomplished through 2 switching circuits that connect the ECU and the ignition control module.

ECU-CONTROLLED RELAYS

System Power Relay

Located on the right strut tower, this relay is energized during engine start up and remains energized until 3 to 5 seconds after the engine is stopped. This permits the ECU to extend the idle speed actuator for the next start up and then cease operation. See Fig. 4.

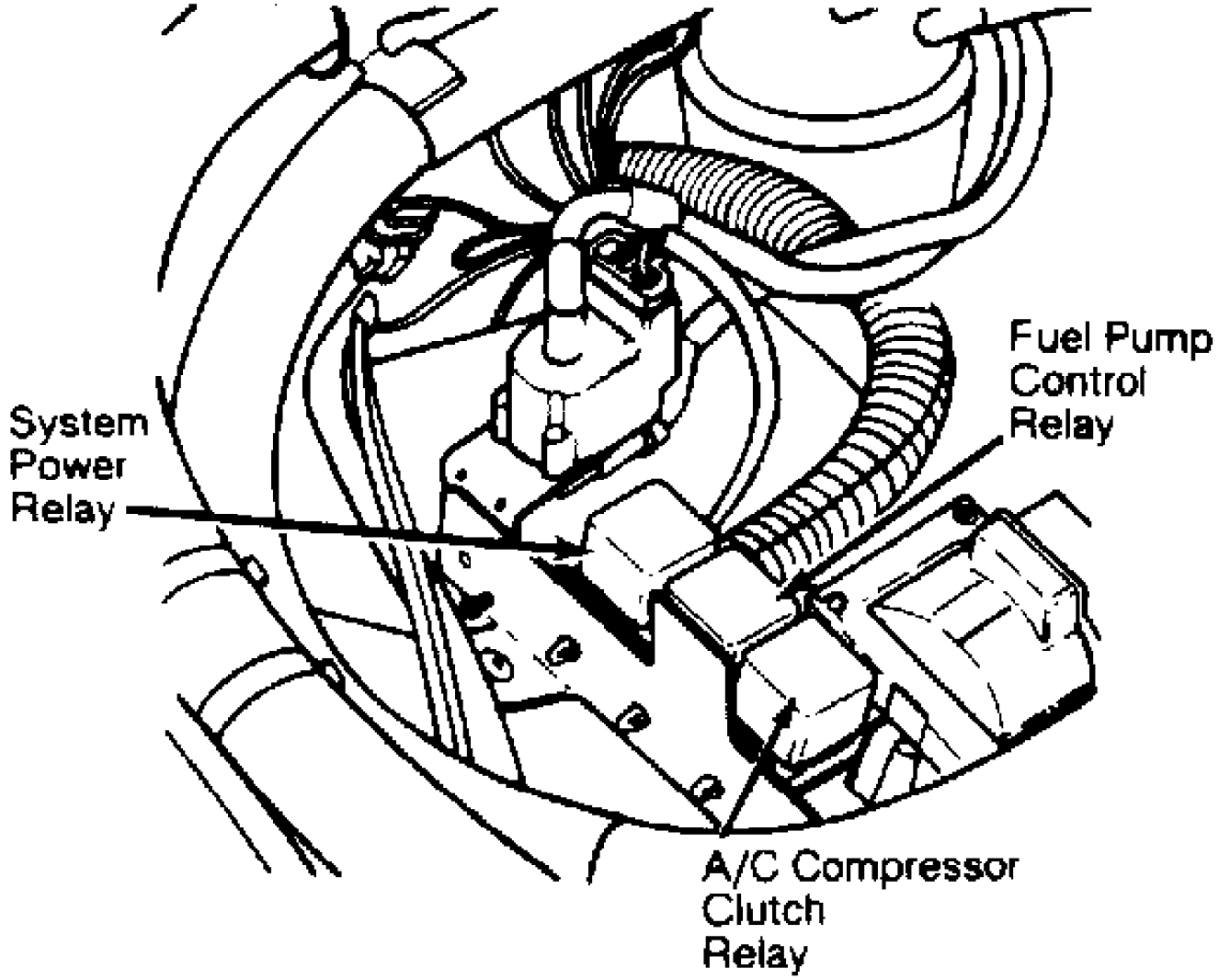


Fig. 4: Location of ECU-Controlled Relays

Load Swap Relay

The Load Swap Relay is used on models with A/C and power steering. The relay works in conjunction with the power steering pressure switch to disengage the A/C compressor clutch.

If the compressor clutch is engaged when the power steering pressure switch contacts close, the input signal from the switch to the ECU also activates the load swap relay. The relay contacts open, cutting off electrical feed to the compressor clutch. The clutch remains disengaged until the pressure switch contacts reopen and engine idle returns to normal.

NOTE: The load swap relay does not reengage the compressor clutch immediately. The relay has a timer that delays energizing the clutch for .5 second to ensure smooth engagement.

Fuel Pump Control Relay

Battery voltage is applied to the relay through the ignition switch. The relay is energized when a ground is provided by the ECU. When energized, voltage is applied to the fuel pump See Fig. 15.

A/C Clutch Relay

The ECU controls the A/C compressor clutch by means of the A/C clutch relay. See Fig. 15.

UP-SHIFT INDICATOR LAMP

Manual transaxle vehicles are equipped with an up-shift indicator lamp. The lamp is normally turned on when the ignition switch is turned "ON", and is turned off when the engine starts.

The lamp will again light during engine operation, according to engine speed and load conditions. A switch, located on the transaxle, prevents lamp from lighting when transmission is shifted to the next highest gear. If the shift of gears is not performed, the ECU will turn the lamp off after 3-5 seconds.

MODES OF OPERATION

IGNITION SWITCH "ON" MODE

When the TBI system is activated by the ignition switch, the system power relay is energized, and the fuel pump is energized by the ECU through the fuel pump relay. The pump will operate for approximately 1 second, unless the engine is operating or the starter motor is engaged.

The ECU receives input from the CTS, MAT, and MAP sensors. The up-shift indicator lamp is illuminated.

ENGINE START-UP MODE

When the starter motor is engaged, the ECU receives inputs from the CTS and speed sensors, the starter motor relay, and the wide open throttle switch. The fuel pump is activated by the ECU and voltage is applied to the injector, with the ECU controlling injection time.

The ECU determines proper ignition timing from the speed sensor input. If the wide open throttle switch is engaged, the ECU will deactivate the injector to prevent flooding.

ENGINE WARM-UP MODE

The ECU receives inputs from the CTS, MAT, MAP, speed, and knock sensors. It also is informed of throttle, gear (automatic transaxle models) and A/C control position.

The ECU provides a ground for the injector, precisely controlling fuel delivery to the engine. The ECU also controls ignition timing, engine idle speed and throttle stop angle. On vehicles with manual transmissions, the up-shift indicator lamp is controlled according to engine speed and load.

CRUISE MODE

During cruising speed, the ECU receives inputs from the CTS, MAT, MAP, EGO, speed and knock sensors. It is also informed of throttle, gear (automatic transaxle models), and A/C control position.

The ECU provides a ground to the injector, precisely controlling injector time. It also controls idle speed, throttle stop angle, ignition timing, air/fuel mixture ratio and up-shift indicator lamp.

DECELERATION MODE

During deceleration, the ECU receives inputs from the CTS,

MAT, MAP, EGO, speed and knock sensors. It also is informed of throttle, gear (automatic transaxle models) and A/C control position.

When the ECU receives deceleration input from the closed throttle (idle) switch, it grounds the EGR valve/canister purge solenoid. This interrupts vacuum to EGR valve and canister purge function. The injector is grounded, and during rapid deceleration, the ECU may stop injection for a short period of time. The ECU also controls engine idle speed and throttle stop angle.

WIDE OPEN THROTTLE MODE

During wide open throttle mode, the ECU receives inputs from the CST, MAT, MAP, EGO, speed and knock sensors. It also monitors throttle position.

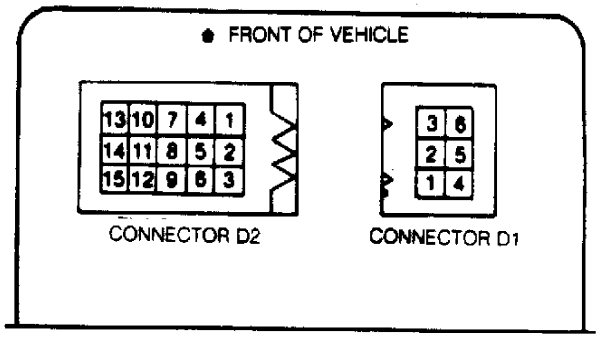
When the ECU receives deceleration input from the closed throttle (idle) switch, it grounds the EGR valve/canister purge solenoid. This interrupts vacuum to EGR valve and canister purge function. The EGO sensor input is not accepted by the ECU. The injector is grounded and amount of fuel is precisely controlled.

IGNITION SWITCH "OFF" MODE

When ignition switch is turned "OFF", the ECU ceases to provide ground for the injector and all fuel injection stops. The ECU causes the idle speed actuator to fully extend for the next start up. The ECU then deactivates.

COMPONENT TESTING

NOTE: When test calls for volt-ohmmeter, use of a high impedance digital type is required.



Connector D2
1. ECU Data Output
2. System Power Relay
3. Park/Neutral Switch
4. System Power (B+)
5. A/C Clutch
7. Ground
8. Air/Fuel Temp. Sensor
9. Ignition Control Module
10. EGR/Canister Purge
11. ISA Motor Forward
12. Coolant Temp. Sensor
13. Closed Throttle Switch
14. ISA Motor Reverse
15. Auto. Trans. Diagnosis

Connector D1
1. Tach (RPM) Voltage
2. Ignition
3. Ground
4. Starter Motor Relay
5. Battery
6. Fuel Pump

Fig. 5: Diagnostic Connectors D1 and D2 Terminal Identification

1) Disconnect wiring harness connector from the MAT sensor. Test resistance of the sensor with an ohmmeter. If resistance is not 185-100,700 ohms (3400 ohms at 70°F; 1600 ohms at 100°F), replace

sensor. With engine warm, resistance should be less than 1000 ohms.

2) Connect one ohmmeter lead to sensor connector terminal. Connect other lead, in turn, to ECU harness connector terminals 32 and 14. Repair wiring harness if resistance is greater than 1 ohm.

COOLANT TEMPERATURE SENSOR

1) Disconnect wiring harness from CTS sensor. Test resistance of sensor. If resistance is not 185-100,700 ohms (3400 ohms at 70°F; 1600 ohms at 100°F), replace sensor. With engine warm, resistance should be less than 1000 ohms.

2) Connect one ohmmeter lead to sensor connector terminal. Connect other lead, in turn to ECU harness connector terminals 15 and 32. Repair wiring harness if an open circuit is indicated.

WIDE OPEN THROTTLE (WOT) SWITCH

1) Disconnect wiring harness from WOT switch. Connect ohmmeter leads to switch terminals, and manually open and close the switch. When switch is closed, resistance should be infinite. A low resistance should be indicated at wide open position. Test switch operation several times. Replace WOT switch if defective. Reconnect wiring harness.

2) With ignition switch "ON", connect voltmeter between pin 6 and pin 7 (ground) of diagnostic connector D2. Voltage should be zero with switch in wide open position and greater than 2 volts in any other position.

3) If voltage is always zero, test for short circuit to ground in wiring harness or switch. Check for open circuit between pin 8 of ECU connector and the switch connector. Repair or replace wiring harness as necessary.

4) If voltage is always greater than 2 volts, test for an open wire or connector between the switch and ground. Repair as required.

CLOSED THROTTLE SWITCH

NOTE: It is important that all testing be done with the idle speed actuator (ISA) motor plunger in the fully extended position (as it would be after a normal engine shut down). If it is necessary to extend the motor plunger to test the switch, an ISA motor failure can be suspected. Refer to ISA motor test.

1) With ignition on, connect voltmeter positive lead to pin 13 of diagnostic connector D2. Attach negative lead to pin 7. Voltage should be close to zero at closed throttle and greater than 2 volts at any position other than closed throttle.

2) If the voltage is always zero, test for a short circuit to ground in the wiring harness or switch. Test for an open circuit between pin 25 of ECU connector and throttle switch.

3) If voltage is always more than 2 volts, test for an open circuit in the wiring harness between the ECU and switch connector. Also check for open circuit between the switch connector and ground. Repair or replace wiring harness as needed.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

1) Inspect MAP sensor vacuum hose connections at sensor and throttle body. Repair as required. Test MAP sensor output voltage at MAP sensor connector pin B (as marked on sensor body) with the ignition switch "ON" and engine off. See Fig. 15. Output voltage should be 4.0-5.0 volts.

NOTE: Voltage should drop 0.5-1.5 volts with hot engine, at idle.

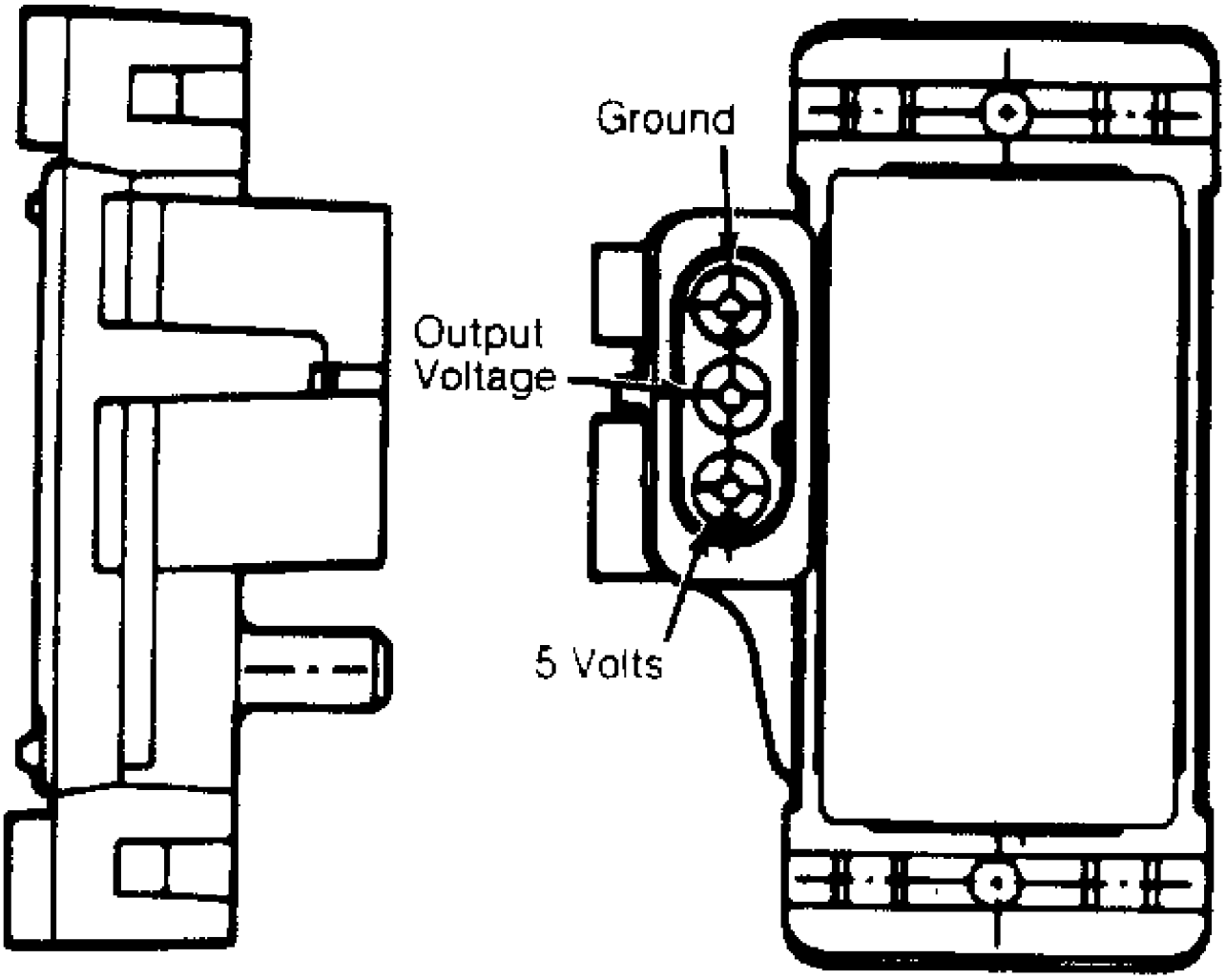


Fig. 6: MAP Sensor Terminal Identification
If markings on MAP sensor vary from illustration, use markings on sensor.

2) Test voltage at pin 33 of ECU connector for 4.0-5.0 volts to verify wiring harness condition. Repair if required.

3) With ignition on, check for MAP sensor supply voltage of 4.5-5.5 volts at sensor connector pin C. Similar voltage should be present at pin 16 of ECU connector. Repair or replace wiring harness if required. Test for sensor ground between pin 17 of ECU connector and pin A of sensor connector.

4) Using an ohmmeter, check for ground from pin 17 of ECU connector to pin 2. If an open circuit is indicated, check for a defective sensor ground on the flywheel housing near the starter motor.

5) If ground is good, the ECU must be replaced. Before replacing ECU, check to see if pin 17 of ECU connector is shorted to 12 volts. If so, correct the condition and test ECU before replacing. Refer to the ELECTRONIC CONTROL UNIT TEST.

ELECTRONIC CONTROL UNIT

1) If all components have been checked and/or repaired, but a system failure or problem still exists, the ECU may be at fault. However, the ECU is a very reliable unit and must always be the final component replaced if a doubt exists concerning the cause of a system failure.

2) The only way to confirm an ECU malfunction is to take the unit to an AMC dealer to have it tested. This is the only sure way to avoid replacing a good ECU.

SYSTEM DIAGNOSIS

PRELIMINARY CHECKS

Be sure fuel is actually reaching the injector. Make sure no air is entering the intake or exhaust system above the catalytic converter. Before assuming an engine control system malfunction, inspect the following systems to ensure components are in good condition and are operating properly.

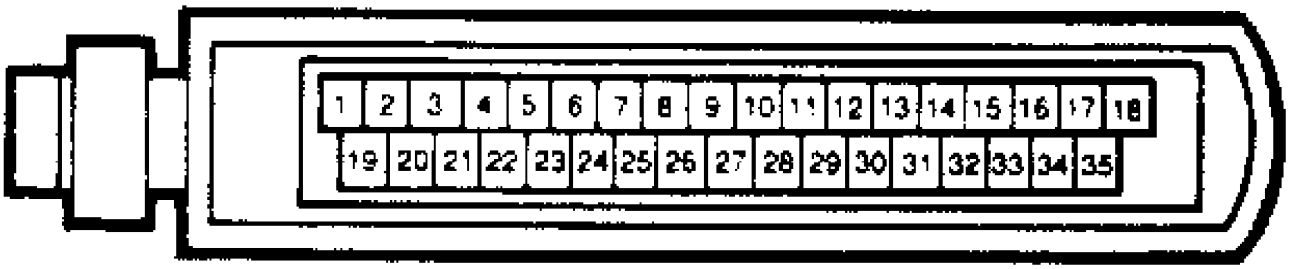
* All support systems and wiring.
* Battery connections and specific gravity.
* Electrical and vacuum connections on components and sensors.
* Emission control devices.
* Ignition system.
* Vacuum hoses.

CAUTION: Never connect or disconnect a component without turning the ignition switch off. Never apply more than 12 volts or AC voltage to system terminals. Disconnect battery cables before charging it. Remove ECU if temperatures are expected to exceed 176°F (80°C), such as in a paint shop bake oven.

DIAGNOSTIC TEST CHARTS

Following are 6 different diagnostic test flow charts, providing the shortest means of testing the system. These include:

* Ignition Switch "OFF" Chart - Tests system power for ECU memory keep-alive voltage.
* Ignition Switch "ON" Power Chart - Tests system power function and fuel pump power function.
* Ignition Switch "ON" Input Chart - Tests closed throttle (idle) switch, wide open throttle (WOT) switch, manifold absolute pressure (MAP) sensor, park/neutral switch, coolant temperature sensor (CTS), manifold air/fuel temperature (MAT) sensor and the respective switch or sensor circuits.
* System Operational Chart - Tests engine start-up and fuel injector circuits, plus function of closed loop air/fuel mixture, coolant temperature sensor, manifold air/fuel temperature sensor, knock sensor and closed loop ignition retard/advance, EGR valve and canister purge solenoid, idle speed actuator, and A/C control.
* Basic Engine Chart - Indicates possible failures within other engine related components.
* Man. Trans. Up-shift Chart - Tests up-shift indicator lamp function on manual transmission vehicles.



1. Ground
2. Ground
3. Ignition Switch
4. Battery
5. EGR/Canister Purge
6. Fuel Pump Relay
7. System Power Relay
8. WOT Switch
9. Not Used
10. System Ground
11. Speed Sensor
12. Park/Neutral Switch
13. TPS Ground
14. MAT Sensor
15. CTS Sensor
16. MAP Supply Voltage
17. MAP Ground
18. Shift Lamp (Man. Trans.)
19. System Power (B+)
20. Not Used
21. Injector
22. A/C Compressor Clutch
23. ISA Motor Retract
24. ISA Motor Extend
25. Closed Throttle Switch
26. Not Used
27. Ignition Output
28. Speed Sensor
29. Start
30. A/C Control Switch
31. Throttle Position Sensor
32. Sensor Ground
33. MAP Output Voltage
34. A/C Temp. Control
35. Oxygen Sensor

Fig. 7: ECU Connector Terminal Identification

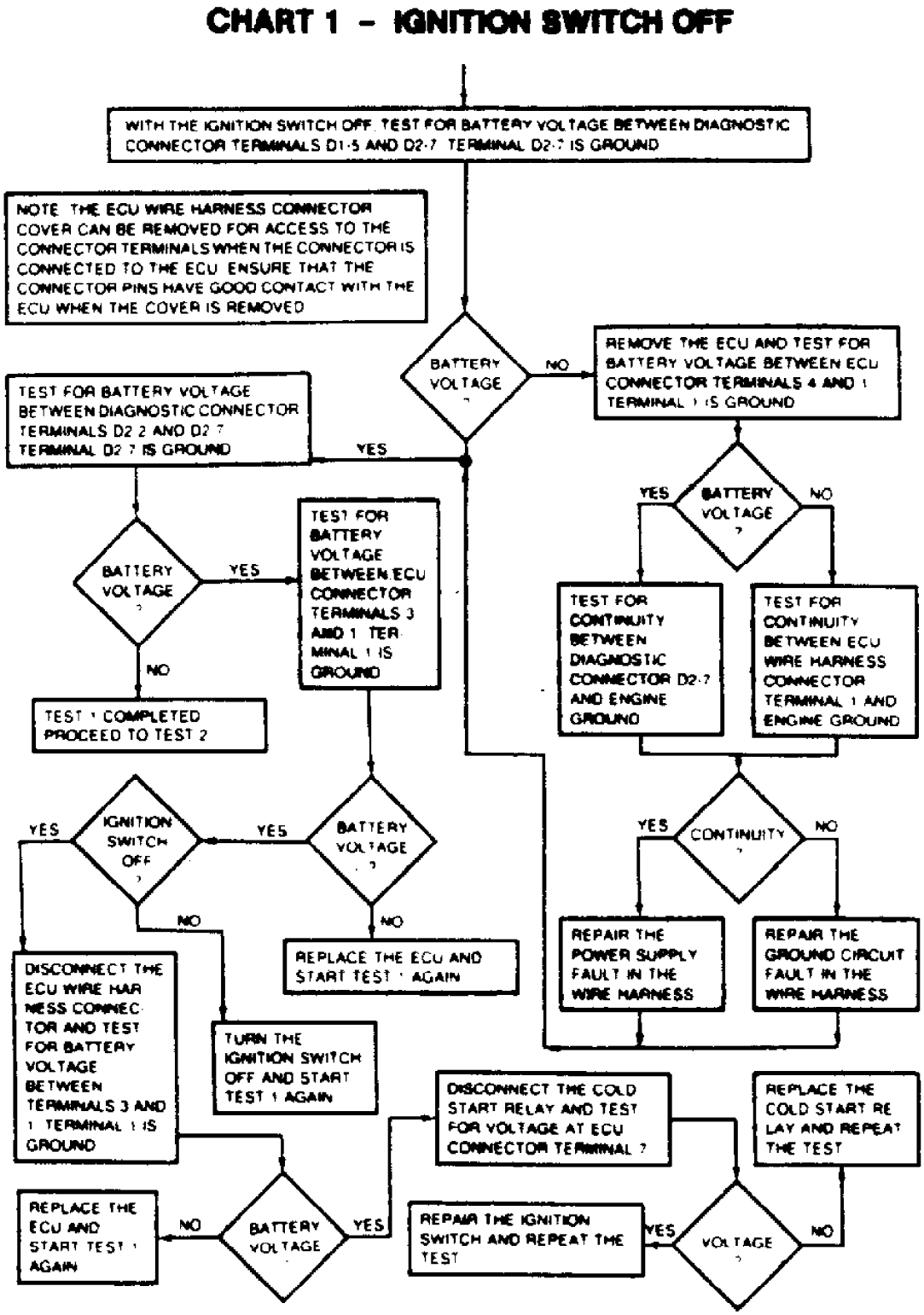


Fig. 8: Chart 1 - Ignition Switch Off

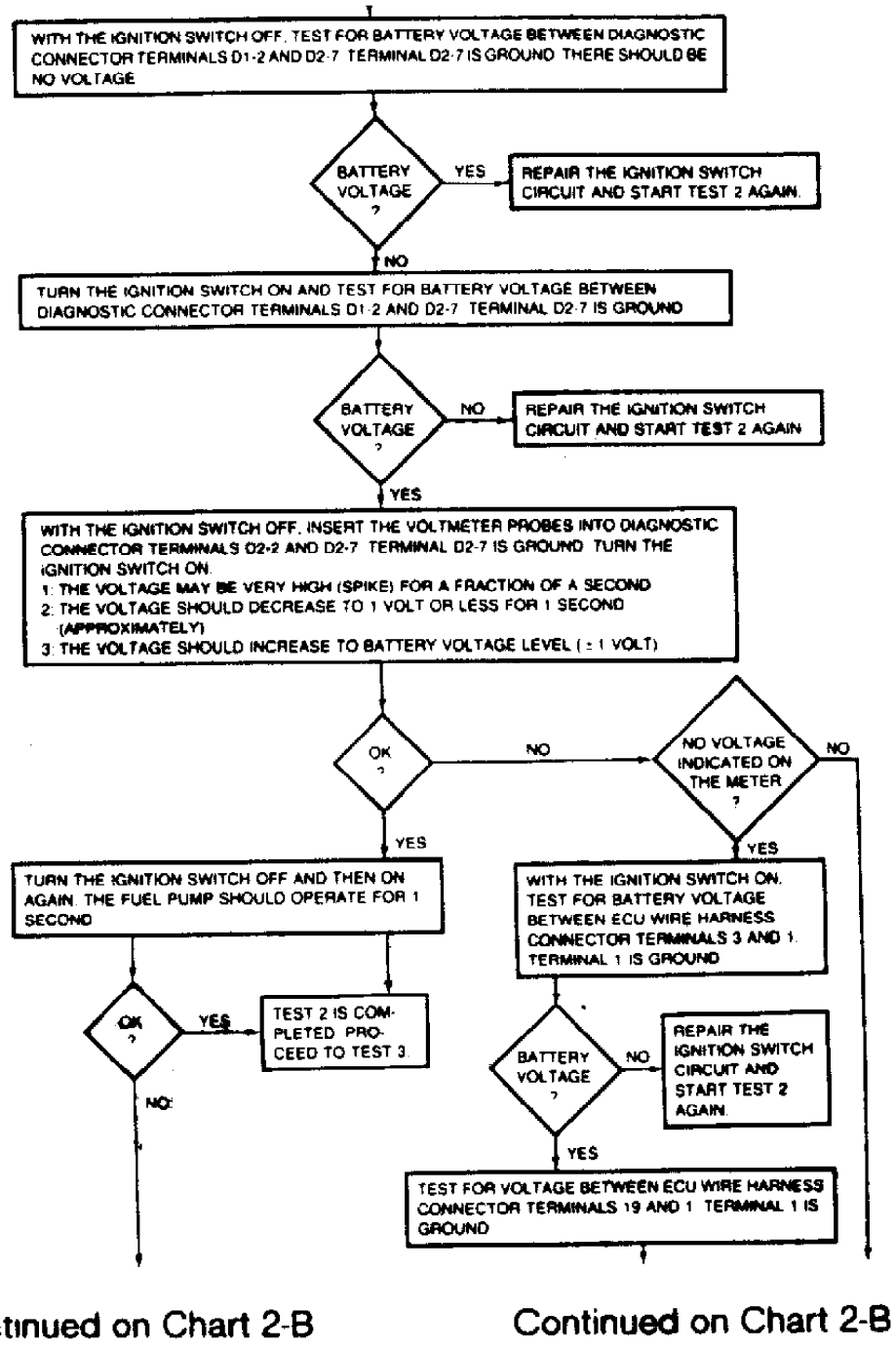


Fig. 9: Chart 2-A - Ignition Switch On

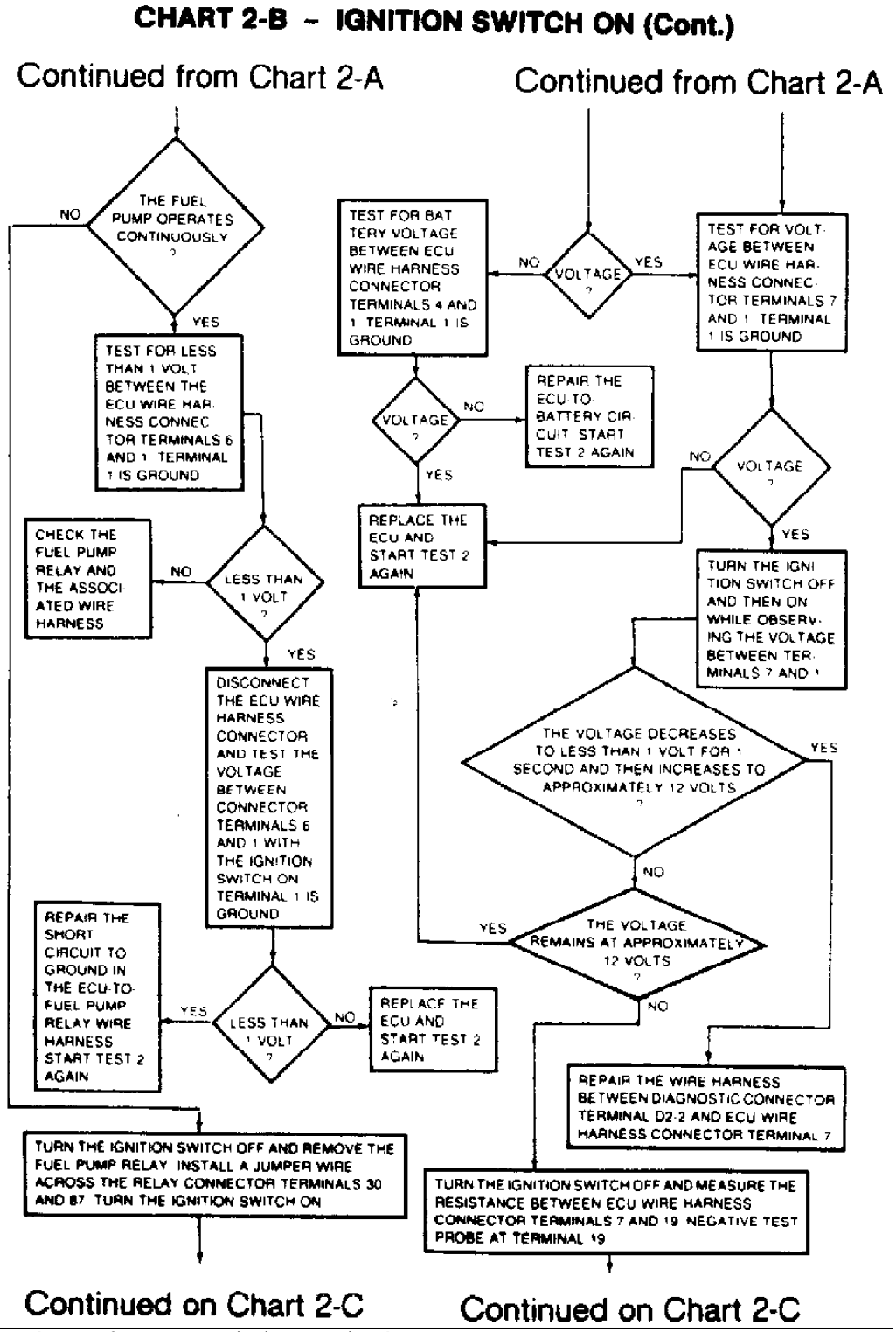


Fig. 10: Chart 2-B - Ignition Switch On (Cont.)

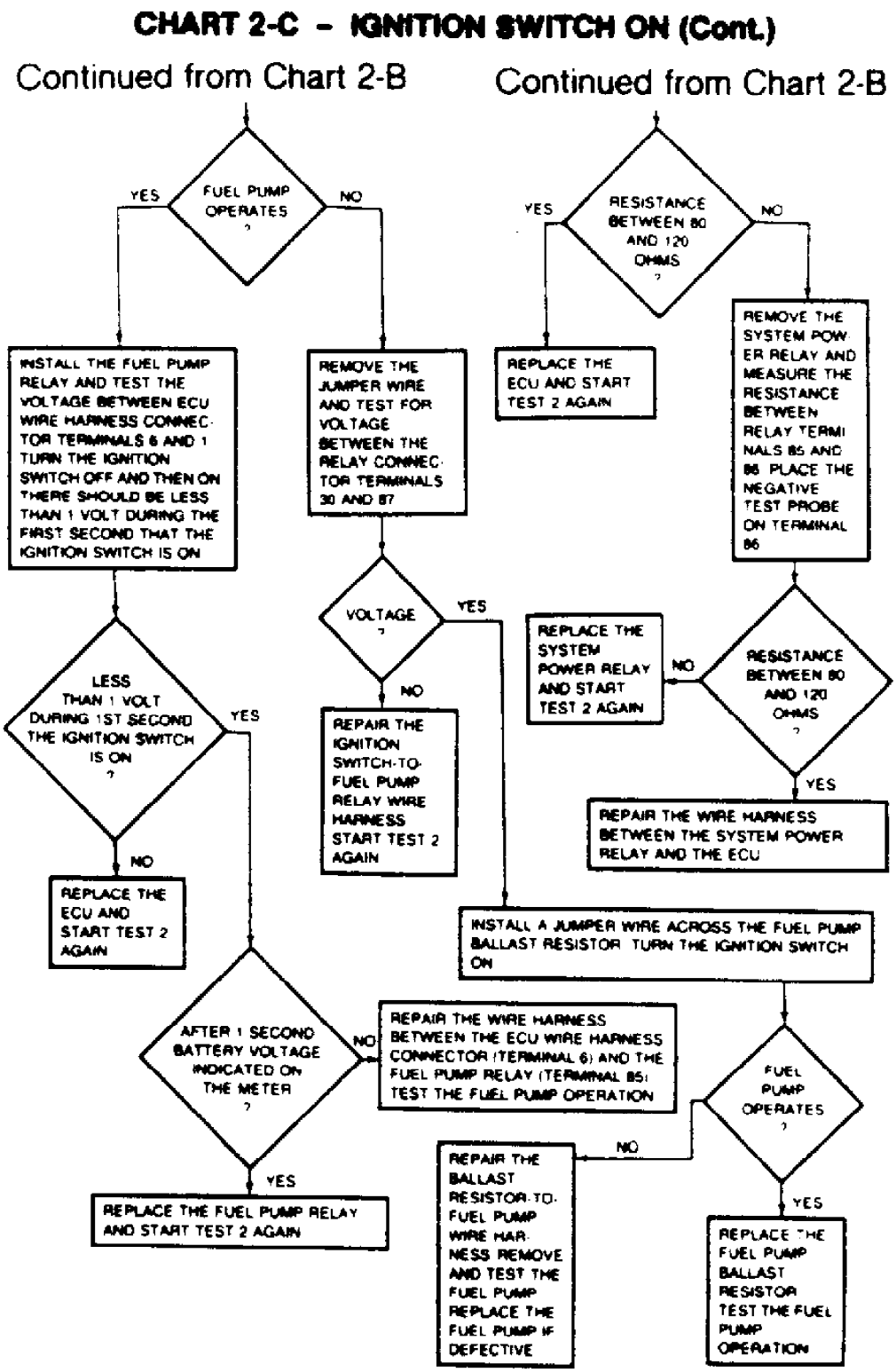


Fig. 11: Chart 2-C - Ignition Switch On (Cont.)

CHART 3 - THROTTLE POSITION SENSOR TEST

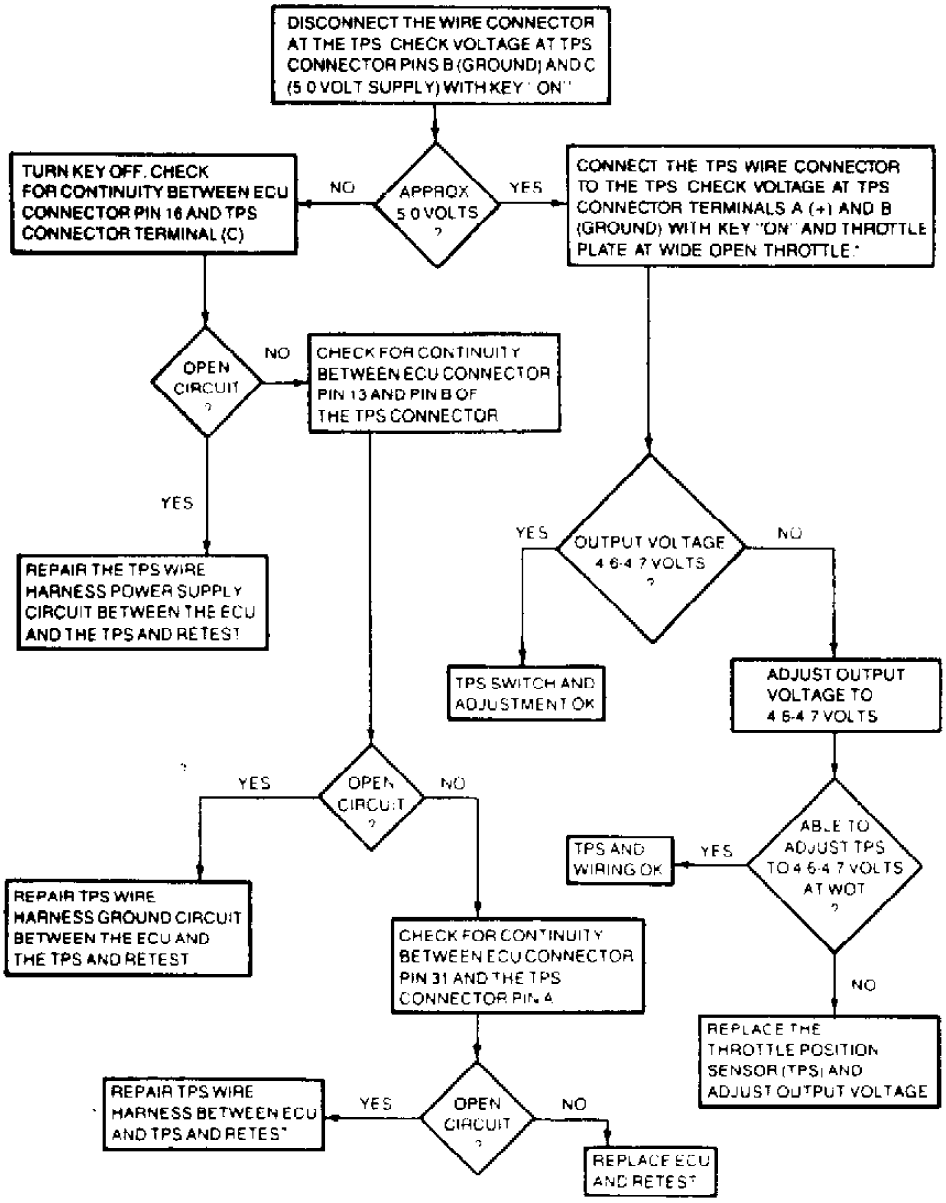


Fig. 12: Chart 3 - Throttle Position Sensor Test

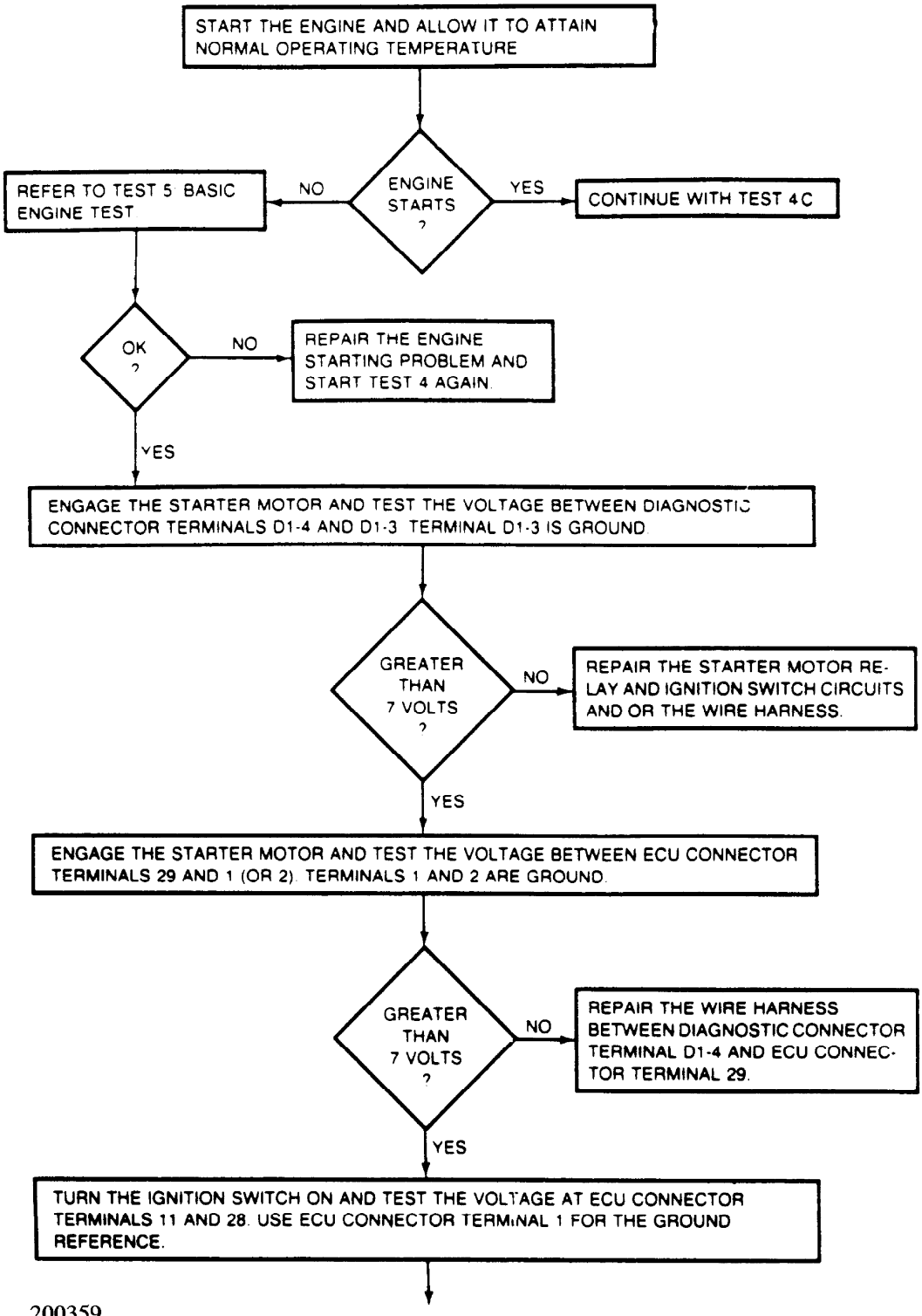


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Fig. 13: Chart 4-A - System Operational Test

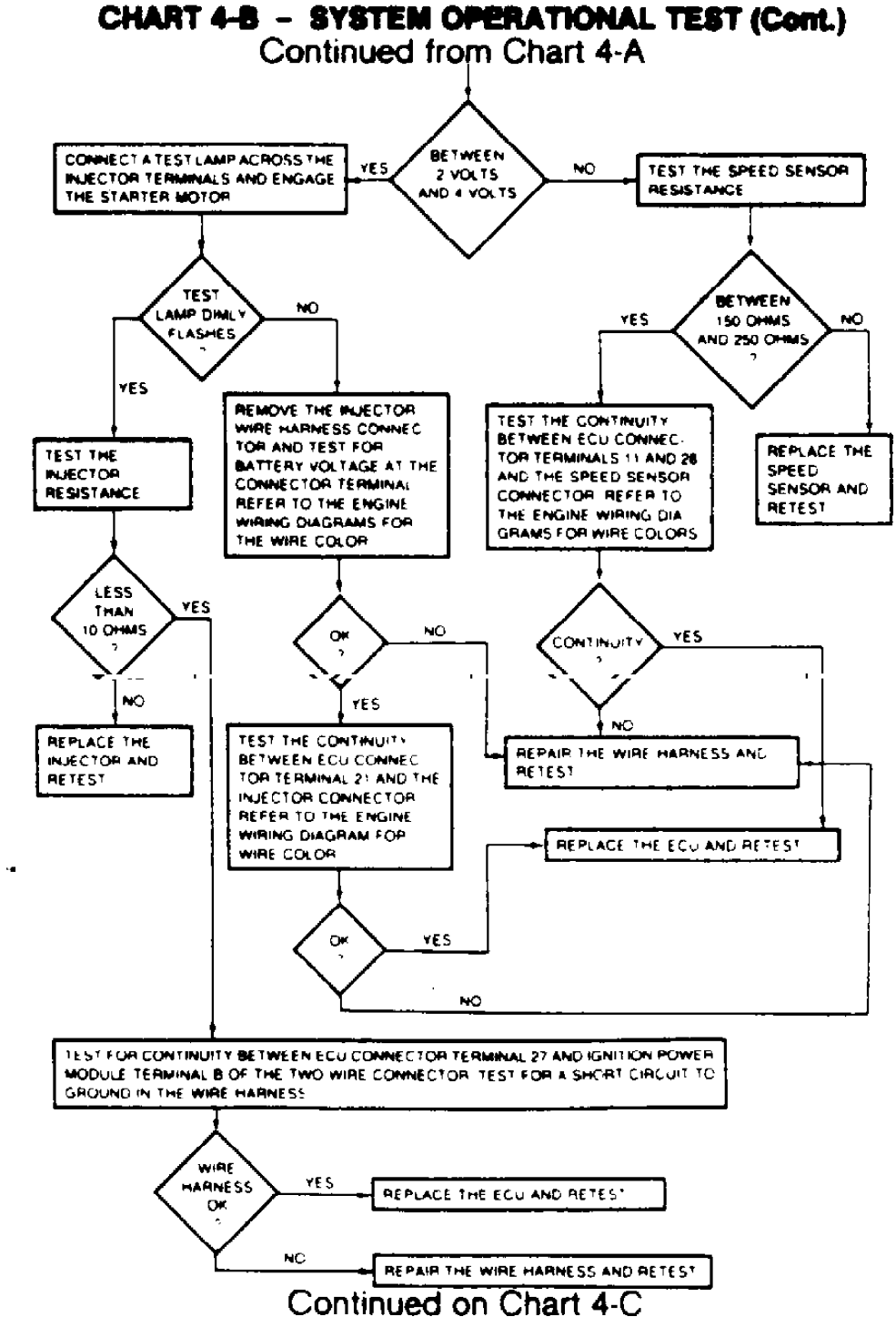
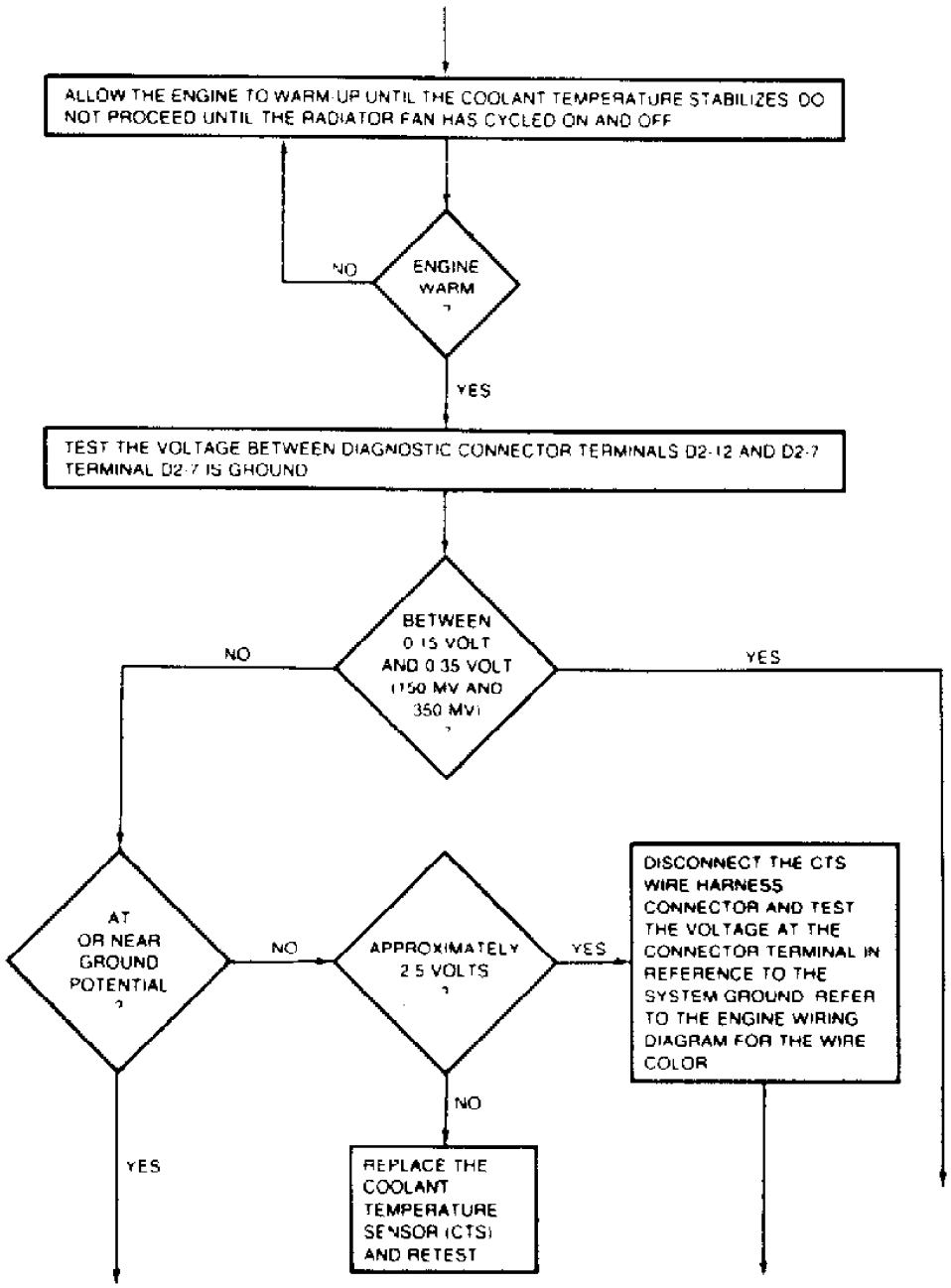


Fig. 14: Chart 4-B - System Operational Test (Cont.)

CHART 4-C - SYSTEM OPERATIONAL TEST (Cont.)

Continued from Chart 4-B



Continued on Chart 4-D

Fig. 15: Chart 4-C - System Operational Test (Cont.)

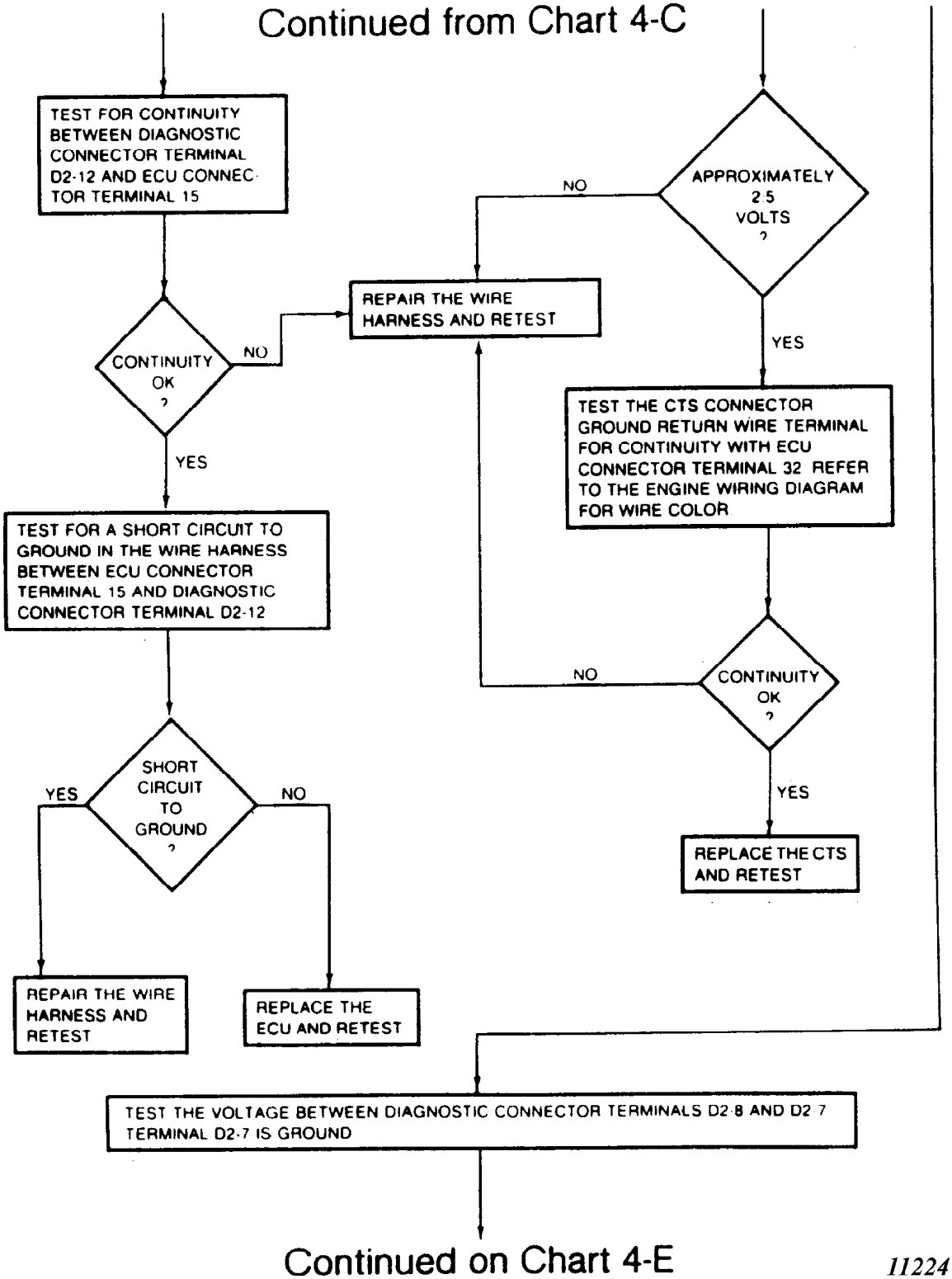


Fig. 16: Chart 4-D - System Operational Test (Cont.)

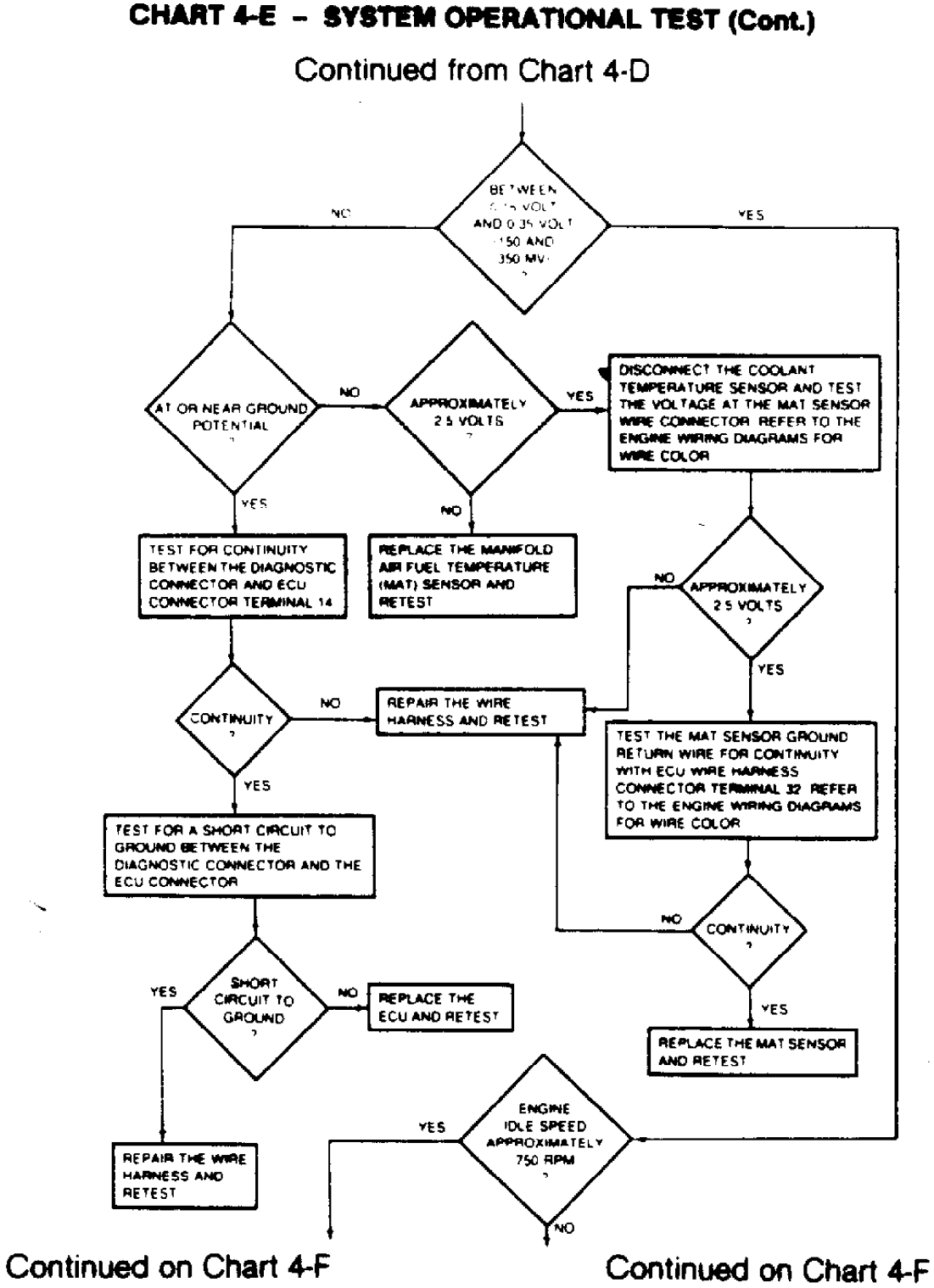


Fig. 17: Chart 4-E - System Operational Test (Cont.)

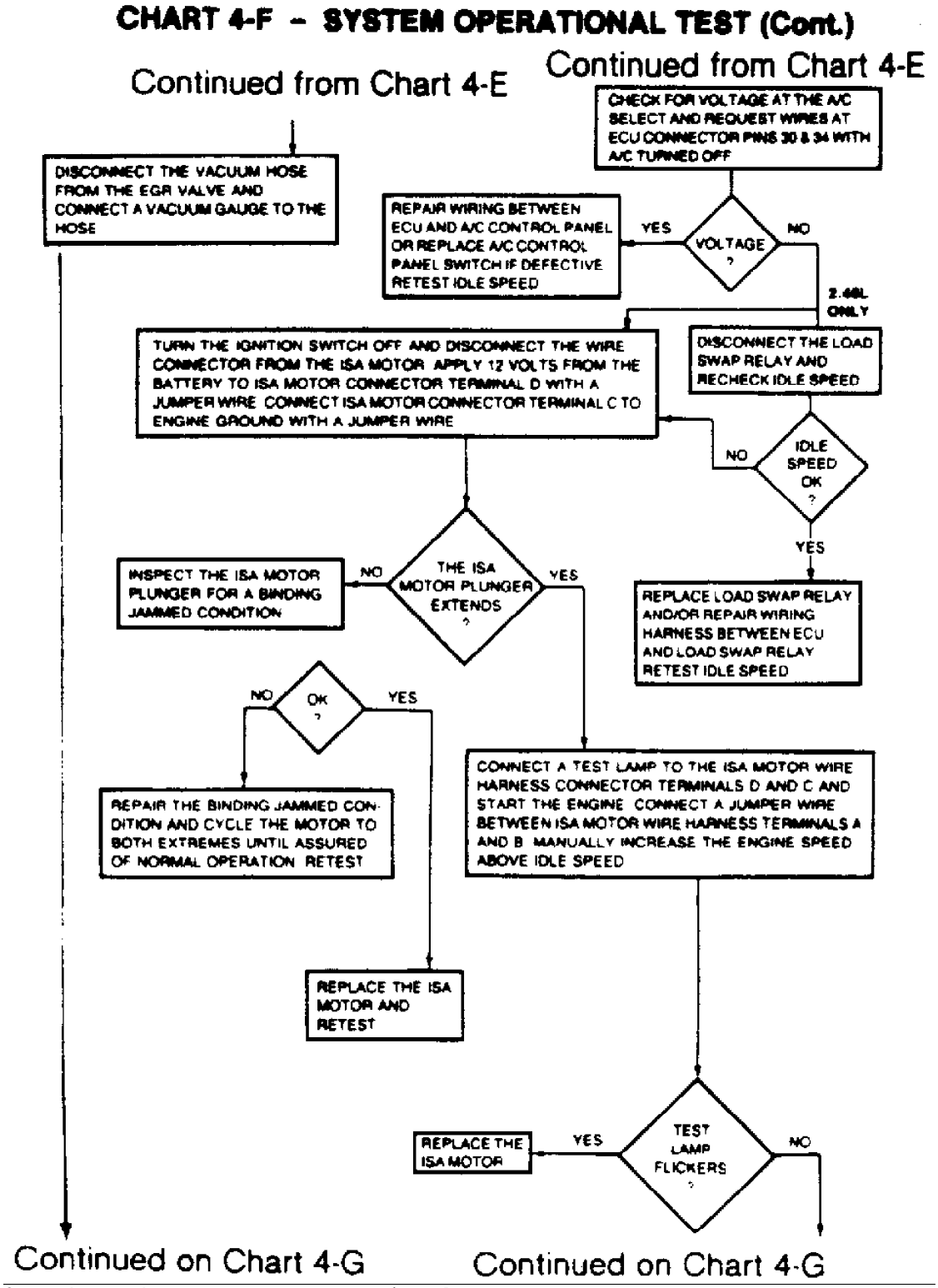


Fig. 18: Chart 4-F - System Operational Test (Cont.)

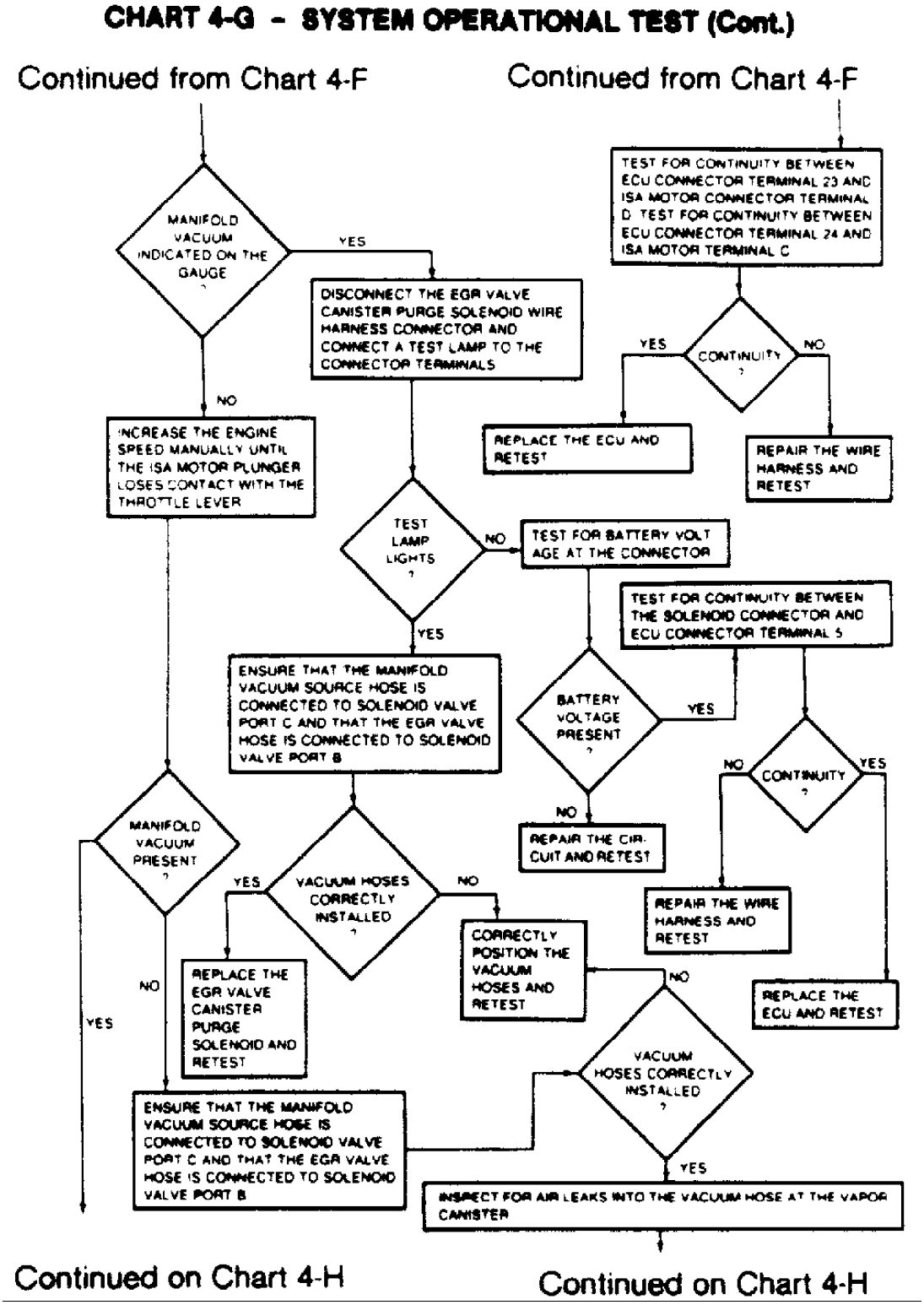


Fig. 19: Chart 4-G - System Operational Test (Cont.)

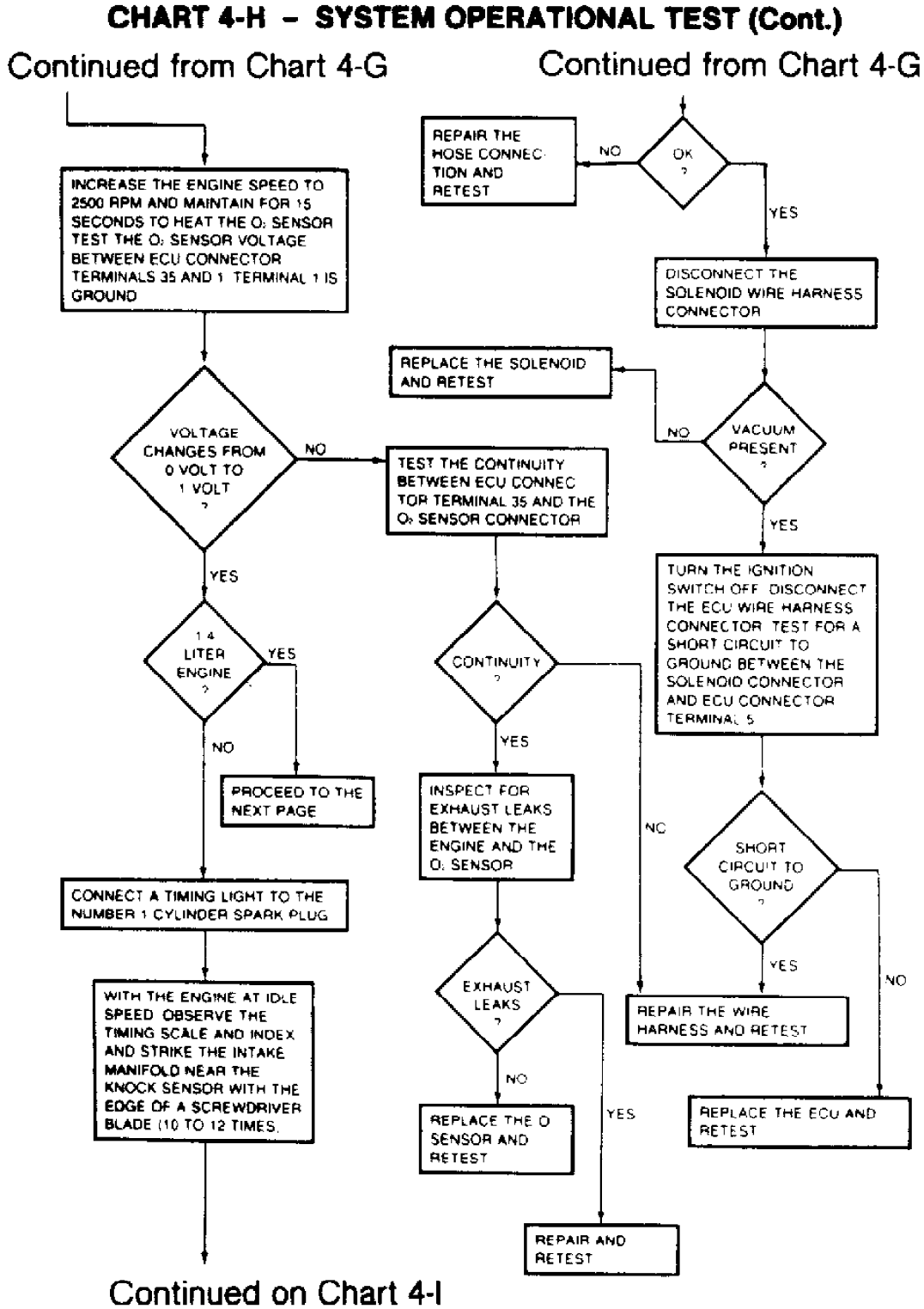


Fig. 20: Chart 4-H - System Operational Test (Cont.)

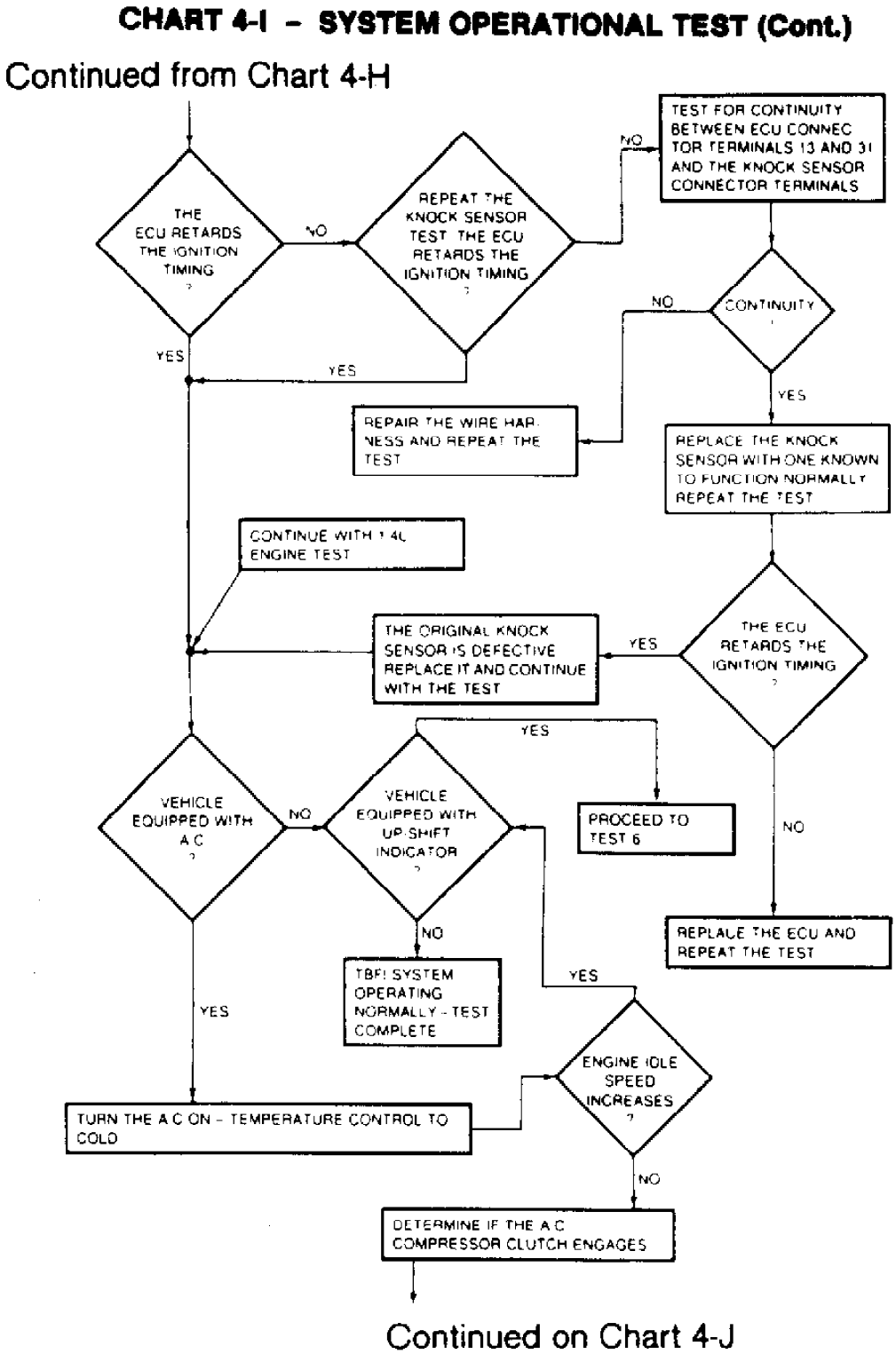


Fig. 21: Chart 4-I - System Operational Test (Cont.)

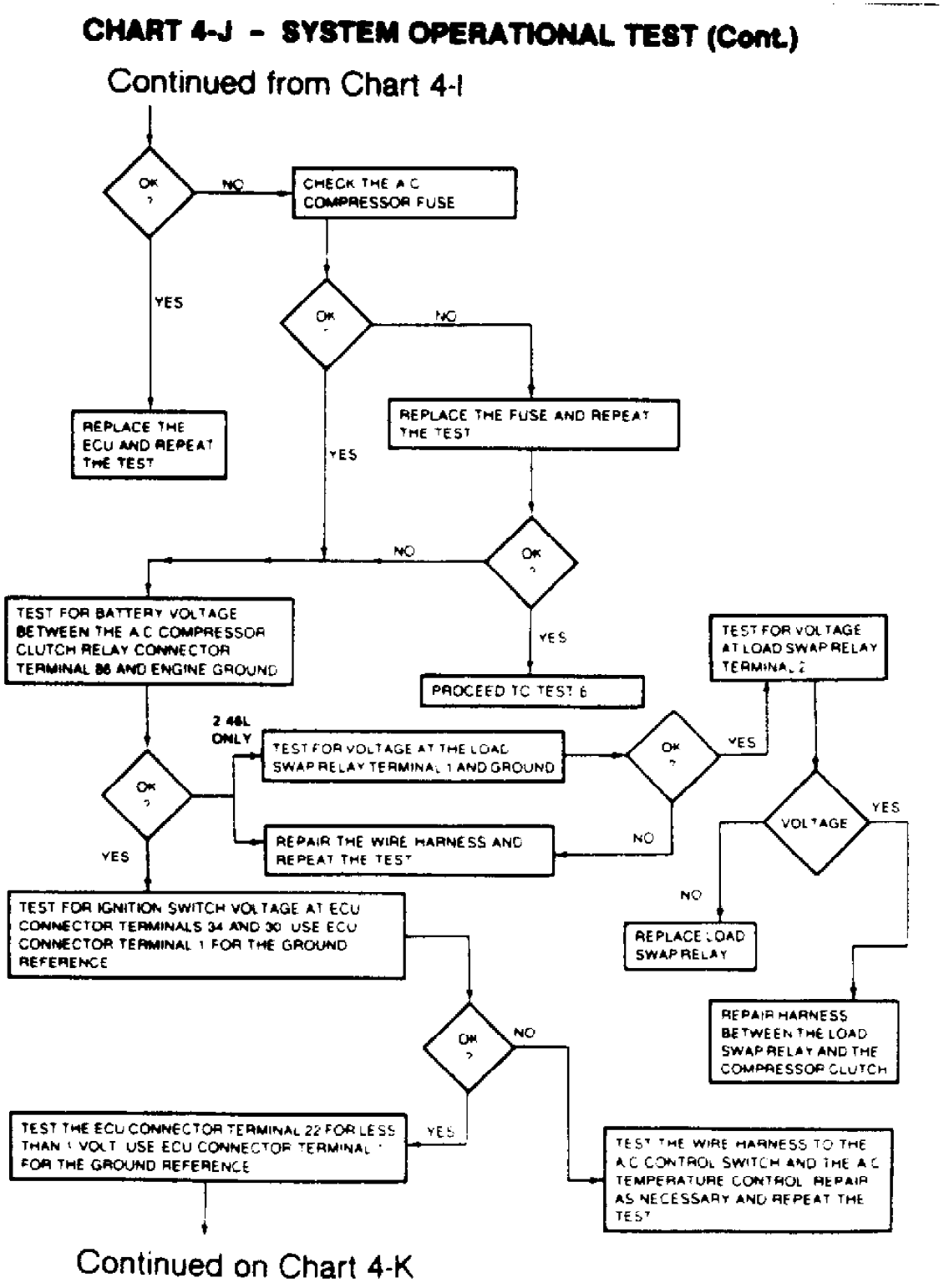


Fig. 22: Chart 4-J - System Operational Test (Cont.)

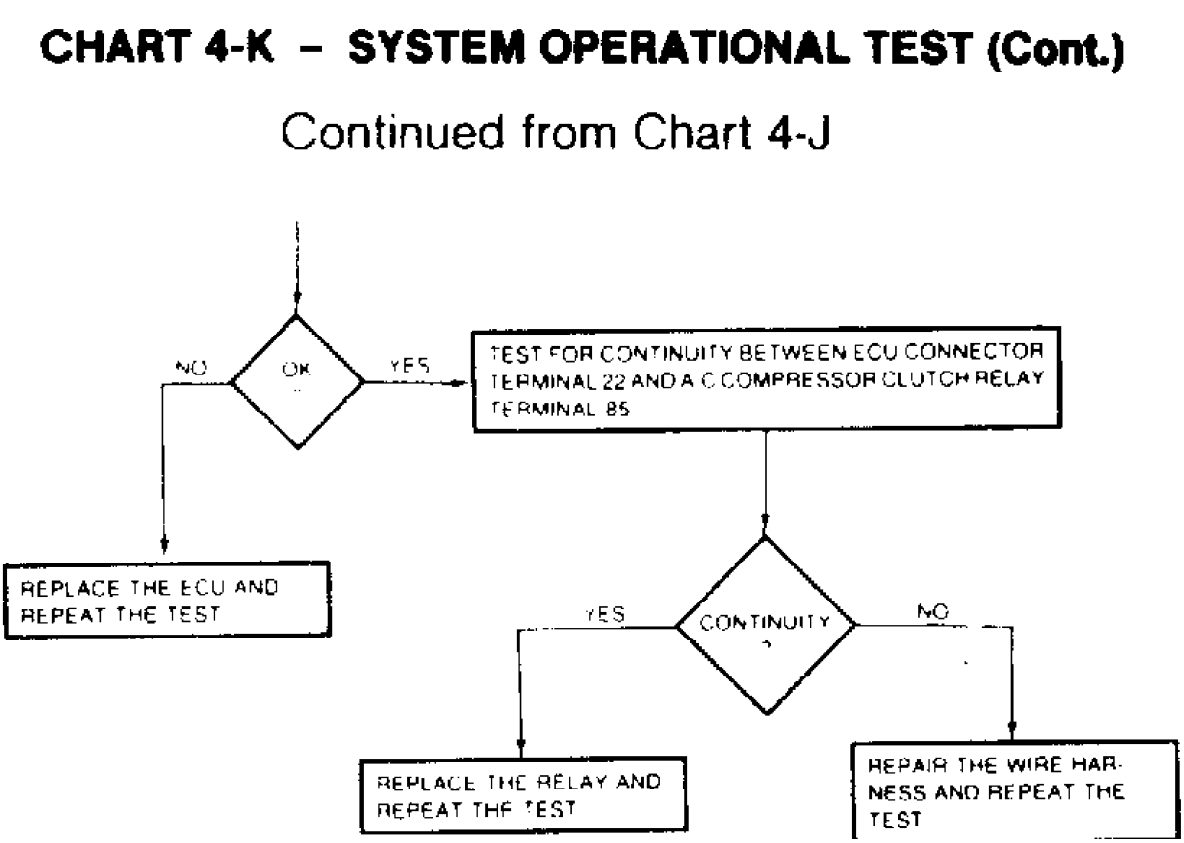


Fig. 23: Chart 4-K - System Operational Test (Cont.)

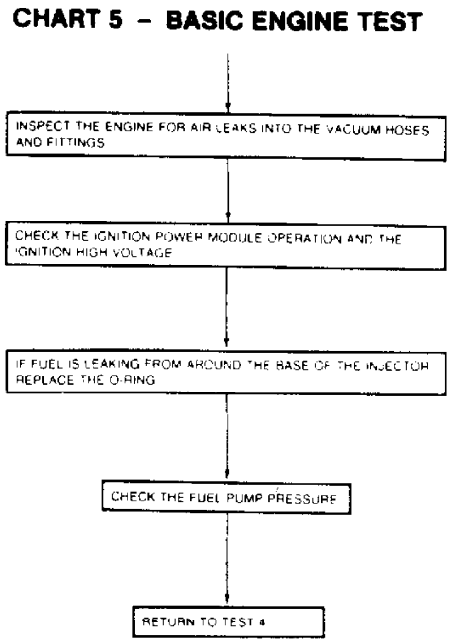


Fig. 24: Chart 5 - Basic Engine Test

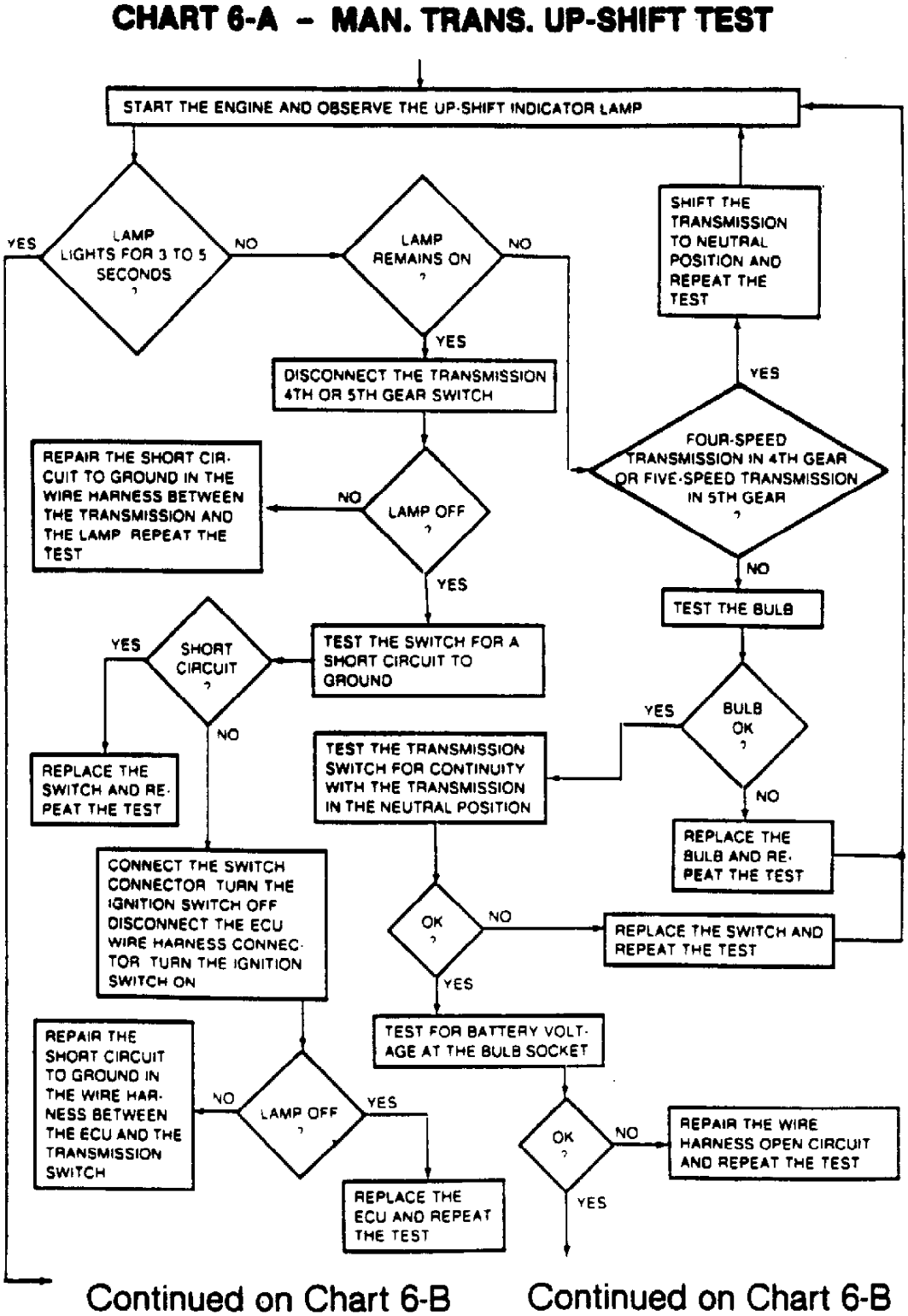


Fig. 25: Chart 6-A - Man. Trans. Up-Shift Test

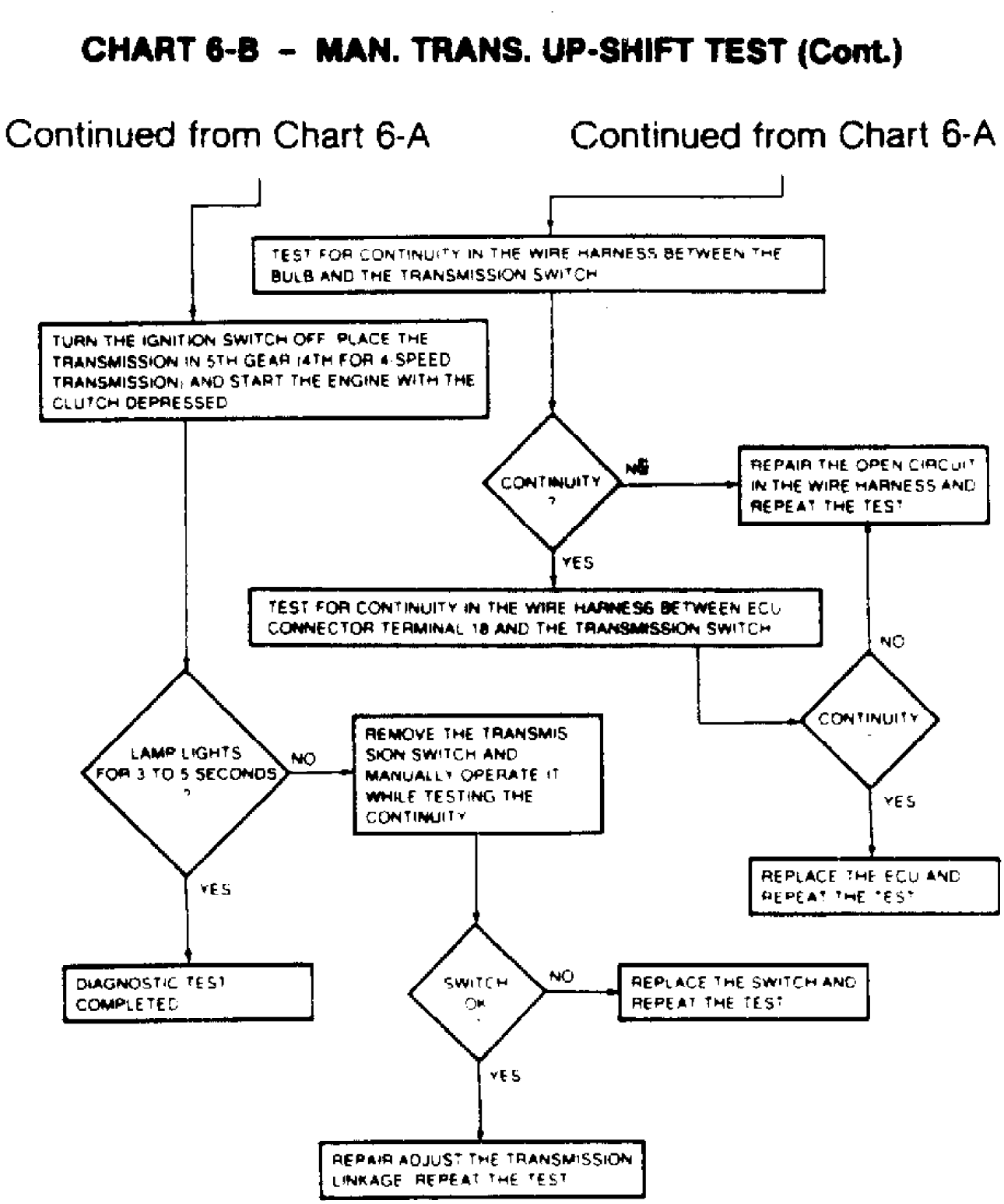


Fig. 26: Chart 6-B - Man. Trans. Up-Shift Test (Cont.)

REMOVAL & INSTALLATION

THROTTLE BODY ASSEMBLY

Removal

1) Remove throttle return spring, throttle cable and cruise control cable, if equipped. Disconnect wiring harness connector from injector, WOT switch, and ISA motor. Remove fuel supply and return pipes from throttle body.

2) Identify and tag vacuum hoses for installation later. Disconnect vacuum hoses from throttle body assembly. Remove throttle body-to-manifold retaining nuts from studs.

3) Remove throttle body assembly from intake manifold. If being replaced, transfer ISA motor and WOT switch and bracket assembly to new throttle body.

Installation

To install, reverse removal procedure using a new gasket between components. Adjust ISA motor and WOT switch.

FUEL INJECTOR

Removal

Remove air cleaner assembly, injector wire connector, and injector retainer clip screws. Using a pair of small pliers, gently grasp center collar of injector (between electrical terminals), and carefully remove injector with a lifting and twisting motion. Note back-up ring fits over upper "O" ring.

Installation

1) Lubricate new lower "O" ring with light oil and install in housing bore. Lubricate new upper "O" ring with light oil and install in housing bore. Install back-up ring over upper "O" ring.

2) Position new injector in fuel body, and center nozzle in lower housing bore. Seat injector with a pushing and twisting motion. Align wire connector terminals properly. Install retainer clip and screws. Connect injector wire connector.

FUEL PRESSURE REGULATOR

Removal

Remove 3 retaining screws, securing pressure regulator to fuel body. After noting location of components for reassembly reference, remove regulator assembly.

Installation

Position pressure regulator assembly with a new gasket. Install 3 retaining screws, securing regulator to throttle body. Adjust regulator. Operate engine and inspect for leaks.

IDLE SPEED ACTUATOR, MOTOR & WIDE OPEN THROTTLE SWITCH

NOTE: Closed throttle (idle) switch is integral with ISA and motor assembly.

Removal

1) Remove air cleaner assembly. Disconnect throttle return spring, throttle cable and cruise control cable, if equipped. Disconnect wiring harness connector from ISA motor and WOT switch.

2) Remove ISA motor and WOT switch bracket from throttle body. Remove motor-to-bracket retaining nuts. See Fig. 23. Do not remove nuts from motor studs.

CAUTION: Do not attempt to remove ISA motor attaching nuts without

using a backup wrench on stud nuts. ISA motor internal components may be dislodged if studs disengage and motor cap comes off.

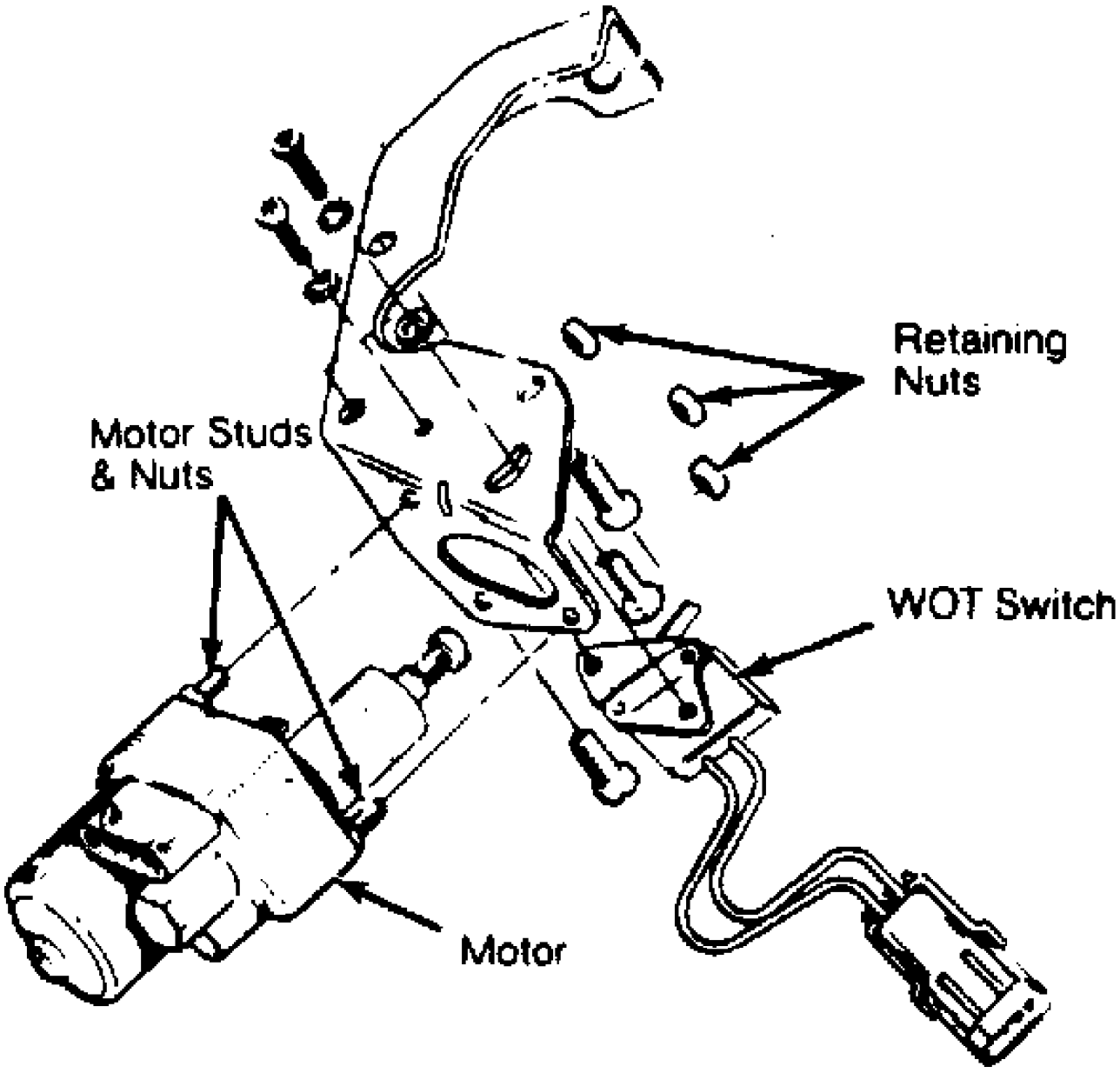


Fig. 27: ISA Motor and WOT Switch Removal
Bracket assembly is mounted on throttle body unit.

3) To remove ISA motor from bracket, place backup 8 mm open end wrench on ISA motor stud nuts to prevent studs from turning. Grind wrench until thin enough to fit between motor and bracket. Remove ISA motor attaching nuts. Remove 2 WOT switch-to-bracket screws. Remove WOT switch.

Installation

1) Install new WOT switch on bracket and tighten 2 screws. Install ISA and motor on bracket. Install motor-to-bracket retaining

nuts. Install motor and WOT switch bracket assembly on throttle body.

2) Connect wiring harness connector to ISA motor and WOT switch. Connect the throttle return spring, throttle cable and cruise control cable. Adjust ISA motor and WOT switch. Install air cleaner assembly.

NOTE: After replacing or reinstalling the original ISA motor, be sure motor plunger is fully extended before starting the engine. If plunger is not fully extended, the closed throttle switch may open prematurely, causing idle speed to drop to approximately 400 RPM.

3) Start engine with throttle at 1/4 open position. This prevents ISA plunger from retracting. Stop engine. When ignition is turned off, the motor plunger will fully extend. After installation is complete, adjust ISA as required.

ELECTRONIC CONTROL UNIT

Removal & Installation

Locate ECU in passenger compartment, below glove box. Remove retaining screws and mounting bracket. Remove the ECU, and disconnect wiring harness connector from ECU. Reverse removal procedure to install.

OXYGEN SENSOR

Removal

Disconnect the wire connector from sensor, and unscrew sensor from exhaust pipe adapter. Clean adapter threads.

Installation

1) Apply anti-seize compound to sensor threads. Do not allow compound to adhere to any other part of sensor. Hand start the sensor into place and tighten. Check that wire terminal ends are properly seated in connector. Connect wire.

2) Do not push the rubber boot over sensor body lower than 1/2" (13 mm) above base of sensor. If the sensor wire should break, sensor must be replaced. These wires cannot be spliced or otherwise repaired.

MANIFOLD AIR TEMPERATURE & MANIFOLD ABSOLUTE PRESSURE SENSORS

Removal & Installation

Disconnect wiring harness connector from sensor. Disconnect vacuum hose from MAP sensor. Remove sensor. Clean MAT sensor manifold threads, and wrap with Teflon tape. To install, reverse removal procedure.

COOLANT TEMPERATURE SENSOR (CTS)

Removal & Installation

Allow engine to cool and release pressure from cooling system. Remove wiring harness from sensor. Remove sensor at rear of intake manifold, and plug hole to prevent excessive coolant loss. To install, reverse removal procedure and replace lost coolant.

EGR VALVE & CANISTER PURGE SOLENOID

Removal & Installation

Disconnect wiring harness and vacuum hose from solenoid. Remove solenoid and bracket as an assembly. Replace solenoid as an

assembly. To install, reverse removal procedure.

ADJUSTMENTS

NOTE: The following adjustment procedures should not be necessary during normal vehicle operation or maintenance. Adjustment of the listed components should only be required when a faulty component is replaced with a new one.

IDLE SPEED ACTUATOR (ISA) MOTOR

1) With air cleaner removed, air conditioner off (if equipped) and engine at normal operating temperature, connect a tachometer to terminals 1 (+) and 3 (-) of the small diagnostic connector D1. See Fig. 16. Turn ignition off and observe ISA motor plunger. The plunger should move to fully extended position.

2) With ISA plunger fully extended, disconnect wire connector and start engine. Engine speed should be 3300-3700 RPM. If not, turn hex head screw on end of plunger until correct speed is obtained.

3) Hold closed throttle switch plunger all the way in while opening throttle. Release the throttle. Throttle lever should not make contact with the plunger. If contact is made, inspect throttle linkage and/or cable for binding or damage. Repair as needed.

4) Reconnect ISA motor wire connector and turn ignition off for 10 seconds. Motor should move to fully extended position. Start engine. Engine speed should be 3300-3700 RPM for a short time and then fall to normal idle. Turn off engine and remove tachometer.

5) When final adjustments have been made, apply thread sealer to adjustment screw threads to prevent movement. Install air cleaner.

WIDE OPEN THROTTLE SWITCH

1) Remove the throttle body assembly from the engine, and loosen 2 WOT switch retaining screws. Hold throttle in wide open position, and attach a Throttle Angle Gauge (J-26701) to flat surface of the throttle lever.

2) Rotate scale to align the 15° mark with the pointer. Level the gauge. Rotate scale to align zero with the pointer, and close the throttle enough to center bubble. This positions the throttle at 15° before wide open throttle.

3) Adjust the WOT switch lever on the throttle cam so that the plunger is just closed at 15° position. Tighten the retaining screws, and remove the gauge.

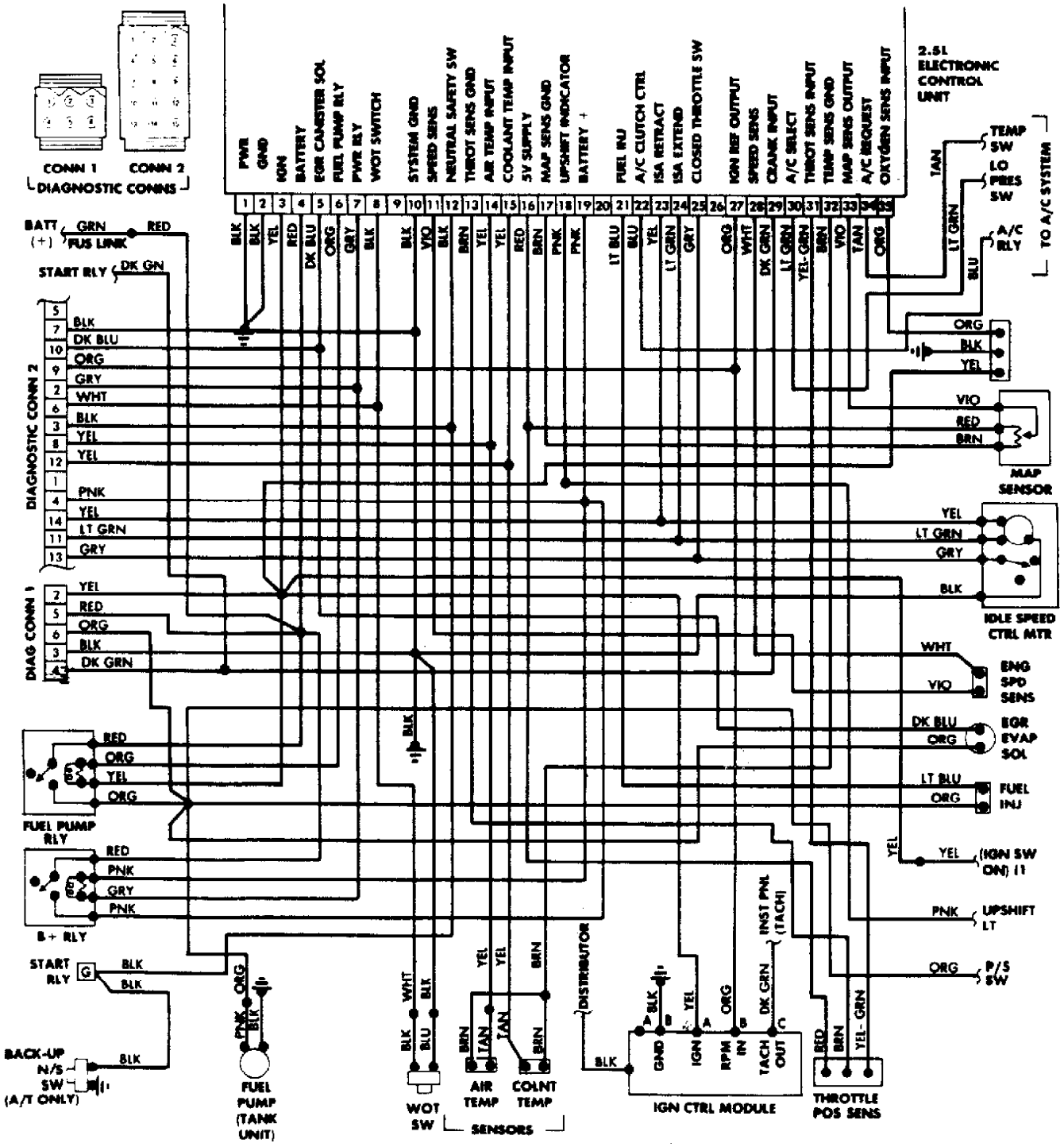


Fig. 28: Jeep 2.5L TBI System Wiring Diagram

FUEL PRESSURE REGULATOR

1) Remove air cleaner assembly. Connect a tachometer to terminals 1 and 3 of small diagnostic connector D1. Remove screw plug and install special Fuel Pressure Test Fitting (8983 501 572).

2) Connect accurate fuel pressure gauge to fuel pressure test fitting. Start engine and accelerate to 2000 RPM. Turn torx head adjustment screw on bottom of fuel regulator to obtain 17.3 psi (1.2 kg/cm(C)) of fuel pressure.

NOTE: Turning screw inward increases pressure; turning screw outward decreases it.

3) After specification is reached, install a lead seal ball to cover regulator adjustment screw. Turn ignition switch off, and disconnect tachometer. Disconnect fuel pressure gauge, remove test fitting, and install original plug screw. Install air cleaner assembly.