JD CAMIRA —LEADED ELECTRONIC FUEL INJECTION (EFI)

The 1985-86 JD Camira introduced a 1.8 litre engine designed for leaded petrol. The following text describes the Bosch LE-2 multi-port fuel injection system. The control unit for the EFI system is located behind the glove box *(see Fig. 3-38)*.

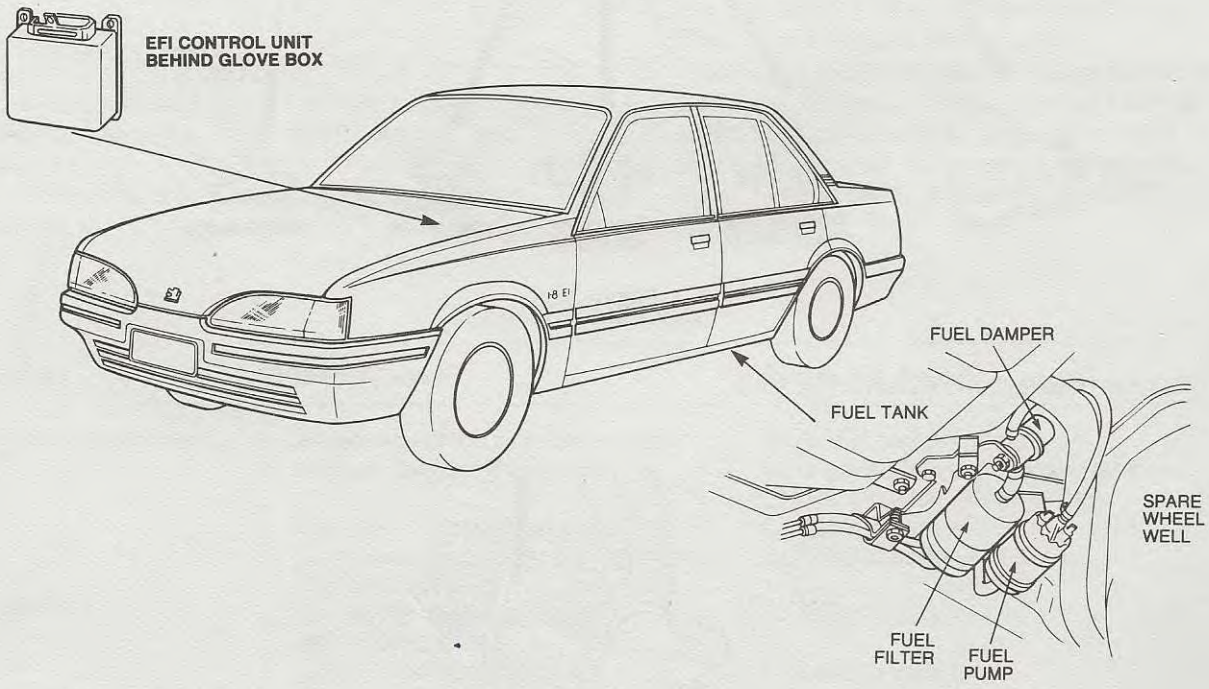

Figure 3-38

The control unit receives signals from the various sensors *(see Fig. 3-39)* and determines the optimum air/fuel ratio for the prevailing engine operating conditions. Although the vapour canister is not part of the EFI system, it has been included, as the test procedure for this particular canister varies from that detailed in Section 1.

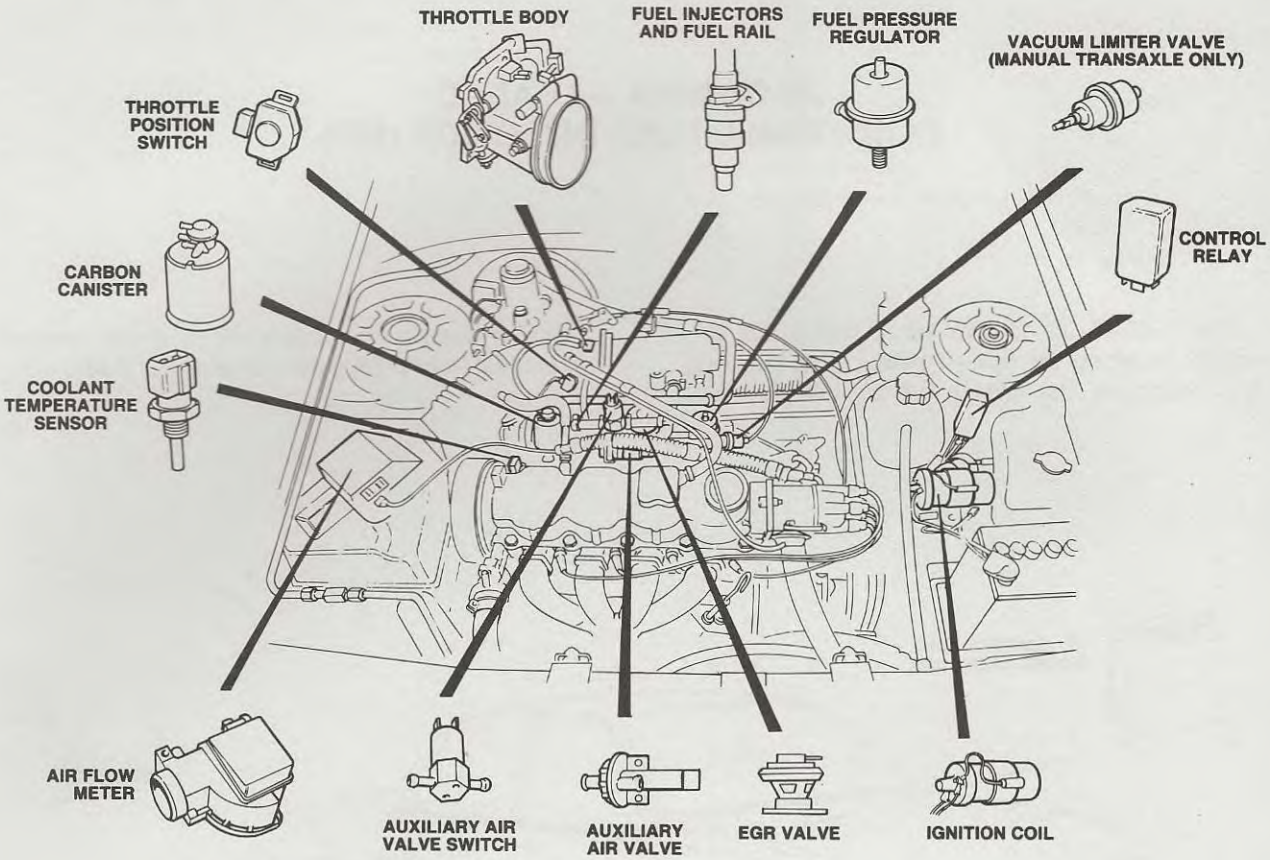

Figure 3-39

Vacuum hose layout is shown in *Fig. 3-40*.

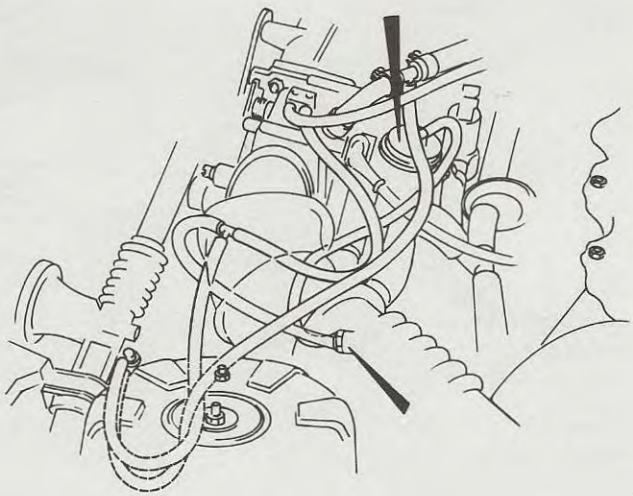

Figure 3-40

In addition to standard workshop equipment, a digital multimeter, a 0-100°C thermometer, a 12 volt, 2 watt test lamp with standard test probes, a hand-operated vacuum pump with gauge and a means of heating water to test thermal sensors will be required to isolate faults within the various electrical circuits.

The wiring harness connector must be disconnected from the control unit to facilitate wiring harness and engine sensor testing. As the terminal numbers are not marked on the control unit wiring harness connector, *Fig. 3-41* illustrates the layout of the connector terminals.

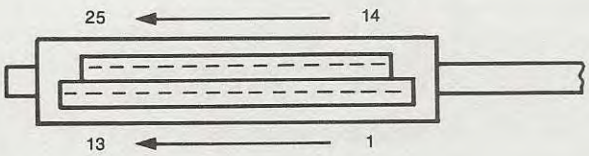

Figure 3-41

NOTE

1. Before proceeding with any tests on the EFI system, read the WARNINGS detailed on page ii.
2. Replacement procedures are not described in this text.

Fig. 3-48 illustrates the EFI system for the JD Camira and should be utilized when carrying out the procedures. However, the following preliminary checks should be carried out before commencing the test procedure:

a. Inspect the engine and the electronic fuel injection system (EFI) wiring for damage and faulty connections. Check for air leaks at the inlet manifold and at the air intake system, and check the fuel lines and air hoses for damage or leaks. Repair or replace parts as necessary.
b. Check the condition of the air cleaner element. Replace the element if it is clogged or damaged.
c. Inspect the ignition wiring for damage or faulty connections. Repair or replace the wiring as necessary.
d. Ensure that both the EGR valve and the air regulator valve are functioning correctly. Repair or replace the valve as necessary.
e. Ensure that the engine is in good mechanical condition, i.e. the engine compression pressures and the valve clearances are to specification, and that the ignition system high tension circuit is functioning correctly. Also ensure that the battery is fully charged and that there is fuel (petrol) in the fuel tank.
f. Ensure that the crankcase ventilation system is free from air leaks, and that the oil filler cap, dipstick and by-pass hose are properly installed and seal correctly. Also ensure that the PCV valve (where fitted) is secure and operating correctly.

FAULT DIAGNOSIS

Symptom	Probable Cause	Corrective Action
1. Engine fails to start.	a. Air leakage at the air intake system.	a. Repair any air leaks.
	b. Fuel contaminated with water.	b. Drain the fuel from the fuel tank and refill the tank with clean fuel.
	c. Fuel pump does not operate.	c. Refer to para. a.
	d. Control relay, control unit or injector(s) malfunctioning.	d. Refer to paras. a to e.
	e. Coolant temperature sensor malfunction.	e. Refer to para. h.
	f. Air flow meter malfunction.	f. Refer to para. i.
2. Engine starts then stalls.	a. Control relay, control unit or injector(s) malfunctioning.	a. Refer to paras. a to e.
	b. Fuel pump is not operating.	b. Refer to para. a.
	c. Coolant temperature sensor malfunctioning.	c. Refer to para. h.
3. Engine idles too fast or idle is unstable (cannot be adjusted with idle speed screw).	a. Throttle position switch malfunctioning.	a. Refer to para.g.
	b. Auxiliary air valve malfunctioning.	b. Refer to para. j.

FAULT DIAGNOSIS (continued)

Symptom	Probable Cause	Corrective Action
4. Engine misfires.	a. Faulty wiring connectors on EFI system.	a. Check wiring harness and repair or replace connectors.
	b. Control unit malfunction.	b. Verify fault, replace control unit as necessary.
	c. Incorrect fuel pressure.	c. Refer to para. m.
	d. Faulty EFI circuit.	d. Refer to paras. a to e.
5 Engine lacks power.	a. Throttle position switch malfunctioning.	a. Refer to para.g.
	b. Air flow meter is malfunctioning.	b. Refer to para. i.
	c. Incorrect fuel pressure.	c. Refer to para. m.
6. Engine has flat spot or hesitation on acceleration.	a. Air flow meter is malfunctioning.	a. Refer to para. i.
	b. Incorrect fuel pressure.	b. Refer to para. m.
	c. Incorrect idle CO%.	c. Refer to para. n.
	d. Faulty EFI circuit.	d. Refer to paras. a to e.
7. Poor fuel consumption or CO% is too high.	a. Incorrect fuel pressure.	a. Refer to para. m.
	b. Faults in various circuits.	b. Test all circuits to isolate faults.
	c. Blocked air cleaner element.	c. Replace element.
8. Engine surge.	a. Fault in air flow meter.	a. Refer to para. i.
	b. Incorrect fuel pressure.	b. Refer to para. m.
	c. Incorrect idle CO%.	c. Refer to para. n.
	d. Faults in various circuits.	d. Test all circuits to isolate faults.
9. Engine backfiring.	a. Incorrect fuel pressure.	a. Refer to para. m.
	b. Faults in various circuits.	b. Test all circuits to isolate faults.
10. Pre-ignition.	a. Faults in various circuits.	a. Test all circuits to isolate faults.

Test Procedure

CAUTION

As some of the following tests involve cranking the engine, appropriate safety precautions must be observed.

a. Fuel Pump.

1. Turn the ignition switch ON, crank the engine and check that the fuel pump can be heard. If the fuel pump can be heard and the engine fails to start when cranked, check the fuel pressure (refer to para. m.) and volume pumped. If necessary, replace the fuel pump. If the fuel pump can not be heard, connect the test lamp to the fuel pump + and – terminals and check that the lamp illuminates with the engine cranking. If the lamp illuminates, replace the fuel pump. If the lamp remains extinguished, connect the lamp to control relay pin 87 *(see Fig. 3-48)* and earth. If the lamp illuminates with the engine cranking, check for a blown fuse or defective wiring from the control relay to the fuel pump. If the lamp remains extinguished, connect the lamp to control relay pin 30 and earth. (It may be necessary to remove the relay to access pin 30). If the lamp remains extinguished (ignition switch position irrelevant), check for a blown fusible link (R) or defective wiring from the control relay to the battery. If the lamp illuminates, connect the lamp to control relay pin 15 and earth. Check that the lamp illuminates with the ignition ON. If the lamp illuminates, replace the control relay. If the lamp is extinguished, check for a blown fuse, blown fusible link (J), defective ignition switch or wiring.

b. Ignition Pulse.

1. To check the ignition pulse signal, connect the test lamp to terminals 1 and 5 *(see Fig. 3-48)* and check that the lamp flickers as the engine is cranked. If not, check for defective wiring or defective ignition system.

c. Start Pulse.

1. To check the crank signal to the starter motor solenoid, connect the test lamp between earth and pin 50 on the control relay *(see Fig. 3-48)* and check that the

lamp illuminates with the ignition in the START position. To check the start signal to the control unit, connect the test lamp to terminals 4 and 5 on the wiring harness connector and check that the lamp illuminates with the ignition in the START position. If the lamp fails to illuminate, use *Fig. 3-48* to assist checking for defective wiring, neutral start switch (A/T only), ignition switch or blown fusible link (J).

d. Control Unit Supply Voltage and System Earth.
   1. To check the control unit supply voltage, connect the test lamp to terminals 9 and 5 on the wiring harness connector *(see Fig. 3-48)*. Check that the lamp illuminates with the ignition switch in both the ON and START positions. If not, check for defective wiring between the connector and the control relay.
   2. Ensure that the ignition switch is OFF, then connect an ohmmeter between the system earth terminals 5 and 13 on the wiring harness connector. The ohmmeter should indicate zero ohms. If not, utilize *Fig. 3-48* to trace the defective wiring or connection.

e. Fuel Injectors.
   1. Before checking the fuel injectors and associated wiring, disconnect the wiring harness connectors at the air flow meter, the auxiliary air valve and the throttle position switch. Ensure that the ignition switch is in the OFF position. Connect an ohmmeter to terminals 9 and 12 *(see Fig. 3-48)* on the wiring harness connector. A reading of approximately 4 ohms should be obtained. If necessary, check the injectors individually with the ohmmeter. A reading of 15-19 ohms should be obtained. Replace any injectors and repair defective wiring as necessary. Connect the wiring harness connectors to the air flow meter, the auxiliary air valve and the throttle position switch.
   2. Connect the wiring harness connector to the control unit to enable the injection pulse signals to be tested. Remove the plug from cylinder 1 injector and install the test lamp across the plug terminals. With the ignition in the START position, check that the lamp flickers brightly initially and dims within ten seconds. Repeat this procedure for the injectors on cylinders 2 to 4. Replace the EFI control unit if necessary.

NOTE

Never allow the terminals on the injector leads to short.

f. Throttle Body.
   1. Inspect the throttle body *(see Fig. 3-42)* for signs of damage, cracking or wear. Check the throttle lever for smooth operation, ensuring that the valve opens and closes fully without binding.

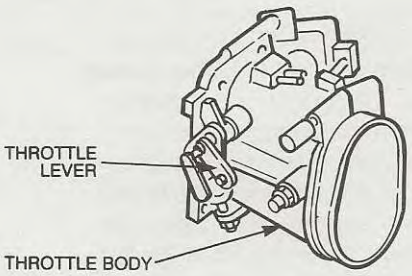

Figure 3-42

   2. Remove the throttle body and check the throttle valve, the bore of the valve body hose parts for accumulated dirt or dust. Clean the throttle body as necessary, then check for severe scoring or damage to throttle valve or the bore of the valve body.
   3. If severe scoring, damage or wear is apparent, replace the throttle body.

g. Throttle Position Switch.
   1. Disconnect the wiring harness connector from the throttle position switch. To check the idle contacts, connect an ohmmeter to switch terminals 2 and 18. With the ignition OFF and the accelerator pedal in the idle position, check that the ohmmeter indicates zero ohms. Depress the accelerator pedal slightly and check that the ohmmeter indicates infinity. To check the full throttle contacts of the switch, connect the ohmmeter to switch terminals 3 and 18 *(see Flg. 3-48)*. With the ignition OFF and the accelerator pedal in the idle position, check that the ohmmeter indicates infinity. Depress the accelerator pedal fully check that the ohmmeter indicates zero ohms. Replace the throttle position switch or repair defective wiring as necessary.

h. Coolant Temperature Sensor.
   1. To check the coolant temperature sensor, remove the temperature sensor from the cylinder head, connect an ohmmeter to the sensor terminals, then suspend the sensor in a container filled with water, ensuring that the sensor does not touch the container. Place a thermometer with at least 0-100 °C scale in the container and apply heat to the

container *(see Fig. 3-43)*. Check the resistance at the sensor terminals at various temperatures (refer to the scale in *Fig. 3-43*). If the ohmmeter readings are not within specification, replace the sensor. If the ohmmeter readings are within specification, check for defective wiring.

Temperature °C	Resistance ohms
Zero (if possible)	5.4 to 6.3 k
20	2.3 to 2.8 k
80	280 to 360
100	170 to 210

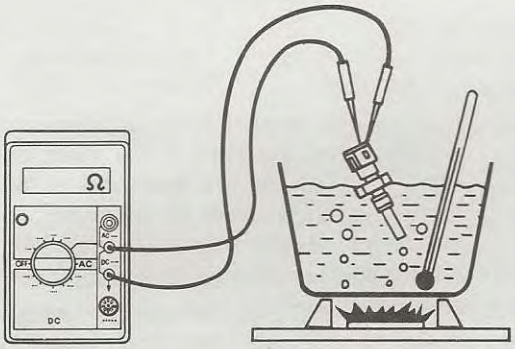

Figure 3-43

i. Air Flow Meter.
   1. Ensure that the ignition switch is OFF, then remove the wiring harness connectors from the auxiliary air valve, the throttle position switch and the control relay. Using an ohmmeter check that the resistance across switch terminals 8 and 9 is approximately 210 ohms and across switch terminals 5 and 7 the resistance varies as the air flow flap is moved by hand (do not use a sharp metal object). If the ohmmeter reading did not vary for terminals 5 and 7, or indicates zero ohms or infinity, replace the air flow meter.
   2. Check for continuity between the air flow meter body and each terminal. If continuity exists, replace the air flow meter.
   3. Check for defective wiring and repair as necessary.

j. Auxiliary Air Valve.
   1. Remove the plug from the auxiliary air valve and install the test lamp across the plug terminals. With the ingition in the START position, check that the lamp illuminates. If not, check for defective wiring. Ensure that the ignition is OFF then connect an ohmmeter across the auxiliary air valve terminals. Check for a reading of 40-50 ohms. Replace the air valve if necessary
   2. Start the engine and pinch the rubber hose between the air flow duct and the auxiliary air valve. When the air valve is cold, the engine speed should decrease as the hose is pinched. With the air valve hot, the engine speed remains unchanged as the hose is pinched.

k. Vacuum Limiter Valve — Manual Transaxle Ony.
   1. Disconnect the vacuum and air hoses *(see Fig. 3-44)* the remove the valve from the mounting bracket. Connect a hand operated vacuum pump with gauge to the vacuum hose inlet port and check that with zero vacuum applied, it is not possible to blow air through the air hose. Replace the valve if air passes. Apply a vacuum of approximately –54 kPa and check that air can now be blown through the valve. If not, replace the valve.

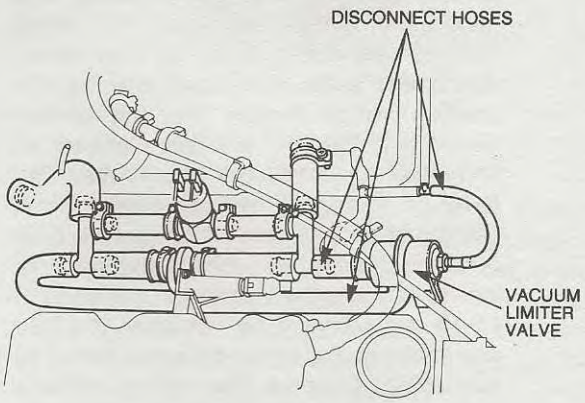

Figure 3-44

l. If the engine peformance is still unsatsifactory after these tests, replace the EFI control unit.

m. Fuel Pressure.
   1. Disconnect the fuel pressure vacuum hose from the T-piece *(see Fig. 3-45)* and connect a vacuum pump to the open end of the hose. Apply a vacuum of –80 kPa to the pressure regulator for approximately ten seconds. Remove the vacuum pump and connect the vacuum hose.
   2. Place a drip tray beneath the vehicle then disconnect the battery earth lead. Disconnect the fuel feed hose from the fuel rail

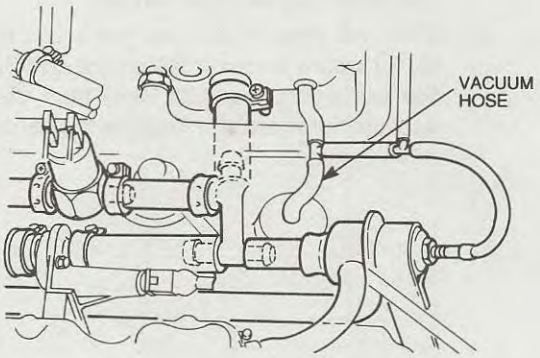

Figure 3-45

(see Fig. 3-46) and install a fuel pressure gauge. Check for leaks then reconnect the battery. Start the engine and note that with the engine at idle the fuel pressure should be approximately 200 ± 20 kPa. Accelerate the engine rapidly and note that the fuel pressure increases to approximately 250 + 20 kPa. If fuel pressure is below specification, check for clogged or deformed fuel lines, a blocked fuel filter or pick-up strainer. If the fuel pressure is above specification, check the pressure regulator and associated vacuum hose, and replace as necessary. Replace the fuel pump if pressure is still outside specifications.

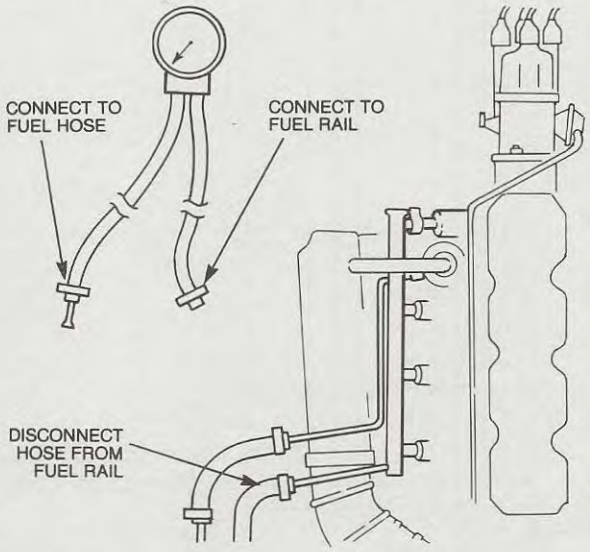

Figure 3-46

n. Idle Speed and Idle Mixture Adjustment.
   1. Connect a timing light and tachometer to the engine, then start the engine and allow it to warm up to normal operating temperature. Check that the idle speed is 850 ± 25 rpm and the ignition timing is 10° BTDC. Turn the ignition OFF.
   2. Insert a gas analyser probe 400 mm up the exhaust pipe, start the engine and allow it to idle. Check the CO concentration is 0.8% ± 0.4%. If the CO concentration is outside specification, remove the (red) plastic cap on the air flow meter and adjust the idle mixture screw in to richen, or out to lean off the mixture. When the CO concentration is within specification, check that the idle speed has not changed. If necessary, readjust.

o. Vapour Canister.
   1. Raise the front of the vehicle and secure on safety stands. Disconnect the hoses from the top and bottom of the canister *(see Fig. 3-47)*, then loosen the bracket and lift the canister out.

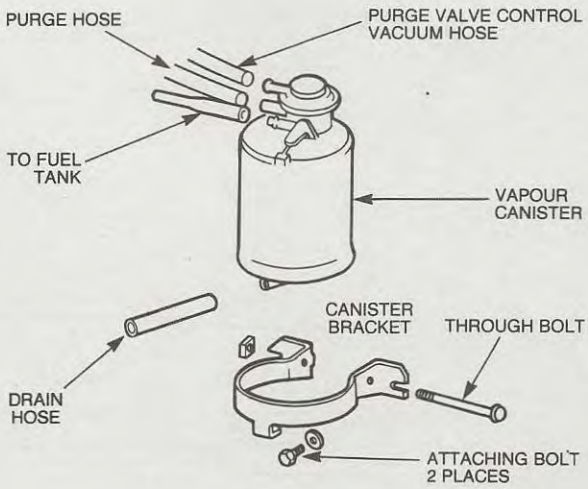

Figure 3-47

   2. Shake the cansiter. If any sound of carbon movement is heard, replace the canister.
   3. Connect a hand operated vacuum pump with gauge to the purge valve control port. Apply a vacuum of –20 to –35 kPa and check that it is possible to blow low pressure air through the purge hose port. Release the vacuum and check that it is no longer possible to blow air through the purge hose port. If either test fails, replace the canister.

4. Using low pressure compressed air (20-35 kPa), blow into the fuel tank port and check that air flows freely from the other ports. If the air flow from the drain port is insufficient, clean the bottom filter by blocking the fuel tank port and blowing compressed air at 300 kPa through the purge port. Connect the low pressure compressed air (20-35 kPa) to the fuel tank port again and check the air flow from the drain port. If this is still insufficient, replace the canister.
5. Block off three of the four ports and apply low pressure compressed air (20-35 kPa) to the fourth port. If any air leaks from the top section of the canister, replace the canister.

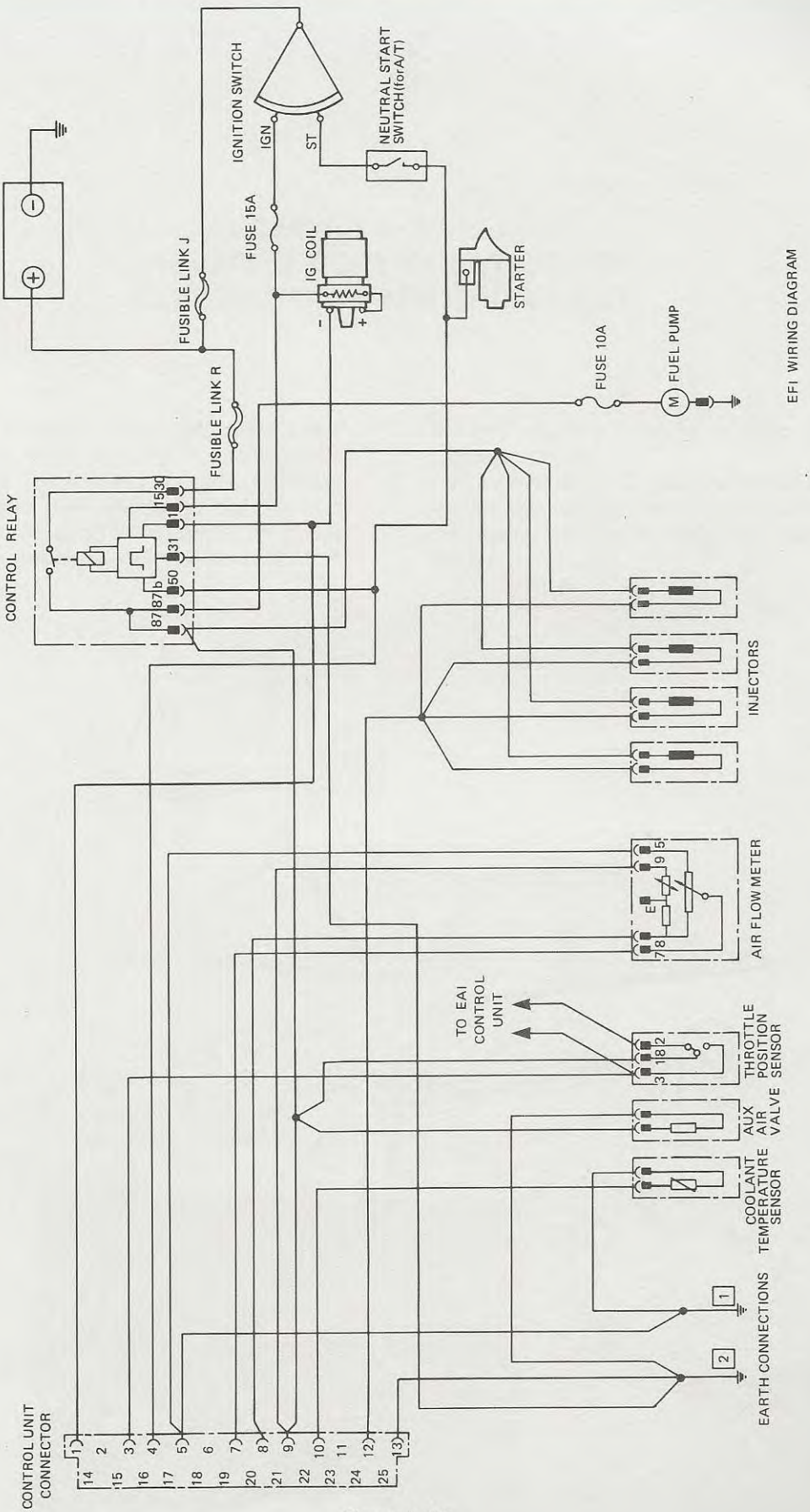
EFI WIRING DIAGRAM
FUSIBLE LINK J
FUSIBLE LINK R
IGNITION SWITCH
IGN
ST
FUSE 15A
IG COIL
NEUTRAL START SWITCH (for A/T)
STARTER
FUSE 10A
FUEL PUMP
CONTROL RELAY
INJECTORS
AIR FLOW METER
TO EAI CONTROL UNIT
THROTTLE POSITION SENSOR
AUX AIR VALVE
COOLANT TEMPERATURE SENSOR
EARTH CONNECTIONS
CONTROL UNIT CONNECTOR

Figure 3-48