SKYLINE — LEADED

ELECTRONIC FUEL INJECTION (EFI)

The 1981-85 R30 Series Skyline utilizes a 2.4 litre L24E engine which is designed to operate on leaded petrol. This engine incorporates a multi-port electronic fuel injection (EFI) system which is controlled by a control unit located behind the left hand cowl panel *(see Fig. 6-61)*. The EFI control unit receives signals from the various engine sensors and determines the optimum air/fuel ratio for the prevailing engine operating conditions.

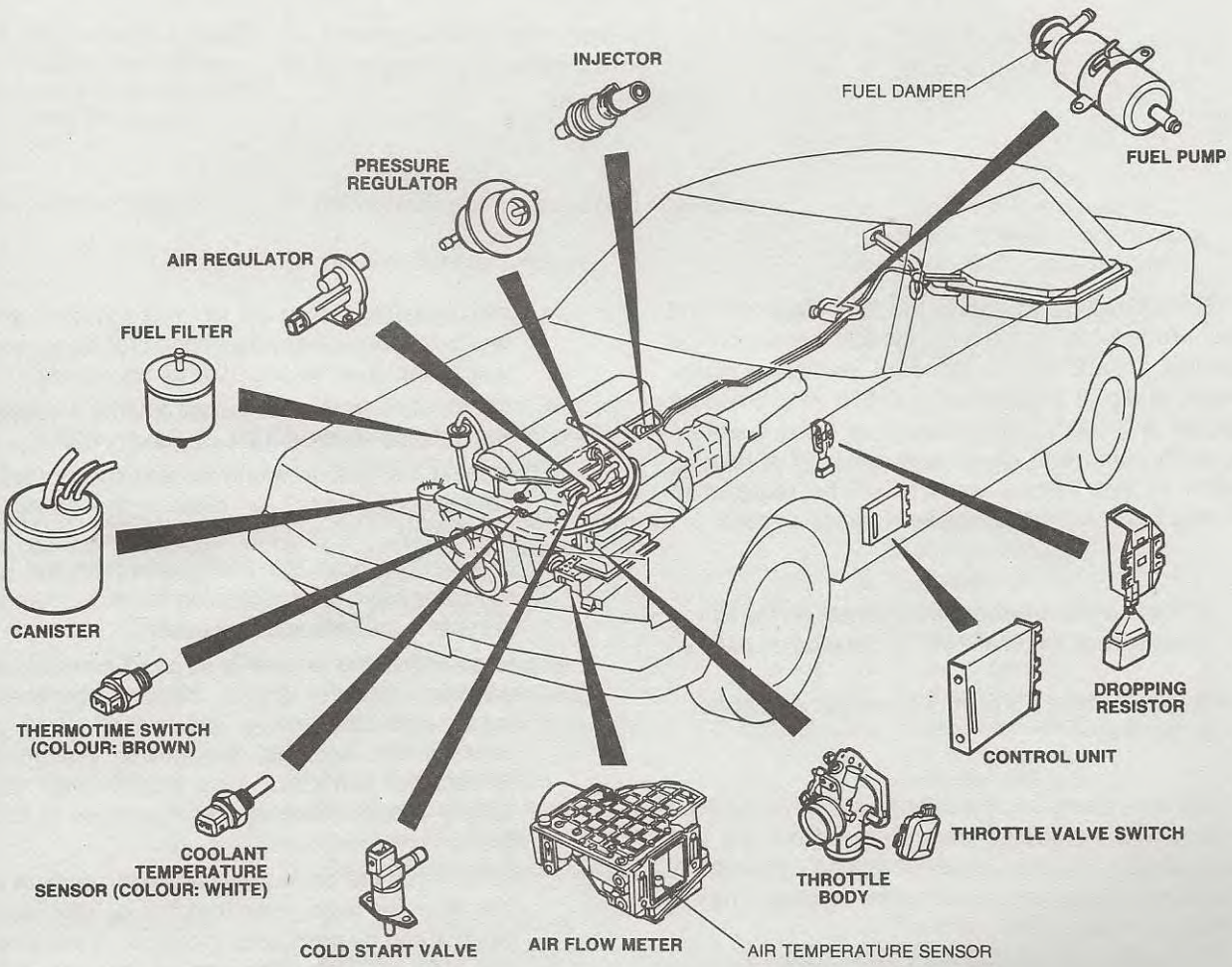

Figure 6-61

The vacuum hose is illustrated in *Fig. 6-62*.

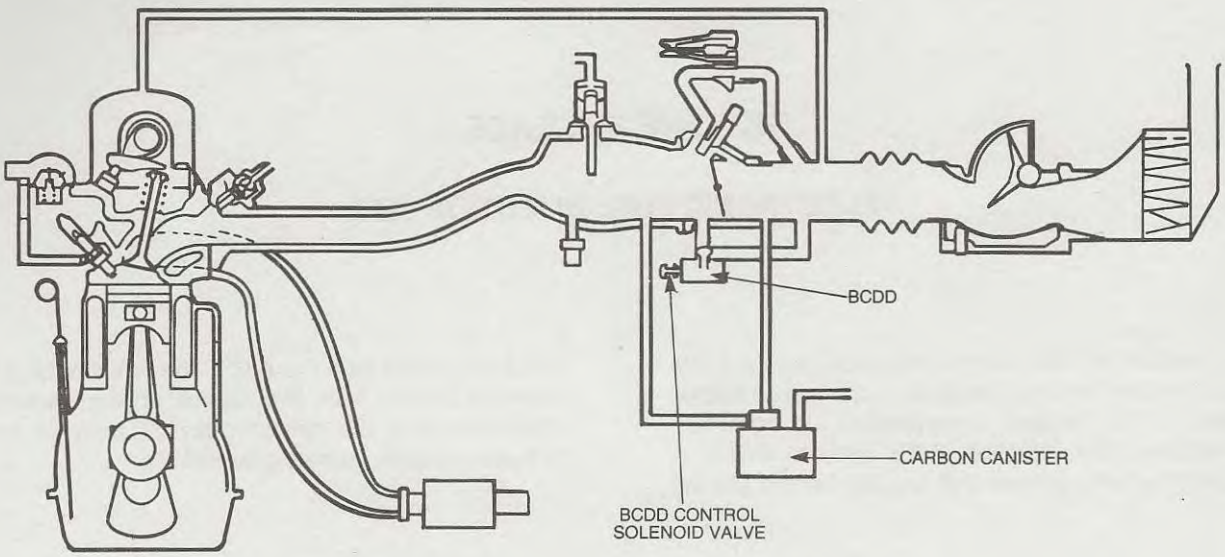

Figure 6-62

The following text details the fault diagnosis and test procedures for the fuel injection system on the Skyline. In addition to standard workshop equipment, a digital multimeter, a 0-500 kPa pressure gauge, a 0-100 °C thermometer, 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.

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. 6-83 illustrates the EFI system for the Skyline and should be utilized when carrying out the test procedure. However, the following preliminary check 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 if necessary.
d. Ensure that both the EGR valve and the air regulator valve are functioning correctly. Repair or replace the valves 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 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 tank and refill the tank with clean fuel.
	c. Fuel pump does not operate.	c. Refer to para. i.
	d. EFI main relay, control unit or injector(s) malfunctioning.	d. Refer to paras i to l.
	e. Coolant temperature sensor malfunction.	e. Refer to para. e.
	f. Air flow meter malfunction.	f. Refer to para. b.
	g. Cold start valve and thermotime switch malfunctioning.	g. Refer to paras. j and k.
2. Engine hard to start when cold.	a. Cold start valve and thermotime switch malfunctioning.	a. Refer to paras. j and k.
3. Engine hard to start when hot.	a. Cold start valve and thermotime switch malfunctioning.	a. Refer to paras. j and k.
4. Engine starts then stalls.	a. EFI main relay, control unit or injector(s) malfunctioning.	a. Refer to paras. i to l.
	b. Fuel pump is not operating.	b. Refer to para. i.
	c. Coolant temperature sensor malfunctioning.	c. Refer to para. e.
5. Engine idles too fast or idle is unstable (cannot be adjusted with idle speed screw).	a. Throttle valve is malfunctioning.	a. Refer to para. c.
	b. Air regulator is malfunctioning.	b. Refer to para. a.
6. 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. g.
	d. Faulty EFI circuit.	d. Refer to paras. g to l.
7. Engine lacks power.	a. Throttle valve is malfunctioning.	a. Refer to para. c.
	b. Air flow meter is malfunctioning.	b. Refer to para. b.
	c. Incorrect fuel pressure.	c. Refer to para. g.
8. Engine has flat spot or hesitation on acceleration.	a. Air flow meter is malfunctioning.	a. Refer to para. b.
	b. Incorrect fuel pressure.	b. Refer to para. g.
	c. Incorrect idle CO%.	c. Refer to para. m.
	d. Faulty EFI circuit.	d. Refer to paras. g to l.
9. Poor fuel consumption or CO% is too high.	a. Incorrect fuel pressure.	a. Refer to para. g.
	b. Faults in various circuits.	b. Test all circuits to isolate faults.
	c. Blocked air cleaner element.	c. Replace element.
10. Engine surge.	a. Fault in air flow meter.	a. Refer to para. b.
	b. Incorrect fuel pressure.	b. Refer to para. g.
	c. Incorrect idle CO%.	c. Refer to para. m.
	d. Faults in various circuits.	d. Test all circuits to isolate faults.
11. Engine backfiring.	a. Incorrect fuel pressure.	a. Refer to para. g.
	b. Faults in various circuits.	b. Test all circuits to isolate faults.
12. Pre-ignition.	a. Faults in various circuits.	a. Test all circuits to isolate faults.

Test Procedure

a. Air Regulator

1. Check that the air regulator is functioning correctly. If not, disconnect the wiring harness from the control unit, then turn the ignition ON and check for battery voltage between terminal 21 and earth (terminal 19) at the wiring harness connector *(see Fig. 6-63)*. If battery voltage is not indicated, check the wiring harness for continuity. Repair the harness as necessary.

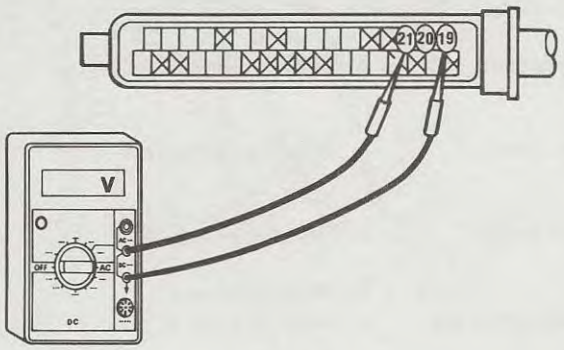

Figure 6-63

2. If there is continuity in the wiring harness, check that there is continuity between the terminals on the air regulator *(see Fig. 6-64)*. If continuity does not exist, replace the air regulator. If continuity does exist, remove the air regulator and check that the shutter is open, after the regulator has been allowed to cool down (no voltage applied). Apply battery voltage to the terminals on the air regulator. After a few minutes the shutter should close. Check also that the shutter operates smoothly by prying the shutter open with a screwdriver, then allowing the shutter to close under spring tension. If the shutter does not operate smoothly or if it fails to operate, replace the air regulator.

b. Air Flow Meter and Temperature Sensor.

1. Disconnect the wiring harness from the air flow meter, then with an ohmmeter, measure the resistance between terminals 34 and 32 while moving the flap on the air flow meter. The resistance should be between zero and infinity. Check that the resistance between terminals 34 and 33 is approximately 100-400 ohms and between terminals 34 and 35 is approximately 200-500 ohms.
2. Connect the ohmmeter between terminal 25 and the body of the air flow meter, then measure the resistance. The resistance should be 2.1-2.9 kohms at 20°C and 0.68-1.00 kohms at 50°C. Use a hair dryer or similar to heat the temperature sensor to the required temperature.
3. Check the insulation of the terminals on the air flow meter by connecting the ohmmeter between each terminal and earth. Infinity should be indicated at each terminal.
4. If any of the resistance or continuity checks are not within specification, replace the air flow meter.
5. Check the operation and the condition of the flap in the air flow meter. If the flap does not operate smoothy or if the flap is damaged, replace the air flow meter.
6. Check the wiring harness for continuity. Repair or replace the harness as necessary.

c. Throttle Valve Switch.

1. Disconnect the wiring harness from the control unit, then with an ohmmeter measure the resistance between terminal 30 and terminals 24 and 29 *(see Fig. 6-65)*. With the throttle released, there should be zero resistance between terminals 29 and 30, and infinity between terminals 24 and 30. With the throttle fully opened, infinity

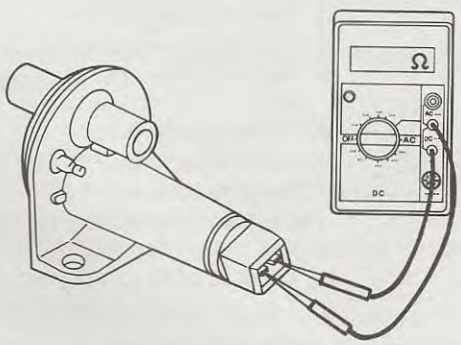

Figure 6-64

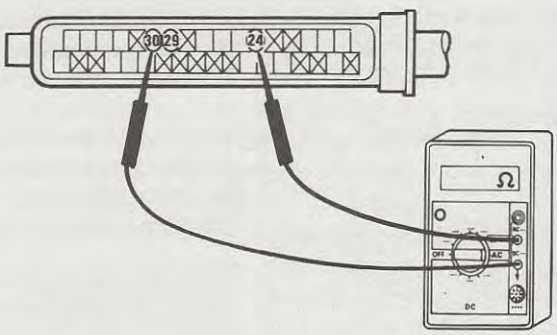

Figure 6-65

should be indicated between terminals 29 and 30, and zero resistance between terminals 24 and 30.

2. If the resistances at the harness connector are not to specification, disconnect the wiring harness from the throttle valve switch and check the resistances between terminal 30 and terminals 24 and 29 *(see Fig. 6-66)*. The resistances should be identical to those in para. l.

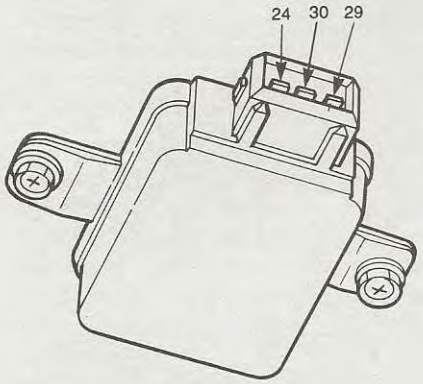

Figure 6-66

3. If the resistances are within specifications, check the wiring harness for continuity. Repair the wiring harness as necessary.
4. If the resistances at the throttle valve switch are not within specification, measure the resistances between terminals 24, 29 and 30 and a good engine earth. A reading of infinity should be found at each terminal, if not, replace the throttle valve switch.
5. Slacken the retaining screws *(see Fig. 6-67)* and adjust the throttle valve switch position so that the idle switch may be changed from ON to OFF when the engine speed is approximately 900 rpm with the engine under no load.

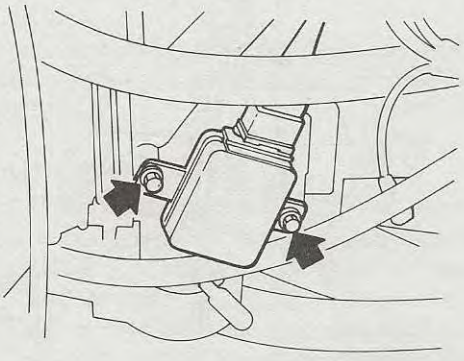

Figure 6-67

6. The setting of the throttle valve switch can be achieved by inserting a 0.3 mm feeler gauge between the throttle valve lever and the stop screw. This places the throttle valve in the position that assimilates the position of the throttle valve when the engine is at 900 rpm.
7. Connect an ohmmeter to the terminals on the throttle valve switch, then adjust the switch until the resistance reading changes from zero to infinity. Tighten the retaining screws and remove the feeler gauge. If the idle switch cannot be adjusted, replace the throttle valve switch.

d. Throttle Body.

1. Ensure that the throttle body is not worn or damaged. Check the bore of the valve body for scoring, and check the throttle valve for damage and smooth operation *(see Fig. 6-68)*. Also check that the by-pass port is clear and free from obstacles. Replace the throttle body if damage is apparent or if the throttle valve does not operate smoothly.

NOTE

Do not adjust the throttle stop screw, as this is preset at the factory.

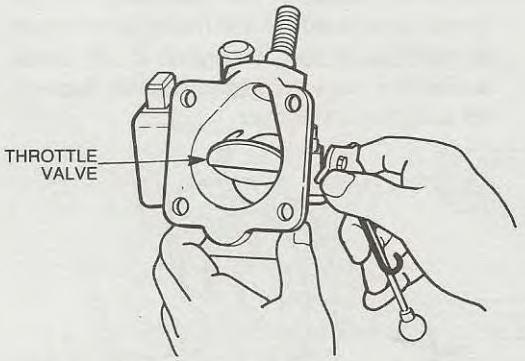

Figure 6-68

e. Coolant Temperature Sensor

1. Disconnect the wiring harness from the control unit, then with an ohmmeter, measure the resistance between terminal 14 and (earth) terminal 15 *(see Fig. 6-69)* at the control unit wiring harness connector. With the engine coolant temperature above 20 °C, the resistance should be below 2.7 kohms. With the coolant temperature below 20 °C the resistance should be above 2.3 kohms.

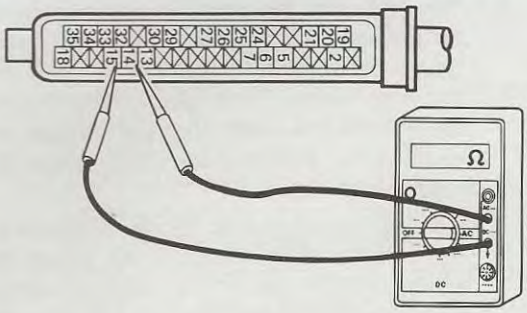

Figure 6-69

2. If the resistances are not within specification, check the wiring harness for damage or faulty connections. Repair the wiring harness as necessary.
3. If there was no fault with the wiring harness, 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 a 0-100 °C scale, in the water and apply heat to the container *(see Fig. 6-70)*. At 20 °C the resistance should be between 2.1-2.9 kohms and at 80 °C the resistance should be between 0.25-0.4 kohms. If the resistances are not within specification, replace the temperature sensor.

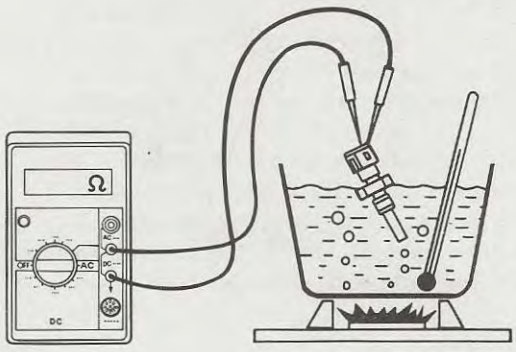

Figure 6-70

f. Ignition Timing.
   1. Before checking the idle speed and ignition timing, turn off all accessories, position the steering wheels in the straight ahead position, ensure the gear lever is in neutral, apply the parking brake and chock the wheels.
   2. Connect a timing light and a tachometer to the engine, then start the engine and allow it to warm up to operating temperature.
   3. Accelerate the engine two or three times under no-load, then allow the engine to idle for one minute. Check the idle speed and if necessary, adjust the idle speed adjusting screw *(see Fig. 6-71)* to obtain an idle speed of 700 rpm (man. trans.), 750 rpm (auto. trans.).

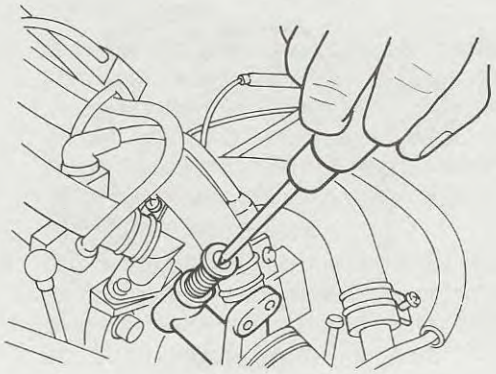

Figure 6-71

   4. Once the correct idle speed has been obtained, check the ignition timing. If necessary, adjust the distributor to obtain 10 ° BTDC at idle.
   5. Stop the engine and remove the timing light and tachometer.

g. Fuel System Inspection.
   1. Start the engine, then disconnect the wiring harness from the fuel pump *(see Fig. 6-72)*. After the engine stalls, crank the engine

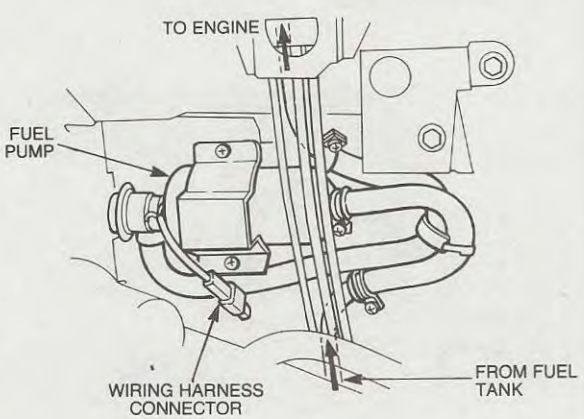

Figure 6-72

several times to ensure that the fuel pressure is released. Turn the ignition OFF and reconnect the fuel pump wiring.

2. Disconnect the fuel line between the fuel filter and the fuel injector rail and install a zero to 500 kPa pressure gauge into the fuel line.
3. Start the engine, rectify any fuel leakage, then check that the pressure indicated by the gauge is approximately 196 kPa with the engine at idle speed.
4. Accelerate the engine and note that the moment the accelerator is fully depressed, the pressure gauge should indicate approximately 255 kPa.
5. If the pressures are not to specification, replace the pressure regulator and repeat the test. If the pressures are less than specified, check for blocked, deformed or damaged fuel lines and replace as necessary. If the pressures are still less than specified, replace the fuel pump assembly.
6. With the engine stopped, disconnect the pressure regulator vacuum hose from the intake manifold and plug the port in the manifold. Connect a hand operated vacuum pump and gauge to the pressure regulator.
7. Turn the ignition ON and note the changes in fuel pressures while applying a vacuum to the pressure regulator. Refer to the following chart for vacuum and pressure readings:

Vacuum kPa	Fuel Pressure kPa
0	248.1-255.0
-16.9	227.5-241.3
-33.9	213.8-220.7
-50.8	200.1-206.9
-67.7	179.5-193.2

NOTE

If the fuel pressure does not decrease as the vacuum increases, replace the fuel pressure regulator.

h. Dropping Resistor.

1. Disconnect the wiring harness from the dropping resistor, then, using an ohmmeter, check the resistance between terminal 43 and terminals 37, 38, 40, 41, 55 and 56 *(see Fig. 6-73)*. The resistance between terminal 43 and each of the other terminals should be approximately 6 ohms. If the resistances are not to specification, replace the dropping resistor.

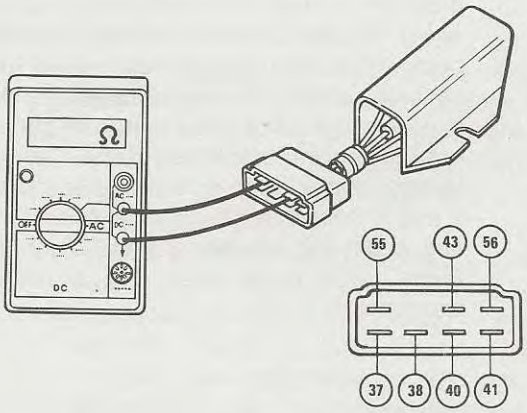

Figure 6-73

i. Fuel Pump.

1. Turn the ignition ON and listen for the sound of the fuel pump operating, which should start a few seconds after the ignition is turned ON. If the pump fails to operate, disconnect the wiring harness at the fuel pump (beneath the vehicle) and check for battery voltage at the terminals in the wiring harness side of the connectors *(see Fig. 6-74)*.

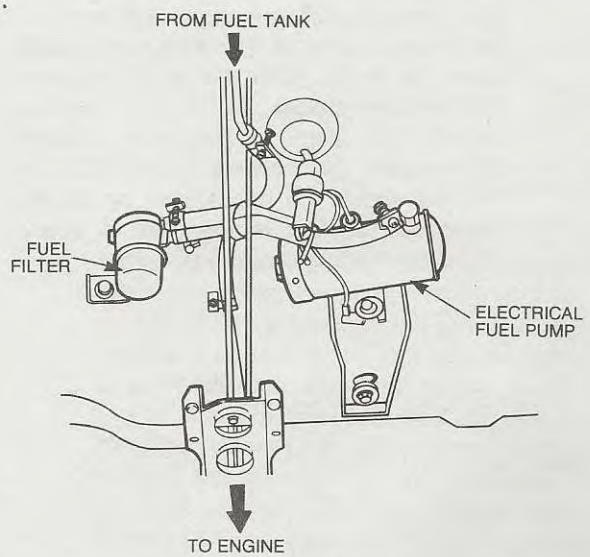

Figure 6-74

2. If battery voltage exists in the wiring harness, turn OFF the ignition and check for

continuity between the terminals on the fuel pump side of the connector. If continuity does not exist, replace the fuel pump.

3. If battery voltage was not indicated at the wiring harness connector, check the fuel pump relay. Using an ohmmeter, check that continuity exists between terminals 1 and 2 and terminals 3 and 5, but continuity should not exist between terminals 3 and 4. When battery voltage is applied between terminals 1 and 2, continuity should exist between 3 and 4, but not between 3 and 5 *(see Fig. 6-75)*. Replace the relay if it is not to specification.

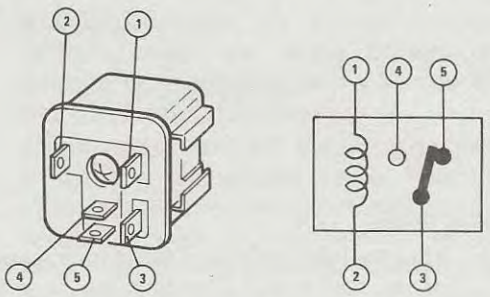

Figure 6-75

j. Thermotime Switch.

1. Disconnect the wiring harness from the thermotime switch and connect an ohmmeter between terminal B and the switch body *(see Fig. 6-76)*. With the engine coolant temperature below 14°C, the reading should be zero. When the coolant temperature is between 14-25°C the reading should be either zero or infinity. When the coolant temperature is above 25°C the reading should be infinity.

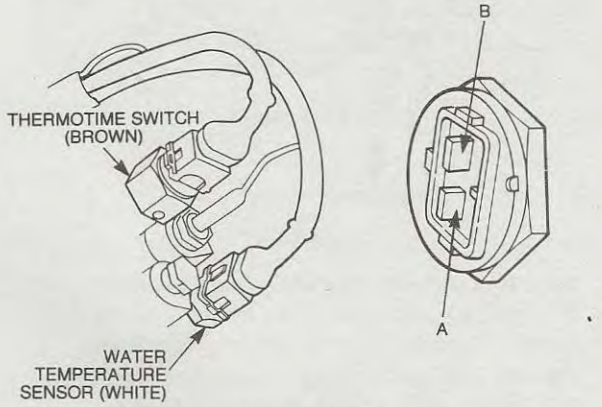

Figure 6-76

2. With the ohmmeter, measure the resistance between terminal A and the switch body. The reading should be 40-70 ohms.
3. Remove the thermotime switch from the engine and connect the ohmmeter to the terminals on the switch, then suspend the switch in a container filled with water, ensuring that the switch does not touch the container. Place a thermometer, with at least a 0—100°C scale, in the water and apply heat to the container *(see Fig. 6-77)*. At temperatures below 10°C a resistance of 40-70 ohms should be indicated, and at temperatures above 30°C infinity should be indicated.

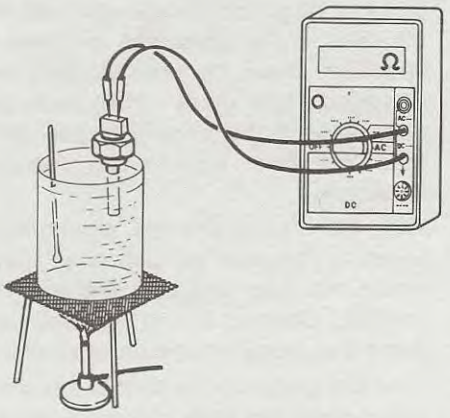

Figure 6-77

4. If the thermotime switch fails to meet any of the resistances as specified, replace the thermotime switch.

k. Cold Start Valve.

1. Disconnect the wiring harness from the cold start valve, then remove the cold start valve from the intake manifold (complete with fuel line connected).
2. Position the nozzle of the cold start valve in a transparent glass container, then plug the top of the container. Carefully connect jumper leads to the terminals on the cold start valve and to the terminals on a battery *(see Fig. 6-78)*. If the fuel is not injected, replace the cold start valve.

WARNING

Take care to ensure that the jumper lead terminals are kept separate to avoid a possible fire or explosion.

l. Fuel Injector Test.

1. Disconnect the wiring harness from the control unit and turn the ignition ON, then

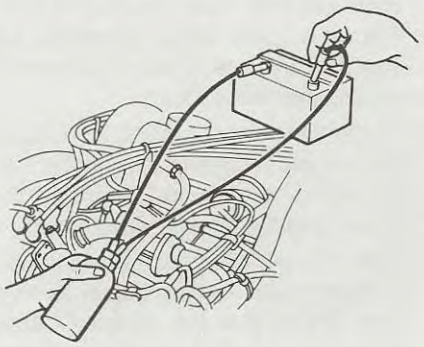

Figure 6-78

with a voltmeter, check for battery voltage between terminals 2,3,5,6,7,8 and (earth) terminal 19 *(see Fig. 6-79)*.

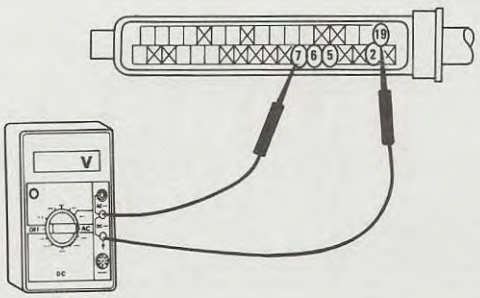

Figure 6-79

2. If no voltage was found at one or more of the terminals, turn OFF the ignition, then disconnect the wiring harness from the injectors. Using an ohmmeter, check for continuity between the terminals of each injector *(see Fig. 6-80)*. If continuity does not exist, replace the faulty injectors(s).

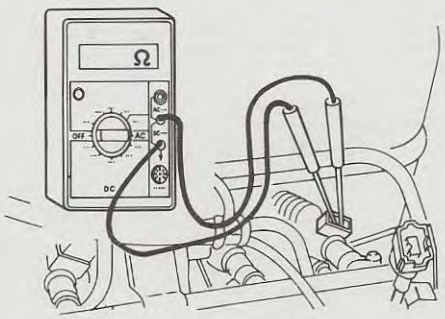

Figure 6-80

3. If continuity exists at the injectors, check the wiring harness for continuity. If continuity does not exist, repair or replace the harness as necessary.

m. Idle Speed and Mixture Ratio.

1. Before checking the idle speed and mixture ration, turn OFF all accessories, position the steering wheels in the straight ahead position, ensure the gear lever is in neutral, apply the parking brake and chock the wheels.
2. Prepare a jumper lead using two x 3 mm wide x 0.8 mm thick male flat terminals held in position side-by-side with a gap of 2 mm between. Solder a lead wire to each terminal, then wrap insulation tape around the soldered part of the terminals *(see Fig. 6-81)*.

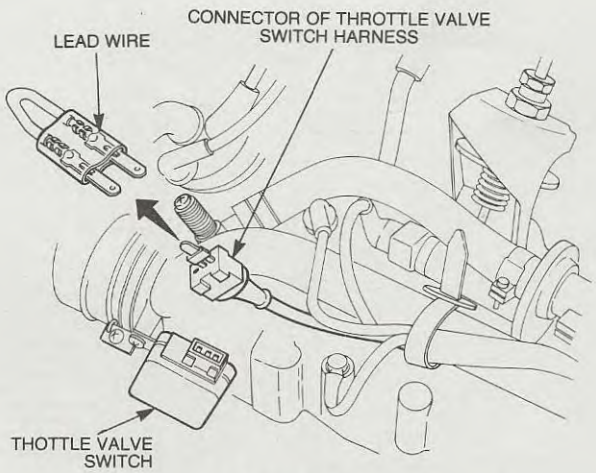

Figure 6-81

3. Insert the probe of a CO meter approximately 400 mm into the tail pipe of the exhaust system, then start the engine and allow the engine to warm up to normal operating temperature then allow the engine to idle. Check the idle speed is 700 rpm (man. trans.), 750 rpm (auto. trans.), if necessary adjust to specification.
4. Check the CO content of the exhaust gas at idle. If 1.0% or lower is not shown on the meter, turn OFF the ignition and disconnect the wiring harness from the throtte valve switch. Install the jumper lead (described in para. 2) into the wiring harness connector, then start the engine. Accelerate the engine two or three times under no load then allow the engine to idle for one minute. Adjust the CO to 3.3% by turning the air by-pass screw

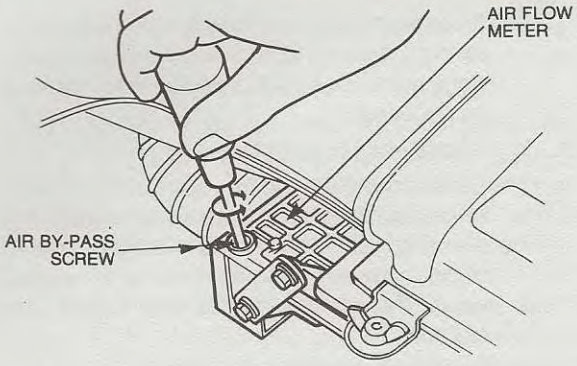

Figure 6-82

on the air flow meter *(see Fig. 6-82)*. Turning the air by-pass screw clockwise will make the fuel mixture richer, counter-clockwise makes the mixture lean.

5. Once the correct setting is obtained, stop the engine, remove the jumper lead from the wiring harness and reconnect the wiring harness to the throttle valve switch.
6. Start the engine, check that the idle speed is within specification, adjust as necessary, then check that the exhaust CO is within specification. Repeat the adjusting procedures as necessary to obtain the specified readings.

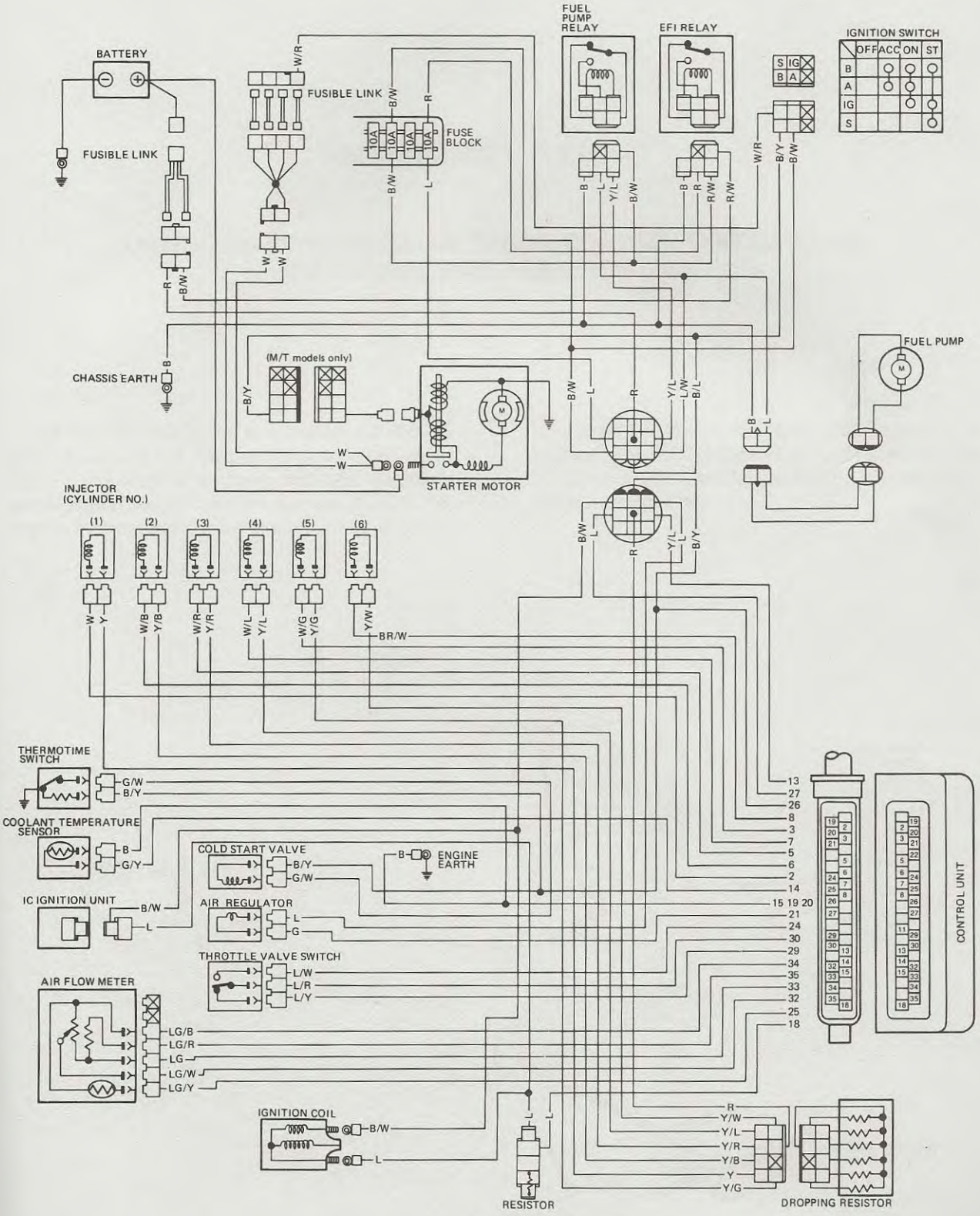
BATTERY
FUSIBLE LINK
FUSIBLE LINK
FUSE BLOCK
FUEL PUMP RELAY
EFI RELAY
IGNITION SWITCH
OFF ACC ON ST
B
A
IG
S
CHASSIS EARTH
(M/T models only)
STARTER MOTOR
FUEL PUMP
INJECTOR (CYLINDER NO.)
(1) (2) (3) (4) (5) (6)
THERMOTIME SWITCH
COOLANT TEMPERATURE SENSOR
COLD START VALVE
ENGINE EARTH
IC IGNITION UNIT
AIR REGULATOR
THROTTLE VALVE SWITCH
AIR FLOW METER
IGNITION COIL
RESISTOR
DROPPING RESISTOR
CONTROL UNIT

Figure 6-83