

# FUEL INJECTION AND ENGINE MANAGEMENT – EFI MODELS

## SPECIFICATIONS

### FUEL INJECTION

Type.....Electronic Controlled Injection  
-Multi Point (ECI-MULTI)

### FUEL PUMP

Type.....Electric  
Regulated Fuel Pressure.....196kPa  
Unregulated Fuel Pressure.....245-264 kPa

### FUEL FILTER

Type.....Disposable Paper Element

### AIR FILTER

Type.....Disposable Paper Element

### DISTRIBUTOR

Make.....Bosch  
Advance Control.....Electronic  
Rotation of rotor.....Clockwise  
Firing Order.....1-3-4-2

### IGNITION COIL

Primary resistance.....0.72-0.88 ohms  
Secondary resistance.....10.3-13.9 kilo ohms

### ADJUSTMENTS

Idle Speed.....800  $\pm$ 50 rpm  
Ignition timing:  
    With electronic  
    control active.....13°  $\pm$ 2° BTDC  
    With electronic  
    control inactive.....5°  $\pm$ 0.5° BTDC

### TORQUE WRENCH SETTINGS

Throttle body bolts.....13 Nm  
Plenum chamber bolts.....20 Nm  
Fuel hose to fuel filter bolts.....35 Nm  
Fuel hose fuel rail bolt.....42 Nm  
Oxygen sensor.....60 Nm

## 1.DESCRPTION

The engine management system on the TN Magna range of vehicles covered by this manual controls the operation of the ignition system and the fuel injection system.

The central component of the engine management system is the control unit. The control unit is a microcomputer which controls the ignition timing and the amount of fuel injected according to signals received from various sensors. As changes are detected in engine load and speed, coolant temperature, air temperature, throttle position, air intake and exhaust emissions, the control unit alters

the ignition system output and the fuel injection to achieve optimum engine efficiency under those conditions.

The control unit also incorporates a self diagnosis mode which stores and displays codes relating to certain system malfunctions. Whenever power is supplied to the control unit, the control unit performs a series of tests on various components in the system and records the results. When the self diagnosis mode is activated, fault codes are displayed, indicating if any faults are present in the system and in which area they have occurred.

This function is very useful in locating system faults, particularly intermittent problems. However, the self diagnosis mode does not provide comprehensive testing of the engine management system, and therefore should always be used in conjunction with the other test procedures, described later in this section, in order to accurately locate system faults.

The high energy electronic ignition system consists of a distributor, power transistor, ignition coil and associated wiring.

The distributor has two functions. The first is to distribute secondary voltage from the coil to the spark plugs as in a conventional system.

The second function is to provide the control unit with information on engine speed, crank angle and No. 1 piston position. This information is produced by the crank angle sensor and the No. 1 cylinder sensor, which are located inside the distributor housing.

The ignition timing is controlled by the engine management system, and adjusted to suit varying engine and vehicle operating conditions.

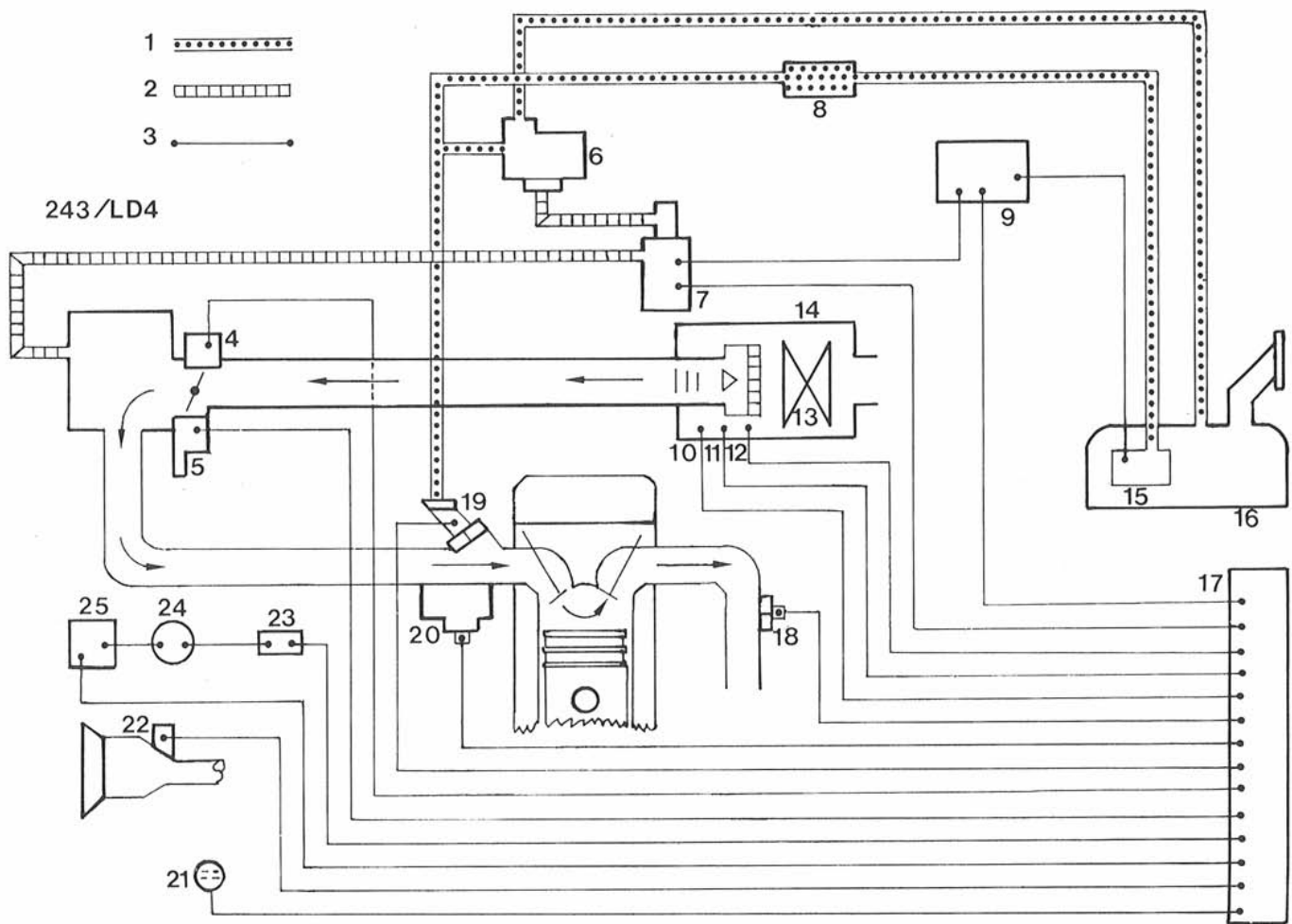
The ignition coil, which is mounted on the left hand inner fender, is of the resin moulded type and designed specifically to suit the electronic ignition system.

The power transistor is located beside the coil, its function being to interrupt the primary circuit when triggered by signals from the control unit. This induces a high voltage to flow in the secondary circuit.

The electronic fuel injection system uses multi point injection, where a metered amount of fuel is injected into the air stream at the inlet ports of the cylinder head. The air/fuel mixture then enters the combustion chamber via the inlet valves.

The fuel supply and pressure is provided by an electric fuel pump mounted within the fuel tank. The fuel is held at a constant pressure, relevant to manifold depression, by the fuel pressure regulator.

The fuel pressure regulator solenoid valve creates high system fuel pressure under certain circumstances to enable satisfactory hot starting.



**Schematic diagram of the engine management system**

**KEY**

- |                                     |                                 |   |
|-------------------------------------|---------------------------------|---|
| 1. Fuel line                        | 9. Control relay                | 18. Oxygen sensor   |
| 2. Vacuum line                      | 10. Air flow meter              | 19. Injector  |
| 3. Electrical circuit               | 11. Air temperature sensor      | 20. Coolant temperature sensor                                |
| 4. Throttle position sensor         | 12. Atmospheric pressure sensor | 21. Engine service connector                                  |
| 5. Idle speed control(ISC) assembly | 13. Air cleaner element         | 22. Vehicle speed sensor                                      |
| 6. Fuel pressure regulator          | 14. Air cleaner                 | 23. Power transistor  |
| 7. Fuel pressure regulator solenoid | 15. Fuel pump                   | 24. Ignition coil   |
| 8. Fuel filter                      | 16. Fuel tank                   | 25. Distributor (crank angle sensor and No.1 cylinder sensor) |
|                                     | 17. Control unit                |   |

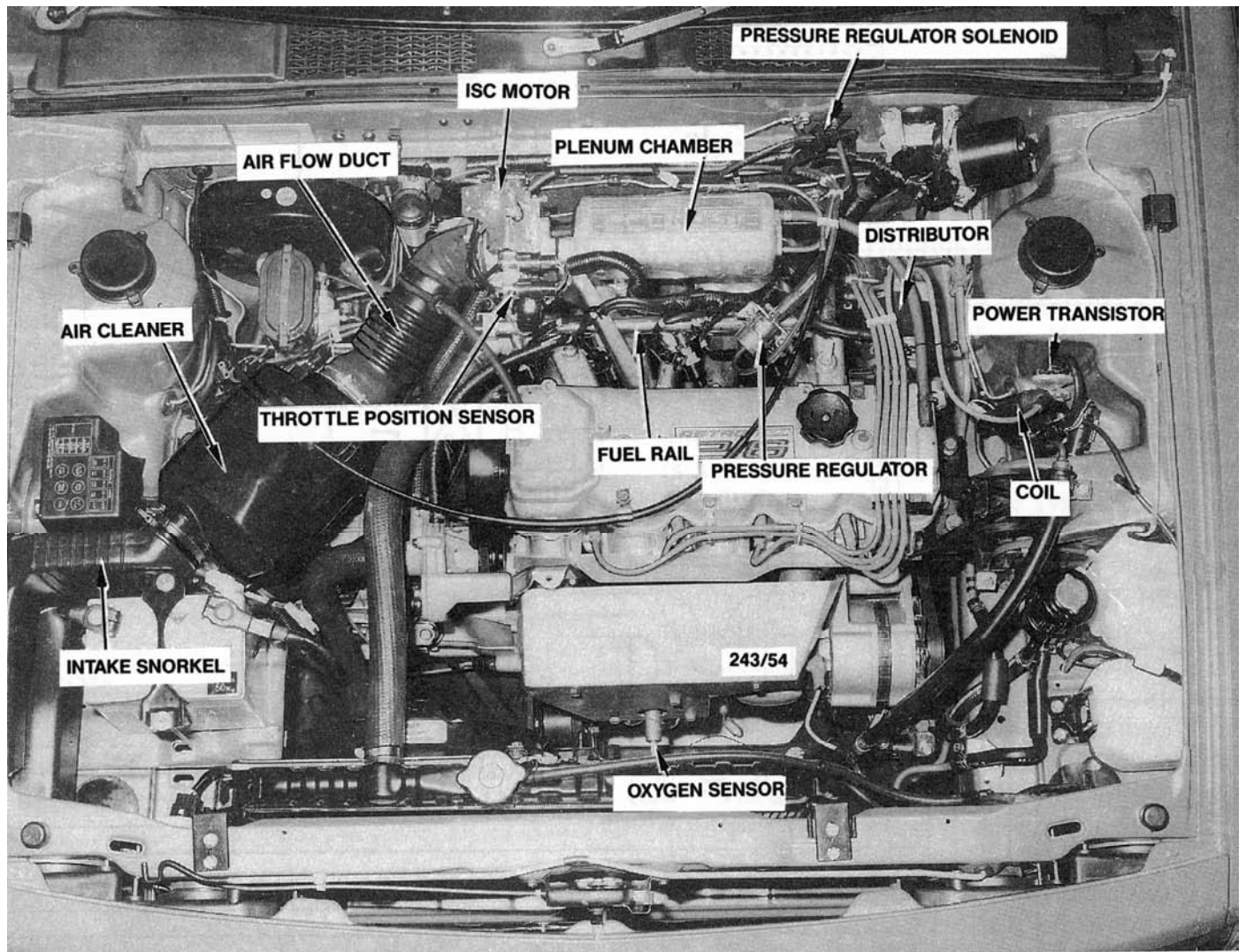
A 10 micron paper element fuel filter is mounted in the engine compartment on the bulkhead.

The fuel supply to the four injectors is stored in the fuel rail.

The amount of fuel injected is relevant to the time the injectors remain open. The basic time the injectors remain open is controlled by the control unit, which uses information from the crank angle sensor and the air flow meter. The basic injection time is then modified by the control unit to give optimum engine efficiency for the given conditions according to information received from the coolant temperature sensor, throttle position sensor, idle switch, No. 1 cylinder sensor, vehicle speed sensor, ignition switch, oxygen sensor, intake air temperature

sensor, atmospheric pressure sensor and on automatic transaxle models, the neutral safety switch.

The idle speed control (ISC) system comprises a reversible electric motor, a motor position sensor and the idle switch. The system controls the fast idle speed during engine warm up, maintains the basic idle speed at a set value by compensating for loads such as air conditioning and selection of Drive on automatic transaxle models, and slows the return of the throttle valve during deceleration.



**View of the engine showing the engine management components.**

The throttle body is located on the plenum chamber and controls the amount of air entering the engine by the action of the throttle valve.

Efficient operation of the engine management system depends on accurate signals being received by the control unit and controlled air flow beyond the air flow meter. Therefore, it is essential that all air, fuel and electrical connections be clean and tight.

## **2. SERVICE PRECAUTIONS AND PROCEDURES**

### **PRECAUTIONS**

Electronic ignition systems can produce dangerously high voltages in both the primary and secondary circuits. For this reason, extreme care must be taken when working on or near the ignition system.

Do not start the engine if the battery terminals are not clean and tight.

Do not use the fast charge or boost settings on a battery charger to start the engine.

Do not disconnect the battery terminals while the engine is running.

Disconnect the battery terminals before charging the battery.

Disconnect the negative battery terminal before working on the engine management system.

Do not subject the control unit to temperatures above 80 deg C.

Ensure that all wiring connectors are clean and tight.

Ensure that the ignition is off and the negative battery terminal is disconnected before disconnecting any engine management component.

Depressurise the fuel system before removing any fuel supply components. The fuel system has a residual pressure of approximately 250 kPa at all times.

Disconnect the battery terminals and the control unit wiring connector and remove the control unit from the vehicle before attempting any welding operations.

Do not direct steam cleaning or pressure washing nozzle at engine management components when cleaning the engine.

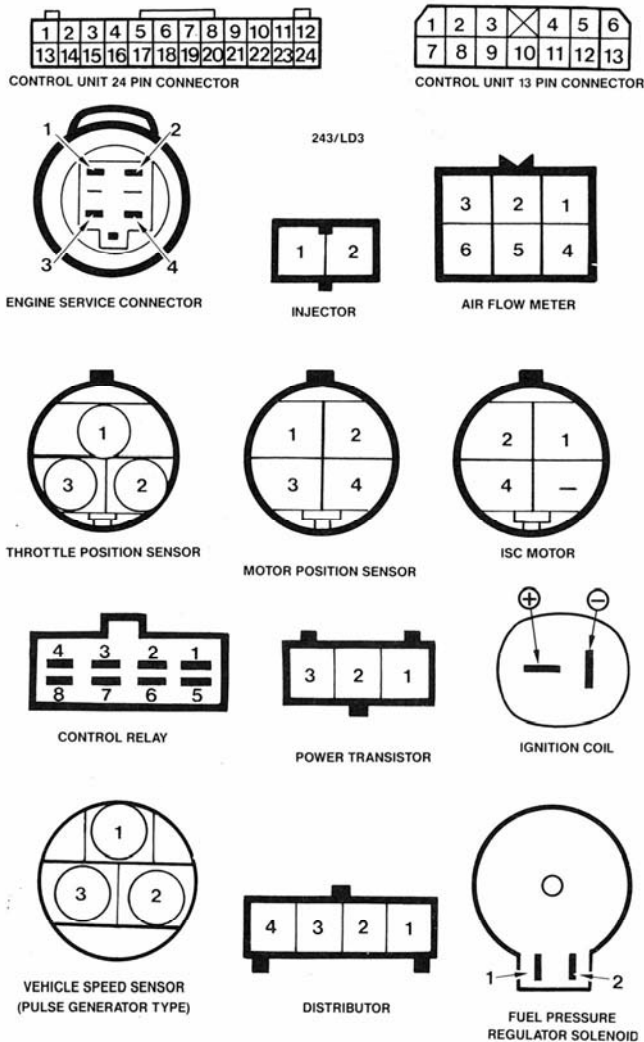
Handle all engine management components with care, particularly the air flow meter and oxygen sensor.

Do not attempt to dismantle the control unit or air flow meter. If faulty, these components must be renewed as complete assemblies.

Do not directly apply battery voltage to the injectors.

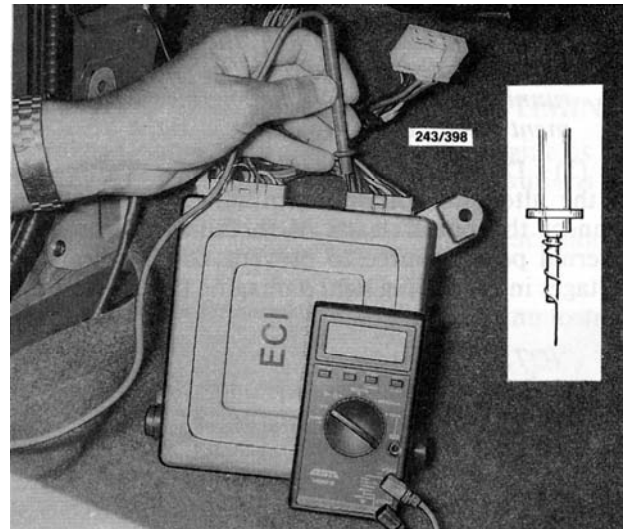
## TO CONNECT ELECTRICAL TEST EQUIPMENT

It is essential that in all tests where voltage or resistance is to be measured, a digital display multimeter with a minimum 10 megohm impedance be used unless otherwise instructed. An analogue display voltmeter is required to read the self diagnosis fault codes and perform certain other tests as indicated in the text.



### Electrical connector terminal numbering diagram

All meter readings are to be performed with the component wiring connectors installed unless otherwise instructed. This can be done by inserting the meter test probes from the wiring harness side of the connector or back probing. If the test probes are not thin, they should be modified by attaching a thin piece



**The correct method of back probing the wiring connectors. The meter test probes should be modified with a thin piece of wire as shown.**

of wire to the end of the probe, giving a fine point that will not damage the connector. Ensure that the wire is making good contact with the probe.

If sealing plugs or boots are removed from wiring connectors to facilitate back probing, ensure that they are correctly installed at the conclusion of the test procedure.

To identify wiring connector terminals, refer to the electrical connector terminal numbering diagram.

### Tachometer

(1) Pull back the rubber boot on the power transistor wiring connector to expose the wires.

(2) Insert the positive lead probe of an accurate tachometer into the white wire connection of the power transistor wiring connector.

*NOTE: Do not allow the tachometer lead to short to earth as damage to the engine management system may result.*

(3) Connect the negative lead to a good earthing point.

(4) After disconnecting the tachometer, ensure that the rubber boot is correctly installed to the wiring connector.

### Timing Light

(1) Connect the timing light to the engine following the instrument manufacturers instructions.

*NOTE: Do not connect or disconnect the timing light with the engine running as voltage surges could damage the alternator or control unit. Do not allow the high tension leads to open circuit with the engine running as damage to the engine management system could result.*

(2) Do not connect the timing light positive lead to the alternator output terminal. Where possible, connect the power leads of the timing light to an external power source to prevent possible transient voltages in the timing light damaging the alternator or control unit.

*NOTE: Some types of tachometers, timing lights, and ignition system analysers are not compatible with this engine management system. It is therefore recommended that the manufacturer of the test equipment be consulted before proceeding to use the test equipment.*

### 3. SYSTEM DIAGNOSIS AND ADJUSTMENTS

*NOTE: Due to the use of complex electronic components in the engine management system, the diagnosis and testing procedures described in this manual should not be carried out by persons lacking an understanding of electronics and the precautions associated with the servicing of electronic components. It is recommended that should a fault arise in the system, the vehicle be taken to a Mitsubishi dealer for rectification.*

*The control unit can be damaged by component faults not indicated by the Self Diagnosis codes and the renewal of the control unit without locating the cause of failure will result in the failure of the replacement unit. It is for this reason that the practice of substituting components to isolate faults is not recommended.*

*Prior to performing any of the following operations, refer to the Service Precautions and Procedures heading.*

#### PRELIMINARY CHECKS

Prior to performing the Self Diagnosis tests, carry out the following preliminary checks and rectify as necessary.

(1) Check for fuel in the fuel tank.  
(2) Check the wiring connectors and earth points of all engine management components for clean, secure connections. To prevent damage to the control unit, disconnect the negative battery terminal before disconnecting any engine management wiring connectors.

(3) Check the condition of the battery. Refer to the Electrical System for checking procedures. Rectify any faults as necessary.

(4) Check the air cleaner element for restriction.

(5) Check for air leaks at the air flow duct, air flow meter, throttle body, plenum chamber, inlet manifold and all related hoses. The air flow beyond the air flow meter is measured by the air flow meter. Therefore, any unmetered air entering the system by leakage will affect engine operation.

(6) Ensure that the control unit wiring harness is routed at least 10 cm away from all other wiring harnesses.

(7) Check the fuel pump pressure as described later in this section.

(8) Ensure that the engine is in satisfactory mechanical condition and is in tune. Refer to the Engine and Engine Tune-up sections as necessary.

#### SELF DIAGNOSIS

This function is very useful in locating system faults, particularly intermittent problems. However, the self diagnosis mode does not provide comprehensive testing of the engine management system, and therefore should always be used in conjunction with the other test procedures described later in order to accurately locate system faults.

##### To Interpret Self Diagnosis Codes

The self diagnosis codes are displayed as a series of 12 volt pulses which can be read by connecting an analogue voltmeter to the engine service connector.

*NOTE: The use of an analogue voltmeter instead of a digital display voltmeter is recommended in this instance as it is easier to identify the fault codes from the analogue display. The use of an analogue voltmeter in this application will not damage any electronic components.*

Each code begins with a 3 second pulse. This will be followed by a series of five pulses of 1.5 and 0.5 second duration. The end of each code is indicated by a 3 second pause.

To identify the code number note the duration and sequence of the five pulses and refer to the self diagnosis code chart.

**Self diagnosis code number chart. \* — = 3 seconds, - = 1.5 seconds, - = 0.5 seconds.**

Code Number	Fault Area	*Pulse Sequence
0	Satisfactory	— — — — —
1	Oxygen sensor	— — — — —
2	Crank angle sensor	— — — — —
3	Air flow meter	— — — — —
4	Atmospheric pressure sensor	— — — — —
5	Throttle position sensor	— — — — —
6	Motor position sensor	— — — — —
7	Coolant temperature sensor	— — — — —
8	No. 1 cylinder sensor	— — — — —

If more than one fault is present, the self diagnosis system will indicate each one in numerical order and then begin the sequence again.

##### Test Procedure

(1) Start the engine and allow it to reach normal operating temperature.

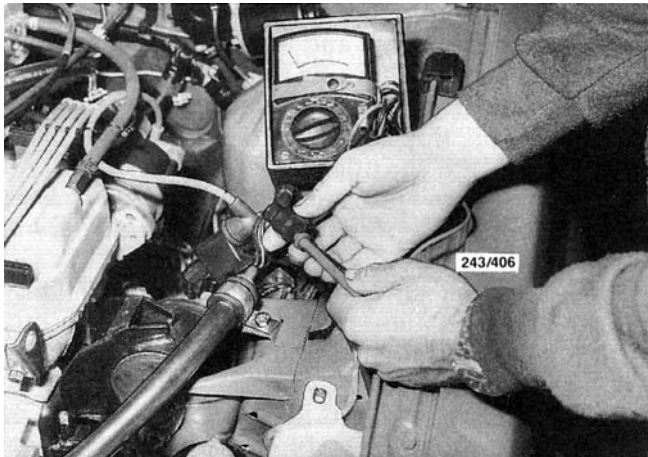
If the engine cannot be started, continue the test procedure with the ignition switch in the On position. Code 1 (oxygen sensor) will be displayed, but should be disregarded, as the oxygen sensor has no bearing on whether or not an engine will start.

(2) Remove the plastic cap from the engine service connector.

(3) If the battery has been disconnected, run the engine for a minimum of 30 seconds.

(4) With the engine running, connect the positive lead of a voltmeter to terminal 3 of the engine service connector and the negative lead to terminal 4.

(5) Note the duration and sequence of the 12 volt pulses and refer to the self diagnosis code diagram.



**Reading the self diagnosis codes using an analogue voltmeter connected to the engine service connector.**

If code 0 is displayed, the system is operating correctly.

If codes other than code 0 are displayed, refer to the component or circuit test procedure under the appropriate heading as indicated by the code number.

*NOTE: If code 1 (oxygen sensor) is displayed, run the engine at 2000 rpm for approximately 30 seconds. If no fault is present in the oxygen sensor circuit, code 1 will be erased.*

If more than one code is being displayed, test each indicated fault working in the order of display of the code numbers.

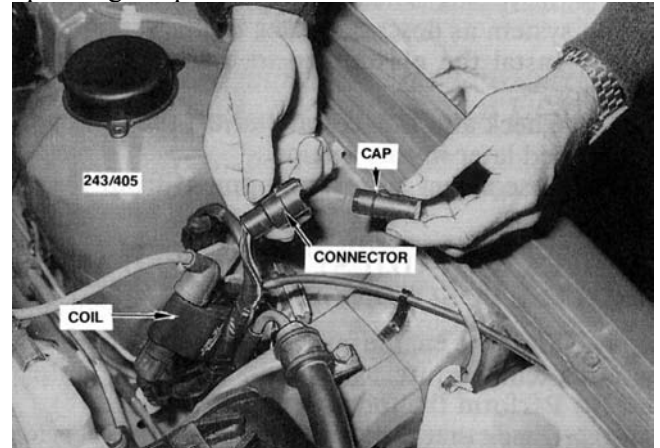
(7) After completing the self diagnosis test procedure, remove the voltmeter leads from the engine service connector and install the plastic cap.

(8) After repairing or renewing the necessary components, erase the self diagnosis -memory by disconnecting the negative battery terminal for 10 seconds.

## TO CHECK AND ADJUST IGNITION TIMING

(1) Connect a timing light to the engine as previously described under the Service Precautions and Procedures heading.

(2) Start the engine and allow it to reach normal operating temperature.



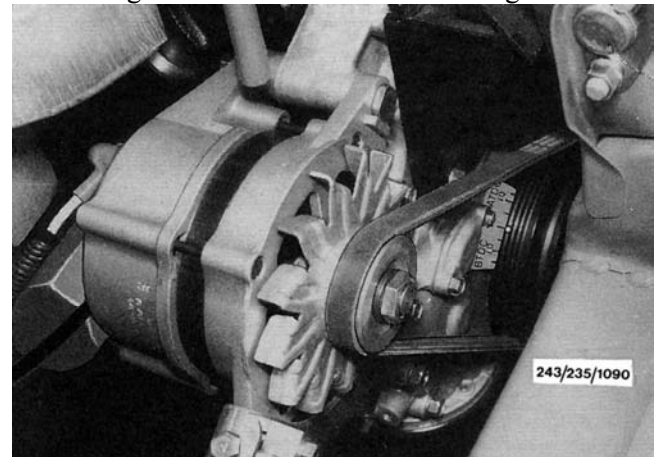
**View showing the location of the engine service connector.**

(3) Switch the engine off and remove the plastic cap from the engine service connector.

(4) Connect a jumper lead between terminals 2 and 4 of the engine service connector.

(5) With the engine at idle speed, check the ignition timing with the timing light. The ignition timing should be  $5 \pm 0.5$  deg BTDC.

The timing marks are located on the timing cover.



**View of the ignition timing marks on the timing cover and the crankshaft pulley.**



The correct timing mark should be aligned with the mark on the crankshaft pulley.

(6) If adjustment is necessary, loosen the distributor body retaining clamp bolt and turn the distributor body until the correct setting is obtained.

(7) Tighten the distributor body retaining bolt and ensure that the timing is still correct.

(8) Remove the jumper lead from the engine service connector and check the ignition timing. The timing should be approximately 13 deg BTDC at idle speed. If the timing is incorrect, check for faults in the ignition system as described later in this section.

(9) Install the plastic cap to the engine service connector.

(10) Check and if necessary adjust the idle speed as described later in this section.

(11) Disconnect all test equipment from the engine.

### TO CHECK AND ADJUST IDLE SPEED AND THROTTLE POSITION SENSOR

(1) Start the engine and allow it to reach normal operating temperature.

(2) Perform the following checks:

(a) Check that the air cleaner element is serviceable.

(b) Check the air intake system for leaks.

(c) Ensure that all accessories are switched off.

(d) Check that all wiring connectors and vacuum hoses are securely connected.

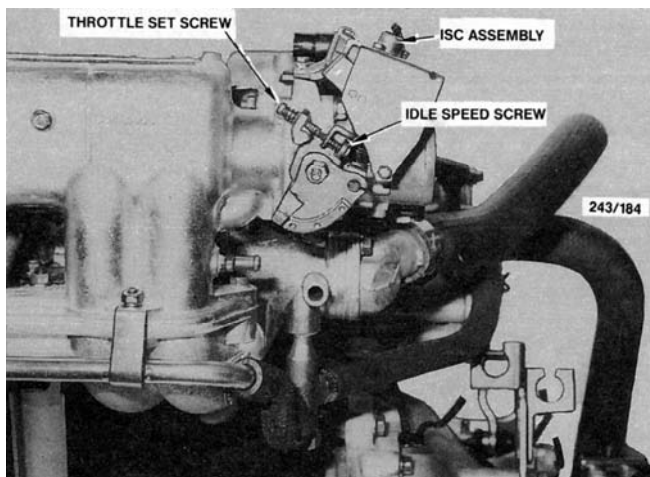
(e) Ensure that the ignition timing is correctly set.

(f) Ensure that the transaxle is in Neutral.

(3) Connect an accurate tachometer to the engine as previously described under the Service Precautions and Procedures heading.

(4) Loosen the throttle cable adjusting bolts and disconnect the inner cable from the throttle linkage.

(5) Turn the throttle set screw anticlockwise until there is approximately 3mm between the end of the screw and the throttle linkage.



**Installed view of the idle adjusting screws. The idle speed must be adjusted following the procedure described in the text.**

(6) Turn the ignition switch on and wait a minimum of 15 seconds. During this time the ISC motor should retract.

(7) With the wiring connectors installed to the motor position sensor and the throttle position sensor, measure the voltage across the motor position sensor connector terminals 1 and 2. The voltage should be approximately 900 millivolts.

If the voltage is not as specified, check the coolant temperature sensor, ISC motor, motor position sensor or the control unit for correct operation.

(8) Turn the ignition switch Off and disconnect the wiring connector from the ISC motor.

(9) Run the engine and adjust the idle speed to the specified speed by turning the idle speed adjusting

screw. Ensure that the electric cooling fan is not operating during this adjustment.

(10) Turn the throttle set screw clockwise until the end of the screw just touches the throttle linkage.

(11) Turn the throttle set screw anticlockwise half a turn.

(12) Turn the ignition switch Off and then On.

(13) Measure the voltage across the throttle position sensor terminals 1 and 2. The voltage should be  $0.5 \pm 0.04$  volts.

If the voltage is not as specified, loosen the throttle position sensor retaining screws and turn the sensor until the correct voltage is obtained.

(14) Move the throttle to the fully open position and release it, allowing it to snap back to the fully closed position.

(15) Measure the voltage as described in operation (13) and adjust the throttle position sensor as necessary.

(16) Disconnect the negative battery terminal for 10 seconds to erase the self diagnosis memory. Connect the negative battery terminal

(17) Install the wiring connector to the ISC motor.

(18) Connect the throttle cable to the throttle linkage and adjust the cable as described later in this section.

(19) Run the engine at 1200 to 1400 rpm for approximately 30 seconds.

(20) Allow the engine to idle and check that the idle speed is as specified.

If the engine is not idling at specified speed, either there is a faulty component or the adjustment procedure has not been carried out correctly. Check all components for correct operation and repeat the adjustment procedure.

*NOTE: Do not attempt to correct the idle speed by turning the throttle set screw or the idle speed adjusting screw.*

### TO ADJUST MIXTURE

There is no provision for mixture adjustment in this system.

## 4. FUEL SUPPLY COMPONENTS

### Special Equipment Required

**To Check Fuel Pressure and For Internal Leakage - 300 kPa pressure gauge, suitable banjo fitting, lengthened banjo bolt, washers**

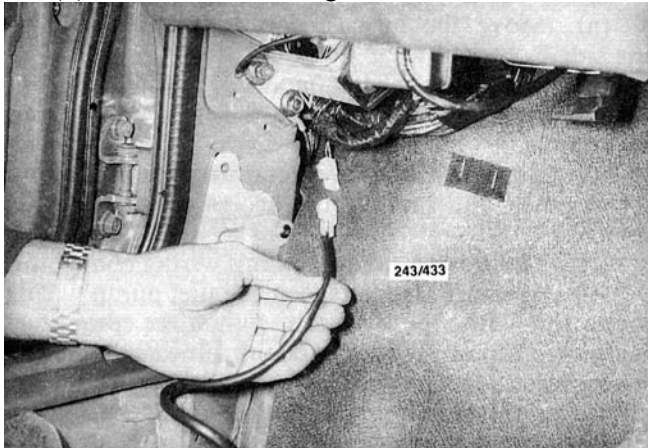
*NOTE: Before proceeding with any of the operations in this section, refer to the Service Precautions and Procedures heading*

### TO DEPRESSURISE FUEL SYSTEM

(1) Remove the screws retaining the passenger side kick panel and remove the panel from the vehicle.

(2) Pull the carpet back slightly to gain access to the fuel pump power supply wire connector. The fuel pump wire is black/white.

(3) Start and run the engine at idle.



**Depressurise the fuel system by disconnecting the fuel pump power supply wire while the engine is running. The connector is located behind the passenger side kick panel.**

(4) Disconnect the fuel pump power supply wiring connector while the engine is running.

(5) Once the engine has stalled, operate the starter motor several times to ensure that all fuel pressure has been released.

(6) Turn the ignition switch Off, connect the wiring connector and install the kick panel.

### TO TEST FOR EXTERNAL LEAKS

(1) Remove the plastic cap from the engine service connector.

(2) Using a jumper lead, supply battery voltage to terminal 1 of the engine service connector.

(3) Check the fuel system for leaks at all connections from the fuel tank to the injectors.

(4) If renewal of any component is required, the fuel system must be depressurised as previously described.

*NOTE: Use only hoses and clamps as specified by the manufacturer.*

(5) Remove the jumper lead and install the cap

to the engine service connector.

### TO TEST FOR INTERNAL LEAKS

(1) Depressurise the fuel system as previously described.

(2) Disconnect the negative battery terminal.

(3) Remove the banjo bolt and washers and disconnect the fuel supply hose from the fuel rail.

(4) Install the washer, fuel supply hose, washer, suitable banjo fitting, washer and lengthened banjo bolt to the fuel rail in that order.

*NOTE: the fittings required to connect a pressure gauge are available as a kit from Mitsubishi.*

(5) Connect the fuel pressure gauge to the banjo fitting.

(6) Connect the negative battery terminal and check the fuel system for external leaks as previously described.

(7) Start and run the engine at idle. Note the reading on the pressure gauge.

(8) Switch the engine off and note the pressure gauge reading. If the pressure does not decrease appreciably in 60 seconds, the fuel system may be considered to be in a serviceable condition.

*NOTE: There may be a small initial decrease in pressure as soon as the engine is switched off. This is acceptable and does not indicate a fault in the system.*

(9) If the pressure decreases quickly, clamp the fuel hose between the fuel filter and the fuel rail with a suitable clamp and note the reading on the pressure gauge. If the pressure stops decreasing, the fuel pump may be considered faulty and should be renewed as described later in this section.

*NOTE: If the fuel pressure has decreased a large amount, run the engine for approximately 30 seconds to repressurise the system. This should be done before the fuel hose is clamped. Repressurise the system as necessary during the testing procedure.*

(10) If the pressure continues to decrease, release the clamp from between the fuel filter and the fuel rail.

Ensure that the fuel system is pressurised, clamp the fuel return line from the pressure regulator and note the reading on the pressure gauge. If the pressure stops decreasing, the pressure regulator may be considered faulty and should be renewed as described later in this section.

(11) If the pressure continues to decrease, release the clamp from the pressure regulator return hose.

(12) Remove the fuel rail and injector assembly from the inlet manifold as described later in this section but leave the fuel supply and return hoses connected to the fuel rail and pressure regulator.



(13) Ensure that the fuel system is pressurised and observe which injectors are leaking. Renew all faulty injectors.

(14) Pressurise the fuel system and check for any pressure decrease.

(15) Install all components, remove the pressure gauge and fittings and connect the fuel supply hose using new sealing washers.

(16) Test the system for external leaks as previously described.

## TO TEST FUEL PRESSURE

(1) Depressurise the fuel system as previously described.

(2) Disconnect the negative battery terminal.

(3) Remove the banjo bolt and washers and disconnect the fuel supply hose from the fuel rail.

(4) Install the washer, fuel supply hose, washer, suitable banjo fitting, washer and lengthened banjo bolt to the fuel rail in that order.

*NOTE: The Fittings required to connect a pressure gauge are available as a kit from Mitsubishi.*

(5) Connect the fuel pressure gauge to the banjo fitting.

(6) Connect the negative battery terminal and check the fuel system for external leaks as previously described.

(7) Start the engine and allow it to idle for at least 2 minutes. The fuel pressure should be approximately 196 kPa.

If the fuel pressure is below the specified value, check for blockages and kinks in the fuel lines and blockages in the fuel filter and fuel pump strainer in the fuel tank.

If the specified pressure cannot be achieved, the fuel pump should be renewed as described later in this section.

If the fuel pressure is above the specified value, check the vacuum hose and connections to the fuel pressure regulator. If the vacuum hose and connections are satisfactory and vacuum is reaching the regulator, the regulator should be renewed as described later in this section.

(8) Disconnect and plug the fuel pressure regulator vacuum hose. The fuel pressure should rise to 245-264 kPa.

If the fuel pressure does not rise to the specified value, the fuel pump should be renewed as described later in this section.

## FUEL PUMP

### To Test Fuel Pump Electrical Circuit

(1) Remove the plastic cap from the engine service connector.

(2) Using a jumper lead, supply battery voltage to terminal 1 of the engine service connector.

(3) Squeeze the fuel supply hose near the fuel rail and feel for pulsations which indicate fuel pump operation. It should also be possible to hear the pump operating in the fuel tank.

If the fuel pump does not operate, check the wiring harness to the fuel pump for faults. Repair or renew as necessary. If the wiring harness is not faulty, proceed to operation (10).

If the fuel pump operates but the engine will not start, proceed as follows.

(4) Disconnect the primary wiring connector from the coil.

(5) Measure and note the voltage at the battery with the ignition switch in the Start position.

(6) On Sedan models, raise the rear of the vehicle and support on chassis stands.

(7) On Station Wagon models, proceed as follows:

(a) Move the luggage compartment carpet to one side.

(b) Disengage the left hand side floor panel from the retaining clips and remove the floor panel from the vehicle.

(c) Remove the screws retaining the fuel pump access cover and remove the access cover from the vehicle.

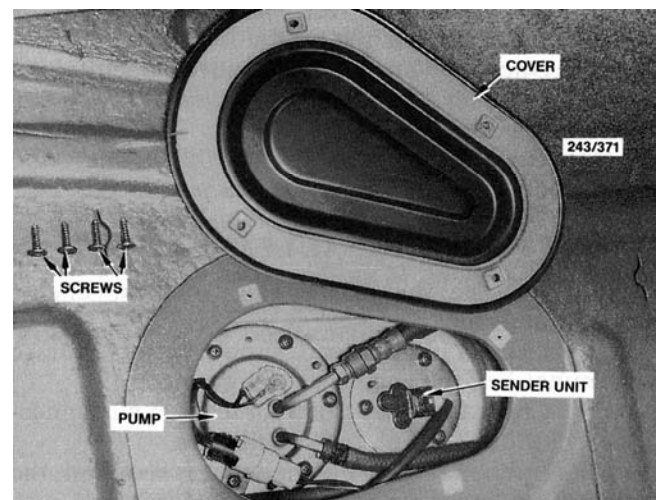
(8) Disconnect the fuel pump wiring connector.

(9) Measure the voltage at the fuel pump wiring connector with the ignition switch in the Start position. The voltage should be the same as that noted in operation (5).

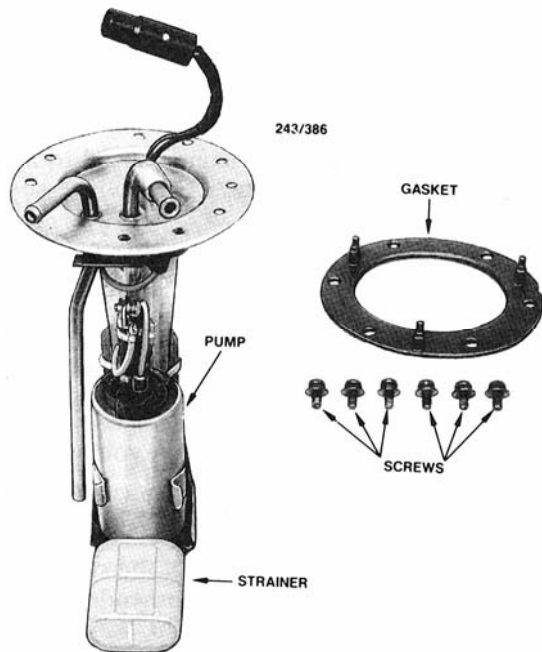
If the voltage is not as specified, check the control relay as described later in this section.

If the voltage is as specified, proceed as follows:

(10) Remove the fuel pump from the vehicle as described in Part 2. Fuel System – Carburettor Models.



**Fuel pump access cover removed showing the fuel pump and fuel gauge sender unit installed to the fuel tank. Station Wagon models.**



**Fuel pump removed from the vehicle.**

(11) Check the condition of the wiring and connections. If the wiring is satisfactory, check the pump motor for continuity across the pump terminals. If there is no continuity, renew the pump.

#### **To Remove and Install**

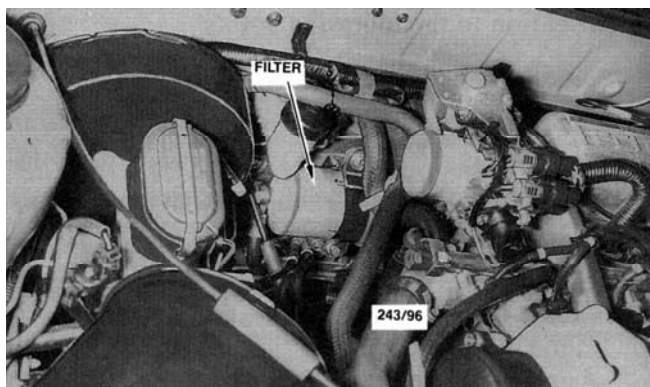
The removal and installation procedures for the fuel pump are fully covered in Part 2. Fuel System Carburettor models section with attention to the following points:

- (1) Prior to removal, depressurise the fuel system as previously described.
- (2) After installation, check the fuel system for external leakage as previously described.

### **FUEL FILTER**

#### **To Remove and Install**

- (1) Depressurise the fuel system as previously described.
- (2) Disconnect the negative battery terminal.



**Installed view of the fuel filter. The air flow duct has been removed for clarity.**

(3) Remove the banjo bolts and washers from the ends of the fuel filter and disconnect the fuel lines from the filter.

(4) Remove the bolts retaining the fuel filter clamp to the mounting bracket and remove the fuel filter from the vehicle.

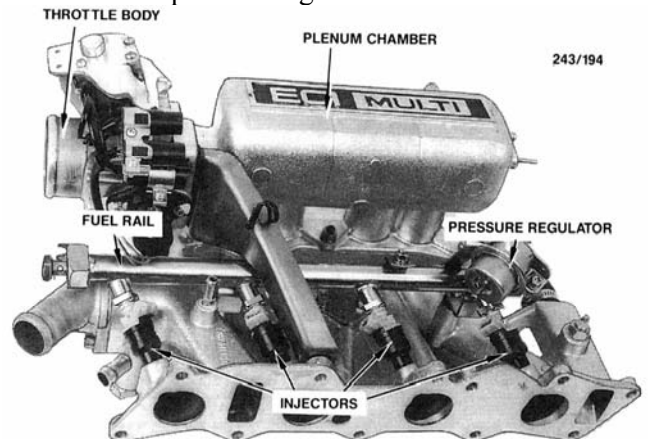
Installation is a reversal of the removal procedure with attention to the following points:

- (1) Always use new sealing washers.
- (2) Ensure that the fuel filter is installed in the correct direction.
- (3) Test the fuel system for external leakage as previously described.

### **FUEL PRESSURE REGULATOR**

#### **To Remove and Install**

- (1) Depressurise the fuel system as previously described.
- (2) Disconnect the negative battery terminal.
- (3) Disconnect the fuel return hose and vacuum hose from the pressure regulator.



**View of the inlet manifold removed from the engine showing the location of various components.**

(4) Remove the screws retaining the pressure regulator to the fuel rail and remove the pressure regulator and O ring from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Check the O ring and sealing washers for damage and renew as necessary.
- (2) Test the fuel system for external leakage as previously described.

### **FUEL PRESSURE REGULATOR SOLENOID**

#### **To Test**

- (1) With the ignition On, measure the voltage at terminal 1 on the fuel pressure regulator solenoid. The voltage should be battery voltage.
- (2) With the engine cold and the ignition switch in the Start position, measure the voltage at terminal 2

on the fuel pressure regulator solenoid. The voltage should be above 8 volts.

If a fault is indicated, check the control relay for correct operation. Also check the wiring harness from the control relay and control unit to the fuel pressure regulator solenoid.

If no fault is indicated, proceed as follows.

(3) Remove the fuel pressure regulator solenoid from the vehicle.

(4) Block one vacuum hose fitting with a finger and apply vacuum to the other vacuum hose fitting. The vacuum should be maintained.

(5) Apply a 12 volt power supply to the solenoid terminals.

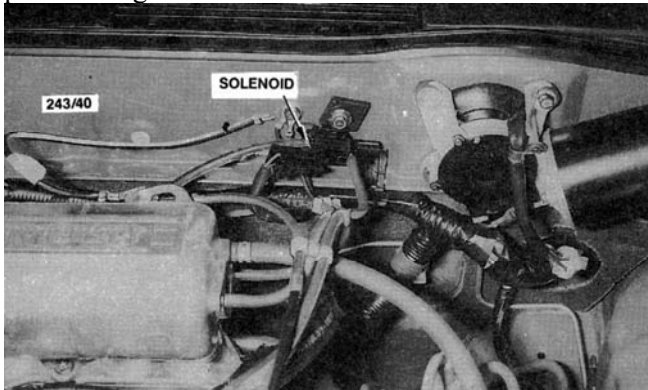
(6) Repeat operation (3). The vacuum should not be maintained.

If the above tests indicate a fault, the solenoid should be renewed.

### To Remove and Install

(1) Disconnect the negative battery terminal.

(2) Disconnect the vacuum hoses from the fuel pressure regulator solenoid.



**Installed view of the fuel pressure regulator solenoid.**

(3) Disconnect the wiring connector from the solenoid.

(4) Remove the retaining bolt and remove the solenoid from the vehicle.

### FUEL RAIL AND INJECTORS

#### To Test Injector Circuit

(1) Disconnect the wiring connectors from the injectors.

(2) Measure the resistance between the terminals of each injector.

The resistance should be 16 k 3 ohms. If the resistance is not as specified, renew the injector as described later in this section.

*NOTE: The injector resistance will vary slightly according to temperature.*

(3) Connect the wiring connectors to the injectors.

(4) Pull back the rubber boot on the rear of each of the injector connectors to gain access to the connector terminals.

(5) Measure the voltage at terminal 1 on each injector connector with the engine running at idle speed. The voltage should be 12-14 volts.

(6) Quickly increase the engine speed to above 2000 rpm and note the voltage. The voltage should decrease slightly.

If the voltage is not as specified, proceed as follows.

(7) With the engine running at idle speed, measure the voltage at terminals 9, 10, 11 and 12 on the control unit 13 pin connector. The voltage should be 12-14 volts.

(8) Quickly increase the engine speed to above 2000 rpm and note the voltage. The voltage should decrease slightly.

If the voltage is as specified, repair or renew the wiring harness as necessary.

If the voltage is not as specified, the control unit may be faulty. It is therefore recommended that the vehicle be referred to a Mitsubishi workshop for comprehensive testing.

### To Remove and Install

(1) Depressurise the fuel system as previously described.

(2) Disconnect the negative battery terminal.

(3) Remove the retaining bolt and nuts and remove the support stay from the plenum chamber and cylinder head.

(4) Remove the banjo bolt and sealing washers from the fuel rail and disconnect the fuel supply hose.

(5) Disconnect the fuel return hose and the vacuum hose from the pressure regulator.

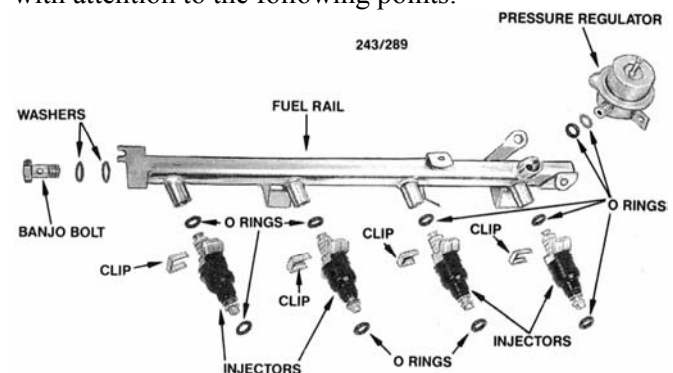
(6) Disconnect the wiring connectors from the injectors.

(7) Remove the bolts retaining the fuel rail and injectors and remove the fuel rail and injectors from the engine.

(8) Remove the retaining clips and remove the injectors from the fuel rail.

(9) Remove the O rings from the injectors.

Installation is a reversal of the removal procedure with attention to the following points:



**Fuel injectors, fuel rail and the pressure regulator removed from the vehicle.**

- (1) Always use new injector sealing rings. Apply petrol to the sealing rings prior to installation.
- (2) Test the fuel system for external leakage as previously described.

## FUEL TANK

The removal and installation procedures for the fuel tank are fully covered in Part 2. Fuel System - Carburettor Models section with attention to the following points:

- (1) Prior to removal, depressurise the fuel system as previously described.
- (2) After installation, check the fuel system for external leakage as previously described.

## 5. AIR FLOW COMPONENTS

*NOTE: Before proceeding with any of the operations in this section, refer to the Service Precautions and Procedures heading.*

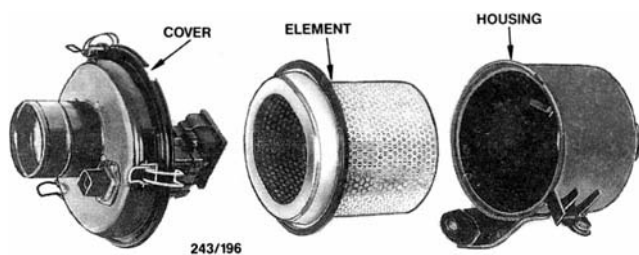
### AIR CLEANER

#### To Renew Element

- (1) Remove the air cleaner assembly as described later in this section.
- (2) Disengage the retaining clips and remove the air cleaner cover and air flow meter assembly from the housing.
- (3) Remove the air cleaner element from the housing.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Use only the specified air cleaner element.
- (2) Clean the air cleaner cover and housing thoroughly taking care not to allow any dirt to enter the air flow meter.



**Dismantled view of the air cleaner.**

#### To Remove and Install Air Cleaner Assembly

- (1) Disconnect the negative battery terminal.
- (2) Release the retaining clip and disconnect the intake snorkel from the air cleaner assembly.
- (3) Loosen the hose clamp retaining the air flow duct to the air cleaner assembly and disconnect the duct from the air cleaner assembly.
- (4) Disconnect the wiring connector from the air flow meter.

(5) Disengage the purge solenoid from the air cleaner assembly.

(6) Remove the bolts retaining the air cleaner assembly and remove the assembly from the vehicle.

Installation is a reversal of the removal procedure with attention to the following point:

After installing all components, run the engine and check for air leaks.

### AIR FLOW METER

#### To Test

(1) Start and run the engine until it reaches normal operating temperature.

(2) Measure the voltage at terminal 2 on the control unit 24 pin wiring connector with the engine at idle speed and then with the engine speed increased to 3000 rpm. The voltage at both engine speeds should be 2.2-3.2 volts.

If the voltage is as specified, the air flow meter is operating correctly.

If the voltage is not as specified, proceed as follows.

(3) Measure the voltage across terminals 3 and 6 on the air flow meter wiring connector with the engine at idle speed and then with the engine speed increased to 3000 rpm. The voltage at both engine speeds should be 2.2-3.2 volts.

If the voltage is as specified, repair or renew the wiring harness between the control unit and the air flow meter.

If the voltage is not as specified, proceed as follows.

(4) With the ignition On, measure the voltage at terminal 2 on the air flow meter wiring connector. The voltage should be battery voltage.

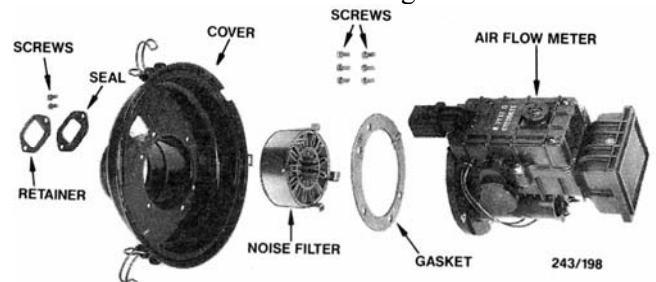
If the voltage is not as specified, check the operation of the control relay as described later in this section. Check the wiring harness from the control relay to the air flow meter. Repair or renew the harness as necessary.

If the voltage is as specified, the air flow meter should be renewed as described later in this section.

#### To Remove and Install

(1) Remove the air cleaner assembly as previously described.

(2) Disengage the retaining clips and remove the air cleaner cover from the housing.



**Air flow meter and associated components removed from the air cleaner cover.**

(3) Remove the screws retaining the retainer and remove the retainer and the seal.

(4) Remove the air flow meter retaining screws and remove the air flow meter, gasket and noise filter.

Installation is a reversal of the removal procedure with attention to the following point:

After installation, run the engine and check for air leaks.

## AIR TEMPERATURE SENSOR

### To Test

(1) With the ignition On, measure the voltage at terminal 5 on the control unit 24 pin wiring connector at the following temperatures and compare the results with the specified values:

0 deg C	.....	3.4-3.6 volts
20 deg C	.....	2.5-2.7 volts
40 deg C	.....	1.7-1.9 volts
80 deg C	.....	0.6-0.8 volts

If the voltages obtained are within the specified ranges, the sensor is operating correctly.

If the voltages obtained are not within the specified ranges at any of the given temperatures, proceed as follows.

(2) Remove the air cleaner assembly as previously described.

(3) Disengage the retaining clips and remove the air cleaner cover from the housing.

(4) Measure and note the resistance between air flow meter terminals 4 and 6.

(5) Heat the sensor with a hair dryer or suitable source of hot air and repeat operation (3). The resistance should decrease as the sensor is heated.

If no fault is indicated, check the wiring harness between the air temperature sensor and the control unit.

If a fault is indicated, renew the air temperature sensor. The air temperature sensor is integral with the air flow meter. If the sensor is faulty, the air flow meter should be renewed.

## ATMOSPHERIC PRESSURE SENSOR

### To Test

(1) With the ignition On, measure the voltage at terminal 1 on the air flow meter wiring connector. The voltage should be 4.5-5.5 volts.

If the voltage is not as specified, check the wiring harness between the air flow meter and the control unit for continuity.

If the voltage is as specified, proceed as follows.

(2) With the ignition On, measure the voltage across terminals 4 and 6 on the air flow meter wiring connector. At normal atmospheric pressure ( 103 kPa), the voltage should be approximately 4 volts.

The atmospheric pressure sensor is integral with the air flow meter. If the sensor is faulty, the air flow meter should be renewed.

## IDLE SPEED CONTROL (ISC) MOTOR

### To Test

(1) Turn the ignition On and observe that the ISC motor opens the throttle slightly.

(2) Leave the ignition On for at least 15 seconds and observe that the ISC motor retracts and allows the throttle to close.

If a fault is indicated, proceed as follows.

(3) With the engine running at idle, measure the voltage at terminal 1 on the ISC motor wiring connector. The voltage should be 0-2 volts.

(4) Increase the engine speed quickly from idle to above 3000 rpm in neutral. The voltage at terminal 1 should increase momentarily to over 3 volts.

(5) With the engine running at idle, measure the voltage at terminal 2 on the ISC motor wiring connector. The voltage should be 0-2 volts.

(6) Increase the engine speed quickly from idle to above 3000 rpm in neutral. The voltage at terminal 2 should increase momentarily to over 3 volts.

If a fault is indicated in operations (3) to (6), check the wiring harness from the ISC motor to the control unit for continuity.

If no fault is indicated, proceed as follows.

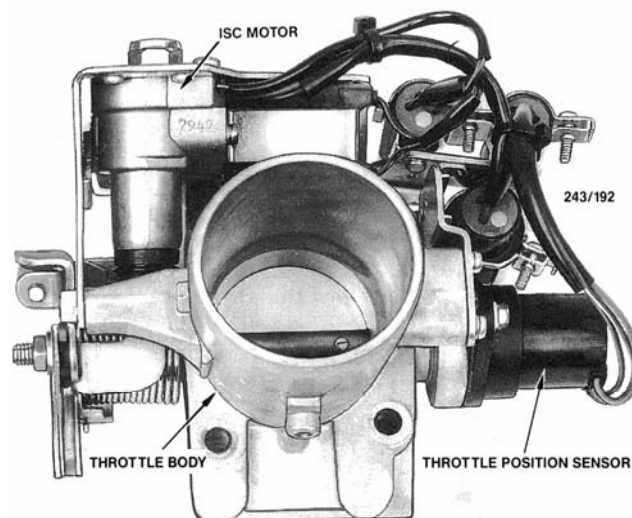
(7) Disconnect the ISC motor wiring connector.

(8) Measure the resistance between terminals 1 and 2 on the ISC motor. The resistance should be 5-11 ohms.

If a fault is indicated, the ISC motor assembly should be renewed.

### To Remove and Install

(1) Disconnect the negative battery terminal.



**Throttle body removed from the vehicle showing the idle speed control (ISC) motor and the throttle position sensor.**

(2) Disconnect the motor position sensor and ISC motor wiring connectors.

(3) Remove the screws retaining the wiring connector clamp and remove the clamp.

(4) Remove the bolts retaining the ISC motor assembly to the throttle body and remove the assembly from the vehicle.

Installation is a reversal of the removal procedure.

## MOTOR POSITION SENSOR

### To Test

(1) With the ignition On, measure the voltage at terminal 3 on the control unit 24 pin wiring connector. After 15 seconds the voltage should 0.8-1.2 volts.

If the voltage is as specified, the motor position sensor is operating correctly.

If the voltage is not as specified, proceed as follows.

(2) With the ignition On, measure the voltage across either terminals 3 and 1 or terminals 4 and 1 on the motor position sensor wiring connector. The voltage should be 4.5-5.0 volts.

(3) With the ignition Off, measure the voltage across either terminals 3 and 2 or 4 and 2 on the motor position sensor wiring connector. The voltage should be between 0.5 and 5 volts depending upon coolant temperature. A low temperature will give a high voltage and a high temperature will give a low voltage.

The voltage on a hot engine should be approximately 0.9 volts after 15 seconds.

(4) Turn the ignition Off, and disconnect the motor position sensor wiring connector.

(5) Measure the resistance across either terminals 3 and 1 or 4 and 1 on the motor position sensor.

The resistance should be 4-6 kilo ohms.

The motor position sensor is integral with the ISC motor assembly. If the sensor is faulty, the motor position assembly should be renewed.

## IDLE SWITCH

### To Test

(1) With the ignition On, measure the voltage at terminal 7 on the control unit 24 pin wiring connector. With the throttle valve fully closed, the voltage should be 0-0.6 volts. With the throttle valve fully open, the voltage should be 8-13 volts.

If the voltages are as specified, the idle switch is operating correctly.

If a fault is indicated, proceed as follows.

(2) Disconnect the ISC motor wiring connector.

(3) Check for continuity between terminal 4 on the ISC motor and a good earthing point. With the throttle pedal released there should be continuity. With the throttle pedal depressed there should be no continuity.

The idle switch is integral with the ISC motor assembly. If the switch is faulty, the ISC motor assembly should be renewed.

## THROTTLE BODY

### To Remove and Instal

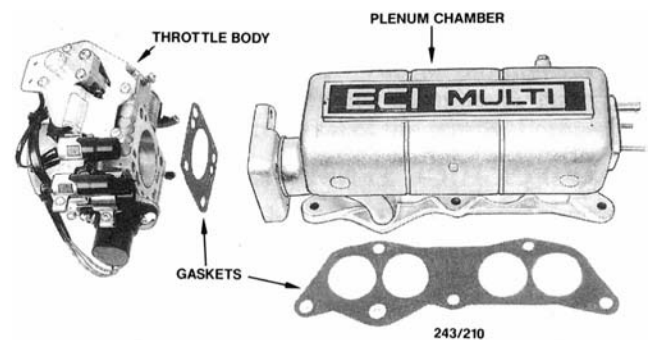
(1) Disconnect the air flow duct from the throttle body.

(2) Disconnect the throttle cable from the throttle body linkage.

(3) Disconnect the wiring connectors from the throttle position sensor, ISC motor and the motor position sensor.

(4) Remove the bolts retaining the throttle body to the plenum chamber and remove the throttle body and gasket from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:



### Throttle body and plenum chamber removed from the vehicle.

(1) Always use a new throttle body gasket.

(2) Tighten the throttle body bolts evenly in a diagonal pattern to the specified torque.

(3) Check and, if necessary, adjust the idle speed and throttle position sensor as previously described under the System Diagnosis and Adjustments heading.

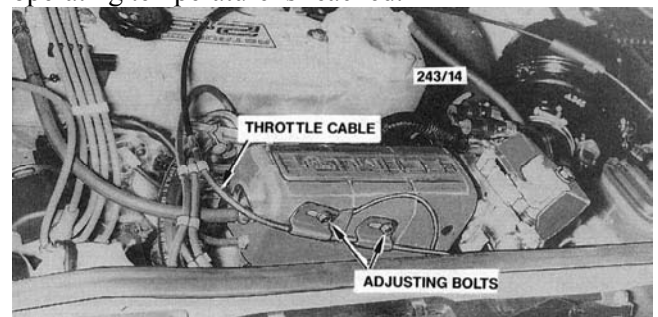
(4) Adjust the throttle cable as described later in this section.

(5) Run the engine and check for air leaks.

## THROTTLE CABLE

### To Adjust

(1) Start and run the engine until normal operating temperature is reached.



### Location of the throttle cable adjusting point.



(2) Loosen the throttle cable adjusting bolts and move the outer cable until there is no slack in the inner cable.

(3) Tighten the adjusting bolts.

(4) With the aid of an assistant, fully depress the throttle and check that the throttle valve is opening fully. Readjust the cable if necessary.

## PLENUM CHAMBER AND INLET MANIFOLD

### To Remove and Install

Refer to the Engine section for the removal and installation procedures relating to the plenum chamber and inlet manifold.

## 6. ELECTRONIC COMPONENTS

*NOTE: Before proceeding with any of the operations in this section, refer to the Service Precautions and Procedures heading.*

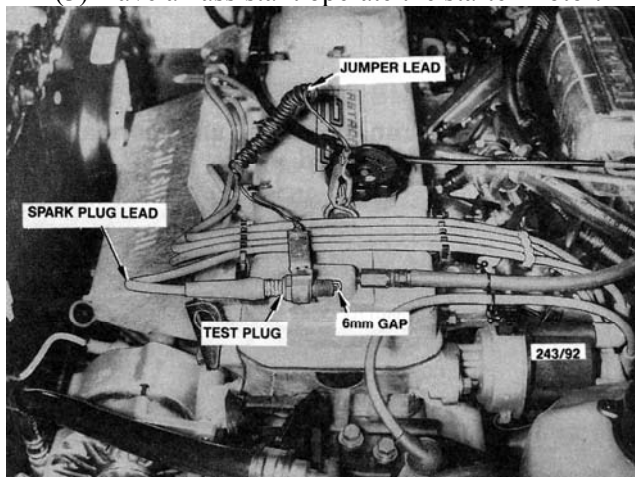
### TO CHECK HIGH TENSION CIRCUIT

*NOTE: Electronic ignition systems can produce dangerously high voltages in both the primary and secondary circuits. For this reason, extreme care must be taken when performing these checks. When disconnecting the wiring from any component, ensure that the ignition switch is Off and the negative battery terminal is disconnected to prevent damage to the solid state circuitry.*

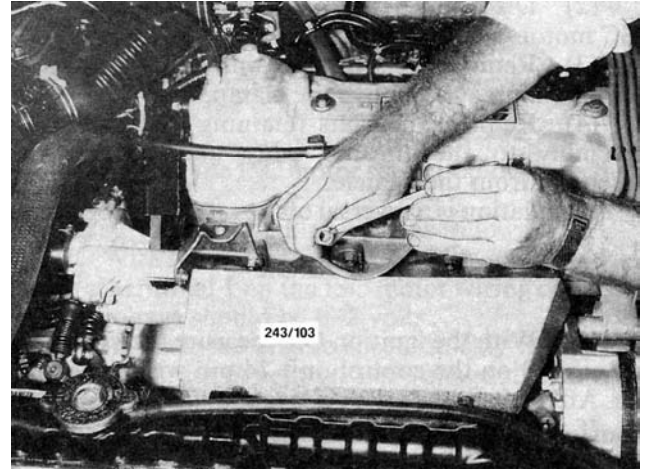
(1) Open the electrode gap of a serviceable spark plug to 6 mm. Securely earth the spark plug using a jumper lead or by tying the plug to an earthed engine component.

(2) Disconnect a high tension lead from a spark plug and connect it to the test spark plug.

(3) Have an assistant operate the starter motor.



Securely earth the body of a test plug to check or sparks at the spark plug leads and coil lead.



**Ensure that the high tension leads have clean, dry and secure connections.**

(4) Check that a spark jumps the gap on the test spark plug. If the spark is satisfactory, proceed to operation (9). If there is no spark, proceed as follows.

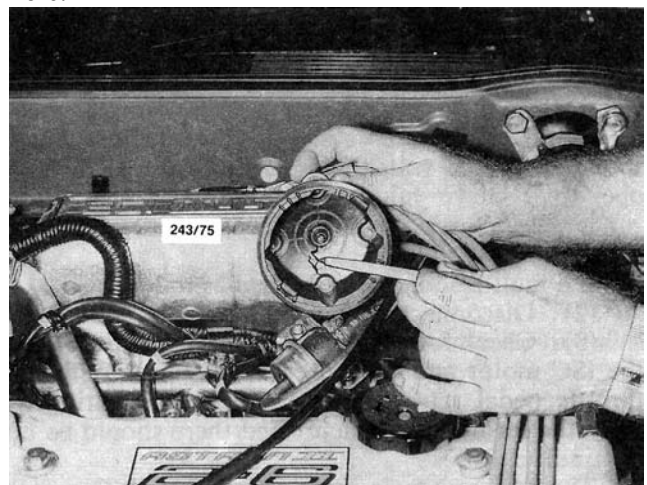
(5) Check the high tension leads to ensure that they are dry and that the insulation is not cracked or perished.

Ensure that the high tension leads have dry, clean and secure connections on the distributor cap.

(6) Check the distributor cap to ensure that it is dry and clean. Examine both the inside and outside of the cap for cracks or tracking, particularly between the high tension lead segments.

Using an ohmmeter, check the resistance from the distributor cap lead terminals to the spark plug lead terminals. On leads up to 635 mm in length, the resistance should not exceed 25,000 ohms. On leads longer than 635 mm, the resistance should not exceed 50,000 ohms.

Check that the carbon brush in the centre of the distributor cap is clean and dry. Ensure that the carbon brush moves freely in and out of the locating hole.



**Check the inside of the distributor cap for cracks and tracking.**

(7) Check the rotor for cracks, deposits and burning on the metal contacts.

(8) Using an ohmmeter, measure the resistance between the positive and negative terminals on the coil. This is the primary resistance. Compare the reading with that in Specifications.

Measure the resistance between the coil high tension terminal and the negative terminal. This is the secondary resistance. Compare the reading with that in Specifications.

If either resistance is outside the specified range, renew the coil.

(9) If the above checks result in a good spark at the spark plug high tension leads but the engine is still not operating satisfactorily, remove all spark plugs and check their condition and electrode gap as described in the Engine Tune-up section under the appropriate heading.

## **DISTRIBUTOR**

### **To Test Crank Angle Sensor and No. 1 Cylinder Sensor**

(1) Measure the voltage at terminal 1 on the control unit 24 pin wiring connector with the ignition switch in the Start position, and then with the engine running at 3000 rpm. The voltage in both cases should be 1.8-2.5 volts.

(2) Measure the voltage at terminal 13 on the control unit 24 pin wiring connector under the following conditions:

With the ignition switch in the Start position, the voltage should oscillate between 0.2- 1.5 volts.

With the engine running at 3000 rpm, the voltage should be 0.8 to 1.2 volts.

If no fault is indicated, the crank angle sensor and No. 1 cylinder sensor are operating correctly.

If a fault is indicated, proceed as follows.

(3) Pull back the sealing boot from the rear of the distributor wiring connector to gain access to the terminals.

(4) With the ignition On, measure the voltage across terminals 1 and 4 on the distributor wiring connector. The voltage should be battery voltage.

If the voltage is not as specified, check the wiring harness and connectors to the distributor.

*NOTE: The following tests should be performed with an analogue display voltmeter.*

(5) Disconnect the primary wiring connector from the coil by squeezing the rubber boot to disengage the locking tab.

(6) With the ignition in the Start position, check for voltage across terminals 2 and 4 on the distributor wiring connector. Voltage should be available.

If voltage is not available, renew the sensor assembly.

(7) With the ignition in the Start position, check for voltage across terminals 3 and 4 on the distributor wiring connector. Voltage should be available.

If voltage is not available, renew the sensor assembly.

### **To Remove and Instal**

(1) Disconnect the negative battery terminal.

(2) Disconnect the wiring connector from the distributor.

(3) Disengage the distributor cap retaining clips and place the cap to one side.

(4) Turn the engine in the direction of rotation until the TDC marks on the crankshaft pulley and the lower timing belt cover are aligned, and the rotor is pointing towards the distributor wiring connector.

(5) Mark the distributor body to cylinder head relationship to aid in setting the ignition timing on installation.

(6) Remove the distributor retaining nut and withdraw the distributor from the cylinder head.

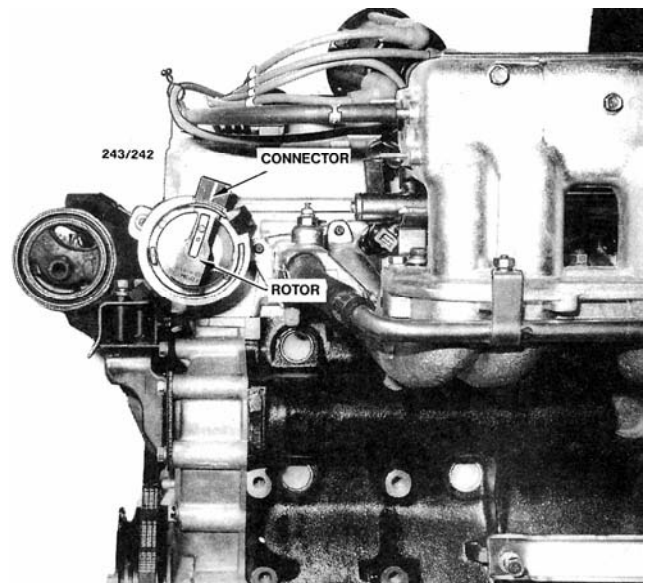
Installation is a reversal of the removal procedure with attention to the following points:

(1) Ensure that the engine has not been rotated while the distributor has been removed. If the engine has been rotated, align the timing marks and ensure that No 1 piston is on the compression stroke.

(2) Check and renew the distributor base O ring if the sealing quality is suspect.

(3) Align the mark on the distributor drive gear with the small notch on the distributor body and install the distributor to the cylinder head, aligning the marks made on removal and ensuring that the rotor is pointing towards the distributor wiring connector.

(4) Install and securely tighten the distributor retaining nut.



**Installed view of the distributor showing the rotor pointing towards the distributor wiring connector when No.1 piston is at TDC.**

(5) Check and adjust the ignition timing as previously described under the System Diagnosis and Adjustments heading.

### To Dismantle

*NOTE: In most cases, the trigger disc will be damaged during removal, necessitating it's renewal. For this reason, the distributor should only be dismantled if it is certain that the sensor assembly is faulty or if the shaft bearing or body are worn or damaged.*

(1) Remove the distributor from the vehicle as previously described.

(2) Remove the rotor from the distributor shaft.

(3) Remove the snap ring from the distributor shaft.

(4) Using two screwdrivers diametrically opposed, lever the trigger disc from the distributor shaft. Remove the locating pin.

(5) Remove the snap ring from the distributor shaft.

(6) Remove the screws retaining the sensor assembly to the distributor and remove the sensor assembly.

(7) Remove the roll pin retaining the drive gear to the distributor shaft and withdraw the drive gear.

(8) Remove the bearing retaining screws from the distributor and withdraw the distributor shaft and bearing from the distributor body.

(9) Remove the snap ring and bearing from the distributor shaft.

(10) Remove the oil seal from the distributor body.

### To Clean and Inspect

(1) Wash all components, with the exception of the sensor assembly and the bearing, in cleaning solvent.

(2) Check the shaft and bearing for wear and damage.

(3) Check the rotor for cracks and burning.

(4) Inspect all components for wear and damage.

### To Assemble

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Use a new roll pin when installing the drive gear.

(2) When installing the trigger disc, press only on the centre to avoid damage to the disc.

(3) Ensure that the locating pin is correctly positioned.

## POWER TRANSISTOR

### To Test

(1) Disconnect the wiring connector from the power transistor.

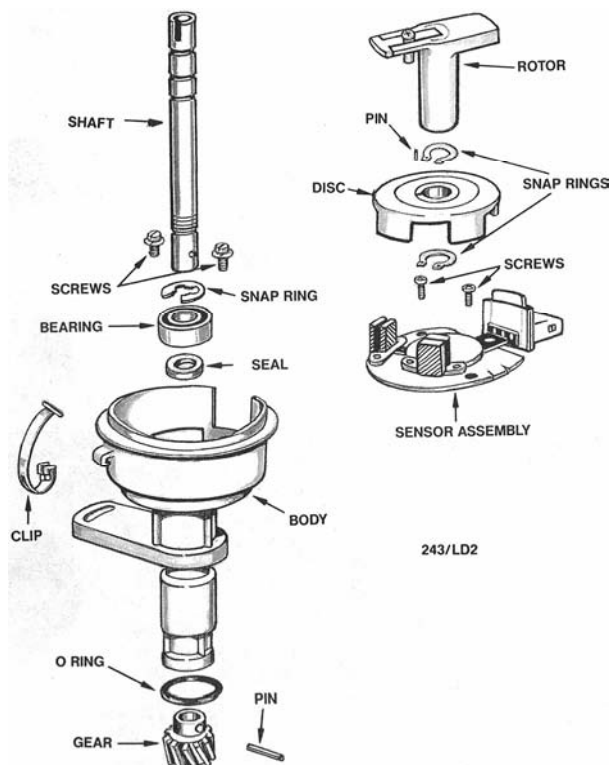
(2) Using an analogue display ohmmeter, check for continuity between the power transistor terminals as follows:

(a) From terminal 2 to terminal 3 there should be no continuity.

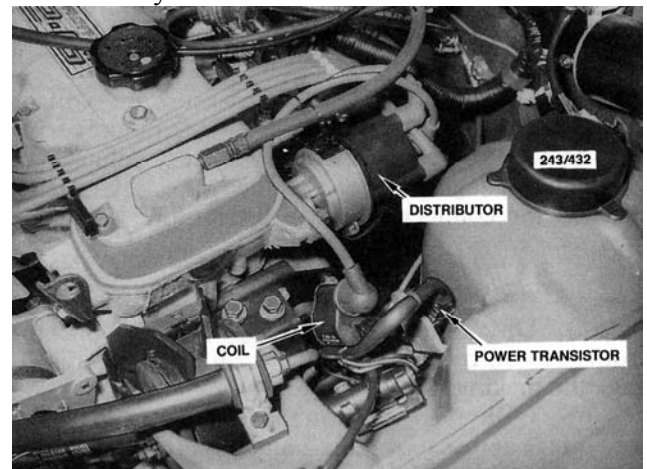
(b) From terminal 3 to terminal 2 there should be continuity.

(c) From terminal 3 to terminal 1 there should be continuity.

(d) From terminal 1 to terminal 3 there should be no continuity.



Dismantled view of the distributor.



Installed view of the distributor, coil and power transistor.

(e) From terminal 2 to terminal 1 there should be continuity.

(f) From terminal 1 to terminal 2 there should be continuity.

If any of the above tests indicate a fault, the power transistor should be renewed as described later in this section.

### **To Remove and Install**

(1) Disconnect the negative battery terminal.

(2) Disconnect the wiring connector from the power transistor.

(3) Remove the power transistor mounting bracket retaining bolt and remove the power transistor and bracket from the vehicle.

(4) Remove the power transistor retaining screws and remove the power transistor from the mounting bracket.

Installation is a reversal of the removal procedure.

### **IGNITION COIL**

#### **To Test**

(1) Disconnect the primary wiring connector from the coil by squeezing the rubber boot to disengage the locking tab.

(2) Measure the resistance between the positive and negative terminals on the coil. This is the primary resistance. Compare the reading with that in Specifications.

(3) Measure the resistance between the coil high tension terminal and the negative terminal. This is the secondary resistance. Compare the reading with that in Specifications.

If either resistance is outside the specified range, renew the coil.

### **To Remove and Install**

(1) Disconnect the negative battery terminal.

(2) Disconnect the primary wiring connector and the high tension lead from the ignition coil.

(3) Remove the coil mounting bracket retaining bolts and remove the coil and bracket from the vehicle.

(4) Remove the retaining screws, nuts and spacers and remove the coil from the mounting bracket.

Installation is a reversal of the removal procedure.

### **CONTROL UNIT**

#### **To Gain Access For Testing**

(1) Remove the control unit from beneath the dashboard as described below.

(2) Install the control unit wiring connectors to the control unit.

(3) Using one of the heater blower motor bracket bolts, secure the wiring harness earth leads to the vehicle frame.



**View of the control unit lowered from the installed position under the dashboard.**

### **To Remove and Install**

(1) Disconnect the negative battery terminal.

(2) Remove the lower dash panel screws. Two screws are hidden by plastic trim covers which can be prised out.

(3) Remove the lower dash panel from the dashboard.

(4) Remove the screws retaining the passenger side kick panel and remove the panel from the vehicle.

(5) Remove the bolts retaining the heater blower motor bracket and remove the bracket from the vehicle.

(6) Open the glovebox and remove the screws retaining the glovebox to the hinge.

(7) Manoeuvre the glovebox assembly from the dashboard.

(8) Disconnect the wiring connector from the control relay.

(9) Remove the screws retaining the left hand side lower dashboard frame and remove the frame with the control relay attached.

(10) Disconnect the wiring connectors from the control unit.

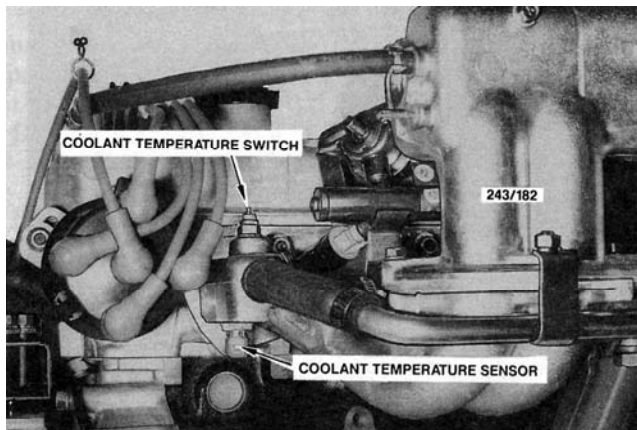
(11) Remove the control unit retaining screws and withdraw the control unit from the support bracket.

Installation is a reversal of the removal procedure with attention to the following points:

(1) If the control unit is to be renewed, ensure that the new control unit has the same identification number as the old one.

(2) Ensure that all earth leads are correctly installed.

(3) When installing the control unit, ensure that the wiring harness does not get caught between the unit and the mounting bracket..



**Installed view of the coolant temperature sensor and switch.**

## COOLANT TEMPERATURE SENSOR

### To Test

(1) Check that the coolant temperature sensor wiring harness connectors are clean and secure.

(2) Remove the coolant temperature sensor from the inlet manifold.

(3) Immerse the metal end of the coolant temperature sensor in a 50/50 mixture of glycol and iced water.

(4) Progressively heat the water and measure the resistance of the coolant temperature sensor at the following temperatures. Compare the results with the specified values:

0 deg C .....	5.6 kilo ohms
20 deg C .....	2.5 kilo ohms
40 deg C .....	1.1 kilo ohms
80 deg C .....	0.3 kilo ohms

If the resistances obtained are not as specified at any of the given temperatures, the coolant temperature sensor should be renewed.

(5) If the coolant temperature sensor resistances are as specified, check the coolant temperature sensor electrical wiring harness at the control unit as follows:

With the ignition On, measure the voltage at terminal 6 on the control unit 24 pin wiring connector at the following temperatures and compare the results with the specified values:

0 deg C . . . . .	3.4 -3.6 volts
20 deg C .....	2.5-2.7 volts
40 deg C . . . . .	1.5-1.7 volts
80 deg C .....	0.5-0.7 volts

If the voltages obtained are not within the specified ranges at any of the given temperatures, check the wiring harness for faults.

### To Remove and Instal

(1) Disconnect the negative battery terminal.

(2) Disconnect the wiring connector from the coolant temperature sensor.

(3) Drain the cooling system as described in the Cooling System section to a level below the coolant temperature sensor.

(4) Unscrew the coolant temperature sensor from the inlet manifold.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Use a suitable sealing compound on the threads of the coolant temperature sensor.

(2) Replenish the cooling system and check for leaks. Refer to the Cooling System section if necessary.

## VEHICLE SPEED SENSOR

*NOTE: Two types of vehicle speed sensor are used on the range of Magna vehicles covered by this manual. On models equipped with analogue instruments, the vehicle speed sensor is a reed switch and is incorporated within the speedometer assembly. On models equipped with digital instruments, the vehicle speed sensor is a pulse generator type and is located on the transaxle.*

### To Test

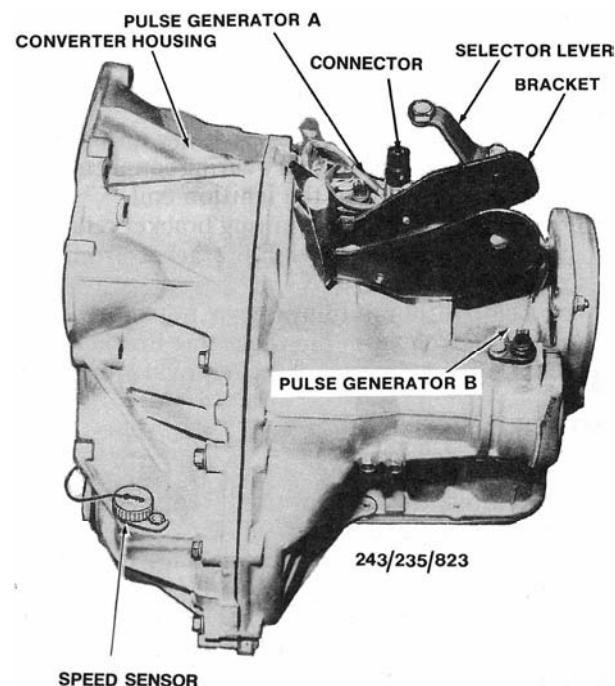
(1) Raise the front of the vehicle and support on chassis stands.

(2) With the engine running at idle speed and the transaxle in Drive or first gear, measure the voltage at terminal 19 on the control unit 24 pin wiring connector.

The voltage should fluctuate between 0 and 2 volts indicating that the vehicle speed sensor is operating correctly.

If a fault is indicated, proceed as follows.

(3) On models with a reed switch type vehicle speed sensor, proceed as follows:



**Rear view of the automatic transaxle showing the location of the pulse generator type vehicle speed sensor.**

(a) Remove the instrument cluster as described in the Electrical System section and remove the speedometer from the instrument cluster.

(b) While turning the speedometer drive input check for continuity between the two soldered terminals on the reed switch using an analogue ohmmeter. The meter needle should oscillate between zero and infinity 4 times per revolution.

If a fault is indicated, the vehicle speed sensor should be renewed.

If no fault is indicated, check the wiring harness between the vehicle speed sensor and the control unit.

(4) On models with a pulse generator type vehicle speed sensor, proceed as follows:

(a) Remove the speed sensor from the vehicle as described later in this section.

(b) Connect a 3-10 kilo ohm resistor between terminals 1 and 3 on the speed sensor.

(c) Connect the positive lead of a 12 volt power supply to terminal 1 on the speed sensor and the negative lead to terminal 3.

(d) Connect an analogue voltmeter between terminals 2 and 3 and rotate the speed sensor shaft in a clockwise direction. The meter needle should pulse 4 times per revolution.

If a fault is indicated, renew the speed sensor.

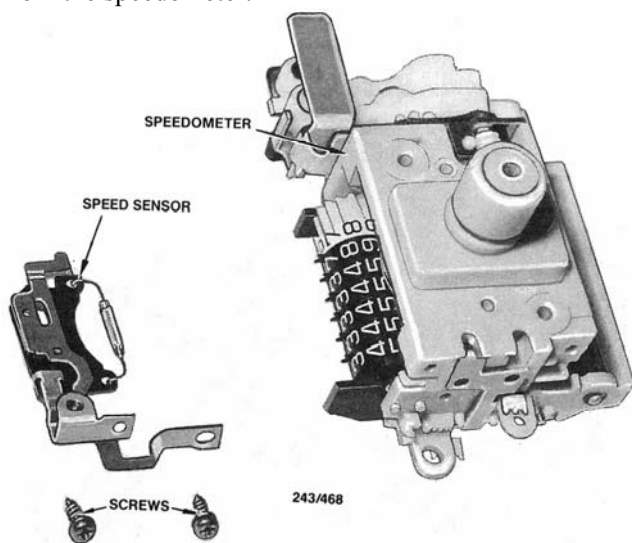
If no fault is indicated, check the wiring harness between the vehicle speed sensor and the control unit.

### To Remove and Install

(1) On models with a reed switch type vehicle speed sensor, proceed as follows:

(a) Remove the instrument cluster as described in the Electrical System section and remove the speedometer from the instrument cluster.

(b) Remove the screws retaining the speed sensor to the speedometer and remove the speed sensor from the speedometer.



**View of the reed switch type vehicle speed sensor removed from the speedometer.**

(2) On models with a pulse generator type vehicle speed sensor, proceed as follows:

(a) Disconnect the wiring connector from the vehicle speed sensor.

(b) Remove the speed sensor retaining bolt and remove the speed sensor from the vehicle.

Installation is a reversal of the removal procedure.

### THROTTLE POSITION SENSOR

#### To Test

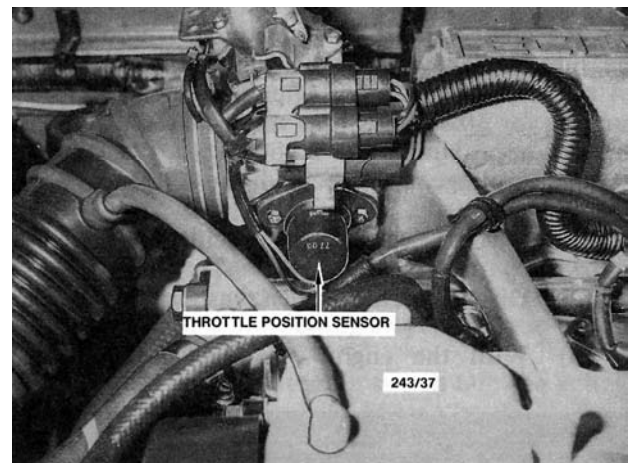
(1) With the engine at operating temperature and the ignition On, measure the voltage at terminal 15 on the control unit 24 pin wiring connector. With the throttle valve fully closed, the voltage should be 0.4-0.7 volts. With the throttle valve fully open, the voltage should be 4.5-5.5 volts.

If the voltages are as specified, the throttle position sensor is operating correctly.

If a fault is indicated, proceed as follows.

(2) Disconnect the throttle position sensor connector.

(3) Measure the resistance between terminals 1 and 3 on the throttle position sensor. The resistance should be 3.5-6.5 kilo ohms.



**Installed view of the throttle position sensor.**

(4) Connect an analogue ohmmeter between terminals 1 and 2 on the throttle position sensor.

(5) Open the throttle valve slowly and check that the meter needle moves smoothly in an uninterrupted swing.

If no fault is indicated in the above tests, check the wiring harness between the throttle position sensor and the control unit for continuity.

If the above tests indicate a fault, the throttle position sensor should be renewed.



### To Remove and Install

- (1) Disconnect the negative battery terminal.
- (2) Disconnect the wiring connector from the throttle position sensor.
- (3) Remove the screws retaining the wiring connector clamp and remove the clamp.
- (4) Remove the bolts retaining the throttle position sensor to the throttle body and remove the throttle position sensor.

Installation is a reversal of the removal procedure with attention to the following point:

Adjust the throttle position sensor and idle speed as described under the System Diagnosis and Adjustments heading.

### To Adjust

The adjustment procedure for the throttle position sensor is combined with the procedure for setting the idle speed and is fully covered under the System Diagnosis and Adjustments heading.

### NEUTRAL SAFETY SWITCH

The removal, installation, testing and adjustment procedures for the neutral safety switch are fully described in the Automatic Transaxle section.

### OXYGEN SENSOR

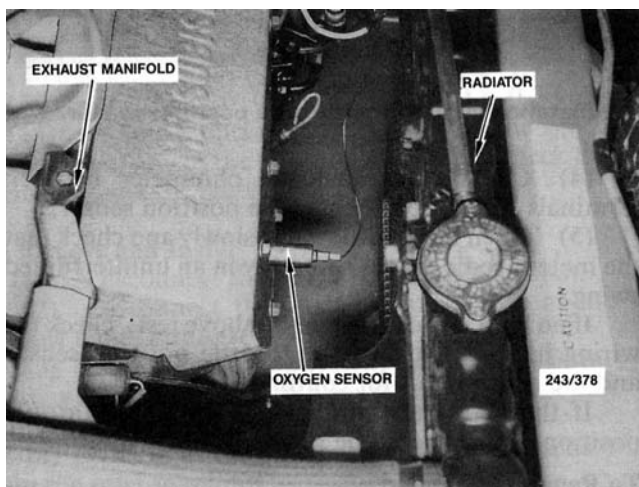
#### To Test

(1) With the engine at operating temperature and the engine speed held steady above 1300 rpm, measure the voltage at terminal 11 on the control unit 24 pin wiring connector. After the engine has been running for 30 seconds, the voltage should fluctuate between approximately 0-2 volts.

If the voltage is as specified the oxygen sensor is operating correctly.

If the voltage is not as specified, proceed as follows.

- (2) Disconnect the oxygen sensor wiring connector.



**Installed view of the oxygen sensor.**

(3) With the engine running at 2500 rpm, measure the voltage at the oxygen sensor. The voltage should fluctuate between 0 and 1 volt approximately 7 to 8 times every 10 seconds.

If the voltage is not as specified, renew the oxygen sensor.

If the voltage is as specified, check the wiring harness between the oxygen sensor and the control unit for continuity.

### To Remove and Instal

- (1) Disconnect the negative battery terminal.
- (2) Disconnect the oxygen sensor wiring connector.
- (3) Unscrew the oxygen sensor from the exhaust manifold.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Coat the threads of the oxygen sensor with a copper based thread release compound.
- (2) Tighten the oxygen sensor to the specified torque.

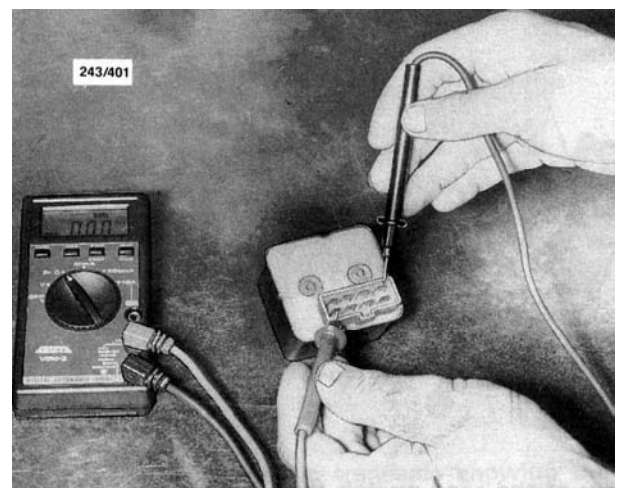
### CONTROL RELAY ,

#### To Test

(1) Remove the control relay from the vehicle as described later in this section.

(2) Check for continuity between the control relay terminals as follows:

- (a) From terminal 4 to terminal 1 there should be no continuity.
- (b) From terminal 8 to terminal 2 there should be continuity, with a resistance of approximately 95 ohms.
- (c) From terminal 8 to terminal 3 there should be continuity, with a resistance of approximately 95 ohms.
- (d) From terminal 6 to terminal 7 there should be continuity, with a resistance of approximately 35 ohms.



**Testing the control relay using a digital multimeter.**

(e) From terminal 3 to terminal 1 there should be no continuity.

(f) From terminal 7 to terminal 5 there should be no continuity.

(g) From terminal 5 to terminal 7 there should be no continuity.

(3) Connect the positive lead of a 12 volt power supply to terminal 6 and the negative lead to terminal 7.

*NOTE: Ensure that the power supply is only connected to the terminals specified. Damage to the control relay may result if the leads are connected to the wrong terminals.*

(4) Check for continuity between terminal 4 and terminal 1. There should be continuity.

(5) Disconnect the positive power supply lead from terminal 6 and reconnect it to terminal 5.

(6) Check for continuity between terminal 3 and terminal 1. There should be continuity.

If any of the above tests indicate a fault, the control relay should be renewed.

#### **To Remove and Install**

(1) Disconnect the negative battery terminal.

(2) Open the glove compartment and remove the screws retaining the glove compartment to the hinge.

(3) Manoeuvre the glove compartment assembly from the dashboard.

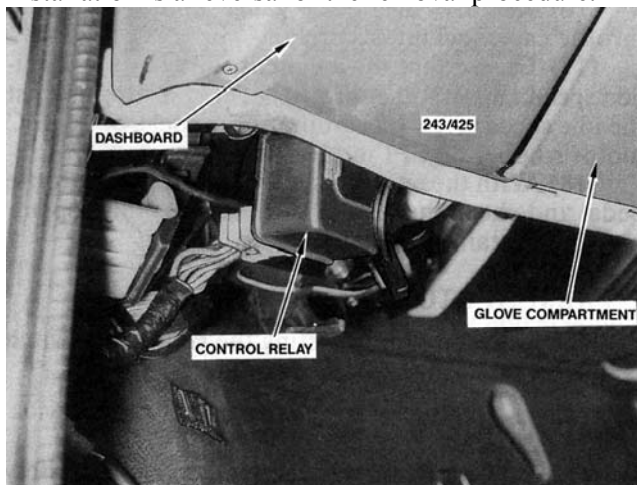
(4) Remove the passenger side lower dash panel retaining screws. Two screws are hidden by plastic trim covers which can be prised out.

(5) Remove the lower dash panel from the dashboard.

(6) Disconnect the wiring connector from the control relay.

(7) Remove the bolts retaining the control relay and remove the relay from the vehicle.

Installation is a reversal of the removal procedure.



**Installed view of the control relay, located below and to the left of the glove compartment.**

## **POWER SUPPLY AND EARTH CIRCUIT**

#### **To Test**

(1) With the ignition On, measure the voltage at terminal 1 on the control unit 13 pin wiring connector. The voltage should be 11-13 volts.

(2) With the ignition On, measure the voltage at terminal 22 on the control unit 24 pin wiring connector. The voltage should be 11-13 volts.

(3) With the engine running at idle speed, measure the voltage at terminal 22 on the control unit 24 pin wiring connector. The voltage should be 0-0.6 volts.

If no fault is indicated in the above tests, the power supply circuit is operating correctly.

If a fault is indicated, test the control relay as previously described. If the control relay is operating correctly, check the wiring harness between the control relay and the control unit for continuity.

(4) With the 13 pin wiring connector disconnected from the control unit, measure the resistance between terminals 2 and 3 on the 13 pin connector, and a good earthing point. The resistance should be 0 ohms.

If a fault is indicated, repair or renew the wiring harness.

## **AIR CONDITIONING SIGNAL**

#### **To Test**

(1) Start the engine, turn the air conditioner to On and check that the air conditioning compressor clutch is activated.

If the clutch is not activated, check the air conditioning circuit for faults.

(2) With the ignition On, measure the voltage at terminal 6 on the control unit 13 pin wiring connector under the following conditions.

With the air conditioning switch Off, the voltage should be 0-0.6 volts.

With the air conditioning switch On, the voltage should be 11 - 13 volts.

If a fault is indicated, check the wiring harness between the air conditioning relay and the control unit for continuity.

## **START SIGNAL**

#### **To Test**

With the ignition switch in the Start position, measure the voltage at terminal 5 on the control unit 13 pin wiring connector. The voltage should be above 8 volts.

If a fault is indicated, check the wiring harness between the ignition switch and the control unit for continuity.

## 7. CRUISE CONTROL

### DESCRIPTION

The electronically controlled cruise control system is fitted as standard equipment on the Elite and SE luxury pack models.

The system consists of an electronic control unit, control switch assembly, and an actuator. The control unit receives signals from the vehicle speed sensor, stop lamp switch, clutch switch on manual transaxle models and on automatic transaxle models, the neutral safety switch.

The electronic control unit signals the actuator to vary the position of the throttle valve according to signals received by the control switch and the vehicle speed sensor.

The system is engaged by the driver and remains in operation until the clutch or brake pedal is depressed, the automatic transaxle selector lever is moved to the neutral position, the Main button is depressed or the vehicle speed falls below 45 km/h or more than 20 km/h below the set speed.

The cruise control system incorporates complex electronic circuitry, therefore it is recommended that the vehicle be taken to a Mitsubishi dealer for testing and rectification should the operation of the system be in doubt and the following adjustment procedures fail to rectify the problem.

### TO CHECK AND ADJUST CRUISE CONTROL CABLES

(1) Remove the screws retaining the actuator shield and remove the shield from the actuator.

(2) Start and run the engine until normal operating temperature is reached. Check that the throttle lever is resting against the idle speed screw on carburettor models, or the ISC motor stopper on EFI models.

(3) With the engine off, fully depress the throttle pedal and check that the throttle valve is fully open.

(4) With the throttle pedal released, check that the actuator cable, which runs from the throttle pedal to the actuator, has freeplay of 0-1 mm on manual transaxle models or 2-3 mm on automatic transaxle models.

(5) Start the engine and insert a 0.7 mm feeler gauge between the actuator drive shaft lever and link B. The engine speed should not change.

(6) Remove the 0.7 mm feeler gauge and insert a 1.2 mm feeler gauge. The engine speed should increase.

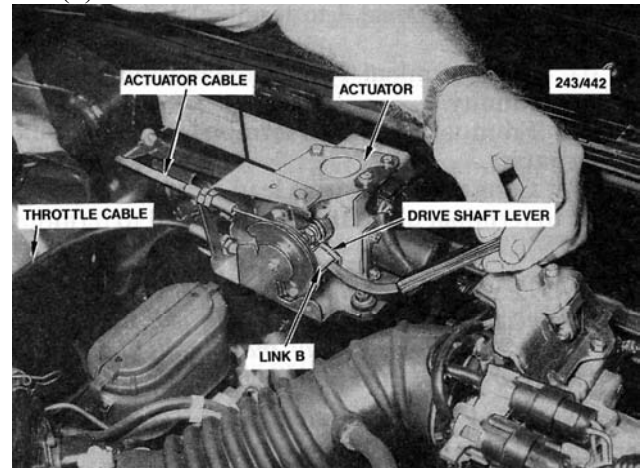
If no faults are indicated in the above procedures, the cruise control cables are correctly adjusted.

If any of the above procedures indicated a fault, adjust the cables as follows.

(7) Ensure that the engine is idling at the specified speed. Adjust if necessary.

(8) Loosen the locknut on the throttle cable, which runs from the actuator to the throttle linkage, and disconnect the cable from the actuator.

(9) Loosen the locknut on the actuator cable.



**Cruise control actuator with the shield removed showing a feeler gauge inserted between the actuator drive shaft lever and link B.**

(10) Hold link A against the stop and turn the actuator cable adjusting nut until link A begins to move.

(11) Back the adjusting nut off 1/2 a turn on manual transaxle models or 2 turns on automatic transaxle models and tighten the locknut securely.

(12) Loosen the throttle cable to plenum chamber bolts, centralise the adjusting slots and tighten the bolts.

(13) Install the throttle cable to the actuator.

(14) Insert a 1.2 mm feeler gauge between the actuator drive shaft lever and link B.

(15) Start the engine and adjust the throttle cable adjusting nut until the engine speed increases by  $100 \pm 50$  rpm.

*NOTE: If the specified speed is exceeded, the adjusting nut will have to be completely backed off and the adjustment repeated.*

(16) Remove the feeler gauge and tighten the throttle cable locknut securely.

(17) Ensure that the engine is idling at the specified speed and that the throttle lever is resting against the idle speed screw on carburettor models, or the ISC motor stopper on EFI models.

(18) With the engine off, fully depress the throttle pedal and check that the throttle valve is fully open.

(19) Install the actuator shield.

### TO ADJUST STOP LAMP SWITCH

The procedure for adjusting the stop lamp switch is fully covered in the Brakes section.

### TO ADJUST NEUTRAL SAFETY SWITCH

The procedure for adjusting the neutral safety switch is fully covered in the Automatic Transaxle section.

## Wiring diagram for the fuel injection and automatic transaxle control systems.

### COLOUR CODE

The first letter of the code represents the main wire colour, the other letters represent the trace colours.

B - BLACK  
 L - BLUE  
 G - GREEN  
 R - RED  
 Y - YELLOW  
 W - WHITE  
 N - BROWN  
 O - ORANGE  
 K - PINK  
 S - GREY  
 V - VIOLET  
 P - PURPLE  
 X - LIGHTGREEN  
 Z - LIGHTBLUE  
 M - DARKGREEN  
 T - DARK BLUE  
 A - LIGHT BROWN  
 E - SLATE  
 D - TAN

### KEY

1.	Purge solenoid	23.	Throttle position sensor	39.	To headlamp relay and horn circuits
2.	Air flow meter	24.	Fuel pressure solenoid	40.	To instrument cluster
3.	Oxygen sensor	25.	To speedometer reed switch (analogue instruments) or pulse generator (digital instruments)	41.	To ignition coil negative terminal
4.	Shielded cable			42.	To speedometer reed switch (analogue instruments) or pulse generator (digital instruments)
5.	Distributor	26.	Neutral safety switch		
6.	Power transistor	27.	Fuel pump relay	43.	To instrument cluster
7.	Ignition coil	28.	Shift control solenoid valve B	44.	Throttle position sensor (carburettor models)
8.	To tachometer	29.	Shift control solenoid valve A	45.	Temperature sender
9.	No.5 20 Amp secondary fusible link	30.	Damper clutch control solenoid valve	46.	No. 10 10 Amp fuse (interior fuse box)
10.	To air conditioner switch	31.	Pressure control solenoid valve	47.	No.12 10 Amp fuse (interior fuse box)
11.	EFI control unit	32.	Pulse generator A	48.	To cruise control circuit
12.	No.4 fuel injector	33.	Pulse generator B	49.	Throttle pedal switch
13.	No.3 fuel injector	34.	Reverse lamps	50.	Automatic transaxle control unit
14.	No.2 fuel injector	35.	To Kickdown switch	51.	Overdrive switch
15.	No.1 fuel injector	36.	Fuel pump	52.	To instrument cluster
16.	Check connector	37.	To No.440 Amp secondary fusible link	53.	Check connector
17.	To air conditioner compressor relay	38.	Ignition switch	54.	To earth (manual transaxle models only)
18.	To stop lamp fail relay				
19.	To starter motor (automatic transaxle)				
20.	Coolant temperature Sensor				
21.	Motor position sensor				
22.	Idle Speed Assembly				

