

FBC SYSTEM CHECK PROCEDURE CHART (Use FBC Harness Connector – MD998475)

ECI Checker Operation		Check Item	Engine Control Unit Terminal # Checked	Condition		Test Specification
Select Switch	Check Switch					
Set to "A"	1	Power supply	12	Ignition switch "LOCK" → "ON"		11V – 13V
	2	Ignition pulse	5	Ignition switch "LOCK" → "START"		2V – 8V
	3	Throttle position sensor	2	Ignition switch "LOCK" → "ON" (warm engine)	Accelerator fully closed	0.4V – 0.7V
					Accelerator fully opened	4.5V – 5.5V
	4	Vacuum switch for idle position	10	Ignition switch "LOCK" → "ON"		9V – 13V
				Idling (warm engine)		0V – 0.6V
	5	Electric choke relay	59	Ignition switch "LOCK" → "ON"		0V – 0.6V
				Idling		13V – 15V
	6	Cold mixture heater relay	51	Idling	Engine coolant temperature less than 60°C (140°F)	0V – 0.6V
					Engine coolant temperature more than 60°C (140°F)	13V – 15V
	7					
	8					
	9					
	10					

Engine control unit terminal

(Large)



(Small)



View from front as installed in engine control unit

03P00199

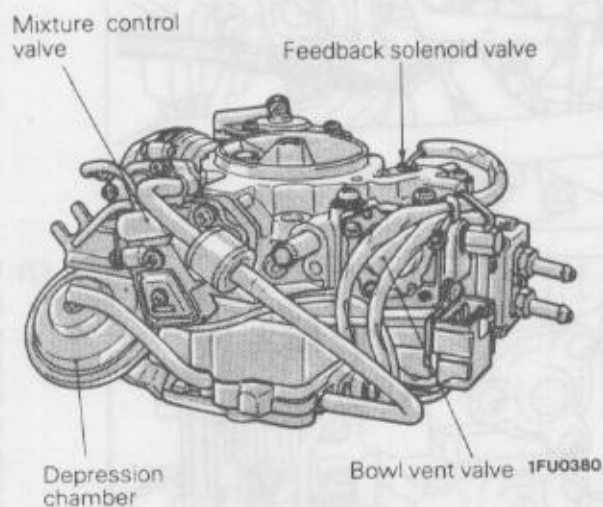
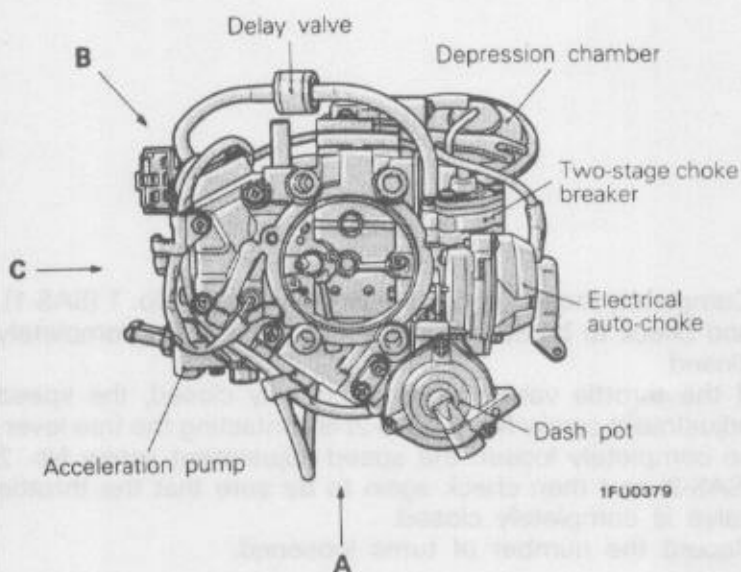
ECI Checker Operation		Check Item	Engine Control Unit Terminal # Checked	Condition		Test Specification
Select Switch	Check Switch					
Set to "B"	1	Cold spark advance control solenoid valve	55	Start the engine, then hold idling	Engine coolant temperature less than 50°C (122°F)	0V – 0.6V
					Engine coolant temperature more than 50°C (122°F)	13V – 15V
	2					
	3					
	4					
	5	Engine coolant temperature sensor	3	Ignition switch "LOCK" → "ON"	0°C (32°F)	3.4V – 3.6V
					20°C (68°F)	2.4V – 2.7V
					40°C (104°F)	1.5V – 1.8V
					80°C (176°F)	0.5V – 0.7V
	6	Feedback solenoid valve	52	Ignition switch "LOCK" → "ON"		11V – 13V
				Idling (warm engine)		2V – 12V
	7	Slow cut solenoid valve	56	Idling		0V – 0.6V
				Quick deceleration from above 4,000 rpm to idling in "N" position		Momentarily 13V – 15V
	8	Oxygen sensor	1	Hold engine at a constant speed above 1,300 rpm, 70 seconds after start of warm engine		0V – 1V ↑ (pulsates) ↓ 2V – 3V*
	9	Secondary air control solenoid valve	58	Idling, 70 seconds after start of warm engine		0V – 0.6V then 13V – 15V
				Quick deceleration from above 2,000 rpm to idling in "N" position		Momentarily drop
	10	Power supply for sensor	8	Ignition switch "LOCK" → "ON"		4.5V – 5.5V

NOTE

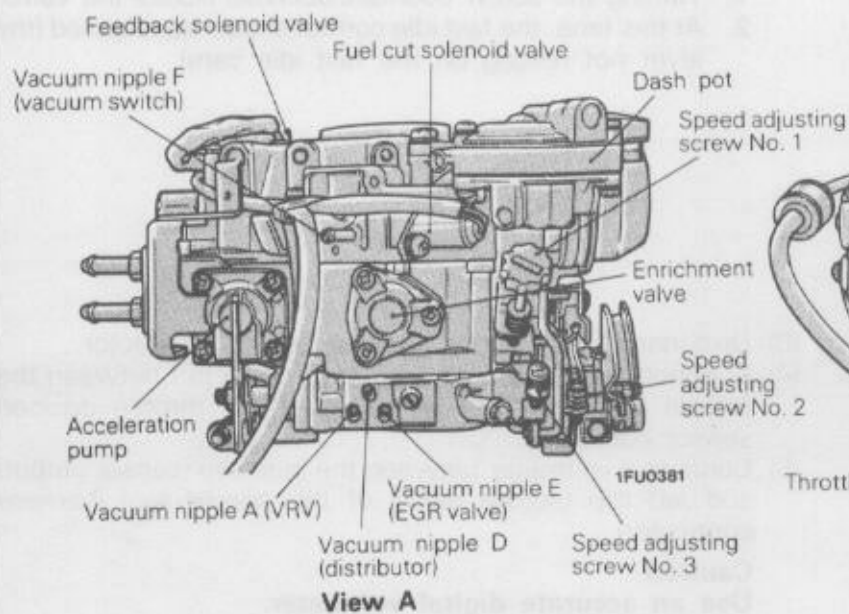
* Since specifications may differ, check the other air-fuel ratio related components when components other than the oxygen sensor are defective.

CARBURETTOR APPEARANCE

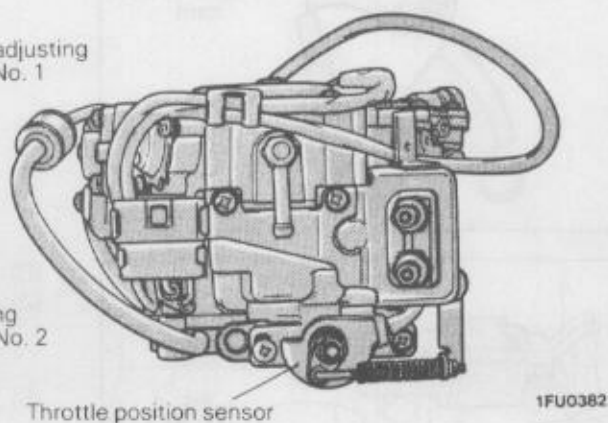
E13FB8C



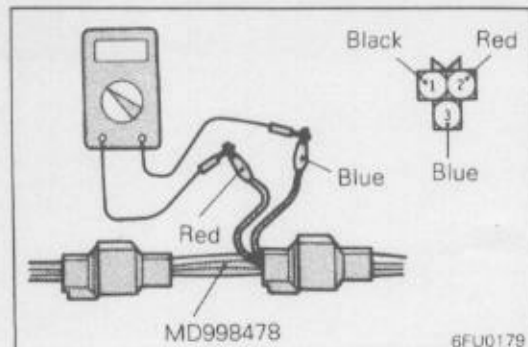
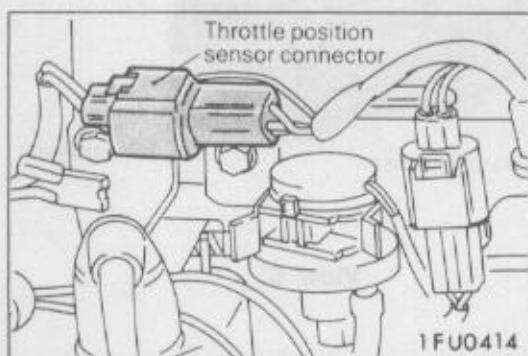
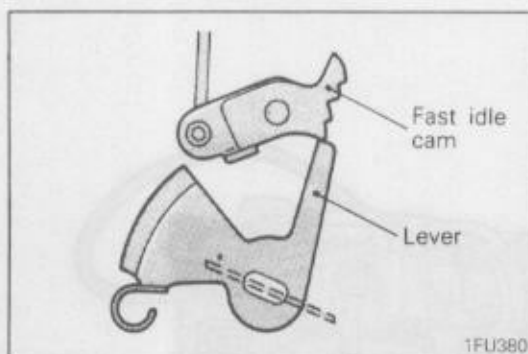
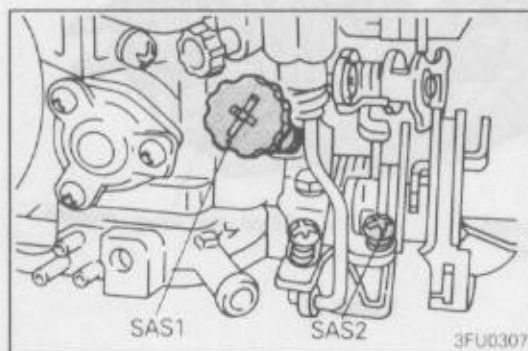
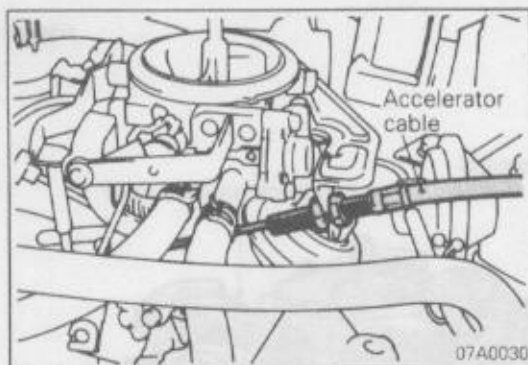
View B



View A



View C



THROTTLE POSITION SENSOR ADJUSTMENT

(1) Loosen the accelerator cable sufficiently.

(2) Completely loosen speed adjustment screw No. 1 (SAS-1), and check to be sure that the throttle valve is completely closed.

If the throttle valve is not completely closed, the speed adjustment screw No. 2 (SAS-2) is contacting the free lever, so completely loosen the speed adjustment screw No. 2 (SAS-2) and then check again to be sure that the throttle valve is completely closed.

Record the number of turns loosened.

NOTE

1. Turning the screw counterclockwise closes the valve.
2. At this time, the fast idle control should be released (the lever not resting on the fast idle cam).

- (3) Disconnect the throttle position sensor connector.
- (4) Connect the special tool (harness connector) between the female and male side terminals of the throttle position sensor connector.
- (5) Connect a voltmeter between the blue clip (sensor output) and red clip (sensor earth) of the special tool (harness connector).

Caution

Use an accurate digital voltmeter.

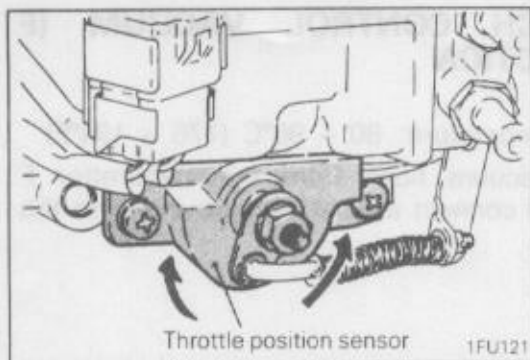
NOTE

Connections between the throttle position sensor connectors and the special tool terminals are as follows.

Throttle position sensor connector	Special tool
Terminal ③ (sensor output)	Terminal Blue
Terminal ② (sensor earth)	Terminal Red

- (6) Turn the ignition switch to ON. (Do not start the engine.)
- (7) Measure the output voltage of the throttle position sensor.

Standard value: 0.250 V



- (8) If it is out of specification, loosen the throttle position sensor attaching screw and adjust it by turning the throttle position sensor to the standard value.

NOTE

Turning the throttle position sensor clockwise increases the output voltage.

- (9) Turn the ignition switch to OFF.
 (10) Tighten the SAS-1 and SAS-2 the amount recorded in step (2). (Return it to its original position.)
 (11) Remove the harness connector (MD998478), voltmeter and then connect the throttle position sensor connector.
 (12) Adjust the play of the accelerator cable.
 (13) Start the engine and check that the idle speed is as specified.

Curb idle speed:

For the first 500 km (300 miles)	750 $\pm$ 150 r/min.
After 500 km (300 miles)	800 $\pm$ 100 r/min.

- (14) If the SAS-2 has been loosened, paint the SAS-2. <Vehicles for Switzerland>

DISTRIBUTOR ADVANCE CONTROL VACUUM (D VACUUM) INSPECTION

Refer to P.13-17.

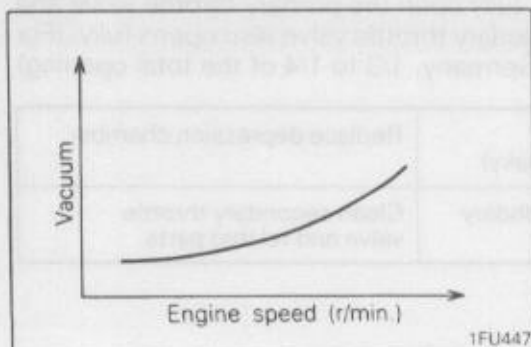
EGR VALVE CONTROL VACUUM (E VACUUM) INSPECTION

Refer to P.13-18.

VRV CONTROL VACUUM (A VACUUM) INSPECTION

Inspection condition

- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- (1) Disconnect the vacuum hose from the carburettor A vacuum nipple and connect a hand vacuum pump to the nipple.



- (2) Start and race the engine to make sure that the A vacuum increases gradually with the engine speed.

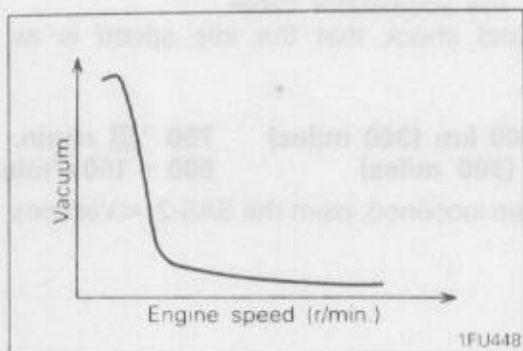
NOTE

If an abnormality is found in the way the vacuum changes, a blocked carburettor A port is suspected. Therefore, clean the port as necessary.

VACUUM SWITCH CONTROL VACUUM (F VACUUM) INSPECTION

Inspection condition

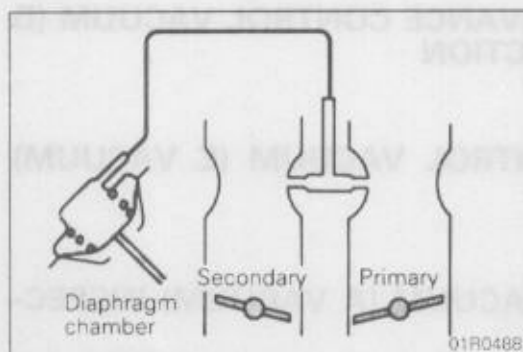
- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- (1) Disconnect the vacuum hose from the carburettor F vacuum nipple and connect a hand vacuum pump to the nipple.



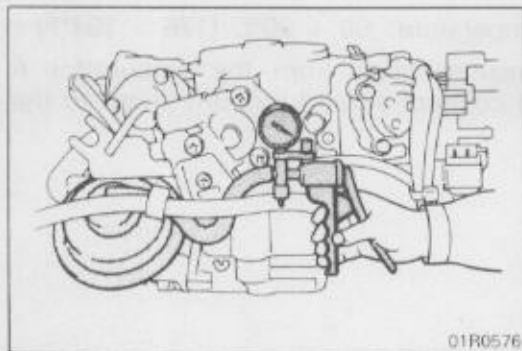
- (2) Start and race the engine to make sure that the F vacuum drops rapidly.

NOTE

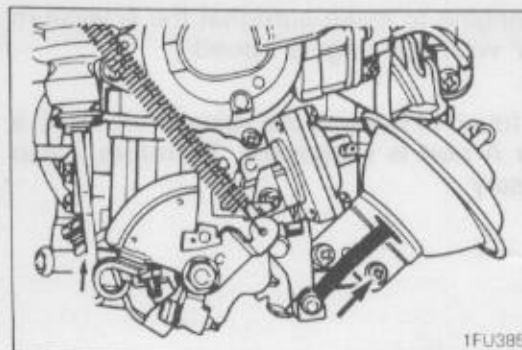
If an abnormality is found in the way the vacuum changes, a blocked carburettor F port and vacuum passage are suspected. Therefore, disassemble and check the carburettor.

**CARBURETTOR SECONDARY VALVE OPERATION INSPECTION**

- (1) Remove the air cleaner.



- (2) Remove the secondary valve vacuum hose from the carburettor throttle body and connect a hand vacuum pump to the disconnected end of hose.

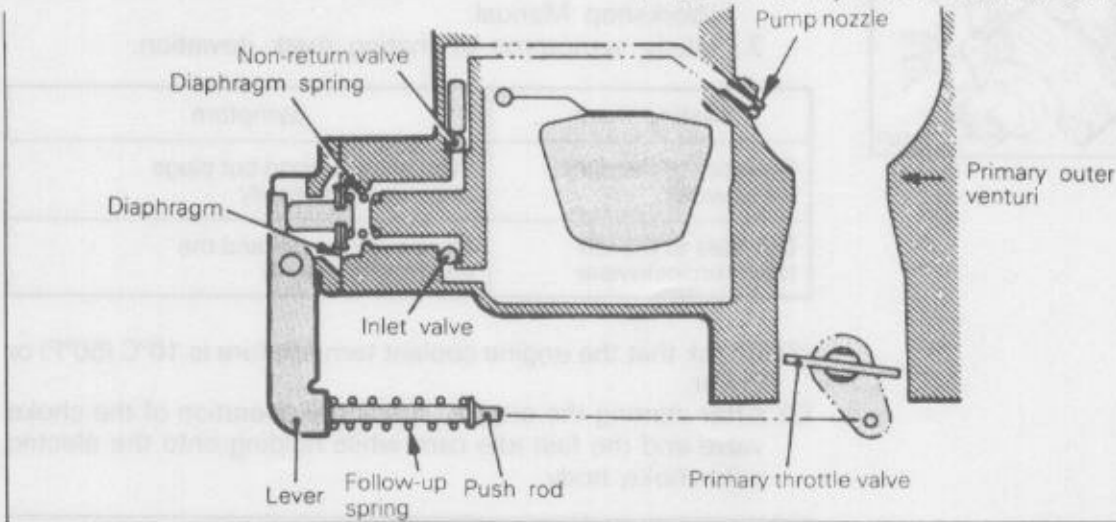


- (3) With a vacuum of 14 kPa (0.14 kg/cm², 1.9 psi) applied by the vacuum pump, fully open the primary throttle valve and check that the secondary throttle valve also opens fully. (For vehicles for West Germany, 1/3 to 1/4 of the total opening)

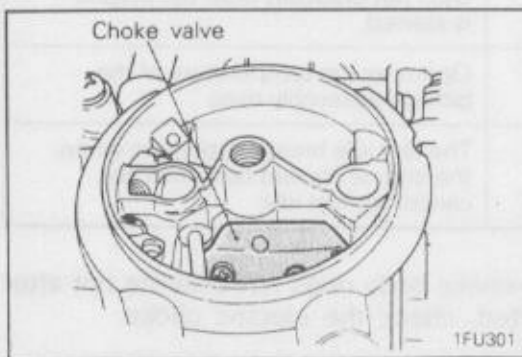
Vacuum is not held in depression chamber. (leaky)	Replace depression chamber.
Vacuum is held but secondary valve does not operate.	Clean secondary throttle valve and related parts.

CARBURETTOR ACCELERATION PUMP INSPECTION

- (1) Remove the air cleaner cover.
- (2) While opening the choke valve, open the throttle valve and check that fuel is injected from the pump nozzle.
If fuel is not injected, clean the carburettor fuel passage.



1FU167

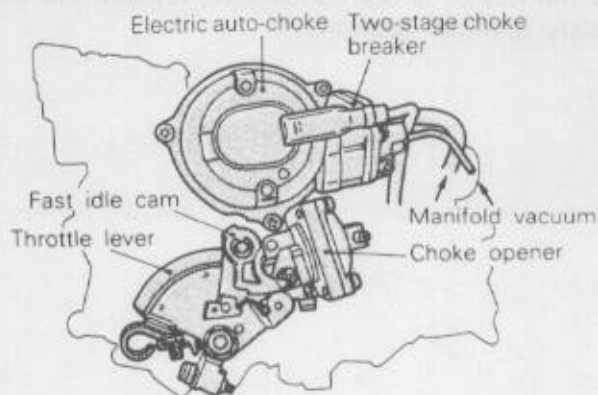


1FU301

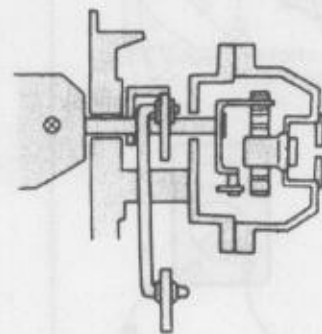
CHOKE VALVE INSPECTION

- (1) Remove the air cleaner.
- (2) Move the choke valve with a finger to check if it moves smoothly without play.

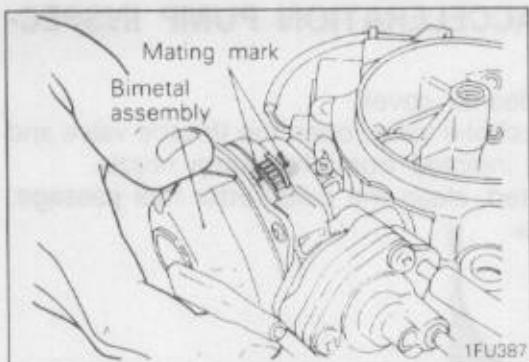
When there is marked play	Replace the float chamber cover assembly
When there is a malfunction (seized up)	Clean around the choke and apply a small amount of oil to the choke shaft

ELECTRIC AUTO-CHOKE INSPECTION

1FU386



1FU359



- (1) Check the mating marks on the electric auto-choke body and bimetal assembly to make sure they are matched. If they are not matched, match them.

NOTE

1. For information concerning the disassembly and reassembly of the bimetal assembly, refer to the Engine Workshop Manual.
2. Likely symptoms of mating mark deviation.

Mating mark	Symptom
Deviates to the right (clockwise)	Startability is good but plugs become sooty easily
Deviates to the left (counterclockwise)	Startability is poor and the engine stalls easily

- (2) Check that the engine coolant temperature is 10°C (50°F) or lower.
- (3) After starting the engine, check the operation of the choke valve and the fast idle cam while holding onto the electric auto-choke body.

Electric auto-choke body	Gets hot gradually after the engine is started.
Choke valve	Opens as the temperature of the bimetal assembly rises
Fast idle cam	The fast idle breaker operates when the engine coolant becomes hot, cancelling fast idle

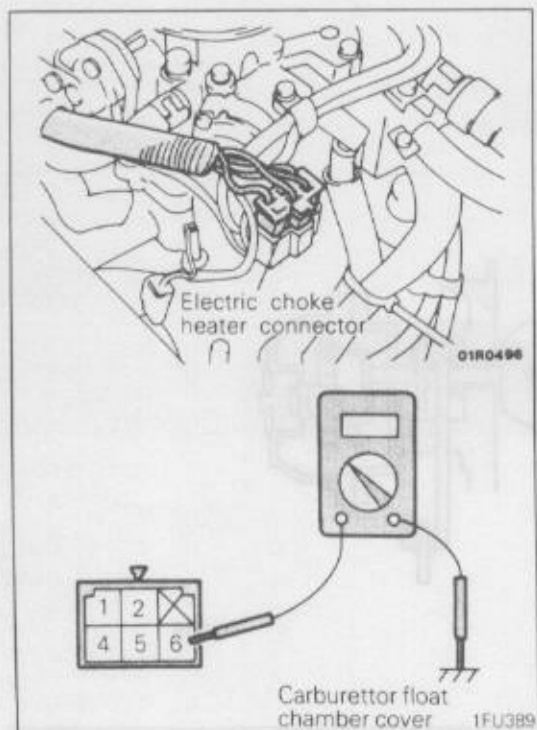
- (4) If the electric auto-choke body does not become hot after the engine is started, check the electric choke.

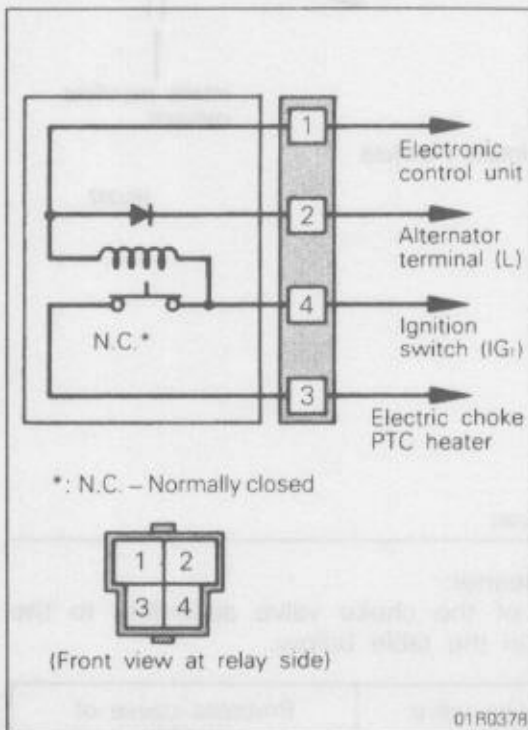
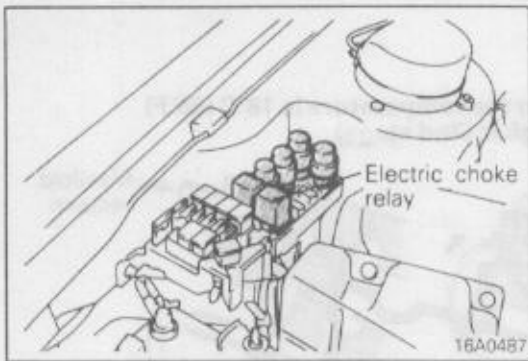
ELECTRIC CHOKE HEATER INSPECTION

- (1) Disconnect the electric choke heater connector and check for continuity of the heater.

Normal state: Should be conductive [approx. 6 Ω resistance at 20°C (68°F)]

- (2) If the heater is not conductive, replace the electric choke body (bimetal assembly).





ELECTRIC CHOKE RELAY INSPECTION

- (1) Remove the electric choke relay.
- (2) Check for continuity between the terminals both when the relay coil is energized, and when not.

Description	Measuring terminal	Continuity
When de-energized	① → ②	Conductive (0 Ω)
	① ← ②	Non-conductive (∞ Ω)
	① – ④	Conductive (approx. 100 Ω)
	③ – ④	Conductive (0 Ω)
When energized	③ – ④	Non-conductive (∞ Ω)

NOTE

1. → indicates the direction of the flow of the current. Check the tester polarity before testing.
2. To energize the relay coil, apply battery voltage directly to terminals ① – ④.
3. Take care as application of battery voltage to the incorrect terminals can damage the relay.

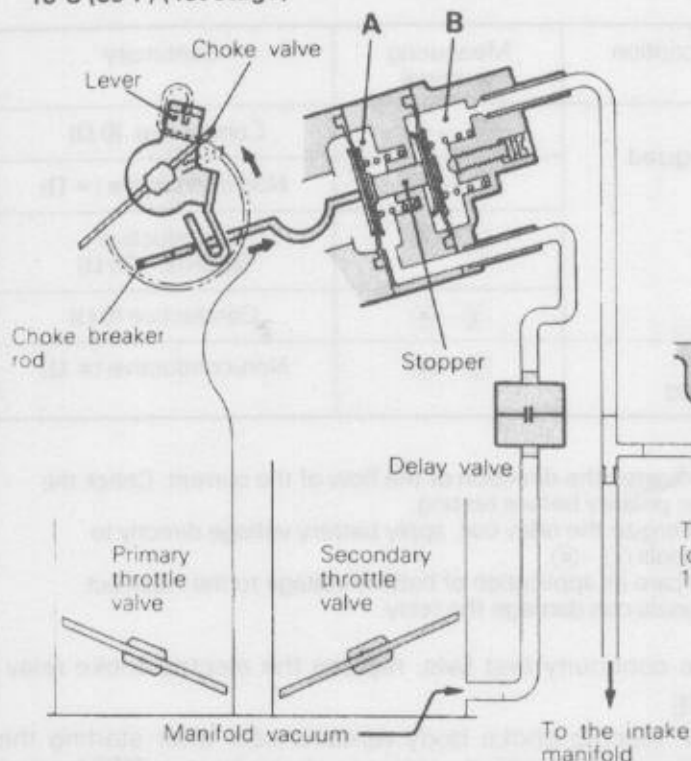
- (3) If the continuity test fails, replace the electric choke relay.

NOTE

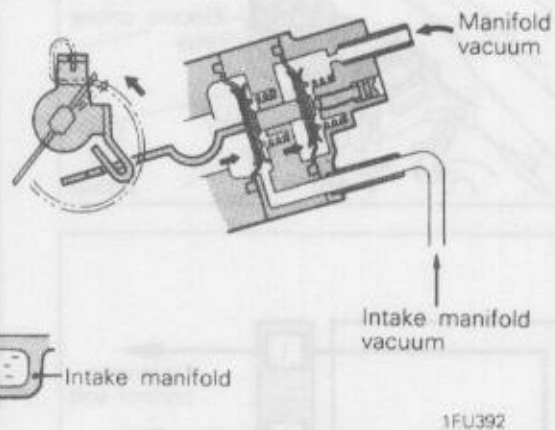
If the electric choke body remains cool after starting the engine even though the electric choke heater (PTC heater) and electric choke relay are normal, check the vehicle body harness circuit.

CHOKE BREAKER SYSTEM INSPECTION

When the temperature is lower than 18°C (65°F) (1st stage)

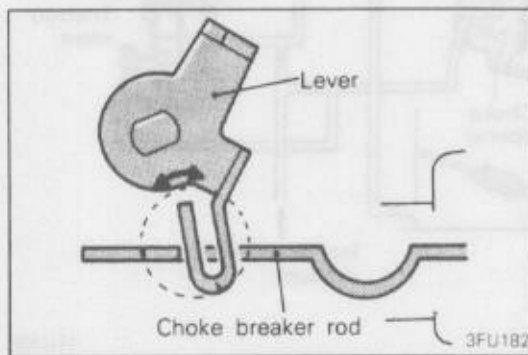
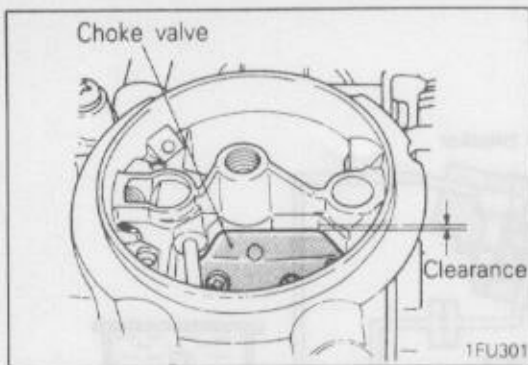


When the temperature is 18°C (65°F) or higher (2nd stage)



- (1) Remove the air cleaner.
- (2) Check conditions of the choke valve according to the procedures given in the table below.

Step	Engine coolant temperature	Checking condition	Normal choke valve operation	Probable cause of trouble
1	Lower than 10°C (50°F)	Before starting the engine	Closes fully	Defective bimetal assembly Linkage operational defective
2	Lower than 10°C (50°F)	Start engine and run idle (fully depress accelerator pedal and then start)	Opens slowly and slightly (immediately after starting) [gap approx. 1.5 mm (0.059 in.)]	• Clogged delay valve • Broken diaphragm (chamber A)
3	Lower than 10°C (50°F)	Disconnect vacuum hose (white stripe) from choke breaker during idling.	Stationary valve	• Faulty thermo valve
4	Higher than 25°C (77°F)	Connect vacuum hose (white stripe) and run engine idle.	When the choke valve is closed lightly with finger, stops at larger opening than step 2 [gap approx. 3 mm (0.12 in.)]	• Faulty thermo valve • Broken diaphragm (chamber B)



CHOKE BREAKER OPENING INSPECTION AND ADJUSTMENT

- (1) After inspection of the choke breaker system, disconnect the vacuum hose (white stripe) from the choke breaker and make the following check.
- (2) With the engine idling, close the choke valve lightly with a finger until the choke valve stops. Then, measure the choke valve to choke bore clearance.

Standard value: 1.4 – 1.6 mm (0.055 – 0.063 in.)

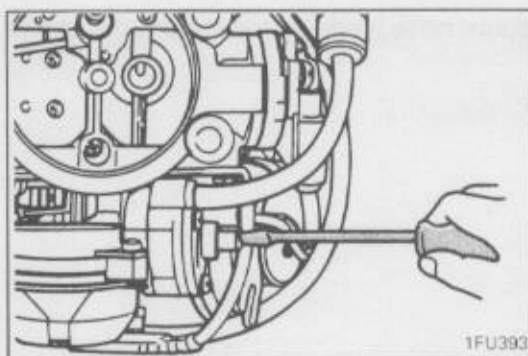
- (3) If the clearance is not as specified, stop the engine, remove the bimetal assembly and adjust the rod end opening for standard clearance.

NOTE

When removing the bimetal assembly, make a mark on the electric choke body.

<Information>

Rod end opening	Valve clearance	Expected result
Large	Large	Poorer startability and stall more likely
Small	Small	Spark plug likely to get sooty



- (4) Reconnect the removed white stripe vacuum hose and measure the choke valve to choke bore clearance as in step (2).

Standard value: 2.9 – 3.1 mm (0.114 – 0.122 in.)

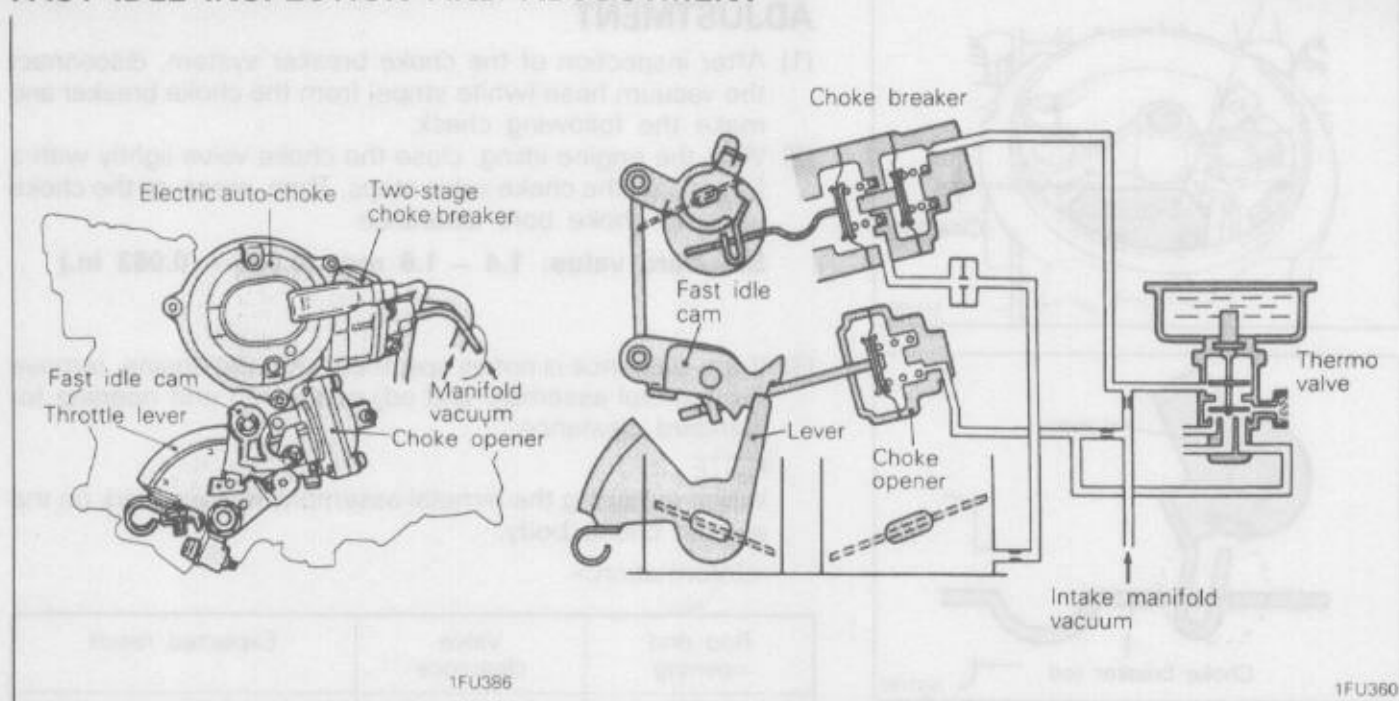
- (5) If the clearance is out of specification, adjust by the adjusting screw.

<Information>

Turning the adjusting screw changes the valve clearance as follows:

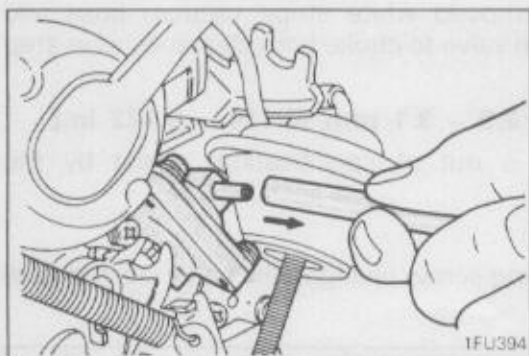
Adjusting screw turning direction	Valve clearance	Expected result
Clockwise	Small	Better startability but plug more likely to get sooty
Counter-clockwise	Large	Poor startability and stall more likely

FAST IDLE INSPECTION AND ADJUSTMENT



Inspection conditions

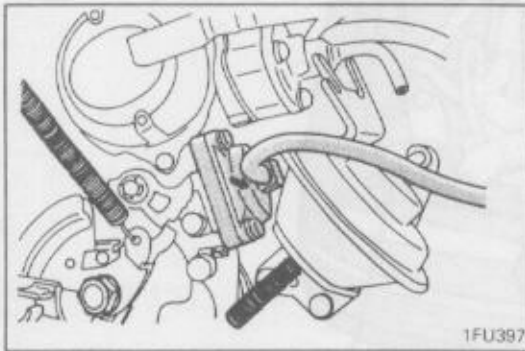
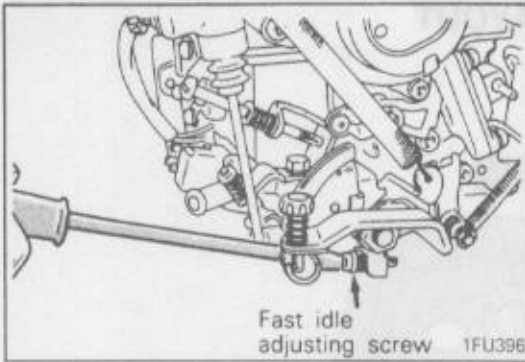
- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- Lamps, electric cooling fan and accessories: Set to OFF
- Transmission: Neutral <N or P for vehicles with A/T>
- Steering wheel: Centre position <Vehicles with power steering>
- Air cleaner: Removed
- Tachometer: Installed



- (1) Disconnect the vacuum hose (yellow stripe) from the choke opener.



- (2) Set the lever on the second highest detent of fast idle cam.



- (3) Start the engine and check the fast idle speed.
Standard value: $2,700 \pm 200$ r/min.
- (4) If the fast idle speed is out of specification, adjust with the fast idle adjusting screw.

<Information>

Turning the adjusting screw changes the fast idle speed as follows:

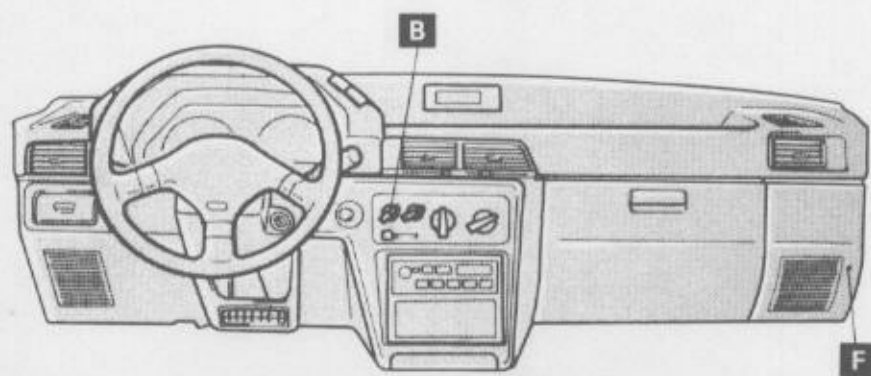
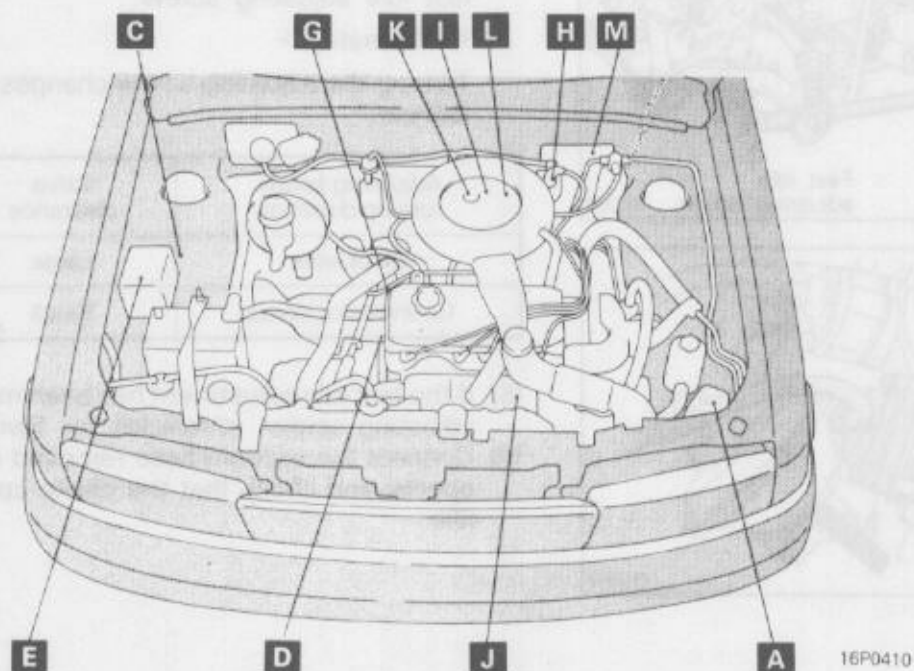
Adjusting screw turning direction	Valve clearance	Fast idle speed
Clockwise	Large	Increases
Counterclockwise	Small	Decreases

- (5) If the fast idle adjustment has been made, paint the fast idle adjusting screw. <Vehicles for Switzerland>
- (6) Connect the vacuum hose removed in step 2 to the choke opener and check that the choke opener cancels the fast idle.

Item	Unit	Value	Remarks
1. Fast idle speed	r/min	2700 ± 200	Standard value
2. Choke opener operation			Check operation
3. Vacuum hose connection			Check connection
4. Fast idle speed	r/min	2700 ± 200	Standard value
5. Choke opener operation			Check operation
6. Vacuum hose connection			Check connection
7. Fast idle speed	r/min	2700 ± 200	Standard value
8. Choke opener operation			Check operation
9. Vacuum hose connection			Check connection
10. Fast idle speed	r/min	2700 ± 200	Standard value
11. Choke opener operation			Check operation
12. Vacuum hose connection			Check connection
13. Fast idle speed	r/min	2700 ± 200	Standard value
14. Choke opener operation			Check operation
15. Vacuum hose connection			Check connection
16. Fast idle speed	r/min	2700 ± 200	Standard value
17. Choke opener operation			Check operation
18. Vacuum hose connection			Check connection
19. Fast idle speed	r/min	2700 ± 200	Standard value
20. Choke opener operation			Check operation
21. Vacuum hose connection			Check connection
22. Fast idle speed	r/min	2700 ± 200	Standard value
23. Choke opener operation			Check operation
24. Vacuum hose connection			Check connection
25. Fast idle speed	r/min	2700 ± 200	Standard value
26. Choke opener operation			Check operation
27. Vacuum hose connection			Check connection
28. Fast idle speed	r/min	2700 ± 200	Standard value
29. Choke opener operation			Check operation
30. Vacuum hose connection			Check connection
31. Fast idle speed	r/min	2700 ± 200	Standard value
32. Choke opener operation			Check operation
33. Vacuum hose connection			Check connection
34. Fast idle speed	r/min	2700 ± 200	Standard value
35. Choke opener operation			Check operation
36. Vacuum hose connection			Check connection
37. Fast idle speed	r/min	2700 ± 200	Standard value
38. Choke opener operation			Check operation
39. Vacuum hose connection			Check connection
40. Fast idle speed	r/min	2700 ± 200	Standard value
41. Choke opener operation			Check operation
42. Vacuum hose connection			Check connection
43. Fast idle speed	r/min	2700 ± 200	Standard value
44. Choke opener operation			Check operation
45. Vacuum hose connection			Check connection
46. Fast idle speed	r/min	2700 ± 200	Standard value
47. Choke opener operation			Check operation
48. Vacuum hose connection			Check connection
49. Fast idle speed	r/min	2700 ± 200	Standard value
50. Choke opener operation			Check operation
51. Vacuum hose connection			Check connection
52. Fast idle speed	r/min	2700 ± 200	Standard value
53. Choke opener operation			Check operation
54. Vacuum hose connection			Check connection
55. Fast idle speed	r/min	2700 ± 200	Standard value
56. Choke opener operation			Check operation
57. Vacuum hose connection			Check connection
58. Fast idle speed	r/min	2700 ± 200	Standard value
59. Choke opener operation			Check operation
60. Vacuum hose connection			Check connection
61. Fast idle speed	r/min	2700 ± 200	Standard value
62. Choke opener operation			Check operation
63. Vacuum hose connection			Check connection
64. Fast idle speed	r/min	2700 ± 200	Standard value
65. Choke opener operation			Check operation
66. Vacuum hose connection			Check connection
67. Fast idle speed	r/min	2700 ± 200	Standard value
68. Choke opener operation			Check operation
69. Vacuum hose connection			Check connection
70. Fast idle speed	r/min	2700 ± 200	Standard value
71. Choke opener operation			Check operation
72. Vacuum hose connection			Check connection
73. Fast idle speed	r/min	2700 ± 200	Standard value
74. Choke opener operation			Check operation
75. Vacuum hose connection			Check connection
76. Fast idle speed	r/min	2700 ± 200	Standard value
77. Choke opener operation			Check operation
78. Vacuum hose connection			Check connection
79. Fast idle speed	r/min	2700 ± 200	Standard value
80. Choke opener operation			Check operation
81. Vacuum hose connection			Check connection
82. Fast idle speed	r/min	2700 ± 200	Standard value
83. Choke opener operation			Check operation
84. Vacuum hose connection			Check connection
85. Fast idle speed	r/min	2700 ± 200	Standard value
86. Choke opener operation			Check operation
87. Vacuum hose connection			Check connection
88. Fast idle speed	r/min	2700 ± 200	Standard value
89. Choke opener operation			Check operation
90. Vacuum hose connection			Check connection
91. Fast idle speed	r/min	2700 ± 200	Standard value
92. Choke opener operation			Check operation
93. Vacuum hose connection			Check connection
94. Fast idle speed	r/min	2700 ± 200	Standard value
95. Choke opener operation			Check operation
96. Vacuum hose connection			Check connection
97. Fast idle speed	r/min	2700 ± 200	Standard value
98. Choke opener operation			Check operation
99. Vacuum hose connection			Check connection
100. Fast idle speed	r/min	2700 ± 200	Standard value

COMPONENTS LOCATION AND VACUUM HOSE LAYOUT

COMPONENTS LOCATION

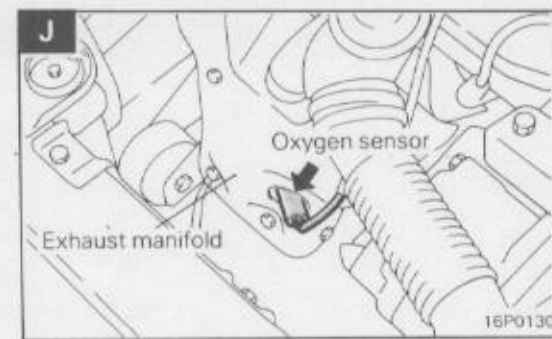
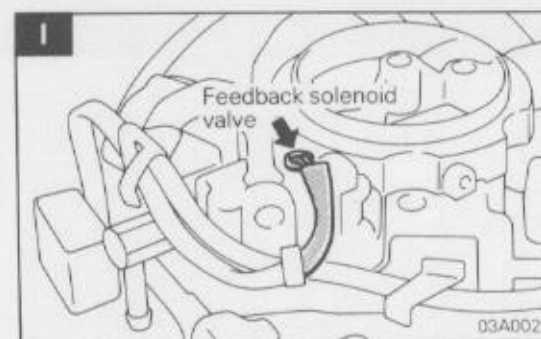
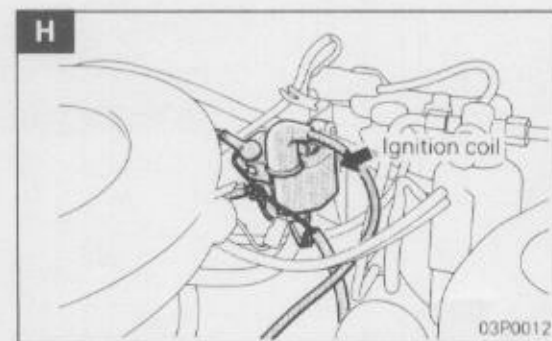
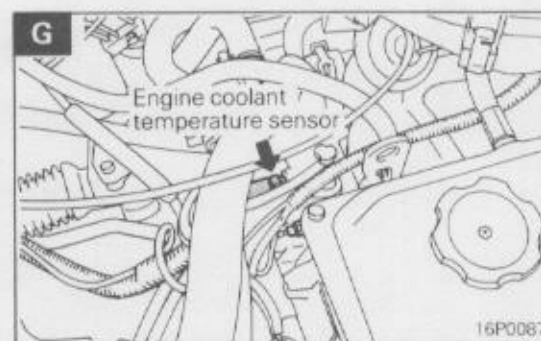
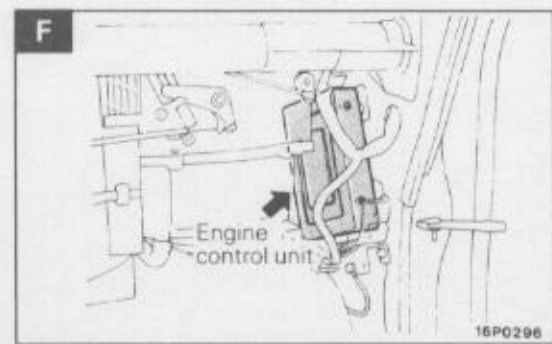
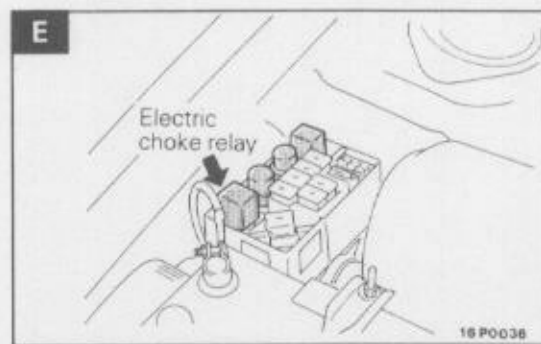
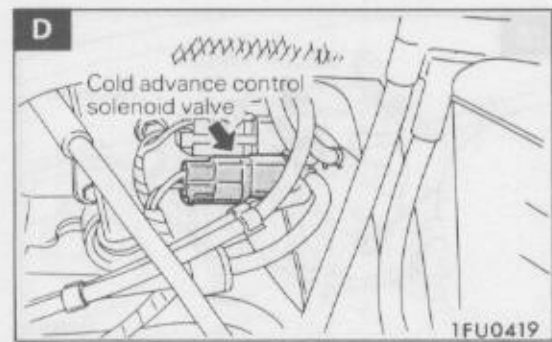
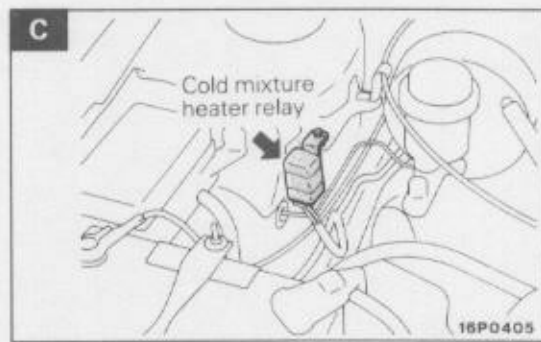
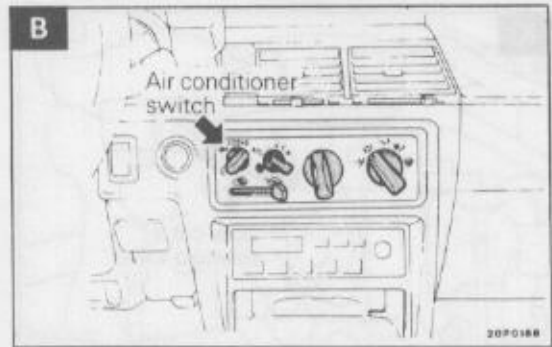


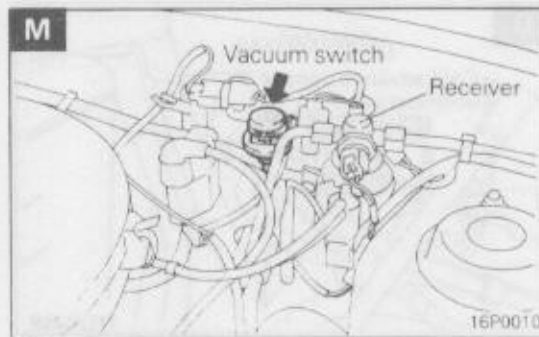
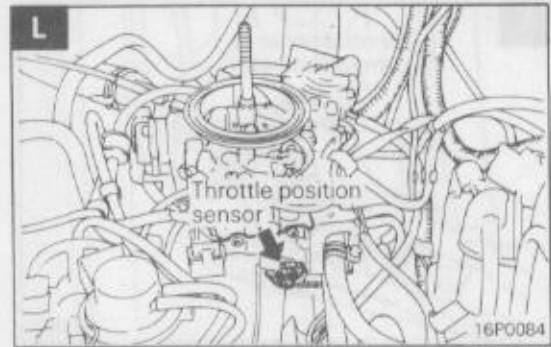
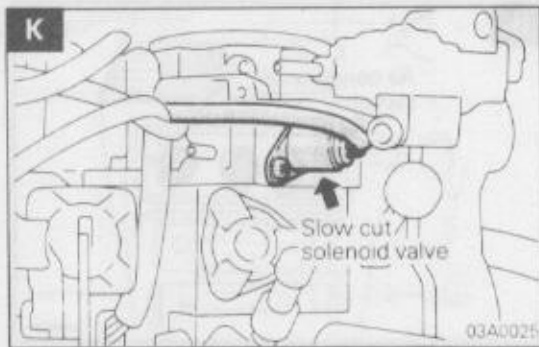
19P0254

Name	Symbol	Name	Symbol
Air conditioner compressor relay	A	Engine speed sensor (ignition coil $\ominus$)	H
Air conditioner switch	B	Feedback solenoid valve	I
Cold advance control solenoid valve	C	Oxygen sensor	J
Cold mixture heater relay	D	Slow cut solenoid valve	K
Electric choke relay	E	Throttle position sensor	L
Engine control unit	F	Vacuum switch	M
Engine coolant temperature sensor	G	—	—

NOTE

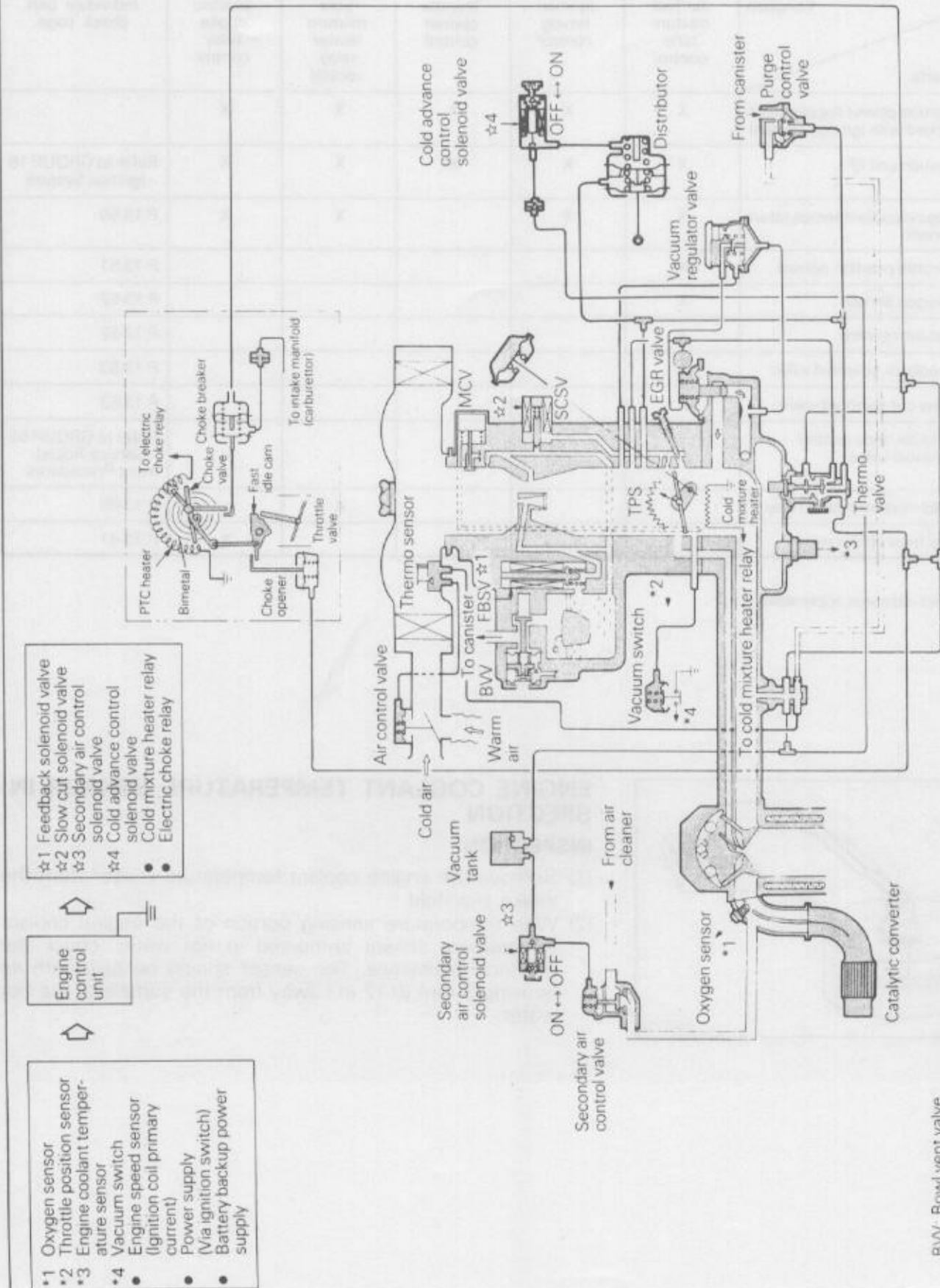
Component names are listed in alphabetical order.





VACUUM HOSE PIPING DIAGRAM

1FU0422



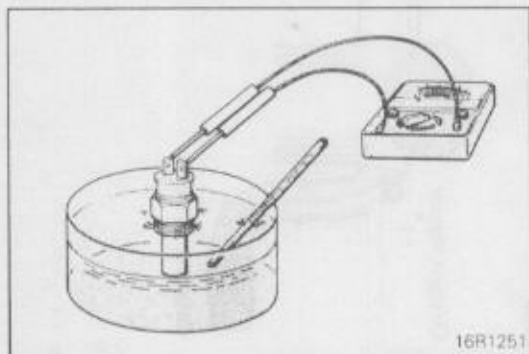
BW: Bowl vent valve
 FBSV: Feedback solenoid valve
 MCV: Mixture control valve
 SCSV: Slow cut solenoid valve
 TPS: Throttle position sensor

RELATION OF CONTROL FUNCTIONS

Function \ Related parts		Air/fuel mixture ratio control	Ignition timing control	Throttle opener control	Cold mixture heater relay control	Electric choke relay control	Individual part check page
Sensors and power supply	Ignition power supply (interlocked with ignition switch)	X	X	X	X	X	
	Ignition coil Θ	X	X	X	X	X	Refer to GROUP 16 – Ignition System.
	Engine coolant temperature sensor	X	X		X	X	P.13-50
	Throttle position sensor	X					P.13-51
	Oxygen sensor	X					P.13-52
	Vacuum switch	X					P.13-52
Actuator	Feedback solenoid valve	X					P.13-53
	Slow cut solenoid valve	X					P.13-53
	Cold advance control solenoid valve		X				Refer to GROUP 55 – Service Adjustment Procedures.
	Cold mixture heater relay				X		P.13-55
	Electrical choke relay					X	P.13-41

NOTE

The X symbol indicates applicability.

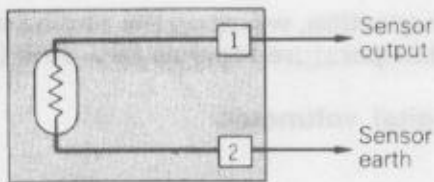


ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

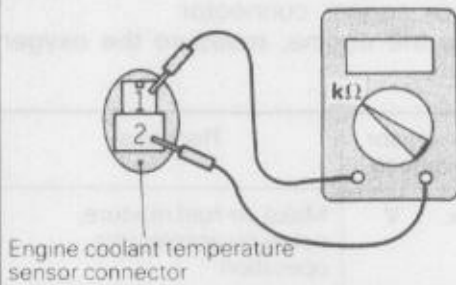
INSPECTION

- (1) Remove the engine coolant temperature sensor from the intake manifold.
- (2) With temperature sensing portion of the engine coolant temperature sensor immersed in hot water, check the electrical resistance. The sensor should be held with its housing 3 mm (0.12 in.) away from the surface of the hot water.

Engine coolant temperature sensor



01R0129



01R0133

Standard value:

Temperature °C (°F)	Resistance kΩ
0 (32)	5.9
20 (68)	2.5
40 (104)	1.1
80 (176)	0.3

- (3) If the resistance deviates greatly from the standard value, replace the engine coolant temperature sensor.

INSTALLATION

- (1) Apply sealant (3M NUT Locking No. 4171 or equivalent) to the threaded portion.
- (2) Install the engine coolant temperature sensor and tighten it to the specified torque.

Sensor tightening torque:

20 – 40 Nm (2.0 – 4.0 kgm, 15 – 28 ft.lbs.)

- (3) Fasten the harness connectors securely.

THROTTLE POSITION SENSOR INSPECTION

- (1) Disconnect the throttle position sensor connector.
- (2) Connect the special tool (harness connector).
- (3) Measure the resistance between the black clip (sensor power) and red clip (sensor earth).

Standard value: 3.5 – 6.5 kΩ

- (4) Connect an ohmmeter (analogue type) between the red clip (sensor earth) and blue clip (sensor output).
- (5) Operate the throttle valve slowly from the idle position to the full open position and check that the resistance makes a smooth change proportional to the degree of the throttle valve opening.

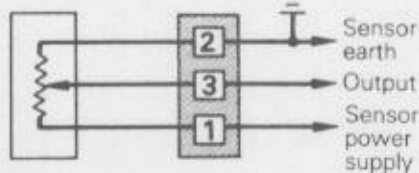
NOTE

The resistance changes within the range from approx. 0.5 kΩ to the value measured at step 2.

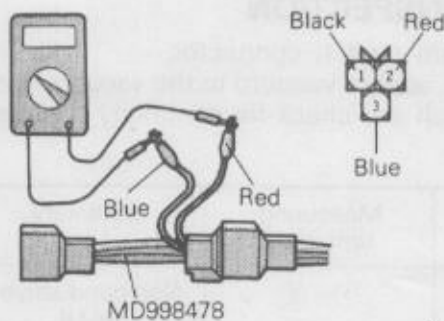
- (6) If the resistance is out of specification or fails to change smoothly, replace the throttle position sensor.

Throttle position sensor installation torque:

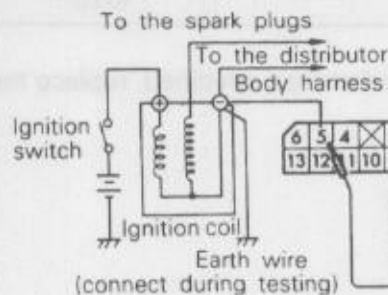
2.5 – 4.5 Nm (0.25 – 0.45 kgm, 1.8 – 3.3 ft.lbs.)



01R0490



3FU0181



3FU0191

ENGINE SPEED SENSOR (IGNITION COIL ⊖ TERMINAL) INSPECTION

Check that there is continuity between the ignition coil ⊖ terminal and the engine control unit terminal No. 5.

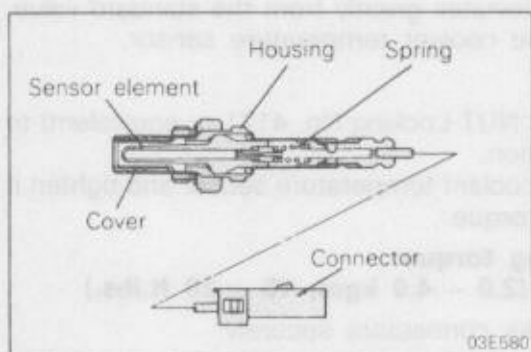
NOTE

Shake the harness connector to check for a lurking open circuit.

OXYGEN SENSOR INSPECTION

Caution

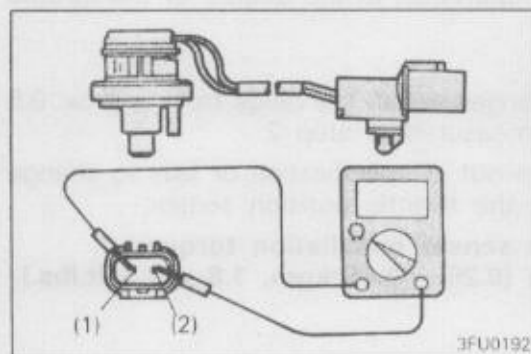
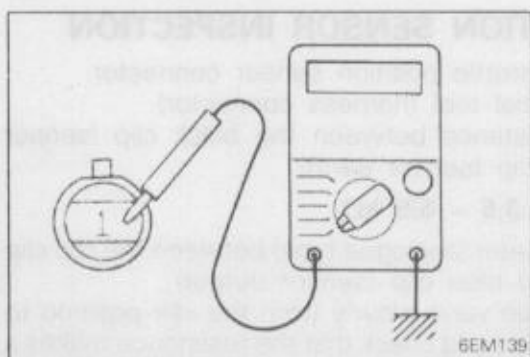
1. Before making the inspection, warm up the engine until the engine coolant temperature reaches 80 – 90°C (176 – 194°F).
2. Use an accurate digital voltmeter.



- (1) Disconnect the oxygen sensor connector and connect a voltmeter to the oxygen sensor connector.
- (2) While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Remarks
Racing	Approx. 1 V	Make air-fuel mixture richer by accelerator operation

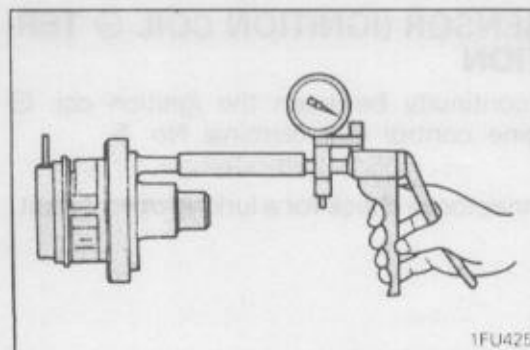
Oxygen sensor installation torque:
40 – 50 Nm (4.0 – 5.0 kgm, 30 – 36 ft.lbs.)

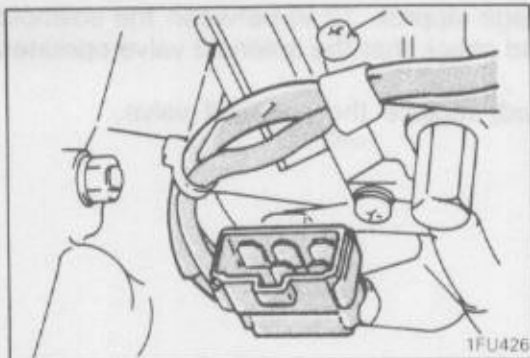


VACUUM SWITCH INSPECTION

- (1) Disconnect the vacuum switch connector.
- (2) Using a vacuum pump, apply a vacuum to the vacuum hose nipple of vacuum switch and check for continuity between the switch terminals.

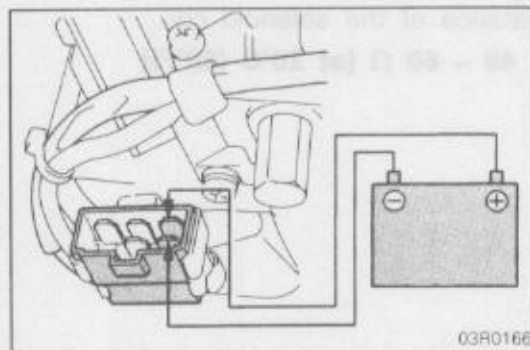
Vacuum gauge	Measuring terminals	Continuity
27 kPa (0.27 kg/cm ² , 3.9 psi) or less	① – ②	Non-conductive ($\infty \Omega$)
41 kPa (0.41 kg/cm ² , 5.8 psi) or more	① – ②	Conductive (0 Ω)





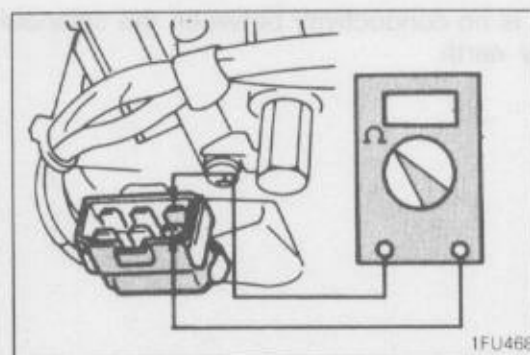
FEEDBACK SOLENOID VALVE SIMPLE INSPECTION

- (1) Disconnect the feedback solenoid valve connector.



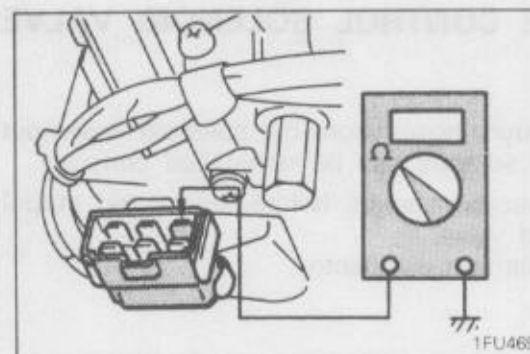
- (2) Apply battery voltage (approx. 12 V) between the solenoid valve terminals and check that the solenoid valve operates with a click.

If no click is heard, replace the solenoid valve.

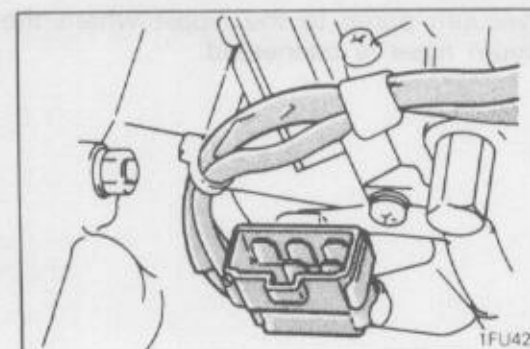


- (3) Measure the resistance of the solenoid coil.

Standard value: 54 – 66 Ω [at 20°C (68°F)]

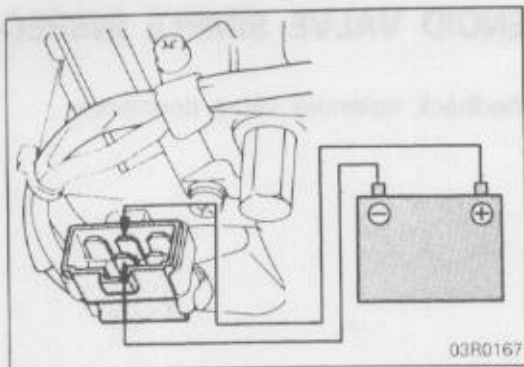


- (4) Ensure that there is no conductivity between the solenoid coil and the body earth.

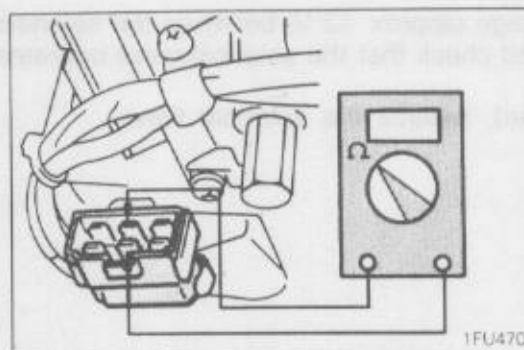


SLOW CUT SOLENOID VALVE SIMPLE INSPECTION

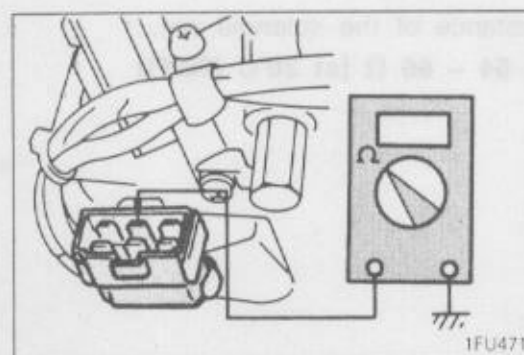
- (1) Disconnect the slow cut solenoid valve connector.



- (2) Apply battery voltage (approx. 12 V) between the solenoid valve terminals and check that the solenoid valve operates with a click.
If no click is heard, replace the solenoid valve.



- (3) Measure the resistance of the solenoid coil.
Standard value: 48 – 60 Ω [at 20°C (68°F)]



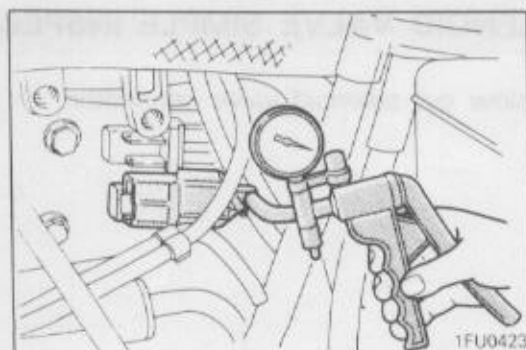
- (4) Ensure that there is no conductivity between the solenoid coil and the body earth.

COLD ADVANCE CONTROL SOLENOID VALVE INSPECTION

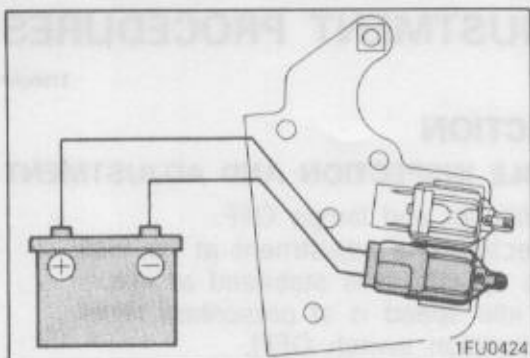
NOTE

Before removing vacuum hoses from the solenoid valve, put marks on the hoses so they can be reinstalled correctly.

- (1) Disconnect the vacuum hoses (white stripe, red stripe) from the solenoid valve.
(2) Disconnect the harness connector.

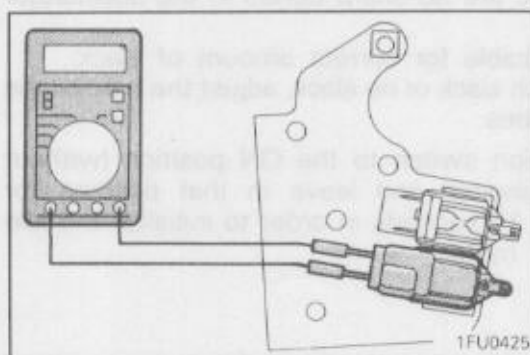


- (3) Connect a hand vacuum pump to the nipple where the white striped vacuum hose is connected.



- (4) Apply a vacuum and check the air tightness when both battery voltage is directly applied to the solenoid valve terminal, and when no voltage is applied.

Battery voltage	Normal state
Applied	Vacuum leaks
Not applied	Vacuum is held



- (5) Measure the solenoid coil resistance.

Standard value: 36 – 44 Ω [at 20°C (68°F)]

COLD MIXTURE HEATER INSPECTION

Refer to P.13-24.

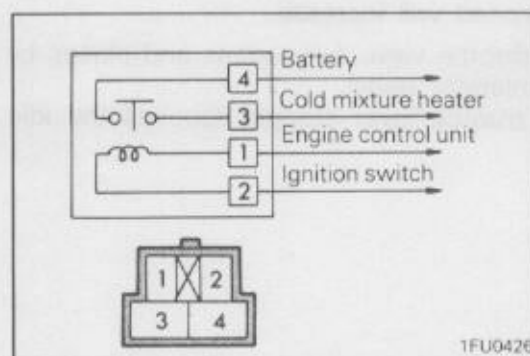
COLD MIXTURE HEATER RELAY INSPECTION

Caution

When applying battery voltage directly to the heater, connect the correct terminals. Incorrect connection can damage the relay.

- (1) Remove the cold mixture heater relay.

- (2) Check for continuity between the terminals when both the relay coil is energized, and when it is not.



Description	Measuring terminals	Continuity
Not energized	③ – ④	Non-conductive (with $\infty \Omega$ resistance)
Energized	③ – ④	Conductive (with 0 Ω resistance)

NOTE

"Energized means battery voltage directly applied between terminals ① and ②.

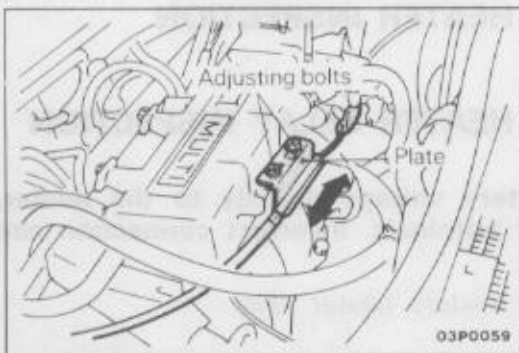
SERVICE ADJUSTMENT PROCEDURES <MPI-SOHC>

E13FCAP

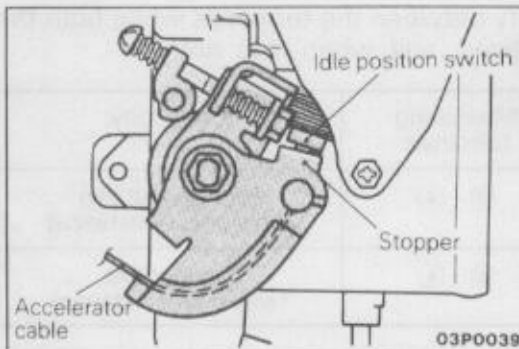
GENERAL INSPECTION

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

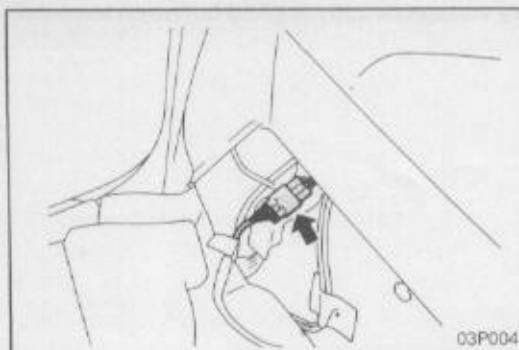
- (1) Turn the air conditioner and lamps OFF.
Perform the inspection and adjustment at no load.
- (2) Warm the engine up until it is stabilized at idle.
- (3) Confirm that the idle speed is at prescribed r/min.
- (4) Stop the engine (ignition switch OFF).
- (5) Confirm that there are no sharp bends in the accelerator cable.
- (6) Check the inner cable for correct amount of slack.
- (7) If there is too much slack or no slack, adjust the play by the following procedures.
 - ① Turn the ignition switch to the ON position (without starting the engine) and leave in that position for approximately 15 seconds in order to initialize the idle speed control motor.



03P0059



03P0039



03P0047

- ② Loosen the adjusting bolts on the air intake plenum, and then secure the outer cable so that the free play of the inner cable will be the standard value.

Standard value:

<M/T>

1 – 2 mm (0.04 – 0.08 in.)

<A/T>

3 – 5 mm (0.12 – 0.20 in.)

NOTE

If there is excessive play of the accelerator cable, the vehicle speed drop ("undershoot") when climbing a slope will be large.

If there is no play (excessive tension) of the accelerator cable, the idling speed will increase.

- (8) Confirm that the throttle valve fully opens and closes by operating the accelerator pedal.
- (9) Confirm that the throttle lever stopper touches the idle position switch.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

E13HABG

Perform the following operations to release the pressure remaining in fuel pipe line so that fuel will not flow out.

- (1) Remove the rear seat cushion. (Refer to GROUP 52 – Rear Seat.)
- (2) Disconnect the fuel pump harness connector.
- (3) Start the engine, and after it stops by itself, turn the ignition switch to OFF.
- (4) Disconnect the battery (–) terminal.
- (5) Connect the fuel pump harness connector.

PWME8802

NOTES

SERVICE ADJUSTMENT PROCEDURE

<MPI-SOHC - Vehicles built up to May 1992>

GENERAL INSPECTION

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

- (1) Turn the air conditioner and lamps OFF.
- (2) Perform the inspection and adjustment as no load.
- (3) Warm the engine up until it is stabilized at idle.
- (4) Confirm that the idle speed is at prescribed value.
- (5) Stop the engine (ignition switch OFF).
- (6) Confirm that there are no sharp bends in the accelerator cable.
- (7) Check the rear cable for correct amount of slack.
- (8) If there is too much slack or no slack, adjust the play by the following procedure.
- (9) Turn the ignition switch to the ON position (without starting the engine) and leave in that position for approximately 10 seconds in order to initialize the idle speed control motor.

- (10) Loosen the adjusting bolt on the air intake plenum, and then secure the outer cable so that the free play of the inner cable will be the standard value.

Standard value:

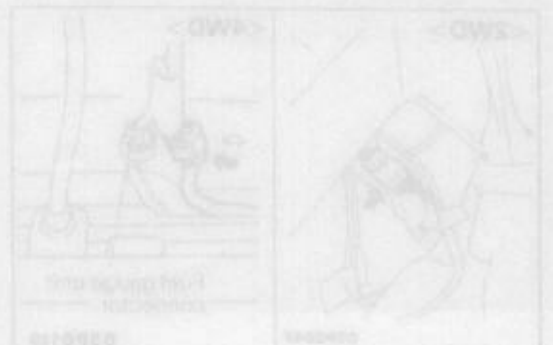
- <MT> 1 - 2 mm (0.04 - 0.08 in.)
<AT> 3 - 5 mm (0.12 - 0.20 in.)

NOTE

- If there is excessive play of the accelerator cable, the vehicle speed drop (understeer) when climbing a slope will be large.
- If there is no play (excessive tension) of the accelerator cable, the idling speed will increase.
- (11) Confirm that the throttle valve fully opens and closes by operating the accelerator pedal.
- (12) Confirm that the throttle lever stops at the idle position switch.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

- Perform the following operation to release the pressure remaining in fuel pipe line so that fuel will not flow out.
- (1) Remove the rear seat cushion. (Refer to GROUP 62 - Rear Seat) <2WD>
 - (2) Disconnect the fuel pump harness connector. On 4WD vehicles, disconnect the fuel pump connector from the upper part of the fuel tank located under the cargo compartment.
 - (3) Start the engine, and after it stops by itself, turn the ignition switch to OFF.
 - (4) Connect the fuel pump harness connector.



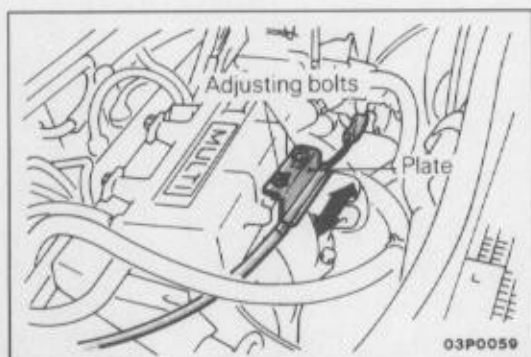
SERVICE ADJUSTMENT PROCEDURES <MPI-SOHC – Vehicles built up to May 1992>

E13FCAP

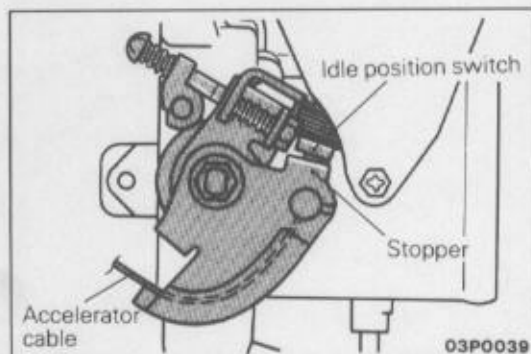
GENERAL INSPECTION

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

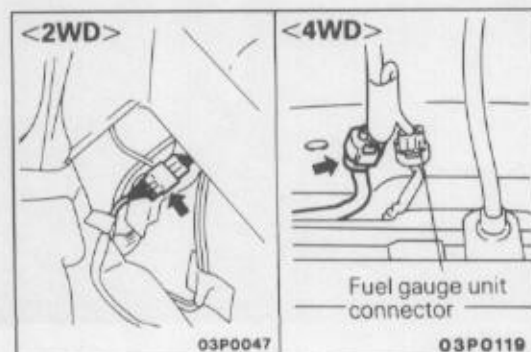
- (1) Turn the air conditioner and lamps OFF.
Perform the inspection and adjustment at no load.
- (2) Warm the engine up until it is stabilized at idle.
- (3) Confirm that the idle speed is at prescribed r/min.
- (4) Stop the engine (ignition switch OFF).
- (5) Confirm that there are no sharp bends in the accelerator cable.
- (6) Check the inner cable for correct amount of slack.
- (7) If there is too much slack or no slack, adjust the play by the following procedures.
 - ① Turn the ignition switch to the ON position (without starting the engine) and leave in that position for approximately 15 seconds in order to initialize the idle speed control motor.



03P0059



03P0039



03P0047

03P0119

Standard value:

<M/T>

1 – 2 mm (0.04 – 0.08 in.)

<A/T>

3 – 5 mm (0.12 – 0.20 in.)

NOTE

If there is excessive play of the accelerator cable, the vehicle speed drop ("undershoot") when climbing a slope will be large.

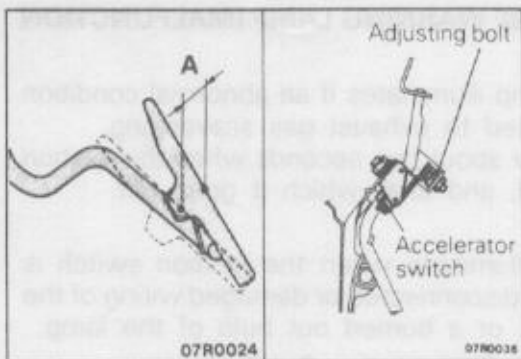
If there is no play (excessive tension) of the accelerator cable, the idling speed will increase.

- (8) Confirm that the throttle valve fully opens and closes by operating the accelerator pedal.
- (9) Confirm that the throttle lever stopper touches the idle position switch.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

Perform the following operations to release the pressure remaining in fuel pipe line so that fuel will not flow out.

- (1) Remove the rear seat cushion. (Refer to GROUP 52 – Rear Seat.) <2WD>
- (2) Disconnect the fuel pump harness connector. On 4WD vehicles, disconnect the fuel pump connector from the upper part of the fuel tank located under the cargo compartment.
- (3) Start the engine, and after it stops by itself, turn the ignition switch to OFF.
- (4) Connect the fuel pump harness connector.

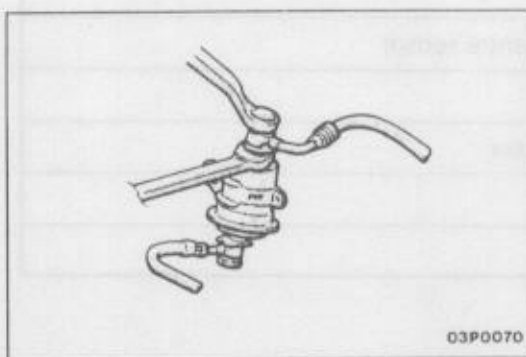
**ACCELERATOR SWITCH INSPECTION AND ADJUSTMENT**

E13HAAB

- (1) After warming up the engine, check to be sure that the accelerator switch is ON when the accelerator pedal is in its free state. If there is a malfunction, adjust it by using the adjusting bolt.
- (2) Press the accelerator pedal by hand until the accelerator switch switches from ON to OFF and confirm that the amount of pedal movement (A in the illustration) is within the standard value range.

Accelerator switch switching point**Standard value range: 2 – 6 mm (0.08 – 0.24 in.)**

- (3) If the distance (A in the illustration) is not within the standard value range, adjust it by using the adjusting bolt.

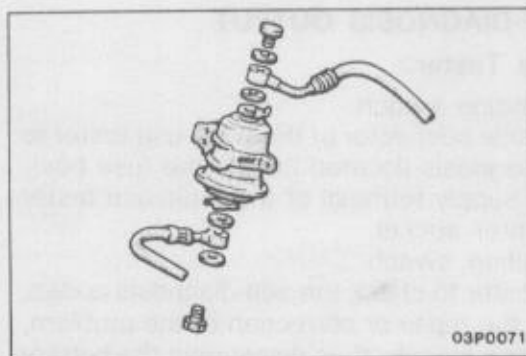
**FUEL FILTER REPLACEMENT**

E13FZAH

- (1) Remove the air cleaner. (Refer to GROUP 15 – Air Cleaner.)
- (2) Reduce the internal pressure of the fuel pipes and hoses. (Refer to P.13-56.)
- (3) Remove the eye bolt while holding the fuel filter nut securely.

Caution**Cover with rags to prevent fuel from splashing.**

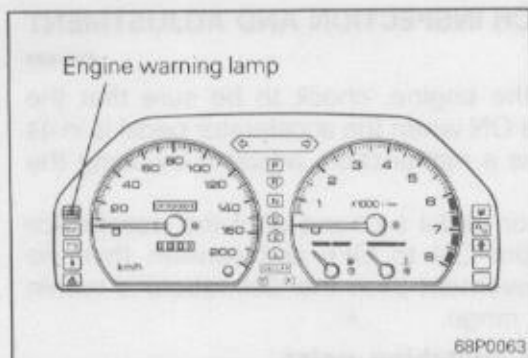
- (4) Remove the fuel filter.
- (5) When the fuel filter is remounted, use new gaskets and tighten the high pressure fuel hoses to the specified torque.
- (6) After the installation is completed, check whether or not there is fuel leakage.
 - ① Apply battery voltage to the terminal for fuel pump activation so as to actuate the fuel pump.
 - ② Check for leakage from the fuel line with fuel pressure applied.

**FUEL CONTROL SYSTEM CHECK**

E13FGDH

Caution

1. When the battery voltage is low, no detection of abnormality can be made. Be sure to check the battery condition before starting the test.
2. Diagnosis data is erased if the battery terminal or the engine control unit connector is disconnected. Do not disconnect the battery terminal before the diagnosis result has been read completely.
3. After the check and corrections have been finished, disconnect the negative terminal of battery for 10 seconds or more and connect it again to make sure that the abnormal code is erased.



CHECKING THE ENGINE WARNING LAMP (MALFUNCTION INDICATOR LAMP)

The engine warning lamp illuminates if an abnormal condition occurs in an item related to exhaust gas scavenging. This lamp illuminates for about two seconds when the ignition switch is switched ON, and after which it goes out.

NOTE

If the lamp does not illuminate when the ignition switch is switched ON, check for disconnected or damaged wiring of the harness, a blown fuse, or a burned out bulb of the lamp.

Engine Warning Lamp Illumination Points

Computer
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Motor position sensor
Engine coolant temperature sensor
Crank angle sensor
No. 1 cylinder top dead centre sensor
Detonation sensor*
Barometric pressure sensor
Injector
Fuel pump

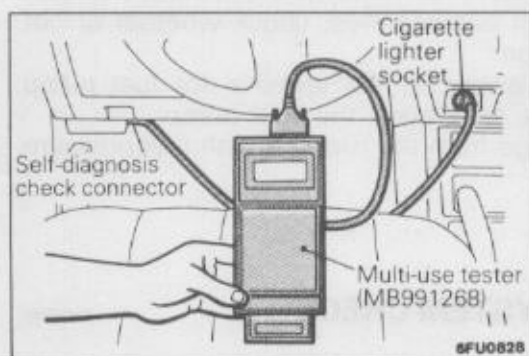
NOTE

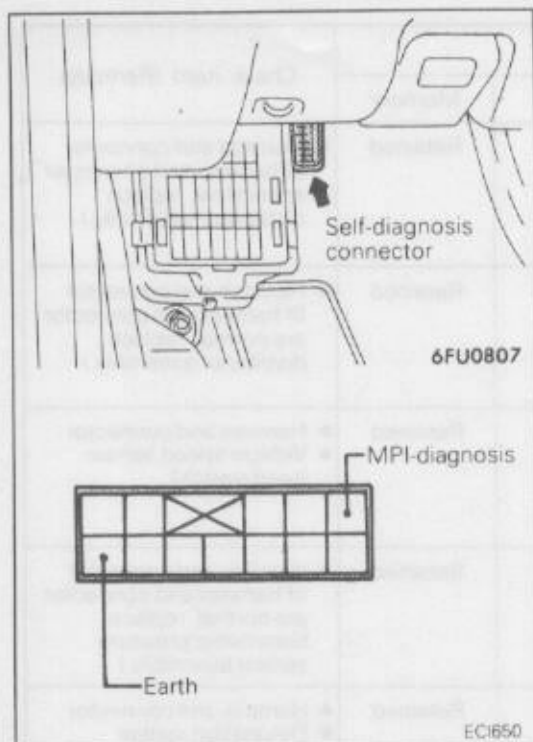
*: Vehicles for Europe

CHECKING THE SELF-DIAGNOSIS OUTPUT

<Using the Multi-use Tester>

- (1) Switch OFF the ignition switch.
- (2) Connect the tester side connector of the multi-use tester to the connector for diagnosis (located beside the fuse box).
- (3) Connect the power supply terminal of the multi-use tester to the cigarette lighter socket.
- (4) Switch ON the ignition switch.
- (5) Use the multi-use tester to check the self-diagnosis codes.
- (6) After completion of the repair or correction of the problem, switch OFF the ignition switch; then disconnect the battery terminals for ten seconds or longer and then, after reconnecting them, check to be sure that no malfunction code is displayed by the multi-use tester.
- (7) Disconnect the multi-use tester.



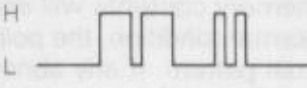
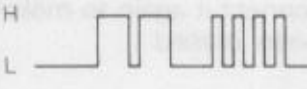
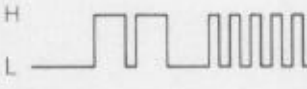
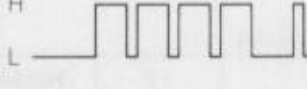


<Using a Voltmeter>

- (1) Connect an analogue voltmeter to the self-diagnosis connector.
- (2) Turn ignition switch to ON, and indication of engine control unit memory contents will immediately start. If the system is in normal condition, the pointer of the voltmeter indicates a normal pattern. If any abnormality is in the memory, the pointer of the voltmeter will deflect, indicating an abnormal item as described in "Diagnosis Chart". After recording the abnormal item, check and repair each part according to the check items in "Diagnosis Chart".
- (3) If the defective parts have been repaired, disconnect the negative terminal of battery cable for 10 seconds or more and connect it again to make sure that the abnormal code has been erased.

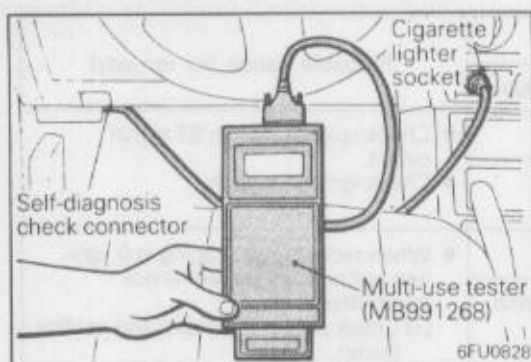
Diagnosis Chart

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
1	Engine control unit	H L 12A0104	—	—	(Replace engine control unit)
2	Air flow sensor	H L 12A0104	12	Retained	• Harness and connector (If harness and connector are normal, replace air flow sensor assembly.)
3	Intake air temperature sensor	H L 12A0104	13	Retained	• Harness and connector • Intake air temperature sensor
4	Throttle position sensor	H L 12A0104	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch
5	Motor position sensor	H L 12A0104	15	Retained	• Harness and connector • Motor position sensor
6	Engine coolant temperature sensor	H L 12A0107	21	Retained	• Harness and connector • Engine coolant temperature sensor

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
7	Crank angle sensor	 12A0107	22	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
8	No. 1 cylinder top dead center sensor	 12A0107	23	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
9	Vehicle speed sensor (reed switch)	 12A0107	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
10	Barometric pressure sensor	 12A0107	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly.)
11	Detonation sensor*	 12R0468	31	Retained	• Harness and connector • Detonation sensor
12	Injector	 12A0105	41	Retained	• Harness and connector • Injector coil resistance
13	Fuel pump	 12A0105	42	Retained	• Harness and connector • Control relay
14	Normal state	 (Continue) 12A0104	-	-	-

NOTE

1. Replace the engine control unit if a malfunction code is output although the inspection reveals that there is no problem with the check items.
2. *: Vehicles for Europe

**CHECKING BY USING THE MULTI-USE TESTER**

- (1) Switch OFF the ignition switch.
- (2) Connect the tester side connector of the multi-use tester to the connector for diagnosis (located beside the fuse box).
- (3) Connect the power supply terminal of the multi-use tester to the cigarette lighter socket.
- (4) Switch ON the ignition switch.
- (5) Use the multi-use tester to make the various checks, and repair if a problem is found.

NOTE

If the engine warning lamp (malfunction indicator lamp) illuminates while the checks are being made, check the self-diagnosis output.

- (6) After repair, check once again to be sure the problem has been corrected.
- (7) Switch OFF the ignition switch.
- (8) Disconnect the multi-use tester.
- (9) Disconnect the battery terminals for ten seconds or longer. This erases the self-diagnosis code.
- (10) Restart the engine. Check (by a driving test and other means) to be sure that the problem has been corrected.

Cranking Check (should be performed when engine fails to start, or before starting the engine)

Check item	Description		Probable cause (or remedy)
	Check condition	Normal value	
Power supply voltage • Data reading • Item No. (16)	• Ignition switch: ON	11 – 13V	• Low battery voltage • No power supply to engine control unit (1) Check power supply circuit. (2) Check ignition switch. (3) Check control relay. • Defective engine control unit earth circuit
Throttle position sensor • Data reading • Item No. (14)	• Ignition switch: Hold it in the ON position for more than 15 secs. (Idle speed control servo set at initial position) • Throttle valve: Idle position	400 – 600 mV	• Throttle position sensor out of adjustment • Defective throttle position sensor or related circuit • Defective idle speed control servo drive circuit
Self-diagnosis output	• After ignition switch has been held in the ON position for more than 15 secs., set ignition switch at LOCK and disconnect idle speed control servo connector. • Crank the engine for more than 4 secs. • Ignition switch: ON (Check injector, crank angle sensor, etc. for open circuit.)	Normal	• Perform checks associated with diagnosis code. (Note that if engine control unit backup power supply circuit has an open circuit, the diagnosis code is cleared.) • Output of various types of diagnosis code is often due to an open circuit in the power supply or earth circuit.
Fuel pump • Actuator test • Item No. (7)	Check fuel pump under both the following conditions: • Engine cranking • Forced activation of fuel pump	Hold return hose between fingers	Fuel flow pulsations felt by fingers
		Listen close to the fuel tank	
			Pump operation sound heard
			• No power supply to fuel pump (1) Check ignition switch (IG, ST). (2) Check control relay. (3) Check related circuits. • Defective fuel pump

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Ignition switch ST circuit • Data reading • Item No. (18)	• Ignition switch: ON	Engine stopped	OFF	• Check ignition switch ST signal circuit. • Check ignition switch.
		Cranking	ON	
Crank angle sensor • Data reading • Item No. (22)	• Engine cranking • Tachometer connected (to check intermittent flow of ignition coil primary current)	Cranking speed	Speed	• When tachometer reading is 0, ignition coil primary current is not intermittent. (1) Check power transistor and control circuit. (2) Check ignition coil and coil power supply circuit. • When speed indicated by the multi-use tester is abnormal: (1) Crank angle sensor circuit defective (2) Crank angle sensor defective (3) Timing belt defective
		Approx. 200 r/min.	Approx. 200 r/min.	
Injector • Data reading • Item No. (41)	• Engine cranking	Listen to operating sound	Injector operating sound heard	• Defective injector • Connector and control relay in loose contact
		Engine coolant temperature	Operation time	• Defective engine coolant temperature sensor • Ignition switch ST circuit defective [Injector operation time shown is when battery voltage is 11V and cranking speed 250 r/min. or less. • When engine coolant temperature is 0°C (32°F), the injectors are injecting fuel into the four cylinders simultaneously.]
		0°C (32°F)	Approx. 17 ms	
		20°C (68°F)	Approx. 36 ms	
		80°C (176°F)	Approx. 9 ms	

Checking the Sensors

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Self-diagnosis output	• Engine: Operated at idle (Allow more than two minutes after starting engine.)		Normal	• Perform checks associated with diagnosis code. (Note that if engine control unit backup power supply circuit has an open circuit, the diagnosis code is cleared.) • Output of various types of diagnosis code is often due to an open circuit in power supply or earth circuit.
Oxygen sensor*1 • Data reading • Item No. (11)	• Engine: Warmed up (Make the mixture lean by deceleration and make it rich by racing.)	Engine state	Voltage	• If oxygen sensor output is too high when engine is suddenly decelerated: (1) Check injector leakage. (2) Check oxygen sensor signal circuit. • If oxygen sensor output voltage is low when engine is raced: (1) Check oxygen sensor and signal circuit.
		When suddenly decelerated from 4,000 r/min.	200 mV or less	
		When suddenly raced	600 – 1,000 mV	
	• Engine: Warmed up (Check air-fuel ratio by use of oxygen sensor signal. In addition, check control by engine control unit.)	Engine speed	Voltage	• If oxygen sensor signal is good, engine control unit is properly controlling air-fuel ratio. • If oxygen sensor output is always low, check for air that may be drawn in. • If oxygen sensor output voltage is always high, check injector for leakage.
		800 r/min. (idle)	Variable between 400 mV or less and 600 – 1,000 mV	
		2,000 r/min.		

NOTE

*1: Vehicles for Europe

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Air flow sensor • Data reading • Item No. (12)	• Engine: Warmed up	Engine state	Frequency	• If a sudden, large change occurs in air flow sensor output frequency, loose contact of air flow sensor or connector is suspected. • When air flow sensor output frequency is abnormally high or low, check the air cleaner element. • When air flow sensor output frequency is too high, increased engine resistance or leakage of compression pressure is suspected.
		800 r/min. (idle)	30 – 45 Hz	
		2,000 r/min.	68 – 88 Hz	
		Racing	Increased according to higher racing speed	
Intake air temperature sensor • Data reading • Item No. (13)	• Ignition switch: ON or engine in operation	Intake air temperature	Temperature	• Defective intake air temperature sensor or related circuits
		–20°C (–4°F)	–20°C (–4°F)	
		0°C (32°F)	0°C (32°F)	
		20°C (68°F)	20°C (68°F)	
		40°C (104°F)	40°C (104°F)	
		80°C (176°F)	80°C (176°F)	
	• Ignition switch: ON	Heat with hair drier, or the like.		
Throttle position sensor • Data reading • Item No. (14)	• Ignition switch: Hold it in ON position for more than 15 secs.	Throttle valve	Voltage	• Throttle position sensor out of adjustment • Defective throttle position sensor or related circuit
		Idle position	480 – 520 mV	
		Open slowly.	Increased in proportion to degree of valve opening	
		Fully open	4,500 – 5,500 mV	
Motor position sensor • Data reading • Item No. (15)	• Engine: Let it run at idle after warm-up. (Idle position switch must be in closed state.)	Engine state	Voltage	• If voltage is abnormally low, check for air which may be drawn in. • If voltage is high either or both of the following are suspected: (1) Deposit on throttle valve area (2) Increased engine resistance • If idle speed is abnormal when everything in the engine is functioning normally, either or both of the following are suspected: (1) Improperly adjusted idle speed control and throttle position sensor (2) Defective position sensor or related circuit
		Idle (800 r/min.)	500 – 1,300 mV	
		Air conditioner switch ON (850 r/min.)	800 – 1,800 mV	
	(When air conditioner switch is in closed state, compressor clutch must be in operation.)	Air conditioner switch ON and shift lever in "D" range (700 r/min.)	900 – 1,900 mV	• If engine speed does not increase when the air conditioner switch is changed from OFF to ON, check the DC motor drive circuit. • Check air conditioner system. • Check inhibitor switch and signal circuit.
Variable resistor** • Data reading • Item No. (17)	• Ignition switch: ON		1 – 4V	• Defective circuit • Defective variable resistor

NOTE

*2: Vehicles for General Export

© Mitsubishi Motors Corporation MAY 88

PWME8802

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Ignition switch ST circuit • Data reading • Item No. (18)	• Ignition switch: ON		OFF	• Check ignition switch ST signal circuit. • Check ignition switch.
Engine coolant temperature sensor • Data reading • Item No. (21)	• Ignition switch: ON or engine in operation	Engine coolant temperature	Temperature	• Defective engine coolant temperature sensor or related circuit
		-20°C (-4°F)	-20°C (-4°F)	
		0°C (32°F)	0°C (32°F)	
		20°C (68°F)	20°C (68°F)	
		40°C (104°F)	40°C (104°F)	
		80°C (176°F)	80°C (176°F)	
Crank angle sensor • Data reading • Item No. (22)	• Engine: Idle operation (Check with idle position switch in the ON state.)	Engine coolant temperature	Idle speed	• If a sudden, large change in speed occurs, defective crank angle sensor or loose contact of connector is suspected.
		-20°C (-4°F)	1,500 – 1,700 r/min.	
		0°C (32°F)	1,350 – 1,550 r/min.	
		20°C (68°F)	1,150 – 1,350 r/min.	
		40°C (104°F)	950 – 1,150 r/min.	
		80°C (176°F)	700 – 900 r/min.	
Barometric pressure sensor • Data reading • Item No. (25)	• Ignition switch: ON	Altitude	Pressure	• Defective barometric pressure sensor or related circuits (When barometric sensor pressure is low during high speed operation, clogged air cleaner element is suspected.)
		0 m (0 ft.)	760 mmHg	
		600 m (1,968 ft.)	710 mmHg	
		1,200 m (3,937 ft.)	660 mmHg	
		1,800 m (5,905 ft.)	610 mmHg	
	• Engine: Race at 2,000 r/min.	Slowly block intake duct with hand.	Falls.	
Idle position switch • Data reading • Item No. (26)	• Ignition switch: ON (Check by depressing accelerator pedal repeatedly)	Throttle valve in idle position	ON	• Defective idle position switch or related circuits • Accelerator cable out of adjustment • Factory-set speed adjusting screw improperly set
		Slightly open throttle valve	OFF	
Power steering oil pressure switch • Data reading • Item No. (27)	• Engine: Let it run at idle	Steering wheel in neutral position (wheels in straight ahead position)	OFF	• Defective power steering oil pressure switch or signal circuit
		Steering wheel turned 180°	ON	
Air conditioner switch • Data reading • Item No. (28)	• Engine: Let it run at idle. (When air conditioner switch is ON, air compressor must be in operation.)	Air conditioner switch OFF	OFF	• Check air conditioner system.
		Air conditioner switch ON	ON	

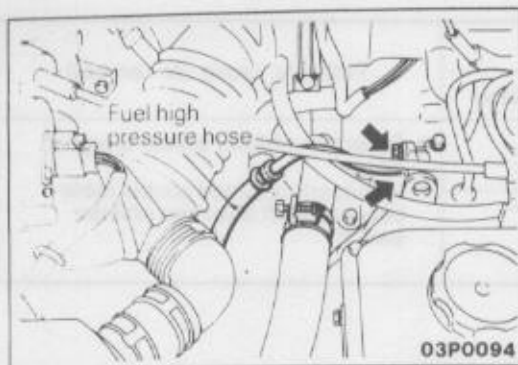
Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Inhibitor switch • Data reading • Item No. (29)	• Ignition switch: ON <A/T>	Shift lever in "P", "N"	"P", "N"	- Defective inhibitor switch or signal circuit - Improperly adjusted control cable between shift lever and inhibitor switch
		Shift lever in "D", "2", "L", "R"	"D", "2", "L", "R"	

Checking the Actuators

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Injectors ● Actuator test ● Item No. (1 – 4)	● Engine: Let it run at idle after warm-up. (Cut off injectors in succession and take note of the cylinder(s) in which no idle condition change occurs.)	Injector No.	Engine	● If a cylinder has had its injector cut off but does not alter the idling condition of the engine, check that cylinder. (1) Check injector operating sound. (2) Check ignition plug and high tension cable. (3) Check power transistor and control circuit. (4) Check injecting condition.
		1	Great change in idling condition occurs. (Idling condition becomes more unstable or engine stalls.)	
		2		
		3		
		4		
Injectors ● Data reading ● Item No. (41)	● Engine: Warmed up	Engine state	Operation time	● When injector operation time is abnormally long or short, defective air flow sensor, engine coolant temperature sensor, intake air temperature sensor and barometric pressure sensor are suspected. ● When injector operation time is long, increased engine resistance or leakage of compression pressure is suspected.
		800 r/min. (idle)	2.4 – 3.0 ms	
		2,000 r/min.	2.0 – 2.6 ms	
		When suddenly raced	Increased	
Ignition advance angle (Power transistor) ● Data reading ● Item No. (44)	● Engine: Warm-up ● Timing light: Set (to check actual ignition timing)	Engine speed	Ignition advance angle	● If ignition advance angle and actual ignition timing are not in agreement, adjust ignition timing. [When engine is running at idle, ignition timing may change but it does not present any problem. At high altitudes, the advance angle is increased (approx. 5°).]
		800 r/min. (idle)	8 – 12°BTDC	
		2,000 r/min.	28 – 36°BTDC	
Air conditioner relay ● Data reading ● Item No. (49)	● Engine: Let it run at idle after warm-up.	Air conditioner switch	Air conditioner relay	● When air conditioner relay output is abnormal, check air conditioner signal input circuit and air conditioner system, or ● If air conditioner compressor clutch malfunctions, check compressor clutch and relay circuit.
		OFF	OFF (Compressor clutch not engaged)	
		ON	ON (Compressor clutch engaged)	
Purge control solenoid valve*1 ● Actuator test ● Item No. (8)	● Ignition switch: ON (Engine stopped)	Actuator activated	Operating sound heard during operation	● Check purge control solenoid valve and its drive circuit.

NOTE

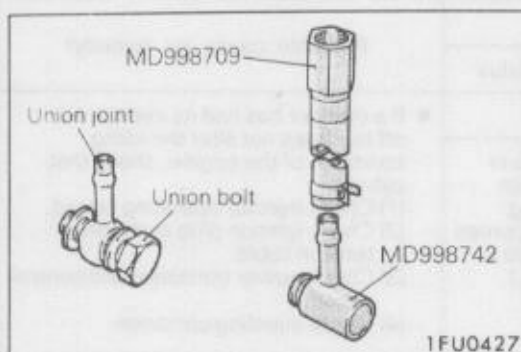
*1: Vehicles for Europe

**FUEL PRESSURE MEASUREMENT**

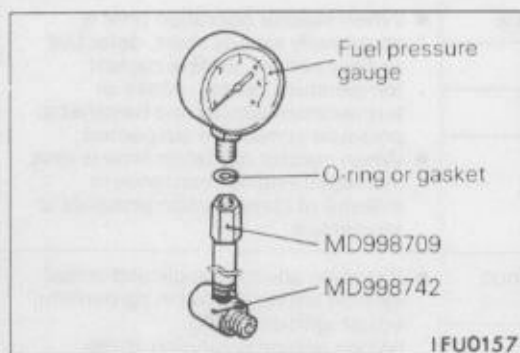
- (1) Reduce the fuel pressure. (Refer to P.13-56.)
- (2) Disconnect the fuel high pressure hose from the delivery pipe.

Caution

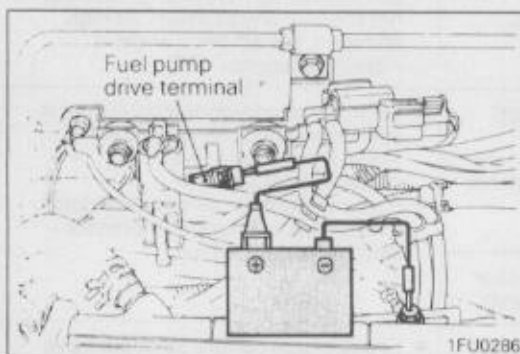
Cover the hose connection with a shop towel to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



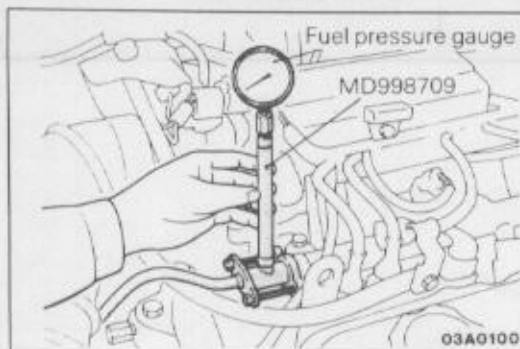
- (3) Remove the union joint and bolt from the special tool (adapter hose MD998709) and instead attach the special tool (hose adapter MD998742) to the adapter hose.



- (4) Install a fuel pressure gauge on the adapter hose that was set up in step (3). Use a suitable O-ring or gasket between the fuel pressure gauge and the special tool so as to seal in order to prevent fuel leakage at this time.
- (5) Install the special tool, which was set in place in steps (3) and (4) between the delivery pipe and the high pressure hose.



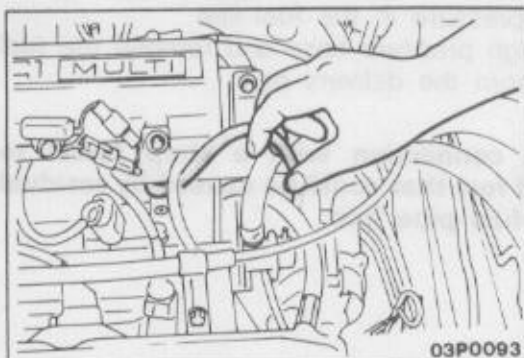
- (6) Apply battery voltage to the terminal for the fuel pump drive and activate the fuel pump; then, with fuel pressure thus applied, check to be sure that there is no fuel leakage from the pressure gauge or the special tool connection area.



- (7) Start the engine and run it at curb idle speed.
- (8) Measure the fuel pressure when the vacuum hose is connected to the pressure regulator:

Standard value:

Approx. 270 kPa (2.7 kg/cm², 38 psi)



- (9) Disconnect the vacuum hose from the pressure regulator and plug the vacuum hose end. Measure the fuel pressure.

Standard value:

330 – 350 kPa (3.3 – 3.5 kg/cm², 47 – 50 psi)

- (10) After racing the engine two or three times, check to be sure that the fuel pressure doesn't drop during idling.
 (11) Check to be sure that there is fuel pressure in the return hose also (by gently pressing the fuel return hose with a finger while repeatedly racing the engine).

NOTE

There will be no fuel pressure in the return hose when the volume of fuel flow is not sufficient.

- (12) If the results of the measurements made in steps (8) and (9) above are not within the standard value range, consult the table below to determine the probable cause, and then make the necessary repair.

Condition	Probable cause	Remedy
Fuel pressure too low	a. Clogged fuel filter b. Fuel leaking toward return port due to improper seating of valve in fuel pressure regulator c. Low delivery pressure of fuel pump	a. Replace fuel filter. b. Replace fuel pressure regulator. c. Replace fuel pump.
Fuel pressure too high	a. Stuck valve in fuel pressure regulator b. Clogged or bent fuel return hose or pipe	a. Replace fuel pressure regulator. b. Repair or replace hose or pipe.
Fuel pressure with vacuum hose connected not different from fuel pressure with vacuum hose not connected	a. Clogged or broken vacuum hose or nipple b. Stuck valve in fuel pressure regulator or defective valve seating	a. Repair or replace vacuum hose or nipple. b. Replace fuel pressure regulator.

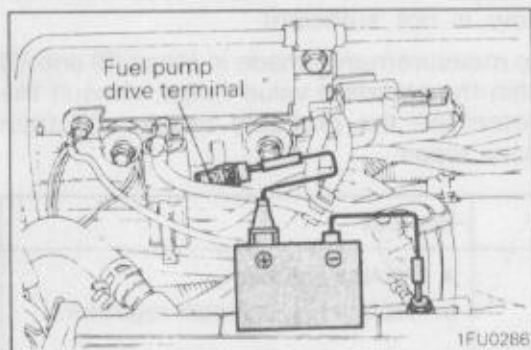
- (13) Stop the engine and check for a change in the fuel pressure gauge indication, which should not drop.
 If the gauge indication drops, observe the rate of drop and determine and repair the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	Leakage from injector	Replace injector.
Fuel pressure drops immediately after engine is stopped	Check valve in fuel pump does not close.	Replace fuel pump.

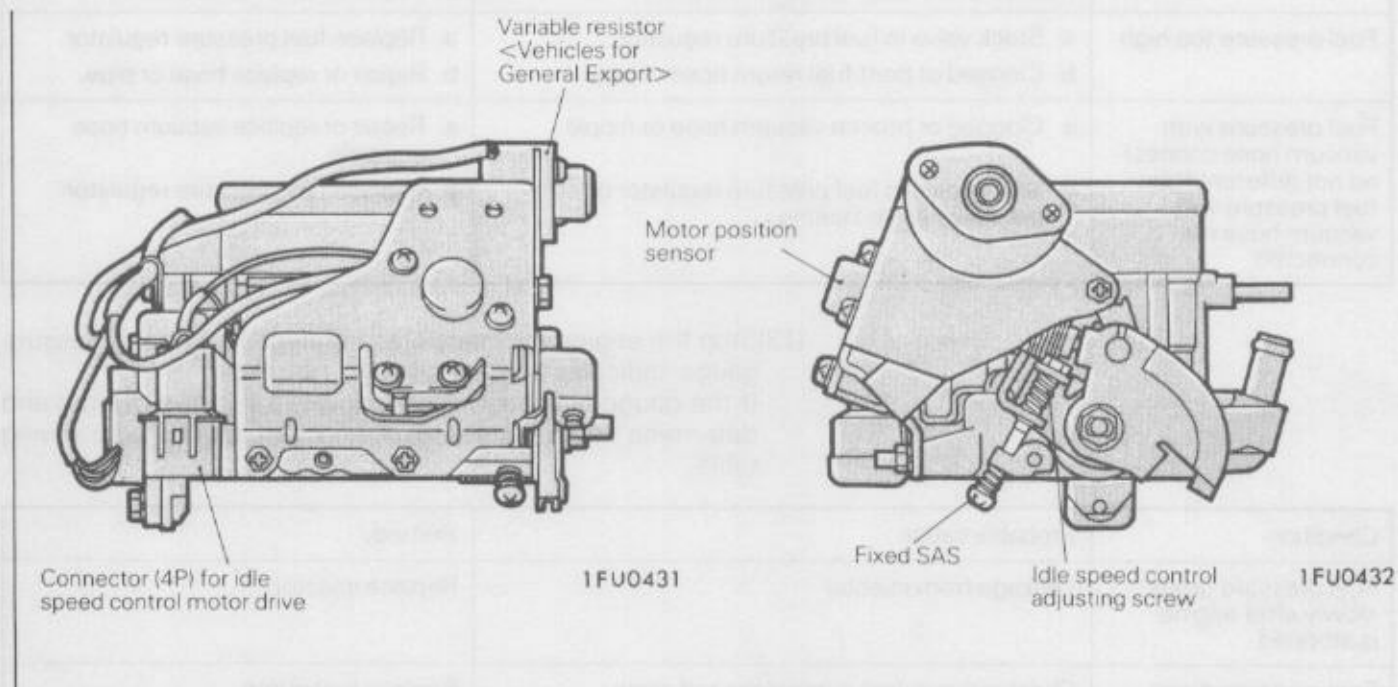
- (14) Reduce the fuel pressure in the fuel line.
 (15) Disconnect the high pressure hose and remove the fuel pressure gauge from the delivery pipe.

Caution

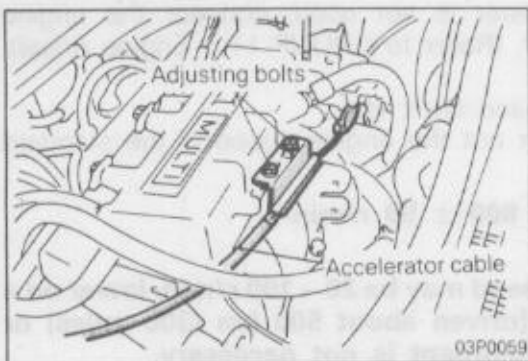
Cover the hose connection with a shop towel to prevent splash of fuel that could be caused by residual pressure in the fuel pipe line.



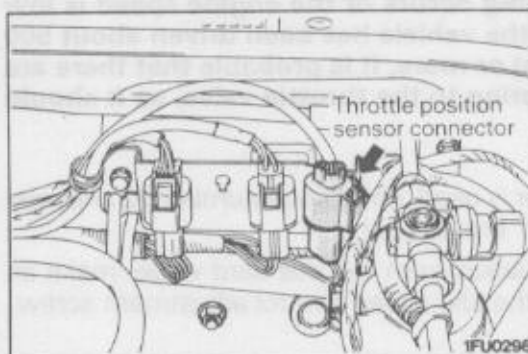
- (16) Mount a new O-ring in the groove at the end of the high pressure hose.
 (17) Connect the fuel high pressure hose to the delivery pipe and tighten the screws to the specified torque.
 (18) Check for fuel leaks.
 ① Apply battery voltage to the fuel pump drive terminal to operate the fuel pump.
 ② With fuel pressure present, check the fuel line for leaks.

ADJUSTMENT OF THE IDLE SPEED CONTROL AND THROTTLE POSITION SENSOR**Conditions before adjustment**

- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- Lamps, cooling fan, and accessory equipment: OFF
- Transmission: Neutral position (for A/T models, the "N" or "P" position)
- Steering wheel: Neutral position



- (1) Loosen the tension of the accelerator cable sufficiently.



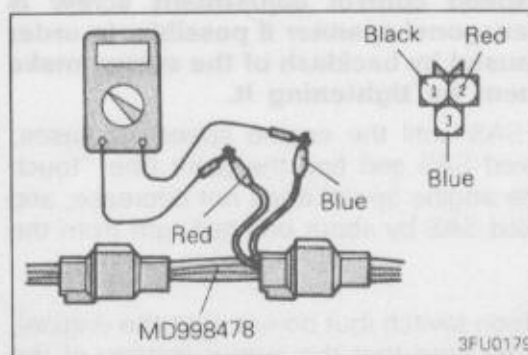
- (2) Disconnect the connector of the throttle position sensor, and then either connect the special tool (harness connector) between the terminals of the connector or connect the multi-use tester to the diagnosis connector located next to the fuse box.

NOTE

Use the special tool described below.

Vehicles for Europe: MD998478

Vehicles for General Export: MD998463



- (3) If a multi-use tester is not used, connect a voltmeter.

<Vehicles for Europe>

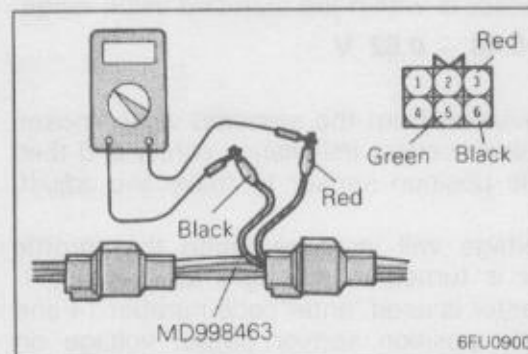
Make the connection between the throttle position sensor's terminal ② (red clip of the special tool) and terminal ③ (blue clip of the special tool).

<Vehicles for General Export>

Make the connection between the throttle position sensor's terminal ③ (red clip of the special tool) and terminal ⑥ (black clip of the special tool).

Caution

If a voltmeter is used, it should be the digital type, and have high precision.



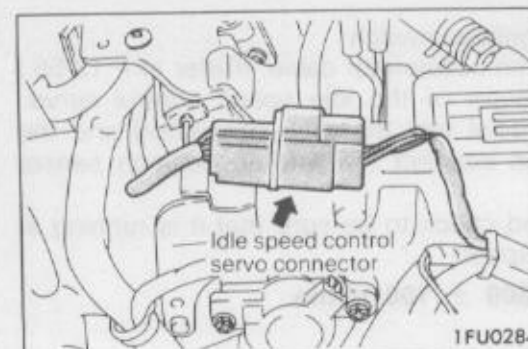
- (4) Maintain this state for 15 seconds or longer with the ignition switch at ON (but do not start the engine), and check to be sure that the idle speed control servo is set at the initial position (idle position).

NOTE

With the ignition switch ON, extend the idle speed control plunger to the fast idle opening degree; then, after 15 seconds pass, contract it, and stop at the initial position.

Initial position: The position appropriate for idling; 0.9 V motor position sensor output voltage

- (5) Set the ignition switch at the OFF position.
- (6) Disconnect the connector of the idle speed control servo, and secure the idle speed control plunger at the initial position.
- (7) In order to prevent the throttle valve from catching, open the throttle valve (half way or more) two or three times and then release it so that it returns securely, and sufficiently loosen the fixed SAS.



- (8) If a multi-use tester is not used, connect the engine tachometer tester. (Refer to GROUP 11 – Engine Adjustment.)
- (9) Start the engine and let it idle.
- (10) Check whether or not the engine speed is the standard value.

Standard value: 800 ± 50 r/min.

Caution

1. The engine speed may be 20 – 100 r/min. lower on a new vehicle [driven about 500 km (300 miles) or less], but adjustment is not necessary.
2. If engine stalling occurs or the engine speed is low even though the vehicle has been driven about 500 km (300 miles) or more, it is probable that there are deposits adhering to the throttle valve, so it should be cleaned.

NOTE

If a multi-use tester is used, enter code number 22 and read the idle speed on the display.

- (11) If there is any deviation from the standard value, make an adjustment using the idle speed control adjustment screw.

Caution

When the idle speed control adjustment screw is adjusted, use a hexagonal spanner if possible; in order to prevent play caused by backlash of the screw, make the final adjustment by tightening it.

- (12) Tighten the fixed SAS until the engine speed increases; next, return the fixed SAS and find the point (the "touch point") at which the engine speed does not decrease, and then loosen the fixed SAS by about one-half turn from the touch point.
- (13) Stop the engine.
- (14) Switch ON the ignition switch (but do not start the engine), and then check to be sure that the output voltage of the throttle position sensor is within the standard value range.

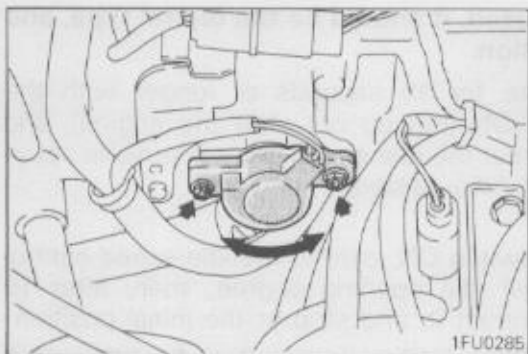
Standard value: 0.48 – 0.52 V

NOTE

1. If there is a deviation from the standard value, loosen the throttle position sensor installation screw and then turn the throttle position sensor to make the adjustment.
2. The output voltage will increase when the throttle position sensor is turned to the right (clockwise).
3. If a multi-use tester is used, enter code number 14 and read the throttle position sensor output voltage on display.

- (15) Switch OFF the ignition switch.
- (16) Adjust the play of the accelerator cable. (Refer to P.13-56.)
- (17) Connect the connector of the idle speed control servo.
- (18) Disconnect the special tool (harness connector) and the voltmeter, and then connect the throttle position sensor connector.
- (19) Start the engine and check to be sure that it is running at the regular idling speed.

Standard value: 800 ± 100 r/min.



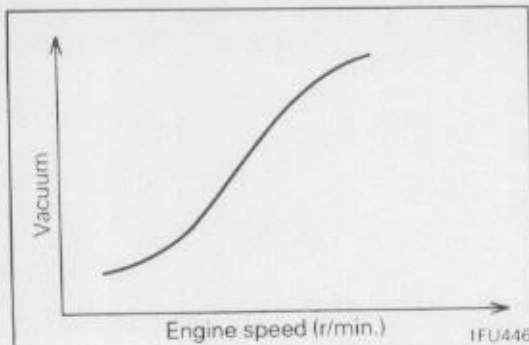
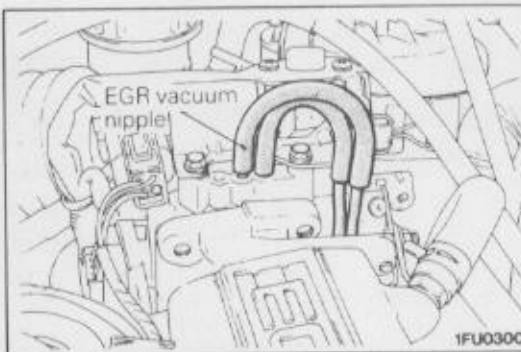
- (20) Switch OFF the ignition switch, and then, after disconnecting the battery terminals for ten seconds or longer, connect them once again.
(This erases the memory of the diagnosis during the idle speed control adjustment.)
- (21) Start the engine once again and let it idle for about five minutes; check that the idling condition is normal.

THROTTLE BODY (THROTTLE VALVE) CLEANING

NOTE

Disconnect the air intake hose from the throttle body, and check the throttle valve for carbon deposits while rotating the valve. Use a spray-type cleaner to remove deposits on the valve.

- (1) After warming up the engine sufficiently, stop the engine.
- (2) Disconnect the air intake hose from the throttle body.
- (3) Spray the valve with cleaner through the throttle body air inlet port, and wait for approx. 5 minutes.
- (4) Start the engine. After racing the engine several times, let it run at idle for approx. one minute. Stop the engine.
- (5) Repeat steps (3) and (4).
- (6) Connect the air intake hose to the throttle body.
- (7) Disconnect the battery terminal for 10 seconds or longer, and then reconnect the terminal.
- (8) Adjust the idle speed and throttle position sensor.



EGR VALVE CONTROL VACUUM CHECK

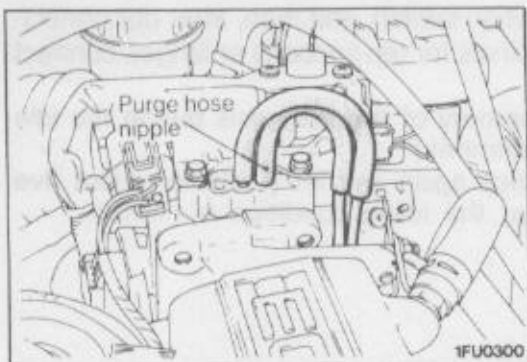
Check condition

- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- (1) Disconnect the vacuum hose from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.

- (2) Start the engine and check to see that, after increasing the engine speed by racing the engine, E vacuum rises proportionately with the rise in engine speed.

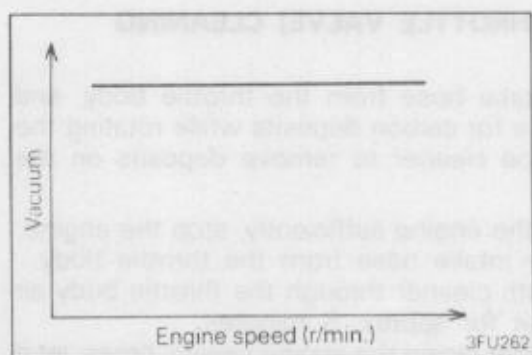
NOTE

If there is a problem with the way the vacuum changes, it is possible that the throttle body E port may be clogged and require cleaning.

**PURGE PORT VACUUM CHECK <Vehicles for Europe>**

Check condition

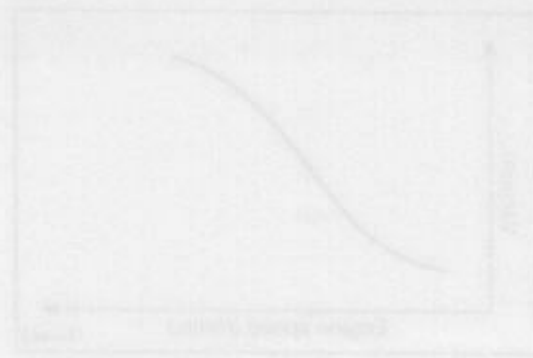
- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- (1) Disconnect the vacuum hose from the throttle body purge hose nipple and connect a hand vacuum pump to the nipple.



- (2) Start the engine and check to see that, after raising the engine speed by racing the engine, the P vacuum remains fairly constant.

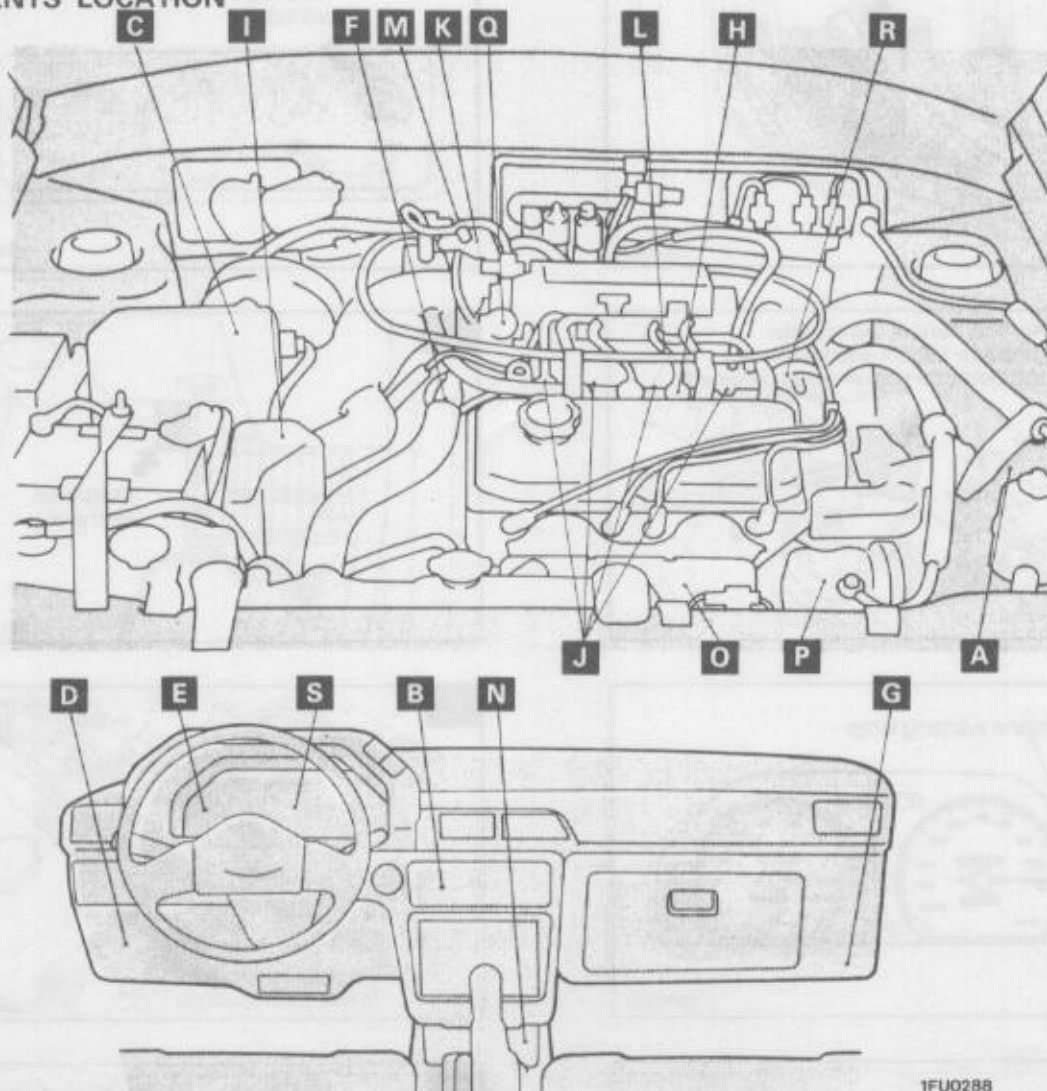
NOTE

If there is no vacuum created, it is possible that the throttle body P port may be clogged and require cleaning.



COMPONENTS LOCATION AND VACUUM HOSE LAYOUT

COMPONENTS LOCATION



1FU0287

1FU0288

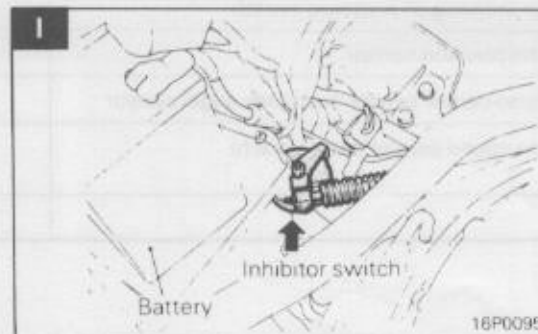
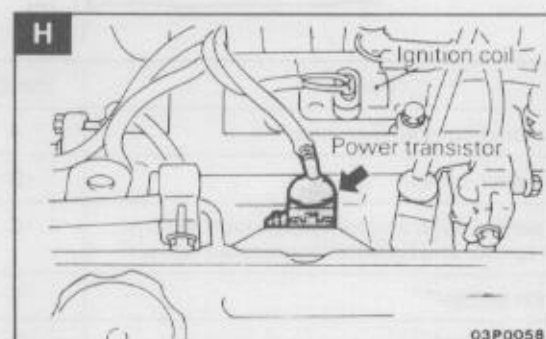
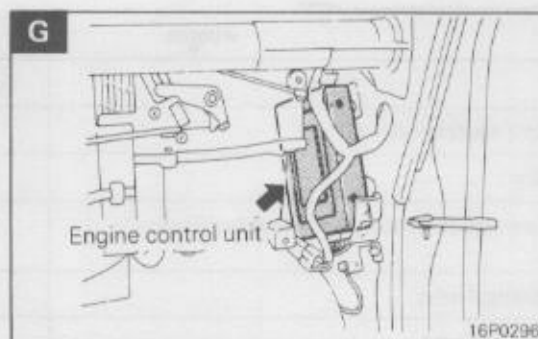
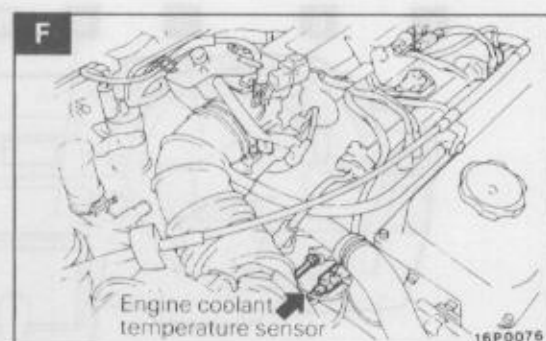
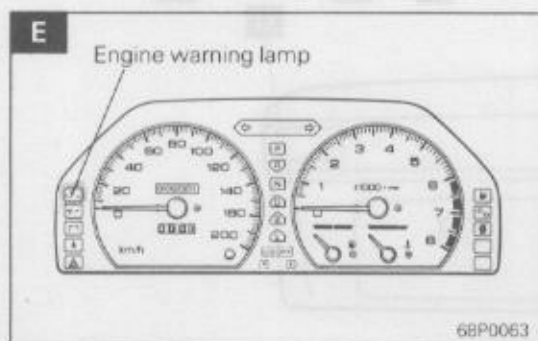
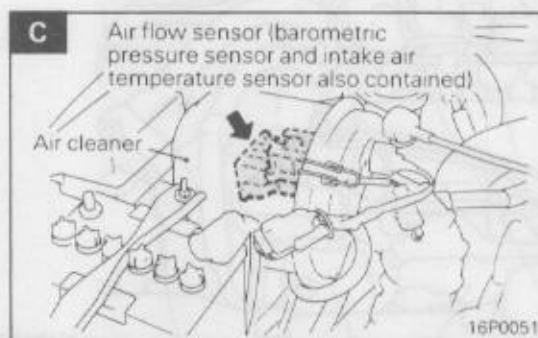
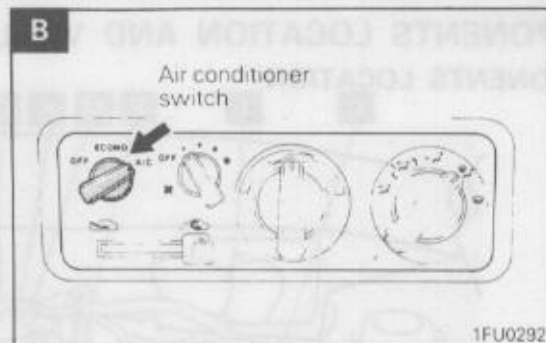
Name	Symbol	Name	Symbol
Air conditioner compressor relay	A	Inhibitor switch <A/T>	I
Air conditioner switch	B	Injector	J
Air flow sensor (with incorporated intake air temperature sensor and barometric pressure sensor)	C	Mixture adjustment screw (variable resistor)*	M
Detonation sensor*	L	MPI control relay	N
Diagnosis terminal	D	Oxygen sensor*	O
Engine control unit	G	Power steering oil pressure switch	P
Engine coolant temperature sensor	F	Throttle position sensor	Q
Engine warning lamp	E	Top dead center sensor and crank angle sensor	R
Idle speed control motor (idle position switch and motor position sensor)	K	Vehicle speed sensor (reed switch)	S
Ignition coil (power transistor)	H		-

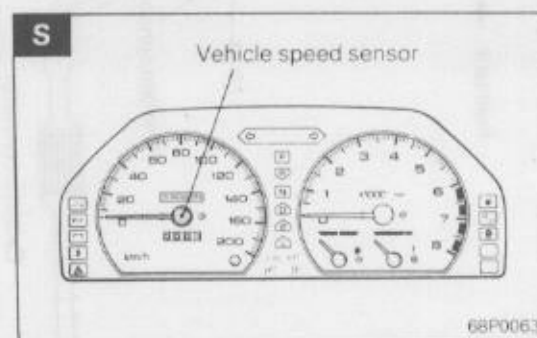
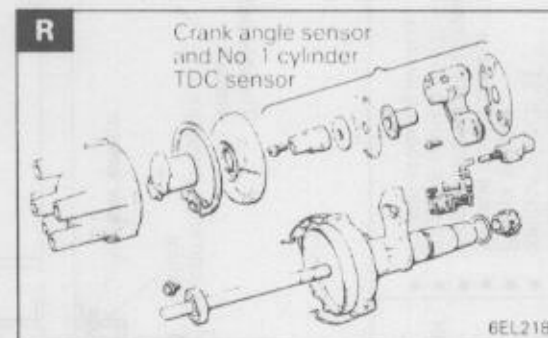
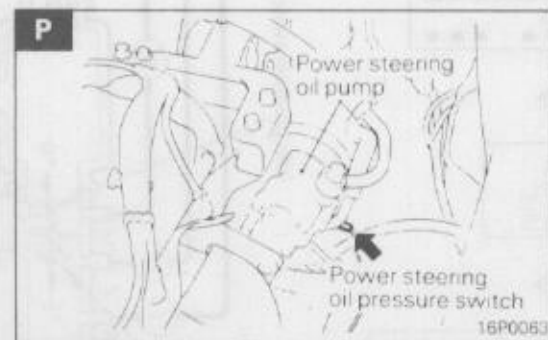
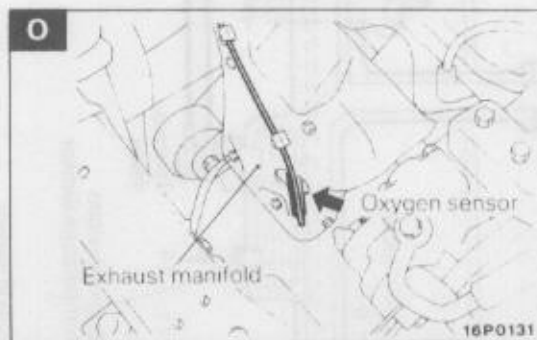
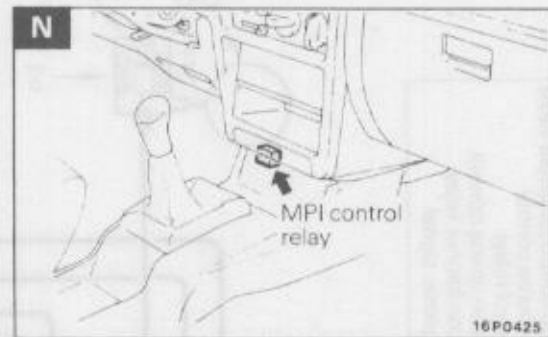
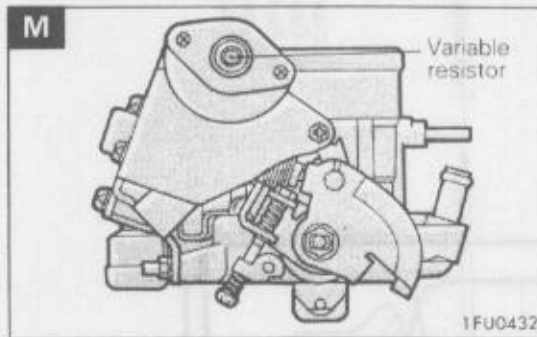
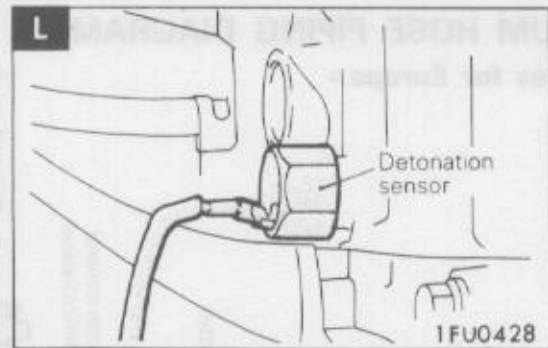
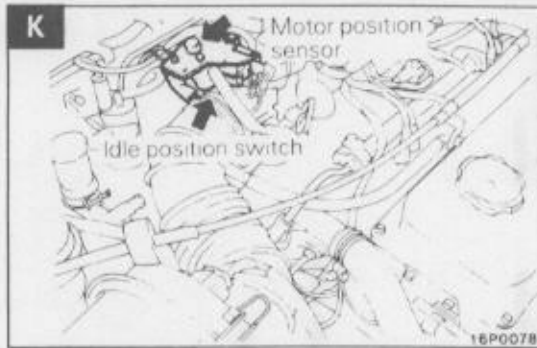
NOTE

Component names are listed in alphabetical order.

*1: Vehicles for Europe

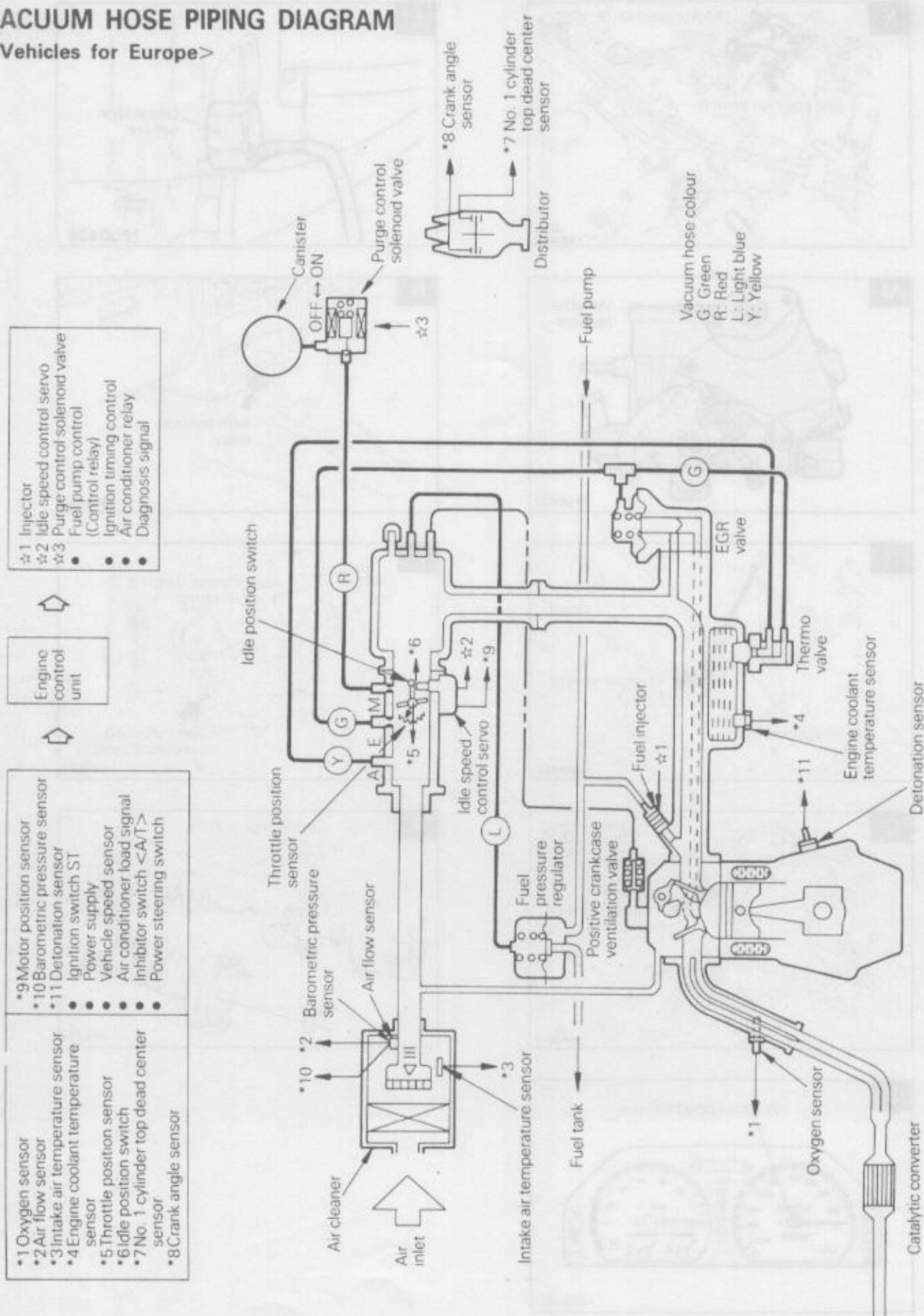
*2: Vehicles for General Export





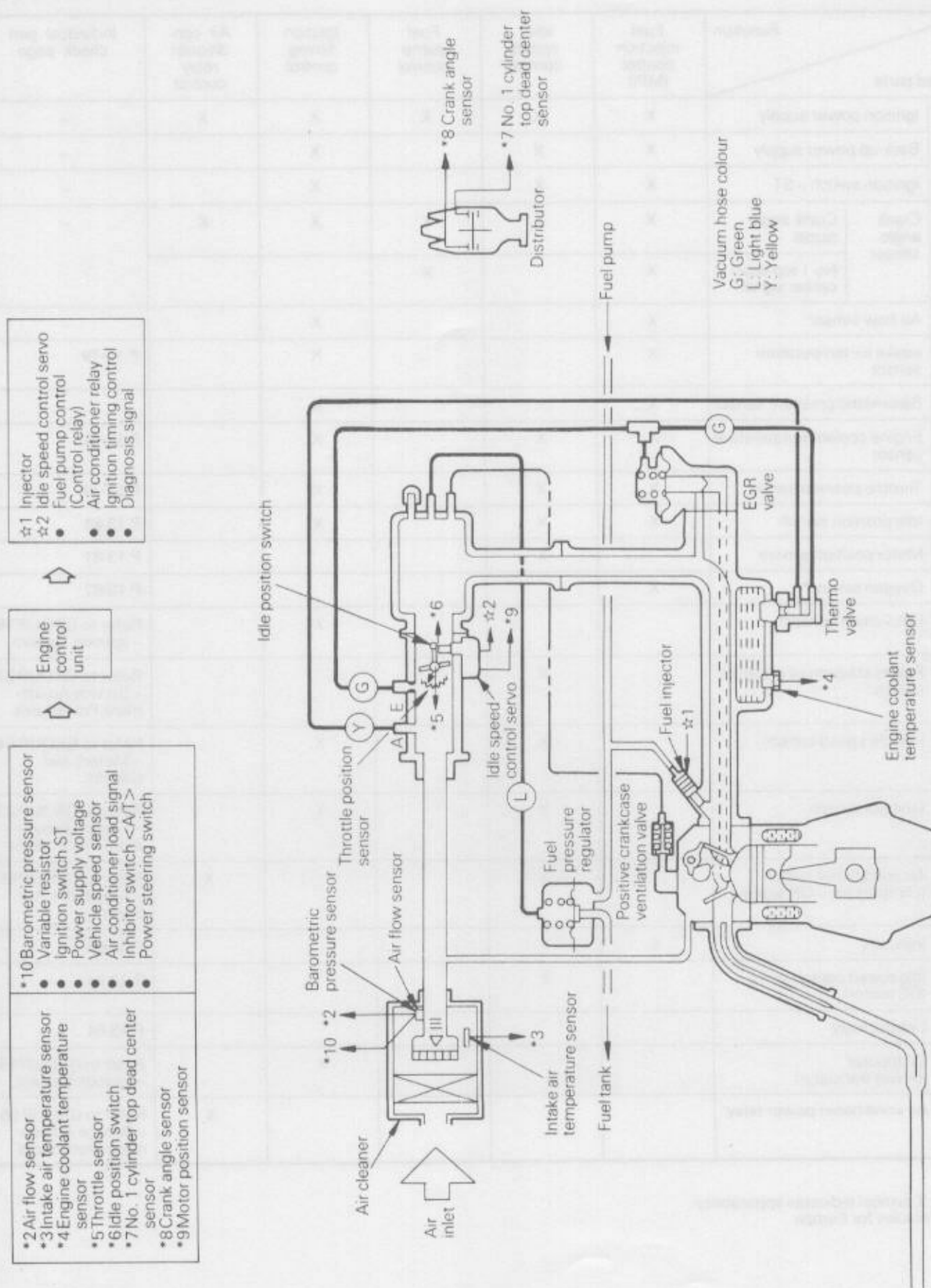
VACUUM HOSE PIPING DIAGRAM

<Vehicles for Europe>



1FU0403

<Vehicles for General Export>



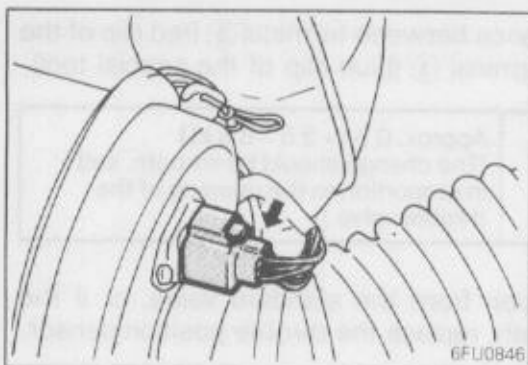
1FU0429

RELATION OF CONTROL FUNCTIONS

Function		Fuel injection control (MPI)	Idle speed control	Fuel pump control	Ignition timing control	Air conditioner relay control	Individual part check page
Related parts							
Sensors and power supply	Ignition power supply	X	X	X	X	X	–
	Back-up power supply	X	X		X		–
	Ignition switch – ST	X	X		X		–
	Crank angle sensor	Crank angle signal	X	X	X	X	–
		No.1 top dead center signal	X	X			
	Air flow sensor		X		X		–
	Intake air temperature sensor		X		X		P.13-79
	Barometric pressure sensor		X		X		–
	Engine coolant temperature sensor		X	X	X		P.13-81
	Throttle position sensor		X	X	X		P.13-79
	Idle position switch		X	X	X		P.13-81
	Motor position sensor			X			P.13-81
	Oxygen sensor*		X				P.13-82
	Detonation sensor*				X		Refer to GROUP 16 – Ignition System.
	Power steering oil pressure switch			X			Refer to GROUP 37 – Service Adjustment Procedures.
	Vehicle speed sensor			X	X		Refer to GROUP 54 – Meters and Gauges.
	Inhibitor switch			X	X		Refer to GROUP 23 – Service Adjustment Procedures.
	Air conditioner switch (compressor – ON signal)			X		X	Refer to GROUP 55 – Air Conditioner Switch.
Actuators	Injectors		X				P.13-82
	Idle speed control servo (DC motor)			X			P.13-84
	Control relay			X			P.13-84
	Distributor (power transistor)				X		Refer to GROUP 16 – Ignition System.
	Air conditioner power relay					X	Refer to GROUP 55 – Service Adjustment Procedures.

NOTE

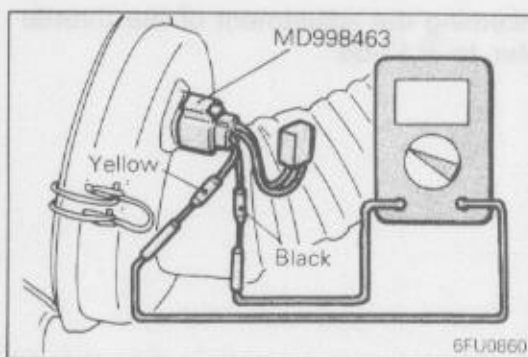
- (1) The X symbol indicates applicability.
 (2) *: Vehicles for Europe



SENSOR AND SWITCH INSPECTION

INTAKE AIR TEMPERATURE SENSOR INSPECTION

- (1) Disconnect the connector of the air flow sensor and connect the special tool (harness connector) where the disconnection was made.

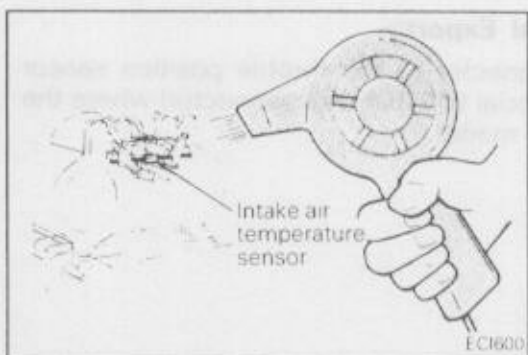


- (2) Measure the resistance between terminal ④ (black clip of the special tool) and terminal ⑥ (yellow clip of the special tool) of the air flow sensor's connector.

Temperature °C (°F)	Resistance kΩ
0 (32)	6.0
20 (68)	2.7
80 (176)	0.4

- (3) Measure the resistance while increasing the temperature of the sensor part (by using a hair dryer).

Temperature °C (°F)	Resistance kΩ
Increases	Decreases

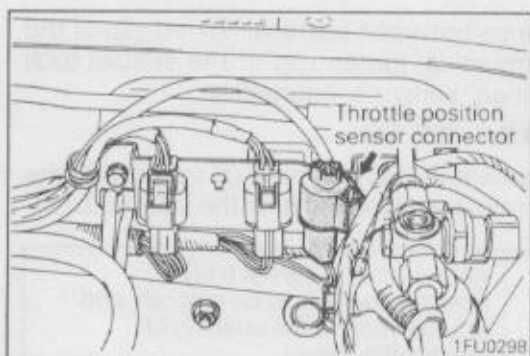


- (4) If there is a deviation from the standard value, or if the resistance does not change, replace the air flow sensor assembly.

THROTTLE POSITION SENSOR INSPECTION

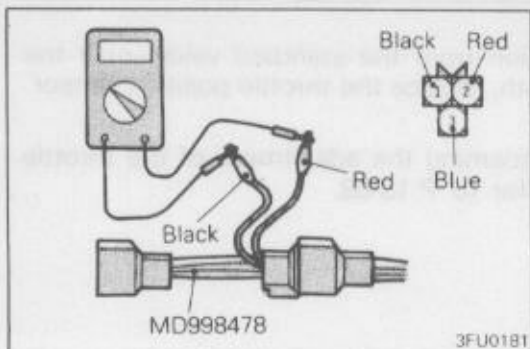
<Vehicles for Europe>

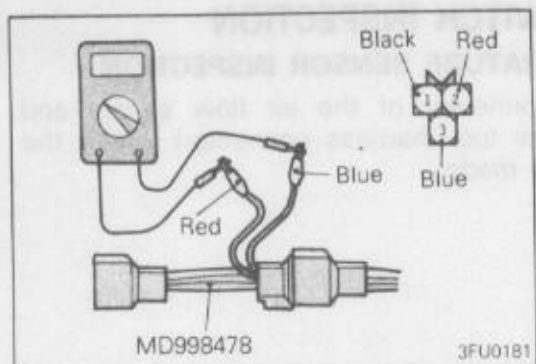
- (1) Disconnect the connector of the throttle position sensor and connect the special tool (harness connector) where the disconnection was made.



- (2) Measure the resistance between terminal ① (black clip of the special tool) and terminal ② (red clip of the special tool) of the throttle position sensor's connector.

Standard value: 3.5 – 6.5 kΩ





- (3) Measure the resistance between terminal ② (red clip of the special tool) and terminal ③ (blue clip of the special tool).

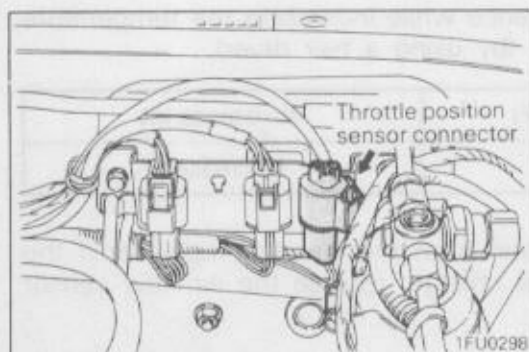
Slowly open the throttle valve (from the idle position to fully open).

Approx. 0.5 → 3.5 – 6.5 k Ω
(The change should be smooth, and in proportion to the opening of the throttle valve.)

- (4) If there is a deviation from the standard value, or if the change is not smooth, replace the throttle position sensor.

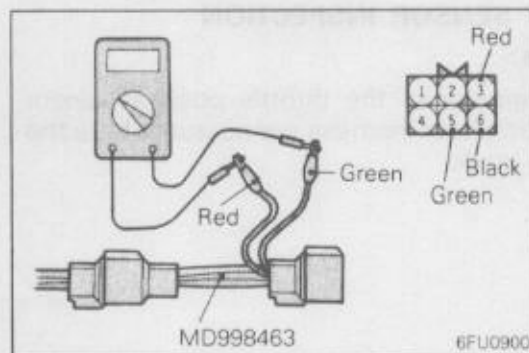
NOTE

For information concerning the adjustment of the throttle position sensor, refer to P.13-68.



<Vehicles for General Export>

- (1) Disconnect the connector of the throttle position sensor and connect the special tool (harness connector) where the disconnection was made.



- (2) Measure the resistance between terminal ③ (red clip of the special tool) and terminal ⑤ (green clip of the special tool) of the throttle position sensor's connector.

Standard value: 3.5 – 6.5 k Ω

- (3) Measure the resistance between terminal ③ (red clip of the special tool) and terminal ⑥ (black clip of the special tool).

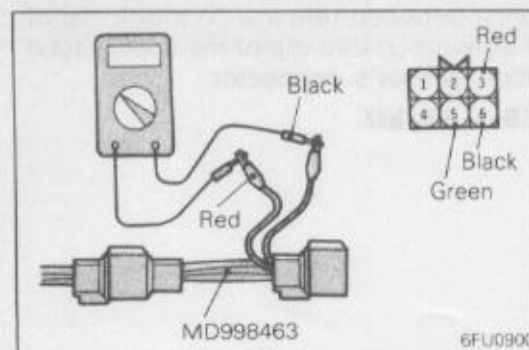
Slowly open the throttle valve (from the idle position to fully open).

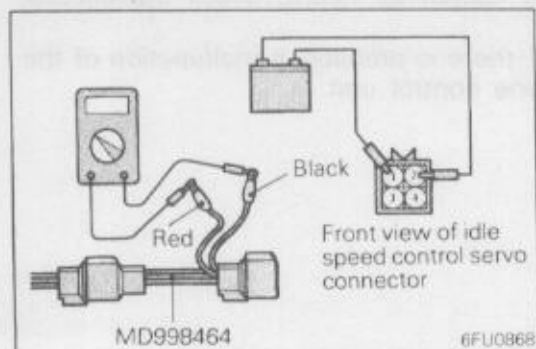
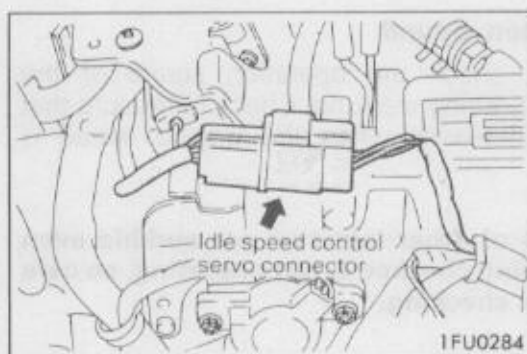
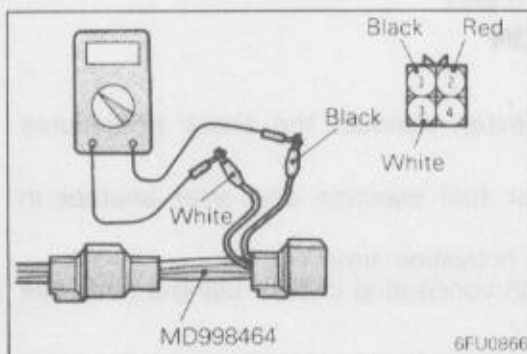
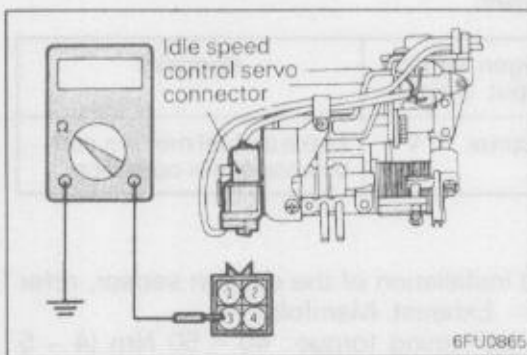
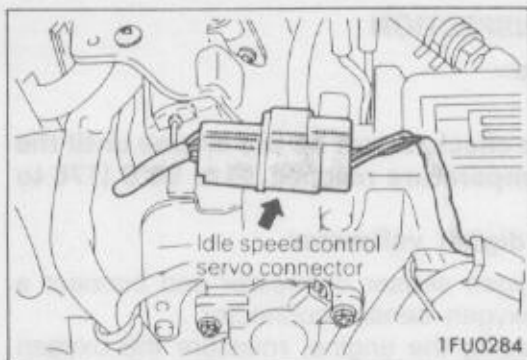
Approx. 0.5 → 3.5 – 6.5 k Ω
(The change should be smooth, and in proportion to the opening of the throttle valve.)

- (4) If there is a deviation from the standard value, or if the change is not smooth, replace the throttle position sensor.

NOTE

For information concerning the adjustment of the throttle position sensor, refer to P.13-68.





IDLE POSITION SWITCH INSPECTION

- (1) Check to be sure that the lever presses the idle position switch with the accelerator pedal in the returned (undepressed) condition.
- (2) Disconnect the connector of the idle speed control servo.
- (3) Check for continuity between the earth and terminal ③ of the connector of the idle position switch.

Accelerator pedal	Continuity
Depressed	No
Released	Yes

- (4) If there is a problem, replace the idle position switch.

MOTOR POSITION SENSOR INSPECTION

- (1) Disconnect the motor position sensor connector.

Caution

The special tool must not be connected to the harness side connector.

- (2) Measure the resistance between terminal ① (black clip of the special tool) of the motor position sensor and terminal ③ (white clip of the special tool).

Standard value: 4 – 6 k Ω

- (3) Disconnect the idle speed control servo connector.
- (4) Connect DC 6V between terminal ① of the idle speed control servo connector and terminal ②, and then measure the resistance between terminal ① (black clip of the special tool) of the motor position sensor connector and terminal ② (red clip of the special tool) when the idle speed control servo is activated (expands and contracts).

Standard value: Within a range of from approximately 0.5 Ω to the resistance value measured in step (2)

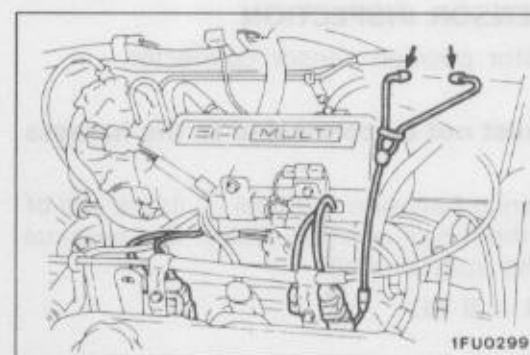
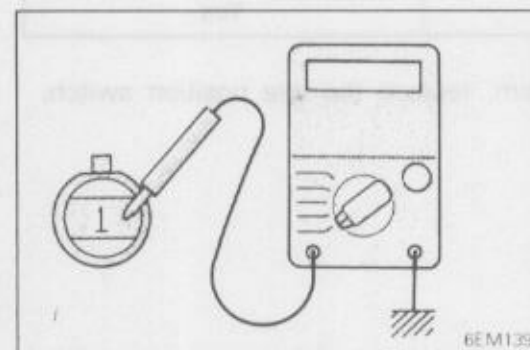
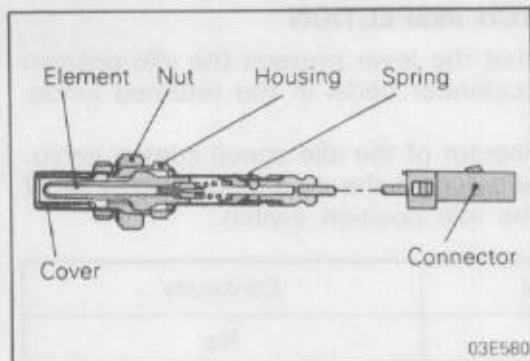
Caution

Apply only a 6V DC or lower voltage. Application of a higher voltage can cause locking of the servo gears.

- (5) If there is a deviation from the standard value range, or the change is not smooth, replace the idle speed control servo assembly.

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Refer to P.13-50.



OXYGEN SENSOR INSPECTION

<Vehicles for Europe>

Caution

1. Before making the check, warm up the engine until the engine coolant temperature reaches 80 to 90°C (176 to 194°F).
2. Use an accurate digital voltmeter.
 - (1) Disconnect the oxygen sensor connector and connect a voltmeter to the oxygen sensor connector.
 - (2) While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Remarks
Race	Approx. 1 V	Make air-fuel mixture rich by accelerator operation

NOTE

1. For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.
2. Oxygen sensor tightening torque: 40 – 50 Nm (4 – 5 kgm, 29 – 36 ft.lbs.)

INJECTOR INSPECTION

Operational Check

Using the multi-use tester, conduct the check procedures described below.

- (1) Cut off the injector fuel injection one after another in sequence.
- (2) Check the injector activation time.
(Refer to the section concerning checks using a multi-use tester.)

Checking the Operation Sound

Using a sound-scope, check the operation sound of the injectors during idling or during cranking. Check to be sure that the operation sound increases when the engine speed is increased.

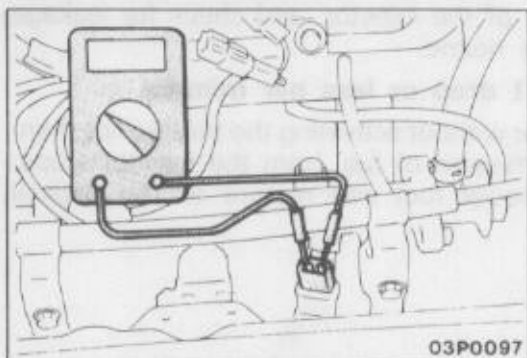
Caution

Note that the sounds of other injectors are audible even though the injector being checked is not operating, so care must be taken when checking.

NOTE

If the operation sound cannot be heard, check the injector activation circuit.

If this circuit is normal, there is probably a malfunction of the injector or of the engine control unit.

**Measurement of Resistance between Terminals**

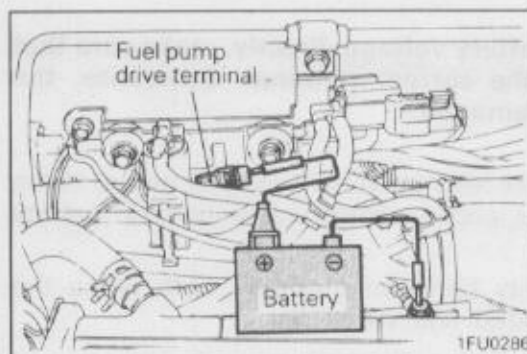
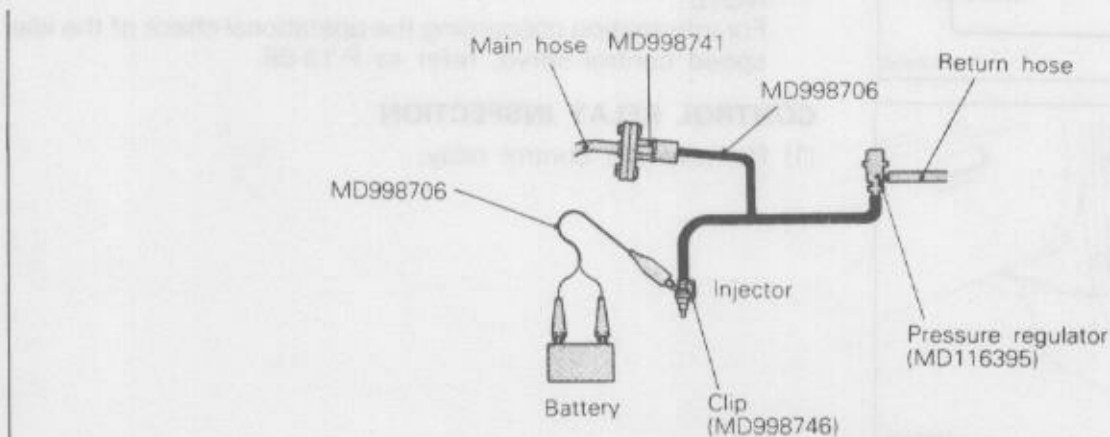
- (1) Disconnect the connector for the injector.
- (2) Measure the resistance between terminals.

Standard value: 13 – 16 Ω at 20°C (68°F)

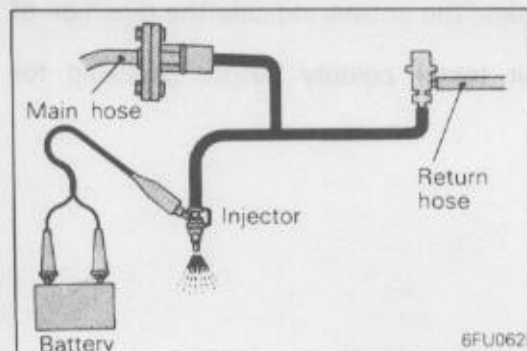
- (3) Connect the connector for the injector.

Checking the Injection Condition

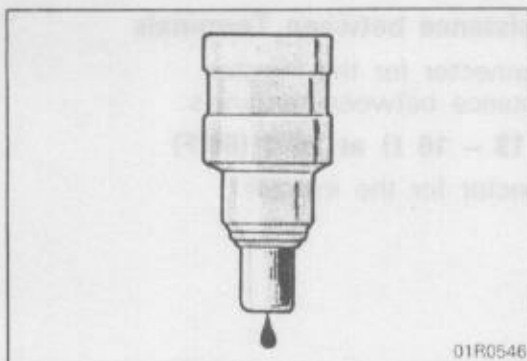
- (1) Following the steps described below, bleed the remaining pressure from within the fuel pipe line in order to prevent fuel from gushing out. (Refer to P.13-56.)
- (2) Remove the injector.
- (3) Arrange and connect the special tool injector test set, adapter, fuel pressure regulator, and clip as shown in the illustration below.



- (4) Connect the battery's negative (-) terminal.
- (5) Apply battery voltage to the fuel pump drive terminal and activate the fuel pump. (Refer to P.13-66.)



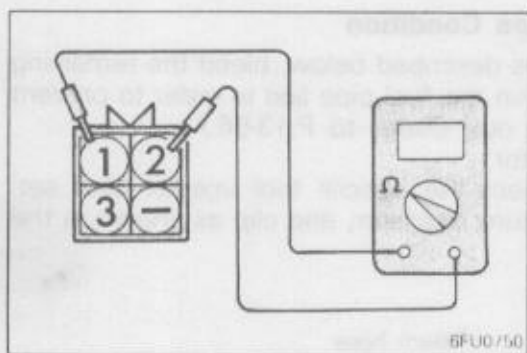
- (6) Activate the injector and check the atomized spray condition of the fuel. The condition can be considered satisfactory unless it is extremely poor.



- (7) Stop the actuation of the injector, and check for leakage from the injector's nozzle.

Standard value: 1 drop or less per minute

- (8) Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore to the original condition.



IDLE SPEED CONTROL SERVO INSPECTION

- (1) Disconnect the idle speed control servo connector.
 (2) Check for continuity between terminal ① and terminal ② of the idle speed control servo connector.

Standard value: 5 – 35 Ω at 20°C (68°F)

- (3) If there is a significant deviation from the standard value, replace the idle speed control servo assembly.

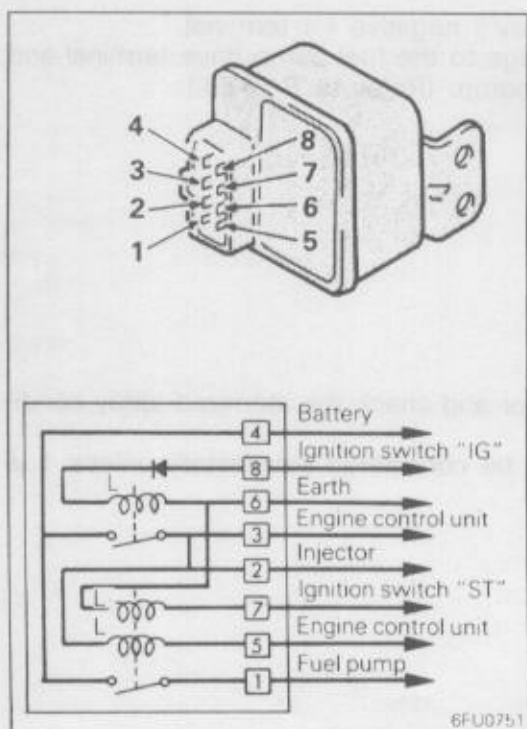
NOTE

For information concerning the operational check of the idle speed control servo, refer to P.13-68.



CONTROL RELAY INSPECTION

- (1) Remove the control relay.



Caution

When applying battery voltage directly, make sure that it is applied to the correct terminal. Otherwise, the relay could be damaged.

NOTE

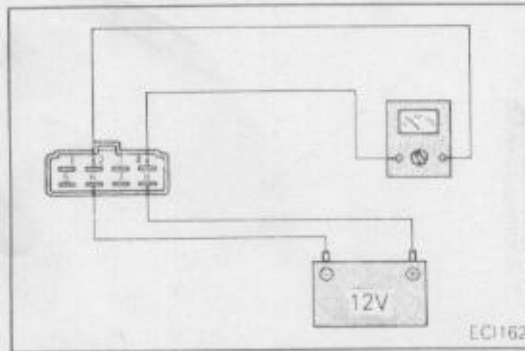
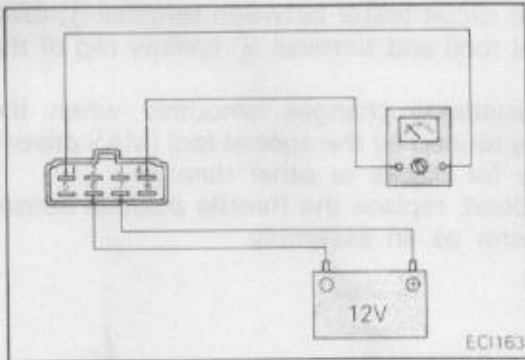
Failure of the control relay prevents supply of power to the fuel pump, injectors, engine control unit resulting in inability to start.

- (2) Check for continuity between terminals both when the relay coil is energized and when not.

NOTE

In the following tables, the arrows indicate the direction of current flow.

Confirm the circuit tester polarity before checking for continuity.



- Coils L_1 and L_2

Condition	Measuring terminals	Continuity
Not energized	① – ④	Non-conductive ($\infty \Omega$)
	③ – ⑤	Conductive (approx. 95 Ω)
	② – ⑤	
	⑥ – ⑦	Conductive (approx. 35 Ω)
Energized	① – ④	Conductive (0 Ω)

NOTE

"Energized" means voltage applied across terminals ⑥ and ⑦.

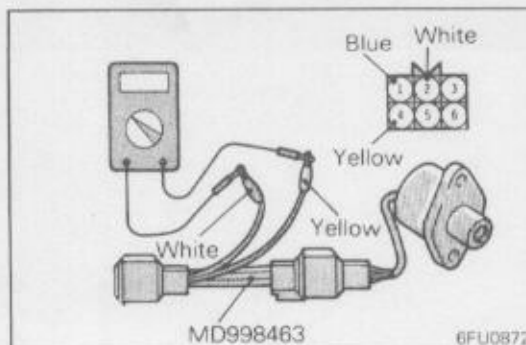
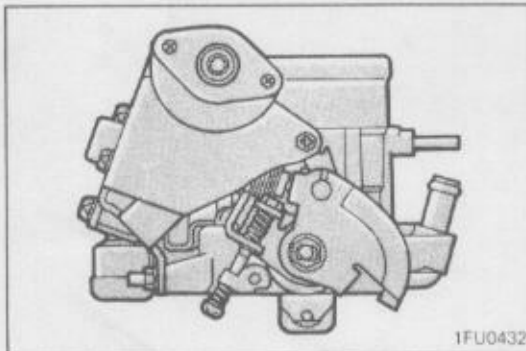
- Coil L_1

Condition	Measuring terminals	Continuity
Not energized	② – ④	Non-conductive ($\infty \Omega$)
	⑥ → ⑧	Non-conductive ($\infty \Omega$)
	⑥ ← ⑧	Conductive (0 Ω)
Energized	② – ④	Conductive (0 Ω)

NOTE

"Energized" means voltage applied across terminals ⑥ and ⑧.

- (3) If the result is not satisfactory, replace the control relay.



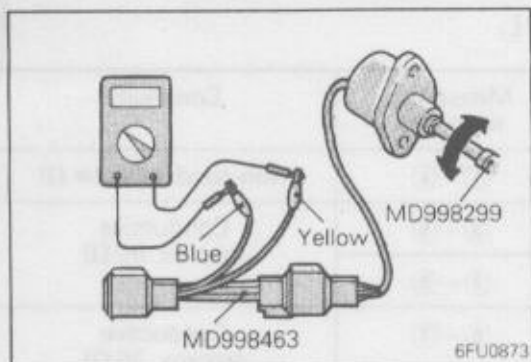
MIXTURE ADJUSTING SCREW (VARIABLE RESISTOR) INSPECTION

<Vehicles for General Export>

- (1) Disconnect the variable resistor connector and connect the special tool (harness connector).

- (2) Use a circuit tester to measure the resistance between terminal ② (white clip of the special tool) and terminal ④ (yellow clip of the special tool) of the throttle position sensor connector.

Standard value: 4 – 6 k Ω



- (3) Next, connect the circuit tester between terminal ① (blue clip of the special tool) and terminal ④ (yellow clip of the special tool).
- (4) Check if the resistance changes smoothly when the adjusting screw is rotated by the special tool (MAS driver).
- (5) Inspect the body for cracks or other damage.
- (6) If any defect is found, replace the throttle position sensor and variable resistor as an assembly.

HARNESS INSPECTION

1 Harness side connector

Engine control unit harness side connector

Check for an open-circuit, or a short-circuit to earth between the engine control unit and the oxygen sensor.

- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → **STOP**

✗ → Repair the harness.

(A) 1	4
(B) 1	4
(C) 1	4

1FU0756

2 (B) Harness side connector

(C) Harness side connector

Check for continuity of the earth circuit.

- Connector: Disconnected

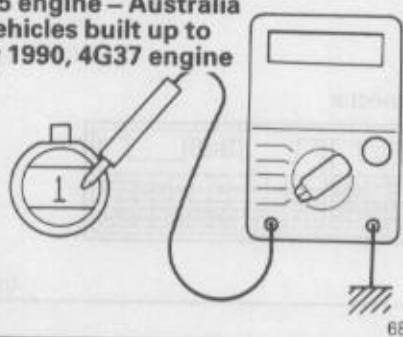
OK → **STOP**

✗ → Repair the harness.

(B) 2	Earth
(C) 2	Earth

1FU0757

4G15 engine – Australia
– Vehicles built up to
May 1990, 4G37 engine



SENSOR INSPECTION

- (1) Warm the engine and check to be sure that the engine coolant temperature is 80 – 95°C (176 – 203°F).
- (2) Disconnect the oxygen sensor connector and connect a digital voltmeter.

Caution

When disconnecting the oxygen sensor connector, do not pull the connector or lead wire too strongly.

- (2) Race the engine repeatedly and measure the oxygen sensor output voltage.

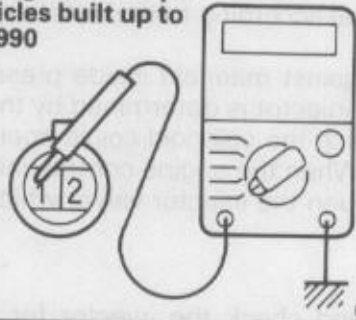
Engine	Sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	When the air/fuel mixture ratio is enriched by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

- (4) If the sensor is defective, replace the oxygen sensor.

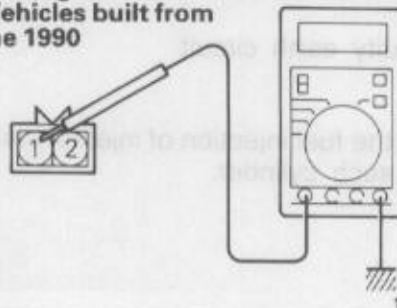
NOTE

For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.

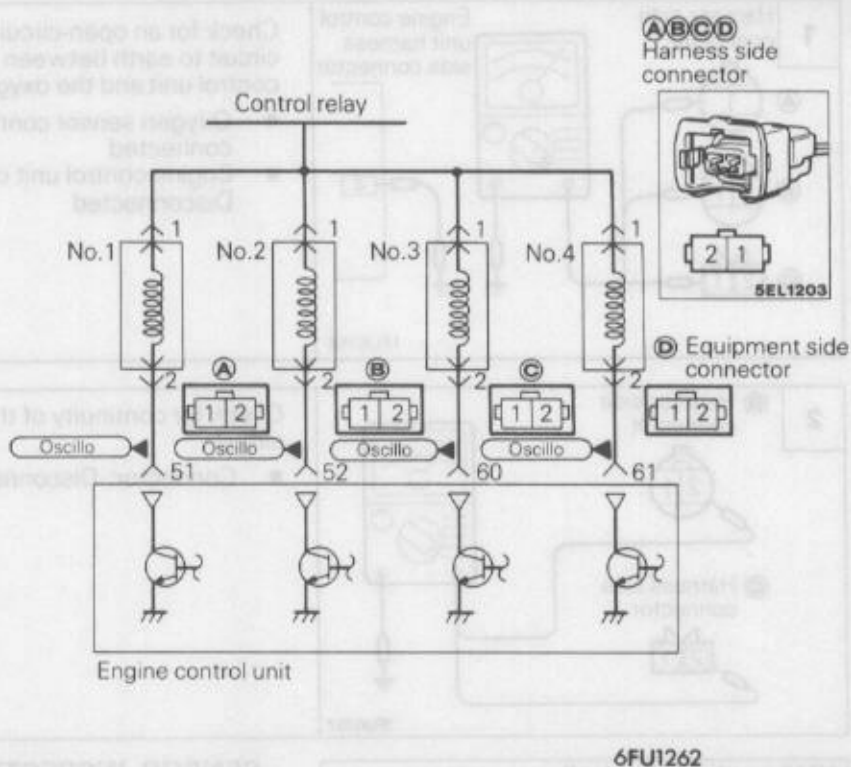
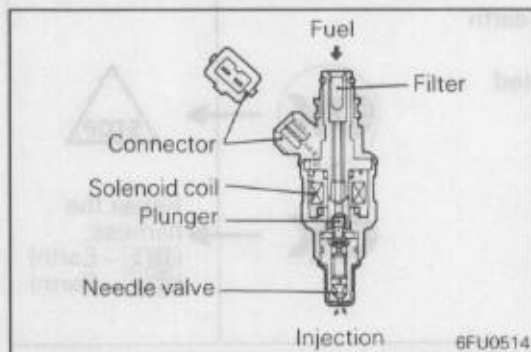
4G15 engine – Europe
– Vehicles built up to
May 1990



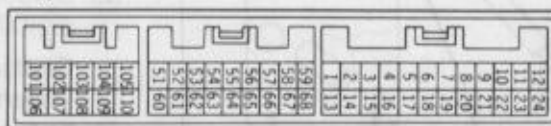
4G15 engine
– Vehicles built from
June 1990



INJECTORS



Engine control unit connector



01L0838

OPERATION

- The injector is an injection nozzle with a solenoid valve which injects fuel according to the injection signal coming from the engine control unit.
- The injector has a fixed nozzle opening area and the fuel pressure against manifold inside pressure is regulated to a fixed level. Therefore, the volume of fuel injected by the injector is determined by the time during which the needle valve is open, namely, by the time during which the solenoid coil is energized.
- The battery voltage is applied through the control relay to this injector. When the engine control unit turns ON the power transistor in the unit, the solenoid coil is energized to open the injector valve, which then injects fuel.

TROUBLESHOOTING HINTS

- Hint 1: If the engine is hard to start when hot, check fuel pressure and check the injector for leaks.
- Hint 2: If the injector does not when the engine that is hard to start is cranked, the following as well as the injector itself may be responsible.
- (1) Faulty power supply circuit to the engine control unit, faulty earth circuit
 - (2) Faulty control relay
 - (3) Faulty crank angle sensor, top dead centre sensor
- Hint 3: If there is any cylinder whose idle state remains unchanged when the fuel injection of injectors is cut one after another during idling, make following checks about such cylinder.
- (1) Injector and harness check
 - (2) Ignition plug and high tension cable check
 - (3) Compression pressure check

SERVICE ADJUSTMENT PROCEDURES <MPI-DOHC – Vehicles built up to May 1992>

E13FCAK

GENERAL INSPECTION

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

Refer to P.13-56.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

E13HAB8

Refer to P.13-56.

FUEL FILTER REPLACEMENT

E13FZAG

Refer to P.13-57.

TROUBLESHOOTING

EXPLANATION OF TROUBLESHOOTING PROCEDURES

Refer to P.13-58.

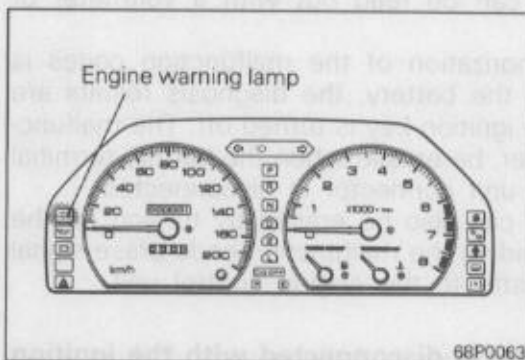
ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Among the self-diagnosis items, a malfunction indicator lamp comes on to notify the driver of the emission control items when an irregularity is detected.

However, when an irregular signal returns to normal and the engine control unit judges that it has returned to normal, the malfunction indicator lamp goes out.

Moreover, when the ignition switch is turned off, the lamp goes out. Even if the ignition switch is turned on again, the lamp does not come on until the irregularity is detected.

Here, immediately after the ignition switch is turned on, the malfunction indicator lamp is lit for 5 seconds to indicate that the malfunction indicator lamp operates normally.



ITEMS INDICATED BY THE MALFUNCTION INDICATOR LAMP

Engine control unit	Top dead centre sensor (No. 1 and No. 4 cylinder top dead centre)
Oxygen sensor* ¹ (Vehicles built from September 1988)	Barometric pressure sensor
Air flow sensor	Detonation sensor* ²
Intake air temperature sensor	Injector
Throttle position sensor	Ignition coil
Coolant temperature sensor	Fuel pump
Crank angle sensor	Ignition timing adjustment signal* ³

NOTE

*1: Vehicles with catalytic converter

*2: Vehicles for Europe

*3: Vehicles built from June 1990 for General Export

Caution

The malfunction indicator light also comes on when the ignition timing adjustment terminal is shorted. Therefore, there is no abnormality even if the light comes on after shorting of ignition timing adjustment terminal during adjustment of ignition timing.

MALFUNCTION INDICATOR LAMP INSPECTION

- (1) Check that when the ignition switch is turned on, the lamp illuminates for about 5 seconds and then goes out.
- (2) If the lamp does not illuminate, check for open circuit in harness, blown fuse and blown bulb.

SELF-DIAGNOSIS

The engine control unit monitors the input/output signals (some signals at all times and the others under specified conditions) of the engine control unit.

When it is noticed that an irregularity has continued for a specified time or longer from when the irregular signal is initially monitored, passing a certain number, the engine control unit judges that an irregularity has occurred, memorizes the malfunction code, and outputs the signal to the self-diagnosis output terminal.

There are 16 diagnosis items, including the normal state, and the diagnosis results can be read out with a voltmeter or multi-use tester.

Moreover, since memorization of the malfunction codes is backed up directly by the battery, the diagnosis results are memorized even if the ignition key is turned off. The malfunction codes will, however, be erased when the battery terminal or the engine control unit connector is disconnected.

The malfunction code can also be erased by turning on the ignition switch and sending the malfunction code erase signal from the multi-use tester to the engine control unit.

Caution

If the sensor connector is disconnected with the ignition switch turned on, the malfunction code is memorized. In this case, send the malfunction code erase signal from the multi-use tester to the engine control unit or disconnect the battery terminal (–) for 10 seconds or more, and the diagnosis memory will be erased.

The 16 diagnosis items are provided as follows, and if plural items are activated, they are all indicated sequentially from the smallest code number.

Caution

The ignition timing adjustment signal malfunction code appears when the ignition timing adjustment terminal line is grounded or shorted.

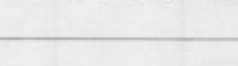
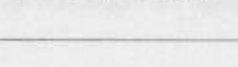
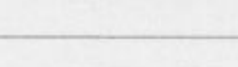
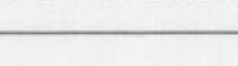
Therefore, this malfunction code is also displayed when the ignition timing adjustment terminal is grounded during ignition timing adjustment but this does not indicate any abnormality.

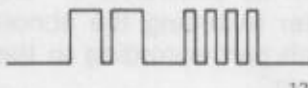
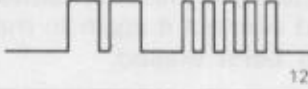
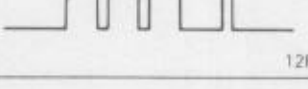
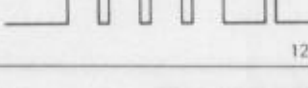
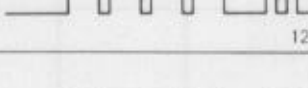
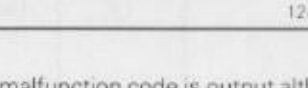


<Using a Voltmeter>

- (1) Connect an analogue voltmeter to the self-diagnosis connector.
- (2) Turn ignition switch to ON, and indication of engine control unit memory contents will immediately start. If the system is in normal condition, the pointer of the voltmeter indicates a normal pattern. If any abnormality is in the memory, the pointer of the voltmeter will deflect, indicating an abnormal item as described in "Diagnosis Chart". After recording the abnormal item, check and repair the each part according to the check items in the "Diagnosis Chart".
- (3) If the defective parts have been repaired, disconnect the negative terminal of battery cable for 10 seconds or more and connect it again to make sure that the abnormal code has been erased.

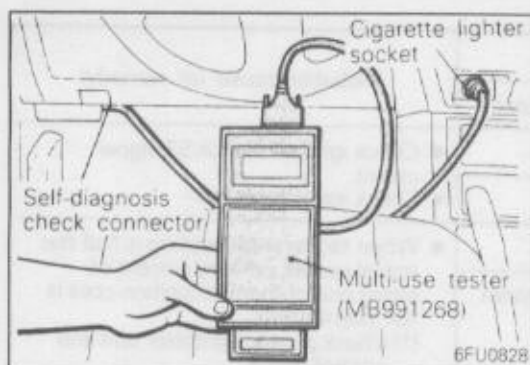
Diagnosis Chart

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
1	Engine control unit	H  L  12A0104	—	—	(Replace engine control unit)
2	Air flow sensor	H  L  12A0104	12	Retained	• Harness and connector (If harness and connector are normal, replace air flow sensor assembly)
3	Intake air temperature sensor	H  L  12A0104	13	Retained	• Harness and connector • Intake air temperature sensor
4	Throttle position sensor	H  L  12A0104	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch
5	Engine coolant temperature sensor	H  L  12A0107	21	Retained	• Harness and connector • Engine coolant temperature sensor
6	Crank angle sensor	H  L  12A0107	22	Retained	• Harness and connector (If harness and connector are normal, replace crank angle sensor assembly)

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
7	Top dead center sensor (No. 1 and No. 4 cylinder sensor)	H  L 12A0107	23	Retained	• Harness and connector (If harness and connector are normal, replace crank angle sensor assembly.)
8	Vehicle speed sensor (reed switch)	H  L 12A0107	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
9	Barometric pressure sensor	H  L 12A0107	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly.)
10	Detonation sensor*	H  L 12R0468	31	Retained	• Harness and connector • Detonation sensor
11	Injector	H  L 12A0105	41	Retained	• Harness and connector • Injector coil resistance
12	Fuel pump	H  L 12A0105	42	Retained	• Harness and connector • Control relay
13	Ignition coil	H  L 12A0105	44	Retained	• Harness and connector • Ignition coil • Power transistor
14	Normal state	H  L 12A0104	—	—	—

NOTE

1. Replace the engine control unit if a malfunction code is output although the inspection reveals that there is no problem with the check items.
2. *: Vehicles for Europe

**CHECKING BY USING THE MULTI-USE TESTER**

- (1) Switch OFF the ignition switch.
- (2) Connect the tester side connector of the multi-use tester to the connector for diagnosis (located beside the fuse box).
- (3) Connect the power supply terminal of the multi-use tester to the cigarette lighter socket.
- (4) Switch ON the ignition switch.
- (5) Use the multi-use tester to make the various checks, and repair if a problem is found.

NOTE

If the engine warning lamp (malfunction indicator lamp) illuminates while the checks are being made, check the self-diagnosis output.

- (6) After repair, check once again to be sure the problem has been corrected.
- (7) Switch OFF the ignition switch.
- (8) Disconnect the multi-use tester.
- (9) Disconnect the battery terminals for ten seconds or longer. This erases the self-diagnosis code.
- (10) Restart the engine. Check (by a driving test and other means) to be sure that the problem has been corrected.

Checking the Cranking (Check when the engine can't be started or when it is started.)

Check item	Description		Probable cause (or remedy)
	Check condition	Normal value	
Power supply voltage • Data reading • Item No. (16)	• Ignition switch: ON	11 – 13V	• Low battery voltage • No power supply to engine control unit (1) Check power supply circuit. (2) Check ignition switch and IG signal input circuit. (3) Check control relay. (4) Check control relay control circuit. • Defective engine control unit earth circuit
Throttle position sensor • Data reading • Item No. (14)	• Ignition switch: ON • Throttle valve: idle position (When throttle position sensor output voltage is less than 700 mV, engine control unit diagnoses the injector signal.)	400 – 600 mV	• Throttle position sensor out of adjustment • Defective throttle position sensor or related circuit
Self-diagnosis output	• Crank the engine for more than 4 secs. • Ignition switch: ON (Check injector, crank angle sensor, etc. for open circuit.)	Normal	• Perform checks associated with diagnosis code. (Note that if engine control unit backup power supply circuit has an open circuit, the diagnosis code is cleared.) • Output of various types of diagnosis code is often due to an open circuit in the power supply or ground circuit.
Fuel pump • Actuator test • Item No. (7)	Check the fuel pump under both the following conditions: • Engine cranking • Forced activation of fuel pump	Hold return hose between fingers Fuel flow pulsations felt by fingers Listen close to the fuel tank Pump operation sound heard	• No power supply to fuel pump (1) Check ignition switch (IG, ST). (2) Check control relay. (3) Check related circuits. • Defective fuel pump

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Ignition switch ST circuit ● Data reading ● Item No. (18)	● Ignition switch: ON	Engine stopped	OFF	● Check ignition switch ST signal circuit. ● Check ignition switch.
		Cranking	ON	
Crank angle sensor ● Data reading ● Item No. (22)	● Engine cranking ● Tachometer connected (to check intermittent flow of ignition coil primary current)	Cranking speed	Speed	● When tachometer reading is half the actual speed, primary current of either one of the two ignition coils is not intermittent. (1) Check power transistor unit and control circuit. (2) Check ignition coil and coil power supply circuit. ● When speed indicated by the multi-use tester is abnormal: (1) Crank angle sensor circuit defective (2) Crank angle sensor defective (3) Timing belt defective
		Approx. 200 r/min.	Approx. 200 r/min.	
Injector ● Data reading ● Item No. (41)	● Engine cranking	Listen to operating sound	Injector operating sound heard	● Defective injector ● Connector and control relay in loose contact ● Defective engine coolant temperature sensor ● Ignition switch ST circuit defective [Injector operation time shown is when battery voltage is 11V and cranking speed 250 r/min. or less. When engine coolant temperature is 0°C (32°F), the injectors are injecting fuel into the four cylinders simultaneously.]
		Engine coolant temperature	Operation time	
		0°C (32°F)	Approx. 17 ms	
		20°C (68°F)	Approx. 28 ms	
		80°C (176°F)	Approx. 6 ms	

Checking the Sensors

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Self-diagnosis output	● Engine: Operated at idle (Allow more than two minutes after starting engine.)		Normal	● Perform checks associated with diagnosis code. (Note that if engine control unit back-up power supply circuit has an open circuit, the diagnosis code is cleared.) ● Output of various types of diagnosis code is often due to an open circuit in power supply or ground circuit.
Oxygen sensor*1 ● Data reading ● Item No. (11)	● Engine: Warmd up (Make the mixture lean by deceleration and make it rich by racing.)	Engine state	Voltage	● If oxygen sensor output is too high when engine is suddenly decelerated: (1) Check injector leakage. (2) Check oxygen sensor signal circuit. ● If oxygen sensor output voltage is too low when engine is raced: (1) Check oxygen sensor and signal circuit. (2) Check oxygen sensor heater and heater circuit.
		When suddenly decelerated from 4,000 r/min.	200 mV or less	
		When suddenly raced	600 – 1,000 mV	
	● Engine: Warmd up (Check air-fuel ratio by use of oxygen sensor signal. In addition, check control by engine control unit.)	Engine speed	Voltage	● If oxygen sensor signal is good, engine control unit is properly controlling air-fuel ratio. ● If oxygen sensor output is always low, check for air that may be drawn in. ● If oxygen sensor output voltage is always high, check injector for leakage.
		850 r/min. (idle)	Variable between 400 mV or less and 600 – 1,000 mV	
		2,000 r/min.		

NOTE

*1: Vehicles with catalytic converter for Europe

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Air flow sensor • Data reading • Item No. (12)	• Engine: Warmed up	Engine state	Frequency	• If a sudden, large change occurs in air flow sensor output frequency, loose contact of air flow sensor or connector is suspected. • When air flow sensor output frequency is abnormally high or low, check the air cleaner element. • When air flow sensor output frequency is too high, increased engine resistance or leakage of compression pressure is suspected.
		850 r/min. (idle)	30 – 45 Hz	
		2,000 r/min.	65 – 85 Hz	
		Racing	Increased according to higher racing speed	
Intake air temperature sensor • Data reading • Item No. (13)	• Ignition switch: ON or engine in operation	Intake air temperature	Temperature	• Defective intake air temperature sensor or related circuits
		–20°C (–4°F)	–20°C (–4°F)	
		0°C (32°F)	0°C (32°F)	
		20°C (68°F)	20°C (68°F)	
		40°C (104°F)	40°C (104°F)	
		80°C (176°F)	80°C (176°F)	
	• Ignition switch: ON	Heat with hair drier, or the like.	Rise.	
Throttle position sensor • Data reading • Item No. (14)	• Ignition switch: ON	Throttle valve	Voltage	• Throttle position sensor out of adjustment • Defective throttle position sensor or related circuit • If there are signs that the setting of idle position switch (factory-set speed adjusting screw) has been disturbed, adjust idle position switch (factory-set speed adjusting screw).
		Idle position	480 – 520 mV	
		Open slowly.	Increased in proportion to degree of valve opening	
		Fully open	4,500 – 5,500 mV	
Variable resistor** • Data reading • Item No. (17)	• Ignition switch: ON		1 – 4V	• Defective circuit • Defective variable resistor
Ignition switch ST circuit • Data reading • Item No. (18)	• Ignition switch: ON		OFF	• Check ignition switch ST signal circuit. • Check ignition switch.
Engine coolant temperature sensor • Data reading • Item No. (21)	• Ignition switch: ON or engine in operation	Engine coolant temperature	Temperature	• Defective engine coolant temperature sensor or related circuit
		–20°C (–4°F)	–20°C (–4°F)	
		0°C (32°F)	0°C (32°F)	
		20°C (68°F)	20°C (68°F)	
		40°C (104°F)	40°C (104°F)	
		80°C (176°F)	80°C (176°F)	

NOTE

*2: All vehicles with catalytic converter

Check item	Description			Probable cause (or remedy)
	Check condition	Normal value		
Crank angle sensor ● Data reading ● Item No. (22)	● Engine: Idle operation (Check with idle position switch in closed state.)	Engine coolant temperature	Idle speed	● If a sudden, large change in speed occurs, defective crank angle sensor or loose contact of connector is suspected. ● If speed is low with engine cold, clogged fast idle air valve is suspected.
		-20°C (-4°F)	1,500 – 1,700 r/min.	
		0°C (32°F)	1,350 – 1,550 r/min.	
		20°C (68°F)	1,150 – 1,350 r/min.	
		40°C (104°F)	950 – 1,150 r/min.	
		80°C (176°F)	750 – 950 r/min.	
Barometric pressure sensor ● Data reading ● Item No. (25)	● Ignition switch: ON	Altitude	Pressure	● Defective barometric pressure sensor or related circuits (When barometric sensor pressure is low during high speed operation, clogged air cleaner element is suspected.)
		0 m (0 ft.)	760 mmHg	
		600 m (1,969 ft.)	710 mmHg	
		1,200 m (3,937 ft.)	660 mmHg	
		1,800 m (5,906 ft.)	610 mmHg	
	● Engine: Race at 2,000 r/min.	Slowly block intake duct with hand.	Falls.	
Idle position switch ● Data reading ● Item No. (26)	● Ignition switch: ON (Check by depressing accelerator pedal repeatedly)	Throttle valve in idle position	ON	● Defective idle position switch or related circuits
		Throttle valve slightly opened	OFF	
Power steering oil pressure switch ● Data reading ● Item No. (27)	● Engine: Let it run at idle	Steering wheel in neutral position (wheels in straight ahead position)	OFF	● Defective power steering oil pressure switch or signal circuit
		Steering wheel turned 180°	ON	
Air conditioner switch ● Data reading ● Item No. (28)	● Engine: Let it run at idle. (When air conditioner switch is ON, air compressor must be driven.)	Air conditioner switch OFF	OFF	● Check air conditioner system.
		Air conditioner switch ON	ON	

Checking the Actuators

Check item	Description			Probable cause (or remedy)
	Check condition		Normal value	
Injectors ● Actuator test ● Item No. (1 – 4)	● Engine: Let it run at idle after warm-up. (Cut off injectors in succession and take note of the cylinder(s) in which no idle condition change occurs.)	Injector No.	Engine	● If a cylinder has had its injector cut off but does not alter the idling condition of the engine, check that cylinder. (1) Check injector operating sound. (2) Check ignition plug and high tension cable. (3) Check power transistor and control circuit. (4) Check injecting condition.
		1	Great change in idling condition occurs. (Idling condition becomes more unstable or engine stalls.)	
		2		
		3		
		4		

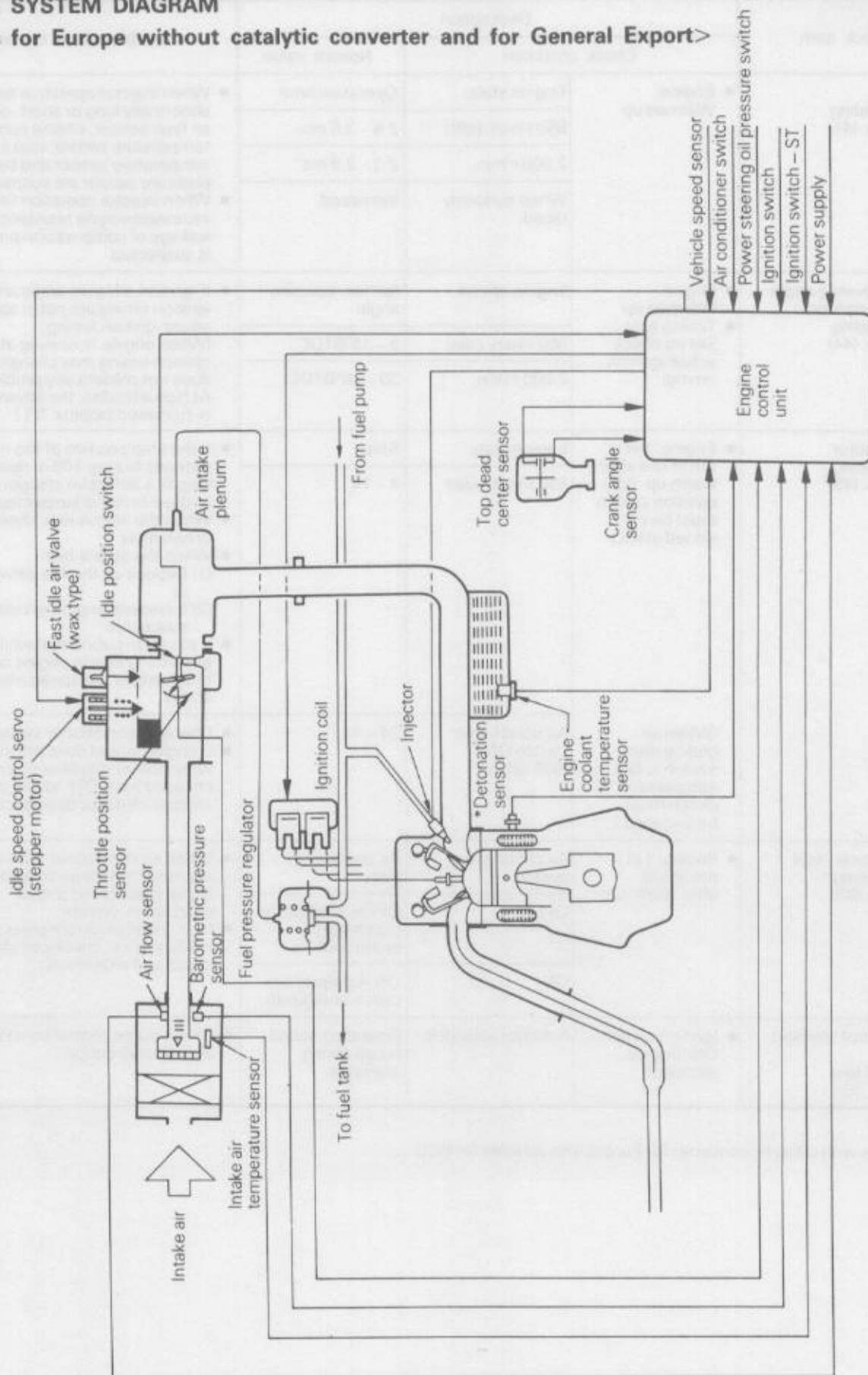
Check item	Description			Probable cause (or remedy)
	Check condition	Normal value		
Injectors ● Data reading ● Item No. (41)	● Engine: Warmed up	Engine state	Operation time	● When injector operation time is abnormally long or short, defective air flow sensor, engine coolant temperature sensor, intake air temperature sensor and barometric pressure sensor are suspected. ● When injector operation time is long, increased engine resistance or leakage of compression pressure is suspected.
		850 r/min. (idle)	2.8 – 3.5 ms	
		2,000 r/min.	2.3 – 2.9 ms	
		When suddenly raced	Increased	
Ignition advance angle (Power transistor) ● Data reading ● Item No. (44)	● Engine: Warmed up ● Timing light: Set (to check actual ignition timing)	Engine speed	Ignition advance angle	● If ignition advance angle and actual ignition timing are not in agreement, adjust ignition timing. [When engine is running at idle, ignition timing may change but it does not present any problem. At high altitudes, the advance angle is increased (approx. 5°).]
		850 r/min. (idle)	5 – 15°BTDC	
		2,000 r/min.	30 – 38°BTDC	
Stepper motor ● Data reading ● Item No. (45)	● Engine: Let it run at idle after warm-up. (Idle position switch must be in closed state.)	Engine state	Step	● If the step position of the motor ascends to step 100 or descends to step 0, a defective stepper motor or drive circuit is suspected. ● When the step is low, check for drawn-in air. ● When the step is high, (1) Deposit on throttle valve area, or (2) Increased engine resistance is suspected. ● If the step is abnormal while everything else in engine is in order, adjust the speed adjusting screw.
		850 r/min. (idle)	4 – 14	
	(When air conditioner switch is ON, compressor clutch must be engaged.)	Air conditioner switch ON (850 r/min.)	24 – 44	● Check air conditioner system. ● If engine speed does not increase when the air conditioner switch is changed from OFF to ON, check the stepper motor or drive circuit.
	Air conditioner relay ● Data reading ● Item No. (49)	● Engine: Let it run at idle after warm-up.	Air conditioner switch	Air conditioner relay
OFF			OFF (Compressor clutch not energized)	
ON			ON (Compressor clutch energized)	
Purge control solenoid valve** ● Actuator test ● Item No. (8)	● Ignition switch: ON (Engine stopped)	Actuator activated	Operating sound heard during activation	● Check purge control solenoid valve and its drive circuit.

NOTE

*3: Vehicles with catalytic converter for Europe and vehicles for GCC.

CONTROL SYSTEM DIAGRAM

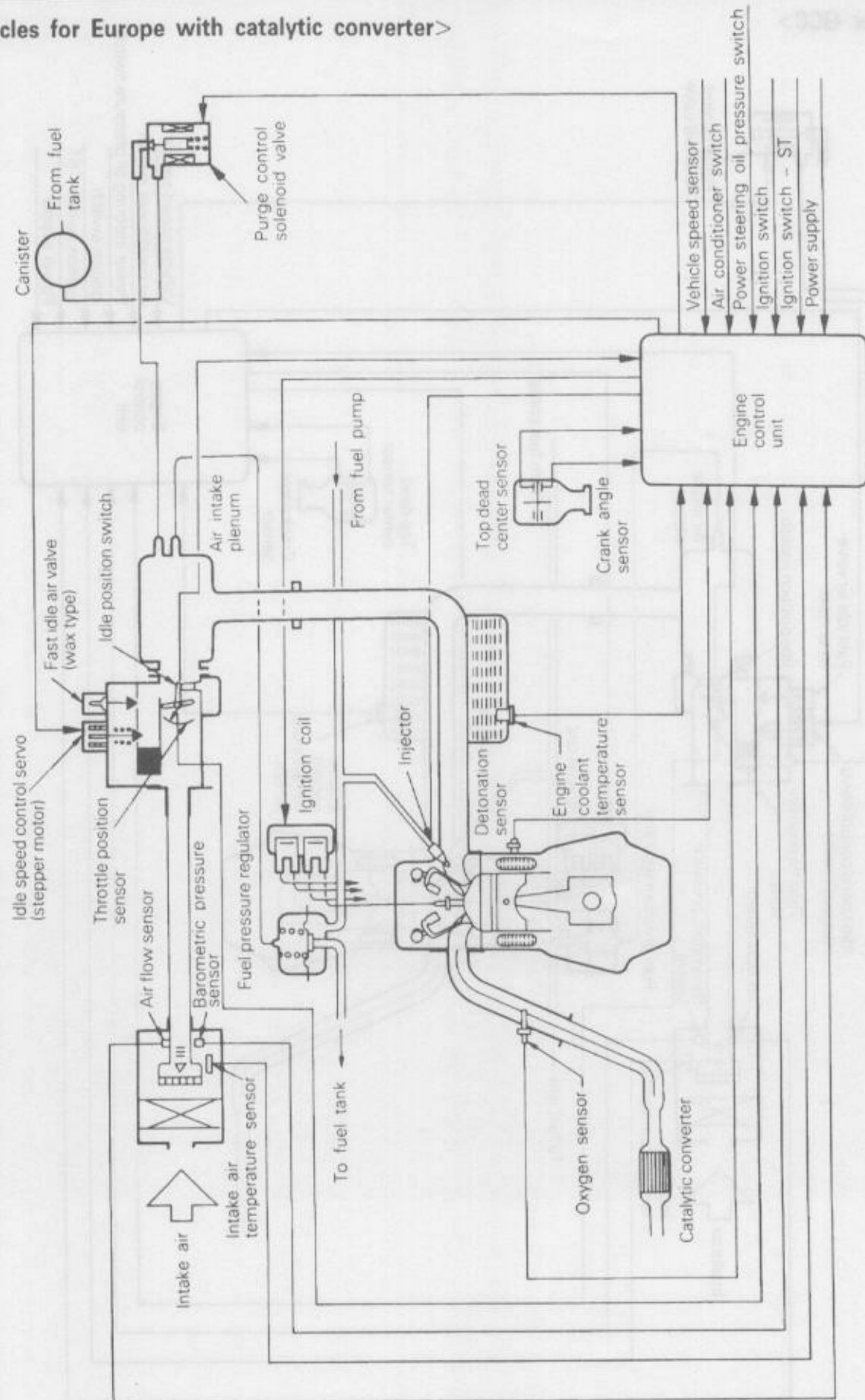
<Vehicles for Europe without catalytic converter and for General Export>



6FU0874

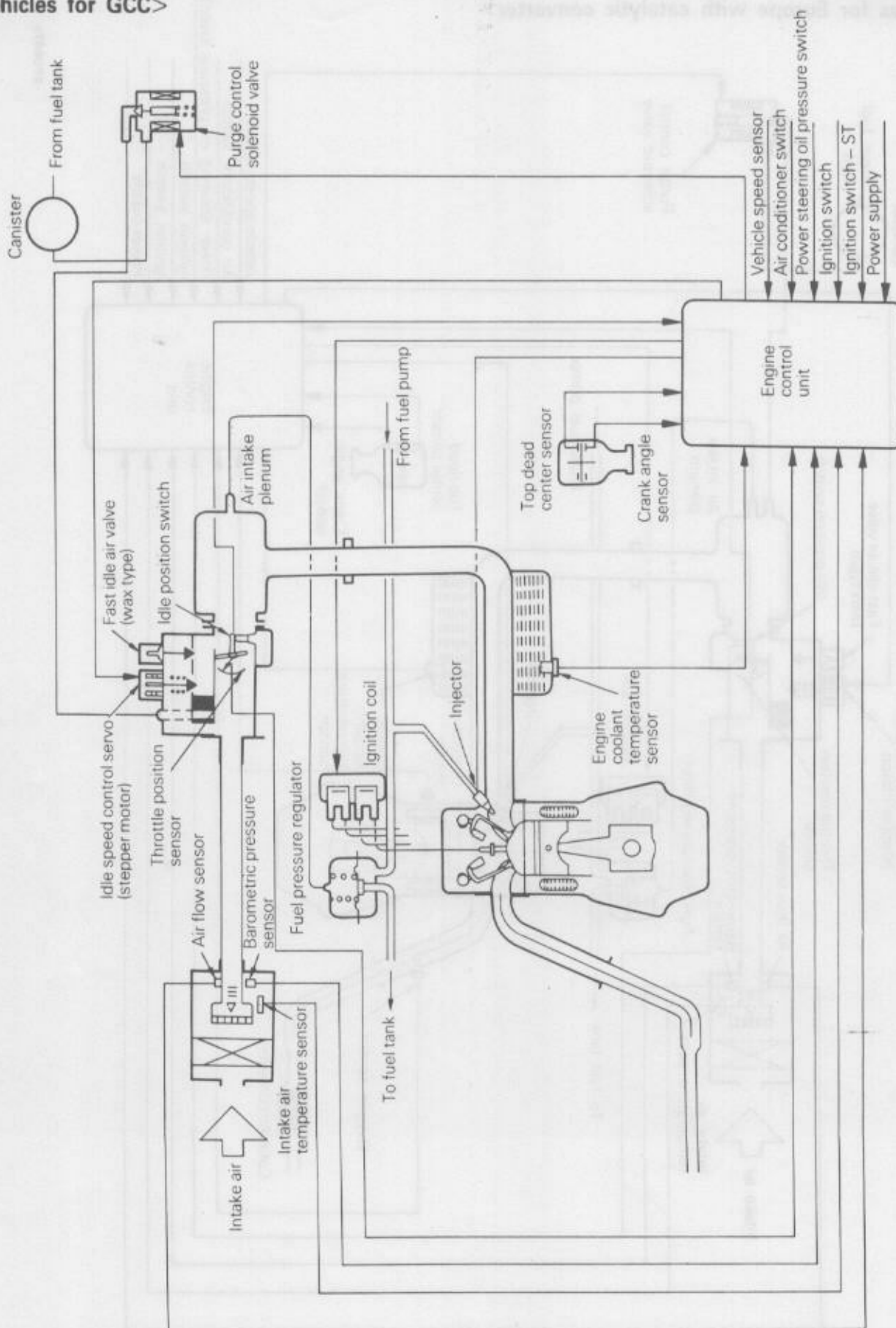
NOTE
 * : Vehicles for Europe without catalytic converter

<Vehicles for Europe with catalytic converter>

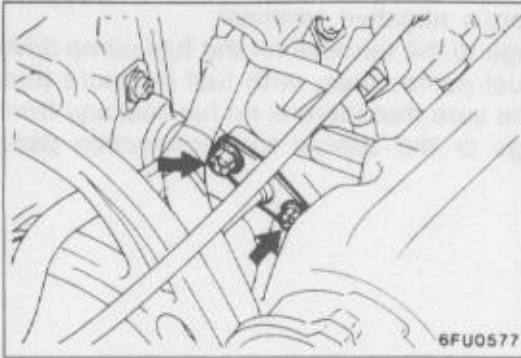


6FU0875

<Vehicles for GCC>



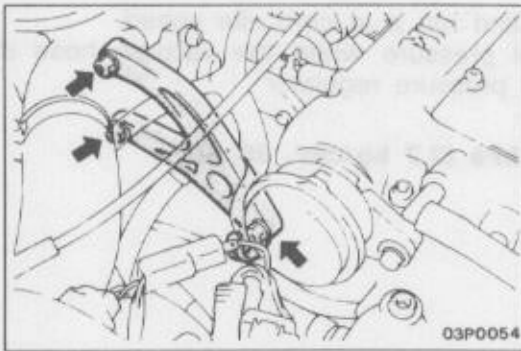
6FU1080

**FUEL PRESSURE MEASUREMENT**

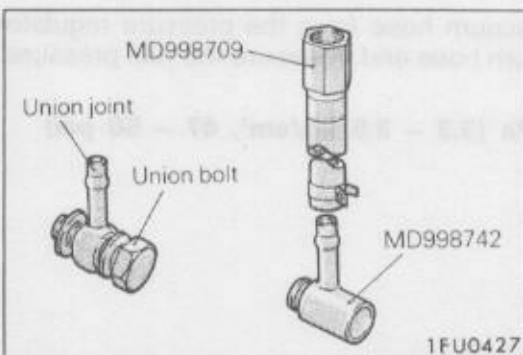
- (1) Reduce the fuel pressure. (Refer to P.13-87.)
- (2) Disconnect the high pressure fuel hose from the delivery pipe.

Caution

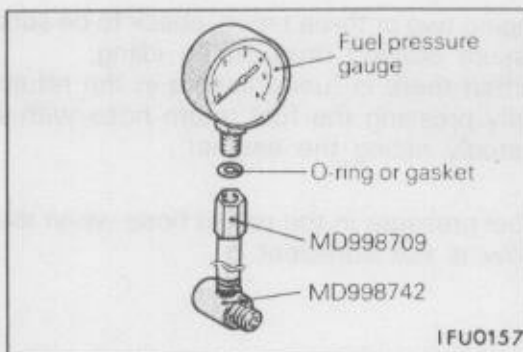
Cover the hose connection with a shop towel to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



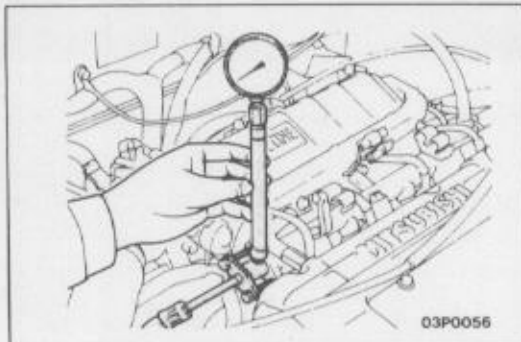
- (3) Remove the throttle body stay.



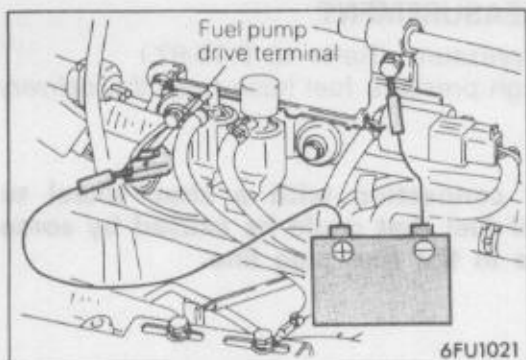
- (4) Remove the union joint and bolt from the special tool (adapter hose MD998709) and instead attach the special tool (hose adapter MD998742) to the adapter hose.



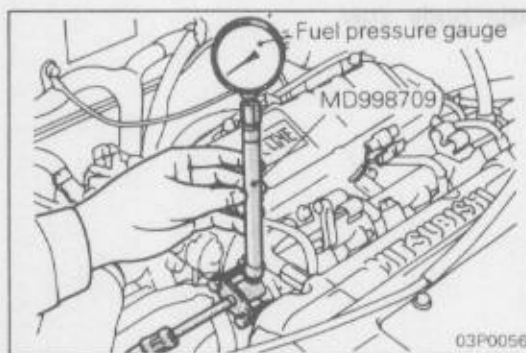
- (5) Install a fuel pressure gauge on the adapter hose that was set up in step (4).
Use a suitable O-ring or gasket between the fuel pressure gauge and the special tool to make a seal in order to prevent fuel leakage at this time.



- (6) Install the special tool, which was set in place in steps (4) and (5) between the delivery pipe and the high pressure hose.



- (7) Connect the battery's negative terminal.
- (8) Apply battery voltage to the terminal for the fuel pump drive and activate the fuel pump; then, with fuel pressure thus applied, check to be sure that there is no fuel leakage from the pressure gauge or the special tool connection part.



- (9) Start the engine and run it at curb idle speed.
- (10) Measure the fuel pressure when the vacuum hose is connected to the pressure regulator:

Standard value:

Approx. 270 kPa (2.7 kg/cm², 38 psi)



- (11) Disconnect the vacuum hose from the pressure regulator and plug the vacuum hose end. Measure the fuel pressure.

Standard value:

330 – 350 kPa (3.3 – 3.5 kg/cm², 47 – 50 psi)

- (12) After racing the engine two or three times, check to be sure that the fuel pressure doesn't drop during idling.

- (13) Check to be sure that there is fuel pressure in the return hose also (by gently pressing the fuel return hose with a finger while repeatedly racing the engine).

NOTE

There will be no fuel pressure in the return hose when the volume of fuel flow is not sufficient.

- (14) If the results of the measurements made in steps (10) and (11) above are not within the standard value range, consult the table below to determine the probable cause, and then make the necessary repair.

Condition	Probable cause	Remedy
Fuel pressure too low	a. Clogged fuel filter b. Fuel leaking toward return port due to improper seating of valve in fuel pressure regulator c. Low delivery pressure of fuel pump	a. Replace fuel filter. b. Replace fuel pressure regulator. c. Replace fuel pump.
Fuel pressure too high	a. Stuck valve in fuel pressure regulator b. Clogged or bent fuel return hose or pipe	a. Replace fuel pressure regulator. b. Repair or replace hose or pipe.
Fuel pressure with vacuum hose connected not different from fuel pressure with vacuum hose not connected	a. Clogged or broken vacuum hose or nipple b. Stuck valve in fuel pressure regulator or defective valve seating	a. Repair or replace vacuum hose or nipple. b. Replace fuel pressure regulator.

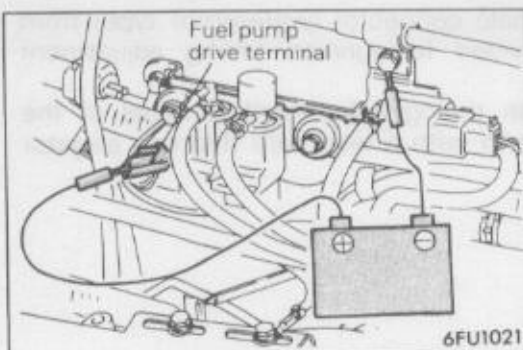
- (15) Stop the engine and check for a change in the fuel pressure gauge indication, which should not drop.
If the gauge indication drops, observe the rate of drop and determine and repair the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	Leakage from injector	Replace injector.
Fuel pressure drops immediately after engine is stopped	Check valve in fuel pump does not close.	Replace fuel pump.

- (16) Reduce the fuel pressure in the fuel line.
(17) Disconnect the high pressure hose and remove the fuel pressure gauge from the delivery pipe.

Caution

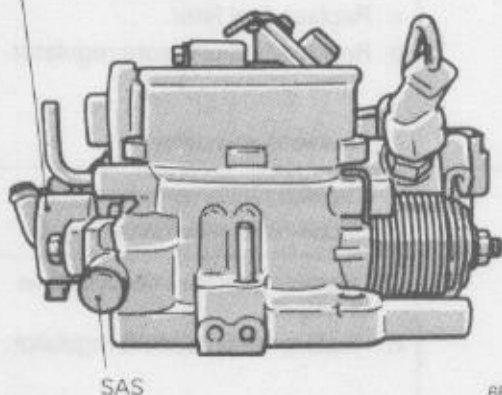
Cover the hose connection with a shop towel to prevent splash of fuel that could be caused by residual pressure in the fuel pipe line.



- (18) Mount a new O-ring in the groove at the end of the high pressure hose.
(19) Connect the fuel high pressure hose to the delivery pipe and tighten the screws to the specified torque.
(20) Check for fuel leaks.
① Apply battery voltage to the fuel pump drive terminal to operate the fuel pump.
② With fuel pressure present, check the fuel line for leaks.

BASIC IDLE SPEED ADJUSTMENT

Throttle position sensor

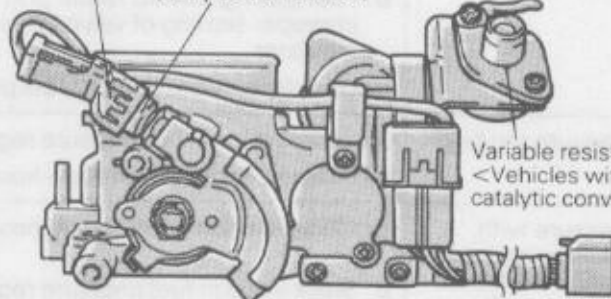


SAS

6FU0880

Idle position switch connector

Fixed SAS (idle position switch)

Variable resistor
<Vehicles with
catalytic converter>

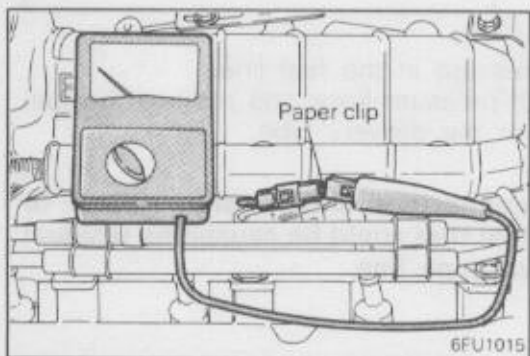
6FU1081

Caution

There should usually be no need to adjust the basic idle speed because it has been precisely adjusted by the manufacturer.

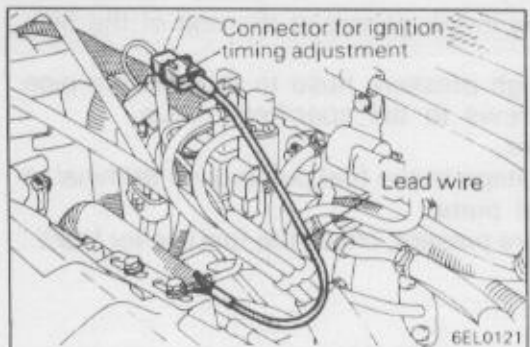
Pre-conditions for inspection

- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- Lamps, electric cooling fan and accessories: OFF
- Steering wheel: Neutral position
- Transmission: Neutral



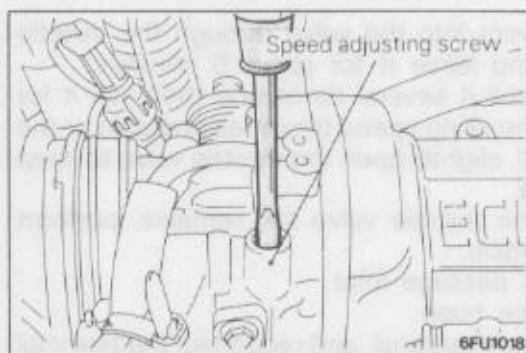
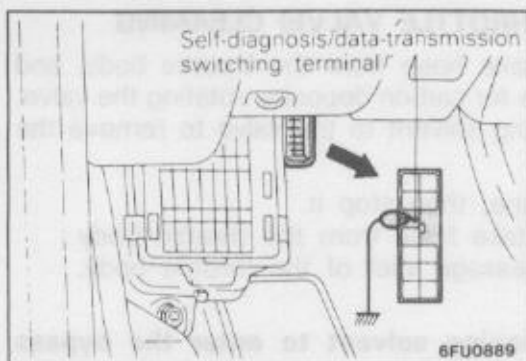
6FU1015

- (1) Connect a tachometer as shown. (This operation is not necessary when the adjustment is performed using the multi-use tester.)



6EL0121

- (2) Disconnect the female connector (waterproof type) from the connector provided for ignition timing adjustment purposes.
- (3) Connect the ignition timing adjustment terminal of the connector to the earth with a lead wire that has alligator clips at both ends.



- (4) If a multi-use tester is not used, connect the No. 10 terminal of the self-diagnosis connector to the earth with a lead wire that has alligator clips at both ends. If a multi-use tester is used, connect the tester to the self-diagnosis connector.

NOTE

Connecting the multi-use tester to the self-diagnosis connector earthes the No. 10 terminal.

- (5) Start the engine and let it run at idle.

- (6) Check that the engine speed is within the basic idle speed range.

Basic idle speed: 850 ± 50 r/min.

If the speed does not conform to specification, follow the instructions given below, and if necessary make adjustments with the speed adjusting screw until the specified basic idle speed is achieved.

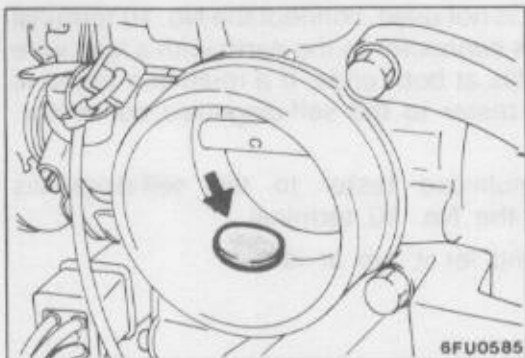
- The engine speed may be 20 – 100 r/min. lower on a new vehicle [driven about 500 km (300 miles) or less], but adjustment is not necessary.
- If engine stalling occurs or the engine speed is low even though the vehicle has been driven about 500 km (300 miles) or more, it is probable that these are deposits adhering to the throttle valve, so it should be cleaned. (Refer to P.13-104.)
- If the engine speed is higher than the standard value even though the speed adjusting screw is fully closed, check for any indication that the idle position switch (fixed speed adjusting screw) position has changed; if there is such an indication, adjust the idle position switch (speed adjusting screw).

If there is no evidence of a change of position, it is probable that there is leakage resulting from deterioration of the fast idle air valve, so replace the throttle body.

NOTE

If a multi-use tester is used, enter code number 22 and read the engine speed on the display.

- Turn OFF the ignition switch to stop the engine.
- If a multi-use tester is not used, remove the earth lead wire from the diagnosis connector. If a multi-use tester is used, disconnect the tester from the connector.
- Remove the earth lead wire from the ignition timing adjustment connector and reconnect the waterproof type connector to that connector.
- Disconnect the tachometer.
- Start the engine once again and let it idle for about five minutes; check to be sure that the idling condition is normal.



THROTTLE BODY (THROTTLE VALVE) CLEANING

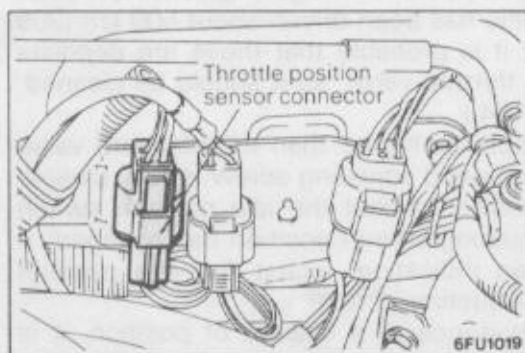
Disconnect the air intake hose from the throttle body, and check the throttle valve for carbon deposits, rotating the valve. Apply the spray cleaning solvent to the valve to remove the carbon deposits.

- (1) Warm up the engine, then stop it.
- (2) Remove the air intake hose from the throttle body.
- (3) Plug the bypass passage inlet of the throttle body.

Caution

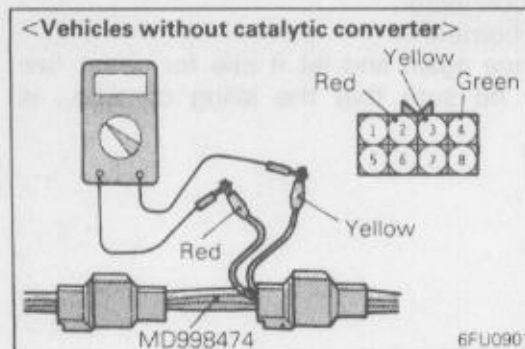
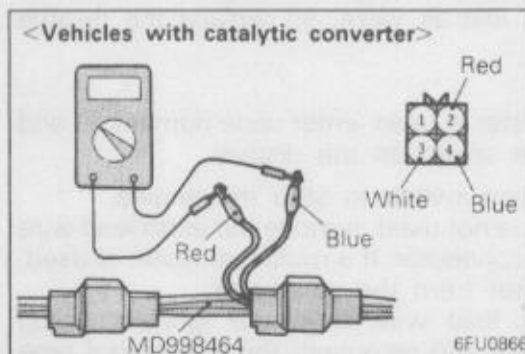
Do not allow cleaning solvent to enter the bypass passage.

- (4) Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
- (5) Start the engine, race it several times and then idle it for about 1 minute. If the idling speed becomes unstable or the engine starts to stall, slightly open the throttle valve to keep the engine running.
- (6) If the deposit on the throttle valve still remains, perform steps (4) and (5) again.
- (7) Unplug the bypass passage inlet.
- (8) Attach the air intake hose.
- (9) Disconnect the battery terminal, and reconnect the terminal more than 10 seconds later.
- (10) Adjust the basic idle speed.



THROTTLE POSITION SENSOR ADJUSTMENT

- (1) Slacken the accelerator cable sufficiently.
- (2) If a multi-use tester is not used, disconnect the throttle position sensor connectors and connect the special tool (harness connector) between the connectors. If a multi-use tester is used, connect the tester to the diagnosis connector.
- (3) If a multi-use tester is not used, connect a voltmeter to the harness connector. The positive lead of the voltmeter is connected to the blue clip (or yellow clip) of the harness connector, and negative lead to the red clip.





- (4) Turn ON the ignition switch and check throttle position sensor output voltage.

Standard value: 0.48 – 0.52 V

- (5) If outside the standard range, loosen the throttle position sensor mounting bolt, and turn the throttle position sensor for adjustment. After adjustment, securely tighten the bolt.

NOTE

1. Turning the throttle position sensor clockwise increases the output voltage.
2. If a multi-use tester is used, enter code number 14 and read the throttle position sensor output voltage on the display.

- (6) Turn OFF the ignition switch.
- (7) Disconnect the test harness and voltmeter and reconnect the throttle position sensor connectors.
- (8) Disconnect the battery terminal for 10 seconds or more, then reconnect it.
- (9) Adjust the acceleration cable.

IDLE POSITION SWITCH (FIXED SAS) ADJUSTMENT

Caution

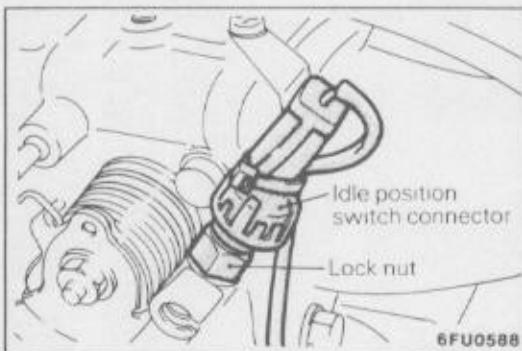
The idle position switch has been adjusted by the manufacturer. Do not change the setting of the idle position switch carelessly. If the setting has been accidentally changed or if the idle position sensor has been replaced, set the switch by the following procedure.

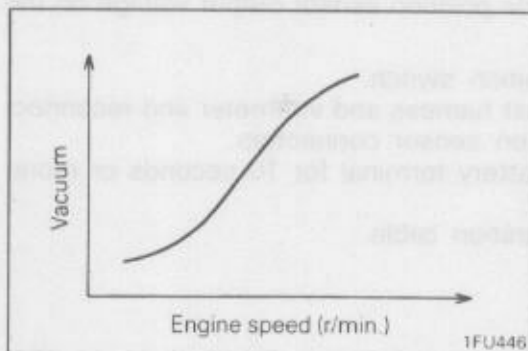
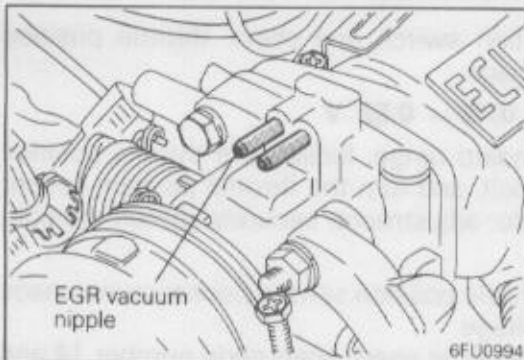
- (1) Sufficiently loosen the tension of the accelerator cable.
- (2) Disconnect the connector of the idle position switch.
- (3) Loosen the lock nut of the idle position switch.
- (4) Sufficiently loosen the idle position switch by turning it in the counterclockwise direction and fully close the throttle valve.

Caution

Be sure to close the throttle valve FULLY.

- (5) Connect a circuit tester (ohm range) between the idle position switch terminal and the body.
- (6) Turn down the idle position switch until it enters the ON state. Turn it down a turn more from that point.
- (7) While holding the idle position switch to make sure that it does not turn, tighten the lock nut.
- (8) Adjust the accelerator cable. (Refer to P.13-87.)
- (9) Adjust the basic idle speed. (Refer to P.13-102.)
- (10) Adjust the throttle position sensor. (Refer to P.13-104.)





EGR VALVE CONTROL VACUUM CHECK

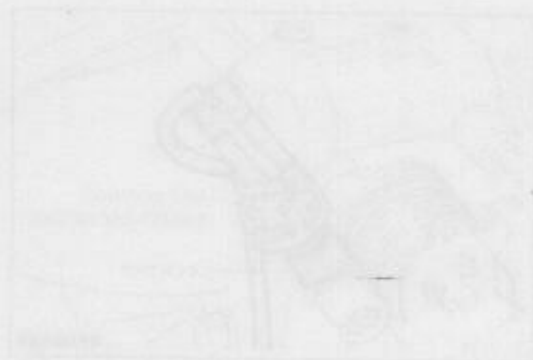
Check condition

- Engine coolant temperature: 80 – 90°C (176 – 194°F)
- (1) Disconnect the vacuum hose from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.

- (2) Start the engine and check to see that, after increasing the engine speed by racing the engine, the vacuum increases proportionately with the rise in engine speed.

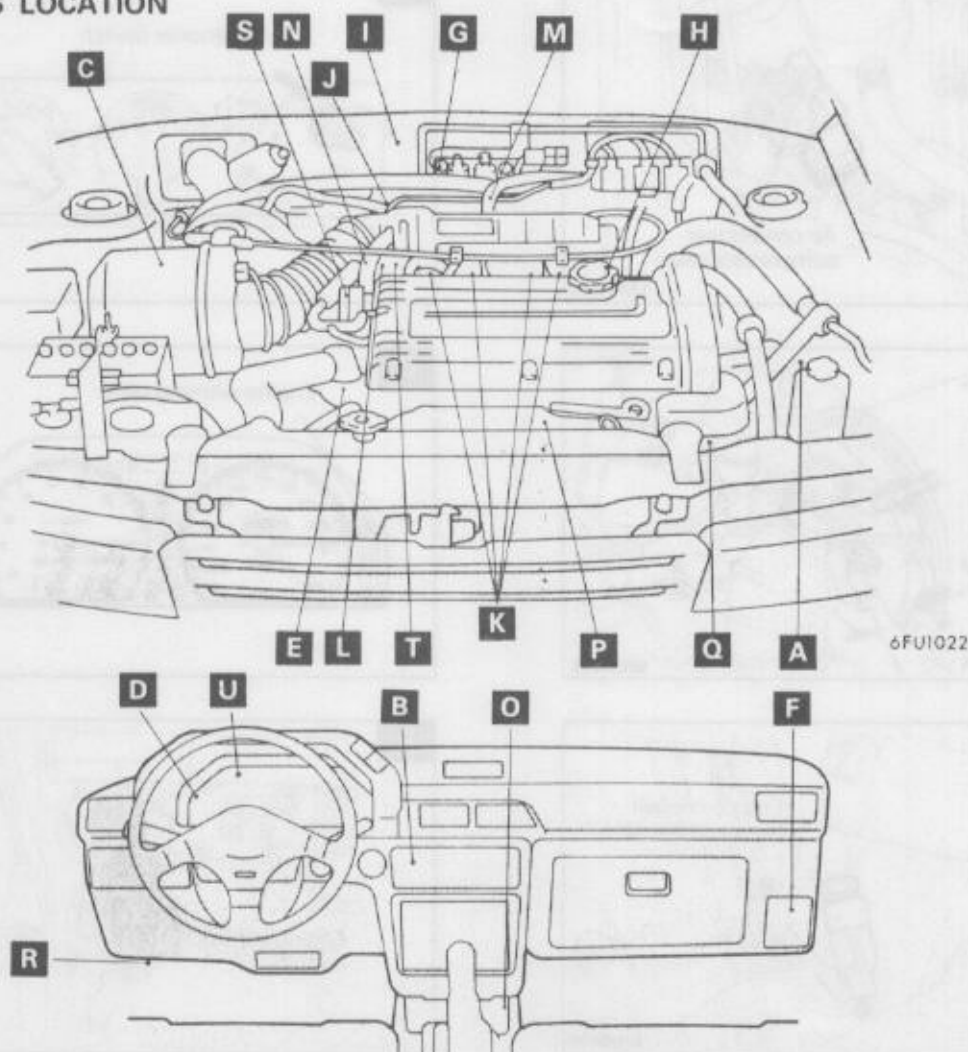
NOTE

If there is a problem with the way the vacuum changes, it is possible that the throttle body vacuum port may be clogged and require cleaning.



COMPONENTS LOCATION AND VACUUM HOSE LAYOUT

COMPONENTS LOCATION



6FU1023

Name	Symbol	Name	Symbol
Air conditioner compressor relay	A	Ignition timing adjustment terminal	I
Air conditioner switch	B	Injector	K
Air flow sensor (including intake air temperature sensor and barometric pressure sensor)	C	Mixture adjustment screw (variable resistor)*1	N
Detonation sensor*2	M	MPI control relay	O
Engine control unit	F	Oxygen sensor*1	P
Engine coolant temperature sensor	E	Power steering oil pressure switch	Q
Engine warning lamp	D	Self-diagnosis output terminal and self-diagnosis/data transmission switching terminal	R
Fuel pump drive terminal	G	Throttle position sensor	T
Idle position switch	J	Top dead center sensor and crank angle sensor	S
Idle speed control servo (stepper motor)	L	Vehicle speed sensor (reed switch)	U
Ignition coil (power transistor)	H	-	-

NOTE

Component names are listed in alphabetical order.

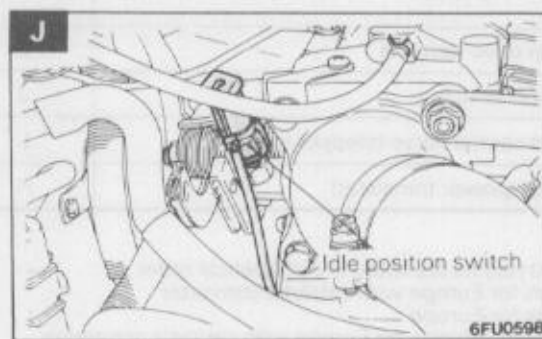
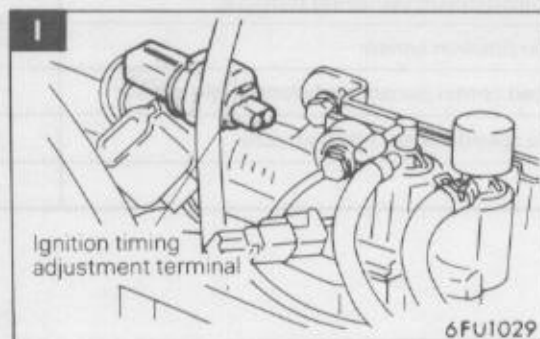
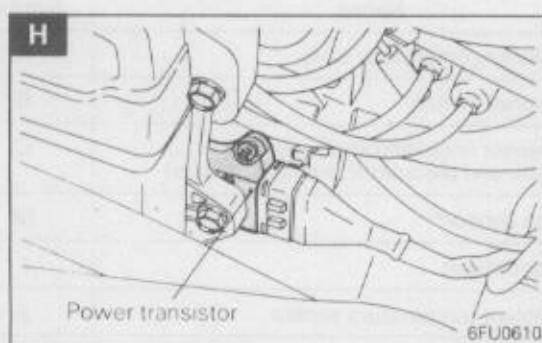
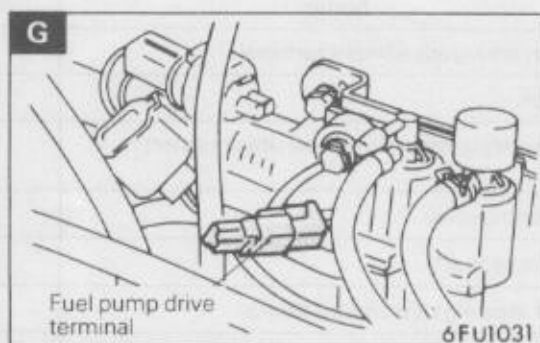
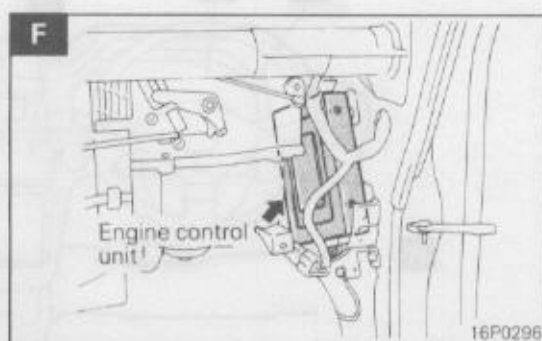
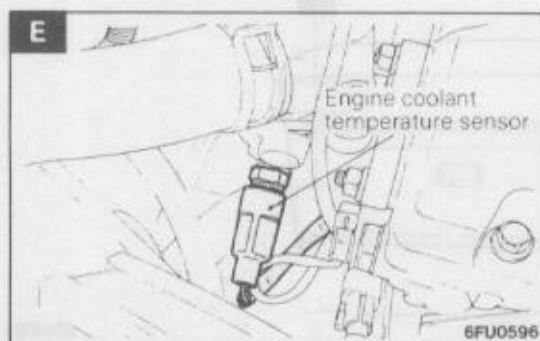
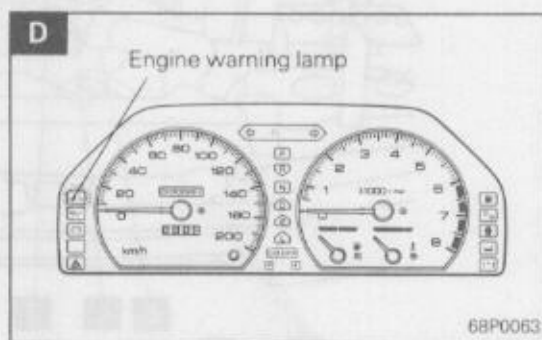
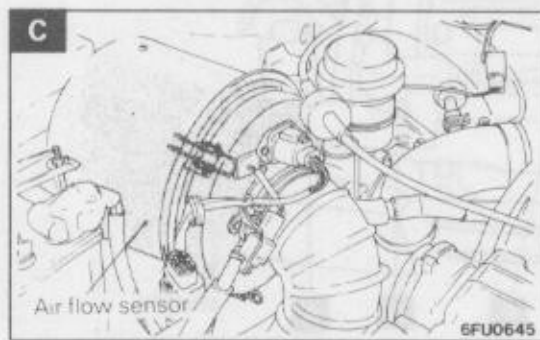
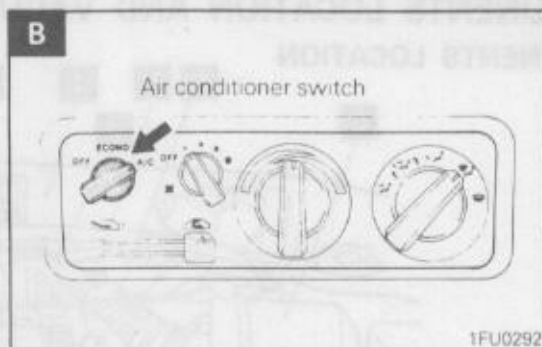
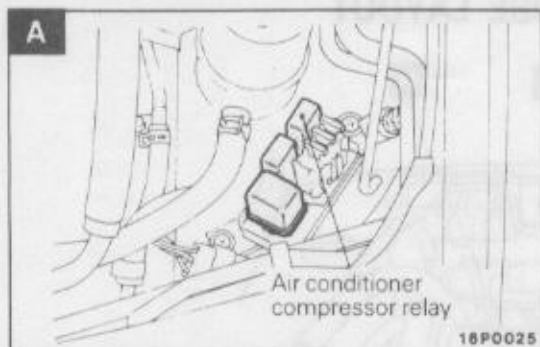
*1: Vehicles for Europe with catalytic converter

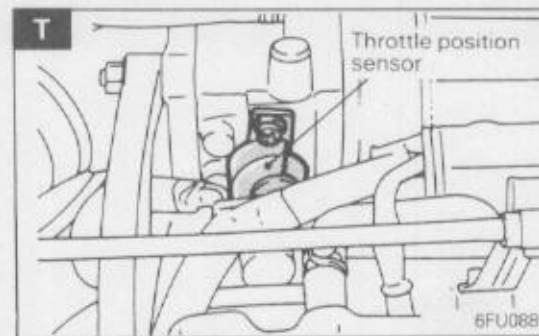
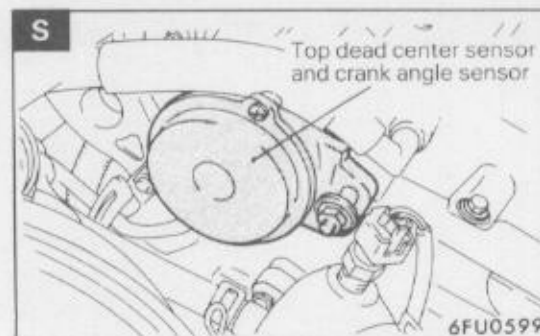
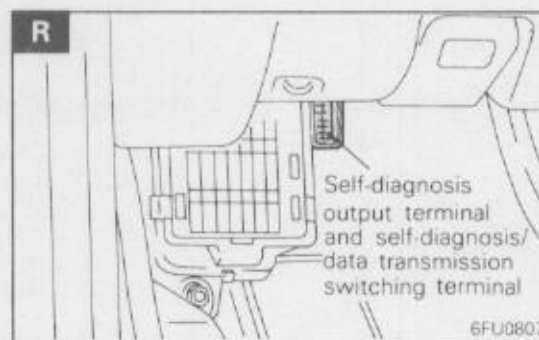
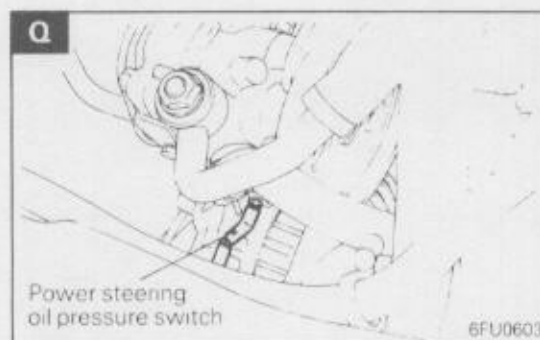
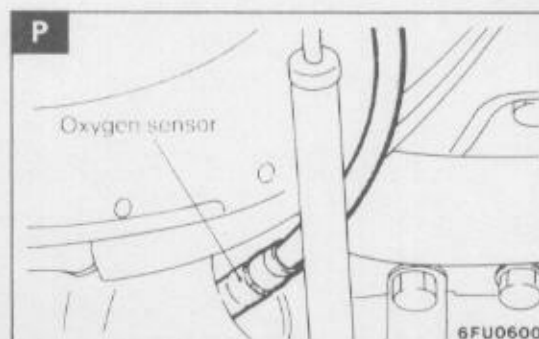
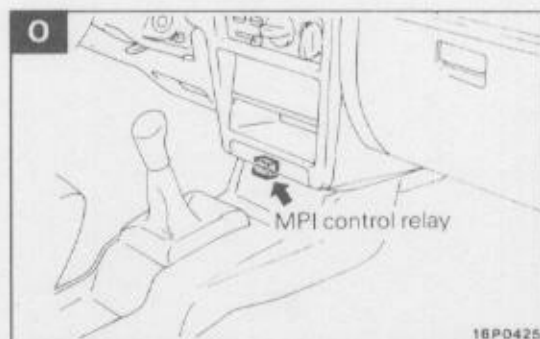
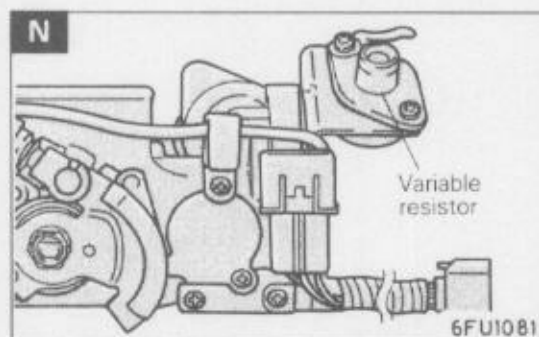
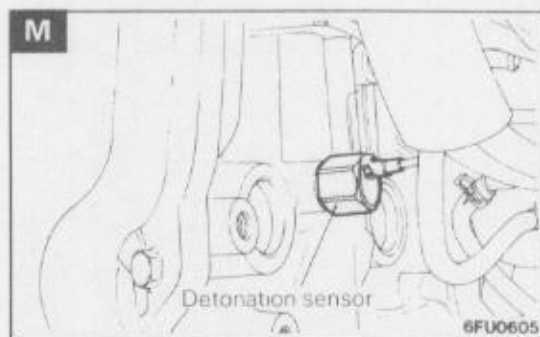
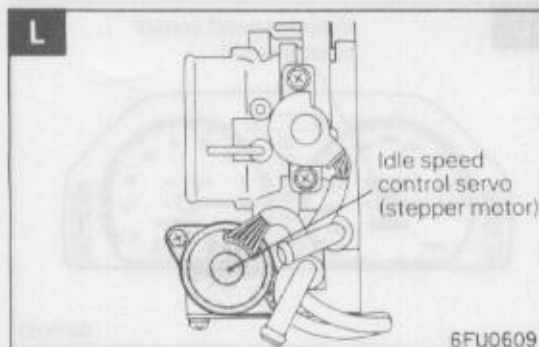
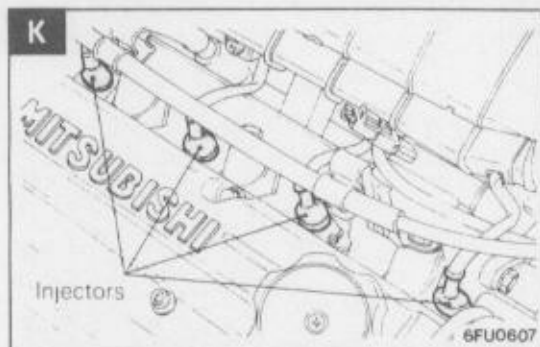
*2: Vehicles for Europe

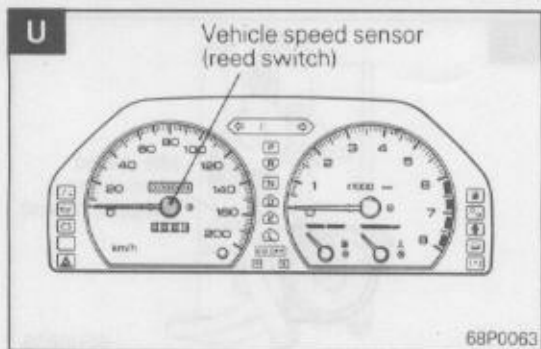
*3: Other than vehicles for Europe with catalytic converter

© Mitsubishi Motors Corporation MAY 88

PWME8902

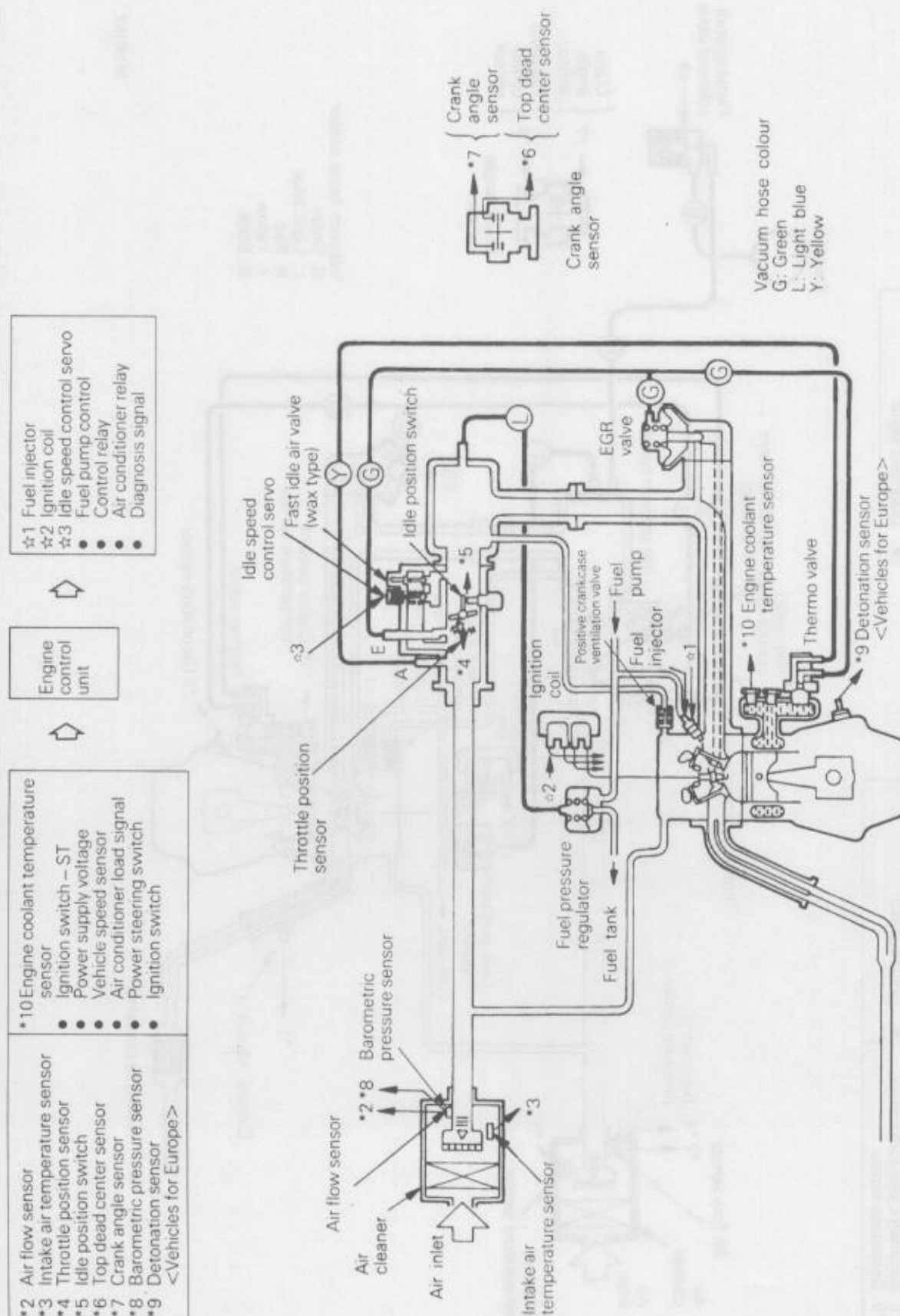






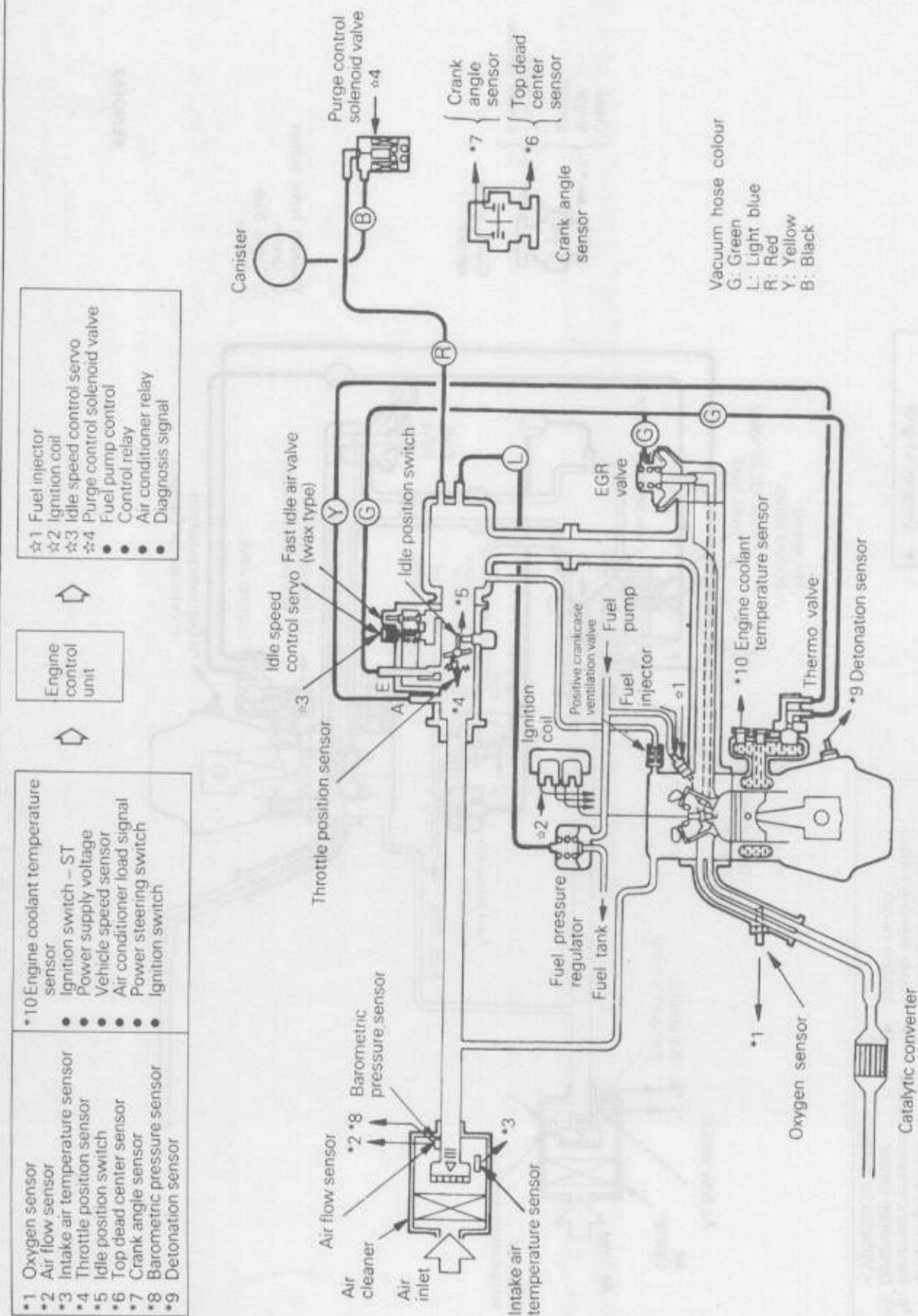
VACUUM HOSE PIPING DIAGRAM

<Vehicles for Europe without catalytic converter and for General Export>



6EN0162

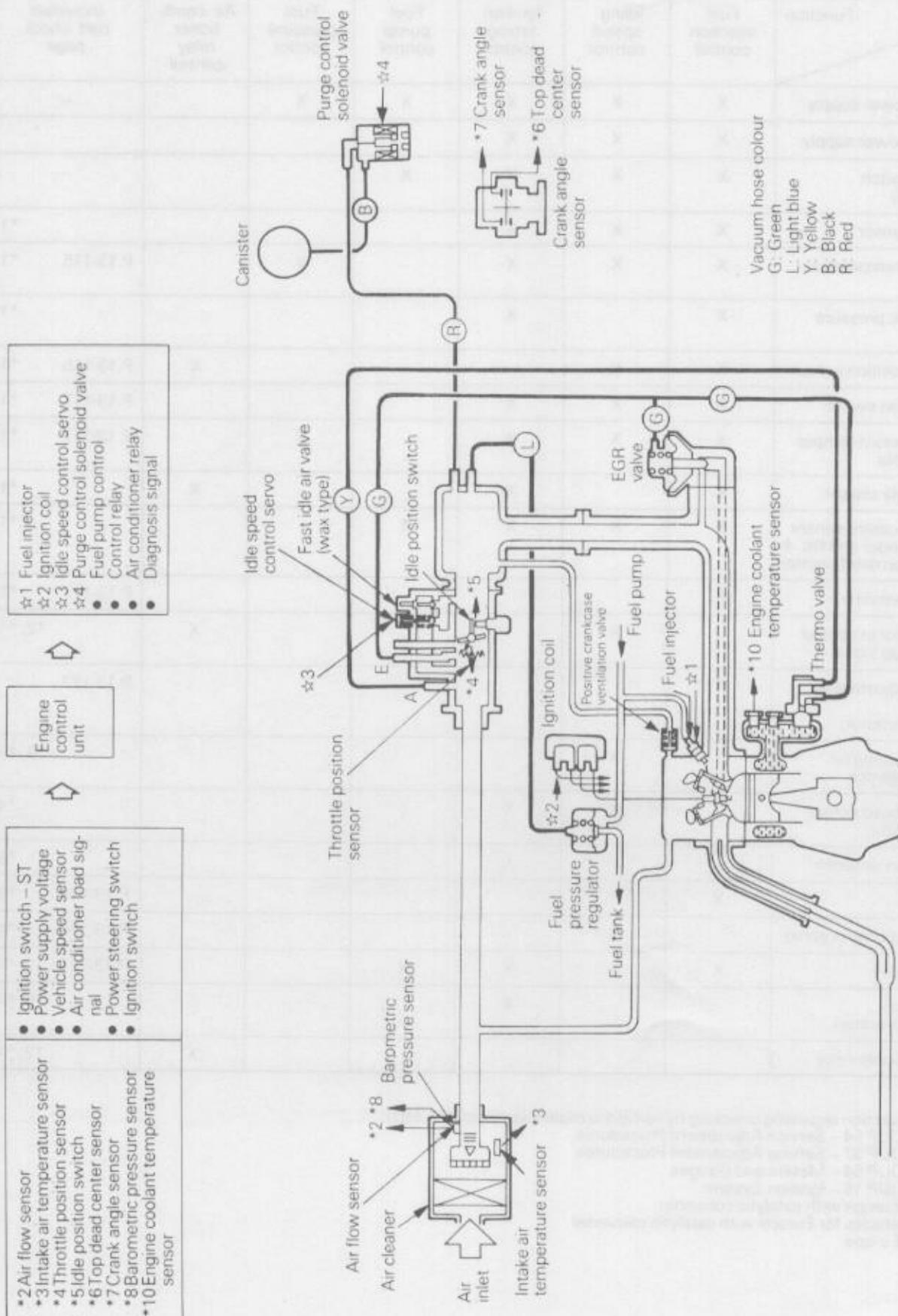
<Vehicles for Europe with catalytic converter>



6EMD163

<Vehicles for GCC>

6EM0228



RELATION OF CONTROL FUNCTIONS

Function Related parts		Fuel injection control	Idling speed control	Ignition timing control	Fuel pump control	Fuel pressure control	Air condi- tioner relay control	Individual part check page
Sensors and power supplies	Ignition power supply	X	X	X	X	X		—
	Back-up power supply	X	X	X				—
	Ignition switch (ST and IG)	X	X	X	X			—
	Air flow sensor	X	X	X				*1
	Intake air temperature sensor	X	X	X		X		P.13-115 *1
	Barometric pressure sensor	X		X				*1
	Throttle position sensor	X	X				X	P.13-115 *1
	Idle position switch	X	X	X				P.13-117 *1
	Engine coolant temper- ature sensor	X	X	X		X		P.13-117 *1
	Crank angle sensor	X		X			X	*1
	Top dead centre sensor (No. 1 cylinder and No. 4 cylinder top dead centre)	X	X	X	X			*1
	Oxygen sensor☆ ¹	X						P.13-117 *1
	Air conditioner control unit, Idle-up signal		X				X	*2, *1
	Mixture adjustment screw☆ ² (variable resistor)	X						P.13-123
	Power steering oil pressure switch		X					*3, *1
	Vehicle speed sensor (reed switch)		X	X				*4
	Detonation sensor☆ ¹			X				*5
Actuators	Injectors	X						P.13-118 *1
	Idle speed control servo		X					P.13-120 *1
	Control relay	X	X	X	X			P.13-121 *1
	Ignition coil (power transistor)			X				*5, *1
	Air conditioner relay						X	*2, *1

NOTE

*1: Refer to the section regarding checking by using the multi-use tester (P.13-91).

*2: Refer to GROUP 54 – Service Adjustment Procedures.

*3: Refer to GROUP 37 – Service Adjustment Procedures.

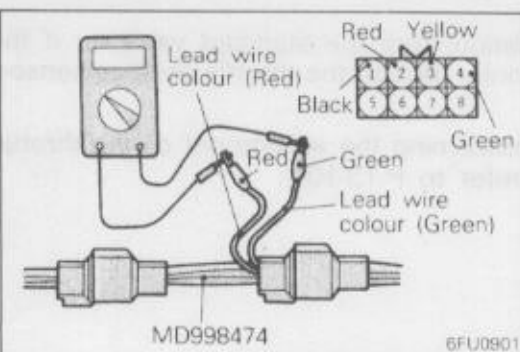
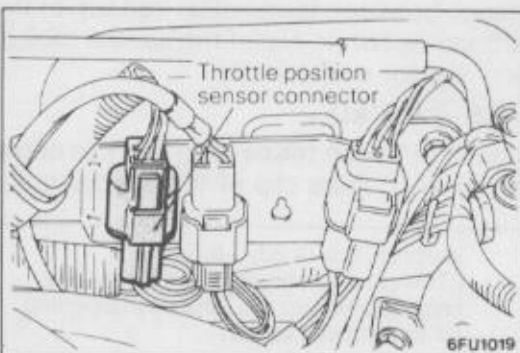
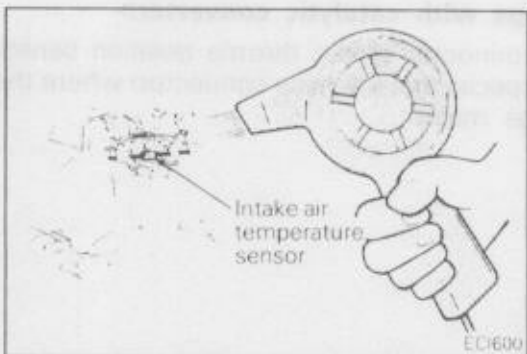
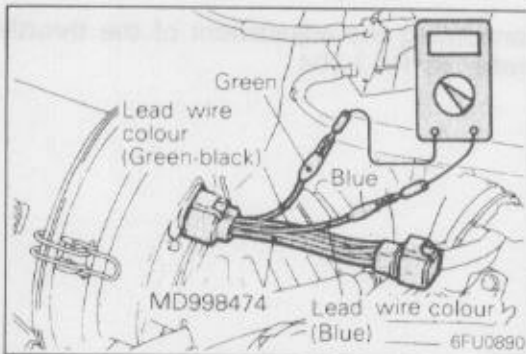
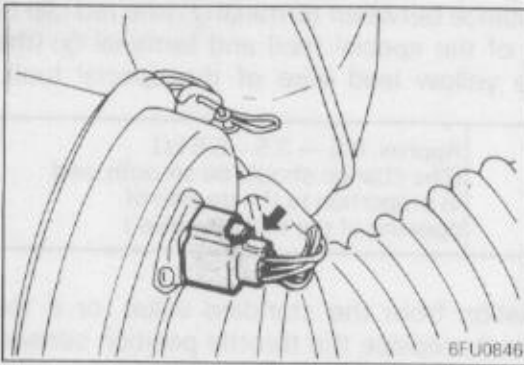
*4: Refer to GROUP 54 – Meters and Gauges.

*5: Refer to GROUP 16 – Ignition System.

☆1: Vehicles for Europe with catalytic converter

☆2: Other than vehicles for Europe with catalytic converter

☆3: Vehicles for Europe



SENSOR AND SWITCH INSPECTION

INTAKE AIR TEMPERATURE SENSOR INSPECTION

- (1) Disconnect the connector of the air flow sensor and connect the special tool (harness connector) where the disconnection was made.

- (2) Measure the resistance between terminal ⑥ (the green clip of the green-black lead wire of the special tool) and terminal ⑧ (the blue clip of the blue lead wire of the special tool) of the air flow sensor's connector.

Temperature °C (°F)	Resistance kΩ
0 (32)	6.0
20 (68)	2.7
80 (176)	0.4

- (3) Measure the resistance while increasing the temperature of the sensor part (by using a hair dryer).

Temperature °C (°F)	Resistance kΩ
Increases	Decreases

- (4) If there is a deviation from the standard value, or if the resistance does not change, replace the air flow sensor assembly.

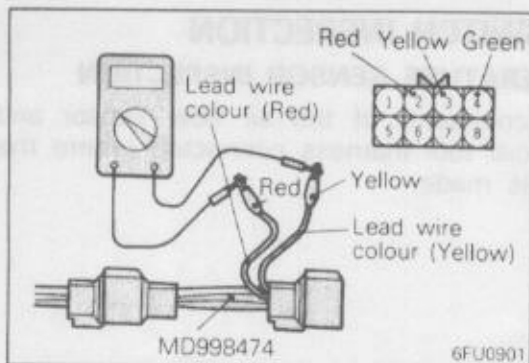
THROTTLE POSITION SENSOR INSPECTION

<All vehicles except vehicles for Europe with catalytic converter>

- (1) Disconnect the connector of the throttle position sensor and connect the special tool (harness connector) where the disconnection was made.

- (2) Measure the resistance between terminal ② (the red clip of the red lead wire of the special tool) and terminal ④ (the green clip of the green lead wire of the special tool) of the throttle position sensor's connector.

Standard value: 3.5 – 6.5 kΩ



- (3) Measure the resistance between terminal ② (the red clip of the red lead wire of the special tool) and terminal ③ (the yellow clip of the yellow lead wire of the special tool).

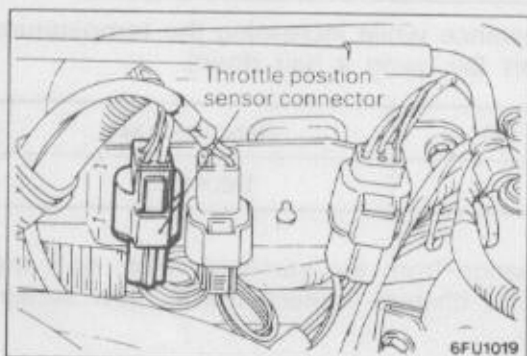
Slowly open the throttle valve (from idle to the fully open position).

Approx. 0.5 → 3.5 – 6.5 k Ω
(The change should be smooth, and in proportion to the degree of opening of the throttle valve.)

- (4) If there is a deviation from the standard value, or if the change is not smooth, replace the throttle position sensor.

NOTE

For information concerning the adjustment of the throttle position sensor, refer to P.13-104.



<Vehicles for Europe with catalytic converter>

- (1) Disconnect the connector of the throttle position sensor and connect the special tool (harness connector) where the disconnection was made.

- (2) Measure the resistance between terminal ② (red clip of the special tool) and terminal ③ (white clip of the special tool) of the throttle position sensor's connector.

Standard value: 3.5 – 6.5 k Ω

- (3) Measure the resistance between terminal ② (red clip of the special tool) and terminal ① (blue clip of the special tool).

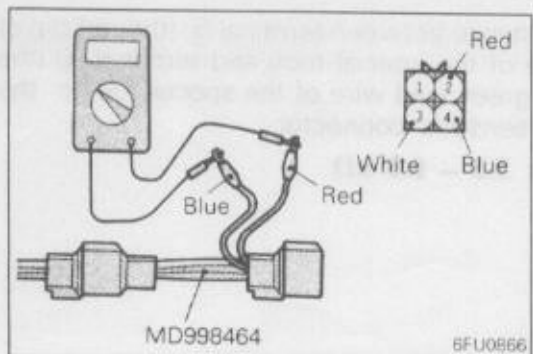
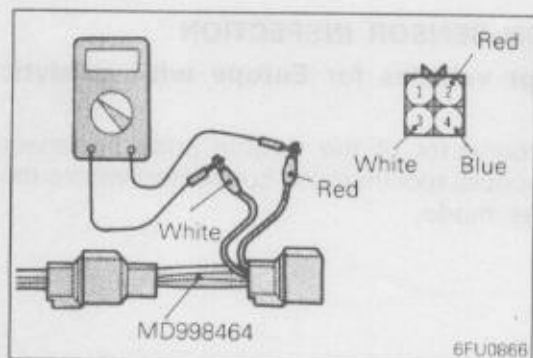
Slowly open the throttle valve (from idle to the fully open position).

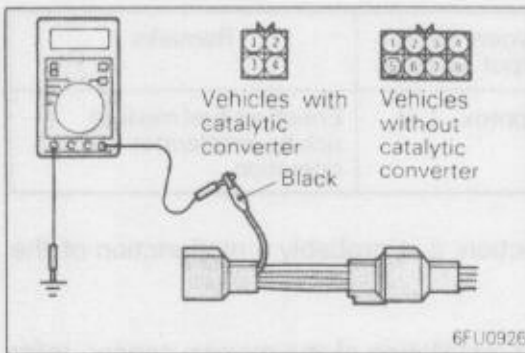
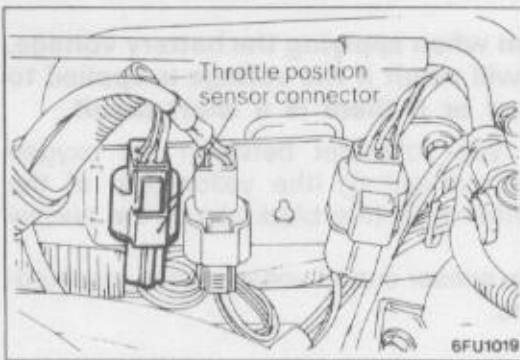
Approx. 0.5 → 3.5 – 6.5 k Ω
(The change should be smooth, and in proportion to the degree of opening of the throttle valve.)

- (4) If there is a deviation from the standard value, or if the change is not smooth, replace the throttle position sensor.

NOTE

For information concerning the adjustment of the throttle position sensor, refer to P.13-104.



**IDLE POSITION SWITCH INSPECTION**

- (1) Check to be sure that the lever presses the idle position switch with the accelerator pedal in the returned (undepressed) condition.

NOTE

If it does not, refer to the section concerning adjustment of the idle position switch (fixed SAS) on P.13-105.

- (2) Disconnect the connector of the throttle position sensor, and connect the special tool (harness connector) at the idle position switch side.

NOTE

The MD998464 should be used for vehicles for Europe equipped with a catalytic converter; the MD998474 should be used for all other vehicles.

- (3) Check for continuity between the earth and terminal ① (black clip of the special tool) of the connector at the idle position switch side.

Accelerator pedal	Continuity
Depressed	No
Released	Yes

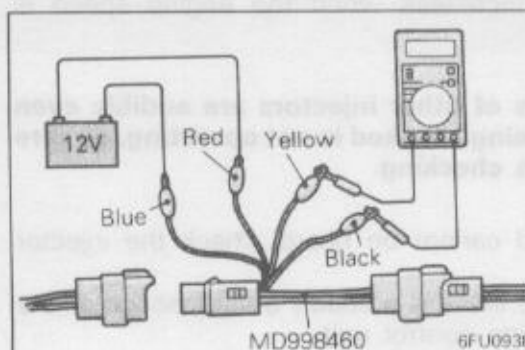
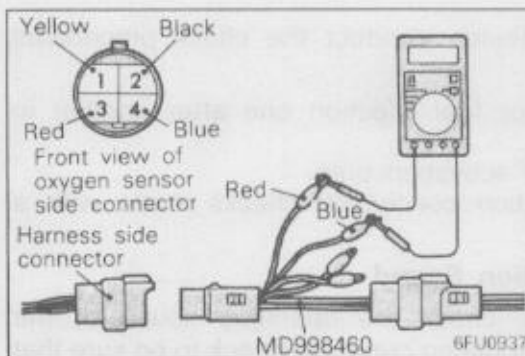
- (4) If there is a problem, replace the idle position switch.

NOTE

An adjustment must be made after the idle position switch is replaced. (Refer to P.13-105.)

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Refer to P.13-50.

**OXYGEN SENSOR INSPECTION****<Vehicles for Europe with catalytic converter>**

- (1) Warm up the engine until the temperature of the engine coolant reaches 80 – 90°C (176 – 194°F).
- (2) Disconnect the oxygen sensor connector, and then connect the special tool (harness connector) to the connector at the oxygen sensor side.
- (3) Measure the resistance between the oxygen sensor connector's terminal ③ (the red clip of the special tool) and terminal ④ (the blue clip of the special tool).

Standard value

Temperature °C (°F)	Resistance Ω
20 (68)	Approx. 12
400 (752)	30 or higher

- (4) Replace the oxygen sensor if there is a malfunction.
- (5) Directly apply battery voltage between the oxygen sensor connector's terminal ③ (the red clip of the special tool) and terminal ④ (the blue clip of the special tool).

Caution

Care must be taken when applying the battery voltage, because damage will result if the voltage is applied to the wrong terminal or if there is a short-circuit.

- (6) Connect a digital type voltmeter between the oxygen sensor connector's terminal ① (the yellow clip of the special tool) and terminal ② (the black clip of the special tool).
- (7) Measure the oxygen sensor output voltage while repeatedly racing the engine.

Standard value

Engine	Oxygen sensor output voltage	Remarks
Racing	Approx. 1 V	Enrich air-fuel mixture rich by accelerator operation

- (8) If there is a malfunction, it is probably a malfunction of the oxygen sensor.

NOTE

1. For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.
2. Oxygen sensor tightening torque: 40 – 50 Nm (4 – 5 kgm, 29 – 36 ft.lbs.)

INJECTOR INSPECTION**Operational Check**

Using the multi-use tester, conduct the check procedures described below.

- (1) Cut off the injector fuel injection one after another in sequence.
- (2) Check the injector activation time.
(Refer to the section concerning checks made with a multi-use tester.)

Checking the Operation Sound

Using a sound-scope, check the operation sound of the injectors during idling or during cranking. Check to be sure that the operation sound increases when the engine speed is increased.

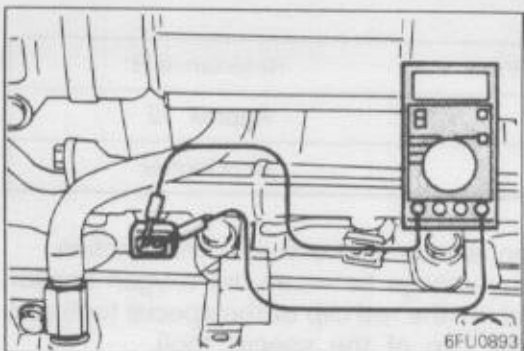
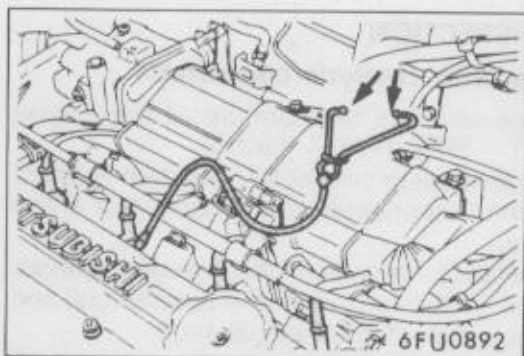
Caution

Note that the sounds of other injectors are audible even though the injector being checked is not operating, so care must be taken when checking.

NOTE

If the operation sound cannot be heard, check the injector activation circuit.

If this circuit is normal, there is probably a malfunction of the injector or of the engine control unit.



Measurement of Resistance between Terminals

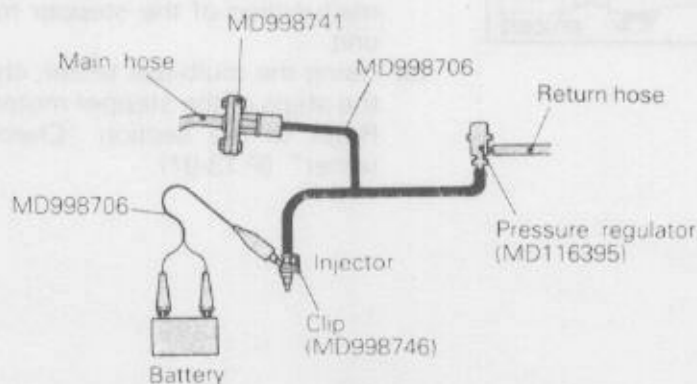
- (1) Disconnect the connector for the injectors.
- (2) Measure the resistance between terminals.

Standard value: 13 – 16 Ω at 20°C (68°F)

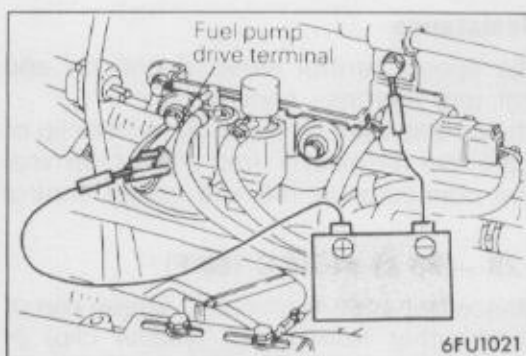
- (3) Connect the connector for the injectors.

Checking the Injection Condition

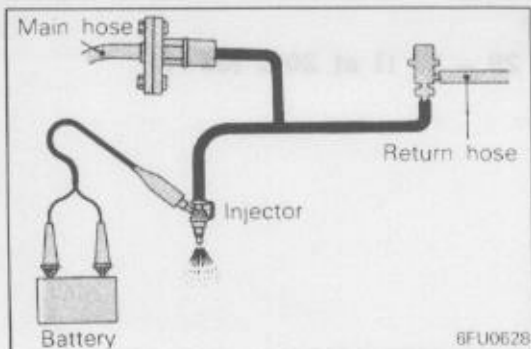
- (1) Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13-83.)
- (2) Remove the injector.
- (3) Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.



7FU0145



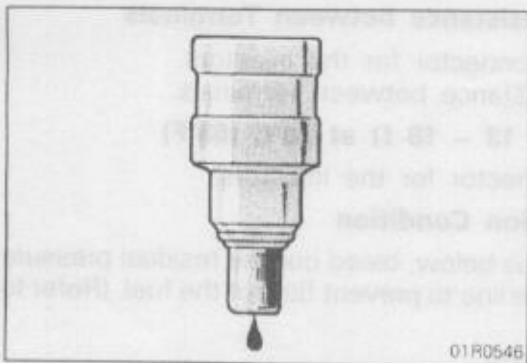
6FU1021



8FU0628

- (4) Connect the battery's negative (–) terminal.
- (5) Apply battery voltage to the fuel pump drive terminal and activate the fuel pump.

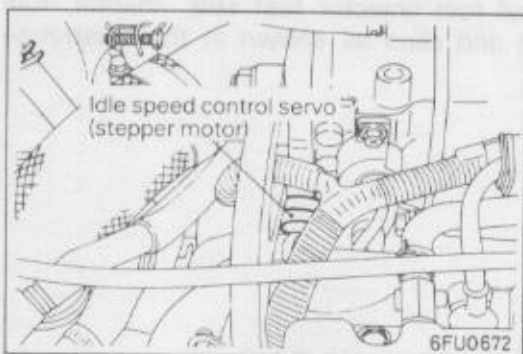
- (6) Activate the injector and check the atomized spray condition of the fuel.
The condition can be considered satisfactory unless it is extremely poor.



- (7) Stop the actuation of the injector, and check for leakage from the injector's nozzle.

Standard value: 1 drop or less per minute

- (8) Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.



IDLE SPEED CONTROL SERVO (STEPPER MOTOR) INSPECTION

Checking the Operation Sound

- (1) Check that the operation sound of the stepper motor can be heard after the ignition is switched ON (but without starting the motor).
- (2) If the operation sound cannot be heard, check the stepper motor's activation circuit.
If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.
- (3) Using the multi-use tester, check the relationship between the steps of the stepper motor and the speed of the engine. Refer to the section "Checking by using the multi-use tester" (P.13-91).

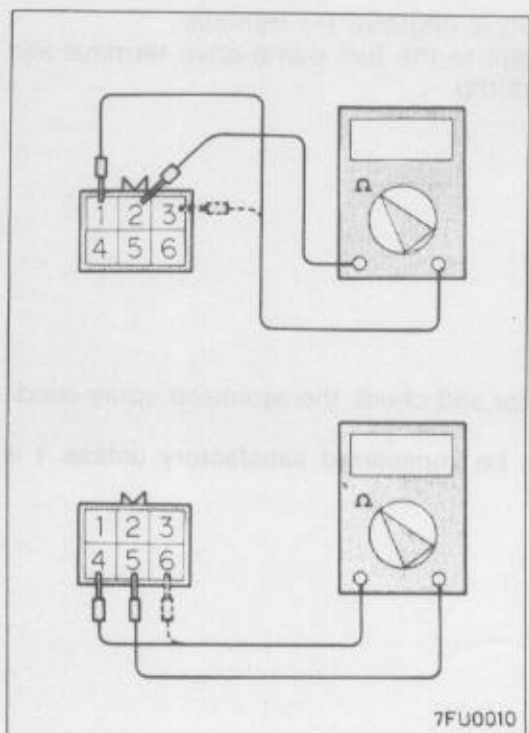
Checking the Coil Resistance

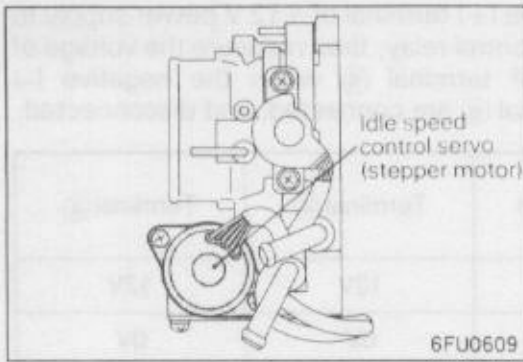
- (1) Disconnect the idle speed control servo connector and connect the special tool (harness connector).
- (2) Measure the resistance between terminal ② (white clip of the special tool) and either terminal ① (red clip) or terminal ③ (blue clip) of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω at 20°C (68°F)

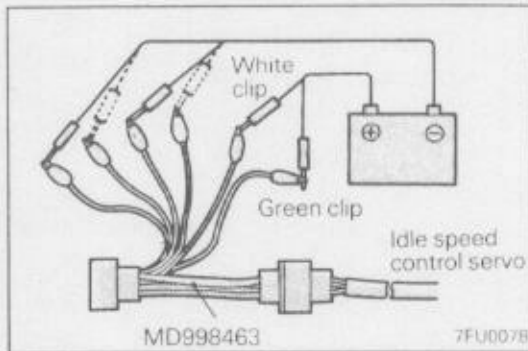
- (3) Measure the resistance between terminal ⑤ (green clip of the special tool) and either terminal ⑥ (yellow clip) or terminal ④ (black clip) of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω at 20°C (68°F)

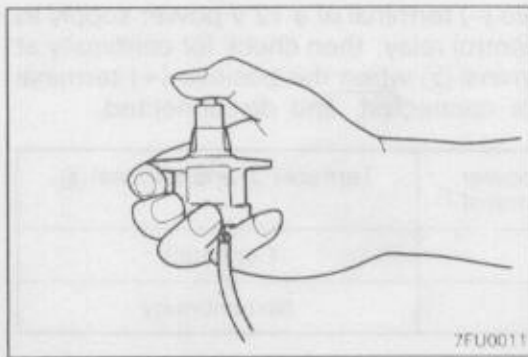


**Operational Check**

- (1) Remove the throttle body.
- (2) Remove the stepper motor.



- (3) Connect the special tool (harness connector) to the idle speed control servo connector.
- (4) Connect the positive (+) terminal of a power supply (approx. 6 V) to the white clip and the green clip.



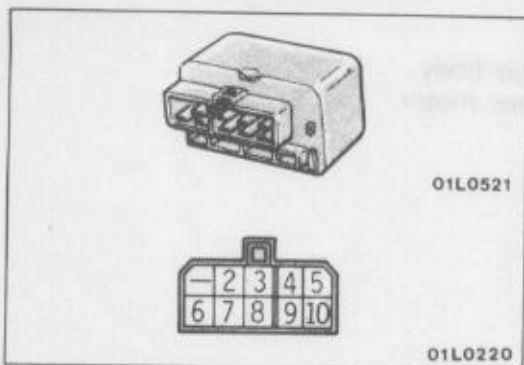
- (5) With the idle speed control servo as shown in the illustration, connect the negative (–) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.

- ① Connect the negative (–) terminal of the power supply to the red and black clip.
- ② Connect the negative (–) terminal of the power supply to the blue and black clip.
- ③ Connect the negative (–) terminal of the power supply to the blue and yellow clip.
- ④ Connect the negative (–) terminal of the power supply to the red and yellow clip.
- ⑤ Connect the negative (–) terminal of the power supply to the red and black clip.
- ⑥ Repeat the tests in sequence from (5) to (1).

- (6) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.

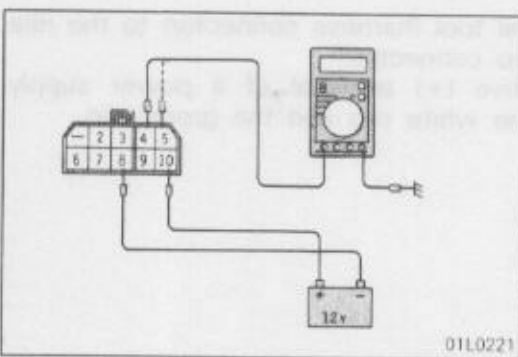
**CONTROL RELAY INSPECTION**

- (1) Remove the control relay.



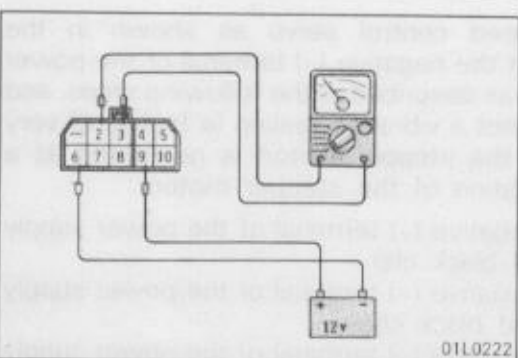
- (2) Connect the positive (+) terminal of a 12 V power supply to terminal ⑩ of the control relay; then measure the voltage of terminal ④ and of terminal ⑤ when the negative (–) terminal and terminal ⑧ are connected, and disconnected.

Terminal ⑧ and 12 V power supply negative (–) terminal	Terminal ④	Terminal ⑤
Connected	12V	12V
Unconnected	0V	0V



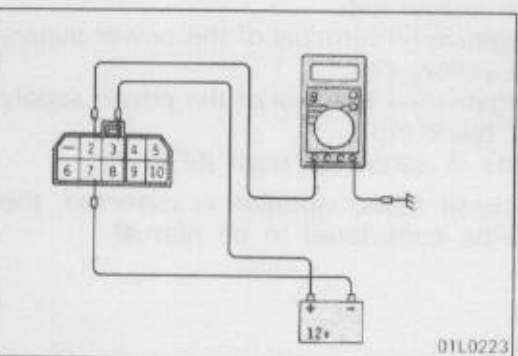
- (3) Connect the negative (–) terminal of a 12 V power supply to terminal ⑥ of the control relay; then check for continuity at terminal ③ and terminal ② when the positive (+) terminal and terminal ⑨ are connected, and disconnected.

Terminal ⑨ and 12 V power supply positive (+) terminal	Terminal ③ and terminal ②
Connected	Continuity
Unconnected	No continuity



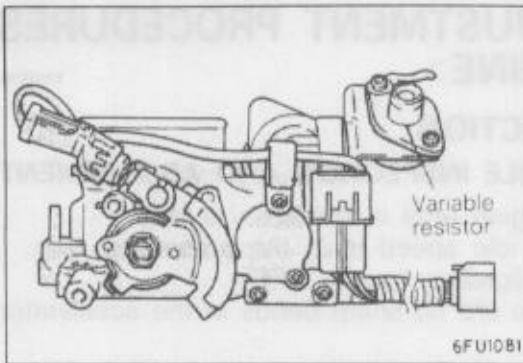
- (4) Connect the positive (+) terminal of a 12 V power supply to terminal ③ of the control relay; then measure the voltage of terminal ② when the negative (–) terminal and terminal ⑦ are connected, and disconnected.

Terminal ⑦ and negative (–) terminal	Terminal ②
Connected	12 V
Unconnected	0 V



- (5) If either is not as indicated, replace the control relay.

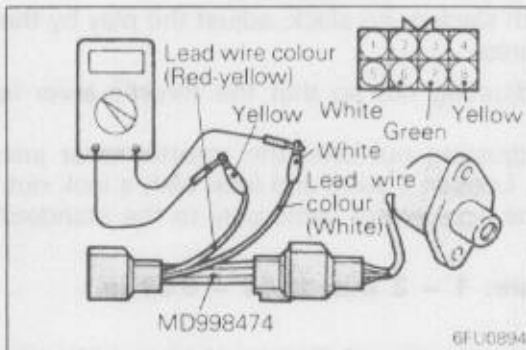




MIXTURE ADJUSTING SCREW (VARIABLE RESISTOR) INSPECTION

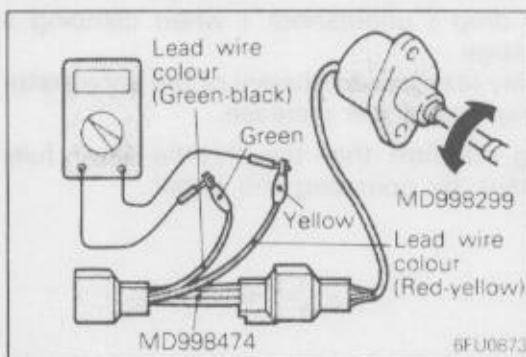
<All vehicles except vehicles for Europe with catalytic converter>

- (1) Disconnect the variable resistor connector, and connect the special tool (harness connector).



- (2) Use a circuit tester to measure the resistance between terminals ⑥ (the white clip of the white lead wire of the special tool) and ⑧ (the yellow clip of the red-yellow lead wire of the special tool) of the throttle position sensor connector.

Standard value: 4 – 6 k Ω



- (3) Next, connect the circuit tester between terminals ⑦ (the green clip of the green-black lead wire of the special tool) and ⑧ (the yellow clip of the red-yellow lead wire of the special tool).
- (4) Check if the resistance changes smoothly when the adjusting screw is rotated by the special tool (MAS driver).
- (5) Inspect the body for cracks or other damage.
- (6) If any defect is found, replace the throttle position sensor and variable resistor as an assembly.

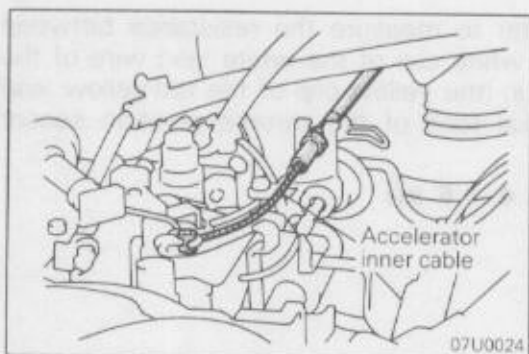
SERVICE ADJUSTMENT PROCEDURES <DIESEL ENGINE>

E13FCAL

GENERAL INSPECTION

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

- (1) Warm up the engine until it stabilizes at idle.
- (2) Confirm that the idle speed is at the prescribed rpm.
- (3) Stop the engine (ignition switch OFF).
- (4) Confirm that there are no sharp bends in the accelerator cable.
- (5) Check the inner cable for correct slack.
- (6) If there is too much slack or no slack, adjust the play by the following procedures.



07U0024

- ① Loosen the adjusting nut so that the throttle lever is free.
- ② Tighten the adjusting nut until the throttle lever just starts moving. Loosen 1 turn, and lock with a lock nut. This adjusts the accelerator cable play to the standard value.

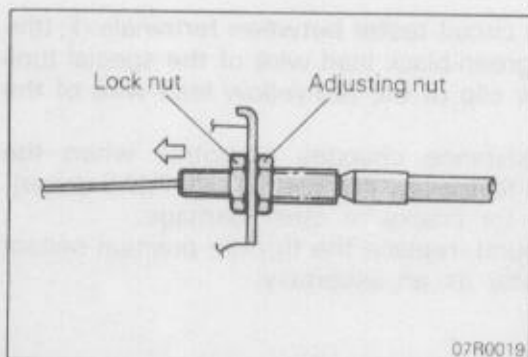
Standard value: 1 – 2 mm (0.04 – 0.08 in.)

NOTE

If there is excessive play of the accelerator cable, the vehicle speed drop ("undershoot") when climbing a slope will be large.

If there is no play (excessive tension) of the accelerator cable, the idling speed will increase.

- ③ After adjusting, confirm that the throttle lever fully opens and closes by operating the pedal.



07R0019

FUEL FILTER REPLACEMENT

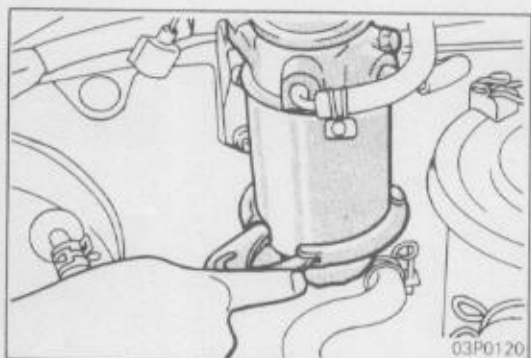
E13FZAI

- (1) Remove the fuel tank cap and release the pressure from the fuel tank.
- (2) Disconnect the water level sensor connector.
- (3) Using an oil filter wrench, remove the fuel filter cartridge from the fuel filter pump body.

Caution

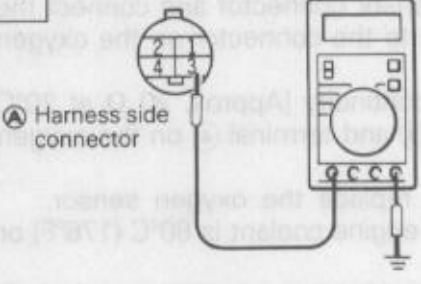
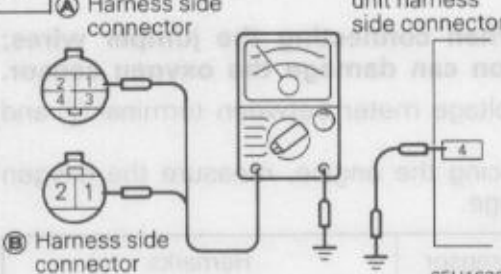
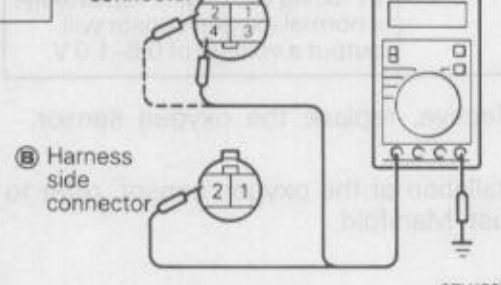
Cover the fuel filter with a shop towel to prevent fuel from splashing out.

- (4) Install a new fuel filter, and then bleed the fuel line. (Refer to P.13-125.)
- (5) Start the engine, and check for fuel leaks.

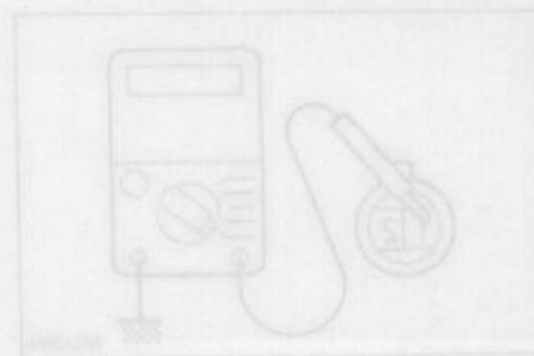


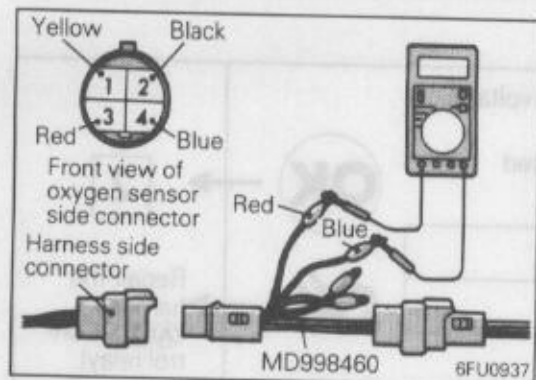
03P0120

HARNESS INSPECTION

1  ① Harness side connector 01A0517	Measure the power supply voltage of the oxygen sensor. - Connector: Disconnected - Ignition switch: ON <table border="1" data-bbox="716 312 1166 421"> <tr> <th>Voltage (V)</th> </tr> <tr> <td>11 – 13</td> </tr> </table> OK → 2 ✗ → Repair the harness. (A3 – Control relay)	Voltage (V)	11 – 13	2
Voltage (V)				
11 – 13				
2  ① Harness side connector ② Engine control unit harness side connector 6FU1626	Check for an open-circuit, or a short-circuit to earth between the engine control unit and the oxygen sensor. - Oxygen sensor connector: Disconnected - Engine control unit connector: Disconnected OK → 3 ✗ → Repair the harness. (A1 – 4) (B1 – 4)	3		
3  ① Harness side connector ② Engine control unit harness side connector 6FU1627	Check for continuity of the earth circuit. Connector: Disconnected OK → STOP ✗ → Repair the harness. (A2 – 105) (A4 – Earth) (B2 – 24)	STOP		

Engine	Sensor output voltage	Remarks
When the actual output ratio is checked by using the engine speed, a normal oxygen sensor will output a voltage of 0.8 – 1.0 V.	0.8 – 1.0 V	





SENSOR INSPECTION

Vehicles for Europe

- (1) Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
- (2) Make sure that there is continuity [Approx. $20\ \Omega$ at 20°C (68°F)] between terminal ③ and terminal ④ on the oxygen sensor connector.
- (3) If there is no continuity, replace the oxygen sensor.
- (4) Warm up the engine until engine coolant is 80°C (176°F) or higher.
- (5) Use jumper wires to connect oxygen sensor terminal ③ (connect to (+) terminal) and terminal ④ (connect to (-) terminal) with the battery (+) terminal and (-) terminal.

Caution

Be very careful when connecting the jumper wires; incorrect connection can damage the oxygen sensor.

- (6) Connect a digital voltage meter between terminal ① and terminal ②.
- (7) While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Remarks
When racing engine	0.6–1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6–1.0 V.

- (8) If the sensor is defective, replace the oxygen sensor.

NOTE

For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.

Vehicles for Australia

- (1) Warm the engine and check to be sure that the engine coolant temperature is $80 - 95^\circ\text{C}$ ($176 - 203^\circ\text{F}$).
- (2) Disconnect the oxygen sensor connector and connect a digital voltmeter.

Caution

When disconnecting the oxygen sensor connector, do not pull the connector or lead wire too strongly.

- (3) Race the engine repeatedly and measure the oxygen sensor output voltage.

Engine	Sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	When the air/fuel mixture ratio is enriched by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

- (4) If the sensor is defective, replace the oxygen sensor.

NOTE

For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.

