FUEL

CONTENTS

E13AA--

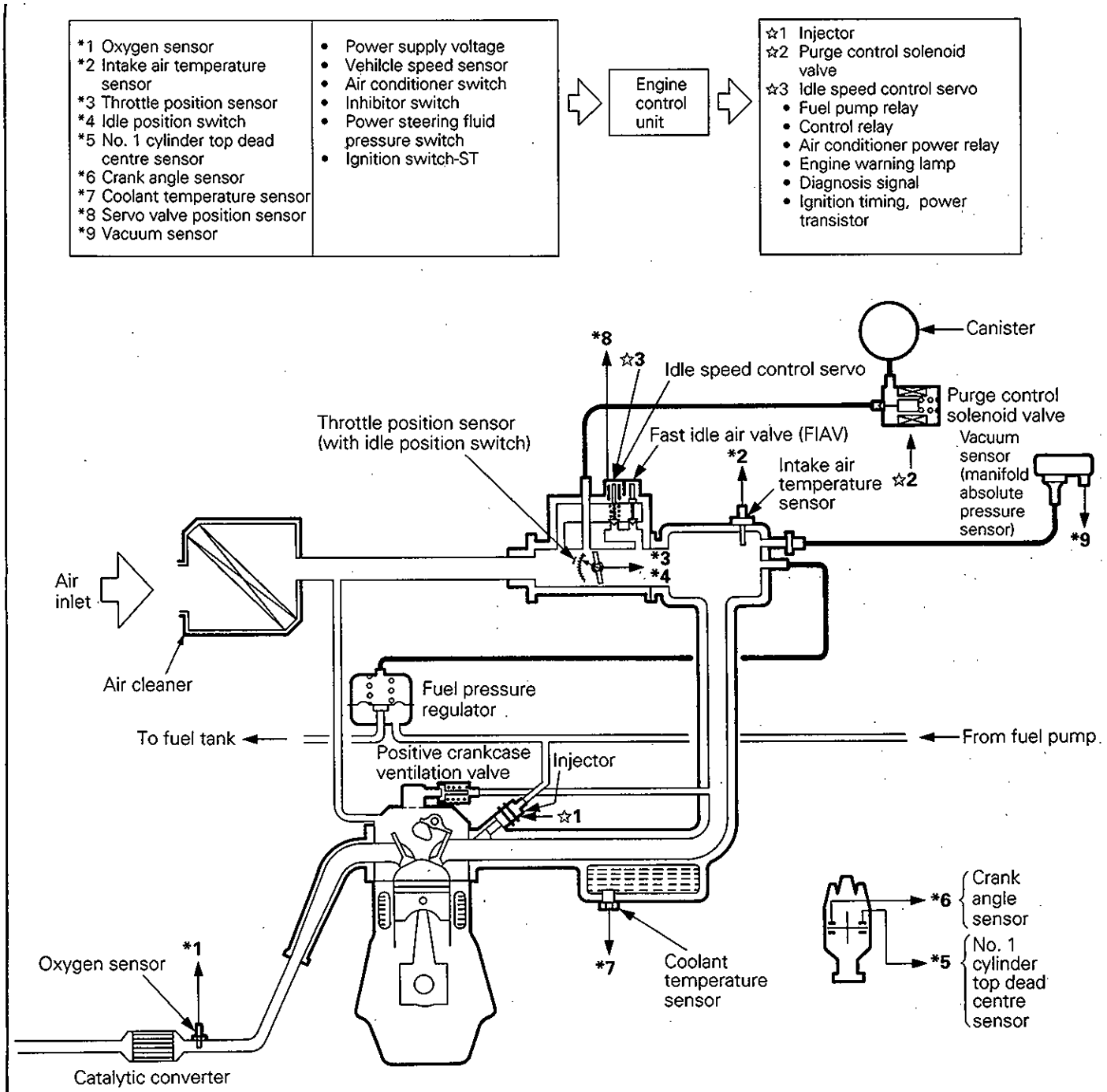
NOTES

FUEL SYSTEM <4G13>

GENERAL INFORMATION

E13BBAM

MULTI POINT INJECTION SYSTEM DIAGRAM



SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA--

Items	Specifications
Fuel	
Tank capacity ℓ (U.S. qts., Imp. qts.)	50 (53, 44)
Return system	Fuel pressure regulator
Fuel pump	
Type	Electrical (Roller vane)
Location	In fuel tank
Throttle body	
Throttle bore mm (in.)	46 (1.81)
Throttle position sensor	Variable resistor type
Idle speed control servo	DC motor type DC motor type by-pass air control system with the Fast Idle Air Valve (FIAV)
Idle position switch	Rotary contact type, within throttle position sensor
Servo valve position sensor	Hall element type
Engine control unit	
Identification model No.	E2T39371 <Vehicles built up to September, 1993> E2T39379 <Vehicles built from October, 1993>
Sensors	
Vacuum sensor (manifold absolute pressure sensor)	Semiconductor type
Intake air temperature sensor	Thermistor type
Coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle speed sensor	Reed switch type
No.1 cylinder top dead centre sensor	Photo interrupter type
Crank angle sensor	Photo interrupter type
Power steering fluid pressure switch	Contact switch type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic type, 4
Injector identification mark	MDH145
Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	
Regulator pressure kPa (kg/cm², psi)	335 (3.35, 47.6)

SERVICE SPECIFICATIONS

E13CB–

Items		Specifications
Basic ignition timing		5°±2° BTDC at curb idle
Curb idle speed	r/min.	750±100
Idle speed when air conditioner is ON	r/min.	850 at neutral position
Basic idle speed	r/min.	750±50
Throttle position sensor adjusting voltage	mV	400–1000
Throttle position sensor resistance	kΩ	3.5–6.5
Intake air temperature sensor resistance	kΩ	2.6 [at 20°C (68°F)]
Coolant temperature sensor resistance	kΩ	
20°C (68°F)		2.4
80°C (176°F)		0.3
Oxygen sensor output voltage	V	0.6–1.0
Fuel pressure	kPa (kg/cm^2, psi)	
Vacuum hose disconnected		330–350 (3.3–3.5, 47–50) at curb idle
Vacuum hose connected		Approx. 270 (2.7, 38) at curb idle
Injector coil resistance	Ω	13–16 [at 20°C (68°F)]
Purge control solenoid valve coil resistance	Ω	36–44 [at 20°C (68°F)]

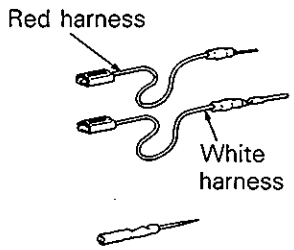
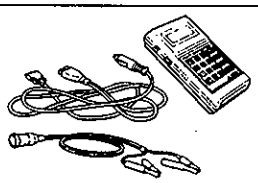
SEALANT

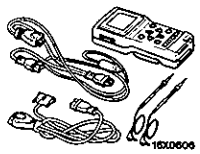
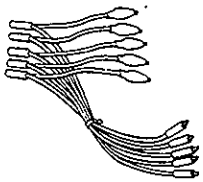
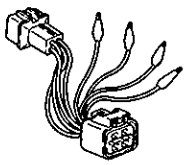
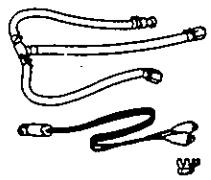
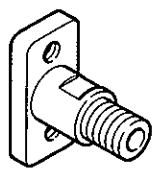
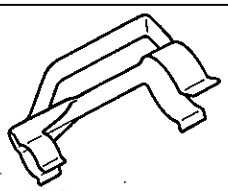
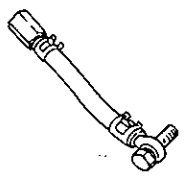
E13CE–

Items	Specified sealant	Remark
Coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Plug and floor pan	3M 8513 Grommeted Windshield Sealer (Black)	—

SPECIAL TOOLS

E13DA–

Tool	Number	Name	Use
	MB991223	Inspection test harness set • Pin contact pressure inspection harness • Market tester contact probe (for general connectors)	Measurement of terminal voltage
	MB991341	Multi-use tester sub assembly	<Up to 1993 models> • Reading diagnosis code • MPI system inspection
	(For the number, refer to GROUP 00 – Precautions before service.)	ROM pack (for multi-use tester)	

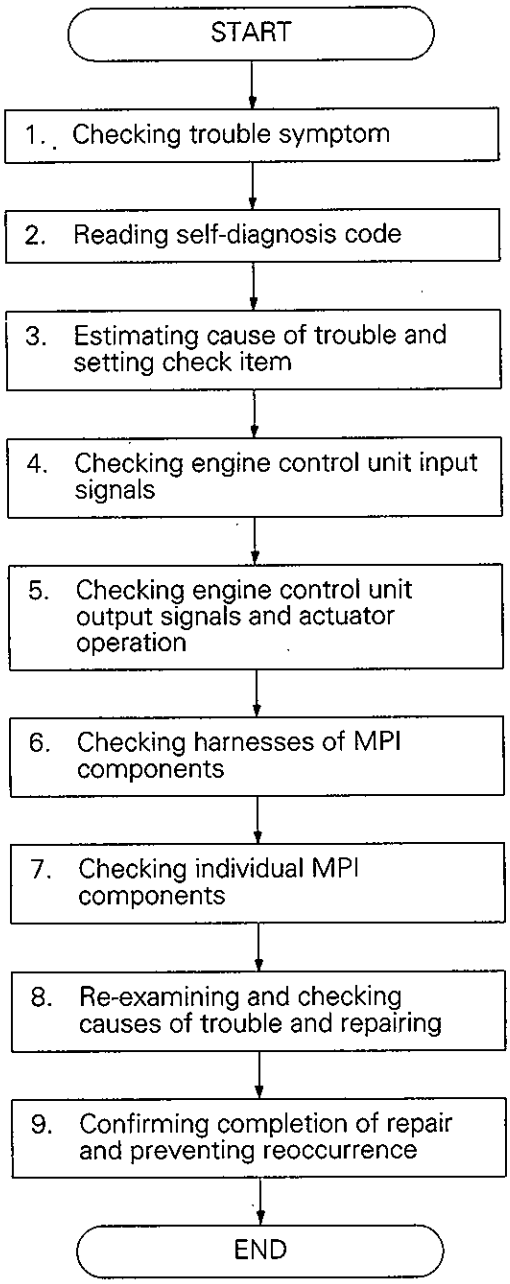
Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	<All models> • Reading diagnosis code • MPI system inspection
 16X0607		ROM pack	
	MB991348	Test harness set	• Adjustment of idle position switch and throttle position sensor • Inspection using an analyzer
	MD998464	Test harness (4 pin, square)	• Inspection of oxygen sensor
	MD998706	Injector test set	Checking the spray condition of injectors
	MD998741	Injector test adapter	
	MD998746	Clip	
	MD998709	Adapter hose	Measurement of fuel pressure
	MD998742	Hose adapter	

TROUBLESHOOTING

E13EFAP

EXPLANATION OF TROUBLESHOOTING PROCEDURES

The troubleshooting procedures that are effective for malfunctions of the MPI system are explained in the following.



(1) Checking trouble symptom
- Reproduce the trouble symptom and check the contents of the trouble and the conditions under which the symptom occurs (engine condition, operating state, etc.).

(2) Reading self-diagnosis code
- Read the self-diagnosis code and correct the malfunction when a malfunction code is output, referring to the diagnostic chart.

(3) Estimating cause of trouble and setting check item
- Referring to CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS, determine the check items and procedures to be followed.

(4) Checking engine control unit input signals
- Use the Multi-use tester (MUT), MUT-II or an analyzer to check the signals input to the engine control unit.
- If the input signals are normal, the sensor input is judged to be normal. Then, check the next check item.

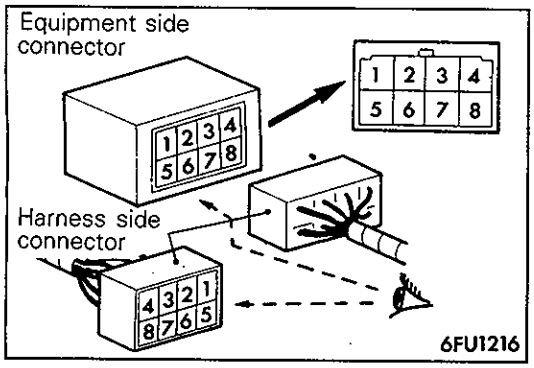
(5) Checking engine control unit output signals and actuator operation
- Use the MUT or MUT-II to check the signals output from the engine control unit. Also, force-drive the actuator using the actuator test function to check the actuator operation.
- Use an analyzer to check the signals output from the engine control unit.
- If the signals output from the engine control unit and the operation of the actuator are normal, the actuator control is judged to be normal. Then, check the next check item.

(6) Checking harnesses of MPI components
- If the input and output signals for the engine control unit are not normal, check the body harnesses of the MPI components and repair as necessary.
- After repairing, check the input and output signals for the engine control unit again. If they are normal this time, check the input and output signals for the next check item.

(7) Checking individual MPI components
- If the body harnesses are normal but the input and output signals for the engine control unit are still abnormal, check the MPI components individually and repair or replace as necessary.
- After repair or replacement, check the input and output signals of the engine control unit again. If they are normal this time, check the input and output signals of the next check item.

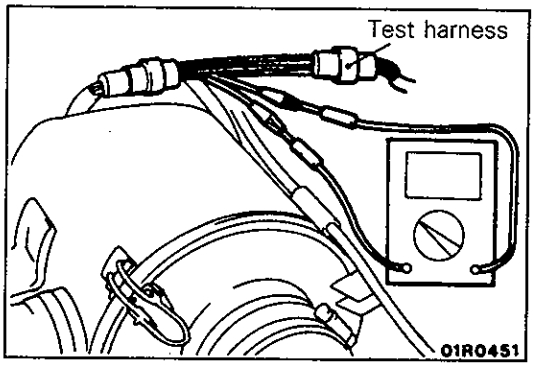
(8) Re-examining and checking causes of trouble and repairing
- If the results of the harness check and individual component check are normal but the input and output signals for the engine control unit are still abnormal, re-examine the causes of the trouble, referring to the troubleshooting hints. Then, carry out checking and repairing including other groups.

(9) Confirming completion of repair and preventing reoccurrence
- Try to reproduce the trouble symptom to make sure that the symptom does not occur again.
- Remove the true cause of the trouble to prevent its reoccurrence.

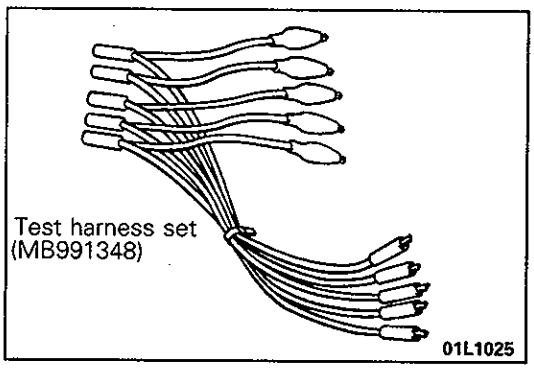


EXPLANATION AND CAUTIONS FOR CIRCUIT CHECKING

- The connector symbols show the pin arrangement as seen from the direction of the terminal end of the connector actually mounted in the vehicle.
- When the standard value when checking the voltage is recorded as SV, this is an abbreviation for system voltage.

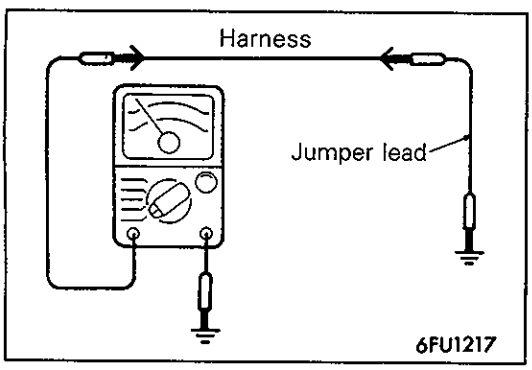


- When checking a waterproof connector with the circuit in a live state, be sure to use the special tool (test harness). Inserting the test probe from the harness side should never be done, as it will adversely affect waterproof performance, which may lead to corrosion. Furthermore, the test harness is used for each setting, so the appropriate item for the connector should be selected.

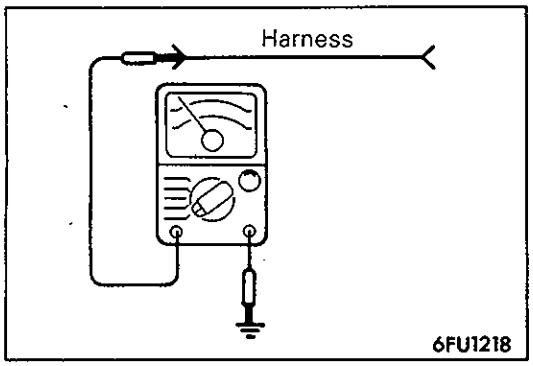


- In addition, if there is no test harness for the appropriate connector, the test harness set (MB991348) which can be connected directly between the terminals can be used.

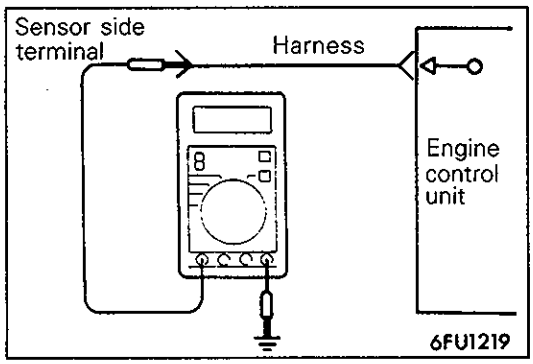
- When checking the terminal voltage, etc., with the connectors disconnected, do not insert the test probe if the check terminal has female pins. Use the special tool (inspection harness set MB991223) instead. Forcing the test probe into such a terminal can cause poor contact.



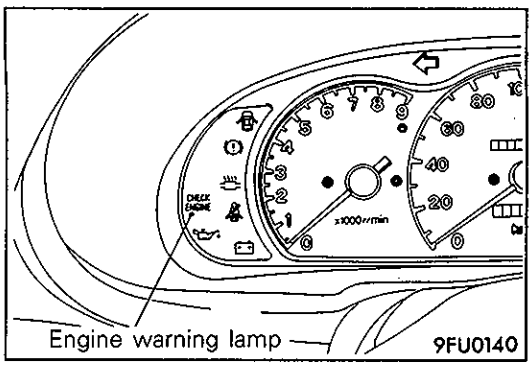
- When checking for a open circuit in a harness with both ends of the harness separated physically, use a jumper lead to earth one end and check continuity between the other end and the earth. This enables checking for a open circuit in the harness to be made. If there is no continuity, repair the harness. However, when checking for a open circuit in the power supply line, check the continuity between both ends directly, without using a jumper lead to earth one end of the harness.



- When checking for a harness short-circuit, open one end of the harness and check for continuity between the other end and the earth.
  If there is continuity, the harness is short-circuited to earth, so repair the harness.
- As a rule, use an analog type ohmmeter (or circuit tester) to measure the continuity.



- If the harness is normal, but the impressed voltage to the sensor is not normal, replace the engine control unit and recheck.
- As a rule, use a digital type voltmeter (or circuit tester) to measure the voltage.
  However, for checking the power transistor drive voltage, use an analog type voltmeter.



ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Among the self-diagnosis items, an engine warning 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 engine warning 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 engine warning lamp is lit for 5 seconds to indicate that the engine warning lamp operates normally.

ITEMS INDICATED BY THE ENGINE WARNING LAMP

Engine control unit
Oxygen sensor
Intake air temperature sensor
Throttle position sensor
Coolant temperature sensor
Crank angle sensor
Top dead centre sensor (No. 1 cylinder top dead centre)
Vacuum sensor (manifold absolute pressure sensor)
Ignition timing adjustment signal
Injector

Caution
Engine warning lamp will come on even when terminal for ignition timing adjustment is short-circuited. Therefore, it is not abnormal that the lamp comes on even when terminal for ignition timing adjustment is short-circuited at the time of ignition timing adjustment.

ENGINE WARNING 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 13 diagnosis items, including the normal state, and the diagnosis results can be read out with a multi-use tester (MUT) or MUT-II.
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.
In addition, the malfunction code can also be erased by turning the ignition switch to ON and sending the malfunction code erase signal from the MUT or MUT-II 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 MUT or MUT-II to the engine control unit and the diagnosis memory will be erased.

The 13 diagnosis items are provided as follows, and if plural items are activated, they are all indicated sequentially from the smallest code number.

Caution
The malfunction code of ignition timing adjustment signal is outputted when terminal for ignition timing adjustment is short-circuited. Therefore, it is not abnormal that the code is outputted even when terminal for ignition timing adjustment is short-circuited at the time of ignition timing adjustment.

Diagnosis Chart

Output preference order	Diagnosis item	Malfunction code		Check item (Remedy)
		No.	Memory	
1	Engine control unit	–	–	(Replace engine control unit)
2	Oxygen sensor	11	Retained	• Harness and connector • Fuel pressure • Injectors (Replace if defective.) • Intake air leaks • Oxygen sensor
3	Intake air temperature sensor	13	Retained	• Harness and connector • Intake air temperature sensor

Output preference order	Diagnosis item	Malfunction code		Check item (Remedy)
		No.	Memory	
4	Throttle position sensor	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch
5	Coolant temperature sensor	21	Retained	• Harness and connector • Coolant temperature sensor
6	Crank angle sensor	22	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
7	No. 1 cylinder top dead centre sensor	23	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
8	Vehicle speed sensor (reed switch)	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
9	Vacuum sensor (Manifold absolute pressure sensor)	32	Retained	• Harness and connector [If harness and connector are normal, replace vacuum sensor (manifold absolute pressure sensor) assembly]
10	Ignition timing adjustment signal	36	–	• Harness and connector
11	Injector	41	Retained	• Harness and connector • Injector coil resistance
12	Servo valve position sensor	55	Retained	• Harness and connector • Servo valve position sensor • Idle speed control servo (DC motor)
13	Normal state	–	–	–

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. The code numbers will be displayed in order, starting from the lowest.

PROBLEM DIAGNOSIS CONTENT CHART

NOTE
*: Fail-Safe/backup function is operating.

Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
–	Engine control unit	Abnormality in engine control unit	–	• Engine stalls • Starting is impossible
11	Oxygen sensor	Oxygen sensor signal voltage does not change (lean/rich) even when air/fuel ratio feedback control (close loop control) operates.	(1) Oxygen sensor malfunction (2) Open circuit or short circuit in oxygen sensor, or connector contact is defective.	• Reduction in exhaust gas purification efficiency*
			(3) Inappropriate fuel pressure (4) Injector malfunction (5) Air leaking in through clearance in gasket (6) Engine control unit malfunction	• Reduction in exhaust gas purification efficiency* • Poor starting • Unstable idling • Poor acceleration
13	Intake air temperature sensor	(1) Voltage of intake air temperature sensor signal is 4.5V or more. (2) Voltage of intake air temperature sensor signal is 0.27V or less.	(1) Intake air temperature sensor malfunction (2) Open circuit or short circuit in the intake air temperature sensor, or connector contact is defective (3) Engine control unit malfunction	• Slightly poor driveability* • At high temperatures: (a) Poor starting* (b) Unstable idling*
14	Throttle position sensor	(1) Voltage of throttle position sensor signal is 0.2V or less. (2) Voltage of throttle position sensor signal is 2V or more, even though idle position switch is ON.	(1) Throttle position sensor malfunction, or adjustment is defective. (2) Open circuit or short circuit in throttle position sensor, or connector contact is defective.	• Slightly poor acceleration <M/T> • Poor driveability <A/T> • Engine stalls
			(3) Idle position switch ON malfunction (4) Short circuit in idle position switch signal wire (5) Engine control unit malfunction	• Engine stalls • Racing is impossible

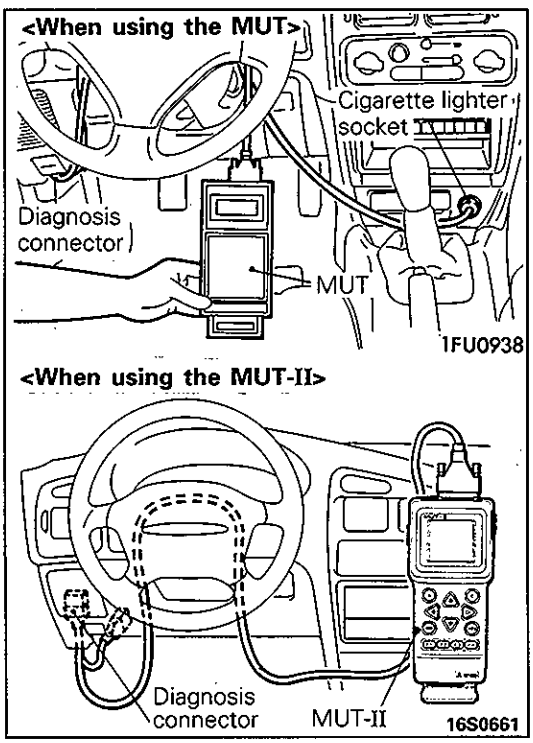
Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
21	Coolant temperature sensor	(1) Voltage of coolant temperature sensor signal is 4.6V or more. (2) Voltage of coolant temperature sensor signal is 0.11V or less. (3) While engine is warming up, coolant temperature sensor signal shows a drop in engine coolant temperature.	(1) Coolant temperature sensor malfunction (2) Open circuit or short circuit in coolant temperature sensor, or connector contact is defective (3) Engine control unit malfunction	When engine is cold: • Poor starting* • Unstable idling* • Poor acceleration*
22	Crank angle sensor	Voltage of crank angle sensor signal does not change (high/low), even though engine has been cranking for 4 seconds or more.	(1) Crank angle sensor malfunction (2) Open circuit or short circuit in crank angle sensor, or connector contact is defective (3) Engine control unit malfunction	• Engine stalls • Starting is impossible
23	Top dead centre sensor	Voltage of top dead centre sensor signal does not change (high/low), even though engine is running.	(1) Top dead centre sensor malfunction (2) Open circuit or short circuit in top dead centre sensor, or connector contact is defective (3) Engine control unit malfunction	• Unstable idling* • Poor acceleration*
24	Vehicle speed sensor (reed switch)	Voltage of vehicle speed sensor does not change (high/low) even though vehicle is accelerating at an engine speed of 3,000 r/min. or more.	(1) Vehicle speed sensor malfunction (2) Open circuit or short circuit in vehicle speed sensor, or connector contact is defective (3) Engine control unit malfunction	Engine stalls when vehicle stops after decelerating

Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
32	Vacuum sensor (Manifold absolute pressure sensor)	(1) Voltage of vacuum sensor signal is 4.5V or more. (2) Voltage of vacuum sensor signal is 0.2V or less.	(1) Vacuum sensor malfunction (2) Open circuit or short circuit in vacuum sensor, or connector contact is defective. (3) Engine control unit malfunction	• Poor acceleration* • Inappropriate idle speed* • Unstable idling*
36	Ignition timing adjustment signal	Ignition timing adjustment signal wire is short-circuited to earth.	(1) Ignition timing adjustment signal wire is short-circuited to earth (2) Engine control unit malfunction	• Poor acceleration • Engine overheats
41	Injector	Injectors do not operate for a continuous 4 second period while engine is cranking or idling.	(1) Injector malfunction (2) Open circuit or short circuit in injector, or connector contact is defective (3) Engine control unit malfunction	• Reduction in exhaust gas purification efficiency* • Poor starting • Unstable idling • Poor acceleration
55	Servo valve position sensor	Servo valve does not move to the intended position (opening angle), even though idle speed control servo motor operates many times.	(1) Servo valve position sensor malfunction (2) Open circuit or short circuit in servo valve position sensor, or connector contact is defective (3) Idle speed control servo motor (DC motor) malfunction (4) Open circuit or short circuit in idle speed control servo motor (DC motor), or connector contact is defective (5) Engine control unit is defective	• Inappropriate idle speed* • Engine stops* • Unstable idling*

FAIL-SAFE/BACKUP FUNCTION TABLE

When the main sensor malfunctions are detected by the self-diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Vacuum sensor (Manifold absolute pressure sensor)	(1) Determines the fuel injection timing and ignition timing by means of the throttle position sensor (TPS) signal and the engine speed signal (crank angle sensor signal). (2) Fixes the ISC servo in the appointed position so idle speed control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 45°C (113°F).
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Coolant temperature sensor	Controls as if the coolant temperature is 80° (176°F).
Top dead centre sensor	Injects fuel simultaneously into all cylinders. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)
Servo valve position sensor	Idle speed control is not performed.
Oxygen sensor	Air/fuel ratio feedback control (closed loop control) is not performed.



READ OUT OF MALFUNCTION CODE

PRECAUTIONS FOR OPERATION

(1) When battery voltage is low, no detection of failure is possible. Be sure to check the battery for voltage and other conditions before starting the test.
(2) Diagnosis item is erased if the battery or the engine control unit connector is disconnected. Do not disconnect the battery before the diagnosis result is completely read.
(3) Connection and disconnection of the Multi-use tester (MUT) or MUT-II should always be made with the ignition switch in the OFF position.

READING PROCEDURE-USING MULTI-USE TESTER (MUT) <Up to 1993 models> OR MUT-II <All models>

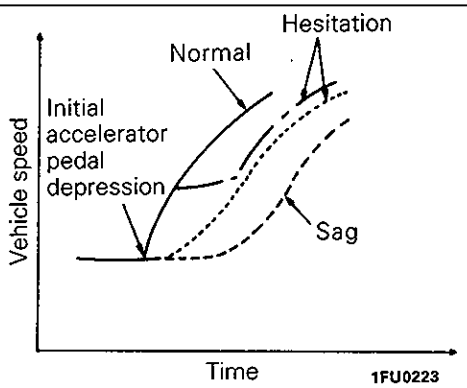
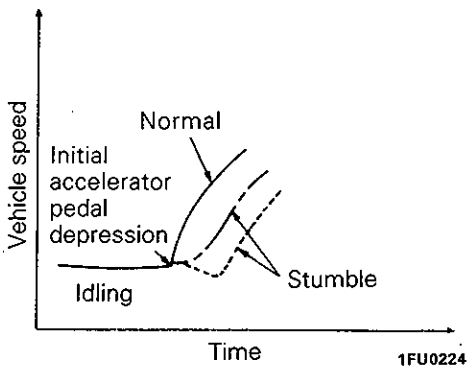
(1) Connect the MUT or MUT-II to the diagnosis connector.
NOTE
When connecting the MUT-II, use the adaptor harness which is supplied as an accessory to the MUT-II sub-assembly.
(2) Turn the ignition switch ON.
(3) Read and make a note of the self-diagnosis output.
(4) Repair the problem location, referring to the diagnosis chart.
(5) After turning the ignition switch once to OFF, turn it back ON.
(6) Erase the malfunction code.
(7) Recheck to be sure that the condition is normal.

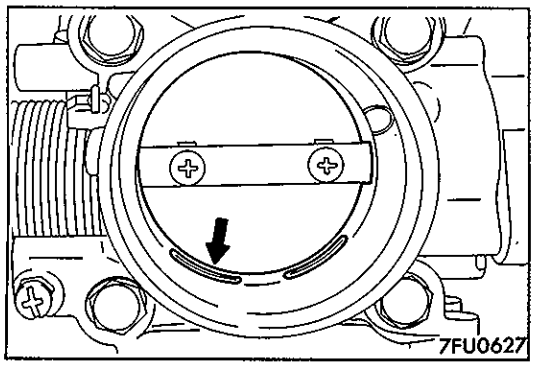
CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS

Problem symptoms / Check items	Starting		Idling stability			Driving						Stopping	Reference page
	Will not start	Starting problem	Idling instability (Rough idling)	Incorrect idling speed	Improper idling continuity	Hesitation, sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run-on (Dieseling)	
Power supply	① 1												P. 13-30
Engine control unit power earth	② 2												P. 13-33
Fuel pump	③ 3	① 1			① 1	① 1	① 1						P. 13-34
Intake air temperature sensor			⑥			④ 4	④ 4				① 1		P. 13-37
Vacuum sensor (Manifold absolute pressure sensor)			⑧			⑦ 7	⑥ 6				② 2		P. 13-40
Coolant temperature sensor		3	⑦ 6	① 1	⑥ 6	⑥ 6	⑤ 5	④ 4		③ 3			P. 13-42
Throttle position sensor						⑤ 5		③ 3	④ 4				P. 13-45
Idle position switch			④ 4	② 2	⑤ 5								P. 13-48
Servo valve position sensor (SOHC)			③ 3	⑤ 3	④ 4				⑤ 5				P. 13-50
Top dead centre sensor	⑤ 5	⑥ 7			⑨ 8				② 2				P. 13-53
Crank angle sensor	⑥ 6	⑦ 8			⑩ 9				③ 3				P. 13-57
Ignition switch-ST	④ 4	③ 4											P. 13-60
Vehicle speed sensor					⑦				⑥				P..13-61
Power steering fluid pressure switch				③									P. 13-63
Air conditioner switch and power relay				④									P. 13-65
Oxygen sensor			⑩										P. 13-67
Injectors	⑧ 8	② 2	② 2		③ 3	② 2	② 2	① 1		① 1		①	P. 13-70
Idle speed control servo		④ 5	① 1	⑥ 4	② 2				⑦ 6				P. 13-76
Ignition coil and power transistor	⑦ 7				⑪ 10		⑦ 7		① 1		③ 3		P. 13-78
Purge control solenoid valve			⑨										P. 13-82
Fuel pressure		⑤ 6	⑤ 5		⑧ 7	③ 3	③ 3	② 2		② 2			P. 13-84

○: Warm engine (number inside indicates check order)
□: Cold engine (number inside indicates check order)

PROBLEM SYMPTOM TABLE (FOR YOUR INFORMATION)

	Items	Symptom
Starting	Won't start (No initial combustion)	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starting problem (Initial combustion, then stall)	There is combustion within the cylinders, but then the engine soon stalls.
	(Starting takes a long time.)	Engine won't start quickly.
Idling stability	Idling instability (Rough idling)	Engine speed doesn't remain constant; changes during idling. Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idling.
	Incorrect idling speed	The engine doesn't idle at the usual correct speed.
	Improper idling continuity Die out Pass out	This non-continuity of idling includes the following elements. (1) Die out....The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not. (2) Pass out..The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle (engine r/min.) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine r/min.) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine rpm response is delayed when the accelerator pedal is initially depressed for acceleration from the stopped condition. 
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".



SERVICE ADJUSTMENT PROCEDURES

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

E13HAJE

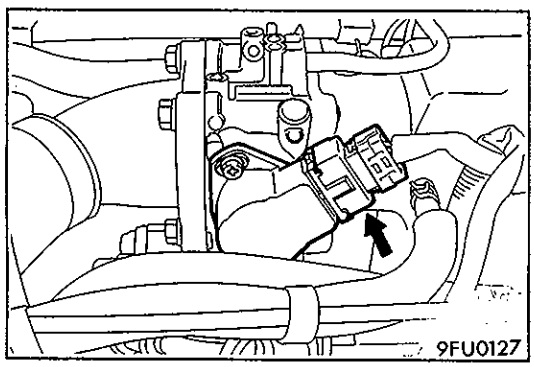
(1) Start the engine and warm it up until the coolant is heated to 80°C (176°F) or higher and then stop the engine.
(2) Remove the air intake hose from the throttle body.
(3) Plug the bypass passage inlet of the throttle body.

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 idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
(6) If the throttle valve deposits are not removed, repeat steps (4) and (5).
(7) Unplug the bypass passage inlet.
(8) Attach the air intake hose.

(9) Use the Multi-use tester (MUT) or MUT-II to erase the self-diagnosis code.
(10) Adjust the basic idle speed. (Refer to P. 13-21.)

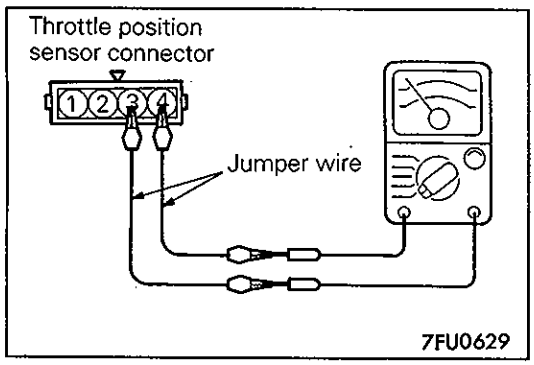
NOTE
If the engine hunts when idling after adjustment of the basic idle speed, remove the ⊖ cable from the battery for 10 seconds or more, and then run the engine at idle again.



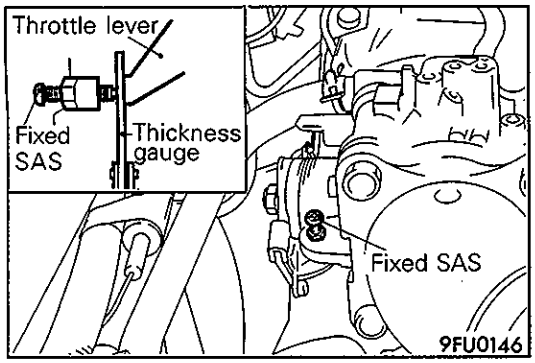
IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT

E13HAKI

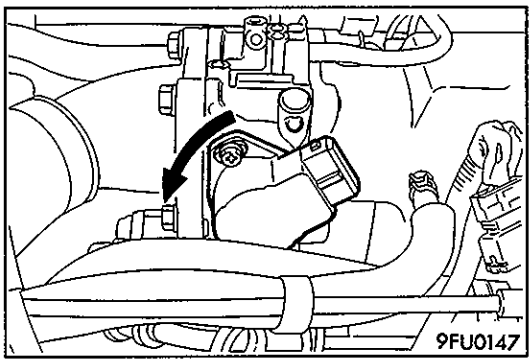
(1) Disconnect the connector of the throttle position sensor.



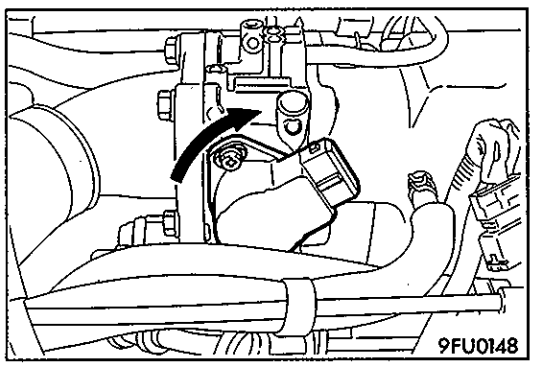
(2) Connect an ohmmeter between terminal ③ (Idle position switch) and ④ (sensor earth) by using jumper wires.



(3) Insert a feeler gauge with a thickness of 0.45 mm (0.0177 in.) between the fixed SAS and the throttle lever.



(4) Loosen the throttle position sensor mounting bolt; then turn the throttle position sensor body fully counter clockwise.
(5) In this condition, check for continuity between terminals ③ and ④.

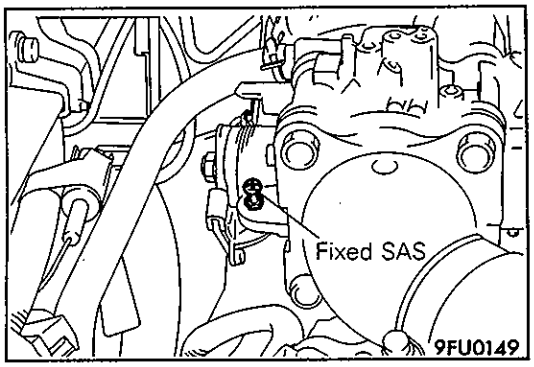


(6) Slowly turn the throttle position sensor in the clockwise direction until the point at which continuity between terminals ③ and ④ changes to non-continuity is found. Tighten the throttle position sensor installation bolt at that position.
(7) Connect the connector of the throttle position sensor.

(8) Connect the Multi-use tester (MUT) or MUT-II to the diagnosis connector (white).
(9) Turn the ignition switch ON (but do not start the engine.)
(10) Select item No. 14 and read the throttle position sensor output voltage.

Standard value: 400–1,000 mV

(11) If there is a deviation from the standard value, check the throttle position sensor and the related harness.
(12) Remove the feeler gauge.
(13) Switch OFF the ignition switch.



FIXED SAS ADJUSTMENT E13HAME

NOTE
1. The fixed SAS should not be moved unnecessarily; it has been precisely adjusted by the manufacturer.
2. If the adjustment for any reason is disturbed, readjust as follows.

(1) Loosen the tension of the accelerator cable sufficiently.
(2) Back out the fixed SAS lock nut.
(3) Turn the fixed SAS counterclockwise until it is sufficiently backed out, and fully close the throttle valve.
(4) Tighten the fixed SAS until the point where the throttle lever is touched (i.e., the point at which the throttle valve begins to open) is found.
From that point, tighten the fixed SAS 1-1/4 turn.
(5) While holding the fixed SAS so that it doesn't move, tighten the lock nut securely.
(6) Adjust the tension of the accelerator cable.
(7) Adjust the basic idling speed.
(8) Adjust the idle position switch and throttle position sensor. (Refer to P. 13-19.)

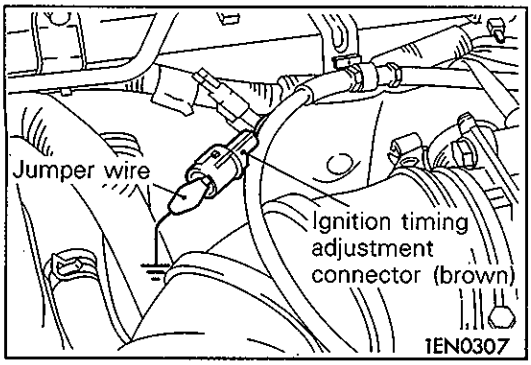
BASIC IDLE SPEED ADJUSTMENT E13HANH

NOTE
1. The standard idling speed has been adjusted, by the speed adjusting screw (SAS), by the manufacturer, and there should usually be no need for readjustment.
2. The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.

(1) The vehicle should be prepared as follows before the inspection and adjustment.
- Engine coolant temperature: 80 – 95°C (176 – 203°F)
- Lamps, cooling fan and accessories: OFF
- Transmission: Neutral (A/T for P range)

(2) Connect the Multi-use tester (MUT) or MUT-II to the diagnosis connector (white).

NOTE
When the MUT or MUT-II is connected, the diagnosis control terminal should be earthed.

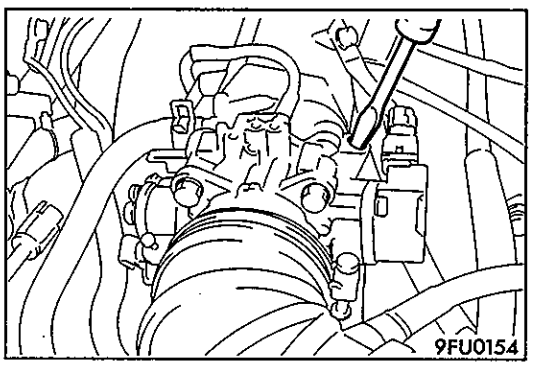


(3) Remove the waterproof female connector from the ignition timing adjustment connector.
(4) Use a jumper wire to earth the ignition timing adjustment terminal.

(5) Start the engine and run at idle.
(6) Select item No. 22 and read the idle speed.

Standard value: 750 ± 50 r/min.

NOTE
1. The engine speed may be 20 to 100 r/min. lower than indicated above for a new vehicle [driven approximately 500 km (300 miles) or less], but no adjustment is necessary.
2. If the engine stalls or the rpm is low even though the vehicle has been driven approximately 500 km (300 miles) or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P. 13-19.)



(7) If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

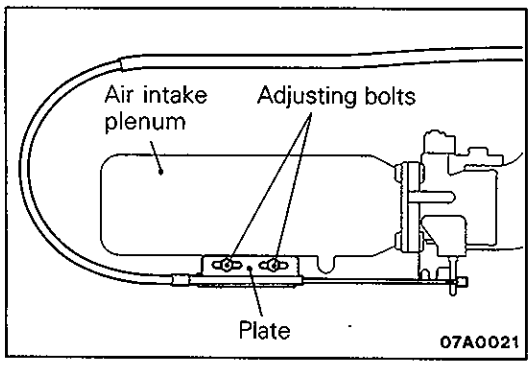
NOTE
If the idling speed is higher than the standard value range even when the SAS is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS. If there are no indications that it has been moved, it is possible that there is leakage as a result of deterioration of the fast idle air valve (FIAV), and, if so the throttle body should be replaced.

(8) Switch OFF the ignition switch.
(9) Disconnect the jumper wire from the ignition timing adjustment terminal and return the connector to its original condition.
(10) Start the engine again and let it run at idle speed for about ten minutes; check to be sure that the idling condition is normal.

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

E13FCBF

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

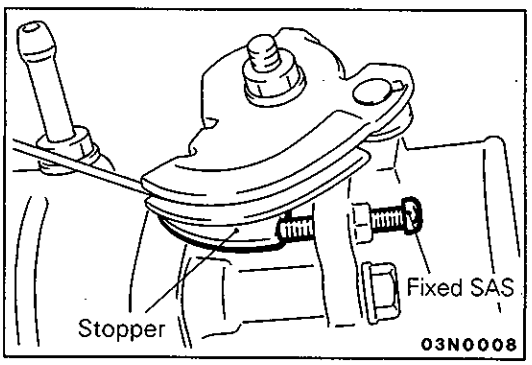


② Loosen the adjusting bolts on the air intake plenum, and then secure the outer cable so that the free play of the inner cable will be the standard value.

Standard value: 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.

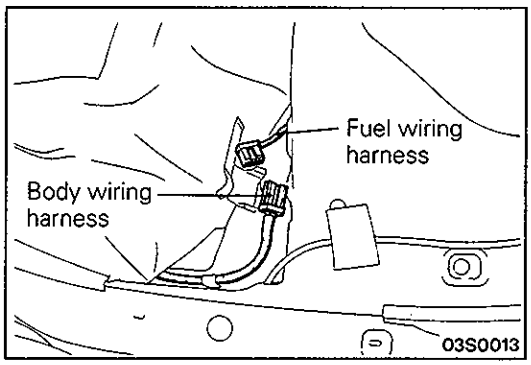
(8) After adjusting, confirm that throttle valve fully opens and closes by operating pedal.



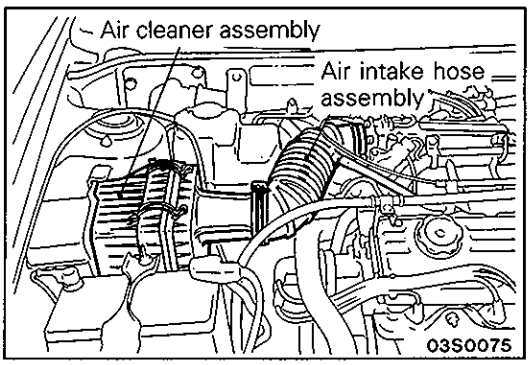
(9) Adjust accelerator cable play and confirm throttle lever stopper touches the fixed SAS.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE) E13HABJ

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.

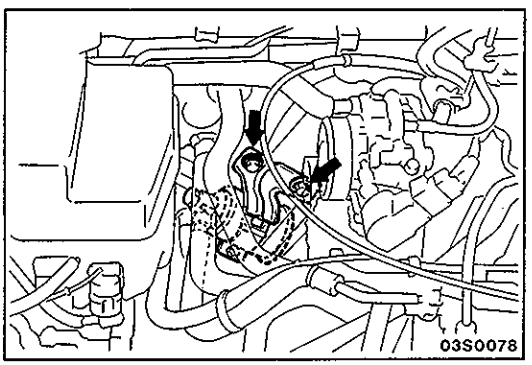


(1) Remove the rear seat cushion. (Refer to GROUP 52A – Seat.)
(2) Disconnect the connection between the body wiring harness and the fuel wiring harness that is under the floor carpet.
(3) After starting the engine and letting it run until it stops naturally, turn the ignition switch to OFF.
(4) Connect the fuel wiring harness and body wiring harness.
(5) Install the rear seat cushion.



FUEL FILTER REPLACEMENT E13FZAO

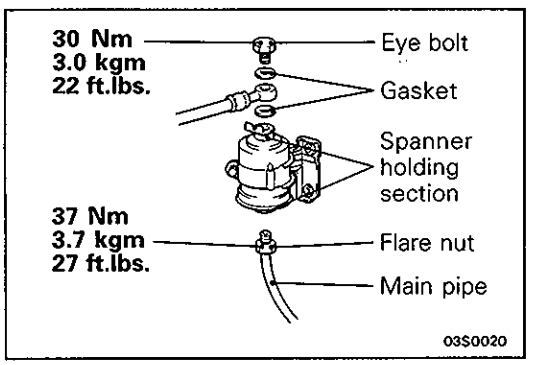
(1) Bleed the residual pressure from inside the fuel line.
(2) Remove the air cleaner and air intake hose.



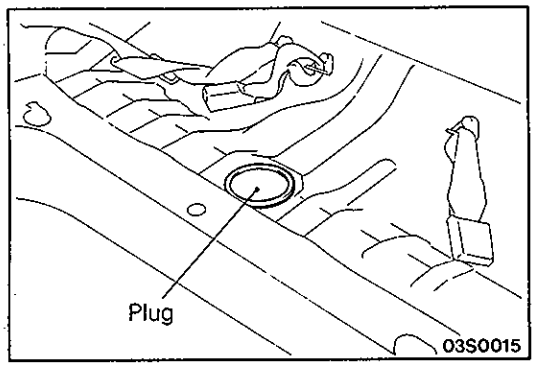
(3) Hold the fuel filter with a spanner and remove the eye bolt. Then remove the high-pressure fuel hose.

Caution
As there will be some pressure remaining in the fuel pipe line, cover it with a rag to prevent fuel from spraying out.

(4) Hold the fuel filter with a spanner and loosen the flare nut. Then disconnect the fuel main pipe connection.
(5) Remove the fuel filter.

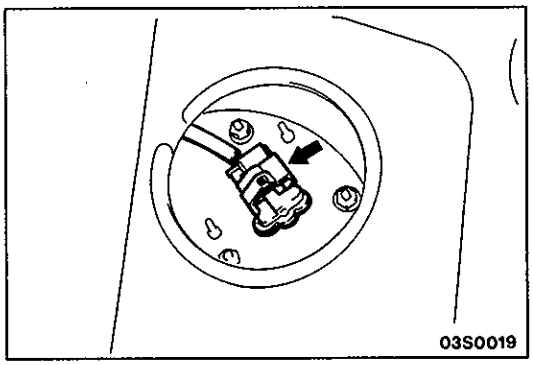


(6) When installing the fuel filter, use a new gasket, and tighten the flare nut of the high-pressure fuel hose and the fuel main pipe to the specified torque.
(7) After installation, check that there are no fuel leaks.
  ① Apply battery voltage to the fuel pump drive terminal to operate the fuel pump. (Refer to P. 13-25.)
  ② Check for leaks when fuel pressure is applied.

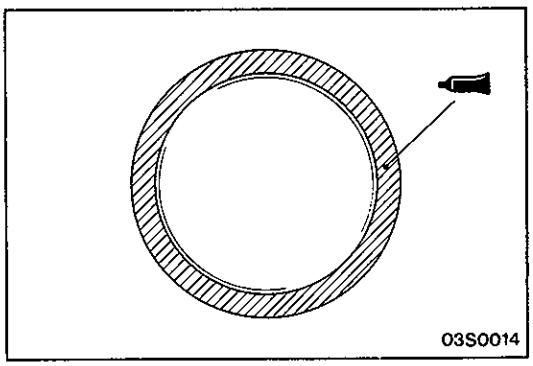


FUEL GAUGE UNIT REPLACEMENT E13FDAG

(1) Remove the rear seat cushion.
(Refer to GROUP 52A –Seat.)
(2) Remove the plug.

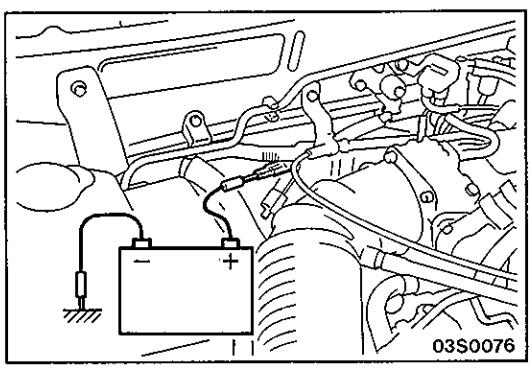


(3) Disconnect the fuel gauge unit connector and remove the fuel gauge unit.



(4) Apply specified sealant to the contact surfaces of the plug and the floor pan, and install the plug.

Specified sealant: 3M 8513 Grommeted Windshield Sealer (Black)



FUEL PUMP OPERATION CHECK E13FGCD

(1) Check the operation of the fuel pump by using the MUT to force-drive the fuel pump.
(2) If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
① Turn the ignition switch to OFF.
② When the fuel pump drive connector (black) is attached directly to the battery, check if the sound of the fuel pump operation can be heard.

NOTE
As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel tank cap and check from the tank inlet.

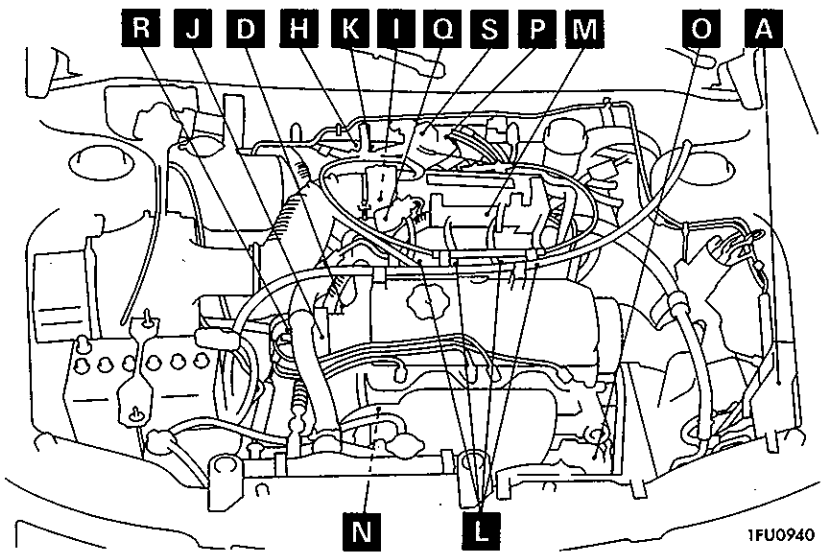
③ Check the fuel pressure by pinching the fuel hose with the fingertips.

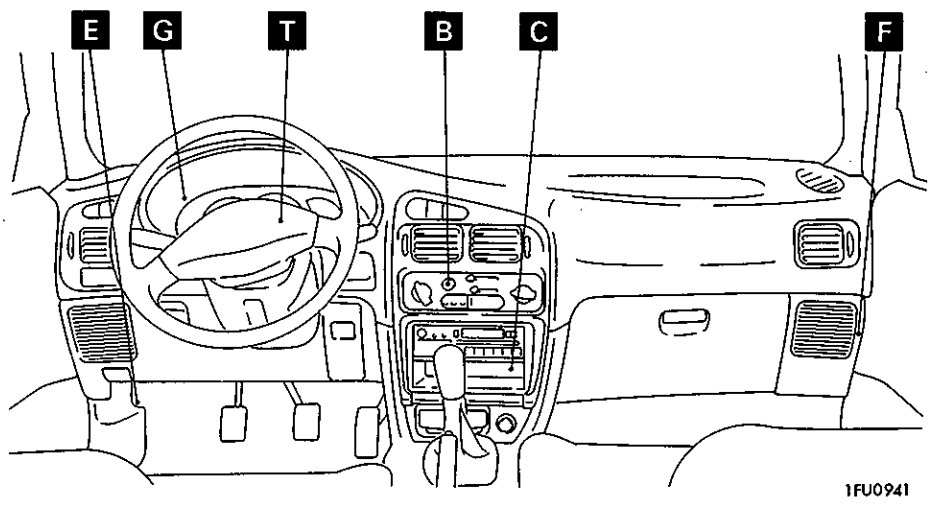
ON-VEHICLE INSPECTION OF MPI COMPONENTS

E13QAAI

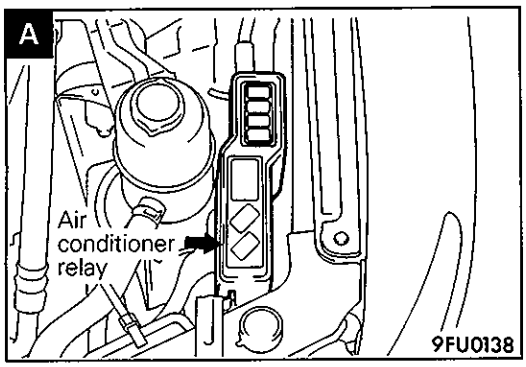
COMPONENT LOCATION

Name	Symbol	Name	Symbol
Air conditioner relay	A	Ignition timing adjustment connector	K
Air conditioner switch	B	Injector	L
Control relay	C	Intake air temperature sensor	M
Coolant temperature sensor	D	Oxygen sensor	N
Diagnosis connector	E	Power steering fluid pressure switch	O
Engine control unit	F	Purge control solenoid valve	P
Engine warning lamp (check engine lamp)	G	Throttle position sensor (with idle position switch)	Q
Fuel pump check terminal	H	No. 1 cylinder top dead centre sensor and crank angle sensor	R
Idle speed control servo	I	Vacuum sensor (Manifold absolute pressure sensor)	S
Ignition coil (power transistor)	J	Vehicle speed sensor (reed switch)	T

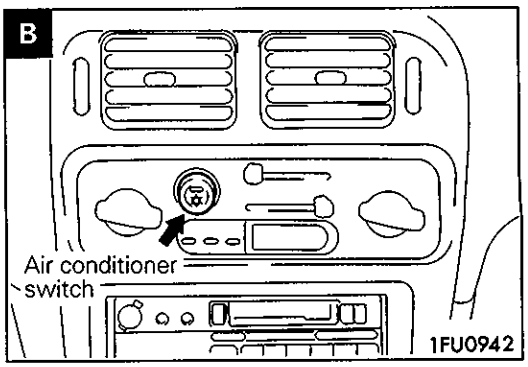




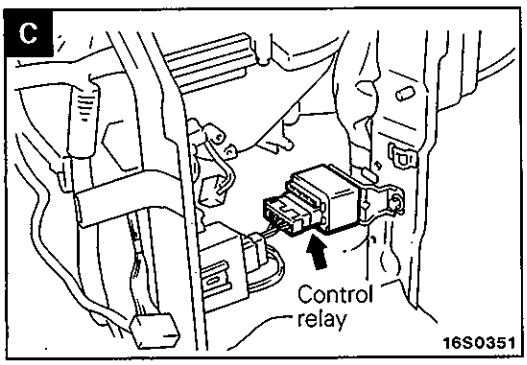
A



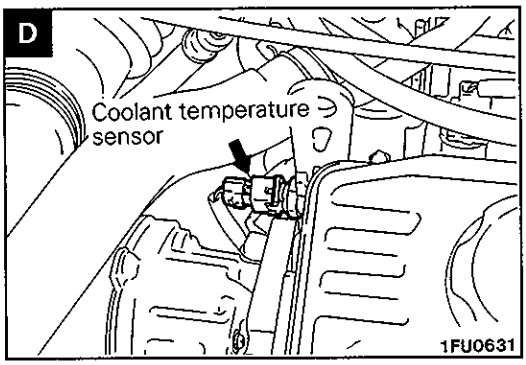
B



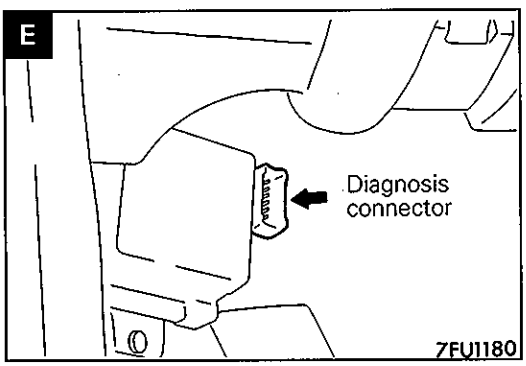
C



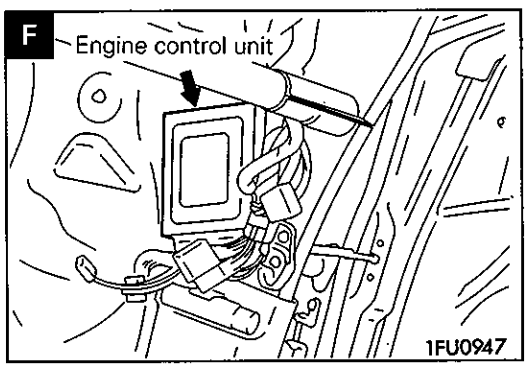
D



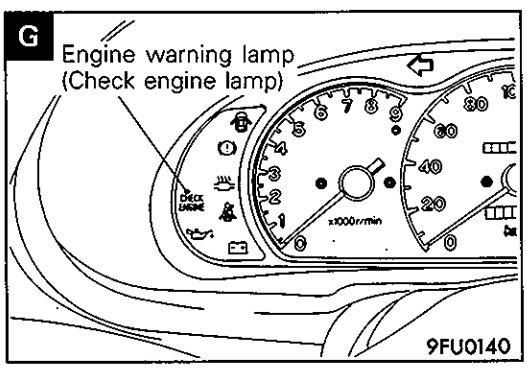
E



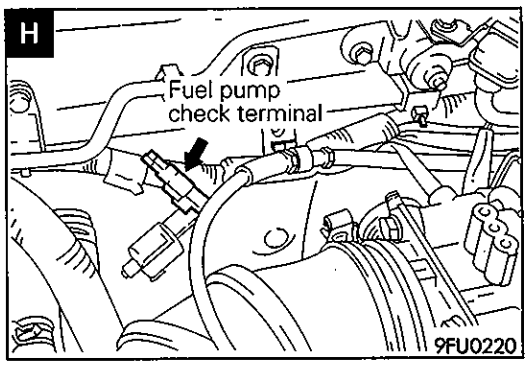
F



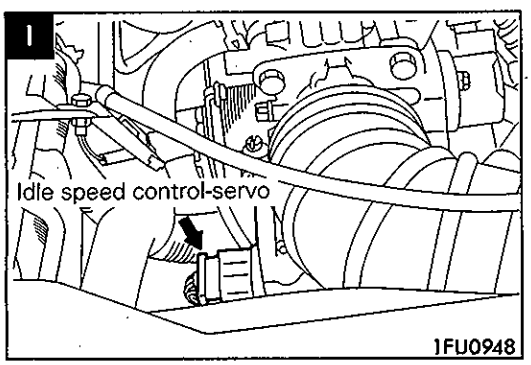
G



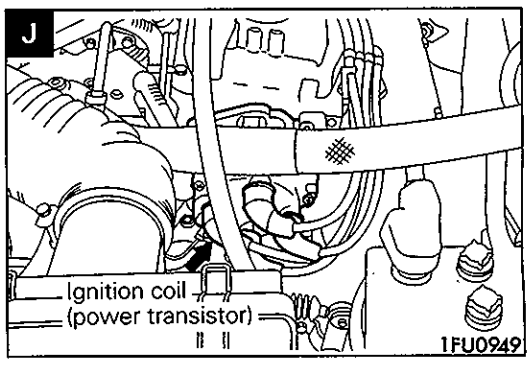
H



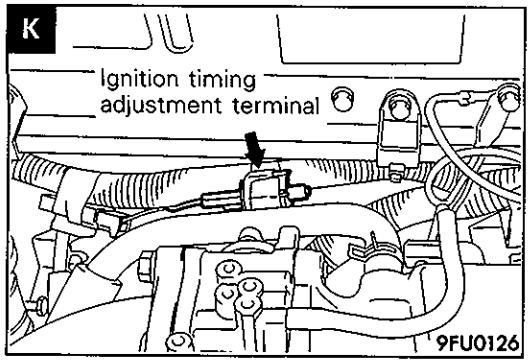
I



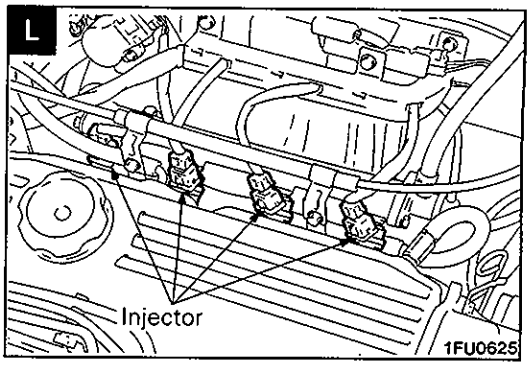
J



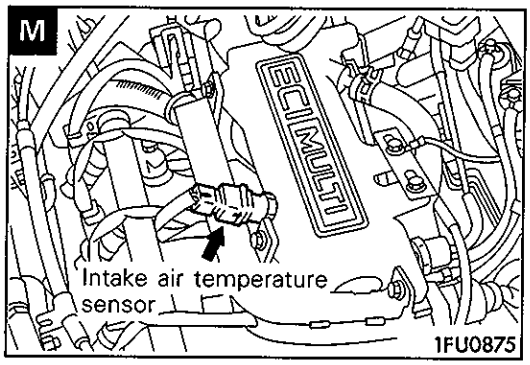
K



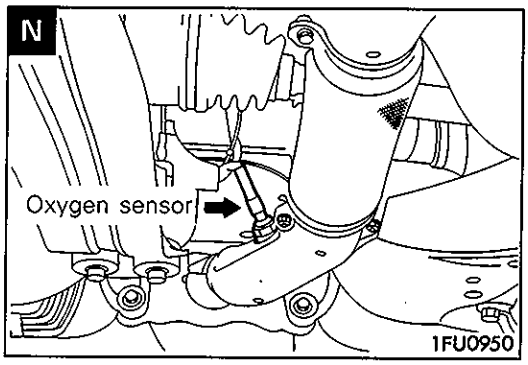
L



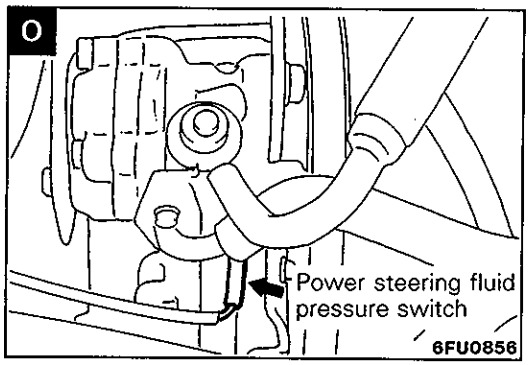
M



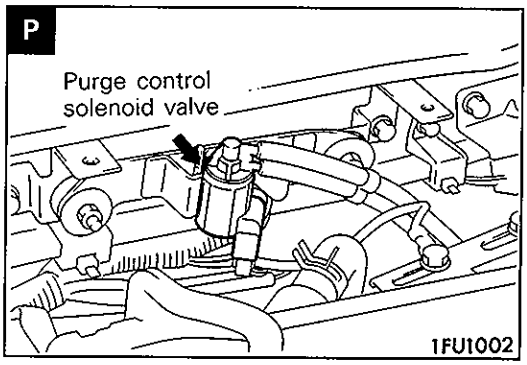
N



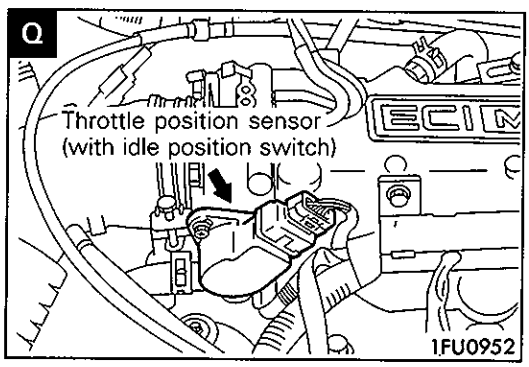
O



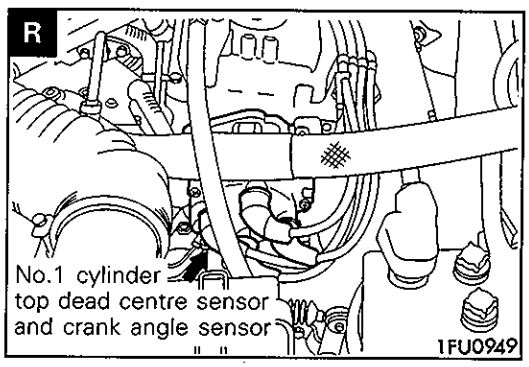
P



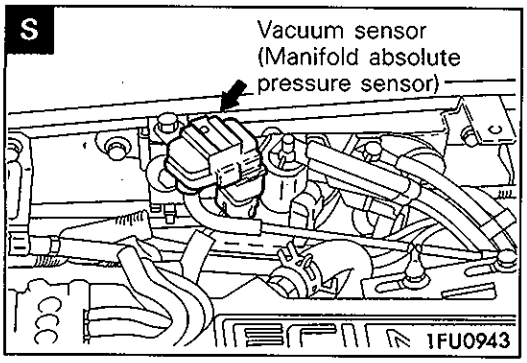
Q



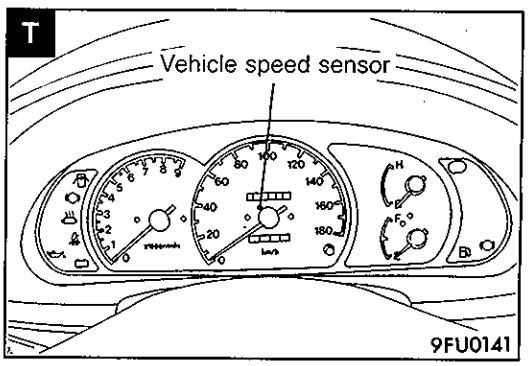
R

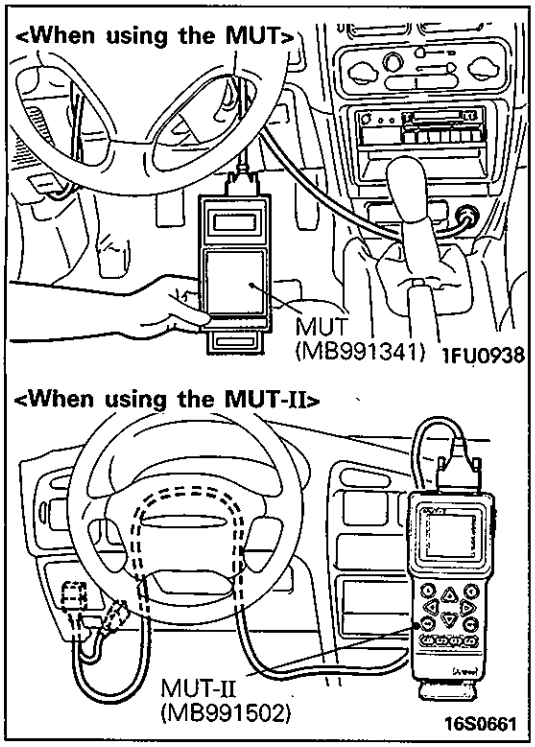


S



T





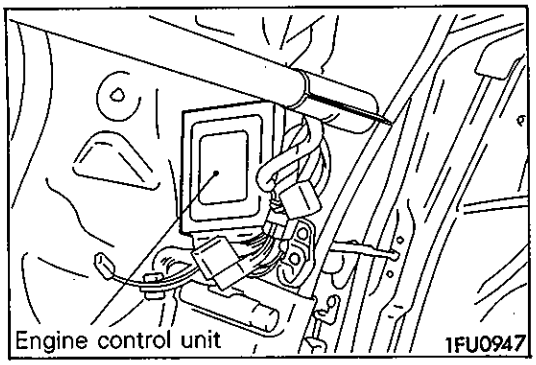
INSPECTION PROCEDURE USING THE MULTI-USE TESTER (MUT) <Up to 1993 models> OR MUT-II <All models>

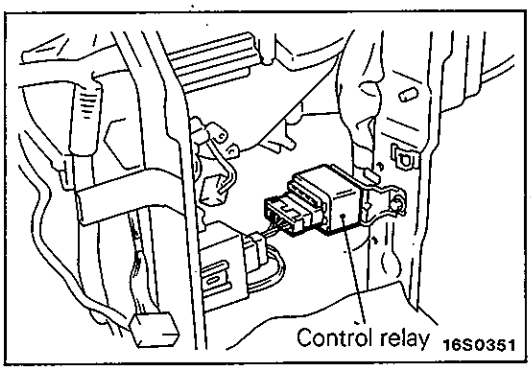
(1) Connect the MUT or MUT-II to the diagnosis connector (white).

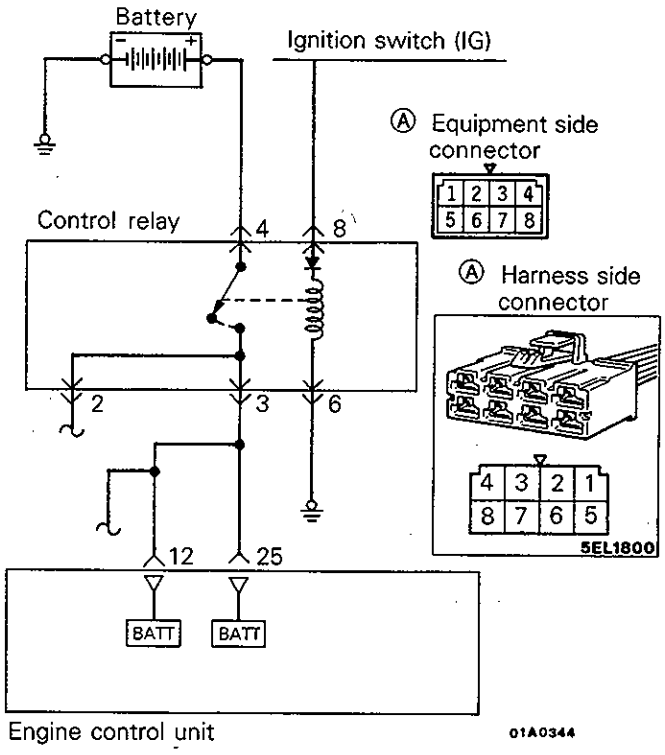
NOTE
When connecting the MUT-II use the adaptor harness which is supplied as an accessory to the MUT-II sub-assembly.

(2) Check by the service data and actuator test function. If any abnormality is found, check the body harness, components, etc., and repair as necessary.
(3) After repair, check again with the MUT or MUT-II to make sure that the input and output signals are now normal.
(4) Erase the self-diagnosis trouble code in memory.
(5) Disconnect the MUT or MUT-II.
(6) Start the engine and perform running test, etc. to make sure that the troubles have been corrected.

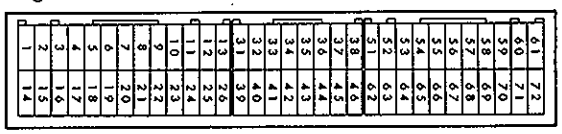
POWER SUPPLY







Engine control unit connector



9FU0101

OPERATION

- While the ignition switch is ON, battery power is supplied to the engine control unit, the injector, etc.
- When the ignition switch is turned ON, current flows from the ignition switch through the control relay coil to earth. This turns ON the control relay switch and power is supplied from the battery through the control relay switch to the engine control unit.

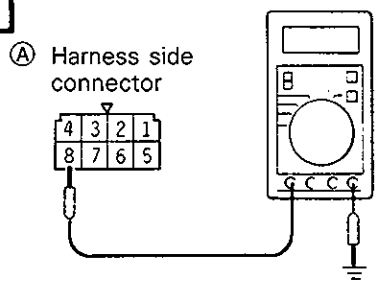
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Standard value
Data reading	16	Engine control unit power voltage	Ignition switch: ON	SV

HARNESS INSPECTION

1



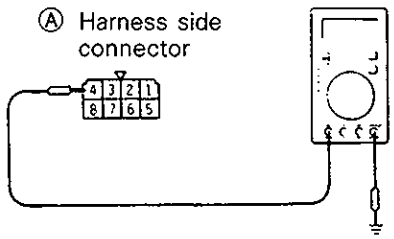
Measure the power supply voltage of the control relay.
- Control relay connector: Disconnected

Ignition switch	Voltage (V)
OFF	0–1
ON	SV

OK → **2** Repair the harness (Ignition switch – Ⓐ8) or check the ignition switch.

NG →

2



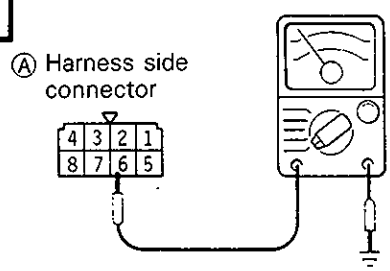
Measure the power supply voltage of the control relay.
- Control relay connector: Disconnected

Voltage (V)
SV

OK → **3**

NG → Repair the harness. (Battery – Ⓐ4)

3

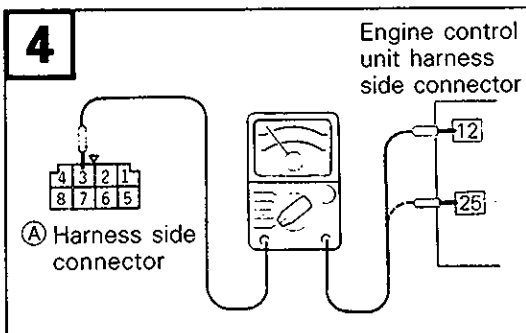


Check for continuity of the earth circuit.
- Control relay connector: Disconnected

OK → **4**

NG → Repair the harness. (Ⓐ6 – Earth)

4

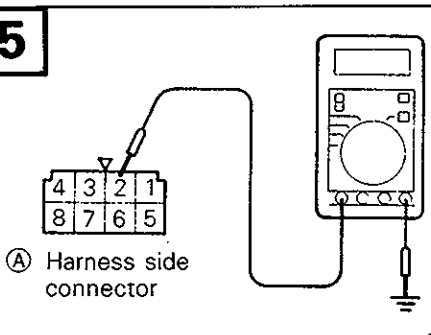


Check for open-circuit, or short-circuit to earth, between the engine control unit and the control relay.
- Engine control unit connector: Disconnected
- Control relay connector: Disconnected

OK → **5**

NG → Repair the harness. (12 – Ⓐ3) (25 – Ⓐ3)

5

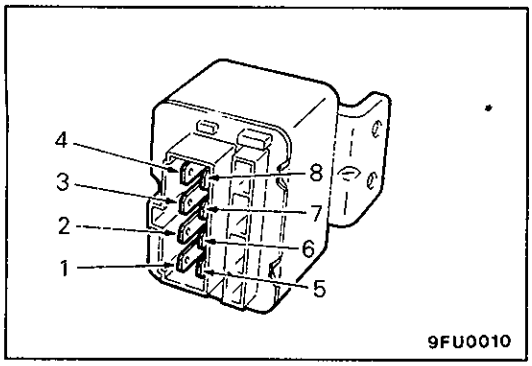


Measure the power voltage to the actuator.
- Control relay connector: Connected
- ECU connector: Connected

Engine	Voltage (V)
Cranking	8V or more
Racing	SV

OK → STOP

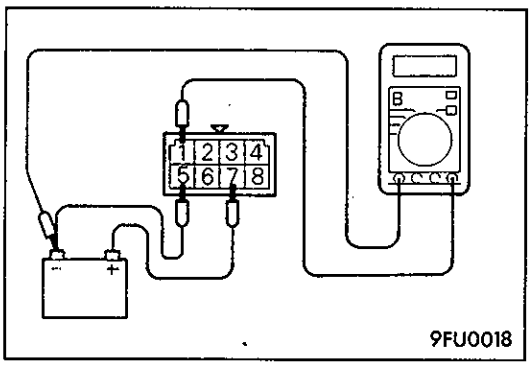
NG → Replace the control relay.



CONTROL RELAY INSPECTION

(1) Remove the control relay.
(2) Check the continuity between the control relay terminals.

Inspection terminals	Continuity
5–7	Continuity
6–8	Continuity in one direction

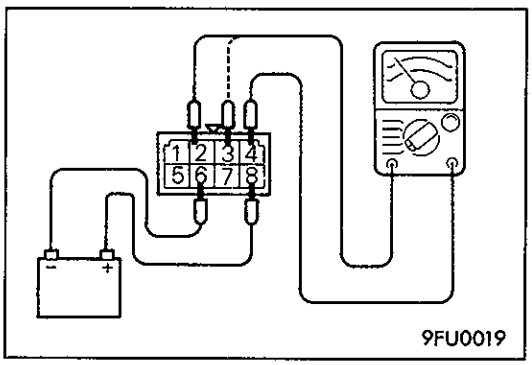


(3) Use jumper leads to connect control relay terminal ⑦ to the battery (+) terminal and terminal ⑤ to the battery (–) terminal.

Caution
When connecting the jumper leads, be careful not to mistake the connection terminals, as damage to the relay will result.

(4) Check the voltage at control relay terminal ① while connecting and disconnecting the jumper lead at the battery (–) terminal.

Jumper lead	Voltage at terminal 1
Connected	SV
Disconnected	0V

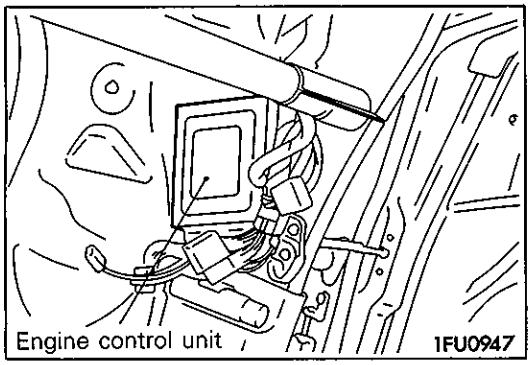


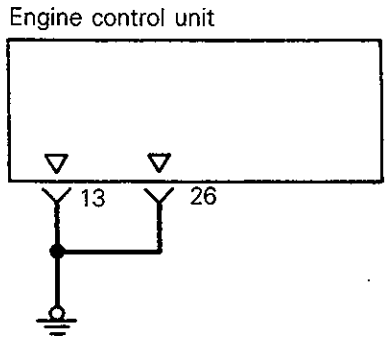
(5) Use the jumper leads to connect control relay terminal ⑧ to the battery (+) terminal and terminal ⑥ to the battery (–) terminal.
(6) Check the continuity between control relay terminals ② – ④ and terminals ③ – ④ while connecting and disconnecting the jumper lead at the battery (–) terminal.

Jumper lead	Continuity between terminals 2 – 4	Continuity between terminals 3 – 4
Connected	Continuity (0Ω)	Continuity (0Ω)
Disconnected	No continuity (∞Ω)	No continuity (∞Ω)

(7) If there is a defect, replace the control relay.

ENGINE CONTROL UNIT POWER EARTH





Engine control unit connector

OPERATION

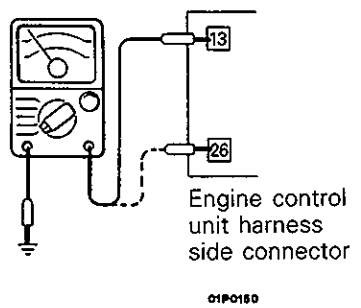
Earth the engine control unit.

TROUBLESHOOTING HINTS

If the earth wire of the engine control unit is not connected securely to earth, the unit will not operate correctly.

HARNESS INSPECTION

1



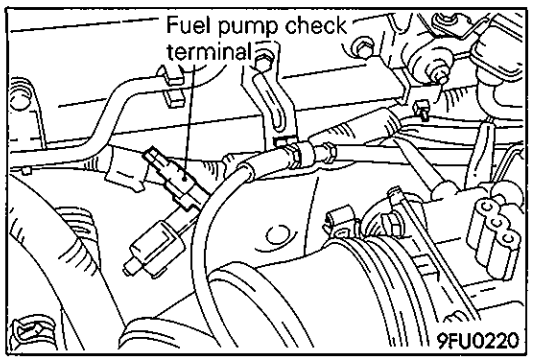
Check for continuity of the earth circuit.

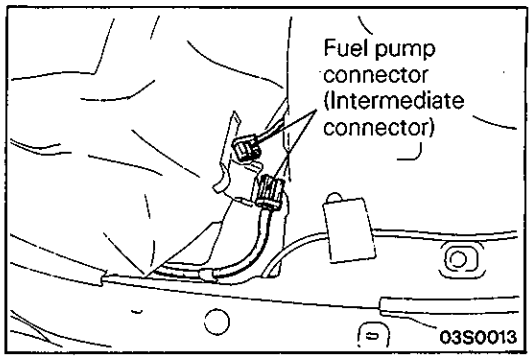
- Connector: Disconnected

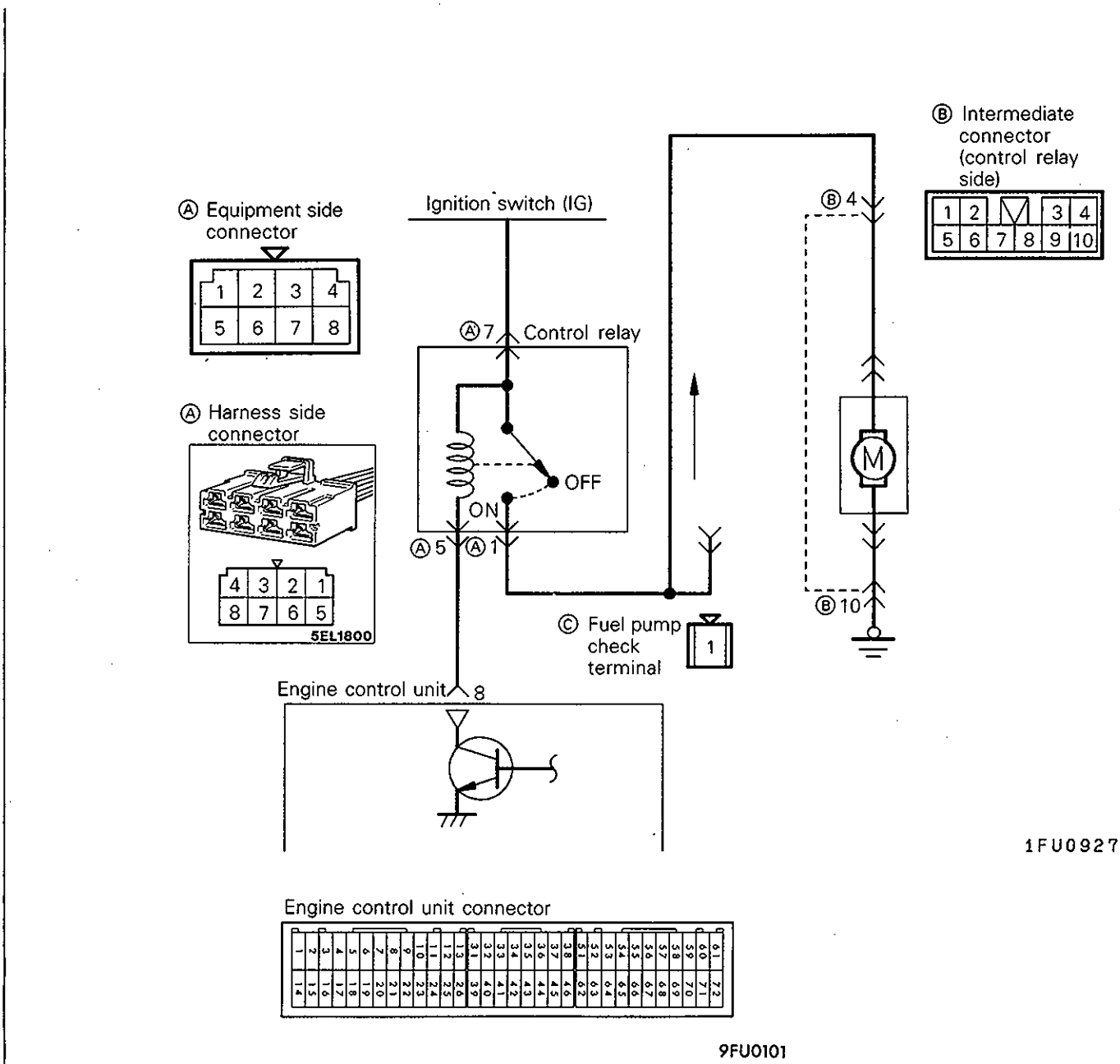
OK → STOP

NG → Repair the harness.
(13 – Earth)
(26 – Earth)

FUEL PUMP


Fuel pump check terminal
9FU0220


Fuel pump connector (Intermediate connector)
03S0013


Ⓑ Intermediate connector (control relay side)
1 2 3 4
5 6 7 8 9 10
Ⓐ Equipment side connector
1 2 3 4
5 6 7 8
Ignition switch (IG)
Ⓑ4
Ⓐ7 Control relay
Ⓐ Harness side connector
4 3 2 1
8 7 6 5
5EL1800
OFF
ON
Ⓐ5 Ⓐ1
M
Ⓑ10
Ⓒ Fuel pump check terminal
1
Engine control unit 8
1FU0927
Engine control unit connector
9FU0101

OPERATION

- The fuel pump is driven when the engine is cranking and while the engine is running.
- When the engine is cranking and while the engine is running, the engine control unit turns the power transistor ON to supply power to the control relay coil. This causes the control relay switch to turn ON, and current is supplied from the ingition switch via the control relay switch to drive the fuel pump.

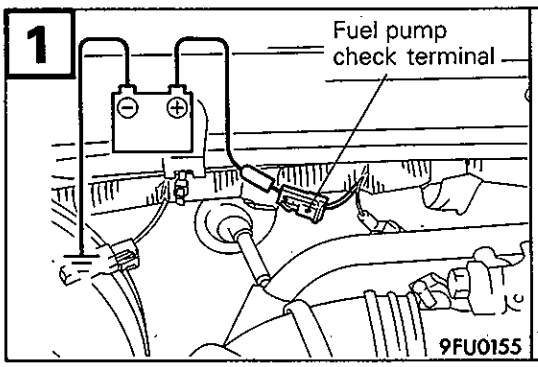
INSPECTION

Using MUT or MUT-II

Function	Item No.	Drive	Check condition	Check content	Normal state
Actuator test	07	Fuel pump is driven to circulate fuel	• Engine cranking • Forced drive of fuel pump Check is made for above two conditions	Hold return hose with fingers to feel pulsation indicating fuel flow	Pulsation is felt
				Listen to pump operating sound near fuel tank	Operating sound is heard

HARNESS INSPECTION

1

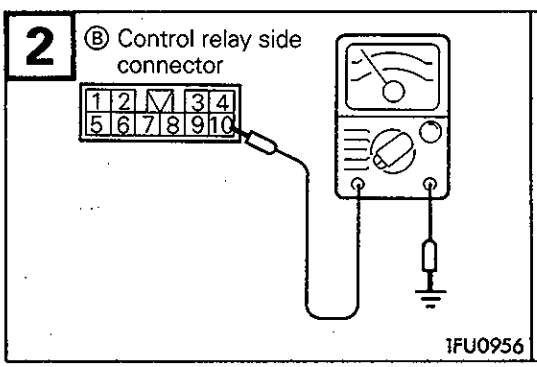


Check the fuel pump.
- Apply battery voltage to the checking terminal and operate the pump.

OK → 4

NG → 2

2

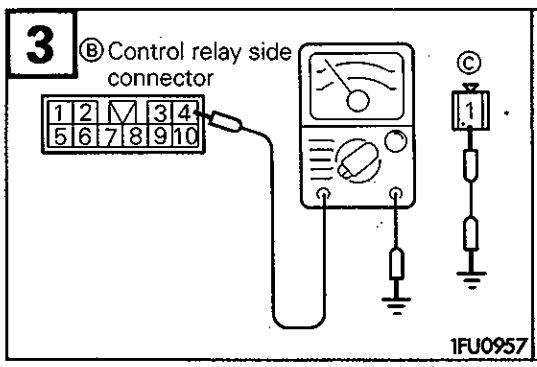


Check for continuity of the fuel pump earthing line.
- Fuel pump connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓑ10 – Earth)

3

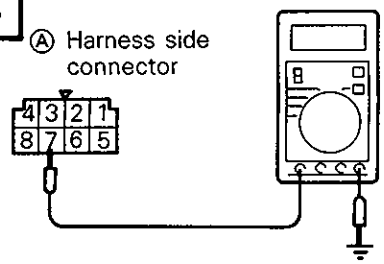


Check for open-circuit or short-circuit between the fuel pump and the fuel pump drive terminal.
- Fuel pump connector: Disconnected
- Control relay connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓑ4 – Ⓒ1)

4



9FU0023

Measure the power supply voltage of the control relay.

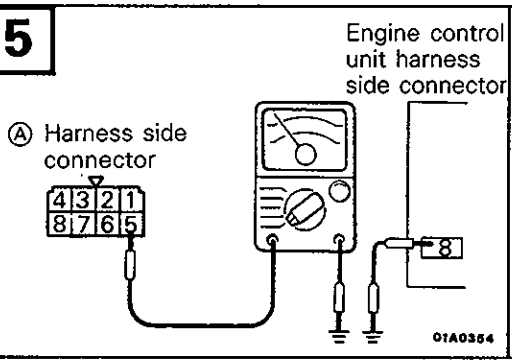
- Control relay connector: Disconnected

Ignition switch	Voltage (V)
OFF	0
START	8V or more

OK → 5 Repair the harness (Ignition switch – Ⓐ7) or check the ignition switch.

NG →

5



01A0354

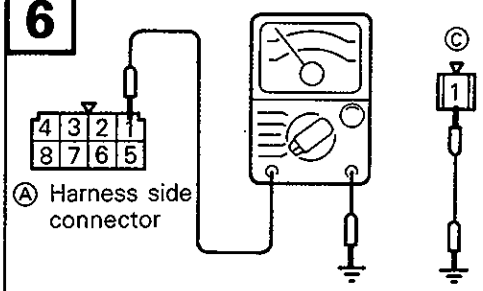
Check for an open-circuit, or a short-circuit to earth between the control relay and the engine control unit.

- Control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → 6

NG → Repair the harness. (Ⓐ5 – 8)

6



9FU0024

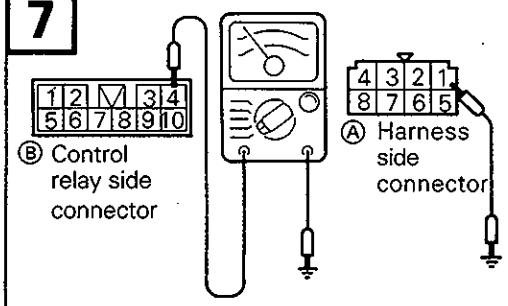
Check for continuity between the fuel pump checking terminal and between the control relay terminals.

- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 7

NG → Repair the harness. (Ⓐ1 – Ⓒ1)

7



1FU0958

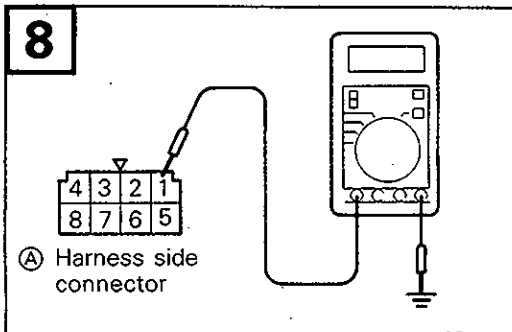
Check for an open-circuit, or a short-circuit to earth between the control relay and the fuel pump.

- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 8

NG → Repair the harness. (Ⓐ1 – Ⓑ4)

8



6FU1753

Measure the power supply voltage of the fuel pump.

- Control relay connector: Connected
- Engine control unit connector: Connected

Engine	Voltage (V)
Cranking	8V or more
Racing	5V

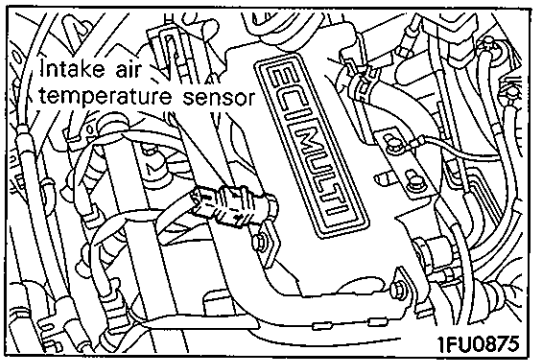
OK → STOP Control relay or engine control unit is defective.

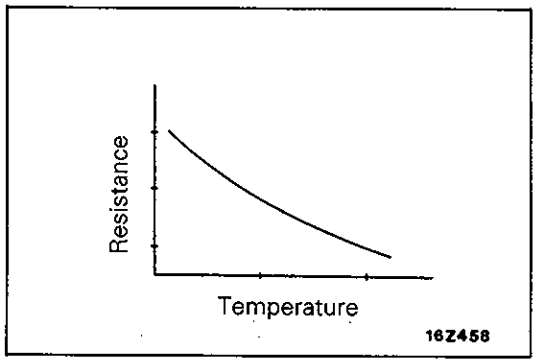
NG →

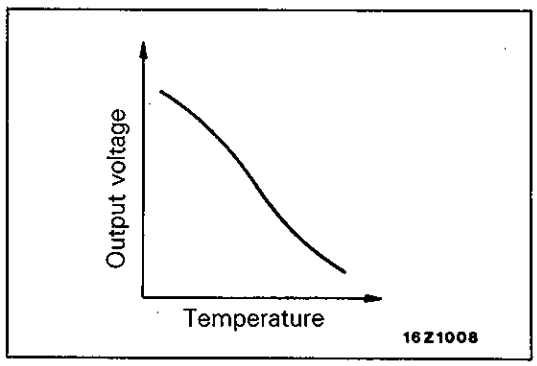
CONTROL RELAY INSPECTION

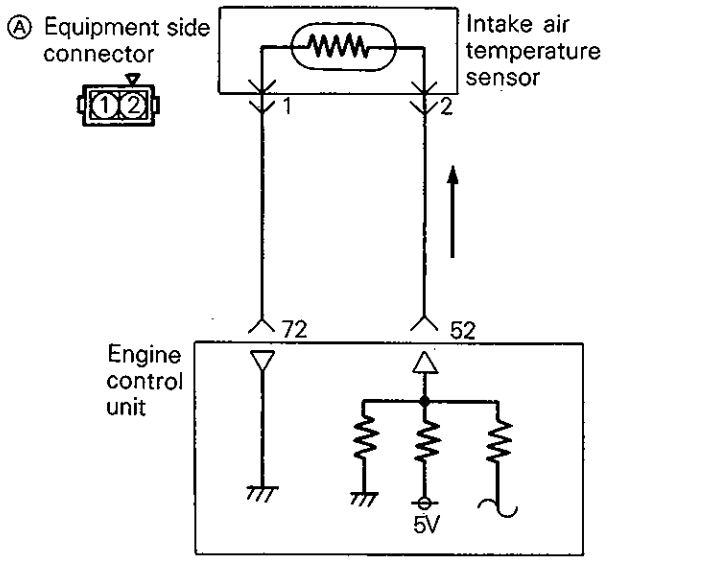
Refer to P. 13-32.

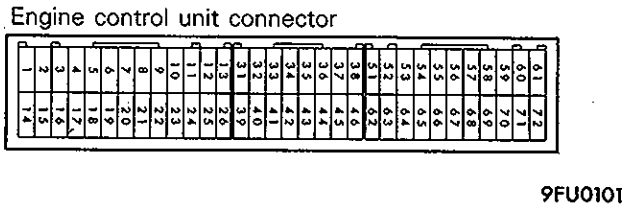
INTAKE AIR TEMPERATURE SENSOR











OPERATION

- The intake air temperature sensor converts the engine intake air temperature into a voltage and inputs it to the engine control unit, which then corrects the fuel injection rate, etc., based on the input signal.
- The 5V power in the engine control unit is supplied via a resistor in the unit to the intake air temperature sensor. Via the sensor which is a kind of resistor, it is then earthed in the engine control unit. The intake air temperature sensor resistor has such characteristic that its resistance decreases as the intake air temperature rises.
- The intake air temperature sensor terminal voltage increases or decreases as the sensor resistance increases or decreases. Therefore, the intake air temperature sensor terminal voltage changes with the intake air temperature, decreasing as the temperature rises.

TROUBLESHOOTING HINTS

The intake air temperature sensor senses the intake air temperature in the air intake plenum so that it may indicate a temperature different from outside temperature depending on engine operating state.

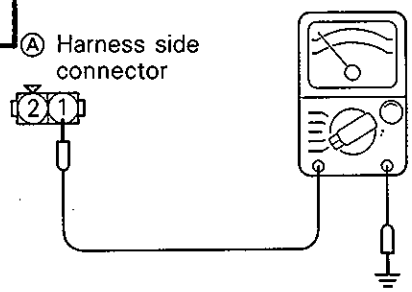
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Intake air temperature	Standard value
Data reading	13	Sensor temperature	Ignition switch: ON or engine running	–20°C (–4°F)	–20°C
				0°C (32°F)	0°C
				20°C (68°F)	20°C
				40°C (104°F)	40°C
				80°C (176°F)	80°C

HARNESS INSPECTION

1

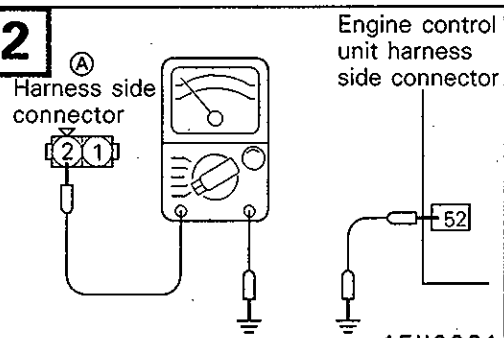


Check for continuity of the earth circuit.
- Intake air temperature sensor connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ1 – 72)

2

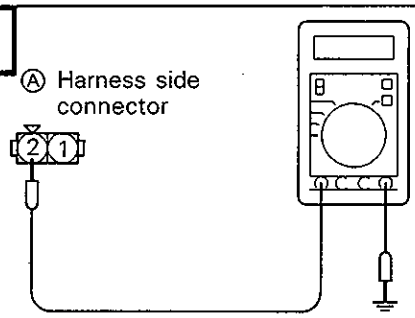


Check for open-circuit or short-circuit to earth, between intake air temperature sensor and engine control unit.
- Intake air temperature sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ2 – 52)

3

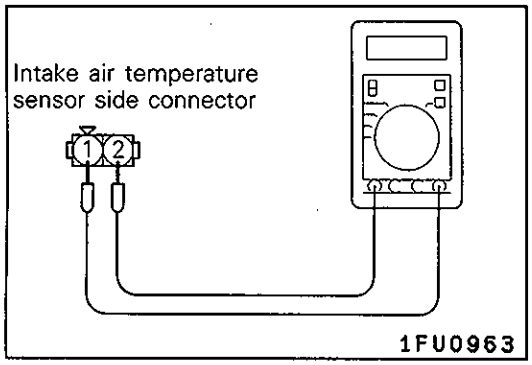


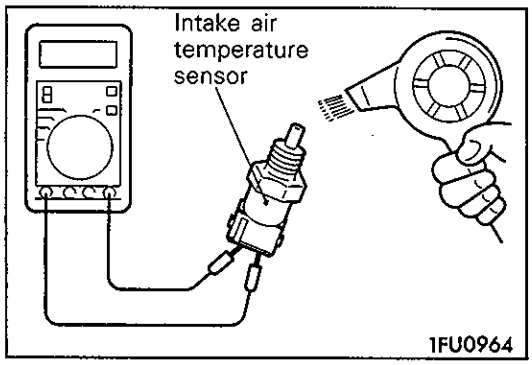
Measure the impressed voltage.
- Intake air temperature sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.5–4.9

OK → STOP

NG → Replace the engine control unit.





SENSOR INSPECTION

(1) Disconnect the intake air temperature sensor connectors.
(2) Measure resistance between terminals ① and ②.

Temperature [°C (°F)]	Resistance (kΩ)
0 (32)	6.0
20 (68)	2.6
80 (176)	0.3

(3) Remove intake air temperature sensor from intake manifold.
(4) Measure resistance while heating the sensor using a hair drier.

Temperature [°C (°F)]	Resistance (kΩ)
Higher	Smaller

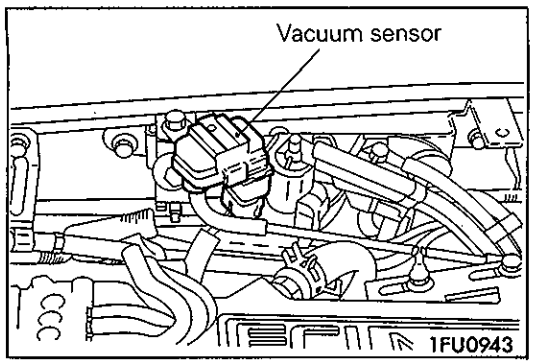
(5) If the value deviates from the standard value or the resistance remains unchanged, replace the intake air temperature sensor.

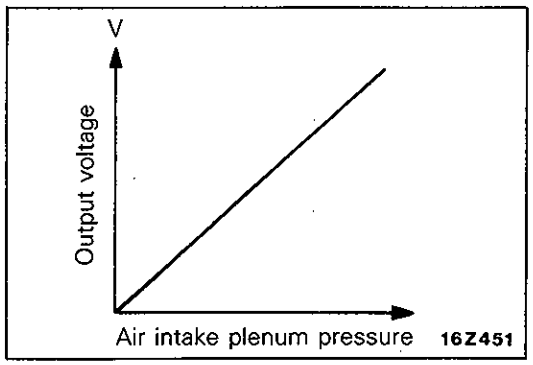
INSTALLATION

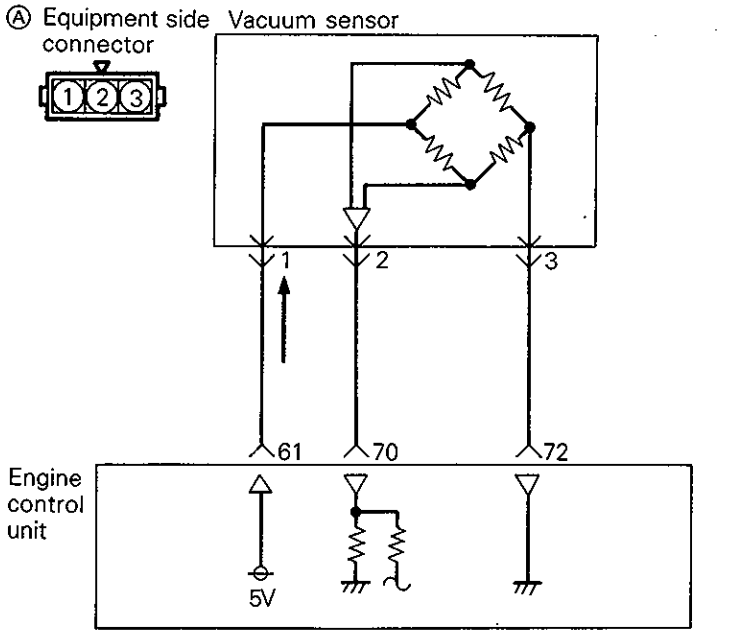
(1) Install intake air temperature sensor and tighten it to specified torque.

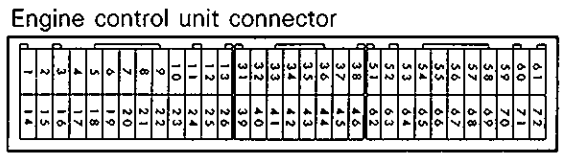
Sensor tightening torque: 12–15 Nm (1.2–1.5 kgm, 9–11 ft.lbs.)

VACUUM SENSOR (MANIFOLD ABSOLUTE PRESSURE SENSOR)









OPERATION

- The vacuum sensor converts the air intake plenum pressure to a voltage value and inputs it to the engine control unit. The engine control unit uses this signal and the engine rpm to calculate the basic fuel injection timing.
- 5V of power is supplied to the vacuum sensor from the engine control unit, and the sensor circuit earth is located in the engine control unit.
- The vacuum sensor output voltage is proportioned to the air intake plenum pressure and sent to the engine control unit.

TROUBLESHOOTING HINTS

Hint 1: If the engine sometimes stalls, try starting the engine and shaking the vacuum sensor harness. If the engine stalls, the vacuum sensor connector contact could be defective. defective.

Hint 2: If acceleration is poor or the engine stalls, the vacuum hose between the vacuum sensor and the intake manifold could be blocked.

Hint 3: If the engine will run at idle speed even if the air intake plenum pressure is outside the standard value, there is a large probability that the cause is something other than the vacuum sensor.

(1) Combustion inside the cylinders is defective
(Defect in spark plugs, ignition coil, injectors, compression pressure, etc.)

(2) Air is entering the intake manifold through a gap in the gasket.

INSPECTION

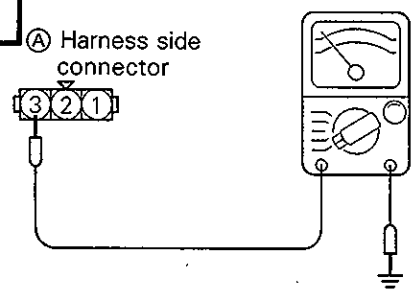
Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Engine state		Standard Value
Data reading	32	Air intake plenum pressure	• Coolant temperature: 80 to 95° (176 to 203°F) • Lamps, electric cooling fan, accessory units: All OFF • Transmission: Neutral • Ignition switch: ON	Stopped	When height is 0m (0 ft.)	760 mmHg
					When height is 600m (1,969 ft.)	710 mmHg
					When height is 1,200m (3,937 ft.)	660 mmHg
					When height is 1,800m (5,906 ft.)	610 mmHg
				750 r/min. (idling)		180-280 *1 mmHg
				When engine is suddenly raced.		Increase

NOTE
*1: In a new vehicle [driven approximately 500 km (300 miles) or less], the air intake plenum pressure is sometimes 10% higher than the standard pressure.

HARNESS INSPECTION

1

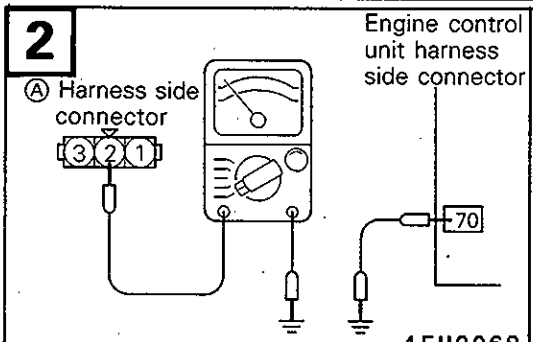


Check for continuity of the earth circuit.
- Vacuum sensor connector: Disconnected

OK → 2

NO → Repair the harness. (Ⓐ 3 – 72)

2

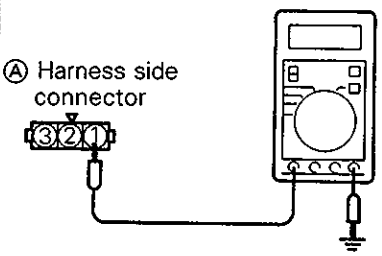


Check for an open-circuit, or a short-circuit to earth between the engine control unit and the vacuum sensor.
- Vacuum sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ 2 – 70)

3



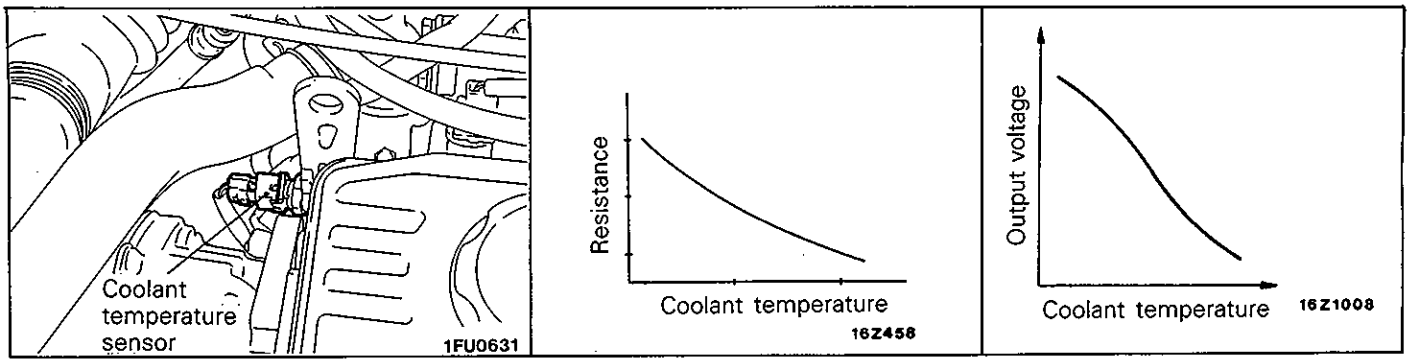
Measure the impressed voltage of the vacuum sensor.
- Vacuum sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

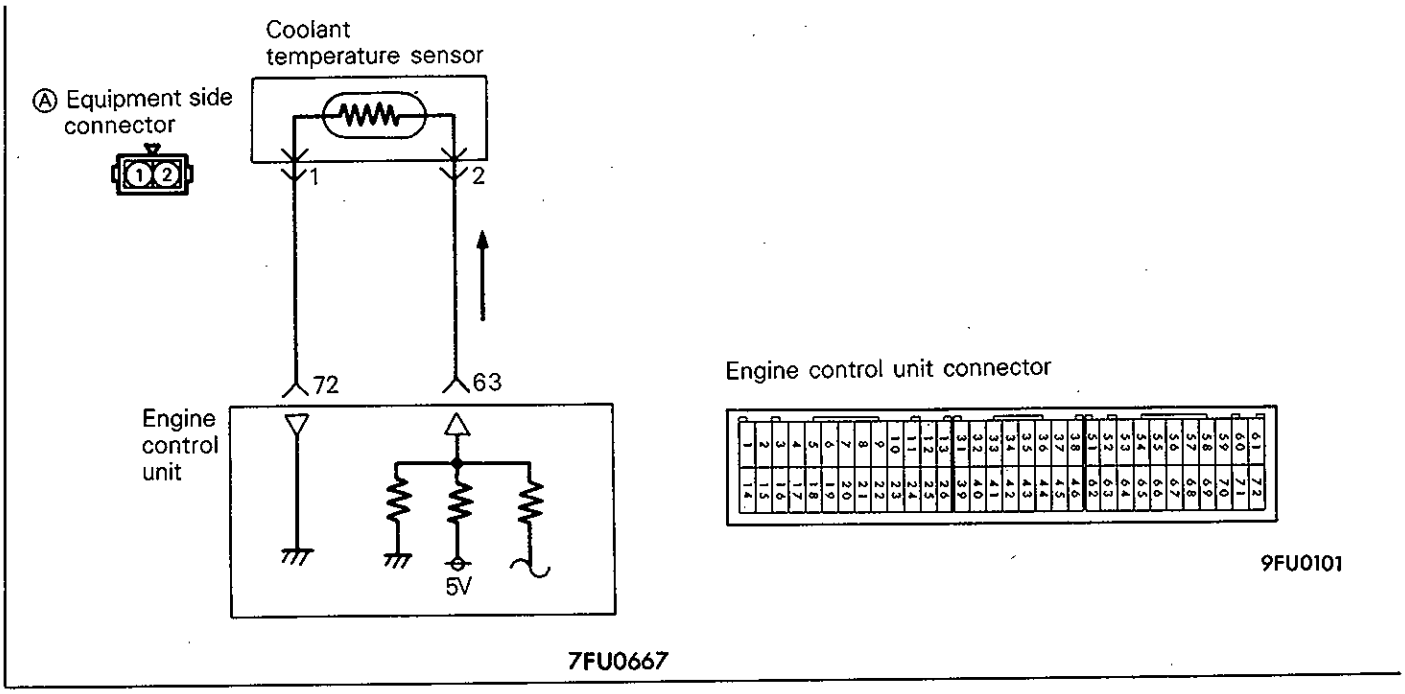
Voltage (V)
4.8–5.2

OK → STOP

NO → Replace the engine control unit.

COOLANT TEMPERATURE SENSOR





OPERATION

- The coolant temperature sensor converts the coolant temperature into a voltage and inputs it to the engine control unit, which then controls the fuel injection rate and fast idle speed when the engine is cold, based on the input signal.
- The 5 V power in the engine control unit is supplied via a resistor in the unit to the coolant temperature sensor. Via the sensor which is a kind of resistor, it is then earthed in the engine control unit. The coolant temperature sensor resistor has such characteristic that its resistance decreases as the coolant temperature rises.
- The coolant temperature sensor terminal voltage increases or decreases as the sensor resistance increases or decreases. Therefore, the coolant temperature sensor terminal voltage changes with the coolant temperature, decreasing as the temperature rises.

TROUBLESHOOTING HINTS

If the fast idle speed is inadequate or the engine emits dark smoke during engine warm up operation, the coolant temperature sensor is often faulty.

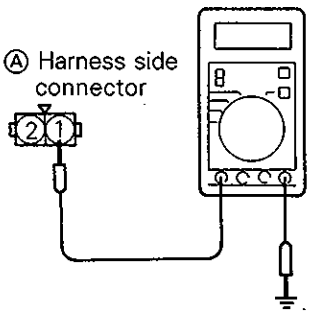
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Coolant temperature	Standard value
Data reading	21	Sensor temperature	Ignition switch: ON or engine operating	–20°C (–4°F)	–20°C
				0°C (32°F)	0°C
				20°C (68°F)	20°C
				40°C (104°F)	40°C
				80°C (176°F)	80°C

HARNESS INSPECTION

1

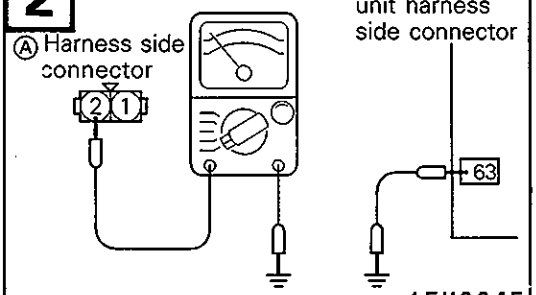


Check for continuity of the earth circuit.
- Coolant temperature sensor connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ1 – 72)

2

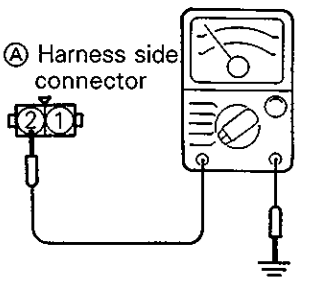


Check for open-circuit, or short-circuit to earth between coolant temperature sensor and engine control unit.
- Coolant temperature connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ2 – 63)

3



Measure the impressed voltage.
- Coolant temperature sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.5–4.9

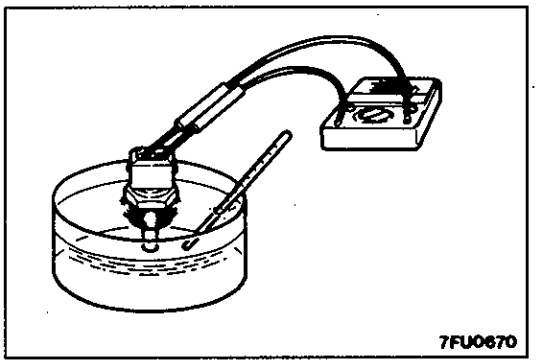
OK → STOP

NG → Replace the engine control unit.

SENSOR INSPECTION

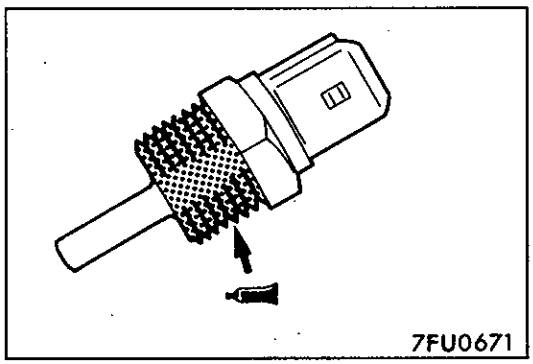
Caution
Be careful not to touch the tool against the connector (resin section) when removing and installing.

(1) Remove coolant temperature sensor from the intake manifold.



(2) With temperature sensing portion of coolant temperature sensor immersed in hot water, check resistance.

Temperature [°C (°F)]	Resistance (kΩ)
0 (32)	5.8
20 (68)	2.4
40 (104)	1.1
80 (176)	0.3



(3) If the resistance deviates from the standard value greatly, replace the sensor.

INSTALLATION

(1) Apply sealant to threaded portion.

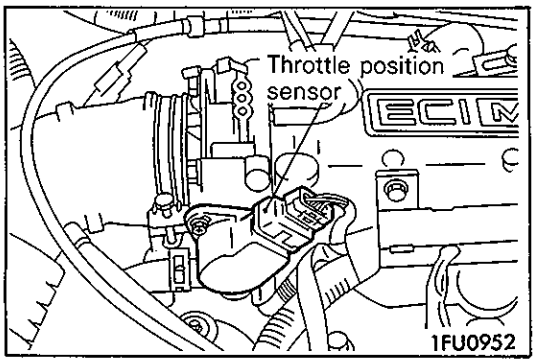
Specified sealant: 3M NUT locking Part No. 4171 or equivalent

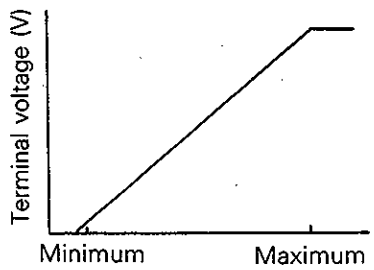
(2) Install coolant temperature sensor and tighten it to specified torque.

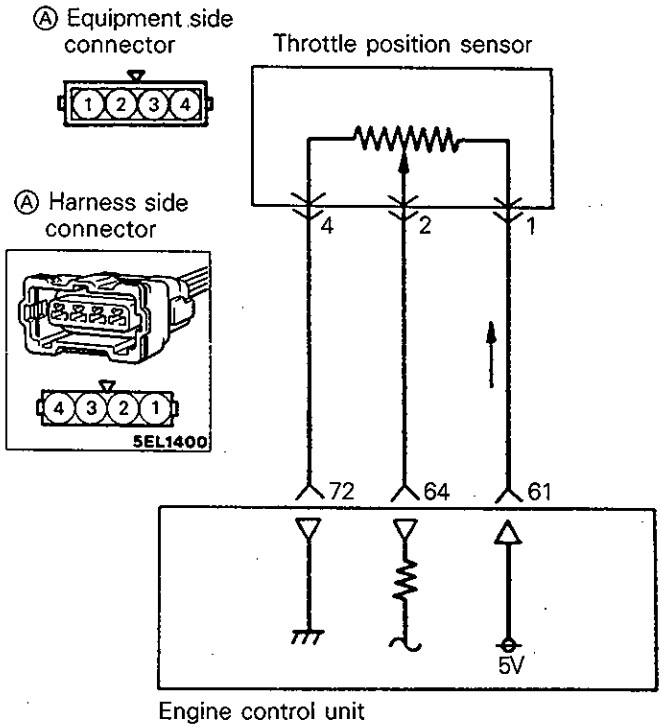
Sensor tightening torque: 30 Nm (3 kgm, 22 ft.lbs.)

(3) Fasten harness connectors securely.

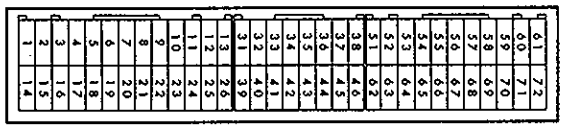
THROTTLE POSITION SENSOR







Engine control unit connector



9FU0101

7FU0672

OPERATION

- The throttle position sensor converts the throttle position opening into a voltage and inputs it to the engine control unit, which then controls the fuel injection, based on the input signal.
- The 5 V power in the engine control unit is supplied to the throttle position sensor. It flows through the resistor in the sensor and is then earthed in the engine control unit.
- As the throttle valve shaft rotates from the idle position to wide open position, the resistance between the variable resistor terminal of the throttle position sensor and the earth terminal increases. As a result, the voltage at the throttle position sensor variable resistance terminal also increases.

TROUBLESHOOTING HINTS

Hint 1: The throttle position sensor signal is more important in the control of automatic transmission than in the engine control. Shifting shock and other troubles will be caused if this sensor is faulty.

Hint 2: If the output voltage of the throttle position sensor is out of specification, adjust the sensor and check the voltage again.
If there is an evidence of disturbed fixed SAS setting, adjust the fixed SAS.

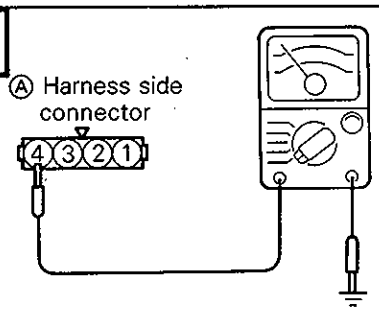
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Throttle valve	Standard value
Data reading	14	Sensor voltage	Ignition switch: Held ON for 15 sec. or more	At idle position	300–1,000 mV
				Open slowly	Increases with valve opening
				Open widely	4,500–5,500 mV

HARNESS INSPECTION

1



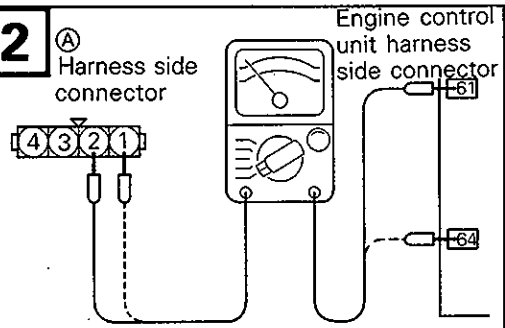
6FU1242

Check for continuity of the earth circuit.
- Throttle position sensor connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ4 – 72)

2



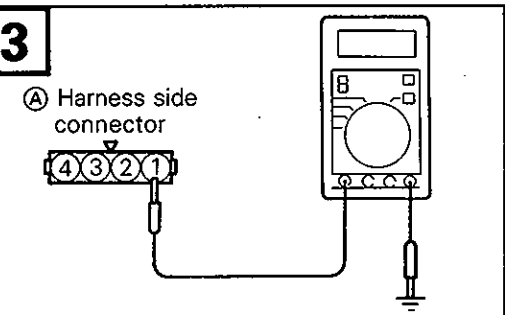
1FU0970

Check for an open-circuit, or a short-circuit to earth between the engine control unit and the throttle position sensor.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ2 – 64) (Ⓐ1 – 61)

3



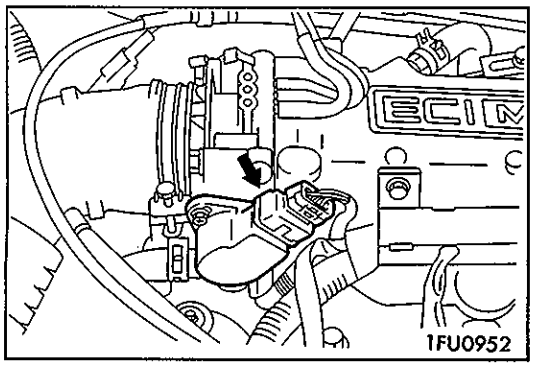
6FU1241

Measure the impressed voltage of the throttle position sensor.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

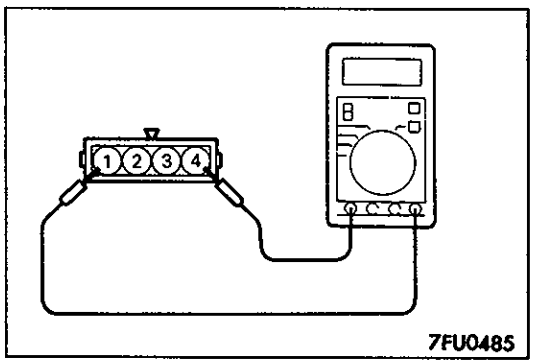
OK → STOP

NG → Replace the engine control unit.



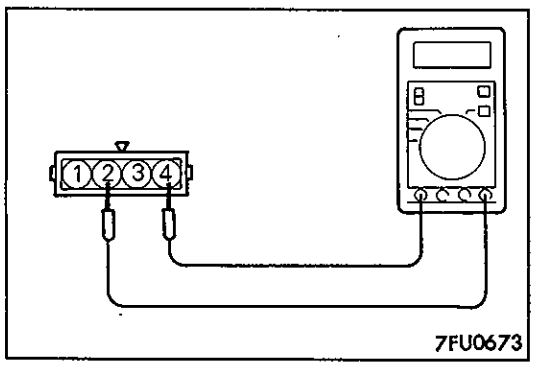
SENSOR INSPECTION

(1) Disconnect the throttle position sensor connector.



(2) Measure the resistance between the throttle position sensor side connector terminal ① and terminal ④.

Standard value: 3.5–6.5 kΩ



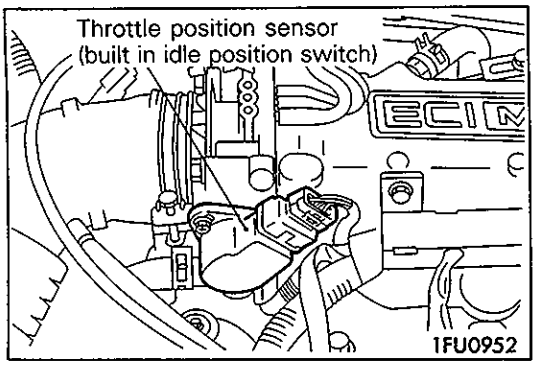
(3) Measure the resistance between the throttle position sensor side connector terminal ② and terminal ④.

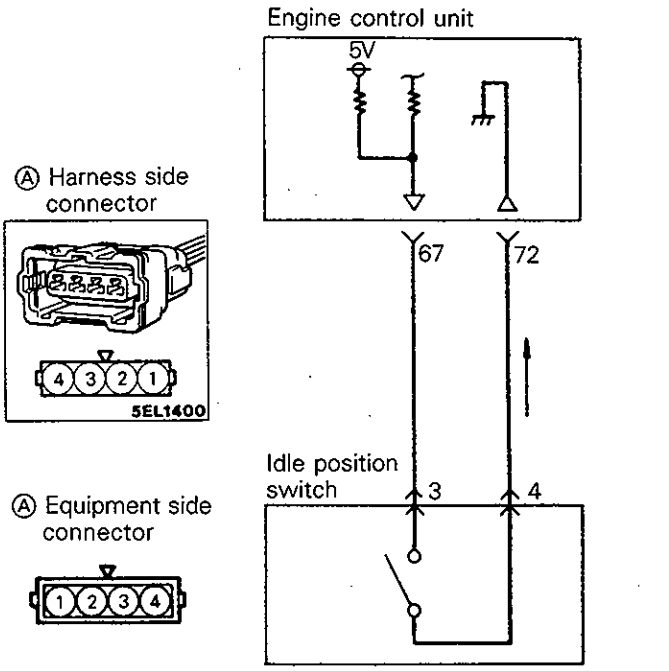
Throttle valve slowly opens until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve

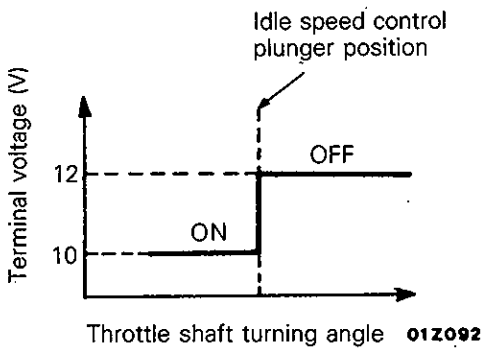
(4) If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

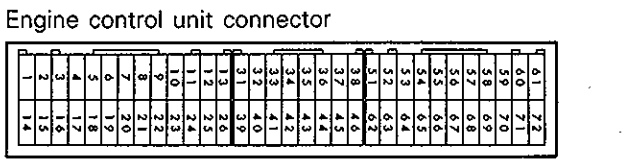
NOTE
For the throttle position sensor adjustment procedure, refer to P. 13-19.

IDLE POSITION SWITCH









OPERATION

- The idle position switch senses whether the accelerator pedal is depressed or not, converts it into high/low voltage and inputs the voltage to the engine control unit, which then controls the idle speed control servo based on the input signal.
- A voltage is applied to the idle position switch from the engine control unit. When the accelerator pedal is released, the idle position switch is turned on to conduct the voltage to earth. This causes the idle position switch termainal voltage to go low from high.

TROUBLESHOOTING HINTS

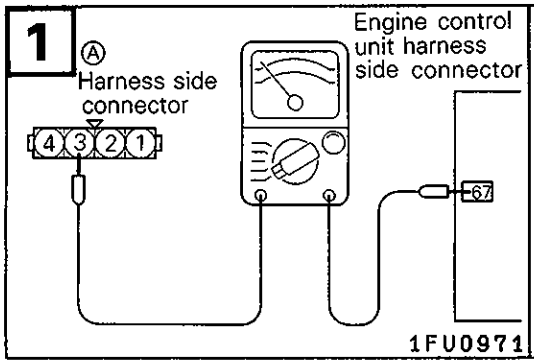
If the idle position switch harness and individual check results are normanl but the idle position switch output is abnormal, the following troubles are suspected.
(1) Poorly adjusted accelerator cable
(2) Poorly adjusted fixed SAS

INSPECTION
Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Throttle valve	Normal indication
Data reading	26	Switch state	Ignition switch: ON (Check by operating accelerator pedal repeatedly)	At idle position	ON
				Open a little	OFF

HARNESS INSPECTION

1

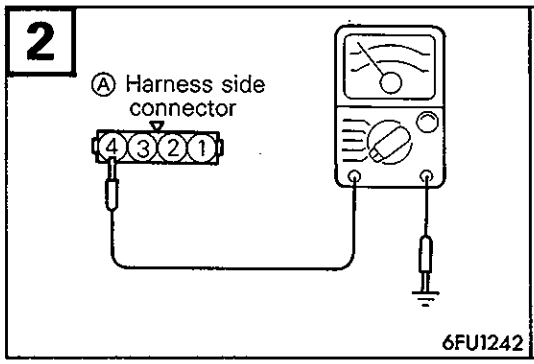


Check for open-circuit, or short-circuit to earth, between idle position switch and engine control unit.
- Engine control unit connector: Disconnected
- Idle position switch connector: Disconnected

OK → 2

NO → Repair the harness. (Ⓐ3 – 67)

2

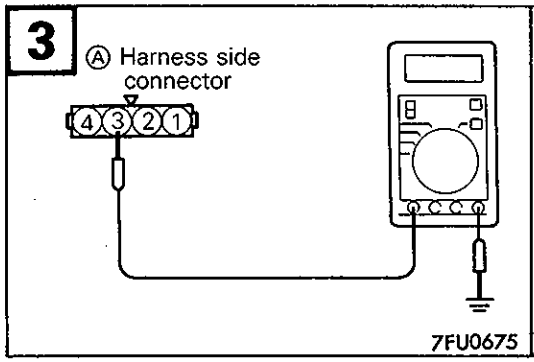


Check for continuity of the earth circuit.
- Idle position switch connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ4 – 72)

3

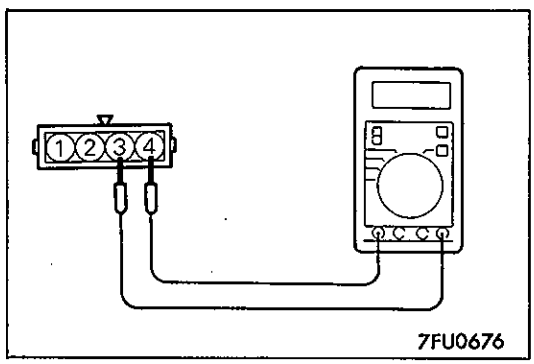


Measure the impressed voltage of the idle position switch.
- Connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4 or more

OK → STOP

NO → Replace the engine control unit.



SENSOR INSPECTION

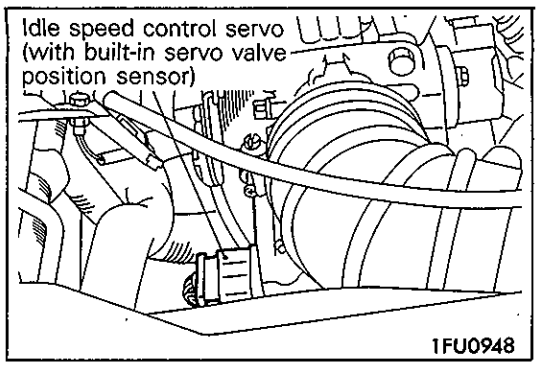
(1) Disconnect the throttle position sensor connector.
(2) Check the continuity between the throttle position sensor connector side terminal ③ and termianl ④.

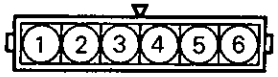
Accelerator pedal	Continuity
Depressed	Non-conductive (∞ Ω)
Released	Conductive (0 Ω)

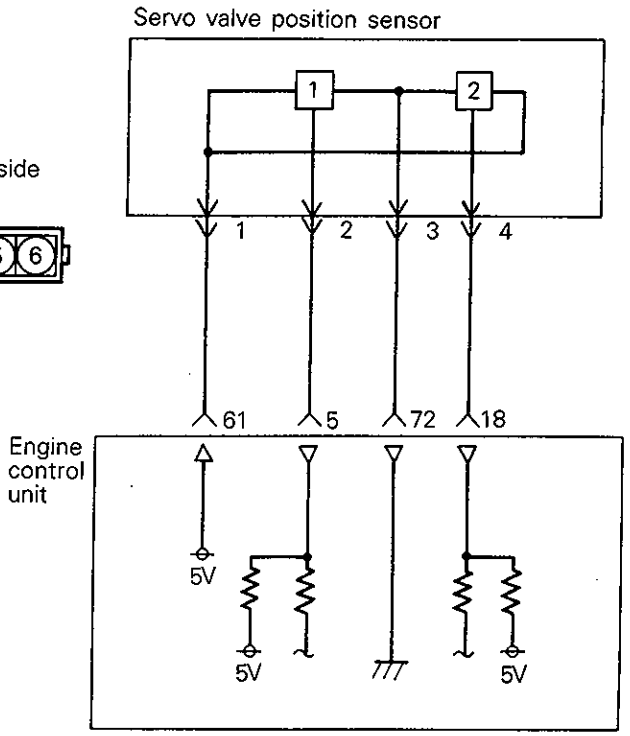
(3) If out of specification, replace the throttle position sensor.

NOTE
After replacement, the throttle position sensor and idle position switch should be adjusted. (Refer to P. 13-19.)

SERVO VALVE POSITION SENSOR

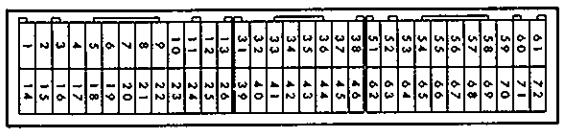






9FU0026

Engine control unit connector



9FU0101

OPERATION

- The servo valve positon sensor converts the changes (increase or decrease) in the valve position of the idle speed control servo (ISC) into pulse signals and inputs these signals to the engine control unit. The engine control unit determines the valve position from these singals, and also controls the idle speed control servo.
- 5V power is supplied to the servo valve position sensor from the engine control unit, and the earth connection is positioned in the engine control unit.
- 5V power is applied to the two servo valve position sensor outpuit terminals from the engine control unit. When the servo valve position is changed (increased or dectrased) by the DC motor inside the servo, the servo valve position sensor generates a pulse signal from the opening and closing between the output terminal and the earth.

TROUBLESHOOTING HINTS

Hint 1: The servo valve position sensor is the most important sensor for controlling the idle speed. If a malfunction develops when the engine is idling and the engine load is varied by turning the air conditioner switch to ON and OFF,etc., this sensor is probably defective.

INSPECTION

Using MUT or MUT-II

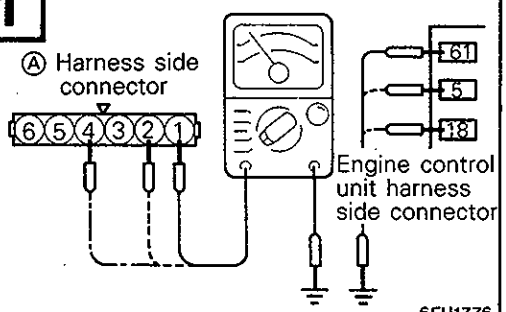
Function	Item No.	Data display	Check condition	Load state	Standard value
Data reading	55	Servo valve position step	• Coolant temperature: 80 to 95°C (176 to 203°F) • Lamps, electric cooling fan, accessories: OFF • Transmission: Neutral • Idle position switch: ON • Engine: At idle (Compressor clutch to be operating in case air conditioner switch is ON)	Air conditioner switch: OFF	2-20 step
				Air conditioner switch: Turn from OFF to ON	Increase from 8-50 step
				• Air conditioner switch: OFF • Selector lever: Shift to D range	Increase from 3-40 step

NOTE
In a new vehicle [driven approximately 500 km (300 miles) or less], the servo valve position sometimes exceeds the standard value by approximately 20 steps.

Caution
When shifting the selector lever to the D range, apply brake to prevent the vehicle from moving forward.

HARNESS INSPECTION

1

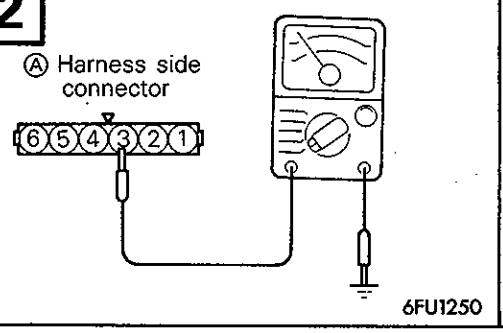


Check for open-circuit, or short-circuit to earth, between engine control unit and servo valve position sensor.
- Engine control unit connector: Disconnected
- Servo valve position sensor connector: Disconnected

OK → **2**

NG → Repair the harness (Ⓐ1 – 61) (Ⓐ2 – 5) (Ⓐ4 – 18)

2

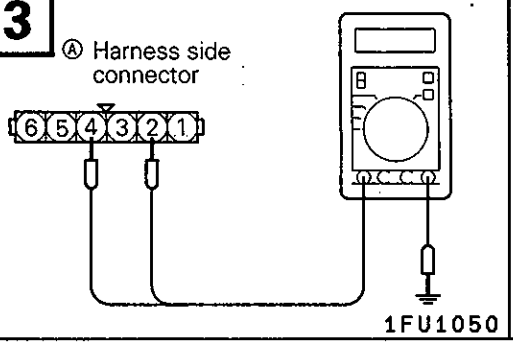


Check for continuity of the earth circuit.
- Servo valve position sensor connector: Disconnected

OK → **3**

NG → Repair the harness (Ⓐ3 – 72)

3



Measure the impressed voltage.

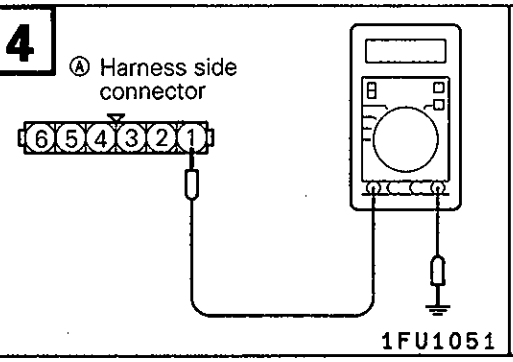
- Servo valve position sensor connector : Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → 4

NG → Replace the engine control unit

4



Measure the impressed voltage.

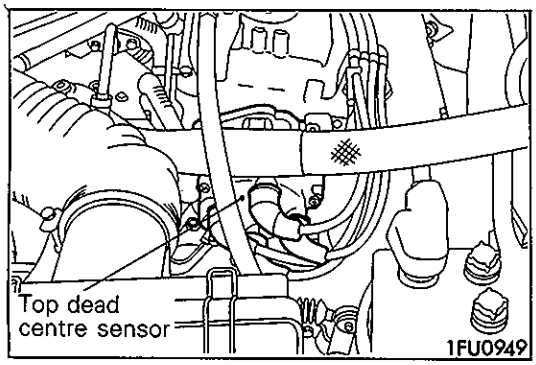
- Servo valve position sensor connector : Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

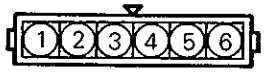
Voltage (V)
4.8–5.2

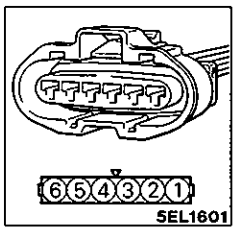
OK → STOP

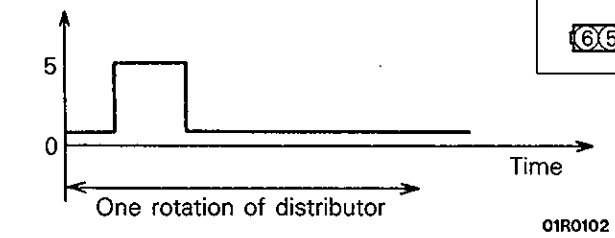
NG → Replace the engine control unit

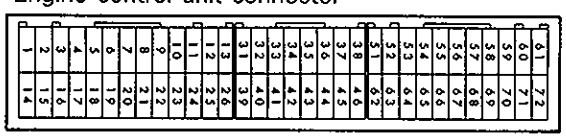
TOP DEAD CENTRE SENSOR <Vehicles built up to September, 1993>

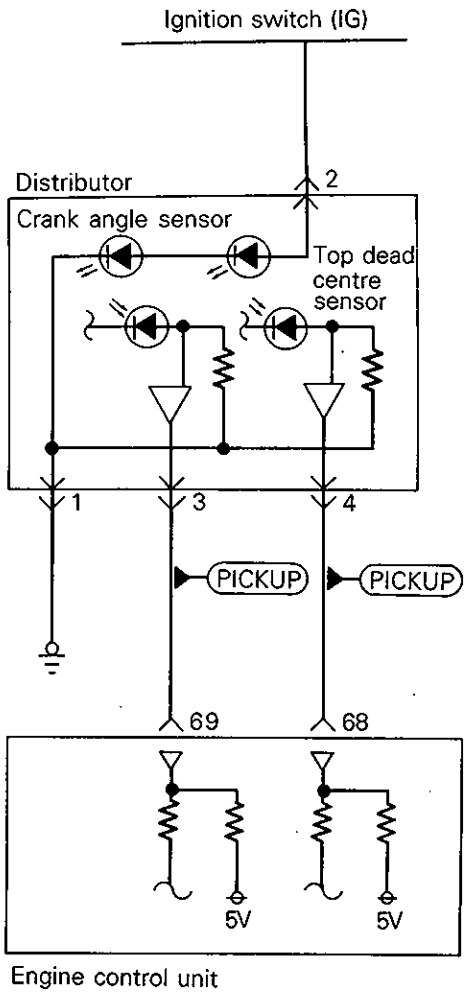












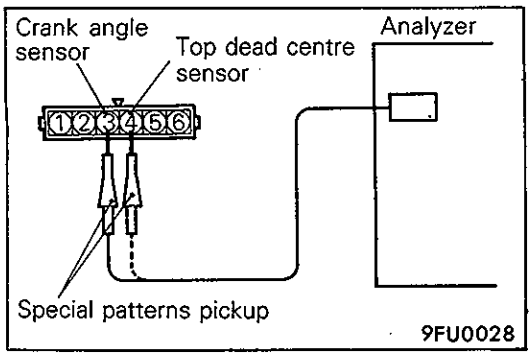
OPERATION

- The top dead centre sensor detects the top dead centre on the compression stroke of the No.1 cylinder, converts it into a pulse signal and inputs it to the engine control unit. The engine control unit determines the fuel injection sequence based on this signal.
- Power to the top dead centre sensor is supplied from the ignition switch (IG) and is earthed to the body. The top dead centre sensor generates a pulse signal as it repeatedly connects and disconnects between 5 V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

Hint 1: If the top dead centre sensor is defective, proper sequential injection will not occur, so the engine will stall, or unstable idling and poor acceleration will occur.

Hint 2: When the top dead centre sensor outputs a pulse signal when the ignition switch is turned to ON (without starting the engine), the top dead centre sensor or engine control unit is probably defective.



INSPECTION

Wave Pattern Inspection Using an Analyzer

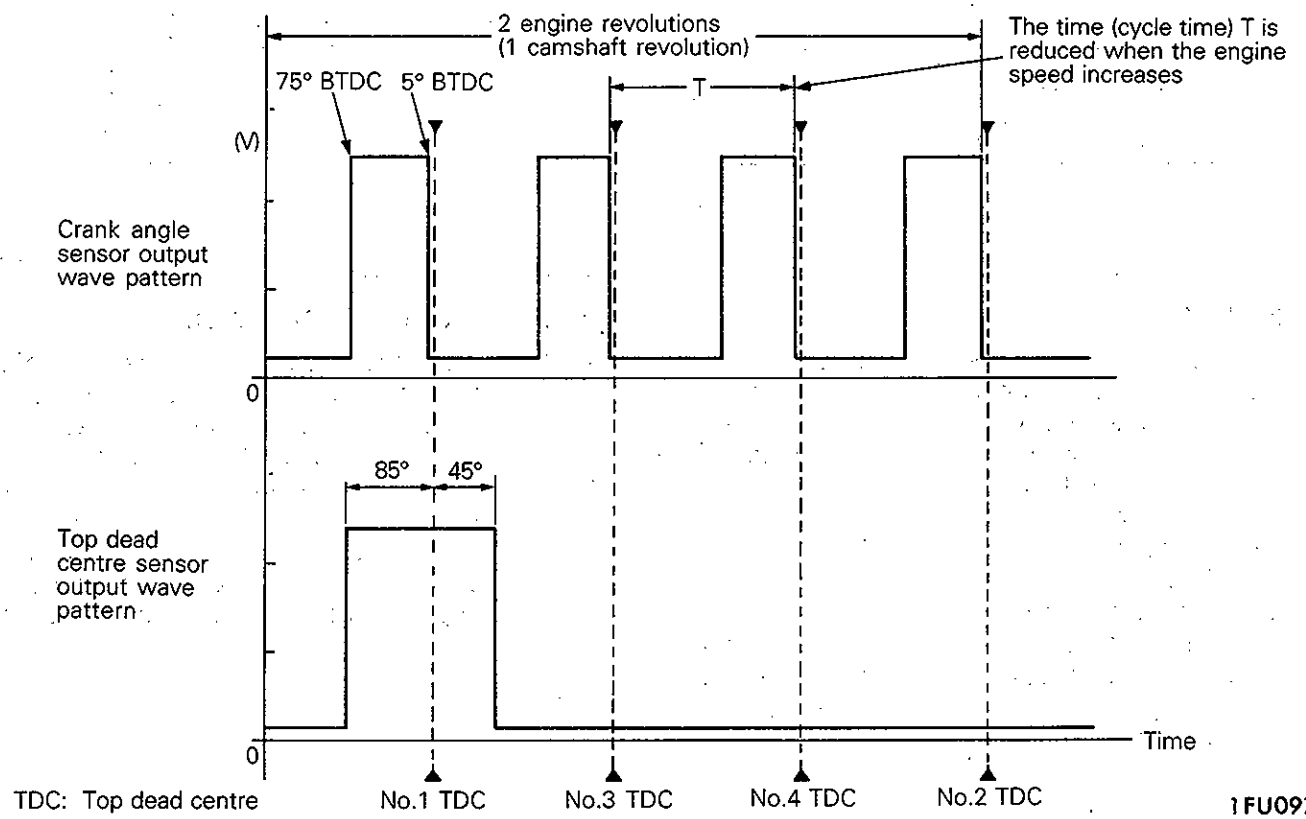
Measurement method

(1) Disconnect the top dead centre sensor & crank angle sensor connector and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to crank angle sensor terminal ④. (When checking the top dead centre sensor signal wave pattern)
(3) Connect the analyzer special patterns pickup to crank angle sensor connector terminal ③. (When inspecting the crank angle sensor signal wave pattern.)

Standard wave pattern

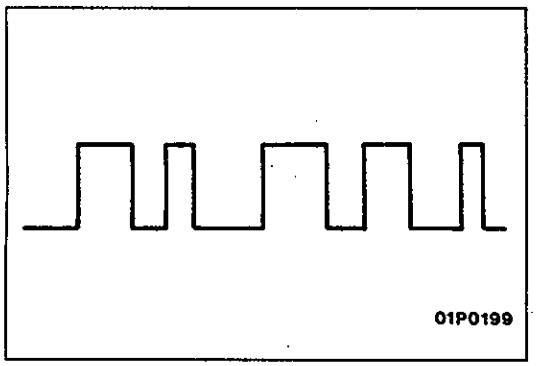
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle speed (750 r/min.)



Wave Pattern Observation Points

Check to be sure that cycle time T becomes shorter when the engine speed increases.



Examples of abnormal wave patterns

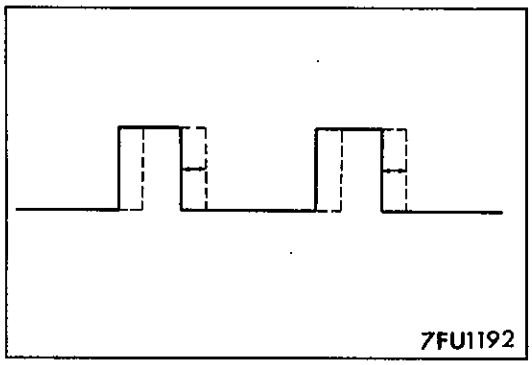
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Rectangular wave pattern is output even when the engine is not started.



- Example 2

Cause of problem

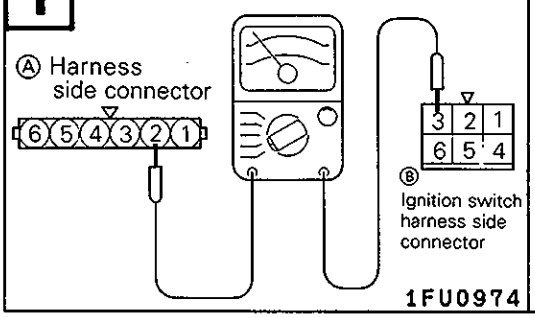
Loose timing belt
Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.

HARNESS INSPECTION

1



Check for continuity between top dead centre sensor and ignition switch.

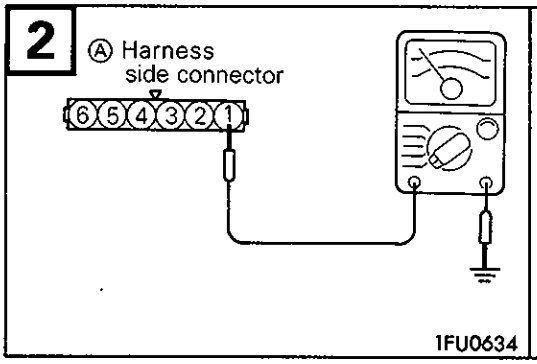
- Top dead centre sensor connector: Disconnected
- Ignition switch connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ2 – Ⓑ3)

2



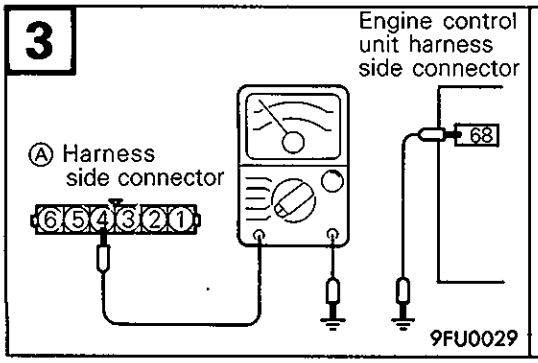
Check for continuity of the earth circuit.

- Top dead centre sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – Earth)

3



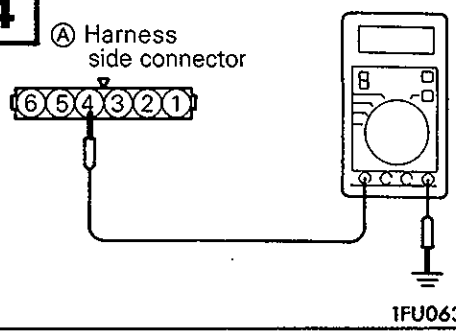
Check for open-circuit or short-circuit to earth, between top dead centre sensor and engine control unit.

- Engine control unit connector: Disconnected
- Top dead centre sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ4 – 68)

4



Measure the impressed voltage.

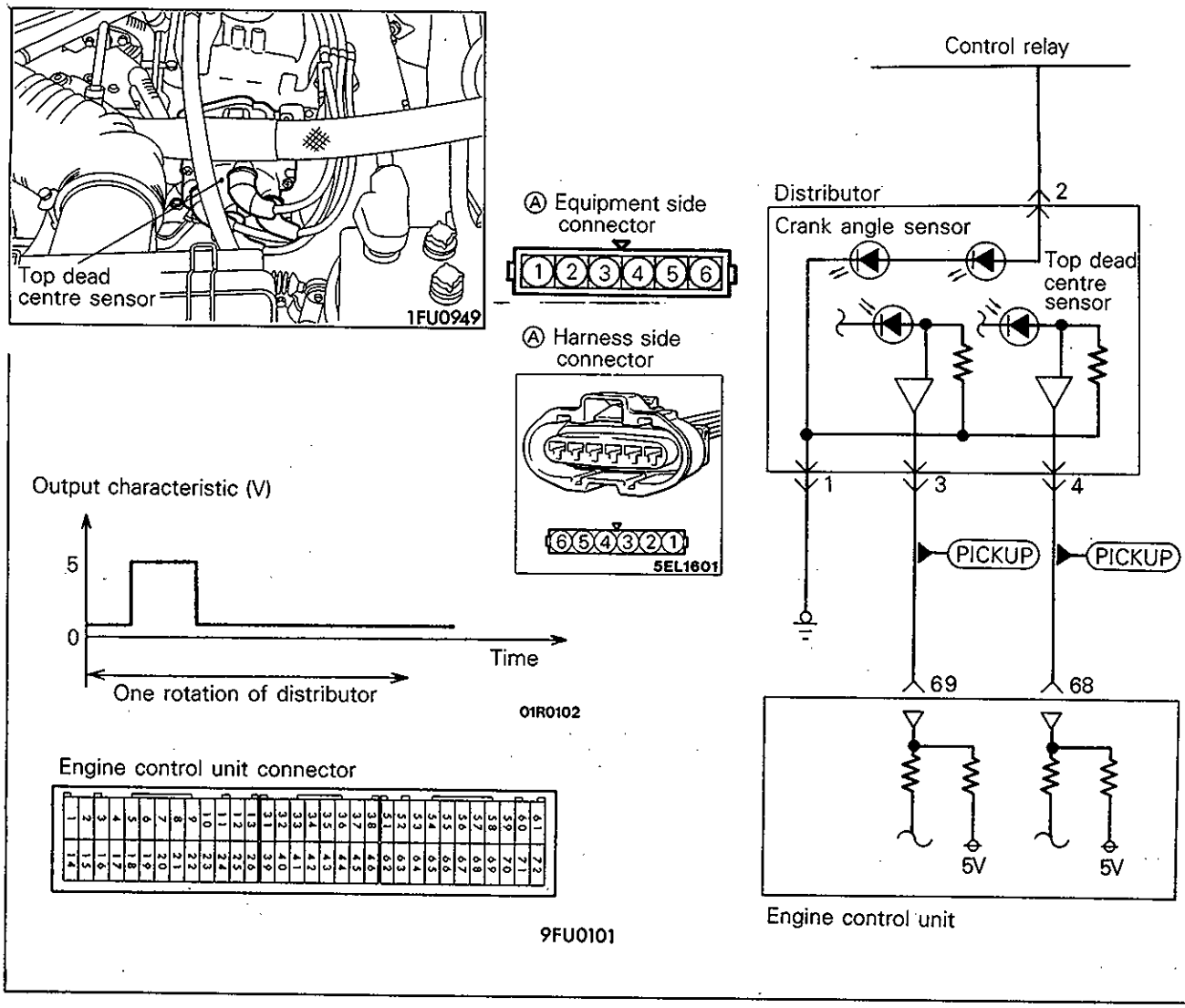
- Top dead centre sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → STOP

NOT OK → Replace the engine control unit.

TOP DEAD CENTRE SENSOR <Vehicles built from October, 1993>



OPERATION

- The top dead centre sensor detects the top dead centre on the compression stroke of the No.1 cylinder, converts it into a pulse signal and inputs it to the engine control unit. The engine control unit determines the fuel injection sequence based on this signal.
- Power to the top dead centre sensor is supplied from the control relay and is earthed to the body. The top dead centre sensor generates a pulse signal as it repeatedly connects and disconnects between 5 V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

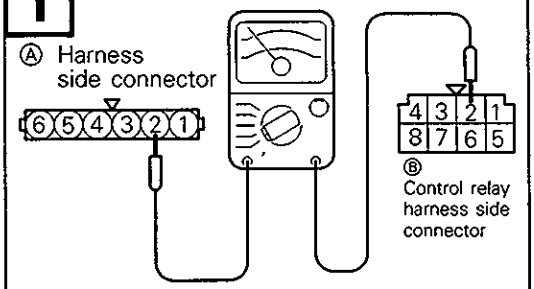
Refer to P. 13-53.

INSPECTION

Refer to P. 13-54.

HARNESS INSPECTION

1



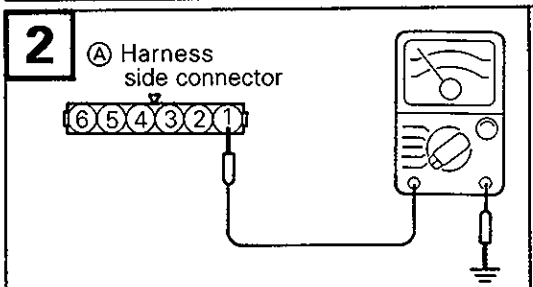
Check for continuity between top dead centre sensor and control relay.
- Top dead centre sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ2 – Ⓑ2)

2

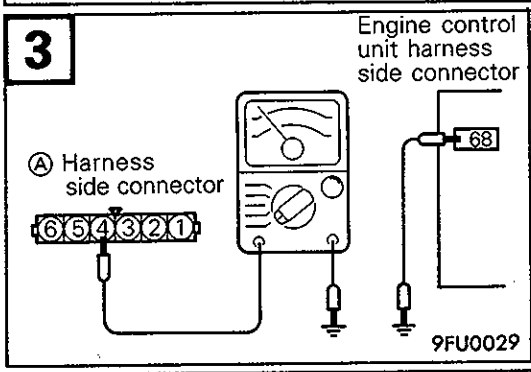


Check for continuity of the earth circuit.
- Top dead centre sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – Earth)

3

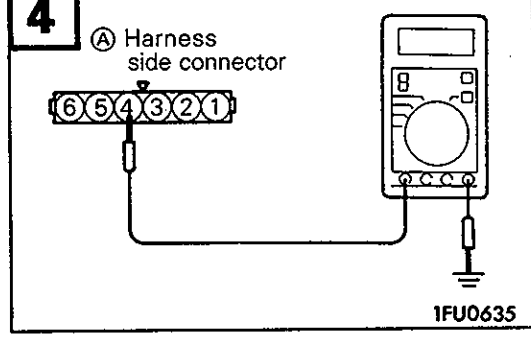


Check for open-circuit or short-circuit to earth, between top dead centre sensor and engine control unit.
- Engine control unit connector: Disconnected
- Top dead centre sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ4 – 68)

4



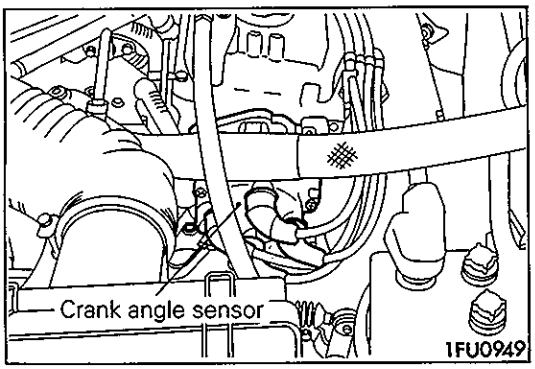
Measure the impressed voltage.
- Top dead centre sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

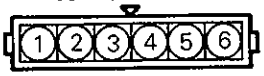
Voltage (V)
4.8–5.2

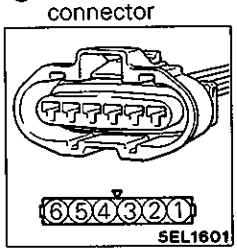
OK → STOP

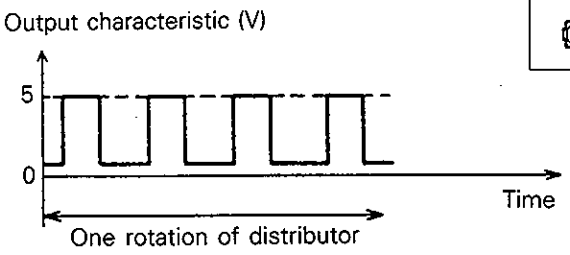
NG → Replace the engine control unit.

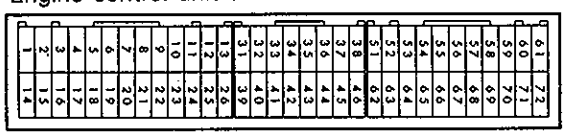
CRANK ANGLE SENSOR <Vehicles built up to September, 1993>

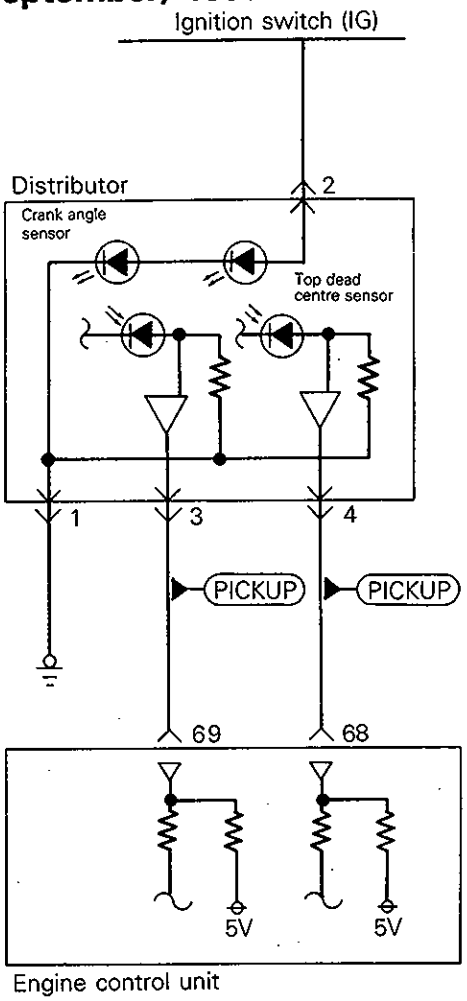












9FU0101

1FU0972

OPERATION

- The crank angle sensor senses the crank angle (piston position) of each cylinder, converts it into a pulse signal and inputs it to the engine control unit, which then computes the engine speed and controls the fuel injection timing and ignition timing based on the input signal.
- Power to the crank angle sensor is supplied from the ignition switch (IG) and is earthed to the body. The crank angle sensor generates a pulse signal as it repeatedly connects and disconnects between 5V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

Hint 1: If unexpected shocks are felt during driving or the engine stalls suddenly during idling, shake the crank angle sensor harness. If this causes the engine to stall, poor contact of the sensor connector is suspected.

Hint 2: If the crank angle sensor outputs a pulse signal when the ignition switch is turned to ON, (without starting the engine), the crank angle sensor or engine control unit is probably defective.

Hint 3: If the tachometer reads 0 r/min. when the engine that has failed to start is cranked, faulty crank angle sensor or broken timing belt is suspected.

Hint 4: If the tachometer reads 0 r/min. when the engine that has failed to start is cranked, the primary current of the ignition coil is not turned on and off. Therefore, troubles in the ignition circuit and ignition coil or faulty power transistor is suspected.

Hint 5: If the engine can be run at idle even though the crank angle sensor reading is out of specification, troubles are often in other than the crank angle sensor.
[Examples]
(1) Faulty coolant temperature sensor
(2) Faulty idle speed control servo
(3) Poorly adjusted basic idle speed

INSPECTON

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Cranking speed	• Engine cranking • Tachometer connected (Check on and off of primary current of ignition coil by tachometer)	Compare cranking speed with MUT or MUT-II reading	Indicated speed to agree

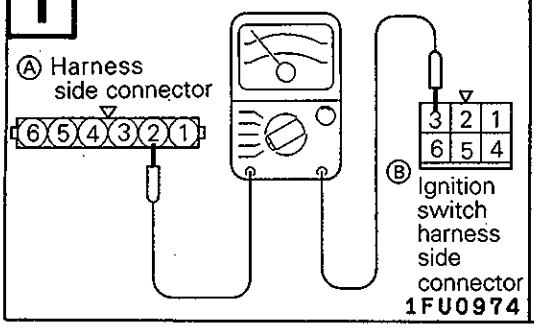
Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Idle speed	• Engine: Idling • Idle position switch: ON	–20°C (–4°F)	1,500–1,700 r/min.
				0°C (32°F)	1,350–1,550 r/min.
				20°C (68°F)	1,150–1,350 r/min.
				40°C (104°F)	940–1,140 r/min.
				80°C (176°F)	650–850 r/min.

Wave Pattern Inspection Using an Analyzer

(Refer to P. 13-54.)

HARNESS INSPECTION

1



Check for continuity between crank angle sensor and ignition switch.
- Crank angle sensor connector: Disconnected
- Ignition switch connector: Disconnected

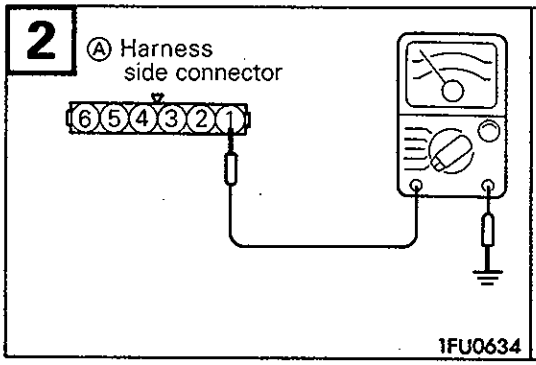
NOTE

Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ2 – Ⓑ3)

2

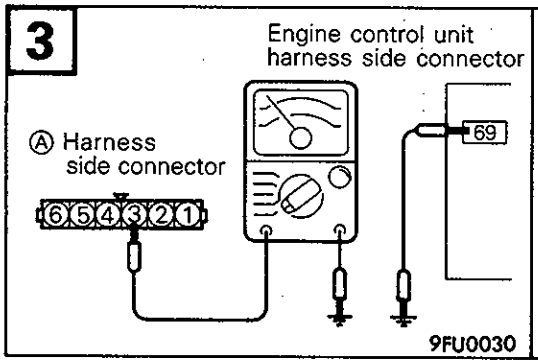


Check for continuity of the earth circuit.
- Crank angle sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – Earth)

3

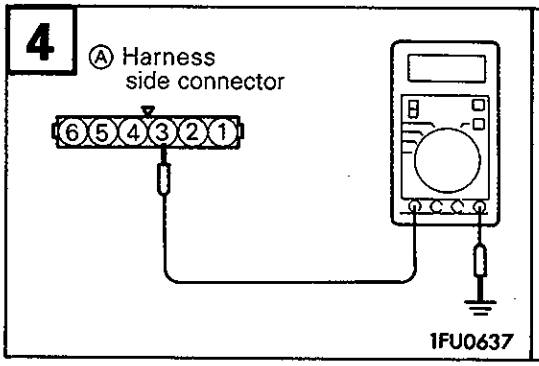


Check for open-circuit or short-circuit to earth, between crank angle sensor and engine control unit.
- Engine control unit connector: Disconnected
- Crank angle sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ3 – 69)

4



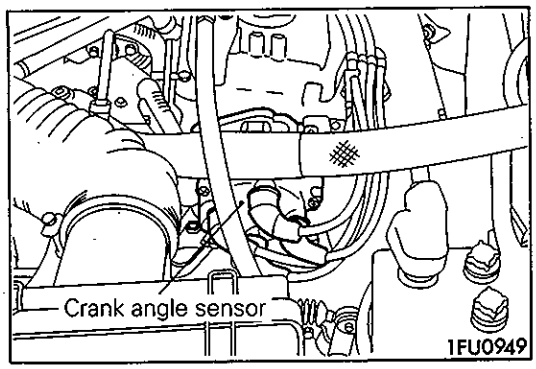
Measure the impressed voltage.
- Crank angle sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

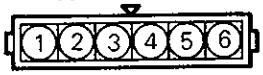
Voltage (V)
4.8–5.2

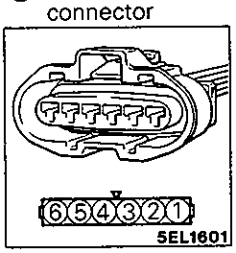
OK → STOP

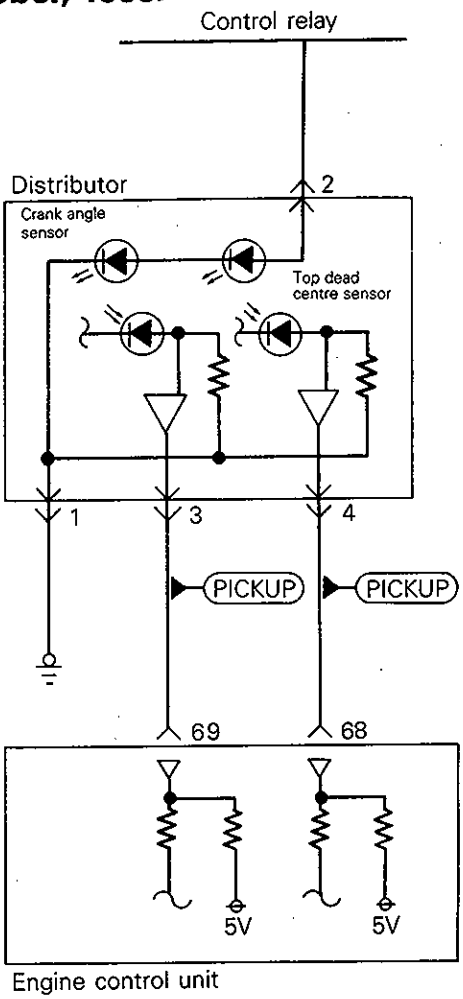
NG → Replace the engine control unit.

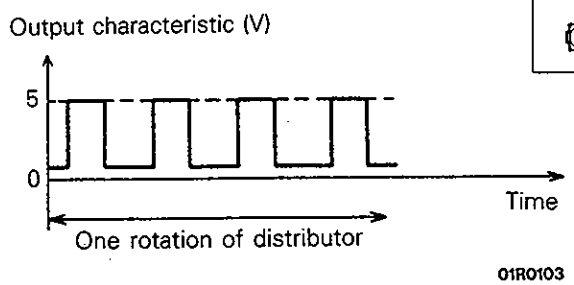
CRANK ANGLE SENSOR <Vehicles built from October, 1993>

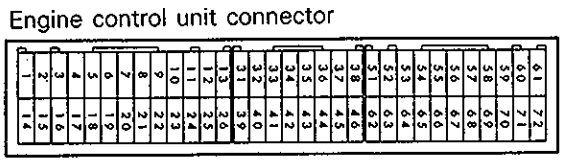












9FU0101

1FU0972

OPERATION

- The crank angle sensor senses the crank angle (piston position) of each cylinder, converts it into a pulse signal and inputs it to the engine control unit, which then computes the engine speed and controls the fuel injection timing and ignition timing based on the input signal.
- Power to the crank angle sensor is supplied from the control relay and is earthed to the body. The crank angle sensor generates a pulse signal as it repeatedly connects and disconnects between 5V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

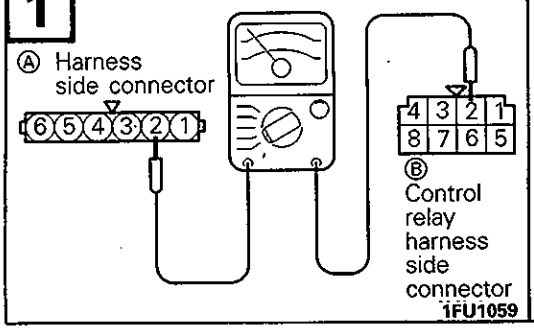
Refer to P. 13-58.

INSPECTION

Refer to P. 13-58.

HARNESS INSPECTION

1



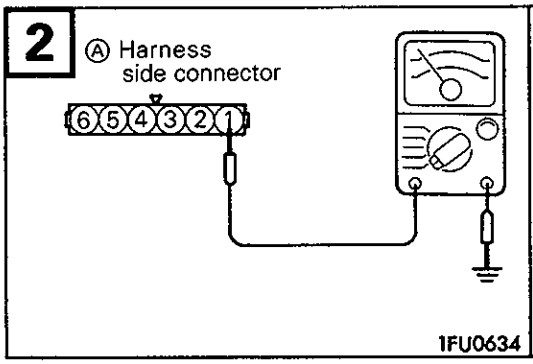
Check for continuity between crank angle sensor and control relay.
- Crank angle sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ2 – Ⓑ2)

2

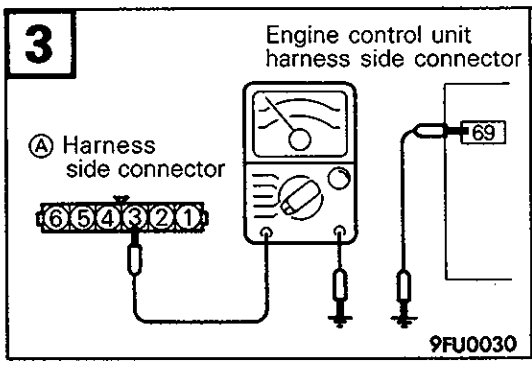


Check for continuity of the earth circuit.
- Crank angle sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – Earth)

3

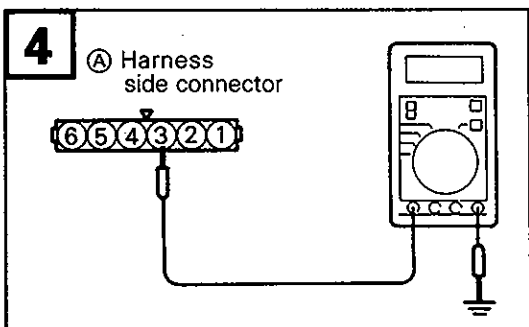


Check for open-circuit or short-circuit to earth, between crank angle sensor and engine control unit.
- Engine control unit connector: Disconnected
- Crank angle sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ3 – 69)

4



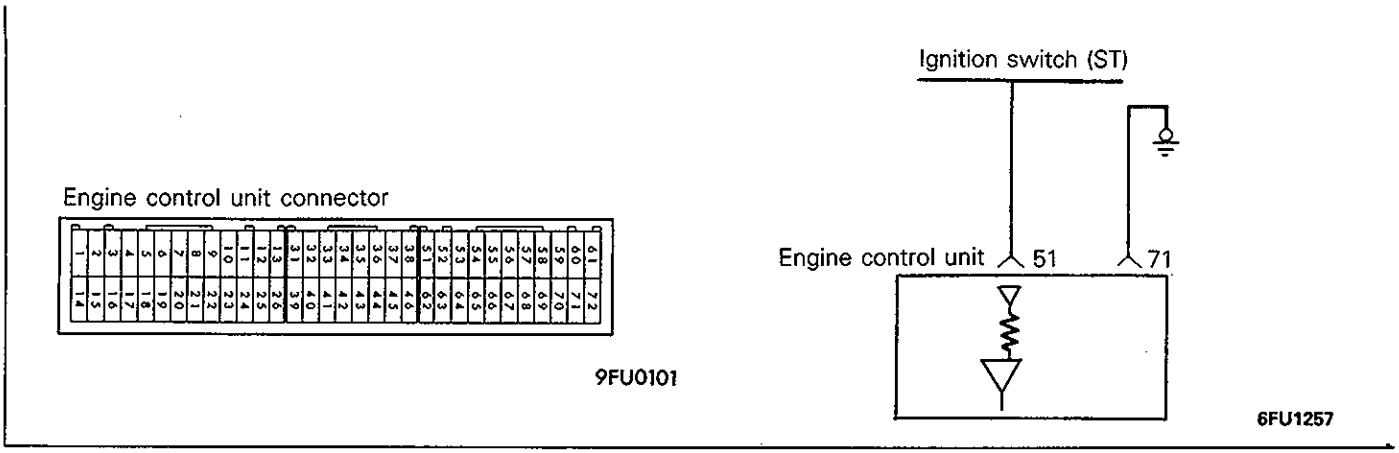
Measure the impressed voltage.
- Crank angle sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → STOP

NG → Replace the engine control unit.

IGNITION SWITCH-ST



OPERATION

- The ignition switch-ST inputs a high signal to the engine control unit while the engine is cranking. The engine control unit provides fuel injection control, etc., at engine start up based on this signal.
- When the ignition switch is set to START, the battery voltage at cranking is applied through the ignition switch to the engine control unit, which detects that the engine is cranking.

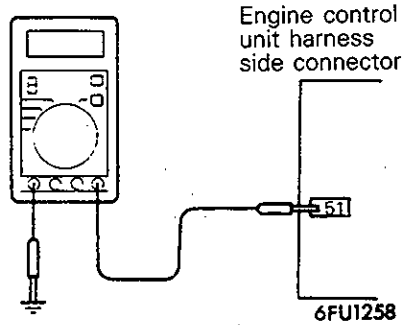
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Engine	Normal indication
Data reading	18	Switch state	Ignition switch: ON	Stop	OFF
				Cranking	ON

HARNESS INSPECTION

1



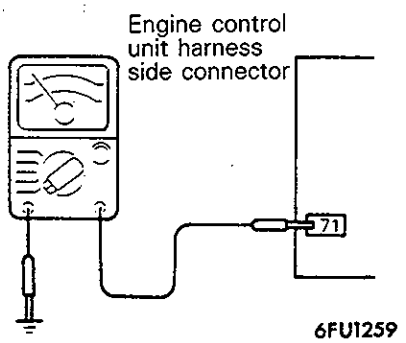
Measure the input voltage to the engine control unit.
- Engine control unit connector: Disconnected
- Ignition switch: START

Voltage (V)
8 or more

OK → 2 Repair the harness. (51 – Ignition switch) or check the ignition switch.

NG → Repair the harness. (51 – Ignition switch) or check the ignition switch.

2

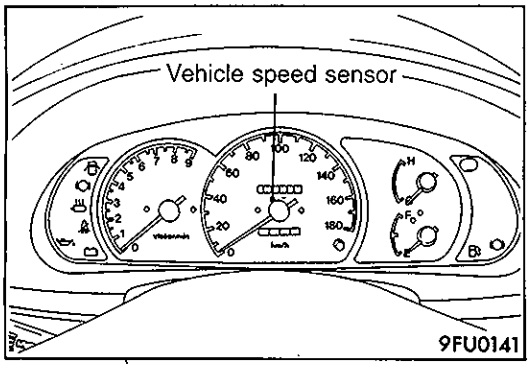


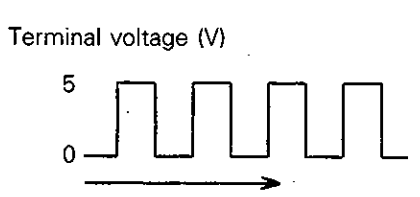
Check for continuity of the earth circuit.
- Engine control unit connector: Disconnected

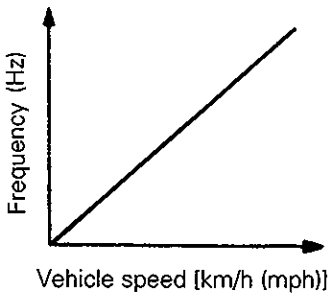
OK → STOP

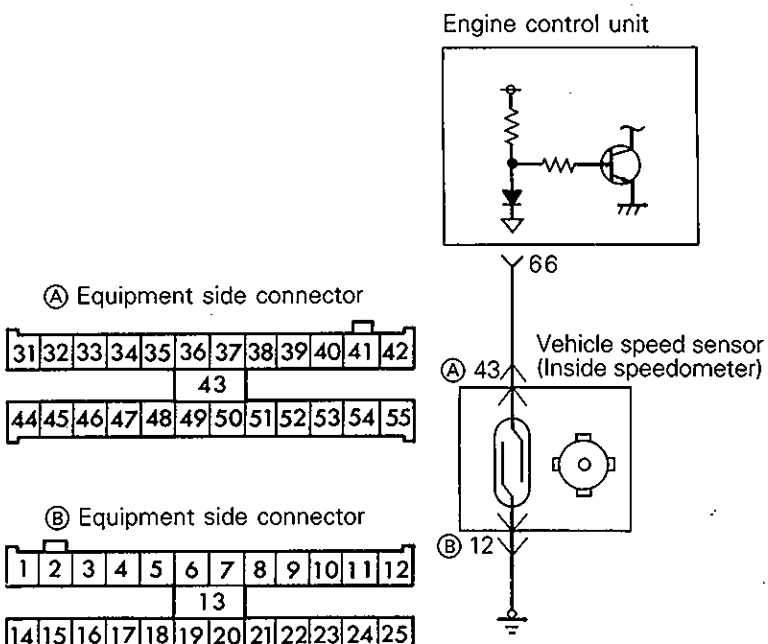
NG → Repair the harness. (71 – Earth)

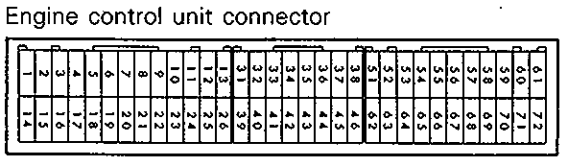
VEHICLE SPEED SENSOR











OPERATION

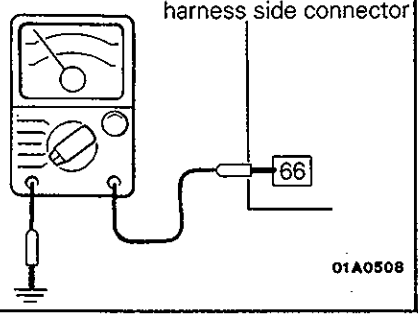
- The vehicle speed sensor which is located in the speedometer converts the vehicle speed into a pulse signal and inputs it to the engine control unit, which then provides the idle speed control, etc., based on this signal.
- The vehicle speed sensor generates the vehicle speed signal by repeatedly opening and closing between the voltage of about 5V applied from the engine control unit and earth using a reed switch.

TROUBLESHOOTING HINTS

If there is an open or short circuit in the vehicle speed sensor signal circuit, the engine may stall when the vehicle is decelerated to stop.

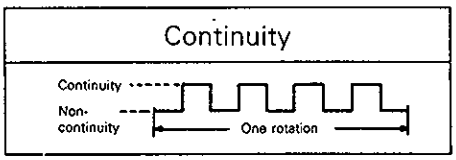
HARNESS INSPECTION

1



Check the vehicle speed sensor output circuit for continuity.

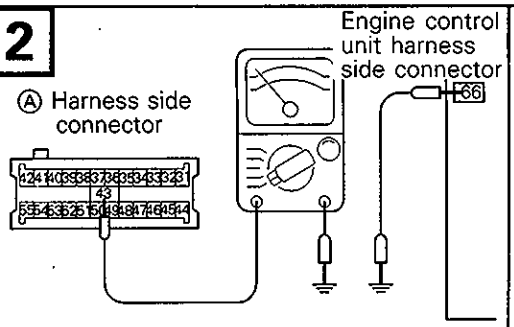
- Engine control unit connector: Disconnected
- Move the vehicle.



OK → 4

NG → 2

2



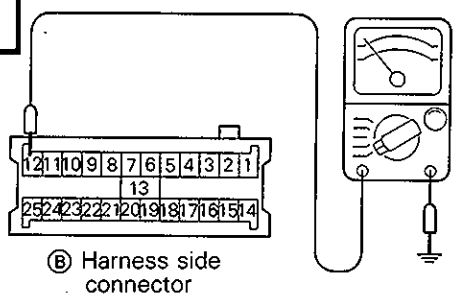
Check for open-circuit or short-circuit to earth between engine control unit and vehicle speed sensor.

- Engine control unit connector: Disconnected
- Vehicle speed sensor connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ43 – 66)

3



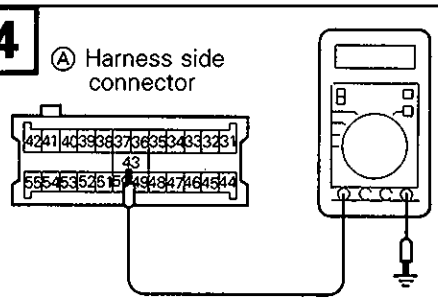
Check for continuity of the earth circuit.

- Vehicle speed sensor: Disconnected

OK → 4

NO → Repair the harness. (Ⓑ12 – Earth)

4



Measure the impressed voltage.

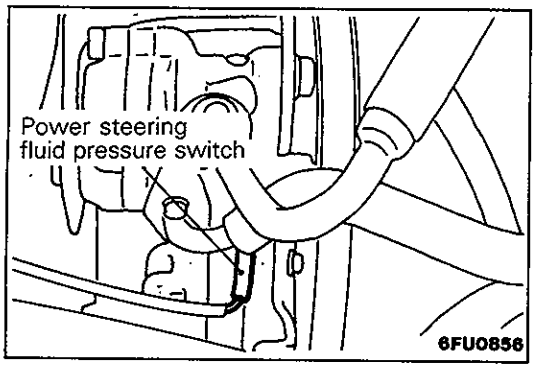
- Vehicle speed sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

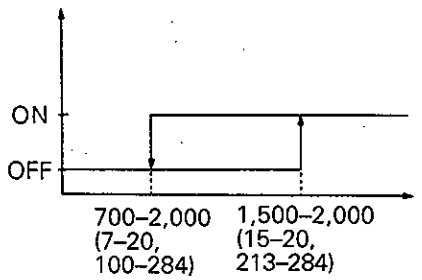
Voltage (V)
4.5–4.9

OK → STOP

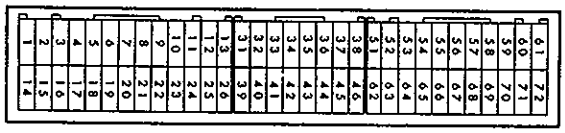
NO → Replace the engine control unit.

POWER STEERING FLUID PRESSURE SWITCH

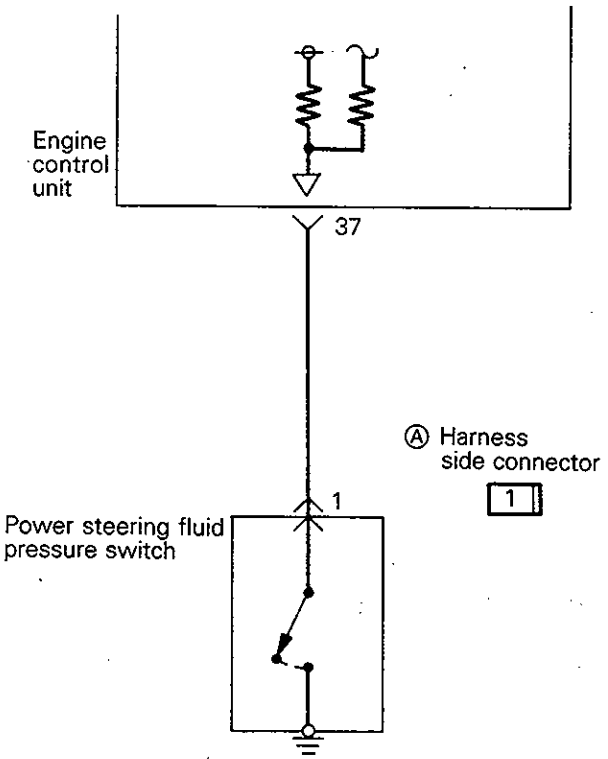




Engine control unit connector



9FU0101



OPERATION

- The power steering fluid pressure switch converts presence/absence of power steering load into low/high voltage and inputs it to the engine control unit, which then controls the idle speed control servo based on this signal.
- The battery voltage in the engine control unit is applied through a resistor to the power steering fluid pressure switch. Steering operating causes the power steering fluid pressure to increase, turning the switch on. As a result, continuity is produced between the battery voltage applied and earth. This causes the power steering fluid pressure terminal voltage to go from high to low.

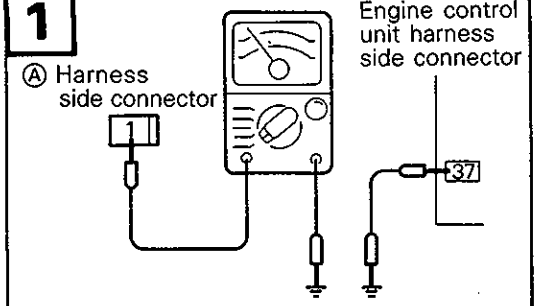
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Steering wheel	Normal indication
Data reading	27	Switch state	Engine: Idling	When stationary	OFF
				When being turned	ON

HARNESS INSPECTION

1



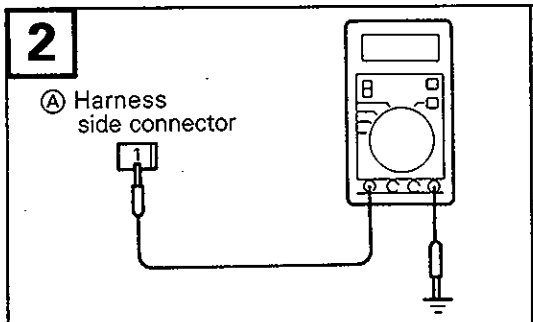
Check for open-circuit or short-circuit to earth, between engine control unit and power steering fluid pressure switch.

- Power steering fluid pressure switch connector: Disconnected
- Engine control unit connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ1 – 37)

2



Measure the impressed voltage.

- Power steering fluid pressure switch connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
5V

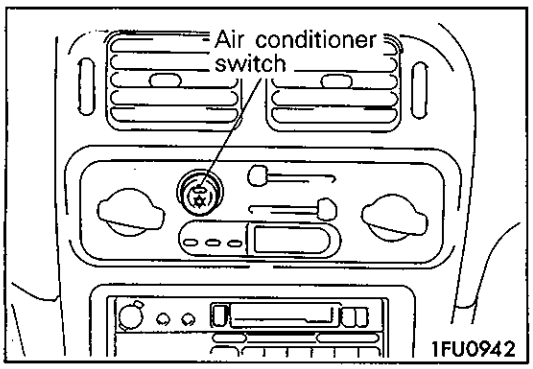
OK → STOP

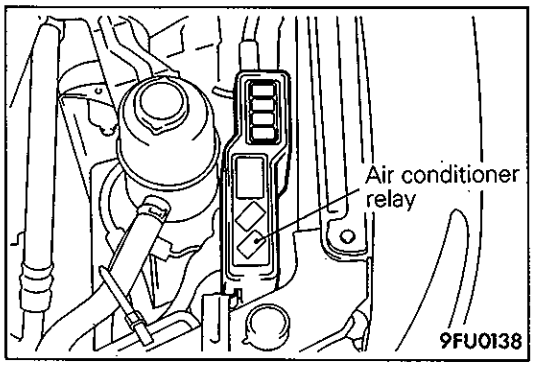
NG → Replace the engine control unit.

SENSOR INSPECTION

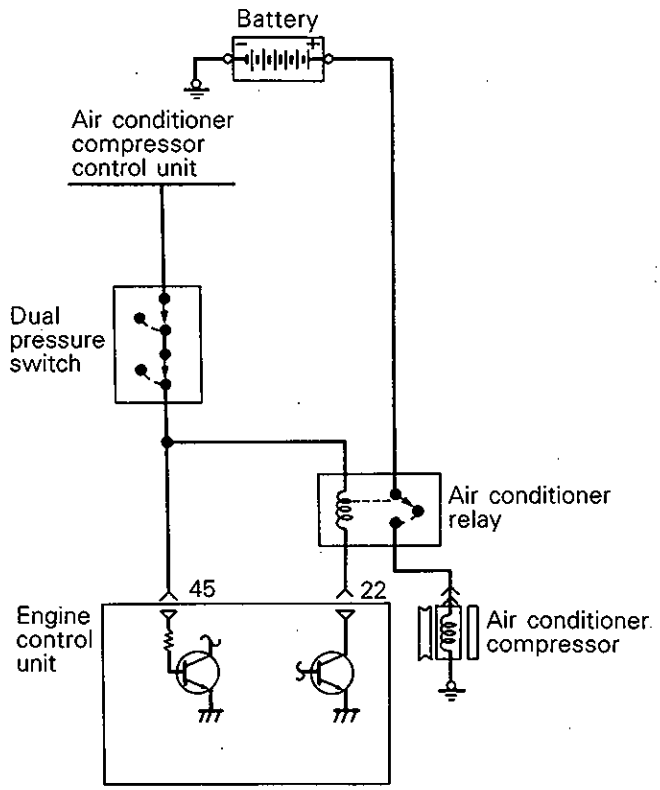
Refer to GROUP 37 – Service Adjustment Procedures.

AIR CONDITIONER SWITCH AND POWER RELAY





9FU0101



7FU0821

OPERATION

- The air conditioner switch applies the battery voltage to the engine control unit when the air conditioner is turned on.
- When the air conditioner ON signal is input, the engine control unit drives the idle speed control servo and turns ON the power transistor. As a result, the air conditioner compressor power relay coil is energized to turn ON the relay switch, which activates the air compressor magnet clutch.

TROUBLESHOOTING HINTS

If the air compressor magnet clutch is not activated when the air conditioner switch is turned ON during idling, faulty air conditioner control system is suspected.

INSPECTION

Using MUT or MUT-II

AIR CONDITIONER SWITCH

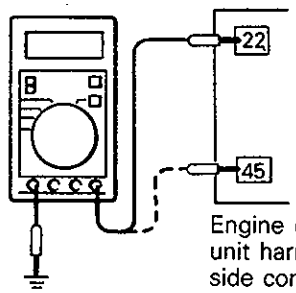
Function	Item No.	Data display	Check condition	Air conditioner switch	Normal indication
Data reading	28	Switch state	Engine: Idling (air compressor to be running when air conditioner switch is ON)	OFF	OFF
				ON	ON

AIR CONDITIONER COMPRESSOR POWER RELAY

Function	Item No.	Data display	Check condition	Air conditioner switch	Normal indication
Data reading	49	Air conditioner compressor power relay state	Engine: Idling after warm-up	OFF	OFF (Compressor clutch non-activation)
				ON	ON (Compressor clutch activation)

HARNESS INSPECTION

1



Engine control unit harness side connector

01R0863

Measure the power supply voltage of the air conditioner circuit.

- Air conditioner: ON
- Engine control unit connector: Disconnected
- Ignition switch: ON

Voltage (V)
6V or more

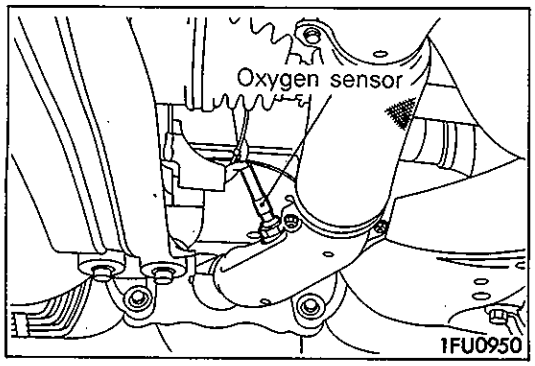
OK → STOP

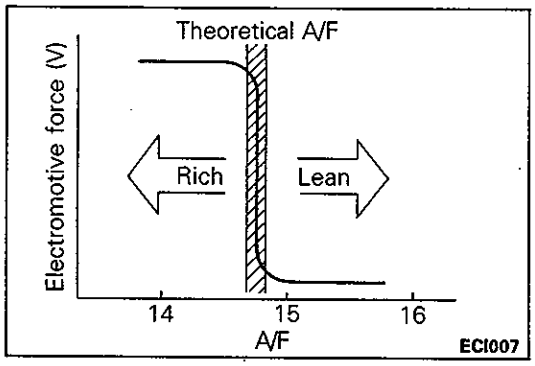
NG → Check the air conditioner circuit.

AIR CONDITIONER INSPECTION

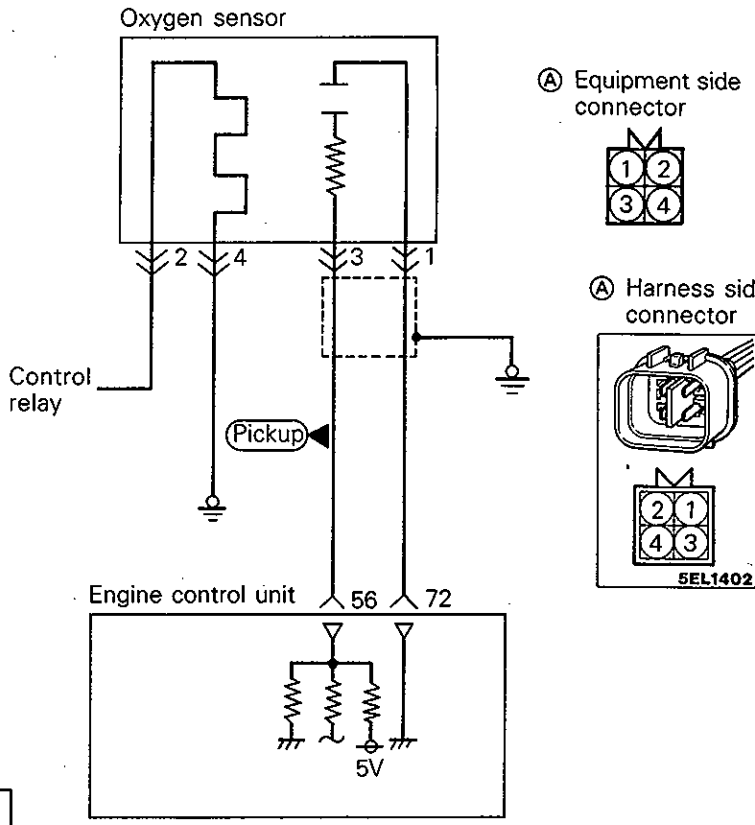
Refer to GROUP 55 – Service Adjustment Procedures.

OXYGEN SENSOR <Vehicles built up to April, 1992>





9FU0101



1FU0975

OPERATION

- The oxygen sensor functions to detect the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the engine control unit.
- If the air/fuel mixture ratio is richer than the theoretical air/fuel mixture ratio (i.e., if the concentration of oxygen in the exhaust gas is sparse), a voltage of approximately 1V is output; if the air/fuel mixture ratio is leaner than the theoretical air/fuel mixture ratio (i.e., if the concentration is dense), a voltage of approximately 0V is output.
- The engine control unit, based upon those signals, regulates the amount of fuel injection so that the air/fuel mixture ratio becomes the theoretical air/fuel mixture raito.
- Battery power supply is applied, by way of the control relay, to the oxygen sensor heater. As a result, the sensor element is heated by the heater, so that the oxygen sensor shows excellent response even if the temperature of the exhaust gas is low

TROUBLESHOOTING HINTS

Hint 1:
The exhaust gas purification performance will worsen if there is a malfunction of the oxygen sensor.
Hint 2:
If the oxygen sensor output voltage deviates from the standard value even though the results of the checking of the oxygen sensor are normal, the cause is probably a malfunction of a component related to air/fuel mixture ratio control.

[Examples]
(1) Malfunction of an injector.
(2) Air leakage into the intake manifold from a leaking gasket.
(3) Malfunction of the air-flow sensor, the intake air temperature sensor, the barometric-pressure sensor, or the coolant temperature sensor.

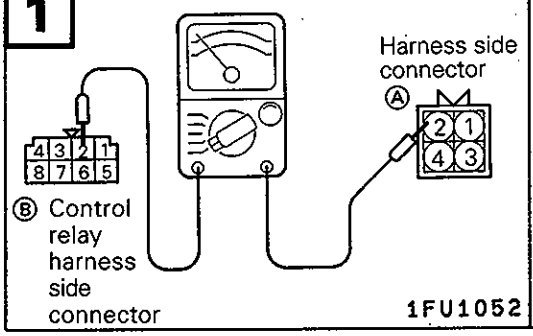
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Select lever position	Standard value
Data reading	11	Sensor voltage	Engine: Warm-up (make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 r/min.	200 mV or lower
				When engine is suddenly raced	600–1,000 mV
			Engine: Warm-up (using the oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control unit)	750 r/min. (Idle)	400 mV or lower ↕(changes)
				2,000 r/min.	600–1,000 mV

HARNESS INSPECTION

1



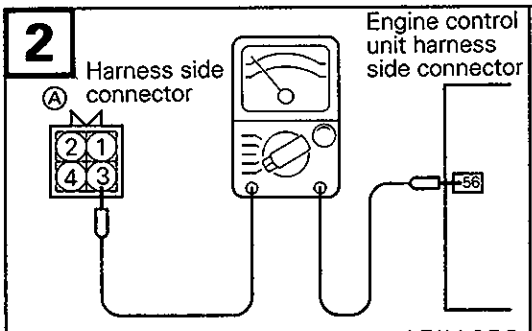
Check for continuity between oxygen sensor and control relay.
- Oxygen sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ2 – Ⓑ2)

2

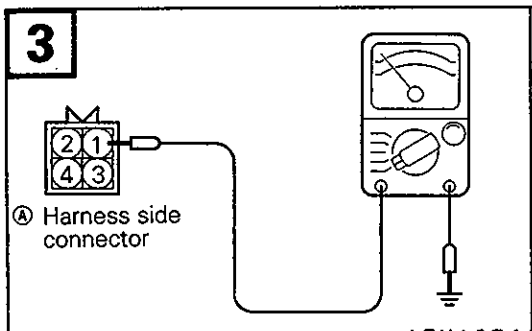


Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the oxygen sensor.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ3 – 56)

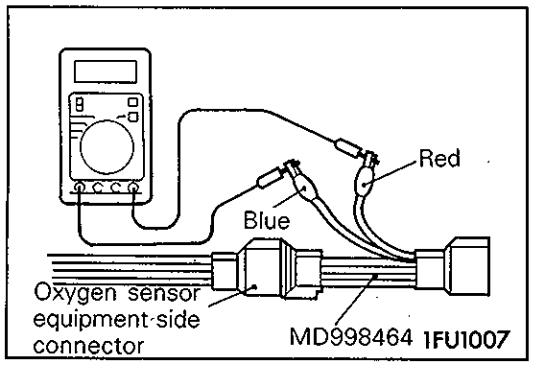
3

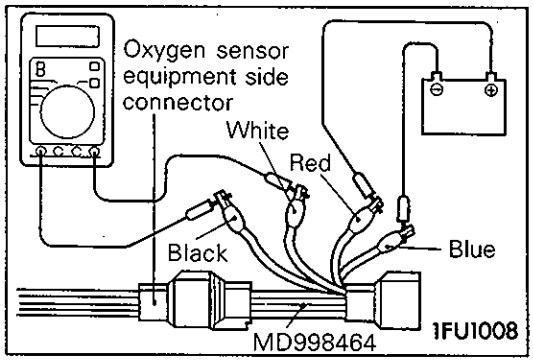


Check for continuity of the earth circuit.
- Oxygen sensor connector: Disconnected

OK → STOP

NO → Repair the harness. (Ⓐ1 – 72)





SENSOR INSPECTION

(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 Ω at 20°C (68°F)] between terminal ② 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 ② (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.

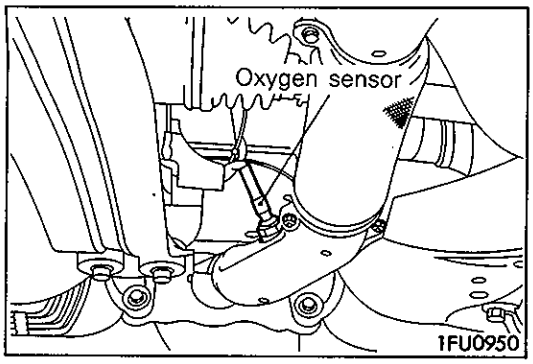
(6) Connect a digital voltage meter between terminal ① and terminal ③.
(7) While repeatedly racing the engine, measure the oxygen sensor output voltage.

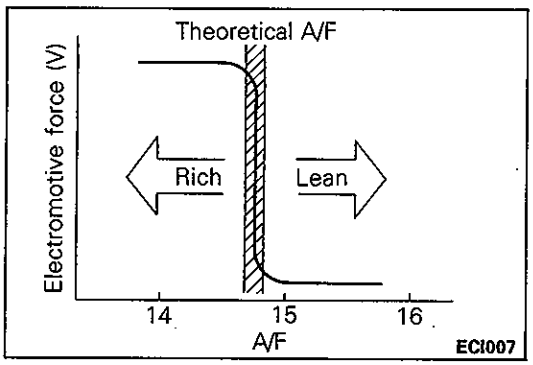
Engine	Oxygen sensor output voltage	Remarks
When racing engine	0.6–1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6–1.0 V.

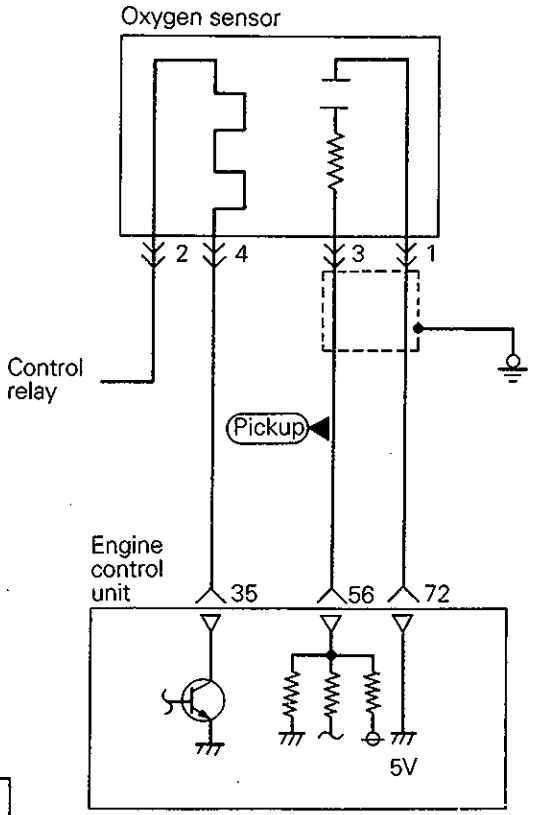
(8) If the sensor is defective, replace the oxygen sensor.

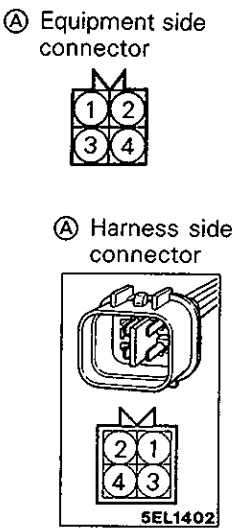
NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.

OXYGEN SENSOR <Vehicles built from May, 1992>

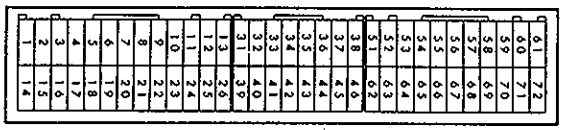








Engine control unit connector



9FU0101

9FU0190

OPERATION

Refer to P.13-67.

TROUBLESHOOTING HINTS

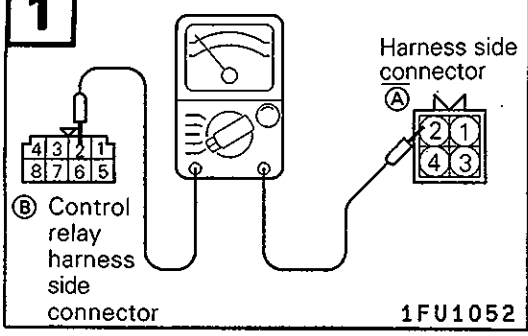
Refer to P.13-67.

INSPECTION

Refer to P.13-68.

HARNESS INSPECTION

1



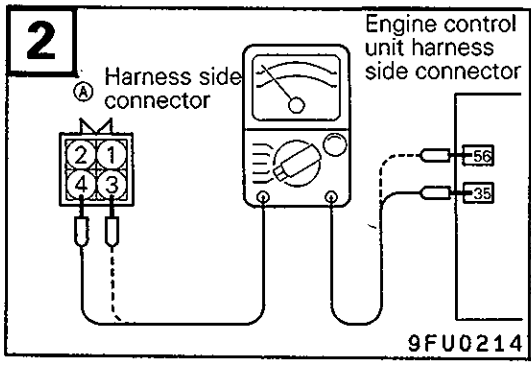
Check for continuity between oxygen sensor and control relay.
- Oxygen sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ2 – Ⓑ2)

2

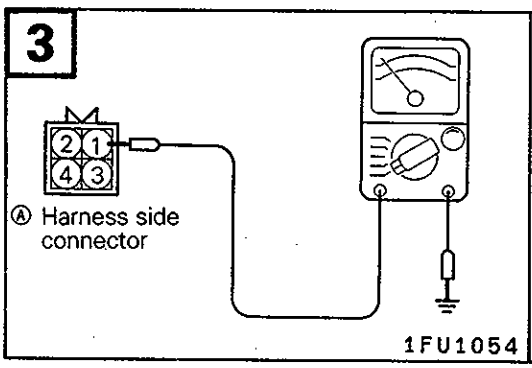


Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the oxygen sensor.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ3 – 56) (Ⓐ4 – 35)

3



Check for continuity of the earth circuit.
- Oxygen sensor connector: Disconnected

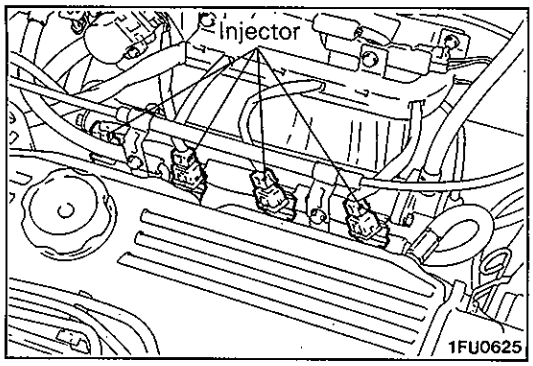
OK → STOP

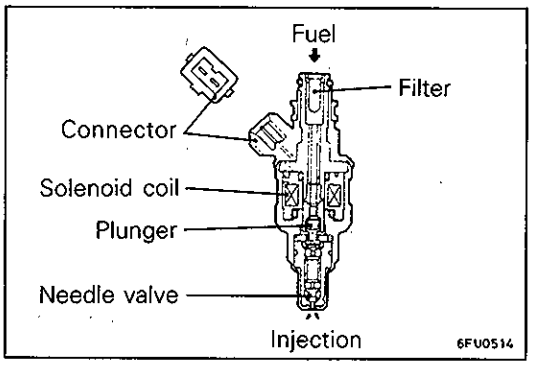
NG → Repair the harness. (Ⓐ1 – 72)

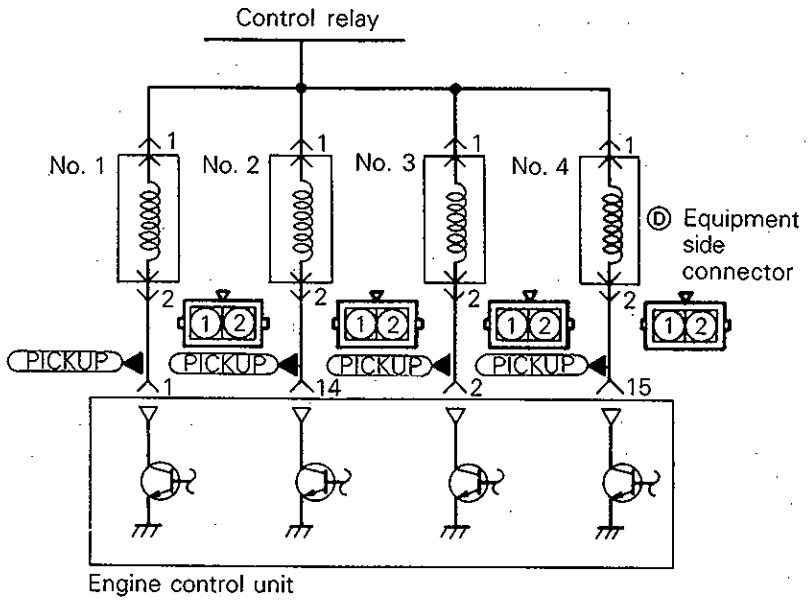
SENSOR INSPECTION

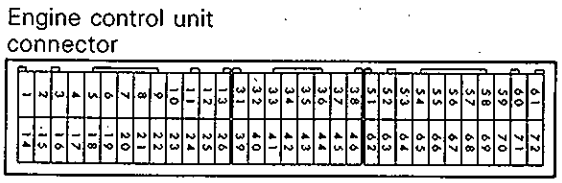
Refer to P.13-69.

INJECTORS









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 operate 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) Spark plug and spark plug cable check
(3) Compression pressure check

Hint 4:If the injector harness and individual part checks have resulted normal but the injector drive time is out of specification, the following troubles are suspected.
(1) Poor combustion in the cylinder (faulty spark plug, ignition coil, compression pressure, etc.)
(2) Loose EGR valve seating
(3) High engine resistance

INSPECTION

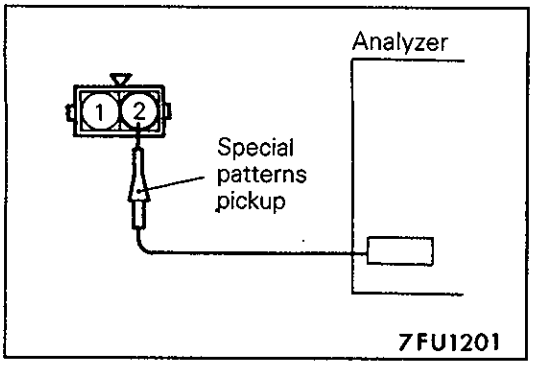
Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Coolant temperature	Standard value
Data reading	41	Drive time *1	Engine: Cranking	0°C (32°F) *2	Approx. 20 ms
				20°C (68°F)	Approx. 40 ms
				80°C (176°F)	Approx. 10 ms

Function	Item No.	Data display	Check condition	Coolant temperature	Standard value
Data reading	41	Drive time *3	• Coolant temperature: 80 to 95°C (176 to 203°F) • Lamps, electric cooling fan, accessories: OFF • Transmission: Neutral	750 r/min. (Idle)	2.2–3.4 ms
				2,000 r/min.	1.9–3.1 ms
				When sharp racing is made	To increase

NOTE
*1: The injector drive time refers to when the supply voltage is 11 V and the cranking speed is less than 250 r/min.
*2: When coolant temperature is lower than 0°C (32°F), injection is made by four cylinders simultaneously.
*3: When the vehicle is new [within initial operation of about 500 km (300 miles)], the injector drive time may be about 10% longer.

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	01	No. 1 injector shut off	Engine: Idling after warm-up (Shut off the injectors in sequence during after engine warm-up, check the idling condition)	Idle state to change further (Becoming less stable or stalling)
	02	No. 2 injector shut off		
	03	No. 3 injector shut off		
	04	No. 4 injector shut off		

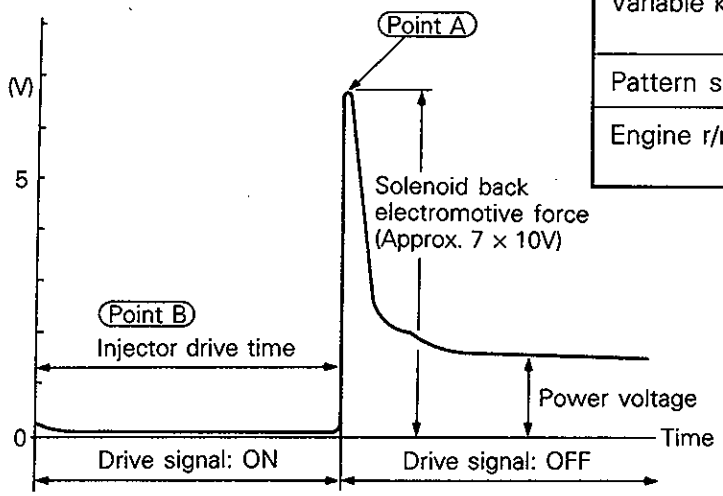


Wave Pattern Inspection Using an Analyzer

Measurement method

(1) Disconnect the injector connector and connect the special tool (test harness: MB991348) in between. (Both the terminal on the engine control unit side and the terminal on the power supply side should be connected.)
(2) Connect the analyzer special patterns pickup to the test harness clip on the engine control unit side.

Standard wave pattern



Observation conditions

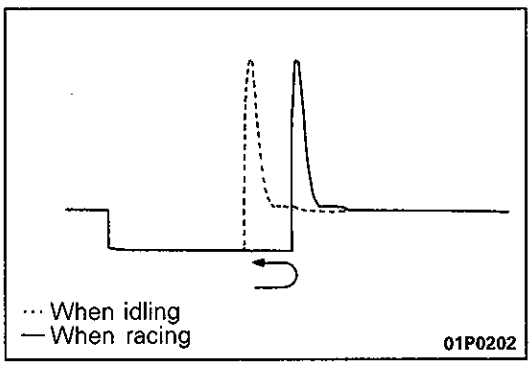
Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min.	Idle speed (750 r/min.)

Wave pattern observation points

Point A : Height of solenoid back electromotive force

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid

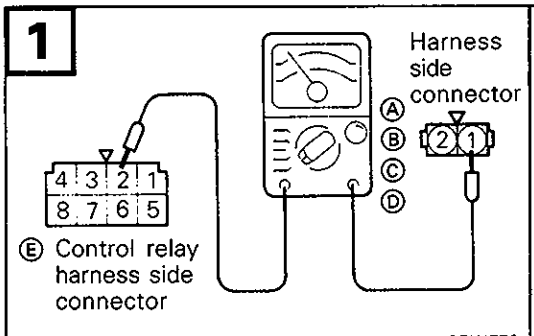
Point B : Injector drive time



- The injector drive time will be synchronized with the multi-use tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.

HARNESS INSPECTION

1



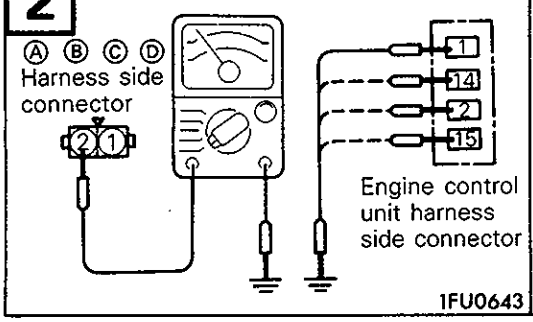
Check for continuity between injector and control relay.
- Injector connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (ⒶⒷⒸⒹ1 – Ⓔ2)

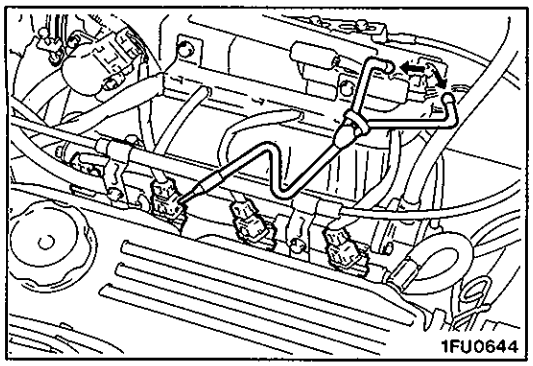
2



Check for an open-circuit, or a short circuit to earth between the engine control unit and the injector.
- Engine control unit connector: Disconnected
- Injector connector: Disconnected

OK → STOP

NG → Repair the harness. (ⒶⒷⒸⒹ 2 – 1, 14, 2, 15)



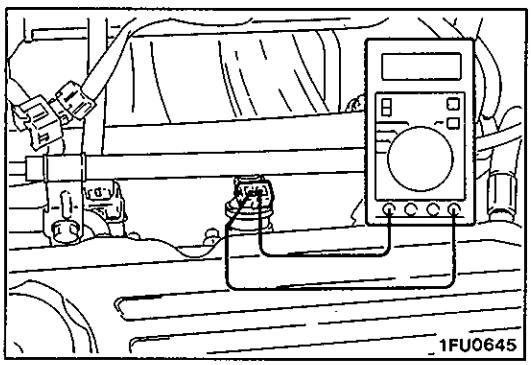
ACTUATOR INSPECTION

Checking Operation Sound

Using a sound scope, check the operation sound ("chi-chi-chi") of injectors during idling or during cranking.
Check that as the rotating speed increases, the frequency of the operating sound also increases.

Caution
Note that even if the injector you are checking is not operating, you will hear the operating sound of the other injectors.

NOTE
If no operating sound is heard from the injector that is being checked, check the injector drive circuit. If there is nothing wrong with the circuit, a defective injector or engine control unit is suspected.

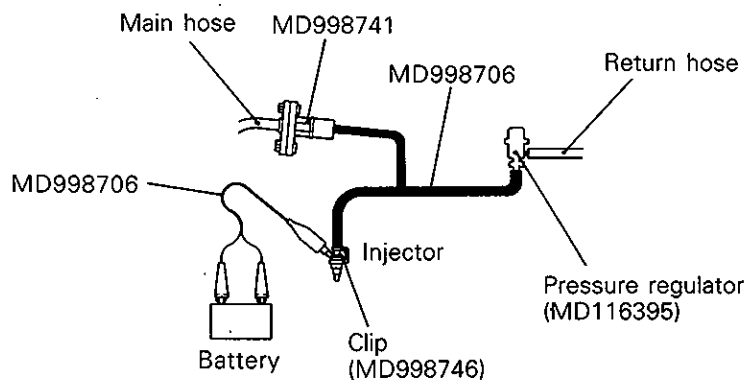


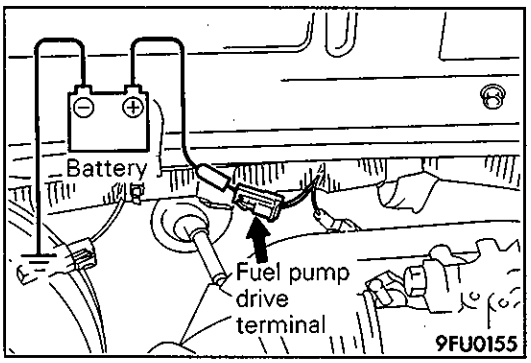
Measurement of Resistance between Terminals

(1) Remove the injector connector.
(2) Measure the resistance between terminals.
Standard value: 13–16 Ω [at 20°C (68°F)]
(3) Install the injector connector.

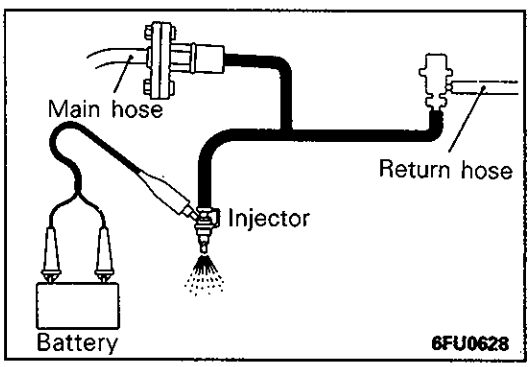
Checking the Injection Condition

(1) Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P. 13-24.)
(2) Remove the injector.
(3) Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.

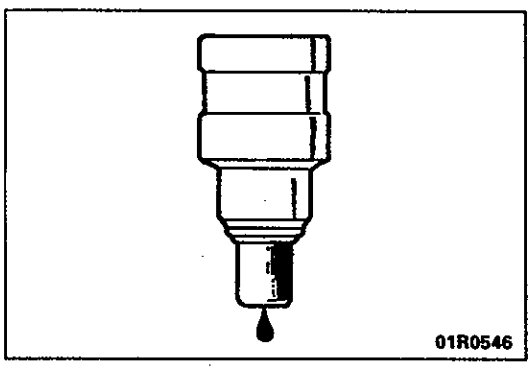




(4) Connect the battery's negative (–) terminal.
(5) Apply battery voltage to the fuel pump drive terminal and activate the fuel pump.



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

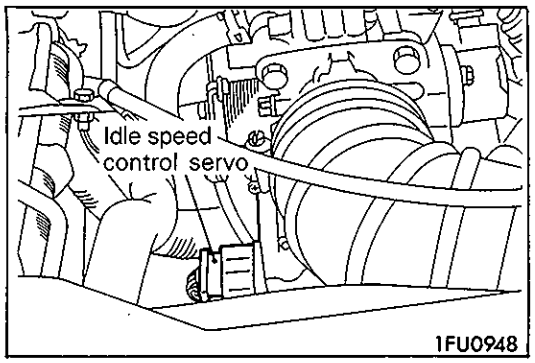


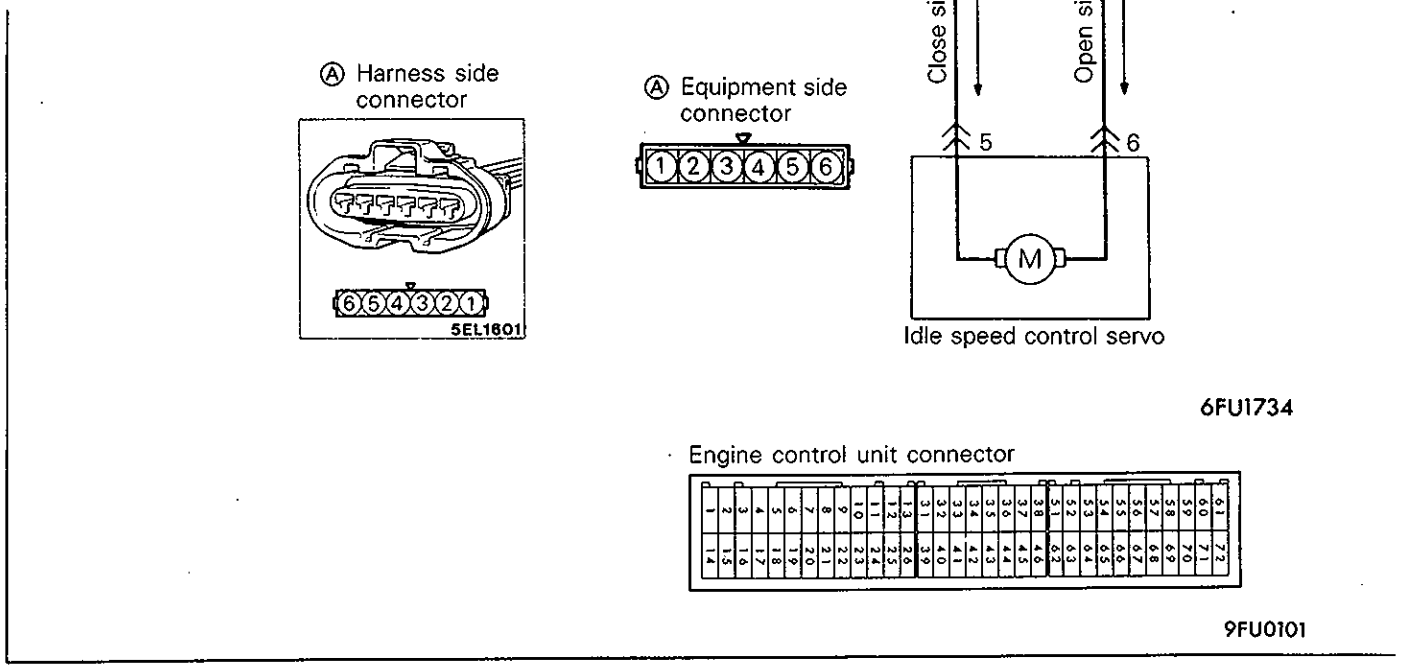
(7) Stop the actuation of the injector, and check for leakage from the injector's nozzle.

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 (DC MOTOR)





OPERATION

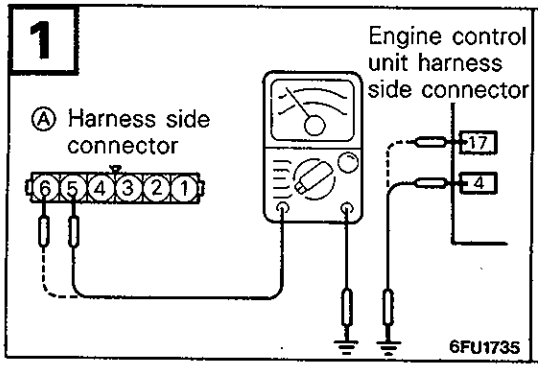
- The volume of intake air during engine idling is controlled by the opening and closing of the servo valve for bypassing the throttle valve, located at the air intake port.
- The servo valve opens and closes depending on whether the DC motor inside the idle speed control servo is turning clockwise or anti-clockwise.
- The DC motor turns clockwise or anti-clockwise according to the change in the direction of current in the motor drive IC inside the engine control unit.

TROUBLESHOOTING HINTS

Hint 1: While the engine is idling, if the idle speed and servo valve position (step) change when the air conditioner switch is turned to ON and OFF, it can be assumed that the idle speed control servo and the servo valve position sensor are operating normally.

Hint 2: If the servo valve position (step) is outside the standard position, the malfunction is probably one of the following:
(1) Basic idle speed adjustment is wrong.
(2) Some deposit is adhering to the throttle valve.
(3) Air is being drawn into the air intake manifold through a defective gasket seal.
(4) EGR valve sheet adhesion is defective.
(5) Combustion malfunction inside a cylinder.
(Spark plug, ignition coil, injector or compression pressure is defective.)

HARNESS INSPECTION

1  	Check for open-circuit or short-circuit to earth, between idle speed control servo and engine control unit. • Idle speed control servo connector: Disconnected • Engine control unit connector: Disconnected	OK →	2
		NG →	Repair the harness. (Ⓐ5 – 4) (Ⓐ6 – 17)

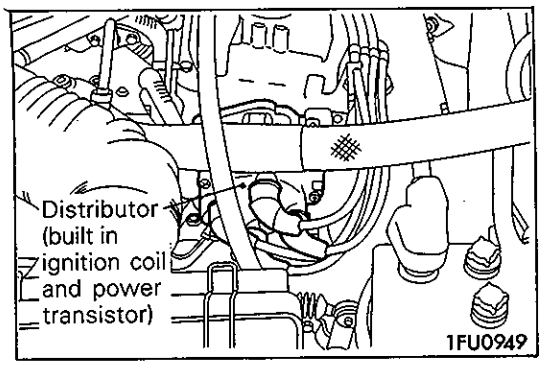
ACTUATOR INSPECTION

Use a sound scope to check if the sound of the idle speed control servo operating can be heard immediately after the ignition switch is turned to "ON".

NOTE

If the sound of the servo operating cannot be heard, check the motor drive circuit and the idle speed control servo motor.

IGNITION COIL AND POWER TRANSISTOR



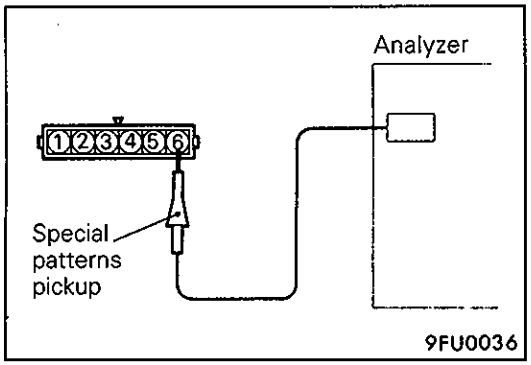
OPERATION

- When the power transistor is turned ON by the signal from the engine control unit, primary current flows to the ignition coil. When the power transistor is turned OFF, primary current is shut off and a high voltage is induced in the secondary coil.
- When the engine control unit turns OFF the transistor in the unit, the battery voltage in the unit is applied to the power transistor unit to turn it On. When the engine control unit turns ON the transistor in the unit, the power transistor unit is turned OFF.

INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	44	Ignition advance	• Engine: Warming up • Timing lamp: Set (set timing lamp to check actual ignition timing)	750 r/min. (Idle)	2–18°BTDC
				2,000 r/min.	15–35°BTDC



Wave Pattern Inspection Using an Analyzer

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition System
- Power transistor control signal

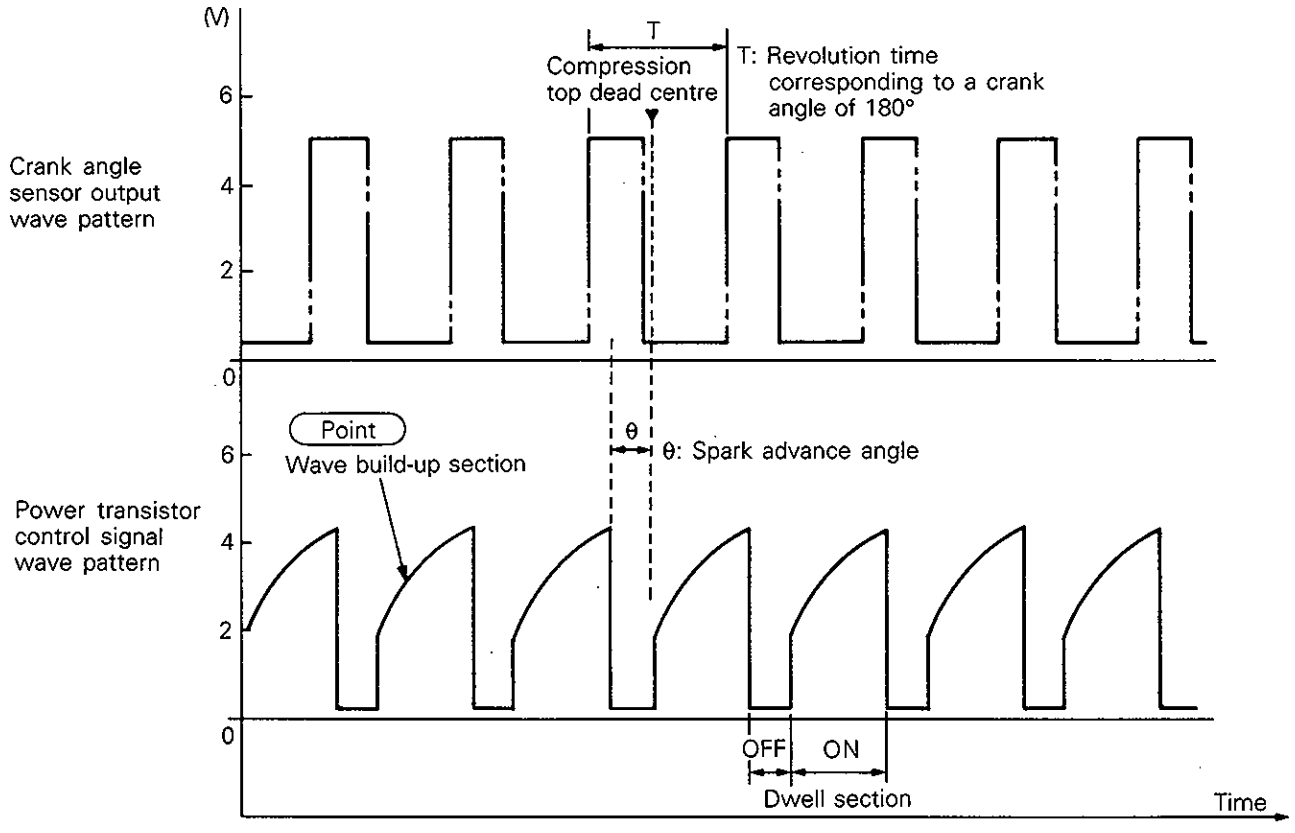
Measurement method

(1) Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to power transistor unit connector terminal ⑥.

Standard wave pattern

Observation condition

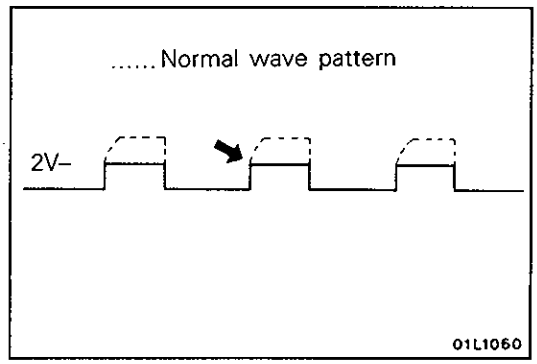
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Approx. 1,200 r/min.



Wave pattern observation points

Point : Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction



Examples of abnormal wave patterns

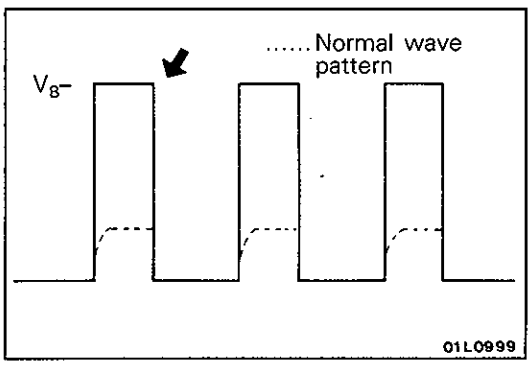
- Example 1
  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

  Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.



- Example 2
  Wave pattern during engine cranking

  Cause of problem

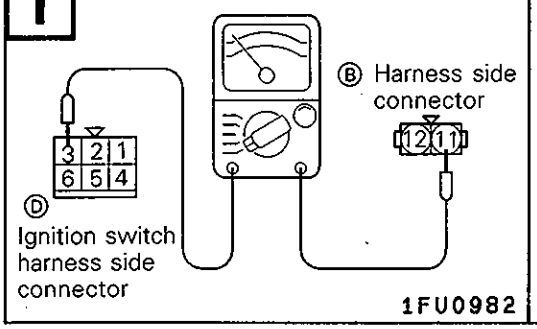
  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.

HARNESS INSPECTION

1



Check for continuity between ignition coil and ignition switch.

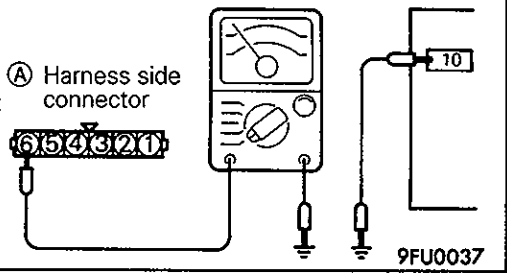
- Ignition switch connector: Disconnected
- Ignition coil connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓑ11 – Ⓓ3)

2

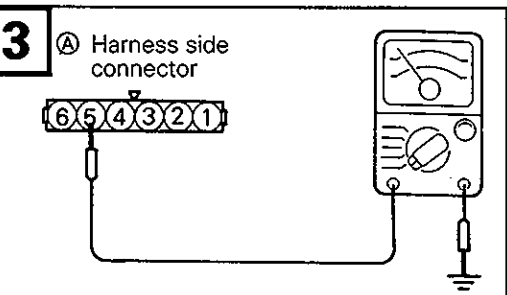


Check for open-circuit or short-circuit to earth, between power transistor and engine control unit.
- Power transistor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ6 – 10)

3

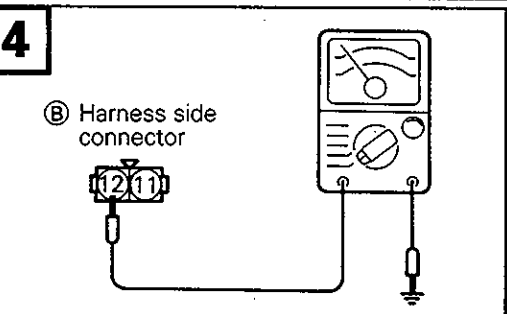


Check for continuity of the earth circuit of a power transistor.
- Power transistor connector: Disconnected

OK → 4

NO → Repair the harness. (Ⓐ5 – Earth)

4

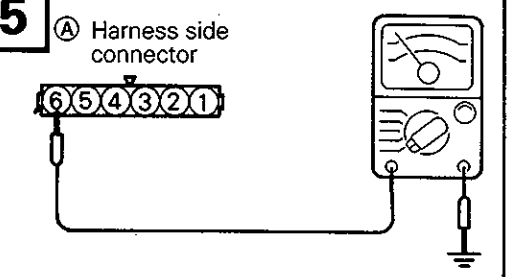


Check to be sure that there is no continuity between the ignition coil and the earth.
- Ignition coil connector: Disconnected

OK → 5

NO → Check for short in the ignition coil primary circuit.

5



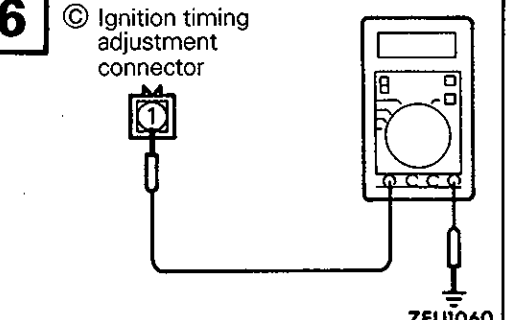
Measure the voltage of the control signal circuit of the power transistor.
- Power transistor connector: Disconnected
- Ignition switch: START

Voltage (V)
2–6

OK → 6

NO → Repair the harness. (Ⓐ6 – 10)

6



Measure the voltage of the ignition timing adjustment terminal.
- Ignition switch: ON

Voltage (V)
4.0–5.2

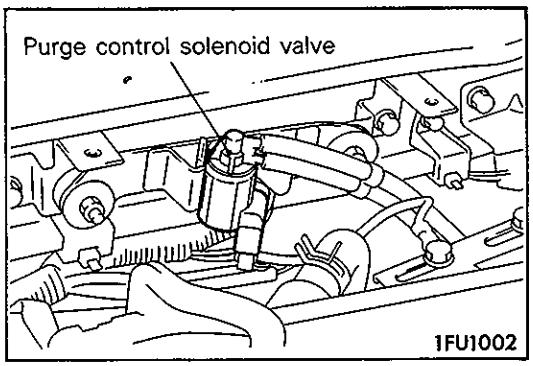
OK → STOP

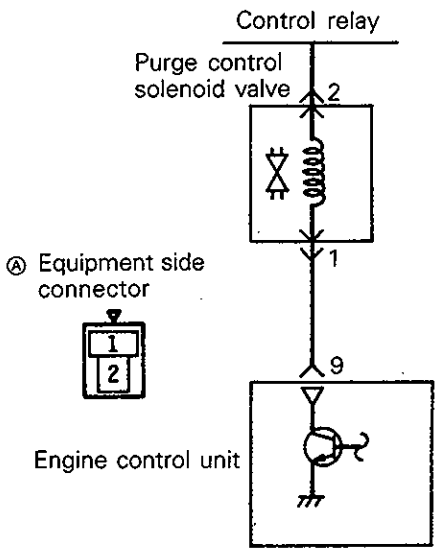
NO → Repair the harness. (Ⓒ1 – 34)

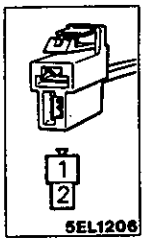
ACTUATOR INSPECTION

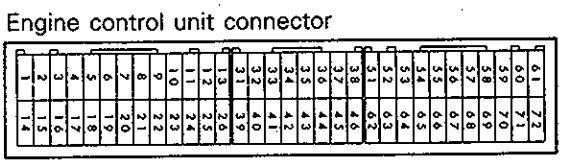
Refer to GROUP 16 – Ignition System.

PURGE CONTROL SOLENOID VALVE









9FU0101

OPERATION

- The purge control solenoid valve is an ON-OFF type of one which controls introduction of purge air from the canister into the intake air plenum.
- The battery power is supplied to the purge control valve through the control relay. When the engine control unit turns ON the power transistor in the unit, current flows to the coil, introducing purge air.

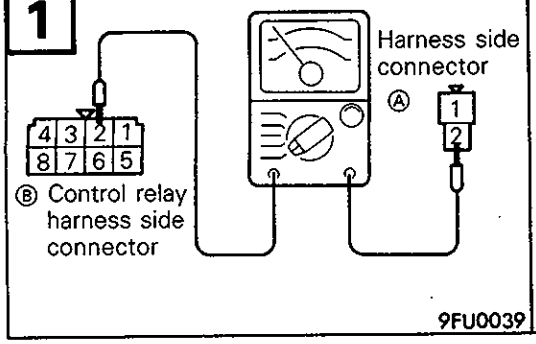
INSPECTION

Using MUT or MUT-II

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	08	Solenoid valve from OFF to ON	Ignition switch: ON	Operating sound is heard when driven

HARNESS INSPECTION

1



Check for continuity between purge control solenoid valve and control relay.

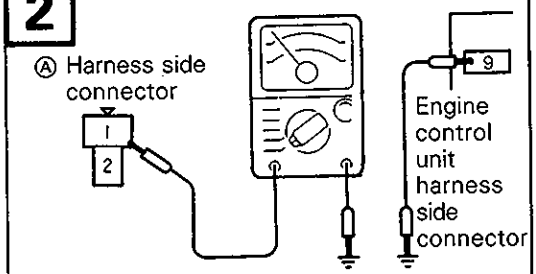
- Purge control solenoid valve connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ 2 – Ⓑ 2)

2



Check for an open-circuit, or a short-circuit to earth, between the purge control solenoid valve and the engine control unit.

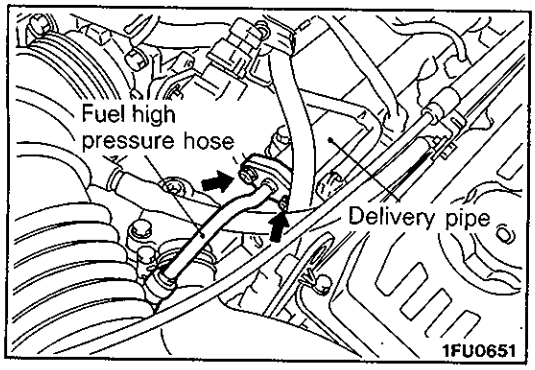
- Purge control solenoid valve connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 1 – 9)

ACTUATOR INSPECTION

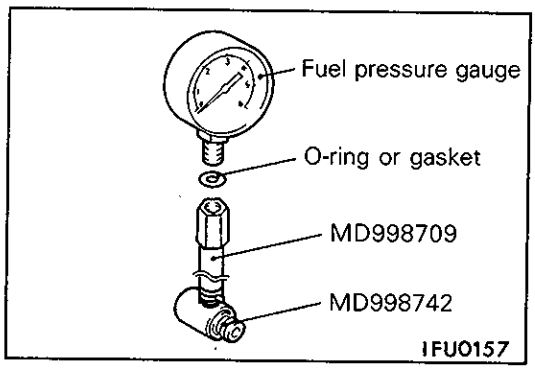
Refer to GROUP 17 – Evaporative Emission Control System.



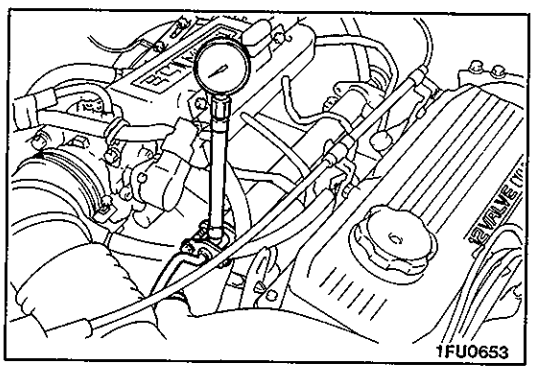
FUEL PRESSURE TEST

(1) Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P. 13-24.)
(2) Disconnect the fuel high pressure hose at the delivery pipe side.

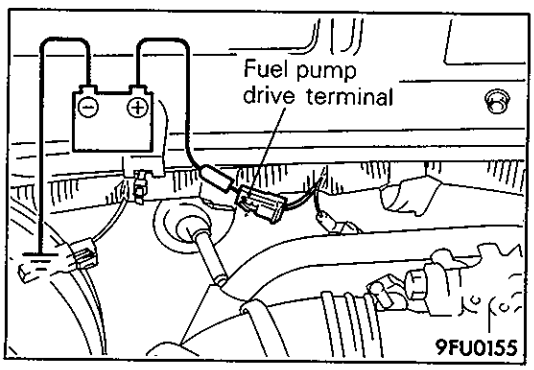
Caution
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



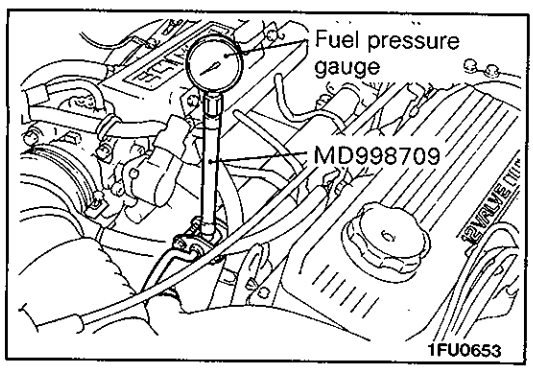
(3) Remove the union joint and bolt from the special tool (adapter hose MD998709) and instead attach the special tool (hose adapter MD998742) to the adapter hose.
(4) Install a fuel pressure gauge on the adapter hose that was set up in step (3).
Use a suitable O-ring or gasket between the fuel pressure 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) Connect the (–) battery terminal.

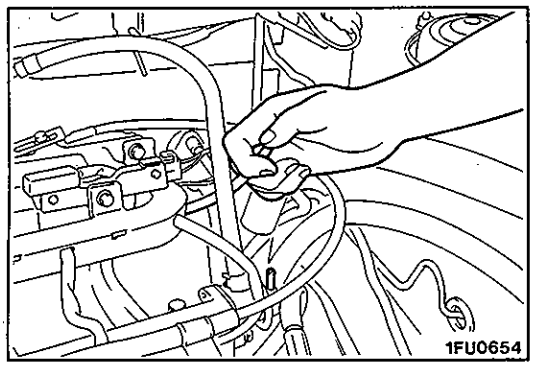


(7) Connect the fuel pump drive terminal with the battery (+) terminal using a jumper wire and drive the fuel pump. Under fuel pressure, check the fuel pressure gauge and special tool connections for leaks.
(8) Disconnect the jumper wire from the fuel pump drive terminal to stop the fuel pump.
(9) Start the engine and run at idle.



(10) Measure fuel pressure while the engine is running at idle.

Standard value:
Approx. 270 kPa (2.7 kg/cm², 38 psi) at curb idle



(11)Disconnect the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

Standard value:
330–350 kPa (3.3–3.5 kg/cm², 47–50 psi) at curb idle

(12)Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.

(13)Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

NOTE
If the fuel flowrate is low, there will be no fuel pressure in the return hose.

(14)If any of fuel pressure measured in steps (9) to (12) is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing • No fuel pressure in fuel return hose	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

(15)Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky injector	Replace injector
	Leaky fuel regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump

(16)Release residual pressure from the fuel pipe line. (Refer to P. 13-24.)

(17)Remove the fuel pressure gauge and special tool from the delivery pipe.

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

(18)Replace the O-ring at the end of the fuel high pressure hose with a new one.

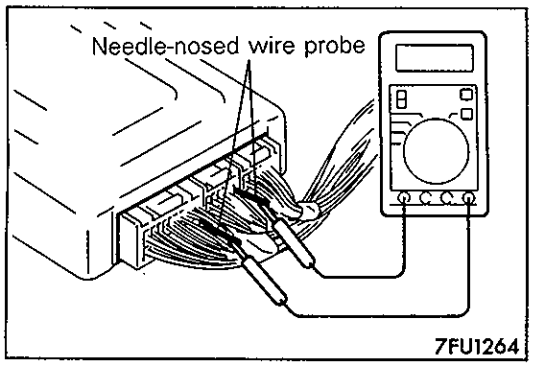
(19)Fit the fuel high pressure hose over the delivery pipe and tighten the bolt to specified torque.

Tightening torque: 5 Nm (0.56 kgm, 3.6 ft.lbs.)

(20)Check for fuel leaks.

① Apply the battery voltage to the fuel pump drive terminal to drive the fuel pump.

② Under fuel pressure, check the fuel line for leaks.



ENGINE CONTROL UNIT TERMINAL VOLTAGE CHECK

(1) Connect a needle-nosed wire probe (test harness: MB991223 or paper clip) to a voltmeter probe.
(2) Insert the needle-nosed wire probe into each of the engine control unit connector terminals from the wire side, and measure the voltage while referring to the check chart.

NOTE
1. Make the voltage measurement with the engine control unit connectors connected.
2. Make the voltage measurement between terminal No. 26 (earth terminal) and each terminal.
3. You may find it convenient to pull out the engine control unit to make it easier to reach the connector terminals.
4. The checks can be carried out off the order given in the chart.

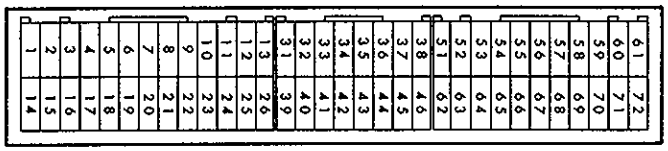
Caution
Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine control unit, or all there. Use care to prevent this!

(3) If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
(4) After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

TERMINAL VOLTAGE CHECK CHART

Engine Control Unit Terminal Arrangement

Engine control unit connector



9FU0101

Terminal No.	Check item	Check condition (Engine condition)		Standard value
60	Backup power supply	Ignition switch: OFF		SV
12	Power supply	Ignition switch: ON		SV
25				
8	Control relay (Fuel pump)	Ignition switch: ON		SV
		Engine: Idle speed		0–3V
61	Sensor impressed voltage	Ignition switch: ON		4.5–5.5V
52	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0 °C (32 °F)	3.2–3.8V
			When intake air temperature is 20 °C (68 °F)	2.3–2.9V
			When intake air temperature is 40 °C (104 °F)	1.5–2.1V
			When intake air temperature is 80 °C (176 °F)	0.4–1.0V
70	Vacuum sensor (Manifold absolute pressure sensor)	Ignition switch: ON	When altitude is 0m	3.7–4.3V
			When altitude is 1,200m (3,937 ft.)	3.2–3.8V
		Engine: Idle speed		0.9–1.5V
		While engine is idling after having warmed up, suddenly depress the accelerator pedal		From 0.9 – 1.5V, momentarily increases
63	Coolant temperature sensor	Ignition switch: ON	When coolant temperature is 0 °C (32 °F)	3.2–3.8V
			When coolant temperature is 20 °C (68 °F)	2.3–2.9V
			When coolant temperature is 40 °C (104 °F)	1.3–1.9V
			When coolant temperature is 80 °C (176 °F)	0.3–0.9V

Terminal No.	Check item	Check condition (Engine condition)		Standard value
64	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3–1.0V
			Fully open throttle vavle	4.5–5.5V
67	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0–1V
			Slightly open throttle valve	4V or more
68	Top dead centre sensor	Engine: Cranking		0.2–3.0V
		Engine: Idle speed		
69	Crank angle sensor	Engine: Cranking		0.2–3.0V
		Engine: Idle speed		
51	Ignition switch-ST	Engine: Cranking		8V or more
66	Vehicle speed sensor	Ignition switch: ON Move the vehicle slowly forward.		0↔5V (Changes repeatedly)
37	Power steering fluid pressure switch	Engine: Idling after warming up	When stationary	SV
			When being turned	0–3V
45	Air conditioner switch	Engine: Idle speed	Turn the air conditioner switch OFF	0–3V
			Turn the air conditioner switch ON. (Air conditioner compressor is operating)	SV
22	Air conditioner relay	Engine: Idle speed Air conditioner switch: OFF → ON Turn the air conditioner switch ON. (Air conditioner compressor is operating)		SV or temporarily 6V or more ↓ 0–3V
56	Oxygen sensor	Engine: Running at 2,000 r/min. after having warmed up. (Check using a digital type voltmeter.)		0↔0.8V (Changes repeatedly)
1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal		From 11–14V, momentarily drops slightly
14	No. 2 injector			
2	No. 3 injector			
15	No. 4 injector			

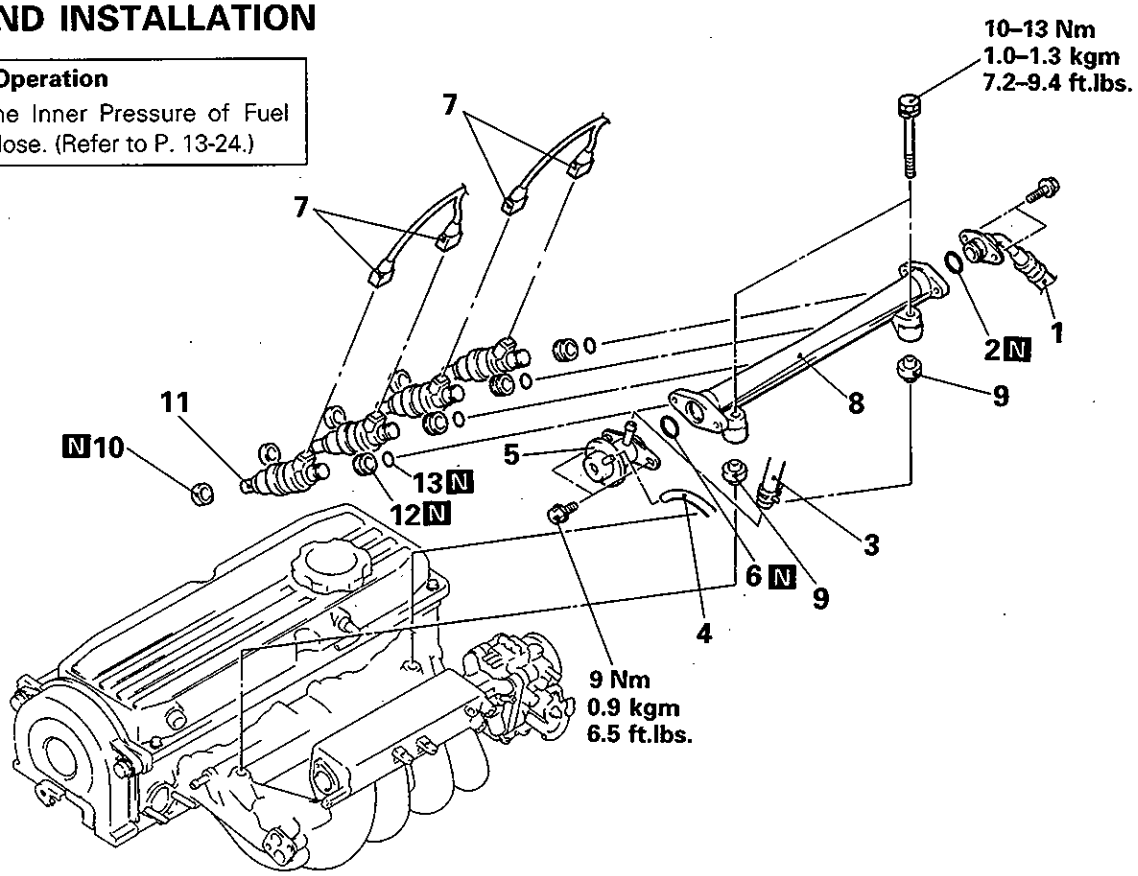
Terminal No.	Check item	Check condition (Engine condition)		Standard value
10	Power transistor unit	Engine r/min.: 3,000 r/min		0.3–3.0V
9	Purge control solenoid valve	Ignition switch: ON		SV
		Running at 3,000 r/min. after having warmed up		0–3V
34	Ignition timing adjustment terminal	Ignition switch: ON	Earth the ignition timing adjustment terminal	0–1V
			Remove the earth connection from the ignition timing adjustment terminal.	4.0–5.5V
36	Engine warning lamp	Ignition switch: OFF → ON		0–3V ↓ 9–13V (After several seconds have elapsed)
5	Idle speed control servo valve position sensor No. 1	Ignition switch: Immediately after turning ON		1.5–4V (Momentarily) ↓ 0.1V or 4.5–5.5V
18	Idle speed control servo valve position sensor No. 2	Ignition switch: Immediately after turning ON		1.5–4V (Momentarily) ↓ 0.1V or 4.5–5.5V
4	Idle speed control motor (Closed)	Ignition switch: Immediately after turning ON		2V or more (Momentarily) ↓ 0.1V
17	Idle speed control motor (Open)	Ignition switch: Immediately after turning ON		4V or more (Momentarily) ↓ 0.1V

INJECTOR

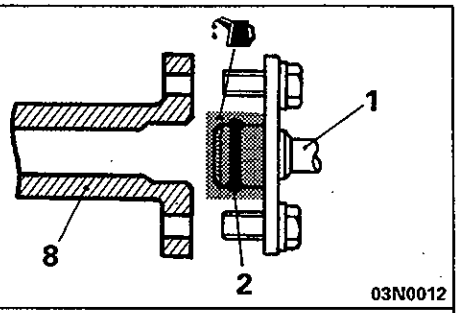
E13JA--

REMOVAL AND INSTALLATION

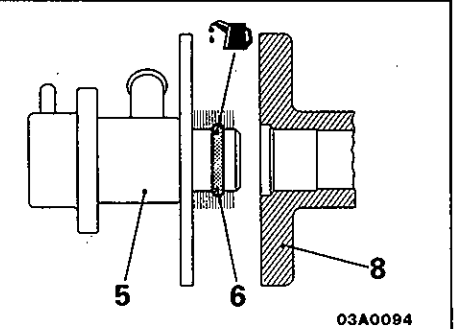
Pre-removal Operation
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)



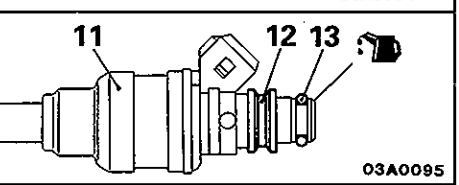
03S0077



03N0012



03A0094



03A0095

Engine oil

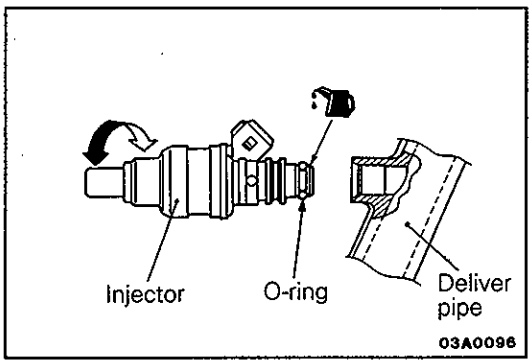
Removal steps
1. Fuel high-pressure hose connection
2. O-ring
3. Return hose connection
4. Vacuum hose connection
5. Fuel pressure regulator
6. O-ring
7. Injector connector
8. Delivery pipe
9. Insulator
10. Insulator
11. Injector
12. Grommet
13. O-ring

SERVICE POINTS OF REMOVAL E13JBAF

8. REMOVAL OF DELIVERY PIPE/11. INJECTOR

Remove the delivery pipe (with the injectors attached to it).

Caution
Care must be taken, when removing the delivery pipe, not drop the injector.



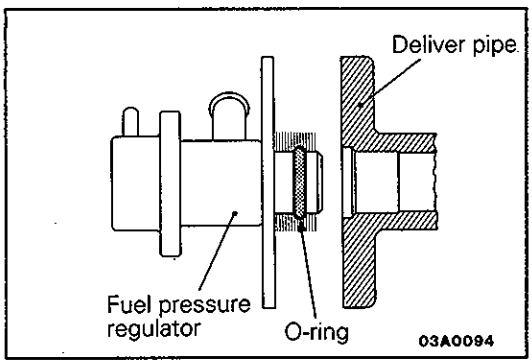
SERVICE POINTS OF INSTALLATION E13JDAD

11. INSTALLATION OF INJECTOR

(1) Apply a drop of new engine oil to the O-ring.

Caution
Be sure not to let engine oil in the delivery pipe.

(2) While turning the injector to the left and right, install it to the delivery pipe.
(3) Check to be sure that the injector turns smoothly.
If it does not turn smoothly, the O-ring may be trapped, remove the injector and then re-insert it into the delivery pipe and check once again.



5. INSTALLATION OF FUEL PRESSURE REGULATOR

(1) When connecting the fuel pressure regulator to the delivery pipe, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

Caution
Be sure not to let engine oil in the delivery pipe.

(2) Check to be sure that the fuel pressure regulator turns smoothly.
If it does not turn smoothly, the O-ring may be trapped, remove the fuel pressure regulator and then re-insert it into the delivery pipe and check once again.
(3) Tighten the bolts to the specified torque.

Specified tightening torque:
9 Nm (0.9 kgm, 6.5 ft. lbs.)

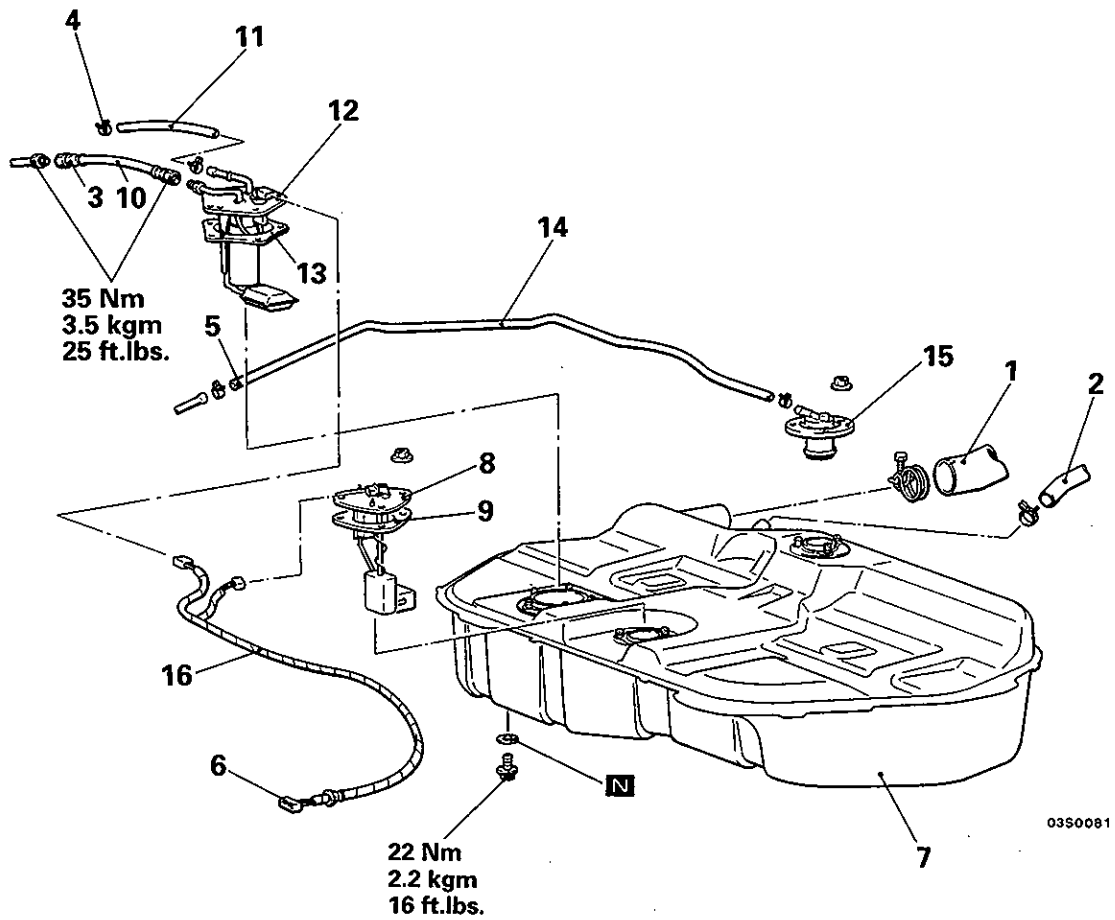
FUEL TANK

E13GA--

REMOVAL AND INSTALLATION

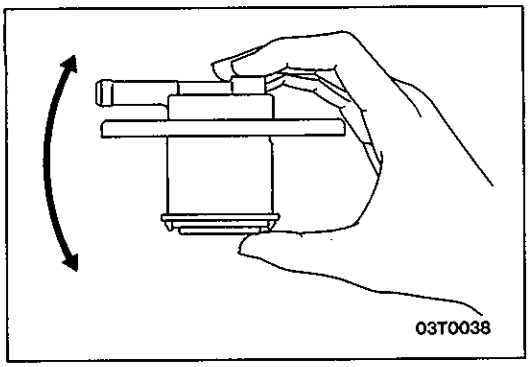
Pre-removal Operation
- Draining the Fuel.
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)

Post-installation Operation
- Refilling the Fuel.
- Checking for Fuel Leaks.



Removal steps

1. Filler hose
2. Vapor hose
3. High-presssure fuel hose connection
4. Return hose connection
5. Vapor hose connection
6. Fuel gauge and pump connector
7. Fuel tank assembly
8. Fuel gauge unit
9. Packing
10. High-pressure fuel hose
11. Return hose
12. Fuel pump
13. Packing
14. Vapor hose
15. Fuel cut off valve
16. Fuel gauge and pump wiring harness



INSPECTION

E13GCAP

FUEL CUT OFF VALVE

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

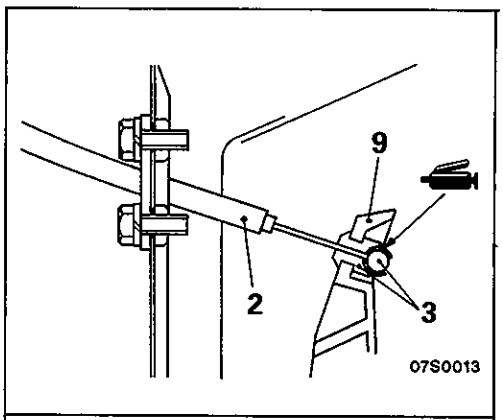
ACCELERATOR CABLE AND PEDAL

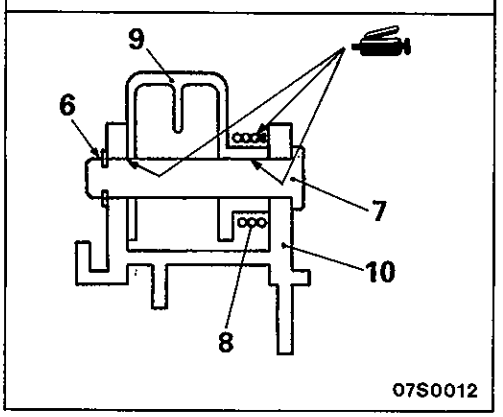
E13OA-1

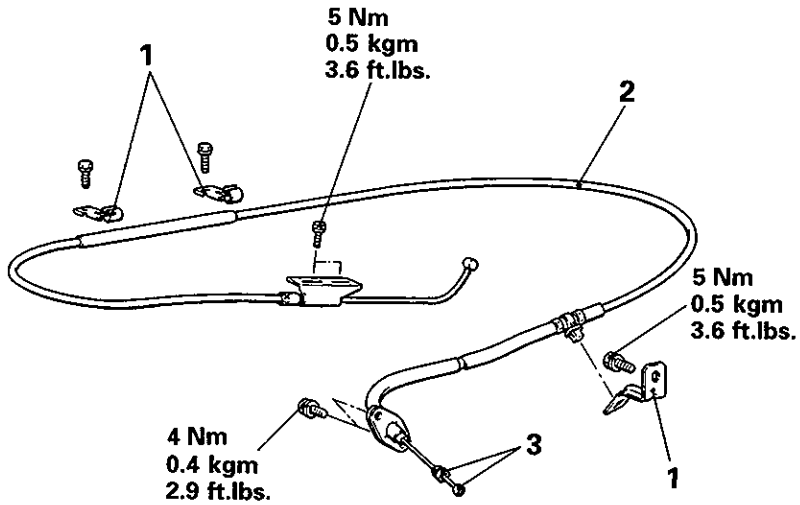
REMOVAL AND INSTALLATION <L.H. DRIVE VEHICLES>

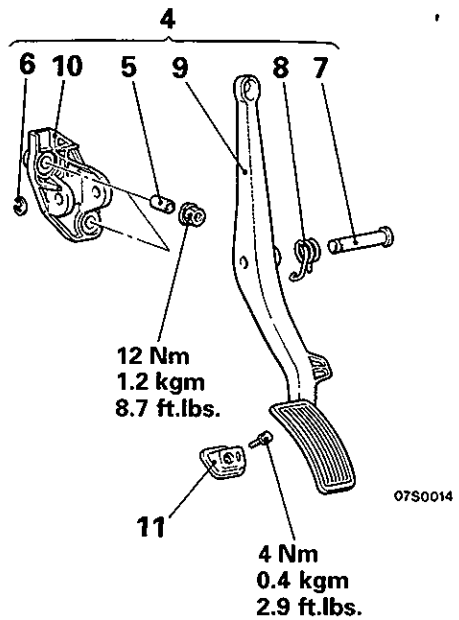
Post-installation Operation

- Adjusting the Accelerator Cable (Refer to P. 13-23.)









Removal steps of accelerator cable

1. Accelerator cable bracket and clamp
2. Accelerator cable

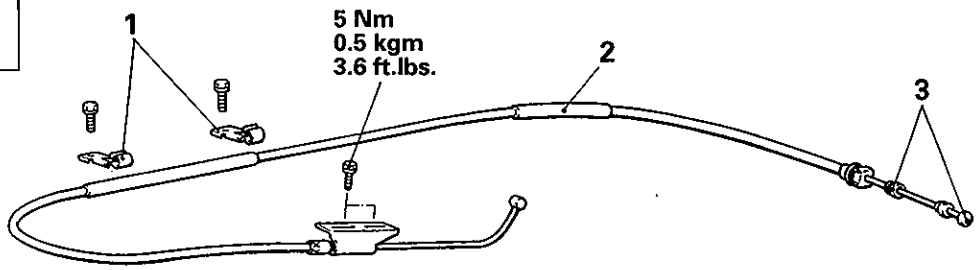
Removal steps of accelerator pedal

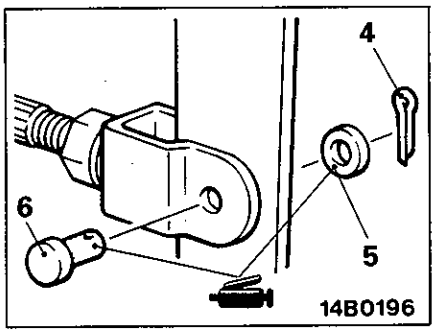
3. Bushing and accelerator cable connection
4. Accelerator pedal assembly
5. Spacer
6. Snap ring
7. Pin
8. Return spring
9. Accelerator pedal arm
10. Accelerator pedal support
11. Accelerator pedal stopper

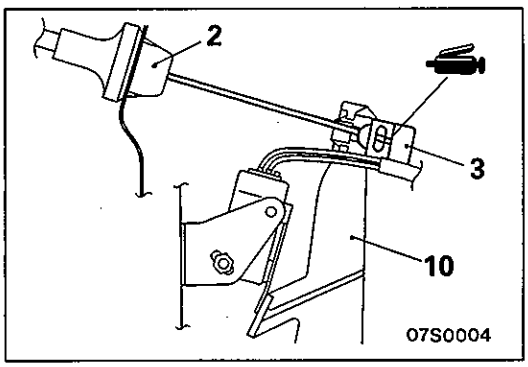
REMOVAL AND INSTALLATION <R.H. drive vehicles)

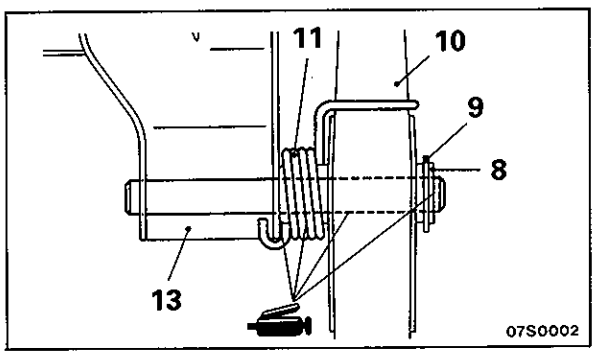
E13OA-2

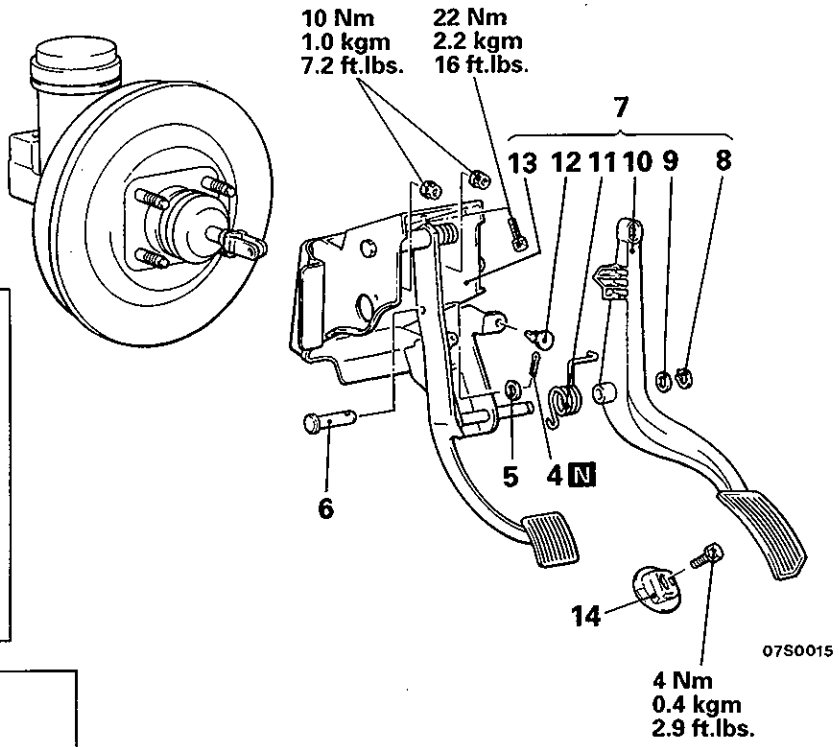
Post-installation Operation
- Adjusting the accelerator cable (Refer to P. 13-23.)





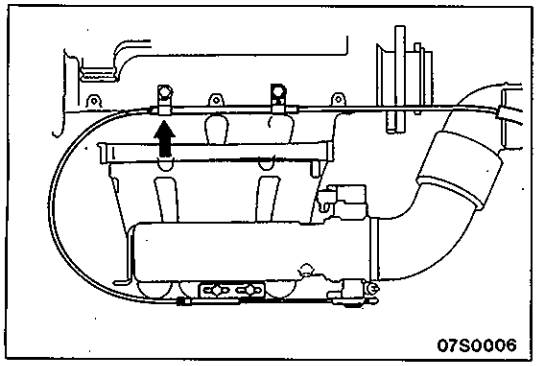


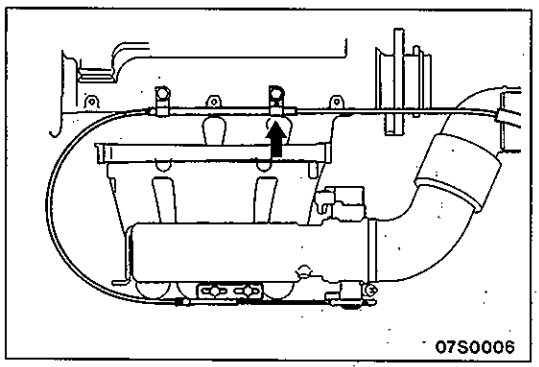




Removal steps of accelerator cable
1. Clamp
2. Accelerator cable

Removal steps of accelerator pedal
3. Bushing and accelerator cable connection
4. Split pin
5. Washer
6. Clevis pin
7. Brake and accelerator pedal assembly
8. Snap ring
9. Washer
10. Accelerator pedal
11. Return spring
12. Stopper
13. Brake pedal assembly
14. Accelerator pedal stopper





SERVICE POINTS OF INSTALLATION E13ODAS

2. INSTALLATION OF ACCELERATOR CABLE

<L.H. drive vehicles>

Install the accelerator cable so that the marking section is aligned with the clamp shown by the arrow.

<R.H. drive vehicles>

Install the accelerator cable so that the crimped section is aligned with the clamp shown by the arrow.

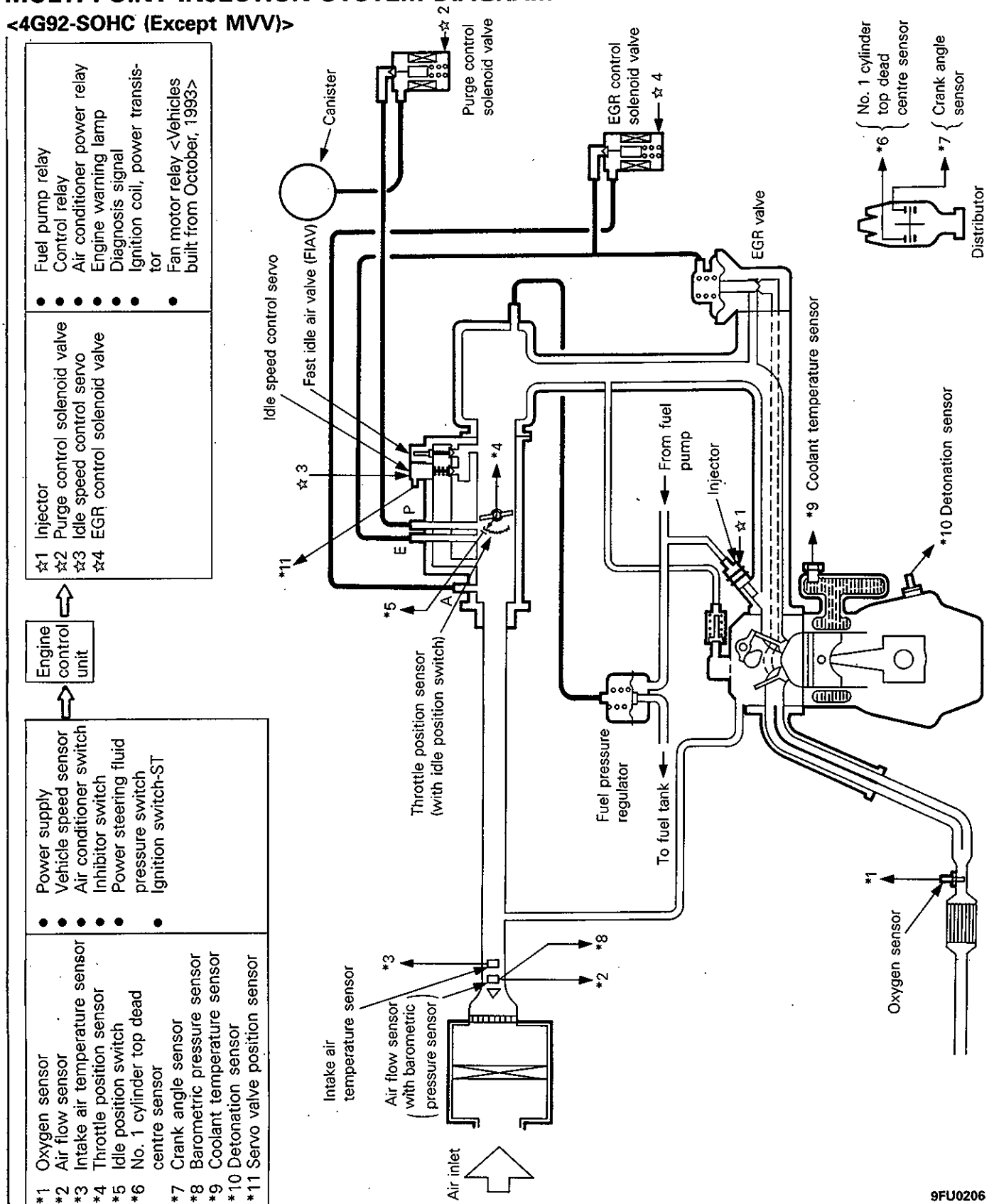
FUEL SYSTEM <4G92, 4G93>

E13BBAN

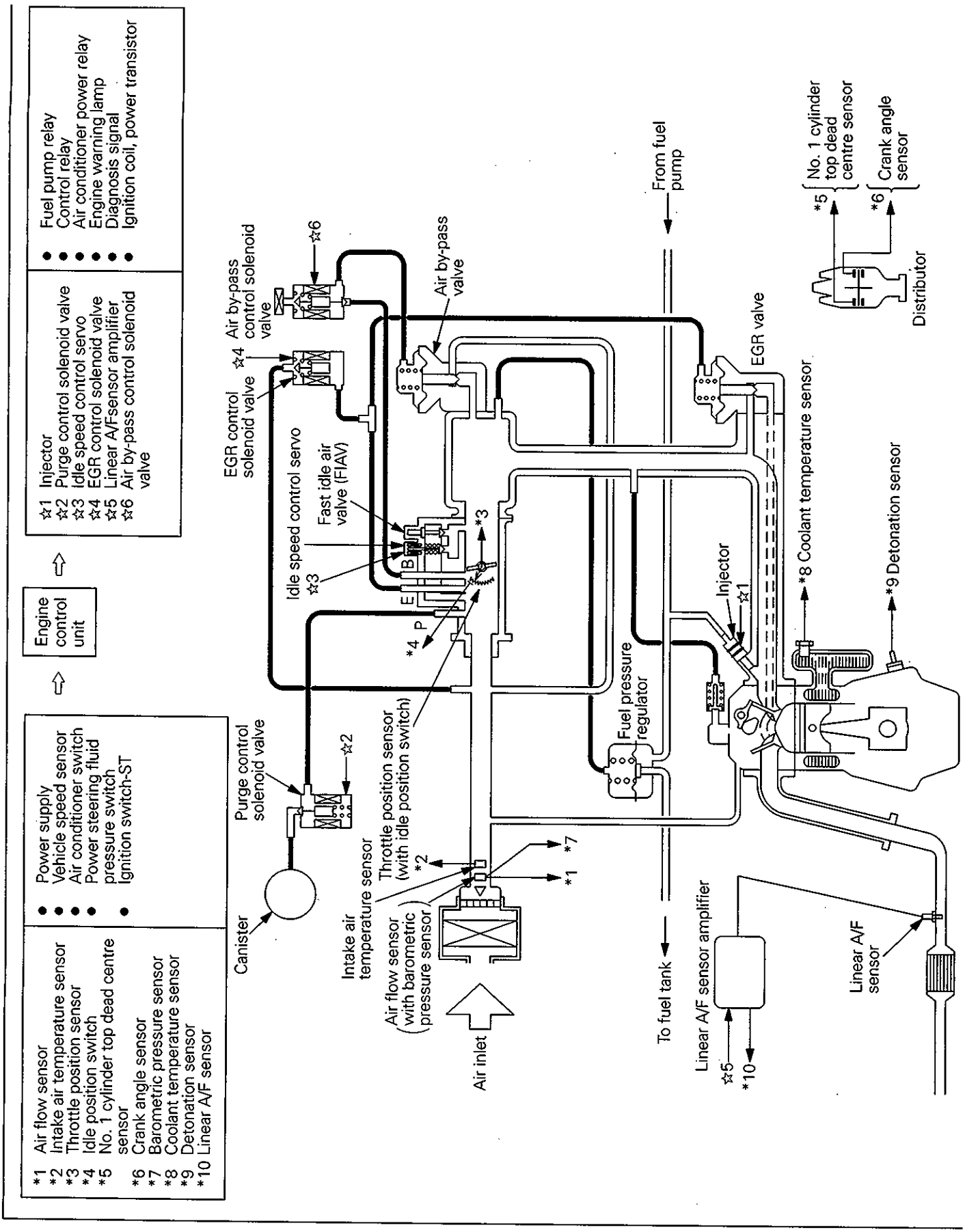
GENERAL INFORMATION

MULTI POINT INJECTION SYSTEM DIAGRAM

<4G92-SOHC (Except MVV)>

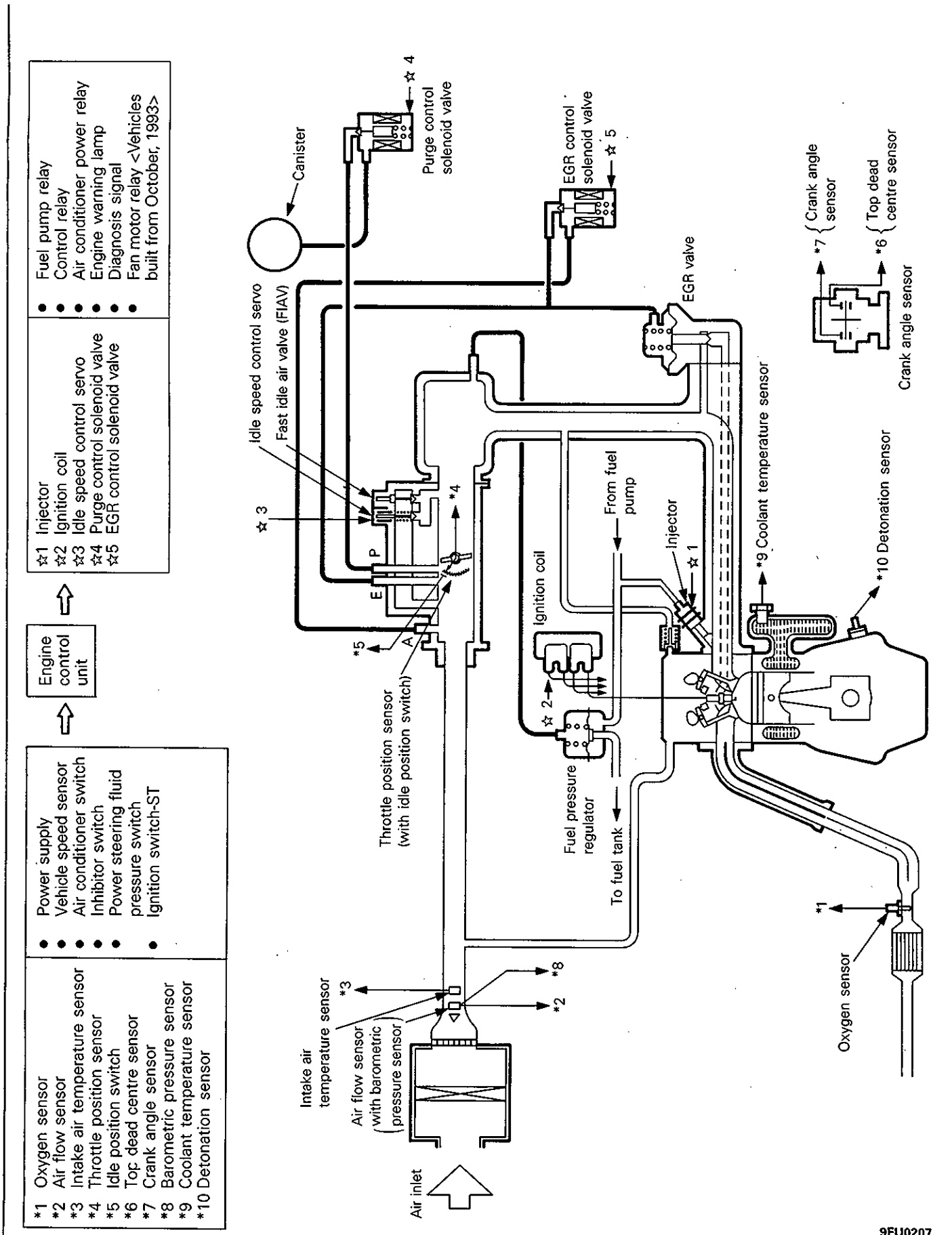


<4G92-SOHC-MVV>



NOTE

<4G93-DOHC>


*1 Oxygen sensor
*2 Air flow sensor
*3 Intake air temperature sensor
*4 Throttle position sensor
*5 Idle position switch
*6 Top dead centre sensor
*7 Crank angle sensor
*8 Barometric pressure sensor
*9 Coolant temperature sensor
*10 Detonation sensor
• Power supply
• Vehicle speed sensor
• Air conditioner switch
• Inhibitor switch
• Power steering fluid pressure switch
• Ignition switch-ST
Engine control unit
☆1 Injector
☆2 Ignition coil
☆3 Idle speed control servo
☆4 Purge control solenoid valve
☆5 EGR control solenoid valve
• Fuel pump relay
• Control relay
• Air conditioner power relay
• Engine warning lamp
• Diagnosis signal
• Fan motor relay <Vehicles built from October, 1993>
Canister
Purge control solenoid valve
EGR control solenoid valve
EGR valve
Idle speed control servo
Fast idle air valve (FIAV)
Throttle position sensor (with idle position switch)
Ignition coil
From fuel pump
Injector
Fuel pressure regulator
To fuel tank
Crank angle sensor
Top dead centre sensor
Coolant temperature sensor
Detonation sensor
Oxygen sensor
Intake air temperature sensor
Air flow sensor (with barometric pressure sensor)
Air inlet
9FU0207

SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA--

<4G92-SOHC (Except MVV)>

Items	Specifications
Fuel	
Tank capacity ℓ (U.S. qts., Imp. qts.)	50 (53, 44)
Return system	Fuel pressure regulator
Fuel pump	
Type	Electrical (Roller vane)
Location	In fuel tank
Throttle body	
Throttle bore mm (in.)	50 (1.97)
Throttle position sensor	Variable resistor type
Idle speed control servo	DC motor type DC motor type by-pass air control system with the Fast Idle Air Valve (FIAV)
Idle position switch	Rotary contact type, within throttle position sensor
Servo valve position sensor	Hall element type
Engine control unit	
Identification model No.	
2WD	E2T38974 <Vehicles built up to September, 1993> E2T38986 <Vehicles built from October, 1993>
4WD	E2T38977 <Vehicles built up to September, 1993> E2T38987 <Vehicles built from October, 1993>
Sensors	
Air flow sensor	Karman vortex type
Barometric pressure sensor	Semiconductor type
Intake air temperature sensor	Thermistor type
Coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle speed sensor	Reed switch type
Inhibitor switch	Contact switch type
No.1 cylinder top dead centre sensor	Hall element type
Crank angle sensor	Hall element type
Detonation sensor	Piezoelectric type
Power steering fluid pressure switch	Contact switch type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic type, 4
Injector identification mark	MDH182
EGR control solenoid valve	ON/OFF type solenoid valve
Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	
Regulator pressure kPa (kg/cm^2, psi)	335 (3.35, 47.6)

<4G92-SOHC-MVV>

Items	Specifications
Fuel	
Tank capacity ℓ (U.S. qts., Imp. qts.)	50 (54, 44)
Return system	Fuel pressure regulator
Fuel pump	
Type	Electrical (Roller vane)
Location	In fuel tank
Throttle body	
Throttle bore mm (in.)	46 (1.81)
Throttle position sensor	Variable resistor type
Idle speed control servo	Stepper motor type Stepper motor type by-pass air control system with the Fast Idle Air Valve (FIAV)
Idle position switch	Rotary contact type, within throttle position sensor
Engine control unit	
Identification model No.	E2T39074
Sensors	
Air flow sensor	Karman vortex type
Barometric pressure sensor	Semiconductor type
Intake air temperature sensor	Thermistor type
Coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle speed sensor	Reed switch type
Top dead centre sensor	Hall element type
Crank angle sensor	Hall element type
Detonation sensor	Piezoelectric type
Power steering fluid pressure switch	Contact switch type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic type, 4
Injector identification mark	LDH182
EGR control solenoid valve	Duty cycle type solenoid valve
Purge control solenoid valve	ON/OFF type solenoid valve
Air by-pass control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	
Regulator pressure kPa (kg/cm^2, psi)	335 (3.35, 47.6)

NOTE

<4G93-DOHC>

Items	Specifications
Fuel	
Tank capacity ℓ (U.S. qts., Imp. qts.)	50 (54, 44)
Return system	Fuel pressure regulator
Fuel pump	
Type	Electrical (Roller vane)
Location	In fuel tank
Throttle body	
Throttle bore mm (in.)	54 (2.13)
Throttle position sensor	Variable resistor type
Idle speed control servo	Stepper motor type Stepper motor type by-pass air control system with the Fast Idle Air Valve (FIAV)
Idle position switch	Rotary contact type, within throttle position sensor
Engine control unit	
Identification model No.	E2T38376 <Vehicles built up to September, 1993> E2T38383 <Vehicles built from October, 1993>
Sensors	
Air flow sensor	Karman vortex type
Barometric pressure sensor	Semiconductor type
Intake air temperature sensor	Thermistor type
Coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle speed sensor	Reed switch type
Inhibitor switch	Contact switch type
Top dead centre sensor	Hall element type
Crank angle sensor	Hall element type
Detonation sensor	Piezoelectric type
Power steering fluid pressure switch	Contact switch type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic type, 4
Injector identification mark	MDH240
EGR control solenoid valve	ON/OFF type solenoid valve
Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	
Regulator pressure kPa (kg/cm^2, psi)	335 (3.35, 47.6)

SERVICE SPECIFICATIONS

E13CB--

Items		Specifications
Basic ignition timing		5°±2° BTDC at curb idle
Curb idle speed	r/min.	800±100 <4G92 (Except MVV), 4G93> 700±100 <4G92-MVV>
Idle speed when air conditioner is ON	r/min.	850 at neutral position
Basic idle speed	r/min.	800±50 <4G92 (Except MVV), 4G93> 700±50 <4G92-MVV>
Throttle position sensor adjusting voltage	mV	400–1000
Throttle position sensor resistance	kΩ	3.5–6.5
Idle speed control servo coil resistance*1	Ω	5–35 [at 20°C (68°F)]
Intake air temperature sensor resistance	kΩ	2.7 [at 20°C (68°F)]
Coolant temperature sensor resistance	kΩ	
20° (68°F)		2.5
80° (176°F)		0.3
Oxygen sensor output voltage	V	0.6–1.0
Fuel pressure	kPa (kg/cm^2, psi)	
Vacuum hose disconnected		330–350 (3.3–3.5; 47–50) at curb idle
Vacuum hose connected		Approx. 270 (2.7, 38) at curb idle
Injector coil resistance	Ω	13–16 [at 20°C (68°F)]
EGR control solenoid valve coil resistance	Ω	36–44 [at 20°C (68°F)]
Purge control solenoid valve coil resistance	Ω	36–44 [at 20°C (68°F)]
Air by-pass control solenoid valve coil resistance*2	Ω	36–44 [at 20°C (68°F)]

NOTE
*1: <4G92-MVV, 4G93>
*2: <4G92-MVV>

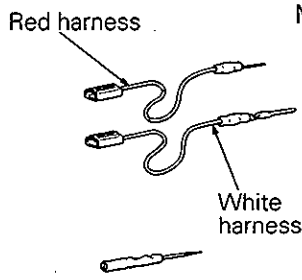
SEALANTS

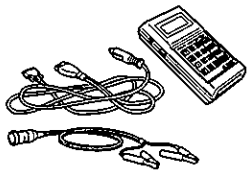
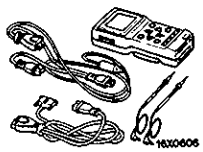
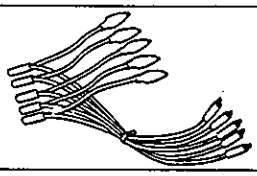
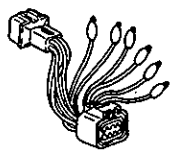
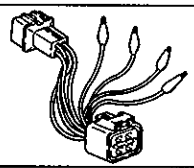
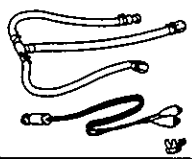
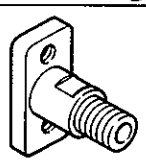
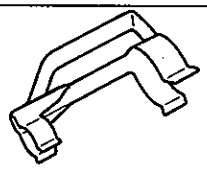
E13CE--

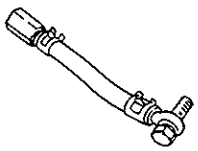
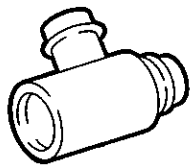
Items	Specified sealant	Remark
Coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Plug and floor pan <2WD>	3M 8513 Grommeted Windshield Sealer (Black)	—
Inspection lid <4WD>	3M 8635 Windo-Weld Ribbon Sealer (Black)	—

SPECIAL TOOLS

E13DA--

Tool	Number	Name	Use
	MB991223	Inspection test harness set • Pin contact pressure inspection harness • Market tester contact probe (for general connectors)	Measurement of terminal voltage

Tool	Number	Name	Use
	MB991341	Multi-use tester sub assembly	<Up to 1993 models> • Reading diagnosis code • MPI system inspection
	For the number, refer to GROUP 00 – Precautions before service.	ROM pack (for multi-use tester)	
	MB991502	MUT-II sub assembly	<All models> • Reading diagnosis code • MPI system inspection
 16X0607		ROM pack	
	MB991348	Test harness set	• Adjustment of idle position switch and throttle position sensor • Inspection using an analyzer
	MD998463	Test harness (6 pin, square)	• Inspection of idle speed control servo • Inspection using an analyzer
	MD998464	Test harness (4 pin, square)	• Inspection of oxygen sensor
	MD998706	Injector test set	Checking the spray condition of injectors
	MD998741	Injector test adaptor	
	MD998746	Clip	

Tool	Number	Name	Use
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	

TROUBLESHOOTING

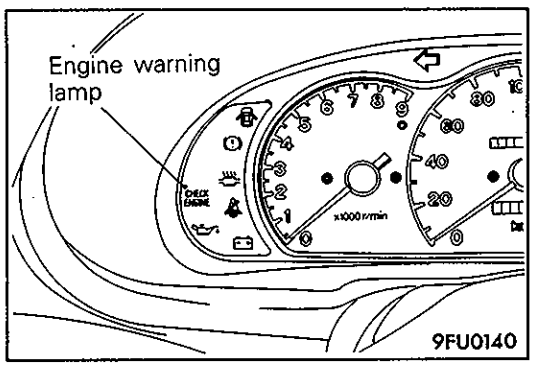
E13EFAQ

EXPLANATION OF TROUBLESHOOTING PROCEDURES

Refer to P. 13-7.

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Refer to P. 13-10.



ITEMS INDICATED BY THE ENGINE WARNING LAMP

Engine control unit
Oxygen sensor <Except SOHC-MVV>
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Coolant temperature sensor
Crank angle sensor
Top dead centre sensor
Barometric pressure sensor
Detonation sensor
Ignition timing adjustment signal
Injector
Ignition coil, power transistor unit <DOHC>

Caution
Engine warning lamp will come on even when terminal for ignition timing adjustment is short-circuited. Therefore, it is not abnormal that the lamp comes on even when terminal for ignition timing adjustment is short-circuited at the time of ignition timing adjustment.

ENGINE WARNING 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 occured, memorizes the malfunction code, and outputs the signal to the self-diagnosis output terminal.
There are 15 diagnosis items, including the normal state, and the diagnosis results can be read out with a multi-use tester (MUT) or MUT-II.
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.

In addition, the malfunction code can also be erased by turning the ignition switch to ON and sending the malfunction code erase signal from the MUT or MUT-II 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 MUT or MUT-II to the engine control unit and the diagnosis memory will be erased.

The 15 diagnosis items are provided as follows, and if plural items are activated, they are all indicated sequentially from the smallest code number.

Caution
The malfunction code of ignition timing adjustment signal is outputted when terminal for ignition timing adjustment is short-circuited. Therefore, it is not abnormal that the code is outputted even when terminal for ignition timing adjustment is short-circuited at the time of ignition timing adjustment.

Diagnosis Chart

Output preference order	Diagnosis item	Malfunction code		Check item (Remedy)
		No.	Memory	
1	Engine control unit	–	–	(Replace engine control unit)
2 <Except SOHC-MVV>	Oxygen sensor	11	Retained	• Harness and connector • Fuel pressure • Injectors (Replace if defective.) • Intake air leaks • Oxygen sensor
3	Air flow sensor	12	Retained	• Harness and connector (If harness and connector are normal, replace air flow sensor assembly.)
4	Intake air temperature sensor	13	Retained	• Harness and connector • Intake air temperature sensor
5	Throttle position sensor	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch

Output preference order	Diagnosis item	Malfunction code		Check item (Remedy)
		No.	Memory	
6	Coolant temperature sensor	21	Retained	• Harness and connector • Coolant temperature sensor
7	Crank angle sensor	22	Retained	• Harness and connector (If harness and connector are normal, replace distributor <SOHC> or crank angle sensor <DOHC> assembly.)
8	Top dead centre sensor	23	Retained	• Harness and connector (If harness and connector are normal, replace distributor <SOHC> or crank angle sensor <DOHC> assembly.)
9	Vehicle speed sensor (reed switch)	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
10	Barometric pressure sensor	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly)
11	Detonation sensor	31	Retained	• Harness and connector (If harness and connector are normal, replace detonation sensor)
12	Ignition timing adjustment signal	36	—	• Harness and connector
13	Injector	41	Retained	• Harness and connector • Injector coil resistance
14 <DOHC>	Ignition coil, power transistor unit	44	Retained	• Harness and connector • Ignition coil • Power transistor unit
14 <SOHC (Except MVV)>	Servo valve position sensor	55	Retained	• Harness and connector • Servo valve position sensor • Idle speed control servo (DC motor)
14 <SOHC-MVV>	Linear A/F sensor and amplifier	63	Retained	• Harness and connector (If the harness and connector are normal, replace the linear A/F sensor amplifier and then check the output voltage. If the output voltage is abnormal, replace the linear A/F sensor and then replace the original linear A/F sensor amplifier.)
15	Normal state	—	—	—

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. The code numbers will be displayed in order, starting from the lowest.

PROBLEM DIAGNOSIS CONTENT CHART

NOTE
*: Fail-Safe/backup function is operating.

Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
–	Engine control unit	Abnormality in engine control unit	–	• Engine stalls • Starting is impossible
11	Oxygen sensor <Except SOHC-MVV>	Oxygen sensor signal voltage does not change (lean/rich) even when air/fuel ratio feedback control (close loop control) operates.	(1) Oxygen sensor malfunction (2) Open circuit or short circuit in oxygen sensor, or connector contact is defective	• Reduction in exhaust gas purification efficiency*
			(3) Inappropriate fuel pressure (4) Injector malfunction (5) Air leaking in through clearance in gasket (6) Engine control unit malfunction	• Reduction in exhaust gas purification efficiency* • Poor starting • Unstable idling • Poor acceleration
12	Air flow sensor	Frequency of air flow sensor signal is 10 Hz or less, even though engine is running.	(1) Air flow sensor malfunction (2) Open circuit or short circuit in air flow sensor, or connector contact is defective. (3) Engine control unit malfunction	• Poor acceleration* • Inappropriate idle speed* • Unstable idling*
13	Intake air temperature sensor	(1) Voltage of intake air temperature sensor signal is 4.5V or more. (2) Voltage of intake air temperature sensor signal is 0.27V or less.	(1) Intake air temperature sensor malfunction (2) Open circuit or short circuit in the intake air temperature sensor, or connector contact is defective (3) Engine control unit malfunction	• Slightly poor driveability* • At high temperatures: (a) Poor starting* (b) Unstable idling*
14	Throttle position sensor	(1) Voltage of throttle position sensor signal is 0.2V or less. (2) Voltage of throttle position sensor signal is 2V or more, even though idle position switch is ON.	(1) Throttle position sensor malfunction, or adjustment is defective (2) Open circuit or short circuit in throttle position sensor, or connector contact is defective	• Slightly poor acceleration <M/T> • Poor driveability <A/T> • Engine stalls
			(3) Idle position switch ON malfunction (4) Short circuit in idle position switch signal wire (5) Engine control unit malfunction	• Engine stalls • Racing is impossible

Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
21	Coolant temperature sensor	(1) Voltage of coolant temperature sensor signal is 4.6V or more. (2) Voltage of coolant temperature sensor signal is 0.11V or less. (3) While engine is warming up, coolant temperature sensor signal shows a drop in engine coolant temperature.	(1) Coolant temperature malfunction (2) Open circuit or short circuit in coolant temperature sensor, or connector contact is defective (3) Engine control unit malfunction	When engine is cold: • Poor starting* • Unstable idling* • Poor acceleration*
22	Crank angle sensor	Voltage of crank angle sensor signal does not change (high/low), even though engine has been cranking for 4 seconds or more.	(1) Crank angle sensor malfunction (2) Open circuit or short circuit in crank angle sensor, or connector contact is defective (3) Engine control unit malfunction	• Engine stalls • Starting is impossible
23	Top dead centre sensor	Voltage of top dead centre sensor signal does not change (high/low), even though engine is running.	(1) Top dead centre sensor malfunction (2) Open circuit or short circuit in top dead centre sensor, or connector contact is defective (3) Engine control unit malfunction	• Engine stalls* <DOHC> • Unstable idling* <SOHC> • Poor acceleration* <SOHC>
24	Vehicle speed sensor (reed switch)	Voltage of vehicle speed sensor does not change (high/low) even though vehicle is accelerating at an engine speed of 3,000 r/min. or more.	(1) Vehicle speed sensor malfunction (2) Open circuit or short circuit in vehicle speed sensor, or connector contact is defective (3) Engine control unit malfunction	Engine stalls when vehicle stops after decelerating

Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
25	Barometric pressure sensor	(1) Voltage of barometric pressure sensor signal is 4.5V or more. (2) Voltage of barometric pressure sensor signal is 0.2V or less.	(1) Barometric pressure sensor malfunction (2) Open circuit or short circuit in barometric pressure sensor, or connector contact is defective (3) Engine control unit malfunction	• Reduction in exhaust gas purification efficiency* • Poor starting • Unstable idling • Poor acceleration
31	Detonation sensor	Detonation sensor signal voltage is abnormal.	(1) Detonation sensor malfunction (2) Open circuit or short circuit in detonation sensor, or connector contact is defective (3) Engine control unit malfunction	• Poor acceleration*
36	Ignition timing adjustment signal	Ignition timing adjustment signal wire is short-circuited to earth.	(1) Ignition timing adjustment signal wire is short-circuited to earth (2) Engine control unit malfunction	• Poor acceleration • Engine overheats
41	Injector	Injectors do not operate for a continuous 4 second period while engine is cranking or idling.	(1) Injector malfunction (2) Open circuit or short circuit in injector, or connector contact is defective (3) Engine control unit malfunction	• Reduction in exhaust gas purification efficiency* • Poor starting • Unstable idling • Poor acceleration
44	Ignition coil, power transistor unit <DOHC>	Ignition signal is not input while engine is running. However, this excludes cases where no ignition signal is input to any cylinders.	(1) Ignition coil malfunction (2) Open circuit or short circuit in ignition primary circuit, or connector contact is defective (3) Power transistor unit malfunction (4) Engine control unit malfunction	• Unstable idling* • Poor acceleration* • Poor starting*

Malfunction code No.	Diagnosis item	Diagnosis contents	Probable cause	Remark (Trouble symptom, etc.)
55	Servo valve position sensor <SOHC (Except MVV)>	Servo valve does not move to the intended position (opening angle), even though idle speed control servo motor operates many times.	(1) Servo valve position sensor malfunction (2) Open circuit or short circuit in servo valve position sensor, or connector contact is defective (3) Idle speed control servo motor (DC motor) malfunction (4) Open circuit or short circuit in idle speed control servo motor (DC motor), or connector contact is defective (5) Engine control unit is defective	• Inappropriate idle speed* • Engine stops* • Unstable idling*
63	Linear A/F sensor and amplifier <SOHC-MVV>	(1) After the engine warmed up, the voltage of the linear A/F sensor amplifier signal is 4.5V or more for a continuous period of approximately 12 seconds. (2) The voltage of the linear A/F sensor amplifier signal is 2.7V or less for a continuous period of approximately 12 seconds even though the target air/fuel mixture ratio is leaner than 20.	(1) Linear A/F sensor malfunction (2) Linear A/F sensor amplifier malfunction (3) Open circuit or short circuit in linear A/F sensor and amplifier, or connector contact is defective	• Poor fuel consumption* • Reduction in exhaust gas purification efficiency*
			(4) Inappropriate fuel pressure (5) Injector malfunction (6) Engine control unit malfunction	• Poor fuel consumption* • Reduction in exhaust gas purification efficiency* • Poor starting • Unstable idling • Poor acceleration

FAIL-SAFE/BACKUP FUNCTION TABLE

When the main sensor malfunctions are detected by the self-diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

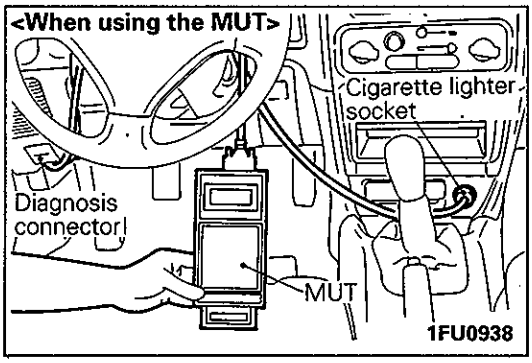
Malfunctioning item	Control contents during malfunction
Air flow sensor	(1) Determines the fuel injection timing and ignition timing by means of the throttle position sensor (TPS) signal and the engine speed signal (crank angle sensor signal). (2) Fixes the ISC servo in the appointed position so idle speed control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25° (77°F).
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Coolant temperature sensor	Controls as if the coolant temperature is 80°C (176°F).
Top dead centre sensor	(1) Injects fuel into the cylinders in the order 1-3-4-2 with irregular timing. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.) (2) After 4 seconds from a malfunction being detected, the fuel supply is cut off. <DOHC> (However, when the No. 1 cylinder top dead centre is not detected after the ignition switch is turned to ON.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (760 mmHg, 30 in. Hg).
Detonation sensor	Retards the ignition timing from normal ignition timing to timing where knocking doesn't occur.
Ignition coil, power stansistor unit <DOHC>	Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Servo valve position sensor <SOHC (Except MVV)>	Idle speed control is not performed.
Oxygen sensor <Except SOHC-MVV>	Air/fuel ratio feedback control (closed loop control) is not performed
Linear A/F sensor and amplifier <SOHC-MVV>	Air/fuel ratio feedback control (closed loop control) is not performed

READ OUT OF MALFUNCTION CODE

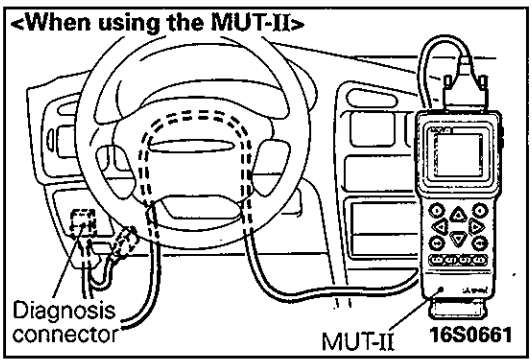
PRECAUTIONS FOR OPERATION

(1) When battery voltage is low, no detection of failure is possible. Be sure to check the battery for voltage and other conditions before starting the test.
(2) Diagnosis item is erased if the battery or the engine control unit connector is disconnected. Do not disconnect the battery before the diagnosis result is completely read.
(3) Connection and disconnection of the multi-use tester (MUT) or MUT-II should always be made with the ignition switch in the OFF position.

<When using the MUT>



<When using the MUT-II>



READING PROCEDURE-USING MULTI-USE TESTER (MUT) <Up to 1993 models> OR MUT-II <All models>

(1) Connect the MUT or MUT-II to the diagnosis connector.

NOTE
When connecting the MUT-II to vehicles built up to 1993, use the adaptor harness which is supplied as an accessory to the MUT-II sub-assembly.

(2) Turn the ignition switch ON.
(3) Read and make a note of the self-diagnosis output.
(4) Repair the problem location, referring to the diagnosis chart.
(5) After turning the ignition switch once to OFF, turn it back ON.
(6) Erase the malfunction code.
(7) Recheck to be sure that the condition is normal.

NOTE

CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS

Problem symptoms / Check items	Starting		Idling stability			Driving						Stopping	Reference page
	Will not start	Starting problem	Idling instability (Rough idling)	Incorrect idling speed	Improper idling continuity	Hesitation, sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run-on (Dieseling)	
Power supply	① □1												13-120 *1, *5
Engine control unit power earth	② □2												13-122
Fuel pump	③ □3	① □1			① □1	① □1	① □1						13-123
Air flow sensor					⑫ □11	⑨ □9		⑤ □5	⑥ □6		④ □4		13-126
Intake air temperature sensor			⑥			⑤ □5	④ □4				② □2		13-130
Barometric pressure sensor			⑧			⑧ □8	⑥ □6				③ □3		13-133
Coolant temperature sensor		□3	⑦ □6	① □1	⑥ □6	⑦ □7	⑤ □5	④ □4		③ □3			13-135
Throttle position sensor						⑥ □6		③ □3	④ □4				13-137
Idle position switch			④ □4	② □2	⑤ □5								13-137
Servo valve position sensor*1			③ □3	⑦ □3	④ □4				⑤ □5				13-137
Top dead centre sensor	⑤ □5	⑥ □7			⑨ □8				② □2				13-138*4 13-139*2
Crank angle sensor	⑥ □6	⑦ □8			⑩ □9				③ □3				13-143*4 13-145*2
Ignition switch-ST	④ □4	③ □4											13-147
Ignition switch-ST and inhibitor switch (A/T)	④ □4	③ □4		⑥									13-148
Vehicle speed sensor					⑦				⑦				13-150
Power steering fluid pressure switch				③									13-150
Air conditioner switch and power relay				④									13-150
Detonation sensor											① □1		13-150
Fan motor relay (radiator fan, condenser fan)				⑤									13-151-1
Oxygen sensor*6			⑩										13-152
Linear A/F sensor*3				⑨									13-153-1
Injectors	⑧ □8	② □2	② □2		③ □3	② □2	② □2	① □1		① □1		①	13-154
Idle speed control servo		④ □5	① □1	⑧ □4	② □2				⑧ □7				13-155*1 13-156*5
Ignition coil and power transistor	⑦ □7				⑪ □10		⑦ □7		① □1		⑤ □5		13-161*4 13-162*2
Purge control solenoid valve			⑨										13-165
EGR control solenoid valve						④ □4		⑥ □6		④ □4			13-166
Air by-pass control solenoid valve*3						⑩	⑧	⑦					13-167-1
Fuel pressure		⑤ □6	⑤ □5		⑧ □7	③ □3	③ □3	② □2		② □2			13-167

NOTE
○: Warm engine (number inside indicates check order)
□: Cold engine (number inside indicates check order)

*1: <SOHC (Except MVV)>
*2: <DOHC>
*3: <SOHC-MVV>
*4: <SOHC>
*5: <SOHC-MVV and DOHC>
*6: <SOHC (Except MVV) and DOHC>

PROBLEM SYMPTOM TABLE (FOR YOUR INFORMATION)

Refer to P. 13-18.

SERVICE ADJUSTMENT PROCEDURES

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING E13HAJF

Refer to P. 13-19.

IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT E13HAKJ

Refer to P. 13-19.

Fixed SAS-to-throttle lever distance (to be adjusted with feeler gauge): 0.65 mm (0.0256 in.)

FIXED SAS ADJUSTMENT E13HAMF

Refer to P. 13-21.

BASIC IDLE SPEED ADJUSTMENT E13HANI

Refer to P. 13-21.

Standard value: 800 r/min.

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT E13FCBG

Refer to P. 13-23.

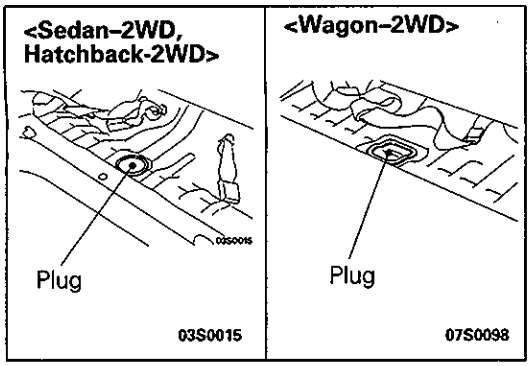
Standard value:
<M/T> 1–2 mm (0.04–0.08 in.)
<A/T> 3–5 mm (0.12–0.20 in.)

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE) E13HABK

Refer to P. 13-24.

FUEL FILTER REPLACEMENT E13FZAP

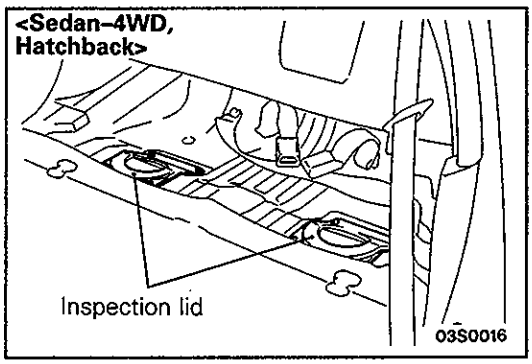
Refer to P. 13-24.

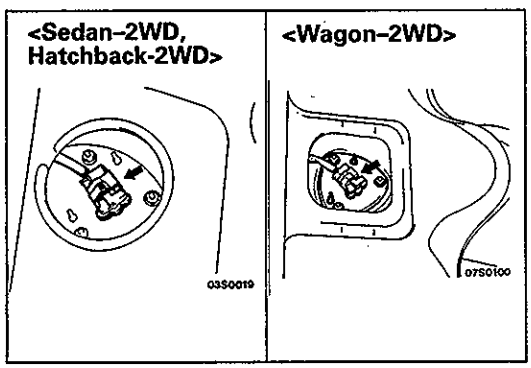


FUEL GAUGE UNIT REPLACEMENT E13FDAH

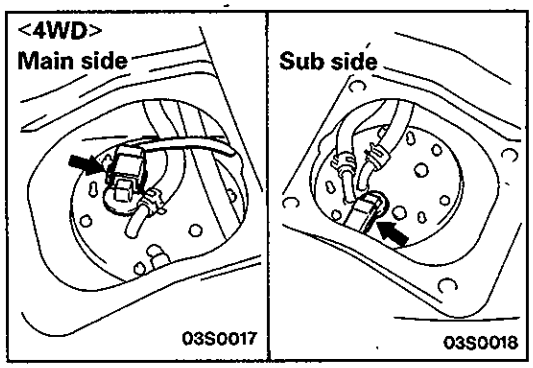
<Except Wagon – 4WD>

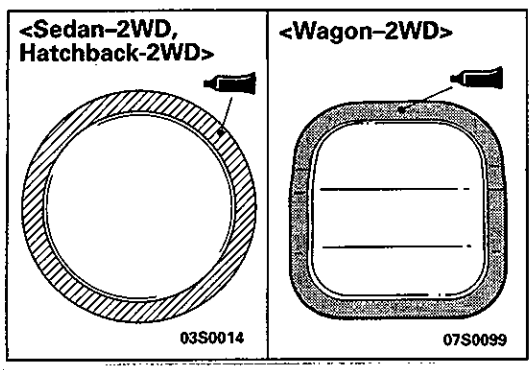
(1) Remove the rear seat cushion.
(Refer to GROUP 52A – Seat.)
(2) Remove the plug <2WD> or inspection lid <4WD>





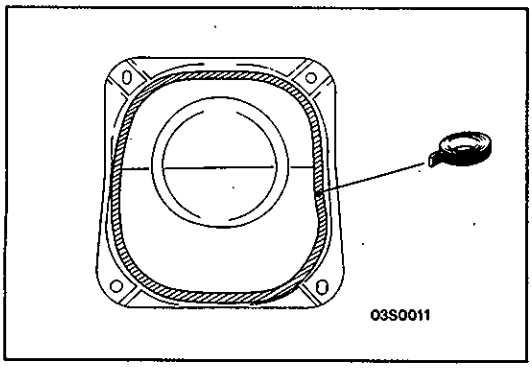
(3) Remove the fuel gauge unit connector and remove the fuel gauge unit.





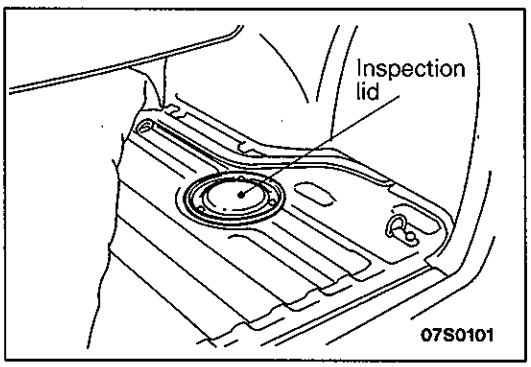
(4) For 2WD vehicles, apply specified sealant between the plug and the floor pan, and install the plug.

Specified sealant: 3M 8513 Grommeted Windshield Sealer (Black)



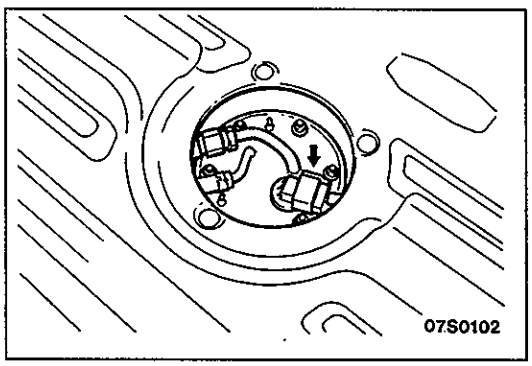
(5) For vehicles with 4WD (except Wagon), after attaching the specified sealant to the inspection lid in the places shown in the illustration, install the inspection lid to the floor.

Specified sealant: 3M 8625 Wind-Weld Ribbon Sealer (Black)



<Wagon-4WD>

(1) Remove the cargo floor mat or carpet.
(2) Remove the inspection lid.



(3) Remove the fuel gauge unit connector and remove the fuel gauge unit.
(4) Install the inspection lid.
(5) Install the cargo floor mat or carpet.

FUEL PUMP OPERATION CHECK E13FGCG

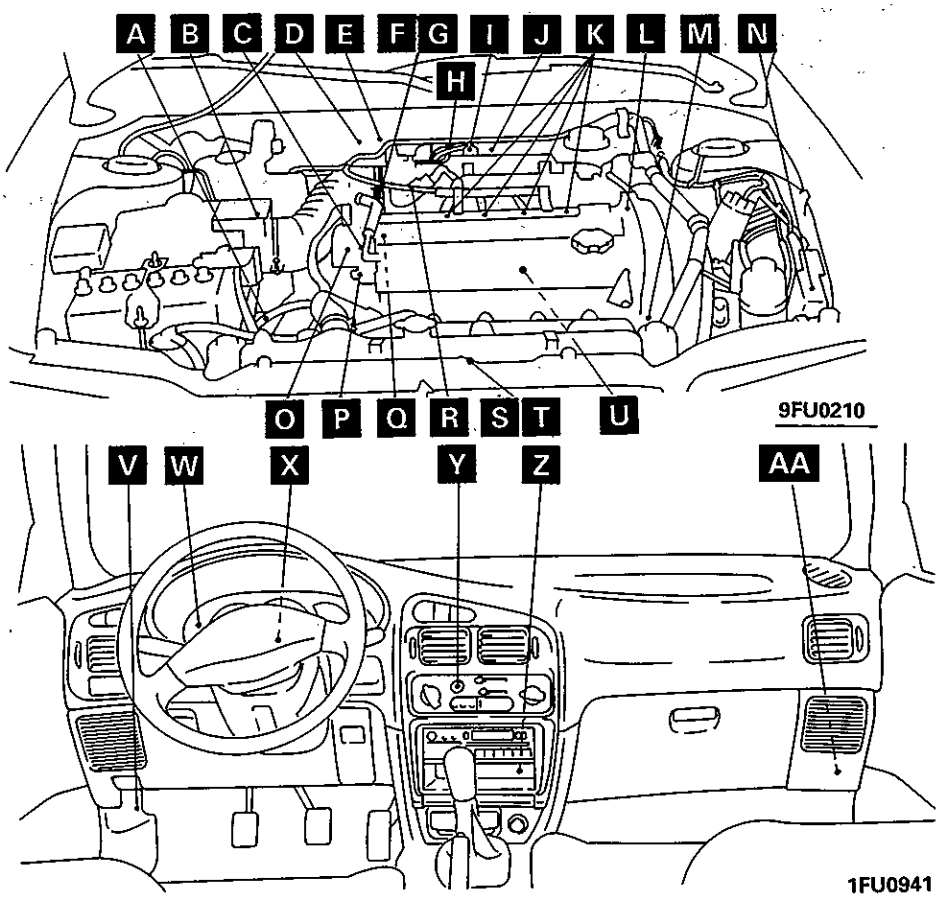
Refer to P. 13-25.

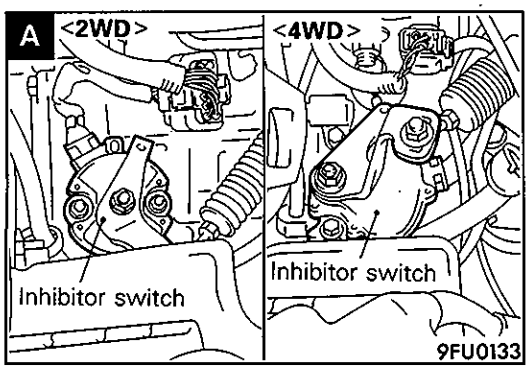
ON-VEHICLE INSPECTION OF MPI COMPONENTS

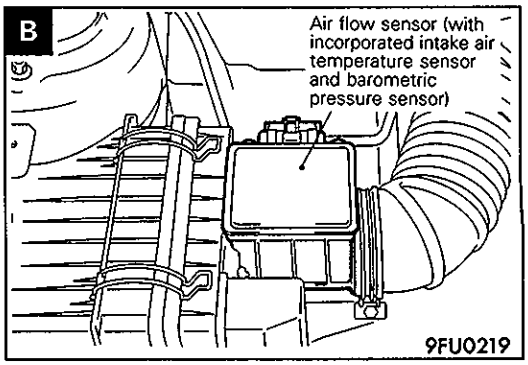
COMPONENT LOCATION

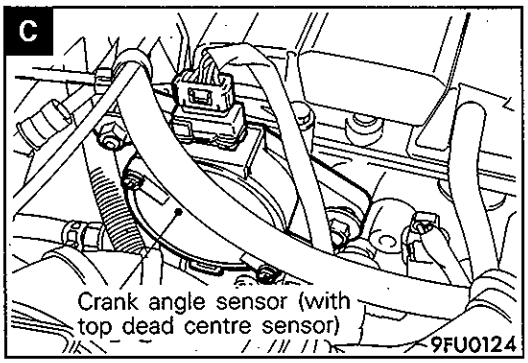
Name	Symbol	Name	Symbol
Air by-pass control solenoid valve, EGR control solenoid valve and purge control solenoid valve*3	H	EGR control solenoid valve*4	I
		Engine control unit	AA
Air conditioner relay	N	Engine warning lamp (check engine lamp)	W
Air conditioner switch	Y	Fuel pump check terminal	D
Air flow sensor (with incorporated intake air temperature sensor and barometric pressure sensor)	B	Idle speed control servo	F*1, *4
			G*3, *2
Control relay	Z	Ignition coil (power transistor)*2	L
Coolant temperature sensor	P*1	Ignition timing adjustment connector	E
	Q*2	Inhibitor switch <A/T>	A
Crank angle sensor (with top dead centre sensor)*2	C	Injector	K
		Liner A/F sensor*3	T
Detonation sensor	U	Oxygen sensor*4	S
Diagnosis connector	V	Power steering fluid pressure switch	M
Distributor (with incorporated top dead centre sensor, crank angle sensor, ignition coil and power transistor)*1	O	Purge control solenoid valve*4	J
		Throttle position sensor (with idle position switch)	R
		Vehicle speed sensor (reed switch)	X

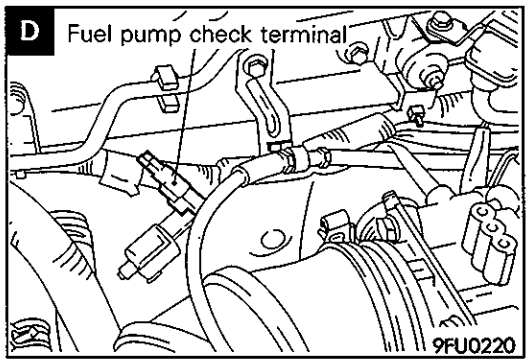
NOTE
*1: <SOHC>
*2: <DOHC>
*3: <MVV>
*4: <Except MVV>

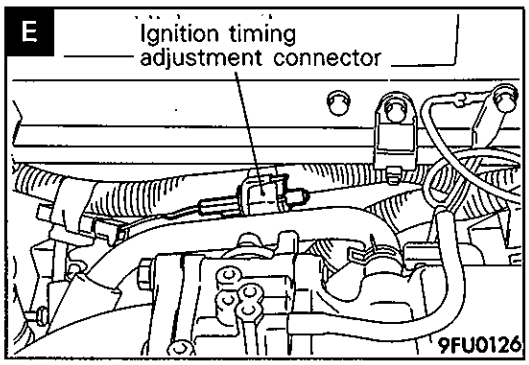


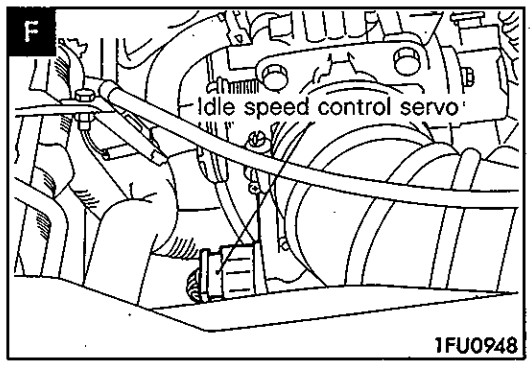
A


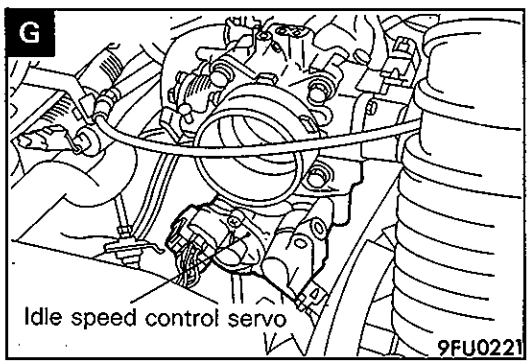
B


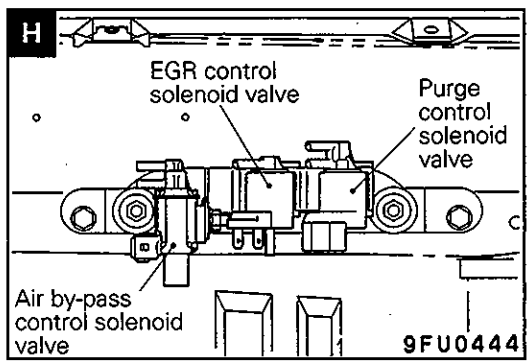
C


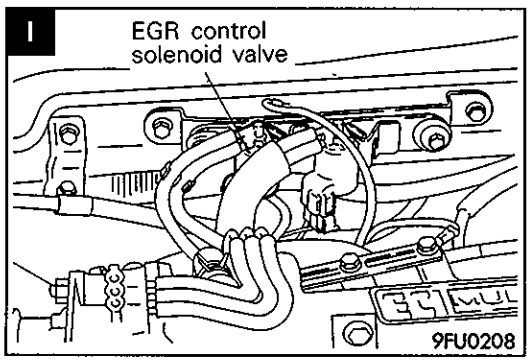
D


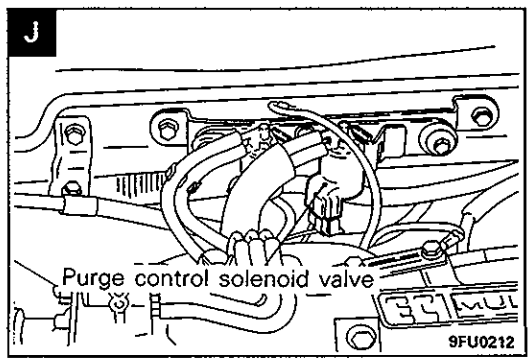
E


F


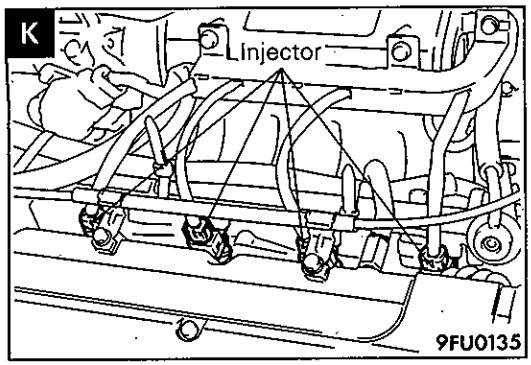
G


H


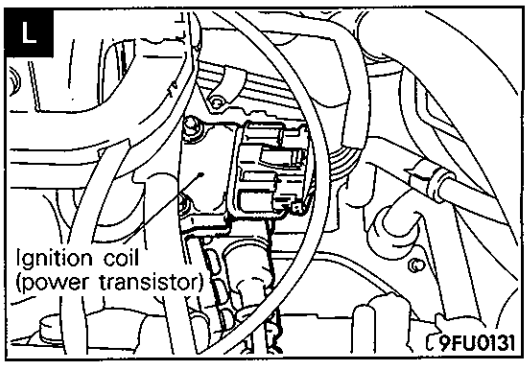
I


J


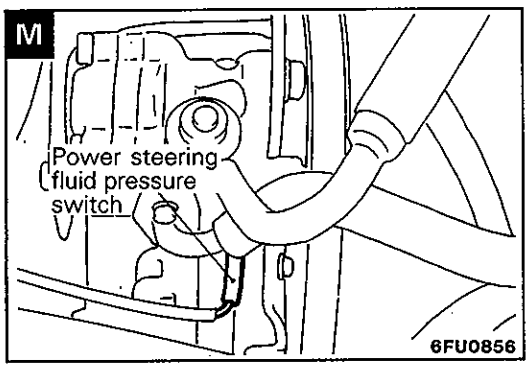
K



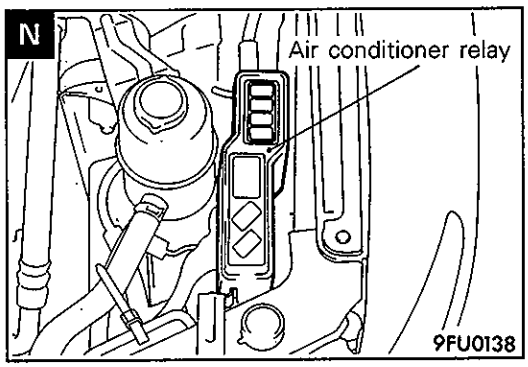
L



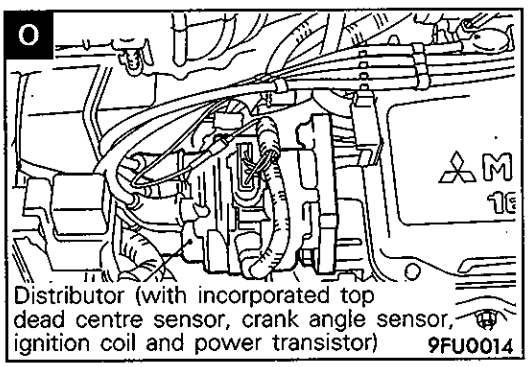
M



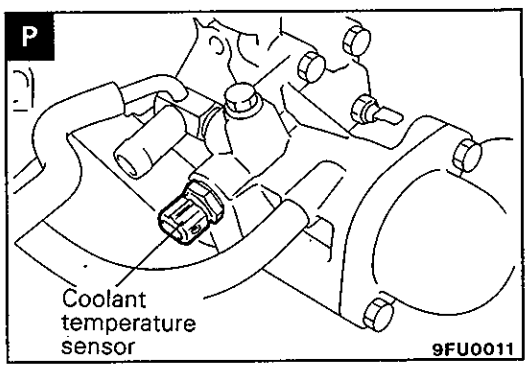
N



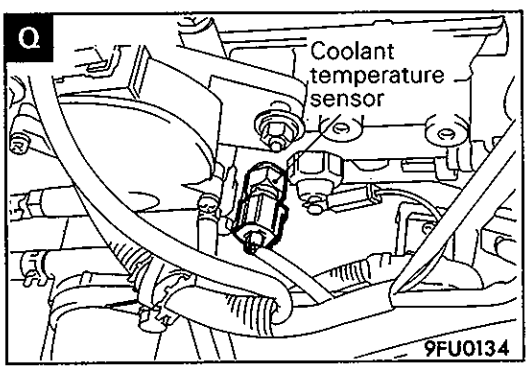
O



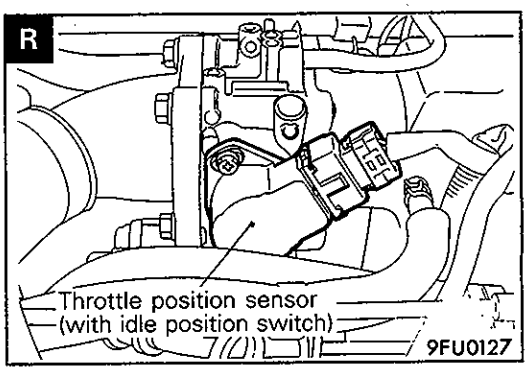
P



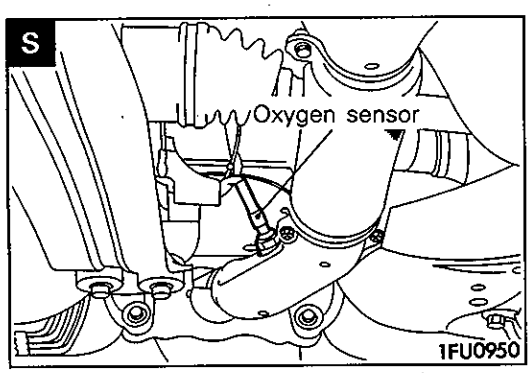
Q



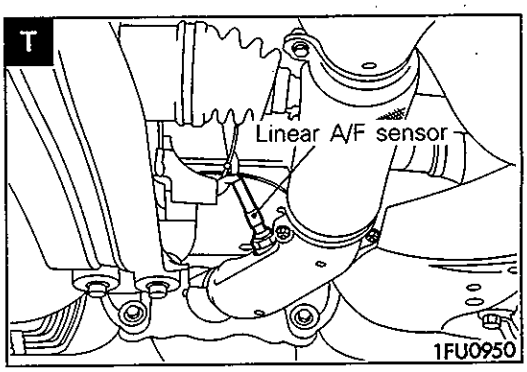
R



S

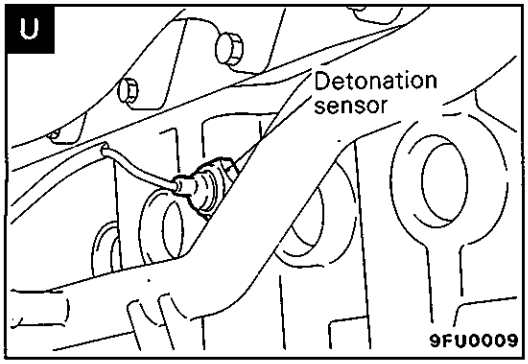


T

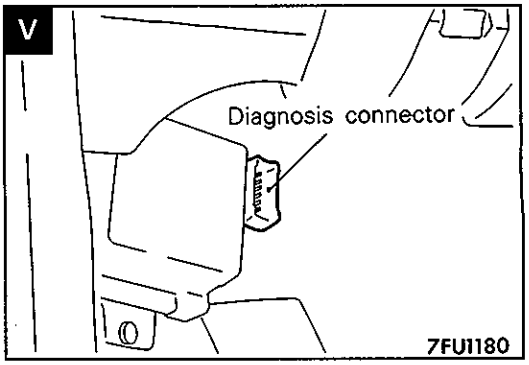


REVISED

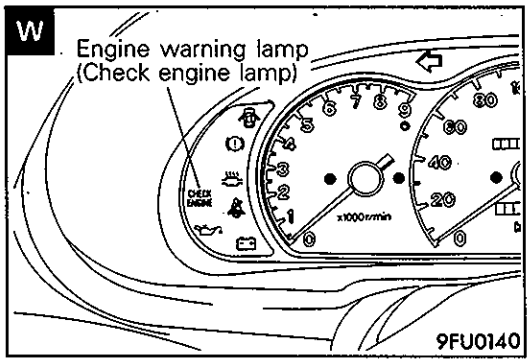
U


Detonation sensor
9FU0009

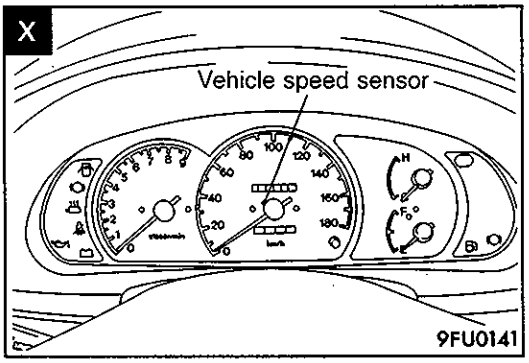
V


Diagnosis connector
7FU1180

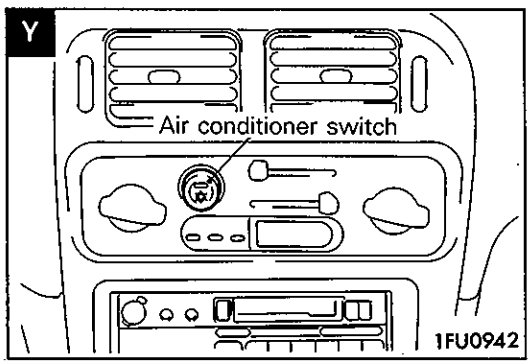
W


Engine warning lamp (Check engine lamp)
9FU0140

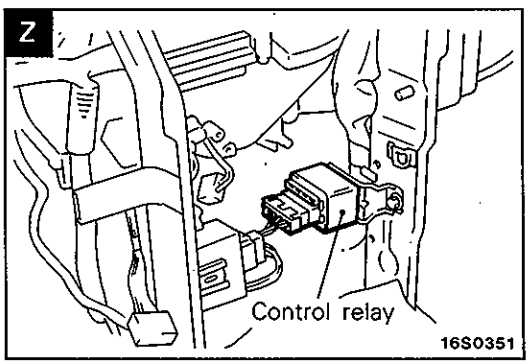
X


Vehicle speed sensor
9FU0141

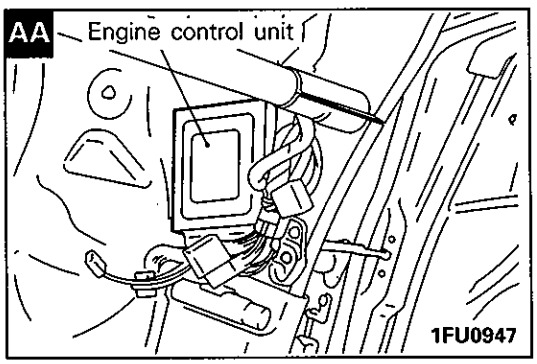
Y

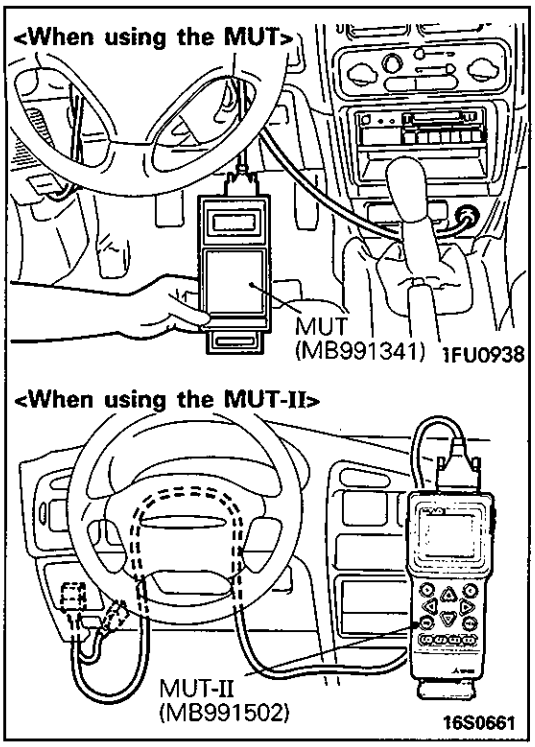

Air conditioner switch
1FU0942

Z


Control relay
16S0351

AA


Engine control unit
1FU0947



INSPECTION PROCEDURE USING THE MULTI-USE TESTER (MUT) <Up to 1993 models> OR MUT-II <All models>

(1) Connect the MUT or MUT-II to the diagnosis connector.

NOTE
When connecting the MUT-II to vehicles built up to 1993, use the adaptor harness which is supplied as an accessory to the MUT-II sub-assembly.

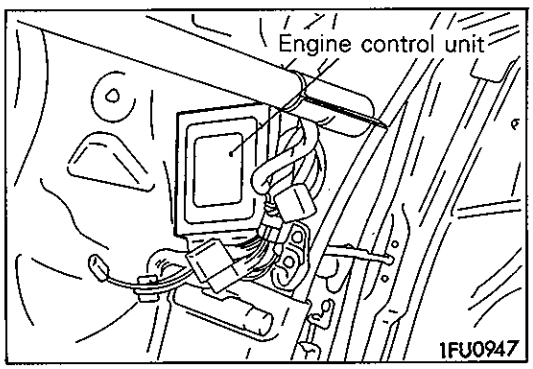
(2) Check by the service data and actuator test function. If any abnormality is found, check the body harness, components, etc. and repair as necessary.
(3) After repair, check again with the MUT or MUT-II to make sure that the input and output signals are now normal.
(4) Erase the self-diagnosis trouble code in memory.
(5) Disconnect the MUT or MUT-II.
(6) Start the engine and perform running test, etc. to make sure that the troubles have been corrected.

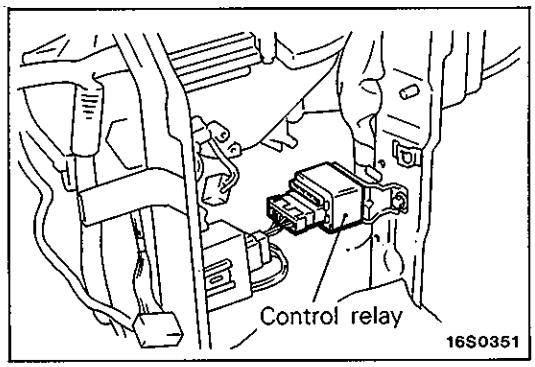
NOTE

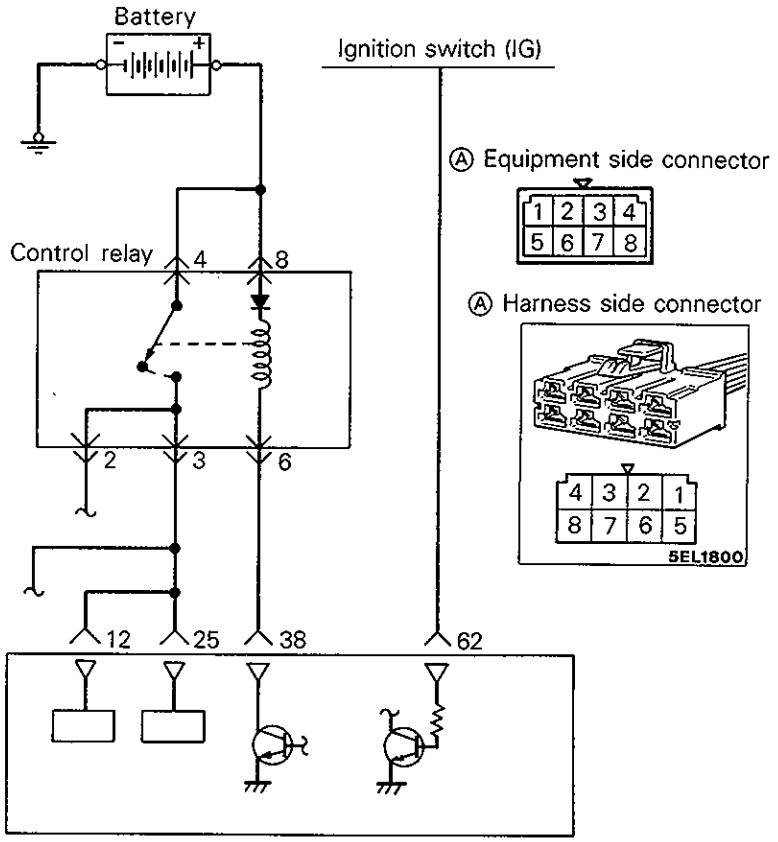
POWER SUPPLY <SOHC (Except MVV)>

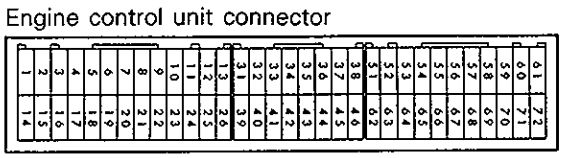
Refer to P. 13-30.

POWER SUPPLY <SOHC-MVV, DOHC>









OPERATION

- While the ignition switch is ON, battery power is supplied to the engine control unit, the injector, the air flow sensor, etc.
- When the ignition switch is turned ON, the battery voltage is applied from the ignition switch to the engine control unit, which then turns ON the power transistor to energize the control relay coil. This turns ON the control relay switch and the power is supplied from the battery to the engine control unit through the control relay switch.

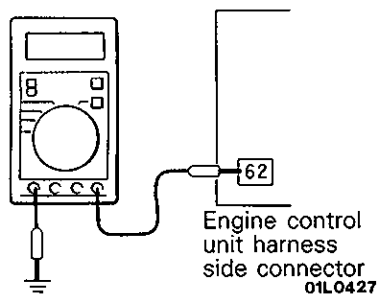
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Standard value
Data reading	16	Engine control unit power voltage	Ignition switch: ON	SV

HARNESS INSPECTION

1



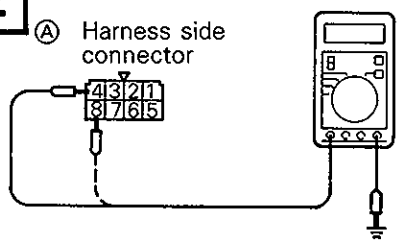
Measure the ignition switch terminal input voltage.
- Engine control unit connector: Disconnected

Ignition switch	Voltage (V)
OFF	0–1
ON	SV

OK → **2** Repair the harness. (Ignition switch – Ⓐ62) or check the ignition switch.

NG →

2



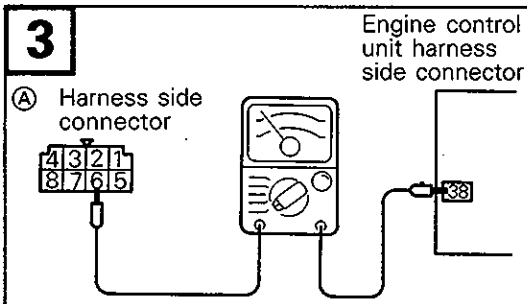
Measure the power supply voltage of the control relay.
- Control relay connector: Disconnected

Voltage (V)
SV

OK → **3** Repair the harness. (Battery – Ⓐ4) (Battery – Ⓐ8)

NG →

3

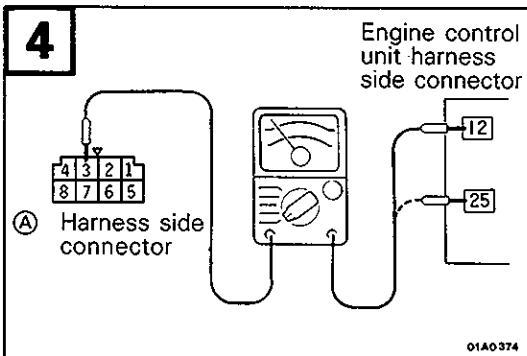


Check for open-circuit, or short-circuit to earth, between the engine control unit and the control relay.
- Engine control unit connector: Disconnected
- Control relay connector: Disconnected

OK → **4** Repair the harness. (Ⓐ6 – 38)

NG →

4

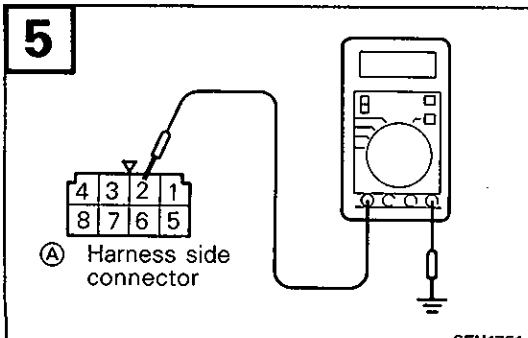


Check for open-circuit, or short-circuit to earth, between the engine control unit and the control realy.
- Engine control unit connector: Disconnected
- Control relay connector: Disconnected

OK → **5** Repair the harness. (12 – Ⓐ3) (25 – Ⓐ3)

NG →

5



Measure the power voltage to the actuator.
- Control relay connector: Connected
- Engine control unit connector: Connected

Engine	Voltage (V)
Cranking	8V or more
Racing	SV

OK → STOP

NG → Replace the control relay.

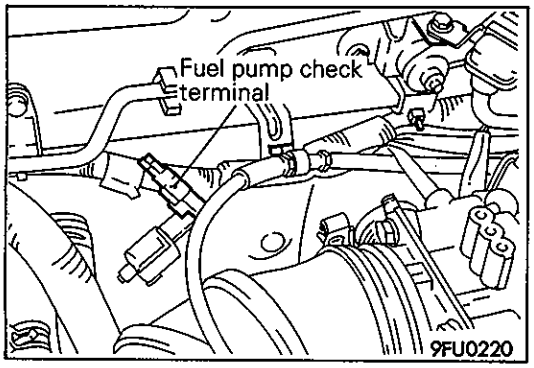
CONTROL RELAY INSPECTION

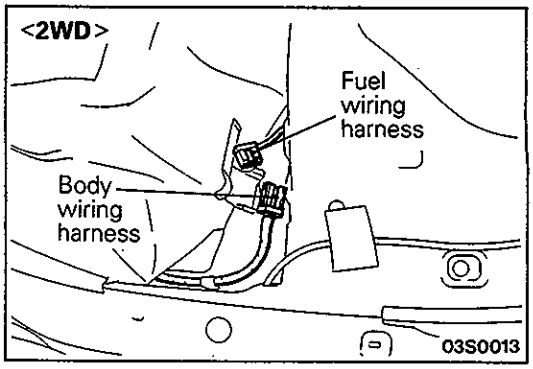
Refer to P. 13-32.

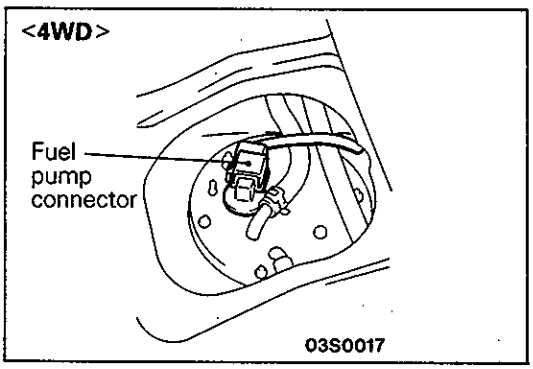
ENGINE CONTROL UNIT POWER EARTH

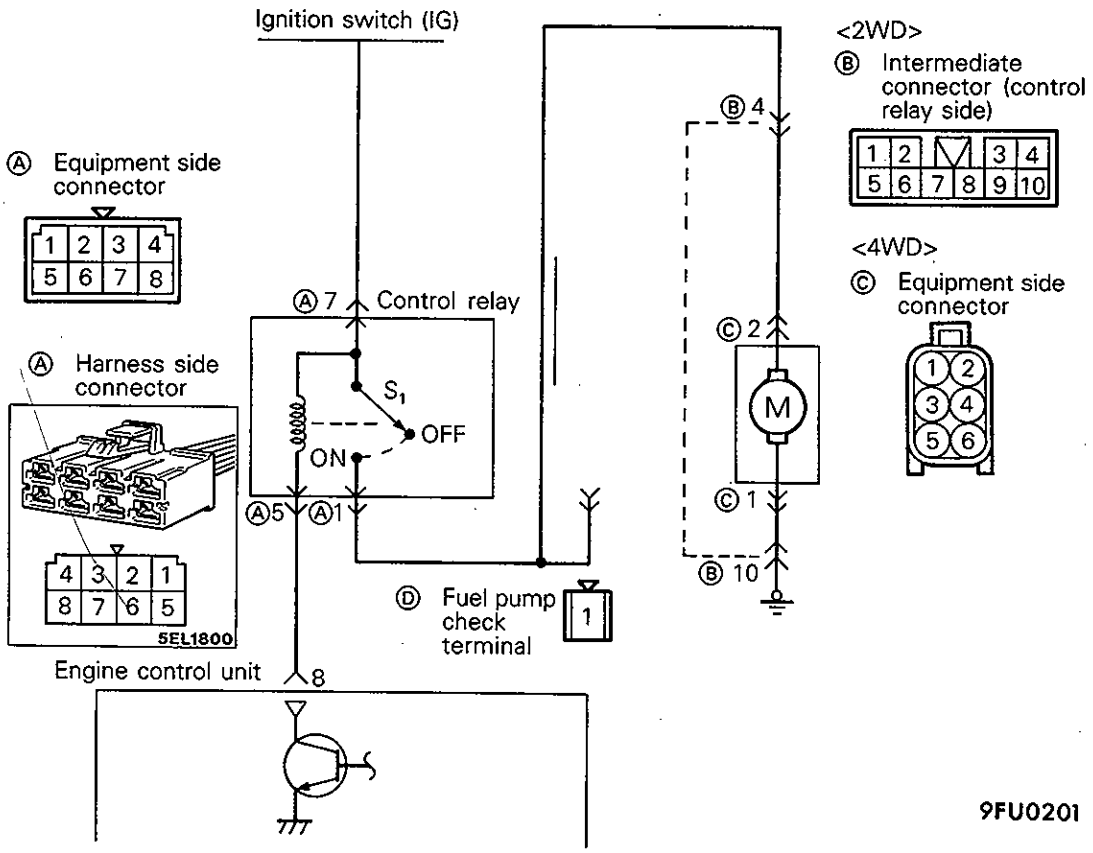
Refer to P. 13-33.

FUEL PUMP

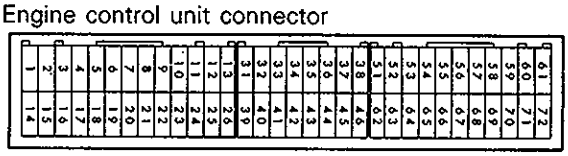








Engine control unit connector



9FU0101

OPERATION

- The fuel pump is driven when the engine is cranking and while the engine is running.
- When the engine is cranking and while the engine is running, the engine control unit turns the power transistor ON to supply power to the control relay coil. This causes the control relay switch to turn ON, and current is supplied from the ingition switch via the control relay switch to drive the fuel pump.

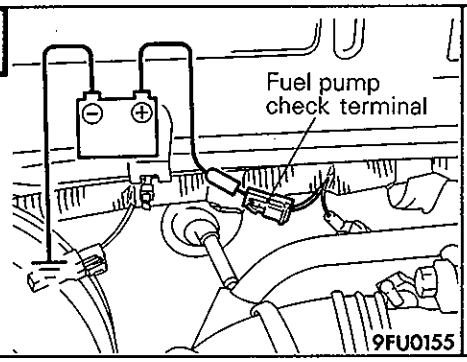
INSPECTION

Using MUT or MUT-II

Function	Item No.	Drive	Check condition	Check content	Normal state
Actuator test	07	Fuel pump is driven to circulate fuel	• Engine cranking • Forced drive of fuel pump Check is made for above two conditions	Hold return hose with fingers to feel pulsation indicating fuel flow	Pulsation is felt
				Listen to pump operating sound near fuel tank	Operating sound is heard

HARNESS INSPECTION

1

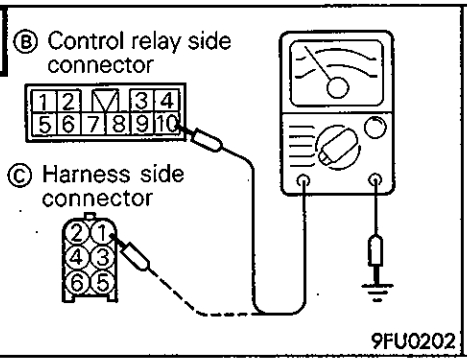


Check the fuel pump.
- Apply battery voltage to the checking terminal and operate the pump.

OK → 4

NG → 2

2

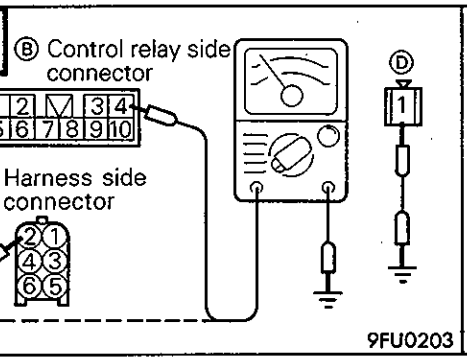


Check for continuity of the fuel pump earthing line.
- Fuel pump connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓑ10 – Earth) (Ⓒ1 – Earth)

3

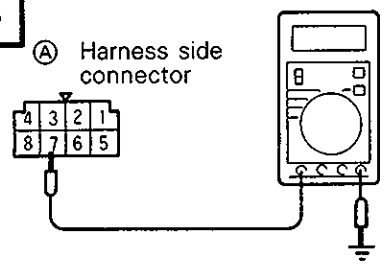


Check for open-circuit or short-circuit between the fuel pump and the fuel pump drive terminal.
- Fuel pump connector: Disconnected
- Control relay connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓑ4 – Ⓓ1) (Ⓒ2 – Ⓓ1)

4



9FU0023

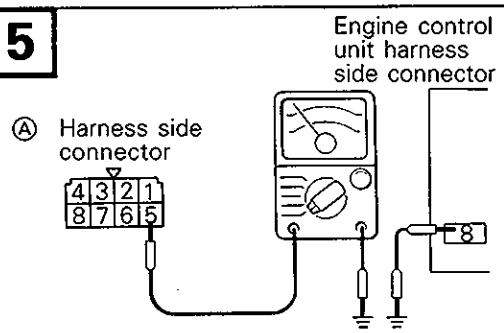
Measure the power supply voltage of the control relay.
- Control relay connector: Disconnected

Ignition switch	Voltage (V)
OFF	0
START	8V or more

OK → 5 Repair the harness. (Ignition switch – Ⓐ7) or check for ignition switch.

NG → Repair the harness. (Ⓐ7 – Ⓒ2)

5



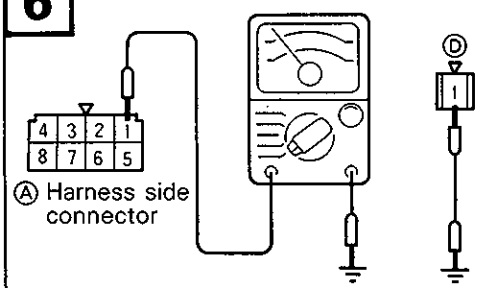
01A0354

Check for an open-circuit, or a short-circuit to earth between the control relay and the engine control unit.
- Control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → 6 Repair the harness. (Ⓐ5 – 8)

NG → Repair the harness. (Ⓐ5 – 8)

6



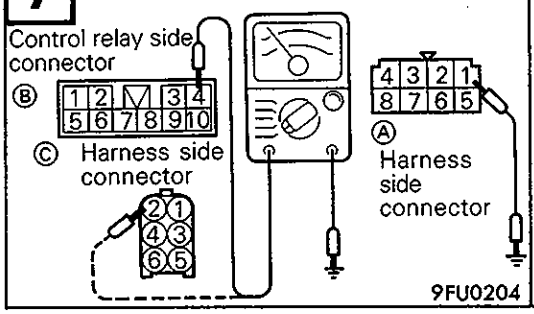
9FU0024

Check for continuity between the fuel pump checking terminal and between the control relay terminals.
- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 7 Repair the harness. (Ⓐ1 – Ⓓ1)

NG → Repair the harness. (Ⓐ1 – Ⓓ1)

7



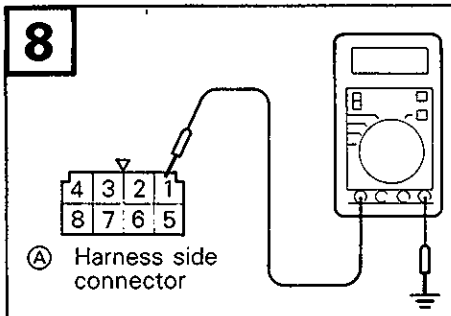
9FU0204

Check for an open-circuit, or a short-circuit to earth between the control relay and the fuel pump.
- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 8 Repair the harness. (Ⓐ1 – Ⓑ4) (Ⓐ1 – Ⓒ2)

NG → Repair the harness. (Ⓐ1 – Ⓑ4) (Ⓐ1 – Ⓒ2)

8



6FU1753

Measure the power supply voltage of the fuel pump.
- Control relay connector: Connected
- Engine control unit connector: Connected

Engine	Voltage (V)
Cranking	8V or more
Racing	SV

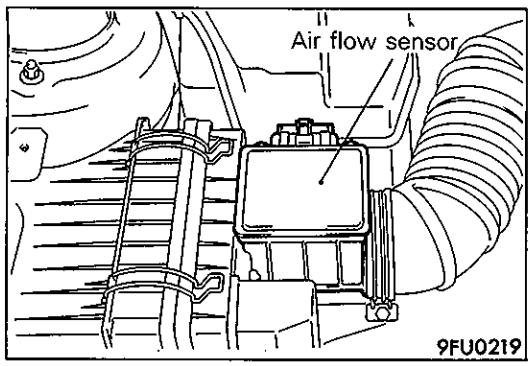
OK → STOP

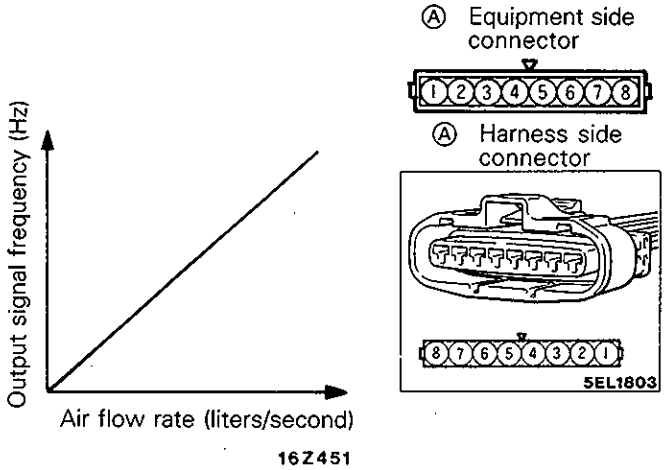
NG → Control relay or engine control unit is defective.

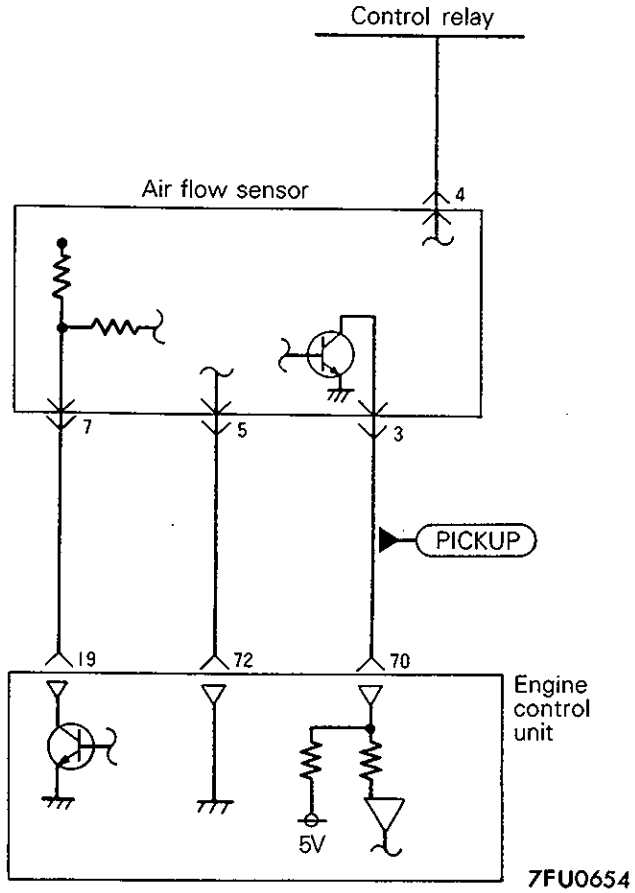
CONTROL RELAY INSPECTION

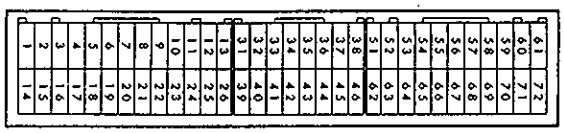
Refer to P. 13-32.

AIR FLOW SENSOR









OPERATION

- The air flow sensor located in the air cleaner converts the engine intake air volume into a pulse signal of frequency proportional to the air volume and inputs it to the engine control unit, which then computes the fuel injection rate, etc. based on the input signal.
- The air flow sensor power is supplied from the control relay to the air flow sensor and is earthed by the engine control unit. The air flow sensor generates a pulse signal as it repeatedly connects and disconnects between the 5V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

Hint 1: If the engine stalls occasionally, crank the engine and shake the air flow sensor harness. If the engine stalls, poor contact of the air flow sensor connector is suspected.

Hint 2: If the air flow sensor output frequency is other than 0 when the ignition switch is turned ON (but not starting the engine), faulty air flow sensor or engine control unit is suspected.

Hint 3: If the engine can be run idle even though the air flow sensor output frequency is out of specification, troubles are often found in other than the air flow sensor itself.

[Examples]

(1) Disturbed air flow in the air flow sensor
(Disconnected air duct, clogged air cleaner element)

(2) Poor combustion in the cylinder
(Faulty spark plug, ignition coil, injector, incorrect compression pressure, etc.)

(3) Air leaking into the intake manifold through gap of gasket, etc.

(4) Loose EGR valve seat

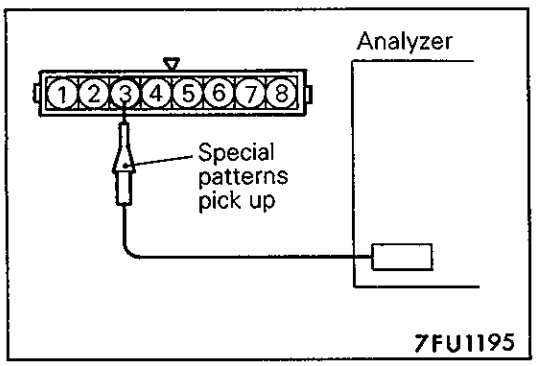
INSPECTON

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	12	Sensor air volume (frequency)	• Coolant temperature: 80 to 95°C (176 to 203°F) • Lamps, electric cooling fan, accessories: OFF • Transmission: Neutral (P range for A/T) • Steering wheel: Neutral	800 r/min.*1, *2 700 r/min.*3 (Idle)	20–46 Hz*1 22–48 Hz*2 17–43 Hz*3
				2,000 r/min.	42–80 Hz*1 42–82 Hz*2 54–94 Hz*3
				Racing	Frequency increases with racing

NOTE
1. When the vehicle is new [within initial operation of about 500 km (300 miles)], the air flow sensor output frequency may be about 10% higher.
2. *1: <SOHC (Except MVV)>
   *2: <DOHC>
   *3: <SOHC-MVV>

Wave Pattern Inspection Using an Analyzer



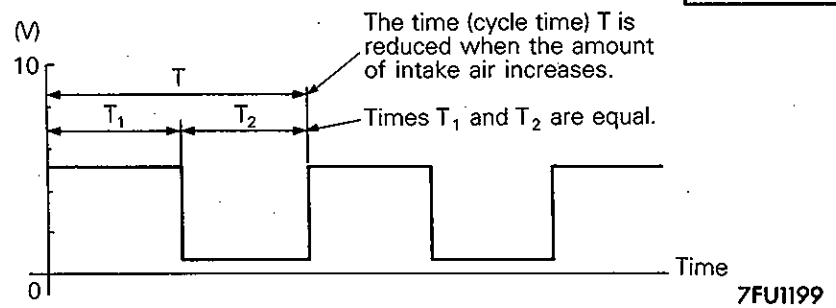
Measurement method

(1) Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to air flow sensor connector terminal ③

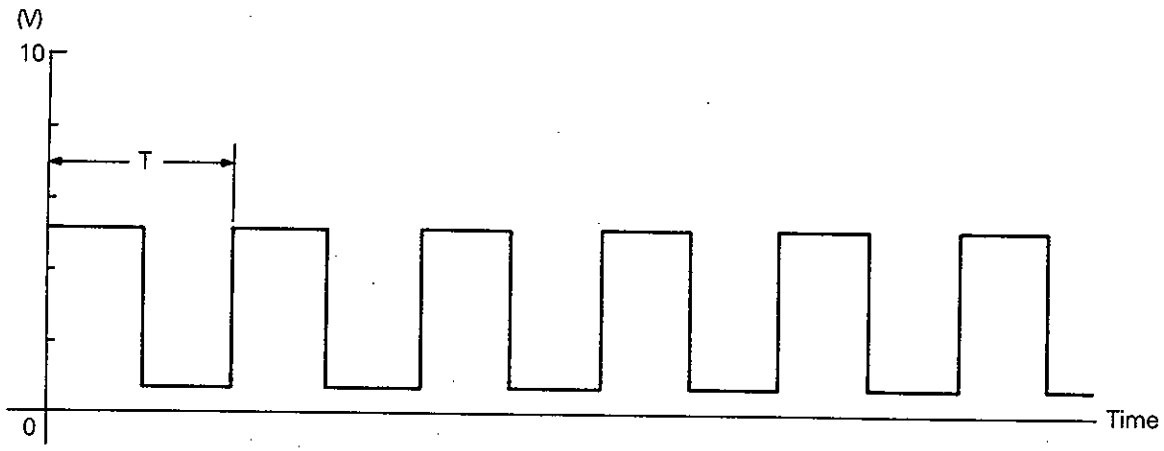
Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle speed



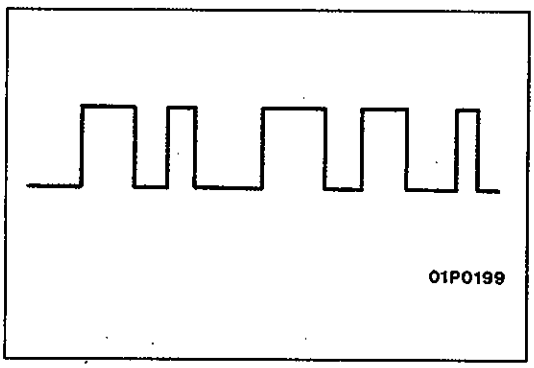
Observation conditions (from conditions above engine speed is increased by racing.)



7FU0880

Wave pattern observation points

Check to be sure that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of abnormal wave patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.

- Example 2

  Cause of problem

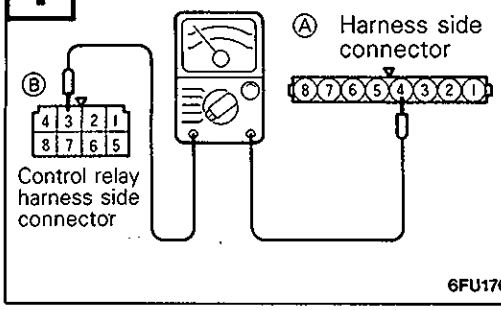
  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.

HARNESS INSPECTION

1



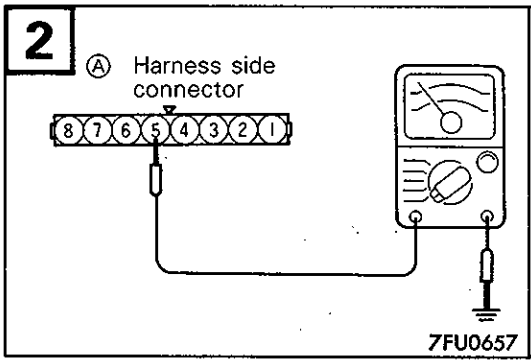
Check for continuity between air flow sensor and control relay.
- Control relay connector: Disconnected
- Air flow sensor connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ4 – Ⓑ3)

2

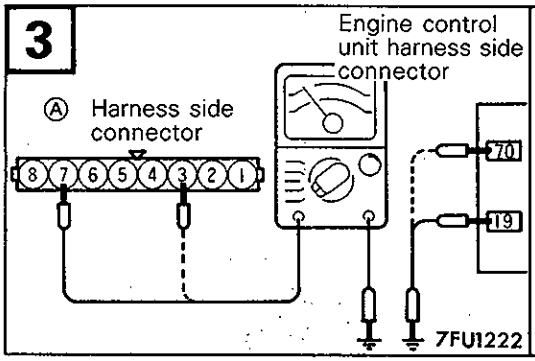


Check for continuity of the earth circuit.
- Air flow sensor connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ5 – 72)

3

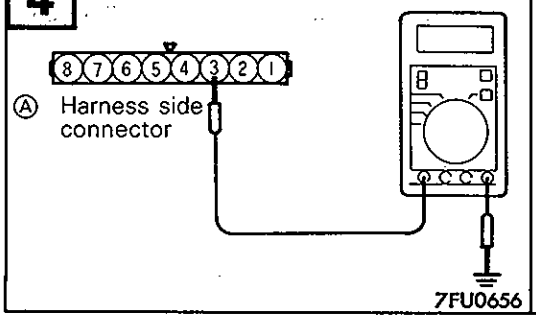


Check for open-circuit, or short-circuit to earth, between air flow sensor and engine control unit.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 4

NO → Repair the harness. (Ⓐ3 – 70) (Ⓐ7 – 19)

4



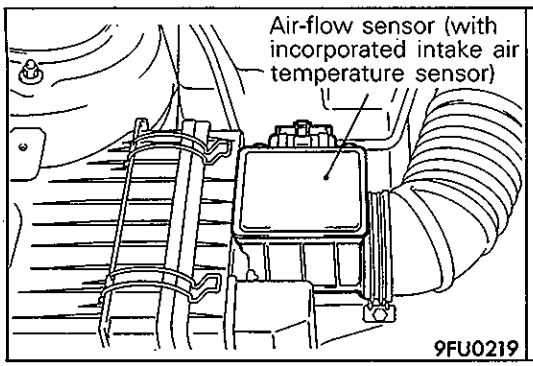
Measure the impressed voltage.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

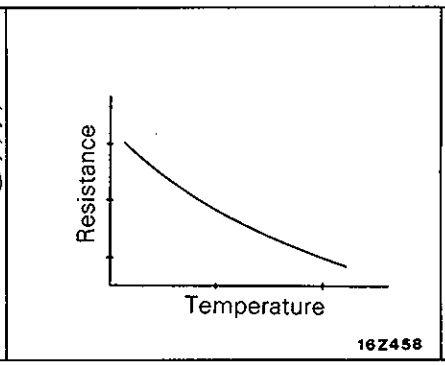
Voltage (V)
4.8–5.2

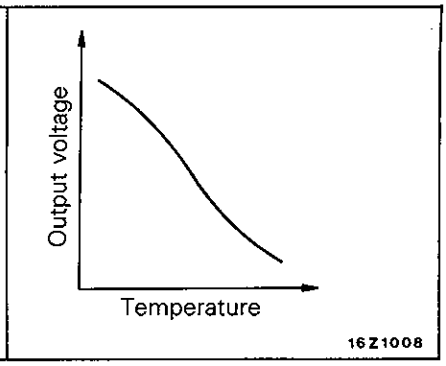
OK → STOP

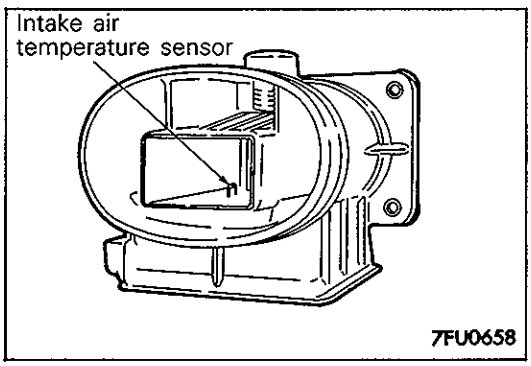
NO → Replace the engine control unit.

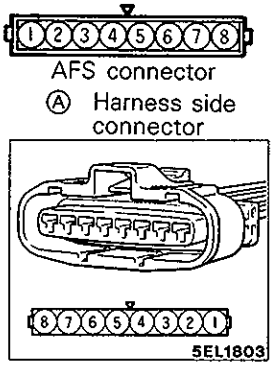
INTAKE AIR TEMPERATURE SENSOR



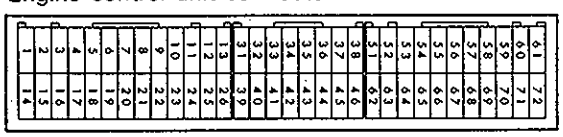








Engine control unit connector



9FU0101

OPERATION

Refer to P. 13-37.

TROUBLESHOOTING HINTS

Refer to P. 13-37.

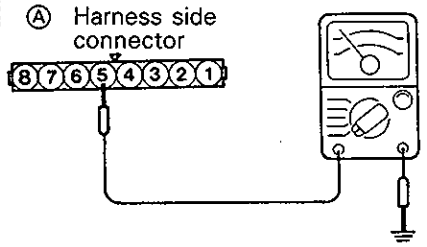
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Intake air temperature	Standard value
Data reading	13	Sensor temperature	• Ignition switch: ON or engine running	–20°C (–4°F)	–20°C
				0°C(32°F)	0°C
				20°C (68°F)	20°C
				40°C (104°F)	40°C
				80°C (176°F)	80°C

HARNESS INSPECTION

1

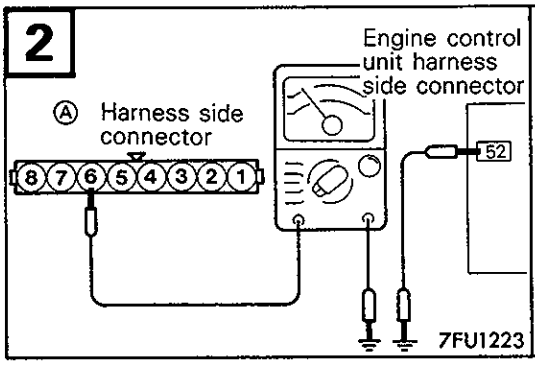


Check for continuity of the earth circuit.
- Air flow sensor connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ5 – 72)

2

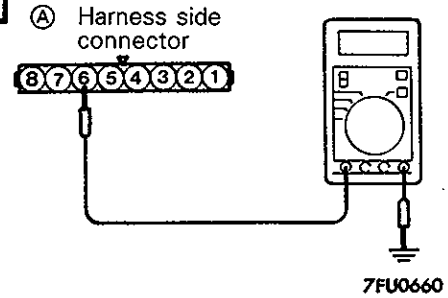


Check for open-circuit or short-circuit to earth, between intake air temperature sensor and engine control unit.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ6 – 52)

3

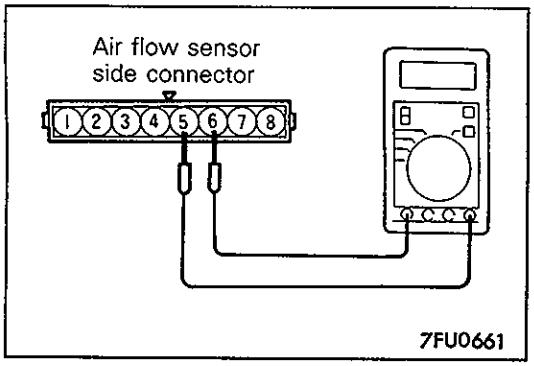


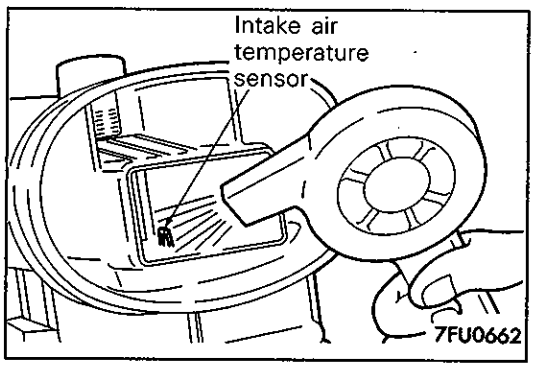
Measure the impressed voltage.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.5–4.9

OK → STOP

NG → Replace the engine control unit.





SENSOR INSPECTION

(1) Disconnect the air flow sensor connectors.
(2) Measure resistance between terminals ⑤ and ⑥.

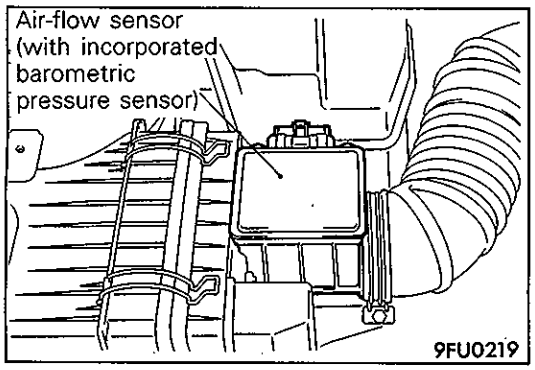
Temperature [°C (°F)]	Resistance (kΩ)
0 (32)	6.0
20 (68)	2.7
80 (176)	0.4

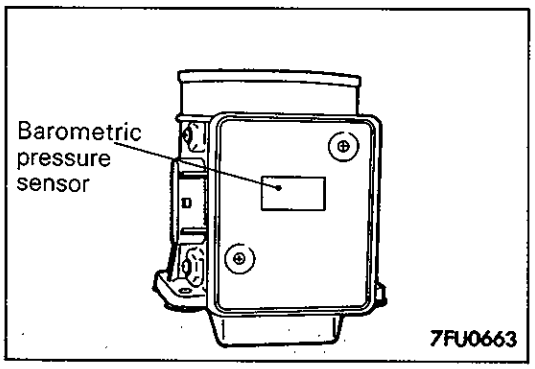
(3) Measure resistance while heating the sensor using a hair drier.

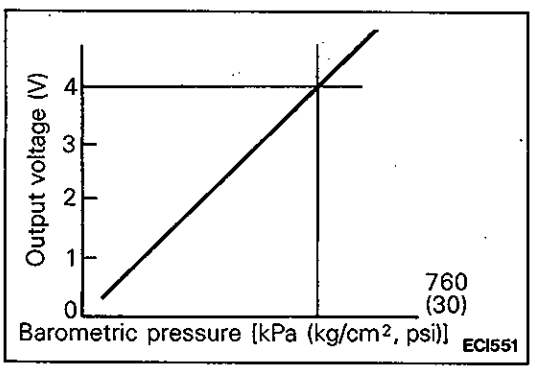
Temperature [°C (°F)]	Resistance (kΩ)
Higher	Smaller

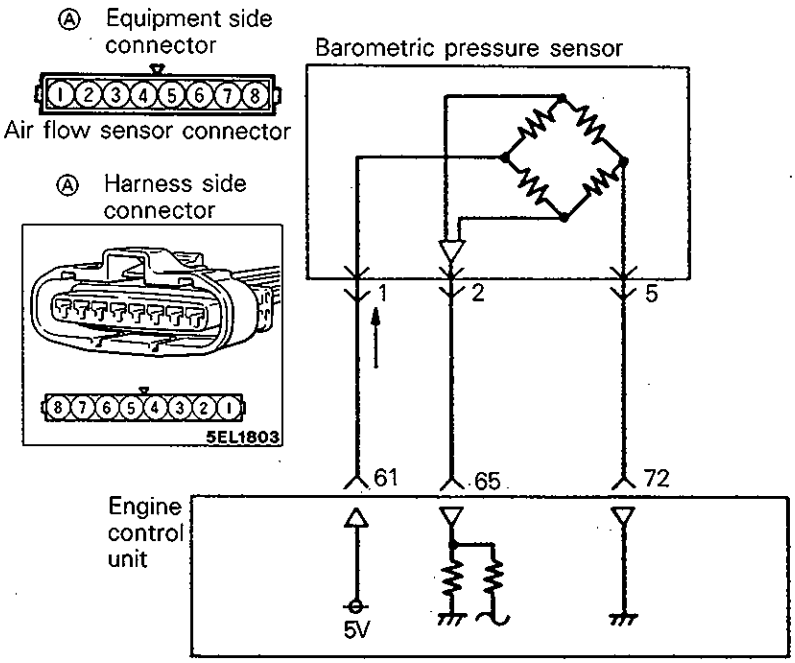
(4) If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.

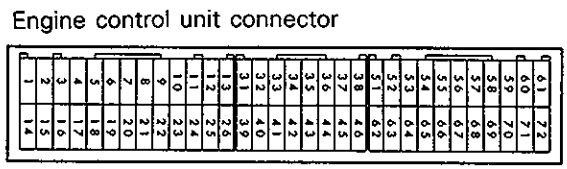
BAROMETRIC PRESSURE SENSOR











OPERATION

- The barometric pressure sensor converts the barometric pressure into a voltage and inputs it to the engine control unit, which then corrects the fuel injection rate, etc. based on the input signal.
- The 5V power in the engine control unit is supplied to the barometric pressure sensor. It flows through the circuit in the sensor and is then earthed in the engine control unit.
- The barometric pressure sensor output voltage which is proportional to the barometric pressure (absolute pressure) is supplied to the engine control unit.

TROUBLESHOOTING HINTS

Hint 1: If the barometric pressure sensor is faulty, poor driveability is caused at high altitude, in particular.

Hint 2: If the pressure indication of the barometric pressure sensor drops significantly during high speed driving, check the air cleaner for clogging.

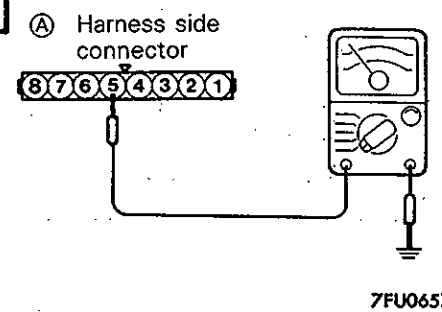
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Altitude	Standard value
Data reading	25	Sensor pressure	Ignition switch: ON	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

HARNESS INSPECTION

1

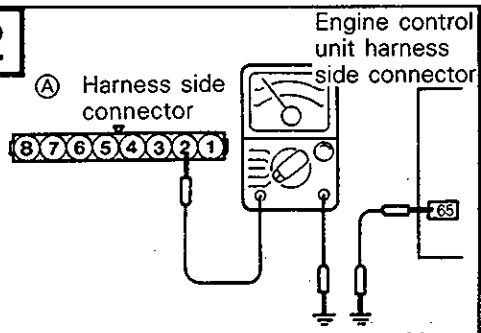


Check for continuity of the earth circuit.
- Air flow sensor connector: Disconnected

OK → 2

NG → Repair the haness. (Ⓐ5 – 72)

2

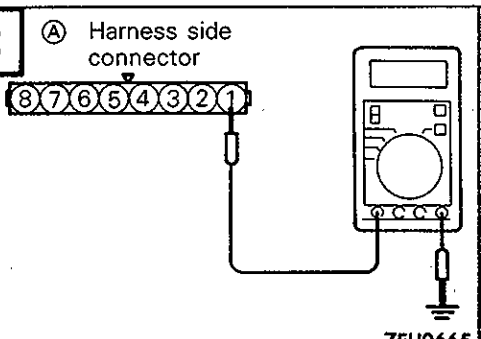


Check for an open-circuit, or a short-circuit to earth between the engine control unit and the barometric pressure sensor.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the haness. (Ⓐ2 – 65)

3



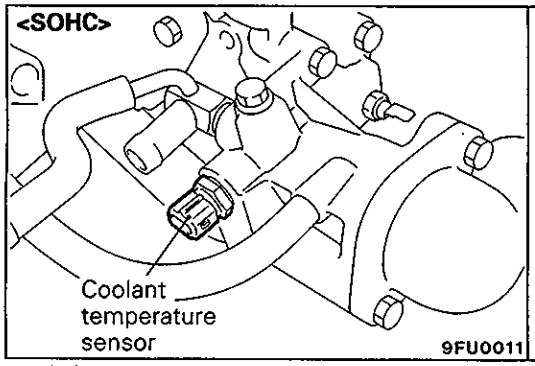
Measure the impressed voltage of the barometric pressure sensor.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

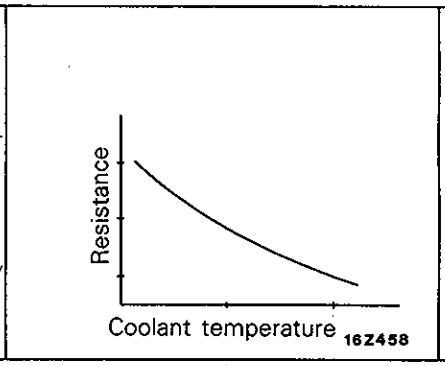
Voltage (V)
4.8–5.2

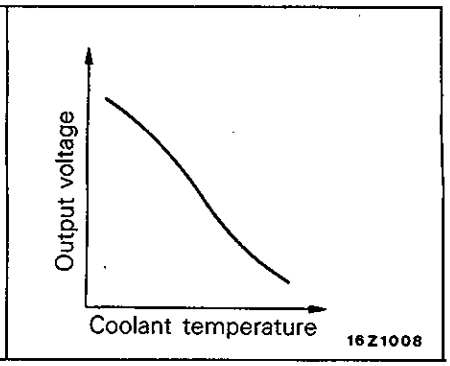
OK → STOP

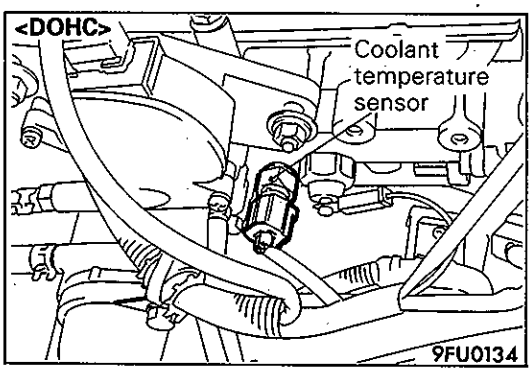
NG → Repair the engine control unit.

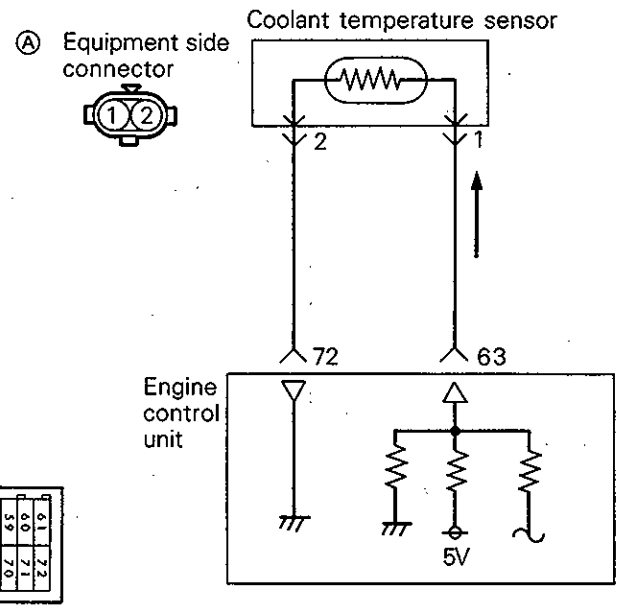
COOLANT TEMPERATURE SENSOR



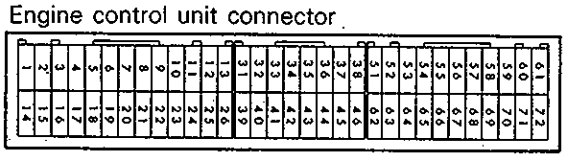








Engine control unit connector



9FU0101

9FU0106

OPERATION

Refer to P. 13-42.

TROUBLESHOOTING HINTS

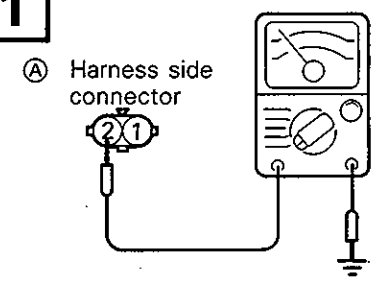
Refer to P. 13-42.

INSPECTION
Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Coolant temperature	Standard value
Data reading	21	Sensor temperature	Ignition switch: ON or engine operating	–20°C (–4°F)	–20°C
				0°C (32°F)	0°C
				20°C (68°F)	20°C
				40°C (104°F)	40°C
				80°C (176°F)	80°C

HARNESS INSPECTION

1

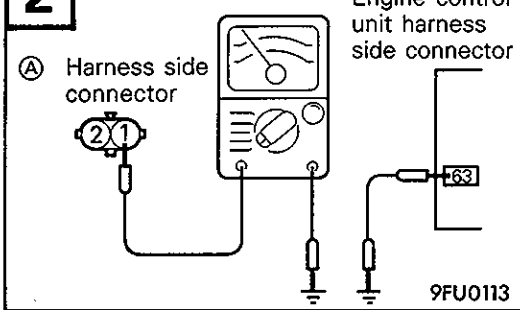


Check for continuity of the earth circuit.
- Coolant temperature sensor connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ2 – 72)

2

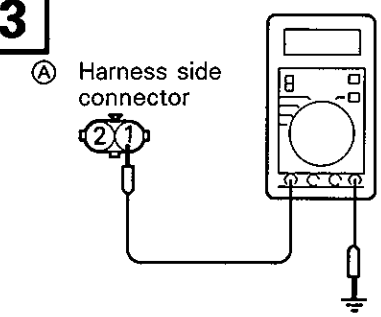


Check for open-circuit, or short-circuit to earth between coolant temperature and engine control unit.
- Coolant temperature sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – 63)

3



Measure the impressed voltage.
- Coolant temperature sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.5–4.9

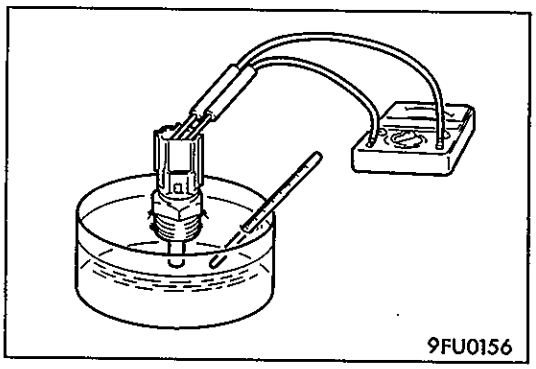
OK → STOP

NG → Replace the engine control unit.

SENSOR INSPECTION

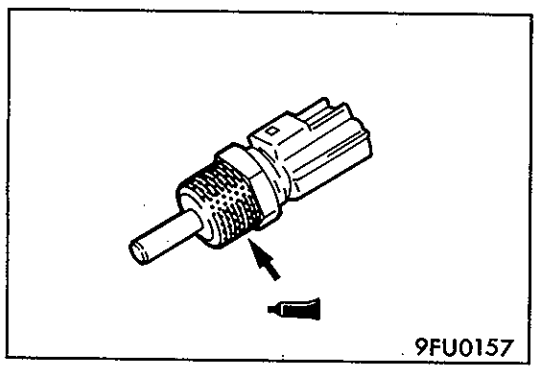
Caution
Be careful not to touch the tool against the connector (resin section) when removing and installing.

(1) Remove coolant temperature sensor from the intake manifold.


9FU0156

(2) With temperature sensing portion of coolant temperature sensor immersed in hot water, check resistance.

Temperature [°C(°F)]	Resistance (kΩ)
0 (32)	5.8
20 (68)	2.4
40 (104)	1.1
80 (176)	0.3


9FU0157

(3) If the resistance deviates from the standard value greatly, replace the sensor.

INSTALLATION

(1) Apply sealant to threaded portion.
Specified sealant: 3M NUT locking Part No. 4171 or equivalent

(2) Install coolant temperature sensor and tighten it to specified torque.
Sensor tightening torque: 30 Nm (3 kgm, 22 ft.lbs.)

(3) Fasten harness connectors securely.

THROTTLE POSITION SENSOR

Refer to P. 13-45.

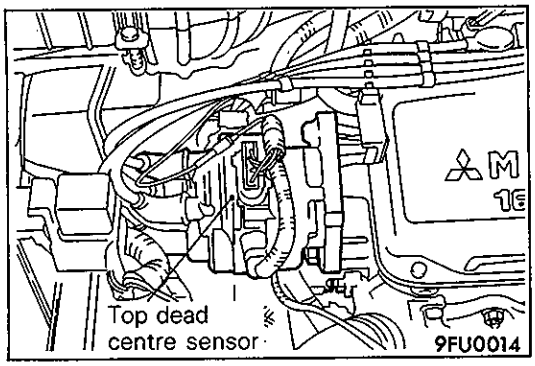
IDLE POSITION SWITCH

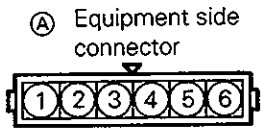
Refer to P. 13-48.

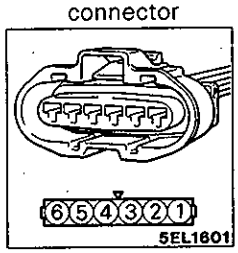
SERVO VALVE POSITION SENSOR <SOHC (Except MVV)>

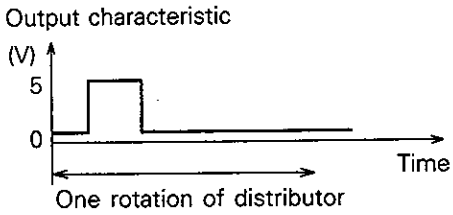
Refer to P. 13-50.

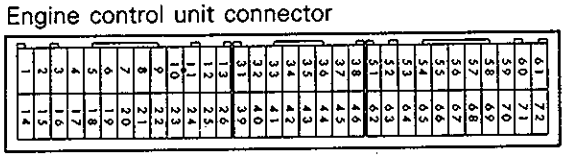
TOP DEAD CENTRE SENSOR <SOHC, built up to September, 1993>

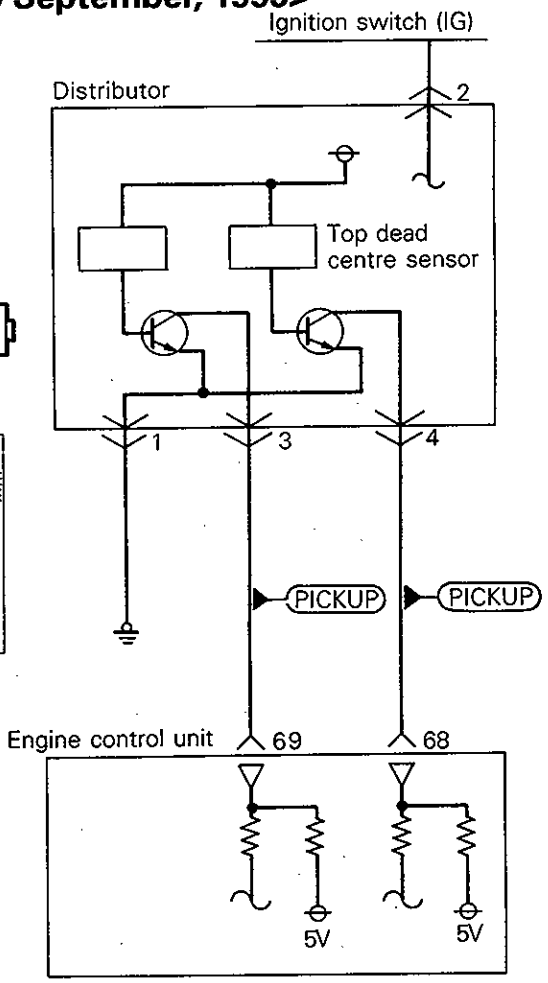












OPERATION

- The top dead centre sensor detects the top dead centre on the compression stroke of the No. 1 cylinder, converts it into a pulse signal and input it to the engine control unit. The engine control unit determines the fuel injection sequence based on this signal.
- Power to the top dead centre sensor is supplied from the ignition switch (IG), and the earth is located in the body. A 5V voltage is applied from the engine control unit to the top dead centre sensor output terminal, and the top dead centre sensor generates a pulse signal as it switches from OPEN to SHORT (power transistor inside the sensor switches ON/OFF) between the output terminal and the earth.

TROUBLESHOOTING HINTS

Hint 1: If the top dead centre sensor is defective, proper sequential injection will not occur, so the engine will stall, or unstable idling and poor acceleration will occur.

Hint 2: When the top dead centre sensor outputs a pulse signal when the ignition switch is turned to ON (without starting the engine), the top dead centre sensor or engine control unit is probably defective.

INSPECTION

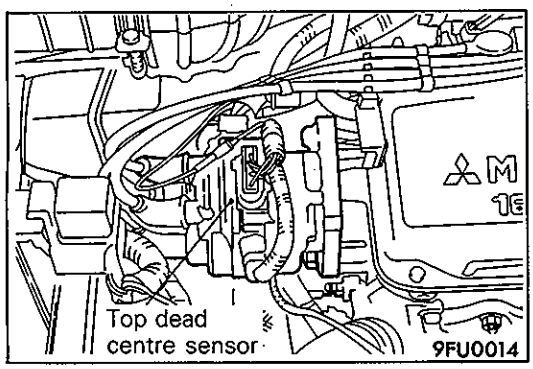
Wave Pattern Inspection Using an Analyzer

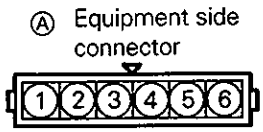
Refer to P. 13-54.

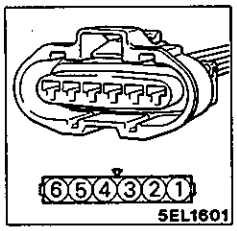
HARNESS INSPECTION

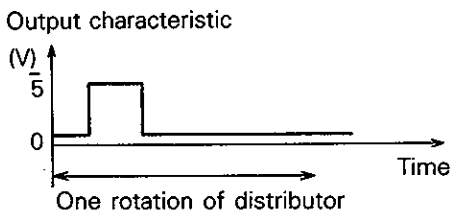
Refer to P. 13-55.

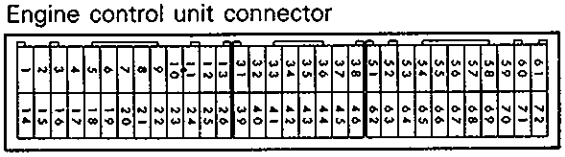
TOP DEAD CENTRE SENSOR <SOHC, built from October, 1993>

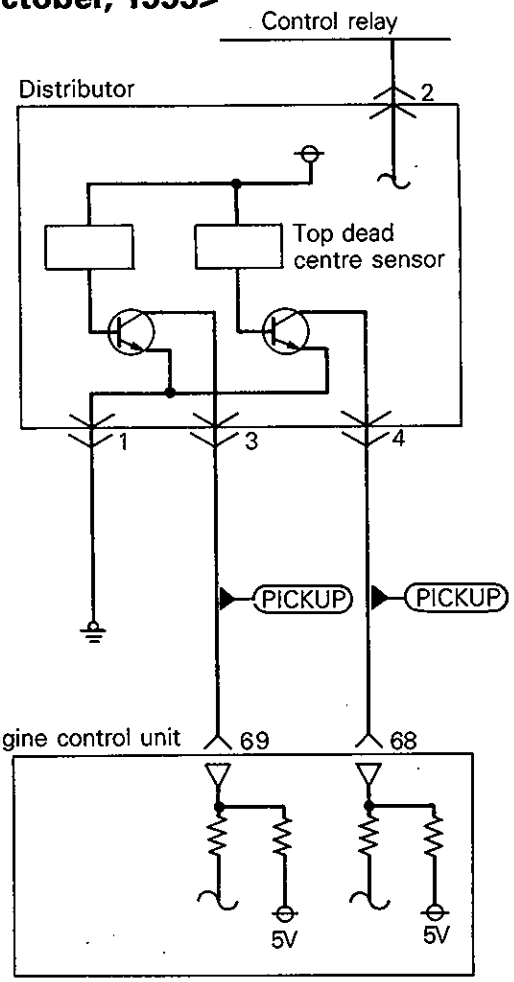












OPERATION

- The top dead centre sensor detects the top dead centre on the compression stroke of the No. 1 cylinder, converts it into a pulse signal and input it to the engine control unit. The engine control unit determines the fuel injection sequence based on this signal.
- Power to the top dead centre sensor is supplied from the control relay, and the earth is located in the body. A 5V voltage is applied from the engine control unit to the top dead centre sensor output terminal, and the top dead centre sensor generates a pulse signal as it switches from OPEN to SHORT (power transistor inside the sensor switches ON/OFF) between the output terminal and the earth.

TROUBLESHOOTING HINTS

Hint 1: If the top dead centre sensor is defective, proper sequential injection will not occur, so the engine will stall, or unstable idling and poor acceleration will occur.

Hint 2: When the top dead centre sensor outputs a pulse signal when the ignition switch is turned to ON (without starting the engine), the top dead centre sensor or engine control unit is probably defective.

INSPECTION

Wave Pattern Inspection Using an Analyzer

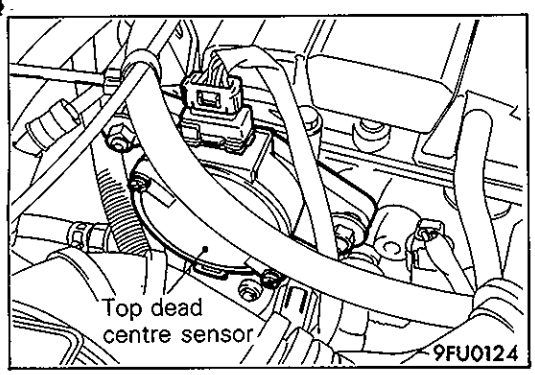
Refer to P. 13-54.

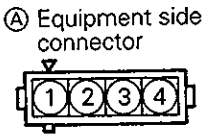
HARNESS INSPECTION

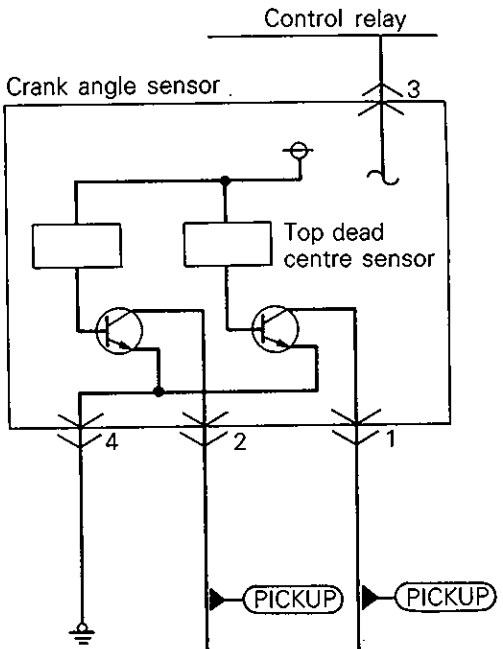
Refer to P. 13-56-2.

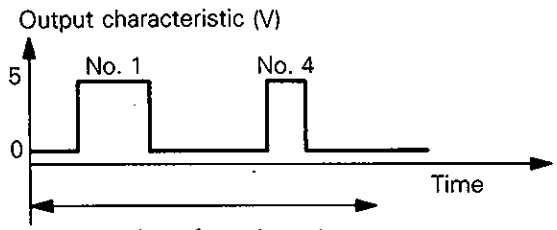
NOTE

TOP DEAD CENTRE SENSOR <DOHC>



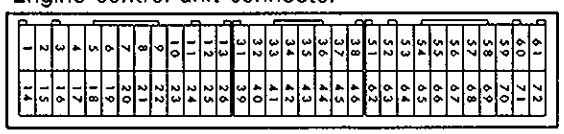






01A0528

Engine control unit connector



9FU0101

9FU0205

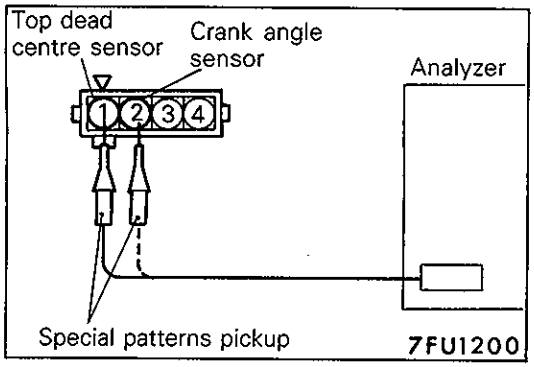
OPERATION

- The top dead centre sensor detects the top dead centre on the compression stroke of the No. 1 and No. 4 cylinder, converts it into a pulse signal and inputs it to the engine control unit. The engine control unit determines the fuel injection sequence based on this signal.
- Power to the top dead centre sensor is supplied from the control relay, and the earth is located in the body. A 5V voltage is applied from the engine control unit to the top dead centre sensor output terminal, and the top dead centre sensor generates a pulse signal as it switches from OPEN to SHORT (power transistor inside the sensor switches ON/OFF) between the output terminal and the earth.

TROUBLESHOOTING HINTS

Hint 1: If the top dead centre sensor is defective, proper sequential injection will not occur, so the engine will stall, or unstable idling and poor acceleration will occur.

Hint 2: When the top dead centre sensor outputs a pulse signal when the ignition switch is turned to ON (without starting the engine), the top dead centre sensor or engine control unit is probably defective.



INSPECTION

Wave Pattern Inspection Using an Analyzer

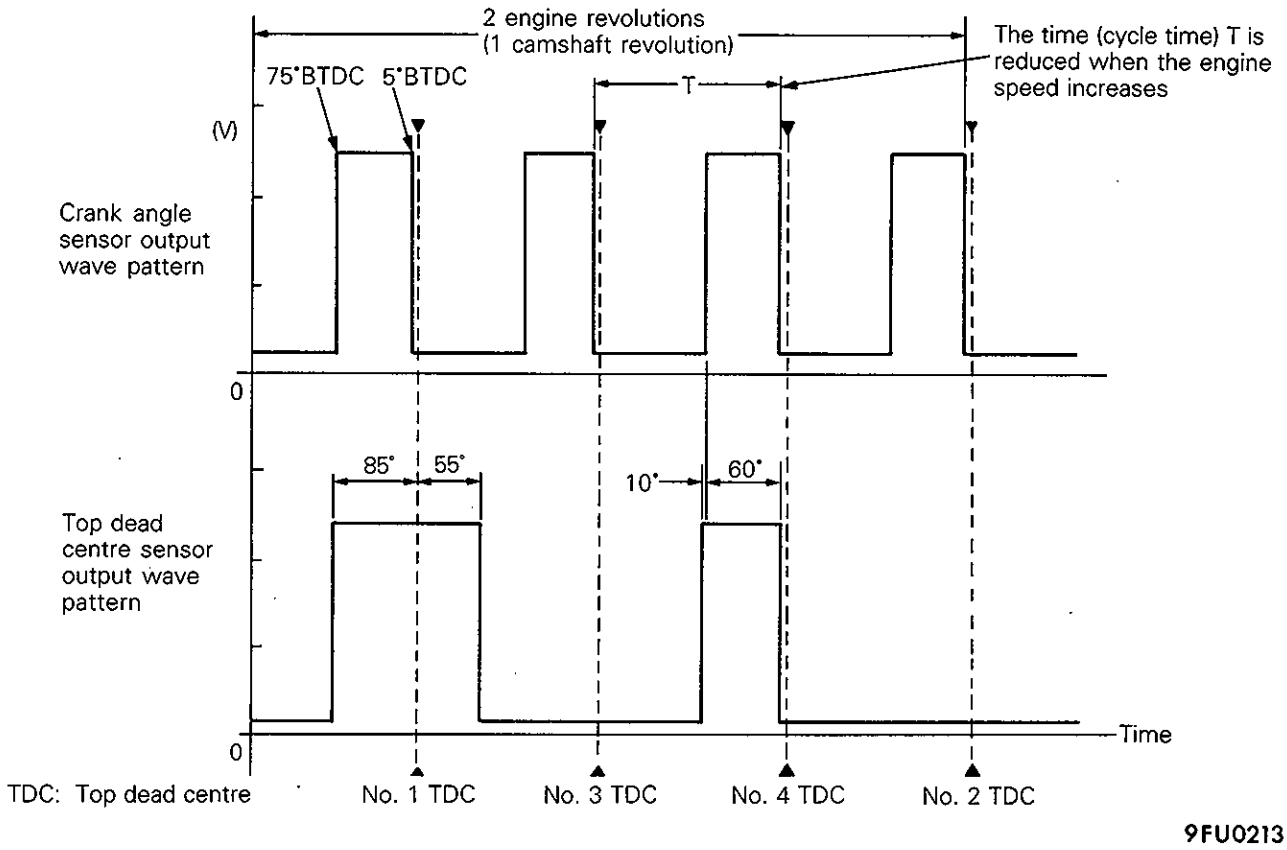
Measurement method

(1) Disconnect the top dead centre sensor & crank angle sensor connector and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to crank angle sensor terminal ①. (When checking the top dead centre sensor signal wave pattern)
(3) Connect the analyzer special patterns pickup to crank angle sensor connector terminal ②. (When inspecting the crank angle sensor signal wave pattern.)

Standard wave pattern

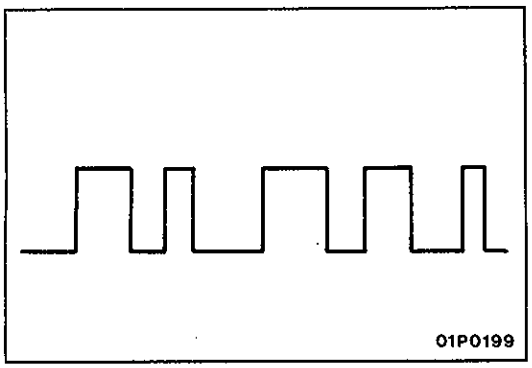
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle speed (800 r/min.)



Wave pattern observation points

Check to be sure that cycle time T becomes shorter when the engine speed increases.



Examples of abnormal wave patterns

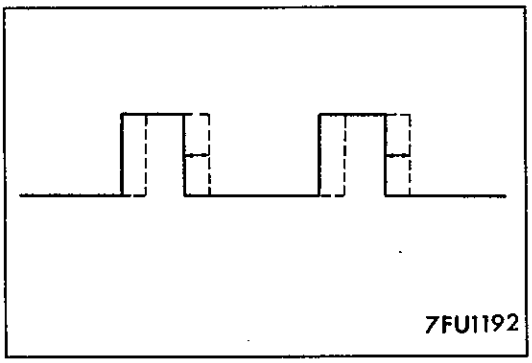
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Rectangular wave pattern is output even when the engine is not started.



- Example 2

Cause of problem

Loose timing belt

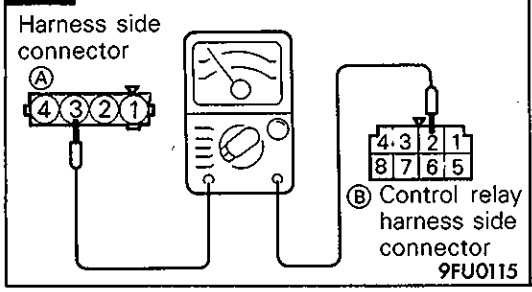
Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.

HARNESS INSPECTION

1



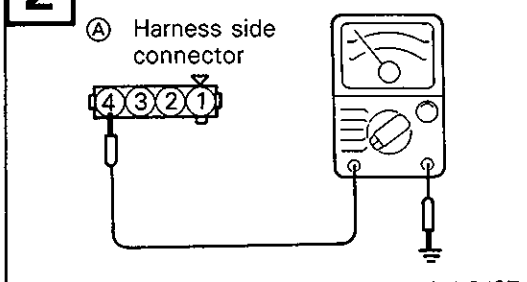
Check for continuity between top dead centre sensor and control relay.
- Top dead centre sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ3 – Ⓑ2)

2

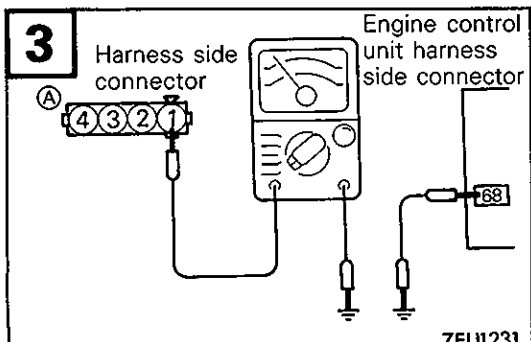


Check for continuity of the earth circuit.
- Top dead centre sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ4 – Earth)

3



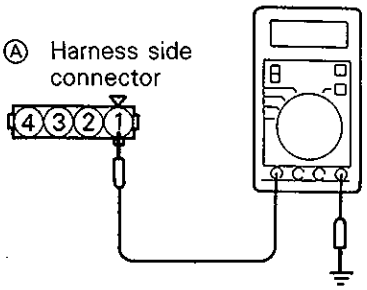
Check for open-circuit or short-circuit to earth, between top dead centre sensor and engine control unit.
- Engine control unit connector: Disconnected
- Top dead centre sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ1 – 68)

4

Ⓐ Harness side connector



7FU0498

Measure the impressed voltage.

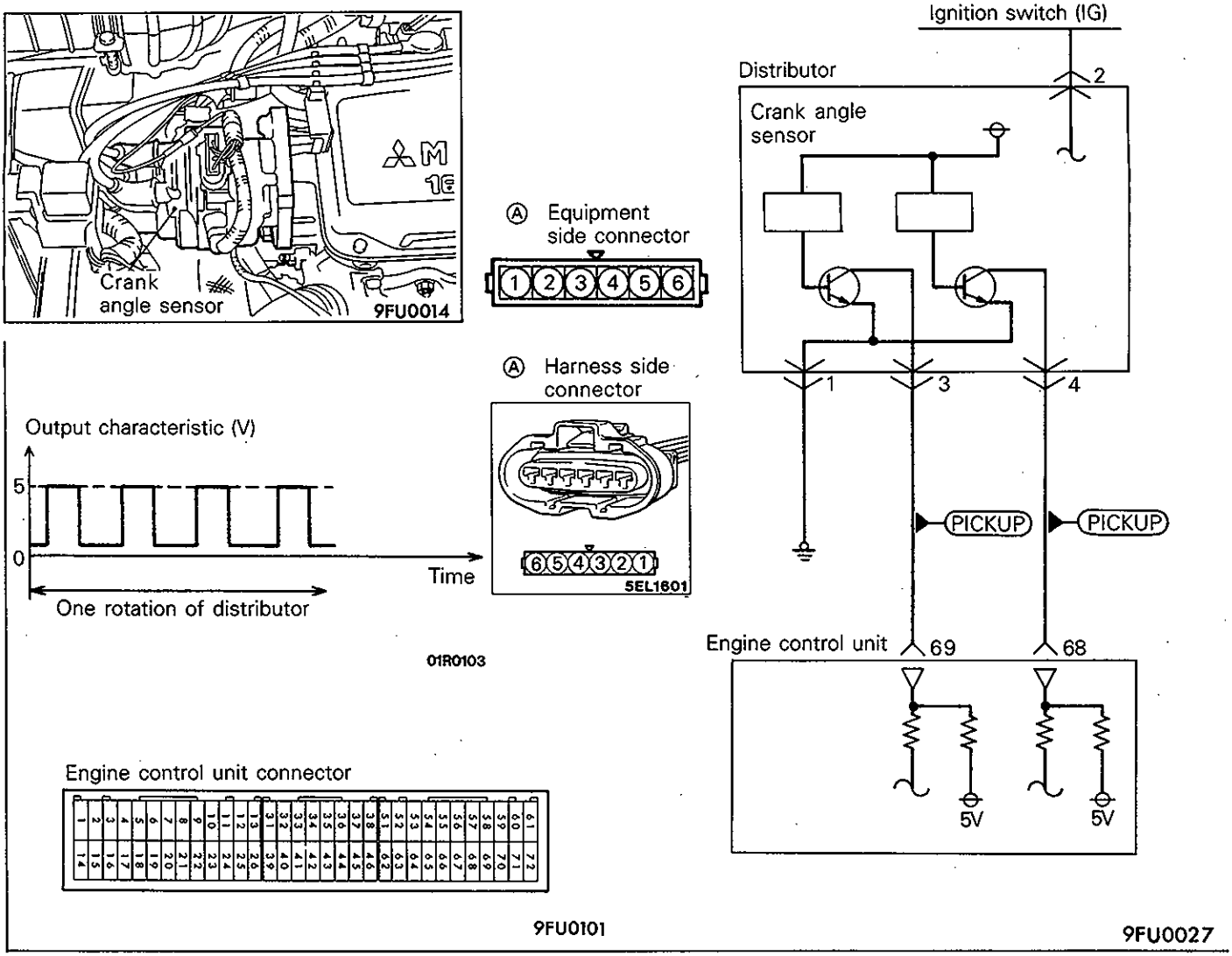
- Top dead centre sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → STOP

NOT OK → Replace the engine control unit.

CRANK ANGLE SENSOR <SOHC, built up to September, 1993>



OPERATION

- The crank angle sensor detects the crank angle (piston position) of each cylinder, converts it to a pulse signal and inputs it to the engine control unit. The engine control unit computes the engine speed and the intake air amount for one stroke and outputs the injector drive signal and injection command signal based on this signal.
- Power to the crank angle sensor is supplied from the ignition switch (IG), and the earth is located in the body. A 5V voltage is applied from the engine control unit to the crank angle sensor output terminal, and the crank angle sensor generates a pulse signal as it switches from OPEN to SHORT (power transistor inside the sensor switches ON/OFF) between the output terminal and the earth.

TROUBLESHOOTING HINTS

Hint 1: If unexpected shocks are felt during driving or the engine stalls suddenly during idling, shake the crank angle sensor harness. If this causes the engine to stall, poor contact of the sensor connector is suspected.

Hint 2: If the crank angle sensor outputs a pulse signal when the ignition switch is turned to ON, (without starting the engine), the crank angle sensor or engine control unit is probably defective.

Hint 3: If the tachometer reads 0 r/min. when the engine that has failed to start is cranked, faulty crank angle sensor or broken timing belt is suspected.

Hint 4: If the tachometer reads 0 r/min. when the engine that has failed to start is cranked, the primary current of the ignition coil is not turned on and off. Therefore, troubles in the ignition circuit and ignition coil or faulty power transistor is suspected.

Hint 5: If the engine can be run at idle even though the crank angle sensor reading is out of specification, troubles are often in other than the crank angle sensor.
[Examples]
(1)Faulty coolant temperature sensor
(2)Faulty idle speed control servo
(3)Poorly adjusted basic idle speed

INSPECTON

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Cranking speed	• Engine cranking • Tachometer connected (check on and off of primary current of ignition coil by tachometer)	Compare cranking speed and multi-use tester reading	Indicated speed to agree

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Idle speed	• Engine: Idling • Idle position switch: ON	–20°C (–4°F)	1,380–1,580 r/min.
				–0°C (32°F)	1,330–1,530 r/min.
				20°C (68°F)	1,250–1,450 r/min.
				40°C (104°F)	1,000–1,200 r/min.
				80°C (176°F)	700–900 r/min.

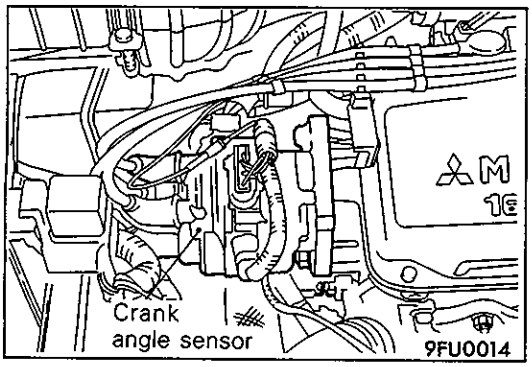
Wave Pattern Inspection Using an Analyzer

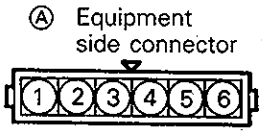
(Refer to P. 13-54.)

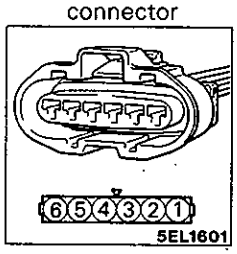
HARNESS INSPECTION

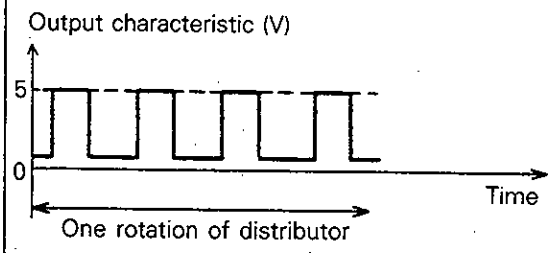
Refer to P. 13-59.

CRANK ANGLE SENSOR <SOHC, built from October, 1993>

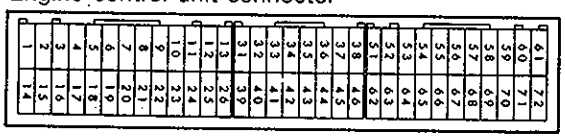




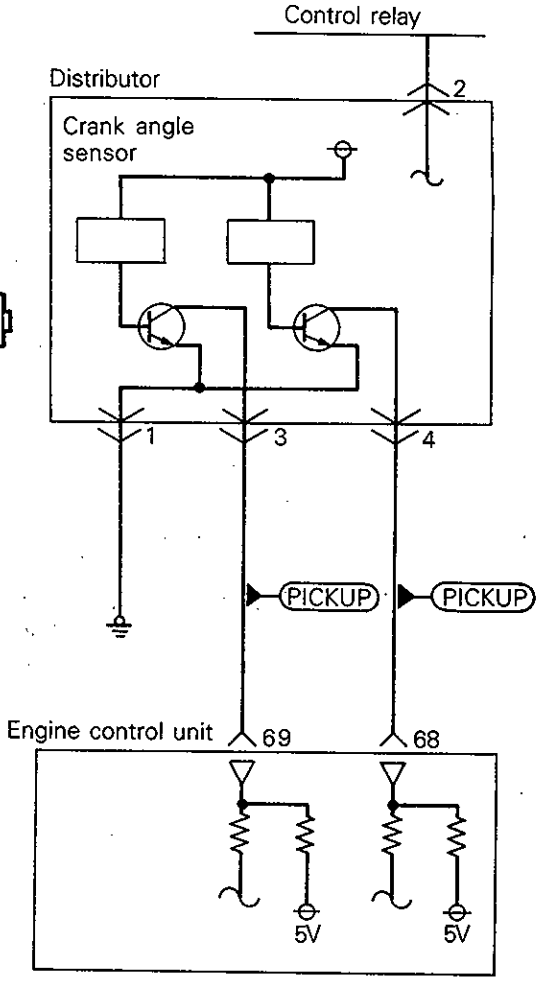




01R0103



9FU0101



9FU0027

OPERATION

- The crank angle sensor detects the crank angle (piston position) of each cylinder, converts it to a pulse signal and inputs it to the engine control unit. The engine control unit computes the engine speed and the intake air amount for one stroke and outputs the injector drive signal and injection command signal based on this signal.
- Power to the crank angle sensor is supplied from the control relay, and the earth is located in the body. A 5V voltage is applied from the engine control unit to the crank angle sensor output terminal, and the crank angle sensor generates a pulse signal as it switches from OPEN to SHORT (power transistor inside the sensor switches ON/OFF) between the output terminal and the earth.

TROUBLESHOOTING HINTS

Refer to P.13-144.

INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Cranking speed	• Engine cranking • Tachometer connected (check on and off of primary current of ignition coil by tachometer)	Compare cranking speed with MUT-II reading	Indicated speed to agree

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Idle speed	• Engine: Idling • Idle position switch: ON	–20°C (–4°F)	1,380–1,580 r/min.*1 1,450–1,650 r/min.*2
				–0°C (32°F)	1,330–1,530 r/min.*1 1,350–1,550 r/min.*2
				20°C (68°F)	1,250–1,450 r/min.*1 1,300–1,500 r/min.*2
				40°C (104°F)	1,000–1,200 r/min.*1 1,100–1,300 r/min.*2
				80°C (176°F)	700–900 r/min.*1 600–800 r/min.*2

NOTE
*1: <Except MVV>
*2: <MVV>

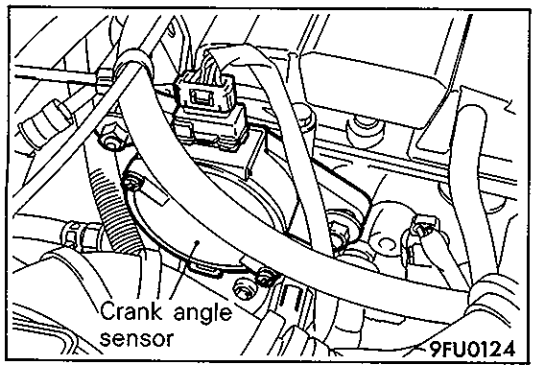
Wave Pattern Inspection Using an Analyzer

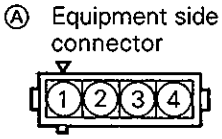
(Refer to P. 13-54.)

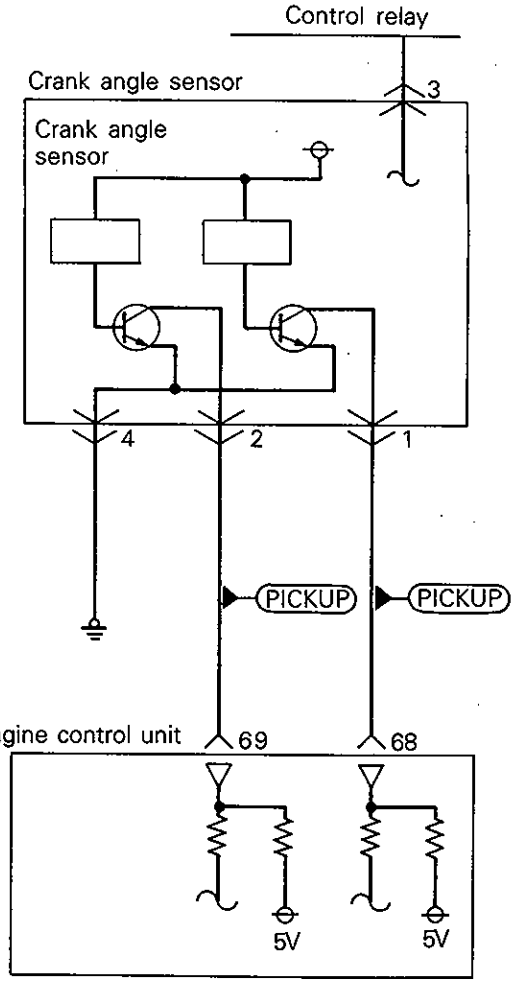
HARNESS INSPECTION

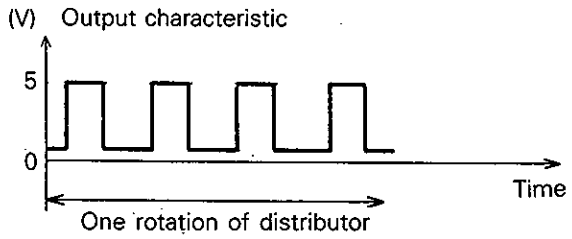
Refer to P. 13-59-2.

CRANK ANGLE SENSOR <DOHC>



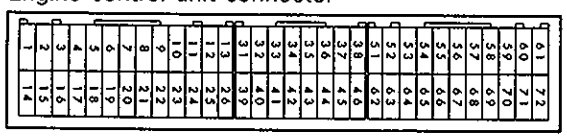






01R0103

Engine control unit connector



9FU0101

9FU0205

OPERATION

- The crank angle sensor detects the crank angle (piston position) of each cylinder, converts it to a pulse signal and inputs it to the engine control unit. The engine control unit computes the engine speed and the intake air amount for one stroke and outputs the injector drive signal and injection command signal based on this signal.
- Power to the crank angle sensor is supplied from the control relay, and the earth is located in the body. A 5V voltage is applied from the engine control unit to the crank angle sensor output terminal, and the crank angle sensor generates a pulse signal as it switches from OPEN to SHORT (power transistor inside the sensor switches ON/OFF) between the output terminal and the earth.

TROUBLESHOOTING HINTS

Hint 1: If unexpected shocks are felt during driving or the engine stalls suddenly during idling, shake the crank angle sensor harness. If this causes the engine to stall, poor contact of the sensor connector is suspected.

Hint 2: If the crank angle sensor outputs a pulse signal when the ignition switch is turned to ON, (without starting the engine), the crank angle sensor or engine control unit is probably defective.

Hint 3: If the tachometer reads 0 r/min. when the engine that has failed to start is cranked, faulty crank angle sensor or broken timing belt is suspected.

Hint 4: If the tachometer reads 0 r/min. when the engine that has failed to start is cranked, the primary current of the ignition coil is not turned on and off. Therefore, troubles in the ignition circuit and ignition coil or faulty power transistor is suspected.

Hint 5: If the engine can be run at idle even though the crank angle sensor reading is out of specification, troubles are often in other than the crank angle sensor.
[Examples]
(1)Faulty coolant temperature sensor
(2)Faulty idle speed control servo
(3)Poorly adjusted basic idle speed

INSPECTON

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Cranking speed	• Engine cranking • Tachometer connected (check on and off of primary current of ignition coil by tachometer)	Compare cranking speed and multi-use tester reading	Indicated speed to agree

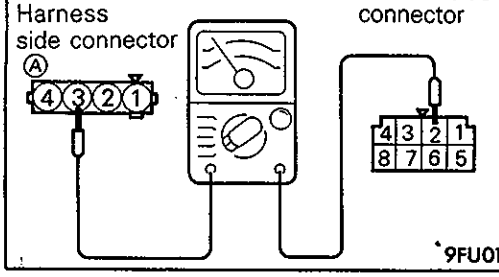
Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Idle speed	• Engine: Idling • Idle position switch: ON	–20°C (–4°F)	1,380–1,580 r/min.
				0°C (32°F)	1,330–1,530 r/min.
				20°C (68°F)	1,250–1,450 r/min.
				40°C (104°F)	1,000–1,200 r/min.
				80°C (176°F)	700–900 r/min.

Wave Pattern Inspection Using an Analyzer

(Refer to P. 13-54.)

HARNESS INSPECTION

1



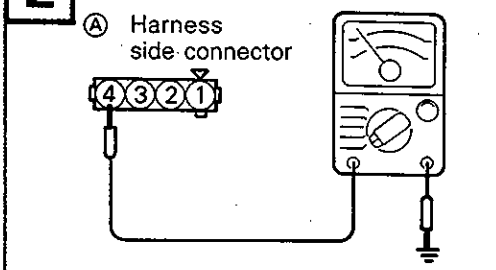
Check for continuity between crank angle sensor and control relay.
- Crank angle sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ3 – Ⓑ2)

2

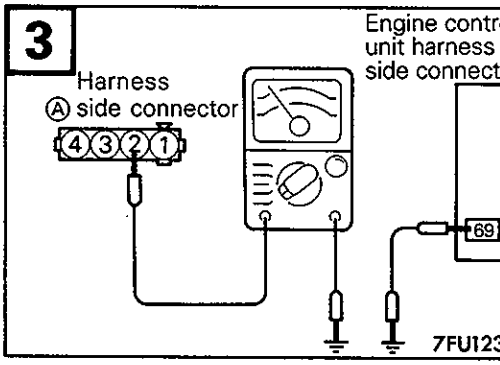


Check for continuity of the earth circuit.
- Crank angle sensor connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ4 – Earth)

3

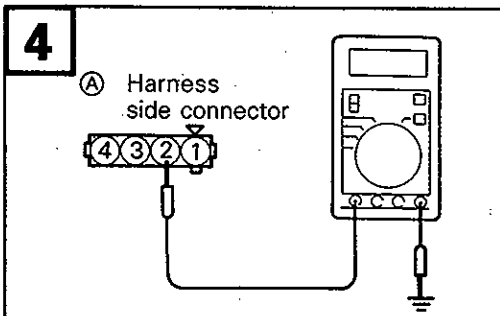


Check for open-circuit or short-circuit to earth, between top dead centre sensor and engine control unit.
- Engine control unit connector: Disconnected
- Crank angle sensor connector: Disconnected

OK → 4

NO → Repair the harness. (Ⓐ2 – 69)

4



Measure the impressed voltage.
- Crank angle sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

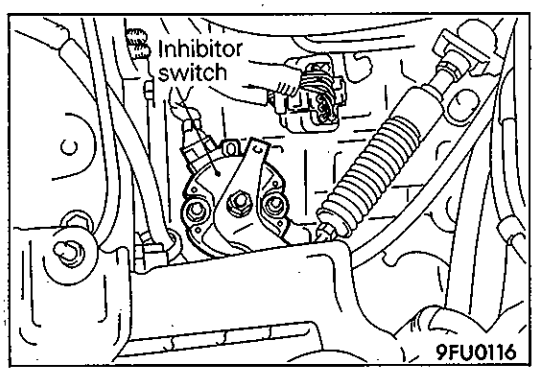
OK → STOP

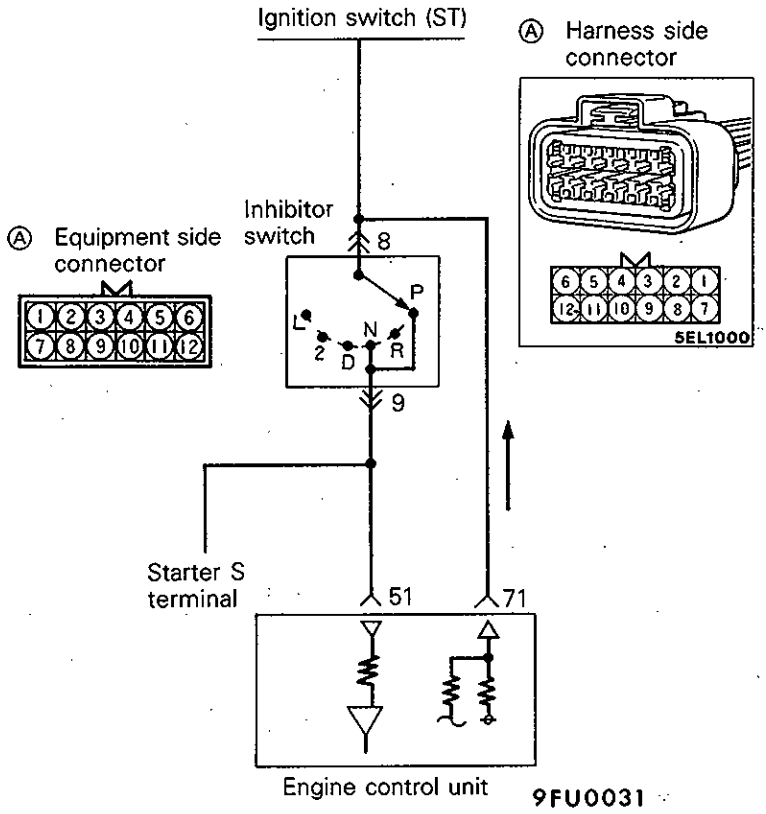
NO → Replace the engine control unit.

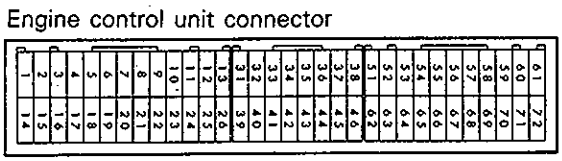
IGNITION SWITCH-ST <M/T>

Refer to P. 13-60.

IGNITION SWITCH-ST AND INHIBITOR SWITCH <A/T, built up to May, 1992>







OPERATION

- The ignition switch-ST inputs a high signal to the engine control unit while the engine is cranking. The engine control unit provides fuel injection control, etc., at engine start up based on this signal.
- When the ignition switch is set to START, the battery voltage at cranking is applied through the ignition switch and inhibitor switch to the engine control unit, which detects that the engine is cranking. In case the selector lever is in a position other than the P/N range, the battery voltage is not applied to the engine control unit.
- The inhibitor switch converts the selector lever position (whether it is at the P/N range or at others) into high/low voltage and inputs it to the engine control unit, which then controls the idle speed control servo based on this signal.
- The battery voltage in the engine control unit is applied through a resistor to the inhibitor switch. When the selector lever is set to the P/N range, continuity is produced between the inhibitor switch terminal of the engine control unit and earth through the starter motor, thereby making the terminal voltage go low.

TROUBLESHOOTING HINTS

If the inhibitor switch harness and individual part check have resulted normal but the inhibitor switch output is abnormal, poorly adjusted control cable is suspected.

INSPECTION

Using MUT or MUT-II

IGNITION SWITCH-ST

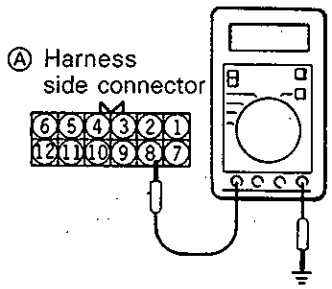
Function	Item No.	Data display	Check condition	Engine	Normal indication
Data reading	18	Switch state	Ignition switch: ON	Stop	OFF
				Cranking	ON

INHIBITOR SWITCH

Function	Item No.	Data display	Check condition	Select lever position	Normal indication
Data reading	29	Shift position	Ignition switch: ON	P or N	P or N
				D, 2, L or R	D, 2, L or R

HARNESS INSPECTION

1



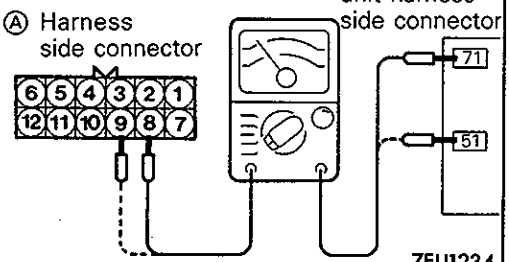
Measure the power supply voltage of the inhibitor switch.
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected
- Ignition switch: START

Voltage (V)
SV

OK → 2

NO → Check the power supply circuit.

2



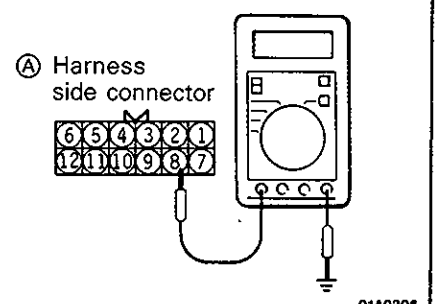
Check for continuity between inhibitor switch and engine control unit.
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness

OK → 3

NO → Repair the harness. (Ⓐ 8 – 71) (Ⓐ 9 – 51)

3



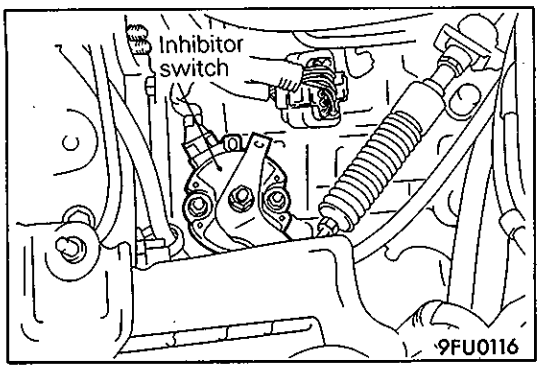
Measure the impressed voltage to inhibitor switch terminal.
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Connected
- Ignition switch: ON

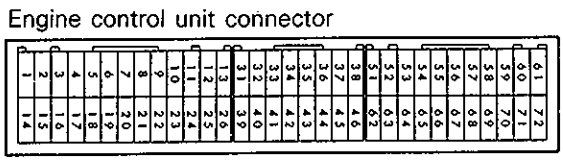
Voltage (V)
SV

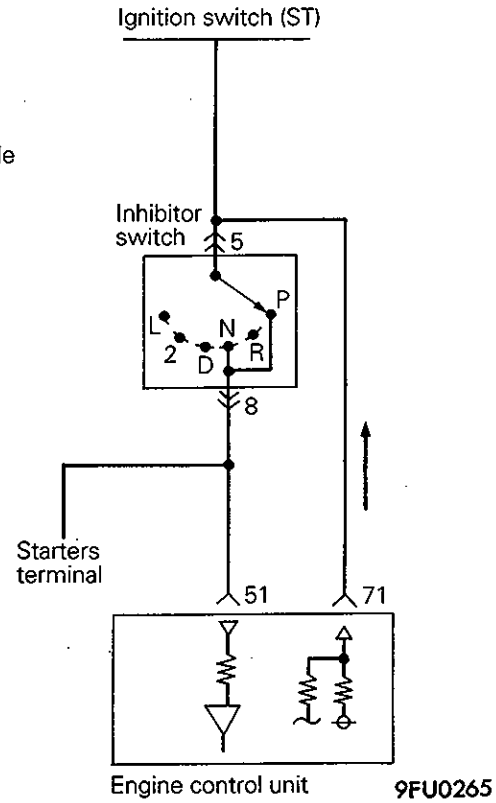
OK → STOP

NO → Replace the engine control unit.

IGNITION SWITCH-ST AND INHIBITOR SWITCH <A/T, built from June, 1992>







OPERATION

TROUBLESHOOTING HINTS

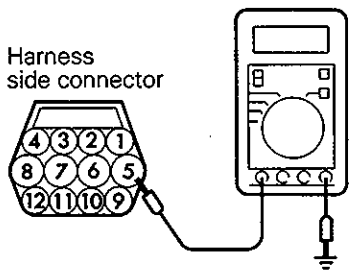
INSPECTION

Using MUT or MUT-II

Refer to P. 13-148.

HARNESS INSPECTION

1



Measure the power supply voltage of the inhibitor switch.

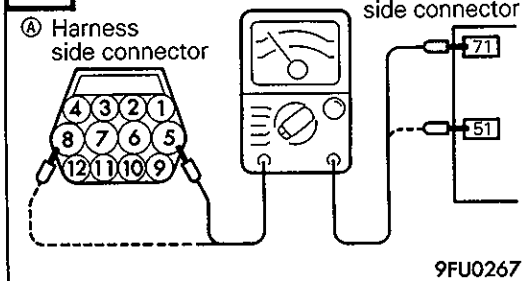
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected
- Ignition switch: START

Voltage (V)
SV

OK → **2**

NG → Check the power supply circuit.

2



Check for continuity between inhibitor switch and engine control unit.

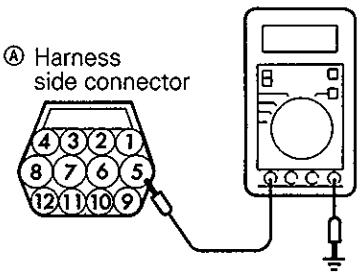
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness

OK → **3**

NG → Repair the harness.
(Ⓐ 5 – 71)
(Ⓐ 8 – 51)

3



9FU0266

Measure the impressed voltage to inhibitor switch terminal.

- Engine control unit connector: Disconnected
- Inhibitor switch connector: Connected
- Ignition switch: ON

Voltage (V)
5V

OK → STOP

NG → Replace the engine control unit.

VEHICLE SPEED SENSOR

Refer to P. 13-61.

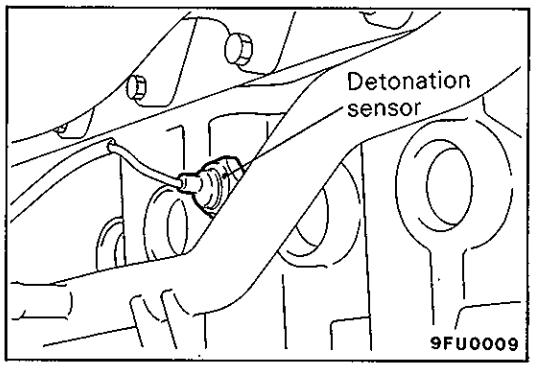
POWER STEERING FLUID PRESSURE SWITCH

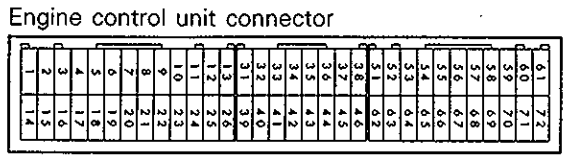
Refer to P. 13-63.

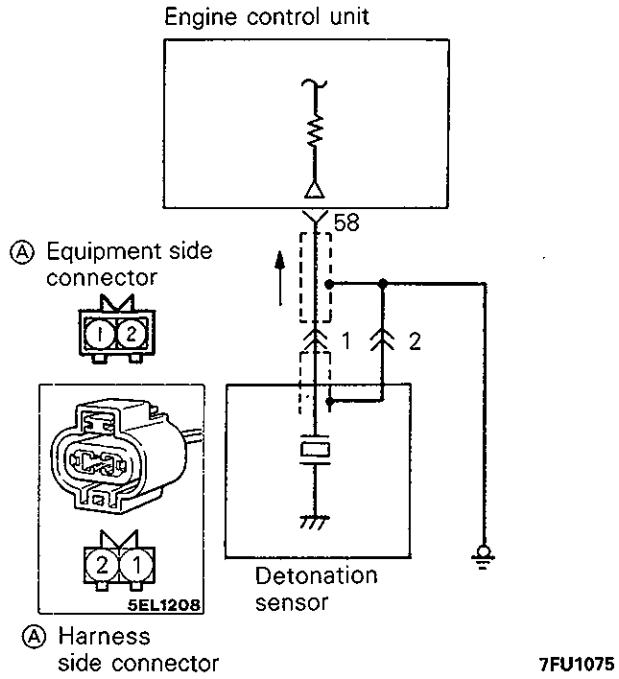
AIR CONDITIONER SWITCH AND POWER RELAY

Refer to P. 13-65.

DETONATION SENSOR







OPERATION

- The detonation sensor converts cylinder block vibration caused by detonation into a voltage that is proportional to intensity of vibration and inputs it to the engine control unit, which then provides delay control of the ignition timing based on this signal.

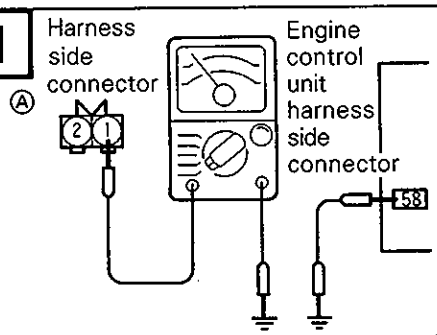
TOUBLESHOOTING HINTS

If detonation is caused while driving with high load, following as well as the detonation sensor may be responsible.

(1) Incorrect heating value of the spark plug
(2) Use of inadequate fuel
(3) Poorly adjusted reference ignition timing

HARNESS INSPECTION

1



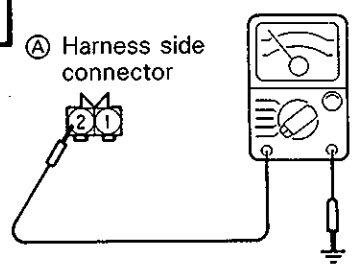
Check for open-circuit, or short-circuit to earth, between detonation sensor and engine control unit.

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

OK → 2

NG → Repair the harness. (Ⓐ1 – 58)

2



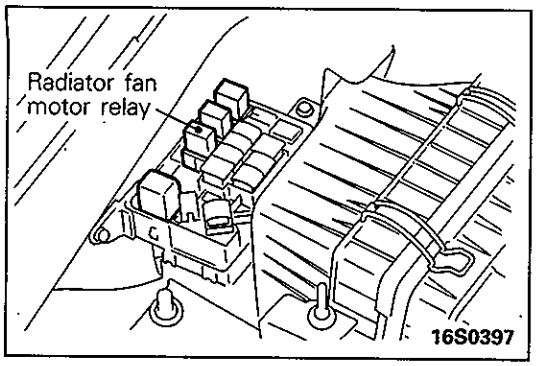
Check for continuity of the earth circuit.

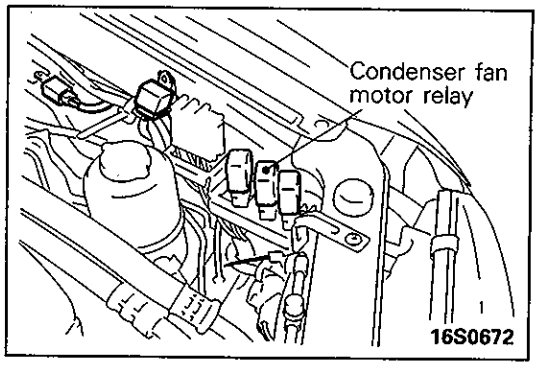
- Detonation sensor connector: Disconnected

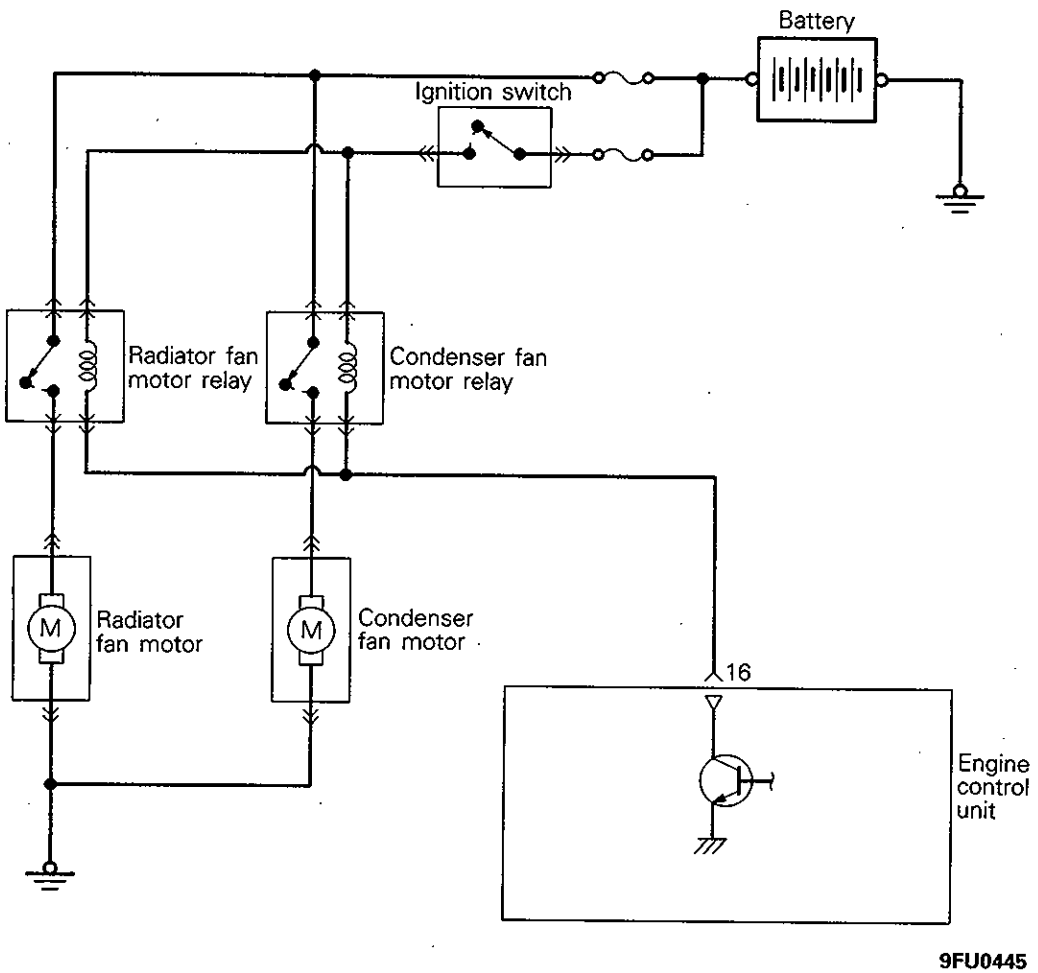
OK → STOP

NG → Repair the harness. (Ⓐ2 – Earth)

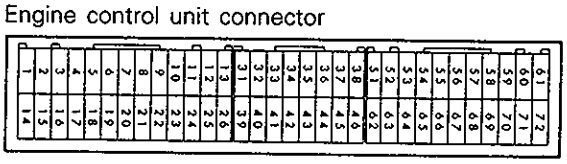
FAN MOTOR RELAY (RADIATOR FAN, CONDENSER FAN) <Vehicles built from October, 1993>







Engine control unit connector



OPERATION

- The engine control unit controls the operation speed of the radiator fan motor and condenser fan motor in accordance with the engine coolant temperature and vehicle speed by controlling the power transistor (for radiator fan control and condenser fan control) inside the engine control unit.
- When the engine control unit turns the power transistor for fan control inside the engine control unit ON, current is supplied from the ignition switch to the engine control unit via the fan motor relay coil.

  When current flows to the fan motor relay coil, the relay switch turns ON, and the motor drive voltage is supplied from the battery to the fan motor via the relay switch.
- When the A/C switch is ON, the radiator fan motor and condenser fan motor will both operate irrespective of the vehicle speed and the engine coolant temperature.

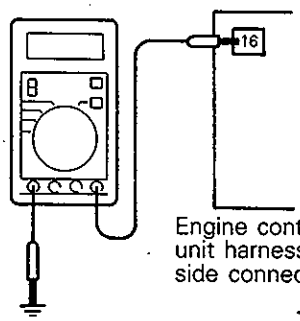
INSPECTION

Using MUT-II

Function	Item No.	Check content	Check condition	Normal state
Actuator test	21	Drive the condenser fan motor and the radiator fan motor	• Ignition switch: ON • A/C switch: ON	The condenser fan motor and radiator fan motor turn.

HARNESS INSPECTION

1



Measure the input voltage to the engine control unit
- Engine control unit connector: Disconnected
- Ignition switch: ON
- A/C switch: ON

Voltage (V)
5V

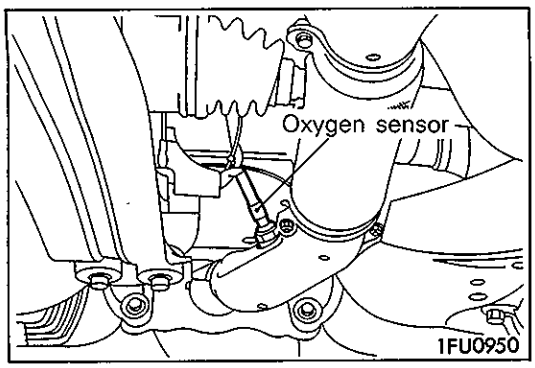
OK → STOP

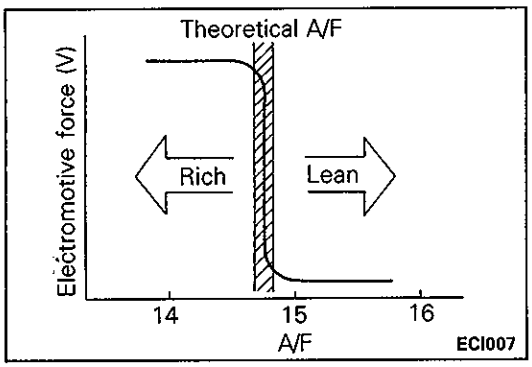
NG → Check the fan motor relay circuit

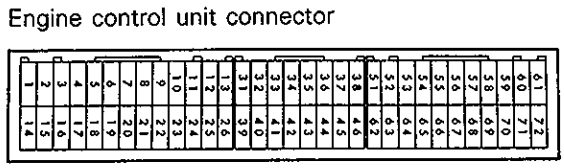
FAN MOTOR RELAY INSPECTION

Refer to GROUP 14 – Radiator and GROUP 55 – Service Adjustment Procedures.

OXYGEN SENSOR

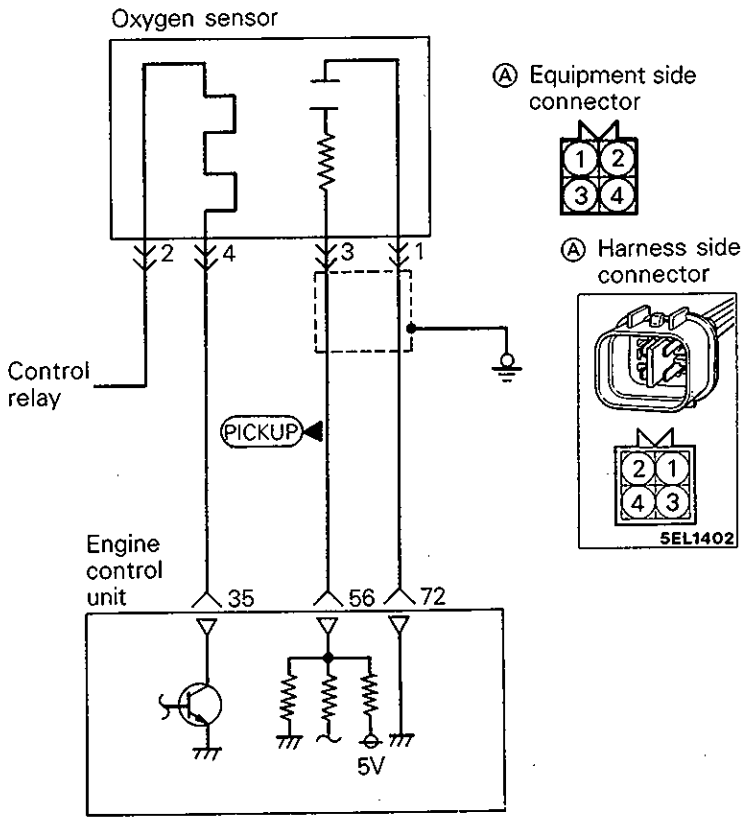






Engine control unit connector

9FU0101



OPERATION

- The oxygen sensor functions to detect the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the engine control unit.
- If the air/fuel mixture ratio is richer than the theoretical air/fuel mixture ratio (i.e., if the concentration of oxygen in the exhaust gas is sparse), a voltage of approximately 1V is output; if the air/fuel mixture ratio in leaner than the theoretical air/fuel mixture ratio (i.e., if the concentration is dense), a voltage of approximately 0V is output.
- The engine control unit, based upon those signals, regulates the amount of fuel injection so that the air/fuel mixture ratio becomes the theoretical air/fuel mixture ratio.
- Battery power supply is applied, by way of the control relay, to the oxygen sensor heater. As a result, the sensor element is heated by the heater, so that the oxygen sensor shows excellent response even if the temperature of the exhaust gas is low.

TROUBLESHOOTING HINTS

Hint 1:
The exhaust gas purification performance will worsen if there is a malfunction of the oxygen sensor.
Hint 2:
If the oxygen sensor output voltage deviates from the standard value even though the results of the checking of the oxygen sensor are normal, the cause is probably a malfunction of a component related to air/fuel mixture ratio control.

[Examples]
(1) Malfunction of an injector.
(2) Air leakage into the intake manifold from a leaking gasket.
(3) Malfunction of the air-flow sensor, the intake air temperature sensor, the barometric-pressure sensor, or the coolant temperature sensor.

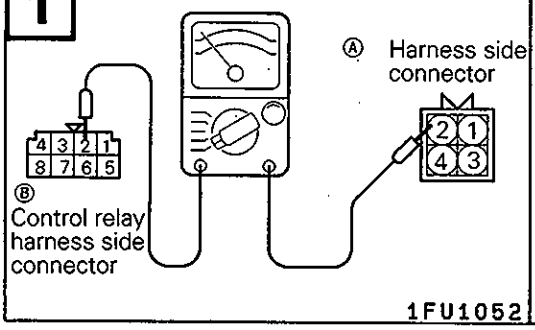
INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Select lever position	Standard value
Data reading	11	Sensor voltage	Engine: Warm-up (make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 r/min.	200 mV or lower
				When engine is suddenly raced	600–1,000 mV
			Engine: Warm-up (using the oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control unit)	800 r/min. (Idle)	400 mV or lower (changes) 600–1,000 mV
				2,000 r/min.	

HARNESS INSPECTION

1



Check for continuity between oxygen sensor and control relay.
- Oxygen sensor connector: Disconnected
- Control relay connector: Disconnected

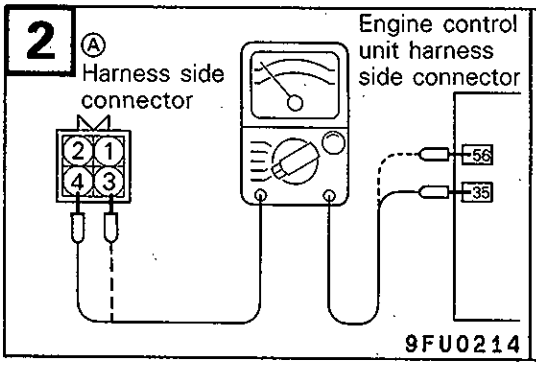
NOTE

Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ2 – Ⓑ2)

2

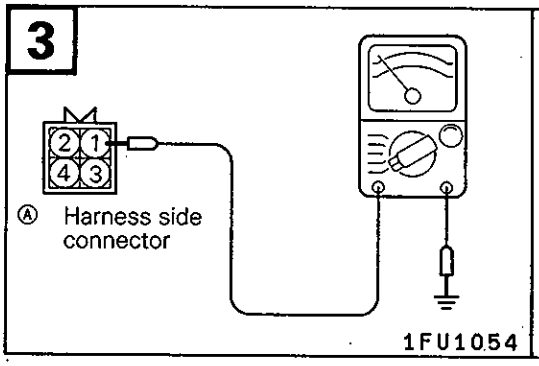


Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the oxygen sensor.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ3 – 56) (Ⓐ4 – 35)

3



Check for continuity of the earth circuit.
- Oxygen sensor connector: Disconnected

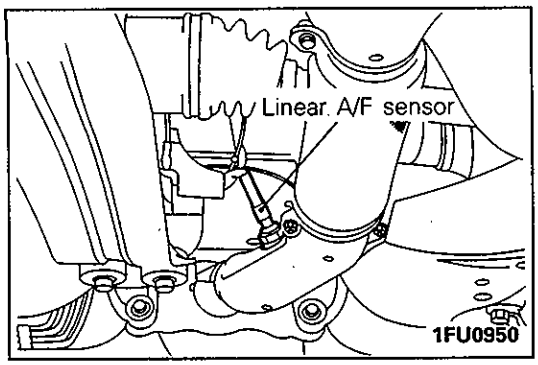
OK → STOP

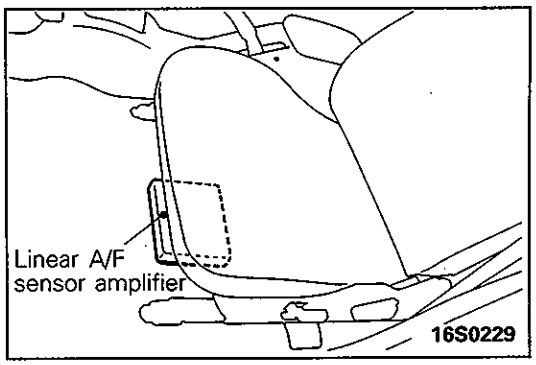
NO → Repair the harness. (Ⓐ1 – 72)

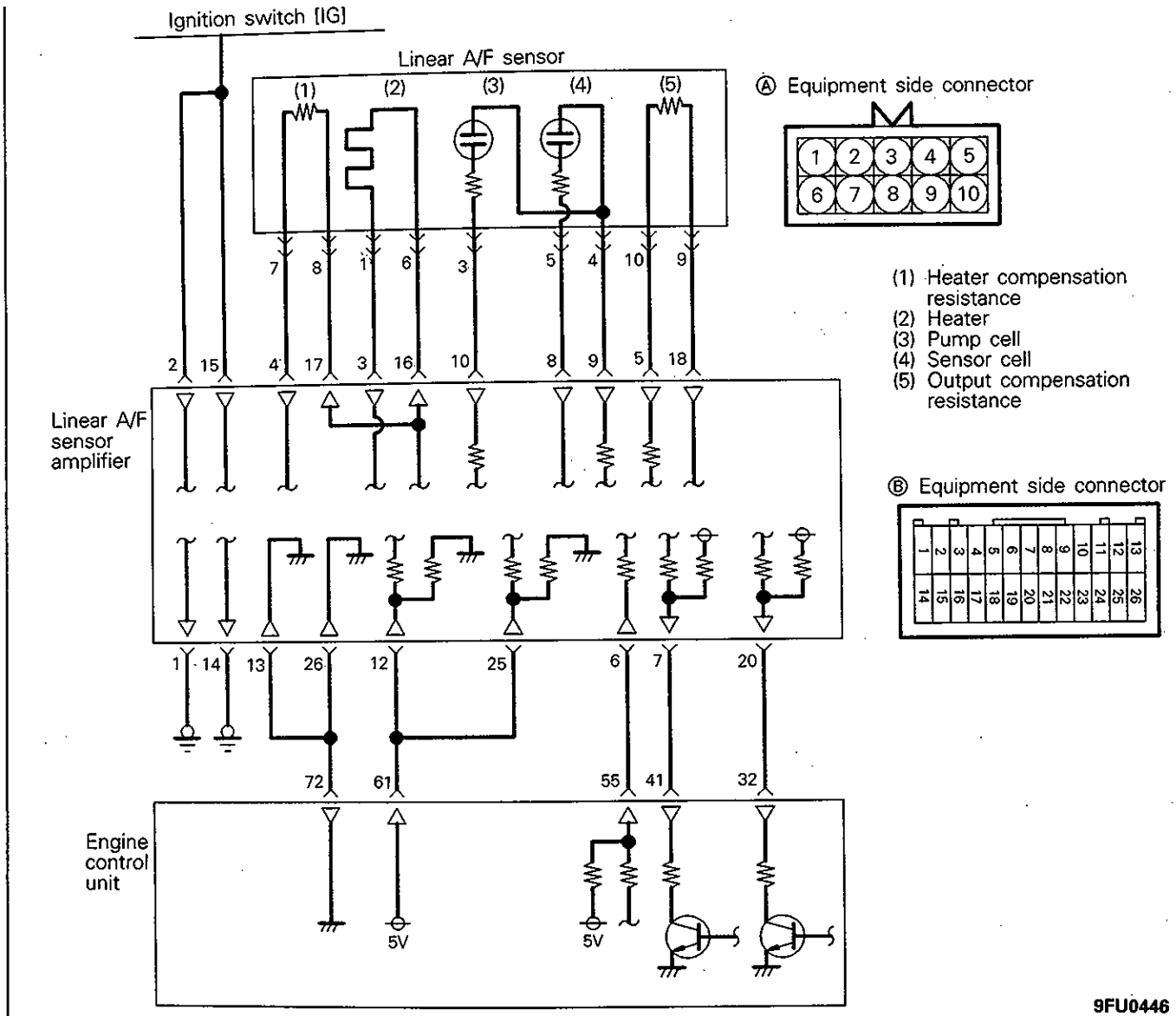
SENSOR INSPECTION

Refer to P. 13-69.

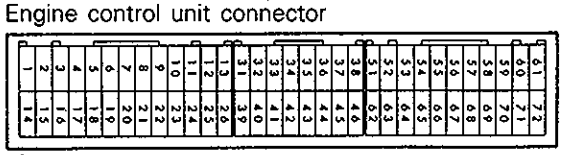
LINEAR A/F SENSOR <SOHC-MVV>







Engine control unit connector



OPERATION

- The linear A/F sensor converts the concentration of oxygen (air/fuel mixture ratio) in the exhaust gas to a current and outputs this current to the linear A/F sensor amplifier.
- The linear A/F sensor amplifier converts the current received from the linear A/F sensor into a voltage and at the same time amplifies it, and then outputs the resulting voltage to the engine control unit.
- The linear A/F sensor has the heater to improve the responsiveness and reliability of the sensor signal.

TROUBLESHOOTING HINTS

Hint 1: If there is a malfunction of the linear A/F sensor, the fuel consumption will become poor and the purification level of the exhaust gas will drop.

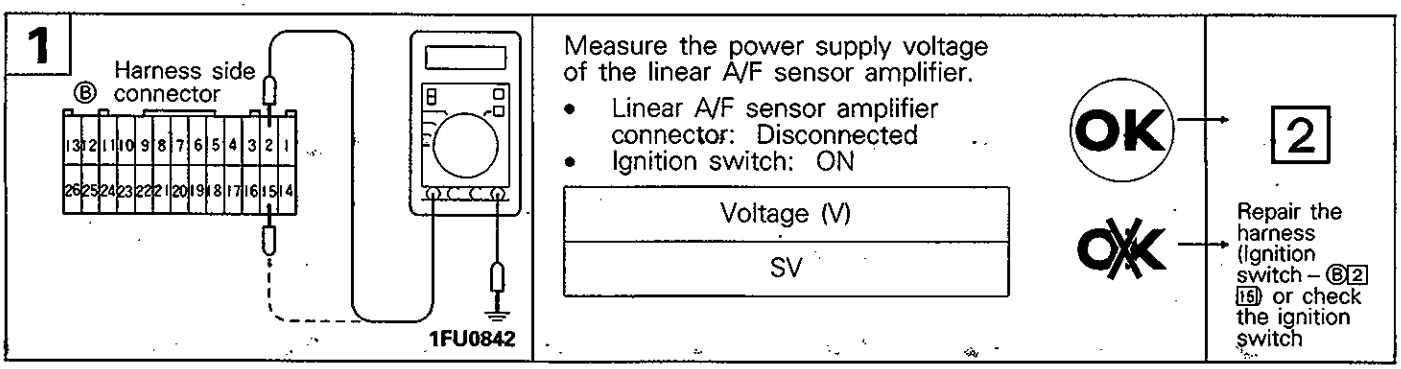
Hint 2: If the output voltage of the linear A/F sensor is not at the standard value, the cause may be a problem in one of the parts related to the air/fuel mixture ratio control system, in addition to being a problem with the linear A/F sensor.
Example of problem:
(1) Malfunction of injector
(2) Air being drawn into the intake manifold due to a leaking gasket, etc.
(3) Malfunction of air flow sensor, intake air temperature sensor, barometric pressure sensor or engine coolant temperature sensor

INSPECTION

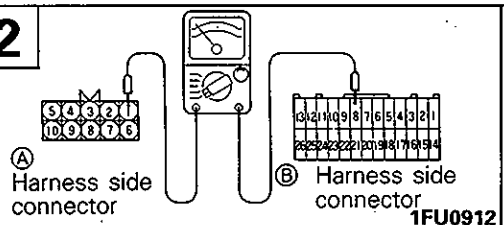
Using MUT-II

Function	Item No.	Data display	Check condition	Engine condition	Standard value
Data reading	63	Sensor voltage	Engine: Warm-up (make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 r/min.	4,000 mV or higher
				When engine is suddenly raced	2,000 mV or lower
			Engine: Warm-up (using the linear A/F sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control unit)	700 r/min. (Idle)	2,700–3,300 mV
				2,000 r/min.	2,100–2,700 mV

HARNESS INSPECTION



2



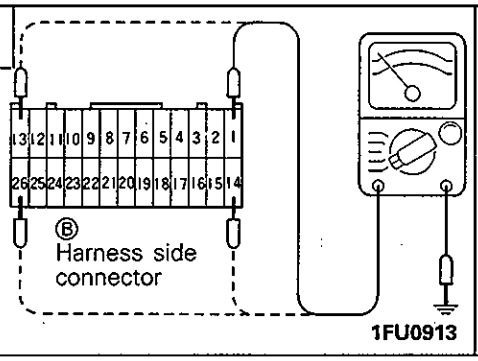
Checking terminal
Ⓐ5 – Ⓑ8
Ⓐ4 – Ⓑ9
Ⓐ3 – Ⓑ10
Ⓐ1 – Ⓑ3
Ⓐ10 – Ⓑ5
Ⓐ9 – Ⓑ18
Ⓐ8 – Ⓑ17
Ⓐ7 – Ⓑ4
Ⓐ6 – Ⓑ16

Check for open-circuit or short-circuit between linear A/F sensor and linear A/F sensor amplifier.
- Linear A/F sensor connector: Disconnected
- Linear A/F sensor amplifier connector: Disconnected

OK → 3

NG → Repair the harness. (Refer to the table at left)

3

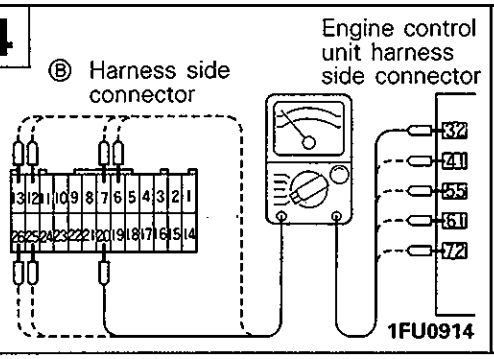


Check for continuity of the earth circuit.
- Linear A/F sensor amplifier connector: Disconnected

OK → 4

NG → Repair the harness.
Ⓑ1 – Earth
Ⓑ14 – Earth
Ⓑ13 26 – 72

4

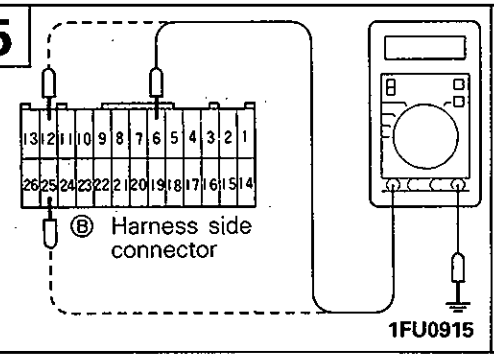


Check for open-circuit or short-circuit between linear A/F sensor amplifier and engine control unit.
- Linear A/F sensor amplifier connector: Disconnected
- Engine control unit connector: Disconnected

OK → 5

NG → Repair the harness.
Ⓑ20 – 32
Ⓑ7 – 41
Ⓑ6 – 55
Ⓑ12 25 – 61
Ⓑ13 26 – 72

5

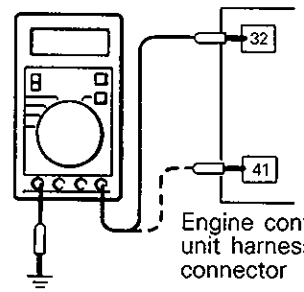


Measure the impressed voltage of the linear A/F sensor amplifier.
- Linear A/F sensor amplifier connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.2–5.2

OK → 6

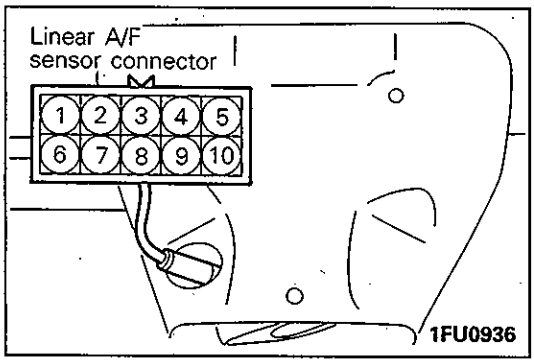
NG → Replace the engine control unit.

6			
	Measure the impressed voltage of the engine control unit. • Linear A/F sensor amplifier connector: Connected • Engine control unit connector: Disconnected • Ignition switch: ON Voltage (V): 6 or higher	OK → STOP NO → Replace the linear A/F sensor amplifier.	

LINEAR A/F SENSOR INSPECTION

(1) Check the output voltage of the linear A/F sensor.
Check using MUT-II (refer to P.13-153-2) or measure the voltage at the engine control unit terminal (No. 55) (refer to P.13-171).

(2) If the output voltage of the linear A/F sensor is not at the standard value, carry out the following check.
1. Check the harness (refer to P.13-171) to confirm that the harness is normal.
2. Disconnect the linear A/F sensor connector.
3. Check for continuity between the linear A/F sensor terminals.

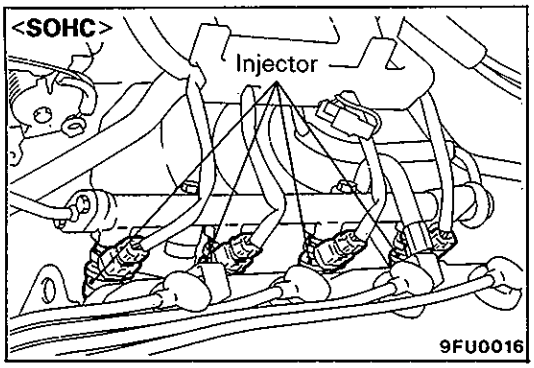


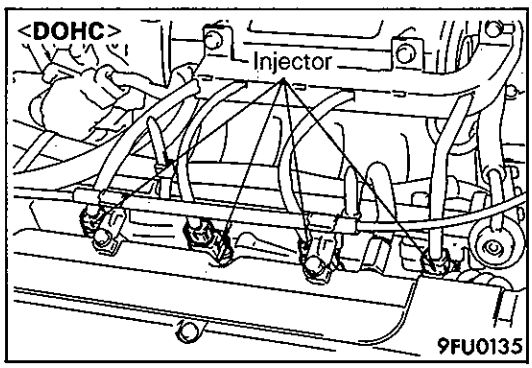
Measurement terminals	Continuity
(1)–(6)	Continuity [approx. 3.4 Ω at 20°C (68°F)]
(9)–(10)	Continuity [approx. 0.2 kΩ at 20°C (68°F)]
(7)–(8)	Continuity [approx. 44 kΩ at 20°C (68°F)]

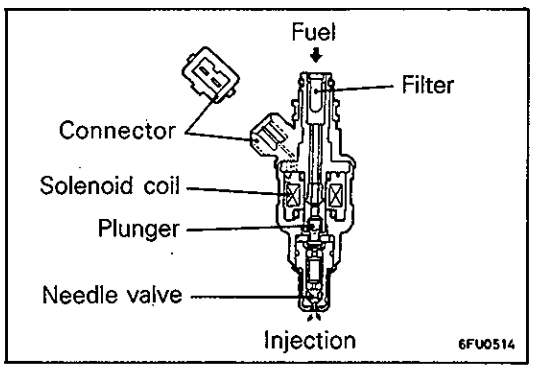
4. If there is an abnormality in the continuity measurements, replace the linear A/F sensor.
5. If the continuity measurements are all normal, replace the linear A/F sensor amplifier and then check the output voltage of the linear A/F sensor again.
6. Check that the output voltage is normal.
If the output voltage is not at the standard value, replace the linear A/F sensor.

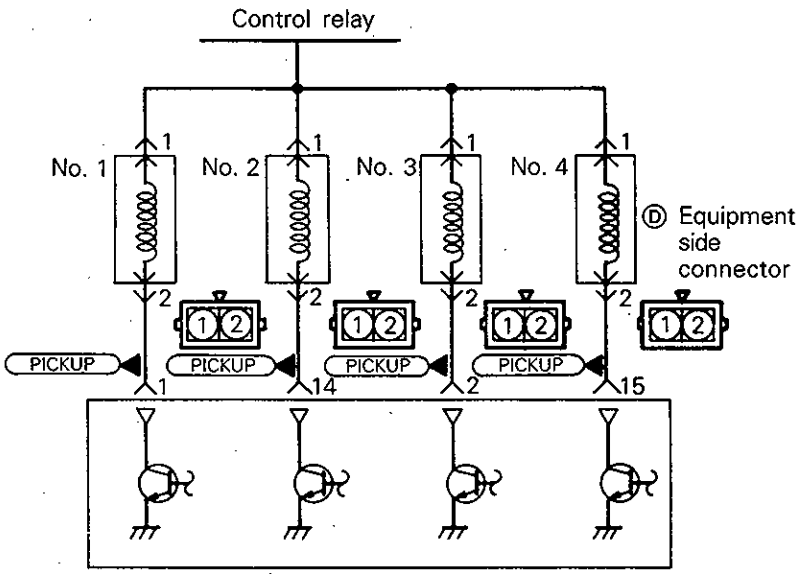
NOTE
In this case, the linear A/F sensor amplifier will be normal, so it can be replaced with the original linear A/F sensor amplifier.

INJECTORS

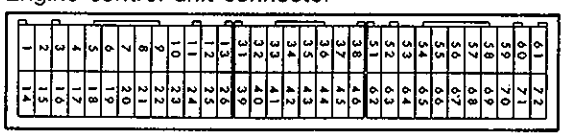








Engine control unit connector



9FU0101

OPERATION

Refer to P. 13-70.

TROUBLESHOOTING HINTS

Refer to P. 13-70.

INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Coolant temperature	Standard value
Data reading	41	Drive time *1	Engine: Cranking	0°C (32°F) *2	20 ms*4 Approx. 34 ms*5 22 ms*6
				20°C (68°F)	38 ms*4 Approx. 36.5 ms*5 46 ms*6
				80°C (176°F)	9.3 ms*4 Approx. 9.0 ms*5 11 ms*6

Function	Item No.	Data display	Check condition	Coolant temperature	Standard value
Data reading	41	Drive time *3	• Coolant temperature: 80 to 95°C (176 to 203°F) • Lamps, electric cooling fan, accessories: OFF • Transmission: Neutral (P range for A/T) • Steering wheel: Neutral	800 r/min.*4, *5 700 r/min.*6 (Idle)	2.0–3.2 ms*4 2.1–3.3 ms*5 1.8–3.0 ms*6
				2,000 r/min.	1.7–2.9 ms*4, *5 1.6–2.8 ms*6
				When sharp racing is made	To increase

NOTE
*1: The injector drive time refers to when the supply voltage is 11V and the cranking speed is less than 250 r/min.
*2: When coolant temperature is lower than 0°C (32°F), injection is made by four cylinders simultaneously.
*3: When the vehicle is new [within initial operation of about 500 km (300 miles)], the injector drive time may be about 10% longer.
*4: <SOHC (Except MVV)>
*5: <DOHC>
*6: <SOHC-MVV>

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	01	No. 1 injector shut off	Engine: Idling after warm-up (Shut off the injectors in sequence during after engine warm-up, check the idling condition)	Idle state to change further (Becoming less stable or stalling)
	02	No. 2 injector shut off		
	03	No. 3 injector shut off		
	04	No. 4 injector shut off		

Wave Pattern Inspection Using an Analyzer

Refer to P. 13-72.

HARNESS INSPECTION

Refer to P. 13-73.

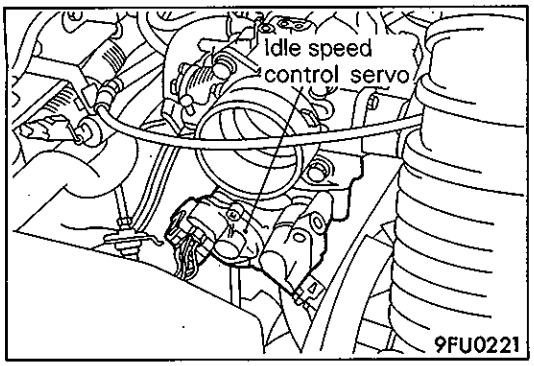
ACTUATOR INSPECTION

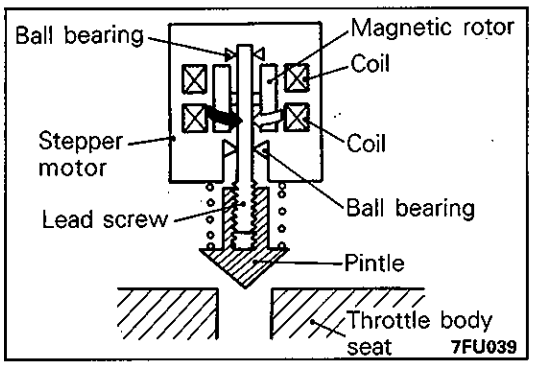
Refer to P. 13-74.

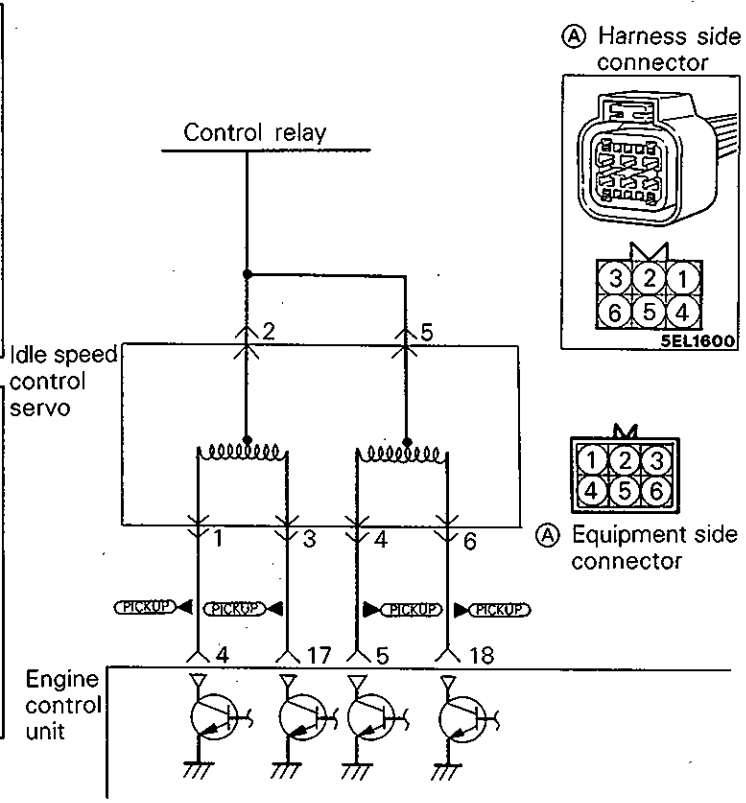
IDLE SPEED CONTROL SERVO (DC MOTOR) <SOHC (Except MVV)>

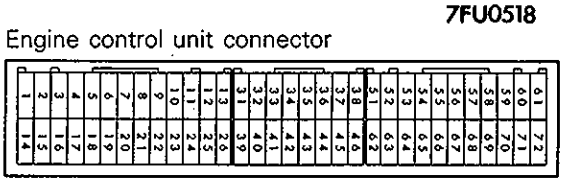
Refer to P. 13-76.

IDLE SPEED CONTROL SERVO (STEPPER MOTOR) <SOHC-MVV, DOHC>









9FU0101

OPERATION

- The intake air volume during idling is controlled by opening or closing the servo valve provided in the air path that bypasses the throttle valve.
- The servo valve is opened or closed by operating the stepper motor in the speed control servo in normal or reverse direction.
- The battery power is supplied to the stepper motor through the control relay. As the engine control unit turns ON power transistors in the unit one after another, the stepper motor coil is energized and the motor rotates in normal or reverse direction.

TROUBLESHOOTING HINTS

Hint 1: If the stepper motor step increases to 100 to 120 steps or decreases to 0 step, faulty stepper motor or open circuit in the harness is suspected.

Hint 2: If the idle speed control servo harness and individual part checks have resulted normal but the stepper motor steps are out of specification, the following faults are suspected.

(1) Poorly adjusted reference idle speed
(2) Deposit on the throttle valve
(3) Air leaking into the intake manifold through gasket gap
(4) Poor combustion in the cylinder (faulty spark plug, ignition coil, injector, low compression pressure, etc.)

INSPECTION

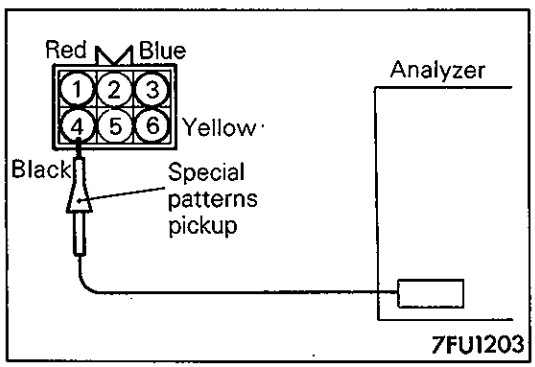
Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Load state	Standard value
Data reading	45	Stepper motor steps	• Coolant temperature: 80 to 95°C (176 to 203°F) • Lamps, electric cooling fan, accessories: OFF • Transmission: Neutral • Idle position switch: ON • Engine: At idle (Compressor clutch to be operating in case air conditioner switch is ON)	Air conditioner switch: OFF	2–25 step
				Air conditioner switch: Turn from OFF to ON	Increase from 10–70 step
				• Air conditioner switch: OFF • Selector lever: Shift to D range	Increase from 5–50 step

NOTE
In a new vehicle [driven approximately 500 km (300 miles) or less], the stepper motor steps sometimes exceeds the standard value by approximately 30 steps.

Caution
When shifting the selector lever to the D range, apply brake to prevent the vehicle from moving forward.

Wave Pattern Inspection Using an Analyzer



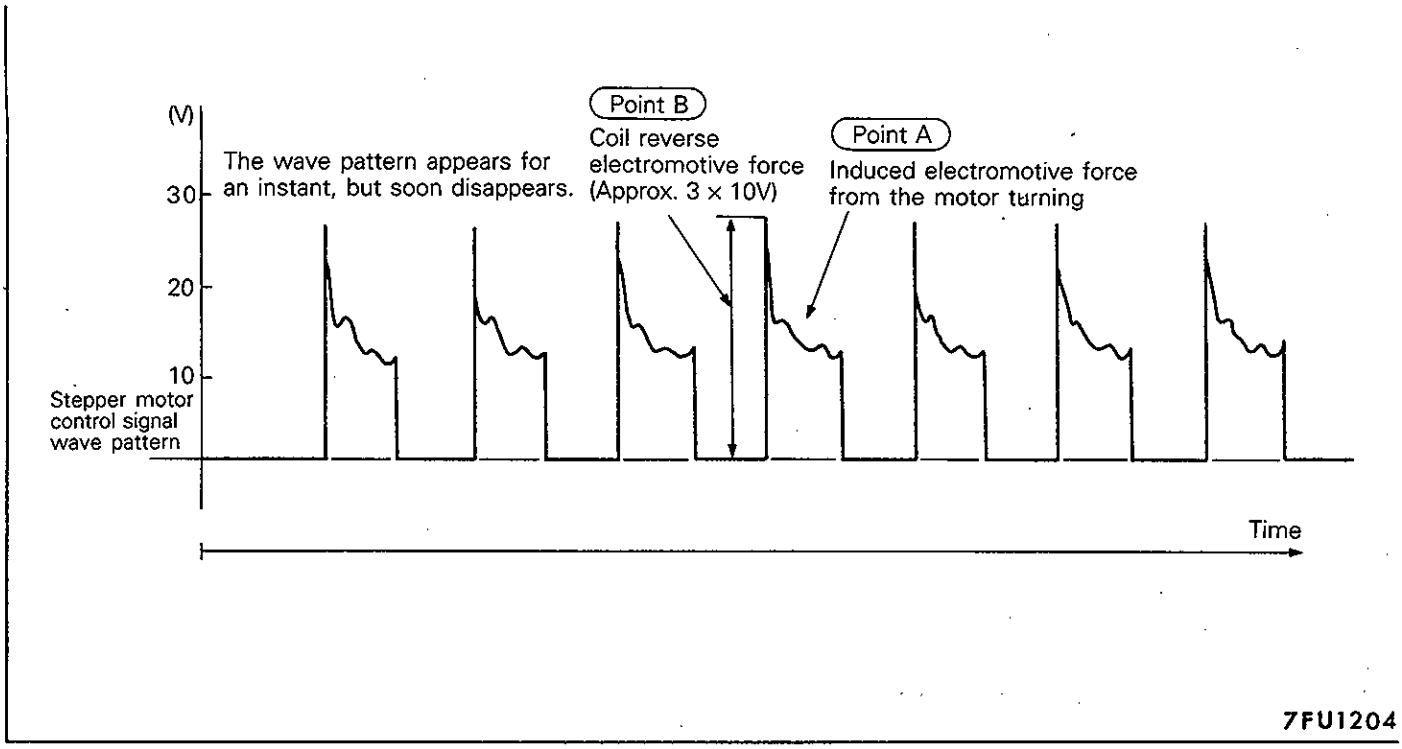
Measurement method

(1) Disconnect the stepper motor connector, and connect the special tool (test harness: MD998463) in between.
(2) Connect the analyzer special patterns pickup to the stepper motor-side connector terminal ① (red clip on the special tool), terminal ③ (blue clip), terminal ④ (black clip) and terminal ⑥ (yellow clip) respectively.

Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C (68°F) or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the air conditioner switch to ON.
	Immediately after starting the warm engine (approx. 1 minute).



Wave pattern observation points

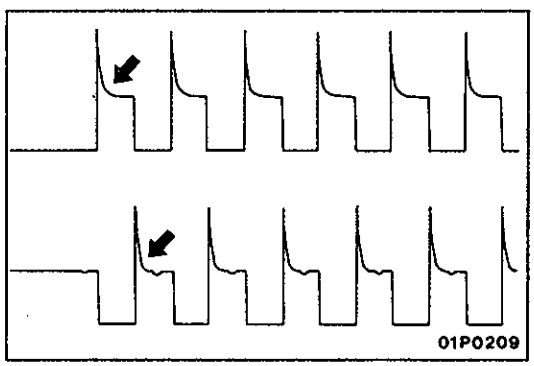
Check that the standard wave pattern appears when the stepper motor is operating.

(Point A:) Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

(Point B:) Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil



Examples of abnormal wave pattern

Cause of problem

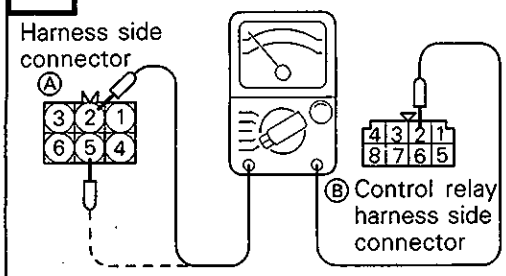
Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.

HARNESS INSPECTION

1



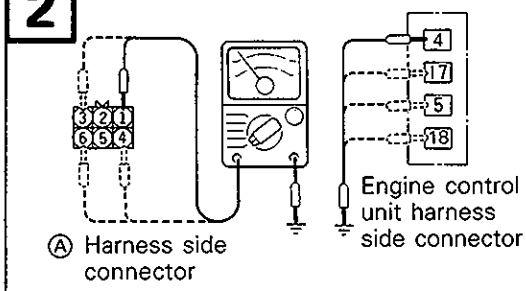
Check for continuity between idle speed control servo and control relay.
- Idle speed control servo connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness.
(Ⓐ2 – Ⓑ2)
(Ⓐ5 – Ⓑ2)

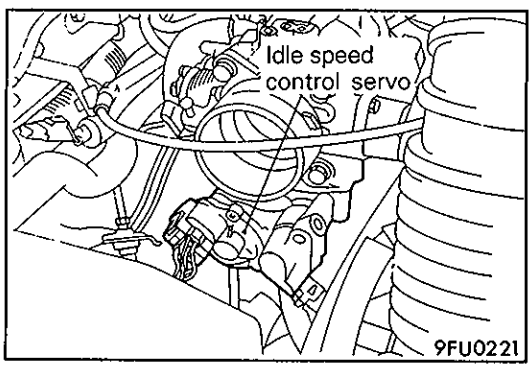
2



Check for open-circuit, or a short-circuit to earth between the engine control unit and the idle speed control servo.
- Engine control unit connector: Disconnected
- Idle speed control servo connector: Disconnected

OK → STOP

NO → Repair the harness.
(Ⓐ1 – 4)
(Ⓐ3 – 17)
(Ⓐ4 – 5)
(Ⓐ6 – 18)



ACTUATOR INSPECTION

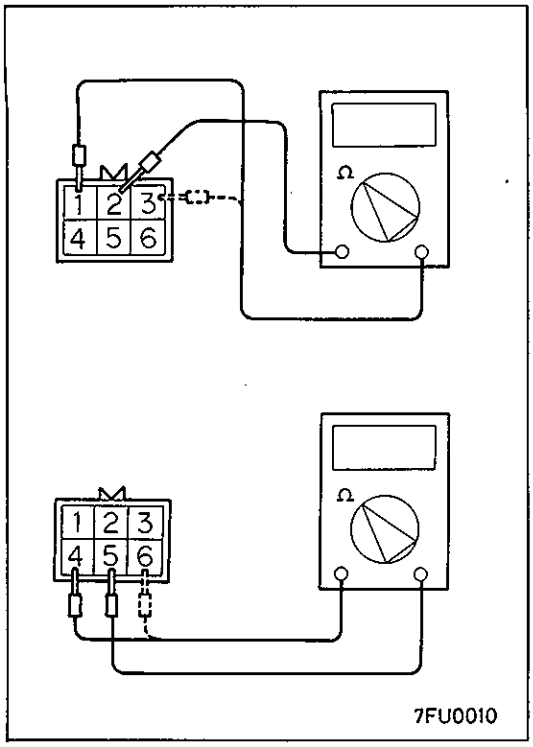
Checking the Operation Sound

(1) Check to be sure that the engine coolant temperature is 20°C (68°F) or below.

NOTE
Disconnecting the coolant temperature sensor connector and connecting the harness-side of the connector to another coolant temperature sensor that is at 20°C (68°F) or below is also okay.

(2) Check that the operation sound of the stepper motor can be heard after the ignition is switched ON (but without starting the motor).

(3) 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.



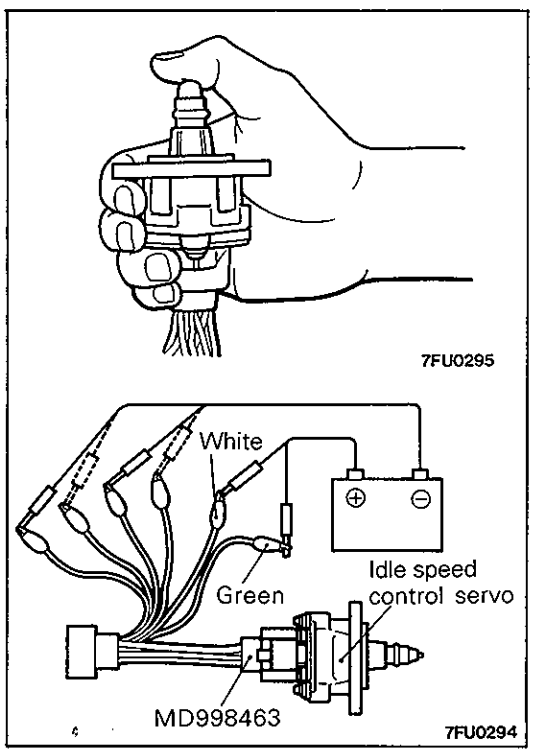
Checking the Coil Resistance

(1) Disconnect the idle speed control servo connector and connect the special tool (test harness).
(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.

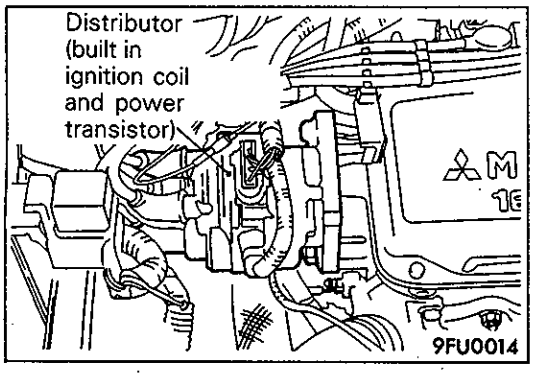
Standard value: 28–33 Ω at 20°C (68°F)



Operational Check

(1) Remove the throttle body.
(2) Remove the stepper motor.
(3) Connect the special tool (test harness) to the idle speed control servo connector.
(4) Connect the positive (+) terminal of a power supply (approx. 6V) 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.

IGNITION COIL AND POWER TRANSISTOR <SOHC>



OPERATION

Refer to P. 13-78.

INSPECTION

Using MUT or MUT-II

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	44	Ignition advance	• Engine: Warming up • Timing lamp: Set (set timing lamp to check actual ignition timing)	800 r/min.*1 700 r/min.*2 (Idle)	0–16°BTDC*1 4–20°BTDC*2
				2,000 r/min.	20–40°BTDC*1 19–39°BTDC*2

NOTE
*1: <Except MVV>
*2: <MVV>

Wave Pattern Inspection Using an Analyzer

Refer to P. 13-79.

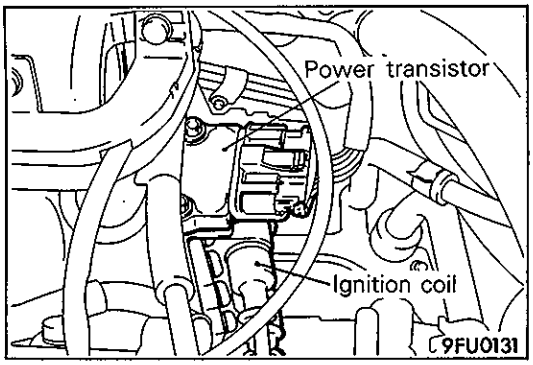
HARNESS INSPECTION

Refer to P. 13-80.

ACTUATOR INSPECTION

Refer to GROUP 16 – Ignition System.

IGNITION COIL AND POWER TRANSISTOR <DOHC>



OPERATION

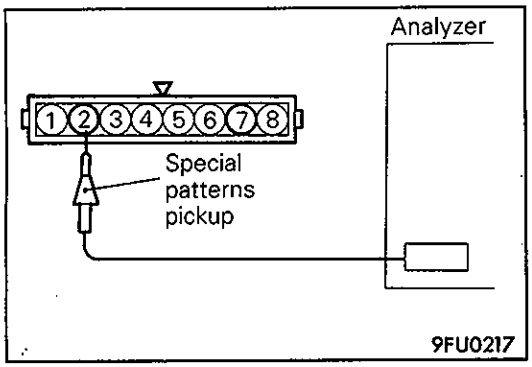
- When the power transistor unit A is turned ON by the signal from the engine control unit, primary current flows to the ignition coil unit A. When the power transistor unit A is turned OFF, primary current is shut off and a high voltage is induced in the secondary coil unit A, causing the spark plugs of No. 1 and No. 4 cylinders to spark. When the power transistor unit B is turned OFF, the spark plugs of No. 2 and No. 3 cylinders to spark.
- When the engine control unit turns OFF the transistor in the unit, the battery voltage in the unit is applied to the power transistor unit to turn it ON. When the engine control unit turns ON the transistor in the unit, the power transistor unit is turned OFF.

INSPECTION

Using MUT or MUT-II

Spark advance value

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	44	Ignition advance	• Engine: Warming up • Timing lamp: Set (set timing lamp to check actual ignition timing)	800 r/min. (Idle)	0-16°BTDC
				2,000 r/min.	20-40°BTDC



Wave Pattern Inspection Using an Analyzer

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition System
- Power transistor control signal

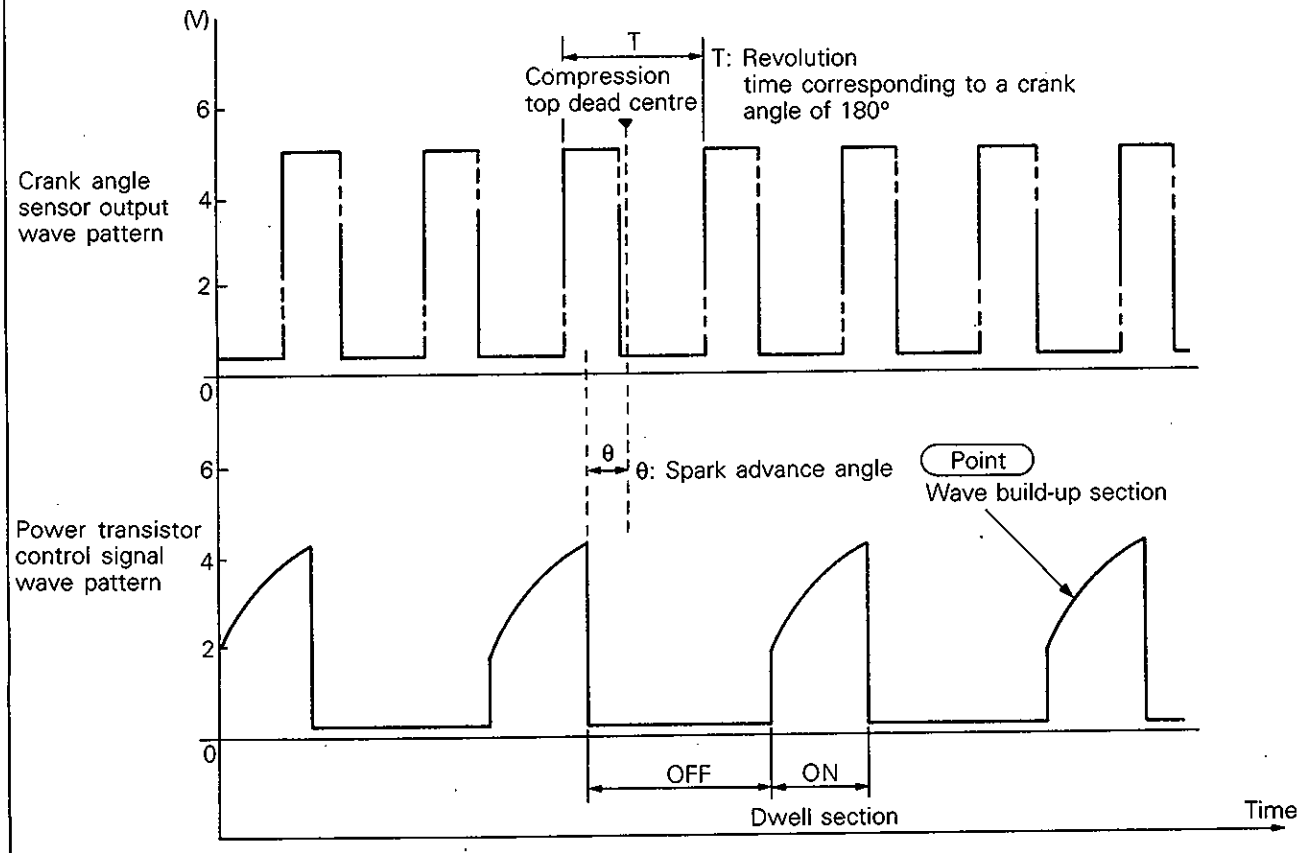
Measurement method

(1) Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to the power transistor connector terminal ② (No. 2 – No. 3) and terminal ⑦ (No. 1 – No. 4) respectively.

Standard wave pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Approx. 2,000 r/min.



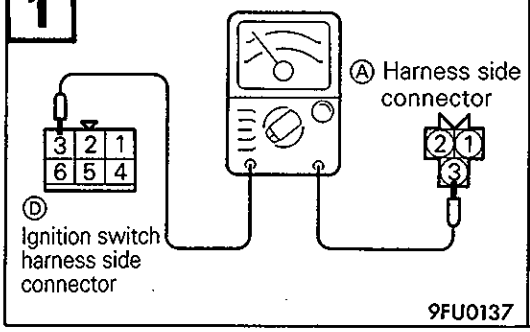
Wave pattern observation points

Examples of abnormal wave patterns

Refer to P. 13-80.

HARNESS INSPECTION

1



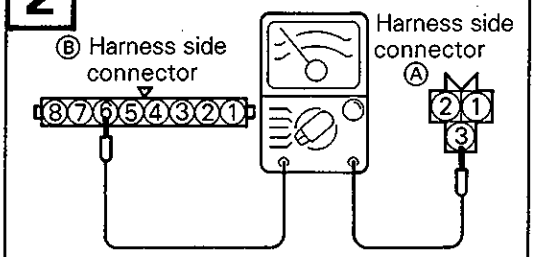
Check for continuity between ignition coil and ignition switch.
- Ignition switch connector: Disconnected
- Ignition coil connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ 3 – Ⓓ 3)

2

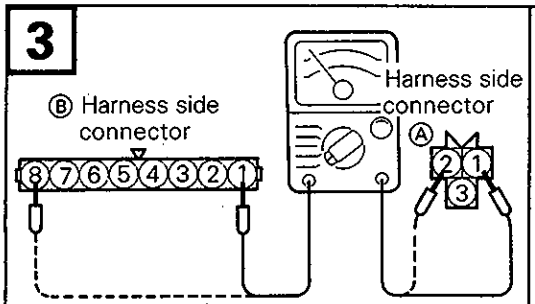


Check for continuity between ignition coil and power transistor.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ 3 – Ⓑ 6)

3

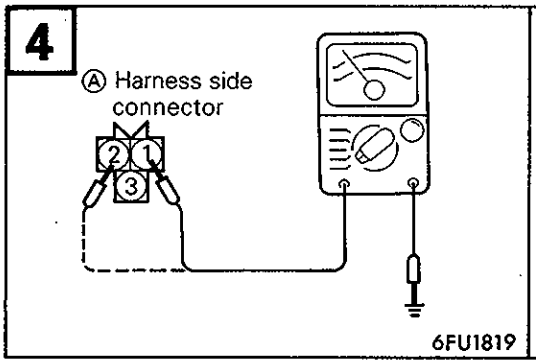


Check for continuity of the circuit between the power transistor and the ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 4

NO → Repair the harness. (Ⓐ 1 – Ⓑ 1) (Ⓐ 2 – Ⓑ 8)

4

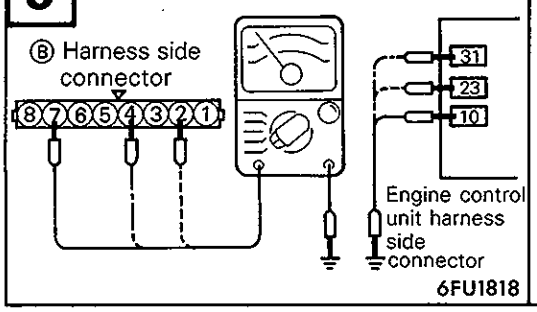


Check for a short-circuit to earth between the power transistor and the ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 5

NO → Check for a short-circuit of the ignition coil primary voltage circuit.

5

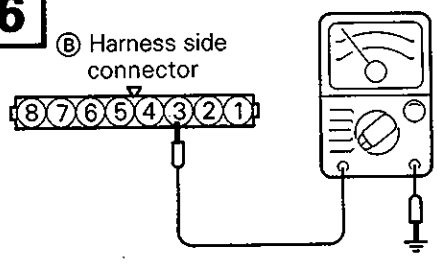


Check for an open-circuit, or a short-circuit to earth between the power transistor and engine control unit.
- Power transistor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 6

NO → Repair the harness. (Ⓑ 7 – 10) (Ⓑ 2 – 23) (Ⓑ 4 – 31)

6

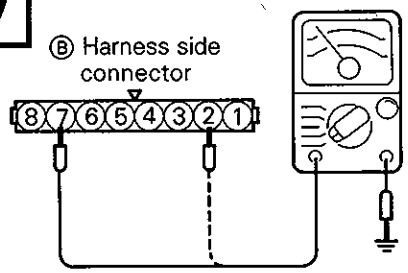


Check for continuity of the earth circuit of the power transistor.
- Power transistor connector: Disconnected

OK → 7

NG → Repair the harness. (Ⓑ3 – Earth)

7



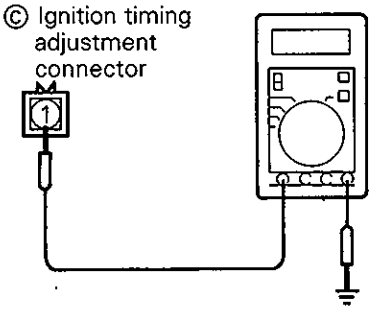
Measure the power transistor control signal voltage.
- Power transistor connector: Disconnected
- Ignition switch: START

Voltage (V)
0.5–4.0

OK → 8

NG → Repair the harness. (Ⓑ7 – 10) (Ⓑ2 – 23)

8



Measure the voltage of the ignition timing adjustment terminal.
- Ignition switch: ON

Voltage (V)
4.0–5.2

OK → STOP

NG → Repair the harness. (Ⓒ1 – 34)

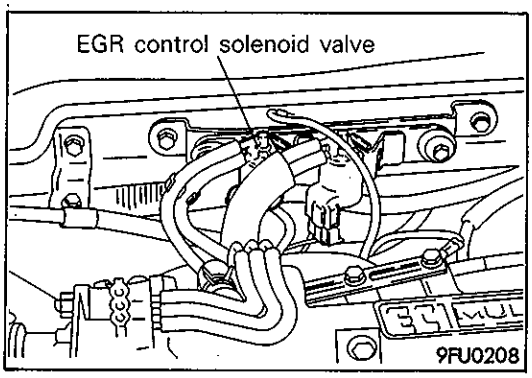
ACTUATOR INSPECTION

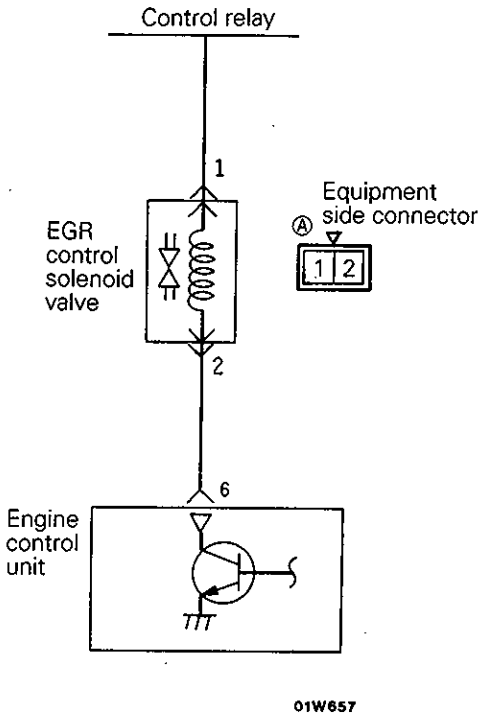
Refer to GROUP 16 – Ignition System.

PURGE CONTROL SOLENOID VALVE

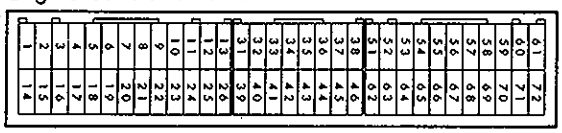
Refer to P. 13-82.

EGR CONTROL SOLENOID VALVE





Engine control unit connector



9FU0101

OPERATION

- The EGR control solenoid valve is ON-OFF type solenoid valve. It makes control by leaking EGR valve operating negative pressure to the throttle body A port.
- Power supply from the battery is sent through the control relay to the EGR control solenoid valve. When the engine control unit turns off the power transistor inside the unit, current no more flows through the coil and EGR valve operating vacuum leaks.

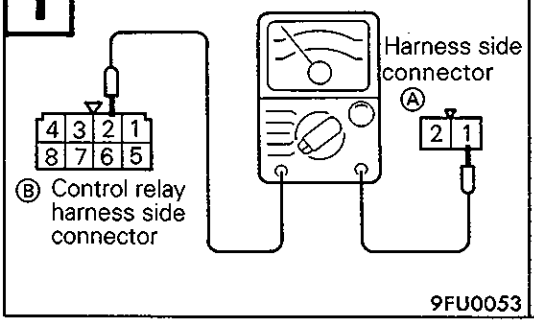
INSPECTION

Using MUT or MUT-II

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	10	Change solenoid valve from OFF to ON state	Ignition switch: ON	Operating sound is heard when driven

HARNESS INSPECTION

1



Check for continuity between EGR control solenoid valve and control relay.

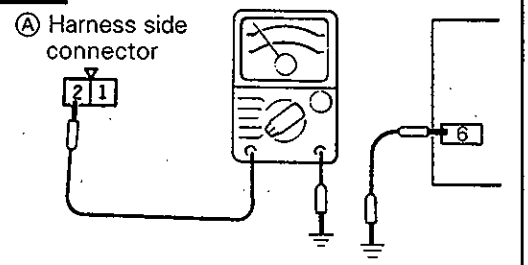
- EGR control solenoid valve connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ1 – Ⓑ2)

2



Check for an open-circuit, or a short-circuit to earth, between the EGR control solenoid valve and the engine control unit.

- EGR control solenoid valve connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

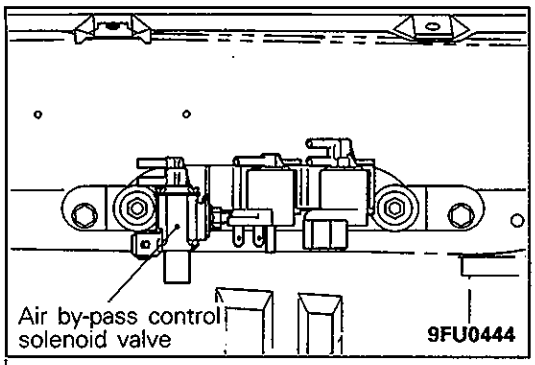
NO → Repair the harness. (Ⓐ2 – 6)

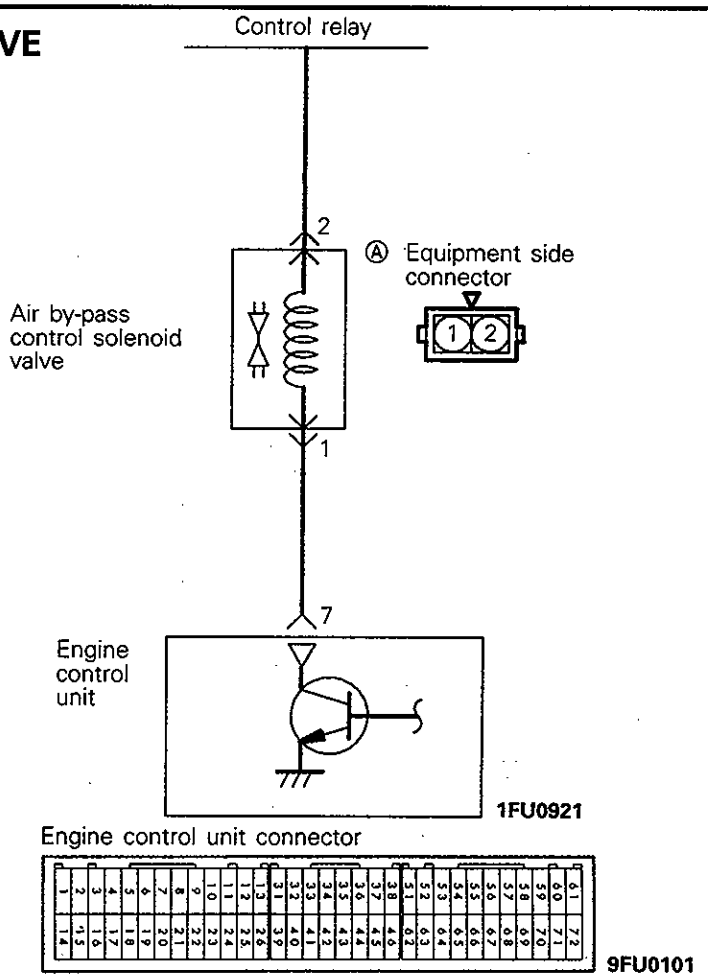
ACTUATOR INSPECTION

Refer to GROUP 17 – Exhaust Gas Recirculation (EGR) System.

AIR BY-BASS CONTROL SOLENOID VALVE

<SOHC-MVV>





OPERATION

- The air by-pass control solenoid valve is an ON-OFF type of valve. It switches the pressure introduced to the air by-pass valve to the negative pressure at throttle body port B or to atmospheric pressure.
- Battery voltage is supplied to the air by-pass control solenoid valve via a control relay. When the engine control unit turns on the power transistor inside the control unit, current flows to the coil and the negative pressure at throttle body port B is introduced into the air by-pass valve. This causes the air by-pass valve to open and air is thus supplied to the intake air plenum while by-passing the throttle valve.

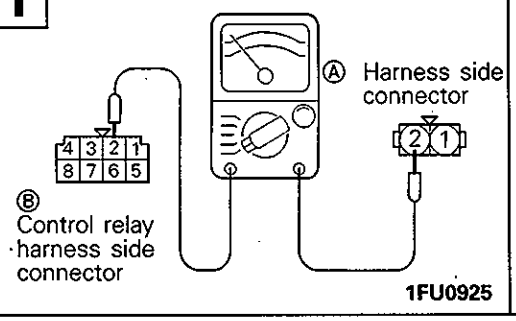
INSPECTION

Using MUT-II

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	18	Solenoid valve from OFF to ON	Ignition switch: ON	Operating sound is heard when driven

HARNESS INSPECTION

1



Check for continuity between air by-pass control solenoid valve and control relay.

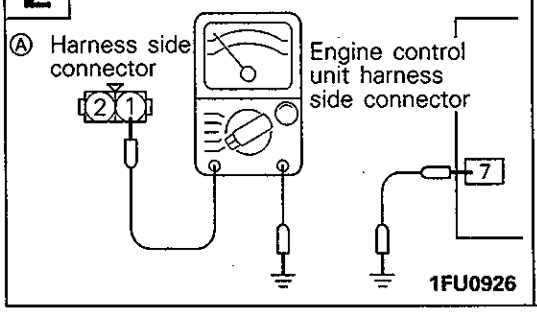
- Air by-pass control solenoid valve connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ2 – Ⓑ2)

2



Check for open-circuit or short-circuit between air by-pass control solenoid valve and engine control unit.

- Engine control unit connector: Disconnected
- Air by-pass control solenoid valve connector: Disconnected

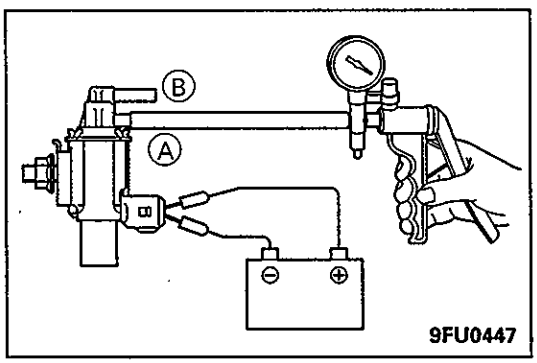
OK → STOP

NO → Repair the harness. (Ⓐ1 – 7)

ACTUATOR INSPECTION

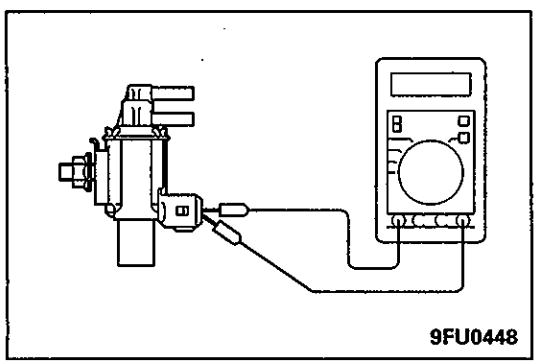
INSPECTION OF AIR BY-PASS CONTROL SOLENOID VALVE FUNCTION

(1) Disconnect the vacuum hoses (yellow striped, green striped) from the solenoid valve.
(2) Disconnect the harness connector.



(3) Connect a hand vacuum pump to the nipple Ⓐ of the solenoid valve.
(4) Connect the solenoid valve terminals and the battery terminals with the jumper wires.
(5) Check airtightness by applying a vacuum with connected and disconnected the jumper wire at the battery (–) terminal.

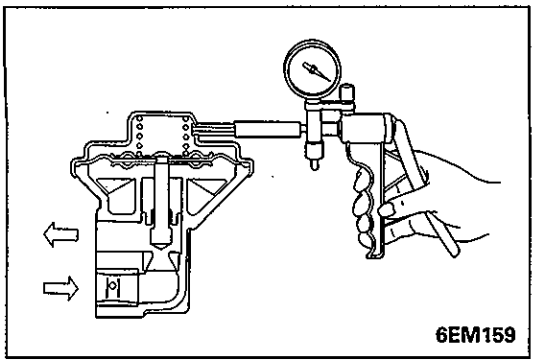
Jumper wire	Condition of the nipple Ⓑ	Normal condition
Connect	Open	Vacuum leaks
	Plug	Vacuum maintained
Disconnect	Plug	Vacuum leaks



INSPECTION OF AIR BY-PASS CONTROL SOLENOID VALVE COIL RESISTANCE

(1) Measure the resistance between the terminals of the solenoid valve.

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



VACUUM ACTUATOR INSPECTION

(1) Remove the air-bypass valve.
(2) Connect a hand vacuum pump to the air by-pass valve.
(3) Apply 67 kPa (500 mmHg, 20 in.Hg) of vacuum, and check to be sure that the vacuum is maintained.
(4) Apply a vacuum and check the passage of air by blowing through one side of the air by-pass valve passage.

Vacuum	Passage of air
2.7 kPa (20 mmHg, 0.8 in.Hg) or less	Air is not blown out
35 kPa (260 mmHg, 10.2 in.Hg) or more	Air is blown out

Installation

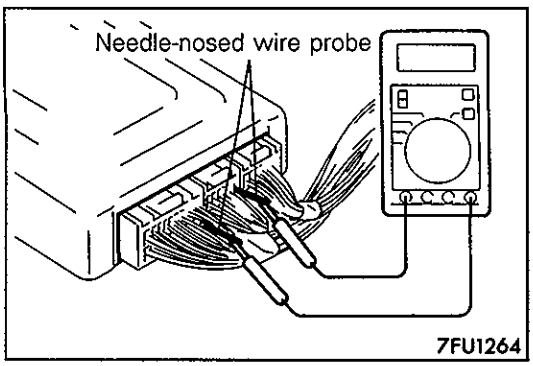
(1) Use a new gasket, and tighten the installation bolt to the specified torque.

Specified torque: 22 Nm (2.2 kgm, 16 ft.lbs.)

FUEL PRESSURE TEST

Refer to P.13-84.

NOTE



ENGINE CONTROL UNIT TERMINAL VOLTAGE CHECK

(1) Connect a needle-nosed wire probe (test harness: MB991223 or paper clip) to a voltmeter probe.
(2) Insert the needle-nosed wire probe into each of the engine control unit connector terminals from the wire side, and measure the voltage while referring to the check chart.

NOTE

1. Make the voltage measurement with the engine control unit connectors connected.
2. Make the voltage measurement between terminal No. 26 (earth terminal) and each terminal.
3. You may find it convenient to pull out the engine control unit to make it easier to reach the connector terminals.
4. The checks can be carried out off the order given in the chart.

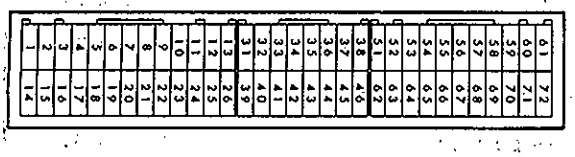
Caution
Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine control unit, or all there. Use care to prevent this!

(3) If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
(4) After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

TERMINAL VOLTAGE CHECK CHART

Engine Control Unit Terminal Arrangement

Engine control unit connector



9FU0101

NOTE
*1: <SOHC (Except MVV)>
*2: <DOHC>
*3: <SOHC-MVV>
*4: <Vehicles built from October, 1993>

Terminal No.	Check item	Check Condition (Engine condition)		Standard value
60	Backup power supply	Ignition switch: OFF		SV
12	Power supply	Ignition switch: ON		SV
25				
62*2, *3	Ignition switch-IG	Ignition switch: ON		SV
38*2, *3	Control relay (Power supply)	Ignition switch: OFF		SV
		Ignition switch: ON		0–3V
8	Control relay (Fuel pump)	Ignition switch: ON		SV
		Engine: Idle speed		0–3V
61	Sensor impressed voltage	Ignition switch: ON		4.5–5.5V
70	Air flow sensor	Engine: Idle speed		2.2–3.2V
		Engine r/min.: 2,000 r/min.		
19	Air flow sensor reset signal	Engine: Idle speed		0–1V
		Engine r/min.: 3,000 r/min.		6–9V
52	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C (32°F)	3.2–3.8V
			When intake air temperature is 20°C (68°F)	2.3–2.9V
			When intake air temperature is 40°C (104°F)	1.5–2.1V
			When intake air temperature is 80°C (176°F)	0.4–1.0V
65	Barometric pressure sensor	Ignition switch: ON	When altitude is 0m	3.7–4.3V
			When altitude is 1,200m (3,937 ft.)	3.2–3.8V

Terminal No.	Check item	Check Condition (Engine condition)		Standard value
63	Coolant temperature sensor	Ignition switch: ON	When coolant temperature is 0°C (32°F)	3.2–3.8V
			When coolant temperature is 20°C (68°F)	2.3–2.9V
			When coolant temperature is 40°C (104°F)	1.3–1.9V
			When coolant temperature is 80°C (176°F)	0.3–0.9V
64	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position.	0.3–1.0V
			Fully open throttle vavle.	4.5–5.5V
67	Idle position switch	Ignition switch: ON	Set throttle valve to idle position.	0–1V
			Slightly open throttle valve	4V or more
68	Top dead centre sensor	Engine: Cranking		0.2–3.0V
		Engine: Idle speed		
69	Crank angle sensor	Engine: Cranking		0.2–3.0V
		Engine: Idle speed		
51	Ignition switch-ST	Engine: Cranking		8V or more
71	Inhibitor switch	Ignition switch: ON	Set selector lever to P or N.	0–3V
			Set selector lever to D, 2, L or R.	8–14V
66	Vehicle speed sensor	Ignition switch; ON Move the vehicle slowly forward.		0↔5V (Changes repeatedly)
37	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	SV
			When steering wheel is turned	0–3V
45	Air conditioner switch	Engine: Idle speed	Turn the air conditioner switch OFF.	0–3V
			Turn the air conditioner switch ON. (Air conditioner compressor is operating)	SV
22	Air conditioner relay	Engine: Idle speed Air conditioner switch: OFF → ON Turn the air conditioner switch ON. (Air conditioner compressor is operating)		SV or temporarily 6V or more ↓ 0–3V

Terminal No.	Check item	Check Condition (Engine condition)		Standard value
16*4	Fan motor relay	Engine: Idling	When radiator fan is not operating	5V
			When radiator fan is operating	0–3V
3*4	Fan motor relay (HI)	When radiator fan is not operating (Engine coolant temperature: 90°C or less)		5V
		When radiator fan is operating at high speed (Engine coolant temperature: 105°C or more)		0–3V
56*1, *2	Oxygen sensor	Engine: Running at 2,000 r/min. after having warmed up. (Check using a digital type voltmeter.)		0↔0.8V (Changes repeatedly)
55*3	Linear A/F sensor output (air fuel/ratio mixture signal)	Engine runs at idle for 5 minutes or more after having warmed up	Engine r/min: from 4,000 r/min, engine is suddenly decelerated	4V or more
			When engine is suddenly raced	2V or less
			Engine: Idling	2.7–3.3V
			Engine r/min.: 2,000 r/min.	2.1–2.7V
41*3	Linear A/F sensor current control	Ignition switch: ON		5V
		Engine: Idling after warming up (several minutes after engine is started)		0–1V
32*3	Linear A/F sensor heater control	Ignition switch: ON		5V
		Engine: After starting		5V or less
1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal		From 11–14V, momentarily drops slightly
14	No. 2 injector			
2	No. 3 injector			
15	No. 4 injector			
4*2, *3	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started		5V ↑↓ 0–6V (Repeat the variation.)
17*2, *3	Stepper motor coil <A2>			
5*2, *3	Stepper motor coil <B1>			
18*2, *3	Stepper motor coil <B2>			
10*1, *3	Power transistor unit	Engine r/min.: 3,000 r/min.		0.3–3.0V
10*2	Power transistor unit A	Engine r/min.: 3,000 r/min.		0.3–3.0V
23*2	Power transistor unit B			
9	Purge control solenoid valve	Ignition switch: ON		5V
		Running at 3,000 r/min. after having warmed up.		0–3V

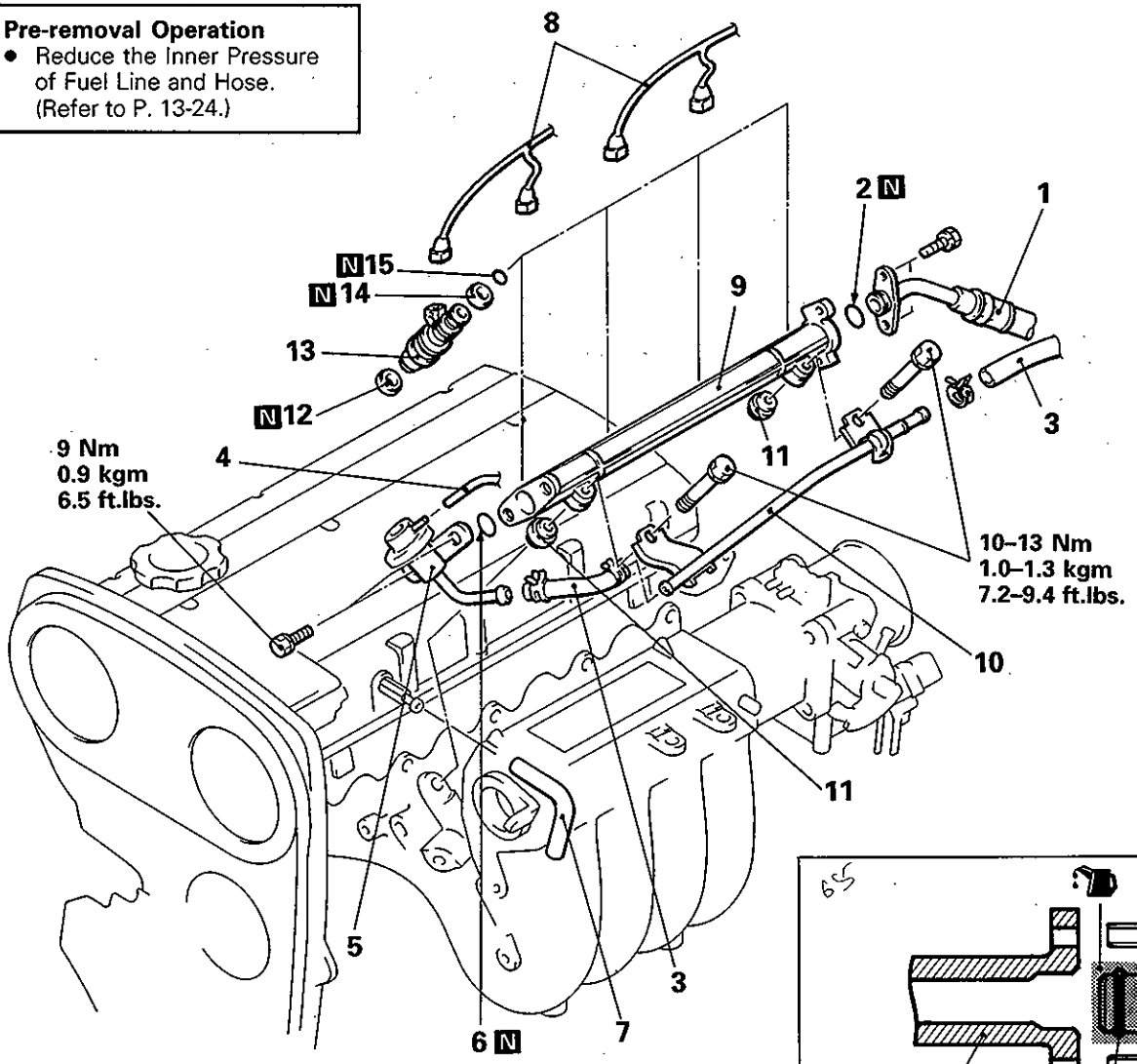
Terminal No.	Check item	Check Condition (Engine condition)		Standard value
31*2	Engine ignition signal	Engine r/min.: 3,000 r/min.		0.3–3.0V
34	Ignition timing adjustment terminal	Ignition switch: ON	Earth the ignition timing adjustment terminal	0–1V
			Remove the earth connection from the ignition timing adjustment terminal.	4.0–5.5V
36	Engine warning lamp	Ignition switch: OFF → ON		0–3V ↓ 9–13V (After several seconds have elapsed)
6	EGR control solenoid valve	Ignition switch: ON		SV
		While engine is idling, suddenly depress the accelerator pedal.		0–3V
7*3	Air by-pass control solenoid valve	Engine: Idling after warming up		0–1V
		Engine r/min.: 1,000 r/min.		SV
35	Oxygen sensor heater	Engine: Idling after warming up		0–3V
		Engine r/min.: 5,000 r/min.		SV
5*1	Idle speed control servo valve position sensor No. 1	Ignition switch: Immediately after turning ON		1.5–4V (Momentarily) ↓ 0–1V or 4.5–5.5V
18*1	Idle speed control servo valve position sensor No. 2	Ignition switch: Immediately after turning ON		1.5–4V (Momentarily) ↓ 0–1V or 4.5–5.5V
4*1	Idle speed control motor (closed)	Ignition switch: Immediately after turning ON		2V or more (Momentarily) ↓ 0–1V
17*1	Idle speed control motor (open)	Ignition switch: Immediately after turning ON		4V or more (Momentarily) ↓ 0–1V

INJECTORS

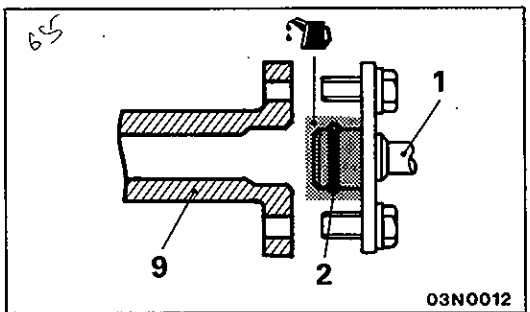
REMOVAL AND INSTALLATION

E13JA--

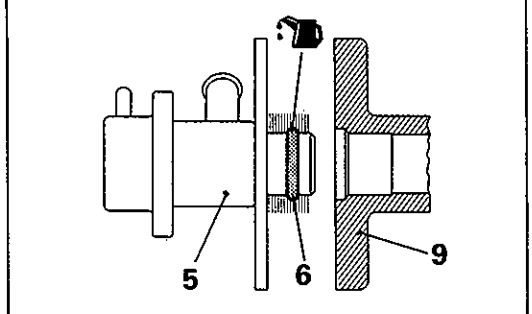
Pre-removal Operation
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)



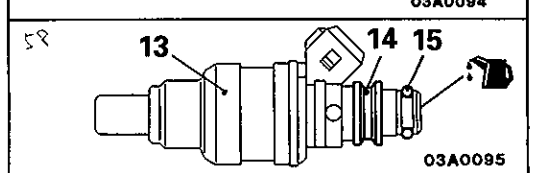
03S0063



03N0012



03A0094



03A0095

Engine oil

Removal steps

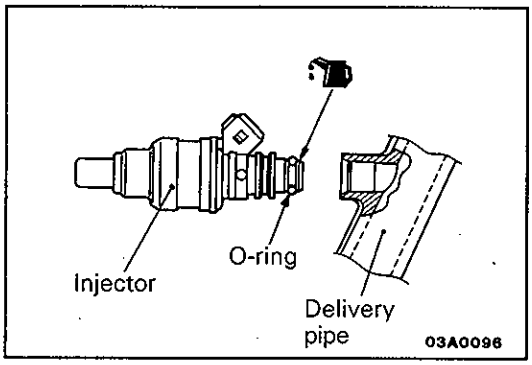
1. High-pressure fuel hose connection
2. O-ring
3. Return hose connection
4. Vacuum hose connection
- ◆◆ 5. Fuel pressure regulator
6. O-ring
7. PCV hose
8. Injector connector
- ◆◆ 9. Delivery pipe
10. Return pipe
11. Insulator
12. Insulator
- ◆◆ ◆◆ 13. Injector
14. Grommet
15. O-ring

SERVICE POINTS OF REMOVAL E13JBAF

9. REMOVAL OF DELIVERY PIPE/13. INJECTOR

Remove the delivery pipe (with the injectors attached to it).

Caution
Care must be taken, when removing the delivery pipe, not drop the injector.



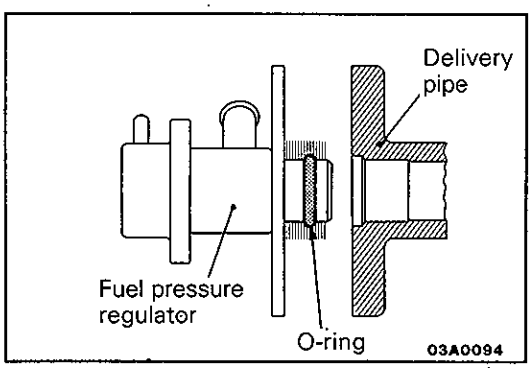
SERVICE POINTS OF INSTALLATION E13JDAD

13. INSTALLATION OF INJECTOR

(1) Apply a drop of new engine oil to the O-ring.

Caution
Be sure not to let engine oil in the delivery pipe.

(2) While turning the injector to the left and right, install it to the delivery pipe.
(3) Check to be sure that the injector turns smoothly.
If it does not turn smoothly, the O-ring may be trapped, remove the injector and then re-insert it into the delivery pipe and check once again.



5. INSTALLATION OF FUEL PRESSURE REGULATOR

(1) When connecting the fuel-pressure regulator to the delivery pipe, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

Caution
Be sure not to let engine oil in the delivery pipe.

(2) Check to be sure that the fuel pressure regulator turns smoothly.
If it does not turn smoothly, the O-ring may be trapped, remove the fuel pressure regulator and then re-insert it into the delivery pipe and check once again.
(3) Tighten the bolts to the specified torque.

Specified tightening torque:
9 Nm (0.9 kgm, 6.5 ft.lbs.)

FUEL TANK <Sedan, Hatchback>

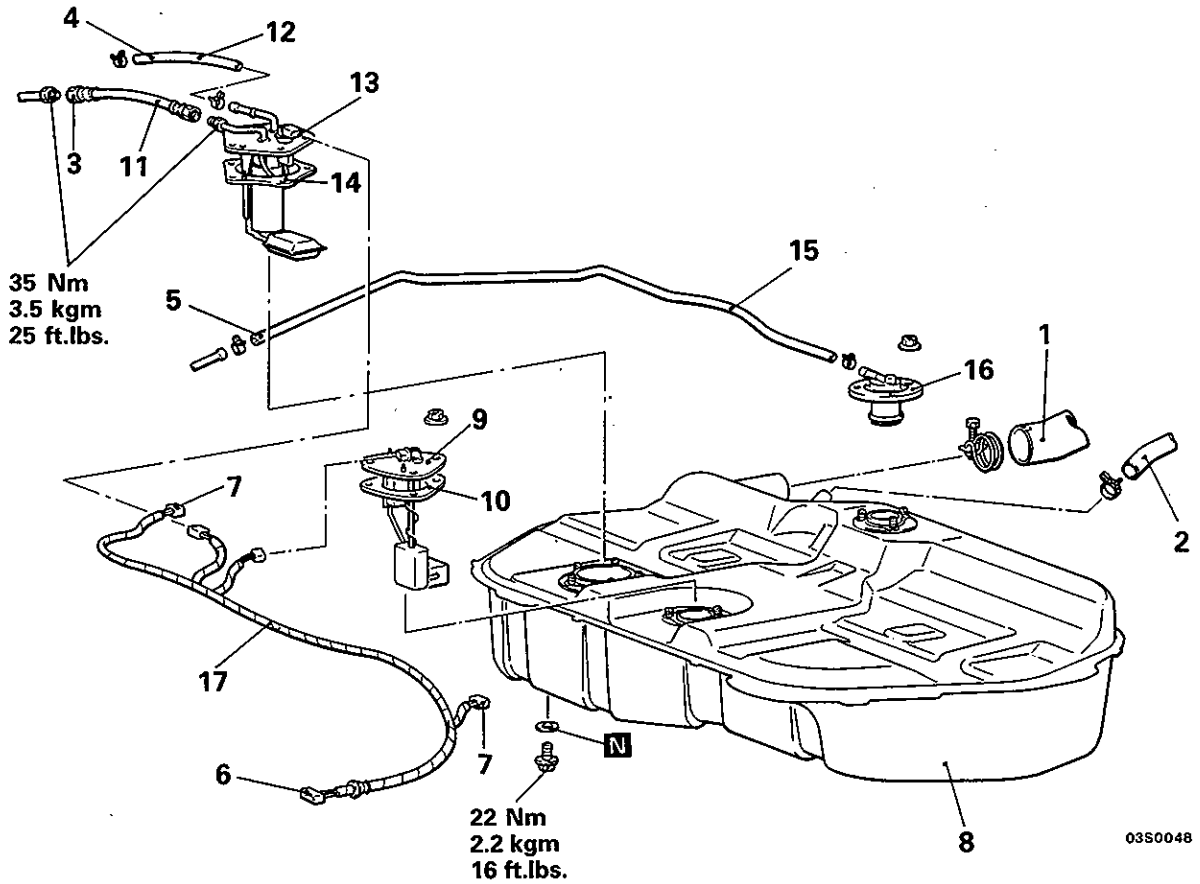
REMOVAL AND INSTALLATION

E13GA--

Pre-removal Operation
- Draining the Fuel.
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)

Post-installation Operation
- Refilling the Fuel.
- Checking for Fuel Leaks

<2WD>



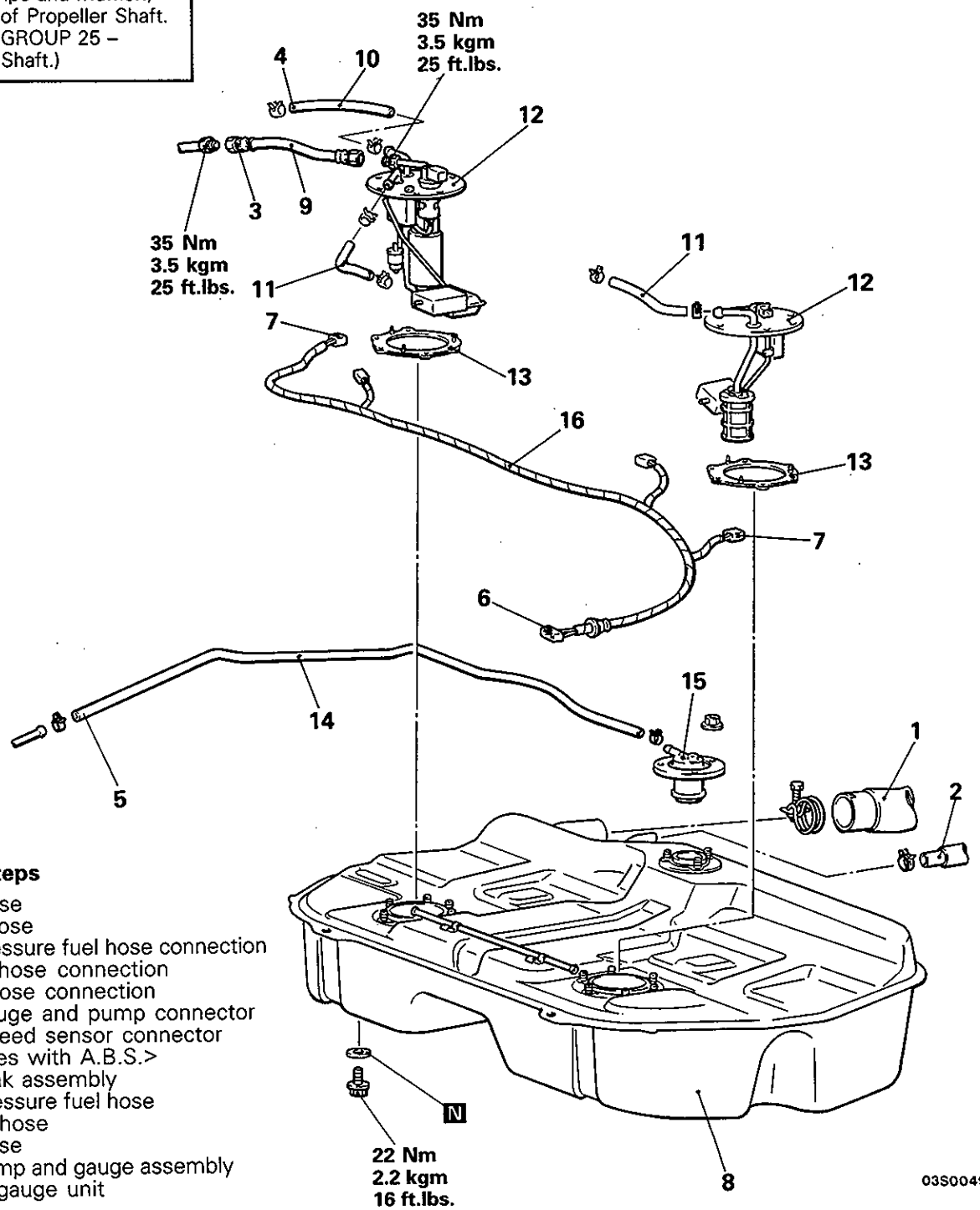
Removal steps

1. Filler hose
2. Vapor hose
3. High-pressure fuel hose connection
4. Return hose connection
5. Vapor hose connection
6. Fuel gauge and pump connector
7. Rear speed sensor connector <Vehicles with A.B.S.>
8. Fuel tank assembly
9. Fuel gauge unit
10. Packing
11. High-pressure fuel hose
12. Return hose
13. Fuel pump
14. Packing
15. Vapor hose
16. Fuel cut off valve
17. Fuel gauge and pump wiring harness

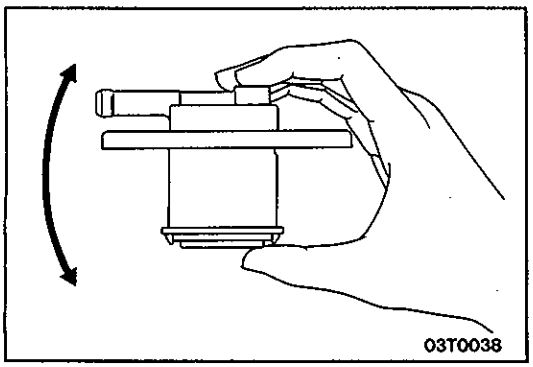
<4WD>

Pre-removal Operation
- Draining the Fuel.
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)
- Removal of Heat Protector.
- Removal of Center Exhaust Pipe. (Refer to GROUP 15 – Exhaust Pipe and Muffler.)
- Removal of Propeller Shaft. (Refer to GROUP 25 – Propeller Shaft.)

Post-installation Operation
- Installation of Propeller Shaft. (Refer to GROUP 25 – Propeller Shaft.)
- Installation of Center Exhaust Pipe. (Refer to GROUP 15 – Exhaust Pipe and Muffler.)
- Installation of Heat Protector.
- Refilling the Fuel.
- Checking for Fuel Leaks.



Removal steps
1. Filler hose
2. Vapor hose
3. High-pressure fuel hose connection
4. Return hose connection
5. Vapor hose connection
6. Fuel gauge and pump connector
7. Rear speed sensor connector <Vehicles with A.B.S.>
8. Fuel tank assembly
9. High-pressure fuel hose
10. Return hose
11. Fuel hose
12. Fuel pump and gauge assembly or fuel gauge unit
13. Packing
14. Vapor hose
15. Fuel cut off valve
16. Fuel gauge and pump wiring harness



INSPECTION

E13GCAP

FUEL CUT OFF VALVE

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

FUEL TANK <Wagon>

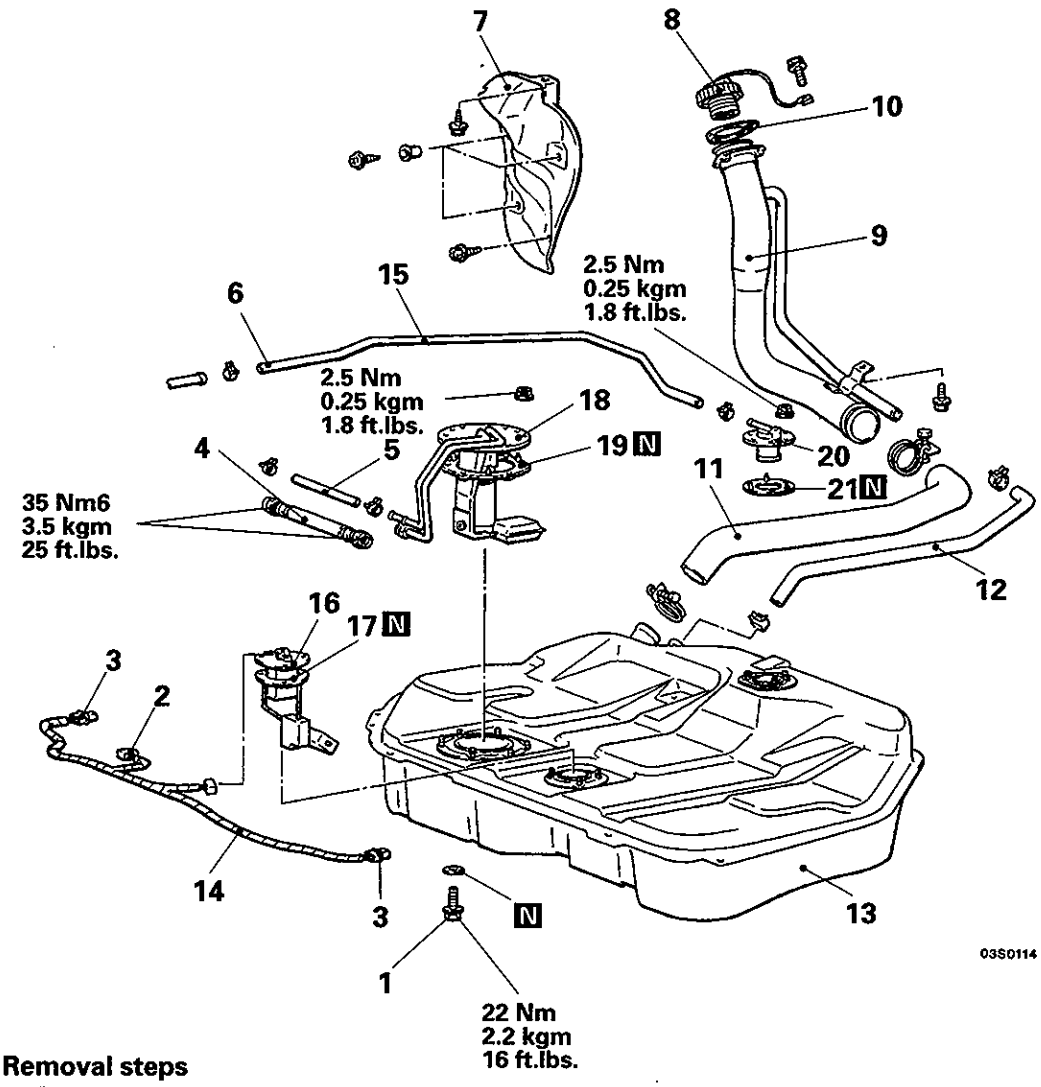
REMOVAL AND INSTALLATION

E13GA--

Pre-removal Operation
- Draining the Fuel.
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)

Post-installation Operation
- Refiling the Fuel.
- Checking for Fuel Leaks

<2WD>

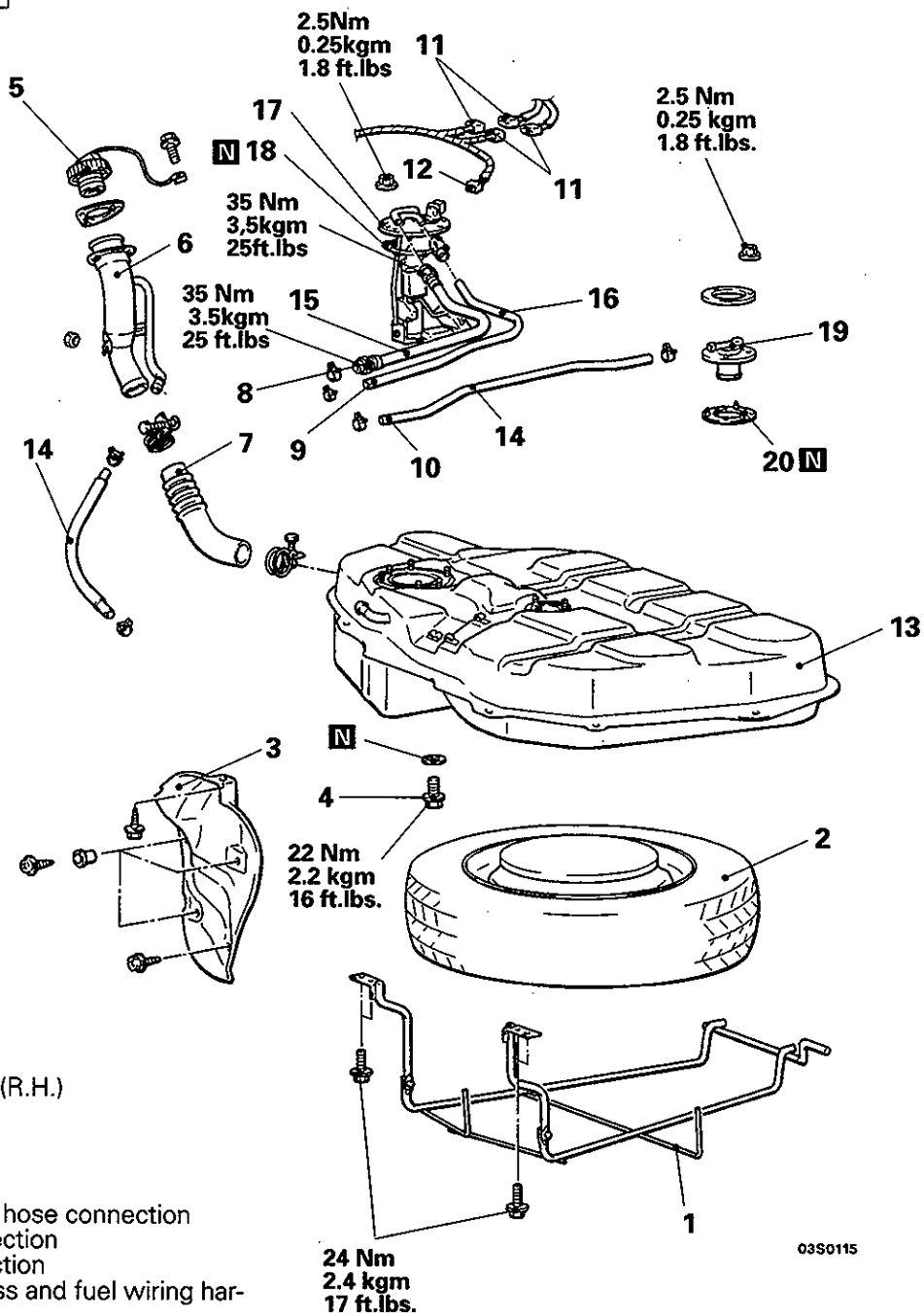


Removal steps
1. Drain plug
2. Body wiring harness and fuel wiring harness connection
3. Rear speed sensor connector <Vehicles with A.B.S.>
4. High-pressure fuel hose
5. Return hose
6. Vapor hose connection
7. Rear splash shield (R.H.)
8. Fuel filler cap
9. Fuel filler neck
10. Packing
11. Fuel filler hose
12. Vapor hose
13. Fuel tank
14. Fuel gauge and pump wiring harness
15. Vapor hose
16. Fuel gauge unit
17. Packing
18. Fuel pump assembly
19. Packing
20. Valve assembly
21. Packing

<4WD>

Pre-removal Operation
- Draining the Fuel.
- Reduce the Inner Pressure of Fuel Line and Hose. (Refer to P. 13-24.)

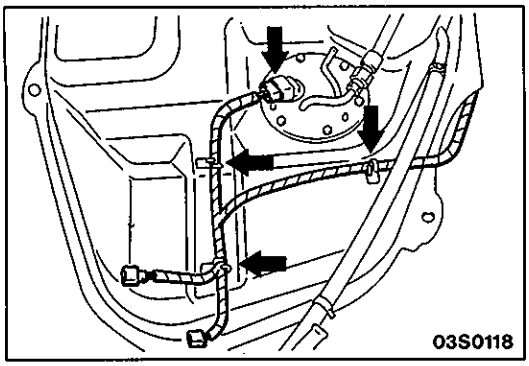
Post-installation Operation
- Refiling the Fuel.
- Checking for Fuel Leaks



Removal steps
1. Spare tyre carrier
2. Spare tyre
3. Rear splash shield (R.H.)
4. Drain plug
5. Fuel filler cap
6. Fuel filler neck
7. Fuel filler hose
8. High-pressure fuel hose connection
9. Return hose connection
10. Vapor hose connection
11. Body wiring harness and fuel wiring harness connection

◆◆ 12. Fuel gauge and pump connector

13. Fuel tank
14. Vapor hose
15. High-pressure fuel hose
16. Return hose
17. Fuel gauge unit and pump assembly
18. Packing
19. Valve assembly
20. Packing



SERVICE POINTS OF REMOVAL E13GBAQ

12. REMOVAL OF FUEL GAUGE AND PUMP CONNECTOR

(1) Lower the fuel tank slightly and support it in this condition with a transmission jack.
(2) After disconnecting the fuel gauge unit and pump connector, disconnect the fuel harness from the fuel tank.

INSPECTION E13GCAQ

Refer to P. 13-177.

ACCELERATOR CABLE AND PEDAL E13OA--

Refer to P. 13-95.

FUEL SYSTEM <4D68>

SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA--

Items		Specifications
Fuel tank		
Capacity	dm^3 (U.S.gal., Imp.gal.)	50 (13.2, 11.0)
Fuel		
Return system		Equipped
Fuel injection pump		
Type		Distribution type
Rotation direction		Clockwise (viewed from driving side)
Injection sequence		1–3–4–2
Cam lift	mm (in.)	2.43 (0.9567)
Plunger diameter	mm (in.)	10 (0.3937)
Governor type		Half all speed
Feed pump type		Vane type
Fast idle system		Wax type
Injection nozzle		
Nozzle type		Throttle type
Holder type		Screw-in type

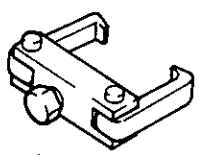
SERVICE SPECIFICATION

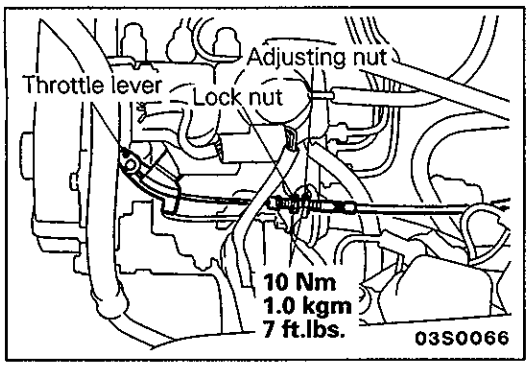
E13CB--

Items		Specifications
Standard value		
Accelerator cable play	mm (in.)	1–2 (0.04–0.08)
Accelerator switch switching point	mm (in.)	2–6 (0.08–0.24)
Injection pressure	kPa (kg/cm^2, psi)	11,768-12,749 (120-130, 1,707-1,849)

SPECIAL TOOL

E13DA--

Tool	Number	Name	Use
	MD998388	Injection pump sprocket puller	Removal of sprocket from drive shaft of injection pump



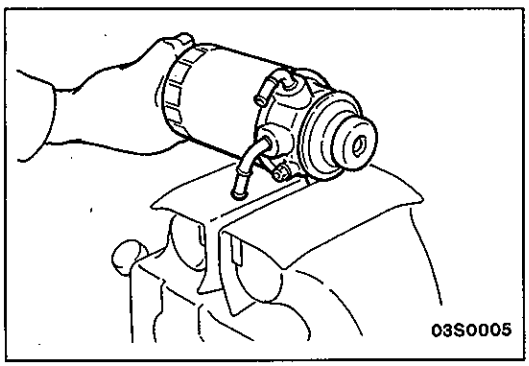
SERVICE ADJUSTMENT PROCEDURES

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT E13FCBH

(1) Turn the air conditioner and all lights OFF so that there is no electrical load when inspecting.
(2) Warm the engine until the engine idling speed becomes stable.
(3) Check that the engine idling speed is at the specified value.
(4) Stop the engine and turn the ignition switch to OFF.
(5) Check that there are no sharp bends in the accelerator cable.
(6) Check the amount of play in the inner cable.
(7) If there is excessive play in the inner cable, or if there is no play, adjust by the following procedures.
    ① Loosen the adjusting nut and fully close the throttle lever.
    ② Tighten the adjusting nut so that the inner cable play is at the standard value, and fix it with the lock nut.

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

    ③ After adjusting, check that the throttle lever is touching the idle adjusting screw (stopper).

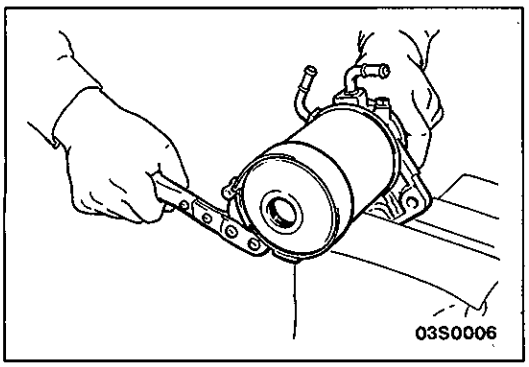


FUEL FILTER REPLACEMENT E13FZAR

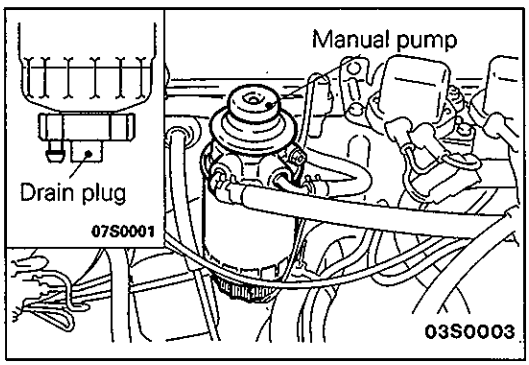
(1) Remove the fuel tank cap to release the pressure inside the tank.
(2) Disconnect the water level sensor connector.
(3) Remove the fuel hose and then remove the fuel filter.

    Caution
    Cover with a rag to prevent fuel from spraying out.

(4) Secure the fuel filter pump in a vise and remove the water level sensor.



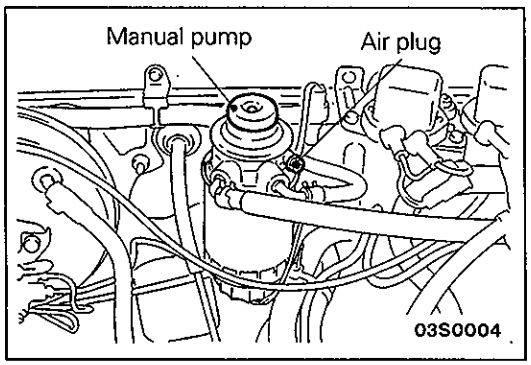
(5) Use an oil filter wrench to remove the fuel filter cartridge.
(6) After installing the fuel filter cartridge to the pump, install the water level sensor to the cartridge.
(7) After bleeding all air from the fuel line, start the engine and check that there are no fuel leakages.



EVACUATION OF WATER FROM FUEL FILTER E13FVAB

Water is in the filter when fuel filter indicator lights. Evacuate water by the following procedures.

(1) Loosen drain plug.
(2) Drain water with hand pump. Finger-tighten drain plug.



EVACUATION OF AIR FROM FUEL LINE E13FSAB

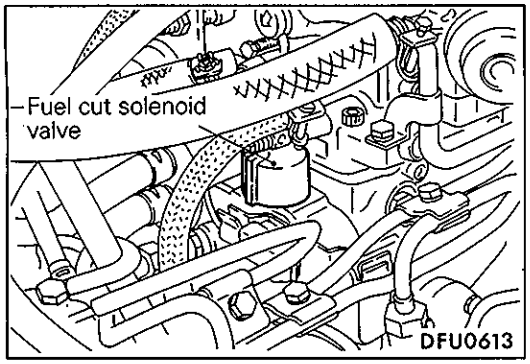
Evacuate air after following services.

- When fuel is drained and re-filler for service.
- When fuel filter is replaced.
- When main fuel line is removed.

(1) Loosen fuel filter air plug.
(2) Place rags around air plug hole. Operate hand pump repeatedly until no bubbles come from plug hole. Tighten air plug.
(3) Repeat until hand pump operation becomes stiff.

FUEL GAUGE UNIT REPLACEMENT E13FDAC

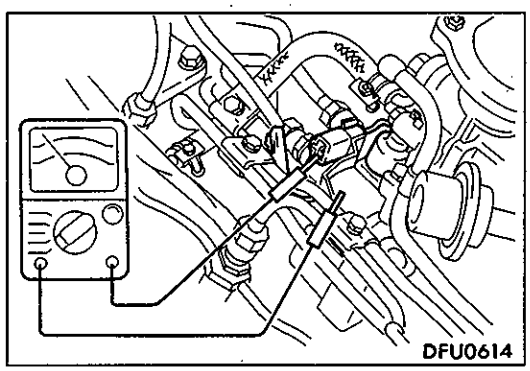
Refer to P. 13-114



FUEL INJECTION PUMP INSPECTION

INSPECTION OF FUEL CUT SOLENOID VALVE OPERATION

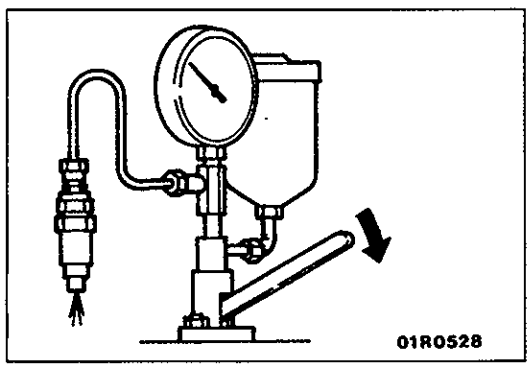
(1) When a sound scope is held against the fuel cut solenoid valve and the ignition switch is turned to "ON", check that the sound of the valve operating can be heard.



INSPECTION OF FUEL CUT SOLENOID VALVE COIL RESISTANCE

(1) Measure the resistance between the fuel cut solenoid valve terminal and the ignition pump body.

Standard value: 9 – 12Ω



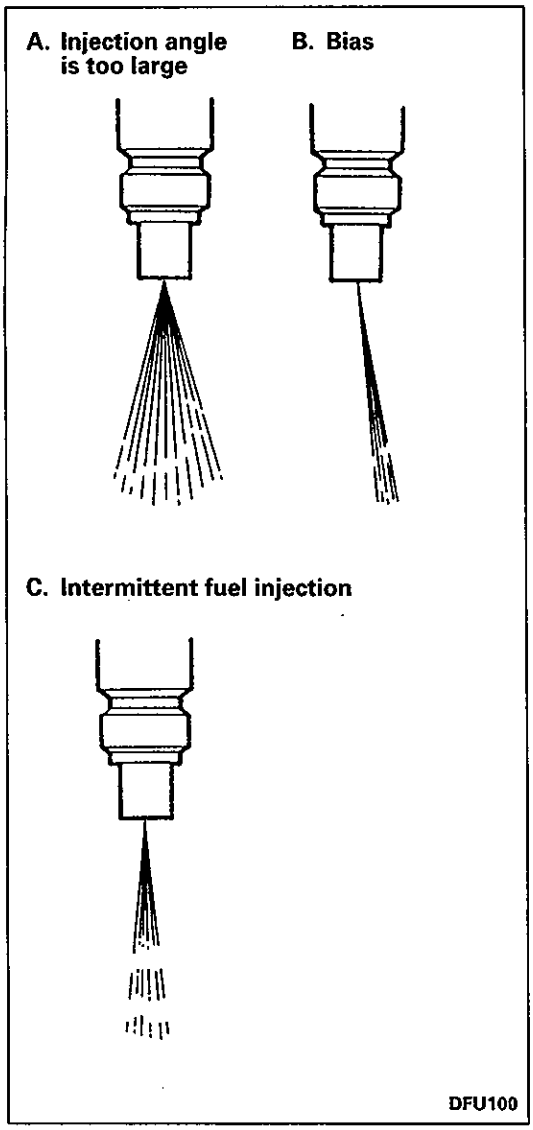
INJECTION NOZZLE INSPECTION AND ADJUSTMENT

Caution
Never touch the injection spray that is injected from the nozzle.

FUEL INJECTION INITIAL PRESSURE INSPECTION

(1) Install the injection nozzle to a nozzle tester.
(2) Move the lever of the nozzle tester 2 - 3 times to inject fuel and to bleed the air.
(3) Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

Standard value (Fuel injection initial pressure):
11,768–12,749 kPa (120–130 kg/cm^2, 1,707–1,849 psi)

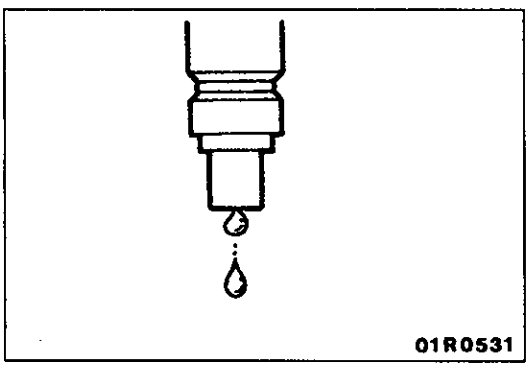


(4) If the fuel injection initial pressure is outside the standard value, disassemble the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

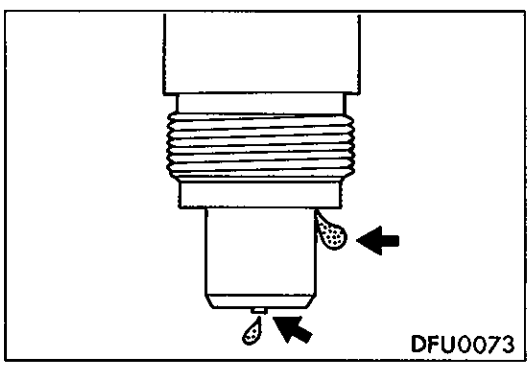
NOTE
1. For disassembly, reassembly and adjustment of the nozzle holder, refer to the Engine Workshop Manual.
2. There are 11 shims for adjustment, with thicknesses in the range 1.20 - 1.70 mm.
3. When the shim thickness is increased by 0.1 mm (0.0039 in.), the fuel injection initial pressure increases by 1471 kPa (15 kg/cm2, 213 psi.).

INJECTION SPRAY CONDITION INSPECTION

(1) Move the lever of the nozzle tester rapidly (4 - 6 times per second) to eject the fuel continuously. Check to be sure that the injection spray comes out evenly in a cone shape (injection spray angle is 15°). The injection spray patterns shown in the illustration at left are wrong.



(2) Check to be sure that no fuel drips after injection is completed.
(3) If there are any drips, disassemble the nozzle, clean it and re-inspect, or replace the nozzle.



NOZZLE FUEL-TIGHT INSPECTION

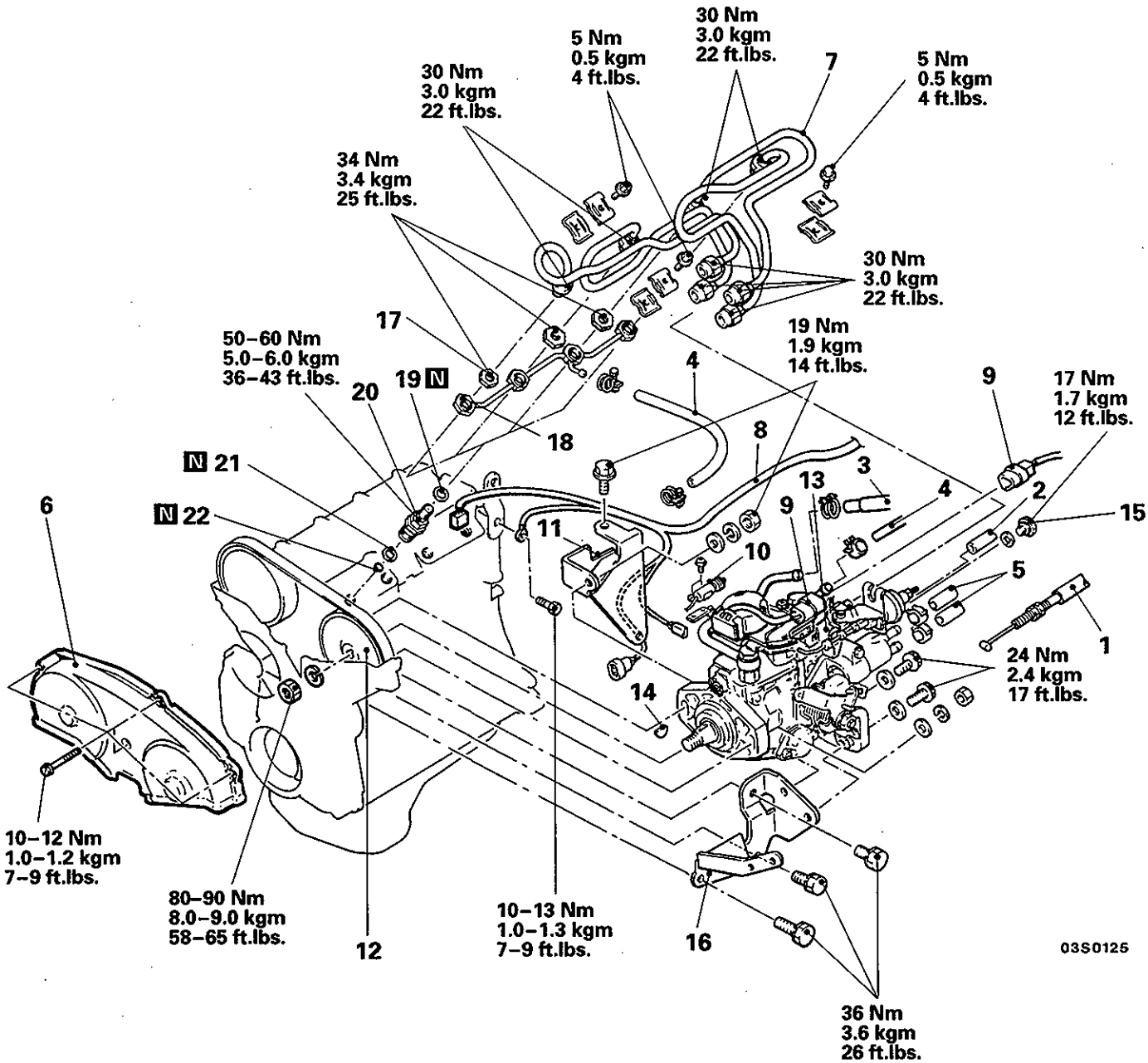
(1) Gently raise the lever of the nozzle tester until the pressure inside the nozzle (value displayed on pressure gauge) becomes 9807-10,787 kPa (100-110 kg/cm^2, 1,422-1,565 psi.), and after holding this pressure for approximately 10 seconds, check to be sure that there are no fuel leaks from the nozzle.
(2) If there are any leaks, disassemble the injection nozzle, clean it and re-inspect, or replace the nozzle.

FUEL INJECTION PUMP AND NOZZLE

REMOVAL AND INSTALLATION

E13MA--

Pre-removal and Post-installation Operation
<Fuel Injection Pump>
- Draining and Supplying of Coolant (Refer to GROUP 14–Service Adjustment Procedures.)
- Removal and Installation of Glow Plugs (Refer to GROUP16–Glow Plug.)
- Removal and Installation of Engine Mount Bracket (Refer to GROUP 32–Engine Mounting)

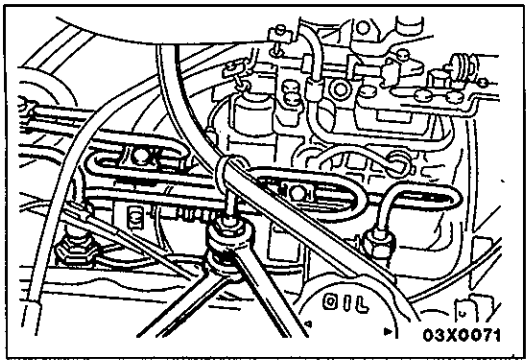


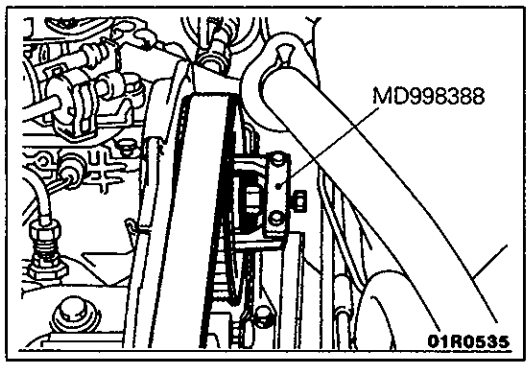
Fuel injection pump removal steps

- Accelerator cable adjustment (Refer to P. 13-182)
1. Accelerator cable connection
2. Vacuum hose connection
3. Fuel main hose connection
4. Fuel return hose connection
5. Water hose connection
6. Timing belt front upper cover
7. Fuel injection pipe
8. Fuel injection pump wiring harness
9. Lever position sensor connector
10. Lever position switch <Vehicles with automatic transmission and air conditioner>
11. Fuel injection pump stay
12. Fuel injection pump sprocket
13. Fuel injection pump
14. Key
15. Timing check plug
16. Fuel injection pump under bracket

Fuel injection nozzle removal steps

4. Fuel return hose connection
7. Fuel injection pipe
17. Nut
18. Fuel return pipe
19. Fuel return pipe gasket
20. Fuel injection nozzle
21. Holder gasket
22. Nozzle gasket





SERVICE POINTS OF REMOVAL E13MBAC

7. REMOVAL OF FUEL INJECTION PIPE

When loosening the nuts at both ends of the fuel injection pipe, use a spanner or similar tool to hold the connected component: the delivery holder (at the pump end) and the hexagonal nut of the fuel return pipe.

Caution
After disconnecting the injection pipe, be sure to use a plug so that foreign material, etc. does not get into the pump.

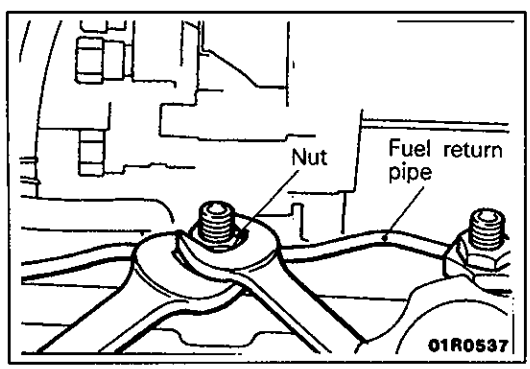
12./13. REMOVAL OF FUEL INJECTION PUMP SPROCKET AND FUEL INJECTION PUMP

(1) After removing the nut, install the special tool to the injection pump sprocket.
(2) Turn crankshaft clockwise to bring No. 1 cylinder piston to top dead center on compression stroke.
(3) Pull the injection pump sprocket off from the pump's drive shaft.
(4) Place the injection pump sprocket (with the timing belt attached) inside the timing belt front lower cover.

Caution
1. **When removing the sprocket, care must be taken not to subject the pump drive shaft to an impact.**
2. **Take care not to apply excessive or unnecessary force (such as excessive twisting, bending, etc.) to the timing belt.**
3. **After removal, the crankshaft should not be turned.**

(5) Remove the fuel injection pump.

Caution
When holding the injection pump, do not hold the accelerator lever or the fast idle lever.
Also, do not attempt to remove these levers, because to do so will result in a malfunction of the performance of the injection pump.

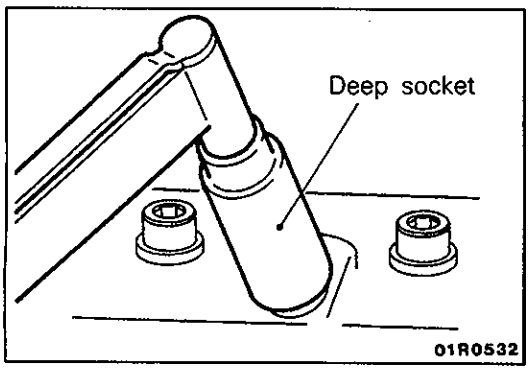


17./18. REMOVAL OF NUT AND FUEL RETURN PIPE

(1) While using a spanner or similar tool to hold the hexagonal nut of the fuel return pipe, remove the nut.

Caution
If an attempt is made to loosen the nut without first holding the fuel return pipe, the pipe may be broken or other wise damaged.

(2) Disconnect the fuel return pipe.

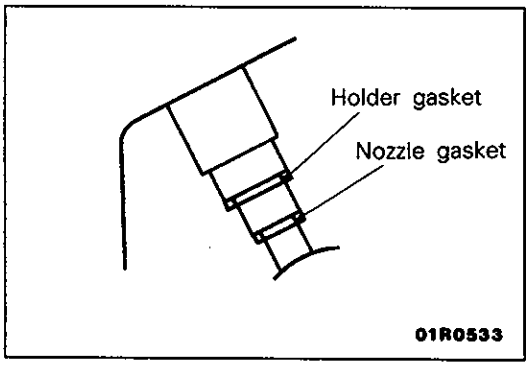


20. REMOVAL OF FUEL INJECTION NOZZLE

Using a deep socket wrench, remove the injection nozzle.

Caution

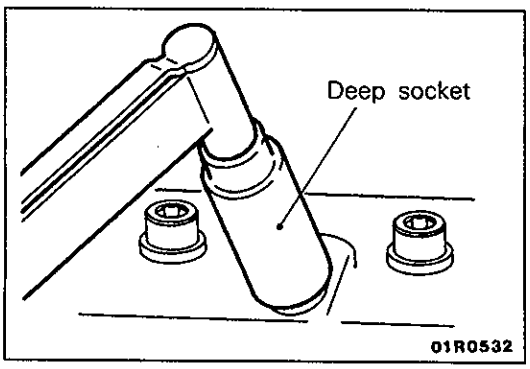
1. **Make a mark on the removed injection nozzle (the cylinder No.).**
2. **Use a cap to prevent foreign material, etc. from entering the injection nozzle hole.**



SERVICE POINTS OF INSTALLATION E13MDAC

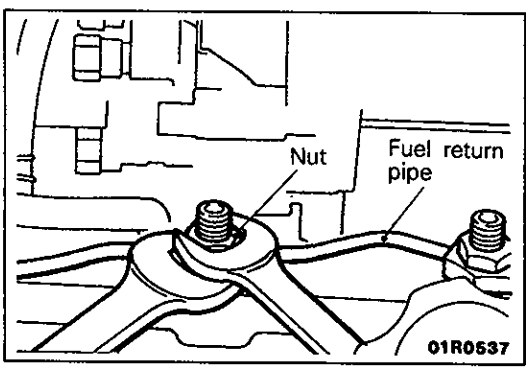
22./21. INSTALLATION OF NOZZLE GASKET AND HOLDER GASKET

Clean the cylinder head's injection nozzle hole, and insert a new gasket.



20. INSTALLATION OF FUEL INJECTION NOZZLE

Using a deep-socket wrench, tighten the fuel injection nozzle at the specified torque.

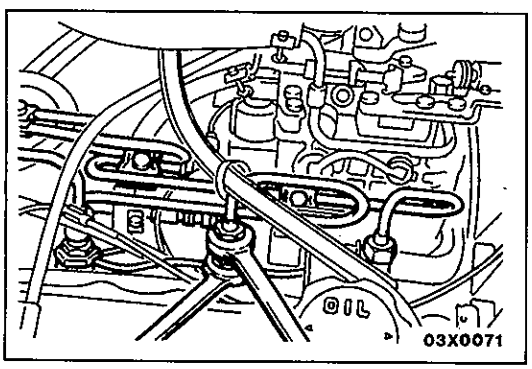


18./17. INSTALLATION OF FUEL RETURN PIPE AND NUT

While holding the hexagonal nut of the fuel return pipe with a spanner or similar tool, tighten the nut at the specified torque.

Caution

If an attempt is made to tighten the nut without first holding the fuel return pipe, the pipe may be broken or otherwise damaged.



7. INSTALLATION OF FUEL INJECTION PIPE

When tightening the nuts at both ends of the fuel injection pipe, use a spanner or similar tool to hold the connected component: the delivery holder (at the pump end) and the hexagonal nut of the fuel return pipe, and tighten at the specified torque.

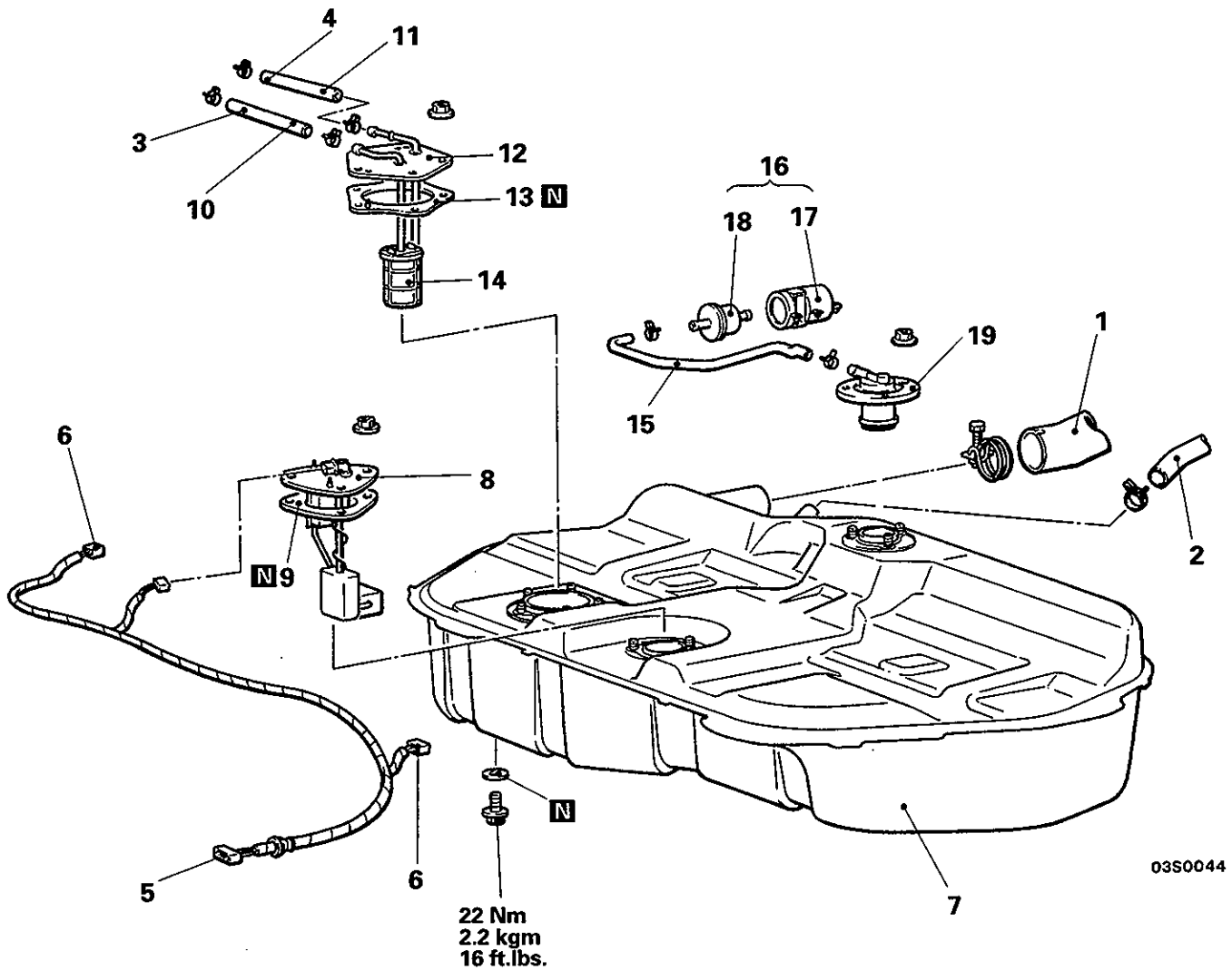
FUEL TANK <Sedan>

REMOVAL AND INSTALLATION

E13GA–

Pre-removal Operation	Post-installation Operation
• Draining the Fuel.	• Refilling the Fuel • Checking for Fuel Leaks

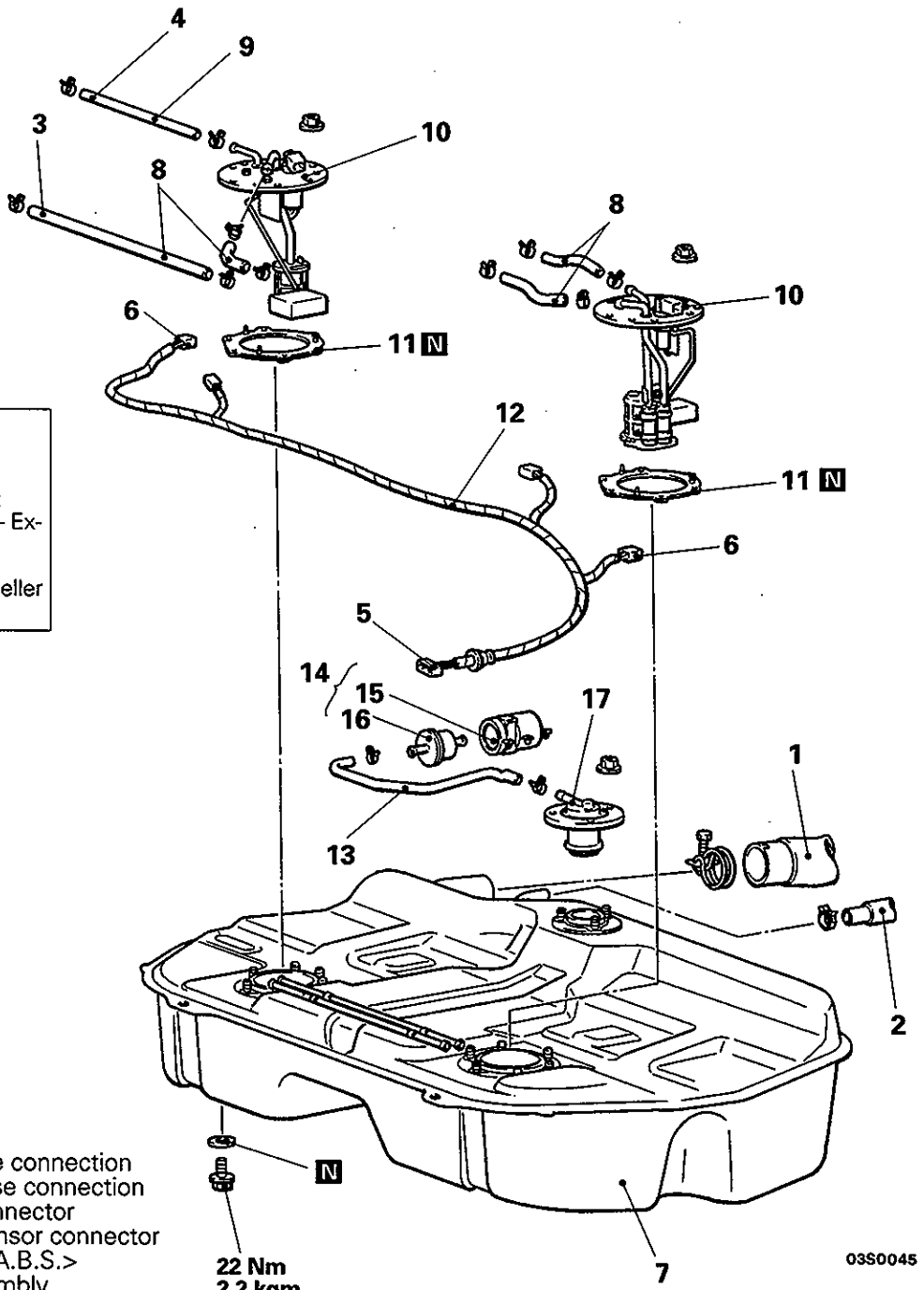
<2WD>



Removal steps

1. Filler hose
2. Vapor hose
3. Fuel main hose connection
4. Fuel return hose connection
5. Fuel gauge connector
6. Rear speed sensor connector <Vehicle with A.B.S.>
7. Fuel tank assembly
8. Fuel gauge unit
9. Packing
10. Fuel main hose
11. Fuel return hose
12. Fuel pipe assembly
13. Packing
14. Intank fuel filter
15. Vapor hose
16. Two-way valve and breather case assembly
17. Breather case
18. Two-way valve
19. Fuel cut off valve

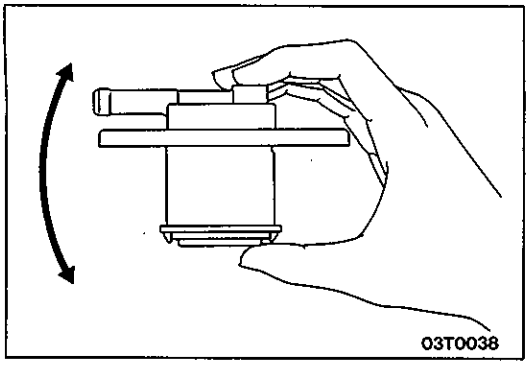
<4WD>



Pre-removal Operation
- Draining the Fuel.
- Removal of Heat Protector.
- Removal of Center Exhaust Pipe. (Refer to GROUP 15 – Exhaust Pipe and Muffler.)
- Removal of Propeller Shaft. (Refer to GROUP 25 – Propeller Shaft.)

Removal steps
1. Filler hose
2. Vapor hose
3. Fuel main hose connection
4. Fuel return hose connection
5. Fuel gauge connector
6. Rear speed sensor connector <Vehicle with A.B.S.>
7. Fuel tank assembly
8. Fuel main hose
9. Fuel return hose
10. Fuel gauge unit and pipe assembly
11. Packing
12. Fuel gauge wiring harness
13. Vapor hose
14. Two-way valve and breather case assembly
15. Breather case
16. Two-way valve
17. Fuel cut off valve

Post-installation Operation
- Installation of Propeller Shaft. (Refer to GROUP 25 – Propeller Shaft.)
- Installation of Center Exhaust Pipe. (Refer to GROUP 15 – Exhaust Pipe and Muffler.)
- Installation of Heat Protector.
- Refilling the Fuel.
- Checking for Fuel Leaks.



INSPECTION

E13GCAP

FUEL CUT OFF VALVE

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

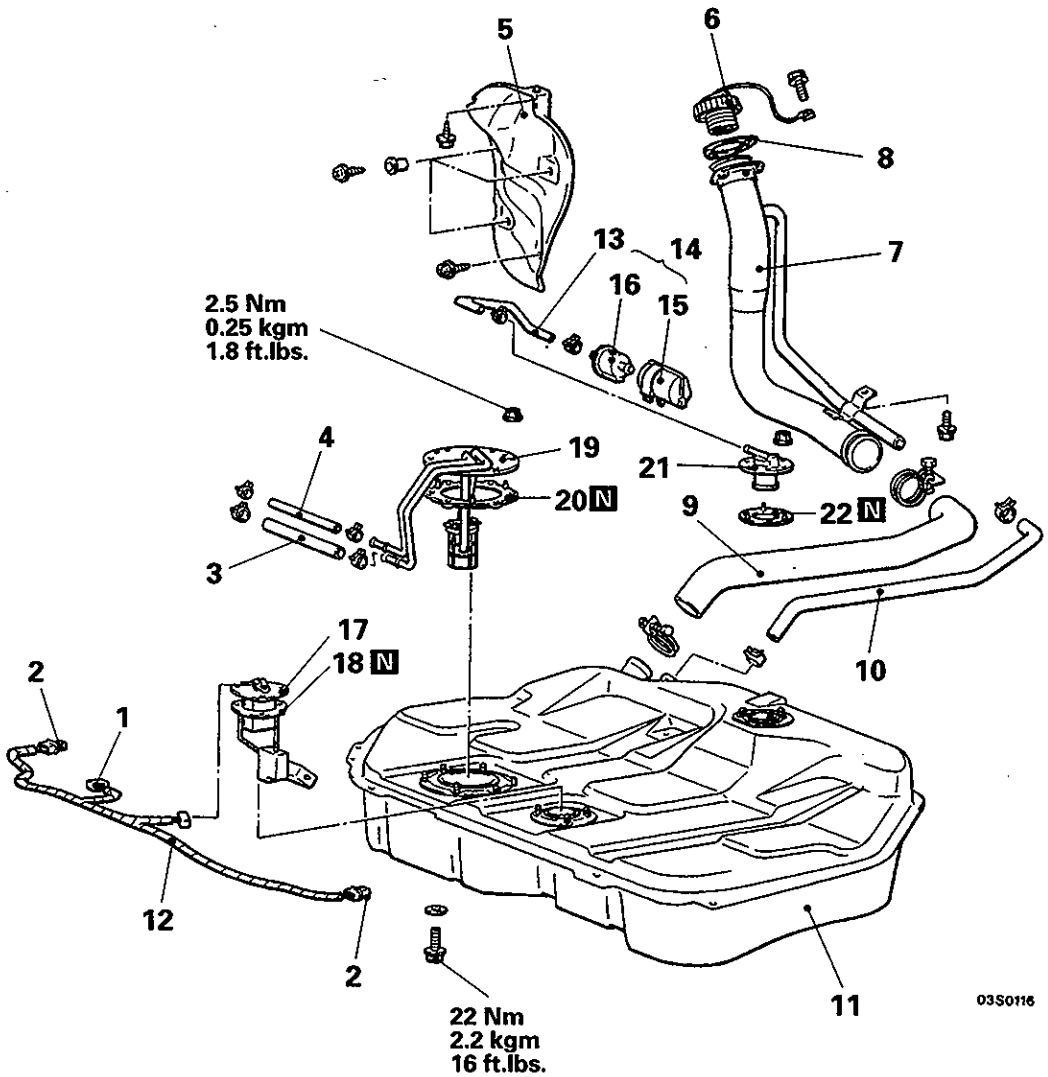
FUEL TANK <Wagon>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining the Fuel.

Post-installation Operation
- Refilling the Fuel
- Checking for Fuel Leaks

<2WD>



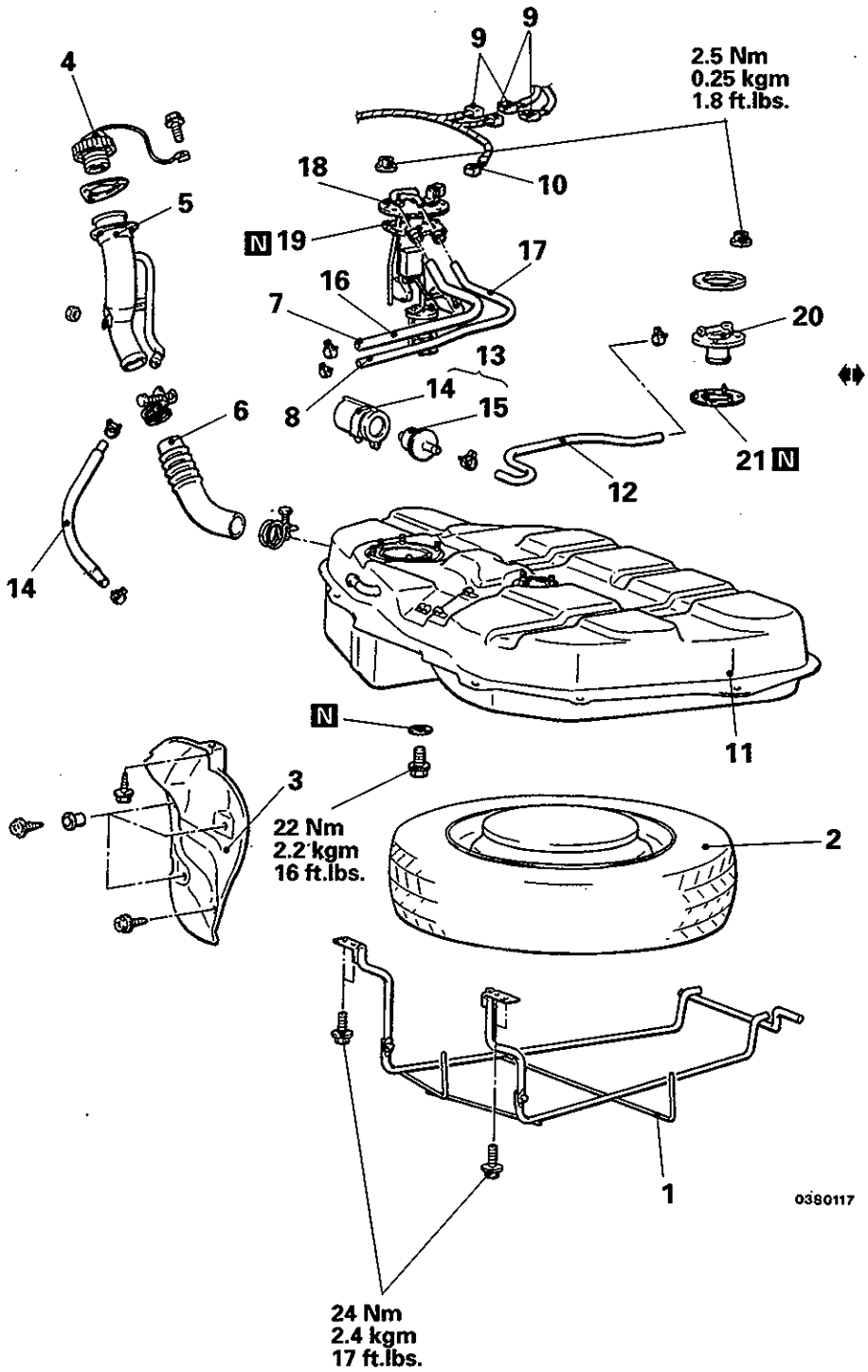
Removal steps

1. Fuel gauge wiring harness connector
2. Rear speeds sensor connector <Vehicle with A.B.S.>
3. Fuel main hose
4. Fuel return hose
5. Rear splash shield (R.H.)
6. Fuel filler cap
7. Fuel filler neck
8. Packing
9. Fuel filler hose
10. Vapor hose
11. Fuel tank assembly
12. Fuel gauge wiring harness
13. Vapor hose
14. Two-way valve and breather case assembly
15. Breather case
16. Two-way valve
17. Fuel gauge unit
18. Packing
19. Fuel pipe assembly
20. Packing
21. Fuel cut off valve
22. Packing

<4WD>

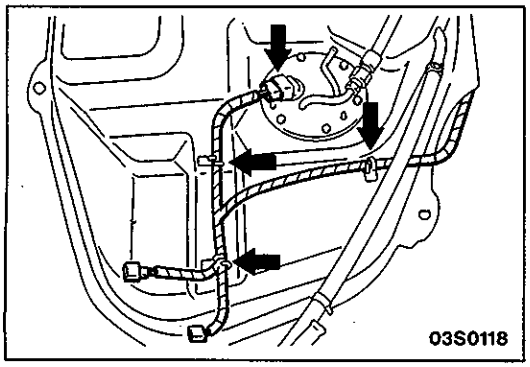
Pre-removal Operation
- Draining the Fuel.

Post-installation Operation
- Refilling the Fuel
- Checking for Fuel Leaks



Removal steps

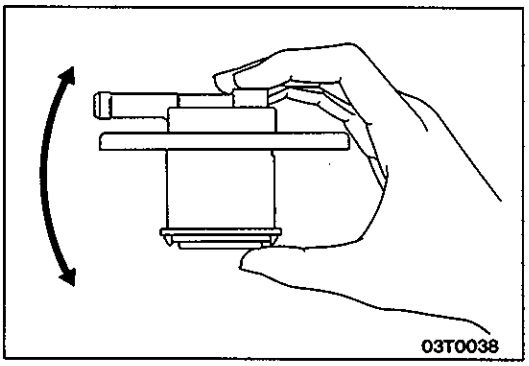
1. Spare tyre carrier
2. Spare tyre
3. Rear splash shield (R.H.)
4. Fuel filler cap
5. Fuel filler neck
6. Fuel filler hose
7. Fuel main hose connection
8. Fuel return hose connection
9. Fuel gauge wiring harness connector
10. Fuel gauge unit connector
11. Fuel tank assembly
12. Vapor hose
13. Two-way valve and breather case assembly
14. Breather case
15. Two-way valve
16. Fuel main hose
17. Fuel return hose
18. Fuel gauge unit
19. Packing
20. Fuel cut off valve
21. Packing



SERVICE POINTS OF REMOVAL E13GBAQ

9. REMOVAL OF FUEL GAUGE WIRING HARNESS CONNECTOR

(1) Lower the fuel tank slightly and support it in this condition with a transmission jack.
(2) After disconnecting the fuel gauge unit and pump connector, disconnect the fuel harness from the fuel tank.



INSPECTION E13GCAP

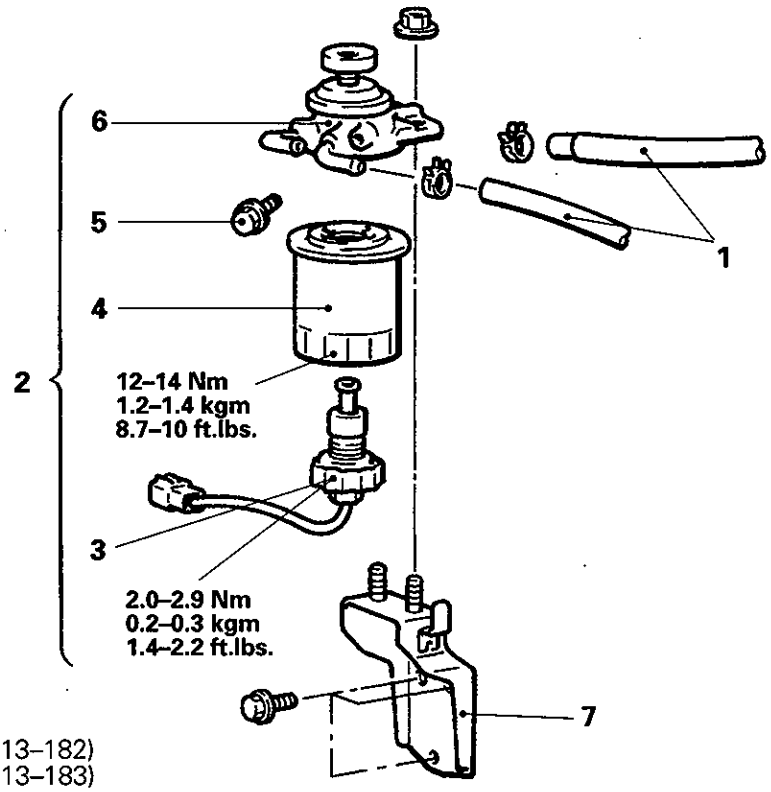
FUEL CUT OFF VALVE

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

FUEL FILTER

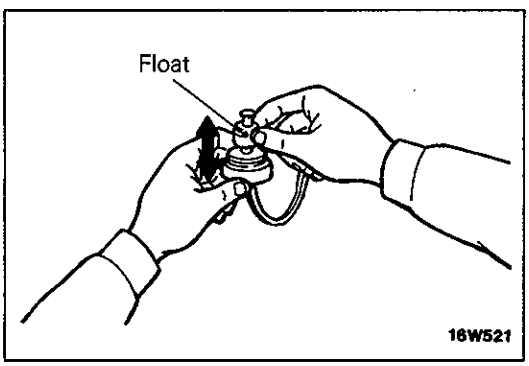
E13ZA--

REMOVAL AND INSTALLATION



Removal steps

◆◆ 1. Fuel main hose connection
2. Fuel filter assembly
3. Water level sensor (Refer to P.13–182)
4. Fuel filter cartridge (Refer to P.13–183)
5. Breather screw
6. Fuel filter pump
7. Fuel filter bracket

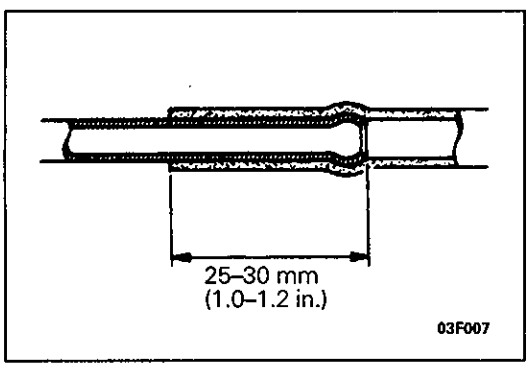


INSPECTION

E13ZCAA

INSPECTION OF WATER LEVEL SENSOR OPERATION

Connect circuit tester to water level sensor connector. Water level sensor is operating correctly if there is continuity when float is raised and no continuity when lowered.



SERVICE POINTS OF INSTALLATION

E13ZDAA

1. INSTALLATION OF FUEL MAIN HOSE

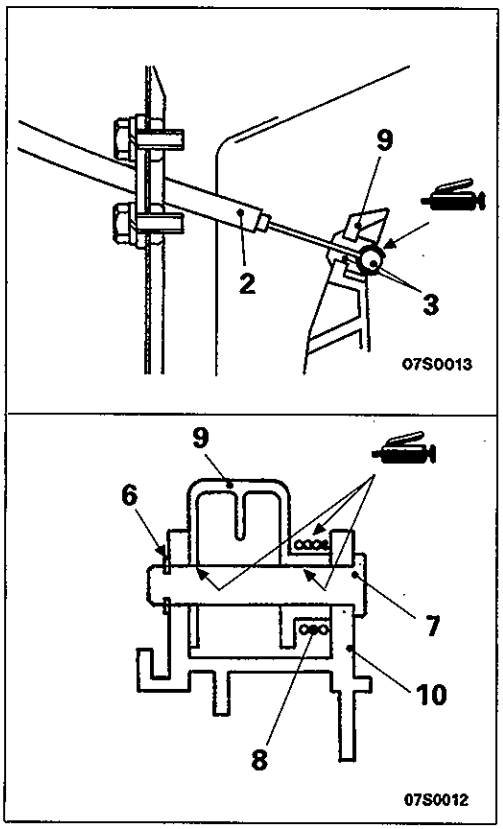
Insert each hose securely as far as the stepped section on the pipes.
Insert each hose 25–30 mm (1.0–1.2 in.). If the pipe side is too short, insert the hose as far as possible.

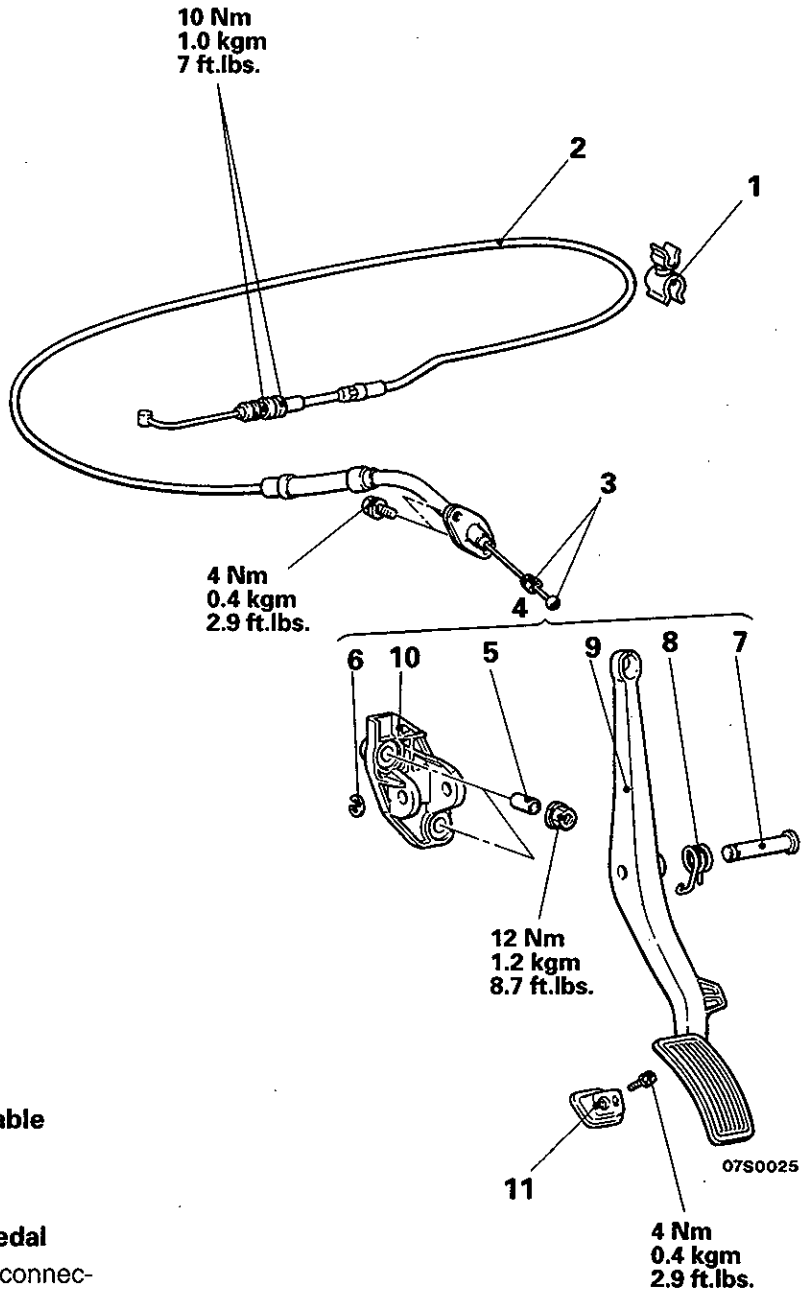
ACCELERATOR CABLE AND PEDAL

E13OA-1

REMOVAL AND INSTALLATION <L.H. DRIVE VEHICLES>

Post-installation Operation
- Adjusting the Accelerator Cable (Refer to P.13–182.)





Removal steps of accelerator cable

1. Clip
2. Accelerator cable

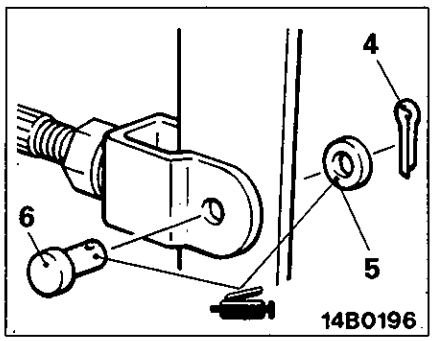
Removal steps of accelerator pedal

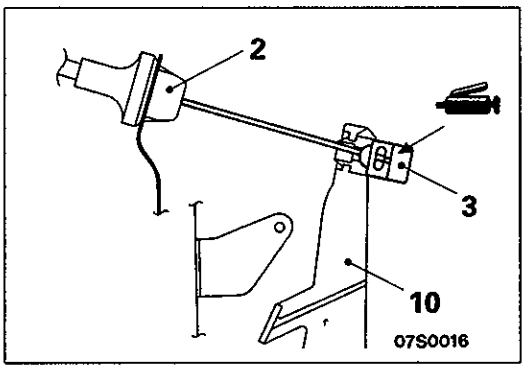
3. Bushing and accelerator cable connection
4. Accelerator pedal assembly
5. Spacer
6. Snap ring
7. Pin
8. Return spring
9. Accelerator pedal arm
10. Accelerator pedal support
11. Accelerator pedal stopper

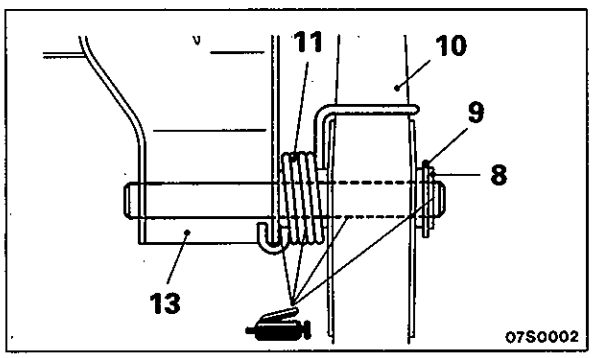
REMOVAL AND INSTALLATION <R.H. drive vehicles>

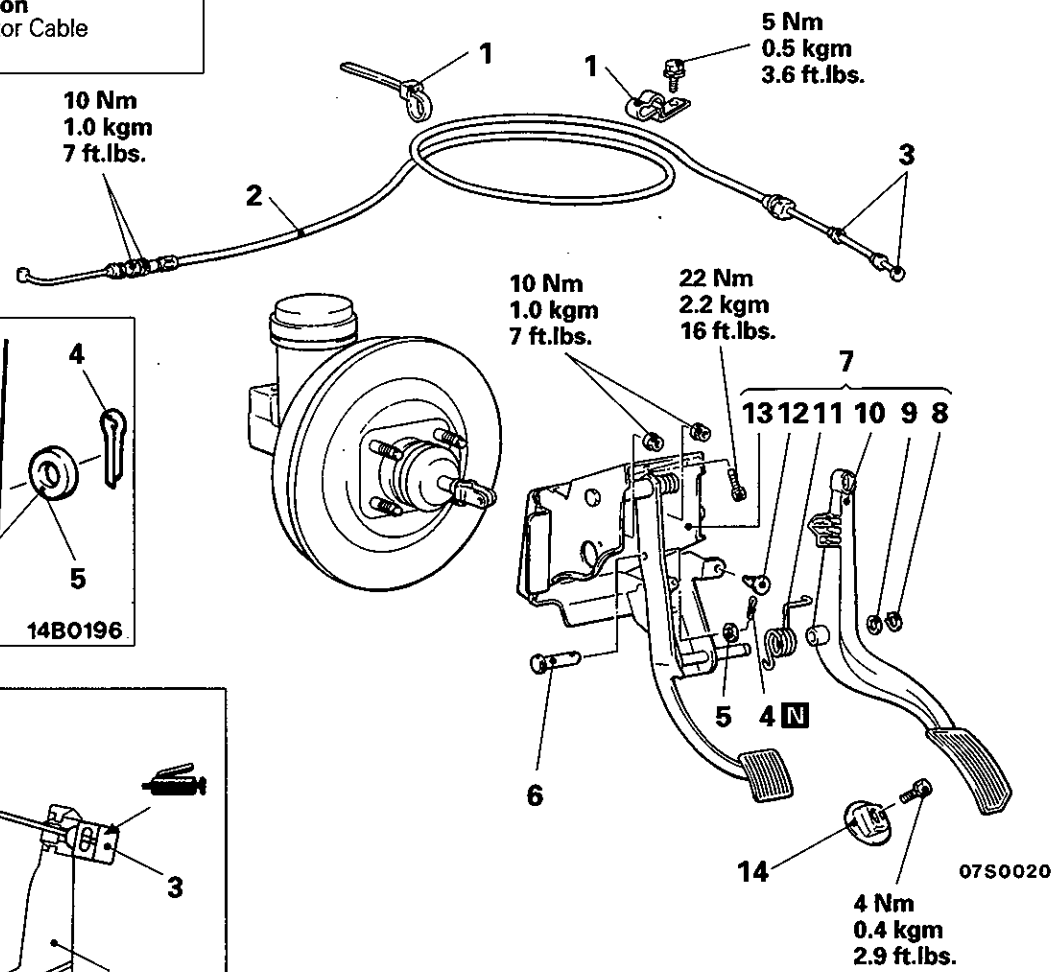
E130A-2

Post-installation Operation
- Adjusting the Accelerator Cable (Refer to P.13–182.)









Removal steps of accelerator cable
1. Clamp and cable band
2. Accelerator cable

Removal steps of accelerator pedal
3. Bushing and accelerator cable connection
4. Split pin
5. Washer
6. Clevis pin
7. Brake and accelerator pedal assembly
8. Snap ring
9. Washer
10. Accelerator pedal
11. Return spring
12. Stopper
13. Brake pedal assembly
14. Accelerator pedal stopper