

ENGINE AND EMISSION CONTROL

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ENGINE CONTROL SYSTEM

GENERAL INFORMATION

A cable-type accelerator mechanism and a suspended-type pedal have been adopted.

SERVICE SPECIFICATIONS

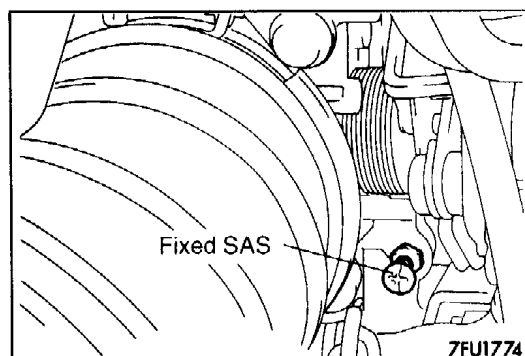
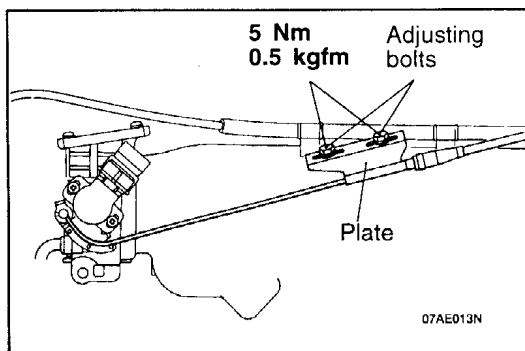
Items	Standard value
Accelerator cable play mm	3–5
Engine idle speed r/min	700 ± 50

ON-VEHICLE SERVICE

ACCELERATOR CABLE CHECK AND ADJUSTMENT

- Turn A/C and lights OFF.
Inspect and adjust at no load.
- Warm engine until stabilised at idle.
- Confirm idle speed is at prescribed r/min.
- Stop engine (ignition switch OFF).
- Confirm there are no sharp bends in accelerator cable.
- Check inner cable for correct slack.
- If there is too much slack or no slack, adjust play by the following procedures.
 - Loosen the adjusting bolt to release the cable.
 - After moving the plate to the position immediately before the throttle lever starts to move, move the plate back towards the throttle body by the standard value amount only to bring the accelerator cable play to the standard value.

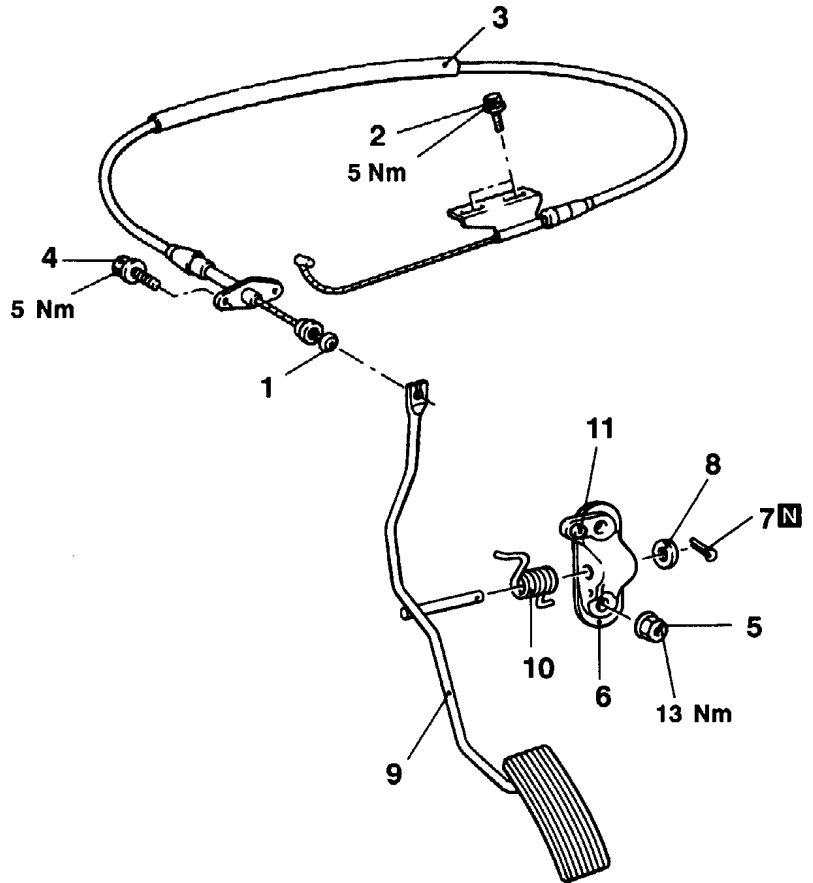
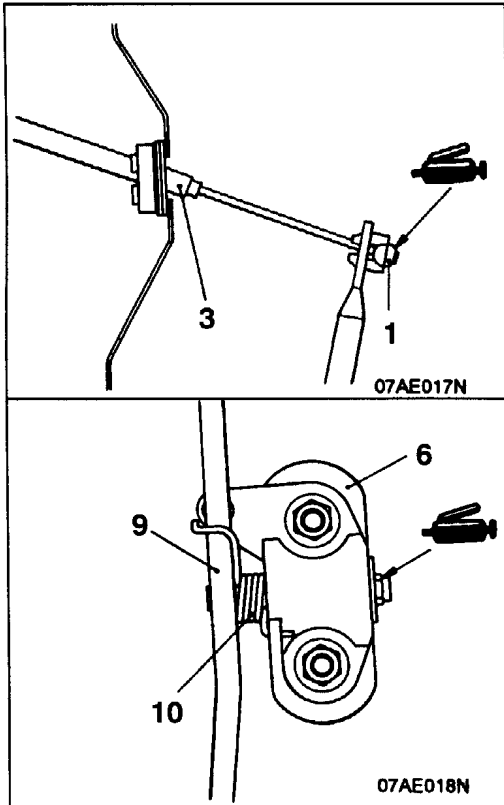
Standard value: 3–5 mm
 - Tighten the adjusting bolts to the specified torque.
- Adjust accelerator cable play and confirm throttle lever stopper touches the fixed SAS.



ACCELERATOR CABLE AND PEDAL REMOVAL AND INSTALLATION

Post-installation Operation

Adjusting the Accelerator Cable (Refer to P.17-3.)



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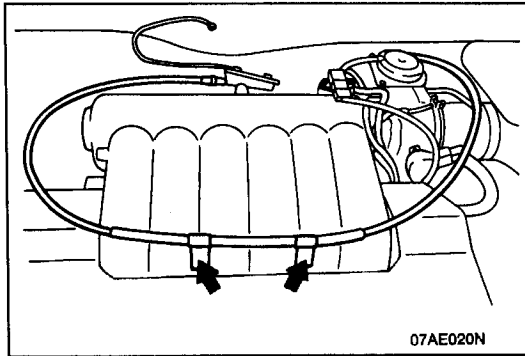
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Removal steps of accelerator cable

1. Accelerator cable connection
2. Adjusting bolts
- ▶◀ 3. Accelerator cable
4. Bolt

Removal steps of accelerator pedal

5. Nut
6. Accelerator pedal bracket
7. Cotter pin
8. Washer
9. Accelerator pedal
10. Spring
11. Accelerator pedal stopper

**INSTALLATION SERVICE POINT****▶A◀ ACCELERATOR CABLE INSTALLATION**

Install the accelerator cable, ensuring that the cable is securely clamped in the support clips as shown by the arrows.

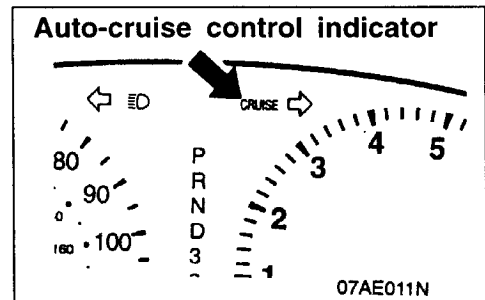
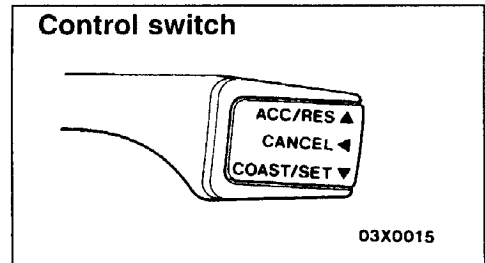
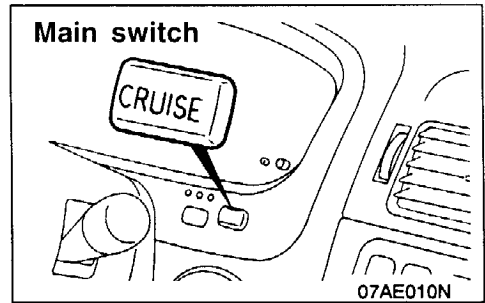
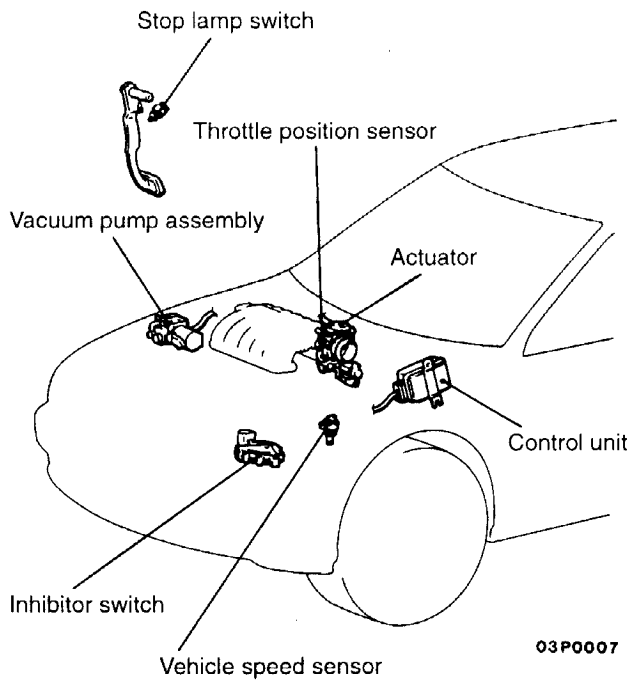
AUTO-CRUISE CONTROL SYSTEM

GENERAL INFORMATION

By using the auto-cruise control, the driver can drive at the speed he/she likes [in a range of approxi-

mately 40–200 km/h] without depressing the accelerator pedal.

CONSTRUCTION DIAGRAM



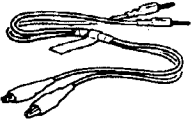


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SERVICE SPECIFICATIONS

Items	Standard value
Accelerator cable play mm	3-5

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II	<ul style="list-style-type: none">• Reading diagnosis codes• Auto-cruise control system inspection
	—	ROM Pack	
	MB991529	Diagnosis code check harness	Checking the diagnosis codes

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Read a diagnosis code by the MUT-II or voltmeter. (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points.

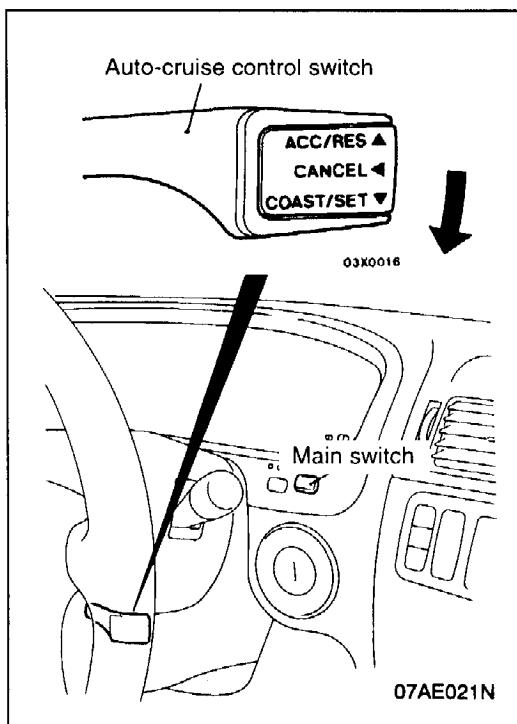
METHOD OF ERASING DIAGNOSIS CODES

The diagnosis codes can be erased by disconnecting the (-) cable from the battery for 10 seconds or more and then re-connecting it, or by the following procedure.

1. Turn the ignition switch to ON.
2. With the SET switch at the ON position, press the main switch to ON, and within 1 second after this, turn the RESUME switch to ON.
3. With the SET switch once more at the ON position, hold the stop lamp switch ON for a continuous period of 5 seconds or more.

INPUT SWITCH CODE INSPECTION METHOD

1. Connect the MUT-II to the diagnosis connector (16-pin) underneath the instrument under cover.
2. With the ignition switch in the ON position, press the cruise control SET switch to the ON position.
3. Within 1 second after pressing the cruise control main switch to ON, turn the cruise control RESUME switch to ON.
4. Operate each switch listed in the input inspection table and take a reading of the input switch codes with the MUT-II.



Input Inspection Table

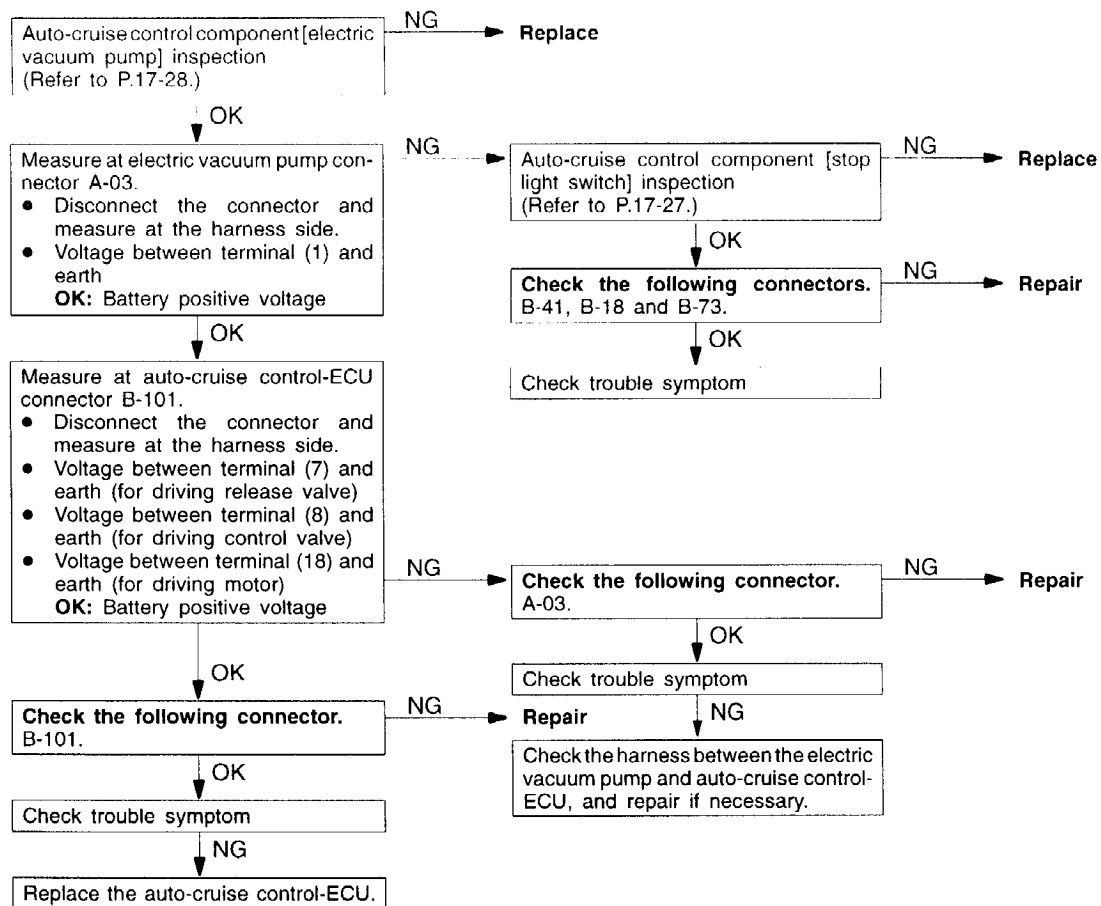
Code No.	Input operation	Operation judgement
21	SET switch ON	Auto-cruise control-ECU judges that SET switch is ON
22	RESUME switch ON	Auto-cruise control-ECU judges that RESUME switch is ON
23	Stop lamp switch (ON when brake pedal is depressed)	Auto-cruise control-ECU judges that stop lamp switch is ON
24	Vehicle speed signal	Auto-cruise control-ECU judges that vehicle speed is 40 km/h or higher
25		Auto-cruise control-ECU judges that vehicle speed is lower than 40 km/h
26	Inhibitor switch (ON when select lever in N range) <A/T> Clutch pedal switch (ON when clutch pedal is depressed) <M/T>	Auto-cruise control-ECU judges that the inhibitor switch or clutch pedal switch is ON
27	CANCEL switch ON	Auto-cruise control-ECU judges that CANCEL switch is ON
28	Throttle position sensor signal	Auto-cruise control-ECU judges that throttle position sensor voltage is 1.5 V or more
29	Idle position switch	Auto-cruise control-ECU judges that idle position switch is OFF

INSPECTION CHART FOR DIAGNOSIS CODES

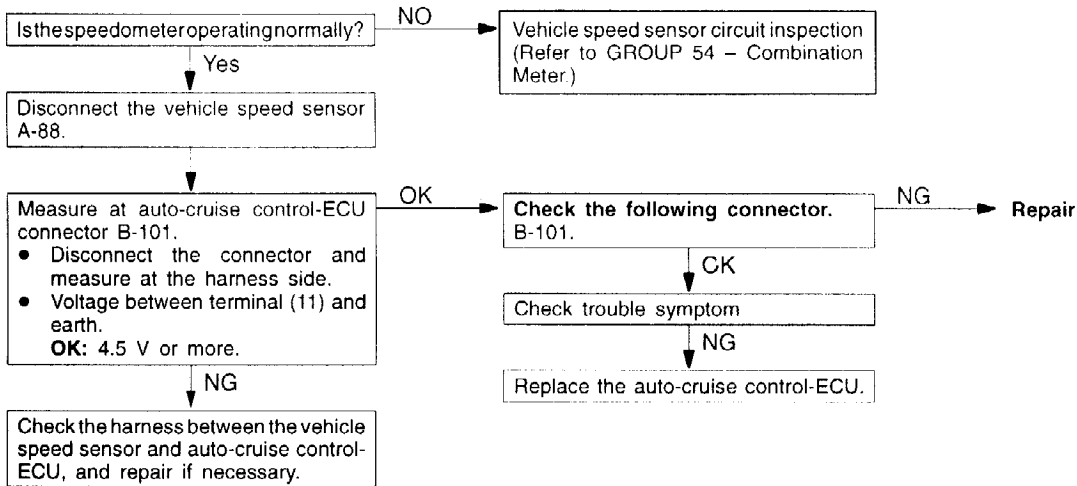
Code No.	Diagnosis items	Reference page
11	Electric vacuum pump drive system	17-10
12	Vehicle speed sensor system	17-11
14	Electric vacuum pump power supply system	17-11
15	Auto-cruise control switch	17-11
16	Auto-cruise control-ECU	17-12
17	Throttle position sensor system	17-12

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

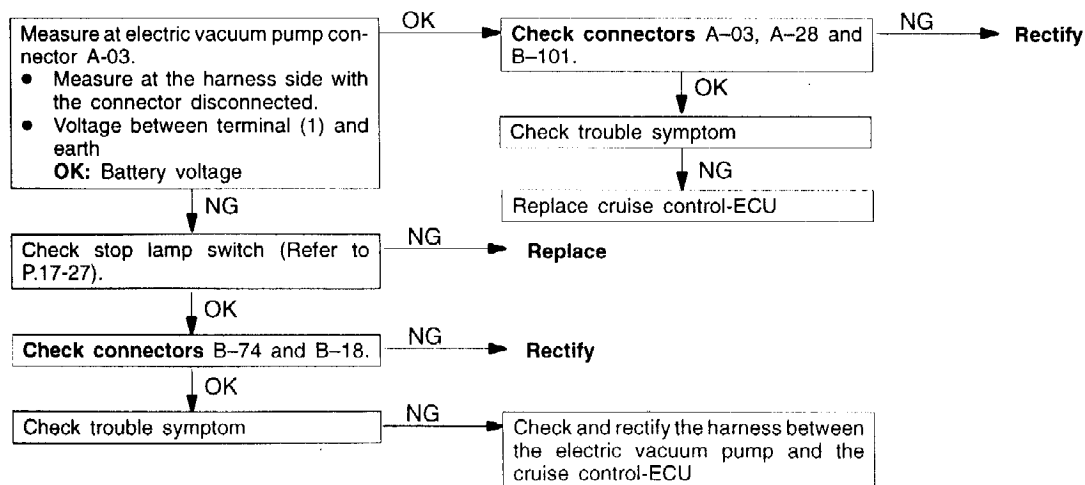
Code No.11 Electric vacuum pump drive system	Probable cause
This diagnosis code is output if the release valve, control valve and motor drive signals from the electric vacuum pump are not input to the auto-cruise control-ECU.	<ul style="list-style-type: none"> ● Malfunction of the electric vacuum pump ● Malfunction of the stop lamp switch ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the auto-cruise control-ECU



Code No.12 Vehicle speed signal system	Probable cause
This diagnosis code is output if the vehicle speed signals from the vehicle speed sensor are not input to the auto-cruise control-ECU when the vehicle speed is 40 km/h or more.	<ul style="list-style-type: none"> • Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



Code No.14 Electric vacuum pump power supply system	Probable cause
This diagnosis code is output if the electric vacuum pump release valve, control valve and motor driving signals are not input into the cruise control-ECU.	<ul style="list-style-type: none"> • Stop lamp switch fault • Connector fault • Harness fault • Cruise control-ECU fault



Code No.15 Auto-cruise control switch	Probable cause
This diagnosis code is output if the cruise control RESUME switch, SET switch or CANCEL switch remains ON.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control switch

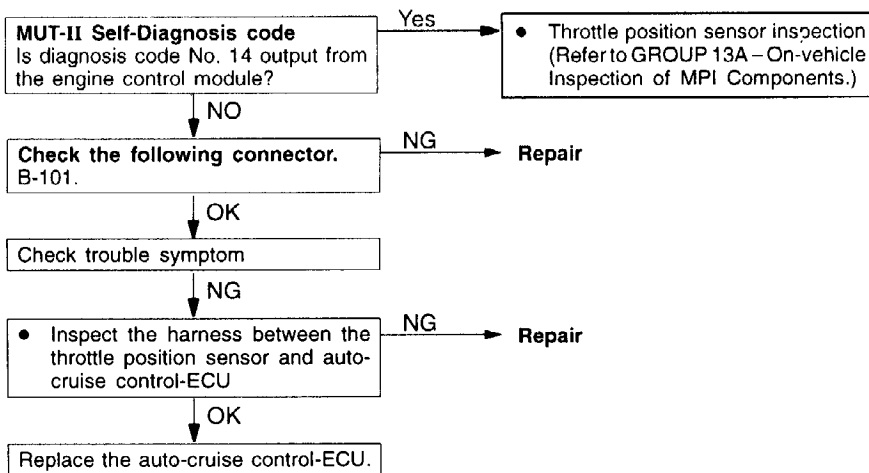
Replace the auto-cruise control switch.

17-12 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

Code No.16 Auto-cruise control-ECU	Probable cause
This diagnosis code is output if there is an abnormality in the CANCEL hold circuit or the microprocessor monitor circuit in the auto-cruise control-ECU.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control-ECU

Replace the auto-cruise control-ECU.

Code No.17 Throttle position sensor system	Probable cause
This diagnosis code is output if a voltage of 1.5 V or more when the idle position switch is ON or 0.2 V or less when the idle position switch is OFF is output for a continuous period of 4 seconds or more.	<ul style="list-style-type: none"> • Malfunction of the throttle position sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	17-13
	Communication with auto-cruise control-ECU only is not possible.	2	17-14
Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)		3	17-15
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	4	17-16
	Even if the clutch pedal is depressed <M/T>	5	17-17
	Even if the select lever is set to N range <A/T>	6	17-18
	Even if CANCEL switch is set to ON	7	17-18
The diagnosis result displayed on the MUT-II is normal even though auto-cruise control cannot be set.		8	17-19
Auto-cruise control cannot be set.		9	17-20
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		10	17-21
Even though auto-cruise control main switch is ON, switch indicator does not illuminate. (However, auto-cruise control is normal.)		11	17-21
Auto-cruise control main switch illumination lamp does not illuminate.		12	17-22
Auto-cruise control indicator lamp inside combination meter does not illuminate. (However, auto-cruise control is normal.)		13	17-22

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

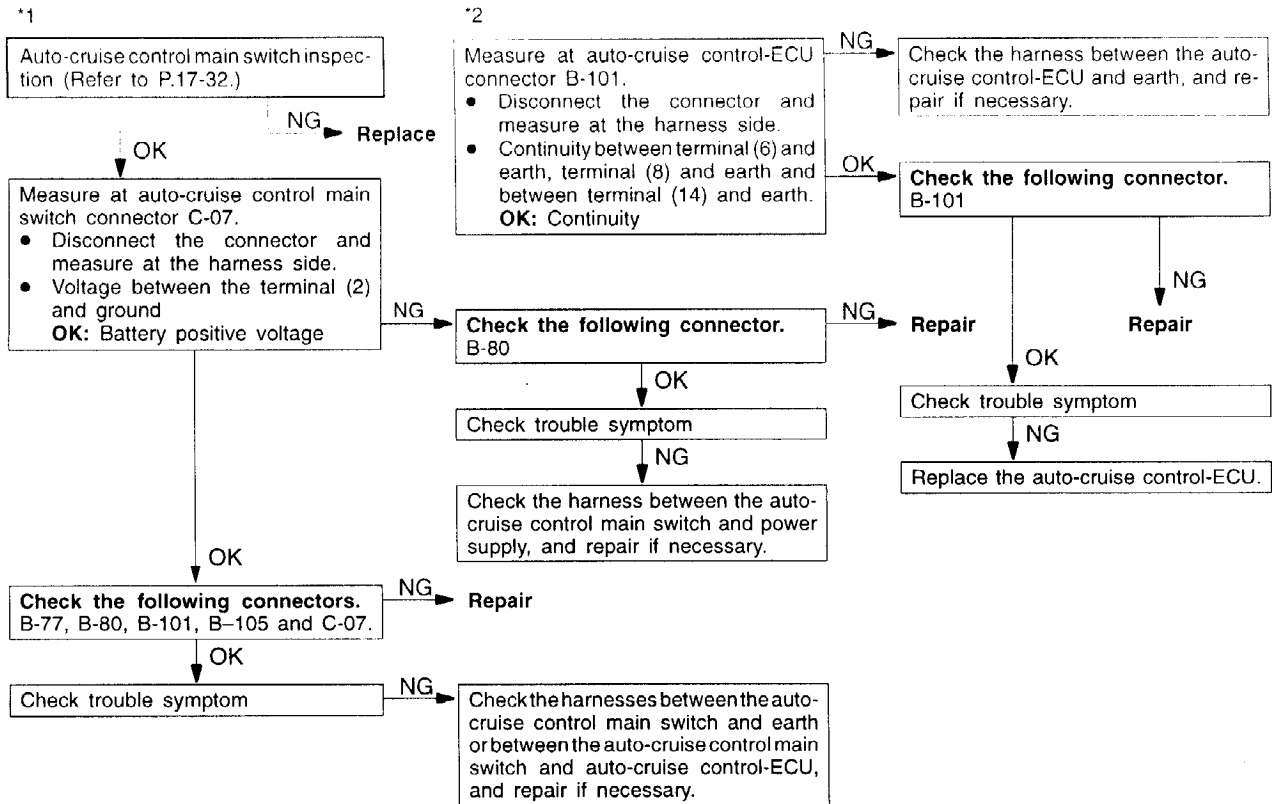
Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The reason is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> ● Malfunction of the connector ● Malfunction of the harness

Refer to GROUP 13A – Troubleshooting

17-14 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

INSPECTION PROCEDURE 2

Communication with MUT-II is not possible. (Communication with auto-cruise control-ECU only is not possible.)	Probable cause
The cause is probably a malfunction of auto-cruise control main switch circuit or a malfunction of auto-cruise control-ECU earth circuit.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control main switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



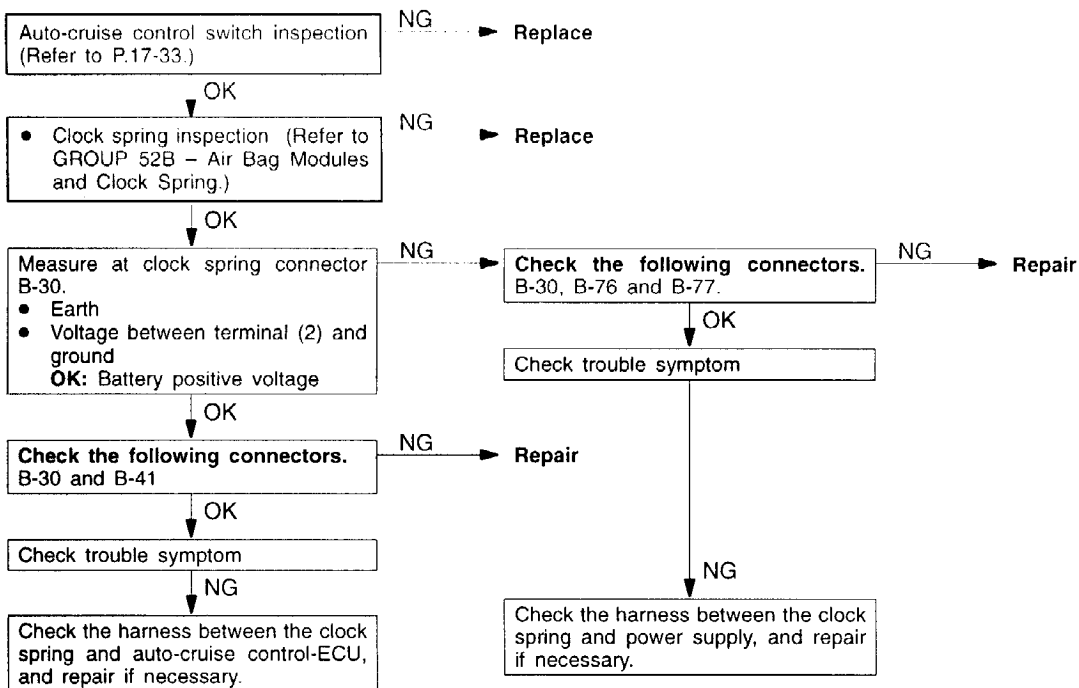
NOTE

*1 indicates malfunction of the auto-cruise control main switch circuit.

*2 indicates malfunction of the auto-cruise control-ECU earth circuit.

INSPECTION PROCEDURE 3

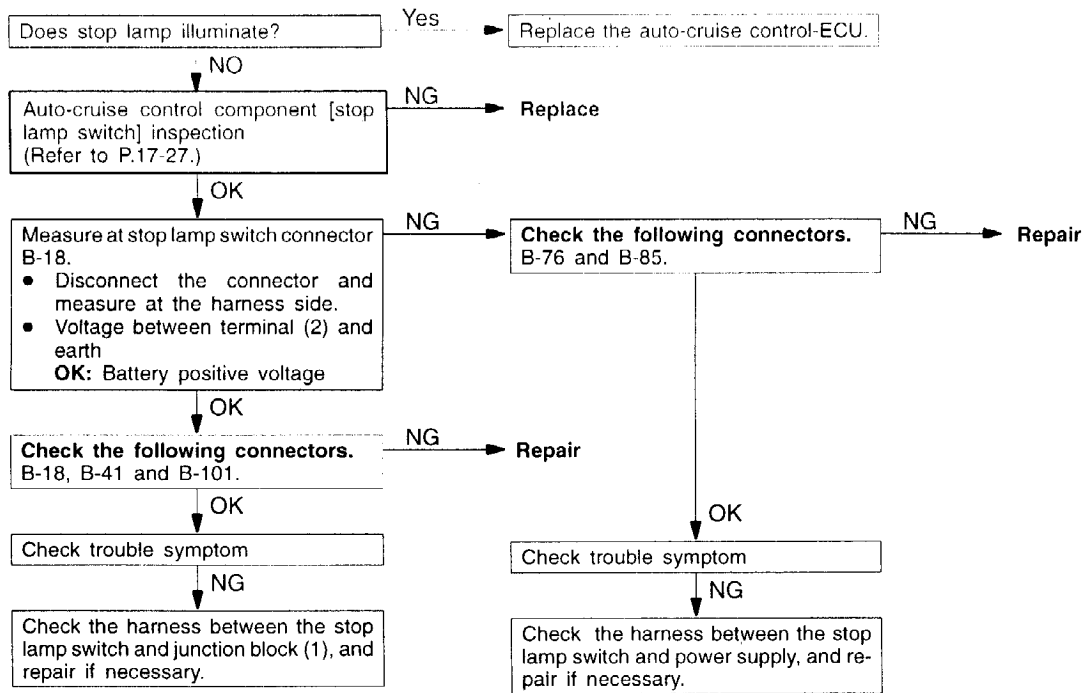
Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)	Probable cause
The cause is probably a malfunction of auto-cruise control switch circuit system.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control switch • Malfunction of the clock spring • Malfunction of the connector • Malfunction of the harness



17-16 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

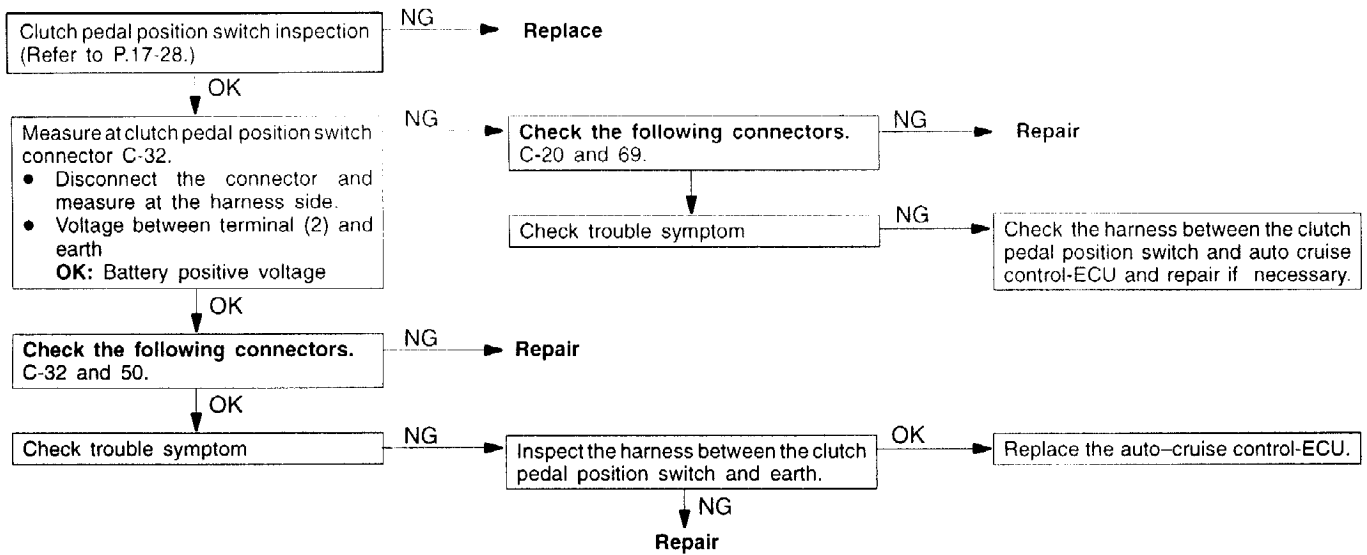
INSPECTION PROCEDURE 4

Even if brake pedal is depressed, auto-cruise control is not cancelled.	Probable cause
The cause is probably a malfunction of stop lamp switch or a malfunction of stop lamp circuit.	<ul style="list-style-type: none"> ● Malfunction of the stop lamp switch ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the auto-cruise control-ECU



INSPECTION PROCEDURE 5

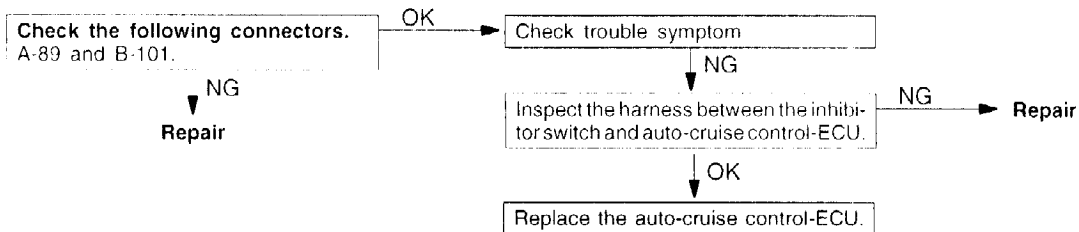
Even if clutch pedal is depressed, auto-cruise control is not cancelled. <M/T>	Probable cause
The cause is probably a malfunction of clutch pedal position switch or clutch circuit.	<ul style="list-style-type: none"> ● Malfunction of the clutch pedal position switch ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the auto-cruise control-ECU



17-18 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

INSPECTION PROCEDURE 6

Even if select lever is set to N range, auto-cruise control is not cancelled. <A/T>	Probable cause
The cause is probably an open-circuit in the output signal circuit in N range.	<ul style="list-style-type: none"> ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the auto-cruise control-ECU



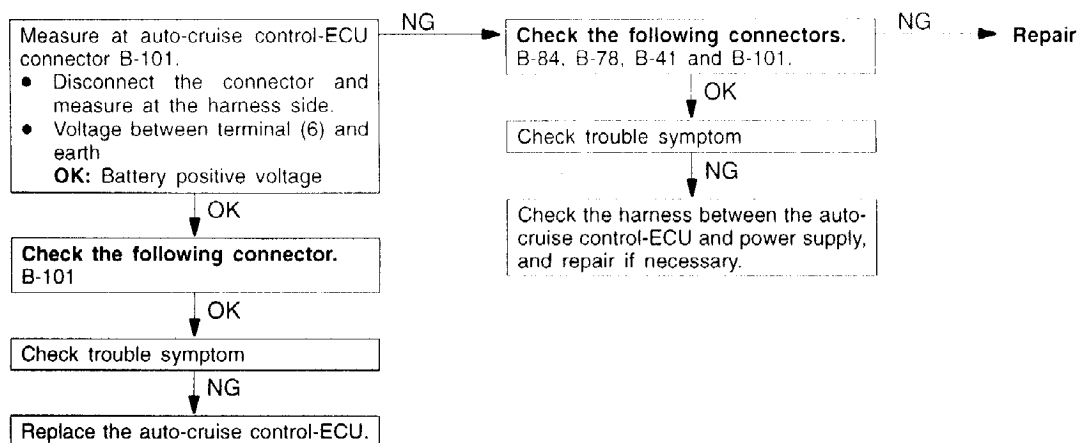
INSPECTION PROCEDURE 7

Even if auto-cruise control CANCEL switch is set to ON, auto-cruise control is not cancelled.	Probable cause
The cause is probably an open-circuit in the circuit inside the CANCEL switch.	<ul style="list-style-type: none"> ● Malfunction of the auto-cruise control-ECU

Replace the auto-cruise control switch.

INSPECTION PROCEDURE 8

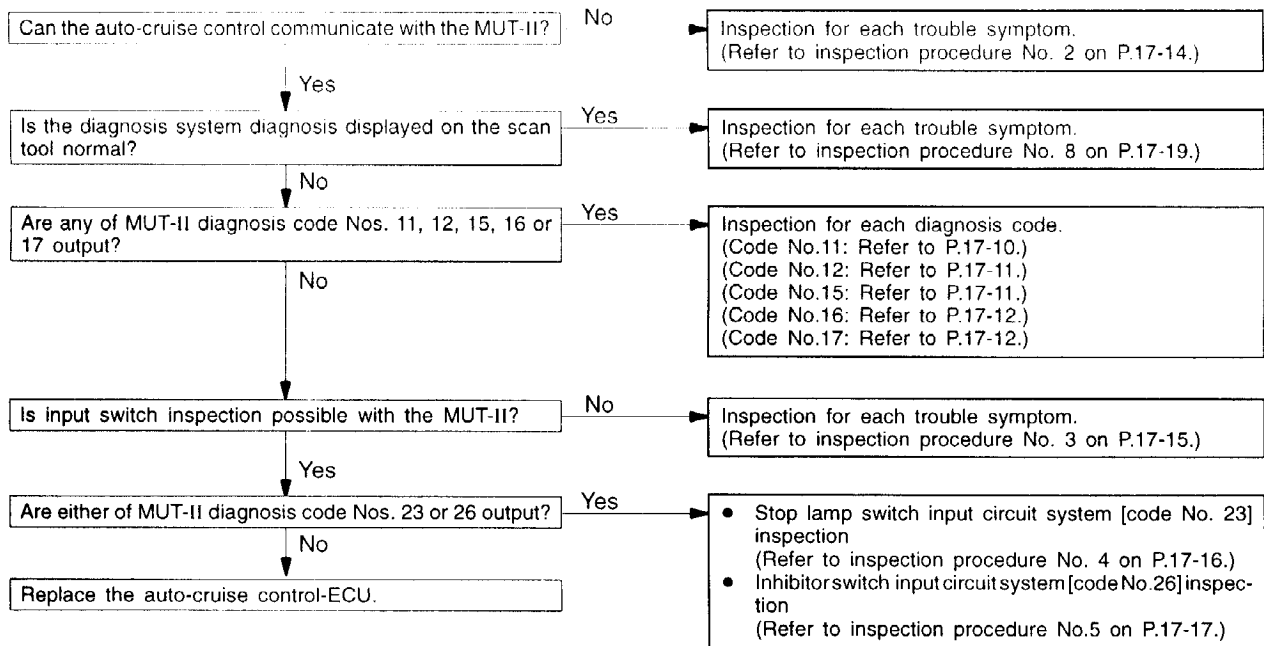
<p>The diagnostic result displayed on the MUT-II is normal even though auto-cruise control cannot be set.</p>	<p>Probable cause</p>
<p>Because of an open-circuit in the battery backup circuit system, the fail-safe function prevents diagnosis codes from being memorised and displayed even though auto-cruise control is cancelled.</p>	<ul style="list-style-type: none"> ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the auto-cruise control-ECU



17-20 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

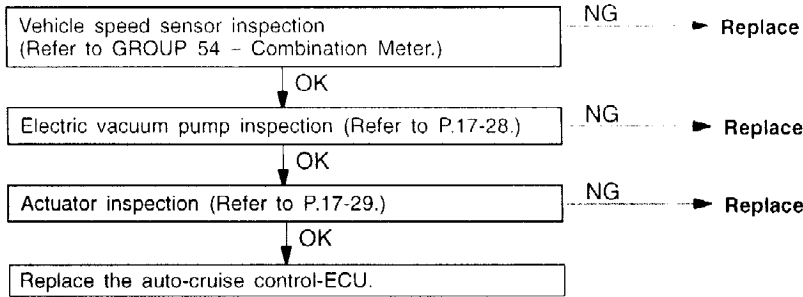
INSPECTION PROCEDURE 9

Auto-cruise control cannot be set.	Probable cause
<p>The cause is probably that the fail-safe function is cancelling auto-cruise control. In this case, the MUT-II can be used to check the trouble symptoms in each system by inspecting the diagnosis codes. The MUT-II can also be used to check if the circuits of each input switch are normal or not by inspecting the input switch codes.</p>	<ul style="list-style-type: none"> ● Malfunction of the auto-cruise control main switch ● Malfunction of the auto-cruise control switch ● Malfunction of the clock spring ● Malfunction of the harnesses or connectors ● Malfunction of the auto-cruise control-ECU



INSPECTION PROCEDURE 10

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
The cause is probably a malfunction of vehicle speed sensor or incorrect vacuum in the electric vacuum pump or actuator.	<ul style="list-style-type: none"> ● Malfunction of the vehicle speed sensor ● Malfunction of the electric vacuum pump ● Malfunction of the actuator ● Malfunction of the auto-cruise control-ECU



INSPECTION PROCEDURE 11

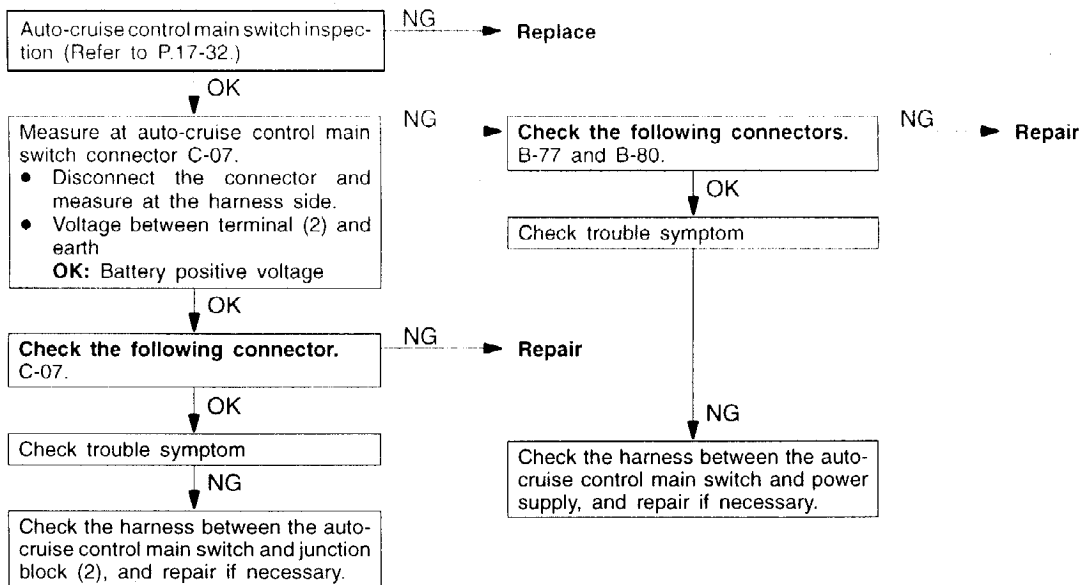
Even though auto-cruise control main switch is ON, switch indicator does not illuminate. (However, auto-cruise control is normal.)	Probable cause
Blown bulb in auto-cruise control main switch	<ul style="list-style-type: none"> ● Malfunction of the auto-cruise control main switch

Replace the auto-cruise control main switch.

17-22 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

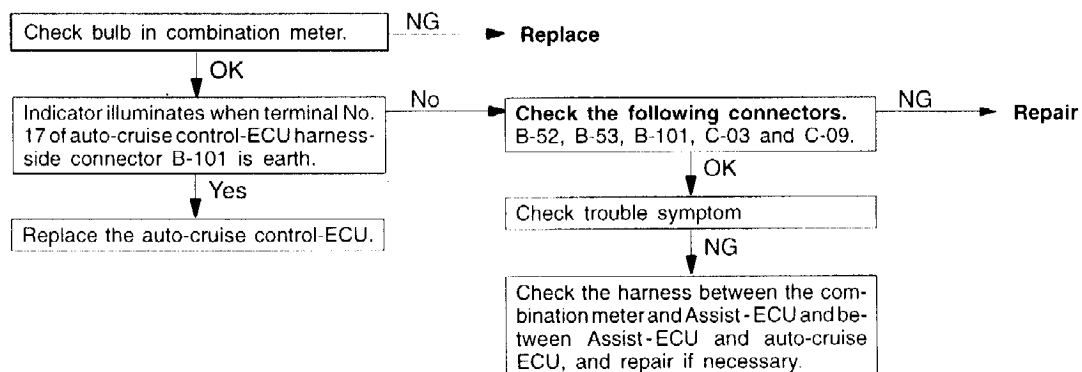
INSPECTION PROCEDURE 12

Auto-cruise control main switch illumination lamp does not illuminate.	Probable cause
The cause is probably a malfunction of auto-cruise control main switch or a malfunction of harness or connector.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control main switch • Malfunction of the connector • Malfunction of the harness



INSPECTION PROCEDURE 13

Auto-cruise control indicator lamp inside combination meter does not illuminate. (However, auto-cruise control is normal.)	Probable cause
The cause is probably a malfunction of bulb or a malfunction of connector or harness.	<ul style="list-style-type: none"> • Malfunction of the bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the auto-cruise control-ECU



INSPECTION PROCEDURE 14

Stop lamp switch input circuit system inspection (Code No. 23)

Check the following connectors.
B-18, B-41, B-74 B-76, B-85 and B-101.

NG → Repair

OK

Check trouble symptom

NG → Check the harness between junction block (2) and auto-cruise control-ECU, and repair if necessary.

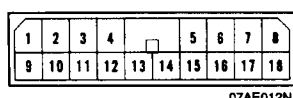
INSPECTION PROCEDURE 15

Inhibitor switch input circuit system inspection (Code No. 26)

Check the harness between auto-cruise control-ECU and power supply.

17-24 ENGINE AND EMISSION CONTROL – Auto-cruise Control System

CHECK AT ECU TERMINALS



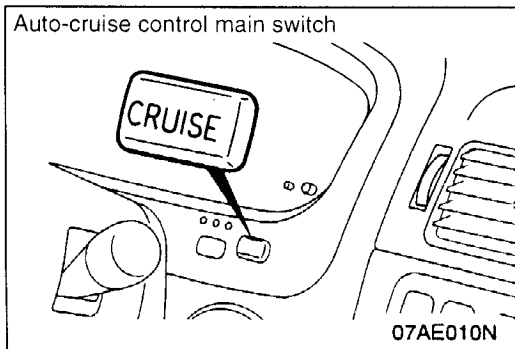
Terminal No.	Check item	Check conditions	Normal condition	
1	Throttle position sensor input	When the accelerator pedal is depressed fully	4.0–5.5V	
		When the accelerator pedal is returned	0.5–0.7V	
2	Idle switch output	When the accelerator pedal is depressed (Idle switch ON)	4.5–5.5V	
		When the accelerator switch is not depressed (Idle switch OFF)	0V	
3	ACC power supply	When the ignition switch is on ACC	Battery voltage	
4	Stop lamp switch input	When the brake pedal is depressed (Stop lamp switch ON)	Battery voltage	
		When the brake pedal is not depressed (Stop lamp switch OFF)	0V	
5	Diagnosis control input	Ignition switch ON	4.0V or greater	
6	ECU backup power supply	At all times	Battery voltage	
7	Electric vacuum pump release valve, control valve input	When decelerating with the set switch during travel at a constant speed	Release valve closed	0V
8			Control valve open	Battery voltage
7		When constant speed travel is cancelled with the cancel switch	Release valve open	Battery voltage
8			Control valve closed	Battery voltage
9	Ground	–	–	
10	A/T control output	No OD-OFF request	Battery voltage	
		OD-OFF request	0V	
11	Vehicle speed sensor input	The sensor repeatedly turns ON/OFF when the vehicle moves forwards or backwards	Sensor ON	0V
			Sensor OFF	4.5V
12	Cruise control switch input	When not operated (All switches OFF)	0V	
		When Flicked down (Set switch ON)	3V	
		When flicked up (Resume switch ON)	6V	
		When flicked toward the driver (Cancel switch ON)	Battery voltage	
13	–	–	–	
14	Inhibitor switch input <A/T>	When the shift lever is other than in the N position (Inhibitor switch OFF)	Battery voltage	
		When the shift lever is in the N position (Inhibitor switch ON)	0V	
	Clutch pedal switch input <M/T>	When the clutch pedal is released (switch OFF)	Battery voltage	
		When the clutch pedal is pressed (switch ON)	0V	

ENGINE AND EMISSION CONTROL – Auto-cruise Control System 17-25

Terminal No.	Check item	Check conditions	Normal condition
15	Pump power supply	Ignition switch ON	Battery voltage
		Main switch ON	
		Stop lamp switch OFF	
16	ECU power supply	Ignition switch ON	Battery voltage
		Main switch ON	
17	Indicator lamp input (In combination meter)	When travelling at constant-speed (Indicator lamp illuminated)	0V
		When constant-speed travel cancelled (Indicator lamp extinguished)	Battery voltage
18	Electric vacuum pump motor input	During constant-speed travel with Set switch (Motor stopped/running)	Battery voltage /0V
		Accelerating with Resume switch during constant-speed travel (Motor stopped/running)	Battery voltage /0V
		Decelerating with Set switch during constant-speed travel (Motor stopped)	Battery voltage
		Constant-speed travel cancelled with Cancel switch (Motor stopped)	Battery voltage

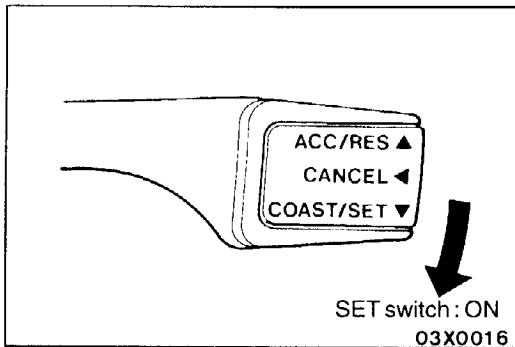
ON-VEHICLE SERVICE

AUTO-CRUISE CONTROL SYSTEM OPERATION CHECK



AUTO-CRUISE CONTROL MAIN SWITCH INDICATOR LAMP

1. Turn the ignition key to ON
2. Check to be sure that the indicator within the switch illuminates when the main switch is switched ON.

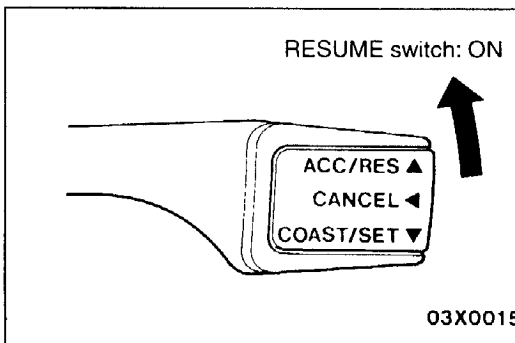


AUTO-CRUISE CONTROL SETTING

1. Switch ON the main switch.
2. Drive at the desired speed within the range of approximately 40–200 km/h.
3. Switch ON the SET switch.
4. Check to be sure that when the switch is released the speed is the desired constant speed.

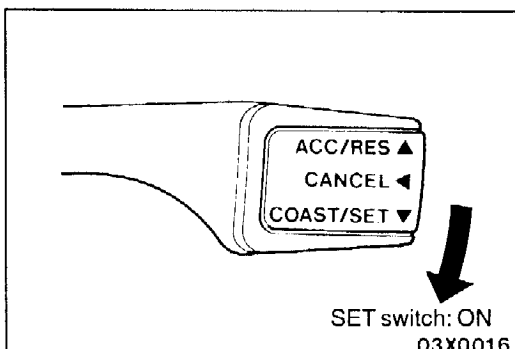
NOTE

If the vehicle's speed decreases to approximately 15 km/h below the set speed because of climbing a hill for example, the auto-cruise control will be cancelled.



SPEED-INCREASE SETTING

1. Set to the desired speed.
2. Switch ON the RESUME switch.
3. Check to be sure that acceleration continues while the switch is held, and that when it is released the constant speed at the time when it was released becomes the driving speed.

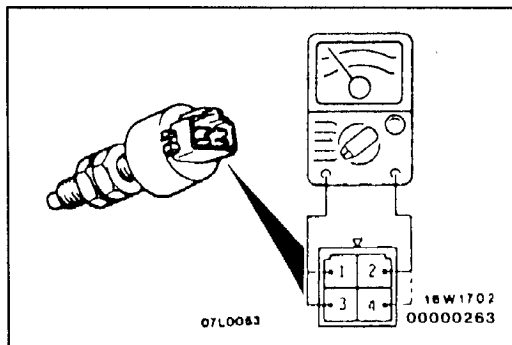
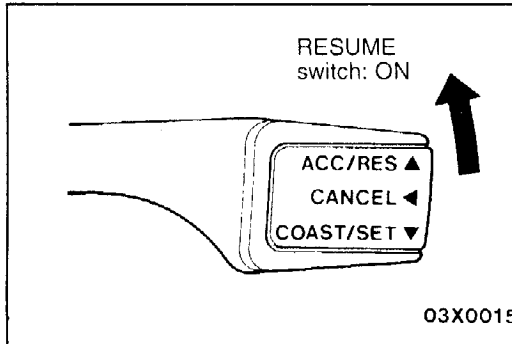
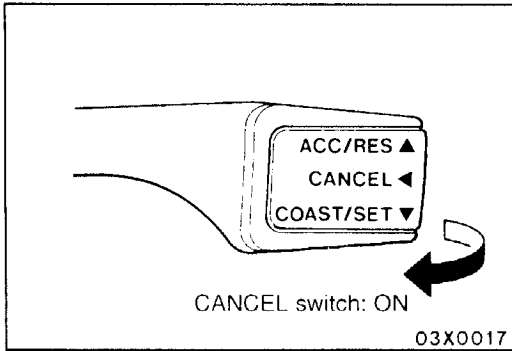


SPEED REDUCTION SETTING

1. Set to the desired speed.
2. Switch ON the SET switch.
3. Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

NOTE

When the vehicle speed reaches the low limit [approximately 40 km/h during deceleration], the auto-cruise control will be cancelled.



RETURN TO THE SET SPEED BEFORE CANCELLATION AND AUTO-CRUISE CONTROL CANCELLATION

1. Set the auto-cruise speed control.
2. When any of the following operations are performed while at constant speed during auto-cruise control, check if normal driving is resumed and deceleration occurs.
 - (1) Switch ON the CANCEL switch.
 - (2) The brake pedal is depressed.
 - (3) The selector lever is moved to the "N" range <A/T>.
 - (4) The clutch pedal is depressed <M/T>.
3. At a vehicle speed of 40 km/h or higher, check if when the RESUME switch is switched ON, vehicle speed returns to the speed before auto-cruise control driving was cancelled, and constant speed driving occurs.
4. When the main switch is turned to OFF while driving at constant speed, check if normal driving is resumed and deceleration occurs.

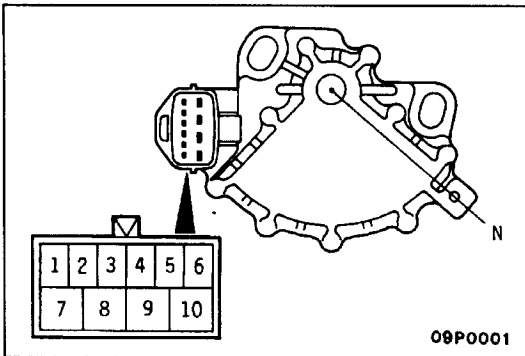
AUTO-CRUISE CONTROL COMPONENT CHECK

STOP LAMP SWITCH

Measurement conditions	For stop lamp circuit Terminal No.		For auto-cruise control circuit Terminal No.	
	2	3	1	4
When brake pedal depressed.	○	○		
When brake pedal not depressed.			○	○

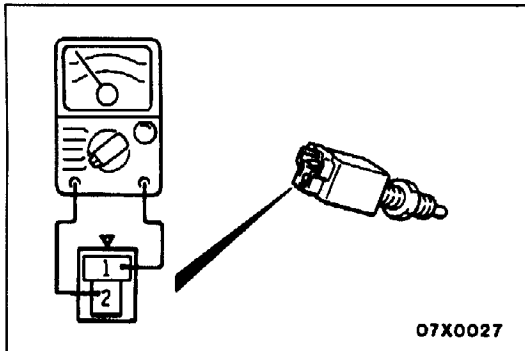
THROTTLE POSITION SENSOR

Refer to GROUP 13A – On-vehicle Inspection of MPI Components.



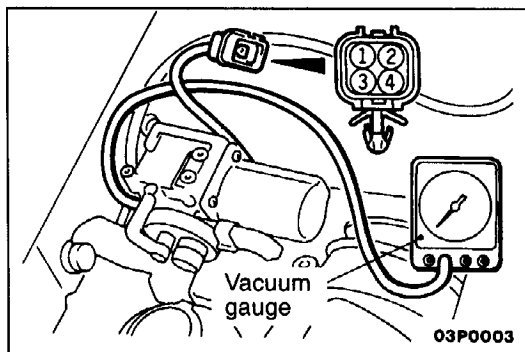
INHIBITOR SWITCH (“N” POSITION)

Measurement conditions	Terminal No.			
	4	8	9	10
Selector lever is at "N" position	○	○	○	○
Selector lever is not at "N" position				



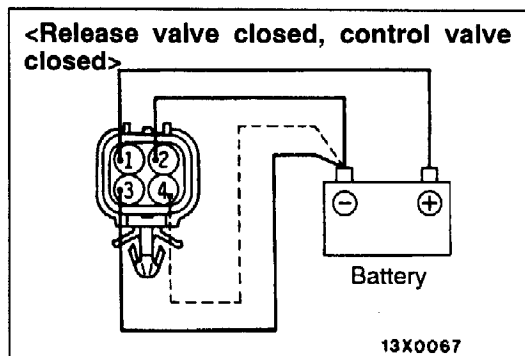
CLUTCH PEDAL SWITCH

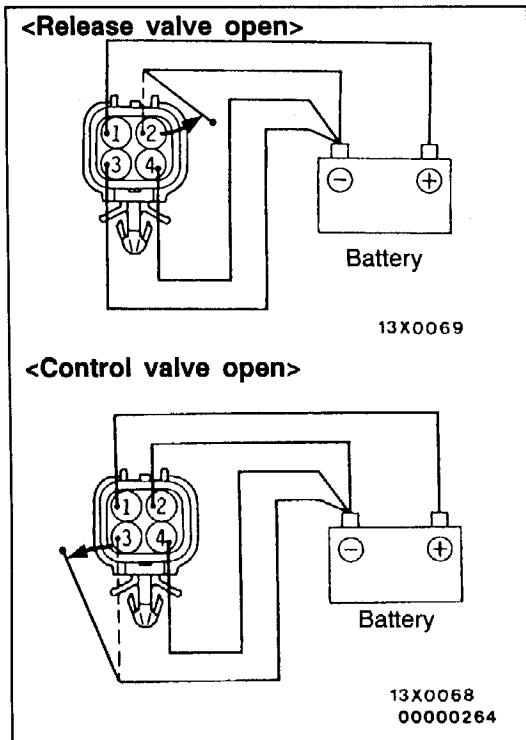
Measurement conditions	Terminal No.	
	1	2
When clutch pedal is depressed	○	○
When clutch pedal is not depressed		



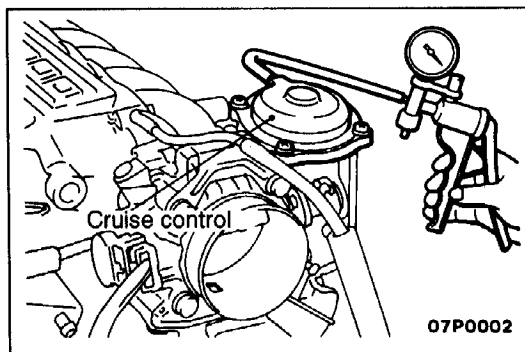
AUTO-CRUISE VACUUM PUMP

1. Disconnect the vacuum hose from the electric vacuum pump and connect a vacuum gauge to the vacuum pump.
2. Disconnect the electric vacuum pump connector.
3. Connect terminal (1) to the battery (+) terminal, and connect terminals (2) and (3) to the battery (-) terminal.
4. Check to be sure that the vacuum gauge shows a reading of 53 kPa (398 mm Hg) or more when terminal (4) is connected to the battery (-) terminal.





5. In this condition, check to be sure that the vacuum gauge shows a 20 kPa (150 mm Hg) or less when terminals (2) and (3) are disconnected from the battery.

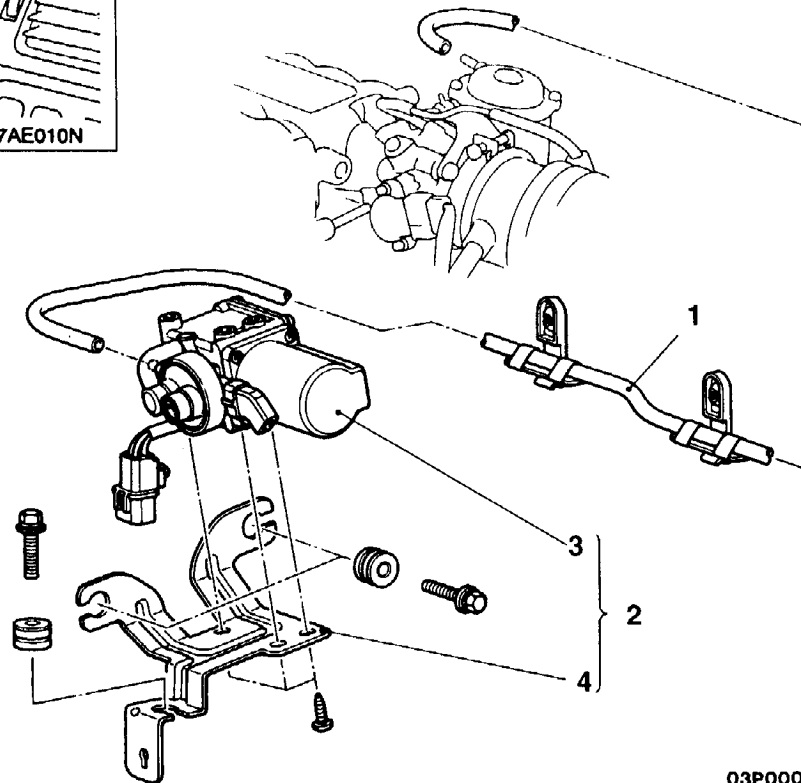
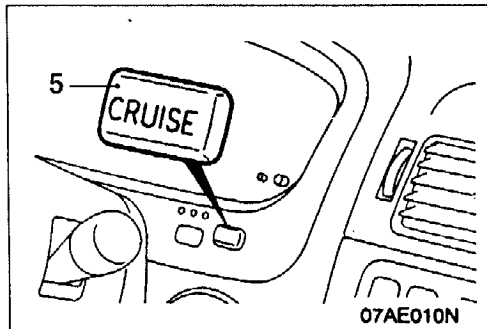


ACTUATOR

1. Disconnect the vacuum hose from the vacuum actuator and connect a hand vacuum pump to the vacuum actuator.
2. Confirm that the throttle lever operates and the vacuum is also maintained when a vacuum is present.

AUTO-CRUISE CONTROL

REMOVAL AND INSTALLATION



Vacuum pump removal steps

1. Vacuum hose
2. Electric vacuum pump and bracket assembly
3. Electric vacuum pump

Main switch removal steps

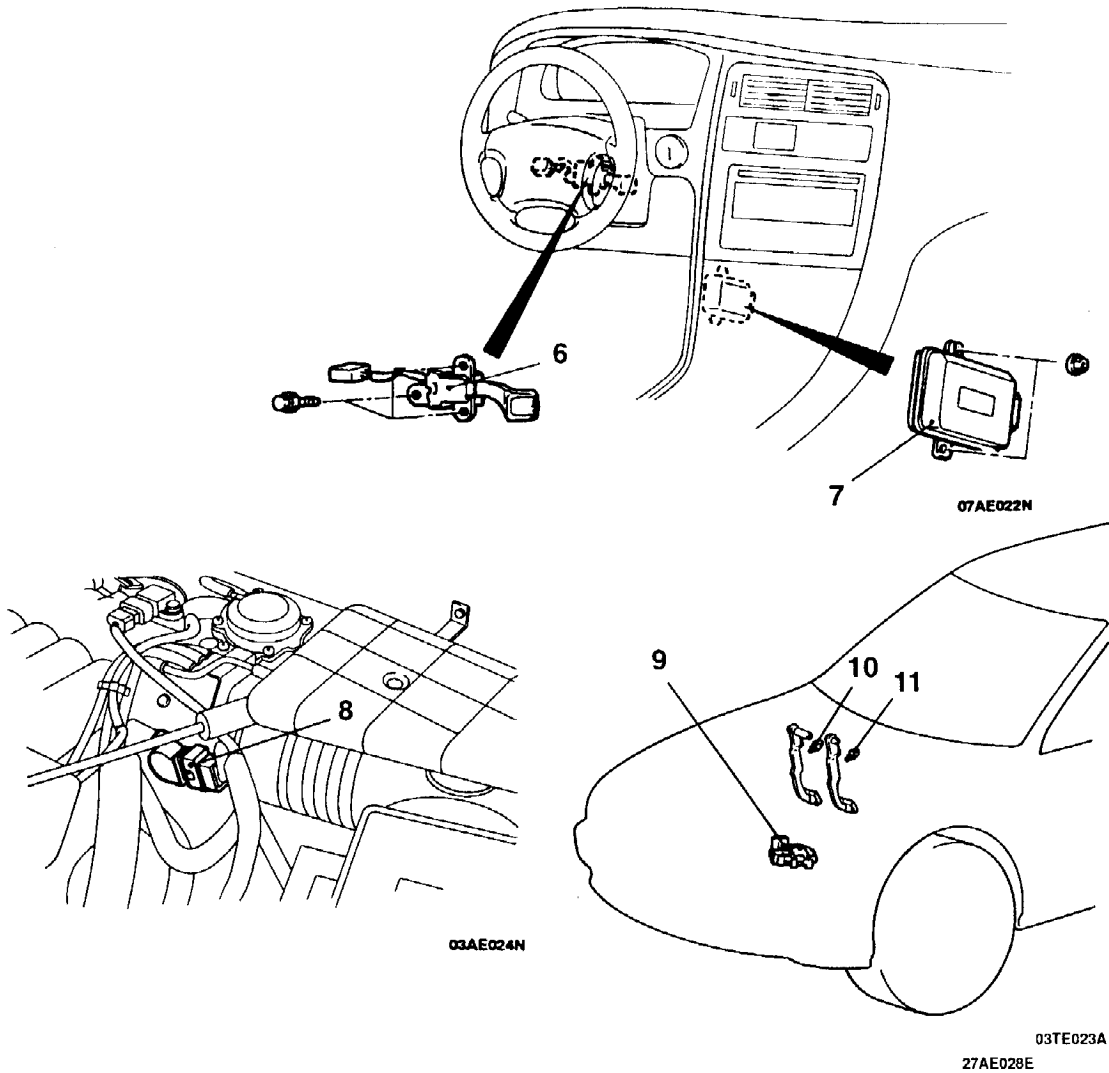
4. Bracket
5. Main switch
(Refer to GROUP 54-Combination meter)

CAUTION: SRS

Before removal of air bag module and clock spring, refer to the followings:

GROUP 52B – SRS Service Precautions.

GROUP 52B – Air Bag Modules and Clock Spring.



Control switch removal steps

- Air bag module (Refer to group 52B)
- 6. Control switch

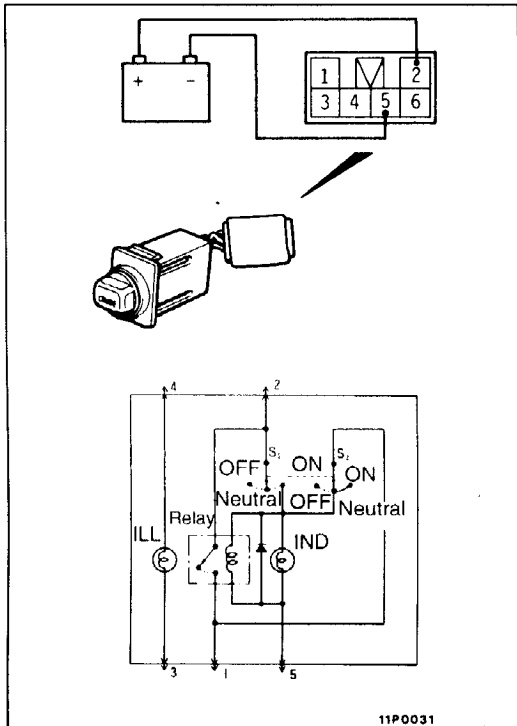
Control unit removal steps

- Floor console box assembly (Refer to group 52A)
- Centre air outlet assembly (Refer to group 52A-Instrument Panel)
- Ash tray (Refer to group 52A-Instrument Panel)

- Air conditioner control unit and radio/tape player
- 7. Auto-cruise control-ECU

Sensor removal steps

- 8. Throttle position sensor
- 9. Inhibitor switch
- 10. Stop lamp switch
- 11. Clutch pedal switch



INSPECTION

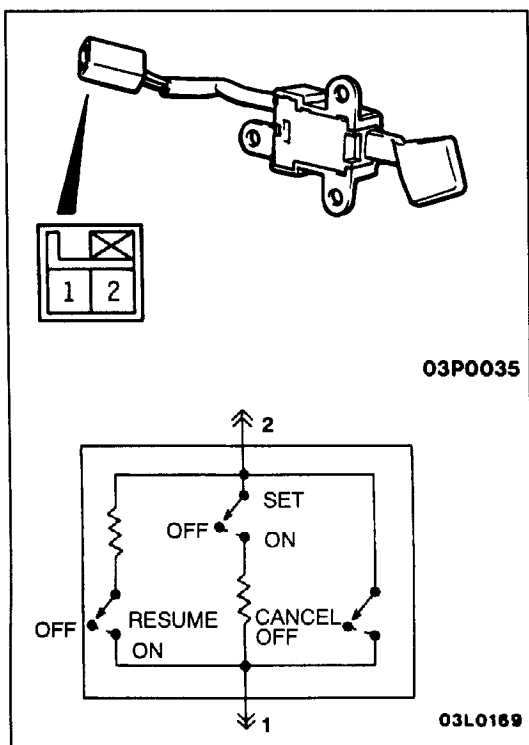
AUTO-CRUISE CONTROL MAIN SWITCH CHECK

1. Operate the switch and check for continuity between the terminals

Switch position	Terminal No.					
	3	ILL	4	2	5	1
OFF	○	⊕	○			
Neutral	○	⊕	○		○	○
ON	○	⊕	○	○		○

2. When the battery (+) side is connected to terminal 2 and the (-) side is connected to terminal 5, and the main switch is turned to ON, check if battery voltage is output between terminal 1 and the earth until the main switch is turned to OFF.

Next, when the main switch is turned to OFF, check if the battery voltage that was output between terminal 1 and the earth becomes 0V.



AUTO-CRUISE CONTROL SWITCH CHECK

Measure the resistance between the terminals when each of the SET, RESUME and CANCEL switches is pressed. If the values measured at this time correspond to those in the table below, then there is no problem.

Switch position	Resistance between terminals
Switch OFF	No continuity
CANCEL switch ON	Approx. 0 Ω
RESUME switch ON	Approx. 820 Ω
SET switch ON	Approx. 2,700 Ω

EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The emission control system consists of the following subsystems:

- Positive crankcase ventilation system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control valve	Equipped Manifold vacuum purge (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device–MPI system (vehicles with catalytic converter)	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system <ul style="list-style-type: none"> • EGR valve • EGR control solenoid valve 	Equipped Single type Duty cycle type solenoid valve (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

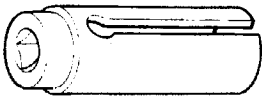
EMISSION CONTROL DEVICE REFERENCE TABLE

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recirculation system	Reference page
PCV valve	X					17-39
MPI system component		X	X			Group 13A
EGR valve					X	17-44
EGR control solenoid valve					X	17-45
Catalytic converter				X		17-46

SERVICE SPECIFICATIONS

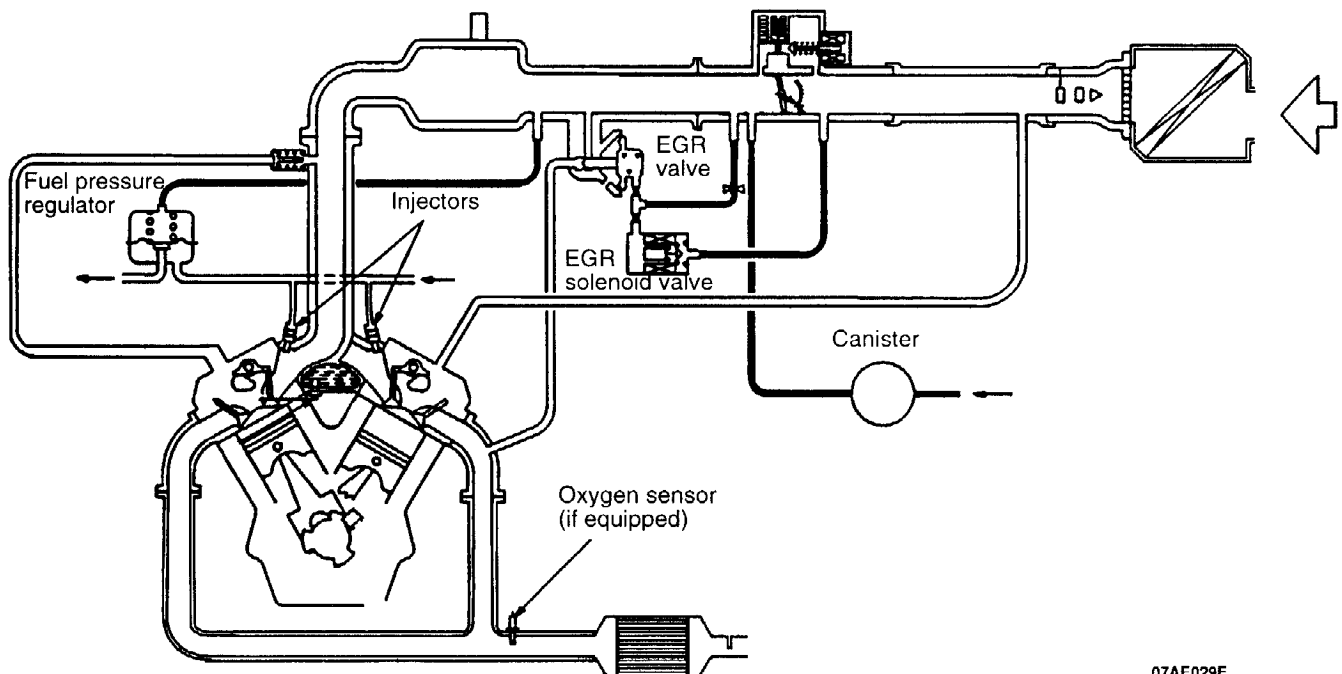
Items	Specification
EGR control solenoid valve coil resistance [at 20°C] Ω	36–44

SPECIAL TOOL

Tool	Number	Name	Use
	MD998770	Oxygen sensor wrench	Removal/Installation of oxygen sensor <vehicles with catalytic converter>

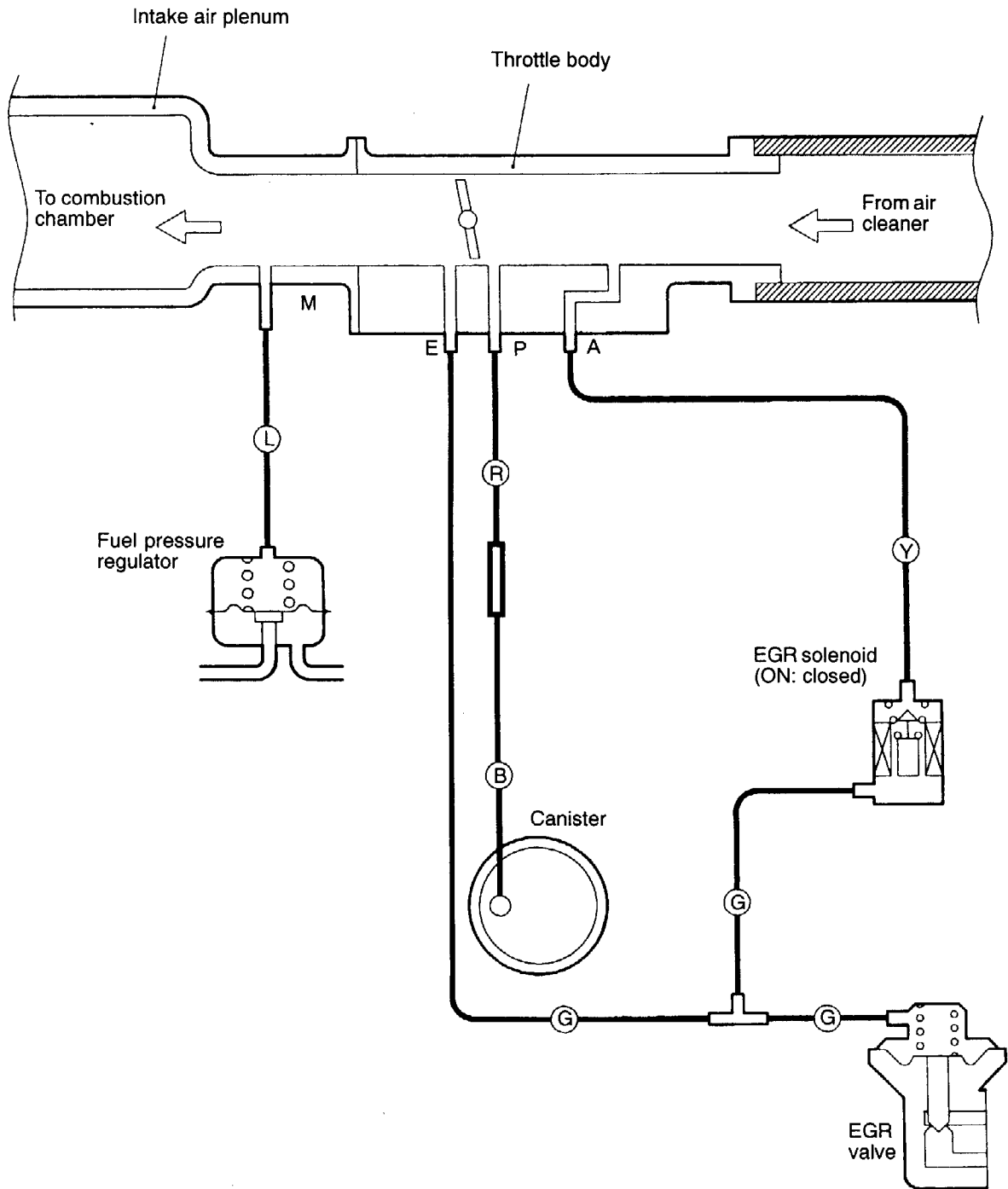
VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM



07AE029E

VACUUM CIRCUIT DIAGRAM



07AE030E

VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the VACUUM HOSE PIPING DIAGRAM as a guide.

VACUUM HOSE INSPECTION

1. Using the VACUUM HOSE PIPING DIAGRAM as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

CRANKCASE EMISSION CONTROL SYSTEM

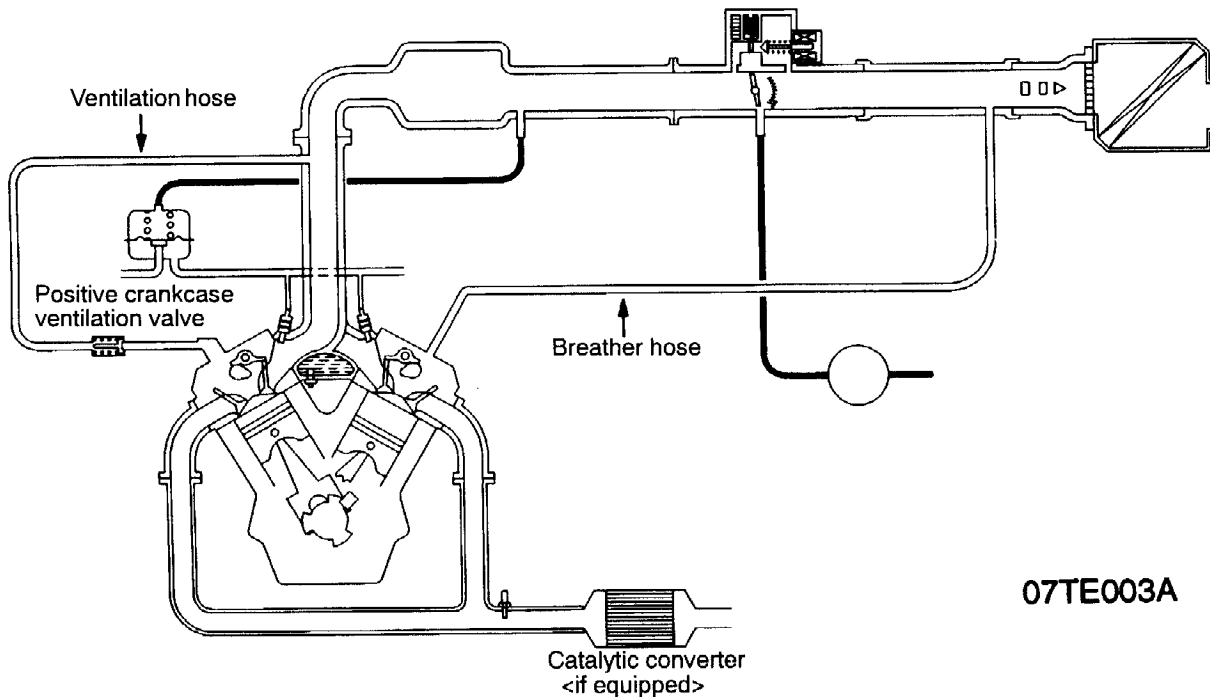
GENERAL INFORMATION

The crankcase emission control system is a system for preventing the escape of blow-by gases from inside the crankcase into the atmosphere. Fresh air is sent from the air cleaner into the crankcase through the breather hose to be mixed with the blow-by gases inside the crankcase. The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation valve.

The positive crankcase ventilation valve is designed to lift the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly.

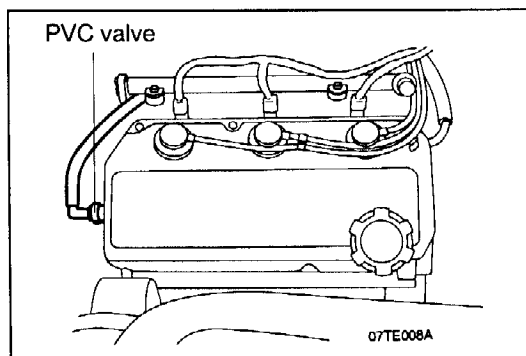
In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



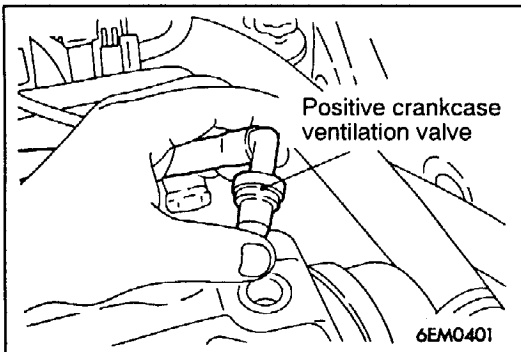
COMPONENT LOCATION

Positive crankcase ventilation valve



POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

1. Remove the ventilation hose from the positive crankcase ventilation valve.
2. Remove the positive crankcase ventilation valve from the rocker cover.
3. Reinstall the positive crankcase ventilation valve at the ventilation hose.
4. Start the engine and run at idle.

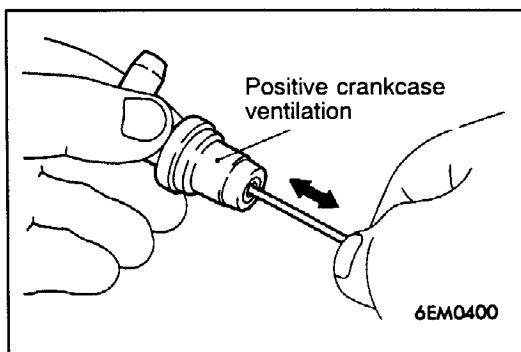


5. Place a finger at the opening of the positive crankcase ventilation valve and confirm that vacuum of the intake manifold is felt.

NOTE

At this moment, the plunger in the positive crankcase ventilation valve moves forward and backward.

6. If vacuum is not felt, clean the positive crankcase ventilation valve or replace it.
7. Install the positive crankcase ventilation valve.



POSITIVE CRANKCASE VENTILATION (PCV) VALVE CHECK

1. Insert a thin rod into the positive crankcase ventilation valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to confirm that the plunger moves.
2. If the plunger does not move, there is a clogging in the positive crankcase ventilation valve. In this case, clean or replace the valve.

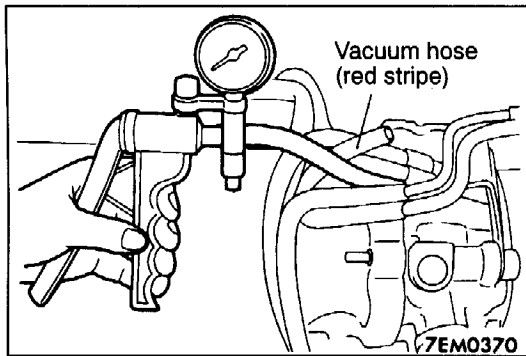
EVAPORATIVE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.

Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister.

When driving the vehicle, the fuel vapours which are stored in the canister are drawn into the intake manifold and are then sent to the combustion chamber.



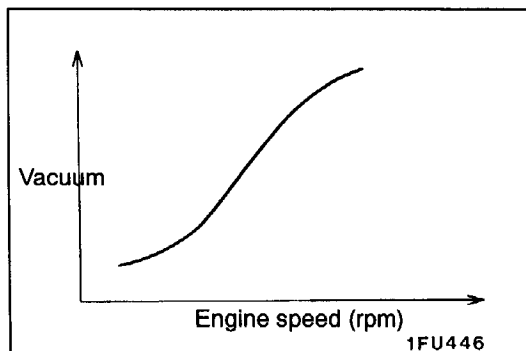
PURGE PORT VACUUM CHECK

1. Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.

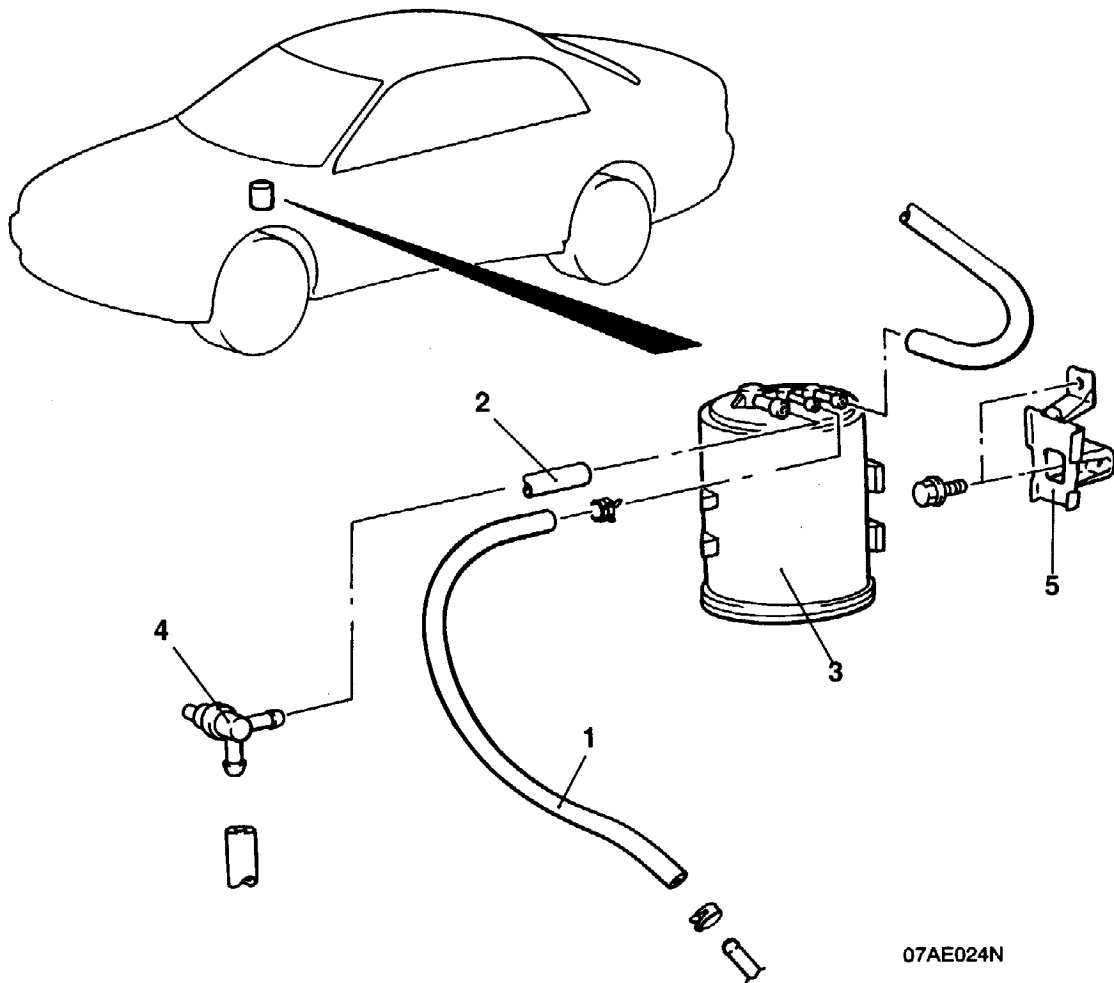
2. Start the engine and check to see that, after raising the engine speed by racing the engine, purge vacuum raises proportionately with the rise in engine speed.

NOTE

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



CANISTER REMOVAL AND INSTALLATION



Removal steps

1. vapour hose
2. Purge hose connection
3. Canister
4. Breather valve
5. Canister bracket

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NO_x) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NO_x) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion

chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NO_x.

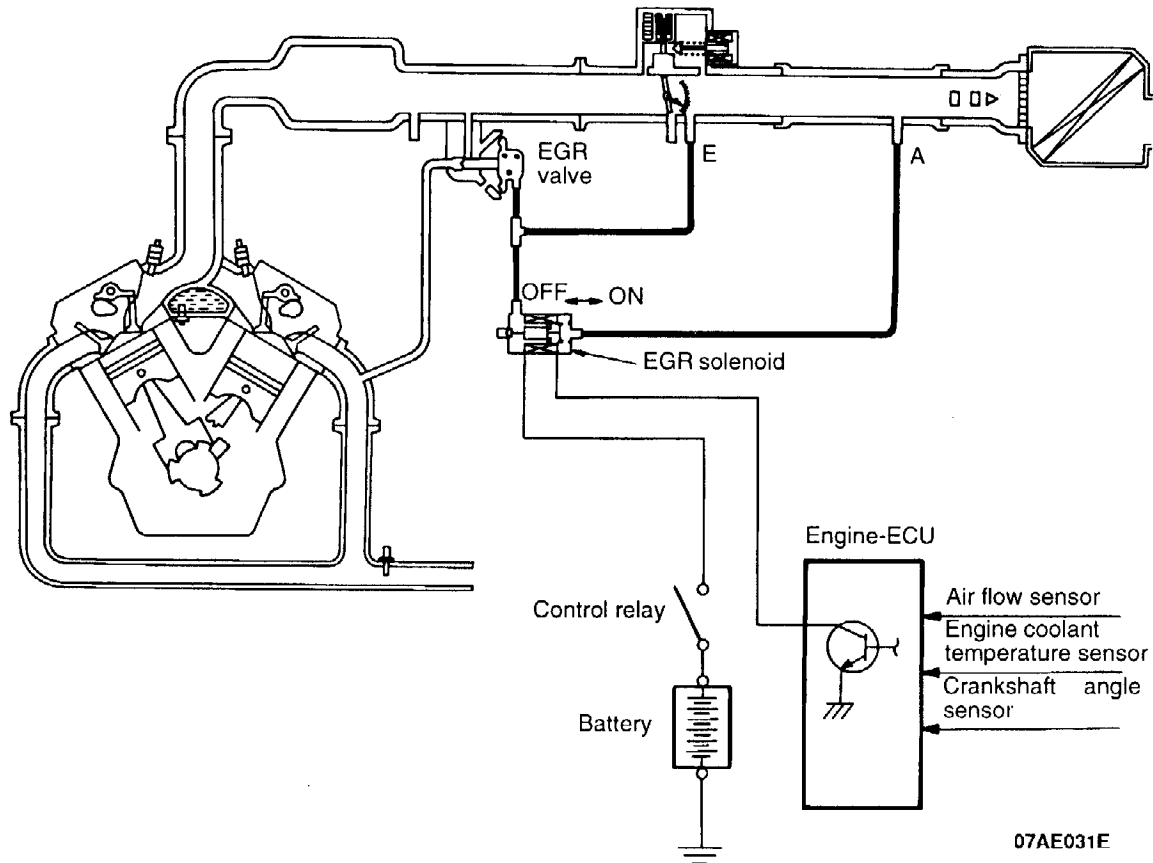
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

When the engine coolant temperature is low, when the engine is at idle or when a wide open throttle operation is performed, the EGR valve is kept closed, achieving no EGR.

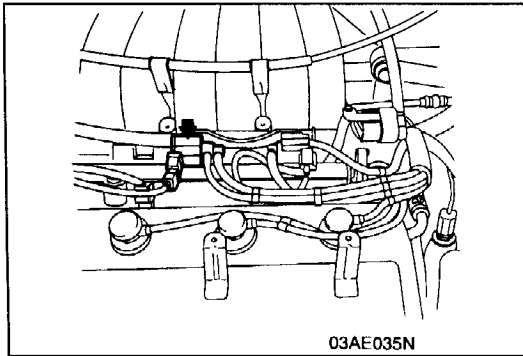
In normal vehicle operation performed after warming up of the engine, the EGR valve is opened to carry out EGR.

SYSTEM DIAGRAM

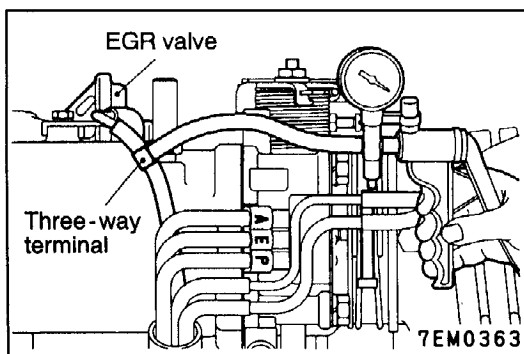
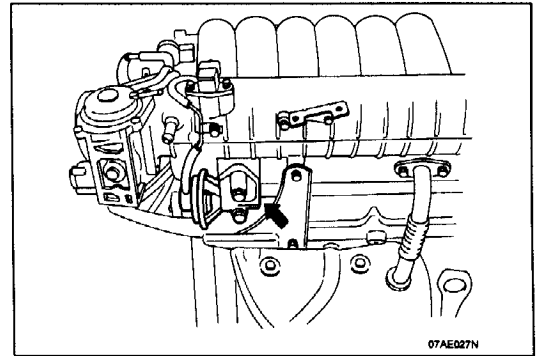


COMPONENT LOCATION

EGR solenoid



EGR valve



EGR SYSTEM CHECK

1. Disconnect the vacuum hose (green stripe) that connects to the EGR valve, and then connect a hand vacuum pump via a three-way terminal.
2. With the engine in cold and hot conditions, check the condition of vacuum when rapid racing has been performed by opening the throttle valve quickly.

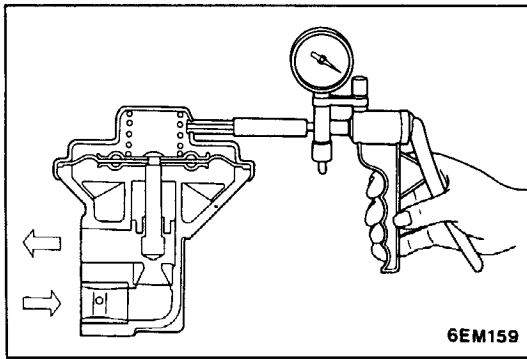
When engine is cold**[Engine coolant temperature: 20°C or less]**

Throttle valve	Normal vacuum condition
Open quickly	No vacuum will generate (remained as barometric pressure).

When engine is hot**[Engine coolant temperature: 80°C or higher]**

Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 100 mm Hg

3. Disconnect the three-way terminal.
4. Connect the hand vacuum pump directly to the EGR valve.
5. Check whether the engine stalls or the idling is unstable when a vacuum of 220 mm Hg or higher is applied during idling.



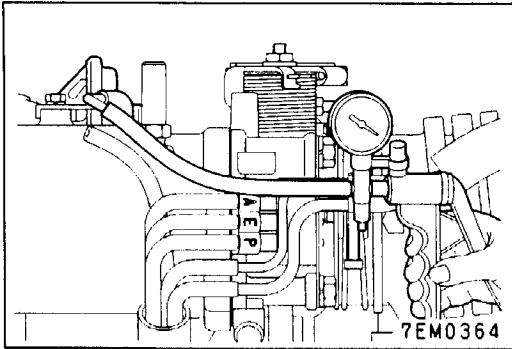
EGR VALVE CHECK

1. Remove the EGR valve and inspect for sticking, carbon deposits, etc. If necessary, clean with a suitable solvent so that the valve seats correctly.
2. Connect a hand vacuum pump to the EGR valve.
3. Apply 500 mm 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 EGR passage.

Vacuum	Passage of air
40 mm Hg or less	Air is not blown out
220 mm Hg or more	Air is blown out

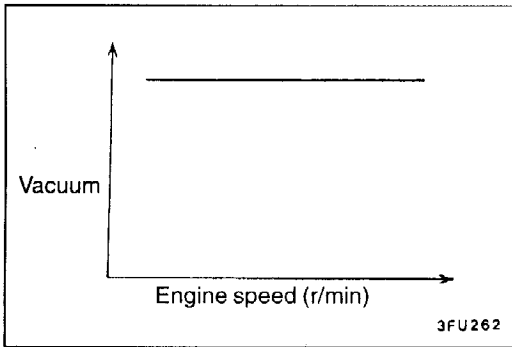
5. Use a new gasket, and tighten to the specified torque.

Specified torque: 22 Nm



EGR PORT VACUUM CHECK

1. Disconnect the vacuum hose (green stripe) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.
2. Start the engine and check to see that, after raising the engine speed by racing the engine, vacuum remains fairly constant.

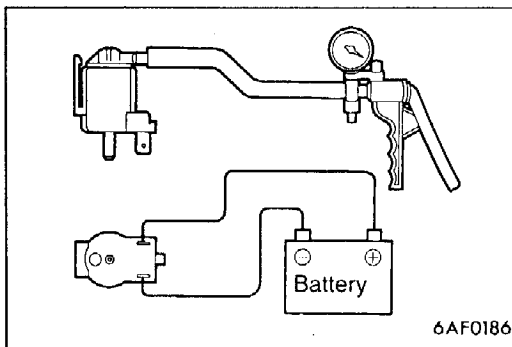


EGR SOLENOID CHECK

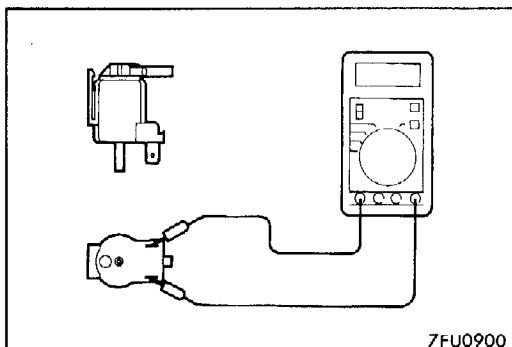
NOTE

When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (yellow stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the EGR control solenoid valve and without applying voltage.



Battery voltage	Normal condition
Not applied	Vacuum leaks
Applied	Vacuum maintained



5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 36–44Ω [at 20°C]

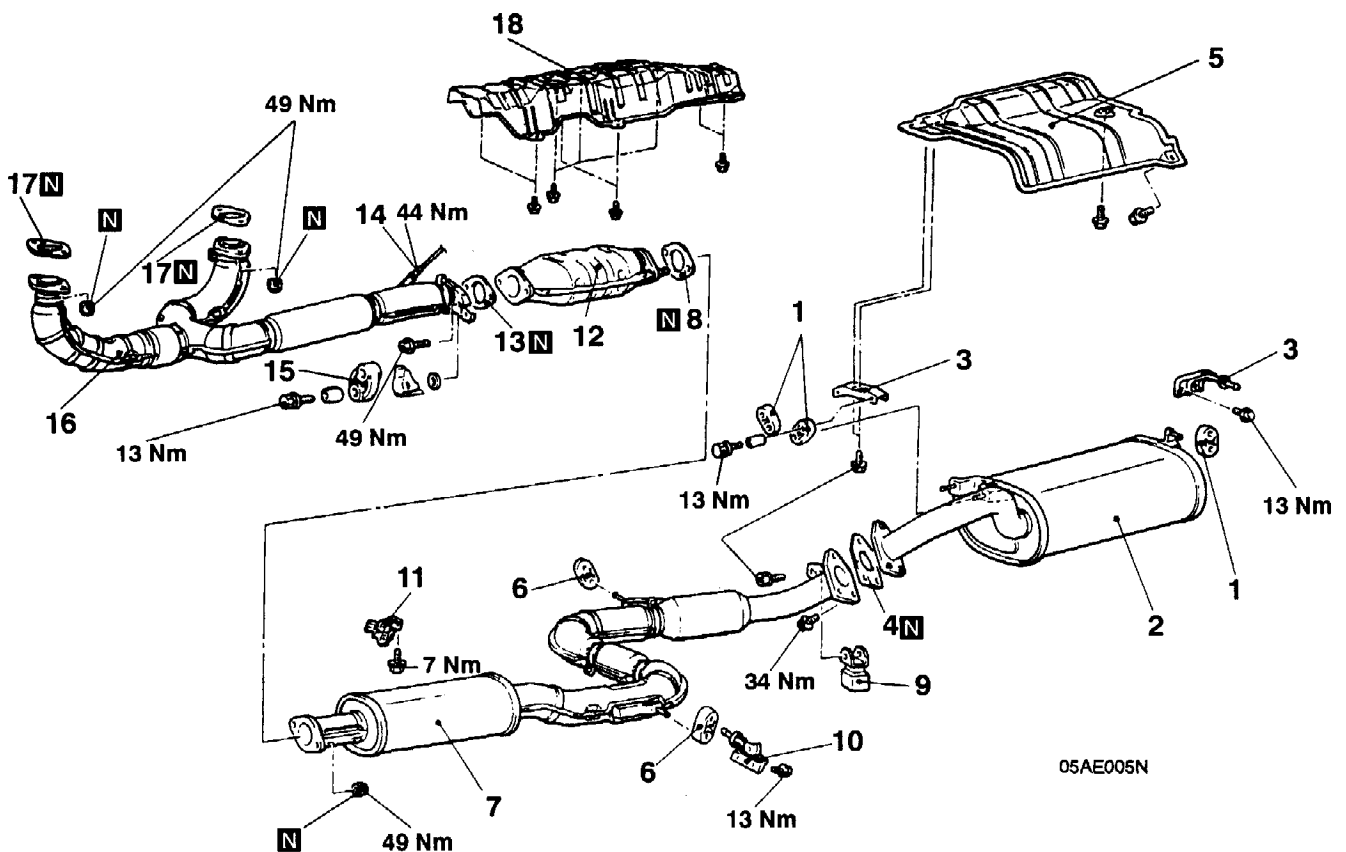
CATALYTIC CONVERTER <IF EQUIPPED>

GENERAL INFORMATION

The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidises carbon monoxides (CO) and hydrocarbons (HC) and reduces nitrogen oxides (NOx).

When the mixture is controlled at stoichiometric air-fuel ratio, the three-way catalytic converter provides the highest purification against the three constituents, namely, CO, HC and NOx.

REMOVAL AND INSTALLATION



Removal steps

1. Hanger
2. Main muffler assembly
3. Hanger bracket
4. Gasket
5. Rear floor heat protector panel
6. Hanger
7. Centre exhaust pipe
8. Gasket
9. Damper



10. Hanger bracket
11. Harness protector
12. Catalytic converter
13. Gasket
14. Oxygen sensor
15. Hanger
16. Front exhaust pipe
17. Gasket
18. Front floor heat protector

REMOVAL SERVICE POINT**◀A▶ OXYGEN SENSOR REMOVAL**

Remove the oxygen sensor with the special tool (MD998770).

INSPECTION

Inspect for damage, cracking or deterioration. Replace if faulty.

Caution

1. Stop the engine immediately if engine misfiring occurs, otherwise an abnormally hot exhaust system will damage the catalytic converter or other underbody parts.
2. Correct and repair the ignition or fuel system if there are malfunctions, otherwise engine misfiring may occur which will damage the catalytic converter.
3. Observe manufacturer's specifications when doing service work.