

ENGINE AND EMISSION CONTROL

CONTENTS

17109000308

ENGINE CONTROL SYSTEM	3	AUTO-CRUISE CONTROL SYSTEM	6
GENERAL INFORMATION	3	6
SERVICE SPECIFICATIONS	3	GENERAL INFORMATION	6
SEALANT	3	SPECIAL TOOL	6
ON-VEHICLE SERVICE	3		
Accelerator Cable Check and Adjustment	3		
ACCELERATOR CABLE AND PEDAL	4		

CONTINUED ON NEXT PAGE

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

- (1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).
- (2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
- (3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: Front impact sensors, SRS-ECU, SRS warning lamp, air bag module, clock spring, and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

TROUBLESHOOTING	7	EXHAUST GAS RECIRCULATION (EGR) SYSTEM	36
ON-VEHICLE SERVICE	23	General Information	36
Auto-cruise Control Main Switch Check	23	Operation	36
Auto-cruise Control Switch Check	23	System Diagram	36
Auto-cruise Control Component Check	24	Component Location	36
AUTO-CRUISE CONTROL*	26	Exhaust Gas Recirculation (EGR) Control System Check	37
EMISSION CONTROL SYSTEM <6G7>	28	EGR Valve Check	37
GENERAL INFORMATION	28	EGR Port Vacuum Check	38
Emission Control Device Reference Table	28	EGR Control Solenoid Valve Check	38
SERVICE SPECIFICATIONS	29	CATALYTIC CONVERTER	39
VACUUM HOSE	29	General Information	39
Vacuum Hose Piping Diagram	29	CANISTER AND TWO-WAY VALVE	40
Vacuum Circuit Diagram	30	EMISSION CONTROL SYSTEM <4D5>	41
Vacuum Hose Check	31	GENERAL INFORMATION	41
Vacuum Hose Installation	31	SERVICE SPECIFICATIONS	41
CRANKCASE EMISSION CONTROL SYSTEM	31	SEALANT	41
General Information	31	SPECIAL TOOL	41
System Diagram	31	EXHAUST GAS RECIRCULATION (EGR) SYSTEM	42
Component Location	32	General Information	42
Positive Crankcase Ventilation System Check	32	System Diagram	42
PCV Valve Check	32	Component Location	42
EVAPORATIVE EMISSION CONTROL SYSTEM	33	Function Check	43
General Information	33	EGR Solenoid Valve Operation Check	43
System Diagram	33	EGR Solenoid Valve Resistance Check	44
Component Location	33	Lever Position Sensor (LPS) Adjustment ...	44
Purge Control System Check	34	Engine Speed Sensor Check	45
Purge Port Vacuum Check	34	Engine Coolant Temperature Sensor Check	45
Purge Control Solenoid Valve Check	35	Check at the Glow & EGR Control Unit	46
		Two-way Valve	47

ENGINE CONTROL SYSTEM

17100010126

GENERAL INFORMATION

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

SERVICE SPECIFICATIONS

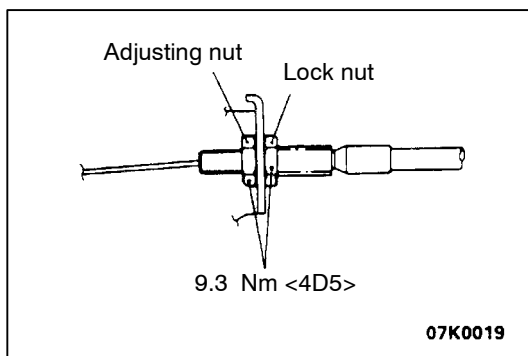
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Items		Standard value
Accelerator cable play mm		1 – 2
Engine idle speed r/min	4D5	750 ± 100
	6G7	700 ± 100

SEALANT

17300050032

Items	Specified sealant	Remarks
Accelerator arm bracket mounting bolt	3M Nut Locking Part No. 4171 or equivalent	Drying sealant



ON-VEHICLE SERVICE

17100090311

ACCELERATOR CABLE CHECK AND ADJUSTMENT

1. Turn A/C and lamps OFF.
Inspect and adjust at no load.
2. Warm engine until stabilized at idle.
3. Confirm idle speed is at prescribed value.

Standard value:

<4D5> 750 ± 100 r/min

<6G7> 700 ± 100 r/min

4. Stop engine (ignition switch OFF).
5. Confirm there are no sharp bends in accelerator cable.
6. Check inner cable for correct slack.

Standard value: 1 – 2 mm

7. If there is too much slack or no slack, adjust play by the following procedures.
 - (1) Loosen the lock nut and fully close the throttle lever.
 - (2) Tighten the adjusting nut until immediately before the throttle lever starts to move.
 - (3) By loosening the adjusting nut one turn, the accelerator cable play will be brought to the standard value.
 - (4) Fix the adjusting nut with the lock nut.
 - (5) After adjusting, check that the throttle lever is touching the stopper.

ACCELERATOR CABLE AND PEDAL

17100120348

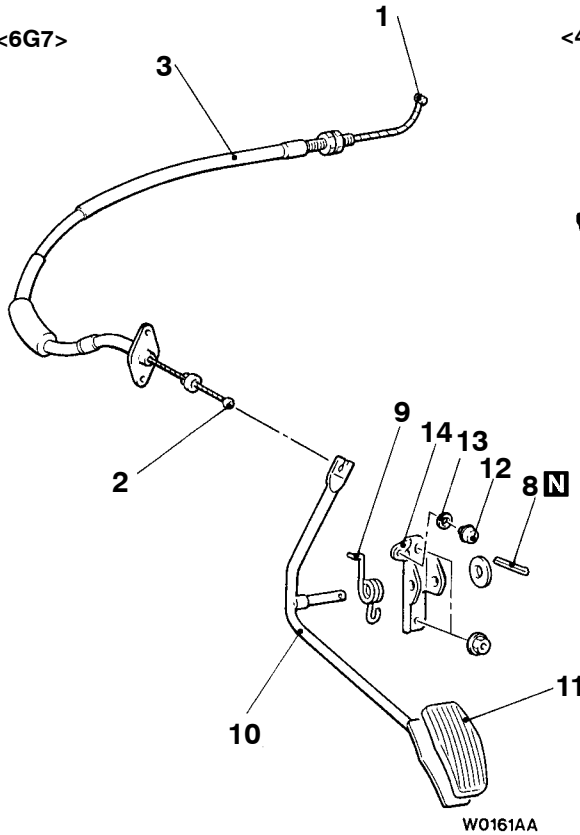
REMOVAL AND INSTALLATION

Post-installation Operation

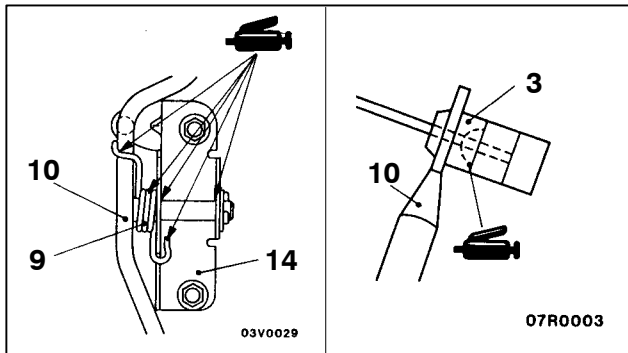
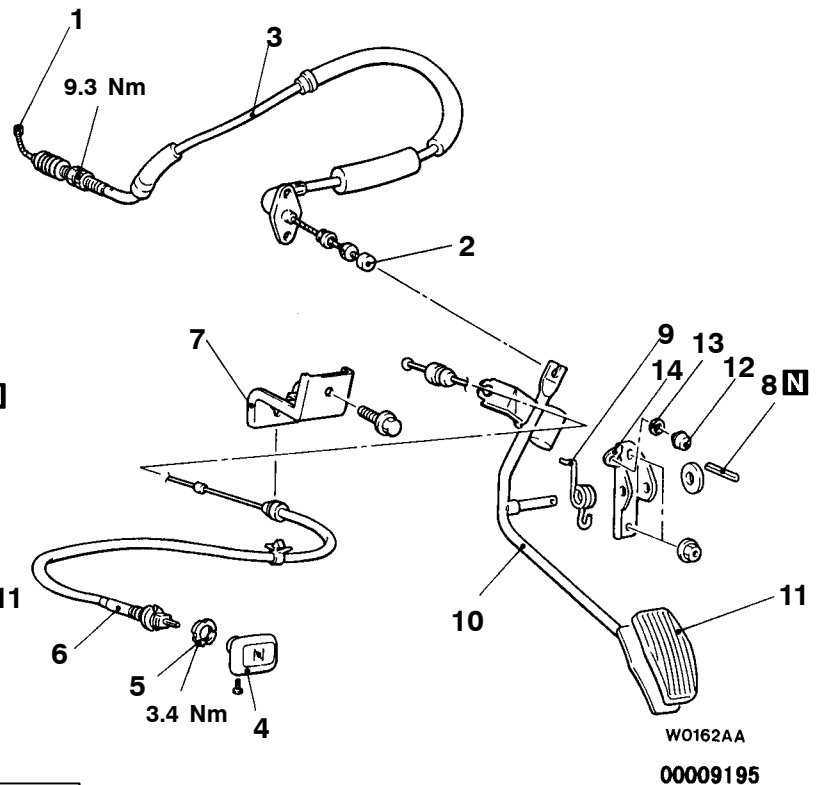
- Adjusting the Accelerator Cable (Refer to P. 17-3.)

<L.H. drive vehicles>

<6G7>



<4D5>



Accelerator cable removal steps

1. Inner cable connection (Injection pump side or throttle body side)
2. Inner cable connection (Accelerator pedal side)
3. Accelerator cable

Throttle control cable removal steps

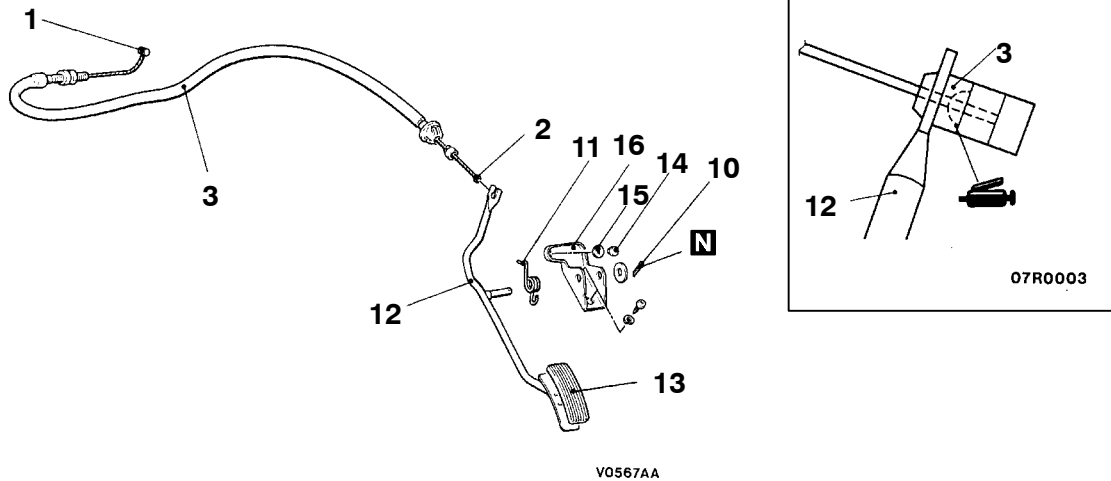
4. Knob
5. Nut
6. Throttle cable
7. Cable bracket

Accelerator pedal removal steps

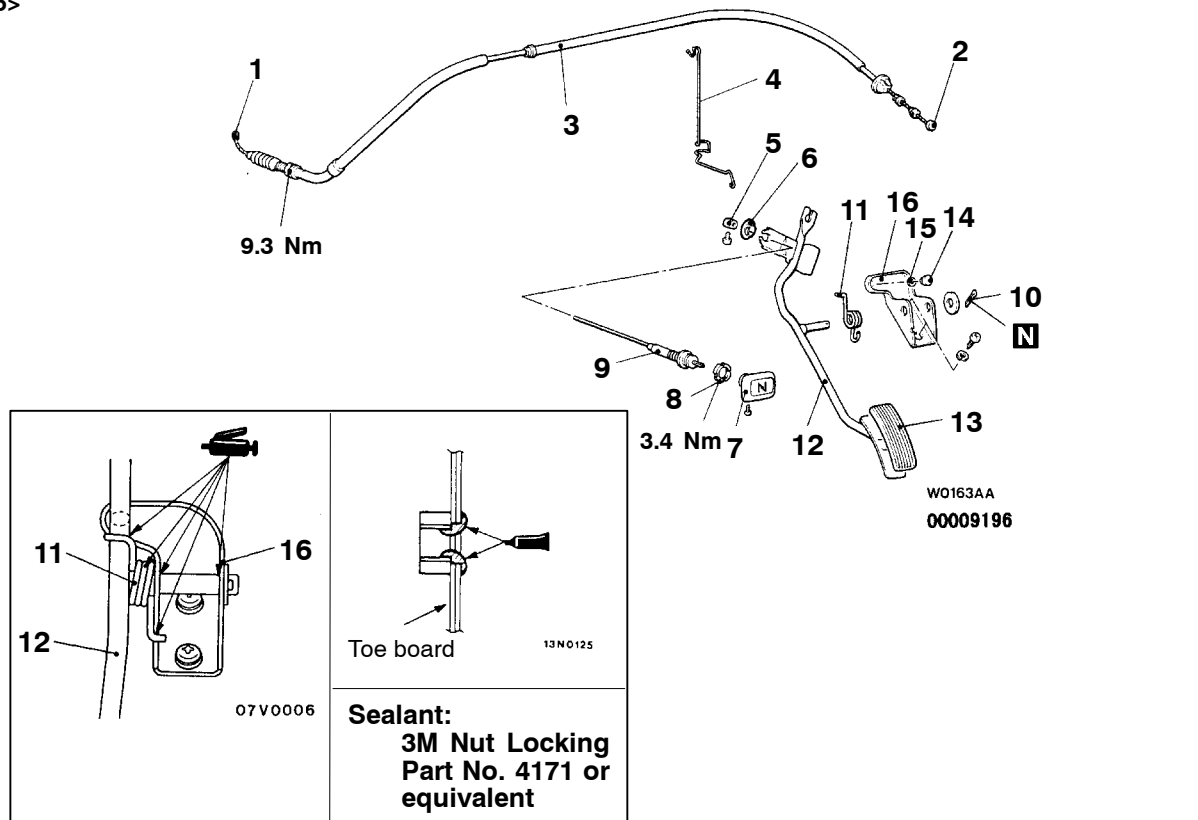
2. Inner cable connection (Accelerator pedal side)
4. Knob
5. Nut
6. Throttle cable
8. Split pin
9. Spring
10. Accelerator arm
11. Pedal pad
12. Stopper
13. Washer
14. Bracket

<R.H. drive vehicles>

<6G7>



<4D5>



Accelerator cable removal steps

1. Inner cable connection (Injection pump side)
2. Inner cable connection (Accelerator pedal side)
3. Accelerator cable
4. Spring

Throttle control cable removal steps

5. Wire stopper
6. Bush
7. Knob
8. Nut
9. Throttle control cable

Accelerator pedal removal steps

2. Inner cable connection (Accelerator pedal side)
5. Wire stopper
10. Split pin
11. Spring
12. Accelerator arm
13. Pedal pad
14. Stopper
15. Washer
16. Bracket

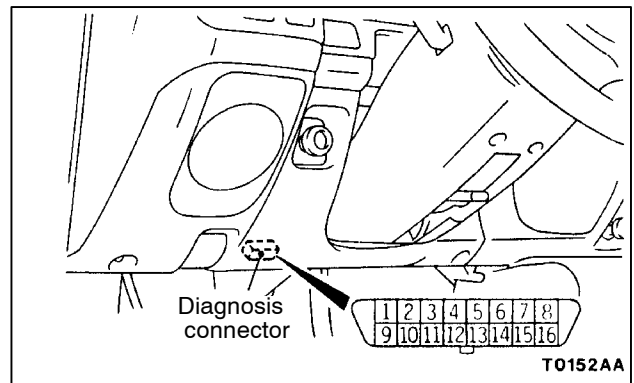
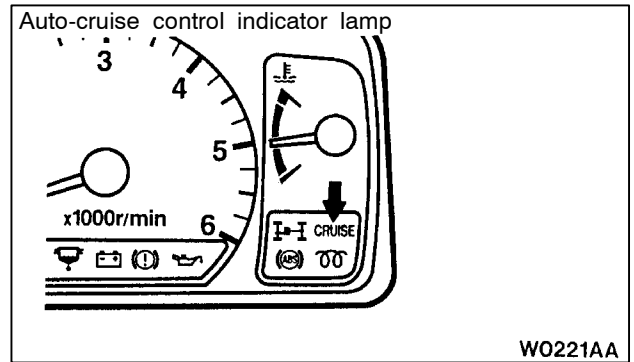
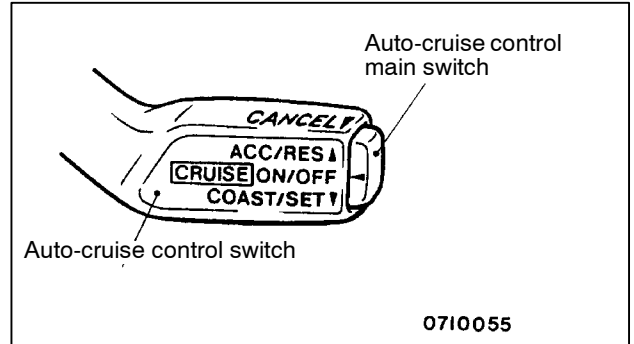
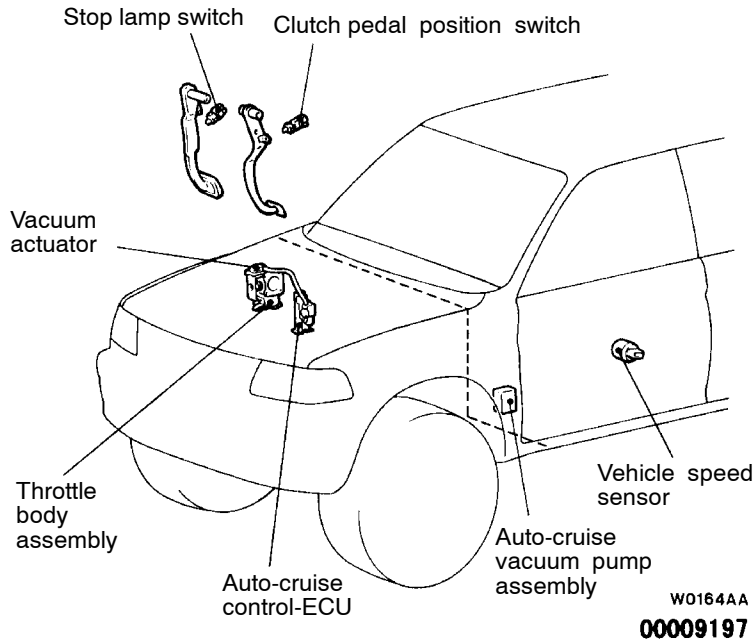
AUTO-CRUISE CONTROL SYSTEM

17200010211

GENERAL INFORMATION

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

approximately 40–200 km/h) without depressing the accelerator pedal.



17200060209

SPECIAL TOOL

Tool	Number	Name	Use
<p>B991502</p>	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> • Reading diagnosis codes • Auto-cruise control system check

TROUBLESHOOTING

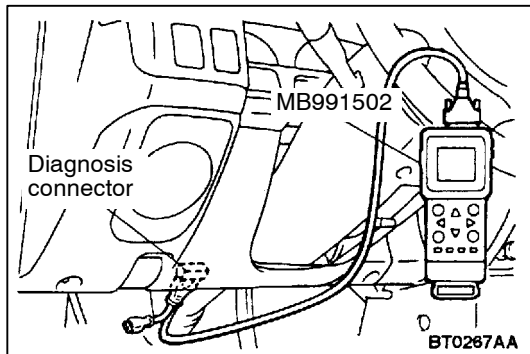
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STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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

NOTE

Check that the vacuum hose is connected correctly and is not damaged, and then carry out the diagnosis.



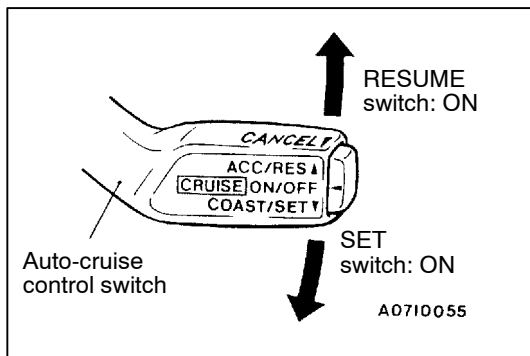
DIAGNOSIS FUNCTION

17200210277

METHOD OF READING THE DIAGNOSIS CODES

Using the MUT-II

1. Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover.
2. With the ignition switch in the ON position, take a reading of the diagnosis codes.



Using a Auto-cruise Control Indicator Lamp

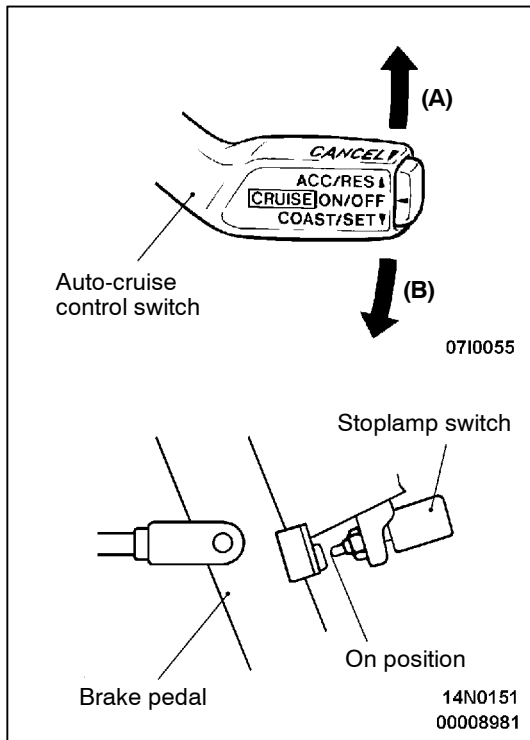
1. Turn the ignition switch ON with the SET switch on. Then, turn the RESUME switch ON within 1 second.
2. Read a diagnosis code by observing the flash display pattern of the auto-cruise control indicator lamp in the combination meter.

Indication of diagnosis code by auto-cruise control indicator lamp

When the diagnosis code No.24 is output	When no diagnosis code is output

NOTE

Other on-board diagnostic items are also output as voltage waveforms corresponding to diagnosis code numbers.



METHOD OF ERASING THE DIAGNOSIS CODES

The diagnosis codes can be erased by the following procedure.

NOTE

The diagnosis code will not be erased even if the battery (-) terminal is disconnected.

Using the MUT-II

1. Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover.
2. With the ignition switch in the ON position, take a erasing of the diagnosis codes.

Without using the MUT-II

1. Turn the ignition switch ON.
2. Push the auto-cruise control swith in the direction of arrow (B) in the illustration. Then press the auto-cruise control main switch to the ON position, and within 1 second push the auto-cruise control switch back in the direction of arrow (A).
3. Push the auto-cruise conteol switch again in the direction of arrow (B) in the illustration. While holding the switch in this position, press the stoplamp switch to the ON position, for 5 seconds or more.

INPUT SWITCH CODE CHECK METHOD

1. Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover.
2. With the ignition switch in the ON position, take a erasing of the input switch codes.

Service Data Output

Items No.	Service data item		Unit
01	Auto-cruise control switch	Main	ON/OFF
02		Set	ON/OFF
03		Resume	ON/OFF
04		Cancel	ON/OFF
05	Stoplamp switch		ON/OFF
10	Vehicle speed sensor		km/h
13	TPS		mV
14	Clutch pedal position switch		ON/OFF
15	Over drive detective		ON/OFF

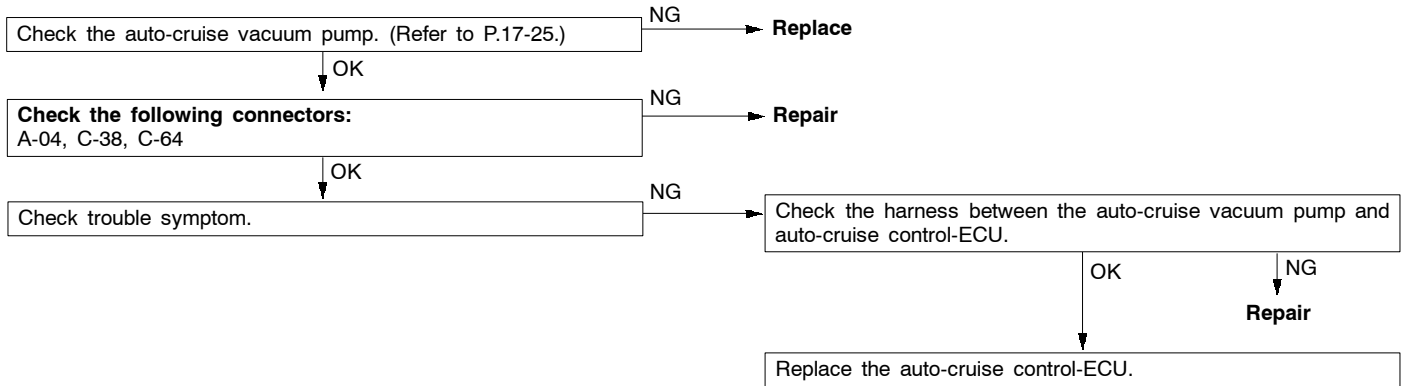
INSPECTION CHART FOR DIAGNOSIS CODES

17200220478

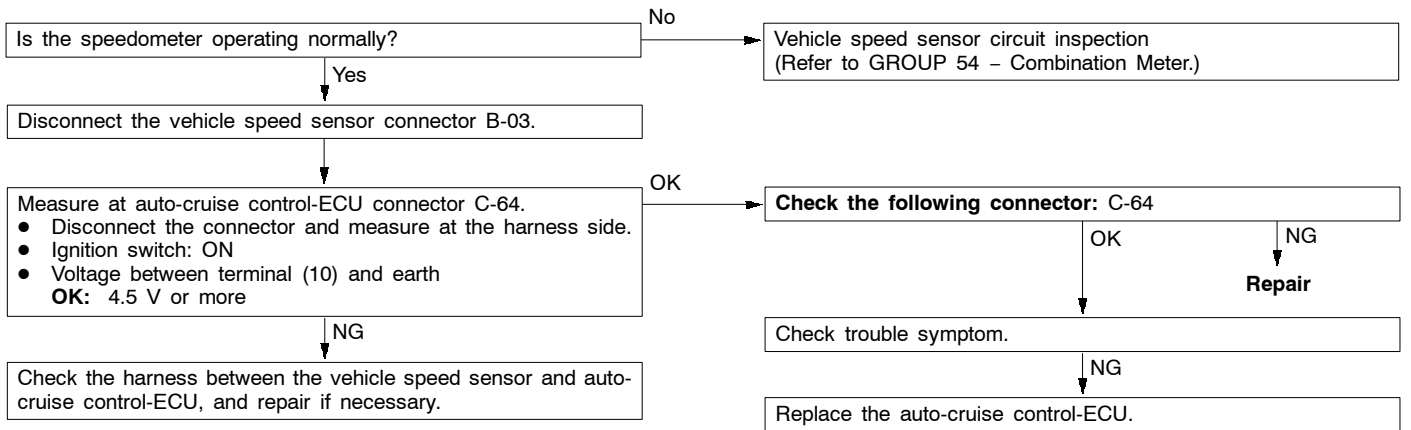
Code No.	Diagnosis item	Reference page
11	Auto-cruise vacuum pump drive system	17-10
12	Vehicle speed signal system	17-10
14	Auto-cruise vacuum pump power supply system	17-11
15	Auto-cruise control switch	17-11
16	Auto-cruise control-ECU	17-11
17	Throttle position sensor system	17-12

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

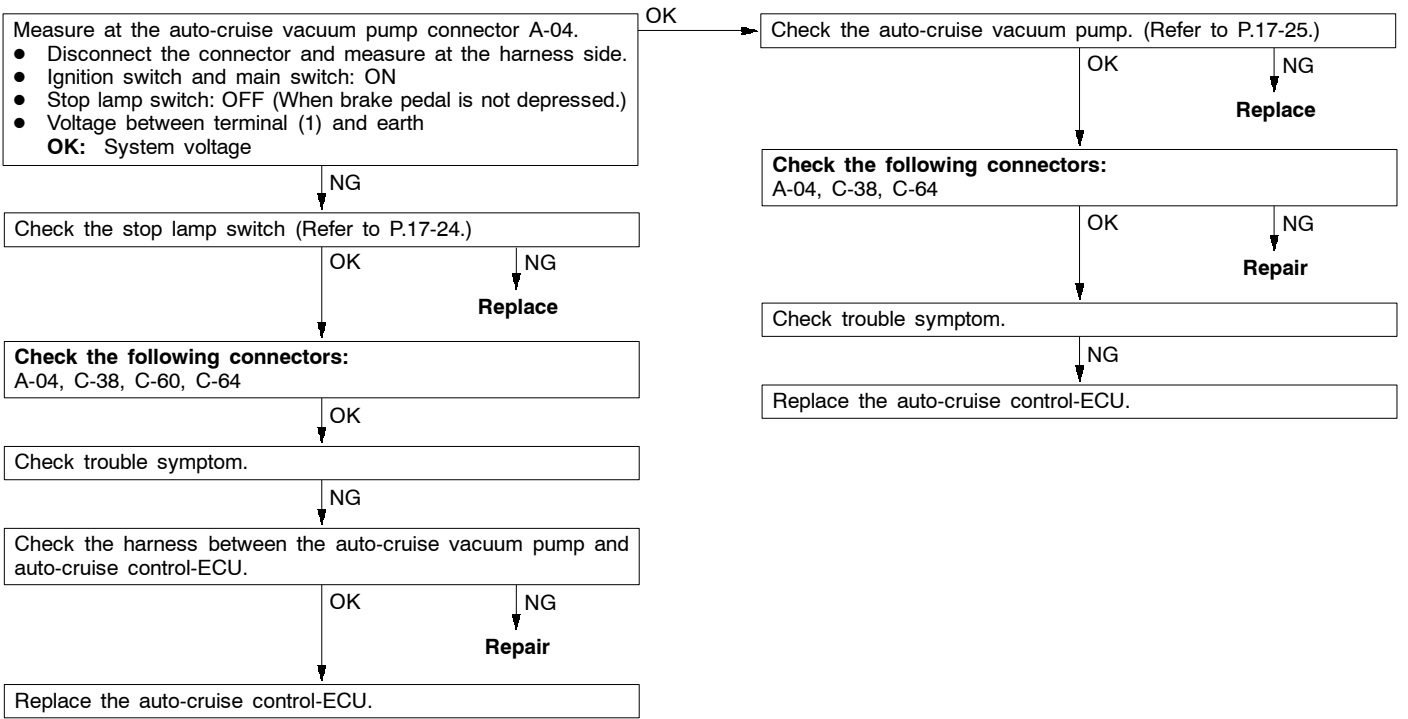
Code No. 11 Auto-cruise vacuum pump drive system	Probable cause
This diagnosis code is output if the release valve, control valve or motor drive signals from the auto-cruise vacuum pump are not input to the auto-cruise control-ECU.	<ul style="list-style-type: none"> ● Malfunction of the auto-cruise vacuum pump ● 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 Auto-cruise vacuum pump power supply system	Probable cause
This diagnosis code is output when none of the drive signals from the release valve, control valve and motor of the auto-cruise vacuum pump are input to the auto-cruise control-ECU.	<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 ● Malfunction of the auto-cruise vacuum pump



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

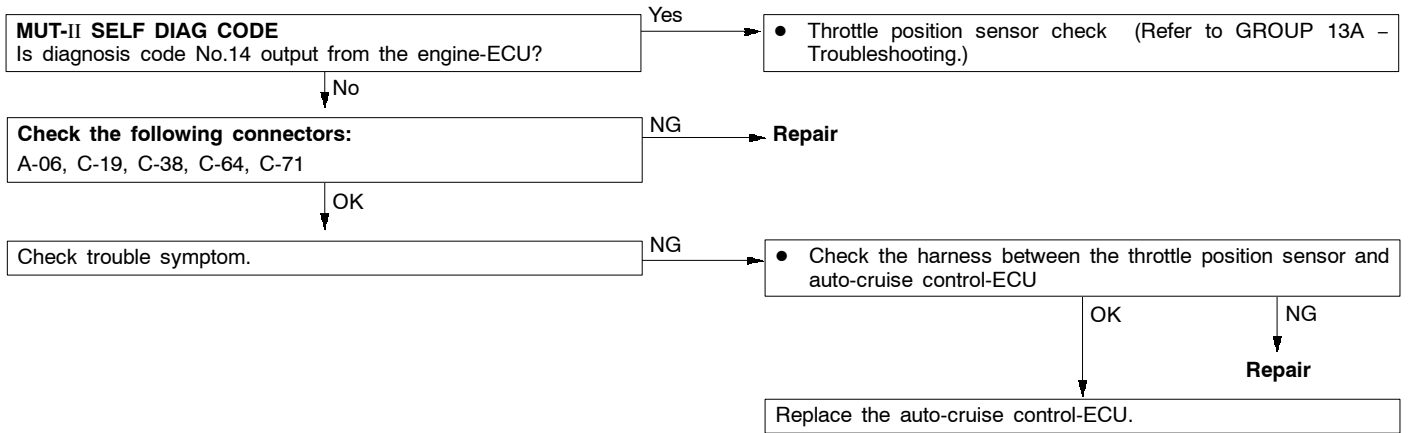
Replace the auto-cruise control switch.

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.

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

Code No. 17 Throttle position sensor system	Probable cause
This diagnosis code is output if a voltage of 2.5 V or more when the idle switch is ON or 0.2 V or less when the idle 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

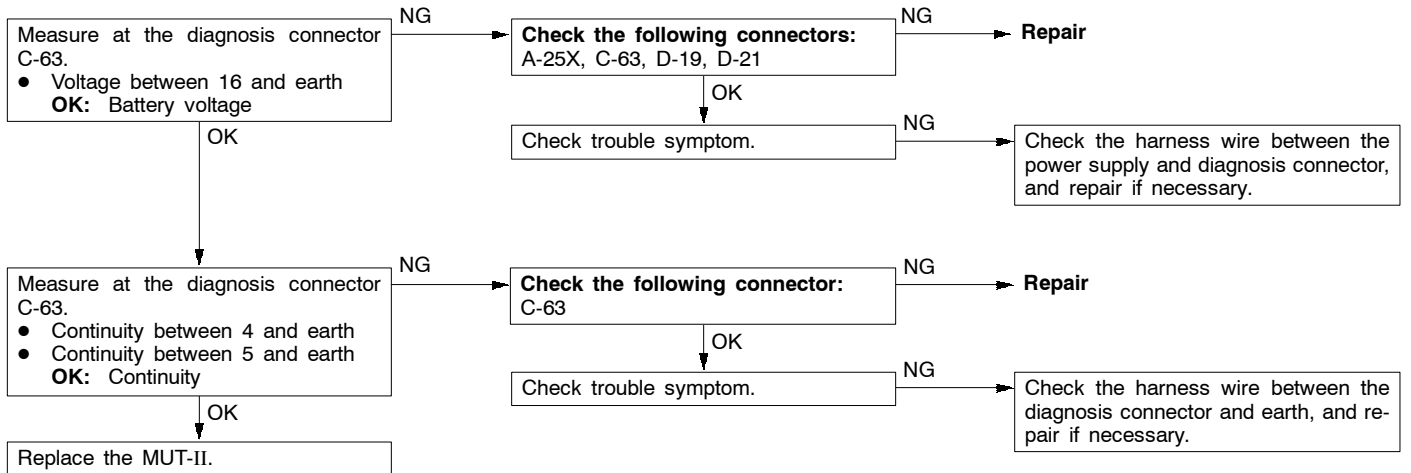
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Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	17-13
	Communication with auto-cruise control-ECU only is not possible.	2	17-14
Input switch inspection 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 clutch pedal is depressed	5	17-17
	Even if CANCEL switch is set to ON	6	17-18
Auto-cruise control cannot be set.		7	17-18
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		8	17-19
Auto-cruise control indicator lamp inside combination meter does not illuminate. (However, auto-cruise control is normal.)		9	17-19

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

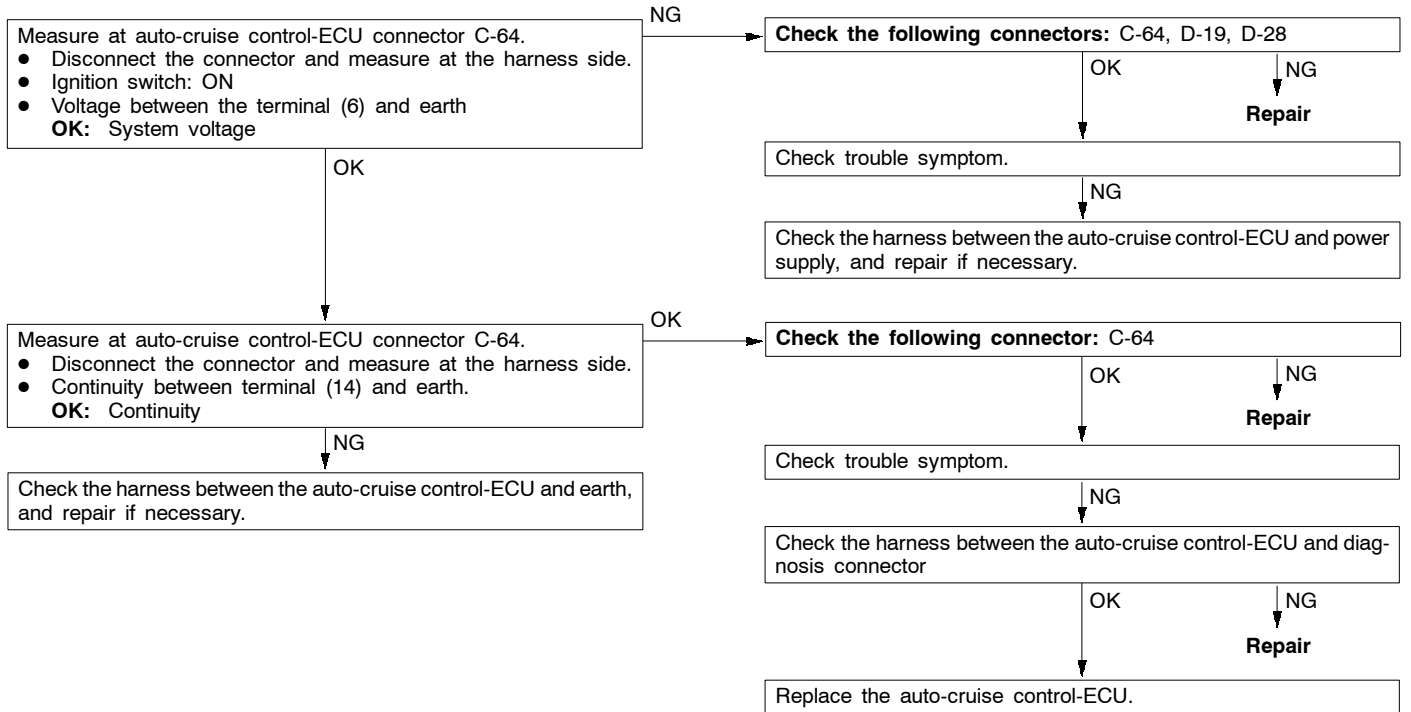
Communication with MUT-II is not possible. (Communication with all system is not possible.)	Probable cause
The reason is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> ● Malfunction of the connector ● Malfunction of the harness



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

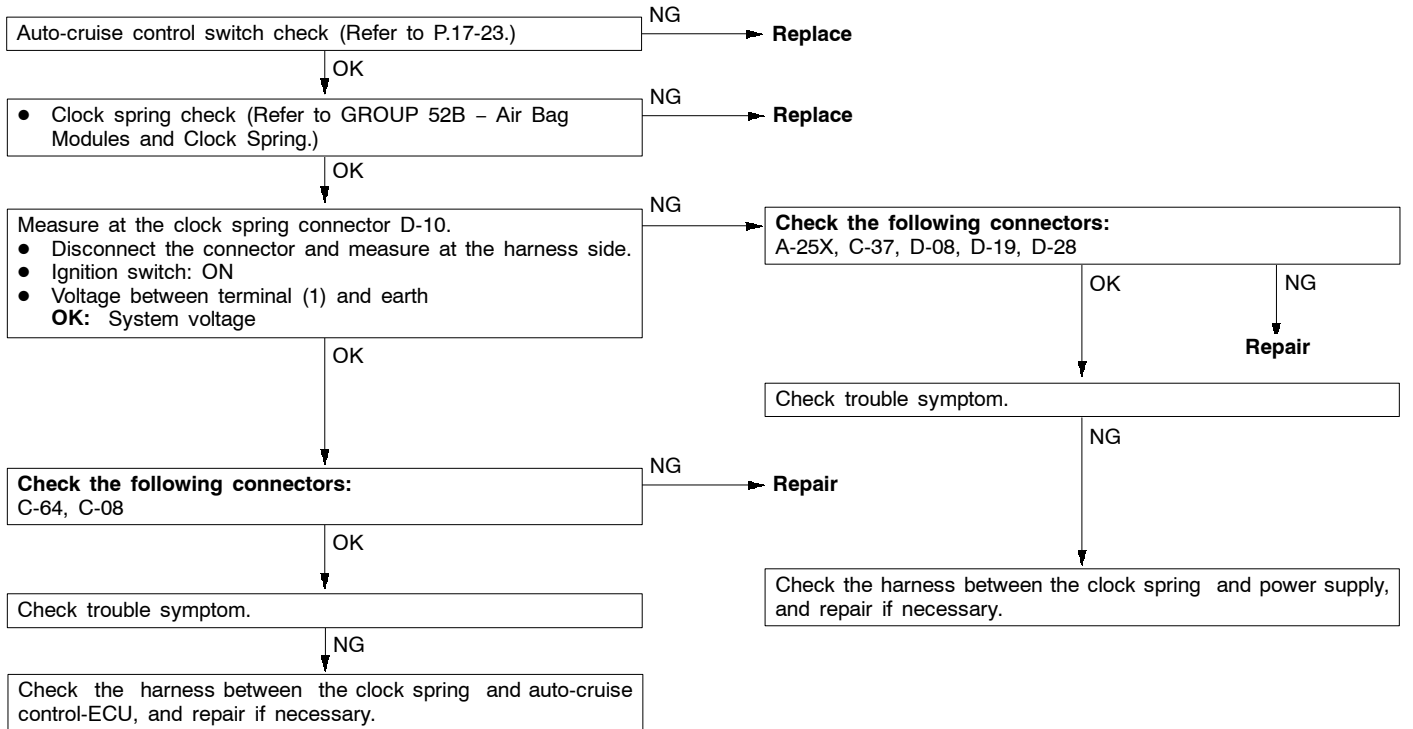
Inspection Procedure 2

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-ECU earth circuit.	<ul style="list-style-type: none"> ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the auto-cruise control-ECU



Inspection Procedure 3

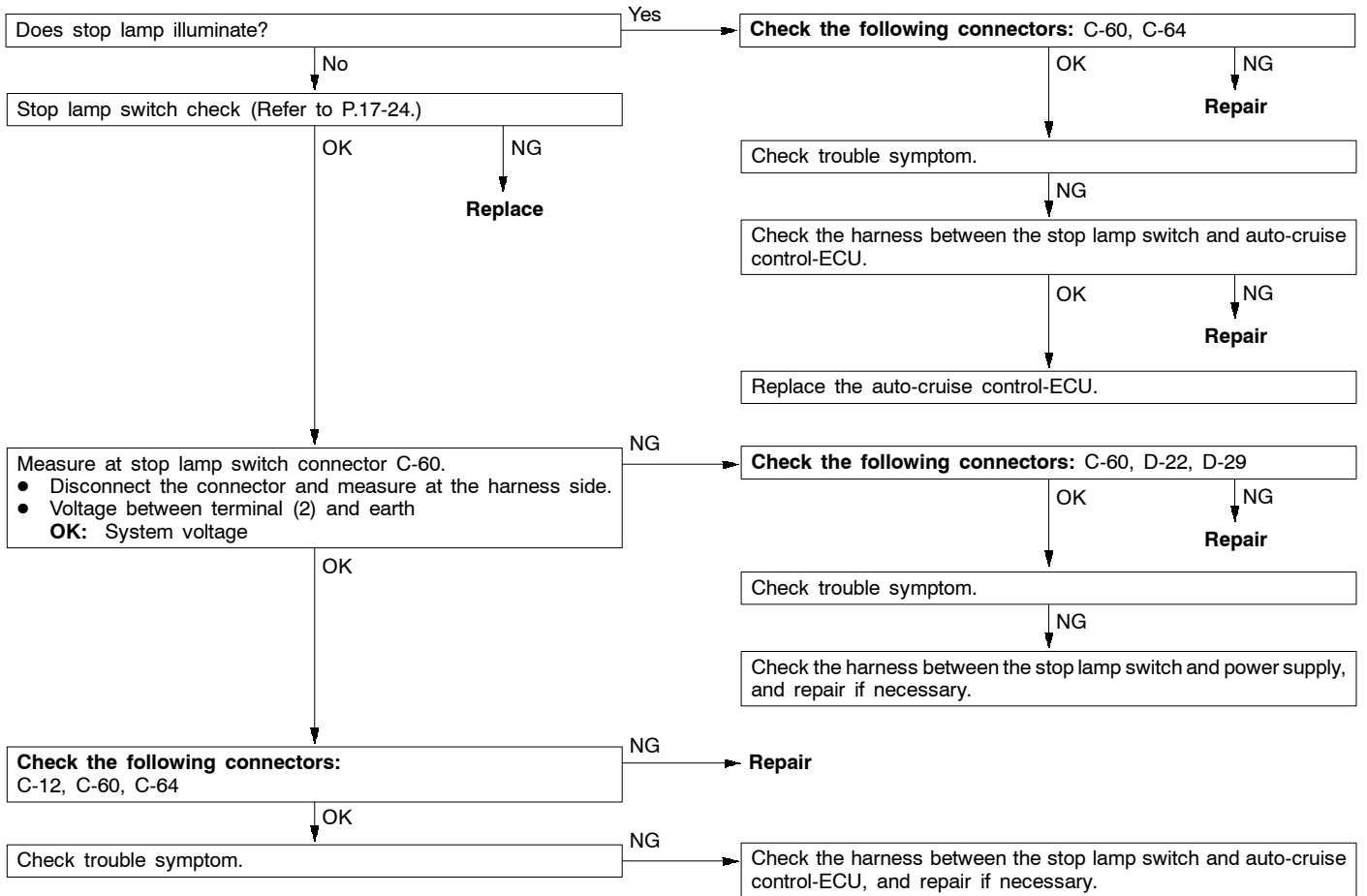
Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)	Probable cause
The cause is probably a malfunction of auto-cruise control switch circuit system.	<ul style="list-style-type: none"> ● Malfunction of the auto-cruise control switch ● Malfunction of the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



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

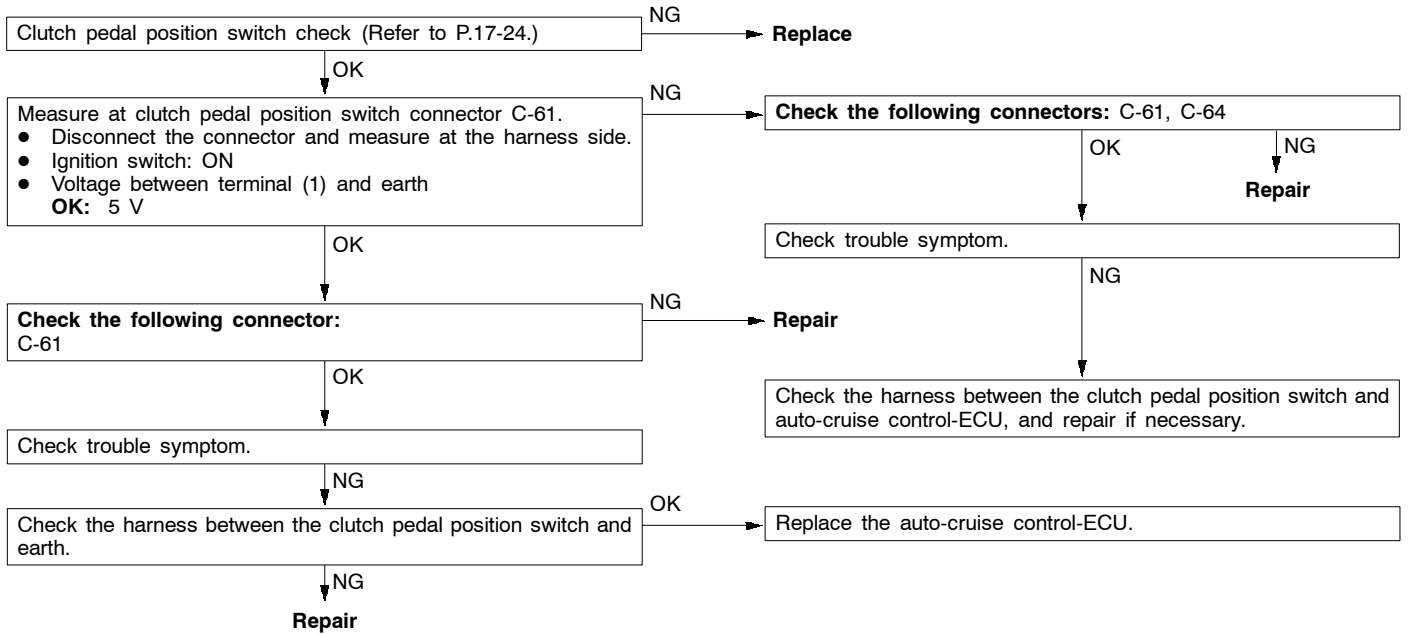
Inspection Procedure 4

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.	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

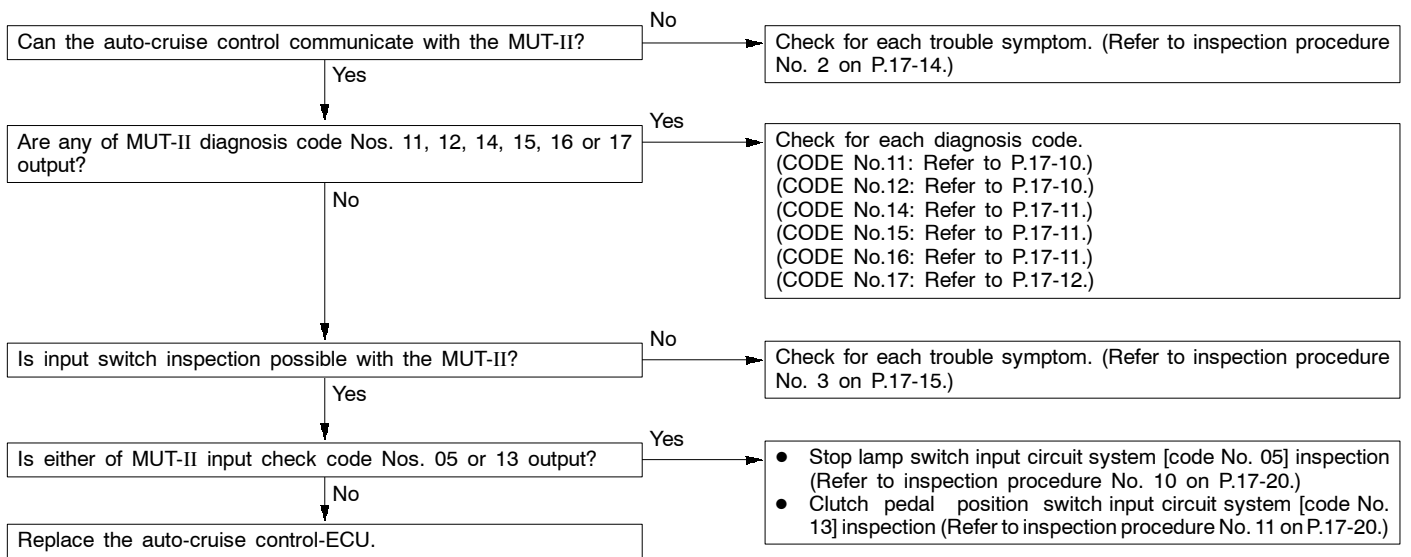
Inspection Procedure 6

Even if 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.

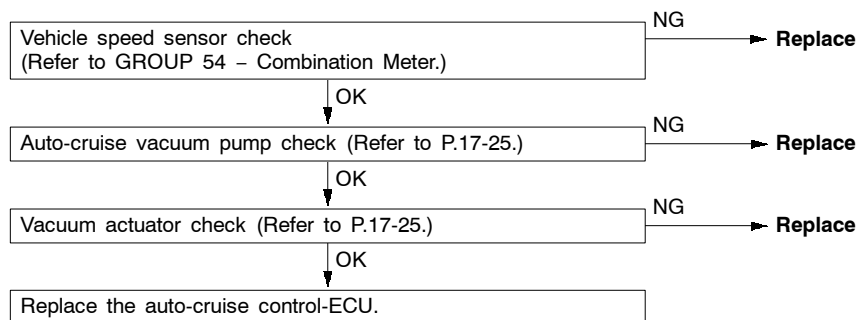
Inspection Procedure 7

Auto-cruise control cannot be set.	Probable cause
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.	<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 clutch pedal position switch Malfunction of the auto-cruise control-ECU



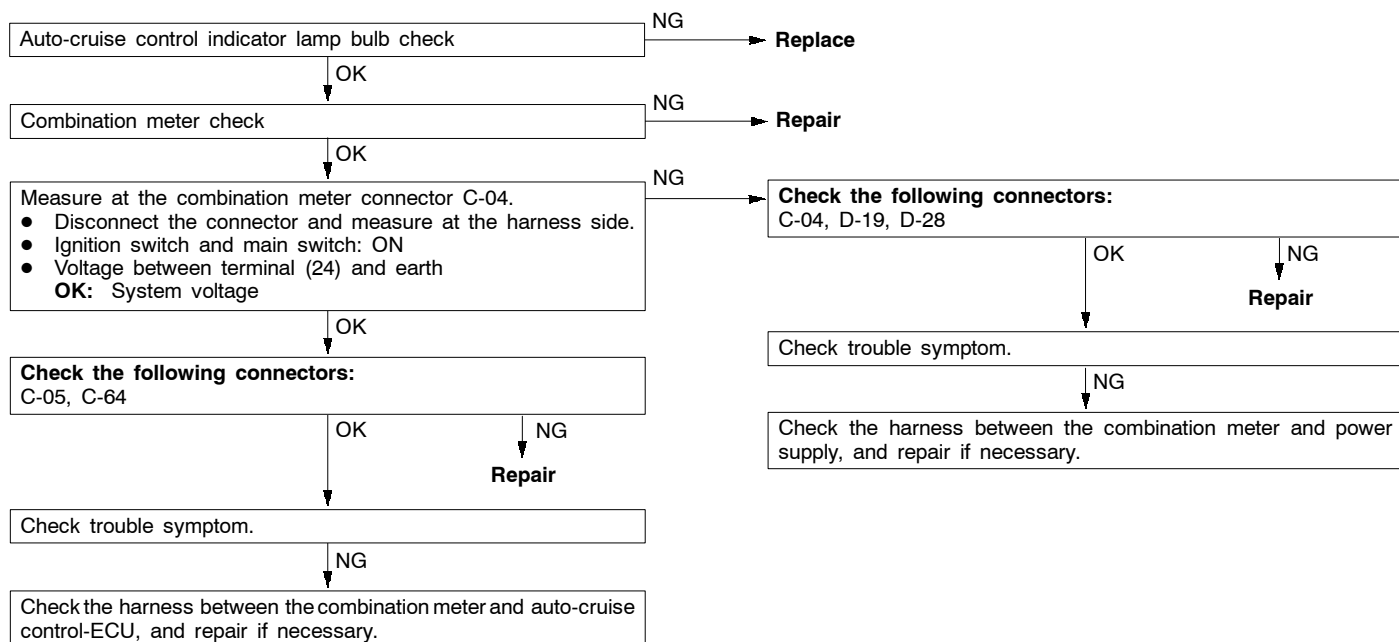
Inspection Procedure 8

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 auto-cruise vacuum pump or vacuum actuator.	<ul style="list-style-type: none"> ● Malfunction of the vehicle speed sensor ● Malfunction of the auto-cruise vacuum pump ● Malfunction of the vacuum actuator ● Malfunction of the auto-cruise control-ECU



Inspection Procedure 9

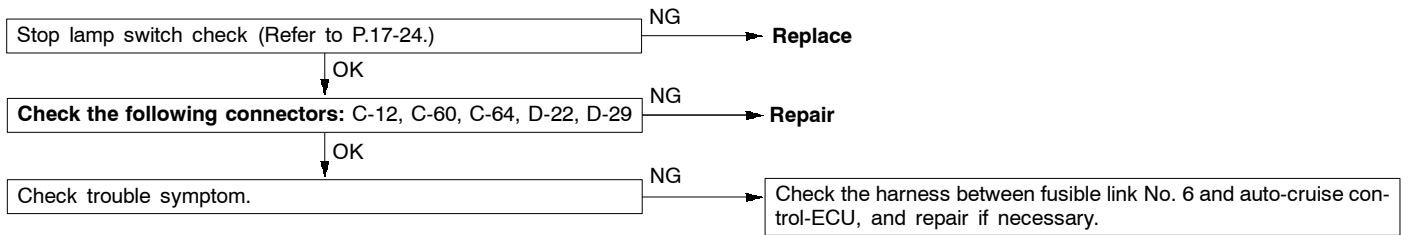
Auto-cruise control indicator lamp inside combination meter does not illuminate. (However, auto-cruise control is normal.)	Probable cause
The cause is probably a malfunction of bulb or a malfunction of connector or harness.	<ul style="list-style-type: none"> ● Malfunction of the bulb ● Malfunction of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



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

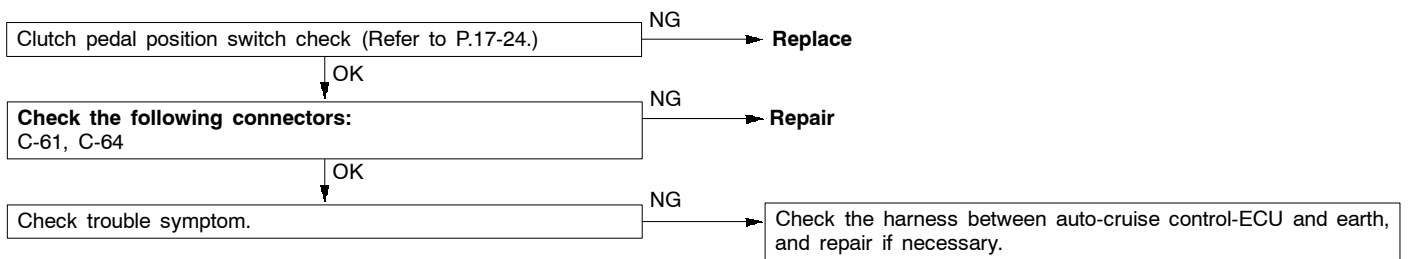
Inspection Procedure 10

Stop lamp switch input circuit system inspection (Code No. 05)



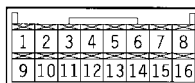
Inspection Procedure 11

Clutch pedal position switch input circuit system inspection (Code No. 13)



CHECK AT ECU TERMINALS

17200270213



07K0059

Terminal No.	Check item	Check conditions		Normal condition
1	Throttle position sensor input	When accelerator pedal is fully depressed		4.5–5.5 V
		When accelerator pedal is released		0.3 –1.0 V
2	Engine-ECU output	When accelerator pedal is depressed		4.5–5.5 V
		When accelerator pedal is not released		0 V
4	Stoplamp switch input	When brake pedal is depressed	When stop lamp switch is ON	System voltage
		When brake pedal is not depressed	When stop lamp switch is OFF	0 V
5	Pump power supply	Ignition switch: ON Stoplamp switch: OFF		System voltage
6	ECU power supply	Ignition switch: ON		System voltage
7	Auto-cruise vacuum pump release valve and control valve input	When decelerating with the SET switch while driving at constant speed	Release valve closed	System voltage
8			Control valve open/closed	System voltage
7		When cancelling constant speed driving with the CANCEL switch	Release valve open	System voltage
8			Control valve open	System voltage
9	Auto-cruise control switch input	When main switch is ON		Approx. 9.0 V
		When input switch has not been operated	When all switches are OFF	Approx. 4.5 V
		When input switch is pushed down	When SET switch is ON	Approx. 1.5 V
		When input switch is pushed up	When RESUMRE switch is ON	Approx. 3.0 V
		When input switch is pulled forward	When CANCEL switch is ON	Approx. 0 V
10	Vehicle speed sensor input	When vehicle is moved forwards and backwards, sensor turns ON and OFF repeatedly	When sensor is ON	0 V
			When sensor is OFF	4.5 V or more
11	Diagnosis control input	When ignition switch is ON		4 V or more
12	ACC power supply	When ignition switch is in ACC position Main switch: ON		System voltage

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

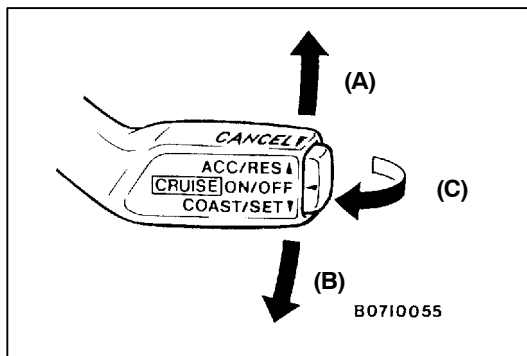
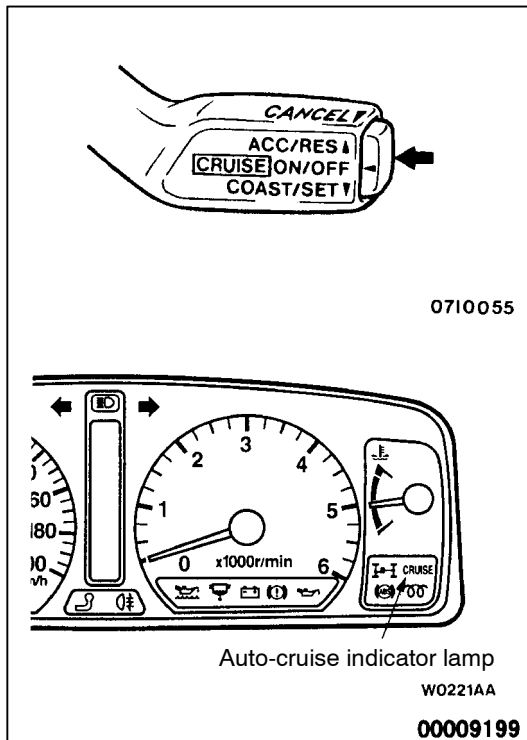
Terminal No.	Check item	Check conditions		Normal condition
13	Clutch pedal position switch input	When pedal is not depressed	When clutch pedal position switch is OFF	System voltage
		When pedal is depressed	When clutch pedal position switch is ON	0 V
14	Earth	At any time		Continuity
15	Indicator lamp input (inside combination meter)	When indicator lamp is illuminated		0 V
		When indicator lamp is switch off		System voltage
16	Auto-cruise vacuum pump motor input	When driving at constant speed using the SET switch	Motor stopped/running	System voltage/0 V
		When accelerating with the RESUME switch while driving at constant speed	Motor stopped/running	System voltage/0 V
		When decelerating with the SET switch while driving at constant speed	Motor stopped	System voltage
		When cancelling constant speed driving with the CANCEL switch	Motor stopped	System voltage

ON-VEHICLE SERVICE

17200120198

AUTO-CRUISE CONTROL MAIN SWITCH CHECK

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

**AUTO-CRUISE CONTROL SWITCH CHECK****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. Push the auto-cruise control switch in the direction of arrow (B).
4. Check to be sure that when the switch is released the speed is the desired constant speed.

NOTE

If the vehicles 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. Push the auto-cruise control switch in the direction of arrow (A).
3. Check to be sure that acceleration continues while the switch is hold, and that when it is released the constant speed at the time when it was released becomes the driving speed.

NOTE

Acceleration can be continued even if the vehicle speed has passed the high-speed limit (approx. 200 km/h). But the speed when the auto-cruise control switch is released will be recorded as the high-speed limit.

SPEED-REDUCTION SETTING

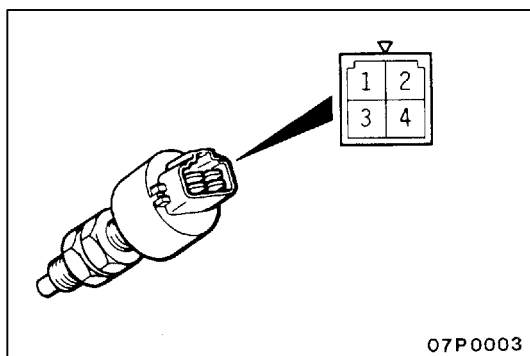
1. Set to the desired speed.
2. Push the auto-cruise control switch in the direction of arrow (B).
3. Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

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.
 - a. The auto-cruise control switch is pushed in the direction of arrow (C).
 - b. The brake pedal is depressed.
 - c. The clutch pedal is depressed.
3. When the auto-cruise control switch is pushed in the direction of arrow (A) at a vehicle speed of 40 km/h or higher, check if the 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

1. Disconnect the connector.
2. Check for continuity between the terminals of the switch.

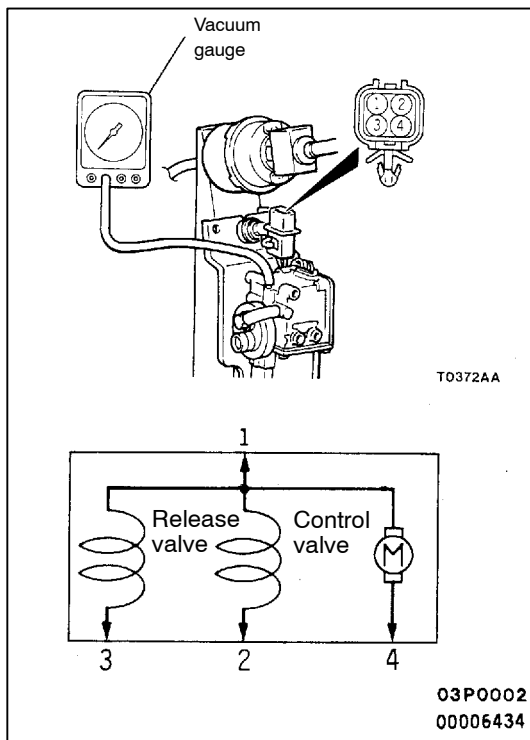
Measurement conditions	Terminal No.			
	1	3	4	5
When brake pedal is depressed. (for stop lamp circuit)		○—○		
When brake pedal is depressed. (for auto-cruise control circuit)	○—○			

CLUTCH PEDAL POSITION SWITCH

Refer to GROUP 21 – On-vehicle Service.

THROTTLE POSITION SENSOR

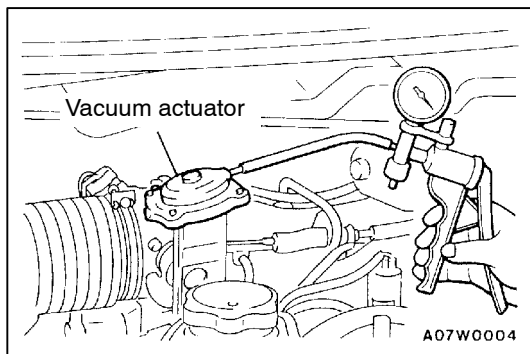
Refer to GROUP 13A – On-vehicle Service.



AUTO-CRUISE VACUUM PUMP

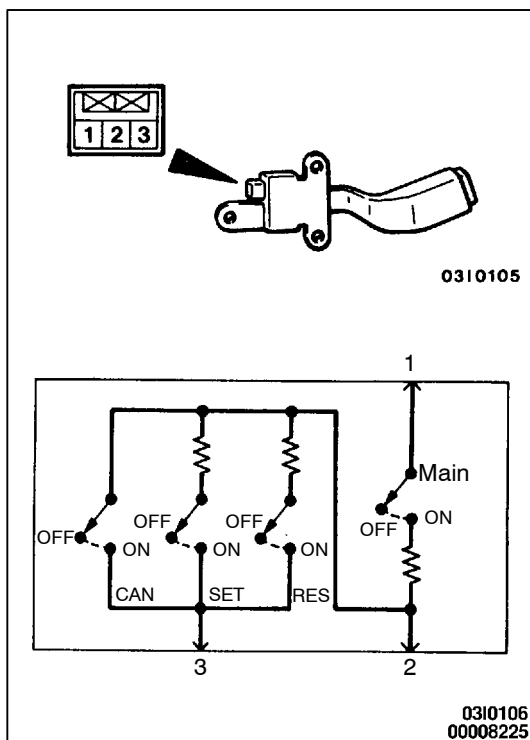
1. Disconnect the vacuum hose from the auto-cruise vacuum pump and connect a vacuum gauge to the vacuum pump.
2. Disconnect the vacuum pump connector.
3. Check that the reading on the vacuum gauge matches the values in the table below when the battery is connected to each connector terminal.

Terminal No.				Valve condition	Vacuum gauge kPa
1	2	3	4		
⊕	⊖	⊖	⊖	Release valve closed Control valve closed	53 or more
⊕		⊖	⊖	Release valve open	20 or less
⊕	⊖		⊖	Control valve open	



VACUUM ACTUATOR

1. Disconnect the vacuum hose from the vacuum actuator, and connect a hand vacuum pump to the actuator.
2. Check that the throttle lever operates when applying vacuum, and the vacuum is kept.



AUTO-CRUISE CONTROL SWITCH CHECK

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

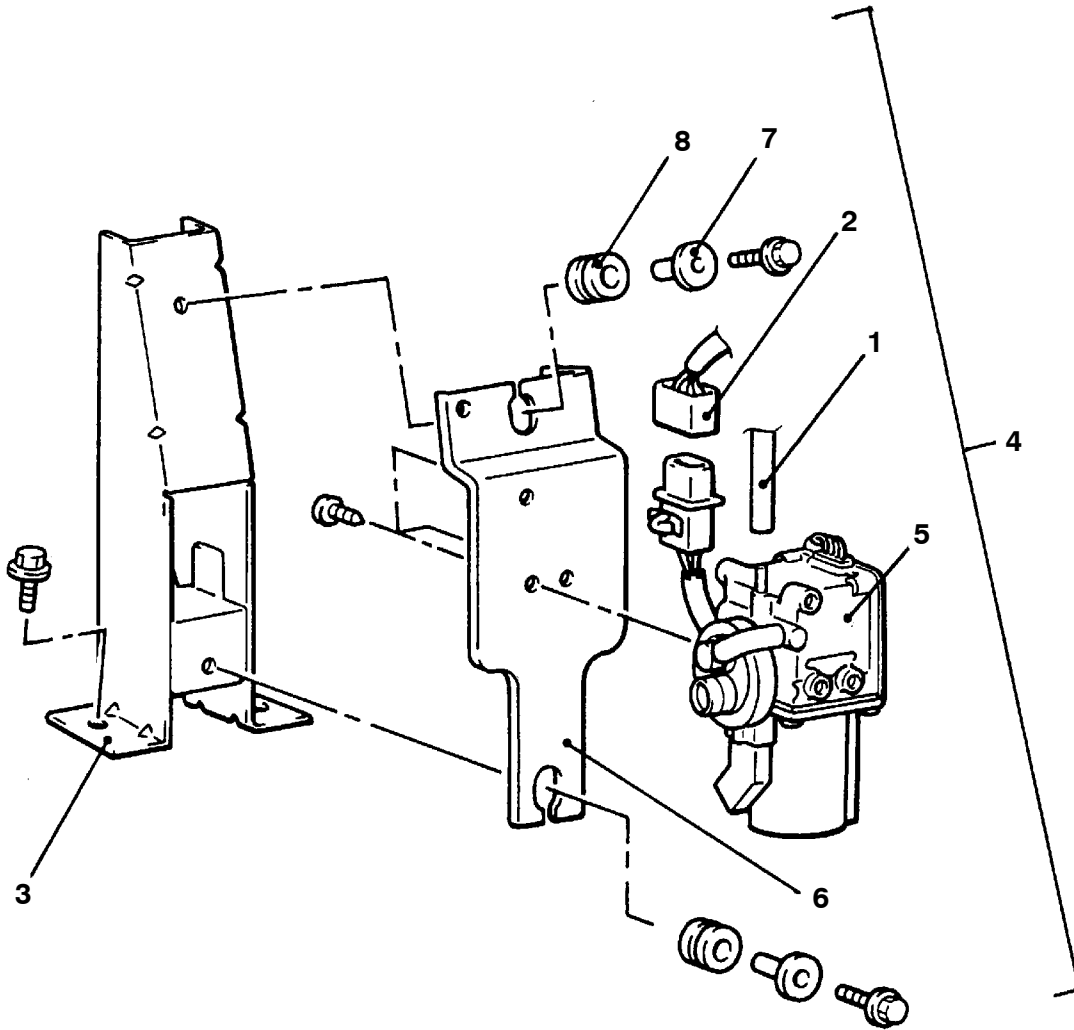
Switch position	Resistance between terminals	
Switch OFF	No continuity	
CANSEL switch ON	Terminals 1 and 3	Approx. 3.9 kΩ
	Terminals 2 and 3	Approx. 0 Ω
RESUME switch ON	Terminals 1 and 3	Approx. 4.8 kΩ
	Terminals 2 and 3	Approx. 910 Ω
SET switch ON	Terminals 1 and 3	Approx. 4.1 kΩ
	Terminals 2 and 3	Approx. 220 Ω
MAIN switch ON	Terminals 1 and 2	Approx. 3.9 kΩ

VEHICLE SPEED SENSOR CHECK

Refer to GROUP54 – Combination meters.

AUTO-CRUISE CONTROL REMOVAL AND INSTALLATION

17200140477



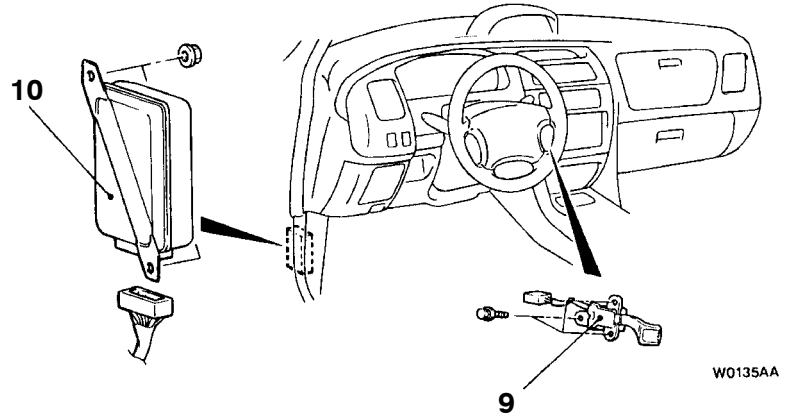
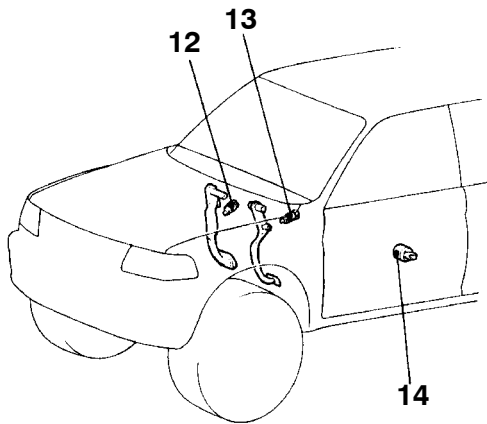
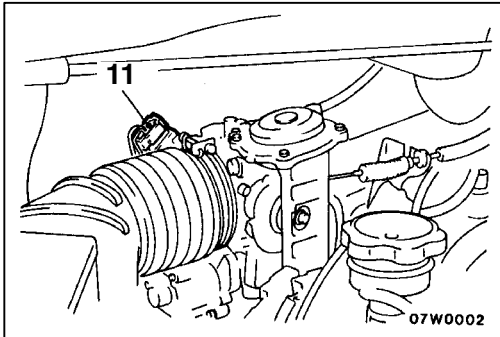
BV0162AA

Removal steps

- | | |
|--|----------------------------|
| 1. Vacuum hose | 5. Auto-cruise vacuum pump |
| 2. Wiring connector | 6. Pump bracket |
| 3. Actuator bracket | 7. Distance piece |
| 4. Auto-cruise vacuum pump and pump bracket assembly | 8. Rubber mount |

CAUTION: SRS

Before removal of air bag module, refer to GROUP 52B – SRS Service Precautions and Air Bag Modules and Clock Spring.



00009198

Auto-cruise control switch removal steps

- Air bag module (Refer to GROUP 52B – Air Bag Module and Clock Spring.)
9. Auto-cruise control switch

Auto-cruise control-ECU removal steps

- Cowl side trim (Refer to GROUP 52A – Trims.)
10. Auto-cruise control-ECU

Sensor removal

- 11. Throttle position sensor
- 12. Stop lamp switch
- 13. Clutch pedal position switch
- 14. Vehicle speed sensor

EMISSION CONTROL SYSTEM <6G7>

17300010283

GENERAL INFORMATION

The emission control system consists of the following subsystems:

- Crankcase emission control 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 solenoid valve	Equipped ON/OFF type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device – MPI system	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	×					17-32
Purge control solenoid valve		×				17-35
MPI system component		×	×			GROUP 13A
Catalytic converter				×		17-39
EGR valve					×	17-37
EGR control solenoid valve					×	17-38

SERVICE SPECIFICATIONS

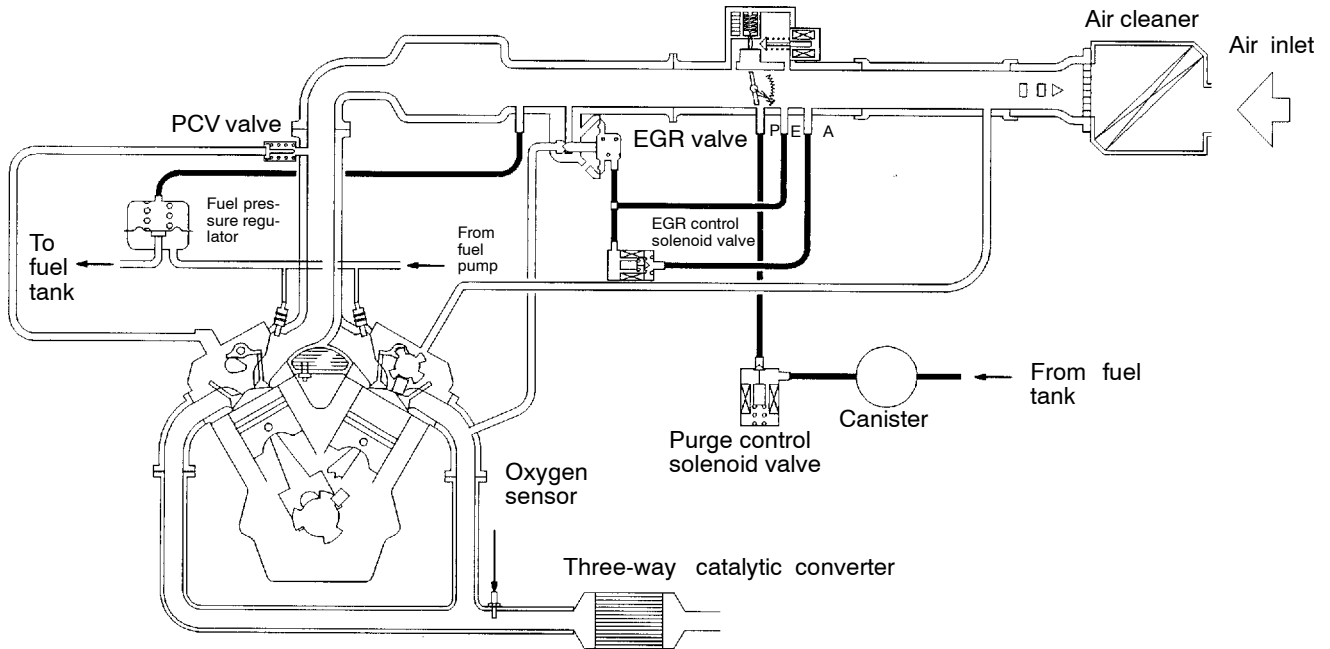
17300030371

Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	28–36
EGR control solenoid valve coil resistance (at 20°C) Ω	28–36

VACUUM HOSE

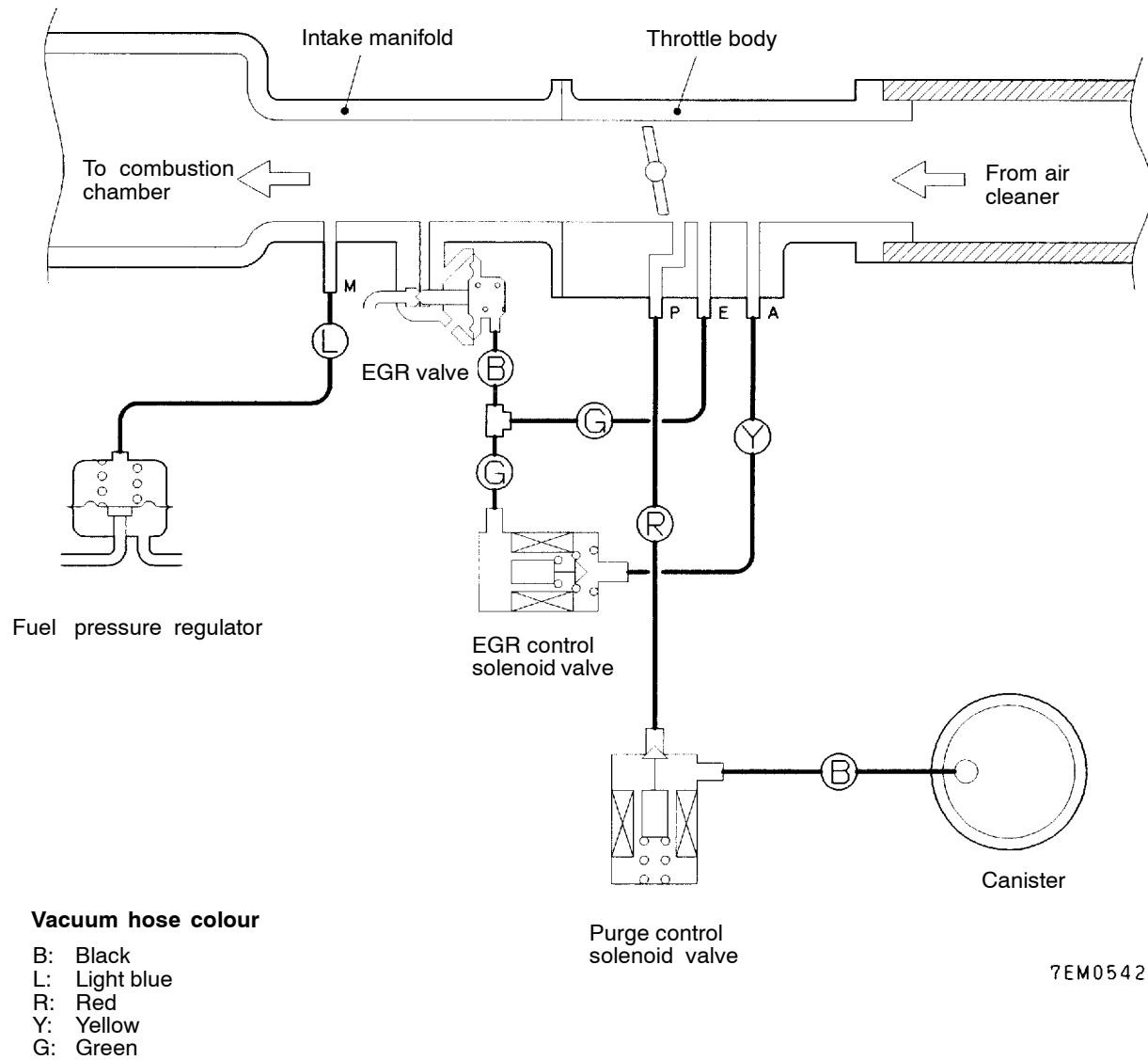
VACUUM HOSE PIPING DIAGRAM

17300090508



7EM0528

VACUUM CIRCUIT DIAGRAM



VACUUM HOSE CHECK

1. Using the 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.

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.

CRANKCASE EMISSION CONTROL SYSTEM

17300500308

GENERAL INFORMATION

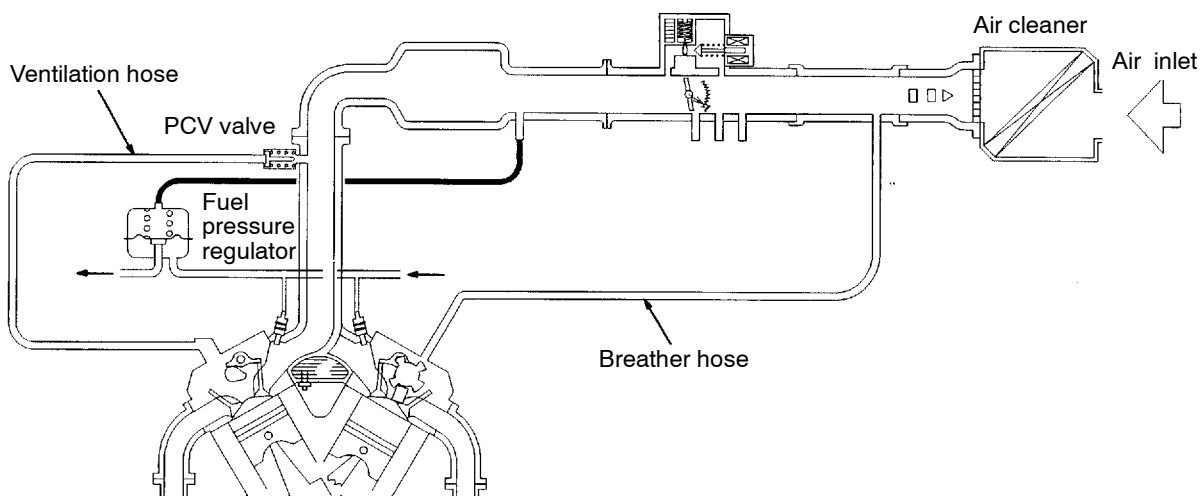
The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.

Fresh air is sent from the air cleaner into the crankcase through the breather hose. The air becomes 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

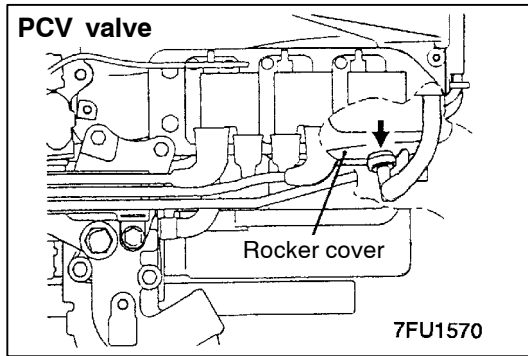
crankcase ventilation (PCV) valve.

The PCV valve lifts 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

7EM0530

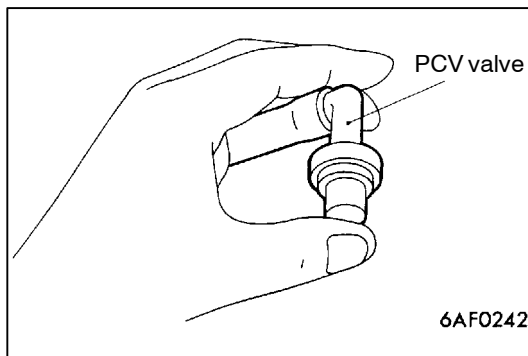
COMPONENT LOCATION



POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

17300110266

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

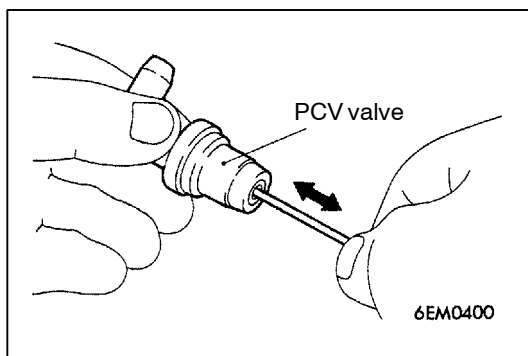


5. Place a finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

NOTE

At this moment, the plunger in the PCV valve moves back and forth.

6. If vacuum is not felt, clean the PCV valve or replace it.



PCV VALVE CHECK

17300120238

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

EVAPORATIVE EMISSION CONTROL SYSTEM

17300510561

GENERAL INFORMATION

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

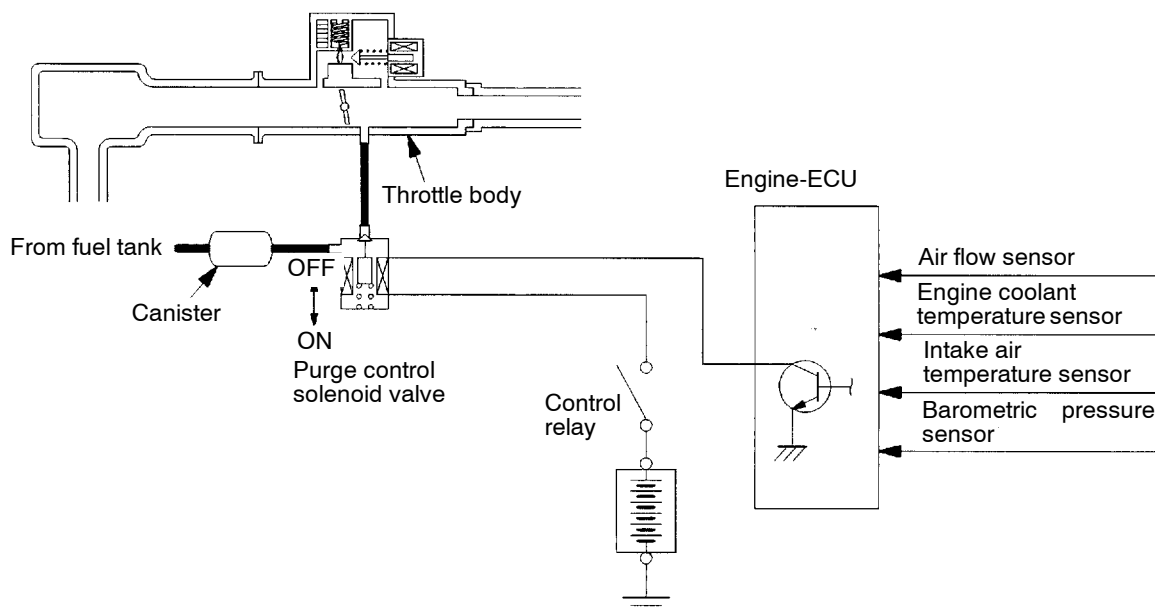
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be

sent to the combustion chamber.

When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the intake manifold.

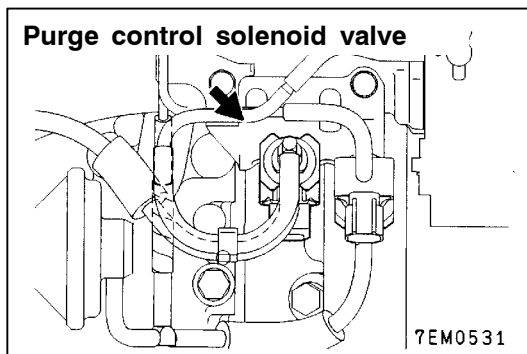
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

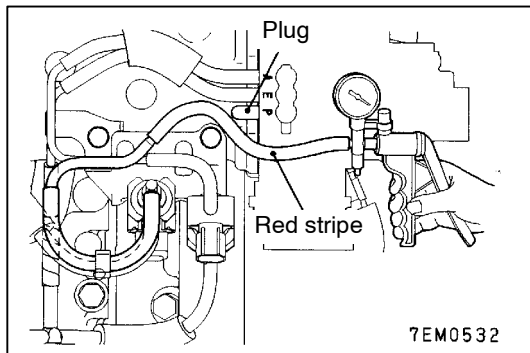
SYSTEM DIAGRAM



6EM0596

COMPONENT LOCATION





PURGE CONTROL SYSTEM CHECK

17300140531

1. Disconnect the vacuum hose (red stripe) from the throttle body and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold or hot, apply a vacuum while the engine is idling, and check the condition of the engine and the vacuum.

**When engine is cold
(Engine coolant temperature: 40°C or less)**

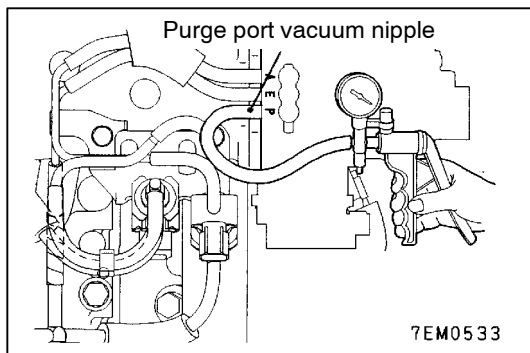
Vacuum	Engine condition	Normal condition
53 kPa	3,000 r/min	Vacuum is maintained

**When engine is hot
(Engine coolant temperature: 80°C or higher)**

Vacuum	Engine condition	Normal condition
53 kPa	At idle	Vacuum is maintained
	3,000 r/min	Vacuum will leak for approximately 3 minutes after the engine is started. After 3 minutes have passed, the vacuum will be maintained momentarily, after which it will again leak.*

NOTE

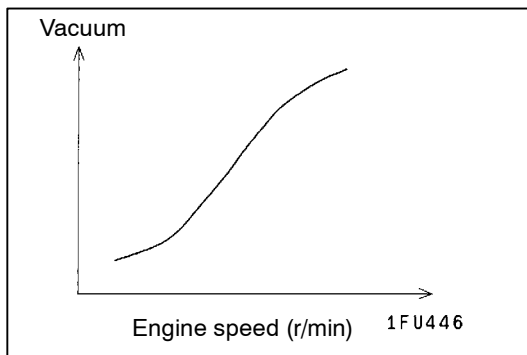
*: The vacuum will leak continuously if the atmospheric pressure is approximately 77 kPa or less, or the temperature of the intake air is approximately 50°C or higher.



PURGE PORT VACUUM CHECK

17300150411

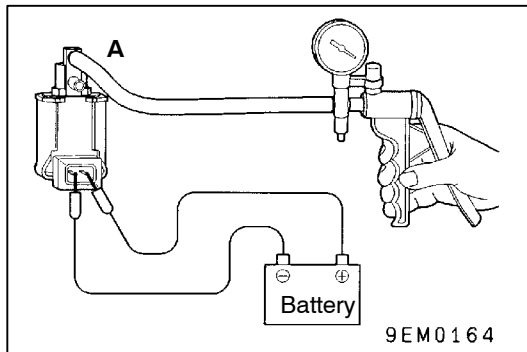
1. Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check that, after raising the engine speed by racing the engine, purge vacuum raises according to engine speed.

NOTE

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



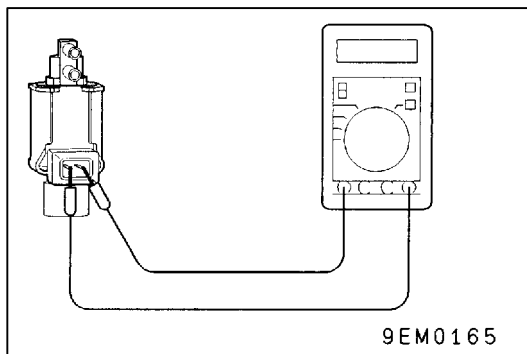
PURGE CONTROL SOLENOID VALVE CHECK

17300170370

NOTE

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

1. Disconnect the vacuum hose (black stripe, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.



Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

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

Standard value: 28 – 36 Ω (at 20°C)

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

17300520434

GENERAL INFORMATION

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

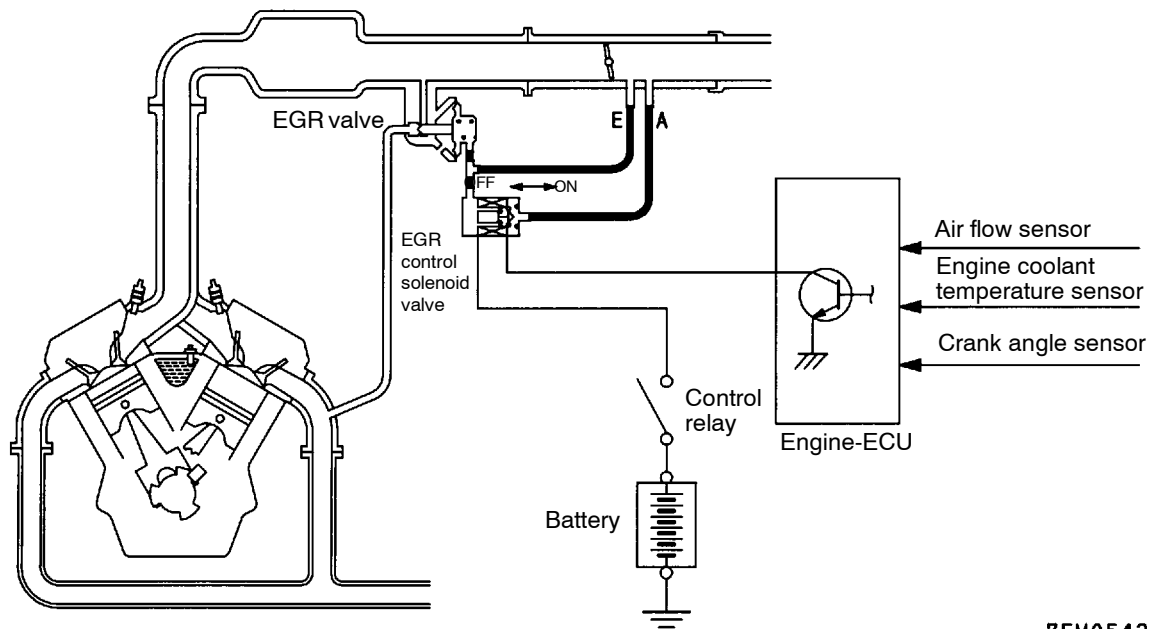
the exhaust port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx. The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

The EGR valve is being closed and does not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculates exhaust gases.

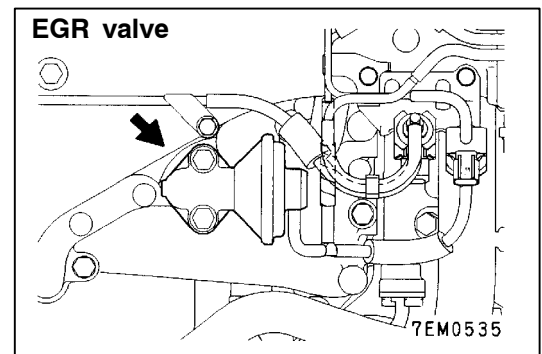
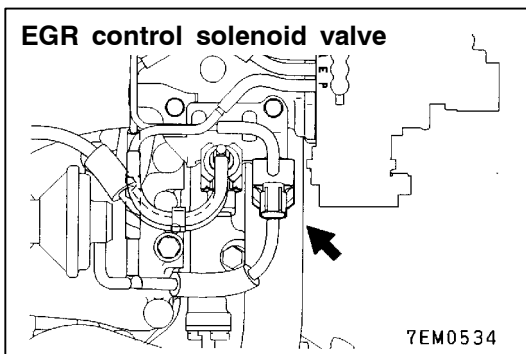
- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

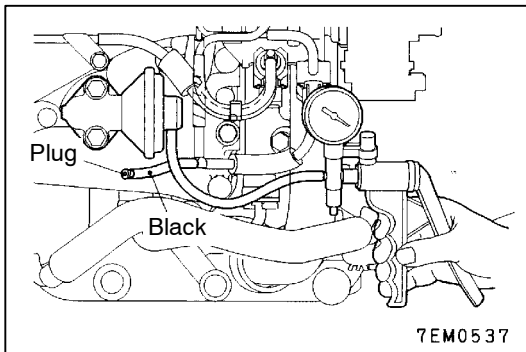
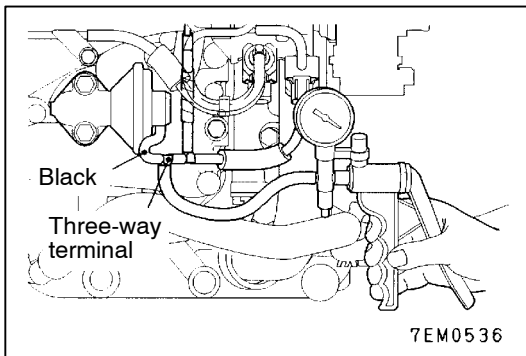
SYSTEM DIAGRAM



7EM0543

COMPONENT LOCATION





EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

17300260398

1. Disconnect the vacuum hose (black) from the EGR valve, and then connect a hand vacuum pump via the three-way terminal.
2. When the engine is hot or cold, check the condition of vacuum by racing the engine.

When engine is cold (Engine coolant temperature: 20°C or less)

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

When engine is hot (Engine coolant temperature: 80°C or higher)

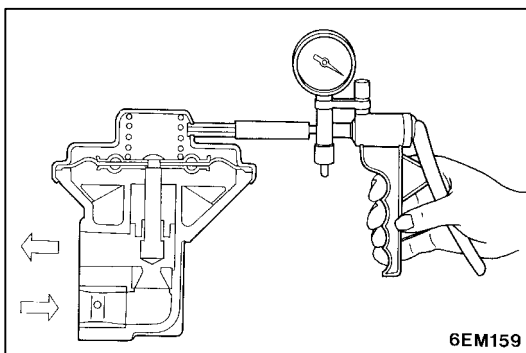
Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 13 kPa

3. Disconnect the three-way terminal.
4. Connect the hand vacuum pump to the EGR valve nipple (Black).
5. Check whether the engine stalls or the idling is unstable when a vacuum of 30 kPa or higher is applied during idling.

EGR VALVE CHECK

17300280257

1. Remove the EGR valve and inspect for sticking, carbon deposits, etc. If found, clean with a suitable solvent so that the valve seats correctly.
2. Connect a hand vacuum pump to the EGR valve.
3. Apply 67 kPa of vacuum, and check that the vacuum is maintained.

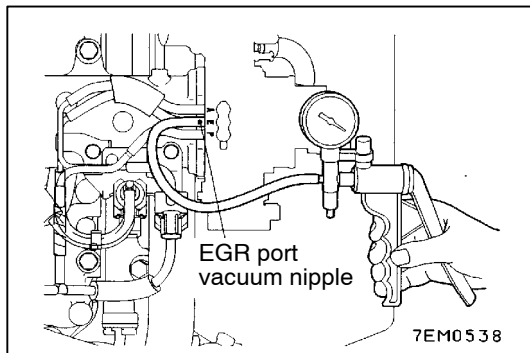


4. Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

Vacuum	Passage of air
2.7 kPa or less	Air is not blown out
29 kPa or more	Air is blown out

5. Replace the gasket, and tighten to the specified torque.

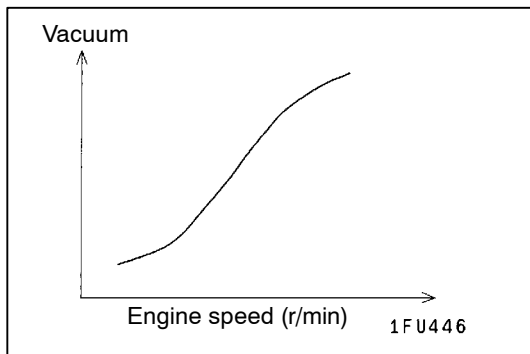
Tightening torque: 22 Nm



EGR PORT VACUUM CHECK

17300290304

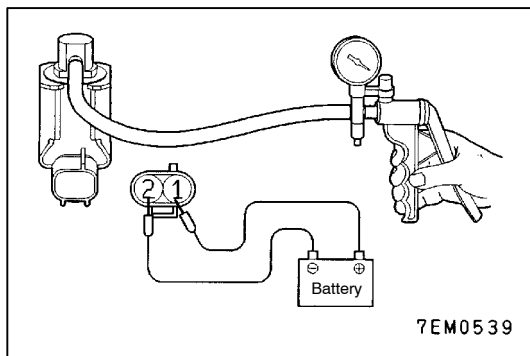
1. Disconnect the vacuum hose (green stripe) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check vacuum remains fairly constant after racing the engine.

NOTE

If the vacuum fluctuates, the throttle body EGR port may be clogged and need cleaning.



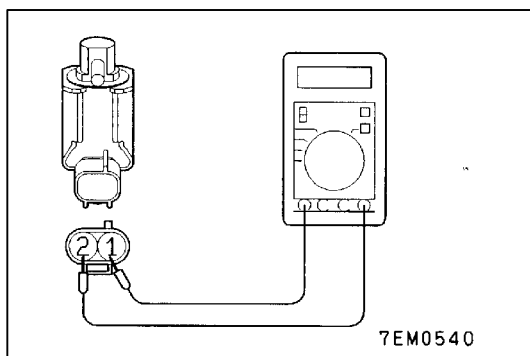
EGR CONTROL SOLENOID VALVE CHECK

17300310352

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: 28 – 36Ω (at 20°C)

CATALYTIC CONVERTER

17300530154

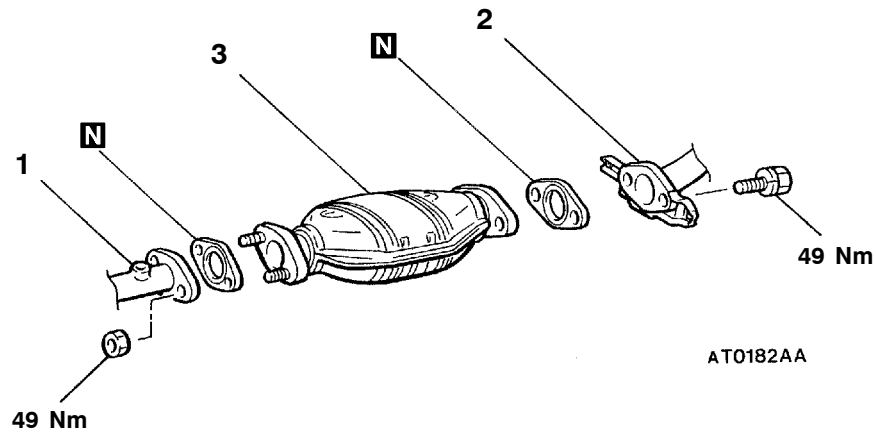
GENERAL INFORMATION

The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidizes 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

17300390325

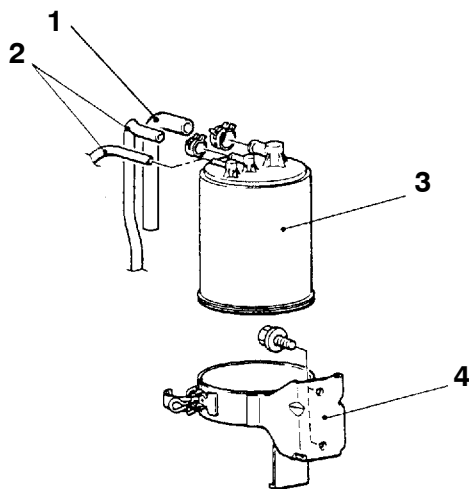


Removal steps

1. Front exhaust pipe
2. Center exhaust pipe
3. Catalytic converter

CANISTER AND TWO-WAY VALVE

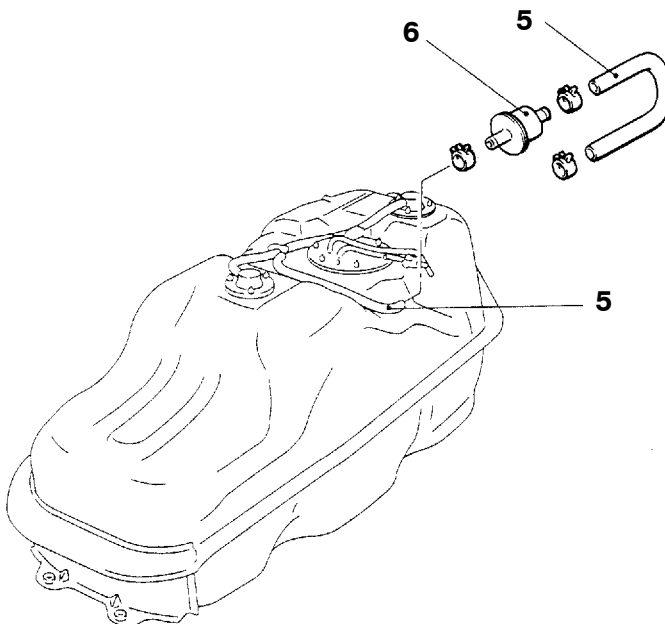
REMOVAL AND INSTALLATION



07V0012

Canister removal steps

1. Breather hose connection
2. Vapour hose connection
3. Canister
4. Canister holder

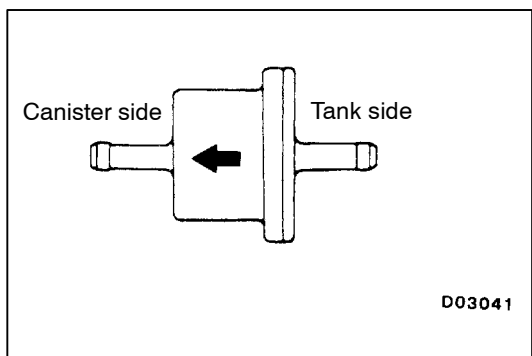


07V0008

00007746

Two-way valve removal steps

5. Vapour hose connection
 6. Two-way valve
- ▶◀

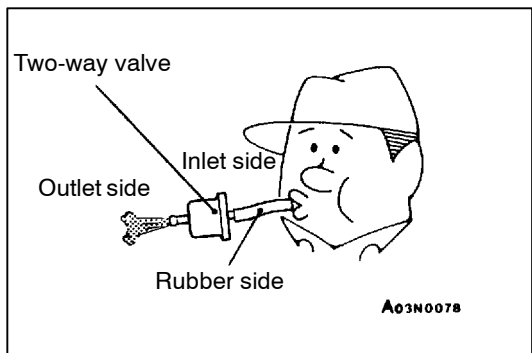


D03041

INSTALLATION SERVICE POINT

▶◀ TWO-WAY VALVE INSTALLATION

Be careful about the installation direction of the two-way valve.



A03N0078

INSPECTION

TWO-WAY VALVE SIMPLE CHECK

Attach a clean hose and check the operation of the two-way valve.

Lightly blow from inlet side (fuel tank side)	Air passes through with a slight feeling of resistance.
Lightly blow from outlet side.	Air passes through.

EMISSION CONTROL SYSTEM <4D5>

17500010043

GENERAL INFORMATION

The electronically-controlled EGR system and the fuel injection timing control system (load timer) reduce the level of exhaust gases (NOx).

Item	Name	Specification
Exhaust emission control system	Exhaust gas recirculation system <ul style="list-style-type: none"> • EGR valve • EGR solenoid valve No.1 • EGR solenoid valve No.2 	Electronically-controlled EGR system Single type Duty cycle solenoid valve ON-OFF solenoid valve

SERVICE SPECIFICATIONS

17500030049

Item	Standard value	
EGR solenoid valve No.1/No.2 resistance (at 20 °C) Ω	36 – 44	
Lever position sensor output voltage V	Idle position	0.8 – 1.0
	Fully open	3.7 – 5.0
Engine speed sensor resistance kΩ	1.3 – 1.9	
Engine coolant temperature sensor resistance kΩ	At 20 °C	2.9 – 3.6
	At 80 °C	0.26 – 0.35

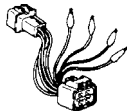
SEALANT

17500050021

Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No.4171 or equivalent	Drying sealant

SPECIAL TOOL

17500060024

Tool	Number	Name	Use
	MD998464	Test harness (4P, square)	Inspection of lever position sensor

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

17500090023

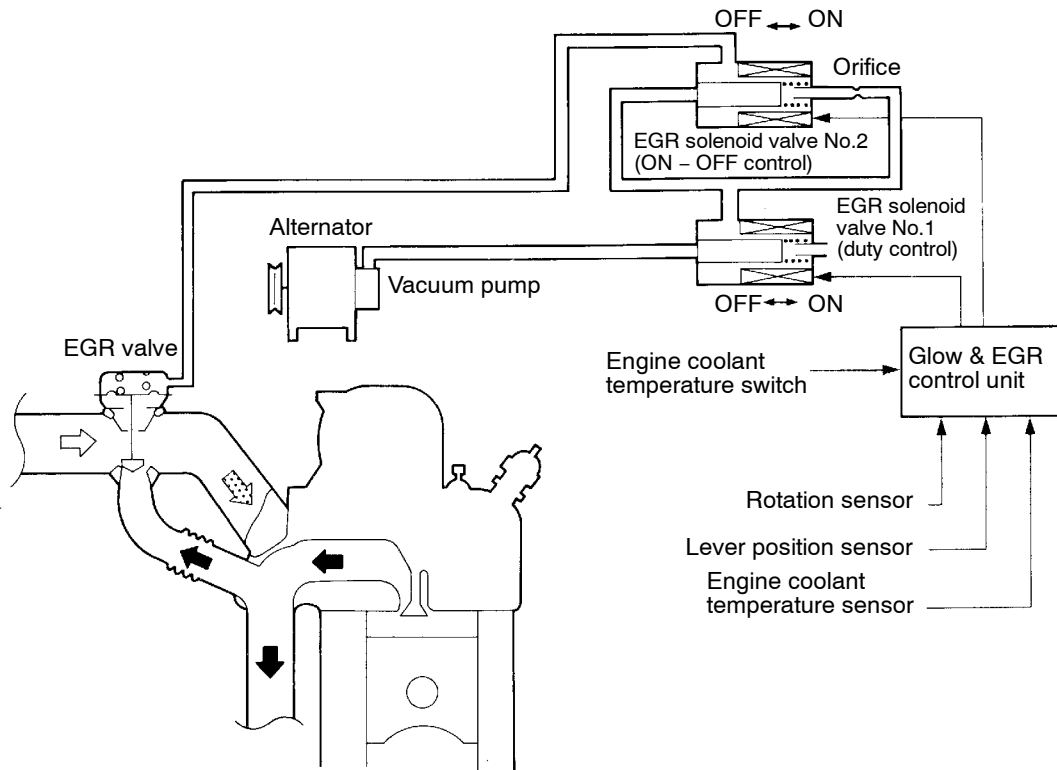
GENERAL INFORMATION

The electronically-controlled EGR system consists of an EGR valve, vacuum pump, EGR solenoid valves No.1 and No.2, glow & EGR control unit and various sensors.

The EGR valve is controlled by the negative pressure inside the valve, which is controlled by EGR solenoid valves No.1 and No.2.

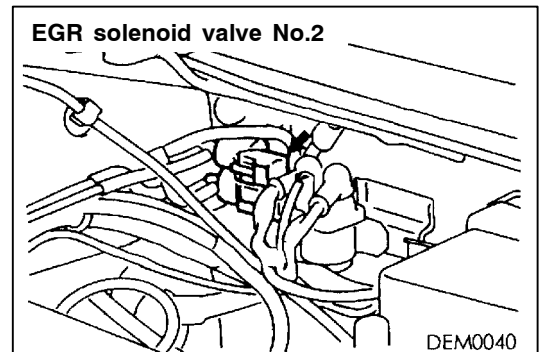
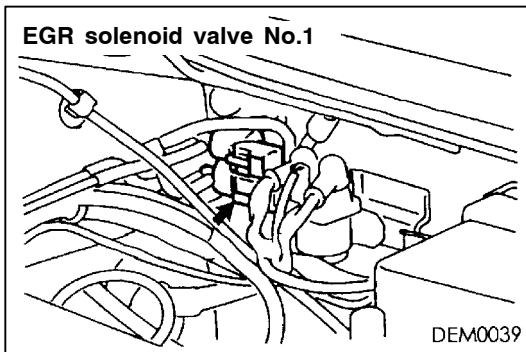
The EGR solenoid valves No.1 and No.2 are optimally controlled by the glow & EGR control unit in response to the engine operation conditions, based on data input from each of the sensors. In this way, the EGR is controlled to reduce NOx emissions while maintaining good engine performance.

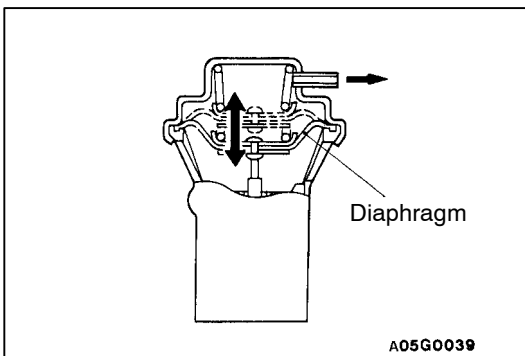
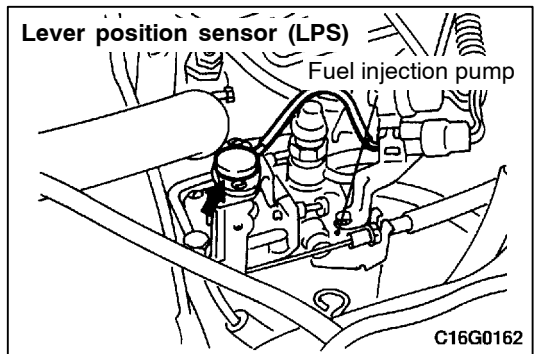
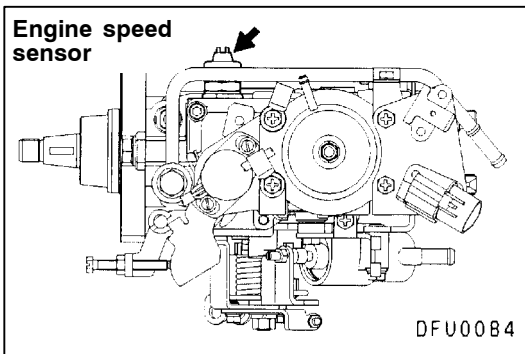
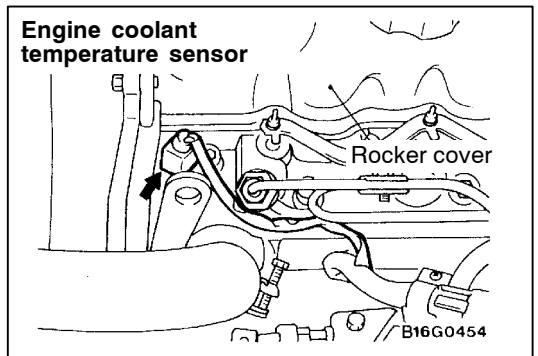
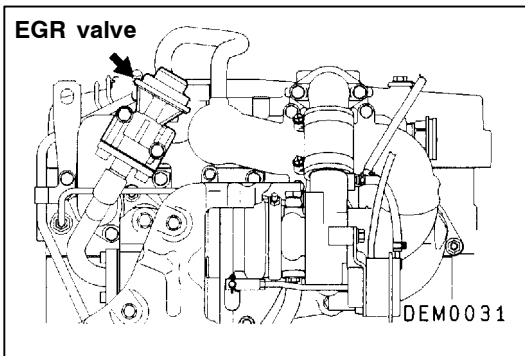
SYSTEM DIAGRAM



DEM0662

COMPONENT LOCATION





FUNCTION CHECK

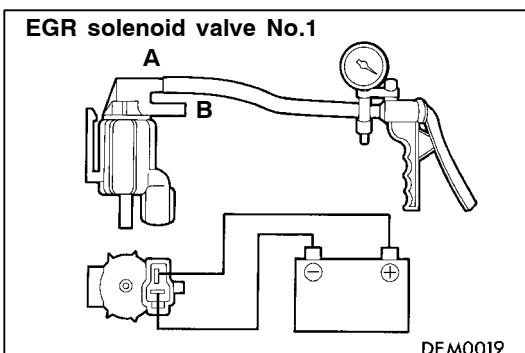
17500100047

1. Start the engine and let it warm up until the engine coolant temperature is 65°C or above.
2. When the engine is raced by suddenly depressing the accelerator pedal, check to be sure that the diaphragm of the EGR valve lifts.

EGR SOLENOID VALVE OPERATION CHECK

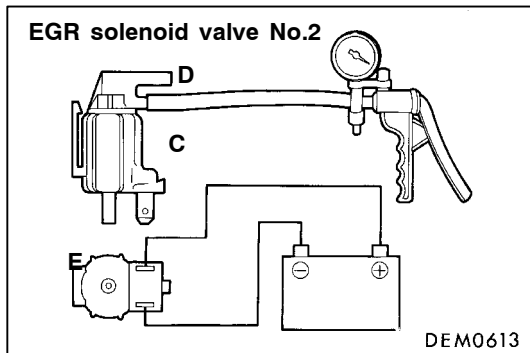
17500290034

1. Remove the EGR solenoid valve No.1/No.2 connectors and vacuum hoses.
2. Attach a vacuum pump to each nipple of the EGR solenoid valve No.1/No.2 and apply negative pressure. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valves and when it is not applied.



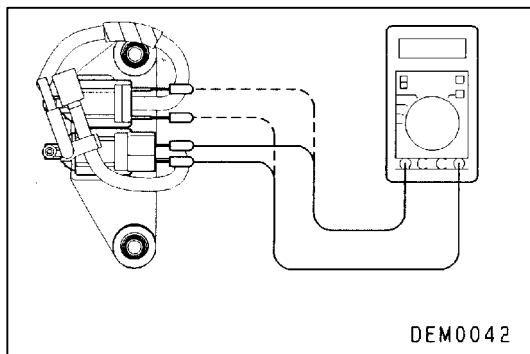
EGR solenoid valve No.1

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple B is covered)
When current is not flowing	Vacuum is maintained



EGR solenoid valve No.2

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple D is covered)
When current is not flowing	Vacuum leaks (Vacuum is maintained when nipple E is covered)

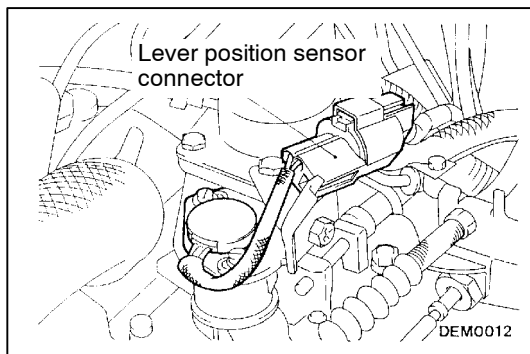


EGR SOLENOID VALVE RESISTANCE CHECK

17500120029

Measure resistances between the terminal of the EGR solenoid valve No.1/No.2 with a circuit tester.

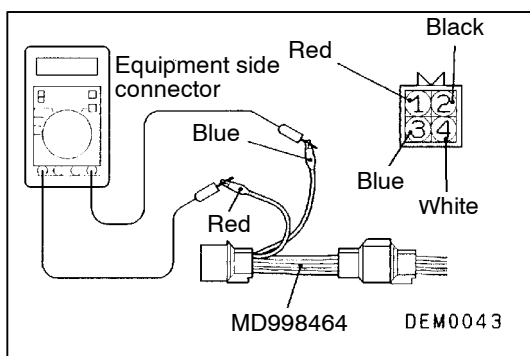
	Solenoid valve No.1/No.2 resistance Ω
Standard value (at 20°C)	36 – 44



LEVER POSITION SENSOR (LPS) ADJUSTMENT

17500130022

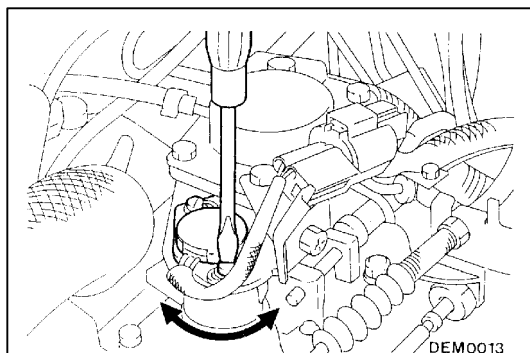
1. Run the engine until the engine coolant temperature rises to 80°C or above, and then release the fast idle.
2. Loosen the accelerator cable tension sufficiently.
3. Connect the special tool (test harness) to the lever position sensor connector shown in the illustration.



4. Connect a digital-type voltmeter between terminal 1 (red clip) and terminal 3 (blue clip) of the lever position sensor.
5. Turn the ignition switch to ON. (Do not start the engine.)
6. Measure the output voltage of the lever position sensor.

Standard value:

Lever condition	Voltage V
Idle position	0.8 – 1.0
Fully open	3.7 – 5.0

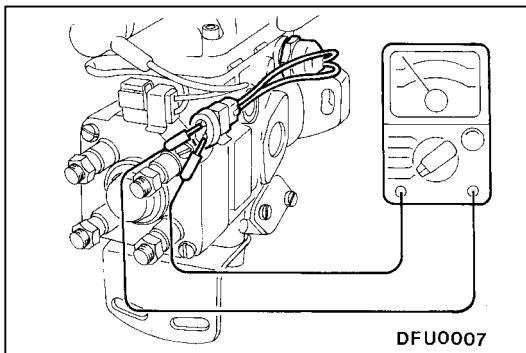


7. If the voltage is outside the standard value, adjust by loosening the lever position sensor mounting screw and turning the lever position sensor body. After adjustment, securely tighten the screw.

NOTE

The output voltage will increase if the lever position sensor body is turned in a clockwise direction.

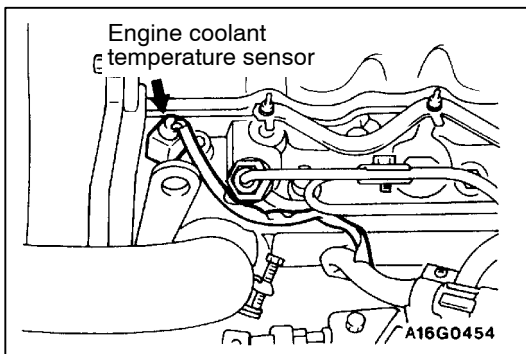
8. Turn the ignition switch to OFF.
9. Adjust the accelerator cable play.

**ENGINE SPEED SENSOR CHECK**

17500140025

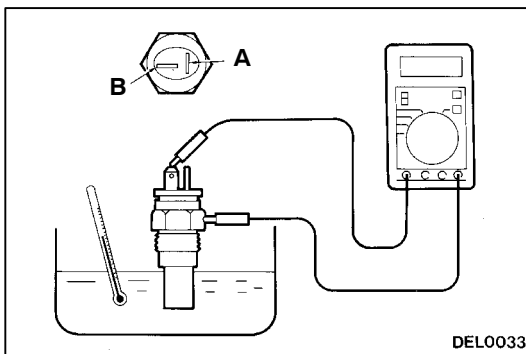
1. Disconnect the engine speed sensor connector.
2. Measure the resistance between the engine speed sensor terminals.

Standard value: 1.3 – 1.9 k Ω

**ENGINE COOLANT TEMPERATURE SENSOR CHECK**

17500150035

1. Remove the engine coolant temperature sensor.



2. Measure the resistance between terminal (B) and the body earth when the temperature sensing portion of the engine coolant temperature sensor is immersed in hot water.

Temperature ($^{\circ}\text{C}$)	Resistance (k Ω)
0	7.7 – 9.5
20	2.9 – 3.6
40	1.3 – 1.7
80	0.26 – 0.35

3. If the resistance deviates from the standard value greatly, replace the sensor.
4. Apply sealant threaded portion.

Specified sealant:

3M NUT Locking Part No. 4171 or equivalent

5. Install engine coolant temperature sensor and tighten it to specified torque.

Sensor tightening torque: 35 Nm

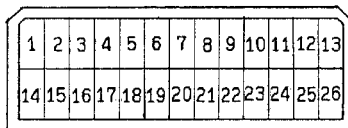
6. Fasten harness connectors securely.

CHECK AT THE GLOW & EGR CONTROL UNIT

17500180041

TERMINAL VOLTAGE CHECK CHART

Glow & EGR Control Unit Connector Terminal Arrangement

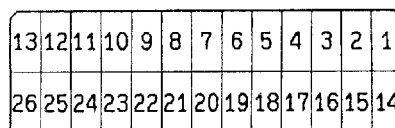


DEM0029

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
3	EGR solenoid valve No.1	Ignition switch: ON	System voltage
		While engine is idle after having warmed up, suddenly depress the accelerator pedal.	Momentarily increases
6	Lever position sensor	Ignition switch: ON	Set throttle lever to idle position
			Fully open throttle lever
			0.8 – 1.0 V
			3.7 – 5.0 V
7	Sensor impressed voltage	Ignition switch: ON	4.5 – 5.5 V
16	EGR solenoid valve No.2	Ignition switch: ON	System voltage
		While engine is idle after having warmed up, suddenly depress the accelerator pedal.	Momentarily decreases

HARNESS-SIDE CONNECTOR TERMINAL RESISTANCE AND CONTINUITY CHECK CHART

Glow & EGR Control Unit Harness Side Connector Terminal Arrangement



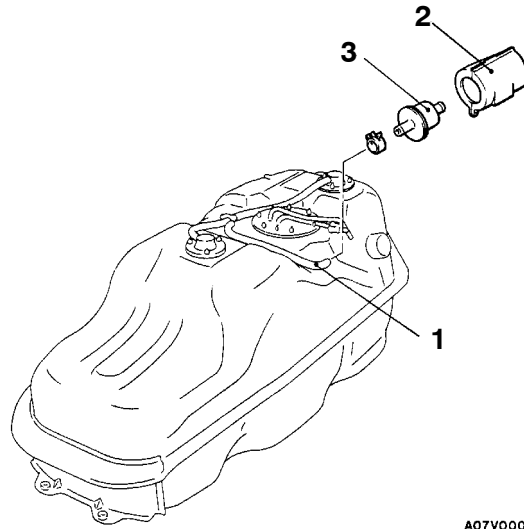
DEM0026

Terminal No.	Check item	Normal condition (Check condition)
3 – 1	EGR solenoid valve No.1	36 – 44 Ω (At 20°C)
5 – Body earth	Engine coolant temperature sensor	7.7 – 9.5 kΩ (When coolant temperature is 0°C)
		2.9 – 3.6 kΩ (When coolant temperature is 20°C)
		1.3 – 1.7 kΩ (When coolant temperature is 40°C)
		0.26 – 0.35 kΩ (When coolant temperature is 80°C)
11 – 24	Engine speed sensor	1.3 – 1.9 kΩ
16 – 1	EGR solenoid valve No.2	36 – 44 Ω (At 20°C)

TWO-WAY VALVE

REMOVAL AND INSTALLATION

17500240022

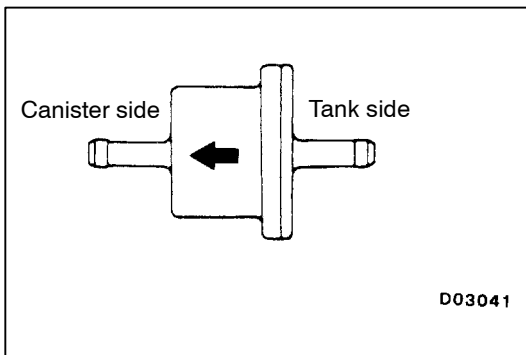


A07V0009

Removal steps

1. Vapour hose connection

- ▶A◀ 2. Breather case
3. Two-way valve

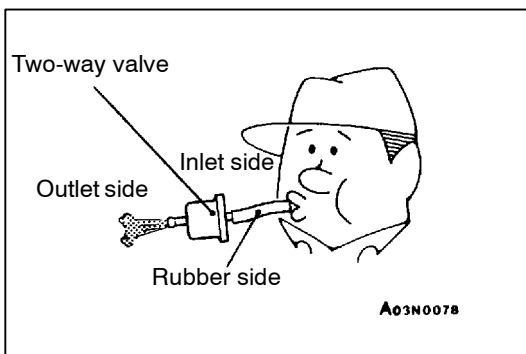


D03041

INSTALLATION SERVICE POINT

▶A◀ TWO-WAY VALVE INSTALLATION

Be careful about the installation direction of the two-way valve.



A03N0078

INSPECTION

17500250025

TWO-WAY VALVE SIMPLE CHECK

Attach a clean hose and check the operation of the two-way valve.

Lightly blow from inlet side (fuel tank side)	Air passes through with a slight feeling of resistance.
Lightly blow from outlet side.	Air passes through.

NOTES