

ENGINE CONTROL SYSTEM

GENERAL INFORMATION

On vehicles with 6G7-GDI and 4M41 engines, an electronic-controlled throttle valve system has been used instead of a conventional cable-type accelerator mechanism.

On 6G7-MPI and 4M40 engines, a cable-type accelerator mechanism and a suspended-type pedal have been used.

SERVICE SPECIFICATIONS

Items		Standard value
Accelerator cable play mm		1 – 2
Engine idle speed r/min	6G7-MPI	700 ± 100
	4M40	750 ± 100

ON-VEHICLE SERVICE

ACCELERATOR CABLE CHECK AND ADJUSTMENT <6G7-MPI, 4M40>

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:

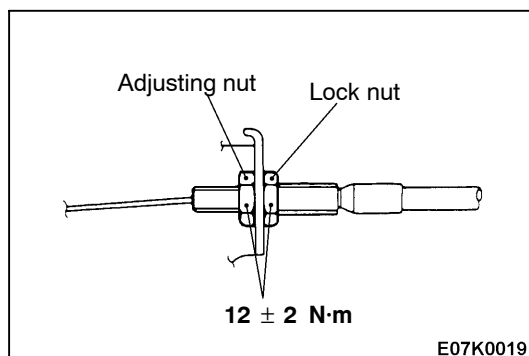
<6G7-MPI> 700 ± 100 r/min

<4M40> 750 ± 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.



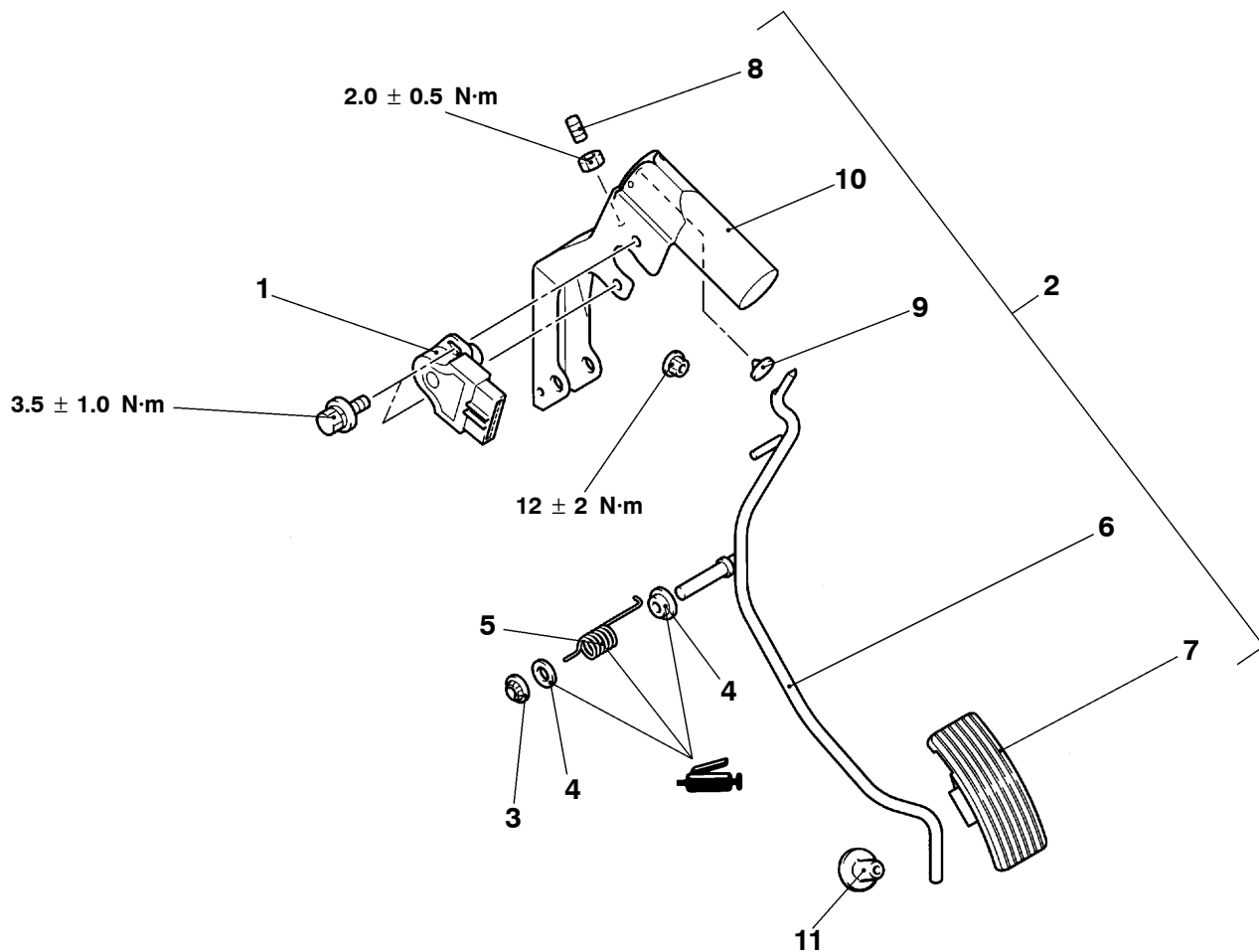
ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

<6G7-GDI, 4M41>

Post-installation Operation

Check and Adjustment of the Accelerator Pedal Position Sensor (Refer to GROUP 13A,D – On-vehicle Service.)



AX0520CA

Removal steps

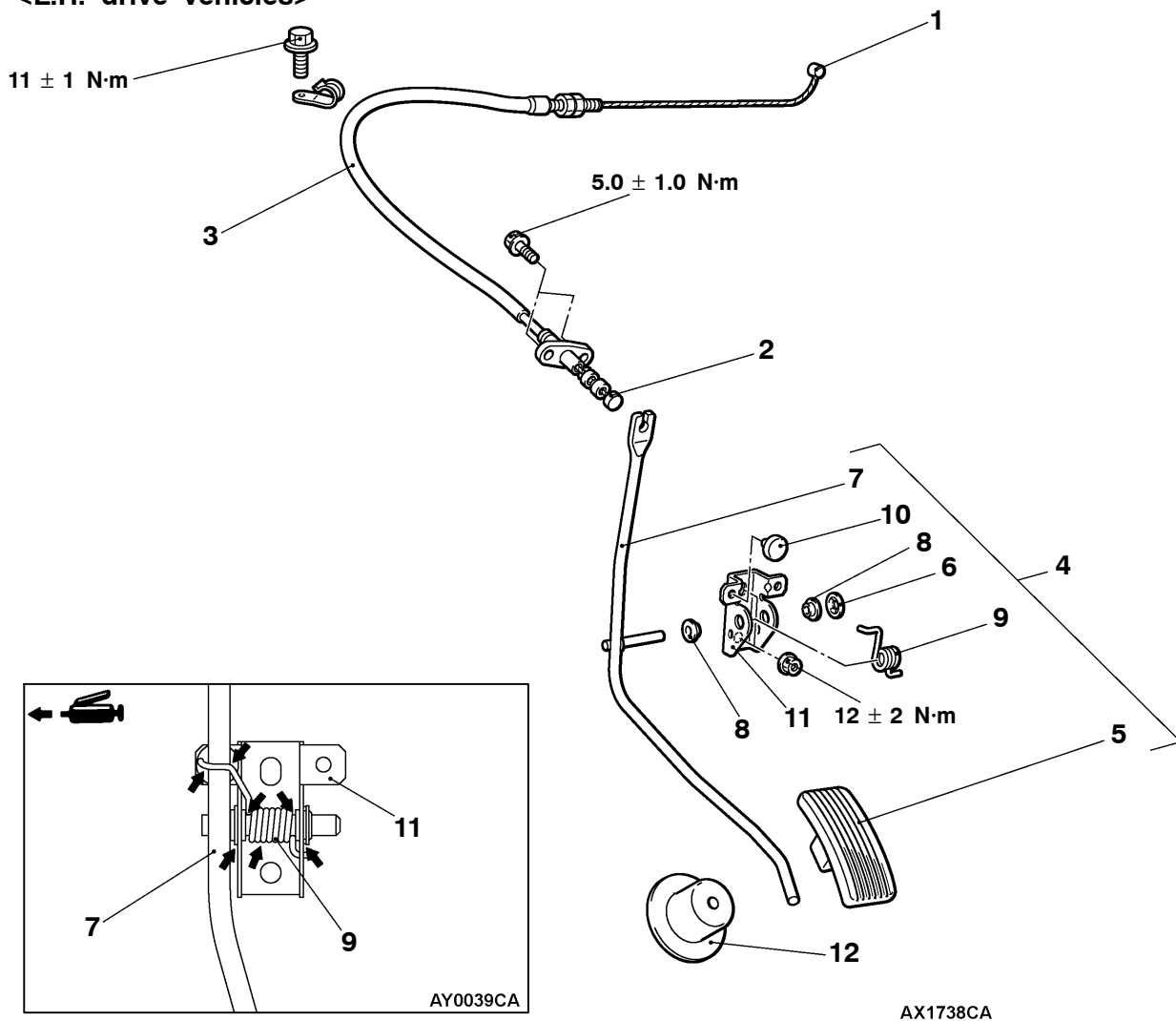
- | | |
|--------------------------------------|---------------------------------------|
| 1. Accelerator pedal position sensor | 7. Accelerator pedal pad |
| 2. Accelerator pedal assembly | 8. Adjusting screw |
| 3. Push-on spring nut | 9. Stopper |
| 4. Bushing | 10. Accelerator pedal bracket |
| 5. Return spring | 11. Stopper <R.H. drive vehicles-M/T> |
| 6. Accelerator pedal | |

<6G7-MPI>

Post-installation Operation

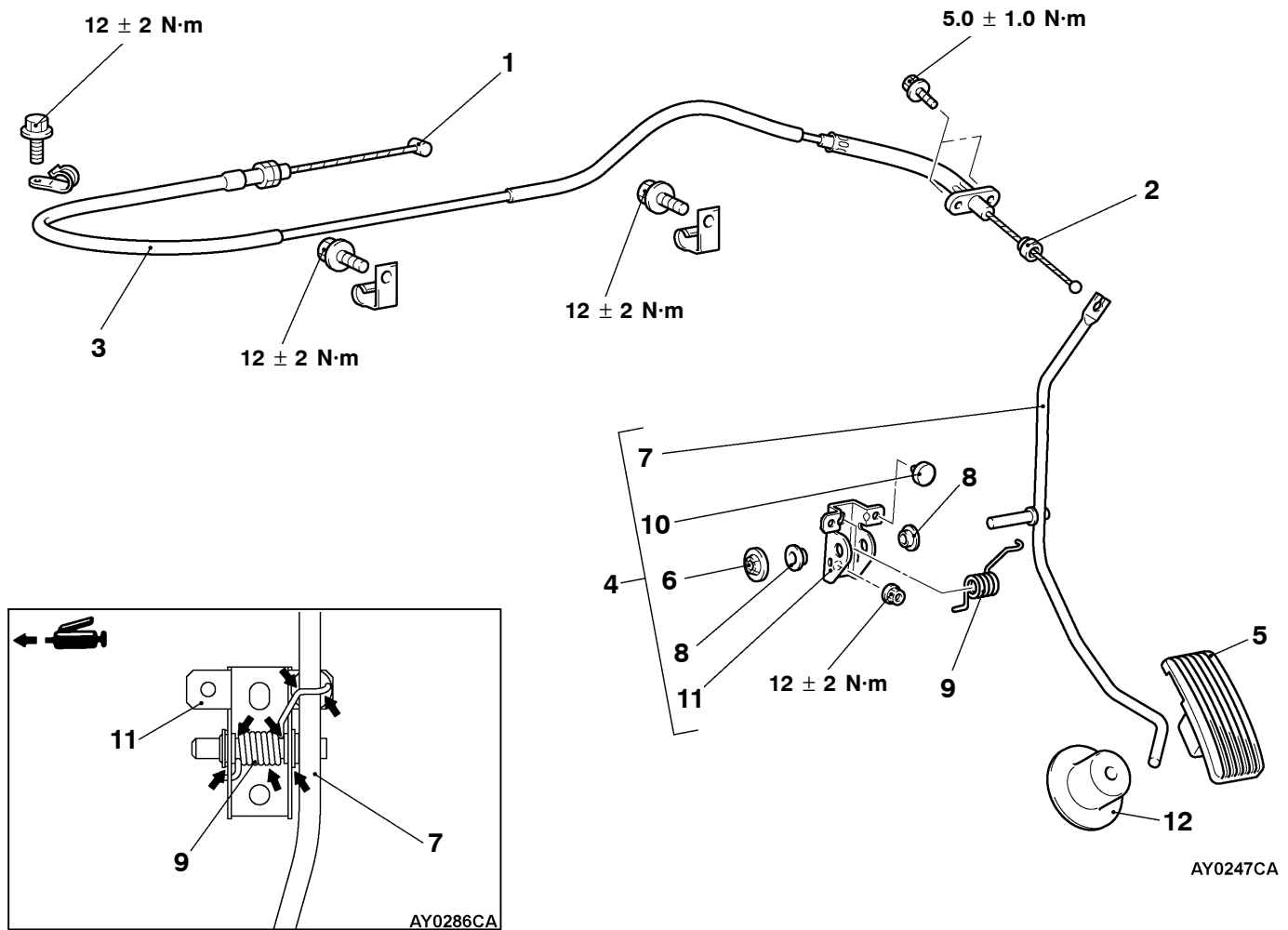
Adjusting the Accelerator Cable (Refer to P.17-4.)

<L.H. drive vehicles>

**Removal steps**

- | | |
|---|-------------------------------|
| 1. Inner cable connection
(Throttle body side) | 6. Push-on spring nut |
| 2. Inner cable connection
(Accelerator pedal side) | 7. Accelerator arm |
| 3. Accelerator cable | 8. Bushing |
| 4. Accelerator pedal assembly | 9. Spring |
| 5. Accelerator pedal pad | 10. Stopper |
| | 11. Accelerator pedal bracket |
| | 12. Accelerator pedal stopper |

<R.H. drive vehicles>

**Removal steps**

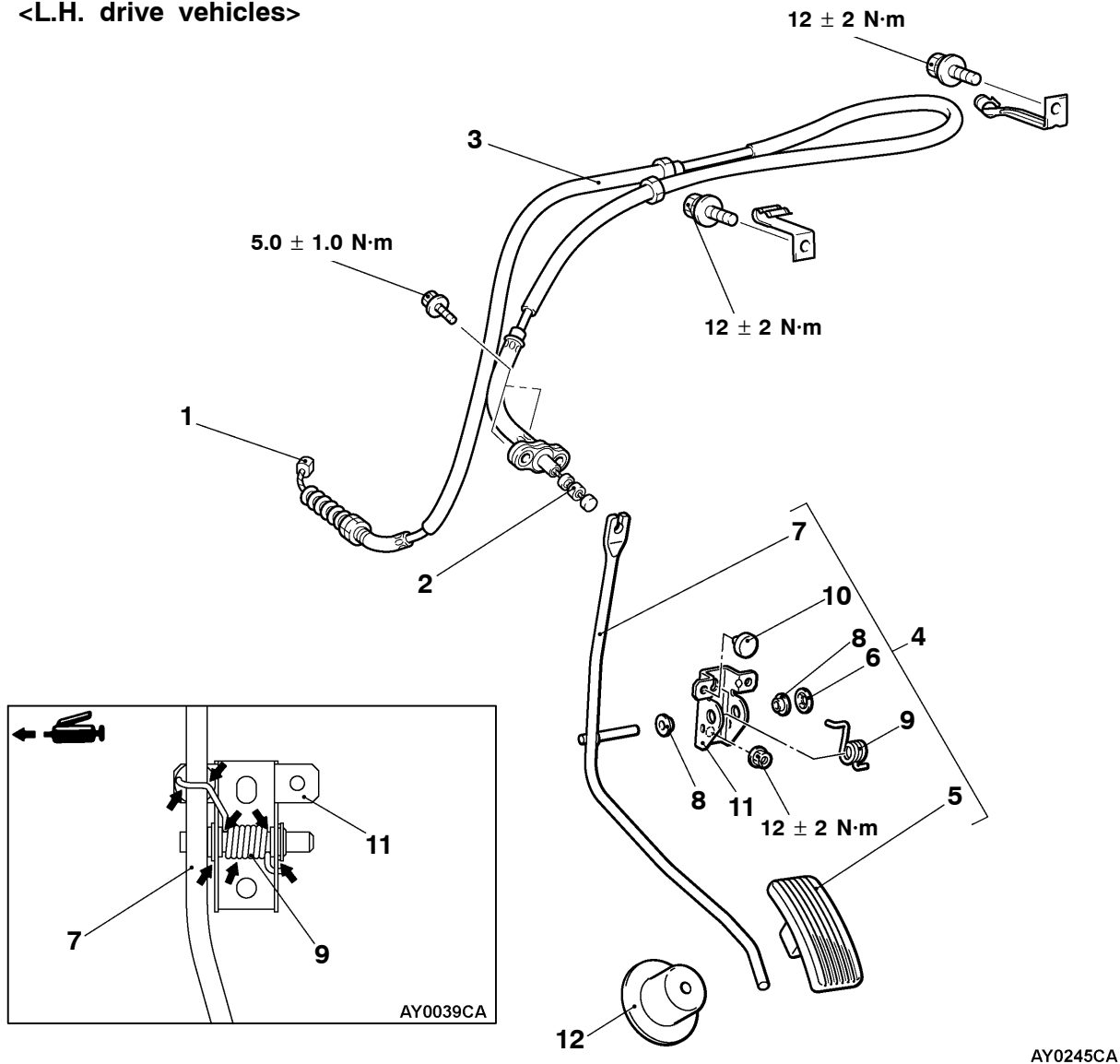
1. Inner cable connection (Throttle body side)
2. Inner cable connection (Accelerator pedal side)
3. Accelerator cable
4. Accelerator pedal assembly
5. Accelerator pedal pad
6. Push-on spring nut
7. Accelerator arm
8. Bushing
9. Spring
10. Stopper
11. Accelerator pedal bracket
12. Accelerator pedal stopper

<4M40>

Post-installation Operation

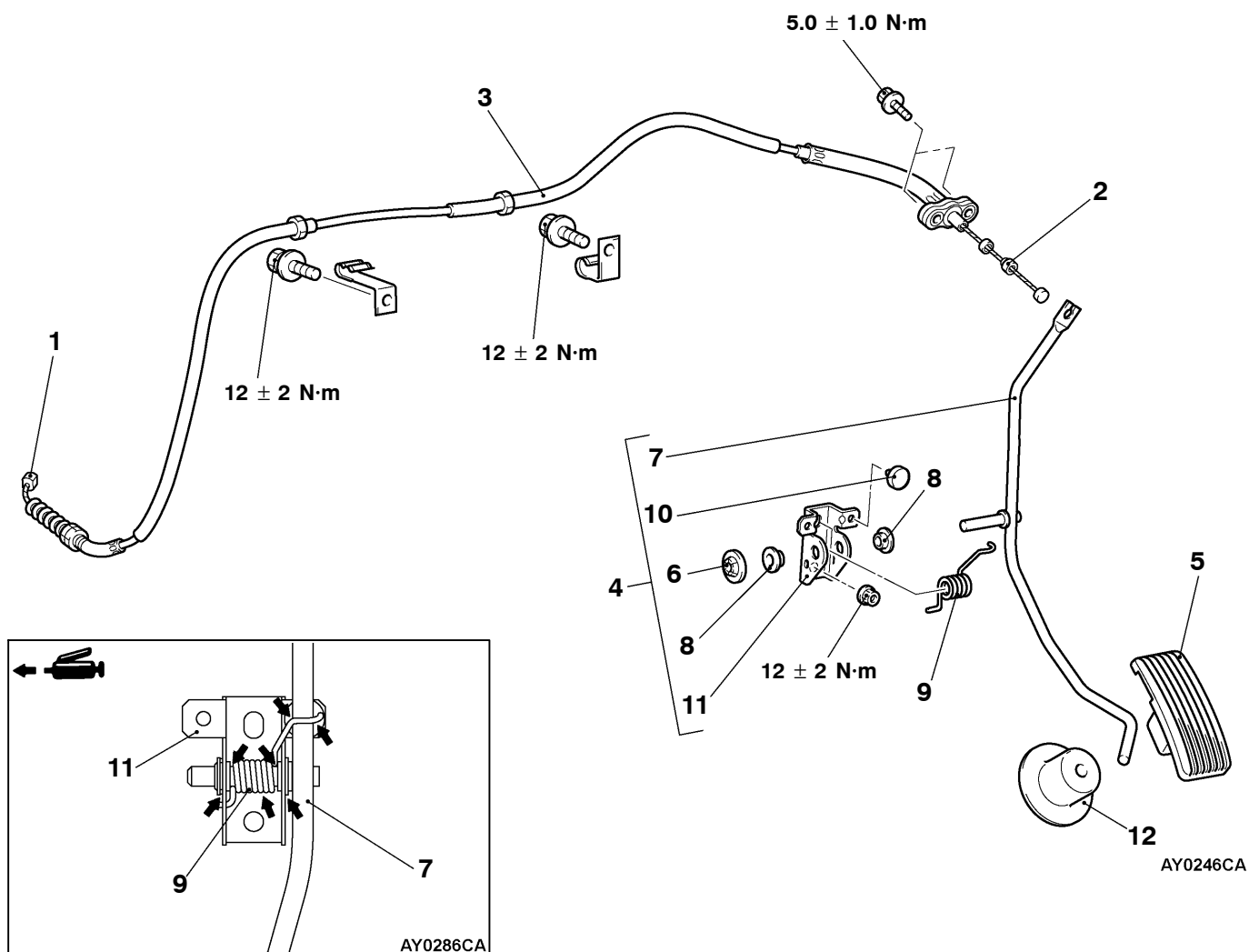
Adjusting the Accelerator Cable (Refer to P.17-4.)

<L.H. drive vehicles>

**Removal steps**

- | | |
|---|-------------------------------|
| 1. Inner cable connection
(Throttle body side) | 6. Push-on spring nut |
| 2. Inner cable connection
(Accelerator pedal side) | 7. Accelerator arm |
| 3. Accelerator cable | 8. Bushing |
| 4. Accelerator pedal assembly | 9. Spring |
| 5. Accelerator pedal pad | 10. Stopper |
| | 11. Accelerator pedal bracket |
| | 12. Accelerator pedal stopper |

<R.H. drive vehicles>

**Removal steps**

- | | |
|---|-------------------------------|
| 1. Inner cable connection
(Throttle body side) | 6. Push-on spring nut |
| 2. Inner cable connection
(Accelerator pedal side) | 7. Accelerator arm |
| 3. Accelerator cable | 8. Bushing |
| 4. Accelerator pedal assembly | 9. Spring |
| 5. Accelerator pedal pad | 10. Stopper |
| | 11. Accelerator pedal bracket |
| | 12. Accelerator pedal stopper |

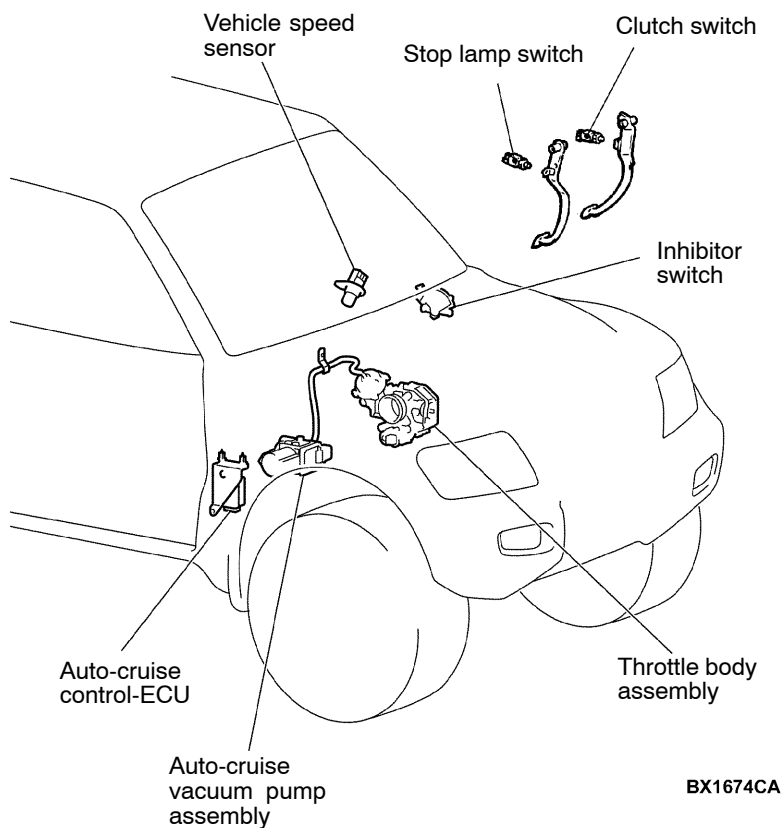
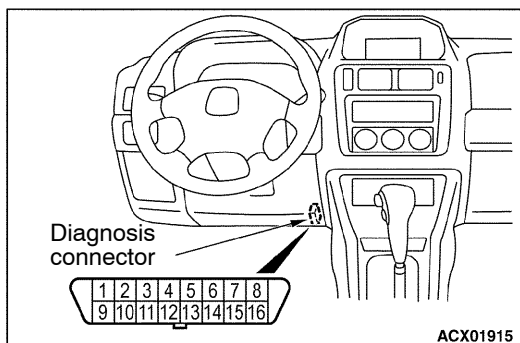
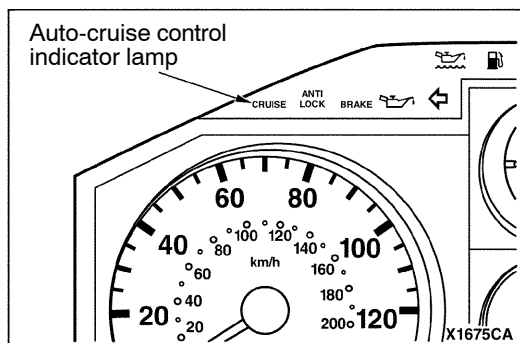
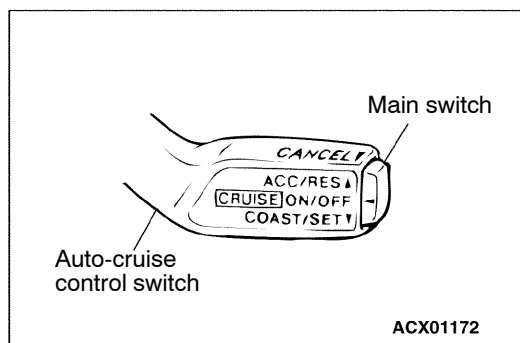
AUTO-CRUISE CONTROL SYSTEM

GENERAL INFORMATION

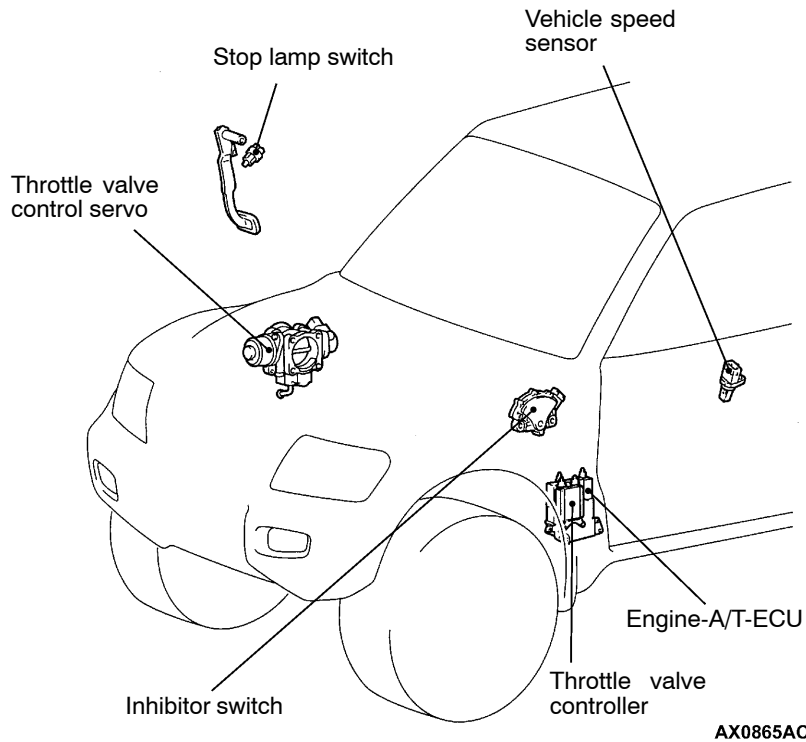
By using the auto-cruise control, the driver can drive at the speed he/she likes (in a range of

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

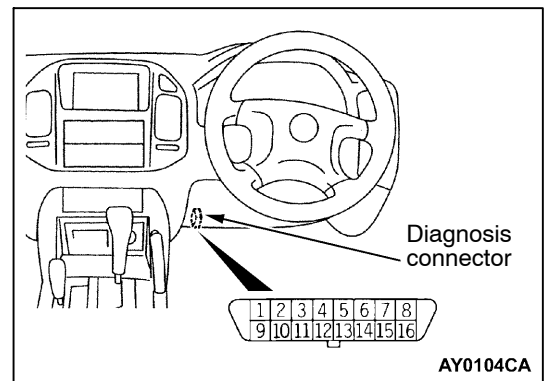
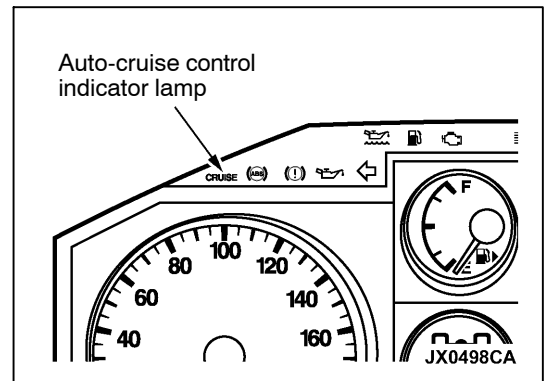
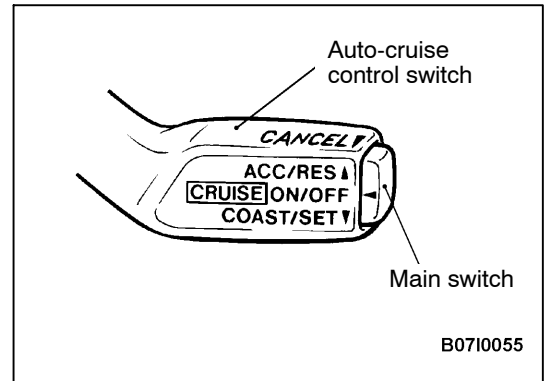
<6G7-MPI>



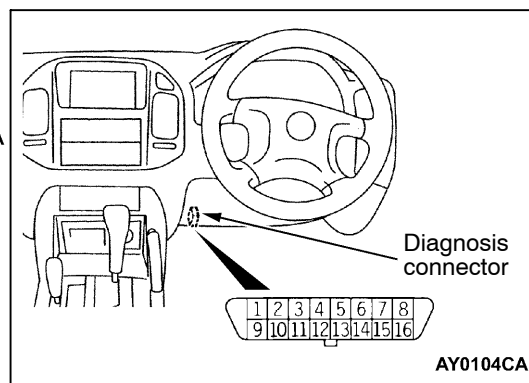
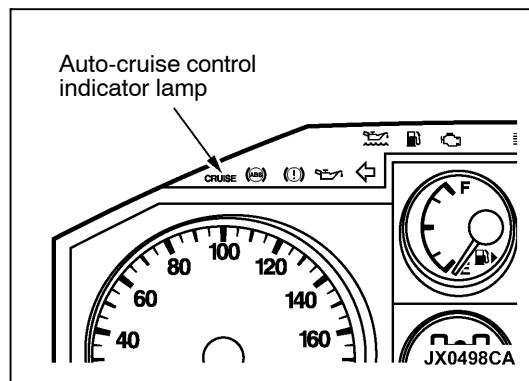
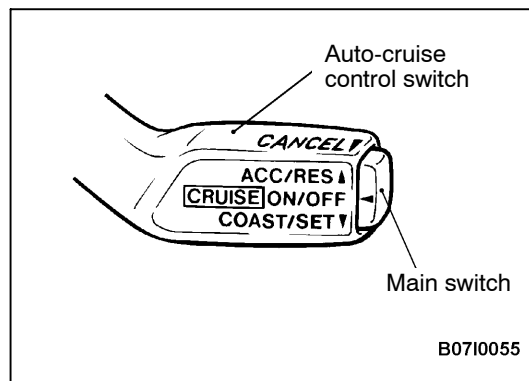
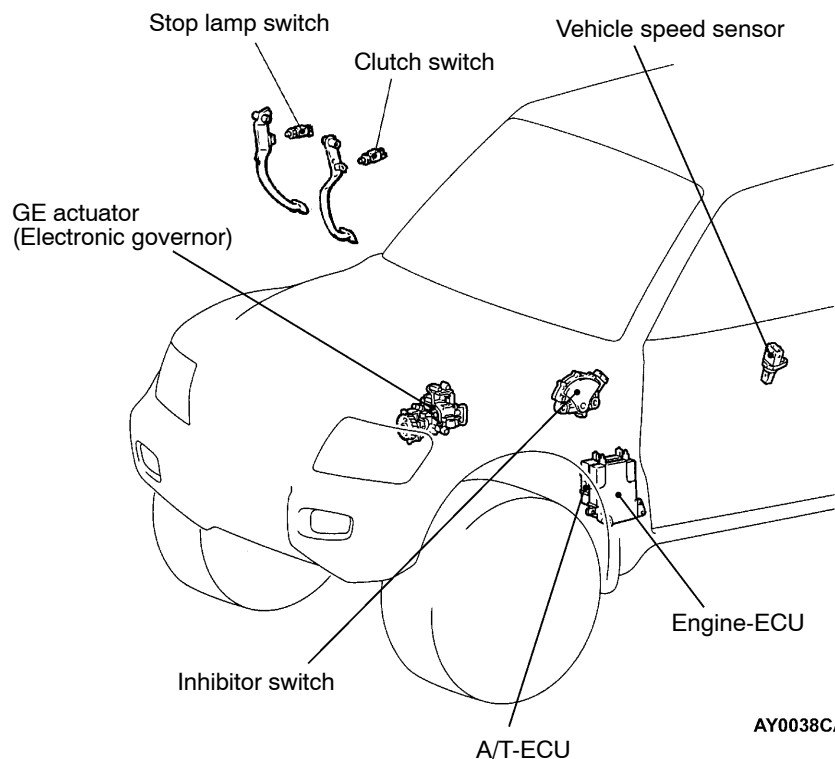
<6G7-GDI>



AX0865AC



<4M41>



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

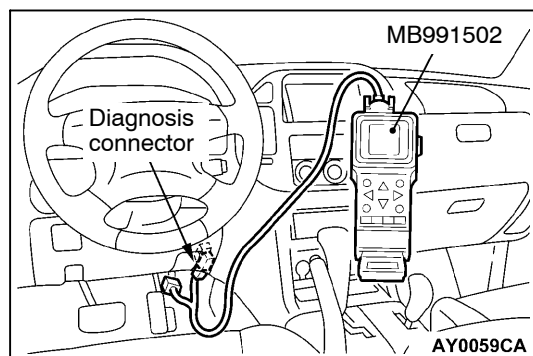
TROUBLESHOOTING

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

METHOD OF READING THE DIAGNOSIS CODES

Using the MUT-II

1. Connect the MUT-II to the diagnosis connector (16-pin) under the instrument cover.

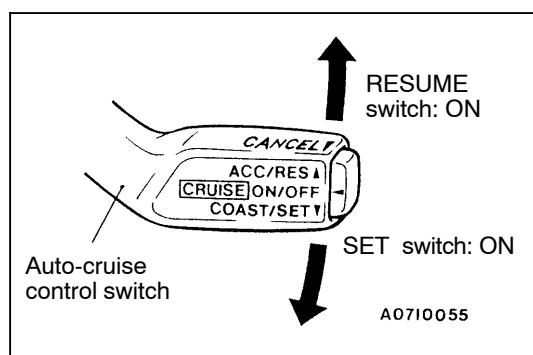
Caution

Turn off the ignition switch before connecting or disconnecting the MUT-II.

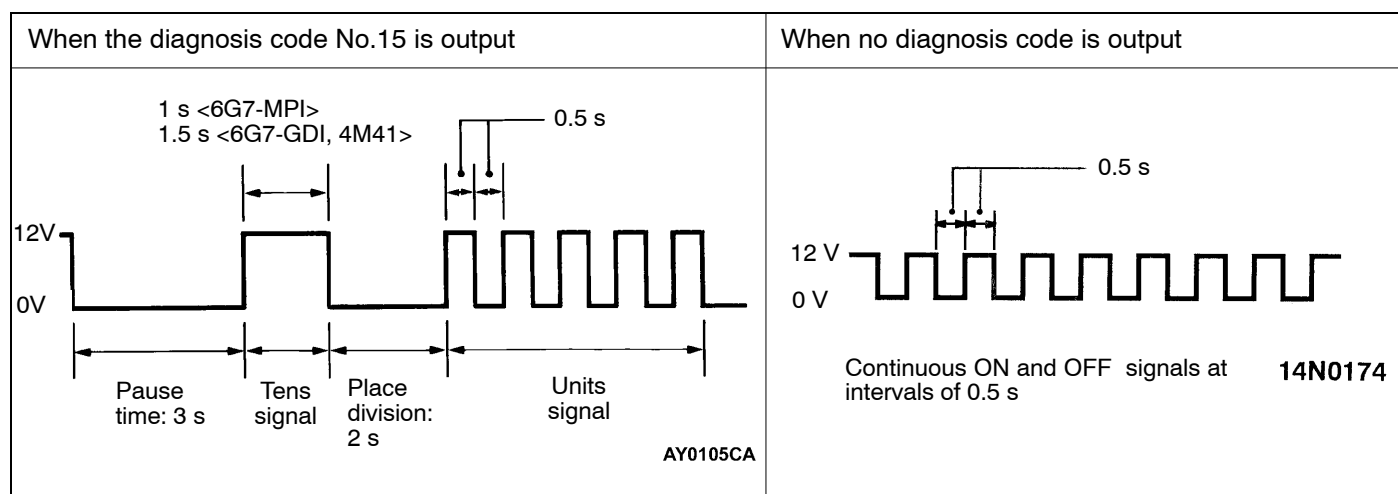
2. With the ignition switch in the ON position, take a reading of the diagnosis codes.

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



NOTE

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

METHOD OF ERASING THE DIAGNOSIS CODES

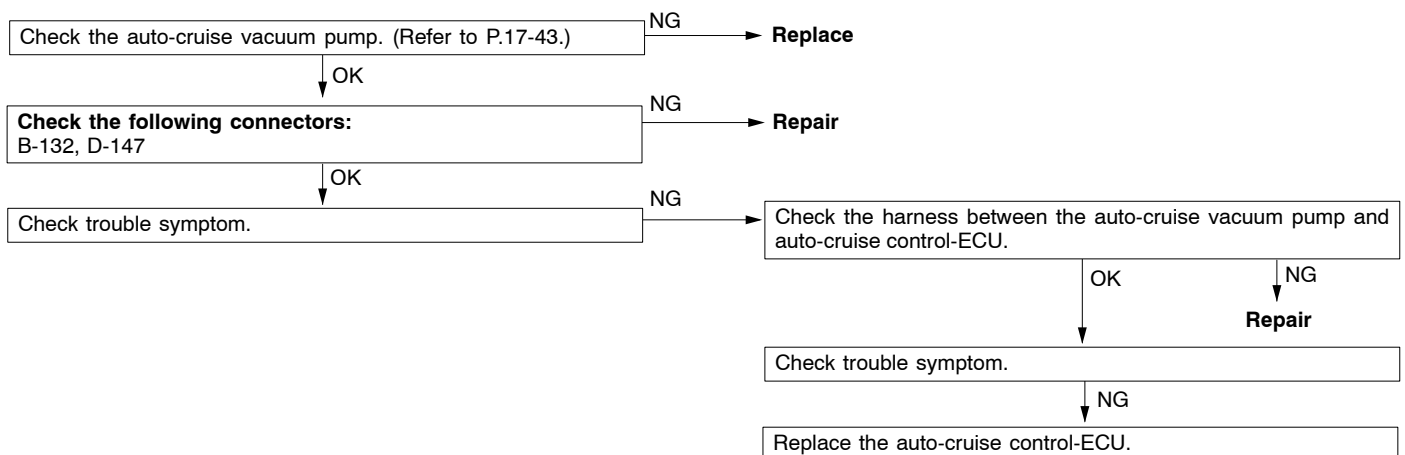
Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

INSPECTION CHART FOR DIAGNOSIS CODES <6G7-MPI>

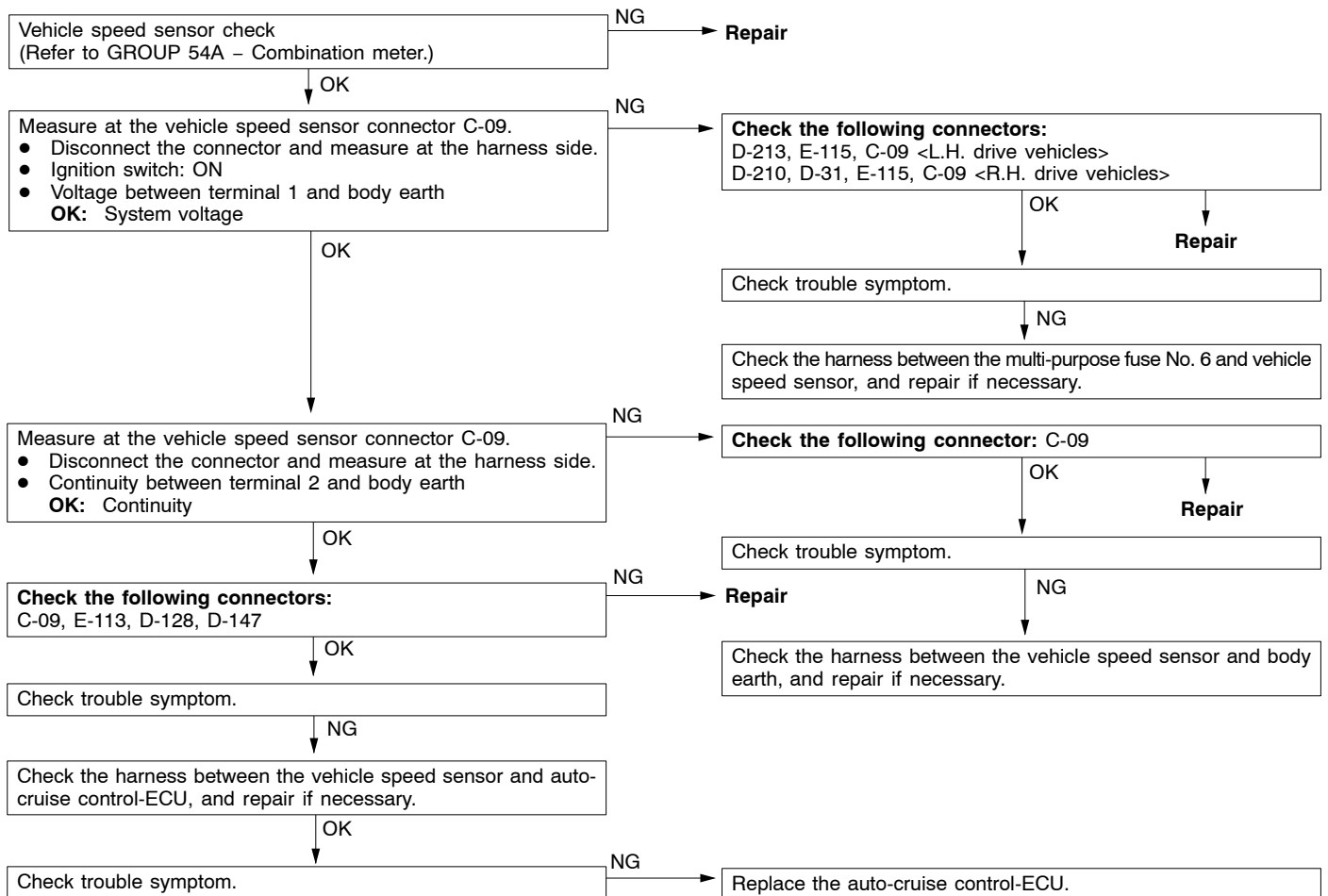
Code No.	Diagnosis item	Reference page
11	Auto-cruise vacuum pump drive system	17-14
12	Vehicle speed sensor signal system	17-15
14	Auto-cruise vacuum pump power supply system	17-16
15	Auto-cruise control switch system	17-17
16	Auto-cruise control-ECU system	17-17
17	Throttle position sensor system	17-18

INSPECTION PROCEDURE FOR DIAGNOSIS CODES <6G7-MPI>

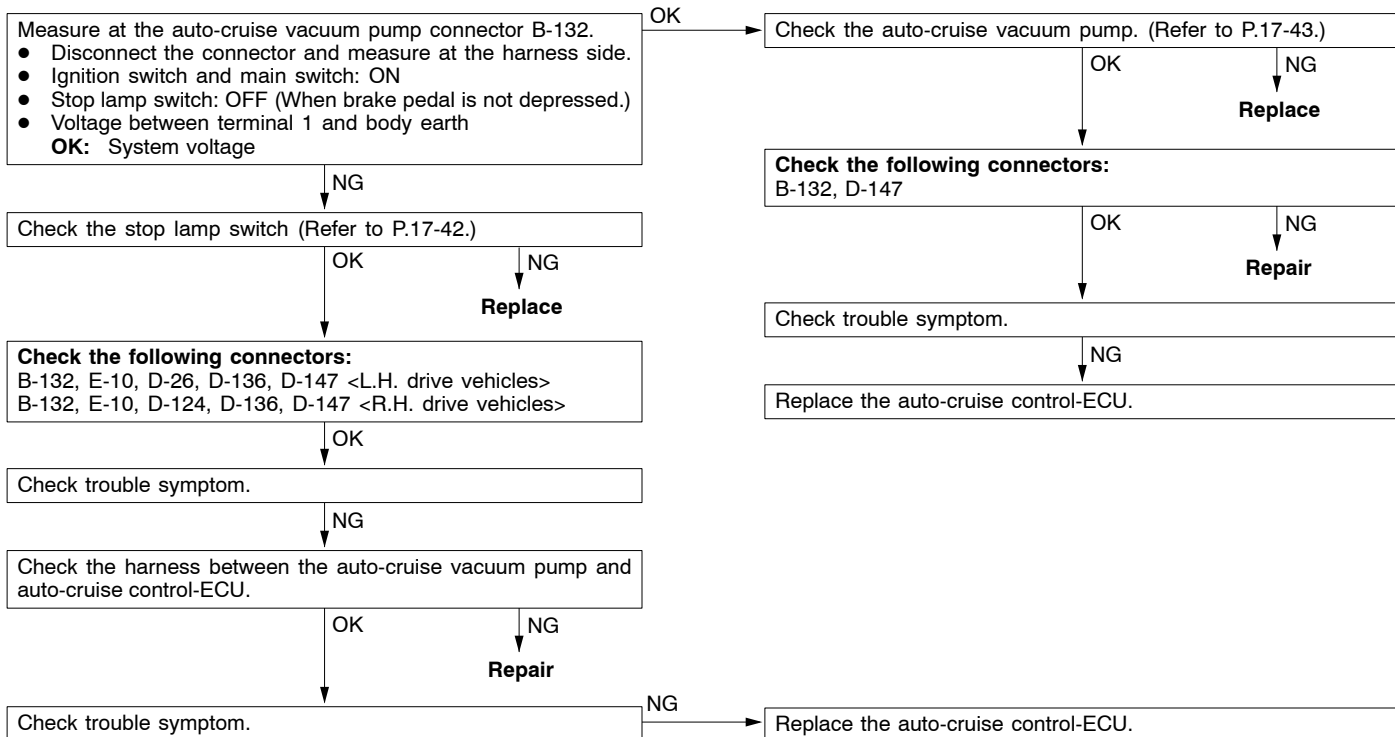
Code No. 11 Auto-cruise vacuum pump drive system	Probable cause
This diagnosis code is output if the release valve, control valve or motor drive signals from the auto-cruise vacuum pump are not input to the auto-cruise control-ECU.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise vacuum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



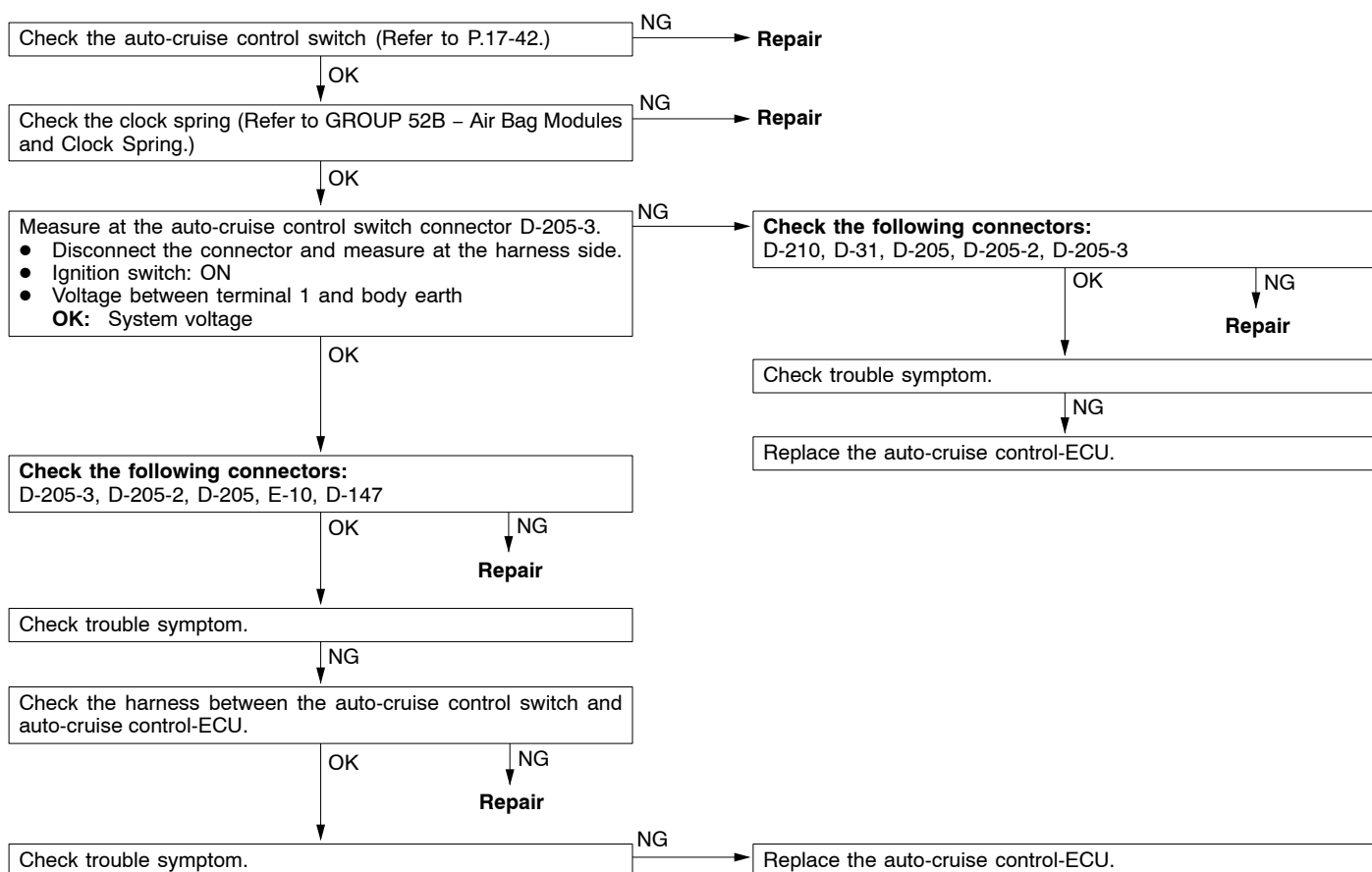
Code No. 12 Vehicle speed sensor signal system	Probable cause
This diagnosis code is output if the vehicle speed signals from the vehicle speed sensor are not input to the auto-cruise control-ECU when the vehicle speed is 40 km/h or more.	<ul style="list-style-type: none"> • Malfunction of the vehicle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



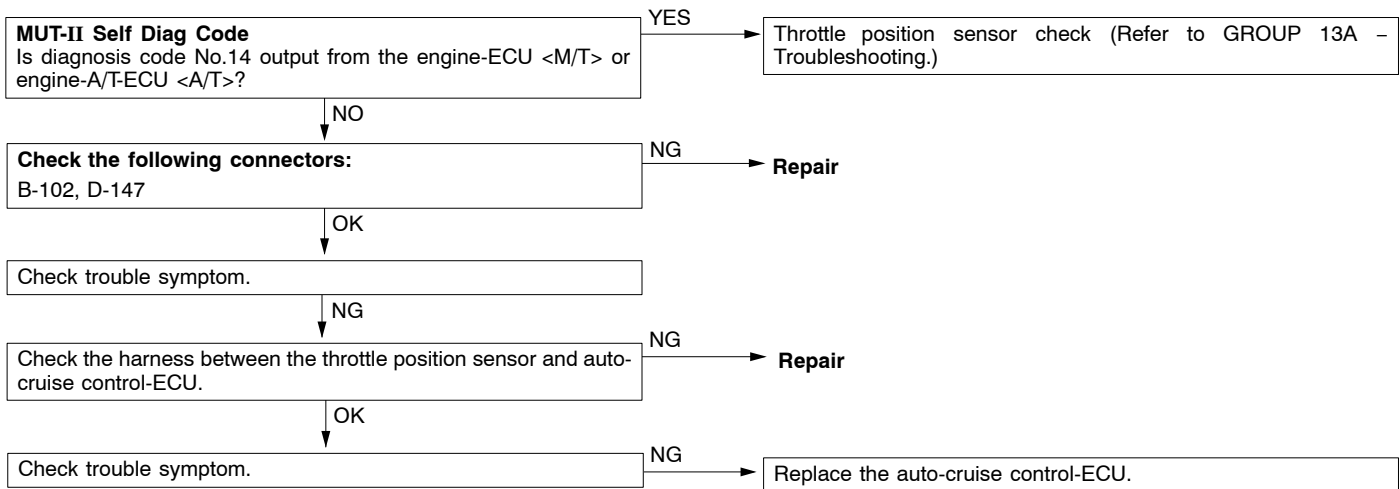
Code No. 15 Auto-cruise control switch system	Probable cause
This diagnosis code is output if the cruise control RESUME switch or SET switch remains ON.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control switch • Malfunction of the clock spring • Malfunction of the connector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



Code No. 16 Auto-cruise control-ECU system	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 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

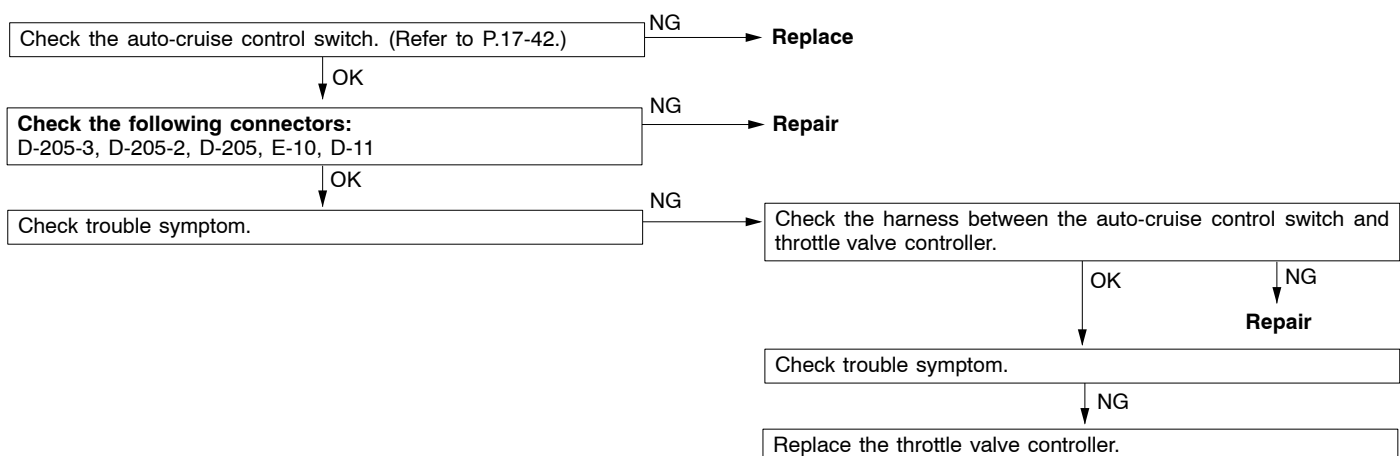


INSPECTION CHART FOR DIAGNOSIS CODES <6G7-GDI>

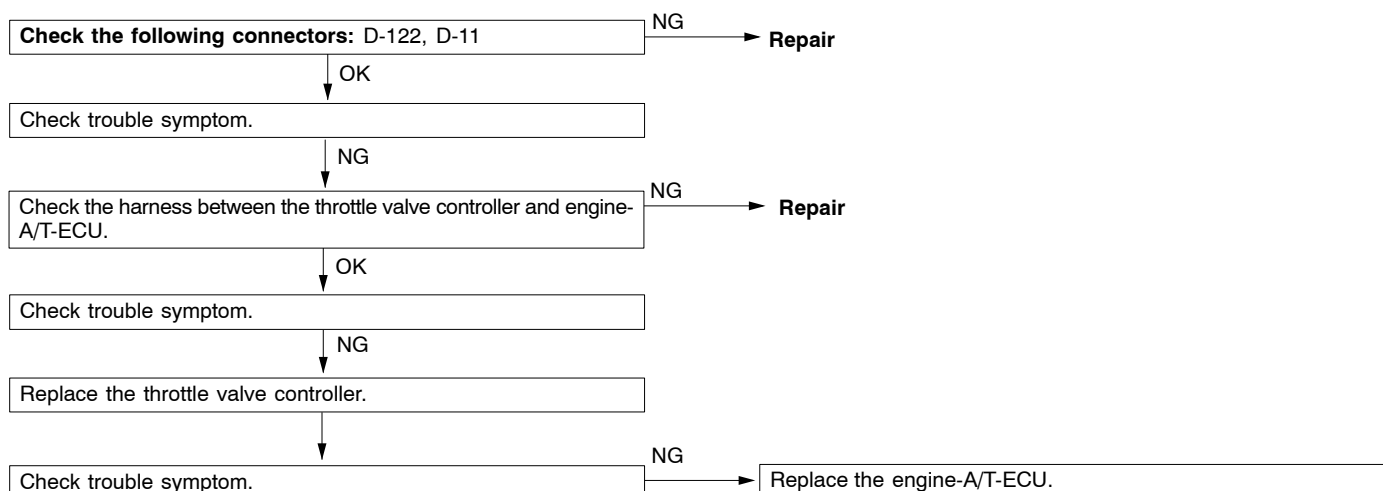
Code No.	Diagnosis item	Reference page
15	Auto-cruise control switch system	17-18
21	Cancel latch signal system	17-19
22	Stop lamp switch system	17-19
23	Engine-A/T-ECU system	17-20

INSPECTION PROCEDURE FOR DIAGNOSIS CODES <6G7-GDI>

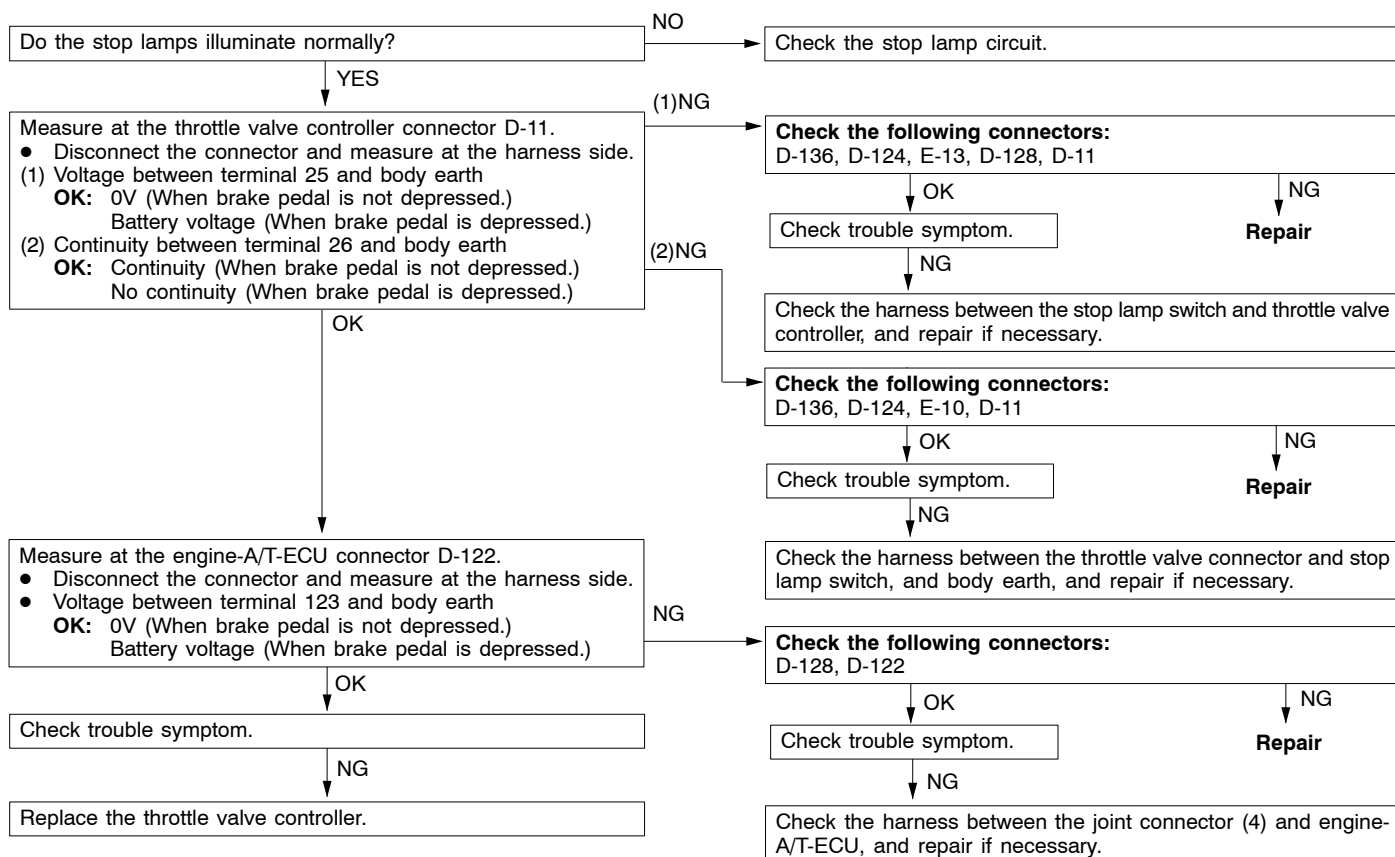
Code No. 15 Auto-cruise control switch system	Probable cause
This diagnosis code is output if the RESUME and SET switches of the auto-cruise control switch remain on.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



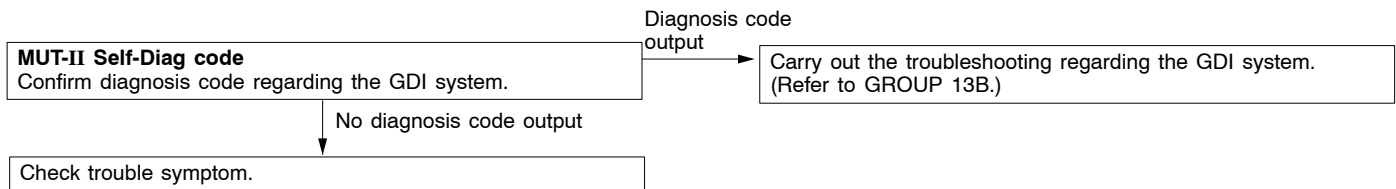
Code No. 21 Cancel latch signal system	Probable cause
<p>The throttle valve controller and engine-A/T-ECU send a cancel holding information to the engine-A/T-ECU via a cancel latch signal line and the serial communication line.</p> <p>This diagnosis code is output if there is a failure in the cancel latch signal line, or a disaccord in the communication data.</p>	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller • Malfunction of the engine-A/T-ECU



Code No. 22 Stop lamp switch system	Probable cause
<p>This diagnosis code is output when the throttle valve controller detects a failure in the stop lamp switch output.</p>	<ul style="list-style-type: none"> • Malfunction of the stop lamp switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



Code No. 23 Engine-A/T-ECU system	Probable cause
<p>This diagnosis code is output if the engine-A/T-ECU system is defective as follows:</p> <ul style="list-style-type: none"> • Communication error between the throttle valve controller and the engine-A/T-ECU • Malfunction of the engine-A/T-ECU • Malfunction of the throttle position sensor • Malfunction of the accelerator pedal position sensor • Malfunction of the throttle control servo • Malfunction of the vehicle speed sensor 	<ul style="list-style-type: none"> • Malfunction of the engine-A/T-ECU

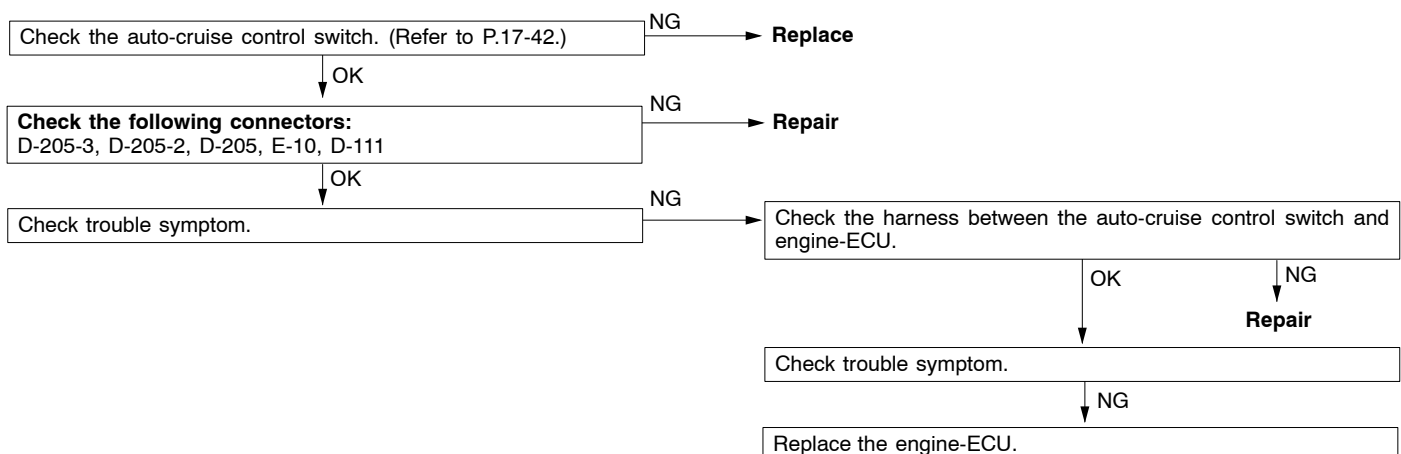


INSPECTION CHART FOR DIAGNOSIS CODES <4M41>

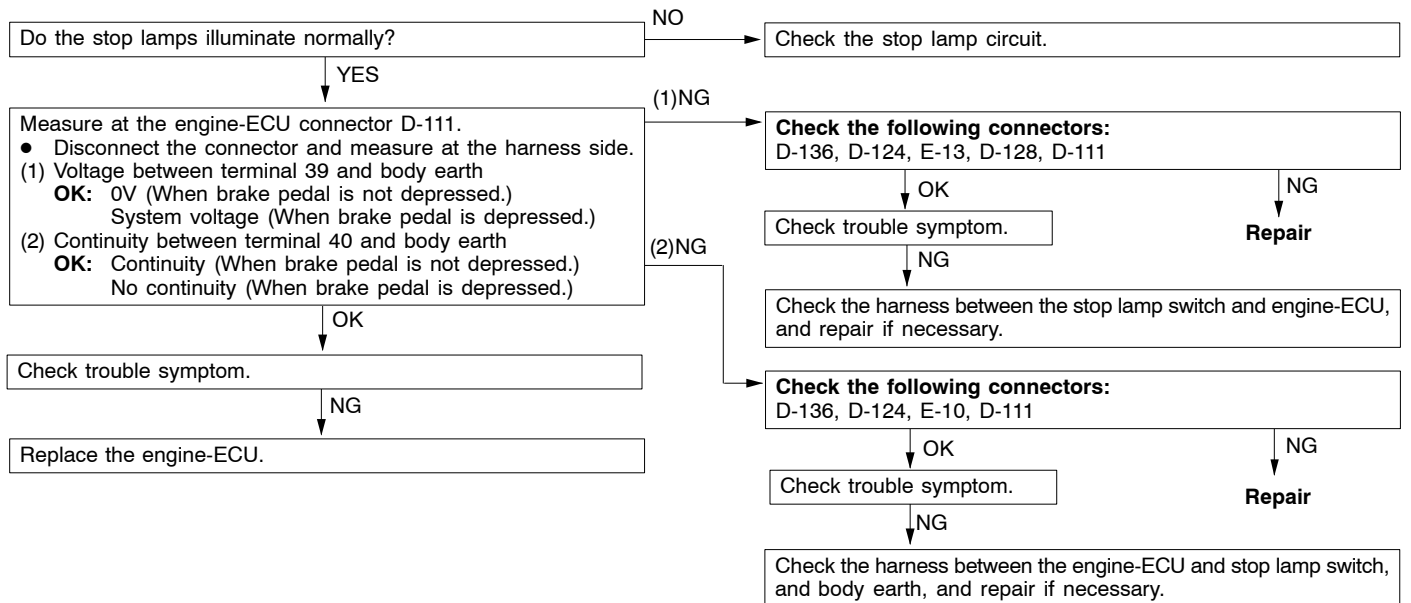
Code No.	Diagnosis item	Reference page
15	Auto-cruise control switch system	17-20
22	Stop lamp switch system	17-21
23	Engine-ECU system	17-21

INSPECTION PROCEDURE FOR DIAGNOSIS CODES <4M41>

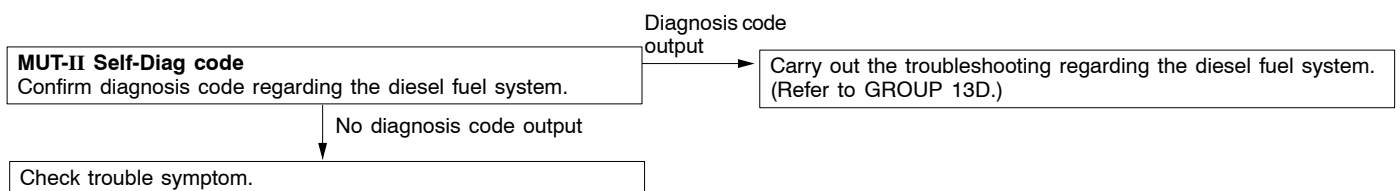
Code No. 15 Auto-cruise control switch system	Probable cause
<p>This diagnosis code is output if the RESUME and SET switches of the auto-cruise control switch remain on.</p>	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



Code No. 22 Stop lamp switch system	Probable cause
This diagnosis code is output when the engine-ECU detects a failure in the stop lamp switch output.	<ul style="list-style-type: none"> • Malfunction of the stop lamp switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



Code No. 23 Engine-ECU system	Probable cause
This diagnosis code is output if the engine-ECU system is defective as follows: <ul style="list-style-type: none"> • Malfunction of the engine-ECU • Malfunction of the accelerator pedal position sensor • Malfunction of the GE actuator (electronic governor) • Malfunction of the vehicle speed sensor 	<ul style="list-style-type: none"> • Malfunction of the engine-ECU



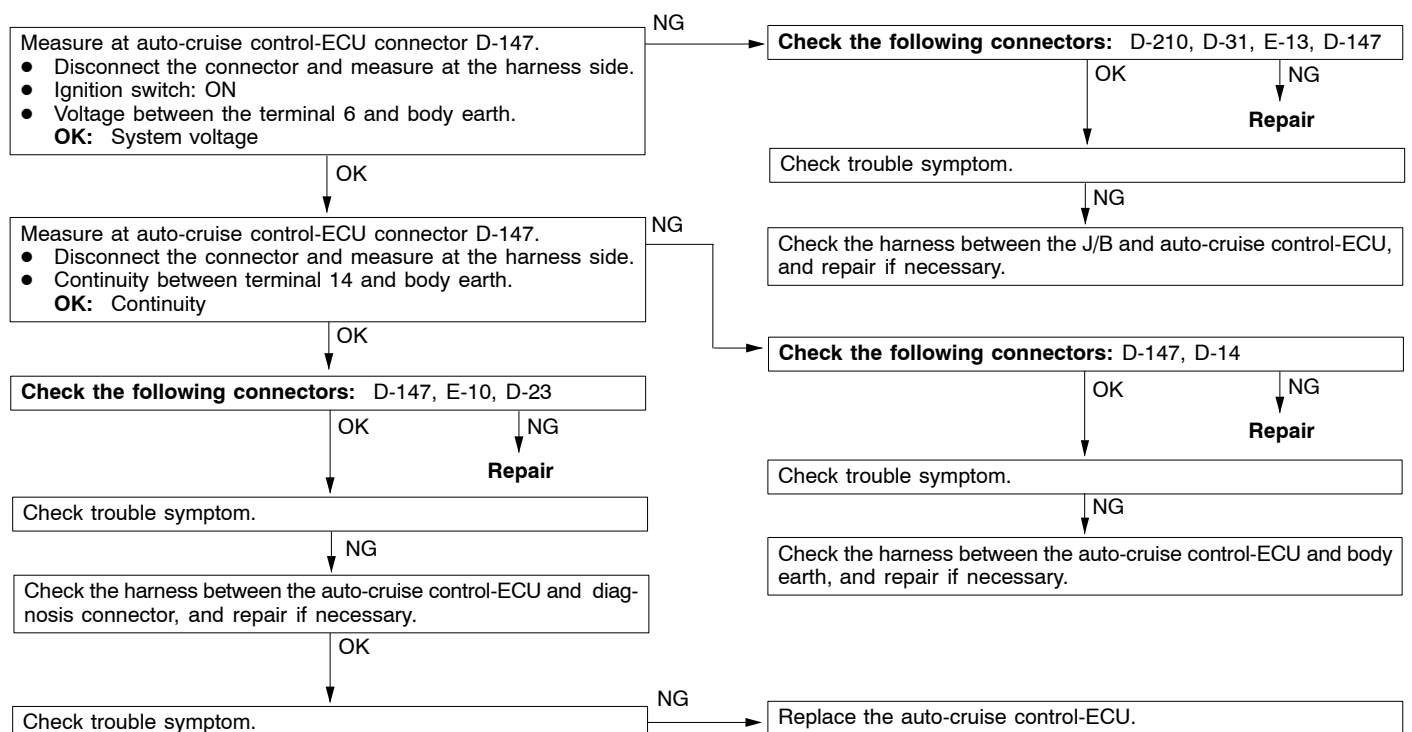
INSPECTION CHART FOR TROUBLE SYMPTOMS <6G7-MPI>

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	–	Refer to GROUP 13A
	Communication with auto-cruise control-ECU only is not possible.	1	17-22
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	2	17-23
	Even if clutch pedal is depressed <M/T>	3	17-24
	Even if select lever is set to N range <A/T>	4	17-24
	Even if CANCEL switch is set to ON	5	17-25
Auto-cruise control cannot be set.		6	17-25
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		7	17-25
When the MAIN switch of the auto-cruise control switch is turned ON, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control system is normal.)		8	17-26

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS <6G7-MPI>

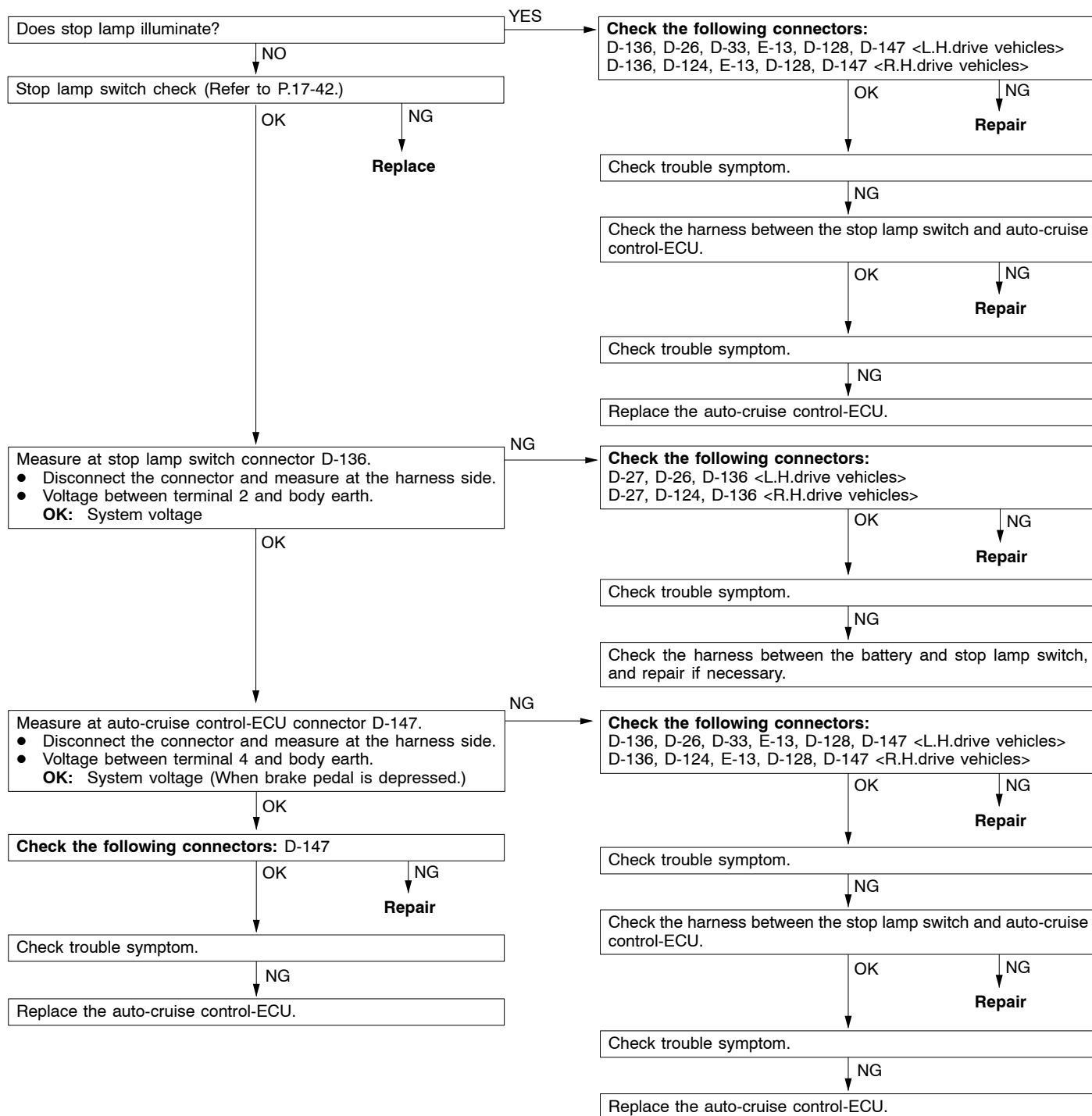
Inspection Procedure 1

Communication with MUT-II is not possible. (Communication with auto-cruise control-ECU only is not possible.)	Probable cause
One of the following causes may be suspected. <ul style="list-style-type: none"> • No power supply to the auto-cruise control-ECU • Defective earth circuit of the auto-cruise control-ECU • Defective the auto-cruise control-ECU • Improper communication line between the auto-cruise control-ECU and MUT-II 	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



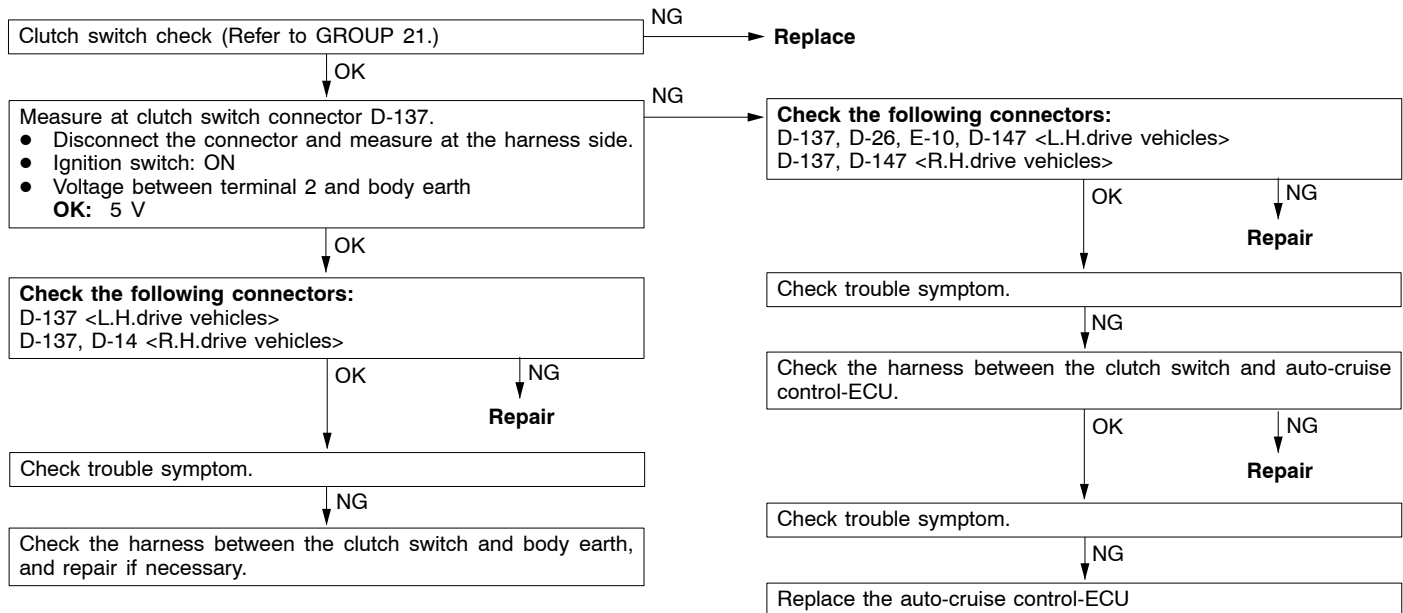
Inspection Procedure 2

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



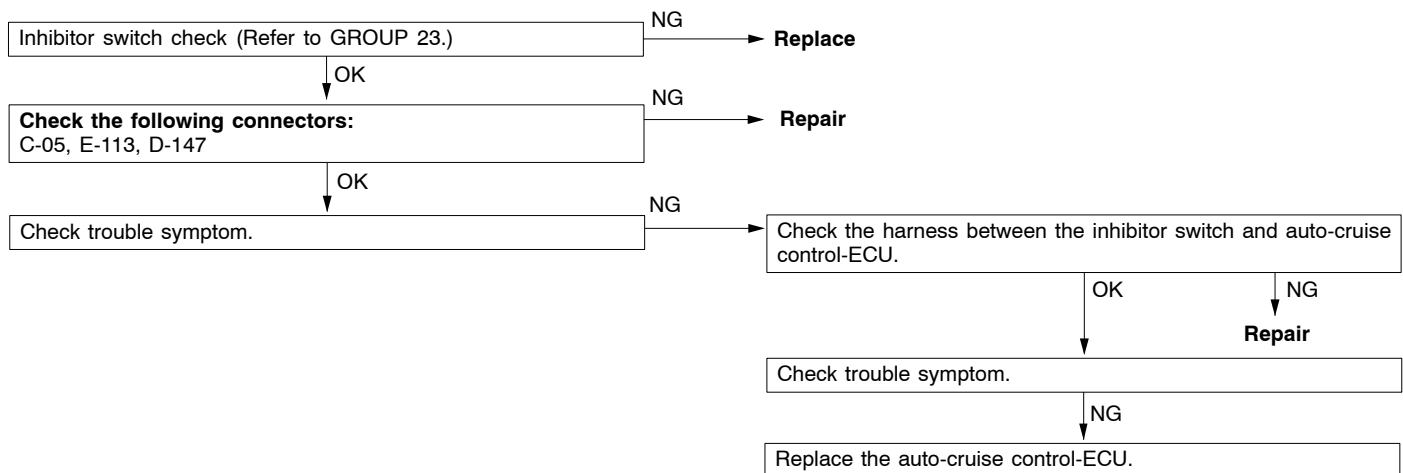
Inspection Procedure 3

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



Inspection Procedure 4

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



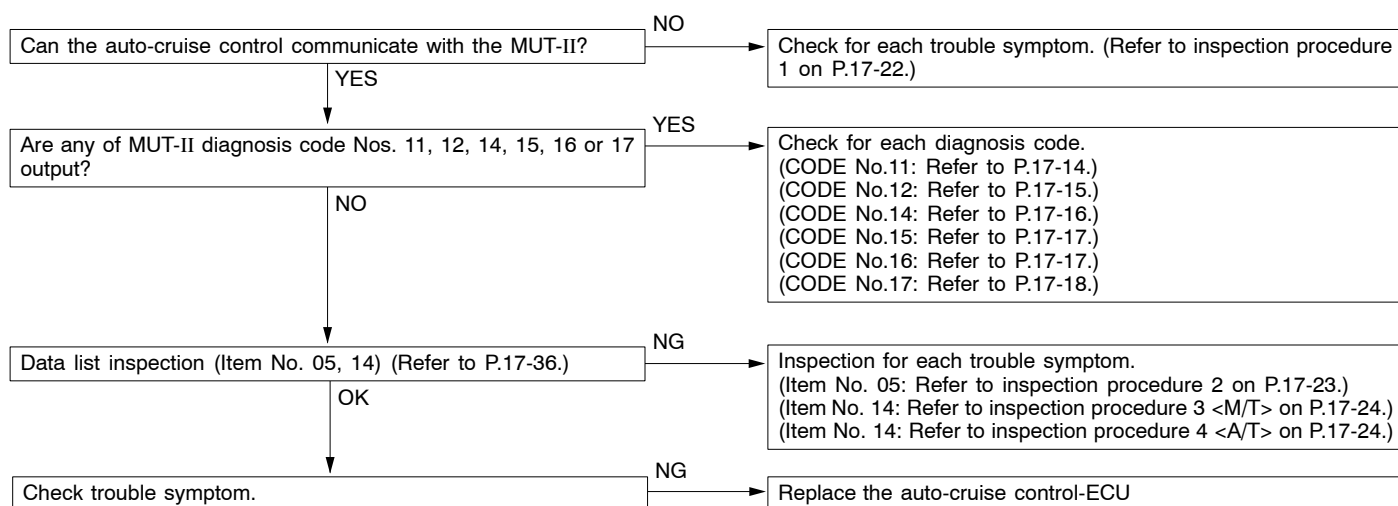
Inspection Procedure 5

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.

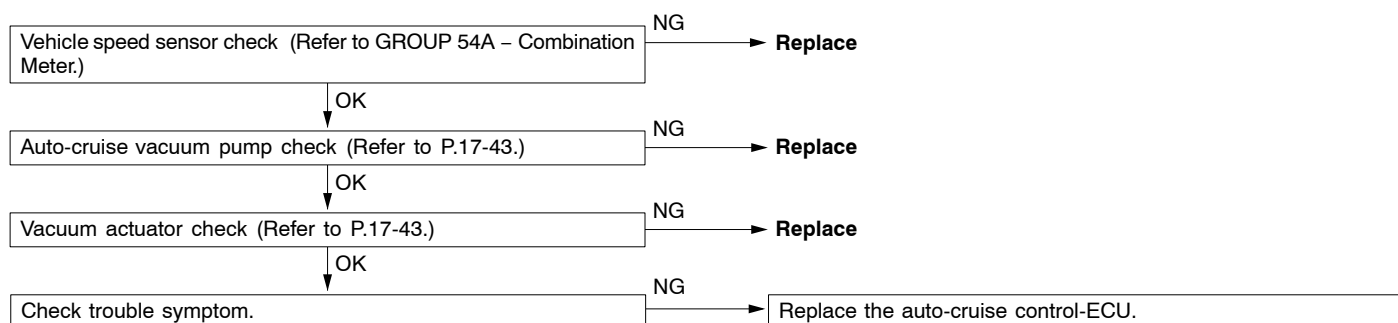
Inspection Procedure 6

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.</p> <p>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 clock spring • Malfunction of the harnesses or connectors • Malfunction of the clutch switch <M/T> • Malfunction of the inhibitor switch <A/T> • Malfunction of the auto-cruise control-ECU



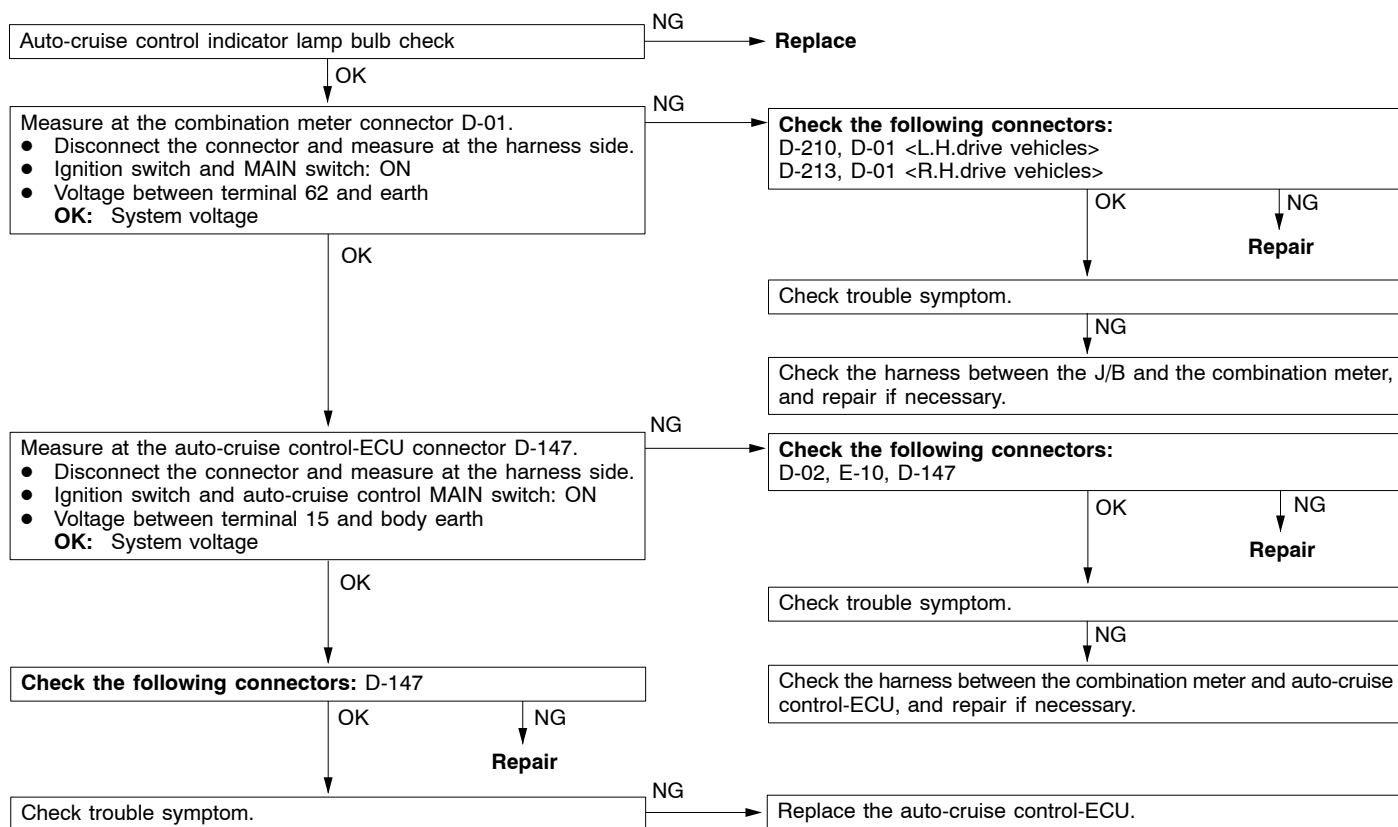
Inspection Procedure 7

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 8

When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control is normal.)	Probable cause
There may be a burnt-out bulb or a malfunction of the auto-cruise control indicator lamp circuit.	<ul style="list-style-type: none"> • Burnt-out bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the auto-cruise control-ECU

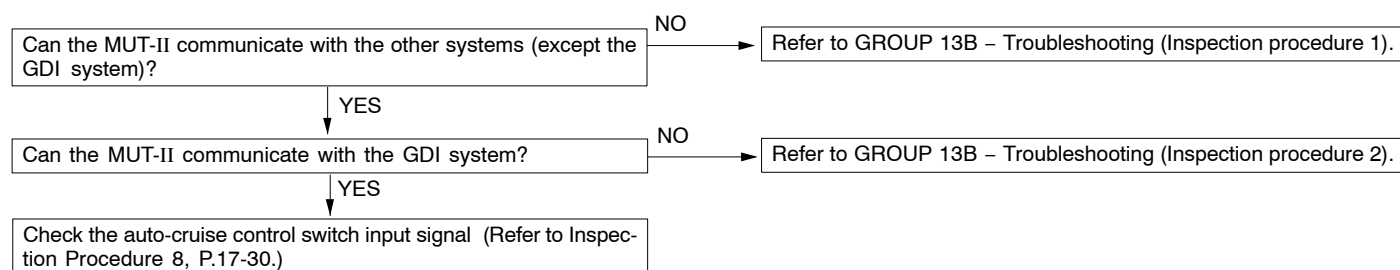


INSPECTION CHART FOR TROUBLE SYMPTOMS <6G7-GDI>

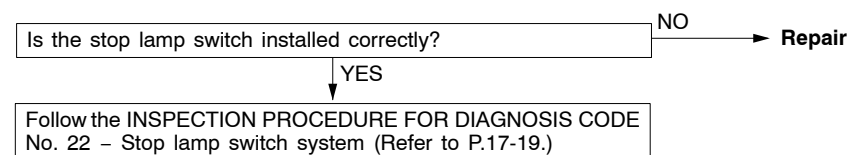
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.		1	17-27
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	2	17-27
	Even if select lever is set to N range	3	17-27
	Even if CANCEL switch is set to ON	4	17-28
Auto-cruise control cannot be set.		5	17-28
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		6	17-28
When the MAIN switch of the auto-cruise control switch is turned ON, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control system is normal.)		7	17-29

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS <6G7-GDI>**Inspection Procedure 1**

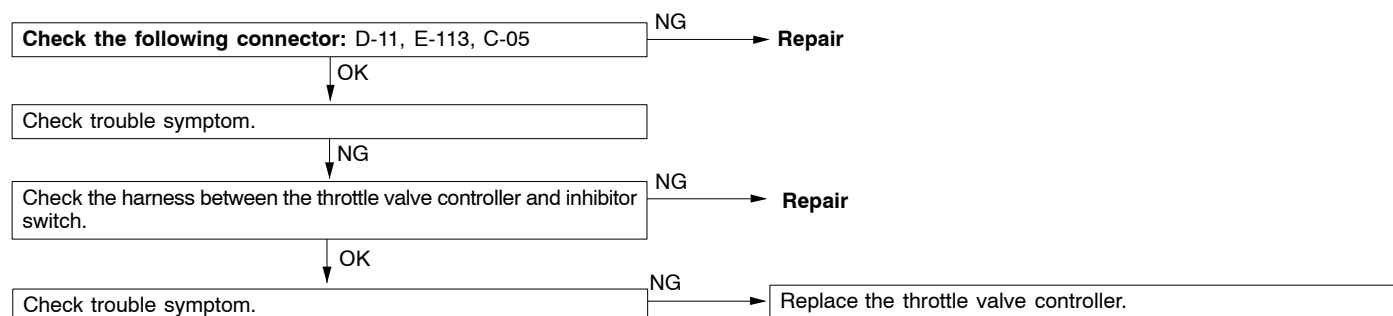
Communication with MUT-II is not possible.	Probable cause
<p>If the MUT-II can not also communicate with the systems other than the GDI system, the diagnosis line circuit may be defective.</p> <p>If the MUT-II can not communication with only the GDI system and the auto-cruise control system, the harness wire between the engine-A/T-ECU and the diagnosis connector, may be defective.</p> <p>In addition, if the MUT-II can not communication with only the auto-cruise control system, the auto-cruise control switch may be defective.</p>	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control switch • Malfunction of the throttle valve controller • Malfunction of the engine-A/T-ECU

**Inspection Procedure 2**

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

**Inspection Procedure 3**

Even if select lever is set to N range, auto-cruise control is not cancelled.	Probable cause
<p>The cause is probably a defective inhibitor switch circuit.</p>	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



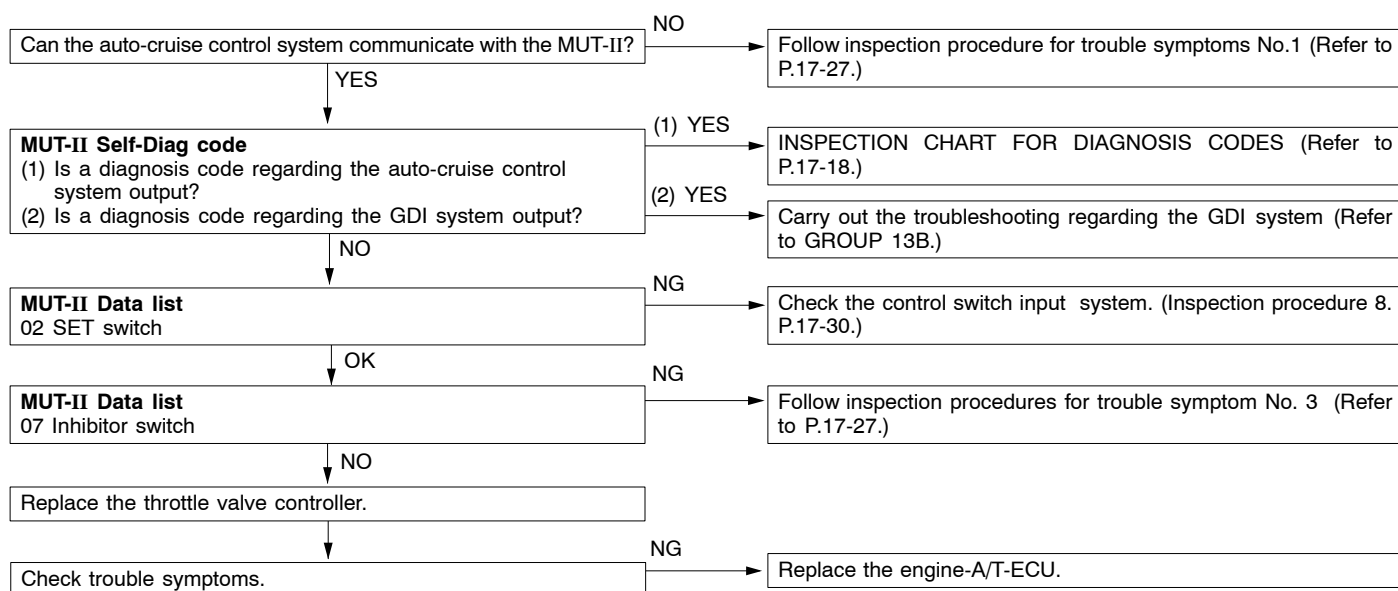
Inspection Procedure 4

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 switch

Replace the auto-cruise control switch.

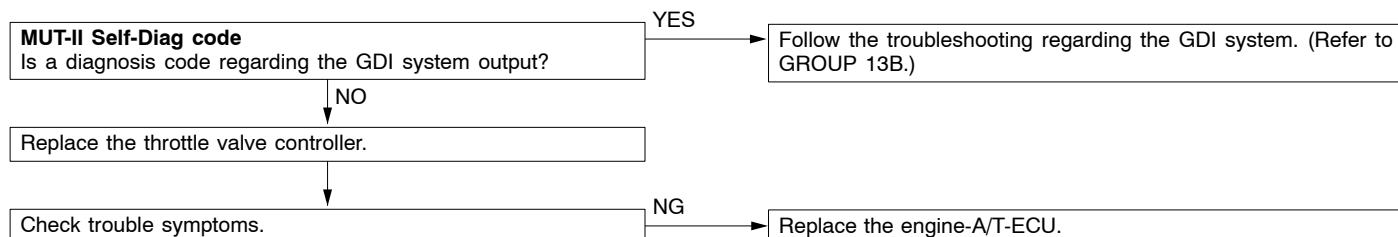
Inspection Procedure 5

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 data list.	<ul style="list-style-type: none"> Malfunction of the auto-cruise control switch Malfunction of the harnesses Malfunction of the connectors Malfunction of the throttle valve controller Malfunction of the engine-A/T-ECU



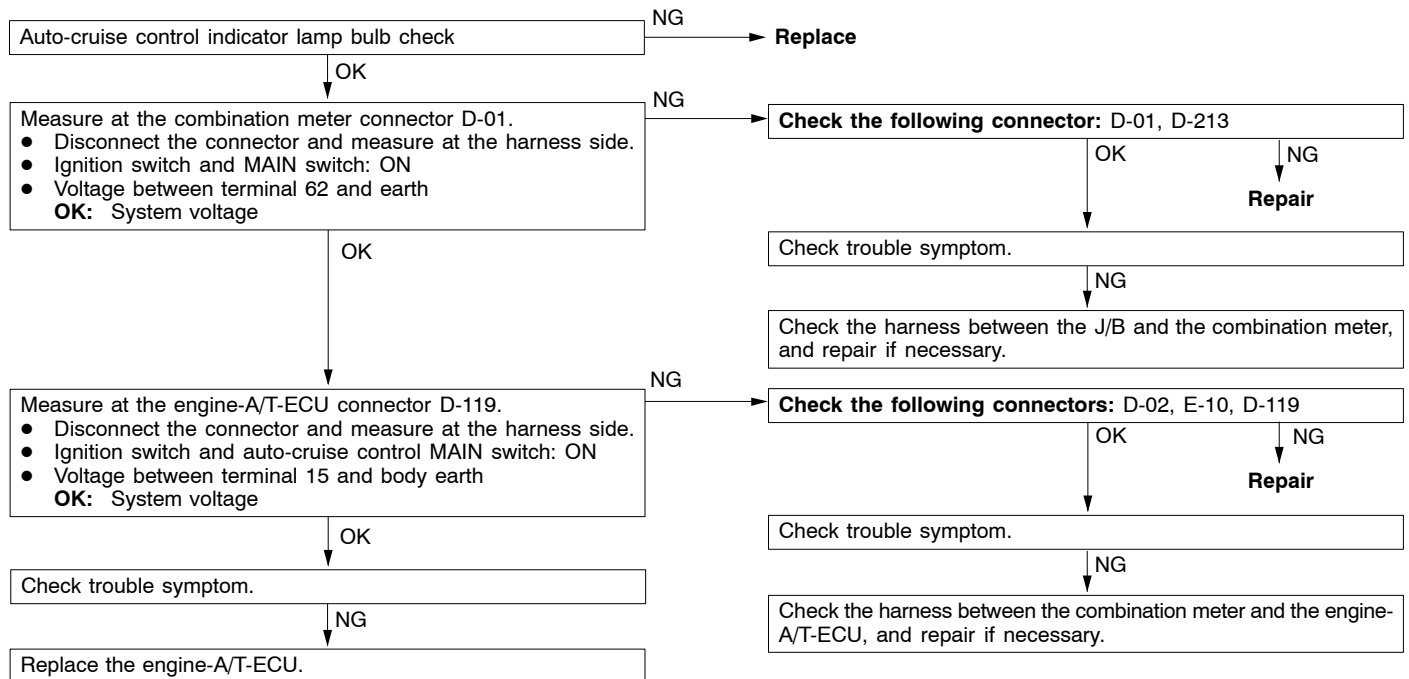
Inspection Procedure 6

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
The cause is probably a malfunction of vehicle speed sensor or throttle control servo. In either case, a diagnosis code regarding the GDI system must be confirmed.	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Malfunction of the throttle control servo Malfunction of the throttle valve controller Malfunction of the engine-A/T-ECU



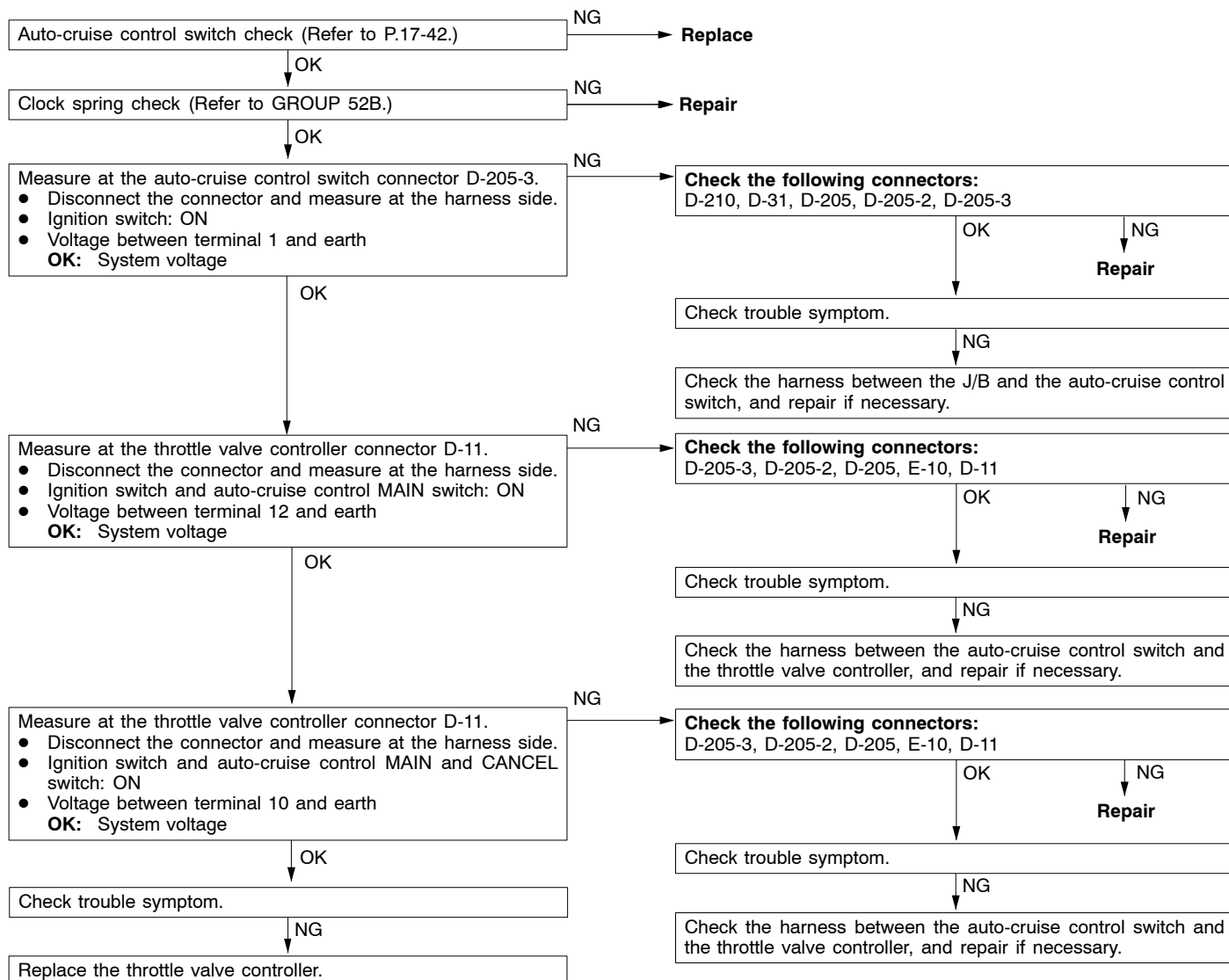
Inspection Procedure 7

<p>When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control in normal.)</p>	<p>Probable cause</p> <ul style="list-style-type: none"> • Burnt-out bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the engine-A/T-ECU
<p>There may be a burnt-out bulb or a malfunction of the auto-cruise control indicator lamp circuit.</p>	



Inspection Procedure 8

Auto-cruise control switch input system check

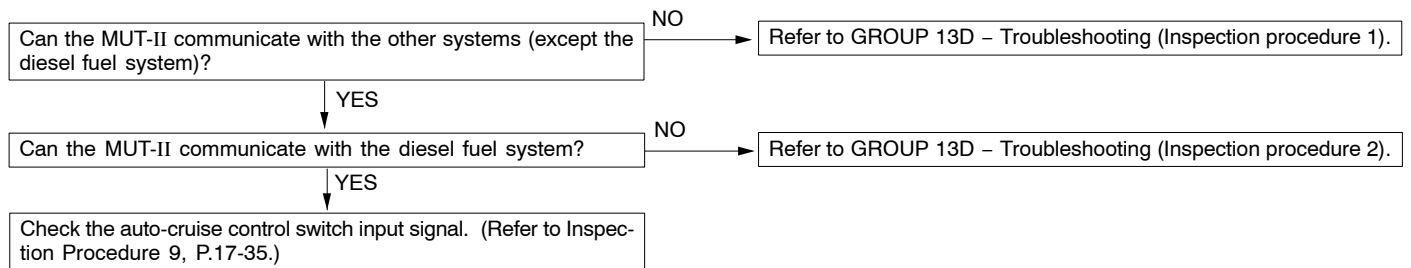


INSPECTION CHART FOR TROUBLE SYMPTOMS <4M41>

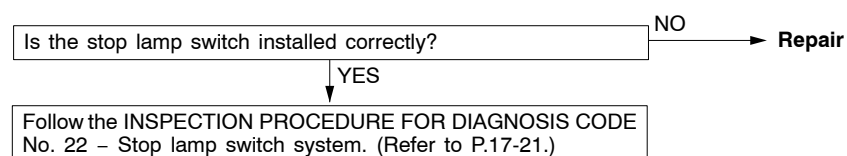
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.		1	17-31
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	2	17-31
	Even if clutch pedal is depressed <M/T>	3	17-32
	Even if select lever is set to N range <A/T>	4	17-32
	Even if CANCEL switch is set to ON	5	17-32
Auto-cruise control cannot be set.		6	17-33
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		7	17-33
When the MAIN switch of the auto-cruise control switch is turned ON, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control system is normal.)		8	17-34

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS <4M41>**Inspection Procedure 1**

Communication with MUT-II is not possible.	Probable cause
<p>If the MUT-II can not also communicate with the systems other than the diesel fuel system, the diagnosis line circuit may be defective.</p> <p>If the MUT-II can not communicate with only the diesel fuel system and the auto-cruise control system, the harness wire between the engine-ECU and the diagnosis connector, may be defective.</p> <p>In addition, if the MUT-II can not communicate with only the auto-cruise control system, the auto-cruise control switch may be defective.</p>	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control switch • Malfunction of the engine-ECU

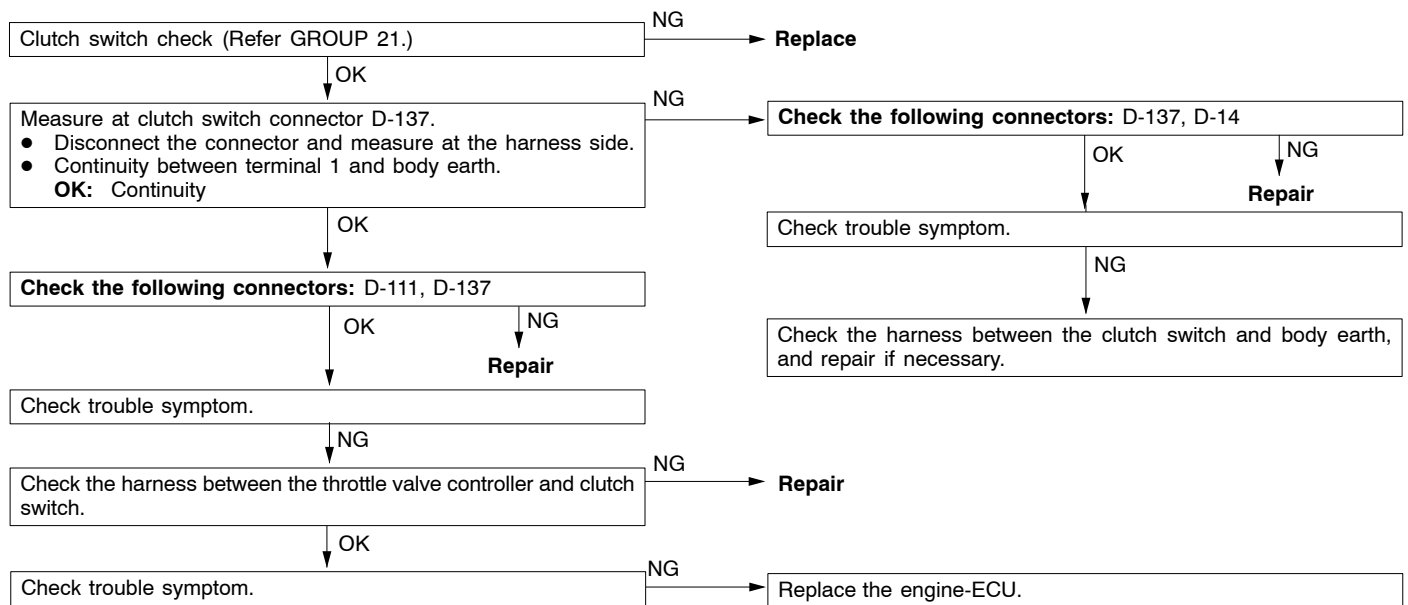
**Inspection Procedure 2**

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 engine-ECU



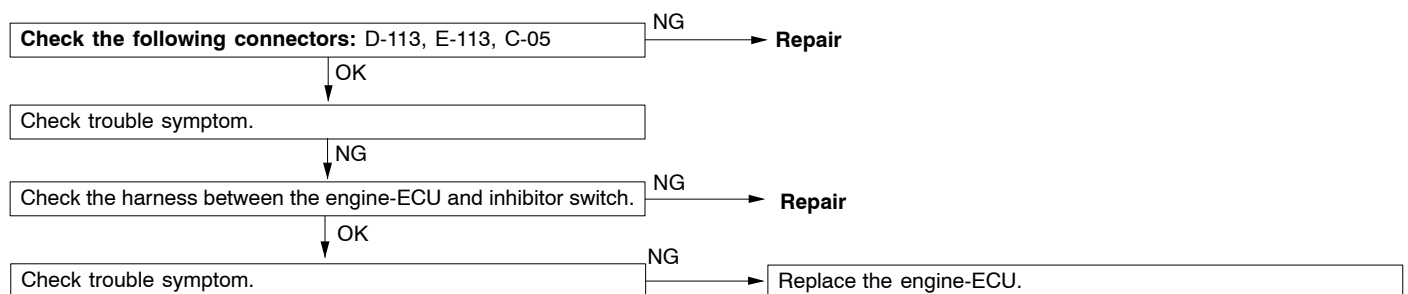
Inspection Procedure 3

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



Inspection Procedure 4

Even if select lever is set to N range, auto-cruise control is not cancelled. <A/T>	Probable cause
The cause is probably a defective inhibitor switch circuit.	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



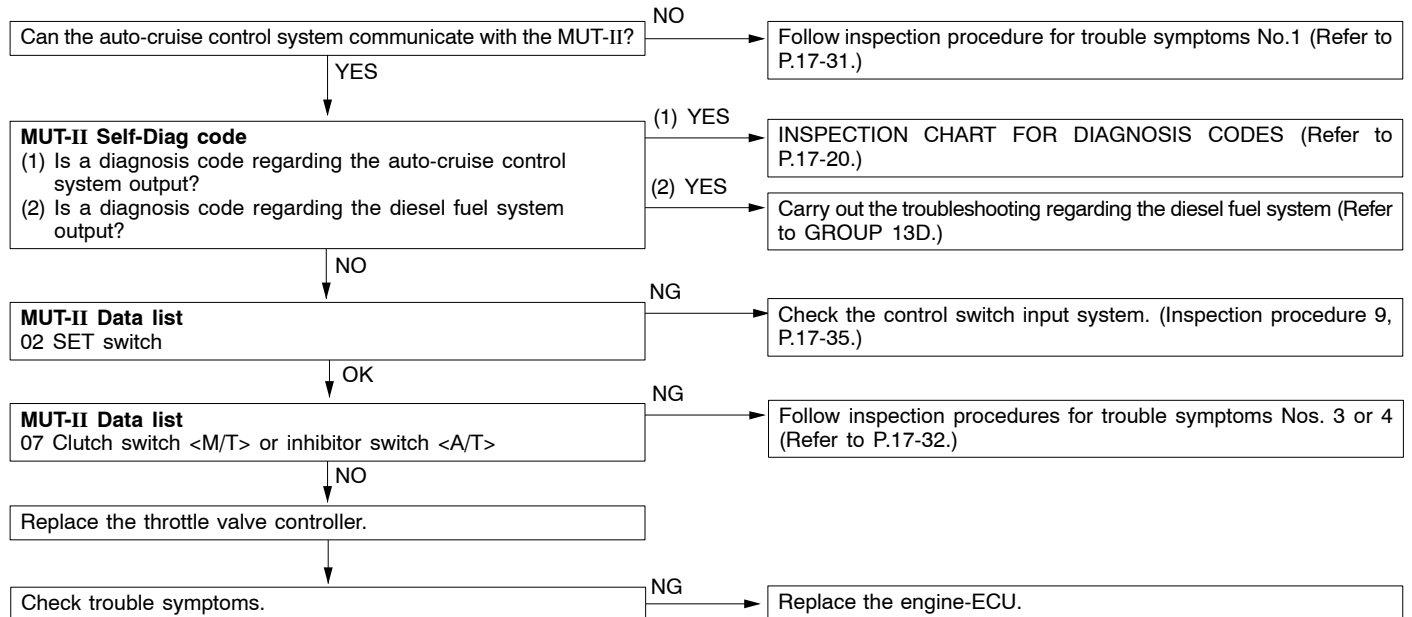
Inspection Procedure 5

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 switch

Replace the auto-cruise control switch.

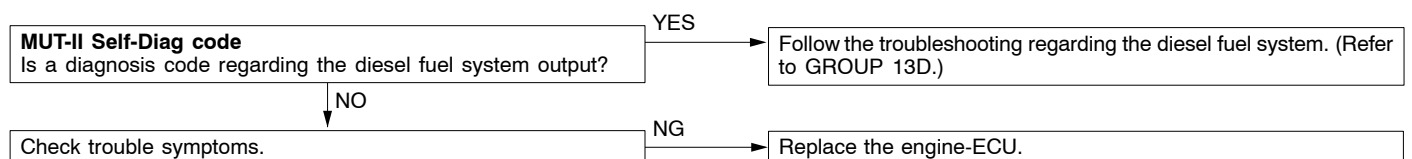
Inspection Procedure 6

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 data list.	<ul style="list-style-type: none"> • Malfunction of the auto-cruise control switch • Malfunction of the harnesses • Malfunction of the connectors • Malfunction of the engine-ECU



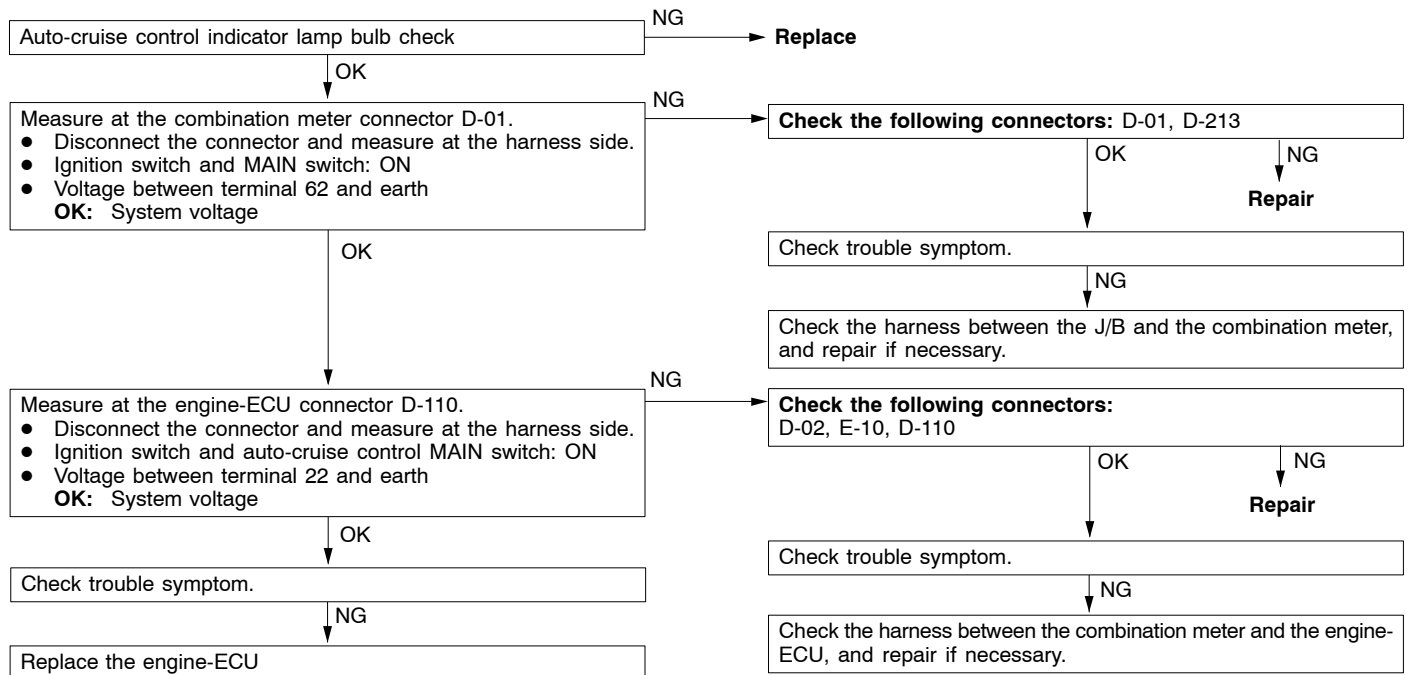
Inspection Procedure 7

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
The cause is probably a malfunction of vehicle speed sensor or GE actuator (electronic governor). In either case, a diagnosis code regarding the diesel fuel system must be confirmed.	<ul style="list-style-type: none"> • Malfunction of the vehicle speed sensor • Malfunction of the GE actuator (electronic governor) • Malfunction of the engine-ECU



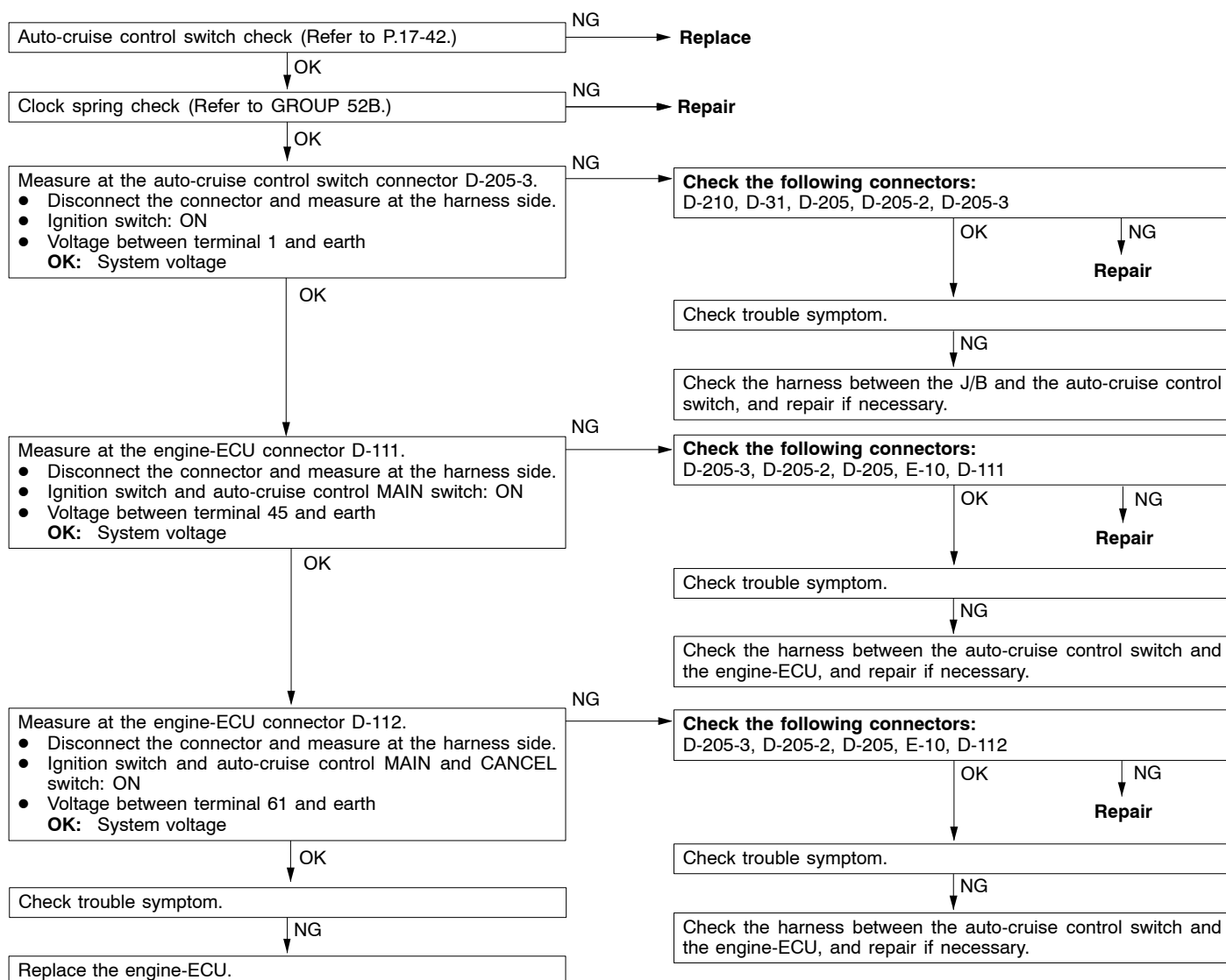
Inspection Procedure 8

When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control in normal.)	Probable cause
There may be a burnt-out bulb or a malfunction of the auto-cruise control indicator lamp circuit.	<ul style="list-style-type: none"> • Burnt-out bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the engine-ECU



Inspection Procedure 9

Auto-cruise control switch input system check



DATA LIST REFERENCE TABLE

For the data, which is input to the auto-cruise control-ECU <6G7-MPI>, engine-ECU <4M41>, engine-A/T-ECU <6G7-GDI> and throttle valve

controller <6G7-GDI>, the following items can be read out by using the MUT-II.

HOW TO READ OUT DATA LIST

1. Connect the MUT-II to the 16-pin diagnosis connector.
2. Turn the ignition switch to ON position.
3. Select auto-cruise control on the MUT-II menu, and then read out the data list.





Caution

Turn off the ignition switch before connecting and disconnecting the MUT-II.

<6G7-MPI>

Terminal No.	Check item		Check conditions		Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON		ON
			MAIN switch: OFF		OFF
02		SET (COAST)	MAIN switch: ON	SET switch: ON	ON
				SET switch: OFF	OFF
03		RESUME (ACCEL)		RESUME switch: ON	ON
				RESUME switch: OFF	OFF
04		CANCEL		CANCEL switch: ON	ON
				CANCEL switch: OFF	OFF
05	Stop lamp switch (for stop lamp circuit)		Brake pedal: Depressed		ON
			Brake pedal: Released		OFF
08	Accelerator switch (Idle position switch)		Accelerator pedal: Released		ON
			Accelerator pedal: Depressed		OFF
10	Vehicle speed sensor		Road test the vehicle		The speedometer and the MUT-II display the same value.
13	Throttle position sensor		Accelerator pedal: Fully depressed		300 – 1,000 mV
			Accelerator pedal: Depressed		The more deeply the pedal is depressed, the higher value the MUT-II display.
			Accelerator pedal: Release		4,500 – 5,500 mV
14	Clutch switch <M/T>		Clutch pedal: Depressed		ON
			Brake pedal: Released		OFF
	Inhibitor switch <A/T>		Selector lever: NPposition		ON
			Selector lever: Other thanNPposition		OFF
15	OD-OFF signal (OD-OFFOD-ON signal)		Driving on level road (No OD-OFF request)		OFF
			Driving on uphill grade (OD-OFF request)		ON

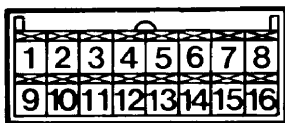
<6G7-GDI>

Terminal No.	Check item		Check conditions		Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON		ON
			MAIN switch: OFF		OFF
02		SET (COAST)	MAIN switch: ON	SET switch: ON	ON
				SET switch: OFF	OFF
03		RESUME (ACCEL)		RESUME switch: ON	ON
				RESUME switch: OFF	OFF
04		CANCEL		CANCEL switch: ON	ON
				CANCEL switch: OFF	OFF
05	Stop lamp switch (for stop lamp circuit)		Brake pedal: Depressed		ON
			Brake pedal: Released		OFF
06	Stop lamp switch (for auto-cruise control circuit)		Brake pedal: Depressed		OFF
			Brake pedal: Released		ON
07	Inhibitor switch		Selector lever:  ,  position		ON
			Selector lever: Other than  ,  position		OFF
08	Accelerator switch (Idle position switch)		Accelerator pedal: Released		ON
			Accelerator pedal: Depressed		OFF
09	Auto-cruise control system		Auto-cruise control system: Activated		ON
			Auto-cruise control system: No activated		OFF
10	Vehicle speed sensor		Road test the vehicle		The speedometer and the MUT-II display the same value.
11	Throttle position sensor		Accelerator pedal: Fully depressed		450 – 800 mV
			Accelerator pedal: Depressed		The more deeply the pedal is depressed, the higher value the MUT-II display.
			Accelerator pedal: Release		4,200 – 4,900 mV
12	Accelerator pedal position sensor		Accelerator pedal: Fully depressed		985 – 1,085 mV
			Accelerator pedal: Depressed		The more deeply the pedal is depressed, the higher value the MUT-II display.
			Accelerator pedal: Release		4,000 mV or more

<4M41>

Terminal No.	Check item		Check conditions		Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON		ON
			MAIN switch: OFF		OFF
02		SET (COAST)	MAIN switch: ON	SET switch: ON	ON
				SET switch: OFF	OFF
03		RESUME (ACCEL)		RESUME switch: ON	ON
				RESUME switch: OFF	OFF
04		CANCEL		CANCEL switch: ON	ON
				CANCEL switch: OFF	OFF
05	Stop lamp switch (for stop lamp circuit)		Brake pedal: Depressed		ON
			Brake pedal: Released		OFF
06	Stop lamp switch (for auto-cruise control circuit)		Brake pedal: Depressed		OFF
			Brake pedal: Released		ON
07	Clutch switch <M/T>		Clutch pedal: Depressed		ON
			Brake pedal: Released		OFF
	Inhibitor switch <A/T>		Selector lever: position		ON
			Selector lever: Other than position		OFF
08	Accelerator switch (Idle position switch)		Accelerator pedal: Released		ON
			Accelerator pedal: Depressed		OFF
09	Auto-cruise control system		Auto-cruise control system: Activated		ON
			Auto-cruise control system: Not activated		OFF
10	Vehicle speed sensor		Road test the vehicle		The speedometer and the MUT-II display the same value.
11	Accelerator pedal position sensor		Accelerator pedal: Fully depressed		0.9 – 1.1 V
			Accelerator pedal: Release		4.1 V or more

CHECK AT ECU TERMINALS



X0072AA

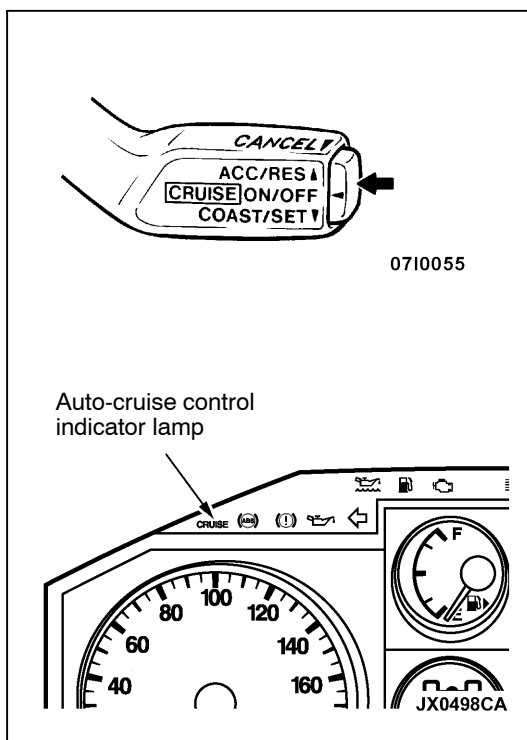
Terminal No.	Check item	Check conditions		Normal condition
1	Throttle position sensor input	Accelerator pedal: Fully depressed		4.5–5.5 V
		Accelerator pedal: Released		0.5–0.7 V
2	Engine-ECU <M/T> or engine -A/T-ECU <A/T> output (Idle switch)	Accelerator pedal: Depressed		4.5–5.5 V
		Accelerator pedal: Released		0 V
3	A/T control output	Driving on level road (NO OD-OFF request)		System voltage
		Driving on uphill grade (OD-OFF request)		0 V
4	Stop lamp switch input	Brake pedal: Depressed (When stop lamp switch is ON)		System voltage
		Brake pedal: Released (When stop lamp switch is OFF)		0 V
5	Pump power supply	Ignition switch: ON, Stop lamp 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
Control valve open/closed			System voltage	
8		When cancelling constant speed driving with the CANCEL switch	Release valve open	System voltage
			Control valve open	System voltage
9	Auto-cruise control switch input	MAIN switch: ON		Approx. 9.0 V
		When input switch has not been operated	All switches: OFF	Approx. 4.5 V
		When input switch is pushed down	SET switch: ON	Approx. 1.5 V
		When input switch is pushed up	RESUME switch: ON	Approx. 3.0 V
		When input switch is pulled forward	CANCEL switch: 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
		Ignition switch: ON	Move the vehicles forward slowly	0 and 8 – 12 V alternate
11	Diagnosis control input	Ignition switch: ON		4 V or more
12	ACC power supply	Ignition switch* ACC, MAIN switch: ON		System voltage

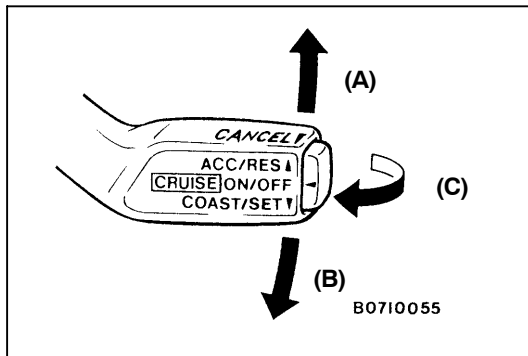
Terminal No.	Check item	Check conditions		Normal condition
13	Clutch switch input <M/T>	Clutch pedal: Released	Clutch switch: OFF	System voltage
		Clutch pedal: Depressed	Clutch switch: ON	0 V
	Inhibitor switch input <A/T>	Selector lever: Other than N or P range	Clutch switch: OFF	System voltage
		Selector lever: N or P range	Clutch switch: ON	0 V
14	Earth	At any time		Continuity
15	Indicator lamp input	MAIN switch: ON (When indicator lamp is illuminated)		0 V
		MAIN switch: OFF (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

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 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. Push the auto-cruise control switch in the direction of arrow (A).
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.

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

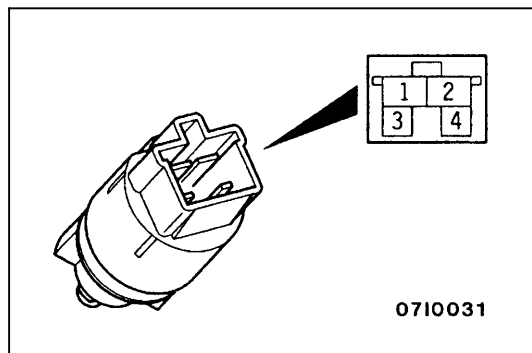
1. Set to the desired speed.
2. Push the auto-cruise control switch in the direction of arrow (B).
3. Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

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

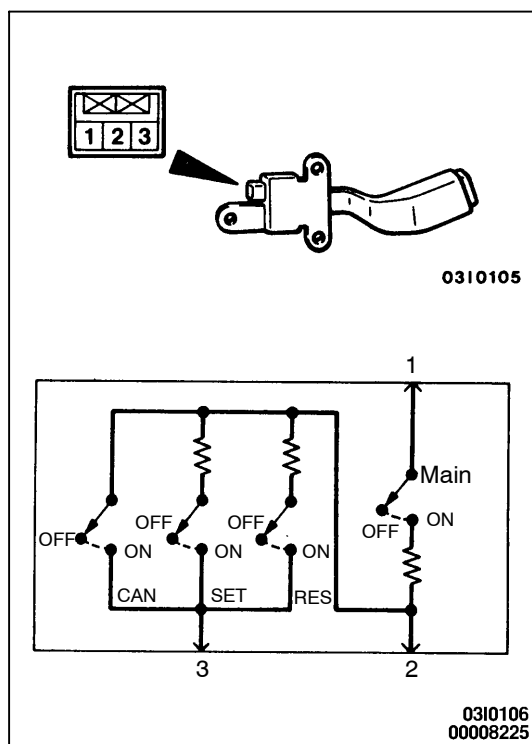
1. Set the auto-cruise speed control.
2. When any of the following operations are performed while at constant speed during auto-cruise control, check if normal driving is resumed and deceleration occurs.
 - a. The auto-cruise control switch is pushed in the direction of arrow (C).
 - b. The brake pedal is depressed.
 - c. The clutch pedal is depressed. <M/T>
 - d. The selector lever is moved to the **P** range. <A/T>
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.

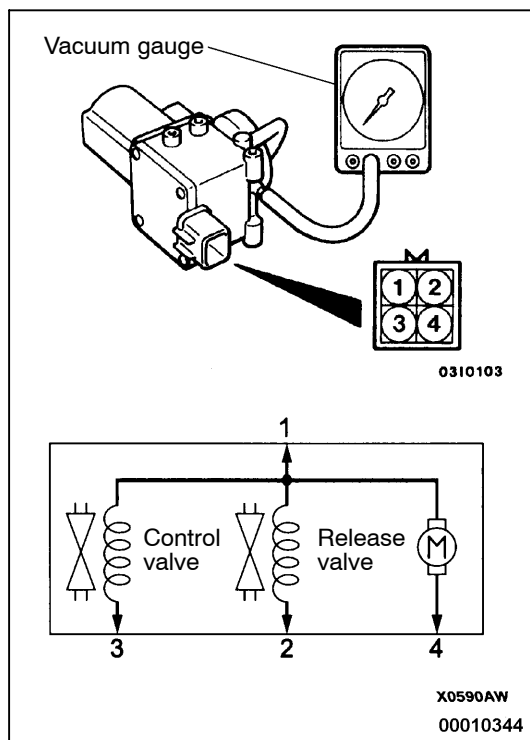
Measurement conditions	Terminal No.			
	1	2	3	4
When brake pedal is depressed. (for stop lamp circuit)	○	○		
When brake pedal is depressed. (for auto-cruise control circuit)			○	○



AUTO-CRUISE CONTROL SWITCH CHECK

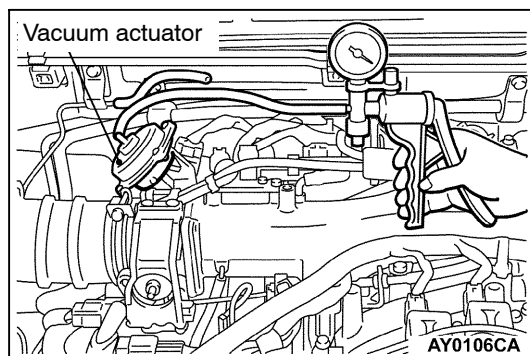
Measure the resistance between the terminals when each of the SET, RESUME, CANCEL and MAIN switches is pressed. If the values measured at this time correspond to those in the table below, then there is no problem.

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



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 auto-cruise vacuum pump and valves according to the following procedure:
 - (1) Connect the positive battery terminal to auto-cruise vacuum pump connector terminal 1, and the negative battery terminal to terminals 2, 3 and 4. The vacuum gauge should read 27 kPa or more.
 - (2) The vacuum should be maintained when terminal 4 is disconnected from the negative battery terminal while terminals 1, 2 and 3 remain connected. Then the vacuum gauge should read 0 kPa when terminal 2 is disconnected from the negative battery terminal while terminals 1 and 3 remain connected.
 - (3) The vacuum should be maintained when terminal 4 is disconnected from the negative battery terminal while terminals 1, 2 and 3 remain connected. Then the vacuum gauge should read 0 kPa when terminal 3 is disconnected from the negative battery terminal while terminals 1 and 2 remain connected.



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.

CLUTCH SWITCH

Refer to GROUP 21 – On-vehicle Service.

THROTTLE POSITION SENSOR

Refer to GROUP 13A – On-vehicle Service. <6G7-MPI>

Refer to GROUP 13B – On-vehicle Service. <6G7-GDI>

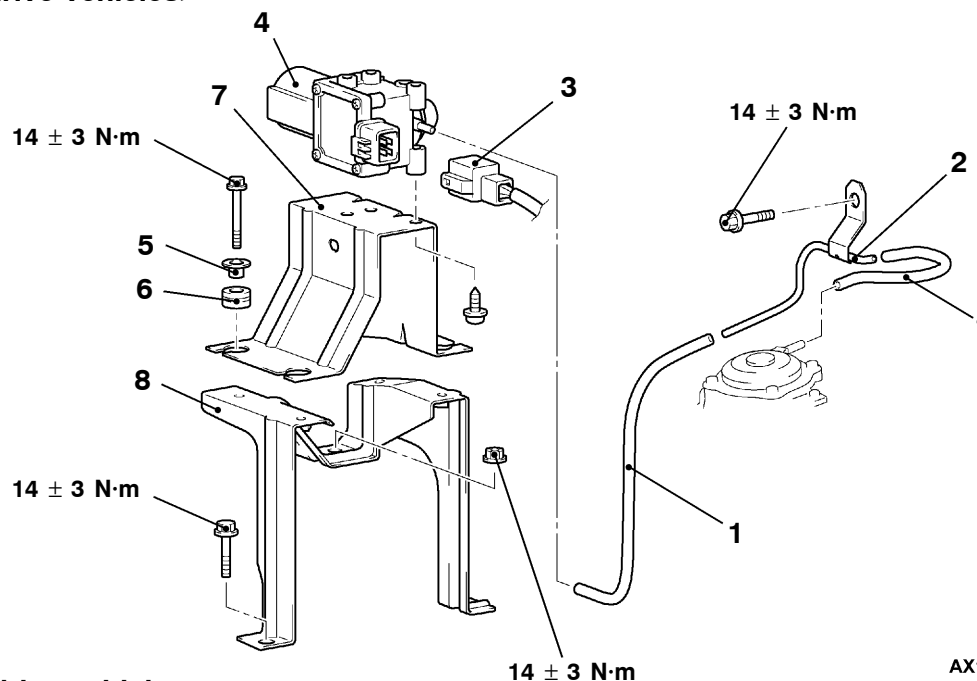
VEHICLE SPEED SENSOR CHECK

Refer to GROUP54A – Combination meters.

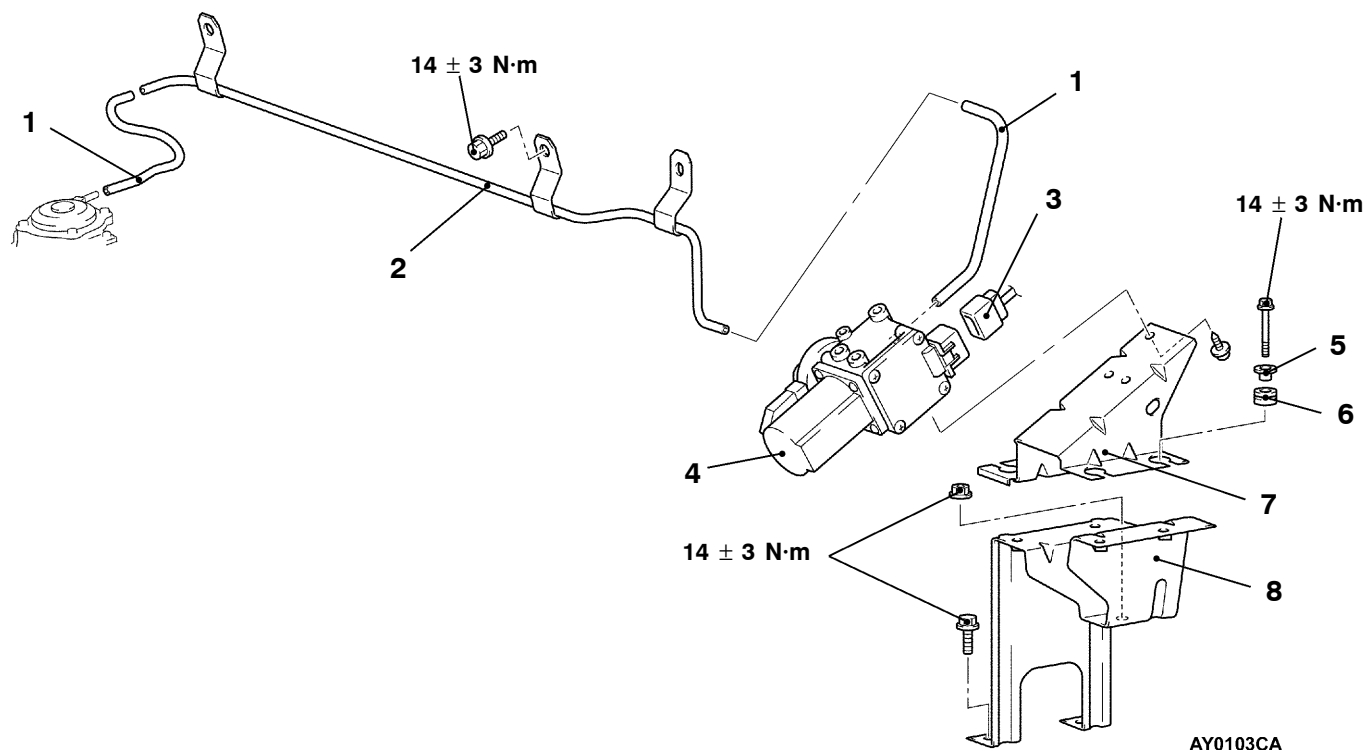
AUTO-CRUISE CONTROL

REMOVAL AND INSTALLATION

<L. H. drive vehicles>



<R. H. drive vehicles>



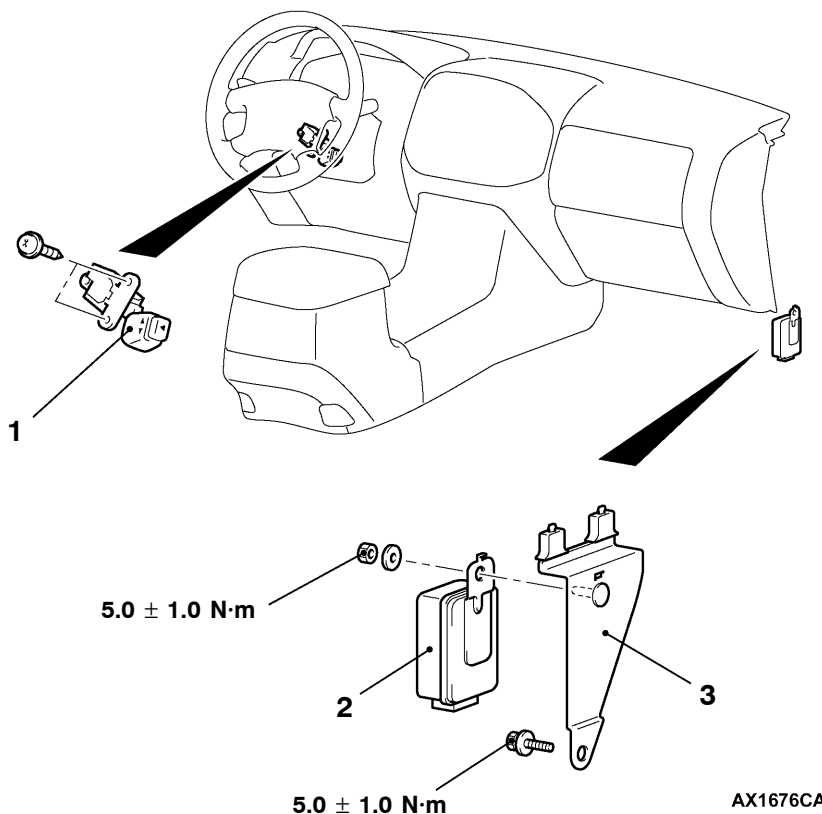
Removal steps

1. Vacuum hose
2. Vacuum pipe
3. Wiring connector
4. Auto-cruise vacuum pump assembly

5. Spacer
6. Rubber mount
7. Pump bracket
8. Pump body bracket

CAUTION: SRS

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

**Auto-cruise control switch removal steps**

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

Auto-cruise control-ECU removal steps

- Engine-ECU <M/T> or engine-A/T -ECU <A/T> (Refer to GROUP 13A.)
2. Auto-cruise control-ECU
 3. Auto-cruise control-ECU bracket

EMISSION CONTROL SYSTEM <6G7-GDI>

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 Duty cycle type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device – GDI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system • EGR valve	Equipped Stepper motor type (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

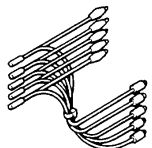
EMISSION CONTROL DEVICE REFERENCE TABLE

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	×					17-50
Purge control solenoid valve		×				17-53
GDI system component		×	×			GROUP 13A
Catalytic converter				×		17-59
EGR valve					×	17-55

SERVICE SPECIFICATIONS

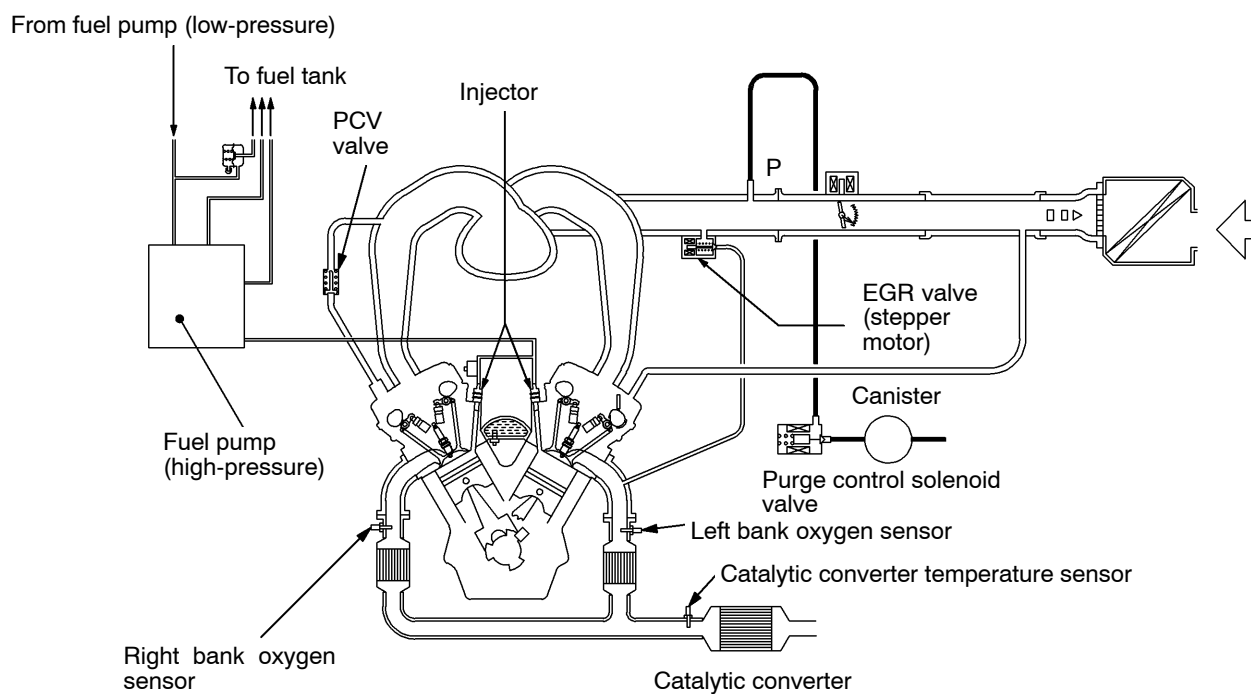
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	30 – 34
EGR valve coil resistance (at 20°C) Ω	10 – 20

SPECIAL TOOL

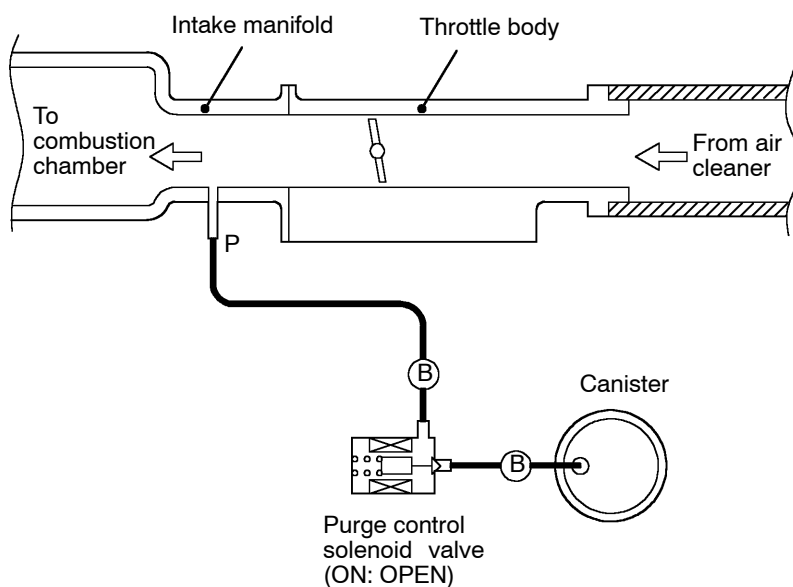
Tool	Number	Name	Use
 B991658	MB991658	Test harness set	Inspection of EGR valve

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM



X6208CA

VACUUM CIRCUIT DIAGRAM

Vacuum hose colour
B: Black

X6131CA

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

GENERAL INFORMATION

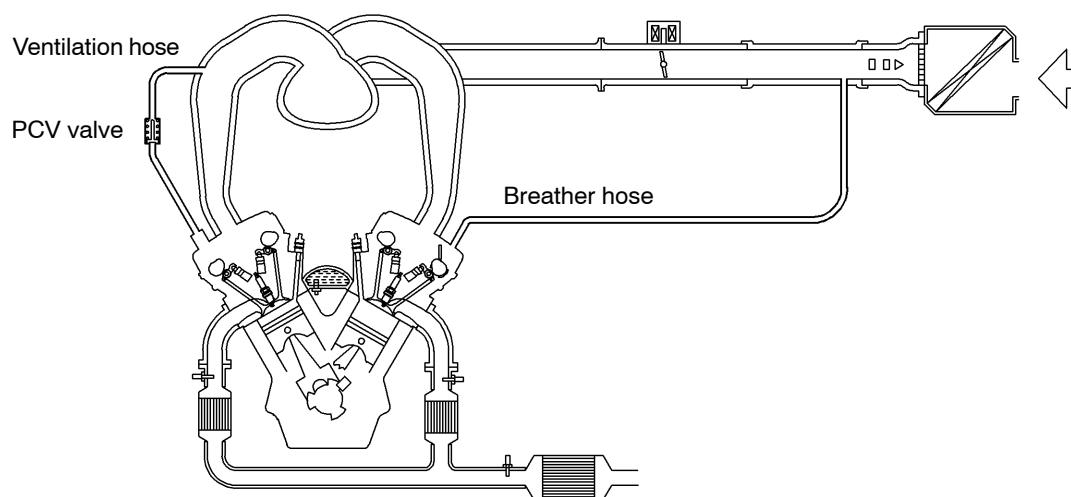
The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.

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.

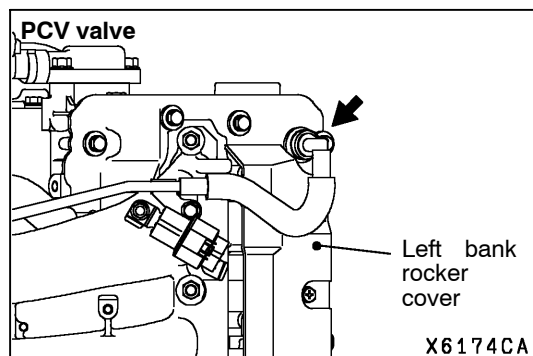
The PCV valve lifts the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly. In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



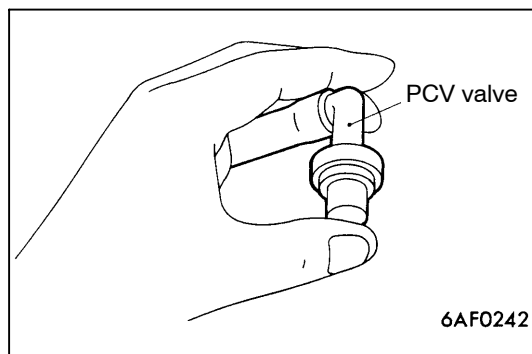
X6036CA

COMPONENT LOCATION



POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

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.

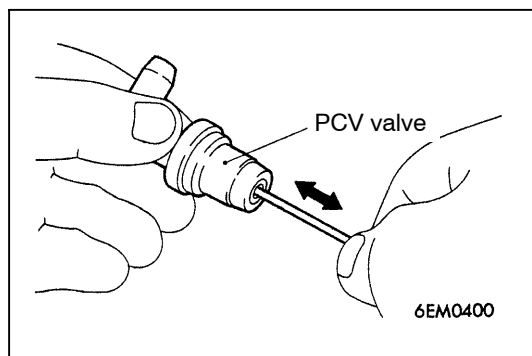


5. Place a finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

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**

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 clogging in the PCV valve. In this case, clean or replace the PCV 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.

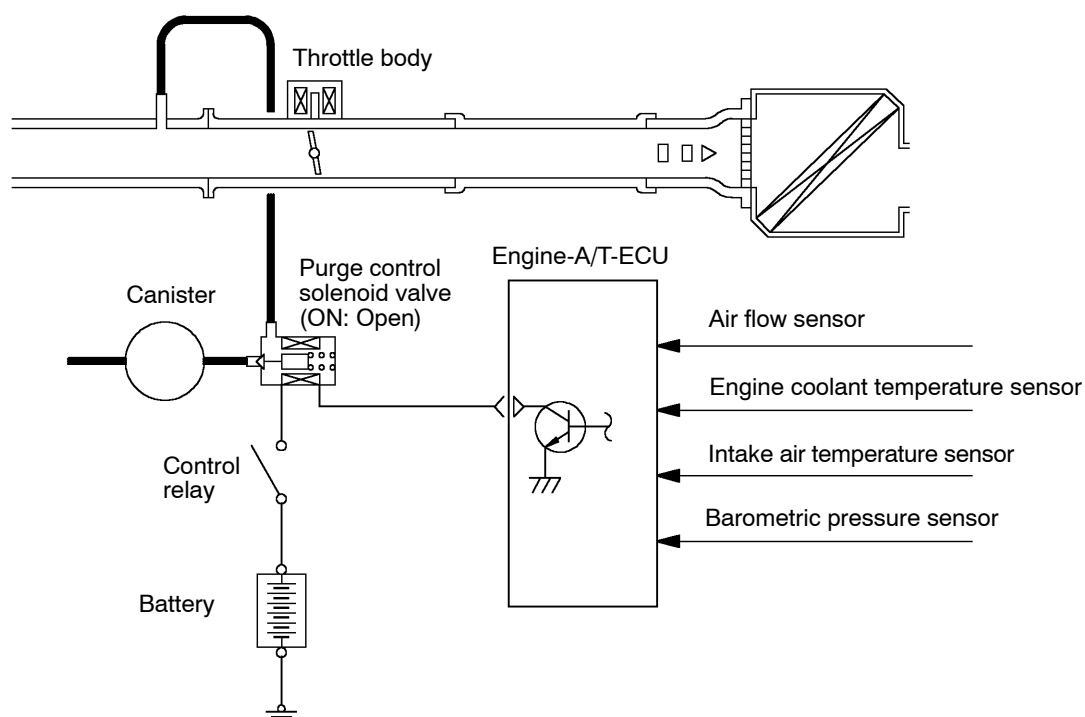
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be sent to the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

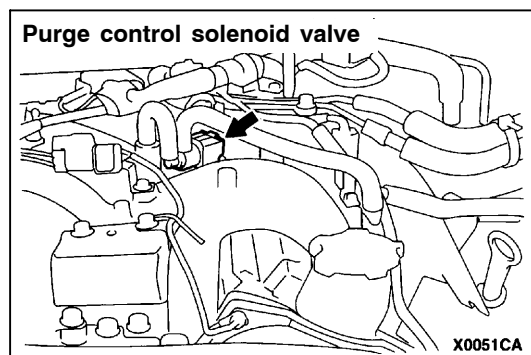
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

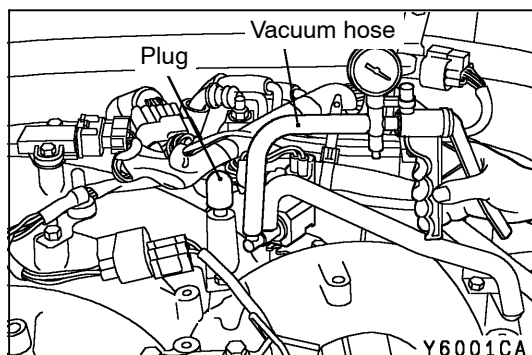
SYSTEM DIAGRAM



X6037CA

COMPONENT LOCATION





PURGE CONTROL SYSTEM CHECK

1. Disconnect the vacuum hose from the intake manifold 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 of 53 kPa, and check the condition of the vacuum.

When engine is cold

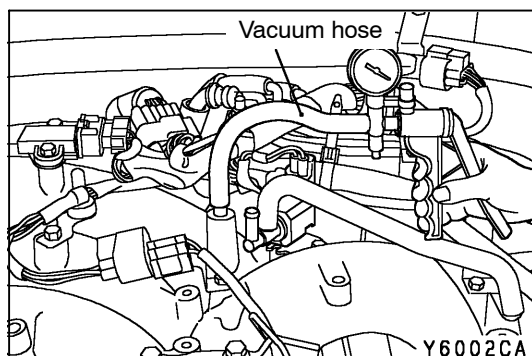
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained.
3,000 r/min	

When engine is hot

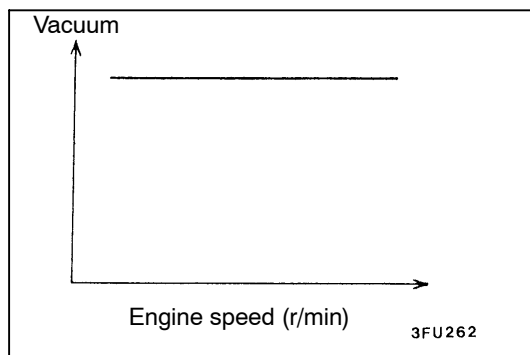
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
<ul style="list-style-type: none"> • At idle • for approximately 6 minutes after the engine is started. 	Vacuum is maintained.
<ul style="list-style-type: none"> • 3,000 r/min • for approximately 3 minutes after the engine is started. 	



PURGE PORT VACUUM CHECK

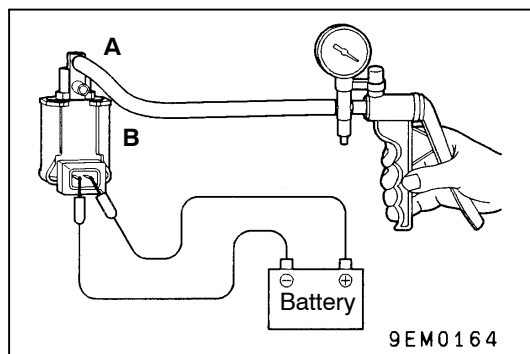
1. Disconnect the vacuum hose from the intake manifold purge vacuum nipple and connect a hand vacuum pump to the nipple.
2. Plug the vacuum hose.



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

NOTE

If vacuum changes, it is possible that the throttle body purge port may be clogged and require cleaning.



PURGE CONTROL SOLENOID VALVE CHECK

NOTE

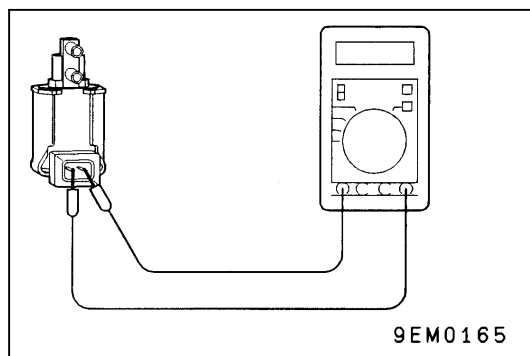
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose 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: 30 – 34 Ω (at 20°C)



EXHAUST GAS RECIRCULATION (EGR) SYSTEM

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.

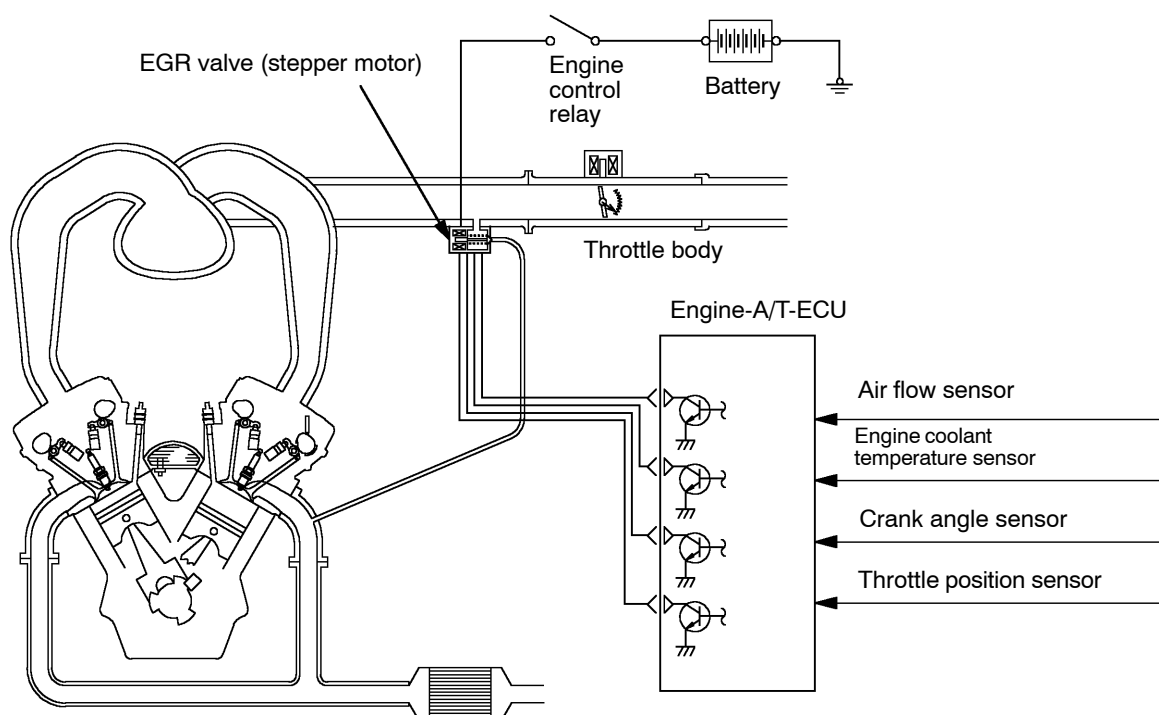
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

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 recirculate exhaust gases.

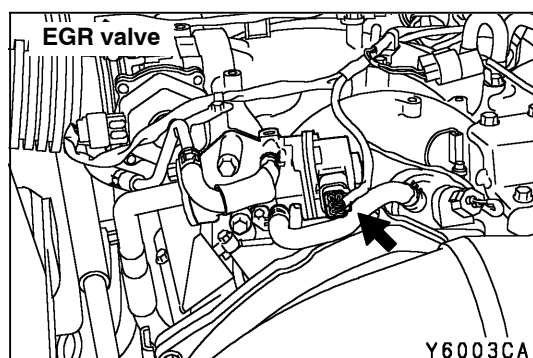
- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

SYSTEM DIAGRAM



X6134CA

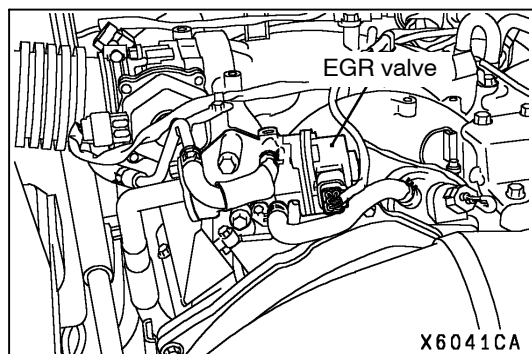
COMPONENT LOCATION



Y6003CA

EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

Refer to GROUP 13 – Troubleshooting.



EGR VALVE (STEPPER MOTOR) CHECK

Checking the Operation Sound

1. Check that the operation sound of the stepper motor can be heard from the EGR valve when the ignition switch is turned to ON (without starting the engine).
2. If the operation sound cannot be heard, check the stepper motor drive circuit.

NOTE

If the circuit is normal, the cause is probably a malfunction of the stepper motor or of the engine-A/T-ECU.

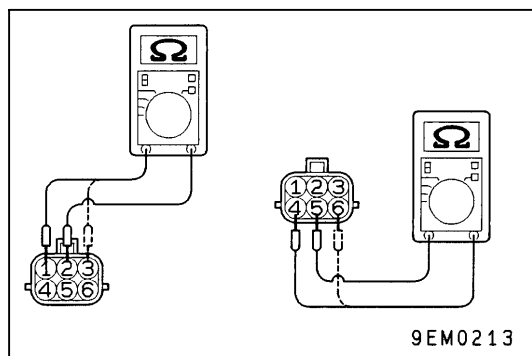
Checking the Coil Resistance

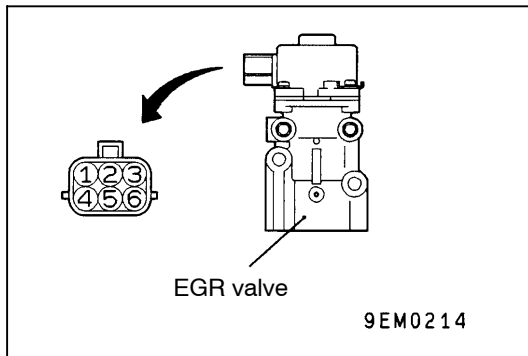
1. Disconnect the EGR valve connector.
2. Measure the resistance between the EGR valve-side connector terminal No.2 and terminal No.1 or terminal No.3.

Standard value: 10 – 20 Ω (at 20°C)

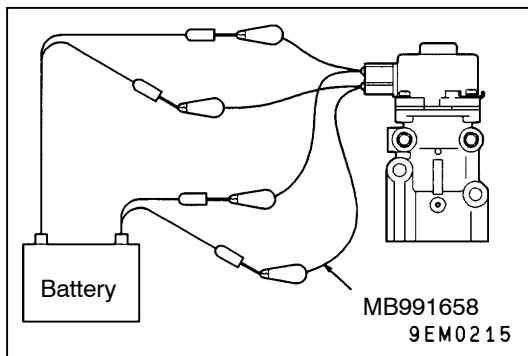
3. Measure the resistance between the EGR valve-side connector terminal No.5 and terminal No.4 or terminal No.6.

Standard value: 10 – 20 Ω (at 20°C)



**Operation Check**

1. Remove the EGR valve.
2. Connect the special tool (test harness: MB991658) to the EGR valve-side connector.
3. Connect terminal No.2 to the positive (+) terminal of the battery.
4. Connect terminal No.1 and terminal No.3 to the negative (-) terminal of battery to test if any vibration occurs (as though the stepper motor is shaking slightly) due to the operation of the stepper motor.
5. Connect terminal No.5 to the positive (+) terminal of battery.



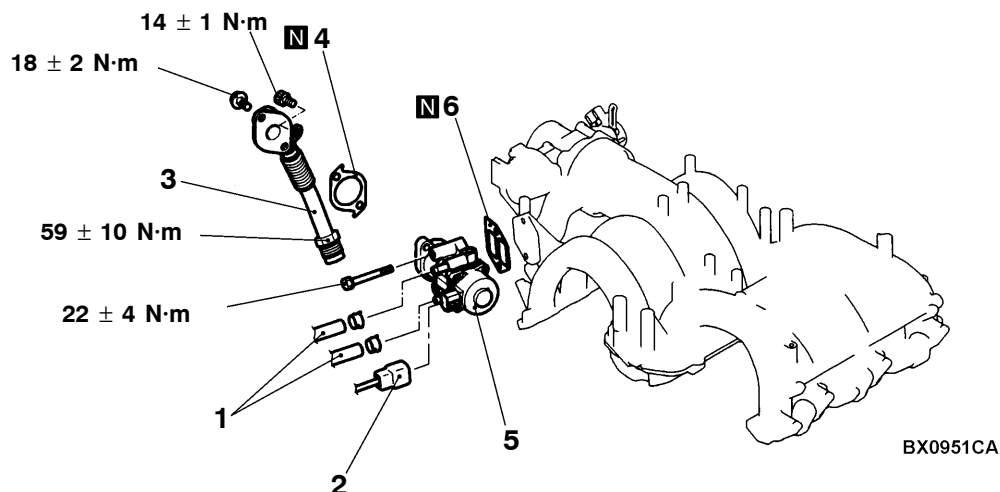
6. Connect terminal No.4 and terminal No.6 to the negative (-) terminal of battery to test if any vibration occurs (as though the stepper motor is shaking slightly) due to the operation of the stepper motor.
7. If the results of testing show that the vibration could be felt, the stepper motor is normal.

EGR VALVE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

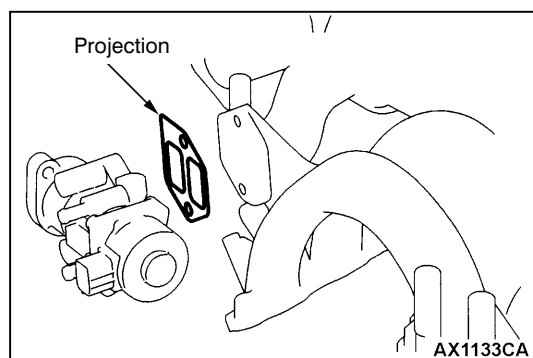
- Engine Coolant Draining and Refilling (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11A – Timing Belt.)
- Air cleaner assembly Removal and Installation (Refer to GROUP 15)



Removal steps

1. Water hose connection
2. EGR valve connector
3. EGR pipe

4. EGR pipe gasket
5. EGR valve
6. EGR valve gasket



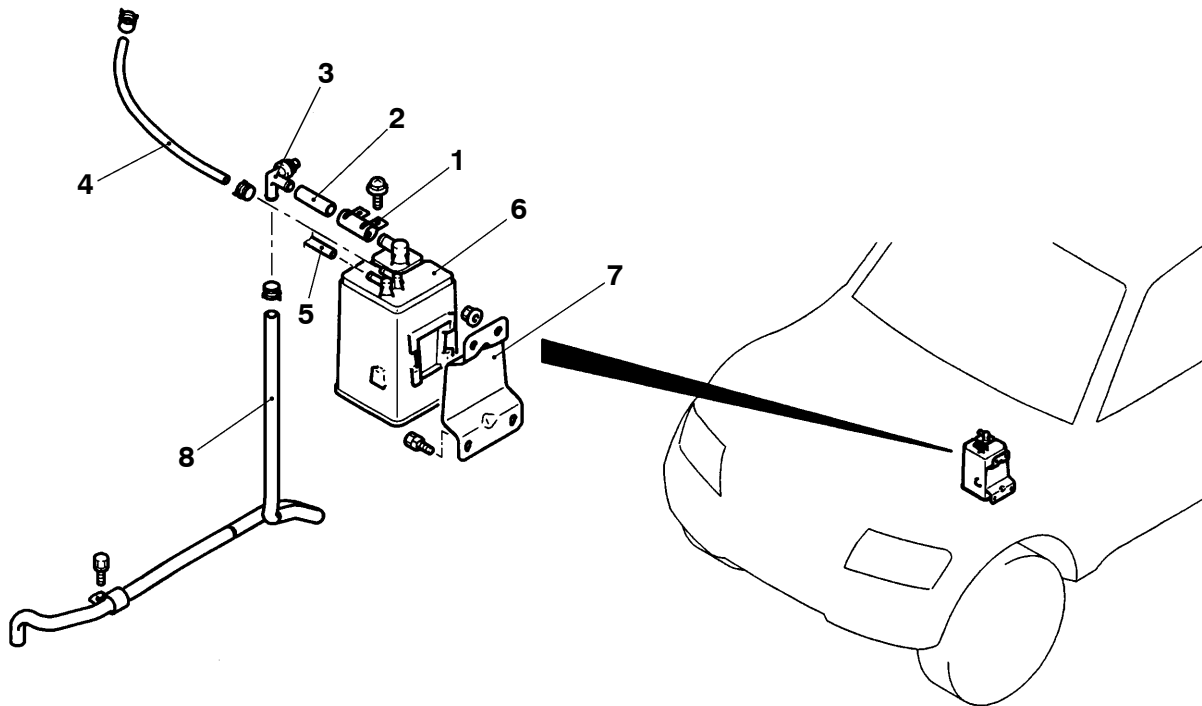
INSTALLATION SERVICE POINT

►A◄ EGR VALVE GASKET INSTALLATION

Install the gasket so that its projection faces towards the direction shown.

CANISTER

REMOVAL AND INSTALLATION



AY0288CA

Removal steps

1. Hose clip
2. Vapor hose
3. Breather valve
4. Vapor hose

5. Purge hose connection
6. Canister
7. Canister bracket
8. Vent hose

CATALYTIC CONVERTER

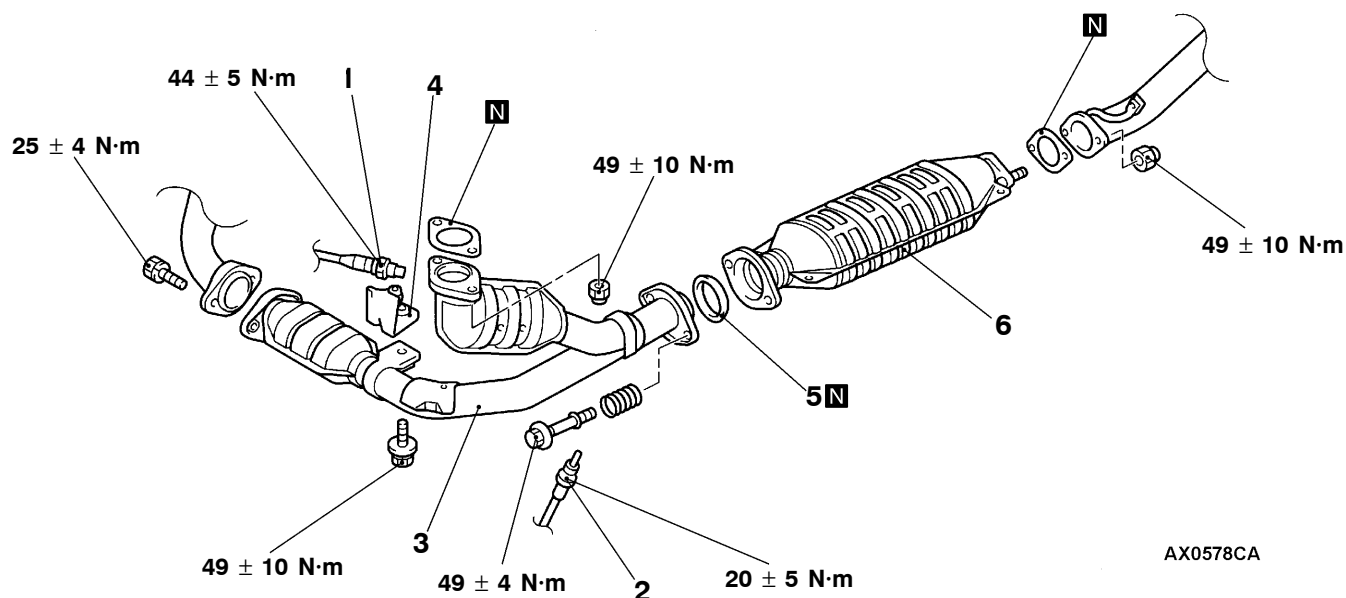
GENERAL INFORMATION

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

Pre-removal and Post-installation Operation
Under Cover Removal and Installation

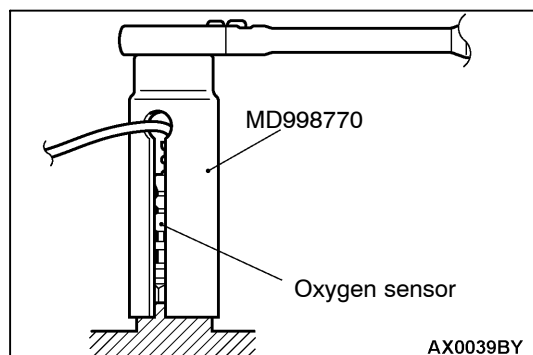


Removal steps



1. Left bank oxygen sensor
2. Catalyst temperature sensor
3. Front catalytic converter

4. Bracket
5. Seal ring
6. Catalytic converter



REMOVAL SERVICE POINTS

◀A▶ LEFT BANK OXYGEN SENSOR REMOVAL

Use special tool to remove the oxygen sensor.

INSTALLATION SERVICE POINTS

▶A◀ LEFT BANK OXYGEN SENSOR INSTALLATION

Use special tool to install the oxygen sensor.

EMISSION CONTROL SYSTEM <6G7-MPI>

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 Duty cycle 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 <Vehicles except for Australia> • 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)

NOTE

*: Vehicles with catalytic converter

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	×					17-72
Purge control solenoid valve		×				17-77
MPI system component		×	×			GROUP 13A
Catalytic converter				×		17-102
EGR valve <Vehicles except for Australia>					×	17-84
EGR control solenoid valve <Vehicles except for Australia>					×	17-86

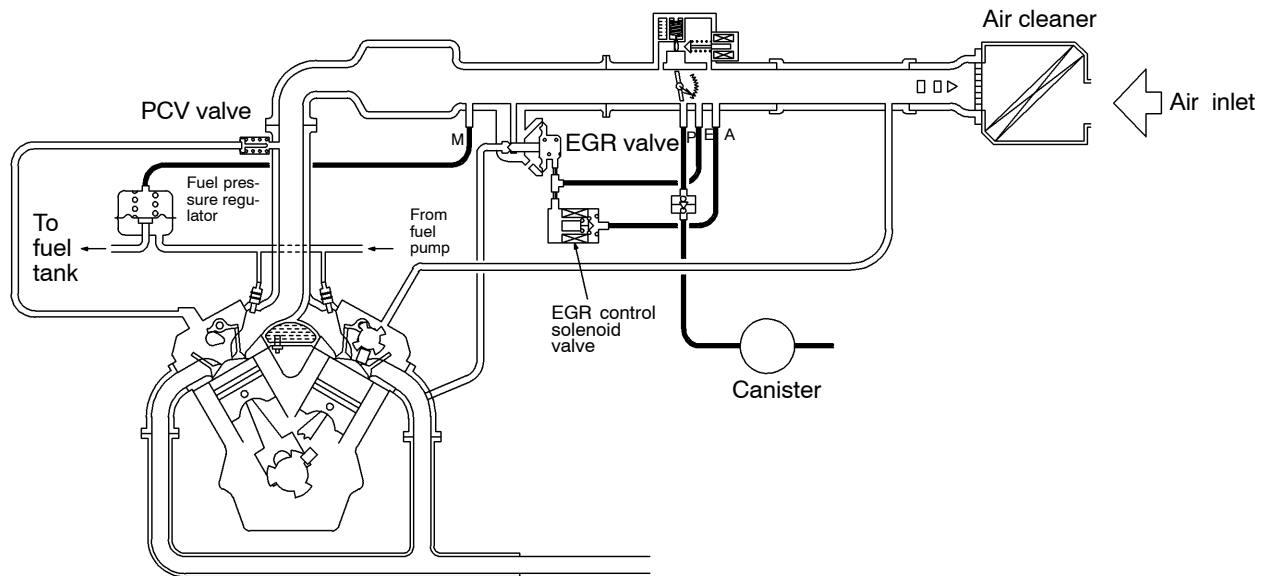
SERVICE SPECIFICATIONS

Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	30–34
EGR control solenoid valve coil resistance (at 20°C) Ω	28–36

VACUUM HOSE

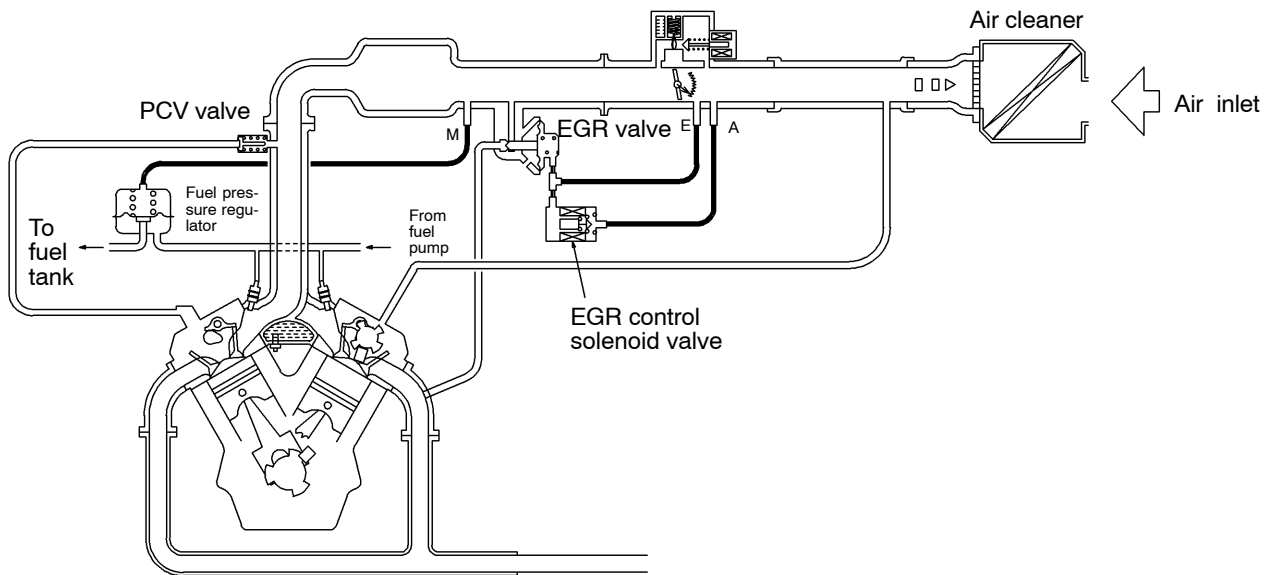
VACUUM HOSE PIPING DIAGRAM

<Vehicles for GCC>



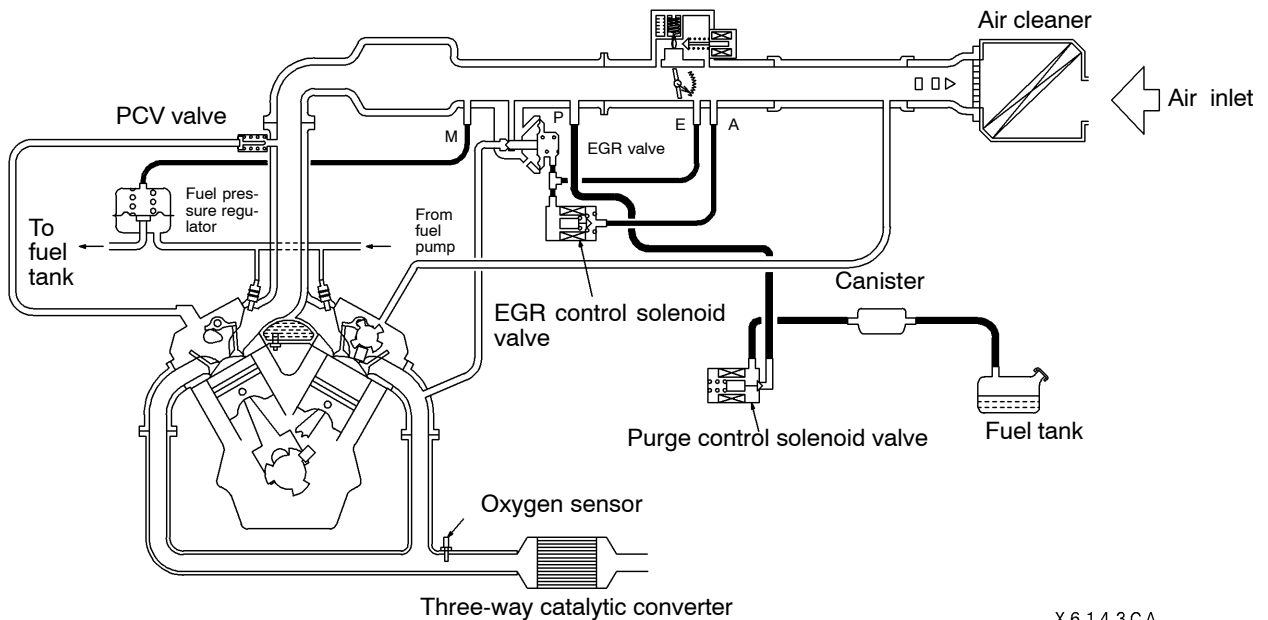
X6141CA

<Vehicles for General Export without catalytic converter, South Africa>



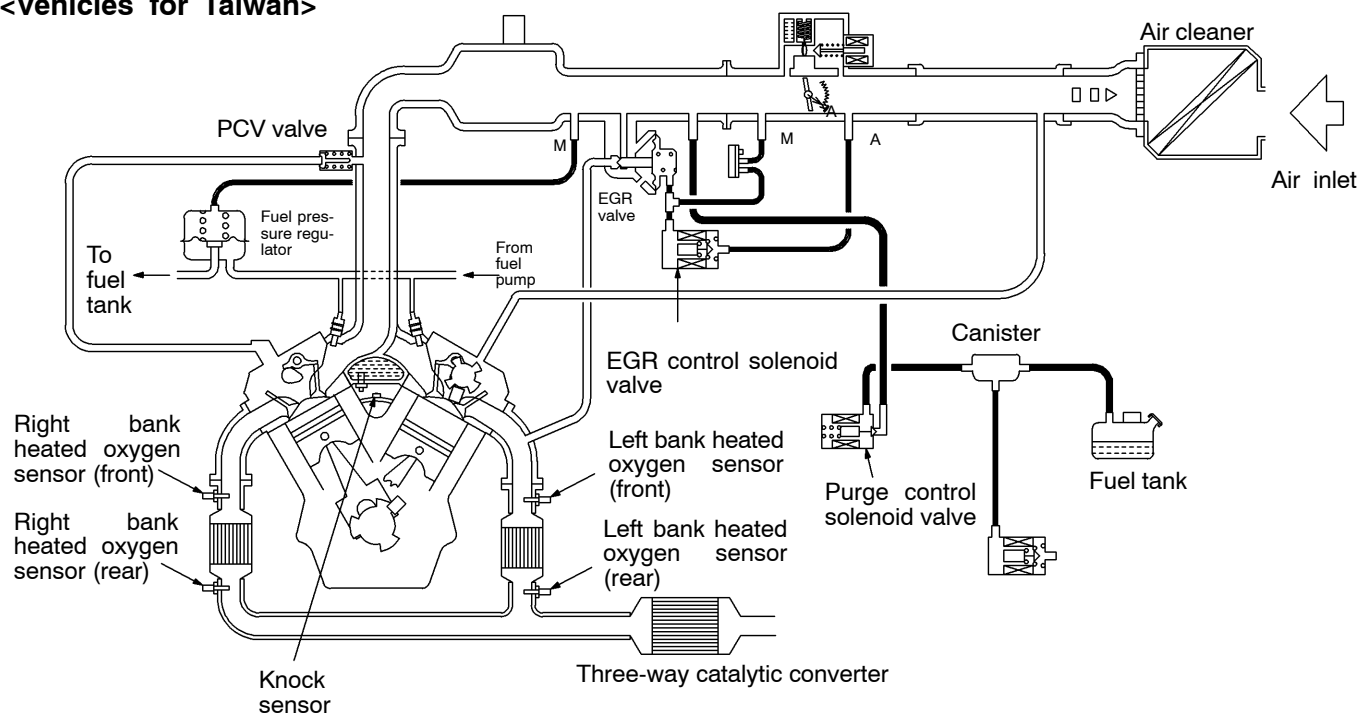
X6187CA

<Vehicles for General Export with catalytic converter, Brazil, China>



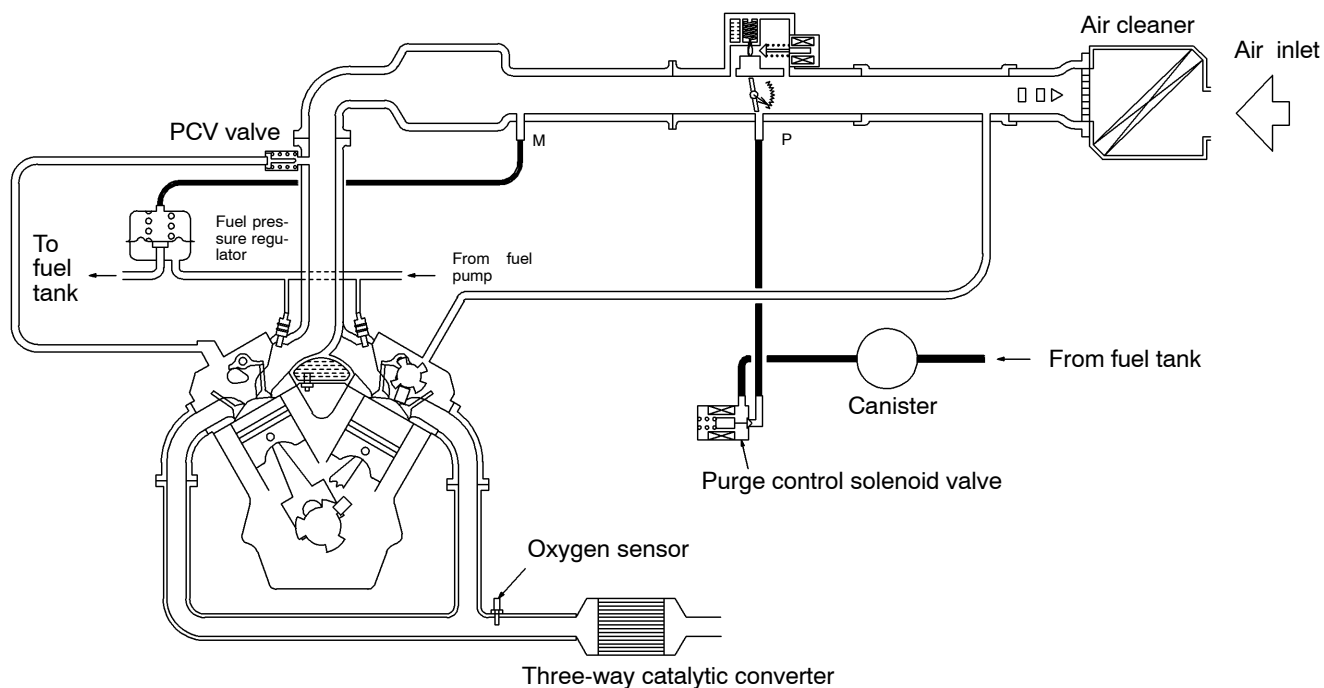
X6143CA

<Vehicles for Taiwan>



X 6 2 2 9 C A

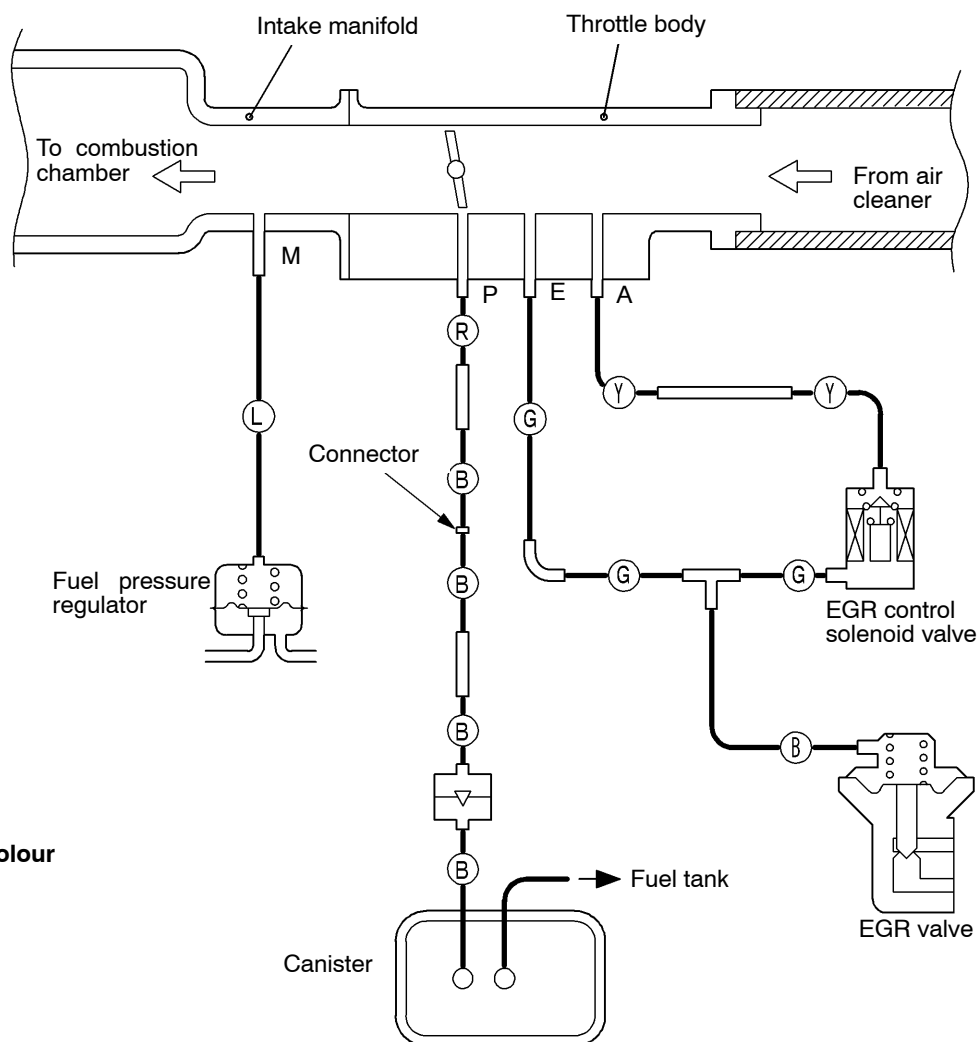
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X 6 2 0 9 C A

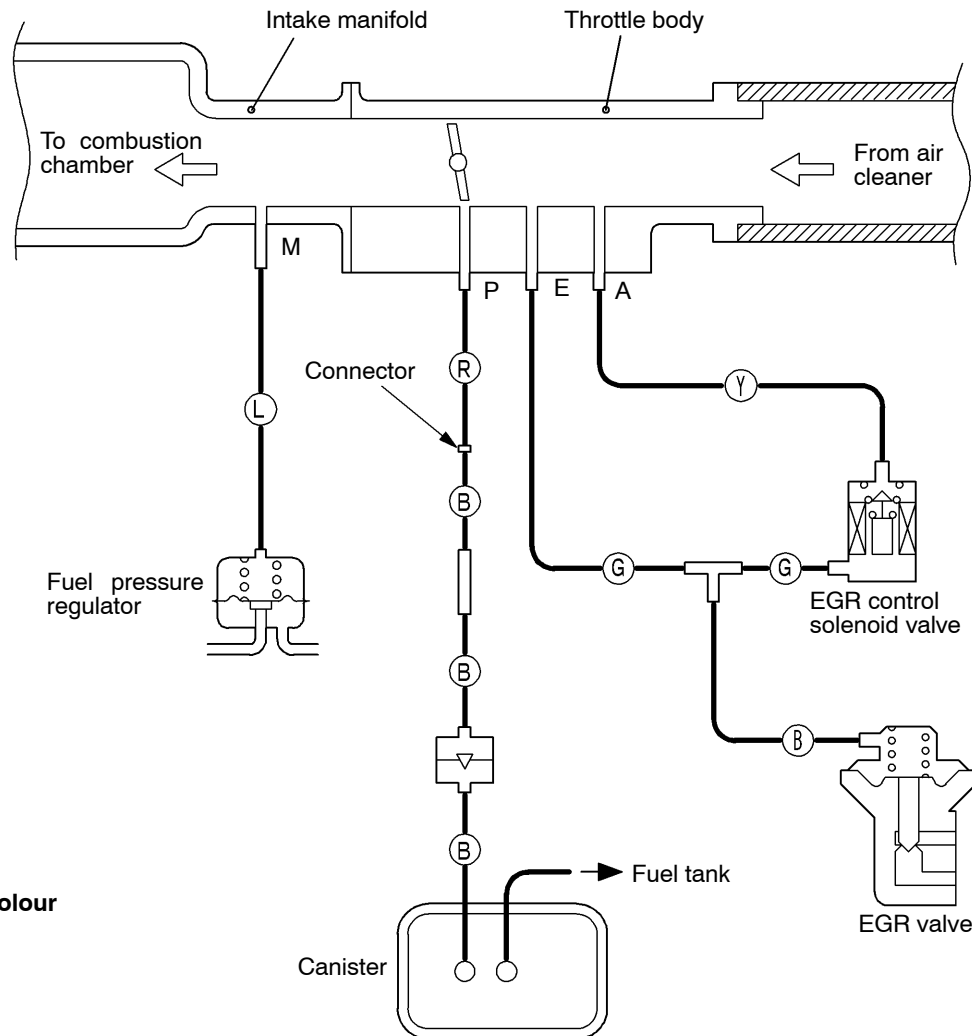
VACUUM CIRCUIT DIAGRAM

<Vehicles for GCC – 6G72>



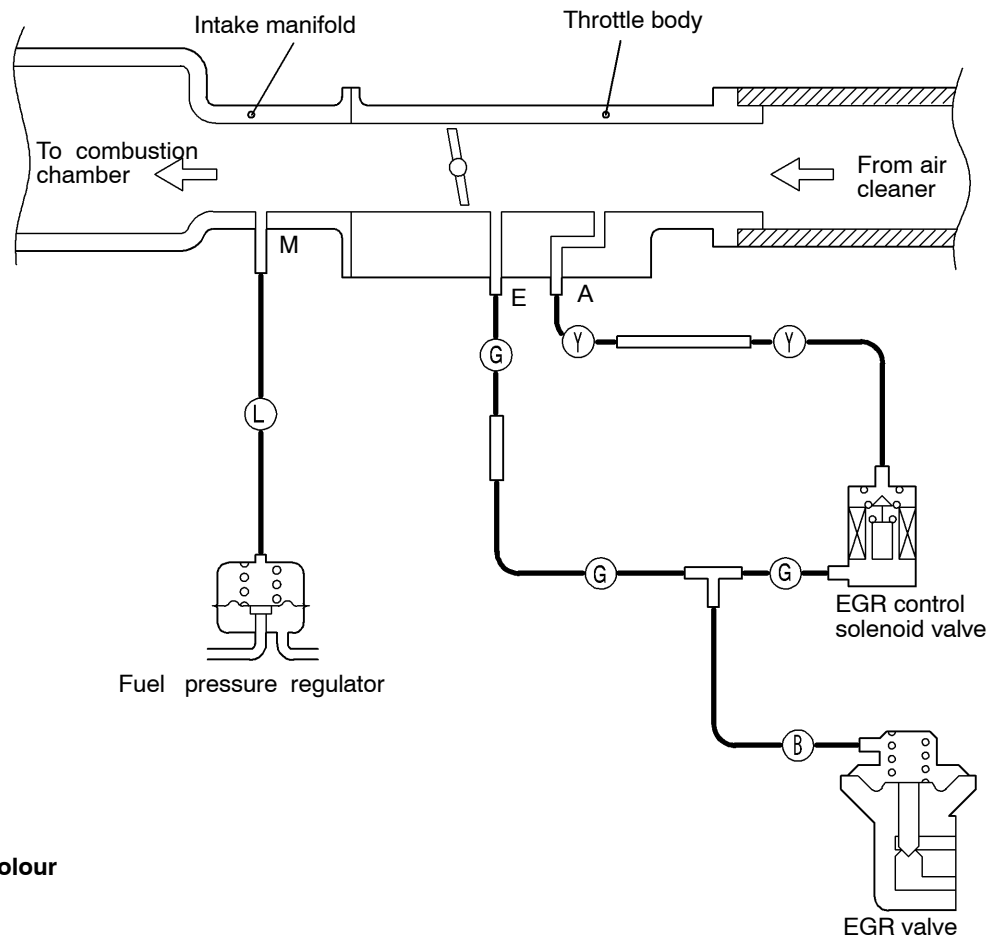
X6210CA

<Vehicles for GCC – 6G74>



X 6 2 2 7 C A

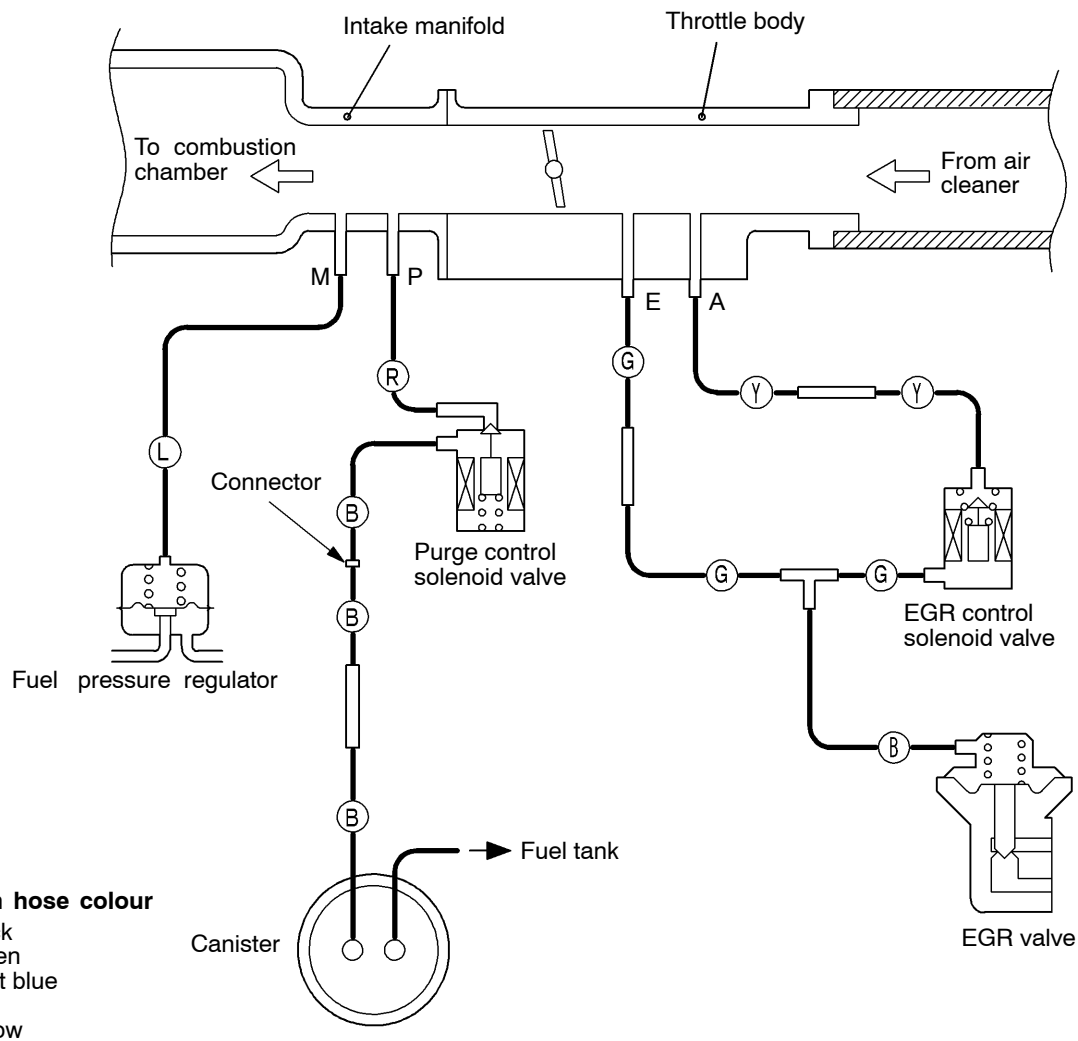
<Vehicles for General Export without catalytic converter, South Africa>

**Vacuum hose colour**

B: Black
G: Green
L: Light blue
Y: Yellow

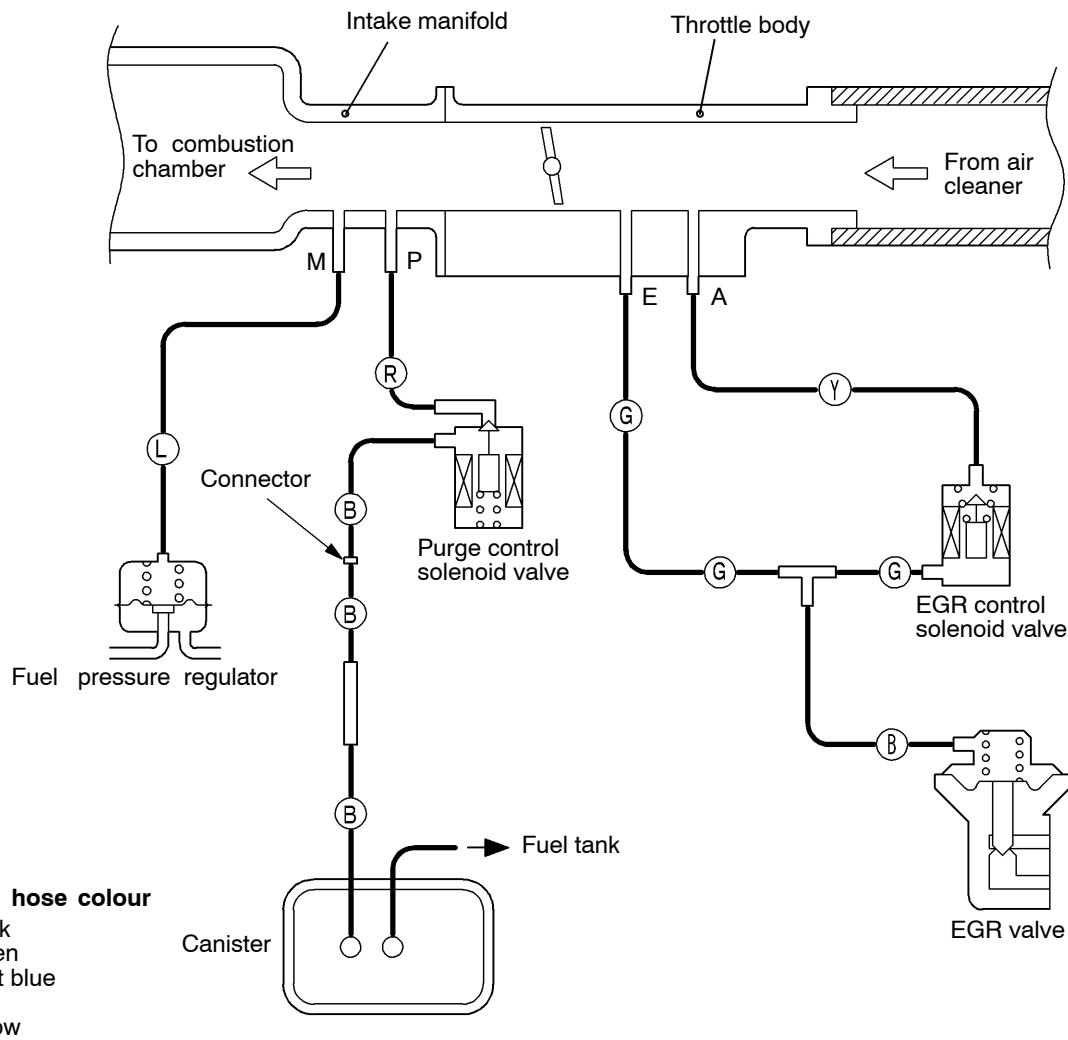
X6211CA

<Vehicles for General Export with catalytic converter – 6G72, Brazil – 6G72, China>



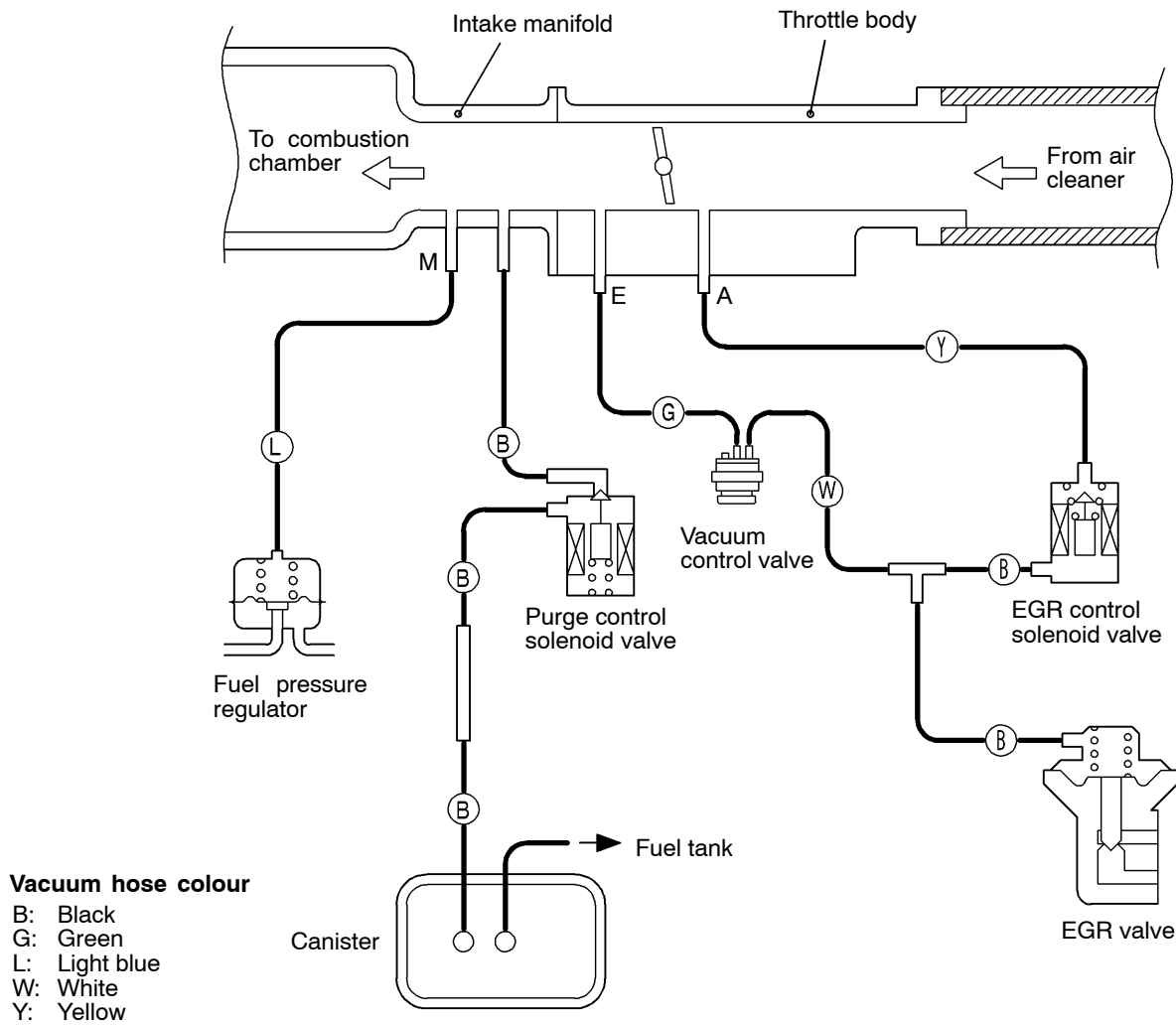
X 6 2 2 8 C A

<Vehicles for General Export with catalytic converter – 6G74, Brazil – 6G74>



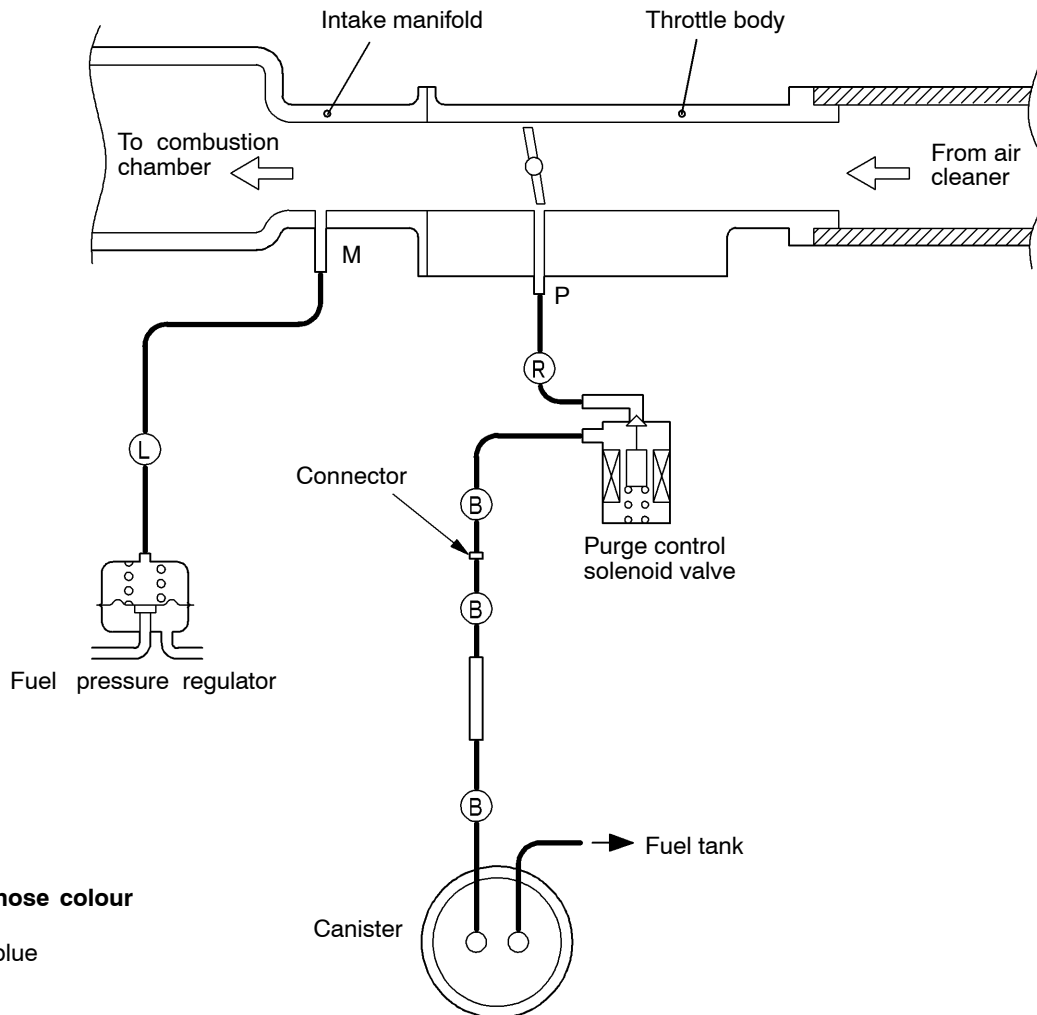
X 6 2 1 2 C A

<Vehicles for Taiwan>



X 6 2 6 8 C A

<Vehicles for Australia>



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

GENERAL INFORMATION

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

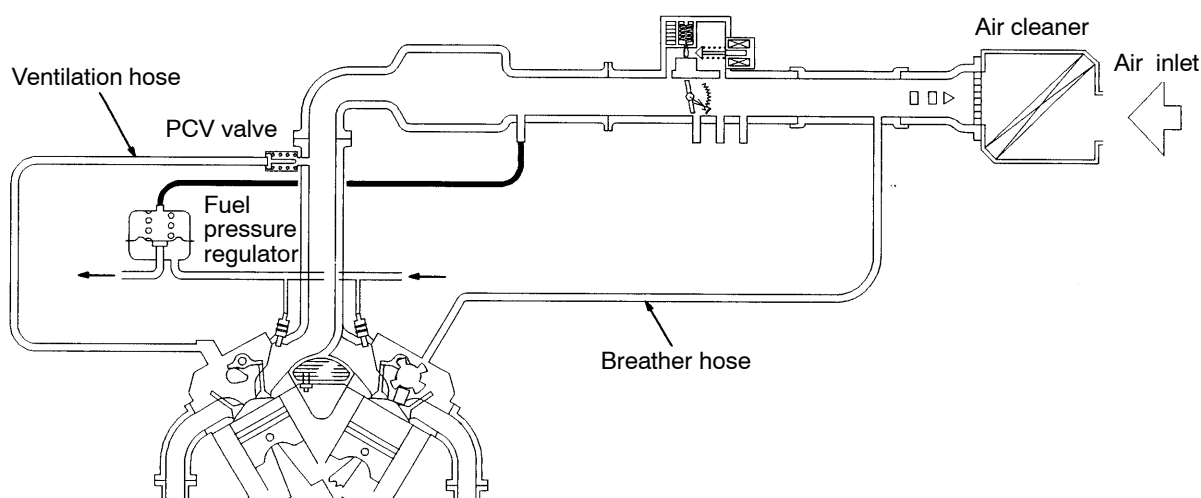
Fresh air is sent from the air cleaner into the crankcase through the breather hose. The air becomes mixed with the blow-by gases inside the crankcase.

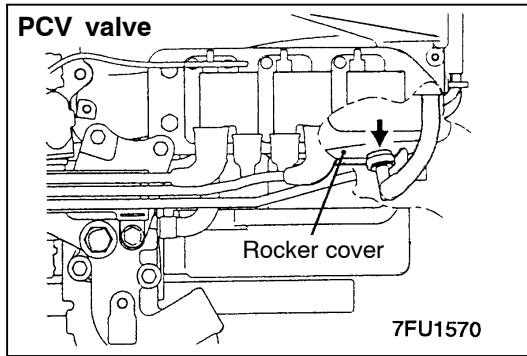
The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase

ventilation (PCV) valve.

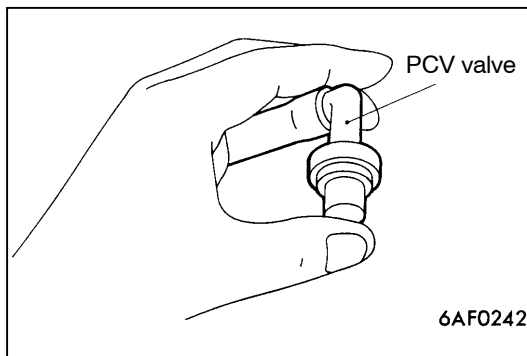
The PCV valve lifts the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly. In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



COMPONENT LOCATION**POSITIVE CRANKCASE VENTILATION SYSTEM CHECK**

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.

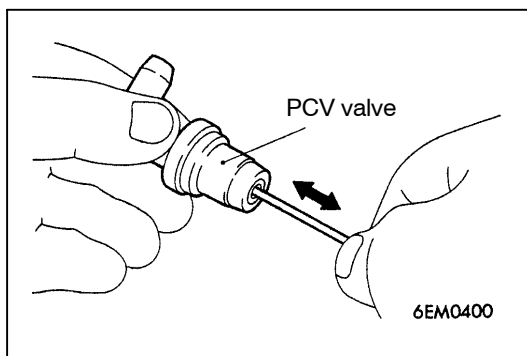


5. Place a finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

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**

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 <VEHICLES FOR GENERAL EXPORT WITH CATALYTIC CONVERTER, BRAZIL, TAIWAN, AUSTRALIA, CHINA>

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

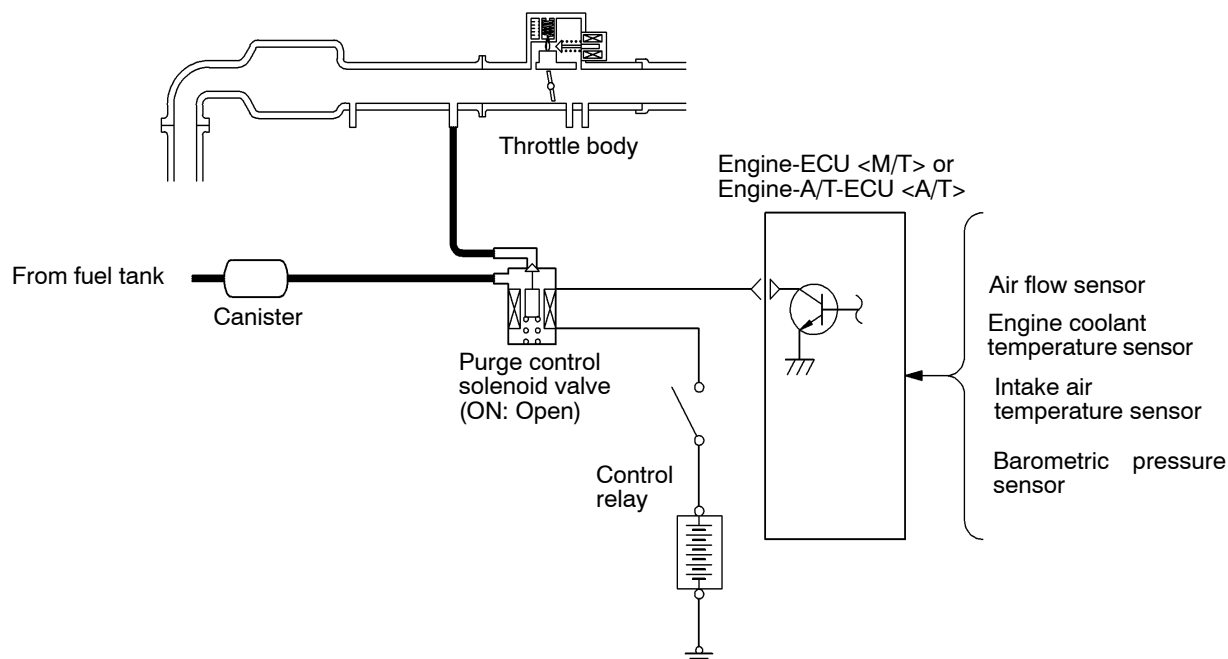
chamber.

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.

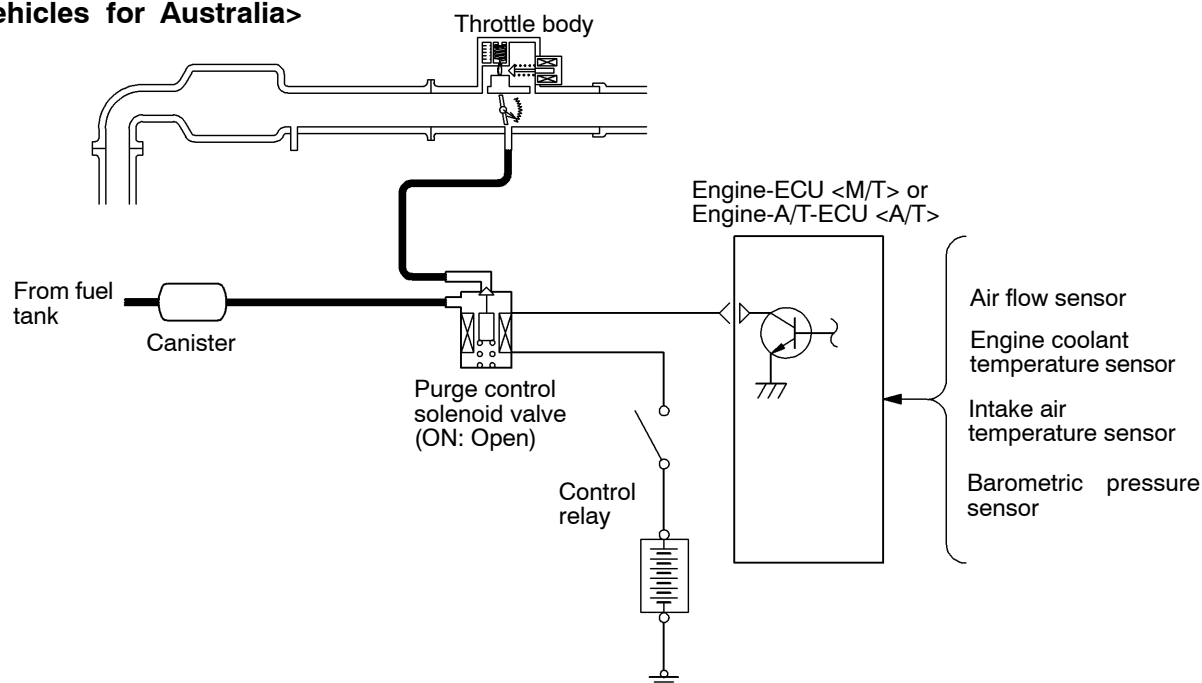
SYSTEM DIAGRAM

<Vehicles for General Export, Brazil, Taiwan, China>



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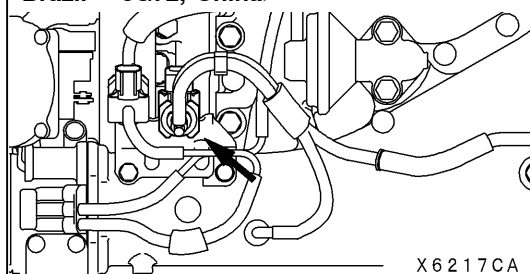
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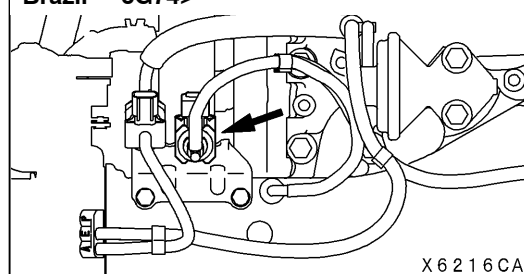
X6215CA

COMPONENT LOCATION

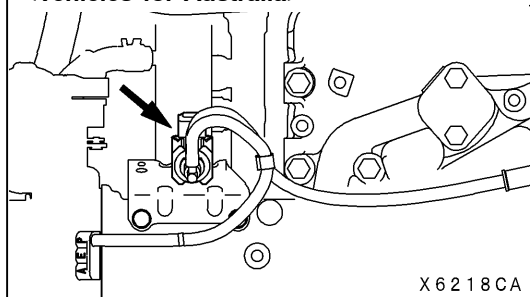
Purge control solenoid valve
 <Vehicles for General Export – 6G72,
 Brazil – 6G72, China>



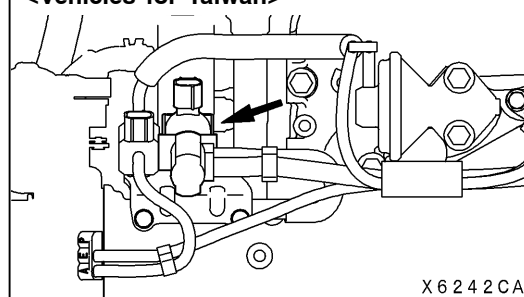
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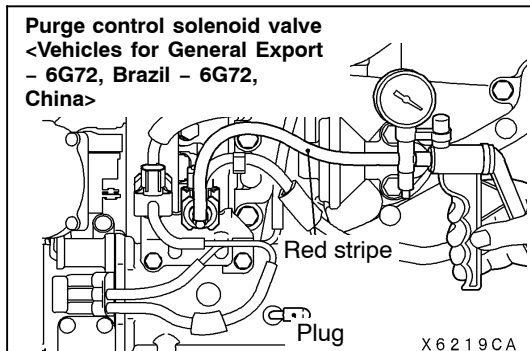
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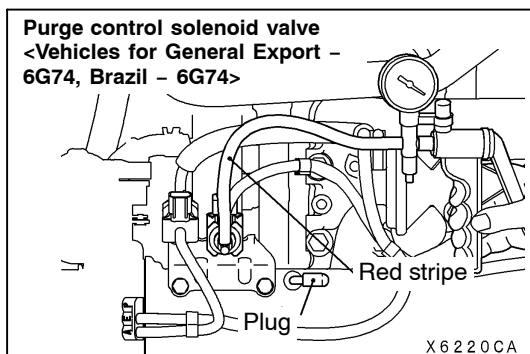
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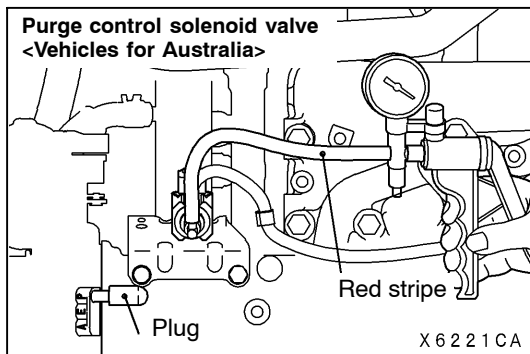
Purge control solenoid valve
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 – 6G72, Brazil – 6G72,
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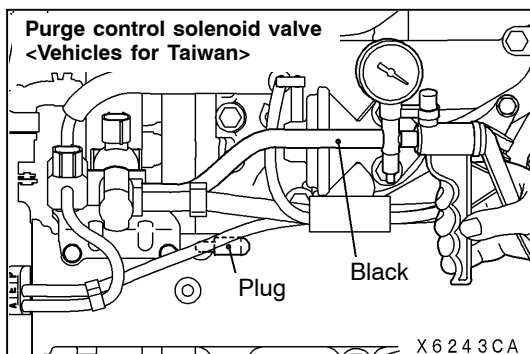
Purge control solenoid valve
 <Vehicles for General Export –
 6G74, Brazil – 6G74>



Purge control solenoid valve
 <Vehicles for Australia>



Purge control solenoid valve
 <Vehicles for Taiwan>



PURGE CONTROL SYSTEM CHECK

1. Disconnect the vacuum hose (red stripe <Vehicles except for Taiwan>, black <Vehicles for Taiwan>) from the intake manifold <Vehicles for General Export, Brazil, Taiwan, China> or throttle body <Vehicles for Australia> 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 of 53 kPa, and check the condition of the vacuum.

When engine is cold

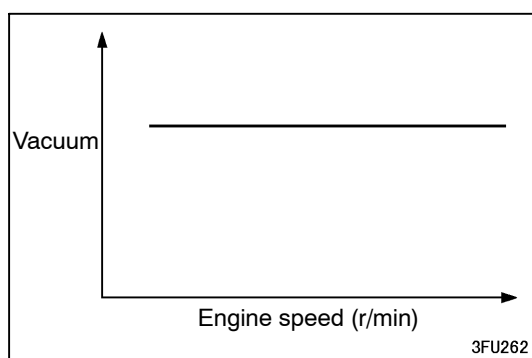
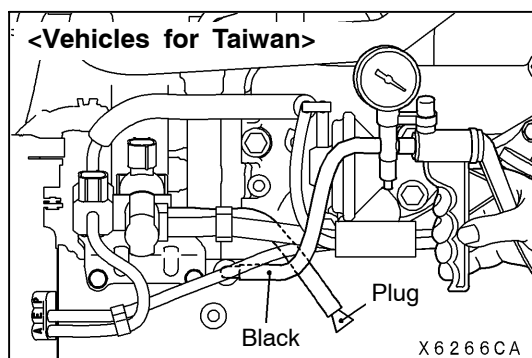
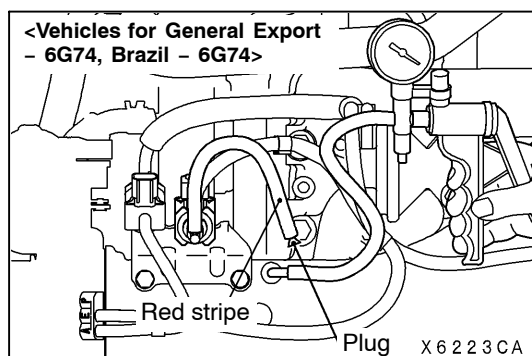
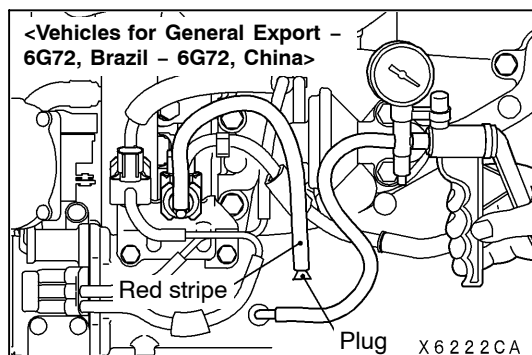
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min	

When engine is hot

(Engine coolant temperature: 80°C or higher)

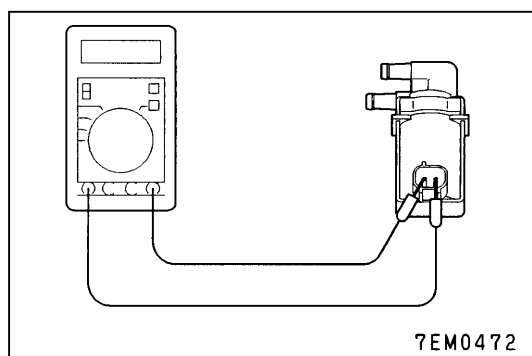
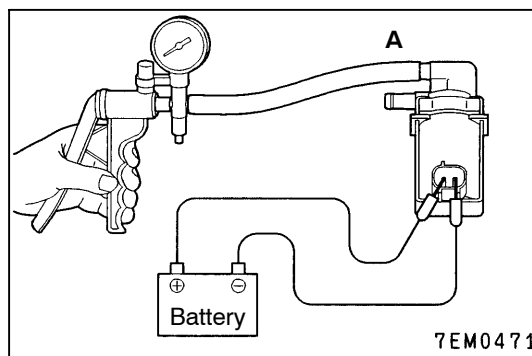
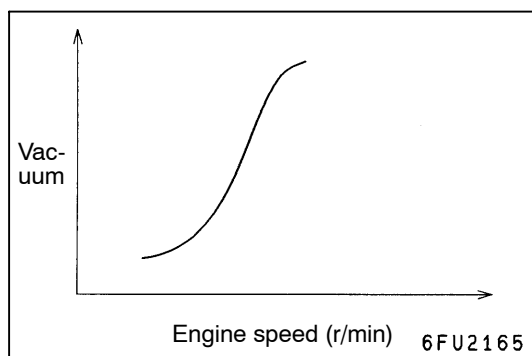
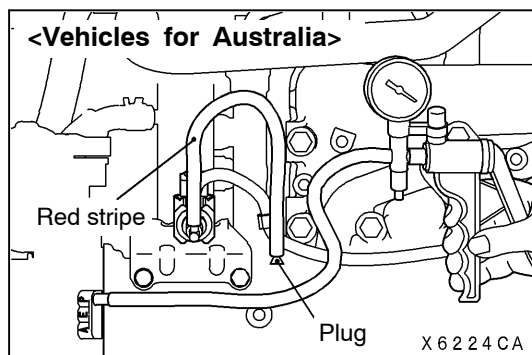
Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min (for approximately 3 minutes after the engine is started.)	Vacuum will leak.



PURGE PORT VACUUM CHECK <Vehicles except for Australia>

1. Disconnect the vacuum hose (red stripe) from the intake manifold purge vacuum nipple and connect a hand vacuum pump to the nipple.
2. Plug the vacuum hose (red stripe <Vehicles except for Taiwan>, black <Vehicles for Taiwan>).

3. Start the engine.
4. Check that a fairly constant negative pressure is generated regardless of the engine speed.
5. If no negative pressure is generated, the port is probably blocked and should be cleaned.



PURGE PORT VACUUM CHECK <Vehicles for Australia>

1. Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.
2. Plug the vacuum hose (red stripe).
3. Start the engine.
4. When the engine speed increases, the vacuum should increase in proportion to the engine speed.
5. If no, the port may be clogged.

PURGE CONTROL SOLENOID VALVE 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 (black, 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: 30 – 34 Ω (at 20°C)

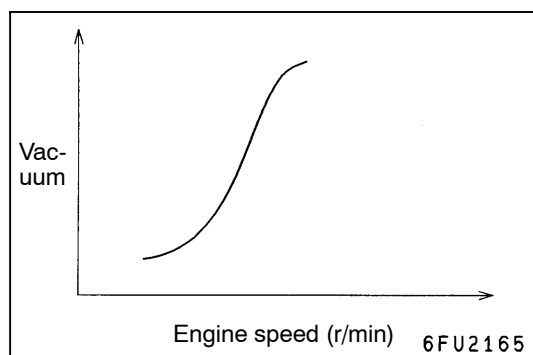
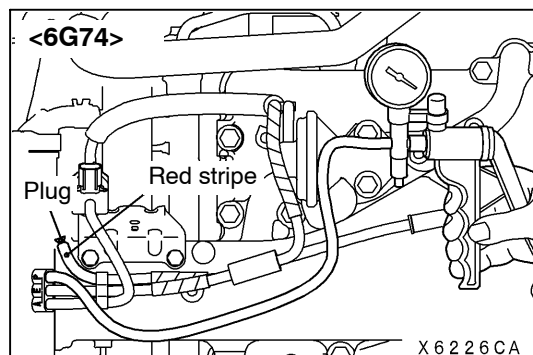
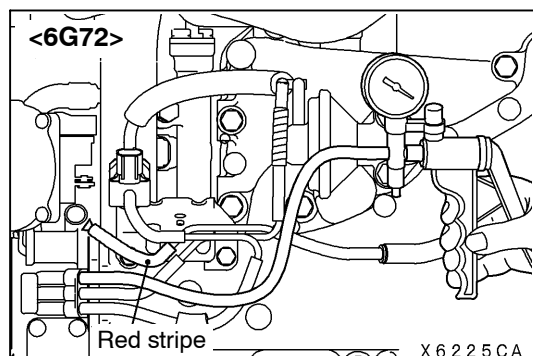
EVAPORATIVE EMISSION CONTROL SYSTEM <VEHICLES FOR GCC>

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 go into the intake manifold to be sent to the combustion chamber.



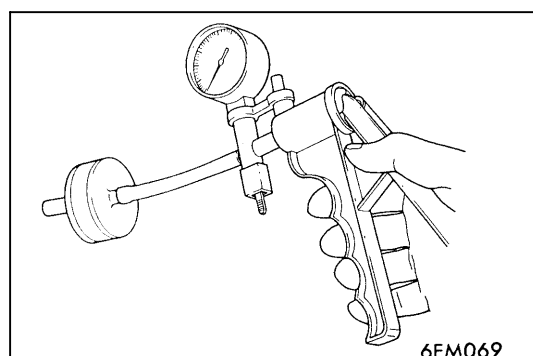
PURGE PORT VACUUM CHECK

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

3. 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.



CHECK VALVE CHECK

Connect a hand vacuum pump to the check valve, apply negative pressure and check the airtightness.

Connected nipple colour	Normal condition
Black	Negative pressure leaks
Brown	Negative pressure is maintained

EXHAUST GAS RECIRCULATION (EGR) SYSTEM <VEHICLES EXCEPT AUSTRALIA>

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.

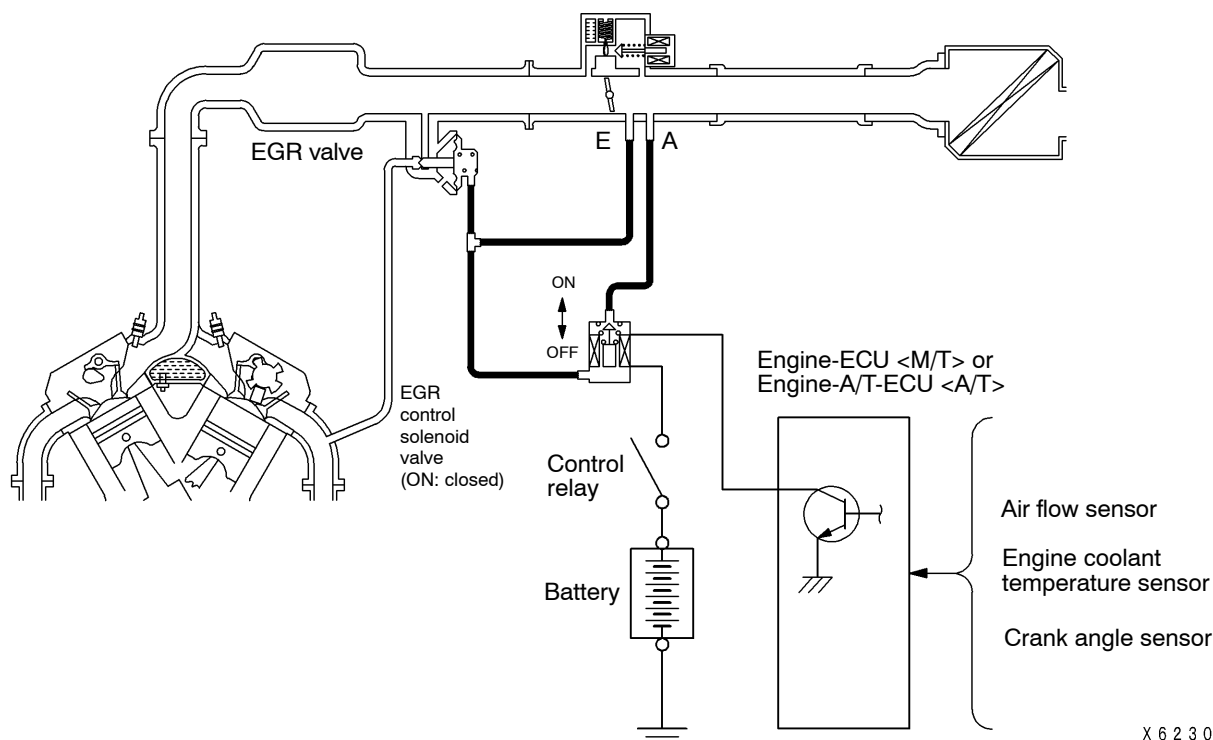
OPERATION

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.

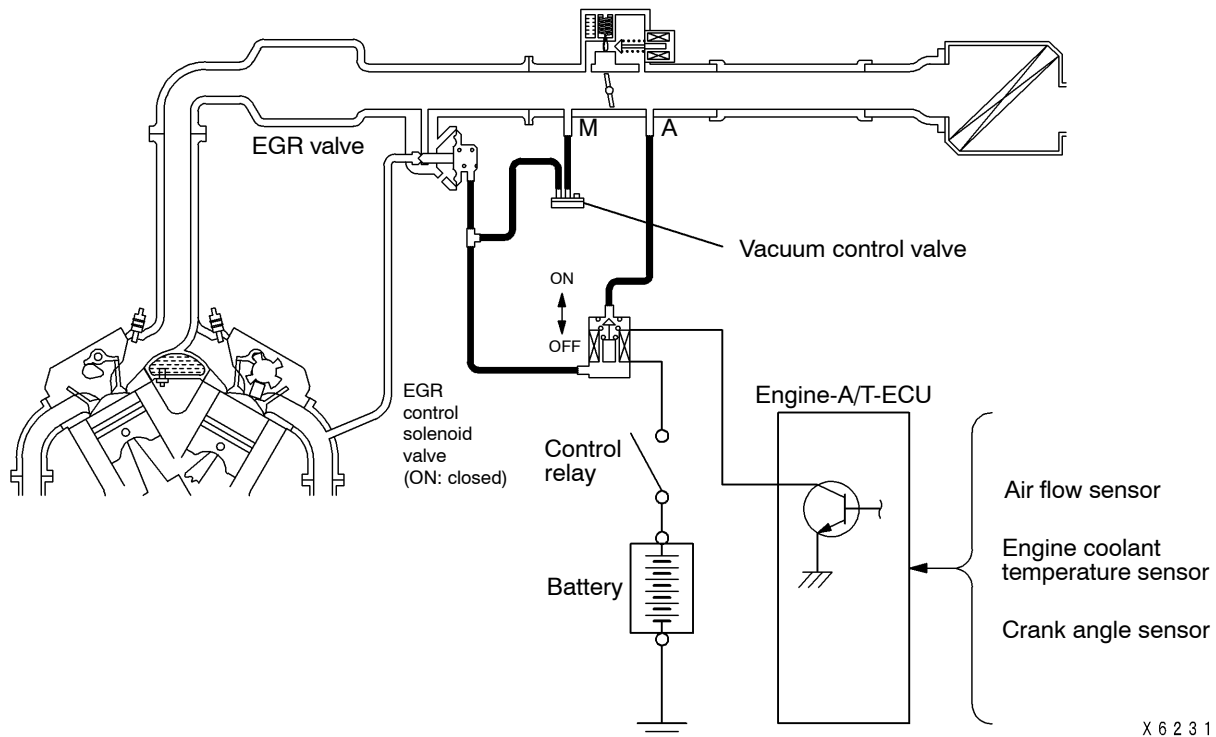
SYSTEM DIAGRAM

<Vehicles except Taiwan>



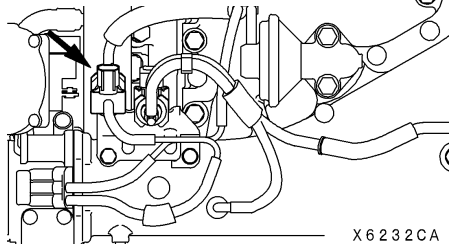
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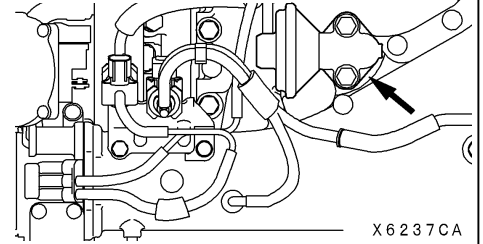


COMPONENT LOCATION

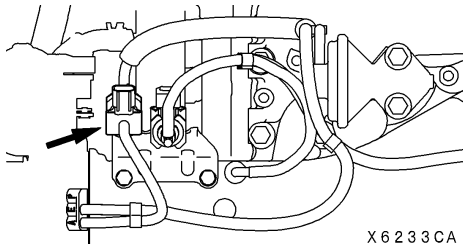
EGR control solenoid valve
 <Vehicles for General Export with catalytic converter – 6G72, Brazil – 6G72, China>



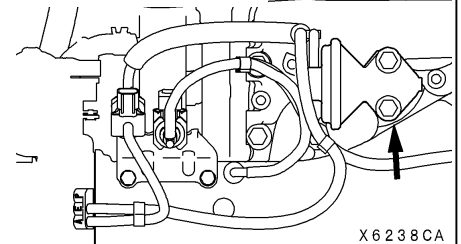
EGR valve
 <Vehicles for General Export with catalytic converter – 6G72, Brazil – 6G72, China>



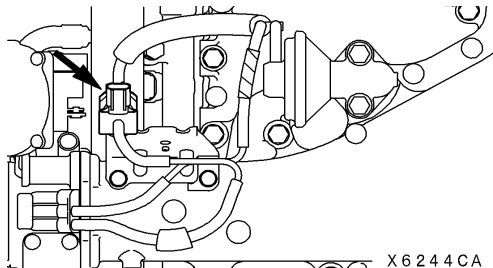
EGR control solenoid valve
 <Vehicles for General Export with catalytic converter – 6G74, Brazil – 6G74>



EGR valve
 <Vehicles for General Export with catalytic converter – 6G74, Brazil – 6G74>

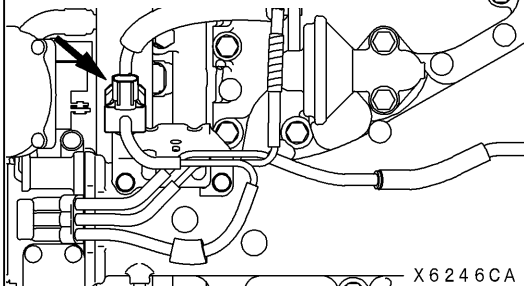


EGR control solenoid valve
<Vehicles for General Export without catalytic converter, South Africa>



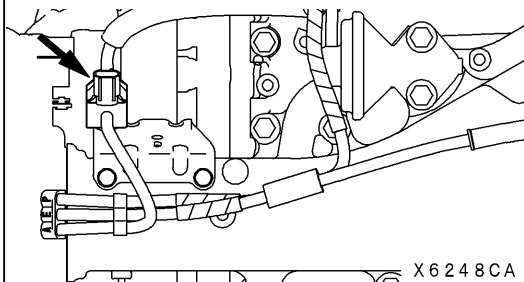
X6244CA

EGR control solenoid valve
<Vehicles for GCC - 6G72>



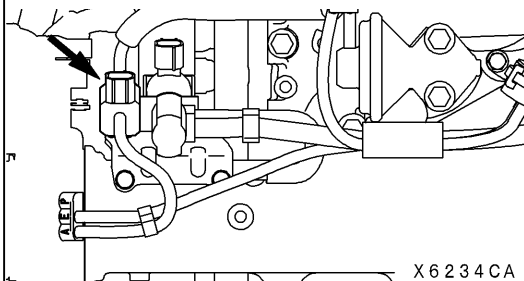
X6246CA

EGR control solenoid valve
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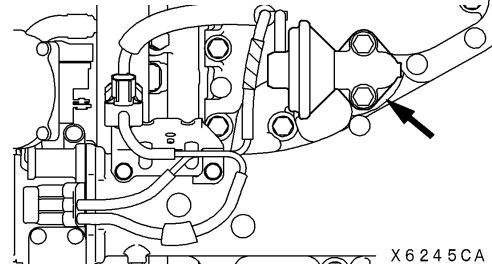
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EGR control solenoid valve
<Vehicles for Taiwan>



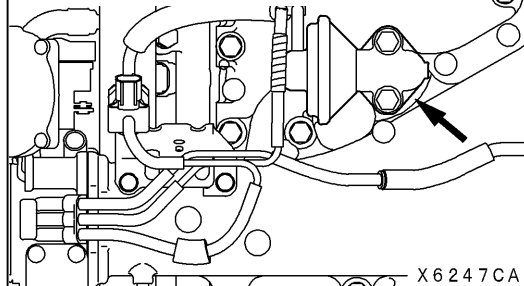
X6234CA

EGR valve
<Vehicles for General Export without catalytic converter, South Africa>



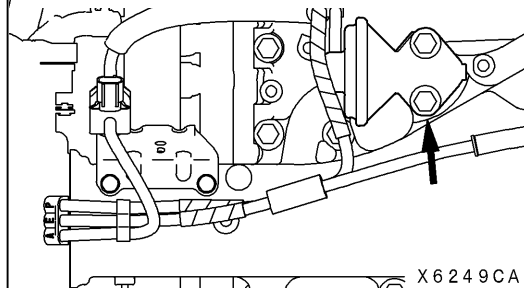
X6245CA

EGR valve
<Vehicles for GCC - 6G72>



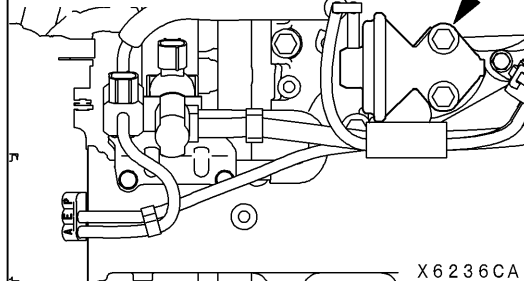
X6247CA

EGR valve
<Vehicles for GCC - 6G74>



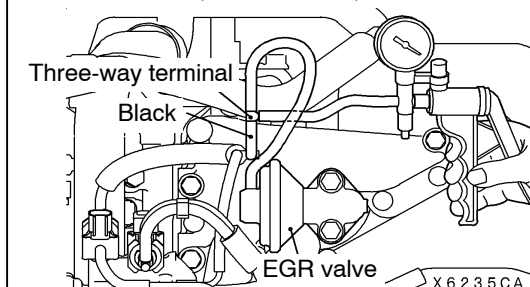
X6249CA

EGR valve
<Vehicles for Taiwan>

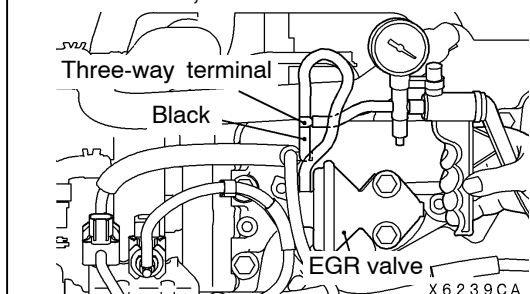


X6236CA

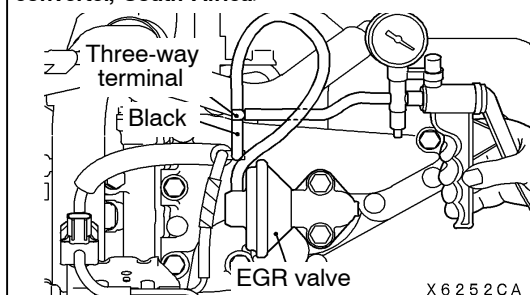
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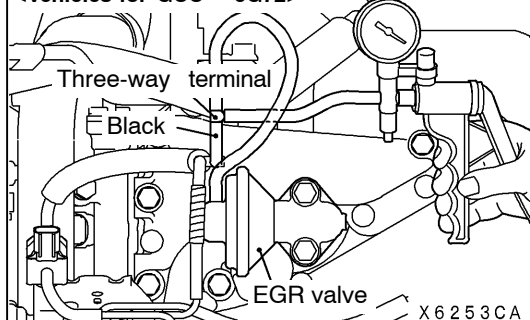
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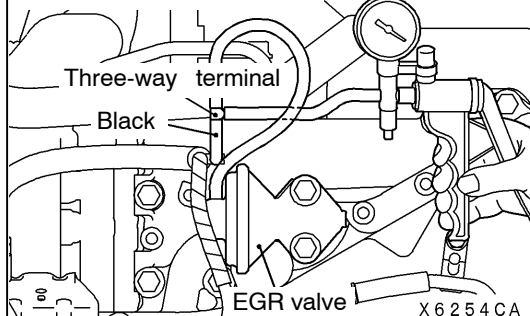
<Vehicles for General Export without catalytic converter, South Africa>



<Vehicles for GCC – 6G72>



<Vehicles for GCC – 6G74>



EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

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.)

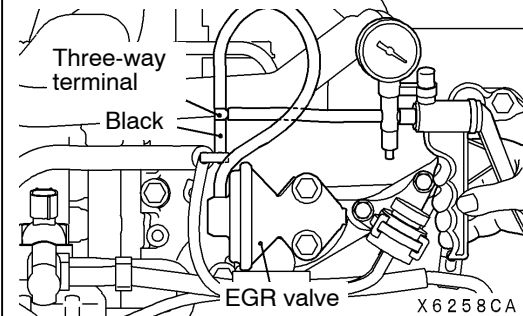
When engine is hot

(Engine coolant temperature: 80°C or higher)

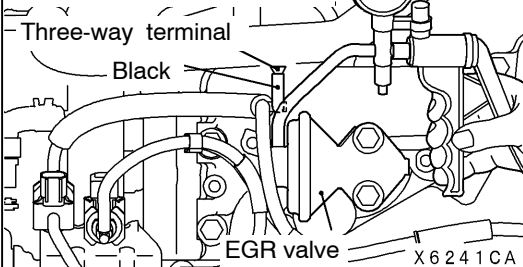
Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 13 kPa

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.

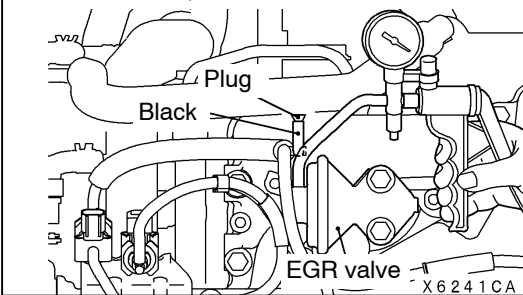
<Vehicles for Taiwan>



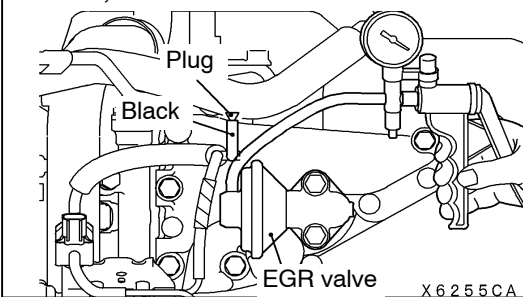
<Vehicles for General Export with catalytic converter – 6G72, Brazil – 6G72, China>



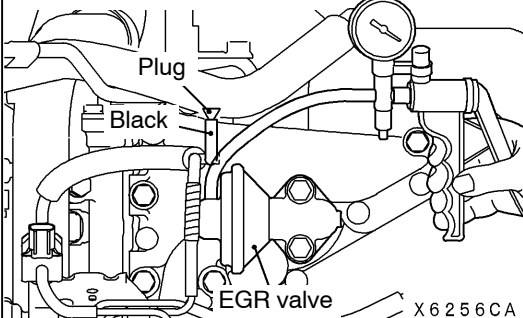
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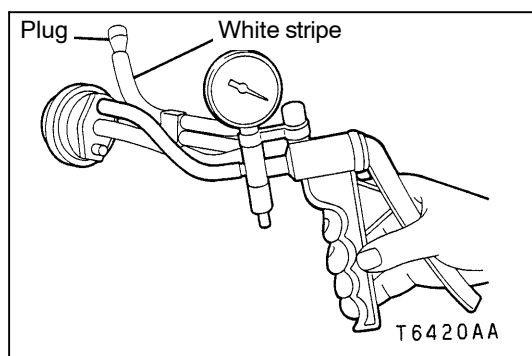
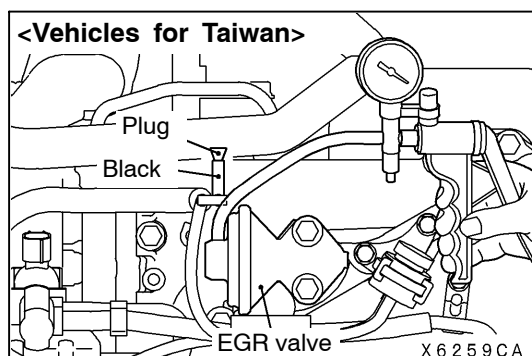
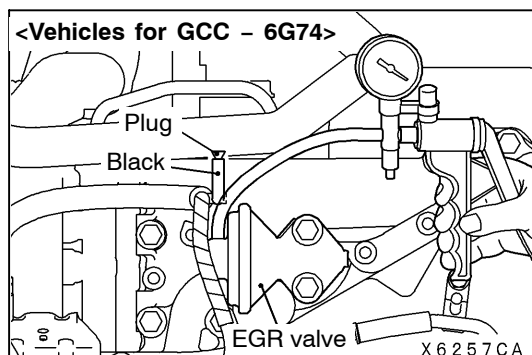


<Vehicles for General Export without catalytic converter, South Africa>



<Vehicles for GCC – 6G72>





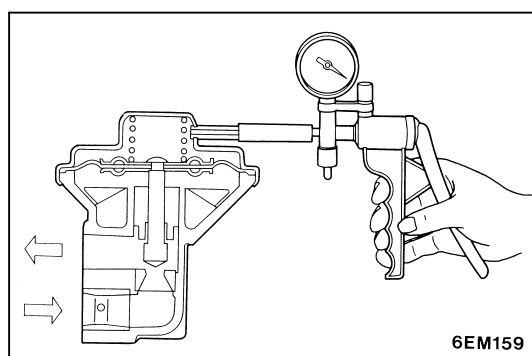
VACUUM CONTROL VALVE CHECK <VEHICLES FOR TAIWAN>

1. Disconnect the vacuum hose (white stripe) from the vacuum control valve and connect the hand vacuum pump to the vacuum control valve.
2. Plug the end of the removed vacuum hose.
3. Start the engine and run at idle.
4. Check the vacuum condition.

Engine condition	Normal vacuum condition
Idling	Approximately 23 kPa

EGR VALVE CHECK

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.

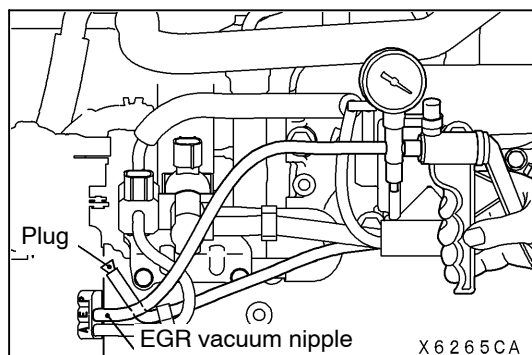


4. Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

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

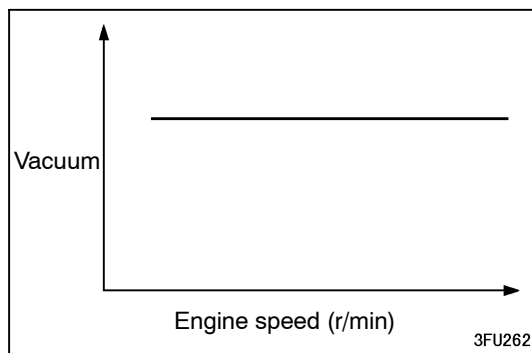
5. Replace the gasket, and tighten to the specified torque.

Tightening torque: 22 Nm

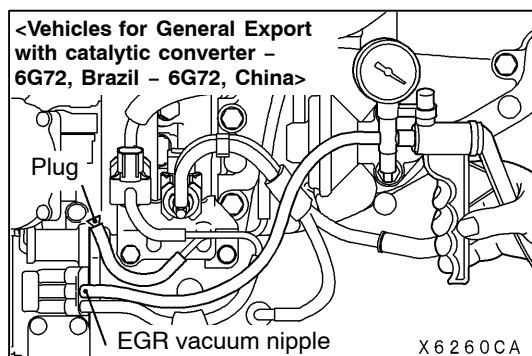


EGR PORT VACUUM CHECK <VEHICLES FOR TAIWAN>

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

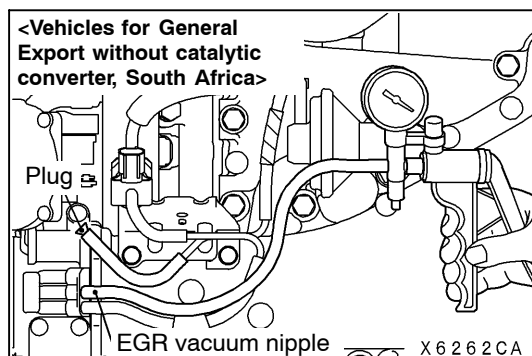
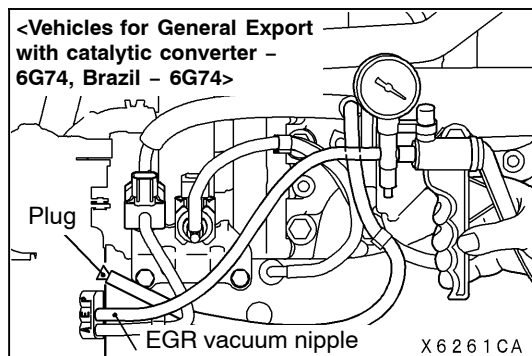


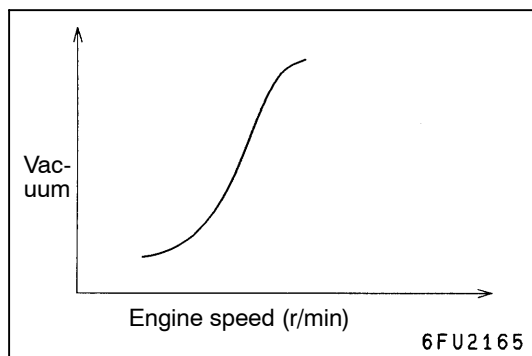
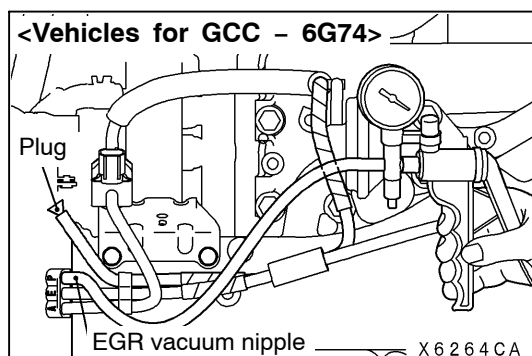
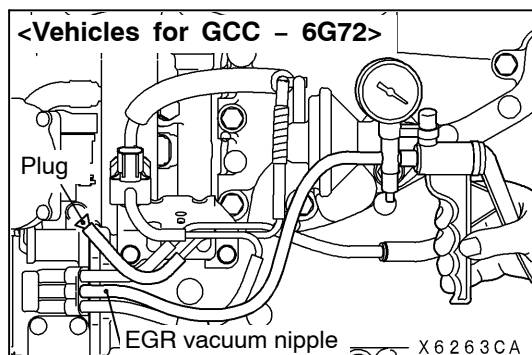
3. Start the engine.
4. Check that a fairly constant negative pressure is generated regardless of the engine speed.
5. If no negative pressure is generated, the port is probably blocked and should be cleaned.



EGR PORT VACUUM CHECK <VEHICLES EXCEPT TAIWAN>

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

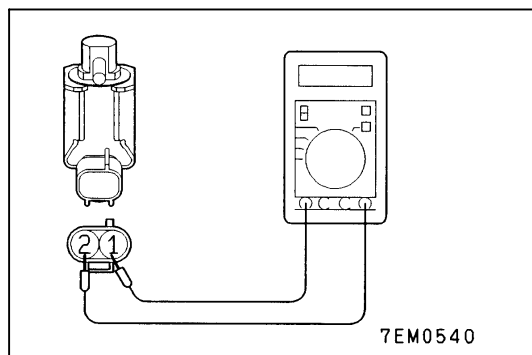
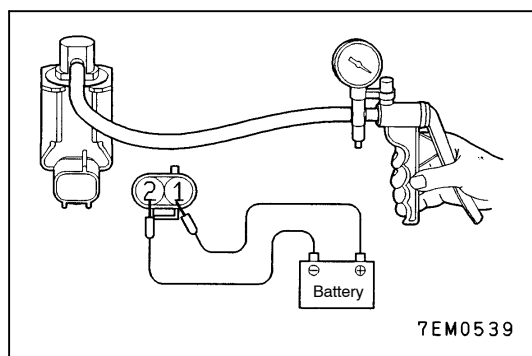




3. Start the engine and check vacuum remains fairly constant after racing the engine.

NOTE

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



EGR CONTROL SOLENOID VALVE CHECK

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

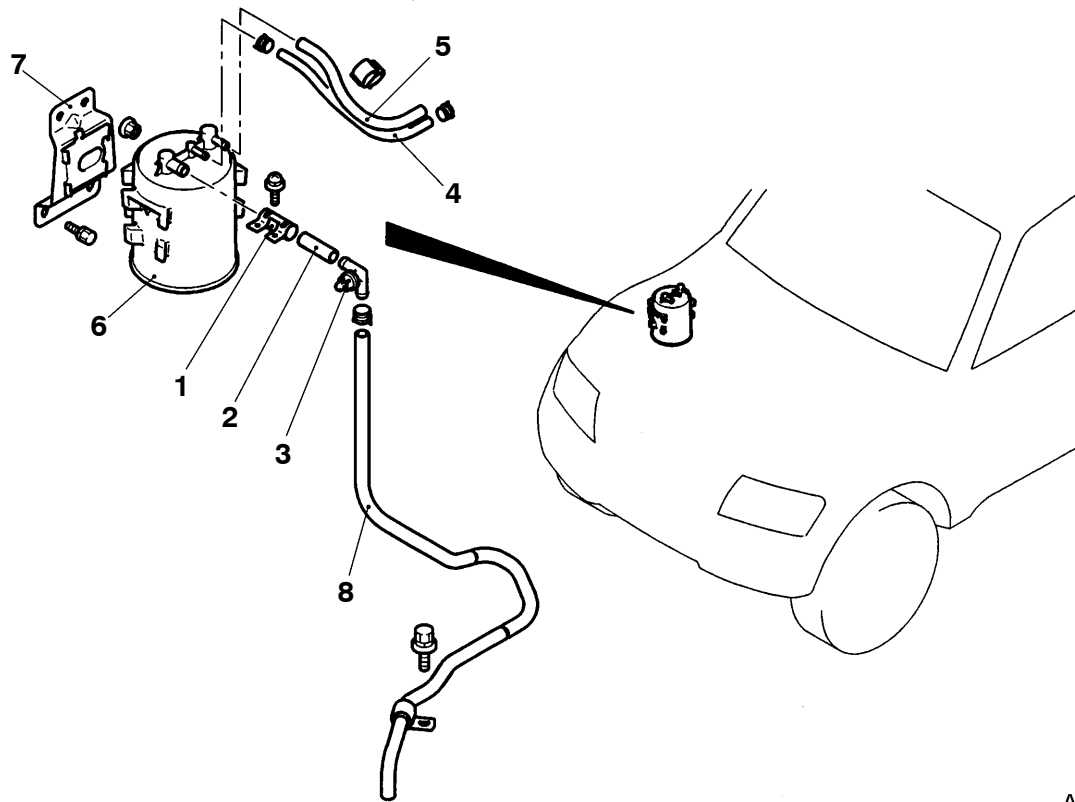
5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 28 – 36Ω (at 20°C)

CANISTER

REMOVAL AND INSTALLATION

<Vehicles except for Taiwan>



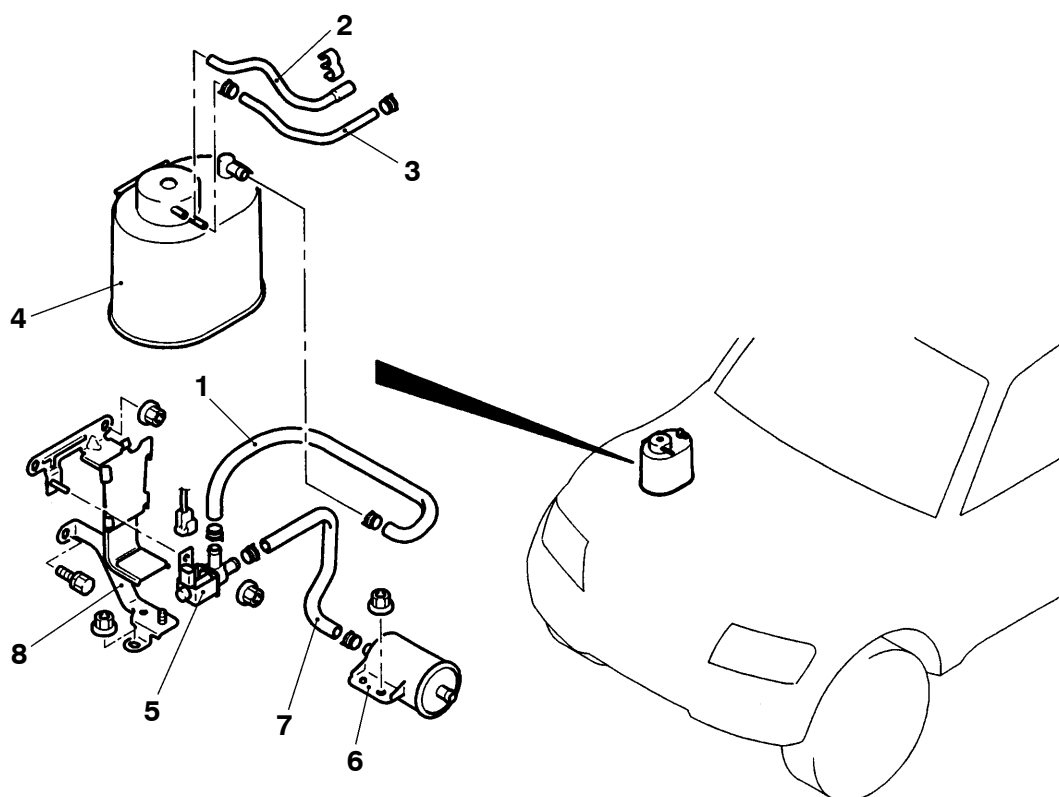
AY0287CA

Removal steps

1. Hose clip
2. Vapor hose
3. Breather valve
4. Vapor hose

5. Purge hose
6. Canister
7. Canister bracket
8. Vent hose

<Vehicles for Taiwan>

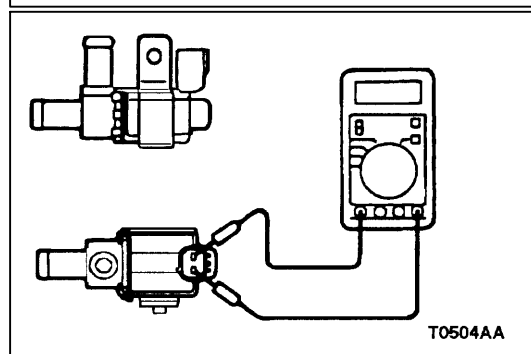
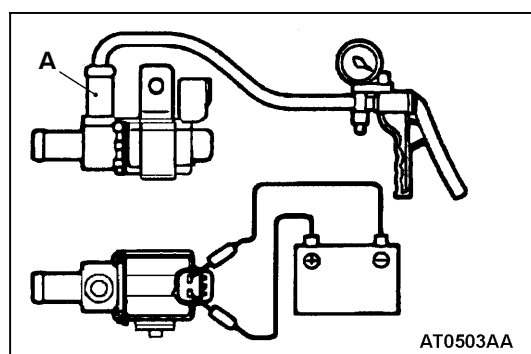


AY0293CA

Removal steps

1. Vent hose
2. Purge hose
3. Vapor hose
4. Canister

5. Vent solenoid valve
6. Air filter
7. Vent hose
8. Canister bracket

**INSPECTION****VENT SOLENOID VALVE CHECK**

1. Connect a hand vacuum pump to nipple (A) of the vent solenoid valve.
2. Check air tightness by applying a vacuum with voltage applied directly from the battery to the solenoid and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum maintained
Not applied	Vacuum leaks

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

Standard value: 17 – 21 Ω (at 20°C)

4. Replace the solenoid valve if the resistance is out of specification.

AIR FILTER CHECK

Remove the air filter. Check the air filter and water drain hole are not clogged by breathing air into either nipple.

CATALYTIC CONVERTER

GENERAL INFORMATION

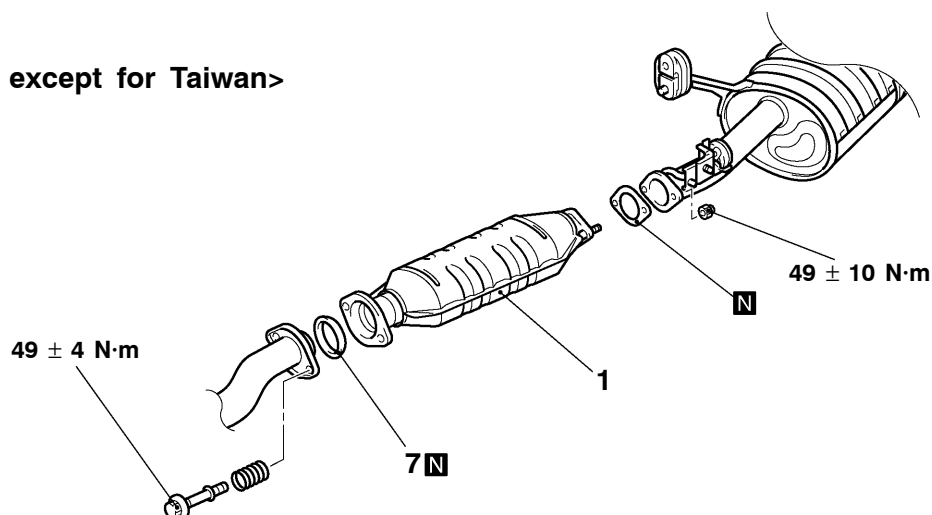
The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidizes carbon monoxides (CO) and hydrocarbons (HC) and reduces nitrogen oxides (NOx).

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.

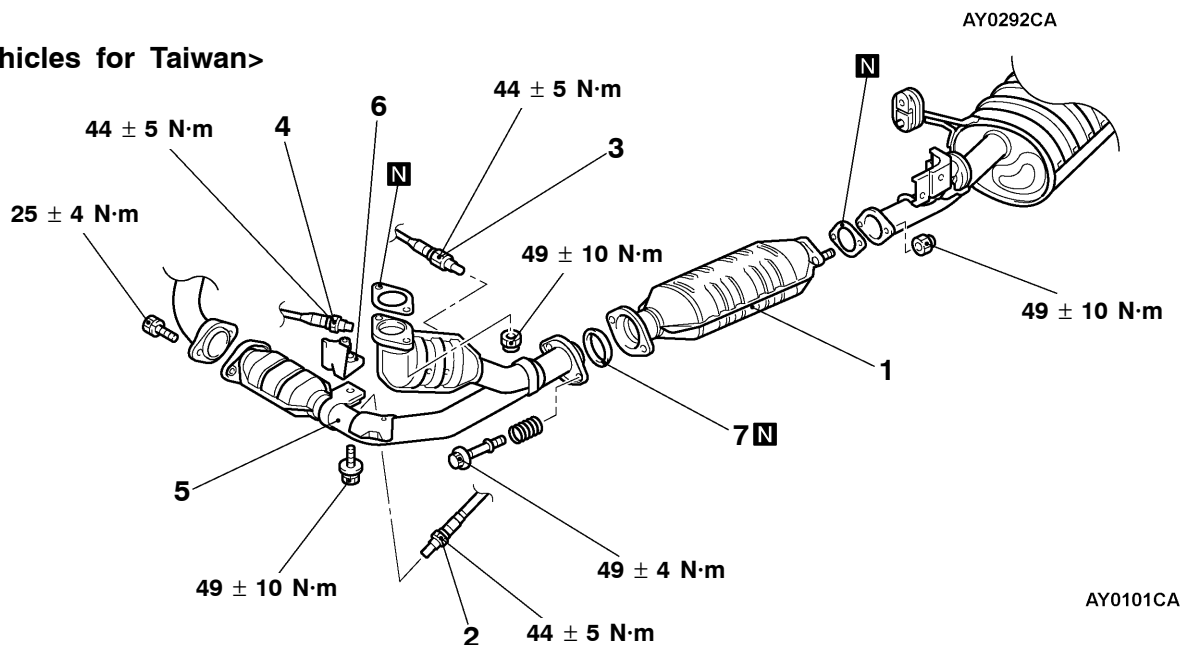
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Under Cover Removal and Installation

<Vehicles except for Taiwan>



<Vehicles for Taiwan>

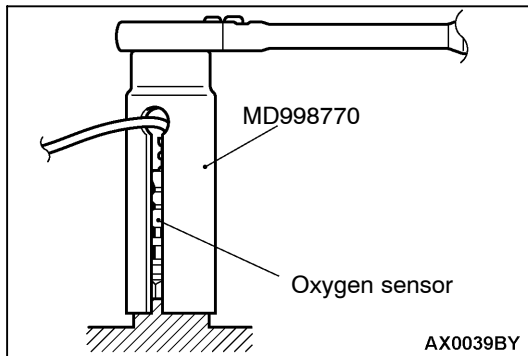


Removal steps



1. Catalytic converter
2. Right bank oxygen sensor (rear)
3. Left bank oxygen sensor (rear)
4. Left bank oxygen sensor (front)

5. Front catalytic converter
6. Bracket
7. Seal ring

**REMOVAL SERVICE POINT**

- ◀A▶ **RIGHT BANK OXYGEN SENSOR (REAR)/LEFT BANK OXYGEN SENSOR (REAR)/LEFT BANK OXYGEN SENSOR (FRONT) REMOVAL**

Use special tool to remove the oxygen sensor.

INSTALLATION SERVICE POINT

- ▶A◀ **LEFT BANK OXYGEN SENSOR (FRONT)/LEFT BANK OXYGEN SENSOR (REAR)/ RIGHT BANK OXYGEN SENSOR (REAR) INSTALLATION**

Use special tool to install the oxygen sensor.

EMISSION CONTROL SYSTEM <4M40-VEHICLES WITH EGR>

GENERAL INFORMATION

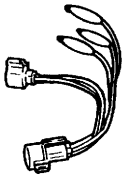
The electronically-controlled EGR system and the fuel injection timing control system (load timer) reduce the level of exhaust gases (NO_x).

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

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 – 1.3
	Fully open	4.1 – 4.9
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

SPECIAL TOOL

Tool	Number	Name	Use
	MD998478	Test harness (3P, square)	Inspection of lever position sensor

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

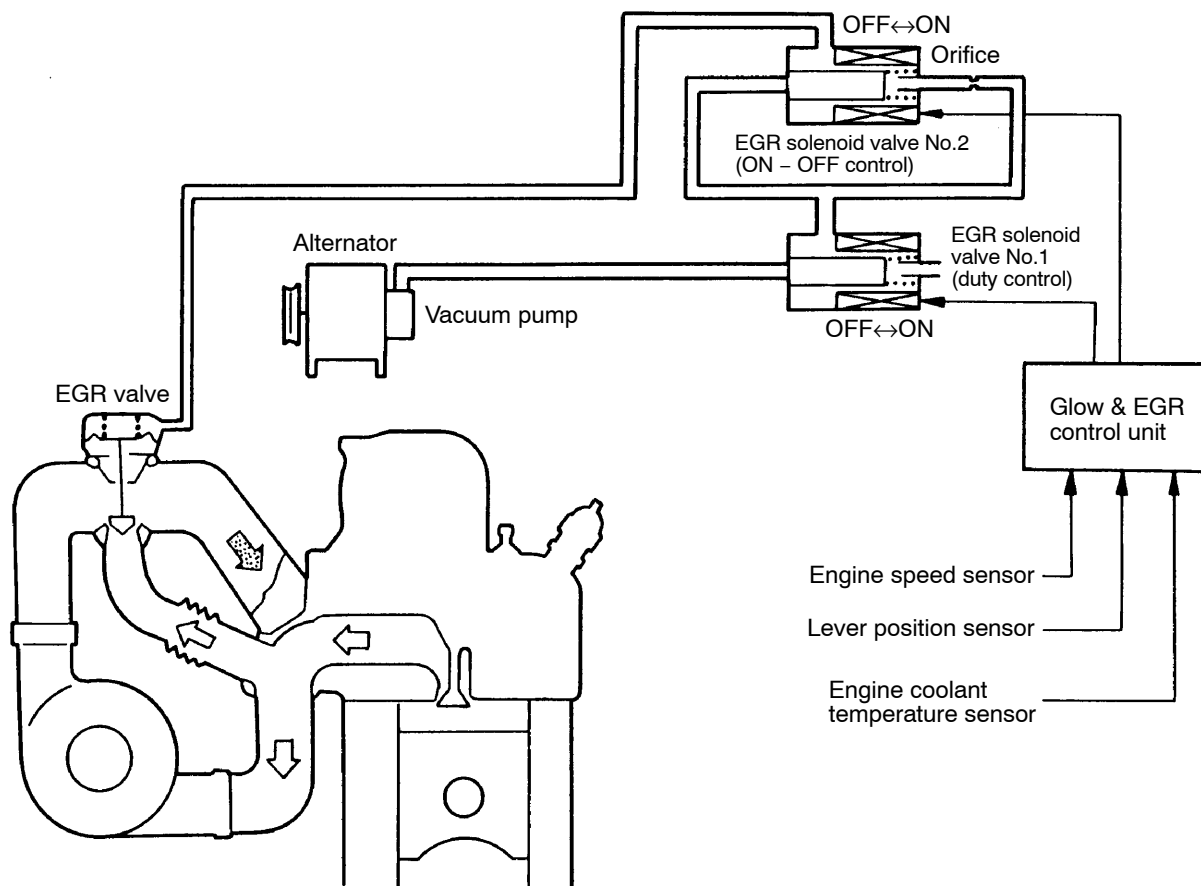
GENERAL INFORMATION

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.

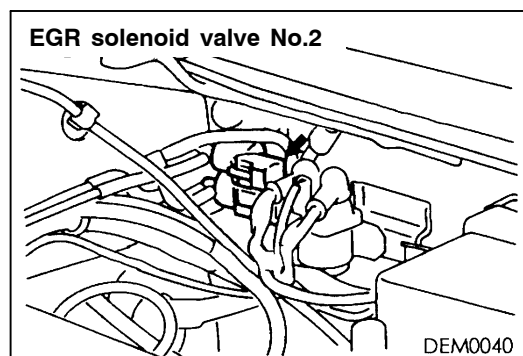
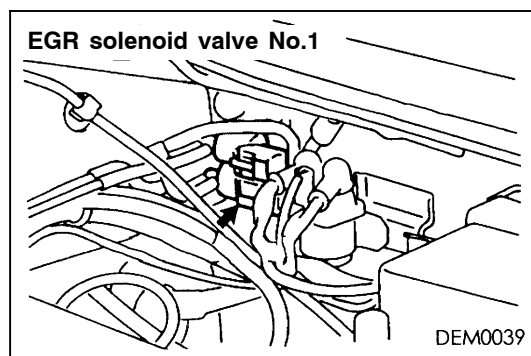
The EGR solenoid valves No.1 and No.2 are optimally controlled by the glow & EGR control unit in response to the engine operation conditions, based on data input from each of the sensors. In this way, the EGR is controlled to reduce NOx emissions while maintaining good engine performance.

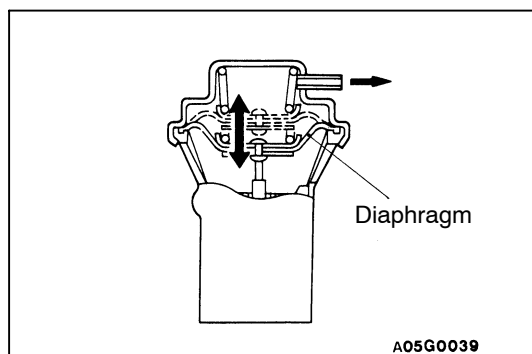
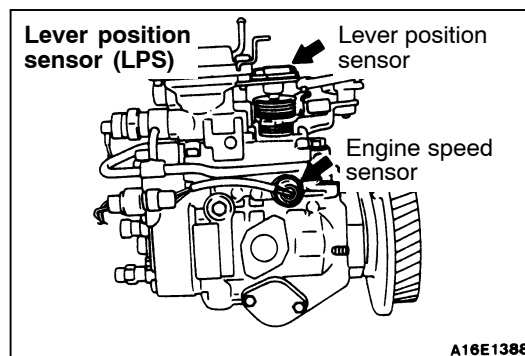
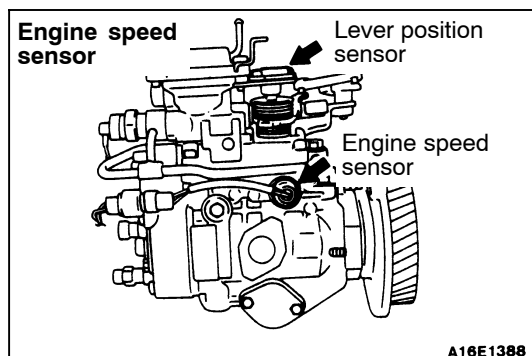
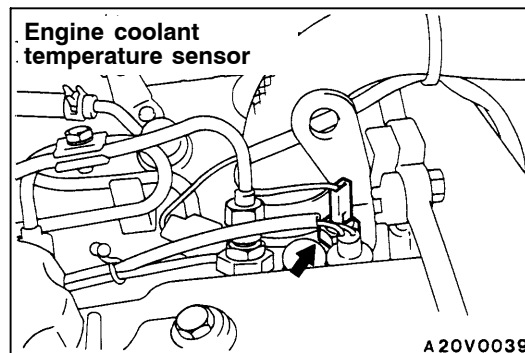
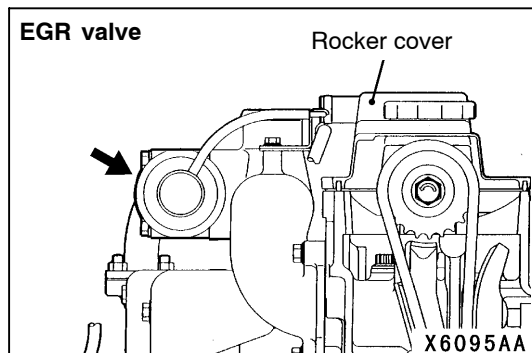
SYSTEM DIAGRAM



DEM0603

COMPONENT LOCATION



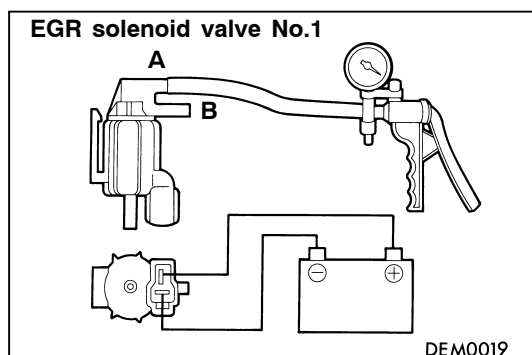


FUNCTION CHECK

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

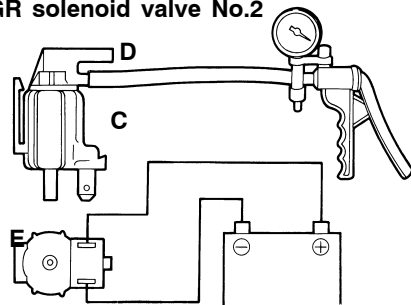
1. Remove the EGR solenoid valve No.1/No.2 connectors and vacuum hoses.
2. Attach a vacuum pump to each nipple of the EGR solenoid valve No.1/No.2 and apply negative pressure. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valves and when it is not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



DEM0613

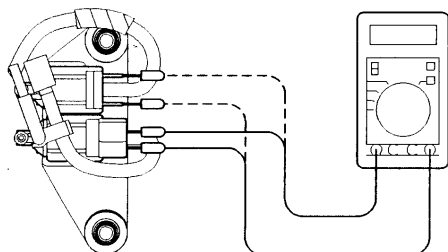
EGR solenoid valve No.2

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

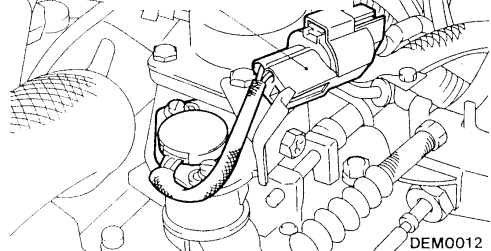
Measure resistances between the terminal of the EGR solenoid valve No.1/No.2 with a circuit tester.

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



DEM0042

Lever position sensor connector



DEM0012

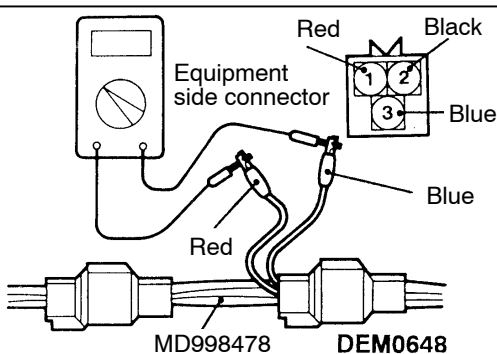
LEVER POSITION SENSOR (LPS) ADJUSTMENT

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

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

Standard value:

Lever condition	Voltage V
Idle position	0.8 – 1.3
Fully open	4.1 – 4.9



MD998478

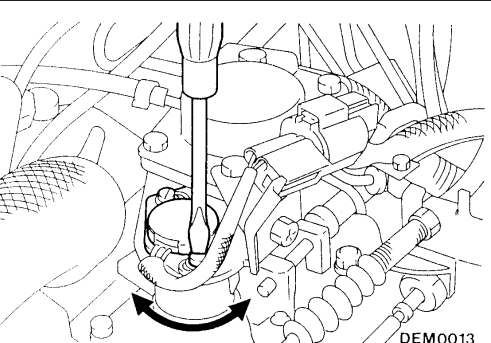
DEM0648

- 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.

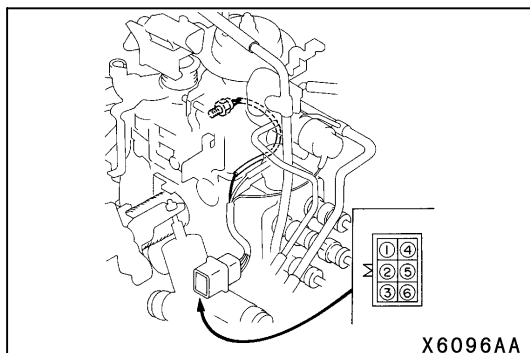
NOTE

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

- Turn the ignition switch to OFF.
- Adjust the accelerator cable play.



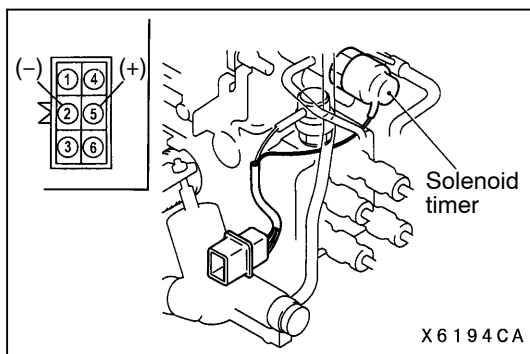
DEM0013



ENGINE SPEED SENSOR CHECK

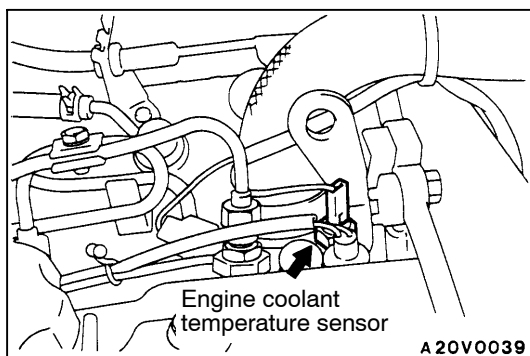
1. Disconnect the engine speed sensor connector.
2. Measure the resistance between the engine speed sensor terminals 3 – 6.

Standard value: 1.3 – 1.9 k Ω



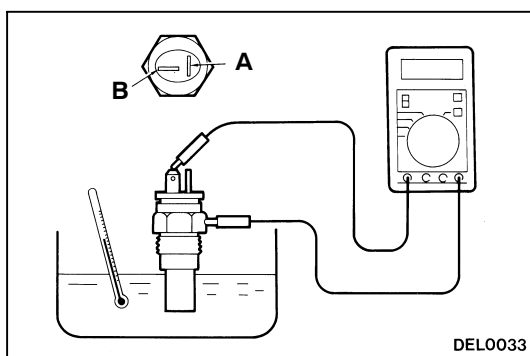
SOLENOID TIMER CHECK

1. Disconnect the solenoid timer connector.
2. When a voltage of more than 8.5 V is applied between terminals 2 and 5, the operating sound should be heard. If no, replace the solenoid timer.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

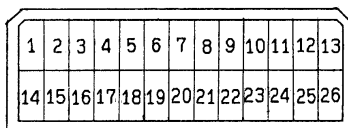
1. Remove the engine coolant temperature sensor.



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.

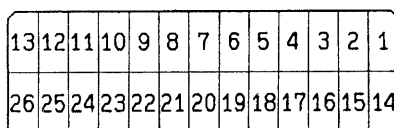
Temperature ($^{\circ}\text{C}$)	Resistance (k Ω)
0	7.7 – 9.5
20	2.9 – 3.6
40	1.3 – 1.7
80	0.26 – 0.35

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

CHECK AT THE GLOW & EGR CONTROL UNIT**TERMINAL VOLTAGE CHECK CHART****Glow & EGR Control Unit Connector Terminal Arrangement**

DEM0029

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
2	Solenoid timer	Ignition switch: OFF to ON, engine coolant temperature: 40°C or less		System voltage
		After warming up, rev the engine from idling		0 V
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	0.8 – 1.3 V
			Fully open throttle lever	4.1 – 4.9 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)

EMISSION CONTROL SYSTEM <4M41>

GENERAL INFORMATION

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

Items	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

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

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

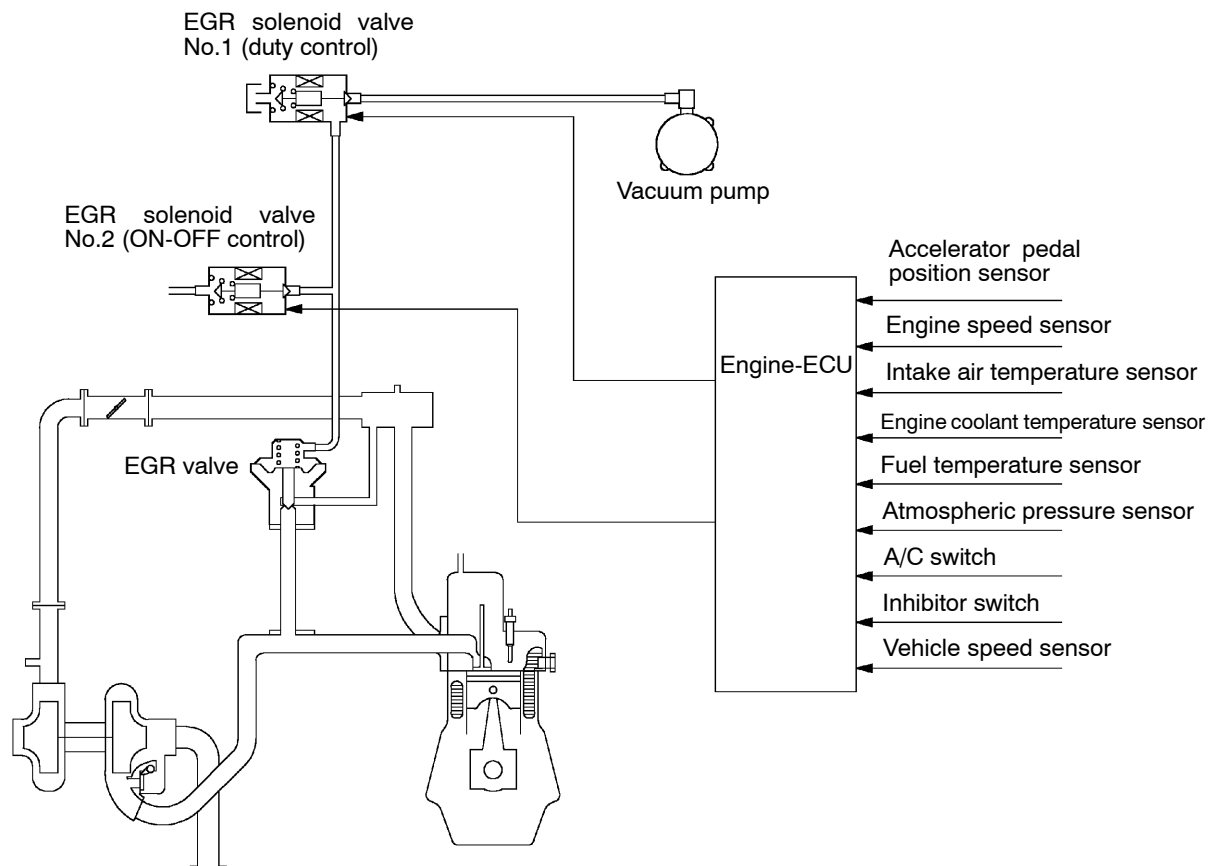
The electronically-controlled EGR system consists of an EGR valve, vacuum pump, EGR solenoid valves No. 1 and No. 2, glow & EGR control unit and various sensors.

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.

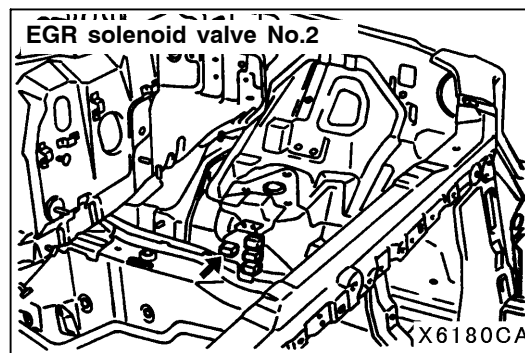
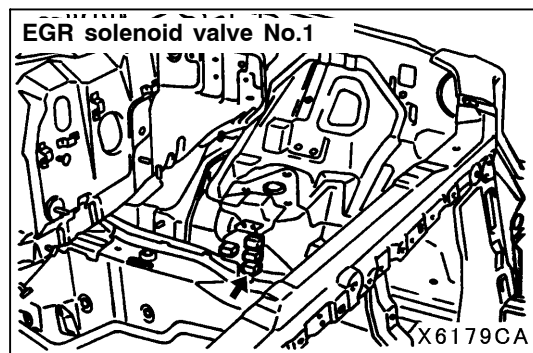
In this way, the EGR is controlled to reduce NO_x emissions while maintaining good engine performance.

SYSTEM DIAGRAM



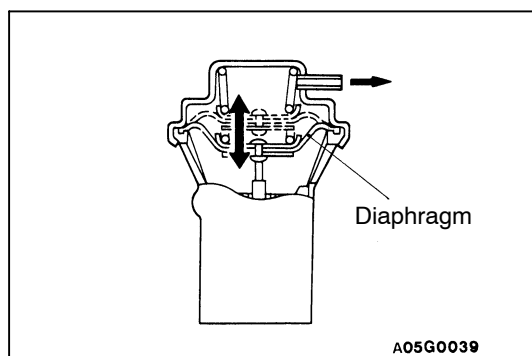
X6178CA

COMPONENT LOCATION



FUNCTION CHECK

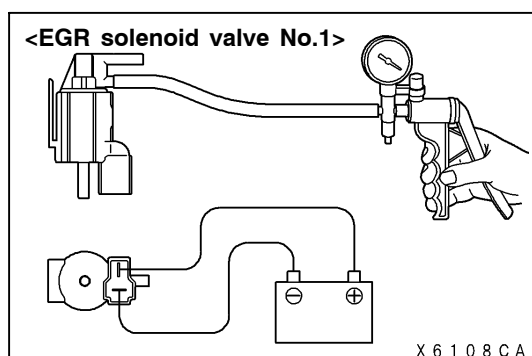
1. Start the engine and warm it up until the engine coolant temperature reaches 65°C or above.
2. Turn the A/C switch "OFF".
3. Place the selector lever in P range.



4. Check the operation of the EGR valve.

Normal condition:

Engine condition	EGR valve condition
Idling without any load	Open
Sudden racing	Closed (Diaphragm lowers)

**EGR SOLENOID VALVE OPERATION CHECK**

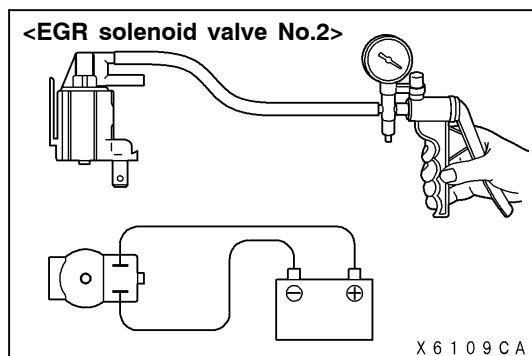
1. Attach a vacuum pump to each nipple of the EGR solenoid valves as shown and apply negative pressure.
2. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valve and when it is not applied.

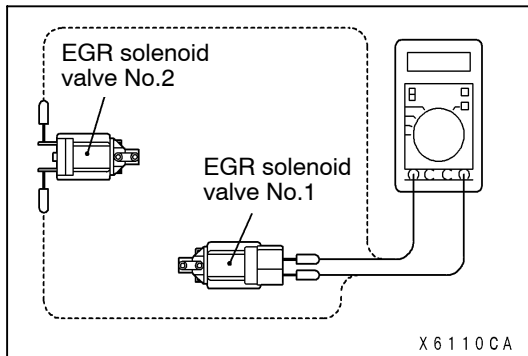
EGR solenoid valve No.1

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

EGR solenoid valve No.2

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple C is plugged).
When current is not flowing	Vacuum is maintained.



**EGR SOLENOID VALVE RESISTANCE CHECK**

Measure the resistance between the terminals of the solenoid valve.

Standard value: 36 – 44 Ω (at 20°C)

ACCELERATOR PEDAL POSITION SENSOR (APS), ENGINE COOLANT TEMPERATURE SENSOR, INTAKE AIR TEMPERATURE SENSOR, FUEL TEMPERATURE SENSOR CHECK

Refer to GROUP 13C – On-vehicle Service.

CHECK AT ENGINE-A/T-ECU

Refer to GROUP 13C – Troubleshooting.

CATALYTIC CONVERTER

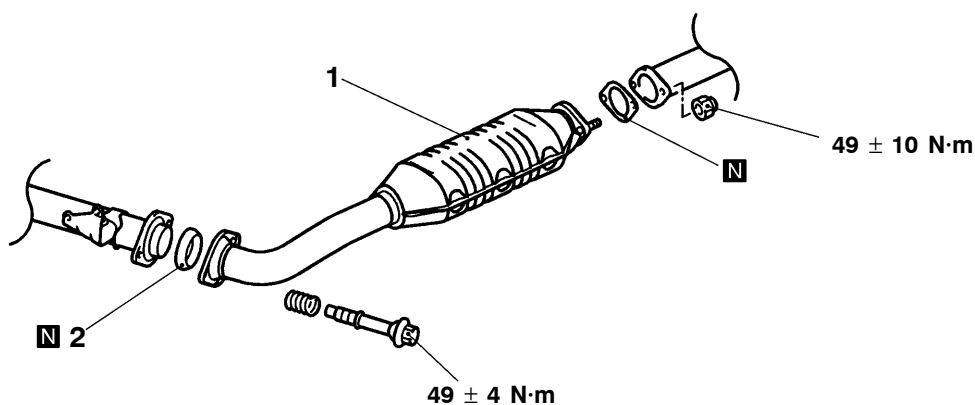
GENERAL INFORMATION

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

Pre-removal and Post-installation Operation
Under Cover Removal and Installation



AX0869CA

Removal steps

1. Catalytic converter
2. Seal ring